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TIMES OF MAXIMA FOR SELECTED DELTA SCUTI STARS

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We are presenting 120 previously unpublished times of maxima for 32 Delta Scuti and SX Phe stars. The observations where obtained in the period 2002 - 2006, using the telescopes and CCD-detectors listed in Tables 1 and 2. CCD-frame calibration and differential aperture photometry where performed using AIP4WIN software (Berry and Burnell, 2005), sextractor and custom-written applications. The times of maxima, presented in Table 3, are all heliocentric, and where determined by polynomial fitting using Peranso software (Vanmunster, 2006).

Table 1: Telescopes and Observatories

Telescope type	Aperture	F-ratio	Observatory
Newtonian	20 cm	f/4	Bossmo Observatory (BMO)
Catadioptric	25 cm	f/10	Rolling Hills Observatory (RHO)
Catadioptric	30 cm	f/5	SETEC Observatory (SEO)

Table 2: Detectors

CCD type	Chip	FOV	Pixels	Observatory
SBIG ST-7	Kodak KAF-400	$19.'4 \times 28.'8$	765 × 510	BMO
SBIG ST-9XE	Kodak KAF-0261	$18.'5 \times 18.'5$	512 × 512	RHO
SBIG ST-8	Kodak KAF-1603ME	$19.'3 \times 29.'3$	1530 × 1020	SEO

Table 3: Times of Maxima

Star	HJD	+/-	Filter	Obs
CC And	2452609.67358	0.00010	*V*	SEO
	2452609.80426	0.00046	*V*	SEO
	2453280.31612	0.00094	*V*	BMO
	2453280.43954	0.00108	*V*	BMO
GP And	2453680.35518	0.00031	None	BMO
V356 Aur	2453708.60049	0.00140	None	BMO

Table 3: (cont.)

YZ Boo	2452374.70620	0.00121	None	SEO
	2452374.81064	0.00102	None	SEO
	2452392.71252	0.00024	None	SEO
	2452392.81760	0.00033	None	SEO
	2452392.91966	0.00074	None	SEO
	2452432.68370	0.00053	*V*	SEO
	2452432.78942	0.00062	*V*	SEO
	2453798.47144	0.00054	None	BMO
	2453798.57500	0.00051	None	BMO
	2453798.67870	0.00052	None	BMO
	2453800.86516	0.00044	*V*	RHO
	2453800.96972	0.00015	*V*	RHO
BL Cam	2453809.30025	0.00004	None	BMO
	2453809.33812	0.00005	None	BMO
UY Cam	2453808.42249	0.00292	None	BMO
V871 Cas	2453816.46696	0.00051	None	BMO
	2453816.60251	0.00094	None	BMO
DQ Cep	2453710.23224	0.00074	None	BMO
	2453797.69160	0.00052	None	BMO
AD CMi	2453810.62591	0.00030	*V*	RHO
XX Cyg	2453169.84064	0.00015	*V*	RHO
	2453499.85607	0.00049	*V*	RHO
	2453538.69645	0.00045	*V*	RHO
	2453626.62920	0.00040	*V*	RHO
	2453660.61528	0.00059	*V*	RHO
	2453686.50947	0.00056	*V*	RHO
	2453695.27639	0.00047	None	BMO
	2453695.41071	0.00043	None	BMO
V2028 Cyg	2453708.27713	0.00155	None	BMO
V2129 Cyg	2453442.33548	0.00027	None	BMO
GW Dra	2453713.19876	0.00018	None	BMO
	2453713.31692	0.00031	None	BMO
QS Gem	2453709.69030	0.00118	*V*	BMO
V345 Gem	2453443.36334	0.00170	None	BMO
DY Her	2452786.65844	0.00064	*V*	RHO
	2453054.93914	0.00015	*V*	RHO
	2453132.67363	0.00005	*V*	RHO
	2453489.83381	0.00018	*V*	RHO
	2453535.61256	0.00039	*V*	RHO
V830 Her	2453817.57388	0.00092	None	BMO
V927 Her	2453803.51891	0.00095	None	BMO
	2453803.66209	0.00099	None	BMO
	2453804.56891	0.00020	None	BMO
V966 Her	2453807.54554	0.00031	None	BMO
VX Hya	2452735.60669	0.00069	*V*	RHO
	2453016.91220	0.00042	*V*	RHO
	2453113.63636	0.00022	*V*	RHO
	2453467.69577	0.00106	*V*	RHO
	2453476.59757	0.00151	*V*	RHO
AN Lyn	2453796.32690	0.00072	None	BMO
	2453802.61728	0.00084	*V*	RHO
	2453802.71466	0.00067	*V*	RHO
BE Lyn	2453416.27845	0.00047	None	BMO
	2453416.37521	0.00046	None	BMO
	2453443.60274	0.00040	None	BMO
	2453798.31817	0.00024	None	BMO
BO Lyn	2453795.53561	0.00044	None	BMO
	2453795.63339	0.00037	None	BMO
CQ Lyn	2453709.38329	0.00069	*V*	BMO
	2453709.49681	0.00076	*V*	BMO

Table 3: (cont.)

SZ Lyn	2452321.73578	0.00063	None	SEO
	2452343.79563	0.00042	None	SEO
	2452623.55155	0.00058	*V*	SEO
	2452623.67342	0.00035	*V*	SEO
	2452640.54936	0.00035	*V*	SEO
	2452640.66976	0.00056	*V*	SEO
	2452643.44217	0.00118	*V*	SEO
	2452643.56365	0.00062	*V*	SEO
	2452643.68337	0.00081	*V*	SEO
	2452647.42013	0.00047	*V*	SEO
	2452647.54057	0.00051	*V*	SEO
	2452647.65949	0.00023	*V*	SEO
	2452648.50325	0.00056	*V*	SEO
	2452648.62321	0.00082	*V*	SEO
	2452658.63939	0.00036	*V*	RHO
	2453064.72252	0.00024	*V*	RHO
	2453338.81318	0.00097	*V*	RHO
	2453395.58528	0.00022	*V*	RHO
	2453416.55775	0.00050	*V*	BMO
	2453745.73923	0.00064	*V*	RHO
	2453758.76187	0.00016	*V*	SEO
	2453758.88451	0.00035	*V*	SEO
	2453759.60604	0.00007	*V*	SEO
	2453759.72692	0.00002	*V*	SEO
	2453759.84713	0.00061	*V*	SEO
	2453759.96792	0.00027	*V*	SEO
	2453798.41955	0.00049	None	BMO
TV Lyn	2453806.53233	0.00062	None	BMO
BP Peg	2453709.23216	0.00025	None	BMO
DY Peg	2452518.74991	0.00053	None	SEO
	2452518.82371	0.00043	None	SEO
	2452522.75997	0.00061	None	SEO
	2452522.83366	0.00071	None	SEO
	2452522.90871	0.00058	None	SEO
	2452524.73135	0.00078	None	SEO
	2452524.80295	0.00022	None	SEO
	2452524.87576	0.00043	None	SEO
	2452524.94893	0.00039	None	SEO
	2453295.21602	0.00015	*V*	BMO
	2453295.28932	0.00014	*V*	BMO
AE UMa	2453409.52857	0.00024	None	BMO
	2453409.61085	0.00032	None	BMO
	2453409.69405	0.00058	None	BMO
	2453794.36194	0.00029	None	BMO
	2453795.31152	0.00031	None	BMO
	2453795.39982	0.00013	None	BMO
	2453827.65701	0.00130	*V*	RHO
GG UMa	2453711.29412	0.00064	*V*	BMO
HH UMa	2453801.92005	0.00193	*V*	RHO
IP UMa	2453712.50592	0.00041	*V*	BMO
	2453712.60750	0.00074	*V*	BMO
	2453797.34943	0.00061	None	BMO
	2453797.45183	0.00082	None	BMO
TU UMi	2453713.50846	0.00045	*V*	BMO

Remarks:

Many Delta Scuti stars have multiple periods, and in these cases $O-C$ values might show some scatter due to the beating of the periods. Still, averaged $O-C$ values are useful when looking for long term trends (Fauvud et al., 2006) or sudden period changes (Breger et al., 1998), if analyzed with care.

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This work has made use of the SIMBAD database, operated at CDS, Strasbourg, France.

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ERRATUM FOR IBVS 5701

The star listed as V2028 Cyg in IBVS 5701 should be V2088 Cyg.

Geir Klingenberg

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ACTIVE MOTION OF MATTER IN THE ENVELOPE OF DI CEPHEI

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Emission spectra of T Tauri stars (TTSs) carry important information from disk accretion areas that interact with the star's magnetosphere. Balmer profiles of young stars suggest the presence of magnetic funnel flows, created as the stellar magnetosphere truncates the inner disk and redirects the accretion flow along magnetic trajectories terminating in accretion shocks on the stellar surface (Königl 1991, Muzerolle et al. 1998, Beristain et al. 1998). However, details of this process are not clear yet. A detailed spectroscopic study of the structure of a star's emission lines can give us information important for understanding interaction of disk accretion with the star's atmosphere.

We present new results of our study of the hydrogen emission lines for the TTS DI Cep. We used the echelle spectrometer in the Cassegrain focus of the 2 m telescope (Shamakha Observatory, Azerbaijan) with a 580×530-pixel CCD (Mikailov et al. 2005). The spectral range was $\lambda\lambda 4400 - 6800$ Å, the spectral resolution was $R = 14000$. The whole range was divided into 28 orders, each of them about 100 Å wide. The linear dispersion varied between 11 and 6 Å/mm. The average signal-to-noise ratio was 60 and 40, respectively in the Hα and Hβ region. The mean exposure time for one spectrum was about one hour. The spectral reductions made use of software developed by Galazutdinov (1992). To undertake cleaning for the telluric lines, we use a special technique (Alieva and Ismailov, 2005) based on the following procedure: after precise position identification of telluric lines, we derive a pseudo-continuum, which ignores positions of the telluric lines. After dividing by this pseudo-continuum, we obtain the so-called "divisor" spectrum, which contains the telluric lines. We then apply this spectrum as a spectrum of a standard star with a smooth continuum (Galazutdinov, 1992). Two spectra were obtained in 2004 and 18, in 2005. Ten of these spectra were obtained on the night of JD 2453589, at 5-minute intervals, to check for rapid variability of the Hα emission. In these spectra, the signal-to-noise ratio is $S/N = 8$, thus the equivalent widths of the Hβ lines are not measurable; the data for JD 2453589.486 in Table 1 (see description below) are mean parameters for these 10 spectra. The mean uncertainty of our radial velocity measurements for standard stars was within 2 km/s, that for equivalent widths was about 4-5%.

The Hα line profiles in different spectra are presented in Fig. 1. The profile basically has two strong peaks (Nos. 3 and 4 in Fig. 1), with a depression between them. In turn, each of the peaks 3 and 4 shows a complex structure. On some nights, weak emission peaks displaced to the blue and to the red in the spectrum by ± 400 km/s (peaks 1 and 5) were observed. The blue wing of the emission peak 1 is very extended and smoothly merges with the continuum at a displacement of −600 km/s. These peaks are especially strong in the spectrum acquired on JD 2453588. The absorption 2 has a blue shift about −320 km/s and forms a typical P Cyg structure. The peak 5 on the same night had a displacement about +491 km/s. Thus we observe strong variations of the Hα structure from night to night as well as within a night.

Table 1. Parameters of the Hα line in the spectrum of DI Cep

JD 24...	W_1, Å	W_2, Å	W_3, Å	W_4, Å	W_5, Å	W, Å	FWHM, Å
53240.298			12	15		27	6.96
53240.392	0.34	0.14	13.1	17.7	0.09	30.8	7.13
53587.390			5.7	6.7		12.5	
53587.420	0.12	0.22	16.7	19.2	0.21	35.8	7.35
53587.488	0.20	0.10	17.7	25	0.12	39.3	7.87
53588.428	0.71	0.56	29.5	26.2	0.78	55.7	8.03
53588.476	0.61	0.50	30.6	28.3	1.18	58.9	7.67
53589.486			24.7	13.5		38.3	7.69
53590.392	0.24	0.12	25.9	12.9		38.8	7.06
	V_1, km/s	V_2, km/s	V_3, km/s	V_4, km/s	V_5, km/s	V_6, km/s	
53240.298			–103	53		–28	
53240.392	–377	–356	–80	56	349	–25	
53587.390			–99	10		–42	
53587.420	–414	–323	–119	18	395	–33	
53587.488	–495	–318	–116	23	440	–27	
53588.428	–412	–339	–74	13	381	–37	
53588.476	–417	–336	–74	18	491	–34	
53589.486			–104	42		–32	
53590.392	–406	–337	–26	66		22	

The results of our measurements of equivalent widths and radial velocities of individual Hα components are presented in Table 1. To measure equivalent widths of individual components, we used the following method from the DECH20 (Galazutdinov, 1992) software package: for each component, we limited the left and right sides of its peak with vertical lines and determined the area between these lines by integration. In our case, we could not apply Gaussian fitting because, for our profiles, the wings of individual components remained mainly unresolved.

The first part of Table 1 presents equivalent widths of the main components marked in Fig. 1. W is the full equivalent width of the emission, FWHM is a line width at half intensity. In the second part of Table 1, radial velocities of the same components are presented.

Figure 2 shows the Hβ line profiles for the same spectrograms. It can be seen that this line exhibits structures similar to those we observe for the Hα line. The Hβ profile is quite similar to the Hα line structure for JD 2453588.476. Here we simultaneously observe the components displaced into the blue and red parts of the spectrum, respectively by about –408 and +328 km/s. On JD 2453588, the Hβ profiles recorded one after another have the peaks 1 and 4 barely visible in the first spectrogram, these peaks were observed stronger in the spectrogram acquired one hour later. Note that, while the blue-displaced component 1 is observed confidently enough, the component 4 is rarely observed and shows active variations. The parameters of the Hβ line are collected in Table 2, which is similar in its contents to Table 1, but the component numbers refer to Fig. 2. We find direct correlation between equivalent widths of individual emission components of the Hα and Hβ lines, with correlation coefficients $\sim 80\%$. For example, we obtained a direct correlation between the equivalent widths of the blue peak 3 of Hα and peak 2 of Hβ, with the correlation coefficient $r = 84\%$. Signatures of simultaneous accretion on T Tauri stars and outflow from them were first observed by Walker (1972) who had noticed an additional absorption component redward of the redshifted emission peak, then the event was observed for other classical TTSs (CTTSs) (Bertout, 1984; Batalha et al., 2001). Our observations show that the Hα and Hβ line profiles of the CTTS DI Cep vary actively. Unstable accretion and emission components of the two hydrogen lines have been observed on the same spectrogram for the first time. This is a rare phenomenon, it also demonstrates the discrete character of the accretion process.

Periodic spectral and photometric variations of the star ($P = 9^{\rm d}\!.24$) were observed (Ismailov, 2003). If they are related to the asymmetric and inhomogeneous envelope, one of the possible causes of the inhomogeneity is the structure of the magnetosphere, with accretion along the magnetic lines. In principle, such activity of DI Cep can be easily explained in modern magnetospheric-accretion models. High activity of the star is provided by kinetic energy of matter accreted onto the star surface across magnetic field lines (Muzerolle et al. 1998, Lamzin 1998).

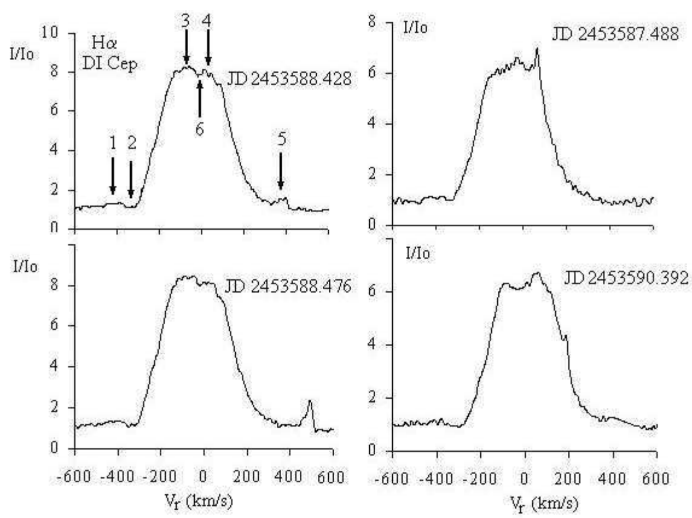

Figure 1. The Hα profiles in the spectrum of DI Cep

Table 2. Parameters of the Hβ line in the spectrum of DI Cep

JD 24...	W_1, Å	W_2, Å	W_3, Å	W_4, Å	W, Å	FWHM, Å	V_1, km/s	V_2, km/s	V_3, km/s	V_4, km/s	V_5, km/s
53240.298		2.4	1.5		3.9	6.96		–93.2	–5.3		–27.2
53240.392	0.07	3.2	1.8		5.0	4.29	–398	–97.2	28.3		–2.1
53587.390		3.5	2.4		6.0	4.98		–109	–9.4		–34.1
53587.420	0.09	3.9	3.2		7.0	5.44	–344	–111	–7.6		–46
53587.488	0.17	4.8	3.7	0.20	8.5	5.35	–420	–93.9	73.5	441	–16.4
53588.428	0.08	5.8	5.6	0.45	11.7	5.20	–410	–85.1	100.7	325	–19.7
53588.476	0.83	6.5	4.5	1.68	10.9	5.71	–408	–94.2	38.6	323	–3.8
53590.392		4.2	2.9		7.1	5.27		–107.3	15.5		–35.1

Thus, we can make the following conclusions:

1. Profile variations of the Hα and Hβ hydrogen lines during a night and from night to night, on time scales from an hour to a day, are observed.

2. For the first time, signatures of matter accretion and outflow were simultaneously observed for the CTTS DI Cep, providing evidence of complex structure of its circumstellar disk.

We thank Dr. N.N. Samus for discussions and assistance during the preparation of the manuscript.

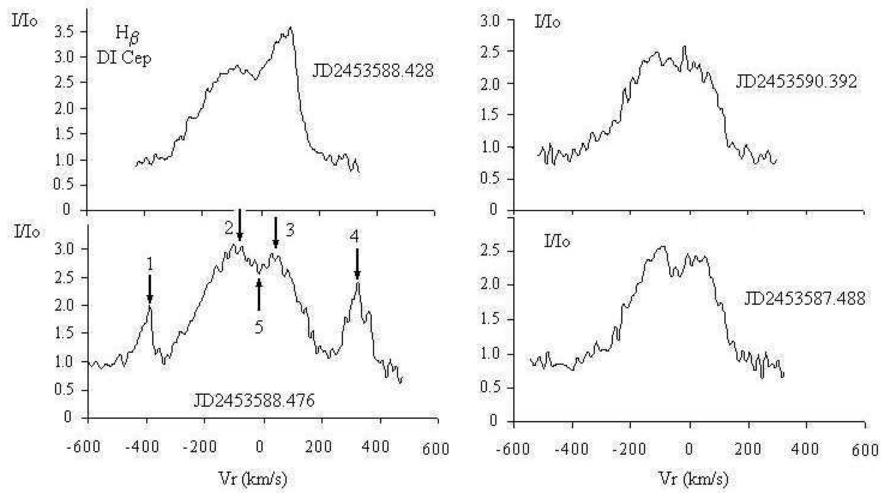

Figure 2. The Hβ profiles in the spectrum of DI Cep

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ELEMENTS FOR 8 RR LYRAE VARIABLES IN OPHIUCHUS

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These stars were reported to be variable by Hoffmeister (1949, 1966, 1967, 1968) and Boyce and Huruhata (1942). Except in the cases of V946 Oph and V2202 Oph (see details noted in the remarks below), no further observations or ephemeris have been published until today. Photographic plates of a field centered at 67 Oph, taken with the Sonneberg Observatory 40cm Astrographs during three intervals spread over the years from 1938 to 1994, were used to investigate the behaviour of these objects (see Table 1).

The given elements were obtained by means of least-squares solutions. Photographic amplitudes were derived with respect to magnitudes of the comparison stars given in Table 2. An extensive list holding the times of maxima derived can be retrieved as `5703-t3.txt`, using the link in the HTML version of this paper. Individual data are available upon request.

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	M−m	No. of Plates
V946 Oph	RRab	49124.459 ±9	0.6398176 ±4	$14.^{m}7$	$15.^{m}7$	$0.^{P}16$	205
V1098 Oph	RRab	49475.496 ±10	0.5983190 ±5	$14.^{m}6$	$16.^{m}3$	$0.^{P}18$	164
V2031 Oph	RRab	45913.374 ±7	0.2616933 ±2	$15.^{m}0$	$16.^{m}0$	$0.^{P}20$	181
V2079 Oph	RRba	48801.491 ±6	0.4675631 ±4	$14.^{m}7$	$16.^{m}2$	$0.^{P}16$	193
V2082 Oph	RRab	49488.572 ±8	0.6655856 ±6	$15.^{m}1$	$15.^{m}8$	$0.^{P}12$	204
V2084 Oph	RRab	49215.391 ±8	0.5152199 ±4	$15.^{m}3$	$16.^{m}4$	$0.^{P}19$	149
V2086 Oph	RRab	49154.514 ±6	0.5432653 ±3	$14.^{m}1$	$15.^{m}5$	$0.^{P}16$	250
V2202 Oph	RRab	48801.508 ±10	0.5924134 ±6	$15.^{m}4$	$16.^{m}3$	$0.^{P}16$	146

Table 2. Comparison stars and cross references

	V946 Oph S 4197 USNO 0900-11245172		V1098 Oph S 9875 USNO 0900-12249834	
Comp. No.	GSC	m*	USNO	m*
1	0900-11242067	$14.^{m}9$	0900-12252310	$14.^{m}7$
2	0900-11243430	$15.^{m}1$	0900-12245301	$15.^{m}2$
3	0900-11248377	$15.^{m}7$	0900-12239936	$16.^{m}0$

	V2031 Oph S 10354 USNO 0900-10975013		V2079 Oph S 9266 USNO 0900-10982172	
Comp. No.	USNO	m*	USNO	m*
1	0900-10979371	$14.^{m}8$	0900-10982884	$13.^{m}3$
2	0900-10983694	$15.^{m}4$	0900-10988752	$15.^{m}1$
3	0900-10971449	$15.^{m}8$	0900-10983912	$15.^{m}4$
4			0900-10985378	$16.^{m}0$

	V2082 Oph S 9848 USNO 0900-11067505		V2084 Oph S 9856 USNO 0900-11418565	
Comp. No.	USNO	m*	USNO	m*
1	0900-11065091	$15.^{m}0$	0900-11416873	$15.^{m}0$
2	0900-11075451	$15.^{m}3$	0900-11414437	$15.^{m}5$
3	0900-11066645	$15.^{m}3$	0900-11416503	$15.^{m}6$
4	0900-11067909	$16.^{m}0$	0900-11420016	$16.^{m}4$

	V2086 Oph S 9296 USNO 0900-11817170		V2202 Oph HV 11035 USNO 0900-10462979	
Comp. No.	USNO	m*	USNO	m*
1	0900-11805844	$14.^{m}0$	0900-10459019	$15.^{m}3$
2	0900-11822141	$14.^{m}1$	0900-10466769	$16.^{m}0$
3	0900-11809655	$15.^{m}1$	0900-10464279	$16.^{m}1$
4	0900-11818657	$15.^{m}5$		

* Magnitudes refer to the B values of the USNO−A2.0 catalogue

Remarks:

V946 Oph

The period previously published by of Götz et al. (1957) and cited in the GCVS is erroneous. The brightest maxima published by Götz et al. were included in our period analysis.

V2202 Oph

The brightest observation published in the paper of Hoffmann (1981) was included in the period analysis.

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

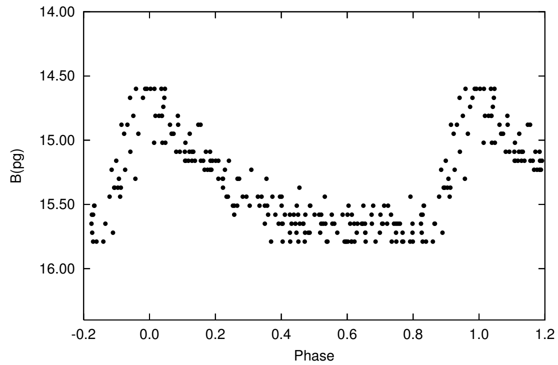

Figure 1. Light curve of V946 Oph

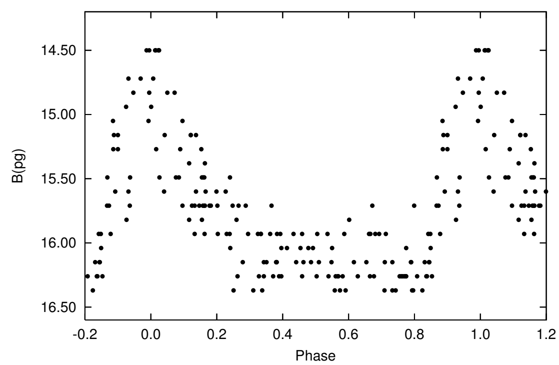

Figure 2. Light curve of V1098 Oph

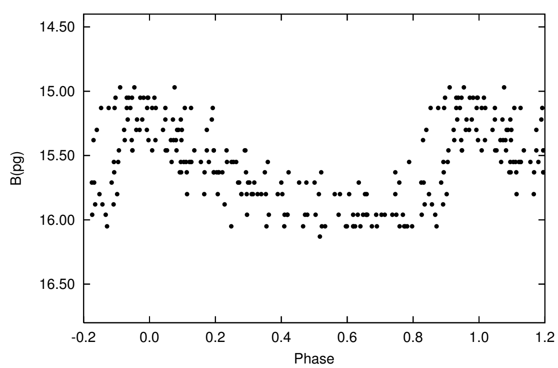

Figure 3. Light curve of V2031 Oph

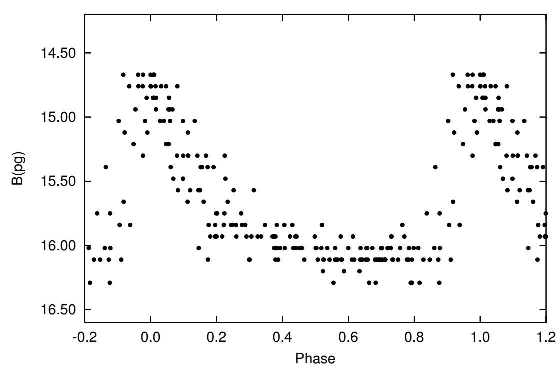

Figure 4. Light curve of V2079 Oph

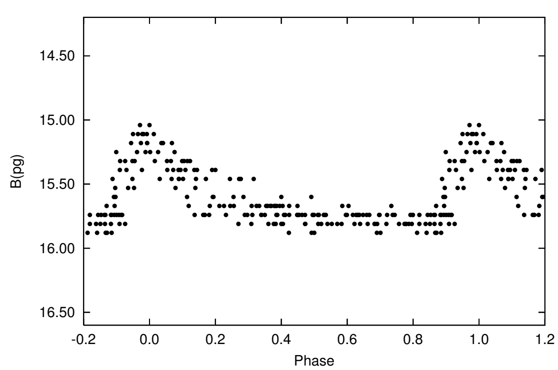

Figure 5. Light curve of V2082 Oph

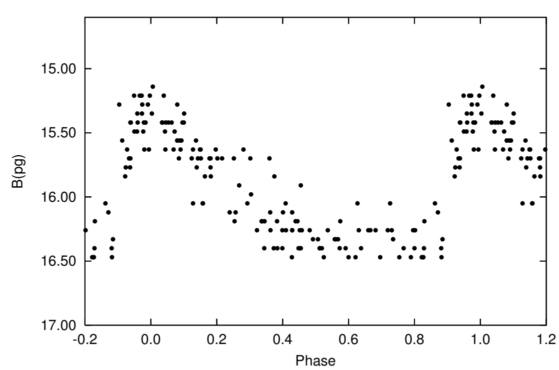

Figure 6. Light curve of V2084 Oph

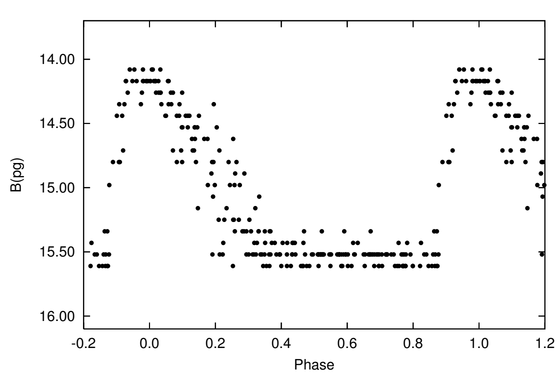

Figure 7. Light curve of V2086 Oph

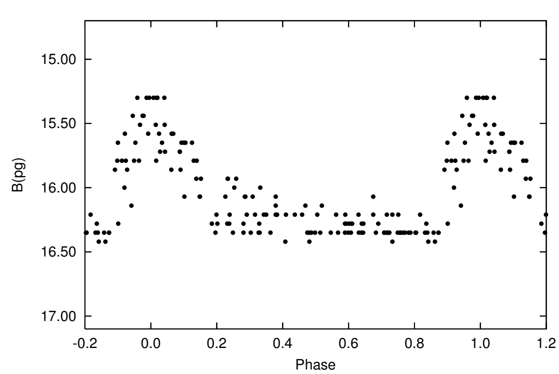

Figure 8. Light curve of V2202 Oph

References:

Boyce, H.E., Huruhata, M., 1942, *Harvard Annals*, **109**, 19
Götz, W., Huth, H., Hoffmeister, C., 1957, *Veröff. Sternw. Sonneberg*, **4**, 123, (H2)
Hoffmann, M., 1981, *Inf. Bull. Var. Stars*, **1979**
Hoffmeister, C., 1949, *Erg. Astron. Nachr.*, **12**, 1
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Hoffmeister, C., 1967, *Astron. Nachr.*, **290**, 43
Hoffmeister, C., 1968, *Astron. Nachr.*, **290**, 277

COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 5704

Konkoly Observatory
Budapest
23 May 2006

HU ISSN 0374 – 0676

THE FIRST COMPLETE PHOTOMETRY OF THE SHORT-PERIOD ALGOL-TYPE BINARY BF Vel

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Name of the object:
BF Vel, CD−39°4980

Equatorial coordinates:	**Equinox:**
R.A.= $08^h56^m24^s$ **DEC.=** $-39°58'54''$	2000

Observatory and telescope:
South African Astronomical Observatory Sutherland Station, 1.0 m Cassegrain telescope

Detector:	CCD camera, liquid nitrogen cooled at 180.5 K, 1024 × 1024 imaging pixels binned to 512 × 512, $5'.3 \times 5'.3$ FOV.
Filter(s):	BVRI

Date(s) of the observation(s):
2006.01.11, 2006.01.12, 2006.01.13

Comparison star(s):	Uncatalogued star 236″ NW of the variable
Check star(s):	Uncatalogued fainter star 63″ NW of the variable
Transformed to a standard system:	No

Availability of the data:
Available at the IBVS website, after 2006.11.26

Type of variability:	EA

Remarks:
Apparently, no suitable times of minima of BF Velorum have been obtained for an accurate period of the system to be calculated. Budding et al. (2004) give a value of 0.7040 day. The heights of the two maxima are unequal in the R and I bands. The secondary minimum is very shallow and deepens considerably at longer wavelengths, indicating a large temperature difference between the components. BF Vel is known to have a spectral type of A3+[G4IV].

Acknowledgements:

This research was included in the project for the support of research groups in the universities, co-funded by the European Social Fund (ESF) and National Resources (EPEAEK II) - *PYTHAGORAS*. This paper uses observations made at the South African Astronomical Observatory (SAAO).

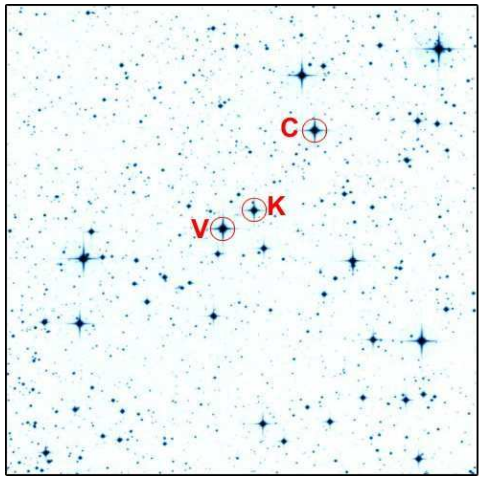

Figure 1. $14' \times 14'$ finding chart with the comparison (C) and check (K) stars marked; BF Vel is marked with a V.

Reference:

Budding, E., Erdem, A., Çiçek, C., Bulut, I., Soydugan, F., Soydugan, E., Bakis, V.; Demircan, O., 2004, *A&A*, **417**, 263.

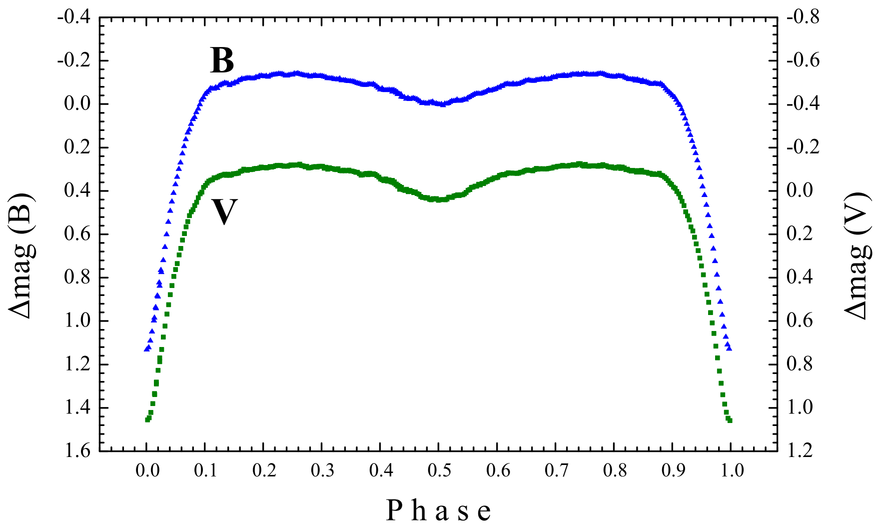

Figure 2. The complete B (upper) and V (lower) light curves of BF Vel.

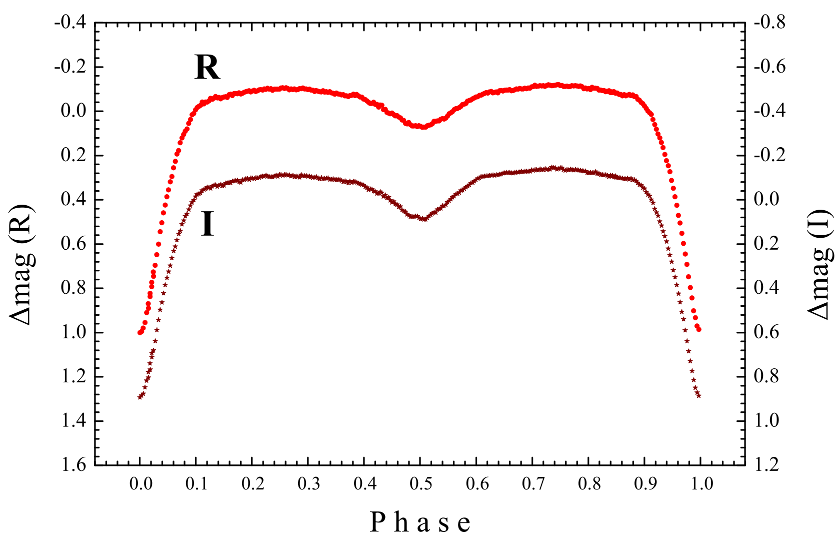

Figure 3. The complete R (upper) and I (lower) light curves of BF Vel.

COMMISSIONS 27 AND 42 OF THE IAU
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Budapest
30 May 2006

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UZ UMa: AN RRab STAR WITH DOUBLE-PERIODIC MODULATION

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UZ UMa was discovered to be variable by Baker (1938). He classified it as an irregular or semiregular type variable based on the photographic observations of Kapteyn. The correct classification (RRab) and period (P=0.4668795 d) were given by Meinunger (1968).

UZ UMa was observed in the course of our survey of short period ($P_{\rm puls} < 0.48$ d), fundamental mode, northern RR Lyrae stars, that aims to determine the real incidence rate of Blazhko variables in this sample and to study the modulation properties in detail. The observations were made with the 60 cm automatic telescope of Konkoly Observatory, Svábhegy, Budapest, equipped with a Wright 750×1100 CCD camera through a Cousins V filter. 1584 brightness measurements were obtained on 30 nights between 27 January and 23 May in 2006 (JD 2453763–878). Data reduction was performed using standard IRAF[1] packages. As no appropriate comparison star was found in the field of view, magnitude differences of UZ UMa from the average magnitude of 5 neighboring stars (GSC 21322-01261, GSC 21322-014531, GSC 21322-01252, GSC 21322-014679 and GSC 21322-01255) were calculated in order to reduce the noise of the comparisons' magnitudes. Instrumental magnitude differences of UZ UMa are given in Table 1, available only electronically.[2]

The following elements for light maxima were derived:

$$t_{\rm max}[{\rm HJD}] = 2453763.3368 + 0.4668413\,{\rm d}\cdot E$$

The original light curve and the light curve prewhitened with the pulsation frequency and its harmonics phased with the pulsation period are shown in Fig. 1–2. The plots clearly show the sign of the Blazhko modulation. The residual light curve indicates that the modulation is the largest on the rising branch and around maximum brightness, significant changes in the shape of the bump preceding minimum light also occur. The light curve is the most stable at minimum and on the mid part of the descending branch.

The Fourier spectrum of the light curve prewhitened with the 18 harmonics of the pulsation shows a complex structure of peaks around the pulsation frequencies. We assume that the Blazhko modulation can be described with the same, symmetric pattern of modulation frequency components of the residual spectrum around the frequency components of the pulsation. In this case the true modulation frequency can be identified more clearly

[1]IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

[2]Available on the IBVS website as `5705-t1.txt`.

in a *cumulative spectrum* defined as the sum of the two sides of the spectrum's segments in the vicinities of the pulsation peaks up to a given order according to the following formula:

$$A'(f) = \sum_{i=1}^{n} \left[A(i \cdot f_\mathrm{p} + f) + A(i \cdot f_\mathrm{p} - f) \right], \quad f < f_\mathrm{r}.$$

$A(f)$ is the original spectrum, f_p is the pulsation frequency, i is the harmonic order, f_r is the length of the examined frequency range and $A'(f)$ is the yielded cumulative spectrum, which has better S/N properties than the original spectrum.

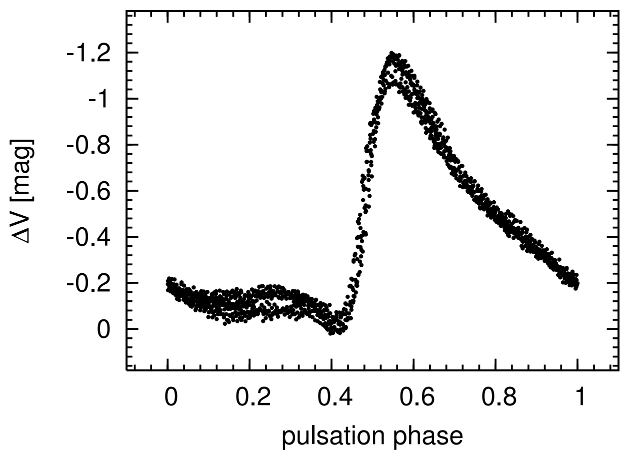

Figure 1. The V light curve of UZ UMa phased with the pulsation period.

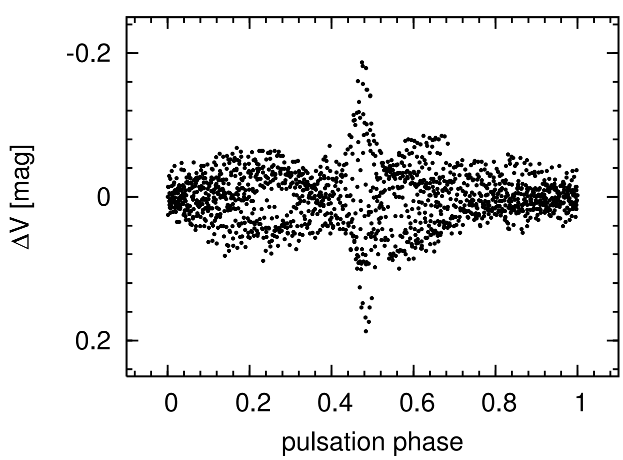

Figure 2. The prewhitened V light curve of UZ UMa phased with the pulsation period.

The cumulative spectrum of the prewhitened light curve shows two modulation peaks of different shapes, one at 0.065 c/d and another, wider component at around 0.03 c/d (see Fig. 3). The wideness of this latter frequency component indicates that there might be some differences in its position in the different harmonic orders and at the different sides of the pulsation components. However, to examine this possibility in more detail a more extended dataset is needed.

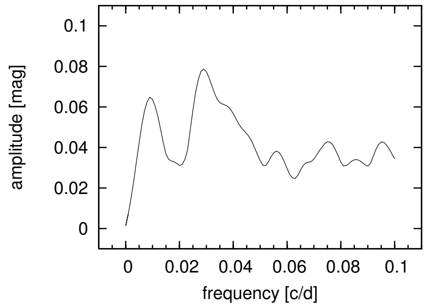

Figure 3. The cumulative residual spectrum of UZ UMa summed for the first 8 pulsational harmonics.

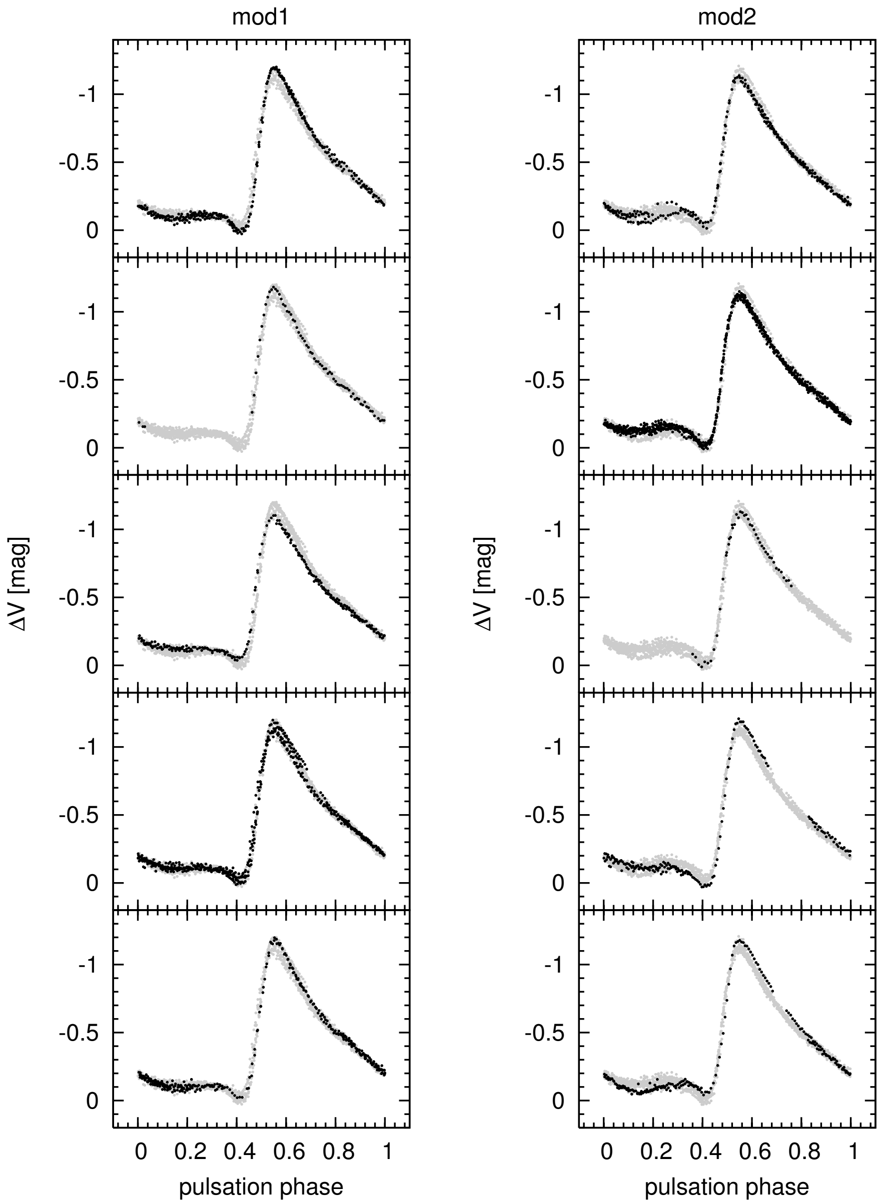

Figure 4. The light curves in different phases of the 26.7-day and 143-day modulations after removing the modulation corresponding to the other modulation period. In the electronic edition animated figures of the modulations are available.

In accordance with the two frequency peaks appearing in the cumulative residual spectrum, the light curve of UZ UMa cannot be fitted with the required accuracy assuming a single modulation period. Instead, even with two different modulation periods the residual scatter remains larger than observational inaccuracies would explain. Though the modulations of many Blazhko stars are known not to be strictly regular, the light curve of only XZ Cyg (LaCluyzé et al., 2004) has been previously described by two pairs of equidistant modulation components.

Data analysis was performed using the utilities of the program package MUFRAN (Kolláth, 1990). First we determined the modulation frequency values, $f_{\mathrm{mod}\,1}$ and $f_{\mathrm{mod}\,2}$ simultaneously through an iterative process, as the frequencies that yield the best fit to the residual light curve prewhitened by the pulsation frequency components up to the 18 th harmonics. The modulation components up to the 8 th harmonic order and also $f_{\mathrm{mod}\,1}$ and $f_{\mathrm{mod}\,2}$ were considered. The following modulation frequencies were thus determined: $f_{\mathrm{mod}\,1} = 0.0374\,\mathrm{c/d}$ and $f_{\mathrm{mod}\,2} = 0.0070\,\mathrm{c/d}$ ($P_{\mathrm{mod}\,1} = 26.7\,\mathrm{d}$ and $P_{\mathrm{mod}\,2} = 143\,\mathrm{d}$). If the modulation frequencies are not determined simultaneously but in consecutive steps, then very similar results arise. The first modulation frequency is then at 0.0372 c/d, and the other modulation frequency gives the best fit with 0.0065 c/d value. The observations span over only 115 days, thus the period of the secondary modulation is somewhat uncertain. Its value is most probably somewhere between 125 d and 170 d.

The 0.017 mag r.m.s. scatter of the residual indicates even more complex behaviour of the modulation, but no further real frequency component can be resolved.

In Kovács (2005) it was noted that in case of good data sampling the mean light curve of Blazhko stars can be used to define the physical properties from the Fourier parameters of the light curve. We came to the same conclusion using the data of the small amplitude modulation RRab stars: RR Gem and SS Cnc (Jurcsik et al., 2005; Jurcsik et al., 2006). Based on the Fourier parameters of the mean light curve of UZ UMa [Fe/H] $= -1.17$ can be determined using the formulae of Jurcsik & Kovács (1996). Our previous multicolour measurements with the same instrumentation indicate that if instrumental v magnitudes are used instead of standard V magnitudes, then the calculated [Fe/H] overestimates the metal content only by $0.02 - 0.04$.

Acknowledgements: The financial support of OTKA grants T-043504, T-046207 and T-048961 is acknowledged.

References:

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Jurcsik, J., Szeidl, B., Sódor, Á., Dékány, I., Hurta, Zs. et al. 2006 *AJ*, in press (astro-ph/0603496)

Kolláth, Z. 1990, Occ. Techn. Notes Konkoly Obs., No. 1, `http://www.konkoly.hu/staff/kollath/mufran.html`

Kovács, G., 2005, *A&A*, **438**, 227

LaCluyzé A., Smith, H., Gill, E-M., Hedden, A., Kinemuchi, K. et al. 2004, *AJ*, **127**, 1653

Meinunger, L. 1968, *MVS 4*, **7**, 179

COMMISSIONS 27 AND 42 OF THE IAU
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Budapest
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HU ISSN 0374 – 0676

NEWLY DISCOVERED VARIABLE STARS IN THE GLOBULAR CLUSTER NGC 6864 (M75)

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[2] Pontificia Universidad Católica de Chile, Departamento de Astronomía y Astrofísica, Av. Vicuña Mackenna 4860, 782-0436 Macul, Santiago, Chile; email: mcatelan@astro.puc.cl

[3] Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA; email: smith@pa.msu.edu

[4] Visiting Astronomer, Cerro Tololo Inter-American Observatory, National Optical Astronomy Observatory, which is operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

The distant globular cluster NGC 6864 (M75) belongs to a group of relatively rare clusters that display multimodal horizontal-branch (HB) morphology (Catelan et al. 1998, 2002). Using Alard's (2000) image-subtraction method, we recently discovered a number of new variables in this cluster, pointing to an unusual Oosterhoff-intermediate classification (Corwin et al. 2003). The present study also uses image subtraction with the data reported on in our previous analysis. This time, however, the image subtraction threshold was substantially reduced. This produced thousands of false identifications, but, in addition to the previously known variables, we found four new variables, all very close to the cluster core.

The CCD images used in this study were obtained with the 0.9 m telescope at the Cerro Tololo Inter-American Observatory. The field was observed over a seven-night interval in 1999 July. Observing conditions were not good for three of the seven nights, and data from these nights were not included in our analysis. The data reported here were obtained on the nights of 1999 July 15/16 (night 1), 19/20, 20/21, and 21/22 (nights 5, 6, and 7). The 2048 × 2048 Tek 2K-3 CCD was used. Images were obtained through both V and B filters. Typical exposure times were 360 s for the B frames and 240 s for the V frames. The pixel scale was $0\farcs395$, giving a field of view $13\farcm5 \times 13\farcm5$.

The location and tentative periods of the variables are given in Table 1. The x and y coordinates are in arcseconds with respect to the cluster center, given in the Clement et al. (2001) online catalog as RA $20^{\rm h}03\fm2$ and Dec $-22°04'$ (J1950). Because the data are limited and relatively noisy, the periods are given to only three significant figures. Light curves (in flux units) based on the periods of Table 1 are shown in Figure 1.

Of the four nights reported here, the data for night one were the least reliable and are not plotted for NV1, NV2, and NV3 (B light curve). NV1 was not found in the data from nights one or six. Three of the stars reported here have periods less than 0.3 d. While the most natural interpretation is that they are simply first-overtone pulsators (Kovács 1998;

Catelan 2004), there also exists the possibility that they are RR Lyrae stars pulsating in the second overtone (Alcock et al. 1996; Clement & Rowe 2000). The low amplitudes of second-overtone and short-period first-overtone pulsators might account for these stars being found only at the lower image-subtraction threshold, although their location very close to the cluster core may have been an important factor as well. NV2 seems to have two distinct B light curves. The reason for this is not clear. It is likely that it is a blended image, but this should not affect the differential flux as determined by ISIS. NV3 has a somewhat unusual curve, showing a large dip in brightness on nights 1 and 6. The light curve is roughly consistent with an eclipsing binary of the β Lyrae type, although our tentative short period could favor a W UMa classification instead. However, a period of approximately 1.93 days will also phase the data well, producing a light curve with large gaps.

Table 1. Locations and tentative periods for new variables.

Variable	$x('')$	$y('')$	Period (d)	Type
NV1	6.4	−2.1	0.278	RRe or RRc
NV2	4.0	2.3	0.276	RRe or RRc
NV3	0.0	1.0	0.634	EB?
NV4	−1.5	1.2	0.269	RRe or RRc

Acknowledgements:

M.C. acknowledges support by Proyecto FONDECYT Regular No. 1030954. H.A.S. acknowledges the NSF for support under grant AST 02-05813.

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Alard, C., 2000, *A&AS*, **144**, 363

Alcock, C., Allsman, R.A., Axelrod, T.S., et al., 1996, *AJ*, **111**, 1146

Catelan, M., 2004, *ASP Conf. Ser.*, 310, 113, in: Variable Stars in the Local Group, ed. D. W. Kurtz & K. R. Pollard (San Francisco: ASP)

Catelan, M., Borissova, J., Ferraro, F.R., Corwin, T.M., Smith, H.A., Kurtev, R., 2002, *AJ*, **124**, 364

Catelan, M., Borissova, J., Sweigart, A.V., Spassova, N., 1998, *ApJ*, **494**, 265

Clement, C.M., Rowe, J., 2000, *AJ*, **120**, 2579

Clement, C.M., et al., 2001, *AJ*, **122**, 2587

Corwin, T.M., Catelan, M., Smith, H.A., Borissova, J., Ferraro, F.R., Raburn, W.S., 2003, *AJ*, **125**, 2543

Kovács, G., 1998, *ASP Conf. Ser.*, 135, 52, in: A Half Century of Stellar Pulsation Interpretations, ed. P. A. Bradley & J. A. Guzik (San Francisco: ASP)

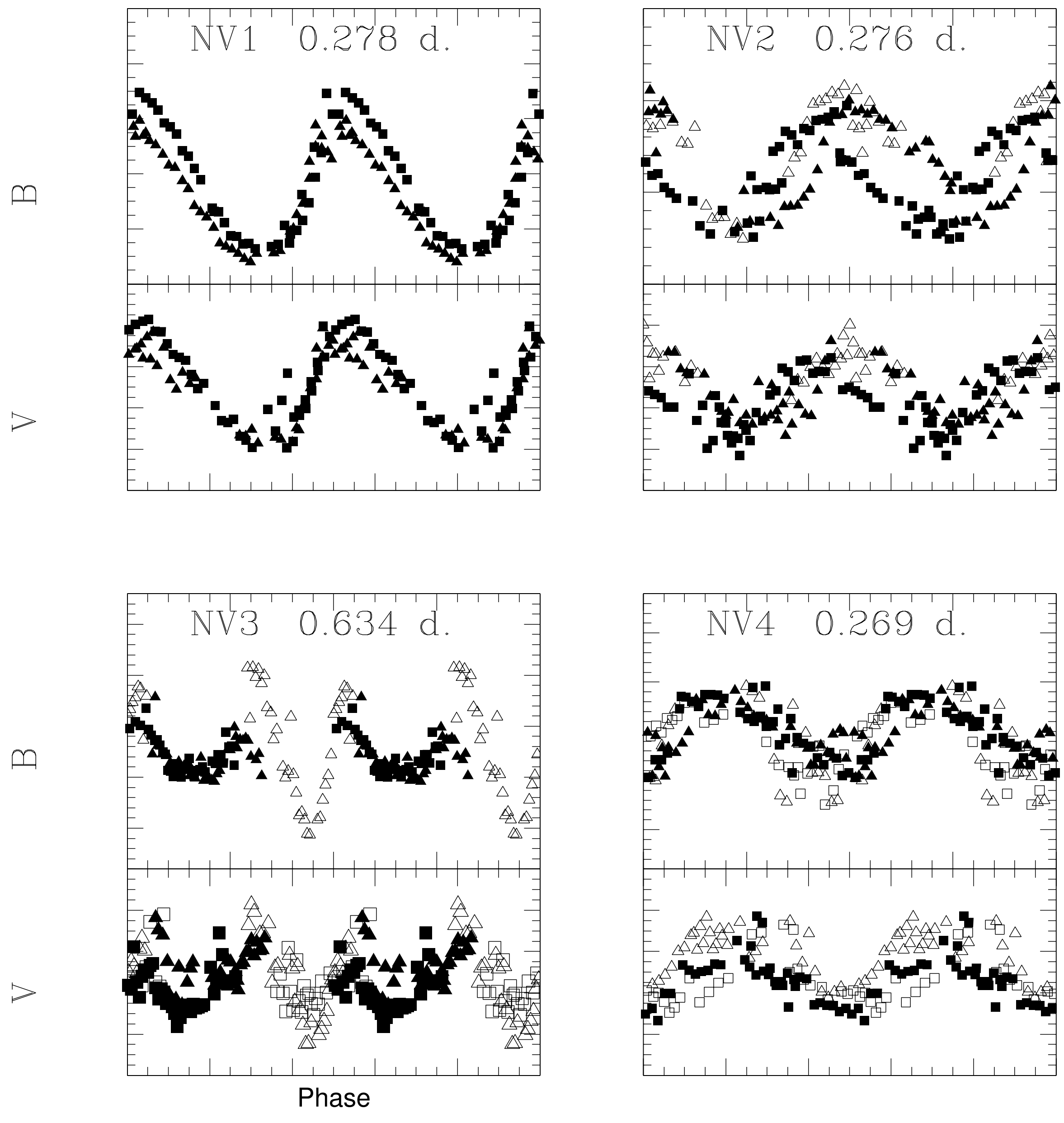

Figure 1. B and V-band differential light curves (in flux units) for the four new variables in M75. The open squares represent data from night 1, the filled squares from night 5, the open triangles from night 6, and the filled triangles from night 7.

COMMISSIONS 27 AND 42 OF THE IAU
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Konkoly Observatory
Budapest
19 June 2006

HU ISSN 0374 – 0676

NEW TIMES OF MINIMA OF SOME ECLIPSING BINARY STARS

DOĞRU, S. S.; DOĞRU, D.; ERDEM, A.; ÇIÇEK, C.; DEMIRCAN, O.

Çanakkale Onsekiz Mart University Observatory, Terzioğlu Campus, TR-17100, Çanakkale, Turkey; e-mail: dogru@comu.edu.tr

Observatory and telescope:
30-cm Cassegrain-Schmidt telescope of the Çanakkale University Observatory, (ÇUG301) 30-cm Cassegrain-Schmidt telescope of the Çanakkale University Observatory, (ÇUG302)

Detector:	-ST10XME camera, Peltier cooling, KAF 3200ME chip, $17' \times 12'$ FOV, 2184×1472 pixels. -ST237 camera, Peltier cooling, TC237 chip, $11' \times 8'$ FOV, 640×480 pixels.

Method of data reduction:
Reduction of the CCD frames was made with C-MUNIPACK[1] software.

Method of minimum determination:
Kwee – van Woerden method (Kwee & van Woerden, 1956).

[1]Motl, D., 2004, C-MUNIPACK, `http://integral.sci.muni.cz/cmunipack/`

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
HL Aur	53787.3073	0.0001	I	V	ÇUG301
TU Boo	53862.4745	0.0002	I	C	ÇUG302
TY Boo	53787.5077	0.0002	I	V	ÇUG301
	53850.4615	0.0001	II	C	ÇUG302
	53862.5131	0.0003	II	C	ÇUG302
TZ Boo	53862.5218	0.0005	I	C	ÇUG302
AC Boo	53862.5157	0.0002	I	C	ÇUG302
CV Boo	53849.3996	0.0002	II	C	ÇUG302
EF Boo	53789.3134	0.0002	II	V	ÇUG301
RW Com	53827.38402	0.00007	I	V	ÇUG301
	53845.3034	0.0001	II	C	ÇUG302
	53863.3379	0.0002	II	C	ÇUG302
RZ Com	52849.4809	0.0006	II	C	ÇUG302
	53863.3564	0.0002	II	C	ÇUG302
CC Com	53850.36952	0.00005	I	C	ÇUG302
RZ Dra	53590.3784	0.0001	I	V	ÇUG301
AX Dra	53800.3190	0.0002	I	V	ÇUG301
BW Dra	53601.4952	0.0003	I	V	ÇUG301
EM Lac	53590.4866	0.0003	II	V	ÇUG301
V502 Oph	53863.4527	0.0002	II	C	ÇUG302
FZ Ori	53771.2680	0.0002	I	BVR	ÇUG301
XZ UMa	53800.5090	0.0002	I	V	ÇUG301
AW Vir	53787.4543	0.0001	II	V	ÇUG301

Remarks:

We present 23 minima times of 18 eclipsing binaries. In the Remarks column of Times of Minima table, telescopes used in the observations are given.

Acknowledgements:

This work was partly supported by the Research Found of Çanakkale Onsekiz Mart University.

Reference:

Kwee, K. K., & van Woerden, H., 1956, *Bull. Astron. Inst. Neth.*, **12**, 327.

ERRATUM FOR IBVS 5707

Time of minimum of RZ Com was given as 52849.4809, but it should be 53849.4809.

S. Serkan Doğru

COMMISSIONS 27 AND 42 OF THE IAU
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Konkoly Observatory
Budapest
22 June 2006

HU ISSN 0374 – 0676

VARIABILITY OF V838 Mon BEFORE ITS OUTBURST

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V838 Mon had an unusual "nova-like" outburst in 2002 (Munari et al., 2002, Kimeswenger et al., 2002). Several attempts at photometry of the progenitor on archival plates led to different results (Munari et al., 2002, Kimeswenger et al., 2002, Goranskij et al., 2004). While the first two used scans based on the SERC-J plate from 1983 and the UKST-ER plate from 1989, Goranskij et al. (2004) added the UKST-I plate from 1982 and the POSS-I plates from 1952. Munari et al. (2005) used the USNO-B1 catalogue and a revised calibration based on their CCD sequence. The USNO-B1 is based on scans with an 8 bit linear greyscale only. Thus the stellar images are without grey wings and no deblending can be done. There are also two bright objects (USNO-B1.0 0861-0120005 and USNO-B1.0 0861-0120000) at/near the target position. It is also not clear to the reader how Munari et al. (2005) averaged the different bands used in USNO-B1 (POSS-I O and SERC-J). The investigation of the "older twin" of this unusual object — V4332 Sgr (Nova Sgr 1994) — shows the progenitor might be variable during the last years before outburst (Kimeswenger, 2006). This is essential for the investigation of the spectral energy distribution (SED).

Here we used not DSS scans, but the SuperCOSMOS scans (except POSS-I O) of the same plates used by Munari et al. (2002) and Goranskij et al. (2004). These scans have a much higher spatial resolution. Bacher et al. (2005) have shown, that this does not normally improve the photometry of unblended stars. But as already mentioned there, blended objects have often been rejected in their work. V838 Mon is within a small group of stars. Small apertures and high resolution are thus essential here (for a calibration of the "best aperture" see Bacher et al., 2005). Figure 1 shows the increase of quality and better de-blending capabilities using the SuperCOSMOS scans. In addition to the surveys used up to now, the SuperCOSMOS server also provides us with the scans of the new UKST-SR survey. This plate was taken in parallel to the UKST Hα survey for off-band continuum subtraction. It was obtained less than four years before the outburst of V838 Mon and was overlooked up to now. It gives us valuable additional information. All photographic plates were calibrated using the CCD sequence of Munari et al. (2005) and the nonlinear tuning for digitized sky surveys by Bacher et al. (2005). The latter change of the method is the main difference to the calibration used by Kimeswenger et al. (2002). They only used a linear approximation to a few stars having the same magnitude.

The blue bands of the POSS-I and of the SERC-J survey strongly differ in their bandpass. Thus the conversion to standard B magnitudes was used for the comparison. While the B_J conversion is well studied (Bacher et al., 2005) there exist no such extensive studies

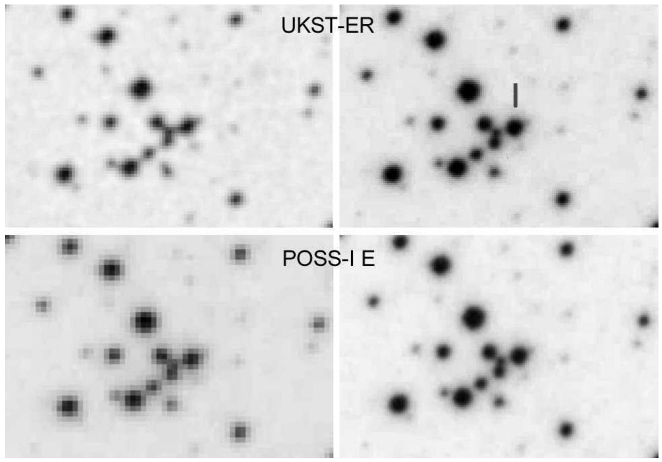

Figure 1. The upper panel shows the 1989 UKST-ER plate. The left hand image is the DSS-2 scan (resolution 1″.01). The right image shows the same plate from the SuperCOSMOS scans (resolution 0″.67). On the DSS-2 scan the stars are clearly elongated and overlap with their neighbors. The lower panel shows the same field on the DSS-1 (resolution 1″.7) POSS-I E plate and again the SuperCOSMOS scan. Here the de-blending problem for V838 Mon is even more obvious

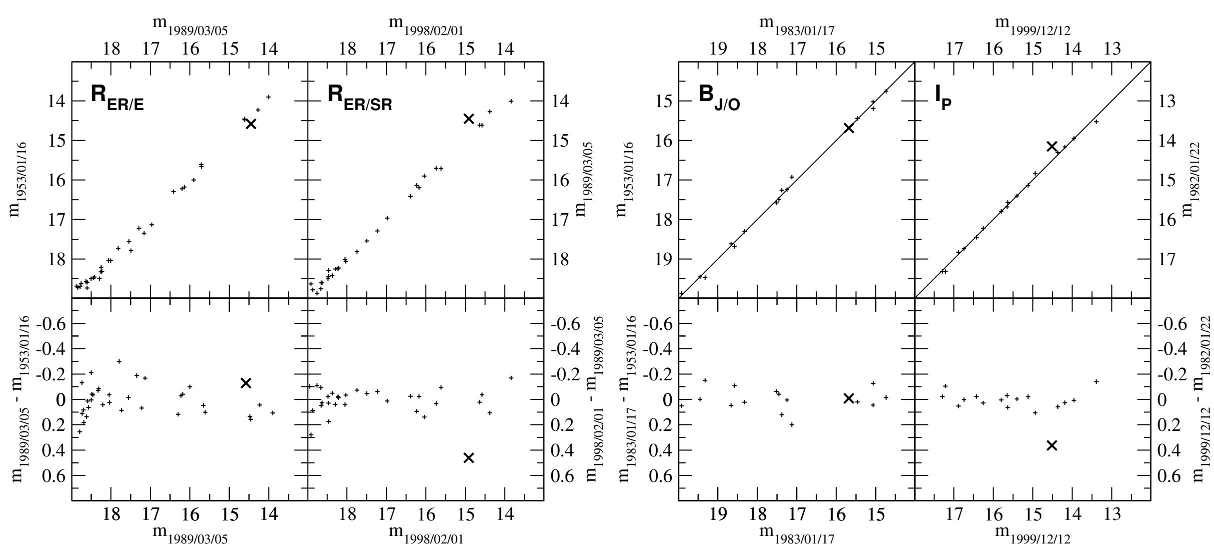

Figure 2. The photographic red band photometries from POSS-I E (1953) and UKST-ER (1989) show no significant variation until at least 1989. The fading of V838 Mon (cross) during the late nineties is evident on the UKST-SR (1998) plate. The blue photometries (converted to standard B magnitudes) show no variations before 1983 either. The I band combines the photographic UKST-IR (1982) plate with the data from the DENIS (1999) CCD survey. The same fading as in the R-band is obvious

for the POSS-I O. Dorschner et al. (1966) assume there is no color correction required. We found with the field stars $m_{\rm O} = {\rm B} - 0.030({\rm B}-{\rm R}) - 0.058$. This correction was applied to derive $m_{\rm O}$ magnitudes of the stars of the CCD sequence for calibration purposes. As most of the field stars are foreground stars with typically $0\overset{\rm m}{.}4 \leq ({\rm B}-{\rm V}) \leq 0\overset{\rm m}{.}8$, this effect is small. This led Goranskij et al. (2004) to the conclusion, that color corrections need not be applied at all. They used a comparison with stars in that color range only. While these field stars have spectral types of A-F with a strong Balmer jump, the progenitor of V838 Mon is a heavily reddened blue object without any Balmer jump. Thus the effective wavelength differs even when they have about the same (B − V) color. This is certainly true for the $\rm B_J \rightarrow B$ conversion. However it is weak at the wavelengths of the SERC-J survey, so it may not affect the work of Goranskij et al. (2004) significantly. It is more significant for the $m_{\rm O} \rightarrow {\rm B}$ calculation (with the filter just on the Balmer continuum absorption).

The last data before the outburst was taken by the DENIS and the 2MASS surveys. The 2MASS survey visited the target twice due to an overlap of neighboring tiles. While the 02/11/1998 data is in the point source data base, another plate was taken just 37 days after that. We have loaded both images from the data base, to redo the photometry on both of them. This gives a good error estimate by using the stars in the overlap of the two observations. Finally we have access to the non-public DENIS images. The DENIS survey is known to sometimes have systematic zero point shifts. The standard survey operations of calibration is insufficient here. Also the $\rm K_s$ band was at its limits for this source. Thus the question arises, whether the difference to 2MASS is therefore high in this band. Using the 2MASS data of the field stars around the target and the improvement of the calibration for DENIS data by Kimeswenger et al. (2004) we obtained a more accurate photometric calibration in J and $\rm K_s$. The corrected values are given in the table below.

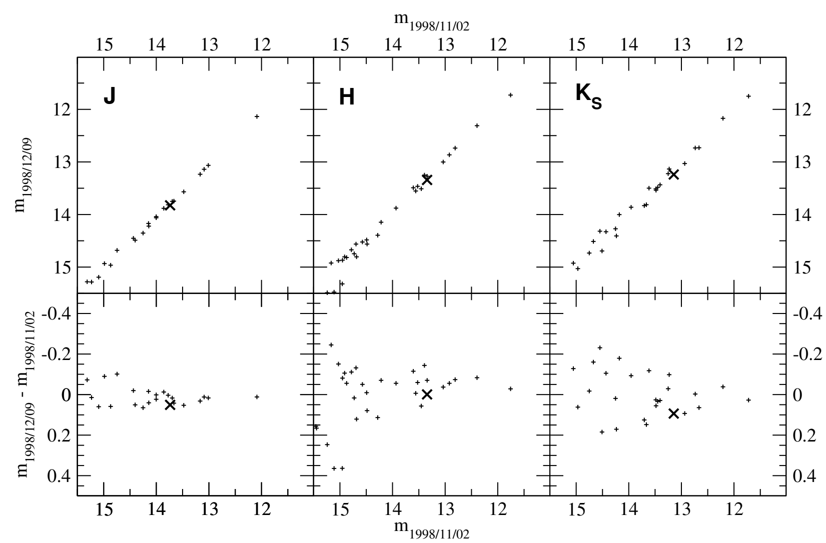

Figure 3. The 2MASS data obtained 2/11/98 vs. those taken 9/12/98

The target seems to be stable before 1990. This corresponds to the finding of Goranskij et al. (2004) who had their last Sonneberg plate 13/03/1991. After this a fading clearly started. The 2MASS data gives a weak indication in all three bands, that this fading continued in late 1998. At the end of 1999 the DENIS J and $\rm K_s$ data show a small re-brightening by about 10%. This is also consistent with the fact that ${\rm I}_{1999} - {\rm I}_{1982} = 0\overset{\rm m}{.}363$ is different from ${\rm R}_{1998} - {\rm R}_{1989} = 0\overset{\rm m}{.}461$ by about ${\rm K}_{1999} - {\rm K}_{1998} \simeq {\rm J}_{1999} - {\rm J}_{1998} \simeq -0\overset{\rm m}{.}1$.

Table 1: Summary of the photometry (sorted by date of observation). The horizontal line in the middle marks the start of the fading. Data before this line should not be mixed with those after the line, when adjusting a SED

date	JD − 2400000.0	material	band name	$\lambda_{\rm eff}$ 1) [μm]	mag	err
16/01/1953	34393.32	POSS-I	E	0.650	$14\overset{\rm m}{.}58$	$0\overset{\rm m}{.}13$
16/01/1953	34393.41	POSS-I	O	0.405	$15\overset{\rm m}{.}68$	$0\overset{\rm m}{.}15$
22/01/1982	44990.57	SERC-I	I_p	0.840	$14\overset{\rm m}{.}15$	$0\overset{\rm m}{.}08$
17/01/1983	45350.52	SERC-J	B_J	0.475	$15\overset{\rm m}{.}49$	$0\overset{\rm m}{.}09$
05/03/1989	47589.47	UKST-ER	r	0.650	$14\overset{\rm m}{.}45$	$0\overset{\rm m}{.}09$
01/02/1998	50844.45	UKST-SR	r	0.650	$14\overset{\rm m}{.}91$	$0\overset{\rm m}{.}10$
02/11/1998	51119.86	2MASS	J	1.150	$13\overset{\rm m}{.}86$	$0\overset{\rm m}{.}03$
			H	1.650	$13\overset{\rm m}{.}50$	$0\overset{\rm m}{.}04$
			K_s	2.150	$13\overset{\rm m}{.}31$	$0\overset{\rm m}{.}04$
09/12/1998	51156.83	2MASS	J	1.150	$13\overset{\rm m}{.}96$	$0\overset{\rm m}{.}04$
			H	1.650	$13\overset{\rm m}{.}55$	$0\overset{\rm m}{.}03$
			K_s	2.150	$13\overset{\rm m}{.}43$	$0\overset{\rm m}{.}05$
12/12/1999	51524.76	DENIS	I_c	0.790	$14\overset{\rm m}{.}52$	$0\overset{\rm m}{.}03$ 2)
			J	1.150	$13\overset{\rm m}{.}82$	$0\overset{\rm m}{.}06$
			K_s	2.150	$13\overset{\rm m}{.}12$	$0\overset{\rm m}{.}07$

1) based on the SED with $T_{\rm eff} > 15\,000$ K and $E({\rm B-V}) \approx 0\overset{\rm m}{.}7$
2) single band — error estimate taken from survey point source catalogue

In our opinion the discrepancies of the photometry mentioned in the introduction originate in the blend with neighboring objects and the different handling of color equations. The new photometry provided here now gives more accurate values for SED fitting. The fading found here might be important for interpreting the nature of this unique object. But even more important is the fact that the photographic data before 1990 should not be used together with the 1998/1999 NIR survey data when fitting the SED or when deriving the foreground extinction. The fading lowered the NIR data and thus leads to an overestimate of the interstellar extinction and/or an overestimate of the progenitors effective temperature. As we do not have blue data during the late nineties, we do not have any idea about a possible color change. Thus we cannot decide, if the fading is caused by a change of the temperature, a contraction of the photosphere, or any other kind of geometric effects.

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BVR$_C$I$_C$ PHOTOMETRY OF THREE RRAB STARS

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The discovery of small amplitude light curve modulation of RR Gem and SS Cnc (Jurcsik et al., 2005, 2006) warns that having not enough extended and accurate photometry similar modulation behaviour of RR Lyrae stars may have escaped detection. In this note CCD observations of three RRab stars (TZ Aur, BH Aur, TW Lyn) extending over 20-30 days intervals are published.

Photoelectric observations of TZ Aur were obtained by Fitch et al. (1966), Sturch (1966), Stepien (1972), and Epstein (1969). Because of the inhomogeneity, their observations did not allow to resolve smaller light curve changes. For TW Lyn and BH Aur only a few, V and R band measurements were published by Schmidt et al. (1995) and Schmidt & Reiswig (1993), respectively. According to our observations the light curves of the three stars remain stable within the accuracy limit of the photometry. Our data do not, however, exclude the possibility of light curve changes on longer time scales.

The observations were made with the 60-cm automatic telescope of Konkoly Observatory, Svábhegy, Budapest, equipped with a Wright 750×1100 CCD camera using BVR_CI_C filters. Log of observations are summarized in Table 1.

Table 1. Log of observations

Star	Comparison	Observation period	No. of nights	filters
TZ Aur	BD +41 1609	2453329 – 2453358	13	BVR_CI_C
BH Aur	GSC 02397-00378	2453743 – 2453762	12	VR_CI_C
TW Lyn	GSC 02971-00853	2453361 – 2453387	17	BVR_CI_C

Data reduction was performed using standard IRAF[1] packages. Instrumental magnitudes were transformed to the standard BVR_CI_C system by observing photometric standards in M67 (Chevalier & Ilovaisky, 1991).

[1]IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

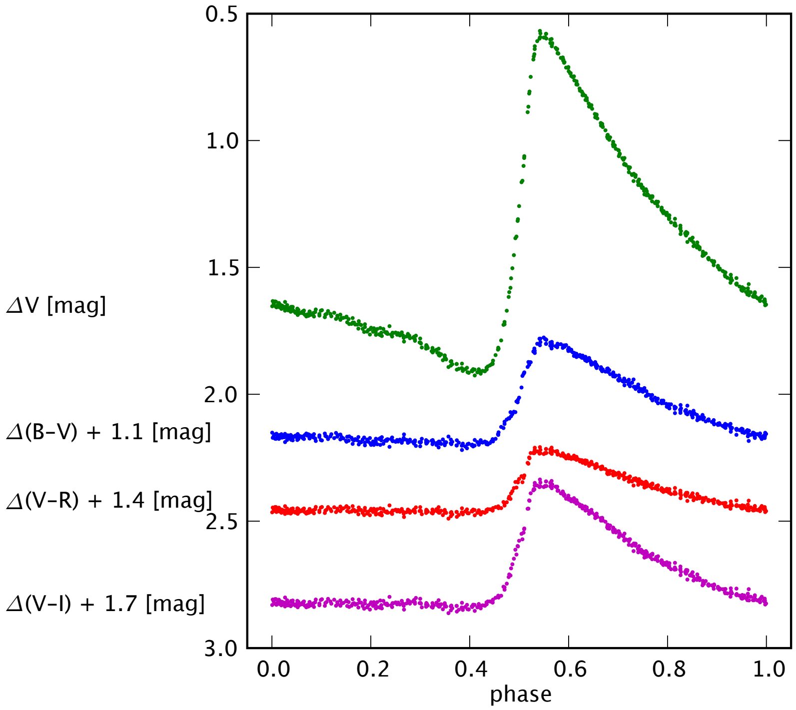

Figure 1. Differential V, $B-V$, $V-R_C$ and $V-I_C$ light and colour curves of TZ Aur

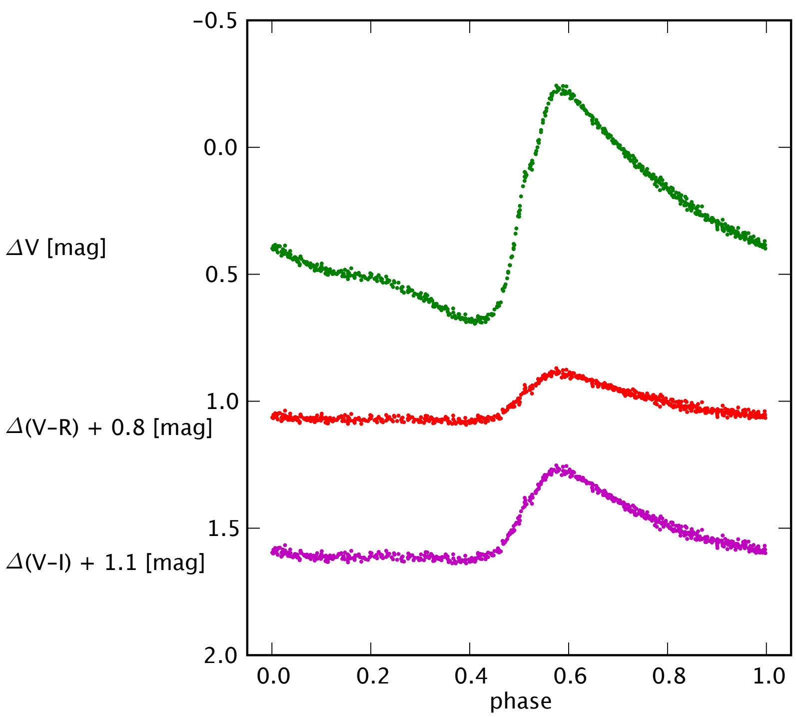

Figure 2. Differential V, $V-R_C$ and $V-I_C$ light and colour curves of BH Aur

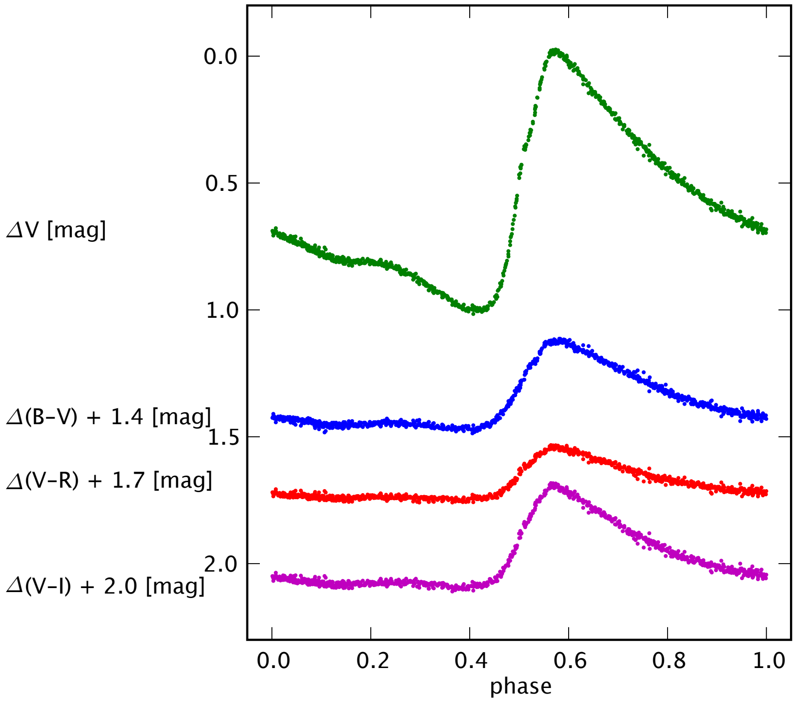

Figure 3. Differential V, $B-V$, $V-R_C$ and $V-I_C$ light and colour curves of TW Lyn

Our photometric data available electronically from the IBVS website list the BVR_CI_C magnitude differences between the variable and the comparison. Standard magnitudes of the comparison stars are available only for TZ Aur in UBV bands (Stepien, 1972). The constancy of the brightness of the comparison stars was checked by measuring magnitude differences to 3-6 other stars in our field of views. The rms. scatter of these data is typically less than 0.01 mag. in each band which equals to the rms scatter of the Fourier fit of the light curves of the variables. The V light curves and the $B-V$, $V-R_C$ and $V-I_C$ colour curves of the three stars are plotted in Figs. 1-3.

Normal maximum timings and the Fourier parameters of the V light curves are listed in Table 2.

Spectroscopic [Fe/H] values from the literature (transformed for the metalicity scale used by Jurcsik & Kovács (1996)) and [Fe/H] calculated from the Fourier parameters according to the formula derived in Jurcsik & Kovács (1996) are given in Table 3.

Table 2. Fourier parameters and normal maximum timings of the V light curves

Star	T_0 [HJD] -2453000	P* [d]	A1 [mag]	R_21	R_31	R_41	R_51	φ_{21}	φ_{31}	φ_{41}	φ_{51}
TZ Aur	343.622	0.3916746	0.441	0.560	0.349	0.238	0.152	2.359	5.094	1.416	4.174
BH Aur	755.264	0.4560898	0.316	0.532	0.326	0.171	0.101	2.606	5.447	2.057	4.707
TW Lyn	375.551	0.4818600	0.344	0.552	0.343	0.195	0.110	2.558	5.358	1.992	4.658

*Taken from the GCVS (Kholopov et al., 1985).

Table 3. Spectroscopic and ‚photometric' [Fe/H] values

Star	[Fe/H] spect.	ref.	[Fe/H] phot.
TZ Aur	−0.60	Layden (1994)	−0.30
	−0.63	Suntzeff et al. (1994)	
BH Aur	+0.14	Fernley & Barnes (1997)	−0.17
TW Lyn	−1.03	Layden (1994)	−0.43
	−0.09	Fernley & Barnes (1997)	

The relative absolute magnitudes of the three stars estimated from the Fourier parameters using the first equation of Table 6. of Kovács & Walker (2001) indicate slight brightness differences between the stars. TW Lyn is the brightest and TZ Aur is the faintest, but the difference between their M_V is only 0.08 mag.

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CCD PHOTOMETRY OF DF Lyr, BY Peg, CW Peg, AND RW Tri

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Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
DF Lyr	EW/D	$18^h53^m34^s.2$	$+28°04'20''$	CTI catalog
BY Peg	EW/KW	$21^h38^m52^s.2$	$+28°05'46''$	CTI catalog
CW Peg	EA/SD	$21^h48^m27^s.6$	$+28°06'29''$	CTI catalog
RW Tri	EA/WD+NL	$02^h25^m36^s.1$	$+28°05'51''$	CTI catalog

Observatory and telescope:

CCD Transit Instrument (CTI), 1.8-m f/2.2 meridian pointing telescope
US Air Force Academy Observatory (AFA), 0.61-m f/15.6 Cassegrain telescope

Detector:	CTI: RCA LN2-cooled CCD, 320 × 512 pixels, 8′.3 wide strip, AFA: Photometrics LN2-cooled CCD, 512×512 pixels, 3′.6 × 3′.6 FOV.
Filter(s):	CTI: BVR, AFA: BVR

Date(s) of the observation(s):

CTI: 1987.10–1991.05, AFA: 2004.02–2005.11

The original CCD/Transit Instrument (CTI) was a stationary, meridian pointing 1.8 meter, f/2.2 optical telescope that imaged a 8.26′ strip of the sky at all right ascensions. CTI operated on Kitt Peak from December 1984 to April 1992 and observed in the meridian at a declination centered at +28°02′ (1987.5 epoch, J2000 equinox), four degrees from the zenith. The resulting CTI survey area not only uncovered a multitude of previously unknown variable stars, but also observed many known variable stars (Wetterer et al. (1996)). This paper reports on observations at the US Air Force Academy (AFA) of four of these previously known variable stars that are eclipsing binary systems. All images were bias subtracted, flat fielded, and the magnitudes of the variable and its comparison stars were extracted using IRAF's aperture photometry.

Photometric characteristics for these stars are listed in Table 1. $V_{\rm Max}$, $V_{\rm MinP}$, and $V_{\rm MinS}$ are the average standard V magnitudes at maximum, primary minimum, and secondary minimum light. AFA magnitudes were transformed to CTI instrumental magnitudes via differential photometry with nearby CTI stars in the same AFA field of view and then to standard magnitudes using previously determined transformation coefficients as detailed in Equations (3) and (4) in Wetterer et al. (1996) and assuming constant $B-V$. Because of the differential photometry between stars on the same field the first order extinction correction is very small and is not applied, the second order term is neglected. Calculated random errors are shown in parentheses while estimated systematic errors introduced by not accounting for the changing $B-V$ with respect to phase are shown in square brackets. We estimated what the systematic error is by using what we know of the system from our Binary Star Maker 3.0 fit to estimate what the $B-V$ is during eclipses and how this would affect the standard magnitude calculation (for RW Tri we used the fact that the GCVS lists the system to have a M0V type star so assumed the primary eclipse's $B-V$ to be 1.4 based on Main Sequence tables we use). CTI/AFA obs is the number of observations from each site. The GCVS period, the Atlas of $O-C$ Diagrams of Eclipsing Binary Stars (Kreiner 2004) period, and period calculated using CTI and AFA V photometry and employing the standard period finding algorithm of Lafler and Kinman (1965) are in days. Finally, new calculated ephemeris light elements (HJD epoch − 2400000, linear term, quadratic term) using new and historical minima timings (uncertainties estimated for those timings whose uncertainties were not reported) are listed in days. The new minima timings were determined from those AFA nights where a minimum was adequately observed using the Kwee and Van Woerden method (Kwee and Van Woerden (1956)). This is not possible for the CTI data because CTI observed each star only once per night, however, approximate CTI minima timings were determined using the most prominent darkenings (close to known minimum magnitude and given an uncertainty related to sharpness of minima) and CTI/AFA period solution in Table 1. All minima timings (HJD − 2400000) are listed in Table 2.

We used Binary Maker 3.0 software and reference manual (Bradstreet (2004)) to obtain preliminary solutions for three of these binaries (RW Tri was excluded due to the volume of literature already available regarding the physical characteristics of this system). Both DF Lyr and BY Peg appear to have rounded minima and smoothly varying light curves characteristic of W UMa eclipsing binaries undergoing partial eclipses. CW Peg, on the other hand, has a deep primary eclipse and a shallow secondary eclipse that was never observed consistent with an Algol type system. For all systems, we assumed both stars were on the Main Sequence and used the measured colors and eclipse depth differences to estimate mass ratios and surface temperatures using tables adapted from Allen (2000). We then adjusted the fillout factor and inclination to most closely reproduce the lightcurve. We also compared the radii of the stars as determined by the fit to the model Main Sequence stars for self-consistency. In this analysis, we used standard values for gravity darkening coefficients (1.00 for radiative stars of $T > 7200$ K and 0.32 for convective stars), limb darkening coefficients (Van Hamme (1993)) and reflection coefficients (1.0 for radiative stars and 0.5 for convective stars) and assumed there was no third light contribution. Table 3 summarizes the results. The V light curves from CTI and AFA data (with Binary Maker 3's fit based on the preliminary solution where applicable) are shown in Figures 1 (DF Lyr), 2 (BY Peg), 4 (CW Peg), and 6 (RW Tri). $O-C$ values (against GCVS light elements) for available data, Kreiner's solution, and solution based on the new ephemerides of Table 1 are plotted in Figures 3 (BY Peg), 5 (CW Peg) and 7 (RW Tri).

Table 1: Photometric characteristics

	DF Lyr	BY Peg	CW Peg	RW Tri
$V_{\rm Max}$	13.031(4)	12.419(8)	11.917(2)	13.082(7)
$V_{\rm MinP}$	13.500(10)[+3]	12.919(9)[+2]	15.352(9)[+103]	15.5(1)[+1]
$V_{\rm MinS}$	13.353(7)[−2]	12.782(6)[−2]	-	-
$V_{\rm Mean}$	13.145(1)	12.585(1)	12.006(1)	13.210(14)
$(B-V)$	0.437(8)	0.849(7)	0.061(6)	0.140(15)
$E(B-V)$	0.27(3)	0.12(1)	0.09(1)	0.07(1)
CTI/AFA obs	27 / 542	22 / 364	22 / 458	54 / 135
GCVS period	0.577128	0.341937	2.372516	0.231883
Kreiner period	0.57712889	0.3419412(2)	2.372521(2)	0.23188318(2)
CTI/AFA period	0.5771285(10)	0.3419371(6)	2.3725201(5)	0.23188297(8)
new ephem epoch	53,522.7396(6)	45,565.4946(8)	53,630.9437(3)	53,639.92521(13)
new ephem linear	0.57712884(3)	0.34193423(8)	2.3725133(15)	0.231882976(6)
new ephem quad	-	$+1.08(3)\times10^{-10}$	$-4.3(5)\times10^{-9}$	$-3.12(6)\times10^{-12}$

Table 2: Minima timings

Object	HJD of Min.	E	Type	Filter
DF Lyr	47,681.91(1)	-10120.5	II	V
	48,101.77(1)	-9393	I	V
	53,513.7956(2)	−15.5	II	V
	53,515.8135(2)	−12	I	R
	53,518.69880(12)	−7	I	V
	53,519.8523(4)	−5	I	V
	53,522.7372(3)	0	I	R
	53,528.7986(3)	10.5	II	R
BY Peg	47,357.92(2)	−18456	I	V
	47,823.64(2)	−17094	I	V
	48,127.79(2)	−16204.5	II	V
	48,175.66(2)	−16064.5	II	V
	48,539.66(2)	−15000	I	B
	53,604.942(3)	−186.5	II	V
	53,628.7084(6)	−117	I	V
	53,628.8751(6)	−116.5	II	V
	53,647.6857(4)	−61.5	II	V
	53,657.7693(2)	−32	I	V
	53,666.6557(3)	−6	I	V
	53,668.71385(17)	0	I	B
CW Peg	47,357.99(3)	−2644	I	B
	47,419.67(3)	−2588	I	B
	53,630.9401(7)	0	I	V
RW Tri	47,475.777(3)	−26583	I	V
	47,823.833(3)	−25082	I	V
	47,833.804(3)	−25039	I	V
	53,626.9326(13)	−56	I	V
	53,639.9221(2)	0	I	V

Table 3: Binary Maker 3 preliminary solutions

	DF Lyr	BY Peg	CW Peg
Mass Ratio ($M_{\rm II}/M_{\rm I}$)	0.73	0.83	0.21
$\rm Fillout_I$	−0.05	0.10	−0.63
$\rm Fillout_{II}$	−0.10	0.10	0.30
$T_{\rm I}$	8400 K	5500 K	10200 K
$T_{\rm II}$	7100 K	5000 K	4300 K
Inclination	77 degrees	71 degrees	86 degrees

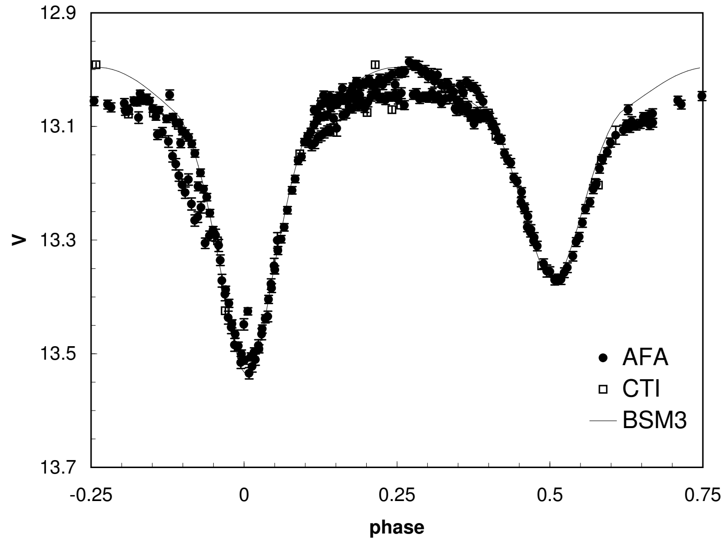

Figure 1. Lightcurve for DF Lyr: $P = 0.5771285(10)$ days, epoch = 2,453,522.7372(3)

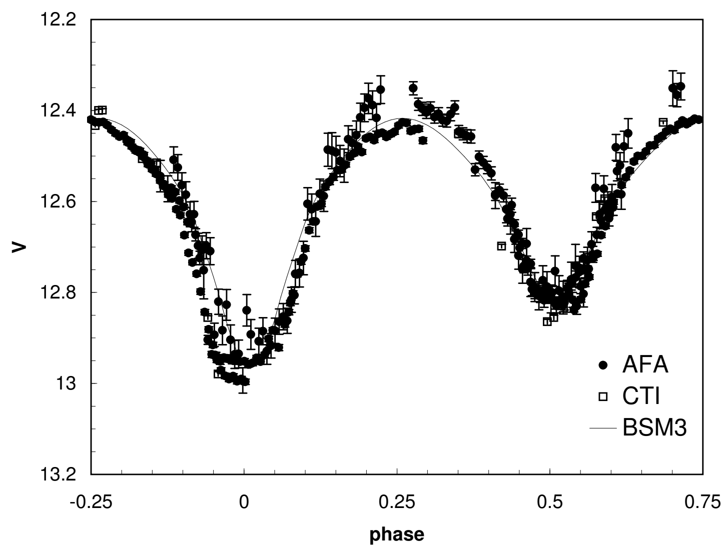

Figure 2. Lightcurve for BY Peg: $P = 0.3419371(6)$ days, epoch = 2,453,668.71385(17)

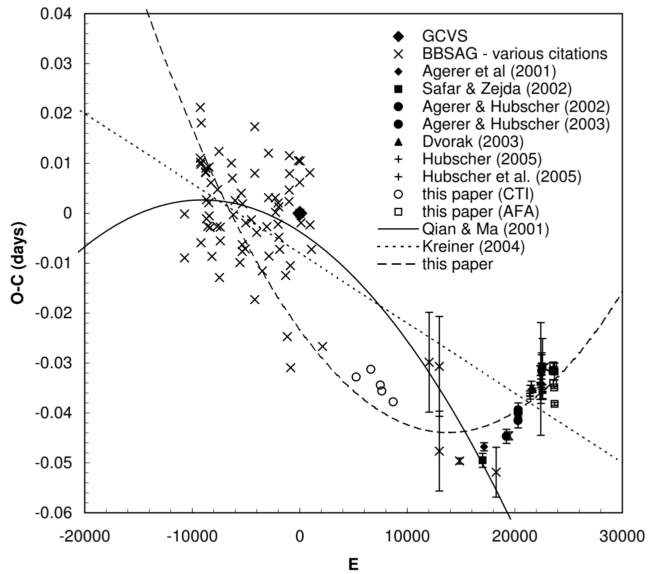

Figure 3. $O - C$ plot for BY Peg using GCVS light elements (BBSAG from Qian and Ma (2001), Diethelm (2005), and Kreiner (2006)

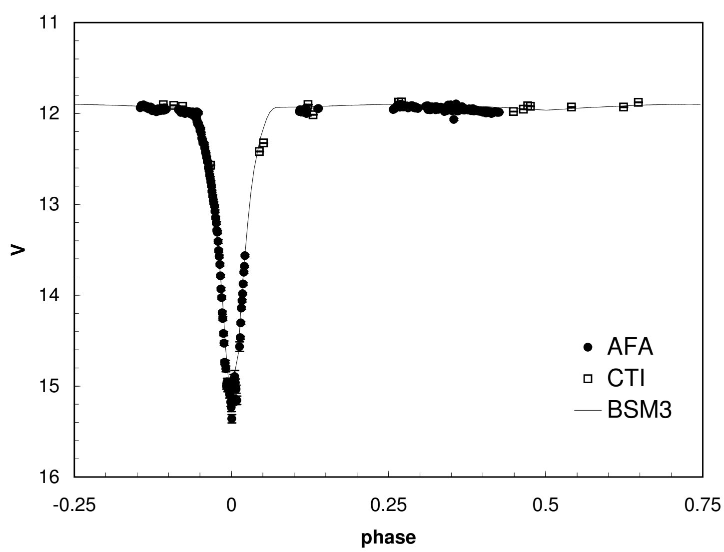

Figure 4. Lightcurve for CW Peg: $P = 2.3725201(5)$ days, epoch = 2,453,630.9401(7)

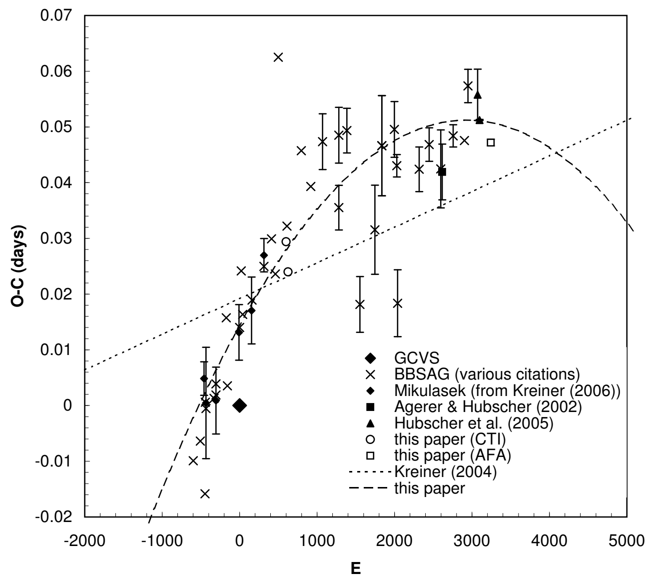

Figure 5. $O-C$ plot for CW Peg using GCVS light elements (BBSAG from Diethelm (2003), Diethelm (2004), and Kreiner (2006))

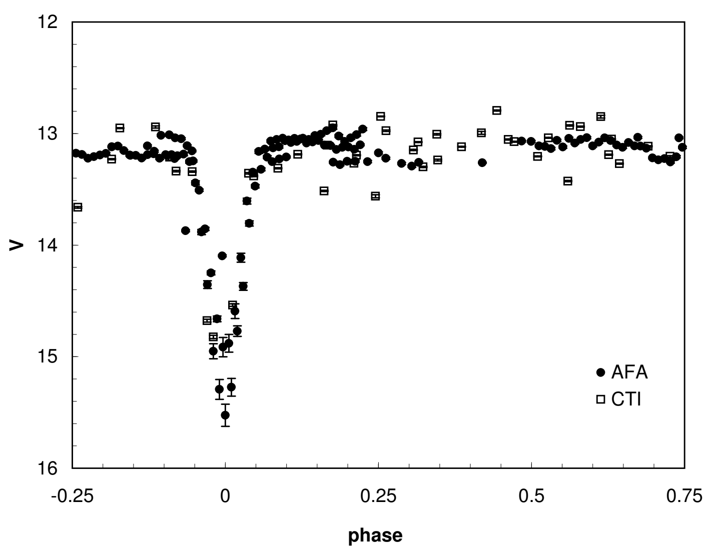

Figure 6. Lightcurve for RW Tri: $P = 0.23188297(8)$ days, epoch = 2,453,639.9221(2)

Notes on individual stars:

DF Lyr is a short-period binary with an EW-type light curve. The preliminary fit indicates a near contact system with radii ~ 7 % smaller than corresponding model Main Sequence stars of the same spectral class. A perfect match is achieved for stars 600 K cooler and is possible if a lower reddening is adopted. The light curve has differences from night to night indicating the possible presence of spots, which may also be producing a larger than expected scatter in the timings in the $O-C$ diagram. With so few timings and having to estimate uncertainties for earlier epochs, a weighted least squares fit to all

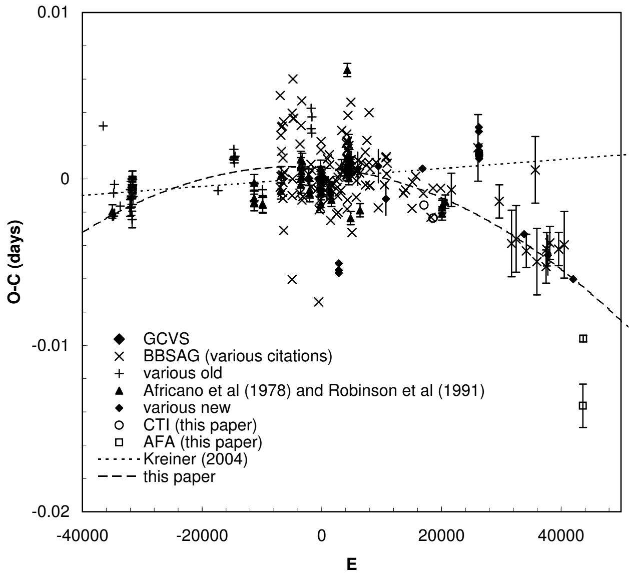

Figure 7. $O-C$ plot for RW Tri using GCVS light elements (BBSAG from Diethelm (2003), Diethelm (2004), Kreiner (2006), and Nelson (2006); "various old" from Walker (1963), Surkova and Skatova (1969), Warner (1973), Winkler (1977), and Protitch, Efimov and Prokofieva from Kreiner (2006); "various new" from Longmore et al. (1981), Smak (1995), Zejda (2004), Krajci (2006), ROTSE from Nelson (2006), and Mikulasek and BRNO observers from Kreiner (2006))

the data yields elements dominated by later epochs and obviously erroneous. The new ephemeris of Table 1 is from a simple least squares linear fit and is essentially identical to Kreiner's solution.

BY Peg is a short-period binary with an EW-type light curve. The preliminary fit indicates a contact system with the primary's radius consistent with the corresponding model Main Sequence star of the same spectral class and the secondary's radius ~ 10 % smaller. The light curve appears to have significant differences from night to night indicating the possible presence of spots or unknown systematic error. The timings in the $O-C$ diagram also displays a larger than expected scatter. Qian and Ma (2001) analyzed $O-C$ values and proposed a revised ephemeris indicating a decreasing period (note that there is an error in Qian and Ma's paper: the exponent of the quadradic term should be -11 and not -8) also shown in Figure 3. It is clear that Qian and Ma's ephemeris is not correct. This paper's new ephemeris of Table 1 uses data after 1970 and indicates the period may actually be increasing at a rate of $dp/dt = +2.31(6) \times 10^{-7}$ day/yr. The three historical timings (one in 1936 and two in 1956) not used do not fit the new ephemeris. Interestingly, the 1936 timing would be close to the new ephemeris if the measured minima was a secondary eclipse and not a primary eclipse.

CW Peg has a deep primary eclipse and very shallow secondary implying a possible semi-detached or Algol-type binary, with the preliminary solution parameters supporting this conclusion. The new ephemeris of Table 1 uses data after 1980 and indicates the period may be decreasing at a rate of $dp/dt = -6.6(8) \times 10^{-7}$ day/yr. The one historical timing from 1936 not used does not fit the new ephemeris.

RW Tri is a nova-like eclipsing binary, well-studied from a variety of perspectives and believed to consist of a late-type star which is transferring material to a companion white dwarf. Past observations have led to the conclusion that it exhibits long-term variations in its mass-transfer rate. The new ephemeris of Table 1 indicates the period may be decreasing at a rate of $dp/dt = -9.8(3) \times 10^{-9}$ day/yr, indicating RW Tri may have entered a period of increased mass transfer.

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CALIBRATION OF A UBVRI SEQUENCE AROUND NOVA Cyg 2006

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Nova Cygni 2006 (= V2362 Cyg) was discovered by H. Nishimura, as reported in Nakano (2006), at mag 10.5 on photographs obtained on April 2.807 UT. Spectroscopic confirmation was given by Yamaoka (2006, and references therein).

The peak brightness reached by the nova ($V \sim 8.5$ on April 5.5 UT) and its slow decline make it a favorable target for protracted observations during the whole summer 2006 season of visibility. To assist interested observers we have calibrated an accurate $UBV(RI)_C$ photometric comparison sequence around the nova, which is identified in Fig. 1 and tabulated in Table 1. The sequence extends over a 6×6 arcmin field centered on the nova itself and the photometric stability of the comparison stars has been checked by repeated observations in twelve independent nights between April and May 2006.

The UBV magnitudes have been calibrated with CCD observations obtained with a variety of private instruments during nine different nights with respect to the Hoag et al. (1961) photoelectric photometry of the nearby open clusters NGC 6910, NGC 6913, NGC 7062, NGC 7063 and NGC 7209. Hoag et al. photometry was obtained with the same instrumentation that was used originally in the definition of the UBV system of Johnson & Morgan (1951, 1953), and it is tightly linked to it. The nova and cluster fields were observed at very similar air-masses during good photometric nights. Color transformation equations were characterized by slopes always within the margins 0.91–1.06. For only two nights the difference in air-mass would project into a ≥ 0.01 mag effect on the derived magnitudes, and for them observations of the reference clusters were protracted long enough to derive the atmospheric extinction coefficients. The telescopes we used were: (*a*) a 0.50-m f/8 Cassegrain reflector equipped with an Apogee Alta 260e CCD camera and Optec UBV filters located on Mt. Zugna, Rovereto (TN), Italy, (*b*) a Newton 0.42-m f/5.5 reflector with an Apogee Alta 260e CCD camera and Schuler UBV filters, located in Bastia (RA), Italy, and (*c*) a Meade RCX 400 12″ f/8 telescope equipped with an SBIG ST-9 CCD camera and native B, V Johnson filters.

The R_C/I_C magnitudes were obtained from the Sonoita Research Observatory (SRO) in southern Arizona (USA), using a 0.35-m robotic telescope and SBIG STL-1001 CCD system. Observations on each photometric night included following an extinction star from

Table 1: Magnitudes and their errors for the stars in the photometric sequence. N indicates the number of nights in which the given star has been measured in the given band. Star a corresponds to TYC 3181-1159-1 = GSC 03181-01159

	U	N_U	B	N_B	V	N_V	$V-R_C$	N_{VR}	$R-I_C$	N_{RI}
a	12.57 ± 0.03	3	11.15 ± 0.01	9	9.70 ± 0.01	9				
b	11.44 ± 0.04	3	11.52 ± 0.01	9	11.23 ± 0.01	9	0.167 ± 0.010	6	0.212 ± 0.018	6
c	11.98 ± 0.04	3	11.94 ± 0.01	9	11.55 ± 0.02	9	0.225 ± 0.014	6	0.261 ± 0.019	6
d	12.89 ± 0.02	3	12.70 ± 0.01	9	12.10 ± 0.01	9	0.338 ± 0.013	6	0.335 ± 0.018	6
e	13.69 ± 0.04	3	13.44 ± 0.01	9	13.05 ± 0.02	9	0.223 ± 0.009	6	0.276 ± 0.017	6
f	14.18 ± 0.04	3	13.95 ± 0.02	9	13.33 ± 0.01	9	0.367 ± 0.014	6	0.364 ± 0.014	6
g	14.46 ± 0.09	3	14.24 ± 0.01	9	13.82 ± 0.01	9	0.244 ± 0.011	6	0.305 ± 0.015	6
h	15.54 ± 0.10	3	14.18 ± 0.02	9	12.70 ± 0.02	9	0.822 ± 0.017	6	0.749 ± 0.019	6
i	14.73 ± 0.05	3	14.32 ± 0.01	9	13.71 ± 0.01	9	0.407 ± 0.014	6	0.421 ± 0.013	6
j	15.52 ± 0.09	3	14.40 ± 0.02	9	12.86 ± 0.01	9	0.910 ± 0.010	6	0.855 ± 0.016	6
l			14.77 ± 0.03	4	14.20 ± 0.04	4	0.326 ± 0.022	6	0.375 ± 0.024	6
m			14.95 ± 0.04	7	13.55 ± 0.01	7	0.783 ± 0.010	6	0.746 ± 0.018	6
n			15.06 ± 0.04	7	14.29 ± 0.02	7	0.476 ± 0.018	6	0.476 ± 0.016	6
p					13.45 ± 0.02	3	0.937 ± 0.010	6	0.862 ± 0.020	6
q					14.56 ± 0.05	6	0.541 ± 0.015	6	0.526 ± 0.019	6

low to high airmass, along with BVR_CI_C exposures of Landolt standard fields (Landolt 1983, 1992). The results were cross-checked using the Asiago 1.82-m and the USNO Flagstaff 1.0-m telescopes and the corresponding equipments.

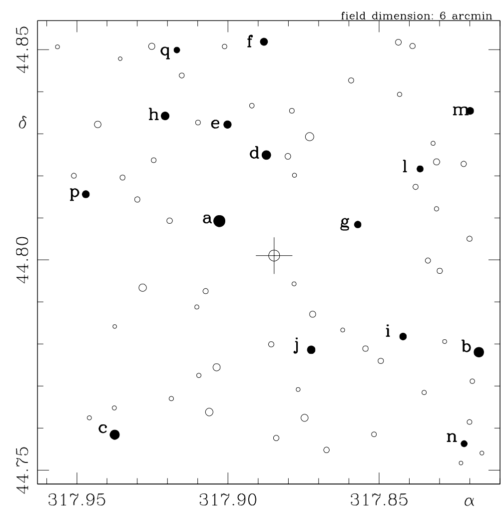

Figure 1. B band finding chart for the photometric sequence. The cross indicates the nova

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SPECTROSCOPY OF THE FAINT DWARF NOVAE DV UMa AND AR Cnc

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Results of time-resolved spectroscopy of the faint dwarf novae DV UMa and AR Cnc are reported. Both objects have attracted little observational attention so far. The present observations were performed using the Low Resolution Spectrograph (LRS) at the 9.2-m Hobby-Eberly Telescope (HET) and the FORS2 instrument at the ESO Very Large Telescope (VLT) Unit No. 2. Table 1 lists the observing log for each object. All spectra were reduced with IRAF† standard tools. Radial velocities were measured using the IRAF 'splot (k)' routine.

Table 1: Journal of observations. UT times refer to the start of the first and last exposure, respectively. The VLT runs were consistently interrupted to observe other targets

Object	Date	First exp. (UT)	Last exp. (UT)	Indiv. exp. time (s)	No. exp.	Res. (Å/pix)	Tel.
DV UMa	2002 Jan. 25	10:31:32	11:28:22	500	7	5	HET[1]
AR Cnc	2001 Feb. 26	01:38:50	03:38:50	480/600	4	1.2	VLT[2]
	2001 Feb. 27	01:49:40	03:08:02	900	2	1.2	VLT[2]
	2002 Feb. 20	09:00:23	09:19:29	800	2	5	HET[1]

1: wavelength range $\lambda\lambda$4400–9200 Å, 2: wavelength range $\lambda\lambda$3700–5900 Å

Table 2: System parameters for DV UMa

i (°)	$M_2/M_\odot$	$M_1/M_\odot$	Type	Reference
72	0.23	0.43	spec.	Szkody & Howell (1993)
71.5–73	0.17	0.31	phot.	Howell & Blanton (1993)
84	0.15	0.90	phot.	Patterson et al. (2000)
84	0.16/0.17	1.14/1.04	phot.	Feline et al. (2004)

DV UMa is known to be a faint ($V \approx 19$) eclipsing ($\Delta V \approx 2$) dwarf nova of SU UMa type. The orbital period amounts to $2^h3^m38^s$. Spectroscopic work on this object is scarce in the literature: Mukai et al. (1990) detected the spectral signature of the secondary in a low resolution spectrum and determined its spectral type to be M4.5. This finding

†IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

was later confirmed by Smith et al. (1997). Szkody & Howell (1993) demonstrated H_β to feature the typical double-peaked line structure of a high inclination system. Based on nine spectra they also derived radial velocities by fitting Gaussians to each of the two peaks of this line with the final velocity being the midpoint of the two Gaussians, respectively. The resulting radial velocity curve ($\gamma = -61 \pm 13$ km/s, $K_1 = 140 \pm 18$ km/s) shows a phase lag of 36° compared to the eclipse thus indicating that the H_β velocities do not exactly reflect the motion of the white dwarf. Therefore, the derived mass estimates given in Table 2 may be less reliable. Table 2 also lists inclinations and masses obtained by several authors using eclipse analyses.

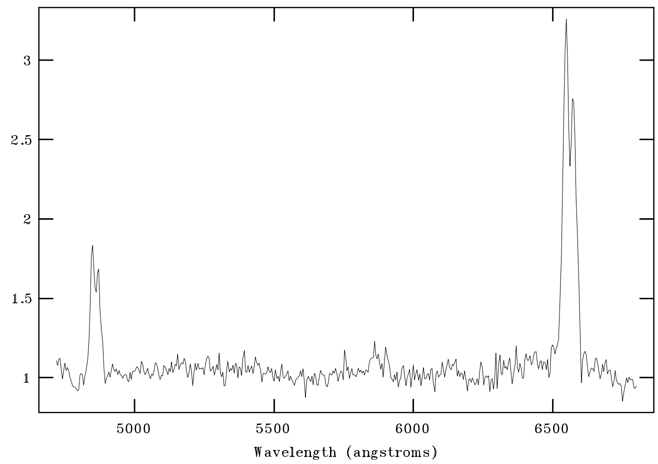

Figure 1. The normalised average spectrum of DV UMa showing the double-peaked lines of H_α and H_β. The He I λ5876 line may also be present

The individual HET spectra of DV UMa (Fig. 1 presents the average spectrum) proved to be suitable to determine the H_α and the H_β velocities in part using the same procedure as Szkody & Howell (1993). Results are shown in Fig. 2. The data points cover roughly half a period and indicate an amplitude $K_1 \approx 115 \pm 20$ km/s as well as a moderate phase lag of about 20°. Assuming $i = 84°$ and $M_2 = 0.16\ M_\odot$ (mass-period relation) one then arrives at $M_1 = 0.39(+0.24/-0.08)\ M_\odot$. Even if the range of dispersion is high and one is aware of the problems in determining the true K_1, the derived range of M_1 is distinctly smaller than the values obtained by recent eclipse analyses. This small mass would be in line with the finding by Webbink (1990) that the mean white dwarf mass for dwarf novae with periods below the gap amounts to $0.5 \pm 0.1\ M_\odot$, which does not, however, exclude a higher value for the individual system DV UMa.

AR Cnc is a faint ($V \approx 19$) dwarf nova which shows deep eclipses (≥ 3 mag) repeating with a period of $5^{\rm h}9^{\rm m}$ (Howell et al. 1990). Spectroscopic confirmation was based on three spectra obtained by Bruch (1989), Mukai et al. (1990) and Szkody & Howell (1992), respectively.

The HET spectra of AR Cnc may resolve one of the puzzling results obtained for this system so far: the spectral features (TiO) to the red side of the A band (Fig. 3) indicate a spectral type around M1 for the secondary rather than M4–M5.5 as deduced by Mukai et al. (1990). This would be in line with the long orbital period of AR Cnc thus supporting a canonical value for the mass of the secondary of about 0.5 $M_\odot$. The unusual high mass

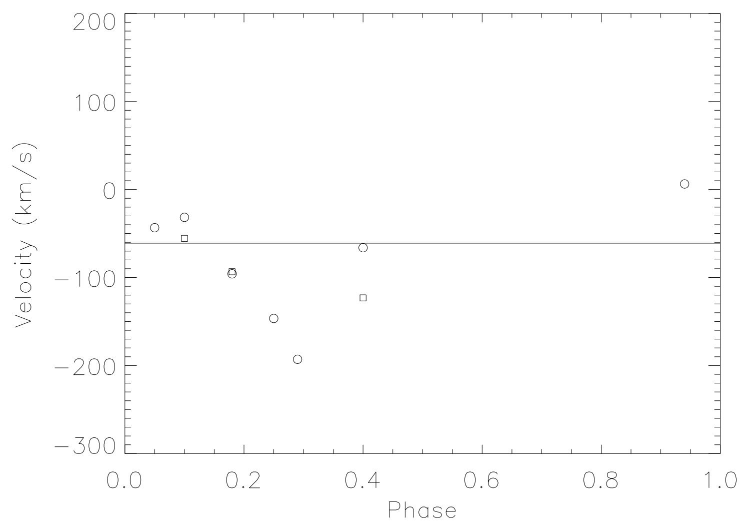

Figure 2. Radial velocities of DV UMa corrected for the motion of the earth (H_α: circles, H_β: squares). Phases are calculated using the precise ephemeris given by Feline et al. (2004). The straight line represents the γ-velocity determined by Szkody & Howell (1993)

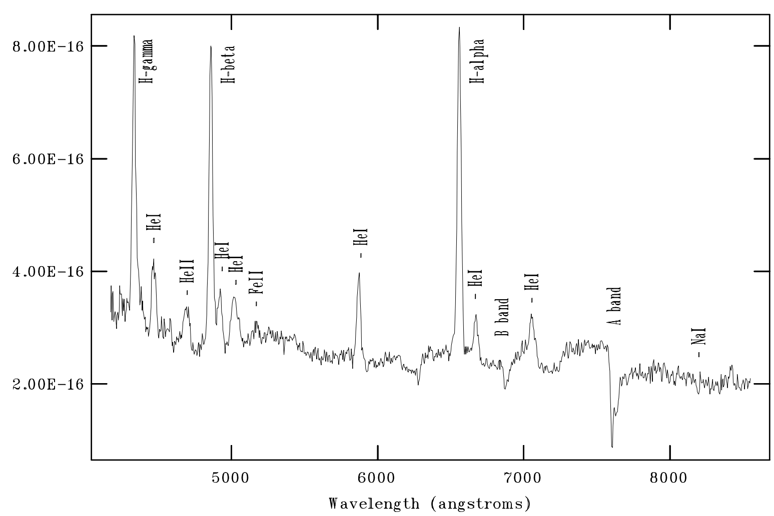

Figure 3. The average flux-calibrated HET spectrum of AR Cnc. It is dominated by Balmer and He I emission lines. Also present are the He II λ4686 and Fe II λ5169 emissions as well as the (unresolved) Na I doublet of the secondary at 8190 Å

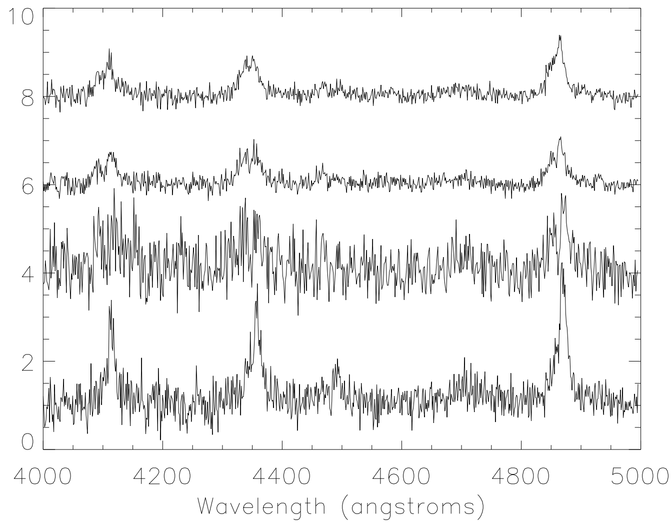

Figure 4. The best VLT spectra of AR Cnc, normalised and separated vertically by offsets (orbital phases from top to bottom: 0.0 (arbitrary), 0.10, 0.67 (bad seeing), 0.71). Note the changing relative intensities and profiles of the Balmer lines

for the primary ($\geq 2.45\ M_\odot$ for $i \geq 80°$) as derived by Howell & Blanton (1993) can only be decreased to a plausible value assuming an inclination $\leq 75°$, which would, however, contradict the large eclipse depth observed and the double-peaked emission lines found by Szkody & Howell (1992). The VLT spectra, though quite noisy (Fig. 4), nevertheless show that the emission lines do not exhibit a permanent double-peaked structure. The profiles vary considerably over the orbital period and may have a quite different appearance even at similar phases. The latter does not necessarily imply such severe variations on a short time scale, because the spectra obtained at phases 0.67 and 0.71 (Fig. 4) are separated by five orbital revolutions.

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165. LIST OF TIMINGS OF MINIMA ECLIPSING BINARIES BY BBSAG OBSERVERS

(BBSAG Bulletin No. 132)

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The following Table lists timings of minima of eclipsing binaries secured by photoelectrical means by BBSAG observers, primarily obtained between July 2005 and June 2006. The given $O-C$ values generally refer to the linear elements of the GCVS (Kholopov et al. 1985), except for the cases stated in the remarks. All times given are heliocentric UTC.

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
SS Aps	p	53556.331	0.006		130	APs	
WX Aps	p	53088.499	0.002	+0.005	412	FH	el.: $2452135.035 + 4.69684 \times E$
	p	53539.387	0.005	−0.003	179	APs	
AS Aps	p	53548.230	0.003		95	APs	GCVS period excluded, close to $0\overset{d}{.}4$
IO APs	p	53559.441	0.020	+1.611	174	APs	
MR Aps	p	53207.419	0.004	−0.009	480	FH	el.: $2452135.852 + 0.52787 \times E$
NT Aps	p	53543.350	0.001	−0.013	100	APs	el.: Hipparcos
	s	53543.497	0.002	−0.014	81	APs	
RafV002 Aps	s	53545.562	0.005	+0.013	57	APs	el.: IBVS, No. 5700
FS Aqr	p	53670.3032	0.0012	+0.0328	14	RD	V; el.: Per. Zv., 22, 327
LT Aql	p	53565.4770	0.0010	+0.0747	24	RD	V
V407 Aql	p	53592.3892	0.0018	+0.4309	15	RD	V
V699 Aql	p	53566.477	0.008	+0.021	12	RD	V
V1075 Aql	p	53557.4155	0.0004	−0.0264	16	RD	V
KO Ara	p	53553.544	0.004		62	APs	
V336 Ara	p	53555.551	0.003	−0.005	120	APs	el.: $2451966.919 + 3.03175 \times E$
V339 Ara	p	53206.435	0.003	+0.016	479	FH	
ZZ Aur	p	53674.4526	0.0006	+0.0141	16	EBl	
	p	53683.4704	0.0009	+0.0136	20	EBl	
	p	53686.4772	0.0002	+0.0143	24	EBl	
	p	53694.2915	0.0008	+0.0128	24	EBl	
	s	53694.5897	0.0010	+0.0104	24	EBl	
	s	53741.4881	0.0010	+0.0140	31	EBl	
	s	53746.2962	0.0007	+0.0124	18	EBl	
	p	53760.4264	0.0004	+0.0141	34	EBl	
	p	53768.245	0.003	+0.017	8	EBl	
	s	53768.546	0.005	+0.017	13	EBl	

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
FO Aur	p	53674.433	0.002	−0.040	21	EBl	
HP Aur	s	53674.3522	0.0013	+0.0476	15	EBl	
HW Aur	s	53674.4248	0.0007	0.0184	23	EBl	el.: IBVS, No. 5016
GSC2393-680 Aur	s	53683.4375	0.0015	+0.0032	14	EBl	el.: IBVS, No. 5699
	p	53683.5913	0.0011	−0.0007	27	EBl	
	p	53686.4416	0.0017	+0.0002	19	EBl	
	s	53686.5983	0.0008	+0.0014	23	EBl	
	p	53694.3571	0.0007	+0.0023	17	EBl	
	s	53694.5141	0.0020	+0.0011	20	EBl	
	p	53694.6702	0.0003	−0.0011	17	EBl	
	p	53705.4330	0.0010	−0.0005	23	EBl	
	s	53705.5913	0.0010	−0.0005	25	EBl	
	s	53741.3591	0.0012	−0.0011	18	EBl	
	p	53741.5188	0.0009	+0.0003	21	EBl	
	s	53760.3483	0.0010	−0.0041	21	EBl	
	p	53760.5127	0.0009	+0.0021	22	EBl	
	s	53768.2638	0.0007	−0.0019	12	EBl	
	p	53768.4251	0.0016	+0.0011	21	EBl	
GSC2903-237 Aur	p	53683.3946	0.0012	−0.0003	10	EBl	el.: IBVS, No. 5699
	s	53683.5942	0.0006	+0.0003	28	EBl	
	s	53686.3792	0.0012	+0.0001	28	EBl	
	p	53686.5791	0.0005	+0.0011	30	EBl	
	s	53694.3367	0.0007	−0.0001	20	EBl	
	p	53694.5367	0.0013	+0.0010	18	EBl	
	s	53705.4779	0.0010	+0.0004	32	EBl	
	p	53705.6755	0.0007	−0.0010	22	EBl	
	s	53741.2885	0.0011	+0.0013	14	EBl	
	p	53741.4860	0.0006	−0.0001	30	EBl	
	s	53760.3851	0.0007	−0.0006	29	EBl	
	p	53760.5831	0.0020	−0.0015	13	EBl	
	s	53768.3423	0.0007	−0.0011	21	EBl	
	p	53768.5430	0.0011	+0.0007	16	EBl	
GSC2915-212 Aur	p	53406.3264	−0.0001		23	EBl	el.: IBVS, No. 5700
	p	53409.3330	0.0005	+0.0007	34	EBl	
	p	53445.4111	0.0013	−0.0003	29	EBl	
	s	53683.6779	0.0009	−0.0009	18	EBl	
	s	53686.6858	0.0021	+0.0005	12	EBl	
	s	53694.210:	0.005	+0.008	9	EBl	
	p	53741.5550	0.0011	+0.0005	27	EBl	
	s	53460.3452	0.0013	−0.0001	17	EBl	
TY Boo	p	53847.4465	0.0007	−0.0235	19	RD	V; el.: BAV Mitt., 68, 21
	s	53847.6090	0.0011	−0.0194	14	RD	V
TZ Boo	s	53847.3649	0.0011	−0.0726	21	RD	V
	p	53847.5104	0.0011	−0.0756	20	RD	V
YY Boo	p	53849.4686	0.0004	−0.1022	23	RD	V
AC Boo	p	53859.5211	0.0003	+0.1034	25	RD	V
AR Boo	p	53859.5407	0.0003	+0.0217	23	RD	V; el.: IBVS, No. 4601
GSC921-412 Boo		53847.4468	0.0007		17	RD	V
GSC2013-288 Boo	p	53382.6234	0.0008	−0.0030	22	EBl	el.: IBVS, No. 5699
	p	53445.3726	0.0010	+0.0006	16	EBl	
	s	53445.5254	0.0017	+0.0018	11	EBl	
	s	53463.4132	0.0008	+0.0056	14	EBl	
	p	53502.3584	0.0004	0.0000	8	EBl	
	s	53502.5128	0.0007	+0.0028	15	EBl	
	p	53515.3906	0.0019	−0.0019	13	EBl	
	s	53515.5444	0.0006	+0.0003	19	EBl	
	s	53517.3660	0.0019	+0.0032	10	EBl	
	p	53517.5157	0.0011	+0.0013	26	EBl	

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC2015-44 Boo	p	53485.3623	0.0005		75	RD	V; el.: ASAS
	s	53847.4969	0.0006		24	RD	V
NSV 6813 Boo	s	53847.4509	0.0009		13	RD	V
VV CVn	p	53849.4391	0.0010	−0.0313	19	RD	V; el.: IBVS, No. 5403
YZ CVn	p	53846.4107	0.0017	−0.0074	10	RD	V
DF CVn	s	53788.3462	0.0018	+0.0393	8	EBl	el.: IBVS, No. 5021
	p	53788.5081	0.0009	+0.0377	10	EBl	
DH CVn	p	53788.4892	0.0006	−0.0123	19	EBl	el.: IBVS, No. 5149
GSC2004-784 CVn	p	53788.4343	0.0016	−0.0018	12	EBl	el.: IBVS, No. 5269
	s	53788.5700	0.0010	−0.0020	12	EBl	
GSC2533-1519 CVn	s	53809.393	0.004	+0.005	13	EBl	el.: IBVS, No. 5541
GSC2534-216 CVn	s	53809.398	0.003	−0.003	10	EBl	el.: IBVS, No. 5403
GSC2534-1121 CVn	p	53809.3467	0.0010	+0.0065	11	EBl	el.: IBVS, No. 5541
GSC2537-520 CVn	p	53809.3599	0.0010	−0.0063	11	EBl	el.: IBVS, No. 5541
GSC2544-1007 CVn	s	53809.4517	0.0010	−0.0027	12	EBl	el.: IBVS, No. 5541
GSC2544-1090 CVn	s	53382.7091	0.0007	−0.0006	13	EBl	el.: IBVS, No. 5699
	p	53445.4256	0.0008	−0.0003	16	EBl	
	s	53463.3712	0.0013	−0.0012	13	EBl	
	s	53502.3537	0.0023	+0.0008	8	EBl	
	p	53502.5464	0.0024	+0.0005	10	EBl	
	s	53515.4755	0.0013	+0.0004	15	EBl	
	s	53517.4051	0.0007	+0.0003	26	EBl	
GSC2545-970 CVn	p	53382.539	0.004	−0.004	6	EBl	el.: IBVS, No. 5699
	s	53382.7261	0.0026	−0.0008	9	EBl	
	s	53445.4833	0.0006	+0.0018	15	EBl	
	s	53463.4644	0.0012	+0.0006	15	EBl	
	s	53502.3652	0.0012	+0.0009	14	EBl	
	p	53502.5476	0.0009	−0.0002	14	EBl	
	p	53515.3925	0.0008	+0.0002	16	EBl	
	s	53515.5758	0.0009	0.0000	15	EBl	
	s	53517.4118	0.0005	+0.0011	23	EBl	
GSC2548-936 CVn	p	53809.4192	0.0018	−0.0044	10	EBl	el.: IBVS, No. 5403
GSC3022-996 CVn	s	53809.352	0.003	−0.002	11	EBl	el.: IBVS, No. 5403
GSC3026-1046 CVn		53788.4428	0.0006	+0.0156	17	EBl	el.: IBVS, No. 5269
GSC3034-299 CVn	p	53382.6910	0.0005	−0.0009	20	EBl	el.: IBVS, No. 5699
	p	53445.4990	0.0012	+0.0005	13	EBl	
	s	53463.4712	0.0010	−0.0002	13	EBl	
	p	53502.3804	0.0003	+0.0005	18	EBl	
	p	53515.4156	0.0010	+0.0004	22	EBl	
	s	53515.607	0.004	−0.006	6	EBl	
	p	53517.3902	0.0005	−0.0011	17	EBl	
EI Cas	p	53660.3060	0.0014	+0.0910	10	RD	V
NN Cas	s	53670.246	0.008	+0.130	18	RD	V
V344 Cas	p	53670.2745	0.0013	−0.1063	14	RD	V
V411 Cas	p	53670.2914	0.0013	+0.1952	18	RD	V
VZ Cep	p	53658.3090	0.0006	−0.0085	15	RD	V
	p	53672.510	0.005	−0.008	198	APs	
GS Cep	p	53670.3134	0.0009	+0.0005	12	RD	V; el.: IBVS, No. 3596
V357 Cep	p	53670.2886	0.0009	−0.2125	14	Rd	V; el.: Brno Contr., 28, 34
TU Cha	p	53554.427	0.010		184	APs	
TX Cha	p	53554.492	0.010		58	APs	
RafV007 Cir	p	53545.391	0.005		95	FH	period close to $0\overset{d}{.}96$
CN Com	p	53844.5790	0.0010	+0.0562	11	RD	V
LL Com	p	53846.3953	0.0008	−0.0448	14	RD	V; el.: IBVS, No. 4386
LO Com	s	53788.4609	0.0011	+0.0059	11	EBl	el.: IBVS, No. 5052
LP Com	s	53788.4521	0.0012	−0.0074	17	EBl	el.: IBVS, No. 5052
GSC1996-437 Com	p	53788.5676	0.0011	−0.0191	15	EBl	el.: IBVS, No. 5269
TW CrB	s	53859.517	0.003	+0.034	7	RD	V
GSC2040-1361 CrB	p	53917.5548	0.0010	−0.0065	17	EBl	R; el.: IBVS, No. 5295
GSC2579-1125 CrB	s	53917.4231	0.0016	−0.0003	10	EBl	R; el.: IBVS, No. 5295

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC2580-2086 CrB	p	53917.4561	0.0012	−0.0099	14	EBl	R; el.: IBVS, No. 5295
V443 Cyg	p	53895.4515	0.0006	−0.0021	27	RD	V
V477 Cyg	s	53899.4726	0.0012	−0.4649	28	RD	V; non-circular orbit
V490 Cyg	s	53660.331	0.005	+0.210	8	RD	V
V725 Cyg	p	53566.4458	0.0015	+0.2332	16	RD	V
V822 Cyg	p	53592.3737	0.0011	−0.1411	15	RD	V
	p	53900.4405	0.0004	−0.1435	25	RD	V
V869 Cyg	s	53660.320	0.008	+0.085	10	RD	V
V880 Cyg	p	53900.4818	0.0005	+0.0003	15	RD	V
V959 Cyg	p	53895.4480	0.0007	−0.0521	29	RD	V
V961 Cyg	p	53592.4161	0.0007	+0.0016	20	RD	V
V1036 Cyg	p	53566.4634	0.0006	+0.0030	13	RD	V; el.: IBVS, No. 5204
V1066 Cyg	p	53557.400	0.005	+0.068	14	RD	V
V1136 Cyg	p	53899.4669	0.0003	+0.0774	35	RD	V
V1355 Cyg	p	53660.306	0.005	+0.045	11	RD	V
	p	53900.4933	0.0014	+0.0438	23	RD	V
V1401 Cyg	p	53592.447	0.008	−0.398	15	RD	V
V2280 Cyg	p	53638.3354	0.0006	+0.0405	16	EBl	el.: IBVS, No. 4996
V2282 Cyg	p	53652.3064	0.0019	−0.0311	13	EBl	el.: IBVS, No. 4996
V2284 Cyg	s	53638.3324	0.0005	−0.0013	14	EBl	el.: IBVS, No. 4985
V2294 Cyg	s	53652.284	0.008	−0.004	7	EBl	el.: IBVS, No. 4995
	p	53652.4555	0.0022	−0.0102	11	EBl	
ET Del	s	53670.2955	0.0008	−0.0169	17	RD	V
EW Del	p	53558.365	0.005	+0.129	102	APs	
	s	53558.571	0.010	+0.140	88	APs	
GG Del	p	53674.3213	0.0014	−0.0232	15	RD	V; el.: IBVS, No. 3406
Z Dra	p	53847.4461	0.0004	−0.1770	33	RD	V
RX Dra	s	53592.4166	0.0022	+0.0426	17	RD	V
AX Dra	p	53847.4711	0.0002	−0.0555	23	RD	V
BX Dra	p	53846.4111	0.0004	+0.0108	10	RD	V; elem IBVS, No. 4266
CK Dra	p	53849.5433	0.0022	+0.1360	50	RD	V; normal minimum
CV Dra	p	53557.3894	0.0012	−0.0019	12	RD	V; el.: BAV Mitt., No. 69
	p	53844.5727	0.0011	−0.0020	13	RD	V
	s	53900.491	0.002	+0.023	22	RD	V
FU Dra	p	53859.5350	0.0003	−0.0104	22	RD	V; el.: Hipparcos
GSC3523-505 Dra	s	53303.2750	0.0006	−0.0001	10	EBl	el.: IBVS, No. 5699
	p	53303.3916	0.0011	−0.0029	12	EBl	
	s	53325.2550	0.0017	−0.0001	12	EBl	
	p	53325.3719	0.0011	−0.0026	13	EBl	
	p	53326.332	0.003	+0.002	12	EBl	
	s	53326.457	0.004	+0.007	10	EBl	
	p	53540.401	0.003	+0.004	8	EBl	
	s	53540.5184	0.0008	+0.0024	8	EBl	
	s	53575.399	0.006	+0.002	11	EBl	
	s	53579.4589	0.0005	+0.0001	9	EBl	
	p	53600.364	0.004	0.000	10	EBl	
	s	53600.4848	0.0018	+0.0016	16	EBl	
	p	53600.6009	0.0014	−0.0018	14	EBl	
GSC3552-321 Dra	p	53303.4075	0.0003	−0.0011	13	EBl	el.: IBVS, No. 5699
	p	53325.2768	0.0013	−0.0025	19	EBl	
	s	53326.3700	0.0011	−0.0028	20	EBl	
	p	53540.4894	0.0015	+0.0024	14	EBl	
	p	53579.4170	0.0019	+0.0002	19	EBl	
	p	53600.4156	0.0012	+0.0029	26	EBl	
GSC3888-464 Dra	s	53612.4519	0.0009	+0.0101	12	EBl	el.: IBVS, No. 5505
	s	53902.4174	0.0010	+0.0084	11	EBl	R

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC3905-60 Dra		53303.416	0.002	+0.004	9	EBl	el.: IBVS, No. 5699
	s	53325.3065	0.0009	+0.0038	24	EBl	
	s	53326.3378	0.0008	+0.0025	27	EBl	
	p	53540.4951	0.0007	+0.0006	17	EBl	
	s	53575.3972	0.0002	+0.0012	18	EBl	
	p	53600.3877	0.0004	+0.0030	32	EBl	
	s	53600.5933	0.0013	+0.0021	16	EBl	
MT Her	s	53900.5117	0.014	+0.0601	14	RD	V; el.: ASAS
V681 Her	p	53565.4968	0.0008	+0.0729	11	RD	V; el.: IBVS, No. 5027
V728 Her	p	53899.4753	0.0006	+0.0667	28	RD	V; el.: IBVS, No. 3234
V1005 Her	p	53899.4691	0.0005	+0.0371	17	RD	V; el.: IBVS, No. 4611
V1033 Her	p	53614.3218	0.0008	−0.0107	12	EBl	el.: IBVS, No. 5146
	p	53917.441	0.004	−0.011	12	EBl	R
V1036 Her	s	53614.4289	0.0006	+0.0036	14	EBl	el.: IBVS, No. 5146
	p	53917.3889	0.0009	+0.0022	15	EBl	R
V1038 Her	s	53614.4238	0.0005	+0.0046	14	EBl	el.: IBVS, No. 5146
	s	53917.4700	0.0014	+0.0086	11	EBl	R
V1039 Her	s	53614.4171	0.0010	+0.0007	12	EBl	el.: BBSAG Bull. 128, 10
	s	53917.5532	0.0006	+0.0034	16	EBl	R
V1044 Her	s	53614.3816	0.0018	−0.0047	12	EBl	el.: IBVS, No. 5192
V1047 Her	s	53614.3342	0.0004	−0.0109	10	EBl	el.: IBVS, No. 5192
V1053 Her	s	53614.3809	0.0007	+0.0039	16	EBl	el.: BBSAG Bull., 128, 10
V1055 Her	s	53614.3297	0.0015	−0.0056	13	EBl	el.: IBVS, No. 5192
V1062 Her	p	53620.4204	0.0017	−0.0078	10	EBl	el.: IBVS, No. 4965
V1067 Her	s	53620.4167	0.0018	−0.0005	14	EBl	el.: IBVS, No. 4966
V1073 Her	s	53620.3489	0.0008	+0.0078	16	EBl	el.: IBVS, No. 4975
	p	53620.4931	0.0007	+0.0048	10	EBl	
GSC1505-565 Her	p	53846.4900	0.0006	+0.1201	20	RD	V; el.: ASAS
	s	53846.6060	0.0006	+0.1181	14	RD	V
GSC1537-1557 Her	s	53612.4616	0.0017	+0.0040	13	EBl	el.: IBVS, No. 5505
	s	53902.4145	0.0015	+0.0083	11	EBl	R
GSC1549-121 Her	p	53612.3165	0.0018	−0.0028	9	EBl	el.: IBVS, No. 5505
	s	53612.5219	0.0025	+0.0038	10	EBl	
	s	53902.4359	0.0013	−0.0016	12	EBl	R
GSC2049-1408 Her	s	53846.5056	0.0003	−0.0053	29	RD	V; el.: ASAS
GSC2056-117 Her	s	53846.4998	0.0004	+0.0540	23	RD	V; el.: ASAS
GSC2083-1870 Her	p	53612.3452	0.0010	+0.0016	12	EBl	el.: IBVS, No. 5306
	s	53612.5256	0.0007	+0.0015	11	EBl	
GSC2613-3432 Her	p	53612.3432	0.0007	+0.0041	12	EBl	el.: IBVS, No. 5306
GSC2614-1369 Her	s	53617.4418	0.0012	+0.0008	20	EBl	el.: IBVS, No. 5516
GSC2615-1821 Her	s	53617.3431	0.0008	+0.0013	12	EBl	el.: IBVS, No. 5516
GSC2618-1385 Her	s	53617.3082	0.0005	−0.0032	10	EBl	el.: IBVS, No. 5516
	p	53617.4782	0.0009	−0.0018	17	EBl	
GSC2629-1932 Her	p	53620.4013	0.0004	+0.0004	14	EBl	el.: IBVS, No. 5333
GSC3097-1297 Her	p	53617.4739	0.0003	+0.0004	18	EBl	el.: IBVS, No. 5564
GSC3098-683 Her	s	53612.4897	0.0014	−0.0033	17	EBl	el.: IBVS, No. 5306
GSC3098-1253 Her	p	53612.3298	0.0021	+0.0058	6	EBl	el.: IBVS, No. 5306
	s	53612.4505	0.0015	+0.0058	12	EBl	
GSC3101-547 Her	s	53617.3741	0.0011	+0.0017	15	EBl	el.: IBVS, No. 5564
GSC3106-1368 Her	p	53652.4051	0.0006	−0.0431	18	EBl	el.: IBVS, No. 5564
GSC3510-5 Her	s	53617.356	0.003	+0.005	14	EBl	el.: IBVS, No. 5564
GSC3510-1283 Her	p	53617.3508	0.0005	−0.0069	10	EBl	el.: IBVS, No. 5516
	s	53617.4892	0.0025	−0.0076	11	EBl	
GSC3528-44 Her	s	53620.2998	0.0006	+0.0029	12	EBl	el.: IBVS, No. 5333
	p	53620.4894	0.0010	+0.0012	14	EBl	
GSC3532-174 Her	s	53620.3495	0.0013	−0.0003	13	EBl	el.: IBVS, No. 5333
	p	53620.4611	0.0016	−0.0025	12	EBl	

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC3532-553 Her	s	53303.3781	0.0004	−0.0004	15	EBl	el.: IBVS, No. 5699
	s	53325.2940	0.0011	+0.0015	17	EBl	
	s	53326.2432	0.0007	−0.0021	16	EBl	
	p	53326.407	0.002	+0.002	14	EBl	
	p	53540.4610	0.0014	−0.0014	15	EBl	
	p	53575.3974	0.0014	−0.0004	14	EBl	
	s	53579.366	0.002	−0.002	13	EBl	
	s	53600.3300	0.0010	+0.0011	9	EBl	
	p	53600.4880	0.0006	+0.0003	28	EBl	
GSC3532-939 Her	p	53620.3724	0.0014	+0.0010	14	EBl	el.: IBVS, No. 5333
BS Lac	p	53674.297	0.008	−0.205	18	RD	V
CG Lac	p	53658.292	0.003	−0.144	12	RD	V
CO Lac	s	53658.3064	0.0004	+0.0096	15	RD	V; non-circular orbit
FL Lac	p	53566.462	0.005	−0.063	18	RD	V
IL Lac	s	53895.4563	0.0005	−0.4676	24	RD	V; el.: IBVS, No. 5621; non-circular orbit
NS Lac	p	53566.4231	0.0009	−0.2054	21	RD	V
XX Leo	p	53846.3884	0.0013	+0.0010	17	RD	V; el.: JAAVSO, 28, 25
AG Leo	p	53849.3757	0.0007	+0.0843	24	RD	V
AH Lyr	p	53557.4002	0.0003	−0.1300	15	RD	V
EX Lyr	p	53899.4677	0.0003	−0.0093	29	RD	V; el.: 2451296.408 + + 0.7172965 × E
MZ Lyr	p	53895.374	0.005	−0.105	9	RD	V
NV Lyr	p	53895.4417	0.0008	−0.0753	26	RD	V
V376 Lyr	p	53899.4893	0.0006	+0.0793	24	RD	V
V400 Lyr	p	53629.3324	0.0011	−0.0276	16	EBl	el.: IBVS, No. 4995
V412 Lyr	p	53566.4536	0.0016	+0.1620	14	RD	V
V574 Lyr	p	53629.2975	0.0012	−0.0060	7	EBl	el.: IBVS, No. 4976
V579 Lyr	p	53629.3480	0.0009	−0.0048	19	EBl	el.: IBVS, No. 4982
V580 Lyr	s	53652.248	0.003	−0.011	10	EBl	el.: IBVS, No. 4982
	p	53652.3922	0.0009	−0.0123	16	EBl	
V582 Lyr	p	53629.3154	0.0014	+0.0299	13	EBl	el.: IBVS, No. 4985
GSC3108-57 Lyr	p	53652.2867	0.0013	+0.0009	14	EBl	el.: IBVS, No. 5525
	s	53652.4680	0.0009	−0.0021	9	EBl	
GSC3109-859 Lyr	p	53652.3904	0.0010	−0.0017	22	EBl	el.: IBVS, No. 5525
GSC3526-1995 Lyr	s	53652.3625	0.0015	−0.0068	13	EBl	el.: IBVS, No. 5525
GSC3526-2369 Lyr	s	53652.4055	0.0008	+0.0063	17	EBl	el.: IBVS, No. 5525
SW Oph	p	53560.432	0.003	+0.305	101	APs	
UU Oph	p	53559.387	0.007	−0.042	147	APs	
V448 Oph	p	53542.348	0.007	+0.032	107	APs	el.: 2426867.378 + + 1.819697 × E
V496 Oph	p	53537.411	0.005	−0.011	67	APs	el.: BAV Rb., 54, 8
	p	53555.437	0.004	−0.016	168	APs	
V509 Oph	p	53556.520	0.004	+0.046	138	APs	
V709 Oph	p	53552.389	0.005	+1.426	88	APs	
V1125 Oph	p	53565.4563	0.0015	−0.0096	16	RD	V; el.: GEOS EB, No. 28
	p	53895.4783	0.0003	−0.0065	26	RD	V
V2332 Oph	p	53565.5153	0.0008	−0.0609	28	RD	V; el.: IBVS, No. 4345
GSC983-1722 Oph	p	53846.5453	0.0004	+0.0007	34	RD	V; el.: ASAS
GSC995-1646 Oph	s	53612.492	0.002	+0.011	10	EBl	el.: IBVS, No. 5505
	s	53902.388	0.003	+0.007	13	EBl	R
NSV9234 Oph	p	53895.4320	0.0004	−0.0178	24	RD	V; el.: IBVS, No. 5630
NSV9637 Oph	p	53895.5071	0.0008	−0.0026	14	RD	V; el.: IBVS, No. 5644
U Peg	p	53674.302	0.003	−0.108	8	RD	V
SvkV001 Peg	p	53551.532	0.003	−0.008	202	APs	el.: IBVS, No. 5700
SvkV002 Peg	p	53553.650	0.007	−0.051	89	APs	el.: IBVS, No. 5700
SvkV003 Peg	p	53542.553	0.007	+0.012	45	APs	el.: IBVS, No. 5700
	s	53543.572	0.009	+0.020	75	APs	
SvkV005 Peg	p	53556.349	0.007		209	APs	
VZ Psc	s	53674.340	0.003	+0.006	18	RD	V; el.: ApJ Suppl., 58, 413

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
DK Sge	p	53592.3950	0.0011	+0.1371	22	RD	V
GSC2035-175 Ser	s	53917.5096	0.0009	+0.0078	17	EBl	R; el.: IBVS, No. 5295
GSC1830-1432 Tau	p	53683.4056	0.0021	+0.0027	11	EBl	el.: IBVS, No. 5699
	s	53683.5398	0.0010	+0.0010	16	EBl	
	P	53683.6726	0.0006	−0.0021	17	EBl	
	p	53686.3901	0.0024	−0.0029	16	EBl	
	s	53686.5286	0.0014	−0.0003	18	EBl	
	p	53686.6634	0.0012	−0.0014	15	EBl	
	p	53694.2780	0.0015	+0.0021	9	EBl	
	s	53694.4147	0.0010	+0.0029	16	EBl	
	p	53694.5467	0.0014	−0.0010	16	EBl	
	s	53694.6829	0.0011	−0.0008	14	EBl	
	p	53705.4217	0.0018	+0.0009	21	EBl	
	s	53705.5584	0.0012	+0.0017	19	EBl	
	p	53705.6913	0.0022	−0.0013	18	EBl	
	p	53741.3032	0.0006	+0.0015	19	EBl	
	s	53741.4375	0.0010	−0.0001	22	EBl	
	p	53741.5724	0.0013	−0.0012	17	EBl	
	p	53760.3311	0.0010	+0.0016	22	EBl	
	s	53760.4671	0.0009	+0.0017	17	EBl	
	s	53768.3492	0.0007	+0.0008	18	EBl	
	p	53768.4878	0.0014	+0.0035	18	EBl	
GSC1848:1264 Tau	p	53683.4307	0.0014	−0.0019	15	EBl	el.: IBVS, No. 5699
	s	53683.6080	0.0010	+0.0016	23	EBl	
	s	53686.3878	0.0012	0.0000	14	EBl	
	p	53686.5598	0.0009	−0.0019	29	EBl	
	s	53694.3846	0.0003	+0.0002	19	EBl	
	p	53694.5591	0.0013	+0.0009	20	EBl	
	p	53705.333	0.003	−0.003	8	EBl	
	s	53705.5131	0.0008	+0.0030	26	EBl	
	p	53705.6854	0.0009	+0.0015	26	EBl	
	s	53741.3209	0.0004	+0.0001	18	EBl	
	p	53741.4933	0.0005	−0.0013	18	EBl	
	p	53760.2680	0.0015	−0.0012	16	EBl	
	s	53760.4452	0.0009	+0.0022	23	EBl	
	p	53768.256	0.003	−0.009	10	EBl	
	s	53768.4418	0.0007	+0.0022	21	EBl	
XZ UMa	p	53849.4038	0.0003	−0.0811	31	RD	V
AA UMa	p	53846.4016	0.0004	+0.0304	12	RD	V
IW UMa	p	53849.4346	0.0005	+0.0084	22	RD	V; el.: IBVS, No. 4402
AH Vir	s	53859.4395	0.0008	−0.0213	11	RD	V
HW Vir	s	53555.3750	0.0004	+0.0024	18	EBl	el.: AA 364,199
GSC2850-1075 Vir		53553.316	0.004		55	APs	
NSV5987 Vir	p	53849.4542	0.0012	−0.0098	16	RD	V; el.: IBVS, No. 5630
DR Vul	s	53899.4721	0.0015	+0.2062	25	RD	V; non-circular orbit
GV Vul	p	53900.4737	0.0010	+0.0621	25	RD	V

Observers:

EBl :	E. Blättler	Wald, Switzerland
RD :	R. Diethelm	Rodersdorf, Switzerland
FH :	F. Hund	Hakos Farm, Namibia
APs :	A. Paschke	Rüti, Switzerland

Reference:

Kholopov, P.N., Samus, N.N., Frolov, M.S., Goranskij, V.P., Gorynya, N.A., Kireeva, N.N., Kukarkina, N.P., Kurochkin, N.E., Medvedeva, G.I., Perova, N.B., Shugarov, S.Yu., 1985, *General Catalogue of Variable Stars*, Moscow

ERRATUM FOR IBVS 5230

In IBVS 5230 we published several times of minima. One is corrected here. Instead of:

```
XZ Leo 52274.5538 .0002 I V -0.0330 "
```

the following should read:

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XZ Leo 52274.5955 .0002 I V +0.0054 "
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Szilárd Csizmadia

ERRATUM FOR IBVS 5438, 5543, 5713

As Dr. Samus reported, the star erroneously labelled GSC 02850-01075 is really GSC 00285-01075.

The Editors

COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

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Konkoly Observatory
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ACCURATE BV LIGHTCURVE OF THE ECLIPSING BINARY V1898 Cyg

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[2] INF Osservatorio Astronomico di Padova, Sede di Asiago, I-36032 Asiago (VI), Italy

Name of the object:
V1898 Cyg = HD 200776

Equatorial coordinates:	**Equinox:**
R.A.= $21^h03^m53\overset{s}{.}8$ **DEC.**= $+46°19'50''$	2000

Observatory and telescope:
28-cm Schmidt–Cassegrain telescope

Detector:	Optec SSP5 photoelectric photometer

Filter(s):	BV

Date(s) of the observation(s):
From July 22, 2003 to September 17, 2004

Comparison star(s):	HD 200595 (B3V); adopted magnitudes $V = 6.486$, $B - V = -0.137$ transformed from Tycho-2 V_T, B_T values following Bessell (2000); the same comparison star adopted by McCrosky and Whitney (1982) and Halbedel (1985)

Check star(s):	HD 201666 (B2V); adopted magnitudes $V = 7.643$, $B - V = -0.013$ transformed from Tycho-2 V_T, B_T values following Bessell (2000)

Availability of the data:
Available at the IBVS website and http://ulisse.pd.astro.it/V1898Cyg/index.html

Type of variability:	EB

Transformed to a standard system:	Yes
Standard stars (field) used:	

Remarks:
Abt et al. (1972) discovered V1898 Cyg as a single lined spectroscopic binary with a period of 2.9258 days. Photoelectric photometry by McCrosky and Whitney (1982) fitted to this period was unable to provide a reasonable light curve. Later on, Halbedel (1985) obtained 110 pairs of B, V photoelectric measurements and indicated an orbital period of 3.0239 days with nearly equally deep eclipses. The Variability Annex to the Hipparcos Catalog suggests that the depth of primary and secondary eclipses should be markedly different and that the orbital period should be around half of the previously published values. Our extensive (607 points in V band, 559 in B band) and accurate (r.m.s. error 0.006 mag in B, 0.008 mag in V) photoelectric photometry provides the first complete mapping of the light and color curves (see Figure 1) of this interesting early type binary (B2III, Fehrenbach et al. 1962). The data show that the correct orbital ephemeris for primary minimum in V band is: $$\mathrm{Min\ (I)} = 2452901.3740(\pm 0.0001) + 1.51311(\pm 0.000005) \times E.$$ Heliocentric times of primary minima are 2452895.3220 ($\pm$ 0.0002) and 2452901.3740 ($\pm$ 0.0001) in V band, 2453246.3663 ($\pm$ 0.0005) in B band.

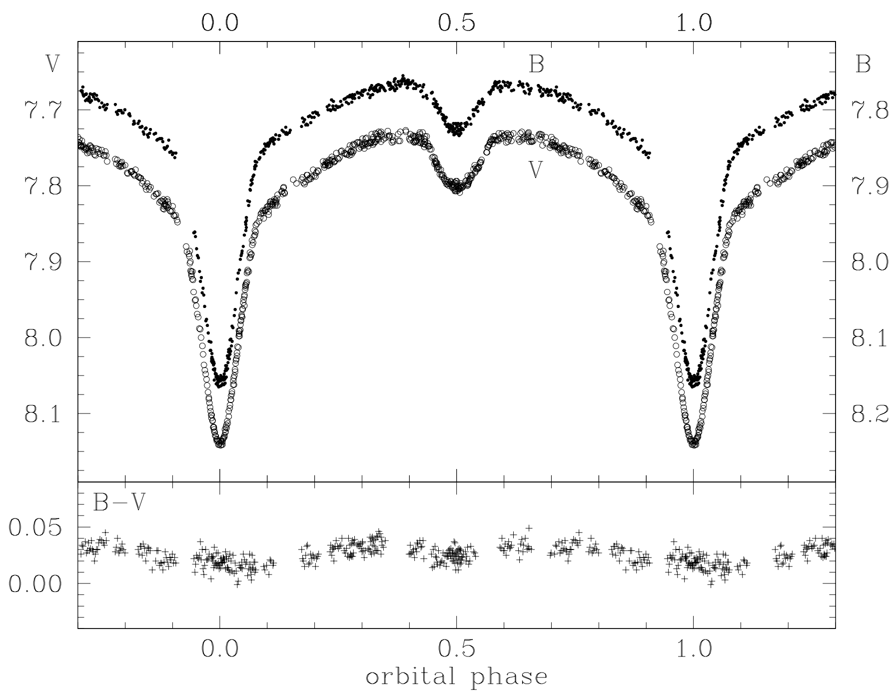

Figure 1. The complete B and V light curves and $B-V$ color curve for V1898 Cyg

References:

Abt, H.A., Levy, S.G., Gandet, T.L., 1972, *AJ*, 77, 138
Bessell, M.S., 2000, *PASP*, 112, 961
Fehrenbach, C. et al., 1962, *J. Obs.*, 45, 349

Halbedel, E.M., 1985, *IBVS*, No. 2663
McCrosky, R.E., Whitney, C.A., 1982, *IBVS*, No. 2186

ERRATUM FOR IBVS 5714

The true shape of the eclipsing binary light curve and the modified, correct period of V1898 Cyg was already published in IBVS 5699/76 (2005, July 20) by Caton & Smith (http://www.konkoly.hu/cgi-bin/IBVS?5699#76).

The Editors

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THE CLASSICAL ALGOL XZ UMa — OBSERVATIONS AND ANALYSIS

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XZ UMa (= SV*BV 32 = BD+50 1651 = TYC 3429 1530, $9^h31^m24^s.5$, $+49°28'03''$, J2000.0) is listed in the General Catalogue of Variable Stars, 4th Edition (Kholopov, 1985) as type EA/SD, period = 1.22232 days, spectral type A5 + F9, and referenced to Remus (1956), who provided the chart (and is presumably the discoverer), and to the authors of the GCVS (who presumably determined the period).

No published light curves or analysis could be found (although there are catalogue parameters given—see Brancewicz & Dworak (1980) and Svechnikov & Kuznetsova (1990)), nor is there any evidence of any existing radial velocities, so this system was selected for study.

Times of minima have been continuously observed since about 1970; an $O - C$ plot (Nelson, 2005a) reveals continuous changes in the period, alternately increasing and decreasing, which suggests a sinusoidal relationship of period 7770 days. (However, this relationship—if it exists—has been observed over only one putative sine period and is therefore highly speculative.)

The following elements (calculated from the last few hundred cycles) were used for phasing:

$$\text{JD Hel Min I} = 53048.7928(32) + 1.2223115(10) \times E.$$

Eleven high-resolution (10 Å/mm) spectra were taken by one of the authors (RHN) in April 2005 at the Dominion Astrophysical Observatory (DAO) in Victoria, British Columbia, Canada. The spectral range was 4997–5260 Å. A log of observations and the derived heliocentric radial velocities is presented in Table 1 and a list of IAU Standard Radial Velocity Stars (Roberts & Boksenberg, 1986) from which the XZ UMa radial velocities were derived is given in Table 2.

Intermediate reductions (overscan removal, cosmic ray cleaning, setting apertures, fitting background, summation of counts, reduction to 1 dimension, calibration from Fe-Ar arc spectra, and finally dispersion correction) were performed by Ravere, software developed by one of the authors (Nelson, 2005b). Final determination of radial velocities was performed by “Broad”, software developed by the same author that uses the Rucinski broadening functions (Rucinski, 2004). As expected, there was some scatter in the values

Table 1

DAO Image #	Start time (HJD – 240000)	Exposure (sec)	Phase at mid-exp	V_1 (km/s)	V_2 (km/s)
3139	53487.6569	3000	0.081	−78	67
3141	53487.7072	3600	0.122	−104	93
3143	53487.7570	3600	0.163	−120	125
3146	53487.8125	3600	0.209	−127	149
3007	53481.7576	3600	0.255	−137	144
3118	53486.6574	3600	0.264	−133	151
3124	53486.7500	3600	0.339	−120	139
3128	53486.8048	3600	0.384	−99	110
3179	53489.6527	7200	0.748	90	−185
3064	53483.6757	3600	0.824	76	−170
3155	53488.6549	3600	0.898	44	−121

Table 2

DAO Image #	Star HD-	V (mag)	Sp. Type	RV (km/s)
3004, 3033	089449	4.78	F6 IV	6.3
3036, 3069	102870	3.59	F8 V	4.3
3019	149803	8.58	F7 V	−7.5
3022, 3057, 3193	154417	6.00	F9 V	−16.8
3026, 3061	187691	5.12	F8 V	0

for a given XZ UMa spectrum from the various radial velocity standard spectra. The mean and standard deviation were taken and those values lying outside twice the sample standard deviation were rejected. In this way, the standard deviations for each radial velocity determination of V_1 and V_2 averaged 6.5 and 8.5 km/s (resp.); the rms deviations from the best-fit WD radial velocities were 7.5 and 11.0 km/s (resp.). Conversions from geocentric radial velocities (relative to that of IAU standard stars) to heliocentric radial velocities was accomplished by one of the authors (RHN) using his own software.

Photometric observations were carried out by DT and JG in the B, V and I_c bands; 754, 770 and 815 values were obtained, respectively. The 14" telescope at the Sonoita Research Observatory (SRO), equipped with a Santa Barbara Instrument Group STL-1001E camera was used to obtain the photometric data. The usual data processing procedures (bias and dark subtraction and flatfielding) were done using IRAF†. Comparison stars are listed in Table 3; the magnitudes and colours are from the Tycho catalogue (ESA, 1997). The data are in the SRO instrumental system

We used the latest version of the Wilson–Devinney (WD) light curve and radial velocity analysis program with the Kurucz atmospheres (Wilson & Devinney, 1971; Wilson, 1990; Kallrath et al., 1998) to analyze the data. To get started, we used the above $B-V=0.20\pm0.04$; the tables of Flower (1996) gave temperature $T_1=7766\pm240$ K; interpolated tables from Cox (2000) gave $\log g=4.282$; an interpolation program by Terrell (1994) gave the (van Hamme, 1993) limb darkening values; and finally, a logarithmic ($LD=2$) law was selected, appropriate for hotter stars (Bessell, 1979). Fitting a double sine wave

†IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

Table 3

Star	GSC ID	V	$B-V$
Var	3429-1530	10.49	0.20
Comp	3429-449	10.33	0.36
Check	3429-1027	9.96	0.53

Table 4

Quantity	Value Star 1	Value Star 2	Error	Quantity	Value	Error
F	1.000	1.000	[fixed]	i (deg)	83.96	0.06
g	1.000	0.320	[fixed]	$L_1/(L_1+L_2)$ (B)	0.820	0.001
A	1.000	0.500	[fixed]	$L_1/(L_1+L_2)$ (V)	0.728	0.002
x (bol)	0.673	0.642	[fixed]	$L_1/(L_1+L_2)$ (I)	0.609	0.002
y (bol)	0.203	0.166	[fixed]	ϕ_0	0.0006	0.00004
x (B)	0.822	0.847	[fixed]	e	0	[fixed]
y (B)	0.332	0.059	[fixed]	a (solar radii)	7.02	0.1
x (V)	0.716	0.784	[fixed]	V_γ (km/s)	−20.4	0.2
y (V)	0.284	0.181	[fixed]	r_1 (pole)	0.2389	0.0008
x (I)	0.507	0.631	[fixed]	r_1 (point)	0.2457	0.0009
y (I)	0.213	0.225	[fixed]	r_1 (side)	0.2416	0.0008
T_1 (K)	7766	—	240	r_1 (back)	0.2445	0.0008
T_2 (K)	—	5346	5	r_2 (pole)	0.3176	0.0004
Ω	4.794	—	0.013	r_2 (point)	0.4542	0.0016
f (fill factor)	−4.470	0.000	0.040	r_2 (side)	0.3320	0.0004
$q = M2/M1$	0.626		0.003	r_2 (back)	0.3642	0.0004

to the radial velocity data gave a mass ratio of $q = M_2/M_1 = 0.658 \pm 0.029$ km/s and a centre of mass radial velocity $V\gamma = -19.5 \pm 0.9$ km/s.

The general appearance of the light curve suggested a detached or semidetached system. Mode 5 (semidetached—Algol) gave the best fit. We selected radiative values for the bolometric albedo and gravity darkening exponents (albedo $A_1 = 1$ and gravity exponent $g_1 = 1$) for star 1 and convective values ($A_2 = 0.5$ and $g_2 = 0.32$) for star 2 based on temperature T_1 and the anticipated temperature T_2, respectively.

Because of the changes in the $O-C$ diagram that suggest a third body, we attempted to adjust third light in the simultaneous light/radial velocity curve solution. However, we could find no statistically significant value of third light in any of the three passbands. Because of the difficulty in recovering small amounts of third light, especially in partially eclipsing systems like XZ UMa, our null result on third light should not be taken as necessarily negating the third body hypothesis. We also adjusted the angular rotation rate of the primary but we found no evidence of asynchronism. Further, attempts with a detached configuration gave a poorer fit, hence the detached configuration can be ruled out.

The results of the fit are listed in Table 4 and fundamental derived quantities, in Table 5. [Note: 's.u.' = solar units.] Note also that the errors quoted are the standard errors computed from the covariance matrix in the differential corrections solution.

A 3-D representation generated by Binary Maker 3.03 (Bradstreet, 1993) is presented in Figure 3.

Table 5

Fund. Quantity	Star 1	error	Star 2	error
Spectral Type	A7		G7	
Mass ($M_\odot$)	1.92	0.09	1.20	0.05
Radius ($R_\odot$)	1.70	0.03	2.38	0.04
$\log g$ (CGS)	4.26	0.2	3.76	0.2
Luminosity ($L_\odot$)	9.5	0.1	4.2	0.1
Distance (pc)	504	26		

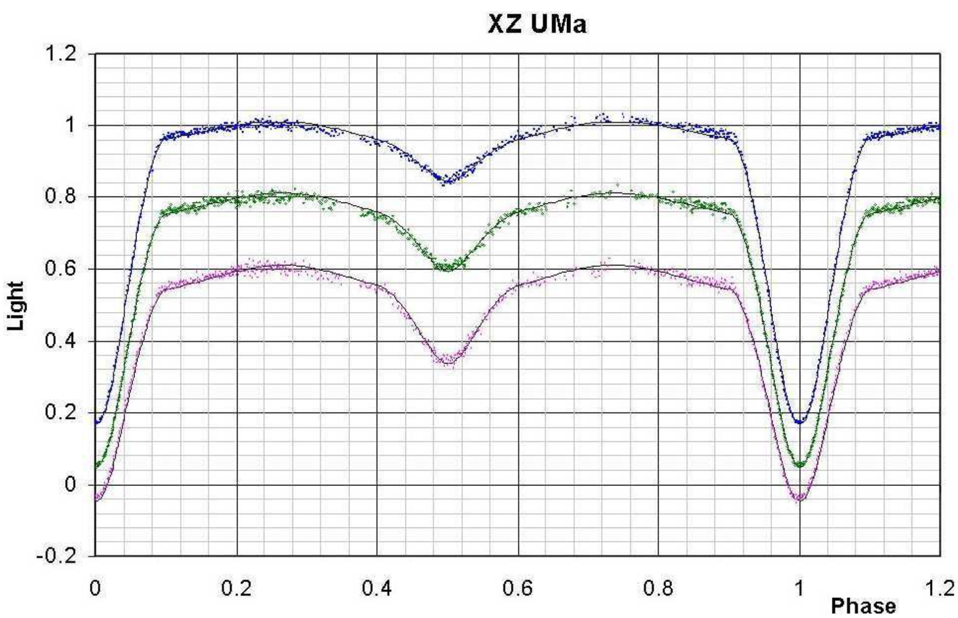

Figure 1.

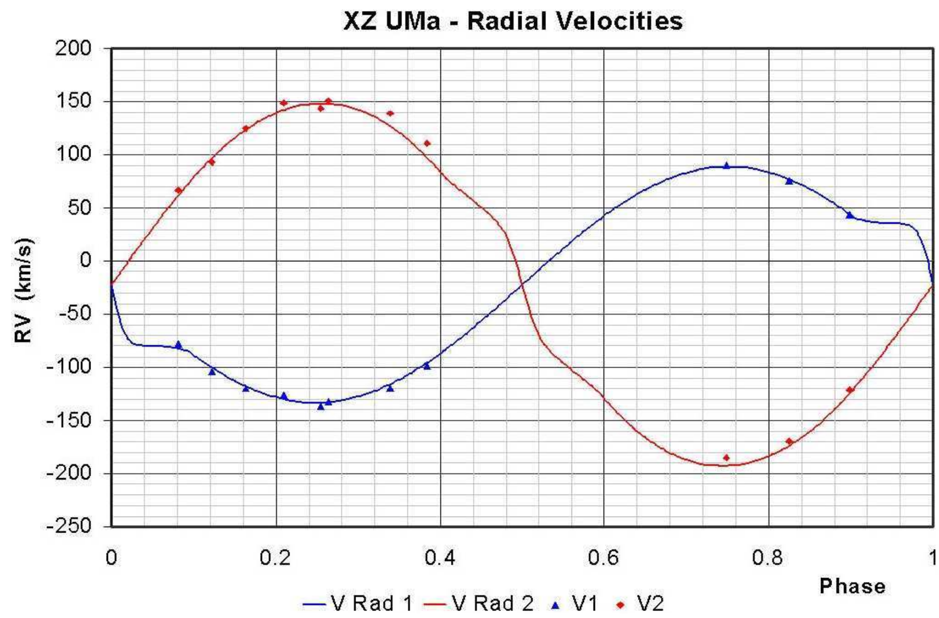

Figure 2.

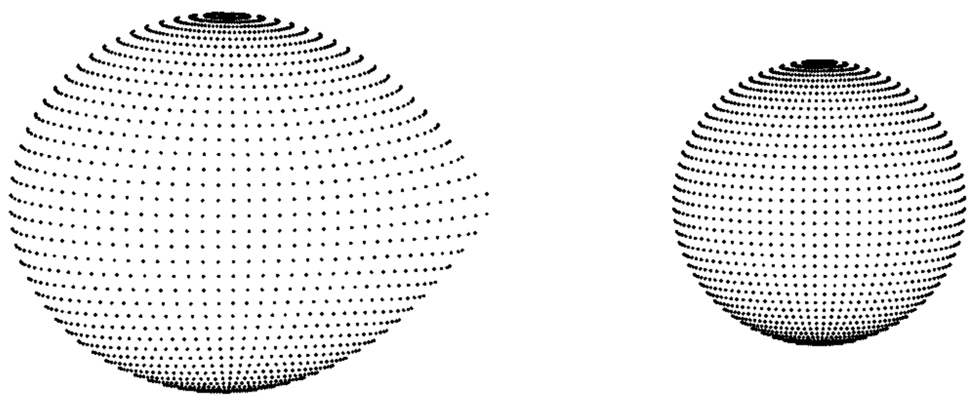

Figure 3.

XZ UMa is a classical Algol, as discussed in Giuricin et al. (1983), in that the A7 primary lies in the middle of the main sequence band (Iben, 1967), and the evolved G7 secondary lies above this band (i.e., is overluminous) by about a magnitude. Further, the masses and stellar radii for this system lie near the lower end of the Algol group and the period is relatively short, as is fitting for late-type Algol systems (ibid). However, the mass ratio, q, lies at the upper end of the group, suggesting that the system is still early in its mass transfer phase. The sinusoidal shape of the $O-C$ plot, as previously mentioned, suggests the presence of a third body (light time effect); however, examination of the spectra does not immediately support this hypothesis. Further monitoring of times of minima over the next decade or two should resolve the matter (but note Zavala, 2004 for an alternate explanation of cyclic period changes).

If there is a third body, this system would somewhat resemble the near Algol DL Vir (EA, A3 + K0-2, $q = 0.485$), where there is evidence of a G8 III third star (Schoffel & Popper, 1974; Schoffel, 1977)—directly from spectra and indirectly from $O-C$ analysis. (The eclipsing pair is only single lined; the mass ratio of this pair comes from analysis of the radial velocities of the A3 and G8 stars.) Although this system was at one time semi-detached (and therefore underwent mass transfer), it now seems to be slightly under-contact; it is also more evolved than XZ UMa. However, the light curve analysis was done using the Russell–Merrill model—an analysis with a modern light curve synthesis code is long overdue.

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ERRATUM FOR IBVS 5715

The orbital inclination of XZ UMa had been omitted from IBVS 5715. It should be $83.9^\circ \pm 0.1^\circ$.

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BVRI PHOTOMETRY OF DX And: THE AUTUMN 2005 OUTBURST

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DX And is a well-known dwarf nova with a long outburst recurrence time (270–330 days, Šimon 2000) and a long orbital period ($P = 10.6$ hours, Bruch et al. 1997). Only few known cataclysmic variables have similar characteristics, and for this reason it has been extensively studied by many astronomers. Spectroscopic observation were made by Bruch (1989) who reports that DX And exhibits a considerable contribution of the secondary star to the continuum energy distribution as well as the line spectrum. During the years 1981–1999, the brightest outbursts reach up to about 11.5 $\mathrm{mag_{vis}}$ from a typical quiescent level of 14–14.7 $\mathrm{mag_{vis}}$ (Šimon 2000). Ritter and Kolb (1998) report a wider range: DX And varies from $V = 16.5$ at minimum to $V = 10.9$ at the maximum of brightness.

In this brief paper we present the results of our observations made in the years 2003 and 2005 at the Porziano Astronomical Observatory, Monte Subasio Astronomical Association. We used the 0.30-m Schmidt–Cassegrain f/6.5 telescope, equipped with an AP-32ME CCD camera (Kodak 3200-ME, 2184×1470 pixels) and Johnson–Cousins BVR_cI_c photometric filters. The exposure time was 60–300 s depending on the brightness of the object. The frames were first corrected for standard de-biasing and flat-fielding, and then processed by a PC-based aperture photometry package developed by one of the authors. The magnitudes were determined relative to the calibration stars reported by Spogli et al. (1998). Calibrations done with standard Landolt stars show negligible color effects in the V, R_c and I_c bands, while B data have been corrected and the reported standard deviations take into account this effect. Heliocentric corrections to observed times were applied before the following analysis.

During the year 2003, DX And was observed for a total of 40 photometric nights only with the R_c filter and it was always in quiescence (Table 1). The variable oscillates between $R_c \simeq 14.4$ and $R_c \simeq 15.0$, with an average of $R_c \simeq 14.63$. In quiescence and at these wavelengths the system is dominated by the late-type secondary and its ellipsoidal variations: this is a familiar pattern for long-period cataclysmic binaries. Hilditch (1995) studied R and I variations of DX And during five consecutive nights, ten orbital cycles, and he found an ellipsoidal variation of amplitude 0.13 mag, superimposed to additional variability. We have already analyzed intra-night data to verify the ellipsoidal variation (Spogli, Fiorucci & Tosti 1998), so we collected data with a longer time-scale with the aim to obtain information about the additional variability. However, periodograms and other statistical tools are not able to find evidence of strict periodicity with the data reported

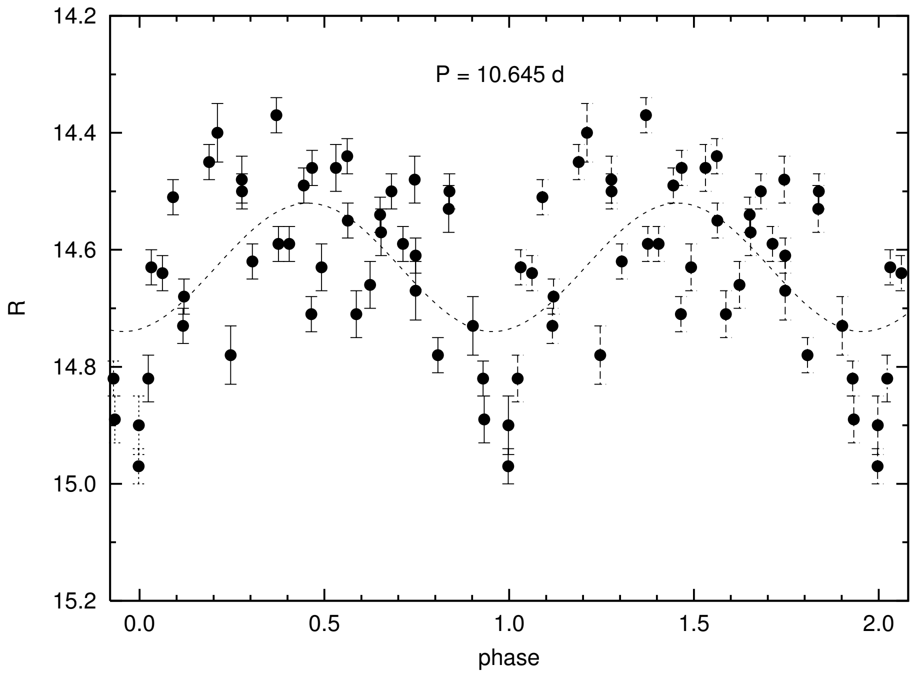

Figure 1. Phase-diagram of DX And in quiescence considering an hypothetical period of 10.645 days. Dotted line is the sinusoidal best fit. This variation is superimposed to an ellipsoidal variation well defined by Hilditch (1995).

Table 1

UT Date	HJD (2452000+)	R_c	UT Date	HJD (2452000+)	R_c
18/07/2003	839.387	14.67 ± 0.05	11/08/2003	863.346	14.90 ± 0.05
19/07/2003	840.339	14.53 ± 0.04	12/08/2003	864.391	14.70 ± 0.10
20/07/2003	841.329	14.82 ± 0.03	13/08/2003	865.373	14.45 ± 0.03
21/07/2003	842.326	14.82 ± 0.04	14/08/2003	866.320	14.50 ± 0.03
22/07/2003	843.329	14.73 ± 0.03	15/08/2003	867.311	14.37 ± 0.03
23/07/2003	844.322	14.40 ± 0.05	16/08/2003	868.316	14.74 ± 0.03
24/07/2003	845.326	14.62 ± 0.03	17/08/2003	869.366	14.55 ± 0.03
25/07/2003	846.388	14.59 ± 0.03	18/08/2003	870.299	14.54 ± 0.03
26/07/2003	847.322	14.63 ± 0.04	19/08/2003	871.293	14.48 ± 0.04
27/07/2003	848.323	14.71 ± 0.04	20/08/2003	872.294	14.47 ± 0.03
28/07/2003	849.333	14.50 ± 0.03	21/08/2003	873.297	14.89 ± 0.04
01/08/2003	853.381	14.64 ± 0.03	22/08/2003	874.349	14.63 ± 0.03
03/08/2003	855.349	14.78 ± 0.05	23/08/2003	875.293	14.68 ± 0.03
05/08/2003	857.453	14.49 ± 0.03	13/09/2003	896.265	14.51 ± 0.03
06/08/2003	858.381	14.46 ± 0.04	15/09/2003	898.248	14.48 ± 0.04
07/08/2003	859.361	14.66 ± 0.04	16/09/2003	899.301	14.59 ± 0.03
08/08/2003	860.312	14.59 ± 0.03	17/09/2003	900.274	14.46 ± 0.03
09/08/2003	861.319	14.78 ± 0.03	18/09/2003	901.295	14.44 ± 0.03
10/08/2003	862.323	14.73 ± 0.05	19/09/2003	902.261	14.57 ± 0.05
11/08/2003	863.342	14.97 ± 0.03	20/09/2003	903.258	14.61 ± 0.03

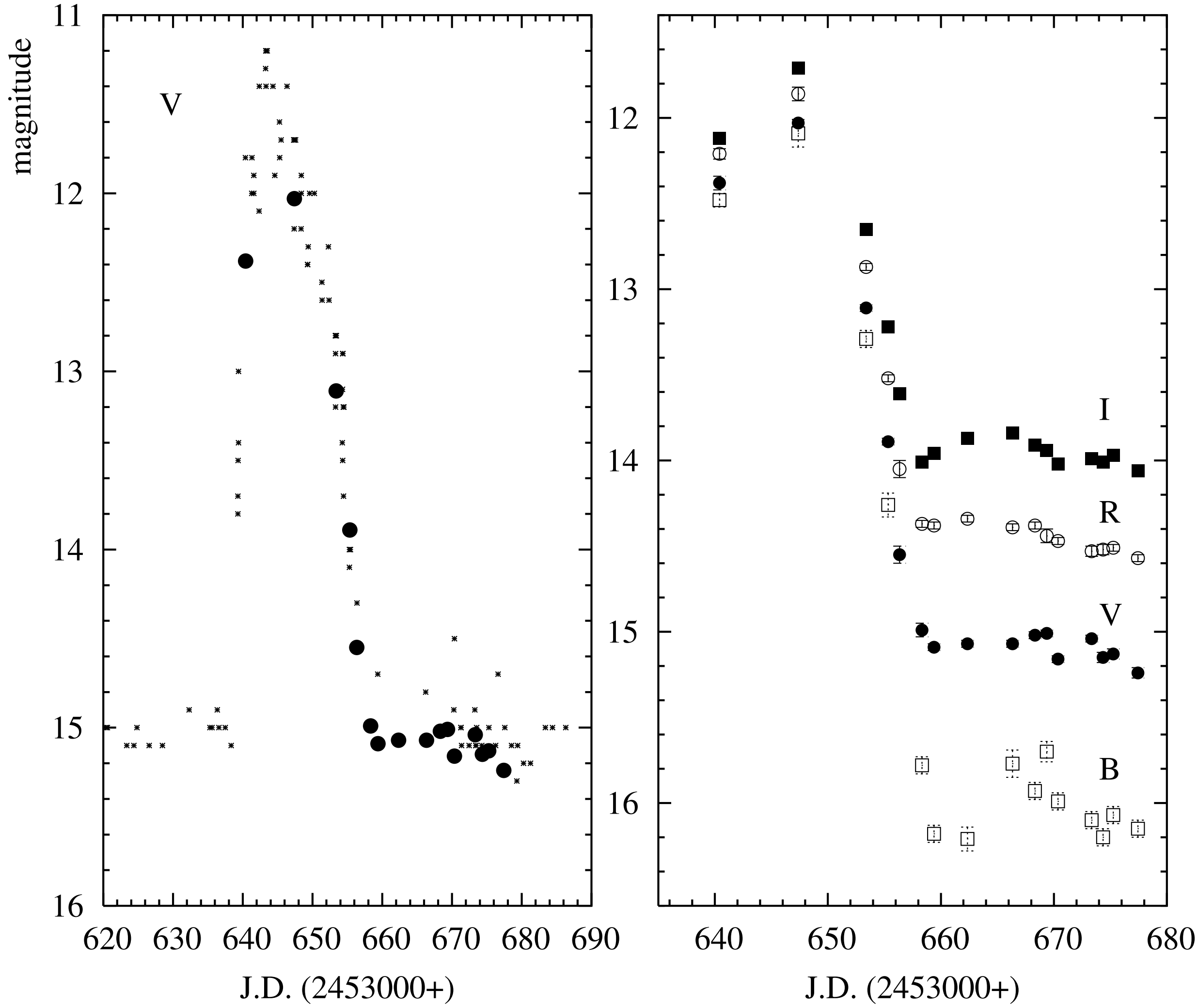

Figure 2. *V* light curve of DX And during Autumn 2005 (left panel), filled circles represent our data, while small crosses are visual estimates available from AFOEV (cdsweb.u-strasbg.fr/afoev/). The right panel shows our BVRI data only: it is evident the different color indices from the outburst to the minimum, and the internal variability during quiescence.

Table 2

UT Date	HJD (2453000+)	B	V	R_c	I_c
26/09/2005	640.414	12.48 ± 0.04	12.38 ± 0.04	12.21 ± 0.03	12.12 ± 0.02
03/10/2005	647.386	12.09 ± 0.08	12.03 ± 0.02	11.86 ± 0.04	11.71 ± 0.02
09/10/2005	653.393	13.29 ± 0.05	13.11 ± 0.02	12.87 ± 0.02	12.65 ± 0.02
11/10/2005	655.341	14.26 ± 0.07	13.89 ± 0.02	13.52 ± 0.02	13.22 ± 0.02
12/10/2005	656.342		14.55 ± 0.05	14.05 ± 0.05	13.61 ± 0.03
14/10/2005	658.324	15.78 ± 0.05	14.99 ± 0.04	14.37 ± 0.02	14.01 ± 0.02
15/10/2005	659.399	16.18 ± 0.05	15.09 ± 0.02	14.38 ± 0.02	13.96 ± 0.03
18/10/2005	662.351	16.21 ± 0.07	15.07 ± 0.02	14.34 ± 0.02	13.87 ± 0.02
22/10/2005	666.344	15.77 ± 0.08	15.07 ± 0.02	14.39 ± 0.02	13.84 ± 0.02
24/10/2005	668.325	15.93 ± 0.05	15.02 ± 0.02	14.38 ± 0.02	13.91 ± 0.02
25/10/2005	669.365	15.70 ± 0.06	15.01 ± 0.02	14.44 ± 0.04	13.94 ± 0.03
26/10/2005	670.364	15.99 ± 0.05	15.16 ± 0.02	14.47 ± 0.02	14.02 ± 0.02
29/10/2005	673.333	16.10 ± 0.05	15.04 ± 0.02	14.53 ± 0.03	13.99 ± 0.02
30/10/2005	674.349	16.20 ± 0.05	15.15 ± 0.03	14.52 ± 0.03	14.01 ± 0.02
31/10/2005	675.263	16.07 ± 0.05	15.13 ± 0.03	14.51 ± 0.02	13.97 ± 0.03
02/11/2005	677.435	16.15 ± 0.05	15.24 ± 0.03	14.57 ± 0.02	14.06 ± 0.03
27/11/2005	702.361	16.11 ± 0.05	15.20 ± 0.02	14.56 ± 0.02	14.04 ± 0.02

in Table 1. The analysis is seriously biased by the data sampling (±1, ±2 c/d alias frequencies) that makes correct identification of the frequency components ambiguous. The most probable results are obtained for $P = 10.645$ days (65 %, Fig. 1), $P = 0.912$ day (58 %), $P = 0.47625$ day (55 %), and $P = 0.4482$ day (50 %). Probably the latter can be identified with the actual value of the orbital period, while the additional variability showed by DX And during quiescence is of an unknown origin.

In the year 2005, DX And was monitored from September 26 to November 11 with the BVR_cI_c photometric bands, for a total of 17 photometric nights (see Table 2). It was in outburst and we followed part of the rise and the decline (Fig. 2). The profile and the time-scales confirm the results obtained by Šimon (2000). Also the color indices are in substantial agreement with our previous BVR_cI_c observations (Spogli et al. 1998). However, these new data increase the historical database on this variable source and they can help to constrain theoretical models.

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THE GEOS RR Lyr SURVEY

Fifth list of maxima of RR Lyr stars observed by the automated telescope TAROT

(GEOS Circular RR 28)

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We present here the fifth list of light maxima of RR Lyrae stars from the GEOS RR Lyr Survey, a GEOS program (`http://www.upv.es/geos/`) (Boninsegna et al., 2002) of automated observations of RR Lyr stars started in January 2004. We are using the 25-cm automatic telescope TAROT (`http://tarot.obs-hp.fr`) (Boër et al., 2001, Bringer et al., 1999) located in Calern Observatory (Observatoire de la Côte d'Azur, Nice University, France). Images are obtained by a 2048×2048 Marconi 42-40 thin back illuminated CCD. Field of view is $1.86^\circ \times 1.86^\circ$. Data reduction, from bias subtraction and flatfielding to photometry using SExtractor (Bertin and Arnouts, 1996), is performed automatically. The aim of this legacy project for the study of period variations of RR Lyr stars is to monitor maxima of light of these stars in order to feed the GEOS RR Lyr web database (`http://dbRR.ast.obs-mip.fr`).

The present list contains 290 maxima observed with no filter between January and June 2006 (Table 1). The maxima are determined by fitting a polynomial function on the data points. The uncertainties on individual maxima are estimated from the data sampling of each maximum. The nominal sampling (two consecutive 30s exposures taken every 10 minutes on a time baseline of 2 hours centered around the predicted maximum time) may be altered by local events (weather or telescope operation). This results uncertainties from 0.002 to 0.010 day. For a well observed star, the mean uncertainty on maxima is about 0.003 day (4.3 minutes). The $O-C$'s are computed with the GCVS elements (Kholopov et al., 1985) and are displayed in table 1 in column "$O-C$". When no elements are available in the GCVS, the reference of the elements is given as a footnote of Table 1. XZ Cyg is also an exception for which we use the elements from Baldwin and Samolyk (2003).

Table 1: maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Variable	Maximum HJD 24...	$O-C$ (days)	E
CI And	53738.435±0.003	0.002	1401.	Z CVn	53776.590±0.003	0.259	22705.
DR And	53739.370±0.004	-0.016	29335.	Z CVn	53833.472±0.005	0.258	22792.
X Ari	53739.376±0.002	0.307	24811.	Z CVn	53839.368±0.003	0.270	22801.
X Ari	53754.352±0.004	0.307	24834.	Z CVn	53867.483±0.005	0.271	22844.
TZ Aur	53737.647±0.002	0.004	86386.	RU CVn	53759.596±0.002	0.004	33626.
TZ Aur	53785.431±0.002	0.003	86508.	RU CVn	53801.444±0.002	0.005	33699.
BH Aur	53758.455±0.002	-0.002	24133.	RU CVn	53848.452±0.002	0.006	33781.
RS Boo	53795.521±0.002	-0.007	31868.	RU CVn	53860.489±0.002	0.005	33802.
RS Boo	53806.466±0.003	-0.005	31897.	RU CVn	53895.458±0.002	0.006	33863.
RS Boo	53807.601±0.002	-0.002	31900.	RU CVn	53899.471±0.005	0.006	33870.
RS Boo	53809.488±0.002	-0.002	31905.	RZ CVn	53760.672±0.002	-0.180	23646.
RS Boo	53863.447±0.002	-0.002	32048.	RZ CVn	53776.563±0.005	-0.176	23674.
RS Boo	53869.486±0.004	0.000	32064.	RZ CVn	53796.420±0.002	-0.178	23709.
RS Boo	53889.485±0.002	0.000	32117.	RZ CVn	53834.437±0.004	-0.178	23776.
RS Boo	53897.410±0.004	0.001	32138.	RZ CVn	53855.436±0.003	-0.173	23813.
RS Boo	53900.430±0.003	0.002	32146.	RZ CVn	53881.534±0.004	-0.176	23859.
ST Boo	53809.545±0.003	0.071	55646.	SS CVn	53807.665±0.002	0.162	29643.
ST Boo	53832.559±0.003	0.061	55683.	SS CVn	53866.535±0.002	0.174	29766.
ST Boo	53834.431±0.005	0.066	55686.	SS CVn	53867.488±0.002	0.170	29768.
ST Boo	53837.541±0.002	0.064	55691.	UZ CVn	53760.476±0.005	0.241	39171.
ST Boo	53839.409±0.003	0.065	55694.	UZ CVn	53776.520±0.005	0.236	39194.
ST Boo	53857.467±0.005	0.077	55723.	UZ CVn	53831.647±0.003	0.239	39273.
ST Boo	53900.404±0.004	0.076	55792.	UZ CVn	53839.322±0.002	0.238	39284.
TW Boo	53756.643±0.002	-0.048	50473.	UZ CVn	53841.406±0.004	0.229	39287.
TW Boo	53837.550±0.002	-0.046	50625.	UZ CVn	53857.464±0.002	0.238	39310.
TW Boo	53851.388±0.003	-0.047	50651.	UZ CVn	53866.535±0.004	0.237	39323.
TW Boo	53860.436±0.002	-0.048	50668.	UZ CVn	53871.416±0.002	0.234	39330.
TW Boo	53885.451±0.003	-0.050	50715.	AA CMi	53755.553±0.002	0.049	36066.
TW Boo	53893.434±0.003	-0.051	50730.	S Com	53749.597±0.002	-0.095	22324.
UY Boo	53802.659±0.003	-0.025	3835.	S Com	53759.570±0.002	-0.094	22341.
UY Boo	53806.561±0.004	-0.029	3841.	S Com	53776.580±0.005	-0.095	22370.
UY Boo	53832.596±0.004	-0.031	3881.	S Com	53796.528±0.002	-0.091	22404.
UY Boo	53834.546±0.004	-0.033	3884.	S Com	53840.519±0.003	-0.094	22479.
UY Boo	53849.528±0.003	-0.023	3907.	S Com	53850.495±0.003	-0.090	22496.
CM Boo	53850.445±0.003	-0.074	29468.	ST Com	53777.606±0.003	-0.023	17620.
AH Cam	53751.342±0.005	-0.364	40740.	ST Com	53798.561±0.002	-0.030	17655.
RW Cnc	53740.462±0.003	0.203	25921.	ST Com	53831.506±0.004	-0.026	17710.
RW Cnc	53746.472±0.003	0.194	25932.	ST Com	53843.486±0.002	-0.025	17730.
SS Cnc	53755.394±0.002	0.048	83511.	ST Com	53849.478±0.003	-0.022	17740.
TT Cnc	53740.529±0.002	0.103	24485.	ST Com	53855.465±0.003	-0.024	17750.
AN Cnc	53739.487±0.002	0.127	28185.	HY Com	53850.502±0.003	0.042	21832.
AS Cnc	53739.632±0.004	-0.282	23545.	TV CrB	53783.631±0.002	0.020	37914.
AS Cnc	53744.572±0.003	-0.283	23553.	TV CrB	53865.488±0.002	0.031	38054.
AS Cnc	53746.422±0.002	-0.285	23556.	TV CrB	53872.500±0.005	0.027	38066.
EZ Cnc [1]	53738.562±0.002	-0.029	12065.	TV CrB	53882.429±0.002	0.018	38083.
EZ Cnc [1]	53755.480±0.002	-0.030	12096.	TV CrB	53889.448±0.002	0.022	38095.
W CVn	53748.640±0.005	-0.123	58624.	TV CrB	53896.465±0.005	0.023	38107.
W CVn	53806.573±0.004	-0.125	58729.	TV CrB	53903.479±0.002	0.022	38119.
W CVn	53807.674±0.003	-0.127	58731.	UY Cyg	53904.459±0.004	0.055	56127.
W CVn	53831.399±0.003	-0.128	58774.	UY Cyg	53913.427±0.003	0.052	56143.
W CVn	53842.439±0.003	-0.123	58794.	XZ Cyg [2]	53845.482±0.002	-0.004	11305.
W CVn	53863.397±0.002	-0.132	58832.	XZ Cyg [2]	53850.621±0.002	0.003	11316.
W CVn	53869.474±0.004	-0.124	58843.	XZ Cyg [2]	53858.557±0.005	0.007	11333.
W CVn	53874.434±0.005	-0.130	58852.	XZ Cyg [2]	53865.553±0.002	0.004	11348.
W CVn	53880.504±0.004	-0.130	58863.	XZ Cyg [2]	53901.478±0.002	0.001	11425.
W CVn	53890.436±0.004	-0.129	58881.	DM Cyg	53917.428±0.002	0.062	26996.
W CVn	53901.474±0.003	-0.127	58901.	DX Del	53915.483±0.004	0.055	30782.

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Variable	Maximum HJD 24...	$O-C$ (days)	E
RW Dra	53836.569±0.002	0.153	32645.	RR Gem	53809.371±0.002	-0.343	31342.
RW Dra	53837.467±0.003	0.165	32647.	SZ Gem	53809.340±0.004	-0.047	53110.
RW Dra	53840.549±0.003	0.146	32654.	GI Gem	53756.465±0.002	0.070	54031.
RW Dra	53844.546±0.002	0.157	32663.	GI Gem	53795.461±0.003	0.072	54121.
RW Dra	53848.539±0.002	0.164	32672.	GI Gem	53799.358±0.002	0.069	54130.
RW Dra	53856.534±0.002	0.186	32690.	TW Her	53842.503±0.004	-0.010	80824.
SU Dra	53337.504±0.003	0.037	14287.	TW Her	53864.480±0.002	-0.011	80879.
SU Dra	53743.664±0.004	0.038	14902.	TW Her	53866.478±0.004	-0.011	80884.
SU Dra	53749.615±0.003	0.046	14911.	VX Her	53836.567±0.002	-0.395	70462.
SU Dra	53783.299±0.003	0.048	14962.	VX Her	53851.595±0.003	-0.395	70495.
SU Dra	53806.410±0.003	0.044	14997.	VX Her	53857.514±0.003	-0.395	70508.
SU Dra	53808.394±0.004	0.047	15000.	VX Her	53858.422±0.002	-0.398	70510.
SU Dra	53839.432±0.003	0.045	15047.	VX Her	53872.540±0.003	-0.397	70541.
SU Dra	53864.526±0.005	0.043	15085.	VX Her	53903.504±0.002	0.057	70608.
SW Dra	53798.400±0.005	0.079	48403.	VZ Her	53837.574±0.003	0.061	38718.
SW Dra	53806.354±0.002	0.057	48417.	VZ Her	53871.480±0.002	0.062	38795.
SW Dra	53831.418±0.003	0.056	48461.	VZ Her	53875.442±0.004	0.061	38804.
SW Dra	53839.395±0.005	0.058	48475.	VZ Her	53901.422±0.003	0.061	38863.
SW Dra	53843.375±0.004	0.050	48482.	DL Her	53860.568±0.002	0.033	26456.
SW Dra	53856.484±0.002	0.056	48505.	DL Her	53866.477±0.005	0.026	26466.
SW Dra	53860.470±0.004	0.055	48512.	DL Her	53882.462±0.004	0.037	26493.
XZ Dra	53917.411±0.002	-0.104	25161.	GO Hya	53710.581±0.003	-0.070	44091.
BC Dra	53748.561±0.003	0.077	15939.	GO Hya	53738.581±0.010	-0.073	44135.
BC Dra	53802.531±0.003	0.078	16015.	GO Hya	53759.570±0.003	-0.086	44168.
BC Dra	53807.562±0.002	0.072	16022.	RR Leo	53746.662±0.004	0.070	23102.
BC Dra	53833.476±0.002	0.082	16057.	RR Leo	53760.688±0.002	0.072	23133.
BC Dra	53836.354±0.004	0.081	16062.	RR Leo	53838.502±0.002	0.074	23305.
BC Dra	53856.504±0.010	0.083	16090.	RR Leo	53843.477±0.002	0.073	23316.
BC Dra	53866.567±0.005	0.072	16104.	RX Leo	53839.471±0.002	0.078	26833.
BC Dra	53892.482±0.006	0.082	16140.	RX Leo	53858.433±0.002	0.091	26861.
BC Dra	53897.518±0.005	0.081	16147.	SS Leo	53759.570±0.002	-0.044	19124.
BC Dra	53905.435±0.003	0.083	16158.	SS Leo	53776.484±0.003	-0.041	19151.
BC Dra	53915.498±0.010	0.072	16171.	SS Leo	53801.531±0.003	-0.048	19191.
BD Dra	53737.642±0.005	0.144	20309.	ST Leo	53796.382±0.004	-0.026	54130.
BD Dra	53740.589±0.002	0.146	20314.	ST Leo	53801.646±0.002	-0.020	54141.
BD Dra	53756.532±0.002	0.184	20341.	SZ Leo	53760.592±0.002	-0.136	15528.
BD Dra	53760.635±0.002	0.164	20348.	WW Leo	53737.613±0.003	0.027	31276.
BD Dra	53795.404±0.002	0.179	20407.	WW Leo	53740.625±0.003	0.025	31282.
BD Dra	53838.377±0.004	0.151	20480.	WW Leo	53746.658±0.003	0.030	31292.
BD Dra	53858.415±0.002	0.161	20514.	AE Leo	53748.696±0.005	-0.369	54106.
BD Dra	53865.483±0.002	0.161	20526.	AE Leo	53758.710±0.005	-1.009	54123.
BD Dra	53911.405±0.005	0.137	20604.	AX Leo	53748.678±0.005	-0.039	39217.
BK Dra	53858.403±0.003	-0.146	47857.	AX Leo	53759.581±0.005	-0.038	39232.
BK Dra	53891.555±0.003	-0.151	47913.	V LMi	53787.456±0.002	0.027	62982.
BK Dra	53897.472±0.005	-0.155	47923.	V LMi	53842.396±0.005	0.032	63083.
BK Dra	53900.435±0.002	-0.152	47928.	V LMi	53848.377±0.002	0.030	63094.
BK Dra	53910.501±0.003	-0.152	47945.	X LMi	53740.609±0.002	0.186	21248.
BK Dra	53916.420±0.003	-0.153	47955.	X LMi	53758.401±0.004	0.185	21274.
BT Dra	53783.575±0.003	-0.002	39154.	TT Lyn	53756.467±0.003	-0.032	28630.
BT Dra	53809.467±0.003	-0.011	39198.	TT Lyn	53795.302±0.002	-0.030	28696.
BT Dra	53849.496±0.002	-0.012	39266.	TW Lyn	53737.430±0.002	0.052	18086.
BT Dra	53859.506±0.002	-0.010	39283.	TW Lyn	53744.658±0.003	0.052	18101.
BT Dra	53865.396±0.004	-0.006	39293.	TW Lyn	53754.296±0.002	0.053	18121.
BT Dra	53875.404±0.005	-0.006	39310.	RZ Lyr	53871.434±0.003	-0.003	24818.
BT Dra	53882.466±0.002	-0.008	39322.	RZ Lyr	53893.422±0.003	0.001	24861.
RR Gem	53334.610±0.002	-0.318	30147.	RZ Lyr	53896.493±0.002	0.005	24867.
RR Gem	53754.544±0.002	-0.341	31204.	RZ Lyr	53917.452±0.002	0.003	24908.

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Variable	Maximum HJD 24...	$O-C$ (days)	E
AW Lyr	53911.483±0.003	0.025	57453.	RV UMa	53801.652±0.002	0.098	18643.
CN Lyr	53869.573±0.005	0.020	22809.	RV UMa	53808.675±0.002	0.101	18658.
CN Lyr	53881.502±0.005	0.019	22838.	RV UMa	53809.612±0.002	0.101	18660.
CN Lyr	53886.442±0.004	0.022	22849.	RV UMa	53831.615±0.005	0.106	18707.
CN Lyr	53911.533±0.002	0.019	22911.	RV UMa	53838.633±0.003	0.103	18722.
CN Lyr	53916.467±0.004	0.016	22923.	RV UMa	53853.611±0.003	0.103	18754.
IO Lyr	53856.524±0.004	-0.026	24670.	RV UMa	53869.522±0.005	0.100	18788.
IO Lyr	53863.450±0.002	-0.026	24682.	RV UMa	53899.472±0.004	0.094	18852.
IO Lyr	53871.530±0.003	-0.026	24696.	RV UMa	53900.411±0.004	0.097	18854.
IO Lyr	53882.494±0.003	-0.027	24715.	TU UMa	53737.601±0.002	-0.025	19557.
IO Lyr	53897.493±0.004	-0.033	24741.	TU UMa	53842.439±0.003	-0.027	19745.
IO Lyr	53904.426±0.002	-0.026	24753.	TU UMa	53857.497±0.003	-0.026	19772.
IO Lyr	53912.498±0.002	-0.033	24767.	AB UMa	53739.604±0.010	0.119	29207.
V455 Oph	53889.482±0.005	-0.226	26561.	AB UMa	53748.599±0.010	0.120	29221.
V455 Oph	53904.456±0.005	0.222	26593.	AB UMa	53838.529±0.005	0.113	29372.
V455 Oph	53909.446±0.002	0.219	26604.	AB UMa	53844.526±0.005	0.115	29382.
AR Per	53738.455±0.010	0.053	62276.	AB UMa	53850.515±0.005	0.108	29392.
AR Per	53750.371±0.002	0.053	62304.	AB UMa	53856.504±0.010	0.101	29402.
VY Ser	53856.437±0.004	0.034	31692.	AB UMa	53859.502±0.008	0.101	29407.
VY Ser	53881.439±0.002	0.043	31726.	AB UMa	53865.508±0.010	0.111	29417.
AN Ser	53844.486±0.003	0.003	74962.	ST Vir	53845.522±0.002	0.037	31909.
AN Ser	53857.533±0.005	-0.002	74987.	ST Vir	53857.429±0.004	0.030	31938.
AN Ser	53892.517±0.004	0.004	75054.	ST Vir	53871.403±0.002	0.036	31971.
AN Ser	53902.430±0.004	-0.003	75073.	UV Vir	53761.581±0.002	0.017	23453.
AT Ser	53845.609±0.004	0.009	16137.	AF Vir	53860.571±0.002	-0.097	27962.
AT Ser	53872.496±0.003	0.020	16173.	AV Vir	53842.510±0.002	0.003	18834.
AT Ser	53881.451±0.002	0.017	16185.	AV Vir	53869.454±0.004	0.014	18875.
AV Ser	53889.526±0.002	0.134	52396.	BB Vir	53843.488±0.002	0.242	30205.
AV Ser	53890.503±0.004	0.135	52398.	BB Vir	53849.610±0.002	0.240	30218.
AV Ser	53872.454±0.002	0.126	52361.	BN Vul	53890.453±0.005	0.062	14071.
RU Sex [3]	53760.485±0.005	0.018	31818.	BN Vul	53912.435±0.002	0.061	14108.
ref.:	1 Boninsegna, 1990						
	2 Baldwin and Samolyk, 2003						
	3 Williams, 1993						

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THE HIGH-AMPLITUDE δ SCUTI STAR GP ANDROMEDAE

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GP And is a well-studied high-amplitude δ Scuti star. Its variability was discovered by Strohmeier et al. (1956). Lange (1969, 1970) derived the type and period of this variable and pointed to possible light curve variation with a modulation period of 0.2684 day. This announcement aroused our interest and we started the star's photoelectric photometry at Konkoly Observatory in 1970.

Since the early seventies photoelectric photometry of this variable has been carried out and published by Eggen (1978), Gieseking et al. (1979), Rodríguez et al. (1993) and Schmidt et al. (1995). Splittgerber (1976), Burchi et al. (1993) and the BAV group (Agerer & Hübscher, 1998, 2002, 2003; Agerer et al., 1999, 2001; Hübscher, 2005; Hübscher et al., 2005) published photoelectric/CCD times of maximum light.

The Hipparcos photometry and the NSVS (Wozniak et al., 2004) provide useful data sets to study the period changes and the possible light curve modulation of the star. Having taken into account the heliocentric corrections normal maxima could be constructed from these data sets:

1) from the Hipparcos photometry: $\mathrm{HJD}_{\mathrm{max}}$ 2448448.1856 and

2) from the NSVS data: $\mathrm{HJD}_{\mathrm{max}}$ 2451484.7904.

Apart from the rather accurate photoelectric/CCD observations a great number of photographic and visual measurements are found in the literature. In our discussion, however, we disregard these inaccurate data.

Our observations extended from 1970 to 1997. Observations at Konkoly Observatory were made with the 60 cm Newtonian reflector (10 nights) and the 50-cm Cassegrain telescope (10 nights) each equipped with an uncooled UBV photometer, and with the 1-m RCC telescope equipped with an $UBV(RI)_C$ refrigerated photoncounting photometer (5 nights).† CCD observations were obtained with the 60/90/180-cm Schmidt telescope using a Photometrics camera (thermoelectrically cooled Kodak KAF-1600 1024 $\times$ 1536 chip) on one night without filter and two nights in the V colour band.

Observations at Leopold Figl-Observatory of the Astronomical Institute of the University of Vienna have been carried out in the V and B band using an uncooled photometer (with standard Corning filters) attached to the 60-cm RC telescope on 13 nights.

Throughout our observations we used GSC 01739-01584 lying $\sim 5'$ west from the variable as comparison star.

†The 1-m RCC $UBV(RI)_C$ observations (Table 1) are available at the IBVS website as 5718-t1.txt.

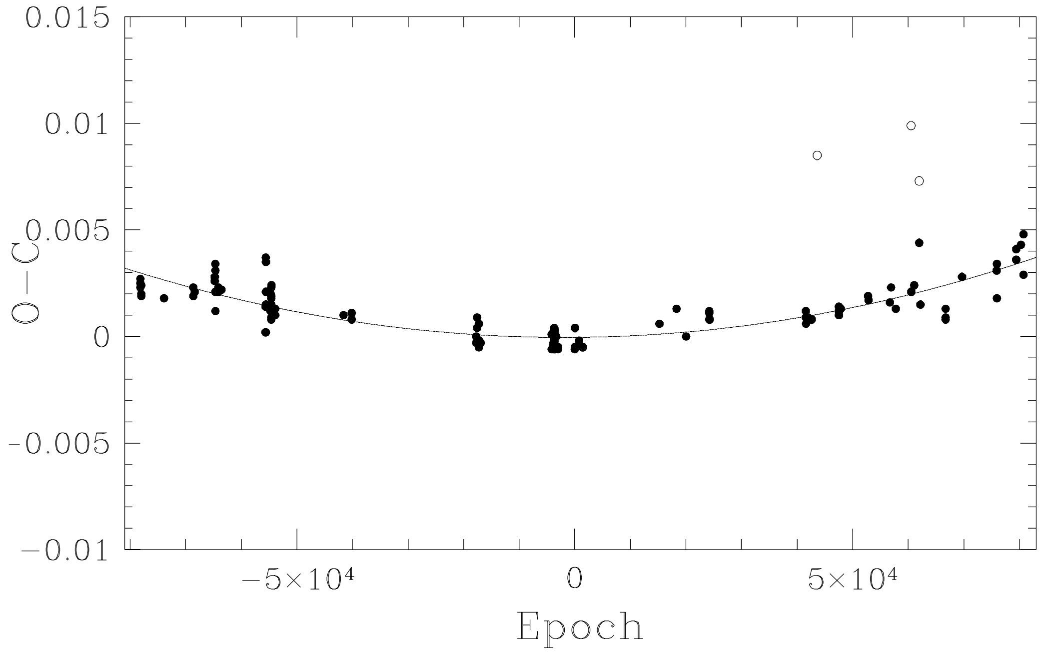

Figure 1. $O - C$ diagram with quadratic fit. The open circles denote uncertain data not taken into account in the fit

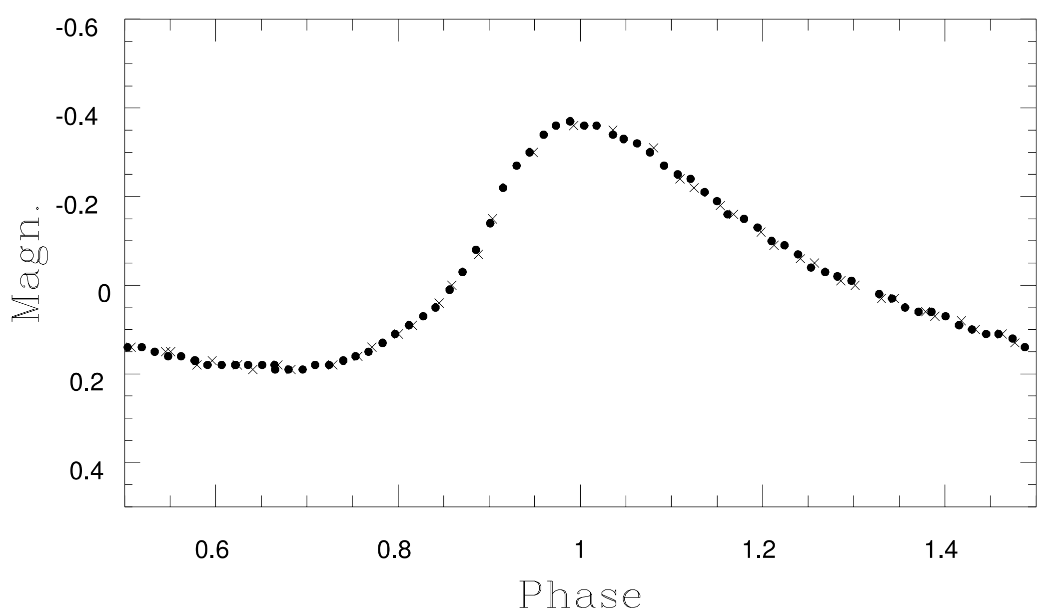

Figure 2. Folded V light curve of two nights (five cycles) of CCD observations (JD 2450746: dots; JD 2450772: crosses)

Table 2. Times of light maximum observed at Leopold Figl and Konkoly Observatories

HJD_{max} 2400000 +	Rem.	HJD_{max} 2400000 +	Rem.	HJD_{max} 2400000 +	Rem.	HJD_{max} 2400000 +	Rem.
40854.4352	[1]	43848.3910	[1]	46704.5745	[3]	46720.5464	[3]
40854.5135	[1]	45609.4674	[2]	46705.4394	[3]	46722.5134	[3]
40854.5923	[1]	45609.5464	[2]	46705.5182	[3]	46743.3650	[2]
40867.4962	[1]	45622.4513	[2]	46713.3867	[3]	46769.3297	[3]
40867.5745	[1]	45622.5294	[2]	46713.4657	[3]	46769.3298	[2]
40869.3841	[1]	45634.4885	[2]	46713.5443	[3]	50277.4810	[4]
41189.4655	[1]	45648.4154	[2]	46714.4882	[3]	50278.5036	[4]
41604.5175	[1]	45648.4939	[2]	46714.5675	[3]	50279.5262	[4]
41604.5958	[1]	45649.4391	[2]	46717.3997	[3]	50310.5275	[4]
41625.4469	[1]	45653.4512	[2]	46717.4778	[3]	50360.4909	[4]
41960.5570	[1]	45674.4594	[2]	46717.5565	[3]	50745.3285	[5]
41960.6355	[1]	46679.4740	[3]	46718.4220	[3]	50745.4074	[5]
42004.3832	[1]	46679.5533	[3]	46718.5008	[3]	50745.4863	[5]
42697.4208	[2]	46680.4975	[3]	46719.3669	[3]	50746.3514	[5]
42697.4986	[2]	46702.4496	[3]	46719.4457	[3]	50746.4303	[5]
42697.5775	[2]	46702.5288	[3]	46719.5239	[3]	50746.5089	[5]
42712.4485	[1]	46702.6067	[3]	46720.4686	[3]	50772.4744	[5]
43848.3126	[1]	46704.4953	[3]				

Remark: [1] Konkoly N 60-cm, [2] Konkoly C 50-cm, [3] Figl RC 60-cm, [4] Konkoly RCC 100-cm, [5] Konkoly Schmidt 60/90-cm CCD

On the whole 70 times of maximum light could be determined from our observations. Each light maximum was derived as an average over the B and V bands since the times of maximum for these colour bands are not perceptibly shifted to each other. (Except some cases, when observations were made only in one colour band.)

The times of maximum light derived from our observations are given in Table 2. The complete list of times of maximum light (Table 3) used to construct the $O-C$ diagram and to study the period changes of the variable is only available electronically through the IBVS website as file 5718-t3.txt.

The $O-C$ values have been calculated by the formula:

$$C = 2447005.6146 + 0\overset{d}{.}07868276 \times E$$

and plotted against E in Fig. 1. A quadratic least-squares fit provides the new ephemeris:

$$\begin{array}{l} C_{\rm new} = 2447005.61456 + 0\overset{d}{.}0786827620 \times E + 5.20 \times 10^{-13} \times E^2. \\ \qquad\qquad\quad \pm .00009 \quad \pm .0000000012 \qquad\qquad \pm .27 \end{array}$$

Three uncertain, outlier points (at JD 2450438.4732, 2451768.528 and 2451882.458) were not taken into account in the fit.

The observations of the years 1970 and 1971 do not support the cubic solution of Pop et al. (2005), but the deviation of these data from the quadratic fit may hint at the reality of the higher order fit or a sine-like solution (Pop et al., 2003) notwithstanding that the slow period increase $1/P(\mathrm{d}P/\mathrm{d}t) = 6.1 \times 10^{-8}$ y^{-1} is not in serious conflict with evolutionary theories (Breger & Pamyatnikh, 1998).

Gieseking et al. (1979) noted that some disturbances were present in the fundamental pulsation. From four nights of photometry they found variability of some 0.1 mag in the amplitude with a period of 0.64 days, furthermore they pointed out that the mean brightness of the star and the shape of the light curve strongly varied from cycle to cycle, while an 18 minute wave superposed on the light curve was present. Rodríguez et al.'s (1993) photometry of high accuracy, however, did not show these kinds of disturbances.

As our photoelectric photometry also exhibited variability in the shape and amplitude of the light curve we decided to go into the matter in more detail. The Fourier analysis of the Hipparcos, the NSVS and our 1983 BV and 1998 $BVRI$ data sets, however, did not prove the existence of any additional frequencies with amplitude higher than 0.01 mag The folded CCD V light curve of two nights (five cycles) presented in Fig. 2. also shows a regular light variation characteristic of stable high amplitude δ Scuti stars.

Since GP And has a 1.5 mag fainter (in minimum, Eggen, 1978) very close visual companion with $11''$ separation (Morlet et al., 2000) its photometry through a 20–$30''$ diafragm becomes uncertain. Therefore we incline to presume that the observed disturbances are rather (at least in significant part) the defect of the photometry.

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GSC 2038.0293 IS A NEW SHORT-PERIOD ECLIPSING RS CVn VARIABLE

(BAV MITTEILUNGEN NO. 177)

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During a programme of optical identification of X-ray sources from the ROSAT all-sky survey bright source catalogue (Voges et al., 1999) with the ROTSE1 database (Woźniak et al., 2004) it was found that the uncatalogued variable NSVS object ID 7869362 (= GSC 2038.0293) was coincident with the X-ray source 1RXS J160248.3+252031. Further details of the programme are presented in Bernhard et al. (2005). GSC 2038.0293 has $V = 10.62$ and $B - V = 0.83$ from the Tycho-2 catalogue (Høg et al., 2000), the 2MASS catalogue gives $J - K = 0.612$ (Cutri et al., 2003).

Our observations were made using both a 20-cm Schmidt–Cassegrain telescope and a Starlight XPress SX CCD camera with BV filters (2005) and BVR filters (2006) in Linz, Austria and a Flatfield Camera 576/2.0 with a CCD camera OES-LcCCD12 and IR-cutting filter in Velden, Germany (2005 and 2006). The comparison stars used were GSC 2038.0565 and GSC 2038.0663, which were found to be constant within < 0.03 mag.

The following primary minima were observed in 2005 and 2006 (Table 1):

Table 1: Times of primary minima of GSC 2038.0293 (HJD 245...)

minimum time	filter	observer	$O - C$ (d)
3566.433 (2)	IR cutt.	Frank	−0.002
3569.405 (2)	V	Bernhard	−0.003
3846.348 (2)	IR cutt.	Frank	+0.005
3877.555 (2)	V	Bernhard	+0.002

Figures in brackets denote rms errors in units of the last decimal, $O - C$ values were calculated with the ephemeris given below.

A Fourier analysis of the available data including ASAS3 (Pojmanski, 2002) and ROTSE1 was performed to search for periodicity of the light variations. The following ephemeris can be derived from the analysis with the algorithm Period04 (Lenz and Breger, 2005):

$$\mathrm{HJD}_{\mathrm{MinI}} = \underset{\pm 3}{2453560.491} + \underset{\pm 1}{0\overset{\mathrm{d}}{.}495410} \times E.$$

The folded (and in y-direction shifted) light curves of the BVR filtered observations in May and June 2006 are given in Figure 1 and show an amplitude of nearly 0.20 mag for the B observations and of nearly 0.18 mag for the V and R observations.

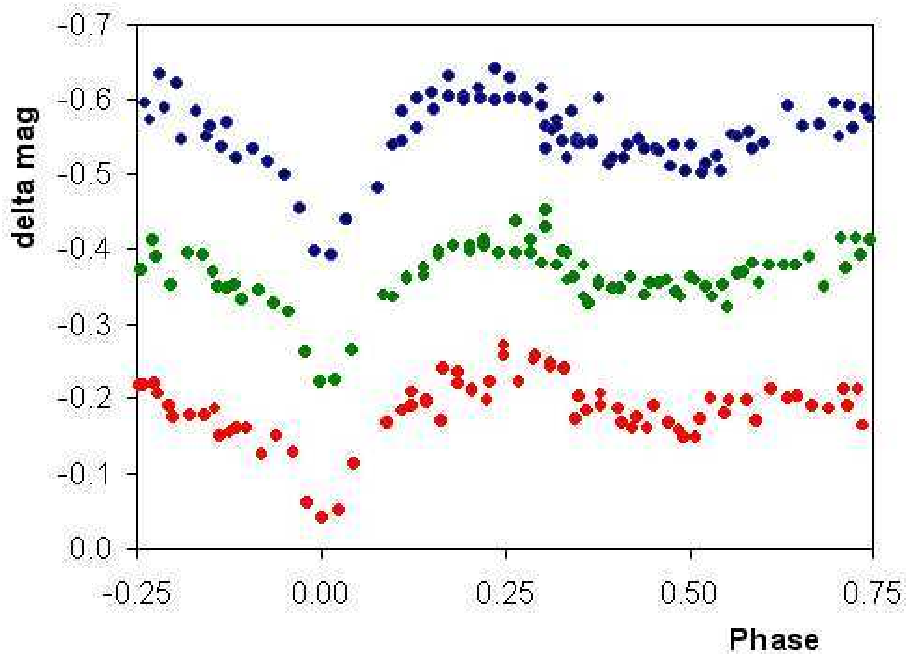

Figure 1. Folded BVR light curves of GSC 2038.0293 in the observing season 2006

The shape of the folded light curve with two minima of considerably different width clearly identifies GSC 2038.0293 with a very short period and heavily spotted RS CVn type star. This finding is also supported by the X-ray identification, and the values of the Tycho-2 and 2MASS colours, which point to a spectral type of late G or early K. $B-V$ and $V-R$ values of our observations in 2006 indicate a slight reddening of the star, when it enters the minimum of the spotted light curve. The peak to peak amplitude (i.e. the magnitude difference between the secondary and primary minima), determined by low order polynomial fitting, is for the B band about 0.09 mag, for the V and R band only 0.07 and 0.06 mag. This is in good agreement with data from literature, where a $\Delta R/\Delta V$ value of 0.90 for active stars has been determined (Drake, 2006).

The period of 0.495410 days is very short for an RS CVn star. Only one of 206 binary systems of the second edition of the catalogue of chromospherically active binary stars has a shorter period (XY UMa, 0.4789944 days; Strassmeier et al., 1993).

The folded light curves of ROTSE1, ASAS3 and our V-band data, which are shifted for the different years, are given in Figure 2.

ROTSE1 data are available for 1999 and 2000, ASAS3 V data for 2003, 2004, 2005 and 2006 (filled circles). Our V-band data for 2005 and 2006 are shown as open circles. The amplitudes of the V and R band are very similar (see Figure 1). Therefore it can be assumed, that also ASAS3 (V) and ROTSE1 amplitudes (near R values) are roughly comparable.

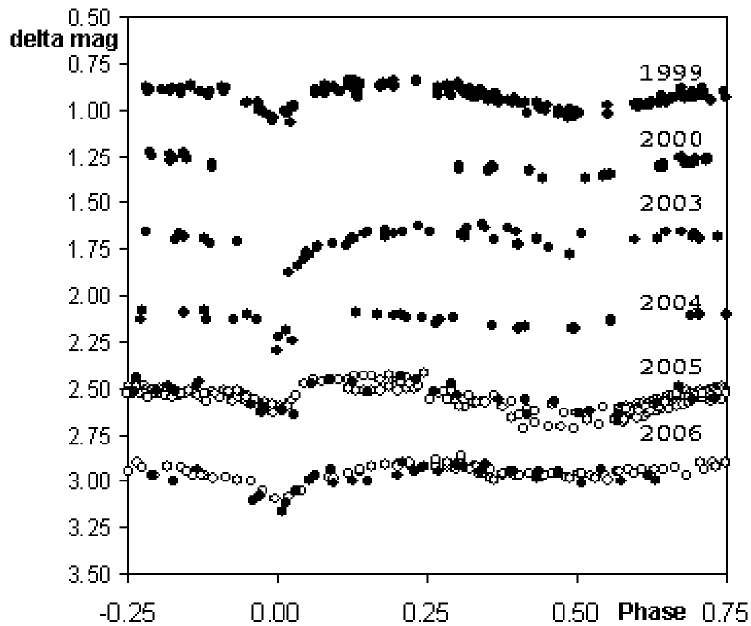

Figure 2. Folded ASAS3 and ROTSE light curves (filled circles) and our V data (open circles) in 1999–2006

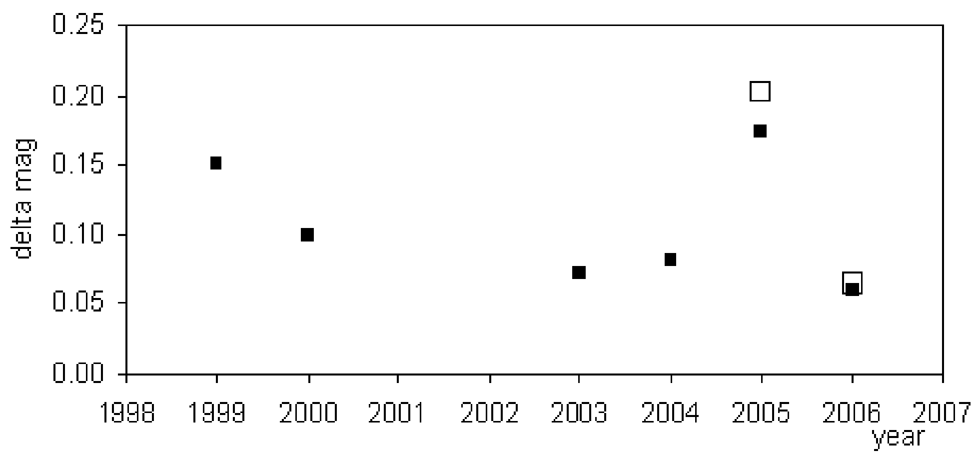

Figure 3. Peak to peak amplitude of the minimum of the spotted light curve in the ASAS3 and ROTSE data (filled squares) and in our V-band data (open squares) in 1999–2006

It can be clearly seen, that the primary minimum has fairly the same amplitude in 1999–2006, but the depth of the minimum of the spotted light curve is changing to a large extent. The long-term changes of the light curve are illustrated in more detail in Figure 3.

The amplitude of the spotted light curve shows a clear variation in 1999–2006 with two clear maxima in the years 1999 and 2005. In 2005, the year of the highest variation, the minimum of the spotted light curve was fainter than the primary (eclipsing) minimum. We noticed considerable changes in the shape of the lightcurve on timescales of a few weeks in our B, V and unfiltered observations. This resulted in an increased scatter near the minimum of the spotted light curve in the ASAS and our data of that year (see Figure 2).

Though it is clear that more observations will be necessary to describe the long-term activity of GSC 2083.0293, (cyclic?) variations on timescales of 6–8 years seem to occur. Similar cycles have also been observed for other RS CVn stars (e.g. Berdyugina and Tuominen, 1998). We conclude that GSC 2038.0293 is a new RS CVn variable with one of the shortest known periods and a dramatically changing light curve. We hope that the present study will stimulate more observations of this interesting, high activity star.

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FOUND A NOVA IN M31: THE TRUE OPTICAL COUNTERPART OF THE M31 SUPERSOFT X-RAY SOURCE 191

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In this note we report the discovery of a nova in M31 (NGC 224) which turned out to be the true optical counterpart of the supersoft X-ray source 191 of the M31 XMM Newton survey catalogue instead of the Nova 1992-01 proposed by Pietsch et al. (2005a). The nova was found by one of us (O.S.) on scanned archival photoplates taken in October and November of 2001 for search for novae in M31 with the Schmidt telescope (80/120/240-cm) at the Baldone Astrophysical Observatory of the Institute of Astronomy, University of Latvia.

The coordinates of the nova were obtained using the Aladin Sky Atlas (CDS) image astrometric calibration tool with respect to the positions of field stars from the $BVRI$ catalogue of M31 (Magnier et al., 1992). The resulting nova position derived from 7 scanned plates is the following:

$$\text{R.A.} = 00^{\text{h}}41^{\text{m}}54\overset{\text{s}}{.}26, \qquad \text{Decl.} = +41^\circ07'23''\!.9 \qquad \text{(equinox 2000.0)},$$

with 1-sigma error of $0''\!.2$. It is located $564''\!.4$ West and $524''\!.6$ South of the center of M31; a finding chart is given in Figure 1. No record of this object was found in any searches of the papers or WWW pages devoted to novae in M31.

Times of the middle of exposures in Julian days and B-magnitudes of the nova based on the secondary standard stars from the $BVRI$ catalogue of M31 (Magnier et al., 1992) are given in Table 1. The light curve of the nova is presented in Figure 2.

Table 1

JD 2452000 +	B mag	JD 2452000 +	B mag
151.472	> 19.5	204.250	17.7
196.262	16.6	207.390	18.0
198.256	16.8	208.267	18.2
199.282	16.8	226.208	18.5:
203.234	17.3	228.238	> 19.6

The available photometric data for the nova do not allow to determine the time and the value of the maximum brightness exactly. However, the dB/dt parameter can be

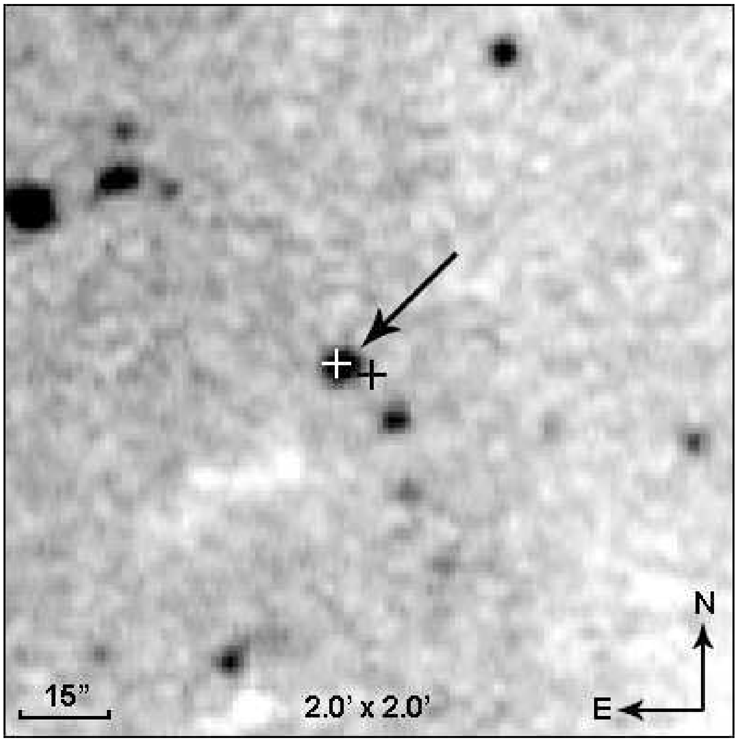

Figure 1. The scan of the photoplate taken on October 15, 2001 with the discovered nova (marked with an arrow). The white and black crosses show positions of X-ray source 191 and Nova 1992-01 respectively

estimated from the general slope of the light curve between the brightest observation, when $B = 16.6$ and the observation closest to 2 magnitudes fainter than the maximum. Excluding an uncertain measurement we estimate $dB/dt = 0.13$ m/d equivalent to the rate of decline $t_2 \sim 15$ days, which corresponds to the fast novae according to the classification by Payne-Gaposchkin (1957). The mean maximum magnitude for novae with similar rate of decline is $B = 16.5$, according to the relation between the rate of decline and the magnitude at maximum for M31 novae obtained by Capaccioli et al. (1989). It could indicate that the first observation of the nova was about one day past its maximum light.

Comparing the nova position with those of X-ray sources in the catalogue of XMM-Newton survey of M31 (Pietsch et al., 2005b) we found that source 191 is located at a distance of $0\farcs9$ East and $0\farcs1$ South from the nova. This X-ray source is classified as supersoft as other known X-ray sources identified with novae. The 1-sigma error of X-ray source position is $0\farcs88$, including systematic error. Within error its position coincides with the position of the nova.

According to Pietsch et al. (2005a) the X-rays at the position of the source 191 was first detected during XMM-Newton observations at JD 2452280.5, so 84 days after the nova outburst and then six days later. No X-ray source was detected at that position during the three XMM-Newton observations made at the moments corresponding to 476, 290 and 107 days before the nova outburst. Evidently this source was not yet active also 17 days after the nova outburst, as it was covered by the Chandra HRC1 observation 1912, but not reported in the catalogue by Kaaret (2002).

Pietsch et al. (2005a), searching for X-ray counterparts of optical novae, correlated this source with the Nova 1992-01, reported by Shafter & Irby (2001) from two Halpha images, taken in December of 1992 and January of 1993. According to Pietsch et al. (2005a) the time separation of 3303 days between Nova 1992-01 outburst and X-ray source rise is significantly larger than that for the other 22 M31 and M33 novae in the dataset. Therefore the authors supposed that the Nova 1992-01 was probably a recurrent nova, which had a new unobserved outburst about 2001, responsible for the observed X-rays.

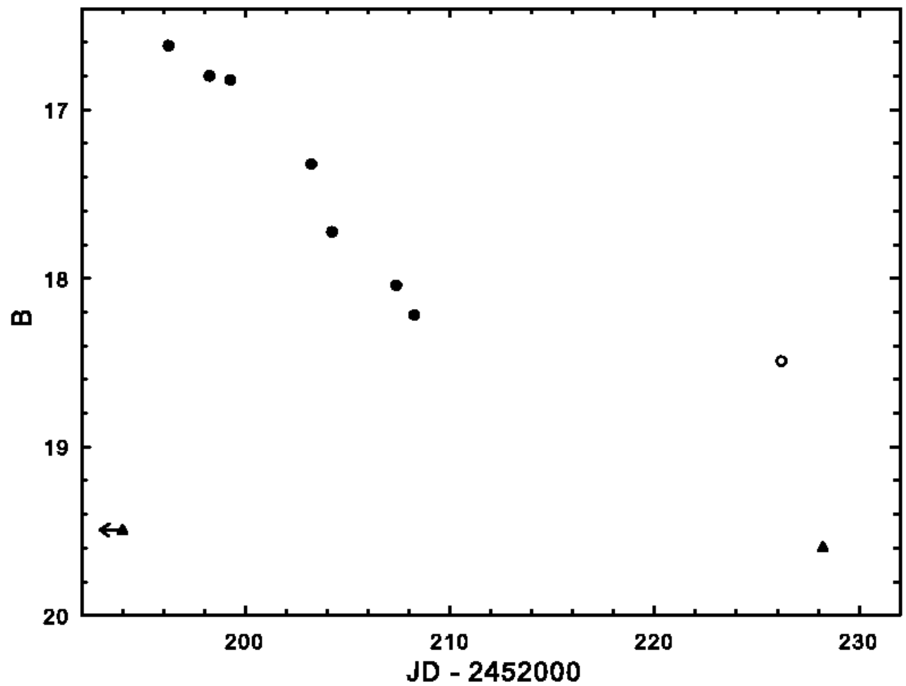

Figure 2. The light curve of the nova in M31. Filled circles: confident measurements; open circle: uncertain measurement; triangles: brightness upper limits (the triangle with arrow corresponds to JD 2452151.472)

To try to verify the possibility, that our reported nova and the Nova 1992-01 is the same object, we inspected Baldone observatory archival plates of M31 taken in 1992. We found the Nova 1992-01 on two 1/10/2001 photographs and measured its coordinates on both plates in the same way, as was done for the reported nova, and we got

$$\text{R.A.} = 00^{\text{h}}41^{\text{m}}53\overset{\text{s}}{.}82, \qquad \text{Decl.} = +41^\circ 07' 22\overset{''}{.}5 \qquad \text{(equinox 2000.0)},$$

with 1-sigma error of $0\overset{''}{.}3$.

The position separation between the Nova 1992-01 and our reported nova is $5\overset{''}{.}2$, thus they are different objects.

As the Nova 1992-01 lies $6\overset{''}{.}1$ apart from the X-ray source 191, but our nova at much smaller distance $0\overset{''}{.}9$, the latest must be considered as an optical counterpart of the X-ray source. In this case the time separation between the optical outburst and X-ray rise—84 days falls in the interval of time separation from 63 d to 170 d observed for four other novae—optical counterparts of X-ray sources in M31, contrary to the extraordinarily long 9 years time separation in case of previously assumed identification with the Nova 1992-01. To the common features of these short-time separation optical counterparts add the fact that three of them are fast novae in the same way as our nova.

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Corrigendum for IBVS 5720 In the paper by Smirnova & Alksnis (2006), third paragraph from the end, instead of 1/10/2001 should be 1/10/1992. Our thanks are due to W. Pietsch for pointing out this error.

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THE 78TH NAME-LIST OF VARIABLE STARS

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The present 78th Name-List of Variable Stars contains all data necessary for identifications of 1706 new variables finally designated in 2006. The total number of named variable stars, not counting designated non-existing stars or stars subsequently identified with earlier-named variables, has now reached 40215.

We are currently working on merging the electronic tables of the GCVS and the Name-Lists. Because of this, we decided to somewhat change the presentation of the 78th Name-List compared to the standard form of several previous lists, which followed the manner first introduced in the 67th Name-List (IBVS No. 2681, 1985). Thus, the main part of the 78th Name-List contains a single printed table, appended with two tables presented in the electronic form only.

The printed Table 1, similar to Table 1 in the previous Name-Lists, contains the list of new variables arranged in the order of their right ascensions (2000.0). For each star, the table gives: its ordinal number; its GCVS name (an asterisk after it means the presence of a remark in the electronic Table E4, see below); the equatorial coordinates for the equinox 2000.0 (right ascensions to $0^{s}.1$ and declinations to $1''$); the range of variability (magnitudes in maximum and minimum light; sometimes the column "Min" gives, in parentheses, the amplitude of light variation; the symbol "<" means that the star, in minimum light, becomes fainter than the magnitude indicated; the system of magnitudes used. Here "p" are photographic magnitudes; "r" are instrumental red magnitudes; the symbols "Rc", "Ic" designate magnitudes in Cousins RI system; "Hp" stands for magnitudes in the system of the Hipparcos Catalogue; "*" corresponds to unfiltered CCD magnitudes; the rest of designations are standard Johnson $UBVRIJKL$ magnitudes or their more or less successful equivalents. In a small number of cases, the value of the variability amplitude (column "Min", in parentheses) could not be expressed in the same system of magnitudes as the star's brightness; in such cases we indicate the photometric band for the amplitude separately. Then follows the type of variability according to the classification system described in the forewords to the first three volumes of the 4th GCVS edition (with the additions introduced in the 68th Name-List, IBVS No. 3058, 1987, in the 69th Name-List, IBVS No. 3323, 1989, in the 72nd Name-List, IBVS No. 4140, 1995, in the 75th Name-List, IBVS No. 4870, 2000, in the 76th Name-List, IBVS No. 5135, 2001; see also the description of variability types and distribution of stars over variability types at http://www.sai.msu.su/groups/cluster/gcvs/gcvs/iii/vartype.txt). In variance with the earlier Name-Lists, the last columns contain up to three references to the literature. The first reference is to the star's study that permitted us to include it into the Name-List, the second one indicates the paper containing a finding chart or refers to the Durchmusterung – DM (BD, CoD, or CPD), or the Hubble Space Telescope Guide Star Catalog – GSC, g2.2, or the USNO A1.0/A2.0/B1.0 catalog – USNO, or the 2MASS catalog – 2MASS, if the star can be found using one of them; in some cases, we add the third reference if information significant for the Name-List (mainly included in the electronic Table E3, see below) comes from a source different from that indicated in the first reference.

The order of stars in Table 1 corresponds to the order of their 2000.0 right ascensions. Note that several stars named between Name-Lists No. 77 and No. 78 upon request from the IAU Bureau of Astronomical Telegrams have GCVS names, within their constellation, are not in their proper order by right ascension. The coordinates presented in the Name-List were taken from positional catalogues or found in the literature.

Then, a short Table 2 follows. This is a list of variable stars earlier named not in their proper constellations, because of erroneous coordinates or of changes in the constellation boundaries (cf. N. N. Samus et al., 2006, *Astronomy Letters*, **32**, 263, section "The Variables to be Renamed"). The present Name-List contains new names for these variables. Their old names will not be given to any other variable, to avoid confusion.

The electronic supplement to this paper contains two additional tables of the Name-List. Table E3 presents a preliminary catalogue of the newly-named variable stars. Its columns contain, besides the information described above for Table 1, also the following data: epoch (minimum for eclipsing variables and RV-type stars or maximum for all other stars, in Julian days minus 2400000); variability period (in days); light curve asymmetry ($M-m$) for pulsating variables or duration of minimum for eclipsing stars, in hundredths of the period; spectral type.

The electronic Table E4 contains the list of variables arranged in the order of their variable star names within constellations. It can have several lines per variable. After the designation of a variable, its ordinal number from Table 1 is given, and then each line contains an identification with one of several major catalogues or an identification necessary to find this star in the papers referred to in Tables 1, E3 or in the papers with the first (or independent) announcement of the discovery of its variability. Some minimal remarks are given if necessary, also occupying a line, with "* Rem" in the beginning of the remark. The abbreviated names of the catalogues in Table E4 generally follow conventions of the GCVS or of the SIMBAD data base.

We take the opportunity to announce corrections of several errors and misprints in earlier Name-Lists of Variable Stars, not announced earlier as lists of corrections in electronic issues of the IBVS.

NL No.	IBVS No.	Position	Printed	Should be
72	4140	Table 2	V1191 Cyg	V1991 Cyg
76	5135	Table 1, IL Cam	03 43 53.0 +67 40 52	03 43 52.5 +67 40 33
76	5135	Table 2, δ Sco	76083	760839
77	5422	Tables 1, 2	V1209 Tau = V738 Tau	

As usual, those wishing to find new and corrected GCVS and NSV catalogue information are asked to regularly visit our web site:

http://www.sai.msu.su/groups/cluster/gcvs/gcvs/

At our web site, there exists access to a table containing accurate coordinates and, whenever available, proper motions for GCVS stars (including Name-Lists) and for many NSV catalogue stars, taken from positional catalogues (referred to in the table) or measured by the GCVS team. The table is being continuously expanded in the course of our positional work. The positional information is based upon our new identifications, primarily using the best finding charts available, and checked via comparison with identifications by other authors whenever possible.

We would like to thank many astronomers who sent us unpublished data, immediately responded to our requests to provide missing data or to correct erroneous data necessary for this Name-List. Also, thanks are due for sending us corrections to our catalogues and Name-Lists. This study was supported in part by Russian Foundation for Basic Research through grant 05-02-16289, by the Programme "Origin and Evolution of Stars and Galaxies" of the Presidium of Russian Academy of Sciences, and by the Support Programme for Leading Scientific Schools of Russia. Our research has made extensive use of the excellent ASAS-3 data base.

Table 1

No.	Name		R.A., Decl., 2000.0 h m s	° ' "	Max m	Min m		Type	References		
780001	V956	Cas	00 05 05.4	+59 39 01	14.2	17.2	B	IS:	001	002	
780002	CD	Scl	00 06 20.8	-35 17 13	12.7	14.2	V	RRAB	130	004	
780003	V439	And	00 06 36.8	+29 01 17	6.13	(0.04)	V	BY	005	DM	
780004	V957	Cas	00 09 45.7	+50 30 39	11.6	12.8	*	SR:	006	USNO	
780005	V958	Cas	00 10 48.5	+57 29 27	8.8	9.8	*	SR:	006	GSC	
780006	V959	Cas	00 12 02.7	+55 05 19	12.0	12.6	*	EW	006	GSC	040
780007	EK	Psc	00 16 54.3	+07 04 30	15.3	(0.02)	B	RPHS	008	009	
780008	V960	Cas	00 19 50.4	+47 42 38	11.5	12.3	*	SR	006	USNO	
780009	V961	Cas*	00 26 49.3	+55 27 24	12.0	(0.40)	V	EB	010	GSC	
780010	V440	And*	00 26 49.5	+41 49 09	12.6	13.2	*	EA	006	GSC	040
780011	CE	Scl*	00 31 33.5	-36 16 25	9.70	9.92	V	EA	011	DM	
780012	CF	Scl	00 33 07.3	-32 01 19	9.78	10.10	V	RS:	012	DM	
780013	CP	Phe	00 34 18.6	-43 00 03	10.6	13.0	V	SRA	130	004	
780014	V962	Cas*	00 35 39.5	+54 55 45	12.93	13.51	*	EA	214	214	
780015	CQ	Phe	00 37 51.6	-39 52 00	13.0	14.6	V	RRAB	130	014	
780016	V963	Cas	00 44 22.5	+57 26 27	12.3	13.8	*	SR:	006	USNO	
780017	EU	Cet	00 44 24.6	-00 27 43	17.5	(1.00)	V	RRAB	015	USNO	
780018	EL	Psc	00 46 33.0	+15 28 32	5.28	(0.22)	V	SRS	016	DM	
780019	V964	Cas	00 49 59.3	+52 56 35	12.3	13.1	*	SR:	006	USNO	040
780020	CR	Phe	00 50 02.5	-48 43 47	9.2	10.6	V	SRB	130	DM	040
780021	CG	Scl	00 55 26.8	-37 31 26	8.67	9.16	V	EA	011	DM	
780022	V965	Cas	00 55 40.9	+67 34 32	14.4	16.2	*	SR:	006	2MASS	
780023	V441	And	00 56 44.2	+41 29 23	13.5	14.3	*	EW	006	GSC	
780024	CH	Scl	00 57 43.8	-26 13 22	9.99	10.18	V	EA:	011	DM	
780025	EV	Cet*	00 57 53.8	-00 46 35	11.6	(0.48)	V	EW	017	GSC	
780026	V966	Cas	01 02 57.2	+69 13 37	7.67	(0.02)	V	BY	018	DM	
780027	V442	And	01 03 53.4	+47 38 32	6.63	6.92	V	BE	019	DM	
780028	CS	Phe	01 09 49.5	-44 18 53	11.9	13.8	V	RRAB	130	021	
780029	V443	And	01 10 41.9	+42 55 55	7.66	(0.02)	V	BY	018	DM	
780030	V967	Cas	01 11 00.0	+67 09 55	12.3	14.3	*	SRA	006	USNO	040
780031	V444	And	01 15 28.7	+41 19 59	13.0	13.7	*	EW	006	GSC	
780032	EW	Cet	01 16 24.2	-12 05 49	7.55	(0.03)	V	BY	018	DM	
780033	V445	And	01 16 29.3	+42 56 22	6.61	(0.03)	V	BY	018	DM	
780034	V968	Cas	01 18 47.2	+56 01 36	12.9	13.7	*	SR	006	USNO	040
780035	EM	Psc*	01 18 48.5	+13 21 08	14.3	(0.45)	V	EW	010	GSC	
780036	EG	Tuc	01 19 48.3	-69 33 27	9.4	9.8	V	SRS	130	DM	
780037	EN	Psc	01 21 28.2	+31 20 29	8.49	(0.02)	V	BY	018	DM	
780038	V446	And*	01 25 40.9	+47 07 07	7.61	(0.09)	V	*	018	DM	
780039	CT	Phe	01 25 46.4	-39 56 11	11.2	11.8	V	EA	130	004	
780040	EO	Psc	01 29 04.9	+21 43 23	7.74	(0.02)	V	RS	018	DM	
780041	AR	Tri	01 34 42.6	+30 25 28	10.60	10.63	V	DSCTC:	022	GSC	
780042	EX	Cet	01 37 35.5	-06 45 38	7.66	(0.02)	V	BY	018	DM	
780043	alpha	Eri	01 37 42.8	-57 14 12	0.40	0.46	Hp	BE	023	DM	
780044	CU	Phe	01 38 30.7	-42 55 40	6.68	(0.06)	V	GDOR:	024	DM	
780045	EY	Cet	01 40 58.8	-05 24 13	8.50	(0.03)	V	BY	018	DM	
780046	V969	Cas	01 43 46.9	+61 51 41	13.18	(0.21 I)	V	EA/RS	025	025	
780047	V970	Cas	01 43 57.4	+67 47 47	13.1	14.5	*	LB:	006	2MASS	
780048	V971	Cas*	01 44 12.0	+61 52 19	14.43	(0.77 I)	V	EA/RS:	025	025	
780049	V972	Cas	01 45 18.0	+61 06 56	9.90	(0.39 Ic)	Rc	BE	026	DM	
780050	V973	Cas	01 45 37.8	+61 07 59	12.97	(0.09 Ic)	Rc	BE	026	GSC	
780051	V974	Cas	01 45 39.6	+61 12 59	12.09	(0.10 Ic)	Rc	BE	026	GSC	
780052	V975	Cas	01 45 46.4	+61 09 21	11.77	(0.10 Ic)	Rc	BE	026	GSC	
780053	V976	Cas	01 45 56.1	+61 12 46	11.58	(0.20 Ic)	Rc	BE	026	GSC	
780054	V977	Cas	01 45 59.3	+61 12 46	10.23	(0.20 Ic)	Rc	BE	026	DM	

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0		Max	Min		Type	References	
			h m s	o ' "	m	m				
780055	V978	Cas	01 46 06.1	+61 13 39	11.11	(0.25 Ic)	Rc	BE	026	DM
780056	V979	Cas	01 46 14.0	+61 13 44	12.85	(0.10 Ic)	Rc	BE	026	GSC
780057	V980	Cas	01 46 20.2	+61 14 22	11.44	(0.15 Ic)	Rc	BE	026	GSC
780058	V981	Cas	01 46 26.8	+61 07 42	10.20	(0.15 Ic)	Rc	BE	026	DM
780059	V982	Cas	01 46 26.9	+61 14 12	11.90	(0.12 Ic)	Rc	BE	026	GSC
780060	V983	Cas	01 46 27.7	+61 12 26	10.34	(0.35 Ic)	Rc	BE	026	GSC
780061	V984	Cas	01 46 30.6	+61 14 29	11.66	(0.42 Ic)	Rc	BE	026	GSC
780062	V985	Cas	01 46 35.5	+61 15 48	9.85	(0.36 Ic)	Rc	BE	026	DM
780063	V986	Cas	01 47 03.7	+61 17 32	12.07	(0.05 Ic)	Rc	BE	026	GSC
780064	V987	Cas	01 47 44.8	+63 51 09	5.63	(0.05)	V	BY	005	DM
780065	EZ	Cet	01 49 23.4	-10 42 13	6.75	(0.05)	V	BY	005	DM
780066	FF	Cet	01 50 50.9	-00 07 56	18.	(0.93)	V	RRAB	015	USNO
780067	FG	Cet	01 50 58.2	-00 50 51	17.5	(0.82)	V	RRAB	015	USNO
780068	FH	Cet*	01 51 05.9	-03 32 41	13.7	14.7	V	EA	028	GSC
780069	FI	Cet	01 51 18.6	-02 23 01	14.0	20.8	R	UG:	029	029
780070	FK	Cet	01 53 31.3	-00 34 18	17.4	(0.57)	V	RRAB	015	USNO
780071	FL	Cet*	01 55 43.4	+00 28 07	15.5	(5.9)	V	E+XM	030	USNO
780072	V447	And	01 58 53.9	+37 34 43	13.39	(0.03)	V	RS	031	GSC
780073	AR	For	01 59 30.2	-31 29 18	10.6	12.1	V	SRA	130	014
780074	V988	Cas	02 00 40.2	+58 31 37	8.54	(0.02)	B	ACVO	032	DM
780075	FM	Cet	02 02 46.0	-00 00 02	16.	(0.98)	V	RRAB	015	USNO
780076	V448	And	02 03 21.2	+46 23 48	10.5	13.6	V	M	332	GSC
780077	AS	Tri	02 03 58.2	+29 54 18	8.25	(0.09)	V	DSCTC	033	DM
780078	FN	Cet	02 04 59.3	-15 40 41	7.79	(0.04)	V	BY	018	DM
780079	FO	Cet	02 06 10.7	-10 16 34	6.68	6.75	V	GDOR	034	DM
780080	FP	Cet	02 08 25.1	-00 34 44	18.	(1.19)	V	RRAB	015	USNO
780081	V678	Per	02 09 30.3	+57 57 38	8.71	(0.02)	B	DSCTC:	035	DM
780082	V449	And	02 09 46.9	+46 43 17	12.2	12.9	*	EW	332	GSC
780083	AZ	Ari	02 11 23.1	+21 22 38	7.33	(0.02)	V	BY	018	DM
780084	FQ	Cet	02 12 18.7	-13 30 42	10.4	(0.1)	V	EA	036	DM
780085	CV	Phe	02 12 47.1	-44 29 20	7.84	(0.02 b)	V	DSCTC	037	DM
780086	V450	And	02 12 55.0	+40 40 06	7.19	(0.02)	V	BY	018	DM
780087	V451	And	02 13 13.3	+40 30 27	7.35	(0.03)	V	BY	018	DM
780088	V989	Cas	02 15 42.6	+67 40 20	7.13	(0.03)	V	BY	018	DM
780089	V990	Cas*	02 16 41.8	+67 17 02	7.03	(0.02)	V	*	018	DM
780090	FR	Cet*	02 24 58.4	-02 46 48	6.31	6.65	V	*	038	DM
780091	CW	Hyi	02 30 51.0	-68 42 05	16.	18.	V	XM	039	039
780092	FS	Cet	02 35 07.6	+03 43 57	12.41	(0.01)	V	R	041	009
780093	FT	Cet	02 36 41.8	-03 09 22	8.10	(0.04)	V	BY	018	DM
780094	V679	Per	02 38 47.6	+56 43 10	12.9	14.2	*	SR:	006	2MASS
780095	V680	Per*	02 41 41.0	+35 42 55	13.55	14.13	*	EW	042	GSC
780096	BB	Ari	02 44 57.7	+27 31 09	13.5	<17.	*	UGSU	043	043
780097	AS	For	02 46 21.1	-36 13 36	10.2	<11.2	V	M	332	USNO
780098	BC	Ari	02 48 09.1	+27 04 07	7.56	(0.02)	V	BY	018	DM
780099	AT	For	02 51 09.4	-38 04 53	9.28	9.90	V	EA	011	DM
780100	IP	Eri	02 54 38.8	-05 19 51	7.32	(0.04)	V	BY:	018	DM
780101	IQ	Eri	02 55 38.0	-22 47 03	17.6	(0.5)	V	NL	039	039
780102	FU	Cet*	02 59 53.2	-00 40 47	7.86	(0.05)	V	*	018	DM
780103	V681	Per	03 00 33.3	+56 21 53	14.9	16.6	*	SR:	006	2MASS
780104	IR	Eri	03 02 32.7	-15 16 21	8.45	(0.02)	V	RS	018	DM
780105	CX	Hyi	03 04 38.7	-81 13 58	9.9	10.1	V	SRS	130	DM
780106	V682	Per	03 05 09.4	+56 10 59	12.4	15.5	*	M:	006	2MASS
780107	CY	Hyi*	03 06 17.2	-68 12 30	9.3	9.8	V	EW	130	DM
780108	IS	Eri	03 09 42.3	-09 34 47	8.48	(0.06)	V	BY	018	DM

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ’ "	Max m	Min m		Type	References
780109	V683	Per	03 13 02.8	+32 53 47	8.15	(0.02)	V	BY	018 DM
780110	V684	Per	03 16 56.1	+55 52 33	13.0	15.1	*	SR:	006 2MASS
780111	V991	Cas	03 16 58.1	+67 02 45	12.2	15.0	*	M	006 2MASS 040
780112	V685	Per	03 20 10.9	+45 58 18	13.0	<15.0	*	SR:	006 GSC 040
780113	V686	Per	03 20 59.5	+33 13 06	7.94	(0.04)	V	BY	018 DM
780114	V687	Per	03 23 12.1	+33 04 42	7.96	(0.02)	V	BY	018 DM
780115	LX	Cam	03 24 46.1	+55 52 12	12.1	<14.5	*	M:	006 2MASS 040
780116	V688	Per	03 26 04.2	+48 48 07	10.65	10.71	V	BY	044 GSC
780117	V1220	Tau	03 28 09.6	-01 18 05	11.9	12.5	V	EB	045 GSC
780118	V1221	Tau	03 28 15.0	+04 09 48	9.49	9.56	V	BY	046 DM
780119	V1222	Tau	03 28 25.8	+09 04 24	13.28	13.64	*	EW	047 GSC
780120	V1223	Tau	03 29 14.7	+09 11 20	12.13	12.59	*	EW	047 GSC
780121	V1224	Tau	03 29 38.4	+24 30 38	12.05	12.23	V	INT	048 GSC
780122	V689	Per	03 32 10.2	+49 08 29	11.99	12.11	V	BY	044 GSC
780123	LY	Cam	03 35 08.3	+55 04 55	10.7	<12.4	*	SRA:	006 2MASS 040
780124	V690	Per	03 36 54.3	+40 55 40	12.2	(0.05)	V	DSCTC:	049 049
780125	V691	Per	03 37 15.0	+40 54 00	11.2	(0.03)	V	DSCTC:	049 049
780126	V1225	Tau	03 39 51.2	+25 11 41	8.81	(0.08)	V	GDOR	050 DM
780127	IT	Eri	03 42 33.6	-14 50 43	9.1	9.6	V	SRB	130 DM 040
780128	V692	Per	03 44 11.3	+32 06 12	14.22	(0.15)	Ic	INT	051 052
780129	V693	Per	03 44 16.4	+32 09 55	12.63	(0.07)	Ic	INT	051 052
780130	V694	Per	03 44 18.2	+32 09 59	15.53	16.06	Ic	INT	051 052
780131	V695	Per	03 44 19.2	+32 07 35	14.87	(0.65)	Ic	INT	051 052
780132	V696	Per	03 44 21.6	+32 10 17	14.55	(0.26)	Ic	INT	051 052
780133	V697	Per	03 44 21.6	+32 10 38	14.80	15.98	Ic	INT	051 052
780134	V698	Per	03 44 22.3	+32 05 43	14.75	15.25	Ic	INT	051 052
780135	V699	Per	03 44 23.7	+32 06 47	14.15	(0.14)	Ic	INT	051 052
780136	V700	Per	03 44 25.6	+32 12 30	13.57	(0.18)	Ic	BY	051 054
780137	V701	Per	03 44 26.6	+32 03 58	14.04	(0.18)	Ic	BY	051 054
780138	V702	Per	03 44 27.2	+32 10 37	15.96	17.12	Ic	INT	051 052
780139	V703	Per	03 44 27.9	+32 07 32	14.08	(0.06)	Ic	INT	051 052
780140	V704	Per	03 44 28.5	+32 07 23	13.33	(0.24)	Ic	INT	051 052
780141	V705	Per	03 44 31.2	+32 06 22	10.56	(0.04)	V	DSCTC:	053 052
780142	V706	Per	03 44 31.5	+32 08 45	12.12	(0.08)	Ic	INT	051 052
780143	V707	Per	03 44 32.8	+32 09 16	14.69	(0.24)	Ic	INT	051 052
780144	V708	Per	03 44 34.0	+32 08 54	13.55	(0.18)	Ic	INT	051 052
780145	V709	Per	03 44 37.4	+32 06 12	13.78	(0.08)	Ic	INT	051 052
780146	V710	Per	03 44 37.4	+32 09 01	14.63	14.97	Ic	INT	051 052
780147	V711	Per	03 44 37.8	+32 12 18	15.40	(0.35)	Ic	INT	051 2MASS
780148	V712	Per	03 44 38.0	+32 03 30	12.97	14.95	Ic	INT	051 054
780149	V713	Per	03 44 38.0	+32 11 37	15.40	15.84	Ic	INT	051 052
780150	V714	Per	03 44 38.4	+32 13 00	14.55	(0.20)	Ic	INT	318 2MASS
780151	V715	Per	03 44 38.4	+32 07 36	13.21	(0.17)	Ic	INT	051 052
780152	V716	Per	03 44 38.5	+32 08 01	14.11	(0.29)	Ic	INT	051 052
780153	V717	Per	03 44 38.7	+32 08 42	13.86	(0.12)	Ic	INT	051 052
780154	V718	Per	03 44 39.2	+32 07 36	12.95	13.65	Ic	E:	055 052
780155	V719	Per	03 44 43.8	+32 10 31	14.12	14.80	Ic	INT	051 052
780156	V1226	Tau*	03 45 43.2	+25 40 23	17.36	(0.01:)	Ic	*	007 2MASS
780157	V1227	Tau	03 45 44.5	+24 42 50	11.1	(0.15)	V	BY	048 056
780158	V720	Per	03 46 12.8	+51 33 24	11.3	13.0	*	SR:	006 GSC
780159	V1228	Tau	03 47 24.1	+24 35 18	7.71	(0.02 v)	V	DSCTC	057 DM
780160	V1229	Tau*	03 47 29.5	+24 17 18	6.84	6.94	V	EA	058 DM
780161	LZ	Cam*	03 47 45.0	+63 28 25	19.5	20.6	V	EB	059 059
780162	MM	Cam*	03 51 00.5	+69 06 10	7.11	(0.04)	V	*	018 DM

Table 1 (continued)

No.	Name		R.A., 2000.0	Decl., 2000.0	Max	Min		Type	References
			h m s	o ' "	m	m			
780163	V1230	Tau*	03 53 06.0	+10 26 45	14.28	14.52	*	EW	060 GSC
780164	MN	Cam	03 57 29.8	+54 56 18	11.2	11.7	*	DCEP	061 GSC 040
780165	MO	Cam	03 58 59.4	+56 11 13	11.14	11.39	V	BE	062 GSC
780166	V721	Per	04 00 39.7	+51 21 02	11.7	13.9	*	SRA	332 2MASS
780167	MP	Cam*	04 01 01.2	+55 11 10	12.5	14.3	*	EB:	214 214
780168	MQ	Cam	04 01 31.0	+55 02 43	11.9	12.3	*	DCEP	061 GSC
780169	MR	Cam	04 12 18.1	+58 40 05	9.8	12.6	*	M	040 GSC
780170	IU	Eri	04 16 36.0	-10 05 09	7.49	7.55	Hp	DSCTC	024 DM
780171	V1231	Tau	04 16 50.8	+18 52 21	15.46	15.93	*	RRC	063 USNO
780172	V722	Per	04 17 01.5	+35 31 11	10.7	(0.15)	R	BY	064 064
780173	V1232	Tau	04 18 01.8	+18 15 24	7.53	(0.05)	V	RS	018 DM
780174	IV	Eri	04 21 15.4	-35 18 14	12.0	13.5	V	RRAB	130 DM
780175	V1233	Tau	04 25 51.7	+18 51 51	8.07	(0.02)	V	BY	018 DM
780176	IW	Eri	04 25 55.2	-19 45 30	16.7	18.0	V	XM	039 039
780177	V1234	Tau*	04 29 25.0	+09 05 30	12.6	13.0	*	EW	065 GSC
780178	V1235	Tau	04 32 10.2	+17 43 18	10.96	11.00	V	DSCTC	022 GSC
780179	MS	Cam	04 33 54.3	+64 38 00	7.75	(0.03)	V	BY	018 DM
780180	MT	Cam*	04 40 24.5	+55 25 15	12.94	13.54	*	EW	214 214
780181	IX	Eri	04 47 36.3	-16 56 04	5.47	5.51	V	BY	005 DM
780182	V536	Aur	04 53 56.2	+36 45 27	7.77	(0.03)	V	BY	018 DM
780183	V1648	Ori	04 55 30.3	+03 04 28	12.9	<14.6	V	M	332 GSC
780184	V537	Aur	05 08 45.0	+40 15 17	12.1	(0.05)	V	DSCTC	067 GSC
780185	V1236	Tau	05 16 28.8	+26 07 39	18.1	(0.17 *)	V	EA	068 068
780186	AS	Col	05 20 38.0	-39 45 18	7.34	7.38	V	RS:	046 DM
780187	V1649	Ori	05 23 31.1	+05 19 23	6.34	(0.01 b)	V	DSCTC	037 DM
780188	V1237	Tau*	05 26 21.1	+24 49 51	14.03	(0.20 *)	V	EW	070 070
780189	AF	Lep	05 27 04.8	-11 54 03	6.26	6.35	V	RS	071 DM
780190	V1650	Ori*	05 29 11.4	-06 08 05	10.43	11.5 :	V	INB:	038 DM
780191	AG	Lep	05 30 19.1	-19 16 32	9.62	9.67	V	BY	046 DM
780192	V1651	Ori	05 31 27.2	-05 10 29	12.00	(0.07)	Ic	INB	072 GSC
780193	V1652	Ori	05 31 31.1	-05 06 29	12.95	(0.07)	Ic	INB	072 USNO
780194	V1653	Ori	05 32 02.3	-05 23 37	14.21	(0.04)	Ic	INB	072 USNO
780195	V1654	Ori	05 32 11.0	-05 24 35	13.55	(0.05)	Ic	INB	072 USNO
780196	V1655	Ori	05 32 11.7	-05 07 08	11.96	(0.05)	Ic	INB	072 GSC
780197	V1656	Ori	05 32 18.9	-05 05 27	13.48	(0.15)	Ic	INB	072 USNO
780198	V1657	Ori	05 33 08.9	-05 23 10	12.36	(0.10)	Ic	INB	072 GSC
780199	V1658	Ori	05 33 14.4	-05 13 40	13.56	(0.32)	Ic	INB	072 USNO
780200	V1659	Ori	05 33 15.0	-05 00 39	14.20	(0.13)	Ic	INB	072 USNO
780201	V1660	Ori	05 33 20.4	-05 11 24	14.02	(0.08)	Ic	INB	072 USNO
780202	V1661	Ori	05 33 21.8	-05 04 17	13.87	(0.08)	Ic	INB	072 USNO
780203	V1662	Ori	05 33 22.5	-05 23 03	14.04	(0.10)	Ic	INB	072 USNO
780204	V1663	Ori	05 33 31.1	-05 25 23	13.07	(0.07)	Ic	INB	072 USNO
780205	V1664	Ori	05 33 39.8	-05 19 54	14.39	(0.17)	Ic	INB	072 USNO
780206	V1665	Ori	05 33 41.6	-04 56 00	14.45	(0.08)	Ic	INB	072 USNO
780207	V1666	Ori	05 33 44.5	-06 05 20	14.50	(0.11)	Ic	INB	072 USNO
780208	V1667	Ori	05 33 46.1	-05 34 26	12.34	(0.11)	Ic	INB	072 USNO
780209	V1668	Ori	05 33 46.3	-06 13 05	14.79	(0.08)	Ic	INB	072 USNO
780210	V1669	Ori	05 33 54.8	-05 08 31	14.69	(0.08)	Ic	INB	072 USNO
780211	AH	Lep	05 34 09.2	-15 17 03	8.46	8.50	V	BY	046 DM
780212	V1670	Ori	05 34 14.4	-04 58 34	14.62	(0.06)	Ic	INB	072 USNO
780213	V1671	Ori	05 34 18.5	-05 34 00	12.60	(0.10)	Ic	INB	072 2MASS
780214	V1672	Ori	05 34 20.3	-04 34 03	13.52	(0.06)	Ic	INB	072 USNO
780215	V1673	Ori	05 34 20.7	-04 35 02	14.12	(0.08)	Ic	INB	072 USNO
780216	V1674	Ori	05 34 20.8	-05 23 29	14.18	(0.10)	Ic	INB	072 2MASS

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0	Max	Min	Type	References
		h m s o ' "	m	m		
780217	V1675 Ori	05 34 23.8 -05 08 16	13.70	(0.08) Ic	INB	072 USNO
780218	V1676 Ori	05 34 23.9 -05 15 40	11.19	(0.16 Ic) J	INB	072 USNO
780219	V1677 Ori	05 34 24.3 -06 06 56	12.96	(0.10) Ic	INB	072 USNO
780220	V1678 Ori	05 34 25.3 -04 54 39	13.24	(0.09) Ic	INB	072 USNO
780221	V1679 Ori	05 34 26.1 -06 15 33	15.64	(0.14) Ic	INB	072 USNO
780222	V1680 Ori	05 34 28.1 -06 16 13	12.67	(0.30) Ic	INB	072 USNO
780223	V1681 Ori	05 34 29.6 -05 04 29	15.50	(0.10) Ic	INB	072 2MASS
780224	V1682 Ori	05 34 30.4 -04 57 05	14.40	(0.07) Ic	INB	072 USNO
780225	V1683 Ori	05 34 31.0 -05 58 04	15.53	(0.10) Ic	INB	072 2MASS
780226	V1684 Ori	05 34 32.2 -05 41 49	14.67	(0.10) Ic	INB	072 2MASS
780227	V1685 Ori	05 34 33.7 -04 44 15	14.95	(0.14) Ic	INB	072 USNO
780228	V1686 Ori	05 34 35.5 -04 27 21	11.17	(0.04) Ic	INB	072 GSC
780229	V1687 Ori	05 34 37.2 -04 38 24	15.41	(0.11) Ic	INB	072 2MASS
780230	V1688 Ori	05 34 38.0 -04 51 09	14.06	(0.10) Ic	INB	072 USNO
780231	V1689 Ori	05 34 38.7 -05 57 43	12.09	(0.09) Ic	INB	072 USNO
780232	V1690 Ori	05 34 39.9 -06 08 34	13.79	(0.04) Ic	INB	072 USNO
780233	V1691 Ori	05 34 40.6 -04 43 31	14.58	(0.09) Ic	INB	072 2MASS
780234	V1692 Ori	05 34 40.9 -04 40 20	12.46	(0.08) Ic	INB	072 USNO
780235	V1693 Ori	05 34 41.0 -05 45 18	11.60	(0.20) Ic	INB	072 USNO
780236	V1694 Ori	05 34 41.8 -04 53 46	13.13	(0.44) Ic	INB	072 USNO
780237	V1695 Ori	05 34 42.0 -05 02 25	14.98	(0.16) Ic	INB	072 2MASS
780238	V1696 Ori	05 34 43.1 -06 12 39	13.49	(0.22) Ic	INB	072 USNO
780239	V1697 Ori	05 34 44.0 -04 39 38	15.28	(0.08) Ic	INB	072 2MASS
780240	V1698 Ori	05 34 45.0 -04 55 39	15.06	(0.10) Ic	INB	072 2MASS
780241	V1699 Ori	05 34 46.4 -04 54 02	16.22	(0.31) Ic	INB	072 2MASS
780242	V1700 Ori	05 34 46.9 -04 59 13	13.19	(0.07) Ic	INB	072 USNO
780243	V1701 Ori	05 34 47.6 -05 43 51	11.34	(0.11) Ic	INB	072 GSC
780244	V1702 Ori	05 34 48.1 -06 18 12	14.21	(0.05) Ic	INB	072 USNO
780245	V1703 Ori	05 34 48.2 -04 47 40	11.55	(0.09) Ic	INB	072 USNO
780246	V1704 Ori	05 34 48.6 -04 47 50	14.05	(0.22) Ic	INB	072 2MASS
780247	V1705 Ori	05 34 50.9 -06 00 14	13.51	(0.11) Ic	INB	072 USNO
780248	V1706 Ori	05 34 51.1 -04 43 41	11.64	(0.06) Ic	INB	072 USNO
780249	V1707 Ori	05 34 51.3 -04 47 57	11.38	(0.10) Ic	INB	072 2MASS
780250	V1708 Ori	05 34 52.1 -06 03 21	13.22	(0.07) Ic	INB	072 USNO
780251	V1709 Ori	05 34 52.2 -04 28 16	13.13	(0.18) Ic	INB	072 USNO
780252	V1710 Ori	05 34 55.6 -06 01 04	13.39	(0.05) Ic	INB	072 2MASS
780253	V1711 Ori	05 34 55.7 -04 37 49	13.91	(0.05) Ic	INB	072 USNO
780254	V1712 Ori	05 34 59.2 -05 44 55	14.79	(0.6) Ic	INB	072 2MASS
780255	V1713 Ori	05 35 02.0 -04 41 14	15.05	(0.09) Ic	INB	072 2MASS
780256	V1714 Ori	05 35 02.4 -04 49 16	13.78	(0.16) Ic	INB	072 2MASS
780257	V1715 Ori	05 35 02.7 -04 49 29	12.10	(0.05) Ic	INB	072 2MASS
780258	V1716 Ori	05 35 02.8 -05 51 03	13.60	(0.15) Ic	INB	072 USNO
780259	V1717 Ori	05 35 03.0 -05 45 33	14.96	(0.30) Ic	INB	072 2MASS
780260	V1718 Ori	05 35 03.3 -04 49 21	10.82	(0.34) Ic	INT	072 2MASS
780261	V1719 Ori	05 35 04.0 -05 40 52	13.35	(0.08) Ic	INB	072 2MASS
780262	V1720 Ori	05 35 05.0 -04 49 13	12.83	(0.12) Ic	INB	072 2MASS
780263	V1721 Ori	05 35 06.8 -05 10 39	14.02	(0.06) Ic	INB	072 2MASS
780264	V1722 Ori	05 35 07.0 -04 54 57	13.44	(0.11) Ic	INB	072 USNO
780265	V1723 Ori	05 35 07.9 -04 35 49	14.45	(0.18) Ic	INB	072 USNO
780266	V1724 Ori	05 35 08.7 -05 04 41	13.87	(0.05) Ic	INB	072 USNO
780267	V1725 Ori	05 35 10.1 -04 51 08	13.86	(0.10) Ic	INB	072 2MASS
780268	V1726 Ori	05 35 11.0 -04 47 12	14.12	(0.08) Ic	INB	072 2MASS
780269	V1727 Ori	05 35 12.5 -04 44 26	11.97	(0.11) Ic	INB	072 2MASS
780270	V1728 Ori	05 35 14.6 -05 02 25	14.13	(0.11) Ic	INB	072 USNO

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m	Type	References
780271	V1729 Ori	05 35 16.3 -06 18 43	14.48	(0.29) Ic	INB	072 USNO
780272	V1730 Ori	05 35 16.8 -04 40 32	11.59	(0.21) Ic	INB	072 2MASS
780273	V1731 Ori	05 35 19.5 -05 36 52	13.45	(0.08) Ic	INB	072 2MASS
780274	V1732 Ori	05 35 19.8 -05 45 41	13.77	(0.10) Ic	INB	072 USNO
780275	V1733 Ori	05 35 20.8 -04 58 34	14.27	(0.16) Ic	INB	072 USNO
780276	V1734 Ori	05 35 21.3 -05 56 36	14.13	(0.09) Ic	INB	072 2MASS
780277	V1735 Ori	05 35 22.5 -05 09 11	11.67	(0.10) Ic	INB	072 USNO
780278	V1736 Ori	05 35 23.2 -04 43 03	12.52	(0.10) Ic	INB	072 2MASS
780279	V1737 Ori	05 35 26.0 -04 34 57	15.02	(0.11) Ic	INB	072 USNO
780280	V1738 Ori	05 35 27.9 -04 45 03	11.83	(0.04) Ic	INB	072 USNO
780281	V1739 Ori	05 35 28.6 -04 55 04	11.17	(0.06) Ic	INB	072 USNO
780282	V1740 Ori	05 35 29.0 -05 06 04	12.13	(0.07) Ic	INB	072 USNO
780283	V1741 Ori	05 35 30.5 -04 51 29	12.76	(0.13) Ic	INB	072 2MASS
780284	V1742 Ori	05 35 31.5 -06 14 19	14.03	(0.10) Ic	INB	072 USNO
780285	V1743 Ori	05 35 31.7 -04 41 08	14.71	(0.21) Ic	INB	072 2MASS
780286	V1744 Ori	05 35 33.1 -05 47 08	14.01	(0.06) Ic	INB	072 2MASS
780287	V1745 Ori	05 35 33.5 -04 56 02	14.32	(0.11) Ic	INB	072 2MASS
780288	V1746 Ori	05 35 34.0 -04 54 11	13.65	(0.10) Ic	INB	072 2MASS
780289	V1747 Ori	05 35 34.2 -04 33 42	13.74	(0.07) Ic	INB	072 USNO
780290	V1748 Ori	05 35 36.6 -05 04 39	13.23	(0.16) Ic	INB	072 USNO
780291	V1749 Ori	05 35 37.3 -06 00 00	14.13	(0.07) Ic	INB	072 USNO
780292	V1750 Ori	05 35 38.0 -04 48 33	13.67	(0.13) Ic	INB	072 2MASS
780293	V1751 Ori	05 35 40.8 -04 48 31	11.12	(0.10) Ic	INB	072 2MASS
780294	V1752 Ori	05 35 41.7 -05 49 26	14.58	(0.04) Ic	INB	072 USNO
780295	V1753 Ori	05 35 43.4 -05 40 55	13.70	(0.06) Ic	INB	072 2MASS
780296	V1754 Ori	05 35 44.0 -05 56 53	14.16	(0.11) Ic	INB	072 USNO
780297	V1755 Ori	05 35 44.4 -04 57 17	14.68	(0.12) Ic	INB	072 2MASS
780298	V1756 Ori	05 35 44.5 -04 44 16	13.16	(0.18) Ic	INB	072 USNO
780299	V1757 Ori	05 35 47.1 -06 11 45	15.67	(0.24) Ic	INB	072 2MASS
780300	V1758 Ori	05 35 47.4 -05 55 11	14.19	(0.05) Ic	INB	072 USNO
780301	V1759 Ori	05 35 50.4 -04 42 08	14.41	(0.08) Ic	INB	072 2MASS
780302	V1760 Ori	05 35 51.6 -05 08 09	10.74	(0.41) Ic	INB	072 GSC
780303	V1761 Ori	05 35 53.6 -05 02 34	14.84	(0.11) Ic	INB	072 2MASS
780304	V1762 Ori	05 35 54.5 -04 48 05	10.74	(0.15) Ic	INB	072 USNO
780305	V1763 Ori	05 35 57.7 -06 11 25	13.52	(0.23) Ic	INB	072 USNO
780306	V1764 Ori	05 36 00.2 -06 03 29	13.05	(0.15) Ic	INB	072 USNO
780307	V1765 Ori	05 36 01.8 -04 34 17	12.31	(0.05) Ic	INB	072 GSC
780308	V1766 Ori	05 36 05.2 -05 41 39	14.13	(0.05:) Ic	INB	072 USNO
780309	V1767 Ori	05 36 05.8 -05 18 56	15.45	(0.15) Ic	INB	072 2MASS
780310	V1768 Ori	05 36 06.8 -04 28 08	13.34	(0.22) Ic	INB	072 USNO
780311	V1769 Ori	05 36 19.2 -04 27 31	13.49	(0.05) Ic	INB	072 USNO
780312	V1770 Ori	05 36 25.4 -05 17 02	15.87	(0.15) Ic	INB	072 2MASS
780313	V1771 Ori	05 36 25.9 -04 33 42	15.36	(0.23) Ic	INB	072 USNO
780314	V1772 Ori	05 36 26.9 -04 31 37	12.89	(0.09) Ic	INB	072 GSC
780315	V1773 Ori	05 36 39.8 -04 37 52	13.38	(0.05) Ic	INB	072 USNO
780316	V1774 Ori	05 36 47.9 -05 45 43	12.54	(0.13) Ic	INB	072 USNO
780317	V1775 Ori	05 36 55.4 -05 26 00	13.68	(0.07) Ic	INB	072 USNO
780318	V1776 Ori	05 36 55.6 -04 32 11	14.46	(0.25) Ic	INB	072 USNO
780319	V1777 Ori	05 37 00.9 -05 41 37	11.46	(0.06) Ic	INB	072 GSC
780320	AT Col	05 37 05.3 -39 32 26	9.52	9.61 V	BY	046 DM
780321	V1778 Ori	05 37 08.6 -05 18 46	15.27	(0.21) Ic	INB	072 USNO
780322	V1779 Ori	05 37 10.9 -05 15 20	14.07	(0.09) Ic	INB	072 USNO
780323	V1780 Ori	05 37 18.4 -05 43 52	12.74	(0.12) Ic	INB	072 USNO
780324	V1781 Ori	05 37 20.1 -05 11 50	12.45	(0.08) Ic	INB	072 USNO

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 ° ' "	Max m	Min m		Type	References	
780325	V1782	Ori	05 37 23.5	-05 43 23	14.07	(0.15)	Ic	INB	072 USNO	
780326	V1783	Ori	05 37 29.6	-05 15 55	14.48	(0.09)	Ic	INB	072 USNO	
780327	V1784	Ori	05 37 38.0	-05 16 34	13.51	(0.16)	Ic	INB	072 USNO	
780328	V1785	Ori	05 38 03.1	-05 51 06	14.49	(0.10)	Ic	INB	072 USNO	
780329	V1786	Ori	05 38 04.2	-05 15 27	13.54	(0.04)	Ic	INB	072 USNO	
780330	V1787	Ori	05 38 09.3	-06 49 17	13.75	13.84	V	INA	038 GSC	
780331	V1788	Ori	05 38 14.5	-05 25 13	9.76	9.85	V	INA	038 DM	
780332	V1789	Ori	05 38 39.7	-05 08 43	11.61	(0.11)	Ic	INB	072 GSC	
780333	AI	Lep	05 40 20.7	-19 40 11	8.97	(0.05)	V	RS	018 DM	
780334	V1790	Ori	05 40 24.3	-00 46 17	10.63	(0.01 b)	V	DSCTC	037 DM	
780335	V1791	Ori	05 40 37.4	-08 04 03	11.55	14.57	V	INB:	038 USNO	
780336	V1792	Ori	05 41 04.1	-09 23 19	14.80	14.92	V	INB	038 GSC	
780337	V538	Aur	05 41 20.3	+53 28 52	6.34	6.38	Hp	BY	005 DM	
780338	V1238	Tau*	05 42 14.6	+22 22 17	8.50	8.87	V	EW	130 DM	
780339	AK	Lep	05 44 26.5	-22 25 19	6.15	(0.06)	V	BY	074 DM	
780340	V1647	Ori*	05 46 13.1	-00 06 05	18.1	<20.	V	FU	075 076	
780341	BC	Dor	05 46 15.0	-68 35 24	13.6	19.7	V	UG	077 078	
780342	V1239	Tau*	05 50 25.9	+26 56 51	10.66	11.08	V	EA:	130 GSC	
780343	V539	Aur	05 51 50.5	+32 32 35	16.05	(0.55 Rc)	V	DSCT	080 080	
780344	V540	Aur	05 52 16.6	+32 28 15	14.98	(0.23 Rc)	V	EA:	080 080	
780345	V541	Aur	05 52 20.4	+32 33 20	13.78	(0.4 Rc)	V	EA:	080 080	
780346	V542	Aur*	05 52 33.0	+32 32 41	16.07	(0.35 Rc)	V	EW	080 080	
780347	V543	Aur*	05 52 39.1	+32 36 31	17.83	(0.68 Rc)	V	EW	080 080	
780348	V544	Aur*	05 52 53.2	+32 33 02	16.17	(0.33 Rc)	V	EW	080 080	
780349	V545	Aur	05 53 00.7	+32 24 51	16.11	(0.39 Rc)	V	RRC:	080 080	
780350	V1793	Ori	05 54 03.0	+01 40 22	9.45	9.95	V	INT	038 DM	
780351	V546	Aur*	06 01 44.1	+49 56 30	13.97	14.07	V	GDOR:	081 081	
780352	V547	Aur*	06 01 57.4	+49 58 55	14.46	14.54	V	GDOR:	081 081	040
780353	V548	Aur*	06 02 05.3	+49 49 11	15.32	15.42	V	DSCT	081 081	
780354	V549	Aur	06 02 21.3	+49 52 37	15.90	<16.40	V	EA	081 081	
780355	V550	Aur	06 02 26.4	+49 51 57	13.01	13.08	V	DSCTC	081 081	
780356	V551	Aur*	06 02 38.1	+49 53 02	14.43	14.65	V	EA+DSCT	081 081	
780357	V575	Pup*	06 04 46.7	-48 27 30	6.62	(0.04)	V	RS	046 DM	
780358	AU	Col	06 09 02.6	-41 07 05	7.45	(0.04 b)	V	DSCTC	037 DM	
780359	V371	Gem*	06 10 19.4	+24 01 15	10.5	11.6	V	DCEP	082 083	
780360	V352	CMa	06 13 45.3	-23 51 43	6.37	6.40	V	BY	046 DM	
780361	V552	Aur*	06 14 09.8	+45 30 09	11.2	14.5	p	AM:	085 085	
780362	V1794	Ori	06 18 24.8	+02 05 34	12.7	<18.2	B	M	086 086	
780363	V1795	Ori	06 18 56.1	+09 18 20	14.8	<19.8	B	M	086 086	
780364	V1796	Ori	06 19 22.9	+15 43 04	15.2	<20.0	B	M	086 086	
780365	V1797	Ori	06 20 57.3	+07 51 27	14.4	<19.8	B	M	086 086	
780366	V353	CMa	06 21 33.1	-22 12 53	8.48	(0.02)	V	BY	018 DM	
780367	MU	Cam*	06 25 16.3	+73 34 39	14.3	15.0	R	XM	087 087	
780368	V354	CMa	06 26 03.8	-14 21 01	11.1	13.9	V	M	130 USNO	
780369	V848	Mon	06 31 11.1	+05 52 37	8.94	(0.02)	V	BY	018 DM	
780370	AI	Pic	06 32 49.6	-63 35 50	12.2	<15.0	V	M	130 USNO	040
780371	V355	CMa	06 32 52.3	-26 10 24	10.8	<14.3	V	M	130 086	040
780372	AK	Pic	06 38 00.4	-61 32 00	6.14	6.19	V	BY	046 DM	
780373	V849	Mon	06 39 02.3	-08 45 29	12.9	<14.8	V	SRB	130 USNO	
780374	V356	CMa	06 39 11.6	-26 34 19	8.44	(0.02)	V	BY:	018 DM	
780375	V850	Mon	06 39 31.4	+03 19 11	9.37	(0.03)	V	BY	018 DM	
780376	V553	Aur	06 44 11.7	+36 59 38	7.53	7.58	Hp	GDOR	091 DM	
780377	V576	Pup	06 50 54.9	-37 29 23	12.4	<15.5	V	M	332 USNO	
780378	V372	Gem*	06 50 55.8	+22 29 22	12.5	(0.50)	V	EB	092 GSC	

Table 1 (continued)

No.	Name		R.A., 2000.0	Decl., 2000.0	Max	Min		Type	References		
			h m s	° ' "	m	m					
780379	V851	Mon*	06 51 40.1	+00 27 07	10.85	10.90	V	ACV:	093	093	
780380	V852	Mon*	06 51 41.7	+00 23 43	16.58	16.74	V	EW:	093	093	
780381	V853	Mon*	06 51 43.3	+00 31 19	15.98	16.12	V	EW	093	093	
780382	V854	Mon	06 51 48.9	+00 26 56	12.56	12.59	V	GDOR	093	093	
780383	V855	Mon	06 51 50.0	+00 28 20	12.66	12.71	V	GDOR	093	093	
780384	V856	Mon	06 51 51.1	+00 25 39	11.62	11.66	V	ACV:	093	093	
780385	V857	Mon*	06 51 56.8	+00 25 47	15.82	16.02	V	EW	093	093	
780386	V858	Mon*	06 51 57.3	+00 25 47	15.73	15.90	V	EW:	093	093	
780387	V859	Mon*	06 52 07.2	+00 32 53	14.47	14.53	V	EB	093	093	
780388	V577	Pup	06 55 12.4	-36 07 10	11.5	<14.4	V	M	090	2MASS	
780389	V860	Mon*	06 58 18.7	-04 38 21	9.22	9.44	V	EA	130	DM	040
780390	V861	Mon*	07 02 49.9	-08 54 47	12.6	13.4	V	EA	095	GSC	040
780391	V862	Mon	07 04 10.4	+05 12 47	9.08	(0.02)	V	BY	018	DM	
780392	V863	Mon*	07 05 25.1	-09 00 34	9.02	9.16	V	EB	130	DM	011
780393	DW	Lyn	07 07 09.7	+60 38 50	14.7	(0.03)	B	RPHS	096	GSC	
780394	V373	Gem*	07 11 55.3	+23 24 56	9.26	9.42	V	EB	011	DM	
780395	CX	CMi*	07 13 34.1	+10 15 13	11.41	12.02	V	EW	097	GSC	
780396	V374	Gem	07 15 08.0	+21 35 22	12.3	<14.	V	M	098	098	040
780397	V864	Mon	07 15 08.5	-04 44 21	9.9	10.6	V	EW	130	GSC	
780398	CY	CMi	07 16 10.3	+09 59 48	8.11	8.26	V	SRD	099	DM	
780399	CZ	CMi	07 16 57.3	+09 12 35	10.54	11.06	V	EW	097	GSC	
780400	V578	Pup	07 17 05.8	-34 49 39	11.2	<14.5	V	M	130	USNO	
780401	V579	Pup*	07 17 59.7	-41 21 19	12.39	13.56	V	EA	130	GSC	
780402	V580	Pup	07 19 05.0	-42 58 01	9.7	11.5	V	SRA	130	GSC	040
780403	V357	CMa	07 20 04.1	-19 30 45	9.6	10.0	V	SRA	090	DM	040
780404	V358	CMa*	07 20 22.4	-23 43 57	13.9	(0.10)	V	WR:	101	102	
780405	V359	CMa	07 21 14.8	-29 18 00	11.2	13.0	V	SRA	130	GSC	332
780406	V865	Mon	07 22 43.2	-08 40 54	11.7	12.6	V	SRB	095	GSC	040
780407	V375	Gem*	07 22 46.0	+17 02 28	12.7	13.6	V	EB	319	GSC	040
780408	V575	Car*	07 24 49.6	-51 28 27	7.82	8.23	V	EA	011	DM	
780409	V581	Pup*	07 28 21.1	-36 43 13	11.87	12.47	V	EW	011	DM	
780410	V376	Gem	07 29 01.8	+31 59 38	7.73	(0.03)	V	BY	018	DM	
780411	DX	Lyn	07 33 00.6	+37 01 47	7.68	(0.02)	V	BY	018	DM	
780412	V582	Pup*	07 34 08.3	-13 02 22	7.86	8.13	V	EA	011	DM	
780413	V866	Mon	07 34 17.8	-08 45 20	12.0	13.7	V	EA	095	GSC	130
780414	V867	Mon	07 34 26.2	-06 53 48	8.16	(0.02)	V	BY	018	DM	
780415	V868	Mon	07 39 04.8	-02 39 06	8.9	9.5	V	EB	094	DM	
780416	V869	Mon	07 39 59.3	-03 35 51	7.18	(0.02)	V	BY	018	DM	
780417	V583	Pup	07 40 47.8	-24 05 14	7.98	8.33	V	EB	011	DM	
780418	V574	Pup	07 41 53.6	-27 06 38	6.93	18. :	V	NA	320		
780419	V870	Mon	07 48 00.8	-02 35 40	8.4	<12.	V	M	103	GSC	
780420	DD	CMi	07 48 58.2	+00 39 43	7.50	7.57	Hp	GDOR	091	DM	
780421	V377	Gem	07 49 55.1	+27 21 47	6.93	(0.05)	V	BY	005	DM	
780422	V584	Pup	07 51 31.4	-46 15 54	9.5	10.2	V	SRB	130	DM	040
780423	V585	Pup	07 59 09.0	-22 26 13	11.5	<14.0	V	M	130	USNO	040
780424	DY	Lyn*	08 00 46.0	+42 10 33	9.67	10.21	V	EA	104	DM	
780425	V586	Pup	08 01 49.4	-48 46 56	11.0	14.5	V	M	090	USNO	040
780426	V587	Pup*	08 03 44.2	-25 54 45	9.11	9.32	V	EA	011	DM	
780427	V871	Mon	08 06 17.3	-04 26 47	8.84	9.18	V	EA	322	DM	
780428	HM	Cnc	08 06 23.0	+15 27 32	21.2	(1.08)	I	XM:	105	105	
780429	V588	Pup*	08 06 32.0	-13 46 35	10.9	<14.5	V	M	130	USNO	040
780430	DE	CMi	08 09 58.5	+01 01 14	7.96	(0.06)	B	DSCTC	106	DM	
780431	V589	Pup*	08 10 26.6	-35 35 38	8.72	9.09	V	EA	011	DM	
780432	DZ	Lyn	08 11 53.5	+42 54 36	9.88	10.25	V	EB:	104	DM	

Table 1 (continued)

No.	Name		R.A., 2000.0	Decl., 2000.0	Max	Min		Type	References
			h m s	° ' "	m	m			
780433	EE	Lyn	08 14 50.3	+48 49 16	9.12	9.14	V	DSCTC	022 DM
780434	V590	Pup	08 15 39.2	-17 32 04	11.6	15.2	V	M	130 107
780435	HN	Cnc*	08 15 46.8	+16 21 56	11.13	11.54	V	EW	065 GSC
780436	V591	Pup	08 17 01.9	-15 00 43	12.6	<14.4	V	M	332 USNO
780437	V576	Car*	08 19 15.7	-60 10 01	6.32	8.17	K	*	108 2MASS
780438	V397	Hya	08 19 19.1	+01 20 20	8.35	(0.03)	V	BY	018 DM
780439	EF	Lyn	08 19 31.8	+35 02 44	7.23	7.27	Hp	GDOR	091 DM
780440	MV	Cam	08 19 47.2	+77 44 32	9.1	9.6	*	SRA	332 GSC
780441	EG	Lyn	08 20 51.1	+49 34 33	18.0	19.4	R	XM	039 039
780442	V577	Car	08 22 03.7	-60 57 13	10.4	14.8	V	M	130 USNO
780443	V592	Pup	08 25 17.7	-34 22 01	7.83	7.87	V	RS	046 DM
780444	V593	Pup	08 25 40.3	-22 10 34	12.5	<14.6	V	M	088 USNO 332
780445	V594	Pup	08 26 04.2	-30 06 41	11.0	13.4	V	RV	332 GSC
780446	V398	Hya	08 26 26.8	-03 17 44	10.9	14.1	V	M	090 GSC
780447	V595	Pup	08 26 27.1	-12 09 09	12.5	13.8	V	EA	040 GSC
780448	V399	Hya	08 26 54.8	-06 12 11	7.59	(0.02)	V	BY	018 DM
780449	LS	UMa	08 27 40.1	+67 58 27	8.12	(0.20)	V	GDOR	091 DM
780450	XX	Vol	08 28 30.1	-64 43 19	10.7	<14.8	V	M	040 GSC
780451	V400	Hya	08 31 02.3	-10 58 04	10.5	<15.0	V	M	332 USNO
780452	CR	Pyx*	08 31 29.0	-31 04 20	11.11	11.59	V	EB	130 DM
780453	CS	Pyx	08 36 23.0	-30 02 15	8.08	(0.03)	V	BY	110 DM
780454	HO	Cnc	08 36 55.8	+23 14 48	8.73	(0.03)	V	BY	018 DM
780455	CT	Pyx	08 37 15.5	-17 29 41	8.72	(0.04)	V	BY	018 DM
780456	V401	Hya	08 37 50.3	-06 48 25	6.73	(0.05:)	V	BY	005 DM
780457	ES	Cha*	08 41 30.5	-78 53 07	17.07	(0.14)	V	INT	111 111
780458	V388	Vel	08 42 16.6	-40 44 10	14.24	14.59	V	INA	038 2MASS
780459	ET	Cha*	08 43 18.6	-79 05 18	13.97	(0.7)	V	INT	111 111
780460	V578	Car	08 43 45.4	-55 01 52	11.2	<14.0	V	M	332 USNO
780461	CU	Pyx*	08 44 02.7	-21 52 10	12.28	14.7	V	EA	112 DM
780462	LT	UMa	08 44 47.8	+55 32 20	8.91	(0.03)	V	BY	018 DM
780463	HP	Cnc	08 50 42.2	+07 51 52	9.08	(0.02)	V	BY	018 DM
780464	HQ	Cnc*	08 50 45.0	+11 45 46	17.77	(0.20)	V	E	113 USNO
780465	HR	Cnc	08 50 55.0	+11 56 51	15.93	(0.12)	V	RS:	113 USNO
780466	HS	Cnc	08 51 04.8	+11 45 57	13.51	(0.14)	V	EW	323 GSC
780467	HT	Cnc*	08 51 07.3	+11 53 00	12.61	(0.06)	V	E:	115 GSC
780468	HU	Cnc*	08 51 13.4	+11 51 40	13.45	13.61	V	RS:	323 GSC
780469	HV	Cnc	08 51 18.0	+11 45 54	12.73	(0.00)	V	EA	311 GSC
780470	HW	Cnc*	08 51 18.7	+11 47 03	12.60	(0.07)	V	RS:	115 GSC
780471	HX	Cnc*	08 51 19.7	+11 52 11	13.90	(0.08)	V	RS:	115 GSC
780472	HY	Cnc	08 51 24.1	+12 01 31	14.98	(0.07)	V	RS:	115 GSC
780473	V402	Hya	08 53 12.1	-07 43 21	9.04	(0.12)	V	BY	046 DM
780474	HZ	Cnc*	08 53 23.7	+16 49 35	14.1	(0.03)	R	*	116 009
780475	V389	Vel	08 53 35.7	-37 32 42	11.6	<12.5	V	SRA	130 GSC 040
780476	II	Cnc	08 53 49.9	+26 54 48	8.46	(0.05)	V	BY	018 DM
780477	V403	Hya	08 54 10.7	-13 00 51	8.8	13.6	V	M	130 GSC 040
780478	IK	Cnc	08 54 41.5	+16 36 40	8.32	(0.03)	V	BY	018 DM
780479	IL	Cnc*	08 55 51.5	+20 03 39	12.35	12.96	*	EW	060 GSC
780480	V390	Vel*	08 56 14.2	-44 43 11	9.01	9.19	V	RV:	119 DM
780481	V391	Vel	08 56 28.1	-43 05 58	11.21	11.64	V	INA	038 GSC
780482	DS	Oct	08 56 35.7	-83 05 11	12.0	<14.8	V	M	332 120
780483	IM	Cnc*	08 57 21.0	+24 06 51	12.82	13.6	V	EA	225 GSC
780484	V392	Vel	08 58 26.2	-43 26 08	11.25	14.76	V	BE	038 DM
780485	CV	Pyx	08 58 35.6	-26 48 37	11.7	13.5	V	SRA	130 GSC 040
780486	V393	Vel	08 59 25.8	-55 58 50	12.5	14.7	V	SRB	332 USNO

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m		Type	References		
780487	V394	Vel	09 00 58.1	-54 55 55	10.6	11.2	V	SRB	130	GSC	332
780488	V395	Vel	09 01 00.9	-54 57 00	11.7	<14.0	V	M	332	GSC	
780489	XY	Vol	09 02 13.6	-64 32 57	12.8	15.4	V	M	130	USNO	040
780490	EH	Lyn	09 02 40.2	+34 19 47	14.00	14.32	*	EW	060	GSC	
780491	CW	Pyx	09 02 42.4	-30 32 43	11.3	<15.0	V	M	332	GSC	
780492	XZ	Vol	09 03 19.4	-66 23 57	12.6	14.4	V	SRA	130	121	040
780493	V579	Car	09 03 26.0	-64 03 57	13.0	15.0	V	SRA	130	USNO	
780494	YY	Vol	09 03 37.2	-66 08 52	12.7	14.2	V	SRA	040	121	
780495	V404	Hya*	09 04 17.8	+04 32 29	14.84	15.24	*	EW	122	GSC	
780496	V405	Hya	09 04 20.7	-15 54 51	8.77	(0.03)	V	BY	018	DM	
780497	V580	Car	09 05 02.8	-57 15 36	12.8	<14.7	V	M	130	USNO	
780498	V581	Car	09 05 13.1	-61 55 45	12.6	<14.4	V	M	130	USNO	
780499	V582	Car	09 05 18.0	-67 08 24	11.0	12.6	V	SRA:	130	121	332
780500	V406	Hya	09 05 54.7	-05 36 08	16.5	20.3	V	NL	123	USNO	
780501	V396	Vel	09 07 15.3	-53 25 19	11.9	<13.8	V	M	332	USNO	
780502	CX	Pyx	09 07 34.0	-26 14 00	11.1	12.8	V	SRA	130	GSC	
780503	CY	Pyx*	09 08 17.1	-37 06 54	8.27	8.36	V	E:	046	DM	
780504	V407	Hya	09 09 17.9	-17 02 24	10.8	12.8	V	SRB	130	124	040
780505	V583	Car	09 09 18.5	-71 47 12	12.7	15.1	V	SRA	130	GSC	
780506	V408	Hya	09 10 07.5	-17 00 38	10.0	11.0	V	SRB	130	DM	040
780507	V409	Hya	09 10 09.6	+03 44 35	11.0	11.6	V	EW	130	125	
780508	V397	Vel	09 10 14.7	-37 55 23	11.8	14.2	V	SRB	130	USNO	332
780509	V584	Car	09 11 30.0	-61 37 13	10.8	15.0	V	M	130	126	040
780510	V410	Hya	09 12 44.4	-14 41 17	10.48	11.11	V	EA	011	DM	
780511	V585	Car	09 12 57.9	-57 48 28	10.9	<15.0	V	M:	130	USNO	332
780512	V411	Hya	09 13 43.5	-20 21 55	10.2	11.1	V	SRB	130	DM	040
780513	EI	Lyn	09 13 48.2	+43 13 04	5.32	(0.03)	V	SXARI	127	DM	
780514	V412	Hya*	09 14 28.9	-13 41 39	12.7	14.1 :	V	EA	112	128	
780515	V413	Hya	09 15 50.7	-15 41 24	10.7	11.5	V	SRB	130	GSC	040
780516	IN	Cnc*	09 16 14.7	+16 15 26	11.87	12.56	*	EB	060	GSC	
780517	V586	Car	09 16 27.5	-72 04 15	11.0	13.5	V	M	130	129	
780518	IO	Cnc*	09 17 16.1	+16 19 34	13.89	14.52	*	EW	060	GSC	
780519	IP	Cnc	09 17 53.5	+28 33 38	7.20	(0.02)	V	BY	018	DM	
780520	CZ	Pyx*	09 18 10.0	-27 13 03	12.3	14.0	V	SRB	130	GSC	040
780521	DD	Pyx	09 18 14.6	-33 01 39	8.4	9.3	V	SRB	130	DM	040
780522	V587	Car	09 20 29.3	-66 48 47	12.0	12.8	V	SRB:	130	121	040
780523	IQ	Cnc*	09 20 59.2	+14 57 25	13.05	13.45	*	EW	122	GSC	
780524	DE	Pyx	09 21 00.5	-26 44 26	13.2	13.8	V	RRC	130	GSC	
780525	V588	Car	09 21 08.9	-61 56 22	11.0	<14.2	V	M	332	USNO	
780526	DF	Pyx	09 22 04.5	-36 42 09	10.6	<14.3	V	M	130	USNO	332
780527	V414	Hya	09 22 53.7	-13 49 21	8.8	9.2	V	RS:	131	DM	130
780528	EU	Cha	09 23 08.1	-78 36 41	12.4	<15.2	V	M	332	USNO	
780529	V589	Car	09 23 32.2	-72 22 49	12.6	<15.0	V	M	040	USNO	
780530	LU	UMa*	09 24 03.3	+61 46 23	8.44	8.65	Hp	GDOR	091	DM	
780531	DG	Pyx	09 24 07.0	-36 05 50	12.5	14.3	V	SRA	130	GSC	332
780532	V415	Hya	09 25 27.0	-06 24 16	7.07	7.10	Hp	GDOR:	091	DM	
780533	V590	Car	09 25 35.9	-63 35 52	12.7	13.8	V	RRAB	130	120	
780534	V591	Car	09 27 00.9	-70 37 56	12.5	13.5	V	LB	130	121	
780535	DH	Pyx	09 27 04.0	-34 53 51	9.6	10.1	V	LB	130	DM	
780536	WY	LMi	09 30 23.3	+33 53 10	14.53	15.29	*	RRAB	063	GSC	
780537	GS	Leo	09 30 35.8	+10 36 06	8.66	(0.06)	V	BY	018	DM	
780538	LV	UMa	09 32 45.7	+49 38 06	10.7	(0.03)	V	DSCTC:	049	049	
780539	V592	Car*	09 33 45.3	-66 01 17	10.87	11.50	V	EW	011	121	
780540	V593	Car	09 35 17.0	-68 23 53	10.9	15.0	V	M	130	GSC	

Table 1 (continued)

No.	Name		R.A., 2000.0	Decl., 2000.0	Max	Min		Type	References	
			h m s	o ’ "	m	m				
780541	V594	Car	09 37 24.3	-63 48 46	10.4	11.2	V	EA	011 132	
780542	V595	Car	09 39 55.1	-74 32 43	10.2	13.6	V	M	090 133	040
780543	GT	Leo	09 42 09.9	+07 35 25	8.92	(0.04)	V	BY	018 DM	
780544	VZ	Sex	09 44 31.7	+03 58 06	12.8	16.8	V	XM	310 USNO	
780545	GU	Leo*	09 47 33.8	+18 21 43	11.62	12.31	*	EW	135 GSC	
780546	V596	Car	09 50 28.5	-60 58 03	8.44	8.75	V	IA	038 DM	
780547	WW	Sex*	09 50 39.3	-05 30 43	9.96	10.50	V	EA	322 DM	
780548	BF	Ant	09 56 54.1	-27 28 31	6.32	(0.01)	V	DSCTC	024 DM	
780549	LW	UMa	09 56 56.1	+41 26 41	10.22	10.27	V	DSCTC	022 DM	
780550	V416	Hya	09 57 39.7	-16 31 20	6.64	6.73	Hp	GDOR	024 DM	
780551	V417	Hya	10 04 37.7	-11 43 47	8.15	(0.03)	V	BY	018 DM	
780552	WX	Sex*	10 06 24.9	+01 00 12	12.4	12.8	V	EW	017 GSC	
780553	WY	Sex*	10 09 37.4	-00 56 28	11.5	(0.36)	V	EW	017 GSC	
780554	GV	Leo*	10 11 59.2	+16 52 30	11.45	11.96	V	EW	306 GSC	
780555	WZ	Sex*	10 13 26.9	-01 39 51	9.8	10.2	V	EB	094 DM	
780556	LX	UMa	10 14 35.8	+53 46 15	8.02	(0.05)	V	BY	018 DM	
780557	XX	Sex	10 16 02.1	-06 18 26	9.32	9.56	V	EW	094 DM	
780558	V597	Car	10 18 10.3	-60 59 42	9.5	10.0	V	SRB	130 GSC	040
780559	GW	Leo	10 18 53.5	+13 41 09	12.06	12.23	*	EW	060 GSC	
780560	V398	Vel	10 20 09.0	-56 36 55	7.92	(0.03)	V	ELL:	136 DM	
780561	XY	Sex	10 20 14.5	-08 53 46	14.43	(0.08)	V	R	020 009	
780562	V399	Vel	10 25 01.1	-57 05 11	8.24	(0.02)	V	BCEP:	136 DM	
780563	XZ	Sex	10 25 57.5	-07 30 51	9.7	<10.4	V	SRA	103 GSC	
780564	WZ	LMi*	10 31 26.5	+31 38 33	12.45	12.71	*	EW	135 GSC	
780565	XX	LMi*	10 33 04.8	+32 22 15	12.42	12.58	*	EW	122 GSC	
780566	XY	LMi*	10 34 12.3	+32 08 52	10.71	11.15	*	EW	122 GSC	
780567	V418	Hya	10 36 30.8	-13 50 36	8.71	(0.02)	V	BY:	018 DM	
780568	YY	Sex	10 39 47.0	-05 06 57	17.40	18.75	V	XM	137 USNO	
780569	V598	Car*	10 42 46.9	-72 59 12	10.81	11.38	V	EA	011 DM	
780570	V419	Hya	10 43 28.3	-29 03 51	7.72	(0.02)	V	BY	018 DM	
780571	LY	UMa	10 48 18.0	+52 18 31	14.95	15.44	V	NL	138 USNO	
780572	LZ	UMa	10 50 40.3	+51 47 59	8.31	(0.02)	V	BY	018 DM	
780573	V400	Vel	10 53 07.9	-41 37 28	11.8	<14.8	V	M	090 USNO	130
780574	V599	Car	10 53 27.3	-58 25 25	8.85	9.41	V	IA	038 DM	
780575	GX	Leo	10 56 16.9	+22 21 06	7.71	7.79	B	SRS	141 DM	
780576	GY	Leo	10 56 30.8	+07 23 19	7.37	(0.03)	V	BY	018 DM	
780577	XZ	LMi*	10 59 48.3	+25 17 23	8.49	(0.03)	V	RS:	018 DM	
780578	GZ	Leo	11 02 02.3	+22 35 46	8.83	8.95	V	RS	141 DM	
780579	AB	Crt	11 02 50.1	-09 19 49	9.03	(0.03)	V	BY	018 DM	
780580	YY	LMi*	11 03 14.5	+30 35 31	8.96	(0.06)	V	RS:	018 DM	
780581	HH	Leo	11 04 41.5	-04 13 16	7.57	7.61	V	BY	046 DM	
780582	V600	Car	11 06 02.8	-68 36 33	10.6	14.0	V	M	142 142	130
780583	MM	UMa*	11 08 30.8	+68 30 17	16.6	(0.01)	Ic	*	007 143	
780584	HI	Leo*	11 12 16.8	+01 19 06	11.2	(0.8)	V	EB	017 GSC	
780585	V601	Car	11 12 23.9	-60 22 43	8.2	8.5	V	SRA	290 DM	
780586	MN	UMa	11 12 32.4	+35 48 51	6.53	6.56	Hp	BY	005 DM	
780587	MO	UMa	11 13 06.0	+40 21 38	11.66	12.04	*	RRC	144 GSC	332
780588	V602	Car	11 13 30.0	-60 05 29	7.6	9.1	V	SRC	130 DM	040
780589	HK	Leo*	11 17 03.5	+18 25 58	14.70	14.85	V	R	146 009	
780590	MP	UMa	11 20 37.7	+39 21 01	12.06	12.19	*	DSCT:	144 GSC	040
780591	MQ	UMa	11 21 41.1	+43 36 53	11.57	11.83	*	EW	144 GSC	332
780592	V1048	Cen*	11 28 42.7	-59 25 43	9.57	9.83	I	CEP(B)	147 DM	
780593	MR	UMa	11 31 22.4	+43 22 38	12.95	17.	V	UGSU	148 149	
780594	MS	UMa*	11 32 20.9	+49 44 10	11.97	12.60	*	EW	144 GSC	332

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m		Type	References		
780595	MT	UMa*	11 33 34.7	+42 58 29	11.75	12.16	*	EW	144	GSC	332
780596	MU	UMa	11 35 36.7	+38 45 58	11.8	12.3	*	RRC	144	GSC	332
780597	V1049	Cen	11 37 17.6	-50 30 23	10.7	11.9	V	SRA	090	150	
780598	V1050	Cen	11 37 43.2	-44 04 31	10.4	14.5	V	M	090	289	
780599	V1051	Cen	11 37 48.4	-63 19 24	7.13	7.24	V	EA	011	DM	
780600	MV	UMa*	11 38 59.7	+42 19 44	8.22	(0.02)	V	RS	018	DM	
780601	V1052	Cen	11 39 44.5	-60 10 28	8.97	9.56	V	IA	038	DM	
780602	MQ	Mus	11 41 19.5	-72 30 39	11.0	<14.4	V	M	090	USNO	
780603	MR	Mus*	11 41 37.8	-67 54 52	8.41	8.53	V	EA	011	DM	
780604	MW	UMa	11 43 02.3	+60 34 37	9.26	(0.49)	Rc	EA	151	151	
780605	HL	Leo	11 43 47.0	+24 00 37	7.40	(0.06)	V	BY	018	DM	
780606	MX	UMa	11 47 52.9	+53 00 55	8.78	(0.08)	B	DSCTC	152	DM	
780607	MS	Mus	11 49 19.9	-66 00 39	9.89	10.33	V	DCEP	130	DM	288
780608	PQ	Vir	11 49 28.1	+00 36 33	9.12	(0.03)	V	BY:	018	DM	
780609	MY	UMa	11 51 57.9	+48 05 19	8.97	(0.03)	V	BY	018	DM	
780610	PR	Vir	11 56 41.2	-02 46 44	9.50	(0.05)	V	BY	018	DM	
780611	PS	Vir*	11 57 51.3	+06 27 05	11.6	12.3	V	EW	154	GSC	130
780612	LV	Com	12 07 50.9	+18 56 56	9.16	(0.03)	V	BY	018	DM	
780613	DN	CVn	12 09 17.0	+33 39 36	14.82	15.20	V	RRC	155	GSC	
780614	MZ	UMa	12 11 27.8	+53 25 17	7.96	(0.02)	V	BY	018	DM	
780615	DZ	Cru	12 23 16.2	-60 22 34	9.7	<20.	V	N:	156	280	
780616	PT	Vir*	12 24 23.0	+10 35 13	13.38	13.56	*	EW	135	GSC	
780617	V420	Hya*	12 24 32.5	-28 18 56	10.1	10.9	V	E:	100	DM	040
780618	NN	UMa	12 26 20.2	+54 35 19	7.53	(0.03)	V	BY:	018	DM	
780619	MW	Cam	12 26 43.7	+81 28 26	9.25	9.36	Hp	DSCT	157	DM	
780620	V1053	Cen*	12 28 58.3	-34 15 02	11.80	12.65	V	EW	011	DM	
780621	NO	UMa*	12 31 18.9	+55 07 08	8.08	(0.03)	V	RS:	005	DM	
780622	V1054	Cen*	12 32 49.0	-35 41 42	11.20	12.20	V	EW	011	DM	
780623	DO	CVn	12 35 51.3	+51 13 17	8.52	(0.02)	V	BY	018	DM	
780624	DP	CVn	12 36 17.0	+51 30 52	8.58	(0.07)	V	BY:	018	DM	
780625	PU	Vir*	12 39 48.6	-02 26 22	11.54	11.71	*	EW	060	GSC	
780626	DQ	CVn*	12 40 33.4	+34 22 56	12.12	12.59	*	EW	264	GSC	158
780627	NP	UMa	12 41 44.5	+55 43 29	8.27	(0.03)	V	BY	018	DM	
780628	DR	CVn*	12 44 41.8	+35 57 56	11.62	11.92	*	EW	264	GSC	279
780629	V1055	Cen	12 45 40.4	-47 40 05	12.0	<15.0	V	M	090	USNO	130
780630	DS	CVn	12 47 16.3	+35 12 06	14.18	15.15	V	RRAB	264	GSC	155
780631	VZ	Crv	12 48 32.3	-15 43 10	7.93	(0.03)	V	BY	018	DM	
780632	LW	Com	12 48 47.0	+24 50 25	6.31	(0.10)	V	BY	160	DM	
780633	DT	CVn	12 50 10.7	+37 31 01	6.04	(0.03)	B	DSCTC	037	DM	
780634	LX	Com	12 51 38.4	+25 30 32	9.09	(0.05)	V	BY	018	DM	
780635	DU	CVn*	12 51 40.0	+37 15 47	14.1	14.6	*	EW	161	GSC	
780636	EE	Cru	12 53 36.1	-60 20 32	12.69	(0.05)	B	LPB:	162	GSC	
780637	EF	Cru	12 53 38.0	-60 22 40	10.17	(0.01)	V	BCEP	162	GSC	
780638	EG	Cru	12 53 43.3	-60 24 02	11.45	(0.01)	V	BCEP:	162	GSC	
780639	EH	Cru	12 53 49.4	-60 20 57	11.81	(0.01)	B	BCEP:	162	GSC	
780640	DV	CVn	12 53 51.2	+32 09 56	14.75	15.30	V	RRC	155	GSC	
780641	EI	Cru	12 53 52.0	-60 22 16	9.44	(0.01)	V	BCEP	162	USNO	
780642	LY	Com	12 54 47.3	+31 16 45	14.46	15.02	V	RRC	155	GSC	
780643	PV	Vir	12 55 36.3	-05 38 35	11.57	11.63	V	DSCTC	022	GSC	
780644	LZ	Com	12 56 51.2	+28 10 35	14.37	14.79	V	RRC	155	GSC	
780645	V1056	Cen	12 58 44.7	-42 30 42	10.4	<11.5	V	M	090	GSC	040
780646	MM	Com*	13 00 11.7	+30 23 11	12.25	12.89	*	EW	264	GSC	040
780647	MN	Com*	13 00 42.5	+19 12 36	15.9	(0.05)	Ic	*	007	2MASS	
780648	DW	CVn	13 02 22.3	+37 20 43	8.12	(0.04)	V	BY:	018	DM	

Table 1 (continued)

No.	Name		R.A., 2000.0	Decl., 2000.0	Max	Min		Type	References
			h m s	o ' "	m	m			
780649	PW	Vir	13 03 10.6	-16 03 20	9.5	<15.1	V	M	090 GSC 130
780650	PX	Vir	13 03 49.7	-05 09 43	7.69	(0.04)	V	BY	018 DM
780651	MO	Com	13 05 14.4	+28 37 13	14.25	14.58	V	RRAB	155 GSC
780652	V421	Hya*	13 05 40.2	-25 41 06	16.94	(0.02)	Ic	*	163 163
780653	DX	CVn*	13 05 49.2	+38 37 06	12.25	12.71	*	EW	264 GSC 164
780654	MP	Com	13 06 22.7	+22 16 48	6.86	6.94	Hp	GDOR	165 DM
780655	MT	Mus	13 08 01.9	-64 57 56	11.2	13.1	V	SRA	130 GSC 040
780656	MQ	Com	13 09 29.7	+27 00 59	14.01	14.36	V	RRAB	155 GSC
780657	PY	Vir*	13 10 32.2	-04 09 33	9.60	10.09	V	EW	094 DM 130
780658	DY	CVn*	13 10 47.8	+36 44 08	13.05	13.90	*	EW	264 GSC 164
780659	V1057	Cen*	13 12 38.2	-63 22 32	12.4	12.8	V	EW	166 166 130
780660	V1058	Cen	13 13 11.0	-63 23 31	11.8	(0.2 *)	R	IS	166 166
780661	MR	Com*	13 14 24.2	+27 11 32	12.00	12.45	*	EW	264 GSC 167
780662	DZ	CVn	13 17 03.4	+36 06 58	14.00	15.03	V	RRAB	155 GSC
780663	V1047	Cen	13 20 49.7	-62 37 51	8.8	<11.0	V	N	261
780664	PZ	Vir	13 24 11.6	+03 20 51	20.5	21.8	r	AM	168 043
780665	NQ	UMa	13 25 45.5	+56 58 14	7.29	(0.04)	V	BY	018 DM
780666	QQ	Vir	13 27 48.6	+09 54 51	13.45	(0.05)	B	RPHS	169 009
780667	EV	Cha	13 32 52.5	-76 12 22	11.1	14.0	V	M	090 133
780668	EE	CVn*	13 34 13.8	+31 21 26	13.7	14.5	*	EW	264 GSC 164
780669	EF	CVn*	13 36 38.4	+28 11 41	13.08	13.56	*	EW	264 GSC 167
780670	GV	Boo*	13 36 59.4	+26 52 48	12.37	12.77	*	EW	264 GSC 167
780671	EG	CVn	13 37 26.2	+37 35 00	12.99	13.60	*	EW	264 GSC 167
780672	EH	CVn*	13 41 13.7	+31 47 24	13.0	13.4	*	EW	161 GSC 040
780673	V1059	Cen*	13 43 01.3	-48 36 22	11.2	<15.0	V	M	090 GSC 040
780674	QR	Vir	13 43 34.0	-17 49 38	9.3	11.1	V	SRA	090 DM 130
780675	V1060	Cen	13 49 32.1	-46 26 11	10.6	<11.5	V	SRA:	090 GSC 040
780676	QS	Vir	13 49 52.0	-13 13 37	14.27	17.76	U	EA+UV	170 171
780677	QT	Vir	13 52 09.3	+06 00 05	8.50	(0.02 b)	V	DSCTC	037 DM
780678	GW	Boo	13 53 13.9	+20 09 43	10.19	10.65	V	EW	104 DM
780679	MP	Dra	13 56 17.8	+66 56 41	8.45	(0.03)	V	BY	018 DM
780680	GX	Boo	14 01 05.6	+24 42 16	12.23	(0.24 V)	*	EW:	161 GSC
780681	EI	CVn*	14 02 05.6	+34 02 40	11.82	12.60	*	EW	264 GSC 164
780682	QU	Vir*	14 05 43.2	+00 34 12	11.75	12.06	*	EW	135 GSC
780683	GY	Boo	14 12 41.6	+23 48 51	8.88	(0.03)	V	BY	018 DM
780684	V1061	Cen*	14 14 56.8	-61 14 18	9.55	9.71	V	EA	011 DM
780685	DF	Cir	14 17 51.4	-68 02 49	7.54	(0.08)	V	RS	046 DM
780686	QV	Vir	14 18 36.7	-06 37 38	14.69	15.20	*	SXPHE	172 GSC
780687	GZ	Boo	14 21 08.9	+37 24 04	8.90	(0.04)	V	BY	018 DM
780688	HH	Boo*	14 21 44.1	+46 41 59	10.91	11.55	V	EW	104 GSC
780689	HI	Boo*	14 26 43.2	+31 52 16	10.34	(0.35)	V	R:	173 GSC
780690	HK	Boo*	14 29 01.2	+12 07 20	8.43	(0.09)	V	RS	018 DM
780691	HL	Boo	14 29 02.8	+11 02 34	7.61	(0.03)	V	EA:	018 DM
780692	HM	Boo	14 29 09.3	+38 16 40	9.17	(0.02)	V	E:/RS	018 DM
780693	V1062	Cen	14 30 28.1	-63 07 45	11.0	<14.5	V	M	130 174
780694	QW	Vir	14 30 56.5	-03 11 09	14.32	14.73	*	RRC	172 GSC
780695	KS	Lib	14 32 59.9	-10 56 03	11.8	<13.9	V	M	090 USNO
780696	HN	Boo	14 36 00.6	+09 44 47	7.48	(0.04)	V	BY	018 DM
780697	QX	Vir*	14 36 28.4	-05 36 21	12.1	12.7	V	EW	130 GSC
780698	KT	Lib	14 39 20.0	-20 50 32	12.8	(0.1 :)	V	SXPHE	175 GSC
780699	KU	Lib	14 40 31.1	-16 12 33	7.36	7.39	Hp	BY	005 DM
780700	V1063	Cen	14 41 26.5	-35 47 38	10.71	(0.02)	B	DSCTC	176 DM
780701	KV	Lib	14 46 00.8	-10 13 16	14.13	14.70	*	SXPHE	063 GSC
780702	HO	Boo	14 46 03.1	+27 30 44	7.98	(0.02)	V	BY	018 DM

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ’ "	Max m	Min m		Type	References		
780703	QY	Vir	14 47 16.1	+02 42 12	7.76	(0.02)	V	BY	018	DM	
780704	KW	Lib	14 47 51.5	-06 34 46	13.64	14.17	*	RRAB	063	GSC	
780705	HP	Boo	14 50 15.8	+23 54 43	5.98	6.01	Hp	BY	005	DM	
780706	V422	Hya	14 56 01.6	-26 42 39	12.4	15.5	V	M	090	128	
780707	KX	Lib	14 57 28.0	-21 24 56	5.72	(0.04)	V	BY	018	DM	
780708	DG	Cir	15 03 23.8	-63 22 59	12.75	16.80	V	INA	038	GSC	
780709	MY	TrA	15 08 20.0	-70 04 35	10.8	<14.0	V	M	090	USNO	
780710	V379	Ser	15 15 59.2	+00 47 47	7.05	7.08	Hp	BY	005	DM	
780711	DE	Cir	15 17 52.5	-61 57 16	7.5	<18.	*	N	177		
780712	V380	Ser	15 26 10.7	+00 31 57	10.8	12.9	V	SRA	090	GSC	
780713	PS	Aps*	15 31 11.1	-78 45 11	7.86	7.97	V	EB	011	DM	
780714	MZ	TrA*	15 34 34.1	-65 06 11	8.57	8.76	V	EA	011	DM	
780715	AN	CrB	15 35 30.2	+36 12 35	8.61	(0.02)	V	BY	018	DM	
780716	V383	Nor	15 35 51.7	-50 17 21	8.18	8.50	V	SRB	012	DM	
780717	NX	Lup	15 37 16.9	-32 03 26	7.95	8.03	Hp	GDOR	024	DM	
780718	AO	CrB	15 39 25.2	+27 37 35	8.99	(0.04)	V	BY	018	DM	
780719	V381	Ser*	15 45 52.4	+05 02 27	9.15	(0.02)	V	RS	018	DM	
780720	V382	Ser	15 48 09.5	+01 34 18	7.44	(0.04)	V	BY	018	DM	
780721	NY	Lup	15 48 14.6	-45 28 40	14.50	14.78	V	XM	178	178	
780722	KY	Lib	15 51 56.6	-09 28 09	8.93	(0.04)	V	RS	018	DM	
780723	NZ	Lup	15 53 27.3	-42 16 01	7.87	(0.04)	V	BY	046	DM	
780724	MQ	Dra	15 53 31.3	+55 16 15	17.7	18.8	V	AM	168	USNO	
780725	AP	CrB	15 54 12.4	+27 21 51	16.5	(0.65)	R	XM	179	179	252
780726	V383	Ser*	15 55 19.1	+16 02 40	8.68	(0.03)	V	RS	018	DM	
780727	KZ	Lib*	15 55 59.8	-17 11 39	11.14	13.1	V	EA	011	GSC	
780728	AQ	CrB	15 57 31.8	+28 38 01	11.78	12.73	V	RRAB	264	181	180
780729	AR	CrB*	15 59 18.6	+27 52 15	10.84	11.45	*	EW	264	GSC	182
780730	AS	CrB*	16 00 14.5	+35 12 32	11.34	11.85	*	EW	264	GSC	182
780731	V384	Ser*	16 01 53.6	+24 52 18	11.88	12.41	*	EW	264	GSC	182
780732	V385	Ser	16 03 25.7	+01 02 37	13.65	(0.54)	V	EW	017	GSC	
780733	V384	Nor*	16 05 18.9	-49 30 08	10.07	10.36	V	EA	011	DM	
780734	AT	CrB	16 06 29.6	+38 37 56	8.58	(0.02)	V	BY	018	DM	
780735	V1189	Sco	16 07 42.6	-26 45 08	11.2	13.2	V	SRA	090	GSC	040
780736	V1190	Sco	16 08 29.7	-39 03 11	16.42	16.93	V	INT	184	184	
780737	V1191	Sco	16 08 48.2	-39 04 19	16.52	17.43	V	INB	184	184	
780738	V1192	Sco	16 08 51.4	-39 05 30	15.70	16.42	J	INT	184	184	
780739	V1193	Sco	16 08 51.6	-39 03 17	14.67	15.33	V	INT:	184	184	
780740	V386	Ser	16 10 33.7	-01 02 22	18.9	19.2	V	NL+ZZ	185	USNO	
780741	V1194	Sco	16 12 21.2	-27 44 40	10.2	12.4	V	SRA	130	GSC	040
780742	NN	TrA	16 12 34.8	-66 36 36	10.4	<13.2	V	M	090	USNO	
780743	AU	CrB	16 13 31.7	+32 34 43	12.3	12.5	*	DSCT	186	GSC	
780744	V2577	Oph*	16 13 53.4	-06 32 16	11.6	<14.8	V	M	103	128	
780745	V1078	Her	16 14 46.9	+42 27 36	14.14	(0.09)	B	RPHS	187	009	
780746	AV	CrB*	16 14 58.6	+30 16 36	11.87	12.48	*	EW	264	GSC	182
780747	AW	CrB*	16 15 20.2	+35 42 26	11.08	11.35	*	DSCT:	264	GSC	
780748	V1195	Sco*	16 19 23.0	-40 56 39	8.86	9.04	V	EA	011	DM	
780749	V382	Nor	16 19 44.7	-51 34 53	8.7	<17.	V	NA	303	043	
780750	NO	TrA*	16 20 04.5	-69 57 48	8.67	8.86	V	EA	011	DM	
780751	V1079	Her	16 20 13.7	+24 36 11	8.9	(0.14)	Rc	BY:	188	188	
780752	V2578	Oph	16 24 19.8	-13 38 30	8.40	(0.02)	V	BY	018	DM	
780753	V385	Nor	16 27 37.8	-49 10 42	11.64	(0.04)	V	ELL:	190	GSC	
780754	V386	Nor	16 27 40.0	-49 10 25	13.52	(0.01)	V	DSCTC	190	190	
780755	V387	Nor	16 27 43.1	-49 07 24	13.57	(0.01)	V	DSCTC	190	190	
780756	V388	Nor	16 27 49.1	-49 06 43	12.43	(0.02)	V	DSCTC	190	GSC	

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s o ' "	Max m	Min m		Type	References
780757	V2579 Oph	16 29 35.3 +01 38 19	11.32	(0.04 R)	B	RPHS	116 009
780758	NP TrA	16 33 05.2 -60 54 13	7.88	(0.03 b)	V	DSCTC	037 DM
780759	V1080 Her	16 36 27.8 +14 11 36	9.83	9.84	V	DSCTC	022 DM
780760	V1081 Her	16 37 38.4 +08 37 21	14.3	16.0	B	SRA	191 002
780761	V2580 Oph	16 39 41.4 -20 52 39	10.3	11.5	V	SRB	090 GSC 040
780762	V1082 Her	16 40 35.1 +49 09 59	9.00	(0.02)	V	BY	018 DM
780763	V2581 Oph	16 41 29.1 +01 18 47	9.42	(0.04)	V	BY	018 DM
780764	V1083 Her	16 42 35.4 +06 09 43	13.2	14.0	B	RRAB	192 125
780765	V1084 Her	16 43 45.7 +34 02 40	12.48	12.75	V	NL	193 193
780766	V1085 Her	16 45 32.3 +33 49 48	9.45	(0.01)	V	BY	018 DM
780767	V1086 Her	16 48 39.3 +30 27 46	13.1	13.	*	DSCT	161 GSC
780768	V1087 Her	16 48 43.2 +06 07 49	12.7	14.5	B	RRAB	192 125
780769	V878 Ara*	16 49 48.8 -47 07 46	8.00	8.22	V	EW:	011 DM
780770	V1196 Sco*	16 51 20.4 -26 00 27	11.9	13.8	V	SRA	130 GSC 040
780771	V1197 Sco	16 51 24.6 -28 21 54	12.4	<16.0	R	M	006 USNO 040
780772	V2582 Oph	16 51 25.1 +08 18 51	12.9	15.6	B	M	194 GSC
780773	V1198 Sco	16 53 59.3 -41 53 04	11.89	(0.05)	V	LPB:	195 GSC
780774	V1199 Sco	16 54 01.9 -41 53 24	13.99	(0.04)	V	DSCTC	195 USNO
780775	V1200 Sco	16 54 04.9 -41 56 46	15.71	(0.20)	V	GDOR:	195 USNO
780776	V2583 Oph	16 54 05.9 -27 16 47	12.3	<16.5	B	M	196 196
780777	V1201 Sco	16 54 10.7 -41 47 47	10.60	(0.03)	V	LPB:	195 GSC
780778	V1202 Sco	16 54 12.9 -41 52 29	14.62	(0.04)	V	GDOR:	195 g2.2
780779	V1203 Sco	16 54 14.1 -41 53 58	14.69	(0.02)	V	DSCTC	195 USNO
780780	V1204 Sco	16 54 15.7 -41 49 32	10.17	(0.05)	V	BCEP:	195 GSC
780781	V1205 Sco	16 54 15.7 -41 51 40	13.45	(0.04)	V	DSCTC	195 GSC
780782	V1206 Sco	16 54 16.2 -41 50 26	10.74	(0.03)	V	LPB:	195 GSC
780783	V1207 Sco	16 54 20.6 -41 49 29	11.20	(0.04)	V	BCEP:	195 GSC
780784	V1208 Sco	16 54 21.3 -41 51 42	9.72	(0.15)	V	E	195 GSC
780785	V1209 Sco	16 54 29.3 -41 55 46	14.33	(0.02)	V	DSCTC	195 GSC
780786	V1210 Sco	16 54 29.8 -41 55 39	13.70	(0.01)	V	GDOR:	195 GSC
780787	V1211 Sco	16 54 30.0 -41 56 05	16.2	(0.25)	V	GDOR:	195 USNO
780788	V1212 Sco*	16 54 31.2 -41 55 29	10.3	(0.04)	V	DSCTC	189 DM
780789	V1213 Sco	16 54 33.4 -41 56 32	15.03	(0.10)	V	GDOR:	195 g2.2
780790	V1214 Sco	16 54 34.2 -41 54 49	15.12	(0.02)	V	GDOR:	195 g2.2
780791	V1215 Sco	16 54 35.6 -41 53 21	15.67	(0.02)	V	GDOR:	195 GSC
780792	V1216 Sco*	16 54 57.7 -43 56 27	10.09	10.52	V	EA	011 DM
780793	V1217 Sco	16 56 09.9 -40 36 34	13.3	(0.09)	B	DSCTC:	197 197
780794	V1218 Sco	16 56 11.6 -40 35 29	10.4	(0.02)	B	BCEP:	197 197
780795	V1219 Sco	16 56 15.7 -40 40 44	14.1	(0.4)	B	EA:	197 197
780796	V1220 Sco	16 56 19.6 -40 34 41	14.2	(0.8)	B	EA	197 197
780797	V1221 Sco	16 56 28.6 -40 33 28	12.5	(0.10)	B	DSCT:	197 197 203
780798	V1222 Sco	16 56 29.9 -40 32 24	14.2	(0.12)	B	DSCT:	197 197
780799	V1088 Her*	16 56 31.1 +32 20 55	13.7	14.2	*	EW	264 GSC 040
780800	V1223 Sco	16 56 43.3 -40 36 25	11.0	(0.22)	B	EA	197 197 040
780801	V1224 Sco	16 56 43.5 -40 32 56	16.1	(0.08)	B	RS:	203 197
780802	V1225 Sco*	16 56 47.4 -40 47 28	10.16	10.25	V	EW:	197 197 040
780803	V2584 Oph	16 56 57.8 -30 01 09	10.7	(16.	*	M:	006 2MASS
780804	V1089 Her	16 57 42.2 +47 21 44	7.93	(0.03)	V	BY	018 DM
780805	V1090 Her	16 57 53.2 +47 22 00	7.76	(0.02)	V	BY	018 DM
780806	V2585 Oph	16 58 11.3 -23 31 08	9.8	12.6	*	M	006 USNO 040
780807	V2586 Oph	16 59 28.1 -13 23 14	13.1	<14.9	V	M	006 USNO 040
780808	V2587 Oph	16 59 42.0 -22 50 13	10.5	13.1	I	M	006 USNO
780809	V2588 Oph	16 59 44.1 +07 38 34	11.4	13.0	V	SRA	194 GSC 040
780810	V2589 Oph	16 59 45.1 -24 12 49	13.0	<14.9	*	M:	006 2MASS

Table 1 (continued)

No.	Name	R.A., 2000.0 (h m s)	Decl., 2000.0 (o ’ ")	Max (m)	Min (m)		Type	References
780811	V2590 Oph	16 59 52.6	+04 59 01	13.0	<15.9	B	M	194 107
780812	V2591 Oph	17 00 07.8	+06 41 23	13.6	15.2	B	RRAB	192 125
780813	V2592 Oph	17 01 48.6	-23 01 16	13.8	<15.6	V	M	006 USNO 040
780814	V2593 Oph	17 02 02.3	-28 38 26	10.9	13.7	*	M:	006 USNO 040
780815	V2594 Oph	17 02 14.9	+08 00 20	13.2	14.4	B	RRAB	194 198
780816	V1226 Sco	17 02 25.0	-36 49 35	10.59	10.78	V	EA	011 DM
780817	V1227 Sco	17 02 28.9	-35 14 57	10.8	12.7	R	M:	199 199
780818	V2595 Oph	17 02 56.6	-29 50 34	11.3	13.5	*	SR	006 2MASS
780819	V2596 Oph	17 03 00.7	-24 45 16	11.2	13.8	*	M:	006 USNO
780820	V2597 Oph*	17 03 31.0	+06 09 51	14.0	15.8	B	RRAB	192 125
780821	MR Dra	17 04 25.6	+52 49 07	8.21	(0.01)	V	DSCTC	200 DM
780822	V2598 Oph	17 05 43.6	+06 25 42	14.1	14.5	B	RRC	194 201
780823	V1091 Her*	17 07 24.5	+36 15 26	12.04	12.28	*	EW	161 GSC
780824	V2599 Oph	17 09 36.2	-26 40 18	5.94	7.06	K	M	202 2MASS
780825	V2600 Oph*	17 11 39.2	-23 28 00	11.5	12.8	V	RV	040 GSC
780826	V2601 Oph	17 12 04.6	+08 54 28	13.2	15.3	B	SRA	191 107
780827	V879 Ara	17 12 05.4	-66 36 00	12.2	<14.8	V	M	130 204 040
780828	V1186 Sco	17 12 51.3	-30 56 38	9.6	<18.	V	N	205 206
780829	V2576 Oph	17 15 33.0	-29 09 40	9.2	<17.	V	N	324 326
780830	V1092 Her*	17 16 39.9	+29 34 05	11.93	(0.50 V)	*	EW	161 GSC
780831	V1093 Her*	17 18 03.9	+42 34 13	13.97	(0.02)	V	*	116 009 183
780832	V2602 Oph	17 18 10.9	-24 30 05	13.4	<18.0	V	M	332 128
780833	V2573 Oph	17 19 14.1	-27 22 35	10.5	<20.	V	NA	207 208 040
780834	V2603 Oph	17 19 29.4	-25 02 56	16.0	17.5	B	RRAB	209 209
780835	V1228 Sco	17 19 59.0	-31 45 01	16.7	<18.	J	XN	210 210
780836	V1094 Her*	17 26 31.3	+35 01 15	12.56	13.15	*	EW	264 GSC 211
780837	V1229 Sco*	17 26 43.3	-42 13 56	8.90	9.08	V	EB	011 DM
780838	V1095 Her*	17 28 03.3	+43 41 24	11.90	12.44	*	EW	264 GSC 211
780839	V2604 Oph*	17 28 19.9	-16 30 02	12.7	14.0 :	V	EA	225 GSC
780840	V1096 Her	17 28 45.0	+43 48 13	13.01	13.39	*	EW	264 GSC 211
780841	V1187 Sco	17 29 18.8	-31 46 02	9.6	18.	V	NA	212 213
780842	V880 Ara	17 29 25.1	-51 10 23	11.2	14.7	V	M	090 GSC
780843	V2605 Oph	17 29 51.5	+01 29 46	10.1	11.9	V	SRA	090 GSC 130
780844	V2575 Oph	17 33 13.1	-24 21 07	11.07	<17.	V	N	117
780845	V1097 Her	17 33 28.0	+26 55 48	10.76	11.30	*	EW	264 GSC 211
780846	V2574 Oph	17 38 45.5	-23 28 19	10.2	<20.	V	NA	215 216
780847	V1098 Her	17 39 37.2	+50 12 03	12.44	(0.38V)	*	EW	161 GSC
780848	MS Dra	17 39 55.7	+65 00 06	8.39	(0.03)	V	BY	018 DM
780849	V1099 Her*	17 40 22.0	+48 53 58	13.2	(0.02)	V	*	116 009
780850	V881 Ara*	17 41 55.0	-45 34 16	10.14	10.63	V	EA	011 014
780851	V2606 Oph	17 42 40.1	-27 44 53	16.3	<19.2	J	XN:	217 145
780852	V2607 Oph	17 43 19.2	-03 30 21	13.5	14.7	V	SRB	140 USNO 040
780853	V1100 Her	17 44 10.6	+40 16 51	10.92	(0.34)	*	EW	264 GSC 159
780854	V1188 Sco	17 44 21.6	-34 16 36	8.66	<17.	V	NA	139 327
780855	V1230 Sco*	17 45 34.6	-34 00 54	11.3	16.5	R	M	218 2MASS 040
780856	V2608 Oph	17 46 43.6	-04 08 07	12.2	14.6	V	SRA	103 2MASS
780857	V1231 Sco	17 48 02.7	-35 28 21	15.42	15.61	I	EW	219 2MASS
780858	V378 Ser	17 49 24.6	-12 59 59	11.5	<18.	*	N	317
780859	V5118 Sgr	17 50 05.0	-29 57 41	16.00	16.07	I	EA	220 220
780860	V5119 Sgr	17 50 40.9	-17 40 38	11.7	13.6	*	SR:	006 USNO
780861	V1232 Sco	17 50 46.0	-30 03 40	14.57	14.63	I	EA:	220 220
780862	V5120 Sgr	17 50 48.1	-30 00 39	16.07	16.14	I	EA:	220 220
780863	V5121 Sgr	17 50 49.5	-30 01 06	14.67	14.71	I	EA	118 220
780864	V1233 Sco	17 50 55.4	-30 14 51	13.89	14.02	I	EA	220 220

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s o ' "	Max m	Min m		Type	References
780865	V5122 Sgr	17 51 03.1 -29 55 50	15.35	15.42	I	EA	220 220
780866	V1234 Sco	17 51 10.0 -30 16 46	15.66	15.71	I	EA	220 220
780867	V5123 Sgr	17 51 14.4 -29 54 24	16.18	16.22	I	EA	134 134
780868	V1235 Sco	17 51 14.6 -30 03 28	14.71	14.79	I	EA	220 220
780869	V1236 Sco	17 51 17.1 -30 03 01	14.77	14.80	I	EA	134 134
780870	V1237 Sco	17 51 24.3 -30 14 06	14.17	14.20	I	EA	220 220
780871	V5124 Sgr	17 51 27.0 -29 52 22	14.51	14.54	I	EA:	220 220
780872	V5125 Sgr	17 51 28.3 -29 52 35	14.92	14.96	I	EP:	134 220
780873	V1238 Sco	17 51 49.0 -30 13 25	15.56	15.59	I	EP	220 220
780874	V5126 Sgr	17 51 49.4 -30 01 44	14.88	14.93	I	EA	220 220
780875	V5127 Sgr	17 51 50.9 -29 54 43	14.01	14.07	I	EA	220 220
780876	V5128 Sgr	17 52 08.6 -29 56 13	14.79	14.84	I	EA	220 220
780877	V1239 Sco	17 52 15.5 -30 13 54	15.60	15.63	I	EA	134 134
780878	V5129 Sgr*	17 52 18.6 -29 56 25	15.64	15.71	I	EA	118 220
780879	V5130 Sgr	17 52 36.0 -29 37 29	16.70	16.75	I	EP:	134 134
780880	V5131 Sgr	17 52 44.8 -17 24 00	12.5	14.4	*	SR:	006 2MASS 040
780881	V5132 Sgr	17 52 45.4 -29 35 12	15.27	15.31	I	EA	220 220
780882	V5133 Sgr	17 52 46.4 -29 45 14	16.43	16.49	I	EA	220 220
780883	V5134 Sgr	17 52 48.6 -30 00 30	14.92	14.96	I	EA	220 220
780884	V5135 Sgr	17 52 54.0 -29 46 34	15.59	15.63	I	EA	134 134
780885	V1240 Sco	17 52 57.5 -30 05 33	16.46	16.51	I	EA	134 134
780886	V5136 Sgr	17 53 04.5 -29 38 30	14.83	14.90	I	EA	220 220
780887	V1241 Sco	17 53 09.8 -30 06 30	15.99	16.04	I	EP:	134 134
780888	V5137 Sgr	17 53 21.2 -29 35 39	14.78	14.85	I	EA	220 220
780889	V5138 Sgr	17 53 22.7 -29 59 23	14.33	14.37	I	EA	220 220
780890	V2609 Oph*	17 53 32.0 +05 25 26	14.6	15.5	B	RRAB	221 002
780891	V2610 Oph	17 53 32.3 -03 54 55	9.20	9.45	V	EW	094 DM
780892	V5139 Sgr	17 53 36.8 -29 34 30	15.71	15.75	I	EA	220 220
780893	V5140 Sgr	17 53 48.1 -29 56 01	15.92	15.97	I	EA	134 134
780894	V5141 Sgr	17 53 51.2 -17 46 14	13.0	14.5	*	SR:	006 2MASS
780895	V5142 Sgr	17 53 51.7 -29 41 54	15.39	15.46	I	EA	220 220
780896	V5143 Sgr	17 54 09.0 -29 47 39	13.49	13.55	I	EA	220 220
780897	V5144 Sgr	17 54 16.5 -29 43 12	16.01	16.06	I	EA	220 220
780898	V5145 Sgr	17 54 23.5 -29 45 58	16.21	16.27	I	EA	118 220
780899	V1242 Sco	17 54 24.5 -31 05 35	14.5	16.1	*	SR:	006 2MASS
780900	V5146 Sgr	17 54 33.4 -29 44 38	16.35	16.42	I	EA	220 220
780901	V5147 Sgr	17 54 33.9 -30 01 32	13.06	13.10	I	EA	220 220
780902	V5148 Sgr	17 54 35.0 -29 38 51	16.39	16.46	I	EA	220 220
780903	V1243 Sco	17 54 37.7 -30 53 28	13.6	16.9	*	M:	006 2MASS
780904	V5149 Sgr	17 54 38.6 -29 38 32	14.55	14.63	I	EA	220 220
780905	V1244 Sco	17 54 44.7 -31 05 40	12.7	<16.5	*	M	006 2MASS
780906	V1245 Sco	17 54 44.7 -30 53 40	13.0	<15.9	*	M:	006 2MASS
780907	V5150 Sgr	17 54 47.0 -29 41 17	15.58	15.63	I	EA	220 220
780908	V1246 Sco	17 54 48.3 -31 02 20	11.8	14.7	*	M:	006 2MASS 040
780909	V5151 Sgr	17 54 52.3 -29 58 20	13.22	13.25	I	EA	220 220
780910	V1247 Sco	17 54 52.6 -31 02 49	13.2	15.6	*	SR:	006 2MASS 040
780911	V1248 Sco	17 54 56.8 -31 02 26	13.9	<16.5	*	M:	006 2MASS
780912	V5152 Sgr	17 55 03.3 -29 48 48	15.19	15.22	I	EA	118 134
780913	V1249 Sco	17 55 13.2 -31 14 52	13.0	15.8	*	M:	006 2MASS
780914	V5153 Sgr	17 55 16.4 -29 31 32	13.48	13.51	I	EA	220 220
780915	V1250 Sco	17 55 18.0 -31 00 33	13.9	<16.0	*	SR:	006 2MASS
780916	V1251 Sco	17 55 28.0 -31 04 25	12.9	17.0	*	M:	006 2MASS
780917	V5154 Sgr	17 55 29.8 -29 33 31	15.39	15.44	I	EA	220 220
780918	V1252 Sco	17 55 31.5 -31 05 23	11.9	15.0	*	M:	006 2MASS

Table 1 (continued)

No.	Name	R.A., 2000.0	Decl., 2000.0	Max	Min		Type	References
		h m s	o ’ "	m	m			
780919	V1253 Sco	17 55 52.2	-30 48 39	15.5	<17.5	*	SR:	006 2MASS
780920	V1254 Sco	17 55 53.0	-31 02 24	15.0	16.4	*	SR:	006 2MASS
780921	V5155 Sgr	17 55 53.2	-29 22 29	15.68	15.73	I	EA	134 134
780922	V1255 Sco	17 55 53.9	-31 14 46	14.1	15.9	*	SR:	006 2MASS
780923	V1256 Sco	17 55 54.0	-31 11 20	14.2	<16.1	*	SR:	006 2MASS
780924	V1257 Sco	17 55 58.1	-30 47 10	13.1	16.2	*	M:	006 2MASS
780925	V1258 Sco	17 56 05.1	-31 15 20	11.7	13.2	*	SR:	006 2MASS
780926	V5156 Sgr	17 56 21.2	-29 24 00	14.67	14.73	I	EA	220 220
780927	V1259 Sco	17 56 24.0	-31 10 48	12.2	15.9	I	M	006 2MASS
780928	V1260 Sco	17 56 33.5	-30 46 28	13.1	14.8	*	SR:	006 2MASS
780929	V5157 Sgr*	17 56 35.5	-29 32 21	15.30	15.32	I	EP	134 134
780930	V1261 Sco	17 56 37.1	-30 51 05	11.5	12.2	I	SR	006 2MASS
780931	V1262 Sco	17 56 37.9	-31 00 46	11.7	15.7	I	M	006 2MASS
780932	V1263 Sco	17 56 38.8	-30 53 18	12.1	14.0	I	SRA	006 2MASS
780933	V1264 Sco	17 56 39.7	-30 59 28	13.4	16.3	*	M:	006 2MASS
780934	V5158 Sgr	17 56 41.2	-29 40 05	13.70	13.74	I	EA	220 220
780935	V1265 Sco	17 56 44.2	-31 04 01	11.6	13.2	I	M:	006 2MASS
780936	V1266 Sco	17 56 44.3	-30 49 41	14.3	17.0	*	M:	006 2MASS
780937	V5159 Sgr	17 56 44.9	-29 40 35	15.99	16.05	I	EA	220 220
780938	V5160 Sgr	17 56 47.5	-29 42 42	14.85	14.89	I	EA	220 220
780939	V1267 Sco	17 56 48.8	-31 01 49	12.7	<15.6	*	M:	006 2MASS
780940	V1268 Sco	17 56 56.2	-30 45 13	11.7	17.0	I	M	006 2MASS
780941	V1269 Sco	17 56 58.3	-30 52 30	11.2	14.8	I	M	006 2MASS
780942	V5161 Sgr	17 56 58.6	-24 06 11	10.7	13.2	I	M	006 2MASS 040
780943	V1270 Sco*	17 57 02.5	-40 07 16	9.17	9.72	V	EA	011 DM
780944	V5162 Sgr	17 57 05.7	-29 22 49	14.68	14.72	I	EA	220 220
780945	V1271 Sco	17 57 08.2	-30 04 29	13.0	<14.4	*	SR:	006 2MASS
780946	V1272 Sco	17 57 09.0	-30 58 23	11.5	14.2	I	M	006 2MASS
780947	V5163 Sgr	17 57 10.3	-29 15 38	14.94	14.97	I	EA	134 220
780948	V1273 Sco	17 57 13.6	-30 06 17	12.7	<14.4	*	SR	006 2MASS
780949	V5164 Sgr*	17 57 16.0	-29 35 31	13.26	13.31	I	EA	118 220
780950	V1274 Sco	17 57 22.2	-30 54 58	11.1	14.2	*	M:	006 2MASS
780951	V1275 Sco	17 57 25.4	-30 49 09	11.8	13.9	I	M	006 2MASS
780952	V5165 Sgr	17 57 28.5	-29 43 50	15.79	15.82	I	EA	134 134
780953	V5166 Sgr	17 57 30.1	-29 28 44	15.17	15.22	I	EA	220 220
780954	V1276 Sco	17 57 35.4	-31 05 18	10.7	13.2	I	M	006 2MASS
780955	V1277 Sco	17 57 36.2	-30 59 52	11.3	13.9	*	M:	006 2MASS
780956	V5167 Sgr	17 57 38.0	-29 35 17	15.76	15.84	I	EA	220 220
780957	V1278 Sco	17 57 46.5	-31 20 06	11.3	13.7	I	M	006 2MASS
780958	V5168 Sgr	17 57 52.4	-22 41 34	10.5	12.9	I	M	006 2MASS
780959	V5169 Sgr	17 58 02.4	-29 44 40	13.7	<15.4	*	SR:	006 2MASS
780960	V5170 Sgr	17 58 11.2	-19 56 41	13.3	<16.2	*	M:	006 2MASS
780961	V5171 Sgr	17 58 19.1	-23 36 29	8.8	10.7	I	M:	006 2MASS
780962	V5172 Sgr	17 58 25.4	-27 05 55	10.3	13.7	*	M:	006 2MASS
780963	V5173 Sgr	17 58 40.3	-29 03 49	13.47	(0.2)	Rc	SR	223 2MASS
780964	V5174 Sgr	17 58 40.8	-29 08 29	15.16	(0.2)	Rc	SR	223 2MASS
780965	V5175 Sgr	17 58 41.1	-31 15 17	13.2	16.6	*	M:	006 2MASS
780966	V5176 Sgr	17 58 41.6	-29 03 54	14.8	15.8	Rc	SRB	223 2MASS
780967	V5177 Sgr	17 58 41.9	-29 06 51	13.92	(0.25)	Rc	SR	223 2MASS
780968	V5178 Sgr	17 58 42.4	-29 05 16	16.65	(0.4)	Rc	SR	223 2MASS
780969	V5179 Sgr	17 58 42.4	-29 10 29	16.10	(0.3)	Rc	SR	223 2MASS
780970	V5180 Sgr	17 58 42.5	-29 02 41	14.01	(0.15)	Rc	SR	223 2MASS
780971	V5181 Sgr	17 58 42.6	-29 03 40	16.31	(0.25)	Rc	SR	223 2MASS
780972	V5182 Sgr	17 58 42.8	-29 08 47	14.8	15.4	Rc	SR	223 2MASS

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s o ' "	Max m	Min m	Type	References
780973	V5183 Sgr	17 58 43.3 -29 10 14	15.21	(0.1)	Rc SRS	223 2MASS
780974	V5184 Sgr	17 58 43.7 -29 03 26	13.41	(0.2)	Rc SR	223 2MASS
780975	V5185 Sgr	17 58 44.5 -29 02 36	14.05	(0.12)	Rc SRS	223 2MASS
780976	V5186 Sgr	17 58 45.5 -29 03 58	15.75	(0.15)	Rc SR	223 2MASS
780977	V5187 Sgr	17 58 45.8 -29 10 35	15.43	(0.1)	Rc SR	223 2MASS
780978	V5188 Sgr	17 58 45.8 -29 03 28	14.43	(0.12)	Rc SR	223 2MASS
780979	V5189 Sgr	17 58 45.9 -29 07 49	15.65	(0.15)	Rc SRS	223 2MASS
780980	V5190 Sgr	17 58 46.0 -29 03 11	15.08	(0.35)	Rc SR	223 2MASS
780981	V5191 Sgr	17 58 46.8 -29 07 20	16.87	(0.1)	Rc SR	223 2MASS
780982	V5192 Sgr	17 58 46.9 -29 03 34	15.10	(0.15)	Rc SR	223 2MASS
780983	V5193 Sgr	17 58 47.1 -29 07 10	16.02	(0.1)	Rc SR	223 2MASS
780984	V5194 Sgr	17 58 47.3 -29 01 58	14.66	(0.15)	Rc SR	223 2MASS
780985	V5195 Sgr	17 58 47.7 -29 09 44	14.24	(0.1)	Rc SR	223 2MASS
780986	V5196 Sgr	17 58 47.8 -29 10 05	13.65	14.35	Rc SRB	223 2MASS
780987	V5197 Sgr	17 58 48.1 -29 01 27	16.10	16.75	Rc SRB	223 2MASS
780988	V5198 Sgr	17 58 48.6 -29 07 45	15.20	15.90	Rc SRB	223 2MASS
780989	V5199 Sgr	17 58 49.0 -29 11 23	14.10	15.10	Rc SRB	223 2MASS
780990	V5200 Sgr	17 58 49.1 -29 05 29	15.14	(0.1)	Rc SRS	223 2MASS
780991	V5201 Sgr	17 58 49.3 -29 10 14	15.75	17.40	Rc SRA	223 2MASS
780992	V5202 Sgr	17 58 50.0 -29 06 33	13.61	(0.1)	Rc SR	223 2MASS
780993	V5203 Sgr	17 58 50.2 -29 04 56	15.15	(0.5)	Rc SR	223 2MASS
780994	V5204 Sgr	17 58 50.4 -29 03 15	14.73	(0.15)	Rc SR	223 2MASS
780995	V5205 Sgr	17 58 50.5 -29 10 17	16.01	(0.5)	Rc SR	223 2MASS
780996	V5206 Sgr	17 58 50.8 -29 01 07	16.70	(0.35)	Rc SR	223 2MASS
780997	V5207 Sgr	17 58 51.1 -29 07 22	13.40	(0.4)	Rc SR	223 2MASS
780998	V5208 Sgr	17 58 51.3 -29 02 06	16.24	(0.1)	Rc SR	223 2MASS
780999	V5209 Sgr	17 58 51.6 -29 03 14	14.15	(0.08)	Rc SRS	223 2MASS
781000	V5210 Sgr	17 58 51.9 -29 05 26	16.14	(0.1)	Rc SR	223 2MASS
781001	V5117 Sgr	17 58 52.6 -36 47 35	9.2	<17.	V NA	084 328
781002	V5211 Sgr	17 58 53.0 -29 08 33	14.16	14.44	Rc SR	223 2MASS
781003	V5212 Sgr	17 58 53.1 -29 04 23	15.74	(0.3)	Rc SR	223 2MASS
781004	V5213 Sgr	17 58 53.4 -28 59 40	14.59	(0.15)	Rc SRS	223 2MASS
781005	V5214 Sgr	17 58 54.0 -29 03 51	14.13	(0.1)	Rc SRS	223 2MASS
781006	V5215 Sgr	17 58 54.1 -29 05 24	15.90	(0.6)	Rc SR	223 2MASS
781007	V5216 Sgr	17 58 54.3 -29 03 25	15.49	(0.2)	Rc SRS	223 2MASS
781008	V5217 Sgr	17 58 54.5 -29 10 33	15.62	(0.4)	Rc SR	223 2MASS
781009	V5218 Sgr	17 58 54.6 -28 58 33	12.74	(0.25)	Rc SRS	223 2MASS
781010	V5219 Sgr	17 58 55.0 -29 06 28	16.21	(0.15)	Rc SR	223 2MASS
781011	V5220 Sgr	17 58 55.2 -28 58 10	13.13	(0.1)	Rc SRS	223 2MASS
781012	V5221 Sgr	17 58 55.4 -29 07 07	15.11	(0.2)	Rc SR	223 2MASS
781013	V5222 Sgr	17 58 55.5 -29 12 08	15.37	(0.25)	Rc SR	223 2MASS
781014	V5223 Sgr	17 58 56.2 -29 00 51	16.46	(0.3)	Rc SR	223 2MASS
781015	V5224 Sgr	17 58 56.6 -29 06 01	15.07	(0.15)	Rc SRS	223 2MASS
781016	V5225 Sgr	17 58 56.7 -29 03 40	15.40	(0.2)	Rc SR	223 2MASS
781017	V5226 Sgr	17 58 56.8 -29 08 04	15.23	(0.1)	Rc SRS	223 2MASS
781018	V5227 Sgr	17 58 56.9 -29 04 47	15.17	(0.3)	Rc SR	223 2MASS
781019	V5228 Sgr	17 58 57.2 -29 12 18	15.88	(0.12)	Rc SR	223 2MASS
781020	V5229 Sgr	17 58 57.4 -29 05 39	13.43	(0.1)	Rc SR	223 2MASS
781021	V5230 Sgr	17 58 57.5 -29 06 33	13.00	13.80	Rc SRA	223 2MASS
781022	V5231 Sgr	17 58 57.7 -29 01 16	15.35	15.95	Rc SRA	223 2MASS
781023	V5232 Sgr	17 58 57.8 -29 03 50	16.17	(0.6)	Rc SR	223 2MASS
781024	V5233 Sgr	17 58 58.3 -29 11 37	13.61	(0.1)	Rc SRS	223 2MASS
781025	V5234 Sgr	17 58 58.4 -29 08 46	15.71	(0.25)	Rc SR	223 2MASS
781026	V5235 Sgr	17 58 58.5 -29 07 23	13.95	14.50	Rc SRB	223 2MASS

Table 1 (continued)

No.	Name	R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m	Type	References
781027	V5236 Sgr	17 58 59.9	-28 58 12	13.74	(0.1)	Rc SRS	223 2MASS
781028	V5237 Sgr	17 59 00.1	-29 11 12	14.50	(1.0)	Rc SR	223 2MASS
781029	V5238 Sgr	17 59 00.1	-29 05 58	15.12	(0.1)	Rc SRS	223 2MASS
781030	V5239 Sgr	17 59 00.6	-29 03 07	14.95	(0.15)	Rc SRS	223 2MASS
781031	V5240 Sgr	17 59 00.8	-29 09 54	16.67	(0.4)	Rc SR	223 2MASS
781032	V5241 Sgr	17 59 00.8	-29 12 40	15.40	(0.2)	Rc SR	223 2MASS
781033	V5242 Sgr	17 59 01.1	-29 09 12	15.61	(0.2)	Rc SRS	223 2MASS
781034	V5243 Sgr	17 59 01.1	-29 05 19	15.83	(0.15)	Rc SR	223 2MASS
781035	V5244 Sgr	17 59 01.3	-29 08 03	16.21	(0.3)	Rc SR	223 2MASS
781036	V5245 Sgr	17 59 01.8	-29 05 32	15.22	(0.2)	Rc SR	223 2MASS
781037	V5246 Sgr	17 59 02.1	-29 06 25	15.36	(0.3)	Rc SR	223 2MASS
781038	V5247 Sgr	17 59 02.7	-29 08 43	16.15	(0.2)	Rc SRS	223 2MASS
781039	V5248 Sgr	17 59 02.9	-29 01 39	15.07	(0.25)	Rc SR	223 2MASS
781040	V5249 Sgr	17 59 03.0	-29 12 06	13.94	(0.15)	Rc SR	223 2MASS
781041	V5250 Sgr	17 59 03.3	-29 06 03	15.30	(0.08)	Rc SR	223 2MASS
781042	V5251 Sgr	17 59 03.5	-28 59 20	15.07	(0.15)	Rc SRS	223 2MASS
781043	V5252 Sgr	17 59 04.1	-29 11 04	14.90	15.80	Rc SRB	223 2MASS
781044	V5253 Sgr	17 59 04.5	-29 07 46	15.43	(0.3)	Rc SR	223 2MASS
781045	V5254 Sgr	17 59 05.1	-29 07 09	13.53	(0.1)	Rc SRS	223 2MASS
781046	V5255 Sgr	17 59 05.4	-28 58 36	16.36	(0.3)	Rc SR	223 2MASS
781047	V5256 Sgr	17 59 05.5	-29 05 46	13.37	(0.1)	Rc SRS	223 2MASS
781048	V5257 Sgr	17 59 05.6	-29 02 35	16.15	(0.3)	Rc SR	223 2MASS
781049	V5258 Sgr	17 59 05.6	-29 11 07	14.03	(0.1)	Rc SR	223 2MASS
781050	V5259 Sgr	17 59 05.7	-29 11 30	16.38	(0.5)	Rc SRS	223 2MASS
781051	V5260 Sgr	17 59 05.9	-29 07 34	13.70	(0.06)	Rc SRS	223 2MASS
781052	V5261 Sgr	17 59 05.9	-29 06 21	13.71	(0.3)	Rc SR	223 2MASS
781053	V5262 Sgr	17 59 06.5	-29 05 29	14.87	(0.15)	Rc SRS	223 2MASS
781054	V5263 Sgr	17 59 07.2	-29 12 43	15.12	(0.15)	Rc SR	223 2MASS
781055	V5264 Sgr	17 59 07.2	-29 10 26	14.02	(0.6)	Rc SR	223 2MASS
781056	V5265 Sgr	17 59 07.5	-29 30 29	10.7	<13.0	* M	006 2MASS
781057	V5266 Sgr	17 59 07.9	-28 58 28	15.07	(0.25)	Rc SR	223 2MASS
781058	V5267 Sgr	17 59 08.2	-29 07 30	13.42	(0.2)	Rc SR	223 2MASS
781059	V5268 Sgr	17 59 08.2	-29 08 57	15.01	(0.6)	Rc SR	223 2MASS
781060	V5269 Sgr	17 59 08.4	-29 12 51	14.08	(0.1)	Rc SRS	223 2MASS
781061	V5270 Sgr	17 59 08.7	-29 13 45	18.12	(0.35)	Rc SR	223
781062	V5271 Sgr	17 59 09.2	-29 04 26	15.05	(0.15)	Rc SRS	223 2MASS
781063	V5272 Sgr	17 59 09.3	-28 58 00	14.36	(0.1)	Rc SRS	223 2MASS
781064	V5273 Sgr	17 59 09.3	-26 38 00	12.9	<18.	V M	006 2MASS 332
781065	V5274 Sgr	17 59 09.4	-29 08 26	14.23	(0.2)	Rc SR	223 2MASS
781066	V5275 Sgr	17 59 10.0	-29 13 59	14.49	(0.35)	Rc SR	223 2MASS
781067	V5276 Sgr	17 59 10.5	-29 04 58	15.25	(0.4)	Rc SR	223 2MASS
781068	V5277 Sgr	17 59 10.6	-29 00 36	14.24	(0.2)	Rc SR	223 2MASS
781069	V5278 Sgr	17 59 10.7	-29 07 09	13.87	(0.25)	Rc SR	223 2MASS
781070	V5279 Sgr	17 59 10.8	-28 57 48	14.00	(0.2)	Rc LB:	223 2MASS
781071	V5280 Sgr	17 59 10.9	-29 03 16	16.50	(0.5)	Rc SR	223 2MASS
781072	V5281 Sgr	17 59 11.1	-29 14 03	16.25	(0.35)	Rc SR	223 2MASS
781073	V5282 Sgr	17 59 12.3	-29 13 59	14.27	(0.1)	Rc SRS	223 2MASS
781074	V5283 Sgr	17 59 12.6	-29 06 10	15.02	(0.25)	Rc SR	223 2MASS
781075	V5284 Sgr	17 59 13.1	-29 09 02	15.62	(0.25)	Rc SR	223 2MASS
781076	V5285 Sgr	17 59 13.3	-29 14 10	15.00	(0.15)	Rc SRS	223 2MASS
781077	V5286 Sgr	17 59 13.5	-28 58 12	12.62	(0.4)	Rc SR	223 2MASS
781078	V5287 Sgr	17 59 13.8	-29 07 04	14.98	(0.15)	Rc SR	223 2MASS
781079	V5288 Sgr	17 59 13.8	-29 09 53	16.28	(0.3)	Rc SR	223 2MASS
781080	V5289 Sgr	17 59 13.9	-29 08 16	15.12	(0.15)	Rc SRS	223 2MASS

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s o ' "	Max m	Min m		Type	References
781081	V5290 Sgr	17 59 14.0 -29 02 42	15.98	(0.35)	Rc	SR	223 2MASS
781082	V5291 Sgr	17 59 14.5 -29 08 53	13.54	(0.1)	Rc	SRS	223 2MASS
781083	V5292 Sgr	17 59 14.8 -29 11 31	15.86	(0.4)	Rc	SR	223 2MASS
781084	V5293 Sgr	17 59 14.8 -29 53 53	11.9	<15.8	*	M:	006 2MASS
781085	V5294 Sgr	17 59 15.3 -29 05 34	14.86	(0.5)	Rc	SR	223 2MASS
781086	V5295 Sgr	17 59 15.8 -29 08 25	15.33	(0.2)	Rc	SR	223 2MASS
781087	V5296 Sgr	17 59 15.9 -29 08 40	14.25	(0.25)	Rc	SR	223 2MASS
781088	V5297 Sgr	17 59 15.9 -29 04 10	14.56	(0.15)	Rc	SR	223 2MASS
781089	V5298 Sgr	17 59 16.3 -29 08 06	15.31	(0.25)	Rc	SR	223 2MASS
781090	V728 CrA	17 59 16.5 -42 35 07	14.2	18.	p	UGSU	224 USNO
781091	V5299 Sgr	17 59 17.0 -29 05 02	13.27	(0.2)	Rc	SR	223 2MASS
781092	V5300 Sgr	17 59 17.3 -29 10 50	14.43	(0.7)	Rc	SR	223 2MASS
781093	V5301 Sgr	17 59 17.8 -29 08 08	15.92	(0.3)	Rc	SR	223 2MASS
781094	V5302 Sgr	17 59 18.1 -29 01 24	12.64	(0.45)	Rc	SR	223 2MASS
781095	V5303 Sgr	17 59 18.3 -29 05 06	14.58	(0.8)	Rc	SR	223 2MASS
781096	V5304 Sgr	17 59 18.4 -29 06 08	16.34	(0.4)	Rc	SR	223 2MASS
781097	V5305 Sgr	17 59 18.5 -29 00 47	13.44	(0.15)	Rc	SRS	223 2MASS
781098	V5306 Sgr	17 59 18.5 -29 13 04	13.70	(0.1)	Rc	SR	223 2MASS
781099	V5307 Sgr	17 59 18.8 -29 05 47	14.30	(0.08)	Rc	SRS	223 2MASS
781100	V5308 Sgr	17 59 19.5 -29 04 52	12.95	(0.15)	Rc	SR	223 2MASS
781101	V5309 Sgr	17 59 19.7 -29 12 48	14.15	(0.15)	Rc	SRS	223 2MASS
781102	V5310 Sgr	17 59 20.0 -29 14 17	17.37	(1.0)	Rc	SR	223 2MASS
781103	V5311 Sgr	17 59 20.4 -29 09 52	17.78	(0.9)	Rc	SR	223 2MASS
781104	V5312 Sgr	17 59 20.6 -29 15 08	15.34	(0.25)	Rc	SR	223 2MASS
781105	V5313 Sgr	17 59 21.0 -31 09 20	13.9	<15.7	*	SR:	006 2MASS
781106	V5314 Sgr	17 59 21.7 -29 08 42	14.84	(0.35)	Rc	SR	223 2MASS
781107	V5315 Sgr	17 59 21.8 -29 11 00	14.86	(0.25)	Rc	SR	223 2MASS
781108	V5316 Sgr	17 59 21.8 -29 05 48	14.69	(0.35)	Rc	SR	223 2MASS
781109	V5317 Sgr	17 59 21.9 -29 12 31	12.84	(0.35)	Rc	SR	223 2MASS
781110	V5318 Sgr	17 59 21.9 -24 59 35	12.4	<16.0	*	M:	006 USNO
781111	V5319 Sgr	17 59 21.9 -29 11 58	17.49	(0.4)	Rc	SR	223 2MASS
781112	V5320 Sgr	17 59 22.4 -29 11 35	14.76	(0.25)	Rc	SR	223 2MASS
781113	V5321 Sgr	17 59 23.1 -29 08 22	13.34	(0.3)	Rc	SR	223 2MASS
781114	V5322 Sgr	17 59 23.3 -29 14 53	16.08	(1.0)	Rc	SR	223 2MASS
781115	V5323 Sgr	17 59 23.8 -29 09 54	14.94	(0.2)	Rc	SR	223 2MASS
781116	V5324 Sgr	17 59 24.3 -29 14 00	13.20	14.10	Rc	SRB	223 2MASS
781117	V5325 Sgr*	17 59 24.4 -29 12 38	15.88	(0.5)	Rc	SR	223 2MASS
781118	V5326 Sgr	17 59 25.2 -29 03 38	16.43	(0.25)	Rc	SR	223 2MASS
781119	V5327 Sgr	17 59 25.5 -29 00 38	13.78	(0.15)	Rc	SR	223 2MASS
781120	V5328 Sgr	17 59 26.0 -29 06 13	17.06	(0.25)	Rc	SR	223 2MASS
781121	V5329 Sgr	17 59 26.3 -29 07 07	13.34	(0.35)	Rc	SR	223 2MASS
781122	V5330 Sgr	17 59 26.3 -29 02 18	15.46	(0.2)	Rc	SR	223 2MASS
781123	V5331 Sgr	17 59 26.8 -29 03 48	15.63	(0.06)	Rc	SRS	223 2MASS
781124	V5332 Sgr	17 59 27.5 -29 13 35	14.41	(0.1)	Rc	SRS	223 2MASS
781125	V5333 Sgr	17 59 27.8 -29 05 31	15.71	(0.3)	Rc	SR	223 2MASS
781126	V5334 Sgr	17 59 27.8 -29 10 40	14.85	(0.3)	Rc	SR	223 2MASS
781127	V5335 Sgr	17 59 27.9 -29 01 19	13.18	(0.1)	Rc	SR	223 2MASS
781128	V5336 Sgr	17 59 29.5 -29 09 27	12.64	(0.2)	Rc	SR	223 2MASS
781129	V5337 Sgr	17 59 31.0 -29 08 59	16.13	(0.3)	Rc	SR	223 2MASS
781130	V5338 Sgr	17 59 32.1 -29 08 59	13.90	(0.3)	Rc	SR	223 2MASS
781131	V5339 Sgr	17 59 32.4 -29 08 02	16.07	(0.1)	Rc	SRS	223 2MASS
781132	V5340 Sgr	17 59 33.9 -29 07 29	16.53	(0.06)	Rc	SRS	223 2MASS
781133	V5341 Sgr	17 59 34.9 -29 11 13	15.64	(0.08)	Rc	SRS	223 2MASS
781134	V5342 Sgr	17 59 35.3 -29 05 07	14.34	(0.05)	Rc	SR	223 2MASS

Table 1 (continued)

No.	Name	R.A., 2000.0	Decl., 2000.0	Max	Min		Type	References
		h m s	o ' "	m	m			
781135	V5343 Sgr	17 59 36.0	-29 09 17	13.61	(0.4)	Rc	SR	223 2MASS
781136	V5344 Sgr	17 59 36.2	-29 05 17	16.38	(0.1)	Rc	SRS	223 2MASS
781137	V5345 Sgr	17 59 36.9	-29 08 36	15.48	(0.6)	Rc	SR	223 2MASS
781138	V5346 Sgr	17 59 37.0	-31 24 47	13.2	<15.4	*	M:	006 2MASS
781139	V5347 Sgr	17 59 37.0	-29 02 53	16.04	(0.05)	Rc	SR	223 2MASS
781140	V5348 Sgr	17 59 37.6	-29 09 28	14.18	(0.25)	Rc	SRS	223 2MASS
781141	V5349 Sgr	17 59 38.2	-29 01 29	15.66	(0.06)	Rc	SR	223 2MASS
781142	V5350 Sgr	17 59 39.2	-29 09 16	14.69	(0.2)	Rc	SR	223 2MASS
781143	V5351 Sgr	17 59 40.8	-29 07 38	16.10	(0.06)	Rc	SR	223 2MASS
781144	V5352 Sgr	17 59 41.2	-21 05 24	13.3	<14.8	V	M:	006 2MASS 040
781145	V5353 Sgr	17 59 43.3	-29 07 36	15.34	(0.05)	Rc	SRS	223 2MASS
781146	V5354 Sgr	17 59 46.8	-29 03 58	16.31	(0.25)	Rc	SRS	223 2MASS
781147	V5355 Sgr	17 59 50.4	-29 35 42	12.4	13.4	V	SR	006 2MASS
781148	V5356 Sgr	18 00 15.6	-21 50 49	12.6	14.6	*	SR:	006 2MASS
781149	V5357 Sgr	18 00 32.8	-24 16 19	7.7	10.8	I	M	006 2MASS
781150	V5358 Sgr	18 00 39.6	-28 31 45	12.4	<15.5	*	M:	006 2MASS
781151	V387 Ser	18 00 40.4	-13 53 17	13.3	16.1	*	M:	006 2MASS
781152	V5359 Sgr	18 00 42.2	-29 44 37	12.7	<15.0	*	M:	006 2MASS
781153	V5360 Sgr	18 01 10.5	-29 30 38	12.3	<14.4	*	SR:	006 2MASS
781154	V5361 Sgr	18 01 13.9	-30 20 37	11.7	13.1	I	RVA	006 2MASS
781155	V388 Ser	18 01 14.9	-15 23 38	13.2	16.3	*	M:	006 2MASS
781156	V5362 Sgr	18 01 31.6	-29 43 52	11.2	17.4	I	M	006 2MASS
781157	V5363 Sgr	18 01 35.9	-30 15 59	11.0	12.9	I	SR	006 2MASS
781158	V5364 Sgr	18 01 49.5	-30 15 45	12.5	13.8	V	SRA	006 2MASS 040
781159	V5365 Sgr	18 02 10.9	-28 47 50	11.5	15.6	I	M	006 2MASS
781160	V5366 Sgr	18 02 14.6	-28 15 37	11.1	13.3	I	M	006 2MASS
781161	V5367 Sgr	18 02 22.8	-28 22 24	10.6	12.2	I	SR	006 2MASS
781162	V5368 Sgr	18 02 29.7	-28 14 10	11.6	<14.4	*	M:	006 2MASS
781163	V5369 Sgr	18 02 32.2	-30 02 01	13.71	(0.06)	Rc	SRS	223 2MASS
781164	V5370 Sgr	18 02 36.1	-30 02 18	15.62	(0.2)	Rc	SRS	223 2MASS
781165	V5371 Sgr	18 02 36.7	-29 57 53	15.03	(0.2)	Rc	LB:	223 2MASS
781166	V5372 Sgr	18 02 37.9	-29 59 34	14.78	(0.15)	Rc	SRS	223 2MASS
781167	V5373 Sgr	18 02 38.7	-29 59 55	16.59	(0.35)	Rc	SR	223 2MASS
781168	V5374 Sgr	18 02 39.3	-29 59 20	13.80	(0.1)	Rc	SRS	223 2MASS
781169	V5375 Sgr	18 02 40.0	-29 58 22	13.87	(0.15)	Rc	SR	223 2MASS
781170	V5376 Sgr	18 02 40.6	-30 00 55	14.67	(0.15)	Rc	SRS	223 2MASS
781171	V5377 Sgr	18 02 40.9	-29 59 03	15.80	(0.2)	Rc	SR	223 2MASS
781172	V5378 Sgr	18 02 41.7	-29 57 54	13.83	(0.2)	Rc	SR	223 2MASS
781173	V5379 Sgr	18 02 41.8	-29 59 58	15.52	(0.3)	Rc	SR	223 2MASS
781174	V5380 Sgr	18 02 42.9	-30 03 36	16.88	(0.5)	Rc	SR	223 2MASS
781175	V5381 Sgr	18 02 43.3	-29 56 15	15.02	(0.25)	Rc	SR	223 2MASS
781176	V5382 Sgr	18 02 43.6	-29 42 15	10.7	11.9	I	SRA	006 2MASS
781177	V5383 Sgr	18 02 45.0	-29 58 13	14.52	(0.1)	Rc	SRS	223 2MASS
781178	V5384 Sgr	18 02 45.3	-29 55 38	13.51	(0.5)	Rc	SRS	223 2MASS
781179	V5385 Sgr	18 02 45.5	-30 03 29	14.14	(0.06)	Rc	SR	223 2MASS
781180	V5386 Sgr	18 02 45.7	-30 01 12	16.22	(0.35)	Rc	SR	223 226
781181	V5387 Sgr	18 02 48.4	-30 03 11	15.40	(0.3)	Rc	SR	223 2MASS
781182	V5388 Sgr	18 02 48.9	-29 54 31	15.65	(0.4)	Rc	SR	223 2MASS
781183	V5389 Sgr	18 02 49.4	-29 58 53	14.63	(0.3)	Rc	SR	223 226
781184	V5390 Sgr	18 02 51.2	-30 00 14	15.14	(0.7)	Rc	SR	223 226
781185	V5391 Sgr	18 02 51.8	-30 02 46	15.32	(0.25)	Rc	SR	223 2MASS
781186	V5392 Sgr	18 02 52.3	-30 00 24	15.70	(0.3)	Rc	SR	223 226
781187	V5393 Sgr	18 02 52.6	-29 54 58	15.76	(0.2)	Rc	SR	223 226
781188	V5394 Sgr	18 02 52.8	-30 01 08	15.92	(0.4)	Rc	SR	223 226

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s o ' "	Max m	Min m		Type	References
781189	V5395 Sgr	18 02 52.9 -30 02 51	15.53	(0.3)	Rc	SR	223 2MASS
781190	V5396 Sgr	18 02 53.8 -29 54 25	14.48	(0.15)	Rc	SR	223 226
781191	V5397 Sgr	18 02 54.1 -30 00 49	14.89	(0.5)	Rc	SR	223 226
781192	V5398 Sgr	18 02 56.1 -29 55 35	15.20	16.20	Rc	SRA	223 2MASS
781193	V5399 Sgr	18 02 56.6 -29 57 06	13.63	(0.5)	Rc	SR	223 2MASS
781194	V5400 Sgr*	18 02 56.9 -29 55 52	15.71	(0.15)	Rc	SRS	223 226
781195	V5401 Sgr	18 02 57.1 -29 52 01	14.54	(0.1)	Rc	SR	223 2MASS
781196	V5402 Sgr	18 02 57.4 -30 03 54	12.77	(0.1)	Rc	SR	223 2MASS
781197	V5403 Sgr	18 02 58.2 -29 50 50	13.17	(0.15)	Rc	SRS	223 2MASS
781198	V5404 Sgr	18 02 58.4 -30 03 12	15.26	(0.2)	Rc	SR	223 2MASS
781199	V5405 Sgr	18 02 58.7 -29 54 27	13.77	(0.5)	Rc	SRB	223 2MASS
781200	V5406 Sgr	18 02 58.7 -29 52 22	13.57	(0.08)	Rc	SR	223 2MASS
781201	V5407 Sgr	18 02 58.8 -30 01 09	14.87	(0.25)	Rc	SR	223 226
781202	V5408 Sgr	18 02 59.0 -29 57 59	14.45	(0.3)	Rc	SR	223 2MASS
781203	V5409 Sgr	18 02 59.5 -30 02 54	15.20	15.95	Rc	SRA	223 226
781204	V5410 Sgr	18 03 01.4 -23 42 31	9.7	11.3	I	SRA	006 2MASS 040
781205	V5411 Sgr	18 03 01.6 -30 00 01	15.63	(0.25)	Rc	SR	223 226
781206	V5412 Sgr	18 03 01.7 -29 50 53	13.59	(0.1)	Rc	SRS	223 2MASS
781207	V5413 Sgr	18 03 03.1 -29 55 16	12.83	(0.06)	Rc	SR	223 2MASS
781208	V5414 Sgr	18 03 03.8 -30 02 43	15.31	(0.5)	Rc	SR	223 226
781209	V5415 Sgr	18 03 03.9 -29 51 36	14.71	(0.1)	Rc	SR	223 226
781210	V5416 Sgr	18 03 04.8 -29 52 59	15.29	(0.15)	Rc	SR	223 2MASS
781211	V5417 Sgr	18 03 05.2 -29 55 16	15.51	(0.3)	Rc	SR	223 226
781212	V5418 Sgr	18 03 05.4 -29 50 32	12.58	(0.05)	Rc	SRS	223 2MASS
781213	V5419 Sgr	18 03 05.8 -29 53 45	14.78	(0.4)	Rc	SR	223 2MASS
781214	V5420 Sgr	18 03 05.8 -30 05 09	14.91	(0.2)	Rc	SRS	223 2MASS
781215	V5421 Sgr	18 03 06.2 -29 51 42	15.29	(0.4)	Rc	SR	223 226
781216	V5422 Sgr	18 03 06.2 -29 52 04	16.42	(0.2)	Rc	SR	223 226
781217	V5423 Sgr	18 03 06.9 -30 06 36	16.00	(0.2)	Rc	SR	223 226
781218	V5424 Sgr	18 03 07.1 -30 05 21	16.08	(0.4)	Rc	SR	223 226
781219	V5425 Sgr	18 03 07.3 -30 02 56	13.29	(0.25)	Rc	SR	223 2MASS
781220	V5426 Sgr	18 03 07.8 -30 04 52	13.88	(0.05)	Rc	SR	223 2MASS
781221	V5427 Sgr	18 03 07.9 -25 18 57	12.3	14.3	*	SR:	006 2MASS 040
781222	V5428 Sgr	18 03 08.2 -30 03 31	15.64	(0.2)	Rc	SR	223 226
781223	V5429 Sgr	18 03 08.7 -29 52 20	16.02	(0.3)	Rc	SR	223 226
781224	V5430 Sgr	18 03 08.8 -30 05 53	14.64	(0.1)	Rc	SRS	223 2MASS
781225	V5431 Sgr*	18 03 09.3 -29 52 44	13.71	(0.2)	Rc	SR	223 2MASS
781226	V5432 Sgr	18 03 09.5 -30 02 41	13.45	(0.1)	Rc	SRS	223 2MASS
781227	V5433 Sgr	18 03 09.9 -30 01 39	14.51	(0.1)	Rc	SRS	223 226
781228	V5434 Sgr	18 03 10.6 -29 56 20	14.66	(0.15)	Rc	SRS	223 2MASS
781229	V5435 Sgr	18 03 11.9 -29 59 02	12.74	(0.05)	Rc	SR	223 2MASS
781230	V5436 Sgr	18 03 12.5 -30 04 30	15.23	(0.4)	Rc	SR	223 226
781231	V5437 Sgr	18 03 13.3 -30 00 56	16.41	(0.7)	Rc	SR	223 226
781232	V5438 Sgr	18 03 13.9 -29 56 21	14.16	(0.4)	Rc	SR	223 2MASS
781233	V5439 Sgr	18 03 17.8 -30 02 30	15.29	(1.0)	Rc	LB	227 226
781234	V5440 Sgr	18 03 18.1 -30 03 11	14.51	(0.1)	Rc	SRS	227 226
781235	V5441 Sgr	18 03 18.4 -29 53 47	15.81	(0.2)	Rc	SR	223 226
781236	V5442 Sgr	18 03 18.7 -30 02 20	15.38	(0.4)	R	SR	227 226
781237	V5443 Sgr	18 03 20.0 -29 59 36	13.83	(0.1)	Rc	SRS	223 226
781238	V5444 Sgr	18 03 20.3 -30 00 40	13.47	(0.15)	R	SR	227 2MASS
781239	V5445 Sgr	18 03 20.3 -29 54 33	14.79	(0.1)	Rc	SRS	223 226
781240	V5446 Sgr	18 03 20.7 -30 04 52	15.42	(0.15)	Rc	SRS	223 226
781241	V5447 Sgr	18 03 22.3 -30 02 56	13.22	(0.25)	Rc	SR	223 226
781242	V5448 Sgr	18 03 23.0 -30 03 20	15.54	(0.8)	R	SR	227 226

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	References
781243	V5449 Sgr	18 03 23.3 -30 08 39	14.97	(1.0)	Rc	SR	223 226
781244	V5450 Sgr	18 03 23.8 -29 54 11	15.15	(0.35)	Rc	SR	223 226
781245	V5451 Sgr	18 03 23.9 -30 00 06	14.33	(0.5)	Rc	SR	223 2MASS
781246	V5452 Sgr	18 03 23.9 -29 59 26	15.57	(0.3)	Rc	SR	223 226
781247	V5453 Sgr	18 03 24.4 -30 04 16	14.41	(0.15)	Rc	SR	223 226
781248	V5454 Sgr	18 03 24.5 -30 04 39	15.93	(0.1)	R	SRS	227 226
781249	V5455 Sgr	18 03 25.0 -30 08 49	14.14	(0.03)	Rc	SRS	223 2MASS
781250	V5456 Sgr	18 03 25.1 -29 59 17	15.15	(0.1)	R	SR	227 226
781251	V5457 Sgr	18 03 25.3 -29 59 48	14.70	(0.2)	Rc	SR	227 226
781252	V5458 Sgr	18 03 25.3 -30 06 46	14.37	(0.4)	Rc	SR	223 226
781253	V5459 Sgr	18 03 25.8 -29 58 47	14.84	(0.7)	Rc	SR	223 226
781254	V5460 Sgr	18 03 26.5 -30 07 02	16.02	(0.15)	Rc	SR	223 2MASS
781255	V5461 Sgr	18 03 27.3 -30 01 03	14.81	(0.3)	Rc	SR	227 226
781256	V5462 Sgr	18 03 27.4 -30 02 26	13.65	(0.1)	Rc	SRS	223 2MASS
781257	V5463 Sgr	18 03 27.8 -30 06 56	15.41	(0.15)	Rc	SR	223 2MASS
781258	V5464 Sgr	18 03 28.4 -29 55 45	16.02	(0.1)	Rc	SR	223 226
781259	V5465 Sgr	18 03 28.8 -30 02 28	14.71	(0.15)	R	SRS	227 226
781260	V5466 Sgr	18 03 29.2 -30 02 49	12.97	(0.6)	Rc	SR	227 2MASS
781261	V5467 Sgr	18 03 29.3 -29 59 40	15.11	(0.4)	Rc	LB:	227 226
781262	V5468 Sgr	18 03 29.6 -30 01 09	14.63	(0.5)	Rc	SR	223 226
781263	V5469 Sgr	18 03 30.0 -29 58 22	13.30	(0.25)	Rc	SR	223 2MASS
781264	V5470 Sgr	18 03 30.5 -29 58 36	12.26	(0.05)	R	SRS	227 2MASS
781265	V5471 Sgr	18 03 30.6 -30 00 51	15.59	(0.4)	R	SR	227 226
781266	V5472 Sgr	18 03 31.1 -29 59 03	15.46	(0.2)	Rc	SR	223 226
781267	V5473 Sgr	18 03 31.2 -29 53 34	15.35	(0.2)	Rc	SR	223 226
781268	V5474 Sgr	18 03 31.7 -30 00 44	13.03	(0.06)	Rc	SR	223 2MASS
781269	V5475 Sgr	18 03 31.9 -30 00 29	13.65	(0.25)	Rc	SR	227 226
781270	V5476 Sgr	18 03 32.2 -30 01 49	13.71	(0.1)	Rc	SR	223 2MASS
781271	V5477 Sgr	18 03 32.3 -30 04 44	14.61	(0.3)	Rc	SRS	223 226
781272	V5478 Sgr	18 03 32.3 -30 03 32	14.62	(0.05)	R	SRS	227 2MASS
781273	V5479 Sgr	18 03 33.3 -30 05 23	14.73	(0.2)	Rc	SR	227 226
781274	V5480 Sgr	18 03 33.7 -30 03 31	12.70	(0.02)	R	SR	227 2MASS
781275	V5481 Sgr	18 03 34.1 -29 59 59	15.30	(0.35)	Rc	SR	223 226
781276	V5482 Sgr	18 03 34.1 -30 05 17	15.39	(0.05)	R	SRS	227 226
781277	V5483 Sgr	18 03 34.1 -30 01 05	14.39	(0.2)	Rc	SR	223 226
781278	V5484 Sgr	18 03 34.6 -30 01 38	14.57	(0.2)	Rc	SR	223 226
781279	V5485 Sgr	18 03 35.0 -29 59 49	15.43	(0.2)	R	SR	227 2MASS
781280	V5486 Sgr	18 03 36.0 -29 58 58	15.83	(0.1)	R	SRS	227 226
781281	V5487 Sgr	18 03 36.9 -30 01 47	15.42	(0.2)	Rc	SRS	223 226
781282	V5488 Sgr	18 03 39.0 -29 58 27	13.55	(0.1)	Rc	SR	223 2MASS
781283	V5489 Sgr	18 03 40.2 -29 55 32	13.35	(0.2)	Rc	SRS	223 2MASS
781284	V5490 Sgr	18 03 40.4 -29 56 13	14.40	(0.15)	Rc	SRS	223 2MASS
781285	V5491 Sgr	18 03 42.7 -30 00 07	14.54	(0.05)	R	SRS	227 2MASS
781286	V5492 Sgr	18 03 43.8 -30 05 17	16.1	(0.2)	R	SR	227 226
781287	V5493 Sgr	18 03 45.3 -30 01 33	14.82	(0.15)	R	SR	227 2MASS
781288	V5494 Sgr	18 03 45.5 -30 04 33	14.98	(0.1)	R	SR	227 226
781289	V5495 Sgr	18 03 46.0 -29 59 13	15.41	(0.3)	Rc	SR	227 226
781290	V5496 Sgr	18 03 46.6 -30 02 27	15.2	(0.15)	R	SRS	227 226
781291	V5497 Sgr	18 03 47.5 -30 03 37	14.90	(0.1)	R	SRS	227 226
781292	V5498 Sgr	18 03 48.5 -29 59 47	14.60	(0.25)	Rc	SR	227 226
781293	V2611 Oph	18 03 48.7 +01 12 59	15.0	16.1	B	RRAB	221 083
781294	V5499 Sgr	18 03 50.1 -30 03 15	14.55	(0.1)	R	SR	227 2MASS
781295	V5500 Sgr	18 03 50.9 -30 01 52	13.76	(0.05)	R	SRS	227 2MASS
781296	V5501 Sgr	18 03 52.0 -30 02 02	14.62	(0.2)	R	SR	227 2MASS

Table 1 (continued)

No.	Name	R.A.,	Decl., 2000.0	Max	Min		Type	References
		h m s	o ’ "	m	m			
781297	V5502 Sgr	18 03 52.2	-30 03 34	14.42	(0.1)	R	SR	227 2MASS
781298	V5503 Sgr	18 03 52.7	-30 01 24	14.31	(0.05)	R	SR	227 226
781299	V5504 Sgr	18 03 52.9	-30 01 59	14.9	(0.15)	R	SR	227 226
781300	V5505 Sgr	18 03 57.9	-29 57 00	11.10	11.48	V	DSCT	022 GSC
781301	V1101 Her*	18 07 33.3	+46 54 35	11.92	12.52	*	EW	264 GSC 228
781302	V5506 Sgr	18 07 36.9	-27 33 47	10.8	12.4	I	SRA	006 2MASS
781303	V5507 Sgr	18 07 54.2	-27 34 16	11.5	13.8	I	M	006 2MASS
781304	V1102 Her*	18 08 01.2	+50 24 52	13.60	14.41	*	EW	264 GSC 228
781305	V5508 Sgr	18 08 08.0	-26 13 14	16.64	<19.0	I	UG:	229 USNO
781306	V1103 Her*	18 08 18.6	+34 34 36	11.91	12.43	*	EW	264 GSC 228
781307	V389 Ser	18 08 36.2	-14 47 34	14.5	16.7	I	M	230 230
781308	V390 Ser	18 09 06.0	-15 18 37	12.9	15.7	I	M	230 230
781309	V1104 Her	18 09 47.8	+49 02 55	13.23	14.19	*	EW	264 GSC 228
781310	V391 Ser*	18 09 58.0	-14 58 36	14.0	16.1	I	M	230 230
781311	V5113 Sgr	18 10 10.4	-27 45 35	8.8	<18.	V	NA	231 232
781312	V5509 Sgr	18 10 37.4	-26 20 00	16.75	<19.0	I	UG:	229
781313	V1105 Her	18 11 23.5	+30 36 39	12.6	13.0	*	EW	161 GSC
781314	V5510 Sgr	18 11 51.2	-26 26 49	15.78	<19.0	I	UG	229
781315	V392 Ser	18 12 19.9	-15 05 03	11.4	12.7	I	SR	040 230 230
781316	V1106 Her*	18 13 24.4	+25 50 12	12.6	12.9	*	EW	161 GSC
781317	V393 Ser*	18 13 29.5	-05 02 56	13.3	<14.4	V	SRA:	103 GSC
781318	V5511 Sgr	18 13 39.0	-33 46 22	18.05	<23.3	R	XP	233 233
781319	V394 Ser	18 13 58.0	-15 22 00	14.6	16.2	I	SR	230 230
781320	V395 Ser	18 14 07.6	-15 06 34	14.7	16.3	I	SRA	230 230
781321	V1107 Her	18 14 23.1	+20 54 28	14.0	(0.58)	Rc	SR	234 2MASS 040
781322	V5512 Sgr	18 14 31.1	-17 09 26	11.87	12.60	K	XB	235
781323	V396 Ser	18 16 32.4	-12 42 18	14.8	16.4	I	M:	230 230
781324	V397 Ser	18 16 43.7	-15 51 07	13.4	15.0	I	EA:	230 230
781325	V398 Ser	18 16 45.9	-13 41 17	15.3	16.6	I	SR	230 230
781326	V5513 Sgr	18 16 56.8	-23 29 51	13.95	<19.0	I	UG	229
781327	V5115 Sgr	18 16 59.0	-25 56 39	7.8	<18.	V	NA	316 114
781328	V399 Ser*	18 17 36.2	-15 02 25	11.6	12.7	V	EA	011 230
781329	V400 Ser	18 17 42.1	-14 34 57	13.7	16.4	I	M	230 230
781330	V5116 Sgr	18 17 50.8	-30 26 31	7.4	<15.	V	NA	109 329
781331	V401 Ser	18 18 49.5	-12 23 43	11.9	<16.0	I	M	230 230
781332	V5514 Sgr	18 18 53.7	-17 18 28	14.0	<16.0	I	M	230 230
781333	V5515 Sgr	18 19 00.9	-25 24 13	14.6	14.8	V	ELL	237 237
781334	V5516 Sgr	18 19 02.2	-25 24 06	15.4	16.0	V	LB	238 238
781335	V5517 Sgr	18 19 02.5	-25 30 20	15.8	16.6	V	SR:	238 238
781336	V5518 Sgr	18 19 03.0	-25 29 35	14.5	15.1	V	SR:	238 238
781337	V5519 Sgr	18 19 03.7	-25 26 31	15.6	16.1	V	SR:	238 238
781338	V5520 Sgr	18 19 06.5	-25 24 12	17.8	18.7	V	SR:	238 238
781339	V5521 Sgr*	18 19 07.8	-25 27 16	15.3	15.8	V	EW	237 237
781340	V590 Lyr	18 19 08.8	+33 13 53	8.28	(0.02)	V	BY	018 DM
781341	V402 Ser	18 19 09.1	-12 42 47	14.9	16.0	I	SRA	230 230
781342	V5522 Sgr	18 19 10.6	-25 27 40	15.5	16.0	V	SRB	238 238
781343	V5523 Sgr	18 19 10.9	-25 27 43	15.6	20.0	V	M	240 240
781344	V5524 Sgr	18 19 11.0	-25 23 20	17.4	18.3	V	DSCT:	239 239
781345	V403 Ser	18 19 12.3	-12 34 56	13.6	<16.0	I	M	230 230
781346	V5525 Sgr	18 19 16.8	-25 23 36	16.6	17.4	V	SRB:	238 238
781347	V5526 Sgr	18 19 22.0	-25 23 17	16.6	17.3	V	LB:	238 238
781348	V5527 Sgr*	18 19 24.4	-25 25 53	16.4	18.1	V	EB	237 237
781349	V5528 Sgr*	18 19 24.8	-25 24 58	17.5	18.0	V	EB	237 237
781350	V5529 Sgr	18 19 28.0	-25 30 14	15.2	15.7	V	SRB	238 238

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m		Type	References		
781351	V5114	Sgr	18 19 32.3	-28 36 36	8.1	<18.	V	NA	241		
781352	V5530	Sgr	18 19 36.7	-25 25 53	12.0	16.8	V	M	240	239	
781353	V5531	Sgr	18 19 40.8	-25 27 13	16.5	16.9	V	SR	238	238	
781354	V5532	Sgr	18 19 58.5	-17 31 34	14.7	<16.0	I	M:	230	230	
781355	V5533	Sgr*	18 23 29.0	-30 15 30	9.77	9.80	V	LPB:	022	DM	040
781356	V5534	Sgr	18 23 30.5	-27 27 14	13.6	16.4	*	M	006	2MASS	
781357	V478	Sct	18 24 12.8	-13 15 55	14.0	16.1	I	M	230	230	
781358	V591	Lyr*	18 24 36.8	+38 17 34	13.28	13.97	*	EW	264	GSC	242
781359	V5535	Sgr*	18 24 57.4	-30 24 43	10.65	11.00	V	EB	022	DM	130
781360	V5536	Sgr	18 25 05.0	-17 03 58	14.6	16.5	I	M	230	230	
781361	V5537	Sgr	18 26 12.7	-26 05 39	10.9	11.5	V	SRB	040	DM	
781362	V479	Sct*	18 26 15.1	-14 50 54	8.53	9.01	K	XJ:	243	GSC	
781363	V5538	Sgr	18 27 54.1	-16 21 28	16.1	17.4	I	SRA	230	230	
781364	V480	Sct	18 28 26.8	-15 45 17	10.0	10.3	V	SRA	090	DM	130
781365	V2612	Oph*	18 29 13.0	+06 47 14	9.36	9.74	V	EW	244	DM	
781366	V592	Lyr*	18 30 53.7	+34 08 10	12.41	12.92	*	EW	264	GSC	242
781367	V476	Sct	18 32 04.8	-06 43 34	11.1	<17.	V	NA	089	330	
781368	V593	Lyr	18 32 06.4	+40 35 57	11.75	(0.62)	V	DSCT	264	GSC	161
781369	V5539	Sgr	18 32 09.6	-29 55 47	11.1	13.5	V	SRA	090	GSC	
781370	V729	CrA	18 32 13.9	-44 37 01	11.4	13.6	V	SRA	090	2MASS	040
781371	V481	Sct	18 33 55.3	-06 58 39	5.85	6.23	K	BE:	245	245	
781372	V477	Sct	18 38 42.9	-12 16 16	10.4	<19.	V	NA	079	331	
781373	V1108	Her*	18 39 26.2	+26 04 10	12.0	17.1	V	UGSU	247		
781374	V5540	Sgr	18 39 58.9	-33 14 12	12.0	12.8	V	SRB	012	GSC	
781375	DT	Oct	18 40 52.4	-83 43 10	11.4	<15.2	V	UGSU	078	248	
781376	V5541	Sgr	18 43 16.6	-18 31 28	13.3	(0.15)	V	PVTEL	249	USNO	
781377	V5542	Sgr	18 43 23.9	-21 20 37	13.18	13.84	*	EA	250	250	
781378	V1664	Aql	18 43 39.2	-00 04 27	11.3	13.0	I	SR	006	2MASS	
781379	V351	Tel*	18 44 00.5	-49 20 53	10.05	10.52	V	EA	011	DM	
781380	V482	Sct	18 44 02.2	-06 38 44	11.4	<14.1	V	M	103	GSC	040
781381	V594	Lyr	18 45 21.8	+45 53 29	14.	(0.33)	V	EW:	161	GSC	
781382	V5543	Sgr	18 45 50.3	-32 16 26	11.5	16.7	R	M	130	2MASS	040
781383	V595	Lyr	18 46 34.6	+38 21 03	8.10	(0.02)	V	BY	018	DM	
781384	V596	Lyr	18 46 55.1	+45 00 52	12.09	12.75	*	EW	264	GSC	242
781385	MT	Dra	18 46 58.8	+55 38 28	16.	20.	R	XM	251	251	
781386	V352	Tel	18 47 20.6	-47 38 06	10.5	<13.0	V	M	090	GSC	130
781387	V5544	Sgr	18 47 21.8	-31 07 48	11.6	14.0	V	SRA	090	USNO	040
781388	V483	Sct	18 48 35.7	-06 41 10	14.20	16.40	V	ZAND	253	2MASS	
781389	V484	Sct*	18 49 16.1	-10 13 30	9.15	9.24	V	EA	011	DM	
781390	V730	CrA*	18 49 21.2	-38 11 05	9.78	10.01	V	EW:	130	DM	
781391	V1109	Her	18 49 29.4	+12 08 41	9.30	9.57	V	EB	011	DM	
781392	V475	Sct	18 49 37.6	-09 33 51	8.4	<16.	V	N	254	255	
781393	V353	Tel*	18 49 57.3	-52 07 19	7.13	7.20	Hp	DSCTC	024	DM	
781394	V1110	Her	18 50 24.5	+24 06 24	7.0	(0.02)	V	BY	018	DM	
781395	V5545	Sgr	18 53 52.8	-22 22 04	12.1	14.2	V	SRA	130	USNO	
781396	V1111	Her	18 55 12.9	+23 13 13	7.90	(0.03)	V	BY	018	DM	
781397	V1665	Aql*	18 56 09.9	+07 56 08	8.09	8.40	V	EA	011	DM	
781398	V1112	Her	18 56 45.5	+13 49 41	13.0	15.7	*	M:	006	2MASS	
781399	V1113	Her	18 56 52.7	+14 45 40	11.8	14.8	*	M:	006	2MASS	
781400	V1114	Her	18 57 01.9	+12 41 26	13.0	<15.0	*	M:	006	2MASS	
781401	V1115	Her	18 57 06.2	+12 58 34	10.3	12.8	*	M	006	2MASS	
781402	V1666	Aql	18 57 10.9	+10 06 17	13.0	<14.9	*	SR:	006	2MASS	
781403	V1667	Aql	18 57 22.1	+11 48 34	13.4	<15.8	*	M:	006	2MASS	
781404	V359	Sge	18 57 29.9	+20 05 28	11.8	<15.2	V	M	006	2MASS	332

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m		Type	References
781405	V485	Sct	18 57 40.7	-13 13 35	12.4	<14.1	V	M	006 2MASS 332
781406	V486	Sct	18 57 42.3	-10 49 04	13.0	<14.2	V	M	006 2MASS 332
781407	V1668	Aql	18 57 42.3	+11 12 57	11.6	14.8	*	M	006 2MASS
781408	V1669	Aql	18 58 13.4	+15 06 22	12.1	<15.1	*	M:	006 256
781409	V1670	Aql	18 58 21.0	+11 20 31	13.4	<15.5	*	SR:	006 2MASS
781410	MU	Dra*	18 58 35.3	+50 09 30	11.51	12.09	*	EW	264 GSC 242
781411	V1671	Aql	18 58 43.6	+12 56 13	13.3	<15.0	*	SR:	006 2MASS
781412	V360	Sge	18 59 12.6	+20 14 38	11.5	13.5	*	SR:	006 2MASS
781413	V361	Sge	18 59 38.6	+19 59 00	11.0	<13.3	*	M	006 2MASS 332
781414	V362	Sge	18 59 40.0	+19 30 11	11.8	14.2	*	M:	006 2MASS
781415	V1672	Aql	19 00 10.9	+03 45 47	6.91	8.58	K	SDOR:	257 2MASS
781416	V1673	Aql	19 00 15.1	+10 50 17	11.8	15.6	*	M:	006 2MASS
781417	V1674	Aql	19 00 16.8	-10 26 36	12.7	13.6	V	RRAB	258 258
781418	V1675	Aql	19 00 28.1	+14 09 53	12.5	15.2	*	M	006 2MASS
781419	V1676	Aql	19 00 40.5	-09 51 48	12.3	14.0	*	SR:	006 2MASS
781420	V1677	Aql	19 01 09.4	+15 38 57	11.6	14.0	*	SR:	006 2MASS
781421	V1678	Aql	19 01 16.3	+10 31 22	13.8	<15.2	*	SR:	006 2MASS
781422	V1679	Aql	19 01 32.3	+15 00 22	11.8	13.7	*	M:	006 2MASS
781423	V1680	Aql	19 02 14.5	+13 03 03	9.7	<21.	V	NA	259 259
781424	V363	Sge	19 02 22.6	+19 56 56	11.0	13.6	*	M:	006 2MASS
781425	V1681	Aql	19 02 27.8	+18 12 36	12.3	15.0	*	M:	006 2MASS
781426	V1682	Aql	19 02 41.8	+12 46 00	12.1	15.1	*	M:	006 2MASS
781427	V1683	Aql	19 02 53.7	-10 26 43	9.8	12.6	*	M	006 2MASS 332
781428	V1684	Aql	19 03 33.4	+16 31 20	13.0	(0.6)	V	SR:	260 GSC
781429	V1663	Aql	19 05 12.2	+05 14 12	10.84	<18.	V	NL	073 2MASS
781430	V1685	Aql	19 10 36.1	+02 49 29	15.9	17.0	V	ZAND	253 262
781431	V597	Lyr	19 11 59.7	+42 18 46	11.0	(0.11)	V	DSCT	263 GSC
781432	MV	Dra	19 12 11.4	+57 40 19	7.04	(0.02)	V	BY	018 DM
781433	V1686	Aql*	19 13 47.7	-01 50 07	8.91	9.01	V	EB	011 DM
781434	V1687	Aql*	19 14 39.7	+03 50 40	11.42	11.85	V	EW	097 GSC
781435	V1688	Aql	19 15 35.1	+11 33 17	8.06	(0.02)	V	BY	018 DM
781436	V1689	Aql	19 20 30.0	-07 02 41	11.3	12.2	V	SRA	130 GSC 040
781437	V598	Lyr	19 20 38.9	+37 49 05	17.28	17.35	R	BY	265 266
781438	V599	Lyr	19 20 39.1	+37 47 26	17.51	(0.02)	V	EP:	267 USNO
781439	V600	Lyr	19 20 39.3	+37 45 40	18.00	(0.02)	V	EP:	267 USNO
781440	V601	Lyr	19 20 39.7	+37 47 36	19.06	(0.08)	V	BY:	267
781441	V602	Lyr	19 20 42.5	+37 44 37	17.54	(0.02)	V	BY:	267 2MASS
781442	V603	Lyr	19 20 43.0	+37 47 33	19.16	(0.08)	V	BY:	267
781443	V604	Lyr*	19 20 45.3	+37 45 49	17.02	(0.05)	V	BY:	267 USNO
781444	V605	Lyr	19 20 46.4	+37 44 14	19.45	(0.08)	V	BY:	267
781445	V606	Lyr	19 20 47.7	+37 44 58	19.74	(0.09)	V	ELL:	267
781446	V607	Lyr	19 20 49.2	+37 49 14	16.49	(0.08)	V	SRS:	267 USNO
781447	V608	Lyr*	19 20 49.7	+37 48 08	16.87	(0.02)	V	ELL:	267 USNO
781448	V609	Lyr*	19 20 49.8	+37 45 51	18.27	(0.03)	V	EB:	267 2MASS
781449	V610	Lyr	19 20 50.1	+37 48 32	19.44	(0.02)	V	BY:	267
781450	V611	Lyr	19 20 51.0	+37 48 25	18.38	18.48	R	BY	265 2MASS
781451	V612	Lyr	19 20 51.7	+37 45 25	18.08	18.15	R	ELL	265 266
781452	V613	Lyr	19 20 52.5	+37 47 30	15.66	15.68	R	ELL:	267 USNO
781453	V614	Lyr	19 20 52.8	+37 44 59	18.12	(0.06)	V	BY:	267 2MASS
781454	V615	Lyr	19 20 52.9	+37 46 37	16.67	(0.02)	V	ELL:	267 2MASS
781455	V616	Lyr	19 20 53.0	+37 46 52	14.84	(0.04)	V	SRS:	267 2MASS
781456	V617	Lyr	19 20 55.2	+37 46 40	18.60	(0.15)	V	EA	267 2MASS
781457	V618	Lyr	19 20 55.4	+37 47 23	16.18	(0.02)	Ic	E:	267 2MASS
781458	V619	Lyr	19 20 56.4	+37 45 39	17.87	(0.03)	V	ELL:	267 2MASS

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 ° ' "	Max m	Min m		Type	References		
781459	V620	Lyr	19 20 56.6	+37 46 36	18.89	(0.10)	V	E:	267		
781460	V621	Lyr	19 20 57.1	+37 48 12	17.54	(0.01)	V	SRS:	267	2MASS	
781461	V622	Lyr	19 20 58.9	+37 44 47	18.11	(0.02)	V	BY:	267	2MASS	
781462	V623	Lyr	19 21 00.5	+37 48 41	18.07	(0.02)	V	BY:	267		
781463	V624	Lyr	19 21 00.7	+37 45 45	18.10	18.44	R	EA	265		267
781464	V625	Lyr	19 21 00.8	+37 44 35	18.25	18.32	R	BY	265	USNO	
781465	V626	Lyr	19 21 01.8	+37 45 42	17.13	(0.04)	V	ELL:	267	2MASS	
781466	V627	Lyr*	19 21 02.5	+37 47 09	16.60	16.62	R	ELL	265	2MASS	
781467	V628	Lyr	19 21 02.7	+37 46 01	18.30	(0.02)	V	BY:	267		
781468	V629	Lyr	19 21 03.1	+37 43 52	18.69	18.78	R	BY:	267	USNO	
781469	V630	Lyr	19 21 03.6	+37 48 04	16.17	<16.26	R	SRS:	267	USNO	
781470	V631	Lyr	19 21 03.7	+37 46 06	18.28	<18.38	R	E:	265		
781471	V632	Lyr	19 21 05.2	+37 47 09	18.12	(0.01)	V	ELL:	267		
781472	V633	Lyr	19 21 06.5	+37 47 27	17.89	(0.04)	V	E:	267	2MASS	
781473	V634	Lyr*	19 21 07.6	+37 48 10	17.26	17.34	R	ELL	265	266	
781474	V2363	Cyg*	19 21 08.4	+51 02 01	12.10	(0.18)	V	EW	161	GSC	
781475	V2364	Cyg*	19 22 11.7	+49 28 34	11.20	11.84	*	EW	268	GSC	
781476	V1690	Aql	19 22 38.4	+14 07 53	10.6	<13.1	*	M:	088	2MASS	
781477	V5546	Sgr	19 24 01.6	-33 32 32	7.69	7.79	Hp	GDOR	024	DM	
781478	V2365	Cyg	19 24 14.7	+50 15 20	9.62	(0.2)	B	EA	269	DM	
781479	V1691	Aql	19 25 01.5	-04 53 04	6.82	(0.04)	B	DSCTC	270	DM	
781480	V1692	Aql*	19 26 28.2	+07 11 49	11.22	11.45	*	EW	065	GSC	
781481	V1693	Aql	19 27 51.0	+11 11 00	12.1	16.4	*	M	006	2MASS	040
781482	V5547	Sgr	19 30 57.4	-32 41 57	7.39	(0.1)	V	ELL:	024	DM	
781483	V364	Sge	19 31 12.0	+19 01 19	15.1	16.4	B	DCEP	271	GSC	
781484	V1694	Aql	19 32 00.4	+11 09 25	11.4	14.1	*	M:	006	2MASS	
781485	V2366	Cyg	19 32 10.8	+45 44 09	12.79	(0.42 V)	*	EW	161	GSC	
781486	V2367	Cyg	19 34 45.6	+45 54 16	11.81	(0.40 V)	*	DSCT	161	GSC	
781487	V5548	Sgr	19 36 01.7	-24 43 09	5.82	(0.04)	B	DSCTC:	270	DM	
781488	V5549	Sgr	19 36 40.5	-28 35 04	11.8	<15.0	V	M	130	GSC	090
781489	V1695	Aql	19 38 22.3	-03 32 37	10.80	11.38	V	EW	272	DM	
781490	V2368	Cyg	19 38 48.3	+30 28 59	13.7	14.8	Rc	SR:	273	273	
781491	V2369	Cyg	19 39 51.1	+38 21 08	10.9	(0.37)	V	RRC	274	GSC	
781492	V2370	Cyg	19 40 05.3	+40 14 17	18.91	(0.16)	V	EA	275	USNO	
781493	V2371	Cyg	19 40 12.5	+40 00 45	18.02	(0.07)	V	EA	275	USNO	
781494	V2372	Cyg	19 40 13.9	+40 11 22	19.13	(0.06)	V	EA	275	USNO	
781495	V2373	Cyg	19 40 21.7	+40 04 10	16.74	(0.03)	V	EA:	275	USNO	
781496	V2374	Cyg*	19 40 21.8	+40 12 09	20.6	(0.40)	V	RRAB:	276	276	040
781497	V2375	Cyg*	19 40 30.5	+40 16 24	19.56	(0.45)	V	EB	276	276	
781498	V2376	Cyg*	19 40 31.6	+40 12 52	20.5	(0.80)	V	EA	276	276	
781499	V2377	Cyg	19 40 32.0	+40 10 41	18.40	(0.15)	V	BY:	276	276	
781500	V2378	Cyg	19 40 38.0	+40 01 05	21.72	(0.21)	V	EA:	275		
781501	V2379	Cyg	19 40 41.6	+40 07 47	19.2	(0.70)	V	CEP:	276	276	040
781502	V2380	Cyg*	19 40 42.7	+40 13 26	20.37	(0.45)	V	EW	276	276	
781503	V2381	Cyg*	19 40 44.8	+40 09 22	17.36	(1.50)	V	EA	276	276	
781504	V2382	Cyg	19 40 48.4	+40 16 19	20.68	(0.6)	V	BY	276	276	
781505	V2383	Cyg*	19 40 53.1	+40 11 18	20.06	(0.60)	V	EA	276	276	
781506	V2384	Cyg	19 40 56.7	+40 05 05	18.67	(0.10)	V	EA	275	USNO	
781507	V2385	Cyg*	19 40 59.6	+40 08 25	19.81	(0.30)	V	EW	276	276	
781508	V2386	Cyg*	19 41 05.8	+40 12 54	20.72	(0.50)	V	EW	276	276	
781509	V2387	Cyg	19 41 09.7	+40 10 38	19.12	(0.10)	V	BY	276	276	
781510	V2388	Cyg*	19 41 10.3	+40 15 19	16.61	(0.45)	V	EW	276	276	
781511	V2389	Cyg*	19 41 11.7	+40 06 40	18.17	(0.35)	V	EW	276	276	
781512	V2390	Cyg*	19 41 15.3	+40 12 32	18.11	(0.15)	V	EB:	276	276	

Table 1 (continued)

No.	Name	R.A., 2000.0 (h m s)	Decl., 2000.0 (° ’ ")	Max (m)	Min (m)		Type	References
781513	V2391 Cyg	19 41 21.3	+40 02 14	16.60	(0.03)	V	EA	275 USNO
781514	V2392 Cyg	19 41 22.2	+40 10 11	19.1	(0.20)	V	BY	276 276
781515	V2393 Cyg	19 41 22.6	+40 11 07	17.49	(0.16)	V	EW:	276 276
781516	V2394 Cyg*	19 41 22.9	+40 14 39	18.27	(0.16)	V	EW:	276 276
781517	V2395 Cyg	19 41 26.8	+40 10 49	18.2	(0.20)	V	BY	276 276
781518	V2396 Cyg	19 41 28.6	+40 16 25	17.25	(0.20)	V	EW	276 276
781519	V2397 Cyg	19 41 33.9	+40 26 35	20.07	(0.25)	V	EA	275
781520	V2398 Cyg	19 41 35.9	+40 13 53	19.76	(0.20)	V	BY	276 276
781521	V2399 Cyg	19 41 36.0	+40 16 20	19.94	(0.20)	V	BY	276 276
781522	V2400 Cyg	19 41 41.5	+40 07 03	18.83	(0.25)	V	BY	276 276
781523	V2401 Cyg	19 41 41.8	+40 11 42	18.47	(0.10)	V	BY:	276 276
781524	V2402 Cyg	19 41 44.5	+40 14 24	18.76	(0.12)	V	BY	276 276
781525	V2403 Cyg	19 41 51.4	+40 12 33	19.40	(0.10)	V	BY	276 276
781526	V2404 Cyg	19 41 52.3	+40 12 24	20.08	(0.50)	V	EW	276 276
781527	V2405 Cyg	19 41 57.1	+40 18 25	18.46	(0.10)	V	EA	275 2MASS
781528	V450 Vul	19 42 05.5	+23 19 00	10.05	10.37	V	BE	277 GSC
781529	V2406 Cyg	19 42 07.1	+39 59 39	20.18	(0.04)	V	EA:	275
781530	V5550 Sgr	19 42 08.9	-28 46 11	11.7	14.7	V	M	090 GSC
781531	V2407 Cyg	19 42 11.7	+40 06 48	17.61	(0.12)	V	BY:	276 276
781532	V2408 Cyg	19 42 15.1	+40 04 42	18.88	(0.19)	V	EA	275
781533	V399 Pav*	19 42 25.4	-68 07 35	11.2	11.9	V	SRB	130 GSC 040
781534	V1696 Aql	19 42 25.9	-10 58 18	10.0	13.1	V	SRA	130 GSC
781535	V5551 Sgr	19 42 31.0	-22 06 12	11.3	15.0	V	M	090 GSC
781536	V1697 Aql	19 43 21.5	+00 30 35	13.2	15.0	V	SRA	332 GSC
781537	V1698 Aql	19 44 49.5	-00 46 57	11.5	13.5	V	SRB	278 278 130
781538	V2409 Cyg*	19 45 06.4	+53 23 36	13.7	14.3	*	EW	161 USNO 040
781539	V1699 Aql	19 48 21.3	-05 15 07	12.9	15.0	*	M	103 GSC 040
781540	V5552 Sgr	19 48 55.3	-37 12 12	12.86	13.74:	V	EA	011 121
781541	V451 Vul	19 53 04.9	+21 51 33	11.9	12.7	V	SRB	040 GSC
781542	V5553 Sgr	19 55 17.7	-44 00 39	8.53	8.62	V	EB	011 DM
781543	V2410 Cyg	19 57 35.0	+37 14 51	12.6	<14.8	*	M:	006 2MASS
781544	V2411 Cyg	19 57 43.2	+30 36 42	13.7	<15.5	*	SR:	006 2MASS
781545	V2412 Cyg	19 58 07.7	+46 56 01	12.7	14.3	*	SR	006 2MASS 040
781546	V2413 Cyg	19 58 42.0	+29 56 07	12.8	<14.7	*	SR:	006 2MASS
781547	V5554 Sgr	19 59 58.0	-22 58 15	11.3	15.4	V	M	090 GSC 040
781548	V452 Vul	20 00 43.7	+22 42 39	7.67	(0.03)	V	BY	018 DM
781549	V1700 Aql	20 00 55.4	+07 24 41	8.27	8.64	V	EA	011 DM
781550	V1701 Aql	20 00 56.9	-06 05 14	12.1	<14.6	V	M	103 2MASS 332
781551	V5555 Sgr*	20 01 49.8	-12 41 18	11.08	11.51	V	*	281 DM
781552	V2414 Cyg*	20 02 19.4	+39 55 09	9.87	10.48	R	E	282 282
781553	V1702 Aql	20 02 26.5	-04 46 35	12.06	13.18	V	EA	283 GSC
781554	V2415 Cyg	20 03 03.1	+31 12 43	10.2	12.0	*	SR	006 2MASS 040
781555	V2416 Cyg	20 03 04.2	+59 06 54	13.4	(0.14)	B	DSCT	284 284
781556	V2417 Cyg*	20 06 40.0	+33 14 28	6.28	6.90	K	BE:	285 GSC
781557	V365 Sge	20 07 55.4	+17 31 16	12.50	13.19	V	EW	286 286 069
781558	V2361 Cyg	20 09 19.1	+39 48 53	10.13	<19.	V	NA	287
781559	V453 Vul	20 09 24.8	+24 03 31	12.2	14.8	*	M:	006 2MASS
781560	V2418 Cyg	20 09 46.0	+50 27 30	12.1	<14.6	*	M:	006 2MASS
781561	V454 Vul	20 10 35.8	+25 55 06	10.9	13.7	*	M:	006 2MASS
781562	V2419 Cyg	20 11 55.1	+31 12 21	13.2	16.0	*	M:	006 2MASS
781563	V1703 Aql	20 13 59.8	-00 52 01	7.79	(0.03)	V	BY	018 DM
781564	V2420 Cyg	20 14 27.8	+47 29 45	12.0	14.4	*	SR	006 2MASS 040
781565	V2421 Cyg*	20 14 38.6	+41 56 14	13.79	15.03	*	EB	006 GSC
781566	V2422 Cyg*	20 16 58.8	+39 05 24	13.3	(0.64 *)	V	EB	291 291

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 ° ' "	Max m	Min m		Type	References
781567	CL	Cap	20 18 26.8	-18 58 20	12.49	12.93	*	EW	122 GSC
781568	CM	Cap*	20 19 49.6	-12 30 38	9.70	10.25	V	EW	130 DM
781569	V1704	Aql	20 20 24.0	-03 48 59	12.45	13.18	*	RRAB	272 GSC
781570	V2423	Cyg	20 21 02.2	+44 17 44	12.8	<13.8	*	SR	006 2MASS
781571	CN	Cap	20 21 54.0	-16 27 03	14.84	15.32	*	RRAB	172 GSC
781572	V455	Vul	20 26 26.0	+24 30 39	11.3	13.2	V	LB:	292 GSC
781573	V2424	Cyg	20 27 23.5	+47 48 52	12.7	13.9	*	SR:	006 2MASS
781574	V5556	Sgr	20 27 29.2	-30 48 37	12.0	<15.0	V	M	090 2MASS 040
781575	V2425	Cyg	20 31 07.8	+33 32 34	8.35	(0.03)	V	BY	018 DM
781576	CO	Cap	20 33 10.5	-23 40 11	10.8	12.8	V	SRA	090 174
781577	OO	Del*	20 33 54.6	+07 19 50	17.78	18.10	V	EW	293 293
781578	OP	Del*	20 34 02.8	+07 19 35	16.99	17.37	V	EW	293 293
781579	V2426	Cyg	20 38 24.1	+48 09 12	12.4	14.5	*	SRA:	040 2MASS
781580	OQ	Del	20 39 37.7	+04 58 19	7.88	(0.04)	V	BY	018 DM
781581	V2427	Cyg	20 39 40.5	+43 51 47	14.4	<17.2	*	M:	006 2MASS
781582	V2428	Cyg*	20 41 19.0	+34 44 52	14.5	16.8	B	ZAND	294 295
781583	V2429	Cyg	20 43 40.6	+44 28 38	10.4	13.7	V	LC:	296 296
781584	NO	Aqr	20 44 18.0	-12 48 02	14.15	14.73	*	EW	135 GSC
781585	V2430	Cyg	20 45 43.1	+44 00 45	13.3	15.8	*	M:	006 2MASS
781586	OR	Del*	20 46 13.3	+15 54 26	7.09	(0.03)	V	RS	018 DM
781587	V713	Cep	20 46 38.7	+60 38 03	15.3	18.8	B	UG	297 USNO
781588	V2431	Cyg	20 49 16.2	+32 17 05	8.25	(0.03)	V	BY	018 DM
781589	DU	Oct*	20 50 04.2	-75 54 37	9.21	9.48	V	EA/RS:	011 DM
781590	V714	Cep	20 50 05.7	+61 14 53	13.2	<15.1	*	M:	040 2MASS
781591	CX	Mic	20 51 09.0	-34 53 53	11.0	15.2	V	M	130 GSC 090
781592	NP	Aqr*	20 51 19.0	-13 55 28	7.59	7.69	V	EB	011 DM
781593	CY	Mic	20 51 55.0	-40 47 05	11.75	12.46	V	EA	011 121 130
781594	CZ	Mic*	20 54 43.9	-39 48 11	12.70	13.53	V	EA	011 121 130
781595	V2432	Cyg	20 57 03.3	+39 16 52	11.9	13.9	*	SR:	006 2MASS
781596	V2433	Cyg	20 59 41.0	+48 08 41	11.5	12.4	*	LB:	006 2MASS
781597	DD	Mic	21 00 06.4	-42 38 44	11.0	11.7	V	ZAND	066 GSC
781598	V456	Vul	21 00 18.0	+27 52 56	12.14	12.81	V	EA	214 GSC
781599	V2434	Cyg	21 00 18.4	+43 50 45	12.1	13.7	*	SR:	006 2MASS
781600	V2435	Cyg	21 00 41.8	+38 50 01	10.5	12.3	*	SR:	006 2MASS
781601	V2436	Cyg	21 02 40.8	+45 53 05	7.69	(0.03)	V	BY	018 DM
781602	TV	Equ	21 05 08.0	+07 56 44	7.98	(0.02)	V	BY:	018 DM
781603	DE	Mic*	21 05 59.0	-36 15 34	7.65	8.05	V	EW	011 DM
781604	V715	Cep	21 06 54.2	+61 31 00	12.3	13.1	*	LB:	006 2MASS
781605	NQ	Aqr*	21 07 53.6	-11 33 25	12.3	13.0	V	EW	011 GSC 130
781606	V397	Peg	21 08 53.7	+15 37 11	15.03	15.97	*	EW	060 USNO
781607	V398	Peg	21 08 57.9	+15 56 55	13.26	14.20	*	RRAB	063 GSC
781608	NR	Aqr	21 09 35.1	-14 07 00	7.56	(0.02)	V	SRS:	018 DM
781609	CG	Ind	21 10 31.3	-48 49 59	10.7	12.4	V	SRA	090 GSC
781610	V2362	Cyg	21 11 32.3	+44 48 04	8.5	<20.	V	N	325 326
781611	V2437	Cyg	21 12 18.5	+47 58 46	11.3	12.8	*	SR:	006 2MASS
781612	V2438	Cyg	21 15 36.9	+47 43 19	12.1	13.7	*	SR:	006 2MASS
781613	NS	Aqr	21 17 02.1	-01 04 39	8.08	(0.02)	V	BY	018 DM
781614	V457	Vul	21 18 58.2	+26 13 50	8.45	(0.04)	V	BY	018 DM
781615	V2439	Cyg	21 23 11.9	+42 59 27	13.2	16.0	*	M:	006 2MASS
781616	V2440	Cyg	21 23 13.6	+46 20 51	14.18	(0.02)	B	S:	298 298
781617	V2441	Cyg	21 23 14.1	+46 24 40	19.17	(0.06)	B	DSCTC	298 298
781618	V2442	Cyg	21 23 18.6	+46 21 24	15.49	(0.02)	B	DSCTC	298 298
781619	V2443	Cyg	21 23 21.5	+46 22 59	13.87	(0.02)	B	DSCTC	298 298
781620	V2444	Cyg	21 23 21.7	+46 25 12	15.01	(0.02)	B	DSCTC	298 298

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 ° ' "	Max m	Min m		Type	References
781621	V2445	Cyg	21 23 22.9	+46 22 25	18.16	(0.07)	B	DSCTC	298 298
781622	V2446	Cyg	21 23 23.7	+46 22 59	17.83	(0.01)	B	DSCTC:	298 298
781623	V2447	Cyg	21 23 29.6	+46 23 05	19.55	(0.34)	B	DSCT	298 298
781624	V2448	Cyg	21 23 29.8	+46 22 38	14.67	(0.02)	B	DSCTC	298 298
781625	V2449	Cyg	21 23 30.6	+46 21 39	13.98	(0.04)	B	DSCTC:	298 298
781626	V2450	Cyg	21 23 33.5	+46 22 08	16.45	(0.03)	B	DSCTC	298 298
781627	V2451	Cyg	21 23 35.9	+46 24 11	15.03	(0.03)	B	DSCTC	298 298
781628	V2452	Cyg	21 23 39.1	+46 20 21	19.90	(0.02)	B	DSCTC	298 298
781629	V2453	Cyg	21 23 40.1	+46 23 56	16.14	(0.01)	B	DSCTC	298 298
781630	V2454	Cyg	21 23 46.4	+46 26 00	17.41	(0.06)	B	DSCTC	298 298
781631	V399	Peg	21 25 44.1	+16 02 11	11.1	<13.0	*	M	319 2MASS 332
781632	V716	Cep	21 27 03.5	+59 24 43	12.0	<17.	*	M	006 2MASS 040
781633	V400	Pav*	21 27 04.4	-62 39 14	9.18	9.33	V	EB	011 DM
781634	XZ	PsA*	21 27 40.0	-31 47 44	7.73	8.12	V	EW	011 DM
781635	V2455	Cyg	21 28 24.6	+46 40 31	8.53	8.97	V	DSCT	299 DM
781636	CH	Ind*	21 29 42.6	-50 20 32	7.50	8.18	V	EA	011 DM
781637	V2456	Cyg*	21 30 43.8	+33 57 24	11.3	11.9	*	EB	013 300
781638	V2457	Cyg	21 32 29.7	+49 43 24	13.1	14.4	*	SR:	006 2MASS
781639	V2458	Cyg	21 33 58.2	+53 16 58	13.2	14.2	*	SR	006 2MASS 040
781640	V400	Peg	21 34 47.0	+19 56 11	6.90	(0.02)	V	LB:	018 DM
781641	V717	Cep	21 43 33.1	+57 25 25	13.2	16.3	*	M:	006 2MASS
781642	V2459	Cyg	21 43 55.6	+42 55 25	12.5	13.5	*	SR:	006 2MASS
781643	V2460	Cyg	21 46 20.0	+49 54 23	12.1	15.0	*	M:	006 2MASS
781644	V718	Cep	21 48 54.8	+59 08 17	13.6	15.8	*	SR:	006 2MASS
781645	V401	Peg	21 50 05.4	+31 50 52	7.34	(0.01)	V	BY:	018 DM
781646	V2461	Cyg	21 50 38.7	+49 16 45	11.5	14.3 :	R	M:	040 2MASS
781647	V719	Cep	21 51 25.3	+59 28 45	12.9	16.0	*	M:	006 2MASS
781648	V402	Peg	21 54 45.0	+32 19 43	7.73	(0.01)	V	BY	018 DM
781649	V720	Cep	21 56 00.9	+56 19 28	13.1	<15.2	*	SR:	006 2MASS
781650	V2462	Cyg	21 56 15.4	+55 00 24	13.0	14.6	*	SR:	006 2MASS
781651	V2463	Cyg	21 56 50.4	+55 14 22	12.5	14.6	*	SR:	006 2MASS
781652	V721	Cep	21 57 20.4	+55 35 40	13.8	<15.2	*	SR	006 2MASS 040
781653	V722	Cep	21 59 12.4	+58 58 52	12.5	13.3	*	SR	006 2MASS 040
781654	V723	Cep	22 00 12.4	+59 31 16	11.4	14.4	*	M:	006 2MASS
781655	V2464	Cyg	22 00 50.9	+52 51 55	12.7	<15.4	*	M:	006 2MASS
781656	V2465	Cyg	22 02 04.9	+53 17 25	12.7	13.8	*	SR:	006 2MASS
781657	V443	Lac	22 02 05.4	+44 20 35	7.96	(0.02)	V	BY:	018 DM
781658	V2466	Cyg	22 02 41.8	+46 39 07	15.7	<21.0	B	UGSU:	297 297
781659	CI	Ind*	22 04 10.5	-56 46 58	15.60	15.67	Ic	*	153 2MASS
781660	V724	Cep	22 04 31.1	+59 30 59	13.1	14.7	*	SR:	006 2MASS
781661	CK	Ind*	22 04 38.4	-64 43 42	7.36	7.44	Hp	GDOR	301 DM
781662	V725	Cep	22 05 16.1	+59 07 55	13.0	14.7	*	SR	006 2MASS 040
781663	NT	Aqr	22 06 05.3	-05 21 29	7.57	(0.06)	V	BY	018 DM
781664	V444	Lac	22 06 19.7	+49 08 20	11.7	12.9	*	SR:	006 2MASS
781665	V445	Lac	22 07 38.5	+49 02 59	12.6	14.5	*	M:	040 2MASS
781666	V726	Cep	22 08 02.5	+58 48 47	12.2	<15.	R	M	006 2MASS 040
781667	V446	Lac	22 11 11.9	+36 15 23	7.23	(0.02)	V	BY	018 DM
781668	V727	Cep*	22 12 25.9	+54 53 22	14.12	14.56	V	EA	027 USNO
781669	V447	Lac	22 15 54.1	+54 40 22	7.50	(0.03)	V	BY	018 DM
781670	V728	Cep	22 17 49.2	+59 16 10	11.0	12.5	*	SR:	006 2MASS
781671	V448	Lac	22 24 31.4	+43 43 11	11.22	11.72	U	SRD:	302 DM
781672	V729	Cep	22 26 08.7	+57 15 48	12.7	14.0	*	SR:	006 2MASS
781673	DR	Gru	22 34 18.7	-54 17 53	7.44	7.51	Hp	DSCTC	037 DM
781674	V449	Lac	22 36 18.8	+48 39 16	14.1	17.2	*	M:	006 2MASS

Table 1 (continued)

No.	Name		R.A., 2000.0	Decl., 2000.0	Max	Min		Type	References
			h m s	o ' "	m	m			
781675	NU	Aqr	22 37 53.2	-13 22 15	8.72	(0.02)	V	LB:	018 DM
781676	NV	Aqr	22 39 34.6	-12 36 55	7.74	(0.02)	V	BY	018 DM
781677	V403	Peg	22 39 50.8	+04 06 58	8.48	(0.03)	V	BY	018 DM
781678	V450	Lac*	22 39 58.9	+47 20 16	13.50	14.8	*	EA	006 GSC
781679	V451	Lac	22 42 20.7	+52 03 34	11.1	13.1	*	M:	006 2MASS
781680	DS	Gru	22 43 11.6	-41 31 58	9.6	15.0	V	M	090 GSC 130
781681	V452	Lac	22 45 27.3	+46 09 05	12.0	13.5	*	SR	006 GSC 040
781682	NW	Aqr	22 49 43.0	+00 46 01	13.2	(0.90)	V	EW	017 GSC
781683	V730	Cep	22 54 03.7	+58 54 01	12.6	15.9	V	ISA	304 304
781684	V404	Peg	22 56 30.9	+33 55 12	10.47	10.77	V	EW	305 GSC
781685	V992	Cas	23 01 24.6	+59 12 25	13.0	16.2	*	M:	006 2MASS
781686	V993	Cas	23 01 49.8	+59 19 02	11.3	12.2	*	SR:	006 2MASS
781687	EP	Psc	23 06 22.4	+02 09 06	16.23	(0.04)	V	RPHS	169 009
781688	V405	Peg*	23 09 49.1	+21 35 17	15.6	(0.3)	V	NL:	039 039
781689	V994	Cas	23 18 33.8	+57 37 38	12.7	15.0	*	SR:	006 2MASS
781690	V452	And	23 18 59.2	+48 31 30	13.7	15.2	*	EB	214 214
781691	V453	And	23 21 36.5	+44 05 52	7.36	(0.04)	V	BY	018 DM
781692	NX	Aqr	23 24 06.3	-07 33 03	7.62	(0.02)	V	BY:	018 DM
781693	V995	Cas	23 33 31.9	+59 18 32	14.1	16.4	*	LB:	006 2MASS
781694	EQ	Psc*	23 34 34.6	-01 19 37	13.06	(0.02 R)	V	*	116 GSC
781695	V406	Peg	23 35 25.6	+31 09 41	7.90	(0.01)	V	BY	018 DM
781696	V407	Peg*	23 36 55.4	+15 48 06	9.28	9.75	V	EW	307 DM
781697	V731	Cep	23 37 43.3	+64 18 12	10.53	(0.85 *)	V	EA	003 308
781698	V454	And	23 37 58.5	+46 11 58	6.58	(0.02)	V	BY	309 DM
781699	V408	Peg	23 40 04.2	+12 38 01	14.8	16.0	V	RRAB	312 312
781700	V996	Cas	23 41 34.0	+59 35 28	11.8	13.3	*	SR	006 2MASS 040
781701	V997	Cas	23 44 43.6	+61 16 58	14.8	15.8	B	DCEP	313 GSC
781702	V998	Cas	23 46 40.8	+59 26 34	12.6	13.9	*	SR:	006 2MASS
781703	V999	Cas	23 47 03.9	+59 15 57	13.2	14.4	*	SR:	040 2MASS
781704	V1000	Cas	23 49 43.7	+57 13 12	12.5	15.2	*	M	006 2MASS
781705	V409	Peg	23 49 53.5	+13 06 13	15.9	(0.03 *)	B	ZZA	314 315
781706	V1001	Cas*	23 50 17.1	+51 11 29	13.6	14.7	*	EA	333 333

Table 2. Renamed variable stars

Old Name		New Name		Old Name		New Name	
SX	Ant	DI	Pyx	SW	Oct	CL	Ind
V597	Aql	V487	Sct	V392	Pav	CM	Ind
V1500	Aql	V488	Sct	HI	Peg	ER	Psc
BG	Aur	V1240	Tau	CT	Per	V1003	Cas
SU	CVn	NR	UMa	VV	Pyx	V596	Pup
VY	Cap	NY	Aqr	MX	Sge	V1705	Aql
V577	Cen	V423	Hya	V1024	Sgr	V489	Sct
R	Cep	UZ	UMi	V1049	Sgr	V490	Sct
CY	Cep	V1002	Cas	V1050	Sgr	V491	Sct
V683	Cyg	V453	Lac	V3917	Sgr	V404	Ser
V1523	Cyg	V732	Cep	Y	Sco	V2613	Oph
WX	Eri	V1241	Tau	V384	Sco	V5557	Sgr
QV	Her	V635	Lyr	V1124	Sco	V2614	Oph
IP	Hya	V1064	Cen	CZ	Sct	V1706	Aql
RR	Hyi	DV	Oct	EK	Tau	V1798	Ori
T	Lac	V410	Peg	ER	Tau	V554	Aur
T	Leo	QZ	Vir	ES	Tau	V555	Aur
HK	Lup	V1279	Sco	AS	TrA	V389	Nor
EG	Nor	NQ	TrA	BM	Vul	V411	Peg

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ERRATUM FOR IBVS 5721

In IBVS No. 5721 ("The 78th Name-List of Variable Stars"), erroneous coordinates of V2609 Oph were given. The coordinates of this variable should correctly be $17^{h}53^{m}34\overset{s}{.}1$ $+05^{\circ}24'58''$(2000.0).

ERRATUM FOR IBVS 5721

See IBVS 5969 - NL 80/I for information on V423 Hya/V577 Cen.

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RV Aps: A UNIQUE ECLIPSING BINARY FOR GRAVITY-DARKENING STUDIES

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In the process of our work aimed at improving astrophysical information for GCVS stars in southern constellations (cf. Pastukhova et al., 2004; Antipin et al., 2005), we found an interesting case of the eclipsing star RV Aps.

The eclipsing binary RV Aps (HV 5079) was discovered by Swope (1931) who had published the variability range between $10^{\mathrm{m}}.6$ and $15^{\mathrm{m}}.2$ pg and the light elements Min = $2425360.4 + 34^{\mathrm{d}}.074 \times E$. To our knowledge, no photometric studies of the star have been published since, probably because of no finding chart available. Stock & Wroblewski (1971) estimated the variable's spectral type as AF. This information refers to the correct star, as confirmed by a good coincidence of the coordinates published by Stock and Wroblewski with those we now find for the confirmed RV Aps ($14^{\mathrm{h}}24^{\mathrm{m}}17^{\mathrm{s}}.0$, $-73°17'27''$, J2000.0; GSC 9269.00545). Our confirmation is based on the ASAS-3 data (Pojmanski, 2002): though the star is not listed in the ASAS-3 catalog of variable stars, about 300 V-band observations can be retrieved from the ASAS-3 photometric catalog. These data show the star to be an Algol eclipsing variable with the light elements (derived by us) Min I = HJD $2453574.517(18) + 34^{\mathrm{d}}.07502(06) \times E$, $12^{\mathrm{m}}.1$–$14^{\mathrm{m}}.0$: V, $D = 0^{\mathrm{p}}.08$. The light curve is shown in Fig. 1, it demonstrates a noticeable wave outside eclipses. Our analysis of the outside-eclipse observations reveals no other periods except the orbital one.

Table 1 presents the results of our preliminary analysis of the system's light curve using the iteration method described in Khaliullin & Khaliullina (2006). The method is based on the "sphere-ellipsoid" model, quite applicable to the star. We use the following notation in the table and in the text: i is the orbital inclination; $r_{1,2} = R_{1,2}/A$, $R_{1,2}$ being the components' radii and A, the radius of the relative orbit; $\mathrm{Sp}_{1,2}$, their spectral types; $M_{1,2}$, masses; $T_{1,2}$, effective temperatures; $u_{1,2}$, limb-darkening coefficients; $\mathrm{BC}_{1,2}$, bolometric corrections; $L_{1,2}$, relative luminosities; $E_{1,2}$, luminous efficiencies; $Y_{1,2}$, the gravity-darkening coefficients respectively for the primary and secondary; $a_{1,2}$ and $b_{1,2}$, the major and minor axes of the components' apparent disks in quadratures (phase $0^{\mathrm{p}}.25$). When searching for the optimal parameters, only $b_{1,2}$ were considered independent values, and $a_{1,2}$ were computed at each step of the iteration process on the base of $b_{1,2}$ using known analytic relations resulting from computations of equilibrium shapes of binaries' components (Chandrasekhar, 1933). It is the values of $b_{1,2}$ that are given in Table 1 as $r_{1,2}$. At all the iteration stages, the secondary was assumed to fill its critical Roche lobe.

The optimal spectral types of the components, $Sp_{1,2}$, and the corresponding absolute parameters were found in the iterations using the following observational restrictions. First, we took into account the spectral type A–F from Stock & Wroblewski (1971). Second, we know the outside-eclipse magnitude, $V = 12^{\rm m}_{\cdot}12$, from the ASAS-3 light curve, and the 2MASS PSC infrared magnitudes: $J = 10^{\rm m}_{\cdot}35$, $H = 9^{\rm m}_{\cdot}70$, $K_S = 9^{\rm m}_{\cdot}50$. The main contribution to the IR range comes from the secondary, and these magnitudes, after taking into account the interstellar reddening and subtracting the small contribution from the primary in the iteration process, restrict Sp_2 rather seriously. (Our estimate of the interstellar extinction, from the $V - K_S$ and $J - K_S$ color indices, is $A_V \approx 0^{\rm m}_{\cdot}6$, in no contradiction to that expected from the maps in Burstein & Heiles, 1982.) Our computer code makes use of the empirical relations between stellar spectral types and absolute parameters from Popper (1980) and Straizys (1982).

Table 1. Parameters of the components

Parameter	Primary	Secondary
Sp	A2V	K4III
M	$2.20\,M_\odot$ (fixed)	$0.26\,M_\odot$
R	$2.72\,R_\odot$	$13.1\,R_\odot$
T	8 750 K	3 900 K
BC	$-0^{\rm m}_{\cdot}08$	$-0^{\rm m}_{\cdot}90$
r	0.0455	0.219
L	0.7 ± 0.02	0.3 ± 0.02
u	0.48 (fixed)	0.90 (fixed)
Y	0.79 (fixed)	0.88 ± 0.012
β	0.25 (fixed)	0.076 ± 0.011
i	$83^\circ_{\cdot}8$	
A	$59.7\,R_\odot$	

The physical and geometrical characteristics of RV Aps presented in Table 1 show that the system is unique for determination of the secondary's gravity-darkening coefficient, Y_2. To compute this coefficient in the first approximation, we write the system's brightness outside eclipses (in intensities) as (Kopal, 1950, 1959):

$$l = A_0 + A_1 cos\theta + A_2 \cos^2\theta, \tag{1}$$

where θ is the phase angle. By least squares, we derive the coefficients $A_0 = 1.054(5)$, $A_1 = -0.011(5)$, $A_2 = -0.107(10)$. The unity here is the brightness of a star with $V_0 = 12^{\rm m}_{\cdot}12$. The A_2 coefficient in (1) is known to be related to reflection and photometric ellipticity effects:

$$A_2 = (0.2(G_1 + G_2) - 0.5L_1N_1\varepsilon_1^2 - 0.5L_2N_2\varepsilon_2^2)\sin^2 i, \tag{2}$$

where

$$G_i = L_{3-i}r_i^2 \times E_i/E_{3-i},\ \varepsilon_i^2 = (a_i^2 - b_i^2)/a_i^2,\ N_i = \frac{15 + u_i}{15 - 5u_i}(1 + Y_i). \tag{3}$$

Here Y is the gravitational limb darkening coefficient for the i-th component, determined from the expression (Kopal, 1968):

$$J = J_0\left(1 + Y\left(\frac{g - g_0}{g_0}\right)\right),$$

J being the surface brightness in the direction of the normal; g, gravity; and J_0 and g_0, the corresponding values on the surface of an undeformed star. The first term in the right side of (2) is the combined reflection effect for the components; the second one is the primary's contribution to the photometric ellipticity; and the third one is the secondary's

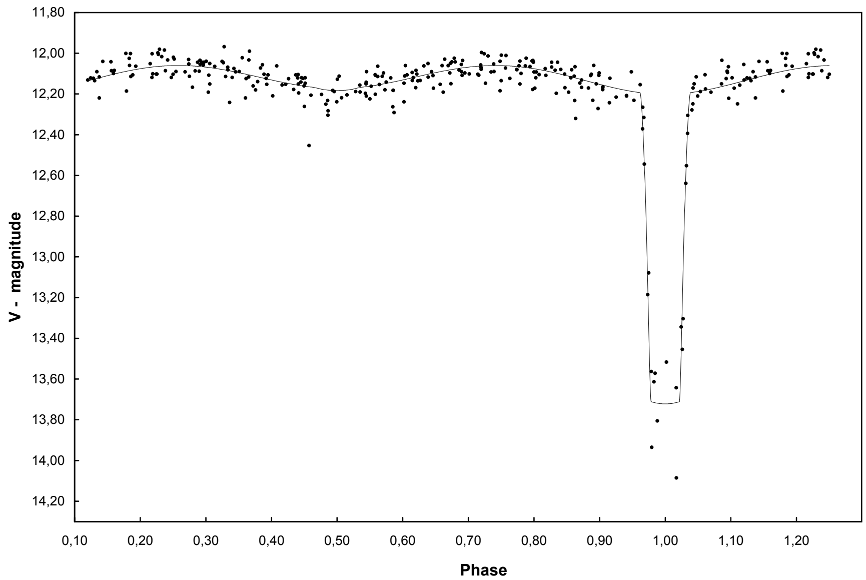

Figure 1. The ASAS-3 V-band light curve of RV Aps. The solid curve is the model one

contribution. The luminous efficiencies in (3) can be estimated from $E_i = 10^{0.4\mathrm{BC}_\lambda(T_i)}$ (Khaliullin & Khaliullina, 2006). Substituting the parameters from Table 1 into (2) and (3) and using the theoretical value, $Y_1 = 0.79$, computed using eq. (5) below, we find $Y_2 = 0.88 \pm 0.12$. Note that the third term in (2), due solely to photometric ellipticity of the secondary, contributes 97% (!) of A_2, this is one of the unique features of the studied system. If we now describe the secondary's spectral energy distribution, J_λ, with the Planck B_λ function, then, according to Kopal (1968),

$$Y = \beta \frac{c_2}{\lambda T(1 - e^{-c_2/\lambda T})}, \tag{4}$$

where $c_2 = 1.439\,\mathrm{cm} \times \mathrm{K}$, λ (for the V band) is 0.55×10^{-4} cm, and β is the exponent in the known gravity-darkening law, $T = g^\beta$, T and g being respectively the local effective temperature and gravity on the undeformed star's surface. Substituting the derived Y_2 into (4), we find: $\beta(B_\lambda) = 0.131$. However, J_λ can differ from B_λ significantly, and it is preferable to use the relation (Khaliullin & Khaliullina, 2006):

$$Y = 4\beta \left(1 + \frac{d(\mathrm{BC}_\lambda)}{10 \times d(\log T)} \;|_{T=T_0}\right), \tag{5}$$

where T_0 is the undeformed-surface temperature, and the relation $\mathrm{BC}_\lambda(T_e)$ and its derivatives (for the corresponding spectral band of observations) can be found using the compilations of empirical data from Popper (1980) and Straizys (1982). The resulting value, $\beta_2 = 0.076 \pm 0.011$, is close to that expected from the theory for stars with convective envelopes, $\beta_2^{\mathrm{th}} = 0.08$ (Lucy, 1967).

Thus, despite the information currently available for RV Aps being rather limited, the system's unique characteristics permitted us to determine β for its secondary quite accurately. According to Kitamura & Nakamura (1983), the relations (1)–(3) we have used can result in errors up to 10% in β. However, at this first-approximation stage, such uncertainties are quite acceptable. To verify and improve our results, spectroscopy and accurate multicolor light curves, especially near Min I, are needed for the system.

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DETECTION OF A LARGE FLARE IN THE RS CVn STAR WY Cnc

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As a part of our ongoing study of RS CVn stars, we obtained new optical photometry of WY Cnc in 2005 and 2006. Here we report on a flare detected on WY Cnc in February 2006. We calculated the flare characteristics and analyzed the WY Cnc spot activity before and during the flare. WY Cnc (G5V+M2V, $P = 0.83$ d) is a short-period eclipsing RS CVn system (N 82 in the catalogue of Strassmeier et al., 1993). WY Cnc has been studied since 1965 (Chambliss, 1965). It shows starspot activity with the hotter primary star being the active one. Recently Heckert et al. (1998), Heckert (2001), and Kjurkchieva et al. (2004) noted secular luminosity increases of nearly 0.1 mag in 1988, 1997 and 2001.

We observed WY Cnc at three observatories. We obtained Johnson–Cousins $BVRI$ photometry with the 61-cm telescope at San Diego State University's Mount Laguna Observatory in May 2005 and January 2006, Johnson $UBVRI$ photometry with the 1.25-m telescope and Piirola photometer at Crimean Astrophysical Observatory in February 2006 and at Ural State University's Kourovka Observatory in January 2005 and February 2006. The Mount Laguna and Crimean data were transformed to the standard system using data reduction methods described by Heckert et al. (1998) and by Alekseev & Gershberg (1996). At Kourovka Observatory we used a three-channel photometer attached to the 70-cm telescope. The program and comparison stars and the sky were observed simultaneously. The data were collected with 4-s sampling times. Because the angular separation between the program and comparison stars is only $17'$, the differential magnitudes are only corrected for the first order atmospheric extinction. The second order atmospheric extinction is small in the V and R bands but can play a role in the B band. However, we compared our data obtained during several consecutive nights and made sure that the points of the individual lightcurves with the same orbital phases and different air masses are in range ± 0.01 mag. Thus, the second order atmospheric extinction during our observations in the B band was small too. Moreover, its influence is cancelled out to some extent when data from different nights are averaged.

Simultaneous measurements of the program and comparison stars are advantageous because they provide more confidence in the reality of the observed brightness variations. However, such observations are difficult to transform to the standard system because we do not know the program and comparison star magnitudes corrected for atmospheric extinction separately. Therefore at Kourovka observatory we used standard Johnson filters, but the data were not transformed. Nonetheless, we compared the Kourovka data to the data obtained at the Mount Laguna and Crimean observatories during the overlapping time intervals in January and February 2006 and found that the Kourovka data are brighter than the Mt. Laguna data only by 0.01 mag. Also the Crimean data are brighter than the Mt. Laguna data by 0.02–0.03 mag (in different bands). Therefore we shifted the Kourovka and Crimean data towards the Mount Laguna data to diminish these deviations. We used HD 77173 as a comparison star at Mt. Laguna and CrAO, and BD+26°1883 at Kourovka. The data points have a statistical accuracy of 0.01 mag or better. Phases were calculated from the ephemeris of Hall & Kreiner (1980): HJD = $2426352.3895 + 0.82937112 \times E$. Figures 1a, 1b, 1c show WY Cnc V band lightcurves.

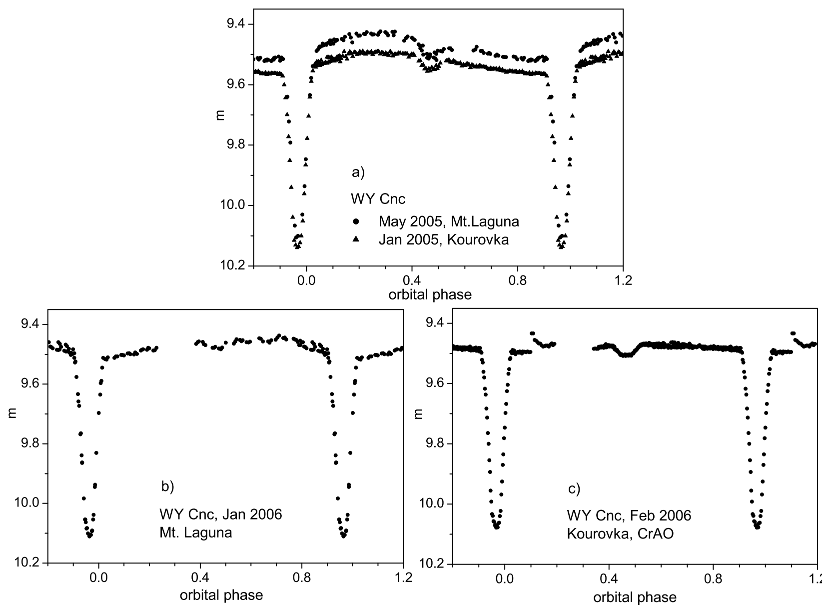

Figure 1. WY Cnc lightcurves in the V band, 2005–2006

Each point of the Kourovka Observatory lightcurves is an average of 31 individual 4-s integrations. The lightcurves show the out-eclipse distortion wave caused by starspots.

The flare was detected on 19.02.2006 during BVR observations at Kourovka observatory (see Fig. 1c). The flare occurred at phase 0.10 near the minimum of the distortion wave. After the initial rapid flaring, the brightness decayed slowly. The star remained 0.025 mag brighter for at least an hour after the flare began.

Figure 2 shows small portions of BVR lightcurves near phase 0.10 with both individual 4-s integrations and averages plotted. Since each color was observed sequentially, some points of the flare may be seen in different colors. The flare peaked at 21:50 UT and had a maximum amplitude of 0.134 mag in the B band. The time required for the flare to peak (impulse phase) is about 3 min. The flare duration is 64 min.

The intensity of the flare was calculated as $I_f/I_0 = (I_{0+f}/I_0) - 1$, where I_0 is the mean intensity of the quiescent star level in one of the B, V, R bands. By numerical integration of the flare intensity over the flare duration, the relative energy of the flare was defined by $RE = \int I_f(t)/I_0\, dt$. We estimated the absolute energy output E_f of the flare using the relation: $E_f = RE \times E_q^X$, where E_q^X is the quiescent star luminosity in X band, which we calculated using: $V = 9.467$, $B - V = 0.73$, $V - R = 0.63$ and a distance of 85 pc to the system. We used the Hipparcos parallax (11.76 mas) of WY Cnc as the most accurate

Table 1: Flare properties

Band	Amplitude, mag	Flare flux/system flux, %	Integrated energy, erg
B	0.134	5	10.24×10^{34}
V	0.062	3	5.63×10^{34}
R	0.045	2.6	0.96×10^{34}

Table 2: WY Cnc spot parameters

Obs. period	$V_{\rm max}$	ΔV	φ_0	$\Delta\varphi$	$f_{\rm min}$	S_1	S_2	Observatory
2005 Jan	9.496	0.069	0	8.3	0.51	6.3	4.5	Kourovka
2005 May	9.430	0.087	0	6.7	0.20	4.7	2.3	Mt. Laguna
2006 Jan	9.456	0.056	0	6.5	0.45	4.8	3.3	Mt. Laguna
2006 Feb	9.461	0.026	0	5.1	0.67	4.1	3.4	Kourovka + CrAO

(http://simbad.u-strasbg.fr/sim-fid.pl). We also used the luminosity of the star with an absolute magnitude of 0 mag from Johnson's calibration (Johnson, 1966).

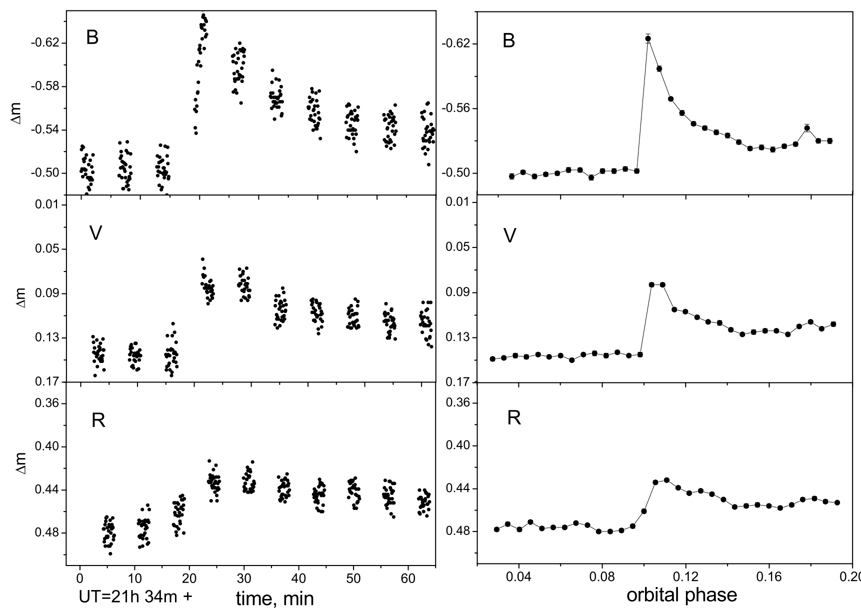

Figure 2. The flare of WY Cnc: lightcurves in B, V, R bands with individual 4-s integrations (left) and averages of 31 points (right) plotted

To study the spot activity before and during the flare, we analyzed all our lightcurves using the Zonal Spottedness Model, developed by Alekseev & Gershberg (1996). Results are given in Table 2. $V_{\rm max}$ is the maximal star brightness and ΔV is the amplitude of the distortion wave. According to the Zonal Model, two spotted belts located symmetrically about the equator can represent spotted regions on cool stars. These belts occupy regions with the latitudes (in degrees) from $\pm\varphi_0$ to $\pm(\varphi_0 + \Delta\varphi)$ and have a spot coverage that varies linearly with the longitude from 1 at the minimum brightness phase to some value $f_{\rm min}$ at the maximum brightness phase. S_1 and S_2 are the spotted areas of the dark and bright hemispheres of the stellar surface that are symmetric to the phase of the brightness minimum, in percents. The analysis of our observations allows us to make the following conclusions.

1. Both before and during the flare minima of the distortion waves were at phases of 0.87–0.03. This means, that the "face side" hemisphere of the primary star (the side facing the secondary component) was more spotted than the "back side" hemisphere (we took into account that WY Cnc is a tidally locked system).

2. In May 2005 the brightness of WY Cnc increased by 0.07 mag compared to January 2005 (see Fig. 1a). Note that this brightness difference is larger than the differences found between the light curves from the two different observatories as discussed earlier in this paper. Hence the difference is real rather than a calibration error. This secular increase is similar to those observed in 1988 and 1997 by Heckert et al. (1998) in that the brightness increases outside of the primary eclipse but remains approximately the same during the primary eclipse. The fact that the primary eclipse portions of the light curves match well is also evidence that this is a real luminosity increase rather than a calibration error resulting from different observatories and instruments. While the luminosity increased, the total spotted area became less with the more asymmetric spots concentrated on the hemisphere facing the secondary: $S_1/S_2 = 2.0$. So we may suppose, that this luminosity jump might be caused by several new bright active regions (analogous to solar plages) with some small-sized spots (spot coverage $f_{\rm min} = 0.20$) which appeared at the back side hemisphere.

3. In January 2006 and in February 2006 the brightness of the system and the amplitude of the distortion wave began to decrease, and spots began to fill the bright hemisphere in a more homogeneous way ($f_{\rm min} = 0.67$). The flare occurred at the time when the amplitude of the distortion wave was minimal (0.026 mag) and the spotted areas of face and back sides hemispheres became almost equal ($S_1/S_2 = 1.2$), i.e. during the flare, the spots filled both hemispheres in an almost homogeneous way.

A flare in WY Cnc was detected for the first time. A similar flare has been reported by Zeilik et al. (1983) for another RS CVn system XY UMa. However, its energy was one order of magnitude smaller than that of the flare reported here. Another similar system SV Cam was reported to show flares too (Patkós, 1981). The strongest of these flares had a duration of 43 minutes and an amplitude of 0.12 mag in U band. In the very active RS CVn star II Peg optical flares had energy from 10^{33} to 2×10^{35} erg (Mathioudakis, 1992). So, compared to other flares on RS CVn stars, we conclude that the flare we detected is a large one. All of these other flares occurred on the spotted hemisphere, just as in our observations.

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GSC 3576-0170: A NEW NEAR-CONTACT SOLAR-TYPE BINARY, PERIOD ANALYSIS AND CLASSIFICATION

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GSC 3576-0170 (at $20^h23^m38^s$, $+46°55'52''$, J2000.0) was discovered to be variable by one of us (RHN) while doing CCD observations of ZZ Cyg at his private observatory (see Nelson, 2003) in early June 2003. Several stars were included in the aperture photometry to serve as check stars and one of them displayed the features of an eclipsing binary. During that period, RMR obtained a full light curve in R_C (525 points) (see Robb & Greimel, 1999) and four times of minima. The light curves shown in Figure 1 show that the system is a close binary. Since the maxima are of different height, we expect spots on one or both stars.

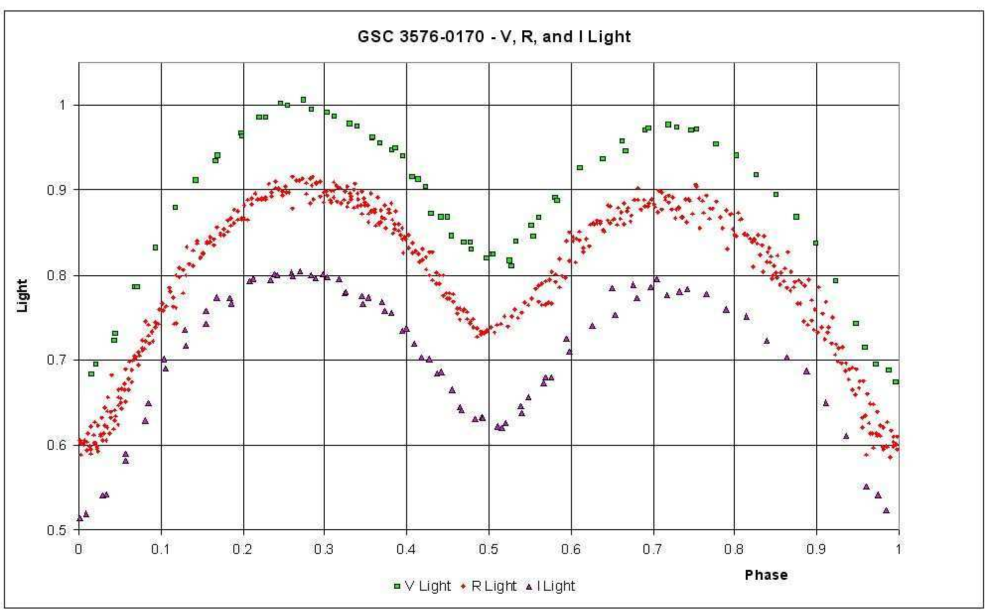

Figure 1.

Table 1: Positions and magnitudes

Star	GSC	Phase	V	$B-V$	$V-R_C$	R_C-I_C
Var	3576-0170	0.39	12.496(5)	0.737(3)	0.438(3)	0.398(5)
Var	3576-0170	0.68	12.484(5)	0.735(3)	0.432(3)	0.411(5)
C	3576-0964	na	11.014(3)	0.138(6)	0.090(1)	0.100(2)
K	3576-0702	na	11.561(6)	0.432(8)	0.265(4)	0.256(5)

Table 2: Observed minima of GSC 3576-0170

Observer	HJD – 2400000	Error (days)	Type	Cycle	$O-C$ (days)
Nelson	52794.863	0.0040	II	−2.5	0.0009
Nelson	52795.8716	0.0005	I	0	−0.0030
Robb	52799.9230	0.0005	I	10	−0.0016
Quester	52802.554	0.0020	II	16.5	−0.0032
Robb	52806.8076	0.0003	I	27	−0.0021
Robb	52807.821	0.0010	II	29.5	−0.0012
Quester	52812.478	0.0020	I	41	−0.0018
Nelson	52826.860	0.0010	II	76.5	0.0025
Krajci	53263.8659	0.0005	II	1155.5	0.0081
Krajci	53264.6735	0.0002	II	1157.5	0.0057
Robb	53305.7787	0.0004	I	1259	0.0029
Krajci	53837.9506	0.0002	I	2573	−0.0018
Krajci	53852.937	0.0002	I	2610	−0.0006
Krajci	53900.7278	0.0002	I	2728	−0.0004
Robb	53939.8099	0.0005	II	2824.5	−0.0012
Robb	53941.8337	0.0004	II	2829.5	−0.0025
Robb	53943.8605	0.0008	II	2834.5	−0.0007

At the USNO Flagstaff Station 1.00-m telescope (see Nelson, 2002), AAH observed the GSC 3576-0170 and ZZ Cyg field in the standard Johnson–Cousins BVR_CI_C passbands on 2003-08-10 (UT). This photometry is summarized in Table 1 with magnitude errors, in millimagnitudes, appearing in brackets.

All known times of minima were collected (Table 2) and an $O-C$ plot constructed (Fig. 2).

Assigning equal weights, the following ephemeris (in days) was obtained, and the above tabular $O-C$ values were calculated from the linear least squares best fit relation:

$$\text{Min. I} = \text{HJD } 2452795.8746(22) + 0.40500(1) \times E.$$

It is clear from Figure 2 that deviations from the line of best fit far exceed the internal error estimates and we suspect there is some systematic effect(s). A quadratic fit can be invoked; however that still leaves the rms error at 0.0020 days. Clearly more times of minima are required to sort out the true period and any period variation and we will reserve a full discussion of the subject to a future paper. Therefore although the period is quoted to five figures, the last figure is uncertain. The error in the period has been

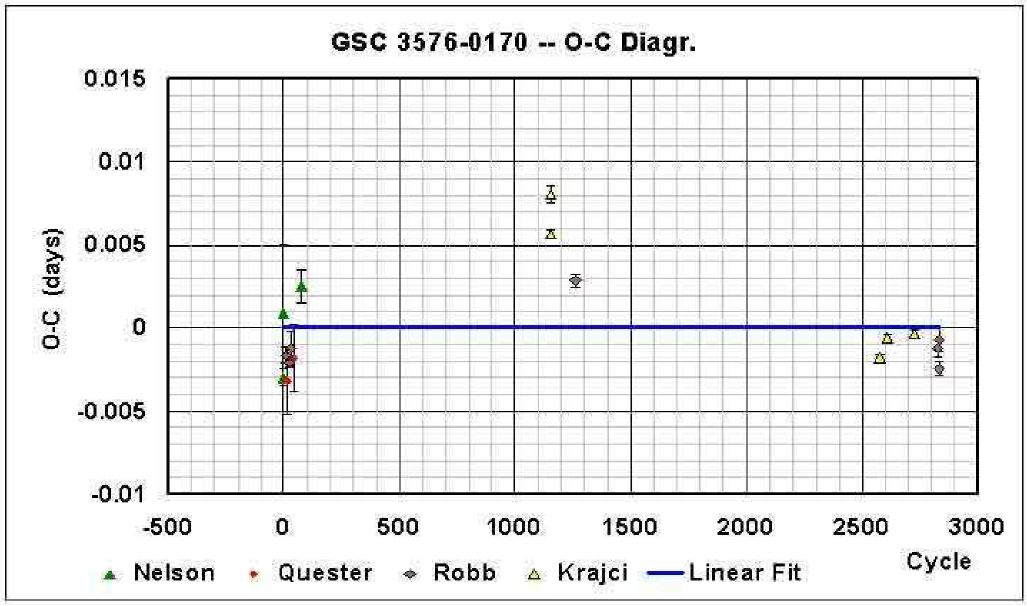

Figure 2.

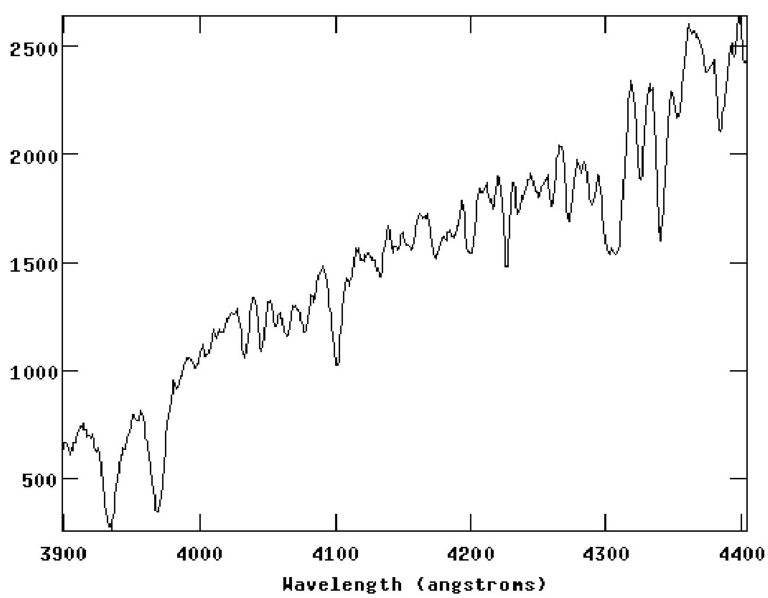

Figure 3.

estimated by the difference in period between the period obtained from the first (2003) and second (2004) groups of data only, and the period from all the data.

A spectrum of GSC 3576-0170 observed with 1.8-m telescope of the Herzberg Institute of Astrophysics (by RMR) is shown in Figure 3. The dispersion was 0.96 Å per pixel. By comparing the Hγ to the FeI 4384 and the Hδ to the CaI 4227 lines we classify this star as G1V with an uncertainty of one sub class. Therefore we estimate its temperature to be 5865 K (Cox, 2000).

Wilson–Devinney modelling (Wilson & Devinney, 1971) was attempted, but since (based on the low depths of the minima) the eclipses were obviously partial, it was not possible to determine the mass ratio based on photometric data alone (Terrell & Wilson, 2005).

Nevertheless, modelling runs were made for a range of mass ratios using detached, overcontact, semi-detached with a bright spot on star 2, and double contact. However, detached consistently gave smaller residuals by $100.15 < q < 0.35$ (because of steeply rising residuals outside this range) giving an inclination in the range of 65–70. The temperature of the secondary is 4800-4900 K, giving it a spectral type of K2 $\pm$ one subclass. One G1V and one K2V star would have an absolute magnitude of $V = 4.37$ with a $(B-V)_0$ of 0.67. Therefore the reddening or colour excess, $E(B-V) = (B-V)-(B-V)_0$ would be 0.07 and, assuming an R of 3.0, the absorption would be $A_V = 0.21$ and the distance becomes approximately 400 parsecs.

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ERRATA FOR IBVS 5557, 5586

Sebastian Otero reported the following errors:

IBVS No.	item	printed	correct
5557	identifier (NSV 233)	GSC 0013-0919	GSC 0013-0976
5586	filter (NSV 15024)	13.20(12.80)	13.20(12.80)*

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THE BRIGHT CEPHEID V411 LACERTAE

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Photometric variability of V411 Lacertae (HD 213233, HIP 110968, SAO 34498) was first detected by the Tycho instrument during the Hipparcos project (Woitas, 1997). Surprisingly enough, variability of such a bright star had escaped the observers' attention before. There are three such bright (between 7-8 mag. in V) Cepheids discovered from the photometric data of this astrometric satellite: CK Cam, V898 Cen, and V411 Lac. While the first two have been observed more or less regularly since then, no more recent observational data are available on V411 Lac. There exist, however, several earlier photometric data obtained between October 1981 and January 1982 whose mean value (averaged from two to four observations) is $V = 9\overset{m}{.}80$ (Scharlach and Craine, 1983). Because the real value is $7\overset{m}{.}80$, this figure is either a typographic error or the result of a misidentification (both the $V - R$ and $V - I$ colour indices assigned to SAO 34498 are too red for a Cepheid).

In the discovery paper, Woitas (1997) reported a $2\overset{d}{.}91$ periodicity. This value was then refined in the Hipparcos Catalogue (ESA, 1997) to be 2.90816 days. In order to have more information (light curve in more than one colour, precise pulsation period and its possible changes), V411 Lacertae was put on the photometric observational program of monitoring bright northern Cepheids in the Konkoly Observatory.

The new photometric observations were obtained with the 50 cm Cassegrain telescope located at Piszkéstető Mountain Station, equipped with a refrigerated photoelectric photometer. The observations were made through UBV filters of Johnson's system. 34 observations were obtained on 31 nights between 1997 and 2004. HD 213159 served as the comparison star whose constancy was regularly checked against the brightness of HD 213243. Moreover, Hipparcos photometry also testifies photometric constancy of this star (HIP 110924). The instrumental magnitude differences have been converted into the standard photometric system using the average transformation coefficients determined for the V magnitude, $B - V$ and $U - B$ colour indices by observing photometric standard stars. The following magnitudes were used for the comparison star, HD 213159: $V = 7\overset{m}{.}73$, $B - V = 0\overset{m}{.}0$, and $U - B = -0\overset{m}{.}34$ (Scharlach and Craine, 1983). The individual observational data are listed in Table 1. The internal accuracy of the photometric data is better than $0\overset{m}{.}01$ in V and B bands and is about $0\overset{m}{.}01$ in U. The phased light curve in V band, the $B - V$ and $U - B$ phase curves are shown plotted in Figures 1-3, respectively. The photometric data have been folded on the period value of $2\overset{d}{.}908269$, obtained from the $O - C$ diagram as discussed below.

Table 1. New photometric observations of V411 Lacertae

JD Hel. 2 400 000+	V [mag]	$B-V$ [mag]	$U-B$ [mag]	JD Hel. 2 400 000+	V [mag]	$B-V$ [mag]	$U-B$ [mag]
50749.2969	7.709	0.697	-	52198.3900	7.826	0.788	0.341
50749.3804	7.720	0.686	-	52199.4228	7.855	0.785	0.321
50750.2973	7.865	0.764	-	52200.3657	7.681	0.708	0.286
50750.3841	7.877	0.794	-	52589.2790	7.831	0.752	0.319
50751.2700	7.836	0.748	-	52618.3074	7.839	0.760	0.324
50751.3396	7.810	0.736	-	52619.2581	7.705	0.702	0.294
50832.2514	7.918	0.769	-	52620.2554	7.806	0.807	0.372
51052.4423	7.810	0.762	-	52673.2423	7.928	0.780	0.365
51758.4083	7.674	0.704	0.289	52901.4175	7.697	0.688	0.313
51759.4032	7.845	0.794	0.358	52902.3468	7.844	0.799	0.362
51838.3429	7.955	0.821	0.363	52903.3790	7.821	0.754	0.315
51839.3167	7.741	0.724	0.287	52904.3444	7.683	0.713	0.299
51840.3195	7.719	0.723	0.318	52906.3452	7.802	0.740	0.314
52194.4521	7.700	0.705	0.285	52948.3702	7.747	0.732	0.336
52195.3596	7.788	0.771	0.332	53266.3669	7.900	0.815	0.387
52197.3657	7.695	0.705	0.291	53286.3753	7.868	0.795	0.370

Table 2. $O-C$ residuals for V411 Lacertae

Normal Max JD $_\odot$ 2 400 000+	E	$O-C$ [day]	Band	Source
47995.0192	−210	+0.0181	H_P	Hipparcos
48256.7478	−120	+0.0026	H_P	Hipparcos
48605.7357	0	−0.0018	H_P	Hipparcos
48969.2470	125	−0.0241	H_P	Hipparcos
50798.5727	754	+0.0004	V	present paper
52031.6791	1178	+0.0007	V	present paper
52860.5396	1463	+0.0046	V	present paper

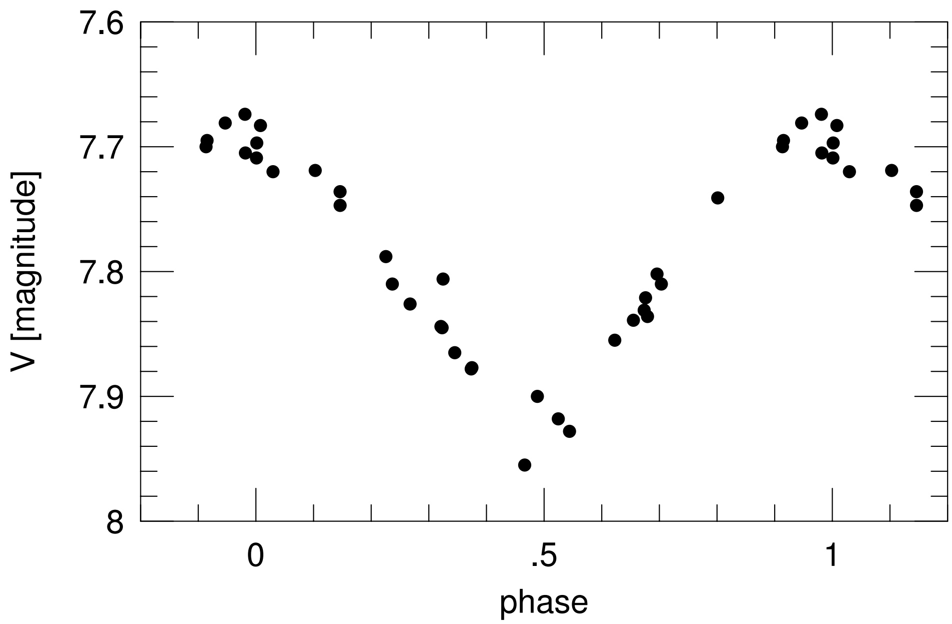

Figure 1. The V light curve of V411 Lacertae

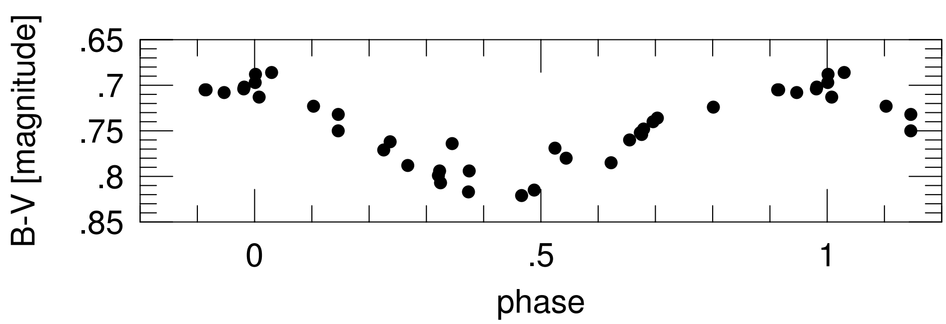

Figure 2. The $B-V$ colour index curve of V411 Lacertae

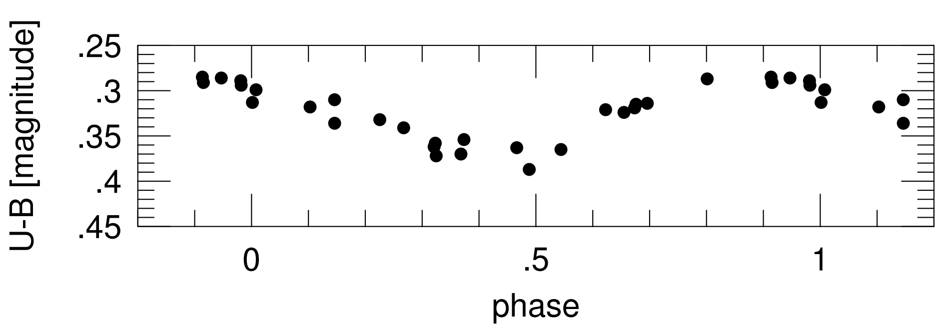

Figure 3. The $U-B$ colour index curve of V411 Lacertae

Availability of the Hipparcos photometric data covering about three years as well as our new data distributed in almost a decade, allow the construction of an $O-C$ diagram. The seasonal normal maxima were determined using the well covered Hipparcos normal light curve. The $O-C$ residuals obtained are listed in Table 2 with respect to the ephemeris:

$$C = 2448605.7375 + 2\overset{d}{.}908269 \times E.$$
$$\pm.0064 \quad \pm.000008$$

The value of the period appearing in this ephemeris was obtained from the least squares fit to the $O-C$ residuals (using equal weights). The new value of the pulsation period is somewhat longer and more precise than that deduced from the Hipparcos data alone.

Future observations of V411 Lac are important, since as is seen in Fig. 1, the light curve shows some excessive scatter which cannot be explained by observational uncertainties. The pulsation period of V411 Lac is well within the range where double-mode pulsation occurs among Galactic Cepheids. Therefore, observers having an access to small photometric telescopes in the northern hemisphere are urged to monitor closely V411 Lacertae already in this observing season.

Acknowledgements: This work was supported by the Hungarian OTKA grant T 046207.

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Woitas, J., 1997, *IBVS*, No. 4444

ERRATA FOR IBVS 5425, 5431, 5455, 5458, 5489, 5500, 5532, 5586, 5700

Geert Hoogeveen reported the following errors in various IBVS issues:

IBVS No.	item	printed	correct
5425	identifier (BD -4°2739)	1RXS J0950391.1-053029	1RXS J095039.1-053029
5431	RA (BD +20°2890)	$13^h53^m53\overset{s}{.}848$	$13^h53^m13\overset{s}{.}848$
5455	Decl. (GSC 4709-1250)	-00 18 05.4	-01 18 05.4
5458	identifier (FASTT 1195)	GSC 0449-0455	GSC 0449-0456
5458	Epoch column header	2400000	2450000
5489	identifier	GSC 7758-1126	GSC 7758-1162
5500	identifier (# 5)	GSC 3328-0163	GSC 6328-0163
5532	identifier (NSV 14532)	HD 214505	HD 220345
5586	identifier (NSV 20599)	HIP 80022	HIP 80222
5586	identifier (NSV 1916)	GSC 8959-0532	GSC 1859-0532
5700	identifier (# 44)	GSC 4207-1658	GSC 4433-1658

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PHOTOMETRIC ANALYSIS OF THE W UMa TYPE BINARY V566 OPHIUCHI

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The variability of V566 Ophiuchi (BD +05°3547) was discovered by Hoffmeister (1935). According to Binnendijk (1970), the system is an A-type W UMa eclipsing binary. Important photoelectric light curves exist in the literature are: B, V light curves obtained by Binnendijk (1959), Bookmyer (1969, 1976) and Niarchos et al. (1993) and ultraviolet (λ 2585–3200 band) light curve obtained with IUE satellite by Eaton (1986).

The photometric solutions of the system were given by Binnendijk (1965), Bookmyer (1969, 1976), Mochnacki & Doughty (1972), Hutchings & Hill (1973), Berthier (1975), Nagy (1977), Van Hamme & Wilson (1985), Eaton (1986), Niarchos et al. (1993) and Niarchos & Manimanis (2003). These solutions give the values of photometric mass ratio in the range $0.23 < q_{\rm ptm} < 0.24$.

Radial velocities of the system were published by Heard (1965), McLean (1983), Hill et al. (1989) and Pribulla et al. (2006). The first spectroscopic mass ratio of the system was given by Heard (1965) as $q_{\rm sp} = 0.34$ but McLean (1983) found $q_{\rm sp} = 0.24 \pm 0.03$ which agrees well with the photometric mass ratio derived previously. Later Van Hamme & Wilson (1985) reanalyzed the radial velocity curves of McLean by taking into account the proximity and eclipsing effects and obtained $q_{\rm sp} = 0.216 \pm 0.018$. Hill et al. (1989) obtained new radial velocity curves based on reticon observations and found $q_{\rm sp} = 0.266 \pm 0.006$. They obtained the mean spectral type of the system as F2 and mean effective temperature as 6700 K using the mean reddening in the field. Lastly, Pribulla et al. (2006) obtained $q_{\rm sp} = 0.263 \pm 0.012$ using the BF (broadening function) extraction technique and the rotational-profile fitting. They also obtained the spectral classification of the system as F4V, indicates a slightly later spectral type than that found by Hill et al. (1989).

The observations of V566 Oph were carried from June 18 to 21 (four nights) at the TÜBITAK National Observatory (TUG) using 40-cm (F/12.5) reflector and on July 24 at the Ege University Observatory (EUO) with the 48-cm (F/13) Cassegrain telescope in 1997. The SSP5 photometers were used at both observatory; the observations were made in U, B, V, R filters at TUG and in B, V, R filters at EUO. A total of 201, 232, 234 and 233 observational points were obtained in U, B, V and R filters, respectively. Differential measurements were made using BD+04°3553 as a comparison and BD+04°3556 as a check star. The differential magnitudes, in the sense variable minus comparison, were corrected for atmospheric extinction and the times of individual observations were reduced to the Sun's center. The extinction coefficients were determined for each night from the observations of the comparison and the color effect on the atmospheric extinction was taken into account.

The unpublished differential magnitudes in U, B, V and R filters are available on request from the author. The instrumental differential $U-B$, $B-V$ and $V-R$ color and the U, B, V, R light curves of the system are also plotted against the orbital phases in Fig. 1. As seen from the figure the levels of maxima I and II are almost equal to each other in B, V, R light curves while in U band the system is slightly brighter at maximum II than that at maximum I.

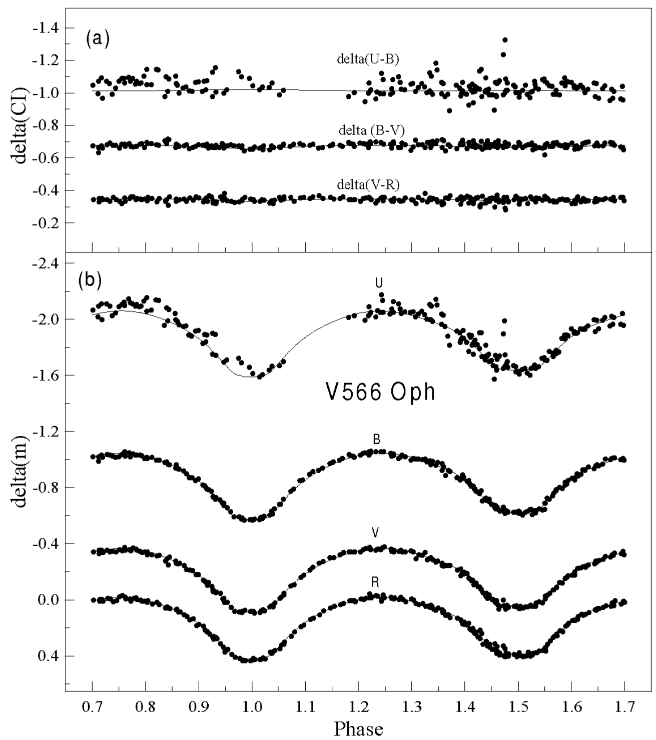

Figure 1. Observed differential (a) color and (b) light curves of V566 Oph. The upper panel shows the observed $U-B$, $B-V$ and $V-R$ color curves while the bottom panel shows computed light curves among the observations

We used the Wilson–Devinney method (Wilson & Devinney, 1971; Wilson, 1994) to analyze the light curves. The analyses were made in MODE 3 which corresponds to over-contact configurations. The temperature of the primary component was taken from Popper (1980) as 7000 K, corresponding to F2 spectral type (Hill et al., 1989). The logarithmic limb darkening coefficients were used in the computations. Assuming a solar chemical composition and $\log g = 4.25$, bolometric and monochromatic limb darkening coefficients were taken from Claret (2000). The bolometric albedos A_h and A_c were set to be equal to 0.5 and synchronized rotation ($F_h = F_c = 1.0$) was assumed. The solutions were obtained with model atmosphere approximation and multiple reflections were assumed. The results are given in Table 1 and the agreements of the computed curves with the observed light curves are shown in Fig. 1. For comparison, the results obtained by Van Hamme & Wilson (1985) (H&W85), in which they also used the Wilson–Devinney method, are also presented in Table 1. The parameters obtained in the solution are in good agreement with those of van Hamme and Wilson.

Table 1: Comparison of the photometric results with those of Van Hamme & Wilson (1985)

Parameter	This study	H&W85
Pshift	-0.0015 ± 0.0002	0.0001
i (degree)	80.8 ± 0.2	80.32 ± 0.17
$x_h = x_c$	0.786 (U), 0.770 (B), 0.674 (V), 0.596 (R)	0.564 (B), 0.452 (V)
$A_h = A_c$	0.5	0.5
$g_h = g_c$	0.39 ± 0.06	0.399 ± 0.030
T_h	7000 K	7000 K
T_c	6902 ± 19 K	6881 ± 9 K
$\Omega_h = \Omega_c$	2.288 ± 0.004	2.2575 ± 0.0026
q	0.2389 ± 0.0007	0.23686 ± 0.00084
$L_h/(L_h+L_c)_U$	0.792 ± 0.005 (U)	–
$L_h/(L_h+L_c)_B$	0.792 ± 0.004 (B)	0.7901 ± 0.0023
$L_h/(L_h+L_c)_V$	0.789 ± 0.003 (V)	0.7879 ± 0.0019
$L_h/(L_h+L_c)_R$	0.788 ± 0.002 (R)	–
r_h (mean)	0.519 ± 0.001	0.5278 ± 0.0010
r_c (mean)	0.275 ± 0.002	0.2848 ± 0.0014
$\sum W(O-C)^2$	0.0020	–

Table 2: The absolute parameters of the components

Parameter	Present work	H&W85	NEA93
$M_h/M_\odot$	1.41 ± 0.18	1.40	1.56
$M_c/M_\odot$	0.34 ± 0.08	0.33	0.41
$R_h/R_\odot$	1.45 ± 0.07	1.47	1.51
$R_c/R_\odot$	0.77 ± 0.04	0.79	0.86
$(T_e)_h$ (K)	7000 ± 100	7000	–
$(T_e)_c$ (K)	6902 ± 100	6881	–
$\log(L_h/L_\odot)$	0.65 ± 0.04	0.66	0.62
$\log(L_c/L_\odot)$	0.09 ± 0.04	0.10	0.12
$\log g_h$ (cgs)	4.26 ± 0.10	–	–
$\log g_c$ (cgs)	4.19 ± 0.10	–	–

Van Hamme & Wilson (1985) solved the radial velocity curves of McLean (1983) and found the semi-major axis of the relative orbit of V566 Oph as $2.788 \pm 0.097\ R_\odot$. Using this value and the photometric parameters given in Table 1 (column 2), the absolute parameters of the components were obtained and presented in Table 2 together with those given by Van Hamme & Wilson (1985) and Niarchos et al. (1993) (NEA93). According to the Hipparcos Catalogue, the $B-V$ color of the system is 0.449 ± 0.025. So, I have estimated the errors on the temperatures of the components as about 100 K using the above value in Popper (1980) table. The large errors in the absolute parameters are due to uncertainties in the determination of radial velocities. If we take into account Kopal's theoretical approach (Kopal, 1978) for W UMa systems, $L \sim M^{2\beta}$ with $\beta = 0.49$, our results seem to be more acceptable.

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ERRATUM FOR IBVS 5714

The true shape of the eclipsing binary light curve and the modified, correct period of V1898 Cyg was already published in IBVS 5699/76 (2005, July 20) by Caton & Smith (http://www.konkoly.hu/cgi-bin/IBVS?5699#76).

The Editors

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BVR_CI_C OBSERVATIONS OF THE DWARF NOVA AH Her DURING 2005

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AH Her belongs to the subclass of dwarf novae (DNe) named by the group prototype Z Cam. DNe in general are cataclysmic variable stars characterized by the presence of sudden increases of brightness (2–5 mag, outbursts) in the optical light curve, and consist of a white dwarf (primary) star accreting matter from a red dwarf (mass donor), which is in contact with its Roche lobe. Outburst intervals for each object are quasi-periodic, but within the DN family, intervals can range from days to decades. In particular stars like AH Her (Z Cam subclass) display intervals of outbursts as well as phases of steady brightness (known as standstill stages). AH Her varies in magnitude between $V = 14.7$ to $V = 13.9$ at minimum, while in the outburst the star may reach the value of $V = 11.3$. During the standstill stages the brightness value is swinging about $V = 12.0$ magnitude (Ritter & Kolb, 1998). The recurrence time (T_c) between two outbursts varies of 7–27 days (for a review see Spogli et al., 2001, and references therein). In particular an increase of T_c accompanied by a slow brightening of the mean V magnitude was reported recently by Šimon (2004), while accurate radial velocity determinations of the AH Her system can be found in North et al. (2002).

Table 1

	B	V	R_C	I_C
Maximum outburst	11.77 ± 0.08	11.84 ± 0.05	11.74 ± 0.05	11.67 ± 0.04
Minimum of light	15.07 ± 0.12	14.52 ± 0.05	14.09 ± 0.05	13.48 ± 0.05
Mean values at minimum	14.2 ± 0.3	13.9 ± 0.3	13.5 ± 0.2	13.1 ± 0.1
Mean values at maximum	12.1 ± 0.2	12.0 ± 0.1	11.9 ± 0.1	11.8 ± 0.1
Outburst amplitude	3.2	2.6	2.4	1.8
Decay rates (mag/day)	0.27 ± 0.12	0.22 ± 0.05	0.18 ± 0.05	0.16 ± 0.05
	$B - V$	$V - R_C$	$R - I_c)$	$V - I_C$
Mean values at Maximum	-0.03	0.08	0.14	0.23
Mean Values at Minimum	0.36	0.34	0.49	0.83

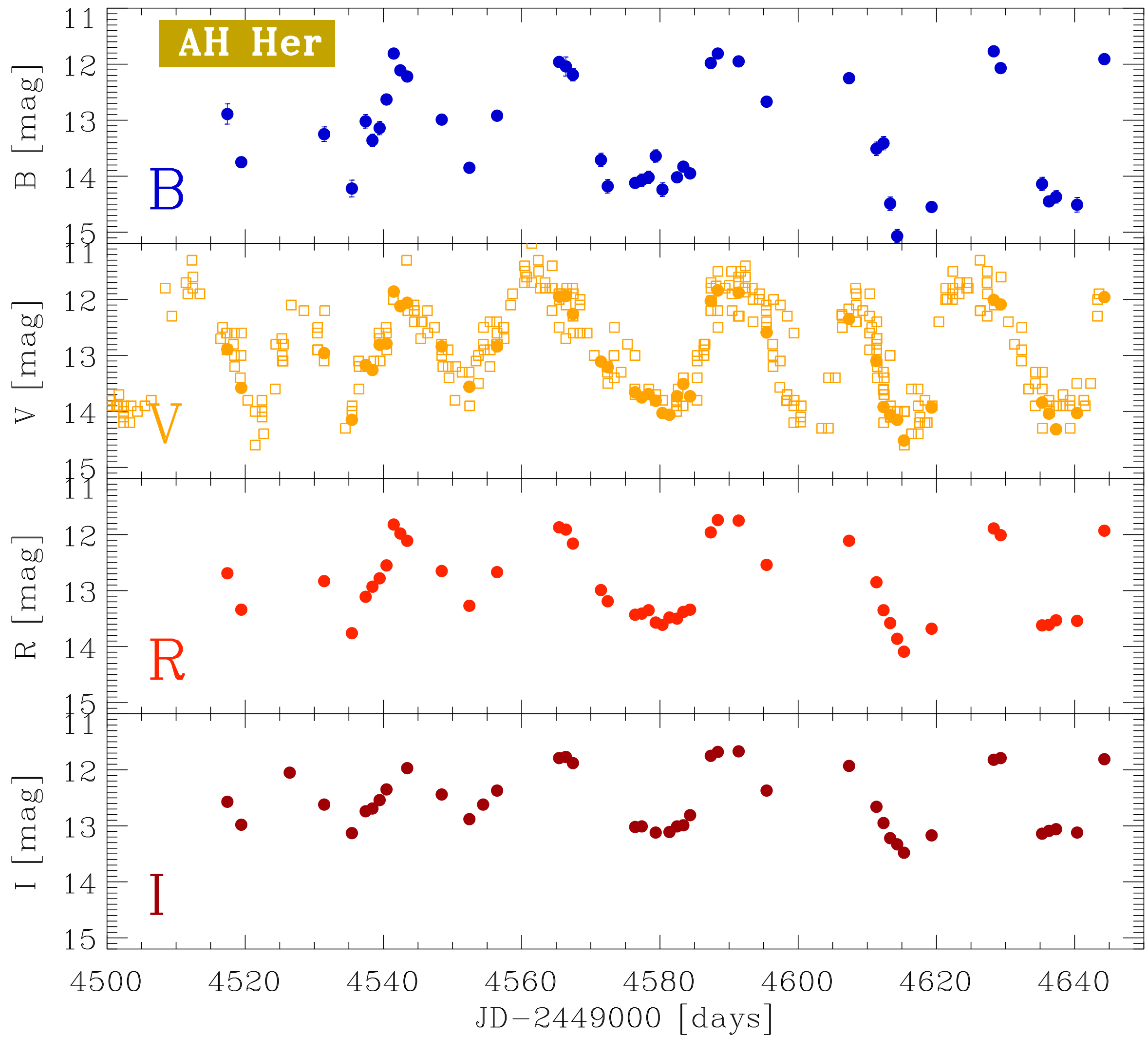

Figure 1. BVR_CI_C light curves of AH Her from 25 May 2005 to 30 September 2005 assembled with our original data (filled circle symbols). The available V-band data from the AFOEV database are also reported for a comparison (open square symbols). Time expressed in Julian Days is reported in the X-axis

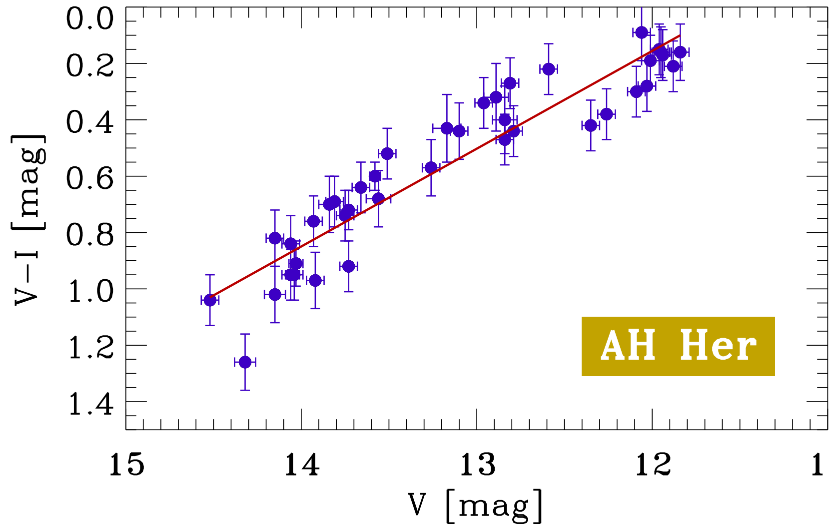

Figure 2. The $V-I$ colour index variations of AH Her plotted against the V magnitude. The star appears to be redder in quiescence and data are well represented by a simple linear trend

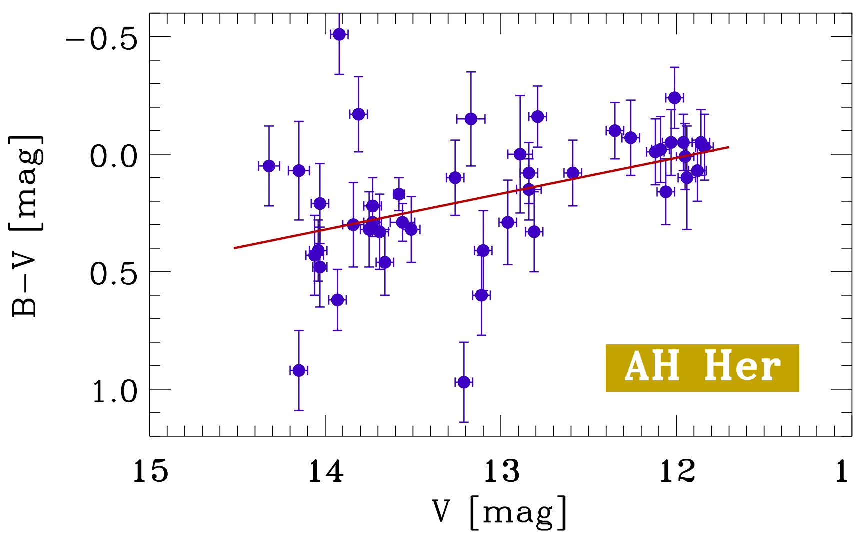

Figure 3. The $B-V$ colour index variations of AH Her plotted against the V magnitude. The scattering in the data (owed to the smaller precision in B data when the star is faint, and possibly to some loop patterns) is evident, even if the bluer when brighter general trend is still identifiable

In this brief paper we present results of our intermittent observations of AH Her made in the year 2005 at the Astronomical Observatory of the Perugia University and the Porziano amateur observatory. Observations were performed in the B, V (Johnson), and R_C, I_C (Cousins) photometric bands. Instruments and photometric techniques used at the Perugia Observatory are already described in Spogli et al. (1998), while the calibration stars are reported in Spogli et al. (2001). In the Porziano Observatory we used a 0.30-m Schmidt–Cassegrain f/6.5 telescope, equipped with an AP-32ME CCD camera (Kodak 3200-ME, 2184 × 1470 pixels). AH Her was monitored from 26/05/2005 to 30/09/2005 for a total of 48 photometric nights (Figure 1). Our data are reported in Table 2, which is available electronically through the IBVS website as file 5727-t2.tex, while in Table 1 the main characteristics of our dataset (improving the values reported in our previous publications) are outlined. We computed the continuum spectral slope using the same procedure described in Spogli et al. (1998). We found a value ranging from 0.6 to 1.1, with a mean value equal to 0.7 ± 0.2.

The results presented here are part of a project devoted to gain multi-band light curves of a sample of DNe, with the goal of increasing the historical database and information on this class of cataclysmic variables which can help to constrain theoretical models. Figure 2 and Figure 3 show the colour-indices versus magnitude diagrams for AH Her: obviously the star is bluer during the outburst and redder in quiescence stages, but it is worth to note that the data seem to be well represented by a linear regression (at least for the $V-I$ plot, characterized by higher precision photometric data), and there is not a loop typical of other DNe (see, for example, Spogli et al., 2000a, 2000b). On the other hand the larger scattering in the $B-V$ plot might also be produced by few loop patterns produced during outburst. A study of this behaviour is underway, even if the statistics is poor.

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Spogli, C., Fiorucci, M., Tosti, G., Raimondo, G., 2001, *IBVS*, No. 5147

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TIMES OF MINIMA OF THE ECLIPSING BINARY SYSTEM EG CEPHEI

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[1] California State University, Chico

[2] San Diego Mesa College

[3] Astronomy Department, San Diego State University; e-mail: angione@mintaka.sdsu.edu

[4] NSF REU student

Observatory and telescope:
Mount Laguna Observatory, 0.4-m and 0.6-m reflectors

Detector:	Photoelectric (see Remarks)

Method of data reduction:
Standard photoelectric differential photometry reduction

Method of minimum determination:
Kwee–van Woerden algorithm

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
EG Cep	EB	$20^h15^m56\overset{s}{.}8$	$+76°48'36''$	HD 193834, HD 194400

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
EG Cep	2439004.7837	3	P	*UBV*	
	2439137.6721	4	P	*UBV*	
	2439290.7096	3	P	*UBV*	
	2439292.8882	5	P	*UBV*	
	2439297.7895	3	P	*UBV*	
	2447732.8995	3	P	*uvb*	
	2448067.8419	3	P	*uvby*	
	2448121.7603	3	P	*uvby*	

Remarks:
The first five times of minima were determined from data in an unpublished master's thesis (Cochran, 1967). Cochran's observations were made at Mount Laguna Observatory using a 0.4-meter reflecting telescope with a dry ice cooled 1P21 photomultiplier, the UBV system, and a charge-integrating photometer. His comparison and check stars were HD 193834 and BD+76°787 respectively. EG Cephei was also observed during 1989 and 1990 at Mount Laguna Observatory with the 24-inch Smith reflector. The 1989 observations were made using a photometer employing an EMI 6256 photomultiplier, while the 1990 observations were made with a Hammamatsu R943-02 tube, both were thermoelectrically cooled. This photometry was carried out in pulse-counting mode using the Strömgren uvby system. Comparison and check stars were HD 194400 (F8, $V = 9.72$) and HD 194130 (F2, $V = 8.87$) respectively.

Acknowledgements:
Acknowledgements: This work was supported by the NSF Research Experience for Undergraduates (REU) Program. Use was made of the SIMBAD data base.

Reference:

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ERRATUM FOR IBVS 5607

The correct identifier for NSV 10478 is USNO 0900-12232367.

The Editors

ERRATUM FOR IBVS 5681

One of the eccentric eclipsers in IBVS 5681 is wrongly identified as GSC 3682-0837 = USNO-A2.0 1425-02073759 = 2MASS J01315922+5926474.

The eclipsing binary with a period of 6.1772 d is actually GSC 3682-0736 = UCAC2 50208296 = 2MASS J01215916+5833136 at $01^{h}21^{m}59^{s}.16$ $+58^{\circ}33^{m}13''.6$ (2000.0). The spectral type is B0.

P. Dubovsky, S. Otero

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NEW TIMES OF MINIMA OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
TUG 40-cm Cassegrain–Schmidt telescope of the Turkish National Observatory, (TUG40); EUO A35-cm Fork–Mounts telescope of the Ege University Observatory, (A35)

Detector:	Apogee camera, Peltier cooling, Ap7p chip, $12'.3 \times 12'.3$ FOV, 512×512 pixels; Apogee camera, Peltier cooling, KAF1600E2 chip, $9'.0 \times 13'.8$ FOV, 1024×1536 pixels

Method of data reduction:
Reduction of the CCD frames was made with IRAF† software

Method of minimum determination:
Kwee–van Woerden method (Kwee & van Woerden, 1956)

Remarks:
We present 23 minima times of 4 eclipsing binaries. In the Remarks column of Times of Minima table, telescopes used in the observations are given.

Acknowledgements:
We are grateful to TÜBİTAK National Observatory and Ege University Observatory for use of the telescope time allocation and other facilities.

†IRAF is distributed by National Optical Astronomy Observatory, which is operated by the Association of University for Research in Astronomy, inc. (AURA) under cooperative agreement with the NSF (National Science Foundation).

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
TT Cet	53271.3394	0.0002	I	*BVR*	TUG40
	53271.5839	0.0002	II	*BVR*	TUG40
	53272.3117	0.0002	I	*BVR*	TUG40
	53273.5278	0.0002	II	*BVR*	TUG40
	53274.5002	0.0002	II	*BVR*	TUG40
	53275.4714	0.0003	II	*BVR*	TUG40
	53276.4449	0.0002	II	*BVR*	TUG40
MZ Del	53213.3062	0.0006	I	*BV*	TUG40
	53214.4165	0.0003	II	*BV*	TUG40
	53215.5123	0.0005	I	*BV*	TUG40
	53217.3404	0.0002	II	*BV*	TUG40
	53218.4438	0.0004	I	*BV*	TUG40
CP Psc	53258.4313	0.0007	I	*UBV*	A35
	53264.5859	0.0004	I	*UB*	A35
	53265.2682	0.0002	I	*UBV*	A35
	53279.2917	0.0007	II	*UBV*	A35
	53287.5058	0.0005	II	*UBV*	A35
	53290.2337	0.0005	II	*UBV*	A35
MX Del	53208.5316	0.0001	I	*V*	A35
	53232.3124	0.0006	II	*BV*	A35
	53237.5008	0.0004	II	*BV*	A35
	53254.3537	0.0005	I	*BV*	A35
	53267.3259	0.0005	I	*UBV*	A35

Reference:

Kwee, K.K., & van Woerden, H., 1956, *Bull. Astron. Inst. Neth.*, **12**, 327

ERRATUM FOR IBVS 5709

The times of observations of BH Aur were erroneously given in IBVS 5709. The normal maximum time of BH Aur in Table 2 should correctly read as 2453755.264 [HJD].

The light curve data files have also been corrected and are available from the IBVS website.

The authors

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GSC 02799-00902: A NEW δ Sct VARIABLE

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GSC 02799-00902 ($\alpha_{2000} = 01^{\rm h}01^{\rm m}26\overset{\rm s}{.}55$, $\delta_{2000} = +38°03'13\overset{''}{.}0$) is a never-studied faint star ($V \simeq 11.1$ mag) in the field of the eclipsing binary WZ And. In the 2004 observation season, we have made a time-series CCD photometry of WZ And (Zhang & Zhang, 2006). GSC 2799-902 was observed as one of the reference stars. Nelson (2000) also used this star as comparison for WZ And. During data reductions, we found that it could be a new pulsating variable star. To identify its spectral type as well as the variation classification, spectroscopy of the star was performed later. In this paper, we report the discovery of this new variable. A preliminary discussion on the properties and pulsating nature of the star is given.

Our photometric observations were carried out at the Xinglong Station of NAOC on three nights between 12 and 14 October, 2004. The data were collected using the 85-cm reflector with a AP7P 512 × 512 CCD camera. A single Johnson V filter was used. The exposure time was 60 seconds for each measurement. The star GSC 02799-00396 was used as the comparison star. The spectroscopy was made on 25 Oct., 2004 with the 2.16-m telescope at the Xinglong Station of NAOC. A Zeiss universal spectrograph was used with a Tektronix 1 k × 1 k CCD and a 200 Å mm^{-1} grating. A He-Ar lamp was used for wavelength calibration.

The light curves obtained for the star are shown in Fig. 1. It shows that GSC 02799-00902 is obviously an oscillating variable with an observed total V amplitude of about 0.04 mag. The spectrum presented in Fig. 2 suggests a spectral type of F0-F2 for the star. Therefore we conclude that GSC 02799-00902 could be a new δ Scuti variable.

To search for periodicity of the light variations, a Fourier analysis was performed by using the algorithm `Period98` (Sperl, 1998). The step-by-step amplitude spectra produced from the data are shown in Fig. 3. The Fourier analysis reveals a dominant pulsating frequency f_1 at 9.9046 c/d. Another frequency could be detected at $f_2 = 5.3804$ c/d, though the S/N ratio is relatively low. It seems that this star could be oscillating with multi-period. The main results of the frequency analysis are given in Table 1. With the 2-frequency model, a fitting to the observed light curve is made as shown in Fig. 1.

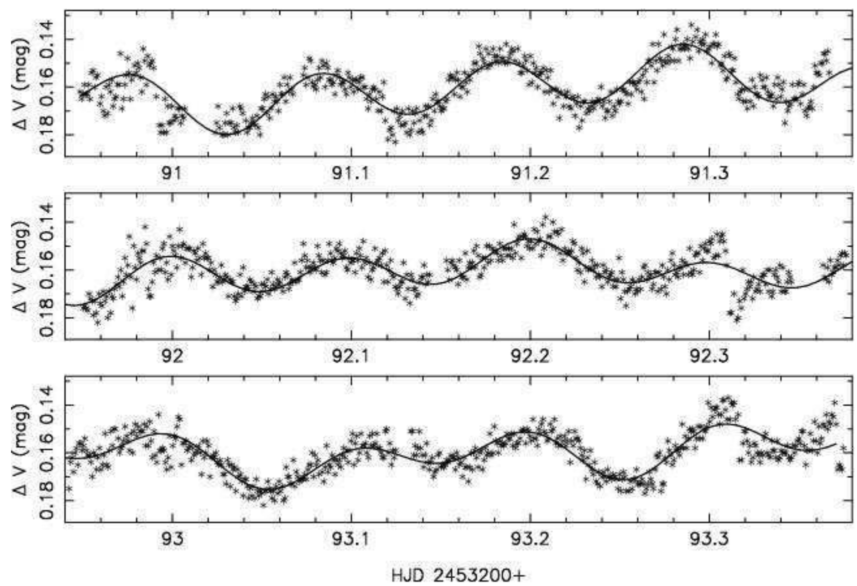

Figure 1. Observed V-band light curve of GSC 02799-00902, fitted with a 2-frequency model

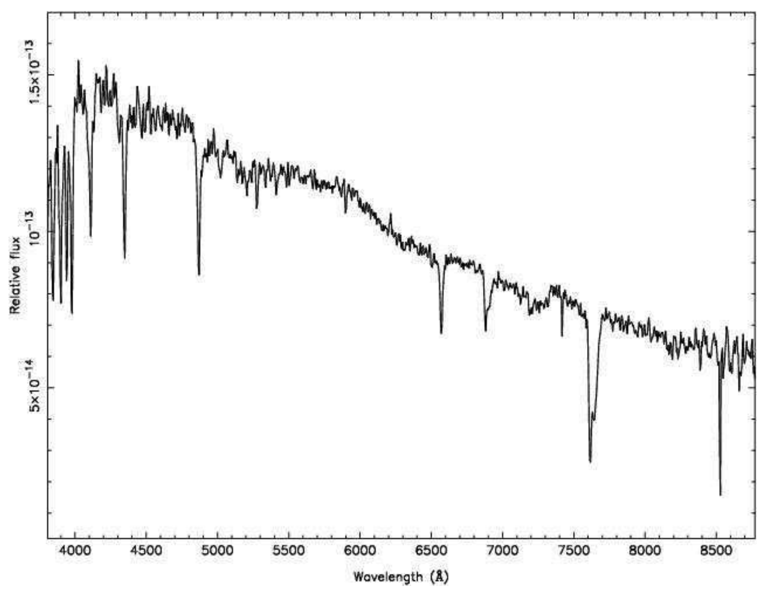

Figure 2. The 1-D spectrum of GSC 02799-00902

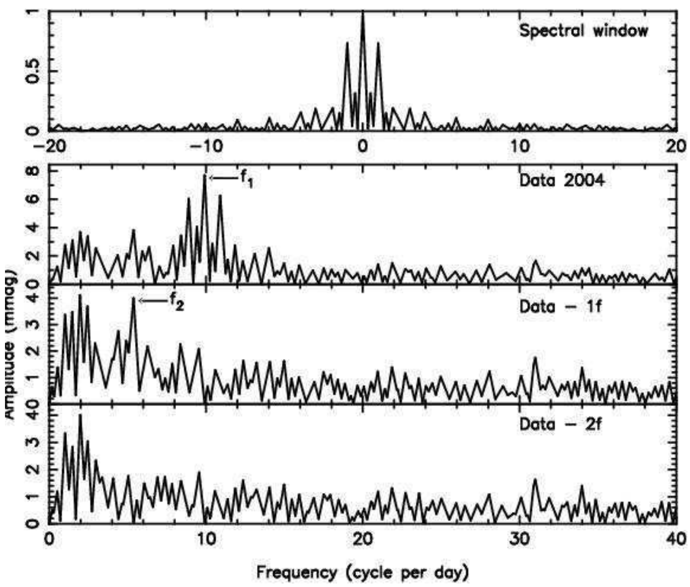

Figure 3. The spectral window and amplitude spectrum of GSC 02799-00902 photometric data

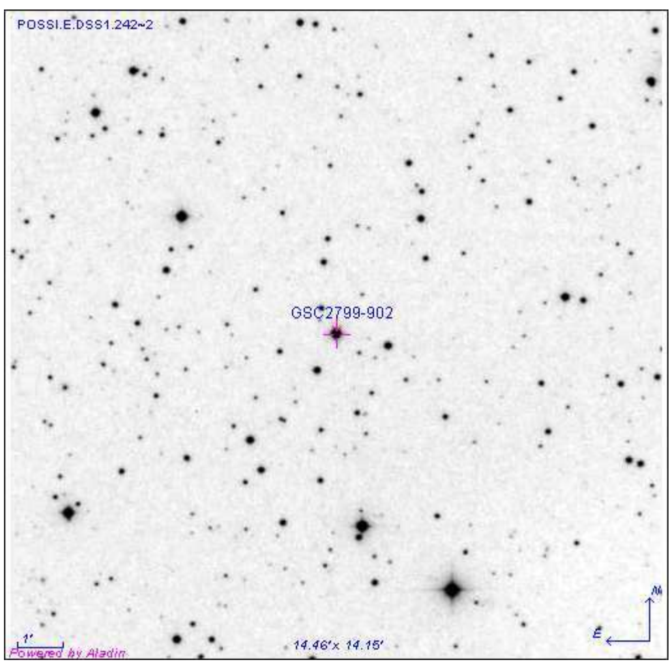

Table 1. Results of the frequency analysis

Name	Frequency (c/d)	Ampl./2 (mmag)	Phase	S/N
f_1	9.9046	7.84	0.5962629	8.4
f_2	5.3804	4.12	0.5564623	3.8

References:

Nelson, R.H., 2000, *IBVS*, No. 4840

Sperl, M., 1998, Manual for Period98 (V1.0.4). A period search-program for Windows and Unix, http://www.univie.ac.at/tops/Period98/

Zhang, X.B., Zhang, R.X., 2006, *New A.*, **11**, 339

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PHOTOELECTRIC MINIMA OF SELECTED ECLIPSING BINARIES AND MAXIMA OF PULSATING STARS

(BAV MITTEILUNGEN NO. 178)

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In this 55th compilation of BAV results, photoelectric observations obtained in the years 2005 till 2006 are presented on 915 variable stars giving 1722 minima and maxima. All moments of minima and maxima are heliocentric. The errors are tabulated in column '±'. The values in column '$O-C$' are determined without incorporation of non-linear terms. The references are given in the section 'Remarks'. All information about photometers and filters are specified in the column 'Rem'. The observations were made at private observatories. The photoelectric measurements and all the lightcurves with evaluations can be obtained from the office of the BAV for inspection.

Table 1: Eclipsing binaries

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
RT And	53661.3525	.0005	JU	−0.0074		GCVS 85		2)
	53716.3829	.0026	JU	−0.0083	s	GCVS 85		2)
TT And	53662.4564	.0006	RAT RCR	−0.0791		GCVS 85	-Ir	1)
WZ And	53658.5125	.0001	RAT RCR	+0.0358		GCVS 85	-Ir	1)
XZ And	53335.2573	.0002	MON	+0.1427		GCVS 85	V	1)
	53681.3712	.0003	JU	+0.1507		GCVS 85		2)
	53715.3055	.0002	RAT RCR	+0.1530		GCVS 85	-Ir	1)
AA And	53657.4414	.0003	AG	−0.0965		GCVS 85	-Ir	1)
AB And	53612.5591	.0019	PC	−0.0165		GCVS 85	-Ir	7)
	53613.5531	.0022	PC	−0.0182		GCVS 85	-Ir	7)
	53619.5285	.0022	PC	−0.0168		GCVS 85	-Ir	7)
	53631.4768	.0029	PC	−0.0166		GCVS 85	-Ir	7)
	53633.4678	.0006	JU	−0.0170		GCVS 85		2)
	53649.3968	.0016	PC	−0.0188		GCVS 85	-Ir	7)
	53656.3685	.0004	AG	−0.0169		GCVS 85	V	1)
	53656.5353	.0007	AG	−0.0160	s	GCVS 85	V	1)
AD And	53653.3470	.0010	JU	−0.0294		GCVS 85		2)
AP And	53618.4586	.0004	AG				-Ir	1)
	53660.5213	.0002	RAT RCR				-Ir	1)
BD And	49646.5962	.0013	MS	+0.0094		GCVS 85		1)
	49688.2583	.0013	MS	+0.0103		GCVS 85		1)
	49948.4109	.0013	MS	+0.0118		GCVS 85		1)
	49954.4298	.0013	MS	+0.0130		GCVS 85		1)
	50081.2650	.0008	MS	+0.0130		GCVS 85		1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
BD And	50346.5092	.0002	MS	+0.0142		GCVS 85		1)
	50380.3016	.0003	MS	+0.0147		GCVS 85		1)
	52955.4219	.0002	RAT RCR	+0.0095		GCVS 85	-Ir	1)
	53268.3486	.0001	MS FR	+0.0142		GCVS 85		6)
	53406.2942	.0017	SCI	+0.0150		GCVS 85		2)
BL And	53657.6266	.0040	AG	−0.0032		GCVS 85	-Ir	1)
DK And	52929.5210	.0007	MZ	−0.0002		BAVR 55,106ff	V	18)
DS And	53619.3284	.0006	DIE	+0.0013		GCVS 85		11)
	53706.2323	.0008	DIE	+0.0005		GCVS 85		11)
EP And	53612.5360	.0001	RAT RCR	+0.0694		GCVS 85	-Ir	1)
	53746.2958	.0002	WTR	+0.0696		GCVS 85	-Ir	12)
EX And	53618.5298	.0004	AG				-Ir	1)
GZ And	53701.2770	.0009	JU	−0.0049		GCVS 85		2)
LO And	53618.3704	.0007	AG	+0.0879	s	GCVS 85	-Ir	1)
	53618.5617	.0003	AG	+0.0888		GCVS 85	-Ir	1)
	53637.5844	.0002	RAT RCR	+0.0689		GCVS 85	-Ir	1)
	53655.4633	.0002	RAT RCR	+0.0477		GCVS 85	-Ir	1)
QW And	53662.2684	.0001	AG				-Ir	1)
	53662.5172	.0020	AG				-Ir	1)
QX And	53600.5261	.0004	RAT RCR				-Ir	1)
	53601.5559	.0003	RAT RCR				-Ir	1)
V376 And	53655.3697	.0080	JU					2)
V404 And	53683.3742	.0004	JU					2)
	53706.3588	.0008	JU					2)
AF Aps	53544.368	.002	HND				-Ir	19)
BH Aps	53923.378	.002	HND				-Ir	19)
CX Aqr	53681.3462	.0021	DIE	+0.0028		GCVS 85		11)
OO Aql	53173.5372	.0022	MON	+0.0286	s	GCVS 85	V	1)
	53530.5719	.0001	SIR	+0.0308		GCVS 85	-Ir	8)
	53609.3790	.0004	MON	+0.0323	s	GCVS 85	V	1)
V346 Aql	53548.4612	.0001	SIR	−0.0106		GCVS 85	-Ir	8)
V417 Aql	53648.2723	.0033	PC	−0.0513	s	BAVR 33,152ff	-Ir	7)
V609 Aql	53612.327	.001	RAT RCR	−0.040		GCVS 85	-Ir	1)
V640 Aql	49169.5463	.0013	MS	+0.0819		GCVS 85		1)
	49888.4686	.0012	MS	+0.1315	s	GCVS 85		1)
	49895.4832	.0017	MS	+0.1286		GCVS 85		1)
	49897.4461	.0011	MS	+0.1266	s	GCVS 85		1)
	49898.5709	.0013	MS	+0.1286	s	GCVS 85		1)
	49952.4479	.0013	MSR	+0.1112	s	GCVS 85		1)
	49997.3483	.0013	MS	+0.0996	s	GCVS 85		1)
	50667.4408	.0014	MS	−0.1195	s	GCVS 85		1)
	51432.3804	.0005	MS	−0.0874		GCVS 85		1)
V724 Aql	53921.4554	.0006	AG	−0.0240	s	IBVS 3555	-Ir	1)
V1341 Aql	53654.3613	.0010	QU				V	2)
V1355 Aql	53555.4517	.0005	AG				-Ir	1)
V1430 Aql	53621.3933	.0004	QU	−0.0055		AJ 119,2391	V	3)
	53635.3723	.0004	QU	−0.0061		AJ 119,2391	V	3)
	53653.2834	.0010	QU	−0.0063	s	AJ 119,2391	V	2)
	53918.4579	.0003	QU	−0.0068		AJ 119,2391	V	3)
V1542 Aql	53612.3523	.0005	WTR	+0.0040		IBVS 5161	-Ir	12)
	53613.3998	.0005	WTR	+0.0077	s	IBVS 5161	-Ir	12)
G472 Aql	53633.4375	.0010	QU				V	3)
	53635.3950	.0010	QU				V	3)
CU Ara	53572.404	.003	HND				-Ir	19)
	53576.562	.003	HND				-Ir	19)
RafV057 Ara	53152.391	.004	HND DVY					15)
SS Ari	53330.3190	.0004	MON	−0.0125		GCVS 85	V	1)
	53409.2829	.0014	ATB	−0.0144	s	GCVS 85		1)
	53681.2900	.0002	RAT RCR	−0.0230	s	GCVS 85	-Ir	1)
	53683.3202	.0003	DIE	−0.0228	s	GCVS 85		11)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
SS Ari	53707.2731	.0004	DIE	−0.0236	s	GCVS 85		11)
	53764.3131	.0006	MON	−0.0256		GCVS 85	V	1)
RY Aur	53426.4116	.0003	RAT RCR	+0.0270		GCVS 85	-Ir	1)
RZ Aur	53755.3392	.0006	AG	−0.1607		GCVS 85	-Ir	1)
	53764.3694	.0004	AG	−0.1624		GCVS 85	-Ir	1)
WW Aur	53759.2722	.0016	JU	−0.0005		GCVS 85		2)
ZZ Aur	53813.3343	.0002	AG	+0.0150		GCVS 85	-Ir	1)
AP Aur	53440.3615	.0011	JU	+0.0526	s	IBVS 3942		2)
	53745.5477	.0037	PC	+0.0573	s	IBVS 3942	-Ir	7)
BC Aur	53755.4890:	.0020	AG	−0.6651		GCVS 85	-Ir	1)
CG Aur	53411.3446	.0010	JU	−0.0005		GCVS 85		2)
	53716.3652	.0021	SCI	−0.0004		GCVS 85		2)
CL Aur	53764.4382	.0005	FR	+0.1123		GCVS 85	-Ir	10)
DO Aur	53769.2844	.0104	FR				-Ir	10)
EM Aur	53658.6012	.0018	MON	+0.0311	s	AA 54.207	V	1)
	53659.5118	.0020	MON	+0.0308		AA 54.207	V	1)
	53671.3383	.0062	FR	+0.0147	s	AA 54.207	-Ir	10)
EO Aur	53744.3353	.0080	JU	+0.0365		GCVS 85		2)
FN Aur	53764.3737	.0011	AG	−0.7076		GCVS 85	-Ir	1)
FO Aur	53765.5973	.0036	FR	−0.0778	s	GCVS 85	-Ir	10)
FP Aur	53755.3590	.0014	AG	−0.0690		GCVS 85	-Ir	1)
FW Aur	53762.4667	.0002	AG	−0.0410		GCVS 85	-Ir	1)
GX Aur	53750.5010	.0080	PC	+0.0429		BAVM 69	-Ir	7)
HU Aur	53683.4075	.0005	RAT RCR	−0.0261		GCVS 85	-Ir	1)
HW Aur	53632.6229	.0003	MS FR	+0.0148		IBVS 5016		6)
	53750.3625	.0058	PC	+0.0127		IBVS 5016	-Ir	7)
KU Aur	53335.3754	.0013	MON	+0.0252		GCVS 85	V	1)
	53360.4476	.0005	MON	+0.0254		GCVS 85	V	1)
	53633.5996	.0005	MON	+0.0250		GCVS 85	V	1)
	53715.4124	.0002	RAT RCR	+0.0240		GCVS 85	-Ir	1)
MO Aur	53765.5486	.0044	FR	+0.0886		BAVM 68	-Ir	10)
MU Aur	53765.3680	.0004	AG				-Ir	1)
NN Aur	50153.3582	.0003	AG					1)
	50488.4731	.0001	AG					1)
	51576.5111	.0003	AG					1)
	51576.5113	.0010	FR					9)
	51957.3251	.0002	AG					1)
	52253.2720	.0002	FR				-Ir	9)
	52279.3843	.0004	AG				-Ir	1)
	52340.3130	.0002	AG				-Ir	1)
	52651.4926	.0004	FR					9)
	52947.4392	.0010	AG					1)
	52947.4407	.0006	FR					10)
	52949.6148	.0006	AG					1)
	52949.6186	.0005	FR					10)
	53082.3540	.0010	AG				-Ir	1)
V364 Aur	53683.3554	.0002	MS FR					6)
V432 Aur	53377.3165	.0025	MON	−0.0013		IBVS 5319	V	1)
SS Boo	53862.5330	.0012	AG	+0.0303		GCVS 85	-Ir	1)
SU Boo	53534.4496	.0016	JU	+0.0229		GCVS 85		2)
TU Boo	53451.4464	.0002	RAT RCR	+0.0499		GCVS 85	-Ir	1)
	53519.5458	.0018	AG	+0.0490		GCVS 85	-Ir	1)
	53765.5145	.0003	MS FR	+0.0462	s	GCVS 85		1)
TY Boo	53450.5406	.0002	RAT RCR	−0.0151	s	BAVM 68	-Ir	1)
	53862.3554	.0001	AG	−0.0206		BAVM 68	-Ir	1)
	53862.5126	.0005	AG	−0.0220	s	BAVM 68	-Ir	1)
TZ Boo	53862.3726	.0012	AG	−0.0537	s	BAVM 68	-Ir	1)
	53862.5216	.0006	AG	−0.0533		BAVM 68	-Ir	1)
	53898.4775	.0003	AG	−0.0534		BAVM 68	-Ir	1)
UW Boo	53767.4834	.0020	MS FR	+0.4960		GCVS 85		6)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
YY Boo	53849.4673	.0020	AG	−0.1035		GCVS 85	-Ir	1)
AC Boo	53464.4246	.0002	RAT RCR	+0.0803		GCVS 85	-Ir	1)
	53541.4350	.0005	QU	−0.0914		GCVS 85	B	3)
	53566.4588	.0002	QU	−0.0900		GCVS 85	B	3)
	53620.3832	.0004	QU	−0.0873		GCVS 85	V	3)
	53895.4705	.0004	QU	−0.0712	s	GCVS 85	V	3)
	53898.4647	.0003	QU	−0.0727		GCVS 85	V	3)
	53901.4619	.0005	QU	−0.0711	s	GCVS 85	B	3)
AD Boo	53461.4575	.0004	RAT RCR	+0.0244		GCVS 85	-Ir	1)
	53522.4864	.0020	SCI	+0.0236		GCVS 85		2)
AR Boo	53351.5425	.0016	MS FR					6)
	53351.7109	.0002	MS FR					6)
	53463.4508	.0002	MS FR					6)
	53813.4999	.0018	AG				-Ir	1)
BG Boo	53509.5285	.0083	SCI					2)
	53510.4660	.0083	SCI					2)
BW Boo	53897.4777	.0017	JU	−0.0110		GCVS 85	-Ir	2)
CV Boo	52415.4396	.0010	MZ	−0.0091	s	BAVR 49,117	-Ir	3)
	53764.6989	.0005	MON	−0.0104	s	BAVR 49,117	V	1)
DU Boo	53509.4731	.0025	JU					2)
	53814.6006	.0031	SCI					2)
EF Boo	53911.4751	.0013	JU					2)
ET Boo	53860.4049	.0020	AG				-Ir	1)
EW Boo	53862.4740	.0048	AG				-Ir	1)
FY Boo	53813.4963	.0016	AG				-Ir	1)
	53813.6148	.0009	AG				-Ir	1)
GT Boo	53862.5191	.0018	AG				-Ir	1)
U1200-07442402 Boo	52722.3765	.0011	AG					1)
	52723.3911	.0022	AG					1)
	52724.4064	.0015	AG					1)
	52725.4133	.0021	AG					1)
	52726.4155:	.0034	AG					1)
	52730.4701	.0017	AG					1)
	52820.5252	.0012	AG					1)
	52858.4779	.0001	AG					1)
	53110.4247	.0025	AG					1)
	53151.4015	.0030	AG					1)
Y Cam	53867.4840	.0009	AG	+0.3015		GCVS 85	-Ir	1)
AK Cam	53867.4460	.0006	AG	+0.0217		BAVM 69	-Ir	1)
AO Cam	53760.3358	.0007	JU	−0.0200		GCVS 85		2)
AT Cam	53767.3818	.0035	JU	−0.0197		BAVR 32, 36ff		2)
FN Cam	53846.3928	.0005	AG				-Ir	1)
TX Cnc	53408.4319	.0002	RAT RCR	+0.0343	s	GCVS 85	-Ir	1)
WW Cnc	53752.5475	.0024	PC	−0.0649		BAVR 32, 36ff	-Ir	7)
XZ Cnc	53764.4691	.0090	HMB				V	4)
	53764.4692	.0040	HMB				C	4)
	53764.4795	.0050	HMB				Rs	4)
	53807.3556	.0050	HMB				C	4)
	53807.3566	.0080	HMB				Rs	4)
	53807.3727	.0090	HMB				V	4)
	53808.4237	.0030	HMB				C	4)
	53808.4272	.0040	HMB				Rs	4)
	53808.4352	.0040	HMB				V	4)
YY Cnc	53453.4057	.0015	RAT RCR				-Ir	1)
FF Cnc	53815.4456	.0005	FR	−0.1455	s	IBVS 3859	-Ir	10)
HN Cnc	53406.2904	.0006	MS FR	−0.0041	s	IBVS 5260		6)
	53463.4055	.0002	PRK	−0.0053		IBVS 5260		2)
GSC1927.862 Cnc	53464.4323	.0002	PRK					2)
	53721.4698	.0004	QU				V	2)
	53765.3723	.0005	QU				V	2)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
RV CVn	53534.4131	.0017	SCI					2)
RY CMi	53765.4132	.0001	AG	−0.2439		BAVM 127	-Ir	1)
TT CMi	53768.5081	.0010	AG				-Ir	1)
TU CMi	53768.4826	.0016	AG				-Ir	1)
TX CMi	53768.3487	.0009	AG				-Ir	1)
	53768.5416	.0011	AG				-Ir	1)
XZ CMi	53813.3672	.0003	AG	−0.0107		GCVS 85	-Ir	1)
AC CMi	53408.3559	.0002	RAT RCR	+0.1566	s	GCVS 85	-Ir	1)
AK CMi	53768.5511	.0021	AG	+0.2771		GCVS 85	-Ir	1)
BB CMi	53813.4106	.0006	AG	−0.0860		GCVS 85	-Ir	1)
BF CMi	53768.4321	.0017	AG				-Ir	1)
CX CMi	51924.4334	.0004	MS FR	+0.0001		IBVS 5366		6)
	51965.3861	.0001	MS FR	+0.0010	s	IBVS 5366		6)
	53673.5785	.0004	MS FR	−0.0029		IBVS 5366		6)
TW Cas	53633.4997	.0024	SCI	−0.0166		GCVS 85		2)
	53746.3402	.0005	QU	−0.0137		GCVS 85	V	2)
ZZ Cas	53653.4972	.0008	AG	−0.0162		GCVS 85	-Ir	1)
	53660.3368	.0010	AG	−0.0160	s	GCVS 85	-Ir	1)
AT Cas	53660.2965	.0011	AG				-Ir	1)
AX Cas	53215.3644	.0002	MS FR	−0.0771		GCVS 85		6)
BH Cas	53717.3954	.0020	AG				-Ir	1)
BS Cas	53745.4799	.0056	PC	−0.0140		IBVS 4778	-Ir	7)
BW Cas	53670.3797	.0010	JU					2)
CW Cas	53652.3711	.0001	RAT RCR	+0.0516		GCVS 85	-Ir	1)
	53660.3435	.0005	AG	+0.0529		GCVS 85	-Ir	1)
	53660.5028	.0009	AG	+0.0528	s	GCVS 85	-Ir	1)
	53660.6620	.0006	AG	+0.0526		GCVS 85	-Ir	1)
	53675.3292	.0001	RAT RCR	+0.0529		GCVS 85	-Ir	1)
DN Cas	53657.4062	.0035	JU	−0.0249		GCVS 85		2)
DO Cas	53632.5148	.0031	SCI	−0.0022		GCVS 85		2)
DZ Cas	53656.4984	.0028	AG	−0.1567	s	GCVS 85	-Ir	1)
EN Cas	53673.2776	.0014	MS FR	+0.2779		GCVS 85		6)
EP Cas	53656.4759	.0020	AG	−0.0348	s	GCVS 85	-Ir	1)
GU Cas	53613.4901	.0003	QU	−0.3063		GCVS 85	V	3)
IS Cas	53653.3125	.0026	AG	+0.0585		GCVS 85	-Ir	1)
KL Cas	53654.2978	.0018	AG	−0.0142	s	GCVS 85	-Ir	1)
KR Cas	53654.3712	.0023	AG	−0.1428		GCVS 85	-Ir	1)
MM Cas	53654.4119	.0034	AG	+0.0203		BAVR 32, 36ff	-Ir	1)
MN Cas	53654.5697	.0010	AG	+0.0194	s	GCVS 85	-Ir	1)
	53659.3537	.0044	AG	+0.0111		GCVS 85	-Ir	1)
MR Cas	53220.5596	.0008	MS FR					6)
MS Cas	53653.4542	.0146	AG				-Ir	1)
	53717.3739	.0009	AG				-Ir	1)
	53768.3888	.0021	AG				-Ir	1)
MT Cas	53759.3698	.0022	AG				-Ir	1)
MV Cas	53660.3515	.0011	AG				-Ir	1)
NN Cas	53654.5647	.0018	AG				-Ir	1)
NU Cas	53671.5382	.0002	AG				-Ir	1)
OR Cas	53660.3375	.0012	AG	−0.0197		GCVS 85	-Ir	1)
	53671.5495	.0016	AG	−0.0191		GCVS 85	-Ir	1)
OX Cas	53671.5437	.0018	AG	+0.0029		GCVS 85	-Ir	1)
PV Cas	53661.3827	.0003	QU	+0.0318	s	AA 54.207	V	3)
QQ Cas	53768.3251	.0012	AG	+0.0965	s	BAVR 35, 1ff	-Ir	1)
V336 Cas	53768.4501	.0022	AG				-Ir	1)
V350 Cas	53657.4335	.0017	AG				-Ir	1)
V359 Cas	53656.4147	.0011	AG	−0.0110		IBVS 5016	-Ir	1)
V360 Cas	53613.5771	.0090	PC				-Ir	7)
	53619.5793	.0101	PC				-Ir	7)
V361 Cas	53656.3510	.0017	AG	−0.1892		GCVS 85	-Ir	1)
V364 Cas	53662.5174	.0005	AG	−0.0219	s	GCVS 85	-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V366 Cas	53656.5723	.0003	RAT RCR	−0.0882		IBVS 4798	-Ir	1)
	53671.5226	.0008	AG	−0.0880	s	IBVS 4798	-Ir	1)
V368 Cas	53764.3400	.0080	JU	−0.0354		GCVS 85		2)
V375 Cas	53653.4421	.0057	AG	+0.1779		BAVR 32, 36ff	-Ir	1)
V389 Cas	53662.3582	.0011	AG	+0.2074		GCVS 85	-Ir	1)
	53672.3393	.0002	MS FR	+0.2095		GCVS 85		6)
V411 Cas	53759.4058	.0015	AG				-Ir	1)
V445 Cas	53697.2575	.0002	MS FR	−0.0137		BAVM 69		6)
V449 Cas	53654.5437	.0018	AG				-Ir	1)
V471 Cas	53716.2534	.0006	AG	−0.0194		GCVS 85	-Ir	1)
	53716.4534	.0004	AG	+0.0126	s	GCVS 85	-Ir	1)
	53716.6523	.0005	AG	+0.0435		GCVS 85	-Ir	1)
V473 Cas	53636.5087	.0016	AG	−0.0132		IBVS 4669	-Ir	1)
	53651.4642	.0005	AG	−0.0143		IBVS 4669	-Ir	1)
	53654.3736	.0005	AG	−0.0131		IBVS 4669	-Ir	1)
	53654.5809	.0017	AG	−0.0135	s	IBVS 4669	-Ir	1)
	53659.3583	.0011	AG	−0.0139		IBVS 4669	-Ir	1)
	53659.5653	.0033	AG	−0.0147	s	IBVS 4669	-Ir	1)
	53716.2768	.0007	AG	−0.0135		IBVS 4669	-Ir	1)
	53716.4858	.0019	AG	−0.0123	s	IBVS 4669	-Ir	1)
	53716.6921	.0007	AG	−0.0137		IBVS 4669	-Ir	1)
V520 Cas	53656.5173	.0015	AG	+0.0462	s	GCVS 85	-Ir	1)
V523 Cas	53648.5080	.0016	PC	−0.0502	s	GCVS 85	-Ir	7)
	53648.6237	.0017	PC	−0.0513		GCVS 85	-Ir	7)
	53650.3771	.0001	RAT RCR	−0.0506	s	GCVS 85	-Ir	1)
	53661.4767	.0001	RAT RCR	−0.0513		GCVS 85	-Ir	1)
	53661.5948	.0002	RAT RCR	−0.0501	s	GCVS 85	-Ir	1)
	53662.2965	.0021	AG	−0.0494	s	GCVS 85	-Ir	1)
	53662.4097	.0066	AG	−0.0531		GCVS 85	-Ir	1)
	53662.5295	.0007	AG	−0.0501	s	GCVS 85	-Ir	1)
	53745.2570	.0017	PC	−0.0491	s	GCVS 85	-Ir	7)
	53745.3730	.0019	PC	−0.0500		GCVS 85	-Ir	7)
	53745.4916	.0024	PC	−0.0482	s	GCVS 85	-Ir	7)
V541 Cas	53650.5248	.0002	RAT RCR	+0.0270	s	GCVS 85	-Ir	1)
V702 Cas	53652.4537	.0021	AG				-Ir	1)
U1425-02081650 Cas	53382.3901	.0005	AG				-Ir	1)
	53388.3683	.0017	AG				-Ir	1)
	53388.5297	.0018	AG				-Ir	1)
	53409.3823	.0013	AG				-Ir	1)
	53716.3454	.0005	AG				-Ir	1)
	53716.5052	.0003	AG				-Ir	1)
	53716.6642	.0013	AG				-Ir	1)
GSC3679.1920 Cas	53636.5414	.0002	AG				-Ir	1)
	53651.3058	.0003	AG				-Ir	1)
	53654.5008	.0010	AG				-Ir	1)
	53659.2893	.0012	AG				-Ir	1)
	53716.3656	.0015	AG				-Ir	1)
GSC3675.1186 Cas	51867.3498	.0008	AG					1)
	51867.4964	.0007	AG					1)
	51867.6458	.0015	AG					1)
	52171.4348	.0012	AG					1)
	52179.303 :	.001	AG					1)
	52179.449 :	.004	AG					1)
	52183.4626	.0017	AG					1)
	52183.6054	.0017	AG					1)
	52193.4171	.0006	AG					1)
	52193.5635	.0008	AG					1)
	52205.2993	.0007	AG					1)
	52224.4639	.0013	AG					1)
	52224.6100	.0011	AG					1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
GSC3675.1186 Cas	52308.3953	.0005	AG				-Ir	1)
	52618.271	.001	AG				-Ir	1)
	52618.4176	.0006	AG				-Ir	1)
	52618.5681	.0008	AG				-Ir	1)
	52898.4343	.0007	AG				-Ir	1)
	52898.5821	.0016	AG				-Ir	1)
	53382.2620	.0002	AG				-Ir	1)
	53382.4098	.0013	AG				-Ir	1)
	53388.3500	.0010	AG				-Ir	1)
	53388.4992	.0008	AG				-Ir	1)
	53409.2992	.0008	AG				-Ir	1)
	53636.4324	.0024	AG				-Ir	1)
	53636.5836	.0002	AG				-Ir	1)
	53651.4393	.0020	AG				-Ir	1)
	53651.5855	.0017	AG				-Ir	1)
	53654.4094	.0012	AG				-Ir	1)
	53654.5535	.0015	AG				-Ir	1)
	53659.3089	.0014	AG				-Ir	1)
	53659.4604	.0012	AG				-Ir	1)
	53659.6041	.0019	AG				-Ir	1)
	53716.3542	.0008	AG				-Ir	1)
	53716.5032	.0003	AG				-Ir	1)
	53716.6482	.0012	AG				-Ir	1)
GSC4030.2020 Cas	53215.4410	.0004	MS FR					6)
	53215.5786	.0004	MS FR					6)
	53254.4031	.0002	MS FR					6)
	53637.4522	.0002	MS FR					6)
SV Cen	53886.307	.002	HND					4)
VW Cep	53612.4447	.0075	PC	−0.0111	s	GCVS 85	-Ir	7)
	53648.3452	.0044	PC	−0.0132	s	GCVS 85	-Ir	7)
WW Cep	53683.5828	.0007	AG	+0.0001		IBVS 4131	-Ir	1)
WZ Cep	53657.3424	.0001	WTR	−0.0636	s	GCVS 85	-Ir	12)
	53672.3705	.0003	WTR	−0.0636	s	GCVS 85	-Ir	12)
DW Cep	53639.3021	.0005	AG	+0.4240		GCVS 85	-Ir	1)
EG Cep	53933.4229	.0001	DIE	+0.0139		GCVS 85		19)
EK Cep	53614.4469	.0041	PC	+0.0073		GCVS 85	-Ir	7)
	53683.2620:	.0010	AG	−0.0076	s	GCVS 85	-Ir	1)
EO Cep	49939.5599	.0008	MS	+0.1644	s	GCVS 85		1)
	49940.4658	.0006	MS	+0.1535		GCVS 85		1)
	50048.6562	.0007	MS	+0.1581		GCVS 85		1)
	50314.5272	.0004	MS	+0.1487		GCVS 85		1)
	50679.4204	.0009	MS	+0.1439		GCVS 85		1)
	53257.5076	.0002	MS FR	+0.1080		GCVS 85		6)
IM Cep	53635.3370	.0004	MS FR					6)
	53671.2772	.0003	MS FR					6)
IP Cep	53683.4691	.0026	AG	−0.0091	s	IBVS 5016	-Ir	1)
LP Cep	53544.4710	.0004	AG				-Ir	1)
NN Cep	53934.4529	.0050	JU	+0.0127		GCVS 85		2)
NS Cep	53639.6134	.0011	AG	+0.1299	s	GCVS 85	-Ir	1)
V338 Cep	53544.4962	.0017	AG	+0.0259		GCVS 85	-Ir	1)
RW Com	53464.3613	.0001	RAT RCR	−0.0214	s	GCVS 85	-Ir	1)
	53840.4377	.0006	JU	−0.0196		GCVS 85		2)
	53863.3423	.0011	FR	−0.0188	s	GCVS 85	-Ir	10)
	53863.4600	.0005	FR	−0.0198		GCVS 85	-Ir	10)
	53863.5800	.0010	FR	−0.0185	s	GCVS 85	-Ir	10)
UX Com	53768.4843	.0005	MS FR	−0.0776		BAVM 69		6)
CC Com	53446.4060	.0001	RAT RCR	−0.0125	s	GCVS 85	-Ir	1)
	53818.3717	.0004	DIE	−0.0135		GCVS 85		11)
	53847.3921	.0001	WTR	−0.0134	s	GCVS 85	-Ir	12)
EK Com	53406.6017	.0001	RAT RCR				-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
EK Com	53408.6027	.0002	RAT RCR				-Ir	1)
EQ Com	53462.4654	.0004	MS FR					6)
LO Com	53450.4120	.0004	RAT RCR				-Ir	1)
	53863.3444	.0003	FR				-Ir	10)
	53863.4874	.0015	FR				-Ir	10)
LP Com	53845.3888	.0019	JU					2)
	53863.4641	.0022	FR				-Ir	10)
NSV5740 Com	53863.4106	.0012	FR				-Ir	10)
RW CrB	53446.4878	.0004	RAT RCR	−0.0080		GCVS 85	-Ir	1)
	53859.4583	.0043	FR	−0.0024	s	GCVS 85	-Ir	10)
TU CrB	53408.5173	.0017	MS FR					6)
TW CrB	53463.4983	.0001	RAT RCR	+0.0051		SAC 70	-Ir	1)
YY CrB	53919.4113	.0010	JU					2)
	53931.4598	.0024	JU					2)
UW Cyg	53614.5040	.0001	RAT RCR	+0.0238		GCVS 85	-Ir	1)
	53928.5256	.0009	AG	+0.0244		GCVS 85	-Ir	1)
VV Cyg	53601.4970	.0007	AG	+0.0047		GCVS 85	-Ir	1)
	53621.4464	.0022	AG	+0.0139	s	GCVS 85	-Ir	1)
WZ Cyg	53612.4780	.0038	PC	+0.0580		GCVS 85	-Ir	7)
ZZ Cyg	53612.3577	.0003	AG	−0.0445		GCVS 85	-Ir	1)
	53637.5028	.0006	AG	−0.0441		GCVS 85	-Ir	1)
	53901.5207	.0004	AG	−0.0451		GCVS 85	-Ir	1)
AE Cyg	53671.3843	.0010	SCI	−0.0053		GCVS 85		2)
BO Cyg	53220.5825	.0014	MON	+0.0914		GCVS 85	V	1)
CV Cyg	53636.5237	.0056	SCI	+0.0065		AA 54.207		2)
DK Cyg	53600.4554	.0004	RAT RCR	+0.0433	s	BAVR 35, 1ff	-Ir	1)
	53637.4063	.0015	JU	+0.0449		BAVR 35, 1ff		2)
DX Cyg	53227.5392	.0006	FR				-Ir	10)
GG Cyg	53656.4096	.0005	RAT RCR	+0.1234		GCVS 85	-Ir	1)
	53656.4103	.0015	FR	+0.1241		GCVS 85	-Ir	10)
	53658.4057	.0036	SCI	+0.1112		GCVS 85		2)
	53658.4143	.0007	AG	+0.1198		GCVS 85	-Ir	1)
	53660.4218	.0008	AG	+0.1189		GCVS 85	-Ir	1)
KR Cyg	53601.4563	.0041	PC	+0.0116		GCVS 85	-Ir	7)
	53639.4865	.0014	AG	+0.0100		GCVS 85	-Ir	1)
MY Cyg	53661.2630:	.0010	AG	−0.0056		GCVS 85	-Ir	1)
	53673.2849	.0013	SCI	+0.0008		GCVS 85		2)
NZ Cyg	53555.4420	.0010	AG				-Ir	1)
	53614.5076	.0029	SCI					2)
PV Cyg	53619.5236	.0020	SCI					2)
QW Cyg	53555.4445	.0013	AG				-Ir	1)
QX Cyg	53612.5263	.0037	SCI					2)
V345 Cyg	51032.5716	.0021	FR	+0.0022		IBVS 5016		9)
	53639.4754	.0012	AG	+0.0265		IBVS 5016	-Ir	1)
	53662.3041	.0033	SCI	+0.0243		IBVS 5016		2)
V346 Cyg	53655.3472	.0007	AG	+0.1001		GCVS 85	-Ir	1)
	53921.4536	.0010	AG	+0.1081		GCVS 85	-Ir	1)
V370 Cyg	53534.5097	.0006	FR	−0.0193		GCVS 85	-Ir	10)
	53593.3736	.0008	WTR	−0.0208		GCVS 85	-Ir	12)
	53639.4615	.0036	FR	−0.0182	s	GCVS 85	-Ir	10)
	53650.3119	.0002	AG	−0.0114	s	GCVS 85	-Ir	1)
	53656.4974	.0012	FR	−0.0223	s	GCVS 85	-Ir	10)
	53657.2719	.0012	FR	−0.0223	s	GCVS 85	-Ir	10)
V382 Cyg	53655.3070:	.0050	AG	+0.0628	s	GCVS 85	-Ir	1)
V401 Cyg	53517.5235	.0003	AG	+0.0471	s	GCVS 85	-Ir	1)
	53578.4199	.0023	AG	+0.0491		GCVS 85	-Ir	1)
	53613.3802	.0017	AG	+0.0460		GCVS 85	-Ir	1)
	53655.3377	.0002	RAT RCR	+0.0476		GCVS 85	-Ir	1)
	53661.4599	.0016	FR	+0.0512	s	GCVS 85	-Ir	10)
V443 Cyg	53619.5287	.0003	RAT RCR				-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V453 Cyg	53662.426	.002	FR				-Ir	10)
V454 Cyg	53655.2350:	.0010	AG				-Ir	1)
V463 Cyg	53519.5221	.0005	AG	−0.0011		AA 54.207	-Ir	1)
	53660.307	.007	FR	−0.064	s	AA 54.207	-Ir	10)
V466 Cyg	53621.5057	.0014	AG	+0.0048	s	GCVS 85	-Ir	1)
	53637.5097	.0015	AG	+0.0058		GCVS 85	-Ir	1)
	53656.2953	.0018	FR	+0.0053	s	GCVS 85	-Ir	10)
	53658.3831	.0015	AG	+0.0057		GCVS 85	-Ir	1)
	53660.4725	.0015	AG	+0.0078	s	GCVS 85	-Ir	1)
V469 Cyg	53656.2778	.0021	SCI					2)
	53921.4072	.0011	AG				-Ir	1)
V477 Cyg	53561.4780	.0030	JU	+0.6963		AA 54.207		2)
	53612.4164	.0052	PC	+0.0010		AA 54.207	-Ir	7)
	53655.3644	.0008	AG	+0.7033		AA 54.207	V	1)
V488 Cyg	53618.4404	.0011	AG	+0.0767	s	GCVS 85	-Ir	1)
	53636.3782	.0003	FR	+0.0781	s	GCVS 85	-Ir	10)
	53639.4608	.0011	AG	+0.0779		GCVS 85	-Ir	1)
V490 Cyg	53660.3244	.0005	AG				-Ir	1)
V493 Cyg	53655.2922	.0022	AG	+0.1078		GCVS 85	-Ir	1)
	53660.3888	.0014	AG	+0.1041		GCVS 85	-Ir	1)
	53920.5081	.0025	AG	+0.1065		GCVS 85	-Ir	1)
V496 Cyg	53600.4092	.0024	SCI					2)
V502 Cyg	53928.4670:	.0020	AG				-Ir	1)
V508 Cyg	53579.3945	.0003	AG				-Ir	1)
	53612.5275	.0009	AG				-Ir	1)
	53621.4931	.0008	AG				-Ir	1)
	53637.4756	.0013	AG				-Ir	1)
V509 Cyg	53621.5846	.0019	AG				-Ir	1)
V513 Cyg	53565.4433	.0008	JU	−0.3234		GCVS 85		2)
	53657.3330	.0035	SCI	−0.3228		GCVS 85		2)
V519 Cyg	53601.4683	.0009	AG				-Ir	1)
	53621.4022	.0012	AG				-Ir	1)
V526 Cyg	53601.4359	.0011	AG	+0.0464		GCVS 85	-Ir	1)
	53622.4063	.0033	AG	+0.0480		GCVS 85	-Ir	1)
V534 Cyg	53619.4066	.0018	AG				-Ir	1)
V587 Cyg	53619.5305	.0012	AG				-Ir	1)
	53621.4891	.0019	AG				-Ir	1)
V628 Cyg	53619.4272	.0087	AG	−0.0053	s	IBVS 4381	-Ir	1)
	53631.5121	.0004	RAT RCR	−0.0028		IBVS 4381	-Ir	1)
V680 Cyg	53618.5660	.0002	RAT RCR	+0.0191		BAVR 32, 36ff	-Ir	1)
V687 Cyg	53519.4213	.0013	AG	−0.0077		GCVS 85	-Ir	1)
	53613.3298	.0006	AG	+0.0031		GCVS 85	-Ir	1)
V700 Cyg	53648.3030	.0037	PC	−0.0235		GCVS 85	-Ir	7)
	53657.3129	.0002	RAT RCR	−0.0248	s	GCVS 85	-Ir	1)
V704 Cyg	53622.3854	.0027	AG	+0.0305		GCVS 85	-Ir	1)
V726 Cyg	53817.5851	.0004	MS FR					6)
V787 Cyg	53901.4612	.0004	AG	+0.0028		GCVS 85	-Ir	1)
V822 Cyg	53658.2974	.0024	AG	−0.1417		GCVS 85	-Ir	1)
V824 Cyg	53658.3893	.0014	AG				-Ir	1)
V836 Cyg	53927.4402	.0015	AG	+0.0147		GCVS 85	-Ir	1)
V841 Cyg	53517.4066	.0027	AG	+0.0070	s	GCVS 85	-Ir	1)
	53614.4541	.0015	AG	+0.0096		GCVS 85	-Ir	1)
V856 Cyg	53516.5277	.0002	AG				-Ir	1)
	53614.3415	.0010	AG				-Ir	1)
V859 Cyg	53517.4520	.0011	AG	−0.0087		GCVS 85	-Ir	1)
	53519.4766	.0005	RAT RCR	−0.0091		GCVS 85	-Ir	1)
	53612.4268	.0014	AG	−0.0067	s	GCVS 85	-Ir	1)
V865 Cyg	53516.4996	.0001	AG				-Ir	1)
V869 Cyg	53620.5015	.0011	AG				-Ir	1)
V870 Cyg	53613.4446	.0012	AG				-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V874 Cyg	53613.3919	.0018	AG				-Ir	1)
V880 Cyg	53519.4017	.0124	AG				-Ir	1)
	53601.5559	.0031	SCI					2)
V884 Cyg	53578.4451	.0022	AG				-Ir	1)
	53620.4490	.0015	AG				-Ir	1)
V885 Cyg	53549.4497	.0004	AG	−0.0857	s	GCVS 85	-Ir	1)
	53661.3234	.0007	FR	−0.0685	s	GCVS 85	-Ir	10)
V887 Cyg	53661.3926	.0080	FR					9)
V909 Cyg	53611.5038	.0002	AG	−0.0198		BAVR 47, 2f	-Ir	1)
	53621.3293	.0006	WTR	−0.0131	s	BAVR 47, 2f	-Ir	12)
V912 Cyg	53620.3547	.0002	AG	−0.0973		GCVS 85	-Ir	1)
	53658.2770	.0015	AG	−0.0980		GCVS 85	-Ir	1)
	53658.2780	.0006	RAT RCR	−0.0970		GCVS 85	-Ir	1)
V931 Cyg	53578.4719	.0019	AG	−0.0434	s	GCVS 85	-Ir	1)
	53602.3761	.0005	AG	−0.0436	s	GCVS 85	-Ir	1)
	53613.4755	.0026	AG	−0.0426		GCVS 85	-Ir	1)
	53681.2624	.0017	SCI	−0.0418	s	GCVS 85		2)
V932 Cyg	53659.3722	.0011	AG				-Ir	1)
V934 Cyg	53516.4601	.0009	AG	−0.0716		GCVS 85	-Ir	1)
	53578.4716	.0009	AG	−0.0720	s	GCVS 85	-Ir	1)
	53613.5064	.0023	AG	−0.0722	s	GCVS 85	-Ir	1)
V941 Cyg	53569.4677	.0015	AG				-Ir	1)
	53578.4323	.0010	AG				-Ir	1)
	53612.4781	.0017	AG				-Ir	1)
	53621.4377	.0020	AG				-Ir	1)
V947 Cyg	53660.3590	.0008	FR				-Ir	10)
V957 Cyg	50189.5694	.0013	MS	+0.1205		GCVS 85		1)
	53661.3301	.0012	AG	+0.1534	s	GCVS 85	-Ir	1)
V961 Cyg	53639.2822	.0018	FR	+0.9314	s	GCVS 85	-Ir	10)
	53650.4910	.0008	AG	+0.9424		GCVS 85	-Ir	1)
	53920.5015	.0008	AG	−0.0754		GCVS 85	-Ir	1)
V963 Cyg	53519.4764	.0007	AG	−0.0005		GCVS 85	-Ir	1)
	53549.4611	.0007	AG	−0.0012		GCVS 85	-Ir	1)
	53637.3265	.0004	RAT RCR	+0.0001		GCVS 85	-Ir	1)
	53658.2450	.0008	AG	−0.0014		GCVS 85	-Ir	1)
	53660.3378	.0002	RAT RCR	−0.0006		GCVS 85	-Ir	1)
	53660.3379	.0004	FR	−0.0005		GCVS 85	-Ir	10)
V964 Cyg	53618.4732	.0014	AG				-Ir	1)
	53657.4274	.0012	FR				-Ir	10)
V965 Cyg	53549.4917	.0034	AG				-Ir	1)
	53658.3901	.0004	AG				-Ir	1)
V974 Cyg	53635.3598	.0013	FR	−0.1142	s	GCVS 85	-Ir	10)
	53656.2815	.0003	FR	−0.1431		GCVS 85	-Ir	10)
V975 Cyg	53660.3599	.0008	AG				-Ir	1)
V979 Cyg	53534.4593	.0010	FR	+0.0376		GCVS 85	-Ir	10)
	53656.2856	.0043	FR	+0.0354		GCVS 85	-Ir	10)
	53656.4696	.0024	FR	+0.0325	s	GCVS 85	-Ir	10)
V1004 Cyg	53620.5218	.0007	AG	−0.1472	s	GCVS 85	-Ir	1)
	53621.5583	.0004	AG	−0.1393		GCVS 85	-Ir	1)
	53637.3239	.0020	AG	−0.1448		GCVS 85	-Ir	1)
	53660.3012	.0025	AG	−0.1384	s	GCVS 85	-Ir	1)
	53661.3222	.0009	AG	−0.1460		GCVS 85	-Ir	1)
	53661.3233	.0007	RAT RCR	−0.1449		GCVS 85	-Ir	1)
	53662.3499	.0023	FR	−0.1468	s	GCVS 85	-Ir	10)
V1009 Cyg	53659.2835	.0004	AG				-Ir	1)
V1023 Cyg	50682.5985	.0018	FR				-Ir	9)
	53661.3337	.0018	AG				-Ir	1)
V1034 Cyg	53612.3987	.0072	PC	−0.0084		GCVS 85	-Ir	7)
	53614.3547	.0022	FR	−0.0063		GCVS 85	-Ir	10)
	53636.3591	.0022	FR	+0.0172	s	GCVS 85	-Ir	10)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V1034 Cyg	53655.3866	.0012	AG	−0.0055		GCVS 85	V	1)
V1066 Cyg	53619.3491	.0029	AG				-Ir	1)
	53622.4487	.0016	AG				-Ir	1)
V1083 Cyg	53611.4820	.0038	SCI	−0.0630		GCVS 85		2)
V1136 Cyg	53899.4658	.0010	AG	+0.0763		GCVS 85	-Ir	1)
V1147 Cyg	53534.4634	.0002	FR				-Ir	10)
	53656.4776	.0040	FR				-Ir	10)
V1171 Cyg	50702.3652	.0086	FR	+0.6834		GCVS 85		9)
	53621.4903	.0029	SCI	−0.0529		GCVS 85		2)
V1191 Cyg	53612.4622	.0062	PC	+0.0614		GCVS 85	-Ir	7)
V1193 Cyg	53639.4604	.0009	AG				-Ir	1)
V1256 Cyg	53517.3797	.0008	AG				-Ir	1)
	53578.4425	.0016	AG				-Ir	1)
	53614.3828	.0021	AG				-Ir	1)
V1356 Cyg	53569.3926	.0010	AG	+0.0954		GCVS 85	-Ir	1)
	53611.4650	.0014	FR	+0.0989	s	GCVS 85	-Ir	10)
	53612.4582	.0007	FR	+0.1138		GCVS 85	-Ir	10)
	53659.4118	.0026	AG	+0.1068		GCVS 85	-Ir	1)
	53661.3759	.0037	AG	+0.1142		GCVS 85	-Ir	1)
	53661.3773	.0063	SCI	+0.1156		GCVS 85		2)
V1417 Cyg	53716.2493	.0010	SCI					2)
V1425 Cyg	53920.4691	.0038	JU	+0.0074		GCVS 85		2)
V2150 Cyg	53600.4884	.0095	JU					2)
V2181 Cyg	53618.6082	.0002	AG	+0.0079		BAVR 50, 45f	-Ir	1)
	53621.4738	.0013	AG	+0.0061		BAVR 50, 45f	-Ir	1)
	53636.3873	.0004	FR	+0.0090		BAVR 50, 45f	-Ir	10)
	53654.4569	.0014	FR	+0.0140	s	BAVR 50, 45f	-Ir	10)
V2239 Cyg	53655.4754	.0022	AG				-Ir	1)
V2240 Cyg	53655.4463	.0024	AG				-Ir	1)
GCS3576.170 Cyg	52802.5543	.0010	QU				-Ic	3)
	52812.4781	.0010	QU				-Ic	3)
	52829.4887	.0017	AG				-Ir	1)
	52831.5151	.0007	AG				-Ir	1)
	52863.5105	.0016	AG				-Ir	1)
	52864.5304	.0065	AG				-Ir	1)
	52867.5607	.0047	AG				-Ir	1)
	52868.3701	.0036	AG				-Ir	1)
	52946.3385	.0015	AG				-Ir	1)
	53215.4640	.0006	AG				-Ir	1)
	53216.4767	.0009	AG				-Ir	1)
	53217.4888	.0011	AG				-Ir	1)
	53221.5370	.0013	AG				-Ir	1)
	53612.3645	.0008	AG				-Ir	1)
	53612.5733	.0006	AG				-Ir	1)
	53621.4824	.0022	AG				-Ir	1)
	53637.4781	.0015	AG				-Ir	1)
	53901.5371	.0019	AG				-Ir	1)
U1275-15134722 Cyg	52863.5507	.0008	AG					1)
	52898.4615	.0022	AG					1)
	52899.4624	.0006	AG				-Ir	1)
	52901.4984	.0006	AG				-Ir	1)
	52903.4967	.0063	AG				-Ir	1)
	52907.5548	.0040	AG				-Ir	1)
	52913.3772	.0014	AG				-Ir	1)
	52928.5470	.0016	AG				-Ir	1)
	52929.3058	.0020	AG				-Ir	1)
	52929.5538	.0031	AG				-Ir	1)
	53619.5514	.0008	AG				-Ir	1)
	53621.5722	.0012	AG				-Ir	1)
	53622.5816	.0024	AG				-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
U1275-15124020 Cyg	52864.4067	.0012	AG					1)
	52902.5326	.0024	AG				-Ir	1)
	53619.5945	.0002	AG				-Ir	1)
U1200-12680286 Cyg	53569.4763	.0018	AG				-Ir	1)
	53578.4043	.0007	AG				-Ir	1)
	53611.5377	.0013	AG				-Ir	1)
	53612.5305	.0011	AG				-Ir	1)
	53613.5221	.0017	AG				-Ir	1)
	53614.3154	.0010	AG				-Ir	1)
	53614.5132	.0002	AG				-Ir	1)
	53618.4820	.0008	AG				-Ir	1)
	53620.4654	.0002	AG				-Ir	1)
	53621.4574	.0007	AG				-Ir	1)
	53637.3294	.0019	AG				-Ir	1)
	53637.5269	.0023	AG				-Ir	1)
	53650.4249	.0035	AG				-Ir	1)
	53659.3546	.0005	AG				-Ir	1)
	53920.4486	.0010	AG				-Ir	1)
GSC3575.3593 Cyg	52886.4397	.0029	AG					1)
	53579.5168	.0007	AG				-Ir	1)
	53601.5283	.0011	AG				-Ir	1)
	53612.5385	.0012	AG				-Ir	1)
	53619.5080	.0006	AG				-Ir	1)
	53621.3446	.0021	AG				-Ir	1)
	53637.4891	.0017	AG				-Ir	1)
U1200-13084491 Cyg	53233.4810	.0034	FR				-Ir	10)
	53245.4929	.0011	FR				-Ir	10)
	53534.5218	.0010	FR				-Ir	10)
Z Dra	53862.3793	.0001	WTR	−0.1758		GCVS 85	-Ir	12)
RR Dra	53900.4166	.0004	AG	+0.0503		GCVS 85	-Ir	1)
TZ Dra	53523.4260	.0017	JU	−0.0190		GCVS 85		2)
	53542.4817	.0009	JU	−0.0161		GCVS 85		2)
	53614.3596	.0001	RAT RCR	−0.0190		GCVS 85	-Ir	1)
	53627.3511	.0004	RAT RCR	−0.0181		GCVS 85	-Ir	1)
AU Dra	53813.4700	.0005	MS FR					6)
BH Dra	53894.4099	.0010	JU	−0.0048		GCVS 85		2)
BV Dra	53634.3578	.0017	SCI					2)
	53634.5220	.0022	SCI					2)
BW Dra	53813.4144	.0014	SCI					2)
	53813.5905	.0011	SCI					2)
DW Dra	53716.5707	.0019	SCI					2)
HP Dra	53656.5277	.0045	SCI					2)
SX Gem	53670.6087	.0011	FR	−0.0582		GCVS 85	-Ir	10)
	53766.2905	.0002	MS FR	−0.0578		GCVS 85		6)
TX Gem	53381.3563	.0003	RAT RCR	−0.0234		GCVS 85	-Ir	1)
TZ Gem	53760.4599	.0014	FR				-Ir	10)
WW Gem	53433.3603	.0042	ATB	+0.0255	s	GCVS 85		1)
AC Gem	53755.4517	.0021	FR	−0.2736		GCVS 85	-Ir	10)
AV Gem	53746.3226	.0007	MS FR					6)
AY Gem	53670.6431	.0013	FR	−0.0488		GCVS 85	-Ir	10)
AZ Gem	53655.5850	.0004	MS FR	+0.0812		GCVS 85		6)
DP Gem	50012.6779	.0013	MS	−0.1393		GCVS 85		1)
	50043.3859	.0013	MS	−0.1433		GCVS 85		1)
	50072.4249	.0013	MS	−0.1411		GCVS 85		1)
	50113.4707	.0013	MS	−0.4169		GCVS 85		1)
	50369.5211	.0013	MS	−0.1137		GCVS 85		1)
	51185.4134	.0006	MS	−0.0438		GCVS 85		1)
	53035.2722	.0004	AG	+0.1150	s	GCVS 85	-Ir	1)
	53635.616 :	.002	MS FR	−0.101		GCVS 85		6)
	53764.3291	.0005	MS FR	−0.0985	s	GCVS 85		6)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
DP Gem	53765.4457	.0006	AG	−0.0987	s	GCVS 85	-Ir	1)
EL Gem	50425.4404	.0013	MS	−0.1826		GCVS 85		1)
	50463.2872	.0013	MS	−0.1865	s	GCVS 85		1)
	50752.5223	.0013	MS	−0.1879		GCVS 85		1)
	53670.5735	.0008	FR	−0.2121		GCVS 85	-Ir	10)
FT Gem	53759.4276	.0005	FR	−0.0301	s	GCVS 85	-Ir	10)
	53762.3685	.0012	FR	−0.0273	s	GCVS 85	-Ir	10)
GM Gem	53408.3347	.0002	MS FR					6)
HI Gem	53780.4468	.0013	AG				-Ir	1)
	53813.3338	.0020	FR				-Ir	10)
HR Gem	53706.4742	.0001	MS FR					6)
KV Gem	53408.5014	.0016	ATB	−0.0037		BAVR 52, 95ff		1)
	53410.4736	.0011	ATB	−0.0034	s	BAVR 52, 95ff		1)
	53745.5109	.0033	PC	−0.0067		BAVR 52, 95ff	-Ir	7)
	53752.5055	.0091	PC	−0.0034	s	BAVR 52, 95ff	-Ir	7)
	53760.3910	.0001	AG	−0.0054	s	BAVR 52, 95ff	-Ir	1)
	53760.5708	.0002	AG	−0.0048		BAVR 52, 95ff	-Ir	1)
LO Gem	53794.3580	.0011	AG				-Ir	1)
MU Gem	53759.5548	.0018	FR	+0.0178		GCVS 85	-Ir	10)
	53762.4595	.0006	FR	+0.0177		GCVS 85	-Ir	10)
OQ Gem	53056.4122	.0013	FR				-Ir	10)
GSC1330.287 Gem	52359.4159	.0069	ATB	−0.0025	s	BAVR 54,105ff		1)
	52690.3392	.0010	AG	−0.0003	s	BAVR 54,105ff	-Ir	1)
	52690.5116	.0011	AG	−0.0022		BAVR 54,105ff	-Ir	1)
	52691.3847	.0002	AG	−0.0009	s	BAVR 54,105ff	-Ir	1)
	52692.2576	.0037	AG	+0.0003		BAVR 54,105ff	-Ir	1)
	52692.4307	.0003	AG	−0.0010	s	BAVR 54,105ff	-Ir	1)
	52694.3485	.0006	AG	−0.0011		BAVR 54,105ff	-Ir	1)
	52694.5234	.0006	AG	−0.0005	s	BAVR 54,105ff	-Ir	1)
	52697.4853	.0009	AG	−0.0026		BAVR 54,105ff	-Ir	1)
	52707.4253	.0005	AG	−0.0007	s	BAVR 54,105ff	-Ir	1)
	52713.3551	.0021	ATB	+0.0011	s	BAVR 54,105ff		1)
	52716.3170	.0024	AG	−0.0010		BAVR 54,105ff	-Ir	1)
	52721.3747	.0007	AG	+0.0005	s	BAVR 54,105ff		1)
	52722.4219	.0014	ATB	+0.0016	s	BAVR 54,105ff		1)
	52735.3237	.0028	ATB	+0.0013	s	BAVR 54,105ff		1)
	53007.4879	.0013	AG	+0.0012		BAVR 54,105ff	-Ir	1)
	53028.4116	.0017	AG	+0.0026		BAVR 54,105ff	-Ir	1)
	53055.4366	.0007	AG	+0.0030	s	BAVR 54,105ff	-Ir	1)
	53070.4299	.0009	AG	+0.0020	s	BAVR 54,105ff	-Ir	1)
	53088.3831	.0021	ATB	−0.0031		BAVR 54,105ff		1)
	53407.4501	.0014	ATB	−0.0012		BAVR 54,105ff		1)
	53408.4977	.0021	ATB	+0.0003		BAVR 54,105ff		1)
	53410.4142	.0005	AG	−0.0011	s	BAVR 54,105ff	-Ir	1)
	53410.4194	.0042	ATB	+0.0041	s	BAVR 54,105ff		1)
	53760.3386	.0008	AG	−0.0022		BAVR 54,105ff	-Ir	1)
	53760.5120	.0004	AG	−0.0031	s	BAVR 54,105ff	-Ir	1)
SZ Her	53894.4210	.0003	AG	−0.0194		GCVS 85	-Ir	1)
TU Her	53920.4811	.0005	AG	−0.1661		GCVS 85	-Ir	1)
UX Her	53621.3582	.0007	DIE	+0.0555		GCVS 85		11)
BV Her	53622.326	.003	SCI					2)
CC Her	53814.5223	.0003	MS FR	+0.1610		GCVS 85		6)
ES Her	53636.364	.001	SCI					2)
	53818.5804	.0003	MS FR					6)
	53894.4361	.0013	AG				-Ir	1)
FN Her	53518.4246	.0010	AG	+0.0982		GCVS 85	-Ir	1)
HS Her	53542.442 :	.001	SCI	−0.021		GCVS 85		2)
	53555.542 :	.001	SCI	−0.021		GCVS 85		2)
IK Her	53565.5663	.0011	SCI					2)
LT Her	53408.6264	.0048	MS FR	−0.0303		BAVM 69		6)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
MS Her	53932.4100	.0013	AG	+0.0953		GCVS 85	-Ir	1)
MX Her	53593.3858	.0022	SCI	−0.5004		GCVS 85		2)
V338 Her	53621.340	.001	SCI	+0.069		GCVS 85		2)
V357 Her	53569.4730	.0007	SCI					2)
V359 Her	53860.3678	.0002	AG	+0.1613		GCVS 85	-Ir	1)
	53895.4833	.0014	JU	+0.1621		GCVS 85		2)
V381 Her	53566.4359	.0007	AG				-Ir	1)
V387 Her	49810.5137	.0009	MS	+0.1217	s	GCVS 85		1)
	49839.3969	.0011	MS	+0.1207	s	GCVS 85		1)
	49841.4594	.0006	MS	+0.1201		GCVS 85		1)
	49843.5250	.0005	MS MSR	+0.1225	s	GCVS 85		1)
	50199.5612	.0009	MS	+0.1177	s	GCVS 85		1)
	50592.4411	.0007	MS	+0.1146		GCVS 85		1)
	50896.6041	.0009	MS	+0.1101		GCVS 85		1)
	51299.5023	.0001	RAT RCR	+0.1043	s	GCVS 85		1)
	51302.4528	.0005	MS	+0.1074	s	GCVS 85		1)
	51345.4834	.0003	KI	+0.1065	s	GCVS 85	-Ir	1)
	51678.5320	.0004	KI	+0.1035	s	GCVS 85	-Ir	1)
	52043.4110	.0003	RAT RCR	+0.0994	s	GCVS 85		1)
	52368.5026	.0004	MS	+0.0972		GCVS 85		6)
	53524.4460	.0015	AG	+0.0863		GCVS 85	-Ir	1)
	53764.6520	.0004	MS FR	+0.0825	s	GCVS 85		6)
V450 Her	53631.3622	.0011	RAT RCR	+0.1425	s	GCVS 85	-Ir	1)
	53860.4467	.0012	AG	+0.1320	s	GCVS 85	-Ir	1)
	53860.4621	.0015	FR	+0.1474	s	GCVS 85	-Ir	10)
V502 Her	53601.3888:	.0067	PC				-Ir	7)
	53863.3991	.0017	AG				-Ir	1)
	53894.4196	.0008	AG				-Ir	1)
	53920.4549	.0009	AG				-Ir	1)
V719 Her	53847.4493	.0015	AG				-Ir	1)
V728 Her	53817.4733	.0003	MS FR	+0.0451		IBVS 3234		6)
	53849.5198	.0021	AG	+0.0440		IBVS 3234	-Ir	1)
V731 Her	53515.4604	.0016	AG				-Ir	1)
	53518.4479	.0016	AG				-Ir	1)
	53847.4224	.0018	AG				-Ir	1)
V732 Her	53849.4764	.0060	AG				-Ir	1)
V733 Her	53849.4712	.0012	AG				-Ir	1)
V742 Her	53515.4699	.0042	AG				-Ir	1)
V829 Her	53860.4227	.0032	AG	+0.0081		IBVS 5496	-Ir	1)
	53933.4921	.0022	JU	+0.0149		IBVS 5496		2)
V842 Her	53453.5199	.0001	RAT RCR	−0.0231		BAVR 49,180	-Ir	1)
	53522.4533	.0014	JU	−0.0219	s	BAVR 49,180		2)
	53621.3451	.0002	RAT RCR	−0.0237	s	BAVR 49,180	-Ir	1)
	53846.3611	.0007	AG	−0.0325	s	BAVR 49,180	-Ir	1)
V856 Her	53516.3955	.0003	AG				-Ir	1)
V857 Her	53516.4427	.0012	AG				-Ir	1)
V878 Her	53932.4204	.0009	JU					2)
V972 Her	53440.474	.008	SCI					2)
	53900.5242	.0028	JU					2)
V1005 Her	53846.4682	.0007	AG				-Ir	1)
V1032 Her	53860.5107	.0027	AG				-Ir	1)
V1033 Her	53565.4408	.0008	AG				-Ir	1)
V1034 Her	53518.5010	.0012	AG				-Ir	1)
V1036 Her	53565.4684	.0007	AG				-Ir	1)
V1042 Her	53519.4176	.0001	RAT RCR				-Ir	1)
V1047 Her	53863.3834	.0013	AG				-Ir	1)
	53863.5489	.0003	AG				-Ir	1)
	53920.4758	.0020	AG				-Ir	1)
V1053 Her	53863.4685	.0015	AG				-Ir	1)
V1055 Her	53515.4444	.0019	AG				-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V1055 Her	53849.4677	.0027	AG				-Ir	1)
V1057 Her	53524.4828	.0011	AG				-Ir	1)
V1062 Her	53515.4461	.0006	AG				-Ir	1)
	53518.4611	.0019	AG				-Ir	1)
	53847.4685	.0020	AG				-Ir	1)
V1064 Her	53863.4480	.0015	AG				-Ir	1)
V1067 Her	53515.4957	.0008	AG				-Ir	1)
	53847.4259	.0037	AG				-Ir	1)
	53847.5546	.0015	AG				-Ir	1)
AV Hya	53808.3342	.0003	MS FR	−0.0855		GCVS 85		6)
SW Lac	53632.4353	.0010	JU	+0.0631		GCVS 85		2)
	53636.4450	.0008	JU	+0.0638	s	GCVS 85		2)
	53656.3297	.0004	AG	+0.0638	s	GCVS 85	V	1)
	53656.4906	.0003	AG	+0.0643		GCVS 85	V	1)
	53656.6507	.0017	AG	+0.0641	s	GCVS 85	V	1)
	53683.4298	.0007	ATB	+0.0630		GCVS 85		1)
	53687.2775	.0003	DIE	+0.0620		GCVS 85		11)
VX Lac	53650.3181	.0003	DIE	+0.0524		GCVS 85		11)
ZZ Lac	53928.4250	.0031	AG				-Ir	1)
AG Lac	53657.6487	.0033	AG				-Ir	1)
	53928.4319	.0004	AG				-Ir	1)
AW Lac	53657.3460:	.0010	AG	+0.0292		BAVR 35, 1ff	-Ir	1)
CG Lac	53657.4763	.0014	AG				-Ir	1)
	53658.2942	.0008	AG				-Ir	1)
CO Lac	53165.5471	.0006	MON	−0.0033		SAC 74	V	1)
	53223.4051	.0009	MON	+0.0218	s	SAC 74	V	1)
	53257.3332	.0007	MON	+0.0212	s	SAC 74	V	1)
	53600.4516	.0006	MON	−0.0024		SAC 74	V	1)
DG Lac	53657.4667	.0009	AG	−0.2103		GCVS 85	-Ir	1)
EK Lac	53653.3422	.0013	AG	−0.0053		GCVS 85	-Ir	1)
EM Lac	53614.4204	.0026	AG	+0.0604		GCVS 85	-Ir	1)
	53657.4180	.0019	AG	+0.0587	s	GCVS 85	-Ir	1)
	53657.6139	.0021	AG	+0.0601		GCVS 85	-Ir	1)
EP Lac	53928.4485	.0013	AG	−0.3610		GCVS 85	-Ir	1)
EQ Lac	53658.3421	.0009	AG	+0.0040		GCVS 85	-Ir	1)
EX Lac	53657.5715	.0021	AG				-Ir	1)
	53657.5727	.0007	AG				-Ir	1)
IL Lac	53895.4549	.0008	AG				-Ir	1)
	53932.4358	.0013	AG				-Ir	1)
IP Lac	53653.3794	.0012	AG				-Ir	1)
	53932.4101	.0001	AG				-Ir	1)
IU Lac	53614.5804	.0023	AG				-Ir	1)
	53653.3444	.0015	AG				-Ir	1)
	53932.4367	.0016	AG				-Ir	1)
IZ Lac	53653.5105	.0027	AG				-Ir	1)
LZ Lac	53614.3853	.0019	AG				-Ir	1)
MW Lac	53895.4741	.0014	AG				-Ir	1)
NR Lac	53658.3403	.0020	AG				-Ir	1)
	53658.6376	.0005	AG				-Ir	1)
PP Lac	53632.2887	.0001	MS FR	−0.0488		GCVS 85		6)
V342 Lac	53653.3969	.0030	AG				-Ir	1)
V344 Lac	53637.4594	.0003	RAT RCR				-Ir	1)
	53932.4253	.0008	AG				-Ir	1)
V345 Lac	53932.4522	.0020	AG	+0.0813		Hartha Mitt. 13	-Ir	1)
V364 Lac	53656.3711	.0023	AG	+0.0158	s	BAVR 47, 33f	V	1)
V441 Lac	53614.5041	.0015	AG	−0.0362	s	IBVS 5024	-Ir	1)
	53653.4210	.0032	AG	−0.0400	s	IBVS 5024	-Ir	1)
	53932.5262	.0016	AG	−0.0205		IBVS 5024	-Ir	1)
Y Leo	53445.4398	.0005	MON	+0.0043		GCVS 85	V	1)
	53750.6199	.0037	PC	−0.0001		GCVS 85	-Ir	7)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
RT Leo	53814.4020:	.0050	AG				-Ir	1)
	53814.4141	.0042	SCI					2)
UZ Leo	53406.4350	.0002	RAT RCR	−0.1502		GCVS 85	-Ir	1)
VZ Leo	53387.4371	.0005	MS FR	−0.0622		GCVS 85		6)
	53752.5433	.0045	PC	−0.0746		GCVS 85	-Ir	7)
WZ Leo	53706.6603	.0010	MS FR	−0.4797	s	GCVS 85		6)
	53814.3876	.0004	AG	−0.2785		GCVS 85	-Ir	1)
XX Leo	53814.3369	.0002	AG	+0.1708	s	GCVS 85	-Ir	1)
XY Leo	53814.3220	.0021	AG	+0.0164	s	GCVS 85	-Ir	1)
XZ Leo	53381.5166	.0002	RAT RCR	+0.0370	s	GCVS 85	-Ir	1)
	53683.6714	.0001	MS FR	+0.0399		GCVS 85		6)
	53814.3850	.0007	AG	+0.0405		GCVS 85	-Ir	1)
AG Leo	53815.4502	.0014	AG	+0.0837		GCVS 85	-Ir	1)
BW Leo	53813.3657	.0002	MS FR					6)
CE Leo	53386.5654	.0002	RAT RCR				-Ir	1)
	53463.3314	.0002	RAT RCR				-Ir	1)
	53766.4570	.0002	MS FR					6)
ET Leo	53833.3687	.0020	WTR				-Ir	12)
RT LMi	53752.6205	.0042	PC	−0.0054		GCVS 85	-Ir	7)
KQ Lib	53465.5329	.0003	PRK	+0.0135		IBVS 5148		2)
RY Lyn	53470.4301	.0008	JU	−0.0494		GCVS 85		2)
UU Lyn	53386.4644	.0002	MS FR	−0.0058		GCVS 85		6)
	53461.4167	.0010	JU	−0.0071		GCVS 85		2)
	53462.3547	.0008	JU	−0.0060		GCVS 85		2)
UV Lyn	53453.4257	.0020	JU	+0.0548		GCVS 85		2)
CD Lyn	53360.3327	.0017	MON	−0.0027	s	IBVS 4911	V	1)
DE Lyn	53463.3838	.0008	JU					2)
TT Lyr	53927.4478	.0005	AG	+0.0131		GCVS 85	V	1)
TZ Lyr	53517.4618	.0021	AG	+0.0051		GCVS 85	-Ir	1)
	53688.2719	.0003	RAT RCR	+0.0041		GCVS 85	-Ir	1)
AA Lyr	53672.3109	.0016	FR				-Ir	10)
EW Lyr	53618.3597	.0003	RAT RCR	+0.2334		GCVS 85	-Ir	1)
FH Lyr	53524.4804	.0007	AG				-Ir	1)
FL Lyr	53612.3871	.0049	PC	−0.0044		GCVS 85	-Ir	7)
	53673.3777	.0009	JU	−0.0021		GCVS 85		2)
HY Lyr	53861.3563	.0029	FR				-Ir	10)
	53861.5461	.0016	FR				-Ir	10)
IW Lyr	53517.4465	.0028	AG	−0.0819		GCVS 85	-Ir	1)
NY Lyr	53612.3849	.0050	PC	+0.1014	s	GCVS 85	-Ir	7)
	53648.3102	.0044	PC	+0.1018		GCVS 85	-Ir	7)
PS Lyr	53658.2966	.0010	FR	+0.0094		GCVS 85	-Ir	10)
PV Lyr	53516.4579	.0011	AG				-Ir	1)
PY Lyr	53517.3796	.0008	AG				-Ir	1)
	53520.4675	.0021	AG				-Ir	1)
QU Lyr	53524.4685	.0016	AG	−0.0006	s	GCVS 85	-Ir	1)
V400 Lyr	53462.5794	.0001	MS FR					6)
	53515.4181	.0003	AG				-Ir	1)
	53515.5475	.0003	AG				-Ir	1)
V401 Lyr	53515.4609	.0005	AG				-Ir	1)
V404 Lyr	53515.4065	.0014	AG	+0.0032	s	IBVS 5017	-Ir	1)
V563 Lyr	53517.4976	.0013	AG				-Ir	1)
V573 Lyr	53517.4268	.0012	AG				-Ir	1)
V574 Lyr	53917.4501	.0005	JU					2)
V580 Lyr	53524.4855	.0026	AG				-Ir	1)
V589 Lyr	53632.4253	.0008	RAT RCR				-Ir	1)
UU Mon	53780.3957	.0023	AG				-Ir	1)
UV Mon	53755.3407	.0013	AG				-Ir	1)
VX Mon	53683.5352	.0003	MS FR					6)
AO Mon	53755.2720:	.0030	AG	−0.0200		BAVR 51, 38f	-Ir	1)
BM Mon	53755.4695	.0011	AG	−0.5859		GCVS 85	-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
GG Mon	53755.3909	.0009	AG				-Ir	1)
	53765.3329	.0010	MS FR					6)
HM Mon	53780.3419	.0004	AG	−0.0018		GCVS 85	-Ir	1)
IX Mon	53650.5772	.0012	MS FR					6)
V395 Mon	53780.4310	.0017	AG				-Ir	1)
V396 Mon	53672.6266	.0010	MS FR	−0.0684		GCVS 87		6)
V448 Mon	53715.5324	.0038	SCI	+0.0488		GCVS 85		2)
	53780.4065	.0011	AG	+0.0519		GCVS 85	-Ir	1)
V453 Mon	52690.2955	.0001	MS FR	−0.1620	s	GCVS 87		6)
V456 Mon	53780.3307	.0006	AG				-Ir	1)
V498 Mon	53780.3713	.0010	AG				-Ir	1)
V514 Mon	53780.4035	.0041	AG	+0.0096		GCVS 85	-Ir	1)
V527 Mon	53755.4275	.0016	AG	−0.0242		GCVS 85	-Ir	1)
V528 Mon	53769.3412	.0004	MS FR					6)
V530 Mon	53763.3920	.0005	MS FR	−0.1334	s	GCVS 85		6)
WZ Oph	53901.4151	.0002	AG	+0.0034		GCVS 85	-Ir	1)
V449 Oph	53483.5444	.0001	RAT RCR	+0.0675		GCVS 85	-Ir	1)
V839 Oph	53520.5035	.0006	AG	−0.0133	s	GCVS 85	-Ir	1)
CQ Ori	53386.3425	.0002	MS FR	+0.0007		GCVS 85		6)
EF Ori	53717.4081	.0014	AG				-Ir	1)
ER Ori	53031.328	.002	HND					19)
FH Ori	53671.5463	.0028	SCI	−0.3163		GCVS 85		2)
FK Ori	53780.2890	.0004	WTR	+0.0039		GCVS 85	-Ir	12)
FT Ori	53701.4728	.0009	MON	+0.0122		GCVS 85	V	1)
	53760.3602	.0011	MON	+0.1077	s	GCVS 85	V	1)
	53764.4813	.0005	MON	+0.0124		GCVS 85	V	1)
GG Ori	53809.2944	.0006	MON	−2.8065		AA 54.207	V	1)
GU Ori	53717.3759	.0001	AG				-Ir	1)
OS Ori	53671.4638	.0002	MS FR	−0.0181		GCVS 85		6)
QV Ori	53673.5542	.0020	SCI					2)
V343 Ori	53407.3614	.0009	RAT RCR	+0.1734	s	GCVS 85	-Ir	1)
V519 Ori	53766.2796	.0005	AG				-Ir	1)
V647 Ori	49752.3134	.0013	MS	−0.1965		GCVS 85		1)
	49771.3762	.0013	MS	−0.1962	s	GCVS 85		1)
	50042.6481	.0013	MS	−0.1989		GCVS 85		1)
	50863.3057	.0002	MS	−0.2079	s	GCVS 85		1)
	51189.3222	.0004	RAT RCR	−0.2097		GCVS 85		1)
	52621.4387	.0001	MS	−0.2274		GCVS 85		6)
	53361.4507	.0004	MS FR	−0.2329		GCVS 85		6)
	53637.6085	.0016	MS FR	−0.2375	s	GCVS 85		6)
V648 Ori	50750.5595	.0013	MS	+0.0330		GCVS 85		1)
GSC1296.975 Ori	53768.3182	.0010	QU				V	2)
U Peg	53648.4401	.0022	PC	−0.0100		BAVR 45, 3	-Ir	7)
	53655.3783	.0004	QU	−0.0052	s	BAVR 45, 3	V	3)
UX Peg	53661.2961	.0007	AG	−0.0060		GCVS 87	-Ir	1)
ZZ Peg	53688.3601	.0029	SCI	+0.1253		GCVS 87		2)
AT Peg	53657.2813	.0001	DIE	+0.0106		GCVS 87		11)
BB Peg	53661.3569	.0004	AG	−0.0002	s	GCVS 87	-Ir	1)
	53661.5390	.0005	AG	+0.0011		GCVS 87	-Ir	1)
	53675.2769	.0008	DIE	+0.0019		GCVS 87		11)
BN Peg	53653.2872	.0039	DIE	−0.0068		GCVS 87		11)
BO Peg	53648.3473	.0056	PC	−0.0304		GCVS 87	-Ir	7)
BX Peg	53601.4569	.0006	AG	+0.0651	s	GCVS 87	-Ir	1)
	53613.3741	.0006	AG	+0.0644		GCVS 87	-Ir	1)
	53613.5159	.0028	AG	+0.0660	s	GCVS 87	-Ir	1)
	53614.4970	.0024	PC	+0.0656		GCVS 87	-Ir	7)
	53648.4272	.0024	PC	+0.0649		GCVS 87	-Ir	7)
	53651.3714	.0028	AG	+0.0647	s	GCVS 87	-Ir	1)
	53651.5111	.0015	AG	+0.0642		GCVS 87	-Ir	1)
	53659.3629	.0003	FR	+0.0642		GCVS 87	-Ir	10)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
BX Peg	53659.5033	.0006	FR	+0.0644	s	GCVS 87	-Ir	10)
BY Peg	53601.5250	.0010	AG				-Ir	1)
	53659.3142	.0017	FR				-Ir	10)
BZ Peg	53651.3615	.0012	AG				-Ir	1)
	53659.4081	.0088	FR				-Ir	10)
CC Peg	53601.4767	.0018	AG	−0.0076		IBVS 5017	-Ir	1)
	53613.5916	.0006	AG	−0.0047		IBVS 5017	-Ir	1)
	53651.4458	.0013	AG	−0.0007	s	IBVS 5017	-Ir	1)
	53659.3272	.0035	FR	+0.0078	s	IBVS 5017	-Ir	10)
CE Peg	53613.5379	.0007	AG				-Ir	1)
	53651.4164	.0006	AG				-Ir	1)
CF Peg	53659.3689	.0026	FR				-Ir	10)
CZ Peg	53613.4253	.0011	AG				-Ir	1)
DI Peg	53634.3450	.0005	DIE	−0.0194		GCVS 87		11)
DK Peg	53614.5317	.0049	PC	+0.0705		GCVS 87	-Ir	7)
	53673.2886	.0006	DIE	+0.0822		GCVS 87		11)
DP Peg	53636.4243	.0004	AG				-Ir	1)
ER Peg	53656.3490	.0023	JU					2)
	53656.3593	.0021	AG				V	1)
GP Peg	53632.5373	.0002	RAT RCR	−0.0405		GCVS 87	-Ir	1)
	53638.3865	.0007	RAT RCR	−0.0450		GCVS 87	-Ir	1)
KW Peg	53601.5201	.0012	AG				-Ir	1)
	53613.3551	.0010	AG				-Ir	1)
	53659.4834	.0009	FR				-Ir	10)
MQ Peg	53651.3333	.0008	RAT RCR				-Ir	1)
	53683.3916	.0018	FR				-Ir	10)
	53716.4029	.0042	FR					9)
	53717.3523	.0053	FR					9)
U1125-18642389 Peg	52505.4982	.0003	AG					1)
	52510.4333	.0012	AG					1)
	52878.4247	.0018	AG					1)
	52887.4157	.0026	AG					1)
	53217.5026	.0032	AG					1)
	53221.5535	.0004	AG					1)
	53226.4927	.0020	AG					1)
	53233.3726	.0047	AG					1)
	53233.5454	.0019	AG					1)
	53242.3641	.0035	AG					1)
	53250.4743	.0036	AG					1)
	53251.3561	.0002	AG					1)
	53253.4708	.0011	AG					1)
	53255.4116	.0017	AG					1)
	53255.5857	.0039	AG					1)
	53256.4698	.0019	AG					1)
	53257.3524	.0042	AG					1)
	53257.5291	.0009	AG					1)
	53267.4023	.0026	AG					1)
	53282.3889	.0032	AG				-Ir	1)
	53284.3265	.0019	AG				-Ir	1)
	53284.5079	.0020	AG				-Ir	1)
	53601.5463	.0023	AG				-Ir	1)
	53613.3605	.0058	AG				-Ir	1)
	53613.5374	.0030	AG				-Ir	1)
	53651.4471	.0019	AG				-Ir	1)
ST Per	53652.3960	.0012	AG	+0.1940		GCVS 87	-Ir	1)
XZ Per	53654.4681	.0001	RAT RCR	−0.0576		GCVS 87	-Ir	1)
BO Per	53683.4171	.0026	SCI					2)
BP Per	53681.3741	.0035	SCI	−0.0242		GCVS 87		2)
BY Per	53636.4174	.0007	AG				-Ir	1)
	53651.4024	.0006	AG				-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
BY Per	53659.4699	.0010	AG				-Ir	1)
HW Per	53632.5114	.0003	MS FR	+0.0229		GCVS 87		6)
II Per	53633.5764	.0010	MS FR					6)
IM Per	53635.5494	.0005	MS FR	+0.0823		GCVS 87		6)
IQ Per	53257.5312	.0007	MON	+0.0041		GCVS 87	V	1)
IU Per	53674.3375	.0012	DIE	+0.0093		GCVS 87		11)
	53705.6226	.0064	AG	+0.0130	s	GCVS 87	-Ir	1)
KN Per	53765.3100	.0006	WTR	+0.0016		BAVR 52, 93ff	-Ir	12)
KW Per	53633.4634	.0002	MS FR	+0.0123		GCVS 87		6)
PS Per	53705.5937	.0008	AG				-Ir	1)
V366 Per	53652.4446	.0026	AG				-Ir	1)
V432 Per	53683.3202	.0008	RAT RCR	−0.0093		IBVS 3797	-Ir	1)
	53701.3355	.0003	RAT RCR	−0.0097		IBVS 3797	-Ir	1)
	53705.5526	.0009	AG	−0.0090		IBVS 3797	-Ir	1)
V449 Per	49569.5532	.0013	MS	+0.0262		GCVS 87		1)
	53651.4936	.0006	RAT RCR	+0.0426		GCVS 87	-Ir	1)
	53652.4395	.0023	AG	+0.0423		GCVS 87	-Ir	1)
V450 Per	53673.4553	.0003	MS FR	+0.0760		GCVS 87		6)
beta Per	53750.3288	.0040	JU	+0.0787		GCVS 87	-Ir	2)
RV Psc	53662.3761	.0020	AG	−0.0450	s	GCVS 87	-Ir	1)
	53662.6509	.0021	AG	−0.0472		GCVS 87	-Ir	1)
	53700.3250	.0008	DIE	−0.0445		GCVS 87		11)
CP Sge	53900.4492	.0011	AG				-Ir	1)
CU Sge	53555.4362	.0006	AG	+0.0163		GCVS 87	-Ir	1)
CW Sge	53565.3995	.0008	AG	−0.0123	s	GCVS 87	-Ir	1)
	53636.3908	.0006	WTR	−0.0084		GCVS 87	-Ir	12)
	53638.3730	.0006	WTR	−0.0072		GCVS 87	-Ir	12)
DK Sge	53592.3968	.0011	AG				-Ir	1)
EI Sge	53565.3891	.0002	AG				-Ir	1)
FX Sge	53566.4722	.0005	AG				-Ir	1)
AU Ser	53482.4294	.0001	RAT RCR	+0.0079		SAC 73	-Ir	1)
BI Ser	53451.6485	.0010	RAT RCR	+0.1134		GCVS 87	-Ir	1)
CC Ser	53462.6007	.0007	RAT RCR	+0.0607	s	GCVS 87	-Ir	1)
CX Ser	53814.5349	.0018	FR	−0.0805	s	GCVS 87	-Ir	10)
GSC2038.293 Ser	53545.4095	.0005	FR				-Ir	10)
	53555.5366	.0008	FR				-Ir	10)
	53557.5168	.0010	FR				-Ir	10)
	53566.4349	.0012	FR				-Ir	10)
	53569.4137	.0010	FR				-Ir	10)
	53846.3486	.0006	FR				-Ir	10)
RW Tau	53406.2848	.0050	SE	−0.0120		BAVR 45,124	-Ir	14)
SV Tau	53674.5217	.0001	RAT RCR	−0.0123		GCVS 87	-Ir	1)
	53765.5328	.0017	AG	−0.0112		GCVS 87	-Ir	1)
WY Tau	53683.5188	.0002	RAT RCR	+0.0529		GCVS 87	-Ir	1)
	53706.3802	.0024	SCI	+0.0533		GCVS 87		2)
	53794.3604	.0010	AG	+0.0531		GCVS 87	-Ir	1)
AQ Tau	53381.2737	.0003	MS FR	−0.0828		GCVS 87		6)
BV Tau	53387.3898	.0004	RAT RCR				-Ir	1)
CF Tau	53683.5127	.0006	AG	+0.0106	s	BAVR 35, 1ff	-Ir	1)
CT Tau	53765.3660	.0003	AG	−0.0447	s	GCVS 87	-Ir	1)
	53794.3741	.0005	AG	−0.0437		GCVS 87	-Ir	1)
CU Tau	53752.3026	.0037	PC	−0.0785	s	GCVS 87	-Ir	7)
EN Tau	53766.3509	.0003	QU	−0.0016		BAVR 52, 49ff	V	2)
	53766.3516	.0011	MON	−0.0009		BAVR 52, 49ff	V	1)
EQ Tau	51498.2838	.0010	HSR	−0.0219		GCVS 87		2)
	53652.5286	.0002	RAT RCR	−0.0274		GCVS 87	-Ir	1)
	53683.4206	.0006	AG	−0.0274	s	GCVS 87	-Ir	1)
	53683.5912	.0005	AG	−0.0275		GCVS 87	-Ir	1)
GQ Tau	53672.4789	.0003	MS FR					6)
	53715.3647	.0029	SCI					2)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
GR Tau	53683.3695	.0008	AG	−0.0315		BAVR 35, 1ff	-Ir	1)
	53683.5937	.0065	AG	−0.0291	s	BAVR 35, 1ff	-Ir	1)
GW Tau	53766.3297	.0013	JU					2)
HU Tau	53662.4891	.0069	SCI	+0.0178		GCVS 87		2)
	53765.3013	.0050	JU	+0.0150		GCVS 87		2)
V781 Tau	53765.3763	.0005	AG	−0.0444	s	GCVS 87	-Ir	1)
	53765.5497	.0011	AG	−0.0435		GCVS 87	-Ir	1)
	53794.3477	.0014	AG	−0.0454	s	GCVS 87	-Ir	1)
V1061 Tau	53706.5924	.0024	SCI					2)
V1123 Tau	53716.3052	.0009	AG				V	1)
	53716.5067	.0008	AG				V	1)
V1128 Tau	53706.3658	.0001	RAT RCR				-Ir	1)
V Tri	53662.6093	.0012	AG	−0.0004		GCVS 87	-Ir	1)
X Tri	53403.2847	.0004	ATB	−0.0612		GCVS 87		1)
	53631.5926	.0022	PC	−0.0641		GCVS 87	-Ir	7)
	53745.2592	.0020	PC	−0.0671		GCVS 87	-Ir	7)
RS Tri	53662.3597	.0013	AG	−0.0234		GCVS 87	-Ir	1)
	53706.2661	.0002	RAT RCR	−0.0223		GCVS 87	-Ir	1)
WW Tri	53613.490 :	.001	RAT RCR				-Ir	1)
TY UMa	53844.3853	.0008	JU	+0.0515	s	GCVS 87		2)
UY UMa	53834.3601	.0009	AG	−0.0908	s	GCVS 87	-Ir	1)
VV UMa	53745.5890	.0023	PC	−0.0506		GCVS 87	-Ir	7)
ZZ UMa	53814.4330	.0004	AG	−0.0019		GCVS 87	-Ir	1)
AA UMa	53814.3351	.0020	WTR	+0.0305	s	GCVS 87	-Ir	12)
	53846.4029	.0007	JU	+0.0317		GCVS 87		2)
AC UMa	53866.4279	.0003	AG				-Ir	1)
AF UMa	53794.4583	.0012	AG	+0.5134		GCVS 87	-Ir	1)
DW UMa	53407.4068	.0002	RAT RCR				-Ir	1)
ES UMa	53794.4755	.0003	AG				-Ir	1)
HH UMa	53834.3182	.0030	WTR				-Ir	12)
KM UMa	53446.361 :	.001	RAT RCR				-Ir	1)
LP UMa	53407.4475	.0009	RAT RCR				-Ir	1)
	53814.3457	.0011	AG				-Ir	1)
RU UMi	53833.4039	.0009	JU	−0.0117		GCVS 87		2)
NSV8499 UMi	53462.4168	.0004	RAT RCR				-Ir	1)
AW Vir	53863.3824	.0001	WTR	+0.0176		GCVS 87	-Ir	12)
AX Vir	53860.3887	.0001	WTR	+0.0092		BAVR 32, 36ff	-Ir	12)
NY Vir	53867.4118	.0002	AG				-Ir	1)
VY Vul	53579.4120:	.0020	AG				-Ir	1)
AT Vul	53542.4565	.0015	AG	−0.0793		GCVS 87	-Ir	1)
AW Vul	53619.3241	.0004	AG	−0.0100		GCVS 87	-Ir	1)
AZ Vul	53549.4914	.0012	AG	+0.0239		GCVS 87	-Ir	1)
BE Vul	53620.4243	.0004	WTR	+0.0523		GCVS 87	-Ir	12)
	53655.3601	.0021	FR	+0.0671	s	GCVS 87	-Ir	10)
BG Vul	53636.4302	.0005	AG				-Ir	1)
BI Vul	53601.4017	.0032	AG				-Ir	1)
	53601.5288	.0007	AG				-Ir	1)
BK Vul	53601.4088	.0003	AG	+0.0456	s	GCVS 87	-Ir	1)
	53648.3420	.0067	PC	+0.0446		GCVS 87	-Ir	7)
BM Vul	53601.5496	.0007	AG				-Ir	1)
	53613.4278	.0022	AG				-Ir	1)
	53636.4252	.0015	AG				-Ir	1)
	53651.5068	.0025	AG				-Ir	1)
BP Vul	53898.5192	.0021	AG	−0.0093		GCVS 87	-Ir	1)
BS Vul	53544.4503	.0046	AG	−0.0199		GCVS 87	-Ir	1)
	53579.4366	.0036	AG	−0.0175	s	GCVS 87	-Ir	1)
	53615.3710	.0002	WTR	−0.0190		GCVS 87	-Ir	12)
BT Vul	53549.5448	.0003	AG	+0.0024		GCVS 87	-Ir	1)
BU Vul	53549.4537	.0020	AG	+0.0194	s	GCVS 87	-Ir	1)
	53601.5142	.0033	PC	+0.0171		GCVS 87	-Ir	7)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
CD Vul	53619.3617	.0001	AG	−0.0010		GCVS 87	-Ir	1)
DR Vul	53674.3637	.0020	JU	−0.0103	s	AA 54.207		2)
EO Vul	53639.3161	.0007	AG				-Ir	1)
	53655.2886	.0018	FR				-Ir	10)
EQ Vul	53920.4116	.0015	AG				-Ir	1)
EU Vul	53542.5112	.0018	AG				-Ir	1)
	53592.4010:	.0020	AG				-Ir	1)
EY Vul	53619.5669	.0007	AG				-Ir	1)
FF Vul	53549.4878	.0020	AG				-Ir	1)
	53619.3470	.0013	AG				-Ir	1)
	53619.5668	.0005	AG				-Ir	1)
FM Vul	53517.5431	.0013	AG	+0.0268	s	GCVS 87	-Ir	1)
	53612.4840	.0028	AG	+0.0262	s	GCVS 87	-Ir	1)
FO Vul	53899.4506	.0020	AG				-Ir	1)
FQ Vul	53658.4544	.0041	FR				-Ir	10)
FR Vul	53544.4840	.0010	AG	−0.0063		GCVS 87	-Ir	1)
	53592.5179	.0009	AG	−0.0072		GCVS 87	-Ir	1)
	53658.4557	.0004	FR	+0.0005		GCVS 87	-Ir	10)
FW Vul	53650.3555	.0020	AG				-Ir	1)
GI Vul	53899.4606	.0007	AG				-Ir	1)
GN Vul	53650.3419	.0022	AG				-Ir	1)
GP Vul	53612.3738	.0014	AG	−0.0349	s	GCVS 87	-Ir	1)
	53659.3529	.0005	AG	−0.0553		GCVS 87	-Ir	1)
	53661.4191	.0015	AG	−0.0541		GCVS 87	-Ir	1)
	53899.4038	.0003	AG	−0.5454	s	GCVS 87	-Ir	1)
GR Vul	53612.3933	.0006	AG				-Ir	1)
	53920.5068	.0015	AG				-Ir	1)
GU Vul	53544.4447	.0007	AG	+0.0253		GCVS 87	-Ir	1)
	53614.5149	.0027	AG	+0.0280	s	GCVS 87	-Ir	1)
	53899.4278	.0010	AG	+0.0253	s	GCVS 87	-Ir	1)
HS Vul	53569.4385	.0022	AG				-Ir	1)
	53592.5192	.0010	AG				-Ir	1)
IW Vul	53612.3404	.0004	AG				-Ir	1)
	53614.4735	.0017	AG				-Ir	1)
	53658.3009	.0012	FR				-Ir	10)
KN Vul	53592.4261	.0009	AG	+0.0469	s	GCVS 87	-Ir	1)
NO Vul	53544.5268	.0035	AG				-Ir	1)
	53555.4627	.0009	AG				-Ir	1)
	53565.4741	.0007	AG				-Ir	1)
GSC2192.1283 Vul	53209.4327	.0083	AG					1)
	53216.4943	.0006	AG					1)
	53217.4502	.0029	AG					1)
	53222.4143	.0020	AG					1)
	53250.4779	.0030	AG					1)
	53251.4357	.0014	AG					1)
	53253.3445	.0007	AG					1)
	53254.4902	.0037	AG					1)
	53255.4417	.0006	AG					1)
	53256.5874	.0009	AG					1)
	53257.3515	.0002	AG					1)
	53257.5448	.0004	AG					1)
	53282.3663	.0038	AG				-Ir	1)
	53282.5561	.0002	AG				-Ir	1)
	53284.4623	.0012	AG				-Ir	1)
	53601.3911	.0009	AG				-Ir	1)
	53601.5844	.0001	AG				-Ir	1)
	53613.4192	.0007	AG				-Ir	1)
	53613.6102	.0001	AG				-Ir	1)
	53636.5217	.0007	AG				-Ir	1)
	53651.4124	.0011	AG				-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$		Fil	Rem
GSC2140.1485 Vul	53569.4746	.0014	AG			-Ir	1)
	53579.4149	.0019	AG			-Ir	1)
	53579.5684	.0006	AG			-Ir	1)
	53584.3864	.0005	AG			-Ir	1)
	53592.5200:	.0050	AG			-Ir	1)
	53611.4950	.0008	AG			-Ir	1)
	53612.3978	.0031	AG			-Ir	1)
	53612.5481	.0011	AG			-Ir	1)
	53614.3544	.0023	AG			-Ir	1)
	53614.5074	.0046	AG			-Ir	1)

Table 2: Pulsating stars

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
XX And	53410.3281	.0035	ATB	+0.0066	BAVR 48,189		1)
XY And	53662.6580	.0030	AG			-Ir	1)
ZZ And	53697.3651	.0002	MZ			-Ir	2)
BK And	53619.5450	.0049	PC	+0.0017	BAVR 49, 41	-Ir	7)
	53649.4795	.0051	PC	+0.0023	BAVR 49, 41	-Ir	7)
CC And	53662.2951	.0035	JU	+0.0291	GCVS 85		2)
CI And	53407.3639	.0022	ATB	−0.0017	BAVR 53, 87ff		1)
GP And	53217.5431	.0011	MON	+0.0035	GCVS 85	V	1)
	53217.6218	.0011	MON	+0.0036	GCVS 85	V	1)
	53265.3833	.0011	MON	+0.0047	GCVS 85	V	1)
	53265.4613	.0011	MON	+0.0040	GCVS 85	V	1)
	53265.5387	.0011	MON	+0.0027	GCVS 85	V	1)
	53609.5417	.0012	MON	+0.0049	GCVS 85	V	1)
	53622.3659	.0012	MON	+0.0038	GCVS 85	V	1)
	53622.4447	.0012	MON	+0.0040	GCVS 85	V	1)
	53622.5238	.0012	MON	+0.0044	GCVS 85	V	1)
	53638.3399	.0007	SG	+0.0053	GCVS 85	V	3)
	53673.2748	.0005	SG	+0.0050	GCVS 85	-Ir	3)
WY Ant	53849.369	.003	HND			-Ir	19)
TY Aps	53091.424	.004	HND DVY				14)
UW Aps	53538.3720	.0040	PS DVY	−0.0651	BAVR 53, 96f		2)
UY Aps	53083.384	.004	HND DVY				13)
	53111.367	.004	HND DVY				13)
VX Aps	53116.368	.004	HND DVY				13)
XZ Aps	53174.423	.004	HND DVY				13)
YZ Aps	53093.425	.004	HND DVY				15)
	53927.525	.002	HND			-Ir	19)
ZZ Aps	53549.398	.002	HND			-Ir	19)
	53580.359	.002	HND			-Ir	19)
	53598.482	.003	HND				19)
	53925.420	.002	HND			-Ir	19)
BS Aps	53547.419	.002	HND			-Ir	19)
	53548.584	.002	HND			-Ir	19)
	53928.409	.002	HND			-Ir	19)
DI Aps	53109.318	.004	HND DVY				14)
	53122.321	.004	HND DVY				14)
	53124.409	.004	HND DVY				14)
EV Aps	53108.371	.004	HND DVY				14)
EX Aps	53089.421	.004	HND DVY				14)
V341 Aql	53936.4250	.0005	QU	+0.0050	BAVR 45, 74	V	3)
V672 Aql	53585.4941	.0036	MZ			-Ir	2)
	53636.3514	.0020	MZ			-Ir	2)
CS Ara	53572.435	.002	HND			-Ir	19)
	53576.381	.002	HND			-Ir	19)
	53608.451	.002	HND			-Ir	19)

Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
DL Ara	53566.420	.003	HND			IRc	19)
	53567.327	.002	HND			-Ir	19)
	53577.304	.002	HND			-Ir	19)
	53610.412	.002	HND			-Ir	19)
DO Ara	53587.482	.003	HND			-Ir	19)
	53599.487	.003	HND			-Ir	19)
EI Ara	53245.363	.004	HND DVY				15)
	53246.378	.004	HND DVY				15)
EZ Ara	53205.494	.004	HND DVY				15)
FM Ara	53166.377	.004	HND DVY				15)
FO Ara	53202.423	.004	HND DVY				15)
MS Ara	53590.560	.003	HND			-Ir	19)
	53600.535	.003	HND			-Ir	19)
QT Ara	53584.387	.003	HND			-Ir	19)
	53592.556	.002	HND			-Ir	19)
	53609.520	.003	HND			-Ir	19)
V414 Ara	53569.505	.003	HND			-Ir	19)
	53611.436	.003	HND			-Ir	19)
V430 Ara	53574.432	.003	HND			-Ir	19)
	53575.489	.003	HND			-Ir	19)
	53594.504	.003	HND			-Ir	19)
V431 Ara	53574.352	.003	HND			-Ir	19)
V453 Ara	53563.490	.002	HND			-Ir	19)
V455 Ara	53552.420	.002	HND			-Ir	19)
V739 Ara	53566.439	.003	HND			-Ir	19)
	53567.498	.003	HND			-Ir	19)
X Ari	53349.3281	.0010	MON	+0.0395	BAVR 48,189	V	1)
RV Ari	53266.5512	.0011	MON	−0.0033	GCVS 85	V	1)
	53346.2687	.0015	MON	−0.0036	GCVS 85	V	1)
	53346.3688	.0016	MON	+0.0034	GCVS 85	V	1)
	53631.5255	.0015	MON	+0.0013	GCVS 85	V	1)
	53631.6126	.0015	MON	−0.0047	GCVS 85	V	1)
	53749.2346	.0007	JU	−0.0037	GCVS 85		2)
	53749.3290	.0008	JU	−0.0024	GCVS 85		2)
	53750.2609	.0019	PC	−0.0018	GCVS 85	-Ir	7)
	53751.2916	.0007	JU	+0.0045	GCVS 85		2)
	53752.3163	.0014	PC	+0.0048	GCVS 85	-Ir	7)
	53759.2960	.0007	SCI	−0.0001	GCVS 85		2)
	53759.3808	.0004	SCI	−0.0085	GCVS 85		2)
TZ Aur	53654.6123	.0019	MON	+0.0116	GCVS 85	V	1)
	53745.4823	.0022	PC	+0.0131	GCVS 85	-Ir	7)
	53751.3555	.0005	QU	+0.0112	GCVS 85	V	2)
	53751.3556	.0012	HNS	+0.0113	GCVS 85	-Ir	17)
	53752.5340	.0024	PC	+0.0147	GCVS 85	-Ir	7)
	53760.3658	.0030	HMB	+0.0130	GCVS 85	Rs	4)
	53760.3674	.0020	HMB	+0.0146	GCVS 85	C	4)
	53760.3682	.0030	HMB	+0.0154	GCVS 85	V	4)
BH Aur	53764.3829	.0020	FR	+0.0023	SAC 73	-Ir	10)
PY Aur	53750.4311	.0056	PC			-Ir	7)
RS Boo	53540.4548	.0017	SE	+0.0211	BAVR 36,157ff	-Ir	14)
	53849.4850	.0002	KRS	+0.0111	BAVR 36,157ff	V	2)
RU Boo	53509.4445	.0004	MZ			-Ir	2)
ST Boo	53862.4310	.0030	AG	−0.0215	BAVR 49,105	-Ir	1)
SW Boo	53088.5674:	.0057	HSR	+0.0736	BAVR 53, 1ff		5)
	53482.4580	.0012	JU	+0.1115	BAVR 53, 1ff		2)
	53483.4977	.0022	HSR	+0.1242	BAVR 53, 1ff		2)
	53502.4866	.0007	JU	+0.1137	BAVR 53, 1ff		2)
	53518.4090	.0021	HSR	+0.1176	BAVR 53, 1ff		2)
	53540.4900	.0007	JU	+0.1182	BAVR 53, 1ff		2)
	53898.4314	.0010	JU	+0.1518	BAVR 53, 1ff		2)

Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
TV Boo	53483.5029	.0026	HSR				2)
UU Boo	53759.6444	.0013	MON	+0.1787	GCVS 85	V	1)
WW Boo	53897.4157	.0003	MZ			-Ir	2)
YZ Boo	53056.6101	.0012	MON	+0.0027	GCVS 85	V	1)
	53462.4632	.0012	MON	+0.0028	GCVS 85	V	1)
	53462.5665	.0012	MON	+0.0020	GCVS 85	V	1)
	53483.3853	.0012	MON	+0.0025	GCVS 85	V	1)
	53483.4891	.0012	MON	+0.0022	GCVS 85	V	1)
CG Boo	53746.6034	.0033	MS FR				6)
	53763.5499	.0030	MS FR				6)
CQ Boo	53809.6592	.0015	MON	−0.0083	BAVR 48,189	V	1)
CS Boo	53808.5243	.0022	MON	−0.0026	IBVS 2855	V	1)
CU Boo	53540.4404	.0040	MZ			V	18)
	53540.4425	.0040	MZ			B	18)
U1200-07442272 Boo	52722.347	.005	AG				1)
	52723.404	.005	AG				1)
	52724.426 :	.010	AG				1)
	52725.490	.002	AG				1)
	52726.532	.005	AG				1)
	52747.448	.010	AG				1)
	52784.431	.003	AG				1)
	52793.507 :	.010	AG				1)
	52858.395	.001	AG				1)
	53097.358	.003	AG				1)
	53145.4910	.0005	AG				1)
	53475.4760	.0100	AG			-Ir	2)
UY Cam	53867.4340	.0030	AG	+0.0579	BAVR 49, 41	-Ir	1)
AH Cam	53796.3173	.0008	MZ	−0.0052	GCVS 85	-Ir	2)
	53807.3772	.0008	MZ	−0.0073	GCVS 85	-Ir	2)
RW Cnc	53472.3195	.0127	SE	+0.1878	GCVS 85	-Ir	14)
SS Cnc	51498.4711	.0010	HSR	−0.0038	BAVR 49, 41	-Ir	2)
	53460.4226	.0017	ATB	−0.0113	BAVR 49, 41		1)
TT Cnc	53432.3018	.0013	MON	+0.0099	BAVR 47, 67	V	1)
	53745.5948	.0032	PC	+0.0239	BAVR 47, 67	-Ir	7)
VZ Cnc	53752.5462	.0047	PC	+0.0074	GCVS 85	-Ir	7)
AN Cnc	53752.5321	.0064	PC			-Ir	7)
AQ Cnc	53430.3311	.0019	MON	−0.0652	GCVS 85	V	1)
	53815.3894	.0013	JU	−0.0675	GCVS 85		2)
AS Cnc	53752.5989	.0095	PC			-Ir	7)
Z CVn	53544.4752	.0031	SCI	+0.2495	GCVS 85		2)
RR CVn	53750.6851	.0043	PC			-Ir	7)
RZ CVn	50607.549 :	.001	KRW ZAU	+0.007	BAVR 48,189		2)
	53455.4063	.0015	JU	+0.0851	BAVR 48,189		2)
	53514.4164	.0010	JU	+0.0856	BAVR 48,189		2)
	53760.6749	.0019	MON	+0.0927	BAVR 48,189	V	1)
UZ CVn	51627.3246	.0019	HSR	−0.0099	BAVR 49, 41	-Ir	2)
	52368.3804	.0036	HSR	−0.0145	BAVR 49, 41		3)
	53750.7001	.0054	PC	−0.0307	BAVR 49, 41	-Ir	7)
BN CVn	52345.5704	.0092	PC	+0.0340	BAVM 75	-Ir	4)
AD CMi	53056.3058	.0010	MON	+0.0122	GCVS 85	V	1)
HU Cas	53631.5614	.0038	PC			-Ir	7)
PS Cas	53636.4950	.0030	AG			-Ir	1)
	53651.5810	.0020	AG			-Ir	1)
	53659.5660	.0030	AG			-Ir	1)
	53716.3610	.0030	AG			-Ir	1)
V470 Cas	53651.5430	.0030	AG	+0.2643	IBVS 4332	-Ir	1)
	53659.3900	.0050	AG	+0.2411	IBVS 4332	-Ir	1)
U1425-00752967 Cas	53654.4880	.0010	AG				1)
	53671.2750	.0010	AG			-Ir	1)
	53671.3480	.0010	AG			-Ir	1)

Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
U1425-00752967 Cas	53671.4210	.0010	AG			-Ir	1)
	53671.4950	.0010	AG			-Ir	1)
	53671.5680	.0010	AG			-Ir	1)
	53717.2350	.0010	AG			-Ir	1)
	53717.3080	.0010	AG			-Ir	1)
	53744.2850	.0010	AG			-Ir	1)
	53759.4580	.0010	AG			-Ir	1)
V444 Cen	53916.396	.002	HND			-Ir	19)
V499 Cen	53919.375	.003	HND			-Ir	19)
V501 Cen	53924.427	.002	HND			-Ir	19)
EL Cep	53631.6063	.0036	PC			-Ir	7)
	53649.5290	.0049	PC			-Ir	7)
	53683.2670	.0030	AG			-Ir	1)
EZ Cep	53750.3441	.0037	PC	+0.0797	SAC 74	-Ir	7)
S Com	53863.3977	.0010	FR	+0.0076	SAC 73	-Ir	10)
DL Com	53903.4239	.0008	MZ			-Ir	2) red
RV CrB	53529.5532:	.0012	JU	+0.1021	GCVS 85		2)
	53541.4933	.0014	JU	+0.1058	GCVS 85		2) 21)
	53544.4771	.0016	JU	+0.1055	GCVS 85		2) 21)
	53639.340	.001	SG	+0.140	GCVS 85	V	3)
TV CrB	53464.4288	.0018	MS FR	−0.0085	BAVR 49,105		6)
W Crt	53467.358	.003	HND	−0.020	GCVS 85	-Ir	19)
UY Cyg	53220.3946	.0014	MON	+0.0502	GCVS 85	V	1)
	53599.4307	.0013	JU	+0.0499	GCVS 85		2)
	53631.3943	.0040	PC	+0.0533	GCVS 85	-Ir	7)
	53649.3345	.0033	PC	+0.0510	GCVS 85	-Ir	7)
XX Cyg	53165.3911	.0015	MON	+0.0030	GCVS 85	V	1)
	53216.3703	.0015	MON	+0.0032	GCVS 85	V	1)
	53463.4431	.0015	MON	+0.0031	GCVS 85	V	1)
	53463.5780	.0015	MON	+0.0031	GCVS 85	V	1)
	53601.4123	.0017	PC	+0.0053	GCVS 85	-Ir	7)
	53601.5466	.0019	PC	+0.0047	GCVS 85	-Ir	7)
	53613.4160	.0019	PC	+0.0060	GCVS 85	-Ir	7)
	53613.5492	.0015	PC	+0.0043	GCVS 85	-Ir	7)
	53648.3478	.0024	PC	+0.0077	GCVS 85	-Ir	7)
	53648.4788	.0015	PC	+0.0039	GCVS 85	-Ir	7)
	53648.6120	.0013	PC	+0.0022	GCVS 85	-Ir	7)
	53649.2894	.0018	PC	+0.0053	GCVS 85	-Ir	7)
	53649.4257	.0022	PC	+0.0067	GCVS 85	-Ir	7)
	53649.5585	.0017	PC	+0.0047	GCVS 85	-Ir	7)
XZ Cyg	53614.5264	.0038	PC	+0.0320	BAVR 48,189	-Ir	7)
DM Cyg	53613.4451	.0033	PC	+0.0005	BAVR 51, 98ff	-Ir	7)
NS Cyg	53555.4660	.0030	AG			-Ir	1)
V882 Cyg	53578.4700	.0050	AG			-Ir	1)
V939 Cyg	50943.394	.001	AG	−0.018	BAVM 92		1)
	53613.5283	.0100	PC	+0.0032	BAVM 92	-Ir	7)
V1719 Cyg	53649.3526	.0060	PC	−0.0510	GCVS 85	-Ir	7)
V1949 Cyg	53614.5098	.0091	PC			-Ir	7)
	53619.5081	.0088	PC			-Ir	7)
CH Del	53640.470	.003	HND			-Ir	19)
DX Del	52835.5470	.0025	HSR				2)
	53614.4281	.0038	PC			-Ir	7)
SW Dra	53451.4479	.0018	JU	+0.0073	BAVR 47, 67		2)
	53541.4552	.0037	SE	+0.0064	BAVR 47, 67	-Ir	14)
VZ Dra	53052.5555	.0019	MON	−0.1202	GCVS 85	V	1)
XZ Dra	53593.4077	.0022	JU	−0.0894	GCVS 85		2)
BD Dra	53636.3755	.0034	HMB			Rs	4)
	53636.3762	.0030	HMB			V	4)
	53647.5288	.0046	HMB			V	4)
	53647.5302	.0030	HMB			Rs	4)

Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
BD Dra	53682.3191	.0052	HMB			V	4)
	53682.3200	.0033	HMB			Rs	4)
	53683.4957	.0030	HMB			V	4)
	53693.4593	.0047	HMB			V	4)
	53693.4644	.0037	HMB			Rs	4)
	53733.5541	.0029	HMB			Rs	4)
	53733.5552	.0037	HMB			V	4)
	53743.5430	.0064	HMB			Rs	4)
	53743.5458	.0094	HMB			V	4)
	53745.3135	.0047	HMB			Rs	4)
	53745.3155	.0046	HMB			V	4)
	53759.4642	.0045	HMB			Rs	4)
	53759.473	.010	HMB			V	4)
	53762.3896	.0054	HMB			V	4)
	53762.3923	.0050	HMB			Rs	4)
BK Dra	53406.6370	.0012	MON	+0.0472	BAVR 46, 1	V	1)
	53601.4358	.0033	PC	+0.0542	BAVR 46, 1	-Ir	7)
CY Dra	53613.4502	.0099	PC			-Ir	7)
	53614.5145	.0078	PC			-Ir	7)
	53649.2789	.0076	PC			-Ir	7)
DD Dra	53601.4006	.0061	PC	−0.0900	BAVR 49, 6	-Ir	7)
	53619.3543	.0052	PC	−0.1099	BAVR 49, 6	-Ir	7)
	53900.4980	.0030	AG	−0.0085	BAVR 49, 6	-Ir	1)
SV Eri	53730.400	.003	HND	−0.006	BAVR 52, 62ff	-Ir	19)
BB Eri	53725.456	.002	HND			-Ir	19)
RR Gem	53301.6299	.0012	MON	+0.0020	BAVR 47, 67	V	1)
	53407.3104	.0065	SE	+0.0027	BAVR 47, 67	-Ir	14)
	53463.3293	.0025	SE	+0.0034	BAVR 47, 67	-Ir	14)
	53661.5758	.0015	MON	+0.0010	BAVR 47, 67	V	1)
	53751.3636	.0012	HNS	+0.0007	BAVR 47, 67	-Ir	17)
	53759.3127	.0016	MON	+0.0040	BAVR 47, 67	V	1)
	53780.3680	.0030	AG	+0.0028	BAVR 47, 67	-Ir	1)
	53813.3395	.0018	FR	−0.0010	BAVR 47, 67	-Ir	10)
SZ Gem	53780.2686	.0015	MON	+0.0068	BAVR 48, 65	V	1)
AK Gem	53759.5699	.0020	FR	−0.0491	GCVS 85	-Ir	10)
	53762.3399	.0020	FR	+0.0742	GCVS 85	-Ir	10)
ER Gem	53766.3382	.0035	FR			-Ir	10)
GI Gem	53737.3988	.0009	MZ	−0.0085	BAVR 51, 40ff	-Ir	2)
IV Gem	53813.4206	.0020	FR			-Ir	10)
AQ Gru	53680.443	.002	HND			-Ir	19)
TW Her	53516.4303	.0016	MON	−0.0088	GCVS 85	V	1)
	53894.4560	.0030	AG	−0.0048	GCVS 85	-Ir	1)
VX Her	53081.5793	.0012	MON	+0.0805	GCVS 85	V	1)
	53531.4754	.0007	JU	+0.0682	GCVS 85		2)
VZ Her	53636.3443	.0014	ATB	+0.0609	GCVS 85		1)
AR Her	53516.4586	.0020	JU	+0.0270	BAVR 52, 3ff		2)
GT Her	53860.3520	.0030	AG			-Ir	1)
HI Her	53860.3920	.0030	AG			-Ir	1)
IP Her	53635.3668	.0035	ATB				1)
	53655.3088	.0049	ATB				1)
V458 Her	53566.4760	.0100	AG			-Ir	1)
V469 Her	53524.4590	.0030	AG			-Ir	1)
V545 Her	53565.5460	.0030	AG			-Ir	1)
V633 Her	53600.4062	.0040	MZ			-Ir	2)
V635 Her	53846.4880	.0030	AG			-Ir	1)
V716 Her	53849.5270	.0030	AG			-Ir	1)
V734 Her	53518.4710	.0030	AG			-Ir	1)
V753 Her	53849.4820	.0030	AG			-Ir	1)
WZ Hya	53464.379	.003	HND	−0.004	GCVS 85	-Ir	19)
GL Hya	53813.3865	.0007	MZ			-Ir	2)

Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
GSC6730.109 Hya	53125.334	.003	HND				19)
	53134.351	.003	HND				19)
SU Hyi	53727.440	.002	HND			-Ir	19)
SX Hyi	53346.465	.003	HND			-Ir	19)
SW Ind	53665.466	.003	HND			-Ir	19)
TW Ind	53663.466	.003	HND			-Ir	19)
CQ Lac	53649.4742	.0051	PC	+0.0274	SAC 74	-Ir	7)
CZ Lac	53649.3757	.0051	PC	−0.0113	BAVR 53, 12f	-Ir	7)
DE Lac	53209.4394	.0012	MON	+0.0341	GCVS 85	V	1)
	53601.3963	.0012	MON	+0.0347	GCVS 85	V	1)
	53613.3210	.0014	MON	+0.0358	GCVS 85	V	1)
	53614.3343	.0012	MON	+0.0343	GCVS 85	V	1)
	53633.3628	.0012	MON	+0.0358	GCVS 85	V	1)
	53636.4089	.0012	MON	+0.0376	GCVS 85	V	1)
	53661.2737	.0012	MON	+0.0404	GCVS 85	V	1)
PW Lac	53612.5686	.0034	PC	+0.0492	BAVM 75	-Ir	7)
	53631.5259	.0032	PC	+0.0489	BAVM 75	-Ir	7)
	53649.4613	.0032	PC	+0.0514	BAVM 75	-Ir	7)
BT Leo	53814.3277	.0010	MZ			-Ir	2)
DL Leo	53750.5819	.0105	PC	+0.0477	IBVS 2533	-Ir	7)
DM Leo	53462.3324	.0010	MZ			V	18)
	53462.3344	.0060	MZ			B	18)
V LMi	53068.5178	.0086	PC	+0.1526	SAC 72	-Ir	7)
	53752.6483	.0053	PC	+0.0334	SAC 72	-Ir	7)
TX Lib	53564.4351	.0009	MZ			-Ir	2)
EH Lib	53503.3782	.0012	MON	+0.0031	GCVS 85	V	1)
	53503.4667	.0012	MON	+0.0031	GCVS 85	V	1)
RW Lyn	53439.4415	.0022	ATB	−0.0011	BAVR 47, 35		1)
	53745.5493	.0026	PC	−0.0108	BAVR 47, 35	-Ir	7)
	53750.5339	.0071	PC	−0.0119	BAVR 47, 35	-Ir	7)
	53752.5276	.0038	PC	−0.0124	BAVR 47, 35	-Ir	7)
SZ Lyn	53397.2734	.0012	MON	+0.0160	GCVS 85	V	1)
	53397.3933	.0012	MON	+0.0153	GCVS 85	V	1)
	53750.5677	.0044	PC	+0.0224	GCVS 85	-Ir	7)
	53752.4994	.0027	PC	+0.0256	GCVS 85	-Ir	7)
	53752.6108	.0025	PC	+0.0164	GCVS 85	-Ir	7)
	53752.6160	.0025	PC	+0.0216	GCVS 85	-Ir	7)
	53766.2372	.0011	MON	+0.0224	GCVS 85	V	1)
	53808.3052	.0012	MON	+0.0237	GCVS 85	V	1)
AN Lyn	53096.4139	.0042	PC			-Ir	7)
	53463.3733	.0015	MON			V	1)
BE Lyn	53349.4617	.0011	MON	+0.0050	Rev Mex 20,37	V	1)
	53349.5569	.0011	MON	+0.0043	Rev Mex 20,37	V	1)
	53349.6526	.0012	MON	+0.0042	Rev Mex 20,37	V	1)
Y Lyr	53631.314 :	.006	PC			-Ir	7)
RR Lyr	53601.4581	.0060	PC	+0.0321	SAC 73	-Ir	7)
	53631.5230	.0035	ATB	+0.0556	SAC 73		1)
RZ Lyr	53619.3843	.0030	PC	−0.0112	BAVR 48,189	-Ir	7)
	53662.3467	.0021	ATB	+0.0069	BAVR 48,189		1)
	53683.3049	.0024	ATB	+0.0041	BAVR 48,189		1)
AQ Lyr	53614.4173	.0024	PC			-Ir	7)
CG Lyr	53575.4865	.0008	MZ			-Ir	2)
CN Lyr	53164.4595	.0015	MON	+0.0034	BAVR 43, 57	V	1)
	53659.3649	.0042	ATB	+0.0154	BAVR 43, 57		1)
DI Lyr	53536.4420	.0004	MZ			V	18)
EZ Lyr	53614.385 :	.007	PC	+0.029	BAVR 34,145ff	-Ir	7)
FN Lyr	53648.4816	.0021	ATB	+0.0217	GCVS 85		1)
IO Lyr	53627.4023	.0021	ATB	−0.0304	GCVS 85		1)
KX Lyr	53601.3659	.0031	PC	+0.0483	SAC 70	-Ir	7)
MW Lyr	53635.4034	.0002	MZ			-Ir	2)

Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
NR Lyr	53672.3031	.0042	ATB				1)
EM Mus	53920.400	.002	HND			-Ir	19)
AX Oph	53520.4570	.0030	AG			-Ir	1)
V430 Oph	53560.5190	.0040	PS DVY				2)
V1640 Ori	53744.4441	.0007	MZ	+0.0881	BAVM 149	-Ir	2)
SW Pav	53644.316	.002	HND			-Ir	19)
BN Pav	53289.355	.002	HND			-Ir	19)
	53649.476	.002	HND			-Ir	19)
BP Pav	53641.398	.002	HND			-Ir	19)
DN Pav	53652.492	.002	HND			-Ir	19)
FO Pav	53636.344	.003	HND			-Ir	19)
	53642.410	.002	HND			-Ir	19)
HV Pav	53634.402	.002	HND			-Ir	19)
QR Pav	53643.406	.005	HND			-Ir	19)
VV Peg	53601.5116	.0032	PC	−0.0270	GCVS 87	-Ir	7)
	53648.3978	.0026	PC	−0.0260	GCVS 87	-Ir	7)
	53649.3743	.0030	PC	−0.0262	GCVS 87	-Ir	7)
AO Peg	53696.2796	.0035	ATB	−0.0091	BAVR 49, 41		1)
AV Peg	53658.3048	.0016	MON	+0.0250	BAVR 47, 67	V	1)
BH Peg	53648.438 :	.005	PC	+0.009	BAVR 47, 67	-Ir	7)
BP Peg	53222.4192	.0016	MON	−0.0122	BAVR 48,189	V	1)
	53222.5333	.0015	MON	−0.0077	BAVR 48,189	V	1)
	53612.5039	.0993	PC	−0.0146	BAVR 48,189	-Ir	7)
	53614.4790	.0035	PC	−0.0113	BAVR 48,189	-Ir	7)
	53617.3233	.0015	MON	−0.0151	BAVR 48,189	V	1)
	53617.4395	.0016	MON	−0.0085	BAVR 48,189	V	1)
	53631.4597	.1067	PC	−0.0099	BAVR 48,189	-Ir	7)
BT Peg	53613.5620	.0030	AG	+0.0850	BAVR 49,105	-Ir	1)
CG Peg	52503.6156:	.0016	PC	−0.0200	SAC 72	-Ir	4)
	53217.4027	.0012	MON	−0.0201	SAC 72	V	1)
	53614.4729	.0040	PC	−0.0174	SAC 72	-Ir	7)
	53635.4895	.0021	ATB	−0.0221	SAC 72		1)
	53657.4452	.0005	QU	−0.0219	SAC 72	V	3)
	53658.3781	.0005	QU	−0.0232	SAC 72	V	3)
	53659.3124	.0016	MON	−0.0232	SAC 72	V	1)
CQ Peg	53613.5570	.0030	AG			-Ir	1)
DH Peg	53648.4296	.0028	PC	+0.0263	GCVS 87	-Ir	7)
DY Peg	53216.4666	.0011	MON	−0.0046	GCVS 87	V	1)
	53216.5392	.0011	MON	−0.0050	GCVS 87	V	1)
	53216.6129	.0011	MON	−0.0042	GCVS 87	V	1)
	53257.4510	.0012	MON	−0.0048	GCVS 87	V	1)
	53283.3402	.0011	MON	−0.0044	GCVS 87	V	1)
	53283.4128	.0012	MON	−0.0048	GCVS 87	V	1)
	53599.4743	.0012	MON	−0.0058	GCVS 87	V	1)
	53599.5473	.0012	MON	−0.0058	GCVS 87	V	1)
	53599.6209	.0012	MON	−0.0051	GCVS 87	V	1)
	53612.3823	.0012	MON	−0.0058	GCVS 87	V	1)
	53612.5279	.0012	MON	−0.0060	GCVS 87	V	1)
	53614.4250	.0012	MON	−0.0050	GCVS 87	V	1)
	53631.4167	.0012	MON	−0.0052	GCVS 87	V	1)
	53648.410 :	.001	PC	−0.004	GCVS 87	-Ir	7)
	53648.4819	.0009	PC	−0.0047	GCVS 87	-Ir	7)
	53654.3156	.0012	MON	−0.0051	GCVS 87	V	1)
	53654.3880	.0012	MON	−0.0056	GCVS 87	V	1)
	53701.2070	.0015	MON	−0.0053	GCVS 87	V	1)
	53701.2796	.0013	MON	−0.0056	GCVS 87	V	1)
DZ Peg	53612.5333	.0039	PC	−0.0225	SAC 74	-Ir	7)
AR Per	53752.5048	.0044	PC	+0.0592	GCVS 87	-Ir	7)
ET Per	53654.3150	.0040	AG	−0.0196	BAVR 49, 41	-Ir	1)
KV Per	53651.5600	.0050	AG			-Ir	1)

Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
NN Per	53766.3430	.0050	AG			-Ir	1)
RV Phe	53681.499	.002	HND			-Ir	19)
	53687.463	.003	HND			-Ir	19)
TZ Phe	53682.429	.002	HND			-Ir	19)
SS Psc	53649.5022	.0126	PC	−0.0061	BAVR 47, 67	-Ir	7)
	53750.2447	.0081	PC	+0.0105	BAVR 47, 67	-Ir	7)
SY Psc	53648.5304	.0050	PC	+0.1000	GCVS 87	-Ir	7)
DP Sge	53565.5510	.0030	AG			-Ir	1)
	53566.5230	.0030	AG			-Ir	1)
	53569.4520	.0030	AG			-Ir	1)
V703 Sco	52065.5969	.0008	HSR	+0.0200	GCVS 87	V	5)
	52066.5175	.0020	HSR	+0.0188	GCVS 87	V	5)
	52066.6363	.0008	HSR	+0.0224	GCVS 87	V	5)
	52073.6629	.0010	HSR	+0.0207	GCVS 87	V	5)
	52075.6214	.0013	HSR	+0.0205	GCVS 87	V	5)
RW Scl	53694.401	.002	HND			-Ir	19)
SV Scl	53705.423	.002	HND			-Ir	19)
TX Scl	53715.446	.003	HND			-Ir	19)
UZ Scl	53689.425	.002	HND			-Ir	19)
VW Scl	53724.492	.003	HND			-Ir	19)
VX Scl	53721.463	.002	HND			-Ir	19)
WY Scl	53690.475	.002	HND			-Ir	19)
AE Scl	53688.444	.002	HND			-Ir	19)
BU Sct	53563.4966	.0030	MZ			-Ir	2)
CF Ser	53561.4288	.0013	MZ			-Ir	2)
CS Ser	53530.4936	.0006	MZ			V	18)
DY Ser	53518.4410	.0006	MZ	+0.0307	GCVS 87	-Ir	2)
T Sex	53451.3773	.0016	MON	−0.0461	BAVR 51,247	V	1)
BR Tau	53797.3145	.0003	MZ			-Ir	2)
GR Tel	53633.298	.002	HND			-Ir	19)
GZ Tel	53654.462	.005	HND			-Ir	19)
HY Tel	53662.369	.003	HND			-Ir	19)
U Tri	53649.5949	.0033	PC	−0.0028	BAVR 49,105	-Ir	7)
	53662.5640	.0030	AG	−0.0040	BAVR 49,105	-Ir	1)
	53745.3036	.0026	PC	−0.0060	BAVR 49,105	-Ir	7)
UX Tri	52250.4183	.0023	HSR				5)
	52257.3982	.0018	HSR				5)
	53221.566 :	.025	HSR				5)
	53272.4951	.0025	HSR			-Ir	2)
	53316.3906	.0020	HSR				2)
	53317.3223	.0031	HSR				5)
	53318.2571	.0017	HSR				5)
	53321.5262	.0018	HSR VMR				5)
	53323.3871	.0023	HSR				5)
	53617.5488	.0012	HSR				4)
	53619.4175	.0026	HSR				5)
	53631.5531	.0063	PC			-Ir	7)
	53653.4541	.0015	HSR				16)
	53654.3815	.0024	HSR				16)
	53658.608	.007	HSR				16)
	53662.3800	.0030	AG			-Ir	1)
	53673.5742	.0016	HSR				5)
	53674.5086	.0012	HSR				5)
	53701.5590	.0041	HSR				16)
	53702.519	.007	HSR				16)
W Tuc	53345.346	.002	HND			-Ir	19)
	53720.414	.002	HND			-Ir	19)
YY Tuc	53723.377	.002	HND			-Ir	19)
AE Tuc	53347.384	.002	HND			-Ir	19)
	53686.467	.002	HND			-Ir	19)

Table 2: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
AG Tuc	53711.499	.003	HND			-Ir	19)
AM Tuc	53706.476	.002	HND			-Ir	19)
BK Tuc	53726.385	.002	HND			-Ir	19)
TU UMa	53746.5235	.0005	QU	−0.0249	GCVS 87	V	2)
	53813.4426	.0005	QU	−0.0249	GCVS 87	V	3)
	53847.4590	.0007	QU	−0.0257	GCVS 87	V	3)
AE UMa	53110.3619	.0019	PC	+0.0071	BAVR 48,189	-Ir	7)
	53427.3272	.0011	MON	−0.0004	BAVR 48,189	V	1)
	53427.4181	.0012	MON	+0.0044	BAVR 48,189	V	1)
	53427.5031	.0012	MON	+0.0034	BAVR 48,189	V	1)
GSC4416.214 UMi	53904.4805	.0020	MZ			-Ir	2)
AF Vel	53864.369	.002	HND			-Ir	19)
AN Vel	53850.337	.003	HND			-Ir	19)
ST Vir	53847.5720	.0030	AG	+0.0332	GCVS 87	-Ir	1)
AV Vir	50953.4435	.0013	BK	+0.0054	BAVR 48,189		2)
RV Vol	53853.342	.002	HND			-Ir	19)
SV Vol	53857.318	.002	HND			-Ir	19)
BN Vul	53653.3929	.0007	QU	−0.0225	SAC 73	V	3)
CE Vul	53544.4670	.0030	AG			-Ir	1)
FH Vul	53649.2763	.0028	PC	−0.0449	BAVR 49, 41	-Ir	7)
FK Vul	53617.4082	.0006	MZ			-Ir	2)
HL Vul	53566.5150	.0030	AG			-Ir	1)
HR Vul	53579.5360	.0030	AG			-Ir	1)

Remarks:

AG :	Agerer, F., Tiefenbach	ATB:	Achterberg, Dr. H., Norderstedt
BK :	Birkner, C., Hagen	DIE:	Dietrich, M., Radebeul
DVY:	Dreveny, R.,	FR :	Frank, P., Velden
HMB:	Hambsch, Dr. F., Mol (B)	HND:	Hund, F., Windhoek (Namibia)
HSR:	Husar, Dr. D., Hamburg	JU :	Jungbluth, Dr. H., Karlsruhe
KI :	Kleikamp, W., Marl	KRS:	Kersten, Dr. P., Weissach
KRW:	Krawietz, A., Kurort Hartha	MON:	Monninger, Dr. G., Gemmingen
MS :	Moschner, W., Lennestadt	MSR:	Moschner, J., Lennestadt
MZ :	Maintz, G., Bonn	PC :	Poschinger, K., Hamburg
PRK:	Proksch, W., Winhöring	PS :	Paschke, A., Rüti (CH)
QU :	Quester, W., Esslingen	RAT:	Rätz, M., Herges-Hallenberg
RCR:	Rätz, Ch., Herges-Hallenberg	SCI:	Schmidt, U., Karlsruhe
SE :	Schlereth, B., Hassfurth	SG :	Sterzinger, Dr. P., Wien (A)
SIR:	Schirmer, J., Willisau (CH)	VMR:	Vanmunster, T., Landen (B)
WTR:	Walter, F., München	ZAU:	Zaunick, H., Radebeul

Remarks (cont.):

:	= uncertain
s	= secondary minimum
E	= CCD- or photoelectric observation
red	= reduced results
1)	= CCD camera ST-6 chip 375 × 242 uncoated
2)	= CCD camera ST-7
3)	= CCD camera ST-7E
4)	= CCD camera ST-8E
5)	= CCD camera ST-8E chip KAF1602E
6)	= CCD camera ST-9 chip 512 × 512
7)	= CCD camera ST-10 XMR/XME
8)	= CCD camera Alpha Maxi chip KAF401e
9)	= CCD camera OES-LcCCD11
10)	= CCD camera OES-LcCCD12
11)	= CCD camera Pictor 1616XT
12)	= CCD camera Pictor 416XT
13)	= CCD camera Starlight Xpress chip 510 × 256
14)	= CCD camera Starlight Xpress chip 752 × 580
15)	= CCD camera Starlight Xpress 716
16)	= CCD camera Starlight Xpress SVX M25C
17)	= CCD camera Starlight Xpress SXV H9
18)	= CCD camera HoLiCam
19)	= CCD camera MX716
20)	= CCD camera Canon EOS D60
21)	= determination of time for the first maximum
GCVS *yy*	= General Catalogue of Variable Stars, 4th ed. 19*yy*
IBVS *nnnn*	= Information Bulletin on Variable Stars No. *nnnn*
SAC *vv*	= Rocznik Astronomiczny No. *vv*, Krakow (SAC)
BAVM *nnn*	= BAV Mitteilungen No. *nnn*
BAVR	= BAV Rundbrief
U	= USNO A 2.0 Catalogue
RafV	= Dreveny, R., Paschke, A., Hund, F., 2006, RafV catalog of newly detected variable stars

Reference:

Dreveny, R., Paschke, A., Hund, F., 2006, `http://var.astro.cz/newrafv.php?lang=en`

ERRATUM FOR IBVS 5643

Correction to BAVM 172

RU Scl 52994.3474 HND correct time: 52994.384

ERRATA FOR IBVS 5731

Corrections to IBVS 5731 = BAVM 178

G472 Aql	53633.4375 QU	
	53635.3950 QU	correct starname: GSC 472.2473

ERRATA FOR IBVS 5731 (BAVM 178)

V463 Cyg	54660.307 FR	must be deleted
GSC 0192700862	53721.4698 QU	correct value: 52721.4698

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ELEMENTS FOR 8 RR LYRAE VARIABLES

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email: tb@4pisysteme.de, pk@4pisysteme.de

These stars were reported to be variable by Hoffmeister (1949, 1966, 1967, 1968) and Boyce & Huruhata (1942). Except in the cases of V871 Oph, V950 Oph and V961 Oph (see details noted in the remarks below), no further observations or ephemeris have been published until today. Photographic plates of a field centered at 67 Oph, taken with the Sonneberg Observatory 40-cm Astrographs during three intervals spread over the years from 1938 to 1994, were used to investigate the behaviour of these objects (see Table 1).

The given elements were obtained by means of least-squares solutions. Photographic amplitudes were derived with respect to magnitudes of the comparison stars given in Table 2. An extensive list holding the times of maxima derived can be retrieved as `5732-t3.txt`, using the link in the HTML version of this paper. Individual data are available upon request.

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	$M-m$	No. of plates
V809 Oph	RRab	48802.512 ±6	0.4456105 ±3	$14^m_.4$	$16^m_.0$	$0^P_.17$	148
V871 Oph	RRab	47591.678 ±5	0.4581308 ±3	$14^m_.2$	$15^m_.3$	$0^P_.12$	209
V950 Oph	RRab	48801.492 ±16	0.6098288 ±7	$15^m_.1$:	$15^m_.9$	$0^P_.21$	197
V961 Oph	RRab	49127.468 ±4	0.5220792 ±2	$13^m_.6$	$15^m_.2$	$0^P_.16$	241
V1094 Oph	RRab	48747.455 ±14	0.6460529 ±10	$15^m_.3$	$16^m_.2$	$0^P_.20$	165
EP Ser	RRab	49154.471 ±12	0.6032100 ±7	$15^m_.3$	$17^m_.0$	$0^P_.17$	134
NSV 9517	RRab	48839.332 ±13	0.7238664 ±9	$14^m_.7$	$15^m_.7$	$0^P_.21$	149
NSV 10061	RRab	49154.517 ±14	0,5644590 ±7	$15^m_.6$	$16^m_.5$	$0^P_.23$	142

Table 2. Comparison stars and cross references

	V809 Oph		V871 Oph	
	HV 11012		S 4183	
	USNO 0900-10274067		USNO 0900-10615121	
Comp. No.	GSC	m^*	USNO	m^*
1	0900-10271285	$14^{m}.3$	0900-10608371	$14^{m}.0$
2	0900-10287295	$14^{m}.9$	0900-10600153	$14^{m}.4$
3	0900-10280680	$15^{m}.1$	0900-10622420	$14^{m}.6$
4	0900-10278316	$16^{m}.1$	0900-10618462	$15^{m}.5$

	V950 Oph		V961 Oph	
	S 4201		S 4214	
	USNO 0900-11371358		USNO 0900-11995376	
Comp. No.	USNO	m^*	USNO	m^*
1	0900-11361747	$15^{m}.8$	0900-12007595	$13^{m}.7$
2	0900-11365177	$16^{m}.1$	0900-12003470	$14^{m}.6$
3			0900-12011821	$15^{m}.4$

	V1094 Oph		EP Ser	
	S 9865		S 9851	
	USNO 0900-11727474		USNO 0825-11738616	
Comp. No.	USNO	m^*	USNO	m^*
1	0900-11739495	$14^{m}.9$	0825-11742658	$14^{m}.9$
2	0900-11727384	$15^{m}.7$	0900-11261581	$15^{m}.4$
3	0900-11728679	$16^{m}.0$	0900-11269383	$15^{m}.8$
4			0825-11741216	$17^{m}.1$

	NSV 9517		NSV 10061	
	HV 11016		S 9854	
	USNO 0900-10298218		USNO 0900-11331091	
Comp. No.	USNO	m^*	USNO	m^*
1	0900-10296357	$14^{m}.5$	0900-11331153	$15^{m}.2$
2	0900-10298639	$14^{m}.8$	0900-11327442	$15^{m}.9$
3	0900-10292848	$15^{m}.8$	0900-11330285	$16^{m}.3$

* Magnitudes refer to the B values of the USNO–A2.0 catalogue

Remarks:

V871 Oph — Possible Blazhko effect; the height of maxima varies considerably. The period previously published by of Götz et al. (1957) and cited in the GCVS is erroneous. See also the paper of Layden (1998).

V950 Oph — The period previously published by of Götz et al. (1957) and cited in the GCVS is a spurious period. The published maxima from Götz et al. (only those after J.D. 2429786, times before this date were rejected due to large scatter) were included in this period analysis.

V961 Oph — The period previously published by of Götz et al. (1957) and cited in the GCVS is a spurious period.

NSV 10061 — Hoffmeister (1967) erroneously assumed this star to be an eclipsing variable.

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

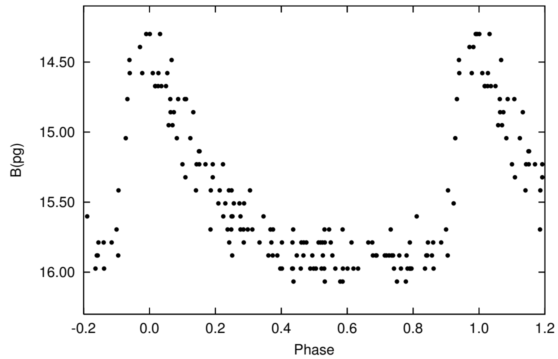

Figure 1. Light curve of V809 Oph

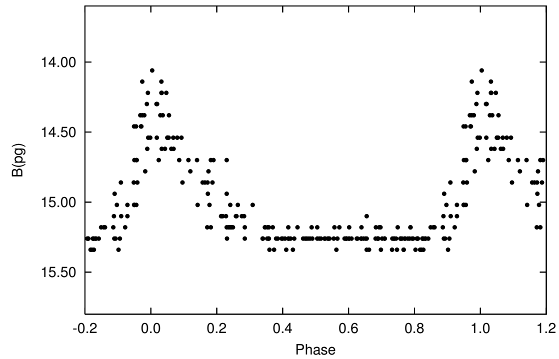

Figure 2. Light curve of V871 Oph

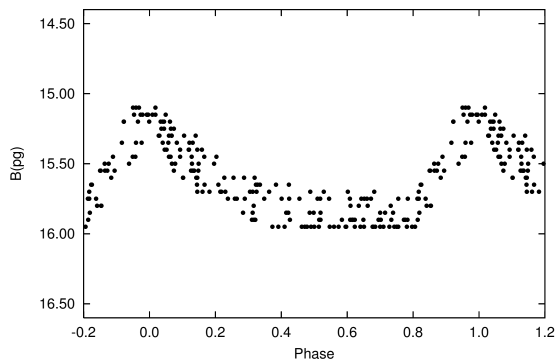

Figure 3. Light curve of V950 Oph

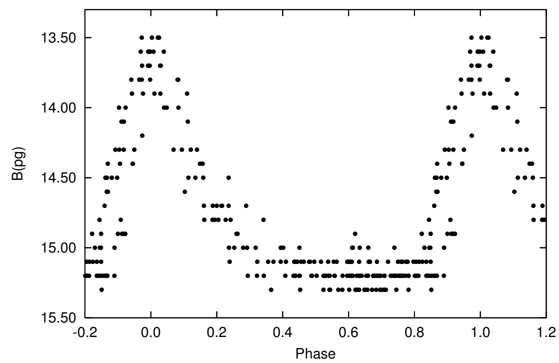

Figure 4. Light curve of V961 Oph

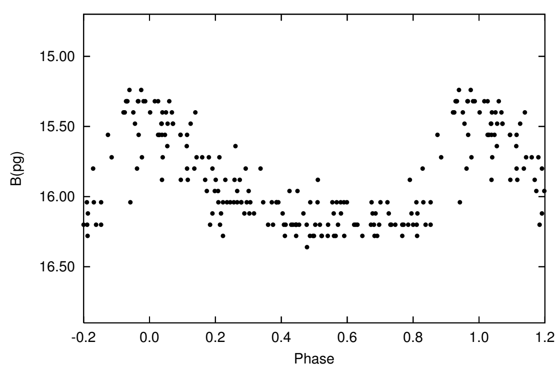

Figure 5. Light curve of V1094 Oph

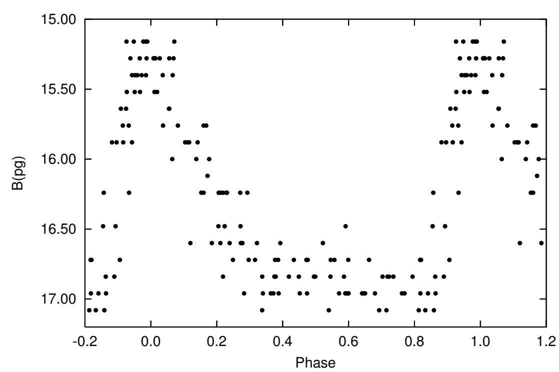

Figure 6. Light curve of EP Ser

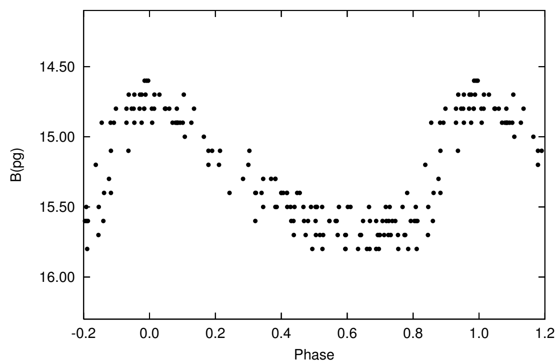

Figure 7. Light curve of NSV 9517

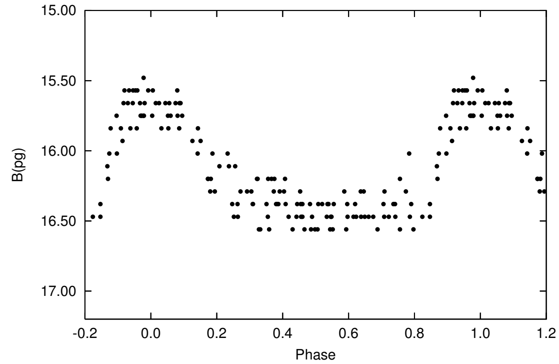

Figure 8. Light curve of NSV 10061

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PHOTOMETRY OF RS Oph AFTER THE 2006 OUTBURST†

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In February 2006, the recurrent nova RS Oph has undergone its first outburst for this century. On February 14th, 2006 it reached $4\overset{m}{.}4$ (Narumi et al., 2006) and began to decline. In late May, the brightness of the star had already returned to its pre-outburst level of $V = 10\overset{m}{.}5$–$11\overset{m}{.}5$ (see O'Brien et al., 2006, and AAVSO light curves for more details).

CCD photometry of this recurrent nova has been secured with the 120-cm telescope at OHP. With an 1024 × 1024 CCD, the field of view is $11\overset{\prime}{.}8 \times 11\overset{\prime}{.}8$. Our aim was to investigate the variability on time scales from minutes to days after the 2006 recurrent nova outburst.

Our B, V, R (Johnson–Cousins) measurements are summarized in Table 1. As comparison stars we have used SAO 141899 (HD 162215, $V = 9.307, B = 10.513, R = 8.601$) and GSC 0509400061 (USNO 0825-11335145, $V = 11.494, B = 12.199, R = 11.040$). The reduction was done in a way similar to Chevalier & Ilovaisky (1991) using average extinction from June 2006. In order to search for rapid variability, we performed time-resolved differential CCD photometry in B band. This procedure involved the repeated measurement of RS Oph relative to our main comparison stars SAO 141899 and set of stars in the field. Each observational run consisted of a series of exposures in B band, with exposure time ~ 40 sec. In Table 2 we give the start of the run, its duration, number of the points obtained, the minimal and maximal value of B magnitude, the mean B magnitude, and the standard deviation ($\sigma_B = \sqrt{\frac{1}{(N-1)} \sum_i (B_i - \overline{B})^2}$) calculated from all points in the run. In Fig. 1 we plot time-resolved B magnitudes. The behaviour of σ_B for the stars in the field is illustrated in Fig. 2.

Table 1. BVR magnitudes of RS Oph. Typical error of our measurement is ±0.015 mag

Date of obs. yyyy/dd/mm	UT	JD 24...	B	V	R
2006/06/06	22.92	53893.454	12.702	—	10.241
2006/06/09	0.53	53895.522	12.732	11.373	10.224
2006/06/09	2.02	53895.584	12.734	11.404	10.222
2006/06/09	23.99	53896.499	12.734	11.396	10.221
2006/06/10	23.44	53897.477	12.722	11.405	10.232
2006/06/11	1.73	53897.571	12.734	11.394	10.230

†Based on observations obtained with the 120-cm telescope at the Observatoire de Haute-Provence.

Table 2. Time-resolved B band photometry

Date of obs. yyyy/mm/dd	UT-start h	length [h]	N_{pts}	B min/max	B mean	σ_B [mag]
2006/06/06	21.258	5.16	136	12.680/12.738	12.708	0.014
2006/06/08	20.704	5.28	144	12.680/12.730	12.706	0.011
2006/06/09	20.558	4.28	100	12.702/12.747	12.727	0.012
2006/06/10	23.515	2.47	66	12.710/12.745	12.730	0.008

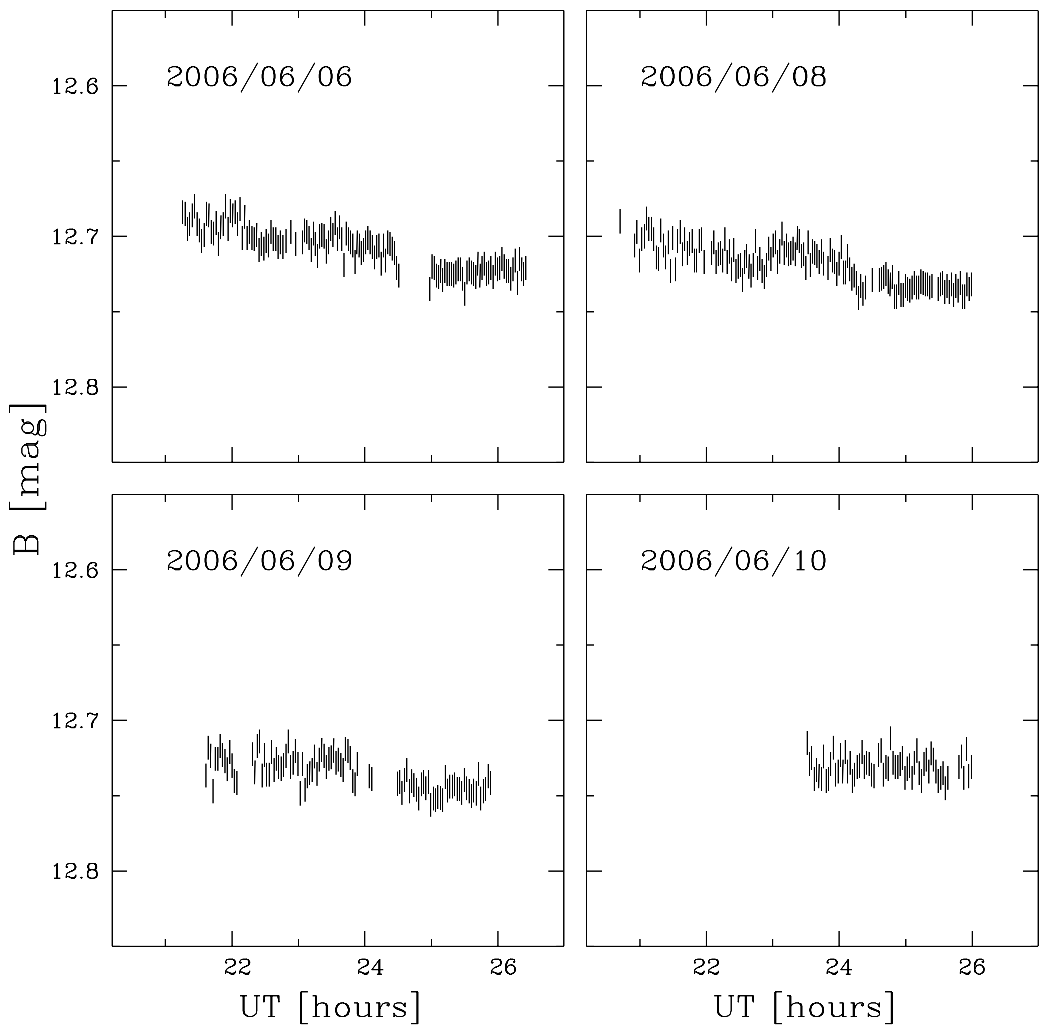

Figure 1. Time resolved CCD photometry of RS Oph obtained in June 2006 with the 120-cm telescope of OHP in B band. The date when the observation started is displayed in YYYY/MM/DD format. No short term variability (flickering) with total amplitude $\Delta B > 0\overset{m}{.}06$ has been detected on minute-to-hour time scale. The behaviour of the check star is plotted in Fig. 3

From Table 2 and Fig. 1, we derive upper limits of the variability: $\Delta B \leq 0\overset{m}{.}06$, and according to Table 1: $\Delta V \leq 0\overset{m}{.}035$, and $\Delta R \leq 0\overset{m}{.}02$. To the best of our knowledge, these are the first observations when the minute-to-day photometric variability of RS Oph in the optical is so low.

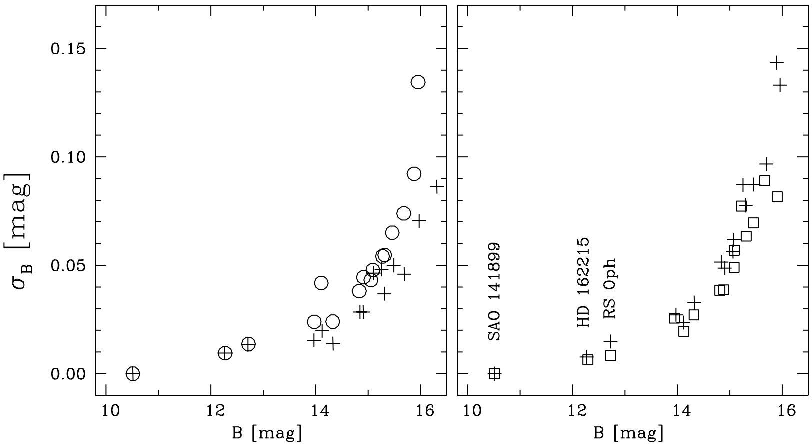

Figure 2. The standard deviation for the stars in the CCD field. Left panel: 2006/06/06 — crosses, 2006/06/08 — circles. Right panel: 2006/06/09 — crosses, 2006/06/10 — squares. The three brightest objects including RS Oph, are indicated on the right panel only. There is no clear departure of RS Oph from the behaviour expected for a star of constant brightness. SAO 141899 has been used as comparison star and its $\sigma_B \equiv 0$

Our B band light curves (see Fig. 1) are considerably different from those obtained with similar setup between the 1985 and 2006 outbursts (examples of the flickering of RS Oph can be seen in Dobrzycka et al., 1996, and Sokoloski et al., 2001). The flickering of RS Oph is known since a long time. However, no systematic investigations of its properties have been made to date. The previous observations in B band (see Table 3), revealed strong variability on the minute-to-hour time scale.

Table 3. Observations of RS Oph in B band on minute-to-hour time scale. In the table are given the date of observations, the amplitude of the B band variability, σ_B, and the reference.

Date of obs. yyyy/mm/dd	ΔB [mag]	σ_B [mag]	Reference
1983/07/14	0.32	0.07	Bruch, 1992
1983/07/18	0.38	0.06	Bruch, 1992
1983/08/14	0.34	0.07	Bruch, 1992
1993/06/06	0.19	0.07	Dobrzycka et al., 1996
1993/06/07	0.28	0.06	Dobrzycka et al., 1996
1993/06/09	0.24	0.05	Dobrzycka et al., 1996
1997/09/02	0.36		Sokoloski et al., 2001
2002/16/06	0.330	0.057	Gromadzki et al., 2006
2002/08/27	0.275	0.047	Gromadzki et al., 2006
2006/June	<0.05	<0.020	this paper

Usually, the variability of RS Oph on flickering time scale has an amplitude of $\Delta B \sim 0^{\rm m}_{.}20$–$0^{\rm m}_{.}35$ and typical $\sigma_B \sim 0^{\rm m}_{.}05$–$0^{\rm m}_{.}07$. During our June 2006 observations, we did not detect such a variability. On the panels for 2006/06/06 and 2006/06/08 in Fig. 1, one can see fading of RS Oph with $0^{\rm m}_{.}05$ during both nights. Our experiments have shown that this trend is probably real, although part of it can be due to the extinction. Is this fading real or not does not change our main result that the flickering of RS Oph is absent.

The disappearance of the flickering of RS Oph indicates that the accretion disk around the white dwarf has been demolished by the 2006 outburst. We can compute the approximate time to rebuild it, as the time needed the matter to cross the accretion disk (viscous time scale). An estimation of this time is $\Delta t = 2(R/H)^2 R^{3/2}/3\alpha\sqrt{GM}$, where R is the outer radius of the accretion disk, and M is the white dwarf mass. For a typical Shakura–Sunyaev accretion disk, we can use $\alpha \approx 0.1$–0.2, $(R/H) \approx 10$. Using parameters appropriate for RS Oph, $R \approx 10$–$20\ R_\odot$, $M \approx 1.4\ M_\odot$, we derive $\Delta t \sim 160$–800 days.

It will be very interesting: (1) to follow the re-appearance of flickering; (2) to detect whether it will appear first on minutes or on hour time scale; (3) to compare the behaviour of the accretion disk after a nova explosion (RS Oph) and after a jet-ejection as observed in CH Cyg (Sokoloski & Kenyon, 2003).

Acknowledgements: We have used IRAF for data processing, and AAVSO data during the interpretation of these results. This program has been supported by the Centre National de la Recherche Scientifique (CNRS, Division des Relations Internationales). We thank Dr. S. Ilovaisky and Mr. D. Gravallon for their help and support during these observations.

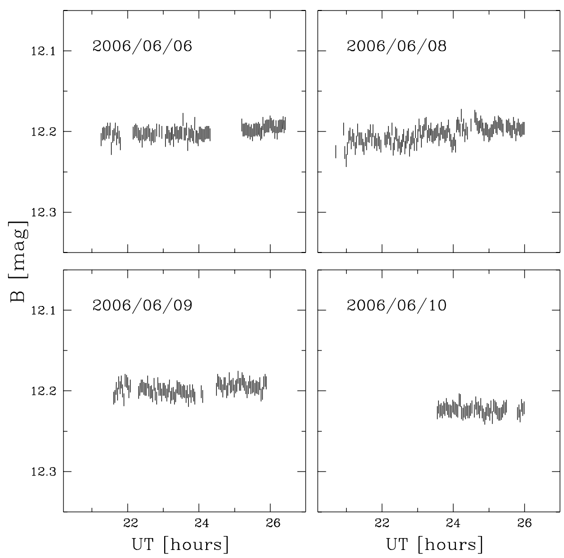

Figure 3. To illustrate the quality of our data, we plot the behaviour of the check star HD 162215 obtained in the same way as RS Oph's data in Fig. 1

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22 November 2006

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FIRST COMPLETE BVRI LIGHT CURVES OF THE SHORT-PERIOD ALGOL-TYPE BINARY DF Pup

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Dept. of Astrophysics, Astronomy and Mechanics, Faculty of Physics, National & Kapodistrian University of Athens, Athens, Greece. e-mail: vmaniman@phys.uoa.gr

Name of the object:
DF Pup

Equatorial coordinates:	**Equinox:**
R.A.= $07^h53^m50^s$ **DEC.=** $-19°41'00''$	2000

Observatory and telescope:
South African Astronomical Observatory Sutherland Station, 1.0-m Cassegrain telescope

Detector:	CCD camera, liquid nitrogen cooled at 180.5 K, 1024 × 1024 imaging pixels binned to 512 × 512, $5'.3 \times 5'.3$ FOV.

Filter(s):	*BVRI*

Date(s) of the observation(s):
2006.01.10, 2006.01.14, 2006.01.15, 2006.01.19, 2006.01.23

Comparison star(s):	Uncatalogued star 208″ SW to the variable

Transformed to a standard system:	No

Availability of the data:
Available at the IBVS website, after 2007.03.27

Type of variability:	EA

Remarks:
The period of the system is 0.7714568 days. The heights of the two maxima are equal within the observational error in all bands. The secondary minimum is shallow and deepens considerably at longer wavelengths; this fact indicates a large temperature difference between the components. DF Pup is known to have a spectral type of A7+[G5IV].

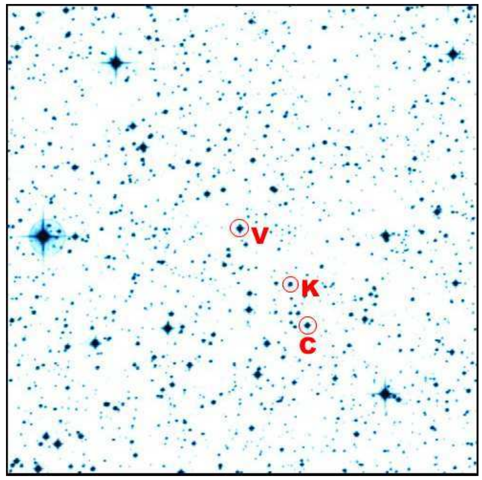

Figure 1. $14' \times 14'$ finding chart with the comparison (C) and check (K) stars marked; DF Pup is marked with a V

Acknowledgements:
This research was included in the project for the support of research groups in the universities, co-funded by the European Social Fund (ESF) and National Resources (EPEAEK II) — *PYTHAGORAS*. This paper uses observations made at the South African Astronomical Observatory (SAAO).

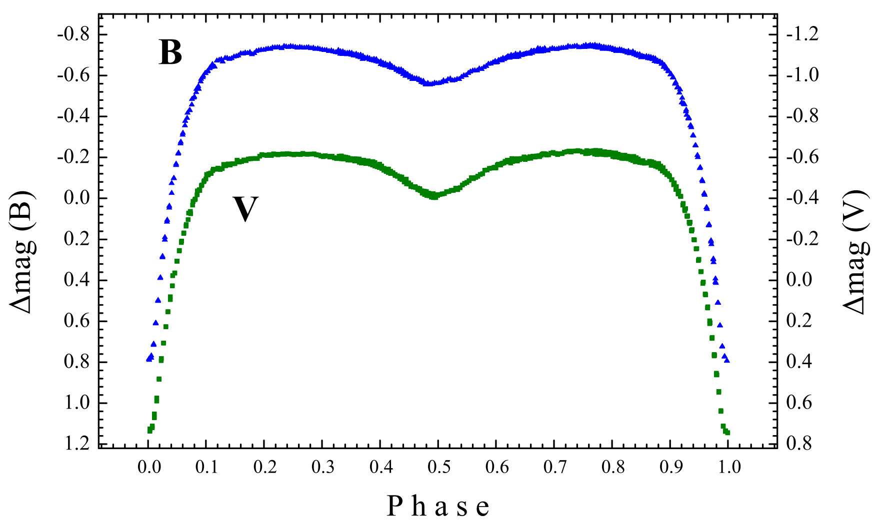

Figure 2. The complete B (upper) and V (lower) light curves of DF Pup

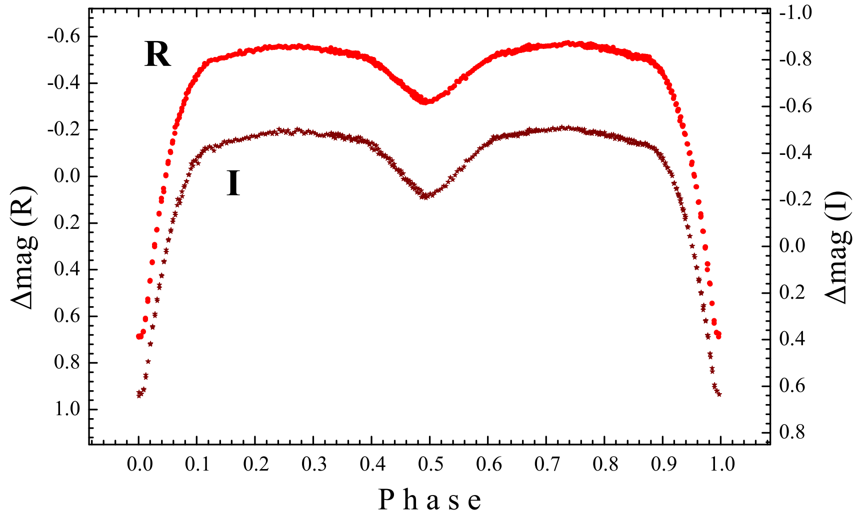

Figure 3. The complete *R* (upper) and *I* (lower) light curves of DF Pup

Reference:

Budding, E., Erdem, A., Çiçek, C., Bulut, I., Soydugan, F., Soydugan, E., Bakış, V., Demircan, O., 2004, *A&A*, **417**, 263

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IV CASSIOPEIAE: A PROBABLE PHOTOMETRIC TRIPLE STAR

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The semi-detached eclipsing binary IV Cassiopeiae (GSC 4001.1104, SVS 948, FL 3529; $\alpha_{2000} = 23^{\rm h}49^{\rm m}31\overset{\rm s}{.}5$, $\delta_{2000} = +53^\circ08'05''$, Sp. A4, $V_{\rm max} = 11.0$ mag) is a relatively frequently observed binary with an orbital period almost exactly one day. This system was selected as a possible candidate for the study of the pulsating component and thus it was also included to our new observational project. IV Cas was discovered to be a variable star on Moscow plates by Faddeejeva in 1940 (Meshkova, 1940). Later Florja (1946) derived the first light elements

$$\text{Pri. Min.} = \text{HJD}2428991.302 + 0\overset{\rm d}{.}9985232 \times E$$

and confirmed the eclipsing character of light changes. Due to the relatively short orbital period and rapid magnitude changes this variable was often observed visually. Recently, Kim et al. (2005) in their photometric study discovered a short-periodic pulsating component with a frequency of 37.672 cycles per day (period about 38 min). The current linear light elements are also given in the database of Kreiner (2004)†:

$$\text{Pri. Min.} = \text{HJD}2452500.3506 + 0\overset{\rm d}{.}9985120 \times E.$$

This variable is also included in the latest catalogue of close binaries with δ Scuti component (Soydugan et al., 2006).

Our new CCD photometry of IV Cas was carried out during several nights in October 2005 and November 2006 at the Brno observatory, Czech Republic, and three private observatories in Japan. Different telescopes, CCD cameras, filters and exposure times were used (see Table 1). The nearby stars GSC 4001.0776 ($V = 12.05$ mag) on the same frame as IV Cas served as a primary comparison star during observations in Brno. See also http://nyx.asu.cas.cz/~lenka/dbvar/ for more information about these observations. The new times of primary minimum and their errors were determined using the least squares fit of the data, by the bisecting chord method or by the Kwee–van Woerden

† http://www.as.ap.krakow.pl/ephem/

Table 1: New times of primary minimum of IV Cas

JD Hel. – 24 00000	Epoch	Error (days)	N	Telescope, camera, filter
52464.4044	11627.0	0.0007	26	40-cm, ST-7, clear
53671.6040	12836.0	0.0001	180	20-cm, ST-7, R
54045.0455	13210.0	0.002	201	20-cm SC, ST-9XE, V
54045.0464	13210.0	0.001	455	20-cm, ST-7E, V
54047.0437	13212.0	0.002	205	20-cm SC, ST-9XE, I_c
54047.0440	13212.0	0.0005	279	25-cm SC, CV-04, B

algorithm. These times of minimum are presented in Table 1. In this table, N stands for the number of observations used in the calculation of the minimum time. The epochs were calculated according to the light elements given in the GCVS catalogue. Figure 1 shows the differential B magnitudes during the primary minimum observed at JD 24 54047.

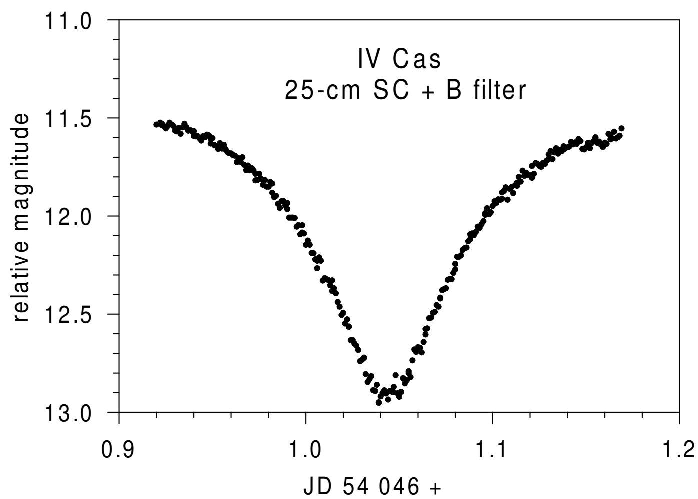

Figure 1. A plot of differential B magnitudes obtained during the primary eclipse of IV Cas on November 7, 2006 by K. Nakajima

The change of period and possible light-time effect of IV Cas were studied by means of an $O-C$ diagram analysis. We took in consideration all older visual and photographic times of minima found in special databases of AAVSO and BRNO[†] observers as well as new photoelectric times given in Diethelm (2003), Demircan et al. (2003), Dworak (2004), Cook et al. (2005) and our own results. The sinusoidal deviations of the $O-C$ values are well remarkable and could be caused by a light-time effect. For its solution we used all these times with different weights. A preliminary analysis of the third body gives the following parameters:

[†] http://www.aavso.org/observing/programs/eclipser/ebtom.shtml, http://var.astro.cz/ocgate

P (period)	$= 21800 \pm 500$ days
	$= 59.7 \pm 1.4$ years
T (time of periastron)	$=$ J.D. 24 43455 $\pm$ 50
A (semi-amplitude)	$= 0.0336 \pm 0.0008$ day
ω (length of periastron)	$= 341.1 \pm 2.5$ degrees
e (eccentricity)	$= 0.09 \pm 0.03$

These values were obtained by the least squares method together with the mean light elements

$$\text{Pri. Min.} = \text{HJD}2440854.6280(5) + 0\overset{\text{d}}{.}99851658(12) \times E.$$

The $O-C$ diagram is plotted in Fig. 2.

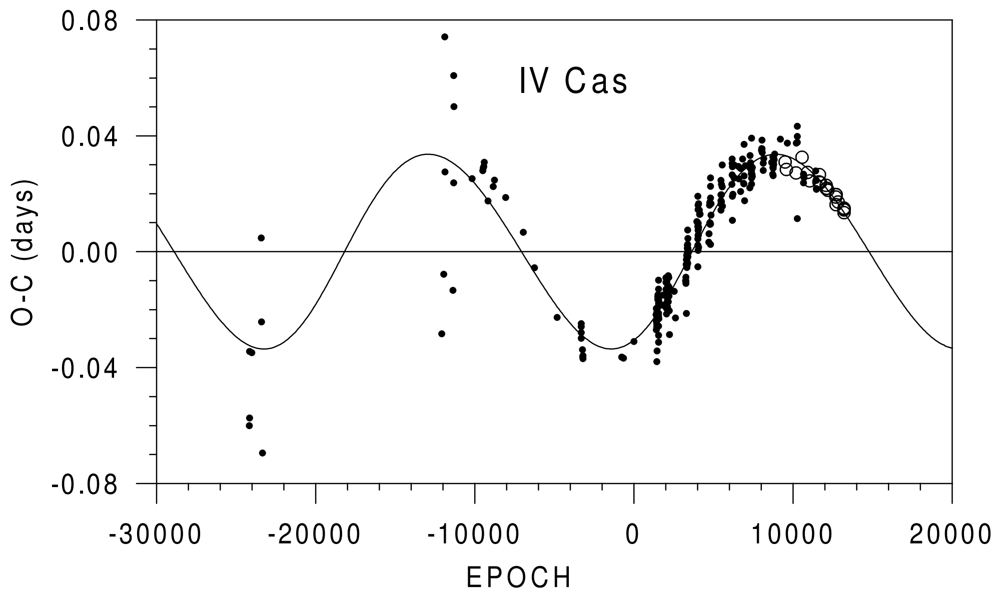

Figure 2. $O-C$ diagram for IV Cas. The numerous visual and photographic times are denoted by dots, the photoelectric and CCD times by circles. The sinusoidal curve corresponds to the third body orbit with a period of about 60 years and a semi-amplitude about 48 minutes

Assuming a coplanar orbit ($i_3 = 90°$) and adopting a total mass of the eclipsing pair with A4 primary to be $M_1 + M_2 \simeq 3.0\ M_\odot$, we can obtain a lower limit for the mass of the third component $M_{3,\text{min}}$. The mass function has a value $f(M) = 0.056\ M_\odot$, from which the minimum mass of the third body follows as 0.96 $M_\odot$. A possible third component of spectral type about G9 with the bolometric magnitude of $m_3 \simeq 5.0$ mag (Harmanec, 1988) produces a detectable third light of $L_3 \simeq 4.5$ % of total light.

Our result indicates, that IV Cas is probably next member of a small group of triple systems with pulsating primary component deserving a regular monitoring (Y Cam – Broglia & Marin, 1974; DG Leo – Lampens et al., 2005; HD 207651 – Henry et al., 2004). Only a relatively small part of the third body orbit is well-covered by the precise photoelectric observations. Therefore, new high-accuracy timings of this eclipsing system are necessary in order to confirm the light-time effect and to improve its parameters given above.

Acknowledgements. This investigation was supported by the Grant Agency of the Czech Republic, grants No. 205/04/2063 and No. 205/06/0217. This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France, and of NASA's Astrophysics Data System.

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Diethelm, R., 2003, *IBVS*, No. 5438
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Florja, N.F., 1946, *Variable Stars*, **6**, 4
Harmanec, P., 1988, *Bull. Astr. Inst. Czech.*, **39**, 329
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Kim, S.-L., Lee, C.-U., Koo, J.-R., et al., 2005, *IBVS*, No. 5669
Kreiner, J.M., 2004, *Acta Astronomica*, **54**, 207
Lampens, P., Frèmat, Y., Garrido, R., Peña, J.H., et al., 2005, *A&A*, **438**, 201
Meshkova, T.S., 1940, *Variable Stars*, **5**, 304
Soydugan, E., Soydugan, F., Demircan, O., Ibanoglu, C., 2006, *MNRAS*, **370**, 2013

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NEW TIMES OF MINIMA OF SOME ECLIPSING BINARY SYSTEMS

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Observatory and telescope:
50-cm $f/15$ Cassegrain telescope (Pi50), 60/90/180 Schmidt telescope (Pi90), 1m $f/13.3$ RCC telescope (Pi100) of the Konkoly Observatory at Piszkéstető Mountain Station (Hungary) and 40-cm $f/8.9$ Ritchey–Chrétien telescope (E40) of the Department of Astronomy, Eötvös Loránd University (Hungary)

Detector:	uncooled UBV Photometer (Pi50u) 1536 × 1024 Photometrics CCD-camera (Pi90) 1340 × 1300 Princeton Instr. CCD camera (Pi100) 4008 × 2672 SBIG STL-11K CCD Camera (E40)

Method of data reduction:
Reduction of CCD frames was made with a customly developed IRAF† package.

Method of minimum determination:
The minima times were computed with parabolic fitting (in case of PV Cas and SV Cam), and Kwee-van Woerden method (Kwee & van Woerden, 1956).

Acknowledgements:
KP thanks the hospitality of Konkoly Observatory. Csz thanks the the hospitality of Dept. of Astronomy of Eötvös University.

†IRAF is distributed by the National Optical Astronomical Observatories, operated by the Association of the Universities for Research in Astronomy, inc., under cooperative agreement with the National Science Foundation

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
CN And	53991.4618	1	I	*C*	KP/E40
EP And	54036.4396	1	I	*V*	Csz/E40
GZ And	54059.3677	1	I	*R*	KP/E40
V376 And	54018.3694	1	I	*V*	Csz/E40
FP Aur	54039.5304	2	I	*V*	Csz/E40
IM Aur	54027.4125	3	II	*RI*	KP/E40
SV Cam	44635.3717	2	I	*BV*	PL/Pi50
	44830.4934	2	I	*BV*	PL/Pi50
	45273.5175	1	I	*BV*	PL/Pi50
	45645.3749	1	I	*BV*	PL/Pi50
CW Cas	53989.4045	1	I	*C*	KP/E40
	54025.4389	5	I	*BRI*	KP/E40
PV Cas	53351.5484	2	I	*BV*	KJ/Pi90
	53400.5572	2	I	*BVR*	KJ/Pi90
	53989.5652	3	II	*B*	Csz/Pi100
V523 Cas	53985.3774	1	II	*C*	KP/E40
	54019.3796	1	I	*R*	Csz/E40
V776 Cas	54039.4274	4	I	*V*	Csz/E40
CQ Cep	54042.2816	31	I	*BVRI*	MG/E40
EV Cnc	52244.6052	9	I	*V*	Csz/Pi100
	52246.6091	9	I	*V*	Csz/Pi100
	52271.4941	7	I	*V*	Csz/Pi100
CE Leo	53765.5474	3	II	*BVRI*	KP/Pi100
	53767.5186	3	II	*BVRI*	KP/Pi100
	53835.4868	5	I	*BVRI*	Bor/Pi100
PY Lyr	53990.3345	2	I	*C*	KP/E40
U Peg	54043.2691	1	I	*V*	Csz/E40
BB Peg	53986.3485	4	II	*BVRI*	Csz/Pi100
	53987.4330	3	I	*BVRI*	Csz/Pi100
	53988.3352	2	I	*BVRI*	Csz/Pi100
	53988.5175	4	II	*BVRI*	Csz/Pi100
	53990.3248	2	I	*BVRI*	Csz/Pi100
	53990.5040	1	II	*BVRI*	Csz/Pi100
	54037.3178	9	I	*V*	KP/E40
V432 Per	53992.4620	1	II	*V*	Csz/Pi100
UV Psc	53990.5121	1	I	*C*	KP/E40
DZ Psc	53992.4205	3	I	*C*	KP/E40
AH Tau	54050.42407	8	I	*V*	Csz/E40
EQ Tau	54026.4781	2	II	*RI*	Csz/E40
WZ Sge	53654.2757	1	I	*V*	Csz/Pi100
NO Vul	53251.434	4	I	*VRI*	Csz/Pi100
	53252.3592	1	II	*VRI*	Csz/Pi100

Explanation of the remarks in the table:		
Observers:	Bor: Tamás Borkovits	Csz: Szilárd Csizmadia
	KJ: János Kelemen	KP: Péter Klagyivik
	MG: Gábor Marschalkó	PL: László Patkós
Filters:	*C* means a 'clear' filter while *BVRI* are Johnson–Cousins ones.	

Reference:

Kwee, K.K., van Woerden, H., 1956, *Bull. Astron. Inst. Neth.*, **12**, 327

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Number 5737

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27 November 2006

HU ISSN 0374 – 0676

THE OPTICAL COUNTERPART OF THE POSSIBLE BRIGHTEST TRANSIENT X-RAY SOURCE IN M31 IS FOUND

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Having found a nova in M31 on plates of the Baldone Schmidt telescope plate archive (Smirnova & Alksnis, 2006), which occurred to be the optical counterpart of the supersoft X-ray source [PFH2005] 191 (Pietsch et al., 2005a), we started to inspect the positions of known M31 supersoft X-ray sources on scans of other plates of M31 taken in the years 2001-2002.

An object was found at the position of the supersoft X-ray source [PFH2005] 543 (Pietsch et al., 2005a) on the plate No. 248 taken on November 12, 2001. Its coordinates R.A. = $00^{\rm h}44^{\rm m}14\overset{\rm s}{.}52$, Decl. = $+41^\circ22'4\overset{''}{.}3$ (equinox 2000.0; estimated maximal error radius $0\overset{''}{.}7$) determined from the scanned discovery plate, on which the nova is the brightest, with respect to the positions of field stars from UCAC2, agree with those of the [PFH2005] 543 within $0\overset{''}{.}5$. So it is highly probable that the newly found object is the optical counterpart of the X-ray source [PFH2005] 543.

The X-ray source, designated as XMMU J004414.0+412204, was discovered on January 5, 2002 by Trudolyubov et al. (2002), confirmed on January 8, 2002 by Garcia et al. (2002), observed on highest luminosity level on February 6, 2002 and included in the catalog of transient X-ray sources in M31 (Williams et al., 2006) as object n1-86. Williams et al. (2006) did not exclude the possibility that the X-ray source n1-86 is in M31 and might have the highest X-ray luminosity of any transients yet observed in M31. Trudolyubov et al. (2005) did not succeed in search for optical counterparts of the X-ray source, but according to them the transient behavior of the source hints that it may be a classical nova in supersoft X-ray spectral phase.

A finding chart of the nova from the discovery plate is given in Figure 1. Times of the middle of exposures in Julian days and blue magnitudes (m_B) of the nova based on the secondary standard stars from the $BVRI$ catalogue of M31 (Magnier et al., 1992) are given in Table 1. The light curve of the nova is presented in Figure 2.

The object was first observed when it was near the outburst maximum, which evidently occurred within a day before or after our first observation. The estimated light decay rate $dB/dt > 0.2$ m/d during observation period suggests that probably the nova was very fast. Thus according to our observations the photometric behavior of the object seems to be typical for novae in M31.

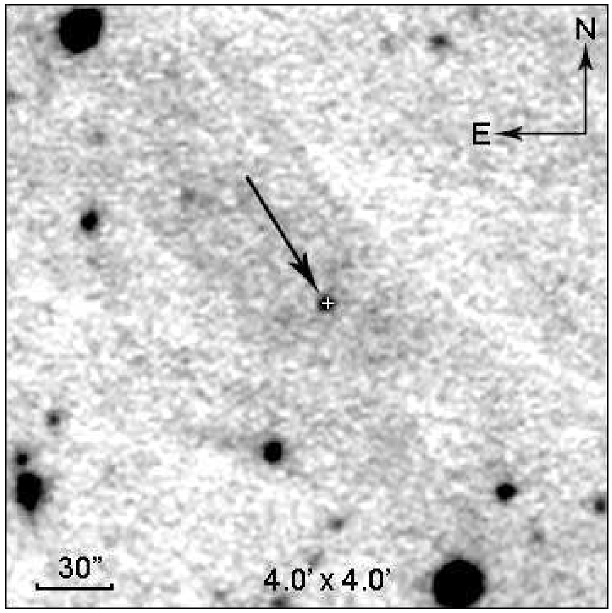

Figure 1. Finding chart for the discovered nova. The cross shows the position of the X-ray source [PFH2005] 543

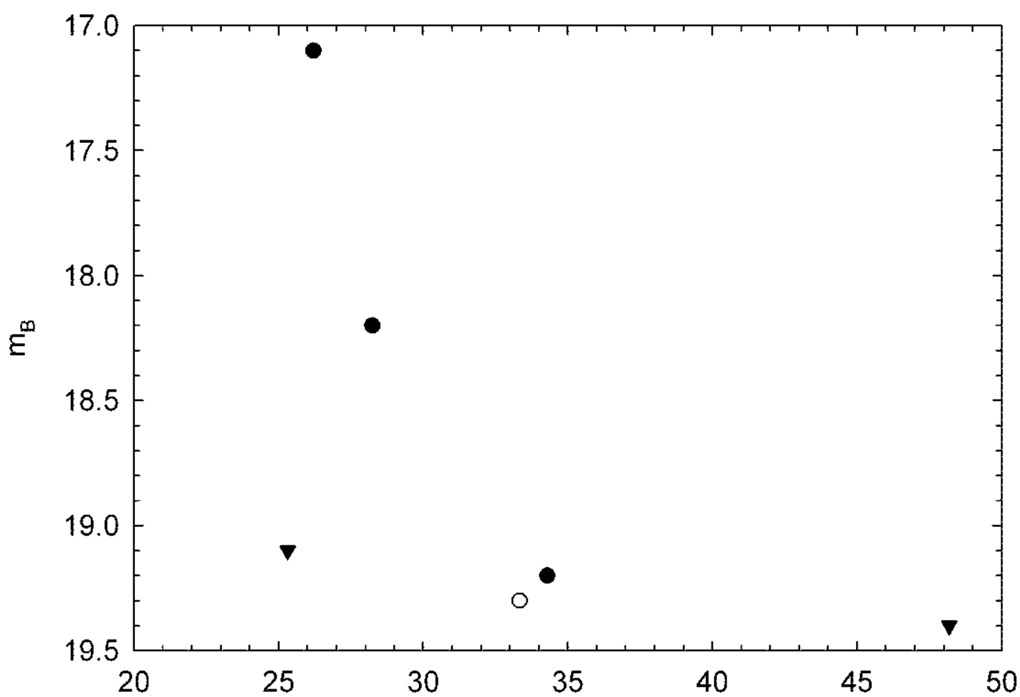

Figure 2. The light curve of the nova in M31. Filled circles: confident measurements; open circle: uncertain measurement; triangles: brightness upper limits

Table 1

JD 2452200 +	m_B mag
25.216	> 19.1
26.208	17.1
28.238	18.2
33.327	19.3:
34.292	19.2
48.188	> 19.4

Possibly because of its high X-ray luminosity the nova is also unique in another aspect: the time separation between its optical outburst and detection as supersoft X-ray source is the shortest known for novae in M31 — only 53 days, followed by WeCaPP-N2001-12 with 63 days (Pietsch et al., 2005b) and the optical counterpart of the X-ray source [PFH2005] 191 with 84 days (Smirnova & Alksnis, 2006).

Corrigendum. In the paper by Smirnova & Alksnis (2006), third paragraph from the end, instead of 1/10/2001 should be 1/10/1992. Our thanks are due to W. Pietsch for pointing out this error.

References:

Garcia, M.R., Kong, A.H.K., McClintock, J.E., Primini, F.A., Kaaret, P., Murray, S.S., 2002, *The Astronomer's Telegram*, No. 82

Magnier, E.A., Lewin, W.H.G., van Paradijs, J., Hasinger, G., Jain, A., Pietsch, W., Truemper, J., 1992, *A&AS*, **96**, 379

Pietsch, W., Freyberg, M., Haberl, F., 2005a, *A&A*, **434**, 483

Pietsch, W., Fliri, J., Freyberg, M.J., Greiner, J., Haberl, F., Riffeser A., Sala, G., 2005b, *A&A*, **442**, 879

Smirnova, O., Alksnis, A., 2006, *IBVS*, No. 5720

Trudolyubov, S., Kotov, O., Priedhorsky, W., Cordova, F., Mason, K., 2005, *ApJ*, **634**, 314

Trudolyubov, S., Priedhorsky, W., Borozdin, K., Mason, K., Cordova, F., 2002, *IAUC*, No. 7798

Williams, B.F., Naik, S., Garcia, M.R., Callanan, P.J., 2006, *ApJ*, **643**, 356

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PLATE ARCHIVE SEARCH FOR THE PROGENITOR OF NOVA Cyg 2006

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Name of the object:
Nova Cyg 2006 = V2362 Cyg

Equatorial coordinates:	**Equinox:**
R.A.= $21^h11^m32\overset{s}{.}35$ **DEC.=** $+44°48'03\overset{''}{.}7$	2000

Observatory and telescope:
67/92 cm and 40/50 cm Asiago Schmidt telescopes

Detector:	Photographic plates

Filter(s):	$UBVR_CI_C$

Date(s) of the observation(s):
From November 2, 1962 to August 27, 1997

Table 1: Asiago archival plates imaging the field of the progenitor of Nova Cyg 2006. The progenitor is invisible on all plates, and its magnitude (fourth column) is given in terms of the faintest star visible close to the position of the progenitor (for identification of R3, R4, R5 reference stars see text)

Date	UT	Band	Plate no.	Telescope	Date	UT	Band	Plate no.	Telescope
02 11 1962	20 52	$B >$ R3	3274	40/50	18 10 1973	18 44	$U >$ R4	6708	67/92
10 07 1967	00 50	$R_C >$ R5	741	67/92	18 10 1973	19 09	$V >$ R5	6709	67/92
13 07 1967	23 27	$R_C >$ R5	754	67/92	18 09 1982	21 18	$V >$ R5	11682	67/92
17 07 1967	00 51	$B >$ R4	768	67/92	15 10 1982	21 17	$V >$ R3	14982	40/50
25 03 1971	03 05	$B >$ R4	4262	67/92	16 10 1982	21 17	$V >$ R3	14994	40/50
25 03 1971	03 21	$V >$ R5	4263	67/92	04 06 1984	23 54	$B >$ R5	12519	67/92
25 03 1971	03 42	$R_C >$ R5	4264	67/92	13 08 1985	00 00	$B >$ R5	16379	40/50
30 03 1971	03 38	$V >$ R4	4281	67/92	09 09 1985	22 08	$B >$ R5	16461	40/50
18 09 1971	21 43	$V >$ R3	9022	40/50	22 11 1995	20 22	$B >$ R5	16003	67/92
18 10 1971	22 50	$B >$ R3	9122	40/50	27 08 1997	23 54	$B >$ R5	16467	67/92
17 12 1971	19 10	$V >$ R3	9312	40/50	23 07 1985	23 50	$B >$ R5	16362	40/50
28 09 1973	22 33	$U >$ R3	6654	67/92	25 06 1984	02 05	$B >$ R5	12510	67/92
28 09 1973	23 12	$I_C >$ R4	6665	67/92					

Remarks:

Nova Cyg 2006 was discovered at unfiltered magnitude 10.5 by H. Nishimura (Nakano, 2006) on panchromatic photographic images obtained on 2.807 April UT. Its precise position was determined by Yamaoka (2006) as R.A. = $21^h11^m32^s.346$ ($\pm$ $0^s.010$), Decl. = $+44°48'03''.66$ ($\pm$ $0''.14$) (equinox 2000.0). At this position the IPHAS $r'i'$Hα survey of the galactic plane recorded previous to the outburst — on August 3, 2004 — an Hα emitting source at magnitudes $r' = 20.30(\pm 0.05)$ and $i' = 19.76(\pm 0.07)$, which has been identified as the progenitor of the Nova by Steeghs et al. (2006). CCD photometry secured by the ANS (Asiago Novae and Symbiotic stars) Collaboration measured a peak brightness for the nova $R_C = 7.5$ and $I_C = 7.2$ that sets the outburst amplitude to $\Delta R_C \sim \Delta I_C \sim 12.7$ mag.

Nova Cyg 2006 has so far displayed a weird lightcurve. After an initial normal exponential slope, the decline has been slowing until a minimum brightness was reached around July 21 when the nova was shining at $B = 12.30, B-V = +0.16, V-I_C = +1.28, R_C - I_C = +0.02$ (Munari et al., 2006a). After that the nova has been *increasing* its brightness, reaching $B = 11.18, B-V = +0.36, V-I_C = +1.10, R_C - I_C = +0.42$ by November 12.8 UT (Munari et al., 2006b). Similarity to the lightcurve of Nova Aql 1999a (= V1493 Aql) has been noted by Goranskij et al. (2006).

To the aim of better constraining the nature of this peculiar nova, we have searched the plate archive of the Asiago 67/92 and 40/50 cm Schmidt telescopes looking for patrol plates covering the position of the Nova. We found 25 plates variously exposed in the $UBVR_CI_C$ bands between 2 November, 1962 and 8 August, 1997. A listing of the plates and date of exposure is given in Table 1. In none of the plates the progenitor is bright enough to be detected. With a typical limiting magnitude fainter than $B = 18.5$, these negative detections and those on the first and second Palomar surveys suggest that the progenitor has been living long and quietly in quiescence for several decades before the 2006 eruption.

The stars reported in Table 1 to identify the plate limiting magnitude are: R3 = USNO-B1.0 1347-0415159 ($B = 18.0, V = 16.4, R_C = 16.2, I_C = 15.9$), R4 = USNO-B1.0 1347-0415150 ($B = 18.1, V = 16.1, R_C = 15.5, I_C = 15.0$) and R5 = USNO-B1.0 1347-0415197 ($B = 18.6, R_C = 16.9, I_C = 16.3$). The magnitudes are taken from the USNO-B1.0 (Monet et al., 2003) and NOMAD (Zacharias et al., 2004) catalogues.

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DISCOVERY OF 19 NEW HISTORICAL NOVA CANDIDATES IN M31

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We have conducted a systematic search for historical novae in M31 on digitized archival plates. A comprehensive description of the data material, the method, and the results will be given in a separate paper (Henze et al., 2007). Here we present a brief summary of the attempt and announce, as the most important result, 19 new nova candidates.

The M31 field is the most frequently observed field in the archive of the Tautenburg Schmidt telescope (134/200/400). Our search is based upon 306 selected plates in the UBV bands taken in the years 1960 to 1996. A single plate covers an unvignetted field of $3.^\circ3 \times 3.^\circ3$ with a plate scale of 51.4 arcsec/mm. The limits of the B plates are typically in the range $B_{\rm lim} = 19^{\rm m} \ldots 21^{\rm m}$. Although the majority of these plates were not taken as a part of a systematic survey, they constitute a valuable observational material suited to search for bright variables in our neighbour galaxy.

All plates have been digitized with the Tautenburg Plate Scanner (Brunzendorf & Meusinger, 1999) and were reduced using the software package *Source Extractor* (Bertin & Arnouts, 1996). For the astrometric and photometric calibration of one selected reference plate per filter band we used the USNO-B1.0 catalogue (Monet et al., 2003) and the Local Group Survey catalogue (Massey et al., 2006), respectively. Special care was taken to consider the strongly fluctuating background surface brightness. All plates of the same filter band were transformed into the system of the corresponding reference plate which results in an overall astrometric uncertainty of ~ 0.5 arcsec and a relative photometric uncertainty of 0.2–0.3 mag. The absolute photometric uncertainties on the reference plates are about 0.5 mag over the magnitude interval 16–20 mag. Finally, the data set for every single plate was cross-correlated with the data sets from all other plates to create two catalogues: (a) the multi-detection table of $\sim 3 \times 10^5$ objects detected on at least two plates of the same colour and (B) the single-detection table of $\sim 1.1 \times 10^6$ objects detected on only one plate. Since we decided to use a low detection limit for the object detection, in order to reach a high completeness at faint magnitudes, the tables are substantially contaminated by noise detections. This has to be considered for the selection of novae candidates: single-detections were used only to *confirm* multi-detections or single-detections in other filter bands. For the multi-detection objects light curves were created and searched for typical nova features.

Typical features of nova light curves were modeled using novae in M31 which were previously discovered on Tautenburg plates by Moffat (1967) and Börngen (1968):

- **Short time span of observability:** Due to the distance of M31 and the plate limit of $\sim 20^{\rm m}$, novae have a typical time of observability of 20–30 days. The parameter value applied for the search was 50 days (U, V) and 70 days (B) respectively.
- **Prominent peak:** A nova light curve should show a significant peak which must be brighter than the plate limit and be outside the 1σ error range of the modified light curve *without* the peak.
- **Singular event:** Classical novae do not recur on a timescale less than 100 years. Therefore every nova event in our data base should be unique. We also searched for recurrent novae, namely such that show repeated outbursts on a timescale less than 100 years, but we did not find any.

Every promising candidate was individually checked on the original plates to decide whether it could be a nova or not. The spatial distribution of the 19 objects classified as formerly unknown nova candidates is shown in Fig. 1. The mapped area is a cutout from the field of the astrometric reference plate corresponding to the area containing the new candidates. The key data are summarized in Table 1. Another 32 previously catalogued novae were established by our program. This is the reason why the consecutive numbering in Table 1 starts with 33. The full set of data will be provided in Henze et al. (2007).

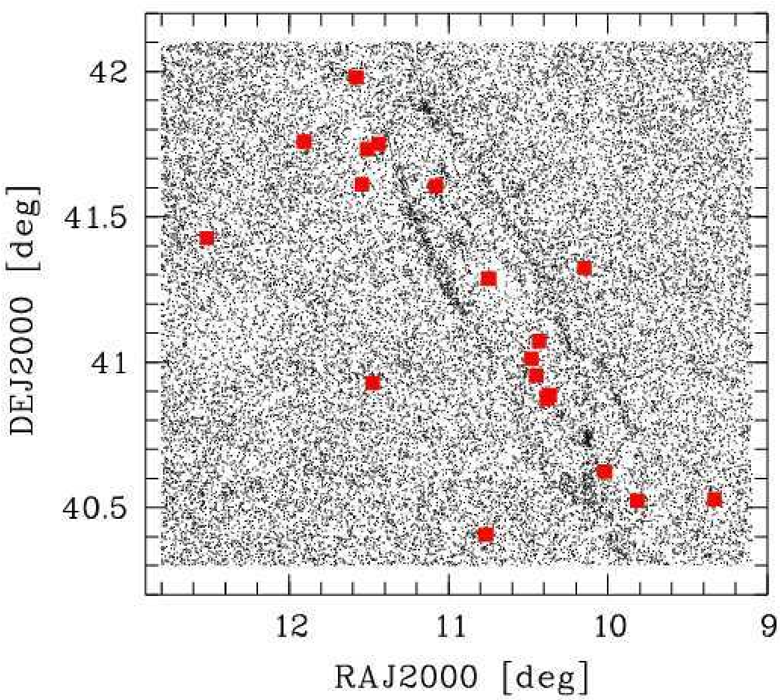

Figure 1. Distribution of the new 19 Tautenburg nova candidates over the galaxy M31. Black dots indicate the objects detected on the reference plate. The outer spiral arms of the galaxy are clearly recognizable by their overabundance of detected objects. Big filled squares mark the new nova candidates

Table 1: Basic data for the new nova candidates: identification number (1), right ascension and declination for J2000 (2,3), magnitude of the detected maximum and filter band (4), Julian date (5), and year of the outburst (6).

ID (1)	α [°] (2)	δ [°] (3)	mag (4)	JD (5)	year (6)
33	11.90747	41.75843	19.4 (B)	2437913	1962
34	10.01956	40.62433	18.5 (V)	2438373	1963
35	11.43947	41.75058	17.7 (U)	2439417	1966
36	9.33152	40.52856	18.9 (B)	2440917	1970
37	10.38148	40.87432	17.7 (B)	2441328	1972
38	9.81823	40.52356	18.9 (B)	2441680	1972
39	10.36907	40.88704	18.7 (V)	2442741	1975
40	10.44820	40.95410	18.2 (U)	2442775	1975
41	11.47816	40.92837	19.3 (B)	2444194	1979
42	10.14823	41.32396	17.8 (U)	2444490	1980
43	10.47874	41.01253	18.1 (U)	2444490	1980
44	10.74837	41.28688	18.0 (U)	2444490	1980
45	11.08057	41.60674	19.4 (B)	2445940	1984
46	11.51205	41.73243	18.9 (U)	2446299	1985
47	11.58009	41.97954	18.5 (U)	2446299	1985
48	12.51510	41.42756	18.8 (U)	2446299	1985
49	10.43303	41.07269	16.9 (B)	2448893	1992
50	10.76761	40.40784	17.5 (B)	2450316	1996
51	11.54533	41.61147	19.4 (B)	2450317	1996

Finally, we would like to emphasize that the good astrometric accuracy of this "new historical" novae makes them suitable for the correlation with previously found ones in order to search for recurrent novae. With the only exception of nova 39, none of our new nova candidates could be identified on POSS II plates, in the SIMBAD database, or in the GCVS (Artyukhina et al., 1995). The position of nova 39 coincides, with a position difference of 1 arcsec, with the nova number 32 in Table 4 of Baade & Arp (1964) discovered between the years 1945–1949. Therefore, nova 39 is a good candidate for a recurrent nova with repeated outbursts on a timescale less than 100 years. Unfortunately, Baade & Arp do not report the epoch of their observation and thus the recurrence time can be estimated only roughly to 26–30 years. Additional information on the actual epoch of the Baade & Arp nova 32 / Table 4 would be useful. Because the 1975 outburst of nova 39 has not been reported so far, we list it as a new nova candidate, even though it is probably a recurrent nova.

Acknowledgments: This research has made use of the SIMBAD database and of the Aladin sky atlas which are operated at CDS, Strasbourg, France, and the General catalogue of Variable Stars Volume V Extragalactic Variable Stars (GCVS Vol. V) which is operated at Sternberg Astronomical Institute, Moscow, Russia.

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ERRATUM FOR IBVS 5701

The star listed as V2028 Cyg in IBVS 5701 should be V2088 Cyg.

Geir Klingenberg

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FIRST SIMULTANEOUS PHOTOMETRIC AND SPECTROSCOPIC ANALYSIS OF THE ACTIVE STAR IT Com

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IT Comae Berenicis (HD 118234) was discovered to be a single-lined spectroscopic binary by Griffin (1988), who determined the orbital period $P_{\rm orb} = 59\overset{\rm d}{.}054$ and eccentricity $e = 0.59$. From existing multicolor photometry, he deduced the primary to be a K0 or K1 giant and suggested the secondary might be of earlier spectral class. Strassmeier (1994) observed CaII H&K emission lines well above the nearby stellar continuum, demonstrating a very high level of chromospheric activity. From time series photometry with an automated photometric telescope (APT), Henry et al. (1995) discovered brightness variability in HD 118234 with an amplitude of about $0\overset{\rm m}{.}20$ caused by rotational modulation in the visibility of photospheric spots. They determined the star's rotation period to be $P_{\rm rot} = 64 \pm 1$ days and noted two unequal minima per rotation cycle, indicating that HD 118234 had large spotted regions on opposite hemispheres of the star. Moreover, by combining their $v \sin i$ measurement with the rotation period, Henry et al. (1995) found a minimum radius of 7.0 $R_\odot$, confirming the giant classification. They also noted that, while the star's orbital and photometric periods are similar, rotation in IT Com is far from the pseudosynchronous rotation period of $15\overset{\rm d}{.}1$ days predicted from the orbital eccentricity.

In this brief paper, we present the results of a coordinated photometric and spectroscopic observing campaign conducted during 2004 April–June at the Fairborn Observatory (FO), Çanakkale Onsekiz Mart University Observatory (ÇOMÜ), and Catania Astrophysical Observatory (OACt). The photometric observations were made with the T3 0.4-m APT at FO and with the 0.4-m Schmidt–Cassegrain telescope at ÇOMÜ and the reduction was performed correcting for atmospheric extinction with nightly extinction coefficients and transformed to the Johnson system with yearly mean transformation coefficients. The spectroscopic observations were made with the FRESCO spectrograph at OACt at a resolution $R = 22\,000$ and the reduction was performed following the standard steps of background subtraction, division by a flat field spectrum, wavelength calibration, and normalization to the continuum through a polynominal fit. The main goal of these observations was to study active regions at photospheric and chromospheric levels, as we have done previously for other RS CVn binaries and single active stars (Frasca et al., 2000; Frasca et al., 2002; Biazzo et al., 2006a; Biazzo et al., 2006b).

For photospheric diagnostics, we used the Johnson V and B light curves and the hemisphere-averaged effective temperature curve derived from line-depth ratios (LDRs) of metal weak lines (Gray & Johanson, 1991; Catalano et al., 2002). We converted seven specific combinations of LDRs to temperatures with LDR–$T_{\rm eff}$ calibrations that we have previously developed (Catalano et al., 2002). The V and B light curves and the resulting $T_{\rm eff}$ values are plotted in the first three panels of Figure 1 as a function of rotational phase computed from the ephemeris

$$\mathrm{HJD}_{\varphi=0} = 2\,453\,063.0 + 64\overset{\rm d}{.}0 \times E, \qquad (1)$$

where the initial epoch is arbitrary (2004 February 27) and the rotational period of $64\overset{\rm d}{.}0$ is adopted from Henry et al. (1995). Both the light curves and the temperature plot exhibit a maximum around $\varphi = 0\overset{\rm p}{.}30$ and a subsequent minimum near $\varphi = 0\overset{\rm p}{.}60$. The V and B light curves also show a second maximum, not visible in the $\langle T_{\rm eff}\rangle$ curve due to a phase gap, and a further minimum at $\varphi \simeq 0\overset{\rm p}{.}05$, perhaps present also in the temperature modulation but not clearly visible due to the scarce phase coverage. This double-wave behaviour, found earlier by Henry et al. (1995) in their 1993 photometry, is thus in our 2004 data, indicating again the presence of spots on opposite hemispheres. The peak-to-peak amplitudes of the top three panels in Figure 1 are $\Delta V = 0\overset{\rm m}{.}077$, $\Delta B = 0\overset{\rm m}{.}075$, and $\Delta\langle T_{\rm eff}\rangle = 77$ K.

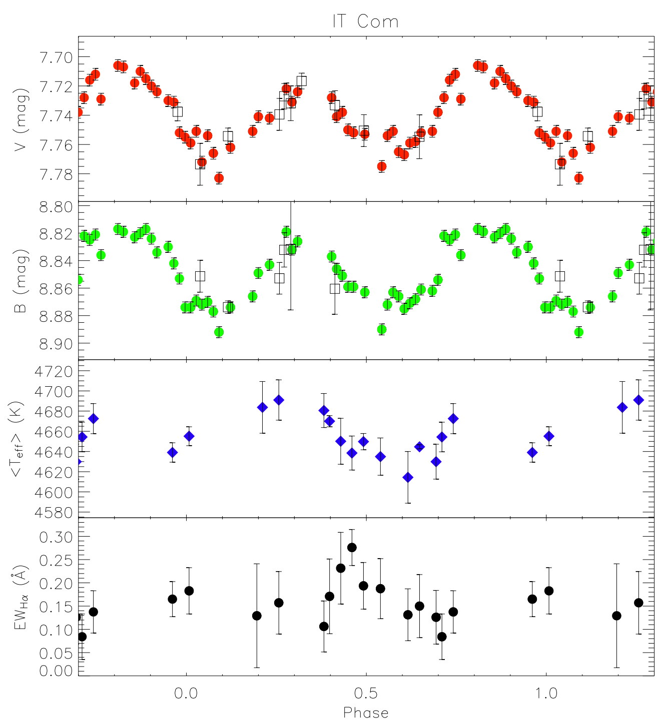

Figure 1. *From top to bottom.* V and B magnitudes, averaged $T_{\rm eff}$ and $EW_{\rm H\alpha}$ as a function of rotational phase. In the light curves, the filled circles are FO data, while the empty squares are ÇOMÜ photometry. For the photometric observations, HD 117816 ($V = 8\overset{\rm m}{.}48$, $B = 10\overset{\rm m}{.}05$) was used as comparison star, while HD 119126 ($V = 5\overset{\rm m}{.}58$, $B = 6\overset{\rm m}{.}59$) was chosen as check star (Yoss & Griffin, 1997). A shift has been applied to the few ÇOMÜ data in order to adequately match those ones from FO

For a chromospheric diagnostic, we used the net Hα emission as derived from the *spectral synthesis method* (e.g., Barden, 1985; Frasca & Catalano, 1994). With this technique, the difference between the observed spectrum and a "non-active" template gives, as residuals, the net Hα chromospheric emission. We have used a well-exposed spectrum of β Gem (K0IIIb, $B-V = 1\overset{m}{.}00$) as our Hα template. This spectrum has not been rotationally broadened since IT Com has a $v \sin i = 6.5$ km s^{-1} (Fekel, 1997), i.e. lower than the resolution of the spectrograph. The Hα equivalent widths ($EW_{\mathrm{H}\alpha}$) integrated across the residuals in the observed-minus-template spectra suggests only marginal modulation with rotational phase (Figure 1, bottom). The most evident feature in the Hα plot is an increase in equivalent width around phase $0\overset{p}{.}5$ (the second minimum in the light curve) of a factor ≈ 2 just over the 3σ level.

The values of the averaged temperature and the net equivalent width $EW_{\mathrm{H}\alpha}$ of IT Com are listed in the Table 1, while the photometric data are reported in Tables 2 and 3, which are available electronically through the IBVS website as files 5740-t2.txt and 5740-t3.txt. The typical precision of the T3 observations, about $0\overset{m}{.}004$, has not been reported in Table 2.

Table 1. Temperature and net Hα equivalent width of IT Com

HJD (+2 400 000)	Phase	$\langle T_{\mathrm{eff}} \rangle$ (K)	$EW_{\mathrm{H}\alpha}$ (Å)
53 108.438	0.710	4654±15	0.08±0.05
53 110.457	0.742	4673±15	0.14±0.05
53 124.512	0.961	4639±10	0.17±0.04
53 127.477	0.007	4655± 9	0.18±0.05
53 139.520	0.196	4684±26	0.13±0.11
53 143.430	0.257	4691±20	0.16±0.07
53 151.453	0.382	4681±17	0.11±0.05
53 152.457	0.398	4670± 6	0.17±0.08
53 154.441	0.429	4650±23	0.23±0.08
53 156.438	0.460	4638±17	0.28±0.04
53 158.488	0.492	4650± 8	0.19±0.05
53 161.508	0.539	4635±18	0.19±0.06
53 166.391	0.616	4614±26	0.13±0.06
53 168.457	0.648	4645± 2	0.15±0.07
53 171.402	0.694	4630±17	0.13±0.06

The results presented here are part of a project devoted to obtain both spectroscopic and photometric observations of a sample of magnetically active stars with different spectral types, ages, masses, rotational periods and activity levels. The ultimate goal is to investigate possible dependences of active region parameters (i.e. temperature and filling factor) on global parameters (such as mass and radius).

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CCD TIMES OF MINIMA OF SELECTED ECLIPSING BINARIES

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The given list of minima from 2004-2005 is one of the results of our long-term observational program, which is devoted to eclipsing binaries (EB) worthy of our attention — EB with eccentric orbits, apsidal motions, spots or simply rarely observed EB.

Observatory and telescope:
N. Copernicus Observatory and Planetarium in Brno, Czech Republic – 16″ Newtonian telescope (f/1750 mm) (RL400) – 8″ Newtonian telescope (f/1000 mm) (RL200) – 3″ refractor (f/340 mm)(RF80) Ulupinar Observatory, Çanakkale Onsekiz Mart University, Canakkale, Turkey – 12″Newtonian telescope (f/3048 mm) (RL300)

Detector:	765 × 510+ SBIG ST7 CCD camera (RL400) 640 × 480+ SBIG ST237 CCD camera (RL300) 765 × 510+ SBIG ST7XMEI CCD camera (RL200) 1530 × 1020+ SBIG ST8 CCD camera (RF80)

Method of data reduction:
Reduction of the CCD frames was made with a software package C-Munipack†

Method of minimum determination:
The minima times were computed using several procedures written by Gaspani (1995) based on artificial neural networks, software AVE based on Kwee–van Woerden method (Barber, 1999) and new mathematical method developed by Mikulášek (2005)

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
BX And	53612.5779	0.0001	I	R_C	MZ,RL200;386
DO And	53674.4210	0.0004	I	R_C	MZ,RL400;25
EP And	53611.5274	0.0002	II	R_C	MZ,RL400;19
GZ And	53255.4958	0.0001	II	$V(RI)_C$	MZ,RL400;146
GZ And	53344.2570	0.0002	II	$V(RI)_C$	MZ,RL400;160
GZ And	53344.4088	0.0001	I	$V(RI)_C$	MZ,RL400;149
V 440 And	53254.6016	0.0002	I	$(RI)_C$	MZ,RL400;112

† Motl, D., 2004, C-Munipack, `http://integral.sci.muni.cz/cmunipack/`

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
UU Aqr	53222.5539	0.0008	I	$(RI)_C$	MZ,RL400;39
CX Aqr	53656.3309	0.0003	I	R_C	MZ,RL200;45
DY Aqr	53299.3738	0.0009	I	C	MZ,RL300;1099
GK Aqr *	53656.3817	0.0002	I	R_C	MZ,RL400;52
V 407 Aql	53222.4193	0.0042	I	C	MZ,RL400;20
V 417 Aql	53222.4121	0.0039	I	R_C	MZ,RL400;20
V 479 Aql	53612.3607	0.0002	I	R_C	MZ,RL400;28
V 699 Aql	53613.3913	0.0004	I	R_C	MZ,RL400;39
V 761 Aql	53233.3578	0.0002	I	C	MZ,RL400;25
V 770 Aql	53613.3574	0.0003	I	R_C	MZ,RL400;27
V 784 Aql	53224.5805	0.0018	I	$V(RI)_C$	MZ,RL400;74
V 784 Aql	53612.4560	0.0006	I	R_C	MZ,RL400;24
V 803 Aql	53222.4938	0.0055	II	C	MZ,RL400;11
V 873 Aql	53611.3942	0.0004	I	R_C	MZ,RL400;36
V1168 Aql	53613.4246	0.0002	I	R_C	MZ,RL400;41
V1355 Aql	53612.4457	0.0003	I	R_C	MZ,RL400;14
HP Aur	53609.6144	0.0002	I	R_C	MZ,RL400;113
IU Aur	53380.3889	0.0011	I	R_C	MZ,RL200;308
KO Aur	53715.5735	0.0001	I	R_C	MZ,RL200;408
QT Aur	53705.4253	0.0006	I	R_C	MZ,RL400;27
V 364 Aur	53360.4067	0.0002	I	C	MZ,RL200;240
V 523 Aur	53442.4606	0.0011	I	$V(RI)_C$	MZ,RL400;65
V 523 Aur	53450.3912	0.0003	I	$V(RI)_C$	MZ,RL400;116
TZ Boo	53442.4868	0.0009	II	VR_C	MZ,RL200;246
TZ Boo	53442.6342	0.0011	I	VR_C	MZ,RL200;214
TZ Boo	53462.3956	0.0004	II	VR_C	MZ,RL200;271
TZ Boo	53462.5428	0.0002	I	VR_C	MZ,RL200;257
FY Boo *	53463.4535	0.0001	I	$V(RI)_C$	MZ,RL400;95
FY Boo *	53463.5751	0.0002	II	$V(RI)_C$	MZ,RL400;96
LR Cam	53684.3758	0.0002	I	R_C	MZ,RL200;152
SW Cnc	53464.3139	0.0003	I	R_C	MZ,RL400;13
WY Cnc	53410.5986	0.0016	I	R_C	MZ,RL400;12
WY Cnc	53465.3369	0.0001	I	R_C	MZ,RL200;389
AC Cnc	53463.2819	0.0003	I	R_C	MZ,RL400;23
08161907 Cnc *	53464.3923	0.0009	II	R_C	MZ,RL400;31
TU CMi *	53344.5768	0.0005	II	$V(RI)_C$	MZ,RL400;183
TU CMi *	53410.4582	0.0005	I	R_C	MZ,RL400;32
TX CMi	53410.2691	0.0001	II	R_C	MZ,RL400;15
TX CMi	53410.4645	0.0001	I	R_C	MZ,RL400;27
TX CMi	53464.3712	0.0004	II	R_C	MZ,RL400;25
XZ CMi	53388.5179	0.0002	I	VR_C	MZ,RL200;158
XZ CMi	53409.3565	0.0003	I	R_C	MZ,RL400;19
AG CMi	53381.4065	0.0003	I	$V(RI)_C$	MZ,RL200;161
AO CMi	53409.3188	0.0001	I	R_C	MZ,RL400;15
AV CMi	53410.5008	0.0004	I	R_C	MZ,RL400;36
07700523 CMi *	53410.3814	0.0048	I	R_C	MZ,RL400;43
CzeV062 CMi *	53410.3376	0.0002	II	R_C	MZ,RL400;21
CzeV062 CMi *	53410.4915	0.0005	I	R_C	MZ,RL400;21
CzeV062 CMi *	53464.3143	0.0009	II	R_C	MZ,RL400;18
AB Cas	53671.4052	0.0001	I	R_C	MZ,RL200;412
AH Cas	53344.5795	0.0008	I	C	MZ,RL200;630
CW Cas	53361.2508	0.0006	II	V	MZ,RL200;460
CW Cas	53361.4115	0.0008	I	$B(RI)_C$	MZ,RL200;292
CW Cas	53612.5143	0.0001	I	R_C	MZ,RL200;173
EI Cas	53256.5902	0.0011	I	R_C	MZ,RL400;18
EY Cas	53256.6101	0.0006	II	R_C	MZ,RL400;23
IV Cas	53671.6040	0.0001	I	R_C	MZ,RL200;207
KL Cas	53256.5960	0.0007	I	R_C	MZ,RL400;22
KT Cas	53252.5624	0.0012	I	R_C	MZ,RL400;40
MM Cas	53705.3900	0.0001	I	R_C	MZ,RL200;275

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
V 541 Cas	53609.5863	0.0001	I	R_C	MZ,RL200;140
V 775 Cas	53674.6113	0.0003	II	R_C	MZ,RL200;285
V 799 Cas	53256.4775	0.0003	II	R_C	MZ,RF80;173
V 851 Cas *	53256.6002	0.0003	I	R_C	MZ,RL400;18
42971664 Cas	53613.4050	0.0002	II	R_C	MZ,RL200;264
WY Cep	53611.5699	0.0003	I	R_C	MZ,RL200;194
ZZ Cep	53651.4587	0.0001	I	R_C	MZ,RL200;212
BE Cep	53653.5005	0.0005	I	R_C	MZ,RL400;41
EK Cep	53388.6311	0.0001	I	$V(RI)_C$	MZ,RL200;593
IO Cep	53653.5083	0.0003	I	R_C	MZ,RL400;41
OT Cep	53613.6059	0.0004	I	R_C	MZ,RL400;59
V 698 Cep	53684.3591	0.0012	I	R_C	MZ,RL400;91
TV Cet	53301.4041	0.0012	I	C	MZ,RL300;963
SS Com	53451.4652	0.0003	II	R_C	MZ,RL400;37
DG Com	53410.6121	0.0036	I	R_C	MZ,RL400;13
EK Com	53484.3432	0.0002	II	VR_C	MZ,RL400;79
LL Com	53451.4807	0.0023	I	R_C	MZ,RL400;37
LO Com	53410.6087	0.0005	I	R_C	MZ,RL400;12
TU CrB	53517.4374	0.0002	I	$V(RI)_C$	MZ,RL400;246
TW CrB	53388.7121	0.0001	I	VR_C	MZ,RL200;112
CG Cyg	53255.3664	0.0001	I	R_C	MZ,RL200;116
GV Cyg	53246.5307	0.0002	I	R_C	MZ,RL400;43
V 388 Cyg	53226.4211	0.0035	I	$(RI)_C$	MZ,RF80;131
V 388 Cyg	53290.4231	0.0025	II	VR_C	MZ,RF80;77
V 401 Cyg	53256.4735	0.0013	II	R_C	MZ,RL400;35
V 442 Cyg	53227.4168	0.0023	I	$V(RI)_C$	MZ,RF80;147
V 442 Cyg	53233.3828	0.0017	II	$V(RI)_C$	MZ,RF80;130
V 442 Cyg	53246.5050	0.0007	I	$V(RI)_C$	MZ,RF80;184
V 442 Cyg	53252.4709	0.0012	II	$V(RI)_C$	MZ,RF80;179
V 456 Cyg	53609.4294	0.0001	I	R_C	MZ,RL200;174
V 500 Cyg	53613.5285	0.0003	I	R_C	MZ,RL400;28
V 509 Cyg *	53613.5407	0.0012	I	R_C	MZ,RL400;28
V 635 Cyg	53246.5214	0.0002	I	R_C	MZ,RL400;43
V 700 Cyg	53290.3923	0.0002	II	R_C	MZ,RL400;17
V 706 Cyg	53256.4150	0.0003	I	R_C	MZ,RL400;36
V 711 Cyg *	53259.3820	0.0003	I	R_C	MZ,RL400;20
V 711 Cyg *	53674.3937	0.0007	I	R_C	MZ,RL400;23
V 787 Cyg	53609.5153	0.0001	I	R_C	MZ,RL200;162
V 822 Cyg	53256.4180	0.0016	I	R_C	MZ,RL400;33
V 859 Cyg	53255.4252	0.0009	I	R_C	MZ,RL400;31
V 870 Cyg	53256.3889	0.0016	I	R_C	MZ,RL400;25
V 877 Cyg	53290.2972	0.0036	I	R_C	MZ,RL400;28
V 959 Cyg	53229.4398	0.0004	I	$V(RI)_C$	MZ,RL400;140
V1004 Cyg	53290.3672	0.0003	I	R_C	MZ,RL400;30
V1019 Cyg	53290.4086	0.0027	I	R_C	MZ,RL400;24
V1147 Cyg	53229.4395	0.0013	I	R_C	MZ,RL400;47
V1414 Cyg	53246.5197	0.0011	I	R_C	MZ,RL400;43
CzeV052 Cyg *	53256.4021	0.0034		R_C	MZ,RL400;26
CzeV053 Cyg *	53256.3472	0.0009		R_C	MZ,RL400;21
CzeV053 Cyg *	53290.3164	0.0047		R_C	MZ,RL400;25
26850099 Cyg *	53226.4262	0.0021	I	$V(RI)_C$	MZ,RF80;95
26850099 Cyg *	53228.5036	0.0009	I	$V(RI)_C$	MZ,RF80;144
26850099 Cyg *	53252.3847	0.0016	I	$V(RI)_C$	MZ,RF80;90
26850099 Cyg *	53255.5031	0.0053	I	$V(RI)_C$	MZ,RF80;74
26851186 Cyg *	53222.4458	0.0026	I	$(RI)_C$	MZ,RF80;88
26851186 Cyg *	53226.4941	0.0025	I	$(RI)_C$	MZ,RF80;184
26851186 Cyg *	53227.4275	0.0029	I	$(RI)_C$	MZ,RF80;116
26851186 Cyg *	53228.3636	0.0065	I	I_C	MZ,RF80;32
26851186 Cyg *	53246.4245	0.0025	I	$(RI)_C$	MZ,RF80;76
26851453 Cyg *	53226.4666	0.0055	I	I_C	MZ,RF80;45

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
26851453 Cyg *	53227.3890	0.0023	I	$(RI)_C$	MZ,RF80;90
26851453 Cyg *	53228.4977	0.0023	I	$(RI)_C$	MZ,RF80;84
26851453 Cyg *	53233.4792	0.0027	I	$(RI)_C$	MZ,RF80;69
HD226957 Cyg	53233.5167	0.0003	II	$V(RI)_C$	MZ,RL400;331
YY Del	53612.3375	0.0002	I	R_C	MZ,RL400;27
FZ Del	53268.3394	0.0005	I	R_C	MZ,RL400;119
TW Dra	53254.3796	0.0003	II	$V(RI)_C$	MZ,RL400;1196
TW Dra	53387.7016	0.0002	I	$BV(RI)_C$	MZ,RL200;1091
TW Dra	53407.3492	0.0001	I	$BV(RI)_C$	MZ,RL200;1365
TW Dra	53463.4867	0.0001	I	$BV(RI)_C$	MZ,RL200;2725
TW Dra	53581.3738	0.0001	I	$(RI)_C$	MZ,RL400;537
EF Dra	53410.2776	0.0003	I	V	MZ,RL200;177
WX Eri	53255.6134	0.0003	I	R_C	MZ,RF80 ;64
BL Eri	53299.5321	0.0003	I	C	MZ,RL300;556
TX Gem	53451.3600	0.0002	I	R_C	MZ,RL400;37
AV Gem	53451.2949	0.0009	II	R_C	MZ,RL400;34
EL Gem	53451.3268	0.0003	II	R_C	MZ,RL400;34
FG Gem	53451.2929	0.0005	I	R_C	MZ,RL400;23
FT Gem	53465.3371	0.0008	I	R_C	MZ,RL400;41
HR Gem	53705.4063	0.0003	I	R_C	MZ,RL400;34
KQ Gem	53715.4792	0.0005	I	R_C	MZ,RL400;31
KV Gem	53329.4482	0.0004	II	$V(RI)_C$	MZ,RL400;91
KV Gem	53329.6271	0.0002	I	$V(RI)_C$	MZ,RL400;152
KV Gem	53451.3464	0.0002	II	R_C	MZ,RL400;37
KV Gem	53465.3281	0.0001	II	R_C	MZ,RL400;41
KV Gem	53715.3974	0.0004	I	R_C	MZ,RL400;31
KV Gem	53715.5759	0.0004	II	R_C	MZ,RL400;32
AK Her	53465.5586	0.0002	I	VR_C	MZ,RL200;485
V 789 Her *	53252.4305	0.0021	I	$V(RI)_C$	MZ,RL400;97
WY Hya	53410.4270	0.0003	I	R_C	MZ,RL400;24
TW Lac	53656.5342	0.0002	I	R_C	MZ,RL400;137
TZ Lac	53259.3761	0.0008	I	R_C	MZ,RL400;28
VY Lac	53612.3376	0.0001	I	R_C	MZ,RL200;170
AU Lac	53259.3324	0.0003	I	R_C	MZ,RL400;19
EM Lac	53228.5894	0.0002	I	$V(RI)_C$	MZ,RL400;116
EM Lac	53259.3313	0.0002	I	R_C	MZ,RL400;19
EM Lac	53259.5272	0.0003	II	R_C	MZ,RL400;30
GH Lac	53259.3400	0.0005	I	R_C	MZ,RL400;26
GH Lac	53653.4770	0.0009	I	R_C	MZ,RL400;22
IP Lac	53246.5407	0.0004	I	R_C	MZ,RL400;35
PP Lac	53259.4099	0.0005	II	R_C	MZ,RL400;23
PP Lac	53259.6108	0.0002	I	R_C	MZ,RL400;23
PP Lac	53674.4109	0.0004	I	R_C	MZ,RL400;25
V 344 Lac	53259.3397	0.0007	II	R_C	MZ,RL400;23
V 344 Lac	53259.5344	0.0004	I	R_C	MZ,RL400;29
V 364 Lac	53656.3650	0.0003	II	R_C	MZ,RL200;765
Y Leo	53445.4401	0.0002	II	R_C	MZ,RL400;21
WZ Leo	53445.4458	0.0004	I	R_C	MZ,RL400;20
AP Leo	53410.5865	0.0007	II	R_C	MZ,RL400;13
AP Leo	53465.4572	0.0001	I	VR_C	MZ,RL200;485
AP Leo	53484.3928	0.0002	I	VR_C	MZ,RL200;278
BL Leo	53445.5331	0.0010	I	VR_C	MZ,RL400;44
BW Leo	53445.4618	0.0025	II	VR_C	MZ,RL400;38
RR Lep	53409.3062	0.0008	I	R_C	MZ,RL400;15
SS Lib	53450.6372	0.0005	I	VR_C	MZ,RL400;108
TY Lib	53442.5582	0.0002	I	VR_C	MZ,RL400;122
VZ Lib	53450.5387	0.0004	I	VR_C	MZ,RL400;72
FL Lyr	53684.2691	0.0001	I	R_C	MZ,RL200;401
V 361 Lyr	53520.3794	0.0001	I	R_C	MZ,RL400;76
V 361 Lyr	53651.3461	0.0003	I	VR_C	MZ,RL400;78

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
UU Mon	53462.3005	0.0006	I	R_C	MZ,RL400;19
BB Mon	53407.4789	0.0022	I	R_C	MZ,RL400;20
BB Mon	53410.4118	0.0008	I	R_C	MZ,RL400;15
BM Mon	53409.3787	0.0024	II	R_C	MZ,RL400;34
BM Mon	53462.2861	0.0010	I	R_C	MZ,RL400;18
GH Mon	53407.2646	0.0014	I	R_C	MZ,RL400;23
HM Mon	53407.3374	0.0003	I	R_C	MZ,RL400;52
NN Mon *	53407.4316	0.0002	I	R_C	MZ,RL400;68
V 396 Mon	53407.4759	0.0011	I	R_C	MZ,RL400;19
V 396 Mon	53409.4576	0.0007	I	R_C	MZ,RL400;24
V 453 Mon	53410.2971	0.0001	I	R_C	MZ,RL400;21
V 501 Mon	53671.6010	0.0009	II	R_C	MZ,RL400;120
48162749 Mon *	53407.3998	0.0034	I	R_C	MZ,RL400;42
CzeV085 Mon *	53409.4463	0.0015	I	R_C	MZ,RL400;31
CzeV087 Mon *	53409.3593	0.0041	I	R_C	MZ,RL400;29
V 913 Oph	53611.4055	0.0002	I	R_C	MZ,RL400;42
V 981 Oph	53611.3850	0.0003	I	R_C	MZ,RL400;45
EF Ori	53445.3406	0.0010	I	R_C	MZ,RL400;71
EQ Ori	53409.3487	0.0001	I	R_C	MZ,RL400;22
GU Ori	53409.3196	0.0004	I	$V(RI)_C$	MZ,RL400;60
GU Ori	53445.3257	0.0002	II	R_C	MZ,RL400;71
GU Ori	53674.5457	0.0005	II	R_C	MZ,RL400;38
QV Ori	53409.4907	0.0027	I	R_C	MZ,RL400;25
V 392 Ori	53450.3752	0.0001	I	R_C	MZ,RL200;420
V 392 Ori	53674.5337	0.0009	I	R_C	MZ,RL400;38
V 392 Ori	53715.4091	0.0001	I	R_C	MZ,RL200;240
V 645 Ori	53674.5770	0.0002	I	R_C	MZ,RL400;39
V1633 Ori	53671.6572	0.0002	I	R_C	MZ,RL400;81
BX Peg	53360.2974	0.0001	I	C	MZ,RL200;332
BX Peg	53613.5150	0.0003	I	R_C	MZ,RL400;28
BY Peg	53609.5597	0.0002	I	R_C	MZ,RL400;63
CE Peg	53613.5381	0.0006	I	R_C	MZ,RL400;28
KW Peg	53360.2722	0.0001	II	C	MZ,RL200;281
XZ Per	53290.5507	0.0000	I	C	MZ,RL200;509
AG Per	53259.4459	0.0017	I	R_C	MZ,RF80;178
II Per *	53611.5057	0.0011	I	R_C	MZ,RL400;20
IU Per	53361.5223	0.0003	I	$BV(RI)_C$	MZ,RL200;283
PS Per	53656.4422	0.0003	I	R_C	MZ,RL400;37
V 680 Per	53290.6198	0.0003	I	VR_C	MZ,RL400;85
V 680 Per	53713.3030	0.0004	I	$(RI)_C$	MZ,RL400;102
37081325 Per	53381.2520	0.0012	I	$V(RI)_C$	MZ,RL200;171
Y Psc	53656.3281	0.0002	I	R_C	MZ,RL400;131
Y Psc	53671.3900	0.0001	I	R_C	MZ,RL400;169
RV Psc	53611.4077	0.0002	II	R_C	MZ,RL200;192
RV Psc	53651.5738	0.0002	I	R_C	MZ,RL200;230
RV Psc	53684.2606	0.0002	I	R_C	MZ,RL400;63
RV Psc	53705.3121	0.0001	I	R_C	MZ,RL400;81
DL Sge	53612.3465	0.0003	I	R_C	MZ,RL400;27
XY Sct	53251.4037	0.0016	I	$(RI)_C$	MZ,RL400;82
XY Sct	53255.3304	0.0002	I	$V(RI)_C$	MZ,RL400;139
FG Sct	53224.4151	0.0016	II	$V(RI)_C$	MZ,RL400;115
FG Sct	53228.3381	0.0001	I	$V(RI)_C$	MZ,RL400;90
FG Sct	53228.4735	0.0002	II	$V(RI)_C$	MZ,RL400;93
LX Ser	53465.6313	0.0003	I	R_C	MZ,RL400;28
AL Tau	53705.4514	0.0005	I	R_C	MZ,RL400;38
GR Tau	53611.5859	0.0005	I	R_C	MZ,RL400;28
HD285166 Tau	53388.3758	0.0019	I	VR_C	MZ,RL200;129
V Tri	53684.2617	0.0002	I	R_C	MZ,RL400;62
X Tri	53290.5883	0.0001	I	R_C	MZ,RF80;150
RW Tri	53671.6945	0.0002	I	R_C	MZ,RL200;32

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
RW Tri	53705.3169	0.0001	I	R_C	MZ,RL200;55
ST Tri	53713.2041	0.0005	I	$(RI)_C$	MZ,RL400;61
UX UMa	53290.6236	0.0001	I	C	MZ,RL200;55
XZ UMa	53387.3717	0.0001	I	$V(RI)_C$	MZ,RL200;200
HW Vir	53410.7014	0.0000	I	R_C	MZ,RL400;52
BT Vul	53613.4524	0.0002	I	R_C	MZ,RL400;24
BU Vul	53612.3247	0.0002	I	R_C	MZ,RL400;28
IM Vul *	53612.3355	0.0003	I	R_C	MZ,RL400;25
HD350731 Vul	53612.4138	0.0001	I	R_C	MZ,RL200;250
HD350731 Vul	53653.2919	0.0001	I	R_C	MZ,RL200;242

Remarks:

The timings of minima presented in this sixth list were obtained from 25781 CCD observations. The last column "Remarks" contains initial of observer, used telescope, and number of measurements used for determination of timings of minima.
CzeV = variability of the star was discovered by Czech astronomers,
http://var.astro.cz
GK Aqr — primary minimum could be a secondary one
FY Boo — new ephemeris $53032.98623(14) + 0.24115879(11) \times E$
GSC 08161907 Cnc — $51397.2637(3) + 0.3216105(15) \times E$
TU CMi — new ephemeris $52900.5133(5) + 0.4334439(5) \times E$
GSC 770 523 = CzeV90 — type of minimum uncertain
CzeV62 CMi — new ephemeris $52611.6147(2) + 0.30755495(7) \times E$
V851 Cas — new period $P = 0.960276(1)$ day
V509 Cyg — $52868.4906(19) + 1.6091738(18) \times E$
V711 Cyg — $52133.400(3) + 0.826717(2) \times E$
CzeV052 Cyg — only 1 minimum
CzeV053 Cyg — new ephemeris $52255.2469(7)+0.4020485(4)\times E$, type of minimum uncertain
GSC 26850099 Cyg = CzeV48 — EA, new ephemeris $53228.505(2)+1.03832(7)\times E$
GSC 26851186 = CzeV13 — EW, new ephemeris $52997.3074(3)+0.6227889(10)\times E$
GSC 26851453 Cyg = CzeV47 — EW, primary minimum could be a secondary one, new ephemeris $53238.6459(8) + 0.369190(18) \times E$
V789 Her — new ephemeris $52296.4653(2) + 0.32004194(13) \times E$
NN Mon — new period 0.9123629(7) day
GSC 48162749 Mon — type of minimum uncertain
CzeV085 Mon — EA:, only 1 minimum
CzeV087 Mon —- EW, new ephemeris $51397.2197(6) + 0.4019464(3) \times E$
II Per — new ephemeris $52438.0281(2) + 0.4798508(2) \times E$
IM Vul — new ephemeris $53277.07615(11) + 0.45427781(14) \times E$

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PHOTOMETRY OF THE ALGOL-TYPE BINARY Z DRACONIS

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Ceraski (1903) first reported the eclipsing nature of Z Draconis, concluding that it was an Algol-type binary. Russell & Shapley (1914) analyzed the photoelectric observations of Dugan (1912) and gave a rough estimate of a distance of 1000 light years for the system. No other published light curves since that of Dugan appear to exist, although the system's times of minimum have been reasonably well observed, as can be seen in the $O-C$ diagram given by Kreiner et al. (2001) based on available times of minimum. Struve (1947) measured radial velocities of the primary.

Z Dra was observed with a 0.25-m Schmidt–Cassegrain telescope and a Santa Barbara Instrument Group ST-7XE CCD camera with BVR_CI_C filters. Calibration (bias, dark, flat) and aperture photometry were done with IRAF (Tody, 1993).

Differential photometric observations were made on seven nights in the period 2005 February to 2005 March. GSC 4396-1170 was used as the comparison star and GSC 4396-0455 was the check star. The Johnson $B-V$ values, based on Tycho B_T-V_T values transformed according to Bessell (2000), are 0.52 ± 0.05 for the comparison star and 0.80 ± 0.12 for the check star. The Johnson $B-V$ for the variable, again based on Tycho data, is 0.45 ± 0.06. The standard deviation for comparison minus check observations was 0.02 magnitudes in B and 0.01 magnitudes in V, R_C and I_C. The instrumental differential magnitudes for Z Dra are available from the IBVS web site as 5742-t2.txt (B), 5742-t3.txt (V), 5742-t4.txt (R_C) and 5742-t5.txt (I_C).

The new photometric data and the radial velocities of Struve (1947) were analyzed simultaneously with the PHOEBE program (Prša & Zwitter, 2005) which uses the most recent release of the 2003 version the Wilson–Devinney program (WD; Wilson & Devinney, 1971; Wilson, 1979). WD's mode 5 was employed, as appropriate for Algol-type binaries. The gravity darkening exponents were fixed at 0.32 and the bolometric albedos were set to 0.5 for both stars. The logarithmic limb darkening law was used with coefficients from Van Hamme (1993).The mean effective temperature of of the primary was initially set equal to 8083 K based on the A5 spectral type given by Struve (1947) and the calibrations of Flower (1996). The reader should note that the temperatures are not accurate to 1 K as this figure might imply but are uncertain by approximately 200 K. The resulting mass and radius of the primary were 1.49 $M_\odot$ and 1.49 $R_\odot$, values that are significantly lower than expected for an A5 V star and more in line with an F4 V star, which is the classification given in the GCVS. The Tycho and 2MASS colors of the system are also in better agreement with the later spectral type, so another solution assuming $T_1 = 6725\ K$

was performed and the results are presented in Table 1. The derived value for the time derivative of the orbital period ($\dot{P}$) was adjusted to allow for a period difference over the nearly six decades of time between the photometric and spectroscopic observations. The $O-C$ diagram of times of minimum (Kreiner et al., 2001) shows complex behavior so the derived value of $\dot{P}$ is useful only as an indicator of the long-term trend of the period changes.

Knowing the magnitude differences in B and V between the two components from the light curve solution, we can compute the intrinsic $B-V$ of the system assuming the intrinsic $B-V$ of the primary (viz. Terrell et al., 2005). An F4 star should have a $B-V$ value of about 0.40. The resulting $B-V$ of the binary is 0.45, in excellent agreement with the observed value, so the interstellar reddening toward Z Dra is small. The estimated distance to the system is 312 ± 28 pc, consistent with the value of 236 ± 80 pc determined by Hipparcos.

Table 1. Parameters for the light/velocity curve Sslution with $T_1 = 6725$ K

Parameter	Value	Std. error†
a	6.38 $R_\odot$	0.06 $R_\odot$
V_γ	-31.3 km sec^{-1}	0.3 km sec^{-1}
i	87°.00	0°.09
T_2	4149 K	12 K
q	0.294	0.002
Ω_1	4.64	0.02
HJD_0	2453430.71662	0.00009
P	$1^d.3574179$	$0^d.000007$
$\dot{P}$	-1.7×10^{-9}	6.5×10^{-11}
$L_1/(L_1+L_2)_B$	0.958	0.002
$L_1/(L_1+L_2)_V$	0.912	0.002
$L_1/(L_1+L_2)_{R_C}$	0.866	0.003
$L_1/(L_1+L_2)_{I_C}$	0.820	0.003
M_1	1.47 $M_\odot$	0.04 $M_\odot$
M_2	0.43 $M_\odot$	0.01 $M_\odot$
R_1	1.48 $R_\odot$	0.01 $R_\odot$
R_2	1.78 $R_\odot$	0.02 $R_\odot$

† Formal errors from the differential corrections solution

All of the light curves show a slightly elevated light level compared to the theoretical curves before the ingress of the secondary eclipse. The mean light curve of Dugan (1912), gathered over approximately 3.5 years, appears to show the same asymmetry, perhaps indicating that this is a persistent feature. The fit to the secondary eclipse in the B light curve is poor and the fit to both eclipses in the I_C curve is also poor. The I_C light curve shows a strong asymmetry between the two maxima. The portion of the light curve between phases 0.6 and 0.9 is noticeably flatter than that between phases 0.1 and 0.4. Some attempts at fitting a variety of single hot and cool spots were made but none appeared to satisfactorily fit the asymmetries of all the light curves, indicating that a single spot model is insufficient.

A high-resolution spectroscopic study of the system is sorely needed. Since the eclipses are partial, the photometric mass ratio is questionable (viz. Terrell & Wilson, 2005) thus making this a preliminary solution. Measurement of the radial velocities of the

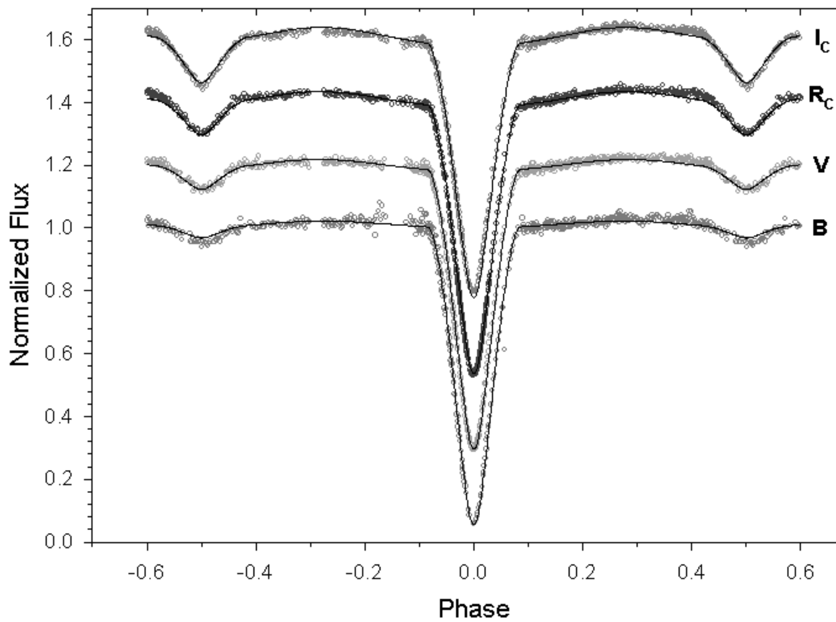

Figure 1. BVR_CI_C light curves of Z Dra and the fits from the Wilson–Devinney solution. The curves have been shifted vertically for clarity.

secondary is crucial to alleviating the concern about the mass ratio. Further photometric observations would reveal any temporal variability of the light curve asymmetries.

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CCD PHOTOMETRY OF THE MULTI-MODE δ SCUTI STAR GSC 1730-1858

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The star ASAS 001856+2239.6 = GSC 1730-1858 (coordinates for equinox 2000.0: $\alpha = 00^{h}18^{m}55^{s}.87$, $\delta = +22^{\circ}39'40''.2$) was found to be a new δ Scuti variable by the All Sky Automated Survey (*ASAS-3*; Pojmanski & Maciejewski, 2005) with a period of 0.0960 days. The phase plot of the *ASAS-3* data at this period shows an unusual amount of scatter. A close investigation of the available data as well as data from the Northern Sky Variability Survey (*NSVS*; Wozniak et al., 2004), showed two more excited modes with periods of 0.0920 and 0.0937 days, both close to the original period and amplitudes somewhat larger than half the main amplitude.

Follow-up observations of this object were then started at three private observatories. A total of 5109 data points in V were obtained during 46 different nights from September to November 2006. In addition, the star was observed simultaneously in B by SK, while FJH also observed in I_c. The observation log of the data is presented in Table 1, while the number of data points is given in Table 2. Schuler filters were used for all observations. All data are available electronically.

The comparison stars used were GSC 1730-2105 (adopted magnitude $V = 12.46$ from the YB6 catalogue; USNO, unpublished), GSC 1730-1709 and GSC 1730-2179. Unfortunately, all three are about two magnitudes fainter than the variable, limiting the precision of the observations. The average nightly standard deviation for the check stars was 0.02 mag in V. To remove small differences in the magnitudes of the variable between observers, the instrumental V magnitudes were shifted by a constant value.

Fig. 1 presents a sample of data from 15 nights showing obvious variations in the amplitude from night to night.

The data were then analysed using Period04 (Lenz & Breger, 2005). In addition to the three frequencies already found in the survey data, two more independent frequencies were found with a much smaller semi-amplitude of 7-8 mmag. Fig. 2 gives the frequency spectrum after prewhitening for the first three frequencies, together with the spectral window. All five frequencies lie between 10 and 11 c/d, with one very close pair: the main frequency f_1 and the frequency f_4, separated by only 0.03 c/d. The occurence of

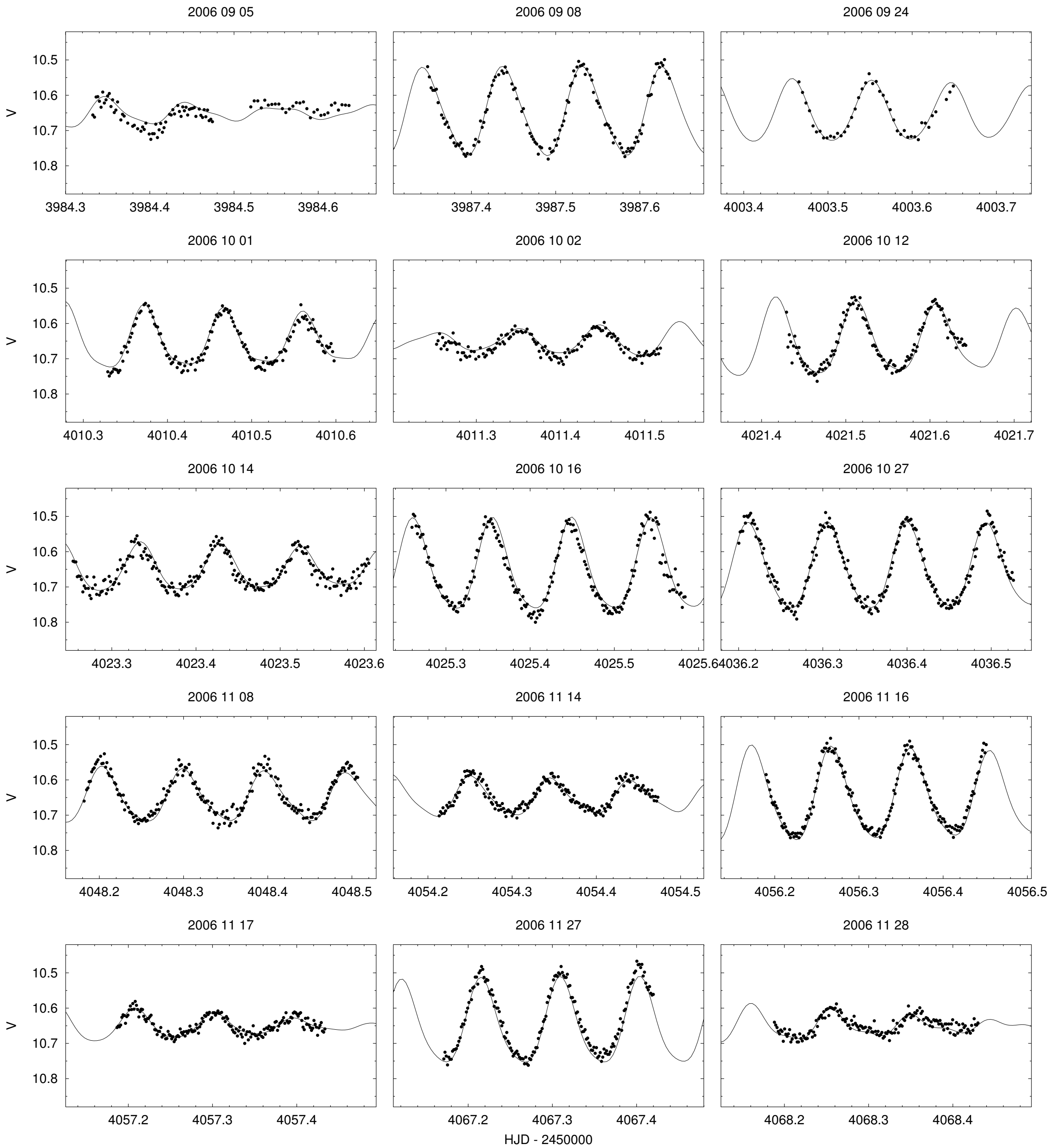

Figure 1. V light curve of GSC 1730-1858 on 15 nights. Also shown is a model plot with the nine frequencies found

Table 1: Observation log

Observer	Telescope	CCD camera	Filters	Timespan (JD − 2450000)	No. of nights	No. of hours
KB	20-cm C8	SX Starlight	V	3984-4064	22	68.3
FJH	35-cm C14	SBIG ST-8	V, I_c	4017-4066	10	57.8
SK	30-cm LX200	SBIG ST-7XMEI	B, V	3984-4068	21	124.1

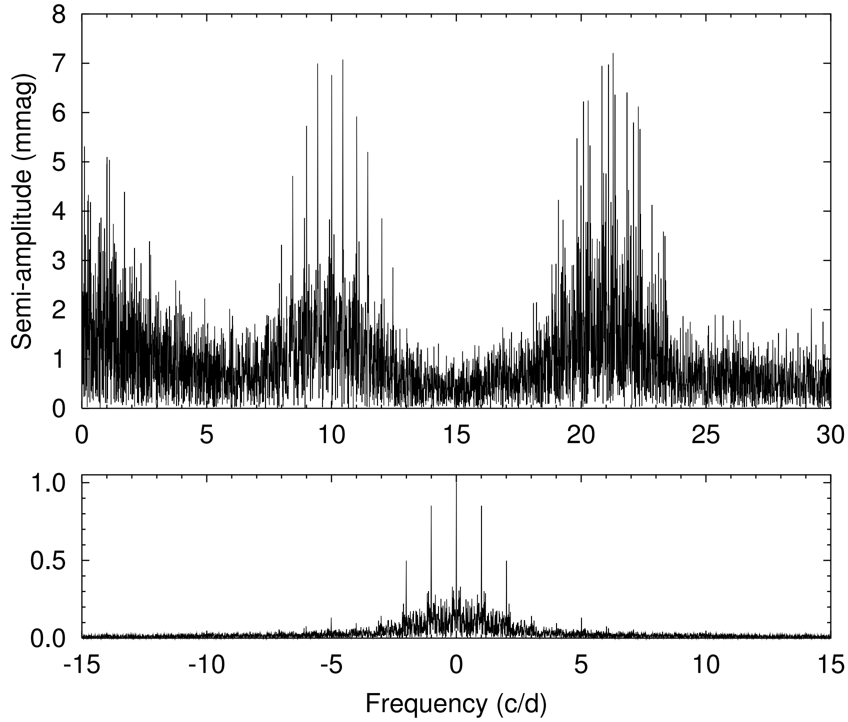

Figure 2. Frequency spectrum of GSC 1730-1858 after prewhitening for f_1 to f_3 (top panel) and spectral window (bottom panel)

Table 2: Number of data points per filter

Observer	B	V	I_c
KB	-	671	-
FJH	-	1347	1109
SK	2975	3091	-

Table 3: Detected frequencies in V

	Frequency c/d	S/N	Semi-ampl. V mmag
f_1	10.41632(5)	90.0	58.0
f_2	10.86918(7)	57.6	36.4
f_3	10.67766(7)	52.8	33.9
f_4	10.44804(34)	12.4	8.0
f_5	10.00745(38)	11.0	7.2
$2f_1$	20.83264(9)	8.4	5.9
$f_1 + f_2$	21.28550(9)	7.9	5.5
$f_1 + f_3$	21.09398(9)	7.8	5.5
$2f_3$	21.35532(15)	7.3	5.1

Table 4: Amplitude ratios and phase differences for B and I_c

Frequency	Ampl. ratio B/V	Ampl. ratio V/I_c	$\phi_B - \phi_V$ degrees	$\phi_V - \phi_I$ degrees
f_1	1.31 ± 0.02	1.66 ± 0.08	0.8 ± 0.7	7 ± 3
f_2	1.22 ± 0.03	1.50 ± 0.09	−2.5 ± 1.3	1 ± 3
f_3	1.33 ± 0.03	1.78 ± 0.12	−3.7 ± 1.3	2 ± 4
f_4	1.32 ± 0.12	2.40 ± 1.16	27.6 ± 5.3	−34 ±25
f_5	1.14 ± 0.13	1.15 ± 0.25	18.9 ± 6.5	−1 ±12
$2f_1$	1.74 ± 0.18	2.60 ± 1.42	1.4 ± 5.9	−51 ±25
$f_1 + f_2$	1.17 ± 0.17	0.80 ± 0.17	−22.3 ± 8.6	−10 ±13
$f_1 + f_3$	1.06 ± 0.17	0.78 ± 0.15	−1.3 ± 9.1	−21 ±10
$2f_3$	1.09 ± 0.18	1.22 ± 0.44	4.9 ± 9.6	22 ±19

close frequencies may be an artifact resulting from the use of inhomogeneous data sets, especially when observations from different instruments are combined. This is not the case here however, because all frequencies found in the aggregated data set were also found in the three longest data sets separately. In addition the data for the check star do not show any frequency with an amplitude above the noise at 2 mmag in the frequency range concerned (at low frequencies the noise is somewhat larger). Four linear combinations of the independent modes were found as well in the frequency spectrum of GSC 1730-1858. These are centered around 21 c/d in Fig. 2. In the low frequency range (less than 3 c/d), none of the frequencies rise significantly above the noise.

An overview of all frequencies found in the V data, is presented in Table 3. The uncertainties of the frequencies given in the table are the errors of the least squares solution. The real uncertainties may be larger. The uncertainties of the V semi-amplitudes are all of the order of 0.4 mmag. No additional frequencies with semi-amplitudes above 2 mmag, other than those listed, could be detected up to 25 c/d. All independently excited frequencies are therefore situated in a narrow band between 115 and 125 μHz. Most other δ Scuti stars with many excited modes show a much broader range of independent modes. At higher frequencies, near 30 c/d, again multiples of the independent frequencies are found. However, their signal to noise ratio is small and they are hard to distinguish from their 1-day aliases. They were therefore not included here.

After fitting the 9 detected frequencies, the average residual is 18 mmag, which may be compared to the standard deviation of the check star. A model plot using those 9 frequencies is shown in Fig. 1.

Amplitude ratios and phase differences for the frequencies in B and I_c, compared to V are presented in Table 4. Because there were less data points for these filters, the amplitudes and phases were calculated using the frequencies obtained from the V data. This table may assist in the identification of the excited modes.

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NEWLY DISCOVERED VARIABLE STARS IN THE GLOBULAR CLUSTER NGC 1261

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NGC 1261 (RA $03^{\rm h}12^{\rm m}15\overset{\rm s}{.}3$, DEC $-55°13'01''$, J2000) is a distant (R_{GC} = 18.2 kpc; Harris, 1996) globular cluster with an intermediate metallicity ([Fe/H] = −1.35) and horizontal branch (HB) morphology not unlike NGC 1851's, with evidence of an HB bimodality — i.e., with fewer known RR Lyrae variables than either red HB or blue HB stars (Ferraro et al., 1993).

The RR Lyrae population in the cluster was discovered in photographic studies by Laborde & Fourcade (1966), Bartolini et al. (1971), Wehlau & Demers (1977), and Wehlau et al. (1977). To the best of our knowledge, no CCD study tackling the variable star populations in this cluster has ever appeared in the literature. In the present note, we report on the discovery of additional variable stars in the cluster. This work is part of a larger effort to bring to light the variable star population properties of several globular clusters that have not been properly investigated with modern CCD images (Catelan et al., 2006).

The cluster images were obtained using the Danish 1.54-m telescope at La Silla, Chile, from September 17 to September 22, 2005. The 2048 × 2048 RINGO CCD was used. Given its $0\overset{''}{.}395$ pixels, the total observed field was $13\overset{'}{.}5 \times 13\overset{'}{.}5$. The time series data consist in 104 B, V pairs, with typical exposure times of 100 sec in B and 35 sec in V. Here we report the results based on the B data only.

To search for variability in our data, we have adopted the image subtraction technique (ISIS v2.1; Alard, 2000). In recent years, this technique has provided the most powerful tools for finding variable stars in crowded regions without the need of large apertures (e.g., Olech et al., 1999; Contreras et al., 2005). Its main drawback is the difficulty to reliably transform relative fluxes into calibrated magnitudes, and even to derive accurate pulsation amplitudes (Corwin et al., 2006, and references therein).

Making use of ISIS we were able to re-discover 19 out of the 21 variables listed in the Clement et al. (2001) catalog, confirming the non-variability of V1 already noted by Wehlau & Demers (1977), but not finding any variability for V18. The latter appears rather surprising, given that Wehlau et al. (1977) found a very precise period (P =

0.33653 d) for V18. However, taking the original data for V18 from Table 1 in Wehlau et al. (1977), we do not find any period that phases the data correctly (Fig. 1). Considering that the position of this variable is only 25″ from the cluster center, and that the magnitudes of Wehlau et al. (1977) were derived by eye, we are confident to discard it as an RR Lyrae star. In the case of V19, Wehlau et al. (1977) do not give a period; we estimate it to be near 0.653 d. For the rest of the known variables we agree with the periods listed in the Clement et al. (2001) catalog.

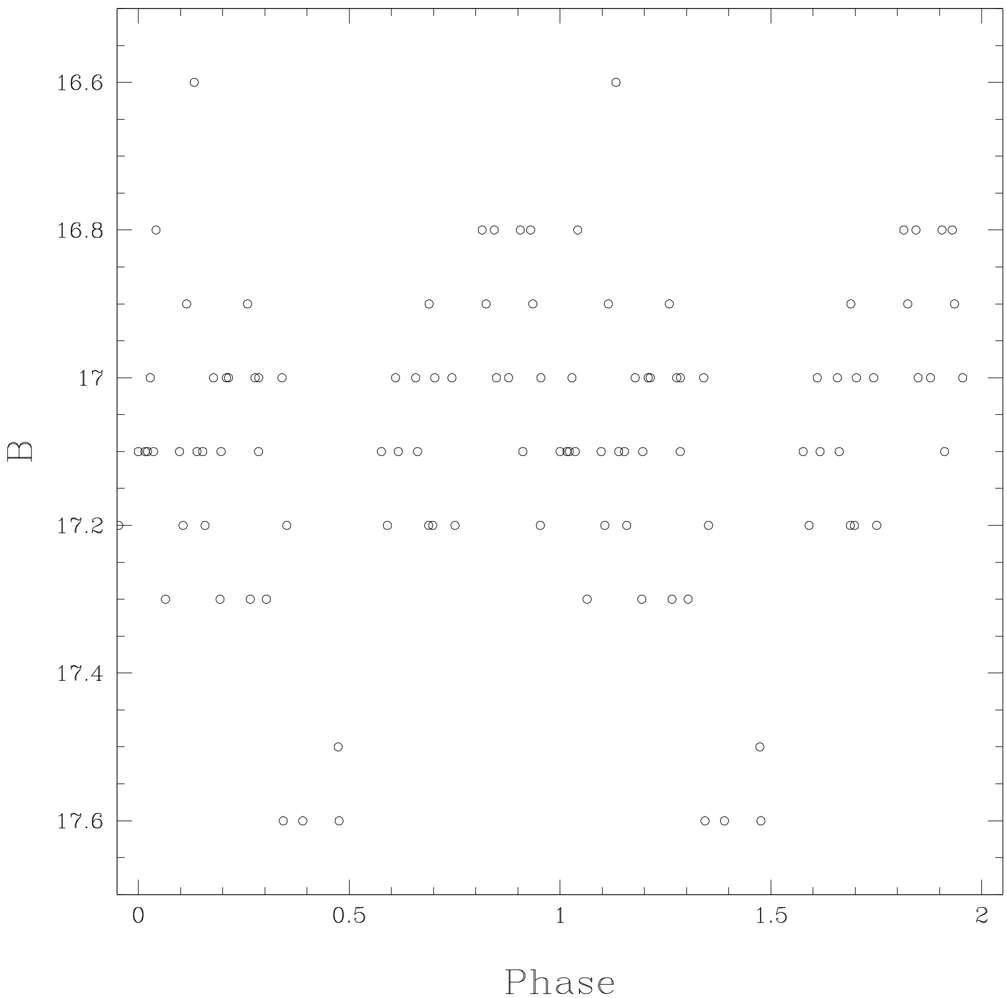

Figure 1. Light curve of V18, using data from Wehlau et al. (1977), with a period of 0.33653 d

Also we have found nine new variables of different types: one long period variable (LPV), three SX Phoenicis and five RR Lyrae stars (3 RRc and 2 RRab). The location, classification and tentative periods for these new variables are given in Table 1. In this table, the x and y coordinates are in arcseconds with respect to the cluster center, as given in the online Clement et al. (2001) catalog. Also a finding chart with all the new variables can be seen in Figure 2.

Due to the relatively small time coverage, it is not possible to give an estimate of the period of V23. For the RR Lyrae stars we think periods are good only up to the third

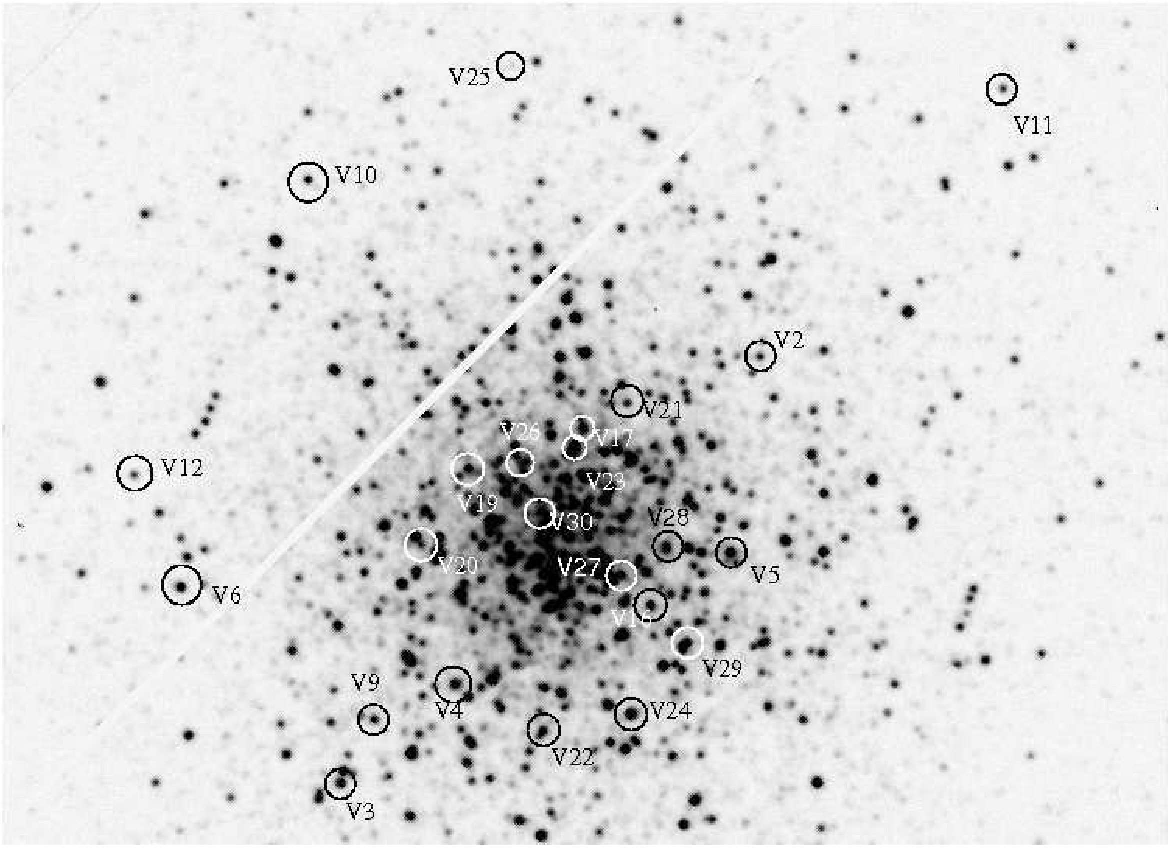

Figure 2. Finding chart for the innermost variable stars in NGC 1261. The field size is approximately $3' \times 2'$. North is up and East to the left

Table 1: Locations and tentative periods for new variable stars in NGC 1261

Variable	x ($''$)	y ($''$)	Period (d)	Type
V22	4.1	−41.3	0.302	RRc
V23	−2.3	15.9	–	LPV
V24	−13.1	−37.8	0.626	RRab
V25	11.2	94.3	0.0535	SX Phe
V26	9.5	12.9	0.0799	SX Phe
V27	−11.6	−9.5	0.341	RRc
V28	−20.9	−3.6	0.287	RRc
V29	−25.3	−23.4	0.593	RRab
V30	4.9	3.0	0.0591	SX Phe

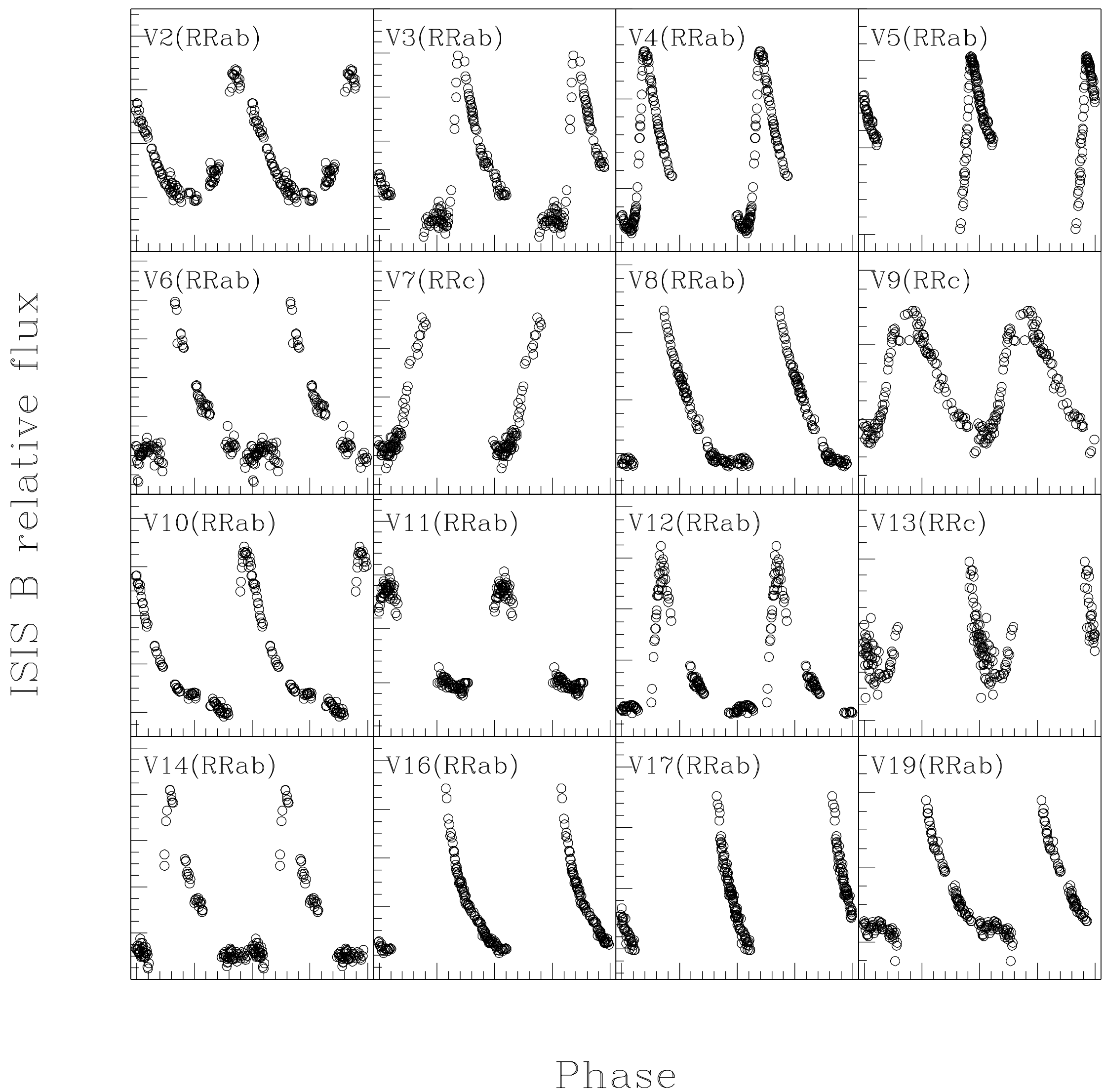

Figure 3. *B*-band differential light curves for previously known variable stars in NGC 1261

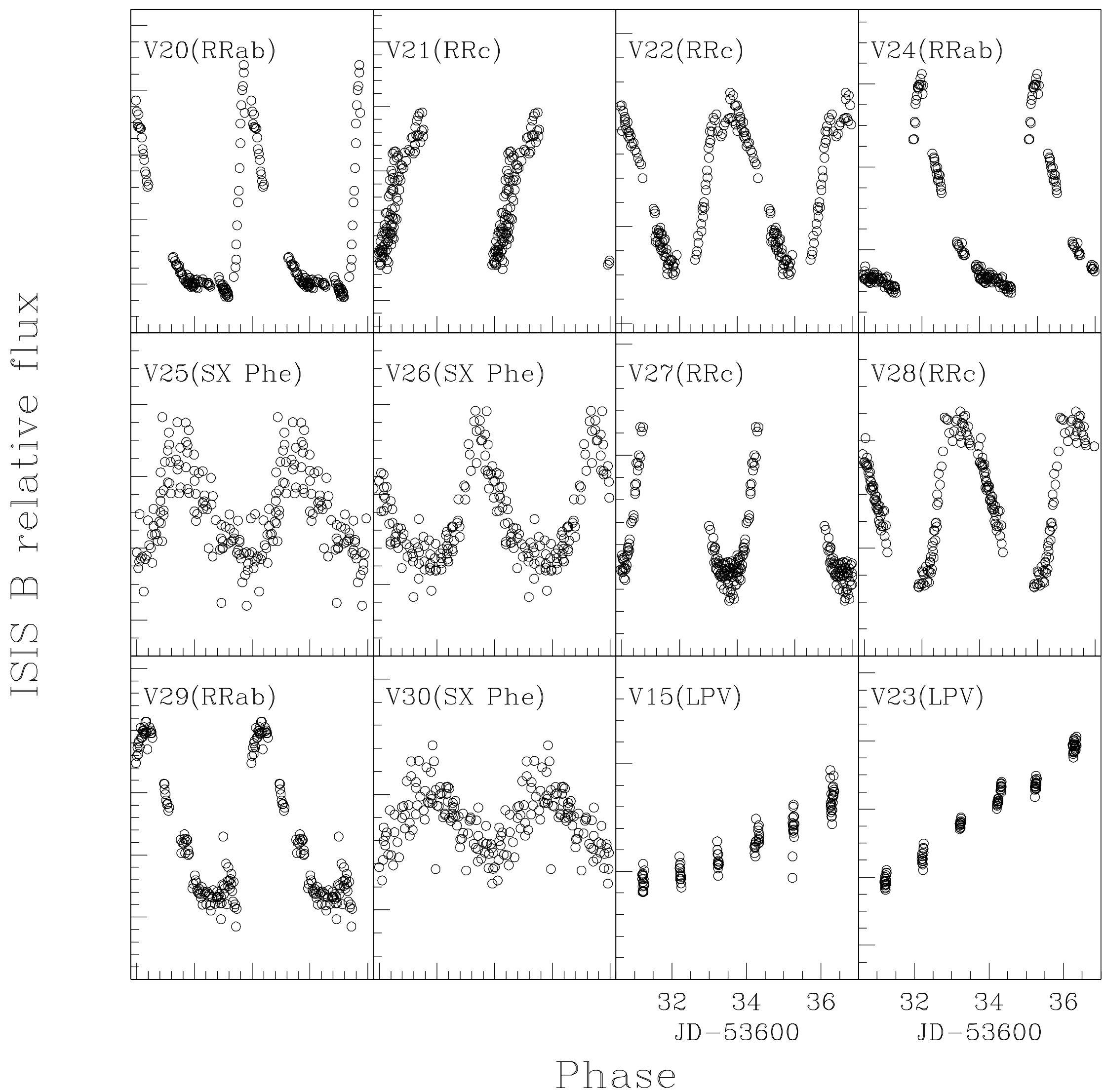

Figure 4. *B*-band differential light curves for the known variables V19, V20 and V21; and for all the newly identified variables. Note that the light curves of V15 and V23 are not phased

decimal place, and for the SX Phe variables we can determine periods to four significant figures.

With our new discoveries, and assuming the new RR Lyrae stars to be cluster members, the value of $\langle P_{ab} \rangle$ changes slightly with respect to Wehlau et al. (1977), from 0.555 d to 0.568 d, and $N_c/(N_c + N_{ab})$ changes from 0.26 to 0.30. In addition, one finds $\langle P_c \rangle$ = 0.319 d, $P_{ab}^{\rm min} = 0.49286$ d, and $P_c^{\rm max} = 0.341$ d. These results do not change NGC 1261's classification as an Oosterhoff type I cluster.

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PRECISE TIMES OF MINIMUM LIGHT OF NEGLECTED ECLIPSING BINARIES

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We present 102 times of minimum light for 60 mostly neglected eclipsing binaries, as a continuation of an ongoing program of monitoring eccentric orbit, apsidal motion and other type systems. This is the first publication in our goal to also release all of our previously unpublished minimums in our archives. As part of this project we are including times of minimum light from CCDs as well as from photoelectric photometers.

These stars were observed during several seasons and are presented for their long-term value as well as for planning new observations. All data were obtained at Appalachian State University's Dark Sky Observatory. The CCD observations include measurements made with the 32-inch DFM Engineering telescope and Photometrics CH250 CCD camera with a Tek 1024^2 chip and Bessell filter set. Other data were obtained with the 18-inch telescope with a Photometrics CH350 CCD camera and SITe 1024^2 chip and Bessell filter set. Some other data were obtained with an SBIG ST-9E CCD on the 16-inch DFM telescope. These are noted in the table as 32, 18, and 16, respectively. The filters are the Johnson equivalents in the Bessell set, with 'C' representing a clear or no filter.

The photoelectric times of minimum light were observed with the 18-inch telescope with a Kitt Peak National Observatory single-channel design employing a thermoelectrically cooled EMI 9865QB photomultiplier tube with matching UBVR filters. One eclipse's data (U Oph) was obtained on the 32-inch with an Optec SSP-3 PIN-diode photomultiplier with Johnson filters, and in fact was the first scientific data obtained with that telescope.

The CCD data in this publication were reduced using Mira AP software.[†] All of our times of minimum and their standard errors, including the photoelectric data and its errors, were calculated using the method of Kwee & van Woerden (1956), using an algorithm by Ghedini (1982).

We are grateful for references provided by Greg Shelton and Brenda Corbin at the U.S. Naval Observatory Library. Other references were obtained at the NASA Astrophysics Data System. This work also made use of the SIMBAD data base and the Space Telescope Science Institute's Digitized Sky Survey. We thank Joe Pollock and Stephen Davis for the development of PMIS macros used in automatic data acquisition, and Lee Hawkins for instrumentation support. We especially thank the other people who observed or reduced the data including Wanda Burns, Brain Walls, Jeff Deal, and Nathan Bergey.

[†]The Mira AP software is produced by Mirametrics Inc., formerly Axiom Research Inc.

Star	Type	Filters	HJD − 2400000	Error	Tel	Instr.
RT And	pri	V	47770.8088	0.0008	18	KPmt
	sec	V	48159.8005	0.0004	18	KPmt
	pri	V	48191.5596	0.0002	18	KPmt
RX Ari	pri	V	47855.7043	0.0004	18	KPmt
WW Aur	pri	V	47893.6516	0.0001	18	KPmt
	sec	V	48225.6955	0.0002	18	KPmt
AR Aur	sec	V	48699.5808	0.0004	18	KPmt
CL Aur	pri	V	53388.6336	0.0001	32	CCD
EO Aur	pri	V	53341.8412	0.0002	18	CCD
HL Aur	pri	V	50110.7977	0.0002	32	CCD
	sec	V	53017.5775	0.0001	32	CCD
YZ Aql	pri	V	51071.6657	0.0003	32	CCD
V1182 Aql	pri	V	53210.7055	0.0007	32	CCD
44i Boo	pri	V	48357.8176	0.0003	18	KPmt
BW Boo	sec	VBRI	52815.6886	0.0015	18	CCD
UW Boo	pri	V	50512.7317	0.0002	18	CCD
	pri	V	50518.7590	0.0002	18	CCD
	sec	VBRI	52757.7543	0.0009	32	CCD
	pri	V	53470.5926	0.0001	32	CCD
AW Cam	pri	V	47919.7904	0.0002	18	KPmt
	sec	V	47972.6246	0.0008	18	KPmt
	pri	V	47994.6094	0.0002	18	KPmt
CV CMa	pri	V	53442.6562	0.0007	32	CCD
	sec	V	53451.5749	0.0006	32	CCD
CC Cas	pri	V	53016.6817	0.0006	18	CCD
IT Cas	sec	V	52592.5766	0.0001	32	CCD
V527 Cas	pri	V	53344.5257	0.0002	32	CCD
GK Cep	pri	V	48521.6067	0.0005	18	KPmt
	sec	V	48526.7590	0.0003	18	KPmt
	pri	V	48902.6232	0.0003	18	KPmt
SS Cet	pri	V	51551.7012	0.0008	32	CCD
TV Cet	sec	V	50110.6454	0.0005	32	CCD
WW Cyg	pri	V	51024.6271	0.0000	32	CCD
DX Cyg	pri	V	50685.5730	0.0009	32	CCD
	pri	V	50726.6848	0.0002	32	CCD
	sec	V	52911.6830	0.0017	32	CCD
V463 Cyg	sec	V	53577.7470	0.0003	16	CCD
	pri	V	53578.8125	0.0002	16	CCD
V469 Cyg	pri	V	53594.5918	0.0004	32	CCD
V490 Cyg	sec	V	51491.5776	0.0004	32	CCD
	pri	V	51495.5994	0.0002	32	CCD
V498 Cyg	sec	V	53584.6639	0.0003	32	CCD
V512 Cyg	sec	V	53619.5818	0.0003	32	CCD
	pri	V	53625.6438	0.0001	32	CCD
V541 Cyg	pri	V	53578.7911	0.0001	16	CCD
V873 Cyg	pri	V	53598.7008	0.0002	32	CCD
V959 Cyg	pri	V	50664.7335	0.0004	32	CCD
V974 Cyg	sec	V	50584.7872	0.0010	32	CCD
	pri	V	50967.7694	0.0001	32	CCD
V1136 Cyg	pri	V	53594.7403	0.0002	32	CCD
	sec	V	53603.7318	0.0003	32	CCD
V1326 Cyg	sec	V	50661.6760	0.0010	32	CCD
	pri	V	53588.8343	0.0005	32	CCD
V1436 Cyg	pri	VBR	52845.7191	0.0004	32	CCD
	sec	VRI	52895.7110	0.0023	32	CCD

Star	Type	Filters	HJD − 2400000	Error	Tel	Instr.
Z Dra	pri	V	52708.5681	0.0000	32	CCD
	sec	VBR	52710.6064	0.0011	32	CCD
	pri	V	52769.6520	0.0001	32	CCD
	sec	VBRI	52771.6911	0.0011	32	CCD
	pri	VBRI	52773.7243	0.0001	32	CCD
	pri	VBRI	53502.6609	0.0001	18	CCD
RR Dra	pri	V	51043.6183	0.0000	32	CCD
BF Dra	pri	V	53341.5523	0.0001	32	CCD
CM Dra	pri	R	53478.6467	0.0001	32	CCD
DI Her	sec	V	52812.7354	0.0001	18	CCD
	pri	V	52899.5675	0.0001	32	CCD
VZ Hya	pri	V	47971.5876	0.0003	18	KPmt
	pri	V	52702.6936	0.0001	32	CCD
CM Lac	sec	V	48210.6531	0.0002	18	KPmt
	pri	V	48530.7850	0.0004	18	KPmt
MZ Lac	pri	V	50422.6427	0.0002	32	CCD
	sec	V	50686.6745	0.0008	32	CCD
	pri	V	50722.7286	0.0004	32	CCD
	pri	V	53025.5097	0.0002	32	CCD
V345 Lac	pri	V	50373.8088	0.0006	32	CCD
	pri	V	50403.7826	0.0009	32	CCD
	pri	V	51377.7229	0.0002	32	CCD
	pri	VB	51849.7155	0.0003	32	CCD
	pri	V	53572.8447	0.0002	32	CCD
V412 Lyr	pri	V	50666.7391	0.0001	32	CCD
	sec	V	50672.7933	0.0010	32	CCD
V431 Lyr	pri	V	53499.7379	0.0003	32	CCD
	sec	V	53576.7384	0.0006	32	CCD
	pri	VBRI	53587.6718	0.0004	32	CCD
RU Mon	pri	C	50138.6517	0.0002	32	CCD
TV Mon	pri	V	51489.8738	0.0001	32	CCD
U Oph*	pri	V	49862.7335	0.0001	32	SSP3
WZ Oph	sec	V	48004.7536	0.0002	18	KPmt
	sec	V	53476.7886	0.0001	32	CCD
V451 Oph	sec	V	53575.7235	0.0001	18	CCD
EW Ori	sec	V	50431.6804	0.0001	32	CCD
	pri	V	52973.8223	0.0001	32	CCD
DV Peg	pri	V	53604.6143	0.0002	32	CCD
IQ Per	pri	V	51937.6525	0.0006	18	CCD
KX Pup	pri	V	53077.5933	0.0006	32	CCD
ER Sct	sec	V	53224.7529	0.0001	16	CCD
AN Tau	pri	V	53344.7797	0.0001	32	CCD
DR Vul	sec	V	50376.7009	0.0002	32	CCD
FQ Vul	pri	VBR	53595.8065	0.0005	32	CCD
GP Vul	sec	V	50985.7005	0.0001	32	CCD
	pri	V	51061.5885	0.0001	32	CCD
MN Vul	pri	V	53492.7941	0.0012	32	CCD

* The comparison star used for U Oph is designated as variable star V2368 Oph. From our own measurments it seems likely that this star is not significantly variable. Also, this same comparison star was used by Jordi et al. (1996) and Wolf et al. (2002), without problems reported.

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ERRATUM FOR IBVS 5707

Time of minimum of RZ Com was given as 52849.4809, but it should be 53849.4809.

S. Serkan Doğru

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NEW TIMES OF MINIMA OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
30-cm Cassegrain–Schmidt telescope of the Çanakkale University Observatory

Detector:	ST237 camera, Peltier cooling, TC237 chip, $11' \times 8'$ FOV, 640×480 pixels, (ÇUG301); ST10XME camera, Peltier cooling, KAF 3200ME chip, $17' \times 12'$ FOV, 2184×1472 pixels, (ÇUG302)

Method of data reduction:
Reduction of the CCD frames was made with C-MUNIPACK software (Motl, 2004)

Method of minimum determination:
Kwee–van Woerden method (Kwee & van Woerden, 1956)

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
WZ And	53982.3315	0.0002	II	C	ÇUG301
	53987.5624	0.0002	I	C	ÇUG301
RT And	53983.3656	0.0003	I	C	ÇUG301
	54016.3838	0.0004	II	C	ÇUG301
	54055.3795	0.0002	II	C	ÇUG301
AB And	53981.2904	0.0001	I	C	ÇUG301
	54016.3037	0.0002	II	C	ÇUG301
LO And	53982.4468	0.0003	I	C	ÇUG301
	53987.3992	0.0001	I	C	ÇUG301
KO Aql	53985.2901	0.0003	I	C	ÇUG301
OO Aql	53995.3022	0.0001	I	C	ÇUG301
CX Aqr	53984.3647	0.0003	I	C	ÇUG301
IM Aur	53982.5077	0.0008	I	C	ÇUG301
CL Aur	54054.3794	0.0001	I	C	ÇUG301
SX Aur	54044.3888	0.0005	I	C	ÇUG301
AB Cas	53995.3590	0.0002	I	C	ÇUG301
BZ Cas	53998.3172	0.0002	I	C	ÇUG301
CW Cas	53998.3347	0.0002	I	C	ÇUG301
TV Cas	54013.4270	0.0005	I	C	ÇUG301
TW Cas	54013.4354	0.0005	I	C	ÇUG301

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
V523 Cas	53987.3632	0.0001	I	C	ÇUG301
	54055.4858	0.0002	II	C	ÇUG301
EG Cep	53657.29724	0.00006	I	BVR_c	ÇUG302
DK Cyg	54014.4274	0.0003	I	C	ÇUG301
KR Cyg	53984.3076	0.0003	I	C	ÇUG301
WZ Cyg	53985.3679	0.0001	I	C	ÇUG301
ZZ Cyg	53685.27620	0.00007	I	BVR_c	ÇUG302
	53985.4359	0.0005	II	C	ÇUG301
	54054.2720	0.0002	I	C	ÇUG301
V456 Cyg	54024.2818	0.0002	II	C	ÇUG301
V700 Cyg	54013.3378	0.0001	I	C	ÇUG301
TY Del	54014.3387	0.0002	I	C	ÇUG301
UX Eri	54054.5423	0.0004	II	C	ÇUG301
SW Lac	53993.4066	0.0001	I	C	ÇUG301
TW Lac	53981.5538	0.0002	I	C	ÇUG301
Y Leo	54057.4833	0.0002	I	C	ÇUG301
TZ Lyr	53998.4246	0.0005	II	C	ÇUG301
V839 Oph	53983.2994	0.0002	II	C	ÇUG301
ER Ori	54055.5439	0.0006	II	C	ÇUG301
U Peg	53685.3553	0.0001	II	BVR_c	ÇUG302
	53985.5537	0.0002	II	C	ÇUG301
	53991.3630	0.0003	I	C	ÇUG301
BB Peg	53991.4089	0.0008	II	C	ÇUG301
BO Peg	53991.3807	0.0011	I	C	ÇUG301
BX Peg	53985.4890	0.0010	II	C	ÇUG301
DI Peg	53991.3226	0.0003	II	C	ÇUG301
DK Peg	53991.4908	0.0010	I	C	ÇUG301
Z Per	53984.4171	0.0005	I	C	ÇUG301
RT Per	53983.4158	0.0002	I	C	ÇUG301
ST Per	53983.4459	0.0007	I	C	ÇUG301
V432 Per	53983.4548	0.0003	I	C	ÇUG301
UV Psc	53984.4866	0.0004	I	C	ÇUG301
RZ Tau	54058.3560	0.0002	II	C	ÇUG301
AH Tau	54057.4103	0.0002	II	C	ÇUG301
V781 Tau	54013.5775	0.0005	I	C	ÇUG301
V Tri	54055.2800	0.0002	I	C	ÇUG301
X Tri	53995.4322	0.0003	II	C	ÇUG301

Remarks:

We present 57 minima times of 47 eclipsing binaries. In the Remarks column of Times of Minima table, telescopes used in the observations are given.

Acknowledgements:

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REMARKABLE ABSORPTION STRENGTH VARIABILITY OF THE ε AURIGAE Hα LINE OUTSIDE ECLIPSE

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In April and May 2005 the Hα line of ε Aur was observed in an exceptional 'weak absorption phase'. In the period October 2005 to November 2006 the normal line profile was registered again, with a variable absorption and a weak red-shifted emission component. The time variations of the line profile and a comparison with former observations outside eclipse are presented.

ε Aur is a binary system, consisting of a yellow supergiant (F0Ia) and an enormous dusty gas disk, that eclipses every 27 years the primary component for approximately two years. From the eclipsing light curve it is concluded that within the dust disk one or two (B?) stars exist, which have so far never been observed directly (Stencel, 1985). The first contact of the next eclipse is expected in August 2009. Castelli (1978) lists the characteristic parameters of the primary component (F0Ia). The Hα line of ε Aur is reported in the literature to be variable, but the line always shows a strong photospheric absorption and mostly weak emission components on the edges of the absorption.

The observations cover the period from 1 April, 2005 to 15 November 15, 2006 (out of eclipse, phase ≈ 0.9). The used amateur equipment consists of a Maksutov Newton telescope (127 mm of aperture, f 1/8) and a slitless reflecting grating spectrograph (grating 25 mm $\times$ 25 mm, 1200 lines/mm, collimator $f = 135$ mm, camera objective $f = 135$ mm). The CCD camera (Audine, KAF 401E) is water-cooled. The chip temperature was, depending on the ambient temperature, between -10 and -30 °C. The dispersion is 41 Å/mm or 0.38 Å/pixel within the range of the Hα line. The resolution was measured from the FWHM of terrestrial lines to 0.8 Å ($R = 8,000$). The quality of the adjustment and the mechanical stability of the system limit the exposure times for a single exposure between 30 and 60 sec. For each sum spectrum, between 10 and 80 single photographs were taken. The data were reduced using ESO MIDAS and the OPA scripts of G. Gebhardt (www.spektros.de). The single photographs are corrected by the median of 10 darks and the background of the sky before extraction of the spectra and their registering. No flatfield correction is performed. The final S/N of the continuum is between 120 and 400 (Table 1). The slitless spectra were wavelength calibrated by using 3 to 6 photospheric absorption lines from the following list: Fe II: 6416.90 Å, 6430.84 Å, 6456.38 Å, 6516.05 Å, Si II: 6347.10 Å, 6371.36 Å as reference lines. The quality of EW measurements is demonstrated by comparison of the EW-integration results of this lines with the data given by Castelli (1978) and the integrations of a reference spectrum of ε Aur (20031101) given in ELODIE (Table 2).

Table 1: List of spectra and equivalent widths of components of ε Aur Hα line

Hα line measurements of ε Aur				Equivalent width [Å]		
Date	JD	Exposure time [min]	S/N	Blue wing	Central absorption	Red wing
April 1, 2005	2,453,462.42	5	140	−0.13	0.01	−0.15
April 11, 2005	2,453,472.40	10	170	−0.18	0.06	−0.17
April 21, 2005	2,453,482.40	10	150	−0.07	0.06	−0.15
May 10, 2005	2,453,501.40	10	120	−0.14	0.06	−0.24
May 11, 2005	2,453,502.40	10	270	−0.06	0.08	−0.15
October 30, 2005	2,453,674.48	30	300	0.00	0.66	0.00
December 10, 2005	2,453,715.50	18	280	0.00	1.07	−0.05
January 23, 2006	2,453,759.31	27	300	0.00	0.99	0.00
January 24, 2006	2,453,760.32	25	400	0.00	1.04	0.00
January 30, 2006	2,453,766.36	30	350	0.00	1.02	0.00
February 1, 2006	2,453,768.32	30	320	0.00	1.02	−0.04
March 12, 2006	2,453,807.33	42	270	0.00	0.78	−0.07
March 13, 2006	2,453,808.42	25	390	0.00	0.82	−0.04
April 7, 2006	2,453,833.42	15	160	−0.06	0.69	−0.04
April 19, 2006	2,453,844.34	15	160	0.00	0.60	−0.10
May 2, 2006	2,453,858.40	50	370	0.00	0.55	−0.12
September 10, 2006	2,453,988.48	30	200	0.00	0.70	0.00
September 21, 2006	2,454,000.53	27	190	0.00	0.66	0.00
October 7, 2006	2,454,016.42	60	360	0.00	0.54	−0.01
November 15, 2006	2,454,055.46	52	210	−0.02	0.49	−0.06

In Fig. 1 the observed spectra and the reference spectrum are plotted. Between 1 April (JD 2453462) and 11 May, 2005 (JD 2453502), the Hα line shows a nearly symmetrical shell spectrum with small variations of the V/R ratio of the emission components and an exceptionally small absorption component in the line core. On 30 October, 2005 (JD 2453674) the Hα line was detected in pure absorption. Until the end of the 2006 observing season, the line was observed in normal absorption, with an occasional variable red shifted emission component. Two types of line profiles can be distinguished: The 'weak absorption phase' from the beginning of the observations (1 April to 11 May, 2005), and the 'normal absorption phase' later. The emission components of the 'weak absorption phase' are symmetrically shifted towards the blue and red, respectively, by about 80 km/s relative to the absorption minimum. In the 'normal absorption phase' the red wing maximum is red-shifted by about 100 to 160 km/s. The equivalent widths of the blue wing, the red wing and the absorption core in the spectra were calculated ($F/Fc > 1$ emission, $F/Fc < 1$ absorption, Table 1). Fig. 2 shows these EW's as time series. The variability of the absorption component is the most dominant effect.

Because of the unusual eclipsing behaviour, which is caused by a dusty cloud every 27.08 years, the star has been observed intensively. The investigations focus on those approximately 2 years of the eclipsing events. Castelli (1977, 1978) also published two measurements out of eclipse (1971). The variable Hα lines consisted of a central absorption (F/Fc 0.45 and 0.55) and two weak emission components which are shifted relative to the core of the absorption by −72 km/s and +61 km/s, respectively. Radial outward flows are attributed to instabilities in the star producing the blue-shifted emission component. Gas from behind the star causes the red-shifted emission component. The last eclipse of 1982 to 1984 is summarized by Stencel (1985). The Hα line profiles of 1984 (Ferluga & Heck in Stencel, 1985) resemble the normal absorption phase, whereby partly also more intensive

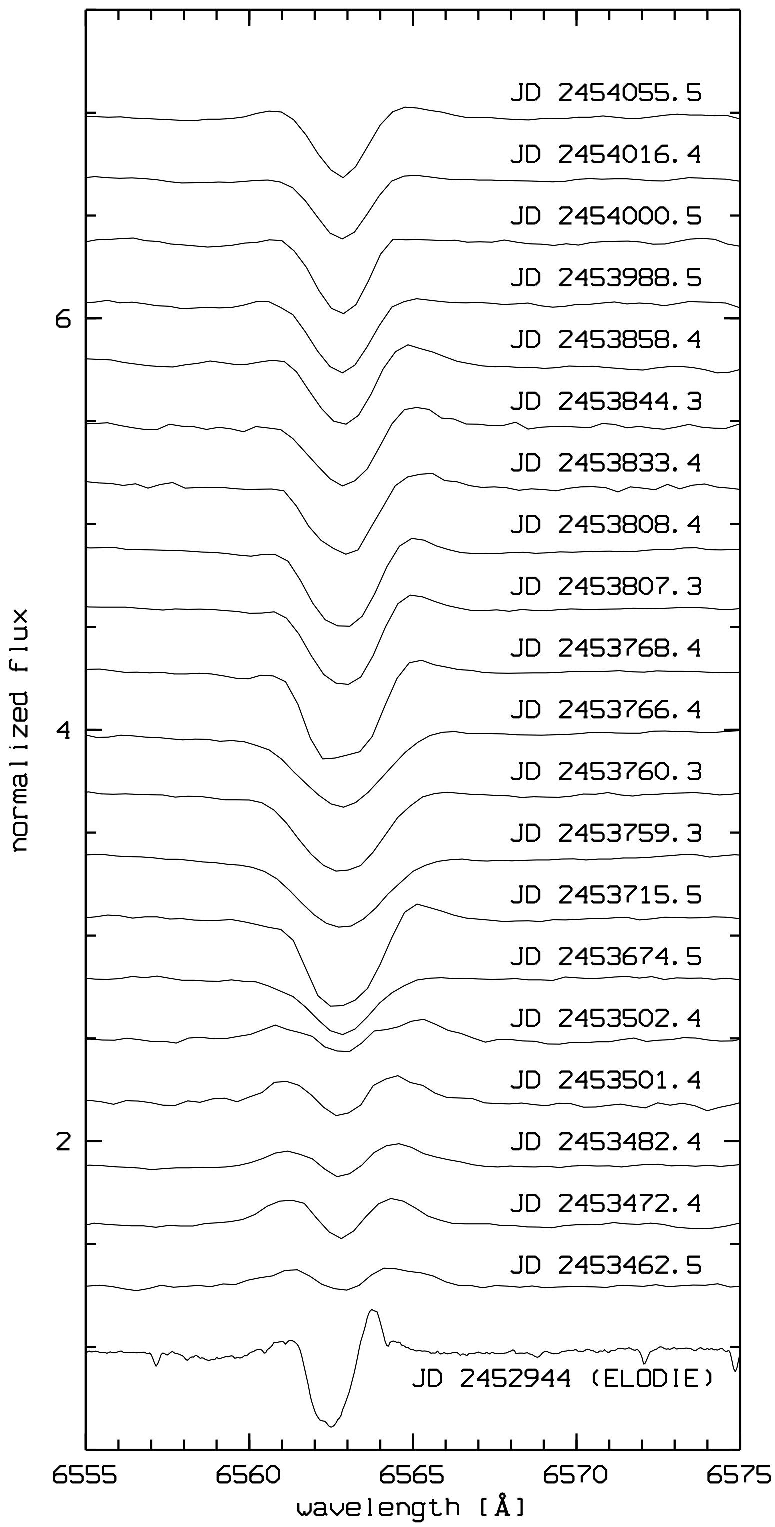

Figure 1. Hα line profiles of ε Aur (measurements April 2005–November 2006 and a reference spectrum ELODIE of November 2003

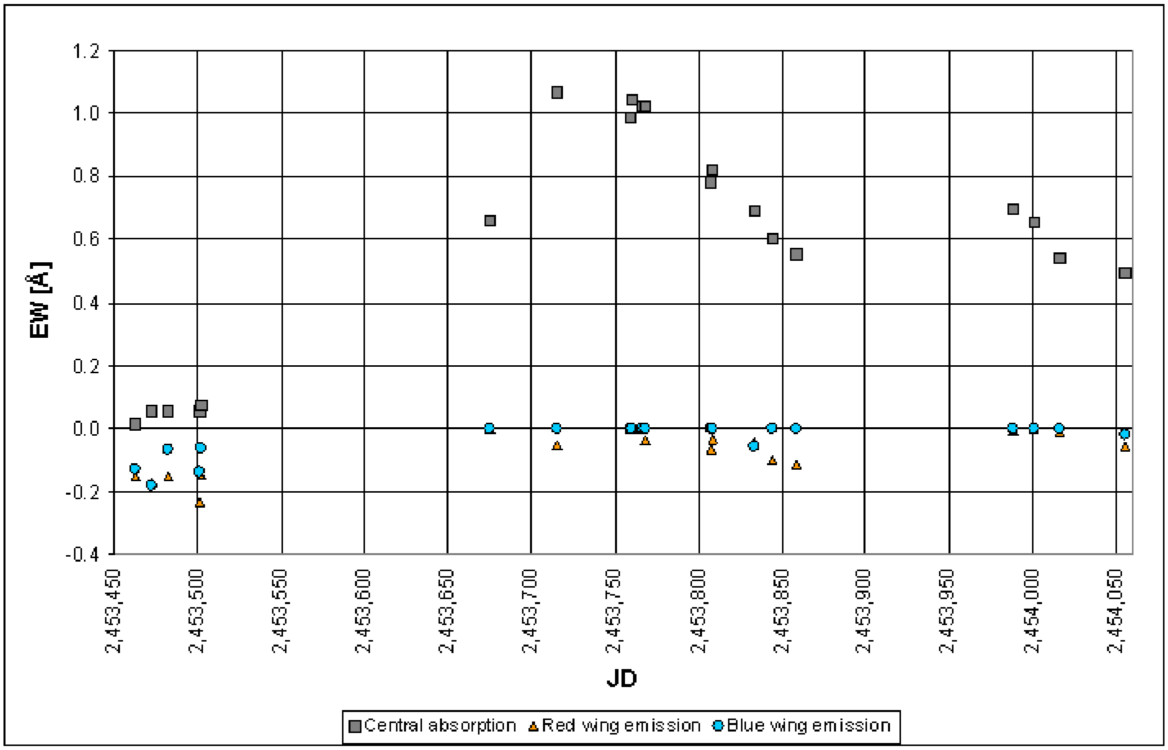

Figure 2. Equivalent widths of ε Aur Hα line components outside eclipse April 2005–November 2006

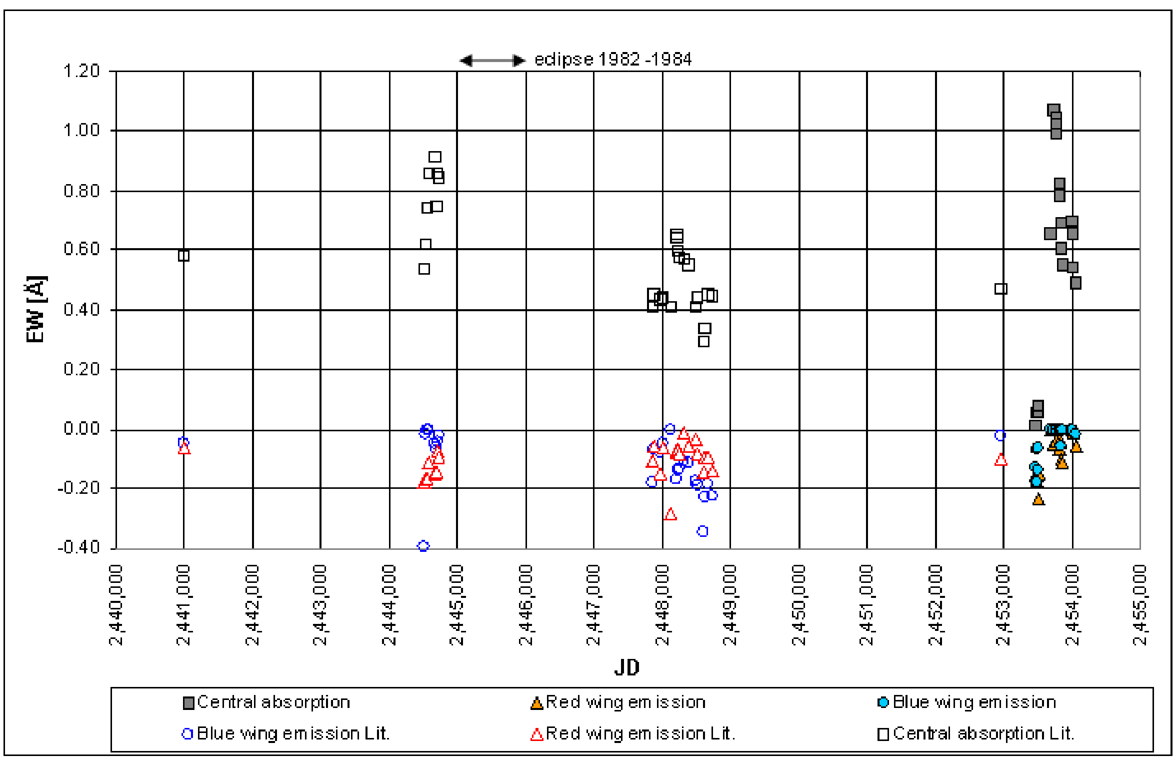

Figure 3. Equivalent widths of ε Aur Hα line components outside eclipse, including data of Castelli (1978), Ferro (1985), Cha et al. (1995) and ELODIE (20031101)

Table 2: Comparison of EW differences of measured spectra and reference spectra of ε Aur

Line	Ion	Reference spectra [Å] Castelli	ELODIE	Measurements [Å] Average	Std. dev.	No. of meas.	Differences [Å] Castelli	ELODIE
6347	SiII	0.694	0.627	0.596	0.027	5	−0.098	−0.031
6371	SiII	0.531	0.538	0.529	0.024	7	−0.002	−0.009
6416	FeII	0.245	0.191	0.190	0.030	14	−0.055	−0.001
6432	FeII	0.178	0.158	0.170	0.027	17	−0.008	0.012
6456	FeII	0.539	0.533	0.513	0.034	17	−0.026	−0.020
6613	?	–	0.120	0.120	0.012	13	–	0.000

blue wings were registered. However, one year earlier the spectra showed the absorption with stable red wings and variable blue wings (Boehm & Ferluga, 1983). 15 spectra, measured between September 1980 and May 1981 by Ferro (1985), just one year before the eclipse of 1982 to 1984, showed a 'normal absorption phase' similar to Fig. 1 with stable red wing and variable blue wing. Hα line profiles measured by Cha et al. (1994) in November 1989 until April 1992 also resemble the profiles of the normal absorption phase in Fig. 1. The radial velocities of the absorption centers vary between +0.4 and −39.1 km/s, the emission components vary parallel to it around −60 and +60 km/s, respectively. The equivalent widths of the absorption move between 296 and 650 mÅ, the emission components between 0 and 343 mÅ (blue wing) and 0 and 295 mÅ (red wing). Additional measurements of Cha et al. (1995) in the year 1993 show absorption with a clear blue emission wing (EW approx. 200 to 300 mÅ), but only a weak red wing. The absorption line has an EW of approx. 550 mÅ in this period. The authors discuss their observations using a model, which explains the emissions with a rotating inhomogenous gas ring around the primary F0Ia component. UV-spectroscopy with the HST taken on 16 February, 1996 are described by Sheffer & Lambert (1999). The split resonance lines are attributed to a gas disk rotating in the orbit around the invisible secondary component. The rotation speed of the disk was determined from the distance of the emission maxima to 103 km/s. The origin of the emissions from a gas disk around the secondary component is not confirmed, however.

Published spectra could be digitized (Castelli: spectrum February 1971; Ferro: spectra 1980-1981)). The calculated component equivalent widths of the published spectra, of the ELODIE reference spectrum (2003) and the results of Cha et al. (1994, Table 2) are shown in Fig. 3 together with the equivalent widths of Table 1. The time series demonstrate the exceptionally small central absorption in spring 2005. The star shows a remarkable variability in absorption strength of the core of the Hα line outside eclipse, also in former observations.

It remains to conclude:

- Hα line in predominant emission and vanishing core absorption - like in spring 2005 is an exceptional phenomenon of ε Aur.
- The absorption components EW of the Hα line show a remarkable variability outside eclipse.

The line profile variations in the optical spectrum outside of the eclipsing phase, e.g. the presented observation of an exceptionally weak absorption phase in Hα, are still not satisfactorily explained. The interpretation of the Hα line in eclipse has to take the out-of-eclipse variations into account. Further observations, also far from eclipse, are needed.

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DETECTION OF A LARGE FLARE IN FR Cnc (=1RXS J083230.9+154940)

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FR Cnc (= BD+16°1753 = MCC 527 = 1ES 0829+15.9 = 1RXS J083230.9+154940 = HIP 41889 = GSC 01392-02634 = TYC 1392-2634-1) ($\alpha_{2000} = 08^{h}32^{m}30\overset{s}{.}5287$ and $\delta_{2000} = +15^\circ 49' 26\overset{''}{.}193$) was first mentioned as a probable active star when it was identified as the optical counterpart of a soft X-ray source 1ES 0829+15.9 in the Einstein Slew Survey. It has $V = 10\overset{m}{.}43$, spectral type K8V, the X-ray flux is of $\approx 10^{-11}$ erg $\cdot$ s^{-1} $\cdot$ cm^{-2} (Elvis et al., 1992; Schachter et al., 1996).

It was classified as BY Dra type star (i.e. its variability is caused by rotational modulation of starspots) and given the name FR Cnc by Kazarovets et al. (1999). The presence of Ca II H, K and H_α emission lines in the spectra indicates high chromospheric activity in FR Cnc (Pandey et al., 2002; Pandey, 2003). The other details concerning history of investigation of this object can be found in Pandey et al. (2005)

Flares in FR Cnc were not previously reported.

FR Cnc was observed on 23 November, 2006 quasi-simultaneously in B, V, R_j, I_j bands at Crimean Astrophysical Observatory (Ukraine) by Alex Golovin, using 38-cm Cassegrain telescope, which is equipped with SBIG ST-9 CCD camera, cooled by a Peltier system to about −30 °C. The exposure times were 20 s, 13 s, 8 s and 17 s for B, V, R_j, I_j bands respectively. Data reduction was done using "Maxim DL" package. Reduction included bias, dark-frame subtraction and flat field correction using twilight sky exposures. Since the field of FR Cnc is not crowded, the technique of aperture photometry was applied to extract the differential magnitudes. The total number of useful frames was 89 for each band. The brightness of FR Cnc was measured with respect to GSC 1392-2636 ($\alpha_{2000} = 08^{h}32^{m}23\overset{s}{.}698; \delta_{2000} = +15^\circ 46' 50\overset{''}{.}15$), while GSC 01392-02708 ($\alpha_{2000} = 08^{h}32^{m}38\overset{s}{.}2271; \delta_{2000} = +15^\circ 44' 22\overset{''}{.}095$) served as a check star. Since the magnitudes of the comparison star in all bands are not known, here we present just differential magnitudes.

The data points have a statistical accuracy of $0\overset{m}{.}01$ or better (determined from the difference *check star− comparison star*). To rule out the possibility of observing brightness variations caused by the comparison star, an independent photometry of GSC 1392-2636 (comp. star) was performed with respect to the check star (GSC 01392-02708).

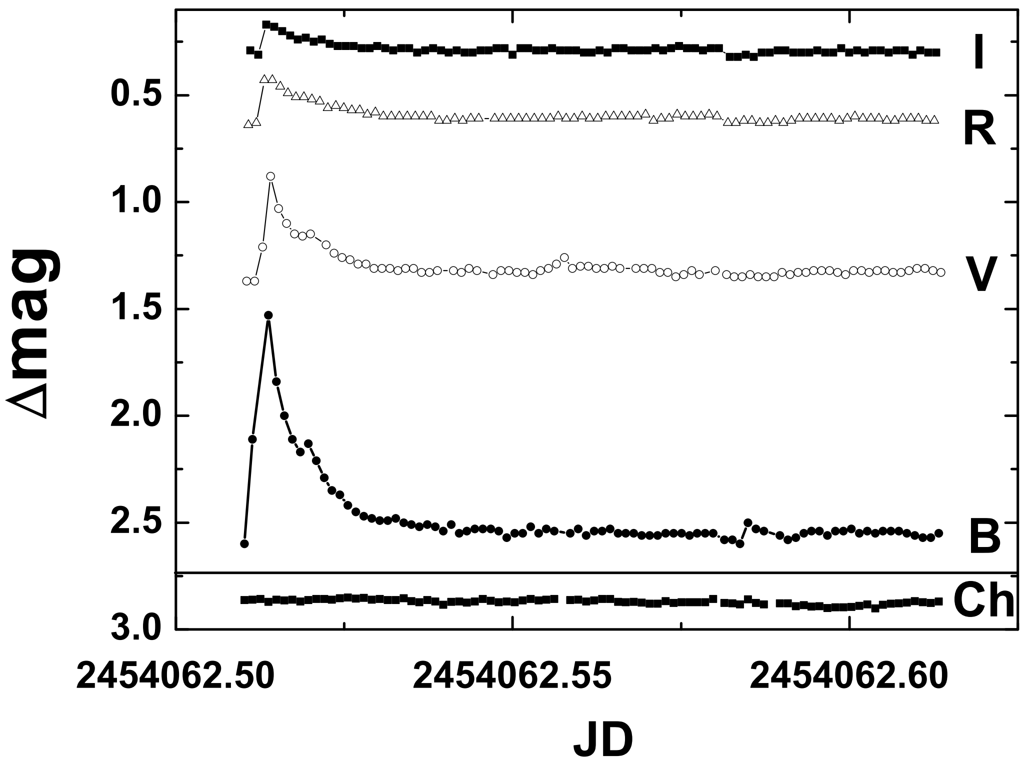

Figure 1. The flare of FR Cnc: shifted differential lightcurves in B, V, R and I bands as well as the difference *check star* – *comparison star* ('Ch' on the plot)

The flare of FR Cnc was detected on 23 November, 2006 with the maximum at 00:19 (UT). After the initial rapid flaring, the brightness of FR Cnc decreased slowly. The time between the flare began and reached its maximum was about 4 minutes, while the total duration of the flare was about 41 minutes.

The flare had a maximum amplitude ($1\overset{m}{.}02$) in the B band. In other bands the amplitudes were $0\overset{m}{.}49$, $0\overset{m}{.}21$ and $0\overset{m}{.}14$ for V, R_j and I_j bands respectively.

Noteworthy, in 8 minutes after the flare's maximum a notable "spike" was observed in B and V bands (in other bands the amplitude was probably too low) during the brightness decline. Remarkable, that FR Cnc remained to be about $0\overset{m}{.}05$ brighter for at least an hour after the flare began comparing with brightness before flare.

Following the idea, described at Kozhevnikova et al. (2006), we calculated the intensity of the flare and the *absolute* energy output. The relative intensity of the flare was determined via the following relation: $\frac{I_f}{I_0} = (\frac{I_0+I_f}{I_0}) - 1$, where $I_0 + I_f$ is the intensity of the object, integrated over the duration of the flare, I_0 is the intensity of the star in quiescent level in one of the bands (corrected to the flare duration). For calculation of the *absolute* energy output, we assume for FR Cnc's quiescent level the following magnitude and colour indices: $V = 10.43, B - V = 1.35, V - R = 1.15, V - I = 1.93$. We used 30.24 ± 2.03 mas parallax (Perryman et al., 1997) that imply distance 33 ± 2 pc.

Similar calculations of the flare intensity and energy output were also done by Moffett (1973) and by Panov et al. (2000).

So, we get the values listed in Table 1. Fig. 1 shows differential lightcurves in B, V, R_j and I_j bands of FR Cnc during our observations on 23 November, 2006.

However, the observed rotational period (0.8267 ± 0.0004 from Pandey et al., 2005) is

Table 1. Flare properties

Band	Amplitude [mag]	Flare flux/quiescent flux [%]	Flare energy [erg / Å]
B	1.02	38.63	1.73×10^{31}
V	0.49	14.05	1.14×10^{31}
R	0.21	8.25	0.89×10^{31}
I	0.14	2.9	0.29×10^{31}

unusually short for such type of stars, which implies that this star should manifest strong flaring activity (see Dorren et al., 1994). We detected a flare of FR Cnc for the first time. Further monitoring of this object is highly desirable.

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BVRI PHOTOMETRY OF VW Vul AND NEW COMPARISON STARS

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The dwarf nova VW Vulpeculae is classified as Z Cam (UGZ) in the GCVS (Kholopov et al., 1985–1990), with B magnitudes ranging from 13.1 to 16.27. Shafter (1985) published a spectroscopic study and reported a period of 0.0731 day. However, Thorstensen et al. (1998) computed an orbital period of 0.1687 day from the measurement of Hα radial velocities in quiescence. Only a few photometric data are available for this source. Wenzel (1985) found a 19 ± 5 days cycle length on 40 years of archival plates. Bruch & Engel (1994) report $B - V = 0.12$ during the outburst, and $B - V = 0.35$ in quiescence. More recently, Kato (1999) gives the light curve of VW Vul during the 1995 standstill.

With the aim to increase the multi-band photometric database of VW Vul, we observed this source at the Porziano Astronomical Observatory during the summers of 2004 and 2005. The photometric system consists of an 0.35-m Schmidt–Cassegrain telescope, equipped with an HiSIS 23 CCD camera (Kodak Kaf 401E of 762×512 pixels) and B, V, R_c, I_c Johnson–Cousins broad-band filters. The exposure time was 120–300 s depending on the brightness of the object. The frames were first corrected for bias and flat-field, and then processed by a PC-based aperture photometry package developed by one of the authors using DAOPHOT routines (Stetson, 1987).

Few other observations were obtained with the AIT at the Perugia University Observatory (see Spogli et al., 1998 for a description of instruments and data-reduction). There is no evaluable difference between the reduced data obtained with the two different telescopes.

All the data of VW Vul here reported were obtained in differential photometry using the calibration stars given by Misselt (1996) with the numbers M2, M3, M6, M7. Moreover, we calibrated these comparison stars with the I_c filter by observing, on different photometric nights, several standard stars (Landolt, 1992) having $B-V$ from -0.2 to 1.4, over a wide range of airmass. The weighted averages are: $I_c(\text{M2}) = 12.33 \pm 0.05$, $I_c(\text{M3}) = 13.61 \pm 0.05$, $I_c(\text{M6}) = 13.82 \pm 0.05$, $I_c(\text{M7}) = 12.01 \pm 0.05$. All these stars are placed in the East direction of VW Vul, so we included more comparison objects to the sequence. Figure 1 shows the finding chart for the new reference stars that we have found near VW Vul, numbered from C1 to C6. Table 1 gives the V, R_c, I_c data of these new reference stars. The first column gives the number (see Fig. 1), the second and the third columns are the J2000.0 coordinates of the objects, the last column is the number of different nights each new reference star has been calibrated to give the average values reported in columns 4–6.

Table 1: New comparison stars of VW Vul

No.	J2000.0 coord. α	δ	V [mag]	R_c [mag]	I_c [mag]	Obs. nights
C1	$20^h57^m32\overset{s}{.}82$	$+25°30'20\overset{''}{.}3$	14.26 ± 0.02	13.86 ± 0.02	13.44 ± 0.03	17
C2	$20^h57^m28\overset{s}{.}48$	$+25°33'27\overset{''}{.}8$	15.17 ± 0.05	14.59 ± 0.02	14.03 ± 0.04	16
C3	$20^h57^m18\overset{s}{.}30$	$+25°29'49\overset{''}{.}0$	15.39 ± 0.03	14.92 ± 0.01	14.44 ± 0.03	10
C4	$20^h57^m20\overset{s}{.}95$	$+25°28'52\overset{''}{.}5$	13.53 ± 0.03	12.49 ± 0.02	11.58 ± 0.03	14
C5	$20^h57^m14\overset{s}{.}35$	$+25°29'36\overset{''}{.}3$	16.02 ± 0.05	15.64 ± 0.02	15.27 ± 0.03	5
C6	$20^h57^m21\overset{s}{.}35$	$+25°26'34\overset{''}{.}6$	15.41 ± 0.04	14.90 ± 0.03	14.41 ± 0.03	9

Table 2: Photometric data of VW Vulpeculae

UT Date	JD (2453000+)	B	V	R_c	I_c
25/06/2004	181.526	15.19 ± 0.08	14.77 ± 0.02	14.49 ± 0.02	14.33 ± 0.03
26/06/2004	182.556	15.08 ± 0.08	14.72 ± 0.04	14.48 ± 0.03	14.24 ± 0.03
27/06/2004	184.421	14.79 ± 0.08	14.50 ± 0.02	14.28 ± 0.02	14.10 ± 0.03
28/06/2004	185.413	14.64 ± 0.09	14.28 ± 0.03	14.11 ± 0.02	13.90 ± 0.03
01/07/2004	188.485	14.34 ± 0.07	13.99 ± 0.03	13.85 ± 0.03	13.59 ± 0.04
02/07/2004	189.457	14.56 ± 0.07	14.25 ± 0.05	14.05 ± 0.03	13.81 ± 0.04
05/07/2004	192.411	15.11 ± 0.08	14.76 ± 0.03	14.48 ± 0.02	14.27 ± 0.04
06/07/2004	193.417		14.84 ± 0.03	14.54 ± 0.04	14.24 ± 0.05
07/07/2004	194.437		14.97 ± 0.03	14.70 ± 0.04	14.37 ± 0.04
09/07/2004	196.475		15.19 ± 0.04	14.85 ± 0.02	14.50 ± 0.03
10/07/2004	197.473	15.38 ± 0.08	14.96 ± 0.02	14.64 ± 0.02	14.38 ± 0.03
13/07/2004	200.437		15.30 ± 0.10	14.98 ± 0.04	14.55 ± 0.04
15/07/2004	202.406	15.28 ± 0.10	14.79 ± 0.02	14.52 ± 0.02	14.18 ± 0.02
17/07/2004	204.471	13.93 ± 0.07	13.71 ± 0.02	13.57 ± 0.02	13.44 ± 0.02
21/07/2004	208.426	14.88 ± 0.08	14.53 ± 0.02	14.30 ± 0.02	14.08 ± 0.02
23/07/2004	210.443	14.68 ± 0.08	14.47 ± 0.05	14.34 ± 0.05	13.99 ± 0.04
14/08/2005	596.525		15.77 ± 0.03	15.39 ± 0.03	15.02 ± 0.04
15/08/2005	597.534	15.77 ± 0.10	15.40 ± 0.04	15.01 ± 0.04	14.61 ± 0.04
16/08/2005	599.441	15.63 ± 0.10	15.15 ± 0.02	14.86 ± 0.02	14.64 ± 0.03
09/09/2005	623.420	15.84 ± 0.05	15.32 ± 0.02	15.03 ± 0.03	14.66 ± 0.03
10/09/2005	624.428	15.65 ± 0.05	15.22 ± 0.03	15.06 ± 0.02	14.71 ± 0.04
23/09/2005	637.415		15.36 ± 0.05	15.06 ± 0.05	14.75 ± 0.04
26/09/2005	640.398		14.61 ± 0.05		14.24 ± 0.04
29/10/2005	673.379		15.17 ± 0.03	14.92 ± 0.02	14.57 ± 0.05
19/11/2005	694.261	14.68 ± 0.07	14.34 ± 0.02	14.16 ± 0.03	13.97 ± 0.03
10/11/2005	695.230	14.95 ± 0.05	14.57 ± 0.02	14.30 ± 0.02	14.10 ± 0.04

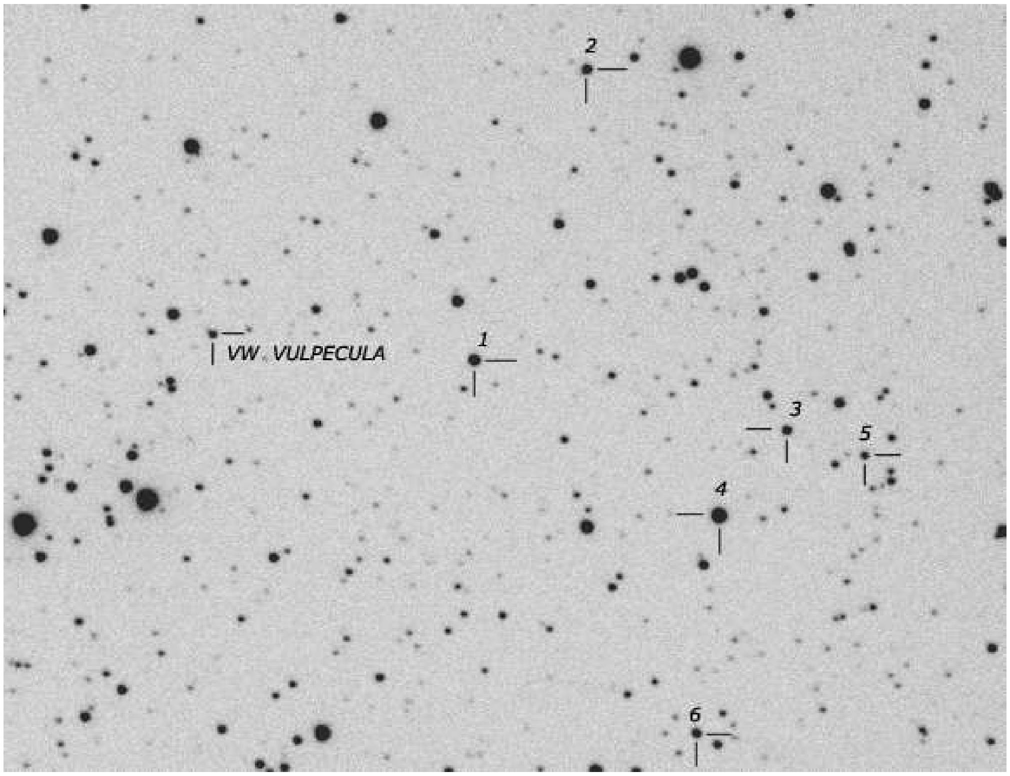

Figure 1. New comparison stars to be added to the Misselt (1996) sequence. North is up and East to the left. The frame is $11' \times 8'$

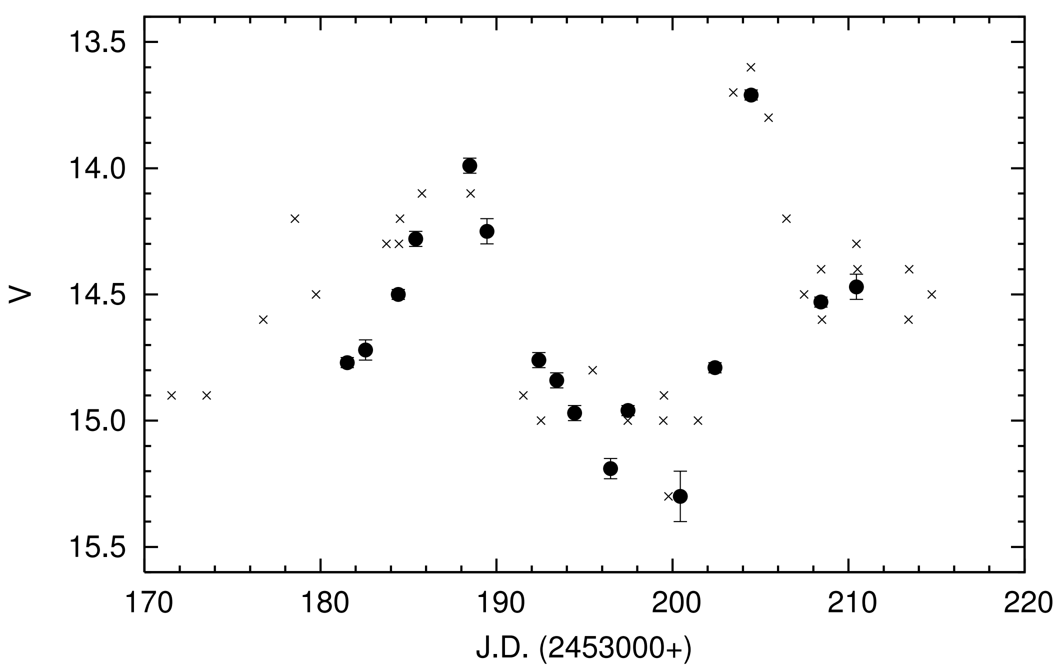

Figure 2. V light curve of VW Vul in summer 2004. Filled circles are our data, while small crosses are visual estimates available from AFOEV (`cdsweb.u-strsbg.fr/afoev`). The variable was observed during the rise to a low-amplitude outburst, the successive decline and the following fast burst. Error bars show the standard deviations

All the stars have been observed for a minimum of 15 months to a maximum of 19 months, so they can be considered stable.

In 2004, VW Vul has been monitored from June 25 to July 23, for a total of 16 nights (see Figure 2). More observations have been collected in 2005, from August 14 to November 10, so the overall database consists of 26 nights for a total of 95 photometric measurements (Table 2). From these data we can see that VW Vul varies between $V = 13.71 \pm 0.02$ and 15.77 ± 0.03.

We know that the UV emission of VW Vul during quiescence is dominated by the accretion disk, plus the white dwarf contribution (Henry & Sion, 2001; Urban & Sion, 2006). The strong emission of the disk is evident also in the optical B band, with a relatively low difference in the average $B-V$ color-index: it varies between $0\overset{m}{.}30$ during the outburst and $0\overset{m}{.}45$ in quiescence. On the other side, in the infrared part of the spectrum, the emission is usually dominated by the late-type secondary star. The average value of $V - I_c$ varies between $0\overset{m}{.}39$ and $0\overset{m}{.}65$, but the complete variation goes from $V - I_c = 0\overset{m}{.}27$ to $0\overset{m}{.}79$.

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A NEW LONG-PERIOD U Gem VARIABLE IDENTIFIED WITH THE X-RAY SOURCE 1RXS J224342.3+305526

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During a programme of optical identification of X-ray sources the uncatalogued variable, NSVS 8915780 at $22^{h}43^{m}40\overset{s}{.}7$ $+30°55'22''$ in the ROTSE1 database (Woźniak et al., 2004), has been found to be coincident the X-ray source 1RXS J224342.3+305526 from the ROSAT all-sky survey faint source catalogue (Voges et al., 1999). The separation between the two sources is $22''$, which is consistent with the uncertainty of $19''$ in the position of the X-ray source. The star is also identified as GSC 02736-01067 and is catalogued by 2MASS at $22^{h}43^{m}40\overset{s}{.}71$ $+30°55'20\overset{''}{.}1$ (2000).

The ROTSE1 light curve is shown in Figure 1 and is available from the Northern Sky Variability Survey (NSVS) website (see reference Woźniak et al., 2004). The data show a cyclical variation between $R \sim 16.0$ and 13.5, with a period ~ 16 days. However, the data are better fitted by a period of twice this value, with alternate maxima having slightly different magnitudes. The large amplitude and short time scale, and the possible association with a X-ray source suggest that this is a U Gem type cataclysmic variable (CV). The 2MASS colours of $J - H = 0.09 \pm 0.02$ and $H - K = 0.06 \pm 0.02$ (Cutri et al., 2003) suggest a star with a spectral type of mid-to-late A. While in general the IR colours of CVs tend to match later-type main sequence stars, these colours are consistent with the bluest CVs seen in the 2MASS data (Hoard et al., 2002). The optical colours from the USNO-B1.0 (Monet et al., 2003) of $b - r \sim 0.6$ although approximate, are consistent with this. Although these are not particularly blue they are again consistent with those of CVs. The pattern of variability is similar to that seen in several well-observed U Gem stars, e.g., AH Her, RX And, HL CMa, SY Cnc, CN Ori and Z Cam. All vary in a relatively periodic way on time scales of ~ 20 days with amplitudes of 2–3 magnitudes. All of these are UGZ stars, possibly indicating that the new variable also belongs to this class.

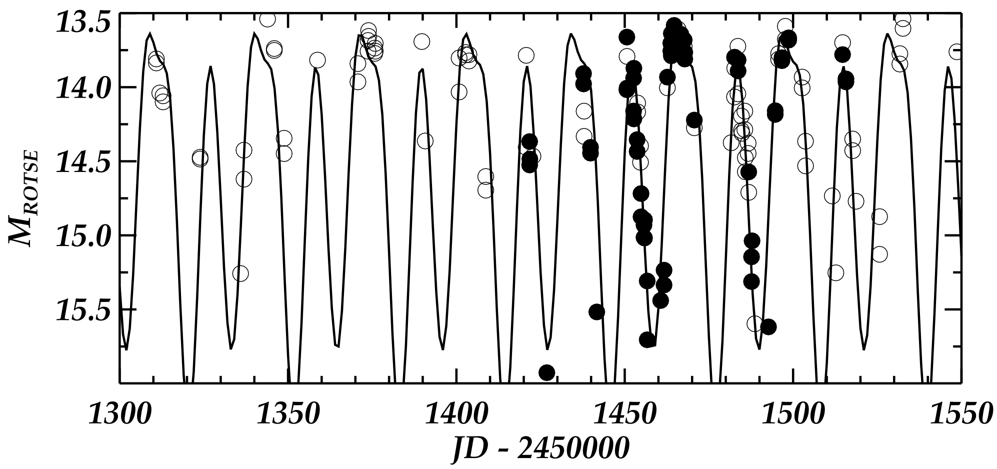

Figure 1. All the ROTSE1 data showing the 16 day outburst cycle with the 32 day period fitted. Flagged (suspect) data, open circles; unflagged data, filled circles

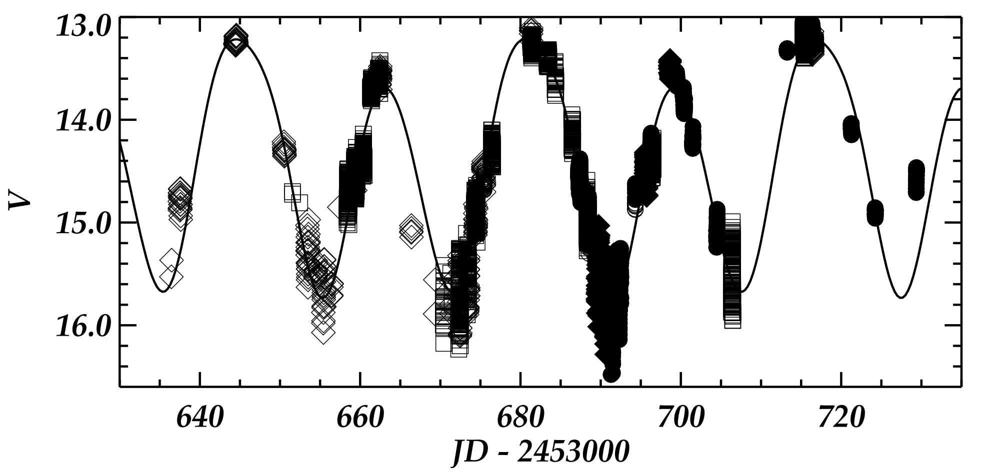

Figure 2. The recent data with different observers shown as different symbols. Small offsets have been applied to each data set as part of the fitting process

The X-ray source was observed by the ROSAT PSPC with a count rate of 0.0195 ± 0.00771 cts/s so assuming optical magnitudes $V = 16$ and $V = 13$ this leads to $F_{\rm X}/F_{\rm opt} = -0.9$ and -2.1 respectively. Despite this uncertainty the $F_{\rm X}/F_{\rm opt}$ ratio is consistent with the less X-ray bright grouping of CVs. The hardness ratios are poorly defined with $\mathrm{HR1} = 0.55 \pm 0.40$ and $\mathrm{HR2} = 0.78 \pm 0.46$ and these are consistent with both of the main groupings of CVs in the hardness ratio plane (see Motch et al., 1998).

Further optical observations have been made between September and December 2005 by Bernhard, using a 20-cm SCT with a Starlight Xpress SX CCD-camera unfiltered

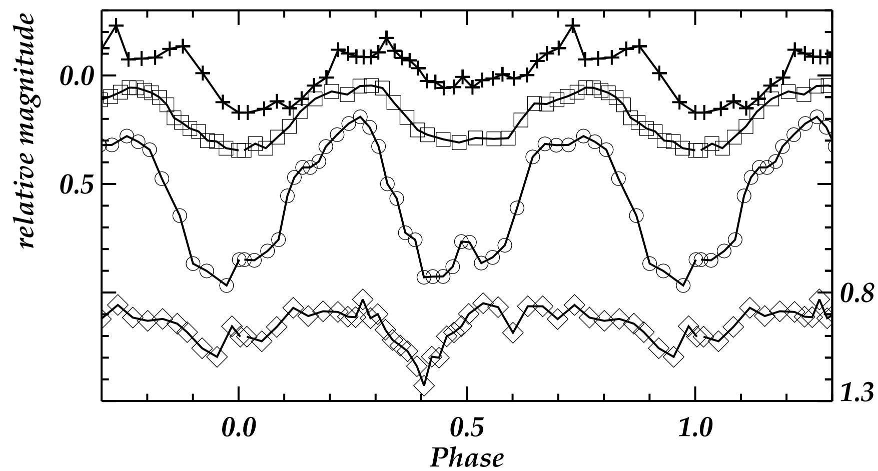

Figure 3. The phase diagram showing the averaged C and V data when the system is bright (top; expanded by a factor of 4), in mid range, and at the minimum of the outburst cycle. The bottom plot show the orbital variation of $V - I$ at the minimum of the outburst cycle.

(C[lear]) and in B, V and R; Boyd, using a 35-cm SCT with a Starlight Xpress SXV-H9 CCD-camera in C, V and I; Pietz using a 28-cm SCT with an ST-6B CCD camera unfiltered and Jones using a 28-cm SCT with an ST-7 CCD camera and V filter. All these observations are shown in Figure 2. The filtered observations have been reduced using a calibration provided by Henden (private communication) while the C observations have either been reduced as V or in the natural system.

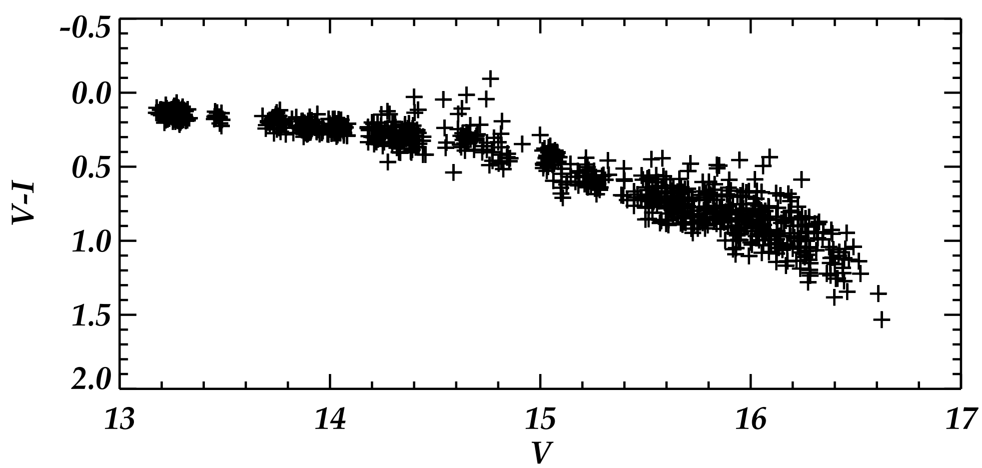

Figure 4. The $V - I$ data showing the change with V

The new observations mirror the ROTSE1 data with a slightly longer cycle at 18 days again with alternately bright and faint maxima. The minimum magnitude is relatively constant from cycle to cycle. The variation is very sinusoidal (e.g., AH Her, RX And) and not triangular (SY Cnc) or saw toothed (Z Cam). On a seasonal time scale the variation also seems to be remarkably repeatable, both within the ROTSE1 and recent data.

The nightly runs of observations have been subjected to a wavelet analysis and the results have been used to construct scalegrams that are widely used to examine flickering in CVs (see Fritz & Bruch, 1998). The scalegrams show the behaviour typical of flickering which is usually taken as direct evidence of accretion processes. By itself this confirms the variable as a CV and strengthens the identification with the X-ray source.

The new observations also reveal a sinusoidal variation with a period of about 5 hours that is consistent with an orbital hump. While this type of variation is seen in many CVs the amplitude seen here is particularly large, reaching as much as $0\overset{m}{.}6$ at minimum of the outburst cycle and reducing to $< 0\overset{m}{.}04$ at maximum. The range of variation is entirely consistent with the orbital variation being diluted as the system brightens. However, differences between alternate cycles suggest that the system shows a double orbit hump with the ephemeris of

$$\mathrm{HJD_{MinI}} = 2453679.90(1) + 0\overset{d}{.}42234(3) \times E$$

for the data in the middle of the range. The light curve (Figure 3) appears to migrate to later phases as the system brightens, in particular the primary minimum and the following maximum. The secondary minimum appears to be relatively stable in phase but flattened, possibly suggesting a partial eclipse. The orbital variation in $V-I$ at minimum brightness (also shown in Figure 3) shows a dramatic increase near secondary minimum, presumably when the cool star dominates the light curve.

Multi-colour photometry reveals a dramatic increase in temperature as the object brightens with $V-I \sim 1.0$ at minimum and $B-V \sim 0.05$, $V-R \sim 0.06$ and $V-I \sim 0.1$ at maximum (Figure 4).

The system probably contains a relatively massive cool star which dominates at the minimum of the outburst cycle, and the large orbital variation suggests that the system is seen at high inclination. The shape of the secondary minimum possibly hints at a grazing eclipse of the accretion disc by the cool star. The changing shape of the light curve can probably be explained by changes in the brightness and distribution of emission from the accretion disc and hot spot as the outburst progresses.

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SPECTROSCOPY OF THE FAINT OLD NOVAE V Per AND V500 Aql

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Results of time-resolved spectroscopy of the faint old novae V Per and V500 Aql are reported for the first time. The observations were performed using the Low Resolution Spectrograph (LRS) at the 9.2-m Hobby-Eberly Telescope (HET) and the FORS1 instrument at the ESO Very Large Telescope (VLT) Unit No. 1. Table 1 lists the observing log for each object. All spectra were reduced with IRAF† standard tools. Radial velocities were measured applying the double-Gaussian convolution method (see e.g. Shafter et al., 1986). The corresponding code was written using the yorick language.

Table 1: Journal of observations. UT times refer to the start of the first and last exposure, respectively

Object	Date	First exp. (UT)	Last exp. (UT)	Indiv. exp. time (s)	No. exp.	Res. (Å/pix)	Tel.
V Per	2001 Oct. 14	04:21:34	05:48:42	500	8	2	HET
	2001 Oct. 14	09:13:47	10:01:15	500	5	2	HET
	2001 Nov. 25	06:30:38	07:38:39	500	8	2	HET
V500 Aql	1999 June 11	06:47:12	10:24:54	420/720	20	1.2	VLT

V Per (Nova Persei 1887) is a faint ($V \approx 18$) eclipsing ($\Delta V \approx 1.3$) classical nova. The orbital period of the system is 2.571 hr, thus placing it near the middle of the period gap of cataclysmic variables (Shafter & Abbott, 1989). In their recent eclipse analysis Shafter & Misselt (2006) investigated the structure of the accretion disk and estimated the masses of the components to be most likely $M_1 = 0.85\ M_\odot$ and $M_2 = 0.17\ M_\odot$. The only spectrum of the postnova known so far is that published by Shafter & Abbott (1989). The exposure time was around 1 hr thus covering nearly half an orbital cycle. Besides the Balmer emissions (H_α, H_β, H_γ) the spectrum shows the high excitation lines He II λ4686 and λ5411 which are characteristic for old novae. Moreover, the fact that He II λ4686 is stronger than H_β led the authors to suggest that V Per might be a magnetic system. But the object was not detected as an X-ray source in the ROSAT All Sky Survey (Verbunt et al., 1997) and shows no circular polarization (Stockman et al., 1992) which would have strengthened this interpretation.

†IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

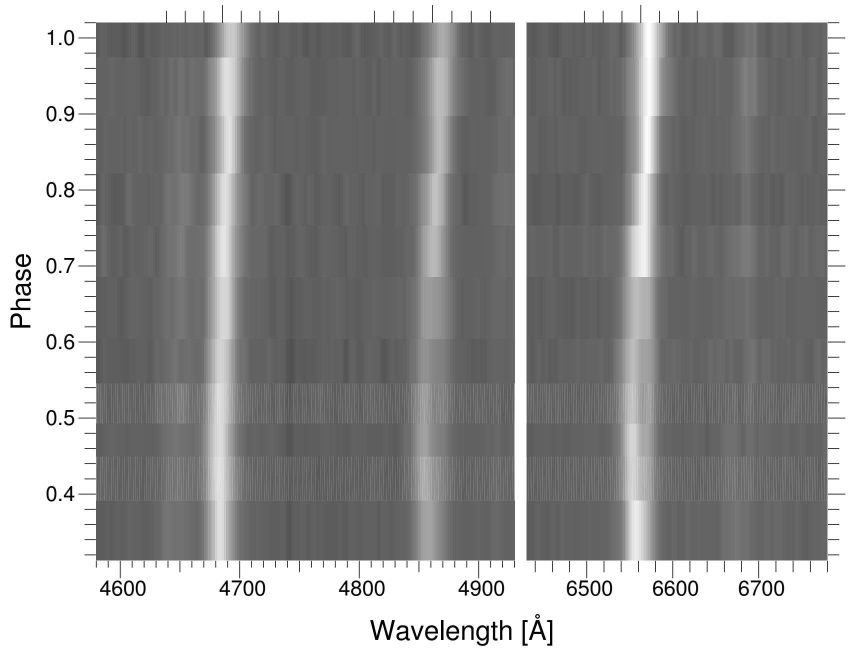

Figure 1. Grey-scale representation of the He II $\lambda 4686$ and H_β lines (left) and the H_α line (right) of V Per. The spectra are folded on the orbital period and averaged into 11 phase bins. A velocity scale is given on top: the central large tick represents zero velocity for each line and the smaller ticks to the left and right follow in steps of ± 1000 km/s. The double-peaked structure of H_α and H_β around phase 0.5 is clearly recognisable whereas the He II line remains single-peaked

V500 Aql (Nova Aquilae 1943) is a faint (~ 18 mag) old nova which shows eclipses (~ 0.4 mag) repeating with a period of 3.485 hr (Haefner, 1999). No spectroscopic information on the postnova is known in the literature.

The phases for our 21 time-resolved spectra of V Per (wavelength range $\lambda\lambda 4500$–7000 Å) were computed using the new ephemeris given by Shafter & Misselt (2006). The spectra cover the phase interval $\varphi = 0.31$–0.97 with respect to the eclipse time. Between $\varphi = 0.39$ and $\varphi = 0.60$ the H_α and H_β emissions exhibit a moderate double-peaked structure whereas the strong He II $\lambda 4686$ line remains single-peaked at all times, a phenomenon shared with the SW Sex stars. Since the spectra are unevenly distributed over the phase, they were averaged into 11 almost evenly spaced phase bins for better presentation of the effect (Fig. 1). Because the high-velocity wings of all lines seemed to be undisturbed an attempt was made to determine radial velocities. The resulting radial velocity curve for H_α ($K_1 = 308 \pm 21$ km/s, $\gamma = 56 \pm 18$ km/s) is convincing (Fig. 2). However, the pronounced phase lag of $75^\circ \pm 4^\circ$ relative to the photometric ephemeris shows that H_α does not follow the motion of the white dwarf. The same holds true for the H_β and He II $\lambda 4686$ lines. But, whereas a (full) Gaussian separation of 1400 km/s was essential to obtain the H_α radial velocity curve showing the least scatter, separations of 1800 km/s and 1960 km/s were required for an optimal solution in the case of H_β and He II, respectively. The corresponding radial velocity curves though being of suboptimal quality show lower semi-amplitudes ($K_1 \sim 235$ km/s) and phase lags on the order of some 60°. Therefore, there must be severe departures from symmetric line emission across the whole accretion disk or the system really harbours a magnetic white dwarf. Though the incomplete phase coverage might have some influence on the resulting radial velocity curves, their amplitudes constitute in any case no reliable quantity to derive e.g.

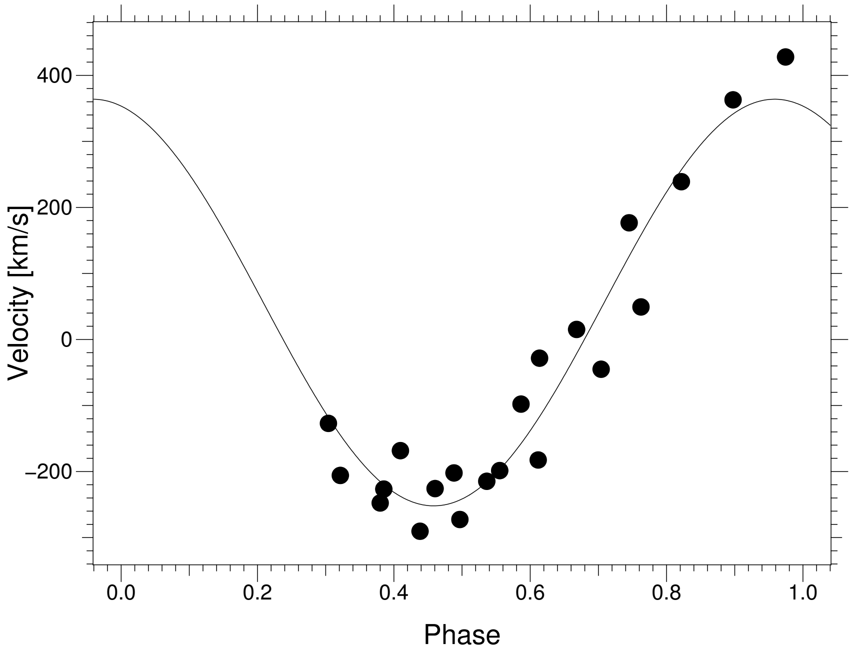

Figure 2. Radial velocity curve of the H_{α} line in V Per along with the best-fitting sinusoid. The velocities were measured using a (full) Gaussian separation of 1400 km/s. Note the large phase lag of 75°. A separation of e.g. 1960 km/s (He II) would reduce the phase lag only marginally by 3° but would increase the scatter of the radial velocity curve

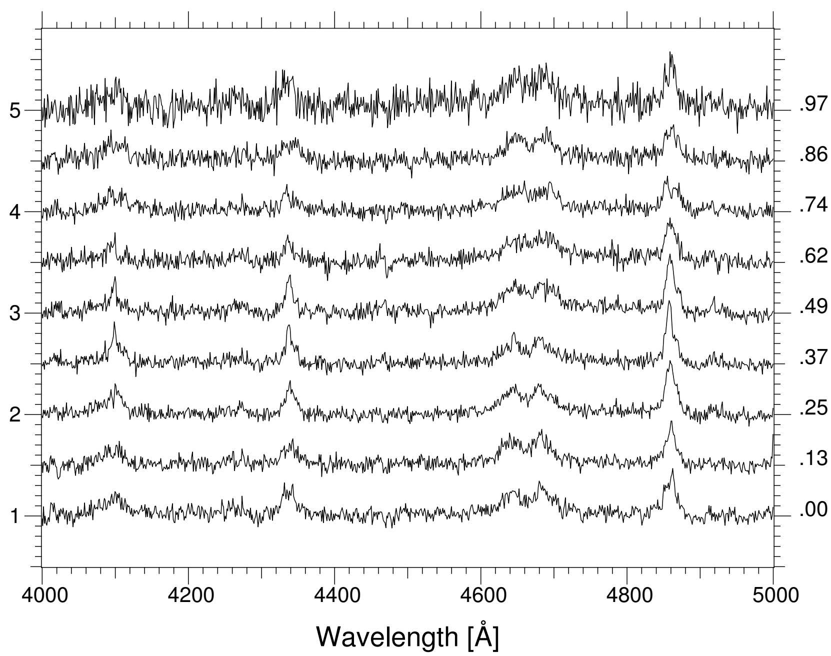

Figure 3. Orbital emission line variations of V500 Aql. The spectra are normalised to continuum level and separated vertically by constant offsets. Phase zero is arbitrarily assigned to the first spectrum of the series. The spectrum for phase 0.97 (actually an average of three) shows larger scatter since the data suffer from large air mass and a possible partial coverage of the shallow eclipse

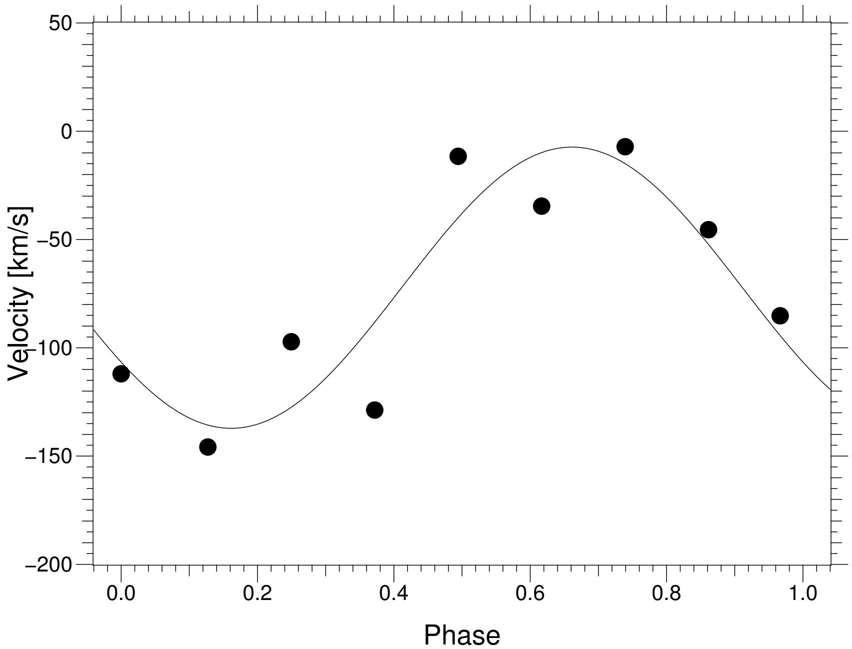

Figure 4. Radial velocity curve of the H_β line in V500 Aql along with the best-fitting sinusoid ($K_1 = 65 \pm 13$ km/s, $\gamma = -72 \pm 10$ km/s). The velocities were measured using a (full) Gaussian separation of 1890 km/s and folded on the orbital period (3.485 hr). Note that phase zero is arbitrary

the mass of the primary. In view of this it rather becomes redundant to mention that the measured large values of K_1 would result in an unrealistically small mass for the white dwarf ($M_1 \ll M_2$).

Our 20 time-resolved spectra of V500 Aql (wavelength range $\lambda\lambda$4000–5000 Å) cover one orbital revolution and show the typical emission line features of old novae. The Balmer lines, as compared with V Per, are quite weak with He II λ4686 being less prominent than H_β. The C III/N III λ4640–4650 complex, however, exhibits the same intensity as the He II line. Since the individual spectra are rather noisy (in particular the first three and last four of the series with individual exposure times of 420 s) the data were averaged resulting in nine spectra which are nearly equally spaced in phase. Complex changes especially in the Balmer line profiles can be recognized (Fig. 3). Nevertheless, at least the H_β line seemed to be suitable for radial velocity measurements. The resulting radial velocity curve (Fig. 4) exhibits a moderate amplitude, but disallows any reliability check since the photometric ephemeris is not known with the required precision to establish a possible phase lag.

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PHOTOMETRY OF 39 PMS VARIABLES IN THE TAURUS-AURIGA REGION

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The previous studies have shown that most of the well known Pre-Main Sequence (PMS) stars in the Tau-Aur region demonstrate some periodic light variations (Grankin, 1997). Such periodicities can be interpreted as the rotational modulation of the stellar flux by a group of dark surface spots. Thus, the photometric observations of spotted PMS stars allow to measure their rotational periods with high accuracy. The aim of our research is an extension of PMS stars sample with known rotational periods, which are fundamental stellar parameters. Unfortunately, most of the spotted PMS stars show the periodic light variations very seldom, when spots are disposed on a star surface extremely inhomogeneously (Grankin, 2005). Therefore, it is necessary to make some long-term observations of such PMS star to discover its rotational period with confidence. In this connection, we have made long-term observations of representative sample of new PMS stars in Tau-Aur region.

We present a photometric study of 39 PMS stars discovered in the Taurus-Auriga star-forming region, based on high-resolution echelle spectroscopy and proper motion data (Wichmann et al., 2000). Photometric data were collected with three 60-cm telescopes at the Mt. Maidanak Observatory (Uzbekistan) during several runs from 2000 to 2006. Each telescope was equipped with a pulse counting FEU-79 photomultiplier tube and a set of standard BV Johnson and R Kron–Cousins filters.

The light curves obtained during our campaign were analyzed with use the string-length algorithm (Dworetsky, 1983). The spacing of our observations in time (one day) causes so-called false periods (Tanner, 1948). Both true and false periods produce fully equivalent folded light curves. In order to determine the true period it is necessary to carry out some intensive monitorings within several nights. Unfortunately, we could make such intensive observations only for several objects from our list.

In Table 1 we present first detection of periodic light variations for 15 PMS stars, for which a few monitorings have been made. Their phased light curves in V band are shown in Figure 1. We found periodic variations for other seven PMS stars, without any monitorings. Therefore, we could not select the true period for them. These seven PMS stars are listed in Table 2 and their phased light curves are displayed in Figure 2. In Table 2 only the two most probable periods for these stars are presented. At last, we could not discover any periodicity for 17 PMS stars from our list. All these stars are the

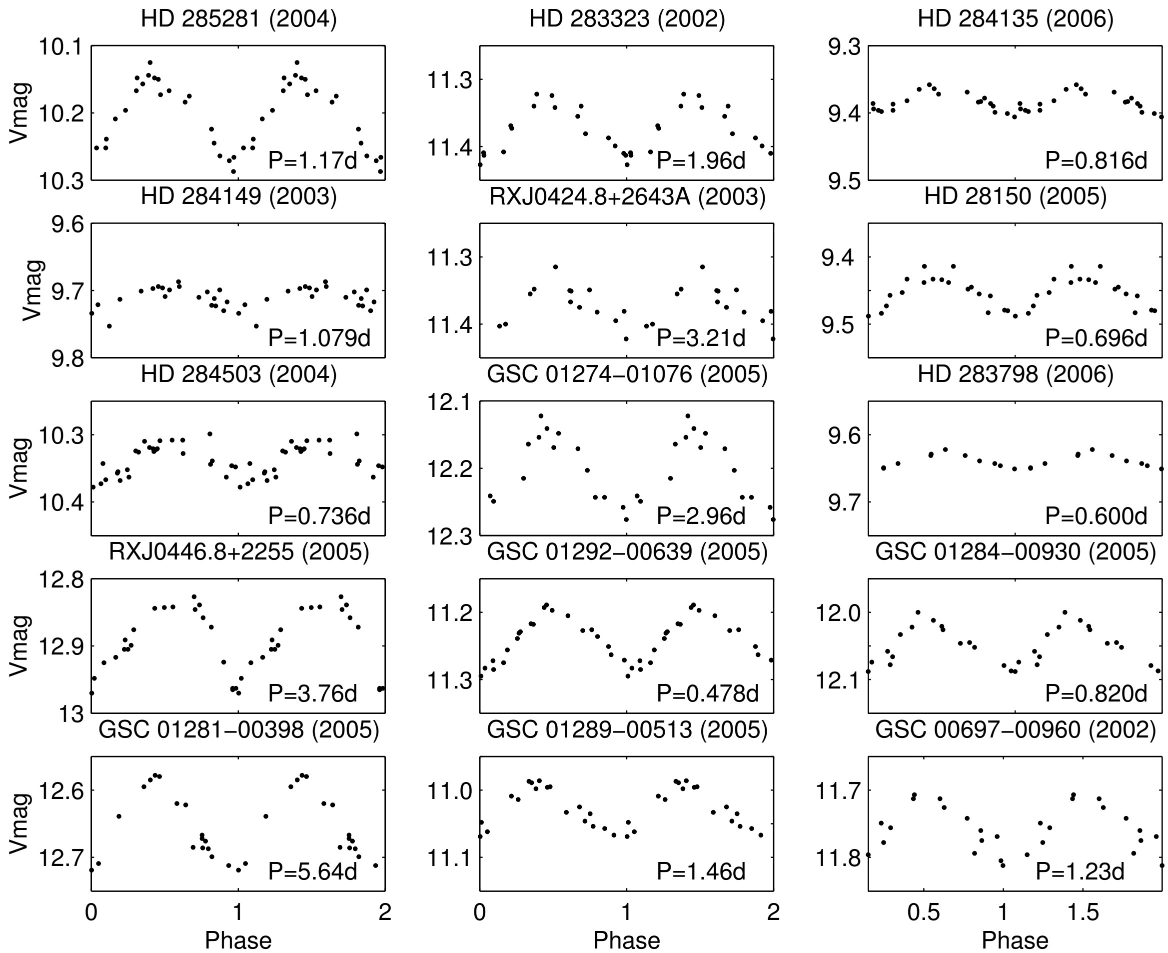

Figure 1. Light curves of new regular PMS stars with a few monitorings

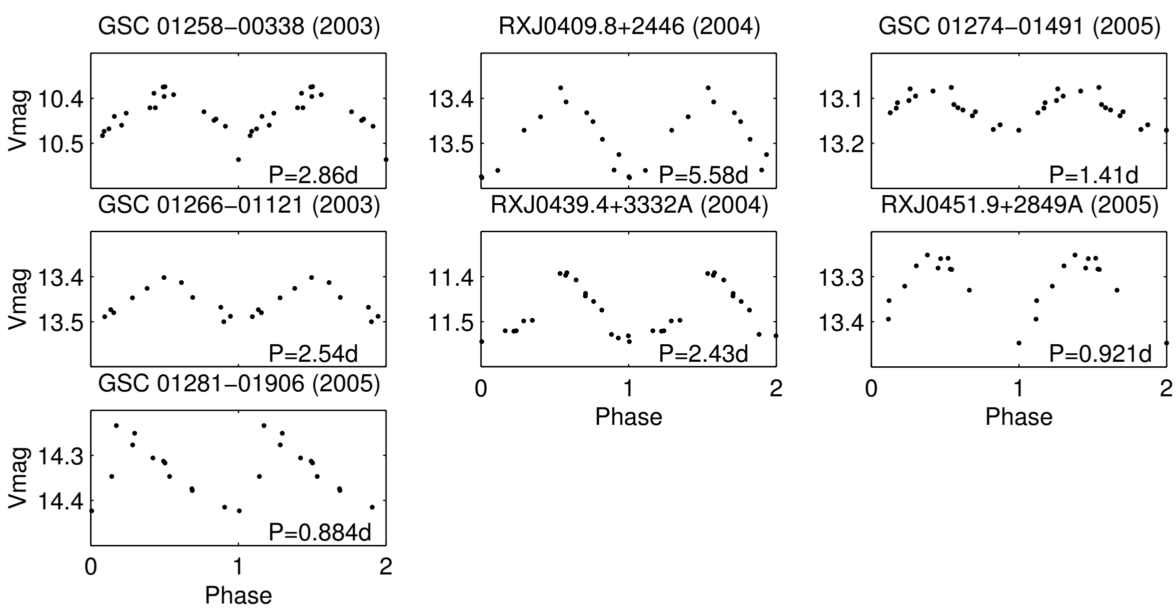

Figure 2. Light curves of new regular PMS stars without any monitorings

Table 1. List of new regular PMS stars with a few monitorings. Columns are: star's name, Right Ascension and Declination of the star calculated for J2000.0, SpT – spectral type, N_s – number of observational seasons, Δm_V – observed maximal amplitude of variation in Johnson V band for one of observational seasons, range V – photometric range in the V band for all observational seasons, P – period of variation in days

Star Name	RA (2000)	Dec (2000)	SpT	N_s	Δm_V	range V	P [days]
HD 285281	04 00 31.07	19 35 20.8	K1	4	0.16	10.12–10.29	1.1683
HD 283323	04 05 12.34	26 32 43.6	K2	6	0.12	11.21–11.49	1.9610
HD 284135	04 05 40.58	22 48 12.0	G3	5	0.06	9.29–9.44	0.8160
HD 284149	04 06 38.80	20 18 11.2	G1	5	0.07	9.62–9.75	1.0790
RXJ0424.8+2643A	04 24 48.18	26 43 16.0	K1	6	0.17	11.22–11.42	3.2100
HD 28150	04 27 04.86	18 12 27.2	G5	6	0.12	9.30–9.51	0.6962
HD 284503	04 30 49.19	21 14 10.7	G8	4	0.13	10.26–10.40	0.7360
GSC 01274-01076	04 38 13.04	20 22 47.0	K2	5	0.15	12.12–12.28	2.9600
HD 283798	04 41 55.16	26 58 49.4	G7	5	0.05	9.61–9.69	0.6000
RXJ0446.8+2255	04 46 53.22	22 55 13.1	M1	3	0.14	12.80–12.97	3.7620
GSC 01292-00639	04 50 00.18	22 29 57.7	K1	4	0.15	11.15–11.31	0.4778
GSC 01284-00930	04 52 30.76	17 30 25.8	K4	6	0.09	12.00–12.11	0.8204
GSC 01281-00398	04 56 13.56	15 54 22.0	K7	3	0.14	12.58–12.76	5.6400
GSC 01289-00513	04 57 30.63	20 14 28.6	K3	4	0.19	10.96–11.20	1.4600
GSC 00697-00960	04 59 46.14	14 30 55.2	K4	7	0.26	11.56–11.89	1.2308

Table 2. List of new regular PMS stars without any monitorings. Columns are: star's name, Right Ascension and Declination of a star calculated for J2000.0, SpT – spectral type, N_s – number of observational seasons, Δm_V – observed maximal amplitude of variation in Johnson V band for one of observational seasons, range V – photometric range in the V band for all observational seasons, P – period of variation in days

Star Name	RA (2000)	Dec (2000)	SpT	N_s	Δm_V	range V	P [days]
GSC 01258-00338	04 05 19.61	20 09 25.2	K1	4	0.16	10.31–10.54	2.86 (0.741)
RXJ0409.8+2446	04 09 51.11	24 46 21.5	M1.5	3	0.20	13.38–13.59	5.58 (1.214)
GSC 01274-01491	04 33 34.68	19 16 48.6	G6	3	0.10	13.08–13.20	1.41 (0.585)
GSC 01266-01121	04 38 27.63	15 43 38.2	K3	4	0.10	13.22–13.50	2.54 (1.651)
RXJ0439.4+3332A	04 39 25.47	33 32 44.8	K5	5	0.16	11.39–11.56	2.43 (0.708)
RXJ0451.9+2849A	04 51 56.90	28 49 42.7	K4	2	0.20	13.25–13.45	0.921 (11.66)
GSC 01281-01906	04 56 56.54	16 00 24.8	M1	2	0.25	14.23–14.50	0.884 (7.62)

irregular variables. These seventeen irregular PMS stars are listed in Table 3. The original photometric data for all 39 PMS stars is available at the IBVS website as `5752-t4.txt`.

Previously to our study the rotational periods for 24 PMS stars from the Wichmann's list were known (Bouvier et al., 1997; Broeg et al., 2006). Now the sample of the PMS stars with known periods in this star-forming region has increased almost twice. We hope that this result will allow to study the evolution of an angular moment of young stars in the Tau-Aur region more carefully.

Table 3. List of new irregular PMS stars. Columns are: star's name, Right Ascension and Declination of a star calculated for J2000.0, SpT – spectral type, N_s – number of observational seasons, Δm_V – observed maximal amplitude of variation in Johnson V band for one of observational seasons, range V – photometric range in the V band for all observational seasons, P – period of variation in days

Star Name	RA (2000)	Dec (2000)	SpT	N_s	Δm_V	range V	P [days]
GSC 01259-00232	04 12 50.65	19 36 58.0	K6	4	0.10	12.51–12.65	1.569?
HD 285579	04 12 59.87	16 11 47.8	G1	5	0.07	10.95–11.12	-
GSC 02371-02073	04 15 51.42	31 00 36.0	G6	4	0.12	12.34–12.47	0.414?
GSC 01270-00735	04 32 53.22	17 35 34.0	M2	2	0.07	13.64–13.77	0.857?
GSC 01270-00230	04 33 42.01	18 24 27.4	G6	3	0.06	12.04–12.12	1.122?
RXJ0435.9+2352	04 35 56.81	23 52 05.4	M1.5	2	0.16	13.31–13.49	-
GSC 02373-00920	04 37 16.87	31 08 19.8	K4	3	0.09	13.12–13.31	1.429?
V1117 Tau	04 38 15.59	23 02 28.1	M1	2	0.12	13.74–13.90	1.185?
GSC 01838-00189	04 41 24.00	27 15 13.2	G8	3	0.05	13.05–13.15	-
GSC 01267-00362	04 43 25.98	15 46 03.6	G7	6	0.13	12.81–12.97	1.11?
GSC 01275-00669	04 44 26.78	19 52 17.5	M1	4	0.11	12.53–12.64	-
HD 283782	04 44 54.40	27 17 45.5	K1	4	0.07	9.48–9.55	-
GSC 01284-01283	04 51 54.24	17 58 28.1	M1.5	2	0.18	13.89–14.08	1.348?
GSC 01843-00400	04 51 56.52	28 49 26.2	K2	2	0.12	14.08–14.20	-
GSC 01288-00790	04 52 57.07	19 19 50.1	K5	6	0.09	12.05–12.29	-
GSC 02391-00494	04 53 08.69	33 12 01.6	G8	2	0.14	13.69–13.88	-
HD 31281	04 55 09.62	18 26 31.1	G1	4	0.07	9.16–9.27	-

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NEW TIMES OF MINIMA OF ECLIPSING BINARY SYSTEMS

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[5] Setec Observatory, Kansas, USA

[6] Beersel Hills Observatory, Belgium

[7] Guest observer at Piszkéstető Observatory of Konkoly Observatory

Observatory and telescope:
50-cm $f/8.4$ Ritchey–Chrétien telescope (Ba50) of the Baja Astronomical Observatory (Hungary) 50-cm $f/6$ modified Cassegrain telescope (Baja Astronomical Robotic Telescope – BART1) of the Baja Astronomical Observatory (Hungary) 50-cm $f/15$ Cassegrain telescope (Pi50) of the Konkoly Observatory at Piszkéstető Mountain Station (Hungary) 25, and 40-cm Newton telescopes (Be25, Be40, respectively; Belgium) 30-cm Cassegrain telescope of Setec Observatory, Kansas (Se30)

Detector:	512 × 512 Apogee AP-7 CCD camera (Ba50) 765 × 510 SBIG ST-7 CCD camera (Ba50ST7) 4096 × 4096 Apogee Alta U16 CCD camera (BART1) cooled $UBVRI$ Photometer (Pi50) 2184 × 1472 SBIG ST10XME with filterwheel (filters Bessell specifications) (Bexx) SBIG ST8 with filterwheel (filters Bessell specifications) (Se30)

Method of data reduction:
Reduction of Baja CCD frames was made with a customly developed IRAF[†]package, while the others were reduced by Mira-AP (6) and (7)*softwares.

[†]IRAF is distributed by the National Optical Astronomical Observatories, operated by the Association of the Universities for Research in Astronomy, inc., under cooperative agreement with the National Science Foundation

*Mira software is produced by Mirametrics Inc.

Method of minimum determination:
The minima times were computed with parabolic fitting, and in some cases with linearized Pogson-method or Kwee-van Woerden method (Kwee & van Woerden, 1956).

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
XZ And	54012.5539	2	I	V	Bor/BART1
AB And	53936.4859	1	I	V	Bor/Ba50
EP And	54048.3612	1	II	V	Heg/BART1
	54048.5641	1	I	V	Heg/BART1
OO Aql	53613.4327	2	II	V	Bor/Ba50
	53881.5279	5	II	R	Bor/Ba50
V889 Aql	53255.392	1	I	B, V, R	Bor/Ba50
SS Ari	54056.4176	1	I	V	Heg/BART1
CL Aur	53675.4626	3	II	R	Bor/Ba50
IM Aur	53326.4270	2	I	V	Bor/Ba50
	53447.411	1	I	V	Bor/Ba50
	53790.4257	2	I	V, R	Reg+Bor/Pi50
	54015.5599	1	II	V	Bor/BART1
	54043.6266	2	I	V	Bor/BART1
IU Aur	52957.4095	12	II	B, V, R	Bír/Ba50ST7
	53035.3063	15	II	V, R	Heg/Ba50
	53764.4187	3	I	B	Be40
	53773.4739	3	I	R	Kis/Ba50
	53780.7217	3	I	V	Se30
	53789.7804	26	I	V	Se30
	53800.6456	3	I	V	Se30
	53803.3690	2	II	V	Bor/Ba50
	53813.3244	11	I	V	Be25
	54003.5350	14	I	V, R	Bor+Reg+Kov/Pi50
	54043.3875	4	I	V	Bor/BART1
TZ Boo	53802.4937	2	II	V, R	Bor/Ba50
	53802.6449	3	I	V, R	Bor/Ba50
	53803.5348	2	I	V, R	Bor/Ba50
Y Cam	53824.5101	3	I	R	Kis/Ba50
	54039.3840	6	I	V	Bor/BART1
AS Cam	53830.405	1	II	R	Kis/Ba50
DN Cas	54066.4437	4	I	V	Be40
PV Cas	53183.5042	3	II	V	Bor/Ba50
VW Cep	53608.4033	7	II	B, V, R	Bor/Ba50
	53848.4473	2	I	V	Bor/Ba50
	53848.5869	1	II	V	Bor/Ba50
	53892.4210	9	I	B, V, R	Reg+Bor/Pi50
	53947.385	1	II	V, R	Kov+Reg/Pi50
XX Cep	54004.4338	4	I	V, R	Bor+Kov+Reg/Pi50
	54018.4576	2	I	V	Bor/BART1
EK Cep	53745.2544	19	II	V	Be25
LS Del	53937.530:	3	I	B, V, R	Heg/Ba50
	53938.4305	3	II	V	Bír/BART1
DI Her	53933.4810	4	I	V	Bor/Ba50
HS Her	53935.4277	4	I	V	Bor/Ba50
V994 Her	53206.365	2	?	V, R	Bor/Ba50
SW Lac[a]	53596.5127	1	II	R	Bor/Ba50
	53596.5136	1	II	V	Bor/Ba50
	54015.3755	1	II	V	Bor/BART1
AR Lac	54001.4618	8	II	B, V, R	Reg+Bor/Pi50
AU Lac	53745.2926	2	I	V	Be40

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
UV Leo	53459.3746	3	II	R	Bor/Ba50
	53797.5236	3	I	V, R	Bor/Pi50
	53828.4280	2	II	R	Bor/Ba50
U Peg	54000.544	1	II	V, R	Bor/Pi50
AG Per	54034.429	1	I	V, R	Kov+Bor+Reg/Pi50
	54039.5241	5	II	V	Bor/BART1
β Per[b]	54084.360	3	II	$(V, R) + N$	Bor+Reg/Pi50
EQ Tau	53802.3811	4	I	V, R	Bor/Ba50
	53815.3525	2	I	R	Bor/Ba50
TW UMa	53813.4281	8	I	–	Be25
VV UMa	53765.5233	1	I	V	Be40
ZZ UMa	53814.4329	1	I	V	Be25
DW UMa	53080.5071	1	I	R	Bor/Ba50
	53080.6434	1	I	R	Bor/Ba50
	53437.3241	1	I	V	Bor/Ba50
	53443.4711	2	I	R	Bor/Ba50
	53443.6082	2	I	R	Bor/Ba50
	53451.3942	1	I	V	Bor/Ba50
	53767.3656	2	I	R	Bor/Ba50
	53815.4506	1	I	R	Bor/Ba50
	53815.5869	1	I	R	Bor/Ba50
	53822.4174	2	I	R	Bor/Ba50
	53861.3504	1	I	R	Bor/Ba50
	53861.4875	2	I	R	Bor/Ba50
LP UMa	53080.5012	3	II	R	Bor/Ba50
	53443.5454	7	I	V, R	Bor/Ba50
	53451.4473	4	II	V	Bor/Ba50
	53767.393	2	I	R	Bor/Ba50
	53815.5834	4	II	R	Bor/Ba50
	53819.4545	2	I	V	Bor/Ba50
	53822.4011	3	II	R	Bor/Ba50
	53861.4435	4	II	R	Bor/Ba50

Explanation of the remarks in the table:

Observer(s)/Instrument

[a]: SW Lac: On the night 53596 the discrepancy between the mid-eclipse time in V and R band is supposed to be real.

[b]: β Per: Due to the brightness of the system we had to use an additional neutral filter (denoted by N).

Acknowledgements:

P.L. and P.V.C. thank Patrick Wils for providing us with software. Part of these data were acquired with equipment purchased thanks to a research fund financed by the Belgian National Lottery (1999).

T.B., Zs.R. and T.K. thank Dr. Miklós Rácz for supporting us with the neutral filter in order to make it possible to observe Algol itself with *Pi*50 telescope.

Reference:

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PHOTOELECTRIC MINIMA OF SOME ECLIPSING BINARY STARS

ŞENAVCI, H.V.; TANRIVERDI, T.; TÖRÜN, E.; ELMASLI, A.; KILIÇOĞLU, T.; ÇINAR, D.; SIPAHIOĞLU, S.; ALAN, N.; ÇOLAK, T.; YILMAZ, M.; ULUŞ, N.D.; BAŞTÜRK, Ö.; ÇALIŞKAN, Ş.; AYDIN, G.; EKMEKÇI, F.; ALBAYRAK, B.; SELAM, S.O.

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Observatory and telescope:
30-cm Maksutov telescope of the Ankara University Observatory

Detector:	OPTEC SSP-5A photoelectric photometer (uncooled) containing a side-on R1414 Hamamatsu photomultiplier.

Method of data reduction:
Reduction of the observations were made in the usual way (Hardie, 1962).

Method of minimum determination:
The minima times were calculated using Kwee & van Woerden's (1956) method.

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
AB And	53555.4740	0.0002	I	*BV*	Çkr-At
	53644.4205	0.0003	I	*BV*	Kh-Sp
	53650.3913	0.0002	I	*BV*	Çf-Bk
	53651.3874	0.0007	I	*BV*	Sp-Sr
	53666.3254	0.0001	I	*BV*	Trn-Kly
	53683.2521	0.0003	I	*BV*	Çl-Blb
	53683.4181	0.0003	II	*BV*	Ün-Tg
BX And	53339.2474	0.0006	I	*UBV*	Yld-Sğ
V363 And	53640.3931	0.0005	I	*BV*	Cv-Çkr
	53649.3501	0.0006	I	*BV*	Dm-Kl
OO Aql	53544.5103	0.0002	II	*BV*	Yld-Öz
	53569.3419	0.0003	II	*BV*	Ak-Ev
	53588.3462	0.0001	I	*BV*	Ylk-Sp
XZ Aql	53641.2863	0.0004	I	*BV*	Dm-Cv
AH Aur	53752.4448	0.0006	I	*BV*	Özg-Blg
AP Aur	54079.4942	0.0006	I	*BV*	Çl-Ün
AR Aur	54070.4924	0.0003	II	*BV*	Dv-Şnd
	54093.2344	0.0002	I	*BV*	Trn-Alt
TT Aur	53073.2932	0.0002	I	*UBV*	HAk-Blt

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
V410 Aur	53652.5615	0.0005	I	*BV*	Cv-Kly
	53682.6025	0.0005	I	*BV*	Öz-Blg
AC Boo	53782.5082	0.0004	I	*BV*	Dm-Çkn
	53798.5466	0.0004	II	*BV*	Kh-Tn
	53884.3565	0.0004	I	*BV*	Trz-At
	53904.4562	0.0004	I	*BV*	Trn-Sk
CK Boo	53804.5019	0.0004	I	*BV*	Şn-Pr
	53874.4676	0.0003	I	*BV*	Ns-Pr
EL Boo	53149.4506	0.0014	I	*UBV*	El-Gl
	53177.3796	0.0009	I	*UBV*	Çn-Gl
TZ Boo	53471.3090	0.0005	I	*BV*	Çrk-Çkr
	53471.4581	0.0004	II	*BV*	Çrk-Çkr
TX Cnc	54063.5440	0.0004	II	*BV*	Şn-Bğ
WY Cnc	53702.5370	0.0002	I	*BV*	At-Av
BI CVn	53729.5475	0.0003	I	*BV*	Ak-Km
CG Cyg	53568.4154	0.0003	I	*BV*	Trn-Şn
	53977.3963	0.0002	I	*BV*	Al-Klç
GO Cyg	53590.3825	0.0018	II	*UBV*	Ul-Çkr
KR Cyg	53269.3084	0.0002	I	*UBV*	Trn-Atm
	53978.3920	0.0002	I	*BV*	Al-Dv
AK Her	53869.3779	0.0009	I	*BV*	Trn-Sk
	53879.4943	0.0005	I	*BV*	Çl-Al
	53881.3910	0.0004	II	*BV*	Pr-Grl
	53885.3941	0.0002	I	*BV*	Klç-Klç
SZ Her	53197.3994	0.0002	I	*UBV*	Kr-Ylm
TT Her	53912.3873	0.0002	I	*BV*	Trz-At
TX Her	53888.3880	0.0006	II	*BV*	Ns-Şn
UX Her	53164.4420	0.0002	I	*UBV*	Atm-Blt
SW Lac	53280.2854	0.0002	II	*BV*	Tn-Cv
	53622.3326	0.0002	I	*BV*	Bk-Uğ
	53622.4942	0.0002	II	*BV*	Bk-Tp
	53623.4566	0.0003	II	*BV*	Tn-Sp
	53624.4171	0.0002	II	*UBV*	Trn-Şn
	53624.5760	0.0002	I	*UBV*	Trn-Şn
	53648.4719	0.0001	II	*BV*	Sl-At
	53658.2549	0.0003	I	*BV*	Sl-Ak
	53665.3107	0.0002	I	*BV*	Tn-Sp
	53665.4692	0.0002	II	*BV*	Ylk-Sp
	53994.3690	0.0002	I	*BV*	Tn-Erd
	54068.2946	0.0004	II	*BV*	Çl-Ym
AM Leo	53821.4172	0.0002	I	*BV*	Ylm
AP Leo	53407.5726	0.0003	II	*UBV*	Em-Erg
FK Leo	53085.4121	0.0005	I	*UBV*	Ylm-Kr
	53105.3902	0.0006	II	*BV*	Sp-Krk
UV Leo	53447.3739	0.0002	II	*BV*	Tp-At
	53823.3265	0.0005	I	*BV*	Klç-Al

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
XY Leo	53380.5079	0.0003	I	*BV*	Kö-Ak
	53783.3590	0.0004	I	*BV*	Bk-Ns
	53799.4098	0.0003	II	*BV*	Trn-Erd
	53799.5520	0.0004	I	*BV*	Trn-Erd
	53814.4676	0.0003	II	*BV*	Çn-Ak
XZ Leo	53826.3363	0.0005	II	*BV*	Eld-Çlk
SW Lyn	53739.4319	0.0002	I	*BV*	Çl-AÇk
V451 Oph	53528.4892	0.0002	I	*BV*	Sğ-Özy
V456 Oph	53894.4647	0.0002	I	*BV*	Ylm-Çkn
V502 Oph	53537.4733	0.0003	II	*BV*	Özg-Klç
	53905.3952	0.0003	I	*BV*	Dv-Çn
V508 Oph	53549.4226	0.0005	II	*UBV*	Özg-Erg
V566 Oph	53886.5249	0.0004	I	*BV*	Çl-Gl
	53893.4883	0.0004	I	*BV*	Klç-Blg
	53913.3570	0.0002	II	*BV*	Ay-Gl
	53906.3937	0.0004	II	*BV*	Klç-Ps
V839 Oph	53533.3896	0.0004	II	*BV*	Bş-Ylm
DI Peg	54059.3020	0.0003	I	*BV*	Sp-Er
	54070.3254	0.0004	II	*BV*	Bğ-Şnv
U Peg	53963.4420	0.0006	II	*BV*	Gl-Ay
	53971.4999	0.0003	I	*BV*	Bb-Çkn
	53995.4867	0.0007	I	*BV*	Sk-Trn
AQ Psc	53642.5405	0.0013	I	*BV*	Özg-Öz
	53709.3197	0.0004	II	*BV*	Ay-Av
VZ Psc	53259.3266	0.0004	I	*BV*	Çn-Klç
	53259.4661	0.0003	II	*BV*	Çn-Klç
	53260.3717	0.0005	I	*BV*	Çn
	53261.2961	0.0006	II	*UBV*	Çn-At
	53261.4206	0.0005	I	*UBV*	Çn-At
	53262.3438	0.0004	II	*UBV*	Çn-Atm
	53262.4650	0.0004	I	*UBV*	Çn-Atm
	53263.3902	0.0004	II	*UBV*	Çn-Alp
	53263.5103	0.0004	I	*UBV*	Çn-Alp
	53264.2935	0.0003	I	*UBV*	Çn-Öz
	53264.4339	0.0006	II	*UBV*	Çn-Öz
	53265.3358	0.0005	I	*BV*	Çn-Sğ
	53265.4764	0.0008	II	*BV*	Çn-Sğ
	53329.2229	0.0011	II	*BV*	Çn
	53620.3896	0.0007	II	*BV*	Çn-Dm
	53620.5187	0.0006	II	*BV*	Çn-Dm
	53621.3176	0.0004	II	*BV*	Çn-Öz
	53621.4362	0.0007	I	*BV*	Çn-Öz
	53674.3429	0.0005	II	*BV*	Çn-Av

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
V781 Tau	53305.5771	0.0004	II	*UBV*	Yld-Gr
	53426.3293	0.0007	II	*BV*	At-Ay
	53666.3886	0.0006	II	*BV*	Trn-Kly
	53666.5603	0.0002	I	*BV*	Trn-Kly
	53674.4932	0.0003	I	*BV*	At-Av
	53708.2940	0.0002	I	*BV*	Trn-Kly
	53708.4677	0.0002	II	*BV*	Trn-Kly
	53729.3312	0.0005	I	*BV*	Trn-Kly
BF Vir	53852.4025	0.0006	I	*BV*	Ylm-Çkn
ER Vul	53599.2997	0.0006	II	*BV*	Ko-Cv
Z Vul	53604.3394	0.0004	I	*BV*	At-Ev

Explanation of the remarks in the table:

Observers: AÇk: A. Çakan, Ak: O. Aksu, Akk: A. Akkaya, Al: N. Alan, Alp: I. Alpay, Alt: B. Altuntaş, Ar: S. Aras, At: Ö. Atlagan, Atm: E. Ataman, Av: Z. Avcı, Ay: G. Aydın, Bb: B. Babaoğlu, Bğ: N. Bağıran, Bk: M. Bakırcı, Blb: B. Bülbül, Blg: D. Bilgiç, Blt: F. Bulut, Bş: G. Başlangıç, Cv: E. Civelek, Çf: N. Çiftçi, Çkn: D. Çakan, Çkr: D. Çoker, Çl: T. Çolak, Çlk: L. Çelik, Çn: D. Çınar, Çrk: C. Çırakoğlu, Dm: U. Demirhan, Dv: O. Deveci, El: A. Elmaslı, Eld: Y. Eldemir, Em: B. Eminoğlu, Er: F. Eriş, Erd: E. Erdogan, Erg: İ. Ergün, Ev: B. Evin, Gl: G. Gülnaz, Gr: G. Gürkan, Grl: S. Güral, HAk: H. Ak, Kh: A.S. Kahraman, Kl: C. Kılıç, Klç: T. Kılıçoğlu, Kly: G. Kalyoncu, Km: N. Kemer, Ko: S. Kocazeybek, Kö: S. Kösemen, Kr: A. Kara, Krc: M. Kırca, Krk: T.Karakaş, Ns: M. Nas, Öy: Ö. Yılmaz, Öz: İ. Özavcı, Özg: E. Özgür, Özy: D. Özuyar, Pk: E. Peker, Pr: G. Parmaksız, Ps: Ç. Püsküllü, Sğ: U. Sağır, Sk: S. Sakallı, Sl: G. Salman, Sp: S. Sipahioğlu, Sr: G. Saral, Şn: H.T. Şener, Şnd: Y. Şendağ, Şnv: H. V. Şenavcı, Tg: O. Tagay, Tn: T. Tanrıverdi, Tp: S. Topal, Trn: E. Törün, Trz: Z. Terzioğlu, Uğ: B. Uğurluoğlu, Ul: N.D. Uluş, Ün: B. Ünal, Yld: Y. Yıldıran, Ylk: K. Yelkenci, Ylm: M. Yılmaz, Ym: S. Yaman

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SPECTROSCOPIC DETECTION OF A SPECTACULAR FLARE ON DX Cnc

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We announce the serendipitous spectroscopic detection of a spectacular flare event on DX Cnc. To our knowledge, this is the first spectroscopically detected strong flare on this star. DX Cnc, classified as a UV Ceti star (Samus et al., 2004), is one of the most nearby stars (GJ1111, LHS248) at a distance of 3.6 pc. Because of its proximity and late spectral type (M6.5) it has been used as a spectroscopic comparison star in various studies (e.g., Basri & Marcy, 1995; Teegarden et al., 2003; Caballero et al., 2006). In a similar sense we used DX Cnc for the classification of late-type stars in a systematic search for so far unidentified candidates for members of the immediate solar neighbourhood (Scholz & Meusinger, 2002; Scholz et al., 2005). In this context DX Cnc has been repeatedly observed with the low-resolution long-slit Nasmyth spectrograph NASPEC at the Tautenburg 2-m telescope and with the faint-object spectrograph CAFOS at the 2.2-m telescope on Calar Alto, Spain. The grisms V200 (Tautenburg) and B400 (Calar Alto) were used resulting in nominal resolutions (FWHM) of about 12 Å (Tautenburg) and 30 Å (Calar Alto), respectively. The corresponding wavelength coverage is 4500 to 9000 Å (Tautenburg) and 3500 to 8000 Å (Calar Alto).

Table 1. Table of observations and measured Hα equivalent widths

year–month–day	J.D. (start)	instrument	$t_{\rm exp}$ [s]	EW(Hα) [Å]
2006–09–24	2454002.6479	NASPEC V200	300	3.2 ± 0.2
2006–09–24	2454002.6443	NASPEC V200	60	2.7 ± 0.3
2006–09–23	2454001.6556	NASPEC V200	180	86.9 ± 9.9
2006–09–23	2454001.6529	NASPEC V200	180	82.2 ± 9.9
2006–09–22	2454000.6553	NASPEC V200	180	4.2 ± 1.0
2006–09–22	2454000.6540	NASPEC V200	60	4.0 ± 0.6
2003–03–03	2452702.3248	CAFOS B400	60	-
2002–03–18	2452352.3622	CAFOS B400	120	-
1999–03–24	2451293.3266	CAFOS B400	120	-

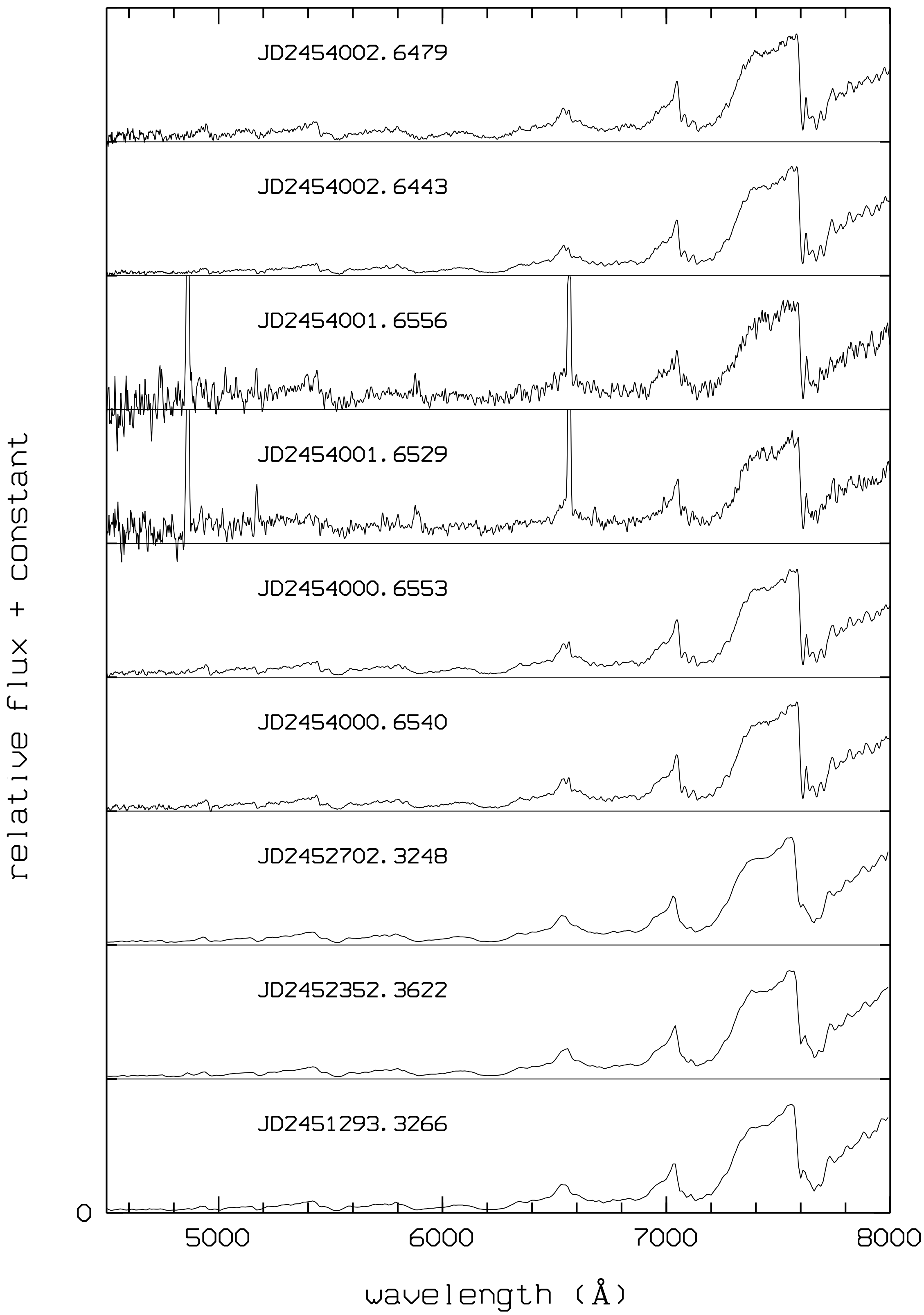

Figure 1. Series of 9 low-resolution spectra of DX Cnc at different epochs normalized at 7500 Å. The Balmer lines in the two flare spectra were truncated for lucidity

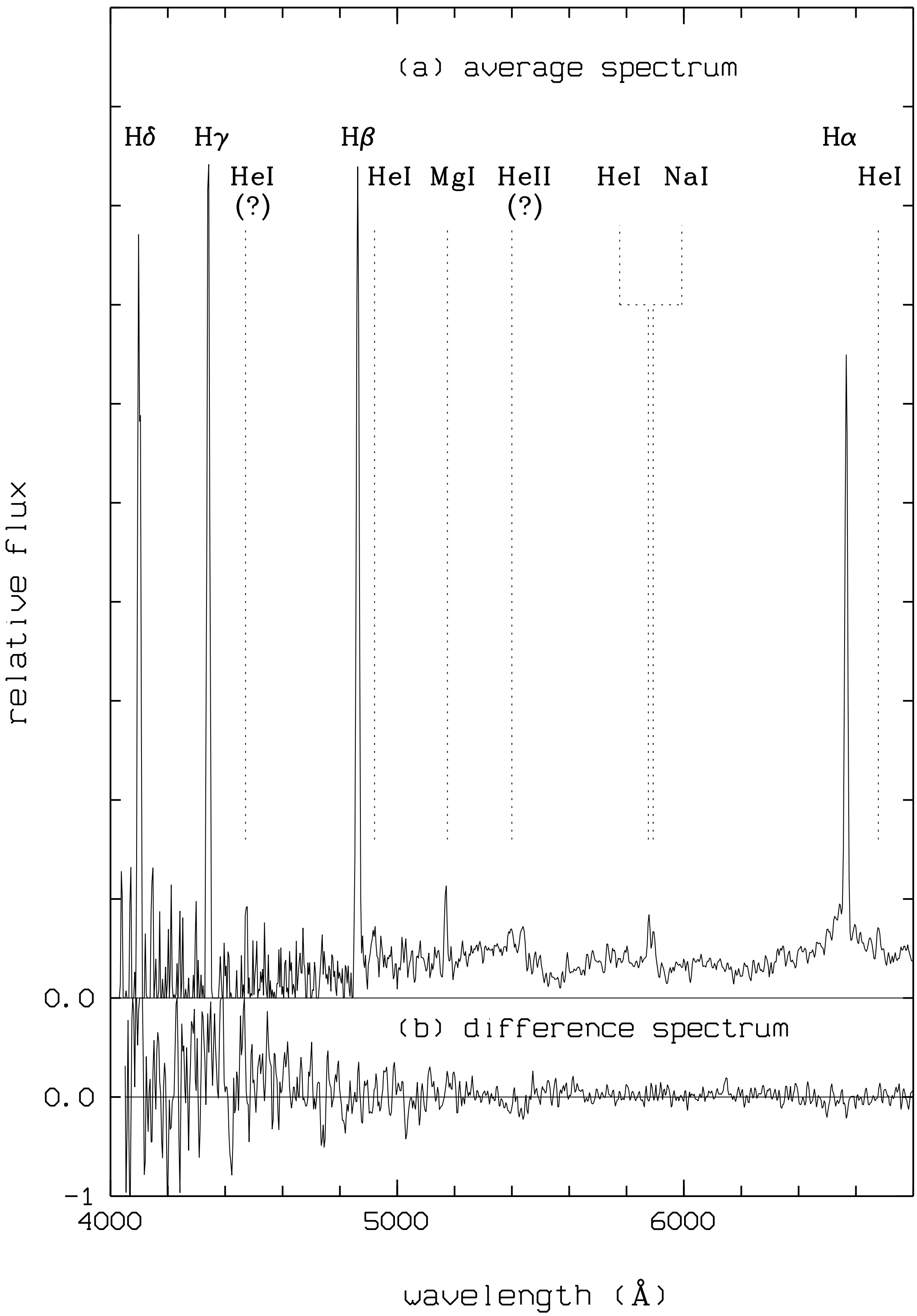

Figure 2. Average (a) and difference (b) of the two normalized flare spectra (relative flux) of DX Cnc from 2006 Sep 23 in the wavelength range of the Balmer lines. The scales of the two panels are different

The flare was detected on two spectra taken at the end of the night of 2006 September 22/23. Actually, the target of these observation was the star USNO-B1.0 1167-0167382 at a distance of about 10 arcsec from DX Cnc. Although the spectrograph slit was not positioned on DX Cnc, the stray light from DX Cnc passing through the long-slit was bright enough to enable the extraction of useful spectra, however with poor S/N below ~ 5000 Å. The time-lag between the end of the first exposure and the beginning of the second exposure was 50 s, hence the two spectra cover a time interval of 430 s. Unfortunately, no other spectra could be taken in the same night because of the break of dawn. The series of all available spectra is shown in Fig. 1. All other spectra of DX Cnc do not show substantial flare activity. The star was obviously in its quiescence stage on the spectra observed in the night before the flare as well as on the spectra from the night after the flare. The two flare spectra do not significantly differ. This is most likely explained by the assumption that the duration of the flare was longer than the time interval covered by the observations. It appears hence useful to compute an average flare spectrum with reduced S/N from the two single spectra. Both the difference spectrum and the average spectrum are shown in Fig. 2. In addition to very strong Balmer lines, HeI emission lines at $\lambda\lambda$ 5876, 6678 and metal lines (Na, Mg) are clearly identified; the identification of the lines HeI λ 4471 and HeII λ 5412 is not safe.

Weak Hα emission is seen in all other Tautenburg spectra. The higher Balmer lines, the He lines, and the metal lines, on the other hand, are usually not seen in emission. For Hα we measure an equivalent width of EW(Hα) $= 3 \ldots 4$ Å in the quiescence stage around the epoch of the flare, in good agreement with the data found in the literature (Liebert, 1976; Martín et al., 1996; Mohanty & Basri, 2003; Fuhrmeister et al., 2005). With their lower resolution, the Calar Alto spectra do not allow to measure Hα in quiescence. From the average flare spectrum we derive EW(Hα) $= 95 \pm 10$ Å. To measure the equivalent width of Hβ, the continuum was estimated by fitting a mean spectrum from the quiescence stage which yields EW(Hβ) $= 580 \pm 10$ Å. For the higher Balmer lines it is not possible to estimate the continuum from our spectra.

Finally, it is worth mentioning that both flare spectra seem to indicate an enhanced blue continuum. Such a behaviour has been found for other late-type stars by e.g., Liebert et al. (1999) and Scholz et al. (2004). However, the quality of our flare spectra is not sufficient for a clear-cut statement on the continuum variation during the flare of DX Cnc.

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LONG-TERM OPTICAL LIGHT VARIATIONS OF THE PECULIAR MASSIVE RUNAWAY STAR HD 108

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Name of the object:
HD 108 = NSV 25 = SAO 10973 = BD+62°2363

Equatorial coordinates:	**Equinox:**
R.A.= $00^{h}06^{m}03\overset{s}{.}3861$ **DEC.=** $+63°40'46\overset{''}{.}763$	2000

Observatory and telescope:
Crimean Laboratory, Sternberg Astronomical Institute, 60-cm Cassegrain telescope

Detector:	photometer: one channel

Filter(s):	BVR

Date(s) of the observation(s):
1989.07/2006.08

Comparison star(s):	HD 134

Transformed to a standard system:	No

Availability of the data:
upon request

Remarks:
HD 108 is a well-known Ofp star which is placed in a list of runaway stars by Bekenstein & Bowers (1974) with a peculiar velocity $V_p > 98$ km/s and the height above the Galactic plane $z = 80$ pc (Cruz-Gonzalez et al., 1974; Stone, 1979). The star belongs to the association Cas $OB5$ (Humphreys, 1978). One of the interesting aspects of investigation of the star is its long-term optical variability which has been found by Barannikov (1999). According to the newest observation data the brightness of the star was constant from 1989 until 1994, then, it began to decline monotonically till now (Fig. 1). Total amplitude of brightness diminution reached $\sim 0\overset{m}{.}06$. Variations of colour indexes $B-V$ and $V-R$ were small (Fig. 2). This result confirms independent deductions about long-term variability of HD 108 in the optical domain (Nazé et al., 2004).

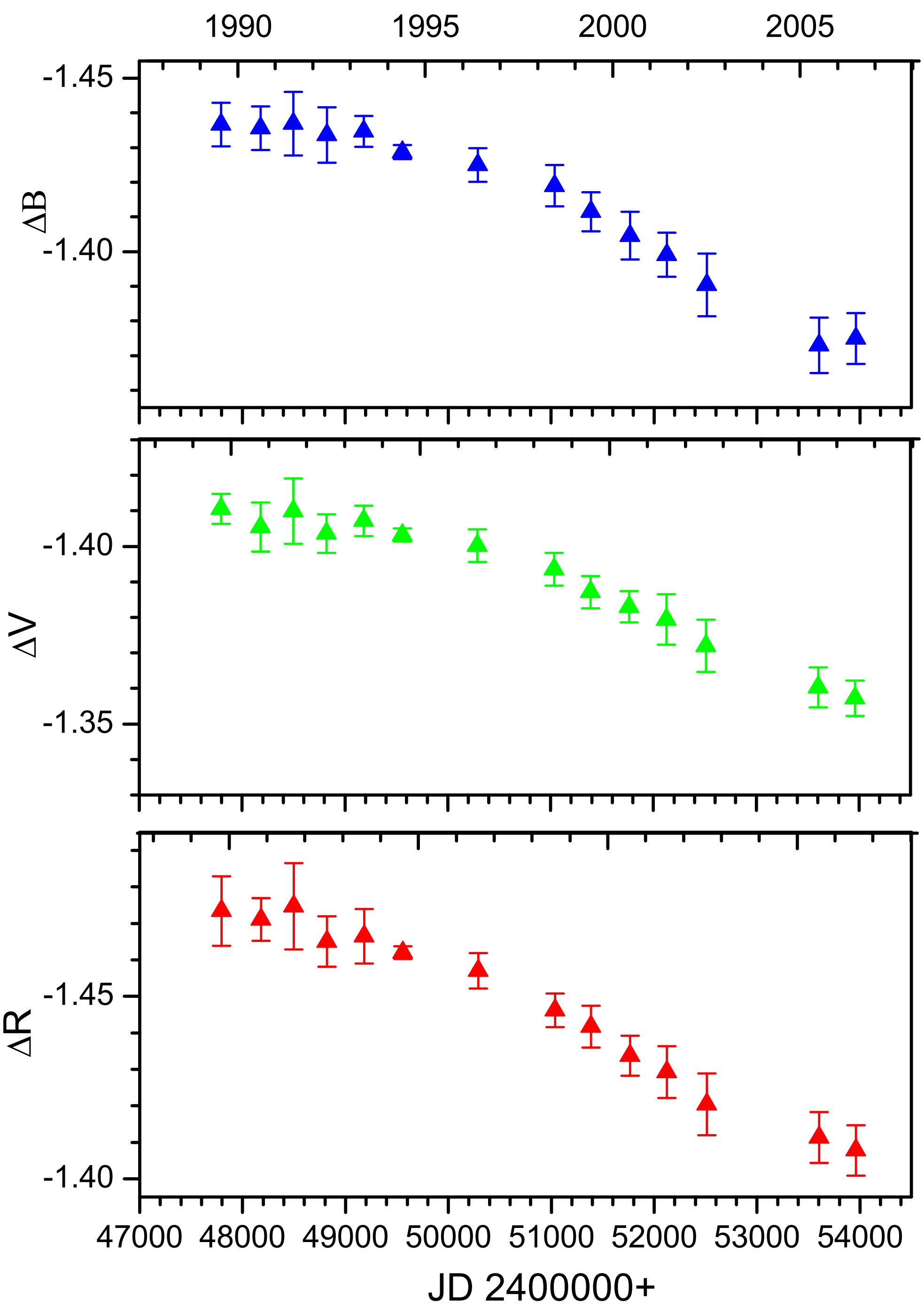

Figure 1. Long-term light curves of HD 108 in the B, V and R bands (yearly averages)

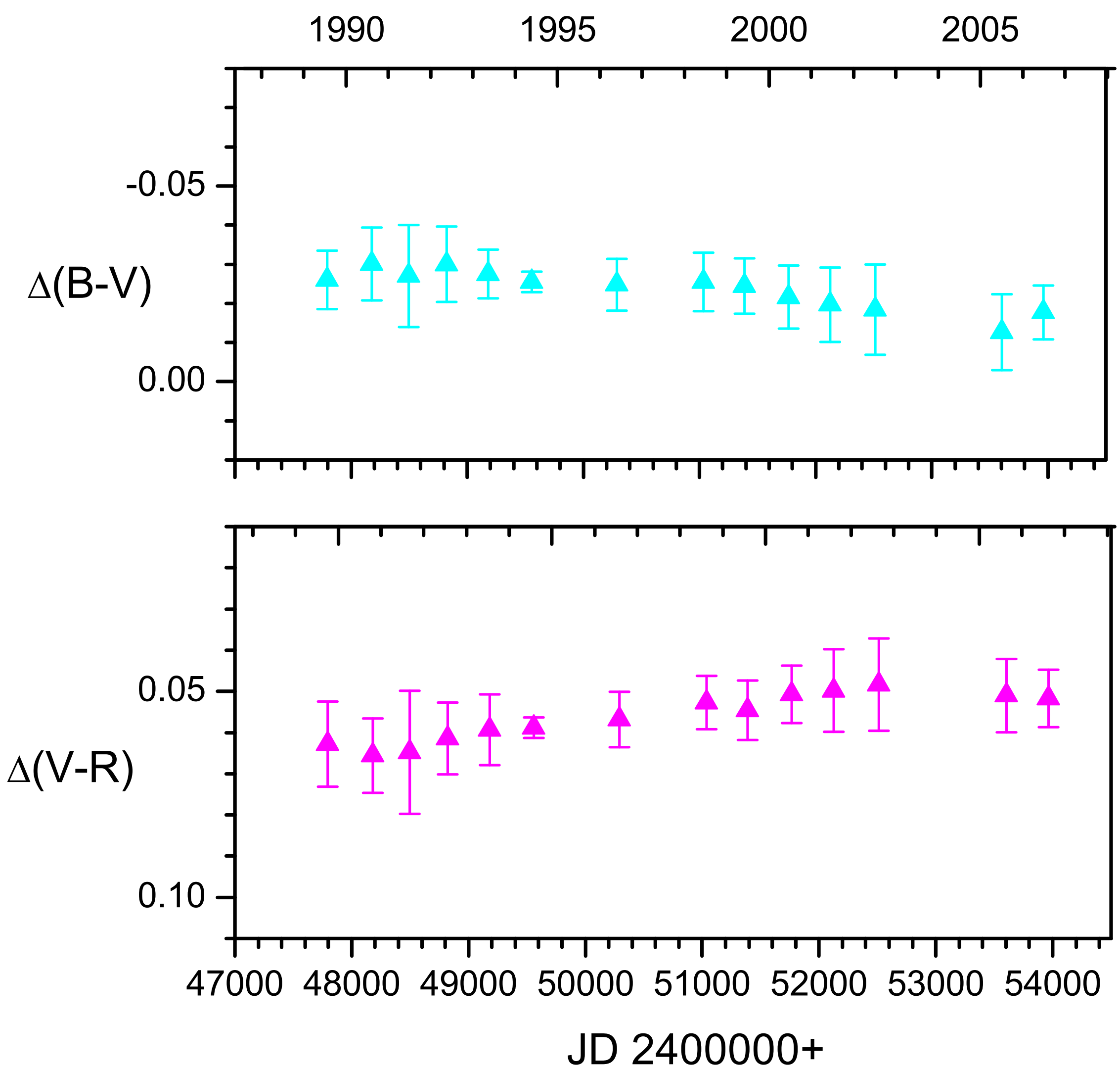

Figure 2. Long-term colour curves of HD 108 (yearly averages)

Acknowledgements:

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FR SCUTI: A TRIPLE VV CEPHEI-TYPE SYSTEM OF PARTICULAR INTEREST

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The VV Cephei-type binaries form a small but interesting group of massive binaries consisting of an M-type supergiant and a late O or an early B-type star (Bidelman, 1954; Cowley, 1969). They are related to, but distinct from two other classes of stars with composite spectra: symbiotic stars and ζ Aurigae systems. The optical spectra of VV Cephei stars are characterized by emission lines of hydrogen and [Fe II]. In addition, weaker emission lines, mostly forbidden, of the other single-ionized elements are observed. Because of the large radius of the M-type supergiant, the orbital periods in VV Cephei systems might be decades long, like for the prototype, VV Cep (20.4 yr), or KQ Gem (26.7 yr). In a few of them, including VV Cep itself, eclipses are observed. The VV Cephei systems are very rare; less than twenty are known in the Galaxy. This rarity comes from the fact that systems with very massive components evolve very fast.

FR Sct (HIP 90115) is a relatively poorly studied VV Cephei system. Its composite spectrum was discovered by Bidelman & Stephenson (1956). In contrast to the other VV Cephei systems, it showed emission lines of [Fe III] and [O III]. The photometric variability was discovered by Shajn (1934). Although Shajn (1935) noted that the star exhibits variability with a short period (of unknown length), the observations made so far (Tsessevich, 1952; Burchi, 1980, Hipparcos data) showed no more than erratic or semi-regular variations in the range of a few tenths of magnitude.

FR Sct is also known as a radio source (Florkowski et al., 1985). The radiation in the radio domain is probably due to a thermal emission of a cloud of plasma. The plasma originated probably as a result of ioniziation of the cool wind coming from M supergiant by the ultraviolet radiation of the OB component. The radio and optical positions of FR Sct were frequently used to define or compare astrometric reference frames (e.g., Johnston et al., 1985; Walter et al., 1997).

The star was also observed by the ASAS survey (Pojmański, 1997) where it is recognized as ASAS 182323−1240.9. Surprisingly, automatic classification applied by the authors of the ASAS catalogue to this star resulted in an ESD/ED classification, i.e., semi-detached or detached eclipsing binary, with a period of only 3.535 d (Pojmański & Maciejewski, 2005). What seemed to be at a first glance an incorrect classification, has been confirmed during our analysis, carried out according to the procedure described by Pigulski (2005). The only difference was that the search for periodic variations we present here was made using eclipse-freed light curves. This was a part of a much wider search for pulsating components of eclipsing binaries (Michalska & Pigulski, 2007). The original ASAS light curve (Fig. 1) does not show the eclipses in an obvious way, because they are contaminated by the quasi-periodic variations originating probably in the M-type supergiant. However, as these long-term variations could be well represented by means of a series of sinusoidal terms with frequencies smaller than 0.01 d^{-1}, we were able to separate them from eclipses. The contributions from the long-term variations and the eclipses are shown in Figs. 2 and 3, respectively. As can be seen in Fig. 2, the long-term changes, presumably due to the variability of the cool supergiant, have a range of about 0.4 mag and a mean V magnitude of about 10.28. The larger scatter after HJD 2453300 is due to the change of the exposure time to smaller value around this date in the ASAS observations. In consequence, the mean accuracy of a single measurement amounts to about 0.02 mag for observations made prior and 0.06 mag for observations made after that date.

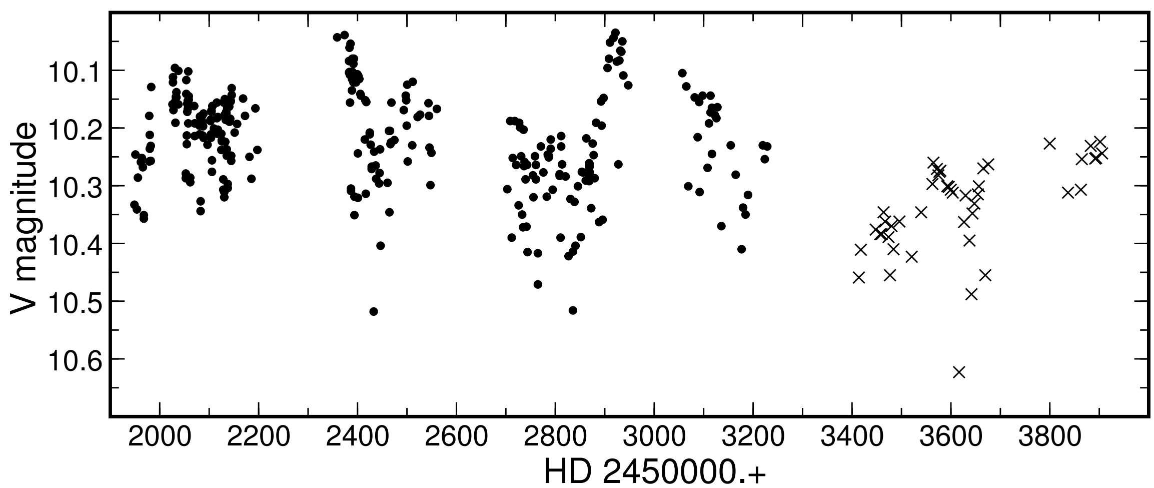

Figure 1. The V-filter ASAS light curve of FR Sct. The data cover the interval between February 2001 and June 2006. Data plotted as crosses are of lower quality

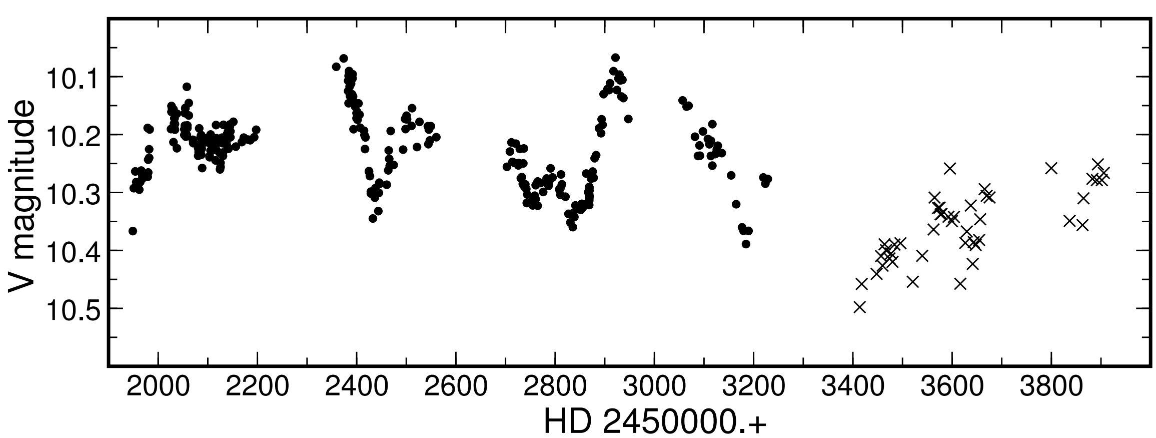

Figure 2. The same as in Fig. 1, but freed from the contribution from the eclipses

On the other hand, the eclipse light-curve (Fig. 3) shows two minima of unequal depth; about 0.23 mag for the primary and 0.13 mag for the secondary eclipse. The epochs of the primary minimum, as derived from the ASAS data, can be represented by the following ephemeris:

$$T_{\min \mathrm{I}} = \mathrm{HJD}\ 2452082.802 \pm 0.006 + (3.53405 \pm 0.00004) \times E, \qquad (1)$$

where E is the number of cycles elapsed from the initial epoch.

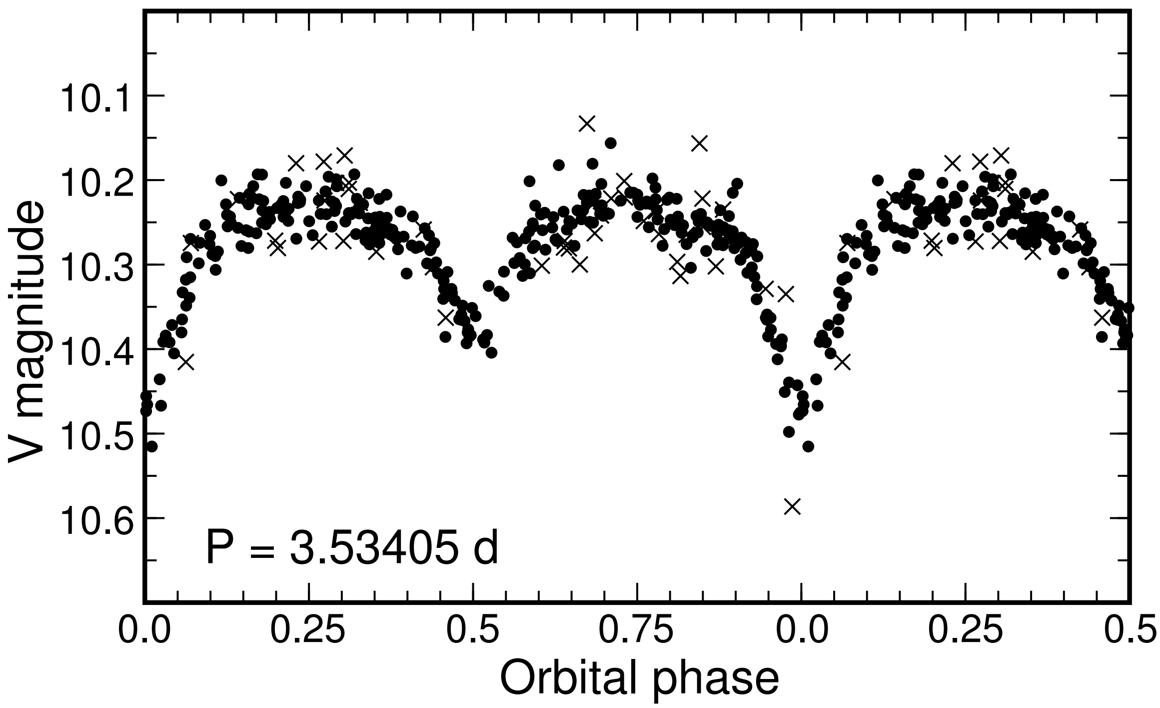

Figure 3. The eclipses in FR Sct. The light curve was folded with the orbital period of 3.53405 d. Like in Figs. 1 and 2, the data obtained prior to HJD 2453300 are plotted with dots, after that date, with crosses. The data were freed from the long-term changes seen in Fig. 2

The immediate conclusion coming from the length of the orbital period is that the eclipses cannot occur between the hot component and the cool M-type supergiant. In that case we would expect the orbital period of at least a few years. Consequently, the most plausible explanation is that the hot component of FR Sct is itself a binary, and what we see are the eclipses in this system. Thus, FR Sct would be a hierarchical triple system consisting of very massive stars. This makes it a very interesting star for the follow-up study and unique among VV Cephei stars.

It has to be pointed out that the separation of the eclipsing light curve (Fig. 3) and the long-term changes (Fig. 2) we made does not mean that Figs. 2 and 3 represent the light changes of the M-type supergiant and the hot binary as if they were seen separately. First, in both cases the contribution from the other component(s) leads to the reduction of the amplitude of the light curve. Next, we cannot exclude that some erratic changes seen in Fig. 2 come from the hot components. The presence of the [Fe III] and [O III] emission lines in the spectra of FR Sct (Bidelman & Stephenson, 1956) may be related to the duplicity of the hot component. The other possibility is that the hot components in FR Sct are hotter than usually the case in VV Cephei systems.

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ELEMENTS FOR 7 PULSATING VARIABLES

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These stars were reported to be variable by Boyce & Huruhata (1942), Hoffmeister (1931, 1943, 1966, 1967) and Götz et al. (1957). Except in the cases of V565 Oph and V943 Oph (see details noted in the remarks below), no further observations or ephemeris have been published until today. Photographic plates of a field centered at 67 Oph, taken with the Sonneberg Observatory 40-cm Astrographs during three intervals spread over the years from 1938 to 1994, were used to investigate the behaviour of these objects (see Table 1).

The given elements were obtained by means of least-squares solutions. Photographic amplitudes were derived with respect to magnitudes of the comparison stars given in Table 2. An extensive list holding the times of maxima derived can be retrieved as `5758-t3.txt`, using the link in the HTML version of this paper. Individual data are available upon request.

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	$M-m$	No. of Plates
V565 Oph	Cep	47736.504 ±23	1.8997213 ±56	$14^{m}0$	$15^{m}0$	$0^{P}20$	242
V943 Oph	RRc	49475.526 ±8	0.2718626 ±2	$15^{m}7$	$16^{m}1$		105
V1066 Oph	CWB	48832.363 ±66	1.9202194 ±121	$15^{m}5$	$16^{m}2$	$0^{P}20$	114
V1079 Oph	RR/DSC	49488.532 ±6	0.2493961 ±1	$15^{m}4$	$16^{m}3$	$0^{P}25$	141
V2034 Oph	RRab	49124.461 ±7	0.6933048 ±5	$15^{m}5$	$16^{m}5$	$0^{P}20$	168
NSV 9519	RRab	48362.569 ±13	0.6477471 ±7	$14^{m}4$	$15^{m}5$	$0^{P}32$	140
NSV 10069	RRab	49475.523 ±5	0.2917116 ±2	$14^{m}1$	$15^{m}4$	$0^{P}30$	219

Table 2. Comparison stars and cross references

	V565 Oph 238.1931 USNO 0900-10946581		V943 Oph S 4192 USNO 0825-11559850	
Comp. No.	USNO	m^*	USNO	m^*
1	0900-10928684	$13^{m}_{.}6$	0825-11549978	$15^{m}_{.}5$
2	0900-10938160	$14^{m}_{.}1$	0825-11557631	$15^{m}_{.}8$
3	0900-10942877	$14^{m}_{.}7$	0825-11555176	$16^{m}_{.}4$
4	0900-10943881	$15^{m}_{.}2$		

	V1066 Oph S 9835 USNO 0900-10308821		V1079 Oph S 9845 USNO 0900-10857955	
Comp. No.	USNO	m^*	USNO	m^*
1	0900-10305081	$15^{m}_{.}6$	0900-10861783	$15^{m}_{.}5$
2	0900-10306618	$15^{m}_{.}9$	0900-10857822	$16^{m}_{.}2$
3			0900-10854899	$16^{m}_{.}5$

	V2034 Oph S 9281 USNO 0900-11253134		NSV 9519 HV 11018 USNO 0975-09544608	
Comp. No.	USNO	m^*	USNO	m^*
1	0900-11261755	$15^{m}_{.}3$	0975-09548857	$14^{m}_{.}4$
2	0900-11259056	$15^{m}_{.}9$	0975-09541815	$15^{m}_{.}1$
3	0900-11253836	$16^{m}_{.}6$	0975-09545937	$15^{m}_{.}5$

	NSV 10069 S 9285 USNO 0900-11358051	
Comp. No.	USNO	m^*
1	0900-11361620	$13^{m}_{.}8$
2	0900-11349891	$14^{m}_{.}7$
3	0900-11352999	$15^{m}_{.}1$
4	0900-11359626	$16^{m}_{.}1$

* Magnitudes refer to the B values of the USNO−A2.0 catalogue

Remarks:

V565 Oph

Both type and period previously published by of Hoffmeister (1943) and cited in the GCVS are erroneous. The variable is situated very near a bright star on the plates. Most of the timings given by Hoffmeister obviously represent brightenings. Only the visual timing (J.D. 2429438.500) has been included in this period analysis.

V943 Oph

Both type and period previously published by of Götz et al. (1957) and cited in the GCVS are erroneous.

V2034 Oph

A spurious period of $0^{d}_{.}4094386$ is possible, but the light curve is better represented with the period given above.

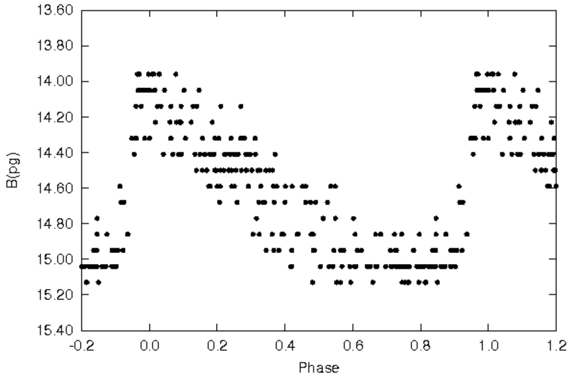

Figure 1. Light curve of V565 Oph

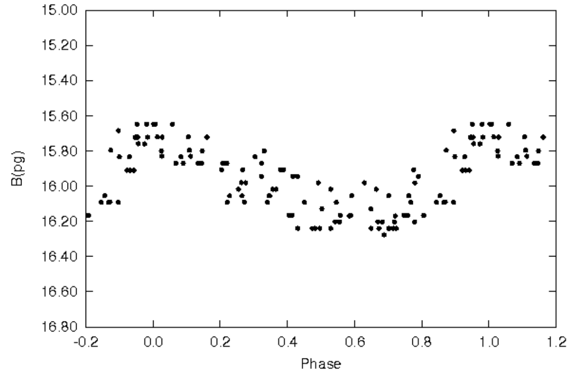

Figure 2. Light curve of V943 Oph

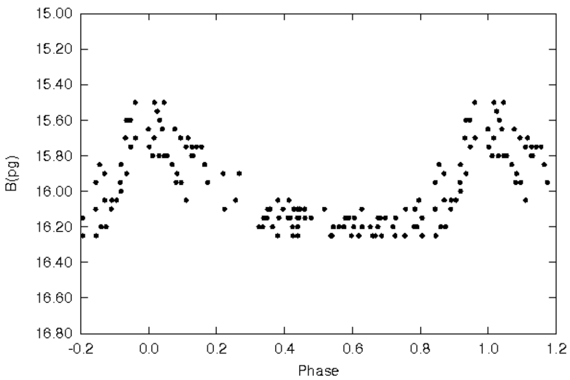

Figure 3. Light curve of V1066 Oph

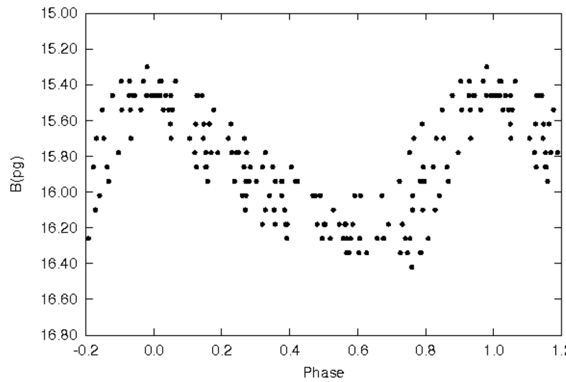

Figure 4. Light curve of V1079 Oph

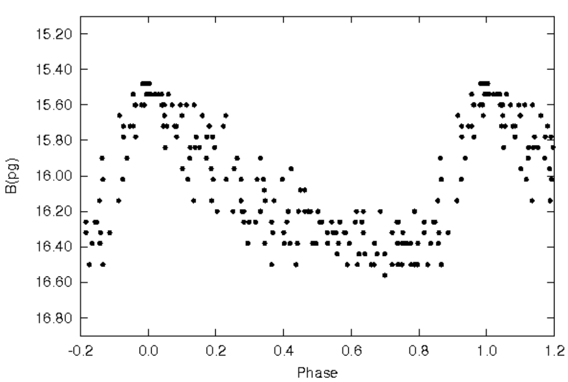

Figure 5. Light curve of V2034 Oph

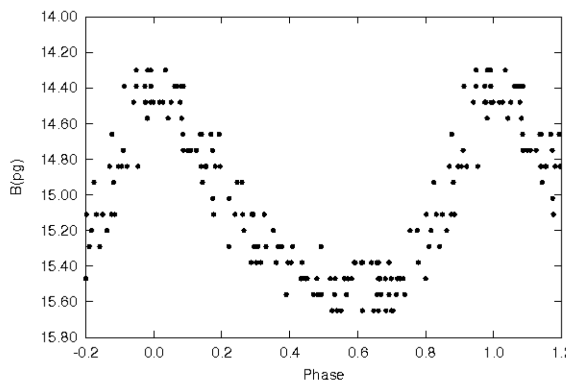

Figure 6. Light curve of NSV 9519

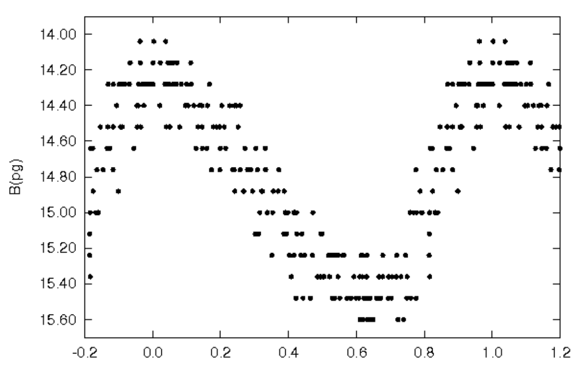

Figure 7. Light curve of NSV 10069

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

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ELEVEN MORE ECLIPSING SYSTEMS WITH APSIDAL MOTION IN THE LARGE MAGELLANIC CLOUD

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With the bulk of time-series photometric data coming from the long-term, mainly microlensing surveys (OGLE, MACHO, EROS, ASAS, NSVS and others), different properties of eclipsing binaries can be studied statistically and confronted with the theory of binary star formation and evolution. As these surveys cover both our Galaxy and Magellanic Clouds, the properties of eclipsing binaries in the environment of different metallicity can be examined. There are already many examples of the use of the large photometric databases for binary star studies (e.g., Paczyński et al., 2006; Derekas et al., 2007b) but the information included in these databases is still far from being exploited.

Apsidal motion, a phenomenon observed in eccentric systems, can be used to test internal structure of components (Claret & Gímenez, 1993; Claret, 1999) or even to derive their parameters (e.g., Benvenuto et al., 2002). Typically, apsidal periods are at least decades long and thus require very long observing runs. Photometric surveys we listed above, many of them still ongoing, are therefore ideal for detection and monitoring of this phenomenon.

In our study of detached eclipsing binaries in the Large Magellanic Cloud (LMC) that are suitable for distance determination (Michalska & Pigulski, 2005, hereafter Paper I), 98 systems were presented, of which fourteen showed apsidal motion clearly. However, a more detailed analysis led us to the detection of eleven more systems in the sample we studied. In these new systems, the apsidal motion is not so well pronounced as in those found earlier albeit still detectable. Thus, in the present paper, we update the list of eclipsing binaries with apsidal motion in the LMC. A discovery of about 40 systems with apsidal motion in the LMC was also recently announced by Derekas et al. (2007a). They used MACHO microlensing survey as the source of data.

Like in Paper I, the main source of the data we used was the OGLE-II I-band photometry of Żebruń et al. (2001) supplemented by the two-colour photometry from the MACHO (Allsman & Axelrod, 2001) and EROS (Grison et al., 1995) sources for stars in common. The light curves in all bands were analyzed simultaneously by means of the improved version of the Wilson–Devinney (WD) program (Wilson & Devinney, 1971; Wilson, 2001).

The detection of the apsidal motion was made in the same way as in Paper I. First, the data were divided into several subsets. For each subset the inclination, the phase shift, the eccentricity, e, the longitude of periastron, ω, the temperature of the secondary,

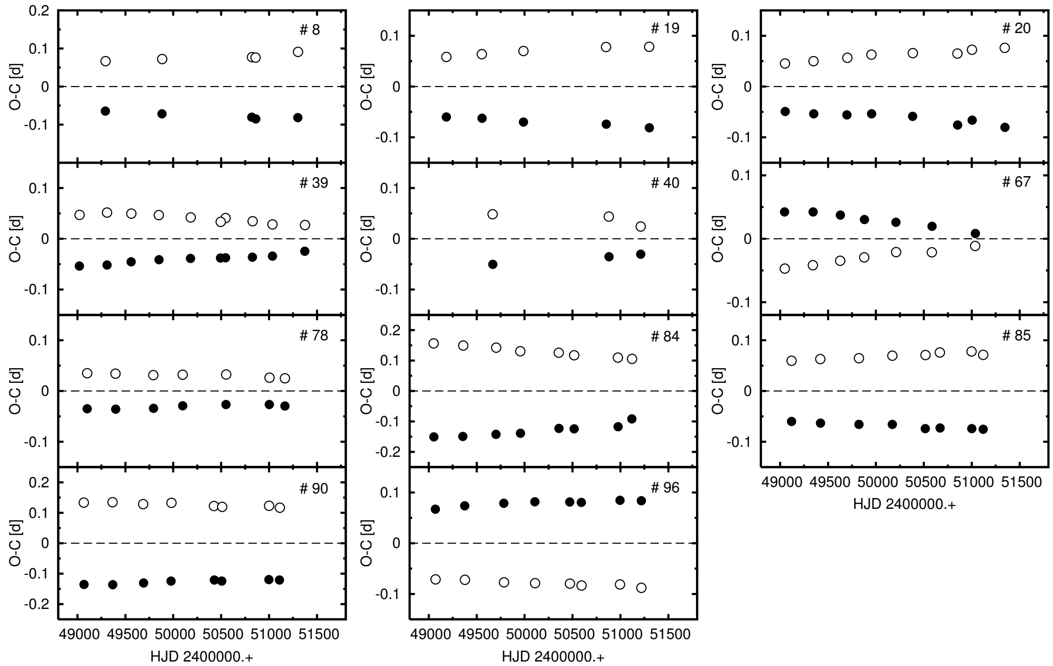

Figure 1. The $O - C$ diagrams for 11 systems with apsidal motion. The filled and open circles denote the primary and secondary times of minimum, respectively

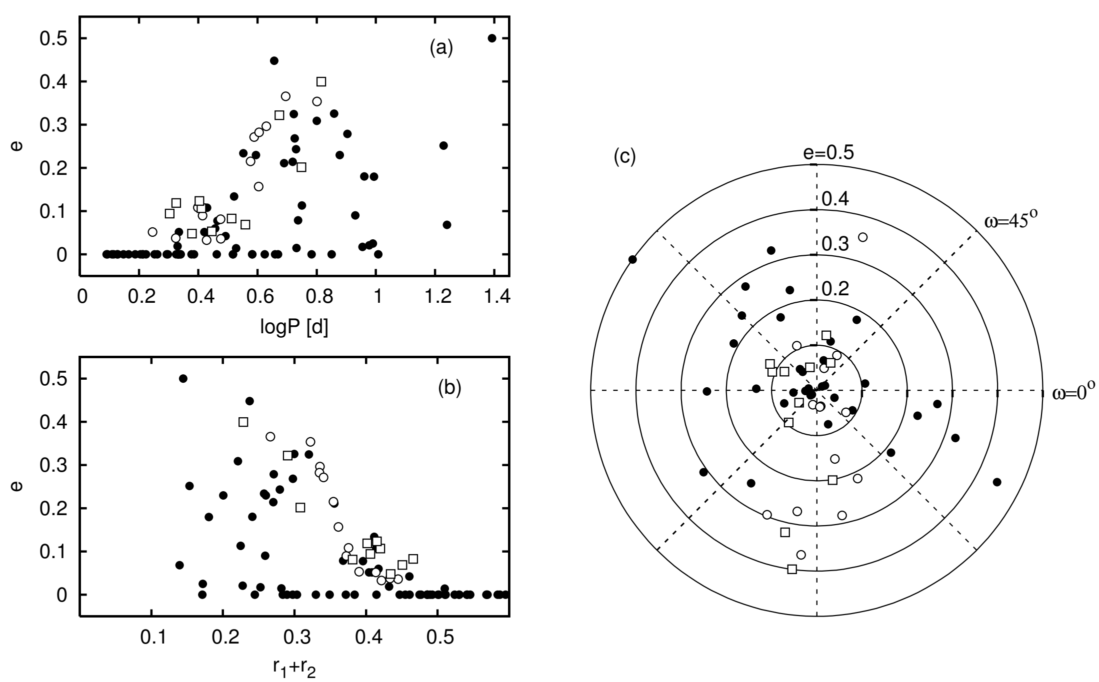

Figure 2. The eccentricities of EA-type binaries in the LMC plotted against: the logarithm of orbital period (a), the sum of fractional radii (b), and longitude of periastron, ω (c). Systems with apsidal motion we found are plotted as open circles (14 systems from Paper I) and open squares (this paper). The remaining points are for systems in which apsidal motion was not detected

Table 1: Parameters for eleven new systems with apsidal motion

Star	OGLE designation	e	ω [°]	$\dot{\omega}$ [°/year]	$P_{\rm mean}$ [d]	$T_{0,\rm mean}$ [HJD 244...]
#8	05350218-6944178	0.081	323	4.16 ± 0.26	2.989470	9292.7814
#19	05371417-7020015	0.083	150	4.40 ± 0.29	3.256681	9184.2182
#20	05164453-6932333	0.202	280	0.62 ± 0.04	5.603488	9053.8272
#39	05250946-7004226	0.069	63	3.0 ± 0.3	3.625506	9021.9995
#40	05404159-6959014	0.094	229	8.6 ± 0.7	2.009973	9668.2172
#67	05312473-6925281	0.124	440	4.34 ± 0.25	2.536666	9048.9340
#78	05121869-6858325	0.048	215	4.9 ± 0.7	2.390521	9102.2382
#84	05221500-6938483	0.322	257	1.17 ± 0.05	4.722937	9054.2332
#85	05203518-6934378	0.119	151	3.5 ± 0.4	2.117476	9120.6445
#90	05264527-6944045	0.399	262	0.20 ± 0.03	6.536149	9069.1179
#96	05181271-6935245	0.107	157	3.8 ± 0.4	2.575571	9071.1041

surface potentials and the luminosity of the primary component were adjusted with the WD program. Then, the mean values of the e and ω were calculated. Next, the WD program was run separately for each subset with e and ω fixed and the phases of primary and secondary minimum were derived from the best fit. These phases were transformed into times of minimum closest to the mean epoch of all observations in a given subset. The individual times of minimum were used in the same way as explained in Paper I to derive mean orbital period, $P_{\rm mean}$, and initial epoch, $T_{0,\rm mean}$, which are listed in Table 1 for all eleven systems. In Fig. 1, the $O-C$ values calculated using $P_{\rm mean}$ and $T_{0,\rm mean}$, are plotted. The numbers in the first column of Table 1 follow designation of stars used in Paper I. The longitudes of periastron passage, ω, are given for epoch HJD 2450500.0.

In Fig. 2 we also show how the parameters of systems with apsidal motion compare with those of all sample of 98 stars studied in Paper I. As expected, for a given eccentricity, they usually have the shortest orbital period (Fig. 2a) or the largest sum of relative radii (Fig. 2b). We have already explained in Paper I that the selection effects cause systems with detected apsidal motion tend to group around $\omega \sim 90°$ and 270°.

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CCD MINIMA FOR SELECTED ECLIPSING BINARIES IN 2006

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Observatory and telescope:
Sylvester Robotic Observatory (SRO): 33-cm $f/4.5$ Newtonian on Paramount ME mount

Detector:	SRO: SBIG ST-7XME, 1.″25 pixels, 15.′8 × 10.′5 FOV, cooled $-30 < T < -10$ °C

Method of data reduction:
Aperture photometry using MIRA, by Axiom Research

Method of minimum determination:
Digital tracing paper method, bisection of chords, curve fitting, and (occasionally) Kwee & van Woerden (1956)

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
DS And	53795.663	0.001	II	*R*	
EP And	54091.6016	0.0002	II	*R*	
HS And	54097.6881	0.0002	I	*R*	
V0376 And	54011.9868	0.0005	II	*B*	
SS Ari	54033.886	0.0002	II	*R*	
AH Aur	54097.8243	0.0003	I	*R*	
HL Aur	54012.9621	0.0002	II	*R*	
V0404 Aur	53738.8679	0.0001	I	*R*	
V0404 Aur	53814.6748	0.0005	II	*R*	
V0410 Aur	54096.5910	0.0003	I	*R*	
SU Boo	53738.9772	0.0001	I	*R*	
TZ Boo	53799.8198	0.0003	II	*R*	
XY Boo	53857.8897	0.0001	I	*R*	
AQ Boo	53815.7686	0.0001	I	*R*	
AR Boo	53821.7770	0.0003	II	*R*	
AY Cam	54018.9537	0.0002	I	*R*	
LR Cam	54091.8210	0.0003	II	*R*	

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
AE Cas	54031.8730	0.0001	I	*R*	
DN Cas	53980.9378	0.0002	I	*R*	
MT Cas	53738.6533	0.0001	I	*R*	
V0364 Cas	54025.9097	0.0001	I	*V, R, I*	
V0364 Cas	54019.7353	0.0002	II	*V, R, I*	
V0374 Cas	54030.773	0.0010	I	*R*	
V0385 Cas	54060.8386	0.0002	I?	*R*	
V0776 Cas	54093.6015	0.0003	II	*R*	
VZ Cep	54009.7691	0.0001	I	*V, R, I*	
AV CMi	54093.9819	0.0001	I	*R*	
WX Cnc	53790.8289	0.0001	I	*R*	
YY Cnc	54100.861	0.001	I	*R*	
AH Cnc	54060.9837	0.0003	II	*R*	
HN Cnc	54096.8741	0.0003	I	clear	
RW Com	53826.7905	0.0005	II	*R*	
RZ Com	53806.8301	0.0001	II	*R*	
SS Com	53791.8356	0.0001	I	*R*	
LO Com	53813.8045	0.0001	I	*R*	
DI CVn	53815.6842	0.0001	II	clear	
V0488 Cyg	53823.0259	0.0001	I	*R*	
V0628 Cyg	53981.9015	0.0002	II	*R*	
V1187 Cyg	54049.6475	0.0001	I	*R*	
V1191 Cyg	54049.6383	0.0001	I	*R*	
V1305 Cyg	53821.9989	0.0005	I	*R*	
V1417 Cyg	53980.7926	0.0002	I	clear	
V1918 Cyg	53806.9416	0.0002	II	*R*	
V2240 Cyg	54028.6978	0.0005	II	*R*	
AR Dra	53785.7261	0.0001	I	*R*	
AX Dra	53828.7218	0.0001	I	*R*	
BX Dra	53829.9089	0.0002	II	*R*	
FU Dra	53819.8177	0.0003	II	*R*	
AI Gem	53741.8795	0.0003	I	*R*	
V0345 Gem	54029.6759	0.0005	II	*R*	
V0502 Her	53855.8287	0.0001	I	*R*	
V0719 Her	53814.9762	0.0001	I	clear	
V0728 Her	53784.0115	0.0001	I	*R*	
V0732 Her	53815.940	0.001	II	*R*	
V0842 Her	53813.8891	0.0001	I	*V*	
V0842 Her	53829.8126	0.0001	I	*R*	
V0857 Her	53822.8000	0.0002	I	*R*	
V0921 Her	53821.8693	0.0003	II	*R*	
V1069 Her	53807.9635	0.0001	II	*R*	
V0339 Lac	54068.635	0.0020	I	*R*	
XX Leo	53814.8274	0.0005	II	*R*	
AL Leo	53859.7539	0.0001	I	*V*	
VW LMi	54093.9820	0.0001	II	*R*	
SW Lyn	54067.9038	0.0001	I	*R*	

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
UV Lyn	53816.7447	0.0002	II	*R*	
V0404 Lyr	53981.7443	0.0002	II	*R*	
V0582 Lyr	53822.9076	0.0001	II	*R*	
V0496 Mon	53784.6559	0.0003	II	*R*	
ER Ori	53807.6393	0.0001	I	*R*	
V0343 Ori	54096.756	0.0010	II	clear	
V0392 Ori	54068.7870	0.0020	I	*R*	
V1363 Ori	54091.698	0.001	I	*R*	
BP Per	53738.7623	0.0003	I	*R*	
II Per	53791.6894	0.0002	II	*R*	
IK Per	54006.8531	0.0002	I	*R*	
V0432 Per	54016.802	0.001	I	*R*	
CU Sge	53983.7327	0.001	I	*V*	
CU Sge	54006.6913	0.0005	I	*V*	
AQ Tau	54059.7436	0.0002	I	*R*	
CT Tau	53799.7082	0.0001	I	*R*	
CU Tau	54074.887	0.001	II	*R*	
GQ Tau	54093.7159	0.0002	I	*R*	
GW Tau	54067.7525	0.0002	II	*R*	
TY UMa	53783.7573	0.0001	I	*R*	
UY UMa	53785.8517	0.0001	I	*R*	
XZ UMa	53807.8435	0.0001	I	*R*	
BG UMa	53807.729	0.001	I	*R*	
BS UMa	53821.6682	0.0005	I?	*R*	
HH UMa	54085.894	0.0003	I	*R*	
HN UMa	53806.7112	0.0003	II	*R*	
AX Vir	53816.8319	0.0002	I	*R*	
CG Vir	53864.7835	0.0003	I	*R*	
BK Vul	54031.7419	0.0002	II	*R*	
G2532-0514	53831.924	0.001	II	*R*	

Acknowledgements:

Thanks are due to Environment Canada for the website satellite views (see reference below) that were essential in predicting clear times for observing runs in this cloudy locale. Thanks are also due to Attilla Danko for his Clear Sky Clocks, (see below). This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France.

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ERRATUM FOR IBVS 4840

In IBVS 4840, the correct time of minimum for AG Vir should be 51281.8282 ± 0.0006 (the original value reported was out by one hour).

ERRATUM FOR IBVS 5760

The original title erroneously indicated year 2007.

The Author

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PHOTOELECTRIC MINIMA OF SELECTED ECLIPSING BINARIES AND MAXIMA OF PULSATING STARS

(BAV MITTEILUNGEN NO. 183)

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In this 57th compilation of BAV results, photoelectric observations obtained in the year 2006 are presented on 389 variable stars giving 611 minima on eclipsing binaries and maxima on pulsating stars. All moments of minima and maxima are heliocentric. The errors are tabulated in column '±'. The values in column '$O-C$' are determined without incorporation of nonlinear terms. The references are given in the section 'Remarks'. All information about photometers and filters are specified in the column 'Rem'. The observations were made at private observatories. The photoelectric measurements and all the lightcurves with evaluations can be obtained from the office of the BAV for inspection.

Table 1: Eclipsing binaries

Variable	M/m	JD 24...	±	Obs	$O-C$		Bibliography	Fil	n	Rem
RT And	Min	54124.2454	.0001	WN	−0.0066		GCVS 85	V	89	21)
AB And	Min	53751.2888	.0007	ATB	−0.0177		GCVS 85		87	3)
AC And	Max	53649.6028	.0087	PC				-Ir	110	9) 32)
AD And	Min	54026.6176	.0042	AG	−0.0280	s	GCVS 85	-Ir	30	3)
AM And	Min	54026.4049	.0022	AG				-Ir	52	3)
AP And	Min	54017.6636	.0005	AG				-Ir	78	3)
	Min	54026.3903	.0006	AG				-Ir	28	3)
BD And	Min	54024.2705	.0005	AG	+0.0167		GCVS 85	-Ir	39	3)
CO And	Min	54029.4488	.0010	AG	+0.0094		GCVS 85	-Ir	33	3)
DK And	Min	54024.4039	.0010	AG	−0.0001		BAVR 55,106ff	-Ir	33	3)
	Min	54024.4060	.0050	WTR	+0.0020		BAVR 55,106ff	-Ir	122	14)
DS And	Min	54094.2714	.0034	SCI	+0.0004		GCVS 85		101	4)
EX And	Min	54026.6553	.0004	AG				-Ir	30	3)
LM And	Min	54056.2857	.0003	AG				-Ir	21	3)
LO And	Min	54026.3966	.0015	AG	+0.0312		GCVS 85	-Ir	29	3)
	Min	54026.5844	.0004	AG	+0.0286	s	GCVS 85	-Ir	29	3)
QX And	Min	54024.4412	.0049	SCI					96	4)
	Min	54024.6577	.0042	SCI					54	4)
	Min	54026.4950	.0023	SCI					70	4)
V404 And	Min	54050.4633	.0026	SCI					40	4)
V412 And	Min	54026.3010	.0043	AG				-Ir	28	3)
AF Aps	Min	53974.2880	.0050	HND					91	7)
GK Aps	Max	53123.4892	.0040	HND DVY					173	15) 24)
HO Aps	Max	53926.5030	.0030	HND				-Ir	504	18) 22)

Table 1: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$		Bibliography	Fil	n	Rem
HO Aps	Max	53936.4270	.0030	HND				-Ir	591	18) 22)
	Max	53967.3660	.0030	HND					38	7) 22)
ST Aqr	Min	53991.4923	.0012	AG	−0.0381		GCVS 85	-Ir	44	3)
GV Aqr	Min	53991.3753	.0020	AG				-Ir	44	3)
	Min	53991.5483	.0014	AG				-Ir	44	3)
OO Aql	Min	53966.4150	.0007	QU	+0.0358		GCVS 85	V	53	6)
QY Aql	Min	53936.5138	.0013	AG	−0.1564		GCVS 85	-Ir	36	3)
V417 Aql	Min	53933.4135	.0013	AG	−0.0524	s	BAVR 33,152ff	-Ir	21	3)
V609 Aql	Min	54023.3594	.0018	AG	−0.0352		GCVS 85	-Ir	18	3)
V997 Aql	Min	53935.4474	.0017	MS FR					330	8)
V1096 Aql	Min	54023.3529	.0015	AG	+0.2732		GCVS 85	-Ir	17	3)
V1097 Aql	Min	53936.4650	.0007	AG				-Ir	18	3)
	Min	54001.4044	.0014	AG				-Ir	23	3)
V1542 Aql	Min	53910.4756	.0003	MS FR	+0.0065		IBVS 5161		322	8)
V628 Ara	Min	53975.3750	.0040	HND					40	7)
SS Ari	Min	53763.2983	.0014	ATB	−0.0254	s	GCVS 85		71	3)
	Min	54116.2986	.0045	WN	−0.0366		GCVS 85	V	60	21)
CL Aur	Min	54085.4892	.0006	AG	+0.1173		GCVS 85	-Ir	36	3)
DO Aur	Min	53671.5139	.0011	FR				-Ir	46	12)
	Min	54039.4182	.0012	FR				-Ir	39	12)
EM Aur	Min	54017.5123	.0023	FR	+0.0212	s	AA 54.207	-Ir	41	12)
	Min	54018.4278	.0037	FR	+0.0258		AA 54.207	-Ir	41	12)
	Min	54019.3299:	.0040	FR	+0.0169	s	AA 54.207	-Ir	43	12)
	Min	54038.4765	.0028	JU	+0.0332		AA 54.207		51	4)
	Min	54039.3661	.0032	FR	+0.0118	s	AA 54.207	-Ir	39	12)
FN Aur	Min	54056.3886	.0016	FR	−0.7105		GCVS 85	-Ir	34	12)
	Min	54085.5748	.0054	AG	−0.7261	s	GCVS 85	-Ir	35	3)
	Min	54085.5829	.0021	FR	−0.7180	s	GCVS 85	-Ir	50	12)
FO Aur	Min	54056.4647	.0032	FR	+0.0995		GCVS 85	-Ir	38	12)
	Min	54085.7265	.0050	FR	+0.0788		GCVS 85	-Ir	50	12)
FP Aur	Min	53397.3051	.0020	JU	−0.0677		GCVS 85		60	4)
FR Aur	Min	54092.6891	.0008	FR	+0.7880		GCVS 85	-Ir	61	12)
HP Aur	Min	54085.5516	.0023	AG	−0.6574		GCVS 85	-Ir	36	3)
IY Aur	Min	54080.3520	.0038	JU	−0.1190		GCVS 85		83	4)
KU Aur	Min	53818.3388	.0010	ATB	+0.0234		GCVS 85		95	3)
NN Aur	Min	54085.5281	.0018	AG				-Ir	36	3)
TY Boo	Min	53861.4042	.0005	MS FR	−0.0204		BAVM 68		196	8)
AC Boo	Min	53817.40 :	.01	MS FR	+0.00		AA 54.207		259	8)
	Min	53904.4553	.0010	QU	+0.0063		AA 54.207	B	59	6)
	Min	53919.4375	.0004	QU	+0.0096	s	AA 54.207	V	59	6)
	Min	53932.4785	.0004	QU	+0.0102	s	AA 54.207	B	55	6)
	Min	53934.4142	.0003	QU	+0.0074		AA 54.207	V	60	6)
	Min	53935.4711	.0004	QU	+0.0070		AA 54.207	B	59	6)
GN Boo	Min	53808.4440	.0005	MS FR					430	8)
	Min	53808.5950	.0005	MS FR					430	8)
	Min	53862.4298	.0003	MS FR					342	8)
GQ Boo	Min	53863.4199	.0009	MS FR					301	8)
AW Cam	Min	53966.3670	.0011	DIE	−0.0136		GCVS 85		28	19)
CD Cam	Min	54091.6169	.0019	AG				-Ir	58	3)
XZ Cnc	Min	54084.6639	.0016	SCI					232	4)
AC Cnc	Min	54092.4778	.0016	SCI					41	4)
U900-05269593 CMi	Min	53768.3327	.0003	AG				-Ir	30	4)
	Min	53768.4862	.0004	AG				-Ir	30	4)
	Min	53813.3886	.0005	AG				-Ir	28	3)
XX Cas	Min	54096.4264	.0016	AG	+0.0158		GCVS 85	-Ir	26	3)
ZZ Cas	Min	54085.6273	.0015	AG	−0.0118	s	GCVS 85	-Ir	30	3)
AB Cas	Min	54096.5090	.0010	WN	+0.0882		GCVS 85		163	21)
AE Cas	Min	54000.4498	.0024	SCI					45	4)
AX Cas	Min	54085.2962	.0013	JU	−0.0901		GCVS 85		80	4)

Table 1: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$		Bibliography	Fil	n	Rem
AX Cas	Min	54092.4997	.0013	AG	−0.0911		GCVS 85	-Ir	37	3)
BH Cas	Min	53990.3612	.0016	AG				-Ir	74	3)
	Min	53990.5592	.0017	AG				-Ir	74	3)
	Min	54019.5868	.0028	AG				-Ir	33	3)
BS Cas	Min	53745.2594	.0039	PC	−0.0142	s	IBVS 4778	-Ir	117	9)
	Min	54092.3483	.0023	AG	−0.0156	s	IBVS 4778	-Ir	36	3)
	Min	54092.5684	.0010	AG	−0.0158		IBVS 4778	-Ir	36	3)
BU Cas	Min	53988.4819	.0034	SCI	−0.0194		GCVS 85		64	4)
	Min	54049.3705	.0016	JU	−0.0212		GCVS 85		80	4)
DN Cas	Min	54050.2669	.0059	SCI	−0.0265		GCVS 85		103	4)
DO Cas	Min	53984.4290	.0010	JU	−0.0064		GCVS 85		76	4)
DZ Cas	Min	52180.5128	.0013	AG	−0.1537		GCVS 85		30	3)
	Min	54017.5467	.0018	AG	−0.1586	s	GCVS 85	-Ir	39	3)
EG Cas	Min	54017.3491	.0006	AG	+0.1253	s	GCVS 85	-Ir	39	3)
EL Cas	Min	54085.5495	.0019	AG				-Ir	30	3)
EY Cas	Min	54019.6025	.0011	AG	+0.0214		GCVS 85	-Ir	35	3)
	Min	54034.3008	.0010	AG	+0.0194	s	GCVS 85	-Ir	34	3)
	Min	54034.5420	.0031	AG	+0.0196		GCVS 85	-Ir	34	3)
GH Cas	Min	54026.4600	.0075	AG				-Ir	23	3)
GK Cas	Min	54073.3021	.0002	AG	−0.3145		GCVS 85	-Ir	6	3)
	Min	54096.3400	.0067	AG	−0.3138		GCVS 85	-Ir	25	3)
GT Cas	Min	54019.6202	.0018	AG	+0.1741		GCVS 85	-Ir	35	3)
	Min	54034.5664	.0013	AG	+0.1713		GCVS 85	-Ir	36	3)
IL Cas	Min	54096.4450	.0019	AG	+0.0060		BAVR 51,1	-Ir	25	3)
IT Cas	Min	54026.5438	.0009	AG	+0.0001	s	AA 54.207	-Ir	30	3)
IV Cas	Min	54026.5806	.0062	AG	+0.4469		GCVS 85	-Ir	30	3)
KL Cas	Min	54092.3935	.0022	AG	−0.0077	s	GCVS 85	-Ir	36	3)
MM Cas	Min	54056.4088	.0003	AG	+0.0271		BAVR 32,36ff	-Ir	184	3)
MN Cas	Min	54026.4416	.0021	AG	+0.0075	s	GCVS 85	-Ir	22	3)
MR Cas	Min	54019.4099	.0056	SCI					17	4)
	Min	54049.4406	.0049	SCI					29	4)
	Min	54049.6560	.0026	SCI					24	4)
	Min	54080.3354	.0028	SCI					27	4)
	Min	54085.3371	.0021	SCI					22	4)
	Min	54085.5561	.0038	SCI					18	4)
	Min	54091.4072	.0024	SCI					22	4)
	Min	54091.6538	.0026	SCI					22	4)
MS Cas	Min	53990.6201	.0016	AG				-Ir	75	3)
	Min	54002.3470	.0035	AG				-Ir	35	3)
	Min	54003.5209	.0007	AG				-Ir	62	3)
	Min	54020.5289	.0032	AG				-Ir	31	3)
MU Cas	Min	53990.5805	.0029	AG				-Ir	75	3)
MV Cas	Min	54002.3723	.0013	AG				-Ir	35	3)
NN Cas	Min	54019.4230	.0002	AG				-Ir	34	3)
NU Cas	Min	54019.6148	.0009	AG				-Ir	35	3)
OR Cas	Min	54020.3476	.0019	AG	−0.0203		GCVS 85	-Ir	32	3)
	Min	54092.5996	.0011	AG	−0.0195		GCVS 85	-Ir	36	3)
OX Cas	Min	54067.3492	.0021	JU	+0.0029		GCVS 85		70	4)
PV Cas	Min	54026.3249	.0010	JU	+0.0022		AA 54.207		69	4)
	Min	54096.3436	.0020	WN	+0.0023		AA 54.207		100	21)
V336 Cas	Min	54002.5868	.0007	AG				-Ir	36	3)
	Min	54035.4366	.0007	AG				-Ir	46	3)
	Min	54085.6064	.0033	AG				-Ir	30	3)
V337 Cas	Min	54034.6197	.0023	AG				-Ir	36	3)
V345 Cas	Min	54023.5552	.0024	SCI					110	4)
V357 Cas	Min	54017.4381	.0012	AG	−0.1712	s	GCVS 85	-Ir	39	3)
V359 Cas	Min	52180.4351	.0013	AG	−0.0033		IBVS 5016		31	3)
	Min	54017.5906	.0005	AG	−0.0086		IBVS 5016	-Ir	39	3)
V360 Cas	Min	52180.5173	.0009	AG					31	3)
V361 Cas	Min	52180.3585	.0030	AG	−0.1707		GCVS 85		30	3)

Table 1: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$		Bibliography	Fil	n	Rem
V374 Cas	Min	54034.4298	.0027	AG				-Ir	29	3)
V381 Cas	Min	54029.3903	.0013	AG	+0.0196	s	BAVR 32,36ff	-Ir	29	3)
	Min	54084.3585	.0014	JU	−0.0094		BAVR 32,36ff		60	4)
	Min	54126.2635	.0003	WN	−0.0071		BAVR 32,36ff		96	21)
V411 Cas	Min	54034.5074	.0037	AG				-Ir	21	3)
V449 Cas	Min	54092.3808	.0021	AG				-Ir	36	3)
V459 Cas	Min	54020.4937	.0029	AG	−0.0108		IBVS 4737	-Ir	32	3)
	Min	54092.3224	.0009	AG	−0.0776	s	IBVS 4737	-Ir	37	3)
V473 Cas	Min	54026.4171	.0019	AG	−0.0147	s	IBVS 4669	-Ir	24	3)
V520 Cas	Min	52180.4088	.0023	AG	+0.0516	s	GCVS 85		30	3)
	Min	54017.5233	.0004	AG	−0.0204		GCVS 85	-Ir	39	3)
V541 Cas	Min	54031.3014	.0004	AG	−0.0783	s	GCVS 85	-Ir	34	3)
V608 Cas	Min	54071.3191	.0024	SCI					67	4)
V651 Cas	Min	54017.5327	.0018	AG	+0.0021	s	IBVS 3554	-Ir	39	3)
V654 Cas	Min	54035.3761	.0015	AG				-Ir	47	3)
GSC3679.1920 Cas	Min	54026.4926	.0005	AG				-Ir	24	3)
GSC3675.1186 Cas	Min	54026.3835	.0025	AG				-Ir	24	3)
GSC4030.2020 Cas	Min	54085.3015	.0015	JU					80	4)
TV Cep	Min	54001.4597	.0005	AG				-Ir	63	3)
VW Cep	Min	53941.4037	.0010	DIE	−0.0200	s	GCVS 85		27	19)
CW Cep	Min	54024.3951	.0038	JU	+0.0192		AA 54.207		59	4)
	Min	54039.3938	.0075	JU	−0.0033	s	AA 54.207		71	4)
DK Cep	Min	53992.4484	.0043	AG	−0.4616		GCVS 85	-Ir	43	3)
	Min	54001.3237	.0007	AG	−0.4595		GCVS 85	-Ir	62	3)
DN Cep	Min	54031.3402	.0039	AG	−0.0417		GCVS 85	-Ir	11	3)
EY Cep	Min	54080.5424	.0008	AG				-Ir	44	3)
GW Cep	Min	54080.2461	.0004	AG	−0.0141	s	BAVR 33,160ff	-Ir	45	3)
	Min	54080.4036	.0003	AG	−0.0160		BAVR 33,160ff	-Ir	45	3)
	Min	54080.5650	.0014	AG	−0.0140	s	BAVR 33,160ff	-Ir	45	3)
IW Cep	Min	54000.5939	.0011	AG				-Ir	31	3)
KP Cep	Min	54018.3839	.0010	AG				-Ir	37	3)
NU Cep	Min	53992.4319	.0011	AG				-Ir	46	3)
V358 Cep	Min	54080.3232	.0028	AG				-Ir	44	3)
	Min	54080.5564	.0013	AG				-Ir	44	3)
Y Cyg	Min	54025.4082	.0034	JU	+0.0404	s	GCVS 85		100	4)
DL Cyg	Min	54062.3438	.0021	AG				-Ir	25	3)
GV Cyg	Min	54006.3710	.0014	SCI					19	4)
	Min	54062.3514	.0024	AG				-Ir	24	3)
KR Cyg	Min	52840.3829	.0003	FR	−0.0027	s	GCVS 85	-Ir	62	12) red
	Min	53636.495	.000	FR	−0.023	s	GCVS 85	-Ir	61	12)
	Min	53991.4921	.0007	FR	+0.0099	s	GCVS 85	-Ir	44	12)
V345 Cyg	Min	53942.5061	.0008	AG	+0.0282		IBVS 5016	-Ir	15	3)
V401 Cyg	Min	53932.4252	.0008	FR	+0.0507	s	GCVS 85	-Ir	32	12)
	Min	53992.4486	.0009	AG	+0.0538	s	GCVS 85	-Ir	29	3)
V463 Cyg	Min	53934.5700	.0013	FR	+0.0033		AA 54.207	-Ir	37	12)
V466 Cyg	Min	53992.3590	.0005	AG	+0.0057		GCVS 85	-Ir	35	3)
V488 Cyg	Min	53654.3145	.0003	FR	+0.0780	s	GCVS 85	-Ir	60	12)
	Min	53900.3718	.0025	FR	+0.0701	s	GCVS 85	-Ir	32	12)
	Min	53935.4047	.0006	AG	+0.0709		GCVS 85	-Ir	14	3)
	Min	53990.6202	.0005	FR	+0.0759	s	GCVS 85	-Ir	43	12) red
	Min	53991.4573	.0015	FR	+0.0722		GCVS 85	-Ir	43	12)
	Min	54001.5386	.0059	FR	+0.0643		GCVS 85	-Ir	48	12)
V508 Cyg	Min	54073.3021	.0002	AG				-Ir	15	3)
V548 Cyg	Min	53966.4702	.0019	JU	+0.0070		GCVS 85		68	4)
V616 Cyg	Min	54018.4433	.0035	AG				-Ir	33	3)
V635 Cyg	Min	54018.2831	.0001	AG				-Ir	33	3)
	Min	54062.3847	.0008	AG				-Ir	25	3)

Table 1: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$		Bibliography	Fil	n	Rem
V680 Cyg	Min	54018.4906	.0041	AG	+0.0302	s	BAVR 32,36ff	-Ir	37	3)
V711 Cyg	Min	53917.4408	.0013	MS FR					207	8)
	Min	54018.3036	.0022	AG				-Ir	33	3)
V725 Cyg	Min	50753.3225	.0043	FR	+0.1888	s	GCVS 85		25	11)
	Min	53942.5022	.0014	AG	+0.2369		GCVS 85	-Ir	15	3)
V729 Cyg	Min	53985.4928	.0015	JU					15	4)
V753 Cyg	Min	54002.4808	.0006	AG	+0.0030		BAVM 69	-Ir	30	3)
V796 Cyg	Min	54002.3148:	.0004	AG				-Ir	28	3)
V836 Cyg	Min	53980.3672	.0001	WTR	+0.0153		GCVS 85	-Ir	68	14)
V841 Cyg	Min	53934.5086	.0007	AG	+0.0064	s	GCVS 85	-Ir	20	3)
	Min	53990.4529	.0007	AG	+0.0071		GCVS 85	-Ir	29	3)
V853 Cyg	Min	53920.4701	.0010	FR				-Ir	20	12)
	Min	53992.3841	.0035	FR				-Ir	43	12)
V856 Cyg	Min	53990.3720	.0016	AG				-Ir	29	3)
V859 Cyg	Min	53934.4063	.0001	AG	−0.0032	s	GCVS 85	-Ir	19	3)
V865 Cyg	Min	53941.5383	.0101	FR				-Ir	23	12)
	Min	53985.3643	.0024	SCI					28	4)
	Min	53985.5428	.0032	SCI					32	4)
V866 Cyg	Min	53936.4997	.0027	FR				-Ir	33	12)
	Min	54035.4097	.0025	FR				-Ir	48	12)
V871 Cyg	Min	53941.4900	.0044	FR				-Ir	19	12)
V873 Cyg	Min	54002.4467	.0032	FR				-Ir	32	12)
V874 Cyg	Min	53934.4021	.0003	AG				-Ir	19	3)
V877 Cyg	Min	53920.5225	.0026	FR	+0.0055	s	GCVS 85	-Ir	32	12)
	Min	53992.3461	.0008	FR	+0.0293		GCVS 85	-Ir	44	12)
	Min	54002.4182	.0020	FR	+0.0242		GCVS 85	-Ir	33	12)
V884 Cyg	Min	53932.4790	.0021	FR				-Ir	31	12)
V885 Cyg	Min	53932.4440	.0028	FR	−0.1151	s	GCVS 85	-Ir	32	12)
V889 Cyg	Min	53992.4076	.0043	AG	−0.1778	s	GCVS 85	-Ir	31	3)
V891 Cyg	Min	54003.3732	.0008	FR	+0.0434		GCVS 85	-Ir	27	12)
V902 Cyg	Min	54029.3098	.0058	FR				-Ir	26	12)
V907 Cyg	Min	53930.5013	.0013	MS FR					330	8)
	Min	53933.4788	.0008	MS FR					451	8)
	Min	54003.3165	.0022	FR				-Ir	31	12)
	Min	54029.3020	.0010	FR				-Ir	25	12)
V909 Cyg	Min	53942.5452	.0003	AG	−0.0140		BAVR 47,2f	-Ir	16	3)
V910 Cyg	Min	53942.4846	.0017	AG				-Ir	16	3)
V931 Cyg	Min	53992.3853	.0002	AG	−0.0177	s	GCVS 85	-Ir	33	3)
	Min	53992.5529	.0012	AG	−0.0209		GCVS 85	-Ir	33	3)
	Min	54023.2919	.0030	FR	−0.0161		GCVS 85	-Ir	24	12)
V934 Cyg	Min	53935.4781	.0008	AG	−0.0718		GCVS 85	-Ir	12	3)
	Min	54023.4268	.0034	FR	−0.0608	s	GCVS 85	-Ir	28	12)
V941 Cyg	Min	53992.3719	.0008	AG				-Ir	35	3)
V947 Cyg	Min	53934.4363	.0036	FR				-Ir	29	12)
V957 Cyg	Min	53813.5886	.0022	MS FR	+0.1211	s	GCVS 85		392	8)
V963 Cyg	Min	53934.3891	.0009	FR	−0.0015		GCVS 85	-Ir	35	12)
V965 Cyg	Min	53935.4342	.0024	AG				-Ir	12	3)
V979 Cyg	Min	53635.3579	.0005	FR	+0.0352		GCVS 85	-Ir	46	12)
	Min	54055.4011	.0030	FR	+0.0317		GCVS 85	-Ir	43	12)
V995 Cyg	Min	53867.5471	.0002	MS FR					561	8)
	Min	54020.4801	.0012	AG				-Ir	35	3)
V1018 Cyg	Min	50693.4812	.0066	FR	−0.0686	s	GCVS 85		42	11)
	Min	54025.2570	.0025	FR	−0.0735	s	GCVS 85	-Ir	42	12)
V1019 Cyg	Min	53935.4484	.0045	AG				-Ir	14	3)
	Min	53992.4382	.0008	AG				-Ir	34	3)
V1023 Cyg	Min	53942.4676	.0021	AG	−0.0447		GCVS 85	-Ir	15	3)
V1034 Cyg	Min	52955.4181	.0008	FR	−0.0029	s	GCVS 85	-Ir	83	12) red
	Min	53991.4580	.0015	FR	+0.0017		GCVS 85	-Ir	45	12)
V1142 Cyg	Min	53942.4627	.0078	FR				-Ir	26	12)
V1256 Cyg	Min	53936.4648	.0039	FR				-Ir	32	12)

Table 1: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$		Bibliography	Fil	n	Rem
V1256 Cyg	Min	54035.3660	.0032	FR				-Ir	29	12)
V1321 Cyg	Min	52836.4196	.0011	AG					13	3)
V1356 Cyg	Min	54024.3538	.0061	FR	+0.1257	s	GCVS 85	-Ir	23	12)
V1411 Cyg	Min	53919.4850	.0005	MS FR	−0.1766	s	GCVS 85		396	8)
	Min	54031.3366	.0024	AG	−0.1755	s	GCVS 85	-Ir	12	3)
V1417 Cyg	Min	54080.3600	.0011	AG				-Ir	46	3)
V1580 Cyg	Min	54020.3689	.0012	AG				-Ir	33	3)
V1815 Cyg	Min	52876.4673	.0014	AG	−0.0048	s	BAVR 55,1ff	-Ir	21	3)
	Min	53619.610 :	.006	PC	−0.007		BAVR 55,1ff	-Ir	46	9)
V2181 Cyg	Min	53900.4735	.0031	FR	+0.0071	s	BAVR 50,45f	-Ir	31	12)
	Min	53935.4542	.0037	AG	+0.0054	s	BAVR 50,45f	-Ir	14	3)
	Min	53990.5111	.0016	FR	+0.0081	s	BAVR 50,45f	-Ir	42	12)
	Min	53991.3724	.0011	FR	+0.0092		BAVR 50,45f	-Ir	43	12)
	Min	54001.4031	.0011	FR	+0.0039	s	BAVR 50,45f	-Ir	47	12)
V2280 Cyg	Min	54002.4708	.0028	AG				-Ir	31	3)
	Min	54020.3167	.0017	AG				-Ir	36	3)
	Min	54020.4929	.0030	AG				-Ir	36	3)
V2284 Cyg	Min	54002.4270	.0027	AG				-Ir	30	3)
	Min	54002.5810	.0004	AG				-Ir	30	3)
	Min	54020.3863	.0021	AG				-Ir	35	3)
	Min	54020.5382	.0009	AG				-Ir	35	3)
V2290 Cyg	Min	54002.4665	.0024	AG				-Ir	29	3)
V2294 Cyg	Min	54020.4244	.0008	AG				-Ir	36	3)
G3576.0170 Cyg	Min	54073.2580	.0008	AG				-Ir	15	3)
U1200-12680286 Cyg	Min	53992.4697	.0014	AG				-Ir	35	3)
U1200-13084491 Cyg	Min	54055.3951	.0028	FR				-Ir	41	12)
YY Del	Min	53966.4618	.0063	AG	+0.0197	s	GCVS 85	-Ir	25	3)
	Min	53991.4346	.0002	AG	+0.0101		GCVS 85	-Ir	37	3)
	Min	53999.3664	.0003	WTR	+0.0110		GCVS 85	-Ir	107	14)
	Min	54001.3466	.0030	AG	+0.0084	s	GCVS 85	-Ir	24	3)
	Min	54001.3503	.0080	WTR	+0.0121	s	GCVS 85	-Ir	122	14)
	Min	54003.3311	.0003	AG	+0.0102		GCVS 85	-Ir	39	3)
AL Del	Min	53966.4120	.0014	AG				-Ir	22	3)
BH Del	Min	53991.3691	.0003	AG				-Ir	36	3)
BN Del	Min	54003.4204	.0004	AG				-Ir	39	3)
BY Del	Min	54001.3687	.0015	AG				-Ir	24	3)
FK Del	Min	53966.4425	.0032	AG				-Ir	25	3)
	Min	53991.4293	.0010	AG				-Ir	36	3)
	Min	54001.4271	.0016	AG				-Ir	24	3)
UZ Dra	Min	53984.4316	.0004	QU	+0.0010	s	GCVS 85	V	65	6)
GQ Dra	Min	54055.6459	.0024	SCI					124	4)
WX Eri	Min	54033.6014	.0003	AG	+0.0176		GCVS 85	-Ir	80	3)
TZ Gem	Min	54092.6542	.0019	AG				-Ir	32	3)
BT Gem	Min	54091.6009	.0025	FR				-Ir	54	12)
CK Gem	Min	54092.3441	.0041	AG				-Ir	32	3)
CP Gem	Min	54083.4195	.0007	FR				-Ir	56	12)
CW Gem	Min	54092.6818	.0005	AG	+0.0036		BAVM 69	-Ir	34	3)
CX Gem	Min	54092.6143	.0033	AG	−0.0134	s	GCVS 85	-Ir	34	3)
EF Gem	Min	54092.3977	.0024	AG				-Ir	35	3)
FQ Gem	Min	54092.6508	.0019	AG				-Ir	35	3)
FT Gem	Min	54096.4274	.0033	FR	−0.0258		GCVS 85	-Ir	37	12)
KQ Gem	Min	54092.4605	.0008	AG				-Ir	34	3)
	Min	54092.6727	.0049	AG				-Ir	34	3)
KV Gem	Min	54092.3841	.0012	AG	−0.0055	s	BAVR 52,95ff	-Ir	35	3)
	Min	54092.5623	.0017	AG	−0.0066		BAVR 52,95ff	-Ir	35	3)
LO Gem	Min	54096.4600	.0013	AG				-Ir	22	3)
MU Gem	Min	54096.5088	.0027	FR	+0.0150		GCVS 85	-Ir	37	12)

Table 1: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$		Bibliography	Fil	n	Rem
GSC1330.0287										
Gem	Min	54092.4798	.0015	AG	−0.0025	s	BAVR 54.105ff	-Ir	35	3)
	Min	54092.6554	.0048	AG	−0.0012		BAVR 54.105ff	-Ir	35	3)
HS Her	Min	54017.2944	.0019	SCI	−0.0255		GCVS 85		238	4)
PW Her	Min	50314.5315	.0015	AG	−0.0137		BAVM 68	B	65	2)
	Min	50314.5324	.0015	AG	−0.0128		BAVM 68	V	66	2)
V501 Her	Min	53963.4443	.0013	AG				-Ir	43	3)
V502 Her	Min	53963.4725	.0006	AG				-Ir	46	3)
V878 Her	Min	53941.4214	.0019	JU					59	4)
AG Lac	Min	54018.3186	.0004	AG				-Ir	37	3)
	Min	54080.3698	.0004	AG				-Ir	46	3)
AW Lac	Min	54018.4950	.0011	AG	+0.0360		BAVR 35,1ff	-Ir	38	3)
CN Lac	Min	53925.5796	.0006	MS FR	−0.0181		GCVS 85		517	8)
	Min	53927.4918	.0004	MS FR	−0.0180		GCVS 85		550	8)
	Min	54018.3205	.0030	AG	−0.0152	s	GCVS 85	-Ir	32	3)
	Min	54018.6391	.0002	AG	−0.0153		GCVS 85	-Ir	32	3)
CO Lac	Min	54123.2630	.0034	WN	−0.0006		SAC 74	V	59	21)
	Min	54126.3464	.0002	WN	−0.0016		SAC 74	V	74	21)
EK Lac	Min	54062.2709	.0029	AG	−0.0026		GCVS 85	-Ir	26	3)
EM Lac	Min	54018.3439	.0007	AG	+0.0634		GCVS 85	-Ir	37	3)
	Min	54018.5387	.0032	AG	+0.0636	s	GCVS 85	-Ir	37	3)
EP Lac	Min	54000.4011	.0011	AG	−0.3623		GCVS 85	-Ir	32	3)
ES Lac	Min	54035.5841	.0032	AG				-Ir	33	3)
FL Lac	Min	54035.4253	.0053	AG	−0.0506	s	GCVS 85	-Ir	35	3)
IL Lac	Min	54080.3486	.0016	AG				-Ir	44	3)
IM Lac	Min	54080.4254	.0016	AG	−0.1732	s	GCVS 85	-Ir	44	3)
IP Lac	Min	54080.2361	.0020	AG				-Ir	45	3)
	Min	54080.6594	.0002	AG				-Ir	45	3)
IU Lac	Min	54031.2787	.0009	AG				-Ir	12	3)
MW Lac	Min	54035.3875	.0005	AG				-Ir	35	3)
NW Lac	Min	54035.5448	.0022	AG				-Ir	35	3)
OS Lac	Min	54035.4630	.0008	AG				-Ir	35	3)
V339 Lac	Min	54000.4657	.0011	AG				-Ir	32	3)
V441 Lac	Min	54031.3758	.0017	AG	−0.0170		IBVS 5024	-Ir	12	3)
AH Lyr	Min	53963.4960	.0009	AG				-Ir	38	3)
AK Lyr	Min	53963.3965	.0011	AG				-Ir	40	3)
	Min	53990.5028	.0042	AG				-Ir	24	3)
PV Lyr	Min	53963.5352	.0018	AG				-Ir	40	3)
PY Lyr	Min	53934.3963	.0029	AG				-Ir	20	3)
V411 Lyr	Max	53515.4890	.0050	AG				-Ir	26	3) 23)
	Max	53524.5220	.0050	AG				-Ir	21	3) 23)
EF Ori	Min	54091.4990	.0011	AG				-Ir	33	3)
ET Ori	Min	54067.4207	.0018	SCI	−0.0038		GCVS 85		52	4)
GG Ori	Min	54094.4465	.0017	SCI	−2.8088		AA 54.207		83	4)
GU Ori	Min	54091.3295	.0016	AG				-Ir	33	3)
	Min	54091.5641	.0025	AG				-Ir	33	3)
QV Ori	Min	54091.5320	.0010	AG				-Ir	38	3)
V343 Ori	Min	54091.4978	.0008	AG	+0.1937		GCVS 85	-Ir	32	3)
V392 Ori	Min	54091.5327	.0036	AG	+0.0067	s	GCVS 85	-Ir	35	3)
U Peg	Min	53752.2555	.0014	ATB	−0.0080		BAVR 45,3		50	3)
	Min	54000.3563	.0020	HNS	−0.0100		BAVR 45,3	-Ir	64	16)
	Min	54024.3416	.0006	AG	−0.0104		BAVR 45,3	-Ir	50	3)
	Min	54024.5315	.0010	AG	−0.0079	s	BAVR 45,3	-Ir	50	3)
UX Peg	Min	54092.2396	.0022	SCI	−0.0106		GCVS 87		71	4)
BK Peg	Min	54000.4181	.0028	AG	+0.0091		GCVS 87	-Ir	37	3)
BN Peg	Min	54026.3492	.0008	DIE	+0.0003		GCVS 87		22	13)
BX Peg	Min	53966.4203	.0017	AG	+0.0608		GCVS 87	-Ir	25	3)
	Min	53966.5597	.0048	AG	+0.0600	s	GCVS 87	-Ir	25	3)
	Min	53992.3574	.0001	WTR	+0.0590	s	GCVS 87	-Ir	78	14)
	Min	54002.4524	.0014	SCI	+0.0589	s	GCVS 87		78	4)

Table 1: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$		Bibliography	Fil	n	Rem
BZ Peg	Min	53966.4844	.0016	AG				-Ir	26	3)
CE Peg	Min	53936.4777	.0006	MS FR					429	8)
DI Peg	Min	54024.4239	.0005	AG	−0.0161		GCVS 87	-Ir	49	3)
DM Peg	Min	54024.3808	.0008	AG	+0.0997		GCVS 87	-Ir	51	3)
GP Peg	Min	53992.5386	.0022	SCI	−0.0422		GCVS 87		112	4)
KW Peg	Min	53966.4520	.0011	AG				-Ir	25	3)
	Min	54002.3717	.0026	SCI					78	4)
V357 Peg	Min	54000.5137	.0029	AG				-Ir	25	3)
V375 Peg	Min	52974.3270	.0010	ENS					99	20) red
V396 Peg	Min	54025.3911	.0006	AG	−0.0017		BAVM 139	-Ir	54	3)
	Min	54025.5654	.0016	AG	+0.0014	s	BAVM 139	-Ir	54	3)
U1125-18642389	Min	52137.5046	.0028	AG					25	3)
	Min	53966.3774	.0017	AG				-Ir	23	3)
RT Per	Min	54091.2898	.0003	JU	+0.0565		GCVS 87		80	4)
RV Per	Min	54055.6156	.0006	AG	−0.0079		GCVS 87	-Ir	50	3)
ST Per	Min	53750.3852	.0009	ATB	+0.1955		GCVS 87		94	3)
	Min	54097.3223	.0001	WTR	+0.2034		GCVS 87	-Ir	135	14)
AB Per	Min	54033.5650	.0200	AG				-Ir	58	3)
AG Per	Min	54092.2705	.0035	JU	+0.0247	s	AA 54.207		77	4)
DM Per	Min	54094.3678	.0023	JU	−0.0022		GCVS 87		123	4)
IM Per	Min	54025.5320	.0023	SCI	+0.0849		GCVS 87		92	4)
KL Per	Min	54056.3813	.0011	AG				-Ir	21	3)
KN Per	Min	53791.3049	.0035	ATB	+0.0025		BAVR 52,93ff		89	3)
KW Per	Min	54056.2537	.0002	AG	+0.0111		GCVS 87	-Ir	21	3)
NP Per	Min	54055.2868	.0008	AG				-Ir	49	3)
V462 Per	Min	54084.4599	.0007	AG				-Ir	52	3)
V482 Per	Min	54055.3865	.0022	JU	+0.2287		BAVM 68		100	4)
Y Psc	Min	54025.3713	.0002	AG	+0.0014		GCVS 87	-Ir	54	3)
SU Psc	Min	54019.4090	.0022	AG	−0.2962		GCVS 87	-Ir	72	3)
UW Psc	Min	53705.6220:	.0020	AG				V	55	3)
	Min	54019.4739	.0010	AG				-Ir	72	3)
VZ Psc	Min	54025.3459	.0012	AG	−0.0550	s	GCVS 87	-Ir	44	3)
	Min	54025.4760	.0018	AG	−0.0555		GCVS 87	-Ir	44	3)
TU Sge	Min	54023.4158	.0002	AG				-Ir	18	3)
CP Sge	Min	53935.4693	.0029	AG				-Ir	19	3)
DK Sge	Min	53934.3998	.0007	AG				-Ir	17	3)
FF Sge	Min	53934.4512	.0021	AG				-Ir	18	3)
	Min	53934.4514	.0003	MS FR					462	8)
	Min	54023.3558	.0012	AG				-Ir	18	3)
FP Sge	Min	53936.4651	.0002	AG				-Ir	22	3)
GN Sge	Min	53935.5131	.0029	AG	+0.0027	s	GCVS 87	-Ir	18	3)
	Min	53979.3587	.0002	WTR	+0.0015		GCVS 87	-Ir	88	14)
RW Tau	Min	54123.3946	.0041	WN	−0.0112		BAVR 45,124	V	101	21)
WY Tau	Min	54096.4036	.0028	AG	+0.0537		GCVS 87	-Ir	22	3)
BN Tau	Min	54055.5954	.0004	AG				-Ir	49	3)
BV Tau	Min	54055.4514	.0039	SCI					71	4)
CF Tau	Min	54084.4860	.0007	AG	+0.0034		BAVR 35,1ff	-Ir	47	3)
EQ Tau	Min	54084.5071	.0006	AG	−0.0254	s	GCVS 87	-Ir	43	3)
GR Tau	Min	54084.4219	.0008	AG	−0.0315		BAVR 35,1ff	-Ir	47	3)
V781 Tau	Min	54096.4785	.0004	AG	−0.0558	s	GCVS 87	-Ir	18	3)
V1123 Tau	Min	54016.4684	.0023	SCI					79	4)
V1128 Tau	Min	54083.4987	.0014	JU					46	4)
V Tri	Min	54026.3146	.0027	FR	−0.0004	s	GCVS 87	-Ir	86	12)
	Min	54026.6067	.0002	FR	−0.0009		GCVS 87	-Ir	86	12)
X Tri	Min	54115.4115	.0007	WN	−0.0697		GCVS 87	V	79	21)
AB Vul	Min	53942.4907	.0012	AG				-Ir	16	3)
BK Vul	Min	53966.4427	.0006	AG	+0.0361	s	GCVS 87	-Ir	26	3)
FM Vul	Min	53933.3940	.0010	FR	+0.0182	s	GCVS 87	-Ir	23	12)
FQ Vul	Min	53921.4630	.0017	FR				-Ir	24	12)
	Min	53990.3467	.0012	AG				-Ir	28	3)

Table 1: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$	Bibliography	Fil	n	Rem
FR Vul	Min	53933.4789	.0022	FR	+0.0009	GCVS 87	-Ir	25	12)
	Min	53934.4107	.0041	AG	−0.0091	GCVS 87	-Ir	19	3)
HI Vul	Min	53935.4488	.0019	AG	−0.0565	GCVS 87	-Ir	12	3)
HS Vul	Min	53934.4022	.0031	AG			-Ir	17	3)
NO Vul	Min	54023.3686	.0013	AG			-Ir	17	3)
GSC2140.1485 Vul	Min	53934.3812	.0003	AG			-Ir	17	3)
	Min	53934.5316	.0013	AG			-Ir	17	3)
GSC2161.0917 Vul	Min	53861.5920	.0002	MS FR				259	8)
	Min	53863.5168	.0003	MS FR				333	8)

Table 2: Pulsating stars

Variable	M/m	JD 24...	±	Obs	$O-C$	Bibliography	Fil	n	Rem
SW And	Max	53764.2890	.0028	ATB	−0.0378	IBVS 4143		92	3)
CC And	Max	53988.4122	.0038	HNS	+0.0120	GCVS 85	-Ir	57	16
CI And	Max	54024.4215	.0006	MZ	+0.0002	BAVR 53,87ff	-Ir	56	4)
FI And	Max	54049.3720	.0009	MZ			-Ir	108	4)
GP And	Max	53987.4544	.0007	HNS	+0.0046	GCVS 85	-Ir	160	16)
	Max	53988.3985	.0008	HNS	+0.0045	GCVS 85	-Ir	55	16)
	Max	54000.3591	.0010	HNS	+0.0054	GCVS 85	-Ir	64	16)
	Max	54069.3633	.0007	WN	+0.0048	GCVS 85		130	21)
OV And	Max	53745.2931	.0028	ATB	−0.0174	MVS 11,133		77	3)
	Max	54000.3455	.0015	HNS	−0.0199	MVS 11,133	-Ir	64	16)
SY Aps	Min	53546.416	.003	HND			-Ir	585	18) 26)
XZ Aps	Max	53968.4110	.0030	HND				26	7)
BS Aps	Max	53967.4430	.0020	HND				82	7)
EV Aps	Max	53969.4960	.0050	HND				100	7)
	Max	53971.4800	.0030	HND				80	7)
	Max	53973.4620	.0020	HND				46	7)
	Max	53975.4470	.0040	HND				110	7)
EX Aps	Max	53951.3970	.0020	HND			-Ir	480	18)
	Max	53967.4420	.0030	HND				60	7)
	Max	53968.3820	.0030	HND				18	7)
	Max	53969.3290	.0030	HND				60	7)
	Max	53975.4600	.0020	HND				76	7)
	Max	53976.4040	.0020	HND				140	7)
UU Aqr	Min	53250.3625	.0004	MS FR				186	8) 31)
HH Aqr	Max	53991.4157	.0008	MZ			-Ir	56	4)
	Max	53991.4180	.0030	AG			-Ir	46	3)
CV Ara	Max	53972.4730	.0030	HND				105	7)
	Max	53977.4900	.0050	HND				36	7)
DL Ara	Max	53951.4430	.0030	HND	+0.1415	GCVS 85		119	7)
	Max	53971.3960	.0030	HND	+0.1405	GCVS 85		92	7)
	Max	53976.3850	.0020	HND	+0.1410	GCVS 85		75	7)
DO Ara	Max	53972.3480	.0040	HND				79	7)
MS Ara	Max	53966.4510	.0030	HND				86	7)
	Max	53975.3740	.0040	HND				43	7)
	Max	53976.4250	.0040	HND				31	7)
QT Ara	Max	53973.3560	.0020	HND				69	7)
	Max	53978.3810	.0030	HND				85	7)
V414 Ara	Max	53951.4900	.0030	HND				96	7)
	Max	53970.4450	.0030	HND				75	7)
V430 Ara	Max	53966.4270	.0050	HND				62	7)
	Max	53984.3950	.0050	HND				74	7)
V455 Ara	Max	53977.3880	.0030	HND				53	7)
V532 Ara	Min	53550.4770	.0020	HND			-Ir	496	18) 25)
	Min	53551.4850	.0020	HND			-Ir	438	18) 25)

Table 2: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$	Bibliography	Fil	n	Rem
V532 Ara	Min	53565.5770	.0030	HND			-Ir	545	18) 25)
VY Boo	Max	53920.4941	.0008	MZ			-Ir	72	4)
AV Boo	Min	53069.6868	.0033	PC			-Ir	22	9) 33)
CG Boo	Max	53814.3896	.0002	MS FR				351	8)
EL Boo	Min	53913.4729	.0024	JU				43	4) 29)
UY Cam	Max	54091.4780	.0030	AG	+0.0557	BAVR 49,41	-Ir	58	3)
EW Cam	Max	54091.4920	.0030	AG			-Ir	52	3)
IU Cas	Max	54055.2950	.0030	AG			-Ir	26	3)
KM Cas	Max	53648.6006	.0069	PC			-Ir	108	9) 30)
PS Cas	Max	54026.4740	.0030	AG			-Ir	24	3)
U1425-00752967									
Cas	Max	54019.5380	.0010	AG				34	3)
DL Com	Max	53899.4242	.0008	MZ			-Ir	0	4)
	Max	53903.4239	.0008	MZ			-Ir	83	4) red
RV CrB	Max	53858.5877	.0050	MS FR	−0.1075	GCVS 85		675	8)
DM Cyg	Max	54070.2531	.0015	WN	−0.0028	BAVR 51,98ff		100	21)
V791 Cyg	Max	54002.3512	.0020	FR			-Ir	33	12)
V881 Cyg	Max	53936.5051	.0008	FR			-Ir	33	12)
	Max	54003.4963	.0015	FR			-Ir	32	12) red
	Max	54035.2944	.0020	FR			-Ir	25	12) red
V882 Cyg	Max	53936.4829	.0020	FR			-Ir	33	12)
V1719 Cyg	Max	53601.4938	.0081	PC	−0.0632	GCVS 85	-Ir	32	9)
ZZ Del	Max	53613.4041	.0095	PC			-Ir	32	9)
BK Del	Max	53966.5720	.0030	AG			-Ir	24	3)
CD Del	Max	53966.3710	.0030	AG			-Ir	21	3)
	Max	54001.3440	.0030	AG			-Ir	25	3)
	Max	54003.3350	.0030	AG			-Ir	38	3)
EG Del	Max	53934.4703	.0013	MZ	+0.0338	GCVS 85	-Ir	119	4)
VY Dor	Min	54121.3510	.0030	HND				57	7) 27)
VZ Dra	Max	53916.4151	.0008	MZ	−0.1545	GCVS 85	-Ir	60	4)
DD Dra	Max	52930.4688	.0051	PC	−0.1149	BAVR 49,6	-Ir	103	9)
RX Eri	Max	54121.3830	.0020	HND	−0.0068	GCVS 85		54	7)
UZ Eri	Max	54120.3550	.0030	HND				50	7)
BY Eri	Max	54118.4080	.0050	HND				31	7)
DT Eri	Max	54121.3840	.0020	HND				58	7)
RX For	Max	54117.3250	.0020	HND				50	7)
SS For	Max	54120.3430	.0030	HND				40	7)
SW For	Max	54118.4080	.0030	HND				58	7)
SX For	Max	54117.4260	.0020	HND				53	7)
TX For	Max	54119.3450	.0030	HND				48	7)
IV Gem	Min	53780.4264	.0013	AG			-Ir	83	4) 25)
TW Her	Max	53992.3517	.0013	SCI	−0.0111	GCVS 85		56	4)
UU Hor	Max	54116.4120	.0030	HND				22	7)
	Max	54118.3460	.0030	HND				77	7)
SX Hyi	Max	54120.3690	.0030	HND				130	7)
BB Hyi	Max	54117.4110	.0050	HND				29	7)
	Max	54119.4210	.0050	HND				138	7)
CH Lac	Max	54024.5190	.0050	AG			-Ir	34	3)
CZ Lac	Max	54096.227 :	.002	WN	−0.038	BAVR 53,12f		100	21)
	Max	54115.2318	.0009	WN	−0.0496	BAVR 53,12f	V	129	21)
	Max	54124.3287	.0005	WN	−0.0285	BAVR 53,12f	V	80	21)
BO Leo	Max	53867.4643	.0030	MZ			-Ir	70	4)
SZ Lyn	Max	54067.5800	.0002	KRS	+0.0279	GCVS 85	V	665	4)
	Max	54067.7015	.0002	KRS	+0.0289	GCVS 85	V	665	4)
	Max	54085.2999	.0001	KRS	+0.0292	GCVS 85	V	571	4)
	Max	54085.4205	.0001	KRS	+0.0292	GCVS 85	V	571	4)
	Max	54085.5652	.0001	KRS	+0.0534	GCVS 85	V	691	4)
	Max	54091.3232	.0001	KRS	+0.0257	GCVS 85	V	691	4)
	Max	54091.4482	.0001	KRS	+0.0302	GCVS 85	V	691	4)
	Max	54091.5392	.0001	KRS	+0.0007	GCVS 85	V	571	4)

Table 2: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$	Bibliography	Fil	n	Rem
SZ Lyn	Max	54116.277 :	.002	KRS	+0.029	GCVS 85	V	362	4)
	Max	54116.3962	.0001	KRS	+0.0274	GCVS 85	V	362	4)
	Max	54116.5168	.0001	KRS	+0.0275	GCVS 85	V	362	4)
TW Lyn	Max	53817.4174	.0021	ATB	+0.0507	GCVS 85		91	3)
AN Lyn	Max	45441.5220	.0013	AG			V	64	1)
CG Lyr	Max	53999.4494	.0009	MZ			-Ir	80	4)
DD Lyr	Max	53251.4537	.0003	MZ			V	26	17)
DI Lyr	Max	53938.4429	.0009	MZ			-Ir	59	4)
NR Lyr	Max	52140.4590	.0030	AG				19	3)
ET Mus	Max	53922.3960	.0030	HND			-Ir	480	18) 28)
	Min	53922.5130	.0020	HND			-Ir	480	18) 28)
NSV2724									
Ori	Max	54075.9106	.0029	HMB				294	10)
	Max	54076.8702	.0027	HMB				288	10)
	Max	54079.7370	.0012	HMB				125	10)
NSV2724									
Ori	Max	54085.9456	.0010	HMB				332	10)
	Max	54104.6630	.0020	HMB				294	10)
	Max	54110.8659	.0008	HMB				384	10)
	Max	54114.6854	.0012	HMB				238	10)
	Max	54126.6041	.0017	HMB				120	10)
VZ Peg	Max	54000.3920	.0050	AG	−0.0037	BAVR 49,41	-Ir	74	3)
AV Peg	Max	54085.3810	.0005	MZ	+0.0275	BAVR 47,67	-Ir	0	4)
BH Peg	Max	53991.3771	.0024	SCI	+0.0198	BAVR 47,67		116	4)
	Max	54000.3396	.0014	SCI	+0.0085	BAVR 47,67		100	4)
	Max	54016.3358	.0017	SCI	−0.0200	BAVR 47,67		112	4)
	Max	54025.3452	.0026	SCI	+0.0156	BAVR 47,67		144	4)
	Max	54039.4166	.0020	SCI	−0.0147	BAVR 47,67		89	4)
CY Peg	Max	53998.4411	.0009	MZ			-Ir	138	4)
	Max	54024.3583	.0040	MZ			-Ir	126	4) red
DY Peg	Max	53932.4553	.0002	KRS	−0.0063	GCVS 87	V	276	5)
	Max	53932.5272	.0002	KRS	−0.0074	GCVS 87	V	276	5)
	Max	53991.3069	.0002	KRS	−0.0062	GCVS 87	V	151	5)
	Max	53991.3798	.0002	KRS	−0.0062	GCVS 87	V	151	5)
	Max	53991.4519	.0002	KRS	−0.0071	GCVS 87	V	151	5)
	Max	53992.3264	.0002	KRS	−0.0077	GCVS 87	V	162	5)
	Max	53992.4010	.0002	KRS	−0.0060	GCVS 87	V	162	5)
	Max	53992.4722	.0002	KRS	−0.0077	GCVS 87	V	162	5)
	Max	53992.5468	.0002	KRS	−0.0061	GCVS 87	V	162	5)
ET Peg	Max	54041.3784	.0005	MZ			-Ir	105	4)
GV Peg	Max	54047.3724	.0002	MZ			-Ir	90	4)
AR Per	Max	54115.4906	.0014	WN	+0.0518	GCVS 87	V	130	21)
NN Per	Max	54034.4800	.0030	AG			-Ir	72	3)
NY Per	Max	54034.3720	.0030	AG			-Ir	74	3)
V375 Per	Max	54033.6720	.0030	AG			-Ir	58	3)
V378 Per	Max	54055.6210	.0030	AG			-Ir	49	3)
	Max	54084.3300	.0020	AG			-Ir	53	3)
SS Psc	Max	54019.6080	.0050	AG	+0.0039	BAVR 47,67	-Ir	66	3)
BT Ser	Max	53985.4307	.0020	MZ			-Ir	180	4) red
AI Tau	Max	54084.4270	.0030	AG			-Ir	35	3)
BO Tau	Max	54096.3133	.0002	MZ			-Ir	89	4)
UX Tri	Max	53285.5619	.0028	ATB	+0.0031	ATB 2006		60	3)
	Max	53291.6246	.0021	ATB	−0.0039	ATB 2006		81	3)
	Max	53350.4293	.0044	ATB	−0.0292	ATB 2006		77	3)
	Max	53387.3198	.0024	ATB	−0.0242	ATB 2006		80	3)
	Max	53408.3683	.0027	ATB	+0.0136	ATB 2006		84	3)
	Max	53659.5706	.0056	ATB	+0.0213	ATB 2006		70	3)
UZ UMa	Max	54091.5550	.0030	AG			-Ir	51	3)
AE UMa	Max	53765.3803	.0002	KRS	+0.0057	BAVR 48,189	V	209	5)
	Max	53765.4660	.0002	KRS	+0.0054	BAVR 48,189	V	209	5)

Table 2: (cont.)

Variable	M/m	JD 24...	±	Obs	$O-C$	Bibliography	Fil	n	Rem
AE UMa	Max	53765.5462	.0002	KRS	−0.0004	BAVR 48,189	V	209	5)
	Max	53766.3278	.0002	KRS	+0.0070	BAVR 48,189	V	185	5)
	Max	53766.4079	.0002	KRS	+0.0011	BAVR 48,189	V	185	5)
	Max	53766.4943	.0002	KRS	+0.0015	BAVR 48,189	V	185	5)
	Max	53766.5849	.0002	KRS	+0.0061	BAVR 48,189	V	185	5)

Remarks:

AG: Agerer, F., Tiefenbach
ATB: Achterberg, Dr. H., Norderstedt
DIE: Dietrich, M., Radebeul
DVY: Dreveny, R.,
ENS: Enskonatus, P., Berlin
FR: Frank, P., Velden
HMB: Hambsch, Dr. F., Mol (B)
HND: Hund, F., Windhoek (Namibia)
HNS: Hanisch, J., Gescher
Ju: Jungbluth, Dr. H., Karlsruhe
KRS: Kersten, Dr. P., Weissach
MS: Moschner, W., Lennestadt
MZ: Maintz, G., Bonn
PC: Poschinger, K., Hamburg
QU: Quester, W., Esslingen
SCI: Schmidt, U. Karlsruhe
WN: Wischnewski, M. Wennigsen
WTR: Walter, F., München

: = uncertain
s = secondary minimum
red = reduced results
1) = photometer 1P21, filter V=GG11; B=BG3+GG13
2) = photometer EMI 9781A, filter V=GG495,1mm
3) = ccd-camera ST-6 chip 375*242 uncoated
4) = ccd-camera ST-7
5) = ccd-camera ST-7 chip KAF0400
6) = ccd-camera ST-7E
7) = ccd-camera ST-8E
8) = ccd-camera ST-9 chip
9) = ccd-camera ST-10 XMR/XME
10) = ccd-camera STL-11K
11) = ccd-camera OES-LcCCD11
12) = ccd-camera OES-LcCCD12
13) = ccd-camera pictor 1616XT
14) = ccd-camera Pictor 416XT
15) = ccd-camera starlight Xpress chip 752x580
16) = ccd-camera starlight Xpress SXV H9
17) = ccd-camera holicam
18) = ccd-camera MX716
19) = ccd-camera Canon EOS D60
20) = ccd-camera CB245
21) = ccd-camera Meade DSI Pro II

Variables which possibly require a new classification

22) = GCVS-type EW/KE - possibly RRC
23) = GCVS-type EW:/KE: - possibly RR
24) = GCVS-type EW:/KW: - possibly RR
25) = GCVS-type RR - possibly E
26) = GCVS-type RR: - possibly E
27) = GCVS-type RR - possibly EB
28) = GCVS-type RRC - possibly EW
29) = GCVS-type DSCT: - possibly RR
30) = GCVS-type SDOR: - possibly RR
31) = GCVS-type SR - possibly E
32) = GCVS-type * - possibly RR
33) = GCVS-type cst - possibly E

AA vv, ppp = Acta Astronomica volume nn, page ppp
ATB = Achterberg (member of the BAV)
BAVM nnn = BAV Mitteilungen No. nnn
BAVR nn, ppp = BAV Rundbrief No. nn, page ppp
GCVS yy = General Catalogue of Variable Stars,4th ed. 19yy
IBVS $nnnn$ = Information Bulletin on Variable Stars No. nnn
MVS vv,ppp = Mitteilungen über Veränderl. Sterne;volume,pages
SAC vv = Rocznik Astronomiczny No. vv, Krakow (SAC)
U = USNO A 2.0 Catalogue
n = Number of measurements

ERRATA FOR IBVS 5296, 5731

Correction to IBVS 5296 = BAVM 152

ER Vul 52141.424 AG correct starname: ER Peg

Corrections to IBVS 5731 = BAVM 178

G472 Aql 53633.4375 QU
53635.3950 QU correct starname: GSC 472.2473

ERRATUM FOR IBVS 5761

Corrections to BAVM 183 AE Cas 54000.4498 SCI correct value: 54017.4498

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RAPID CHANGES IN THE LIGHT CURVE OF THE ACTIVE, LATE-TYPE SUBGIANT CF OCTANTIS

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CF Octantis (HD 196818) is a very active late-type (K0) subgiant showing strong Ca II emission (e.g. Hearnshaw, 1979; Innis et al., 1997) and a 20.15-d spot wave of varying amplitude (Innis et al., 1983; Lloyd Evans & Koen, 1987; Pollard et al., 1989; Innis et al., 1997). The radial velocity data of Lloyd Evans (1986), Balona (1987), Collier Cameron (1987a) and Innis et al. (1997) show no evidence for binarity. The star is active at radio wavelengths (Slee et al., 1987a, 1987b; Vaughan & Large, 1987), indeed it appeared as one of the stronger flaring microwave sources seen in the Parkes survey. It also appears in the ROSAT bright source catalogue (Schwope et al., 2000).

Apart from the work mentioned above, CF Oct has not been well studied, probably in part due to its high southern declination. It was first noted as a variable star on the Bamberg Southern Sky Survey photographic plates (Strohmeier, 1967). A recent reanalysis of the Bamberg material recovered the spot-wave light curve for the years 1964–1969, with some data from 1970, 1971, and 1976, showing the overall light variation of the star from that time (Innis et al., 2004). This photographic material, and the photoelectric photometry noted above, showed that while the spot wave was variable, the changes were slow, and often data from many rotations, or even at times from different seasons, could be combined to produce reasonably well defined light curves. In contrast, our recent data, presented here, reveal the star underwent a rapid change in the form of its spot wave in a very short interval, possibly also showing a low level of continuous change.

We commenced observations of CF Oct in mid 2006. We used an ST7 CCD and motorised BVR filter wheel on a 70-mm diameter, 480-mm focal length refractor. The field of view of the CCD was 0.8×0.55 degrees. (See Innis et al., 2007, for more details of the equipment and method.) CF Oct and the comparison star HD 196520 could be obtained on the same frame. HD 196520 was also used as a comparison star by Lloyd Evans et al. (1983), Collier Cameron (1987b), Pollard et al. (1989) and Innis et al. (1997), and has not been seen to vary. CF Oct and HD 196520 are almost identical in $B-V$, so that colour transformation corrections are negligible. We use $B-V = 1.07$ and $V = 7.60$ (Innis et al., 1997) for HD 196520.

CF Oct was observed for a total of 38 nights between 2006 July and 2007 March. We collected four 45-second B and four 30-second V exposures in succession and averaged the measurements, so that each resultant data point represents an equivalent 180- or 120-second integration in B and V respectively. We typically repeated this sequence at least four times on a given night. We have in total around 240 measurements (each composed of a 4-point average as noted) in each of B and V. The resulting V-light phase plot, using the period of 20.15 d (from Pollard et al., 1989; Innis et al., 1997) is shown in Figure 1. On any given night the scatter in the data is not much greater than the nominal ±0.01 mag error bar shown in the top left of the Figure. We have inspected the magnitude differences between the comparison star HD 196520 and several fainter field stars, and find no evidence for long-term change greater than 0.01 or 0.02 mag. (We had originally intended using the star CPD −80 966 as the check star, but our data have shown this to be a red semiregular star, Innis et al., 2006.) We conclude that the scatter seen in the phase plot was due to real changes in CF Oct.

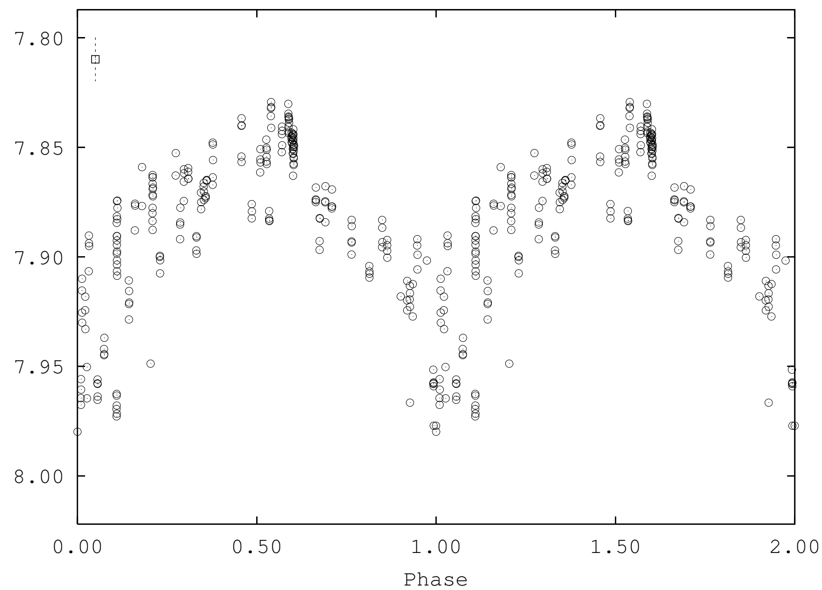

Figure 1. CF Octantis V light curve for 2006 July–2007 March, phased with the known 20.15 d rotation period. The symbol in the top left of the plot represent a typical error bar per point of ±0.01 mag. The scattered nature of the plot is due to a real variation in the star

The changes in CF Oct are more easily seen in Figure 2, where we plot V magnitude versus HJD. We also show two least-squares fitted sine waves to better illustrate the changes. These are not intended to be fits to the data (the star clearly does not have a pure sinusoidal variation) but are to assist in judging the phasing of the data when inspecting the plot. We fixed the periods of the sine waves to be 20.15 d, and allowed the amplitudes, mean levels and phases to be determined in the fit. We arbitrarily split the data at HJD 2454040 when fitting the two sine waves.

The amplitude of the first segment of data (pre HJD 2454040) is about 0.12 mag peak-to-peak, which is around twice that of the later data. It appears that both maximum and minimum light have changed over the course of the observations, with maximum light being several hundredths of a magnitude fainter at the end of the data set compared to the start. The change in maximum light has the appearance of a step-like decrease near HJD 2454040. Minimum light appears to have brightened, but possibly in a more gradual manner, and may have been continually variable.

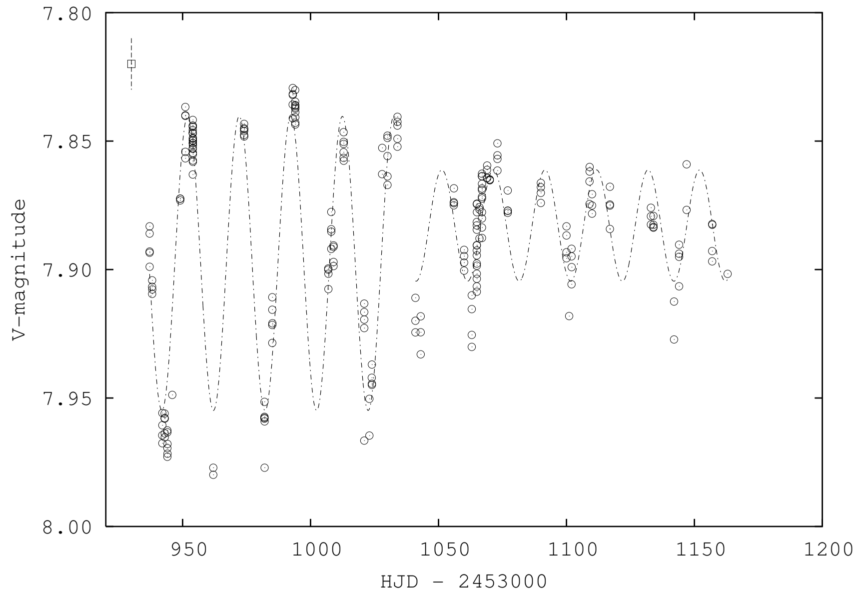

Figure 2. CF Octantis V light curve versus HJD for 2006 July–2007 March (circles). The lines represent two least-squares fitted sine curves, as a schematic representation of the data before and after HJD 2454040. It is clear that the light curve is variable, possibly continually variable, but that a significant change occurred near the above noted date. The symbol in the top left of the plot represent a typical error bar per point of ± 0.01 mag

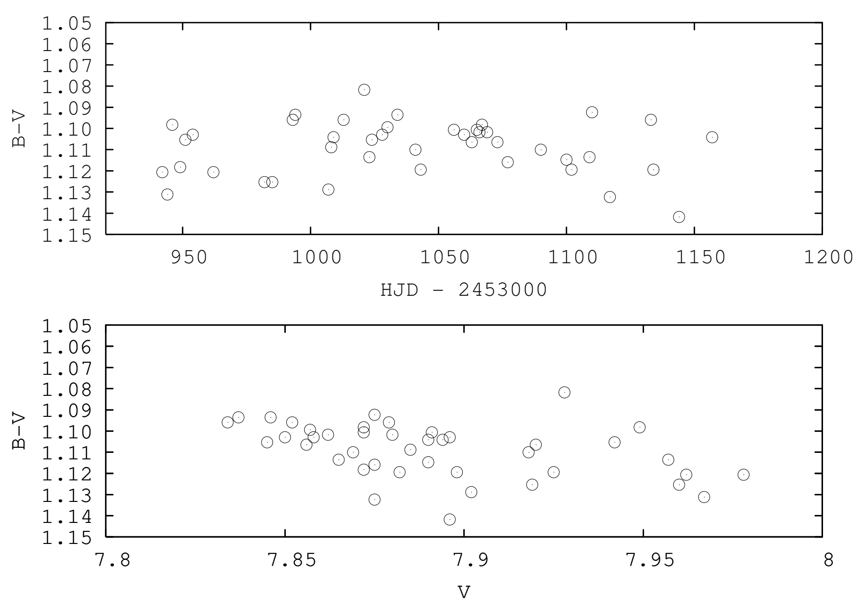

Figure 3. Top panel: CF Octantis $B-V$ light curve versus HJD. These are nightly averaged points. Lower panel: Nightly averaged $B-V$ versus V

Such rapid changes in the light curve of CF Oct have not been previously reported. Possibly the starspots are currently undergoing an interval of rapid change. It is also possible that the earlier published observations represented an unusually stable interval of spot behaviour, although the photoelectric data cover the interval ~ 1979 to ~ 1989.

Changes in the light curve of the fast-rotating, active star FK Com have been interpreted as being due to either *phase jumps*, when a new spot (or spot group) first appears around 90° in longitude away from an existing spot, or as *flip-flops* when a new spot first appears 180° away from a decaying spot (Oláh et al., 2006). The recent behaviour of CF Oct, with a contemporaneous variation in minimum and maximum light, may be suggestive of similar types of changes. Further analysis is planned.

Our nightly averaged $B-V$ data are shown in Figure 3. The top panel shows $B-V$ versus HJD, while the lower panel shows $B-V$ versus V. A clear gradient is seen in the lower panel, which is similar to the spot-induced colour change reported in Pollard et al. (1989) and Innis et al. (1997). These new data suggest CF Oct may be slightly bluer at a given V magnitude compared to the 1980s-era photoelectric photometry, but small errors in the transformations may equally well account for the differences.

We will continue to monitor this star. It would be of interest to obtain new spectroscopic observations of the Ca II and Hα lines, and also see if the possible increased activity is manifested in the radio and X-ray spectral regions.

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SDSS J102146.44+234926.3: NEW WZ SGE-TYPE DWARF NOVA

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The cataclysmic variable SDSS J102146.44+234926.3 (SDSS J1021 hereafter; $\alpha_{2000} = 10^{\mathrm{h}}21^{\mathrm{m}}46\overset{\mathrm{s}}{.}44; \delta_{2000} = +23^\circ 49' 26\overset{''}{.}3$) was discovered in outburst having a V magnitude of $13\overset{\mathrm{m}}{.}9$ by Christensen on CCD images obtained in the course of the Catalina Sky Survey on October 28.503 UT 2006. In an archival image there is a star with $V \sim 21^{\mathrm{m}}$ at this position (Christensen, 2006) and there is an object in the database of the *Sloan Digital Sky Survey* Data Release 5 (Adelman-McCarthy et al., 2007; SDSS DR5 hereafter) with the following magnitudes, measured on January 17.455 UT, 2005: $u = 20.83, g = 20.74, r = 20.63, i = 20.84, z = 20.45$. In the USNO-B1.0 catalog this object is listed as USNO-B1.0 1138-0175054 with magnitudes $B_{2\mathrm{mag}} = 20.79$ and $R_{2\mathrm{mag}} = 20.35$. The large amplitude and the blue color imply that the object could be a dwarf nova of SU UMa or WZ Sge type (Waagen, 2006).

Fig. 1 (left) shows the $8' \times 8'$ image of the SDSS J1021 vicinity, generated from SDSS DR5 Finding Chart Tool (`http://cas.sdss.org/astrodr5/en/tools/chart/chart.asp`).

Time resolved CCD photometry has been carried out from different sites by the authors since November 21, 2006 (the first night after the discovery was reported) until 2006 December 06 (Data available for download at `http://www.aavso.org/data/download` and from IBVS server; See Table 1 for log of observations). The photometry was done in the V and R_c bands as well as unfiltered; this did not affect the following period analysis. The error of a single measurement can be typically assumed to be $\pm 0\overset{\mathrm{m}}{.}02$. Fig. 1 (right) shows the overall light curve of the object. Here we assume $m_R = m_{\rm unfiltered}$. The light curve could be divided into three parts, denoting the plateau stage, dip and long-lasting echo-outburst (rebrightening).

Before carrying out Fourier analysis for the presence of short-periodic signal in the light curve (superhumps), each observer's data set was individually transformed to a uniform zero-point by subtracting a linear fit from each night's observations. This was done to remove the overall trend of the outburst and to combine all observations into a single data set.

From the periodogram analysis (Fig. 2, left) the value of the superhump period $P_{\rm sh} = 0\overset{\rm d}{.}05633 \pm 0.00003$ was determined. Such a value is typical for the WZ Sge-type systems and is just 58.7 seconds shorter than $P_{\rm sh}$ of another WZ Sge-like system: ASAS 002511+1217.2 (Golovin et al., 2005).

The superhump light curve (with 15-point binning used) folded with $0\overset{\rm d}{.}05633$ period is shown on Fig. 2 (right). It is plotted for two cycles for clarity. Only JD 2454061.0-2454063.6 data was included. Note the $0\overset{\rm m}{.}1$ amplitude of variations and the double-humped profile of the light curve. There remain many questions concerning the nature of a double-humped superhumps in the WZ Sge-type stars. The explanation of a double-humped light curve could lie in a formation of a two-armed precessional spiral density wave in the accretion disk (Osaki, 2003) or a one-armed *optically thick* spiral wave, but with the occurrence of a self-eclipse of the energy emitting source in the wave (Bisikalo, 2006).

Other theories concerning a double-peaked superhumps can be found in Lasota et al. (1995), Osaki & Meyer (2002), Kato (2002), Patterson et al. (2002), Osaki & Meyer (2003).

Applying the method of "sliding parabolas" (Marsakova & Andronov, 1996) we deter-

Table 1. Log of observations

JD (mid of obs. run)	Duration of observational run [minutes]	Observatory	Telescope	CCD	Filter
2454060.9	214	Rolling Hills, FL, USA	Meade LX200-10	SBIG ST-9	V
2454061.0	158	Cloudcroft, NM, USA	C-11	SBIG ST-7	none
2454062.0	259	Cloudcroft, NM, USA	C-11	SBIG ST-7	none
2454062.9	288	Cloudcroft, NM, USA	C-11	SBIG ST-7	none
2454063.6	115	CrAO, Ukraine	K-380	SBIG ST-9	R
2454064.6	222	CrAO, Ukraine	K-380	SBIG ST-9	R
2454066.7	S.D.P. *	Pic du Midi, France	T-60	Mx516	None
2454067.6	90	CrAO, Ukraine	K-380	Apogee 47p	R
2454067.9	S.D.P.	Las Cruses, NM, USA	Meade LX200	SBIG ST-7	V
2454069.0	S.D.P.	Arch Cape, USA	SCT-30	SBIG ST-9	V
2454069.0	S.D.P.	Las Cruses, NM, USA	Meade LX200	SBIG ST-7	V
2454069.6	63	CrAO, Ukraine	K-380	Apogee 47p	R
2454071.9	S.D.P.	Las Cruses, NM, USA	Meade LX200	SBIG ST-7	V
2454072.9	S.D.P.	Las Cruses, NM, USA	Meade LX200	SBIG ST-7	V
2454073.9	S.D.P.	Las Cruses, NM, USA	Meade LX200	SBIG ST-7	V
2454074.9	S.D.P.	Las Cruses, NM, USA	Meade LX200	SBIG ST-7	V
2454075.9	S.D.P.	Las Cruses, NM, USA	Meade LX200	SBIG ST-7	V
2454166.8	S.D.P.	Sonoita Observatory, USA	0.35 m telescope	SBIG STL-1001XE	V
2454167.7	S.D.P.	Sonoita Observatory, USA	0.35 m telescope	SBIG STL-1001XE	V

* S.D.P. - Single Data Point

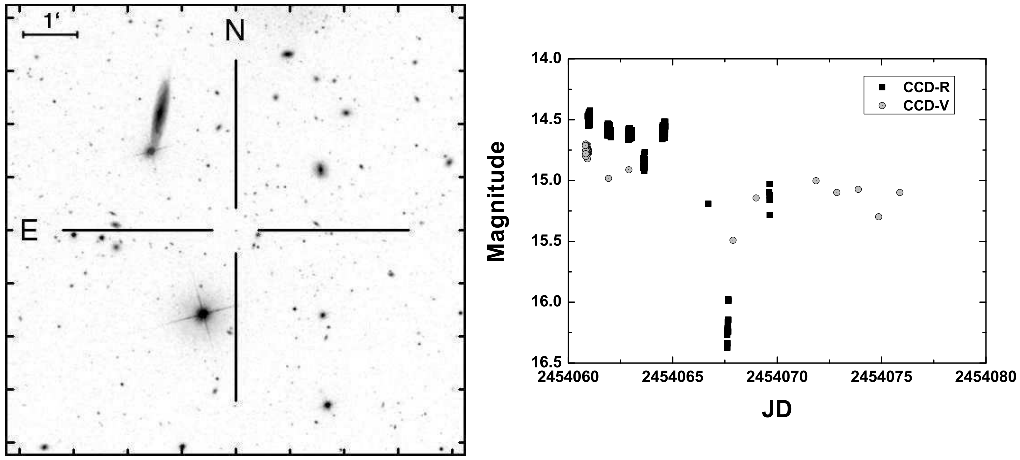

Figure 1. Left: SDSS image of the SDSS J1021 vicinity. Right: Light curve of SDSS J1021 during the outburst

mined, when it was possible (JD 2454061.0–2454063.6), the times of maxima of superhumps (with mean 1σ error of $0\overset{\mathrm{d}}{.}0021$) and calculated $O-C$ residuals based on founded period. The moments of superhump maximua are given in Table 2. No period variations reaching the 3σ level were found during the time of observations.

Another prominent feature of the SDSS J1021 light curve is the echo-outburst (or *re-brightening* — another term for this event) that occurs during the declining stage of the superoutburst. On Nov. 27/28 2006 (i.e. JD 2454067.61-2454067.68) a rapid brightening with the rate of $0\overset{\mathrm{m}}{.}13$ per hour was detected at Crimean Astrophysical Observatory (Ukraine; CrAO hereafter), that most probably was the early beginning of the echo-outburst. Judging from our light curve, we conclude that rebrightening phase lasted at least 8 days. Similar echo-outbursts are classified as "type-A" echo-outburst according to classification system proposed by Imada et al. (2006) as observed in the 2005 superoutburst of TSS J022216.4+412259.9 and the 1995 superoutburst of AL Com (Imada et al., 2006; Patterson et al., 1996).

Rebrightenings during the decline stage are observed in the WZ Sge-type dwarf novae (as well as in some of the WZ Sge-type candidate systems). However, their physical mechanism is still poorly understood. In most cases, just one rebrightening occurs (also observed sometimes in typical SU UMa systems), though a series of rebrightenings are also possible, as it was manifested by WZ Sge itself (12 rebrightenings), SDSS J0804 (11) and EG Cnc (6) (Pavlenko et al., 2007). There are several competing theories concerning what causes an echo-outburst(s) in such systems, though all of them predict that the disk must be heated over the thermal instability limit for a rebrightening to occur. See papers by Patterson et al. (1998), Buat-Menard & Hameury (2002), Schreiber & Gansicke (2001), Osaki, Meyer & Meyer-Hofmeister (2001) and Matthews et al. (2005) for a discussion of the physical reasons for echo-outbursts.

Recent CCD-V photometry manifests that SDSS J1021 has a magnitude of $19\overset{\mathrm{m}}{.}72\pm0.07$ and $19\overset{\mathrm{m}}{.}59\pm0.07$ as of 06 March and 07 March, 2007 (HJD = 2454165.80 and HJD = 2454167.74) respectively, at Sonoita Research Observatory (Sonoita, Arizona, USA) using a robotic 0.35 meter telescope equipped with an SBIG STL-1001XE CCD camera.

Spectroscopic observations were carried out on November 21.8 UT with the CCD spectrograph mounted on the 1.01-m telescope of Bisei Astronomical Observatory (Japan).

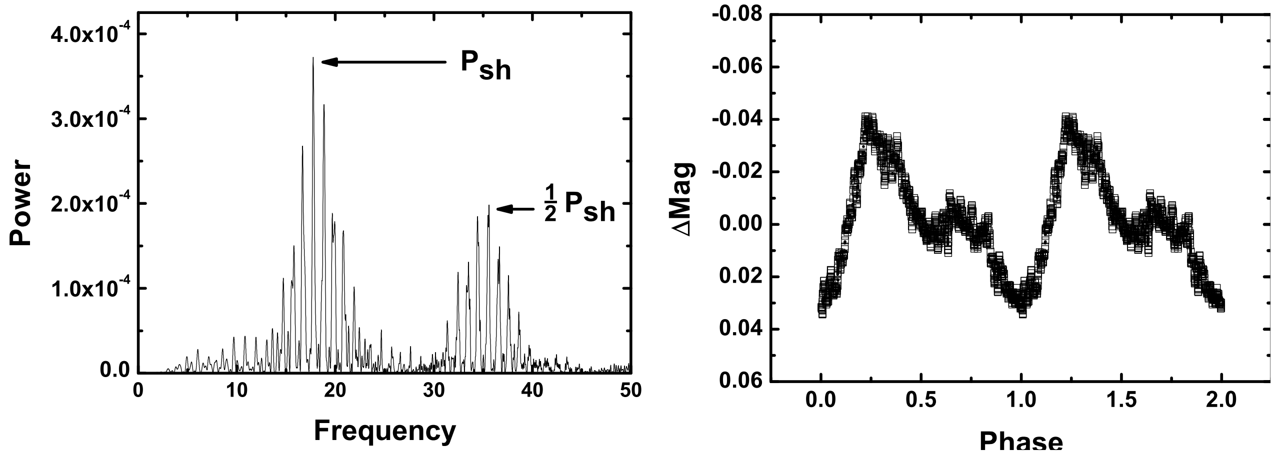

Figure 2. Left: Power spectrum, revealing the $P_{\rm sh}$ of SDSS J1021. Right: Superhump profile of SDSS J1021

Table 2. Times of superhump maximums

HJD	E	$O-C$	$\sigma_{(O-C)}$
2454061.03380	0	0	0.00120
2454061.88103	15	0.00228	0.00130
2454061.93507	16	−0.00001	0.00368
2454061.99121	17	−0.00020	0.00099
2454062.89325	33	0.00056	0.00179
2454062.94709	34	−0.00193	0.00214
2454063.00533	35	−0.00002	0.00156
2454063.62385	46	−0.00113	0.00464

The preliminary discussion of the spectra can be found in (Ayani & Kato, 2006). The spectral range is 400–800 nm, and the resolution is 0.5 nm at H_α. HR 3454 ($\alpha_{2000} = 08^{\rm h}43^{\rm m}13\overset{\rm s}{.}475; \delta_{2000} = +03°23'55\overset{''}{.}18$) was observed for flux calibration of the spectra. Standard IRAF routines were used for data reduction.

Spectrum (Fig. 3) shows blue continuum and Balmer absorption lines (from H_ϵ to H_α) together with K CaII 3934 in absorption. Very weak HeI 4471, Fe 5169, NII 5767 absorption lines may be present. H_ϵ 3970 is probably blended by H Ca II 3968. The FeIII 5461 line resembles weak P-Cygni profile. Noteworthy, FeIII 5461 and NII 5767 may be artifacts caused by imperfect subtraction of city lights: HgI 5461 and 5770 (spectrum of the sky background which was subtracted, is available upon request). The HeI 5876 line (mentioned for this object in Rau et al., 2006) is not detectable on our spectrum. It is remarkable that H_α manifests a "W-like" profile: an emission component embedded in the absorption component of the line.

Table 3 represents EWs (equivalent widths) of detected spectral lines. EW was calculated by direct numerical integration over the area under the line profile.

The archive photographic plates from the Main Astronomical Observatory Wide Field Plate Archive (Kyiv, Ukraine; MAO hereafter) and Plate Archive of Sternberg Astronomical Institute of Moscow State University (Moscow, Russia; SAI hereafter) and plate from Crimean Astrophysical Observatory archive (Ukraine) were carefully scanned and inspected for previous outbursts on the plates dating from 1978 to 1992 from MAO, 1913–1973 from SAI and 1948 from CrAO archives. The number of plates from each archive

Table 3. Equivalent widths of spectral lines

Line	EW [Å]
K CaII 3934	−5.8
H_ϵ 3970 / H CaII 3968	−8.7
H_δ 4101	−6.4
H_γ 4340	−8.5
H_β 4861	−6.4
H_α 6563	−7.7
H_α 6563 (emission)	2.3
HeI 4471	−0.95
FeII 5169	−0.65
NII 5767	−0.7

is 22 for SAI, 6 for MAO and 1 for CrAO archives. For all plates the magnitude limit was determined (this data as well as scans of plates are available upon request). The selection of plates from MAO archive was done with the help of the database developed by L.K. Pakuliak, which is accessible at *http://mao.kiev.ua/ardb/* (Sergeeva et al., 2004; Pakuliak, L.K. & Sergeeva, T.P., 2006;). No outbursts on the selected plates from the MAO, SAI and CrAO archives were detected. This implies that outbursts in SDDS J1021 are rather rare, which is typical for the WZ Sge-type stars.

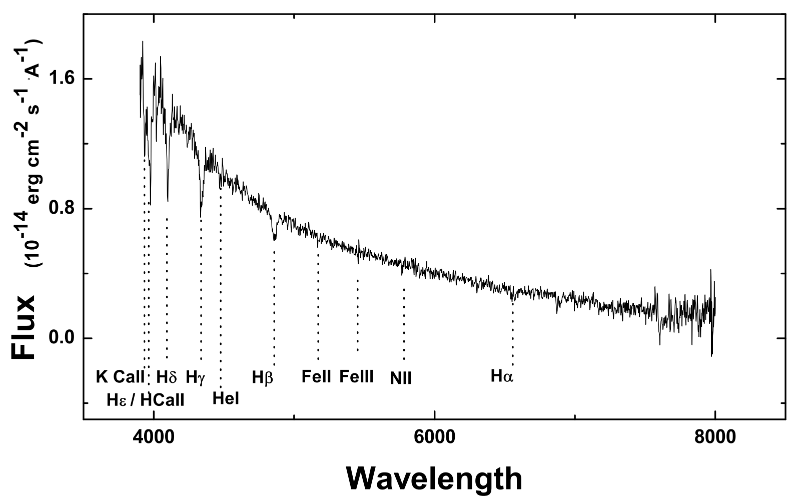

Figure 3. Spectra of SDSS J1021 obtained on November 21.8 UT on 1.01-m telescope of Bisei Astronomical Observatory (Japan)

Table 4 (available only electronically from IBVS server or via AAVSO ftp-server at `ftp://ftp.aavso.org/public/calib/varleo06.dat`) represents BVR_cI_c photometric calibration of 52 stars in SDSS J1021 vicinity, which have a V-magnitude in the range of $11^{\rm m}_{.}21$–$17^{\rm m}_{.}23$ and can serve as a comparison stars. Calibration (by AH[8]) was done at Sonoita Research Observatory (Arizona, USA).

The large amplitude of the SDSS J1021 outburst of $7^{\rm m}$, superhumps with a period below the "period gap", rebrightening during the declining stage of superoutburst, rarity of outbursts and obtained spectrum allow to classify this object as a WZ Sge type dwarf nova.

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NEW TIMES OF MINIMA OF SOME ECLIPSING VARIABLES

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Observatory and telescope:
URSA: URSA Observatory at the University of Arkansas (`ursa.uark.edu`); 10-inch Schmidt-Cassegrain reflector. NFO: NFO WebScope near Silver City, NM, USA (`www.nfo.edu`); 24-inch classical Cassegrain.

Detector:	URSA: 1020×1530 pixels SBIG ST8EN CCD cooled to (typ.) −20°C; 1.15 arcsec square pixels; 20′(N-S)×30′(E-W) field of view. NFO: 2102×2092 pixels Kodak KAF 4300E CCD cooled to (typ.) −20°C; 0.78 arcsec square pixels; 27′ square field of view.

Method of data reduction:
Virtual measuring engine (Measure 2.0) written by C.H.S. Lacy (2005).

Method of minimum determination:
Kwee & van Woerden (1956)

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
AP And	53733.5372	0.0001	1	V	URSA
	53736.7119	0.0004	1	V	NFO
	53916.8694	0.0003	2	V	NFO
	53998.6147	0.0002	1	V	NFO
	54009.7256	0.0002	1	V	NFO
	54017.6619	0.0002	1	V	URSA
	54021.6303	0.0002	2	V	URSA
	54021.6302	0.0002	2	V	NFO
	54028.7733	0.0001	1	V	URSA
	54029.5670	0.0001	2	V	URSA
	54032.7414	0.0001	2	V	URSA
	54048.6143	0.0002	2	V	URSA
	54051.7892	0.0002	2	V	URSA
	54052.5824	0.0002	1	V	NFO
	54059.7253	0.0002	2	V	NFO
	54063.6939	0.0001	1	V	URSA
	54067.6620	0.0003	2	V	NFO
	54071.6304	0.0003	1	V	URSA
	54071.6299	0.0002	1	V	NFO

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
AP And	54075.5982	0.0003	2	V	NFO
	54082.7410	0.0001	1	V	NFO
	54086.7091	0.0001	2	V	NFO
	54094.6458	0.0001	2	V	NFO
	54110.5186	0.0002	2	V	URSA
CO And	53731.5451	0.0002	2	V	URSA
	53751.6494	0.0003	1	V	URSA
	54016.6612	0.0004	1	V	URSA
	54027.6270	0.0003	1	V	NFO
	54038.5924	0.0005	1	V	URSA
	54045.9039	0.0003	1	V	NFO
	54047.7310	0.0002	2	V	NFO
	54067.8365	0.0006	1	V	NFO
	54080.6281	0.0002	2	V	NFO
	54100.7342	0.0002	1	V	NFO
CG Aur	54063.8508	0.0004	2	V	URSA
	54071.9252	0.0005	1	V	URSA
	54109.8242	0.0003	1	V	URSA
	54109.8241	0.0002	1	V	NFO
	54110.7769	0.0005	2	V	URSA
	54110.7750	0.0006	2	V	NFO
	54138.6998	0.0003	1	V	NFO
HP Aur	53735.5350	0.0003	2	V	URSA
	53764.7023	0.0003	1	V	NFO
	53771.8161	0.0002	1	V	NFO
	53776.7970	0.0003	2	V	NFO
	53779.6425	0.0002	2	V	URSA
	53781.7770	0.0002	1	V	NFO
	53786.7573	0.0002	2	V	NFO
	53811.6569	0.0002	1	V	URSA
	53995.9131	0.0003	2	V	NFO
	54022.9466	0.0003	2	V	URSA
	54032.9059	0.0002	2	V	URSA
	54049.9798	0.0001	2	V	NFO
	54059.9401	0.0001	2	V	NFO
	54069.8998	0.0003	2	V	NFO
	54077.7262	0.0003	1	V	NFO
	54091.9536	0.0002	1	V	NFO
	54094.7994	0.0002	1	V	NFO
	54109.7384	0.0004	2	V	URSA
	54131.7931	0.0003	1	V	URSA
	54134.6376	0.0002	1	V	URSA
	54134.6378	0.0002	1	V	NFO
	54136.7722	0.0002	2	V	NFO
V456 Cyg	53900.8502	0.0001	1	V	URSA
	54004.6746	0.0002	2	V	NFO
V974 Cyg	53838.9325	0.0004	1	V	NFO
V1136 Cyg	53866.9000	0.0007	2	V	NFO
	53873.8239	0.0009	2	V	URSA

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
BF Dra	54019.6359	0.0006	2	V	NFO
	54036.6322	0.0002	1	V	NFO
GX Gem	53733.8903	0.0004	2	V	URSA
	53733.8889	0.0007	2	V	NFO
	53741.9658	0.0006	2	V	NFO
	53808.5921	0.0006	1	V	URSA
	53818.6871	0.0003	2	V	NFO
	54042.7918	0.0004	1	V	URSA
	54044.8142	0.0004	2	V	NFO
	54046.8303	0.0003	1	V	NFO
	54048.8492	0.0004	2	V	URSA
	54050.8679	0.0007	1	V	NFO
	54052.8871	0.0005	2	V	NFO
	54058.9444	0.0003	1	V	NFO
	54060.9613	0.0005	2	V	NFO
	54062.9824	0.0005	1	V	URSA
	54125.5673	0.0005	2	V	URSA
	54129.6067	0.0004	2	V	URSA
	54135.6650	0.0004	1	V	NFO
	54137.6834	0.0003	2	V	NFO
	54139.7025	0.0003	1	V	NFO
	54147.7777	0.0003	1	V	NFO
LV Her	53870.8866	0.0002	2	V	NFO
	53907.7573	0.0002	2	V	URSA
	53928.7308	0.0003	1	V	NFO
RW Lac	54052.6655	0.0011	2	V	NFO
V506 Oph	53880.9280	0.0001	1	V	NFO
	53905.8481	0.0002	2	V	URSA
	53913.8012	0.0002	1	V	URSA
	53914.8613	0.0002	1	V	URSA
	53914.8613	0.0002	1	V	NFO
	54007.6489	0.0002	2	V	NFO
	54137.0212	0.0004	2	V	NFO
	54179.9684	0.0001	1	V	NFO
V530 Ori	54104.7112	0.0009	2	V	NFO
IM Per	53734.7371	0.0004	1	V	URSA
	53734.7368	0.0005	1	V	NFO
	53760.6667	0.0003	2	V	URSA
IM Per	54010.8849	0.0006	2	V	NFO
	54028.9216	0.0008	2	V	URSA
	54037.9356	0.0005	2	V	URSA
	54037.9354	0.0002	2	V	NFO
	54053.7154	0.0005	2	V	NFO
	54061.6011	0.0003	1	V	URSA
	54070.6165	0.0002	1	V	NFO
	54107.8150	0.0003	2	V	NFO
	54124.7191	0.0002	1	V	NFO
	54176.5689	0.0004	1	V	URSA

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
NP Per	54021.8587	0.0003	1	V	URSA
	54021.8589	0.0001	1	V	NFO
	54108.7723	0.0002	1	V	URSA
V482 Per	53739.7567	0.0003	1	V	URSA
	53744.6506	0.0003	1	V	URSA
	53766.6715	0.0002	1	V	URSA
	53793.5857	0.0003	1	V	URSA
	54057.8341	0.0003	1	V	URSA
	54073.7380	0.0003	2	V	URSA
V514 Per	53799.6571	0.0006	2	V	NFO
	54081.6271	0.0006	2	V	NFO
	54130.7458	0.0007	2	V	NFO
AQ Ser	53740.0003	0.0011	2	V	URSA
	53766.9983	0.0003	2	V	NFO
	53777.9660	0.0005	1	V	NFO
	53788.9354	0.0003	2	V	NFO
	53837.8704	0.0002	2	V	NFO
	53842.9333	0.0004	2	V	NFO
	53843.7773	0.0006	1	V	URSA
	54171.9817	0.0004	2	V	NFO
CF Tau	53738.6338	0.0004	2	V	URSA
	53742.7627	0.0005	1	V	URSA
	53749.6548	0.0005	2	V	URSA
	53753.7858	0.0006	1	V	NFO
	54041.7705	0.0005	2	V	URSA
	54041.7675	0.0004	2	V	NFO
	54085.8649	0.0004	2	V	NFO
BP Vul	53987.7740	0.0001	1	V	NFO
	54026.5809	0.0001	1	V	URSA
BT Vul	53867.9405	0.0002	1	V	NFO
	53875.9294	0.0002	1	V	NFO
	53887.9115	0.0003	2	V	NFO
	53895.7740	0.0002	1	V	URSA
	53902.7463	0.0004	2	V	URSA
	53914.7286	0.0002	1	V	URSA
	53915.8699	0.0002	1	V	NFO
	54015.7258	0.0009	2	V	URSA
	54031.7022	0.0002	2	V	NFO
	54042.5445	0.0003	1	V	URSA
EQ Vul	53901.8290	0.0008	1	V	URSA

Remarks:

A sample of the observations has been published by Lacy et al. (2001). Mean deviations between independently timed eclipses by the two telescopes are not significantly larger than expected, implying that the estimated timing uncertainties are realistic.

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A SUDDEN PERIOD CHANGE IN THE RRc VARIABLE GSC 6199-0755

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The All Sky Automated Survey (*ASAS-3*; Pojmanski & Maciejewski, 2004) found the star ASAS 155552-2148.6 = GSC 6199-0755 to be a new first overtone RR Lyrae (RRc) variable with a period of 0.254144 days (coordinates for equinox 2000.0: $\alpha = 15^{\rm h}55^{\rm m}51\overset{\rm s}{.}59$, $\delta = -21^\circ 48' 32\overset{''}{.}8$). However, phase plots show that it is impossible to find one single fixed period to fit the *ASAS-3* data for the years 2001–2006 and the data from the Northern Sky Variability Survey (*NSVS*; Wozniak et al., 2004) for the years 1999 and 2000. This indicates that the period has changed in the interval. In general, the study of period changes in variable stars is based on $O-C$ diagrams. These studies are often hindered by large gaps between observations, as they cause difficulties to obtain unambiguous cycle counts. For GSC 6199-0755 this is not a problem since eight years of nearly continuous data exist.

To further investigate the period of this star, the two *NSVS* data sets were shifted by 0.14 magnitude to align them with the *ASAS-3* data set. Heliocentric correction of the *NSVS* times of observations were taken into account. No attempt was made to convert the red sensitive *NSVS* magnitudes to the V system of *ASAS-3*. The amplitude of the star in the *NSVS* data is therefore slightly less than in V. In addition FJH collected data of this star with a 50-cm Ritchey–Chrétien telescope with an unfiltered STL11000XM CCD camera during 11 nights early 2007. Fig. 1 gives the phase plot of all available data using the average period for the total observing interval. The data have been plotted with a different symbol for each year. Uncertainties on the magnitude values (not plotted for clarity) are generally of the order of 0.03 magnitude for the survey data, and about 0.01 mag for the data of FJH. The latter are presented in the plot as averages of 5 consecutive data points. It is obvious that there is a considerable phase shift over the years.

The period change was studied in more detail in two ways. First normal maxima were calculated for each of the eight available years. The light curve of GSC 6199-0755 shows a hint of a short pre-maximum hump that is often seen in other RRc stars as well. This is fairly obvious from our recent data. There is an indication that the magnitude of this hump varies from cycle to cycle, but this has to be investigated further. This hump also makes it difficult to get a reliable time of maximum for the years with less data. Since there is no indication that the general shape of the light curve has changed over the

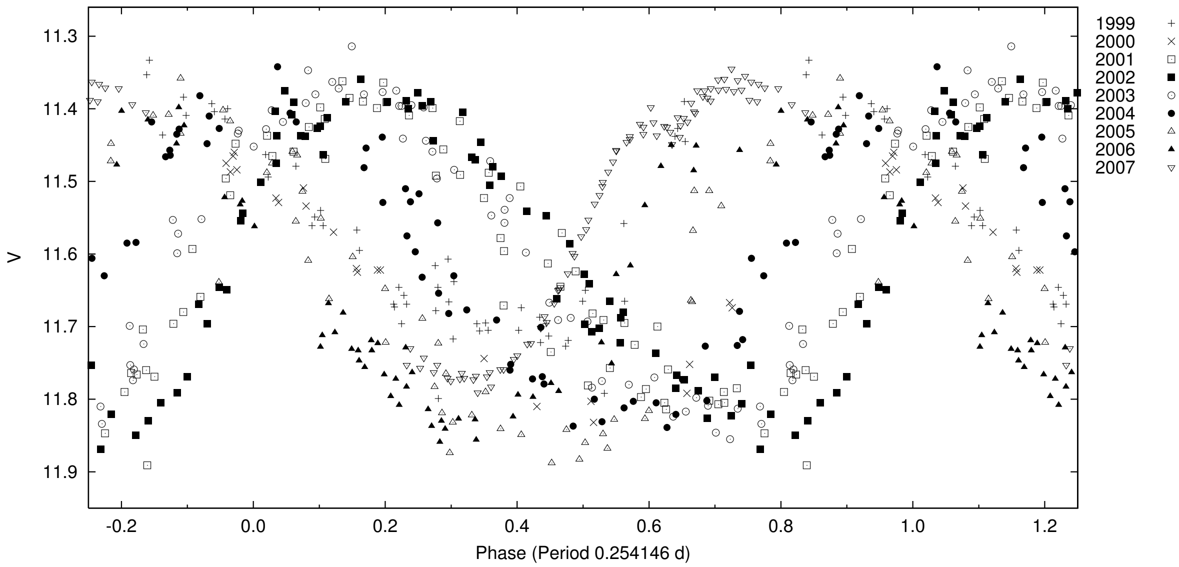

Figure 1. Phase plot of GSC 6199-0755 with one fixed period for the years 1999–2000 (*NSVS*), 2001–2006 (*ASAS-3*), 2007 (HMB)

years, a model curve (a Fourier series with the main frequency and two harmonics) was therefore calculated from the *ASAS-3* data for 2002. This model was then fitted to the data of the other years to get a time of maximum (allowing for differences in amplitude for the unfiltered data), giving a consistent set of maxima timings over the years. The calculated times of maxima are presented in Table 1. Uncertainties of these times are of the order of 0.01 days or better.

Table 1: Normal times of maximum of GSC 6199-0755

HJD − 2450000	E	$O-C$ (1)	$O-C$ (2)	$O-C$ (3)	$O-C$ (4)	Source
1313.554	−2912	−0.062	−0.011	+0.000		NSVS
1614.752	−1727	−0.022	−0.005	−0.000		NSVS
2053.713	0	+0.037	+0.018	+0.000		ASAS-3
2396.567	1349	+0.054	+0.019		−0.003	ASAS-3
2834.948	3074	+0.040	+0.001		+0.007	ASAS-3
3129.477	4233	+0.019	−0.013		+0.002	ASAS-3
3518.032	5762	−0.009	−0.020		−0.005	ASAS-3
3812.566	6921	−0.025	−0.011		−0.006	ASAS-3
4174.964	8347	−0.033	+0.022		+0.005	HMB

Using these times of maximum a linear and a parabolic ephemeris were calculated. These are given below with formal uncertainties on the last digit between brackets.

$$\mathrm{HJD(Max)} = 2452053.677(15) + 0.254142(3) \times E, \tag{1}$$

$$\mathrm{HJD(Max)} = 2452053.695(7) + 0.254157(3) \times E - 2.9(4) \times 10^{-9} E^2. \tag{2}$$

The $O-C$ values for both sets of elements are given in Table 1, those for the linear ephemeris are also plotted in Fig. 2, together with the calculated parabolic elements.

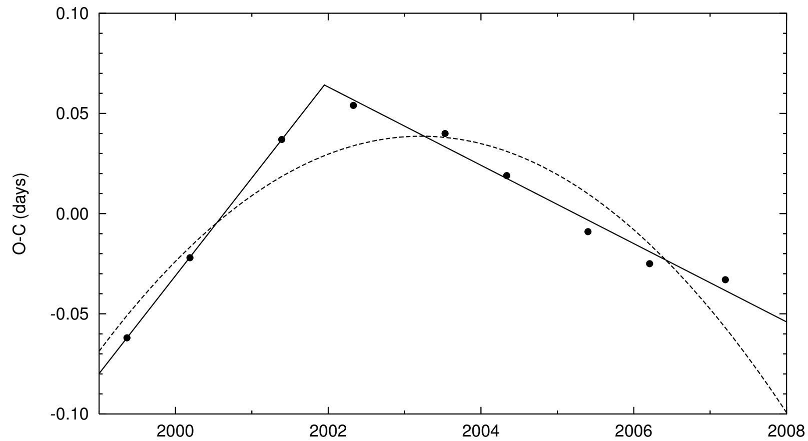

Figure 2. $O-C$ plot for GSC 6199-0755 with the period of equation (1). Also given are the parabolic elements (dashed line) and line segments (solid lines) corresponding to the elements with a sudden period change

From the latter a period decrease $dP/dt = 0.72 \pm 0.11$ s/yr would follow, much higher than what is expected from evolutionary considerations (Smith, 1995). However, neither the linear nor the parabolic ephemeris gives a good fit to the available times. Fig. 2 rather suggests an abrupt period change at the end of 2001. Fitting linear elements for these two intervals results in the following equations:

$$\mathrm{HJD(Max)} = 2452053.713(1) + 0.2541756(1) \times E \tag{3}$$

before JD 2452258 and

$$\mathrm{HJD(Max)} = 2453129.476(2) + 0.2541281(9)(E - 4233) \tag{4}$$

after JD 2452258.

These are also plotted in Fig. 2, and $O-C$ values for the relevant maxima are given in Table 1. From these it follows that the period decreased by 4.1 ± 0.1 seconds around $\mathrm{HJD} = 2452258 \pm 12$.

The above calculations only make use of the times of extrema, and not of all data points. To make sure that all the data fit the suggested change in period, the following procedure was followed. A time of period jump t_0 was chosen, and all observation times after t_0 were transformed from t to $t' = t_0 + q(t - t_0)$, with q a parameter denoting the fractional period change. For times before t_0, $t' = t$ was taken. With these modified times t' a new period may be calculated, based on all the data. Using the downhill simplex minimization method (Nelder & Mead, 1965), the values of t_0 and q were determined for which a Fourier series with two harmonics gave the best fit. This resulted in a calculated period decrease of 4.0 seconds at $t_0 = 2452272$, in excellent agreement with the results found above. The phase plot taking into account this sudden period decrease is presented in Fig. 3 (with a period 0.254174 days, as determined before the change). A similar procedure as above, but with $t' = rt^2$, where r represents a constant rate of change of the period (for parabolic elements) yielded a worse fit. The sudden period jump is therefore favoured to a constant rate of change. At this moment cyclic period changes cannot be entirely excluded.

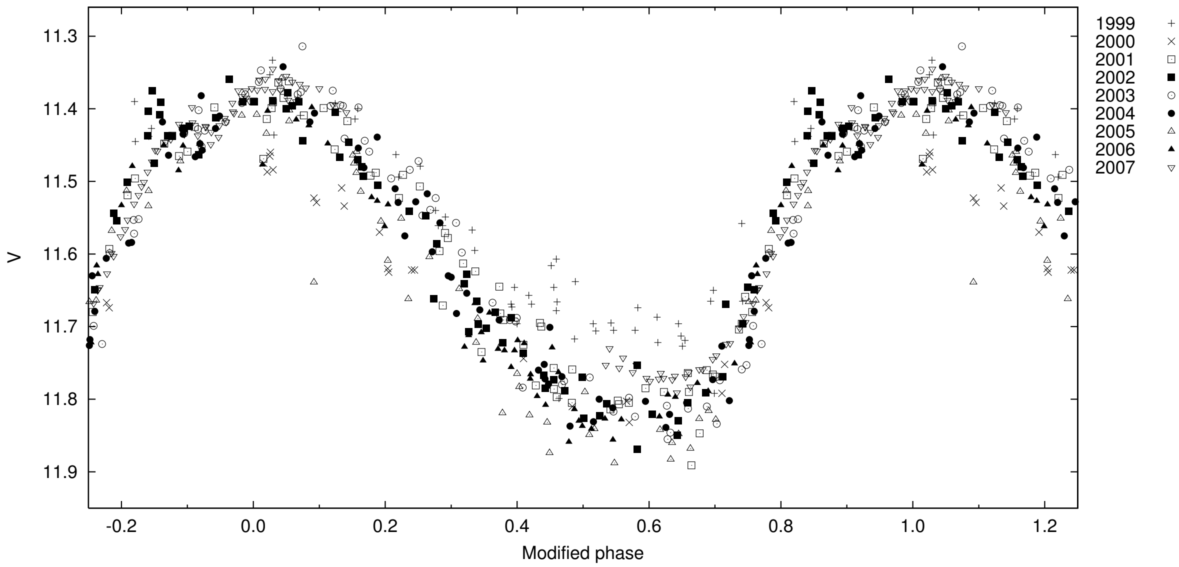

Figure 3. Phase plot of GSC 6199-0755 with the same data as Fig. 1 but taking into account a sudden period decrease of 4.0 seconds at HJD = 2452272

Similar period jumps are seen in other RR Lyrae stars as well (see e.g. Smith, 1995, and Schmidt & Lee, 2000), although some are poorly documented. One example is the RRc star HY Com (Oja, 1995), which is known to undergo frequent abrupt period changes. The explanation for these period jumps are yet unclear.

It is important to follow GSC 6199-0755 in the coming years to see whether other changes will occur like in HY Com or whether the period changes are cyclic. Also an archival plate search would be worthwhile to study the early period history.

Acknowledgements: This research made use of the SIMBAD and VizieR databases operated at the *Centre de Données Astronomiques (Strasbourg)* in France.

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A LESSON OF Y SCORPII

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Table 2 of the 78th Name-List of Variable Stars (Kazarovets et al., 2006) introduces new GCVS names for 38 variable stars with old GCVS names in wrong constellations. While working on integrating this list into the International Variable Star Index (VSX; Watson, 2006), one of us (Ch.W.) noticed that Y Sco was actually in the constellation of Scorpius and did not need the new name “V2613 Oph”. The GCVS team agrees with this correction and will continue to use the name Y Sco as the main GCVS name for the star.

The GCVS team uses thoroughly tested software to determine constellations, and thus it seems important to exactly identify the causes of the error. We could trace it down to a mistake in the widely used table of constellation boundaries (Roman, 1987). There exist two differences between the published paper (in its printed form as well as in its version available as .gif or .pdf files from the ADS) and the electronic table provided by the international data centers. Namely, line 229 of the electronic table reads:

```
229 16.2667 16.3750 -19.2500 Sco
```

— whereas the corresponding line of the printed paper suggests the constellation of Ophiuchus. This difference affects a small sky region (less than 1.5 square degrees) between right ascensions $16^h16^m$and $16^h22\overset{m}{.}5$, declinations $-18^\circ15'$ and $-19^\circ15'$ (equinox 1875.0, the official IAU equinox for constellation boundaries). Comparison to earlier published tables (see, for example, Schlesinger & Jenkins, 1940) confirms the correctness of the electronic table. Only one GCVS variable, Y Sco, is in this region.

Then, line 267 of the electronic table reads:

```
267 0.0000 1.6667 -40.0000 Scl
```

— while the printed paper has two lines with the same coordinates here, the first one referring to Sculptor and the second one, to Phoenix. Thus, the electronic table has 357 lines and the printed table, 358. Since the algorithm suggested in Roman (1987) scans the table from north to south, this difference does not affect any sky regions.

We are not aware of any errata published to Roman (1987). However, the readme file accompanying the electronic table in the international data centers contains the following remark:

"**History:** * 30-Dec-1999: one line (#229) was corrected by Nancy G. Roman".

Variable stars are probably the only field of modern astronomy where constellations are still widely used. We would like to warn the variable-star community about this problem with constellation boundaries.

The GCVS studies are supported, in part, by grants from the Russian Foundation for Basic Research (05-02-16289), from the Program "Origin and Evolution of Stars and Galaxies" of the Presidium of Russian Academy of Sciences, and from the Program of Support for Leading Scientific Schools of Russia (NSh 5290.2006.2).

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THE GEOS RR Lyr SURVEY

Sixth list of maxima of RR Lyr stars observed by the automated telescopes TAROT

(GEOS Circular RR 29)

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We present here the sixth list of light maxima of RR Lyrae stars from the GEOS RR Lyr Survey, a GEOS program (`http://www.upv.es/geos/`) (Boninsegna et al., 2002) of automated observations of RR Lyr stars started in January 2004.

We are using the 25-cm automatic telescopes TAROT (`http://tarot.obs-hp.fr`) (Boër et al., 2001, Bringer et al., 1999). One of the telescopes is located in the northern hemisphere in Calern Observatory (Observatoire de la Côte d'Azur, Nice University, France). A second identical telescope in the southern hemisphere, located in ESO La Silla Observatory, Chile, is in operation since 2006 September. Images are obtained by 2048×2048 Marconi 42-40 thin back illuminated CCDs. Field of view of both telescopes is $1.86^\circ \times 1.86^\circ$. Data reduction, from bias subtraction and flatfielding to photometry using SExtractor (Bertin & Arnouts, 1996), is performed automatically. The aim of this legacy project for the study of period variations of RR Lyr stars is to monitor maxima of light of these stars in order to feed the GEOS RR Lyr web database (`http://dbRR.ast.obs-mip.fr`).

The present list contains 587 maxima observed with no filter between July and December 2006 (Table 1). The maxima are determined by fitting a polynomial function on the data points. The uncertainties on individual maxima are estimated from the data sampling of each maximum. The nominal sampling (two consecutive 30-s exposures taken every 10 minutes on a time baseline of 2 hours centered around the predicted maximum time) may be altered by local events (weather or telescope operation). This results uncertainties from 0.002 to 0.010 day. For a well observed star, the mean uncertainty on maxima is about 0.003 day (4.3 minutes). The $O-C$'s are computed with the GCVS elements (Kholopov et al., 1985) and are displayed in Table 1 in column '$O-C$'. The column 'E' contains the cycle number. Note that this cycle number takes into account the shifts induced by the elements when the period of the elements is very different from the actual one, the absolute value of $O-C$ becoming greater than 1 period. When no elements are available in the GCVS, the reference of the elements, if exists, is given as a footnote of Table 1. The fifth column in Table 1 gives the abbreviation of the name of the observatory where the star was observed.

Table 1: Maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.*
SW And	53946.501±0.002	−0.754	80977.	C
SW And	53950.480±0.002	−0.755	80986.	C
SW And	53957.557±0.003	−0.755	81002.	C
SW And	53985.420±0.002	−0.755	81065.	C
SW And	54022.573±0.002	−0.754	81149.	C
SW And	54024.340±0.002	−0.756	81153.	C
SW And	54034.514±0.002	−0.754	81176.	C
SW And	54053.529±0.002	−0.757	81219.	C
SW And	54059.277±0.003	−0.759	81232.	C
SW And	54061.487±0.002	−0.760	81237.	C
SW And	54081.391±0.002	−0.759	81282.	C
SW And	54093.332±0.002	−0.760	81309.	C
XX And	53967.579±0.005	0.224	20588.	C
XX And	53980.588±0.002	0.223	20606.	C
XX And	53986.372±0.002	0.225	20614.	C
XX And	53999.376±0.002	0.220	20632.	C
XX And	54001.542±0.004	0.218	20635.	C
XX And	54012.390±0.002	0.225	20650.	C
XX And	54035.514±0.001	0.221	20682.	C
XX And	54051.417±0.002	0.223	20704.	C
XX And	54067.320±0.002	0.226	20726.	C
XX And	54090.447±0.002	0.225	20758.	C
XX And	54093.338±0.002	0.225	20762.	C
AT And	53952.522±0.002	0.000	18818.	C
AT And	53957.461±0.004	0.003	18826.	C
AT And	53973.483±0.002	−0.014	18852.	C
AT And	53981.510±0.005	−0.007	18865.	C
AT And	53999.408±0.002	0.000	18894.	C
AT And	54012.358±0.003	−0.005	18915.	C
AT And	54018.527±0.004	−0.005	18925.	C
AT And	54033.333±0.004	−0.005	18949.	C
AT And	54036.422±0.001	−0.001	18954.	C
AT And	54039.502±0.002	−0.005	18959.	C
AT And	54046.297±0.005	0.004	18970.	C
AT And	54062.335±0.006	0.002	18996.	C
AT And	54081.447±0.003	−0.010	19027.	C
CI And	54049.622±0.003	0.090	37818.	C
CI And	54084.525±0.002	0.093	37890.	C
CI And	54087.440±0.002	0.100	37896.	C
NX And [1]	54001.555±0.005	0.015	23702.	C
NX And [1]	54051.452±0.005	0.012	23779.	C
EX Aps	54014.619±0.002	0.012	55280.	LS
EX Aps	54023.582±0.002	0.011	55299.	LS
SW Aqr	53936.564±0.002	0.000	62789.	C
SW Aqr	53942.536±0.002	0.001	62802.	C
SW Aqr	53948.506±0.003	0.000	62815.	C
SW Aqr	53960.446±0.002	−0.002	62841.	C
SW Aqr	53970.553±0.003	0.000	62863.	C
SW Aqr	54000.407±0.002	−0.001	62928.	C
SW Aqr	54017.401±0.004	−0.001	62965.	C
SW Aqr	54018.321±0.002	0.001	62967.	C
SW Aqr	54023.372±0.002	−0.001	62978.	C
SX Aqr	53937.468±0.002	−0.106	26397.	C
SX Aqr	53944.432±0.004	−0.106	26410.	C
SX Aqr	53961.574±0.005	−0.107	26442.	C
SX Aqr	53988.357±0.002	−0.110	26492.	C
SX Aqr	53999.607±0.002	−0.110	26513.	LS
SX Aqr	54017.288±0.003	−0.107	26546.	C
SX Aqr	54018.356±0.002	−0.111	26548.	C
TZ Aqr	53952.470±0.004	0.012	28718.	C
TZ Aqr	53968.459±0.002	0.008	28746.	C
TZ Aqr	53972.461±0.005	0.011	28753.	C
TZ Aqr	53976.463±0.004	0.015	28760.	C
TZ Aqr	54000.446±0.002	0.008	28802.	C
TZ Aqr	54017.586±0.002	0.012	28832.	LS
TZ Aqr	54023.298±0.003	0.012	28842.	C
WZ Aqr	53998.699±0.002	0.070	67289.	LS
YZ Aqr	53996.599±0.002	0.053	33758.	LS
BN Aqr	53970.562±0.005	0.538	34276.	C
BN Aqr	53979.485±0.005	0.538	34295.	C
BO Aqr	54027.665±0.001	0.137	17876.	LS
BR Aqr	53997.769±0.003	−0.153	33954.	LS
BR Aqr	54035.357±0.002	−0.151	34032.	C
BR Aqr	54048.367±0.002	−0.152	34059.	C
CP Aqr	53933.500±0.002	−0.104	34633.	C
CP Aqr	53945.547±0.002	−0.105	34659.	C
CP Aqr	53960.375±0.002	−0.106	34691.	C
CP Aqr	53971.497±0.002	−0.106	34715.	C
CP Aqr	53978.449±0.002	−0.105	34730.	C
CP Aqr	53997.447±0.002	−0.107	34771.	C
CP Aqr	54017.374±0.002	−0.106	34814.	C
CP Aqr	54018.302±0.002	−0.105	34816.	C
DN Aqr	54017.558±0.002	0.024	40382.	LS
GP Aqr	53970.455±0.010			C
GP Aqr	54022.310±0.005			C
GP Aqr	54024.342±0.002			C
GP Aqr	54033.262±0.003			C
HH Aqr	53972.464±0.007			C
HH Aqr	53980.502±0.002			C
HH Aqr	54018.418±0.005			C
HH Aqr	54022.435±0.002			C
HH Aqr	54027.604±0.001			LS
HH Aqr	54033.352±0.005			C
HH Aqr	54037.374±0.004			C
HH Aqr	54048.283±0.003			C
AA Aql	53932.549±0.003	0.030	81775.	C
AA Aql	53944.491±0.002	0.033	81808.	C
AA Aql	53960.407±0.002	0.031	81852.	C
AA Aql	53973.435±0.002	0.034	81888.	C
AA Aql	53996.590±0.002	0.035	81952.	LS
V341 Aql	53933.536±0.002	0.024	22036.	C
V341 Aql	53940.475±0.002	0.027	22048.	C
V341 Aql	53947.411±0.002	0.027	22060.	C
V341 Aql	53962.440±0.002	0.027	22086.	C
V341 Aql	53969.378±0.002	0.029	22098.	C
V341 Aql	53977.464±0.003	0.023	22112.	C
V341 Aql	53988.450±0.004	0.026	22131.	C
V341 Aql	53999.433±0.005	0.027	22150.	C

Table 1 (cont.): Maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
X Ari	54011.564±0.005	0.317	25229.	C	AA CMi	54093.748±0.002	0.055	36776.	LS
X Ari	54024.586±0.002	0.316	25249.	C	AA CMi	54096.605±0.002	0.054	36782.	C
X Ari	54037.605±0.003	0.313	25269.	C	AL CMi	54092.691±0.002	0.445	31780.	LS
X Ari	54039.564±0.002	0.318	25272.	C	AL CMi	54098.744±0.002	0.442	31791.	LS
X Ari	54058.449±0.005	0.320	25301.	C	EE Car	54101.680±0.005	0.022	43536.	LS
X Ari	54062.355±0.005	0.319	25307.	C	IU Car	54065.681±0.002	0.241	16781.	LS
X Ari	54067.564±0.002	0.319	25315.	C	IU Car	54093.695±0.002	0.244	16819.	LS
X Ari	54079.286±0.004	0.321	25333.	C	V363 Cas	53957.417±0.003	0.507	32595.	C
X Ari	54084.495±0.002	0.320	25341.	C	V363 Cas	53980.383±0.004	0.518	32637.	C
X Ari	54086.449±0.002	0.321	25344.	C	V363 Cas	54012.625±0.005	0.515	32696.	C
X Ari	54090.356±0.002	0.321	25350.	C	V363 Cas	54015.362±0.005	0.519	32701.	C
X Ari	54092.310±0.002	0.322	25353.	C	V363 Cas	54016.471±0.005	0.535	32703.	C
X Ari	54094.262±0.002	0.320	25356.	C	V363 Cas	54035.593±0.005	0.528	32738.	C
TZ Aur	54034.537±0.003	0.012	87144.	C	V363 Cas	54039.402±0.002	0.512	32745.	C
TZ Aur	54036.495±0.002	0.012	87149.	C	V363 Cas	54046.522±0.005	0.527	32758.	C
TZ Aur	54039.630±0.002	0.013	87157.	C	V363 Cas	54067.287±0.002	0.523	32796.	C
TZ Aur	54045.505±0.005	0.013	87172.	C	AQ Cep	54079.490±0.005	0.061	39836.	C
TZ Aur	54058.426±0.002	0.009	87205.	C	RR Cet	53978.586±0.003	0.006	37606.	C
TZ Aur	54061.561±0.003	0.010	87213.	C	RR Cet	53983.565±0.002	0.008	37615.	C
TZ Aur	54081.537±0.002	0.011	87264.	C	RR Cet	53998.493±0.004	0.004	37642.	C
TZ Aur	54091.329±0.002	0.011	87289.	C	RR Cet	54023.376±0.004	0.000	37687.	C
TZ Aur	54100.338±0.002	0.012	87312.	C	RR Cet	54034.436±0.002	0.000	37707.	C
U Cae	54013.746±0.002	−0.097	46926.	LS	RR Cet	54039.419±0.002	0.006	37716.	C
U Cae	54021.725±0.001	−0.094	46945.	LS	RR Cet	54090.295±0.002	0.003	37808.	C
U Cae	54040.610±0.001	−0.100	46990.	LS	RU Cet	54025.613±0.003	0.087	24219.	LS
U Cae	54045.652±0.003	−0.096	47002.	LS	RU Cet	54046.711±0.001	0.079	24255.	LS
U Cae	54084.687±0.004	−0.101	47095.	LS	RV Cet	54011.641±0.005	0.193	23898.	LS
U Cae	54087.631±0.002	−0.096	47102.	LS	RV Cet	54024.743±0.004	0.204	23919.	LS
U Cae	54089.731±0.002	−0.095	47107.	LS	RV Cet	54049.675±0.002	0.200	23959.	LS
U Cae	54094.769±0.002	−0.094	47119.	LS	RV Cet	54054.678±0.010	0.215	23967.	LS
U Cae	54100.642±0.002	−0.099	47133.	LS	RV Cet	54064.644±0.002	0.207	23983.	LS
V Cae	54011.639±0.003	0.218	34494.	LS	RZ Cet	54011.539±0.003	−0.140	39374.	C
V Cae	54064.643±0.003	0.138	34587.	LS	RZ Cet	54036.569±0.005	−0.130	39423.	LS
V Cae	54076.591±0.002	0.099	34608.	LS	RT Col	54049.852±0.001	−0.247	48958.	LS
V Cae	54084.584±0.003	0.101	34622.	LS	RT Col	54063.803±0.002	−0.248	48984.	LS
V Cae	54088.579±0.002	0.100	34629.	LS	RT Col	54085.802±0.002	−0.249	49025.	LS
V Cae	54097.714±0.002	0.102	34645.	LS	RT Col	54092.778±0.002	−0.249	49038.	LS
V Cae	54101.710±0.003	0.103	34652.	LS	RW Col	54048.697±0.002	0.231	49581.	LS
AH Cam	53975.493±0.005	−0.403	41348.	C	RW Col	54065.597±0.002	0.196	49613.	LS
AH Cam	53978.470±0.005	−0.376	41356.	C	RW Col	54083.609±0.002	0.214	49647.	LS
AH Cam	53999.489±0.002	−0.375	41413.	C	RW Col	54101.615±0.006	0.226	49681.	LS
AH Cam	54013.492±0.002	−0.384	41451.	C	RY Col	54016.841±0.003	−0.130	41153.	LS
AH Cam	54016.425±0.005	−0.401	41459.	C	RY Col	54028.802±0.001	−0.141	41178.	LS
AH Cam	54023.446±0.002	−0.386	41478.	C	RY Col	54039.816±0.001	−0.140	41201.	LS
AH Cam	54058.468±0.004	−0.394	41573.	C	RY Col	54052.748±0.002	−0.138	41228.	LS
AH Cam	54079.494±0.004	−0.385	41630.	C	RY Col	54063.767±0.002	−0.132	41251.	LS
TT Cnc	54086.497±0.003	0.114	25099.	C	RY Col	54074.786±0.004	−0.127	41274.	LS
TT Cnc	54095.504±0.002	0.105	25115.	C	RY Col	54097.767±0.002	−0.131	41322.	LS
TT Cnc	54099.447±0.005	0.104	25122.	C	S Com	54098.616±0.002	−0.097	22919.	C
TT Cnc	54100.574±0.002	0.104	25124.	C	HY Com	54093.664±0.005	0.055	22374.	C
UZ CVn	54092.619±0.003	0.240	39647.	C	UY Cyg	53923.517±0.003	0.049	56161.	C
UZ CVn	54099.605±0.010	0.248	39657.	C	UY Cyg	53932.494±0.005	0.055	56177.	C
AA CMi	54054.687±0.002	0.052	36694.	C	UY Cyg	53941.468±0.003	0.057	56193.	C
AA CMi	54082.792±0.001	0.054	36753.	LS	UY Cyg	53946.513±0.002	0.056	56202.	C

Table 1 (cont.): Maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
UY Cyg	53968.378±0.005	0.053	56241.	C	BC Dra	54097.560±0.003	0.081	16425.	C
UY Cyg	53973.426±0.002	0.055	56250.	C	BD Dra	53925.576±0.006	0.759	20627.	C
UY Cyg	53987.437±0.005	0.049	56275.	C	BD Dra	53938.524±0.002	0.748	20649.	C
UY Cyg	54000.341±0.004	0.056	56298.	C	BD Dra	53954.416±0.004	0.736	20676.	C
UY Cyg	54023.333±0.003	0.059	56339.	C	BD Dra	53958.521±0.004	0.717	20683.	C
UY Cyg	54024.447±0.002	0.052	56341.	C	BD Dra	53984.456±0.002	0.734	20727.	C
UY Cyg	54037.342±0.002	0.051	56364.	C	BD Dra	53985.635±0.002	0.735	20729.	C
XZ Cyg [2]	53935.544±0.002	0.005	11498.	C	BD Dra	53988.600±0.003	0.755	20734.	C
XZ Cyg [2]	53956.531±0.002	−0.005	11543.	C	BD Dra	54013.341±0.002	0.756	20776.	C
XZ Cyg [2]	53962.600±0.004	−0.002	11556.	C	BD Dra	54017.465±0.002	0.756	20783.	C
XZ Cyg [2]	53976.605±0.002	0.005	11586.	C	BD Dra	54033.345±0.003	0.732	20810.	C
XZ Cyg [2]	53983.607±0.002	0.008	11601.	C	BD Dra	54036.312±0.002	0.754	20815.	C
XZ Cyg [2]	53998.528±0.002	−0.002	11633.	C	BD Dra	54046.327±0.003	0.755	20832.	C
DM Cyg	53927.502±0.003	0.059	27021.	C	BD Dra	54053.360±0.003	0.719	20844.	C
DM Cyg	53950.594±0.003	0.059	27076.	C	BD Dra	54079.272±0.004	0.713	20888.	C
DM Cyg	53956.474±0.002	0.061	27090.	C	BD Dra	54094.625±0.002	0.750	20914.	C
DM Cyg	53961.512±0.002	0.060	27102.	C	BK Dra	53936.554±0.004	−0.150	47989.	C
DM Cyg	54011.471±0.002	0.056	27221.	C	BK Dra	53942.472±0.005	−0.153	47999.	C
DM Cyg	54016.511±0.003	0.058	27233.	C	BK Dra	53952.537±0.002	−0.153	48016.	C
DM Cyg	54022.389±0.002	0.058	27247.	C	BK Dra	53958.459±0.003	−0.152	48026.	C
DM Cyg	54024.490±0.002	0.059	27252.	C	BK Dra	53984.509±0.002	−0.154	48070.	C
DM Cyg	54033.307±0.003	0.059	27273.	C	RX Eri	54022.716±0.004	−0.016	55054.	LS
DM Cyg	54035.405±0.002	0.058	27278.	C	RX Eri	54032.707±0.003	−0.009	55071.	LS
DX Del	53933.442±0.003	0.054	30820.	C	RX Eri	54042.692±0.002	−0.007	55088.	LS
DX Del	53940.535±0.003	0.058	30835.	C	RX Eri	54049.737±0.002	−0.009	55100.	LS
DX Del	53948.569±0.002	0.058	30852.	C	RX Eri	54066.765±0.002	−0.011	55129.	LS
DX Del	53960.385±0.002	0.058	30877.	C	RX Eri	54079.692±0.003	−0.003	55151.	LS
RT Dor	54091.639±0.002	−0.040	48307.	LS	RX Eri	54089.671±0.002	−0.007	55168.	LS
RT Dor	54100.811±0.002	−0.042	48326.	LS	RX Eri	54096.716±0.003	−0.009	55180.	LS
VW Dor	54038.630±0.001	−0.073	27443.	LS	SV Eri	53998.777±0.005	0.741	25842.	LS
VW Dor	54094.551±0.002	−0.072	27541.	LS	XY Eri	54024.718±0.005	−0.257	52794.	LS
RW Dra	53922.496±0.004	0.154	32839.	C	XY Eri	54029.710±0.010	−0.253	52803.	LS
RW Dra	53926.482±0.005	0.153	32848.	C	XY Eri	54039.720±0.001	−0.219	52821.	LS
XZ Dra	53935.526±0.002	−0.096	25199.	C	XY Eri	54049.696±0.001	−0.220	52839.	LS
XZ Dra	53945.535±0.005	−0.093	25220.	C	XY Eri	54054.661±0.002	−0.243	52848.	LS
XZ Dra	53975.549±0.002	−0.099	25283.	C	XY Eri	54064.618±0.001	−0.263	52866.	LS
XZ Dra	53984.595±0.002	−0.106	25302.	C	XY Eri	54080.701±0.005	−0.253	52895.	LS
BC Dra	53925.575±0.006	0.075	16186.	C	XY Eri	54085.704±0.002	−0.238	52904.	LS
BC Dra	53933.495±0.006	0.080	16197.	C	XY Eri	54090.722±0.010	−0.208	52913.	LS
BC Dra	53938.528±0.008	0.075	16204.	C	XY Eri	54095.719±0.003	−0.200	52922.	LS
BC Dra	53943.569±0.005	0.079	16211.	C	BB Eri	54049.735±0.003	0.217	25426.	LS
BC Dra	53946.455±0.005	0.087	16215.	C	BB Eri	54053.726±0.002	0.219	25433.	LS
BC Dra	53956.523±0.010	0.081	16229.	C	BB Eri	54065.693±0.001	0.218	25454.	LS
BC Dra	53959.410±0.010	0.090	16233.	C	BB Eri	54085.643±0.002	0.222	25489.	LS
BC Dra	53969.472±0.004	0.078	16247.	C	BB Eri	54089.630±0.003	0.220	25496.	LS
BC Dra	53982.423±0.003	0.076	16265.	C	BB Eri	54093.617±0.002	0.217	25503.	LS
BC Dra	53984.580±0.005	0.075	16268.	C	RX For	54030.687±0.003	−0.048	23772.	LS
BC Dra	53987.461±0.004	0.077	16272.	C	RX For	54033.670±0.005	−0.052	23777.	LS
BC Dra	54013.379±0.005	0.091	16308.	C	RX For	54042.657±0.002	−0.025	23792.	LS
BC Dra	54018.407±0.005	0.082	16315.	C	RX For	54048.645±0.002	−0.010	23802.	LS
BC Dra	54036.393±0.003	0.078	16340.	C	RX For	54064.728±0.002	−0.054	23829.	LS
BC Dra	54046.473±0.010	0.084	16354.	C	RX For	54067.724±0.005	−0.045	23834.	LS
BC Dra	54059.421±0.003	0.080	16372.	C	RX For	54073.711±0.002	−0.031	23844.	LS
BC Dra	54067.333±0.008	0.076	16383.	C	RX For	54088.640±0.001	−0.035	23869.	LS

Table 1 (cont.): Maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
RX For	54091.619±0.002	−0.042	23874.	LS	VX Ind	54018.621±0.005	0.020	28150.	LS
SS For	54080.705±0.003	−0.145	31108.	LS	RR Leo	54084.607±0.002	0.077	23849.	C
SW For	54014.720±0.010	0.397	24474.	LS	RR Leo	54093.656±0.002	0.078	23869.	C
SW For	54030.799±0.005	0.401	24494.	LS	RR Leo	54098.631±0.002	0.077	23880.	C
SW For	54039.640±0.002	0.401	24505.	LS	SS Leo	54099.669±0.005	−0.049	19667.	C
SW For	54043.661±0.001	0.404	24510.	LS	ST Leo	54094.649±0.004	−0.021	54754.	C
SW For	54051.696±0.003	0.401	24520.	LS	AX Leo	54094.658±0.005	−0.029	39693.	C
SW For	54067.769±0.004	0.399	24540.	LS	AX Leo	54097.578±0.010	−0.016	39697.	C
SW For	54080.629±0.002	0.400	24556.	LS	V LMi	54061.592±0.005	0.028	63486.	C
SW For	54084.643±0.004	0.395	24561.	LS	V LMi	54067.582±0.005	0.035	63497.	C
SW For	54088.666±0.002	0.399	24566.	LS	V LMi	54091.504±0.002	0.025	63541.	C
SW For	54092.688±0.004	0.402	24571.	LS	V LMi	54097.491±0.002	0.029	63552.	C
SW For	54096.704±0.005	0.400	24576.	LS	U Lep	54022.760±0.004	0.048	21790.	LS
SX For	54012.708±0.010	0.046	24539.	LS	U Lep	54029.734±0.001	0.044	21802.	LS
SX For	54026.622±0.003	0.037	24562.	LS	U Lep	54036.710±0.005	0.042	21814.	LS
SX For	54038.726±0.002	0.034	24582.	LS	U Lep	54040.781±0.002	0.043	21821.	LS
SX For	54055.680±0.001	0.039	24610.	LS	U Lep	54043.690±0.001	0.044	21826.	LS
SX For	54075.656±0.002	0.039	24643.	LS	U Lep	54047.759±0.001	0.043	21833.	LS
SX For	54084.732±0.003	0.035	24658.	LS	U Lep	54064.620±0.001	0.041	21862.	LS
SX For	54095.628±0.001	0.035	24676.	LS	U Lep	54075.670±0.002	0.043	21881.	LS
SX For	54098.657±0.005	0.037	24681.	LS	U Lep	54079.742±0.002	0.045	21888.	LS
RR Gem	54044.565±0.003	−0.357	31934.	C	U Lep	54082.646±0.002	0.042	21893.	LS
RR Gem	54058.472±0.004	−0.356	31969.	C	U Lep	54089.626±0.002	0.044	21905.	LS
RR Gem	54081.510±0.002	−0.362	32027.	C	U Lep	54093.694±0.002	0.042	21912.	LS
SZ Gem	54092.477±0.002	−0.052	53675.	C	U Lep	54096.605±0.002	0.045	21917.	LS
SZ Gem	54098.488±0.002	−0.054	53687.	C	U Lep	54100.674±0.002	0.044	21924.	LS
SZ Gem	54100.491±0.002	−0.056	53691.	C	TT Lyn	54082.661±0.005	−0.037	29177.	C
GI Gem	54044.587±0.002	0.070	54696.	C	TT Lyn	54084.457±0.003	−0.033	29180.	C
GI Gem	54081.416±0.002	0.072	54781.	C	TT Lyn	54087.448±0.003	−0.030	29185.	C
GI Gem	54086.613±0.002	0.069	54793.	C	TT Lyn	54090.426±0.005	−0.039	29190.	C
GI Gem	54096.578±0.002	0.069	54816.	C	TT Lyn	54096.406±0.002	−0.033	29200.	C
AP Gru	54014.644±0.002	0.033	51226.	LS	TT Lyn	54099.400±0.005	−0.026	29205.	C
TW Her	53946.398±0.002	−0.011	81084.	C	TW Lyn	54081.479±0.002	0.053	18800.	C
TW Her	53954.391±0.002	−0.010	81104.	C	TW Lyn	54096.417±0.002	0.053	18831.	C
TW Her	53970.375±0.002	−0.010	81144.	C	TW Lyn	54098.345±0.002	0.054	18835.	C
VX Her	53919.442±0.003	−0.398	70644.	C	RZ Lyr	53919.501±0.003	0.007	24912.	C
VZ Her	53937.528±0.002	0.060	38945.	C	RZ Lyr	53920.525±0.002	0.008	24914.	C
VZ Her	53945.456±0.002	0.062	38963.	C	RZ Lyr	53959.364±0.003	−0.007	24990.	C
VZ Her	53952.500±0.003	0.061	38979.	C	RZ Lyr	53982.370±0.002	−0.007	25035.	C
VZ Her	53967.471±0.002	0.061	39013.	C	RZ Lyr	53983.393±0.002	−0.006	25037.	C
DL Her	53931.557±0.003	0.027	26576.	C	AW Lyr	53916.460±0.002	0.027	57463.	C
UU Hor	54079.724±0.002	0.141	45608.	LS	AW Lyr	53923.424±0.006	0.027	57477.	C
UU Hor	54088.732±0.002	0.137	45622.	LS	CN Lyr	53923.462±0.005	0.018	22940.	C
UU Hor	54099.678±0.002	0.141	45639.	LS	CN Lyr	53927.579±0.005	0.021	22950.	C
DD Hya	54059.619±0.003	−0.147	24641.	C	CN Lyr	53972.418±0.002	0.019	23059.	C
DD Hya	54092.735±0.001	−0.149	24707.	LS	CN Lyr	53979.405±0.002	0.013	23076.	C
DD Hya	54098.761±0.003	−0.144	24719.	LS	CN Lyr	53981.473±0.003	0.024	23081.	C
DG Hya	54098.761±0.003	0.036	39729.	LS	IK Lyr	53926.462±0.005	−0.196	59547.	C
GO Hya	54067.630±0.010	−0.062	44652.	C	IK Lyr	53940.490±0.005	−0.187	59581.	C
GO Hya	54090.528±0.003	−0.076	44688.	C	IK Lyr	53973.475±0.004	−0.187	59661.	C
GO Hya	54095.611±0.005	−0.084	44696.	C	IK Lyr	53985.395±0.005	−0.224	59690.	C
TW Hyi	54066.555±0.002	0.009	21619.	LS	IO Lyr	53938.470±0.004	−0.032	24812.	C
TW Hyi	54072.634±0.001	0.009	21628.	LS	IO Lyr	53979.444±0.004	−0.034	24883.	C
TW Hyi	54093.571±0.003	0.010	21659.	LS	IO Lyr	53983.489±0.002	−0.028	24890.	C

Table 1 (cont.): Maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
IO Lyr	54001.378±0.002	−0.030	24921.	C	BH Peg	53969.590±0.010	−0.075	22784.	C
V340 Lyr	53982.368±0.003	−0.037	41194.	C	BH Peg	54048.392±0.004	−0.115	22907.	C
Z Mic	54015.612±0.004	−0.114	21158.	LS	BH Peg	54059.290±0.002	−0.114	22924.	C
DV Mon	54073.780±0.002	0.076	69733.	LS	CG Peg	53926.516±0.002	−0.044	31734.	C
DV Mon	54080.808±0.002	0.076	69750.	LS	CG Peg	53947.535±0.002	−0.046	31779.	C
DV Mon	54085.760±0.002	0.068	69762.	LS	CG Peg	53961.550±0.002	−0.045	31809.	C
RS Oct	54015.671±0.002	0.123	38615.	LS	CG Peg	53974.630±0.005	−0.045	31837.	C
RS Oct	54037.651±0.001	0.118	38663.	LS	CG Peg	53989.576±0.004	−0.047	31869.	C
RS Oct	54048.642±0.002	0.117	38687.	LS	CG Peg	53997.520±0.002	−0.045	31886.	C
RS Oct	54054.595±0.002	0.116	38700.	LS	CG Peg	54026.481±0.003	−0.046	31948.	C
RS Oct	54065.579±0.002	0.108	38724.	LS	CG Peg	54034.425±0.002	−0.044	31965.	C
SS Oct	54042.670±0.002	−0.070	41848.	LS	CG Peg	54043.297±0.002	−0.047	31984.	C
UW Oct	54012.752±0.005	−0.007	44265.	LS	CV Peg	54001.455±0.002	−0.059	51977.	C
UW Oct	54033.643±0.010	−0.007	44312.	LS	DZ Peg	53954.472±0.003	0.159	33034.	C
UW Oct	54045.642±0.001	−0.009	44339.	LS	DZ Peg	53979.369±0.002	0.155	33075.	C
UW Oct	54053.639±0.002	−0.013	44357.	LS	DZ Peg	53982.408±0.002	0.157	33080.	C
UW Oct	54066.538±0.004	−0.004	44386.	LS	DZ Peg	54022.496±0.003	0.160	33146.	C
UW Oct	54074.534±0.002	−0.009	44404.	LS	DZ Peg	54033.425±0.002	0.157	33164.	C
AR Oct	54092.545±0.002	0.154	43829.	LS	DZ Peg	54036.462±0.002	0.158	33169.	C
V455 Oph	53938.495±0.003	−0.236	26669.	C	DZ Peg	54058.322±0.002	0.153	33205.	C
V455 Oph	53943.489±0.002	−0.235	26680.	C	DZ Peg	54061.362±0.004	0.156	33210.	C
V455 Oph	53948.482±0.004	−0.235	26691.	C	AR Per	53997.616±0.002	0.054	62885.	C
CM Ori	54090.782±0.002	−0.023	43896.	LS	AR Per	54023.575±0.004	0.055	62946.	C
CM Ori	54094.719±0.002	−0.022	43902.	LS	AR Per	54050.386±0.002	0.056	63009.	C
V964 Ori	54037.709±0.001	−0.370	44660.	LS	AR Per	54053.361±0.002	0.052	63016.	C
V964 Ori	54080.601±0.001	−0.374	44745.	LS	AR Per	54079.323±0.002	0.056	63077.	C
BN Pav	54013.567±0.001	−0.002	45272.	LS	AR Per	54084.427±0.005	0.053	63089.	C
BN Pav	54030.579±0.001	−0.005	45302.	LS	AR Per	54089.530±0.002	0.050	63101.	C
BN Pav	54047.593±0.002	−0.006	45332.	LS	AR Per	54092.515±0.002	0.056	63108.	C
BN Pav	54051.563±0.003	−0.007	45339.	LS	AR Per	54095.491±0.002	0.053	63115.	C
BN Pav	54055.533±0.002	−0.007	45346.	LS	RV Phe	54043.516±0.005	−0.173	20335.	LS
BP Pav	54013.553±0.001	−0.049	47784.	LS	RV Phe	54053.659±0.002	−0.169	20352.	LS
BP Pav	54032.529±0.001	0.118	47819.	LS	U Pic	54046.654±0.002	0.055	28113.	LS
BP Pav	54052.561±0.002	0.267	47856.	LS	U Pic	54053.701±0.001	0.056	28129.	LS
VV Peg	53980.500±0.002	−0.027	29876.	C	U Pic	54075.719±0.002	0.056	28179.	LS
VV Peg	54022.502±0.002	−0.026	29962.	C	U Pic	54083.645±0.001	0.055	28197.	LS
VV Peg	54046.431±0.002	−0.028	30011.	C	U Pic	54090.691±0.002	0.055	28213.	LS
VV Peg	54048.389±0.003	−0.024	30015.	C	U Pic	54094.655±0.002	0.056	28222.	LS
VV Peg	54052.291±0.003	−0.029	30023.	C	U Pic	54101.701±0.002	0.056	28238.	LS
AV Peg	53935.477±0.002	0.103	25988.	C	RY Psc	54028.578±0.001	0.500	21421.	LS
AV Peg	53940.550±0.002	0.101	26001.	C	RY Psc	54037.574±0.001	0.491	21438.	LS
AV Peg	53969.439±0.002	0.103	26075.	C	XX Pup	54083.653±0.003	0.456	23802.	LS
AV Peg	54001.451±0.002	0.104	26157.	C	XX Pup	54097.616±0.002	0.455	23829.	LS
AV Peg	54017.456±0.003	0.104	26198.	C	HH Pup	54072.670±0.002	0.010	39853.	LS
AV Peg	54035.413±0.003	0.103	26244.	C	HH Pup	54079.704±0.001	0.010	39871.	LS
AV Peg	54037.366±0.004	0.104	26249.	C	HH Pup	54083.611±0.002	0.010	39881.	LS
AV Peg	54044.391±0.002	0.103	26267.	C	HH Pup	54095.725±0.003	0.011	39912.	LS
AV Peg	54048.295±0.002	0.103	26277.	C	HK Pup	54097.699±0.003	−0.238	23820.	LS
AV Peg	54051.421±0.002	0.106	26285.	C	HK Pup	54100.638±0.002	−0.236	23824.	LS
AV Peg	54053.372±0.002	0.105	26290.	C	V2279 Sgr	54014.689±0.005	0.098	35126.	LS
AV Peg	54060.400±0.002	0.106	26308.	C	UZ Scl	54021.773±0.002	0.035	33197.	LS
BH Peg	53937.521±0.004	−0.094	22734.	C	UZ Scl	54031.656±0.002	0.037	33219.	LS
BH Peg	53944.586±0.005	−0.080	22745.	C	VW Scl	54011.623±0.001	−0.018	51285.	LS
BH Peg	53953.559±0.009	−0.081	22759.	C	VW Scl	54032.574±0.004	−0.015	51326.	LS

Table 1 (cont.): Maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
VW Scl	54033.593±0.005	−0.018	51328.	LS	AE Tuc	54053.739±0.001	0.060	47737.	LS
VX Scl	54012.615±0.002	−0.435	19454.	LS	AE Tuc	54083.585±0.001	0.072	47809.	LS
VX Scl	54033.635±0.005	−0.447	19487.	LS	AE Tuc	54095.606±0.002	0.077	47838.	LS
VX Scl	54038.726±0.002	−0.454	19495.	LS	AE Tuc	54100.579±0.002	0.077	47850.	LS
VX Scl	54047.650±0.002	−0.453	19509.	LS	AG Tuc	54067.626±0.001	0.047	23690.	LS
VX Scl	54052.746±0.001	−0.456	19517.	LS	AG Tuc	54093.537±0.002	0.047	23733.	LS
VX Scl	54075.689±0.002	−0.457	19553.	LS	AG Tuc	54096.550±0.002	0.047	23738.	LS
RU Sex [3]	54093.594±0.005	0.057	32770.	C	BK Tuc	54011.868±0.003	−0.017	31400.	LS
RU Sex [3]	54100.581±0.003	0.039	32790.	C	BK Tuc	54024.521±0.001	−0.019	31423.	LS
SS Tau	54022.763±0.002	0.478	43420.	LS	BK Tuc	54030.572±0.001	−0.020	31434.	LS
SS Tau	54039.774±0.002	0.473	43466.	LS	BK Tuc	54041.574±0.001	−0.022	31454.	LS
SS Tau	54049.756±0.002	0.467	43493.	LS	BK Tuc	54085.579±0.002	−0.033	31534.	LS
SS Tau	54055.674±0.002	0.467	43509.	LS	BK Tuc	54096.579±0.003	−0.037	31554.	LS
SS Tau	54065.659±0.001	0.464	43536.	LS	TU UMa	54095.617±0.002	−0.026	20199.	C
SS Tau	54079.712±0.002	0.460	43574.	LS	TU UMa	54096.729±0.002	−0.029	20201.	C
SS Tau	54082.675±0.002	0.464	43582.	LS	AB UMa	54094.547±0.005	0.112	29799.	C
W Tuc	54012.636±0.001	0.154	26679.	LS	AB UMa	54100.544±0.010	0.113	29809.	C
W Tuc	54041.533±0.001	0.151	26724.	LS	BN Vul	53922.533±0.005	0.059	14125.	C
W Tuc	54073.645±0.002	0.151	26774.	LS	BN Vul	53956.400±0.003	0.060	14182.	C
W Tuc	54075.574±0.004	0.154	26777.	LS	BN Vul	53959.375±0.003	0.065	14187.	C
W Tuc	54084.566±0.004	0.154	26791.	LS	BN Vul	53972.444±0.002	0.063	14209.	C
W Tuc	54091.628±0.002	0.152	26802.	LS	BN Vul	54000.365±0.004	0.060	14256.	C
W Tuc	54100.621±0.003	0.154	26816.	LS	BN Vul	54016.412±0.005	0.065	14283.	C
AE Tuc	54011.872±0.001	0.044	47636.	LS					

* C = Calern, LS = La Silla
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13 NEW ECLIPSING BINARIES WITH ADDITIONAL VARIABILITY IN THE ASAS CATALOGUE

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The All Sky Automated Survey has already collected over 6 years of observations for the majority of the sky (declinations $< +28°$), down to 14th magnitude. Semi-automatic classification of variable stars resulted in the ASAS Catalogue of Variable Stars — ACVS (Pojmański et al., 2006). For details on the classification procedure see Pojmański (2002). A big part of ACVS consists of eclipsing binaries, among them are 5384 contact (EC), 2957 semidetached (ESD), and 2758 detached (ED) binaries. Recently a sub-sample of these has been searched for period changes (Pilecki et al. 2007). During this investigation a side analysis was performed which resulted in 16 (13 new) binaries which are suspect to additional periodic behaviour of various origin; secondary variability may be due to spots, pulsations, or second eclipsing binary in the system. Two of them, namely 115143-6253.2 and 164802-6715.2, were found by D. Fabrycky, who pointed out (private comm.) that these stars showed eclipses with another period.

The search for second periodicity was performed on residual lightcurves of all EC and ESD binaries in ACVS (8,341 objects). After detecting an additional frequency for each object, all the lightcurves were sorted by amplitude of the frequency and the ones with a significant signal strength were inspected visually. This left us with 14 objects for which (together with additional two stars mentioned above) a more detailed analysis was performed.

In order to separate the lightcurves for both kinds of variability we applied an iterative method. In the first step the best fitting model of an eclipsing binary M_1 with orbital period P_1 was removed from the original lightcurve. Then we analysed the residual lightcurve in the search for secondary period P_2, which was used to construct the model M_2 of additional variability. This model was then subtracted from the original lightcurve and the residual lightcurve was again investigated to find a refined M_1. After subtracting the new M_1 from the raw lightcurve, the new M_2 was once again determined. In some cases one more step was performed to get a better model M_1.

Using residual lightcurves of models M_1 and M_2, variability was then classified with periods P_1 and P_2 using the same procedure as in Pojmański (2002). However, all pulsating types were combined into one PULS category and, when it was plausible, we changed automatic classification to 'Spot' type.

In Table 1 we listed both periods (P_1 and P_2), separate variability types and the possible degree of blending (0 for none, 1 for small and 2 for large) listed in two columns,

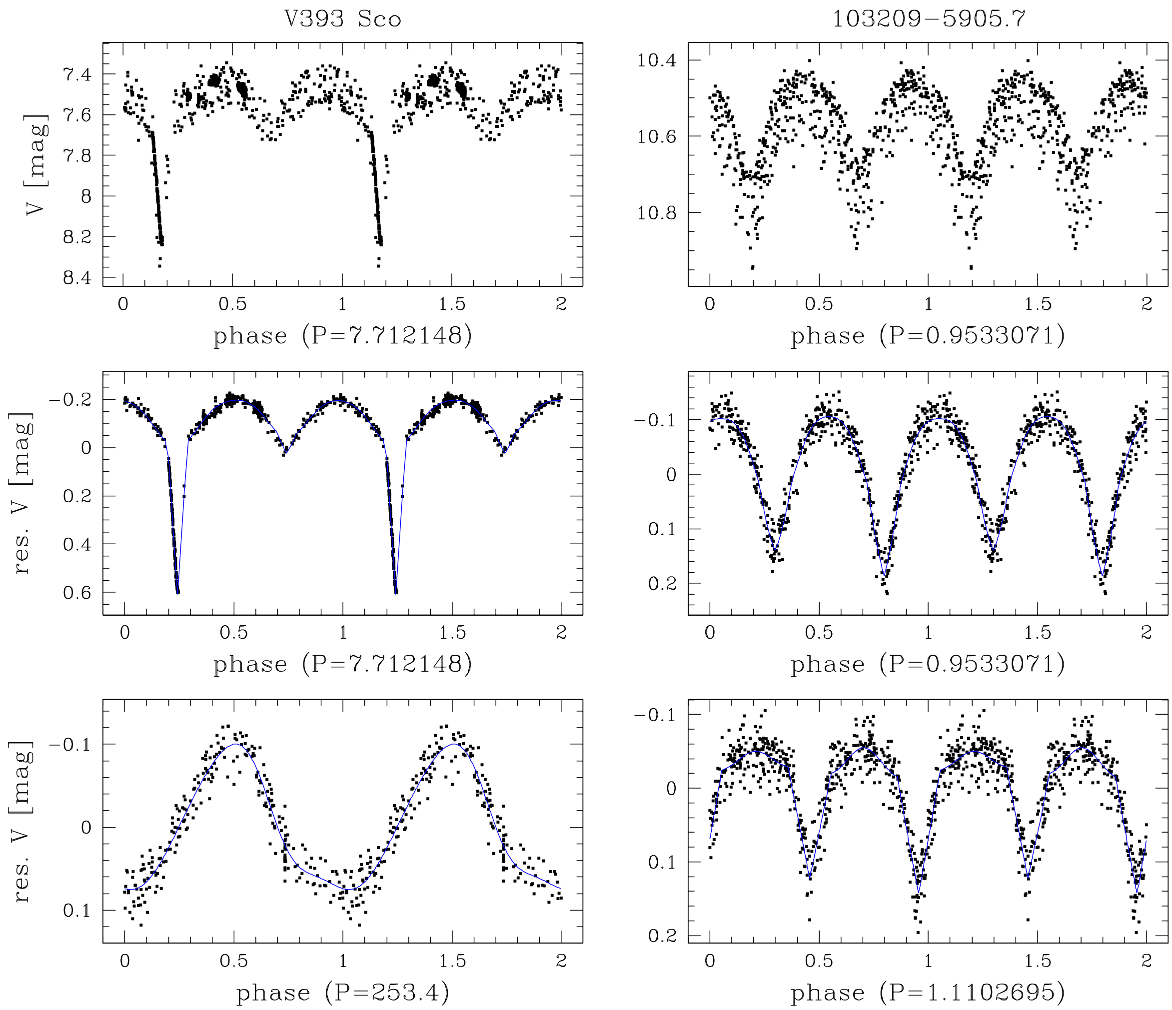

Figure 1. Two examples of double periodic behaviour. Original and residual lightcurves are showed. Plots of the rest of the light curves are given electronically

Table 1. ASAS eclipsing binaries exhibiting additional periodic variability

ASAS ID (RA-DEC)	$V_{\max}$ [mag]	P_1 [days]	Type	P_2 [days]	Type	Blend I A	Other data	Other ID
174848-3503.5	7.45	7.71215	ESD	253.4	PULS	0 0	B3III	V393 Sco
103209-5905.7	10.50	0.953307	ESD	1.110270	ESD = ED	2 1	F	HD 302992
153713-1820.1	8.38	6.86170	ESD	6.87811	Spot	0 0	K1III, X	IV Lib
172738-3808.6	11.56	0.378603	ESD	0.423350	EC/PULS	2 2	—	—
115143-6253.2	9.93	0.876114	ESD	19.11(×2)	ED	2 1	B5	BV 729
164802-6715.2	10.43	0.422509	EC = ESD	1.593378	ED/ESD	2 2	—	TYC 9050-298-1
144001-1959.5	10.00	0.354445	EC = ESD	0.334349	ESD/EC	0 1	G0, X	BD-19 3931
031509-5144.2	9.61	21.4105	EC/ESD	21.1067	Spot	1 0	K1, X	CD-52 646
125523-7322.2	9.74	206.1	EC	250.2	?	1 0	—	TYC 9253-1392-1
103513-1206.5	11.43	0.384647	EC	0.353901	ESD/EC	0 0	—	—
131055-4844.0	10.80	7.06562	EC?	3.537421	Spots?	2 0	—, X	—
103308-7133.8	10.58	0.816190	EC	0.388607	ESD=ED	0 0	—	TYC 9219-3329-1
190004-2741.4	12.24	0.439555	EC	0.537903	ESD/EC	2 2	—	V395 Sgr

Table 2. Objects examined independently by Pigulski & Michalska

ASAS ID (RA-DEC)	2nd type	Blend I A	Other ID
182323-1240.9	PULS	2 0	FR Sct
234520-3100.5	EC/PULS	0 0	—
084350-4607.2	ESD/EC	2 2	ALS 1135

designated by I and A. The first one (I) is the degree of blending evaluated subjectively by an examination of higher resolution images from Digitized Sky Survey, whereas A is the result of brightness comparison in different apertures of ASAS photometry. The radius of the smallest aperture is 1 pixel and for the largest 3 pixels, so two faint stars close to each other are separated when using small aperture and counted as one object when using a large aperture, significantly increasing the brightness. Some additional information from the SIMBAD database is given (if available) such as an other identifier, spectral type, and whether the star might be an X-ray source (X).

Two stars were found in the WDS catalogue of astrometric doubles and multiples (Mason et al., 2001). 234520-3100.5 was identified as a double star (11.58 mag + 11.94 mag) with a separation of 1″ and 125523-7322.2 (10.6 mag + 11.5 mag) with a separation of 2.4″.

In the course of this analysis 7 out of 13 objects turned out to be double eclipsing binaries (ie. quadruples that consist of two doubles), whereas one exhibits additional pulsations. For one object we have not been able to determine which of the above two scenarios is more probable. There are also 2 stars whose secondary periods have values close to that of primary periods. This kind of behaviour is believed to be due to spots on one of the binary's components. For the remaining two we have no plausible explanation.

Three stars listed in Table 2 were independently found and recently analysed by Pigulski & Michalska (2007a, 2007b). They found FR Sct to be a triple VV Cephei-type system, 234520-3100.5 to show additional δ Scuti behaviour, and 084350-4607.2 to exhibit β Cephei-type variations. For them we quote only our second variability type and an estimation of a degree of blending.

One star, namely 131055-4844.0, has a secondary period value close to (but not the same as) half the value of the primary variation period. Moreover, a residual lightcurve of the second variability has an eclipsing-like shape with two minima of different depth. This cautions, that the primary period may be two times smaller and the primary variability may be due to pulsations rather than eclipses.

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PHOTOMETRIC SEQUENCES AND ASTROMETRIC POSITIONS FOR NOVA Cyg 2007 AND NOVA Oph 2007

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Nova Cyg 2007 (= V2467 Cyg) was discovered by A. Tago at ~ 7.4 mag on CCD images exposed on March 15.79 UT (cf. Nakano, 2007a). It was confirmed spectroscopically on March 16.8 UT by Ayani (2007) and Naito & Sakamoto (2007). A detailed quantitative description of the optical spectra of the nova for March 18.16 UT was given by Munari et al. (2007a). The nova belongs to the "FeII" class defined by Williams (1992). Steeghs et al. (2007) described the identification of the progenitor at $r' = 18.46(\pm 0.01)$ and $i' = 17.49(\pm 0.01)$ mag on IPHAS survey images obtained on August 8 and 9, 2004. According to AAVSO database, Nova Cyg 2007 was already declining when it was discovered and the true maximum occured between the last negative observation ($V \geq 12$, cf. Nakano 2007a) on Mar 12.80 and the discovery one on Mar. 15.79 UT.

Nova Oph 2007 (= V2615 Oph) was discovered by H. Nishimura at ~ 10 mag on photographic film exposed on March 19.81 UT (cf. Nakano 2007b), and confirmed spectroscopically by Naito & Narusawa (2007) on March 20.84 UT as a FeII type of nova. Das et al. (2007) reported infrared spectroscopy showing strong CO molecular bands in emission on March 28.93 UT, and a detailed quantitative description of the optical spectra of the nova on Mar. 22.17 and 24.18 UT was provided by Munari et al. (2007b). According to AAVSO database, Nova Oph 2007 reached maximum around March 27.0 at $V \sim 9.0$.

In this note we present $BVR_\mathrm{C}I_\mathrm{C}$ photometric sequences around both novae. All stars have been checked in SIMBAD for published previous reports on variability. To calibrate the sequences, we obtained CCD photometry with the Sonoita Research Observatory 0.35-m robotic telescope on four distinct photometric nights, using $BVR_\mathrm{C}I_\mathrm{C}$ filters and an SBIG STL-1001E CCD camera. Pixel size is $1.25''$/pix and the field of view is $20' \times 20'$. Observations on each photometric night included following an extinction star from low to high airmass, along with $BVR_\mathrm{C}I_\mathrm{C}$ exposures of Landolt standard fields (Landolt 1983, 1992). The photometric sequences are presented in Figures 1 and 2.

Astrometry was performed using SLALIB (Wallace, 1994) linear plate transformation routines in conjunction with the UCAC2 reference catalog. Errors in coordinates were typically under 0.1 arcsec in both coordinates, referred to the mean coordinate zero point of the reference stars in each field. The coordinates we derived for Nova Cyg 2007 are:

$$\alpha_{\mathrm{J2000}} = 20\ 28\ 12.492\ (\pm 0\overset{''}{.}058) \qquad \delta_{\mathrm{J2000}} = +41\ 48\ 36.33\ (\pm 0\overset{''}{.}044),$$

Nova Cyg 2007 $\alpha_{J2000} = 20\ 28\ 12.492$ $\delta_{J2000} = +41\ 48\ 36.33$

	α_{J2000}	(±")	δ_{J2000}	(±")	N	V	(±)	B–V	(±)	V–R_C	(±)	R–I_C	(±)
a	307.085679	0.074	41.828942	0.049	4	11.292	0.014	0.507	0.020	0.329	0.043	0.277	0.032
b	307.115075	0.068	41.799538	0.063	4	12.140	0.027	1.310	0.005	0.690	0.020	0.698	0.029
c	307.000743	0.041	41.794607	0.180	4	13.151	0.008	0.546	0.015	0.341	0.039	0.311	0.075
d	306.999448	0.095	41.837653	0.220	4	13.679	0.050	0.645	0.011	0.387	0.069	0.385	0.069
e	307.047839	0.106	41.859748	0.079	4	13.049	0.030	1.306	0.031	0.756	0.048	0.633	0.076
f	307.066378	0.085	41.793821	0.161	4	13.344	0.033	1.185	0.046	0.612	0.113	0.516	0.049
g	307.110764	0.063	41.821186	0.292	3	13.629	0.034	0.632	0.049	0.323	0.049		
α	307.117452	0.091	41.957211	0.052	4	8.571	0.082	0.780	0.026	0.421	0.034	0.352	0.020
β	306.877339	0.041	41.901431	0.025	4	9.071	0.101	0.199	0.036	0.002	0.015	0.063	0.013
γ	306.824865	0.096	41.980019	0.113	4	9.892	0.009	1.155	0.037	0.583	0.010	0.520	0.030
δ	306.820622	0.117	41.789043	0.067	4	9.979	0.023	0.051	0.033	−0.018	0.047	0.038	0.031
ϵ	307.109590	0.046	41.721316	0.036	4	10.816	0.018	0.300	0.017	0.160	0.022	0.159	0.020
ζ	306.854831	0.089	41.869731	0.036	4	11.071	0.007	0.285	0.026	0.157	0.036	0.113	0.052
η	307.220886	0.054	41.838218	0.059	4	11.351	0.015	0.931	0.023	0.519	0.017	0.412	0.027
θ	307.119788	0.068	41.936323	0.034	4	11.462	0.019	1.212	0.026	0.677	0.028	0.598	0.040
ι	306.970465	0.124	41.735072	0.125	4	12.139	0.039	1.646	0.017	1.127	0.052	1.156	0.037
κ	307.223231	0.091	41.852592	0.051	4	12.571	0.015	0.644	0.014	0.397	0.033	0.377	0.017

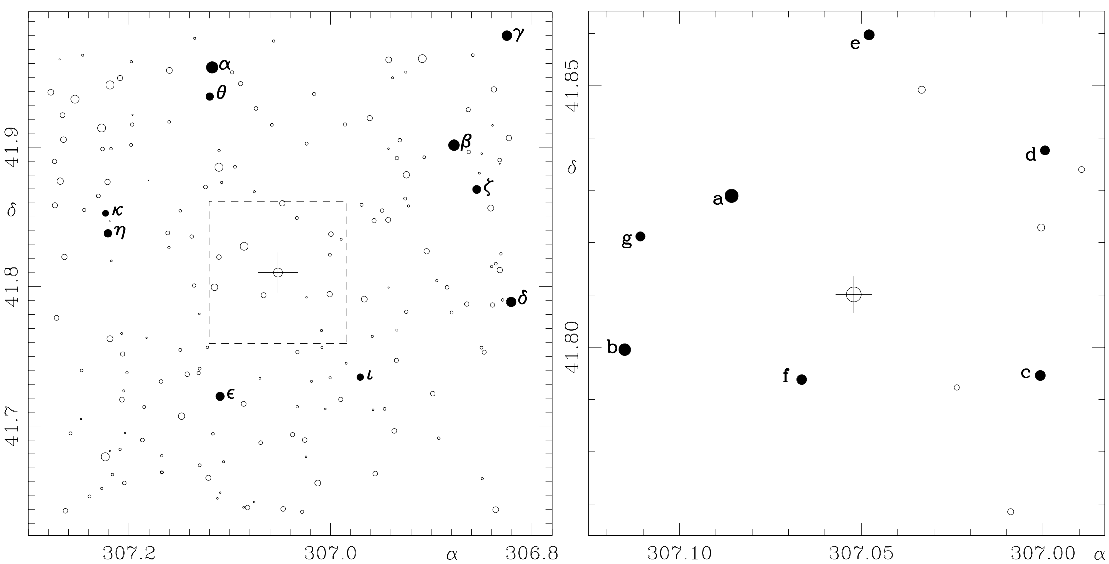

Figure 1. BVR_CI_C photometric comparison sequence around Nova Cyg 2007. The cross indicates the nova. N is the number of nights in which the given star has been measured in the given band. The error in α and δ are in arcsec. The panel on the left covers a $20' \times 20'$ area centered on the nova and shows stars down to $V = 16.5$. The dashed $6' \times 6'$ area is zoomed in on the right panel.
a = TYC 3160-1716-1, α = BD+41.3764, β = BD+41.3757, γ = TYC 3160-1572-1,
δ = TYC 3160-1841-1, ϵ = BD+41.3763, ζ = TYC 3160-1645-1

Nova Oph 2007	$\alpha_{J2000} = 17\ 42\ 44.013$	$\delta_{J2000} = -23\ 40\ 35.05$

	α_{J2000} (±")		δ_{J2000} (±")		N	V	(±)	B–V	(±)	V–R_C	(±)	R–I_C	(±)
a	265.665733	0.056	–23.708134	0.112	4	13.152	0.029	0.845	0.014	0.492	0.043	0.539	0.021
b	265.733692	0.065	–23.642616	0.120	4	13.948	0.035	0.888	0.026	0.542	0.049		
c	265.708289	0.074	–23.679742	0.427	3	14.988	0.066	1.257	0.000				
α	265.605326	0.077	–23.736586	0.136	4	9.287	0.014	0.710	0.022	0.451	0.018	0.467	0.010
β	265.750569	0.065	–23.510333	0.105	4	11.183	0.013	0.658	0.023	0.407	0.029	0.496	0.039
γ	265.662570	0.065	–23.753022	0.124	4	11.765	0.020	0.817	0.026	0.506	0.022	0.548	0.028
δ	265.854080	0.074	–23.830975	0.102	4	12.498	0.006	0.566	0.023	0.351	0.026	0.390	0.030
ϵ	265.809502	0.060	–23.576961	0.090	4	12.528	0.026	0.951	0.038	0.582	0.026	0.594	0.043
ζ	265.797109	0.084	–23.546070	0.113	4	12.609	0.012	0.767	0.021	0.485	0.022	0.573	0.023
η	265.744712	0.033	–23.565366	0.093	4	12.805	0.027	1.593	0.015	0.925	0.043	0.928	0.019
θ	265.504715	0.127	–23.536622	0.164	4	13.149	0.009	0.722	0.030	0.442	0.040	0.525	0.036
ι	265.642594	0.147	–23.760569	0.170	4	13.664	0.015	1.123	0.020	0.651	0.048	0.661	0.054
κ	265.715803	0.094	–23.604210	0.132	4	14.107	0.044	1.062	0.043	0.634	0.084	0.640	0.095
λ	265.776500	0.608	–23.638827	0.421	3	15.077	0.064	1.292	0.063				

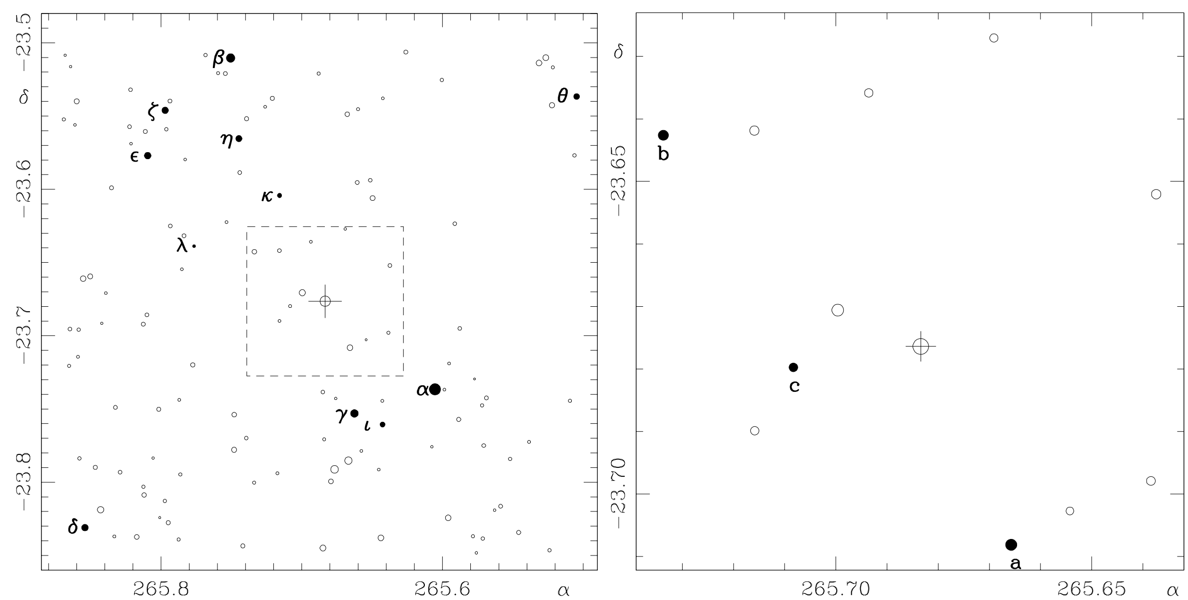

Figure 2. BVR_CI_C photometric comparison sequence around Nova Oph 2007. The cross indicates the nova. N is the number of nights in which the given star has been measured in the given band. The error in α and δ are in arcsec. The panel on the left covers a $20' \times 20'$ area centered on the nova and shows stars down to $V = 15.8$. The dashed $6' \times 6'$ area is zoomed in on the right panel. α = HD 160704 (B0 II)

close to the coordinates derived by Nishiyama & Sakamoto (2007) at position end figures $12^{\rm s}.52$ and $36''.5$, and by Steeghs et al. (2007) at end figures $12^{\rm s}.47$ and $36''.4$. The USNO-A2.0 star closest to this position is object 1275-13944467 at position end figures $12^{\rm s}.505$ and $36''.69$, with $B = 20.0$ and $R = 18.5$.

The coordinates we derived for Nova Oph 2007 are:

$$\alpha_{\rm J2000} = 17\ 42\ 44.013\ (\pm 0''.032) \qquad \delta_{\rm J2000} = -23\ 40\ 35.05\ (\pm 0''.072),$$

close to the coordinates derived by Kadota (2007) at position end figures $44^{\rm s}.00$ and $35''.1$, and by Itagaki (2007) at position end figures $43^{\rm s}.99$ and $35''.0$. Our position is roughly halfway between that of USNO-A2.0 0600-28293794 (position end figures $44^{\rm s}.014$ and $40''.80$, $B = 15.6$ and $R = 12.3$) and that of USNO-A2.0 0600-28294416 (position end figures $44^{\rm s}.353$ and $28''.29$, $B = 18.6$ and $R = 16.4$), the closest two USNO-A2.0 stars.

We would like to thank J. Gross, W. Cooney and D. Terrell for their help in setting up the SRO observations and relinquishing their observing time.

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COMMISSIONS 27 AND 42 OF THE IAU
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ELEMENTS FOR 10 RR LYRAE STARS

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These stars were discovered and reported to be of RR Lyrae type by Boyce & Huruhata (1942) and Hoffmeister (1966, 1967, 1968). Except for V552 Her and V659 Her (see details noted in the remarks below), no further observations or ephemeris have been published until today. Photographic plates of a field centered at alpha Oph, taken with the Sonneberg Observatory 40-cm Astrographs during three intervals spread over the years from 1964 to 1994, were used to investigate the behaviour of these objects (see Table 1).

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	$M-m$	No. of Plates
V550 Her	RRab	49475.463 ±9	0.5603952 ±8	$15^m_.1$	$16^m_.4$	$0^P_.19$	203
V551 Her	RRab	49076.570 ±8	0.4365392 ±5	$14^m_.5$	$16^m_.4$	$0^P_.21$	235
V552 Her	RRab	49124.456 ±4	0.3785196 ±2	$11^m_.2$	$12^m_.8$	$0^P_.17$	297
V555 Her	RRab	49213.346 ±7	0.5839040 ±6	$15^m_.3$	$16^m_.5$	$0^P_.20$	240
V556 Her	RRab	47265.573 ±8	0.4775347 ±7	$14^m_.5$	$15^m_.4$	$0^P_.19$	265
V557 Her	RRab	49488.536 ±9	0.6114131 ±9	$13^m_.5$	$14^m_.2$	$0^P_.18$	287
V562 Her	RRab	49484.471 ±7	0.4653154 ±7	$14^m_.1$	$15^m_.5$	$0^P_.20$	199
V626 Her	RRab	49076.609 ±10	0.5871079 ±13	$14^m_.5$	$15^m_.5$	$0^P_.18$	194
V659 Her	RRab	53891.711 ±9	0.5164255 ±4	$13^m_.8$	$15^m_.1$	$0^P_.19$	276
V763 Oph	RRab	49076.563 ±7	0.4439681 ±5	$14^m_.7$	$16^m_.0$	$0^P_.16$	254

The given elements were obtained by means of least-squares solutions. Photographic amplitudes were derived with respect to magnitudes of the comparison stars given in Table 2. An extensive list holding the times of maxima derived can be retrieved as `5770-t3.txt`, using the link in the HTML version of this paper. Individual data are available upon request.

Table 2. Comparison stars and cross references

	V550 Her S 9802 USNO 1050-08668833		V551 Her S 9804 USNO 0975-09236295	
Comp. No.	USNO	m^*	USNO	m^*
1	1050-08669099	$14\overset{m}{.}9$	0975-09240518	$14\overset{m}{.}6$
2	1050-08671787	$15\overset{m}{.}2$	0975-09231390	$14\overset{m}{.}8$
3	1050-08671790	$15\overset{m}{.}6$	0975-09237192	$15\overset{m}{.}6$
4	1050-08670689	$16\overset{m}{.}8$	0975-09236592	$16\overset{m}{.}8$

	V552 Her S 9806 GSC 1004 993		V555 Her S 8623 USNO 1050-08969873	
Comp. No.	USNO	m^*	USNO	m^*
1	GSC 1004 603	$10\overset{m}{.}67$	1050-08972384	$15\overset{m}{.}1$
2	GSC 1004 2003	$11\overset{m}{.}55$	1050-08971269	$15\overset{m}{.}5$
3	GSC 1004 1692	$12\overset{m}{.}55$	1050-08970928	$16\overset{m}{.}1$
4	GSC 1004 1833	$12\overset{m}{.}67$	1050-08969012	$16\overset{m}{.}6$

	V556 Her S 8627 USNO 0975-09653264		V557 Her S 9824 USNO 1050-09117461	
Comp. No.	USNO	m^*	USNO	m^*
1	0975-09660147	$14\overset{m}{.}5$	1050-09116433	$13\overset{m}{.}3$
2	0975-09653655	$14\overset{m}{.}7$	1050-09121021	$13\overset{m}{.}7$
3	0975-09653142	$15\overset{m}{.}1$	1050-09117300	$13\overset{m}{.}9$
4	0975-09652715	$15\overset{m}{.}4$	1050-09116424	$14\overset{m}{.}5$

	V562 Her S 9830 USNO 1050-09311278		V626 Her S 10350 USNO 0975-09955355	
Comp. No.	USNO	m^*	USNO	m^*
1	1050-09309572	$13\overset{m}{.}9$	0975-09957358	$14\overset{m}{.}2$
2	1050-09312674	$14\overset{m}{.}0$	0975-09948638	$14\overset{m}{.}5$
3	1050-09312330	$14\overset{m}{.}8$	0975-09955218	$15\overset{m}{.}3$
4	1050-09311285	$15\overset{m}{.}6$	0975-09956666	$15\overset{m}{.}7$

	V659 Her S 8619 USNO 0975-09311040		V763 Oph HV 10945 USNO 0975-09245600	
Comp. No.	USNO	m^*	USNO	m^*
1	0975-09305418	$13\overset{m}{.}7$	0975-09244389	$14\overset{m}{.}6$
2	0975-09318049	$14\overset{m}{.}2$	0975-09243330	$15\overset{m}{.}2$
3	0975-09312948	$14\overset{m}{.}6$	0975-09248801	$15\overset{m}{.}5$
4	0975-09310612	$15\overset{m}{.}5$	0975-09244653	$16\overset{m}{.}2$

* Magnitudes refer to the B values of the USNO−A2.0 catalogue

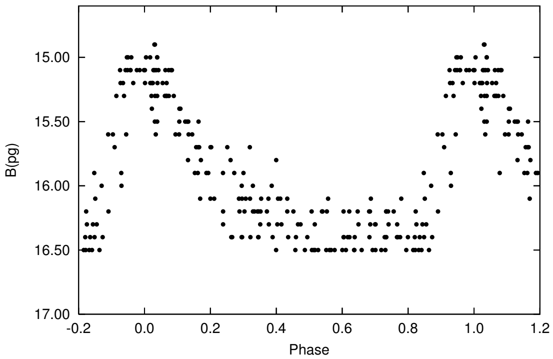

Figure 1. Light curve of V550 Her

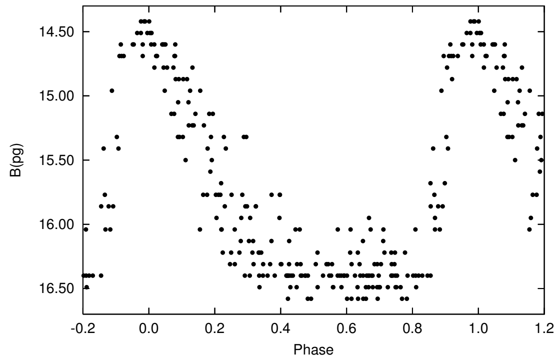

Figure 2. Light curve of V551 Her

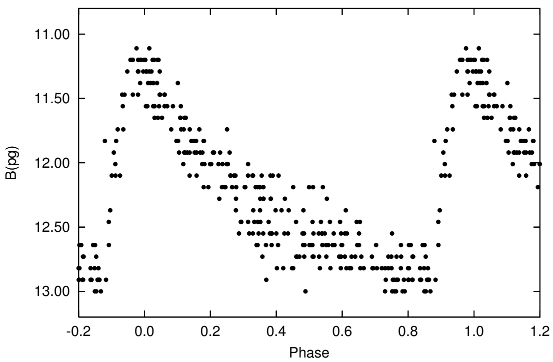

Figure 3. Light curve of V552 Her

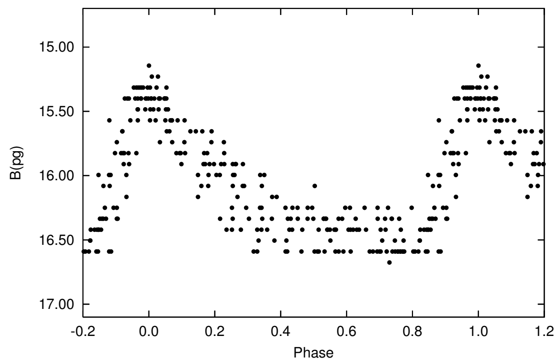

Figure 4. Light curve of V555 Her

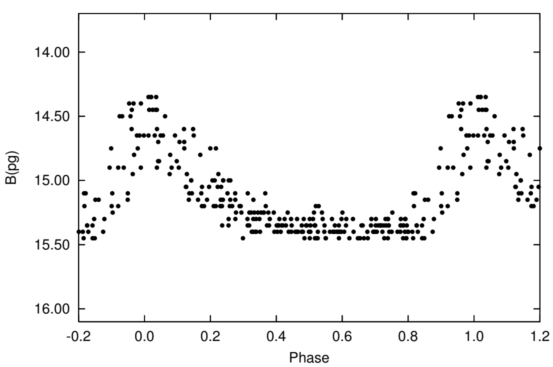

Figure 5. Light curve of V556 Her

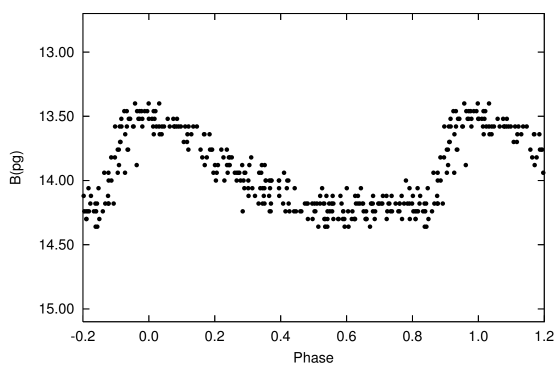

Figure 6. Light curve of V557 Her

Remarks:

V552 Her

First elements were derived from Northern Sky Variability Survey data (NSVS 10885457, Max (hel) = J.D. 2451338.78 + $0\overset{d}{.}37854$) by Wils et al., 2006.

V659 Her

In addition to our observations three further maximum times were derived from ASAS data (ASAS 173053+1421.9, J.D. hel. 2453817.862, 2453832.835 and 2453891.700) and used for this period analysis.

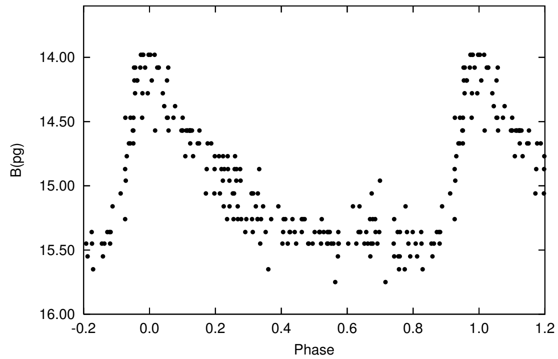

Figure 7. Light curve of V562 Her

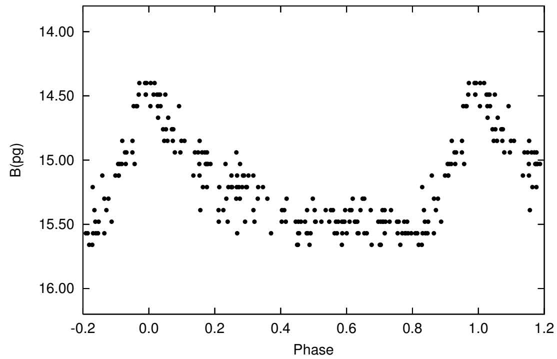

Figure 8. Light curve of V626 Her

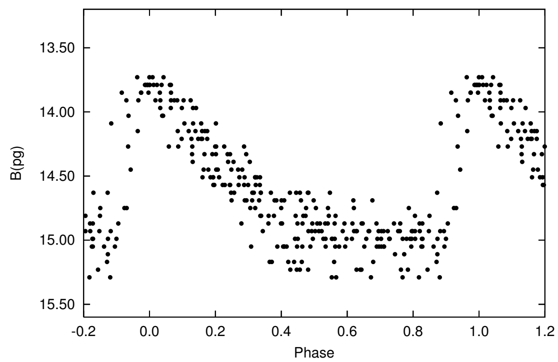

Figure 9. Light curve of V659 Her

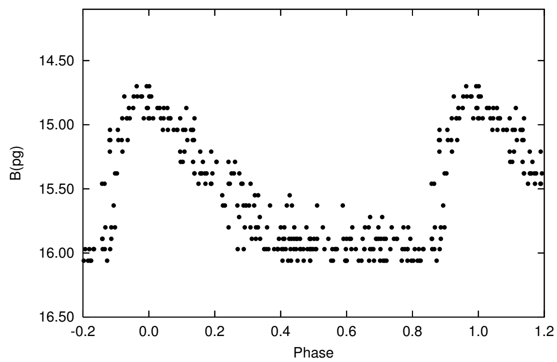

Figure 10. Light curve of V763 Oph

This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France.

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PHOTOMETRIC SEQUENCES AND ASTROMETRIC POSITIONS OF NOVA Sco 2007 N.1 AND N.2

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Nova Sco 2007 N.1 (= V1280 Sco) was discovered by Y. Nakamura and Y. Sakurai at $\sim$ 9.6 mag on CCD images exposed on Feb 4.85 UT (cf. Yamaoka 2007a). It was confirmed spectroscopically on Feb. 5.87 UT by Naito & Narusawa (2007a). Further optical spectra were described by Yamaoka (2007b) for Feb. 14.86 UT, by Buil (2007) for Feb. 20.20 UT, and infrared spectra for Feb. 14–16 by Rudy et al. (2007). Negative X-ray detection by RXTE and SWIFT on Feb. 21 and corresponding flux upper limits were given by Swank (2007) and Osborne et al. (2007), respectively. A detailed quantitative description of early post-maximum high resolution optical spectroscopy for Feb. 20.24 UT was presented by Munari et al. (2007). According to the AAVSO International Database, maximum brightness was reached on Feb. 16.7 at $V \sim 4.0$.

Nova Sco 2007 N.2 (= V1281 Sco) was discovered by Y. Nakamura at $\sim$ 9.3 mag on CCD images exposed on Feb. 19.86 UT (cf. Yamaoka 2007c), and confirmed spectroscopically by Naito & Narusawa (2007b) on Feb. 21.84 UT. A negative X-ray detection by SWIFT on Feb. 21 is reported by Osborne et al. (2007). It is not possible to accurately determine the date of maximum with the available data. Data reported in IAUC 8810 and 8812 indicate the latest negative detection was on Feb 18.85 and the first entries in the AAVSO database are for Feb. 22.7 UT at $V \sim 9.1$ mag when the nova was already on the declining branch of the light-curve. An extrapolation of the available data supports a maximum around Feb 20.5 UT at $V \sim 8.5$ mag.

In this note we present a $BVR_{\rm C}I_{\rm C}$ photometric sequence around both novae. To calibrate the sequences, we obtained CCD photometry with the Sonoita Research Observatory 0.35-m robotic telescope on several distinct photometric nights, using $BVR_{\rm C}I_{\rm C}$ filters and an SBIG STL-1001E CCD camera. Pixel size is $1.25''$/pix and the field of view is $20' \times 20'$. Observations on each photometric night included following an extinction star from low to high airmass, along with $BVR_{\rm C}I_{\rm C}$ exposures of Landolt standard fields (Landolt, 1983, 1992). The photometric sequences are presented in Figures 1 and 2.

Astrometry was performed using SLALIB (Wallace, 1994) linear plate transformation routines in conjunction with the UCAC2 reference catalog. Errors in coordinates were typically under 0.1 arcsec in both coordinates, referred to the mean coordinate zero point of the reference stars in each field. The coordinates we derived for Nova Sco 2007 N.1 are:

$$\alpha_{\rm J2000} = 16\ 57\ 41.217(\pm0\farcs052) \qquad \delta_{\rm J2000} = -32\ 20\ 35.63(\pm0\farcs028)$$

Nova Sco 2007 N.1 $\alpha_{\rm J2000} = 16\ 57\ 41.217$ $\delta_{\rm J2000} = -32\ 20\ 35.63$

	α_{J2000}	(±")	δ_{J2000}	(±")	N	V	(±)	B–V	(±)	V–$R_{\rm C}$	(±)	R–$I_{\rm C}$	(±)
a	254.407340	0.091	–32.365394	0.047	22	10.759	0.039	1.401	0.036	0.710	0.063	0.699	0.040
b	254.455661	0.054	–32.366616	0.051	22	12.098	0.038	0.531	0.043	0.303	0.035	0.319	0.029
c	254.427132	0.091	–32.306776	0.093	19	12.493	0.048	1.798	0.034	1.059	0.038	1.152	0.033
d	254.360533	0.062	–32.294085	0.108	22	12.923	0.045	1.211	0.038	0.676	0.046	0.639	0.040
e	254.389346	0.051	–32.393890	0.065	22	13.511	0.062	1.156	0.036	0.636	0.059	0.594	0.036
f	254.429934	0.090	–32.373744	0.050	20	13.936	0.064	0.937	0.053	0.506	0.046	0.487	0.042
g	254.425857	0.056	–32.379776	0.070	17	14.637	0.053	0.760	0.070	0.438	0.078	0.442	0.037
h	254.451915	0.095	–32.374468	0.146	16	15.395	0.052	0.828	0.050	0.408	0.060	0.432	0.058
i	254.458309	0.164	–32.303689	0.241	7	16.325	0.059	1.092	0.057	0.673	0.060	0.636	0.038
j	254.425956	0.511	–32.341853	0.116	2	17.319	0.071	0.988	0.073				
α	254.240999	0.082	–32.337911	0.130	6	7.576	0.027	0.154	0.040	0.076	0.033	0.057	0.033
β	254.261365	0.099	–32.480897	0.066	20	9.791	0.067	0.194	0.054	0.110	0.054	0.137	0.042
γ	254.270053	0.123	–32.422711	0.057	22	9.935	0.069	0.016	0.049	0.057	0.058	0.031	0.039
δ	254.535466	0.063	–32.375566	0.042	22	10.264	0.073	1.672	0.046	0.807	0.102	0.880	0.042
ϵ	254.579693	0.058	–32.403422	0.047	22	10.475	0.041	0.428	0.036	0.233	0.037	0.262	0.038
ζ	254.357711	0.075	–32.247917	0.088	22	11.461	0.040	0.673	0.040	0.379	0.039	0.363	0.027

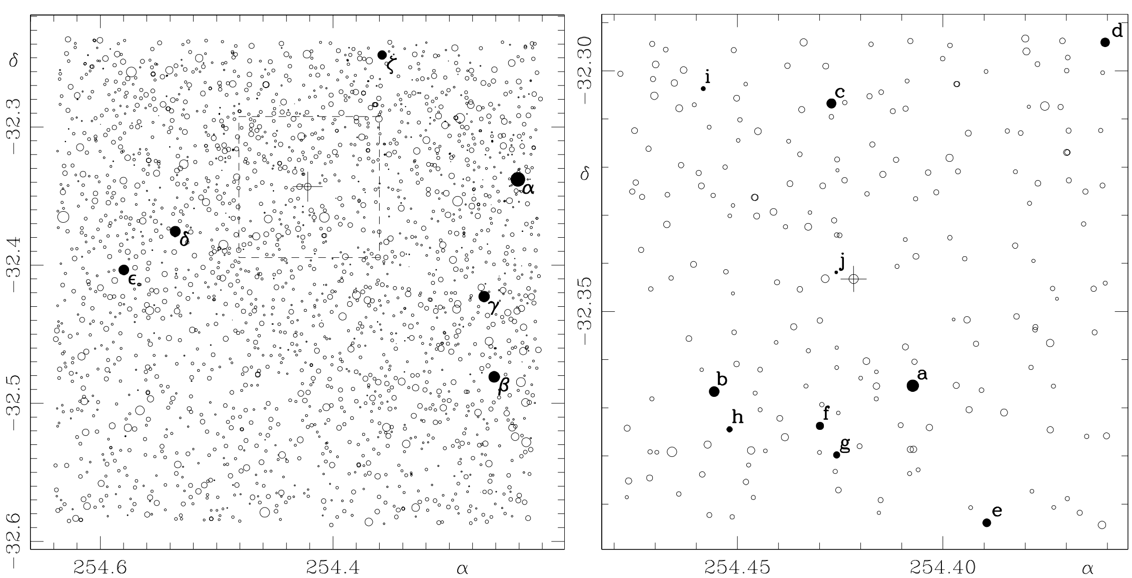

Figure 1. $BVR_{\rm C}I_{\rm C}$ photometric comparison sequence around Nova Sco 2007 N.1. The cross indicates the nova. N is the number of nights in which the given star has been measured in the given band. The errors in α and δ are in arcsec. The panel on the left covers a $20' \times 20'$ area centered on the nova and shows stars down to $V = 18.0$. The dashed $6' \times 6'$ area is zoomed in on the right panel.
a = TYC 7364-1316-1, α = HD 152805 (A3V), β = HD 152806 (A0V), γ = HD 152819 (B4IV), ϵ = TYC 7364-1321-1

Nova Sco 2007 N.2	$\alpha_{J2000} = 16\ 56\ 59.353$	$\delta_{J2000} = -35\ 21\ 50.40$

	α_{J2000}	(±")	δ_{J2000}	(±")	N	V	(±)	B–V	(±)	V–R_C	(±)	R–I_C	(±)
a	254.309520	0.050	–35.316804	0.067	10	12.601	0.039	1.092	0.048	0.656	0.047	0.657	0.051
b	254.211325	0.063	–35.371121	0.117	10	12.877	0.043	1.688	0.044	0.903	0.042	0.833	0.052
c	254.214301	0.092	–35.365098	0.070	10	13.503	0.071	0.977	0.052	0.573	0.066	0.568	0.055
d	254.232278	0.065	–35.360077	0.124	10	13.353	0.053	1.341	0.041	0.783	0.046	0.765	0.051
e	254.210946	0.144	–35.382090	0.144	9	14.362	0.036	0.859	0.044	0.530	0.038	0.554	0.046
f	254.217448	0.104	–35.368745	0.155	7	15.030	0.074	1.049	0.050	0.599	0.112	0.666	0.068
g	254.281649	0.311	–35.369735	0.117	3	15.993	0.016	1.270	0.059	0.644	0.140	0.762	0.081
α	254.036042	0.113	–35.450088	0.059	10	9.931	0.037	0.669	0.052	0.357	0.046	0.376	0.052
β	254.073794	0.195	–35.544186	0.352	3	10.086	0.039	1.409	0.036	0.692	0.018		
γ	254.200979	0.120	–35.511953	0.170	10	10.958	0.073	1.760	0.064	0.879	0.062	0.844	0.053
δ	254.303689	0.105	–35.277839	0.094	10	11.818	0.047	0.704	0.045	0.379	0.039	0.434	0.039
ϵ	254.212949	0.096	–35.224904	0.042	10	12.057	0.038	0.553	0.039	0.320	0.045	0.361	0.048

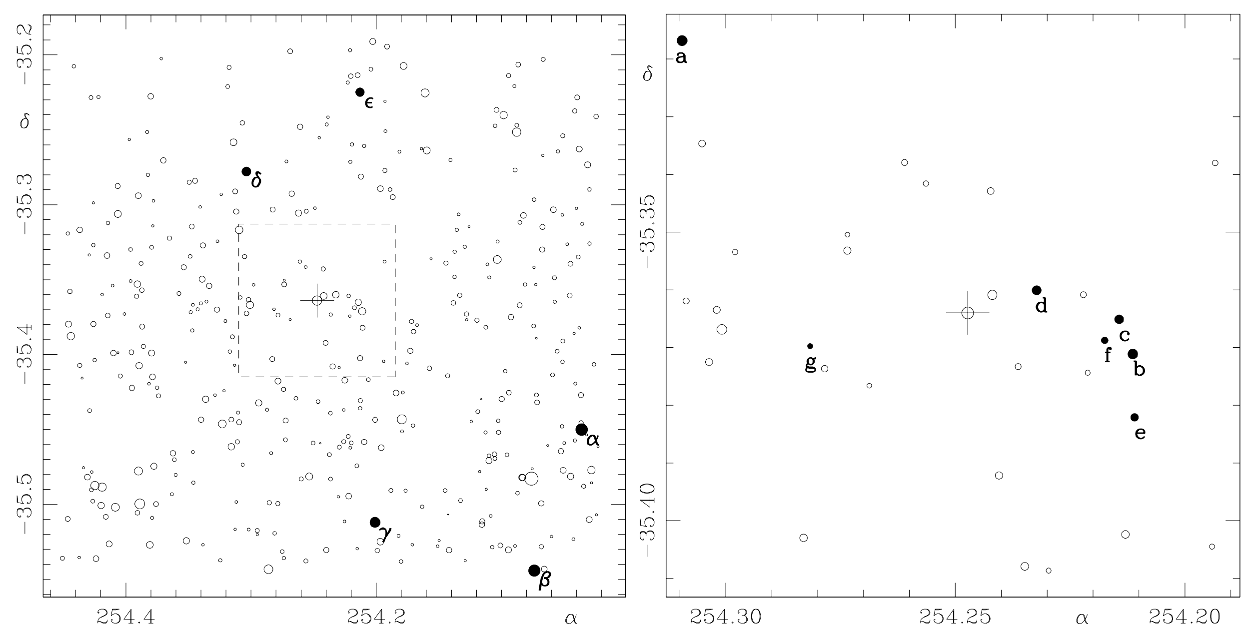

Figure 2. BVR_CI_C photometric comparison sequence around Nova Sco 2007 N.2. The cross indicates the nova. N is the number of nights in which the given star has been measured in the given band. The errors in α and δ are in arcsec. The panel on the left covers a $20' \times 20'$ area centered on the nova and shows stars down to $V = 16.8$. The dashed $6' \times 6'$ area is zoomed in on the right panel.
α = HD 152663 (A4II/III), β = CD-35.11195

close to the coordinates measured by Kadota (2007) at position end figures $41^{\mathrm{s}}.20$ and $35''.8$. Nearest cataloged field stars are GSC2.2 S222213212743 at position end figures $40^{\mathrm{s}}.908$, $43''.59$ and $V = 15.9$, $R = 15.1$, and GSC2.2 S222213213017 at position end figures $41^{\mathrm{s}}.101$, $30''.82$ and $V = 17.4$, $R = 16.5$.

Our coordinates for Nova Sco 2007 N.2 are:

$$\alpha_{\mathrm{J2000}} = 16\ 56\ 59.353(\pm 0''.183) \qquad \delta_{\mathrm{J2000}} = -35\ 21\ 50.40(\pm 0''.093)$$

close to the coordinates measured by Itakagi (2007) at position end figures $59^{\mathrm{s}}.35$ and $50''.2$. Nearest cataloged field star is USNO-A2.0 0525-24996449 at position end figures $58^{\mathrm{s}}.656$, $44''.41$ and $B = 17.7$, $R = 15.9$.

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GSC 3377-0296 IS A NEW SHORT-PERIOD ECLIPSING RS CVn VARIABLE

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During a programme of optical identification of X-ray sources the uncatalogued variable, NSVS 4620766 in the ROTSE1 database (Wozniak et al., 2004), has been found to be coincident the variable X-ray source 1RXS J064117.0+464904 from the ROSAT all-sky survey bright source catalogue (Voges et al., 1999, Fuhrmeister & Schmitt 2003). The variable lies within the 10″ uncertainty in the position of the X-ray source. The star is also identified as GSC 3377-0296 and is catalogued by 2MASS at $06^{h}41^{m}16\overset{s}{.}76$ $+46°49'09\overset{''}{.}0$ (2000). Further details of the programme are presented in Bernhard et al. (2005) and Bernhard & Frank (2006). GSC 3377-0296 has $V = 12.32$ and $B - V = 0.83$ transformed from the Tycho-2 catalogue (Høg et al., 2000), the Tycho Input Catalogue, revised version gives $V = 11.80$ (Egret et al., 1992), the 2MASS catalogue gives $J - K = 0.676$ (Cutri et al., 2003). The star is a high proper-motion object (Kislyuk et al., 1999; Zacharias et al., 2004).

Further observations were made using both a 20-cm Schmidt–Cassegrain telescope and a Starlight XPress SX CCD camera with BVR filters in Linz, Austria and a 34-cm Cassegrain telescope with a CCD camera SBIG ST-6 and a V filter in Gemmingen, Germany. The comparison star used was GSC 3377-0179. No reliable magnitude estimates exist for this star. The Tycho-2 magnitudes are most probably wrong, as these contradict other available photometric information. The check stars were GSC 3377-0285 and GSC 3377-0811, which were found to be constant within < 0.02 mag.

The following primary minima were observed in 2006 and 2007:

Table 1: Times of primary minima of GSC 3377-0296 (HJD 245...)

minimum time	filter	observer	$O - C$ (d)
4085.5907 (2)	V	Monninger	−0.0003
4092.3513 (2)	V	Monninger	+0.0008
4096.5776 (2)	V	Monninger	+0.0024
4171.3497 (3)	V	Bernhard	−0.0021

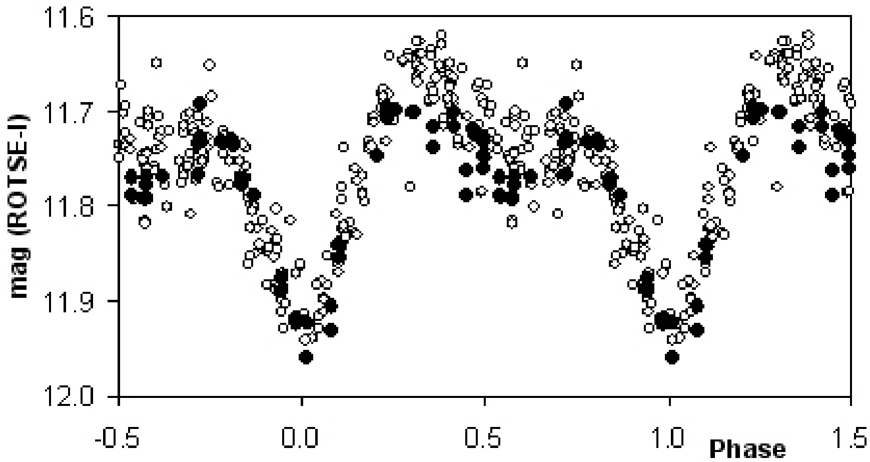

Figure 1. ROTSE1 light curve of GSC 3377-0296 folded with a period 0.4224672 days

Figures in brackets denote rms errors in units of the last decimal, $O - C$ values were calculated with the ephemeris given below.

A Fourier analysis of all the available data including TASS (http://www.tass-survey.org/) and ROTSE1 was performed to search for periodicity of the light variations. The following ephemeris can be derived from the analysis with the algorithm Period04 (Lenz & Breger, 2005):

$$\mathrm{HJD}_{\mathrm{MinI}} = \underset{\pm 3}{2454085.591} + \underset{\pm 1}{0\overset{\mathrm{d}}{.}422467} \times E.$$

The folded ROTSE1 light curve is shown in Figure 1, which identifies GSC 3377-0296 with a very short period and heavily spotted RS CVn type star. The ROTSE1 dataset (April 1999–March 2000) was divided into two parts of equal length to search for secondary variations (April 1999–October 1999: filled circles; November 1999–March 2000: open circles). It can be seen, that the shape of the light curve varies between phase 0.2 and 0.5 due to the changing activity of star spots.

The folded light curve of our observations with V filters (G. Monninger: 15–27 December 2006, filled circles; K. Bernhard: 4–15 March 2007) is given in Figure 2. Small offsets have been applied to G. Monningers data set as part of the fitting process.

It shows distinct variations within the time span of four months from phase 0.4 to 0.8. Changes of the light curve were noticed even within a week near phase 0.7 (see filled circles). Considering the ROTSE1 data, large parts of the light curve (phase 0.2 to 0.8) are affected by stellar activity, which suggests, that there could be two active longitudes similar to other RS CVn variables (e.g. Berdyugina and Tuominen, 1998).

The folded $\Delta V, \Delta(B-V), \Delta(V-R_C)$ light curves, relative to GSC 3377-0179, of the filtered observations in March 2007 are shown in Fig 3. The $B-V$ and $V-R_C$ colour differences between the variable and the comparison are relatively small, and indicate a slight reddening of the star, when it enters the minimum of the spotted light curve at phase 0.63.

The magnitude difference between the maximum and this minimum, determined by low order polynomial fitting, is for the B band about 0.14 mag, for the V and R_C band

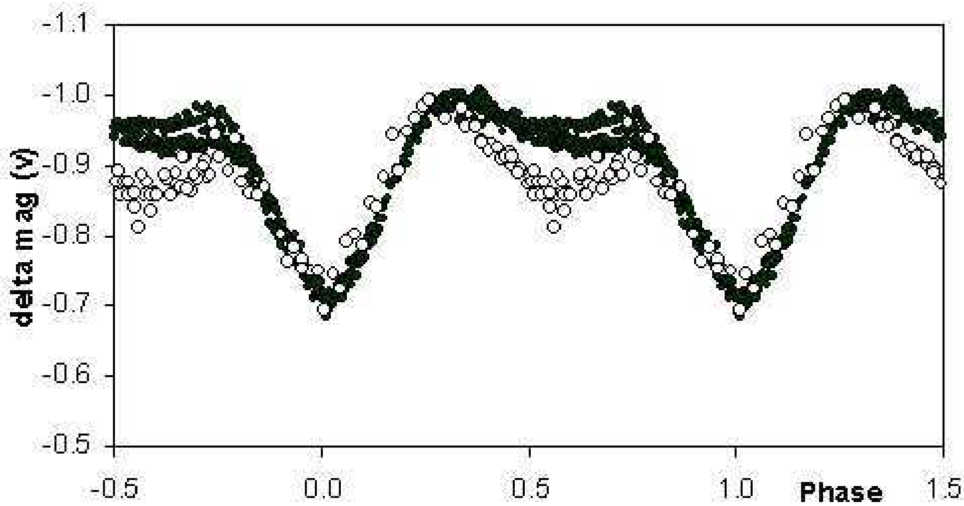

Figure 2. Our V-band observations from 15 December 2006–15 March 2007 relative to GSC 3377-0179

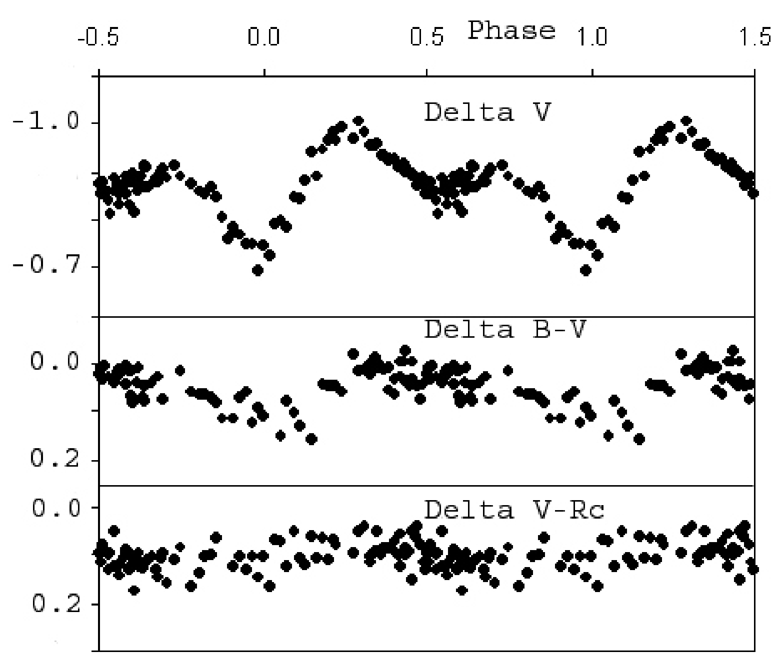

Figure 3. Folded $\Delta V, \Delta(B-V)$ and $\Delta(V-R_C)$ light curves of GSC 3377-0296, March 2007

only 0.12 and 0.10 mag. This is in good agreement with data from literature, where a $\Delta R/\Delta V$ value of 0.90 for active stars has been determined (Drake, 2006).

The median magnitude of the NSVS data of the variable is 0.87 mag brighter than of the comparison star GSC 3377-0179, which is similar to the respective value of our observations in R_C band (0.96 mag) and V band (0.89 mag).

The variability type RS CVn is also supported by the X-ray identification and the 2MASS colours $J - H = 0.54$ and $H - K = 0.14$, which suggest a spectral type of K3.

The period of 0.4224672 days is very short for an RS CVn star. It is shorter than the periods of all 206 binary systems listed in the second edition of the catalogue of chromospherically active binary stars (shortest period: XY UMa, 0.4789944 days; Strassmeier et al., 1993).

Although the period is similar to that of XY UMa the light curve is rather different (Collier Cameron & Hilditch 1997), and suggests a smaller, near-contact system. The light curve is similar to the near-contact binary GR Tau (P=0.42985 days Zhang et al., 2002), although this class of star is limited to spectral types A–F and does not show RS CVn-like chromospheric activity. GSC 3377-0296 clearly shows evidence of cool spots, probably at two opposite longitudes, but is also probably a near-contact system.

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LONG-TERM SPECTROSCOPIC VARIABILITY OF TWO Oe STARS

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The Oe spectral category was first introduced by Conti & Leep (1974) to classify those O-stars exhibiting emission in the hydrogen Balmer lines, but not in He II λ 4686 nor N III $\lambda\lambda$ 4634-40. These objects are quite rare (see e.g. Negueruela et al., 2004) and most of them have not been studied in detail. Oe stars have rather large rotational velocities and their emission lines frequently display a double-peaked morphology. As for Be stars, these emission lines are interpreted as the signature of a circumstellar disk of matter expelled by the star. Oe stars are thus believed to represent the earliest representatives of the Be phenomenon. Indeed, Negueruela et al. (2004) argued that many Oe stars had previously been classified too early because of the infilling of He I classification lines.

In this paper, we present the results of a spectroscopic monitoring of HD 45314 and HD 60848, which have been reclassified as B0 IVe and O9.5 IVe respectively by Negueruela et al. (2004). Spectra of these stars were collected with the Aurélie spectrograph at the 1.52-m telescope of the Observatoire de Haute Provence (OHP, France) and echelle spectra were taken with the FEROS instrument at the 1.5 and 2.2-m telescopes at La Silla (ESO, Chile; see Table 1). All the data were reduced with the MIDAS software developed at ESO and with private routines designed for the specific reduction of Aurélie and FEROS data. Special attention was paid to ensure a homogeneous normalisation of the spectra.

Table 1. Journal of the observations of HD 45314 and HD 60848

Epoch	Instrument	Resolving power	Wavelength range	Number of spectra	
				HD 45314	HD 60848
Feb. 1997	Aurélie	20000	6510–6710 Å	11	6
Nov. 1998	Aurélie	30000	6500–6620 Å	7	6
Nov. 1998	Aurélie	30000	4795–4925 Å	1	1
May 1999	FEROS	48000	3900–7100 Å	10	10
May 2000	FEROS	48000	3900–7100 Å	4	6
Sep. 2000	Aurélie	10000	4460–4900 Å	3	2
May 2001	FEROS	48000	3900–7100 Å	3	3
Sep. 2001	Aurélie	10000	6350–6770 Å	3	-
Sep. 2001	Aurélie	10000	4460–4900 Å	1	-
Mar. 2002	FEROS	48000	3900–7100 Å	3	3

In addition to the strong hydrogen Balmer emission lines (mainly Hγ, Hβ and Hα), the optical spectrum of HD 45314 displays double-peaked emission in many Fe II lines (e.g. $\lambda\lambda$ 5169, 5198, 5235, 5275, 5319, 5363, 6318, 6346, 6370, 6384…) as well as some He I lines ($\lambda\lambda$ 5876, 6678, 7065 being the strongest ones). We further note the existence of weak (but definite) He II absorption lines at $\lambda\lambda$ 4200, 4542, 4686 and 5412, but also some lines of C III, N III and Si IV. These features are broadly consistent with an O9.5-B0 spectral type. We note that Fremat et al. (2006) inferred $T_{\rm eff} = 31092 \pm 557$ K and $\log g = 3.97 \pm 0.05$ for HD 45314 which corresponds to an O9.5 V spectral type, but does not rule out a B0 classification.

The spectrum of HD 60848 is dominated by emissions in Hα, Hβ, He I $\lambda\lambda$ 5876, 6678 and 7072. During some campaigns, the emission lines (with the exception of Hα) appear shell-like with a strong central absorption that reaches below the continuum level. There are a number of strong absorption lines, including amongst others He I λ 4471 and He II $\lambda\lambda$ 4200, 4542, 4686 and 5412, as well as lines of C III, C IV, N III, O II, O III, Si III and Si IV. There is no indication of Fe II emissions with a strength comparable to those seen in the spectrum of HD 45314.

We have analysed the variability of the various spectral features using the tools described by Rauw et al. (2001). All emission lines were found to display significant variations. Here, we focus on the changes seen in the hydrogen Balmer lines (see Figs. 1, 2) as well as the Fe II lines.

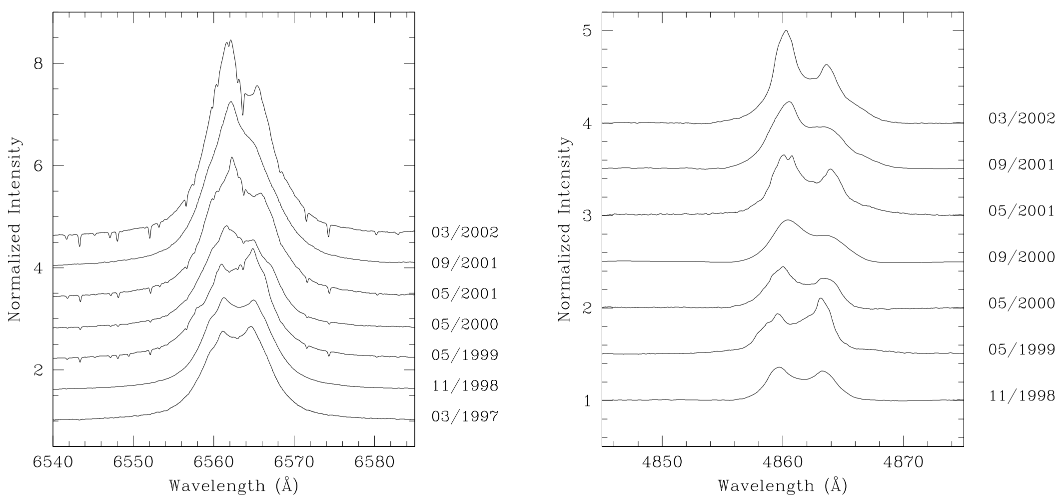

Figure 1. Line profile variations of the Hα and Hβ emission lines of HD 45314

HD 45314 presents important variations of the strengths of its emission features: the equivalent width (EW) of the Hα emission increased from ~ -20 to ~ -35 Å between 1997 and 2002 (Fig. 3). During our campaign, the Hα emission was hence much stronger than the EWs of -7.4 and -4.7 Å reported by Andrillat et al. (1982) and Andrillat (1983) from observations obtained in February 1981 and October 1981 respectively. The EW variations obviously occur on time scales of more than five years and our data do not allow to detect any periodicity. Simultaneously, we note prominent variations of the V/R ratio (see Fig. 3). Significant variations of this ratio sometimes occur over the typical duration of our observing campaigns (see the top panels of Fig. 3) tentatively suggesting a time scale of order a few months. The V/R variations of the Hβ line are less clear cut, though they qualitatively agree with the trends seen in Hα. We have also measured the radial velocity of the He II λ 4686 absorption line. On average, we obtain

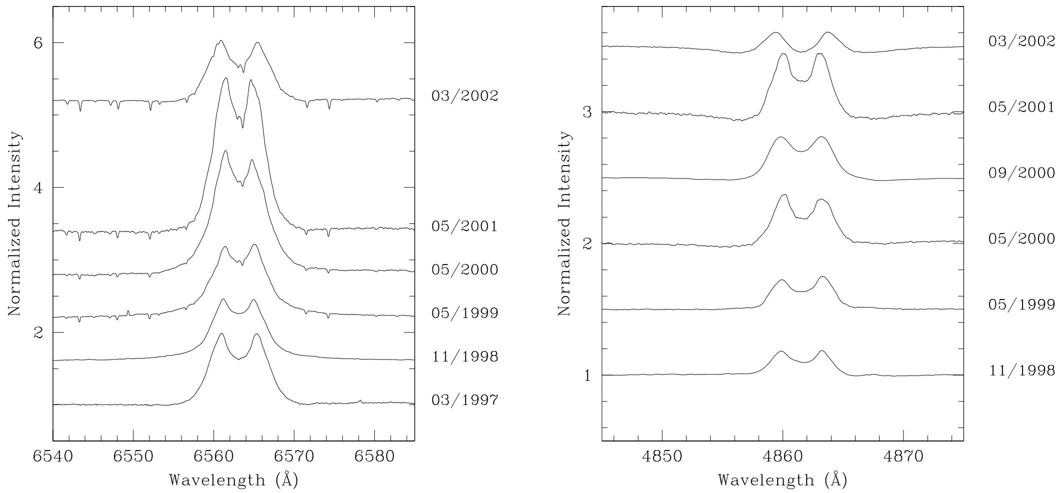

Figure 2. Same as Fig. 1 but for the Hα and Hβ emission lines of HD 60848

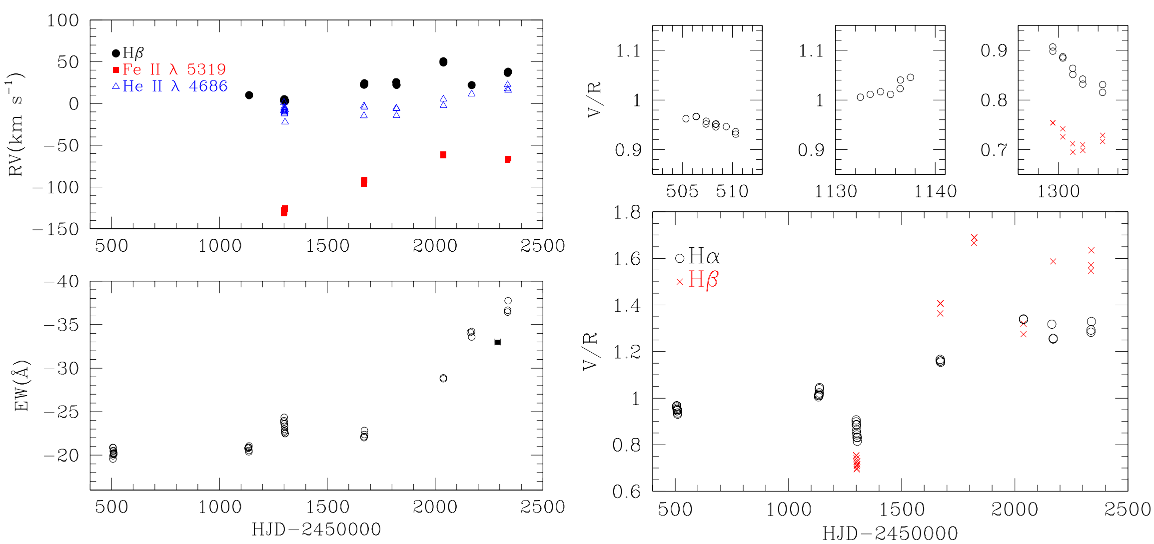

Figure 3. Variations of the spectral characteristics of HD 45314. *Left, top panel*: radial velocities of the He II λ 4686 absorption and average of the RVs of the violet and red peaks of the Hβ and Fe II λ 5319 emissions. *Left, bottom panel*: equivalent width of the Hα line as a function of time as measured on our spectra. The filled square corresponds to the January 2002 measurement of Negueruela et al. (2004). *Right*: $V/R = (I_V - I_c)/(I_R - I_c)$ ratio (where I_V and I_R are the intensities of the violet and red peaks respectively and I_c is the intensity of the continuum) of the Hα and Hβ lines. The top panels zoom in on those campaigns where significant trends were observed

$-2.9 \pm 11.2\,\mathrm{km\,s^{-1}}$ with the RV increasing progressively from a minimum of -22.1 to a maximum of $+22.3\,\mathrm{km\,s^{-1}}$ between May 1999 and March 2002. The violet and red peaks of the Hβ and Fe II emissions also shift in RV with time, although it is not fully clear whether these RV variations are correlated with those of the absorption line (see Fig. 3).

HD 60848 also displays strong variations of the strengths of its emission features. The EW of the Hα emission varies between ~ -5.5 and ~ -14.5 Å, with a maximum occurring between May 2000 and May 2001 (Fig. 4). The EW apparently increased at a rather slow rate between 1998 and 2001 and subsequently decreased dramatically back to its initial level in 2002. It is interesting to note that a similar decrease in the Hα EW from about -17 to -7 Å was observed between early 1981 and early 1983 (Divan et al. 1983, Andrillat et al. 1982). This suggests that the EW variations might be cyclic with a recurrence time of order five years. Contrary to HD 45314, the V/R ratio remains close to unity and displays no large variations (see Fig. 4). The radial velocity of the He II λ 4686 absorption line is found to be $22.7 \pm 6.2\,\mathrm{km\,s^{-1}}$ on average with a minimum of $+13.1$ and a maximum of $+41.3\,\mathrm{km\,s^{-1}}$ with no clear trend during our campaign.

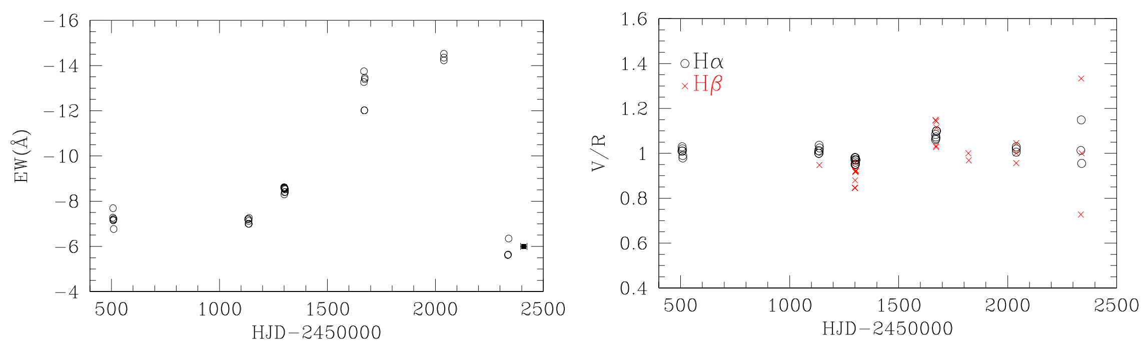

Figure 4. Variations of the spectral characteristics of HD 60848. *Left:* equivalent width of the Hα line as a function of time. The filled square corresponds to the May 2002 measurement of Negueruela et al. (2004). *Right:* V/R ratio of the Hα and Hβ lines

In summary, HD 45314 and HD 60848 both display strong long-term spectroscopic variations. Part of these variations could be recurrent. Monitoring these stars over several months and/or several years could help to specify the origin of the Oe phenomenon.

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AD CMi

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The variability of AD CMi was discovered by Hoffmeister (1934). Abhyankar (1959) observed the star during five nights in 1959 and showed the star to be a short period pulsating variable with a period of 0.12297 day.

Since the correct identification of the type of variability of AD CMi a great number of photoelectric and CCD observations have been obtained by different observers and more than seventy times of maximum light are given in the literature (Abhyankar, 1959; Agerer & Hübscher, 1997, 1998, 2000, 2003; Agerer et al., 2001; Anderson & McNamara, 1960; Balona & Stobie, 1983; Breger, 1975; Burchi et al., 1993; Epstein & Epstein, 1973; Fu & Jiang, 1996; Hübscher, 2005; Hübscher et al., 1994; Jiang, 1987; Klingenberg et al., 2006; Langford, 1976; Rodríguez et al., 1988, 1990; Yang et al., 1992). The period change of AD CMi was studied by Jiang (1987), Rodríguez et al. (1988, 1990), Yang et al. (1992) and Fu & Jiang (1996). Fu & Jiang remarked that the groups of data points distributed above and below the parabolic fit curve which seemed to suggest a trigonometric function type period variation. They came to the conclusion that light time effect caused by orbital motion might explain the sine like variation and deduced a period of $P_B = 10965$ days ≈ 30 years and eccentricity $e = 0.59$ of the elliptical orbital motion and a rate of increase in the pulsation period $(1/P)(dP/dt) = 1.1 \times 10^{-8}$ yr^{-1}.

Radial velocity measurements could give further evidence for binary nature. Abhyankar (1959) and Balona & Stobie (1983) published radial velocity curves of AD CMi. Abhyankar (1959) gave mean radial velocity of the star as 34.5 km/s, while from the radial velocity data of Balona & Stobie (1983) obtained in 1977 and 1978 Rodríguez et al. (1988) deduced a mean value of 38.8 km/s. Recently, Derekas et al. (2006) reported new radial velocity measurements and deduced 35 km/s for the mean radial velocity of AD CMi.

During the past thirty-five years AD CMi was observed with the different instruments of the Konkoly Observatory on 11 nights. Different combination of the $UBVR_CI_C$ filters were used. Throughout the photoelectric observations the comparison star was GSC 00181-00490 (except for the nights 2453451 and 2453452 when GSC 00184-00604 was used) while for the CCD photometry the comparison star was GSC 00181-00708. All the photometric observations are given electronically through the IBVS website as files 5774-t3.txt, 5774-t4.txt, 5774-t5.txt, 5774-t6.txt and 5774-t7.txt.

On the whole 10 times of maximum light (Table 1) could be determined from our observations. Each light maximum was derived as an average over the B and V bands

Table 1. Observations at Konkoly Observatory

times of maximum HJD 2400000+	telescope	detector	observation duration
41681.5258	50-cm Cassegrain	pe	.4537 – .5860
41682.5090	50-cm Cassegrain	pe	.4589 – .5277
42461.4291	60-cm Newton	pe	.3485 – .4492
43572.3810	60-cm Newton	pe	.3480 – .3838
43936.2635	60-cm Newton	pe	.2658 – .3322
46775.6235	1-m RCC	pe	.5159 – .6498
48254.5171	1-m RCC	pe	.4410 – .6281
53452.2795	1-m RCC	pe	.2673 – .3880
54165.2862	60-cm Newton	CCD	.2343 – .4510
54172.2961	60-cm Newton	CCD	.2343 – .4186

since the times of maximum for these colour bands are not perceptibly shifted to each other. The typical error of maximum times derived from our observations is about 1 minute.

From the ASAS (Pojmanski, 2005) and NSVS (Woźniak et al., 2004) datasets normal maxima were derived through third order Fourier fits (The NSVS observations have been subject to heliocentric correction).

The Hipparcos database provides one useful time of maximum light. Since heliocentric corrections have not been applied to these data we determined a new epoch of maximum taking the heliocentric correction into account.

Kilambi & Rahman (1993) and Kim & Joner (1994) published photometry of AD CMi, which made the determination of ten further times of maximum light possible.

All the published and newly determined times of maximum light are given in Table 2 (available only in the electronic version on the IBVS website as 5774-t2.txt.) The $O-C$ values have been calculated by the formula:

$$C = \text{J.D. } 2436601.82736 + 0\overset{d}{.}12297451 \times E.$$

We attempted to fit the $O-C$ diagram by the sum of a quadratic and a trigonometric function, assuming that the $O-C$ diagram is a product of a slow linear period change and light time effect caused by binary motion:

$$O-C = a + bE + cE^2 + A\sin\varphi + B\cos\varphi.$$

φ is the solution of the Kepler equation:

$$\varphi - e\sin\varphi = 2\pi P_{\text{orb}}^{-1}(PE - T)$$

where e is the eccentricity, T the time of the periastron of the assumed elliptical orbit and P_{orb} is the orbiting period. The deduced parameters are:

$$a = -0.00002 \pm 0.00018, \qquad b = (-2.95 \pm 0.02) \times 10^{-7}, \qquad c = (1.93 \pm 0.03) \times 10^{-12},$$

$$A = -0.00440 \pm 0.00012, \qquad B = 0.00056 \pm 0.00042, \qquad e = 0.71 \pm 0.05,$$

$$P_{\text{orb}} = 15660 \pm 300, \qquad T = 13870 \pm 150.$$

Figure 1 shows the $O-C$ diagram fitted by the above formula.

After subtracting the quadratic function the $O-C$ residual is presented in Figure 2 fitted only with the trigonometric term. The satisfactory approximation indicates that the $O-C$ diagram of AD CMi can be interpreted by a slow increase in the pulsation

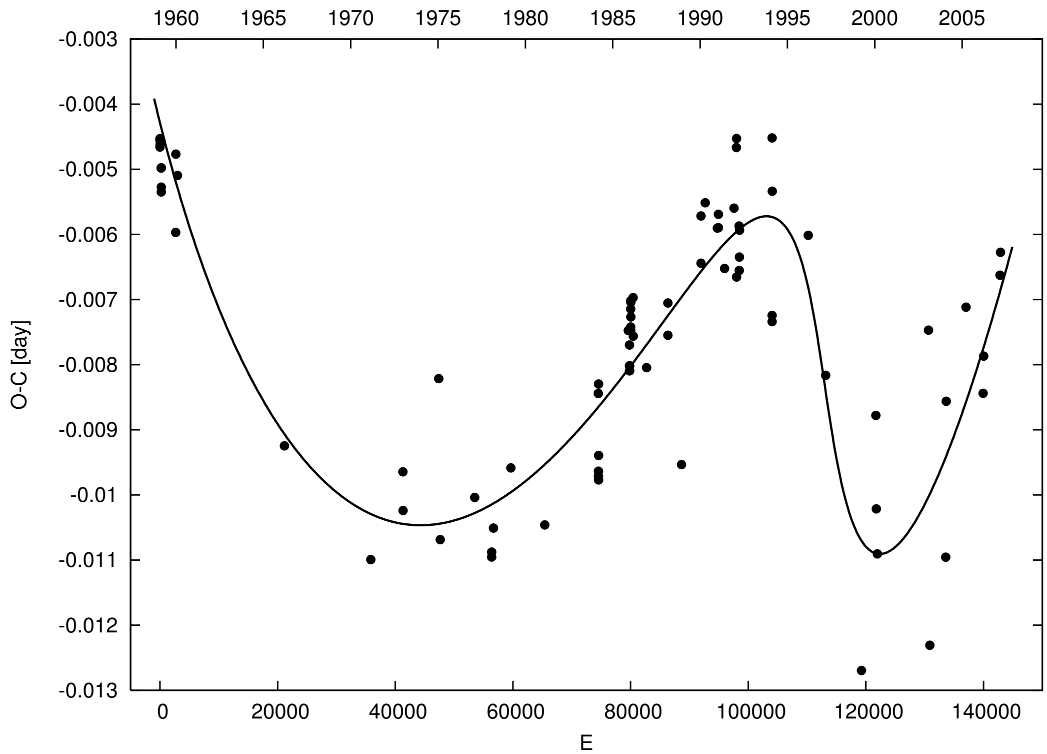

Figure 1. $O-C$ diagram of AD CMi

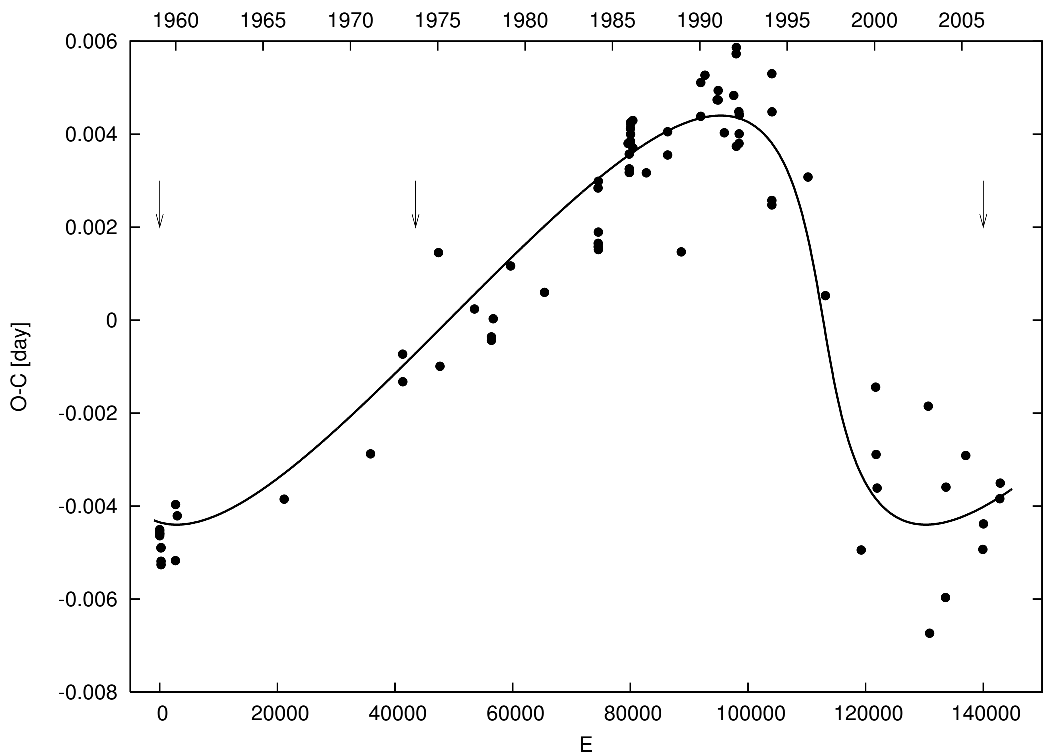

Figure 2. $O-C$ diagram of AD CMi after the subtraction of the quadratic function. The arrows indicate when radial velocity data were obtained

period with a rate of $(1/P)(dP/dt) = (9.32 \pm 0.11) \times 10^{-8}$ yr^{-1} and by the light time effect caused by binary motion on an elliptical orbit with orbiting period $P_{\rm orb} = 42.88 \pm 0.83$ yr, eccentricity $e = 0.71 \pm 0.05$, projected semi major axis $a \sin i = 1.092 \pm 0.080$ AU and the longitude of the periastron passage $\omega = 175^\circ \pm 4^\circ$.

The slow increase in the pulsation period is in accord with evolutionary theories (Breger & Pamyatnykh, 1998).

The spectroscopic observations did not show any sign of a companion, therefore on the one hand an upper limit can be given for the mass of the companion, on the other hand the mass function provides a lower limit. The mass function is $f(M) \approx 7.2 \times 10^{-4}\ M_\odot$. If we assume that the mass of AD CMi is around 2 $M_\odot$, the mass of the companion should be between 0.15 and 1 $M_\odot$. For the radial velocity (semi) amplitude $K \approx 1.1$ km/s can be deduced. This value is not in conflict with the radial velocity data.

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THE ULTRA-COMPACT BINARY CANDIDATE KUV 23182+1007 IS A BRIGHT QUASAR

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The Kiso Ultraviolet Survey (Noguchi et al., 1980; Kondo et al., 1984) identified 1186 objects with blue colours in a set of fields observed using the 1.0-m Schmidt telescope of Kiso Observatory. Classification-dispersion spectroscopy of these objects were presented in a series of papers by Wegner and colleagues. The spectra of three objects, KUV 01584−0939, KUV 23182+1007 KUV 23061+1229, were given by Wegner et al. (1987) and Wegner & McMahan (1988). All three of these showed an interesting strong emission in the region of the He II 4686 Å spectral line.

However, confusion arose between the objects KUV 23182+1007 and KUV 23061+1229 in Wegner & McMahan (1988). In that work, both objects were found to have He II 4686 Å emission lines (with some night-to-night variability noted), but the names in the figure titles and figure captions were in mutual disagreement. Koester et al. (2001) have since found that KUV 23061+1229 is a white dwarf of type DA.

Strong He II emission is a characteristic of the rare AM CVn class of cataclysmic variable stars (Warner, 1995; Southworth et al., 2006). These objects are particularly interesting ultra-short period helium-rich systems which are thought to be interacting binaries composed of two degenerate objects, the mass donor being a helium white dwarf. KUV 01584−0939 has since been confirmed to be an AM CVn star (Warner & Woudt, 2002; Espaillat et al., 2005), and is included in the *General Catalogue of Variable Stars* under the name ES Ceti.

As very few AM CVn systems are known we have obtained a spectrum of the second of the objects, KUV 23182+1007, in order to investigate its classification as a cataclysmic variable. We also obtained a spectrum of KUV 23061+1229 in order to confirm that it is a white dwarf and to fully clear up the confusion over the identities of these two objects. For these observations we adopted the object identifications and sky co-ordinates as given by the CDS *Simbad* tool[1].

Two consecutive long-slit spectra of KUV 23182+1007, immediately followed by one spectrum of KUV 23061+1229, were obtained on the night of 2007 May 19. We used the LDSS3 spectrograph attached to the 6.5-m Magellan Clay telescope at Las Campanas

[1] http://simbad.u-strasbg.fr/simbad/sim-fid

Observatory, Chile. The VPH_Blue grism was used along with a slit width of 0.75″, giving a useful wavelength coverage of 4000–6130 Å (depending on brightness) at a reciprocal dispersion of 0.68 Å/pixel. From the arc lamp and sky lines we estimate a resolution of approximately 2 Å. Wavelength and flat-field calibration was achieved using observations of helium/neon/argon and quartz lamps, taken immediately after the science spectra and at the same sky position. The two science spectra of KUV 23182+1007 have been combined and rebinned to increase the signal-to-noise ratio, resulting in a single spectrum with a reciprocal dispersion of 2 Å/pixel. The effective midpoint of this observation is HJD 2 454 240.88628. The midpoint of the spectrum of KUV 23061+1229 occurred at HJD 2 454 240.90236.

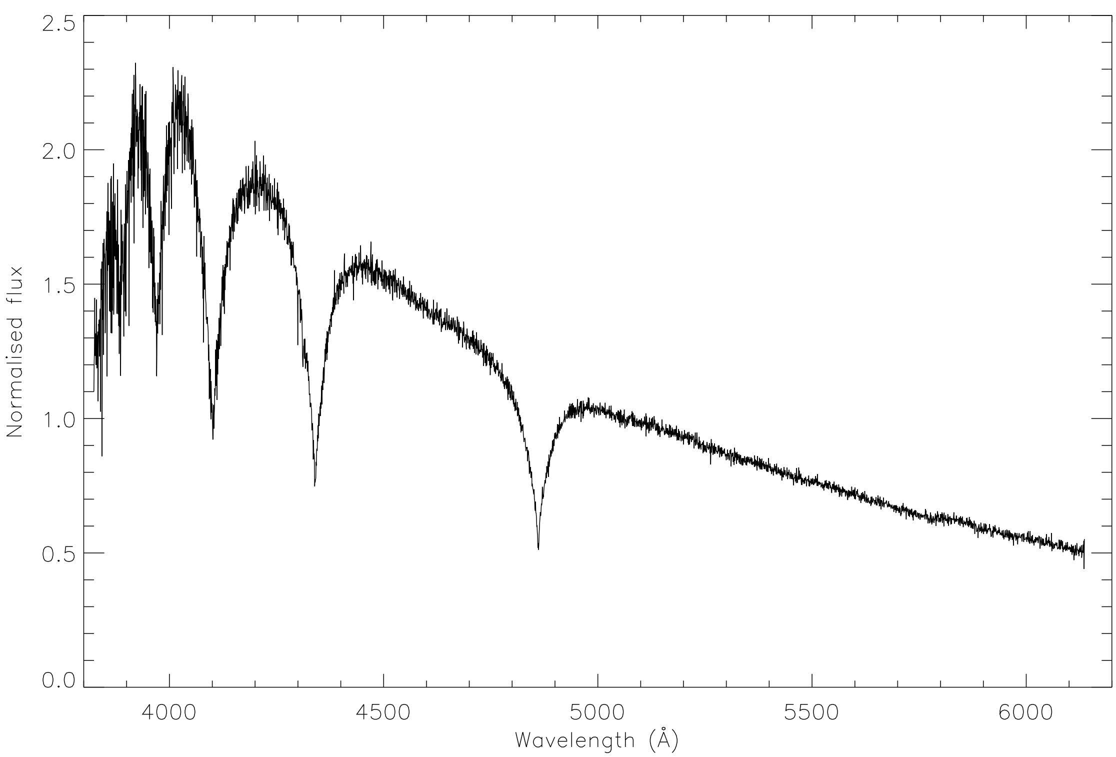

Figure 1. Magellan/LDSS3 spectrum of the second AM CVn candidate, KUV 23061+1229, confirming that this object is a DA white dwarf

The spectrum of KUV 23061+1229 (Fig. 1) is clearly that of a DA white dwarf, in agreement with the results of Koester et al. (2001) and its inclusion in the white dwarf catalogue of McCook & Sion (1999). We have therefore adopted the atmospheric parameters found by Koester et al. (2001) to calculate a model spectrum (Gänsicke et al., 1995) of KUV 23061+1229 and used this to divide out the wavelength-dependent response function of the spectrograph from the spectrum of KUV 23182+1007.

The KUV 23182+1007 spectrum is plotted in Fig. 2 and shows a strong emission line at 4660 Å which we identify to be the Mg 2800 Å line which is a characteristic feature of quasar spectra. In Fig. 2 we have also plotted a template quasar spectrum[2] from the *Sloan Digital Sky Survey* to which we have applied a redshift of $z = 0.665$. It can be seen that several additional quasar emission lines match the spectrum of KUV 23182+1007, confirming that this object is a bright ($B = 16.8$) quasar with a redshift of $z = 0.665$.

[2]The spectrum was obtained from `http://www.sdss.org/dr5/algorithms/spectemplates/spDR2-029.fit`

As active galactic nuclei are often X-ray sources we have investigated the XMM-Newton and ROSAT databases for sources at the position of KUV 23182+1007. This region of sky has not been observed using pointed observations by these satellites. However, the ROSAT All-Sky Survey[3] (Voges et al., 1999, 2000) includes an exposure of 444 s of this position, in which a source RXS J232044.6+102354 is detected with a count rate of 0.0249 ± 0.0094 counts s^{-1}. This is within $6''$ of the position of KUV 23182+1007, and over $35'$ from the next nearest X-ray source. Given the quoted ROSAT positional error of $15''$, this is a strong detection. The detected X-ray emission is consistent with our identification of KUV 23182+1007 as a quasar.

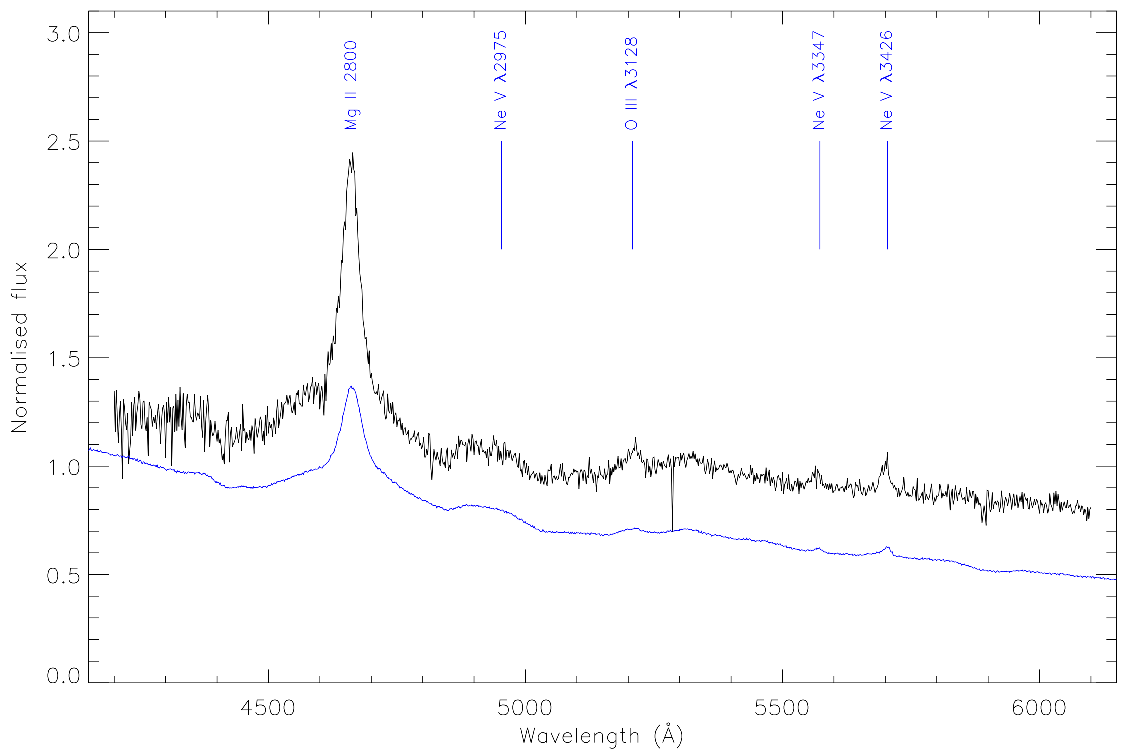

Figure 2. Magellan/LDSS3 spectrum of the main AM CVn candidate, KUV 23182+1007 (upper solid line), after combining and rebinning. A template quasar spectrum from the SDSS is also shown (lower solid line) after applying a redshift of $z = 0.665$ to the wavelength scale. The stronger quasar emission lines are labelled with their rest wavelengths, taken from Vanden Berk et al. (2001)

We have therefore clearly identified that KUV 23182+1007 is an X-ray emitting quasar with a redshift of $z = 0.665$, and confirmed that KUV 23061+1229 is a normal DA white dwarf. The classification of KUV 23182+1007 in *Simbad* and catalogues of cataclysmic variables (Downes et al., 2001; Ritter & Kolb, 2003) should be corrected. This report is intended to avoid other researchers using valuable telescope time to investigate the basic properties of KUV 23182+1007.

[3]The ROSAT All-Sky Survey catalogue can be accessed using the CDS *VizieR* service at `http://cdsweb.u-strasbg.fr/viz-bin/VizieR-2?-source=IX/29`

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Hα OBSERVATIONS OF THE GALACTIC MICROQUASAR LSI+61°303

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LSI+61°303 (V615 Cas, GT0236+610) is a Be/X-ray binary star at a distance of 2.3 kpc (Steele et al., 1998) and with radio outbursts every 26.496 d (Gregory, 2002, and references therein) which is assumed to be the orbital period. The variable radio counterpart of the system was resolved at milliarcsecond scales as a rapidly processing relativistic compact jet (Massi et al., 2004), so LSI+61°303 joined the group of Galactic microquasars. It is also a variable γ-ray source (Albert et al., 2006). The compact object is probably a black hole orbiting around a Be star in a highly eccentric orbit (Casares et al., 2005). Spectral observations show that the Hα emission is variable on time scales days-years (see Grundstrom et al., 2007, and references therein). Here we present the results of our Hα spectroscopy during the period January 2000–April 2007.

We have secured 53 spectra with the Coudé spectrograph of the 2-m RCC telescope at the Bulgarian National Astronomical Observatory Rozhen and Photometrics AT200 CCD. The wavelength coverage is from 6500 Å to about 6700 Å at resolution 0.2 Å/pixel. For each spectrum, we have measured the equivalent width (EW) of the Hα emission line and the separation between the blue and red humps (ΔV). The measured quantities are given in Table 1. The typical error of our measurements is ±10% in EW, and ±10 km s^{-1} in ΔV.

In Fig. 1 (left panel) we show a few examples of the Hα line. From up to down are plotted our spectra 20000127, 20000820, and 20000623. In all our spectra the Hα line is in emission with two peaks and EW(Hα) is always > 8 Å. We have not observed a third peak in the emission, as visible in the September 2001 observations of Liu & Yan (2005), nor very weak emission in Hα as detected by Grundstrom et al. (2007) at JD2451468.

In Fig. 1 (right panels) we plot the long-term variability of EW(Hα) and ΔV. We also use data from Paredes et al. (1991), Zamanov et al. (1999, 2001), Liu & Yan (2005), and Grundstrom et al. (2007). EW(Hα) achieved values ≈ 18 Å during the two prominent maxima at JD2448800 and at JD2450000. It seems that there are three minima of EW(Hα) at about JD2449200, JD2451200, and JD2453270, when EW(Hα) was ~ 7 Å. During the last 2000 days, there is not a prominent maximum. After JD2451000, the EW(Hα) is always < 14 Å. We see a clear minimum in ΔV at JD2451900, when ΔV dropped to $\Delta V \leq 280$ km s^{-1}, values similar to those observed during the maximum of EW(Hα) at JD2450000.

The distance between the blue and red peak (ΔV) is connected with the outer size of the Hα emitting disk: $\Delta V/(2v \sin i) = (R_{\rm out}/R_*)^{-1/2}$ for a Keplerian disk (Huang, 1972).

Adopting for a typical B0 star radius $R_* = 10\ R_\odot$, and $v \sin i = 360$ km s^{-1} (Hutchings & Crampton, 1981), we obtain that $R_{\rm out}$ varies from 3.7 R_* (37 $R_\odot$) to 7.7 R_* (77 $R_\odot$). These values are in the range 1.2–100 R_* as derived by Hanuschik et al. (1988) in other Be stars.

It deserves noting that the sudden drop on 1 week scale of the EW(Hα) observed by Grundstrom et al. (2007) at JD2451468 is not accompanied with dramatic changes in ΔV, indicating that the disk size does not change on such time scale.

Using the PDM method (Stellingwerf, 1978), we did not detect a clear periodicity in Hα line parameters in the interval 200–3000 days. However, when we plot the data folded with the radio period $P = 1667$ days (Gregory, 2002) we see that the modulation is clearly visible (Fig. 2). All of the data (and the subsets of data when EW < 12 Å and EW ≥ 12 Å) show signs of the 1667 day modulation in EW(Hα) and ΔV. The maximum of EW(Hα) and the minimum of ΔV are at phase 0.25 ± 0.10. At the minimum $\Delta V \approx 260$ km s^{-1}, and at phase 0.75 it achieves ~ 370 km s^{-1}.

Table 1. Parameters of the Hα line in the spectrum of LSI+61°303

date yyyymmdd	JD 2400000+	EW(Hα) [Å]	ΔV [km s^{-1}]	date yyyymmdd	JD 2400000+	EW(Hα) [Å]	ΔV [km s^{-1}]
20000127	51571.29	13.1	351	20010206	51947.40	8.8	307
20000621	51717.48	8.6	325	20010207	51948.29	9.7	307
20000621	51717.51	8.3	338	20010208	51949.29	10.3	299
20000621	51717.52	10.0	313	20010317	51986.23	9.7	281
20000623	51718.50	7.8	325	20010317	51986.24	10.2	294
20000623	51718.51	8.8	401	20010407	52007.24	10.5	319
20000623	51718.52	9.6	338	20010709	52100.57	11.8	345
20000623	51719.48	8.1	313	20010727	52118.53	10.8	256
20000623	51719.50	8.5	363	20010903	52156.44	13.4	332
20000623	51719.51	9.5	338	20010904	52157.36	12.4	332
20000817	51774.38	9.4	313	20011003	52186.55	12.0	331
20000817	51774.39	9.0	300	20020123	52298.34	9.2	280
20000818	51775.39	9.4	275	20020622	52448.54	8.6	332
20000818	51775.40	9.5	288	20020624	52450.55	9.7	357
20000819	51776.39	10.4	325	20021020	52568.46	11.0	332
20000820	51777.39	10.3	325	20021112	52591.45	10.3	306
20000820	51777.40	12.3	300	20030717	52838.58	9.3	390
20000821	51778.35	9.8	300	20030718	52838.58	11.8	362
20000821	51778.36	10.2	325	20031205	52979.46	11.4	312
20000822	51779.35	10.3	338	20031208	52982.39	12.4	349
20000822	51779.36	11.0	338	20031208	52982.40	12.8	375
20000917	51805.50	10.1	338	20041001	53280.50	10.6	300
20000917	51805.52	10.5	351	20060116	53752.40	12.4	361
20001205	51884.43	11.4	332	20061202	54072.46	10.0	300
20001206	51885.48	11.8	299	20070401	54192.25	10.6	337
20001208	51887.43	10.2	281	20070402	54493.24	9.5	340
20010204	51945.32	12.0	332				

Possible origins of 4.5 year modulation are:

- (1) precessing relativistic jet (Gregory et al., 1989);
- (2) quasi-cyclic Be star envelope variations (Gregory et al., 1989);
- (3) precession of the Be star (Lipunov & Nazin, 1994);
- (4) outward-moving density enhancement in the equatorial disk (Gregory & Neish, 2002);
- (5) variability of the Be star mass loss;

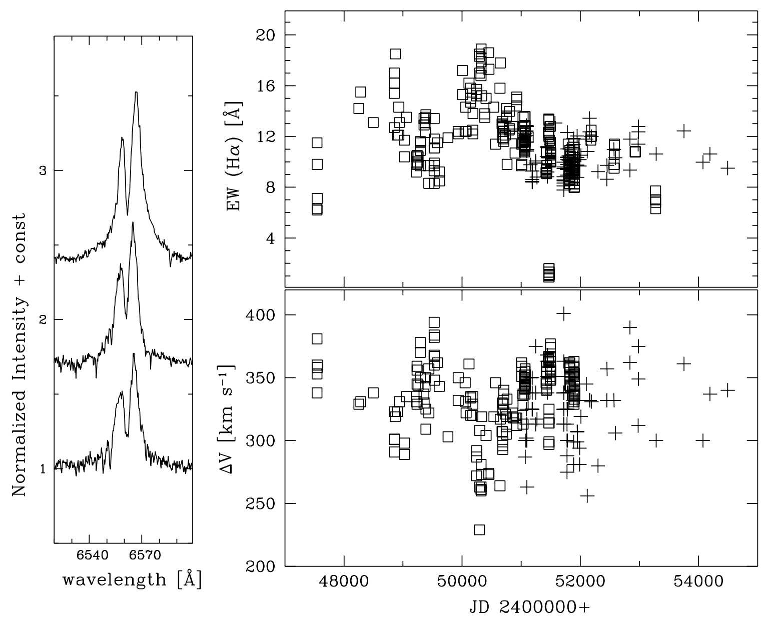

Figure 1. Profiles of the Hα emission line in the spectrum of LSI+61°303 (left panel). Long-term variability of the EW(Hα) and ΔV (right panels). Squares indicate the previous data, and crosses indicate our new observations

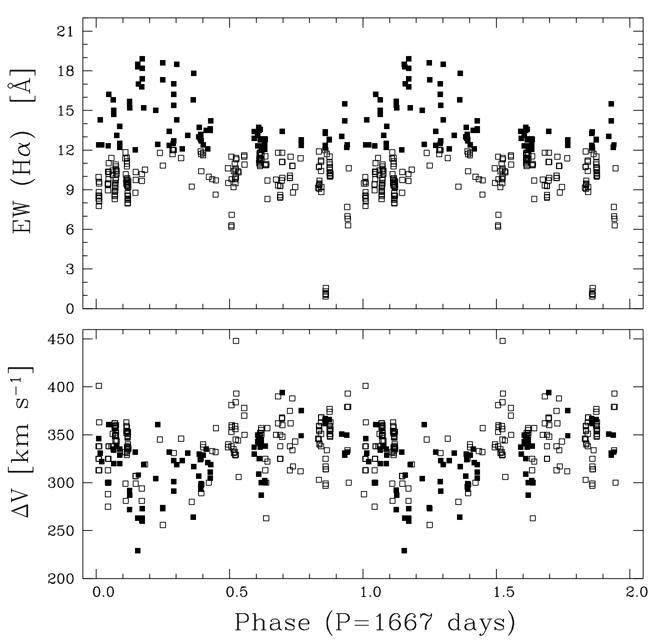

Figure 2. Variability of the EW(Hα) and ΔV folded with period $P = 1667$ days. Filled squares indicate EW(Hα) ≥ 12 Å, open squares indicate EW(Hα) < 12 Å

- (6) variability of the size of the circumstellar disk.

The circumstellar disks in Be/X-ray binaries are truncated by the gravitational influence of the compact object (Okazaki & Negueruela, 2001). Very likely in LSI+61°303 a precession of the Be star leads to variations of the truncation radius, which combined with variable mass-loss rate of the Be star, creates the 4.5 year modulation in Hα and radio emission.

To conclude, the main results of our spectral observations of the Be/X-ray binary and galactic microquasar LSI+61°303 are:

- **(i)** In our observations the equivalent width of the Hα emission line varied from 8 Å to 14 Å.
- **(ii)** The separation of the Hα peaks varied from 250 to 400 km s^{-1}.
- **(iii)** The signs of 1667 day modulation are visible in the Hα parameters, even during the time of lower EW(Hα).

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NEW MINIMA TIMES OF SELECTED ECLIPSING BINARIES

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Observatory and telescope:
50-cm Newtonian (G1) and 60-cm Cassegrain (G2) telescopes at Stará Lesná, 256/1360 Newton telescope (K1) and 5.6/400 Zeiss Objective (K2) at Kolonica Observatory, 40-cm Cassegrain telescope at Roztoky Observatory (RO), 600/2400 Cassegrain telescope (H1) and 5,6/1000 Zeiss Spiegelobjektiv (H2) at Hlohovec Observatory, 15-cm refractor at David Dunlap Observatory, University of Toronto (DDO)

Detector:	SBIG ST-10XME CCD camera (G1), photoelectric photometer (G2), Meade DSI Pro CCD camera (K1, K2), SBIG ST-8 CCD camera (RO), SBIG ST-9XE camera (H1,H2), SBIG ST-6 and SBIG ST-402 camera (DDO)

Method of data reduction:
G1 and DDO data were analysed by scripts written under the MIDAS reduction package (`http://www.eso.org/projects/esomidas/`) by one of the authors (TP) while at K1, K2, RO and HL the C-Munipack package (`http://integral.physics.muni.cz/cmunipack/`) has been used. Part of the photoelectric photometry was performed with neutral filter (N). Photometric observations at DDO were performed simultaneously with medium-dispersion spectroscopy using the main telescope.

Method of minimum determination:
The minima times were computed by Kwee & van Woerden method

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
AB And	53935.4904	0.0001	I		K2
EP And	53944.5054	0.0001	II		K1
	53945.5155	0.0001	I		K1
	53005.3233	0.0001	I	V	K1
GZ And	53943.4620	0.0001	I	V	K1
	53947.4616	0.0001	I	V	K1
	54027.3420	0.0002	I	V	K1
LO And	53919.4921	0.0001	II	V	K1
	53935.4702	0.0001	II	V	K1
	53966.4748	0.0004	I	V	K1
QR And	53991.5901	0.0002	I	BVR_C	H1
	54003.4696	0.0001	I	BVR_C	H1
	54009.4160	0.0002	I	BVR_C	H1
	54025.2708	0.0001	II	$BV(RI)_C$	H1
	54026.5804	0.0001	I	$BV(RI)_C$	H1
AH Aur	53768.2584	0.0001	II	$V(RI)_C$	G1
TY Boo	53932.4444	0.0001	I	V	K1
TZ Boo	53934.4327	0.0003	II		K1
	53947.3621	0.0001	I		K1
	54178.8486	0.0001	I		DDO
AO Cam	53746.6428	0.0006	I	R	RO
	54020.4641	0.0001	II	V	K1
	54027.5584	0.0004	I	V	K1
BS Cas	53988.3972	0.0001	II	$V(RI)_C$	G1
	53990.5998	0.0001	II	$V(RI)_C$	G1
CW Cas	53854.5284	0.0002	I		K1
	53921.4902	0.0002	I	V	K1
	53926.4327	0.0002	II	V	K1
	53930.4183	0.0001	I	V	K1
	53942.4711	0.0001	I	V	K1
	53944.4477	0.0001	I	V	K1
V523 Cas	53930.4592	0.0001	II	V	K1
	53943.4294	0.0001	I		K1
	53943.5460	0.0001	II		K1
	53947.5188	0.0001	II		K1
V776 Cas	53966.5385	0.0007	I		K2
EG Cep	53761.3173	0.0008	I	R	RO
GW Cep	53747.2237	0.0003	I	RI	RO
	53763.4836	0.0001	II	RI	RO
	53763.6436	0.0002	I	RI	RO
	53764.2813	0.0002	II	RI	RO
	53764.4405	0.0002	I	RI	RO
	53765.3975	0.0003	I	I	RO
	53765.5577	0.0008	II	I	RO

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
GW Cep	53866.4409	0.0007	I	I	RO
	53895.4816	0.0001	I		K1
	53929.4367	0.0001	II	V	K1
WZ Cep	53791.3402	0.0002	I	RI	RO
	53795.3050	0.0003	I	RI	RO
	53922.4157	0.0001	II	V	K1
	53965.4127	0.0001	II		K1
CC Com	53823.7849	0.0003	II		DDO
	53824.7758	0.0002	I		DDO
RZ Com	53845.4203	0.0001	II		K1
RW Com	53760.5710	0.0001	II	$BV(RI)_C$	G1
	53760.6892	0.0001	I	$BV(RI)_C$	G1
	53818.4821	0.0002	I	RI	RO
	53818.5996	0.0003	II	R	RO
	53830.3059	0.0004	I	RI	RO
	53847.4787	0.0005	I	RI	RO
	54167.3830	0.0003	I	RI	RO
	54174.3836	0.0005	I	RI	RO
	54182.3341	0.0002	I	VRI	RO
GO Cyg	53650.3114	0.0001	I	$BV(RI)_C$	G1
V401 Cyg	53550.4480	0.0001	I	$V(RI)_C$	G1
	53584.5375	0.0001	II	$V(RI)_C$	G1
	53617.4605	0.0001	I	$V(RI)_C$	G1
	53620.3740	0.0001	I	$V(RI)_C$	G1
	53651.2584	0.0001	I	$V(RI)_C$	G1
	53653.2997	0.0001	II	$V(RI)_C$	G1
	53900.3758	0.0001	II	$V(RI)_C$	G1
	53920.4796	0.0001	I	V	K1
	53927.4714	0.0001	I	V	K1
	53941.4586	0.0002	I	V	K1
V1191 Cyg	53915.5113	0.0005	I	V	K1
	53921.4649	0.0002	I	V	K1
	53934.4683	0.0004	II		K2
V1918 Cyg	53924.4905	0.0003	I	V	K1
BE Dra	53834.5354	0.0002	I		K1
EF Dra	53848.5136	0.0003	II		K2
	53911.4791	0.0006	I		K1
FU Dra	53939.4375	0.0002	II		K2
AK Her	53867.4823	0.0002	II		K1
V829 Her	53944.4123	0.0001	II	$V(RI)_C$	G1
	53945.4914	0.0002	II	V	K1
	53947.4613	0.0007	I	V	K1
	53963.3987	0.0004	II	V	K1
V857 Her	53937.4694	0.0004	I		K1
	53965.3739	0.0007	I	V	K1
PP Lac	53944.3915	0.0001	I		K1
	53964.4499	0.0001	I	V	K1

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
PP Lac	54001.3565	0.0001	I		K1
V344 Lac	53928.5027	0.0001	II		K1
	53939.4857	0.0001	II		K1
	54004.4019	0.0001	I		K1
	54018.5225	0.0002	I	V	K1
	54068.3360	0.0003	I		K1
CE Leo	54085.6639	0.0001	I		K1
XY Leo	53842.5981	0.0003	I		DDO
UV Lyn	54067.6037	0.0002	I	V	K2
	54068.6367	0.0005	I	V	K2
V361 Lyr	53814.5114	0.0001	I	$V(RI)_C$	G1
	53990.3713	0.0001	I	$BV(RI)_C$	G1
	54003.3748	0.0001	I	$BV(RI)_C$	G1
	54004.3037	0.0001	I	$BV(RI)_C$	G1
BB Peg	54039.3068	0.0001	I	$V(RI)_C$	G1
DI Peg	53967.4772	0.0001	I		K2
V351 Peg	53945.4657	0.0001	II		K2
V357 Peg	54005.4320	0.0001	I		K2
V432 Per	54003.3866	0.0001	I	V	K1
	54017.5696	0.0001	I	V	K1
DV Psc	53618.5659	0.0001	I	$BV(RI)_C$	G1
	53637.3862	0.0001	I	$BV(RI)_C$	G1
	53640.4720	0.0001	I	$BV(RI)_C$	G1
	53648.3397	0.0002	II	$BV(RI)_C$	G1
	53648.4938	0.0001	I	$BV(RI)_C$	G1
	53671.3290	0.0001	I	$BV(RI)_C$	G1
	53963.5049	0.0001	I		K1
	53965.5111	0.0004	II		K1
	53972.4523	0.0001	I		K1
	53974.4580	0.0001	II		K1
	53995.4397	0.0001	II		K1
	54026.2961	0.0001	II	$BV(RI)_C$	G1
	54026.4530	0.0001	I	$BV(RI)_C$	G1
	54027.3771	0.0001	I	$BV(RI)_C$	G1
	54035.3992	0.0001	I	$BV(RI)_C$	G1
CW Sge	53935.5438	0.0005	II		K1
	53936.5269	0.0002	I		K1
	53942.4714	0.0003	I		K1
	53967.5616	0.0003	I	V	K1
	54019.4057	0.0003	I	V	K1
V Sge	53515.4940	0.0002	I	V	H2
	53579.5023	0.0001	I	VR_C	H2
	53580.5293	0.0002	I	$BV(RI)_C$	H2
	53581.5574	0.0003	I	$B(RI)_C$	H2
	53596.4716	0.0004	I	$V(RI)_C$	H2
	53615.5040	0.0001	I	$BV(RI)_C$	H2
	53619.3585	0.0003	II	$(RI)_C$	H2

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
V Sge	53900.3619	0.0001	I	V	K1
	53902.4117	0.0001	I	V	K1
	53940.4648	0.0003	I	V	K1
	53967.4877	0.0006	II	BVR_C	H1
	53972.3476	0.0005	I	V	K1
	53975.4324	0.0002	I		K1
	53991.3636	0.0002	I	BVR_C	H1
	53992.4066	0.0001	I	BVR_C	H1
	53993.4375	0.0001	I	VR_C	H1
	53993.4427	0.0006	I	V	K1
	53999.3319	0.0003	II	BVR_C	H1
	54000.3932	0.0003	II	BVR_C	H1
	54007.3107	0.0001	I	V	K1
	54018.3713	0.0005	II	V	H1
	54023.2561	0.0001	I	BVI_C	H1
	54024.2779	0.0001	I	$BV(RI)_C$	H1
	54026.3407	0.0003	I	V	K1
EQ Tau	54022.5508	0.0001	I	V	K1
V781 Tau	53767.2730	0.0003	I	RI	RO
XY UMa	53833.3711	0.0001	II	$BV(RI)_C$	G1
	53834.3295	0.0001	II	$BV(RI)_C$	G1
TV UMi	53848.3990	0.0008	I		K1
	53860.4463	0.0001	I		K1
	53865.4388	0.0002	I		K1
	53866.4750	0.0006	II		K1
AG Vir	53450.4496	0.0002	II	N	G2
	53451.4089	0.0002	I	N	G2
	53285.3871	0.0001	II	V	G1
PY Vir	54201.7944	0.0001	I		DDO
ER Vul	53936.4766	0.0004	II		K2
BD+7 3142	54188.8663	0.0001	I		DDO

Explanation of the remarks in the table:

Remark gives observatory

Remarks:

Times of minima are weighted averages from all filters used

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ERRATUM FOR IBVS 5777

The following corrections for the paper "New Minima Times of Selected Eclipsing Binaries" by Parimucha et al. were communicated by the authors after the publication:

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Star     Original           Corrected
---------------------------------------
EP And  53005.3233  I      54005.3233  I
UV Lyn  54068.6367  I      54068.6367  II
GZ And  53947.4616         should be deleted
CW Cas  53942.4711         should be deleted
GW Cep  53866.4409         should be deleted
RW Com  53830.3059         should be deleted
RW Com  53847.4787         should be deleted
AG Vir  53285.3871         should be deleted
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Hα OBSERVATIONS OF THE BINARY SYSTEM HR 2142

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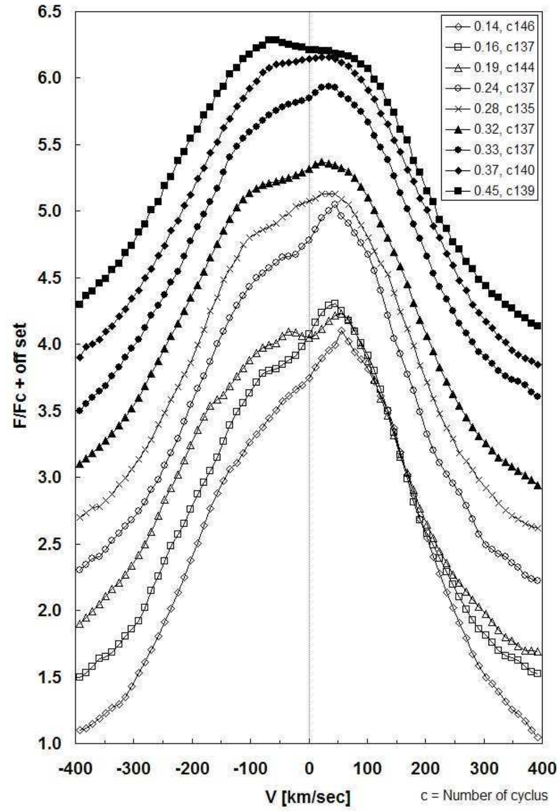
HR 2142 (HD 41335, V696 Mon) is a Be star of visual magnitude 5.2 mag. In the past 50 years it was the subject of many studies. Its projected rotational velocity ($v \sin i$) is very high (350–400 km/s) (Peters, 1972; Slettebak, 1982). The extreme width of the emission lines made it difficult to classify the spectrum, but today HR 2142 is classified as B2IVe. The most remarkable characteristics of its spectrum are the Balmer emission lines with a central reversal or absorption feature from the circumstellar envelope. Since the discovery of periodic profile variations in the Balmer lines HR 2142 has been considered to be a binary system with an orbital period of 80.86 days (Peters, 1983, 2001; Peters & Gies, 2002). The circular orbital solution was obtained from RV measurements based upon measurements of the wings of the broad Balmer and He lines (Peters, 1983). The ephemeris from that paper:

$$T = \text{JD } 2441990.5 \pm 1.1, \qquad P = 80.860 \pm 0.005 \text{ days}$$

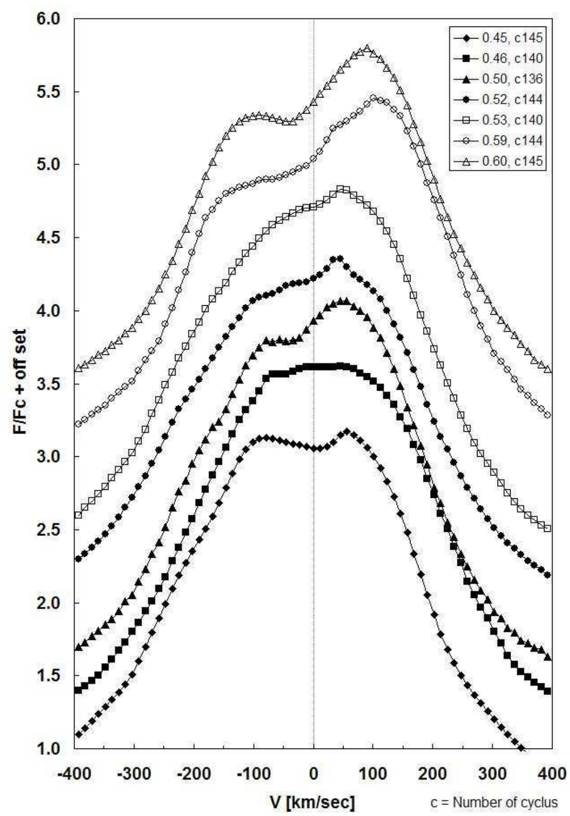
was used for calculation of the phases here. The periodic behaviour mainly pertains the appearance of primary and secondary shell phases (Peters, 1972). This is indicated by the appearance of shell (absorption) lines in the emission Balmer profiles and by periodic Hα V/R variations.

Since the azimuthal distribution of this plasma material is complex and the Hα profile comes from extended disk regions, a tomographic study for mapping the V/R-variations is considered particularly useful. It may contribute to clarify whether the variability is further strictly periodic or whether there are references of disturbances by disk instability (completely without companions) or tidal disturbances. Therefore Monika Maintz and Thomas Rivinius, then staff astronomers from the Landessternwarte Heidelberg in Germany, suggested a collaboration with amateur astronomers who could provide line profile observations with a more frequent coverage than it is possible at large observatories. In general the strength of central reversal depends on the inclination of the binary's orbital plane to the line of sight. High inclination causes a strong central absorption, because the infalling gas intersects the line of sight. With a dispersion of at least 35 Å/mm and $R \sim 12000$ these V/R variations can be observed with instruments now available to amateurs.

The spectra discussed here were obtained with a 20-cm ($f/4$) Schmidt–Cassegrain telescope at the observatory of the Vereinigung der Sternfreunde, Köln, connected with a slitless spectrograph: dispersion = 27 Å/mm, $R \sim 14000$. Fig. 1 illustrates my findings with 30 individual Hα spectra that were obtained from September 2003 to April 2006.



F/Fc + off set
V [km/sec]
0.14, c146
0.16, c137
0.19, c144
0.24, c137
0.28, c135
0.32, c137
0.33, c137
0.37, c140
0.45, c139
c = Number of cyclus



F/Fc + off set
V [km/sec]
0.45, c145
0.46, c140
0.50, c136
0.52, c144
0.53, c140
0.59, c144
0.60, c145
c = Number of cyclus

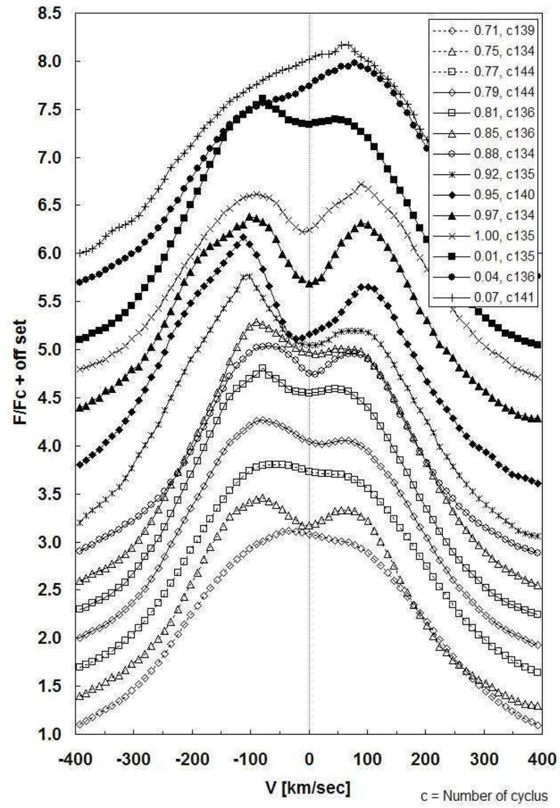


Figure 1.a–c. The three panels show the Hα profiles arranged according to the orbital phase. It can be seen that the V/R ratios during the orbital period are mostly less than 1, while between phases 0.75 and 0.07 the V/R ratios larger than 1 are more common. During the shell phase the absorption component in Hα is flanked by the emission. On the other hand, we do not see any strict periodic behaviour of the V/R ratio like in some (but not all) other binary systems. This fact can be an indication of a complicated behaviour in the circumstellar matter in the system of HR 2142

Depending on the orbital phase, we see the enhanced emission either red- or blueshifted as V/R variation. The central reversal develops around phase 0.0 or 1.0, when an additional plasma material infall is in front of the Be primary. At this phase the companion is between the observer and the Be star. The extent, to which the disk is symmetrically distributed with respect to the line of sight, affects the observed strength of the V and R peaks.

Within the three observational periods different orbits are phasedly represented. Fig. 1 shows variations with the orbital phase and some changes from cycle to cycle. The legend at right identifies the orbital phase of each spectrum. The phase-dependent V/R behavior derived from these spectra is shown in Fig. 2.

The uncertainties on EW and V/R were determined by measurements of standard stars on three nights for a total of 8 hours of observation. For both values uncertainty was less than 3% for individual measurements at one night. A sharp decrease in V/R between phases 0.9–1.04 is clearly visible. The derived V/R ratios of the spectra between 09/2003–04/2006 have maximum values of 1.07 at phase 0.85 (2003/2004), 1.22 at phase 0.93 (2004/2005) and 1.16 at phase 0.9 (2005/2006). In addition there is a remarkable V/R change between phases 0.5 and 0.6. At these phases, the companion is behind the primary component. The V/R change is also observable here, similar to the situation at phase 1.0, although it is less pronounced because of the eclipse of the primary.

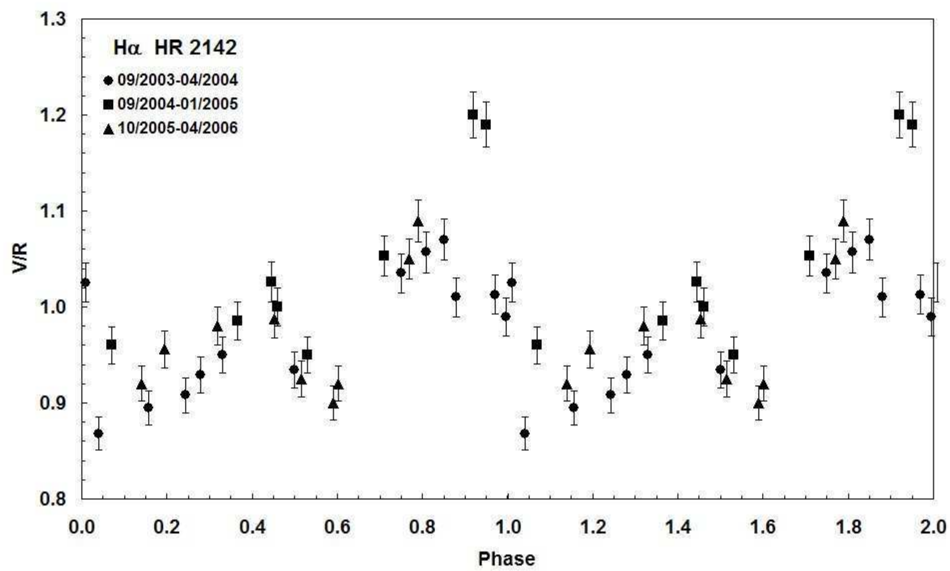


Figure 2. V/R variation of Hα based on observations from 09/2003–04/2004, 09/2004–01/2005, 10/2005–04/2006

Acknowledgment. The author thanks Dr. Monika Maintz and Dr. Thomas Rivinius (both formerly from Landessternwarte Heidelberg) for encouraging this study, and Dr. Reinhard Hanuschik (European Southern Observatory) and Dr. Anatoly Miroshnichenko (University of North Carolina at Greensboro) for carefully reading the manuscript.

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V2467 CYG — A NOVA WITH EXTREMELY STRONG O I 8446 Å EMISSION

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V2467 Cyg ≡ Nova Cyg 2007 was discovered by Tago (see Nakano et al., 2007) at $7\overset{\mathrm{m}}{.}4$ on March 15.8 already declining from the maximum. The brightness maximum occurred somewhere between this date and Tago's last negative observation on March 12.8 (Nakano et al., 2007). The nova was confirmed spectroscopically on March 16.8 with an expansion velocity of ~ 1200 km s^{-1}, measured for the P Cyg absorption component of Hα (Nakano et al., 2007). Kubat & Niemczura (2007) reported a velocity of 968 km s^{-1} on March 17.1 and 900 km s^{-1} on March 17.2. Munari et al. (2007) presented a detailed quantitative description of the optical spectrum on March 18.2 and concluded that V2467 Cyg belongs to Williams's (1992) "Fe II" class. They reported the presence of two P Cyg absorption components in the Hα and Hβ profiles with velocities 913 km s^{-1} and 1900 km s^{-1}. Steeghs et al. (2007) identified the progenitor as an early A spectral type object with IPHAS magnitudes $r' = 18\overset{\mathrm{m}}{.}46 \pm 0\overset{\mathrm{m}}{.}01$ and $i' = 17\overset{\mathrm{m}}{.}49 \pm 0\overset{\mathrm{m}}{.}1$. They estimated the distance to V2467 Cyg in the range 1.5–4 kpc and an outburst amplitude $\sim 12^{\mathrm{m}}$ typical for "Fe II" type galactic novae.

Photometric and spectral observations of V2467 Cyg at the Toruń Observatory began on March 24, about ten days after the maximum brightness. Photometric data were recorded with the 60-cm Cassegrain and 60/90-cm Schmidt–Cassegrain telescopes and the SAVS equipment (Niedzielski et al., 2003), all of them equipped with CCD cameras. We used the Henden & Munari (2007) photometric sequence to reduce our observational data. Additionally, we carried out rapid brightness variation monitoring, mainly in V and R_{C}. The photometric data are listed in Table 1, the monitoring data are available electronically.

Spectra with $R \sim 3000$, ~ 1500 and ~ 750 covering different regions in the spectral interval 4000 Å–8800 Å were recorded with the Canadian Copernicus Spectrograph (CCS) attached to the 60/90-cm Schmidt–Cassegrain telescope. Additionally, with the same telescope, we obtained prismatic spectra in the range 4300 Å–10500 Å with a resolution of about ~ 5 Å, ~ 20 Å and ~ 60 Å at Hγ, Hα and 9000 Å, respectively.

The nova light curve and the color indices after April 12, 2007 are shown in Fig. 1. The star is already $\sim 4^{\mathrm{m}}$ fainter than at maximum, one month earlier. During the following month the V2467 Cyg brightness in V decreased by about $0\overset{\mathrm{m}}{.}9$. The most remarkable variation is a dip between JD 2454206 and JD 2454214. The colors $U - B$ and $B - V$

Table 1. Toruń $UBVR_CI_C$ photometric observations of V2467 Cyg

HJD	U	B	V	R_C	I_C	Telescope	Monitoring*
2454184.611			9.56			SAVS	
2454185.615			9.70			SAVS	
2454203.458		12.40	11.42			90-cm	$3^{h}.6$ (V)
2454203.595	12.87	12.45	11.37	8.92	7.84	60-cm	$0^{h}.3$ (B), $0^{h}.9$ (R_C)
2454204.508	12.95	12.47	11.42	8.93	7.87	60-cm	$2^{h}.3$ (B), $2^{h}.2$ (R_C)
2454206.483	13.09	12.64	11.60	9.10	8.07	60-cm	$2^{h}.8$ (B), $2^{h}.7$ (R_C)
2454207.481	13.43	12.82	11.84	9.34	8.37	60-cm	
2454207.549			11.79			SAVS	
2454209.551			12.11			SAVS	
2454211.598	13.23	12.80	11.81	9.39	8.46	60-cm	$3^{h}.4$ (V), $3^{h}.3$ (R_C)
2454212.544			11.71			SAVS	
2454216.503	13.09	12.73	11.71	9.37	8.52	60-cm	$1^{h}.6$ (V), $1^{h}.7$ (R_C)
2454217.475	13.18	12.72	11.71	9.34	8.48	60-cm	$2^{h}.6$ (V, R_C)
2454218.588	13.12	12.79	11.76	9.41	8.57	60-cm	$2^{h}.7$ (V, R_C)
2454221.455	13.25	12.89	11.84	9.53	8.75	60-cm	$3^{h}.0$ (R_C)
2454222.430	13.29	12.75	11.76	9.49	8.73	60-cm	$2^{h}.9$ (V), $3^{h}.5$ (R_C)
2454224.433	13.37	12.80	11.77	9.52	8.75	60-cm	$3^{h}.5$ (V, R_C)
2454226.457	13.45	12.91	11.88	9.65	8.91	60-cm	$1^{h}.0$ (R_C)
2454230.501		12.99	12.04	9.82	9.17	60-cm	
2454240.560			12.13	9.98	9.42	60-cm	
2454241.419	13.17	13.01	12.12	9.96	9.37	60-cm	$3^{h}.5$ (V, R_C)
2454244.554	13.06	12.96	11.99	9.92	9.30	60-cm	
2454245.397		13.05	12.04	9.94	9.34	60-cm	
2454246.392		13.12	12.21	10.06	9.54	60-cm	
2454249.421	13.80	13.19	12.32	10.19	9.66	60-cm	

* Available at the IBVS website for B, V, R_C filters as files 5779-t1.txt, 5779-t2.txt, 5779-t3.txt, respectively

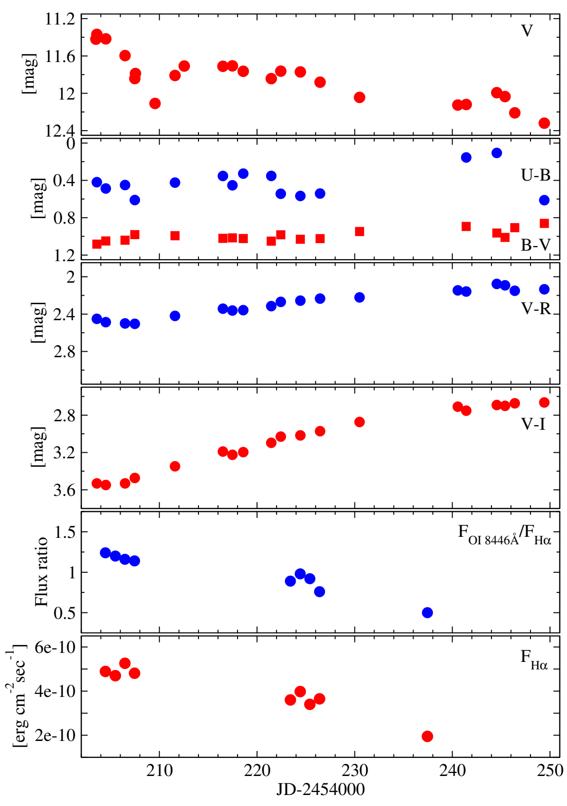

Figure 1. The V light curve and the color variations of V2467 Cyg. In the two bottom panels, the flux ratio O I 8446 Å/Hα and the Hα flux from our objective prism spectra are shown

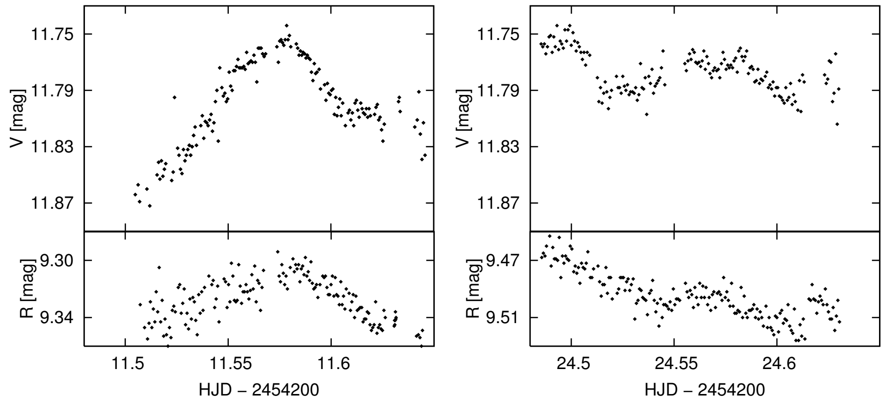

Figure 2. Examples of the rapid brightness variations of V2467 Cyg in V and $R_{\rm C}$ filters

vary around $0^{\rm m}.4$ and $1^{\rm m}$, respectively. Stronger variations are apparent in the $V-R$ and $V-I$ colors. $V-R$ became bluer by about $0^{\rm m}.40$ and $V-I$ changed from $3^{\rm m}.6$ to $2^{\rm m}.7$.

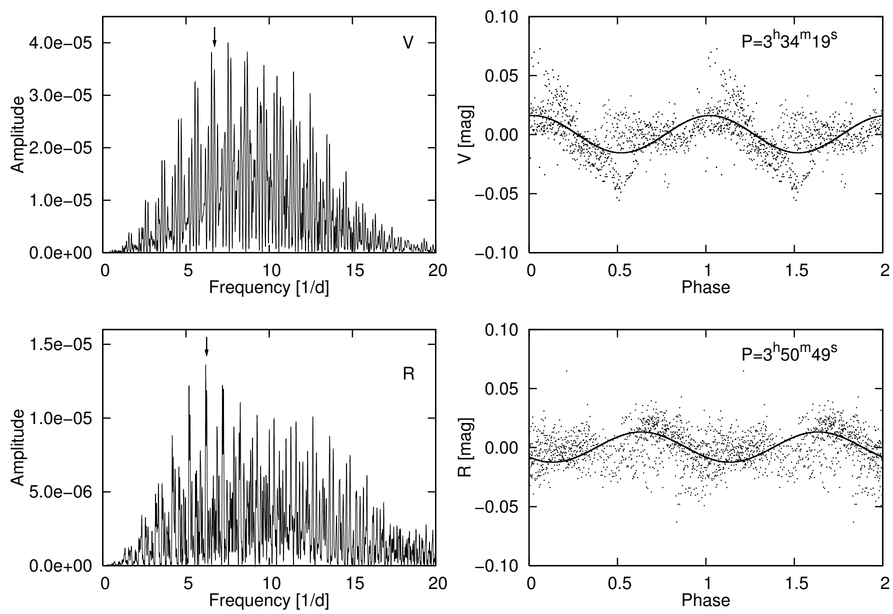

Figure 3. The power spectra and the light curves in V and $R_{\rm C}$, phased with the corresponding periods marked by arrows

In Fig. 2 examples of our V and $R_{\rm C}$ monitoring are shown. Similar short time variability is obvious in both filters with a significantly larger amplitude in V. Fourier analysis cannot distinguish a single coherent frequency in both V and $R_{\rm C}$ bands. We have analyzed residuals from each night's mean brightness for 18.4 hours and 1220 observational points in V, and 17.3 hours and 983 points in the $R_{\rm C}$ band, obtained during the period April 12–May 5. The resulting power spectra are shown in Fig. 3 and look like a superposition of two quasi periodic oscillations (QPO) $P_1 \geq 3^{\rm h}$ and $P_2 \leq 2^{\rm h}$, just above and below the period gap for cataclysmic variables. The most probable period lies between the peaks at 6.24 $\rm d^{-1}$ for $R_{\rm C}$ and at 6.72 $\rm d^{-1}$ for V, both marked in Fig. 3. The light curves corresponding to these frequencies are presented in the right panels of the same figure. The light curves for any other strong aliases look similar.

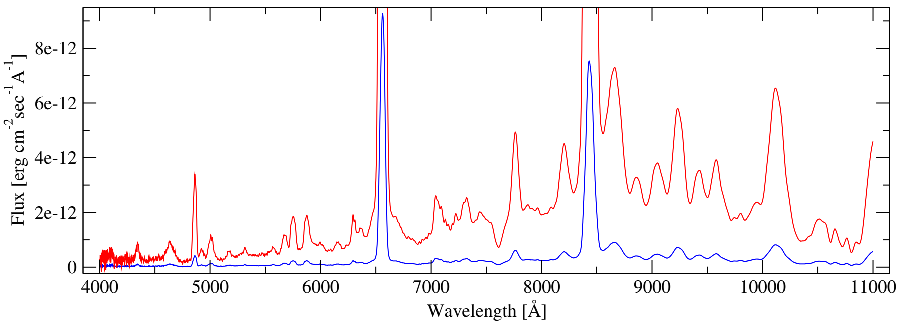

Figure 4. The lower curve shows the objective prism spectrum of V2467 Cyg obtained on April 13, 2007. The same spectrum multiplied by 8 is also plotted

Since the beginning of our observations, V2467 Cyg followed a normal "Fe II" nova spectral evolution. At the end of March, the spectrum was dominated by Balmer and Fe II emission lines. Two P Cyg absorption components were obvious in the Balmer lines and the slowest one was easily visible in the Fe II lines as well. Their velocities were about 2290 km s^{-1} and 1300 km s^{-1} on March 24 and increased to $\sim$ 2590 km s^{-1} and $\sim$ 1405 km s^{-1} on April 1.

Between April 1 and 13 the nova spectrum changed significantly. The [OI] lines 6300 Å and 6364 Å, visible as weak emissions since the beginning of our observations, increased significantly during this period. Many new emission lines appeared in the spectrum. The most intensive among them were [OIII] 5007 Å, [OI] 5577 Å, [NII] 5755 Å, He I 5876 Å, 6678 Å, 7065 Å, C II 7234 Å, [OII] 7325 Å. However, the strongest emission line was O I 8446 Å (Fig. 4). We started our objective prism observations covering this region on April 13 but the line was probably present in the spectrum during all the time of our observations. The reason why we think this relates to the other O I line at 7774 Å visible at the red edge of our CCS spectrum obtained on March 26. In the later spectra, both O I lines were visible together and the 8446 Å one was much stronger. In Fig. 1 the changes in the Hα flux as well as the flux ratio O I 8446 Å/Hα are shown. The Hα flux decreases from $\sim 4.9\times10^{-10}$ erg cm^{-2} sec^{-1} in mid April to $\sim 2.0\times10^{-10}$ erg cm^{-2} sec^{-1} in mid May. During the same time the flux ratio O I 8446 Å/Hα changes from $\sim$ 1.2 to $\sim$ 0.5. The O I 8446 Å flux larger than Hα is probably exceptional. However, this O I line is produced in a fluorescent cascade as a result of pumping by Lyβ H I photons (Kastner & Bhatia, 1995), so such a strong O I flux could indicate an extremely high oxygen overabundance.

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CL AURIGAE: A TRIPLE SYSTEM WITH MASS TRANSFER

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The semi-detached eclipsing binary CL Aurigae (GSC 2393.1455, FL 439, HV 6886; $B_{\rm max} = 11.7$ mag) is a relatively faint but frequently observed binary with a short orbital period about 1.24 days. CL Aur was discovered to be a variable star photographically by Hoffleit (1935). Later Kurochkin (1951) derived the first light elements

$$\text{Pri. Min.} = \text{HJD } 24\ 32967.262 + 1\overset{\rm d}{.}2443666 \times E.$$

Next visual observations were made by Szafraniec (1960), the spectral type was determined by Götz & Wenzel (1968). Wolf et al. (1999) in their period study predicted a third body in eccentric orbit ($e = 0.4$) with a period of about 22.5 years. To our knowledge this star has not been measured spectroscopically since discovery.

We observed eclipses of CL Aur regularly every year and obtained 18 new precise times of minimum light. Our CCD photometry was carried out from 2001 until March 2007 at six observatories: Brno, Lelekovice, Hradec Králové, Ondřejov, Pec pod Sněžkou and Valašské Meziříčí observatories, Czech Republic. Different telescopes, CCD cameras and filters were used (see Table 1). The nearby star GSC 2393.1532 ($V = 11.4$ mag) on the same frame as CL Aur served as a primary comparison star during these observations. See also `http://nyx.asu.cas.cz/~lenka/dbvar/` for more information. The new times of primary minimum and their errors were determined using the least squares fit of the data by the bisecting chord method. These times of minimum are presented in Table 1. In this table, N stands for the number of observations used in the calculation of the minimum time, the others are self-evident. The epochs were calculated according to the new ephemeris given in the text.

The change of period of CL Aur was studied by means of an $O-C$ diagram analysis. We took in consideration all older visual and photographic times of minima found in

Table 1: New times of minimum light of CL Aur

JD Hel. – 24 00000	Epoch	Error (days)	N	Observatory Telescope, camera, filter
51901.6065	1450.0	0.0002	107	Hradec Králové 40-cm, ST-7, V
51901.6070	1450.0	0.0003	89	Lelekovice 35-cm, ST-6V, R
52017.3345	1543.0	0.0003	52	Lelekovice 35-cm, ST-6V, R
52252.5171	1732.0	0.0001	80	Ondřejov 65-cm, AP7p, R
52333.4014	1797.0	0.0001	88	Ondřejov 65-cm, AP7p, R
52522.5455	1949.0	0.0001	46	Ondřejov 65-cm, AP7p, R
52684.3143	2079.0	0.0001	77	Ondřejov 65-cm, AP7p, R
52899.5915	2253.0	0.0002	31	Ondřejov 65-cm, AP7p, R
52964.2991	2304.0	0.0001	90	Ondřejov 65-cm, AP7p, R
53425.3416	2674.5	0.0001	98	Ondřejov 65-cm, AP7p, R
53713.4178	2906.0	0.0001	83	Ondřejov 65-cm, AP7p, R
53746.3945	2932.5	0.0002	73	Ondřejov 65-cm, AP7p, R
53769.4149	2951.0	0.0001	64	Ondřejov 65-cm, AP7p, R
54070.5565	3193.0	0.0002	65	Pec pod Sněžkou 20-cm, ST-8, R
54141.4868	3250.0	0.0002	104	Brno 20-cm, ST-6V, R
54171.3516	3274.0	0.0001	137	Brno 20-cm, ST-6V, R
54176.3298	3278.0	0.0001	33	Valašské Meziříčí 28-cm, ST-7, V, R
54186.2843	3286.0	0.0002	16	Valašské Meziříčí 28-cm, ST-7, V, R

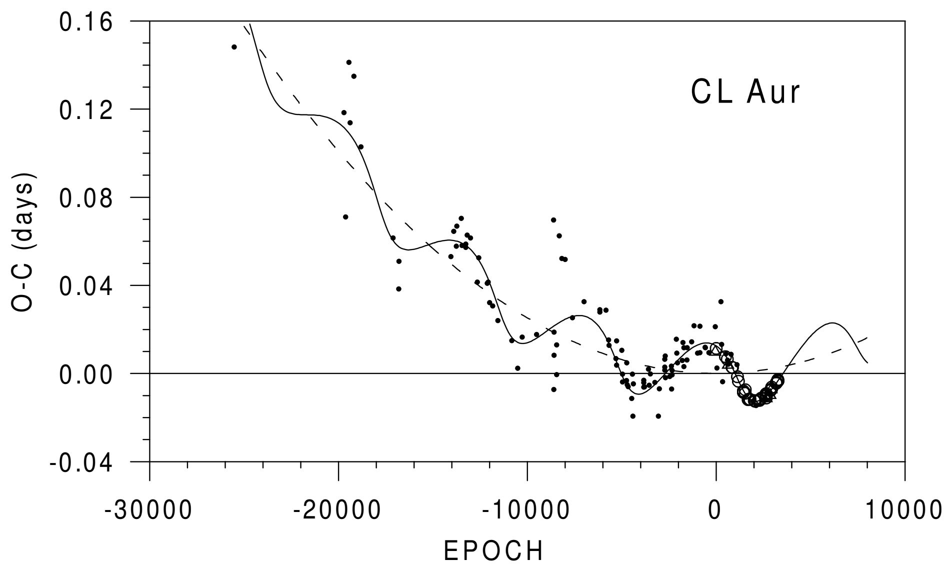

Figure 1. The complete $O-C$ diagram for CL Aur. The numerous visual and photographic times are denoted by dots, the primary and secondary CCD times are denoted by circles and triangles, resp. The sinusoidal curve corresponds to the third body orbit, the dashed curve denotes a period increase of about 1.3 seconds per century

special databases of AAVSO[1] and BRNO[2] observers, all times given in Wolf et al. (1999, their Table 1), as well as current numerous CCD timings given in Hübscher et al. (2005, 2006), Nelson (2006), Bíró et al. (2007), Dogru et al. (2007), Hübscher & Walter (2007) and Smith & Caton (2007). The period increase and sinusoidal deviations of the $O-C$ values caused by a light-time effect are well remarkable. Our analysis of the third body gives the following parameters:

P_3 (period)	$= 7910 \pm 80$ days
	$= 21.7 \pm 0.2$ years
T (time of periastron)	= J.D. 24 43880 ± 80
A (semi-amplitude)	$= 0.0138 \pm 0.0012$ day
ω (length of periastron)	$= 209.2 \pm 1.2$ degrees
e_3 (eccentricity)	$= 0.32 \pm 0.02$

These values were obtained by the least squares method together with the quadratic light elements

$$\text{Pri. Min.} = \text{HJD } 2450097.2712(5) + 1\overset{\text{d}}{.}24437505(18) \times E + 2\overset{\text{d}}{.}52(4) \times 10^{-10} \times E^2.$$

The period increase resulting from these elements is 5.04×10^{-10} day/cycle or 1.48×10^{-7} day/year or 1.3 seconds per century, respectively. For this solution all times were used with different weights, their list is given in an electronic table available through the IBVS website as file 5780-t2.txt. The corresponding $O-C$ diagrams are plotted in Fig. 1 and Fig. 2.

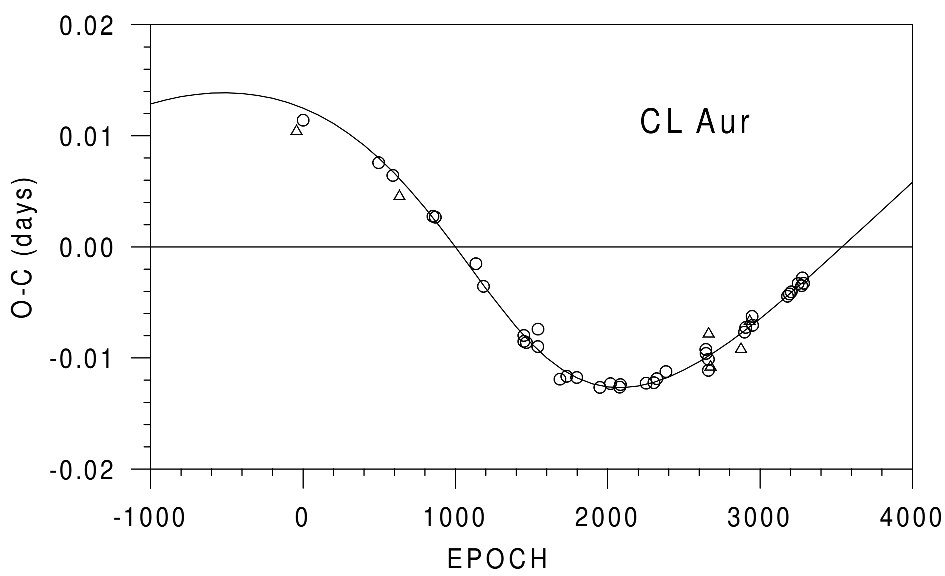

Figure 2. The $O-C$ diagram of CL Aur based on current CCD measurements. Primary and secondary times are denoted by circles and triangles, resp. The sinusoidal curve corresponds to the third body orbit with a short period of about 22 years and a semi-amplitude about 20 minutes

[1] http://www.aavso.org/observing/programs/eclipser/ebtom.shtml

[2] http://var.astro.cz/ocgate

Assuming a coplanar orbit ($i_3 = 90°$) and adopting a total mass of the eclipsing pair with A1 primary to be $M_1 + M_2 \simeq 3.0\ M_\odot$, we can obtain a lower limit for the mass of the third component $M_{3,\mathrm{min}}$. The mass function has a value $f(M) = 0.034\ M_\odot$, from which the minimum mass of the third body follows as $0.79\ M_\odot$. A possible third component of spectral type about K2 with the bolometric magnitude of $m_3 \simeq 5.7$ mag (Harmanec, 1988) produces a hardly detectable third light of $L_3 \simeq 1.5\%$ of the total light.

Our result indicates, that CL Aur is probably the next member of a group of triple systems with mass transfer deserving a regular monitoring (e.g. RR Dra, TZ Eri; Zasche, 2007). Approx. 50% of the third-body orbit is well-covered by the precise photoelectric and CCD observations. Therefore, new high-accuracy timings of this eclipsing system are necessary in order to cover the third-body orbit and to improve parameters given above.

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ERRATUM FOR IBVS 4683

CL Aur is not BD +33°0975.

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166. LIST OF TIMINGS OF MINIMA ECLIPSING BINARIES BY BBSAG OBSERVERS

(BBSAG Bulletin No. 133)

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The following Table lists timings of minima of eclipsing binaries secured by photoelectrical means by BBSAG observers, primarily obtained between July 2006 and June 2007. The given $O - C$ values generally refer to the linear elements of the GCVS (Kholopov et al., 1985), except for the cases stated in the remarks. All times given are heliocentric UTC.

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
DS And	p	54096.2943	0.0004	+0.0022	29	RD	V
KN And	p	54090.3058	0.0005	+0.0012	18	RD	V; el.: BAV Mitt. 36, 11
GSC2808-139 And	s	54097.2513	0.0009		12	RD	V
V557 Aql	p	53919.5378	0.0009	+0.4546	12	RD	V
V737 Aql	p	53933.4849	0.0002	−0.1271	26	RD	V
V760 Aql	p	53934.4143	0.0003	−0.0225	22	RD	V
V770 Aql	p	53933.5302	0.0004	+0.3455	18	RD	V
V917 Aql	p	53919.4687	0.0002	+0.1154	35	RD	V; d=0.06 days
	p	53941.4566	0.0002	+1.1145	27	RD	V
NSV12008 Aql	s	53918.4289	0.0008	−0.0076	15	RD	V; el.: IBVS, No. 5644
ZZ Aur	s	54165.3516	0.0009	+0.0206	21	EBl	C
AP Aur	s	54172.303	0.003	+0.003	8	RD	V
EM Aur	s	54172.3949	0.0013	−0.1716	12	RD	V
GX Aur	p	54172.3759	0.0005	+0.0581	17	RD	V; el.: BAV Mitt. 69
HP Aur	s	54172.3419	0.0005	+0.0527	23	RD	V
IZ Aur	p	54097.5126	0.0003		30	RD	V
V365 Aur	p	54172.3323	0.0003	−0.0075	21	RD	V; el.: MVS 10, 153
V523 Aur	p	54172.3952	0.0011		9	RD	V
GSC2393-680 Aur	s	54130.3887	0.0015	+0.0070	10	EBl	C; el.: IBVS No. 5699
GSC2903-237 Aur	s	54130.4206	0.0005	+0.0019	17	EBl	C; el.: IBVS No. 5699
GSC2915-212 Aur	p	54165.4772	0.0005	+0.0021	25	EBl	C; el.: IBVS No. 5700
GSC3751-178 Aur	s	54097.5513	0.0003	−0.0071	27	RD	V; el.: 2453285.2664 + 0.3286 * E
	s	54172.3345	0.0002	−0.0079	21	RD	V
GM Boo	s	53936.4531	0.0008	+0.0313	13	EBl	R; el.: IBVS No. 5125
	s	54174.4301	0.0011	+0.0355	13	EBl	C
GN Boo	s	53936.4724	0.0011	+0.0100	10	EBl	R; el.: IBVS No. 5125
	s	54174.4349	0.0006	+0.0094	12	EBl	C
GQ Boo	p	53936.493	0.004	−0.008	11	EBl	R; el.: IBVS No. 5125
	s	54197.4751	0.0014	−0.0046	25	EBl	C

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GR Boo	p	53936.4397	0.0014	+0.0052	16	EBl	R; el.: IBVS No. 5125
	p	54174.4916	0.0003	+0.0016	16	EBl	C
GSC2013-288 Boo	p	53936.4179	0.0017	−0.0069	14	EBl	R; el.: IBVS No. 5699
	p	54174.3699	0.0007	−0.0034	16	EBl	C
	s	54174.5203	0.0008	−0.0045	14	EBl	C
AO Cam	p	54173.3745	0.0003	−0.0313	29	RD	V; el.: PASP 97, 648
CD Cam	p	54173.3819	0.0009	+0.0999	31	RD	V; el.: IBVS No. 3753
HW Cam	p	54173.4001	0.0008	+0.0563	22	RD	V; el.: IBVS No. 4526
MT Cam	s	54173.3388	0.0003	−0.0157	29	RD	V; el.: IBVS No. 5600
GSC3715-1039 Cam	p	54173.3517	0.0006	−0.0469	37	RD	V; el.: IBVS No. 5700
NSV3715 Cam	p	54173.278	0.005		6	RD	V
DF CVn	s	54170.4856	0.0004	+0.0443	22	EBl	C; el.: IBVS No. 5021
DH CVn	p	54170.3917	0.0006	−0.0134	12	EBl	C; el.: IBVS No. 5149
DQ CVn	p	54170.337	0.003	−0.001	10	EBl	C; el.: IBVS No. 5541
DX CVn	s	54172.4590	0.0007	+0.0051	16	EBl	C; el.: IBVS No. 5403
DY CVn	p	54172.2952	0.0003	−0.0041	9	EBl	C; el.: IBVS No. 5403
	s	54172.4138	0.0015	−0.0085	13	EBl	C
EE CVn	s	53979.3337	0.0010	−0.0187	15	EBl	R; el.: IBVS No. 5403
	s	54172.3757	0.0010	−0.0040	10	EBl	C
EF CVn	s	54172.4335	0.0010	−0.0003	19	EBl	C; el.: IBVS No. 5269
EG CVn	s	54172.4727	0.0005	+0.0220	16	EBl	C; el.: IBVS No. 5269
EI CVn	p	54172.4083	0.0009	−0.0043	11	EBl	C; el.: IBVS No. 5403
GSC2534-1121 CVn	s	54170.3640	0.0008	+0.0031	14	EBl	C; el.: IBVS No. 5541
GSC2537-520 CVn	p	54170.3811	0.0009	−0.0061	19	EBl	C; el.: IBVS No. 5541
GSC2544-1007 CVn	p	53936.3887	0.0008	−0.0009	10	EBl	R; el.: IBVS No. 5541
	p	54170.3973	0.0002	+0.0054	11	EBl	C
GSC2544-1090 CVn	s	53979.381	0.003	−0.002	10	EBl	R; el.: IBVS No. 5699
	p	54174.4864	0.0007	+0.0085	18	EBl	C
GSC2545-970 CVn	s	53936.5091	0.0014	+0.0004	10	EBl	R; el.: IBVS No. 5699
	p	54174.4923	0.0004	−0.0069	11	EBl	C
GSC3034-299 CVn	p	53936.4936	0.0003	−0.0023	9	EBl	R; el.: IBVS No. 5699
	s	54174.4898	0.0008	+0.0004	18	EBl	C
AX Cas	p	54097.3037	0.0003	−0.0901	27	RD	V
DP Cas	p	54097.256	0.003	+0.049	16	RD	V
GH Cas	p	54090.2659	0.0002	−0.4710	24	RD	V
KT Cas	p	54097.3096	0.0004	−0.1208	29	RD	V
MS Cas	p	54090.3051	0.0006	+0.0397	19	RD	V
NU Cas	p	54096.2857	0.0009	+0.2315	24	RD	V
V374 Cas	p	54090.3276	0.0005	+0.0165	10	RD	V
V419 Cas	p	54097.3637	0.0013	+0.0393	14	RD	V
V423 Cas	-	54090.3323	0.0012	−0.1386	9	RD	V
V651 Cas	s	54090.3002	0.0007	+0.0025	16	RD	V; el.: IBVS No. 3554
V775 Cas	p	54172.364	0.003	−0.004	18	RD	V; el.: IBVS No. 5557
NSV517 Cas	p	54096.361	0.008	+0.043	11	RD	V; el.: IBVS No. 5609
CO Cep	p	53918.4686	0.0006	−0.1795	33	RD	V; eccentric orbit
EO Cep	p	54097.2971	0.0007	+0.0821	29	RD	V; d = 0.09 d
GG Cep	p	54096.2931	0.0004	−0.0809	26	RD	V
GW Cep	p	54097.3022	0.0007	−0.0069	20	RD	V; el.: IBVS No. 4293
IW Cep	p	54096.3551	0.0007	+0.0260	9	RD	V
NSV43 Cep	s	53932.534	0.005	+0.169	18	RD	V; el.: IBVS, No. 5630; eccentric orbit
VY Com	p	54200.4174	0.0018	+0.0491	35	RD	V
LL Com	p	54200.4087	0.0004	−0.0322	27	RD	V; el.: IBVS No. 4386
LO Com	s	54170.4664	0.0005	+0.0071	21	EBl	C; el.: IBVS No. 5052
	p	54200.3953	0.0010	+0.0113	20	RD	V
LP Com	p	54170.4792	0.0004	−0.0159	20	EBl	C; el.: IBVS No. 5052
	s	54200.3910	0.0007	−0.0113	17	RD	V
MR Com	p	54172.4182	0.0006	−0.0250	20	EBl	C; el.: IBVS No. 5269

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
AR CrB	s	54197.4971	0.0009	+0.0013	15	EBl	C; el.: IBVS No. 5295
AS CrB	p	54197.4022	0.0012	+0.0049	16	EBl	C; el.: IBVS No. 5295
AV CrB	s	54197.4513	0.0006	−0.0080	22	EBl	C; el.: IBVS No. 5295
GG Cyg	p	53919.5050	0.0007	+0.1230	24	RD	V; d=0.05 days
PQ Cyg	p	53941.4343	0.0012	+0.0273	22	RD	V; d=0.04 days
V346 Cyg	p	53932.4276	0.0002	+0.1090	23	RD	V
V385 Cyg	p	53934.4300	0.0008	−0.1270	25	RD	V
V501 Cyg	p	53918.377	0.005	−0.202	8	RD	V
V635 Cyg	p	53941.4878	0.0003	−0.0452	27	RD	V
V753 Cyg	p	53932.4807	0.0001	+0.0026	27	RD	V; el.: BAV M., 69
V824 Cyg	p	53934.4227	0.0005	+0.0163	19	RD	V
V853 Cyg	p	53932.4625	0.0005	+0.0223	28	RD	V
V869 Cyg	s	53932.4396	0.0011	+0.0096	21	RD	V
V910 Cyg	p	53934.4333	0.0005	−0.0257	25	RD	V
V961 Cyg	p	53918.4636	0.0002	+0.0013	18	RD	V; el.: IBVS, No. 4278
V964 Cyg	p	53919.4529	0.0009	+0.0396	25	RD	V
V1066 Cyg	p	53941.4587	0.0005	+0.0730	23	RD	V; d=0.06 days
V1083 Cyg	p	53946.4098	0.0002	−0.0603	23	RD	V; d=0.03 days
V1411 Cyg	p	53919.4873	0.0007	+0.2141	18	RD	V
V2280 Cyg	s	54019.4317	0.0006	+0.0403	25	EBl	R; el.: IBVS No. 4996
V2282 Cyg	s	54019.3294	0.0004	−0.0374	24	EBl	R; el.: IBVS No. 4996
V2284 Cyg	s	54019.3126	0.0006	+0.0022	19	EBl	R; el.: IBVS No. 4985
V2294 Cyg	s	54019.3626	0.0011	+0.0187	20	EBl	R; el.: IBVS No. 4995
GSC3159-1247 Cyg	p	53934.5424	0.0014	+0.1086	11	RD	V; el.: IBVS, No. 5600
Z Dra	p	54200.3792	0.0002	−0.1825	30	RD	V
MU Dra	p	54018.268	0.005	−0.010	8	EBl	R; el.: IBVS No. 5232
	s	54018.432	0.002	−0.021	13	EBl	R
DW Dra	p	53932.4125	0.0007	+0.0076	18	RD	V; el.: BBSAG Bull., 118, 7
KP Dra	p	53946.3934	0.0003	−0.0257	18	RD	V; el.: IBVS, No. 5599
GSC3523-505 Dra	s	53984.409	0.002	−0.008	9	EBl	R; el.: IBVS No. 5699
	p	53984.538	0.002	+0.002	12	EBl	R
GSC3552-321 Dra	p	53984.4656	0.0014	+0.0034	17	EBl	R; el.: IBVS No. 5699
GSC3905-60 Dra	p	53984.5007	0.0008	−0.0075	22	EBl	R; el.: IBVS No. 5699
AV Gem	s	54097.5466	0.0005	−0.0307	35	RD	V
EG Gem	p	54097.5907	0.0005	+0.2632	22	RD	V
LO Gem	s	54097.5786	0.0003	+0.0145	29	RD	V; el.: IBVS No. 5020
DI Her	p	53933.4817	0.0004	−0.0022	31	RD	V; eccentric orbit
V1033 Her	p	54210.4238	0.0003	−0.0127	13	EBl	C; el.: IBVS 5146
	s	54210.5733	0.0003	−0.0122	14	EBl	C
V1036 Her	s	54210.5591	0.0002	+0.0029	19	EBl	C; el.: IBVS No. 5146
V1038 Her	p	54210.4519	0.0005	+0.0049	10	EBl	C; el.: IBVS No. 5146
V1039 Her	s	54210.5300	0.0004	+0.0022	19	EBl	C; el.: BBSAG Bull. 128, 10
V1044 Her	p	53992.308	0.003	−0.005	8	EBl	R; el.: IBVS No. 5192
	s	53992.4266	0.0008	−0.0067	10	EBl	R
	s	54202.5078	0.0003	−0.0051	19	EBl	C
V1047 Her	p	53992.3248	0.0011	−0.0088	10	EBl	R; el.: IBVS No. 5192
	p	54202.410	0.002	−0.006	10	EBl	C
	s	54202.5686	0.0009	−0.0080	18	EBl	C
V1053 Her	p	53992.406	0.004	+0.010	8	EBl	R; el.: BBSAG Bull., 128, 10
	p	54202.4899	0.0006	+0.0030	13	EBl	C
V1055 Her	p	53992.3522	0.0006	+0.0004	12	EBl	R; el.: IBVS No. 5192
	p	54202.4118	0.0012	−0.0017	16	EBl	C
	s	54202.5752	0.0004	+0.0040	17	EBl	C
V1062 Her	s	53992.423	0.003	−0.005	10	EBl	R; el.: IBVS No. 4965
	p	54202.4958	0.0009	−0.0063	14	EBl	C
	s	54202.619	0.003	−0.009	9	EBl	C

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
V1067 Her	s	53992.363	0.003	+0.010	11	EBl	R; el.: IBVS No. 4966
	p	53992.482	0.004	0.000	11	EBl	R
	s	54202.4550	0.0010	+0.0011	11	EBl	C
	p	54202.5873	0.0002	+0.0043	14	EBl	C
V1073 Her	s	53992.3194	0.0006	+0.0083	10	EBl	R; el.: IBVS No. 4975
	p	53992.4685	0.0010	+0.0102	12	EBl	R
	s	54202.4408	0.0008	+0.0137	12	EBl	C
	p	54202.5892	0.0015	+0.0149	15	EBl	C
V1094 Her	s	54000.3477	0.0004	+0.0019	16	EBl	R; el.: IBVS No. 5306
	s	54210.5274	0.0005	+0.0032	19	EBl	C
V1095 Her	p	54002.3187	0.0007	−0.0094	24	EBl	R; el.: IBVS No. 5306
	p	54210.4235	0.0007	−0.0104	16	EBl	C
V1096 Her	s	54002.3346	0.0010	+0.0047	14	EBl	R; el.: IBVS No. 5306
	s	54210.446	0.003	+0.016	12	EBl	C
V1097 Her	p	54002.4182	0.0010	−0.0010	18	EBl	R; el.: IBVS No. 5306
	s	54210.4505	0.0002	+0.0029	13	EBl	C
V1101 Her	s	54000.277	0.004	+0.004	12	EBl	R; el.: IBVS No. 5333
	p	54217.4343	0.0005	+0.0042	14	EBl	C
V1102 Her	p	53941.434	0.002	+0.006	11	EBl	R; el.: IBVS No. 5333
	p	54217.3736	0.0008	+0.0045	9	EBl	C
V1103 Her	p	54000.3242	0.0003	−0.0010	17	EBl	R; el.: IBVS No. 5333
	p	54217.3771	0.0009	−0.0061	11	EBl	C
	s	54217.5251	0.0008	−0.0038	12	EBl	C
V1104 Her	p	54000.3333	0.0006	−0.0005	19	EBl	R; el.: IBVS No. 5333
	s	54217.3833	0.0006	−0.0029	7	EBl	C
	p	54217.4962	0.0011	−0.0039	15	EBl	C
GSC963-246 Her	s	53858.4941	0.0003	0.0000	21	EBl	R; el.: IBVS No. 5799
	s	53877.386	0.004	+0.003	8	EBl	R
	p	53894.5374	0.0008	−0.0003	18	EBl	R
	p	53896.4629	0.0013	−0.0023	15	EBl	R
	p	53898.3971	0.0011	+0.0045	13	EBl	R
	s	53898.5831	0.0016	−0.0023	14	EBl	R
	s	53900.5100	0.0006	−0.0029	23	EBl	R
	p	53906.4903	0.0007	+0.0023	24	EBl	R
	s	53910.5352	0.0007	−0.0005	12	EBl	R
GSC1518-913 Her	p	53858.4569	0.0018	+0.0019	18	EBl	R; el.: IBVS No. 5799
	p	53877.4043	0.0017	+0.0011	9	EBl	R
	s	53894.583	0.003	−0.002	8	EBl	R
	s	53896.5096	0.0008	−0.0024	22	EBl	R
	s	53898.4382	0.0009	−0.0007	17	EBl	R
	p	53900.5267	0.0007	+0.0003	24	EBl	R
	s	53906.4678	0.0006	0.0000	16	EBl	R
	p	53910.4837	0.0004	+0.0015	15	EBl	R
GSC2587-289 Her	s	53858.4640	0.0008	+0.0039	22	EBl	R; el.: IBVS No. 5799
	p	53877.5007	0.0013	−0.0023	11	EBl	R
	s	53894.5214	0.0010	−0.0023	15	EBl	R
	p	53896.383	0.003	+0.006	7	EBl	R
	s	53896.5437	0.0008	−0.0023	22	EBl	R
	p	53898.3969	0.0008	−0.0028	15	EBl	R
	s	53898.5664	0.0008	−0.0018	16	EBl	R
	p	53900.4244	0.0009	+0.0024	18	EBl	R
	p	53906.4910	0.0006	+0.0023	17	EBl	R
	p	53910.5309	0.0011	−0.0023	13	EBl	R
GSC2587-1888 Her	p	53858.5169	0.0006	+0.0018	17	EBl	R; el.: IBVS No. 5799
	p	53877.4660	0.0009	−0.0034	11	EBl	R
	p	53894.5642	0.0015	+0.0049	17	EBl	R
	p	53896.4236	0.0019	−0.0001	10	EBl	R
	s	53898.4438	0.0011	+0.0004	25	EBl	R
	p	53900.4655	0.0010	+0.0024	19	EBl	R
	s	53906.5196	0.0012	−0.0027	14	EBl	R
	p	53910.4047	0.0018	+0.0017	13	EBl	R

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC2614-1369 Her	p	53988.4691	0.0006	+0.0009	17	EBl	R; el.: IBVS No. 5516
	p	54217.4103	0.0005	−0.0001	14	EBl	C
GSC2615-1821 Her	s	53988.3813	0.0008	−0.0009	22	EBl	R; el.: IBVS No. 5516
	p	54217.4371	0.0006	+0.0029	17	EBl	C
GSC2618-1385 Her	p	53988.3350	0.0003	−0.0056	21	EBl	R; el.: IBVS No. 5516
	s	54217.4258	0.0004	−0.0056	16	EBl	C
GSC3097-1297 Her	s	53941.360	0.004	+0.002	10	EBl	R; el.: IBVS No. 5564
GSC3101-547 Her	s	53941.3920	0.0010	+0.0038	12	EBl	R; el.: IBVS No. 5564
GSC3106-1368 Her	s	53941.435	0.003	−0.061	14	EBl	R; el.: IBVS No. 5564
GSC3510-5 Her	s	53984.4057	0.0012	+0.0132	20	EBl	R; el.: IBVS No. 5564
GSC3510-1283 Her	p	53988.3923	0.0013	−0.0065	17	EBl	R; el.: IBVS No. 5516; pulsator?
	s	54217.335	0.003	−0.007	8	EBl	C
	p	54217.4758	0.0014	−0.0053	11	EBl	C
GSC3532-553 Her	s	53984.3035	0.0010	+0.0034	9	EBl	R; el.: IBVS No. 5699
	p	53984.4578	0.0006	−0.0010	16	EBl	R
NSV10870 Her	s	53918.4067	0.0021	−0.0065	19	RD	V; el.: IBVS, No. 5630
TZ Lac	p	53946.5332	0.0007	+0.3197	16	RD	V
CO Lac	s	54096.2892	0.0004	+0.0055	29	RD	V; eccentric orbit
MZ Lac	p	53941.567	0.002	−0.003	11	RD	V; el.: JAAVSO 19, 12; eccentric orbit
	s	53946.4775	0.0004	+0.1684	34	RD	V
	p	54096.3501	0.0003	−0.0029	10	RD	V
NW Lac	p	53946.3998	0.0006	−0.1058	19	RD	V; d=0.03 days
EW Lyr	p	53918.4628	0.0002	+0.2332	31	RD	V
V336 Lyr	p	53933.4464	0.0012	−0.0053	27	RD	V
V400 Lyr	p	54018.3454	0.0004	−0.0306	11	EBl	R; el.: IBVS No. 4995
V574 Lyr	s	54018.3694	0.0009	−0.0036	15	EBl	R; el.: IBVS No. 4976
V579 Lyr	s	54018.3642	0.0009	−0.0090	15	EBl	R; el.: IBVS No. 4982
V580 Lyr	p	54018.332	0.003	−0.016	14	EBl	R; el.: IBVS No. 4982
V582 Lyr	p	54018.2872	0.0019	+0.0326	10	EBl	R; el.: IBVS No. 4985
	s	54018.4202	0.0020	+0.0377	9	EBl	R
V591 Lyr	s	54014.3130	0.0011	−0.0024	15	EBl	R; el.: IBVS No. 5232
V592 Lyr	s	54017.2705	0.0008	+0.0073	15	EBl	R; el.: IBVS No. 5232
V596 Lyr	s	54017.2704	0.0005	+0.0075	15	EBl	R; el.: IBVS No. 5232
GSC3108-57 Lyr	s	54018.2698	0.0010	−0.0031	12	EBl	R; el.: IBVS No. 5525
	p	54018.4562	0.0006	−0.0009	11	EBl	R
GSC3109-859 Lyr	p	54014.3153	0.0003	−0.0027	21	EBl	R; el.: IBVS No. 5525
GSC3526-1995 Lyr	p	54014.3175	0.0013	−0.0133	15	EBl	R; el.: IBVS No. 5525
GSC3526-2369 Lyr	s	54017.3537	0.0005	+0.0183	17	EBl	R; el.: IBVS No. 5525
AL Oph	p	53933.4090	0.0013	−0.0324	13	RD	V; el.: IBVS, No. 4452
FH Ori	p	54097.4627	0.0003	−0.3295	28	RD	V
FT Ori	s	54097.4483	0.0005	+0.6106	21	RD	V; eccentric orbit
V1202 Ori	p	54097.4807	0.0002	−0.0297	32	RD	V; el.: IBVS No. 3544
GSC107-596 Ori	p	54066.4295	0.0003	−0.0007	18	EBl	el.: IBVS No. 5799
	s	54066.5655	0.0008	+0.0021	18	EBl	
	s	54083.3477	0.0014	+0.0043	13	EBl	R
	p	54083.4719	0.0010	−0.0047	14	EBl	R
	s	54083.6122	0.0010	+0.0025	15	EBl	R
	p	54085.3375	0.0006	−0.0035	14	EBl	R
	s	54085.4762	0.0011	+0.0020	13	EBl	R
	p	54085.6085	0.0012	+0.0011	15	EBl	R
	p	54090.4017	0.0006	0.0000	14	EBl	R
	s	54090.5353	0.0003	+0.0005	15	EBl	R
	p	54097.3229	0.0008	−0.0039	12	EBl	R
	s	54097.4626	0.0011	+0.0027	18	EBl	R
	p	54097.5949	0.0015	+0.0018	15	EBl	R
	s	54114.2420	0.0016	+0.0020	11	EBl	R
	p	54114.3687	0.0006	−0.0044	17	EBl	R
	s	54114.5041	0.0005	−0.0022	10	EBl	R

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC702-1892 Ori	p	54066.3455	0.0009	+0.0002	13	EBl	el.: IBVS No. 5799
	s	54066.4841	0.0004	+0.0003	17	EBl	
	p	54066.6197	0.0011	−0.0026	12	EBl	
	s	54083.3803	0.0005	+0.0029	18	EBl	R
	p	54083.5170	0.0003	+0.0011	16	EBl	R
	s	54083.6523	0.0012	−0.0011	13	EBl	R
	s	54085.3181	0.0004	+0.0024	13	EBl	R
	p	54085.4516	0.0008	−0.0029	16	EBl	R
	s	54085.5966	0.0010	+0.0036	16	EBl	R
	s	54090.3000	0.0009	−0.0011	14	EBl	R
	p	54090.4428	0.0006	+0.0033	16	EBl	R
	s	54090.5764	0.0008	−0.0016	19	EBl	R
	p	54097.3646	0.0005	+0.0014	13	EBl	R
	s	54097.4984	0.0015	−0.0032	16	EBl	R
	p	54114.2573	0.0004	+0.0005	14	EBl	R
	s	54114.3927	0.0011	−0.0026	13	EBl	R
GSC706-845 Ori	p	54066.4689	0.0013	+0.0019	20	EBl	el.: IBVS No. 5799
	s	54083.4375	0.0011	+0.0033	15	EBl	R
	p	54083.6050	0.0011	−0.0006	22	EBl	R
	p	54085.3187	0.0006	−0.0007	16	EBl	R
	s	54085.4945	0.0009	+0.0037	15	EBl	R
	s	54090.306	0.002	+0.016	10	EBl	R
	p	54090.4555	0.0011	−0.0055	18	EBl	R
	s	54090.6329	0.0010	+0.0005	12	EBl	R
	p	54097.3261	0.0014	+0.0097	16	EBl	R
	s	54097.4906	0.0011	+0.0028	18	EBl	R
	s	54114.2786	0.0013	−0.0050	19	EBl	R
	p	54114.4545	0.0010	−0.0005	15	EBl	R
GSC1283-53 Ori	s	54066.3849	0.0008	−0.0014	22	EBl	el.: IBVS No. 5799
	p	54066.5781	0.0002	+0.0003	23	EBl	R
	p	54083.4277	0.0009	−0.0023	20	EBl	R
	s	54083.6169	0.0012	−0.0046	19	EBl	R
	p	54085.3511	0.0010	+0.0061	17	EBl	R
	s	54085.5383	0.0006	+0.0018	14	EBl	R
	p	54090.3238	0.0009	−0.0002	17	EBl	R
	s	54090.5181	0.0006	+0.0026	24	EBl	R
	s	54097.4085	0.0002	−0.0011	19	EBl	R
	p	54097.5996	0.0004	−0.0015	18	EBl	R
	s	54114.2636	0.0004	+0.0018	18	EBl	R
	p	54114.4514	0.0005	−0.0019	18	EBl	R
FF Sge	p	53934.4540	0.0006	+0.0355	27	RD	V
FL Sge	p	53918.4879	0.0006	+0.1051	26	RD	V
GO Sge	p	53933.4194	0.0012	+0.0024	22	RD	V; el.: 2451426.88 + 3.401 * E
V384 Ser	p	54197.3869	0.0009	+0.0038	10	EBl	C; el.: IBVS No. 5295
GSC1830-1432 Tau	p	54130.2911	0.0010	+0.0069	16	EBl	C; el.: IBVS No. 5699
	s	54130.4169	0.0011	−0.0032	21	EBl	C
GSC1848-1264 Tau	s	54130.3697	0.0005	−0.0016	15	EBl	C; el.: IBVS No. 5699
UX UMa	p	54200.4268	0.0007	+0.0031	9	RD	V
AA UMa	s	54173.3929	0.0005	+0.0360	28	RD	V
IW UMa	p	54200.3845	0.0003	+0.0120	25	RD	V

Observers:

EBl : E. Blättler Wald, Switzerland
RD : R. Diethelm Rodersdorf, Switzerland

Reference:

Kholopov, P. N., Samus, N. N., Frolov, M. S., Goranskij, V. P., Gorynya, N. A., Kireeva, N. N., Kukarkina, N. P., Kurochkin, N. E., Medvedeva, G. I., Perova, N. B., Shugarov, S. Yu., 1985, *General Catalogue of Variable Stars*, Moscow

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ORBITAL EFFECTS ON THE LIGHT CURVES OF η Car, BP Cru, AND OTHER ECCENTRIC BINARIES

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The very eccentric and massive binary η Carinae shows at each periastron passage a light peak ($0\overset{m}{.}1$–$0\overset{m}{.}2$) in the optical as well as in the near-infrared. Thereafter, a short lasting eclipse-like dip occurs, followed by a so-called 'egress-maximum' that subsequently fades away (see Fig. 1). Van Genderen et al. (2006, 2007) suggested that the peaks may well be the result of an enhancement of the deformation by tidal forces on the primary, and that the egress-maximum is the continuation of the peak (after interruption by the dip, which has another cause) until it disappears some months after the periastron passage.

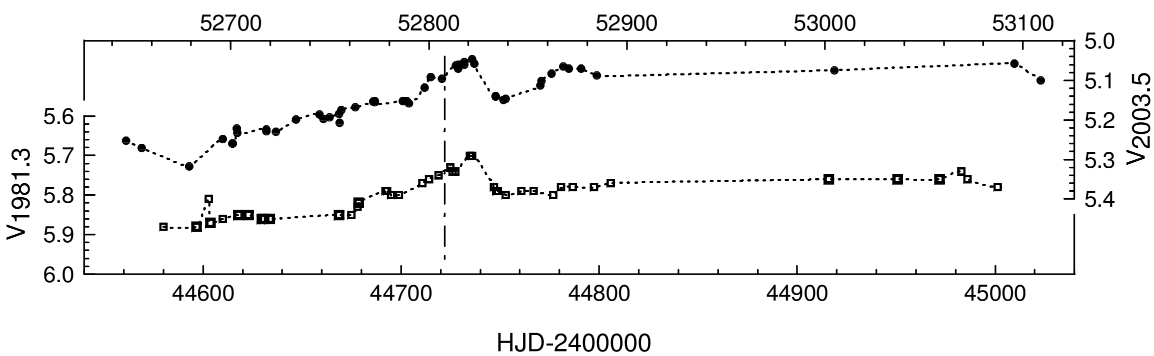

Figure 1. *V* light curves of the events of 2003.5 (•; magnitudes on the right, JD axis at the top) and 1981.3 (squares; magnitude scale on the left, JD axis at the bottom). Vertical dash-dotted line: periastron passages. The dotted lines are spline fits. Based on Fig. 1 of van Genderen et al. (2006).

The first aim of this paper is to provide additional support for these two suggestions. Therefore, the literature on photometrically well-observed eccentric detached binaries was surveyed. Among the dozens of suitable eccentric binaries, five show a clear bump, in the literature called the periastron effect (Table 1). One of these is BP Cru = WRA 977, a B-type hypergiant with an X-ray pulsar (GX301-2), in which the effect was first noticed by Pakull (1982). The second purpose of this note is to supplement Pakull's light curve with more photometric evidence.

It should be noted that eccentric detached binaries are important for the study of the internal structure of stars. Tidal distortion depends on the internal structure (though modified by stellar rotation), i.e. the density concentration. The more evolved a star is, the larger the effect of the tidal pull during the periastron passages will be. Due to tidal distortion – together with rotational flattening – these binaries show an apsidal motion, mostly in advance of the orbital motion. General Relativity also predicts a certain amount of secular apsidal motion, usually of a much smaller, though often non-negligible quantity.

Apart from the observable periastron effect in the light curves, the periodic variability of the tidal pull can also modulate the pulsational behaviour when one of the components is a pulsating star. Examples are the β Cep primaries of Spica (α Vir = HD 116658, Dukes 1974; Smith 1985; Claret & Giménez 1993) and σ Sco (= HD 142669, Chapellier & Valtier 1992). The S Dor-phases of η Car (which are a kind of slow pulsation) appear to reach maximum light during most of the periastron passages (van Genderen et al. 2001; Whitelock et al. 2004), and the quasi-period of the α Cyg-type variations of the primary of BP Cru (van Genderen & Sterken 1996) is about a quarter of the orbital revolution (Kaper et al. 2006). Something similar seems to be the case for the eccentric X-ray binary Vela X-1 (= HD 77581, Quaintrell et al. 2003).

Since the intrinsic variations of the hypergiant primary of BP Cru are relatively strong (showing a quasi-period of $11\overset{d}{.}9$, van Genderen & Sterken 1996), the light curve is folded with the binary period. We used the data sets of Bord et al. (1976, UBV), Hammerschlag-Hensberge et al. (1976, $uvby$) and van Genderen (1977, $VBLUW$, also used by Pakull 1982), and a new larger $VBLUW$ data set (63 nightly averages). The latter was obtained in 1976, 1977 and 1978 (van Genderen & Sterken 1996). However, we could not get hold of the three other data sets used by Pakull (1982).

As three different photometric systems are involved, the V_{UBV} and $y(uvby)$ light curves were matched with the V_{VBLUW} light curve by shifting them along the magnitude scale, until a good fit was obtained. Then, the data points of the two first mentioned photometric systems were transformed to the relative magnitude scale of the V_{VBLUW} system. The comparison star is HD 109164 (B2 II). Averages in ten phase-bins were computed, yielding an average mean error of $0\overset{m}{.}007$. Phases were computed with the ephemeris $JD_0 = 2\,443\,451.55 + 41\overset{d}{.}498$, where the period is from Kaper et al. (2006) and the zero point for the periastron is taken from Watson et al. (1984). This choice is justified because of the close proximity of JD_0 to all the data sets used by Pakull (1982), and to the new one in this paper.

Fig. 2 shows the phase diagram based on 169 nightly averages. The periastron effect – a small modulation ($\sim 3\%$) of the optical brightness around phase zero – is obvious as in the case of the Pakull (1982) curve, though obtained from a different combination of data sets. The amplitude of the periastron effect is of the order of $0\overset{m}{.}03$, and the duration of the effect is about 6 days ($\sim 0.15 \times P$).

Table 1 lists six eccentric binaries (including η Car and BP Cru), and gives the spectral types, masses, eccentricities (e), orbital periods (P), the amplitude of the periastron effect in magnitudes, and its duration in phase units ($\triangle\phi$). The six binaries are listed in order of increasing eccentricity. It should be noted that spectral types, masses and eccentricity of η Car are uncertain and based on current estimates (Davidson 1999; Corcoran et al. 2001). The period, first discovered by Damineli (1996), is an average from various authors. The stellar parameters of the four other binaries are taken from the compilations by Claret & Giménez (1993) and Claret & Willems (2002), including the references to the original papers.

To illustrate the subtle character of the periastron effect, we show in Figs. 3 and 4 two examples of phase diagrams. The V 380 Cyg case (based on data from Guinan et al. 2000) shows a periastron effect near phase 0.15. For V 346 Cen (extracted from Giménez

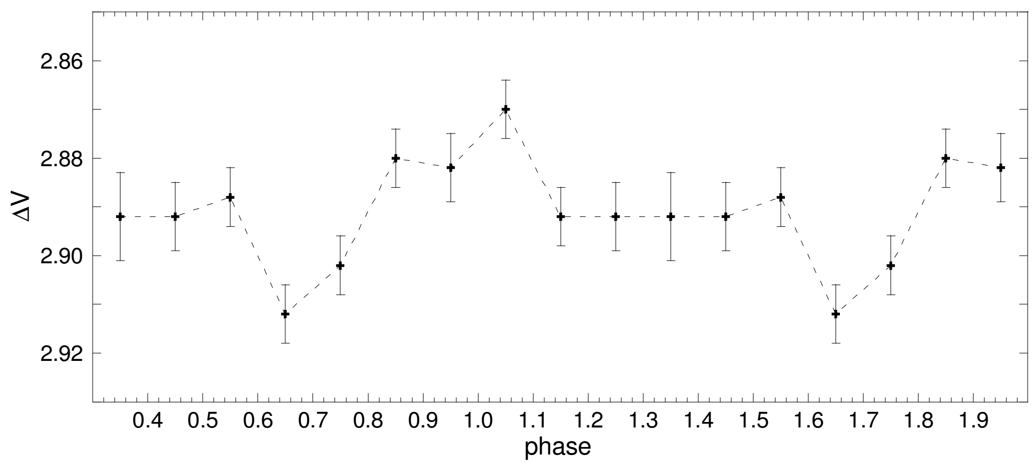

Figure 2. The differential orbital phase-diagram of BP Cru = WRA 977. Phase 0.0 corresponds to the periastron passage, and $P = 41\overset{\mathrm{d}}{.}498$.

et al. 1986), the periastron effect is visible as a point-like maximum near phase −0.2. These authors point to *"a persistent, though small, discrepancy between the predicted and observed light curves around periastron"* that cannot be removed by changing the model parameters. Their Figure 5d clearly illustrates the very small amplitude of the associated colour variations, and implicitly underlines the fact that only high-quality and homogeneous data sets can reveal the presence of a periastron effect. The difficulty of detection is emphasised by the counter example of β Ari – one of the most eccentric orbits ($e \sim 0.9$, as for η Car) known among spectroscopic binaries – where Lovell and Hall (1971) found a very weak ($0\overset{\mathrm{m}}{.}01$) effect, though Ogata (1973) subsequently reports no photometric evidence supporting an appreciable periastron effect.

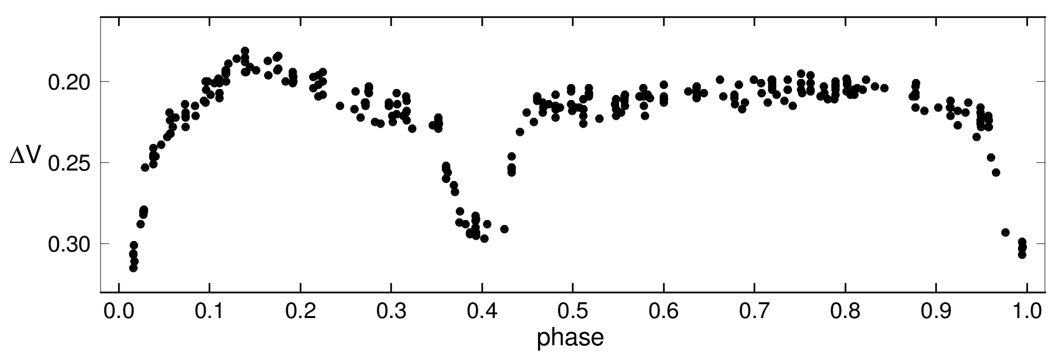

Figure 3. Phase diagram of V 380 Cyg (based on differential V data from Guinan et al. (2000).

The $\triangle\phi$ of η Car and BP Cru are uncertain because the effect occurs on top of cyclic, or quasi-periodic light oscillations. It should be noted that in most cases a small part of the periastron effect can be attributed to reflection and/or ellipticity (distortion by rotation). Furthermore, the amplitude of the periastron effect possibly depends on the viewing angle to the tidally distorted star, thus on how much of the distortion is seen.

It is perhaps not surprising that η Car shows the strongest periastron effect, amongst

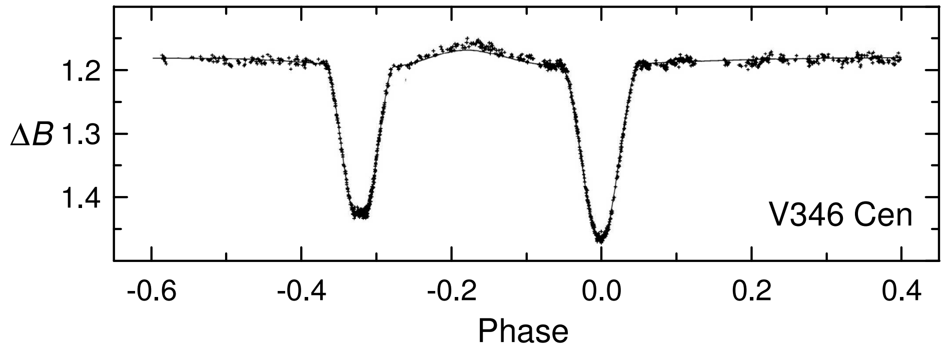

Figure 4. Phase diagram of V 346 Cen (differential B, extracted from Giménez et al. (1986).

Table 1: The six eccentric binaries showing the periastron effect

Object	Sp	$M_1 + M_2$ ($M_\odot$)	e	P (d)	peri.eff. (mag)	$\triangle\phi$	Ref. l.c.
V 380 Cyg (= HD 187879)	B1.5II–III + B2V	14.3 + 8.0	0.23	12.4	0.03	0.15	1
V 346 Cen (= HD 101837)	B0.5-1V + B0.5-1V	11.8 + 8.4	0.29	6.3	0.03	0.2	2
V 1647 Sgr (= HD 163708)	A1V + A2V	2.2 + 2.0	0.41	3.3	0.015	0.1	3
V 560 Car (= HD 93205)	O3V + O8V	45 + 20	0.46	6.08	0.02	0.15	4
BP Cru (=WRA 977)	B1.5Ia$^+$ + NS	43 + 1.85	0.46	41.5	0.03	0.15	5
η Car (= HD 93308)	B + O	80 + 30	0.9	2023	0.1–0.2	0.1	6

`References light curve`: 1. Guinan et al. (2000); 2. Giménez et al. (1986); 3. Clausen et al. (1977); 4. Antokhina et al. (2000), van Genderen (2003); 5. Pakull (1982), this paper; 6. van Genderen et al. (2006).

others because of its extreme eccentricity and its highly evolved state. There are spectroscopic indications for a shell ejection, or at least a mass-ejection event during the 2003.5 periastron passage (Stahl et al. 2005). Corcoran et al. (2001), moreover, needed a substantial increase of the mass-loss rate to properly explain the X-ray light curve of the 1997.9 periastron passage. It is quite well thinkable that η Car's primary exceeds its Roche Lobe during the periastron passage, enabling an increase of mass flow into the system.

The eclipse-like dip interrupting the periastron effect of η Car appears to be a short intermezzo and we speculate that it is due to some obscuration process of the emitting material associated with the secondary (van Genderen et al. 2006). A similar type of attenuation process was suggested earlier by Whitelock and Laney (1999) as an explanation for the dip. In the light of the evidence offered by the examples in Table 1, it seems to be justified to assume that in the case of η Car, the egress-maximum is also part of the periastron effect that finally fades away after a couple of months.

We conclude that η Car's optical and near-infrared 'light peak' around the periastron passages are in various respects similar to the periastron effects exhibited by other eccentric binaries, and therefore may well have the same physical cause.

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QUIESCENT PHOTOMETRY OF V5115 SGR

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V5115 Sgr (Nova Sgr 2005) was independently discovered by Nishimura (2005) and Sakurai (2005). At peak, it reached a visual magnitude of 7.8 on March 29.7, in 2005. The AAVSO light curve for this nova is given in Figure 1.

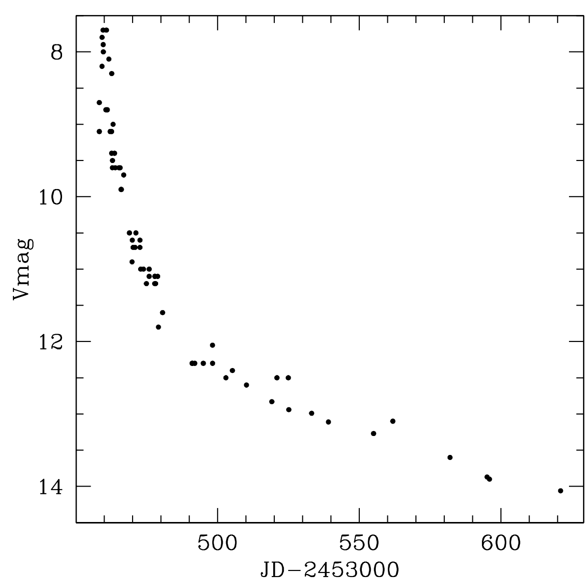

Figure 1. AAVSO light curve of V5115 Sgr. Points are a mixture of visual observations and CCD V-band observations.

Kiss and Derekas (2005) confirmed the nova classification based on H-alpha emission with a strong P-Cyg profile with full-width-zero-intensity exceeding 5000 km/s. The Na D doublet was saturated, indicating high interstellar reddening. Rudy et al. (2005) indicate that the reddening derived from the NIR O I lines was $E(B-V)=0.53$. Likewise, the Schlegel et al. (1998) galactic extinction maps give $E(B-V)=0.586$mag, and a total extinction of 1.942mag at V-band. The light curve looks like a typical fast nova, with the time to drop 3 magnitudes (t_3) of about 12 days.

Several independent astrometric positions were given for the nova, as given in Table 1. Three additional measurements are given there, based on new astrometric measurements of B-band images taken by Di Scala (DSI), reduced using the UCAC2 astrometric catalog (Zacharias et al. 2004), and also recent imagery from the U.S. Naval Observatory, Flagstaff Station (NOFS) as described later.

Table 1. V5115 Sgr astrometric positions

Observer	Epoch	RA(J2000)	DEC(J2000)
Nakano (2005a)	2005.33	18:16:59.04	−25:56:38.8
Nakano (2005b)	2005.33	18:16:58.96	−25:56:38.9
Nakano (2005b)	2005.33	18:16:58.97	−25:56:39.1
DSI	2005.58	18:16:58.95	−25:56:39.7
DSI	2005.66	18:16:58.96	−25:56:39.6
NOFS	2007.40	18:16:58.96	−25:56:39.6

As this is a very crowded region near the center of the Galaxy (galactic longitude 6.0464 degrees; latitude −4.5674 degrees) and is heavily reddened, no progenitor was identified in the IAUC. Yamaoka (2005) noted that there was a nearby bright infrared source in the 2MASS catalog.

Other than these initial reports, no additional information has been published on this nova. Hans-Guenter Diederich asked on the BAV mail list on May 8, 2007, about the proper identification for V5115 Sgr now that it has faded. In addition, late-time photometry for novae is often neglected. For these reasons, we made further observations of V5115 Sgr at NOFS in May, 2007.

DSI observed V5115 Sgr during the outburst, using a 30cm telescope, SBIG ST-6 CCD camera and Custom Scientific BVR_c filters. Standard dark subtraction and flatfielding were performed. Stars were extracted using `AIP4WIN` software. First order extinction corrections as well as transformation coefficients were applied. Since this field was not yet calibrated, the DSI observations are all-sky, using SA109-747 as the primary standard. Table 2 gives the BVR_c photometry during outburst.

The field of V5115 Sgr was also observed at BVR_cI_c on May 26, 2007 (UT) and at BV on May 28, 2007, using the 1.0m R/C telescope at NOFS. Conditions were photometric. A BVR_cI_c calibration of the field was obtained, with results given in Table 3 (available through the IBVS website as `5783-t3.txt`). For each night, multiple Landolt (1983, 1992) fields were observed to both obtain the transformation coefficients as well as extinction. As this field is at −25 degrees declination, it transits at relatively high airmass, so the quality of the calibration is not as high as for other fields. In addition, the high airmass results in poorer image quality; the typical seeing on these two nights was about 2.5arcsec for this field. Note that automated starfinding routines were used to generate Table 3, and that many spurious objects will be present due to blending. Take care when using this table to identify isolated objects.

Each image was bias subtracted and flatfielded using standard procedures. The images were then psf-fit using DAOPHOT (Stetson, 1987) as implemented in IRAF. The photometry was calculated using inhomogeneous ensemble photometry techniques similar to Honeycutt (1992). Astrometry was performed using the SLALIB astronomical library (Wallace, 2002) along with UCAC2.

This is a very crowded region and exposures were shorter than necessary for high-precision photometry. However, we report the new photometry for V5115 Sgr also in Table 2.

Yamaoka (2005) noted that there was a nearby bright infrared source in the 2MASS

Table 2. V5115 Sgr multifilter data from DSI and NOFS

JD	V	err	$(B-V)$	err	$(V-R_c)$	err	Observer
2453498.2049	12.05	0.05	0.25	0.10	1.40	0.10	DSI
2453505.2479	12.40	0.02	–	–	1.18	0.04	DSI
2453519.1458	12.83	0.02	0.07	0.04	1.16	0.04	DSI
2453525.1417	12.94	0.02	0.05	0.03	1.06	0.03	DSI
2453533.1875	12.99	0.02	0.18	0.04	0.85	0.04	DSI
2453539.1188	13.11	0.02	0.10	0.04	0.97	0.04	DSI
2453555.0451	13.27	0.02	0.32	0.04	0.80	0.04	DSI
2453582.0090	13.60	0.02	0.36	0.04	0.50	0.04	DSI
2453595.0833	13.87	0.03	–	–	0.55	0.05	DSI
2453595.9507	13.90	0.02	0.29	0.04	0.58	0.04	DSI
2453621.0278	14.06	0.02	0.43	0.04	0.69	0.04	DSI
2454246.9038	18.50	0.06	0.50	0.08	–	–	NOFS
2454248.9211	18.42	0.08	0.29	0.09	–	–	NOFS

catalog. The recent BVR_cI_c images make it clear that V5115 Sgr has a red companion about 4.2arcsec due west of the variable. The BVR_cI_c photometry for the red companion is given in Table 4. Table 5 gives the astrometry for the companion from existing catalogs as well as from the recent NOFS images. The NOFS astrometry has internal errors around 50mas. Based on the astrometry shown in the Table, there is no detectable proper motion for the red companion.

Table 4. Red companion optical photometry

V	err	$(B-V)$	err	$(V-R_c)$	err	(R_c-I_c)	err
17.154	0.022	2.409	0.086	2.491	0.023	2.358	0.015

Table 5. Red companion information

Source	Epoch	RA(J2000)	Dec(J2000)	i'	err	J	err	H	err	K	err
USNO-B	1969.7	18:16:58.63	−25:56:38.6	–	–	–	–	–	–	–	–
GSC2.3.2	1996.70	18:16:58.65	−25:56:39.1	–	–	–	–	–	–	–	–
DENIS	1999.52	18:16:58.62	−25:56:38.3	12.263	0.03	9.297	0.06	–	–	7.764	0.09
2MASS	2000.82	18:16:58.67	−25:56:39.0	–	–	9.243	0.048	8.142	0.036	7.690	0.026
NOFS	2007.40	18:16:58.66	−25:56:39.2	–	–	–	–	–	–	–	–

The MACHO and OGLE databases were searched for progenitor photometry, with none found. Likewise, ASAS does not show any outbursts of this nova, including the 2005 outburst to V=8. This may be due to the continuing hard drive failures that the system is having. No CFHT, Gemini, HST, AAT or ING images were found during CADC searches that covered the field of V5115 Sgr.

We examined available Schmidt plate material from the PMM archive at NOFS, and see no progenitor for V5115 Sgr to their plate limit (about 21mag). These plate searches indicate that any progenitor must have been V=21 or fainter, indicating that the full amplitude of the outburst is greater than 13 magnitudes.

Figure 2 is a B-band image from NOFS identifying V5115 Sgr and its red companion. Figure 3 is the corresponding field from a POSS-I survey plate, showing the red companion and the lack of a progenitor.

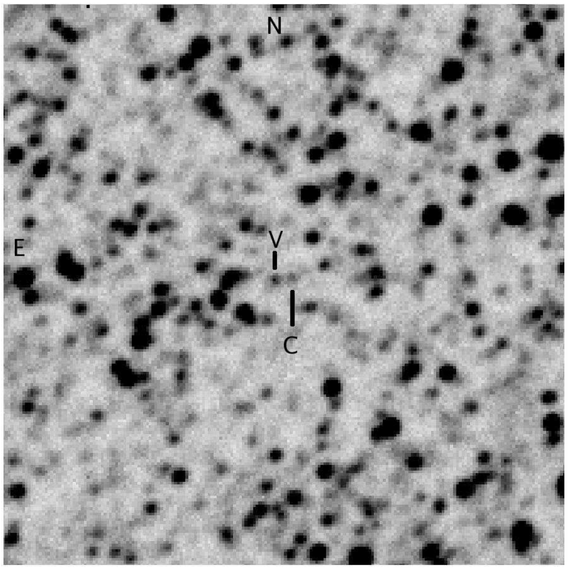

Figure 2. NOFS 1.0m B image of field. FOV 2×2arcmin. V=variable; C=companion

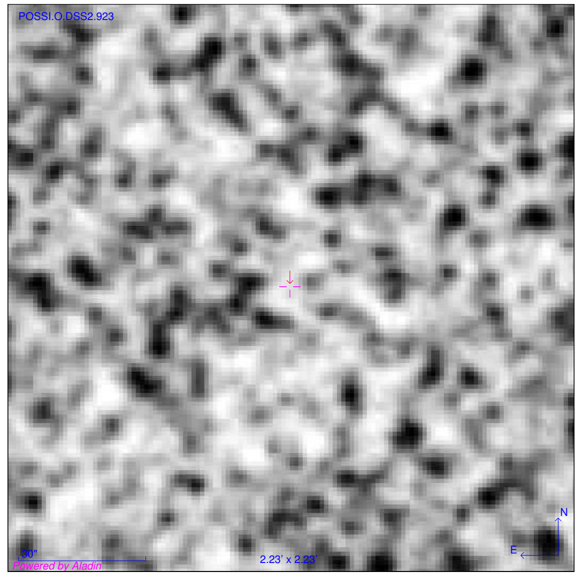

Figure 3. POSS-I O(blue) image of field.FOV 2×2arcmin

V5115 Sgr appears to be a typical fast nova, with an amplitude exceeding 13 magnitudes. No progenitor is known. It currently is at V=18.5, still above the quiescent level, but any new photometry must account for the nearby bright red companion and the otherwise extremely crowded field.

This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France. This research made use of the facilities of the U.S. Naval Observatory, Flagstaff, Arizona USA. The astronomical catalog facility of VizieR (Ochsenbein et al. 2000) was also used.

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CCD TIMES OF MINIMA OF SOME ECLIPSING BINARIES FROM THE SAVS SKY SURVEY

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Observatory and telescope:
Piwnice Observatory of the Nicholas Copernicus University, 135 mm f/2.8 semi-automatic CCD camera

Detector:	SBIG ST-8XE CCD Camera

Method of data reduction:
Reduction of the CCD frames was performed with a software developed for the Semi-Automatic Variability Search[1] sky survey.

Method of minimum determination:
The minima times were computed with Kwee-van Woerden method (Kwee, van Woerden 1956).

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
V444 And	53966.6965	0.0014	I	*V*	
	53966.9314	0.0009	II	*V*	
V344 Cas	53761.3077	0.0003	I	*V*	
WX Cnc	53049.9535	0.0018	I	*V*	
	53050.5530	0.0012	II	*V*	
WY Cnc	53046.5072	0.0007	I	*V*	
LL Com	53055.9547	0.0010	I	*V*	
	53056.1590	0.0012	II	*V*	
LT Com	53056.2297	0.0034	I	*V*	
	53056.4913	0.0011	II	*V*	
MM Com	53056.2653	0.0005	I	*V*	
	53056.4207	0.0005	II	*V*	
AU Dra	53817.5930	0.0012	I	*V*	
	53817.8509	0.0016	II	*V*	
	53999.4852	0.0016	I	*V*	
	53999.7487	0.0012	II	*V*	
	54150.9664	0.0031	I	*V*	
	54151.2131	0.0051	II	*V*	

[1]For further information on SAVS see http://www.astri.uni.torun.pl/~gm/SAVS/.

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
RZ Dra	53818.4493	0.0011	I	*V*	
	53818.7297	0.0011	II	*V*	
	54000.2280	0.0008	I	*V*	
	54000.5077	0.0025	II	*V*	
VY Lac	53967.2486	0.0003	I	*V*	
UV Lyn	53046.1202	0.0013	I	*V*	
	53046.3268	0.0005	II	*V*	
V563 Lyr	53851.9636	0.0009	I	*V*	
	53852.2430	0.0021	II	*V*	
V576 Lyr	53851.2646	0.0007	I	*V*	
	53851.5297	0.0008	II	*V*	
XY UMa	53817.8032	0.0010	I	*V*	
	53818.0377	0.0021	II	*V*	
GSC 03109-00859	53851.6401	0.0010	I	*V*	
	53851.8762	0.0012	II	*V*	
GSC 04428-01574	53819.2119	0.0011	I	*V*	
	53819.4636	0.0008	II	*V*	
	53999.4219	0.0008	I	*V*	
	54026.5768	0.0017	I	*V*	
	54026.8350	0.0008	II	*V*	
ROTSE1 J131228.30+251426.1	53056.2726	0.0008	I	*V*	
ROTSE1 J183824.48+423643.1	53850.6825	0.0009	I	*V*	
	53850.8617	0.0013	II	*V*	

Reference:

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ERRATUM FOR IBVS 5777

The following corrections for the paper "New Minima Times of Selected Eclipsing Binaries" by Parimucha et al. were communicated by the authors after the publication:

```
Star     Original          Corrected
--------------------------------------
EP And  53005.3233  I      54005.3233  I
UV Lyn  54068.6367  I      54068.6367  II
GZ And  53947.4616         should be deleted
CW Cas  53942.4711         should be deleted
GW Cep  53866.4409         should be deleted
RW Com  53830.3059         should be deleted
RW Com  53847.4787         should be deleted
AG Vir  53285.3871         should be deleted
```

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ASAS 122801-2328.4 - A NEW GALACTIC FIELD RRd STAR

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There are 27 double mode RR Lyrae (RRd) stars known in the field of our Galaxy, without including fainter objects in the Galactic Bulge or Sagittarius dwarf galaxy (Szczygieł & Fabrycky 2007, and references therein). The incidence ratio defined as a number of RRd divided by number of RRc is much lower for the Galactic field than for LMC which might suggest that there are still many RRd undiscovered.

Recently there have been several attempts to search for RRd variables in the ASAS database of RR Lyrae stars, but the number of these objects is still very small. This may be a result of misclassification between some of the classes of stars with similar light curve shapes, eg. RRc and EC (Eclipsing Contact) binaries, especially at the dimmer end of the catalogue. Such a possibility is even higher for RRd stars, because ASAS uses only one period in the classification process (for details see Pojmański 2002) and another periodicity just increases apparent observational errors.

The newly discovered RRd, namely ASAS 122801-2328.4, is such a case. In the ACVS (ASAS Catalogue of Variable Stars) it is classified as EC/RRc object with the period of 0.721272 d and the maximum brightness of V=13.19 mag. Multiperiodic light curve analysis of ASAS 122801-2328.4 reveals two pulsation modes with periods $P_0 = 0.484820$d (fundamental) and $P_1 = 0.360634$d (first overtone) and full amplitudes $Amp_0 = 0.28$mag and $Amp_1 = 0.44$mag. The dominant pulsation mode is the first overtone, which is the usual behaviour among double pulsators. The period ratio $P_1/P_0 = 0.74385$ is also representative of this group of variables.
All the numbers are summarized in Table 1, and the light curves phased with both pulsation periods are shown in Figure 1. These light curves were obtained in iterative process of subtracting one mode while searching for the other. Blue (solid) lines are fits used in that process.

Table 1. Characteristics of the star ASAS 122801-2328.4

V_{max} [mag]	13.19
2MASS J, H, K [mag]	12.42, 12.17, 12.10
P_0 [days]	0.484820
P_1 [days]	0.360634
Amp_0 [mag]	0.28
Amp_1 [mag]	0.44

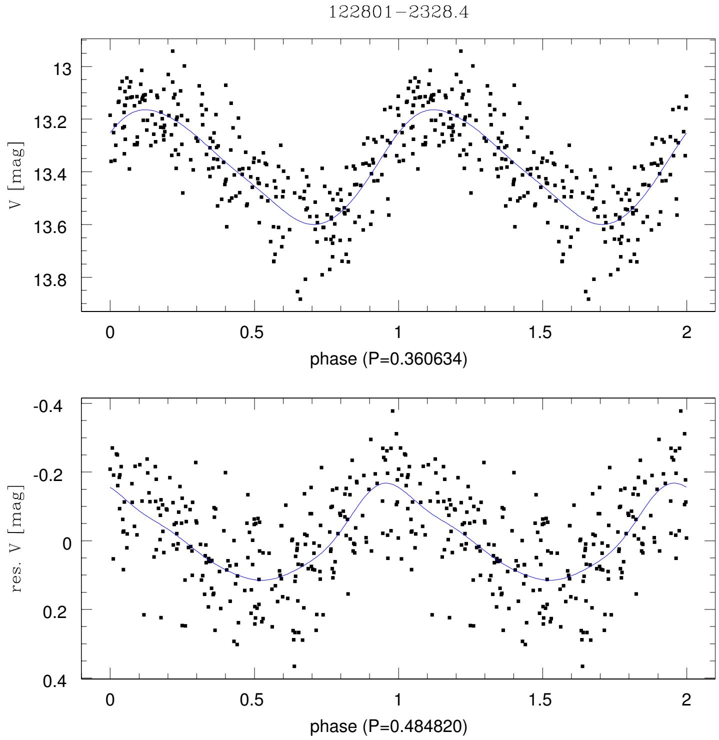

Figure 1. Separated light curves for an overtone (top) and a fundamental (bottom) pulsation mode.

Acknowledgements. This work was supported by the MNiSW grant N203 007 31/1328.

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V963 CYGNI IS AN ACTIVE DETACHED BINARY WITH A 33.5 HOUR PERIOD

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As a part of our study of observationally neglected eclipsing binaries we observed the eclipsing binary V963 Cygni, [GSC 2656-1995, $\alpha(2000) = 19^{\rm h}44^{\rm m}4\overset{\rm s}{.}92$, $\delta(2000) = 31^\circ41'50\overset{''}{.}2$]. Wachmann (1961) discovered this variable and reported 21 times of minimum light and the ephemeris

$$\text{HJD Tmin I} = 2434629.397 + 0.6973\text{d} \times \text{E}. \tag{1}$$

From his photographic light curves he classified this as an Algol. Sixteen subsequent times of minimum light have appeared in the literature (Safár and Zejda 2000, and 2002, Agerer and Hübscher 2000, Dvorak 2005, Hübscher 2005, Hübscher, Paschke, and Anton 2005, Hübscher, Paschke, and Walter 2005 and 2006, Hübscher, Paschke, and Walter 2006, Hübscher and Walter 2007).

Our $UBVRI$ light curves were taken on 19-25, July, 2004 by NCH, RGS, and DRF with the Lowell 31 inch reflector in Flagstaff, AZ through the National Undergraduate Research Observatory (NURO). The CCD camera was liquid nitrogen cooled, and the chip was a metachrome coated TEK 512×512. Sixty-nine observations were taken in U, 94 in B, 125 in V, 105 in R and 96 in I. Our observations, variable minus comparison delta magnitudes are given in electronic Table 1 (available through the IBVS-website as `5786-t1.txt`). The stars [GSC 2656-3363, $\alpha(2000) = 19^{\rm h}44^{\rm m}03\overset{\rm s}{.}64$, $\delta(2000) = 31^\circ41'13\overset{''}{.}3$], and [GSC 2656-2055, $\alpha(2000) = 19^{\rm h}44^{\rm m}16\overset{\rm s}{.}91$, $\delta(2000) = 31^\circ41'31\overset{''}{.}6$], were used as comparison and check respectively. A finding chart of V963 Cyg (V), the comparison (C), and the check star, (K) are given in Figure 1.

Early in the observing run we discovered that the two consecutive deep eclipses were of different depths, ~ 0.78 and ~ 0.67 magnitudes in V, respectively. There was no hint of a shallow secondary eclipse as expected in an Algol light curve. Rather, there is a fairly flat maximum between the eclipses. Evidently this system had been mistakenly classified. Instead of two dissimilar stars in a semidetached mode, there are two similar stars in a detached configuration. The period, consequently, needs to be doubled. Three

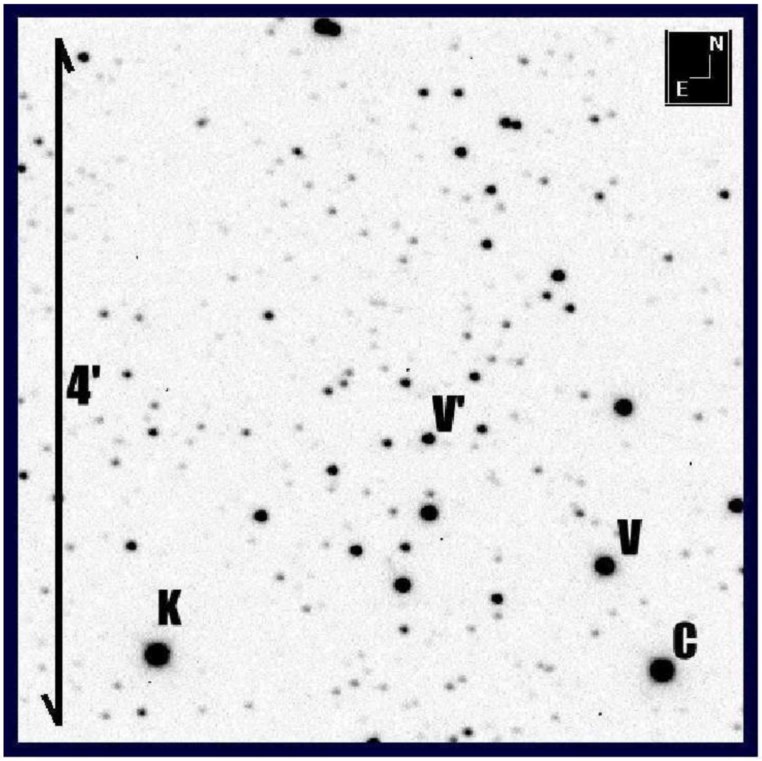

Figure 1. Finder Chart, V963 Cygni, comparison (C) and Check (K). V' is V965 Cygni.

mean epochs of minimum light were determined from $UBVRI$ timings of one primary and two secondary eclipses, HJD I = 2453207.7686 ± 0.003, HJD II = 2453209.8607 ± 0.0010, 2453211.9540 ± 0.0031. The following ephemeris reflects this finding:

$$\text{HJD Tmin I} = 2453209.8609 \pm 0.0007 + 1.39466785 \pm 0.00000016\text{d} \times \text{E}. \quad (2)$$

This was arrived at from 38 available times of minimum light (including ours) covering some 15000 orbits. Very recent timings seem to be forming a pattern, possible a negative parabola, but further observations are needed to verify the effect. All times of minimum light are shown in electronic Table 2 (available through the IBVS-website as `5786-t2.txt`). The next equation was calculated by the ephemeris option of the Wilson code (van Hamme and Wilson, 1998):

$$\text{HJD Tmin I} = 2453209.8585 \pm 0.0003 + 1.3945 \pm 0.0002\text{d} \times \text{E}.. \quad (3)$$

Standard magnitudes were calculated from our observations and 6 and 7 Landolt standard stars taken on July 20 and 24, respectively. They reveal that V963 Cyg is of spectral type F6.5 ± 1.0. Values for the comparison and check star are both F5 ± 0.5. Our standard magnitudes and color indices are given in electronic Table 3 (available through the IBVS-website as `5786-t3.txt`).

A $UBVRI$ synthetic solution was calculated. We first used Binary Maker 3.0 (Bradstreet, 2002) to provide an initial fit to each of the V, R, and I light curves. The fits were all detached. The main difficulty encountered in fitting the light curves were the irregularities in the out-of-eclipse portions, which evidently is due to several large spot regions. Thus, V963 Cyg has strong magnetic activity. The eclipse shoulders have somewhat different shapes in each effective wavelength. Particularly, the R curve is much different from the B curve in the shoulder of the secondary eclipse. This is believed be due to roving star magnetic spots arising from nonsynchronous rotation of each component. Our Binary Maker fits all gave a mass ratios of about 0.9.

Using our starting values, we proceeded to compute a simultaneous five color light curve solution with the updated Wilson Code (Wilson and Devinney, 1971; Wilson, 1990, 1994; Van Hamme and Wilson, 1998), which includes Kurucz stellar atmospheres, rather than black body, and a detailed reflection treatment along with 2-D limb darkening coefficients. The main mode of calculation is differential corrections. In addition to spot modeling, we tried adjusting the F parameter (non-synchronous rotation, Wilson 1979, Limber 1963), and third-light. It was found that the F parameter is the key to successfully modeling of the system. The system is evidently young and the stars are not yet gravitationally locked. This gives further evidence that the period is ∼ 1.4d rather than ∼ 0.7. An 0.7 day system in a nonsynchronous orbit would be exceptionally rare. Our solution indicates that the binary is a detached system with a mass ratio, $m_2/m_1 \sim 0.9$. The component temperature difference was only about 300 K. The solution reported here has 2 large spot regions. This indicates the magnetically active nature of this binary. The light curve solutions are given in electronic Table 4 (available through the IBVS-website as `5786-t4.txt`), and the calculated synthetic light curves are shown overlying the normalized light curve in Figure 2 and 3. The star surfaces are shown in Figure 4 (from Binary Maker). Due to the fact that the eclipses are partial, our model is preliminary. But a mass ratio near one is strongly suggested due to the deep and fairly equal eclipse depths. Radial velocity curves are needed for a complete solution. In this regard, we note here that errors given in the table are model dependent standard errors.

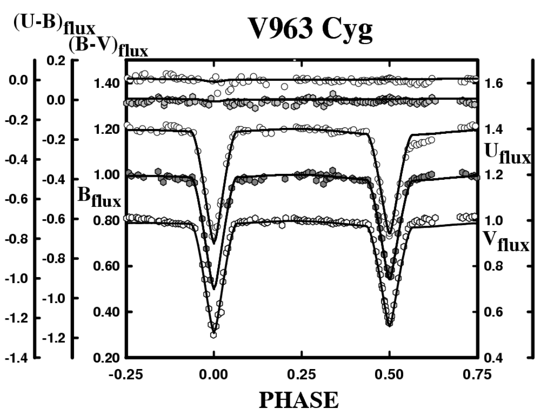

Figure 2. *UBVRI* Light curves compared with WD solution.

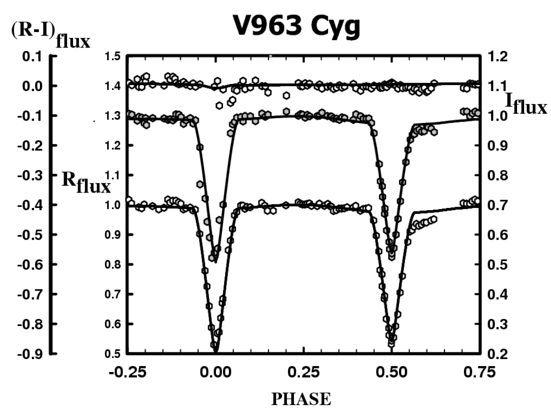

Figure 3. *UBVRI* Light curves compared with WD solution.

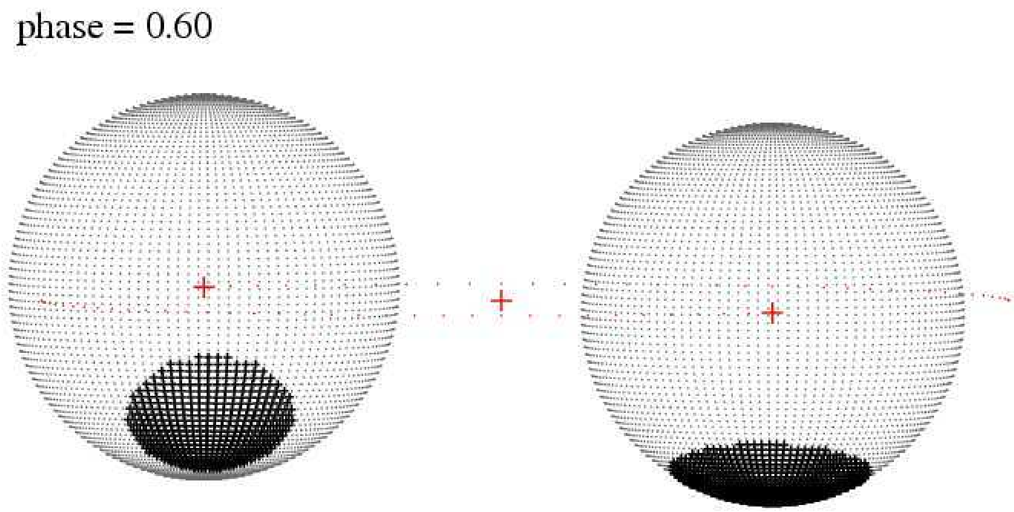

Figure 4. Star surfaces, V963 Cygni.

We wish to thank NURO for their allocation of observing time, and a small research grant from the American Astronomical Society and an Arizona Space Grant which supported this observing run.

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DISCOVERY OF 6-MINUTE OSCILLATIONS IN HD 151878

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The rapidly oscillating Ap (roAp) stars are cool, magnetic, chemically peculiar A-type stars, pulsate with periods ranging from 4-21 minutes, and have pulsation amplitudes ≤ 16 mmag in Johnson B. Some of the roAp stars are of great significance to astrophysics because they allow us to study pulsation and chemical diffusion in presence of magnetic fields. Till 2006, of the 35 roAp stars known, 30 are in the southern hemisphere, and thus inaccessible with most of the astronomers from the northern hemisphere. To discover northern roAp stars, we are carrying out a survey programme entitled "Search for pulsation in chemically peculiar stars".

HD 151878 is classified as a F2 star in HD catalogue. The Strömgren indices of the star HD 151878 are $b - y = 0.225$, $m_1 = 0.234$, $c_1 = 0.684$, $\beta = 2.759$ (Hauck & Mermilliod, 1998) which indicate a strong metallicity which is generally found in Ap and Am stars. On the basis of these peculiar colours, we observed the star HD 151878 on May 30, 2007 with 104-cm Sampurnanand telescope of ARIES, Nainital, equipped with high-speed fast photometer. We were rewarded with the discovery of 6-min oscillations in the star. Further, we observed the star HD 151878 on June 01 and 03, 2007 (corresponding JDs 2454253, and 2454255) and noted the same 6-min oscillations.

As we were searching for variations in the 4-21 min range and also due to the absence of any suitable comparison star in the field, we did not observe any comparison star. The data were acquired as continuous single channel 10s integrations through a Johnson B filter. A diaphragm of 2-mm in diameter which corresponds to 30 arcsec was used to minimize the light losses arising from seeing effect and tracking drifts. The observations were interrupted, nearly every 20-30 minutes, for sky background measurements to take account of changes of sky brightness during the night as well as to check the centering of the programme star in the diaphragm.The observed data were corrected for coincidence counting losses due to the dead time of the photon counting electronics, sky background and atmospheric extinction. Because of the absence of any comparison star observations, the observed data have been normalized in the mean to zero on a nightly basis. There is always some degree of contamination of single channel high-speed photometry by sky transparency variations. The normalized nightly data were prewhitened due to some mild sky transparency variations on time scale ≥ 0.5 hr with caution, as they do not discriminate between the sky transparency variations and real variations in the star.

The nightly observed light curves of HD 151878 are plotted in Figure 1. Figure 2 shows the nightly amplitude spectrum of the light curve depicted in Figure 1. The amplitude spectrum of the light curve peaks strongly at 2.78 mHz (Period = 6 min) for all the three dates. It is evident from Figures 1 and 2 that the nightly observed mean amplitude of the oscillations of all the three dates are different from each other. This amplitude modulation may be either due to excitation of different modes or due to rotation of the star. Further observations will be carried out to study rotational and multi-pulsational behaviour of this star.

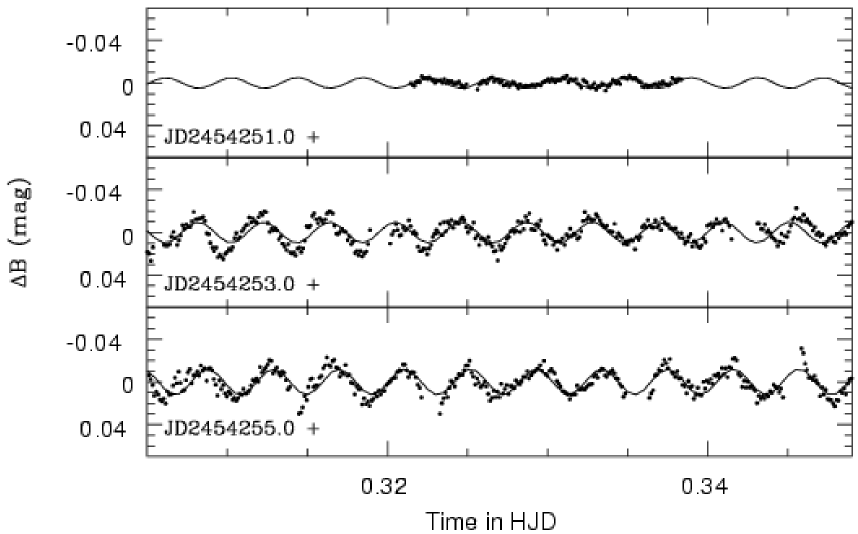

Figure 1. Discovery and confirming light curves of HD 151878 observed in Johnson B filter.

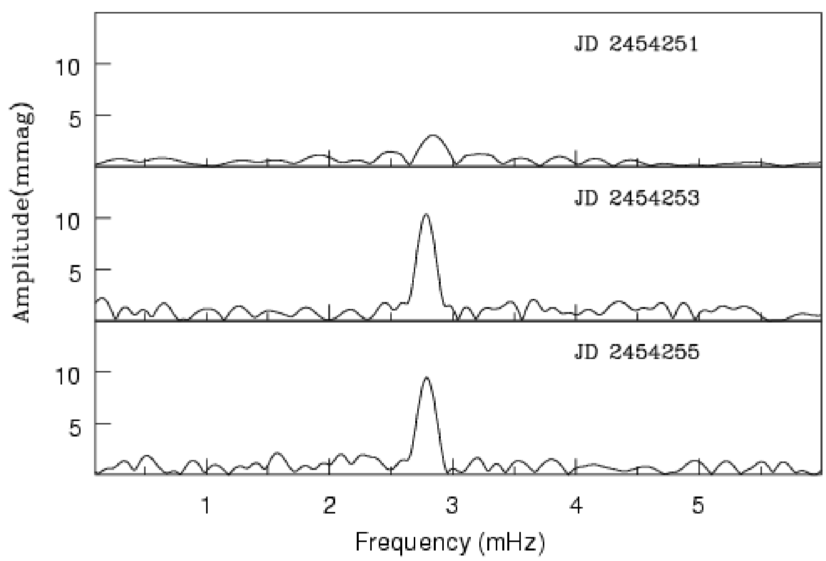

Figure 2. Amplitude spectrum of the nightly light curves depicted in Figure 1.

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EVIDENCE FOR A THIRD BODY IN THE ECLIPSING BINARY DI HERCULIS

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The detached eclipsing binary DI Herculis (HD 175227, B3V+B4V, $P = 10^{\mathrm{d}}.55$) exhibits a significant discrepancy between the theoretically expected apsidal motion rate and the rate measured based on observations of the difference between the primary and secondary eclipse periods ΔP.

The hypotheses of a third star in a highly inclined orbit can explain the observed apsidal motion (Martynov, and Khaliullin, 1980; Guinan, and Maloney, 1985; Khaliullin, Khodykin, and Zakharov, 1991). However, observational evidence of a third body in DI Her has hitherto escaped detection. We collected observed times of photo-visual and photoelectric minima spanning an interval of 75 years (Semeniuk, 1968; Martynov, and Khaliullin, 1980; Guinan, and Maloney, 1985; Khodykin, and Volkov, 1989; Guinan, Marshall, and Maloney, 1994; Dariush, Afroozeh, and Riazi, 2001; Smith, and Caton, 2007). Cyclic variations in $O-C$ residuals can provide indirect evidence for an invisible third companion as in the case of AS Cam (Kozyreva, and Khaliullin, 1999).

This bulletin reports the discovery of cyclic variations in $O-C$ residuals, consistent with the light-time effect on eclipse timing, for DI Her. These variations provide the first indirect evidence of a third body presence in DI Herculis.

The linear ephemerides were calculated according to Khodykin and Volkov (1989):

$$\text{Min I} \quad \mathrm{JD_{hel}} = 2447371.27914(8) + 10^{\mathrm{d}}.5501680(2) \times N$$

$$\text{Min II} \quad \mathrm{JD_{hel}} = 2447379.39548(9) + 10^{\mathrm{d}}.5501749(2) \times N$$

The primary (17) and secondary (20) minima (available electronically as `5788-t1.txt`) were analyzed separately to eliminate the small phase variation caused by the apsidal motion $\dot{\omega}$ and/or possible secular decreasing of orbital eccentricity $\dot{e}$ due to third body perturbations. Several photoelectric timings were removed because of unreasonably large residuals: 5 determined by Koch, 4 - by Biro and Hegedus, 2 secondary minima found by Battistini and Scarfe (the errors $0^{\mathrm{d}}.003$ are too large). We rejected two low accuracy timings obtained with the Fine-Error Sensor on board the IUE satellite, and 3 dubious timings determined by Guinan and Maloney from UBV data of Martynov and Khaliullin, which based on 12, 11, and 24 points only.

Plots of $O-C$ residuals versus orbital phase of the third body were examined for various trial values of the third body period. Generally, the points in the $(O-C)_{I,II}$ diagrams appeared chaotically, indicating random phases relative to the hypothetical orbital period of a third body.

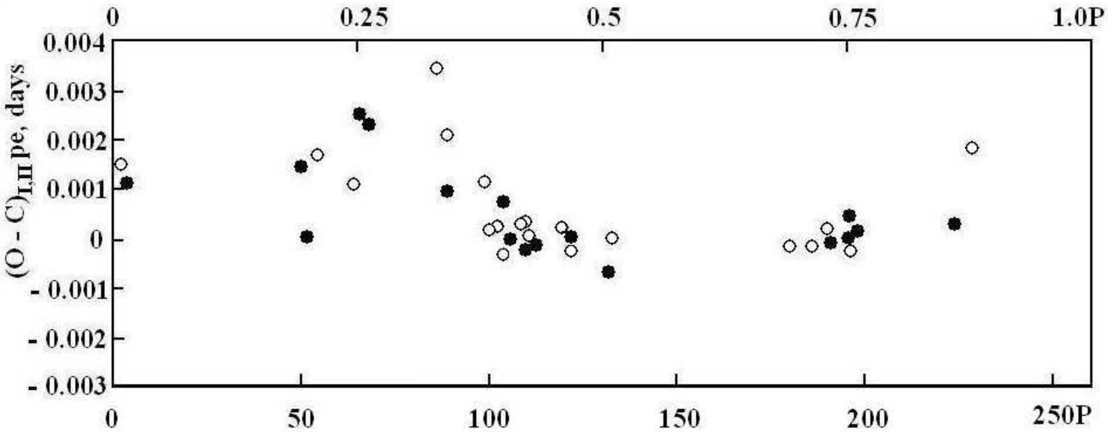

Figure 1. Photoelectric $O-C$ residuals for primary (•) and secondary (○) timings of minima of DI Her convolved with period $P' = 260P$ (7.51 yr).

A unique solution, shown in Fig. 1, was found that provided synchronous deviations for both primary and secondary photoelectric timings of minima with respect to phase: $P' = 260\ P = 2743^{\mathrm{d}} = 7.51\,\mathrm{yr}$. This periodic signal seems to be a light term caused by orbit of a third body. It is interesting to note that the low-precision photographic and visual timing tend to vary with the same period, albeit with more scatter (Fig. 2).

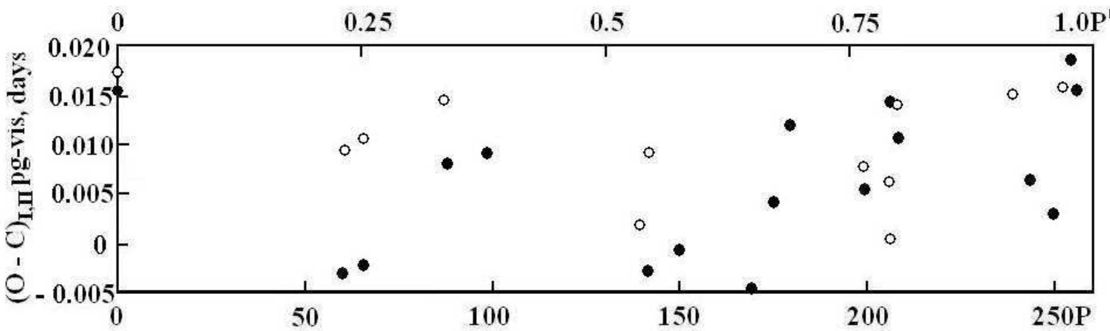

Figure 2. The symbols are the same as in Fig. 1, but for low-precision visual and photographic $O-C$ residuals. A weak tendency for $(O-C)$s to vary with the same period as in Fig. 1 occurs, although the deviations are large.

The asymmetric non-sinusoidal shape of the points (narrow peak, with an abrupt slope change and shallow extended bottom) indicates a large eccentricity e'. The curve corresponding to approximate values of the eccentricity $e' = 0.7$ and the longitude of periastron $\omega' = 330°$ is shown in Fig. 3.

The $O-C$ residuals of the primary and secondary minima vary synchronously with an amplitude about $0\overset{\mathrm{d}}{.}0028$, or 240^{s}, consistent with displacement of the binary along the line of sight at 0.485 AU

The perturbations in the orbital elements of a close binary were found by Khaliullin, Khodykin, and Zakharov (1991) to vary at twice the frequency of the third body orbit. As a result, additional $O-C$ variations of twice the orbiting frequency should occur; moreover, they must be in opposite phase for primary and secondary minima. The residuals between photoelectric $O-C$ residuals and the theoretical curve describing the effect

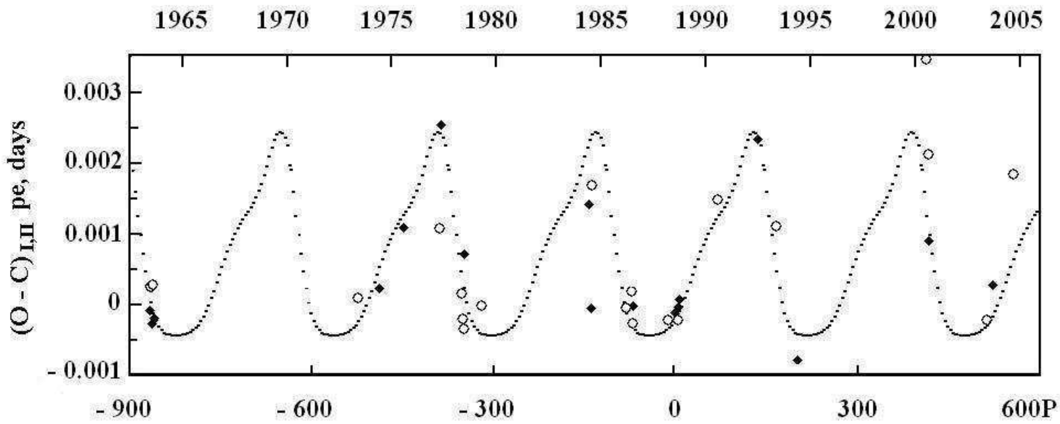

Figure 3. Photoelectric $O-C$ residuals, computed by linear ephemerides from Khodykin and Volkov (1989), versus minima numbers and years. The theoretical light-term curve (dotted) for third body period $P' = 7.51\,\mathrm{yr}$, eccentricity $e' = 0.7$ and argument of periastron $\omega' = 330°$ is shown.

of the third body $\Delta_{I,II} = (O-C)_{I,II} - LT$ (as shown in Fig. 3) were plotted versus phase assuming a period $0.5P' = 130P = 3.76\,\mathrm{yr}$ (Fig. 4).

There is a weak evidence of approximately sinusoidal oscillations of $(O-C)_I$ and $(O-C)_{II}$ in opposing phase. Altogether, these anomalies in the $O-C$ curve seem to provide convincing evidence of the presence of a third body in DI Her.

Consider now the properties of the third companion. Assuming the total mass of the close binary system (CBS) is $m_1 + m_2 = 9.67 M_\odot$ and a partial luminosity of a third body $L' \leq 0.03$, Guinan and Maloney (1985) obtained the restrictions to its mass: $0.8M_\odot \leq m' \leq 2.5M_\odot$. Let D^+ and D^- are the maximal distances of CBS to the visual plane. Then the light-term effect is $LT = (D^+ + D^-)/c$, where c is a light velocity. The projection of an elliptical orbit of the binary onto the line of sight is given by formula (Kopal, 1978)

$$D^+ + D^- = a'(1 - e'^2)\sin i' \frac{m'}{m_1 + m_2 + m'} \sqrt{1 - e'^2 \cos 2\omega'}.$$

Substituting the amplitude of a theoretical curve $0\overset{\mathrm{d}}{.}0028$ (Fig. 3), and using the third Kepler's law we obtained the relation:

$$\frac{a' m' \sin i'}{m_1 + m_2 + m'} = \frac{P'^{2/3} m' \sin i'}{(m_1 + m_2 + m')^{2/3}} = 0.3045, \quad \text{or} \quad \sin i' = \frac{0.0794(9.67 + m')^{2/3}}{m'}.$$

For minimal mass $m' = 0.8M_\odot$ the semimajor axis $a' = 8.39\,\mathrm{AU}$ and $i' = 28\overset{\circ}{.}4$, then the mutual inclination of orbits is $\varepsilon \geq 90° - i' = 61\overset{\circ}{.}6$. For maximal mass $m' = 2.5M_\odot$ we have $a' = 8.82\,\mathrm{AU}$, $i' = 9\overset{\circ}{.}6$, and $\varepsilon \geq 80°$. The space orientation of the third body orbits with masses mentioned above providing observed period difference $\Delta P = P_2 - P_1$ consistent with Khaliullin, Khodykin, and Zakharov (1991). All stellar and orbital parameters presented above are in a good accord with those considered in the numerical predictions of a hierarchical triple model of DI Her. It should be noted that the hypothetical third body perturbs all the orbital elements of close binary, and because of the orientation of its highly inclined orbit with relative to the line of apsides the perturbations in ω are positive

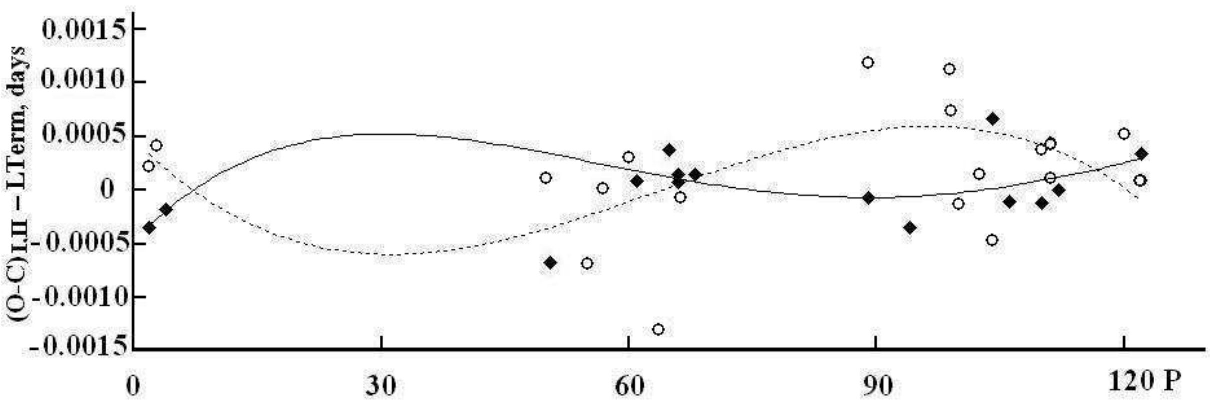

Figure 4. Differences between the observed photoelectric residuals $(O-C)$s and theoretical light-term curve (see Fig. 3.) convolved with a half-period of a third body. The symbols are the same as in the previous figures. The primary and secondary timings of minima seem to vary in opposing phase with double frequency of the third body, in agreement with theoretical predictions for third body perturbations in the framework of the once-averaged three-body problem.

or are close to zero: $(\mathrm{d}\omega/\mathrm{d}t)_{tb} \geq 0$. The third body seems not to affect considerably to the apsidal motion of the close pair. It turns out that the secondary minima phase's shift in DI Her is provided mainly by slow decreasing of the orbital eccentricity: $(\mathrm{d}e/\mathrm{d}t)_{tb} < 0$, as it was determined by Khodykin and Vedeneyev (1997) on the basis of comparison of two light curve solutions. Therefore, further observations of this unique eclipsing system are needed to improve both the values of the orbital elements and their possible long-term or secular perturbations.

The most reliable and direct confirmation of a third body presence in DI Herculis would be the observations of a faint companion. As it was noted in Khodykin, Zakharov and Andersen (2004), interferometric observations in the infrared range (H and K bands) are more preferable in this case.

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AN INCREASE IN STELLAR ACTIVITY IN THE ECLIPSING BINARY CM Dra

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CM Draconis is a system of interest for many reasons. It is one of the few known M-dwarf eclipsing binary systems. Although these types of systems may form a large percentage of stellar systems in our galaxy, their low luminosity limits their detection to nearby systems. Thus, study of these few systems may provide insight into an important subset of the stellar population. As a UV-Cet type system, CM Dra is prone to violent flare activity. UV-Cet stars can produce flares 10-1000 times as energetic as solar flares (Shakhovskaya, 1989), and can occur at a rate greater than 2 flares/hour (Lacy et al., 1976). Presented in this paper are six such flare events, observed at Appalachian State University's Dark Sky Observatory in May 2006.

Despite the presence of strong flares, which emit large amounts of UV radiation, M-dwarf stars are suitable hosts for life supporting planets (Heath et al., 1999). In the case of CM Dra, its low luminosity and its nearly edge on inclination make it a suitable target for ground based planet transit searches as shown by the efforts of the TEP (Transits of Extrasolar Planets) network (Deeg et al., 1998). While the TEP group initially reported several transit events, follow-up observations failed to confirm the events as planet transits.

A transiting planet search program is currently underway at Appalachian State University. To follow up the results of the TEP network, we decided to include CM Dra in our target list. To date, we have amassed 105 hours of observation time on the system. These observations were obtained using the 32-inch main telescope at Appalachian's Dark Sky Observatory, located 20 miles northeast of Boone, NC, at an elevation of 1km. The 32-inch Richey-Chretien is equipped with a Photometrics CH250 CCD camera with a Tektronix 1024-square chip, thinned and thermoelectrically cooled. All data were taken in the R-band at 120 second exposures, and were reduced using MIRA 6 and comparison and check stars as shown in Figure 1 (C: V=$12\overset{\text{m}}{.}7$, $B-V$=$0\overset{\text{m}}{.}54$; K1: V=$13\overset{\text{m}}{.}1$, $B-V$=$0\overset{\text{m}}{.}52$; K2: V=$13\overset{\text{m}}{.}7$, $B-V$=$0\overset{\text{m}}{.}66$). These are a subset of the standard stars used in the TEP project (Deeg et al., 1998).

Over the course of three nights of observations in May 2006, six flares in CM Dra were observed: one on JD2453878 with a magnitude change of 0.23 and a duration of one hour, three on JD2453879 with a magnitude change of 0.04, 0.08, and 0.09 respectively, with the whole event lasting well over two hours, and two on JD2453883 with magnitude changes of 0.02, and both events lasting over 30 minutes. The fact that all of the flares were observed in the R-band speaks to the highly energetic nature of these flares, as flares are most readily observed in the U, B, and V, respectively (Oláh et al., 1991).

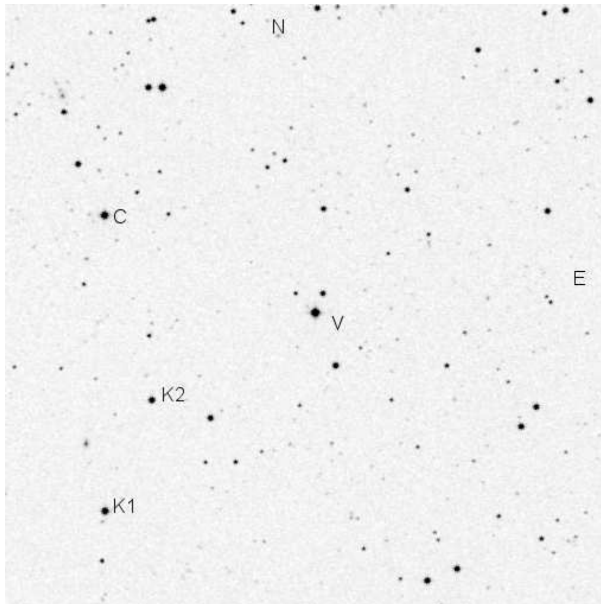

Figure 1. Finding chart for CM Dra. (13 arc-min square.)

All six events display the classic shape of a stellar impulsive flare, with the maximum brightening occurring during a single exposure, and each subsequent point tailing off gradually back towards the quiescent magnitude of the system. The three flares on JD2453879 are a special case because they occurred in such proximity chronologically to each other. The second flare event began before the first subsided, and likewise with the third. Also, each successive flare was more powerful than the proceeding. These flares are an instance of sympathetic flaring. All of the flares are plotted by night in Figure 2.

Table 1. Observation Log

Obs. Dates	Obs. Period	Airmass	Phase
May 2006			
22-23	2453878.62 - 2453878.88	1.27 - 1.25	0.336 - 0.543
23-24	2453879.61 - 2453879.88	1.26 - 1.26	0.124 - 0.330
27-28	2453883.64 - 2453883.88	1.18 - 1.29	0.294 - 0.483

Phase determined from P = 1.2683897 (Lacy, 1977) and E = 53478.6467 (Smith et al., 2007)

Table 2. Observed Flare Events

Flare	Date (H.J.D.)	Phase	Variation (mags in R)	Duration (hrs)
1	2453878.848	0.519	0.23	1.00
2	2453879.784	0.257	0.04	$\geq$ 2.25
3	2453879.808	0.276	0.08	$\geq$ 2.25
4	2453879.836	0.298	0.09	$\geq$ 2.25
5	2453883.702	0.346	0.02	0.57
6	2453883.853	0.465	0.02	$\geq$ 0.67

Phase determined from P = 1.2683897 (Lacy, 1977) and Epoch = 53478.6467 (Smith et al., 2007)

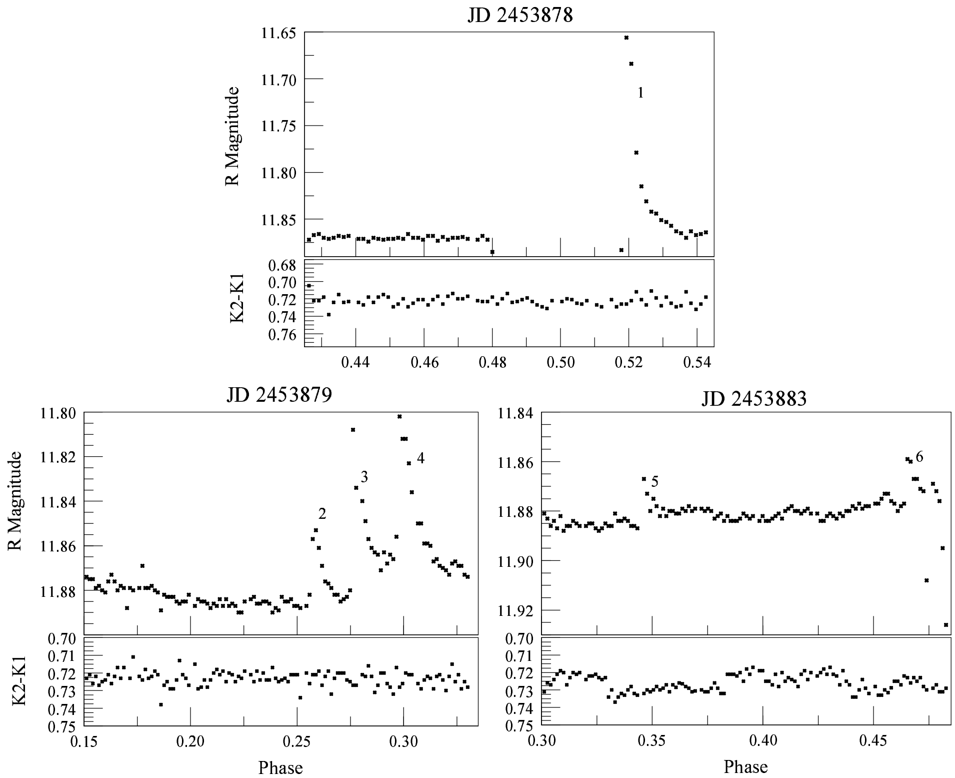

Figure 2. Six flare events were observed in CM Dra over three nights in May 2006.

Flares on CM Dra have been recorded before (Eggen et al., 1967; Lacy, 1977; Metcalfe et al., 1996; Kim et al., 1997; and Kozhevnikova et al., 2004), with magnitude increases ranging from 0.02 to 0.7 mag (in different filters) and most lasting on the order of one hour. Although, as Lacy (1977) points out, the rate of flaring observed from CM Dra is much lower than other Population I, UV-Cet type flare stars. From this, he hypothesized that CM Dra is actually an evolved Population II star system. Since then there has been little to refute this hypotheses. Observed flare rates are still much lower than would be expected from a Pop. I system, which could exceed two flares per hour. Lacy (1997) estimated a rate of less than 0.05 flares/hour, Metcalfe et al. (1996) estimated a rate of 0.02 flares/hour, Kim et al. (1997) estimated less than 0.04 flares/ hour, and Kozhevnikova et al. estimated 0.026 flares/hour.

From these new data, we are estimating a rate of 0.057 flares/hour, higher than any previous determination, but still well below the expected rate of a Pop. I UV-Cet type flare star.

However, even though our overall flare rate is fairly low, all six observed flares were observed during one week, giving an estimated localized rate of 0.33 flares/hour during that span. The previous observed flare events occurred apparently randomly in the phase of the system, as well as randomly in time. Not only did the flare observations presented here occur in a short time span, they also occupy a localized section of the system's phase. All of the flares occurred shortly before or after the secondary minimum. In fact, flare 1 began before a secondary eclipse ended, and flare 6 was still occurring when an eclipse began. With the system inclination nearly 90 degrees, it is very likely that flare 1 and 6 erupted from the secondary component. It is also possible that all six flares stemmed from a very large region of activity on the secondary star, one that covered a quarter of the star's surface in longitude.

On our own sun, we observe an eleven year cycle of solar activity, with flares and sunspots observed more often near the peak of the cycle. These new data may suggest just such a cycle on CM Dra, with such high activity in a short period of time. Of course, further observation is needed to detect any periodicity in flare activity. We can use these data, however, as direct evidence of a localized period of time of high surface activity, including spots and flares, in CM Dra.

We are grateful for support for this work provided by National Science Foundation grant AST-0520812. Also, one of us (TEN) was supported by a North Carolina Space Grant Fellowship during this work. We would like to thank the editor, Katalin Oláh, for her contribution to this paper. This research has made use of the SIMBAD database maintained and operated at CDS, Strasbourg, France.

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THE GEOS RR Lyr SURVEY

Seventh list of maxima of RR Lyr stars observed by the automated telescopes TAROT

(GEOS Circular RR 31)

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We present here the seventh list of light maxima of RR Lyrae stars from the GEOS RR Lyr Survey, a GEOS program (`http://www.upv.es/geos/`) (Boninsegna et al., 2002) of automated observations of RR Lyr stars started in January 2004.

We are using the 25-cm automatic telescopes TAROT (`http://tarot.obs-hp.fr`) (Boër et al., 2001, Bringer et al., 1999). One of the telescopes is located in the northern hemisphere in Calern Observatory (Observatoire de la Côte d'Azur, Nice University, France). A second identical telescope in the southern hemisphere, located in ESO La Silla Observatory, Chile, is in operation since 2006 September. Images are obtained by 2048×2048 Marconi 42-40 thin back illuminated CCDs. Field of view of both telescopes is $1.86° \times 1.86°$. Data reduction, from bias subtraction and flatfielding to photometry using SExtractor (Bertin & Arnouts, 1996), is performed automatically. The aim of this legacy project for the study of period variations of RR Lyr stars is to monitor maxima of light of these stars in order to feed the GEOS RR Lyr web database (`http://dbRR.ast.obs-mip.fr`).

The present list contains 974 maxima observed with no filter between January and June 2007 (Table 1). The maxima are determined by fitting a polynomial function on the data points. The uncertainties on individual maxima are estimated from the data sampling of each maximum. The nominal sampling (two consecutive 30-s exposures taken every 10 minutes on a time baseline of 2 hours centered around the predicted maximum time) may be altered by local events (weather or telescope operation). This results uncertainties from 0.002 to 0.010 day. For a well observed star, the mean uncertainty on maxima is about 0.003 day (4.3 minutes). The $O-C$'s are computed with the GCVS elements (Kholopov et al., 1985) and are displayed in Table 1 in column '$O-C$'. The column 'E' contains the cycle number. Note that this cycle number takes into account the shifts induced by the elements when the period of the elements is very different from the actual one, the absolute value of $O-C$ becoming greater than 1 period. When no elements are available in the GCVS, the reference of the elements, if exists, is given as a footnote of Table 1. The fifth column in Table 1 gives the abbreviation of the name of the observatory where the star was observed.

Table 1: maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
XX And	54106.347±0.002	0.224	20780.	C	SW Aqr	54277.826±0.002	−0.001	63532.	LS
CI And	54103.429±0.002	0.093	37929.	C	TZ Aqr	54021.585±0.002	0.013	28839.	LS
CI And	54106.338±0.002	0.094	37935.	C	AA Aqr	54028.578±0.002	−0.113	54657.	LS
CI And	54107.307±0.005	0.093	37937.	C	BN Aqr	54016.589±0.002	0.540	34374.	LS
WY Ant	54114.714±0.005	0.202	23452.	LS	BN Aqr	54023.634±0.002	0.540	34389.	LS
WY Ant	54125.628±0.005	0.203	23471.	LS	BR Aqr	54026.682±0.002	−0.152	34014.	LS
WY Ant	54129.647±0.004	0.202	23478.	LS	CP Aqr	54277.806±0.002	−0.109	35376.	LS
WY Ant	54140.561±0.003	0.204	23497.	LS	FX Aqr	54016.647±0.003	0.120	14932.	LS
WY Ant	54156.641±0.002	0.202	23525.	LS	HH Aqr	54016.697±0.002			LS
WY Ant	54160.661±0.002	0.202	23532.	LS	HH Aqr	54031.627±0.002			LS
WY Ant	54171.577±0.005	0.206	23551.	LS	AA Aql	54278.782±0.002	0.033	82732.	LS
WY Ant	54206.611±0.005	0.206	23612.	LS	V341 Aql	54268.795±0.002	0.031	22616.	LS
TY Aps	54185.619±0.002	0.036	28821.	LS	S Ara	54231.903±0.004	0.184	28944.	LS
TY Aps	54192.643±0.005	0.036	28835.	LS	IN Ara	54221.806±0.004	0.128	42715.	LS
TY Aps	54193.647±0.004	0.037	28837.	LS	IN Ara	54233.794±0.002	0.118	42734.	LS
TY Aps	54199.672±0.002	0.041	28849.	LS	IN Ara	54276.729±0.004	0.111	42802.	LS
TY Aps	54227.773±0.003	0.047	28905.	LS	MS Ara	54213.719±0.002	−0.168	49959.	LS
VX Aps	54177.786±0.005	−0.021	41146.	LS	MS Ara	54234.722±0.002	−0.163	49999.	LS
VX Aps	54179.727±0.002	−0.019	41150.	LS	X Ari	54105.334±0.002	0.323	25373.	C
VX Aps	54205.903±0.002	−0.010	41204.	LS	X Ari	54107.285±0.005	0.320	25376.	C
VX Aps	54281.499±0.002	−0.008	41360.	LS	TZ Aur	54108.562±0.002	0.010	87333.	C
XZ Aps	54155.747±0.003	−0.175	43308.	LS	TZ Aur	54192.385±0.002	0.015	87547.	C
XZ Aps	54162.795±0.002	−0.176	43320.	LS	TZ Aur	54194.338±0.002	0.010	87552.	C
XZ Aps	54165.732±0.005	−0.176	43325.	LS	RS Boo	54113.628±0.002	0.003	32711.	C
XZ Aps	54168.666±0.002	−0.179	43330.	LS	RS Boo	54136.647±0.002	0.005	32772.	C
XZ Aps	54178.649±0.002	−0.183	43347.	LS	RS Boo	54147.585±0.002	0.000	32801.	C
XZ Aps	54185.697±0.002	−0.184	43359.	LS	RS Boo	54164.566±0.005	0.001	32846.	C
XZ Aps	54205.665±0.002	−0.189	43393.	LS	RS Boo	54189.470±0.002	0.000	32912.	C
XZ Aps	54225.632±0.002	−0.194	43427.	LS	RS Boo	54217.390±0.002	−0.003	32986.	C
XZ Aps	54272.618±0.005	−0.203	43507.	LS	RS Boo	54240.408±0.004	−0.003	33047.	C
XZ Aps	54282.595±0.002	−0.212	43524.	LS	RS Boo	54266.440±0.003	−0.007	33116.	C
YZ Aps	54218.790±0.005	0.002	35602.	LS	ST Boo	54135.617±0.005	0.063	56170.	C
YZ Aps	54222.716±0.005	0.016	35610.	LS	ST Boo	54145.574±0.007	0.063	56186.	C
BS Aps	54180.672±0.010	0.021	28771.	LS	ST Boo	54160.515±0.005	0.069	56210.	C
BS Aps	54191.750±0.005	0.030	28790.	LS	ST Boo	54168.608±0.005	0.073	56223.	C
BS Aps	54222.613±0.005	0.018	28843.	LS	ST Boo	54198.481±0.003	0.076	56271.	C
BS Aps	54275.642±0.002	0.034	28934.	LS	ST Boo	54208.438±0.003	0.076	56287.	C
BS Aps	54282.620±0.003	0.021	28946.	LS	ST Boo	54211.550±0.002	0.077	56292.	C
CK Aps	54191.890±0.003	−0.205	28070.	LS	ST Boo	54229.600±0.002	0.080	56321.	C
CK Aps	54193.764±0.010	−0.201	28073.	LS	TW Boo	54158.506±0.002	−0.051	51228.	C
CK Aps	54196.870±0.005	−0.213	28078.	LS	TW Boo	54173.408±0.003	−0.053	51256.	C
CK Aps	54218.712±0.002	−0.193	28113.	LS	TW Boo	54181.395±0.003	−0.050	51271.	C
CK Aps	54223.696±0.003	−0.197	28121.	LS	TW Boo	54189.378±0.002	−0.051	51286.	C
CK Aps	54278.580±0.002	−0.181	28209.	LS	TW Boo	54205.348±0.003	−0.049	51316.	C
DD Aps	54230.710±0.006	0.101	27006.	LS	TW Boo	54214.395±0.005	−0.051	51333.	C
DD Aps	54267.646±0.005	0.089	27063.	LS	TW Boo	54215.461±0.003	−0.049	51335.	C
DD Aps	54282.567±0.002	0.102	27086.	LS	TW Boo	54239.413±0.005	−0.049	51380.	C
EL Aps	54196.840±0.008	−0.164	45205.	LS	TW Boo	54256.443±0.002	−0.052	51412.	C
EL Aps	54207.847±0.002	−0.171	45224.	LS	TW Boo	54272.411±0.003	−0.052	51442.	C
EL Aps	54224.667±0.005	−0.163	45253.	LS	TW Boo	54274.540±0.003	−0.052	51446.	C
EL Aps	54235.675±0.010	−0.170	45272.	LS	UY Boo	54198.421±0.003	0.088	18995.	C
EL Aps	54278.573±0.002	−0.172	45346.	LS	XX Boo	54164.603±0.005	0.016	42652.	C
EL Aps	54282.624±0.002	−0.179	45353.	LS	XX Boo	54188.443±0.010	0.018	42693.	C
EX Aps	54185.885±0.002	0.015	55643.	LS	XX Boo	54199.486±0.002	0.015	42712.	C
EX Aps	54210.889±0.004	0.013	55696.	LS	XX Boo	54207.629±0.003	0.018	42726.	C
EX Aps	54218.909±0.002	0.013	55713.	LS	XX Boo	54231.467±0.005	0.019	42767.	C
EX Aps	54235.894±0.002	0.013	55749.	LS	CM Boo	54119.632±0.002	−0.100	29911.	C
LU Aps	54215.915±0.010	0.201	22410.	LS	CM Boo	54127.552±0.004	−0.098	29924.	C

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
CM Boo	54130.598±0.005	−0.097	29929.	C
CM Boo	54152.528±0.005	−0.094	29965.	C
CM Boo	54155.573±0.002	−0.095	29970.	C
CM Boo	54172.625±0.002	−0.097	29998.	C
CM Boo	54197.598±0.003	−0.096	30039.	C
CM Boo	54205.514±0.002	−0.098	30052.	C
CM Boo	54213.432±0.004	−0.098	30065.	C
CM Boo	54216.477±0.005	−0.099	30070.	C
CM Boo	54227.443±0.002	−0.096	30088.	C
CM Boo	54238.405±0.003	−0.097	30106.	C
U Cae	54102.740±0.004	−0.100	47138.	LS
U Cae	54108.617±0.002	−0.100	47152.	LS
U Cae	54121.635±0.002	−0.095	47183.	LS
U Cae	54126.667±0.002	−0.101	47195.	LS
V Cae	54121.692±0.004	0.107	34687.	LS
V Cae	54129.686±0.002	0.110	34701.	LS
AH Cam	54105.279±0.003	−0.412	41700.	C
AH Cam	54106.394±0.002	−0.403	41703.	C
AH Cam	54107.513±0.005	−0.390	41706.	C
AH Cam	54108.261±0.003	−0.380	41708.	C
AH Cam	54109.371±0.005	−0.376	41711.	C
AH Cam	54111.570±0.002	−0.389	41717.	C
AH Cam	54119.321±0.002	−0.382	41738.	C
AH Cam	54134.419±0.002	−0.402	41779.	C
TT Cnc	54112.399±0.003	0.097	25145.	C
TT Cnc	54143.380±0.002	0.088	25200.	C
TT Cnc	54183.396±0.005	0.099	25271.	C
W CVn	54121.624±0.002	−0.128	59300.	C
W CVn	54147.554±0.005	−0.131	59347.	C
W CVn	54152.526±0.003	−0.125	59356.	C
W CVn	54157.486±0.004	−0.131	59365.	C
W CVn	54162.455±0.004	−0.128	59374.	C
W CVn	54188.387±0.003	−0.128	59421.	C
W CVn	54199.423±0.002	−0.128	59441.	C
W CVn	54215.420±0.005	−0.132	59470.	C
W CVn	54236.389±0.004	−0.129	59508.	C
W CVn	54242.456±0.002	−0.132	59519.	C
Z CVn	54095.686±0.007	0.291	23193.	C
Z CVn	54103.536±0.005	0.295	23205.	C
Z CVn	54114.648±0.003	0.292	23222.	C
Z CVn	54120.535±0.004	0.295	23231.	C
Z CVn	54139.490±0.003	0.289	23260.	C
Z CVn	54143.416±0.003	0.292	23266.	C
Z CVn	54194.424±0.005	0.302	23344.	C
Z CVn	54198.338±0.005	0.293	23350.	C
Z CVn	54211.421±0.002	0.300	23370.	C
RU CVn	54108.705±0.005	0.004	34235.	C
RU CVn	54127.625±0.002	0.006	34268.	C
RU CVn	54135.651±0.004	0.007	34282.	C
RU CVn	54181.513±0.002	0.009	34362.	C
RU CVn	54196.417±0.002	0.008	34388.	C
RU CVn	54200.432±0.004	0.011	34395.	C
RU CVn	54235.400±0.002	0.010	34456.	C
RU CVn	54243.424±0.002	0.009	34470.	C
RU CVn	54259.473±0.003	0.007	34498.	C
RZ CVn	54113.613±0.002	−0.168	24268.	C
RZ CVn	54121.557±0.002	−0.168	24282.	C
RZ CVn	54130.628±0.003	−0.175	24298.	C
RZ CVn	54142.549±0.002	−0.170	24319.	C
RZ CVn	54158.436±0.002	−0.171	24347.	C
RZ CVn	54168.647±0.003	−0.173	24365.	C
RZ CVn	54171.483±0.002	−0.174	24370.	C
RZ CVn	54187.377±0.005	−0.168	24398.	C
RZ CVn	54196.450±0.002	−0.173	24414.	C
RZ CVn	54213.478±0.004	−0.167	24444.	C
RZ CVn	54238.438±0.003	−0.174	24488.	C
RZ CVn	54242.413±0.004	−0.170	24495.	C
RZ CVn	54259.431±0.005	−0.175	24525.	C
SS CVn	54119.633±0.005	0.134	30295.	C
SS CVn	54120.584±0.005	0.128	30297.	C
SS CVn	54130.622±0.005	0.117	30318.	C
SS CVn	54133.497±0.004	0.121	30324.	C
SS CVn	54141.668±0.010	0.157	30341.	C
SS CVn	54168.474±0.002	0.166	30397.	C
SS CVn	54189.524±0.003	0.161	30441.	C
SS CVn	54199.567±0.004	0.155	30462.	C
SS CVn	54214.378±0.004	0.132	30493.	C
SS CVn	54248.389±0.003	0.168	30564.	C
SS CVn	54268.484±0.004	0.165	30606.	C
UZ CVn	54113.553±0.005	0.240	39677.	C
UZ CVn	54120.529±0.002	0.238	39687.	C
UZ CVn	54127.511±0.002	0.243	39697.	C
UZ CVn	54129.603±0.005	0.241	39700.	C
UZ CVn	54148.444±0.005	0.242	39727.	C
UZ CVn	54155.419±0.002	0.239	39737.	C
UZ CVn	54157.518±0.004	0.245	39740.	C
UZ CVn	54159.611±0.003	0.245	39743.	C
UZ CVn	54229.389±0.004	0.244	39843.	C
AA CMi	54108.512±0.002	0.053	36807.	C
AA CMi	54113.752±0.002	0.053	36818.	LS
AA CMi	54115.657±0.005	0.053	36822.	LS
AA CMi	54121.374±0.002	0.054	36834.	C
AA CMi	54124.707±0.003	0.053	36841.	LS
AA CMi	54135.663±0.002	0.053	36864.	LS
AA CMi	54136.616±0.001	0.054	36866.	LS
AA CMi	54139.473±0.002	0.053	36872.	C
AA CMi	54142.335±0.005	0.057	36878.	C
AA CMi	54145.667±0.001	0.054	36885.	LS
AA CMi	54149.474±0.002	0.051	36893.	C
AL CMi	54109.752±0.004	0.441	31811.	LS
AL CMi	54114.706±0.003	0.440	31820.	LS
AL CMi	54124.620±0.005	0.445	31838.	LS
AL CMi	54141.683±0.002	0.442	31869.	LS
AL CMi	54146.639±0.003	0.444	31878.	LS
AL CMi	54151.594±0.001	0.444	31887.	LS
RV Cap	54275.761±0.003	−0.002	45545.	LS
TX Car	54125.624±0.005	0.123	49172.	LS
TX Car	54134.645±0.002	0.127	49187.	LS
TX Car	54137.654±0.002	0.130	49192.	LS
TX Car	54140.659±0.002	0.129	49197.	LS
TX Car	54146.670±0.003	0.129	49207.	LS
TX Car	54152.674±0.002	0.121	49217.	LS
TX Car	54161.694±0.002	0.124	49232.	LS
TX Car	54164.704±0.002	0.129	49237.	LS
TX Car	54167.707±0.004	0.126	49242.	LS
TX Car	54179.724±0.002	0.120	49262.	LS

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
TX Car	54185.744±0.003	0.129	49272.	LS	V671 Cen	54199.794±0.010	−0.017	45240.	LS
TX Car	54191.752±0.002	0.126	49282.	LS	V671 Cen	54213.818±0.004	0.002	45272.	LS
TX Car	54196.561±0.002	0.126	49290.	LS	V671 Cen	54228.625±0.003	−0.072	45306.	LS
TX Car	54199.566±0.002	0.125	49295.	LS	V671 Cen	54235.633±0.004	−0.067	45322.	LS
TX Car	54217.599±0.003	0.124	49325.	LS	RX Cet	54054.649±0.002	0.187	24279.	LS
TX Car	54220.601±0.002	0.120	49330.	LS	UU Cet	54018.576±0.005	−0.128	21136.	LS
TX Car	54223.610±0.003	0.123	49335.	LS	UU Cet	54024.635±0.003	−0.130	21146.	LS
TX Car	54226.613±0.005	0.121	49340.	LS	RT Col	54112.630±0.004	−0.251	49075.	LS
TX Car	54232.631±0.003	0.127	49350.	LS	RT Col	54120.678±0.002	−0.252	49090.	LS
EE Car	54103.703±0.004	0.009	43539.	LS	RT Col	54127.655±0.002	−0.251	49103.	LS
EE Car	54118.635±0.003	0.009	43561.	LS	RW Col	54113.616±0.001	0.054	49704.	LS
EE Car	54120.661±0.002	−0.001	43564.	LS	RW Col	54131.623±0.002	0.067	49738.	LS
EE Car	54126.774±0.004	0.004	43573.	LS	RW Col	54137.628±0.003	0.251	49749.	LS
EE Car	54128.811±0.005	0.004	43576.	LS	RX Col	54108.805±0.004	0.105	42583.	LS
EE Car	54135.601±0.005	0.007	43586.	LS	RY Col	54109.727±0.004	−0.143	41347.	LS
EE Car	54139.673±0.002	0.007	43592.	LS	RY Col	54110.690±0.010	−0.137	41349.	LS
EE Car	54160.715±0.002	0.009	43623.	LS	RY Col	54121.696±0.002	−0.145	41372.	LS
EE Car	54162.751±0.002	0.009	43626.	LS	S Com	54105.656±0.002	−0.096	22931.	C
EE Car	54164.786±0.007	0.008	43629.	LS	S Com	54118.562±0.003	−0.095	22953.	C
EE Car	54166.822±0.005	0.008	43632.	LS	S Com	54131.469±0.005	−0.093	22975.	C
EE Car	54168.857±0.002	0.007	43635.	LS	S Com	54141.437±0.004	−0.097	22992.	C
EE Car	54192.615±0.005	0.010	43670.	LS	S Com	54145.541±0.003	−0.100	22999.	C
EE Car	54207.542±0.006	0.006	43692.	LS	S Com	54148.479±0.005	−0.094	23004.	C
EE Car	54209.586±0.005	0.014	43695.	LS	S Com	54168.420±0.002	−0.098	23038.	C
IU Car	54110.650±0.010	0.244	16842.	LS	S Com	54209.480±0.002	−0.099	23108.	C
IU Car	54121.708±0.002	0.245	16857.	LS	ST Com	54128.572±0.005	−0.029	18206.	C
IU Car	54124.652±0.002	0.241	16861.	LS	ST Com	54134.568±0.005	−0.022	18216.	C
IU Car	54132.766±0.004	0.246	16872.	LS	ST Com	54155.529±0.004	−0.024	18251.	C
IU Car	54152.667±0.001	0.244	16899.	LS	ST Com	54206.434±0.002	−0.028	18336.	C
IU Car	54158.566±0.002	0.246	16907.	LS	ST Com	54212.425±0.002	−0.026	18346.	C
IU Car	54163.728±0.003	0.248	16914.	LS	ST Com	54230.393±0.005	−0.026	18376.	C
IU Car	54166.674±0.005	0.245	16918.	LS	ST Com	54236.381±0.004	−0.027	18386.	C
IU Car	54172.574±0.001	0.248	16926.	LS	WW CrA	54217.827±0.002	−0.039	40986.	LS
IU Car	54200.586±0.005	0.248	16964.	LS	WW CrA	54231.806±0.002	−0.047	41011.	LS
BI Cen	54103.820±0.003	0.039	38425.	LS	WW CrA	54272.664±0.005	−0.031	41084.	LS
BI Cen	54136.883±0.002	0.020	38498.	LS	V413 CrA	54237.797±0.008	0.044	21613.	LS
BI Cen	54141.868±0.004	0.020	38509.	LS	V592 CrA	54233.740±0.002	0.192	39131.	LS
BI Cen	54161.815±0.002	0.027	38553.	LS	TV CrB	54156.625±0.005	0.030	38552.	C
BI Cen	54163.627±0.001	0.026	38557.	LS	TV CrB	54159.546±0.003	0.028	38557.	C
BI Cen	54168.619±0.002	0.033	38568.	LS	TV CrB	54163.631±0.003	0.020	38564.	C
BI Cen	54173.608±0.002	0.037	38579.	LS	TV CrB	54231.449±0.002	0.023	38680.	C
BI Cen	54178.593±0.002	0.037	38590.	LS	TV CrB	54248.408±0.004	0.028	38709.	C
BI Cen	54188.567±0.005	0.041	38612.	LS	W Crt	54125.759±0.005	−0.019	35148.	LS
BI Cen	54193.548±0.002	0.037	38623.	LS	W Crt	54130.700±0.002	−0.022	35160.	LS
BI Cen	54216.643±0.002	0.020	38674.	LS	W Crt	54132.761±0.002	−0.021	35165.	LS
BI Cen	54217.553±0.002	0.023	38676.	LS	W Crt	54144.709±0.002	−0.021	35194.	LS
BI Cen	54280.560±0.003	0.038	38815.	LS	W Crt	54153.773±0.002	−0.022	35216.	LS
V499 Cen	54149.747±0.004	0.025	24987.	LS	W Crt	54156.658±0.002	−0.021	35223.	LS
V499 Cen	54161.737±0.002	0.027	25010.	LS	W Crt	54181.789±0.003	−0.023	35284.	LS
V499 Cen	54163.822±0.002	0.027	25014.	LS	W Crt	54196.624±0.002	−0.020	35320.	LS
V499 Cen	54172.684±0.002	0.028	25031.	LS	X Crt	54132.725±0.003	0.070	16831.	LS
V499 Cen	54184.671±0.003	0.028	25054.	LS	X Crt	54143.713±0.004	0.065	16846.	LS
V499 Cen	54207.604±0.005	0.027	25098.	LS	X Crt	54151.778±0.002	0.069	16857.	LS
V499 Cen	54218.550±0.002	0.028	25119.	LS	X Crt	54173.747±0.004	0.053	16887.	LS
V499 Cen	54268.585±0.003	0.027	25215.	LS	X Crt	54198.676±0.005	0.066	16921.	LS
V671 Cen	54174.867±0.002	0.003	45183.	LS	X Crt	54209.672±0.005	0.069	16936.	LS
V671 Cen	54178.759±0.002	−0.044	45192.	LS	SW Cru	54107.815±0.003	0.064	85659.	LS
V671 Cen	54189.672±0.005	−0.072	45217.	LS	SW Cru	54135.670±0.003	0.057	85744.	LS

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
SW Cru	54181.570±0.010	0.068	85884.	LS
SW Cru	54183.860±0.005	0.064	85891.	LS
SW Cru	54196.649±0.010	0.069	85930.	LS
SW Cru	54219.589±0.004	0.065	86000.	LS
SW Cru	54220.570±0.010	0.062	86003.	LS
SW Cru	54221.552±0.005	0.061	86006.	LS
SW Cru	54223.525±0.010	0.067	86012.	LS
SW Cru	54224.506±0.005	0.065	86015.	LS
SW Cru	54225.489±0.005	0.065	86018.	LS
SW Cru	54227.780±0.004	0.061	86025.	LS
SW Cru	54278.589±0.005	0.064	86180.	LS
SW Cru	54281.537±0.004	0.062	86189.	LS
SW Cru	54282.524±0.005	0.066	86192.	LS
UY Cyg	54269.475±0.003	0.052	56778.	C
UY Cyg	54274.523±0.003	0.054	56787.	C
UY Cyg	54278.445±0.005	0.051	56794.	C
V939 Cyg [1]	54235.542±0.002	0.024	11475.	C
RT Dor	54103.707±0.002	−0.043	48332.	LS
RT Dor	54114.813±0.005	−0.042	48355.	LS
VW Dor	54103.671±0.002	−0.082	27557.	LS
VW Dor	54111.663±0.002	−0.078	27571.	LS
VW Dor	54115.656±0.002	−0.080	27578.	LS
VW Dor	54127.640±0.002	−0.078	27599.	LS
VW Dor	54132.774±0.002	−0.080	27608.	LS
VW Dor	54139.622±0.004	−0.079	27620.	LS
VW Dor	54159.590±0.002	−0.083	27655.	LS
VW Dor	54163.586±0.001	−0.081	27662.	LS
VW Dor	54167.583±0.002	−0.078	27669.	LS
VW Dor	54183.556±0.002	−0.082	27697.	LS
VW Dor	54191.546±0.001	−0.081	27711.	LS
VW Dor	54199.542±0.003	−0.073	27725.	LS
RW Dra	54193.606±0.003	0.198	33451.	C
RW Dra	54209.509±0.004	0.156	33487.	C
RW Dra	54217.486±0.002	0.161	33505.	C
RW Dra	54268.449±0.005	0.188	33620.	C
SU Dra	54109.545±0.002	0.047	15456.	C
SU Dra	54111.524±0.005	0.044	15459.	C
SU Dra	54131.343±0.002	0.051	15489.	C
SU Dra	54135.304±0.003	0.049	15495.	C
SU Dra	54164.362±0.002	0.049	15539.	C
SU Dra	54168.325±0.003	0.049	15545.	C
SU Dra	54228.423±0.003	0.049	15636.	C
SW Dra	54129.358±0.002	0.059	48984.	C
SW Dra	54134.488±0.006	0.062	48993.	C
SW Dra	54137.330±0.002	0.055	48998.	C
SW Dra	54141.323±0.005	0.060	49005.	C
SW Dra	54162.399±0.005	0.059	49042.	C
SW Dra	54187.461±0.003	0.055	49086.	C
SW Dra	54207.401±0.004	0.057	49121.	C
SW Dra	54211.389±0.002	0.057	49128.	C
SW Dra	54215.382±0.003	0.062	49135.	C
XZ Dra	54219.500±0.005	−0.114	25795.	C
XZ Dra	54221.407±0.004	−0.113	25799.	C
BC Dra	54102.601±0.006	0.085	16432.	C
BC Dra	54112.675±0.010	0.085	16446.	C
BC Dra	54133.535±0.006	0.077	16475.	C
BC Dra	54164.482±0.005	0.083	16518.	C
BC Dra	54213.408±0.005	0.077	16586.	C
BC Dra	54215.571±0.010	0.082	16589.	C
BC Dra	54218.444±0.005	0.076	16593.	C
BC Dra	54236.439±0.010	0.082	16618.	C
BC Dra	54272.423±0.004	0.087	16668.	C
BC Dra	54277.459±0.004	0.086	16675.	C
BD Dra	54107.569±0.005	0.735	20936.	C
BD Dra	54114.655±0.003	0.753	20948.	C
BD Dra	54120.535±0.005	0.742	20958.	C
BD Dra	54127.570±0.002	0.709	20970.	C
BD Dra	54133.494±0.002	0.742	20980.	C
BD Dra	54189.449±0.004	0.737	21075.	C
BD Dra	54192.393±0.005	0.736	21080.	C
BD Dra	54193.555±0.003	0.720	21082.	C
BD Dra	54219.474±0.005	0.720	21126.	C
BK Dra	54273.444±0.002	−0.154	48558.	C
BT Dra	54148.547±0.005	−0.008	39774.	C
BT Dra	54164.440±0.002	−0.009	39801.	C
BT Dra	54207.409±0.003	−0.013	39874.	C
BT Dra	54217.415±0.002	−0.015	39891.	C
BT Dra	54230.370±0.002	−0.010	39913.	C
BT Dra	54237.442±0.005	−0.002	39925.	C
BT Dra	54240.379±0.005	−0.009	39930.	C
BT Dra	54267.455±0.002	−0.012	39976.	C
RR Gem	54108.526±0.002	−0.363	32095.	C
RR Gem	54113.297±0.003	−0.359	32107.	C
RR Gem	54136.338±0.002	−0.362	32165.	C
SZ Gem	54109.514±0.002	−0.053	53709.	C
GI Gem	54136.440±0.002	0.071	54908.	C
GI Gem	54149.437±0.004	0.070	54938.	C
RW Gru	54275.826±0.002	−0.136	36190.	LS
TW Her	54194.550±0.002	−0.010	81705.	C
TW Her	54218.526±0.002	−0.011	81765.	C
TW Her	54266.477±0.003	−0.012	81885.	C
TW Her	54268.474±0.005	−0.013	81890.	C
TW Her	54274.469±0.002	−0.012	81905.	C
TW Her	54276.466±0.002	−0.013	81910.	C
VX Her	54172.621±0.002	−0.406	71200.	C
VX Her	54188.561±0.002	−0.405	71235.	C
VX Her	54219.524±0.005	−0.407	71303.	C
VX Her	54261.415±0.004	−0.410	71395.	C
VX Her	54271.432±0.002	−0.411	71417.	C
VX Her	54276.444±0.004	−0.408	71428.	C
VZ Her	54210.531±0.002	0.060	39565.	C
VZ Her	54240.476±0.003	0.063	39633.	C
VZ Her	54266.455±0.002	0.062	39692.	C
VZ Her	54277.465±0.005	0.064	39717.	C
VZ Her	54281.428±0.003	0.064	39726.	C
AG Her	54219.362±0.010	−0.013	40892.	C
AR Her	54164.577±0.002	0.203	27041.	C
AR Her	54188.549±0.003	0.203	27092.	C
AR Her	54196.546±0.003	0.210	27109.	C
DL Her	54218.494±0.005	0.024	27061.	C
DL Her	54241.587±0.005	0.044	27100.	C
SV Hya	54151.859±0.003	0.113	30997.	LS
SV Hya	54174.593±0.001	−0.123	31045.	LS
SV Hya	54213.591±0.004	0.113	31126.	LS
SV Hya	54234.637±0.003	0.103	31170.	LS
SZ Hya	54103.807±0.002	−0.164	24988.	LS

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
SZ Hya	54114.498±0.005	−0.217	25008.	C	FX Hya	54226.573±0.002	0.024	47883.	LS
SZ Hya	54121.536±0.002	−0.164	25021.	C	FX Hya	54241.599±0.003	0.025	47919.	LS
SZ Hya	54123.685±0.002	−0.164	25025.	LS	FY Hya	54152.760±0.002	0.007	20519.	LS
SZ Hya	54128.519±0.002	−0.165	25034.	C	FY Hya	54173.772±0.004	0.010	20552.	LS
SZ Hya	54130.668±0.002	−0.165	25038.	LS	FY Hya	54215.787±0.002	0.006	20618.	LS
SZ Hya	54138.699±0.005	−0.192	25053.	LS	FY Hya	54226.614±0.005	0.010	20635.	LS
SZ Hya	54142.434±0.005	−0.218	25060.	C	GO Hya	54102.622±0.008	−0.074	44707.	C
SZ Hya	54149.472±0.003	−0.164	25073.	C	GO Hya	54111.525±0.007	−0.081	44721.	C
SZ Hya	54151.619±0.001	−0.166	25077.	LS	GO Hya	54114.718±0.005	−0.070	44726.	LS
SZ Hya	54166.617±0.004	−0.211	25105.	LS	GO Hya	54121.707±0.004	−0.082	44737.	LS
SZ Hya	54180.625±0.002	−0.171	25131.	LS	GO Hya	54142.717±0.004	−0.074	44770.	LS
SZ Hya	54194.557±0.006	−0.207	25157.	LS	GO Hya	54155.441±0.002	−0.079	44790.	C
UU Hya	54113.749±0.002	0.027	27936.	LS	GO Hya	54165.629±0.005	−0.074	44806.	LS
UU Hya	54123.713±0.002	0.038	27955.	LS	GO Hya	54172.628±0.003	−0.076	44817.	LS
UU Hya	54144.651±0.002	0.021	27995.	LS	GO Hya	54179.635±0.005	−0.070	44828.	LS
UU Hya	54166.671±0.004	0.039	28037.	LS	GS Hya	54161.682±0.002	−0.085	23663.	LS
UU Hya	54176.604±0.002	0.018	28056.	LS	GS Hya	54172.649±0.004	−0.104	23684.	LS
UU Hya	54197.578±0.003	0.037	28096.	LS	GS Hya	54228.605±0.003	−0.125	23791.	LS
WZ Hya	54118.771±0.004	−0.011	26950.	LS	GS Hya	54272.530±0.005	−0.144	23875.	LS
WZ Hya	54125.771±0.005	−0.002	26963.	LS	TW Hyi	54103.701±0.002	0.009	21674.	LS
WZ Hya	54131.689±0.003	0.002	26974.	LS	TW Hyi	54120.585±0.002	0.008	21699.	LS
WZ Hya	54140.828±0.004	−0.001	26991.	LS	TW Hyi	54126.659±0.002	0.004	21708.	LS
WZ Hya	54145.662±0.001	−0.006	27000.	LS	TW Hyi	54143.548±0.004	0.008	21733.	LS
WZ Hya	54152.649±0.002	−0.009	27013.	LS	V Ind	54275.782±0.005	−0.137	29520.	LS
WZ Hya	54159.639±0.004	−0.010	27026.	LS	RR Leo	54103.608±0.002	0.078	23891.	C
WZ Hya	54167.708±0.005	−0.006	27041.	LS	RR Leo	54119.445±0.005	0.081	23926.	C
WZ Hya	54180.617±0.002	−0.002	27065.	LS	RR Leo	54124.419±0.002	0.079	23937.	C
WZ Hya	54194.598±0.002	−0.002	27091.	LS	RR Leo	54129.395±0.002	0.078	23948.	C
WZ Hya	54208.577±0.002	−0.004	27117.	LS	RR Leo	54175.541±0.002	0.080	24050.	C
WZ Hya	54209.652±0.005	−0.004	27119.	LS	RR Leo	54209.471±0.003	0.081	24125.	C
WZ Hya	54222.562±0.005	0.001	27143.	LS	RX Leo	54112.607±0.005	0.088	27251.	C
XX Hya	54123.716±0.002	0.090	28146.	LS	RX Leo	54120.453±0.005	0.093	27263.	C
XX Hya	54179.565±0.001	0.085	28256.	LS	RX Leo	54205.388±0.004	0.085	27393.	C
BI Hya	54144.656±0.002	0.219	49848.	LS	SS Leo	54141.636±0.003	−0.047	19734.	C
BI Hya	54173.612±0.002	0.219	49903.	LS	SS Leo	54198.626±0.002	−0.055	19825.	LS
BI Hya	54183.615±0.002	0.219	49922.	LS	SS Leo	54200.503±0.005	−0.057	19828.	C
BI Hya	54223.625±0.002	0.218	49998.	LS	SS Leo	54208.655±0.002	−0.047	19841.	LS
DD Hya	54127.364±0.005	−0.142	24776.	C	SS Leo	54212.412±0.003	−0.048	19847.	C
DD Hya	54128.362±0.003	−0.148	24778.	C	SS Leo	54213.660±0.002	−0.053	19849.	LS
DG Hya	54113.849±0.002	0.075	39764.	LS	ST Leo	54141.493±0.002	−0.020	54852.	C
DG Hya	54126.674±0.002	0.000	39794.	LS	ST Leo	54159.656±0.003	−0.020	54890.	C
DG Hya	54138.735±0.002	0.022	39822.	LS	SW Leo	54130.743±0.002	−0.055	48688.	LS
DG Hya	54141.754±0.002	0.031	39829.	LS	SW Leo	54145.702±0.002	−0.058	48715.	LS
DH Hya	54111.789±0.002	0.062	46903.	LS	SW Leo	54150.690±0.002	−0.057	48724.	LS
DH Hya	54115.696±0.002	0.057	46911.	LS	SW Leo	54155.674±0.002	−0.060	48733.	LS
DH Hya	54138.681±0.002	0.060	46958.	LS	SW Leo	54200.561±0.002	−0.060	48814.	LS
DH Hya	54157.754±0.005	0.062	46997.	LS	SW Leo	54205.550±0.003	−0.058	48823.	LS
DH Hya	54183.671±0.003	0.062	47050.	LS	SZ Leo	54140.868±0.004	−0.112	16241.	LS
IK Hya	54188.759±0.010	−0.151	24196.	LS	SZ Leo	54147.813±0.005	−0.110	16254.	LS
IK Hya	54235.549±0.005	−0.161	24268.	LS	SZ Leo	54148.874±0.005	−0.117	16256.	LS
IV Hya	54123.732±0.002	0.124	20809.	LS	SZ Leo	54168.636±0.005	−0.115	16293.	LS
IV Hya	54129.585±0.005	0.029	20820.	LS	SZ Leo	54176.627±0.004	−0.135	16308.	LS
IV Hya	54156.727±0.007	0.134	20870.	LS	SZ Leo	54183.580±0.003	−0.125	16321.	LS
FX Hya	54144.774±0.002	0.026	47687.	LS	SZ Leo	54199.595±0.002	−0.131	16351.	LS
FX Hya	54149.782±0.002	0.026	47699.	LS	SZ Leo	54222.529±0.005	−0.162	16394.	LS
FX Hya	54162.723±0.004	0.029	47730.	LS	TV Leo	54142.718±0.002	0.106	25416.	LS
FX Hya	54190.682±0.005	0.025	47797.	LS	TV Leo	54148.775±0.002	0.108	25425.	LS
FX Hya	54200.698±0.002	0.025	47821.	LS	TV Leo	54183.764±0.002	0.108	25477.	LS

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
TV Leo	54198.566±0.003	0.108	25499.	LS	TW Lyn	54201.465±0.005	0.056	19049.	C
WW Leo	54113.796±0.004	0.035	31901.	LS	RZ Lyr	54214.470±0.005	−0.011	25489.	C
WW Leo	54130.675±0.004	0.034	31929.	LS	RZ Lyr	54235.436±0.002	−0.006	25530.	C
WW Leo	54139.718±0.005	0.035	31944.	LS	RZ Lyr	54256.408±0.003	0.005	25571.	C
WW Leo	54148.762±0.005	0.036	31959.	LS	RZ Lyr	54279.416±0.005	0.007	25616.	C
WW Leo	54156.595±0.003	0.032	31972.	LS	CN Lyr	54234.473±0.004	0.024	23696.	C
WW Leo	54168.659±0.002	0.039	31992.	LS	CN Lyr	54241.459±0.005	0.016	23713.	C
WW Leo	54171.667±0.002	0.033	31997.	LS	CN Lyr	54246.401±0.004	0.022	23725.	C
AA Leo	54141.518±0.002	−0.076	24296.	C	CN Lyr	54269.436±0.005	0.019	23781.	C
AX Leo	54102.635±0.004	−0.047	39704.	C	IO Lyr	54212.604±0.003	−0.031	25287.	C
AX Leo	54129.548±0.003	−0.027	39741.	C	IO Lyr	54234.537±0.005	−0.029	25325.	C
AX Leo	54142.620±0.010	−0.037	39759.	C	IO Lyr	54256.467±0.004	−0.030	25363.	C
AX Leo	54145.527±0.003	−0.038	39763.	C	IO Lyr	54267.430±0.003	−0.032	25382.	C
AX Leo	54180.417±0.005	−0.036	39811.	C	IO Lyr	54271.472±0.002	−0.030	25389.	C
AX Leo	54196.409±0.005	−0.034	39833.	C	IO Lyr	54275.512±0.003	−0.030	25396.	C
AX Leo	54201.498±0.005	−0.033	39840.	C	V340 Lyr	54235.433±0.004	−0.042	41627.	C
AX Leo	54209.490±0.005	−0.036	39851.	C	XZ Mic	54018.653±0.002	0.063	25334.	LS
V LMi	54103.477±0.004	0.032	63563.	C	XZ Mic	54268.834±0.002	0.035	25891.	LS
V LMi	54111.636±0.002	0.032	63578.	C	XZ Mic	54273.770±0.005	0.029	25902.	LS
V LMi	54127.408±0.002	0.030	63607.	C	XZ Mic	54277.816±0.002	0.033	25911.	LS
V LMi	54170.375±0.002	0.028	63686.	C	DV Mon	54107.674±0.001	0.072	69815.	LS
V LMi	54176.362±0.002	0.032	63697.	C	DV Mon	54138.679±0.004	0.072	69890.	LS
V LMi	54201.381±0.002	0.030	63743.	C	DV Mon	54145.708±0.002	0.074	69907.	LS
V LMi	54207.367±0.005	0.033	63754.	C	TX Mus	54134.648±0.004	0.100	63129.	LS
Y LMi	54134.701±0.005	−0.199	35424.	C	TX Mus	54157.832±0.002	0.096	63178.	LS
Y LMi	54141.514±0.002	−0.204	35437.	C	TX Mus	54165.876±0.002	0.095	63195.	LS
Y LMi	54170.360±0.001	−0.204	35492.	C	TX Mus	54167.768±0.002	0.094	63199.	LS
Y LMi	54172.459±0.002	−0.203	35496.	C	TX Mus	54189.540±0.003	0.098	63245.	LS
Y LMi	54173.508±0.002	−0.203	35498.	C	TX Mus	54192.848±0.002	0.093	63252.	LS
Y LMi	54181.375±0.002	−0.203	35513.	C	TX Mus	54211.781±0.004	0.097	63292.	LS
U Lep	54107.652±0.001	0.044	21936.	LS	TX Mus	54220.770±0.002	0.095	63311.	LS
U Lep	54114.623±0.002	0.037	21948.	LS	TX Mus	54225.509±0.005	0.101	63321.	LS
TV Lib	54176.775±0.001	−0.004	126693.	LS	EM Mus	54137.685±0.002	−0.149	33387.	LS
TV Lib	54200.772±0.002	−0.003	126782.	LS	EM Mus	54151.704±0.003	−0.148	33417.	LS
TV Lib	54233.666±0.003	−0.004	126904.	LS	EM Mus	54165.725±0.002	−0.146	33447.	LS
TV Lib	54267.638±0.002	−0.004	127030.	LS	EM Mus	54189.555±0.001	−0.149	33498.	LS
UX Lib	54184.814±0.002	0.001	57972.	LS	EM Mus	54193.760±0.002	−0.149	33507.	LS
UX Lib	54200.756±0.002	−0.001	58005.	LS	EM Mus	54221.798±0.002	−0.149	33567.	LS
UX Lib	54212.836±0.002	0.000	58030.	LS	EM Mus	54225.537±0.002	−0.148	33575.	LS
UX Lib	54217.667±0.002	−0.001	58040.	LS	EM Mus	54281.608±0.002	−0.153	33695.	LS
VY Lib	54184.789±0.002	−0.027	24423.	LS	VY Nor	54193.751±0.005	−0.163	76361.	LS
VY Lib	54191.729±0.002	−0.028	24436.	LS	VY Nor	54208.743±0.005	−0.183	76401.	LS
VY Lib	54230.705±0.005	−0.030	24509.	LS	VY Nor	54220.763±0.005	−0.173	76433.	LS
VY Lib	54237.647±0.003	−0.029	24522.	LS	VY Nor	54232.785±0.006	−0.161	76465.	LS
VY Lib	54268.612±0.005	−0.033	24580.	LS	VY Nor	54267.688±0.010	−0.161	76558.	LS
XX Lib	54175.811±0.010	−0.002	37542.	LS	Y Oct	54191.765±0.005	−0.195	39920.	LS
XX Lib	54182.804±0.005	0.007	37552.	LS	Y Oct	54222.796±0.002	−0.202	39968.	LS
AZ Lib	54212.849±0.002	0.169	40266.	LS	Y Oct	54224.747±0.005	−0.191	39971.	LS
TT Lyn	54109.549±0.002	−0.034	29222.	C	Y Oct	54233.788±0.002	−0.203	39985.	LS
TT Lyn	54114.330±0.003	−0.032	29230.	C	Y Oct	54281.637±0.004	−0.204	40059.	LS
TT Lyn	54128.665±0.005	−0.036	29254.	C	RS Oct	54280.850±0.003	0.114	39194.	LS
TT Lyn	54148.381±0.002	−0.035	29287.	C	RV Oct	54135.750±0.003	0.119	68315.	LS
TT Lyn	54173.475±0.002	−0.033	29329.	C	RV Oct	54139.750±0.005	0.121	68322.	LS
TT Lyn	54194.384±0.004	−0.034	29364.	C	RV Oct	54147.748±0.004	0.122	68336.	LS
TW Lyn	54108.463±0.002	0.053	18856.	C	RV Oct	54163.735±0.005	0.117	68364.	LS
TW Lyn	54136.413±0.002	0.055	18914.	C	RV Oct	54166.595±0.005	0.121	68369.	LS
TW Lyn	54137.373±0.003	0.051	18916.	C	RV Oct	54174.593±0.001	0.123	68383.	LS
TW Lyn	54172.550±0.002	0.052	18989.	C	RV Oct	54178.589±0.002	0.121	68390.	LS

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
RV Oct	54186.586±0.002	0.121	68404.	LS
RV Oct	54192.874±0.002	0.127	68415.	LS
RV Oct	54194.584±0.003	0.123	68418.	LS
RV Oct	54220.856±0.003	0.122	68464.	LS
RV Oct	54222.571±0.002	0.123	68467.	LS
RV Oct	54224.857±0.002	0.124	68471.	LS
RV Oct	54226.572±0.005	0.126	68474.	LS
RV Oct	54238.563±0.005	0.123	68495.	LS
RV Oct	54278.545±0.002	0.123	68565.	LS
RV Oct	54282.543±0.002	0.123	68572.	LS
SS Oct	54275.860±0.002	−0.064	42223.	LS
SS Oct	54280.837±0.005	−0.062	42231.	LS
SS Oct	54282.702±0.002	−0.062	42234.	LS
UV Oct	54179.686±0.005	−0.103	36584.	LS
UV Oct	54192.705±0.003	−0.107	36608.	LS
UV Oct	54200.850±0.003	−0.101	36623.	LS
UV Oct	54223.636±0.010	−0.106	36665.	LS
UV Oct	54224.725±0.010	−0.102	36667.	LS
UV Oct	54235.579±0.003	−0.100	36687.	LS
UV Oct	54281.686±0.003	−0.117	36772.	LS
UW Oct	54281.671±0.003	−0.004	44870.	LS
AR Oct	54280.893±0.005	−0.042	44308.	LS
ST Oph	54213.813±0.002	−0.023	57260.	LS
ST Oph	54218.768±0.002	−0.022	57271.	LS
ST Oph	54241.740±0.007	−0.018	57322.	LS
V445 Oph	54237.786±0.002	0.021	67236.	LS
V455 Oph	54244.420±0.005	−0.247	27343.	C
V455 Oph	54268.480±0.004	−0.244	27396.	C
V455 Oph	54278.466±0.002	−0.244	27418.	C
V816 Oph	54215.821±0.002	−0.099	46926.	LS
V816 Oph	54220.770±0.002	−0.099	46939.	LS
TX Pav	54184.806±0.002	−0.165	58761.	LS
TX Pav	54189.867±0.002	−0.163	58772.	LS
TX Pav	54206.885±0.005	−0.160	58809.	LS
TY Pav	54221.792±0.005	0.285	17862.	LS
TY Pav	54231.737±0.005	0.285	17876.	LS
TY Pav	54241.679±0.005	0.281	17890.	LS
WY Pav	54213.820±0.003	0.073	46460.	LS
BH Pav	54223.795±0.003	0.220	54886.	LS
BN Pav	54231.907±0.002	−0.024	45657.	LS
BN Pav	54234.743±0.002	−0.024	45662.	LS
BN Pav	54267.637±0.003	−0.026	45720.	LS
BP Pav	54230.731±0.002	0.020	48188.	LS
BP Pav	54276.591±0.002	0.201	48273.	LS
DN Pav	54028.657±0.002	0.095	27421.	LS
DN Pav	54052.548±0.001	0.096	27472.	LS
DN Pav	54217.910±0.003	0.098	27825.	LS
DN Pav	54232.900±0.003	0.097	27857.	LS
HV Pav	54013.635±0.004	0.176	30722.	LS
HV Pav	54268.887±0.004	−0.257	31178.	LS
HV Pav	54272.813±0.005	−0.256	31185.	LS
HV Pav	54277.863±0.004	−0.252	31194.	LS
AR Per	54105.278±0.002	0.052	63138.	C
AR Per	54106.556±0.002	0.054	63141.	C
AR Per	54109.534±0.003	0.053	63148.	C
AR Per	54113.367±0.002	0.056	63157.	C
AR Per	54124.436±0.005	0.061	63183.	C
AR Per	54135.494±0.002	0.054	63209.	C
U Pic	54108.745±0.004	0.054	28254.	LS
U Pic	54112.708±0.004	0.053	28263.	LS
U Pic	54120.637±0.001	0.056	28281.	LS
U Pic	54124.599±0.002	0.054	28290.	LS
U Pic	54131.647±0.002	0.056	28306.	LS
XX Pup	54112.615±0.002	0.456	23858.	LS
XX Pup	54127.616±0.002	0.458	23887.	LS
XX Pup	54141.579±0.003	0.458	23914.	LS
XX Pup	54157.610±0.001	0.456	23945.	LS
XX Pup	54171.574±0.002	0.456	23972.	LS
BB Pup	54164.748±0.004	0.111	31951.	LS
BB Pup	54192.620±0.002	0.111	32009.	LS
HH Pup	54108.619±0.002	0.010	39945.	LS
HH Pup	54115.653±0.002	0.011	39963.	LS
HH Pup	54120.733±0.001	0.011	39976.	LS
HH Pup	54135.581±0.002	0.011	40014.	LS
HH Pup	54140.660±0.002	0.010	40027.	LS
HH Pup	54160.590±0.001	0.012	40078.	LS
HH Pup	54167.622±0.002	0.011	40096.	LS
HH Pup	54174.656±0.001	0.011	40114.	LS
HK Pup	54108.712±0.002	−0.238	23835.	LS
HK Pup	54136.614±0.005	−0.238	23873.	LS
HK Pup	54147.631±0.005	−0.234	23888.	LS
X Ret	54150.639±0.002	0.207	29903.	LS
V675 Sgr	54209.909±0.005	0.066	40204.	LS
V675 Sgr	54218.901±0.005	0.066	40218.	LS
V675 Sgr	54231.740±0.002	0.059	40238.	LS
V675 Sgr	54238.826±0.010	0.080	40249.	LS
V756 Sgr	54207.883±0.005	0.093	47280.	LS
V756 Sgr	54237.762±0.005	0.106	47337.	LS
V756 Sgr	54268.667±0.005	0.096	47396.	LS
V1025 Sgr	54275.775±0.003	−0.016	46399.	LS
V1130 Sgr	54223.868±0.002	0.041	47290.	LS
V1130 Sgr	54272.722±0.003	0.042	47376.	LS
V1130 Sgr	54277.833±0.002	0.040	47385.	LS
V494 Sco	54231.687±0.004	−0.137	30668.	LS
V494 Sco	54234.677±0.004	−0.139	30675.	LS
V494 Sco	54275.695±0.002	−0.144	30771.	LS
V690 Sco	54205.848±0.004	−0.018	25207.	LS
V765 Sco	54189.760±0.002	0.136	52589.	LS
V765 Sco	54201.820±0.002	0.141	52615.	LS
RU Scl	54017.600±0.002	−0.105	46408.	LS
RU Scl	54046.712±0.002	−0.100	46467.	LS
AE Scl	54025.665±0.002	0.190	23283.	LS
AE Scl	54031.720±0.002	0.194	23294.	LS
AE Scl	54036.674±0.005	0.197	23303.	LS
AE Scl	54047.680±0.003	0.201	23323.	LS
AE Scl	54052.628±0.001	0.198	23332.	LS
AE Scl	54063.631±0.003	0.199	23352.	LS
VY Ser	54182.787±0.005	0.043	32149.	LS
VY Ser	54213.499±0.002	0.049	32192.	C
VY Ser	54217.781±0.005	0.047	32198.	LS
VY Ser	54218.492±0.003	0.043	32199.	C
VY Ser	54228.496±0.005	0.050	32213.	C
VY Ser	54233.493±0.005	0.048	32220.	C
VY Ser	54270.622±0.005	0.045	32272.	LS
AN Ser	54187.488±0.005	0.004	75619.	C
AN Ser	54199.494±0.002	0.003	75642.	C

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
AN Ser	54233.428±0.002	0.002	75707.	C
AN Ser	54244.394±0.002	0.004	75728.	C
AN Ser	54269.447±0.002	−0.002	75776.	C
AV Ser	54192.788±0.002	0.135	53018.	LS
AV Ser	54201.553±0.002	0.124	53036.	C
AV Ser	54218.630±0.003	0.136	53071.	C
AV Ser	54231.789±0.002	0.131	53098.	LS
AV Ser	54241.550±0.005	0.141	53118.	C
AW Ser	54216.398±0.005	−0.037	43330.	C
CS Ser	54184.769±0.002	0.001	43676.	LS
CS Ser	54212.705±0.006	0.017	43729.	LS
CS Ser	54241.679±0.003	0.017	43784.	LS
CS Ser	54269.596±0.002	0.014	43837.	LS
RU Sex [2]	54124.731±0.010	0.023	32859.	LS
RU Sex [2]	54139.794±0.010	0.026	32902.	LS
RU Sex [2]	54152.412±0.003	0.036	32938.	C
RU Sex [2]	54156.623±0.005	0.044	32950.	LS
RU Sex [2]	54169.575±0.005	0.037	32987.	LS
RU Sex [2]	54197.598±0.005	0.042	33067.	LS
RV Sex	54129.713±0.002	0.064	48646.	LS
RV Sex	54140.780±0.002	0.056	48668.	LS
RV Sex	54185.584±0.001	0.056	48757.	LS
RV Sex	54197.666±0.005	0.056	48781.	LS
HY Tel	54223.771±0.005	−0.026	63357.	LS
RW TrA	54177.814±0.002	−0.166	33923.	LS
RW TrA	54186.788±0.002	−0.169	33947.	LS
RW TrA	54189.783±0.002	−0.166	33955.	LS
RW TrA	54192.778±0.003	−0.164	33963.	LS
RW TrA	54211.850±0.002	−0.168	34014.	LS
W Tuc	54102.543±0.005	0.149	26819.	LS
W Tuc	54109.611±0.007	0.152	26830.	LS
W Tuc	54118.606±0.005	0.156	26844.	LS
W Tuc	54127.596±0.002	0.155	26858.	LS
AE Tuc	54102.653±0.002	0.080	47855.	LS
AE Tuc	54112.601±0.002	0.083	47879.	LS
AE Tuc	54117.576±0.002	0.086	47891.	LS
AE Tuc	54122.550±0.001	0.087	47903.	LS
AG Tuc	54102.573±0.004	0.045	23748.	LS
AG Tuc	54108.602±0.004	0.048	23758.	LS
BK Tuc	54107.582±0.002	−0.038	31574.	LS
RV UMa	54133.521±0.002	0.113	19352.	C
RV UMa	54162.533±0.005	0.105	19414.	C
RV UMa	54198.581±0.003	0.113	19491.	C
TU UMa	54147.479±0.002	−0.026	20292.	C
TU UMa	54175.364±0.002	−0.024	20342.	C
TU UMa	54209.375±0.003	−0.030	20403.	C
TU UMa	54234.473±0.005	−0.027	20448.	C
AB UMa	54103.554±0.006	0.125	29814.	C
AB UMa	54112.540±0.010	0.118	29829.	C
AB UMa	54124.518±0.003	0.104	29849.	C
AB UMa	54148.510±0.003	0.113	29889.	C
AB UMa	54157.504±0.005	0.113	29904.	C
AB UMa	54187.482±0.010	0.113	29954.	C
AB UMa	54199.479±0.010	0.118	29974.	C
AB UMa	54205.469±0.006	0.112	29984.	C
AB UMa	54211.462±0.005	0.109	29994.	C
AB UMa	54214.462±0.005	0.112	29999.	C
AB UMa	54229.448±0.006	0.108	30024.	C
AB UMa	54232.446±0.005	0.108	30029.	C
AB UMa	54241.445±0.010	0.114	30044.	C
AB UMa	54247.434±0.005	0.107	30054.	C
EX UMa	54157.429±0.005	0.024	9477.	C
EX UMa	54158.516±0.005	0.026	9479.	C
EX UMa	54159.608±0.002	0.032	9481.	C
EX UMa	54176.436±0.005	0.032	9512.	C
EX UMa	54190.549±0.005	0.032	9538.	C
EX UMa	54201.399±0.005	0.025	9558.	C
AF Vel	54141.785±0.010	−0.256	24099.	LS
AF Vel	54157.611±0.002	−0.252	24129.	LS
AF Vel	54176.613±0.004	−0.236	24165.	LS
AF Vel	54186.631±0.002	−0.239	24184.	LS
AF Vel	54205.606±0.002	−0.250	24220.	LS
AF Vel	54224.601±0.002	−0.242	24256.	LS
AF Vel	54234.632±0.004	−0.231	24275.	LS
FS Vel	54195.586±0.005	−0.170	30764.	LS
FS Vel	54223.655±0.002	−0.169	30823.	LS
FS Vel	54224.603±0.002	−0.172	30825.	LS
ST Vir	54200.469±0.004	0.029	32773.	C
ST Vir	54207.449±0.003	0.025	32790.	C
ST Vir	54215.658±0.002	0.017	32810.	LS
ST Vir	54216.486±0.005	0.024	32812.	C
ST Vir	54244.417±0.002	0.018	32880.	C
UU Vir	54206.503±0.002	−0.008	26091.	C
UV Vir	54119.695±0.010	0.011	24063.	C
UV Vir	54129.668±0.003	0.004	24080.	C
UV Vir	54143.761±0.002	0.007	24104.	LS
UV Vir	54150.815±0.002	0.016	24116.	LS
UV Vir	54153.753±0.005	0.018	24121.	LS
UV Vir	54155.518±0.002	0.022	24124.	C
UV Vir	54159.628±0.004	0.023	24131.	C
UV Vir	54160.800±0.002	0.020	24133.	LS
UV Vir	54182.521±0.002	0.019	24170.	C
UV Vir	54186.621±0.002	0.010	24177.	LS
UV Vir	54198.361±0.005	0.008	24197.	C
UV Vir	54200.707±0.005	0.006	24201.	LS
UV Vir	54213.632±0.004	0.015	24223.	LS
UV Vir	54233.592±0.005	0.014	24257.	LS
WW Vir	54172.673±0.004	0.293	26781.	LS
WW Vir	54198.738±0.003	0.294	26821.	LS
XZ Vir	54227.674±0.003			LS
XZ Vir	54230.537±0.002			LS
XZ Vir	54231.492±0.003			LS
XZ Vir	54232.444±0.003			C
XZ Vir	54233.394±0.005			C
XZ Vir	54238.651±0.010			LS
XZ Vir	54239.603±0.004			LS
AF Vir	54155.659±0.002	−0.103	28572.	C
AF Vir	54180.807±0.003	−0.110	28624.	LS
AF Vir	54198.712±0.002	−0.104	28661.	LS
AF Vir	54208.388±0.004	−0.104	28681.	C
AF Vir	54232.571±0.005	−0.109	28731.	C
AS Vir	54172.775±0.002	0.148	27136.	LS
AS Vir	54177.756±0.002	0.149	27145.	LS
AS Vir	54182.741±0.002	0.153	27154.	LS
AS Vir	54207.637±0.002	0.145	27199.	LS
AS Vir	54228.669±0.003	0.147	27237.	LS

Table 1 (cont.): maxima of RR Lyrae stars

Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.	Variable	Maximum HJD 24...	$O-C$ (days)	E	Obs.
AS Vir	54233.653±0.005	0.150	27246.	LS	BC Vir	54233.621±0.002	0.130	60780.	LS
AT Vir	54146.773±0.005	0.262	27517.	LS	BQ Vir	54230.640±0.005	−0.058	54052.	LS
AT Vir	54155.714±0.002	−0.261	27535.	LS	BQ Vir	54237.632±0.005	−0.061	54063.	LS
AT Vir	54171.487±0.002	−0.262	27565.	C	DO Vir	54211.702±0.005	0.212	51853.	LS
AT Vir	54175.691±0.005	0.262	27572.	LS	DO Vir	54234.606±0.002	0.209	51896.	LS
AT Vir	54181.477±0.002	−0.262	27584.	C	SV Vol	54136.662±0.002	−0.127	32746.	LS
AT Vir	54184.631±0.002	−0.263	27590.	LS	SV Vol	54139.714±0.005	−0.103	32754.	LS
AT Vir	54225.643±0.003	−0.262	27668.	LS	SV Vol	54153.741±0.004	−0.080	32791.	LS
AT Vir	54234.582±0.002	−0.262	27685.	LS	SV Vol	54164.715±0.005	−0.083	32820.	LS
AV Vir	54129.599±0.005	0.023	19271.	C	SV Vol	54166.543±0.004	−0.148	32825.	LS
AV Vir	54180.834±0.003	0.019	19349.	LS	SV Vol	54167.763±0.002	−0.063	32828.	LS
AV Vir	54186.743±0.004	0.016	19358.	LS	SV Vol	54186.670±0.010	−0.081	32878.	LS
AV Vir	54198.569±0.003	0.017	19376.	C	SV Vol	54200.695±0.003	−0.061	32915.	LS
BB Vir	54172.792±0.002	−0.221	30905.	LS	SV Vol	54208.626±0.002	−0.078	32936.	LS
BB Vir	54180.802±0.002	−0.220	30922.	LS	SV Vol	54211.677±0.005	−0.055	32944.	LS
BB Vir	54198.703±0.002	−0.221	30960.	LS	SV Vol	54216.559±0.002	−0.093	32957.	LS
BB Vir	54200.587±0.004	−0.221	30964.	C	SV Vol	54222.662±0.005	−0.047	32973.	LS
BB Vir	54232.626±0.003	−0.217	31032.	LS	SV Vol	54224.492±0.005	−0.109	32978.	LS
BB Vir	54234.504±0.002	−0.223	31036.	C	SV Vol	54227.540±0.005	−0.089	32986.	LS
BC Vir	54178.859±0.002	0.126	60683.	LS	SV Vol	54233.640±0.003	−0.045	33002.	LS
BC Vir	54182.812±0.002	0.127	60690.	LS	BN Vul	54250.499±0.003	0.065	14677.	C
BC Vir	54199.748±0.002	0.128	60720.	LS	BN Vul	54275.453±0.005	0.066	14719.	C
BC Vir	54207.652±0.002	0.128	60734.	LS	BN Vul	54278.418±0.004	0.060	14724.	C

* C = Calern, LS = La Silla
1 Agerer and Moschner, 1996
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MINIMA TIMES OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
AUO1 and AUO2: 30-cm Maksutov telescope of the Ankara University Observatory. TUG1: 40-cm Cassegrain-Schmidt telescope of the Turkish National Observatory. TUG2: 40-cm Meade LX200-GPS telescope of the Tubitak National Observatory.

Detector:	Before 29 September 1992 the observations made with EMI9789QB photomultiplier tube. After that time we used OPTEC SSP-5A photometer containing a side-on R1414 Hamamatsu photomultiplier for AUO1 and AUO2 respectively. Ap7p and ST8-E CCD cameras were used for TUG1 and TUG2 respectively.

Method of data reduction:
Reduction of the AUO observations were made in the usual way (Hardie 1962). We used the MaxIm DL software for the reduction of the TUG data.

Method of minimum determination:
The minima times were computed by Kwee & van Woerden (1956) method.

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Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
LO And	53215.4797	0.0003	I	*BV*	AUO2, BG
44i Boo	47634.4403	0.0005	I	*UBV*	AUO1, ZM
	47635.5157	0.0002	I	*UBV*	AUO1, SOS
	47635.3826	0.0002	II	*UBV*	AUO1, SOS
	47640.4683	0.0004	II	*UBV*	AUO1, ZM
	47691.3562	0.0008	II	*UBV*	AUO1, SOS
	47692.4247	0.0004	II	*BV*	AUO1, FFÖ
	47697.3767	0.0003	I	*UBV*	AUO1, GK
	47697.5125	0.0004	II	*UBV*	AUO1, GK
	47960.3747	0.0001	I	*UBV*	AUO1, BG
	47960.5099	0.0005	II	*UBV*	AUO1, BG
	47962.5213	0.0008	I	*BV*	AUO1, GK
	47988.4949	0.0004	I	*BV*	AUO1, SOS
	48019.4285	0.0004	II	*UBV*	AUO1, ZM
	48049.4262	0.0006	II	*UBV*	AUO1, GK
	48049.2943	0.0004	I	*UBV*	AUO1, GK
	48050.3625	0.0002	I	*UBV*	AUO1, SOS
	48050.4949	0.0003	II	*BV*	AUO1, SOS
	48051.4327	0.0003	I	*BV*	AUO1, FFÖ
	48430.3967	0.0007	I	*BV*	AUO1, BA
	48431.3377	0.0002	II	*BV*	AUO1, BG
	48431.4695	0.0004	I	*BV*	AUO1, BG
	48433.3444	0.0004	I	*BV*	AUO1, AA
	48727.4089	0.0001	I	*UBV*	AUO1, HD
	48727.5438	0.0002	II	*UBV*	AUO1, HD
	48730.4898	0.0003	II	*UBV*	AUO1, ZM
	48761.4220	0.0001	I	*UBV*	AUO1, FE
	49109.5898	0.0001	I	*UBV*	AUO2, ZM
	49139.4487	0.0002	II	*UBV*	AUO2, SOS
	49139.3165	0.0001	I	*UBV*	AUO2, SOS
	49142.3936	0.0001	II	*UBV*	AUO2, ZM
	49944.3826	0.0004	I	*BV*	AUO2, SOS
	49945.3209	0.0001	II	*BV*	AUO2, BG
	50206.3100	0.0002	I	*BV*	AUO2, BG
	50245.4112	0.0003	I	*UBV*	AUO2, SOS
	50246.4824	0.0002	I	*BV*	AUO2, BG
	50248.4898	0.0002	II	*BV*	AUO2, ZM
	52031.5014	0.0001	I	*BV*	AUO2, LG-UA
	52052.5184	0.0001	II	*BV*	AUO2, LG-UA
	52073.4135	0.0004	II	*BV*	AUO2, LG-UA
	52108.3639	0.0001	I	*UBV*	AUO2, LG-UA
	52318.4627	0.0001	II	*BV*	AUO2, LG-MK
	52500.3167	0.0003	II	*BV*	AUO2, MK-LG
	52745.5027	0.0001	I	*BV*	AUO2, AT-MK
	52759.5605	0.0001	II	*UBV*	AUO2, AT-TE

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
FG Hya	53445.4428	0.0003	II	*BVR*	TUG1, GG-RK
XX LMi	53474.4515	0.0003	I	*BVR*	TUG1, US-NÖ
DI Peg	52843.5166	0.0002	I	*BV*	AUO2, LG-TE
CU Sge	53169.4984	0.0002	II	*BV*	AUO2, BG-ZM
AU Ser	53215.3608	0.0002	I	*BV*	AUO2, BG
HD 65498	53446.4341	0.0002	I	*BVR*	TUG1, YD-GG
	53448.4039	0.0002	II	*BVR*	TUG1, YD-GG
BD+42 2782	54215.5055	0.0000	II	*BVR*	TUG2, DC-BE
	54216.4314	0.0001	I	*BR*	TUG2, DC-BE
GSC 1174-0344	54045.4107	0.0002	I	*BVR*	TUG2, GG-GGl
	54046.3821	0.0002	II	*BVR*	TUG2, GG-GGl
GSC 2765-0348	53302.3008	0.0003	II	*BVR*	TUG1, NÖ-GS
	53302.4426	0.0002	I	*BVR*	TUG1, NÖ-GS
	53302.5844	0.0003	II	*VR*	TUG1, NÖ-GS
GSC 2751-1007	53300.4014	0.0002	I	*BVR*	TUG1, NÖ-GS
	53301.2365	0.0001	I	*BVR*	TUG1, NÖ-GS
	53301.4443	0.0001	II	*BVR*	TUG1, NÖ-GS

Explanation of the remarks in the table:

Remark gives observatory and the observers as BG: B. Gürol, ZM: Z. Müyesseroğlu, SOS: S.O. Selam, FFÖ: F.F. Özeren, GK: G. Kahraman, BA: B. Albayrak, AA: A. Akalın, HD: H. Dündar, FE: F. Ekmekçi, LG: L. Gürdemir, MK: M. Kırca, UA: U. Akçay, AT: A. Tunç, TE: T. Elmas, GG: G. Gökay, GGl: G. Gülnaz, NÖ: N. Özbek, RK: R. Kalcı, US: U. Sağır, YD: Y. Demircan, GS: G. Salman, DÇ: D. Çoker, BE: B. Eminoğlu.

Remarks:

The times of minima are weighted averages from all filters observed.

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UBVRI PHOTOMETRY OF DX And: THE 2006 OUTBURST

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The dwarf nova DX And is one of the few cataclysmic variables with the orbital period length near the upper limit of the range (10.6 hours), together with an exceptional long cycle length (270-330 days), a secondary star probably evolved off the main sequence, and a very low mass–transfer rate (Šimon, 2000). For all these reasons, DX And can be considered representative of the upper limit of the distribution of dwarf novae, and a detailed study of its activity can help to constrain theoretical models. Nevertheless, only a few outbursts have been studied in detail, and rarely with multi–colors photometry (see Šimon 2000 for an overview of the scarce database available in literature).

In the contest of a long-term variability study of a sample of dwarf novae, we are monitoring DX And since 1994 and we have already obtained photometric data in the BVR_CI_C bands during two outbursts, in 1994 and 2005 (Spogli et al., 1998, 2006). In this brief paper we present the results of our observations done in 2006, that includes also the U broad band together with the usual BVR_CI_c Johnson-Cousins filters. These are the firsts U data during the rise and the maximum of the outburst, since we know only two other data reported in literature obtained during the descending phase (Echevarria, 1984). The telescope we used was a 0.30-m f/6.5 Schmidt-Cassegrain reflector, equipped with an AP-32ME CCD camera (Kodak 3200-ME, 2184×1470 pixels) and Schuler $UBVR_CI_C$ filters, located on Mt. Subasio, Assisi (PG), Italy. The exposure time was 120–600 s depending on the brightness of the object and the filter used. The frames were first corrected for bias and flat-field, and then processed by a PC-based aperture photometry package developed by one of the authors using DAOPHOT routines (Stetson, 1987).

All the data here reported were obtained in differential photometry using the photometric comparison sequence around DX And tabulated in Table 1. The $UBVR_CI_C$ magnitudes have been calibrated with CCD observations obtained in July-August 2006 during three different photometric nights with respect to a selected sample of standard stars (Landolt 1983, 1992). Color transformation equations were characterized by slopes always within the margins 0.9–1.1. The photometric stability of the comparison stars can be guaranteed for C1 and C2 because they have been checked by repeated observations since 1994 (Spogli et al., 1998), while for the other stars we can only say that they were stable during the four months reported in this paper.

DX And has been monitored from July 23 to November 15, for a total of 40 different nights (Table 2). During the minimum we used only the R_C broad-band, because we already knew that in quiescence the emission of DX And is dominated by the secondary star (Spogli et al., 2006). Our data confirm that in this phase of activity the R_C magnitude oscillate between 14.4 and 14.6, probably ellipsoidal variations superimposed to additional variability, a typical pattern for long–period cataclysmic binaries (Hilditch, 1995). The precedent outburst occurred at the end of September 2005 (Spogli et al., 2006), so our aim was to observe the rise to the new outburst with the $UBVR_CI_C$ filters, and the outburst effectively went up at the middle of September 2006 (Fig. 1). We obtained data in all the photometric range during the rise up to the maximum, observed in the night of September 23. Unfortunately, soon after the outburst we were not able to use the U filter for technical problems, so we followed the decline with the BVR_CI_C bands.

Fig. 2 shows the spectral flux distribution of DX And during the rise. The magnitudes have been converted in $f(\lambda)$ using the flux calibrations reported by Bessell (2000). The increasing rate is more or less the same in all the filters, with the remarkable exception in the U, where the brightness continues to increase when in the other bands the maximum is already reached. This feature is quite common in outside–in outbursts, i.e. when the thermal instability (that gives rise to the outburst) starts in the outer part of the accretion disk and propagates inwards, producing an asymmetric light curve with a rapid rise and slow decay. The figure shows the progressive increase of the disk emission, theoretically represented - in a first approximation - as a power–law $f(\lambda) \propto \lambda^{-7/3}$, during the final steps of the outburst.

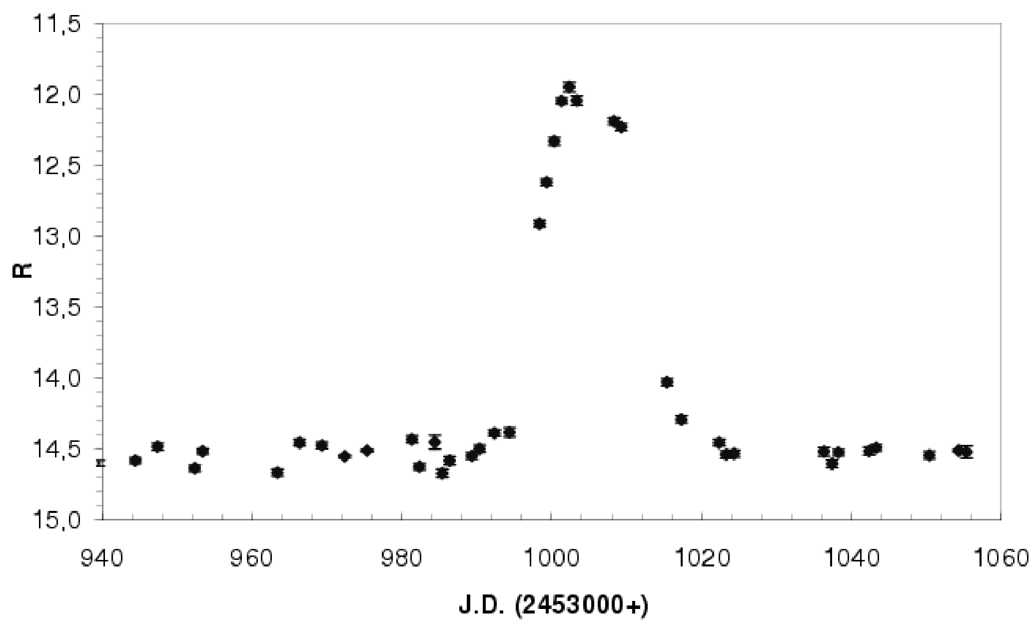

Figure 1. R_C light curve of DX And in July–October 2006. The maximum occurred in Sept.23

Table 1: Magnitudes and their errors for the stars in the photometric sequence.

Id	GSC id 03242-	RA (J2000)	DEC	U	B	V	R_C	I_C
C1	00510	23 29 42.7	+43 45 42	13.65±0.07	13.42±0.04	12.72±0.03	12.26±0.03	11.90±0.03
C2	00216	23 29 50.5	+43 44 49	13.98±0.07	13.90±0.04	13.33±0.03	12.95±0.03	12.64±0.03
C3	00856	23 30 01.2	+43 48 41	13.4±0.1	12.71±0.05	11.68±0.04	11.10±0.04	10.58±0.04
C4	00562	23 29 40.2	+43 50 04	13.2±0.1	12.21±0.05	11.03±0.04	10.36±0.04	9.84±0.04
C5	00990	23 29 24.5	+43 43 27	12.6±0.1	12.58±0.05	12.12±0.04	11.80±0.04	11.55±0.04

Table 2: $UBVR_CI_C$ magnitudes of DX And during the 2006 outburst

UT date	J.D. 2453000+	U	B	V	R_C	I_C
23/07/2006	939.534				14.60±0.02	
27/07/2006	944.401				14.58±0.02	
30/07/2006	947.378				14.48±0.03	
04/08/2006	952.359				14.63±0.02	
05/08/2006	953.391				14.52±0.02	
15/08/2006	963.369				14.67±0.03	
18/08/2006	966.354				14.45±0.02	
21/08/2006	969.335				14.47±0.02	
24/08/2006	972.353				14.55±0.01	
27/08/2006	975.329				14.51±0.01	
02/09/2006	981.325				14.43±0.02	
03/09/2006	982.327				14.62±0.02	
05/09/2006	984.352				14.45±0.05	
06/09/2006	985.375				14.67±0.03	
07/09/2006	986.343				14.58±0.03	
10/09/2006	989.316				14.55±0.02	
11/09/2006	990.335				14.50±0.02	
13/09/2006	992.342				14.39±0.02	
15/09/2006	994.345				14.38±0.03	
19/09/2006	998.371	12.70±0.10	13.31±0.03	13.12±0.03	12.91±0.02	12.80±0.06
20/09/2006	999.305	12.38±0.08	12.94±0.03	12.79±0.02	12.62±0.02	12.49±0.03
21/09/2006	1000.304	12.05±0.03	12.60±0.08	12.53±0.03	12.33±0.03	12.23±0.02
22/09/2006	1001.309	11.75±0.05	12.28±0.04	12.21±0.02	12.05±0.02	11.97±0.03
23/09/2006	1002.309	11.58±0.10	12.23±0.03	12.14±0.03	11.95±0.03	11.85±0.02
24/09/2006	1003.336		12.40±0.04	12.21±0.04	12.05±0.03	11.92±0.02
29/09/2006	1008.306		12.54±0.03	12.39±0.02	12.19±0.02	12.00±0.03
30/09/2006	1009.284		12.66±0.05	12.45±0.02	12.23±0.03	12.09±0.03
06/10/2006	1015.376		14.73±0.03	14.33±0.02	14.03±0.02	13.68±0.01
08/10/2006	1017.288		15.59±0.03	14.77±0.02	14.29±0.02	13.77±0.03
13/10/2006	1022.321				14.45±0.02	
14/10/2006	1023.278				14.54±0.02	
15/10/2006	1024.298				14.53±0.03	
27/10/2006	1036.305				14.52±0.03	
28/10/2006	1037.391				14.60±0.03	
29/10/2006	1038.227				14.52±0.02	
02/11/2006	1042.337				14.51±0.03	
03/11/2006	1043.267				14.49±0.02	
10/11/2006	1050.383				14.54±0.03	
14/11/2006	1054.302				14.51±0.01	
15/11/2006	1055.295				14.52±0.04	

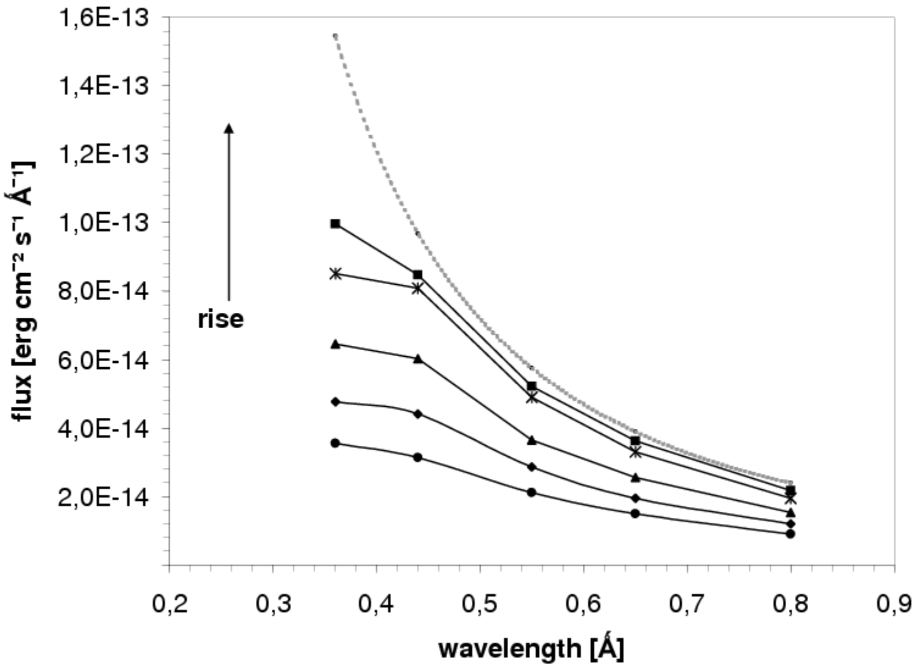

Figure 2. Spectral flux distribution of DX And during the rise to the outburst. The data have been obtained during the nights of September 19 (circle), 20 (diamond), 21 (triangle), 22 (cross) and 23 (box). The dotted line represents a generic power-law function $f(\lambda) \propto \lambda^{-7/3}$.

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MULTICOLOUR CCD PHOTOMETRY OF THREE RRab STARS

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We present multicolour CCD photometric observations of the three monoperiodic fundamental mode RR Lyrae variables BK Cas, EZ Cep, and ET Per. These stars were targets of our survey of brighter, northern, short period fundamental mode RR Lyrae variables (Sódor, 2007). The observations of all the three stars span two seasons, that is about 200−400 days. During these intervals none of them showed light curve variation exceeding our photometric accuracy which was somewhat less than 0.01 mag. Our light curves consist typically of 350−600 data points in each band.

Earlier photometric observations of BK Cas were published by Goranskij et al. (1973) and Schmidt & Seth (1996). NSVS (Wozniak et al., 2004) and Hipparcos (ESA, 1997) photometry is available of EZ Cep. ET Per was observed by Schmidt & Reiswig (1993) and by the NSVS (Wozniak et al., 2004). The few number of data points and/or the large errors of these observations do not allow to study the light curve stability of these variables and provide Fourier parameters only with large uncertainty.

Our observations were made with the 60 cm automatic telescope of Konkoly Observatory, Svábhegy, Budapest, equipped with a Wright 750x1100 CCD camera using BVI_C filters. ET Per was also observed with a Photometrics AT 200 CCD camera and BVR_CI_C filters attached to the 60/90 cm Schmidt telescope of Konkoly Observatory, Piszkéstető mountain station. Log of observations are summarized in Table 1.

Table 1. Log of observations

Star	Comparison	V_{comp} * [mag]	Observation period	No. of nights	filters	telescope
BK Cas	GSC 4025-01395	12.74	2453991 – 2454328	11	VI_C	60 cm
EZ Cep	GSC 4521-00784	13.63	2453964 – 2454166	26	BVI_C	60 cm
ET Per	GSC 3671-01241	11.90	2453728 – 2453751	4	BVR_CI_C	Schmidt
ET Per	GSC 3671-01241	11.90	2453988 – 2454171	8	BVI_C	60 cm

* V magnitudes of the comparison stars from the NOMAD catalogue (Zacharias et al., 2004).

CCD reduction and photometry was performed using standard IRAF†packages. Instrumental magnitudes were transformed to the standard BVR_CI_C system by observing photometric standards in M67 (Chevalier & Ilovaisky, 1991) with both telescopes.

†IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

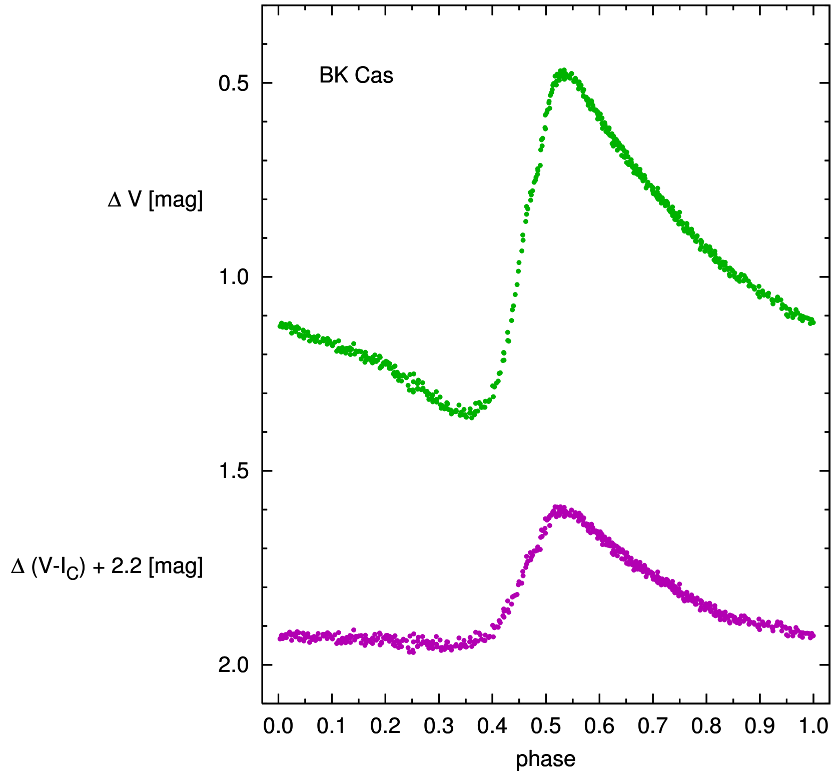

Figure 1. Differential V and $V - I_C$ light and colour curves of BK Cas.

Our photometric data available electronically from the IBVS website (5793-t5.txt−5793-t16.txt) list the relative BVR_CI_C magnitude and relative $B-V$, $V-R_C$ and $V-I_C$ colour time series with respect to the comparison stars. The constancy of the brightness of the comparisons was checked by measuring magnitude differences to several check stars in our field of view. The *r.m.s.* scatter of these data is between 0.006 and 0.01 mag in each band in accordance with the *r.m.s.* scatter of the Fourier fit of the light curves of the variables. The V light curves and the colour curves of the three stars are plotted in Figs. 1 − 3.

Fourier parameters of the V light curves are listed in Table 2. Normal and discrete maximum timings are given in Table 3.

Spectroscopic [Fe/H] values from the literature (transformed to the metallicity scale used by Jurcsik & Kovács, 1996) and [Fe/H] calculated from the Fourier parameters according to the formula derived in Jurcsik & Kovács (1996) are given in Table 4. The

Table 2. Fourier parameters of the V light curves.

Star	P [d]	A_1 [mag]	R_{21}	R_{31}	R_{41}	R_{51}	ϕ_{21} * [rad]	ϕ_{31} * [rad]	ϕ_{41} * [rad]	ϕ_{51} * [rad]
BK Cas	0.3902700(2)	0.306	0.539	0.301	0.167	0.095	2.612	5.461	1.978	4.647
EZ Cep	0.3790035(1)	0.393	0.572	0.349	0.231	0.137	2.431	5.266	1.675	4.421
ET Per	0.3940135(1)	0.439	0.542	0.369	0.239	0.166	2.320	5.042	1.346	4.098

* Phase differences are given according to sine term decomposition.

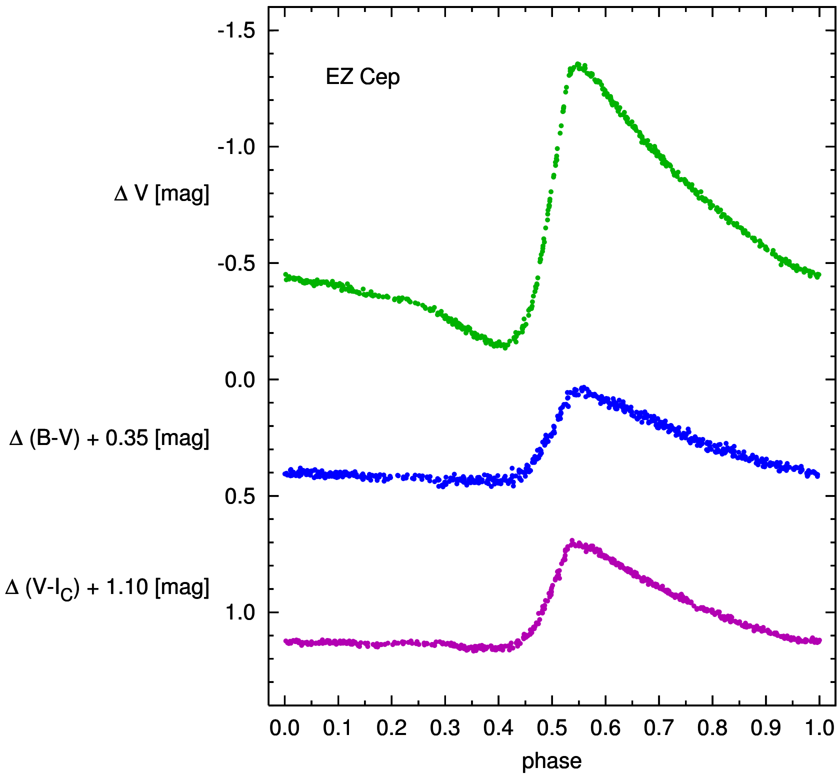

Figure 2. Differential V, $B-V$ and $V-I_{\rm C}$ light and colour curves of EZ Cep.

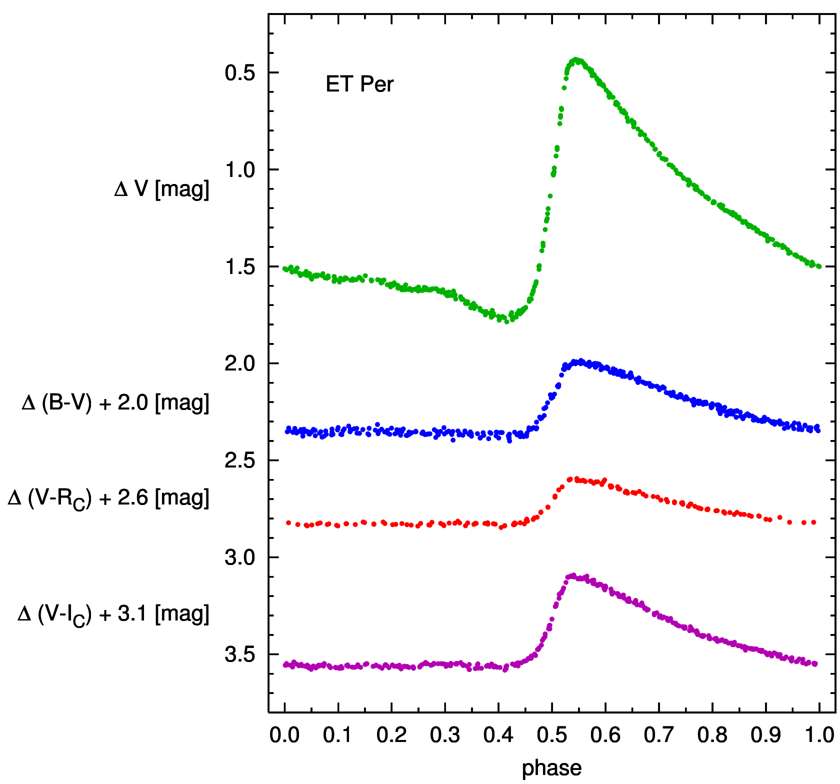

Figure 3. Differential V, $B-V$, $V-R_{\rm C}$ and $V-I_{\rm C}$ light and colour curves of ET Per.

metallicity of EZ Cep given by Mendes de Oliveira & Smith (1990) seems to be erroneous, as it differs significantly from the other two [Fe/H] determinations.

Table 3. Normal and discrete maximum timings of the V light curves.

Star	$T_{\max}$ - 2450000 [HJD]	type
BK Cas	54019.4667	Normal
	54327.1793	Normal
EZ Cep	54005.4023	Normal
	54166.478	Discrete
ET Per	53733.9048	Normal
	54000.2585	Normal
	54171.262	Discrete

Table 4. Spectroscopic and photometric [Fe/H] values.

Star	$[Fe/H]_{phot}$	$[Fe/H]_{spect}$
BK Cas	+0.21	
EZ Cep	0.00	−0.01 [a]
		−0.92 [b]
ET Per	−0.38	

a: Fernley & Barnes (1997)
b: Mendes de Oliveira & Smith (1990)

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ERRATUM FOR IBVS 5793

In IBVS 5793 Table 3 the 2nd line on the maximum timings of BK Cas gives erroneous $T_{\max}$ value. This line should correctly be: “BK Cas **54321.1434** normal”.

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DISCOVERY OF RAPID OSCILLATIONS IN HD 218994

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Asteroseismology has the potential to provide new insights into the physics of stellar interiors. Among the most promising objects that can be studied through this technique are the rapidly oscillating Ap (roAp) stars. These pulsate in high-overtone, low-degree, nonradial p-modes, with periods in the range 6–21 min. Our previous study (Hubrig et al., 2000) discussed the relationship between the roAp stars and the non-oscillating Ap (noAp) stars and concluded that the noAp stars are, in general, slightly more evolved than the roAp stars. The Ap Sr star HD 218994 was checked photometrically for the presence of rapid oscillations in the Cape Survey, but no oscillations have been detected by Martinez & Kurtz. This star was previously included in the sample of non-pulsating binary Ap stars studied by Hubrig et al. (2000). We have been granted one hour of UVES high time resolution observations of this star at ESO VLT on Cierro Paranal on November 15, 2006 and were able to obtain 15 spectra with exposure times of 3 min and a sampling of 3.7 min, taking into account the CCD readout time. To search for pulsational line variability, we calculated the average spectrum of the observed 15 spectra and subtracted it from the original spectra. In Fig. 1 we present the behaviour of the spectral profile of the Nd III line at λ 6327 and its standard deviations. Similar variations were also found for the Pr III lines at λ 6053 and λ 6090.

It was already shown in numerous studies that rare elements have higher amplitudes in roAp stars compared to lines of Fe-peak elements (e.g. Kurtz, Elkin & Mathys 2005). We also note that the mean RV for different elements is different, indicating the presence of chemical inhomogeneities on the stellar surface. Our analysis of RV variations of the Nd III line indicates two pulsation periods: one period of 5.1 min with an amplitude of 516 m/s and another one of 13.9 min and an amplitude of 497 m/s. It is very likely that one of these peaks is an alias. The amplitude spectrum of the radial velocity variations is presented in Fig. 2.

We note that a longer time series with better temporal resolution is needed for a careful identification of the principal frequency and a search for the presence of other pulsation frequencies. To confirm the detected spectroscopic variation period, we searched for a periodicity in the photometric data using Hipparcos and ASAS photometric databases. Indeed, also the photometric data show a sinusoidal variation with a period identical to the spectroscopic period, P=5.1 min, and an amplitude of 0.005 mag. In Fig. 3 we present both the RV variations of the Nd III line and the ASAS light curve.

The star HD 218994 becomes now the 36th star known to be a roAp star.

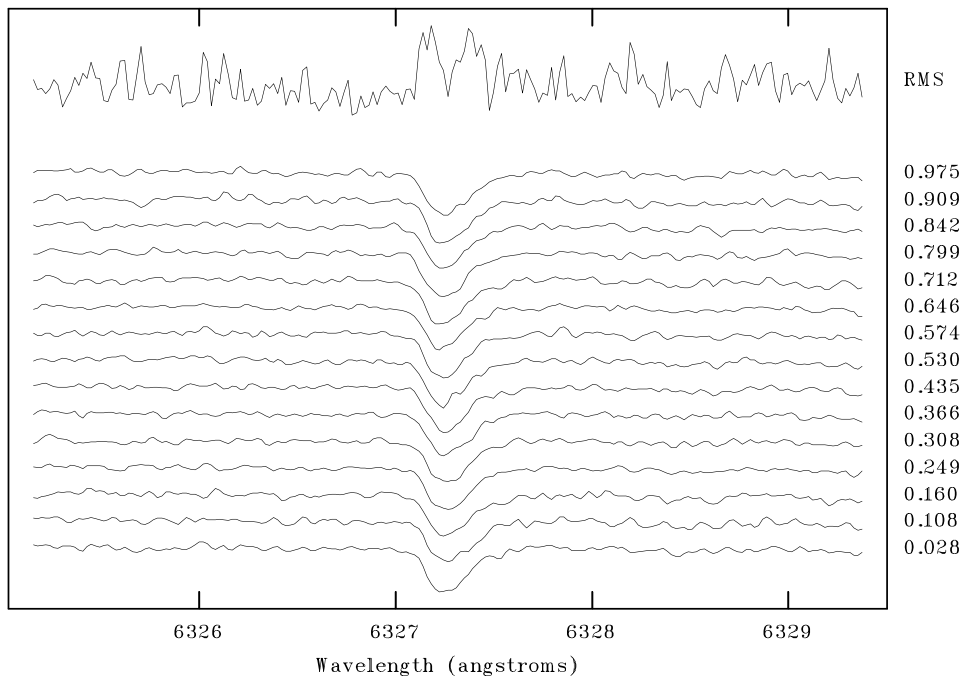

Figure 1. The behaviour of the profile of the Nd III line at λ 6327. In the top part we present the standard deviation and in the bottom the observed variations of this line.

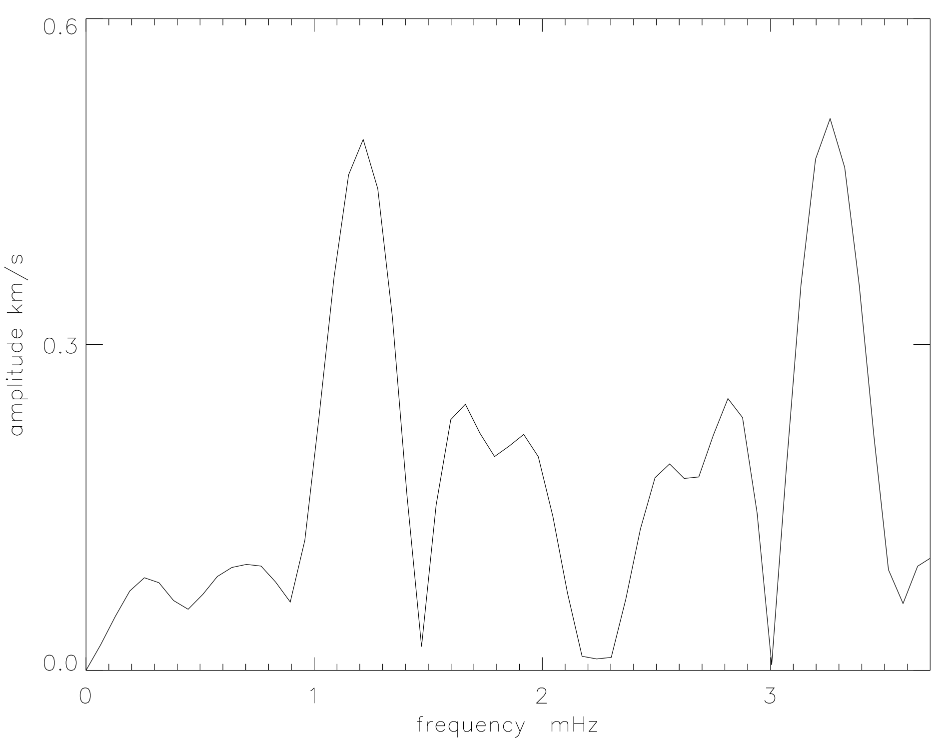

Figure 2. The amplitude spectrum of the radial velocity variations of the Nd III line at λ 6327.

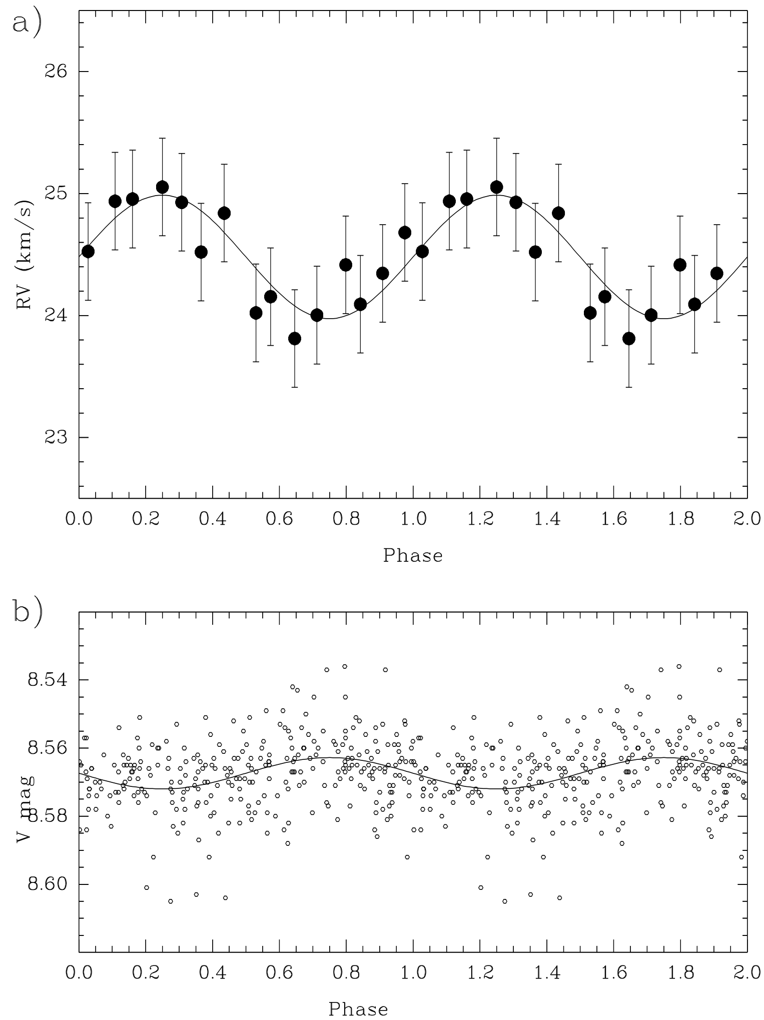

Figure 3. RV curve of the Nd III line at λ 6327 (upper panel) and photometric data from the ASAS database phased with the period P=5.1 min (lower panel).

References:

Hubrig, S., Kharchenko, N. Mathys, G., North, P., 2000, *A&A*, **355**, 1031
Kurtz, D.W., Elkin, V.G., Mathys, G., 2006, *MNRAS*, **370**, 1274
Martinez, P., Kurtz, D.W., 1994, *MNRAS*, **271**, 129

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NEW TIMES OF MINIMA OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
30-cm Cassegrain-Schmidt telescope of the Çanakkale University Observatory

Detector:	-ST237 camera, Peltier cooling, TC237 chip, $11' \times 8'$ FOV, 640×480 pixels, (ÇUG301). -ST10XME camera, Peltier cooling, KAF 3200ME chip, $17' \times 12'$ FOV, 2184×1472 pixels, (ÇUG302).

Method of data reduction:
Reduction of the CCD frames was made with C-MUNIPACK[1] software.

Method of minimum determination:
Kwee – van Woerden method (Kwee & van Woerden, 1956).

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
SX Aur	54084.3175	0.0007	I	C	ÇUG301
ZZ Aur	54184.2922	0.0002	I	C	ÇUG301
GX Aur	54116.3510	0.0003	I	C	ÇUG301
TU Boo	54211.4025	0.0002	I	C	ÇUG301
TZ Boo	54198.4612	0.0002	I	C	ÇUG301
VW Boo	54201.4855	0.0002	II	C	ÇUG301
BI CVn	54184.4517	0.0008	I	C	ÇUG301
	54211.3464	0.0002	I	C	ÇUG301
XZ CMi	54085.4095	0.0009	I	C	ÇUG301
	54184.3868	0.0003	I	C	ÇUG301

[1]Motl, D., 2004, C-MUNIPACK, `http://integral.sci.muni.cz/cmunipack/`

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
BS Cas	54074.2906	0.0005	II	C	ÇUG301
V366 Cas	54086.4929	0.0008	I	C	ÇUG301
V389 Cas	54076.5044	0.0008	I	C	ÇUG301
	54161.3283	0.0005	I	C	ÇUG301
V523 Cas	54086.4499	0.0001	I	C	ÇUG301
VW Cep	54076.3909	0.0012	I	C	ÇUG301
WZ Cep	54086.2622	0.0003	II	C	ÇUG301
BE Cep	54086.3805	0.0002	I	C	ÇUG301
EG Cep	54067.4001	0.0003	I	C	ÇUG301
	54213.3582	0.0001	I	C	ÇUG301
GI Cep	54086.3182	0.0003	I	C	ÇUG301
GW Cep	54211.2857	0.0002	II	C	ÇUG301
RW Com	54201.4419	0.0002	I	C	ÇUG301
RZ Com	54201.5286	0.0002	II	C	ÇUG301
CC Com	54198.3907	0.0001	I	C	ÇUG301
	54213.3979	0.0003	I	C	ÇUG301
TW CrB	54213.4330	0.0002	II	C	ÇUG301
YY Eri	54067.4528	0.0002	II	C	ÇUG301
DF Hya	54161.4093	0.0001	I	C	ÇUG301
SW Lac	54067.3324	0.0004	II	C	ÇUG301
UZ Leo	54255.3401	0.0003	I	V	ÇUG302
AP Leo	54211.4842	0.0004	II	C	ÇUG301
FZ Ori	54117.2571	0.0005	I	C	ÇUG301
RZ Tau	54111.3552	0.0002	II	C	ÇUG301
	54138.3745	0.0002	II	C	ÇUG301
EQ Tau	54116.4222	0.0003	I	C	ÇUG301
BM UMa	54211.4417	0.0002	I	C	ÇUG301

Remarks:

We present 37 minima times of 31 eclipsing binaries. In the Remarks column of Times of Minima table, telescopes used in the observations are given.

Acknowledgements:

This work was partly supported by the Research Found of Çanakkale Onsekiz Mart University.

Reference:

Kwee, K. K., & van Woerden, H., 1956, *Bull. Astron. Inst. Neth.*, **12**, 327.

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MINIMA TIMES FOR SELECTED CLOSE BINARY STARS

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Observatory and telescope:
50cm LOMO Cassegrain N 274 500 f/10 telescope, University of Göttingen, Physics building (51° 33′ 38.″5 N, 09° 56′ 41.″3 E, elevation 201 m)

Detector:	SBIG STL-6303E, KAF-6303E chip, Peltier cooling, 18.′9 × 12.′6 FOV, 3072 × 2048 pixels.

Method of data reduction:
Reduction of the CCD frames was made with the custom-made IDL[1] aperture photometry package TRIPP (Schuh et al. 2003).

Method of minimum determination:
The minima times were determined with a linear combination of a Gaussian and a quadratic function.

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
PX And	53752.3519	0.0018	I	V	RDD; TMA
	53759.3799	0.0011	I	V	DJ; WS
	54085.3082	0.0014	I	R	AR; GS; HT; WA
	54085.4551	0.0014	I	R	AR; GS; HT; WA
EX Dra	53863.5422	0.0023	I	R	BB; BP
	53896.5007	0.0014	I	R	HI; KR
	53899.4405	0.0013	I	R	BrS; DT; TI
HS 0705+67	54126.4097	0.0011	I	R	BC; BeS; KN; KT; TI
	54126.4580	0.0011	II	R	BC; BeS; KN; KT; TI
	54126.5049	0.0011	I	R	BC; BeS; KN; KT; TI
	54126.5533	0.0011	II	R	BC; BeS; KN; KT; TI
	54126.6007	0.0024	I	R	BC; BeS; KN; KT; TI
AI Tri	54049.4686	0.0011	unknown	clear	TI; WS

[1]Interactive Data Language by http://www.ittvis.com

Explanation of the remarks in the table:
Observers: AR = Anderson, R.; BB = Beeck, B.; BC = Bergmann, C.; BP = Bittihn, P.; BeS = Becker, S.; BrS = Brandert, S.; DD = Dauber, D.; DJ = Dobschinski J.; DT = Dabrowski T.; GS = Grünheit, S.; HI = Heinze, I.; HT = Hattermann, T.; KN = Kurz, N.; KR = Kruspe, R.; KT = Kresse, T.; NN = Nolte, N.; RDD = Röhrs, D.D.; TI = Traulsen, I.; TMA = Tyra, M.A.; WA = Wiesbaum, A.; WS = Wende, S. All observations (except for the AI Tri observation) were taken during the "Physikalisches Praktikum für Fortgeschrittene" under the supervision of S. Schuh.

Remarks:
Exposure times were either 3 or 4 minutes. The time stamp uncertainty in the images was determined to be never any larger than 15 s. Typical photometric accuracies obtained were around 0.03 mag.

Acknowledgements:
We would like to thank K. Reinsch for providing technical support at the observatory whenever necessary, and S. Dreizler for having made possible this work.

Reference:

Schuh, S., Dreizler, S, Deetjen, J.L., Göhler, E., 2003, *Baltic Astronomy*, **12**, 167

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PHYSICAL PARAMETERS OF THE COMPONENTS OF THE VISUAL BINARY CCDM 11289–6256

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Recently (Fabricius et al., 2002), the star HD 99898 was discovered to be a visual binary (CCDM 11289–6256) with V_A=9$^m_.$9, V_B=10$^m_.$3, and $\rho = 0''.8$. Somewhat earlier, it was found to be an eclipsing system with $P = 5^d_.048912$ (Pojmanski, 2000). Otero and Wils (2006) reported fast apsidal motion of the eclipsing binary's elliptic orbit, with the period $U_{\rm obs} = 135 \pm 10$ years.

Earlier the star, which is a member of the young association Cru OB1, was considered a single object. Its brightness variability was first noticed from outside-atmosphere ultraviolet observations by Wesselius et al. (1982), and it entered the Supplement to the NSV catalog as NSV 18773. From Strömgren and H_β photometry, Kaltcheva and Georgiev (1994) estimated the star's absolute parameters. However, the discovery of the star being a visual binary and of its eclipsing variability makes it necessary to revise the parameters determined earlier.

Figures 1 and 2 present the V-band and I-band light curves of NSV 18773, respectively from ASAS-3 (Pojmanski, 2002) and ASAS-2 (Pojmanski, 2000) data. To plot the curves, the phases of the observations near MinI and MinII were calculated with the same epoch, MinI = HJD 2452068.1717(22), which corresponds to the primary minimum epoch in the middle of the available observations, but with different periods, $P_{\rm I}$ and $P_{\rm II}$ respectively for MinI (phases between 0.75 and 0.25) and MinII (phases between 0.25 and 0.75), derived from our analysis of all the observations:

$$P_{\rm I} = 5^d_.049164(10), \quad P_{\rm II} = 5^d_.049833(12).$$

It appears from the figures that the V-band and I-band light curves are very similar and that the primary minimum is twice wider than the secondary one, evidencing a large orbital eccentricity. We determined the photometric elements from our analysis of these light curves applying the iterative method of differential corrections (Khaliullina and Khaliullin, 1984), they are presented in the figures using the standard notation. Table 1 contains the V- and I-band magnitudes of all the components of the system, found from the derived L_1, L_2, and L_3 and the combined outside-eclipse V and I magnitudes of the system. The physical parameters of the components computed from our photometric elements are collected in Table 2.

The following remarks to the tables are needed.

1. The contribution of the third light to the V-band and I-band light curves is the same, $L_3 \equiv L_A = 0.61$ of the visual system's combined brightness. Thus, it is the fainter B component of the visual system that is the eclipsing binary, $L_B \equiv L_1 + L_2 = 0.39$.

2. The minima being shallow, the light curves do not permit to find the components' radius ratio precisely enough without additional assumptions. Thus we used the natural assumption that the components are of equal age. The ages of the components were determined by comparison of $\log g_1$ and $\log g_2$ to the stellar evolutionary models from Claret and Gimenez (1992).

3. Since it is the A component that mainly contributes to the system's light, the spectral type estimate Sp = O9V (Jaschek, 1978) must refer to this particular component. In such a case, we are able to estimate the spectral type of the primary of the eclipsing binary as Sp_1 = B0V and of its secondary, as Sp_2 = B1V from the V-magnitude differences of all the components (equivalent to the differences of their absolute magnitudes, M_V) and the ratio of surface brightnesses, J_2/J_1.

4. No radial velocity curves were published for the system. We thus adopted $M_1 = (20 \pm 1.5) M_\odot$ and $T_1 = (31\,500 \pm 1\,500)$ K for Sp_1 = B0V, in agreement with the known empirical relations between stellar parameters. The rest of the absolute parameters in Table 2 are derived from M_1, T_1, and the photometric elements.

5. The color excess, $E_{B-V} = 0^m.65$, and the extinction, $A_V = R \cdot E_{B-V} = 2^m.02$ for $R = 3.1$, were calculated using the UBV magnitudes of HD 99898: V = $9^m.35$, B–V = $0^m.34$, U–B = $-0^m.63$ (Nicolet, 1978) and $(B–V)_0 = -0^m.31$ for Sp = O9V. IR photometry of HD 99898 is known from the 2MASS Point Source Catalog: J = $8^m.421$, H = $8^m.352$, and K = $8^m.287$. The value $R = 3.1$ used to calculate A_V is based on the agreement of $(V–K)_0^{obs}$ with the mean $(V–K)_0 = -0^m.90$ for OV and B0V stars.

The age we derive for the system, $t = (2.8 \pm 0.5) \cdot 10^6$ years, is twice lower than that found by Kaltcheva and Georgiev (1994), whereas our distance to the system, $d = (3.3 \pm 0.3)$ kpc, is larger by a factor of 1.5. This is obviously due to multiplicity of HD 99898 not taken into account in the cited paper.

With the derived parameters of the system, we can use the known theoretical relations (Kopal, 1978) and models of stellar evolution (Claret and Gimenez, 1992) to compute the theoretically expected apsidal-motion period:

$$U_{\rm th} = 169 \pm 15 \text{ years.}$$

$U_{\rm th}$ somewhat exceeds $U_{\rm obs} = 135 \pm 10$ years, as found in Otero and Wils (2006). To improve the system parameters, spectroscopic observations permitting to obtain the radial velocity curves and to determine the axial-rotation angular velocities of the components are needed.

This study was supported, in part, by a grant from the Russian Foundation for Basic Research (grant No. 05-02-16289) and by a grant from the "Origin and Evolution of Stars and Galaxies" Program of the Presidium of the Russian Academy of Sciences.

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Jaschek, M., 1978, *Bull. Inform. CDS*, **15**, 121
Kaltcheva, N.T. and Georgiev, L.N., 1994, *MNRAS*, **269**, 289
Khaliullina, A.I. and Khaliullin, Kh.F., 1984, *Soviet Astronomy*, **28**, 228

Kopal, Z., 1978, *Dynamics of Close Binary Systems*, Dordrecht: D. Reidel Publishing Co.
Nicolet, B., 1978, *Astron. and Astrophys. Suppl. Ser.*, **34**, 1
Otero, S., Wils, P., 2006, *IBVS*, No. 5680
Pojmanski, G., 2000, *Acta Astron.*, **50**, 177
Pojmanski, G., 2002, *Acta Astron.*, **52**, 397
Wesselius, P.R., van Duinen, R.J., de Jonge, A.R.W., et al., 1982, *Astron. and Astrophys. Suppl. Ser.*, **49**, 427

Table 1. Magnitudes and spectral types of the components of the visual binary CCDM 11289–6256 (A + B), the eclipsing binary NSV 18773 (B = Pr + Sec), and the whole system of HD 99898 (A + Pr + Sec)

	A	B = Pr + Sec	Primary	Secondary	HD 99898 A + Pr + Sec
V	$9\overset{\mathrm{m}}{.}89$	$10\overset{\mathrm{m}}{.}37$	$10\overset{\mathrm{m}}{.}80$	$11\overset{\mathrm{m}}{.}58$	$9\overset{\mathrm{m}}{.}35$
I	$9\overset{\mathrm{m}}{.}37$	$9\overset{\mathrm{m}}{.}85$	$10\overset{\mathrm{m}}{.}27$	$11\overset{\mathrm{m}}{.}09$	$8\overset{\mathrm{m}}{.}83$
Sp	O9V	–	B0V	B1V	–

Table 2. Physical parameters for the eclipsing binary NSV 18773

Parameter	Primary	Secondary
Mass $M/M_\odot$	20 ± 1.5	14 ± 1.0
Radius $R/R_\odot$	6.5 ± 0.2	5.0 ± 0.2
Effective temperature T_e, K	$31\,500 \pm 1\,500$	$27\,000 \pm 1\,000$
Luminosity $\log L/L_\odot$	4.57 ± 0.08	4.08 ± 0.06
Gravity $\log g$	4.11 ± 0.03	4.18 ± 0.03
Abs. visual magnitude M_V	$-3\overset{\mathrm{m}}{.}79 \pm 0\overset{\mathrm{m}}{.}21$	$-3\overset{\mathrm{m}}{.}00 \pm 0\overset{\mathrm{m}}{.}17$

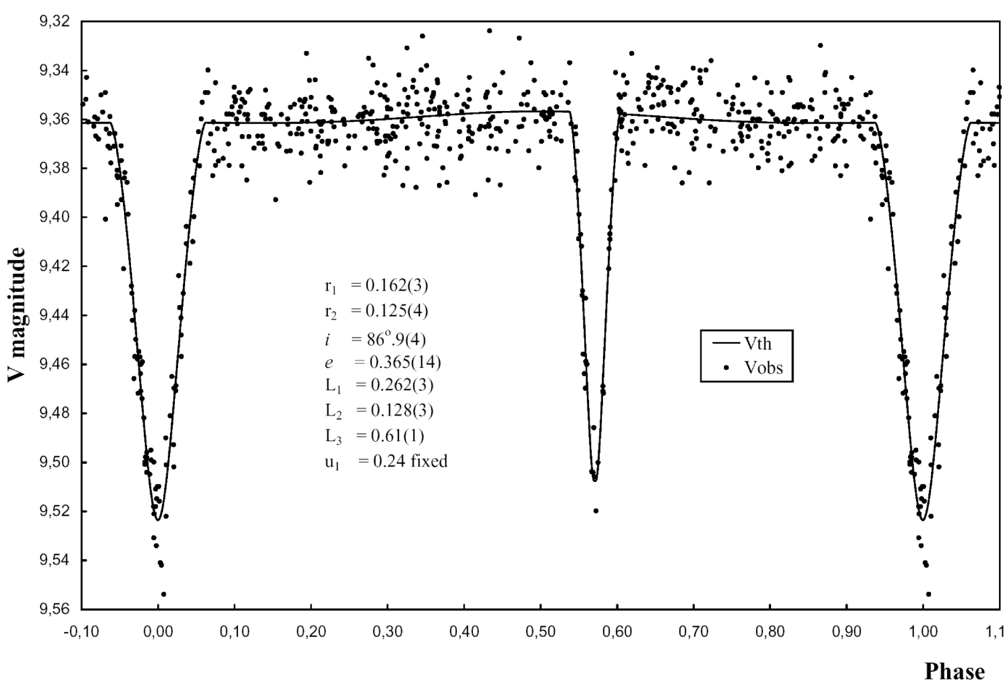

Figure 1. The ASAS-3 V-band light curve of NSV 18773. The solid curve is the theoretical light curve with the photometric elements given in the figure

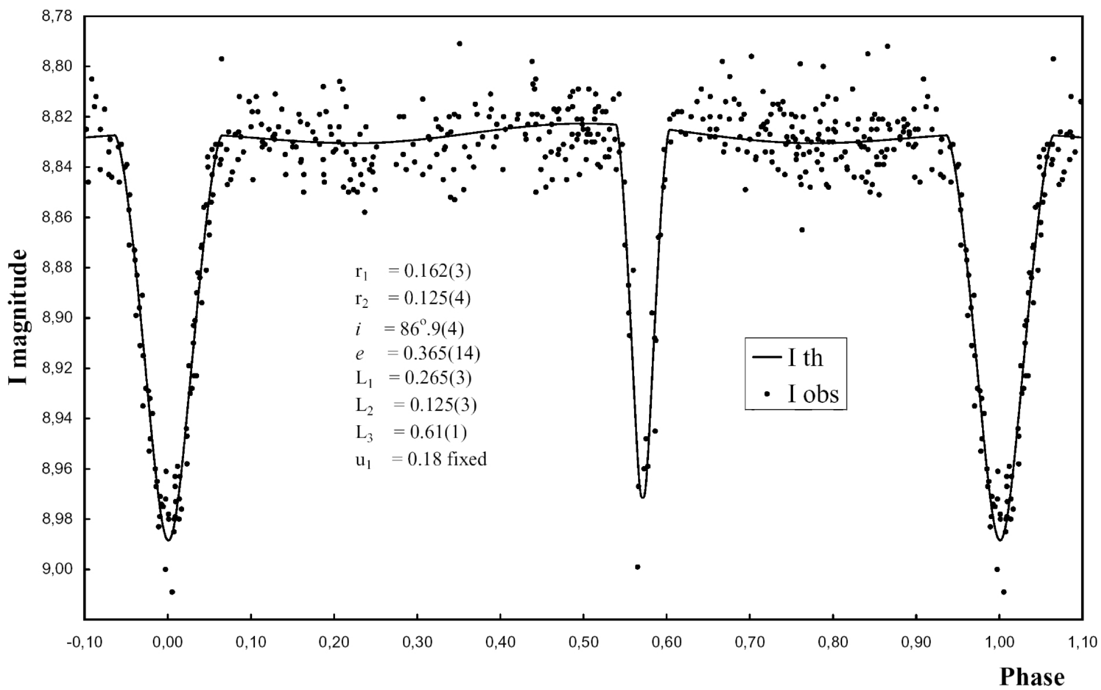

Figure 2. The ASAS-3 I-band light curve of NSV 18773. The solid curve is the theoretical light curve with the photometric elements given in the figure

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δ SCUTI COMPONENT DISCOVERED IN ECLIPSING BINARY SYSTEM BO Her

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BO Her (HD 336759) is listed as a likely semidetached eclipsing binary system in the catalog of Budding et al. (2004). The General Catalogue of Variable Stars (GCVS), 4th Edition (Kholopov, 1985) describes BO Her as having a period of 4.272843 days, magnitude of V=10.8, and depth of primary minimum of 2.1. An $O-C$ diagram for this system spanning 60 years shows subtle variations that have not yet been examined (Kreiner et al., 2001).

In a recent publication, E. Soydugan et al. (2006) identified the primary component of BO Her (spectral type A7) as lying in the δ Scuti region of the Cepheid instability strip and have placed it on a list of eclipsing binary systems that might contain pulsating components. At present there are only about three dozen known binary systems with one or more δ Scuti components (E. Soydugan et al., 2006; Pigulski & Michalska, 2007; E. Soydugan & F. Soydugan, 2007; Christiansen et al., 2007). Most are semidetached systems; such stars are also called oscillating eclipsing Algol (oEA) stars.

We chose to conduct multifilter photometry of BO Her as part of an ongoing project to determine complete light curves of selected Algol-type (semidetached) binary systems, initially unaware of its potential to contain a pulsating component. We observed BO Her during ten nights between June 14 and July 25, 2007 at the Truman State University Observatory using a 20-cm Meade LX200-GPS telescope. We used both a SBIG ST-7XME CCD camera with B and V filters, and a SBIG ST-402ME CCD camera with B, V, and I filters. The stars HD 336745, HD 336750 and a third uncatalogued star were used as comparisons. MPO Connections was used to control the telescope and CCD camera; MPO Canopus was used for image reduction and data analysis.[1] At present, the light curve for BO Her is about 50% complete, and is shown in Figure 1.

There is some confusion in the literature about the period of BO Her. The GCVS gives a period of 4.272843 days, but the Budding catalog (2004) lists two periods, the GCVS value and 3.087357 days, citing Kreiner et al. (2001). This shorter period is further quoted by E. Soydugan et al. (2006). Our observations show a period of 4.2731 days, in agreement with the GCVS value. The erroneous period of 3.087357 days actually belongs to BC Her, which appears immediately before BO Her in Kreiner's list.

Upon inspection of a single night's worth of data where an eclipse is not present, it became apparent that the binary nature of BO Her was not the only source of variability.

[1]Bdw Publishing, Colorado Springs, CO, `http://www.minorplanetobserver.com`

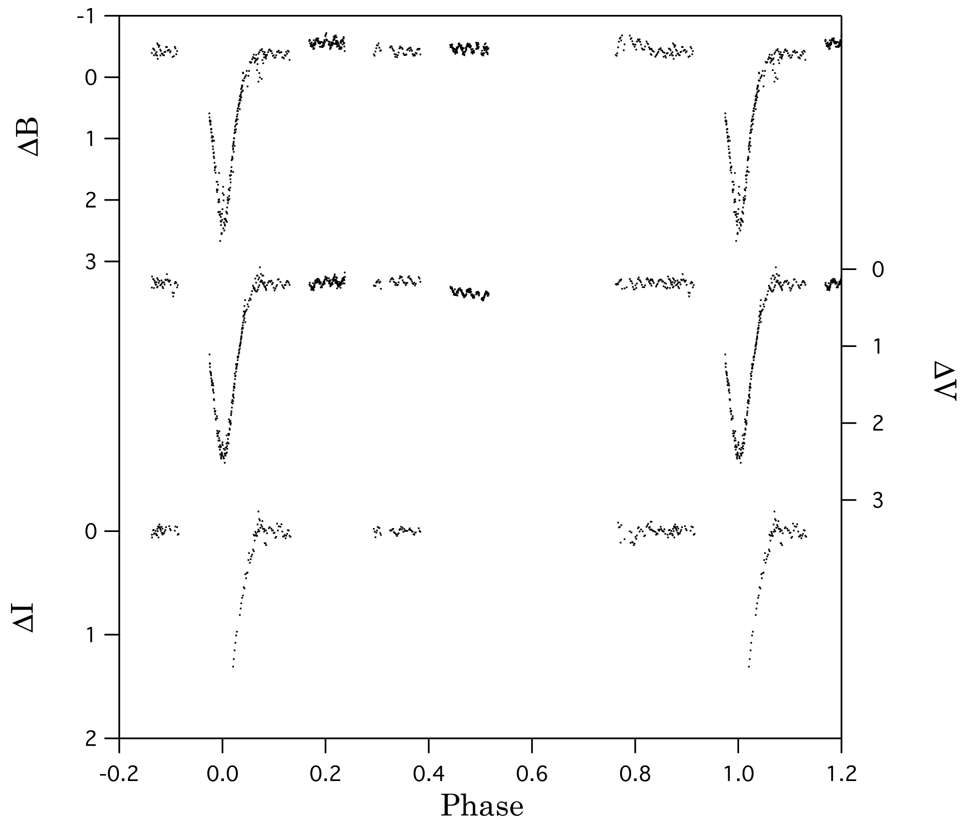

Figure 1. Phased B, V, and I light curves of BO Her.

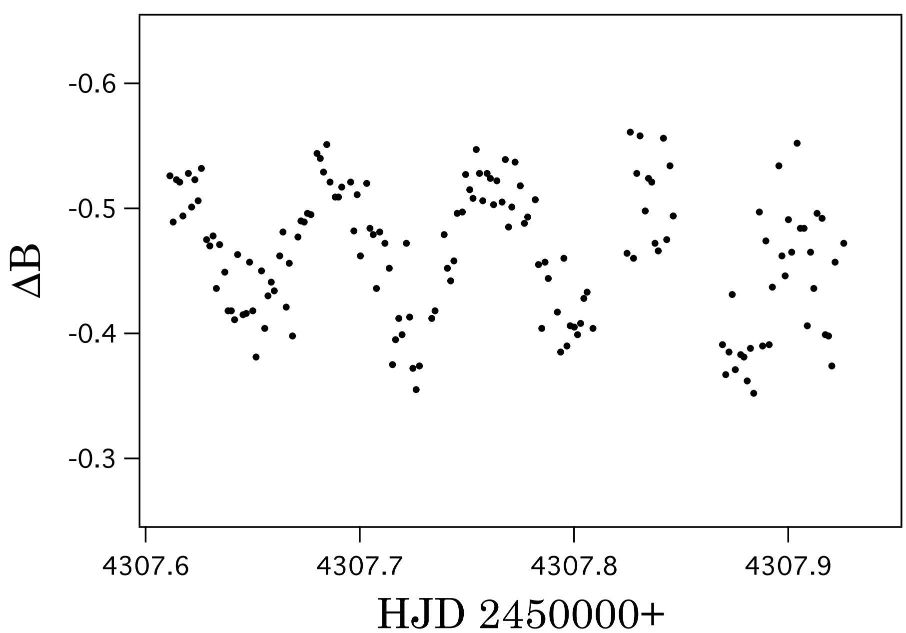

Figure 2. Light curve of BO Her on July 25, 2007 (B filter), showing short-period oscillations.

Figure 2 shows 6.5 hours of data from the night of July 25, 2007, which reveals a rapid, low amplitude variation that we attribute to the presence of a δ Scuti component in this system. On one night we were able to observe about half of the shallow secondary eclipse, which is most clearly seen in the V-filter light curve of Figure 1. Because the short-period variability is present during the secondary eclipse, we can identify the primary star of the system as the δ Scuti component.

After removing the nightly trends in the data due to the binary nature of the system, we performed a period analysis on the short-period variability using Peranso.[2] Figure 3 shows the power spectrum generated using the Lomb-Scargle method, which reveals only a single period, suggesting that the δ Scuti component pulsates in a single mode. Using the discovered period of P = $1.7871^h \pm 0.0007$, the data set was folded to reveal the characteristic light curve of a δ Scuti star with an amplitude of approximately 0.12 in B, 0.08 in V, and 0.05 in I; see Figure 4.

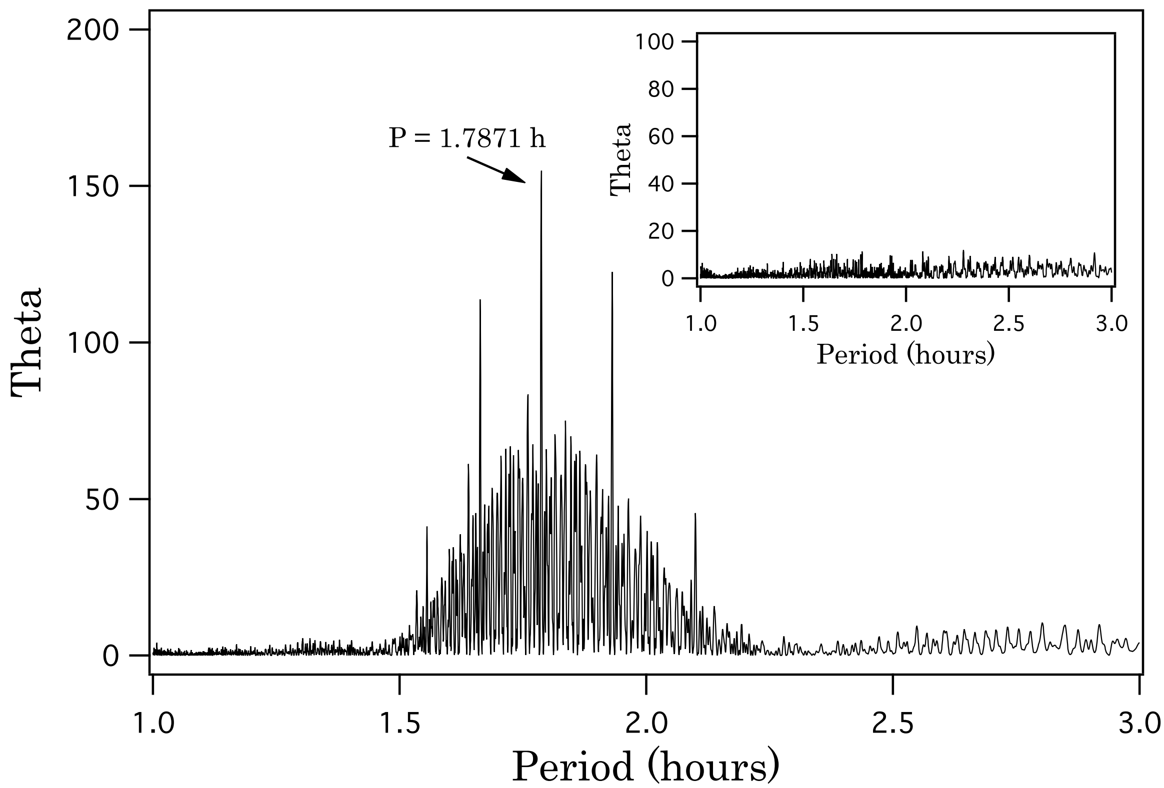

Figure 3. Lomb-Scargle power spectrum of small-amplitude oscillations (V filter). The insert shows the residual power spectrum after prewhitening and removal of dominant period of 1.7871^h.

Acknowledgments. This material is based upon work supported by the National Science Foundation under Grant No. 0431664

[2]T. Vanmunster, Landen, Belgium, `http://www.peranso.com`

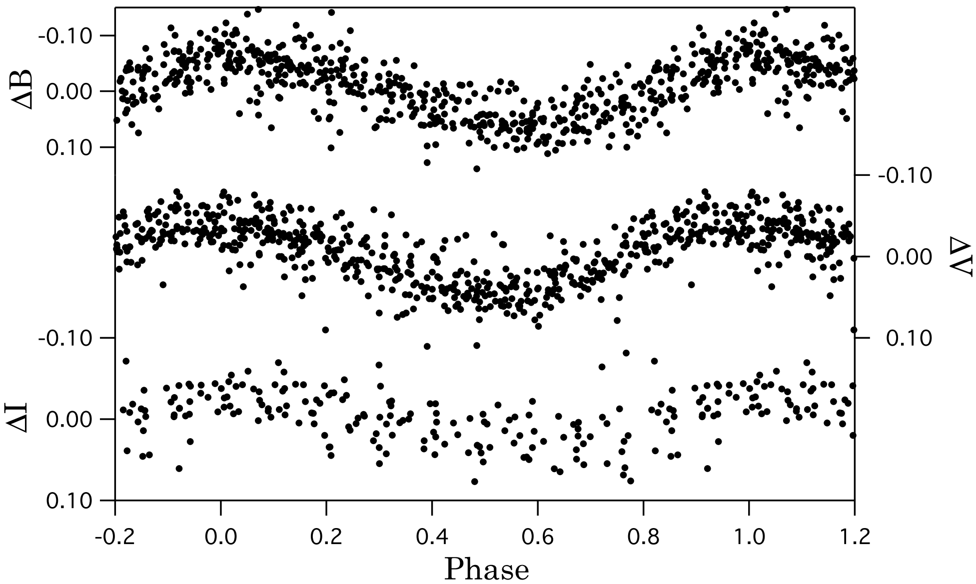

Figure 4. B, V, and I light curves for BO Her with variations due to eclipses removed. Data has been folded with a period of 1.7871 hours.

References:

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OBSERVATIONS OF VARIABLES

The last but one issue of the volume publishes new observations, and results on known variable stars. Figures and data files are available electronically.

Previous reports can be found in IBVS No. 5699.

The Editors

Date: 7 November 2006
Reported by:
Blättler, E. - BBSAG, Switzerland, blaettler-wald@bluewin.ch
Diethelm, R. - BBSAG, Switzerland, rdiethelm@gmx.ch

Blättler has performed CCD observations in the V and R bands on the following stars with a SBIG ST-7 camera attached to his 0.15-m Starfire refractor in Wald, Switzerland, during 8 nights between JD 2453858 and JD 2453910.

Name of the object:
GSC 1518-913 = NSVS 10695152 = ASAS 162446+2139.1
Remarks:
A total of 166 measurements in both colours were obtained, using GSC 1518-635 (10.50 mag) as comparison and GSC 1518-649 (10.75 mag) as check star. A linear regression of the 8 times of minimum with the ROTSE1 data yields the following results: Type: EW; JD (min I, hel) = 2453900.5264 + 0.321156 × E; ΔR(prim.) = 0.18 mag; ΔR(sec) = 0.15 mag. The $V - R$ colour curve shows no variation exceeding the accuracy of the photometry.

Name of the object:
GSC 2587-1888 = NSVS 7913634
Remarks:
A total of 169 measurements in both colours were obtained, using GSC 2587-918 (11.02 mag) as comparison and GSC 2587-610 (11.03 mag) as check star. A linear regression of the 8 times of minimum with the ROTSE1 data yields the following results: Type: EW; JD(min I, hel) = 2453877.4694 + 0.310726 × E; ΔR(prim.) = 0.17 mag; ΔR(sec) = 0.17 mag. The $V - R$ colour curve shows no variation exceeding the accuracy of the photometry.

Name of the object:
GSC 2587-289 = NSVS 7912995

Remarks:
A total of 214 measurements in both colours were obtained, using SAO 65316 (10.39 mag) as comparison and SAO 65330 (10.06 mag) as check star. A linear regression of the 10 times of minimum with the ROTSE1 data yields the following results: Type: EW; JD(min I, hel) = 2453898.3997 + 0.337043 × E; ΔR(prim.) = 0.41 mag; ΔR(sec) = 0.36 mag. The $V-R$ colour curve shows no variation exceeding the accuracy of the photometry.

Name of the object:
GSC 963-246 = NSVS 10670664 = NSVS 10732160 = ASAS 162745+1103.6

Remarks:
A total of 195 measurements in both colours were obtained, using GSC 963-370 (10.41 mag) as comparison and GSC 963-108 (11.32 mag) as check star. A linear regression of the 9 times of minimum with the ROTSE1 data yields the following results: Type: EW; JD(min I, hel) = 2453906.4880 + 0.385493 × E; ΔR(prim.) = 0.33 mag; ΔR(sec) = 0.30 mag. The $V-R$ colour curve shows no variation exceeding the accuracy of the photometry.

Date: 8 November 2006

Reported by:
Zboril, M. - Astronomical Institute, Tatranská Lomnica, 059 60, Slovakia, zboril@astro.sk

Name of the object:
FY Boo

Remarks:
FY Boo was observed in V and R colors with the 0.5m telescope / SBIG ST10 CCD camera of the Stará Lesná observatory, on May 3rd 2006. The comparison and check stars were GSC 1999-854 and GSC 1999-388, respectively.

Name of the object:
V523 Cas

Remarks:
V523 Cas was observed in V and R colors with the 0.5m telescope / SBIG ST10 CCD camera of the Stará Lesná observatory, on September 5th 2006. The comparison and check stars were GSC 3257-1068 and USNO-A2.0 1350-00691230, respectively.

Date: 31 January 2007
Reported by: Bedient, J. - Honolulu, Hawaii, jbedient@gmail.com

Name of the object:
V2362 Cyg
Remarks:
The field of V2362 Cyg was checked on 237 RH series plates in the Harvard College Observatory Plate Archive. The star was not detected on these plates, dating from 20 April 1928 to 5 August 1962. The mean limiting magnitude of these blue plates was 13.22. The comparison sequence used was that published by Frigo et al. (2006).

Date: 9 March 2007
Reported by: Blättler, E. - BBSAG, Switzerland, blaettler-wald@bluewin.ch Diethelm, R. - BBSAG, Switzerland, rdiethelm@gmx.ch

Blättler has performed CCD observations in the V and R bands on four EW stars with a SBIG ST-7 camera attached to his 0.15-m Starfire refractor in Wald, Switzerland. The observations were made during 6 nights between JD 2454066 and JD 2454114.

Name of the object:
GSC 107-596 Ori = NSVS 12310076 = ASAS 050837+051218
Remarks:
A total of 221 measurements in both colours were obtained, using GSC 107-1120 (10.85 mag) as comparison and GSC107-165 (10.69 mag) as check star. A linear regression of the 16 times of minima with the ROTSE1 data yields the following results: Type: EW; JD(min I, hel) = 2454066.4302 + 0.2663496 × E; ΔR(prim.) = 0.60 mag; ΔR(sec) = 0.54 mag. The $V-R$ colour curve shows no variation exceeding the accuracy of the photometry.

Name of the object:
GSC 1283-53 Ori = NSVS 9553026 = ASAS 051305+155812
Remarks:
A total of 236 measurements in both colours were obtained, using SAO 94388 (9.18 mag) as comparison and GSC 1283-239 (11.01 mag) as check star. A linear regression of the 12 times of minima with the ROTSE1 data yields the following results: Type: EW; JD(min I, hel) = 2454066.5778 + 0.383004 × E; ΔR(prim.) = 0.42 mag; ΔR(sec) = 0.39 mag. The $V-R$ colour curve shows no variation exceeding the accuracy of the photometry.

Name of the object:
GSC 702-1892 Ori = Brh V43 = NSVS 9512770 = ASAS 051245+101512

Remarks:
A total of 221 measurements in both colours were obtained, using GSC 702-2174 (11.03 mag) as comparison and GSC 702-2730 (12.42 mag) as check star. A linear regression of the 16 times of minima with the ROTSE1 data and the minimum reported by Nelson (2004) yields the following results: Type: EW; JD(min I, hel) = 2454083.5159 + 0.276945 $\times$ E; ΔR(prim.) = 0.67 mag; ΔR(sec) = 0.64 mag. The $V-R$ colour curve shows no variation exceeding the accuracy of the photometry.

Name of the object:
GSC 706-845 Ori = NSVS 9508259 = ASAS 050830+113148

Remarks:
A total of 227 measurements in both colours were obtained, using GSC 706-30 (10.77 mag) as comparison and GSC 706-238 (11.13 mag) as check star. A linear regression of the 12 times of minimum with the ROTSE1 data yields the following results: Type: EW; JD(min I, hel) = 2454090.4610 + 0.342271 $\times$ E; ΔR(prim.) = 0.27 mag; ΔR(sec) = 0.24 mag. The $V-R$ colour curve shows no variation exceeding the accuracy of the photometry.

Date: 13 July 2007

Reported by:
Arranz Heras, T., Observatorio "Las Pegueras", Navas de Oro, Segovia, Spain
Sánchez-Bajo, F., Departamento de Física Aplicada, Escuela de Ingenierías Industriales, Universidad de Extremadura, Avda de Elvas s/n, 06071 Badajoz, Spain, fsanbajo@unex.es

Name of the object:
TX Cnc

Remarks:
785 measurements in the Johnson V filter have been obtained by Arranz Heras using a 0.35 m Schmidt-Cassegrain telescope and a Starlight MX916 CCD camera, during 8 nights between JD 2454144 and JD 2454163. Comparison star was GSC 1395-1090 (V = 9.78). A parabolic fit using 5 new minima timings along with other 70 obtained from the bibliography provide the following ephemeris: HJD(Min I) = 2434426.4859(28) + 0.38288048(24) E + 3.20(39) $\times 10^{-11}$ E^2

References:

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NSVS 14256825: A NEW HW Vir TYPE SYSTEM

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The object NSVS 14256825 = 2MASS J20200045+0437564 = UCAC2 33483055 = USNO-B1.0 0946-0525128 at position $\alpha_{2000} = 20^{\rm h}20^{\rm m}00\overset{\rm s}{.}458$, $\delta_{2000} = +04^\circ37'56\overset{''}{.}50$ (UCAC2; Zacharias et al., 2004), has been found to be a new eclipsing binary in the public data release from the Northern Sky Variability Survey (NSVS, Wozniak et al., 2004). A very short period of 0.1104 days was found, revealing the peculiar nature of the system, also justified by the extremely blue colour measured by the 2MASS survey (Cutri et. al, 2003): $J - K_s = -0.29$ and $H - K_s = -0.15$.

Multi-band CCD observations of NSVS 14256825 were carried out with a 12″ LX200 GPS Schmidt-Cassegrain telescope located at Carnes Hill Observatory. The CCD employed was primarily a SBIG ST9XE camera coupled to a CFW8A filter wheel. BVR_CI_C Custom Scientific Photometric filters were used with this camera. Some observations were also performed with a SBIG ST402ME camera utilising the internal filter wheel and SBIG supplied BVI_C filters.

All images were reduced by applying bias, dark and flat fields before instrumental magnitudes were extracted using AIP4WIN 1.4 software (Berry & Burnell, 2000). This was done using typical aperture photometry techniques. The observation log is given in Table 1.

On two occasions, all sky photometry was performed under photometric conditions to measure the targets and surrounding field stars so that accurate photometric data could be obtained. For the all sky data, the Landolt standards SA111 717, SA111 2009 and SA111 2522 were the primary standards employed. First order extinction coefficients were applied to the instrumental magnitudes. Typical first order extinction values in Sydney at that time of year are 0.28, 0.16, 0.12 and 0.09 for BVR_CI_C respectively. Extinction values were measured using a scatter technique by observing a number of E and Landolt standards at a variety of air masses (typically ranging from ~ 1.0 to ~ 1.9). Second order extinction corrections were partially applied by using standards that were close in colour to the targets. Transformation coefficients were applied to produce properly standardised magnitudes (see Table 2 for a summary of the photometry for all stars). For the differential time series photometry, the bright field star UCAC2 33483104 was used as the comparison and UCAC2 33483048 was used as the check star. The full range of variation for NSVS 14256825 thus obtained is 13.22-14.03V, the magnitude of secondary minimum is 13.34V. All data are available in the electronic edition and from the AAVSO.

Table 1: Observation log for NSVS 14256825.

Filter	JD - 2400000	Nights	Hours	Points
B	54280-54294	4	13.2	962
V	54274-54326	16	41.0	3010
I_C	54317-54318	2	5.5	464

Table 2: Absolute photometry of the variables and comparison stars.

Star	JD-2400000	V	$B-V$	$V-R_C$	$V-I_C$
NSVS	54274.14	13.24 ± 0.02	-0.18 ± 0.03	-0.06 ± 0.03	-0.20 ± 0.03
14256825	54316.66	13.24 ± 0.03	-0.16 ± 0.04		-0.24 ± 0.04
NSVS	54274.14	14.25 ± 0.02	$+0.44 \pm 0.03$	$+0.20 \pm 0.02$	$+0.54 \pm 0.03$
14256492	54316.66	14.29 ± 0.03	$+0.41 \pm 0.04$		$+0.47 \pm 0.04$
UCAC2	54274.14	11.23 ± 0.02	$+0.75 \pm 0.01$	$+0.42 \pm 0.01$	$+0.80 \pm 0.02$
33483104	54316.66	11.23 ± 0.02	$+0.76 \pm 0.02$		$+0.78 \pm 0.02$
UCAC2	54274.14	11.50 ± 0.02	$+1.10 \pm 0.01$	$+0.59 \pm 0.02$	$+1.14 \pm 0.02$
33483048					

Table 3: List of primary minima of NSVS 14256825. $O-C$ values are derived from Eq. 1.

Epoch HJD-2400000	Uncertainty [days]	$O-C$ [days]	Points used	Filter
54274.2081	0.0001	+0.0000	16	V
54282.1552	0.0002	+0.0002	20	B/V
54282.2654	0.0002	+0.0000	21	B/V
54286.1284	0.0001	−0.0001	18	V
54293.1925	0.0001	+0.0000	21	B
54294.0755	0.0001	+0.0000	24	B
54294.1859	0.0001	+0.0001	24	B
54295.1792	0.0001	−0.0000	17	V
54309.0863	0.0001	+0.0000	17	V
54309.1966	0.0001	−0.0000	19	V
54310.0797	0.0001	+0.0001	21	V
54314.1635	0.0001	−0.0000	15	V
54316.1502	0.0001	−0.0001	18	V
54318.0267	0.0001	+0.0001	22	I_C
54319.0199	0.0001	−0.0001	20	I_C
54319.1305	0.0001	+0.0002	22	I_C
54323.1038	0.0001	−0.0001	18	V
54324.0972	0.0001	−0.0000	22	V
54366.0394	0.0001	+0.0000	21	V

From the CCD data twenty one times of primary eclipse could be determined. These are listed in Table 3. The given uncertainties are those derived from fitting a second degree polynomial through the data around the minimum. From these timings and single data points showing the star in eclipse from NSVS and the All Sky Automated Survey (ASAS3; Pojmanski, 2002), the following ephemeris could be derived:

$$\mathrm{HJD} = 2451288.9198(5) + 0.11037410(2)\mathrm{E}. \quad (1)$$

The short orbital period in the period gap for cataclysmic variables, blue colour and strong reflection effect seen in its light curve suggest that the system is made up of a hot subdwarf and a red dwarf showing a large reflection effect. The period and light curve are strikingly similar to that of the other short period eclipsing sdOB+dM systems HW Vir (0.1167 d, Wood et al., 1993), NY Vir (0.1010 d, Kilkenny et al., 1998) and HS 0705+6700 (0.0956 d, Drechsel et al., 2001).

To determine the photometric parameters of the system, the 2003 version of the WD program (Wilson & Devinney, 1971) was used. Calculations were done in mode 2 (for detached systems). As is usual when only photometric data is available and no radial velocity curves, it is very difficult to obtain a precise value for the mass ratio q. Furthermore, the secondary is so faint compared to the primary, that it practically does not contribute to the total brightness, unless through reflection of the light from the primary. Therefore it is hard to determine a precise value of the surface temperature T_2 of the secondary. This means that when using the differential correction program *dc* of WD, convergence is not easily obtained. To remedy this, a large range of values for T_1, T_2 and q were tried, and the resulting residual values compared. The values used ranged between 20 000 and 50 000K for T_1 (in line with the $B-V$ and $J-K_s$ colours), between 2400 and 6500K for T_2 and between 0.3 and 0.9 for q. Within this range of parameters a shallow minimum for the residuals was obtained. The final parameters obtained in this case are given in Table 4. The phased light curve with the model curve is given in Fig. 1. The uncertainties for the assumed parameters are those for when the resulting residual curve began to show systematic differences, especially near secondary minimum. The uncertainties for the calculated parameters are those based on their extreme values calculated with *dc* considering the range of assumed parameters. Values for the limb darkening coefficients (not listed) were taken from the tables of van Hamme (1993).

Assuming an absolute magnitude of $M_V = 4.0$ for the hot subdwarf, a distance of about 570 pc can be derived taking into account an interstellar extinction value $E(B-V) = 0.14$ and $A(V) = 0.46$ (from the NASA/IPAC Extragalactic Database, see also Schlegel et al. 1998). The mass of slightly less than 0.5 $M_\odot$ for the hot subdwarf thus obtained, and the radius of 0.2 $R_\odot$ do then agree very well with those found for the three other similar eclipsing binaries mentioned above.

Because of its low surface temperature, the secondary has a convective atmosphere. Its bolometric albedo A_2 is then normally assumed to be 0.5. However none of the combinations of the other parameters then gave a secondary minimum deep enough to fit the observations. Making A_2 an adjustable parameter resulted in a value slightly larger than 1, which it physically cannot be. Therefore A_2 was assumed to be 1. Fitting the individual light curves independently also indicated that much more light is absorbed at shorter wavelengths and re-emitted at longer wavelengths than is assumed by the WD code.

Pulsations of the subdwarf, known to occur in other hot subdwarfs such as NY Vir (Kilkenny et al., 1998), were not observed in NSVS 14256825. Any variations due to such pulsations should have an amplitude of less than 0.01 magnitude (which is the semi-

Table 4: System parameters for NSVS 14256825.

Assumed parameters		Calculated parameters	
Eccentricity e	0	Semi-major axis a	$0.85 \pm 0.10\ R_\odot$
Mass ratio q	$0.45^{+0.15}_{-0.10}$	i	$81.9\ ^{+0.5}_{-0.8}$
Effective temperatures		Ω_1	4.7 ± 0.2
T_1	$35\,000 \pm 5000$ K	Ω_2	$3.7\ ^{+0.8}_{-0.6}$
T_2	3500^{+500}_{-800}K	Mass M_1	$0.46\ M_\odot$
Bolometric albedos		Mass M_2	$0.21\ M_\odot$
A_1	1.0	distance	570 pc
A_2	1.0	Surface gravity (cgs units)	
Gravitational darkening exponents		$log(g_1)$	5.50 ± 0.02
g_1	1.0	$log(g_2)$	5.35 ± 0.11
g_2	0.32	Mean radii	
Absolute magnitude		R_1	$0.20 \pm 0.03\ R_\odot$
$M_{V,1}$	4.0	R_2	$0.16 \pm 0.03\ R_\odot$
		Absolute magnitude	
		$M_{V,2}$	$12.9\ ^{+3.1}_{-1.0}$

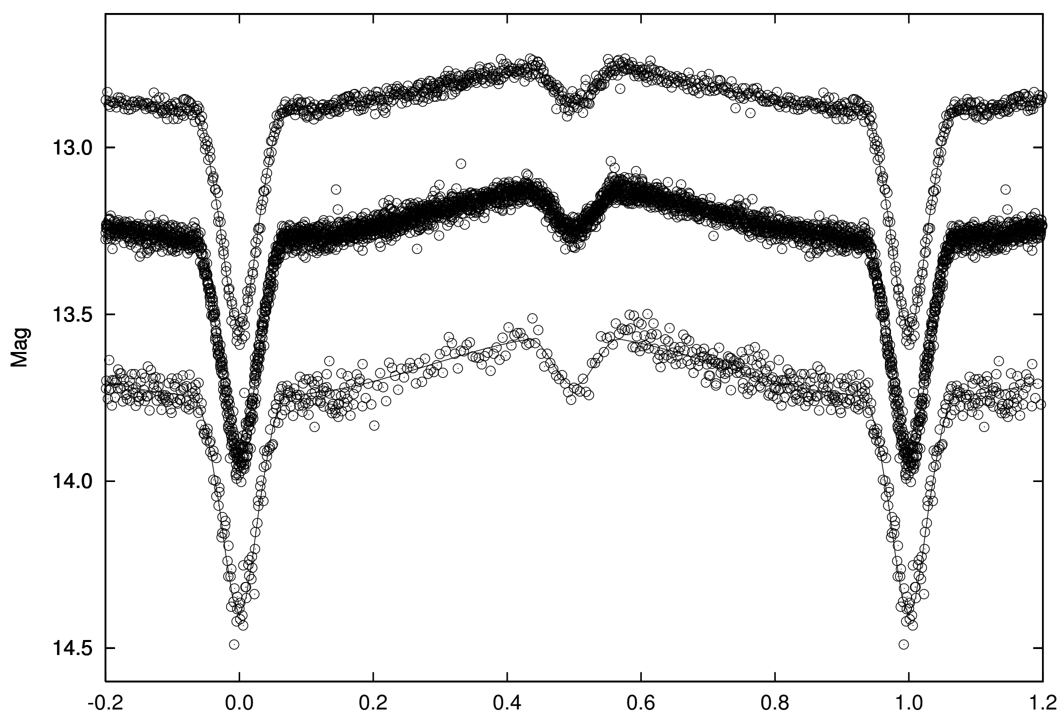

Figure 1. Phase plots of NSVS 14256825: from top to bottom respectively in B, V and I_C. The B and I_C light curves have been shifted vertically so as to not interfere with the V light curve. Note that the secondary eclipse is deeper for longer wavelengths.

amplitude of the pulsations in NY Vir). It is worthwhile to follow NSVS 14256825 further to study its period stability and to perform spectroscopic observations to determine the physical parameters more accurately.

When observing NSVS 14256825 care should be taken not to use NSVS 14256492 = UCAC2 33482998 = USNO-B1.0 0945-0527099, at position $\alpha_{2000} = 20^{\rm h}19^{\rm m}47\overset{\rm s}{.}737$, $\delta_{2000} = +04^\circ34'01\overset{''}{.}81$ (UCAC2), as a comparison star as it is a semi-detached eclipsing binary with a full range of 14.25-14.7V, amplitude of the secondary minimum about 0.1V, and the following ephemeris:

$$\mathrm{HJD} = 2454326.04 + 0.963627\mathrm{E}. \quad (2)$$

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