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NEW AND SUSPECTED MIRA VARIABLES ON STARDIAL IMAGES

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The Stardial system consists of an autonomous drift-scan CCD camera, run by the University of Illinois at Urbana-Champaign (McCullough and Thakkar, 1997). One image per day is taken of each 8×5 degree area of sky centered at a declination of $-4°$, when the region is near the meridian. The system is therefore ideally suited to follow long period variables (see e.g. Bedient, 2001). Images are publicly available at `http://www.astro.uiuc.edu/stardial/`.

This paper reports on observations of 9 Mira stars, six of which were suspected variables already before, four of them catalogued in the NSV and NSVS. The three other Mira variables are new.

The available images, spanning the years 1999 to the end of 2002 or early 2003, of a particular region were treated as follows. First, photometry was done using the XVista programs written by Michael Richmond[1]. His match programs were then used to transform image coordinates to sky coordinates by comparing star positions from the Tycho catalogue. The programs have at this time essentially produced lists of sky coordinates with raw magnitudes. Then the technique of ensemble photometry (Honeycutt, 1992) was applied to produce homogeneous magnitudes for all the images of the region. Since a non-standard red broadband filter is used by Stardial, the magnitudes obtained cannot really be compared to magnitudes obtained with standard filters. Therefore no attempt was made to transform the magnitudes to a standard system. Only a simple translation was applied to fix the zero point of the magnitude scale, in such a way that for Tycho stars with $-0.1 < B - V < 0.1$, Tycho V magnitudes and Stardial magnitudes are aligned as much as possible. Error bars on the magnitudes are a combination of the photon statistics errors and the errors on the ensemble solution for a particular night.

In the data set, long period variables were then searched for by using the Mean Square Successive Difference technique (von Neumann et al., 1941). This method assumes that the deviation between subsequent data points is small compared to the total variation for a time series showing a trend. In this way a number of long period variables could be discovered and known and suspected variables recovered. This paper reports on nine Mira variable stars, presented in Table 1. The first column gives the USNO-B1.0 identification of the objects, except for two cases where exact identification proved impossible (note that the Stardial pixel size is 36″, which is not accurate enough for correct identification

[1] `http://spiff.rit.edu/tass/pipeline/pipeline.html`

in crowded fields). The following columns contain the IRAS identification when available, the Julian Date of an observed maximum, the period in days, the amplitude in Stardial magnitudes, and remarks and other identifications. The periods of these stars have been determined using the PDM technique (Stellingwerf, 1978). Light curves are presented in Figures 1 and 2.

Table 1. Data on nine Mira variables

USNO-B1.0	IRAS	JD Max	Period [d]	Amplitude [m]	Remark
0874-0221669	07454-0228	2451491	293	2.0	1
0867-0188840	08239-0307	2451538	323	2.0	2
0824-0264160	–	2451950	364	2.0	3
0834-0296187	16112-0624	2451350	232?	> 3	4
0858-0334726	17440-0407	2451310	349	> 2.0	5
?	18108-0503	2452491	340	1.5	
?	18413-0641	2452516	260:	> 3	6
0847-0554572	19456-0522	2452470	290:	2.5	7
0839-0602533	19582-0613	2452540	115?	> 1.5	

1 GSC 04836-01821 = CSS 401 (Stephenson 1984)
Magnitude in maximum varies by at least 0.5 mag
2 NSV 4082 = GSC 04853-01862
3 NSV 18400 = MSX5C G252.1851+40.6061 = StM 138 (Stephenson 1986)
4 NSV 7549 = BV 1112, amplitude from USNO-B1.0 B1 and R1
5 TASS J174643.5-040811 (Richmond et al. 2000)
6 NSV 11266 = BV 1635
7 GSC 05154-01249, close companion 5″E

Acknowledgements: This research has made use of the USNOFS Image and Catalogue Archive operated by the United States Naval Observatory, Flagstaff Station (`http://www.nofs.navy.mil/data/fchpix/`), and of the SIMBAD and VizieR database operated at the *Centre de Données Astronomiques (Strasbourg)* in France. The author would like to thank Michael Richmond for providing the XVista and match programs, and John Greaves and Paul Van Cauteren for helpful discussions.

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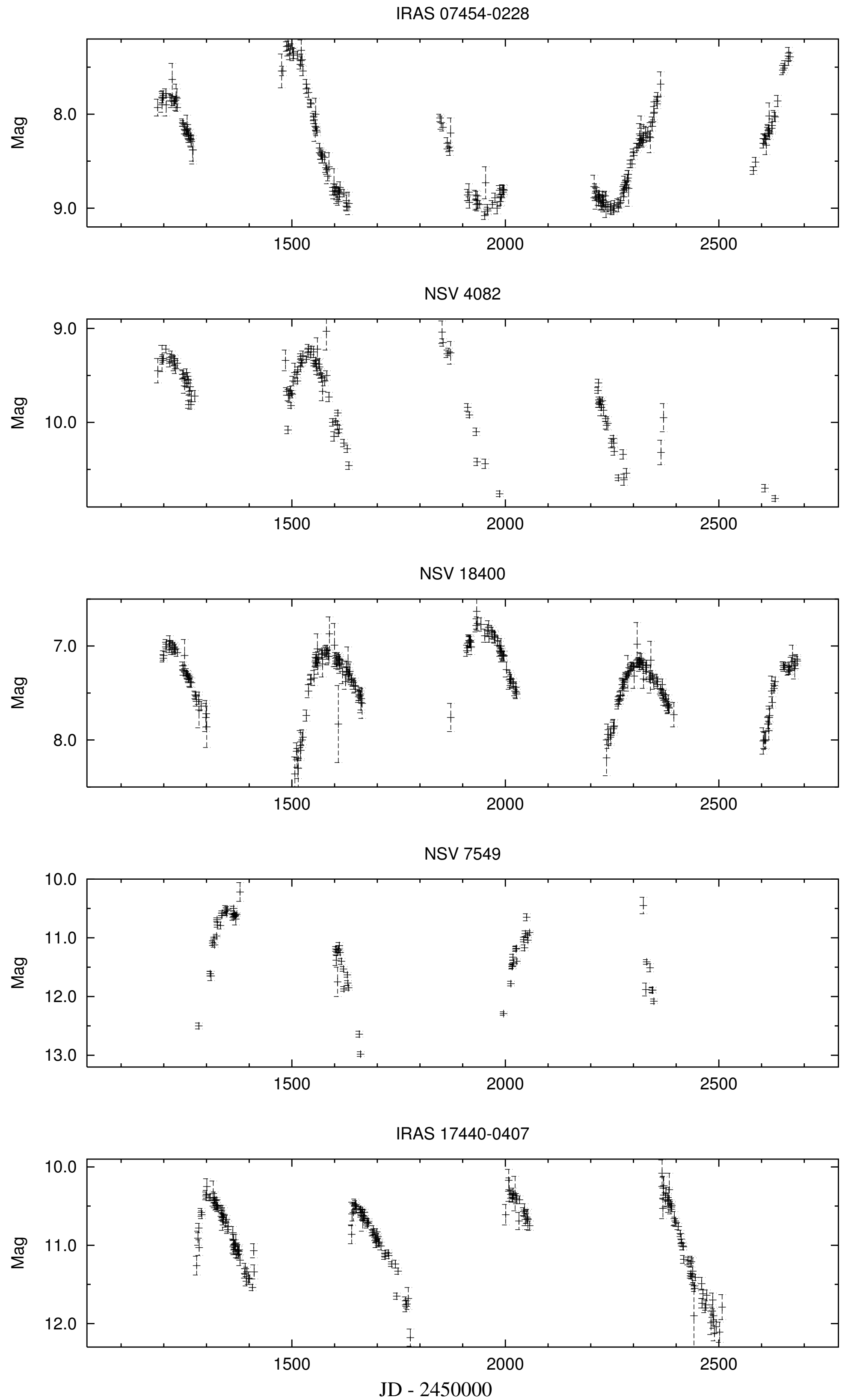

Figure 1. Light curves of five Mira stars.

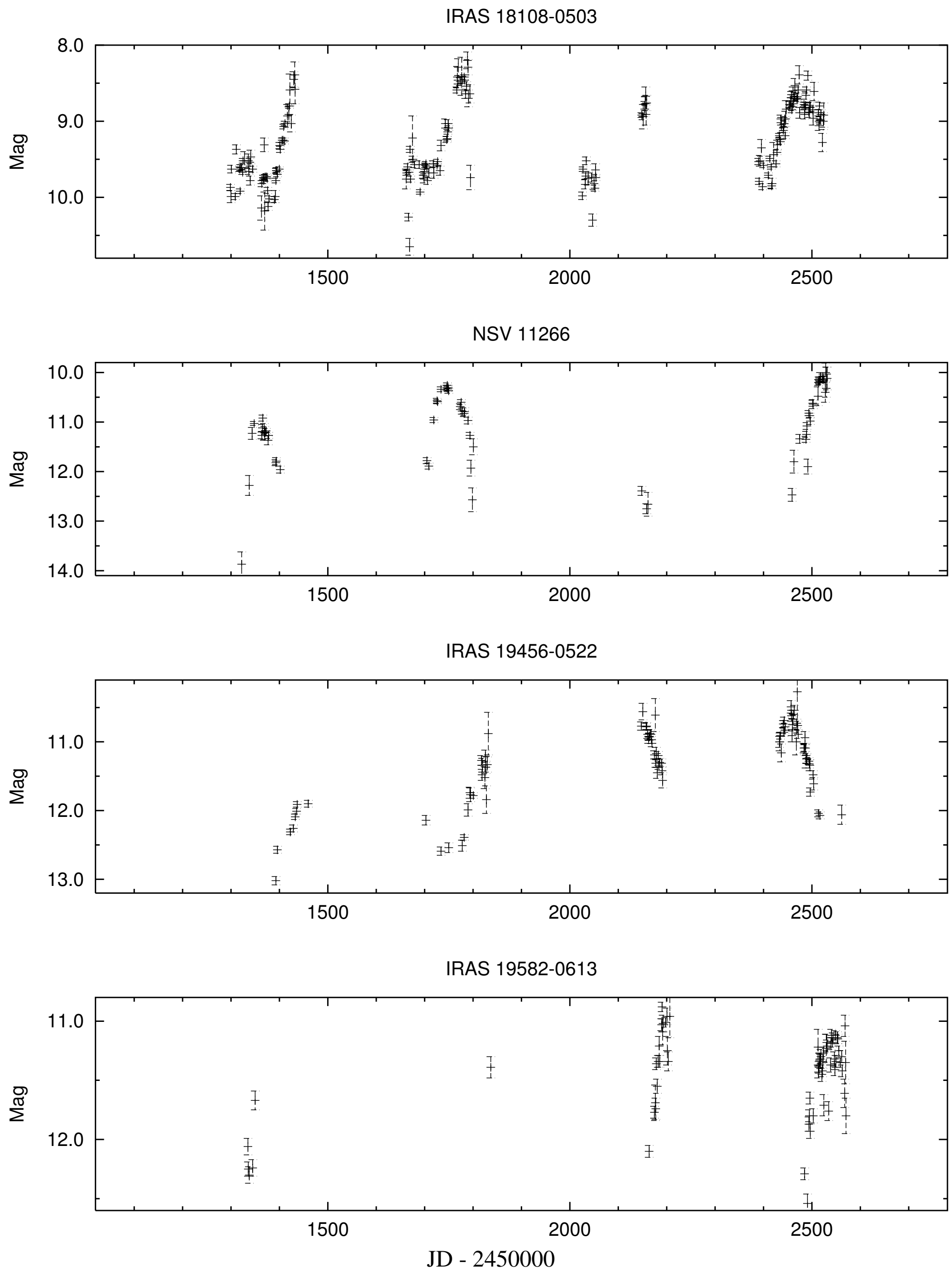

Figure 2. Light curves of the remaining four Mira stars.

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DISCOVERY OF A BRIGHT ECLIPSING BINARY IN THE PLEIADES CLUSTER

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The bright ($V = 6.83$) Pleiades cluster member HD 23642 (Hertzsprung designation H III-1431, HIP 17704, $03^{\rm h}47^{\rm m}29\overset{\rm s}{.}45$ / $+24^\circ17'18\overset{''}{.}0$, J2000,SpT A0V) was the first double-lined spectroscopic binary to be discovered in that cluster, by Pearce (1957) and Abt (1958). The period is 2.46 days and the orbit is essentially circular. Abt considered eclipses possible, but this was never confirmed. The availability of 66 accurate photometric measurements (typical error 0.008 mag) from the Hipparcos mission (ESA, 1997) over a 3-year interval prompted us to investigate this suggestion, and we indeed found strong indications of a dip in brightness at about the expected phase for a secondary eclipse.

Because of the time elapsed since the spectroscopic measurements by Pearce (interval 1943-1949) and Abt (Nov-Dec 1957), and the limited precision of the orbital periods derived independently by the two investigators, we combined the measurements to obtain a more accurate ephemeris suitable for predicting eclipses some 35 years into the future, at the mean epoch of the Hipparcos observations. Weights were assigned to the photographic radial velocities according to the information in the original sources, and a velocity offset was allowed for (but was found to be insignificant). The result, Min I (HJD) = 2,434,127.6203(80) + 2.4611240(90) $\times$ E, leads to the folded plot of the Hipparcos data seen in Figure 1a. The 5 faintest measurements cluster very close to the predicted time of secondary eclipse, and are essentially within the uncertainty in that prediction indicated by the horizontal error bars.

In order to improve the period further, we obtained additional high-resolution echelle spectra of HD 23642 with the 1.5-m Wyeth reflector at the Oak Ridge Observatory (Harvard, Massachusetts). The four single-order spectra cover 45 Å centered at 5187 Å, and have a resolving power of $\lambda/\Delta\lambda$ = 35,000. We derived radial velocities for both components using the two-dimensional cross-correlation technique TODCOR (Zucker & Mazeh 1994). Typical uncertainties are 1–1.5 km s^{-1}, far superior to the velocities from the older sources. Merging these velocities (weighted appropriately) with those of Pearce and Abt yields a period that is more than an order of magnitude more precise: Min I (HJD) = 2,436,096.5204(44)+2.46113329(66)$\times E$. The spectroscopic orbit is shown in Figure 2, and the elements are given in Table 1. The preliminary light ratio we obtain, at the mean wavelength of our observations, is $l_B/l_A = 0.31 \pm 0.03$, or $\Delta m = 1.3$ mag.

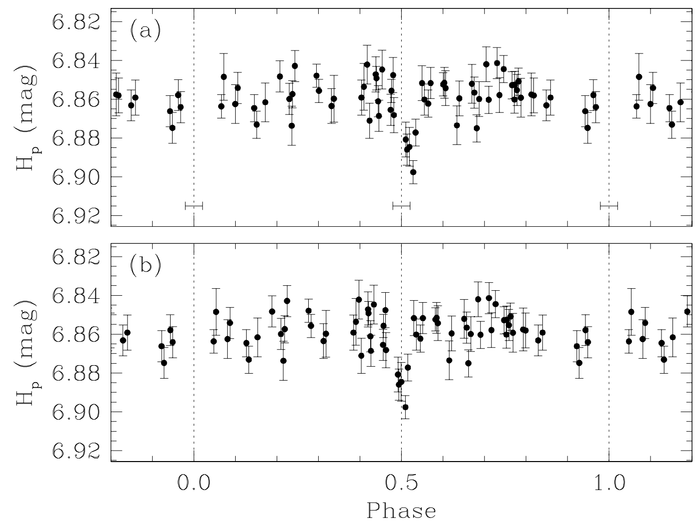

Figure 1. Hipparcos epoch photometry for HD 23642. (a) Data folded with the ephemeris derived from the radial velocities of Pearce (1957) and Abt (1958). The eclipse phases are indicated with dotted lines. The formal uncertainty in the phases is indicated by the horizontal error bars. (b) Data folded with the improved ephemeris derived by adding our new velocities. The phase uncertainty is negligible on the scale of this figure.

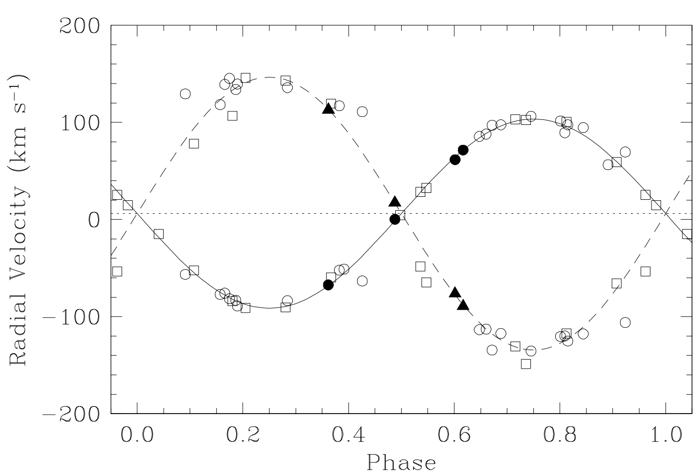

Figure 2. Radial velocity curve of HD 23642, with the observations by Pearce (1957; open circles), Abt (1958; open squares), and our new observations (filled symbols). The solid line is for the primary, and the dashed line for the secondary. The center-of-mass velocity is indicated by the dotted line.

The Hipparcos data folded with this new period are shown in Figure 1b. The apparent dip in brightness is seen to shift even closer to phase 0.5, which is unlikely to be a coincidence. The eclipsing nature of the binary is thus confirmed. Further support for this is given by the large minimum masses (Table 1), in particular for the primary, which is consistent with the values expected from the A0V spectral type.

Table 1. Combined spectroscopic solution for HD 23642.

Parameter	Value
P (days)	2.46113329 ± 0.00000066
γ (km s^{-1})	+6.1 ± 1.7
K_A (km s^{-1})	97.40 ± 0.84
K_B (km s^{-1})	140.47 ± 0.85
e	0 (adopted)
$T_{\rm max}$ (HJD)	2,436,095.9051 ± 0.0040
$a_A \sin i$ (10^6 km)	3.296 ± 0.030
$a_B \sin i$ (10^6 km)	4.754 ± 0.030
$a \sin i$ ($R_\odot$)	11.566 ± 0.061
$M_A \sin^3 i$ ($M_\odot$)	2.027 ± 0.032
$M_B \sin^3 i$ ($M_\odot$)	1.405 ± 0.026
$q \equiv M_B/M_A$	0.6934 ± 0.0077
ΔRV (Pearce − Abt) (km s^{-1})	+1.9 ± 1.9
ΔRV (Pearce − new) (km s^{-1})	+0.8 ± 1.8
N_A, N_B (Pearce)	21, 19
N_A, N_B (Abt)	15, 12
N_A, N_B (new)	4, 4
σ_A, σ_B (Pearce) (km s^{-1})	8.9, 20.8
σ_A, σ_B (Abt) (km s^{-1})	3.1, 17.8
σ_A, σ_B (new) (km s^{-1})	1.68, 1.01

As seen in Figure 1b, there are no Hipparcos observations near phase 0.0, and thus the primary eclipse was missed. A very tentative fit to the secondary eclipse performed with the light curve program EBOP along with estimates of the components' properties is shown in Figure 3. While the secondary eclipse has a depth of ∼0.03 mag, the primary is expected to be approximately 0.07 mag deep. The eclipses are thus grazing ($i \approx 78°$), and the system is well detached.

HD 23642 appears to be the first eclipsing binary to be confirmed in the Pleiades cluster[1], and it is quite remarkable that such a bright star has not been inspected carefully before, particularly since it is known to be chemically peculiar (spectral classification A0Vp(Si)+Am; Abt & Levato 1978). Further spectroscopic and photometric observations of HD 23642 are underway to improve the orbits. Eventually this system may well yield the first dynamically determined stellar masses in the Pleiades, and may even have a bearing on the issue of its distance.

[1]A report by Prosser & Stauffer (1993) about an anomalous dimming in the light of the Pleiades member H III-263, possibly due to eclipses, has yet to be confirmed.

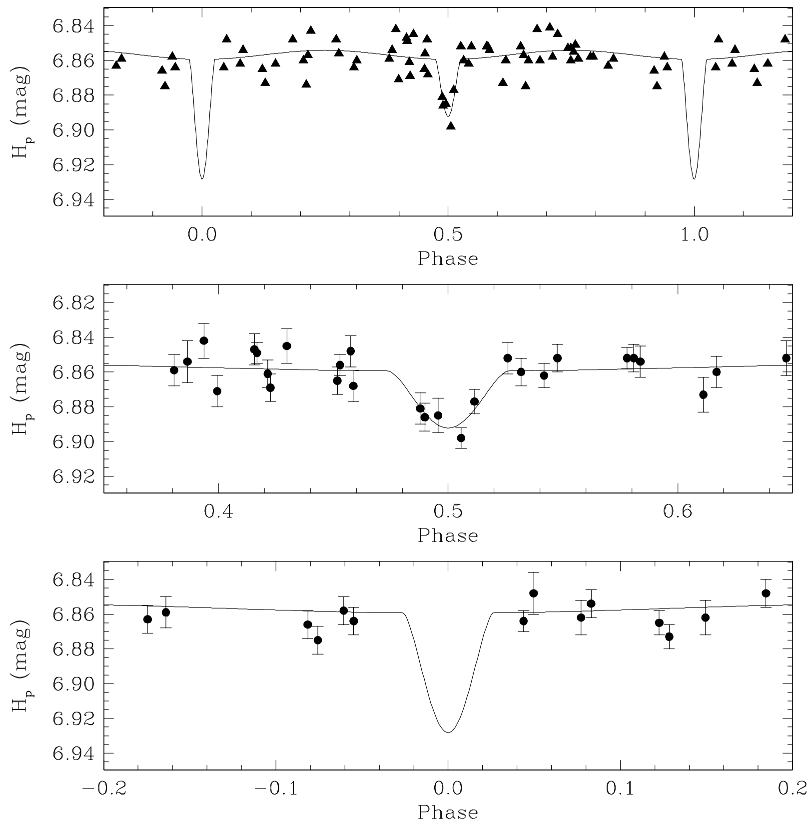

Figure 3. Tentative EBOP light curve superimposed on the Hipparcos epoch photometry of HD 23642.

Acknowledgements: This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France, and of NASA's Astrophysics Data System Abstract Service. The author acknowledges partial support for this work by NASA's SIM project (JPL grant 1240033).

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CCD LIGHT CURVES OF ROTSE1 VARIABLES, XVIII: GSC 3022:996, CVn, GSC 2534:216 CVn, GSC 2536:122, CVn, GSC 2548:936 CVn AND VV CVn

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Observatory and telescope:
Private observatory Schüsselacher, Wald, 0.15-m Starfire refractor

Detector:	SBIG ST-7 CCD camera

Method of data reduction:
Standard CCD-frame reduction using AIP4WIN software

Method of minimum determination:
Kwee – van Woerden algorithm

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
GSC 3022:996				
ROTSE1 J130549.16+383706.1	EW	13 05 49.2	+38 37 06	GSC 3022:738 / GSC 3022:964
GSC 2534:216				
ROTSE1 J131047.78+364407.2	EW	13 10 47.8	+36 44 07	GSC 2534:733 / GSC 2534:10
GSC 2536:122				
ROTSE1 J133413.76+312125.0	EW	13 34 13.8	+31 21 25	GSC 2536:1064 / GSC 2536:752
GSC 2548:936				
ROTSE1 J140205.83+340239.1	EW	14 02 05.8	+34 02 39	GSC 2548:79 / GSC 2548:10
VV CVn	EB	13 17 41.7	+32 39 58	GSC 2538:211 / GSC 2538:255

Ephemeris:

Star name	E 2400000+	P [day]	Source
ROTSE1 J130549.16+383706.1	52694.5006	0.357382	present paper
ROTSE1 J131047.78+364407.2	52691.6833	0.2459495	”
ROTSE1 J133413.76+312125.0	52691.7085	0.280563	”
ROTSE1 J140205.83+340239.1	52694.3796	0.260768	”
VV CVn	51246.681	0. 53314	”

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
GSC3022:996 (CVn)	51260.863	2	s	none		ROTSE1
	51340.7375	4	p	none		ROTSE1
	52601.583	2	p	none		
	52691.4635	15	s	none		
	52691.6397	10	p	none		
	52694.4996	7	p	none		
	52694.6772	6	s	none		
	52721.3064	14	p	none		
	52723.4485	10	p	none		
GSC2534:216 (CVn)	51274.8914	5	s	none		ROTSE1
	51337.7364	9	p	none		ROTSE1
	52337.5161	9	p	none		Diethelm 2002
	52337.639	3	s	none		Diethelm 2002
	52601.6656	10	p	none		
	52691.4366	14	p	none		
	52691.5599	10	s	none		
	52691.6833	4	p	none		
	52694.3889	7	p	none		
	52694.5117	8	s	none		
	52694.6339	8	p	none		
	52721.3208	12	s	none		
	52723.4119	9	p	none		
	52723.5335	11	s	none		
GSC2536:122 (CVn)	51246.8100	6	p	none		ROTSE1
	51260.7012	9	s	none		ROTSE1
	52337.5003	10	s	none		Diethelm 2002
	52337.643	2	p	none		Diethelm 2002
	52601.6482	17	p	none		
	52655.511	3	p	none		
	52691.429	4	p	none		
	52691.5258	16	s	none		
	52691.7060	13	p	none		
	52694.3743	11	s	none		
	52694.5153	6	p	none		
	52694.6550	4	s	none		
	52721.3130	14	s	none		
	52723.412	2	p	none		
	52723.5523	5	s	none		
GSC2548:936 (CVn)	51304.8765	7	s	none		ROTSE1
	51348.8201	10	p	none		ROTSE1
	52655.5242	10	p	none		
	52691.5112	16	p	none		
	52691.6429	18	s	none		
	52694.3801	7	p	none		
	52694.5094	4	s	none		
	52694.6420	8	p	none		
	52721.3689	5	s	none		
	52723.3241	8	p	none		
	52723.4541	12	s	none		
	52723.5856	13	p	none		
VV CVn	51246.681	4	p	none		ROTSE1
	52287.640	2	s	none		Blättler 2002
	52308.695	2	p	none		Blättler 2002
	52344.4157	8	p	none		Blättler 2002
	52347.354	3	s	none		Blättler 2002
	52601.664	3	s	none		Blättler 2003
	52655.504	7	s	none		Blättler 2003
	52691.490	3	p	none		Blättler 2003
	52694.424	5	s	none		Blättler 2003

Explanation of the remarks in the table:
ROTSE1: Observations of Akerlof et al. (2000).

Remarks:
As a byproduct of the ROTSE1 CCD survey, a large number of new variables have been discovered (Akerlof et al., 2000). In a series of papers, we report unfiltered CCD observations for some of the close binary systems (type EW) in the list of Akerlof et al. (2000). This installment contains information on four variables in the constellation CVn as well as a first CCD light curve of the known variable VV CVn. The five stars were observed with our CCD equipment during several nights between JD 2452285 and JD 2452723. A total of 175 CCD frames were measured of GSC 3022:996, 183 frames of GSC 2534:216, 176 frames of GSC 2536:122, 138 frames of GSC 2548:936 as well as 231 frames for VV CVn. Figures 1 through 5 show our observations folded with the elements given in the Table of Ephemeris. These elements of variation are deduced from a linear fit to the normal minima from the ROTSE1 data and the timings of minimum derived from our data given in the table of Times of Minima. The star VV CVn = SVS 1290 was reported to be variable by Kurochkin (1961), who, based on photographic material, assigned the star to the EA class, providing the elements of variation stated in the GCVS. According to the SIMBAD data base, no further observations have been reported until the CCD photometry of the ROTSE1 survey (Akerlof et al., 2000). As can be inferred from the CCD light curve, VV CVn belongs to the EB subtype of the eclipsing binaries with a marked difference in amplitude between primary (0.55 mag) and secondary (0.30 mag) minimum.

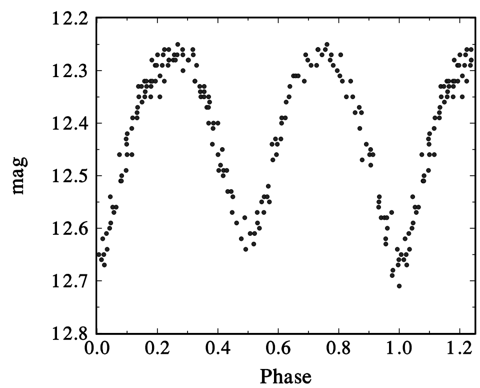

Figure 1. CCD light curve (without filter) of GSC 3022:996

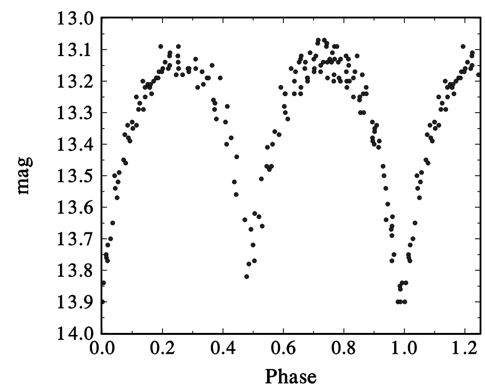

Figure 2. CCD light curve (without filter) of GSC 2534:216

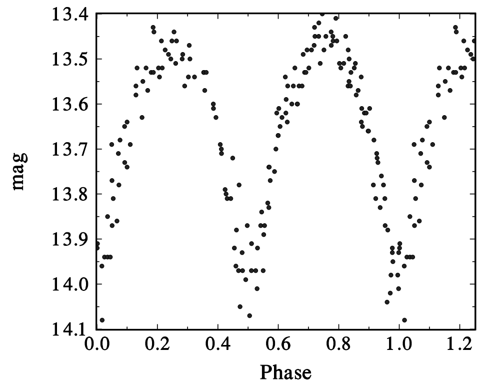

Figure 3. CCD light curve (without filter) of GSC 2536:122

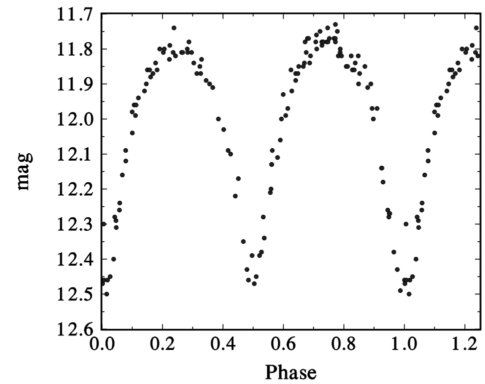

Figure 4. CCD light curve (without filter) of GSC 2548:936

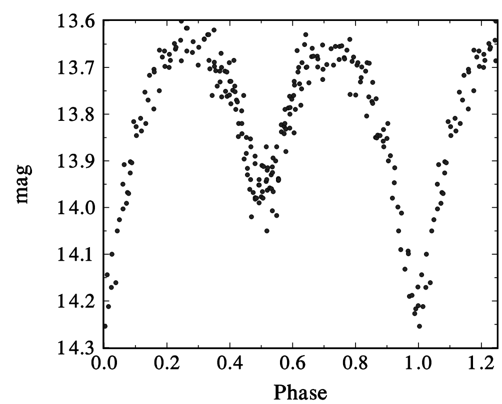

Figure 5. CCD light curve (without filter) of VV CVn

Availability of the data:
Upon request from diethelm@astro.unibas.ch

Acknowledgements:
This research made use of the SIMBAD data base, operated at CDS,Strasbourg, France

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THE FIRST PRECISION CCD OBSERVATIONS OF THE NEGLECTED, DWARF CONTACT BINARY V524 MONOCEROTIS

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Wachmann (1966) discovered V524 Monocerotis [HBV 463, GSC 153 1410, RA(2000)= $6^h59^m1\overset{s}{.}2$, DEC(2000) = $+02°12'51''$] in his study of 38 variables in the field SA 98. An ephemeris (P = 0.28361714 d) and 39 times of minimum light are given in his paper. His photographic light curve indicates that V524 Monocerotis is a W UMa contact binary. Hoffmann (1981) presented a low-precision B light curve along with two times of minimum light. He suggested that it is of A-type (more massive component is hotter). During a recent observing run at Cerro Tololo InterAmerican Observatory in Chile, we were able to include this 15th mag neglected very short period system in our observing schedule. Our present observations were taken with the 0.9-m reflector and the CFIM T2K CCD with standard UBV$(RI)_C$ filters on 31 December 2002 and 1 January 2003, by RGS. The observations are available through the IBVS-website as `5404-t2.txt`. The images were calibrated and the magnitudes extracted using standard IRAF procedures. Around 100 observations were taken in each pass band. An unnamed comparison star [RA(2000) = $06^h59^m3\overset{s}{.}8$, DEC(2000) = $+02°14'52''$] and the check star [GSC 153 1435, RA(2000) = $6^h58^m54\overset{s}{.}8$, DEC(2000) = $+02°15'37''$] are shown in Figure 1 as C and K, with the variable, V. Both BBSAG (1998, 1987, 1986, 1984) and Zejda (2002) give additional times of minimum light.

Table 1: Times of Minimum Light, V524 Mon

JD Hel. 2450000+	Min	Cycles	$O-C_1$	$O-C_2$
2640.74555 (28)	II	−3.5	0.00086	0.00024
2641.73843 (66)	I	−0.0	0.00108	0.00046

Two mean epochs of minimum light were determined from a primary and secondary eclipse using and comparing the results from bisection of chords and parabola fits. These precision epochs of minimum light are given in Table 1 along with their standard errors shown in parentheses. The data indicates a variable period. A linear ephemeris was calculated using the most recent timings from the last 29,000 orbits.

$$\mathrm{HJD_{MinI}} = 2452641.73735(213)d + 0.283616062(126)E(1).$$

The following quadratic ephemeris provides a good fit to the available minima. Fifty minima spanning some 82,500 cycles or 64 years were used in this study.

$$\mathrm{HJD_{MinI}} = 2452641.73797(113)d + 0.2836160386(9)E - 1.1(1) \times 10^{-11}E^2.(2)$$

The linear residuals from the equations 1 and 2 are given as $O-C_1$ and $O-C_2$ above. The $O-C_2$ residuals are shown in Figure 2. Our quadratic result is significant at the 5 sigma level. This may indicate that the system is losing angular momentum via magnetic braking, i.e., it is slowly coalescing.

The $UBVRI$ normalized flux light curves and the $U-B$, $B-V$ and $R-I$ color curves of the variable are shown as Figure 4 as calculated from the differential magnitudes (VAR - COMP) versus phase. The probable errors of a single observation were under 1% in B, V, and R and I and about 2.5% in U.

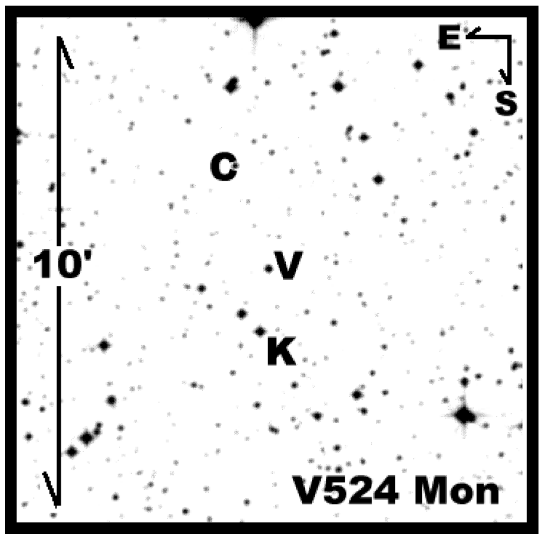

Figure 1. Finder chart

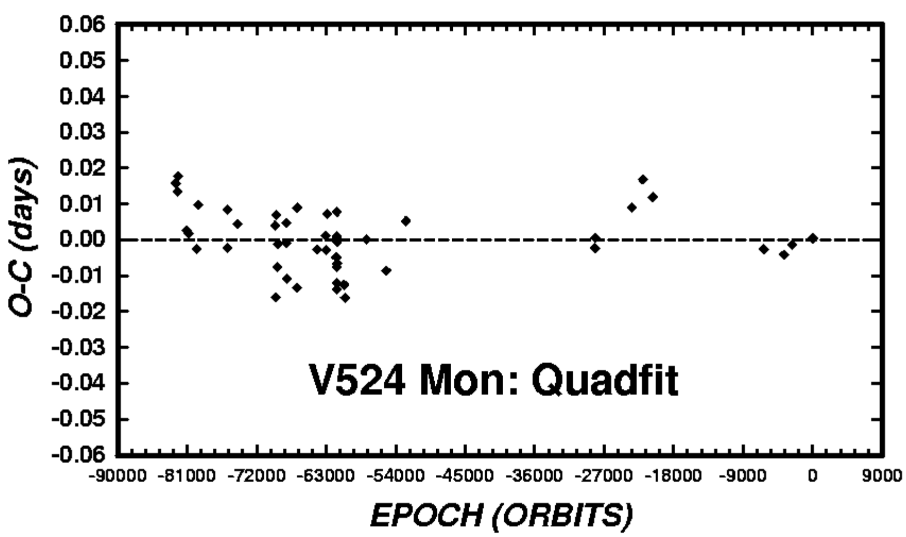

Figure 2. $O-C$ residual plot

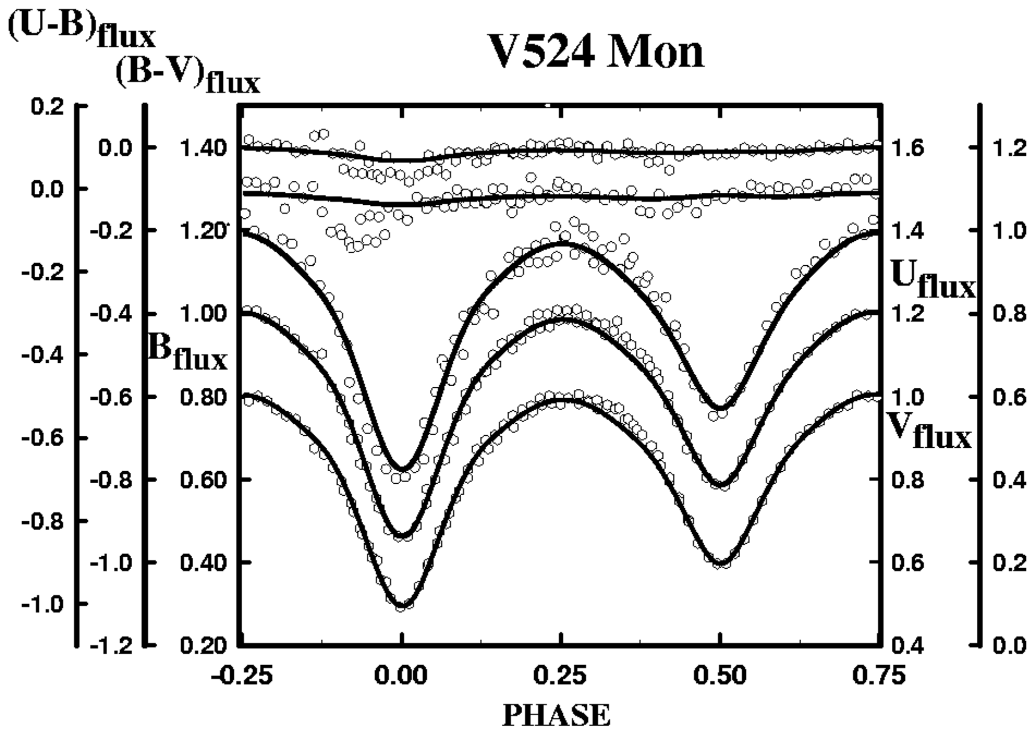

Figure 3. UBV light curves

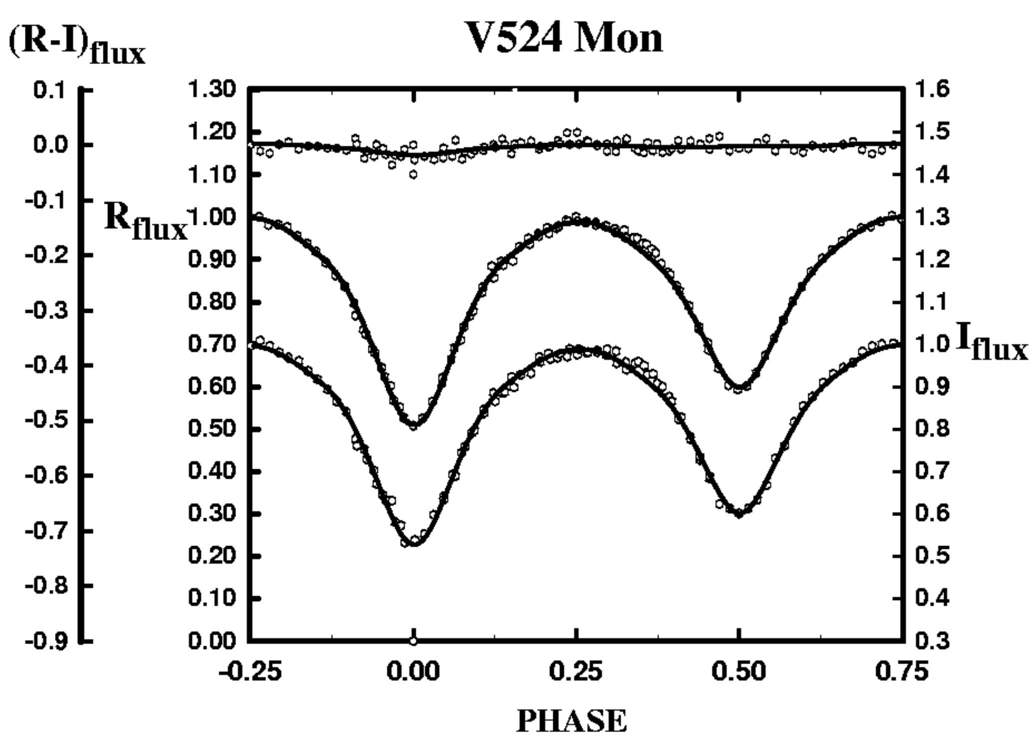

Figure 4. RI curves

We have calculated models for the light curve. First we hand modelled a Binary Maker 2.0 (Bradstreet, 1992) solution in B and V. A shallow contact W-type model gave the best fit. It included $m2/m1 = 1.4$ with a fill-out of only 5%. From these starting values a simultaneous 5 color synthetic light curve solution was calculated using the Wilson Code (Wilson & Devinney, 1971; Wilson, 1990, 1994). The final parameters include $m2/m1 = 1.84$ (1), fill-out 4.5%, $T1 - T2 = 353(20)$ K, and an inclination 79.1(1). A hot spot was modelled on the primary component (star 1). This included a co-latitude of 125(2) degrees and longitude 116(4) degrees, spot radius 14.3(7) and temperature factor of 1.142(9). Our UBVRI solution is shown overlaying the data in Figure 3 and 4. The curves are of W-type, with the larger star having the cooler surface. This indicates the presence of heavy, saturated magnetic activity. The Roche lobe model is shown as Figure 5.

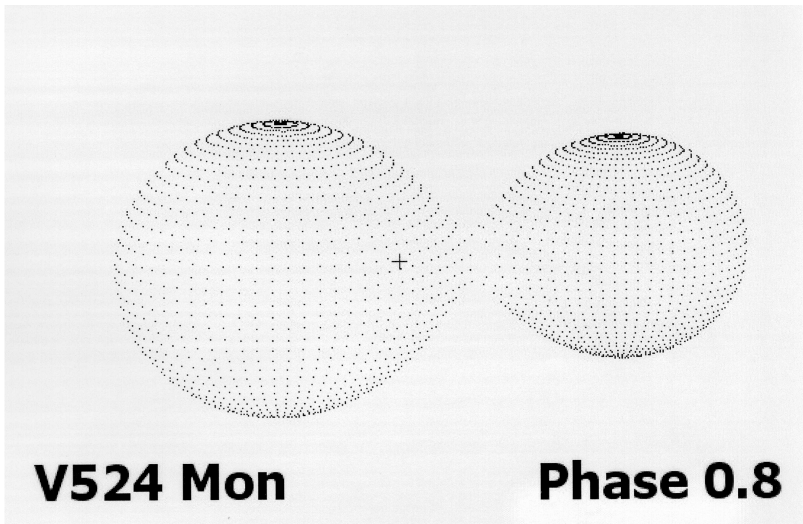

Figure 5. Roche lobe figure

We wish to thank Cerro Tololo InterAmerican Observatory for their allocation of observing time, and the grant from NASA administered by the American Astronomical Society which supported this run.

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CCD OBSERVATIONS OF THE SHORT PERIOD NEAR CONTACT SYSTEM: UY MUSCAE

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As a part of our search for solar type binaries with gas streams we observed the neglected variable, UY Muscae [Star“y” (Oosterhoff, 1928) GSC 8987 392, $\alpha(2000) = 12^{\rm h}30^{\rm m}47^{\rm s}$, $\delta(2000) = -66^\circ01'52''\!.8$]. Oosterhoff gave seven times of minimum light and a starting ephemeris (recalculated by us),

$$\mathrm{HJD_{MinI}} = 2424293.41(1) + 0.56245(3)d \times E.[1]$$

Standard errors in the last digit/s are given in parentheses. His photographic light curves suggest that UY Mus is a near contact binary.

Our present $UBVRI$ light curves of UY Mus were taken at CTIO in Chile with the 0.9-m reflector on 18, 19, 20, 23 May 2001, by RGS and DRF. The CFIM 2K × 2K T2K CCD camera operating in a 1K × 1K quad amplifier mode for fast readouts. Standard $UBVR_cI_c$ Johnson-Cousins filters were used. More than 200 observations were taken in each pass band. The data are available through the IBVS-website as `5405-t1.txt`. The light curves and color curves of the variable are given in Figures 1-2 as normalized flux versus phase. The stars (GSC 8987 1279 $\alpha(2000) = 12^{\rm h}30^{\rm m}43^{\rm s}\!.7$, $\delta(2000) = -65^\circ59'45''$) and (GSC 8987 1884, $\alpha(2000) = 12^{\rm h}30^{\rm m}45^{\rm s}\!.7$, $\delta(2000) = -66^\circ01'5''$) were used as comparison and check stars, respectively. A finding chart of UY Mus (V), the comparison (C) and check star (K) are given in Figure 3.

Two mean epochs of minimum light were determined from U, B, V, R, I timings of primary and secondary eclipses: HJD = 2452047.6240(17) and 2452049.5920(5) using parabola fits. We calculated the following ephemeris from our observations:

$$\mathrm{HJD_{MinI}} = 2452047.6240(4) + 0.56227(15)d \times E, [2]$$

A linear fit to all available timings of minimum light give:

$$\mathrm{HJD_{MinI}} = 2452047.62(3) + 0.5622769(14)$$

At this time we cannot make a firm conclusion regarding the period behavior of this system.

In modeling the light curve we first used Binary Maker 2.0 (Bradstreet, 1992) to fit the B and V light curves. We tried both detached and semi-detached configurations. In the semi-detached mode we tested both the primary component (more massive) and the secondary component filling their associated critical lobes. Only the latter gave satisfactory fits to the light curve. The fit indicated a q=0.6 with a primary component filling 96% of its Roche lobe. Two spots were also included in our initial fit. The smaller hot spot is near the L1 point of the primary component and a larger cool solar type spot is on the same component.

Using these starting values we calculated a simultaneous 5 color synthetic light curve solution with the Wilson Code (Wilson & Devinney, 1971; Wilson, 1990, 1994). The solution indicates that the primary component is under-filling its Roche lobe (fill-out = 94.4(1)%) while the secondary component is filling. This is similar to an Algol system. Other parameters include a temperature difference of $T_1 - T_2 = 1280(3)$K, mass ratio $m_2/m_1 = 0.551(1)$ and an inclination of 81.69 degrees. Two spots were modelled as follows: a stream spot with a temperature factor of 1.060(2) very near the L1 point of the primary component and a solar type dark spot of radius 25.2(3) degrees with a T factor of 0.970(1).

The solution is shown overlaying the data in Figures 1-2. A geometrical representation of UY Mus with the two spots is given in Figure 4.

Large night to night variations in the light curve lead us to believe that the components are saturated with magnetic activity. It is possible that the system was previously in contact and is undergoing TRO oscillations. For a small stream spot with conservative mass transfer indicates that the period is increasing which means that the components are currently separating. Further observations of eclipse timings and archival work are needed to confirm this prediction.

We wish to thank CTIO for their allocation of observing time, and a small research grant from the American Astronomical Society which supported this run.

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Wilson, R. E. 1994, *PASP*, **106**, 921
Wilson, R. E. & Devinney, E. J., 1971, *ApJ*, **166**, 605

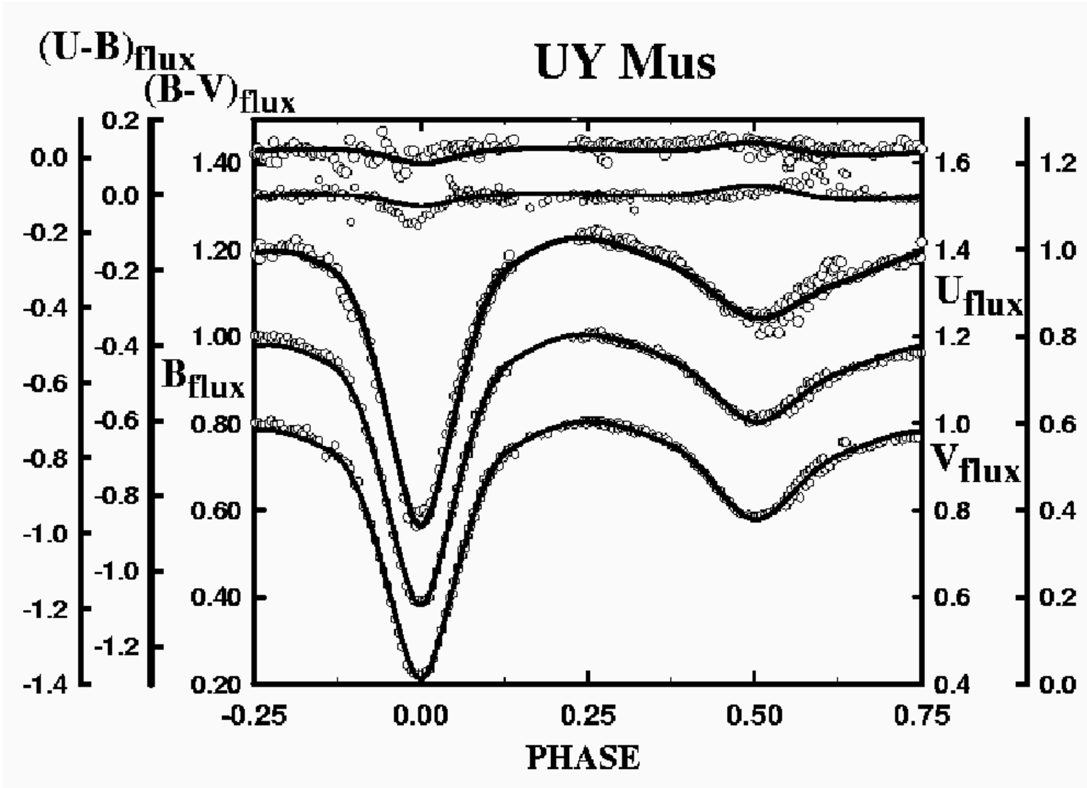

Figure 1. UBV light curves

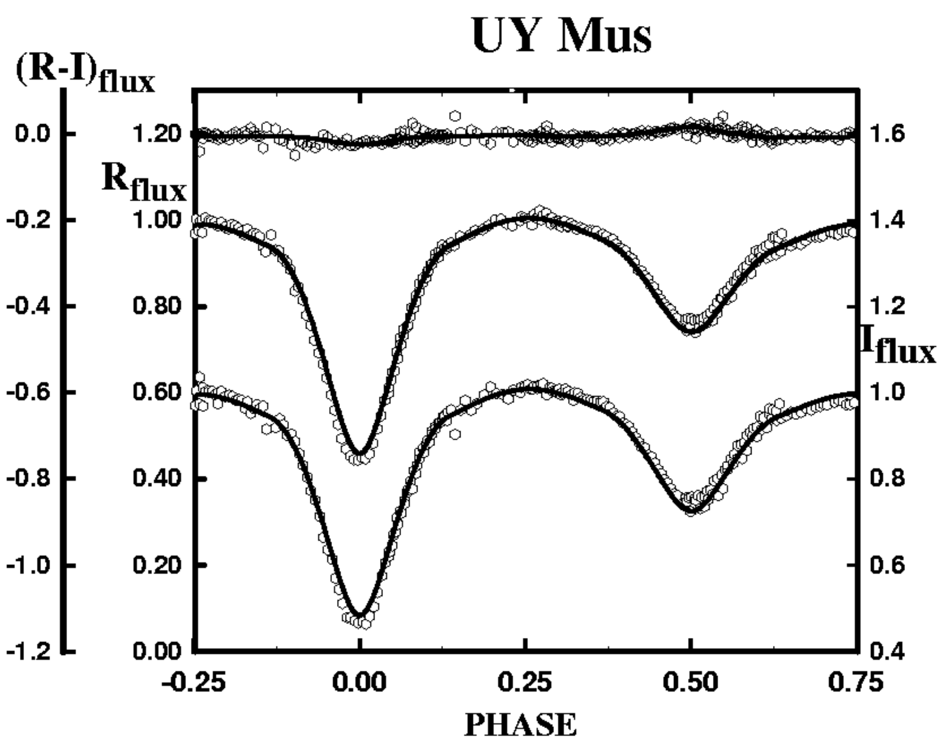

Figure 2. RI light curves

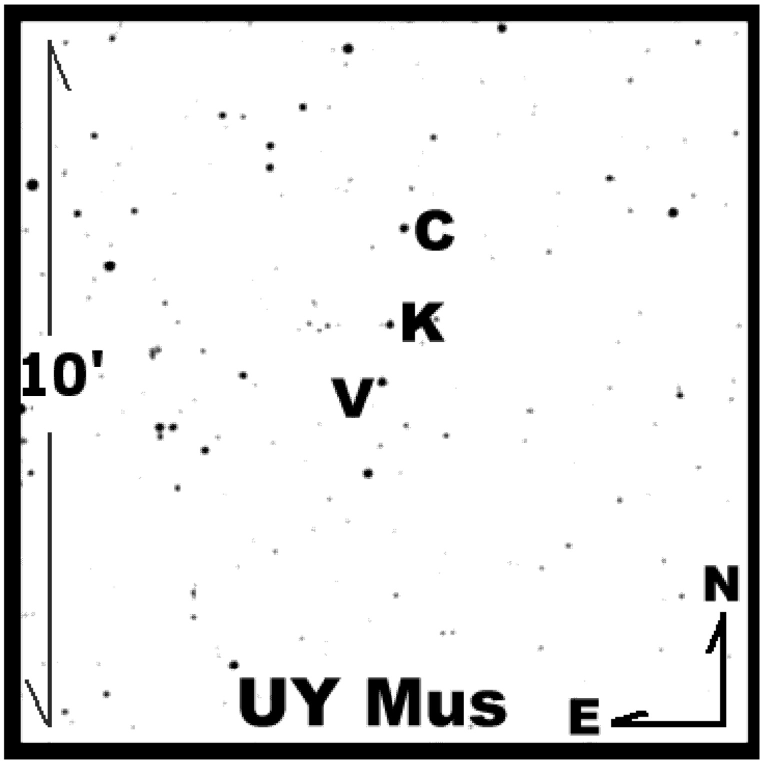

Figure 3. Finder charts

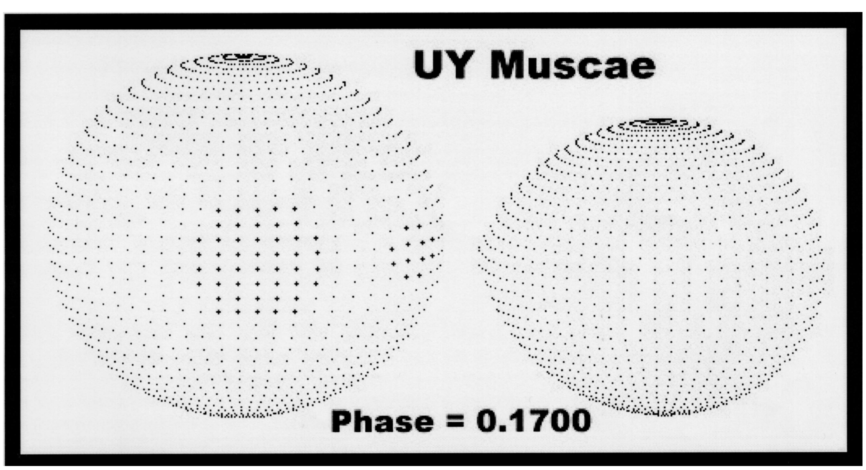

Figure 4. Roche lobe figure

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THREE NEW PMS VARIABLES IN THE VICINITY OF NGC 7129

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The previous observations suggest that NGC 7129 is a region of active star formation (Magakian and Movsesian, 1997). The small emission nebula and the dark clouds around are a part from the giant molecular cloud complex in Cepheus. T Tauri and Herbig's Ae/Be stars, Herbig-Haro objects, collimated jets and cometary nebulae are observed in the region of NGC 7129. One of the best-studied objects in this region is the Pre-Main Sequence star (PMS) V391 Cep (Semkov, 2003). The star lie in the dark clouds 40′ northwest from the center of NGC 7129. In this paper we present photometric data for tree new PMS variables in the close proximity of V391 Cep.

Our CCD photometric observations were made with three telescopes: the 2-m RCC and the 50/70/172 cm Schmidt telescopes of the National Astronomical Observatory Rozhen (Bulgaria) and the 1.3-m RC telescope of the Skinakas Observatory[1] of the Institute of Astronomy, University of Crete (Greece). The observations ware taken with the purpose to study variability of V391 Cep and all information concerning used CCD cameras, filters, exposures, standards and aperture photometry is summarized in Semkov (2003).

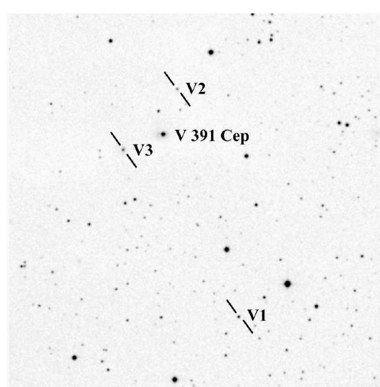

Figure 1. Finding chart of the new variable stars

The finding chart of the new variable stars is presented in Fig. 1. New variables are labeled V1, V2 and V3 in order of their R. A. The position of V391 Cep is also marked on the figure. The field is $10' \times 10'$, north is at the top and east to the left. The chart is retrieved from the STScI Digitized Sky Survey Second Generation Red. The positions of the tree new variables (J2000.0) in the Aladin Sky Atlas are:

[1]Skinakas Observatory is a collaborative project of the University of Crete, the Foundation for Research and Technology - Hellas, and the Max-Planck-Institut für Extraterrestrische Physik.

V1 R.A. = $21^h40^m11\overset{s}{.}75$ and Dec = $66°30'21\overset{''}{.}4$
V2 R.A. = $21^h40^m22\overset{s}{.}88$ and Dec = $66°36'31\overset{''}{.}6$
V3 R.A. = $21^h40^m38\overset{s}{.}79$ and Dec = $66°35'02\overset{''}{.}7$

The results from our CCD photometric observations of V1, V2 and V3 are given in Tables 1, 2 and 3 respectively. The tables contains Date, Julian Date, V magnitude, $B-V$, $V-R_C$ and $V-I_C$ indices and telescope used. The V-light curves of the new variables are presented in Fig. 2, Fig. 3 and Fig. 4. V2 and V3 were discovered as variables during our campaign to calibrate a standard comparison sequence in the field of V391 Cep. The both objects exhibit extended emission a characteristic typical of PMS stars. The new variable V1 was discovered and as an Hα emission source in our objective prism survey (Semkov and Tsvetkov, 1986).

Our observations reviled that the V1, V2 and V3 show irregular variability with amplitudes of $0\overset{m}{.}7$, $1\overset{m}{.}1$ and $1\overset{m}{.}2$ (V-light) respectively. Having in mind the observed irregular variability, extended emission around V2 and V3 and observed Hα emission for V1 it is possible to suspect that the tree new variables belong to the class of PMS stars.

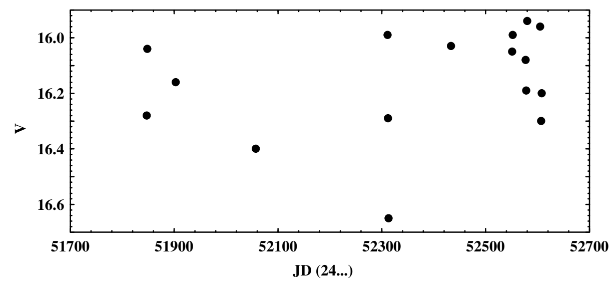

Figure 2. V-light curve of V1 during the period of observations

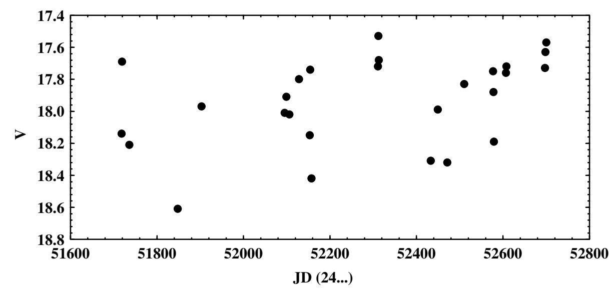

Figure 3. V-light curve of V2 during the period of observations

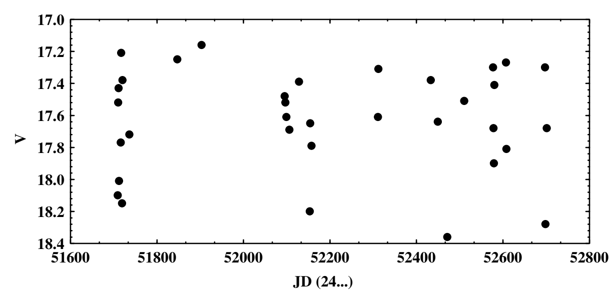

Figure 4. V-light curve of V3 during the period of observations

Table 1: Photometric observations of V1 in the period October 2000 - November 2002

Date	J.D. (24...)	V	$B-V$	$V-R_C$	$V-I_C$	Tel.
29.10.2000	51847.379	16.28	1.32	0.83	1.88	Scm
30.10.2000	51848.419	16.04	1.36	0.81	1.75	Scm
24.12.2000	51903.287	16.16	1.13	0.89	1.88	Scm
27.05.2001	52057.492	16.40	–	–	1.58	Scm
5.02.2002	52311.261	15.99	1.14	0.83	1.92	Scm
6.02.2002	52312.259	16.29	–	0.80	1.83	Scm
7.02.2002	52313.247	16.65	1.84	0.99	2.08	Scm
8.06.2002	52433.536	16.03	1.26	0.82	1.76	1.3m
3.10.2002	52551.459	16.05	–	0.79	1.64	Scm
4.10.2002	52552.487	15.99	–	0.77	1.71	Scm
29.10.2002	52577.375	16.08	1.20	0.81	1.82	Scm
30.10.2002	52578.371	16.19	1.34	0.87	1.90	Scm
31.10.2002	52579.275	16.09	1.12	0.83	1.75	Scm
1.11.2002	52580.258	15.94	1.21	0.78	1.73	Scm
26.11.2002	52605.233	15.96	–	–	1.76	Scm
28.11.2002	52607.258	16.30	1.29	0.87	1.94	Scm
29.11.2002	52608.246	16.20	1.28	0.87	1.91	Scm

Table 2: Photometric observations of V2 in the period June 2000 - March 2003

Date	J.D. (24...)	V	$B-V$	$V-R_C$	$V-I_C$	Tel.
22.06.2000	51718.449	18.14	–	1.07	2.24	1.3m
23.06.2000	51719.448	17.69	1.32	1.04	2.18	1.3m
24.06.2000	51720.384	17.67	1.34	–	2.18	1.3m
11.07.2000	51736.507	18.21	1.28	1.02	2.21	1.3m
30.10.2000	51848.419	18.61	–	1.28	2.37	Scm
24.12.2000	51903.287	17.97	–	0.89	2.14	Scm
5.07.2001	52095.559	18.01	1.12	1.08	2.16	1.3m
6.07.2001	52097.298	17.99	–	–	2.21	1.3m
8.07.2001	52099.293	17.91	–	–	2.10	1.3m
16.07.2001	52106.536	18.02	1.34	–	2.22	1.3m
7.08.2001	52128.528	17.80	1.33	–	2.15	1.3m
1.09.2001	52153.592	18.15	1.54	–	2.41	1.3m
2.09.2001	52154.575	17.74	1.06	–	2.19	1.3m
5.09.2001	52157.546	18.42	–	–	2.39	1.3m
5.02.2002	52311.261	17.72	–	1.20	2.34	Scm
6.02.2002	52312.259	17.53	–	0.87	2.00	Scm
7.02.2002	52313.247	17.68	–	0.75	1.88	Scm
8.06.2002	52433.536	18.31	1.38	1.13	2.29	1.3m
24.06.2002	52449.532	17.99	–	–	2.05	1.3m
16.07.2002	52471.540	18.32	–	–	2.36	1.3m
23.08.2002	52510.564	17.83	1.53	1.13	2.23	1.3m
29.10.2002	52577.375	17.75	–	0.78	2.07	Scm
30.10.2002	52578.371	17.88	–	0.96	2.14	Scm
31.10.2002	52579.275	18.19	–	1.23	2.43	Scm
1.11.2002	52580.258	17.86	–	1.01	2.26	Scm
28.11.2002	52607.258	17.76	–	1.07	2.32	Scm
29.11.2002	52608.246	17.72	–	1.12	2.31	Scm
27.02.2003	52697.599	17.73	1.37	1.10	2.13	2m
28.02.2003	52698.559	17.63	1.38	1.09	2.15	2m
2.03.2003	52700.547	17.57	1.29	1.11	2.20	2m
3.03.2003	52701.509	17.64	–	1.12	2.14	2m

Table 3: Photometric observations of V3 in the period June 2000 - March 2003

Date	J.D. (24...)	V	$B-V$	$V-R_C$	$V-I_C$	Tel.
13.06.2000	51709.485	18.10	–	1.27	2.63	1.3m
14.06.2000	51710.497	17.52	–	1.16	2.44	1.3m
15.06.2000	51711.493	17.43	–	1.14	2.44	1.3m
16.06.2000	51712.490	18.01	1.21	–	2.49	1.3m
21.06.2000	51716.512	17.77	1.71	1.18	2.49	1.3m
21.06.2000	51717.392	17.21	–	–	2.36	1.3m
22.06.2000	51718.449	17.41	1.63	1.12	2.40	1.3m
23.06.2000	51719.448	18.15	1.67	1.19	2.50	1.3m
24.06.2000	51720.384	17.38	1.92	–	2.40	1.3m
11.07.2000	51736.507	17.72	1.80	1.17	2.53	1.3m
29.10.2000	51847.379	17.25	–	1.18	2.51	Scm
30.10.2000	51848.419	17.26	1.29	1.26	2.61	Scm
24.12.2000	51903.287	17.16	–	1.09	2.42	Scm
5.07.2001	52095.559	17.48	–	1.07	2.34	1.3m
6.07.2001	52097.298	17.52	–	–	2.37	1.3m
8.07.2001	52099.293	17.61	1.54	–	2.32	1.3m
16.07.2001	52106.536	17.69	1.71	–	2.42	1.3m
7.08.2001	52128.528	17.39	1.74	–	2.38	1.3m
1.09.2001	52153.592	18.20	1.13	–	2.78	1.3m
2.09.2001	52154.575	17.65	1.24	–	2.56	1.3m
5.09.2001	52157.546	17.79	–	–	2.67	1.3m
5.02.2002	52311.261	17.61	–	1.16	2.58	Scm
6.02.2002	52312.259	17.31	–	1.26	2.57	Scm
7.02.2002	52313.247	17.30	–	1.14	2.59	Scm
8.06.2002	52433.536	17.38	1.74	1.19	2.49	1.3m
24.06.2002	52449.532	17.64	–	–	2.62	1.3m
16.07.2002	52471.540	18.36	–	–	2.66	1.3m
23.08.2002	52510.564	17.51	1.41	1.24	2.54	1.3m
29.10.2002	52577.375	17.30	–	1.15	2.59	Scm
30.10.2002	52578.371	17.68	–	1.08	2.46	Scm
31.10.2002	52579.275	17.90	–	1.21	2.42	Scm
1.11.2002	52580.258	17.41	–	1.12	2.57	Scm
28.11.2002	52607.258	17.27	–	1.13	2.50	Scm
29.11.2002	52608.246	17.81	–	1.17	2.62	Scm
27.02.2003	52697.599	17.30	1.49	1.19	2.33	2m
28.02.2003	52698.559	18.28	1.44	1.32	2.48	2m
2.03.2003	52700.547	17.30	1.43	1.16	2.30	2m
3.03.2003	52701.509	17.68	–	1.24	2.47	2m

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Semkov, E. H., 2003, *IBVS*, No. 5373

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PHOTOELECTRIC MINIMA OF SOME ECLIPSING BINARY STARS

TANRIVERDİ, T.; KUTDEMİR, E.; ELMASLI, A.; ŞENAVCI, H. V.; ALBAYRAK, B.; SELAM, S. O.; AYDIN, C.; AKSU, O.; BULCA, İ.; ÇINAR, D.; KARA, A.; DEMİRHAN, M.; YILMAZ, M.; ÇETİNTAŞ, C.; GÖZLER, A. P.; KARAKAŞ, T.; SEZGİN, A. S.; TURHANOĞLU, B.

Ankara University, Faculty of Science, Astronomy and Space Sciences Department 06100, Tandoğan, Ankara, Turkey; e-mail: taner@astro1.science.ankara.edu.tr

Observatory and telescope:
30-cm Maksutov telescope of the Ankara University Observatory and 40-cm Cassegrain telescope of the TÜBİTAK† National Observatory.

Detector:	OPTEC SSP-5A photometer 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:
Times of minima were determined by the method of Kwee and van Woerden (1956).

Observed star(s):

Star name	GCVS type	RA (J2000)	Dec (J2000)	Comp. star	E 2400000+	P [day]	Source
V376 And	EW	02 35 11	+49 51 37	BD+49 699	51644.3215	0.798669	1
HV Aqr	EW/KW/RS	21 21 24	−03 09 36	BD−03 5184	48835.7742	0.3744576	2
SV Cam	EA/DW/RS	06 41 19	82 16 02	BD+82 0176	52282.4579	0.59307301	3
V776 Cas	EW	01 53 23	+70 02 33	BD+69 118	52556.3106	0.44041618	4
CG Cyg	EA/SD/RS	20 58 13	+35 10 29	BD+34 4216	52490.4173	0.6311436	3
SW Lac	EW/KW	22 53 41	+37 56 18	BD+37 4715	52505.5960	0.32071417	3
ET Leo	EW	10 33 25	+17 34 27	HD 91149	48499.9714	0.3465039	4
V781 Tau	EW/KW	05 50 13	+26 57 43	HD 38980	52554.9210	0.344908	5
DI Peg	EA/SD	23 32 14	+14 58 08	BD+14 5004	25918.3597	0.71181663	6
V357 Peg	EW	23 45 35	+25 28 18	BD+25 5001	48500.3159	0.578452	7

Source(s) of the ephemeris:
1.: Rucinski et al. (2001); 2.: Molik & Wolf (2000); 3.: Pribulla et al. (2002); 4. this study; 5.: Nelson (2003); 6.: Vinkó (1992); 7.: ESA (1997)

† TÜBİTAK : The Scientific and Technical Research Council of Turkey

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V376 And	52595.5273	0.0006	I	*BV*	−0.0090	El-Kr
HV Aqr	52491.4263	0.0001	II	*BV*	0.0098	Kt-Çn
	52545.3387	0.0003	II	*BV*	0.0003	Tn-Krk
	52596.2606	0.0003	II	*BV*	−0.0040	Kt-Gz
SV Cam	52674.4757	0.0001	I	*UBV*	−0.0034	El-Ak
V776 Cas	52556.3107	0.0005	I	*UBV*	0.0000	Şn- El
	52556.5306	0.0004	II	*UBV*	−0.0003	El-Şn
CG Cyg	52497.3603	0.0001	I	*BV*	0.0004	El-Çt
	52498.3099	0.0003	II	*BV*	0.0033	Kt-Tr
SW Lac	52503.5114	0.0002	II	*BV*	0.00004	Tn-Bl
	52517.4617	0.0001	I	*BV*	−0.0007	Tn-Dm
	52538.3082	0.0001	I	*BV*	−0.0006	Tn-Krk
	52538.4700	0.0002	II	*BV*	0.0008	Tn-Krk
ET Leo	52726.2833	0.0005	I	*BVR*	0.0148	Tn-Krk
	52726.4488	0.0005	II	*BVR*	0.0071	Tn-Krk
DI Peg	52594.3820	0.0003	I	*BV*	−0.0177	Tn-Bl
V357 Peg	52526.3326	0.0003	I	*BV*	−0.0094	Kt-Çn
V781 Tau	52594.5853	0.0002	I	*BV*	0.0089	Tn-Dm

Explanation of the remarks in the table:

Ak: O. Aksu, Bl: İ. Bulca, Çn: D. Çınar, Çt: C. Çetintaş, Dm: M. Demirhan, El: A. Elmaslı, Gz: A.P. Gözler, Kr: A. Kara, Krk: T. Karakaş, Kt: E. Kutdemir, Şn: H. V. Şenavcı, Sz: A. S. Sezgin, Tn: T. Tanrıverdi, Tr: B. Turhanoğlu, Yl: M. Yılmaz

Acknowledgements:

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ERRATUM FOR IBVS 5407

We noticed an error in the minima of ET Leo which should be corrected as:

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Mean time 52726.2809, Mean error 0.0004  Min I (BVR)
Mean time 52726.4513, Mean error 0.0002  Min II(BVR)
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Taner TANRIVERDI

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OBSERVATIONS OF HD 279684

ROBB, R. M.[1,2,3]; INGRAHAM, P. J.[3]; WRIGHT, N. H.[3]

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[2] Guest Observer, Dominion Astrophysical Observatory, which is operated by the Herzberg Institute of Astrophysics, National Research Council of Canada

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Our understanding of the solar dynamo can be furthered by studying stars with active regions. These stars can be discovered by searching for X-ray sources with periodic sinusoidal photometric variations. The star HD 279684 is catalogued as the X-ray source 1RXSJ041702.1+353116 by the ROSAT satellite (Voges et al., 1999). It is in the TYCHO Catalogue (ESA, 1997) as TYC 2379-665-1 and has its parallax measured to be 162±62 mas giving a nominal distance of about 4 to 10 parsecs and $(B-V)$ of 1.1, which agrees with the HD spectral class of K0. 2MASS measurements of HD 279684 reveal that J=8.75, H=8.20 and K=8.07 all with an uncertainty of about ±0.02. All these colour measurements are consistent with a spectral class of K4V±1 Assuming a main sequence K4 star implies an absolute magnitude of about $M_V = 7.0 \pm 0.1$ so with an apparent magnitude of $V_T = 10.72 \pm 0.1$ a second estimate of the distance would be about 50 ± 5 parsecs, which is probably more accurate than the Hipparcos parallax.

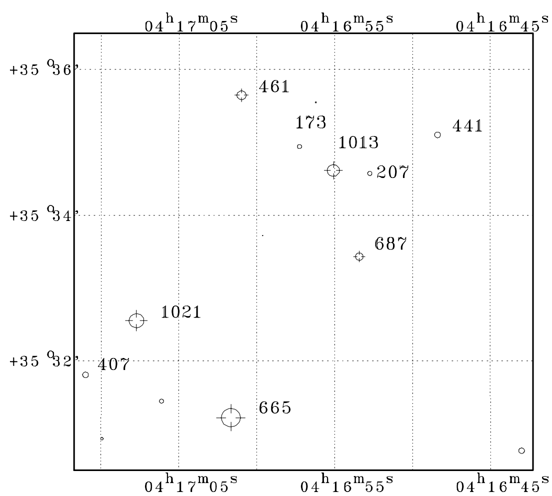

Figure 1. Finder chart labelled with the GSC identification numbers from region 2379.

The University of Victoria observations were made with our automated 0.5m telescope, Star I CCD and reduced in a fashion similar to that described in Robb and Greimel (1999). The field of stars observed is shown in Figure 1.

Table 1: Stars observed in the field of HD 279684=GSC 2379-0665

Star GSC Id	R.A. J2000	Dec. J2000	GSC Mag.	ΔR Mag.	Std Dev Between	Std Dev Within
0665	$04^h17^m01.8^s$	$35°31'17.1''$	10.5	−0.787	0.041	0.005
1021	$04^h17^m07.7^s$	$35°32'33.3''$	11.5	–	–	–
1013	$04^h16^m55.0^s$	$35°34'37.0''$	12.1	0.969	0.005	0.004
0461	$04^h17^m00.9^s$	$35°35'39.3''$	12.9	1.558	0.010	0.005
0687	$04^h16^m53.3^s$	$35°33'26.7''$	13.2	1.988	0.014	0.013
0441	$04^h16^m48.3^s$	$35°35'06.1''$	13.6	2.257	0.006	0.014
0207	$04^h16^m52.7^s$	$35°34'34.7''$	14.0	2.573	0.011	0.018
0173	$04^h16^m57.2^s$	$35°34'56.5''$	14.0	2.917	0.022	0.029
0407	$04^h17^m10.9^s$	$35°31'48.7''$	13.7	2.389	0.023	0.018

The Julian Dates of observation (-2450000) are 2682, 2683, 2694, 2695, 2697-2700, 2726 and 2734. Table 1 lists the stars' identification numbers and magnitudes from the Hubble Space Telescope Guide Star Catalogue (GSC) (Jenkner et al., 1990) and positions from the USNO-A 2.0 catalogue (Monet et al., 1998). All observations were made using a filter identical to the Cousins R.

Our differential ΔR magnitudes are calculated in the sense of the star minus GSC 2379-1021. Brightness variations during a night were measured by the standard deviation of the differential magnitudes and are listed for the most photometric night in the last column as "Std Dev Within". A "Std Dev Within" one night of 0.004 sets an upper limit on variations of an hourly timescale. For each star the mean of the nightly means is shown as ΔR in Table 1. The standard deviation of the nightly means is a measure of the night to night variations and is called "Std Dev Between" in Table 1. The smallest "Std Dev Between" is 0.005 magnitudes. This excellent photometry shows that night to night variations in GSC 2379-1021 must be less than a few millimagnitudes.

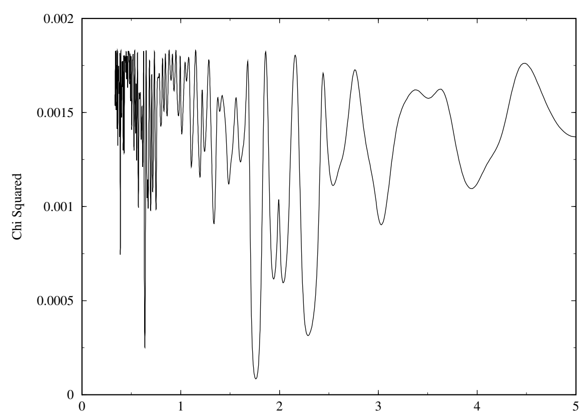

Figure 2. Periodogram for sine curve fit to photometric data

The star HD 279684 varied in brightness during some nights and had obvious variations from night to night. Sine curves of various periods were fitted to the data and the chi squared value is plotted as a function of period in Figure 2. Plots of the light curve at the period corresponding to each of the minima of chi squared showed that the only reasonable period was approximately 1.75 days. A plot at twice this period did not show any improvement in the scatter. Our best estimate of the ephemeris is:

$$\text{HJD of Maximum Brightness} = 2452681\overset{\text{d}}{.}05(7) + 1\overset{\text{d}}{.}75(1) \times \text{E}.$$

where the uncertainty in each final digit is given in brackets. In Figure 3 the differential ΔR_C magnitudes phased at this period are plotted. The light curve is typical of stars with active regions and/or spots such as BY Dra. Spot size and/or position changes that are usual on active dwarf stars explain the discontinuities on the light curve, which was observed during 30 rotations.

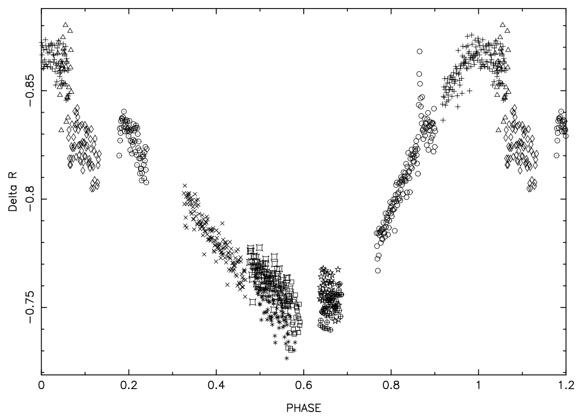

Figure 3. *R* filtered light curve of HD 279684 with different symbols for different nights.

The night shown in open circles in Figure 3 is replotted at a larger scale in Figure 4. We see that the brightness variation is caused by a flare on the star, occurring at Heliocentric Julian Date 2452694.813 with an amplitude of 0.04 magnitudes in *R* band.

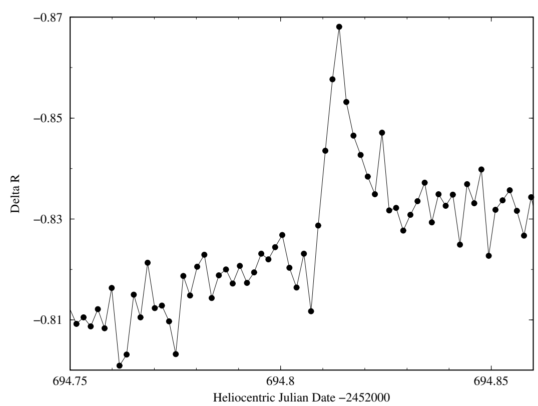

Figure 4. Flare on the star HD 279684

A spectrum of HD 279684 observed with the Dominion Astrophysical Observatory's 1.8m telescope is shown in Figure 5. The time of observation was 9:00 UT 18 Jan 2003, which corresponds to a phase of approximately 0.75. The obvious Hα emission line is a characteristic of stars with active regions. The great number and strength of the CaI and FeI absorption lines are consistent with late type stars.

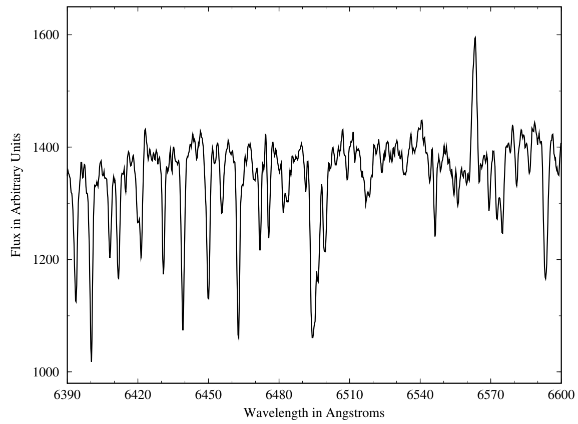

Figure 5. Spectrum of HD 279684 showing the Hα emission line at 6563Å

HD 279684 seems to be a fairly rapidly rotating late type dwarf star with active regions covering a significant part of its surface and energizing a hot corona producing X-rays. While it is at about the distance of the Hyades cluster and in the direction to be an outlying member, radial velocity and proper motion studies will be necessary to establish its membership. Further spectral observations will be of interest to see if the Hα emission will vary in intensity with phase. Photometric observations will be important to tell if differential rotation will modify the period and/or shape of the light curve.

Acknowledgements

We would like to thank Karen Butler for reducing the spectrum used in Figure 5.

This research has made use of the NASA/ IPAC Infrared Science Archive, which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

This research has made use of the USNOFS Image and Catalogue Archive operated by the United States Naval Observatory, Flagstaff Station[1].

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[1] `http://www.nofs.navy.mil/data/fchpix/`

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NSV 16, THE ENIGMATIC VARIABLE IN CASSIOPEIA

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Name of the object:
NSV 16 = S 10134

Equatorial coordinates:	**Equinox:**
R.A.= $00^h05^m05^s.41$ **DEC.=** $+59°39'01''.3$	2000

Observatory and telescope:
Crimean Laboratory of Sternberg Astronomical Institute, 40-cm astrograph

Detector:	Photoplate

Filter(s):	None

Comparison star(s):

α (J2000)	δ (J2000)	B_{pg}
$00^h05^m05^s.5$	$+59°36'00''$	$14^m.16$
$00^h05^m04^s.5$	$+59°36'46''$	$15^m.12$
$00^h04^m51^s.7$	$+59°36'49''$	$15^m.37$
$00^h04^m48^s.4$	$+59°40'54''$	$15^m.48$
$00^h05^m01^s.6$	$+59°41'32''$	$15^m.86$
$00^h05^m11^s.8$	$+59°37'50''$	$16^m.12$
$00^h05^m00^s.3$	$+59°38'31''$	$16^m.59$
$00^h04^m50^s.5$	$+59°38'18''$	$16^m.93$
$00^h04^m58^s.1$	$+59°38'09''$	$17^m.00$
$00^h04^m52^s.1$	$+59°38'53''$	$17^m.03$
$00^h04^m48^s.0$	$+59°39'24''$	$17^m.17$

Transformed to a standard system:	$B_{\rm pg}$
Standard stars (field) used:	Calibrated using the photoelectric standard sequence in NGC 225 (Hoag *et al.*, 1961)

Date(s) of the observation(s):
JD 2438587–2449274

Availability of the data:
Upon request

Type of variability:	Unknown

Remarks:

The variable star NSV 16 (S 10134) was discovered by Hoffmeister (1967). He found variations between the photographic magnitudes $15^{m}_{.}5$ and 17^{m}, suspected intermediate-period variability, but could not determine the variability type. The star was faint on most of Sonneberg plates.

We studied the star on 411 plates of the Moscow collection and found a very complex pattern of variations between $14^{m}_{.}2$ and fainter than $17^{m}_{.}2$. Figure 1 displays examples of seasonal light curves of different years, with apparently quite different behavior. The first two sections (two consecutive moonless intervals when photograps were acquired) from the upper panel of Fig. 1 are shown in more detail in Fig. 2; whereas the first of them is characterized by almost constant (high) brightness, the star was fainter during the next month and seemed to vary quasi-cyclically. Finally, Fig. 3 shows short term variability on JD 2443079.

The star is faint in the major all-sky surveys (17.64B and 16.08R in GSC2.2; 18.10 and 17.66B, 15.94 and 16.49R; 15.39I in USNO B1.0). Its USNO A2.0 magnitudes, based on plates taken on the same night in 1954, confirm the star's yellow or slightly reddish color (17.4B, 15.7R).

It is difficult to attribute NSV 16 to any of the traditional variability types. At the galactic latitude $b \approx 3°$, it is probably a Population I object. The density of stars around the object is normal, without obvious nebulae. The object definitely deserves a CCD-photometric and spectroscopic study.

Acknowledgements:

The work of the GCVS team is supported, in part, by grants from the Russian Foundation for Basic Research (grant 02-02-16069), The Federal Scientific and Technological Program "Astronomy", the program of support for leading scientific schools of Russia (00-15-96627), and the program "Unstable Processes in Astronomy" of the Presidium of Russian Academy of Sciences.

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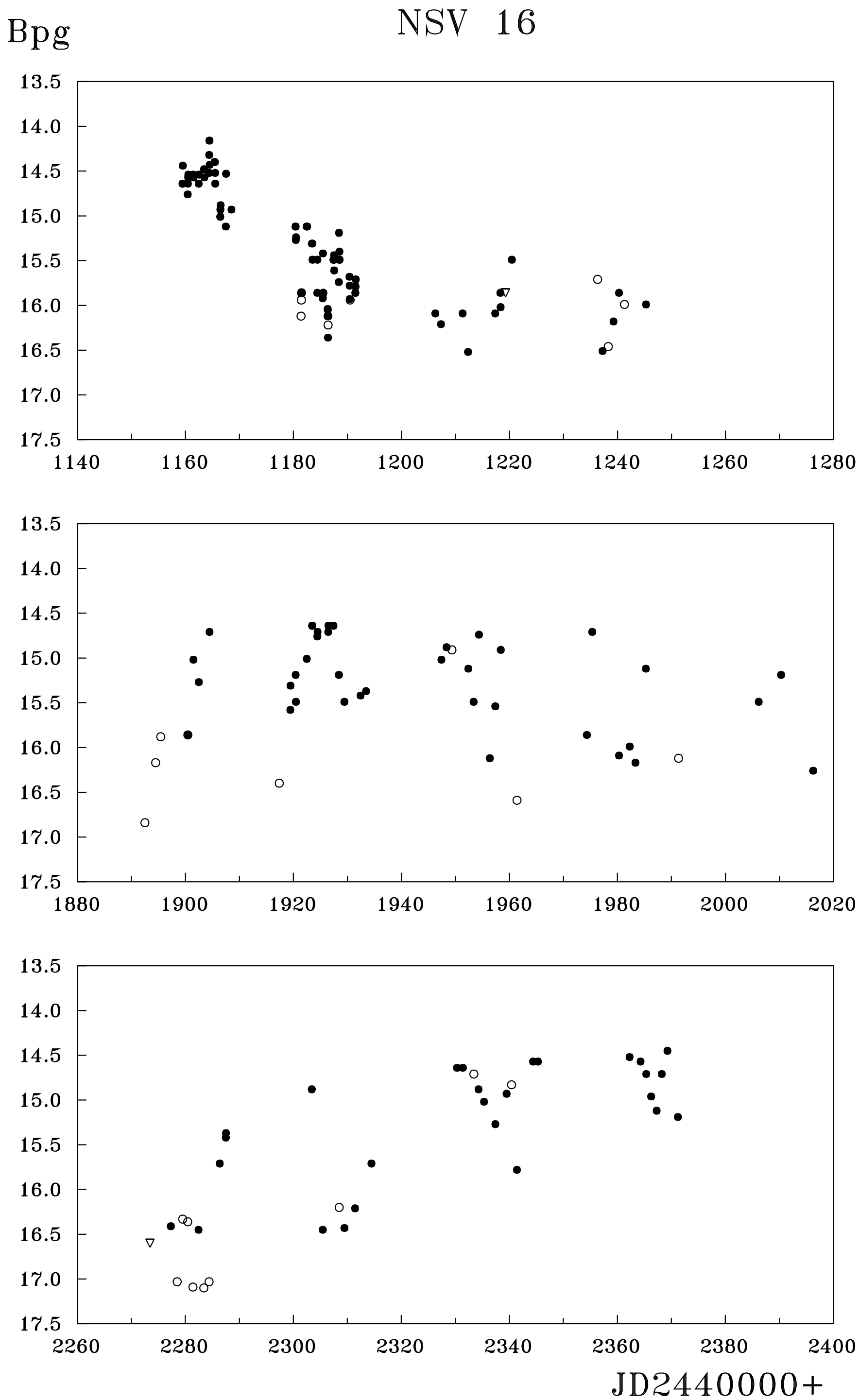

Figure 1. The sample light curves of NSV 16 for three yearly seasons of observations. Open circles: uncertain estimates; open triangles: brighter limits.

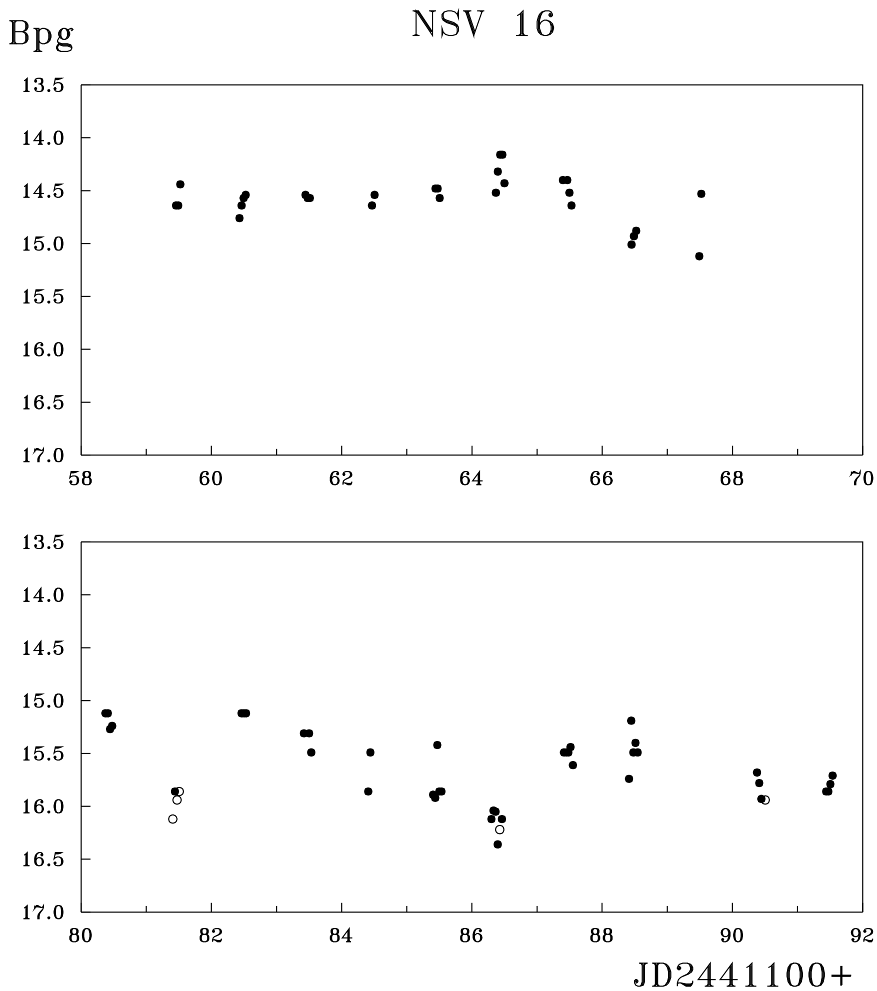

Figure 2. The first two monthly seasons from the upper panel of Fig. 1.

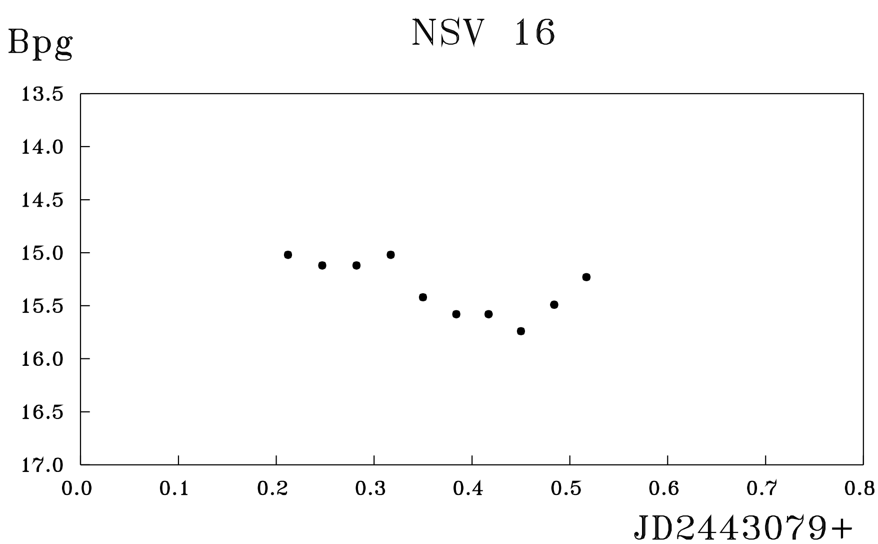

Figure 3. The light curve of the Algol-like minimum of NSV 16 on JD 2443079.

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ACCURATE ASTROMETRIC POSITION FOR M31-RV

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A mysterious event took place in the Andromeda galaxy in the summer of 1988, when a star of the inner bulge region erupted, peaking at $M_V = -10.0$. The event was different from other novae discovered in M31 (e.g. Rosino, 1973; Ciardullo et al., 1990): at peak brightness it displayed an M supergiant spectrum, as revealed by observations with the Palomar 5m telescope by Rich et al. (1989). The short duration of the event, the faint apparent magnitude and the delay of the announcement until the outburst was already over are responsible for limited observations on this very interesting and highly unusual event, for which theorists have not yet agreed on a shared interpretation.

The recent colorful happenings of V838 Mon, where a star erupted and became - within an expanding huge light echo - a supergiant with first K, than M and later a spectrum dominated by such cool features as have been observed only in brown dwarfs (Munari et al., 2002a; Geballe et al., 2002; Bond et al., 2003), have revitalized the interest in the similar red variable of M31, cited in literature as M31-RV or M31-RedVar.

The discovery that V838 Mon is a binary system where the companion to the exploded star is a massive B3V star (Munari et al., 2002b) and that it has developed a bright, huge and long lasting light-echo (Henden et al., 2002) is a stimulus to a detailed investigation, in particular on HST archive images, trying to locate the remnant - if any - of the M31-RV event. The understandably very crowded HST images of the bulge of the Andromeda galaxy would greatly benefit from the most precise astrometric position possible for M31-RV. The same coordinates and a good finding chart would also support the search in plate archives around the world for further photometry of the 1988 event. The original frame grabbed from the TV screen of the telescope guider and presented by Rich et al. (1989) as an identification of the field is hardly suited for the task. Furthermore, good coordinates and a finding chart could also stimulate screening of plate archives around the world looking for a confirmation or dismissal of a second, weaker outburst of M31-RV in 1967 allegedly reported by Sharov (1990) which, if real, could dramatically affect the interpretation of the event.

The position of M31-RV has been reported as 214″ E and 196″ S (±2″) of M31 nucleus by Rich et al. (1989), as 214″ E and 198″ S by Sharov (1990) citing Rich et al., and as 3′ from the nucleus by Mould et al. (1990). More precise positions of M31-RV (referred to J2000 equinox) have been reported by Ciardullo et al. (1990, their nova N.36) as

$$\alpha = 00^{\rm h}43^{\rm m}02\overset{\rm s}{.}1 \qquad \delta = +41^\circ 12' 55''$$

by Bryan and Royer (1992) as

$$\alpha = 00^{\rm h}43^{\rm m}01\overset{\rm s}{.}7 \quad \delta = +41^\circ12'59''$$

and by Tomaney and Shafter (1992) as

$$\alpha = 00^{\rm h}43^{\rm m}02\overset{\rm s}{.}4 \quad \delta = +41^\circ12'56''$$

The scatter among these measures (4.6 arcsec) is large and unsuited to support identification of the remnant on HST images.

Table 1: Asiago archive plates imaging the 1988 outburst of M31-RV.

plate N.	date	UT	emul.	filter	exp. (sec)
14197	13 Aug 1988	00:03	103a-E	RG-1	1800
14222	8 Sep 1988	01:27	103a-E	RG-1	1800

We have located in the plate archive of the Asiago 67/92 cm Schmidt telescope (205 cm focal length) two plates secured during the outburst of M31-RV in 1988. Details of the plates are given in Table 1. The USNO-B catalog uses plate material that is saturated near the nucleus of M31. To properly measure the position of M31-RV on the Asiago plates, a deep image of M31 was taken with the USNO Flagstaff Station 1.0m telescope. USNO-B stars further from the nucleus were used to place all stars visible on the Asiago plates on the same astrometric system. Measurement of M31-RV was then possible with respect to these secondary astrometric standards, resulting in:

$$\text{plate14197} \qquad \alpha = 00^{\rm h}43^{\rm m}02\overset{\rm s}{.}42 \quad \delta = +41^\circ12'56\overset{''}{.}7 \tag{1}$$

$$\text{plate14222} \qquad \alpha = 00^{\rm h}43^{\rm m}02\overset{\rm s}{.}41 \quad \delta = +41^\circ12'57\overset{''}{.}1 \tag{2}$$

The position on the two plates agrees within 0.2 arcsec, representing more than an order of magnitude gain in accuracy compared to what available so far in the literature, and making the search for the remnant on HST images now more feasible. A finding chart from plate 14197 is presented in Figure 1.

Acknowledgements. We would like to thank Sergio Dalle Ave for his skillful digital preparation of the plate material for successive astrometric work, and Cesare Barbieri for useful suggestions on the plate digitization technique (cf. Barbieri et al. 2003).

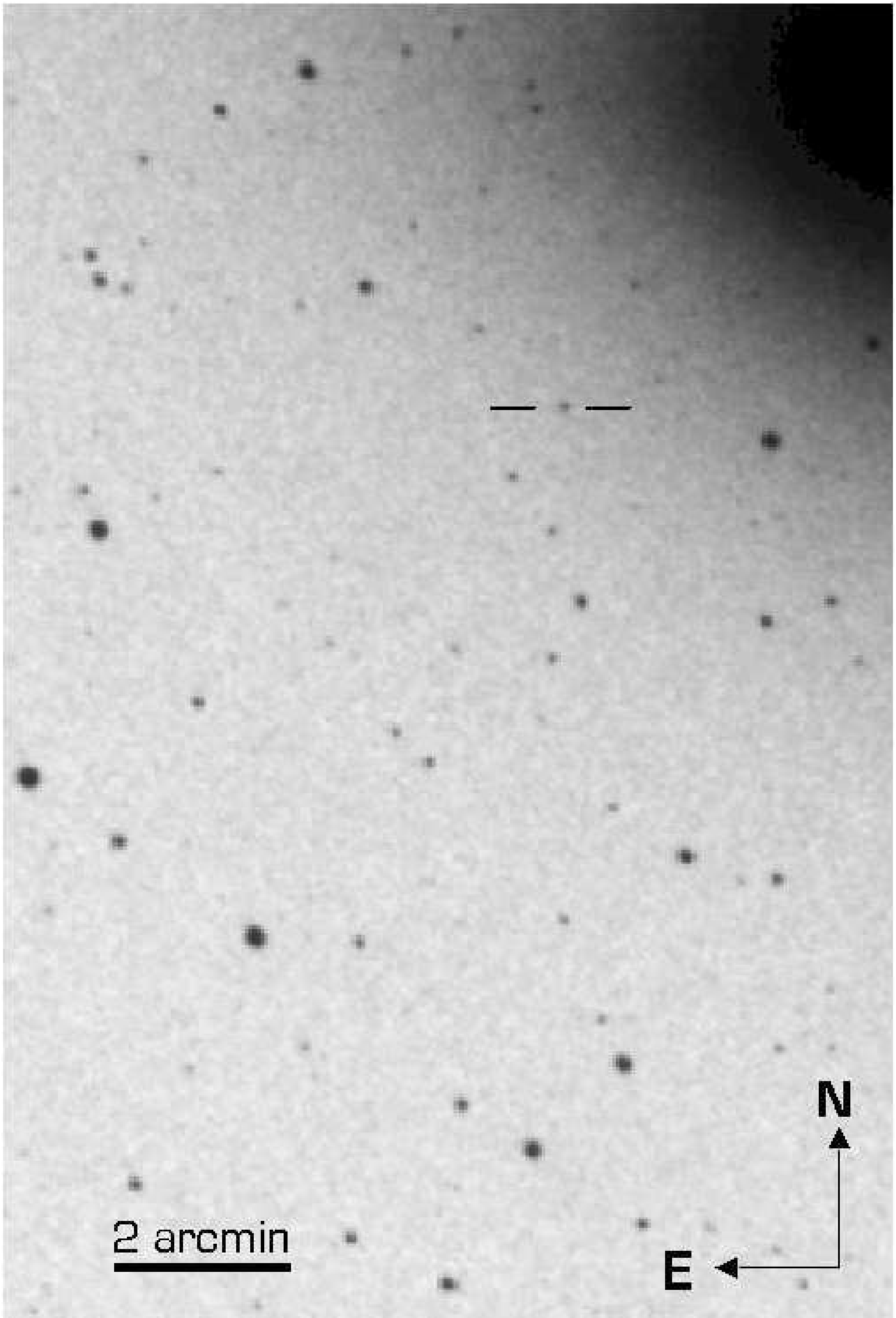

Figure 1. Finding chart for M31-RV from Asiago archive plate 14197 (cf. Table 1).

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ERRATUM FOR IBVS 4807

The original title of IBVS 4807 contained an error:

"Two New Eclipsing Binary Systems in Cepheus: the W UMa NSV 14312 and the Eccentric EA GSC 3992_30847"

The correct GSC number is, as used in the body of the paper: 3992_0847 .

The Editors

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FIVE NEW W UMa VARIABLES

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Observed star(s):				
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
TYC 2511-167-1	EW	$10^h34^m12^s.41$	$+32°08'52''.0$	*
GSC 2511-53	EW	$10^h33^m04^s.91$	$+32°22'15''.3$	*
GSC 6336-140	EW	$20^h18^m26^s.75$	$-18°58'19''.7$	*
GSC 825-1465	EW	$09^h20^m59^s.20$	$+14°57'24''.8$	*
GSC 229-701	EW	$09^h04^m17^s.82$	$+04°32'29''.8$	*

* R magnitudes of about ten USNO-A2.0 stars in the fields.

Observatory and telescope:
Les Engarouines Observatory (IAU astrometric code A14), 0.212m Newton.

Detector:	KAF-1600 CCD.
Filter(s):	None, roughly *R*.

Availability of the data:
Upon request

Method of data reduction:
Standard CCD-frame reduction using `Prism`.

Date(s) of the observation(s):

TYC 2511-167-1	2002−3−9, 13; 2002−4−6, 17, 18, 19; 2002−12−3, 7; 2003−4−5
GSC 2511-53	2002−3−13; 2002−4−6, 17; 2002−12−3, 7; 2003−2−2; 2003−4−5
GSC 6336-140	2002−8−5, 7, 14, 16; 2002−9−7, 15
GSC 825-1465	2003−2−7, 8, 9; 2003−3−5
GSC 229-701	2003−2−8; 2003−3−5, 7, 8

Table 1. Light curve parameters from the data analysis by the `CourbRot` software (Behrend, 2001). Uncertainties correspond to one standard-deviation.

Star name	HJD of a pr. min.	Period	Tot. var.	Type
TYC 2511-167-1	$2452366^{\rm d}.884$	$0^{\rm d}.4368897$	$0^{\rm m}.38$	W UMa
	$\pm0^{\rm d}.010$	$\pm0^{\rm d}.0000015$	$\pm0^{\rm m}.03$	
GSC 2511-53	$2452358^{\rm d}.913$	$0^{\rm d}.3709787$	$0^{\rm m}.143$	W UMa
	$\pm0^{\rm d}.003$	$\pm0^{\rm d}.0000014$	$\pm0^{\rm m}.005$	
GSC 6336-140	$2452508^{\rm d}.702$	$0^{\rm d}.39118$	$0^{\rm m}.376$	W UMa
	$\pm0^{\rm d}.002$	$\pm0^{\rm d}.00002$	$\pm0^{\rm m}.009$	
GSC 825-1465	$2452678^{\rm d}.248$	$0^{\rm d}.53461$	$0^{\rm m}.394$	W UMa
	$\pm0^{\rm d}.002$	$\pm0^{\rm d}.00004$	$\pm0^{\rm m}.009$	
GSC 229-701	$2452678^{\rm d}.548$	$0^{\rm d}.30953$	$0^{\rm m}.30$	W UMa
	$\pm0^{\rm d}.003$	$\pm0^{\rm d}.00003$	$\pm0^{\rm m}.02$	

Remarks:

The Simbad database reports no known variable stars in the vicinity of these five objects. Tycho's photometry for TYC 2511-167-1 was downloaded from the CDS web-server. As expected, the uncertainties for this faint star were too high to usefully constrain the light curve and its period; the general trend is nevertheless in relative agreement with the parameters we deduced from our observations. All objects were found to be variable by L. B., in the course of asteroidal light curve determination.

Acknowledgements:

These researches used the Simbad database, operated by the CDS at Strasbourg, France.

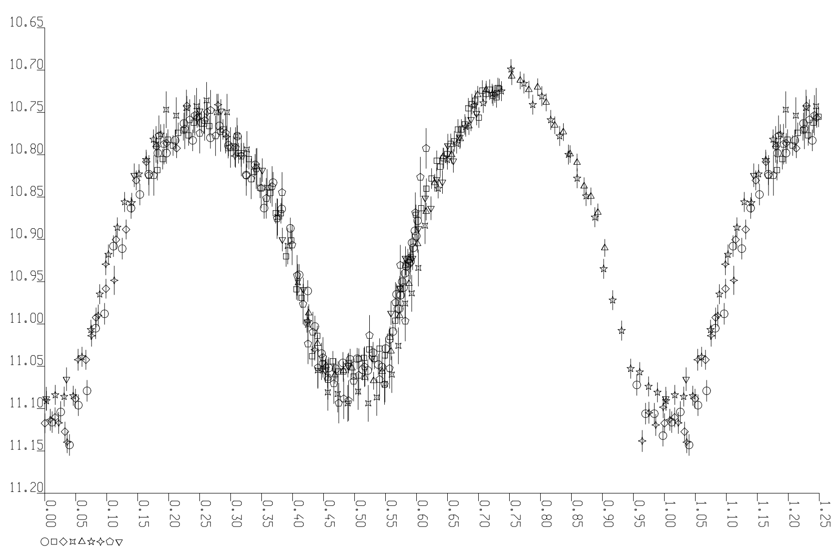

Figure 1. Unfiltered light curve of TYC 2511-167-1, $P = 0^{\rm d}.4368897$.
The small labels denote the chronologic order of the series of observations in Figs. 1-5.

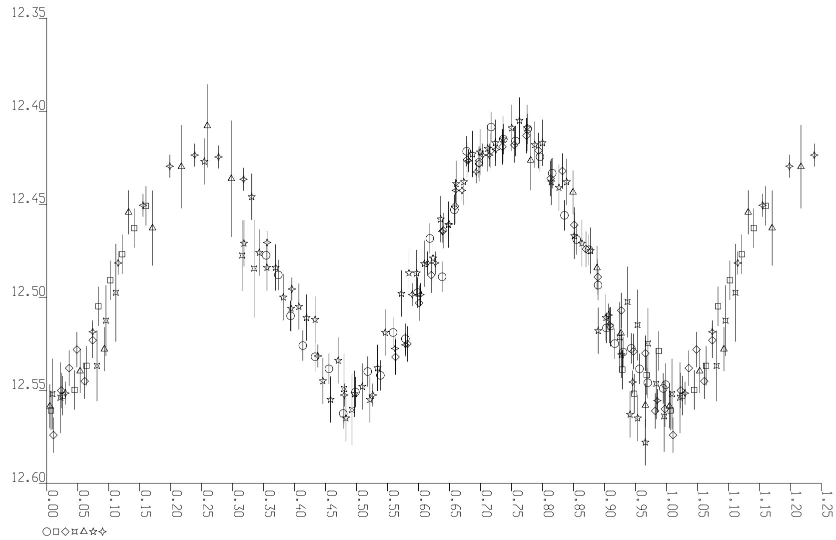

Figure 2. Unfiltered light curve of GSC 2511-53, $P = 0^{\rm d}.3709787$.

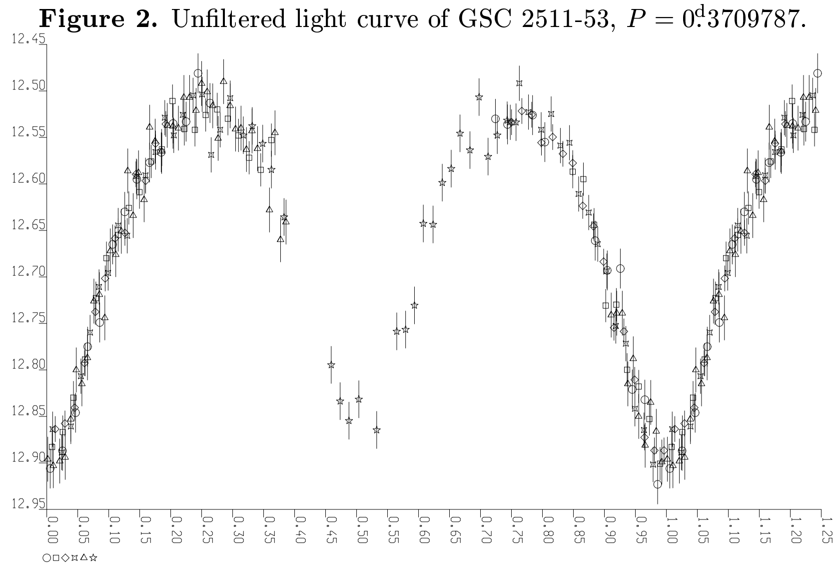

Figure 3. Unfiltered light curve of GSC 6336-140, $P = 0^{\rm d}.391178$.

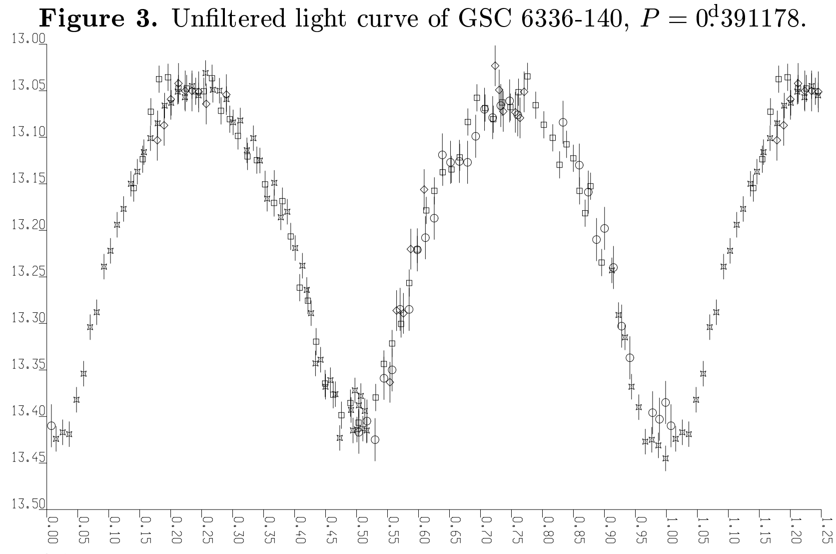

Figure 4. Unfiltered light curve of GSC 825-1465, $P = 0^{\rm d}.534615$.

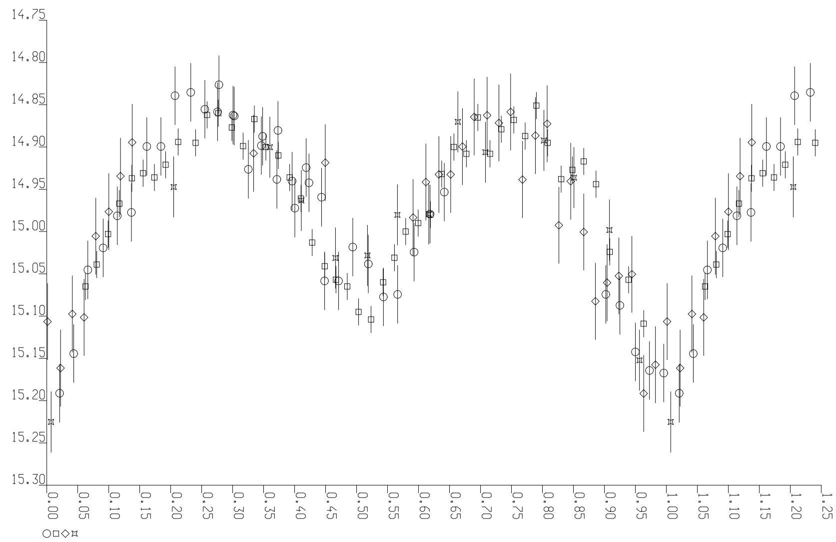

Figure 5. Unfiltered light curve of GSC 229-701, $P = 0\overset{d}{.}309525$.

Reference:

Behrend, R., 2001, *Orion*, **304**, 12

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THE START OF THE 2003 ECLIPSE OF EE CEPHEI

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The variable nature of 11th magnitude star EE Cep (=BD+55°2693) was discovered by Romano (1956), and confirmed by Weber (1956), who observed two independent deep ($\Delta B \geq 1\overset{m}{.}5$) minima in 1947 and 1952. The eclipsing nature of these minima was first suggested by Romano & Perissinotto (1966) who noticed a third minimum in 1958 July. Meinunger (1973) then observed two more minima in 1964 and 1969, and confirmed this suggestion. He published the first ephemeris for EE Cep eclipses with orbital period of 2049 days (5.6 years). So far there have been no traces of secondary eclipse in the light curve of EE Cep.

The most striking characteristics of EE Cep are the extremely large changes of shape and depth of the minima. Recently, Graczyk et al. (2003) compiled light curves of all available past eclipses. The observed depths range from about $2^{\rm m}$ in 1958 and 1964 to about $0\overset{m}{.}6 - 0\overset{m}{.}8$ in 1969 and 1992. The depths of the eclipses correlate roughly inversely to their total durations. As an example, two different shape minima are presented in Fig. 1. The extremely shallow minimum ($\Delta B \approx 0\overset{m}{.}6$) in 1969 was simultaneously the longest one ($D \approx 60^{\rm d}$). Additionally, this eclipse showed a flat bottom phase with duration $d \approx 20^{\rm d}$. Most typical eclipses are similar to that of 1975. They have depth at least $1\overset{m}{.}5$ and show asymmetry of the ascending branch produced by a kind of slope-bottom phase in the minimum. A sketch view of such a typical minimum is presented in Fig. 2.

Multicolour *UBVRI* observations of a 1997 eclipse (Mikołajewski & Graczyk 1999) showed that the amplitude of the minimum changes very weakly with the wavelength, from about $1\overset{m}{.}75$ in U, to about $1\overset{m}{.}45$ in I light. This is probably caused by selective extinction in semitransparent parts of a dark eclipsing body. The contribution of the secondary light in the red RI bands is negligible. The characteristic slope-bottom phase (C-D part in Fig. 2) during the eclipse is easy to understand if the obscuring body is very elongated and tilted with respect to the direction of motion (Graczyk et al. 2003). Changes of tilt angle produce variations in the duration and slope of this transit phase. In particular, when the tilt angle is very small, a flat-bottom phase would be observed during the minimum. Simultaneously, the effective thickness of the eclipsing body also changes during the different eclipses, causing variations of the minima depths. The most promising model remains that of a dark, precessing disk around a low luminosity central

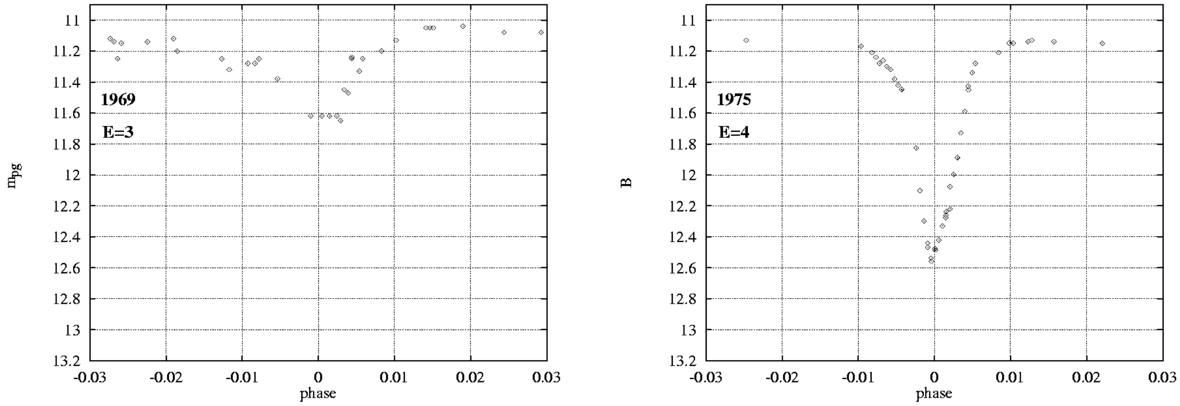

Figure 1. Examples of shallow, flat-bottom (*left*) and deep, slope-bottom (*right*) eclipses of EE Cep (Graczyk et al. 2003, and references therein).

object (Mikołajewski & Graczyk 1999, Graczyk et al. 2003). The precession changes both the inclination of the disc to the line of sight, and the tilt of its cross-section to the transit direction. The unique shape of the eclipse observed in 1969 can be explained by a practically edge-on and non-tilted projection of the disc. Two hypotheses can be considered for such a disc: (i) it has a proto-planetary origin; (ii) it is a post-planetary object (a result of planetary disintegration). An important question is the nature of the central body embedded in the disk. It can be a low massive single star or a close binary system. The only similar object previously known with a dark circumstellar disc is ϵ Aur – the longest period (~ 27 years) eclipsing binary.

Surprisingly, low resolution spectroscopic observations during past eclipses (Brükner 1976, Baldinelli, Ferri & Ghedini 1981) did not detect any trace of secondary spectrum. Moreover, there were no changes in the spectrum (especially in Hα, Hβ emissions) despite the large depth of the minima (about $1\overset{m}{.}5$). Our recent observations at Asiago Observatory ($R = \lambda/\Delta\lambda \approx 4000$) show that the profiles of the Hα and Hβ lines in the spectrum of EE Cep are very similar to those observed in Be stars. However, we cannot be sure that they indeed belong to the visible, eclipsed B5III component. The observed Hα and Hβ profiles are rather characteristic for Be stars located nearly pole-on (*e.g.* Hanuschik et al. 1996). Already far outside eclipse we found spectacular variations in the Hα emission (Graczyk et al.2003), which seem to be more naturally connected with the complex around the secondary. Additionally, in the same paper we pointed out variations in the radial velocities of the NaI absorption doublet. This finding can be considered an indication of its possible circumstellar origin. Moreover, last month we found these lines as pure P-Cyg type profiles (Fig. 3). This dramatic change can already be connected with the beginning of the eclipse.

The incoming event, according to the ephemeris of Mikołajewski & Graczyk (1999), has number $E = 9$. The mid-eclipse should occur on June 3, 2003. The external first contact of the semitransparent part of the disc (A in Fig. 2) can start at least three weeks earlier ($\sim$ May 13). The central part of the minimum (B-C-D-E in Fig. 2) should occur between $\sim$ May 23 and $\sim$ June 13 corresponding to the occultation of the primary by the inner, opaque part of the disc. The end of the minimum should take place $\sim$ June 24. We would like to remember that the eclipse duration D can last even $2-3$ weeks. In Graczyk

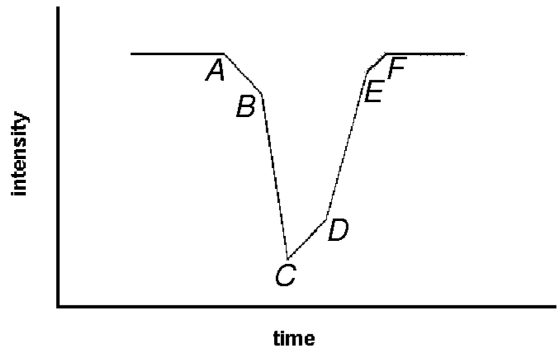

Figure 2. Schematic view of the EE Cep eclipse: A–B - descending atmospheric phase; B–C eclipse ingress; C–D transit phase; D–E eclipse egress; E–F ascending atmospheric phase.

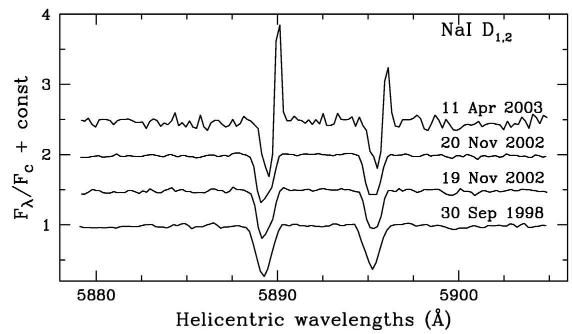

Figure 3. Profiles ($R = \lambda/\Delta\lambda \approx 15000$) of NaI $D_{1,2}$ doublet obtained with the coudé spectrograph of the 2m telescope at Rozhen Observatory.

et al. (2003) we speculate that the possible precession period may be about 50 years and the shape of the eclipse can be similar to the one observed in 1952. That one was very deep (at least $1\overset{m}{.}9$) and no longer than 40 days. A slope-bottom with inverse inclination, placed on the ascending branch of the present eclipse, would not be a surprise.

Photometric observations of EE Cep (with CCDs or photomultipliers) from widely spaced longitudes will help to obtain a detailed light curve of this minimum and to determine precisely all six contacts A-F (Fig. 2). These observations will be useful for numerical modelling of the disc. We recommend as comparison and check stars the brightest objects from the Meinunger's (1975) sequence (Fig. 4). Their Johnson magnitudes, obtained using a diaphragm cooled photometer attached to the 60cm reflector at Toruń observatory, are:

Star	U	B	V	R	I	n
a = BD + 55°2690	10.86	10.68	10.38	10.09	9.87	40
b = GSC 3973 2150	11.31	11.47	11.23	10.99	10.81	5
c = BD + 55°2691	11.59	11.47	11.22	10.96	10.75	2

Our data are in good agreement with earlier UBV measurements for star "a" (Meinunger 1976), V brightness for "b" and "c" stars (Skiff 2003) and BRI estimations for all these objects from USNO-B1 catalogue (Monet et al. 2003). Star "c" was suspected variable (Baldinelli & Ghedini 1976), and its contemporary magnitudes differ about $0\overset{m}{.}1$ from the data of Barbieri et al. (1973). Nevertheless, our own observations and the observations of Skiff (2003) do not confirm its variability.

Very important will be high resolution spectroscopic observations during the eclipse. We expect the appearance of strong shell spectrum from the gaseous component of the disc, as in ϵ Aur (Ferluga & Mangiacapra 1991), and possible strengthening of the diffuse interstellar bands (DIBs) caused by the dust component of the disc. Several strong DIBs (*e.g.* $\lambda\lambda$ 6619 Å, 5780 Å, 5797 Å, 5850 Å) are visible already in the spectrum outside the eclipse. Possible changes in the Balmer line profiles should determine where their emissions arise, i.e. whether the primary is a Be star. Of course, systematic radial velocity measurements are necessary for the spectroscopic orbit solution and the estimation of the masses of the EE Cep system components.

Also very important should be infrared photometric (at least JHK) observations during and outside the eclipse. These could be helpful in finding the flux originating in the disc and its central object, as well as in estimating their temperatures.

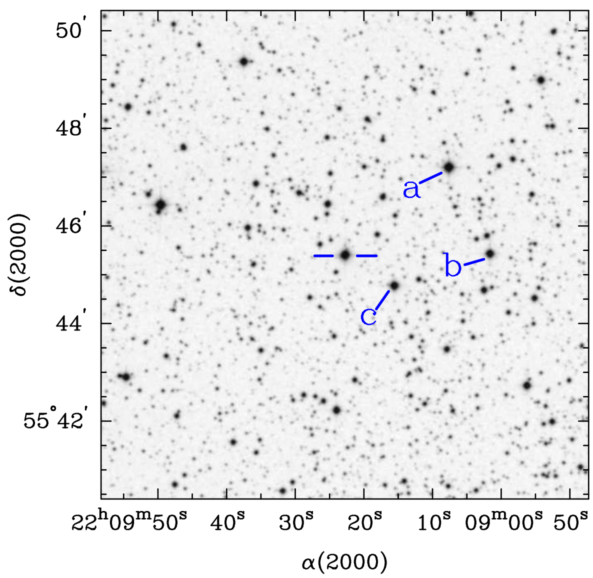

Figure 4. $10' \times 10'$ DSS-2-red finding chart for EE Cep.

We started our $UBVR_CI_C$ and optical spectroscopic observations of EE Cep at Toruń, Rozhen and Asiago observatories. Of course, it is not realistic to expect that we will be able to secure enough data for a good photometric and spectral coverage of the eclipse. Because of this we welcome future collaboration with interested observers.

Acknowledgements: This work was supported by KBN Grant No. 5 P03D 003 20. We are grateful to Fred E.J. Linton for the improvement of English.

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V1154 Tau: A NEW ECLIPSING STAR WITHIN A TRIPLE SYSTEM

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V1154 Tau (= HD 32641 = BD +22°818, spectral type B5) has been discovered as a variable star by the Hipparcos satellite (HIP 23699, V_T=6.^{m}72, B_T=6.^{m}80, H_P=6.^{m}73) which did not however recognize its type of variability. V1154 Tau was therefore logged as an "unsolved" variable in the *Hipparcos Catalogue* (ESA 1997), with an amplitude of ΔH_P= 0.243 mag. V1154 Tau is located (J2000.0) at α=05^{h}05^{m}37.^{s}72 and δ=+23°03′39.″8, corresponding to galactic coordinates l=179.°90 and b=–10.°73. The parallax measured by Hipparcos is $\pi = 4.02 \pm 1.21$, for a distance of 250 pc.

V1154 Tau long known as a close double, under the name Stt 97. Early speckle observations by McAlister and DeGioia (1979) gave a separation ρ=0.358±0.002 arcsec and a position angle θ=154.1±0.3 deg for 1977. Hipparcos in 1991 obtained ρ=0.355±0.003 and θ=152.0±0.5, and Prieur et al. (2001) got ρ=0.355±0.003 and θ=150.4±0.8 with speckle observations in 1998. Such data do not show evidence of orbital motion, nor different proper motion during the 21 elapsed years, and therefore support a physical association of the pair (physical separation ∼90 AU). Hipparcos has derived a 1.48 mag difference in H_P magnitude for the two components. According to Fabricius and Makarov (2000), the two components of the physical pair have:

- Component A: H_P=6.974±0.005, B_T=7.06±0.01, V_T=7.00±0.01
- Component B: H_P=8.452±0.019, B_T=8.68±0.01, V_T=8.42±0.01

V1154 Tau lies in the vicinity of the NGC 1746/1750/1758 complex of possible real open clusters. During a photometric investigation of such complex, Straižys et al. (1992) obtained for V1154 Tau in the Vilnius photometric system V=6.67, $U-P$=0.33, $P-X$=0.43, $X-Y$=0.28, $Y-Z$=0.18, $Z-V$=0.12, $V-S$=0.25, from which they derived a B4 V classification, M_V=–0.8, A_V=0.99 and a distance of 280 pc, in good agreement with what later determined by Hipparcos. Such a short distance rules out partnership with both NGC 1750 and NGC 1758 that should lie at 510 and 680 pc according to Straižys et al. (1992; NGC 1746 does not seem to be a real cluster according to them).

We observed V1154 Tau in B and V (standard Johnson filters) from a private observatory near Cembra (Trento), Italy, in a similar way to our previous investigations of unsolved Hipparcos variables GV Dra and V432 Aur (Dallaporta et al., 2000, 2002b) and the eclipsing binary GK Dra with wrong Hipparcos orbital period (Dallaporta et al., 2002a). The instrument was a 28 cm Schmidt-Cassegrain telescope equipped with an Optec SSP5 photometer. The diaphragm had a size of 77 arcsec, and the exposure time was usually 10 seconds. HD 32811 (HIP 23784, V_J=7$^{\rm m}_{.}$146, $(B-V)_J = 0.131$, spectrum B9) was chosen as comparison star and HD 32500 (HIP 23606, V_J=7$^{\rm m}_{.}$842, $(B-V)_J = 1^{\rm m}_{.}120$, spectrum K0. As for HD 32811, Jonhson's B_J, V_J are derived from Tycho's values following Bessell (2000) transformations) as a check star. The comparison has been measured by Hipparcos 102 times and found constant. We have measured it against the check star five times in different nights and found V_J=7$^{\rm m}_{.}$843 (r.m.s. 0.009 mag) and B_J=8$^{\rm m}_{.}$971 (r.m.s. 0.007 mag), thus pretty well confirming the absence of variability.

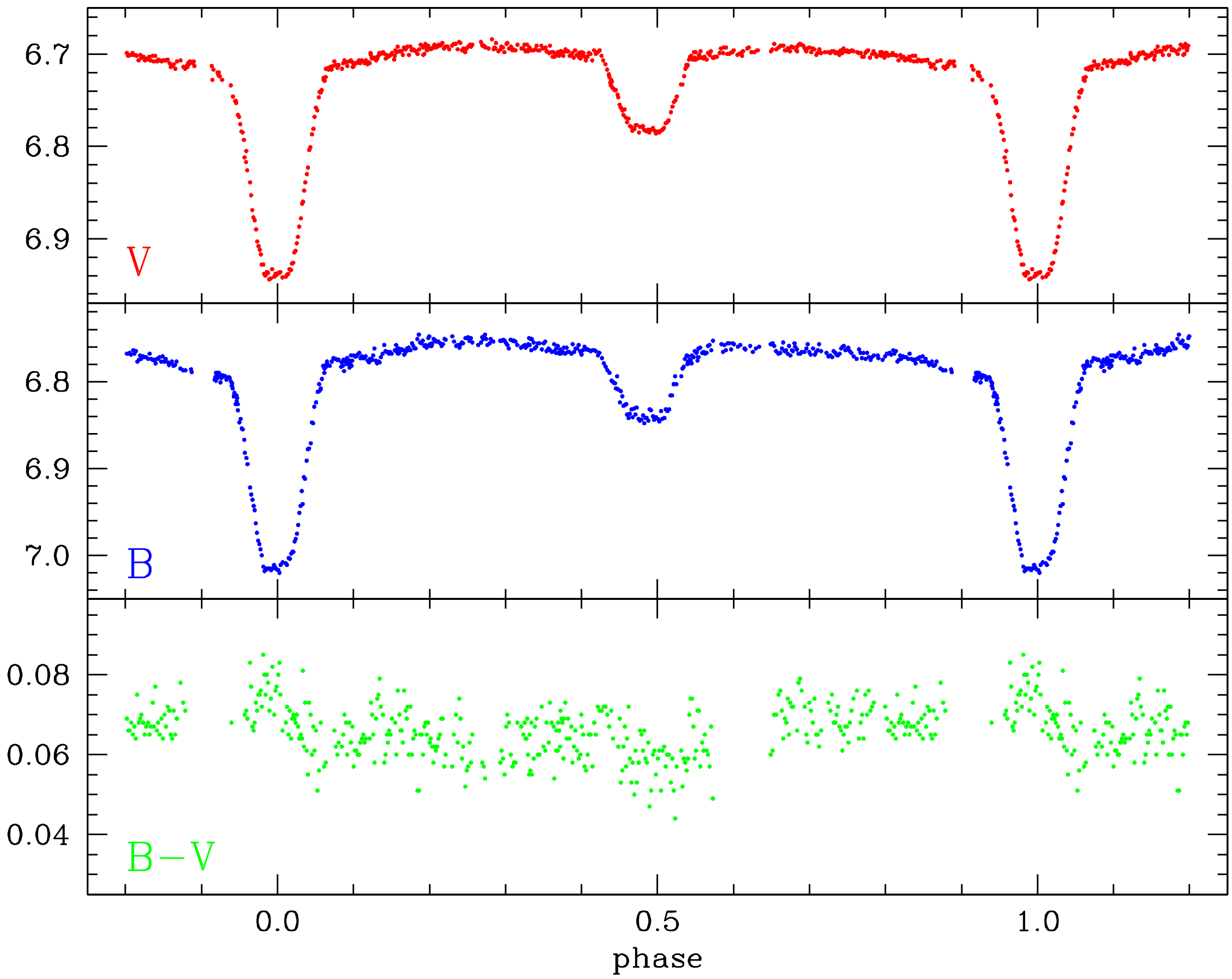

Figure 1. Our light and color curves of V1154 Tau for the 1$^{\rm d}_{.}$7678805 period.

All together, 511 measurements in V, and 518 in B have been collected of V1154 Tau between Dec. 2002 and Feb. 2003. All the observations were corrected for atmospheric extinction and color corrections (via calibration on Landolt's equatorial fields), and the instrumental differential magnitudes were transformed into the standard Johnson UBV system. The variable, comparison and check stars are very close on the sky so the atmospheric corrections were rather small (36 arcmin distance for HD 32811 and 38 arcmin for HD 32500). The close similarity of the color between the variable and comparison star and the fact that all observations have been obtained for zenith distances $< 60°$ argue for a high internal consistency of our photometry of V1154 Tau.

A Deeming-Fourier code has been applied to the set of data, resulting in the detection of a strong periodicity at $1\overset{d}{.}76789$. Combining with Hipparcos H_P data it has been possible to refine the period to $1\overset{d}{.}7678805 \pm 0.000002$, with the ephemeris:

$$\text{Min. I} = \text{HJD } 2452643.3792(\pm 0.0003) + 1\overset{d}{.}7678805(\pm 0.000002) \times E.$$

Our B and V photometric data folded to this ephemeris are presented in Figure 1. The system is clearly an eclipsing one, with both eclipses total and very well marked. Phase plot of Hipparcos and Tycho data according to the same ephemeris is presented in Figure 2. The eclipsing nature is well evident in Hipparcos data too, and it is surprising that automatic data treatment in preparation of the Hipparcos Catalogue has not solved the type of variability affecting V1154 Tau.

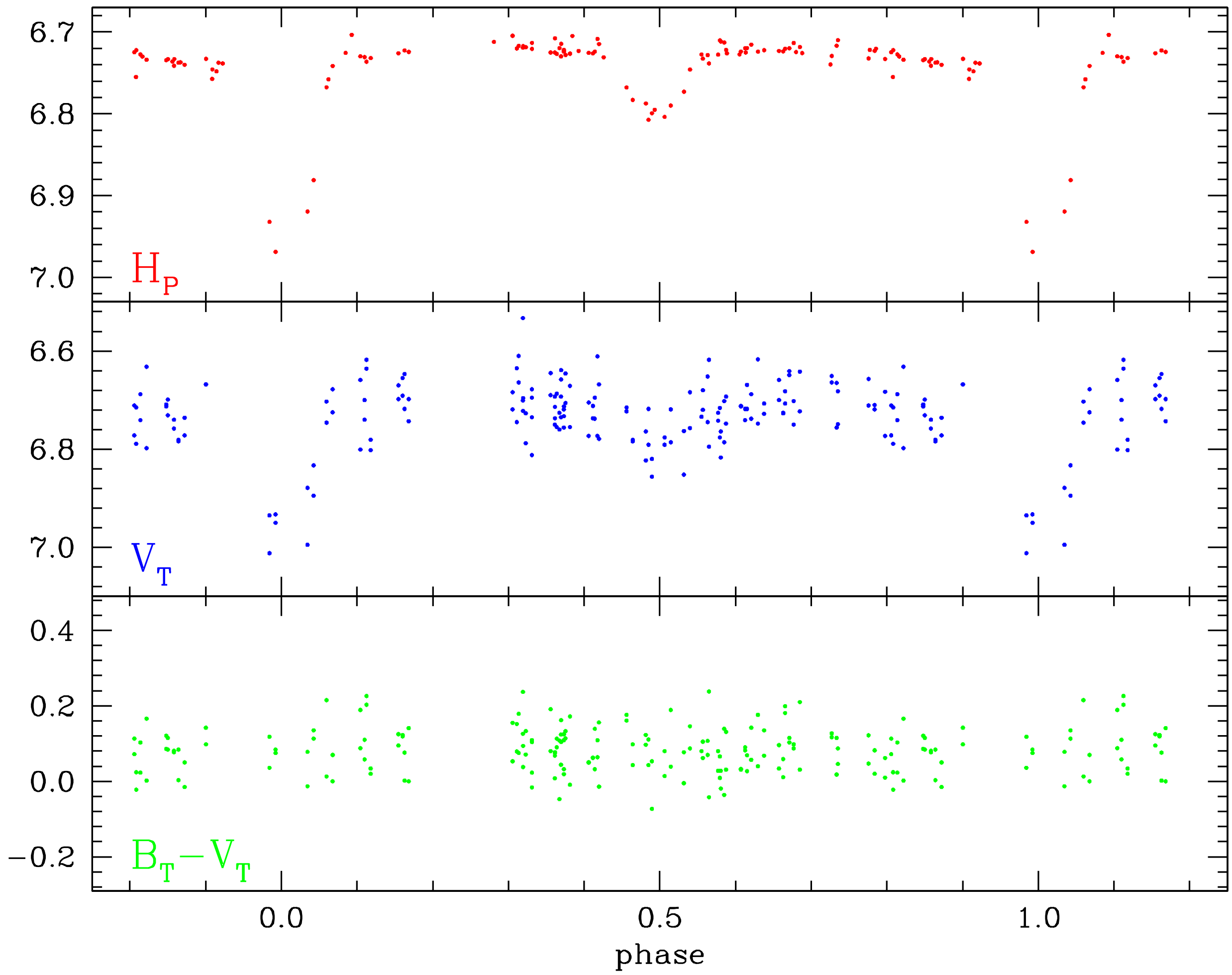

Figure 2. Hipparcos and Tycho data for V1154 Tau folded onto the $1\overset{d}{.}7678805$ period.

Koen and Eyer (2002) have investigated with improved statistical methods a large set of Hipparcos epoch photometry data, and found likely periodicities for 2082 “unsolved” Hipparcos variables, including V1154 Tau for which they determined a period of $1\overset{d}{.}8427$ (even if not assessing the nature of the variability). However, when plotting our as well as Hipparcos data according to Koen and Eyer (2002) period, the resulting light curve is not what expected, indicating automatic detection of a wrong periodicity (cf. Figure 3).

The discovered eclipsing binary is the “A” speckle component listed above, and therefore V1154 Tau turns out to be a triple system, with the third body contributing a constant 21% of the total system light in the V band light curve (our diaphragm obviously includes the triple system as a whole). The phase of the secondary eclipse indicates an eccentric orbit. The $\Delta(B-V)$=+0.01 at primary eclipse and $\Delta(B-V)$=–0.01 at secondary suggests a small temperature difference between the two components, with the hotter one being eclipsed at primary minimum. None of the components displays intrinsic variability larger than 0.003 mag.

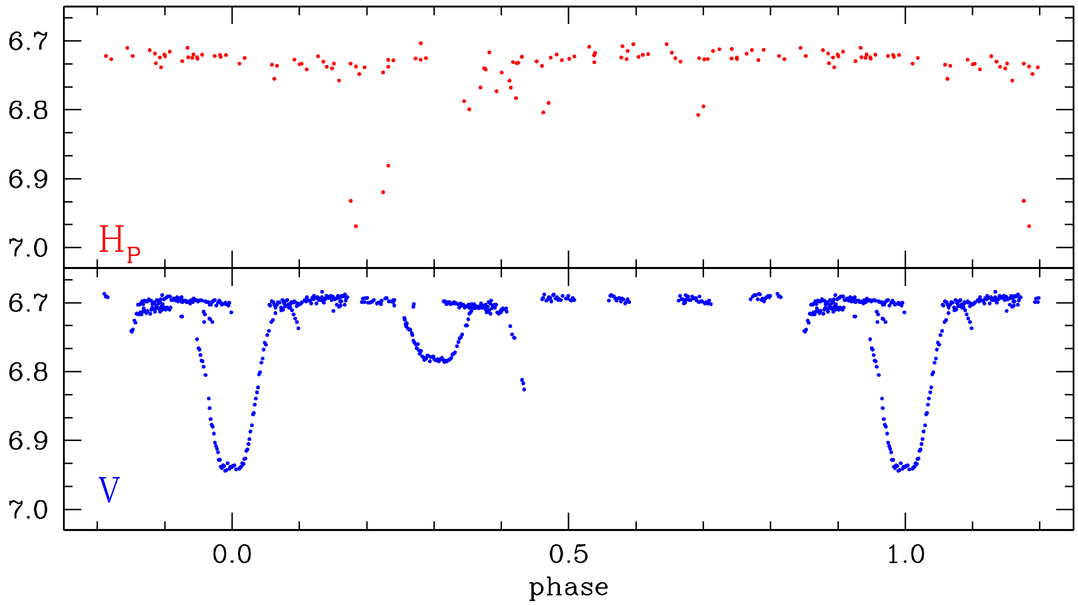

Figure 3. Hipparcos H_P and our V band data for V1154 Tau folded onto the $1\overset{d}{.}8427$ period reported by Koen and Eyer (2002), evidently not the correct orbital one.

Following these photometric results, V1154 Tau has been placed on the Asiago eclipsing binary program (e.g. Munari et al. 2001). At the time of writing, acquisition of radial velocities with the Asiago Echelle+CCD spectrograph is progressing, while B,V photometry is completed. We present here only the basic photometric evidences, with a full and detailed orbital solution including radial velocity data and synthetic spectral analysis being postponed to a devoted paper at the conclusion of the spectroscopic campaign.

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HH UMa IS A CONTACT BINARY

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HH UMa (HIP54165, GSC 2521-1524, $\alpha_{2000} = 11^{\rm h}4^{\rm m}48\overset{\rm s}{.}1519$, $\delta_{2000} = +35°36'26\overset{''}{.}604$, $V_{max} = 10.58, V_{min} = 10.80$) is one of the variables discovered by the Hipparcos mission (ESA, 1997). In the Hipparcos catalogue it is classified as a periodic variable star of the F8 spectral type with the following ephemeris for the maxima:

$$\mathrm{Max} = \mathrm{HJD}\,2\,448\,500.155 + 0.1877470 \times E. \tag{1}$$

In the Simbad astronomical database (`http://simbad.u-strasbg.fr/`) the system is denoted simply as a variable star. Duerbeck (1997) lists HH UMa as a contact binary with the double period $P = 0.3755$ days since in such a case it obeys period-colour relation of contact binaries. Our observations show that the primary eclipse precedes JD_0 maximum by 0.5 of the pulsating period given by ephemeris (1). Then, the corrected Hipparcos ephemeris for the primary minima of contact binary HH UMa is:

$$\mathrm{Min\ I} = \mathrm{HJD}\,2\,448\,500.0611 + 0.375494 \times E. \tag{2}$$

HH UMa was observed during the tests of a new 50 cm Newton telescope in the G1 pavilion of the Stará Lesná Observatory of the Astronomical Institute of the Slovak Academy of Sciences. The telescope is equipped with the SBIG ST-10 MXE camera. The observations were obtained in Strömgren v filter on February 11, 2003 and in Johnson BV filters on February 12 and 22, 2003. The exposure times for the v and BV filters were 10 and 5 seconds, respectively. Due to the fast USB interface we obtained about 1000 observations in each filter. Hence, for clarity Fig. 1 (left) shows normal points from five observations (in average).

Second part of the CCD photometry was obtained at the Roztoky Observatory (RO) ($\lambda = 21°28'54''$ E, $\varphi = 49°33'57''$ N) on three nights on April 3, 4, 9, 2002. The 40 cm Cassegrain telescope equipped with the SBIG ST-8 CCD camera and standard Johnson VRI filters was used. For detailed description of the telescope and equipment see Pribulla (2003). The exposure times for the V and RI passband were 20 and 10 seconds,

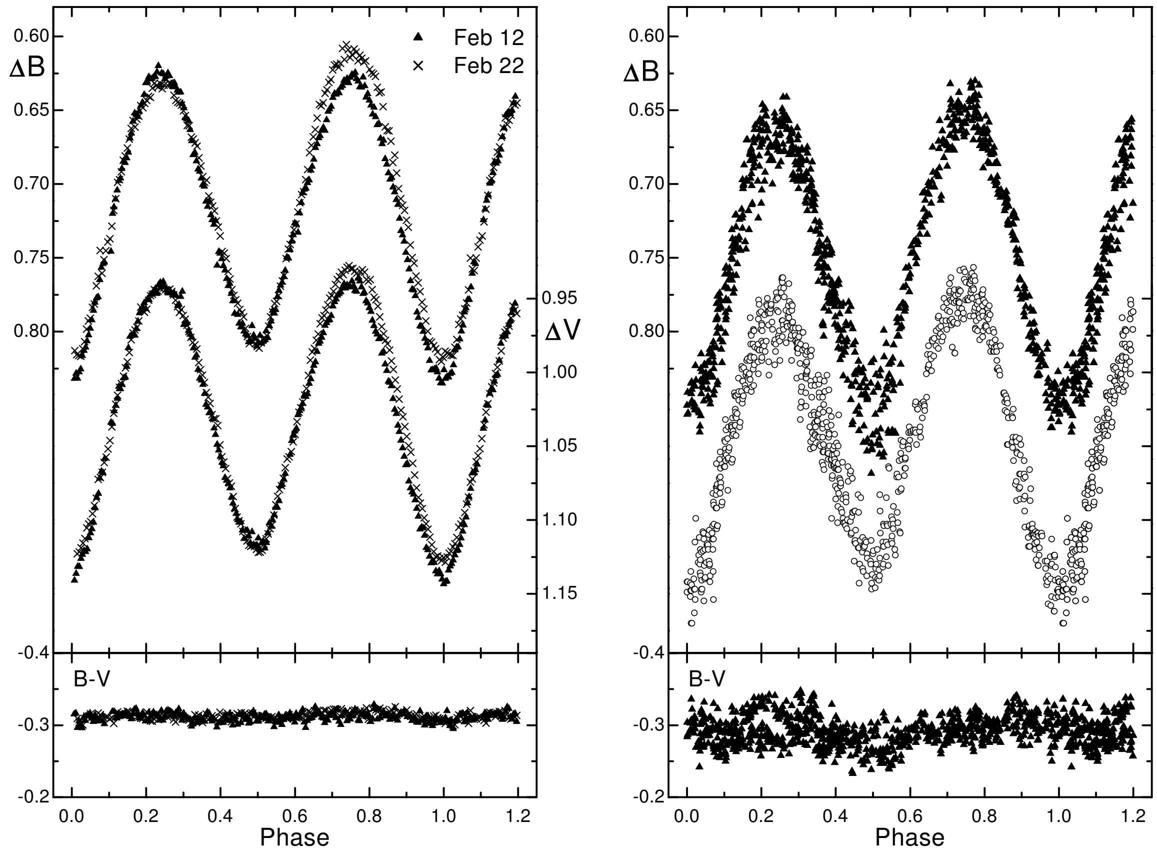

Figure 1: The BV CCD light curves and the $B-V$ colour index obtained on February 12 and 22, 2003 (left) and BV photoelectric light curves $B-V$ colour index from all nights (right). The data were phased according to the ephemeris (3)

respectively. The data are quite scattered due to bad sky conditions and short exposures. Therefore, they were used for determination of the minima times only.

The CCD frames in both cases were reduced in the usual way (bias and dark subtraction, flat-field correction) in MIDAS reduction package using procedures written by the first author. The brightness of the variable was determined by the aperture photometry with respect to BD+36°2151. Since the variable-comparison distance is less than 2′ no extinction correction to the differential magnitudes has been applied. The resulting differential magnitudes were left in the instrumental system.

Some additional observations were obtained using 60 cm Cassegrain telescope in the G2 pavilion of the Stará Lesná Observatory of the Astronomical Institute of the Slovak Academy of Sciences. The 60 cm Cassegrain telescope equipped with a single-channel photoelectric photometer was used. HH UMa was observed in five nights: March 30, 2002, February 22, 23, 24 and March 2, 2003 in Johnson BV filters. Data reduction, the atmospheric extinction correction and transformation to the standard international UBV system were carried out in the usual way (see e.g., Pribulla et al., 2001). For all observations 10 second integration time was chosen. BD+36°2151 and BD+36°2150 were used as the comparison and check star, respectively. The check and standard star difference was found to be stable within 0.01 mag during all nights. The resulting BV light curves from all nights are shown in Fig. 1 (right).

The shape of the light curve as well as small variation (≈ 0.02 mag) of the $(B-V)$

colour index definitely prove that HH UMa is a contact binary. The system, however, seems to be active - the light curve shows small differences between individual nights. On most LCs the maximum I (phase 0.25) is fainter than the other maximum.

13 new minima times of HH UMa (Table 1) determined using the Kwee & van Woerden method (weight $w = 2$), together with corrected Hipparcos JD_0 (ephemeris 2, $w = 1$) provide new linear ephemeris:

$$\text{Min I} = \text{HJD } 2\,452\,368.3979 \underset{\pm 7}{} + 0.3754937 \underset{\pm 3}{} \times E. \tag{3}$$

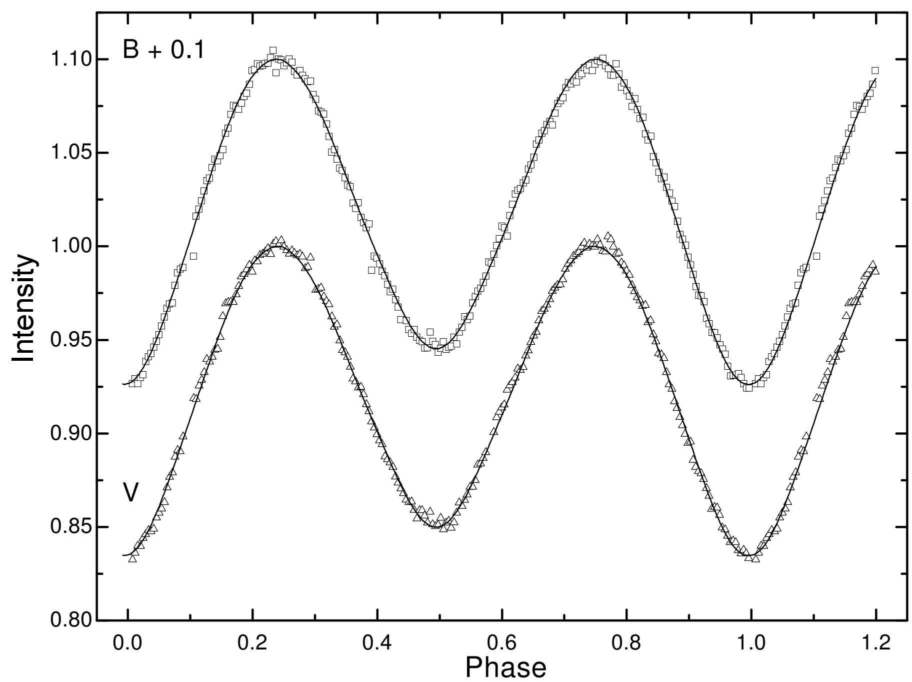

Figure 2. The best fits to the *BV* CCD light curves obtained on February 12, 2003

Table 1: Average *vBVRI* times of the primary (I) and secondary (II) minima. The standard errors of the minima are given in parentheses. The (O-C) residuals are given with respect to the ephemeris (3)

JD_{hel} 2 400 000+	Type	$(O-C)$ [days]	Obs.	Filters	JD_{hel} 2 400 000+	Type	$(O-C)$ [days]	Obs.	Filters
52368.3983(2)	I	−0.0001	RO	*VRI*	52683.4364(1)	I	−0.0011	G1	*BV*
52369.338(2):	II	0.0021	RO	*VRI*	52683.6236(3)	II	−0.0014	G1	*BV*
52369.5276(9)	I	0.0042	RO	*VRI*	52693.3863(9)	II	−0.0004	G2	*UBV*
52374.4074(9)	I	0.0011	RO	*VRI*	52693.3864(1)	II	−0.0003	G1	*BV*
52374.5915(5)	II	−0.0022	RO	*VRI*	52693.5772(2)	I	0.0030	G1	*BV*
52673.4881(2)	II	−0.0002	G2	*UBV*	52695.4540(6)	I	0.0009	G1	*BV*
52682.4958(3)	II	−0.0042	G1	*v*					

Since the spectroscopic mass ratio is unknown and the amplitude of the light variations is rather low, we tried to determine the photometric elements for several fixed mass ratios. We used symmetric *BV* LCs from 50 cm telescope obtained on February 12, 2003. Experiments with the new code *ROCHE* (see Pribulla, 2003) based on the Roche geometry, showed that the minimum sum of squares occurs around $q = 0.35 - 0.45$. The resulting photometric elements for fixed mass ratio $q = 0.40$ and temperature of the primary component $T_1 = 6200$ (corresponding to F8 sp. type) are $i = 52\overset{\circ}{.}6 \pm 0\overset{\circ}{.}9$, fill-out $F = 0.19 \pm 0.04$. The resulting fits are shown in Fig. 2. The detailed analysis of all individual light curves is under preparation.

Acknowledgements. This study was supported by ApVT grant 20-014402 and grant VVGS/014/2003/F (University of P.J. Šafárik, Košice).

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GRB030329: MULTICOLOR LIGHT CURVE AND IONOSPHERIC DETECTION

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The optical afterglow to GRB 030329 was discovered at position $\alpha = 10^{\rm h}44^{\rm m}49\overset{\rm s}{.}5$, $\delta = +21^\circ31'23''$ (Peterson et al., 2003). The AAVSO International GRB Network has collected 452 multicolor observations of the afterglow from 03:47 on March 31 to 03:09 on April 17, 2003. All observations have been reduced using field photometry from Henden et al. (Henden, 2003) The full light curve is displayed in Figure 1. The comparison stars are given in the chart in Figure 2. The light curve can be represented by 3 straight lines, with breaks at JD 2452729.0 and 2452736.5.

Additionally, a disturbance of the Earth's ionosphere was observed coincident with the HETE detection time of GRB030329 (Vanderspek et al., 2003). This disturbance was detected with a Sudden Ionospheric Disturbance (SID) detector by P. Schnoor as an increase in the signal strength from a Low Frequency (LF) radio beacon received in Kiel, transmitted as a time signal from station HBG (75 kHz) near Geneva, 920 km from the receiver. See Figure 3. (Note: This is not a radio detection of GRB030329; this disturbance was caused by the prompt X-rays and/or gamma-rays from GRB030329 ionizing the upper atmosphere and modifying the radio propagation properties of the Earth's ionosphere.)

Previously, at least three other transient, high-energy sources have produced detectable ionospheric disturbances, as measured with VLF receivers: GRB830801 (Fishman et al., 1988); XRF 020427 (Fishman et al., 2002), and the Aug. 27, 1998 super-flare from SGR 1900+14 (Inan et al., 1999).

All raw data shown in these figures, FITS images, and more information about each observation and the SID detection is available for download from the AAVSO WWW site at `http://www.aavso.org/grb/grb030329.shtml` or by e-mail: `aavso@aavso.org` and also through the IBVS website as `5415-t1.txt`.

The AAVSO International GRB network is grateful for the financial support of the Curry Foundation, NASA Office of Space Science, NASA Marshall Space Flight Center, and Sonoma State University for their support for the High Energy Workshops for Amateur Astronomers, from which this network grew.

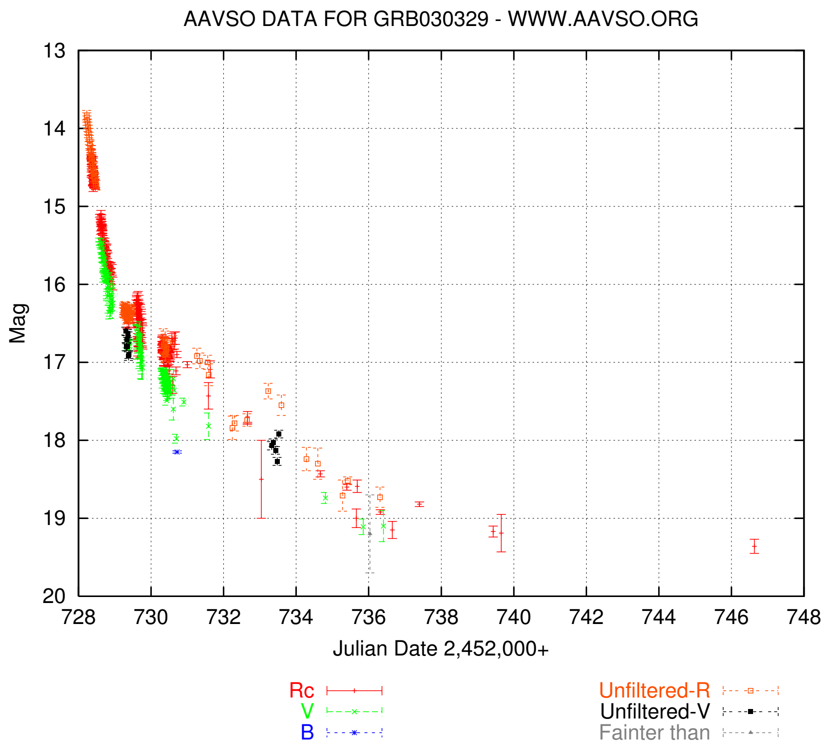

Figure 1. Complete Light curve of all AAVSO data for GRB030329. On the scale of these plots the zeropoint difference between the unfiltered-R observations and Rc is small. The same is true of the unfiltered-V data and Johnson V.

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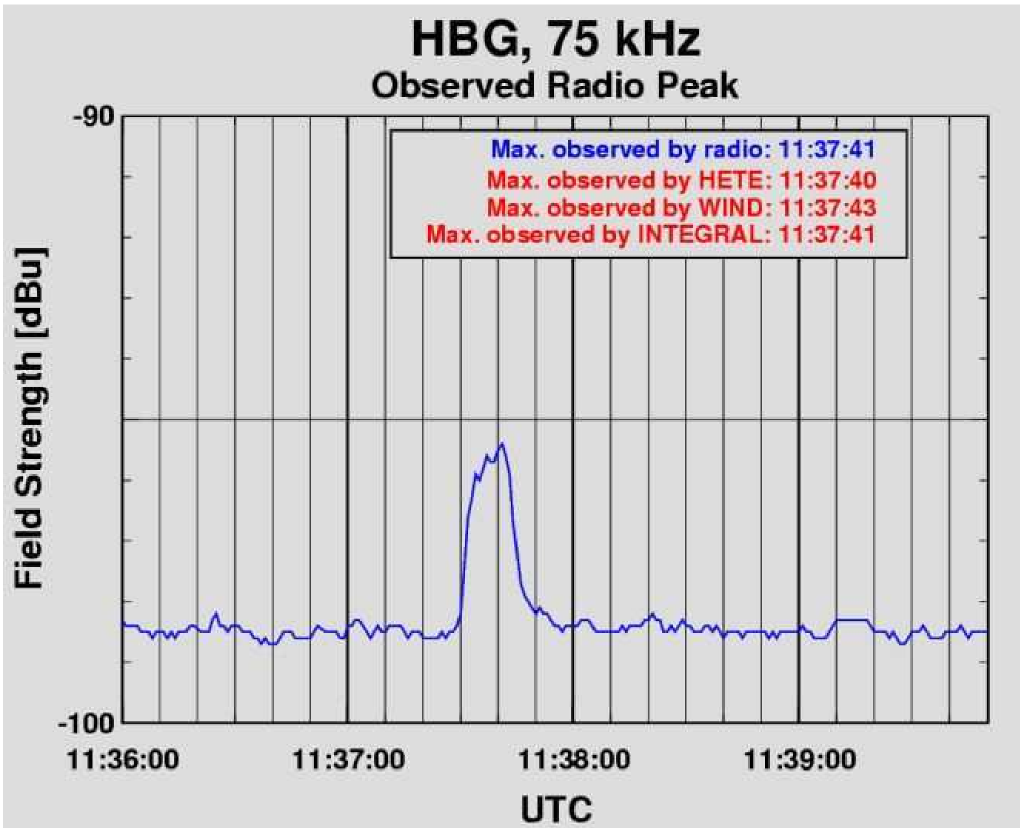
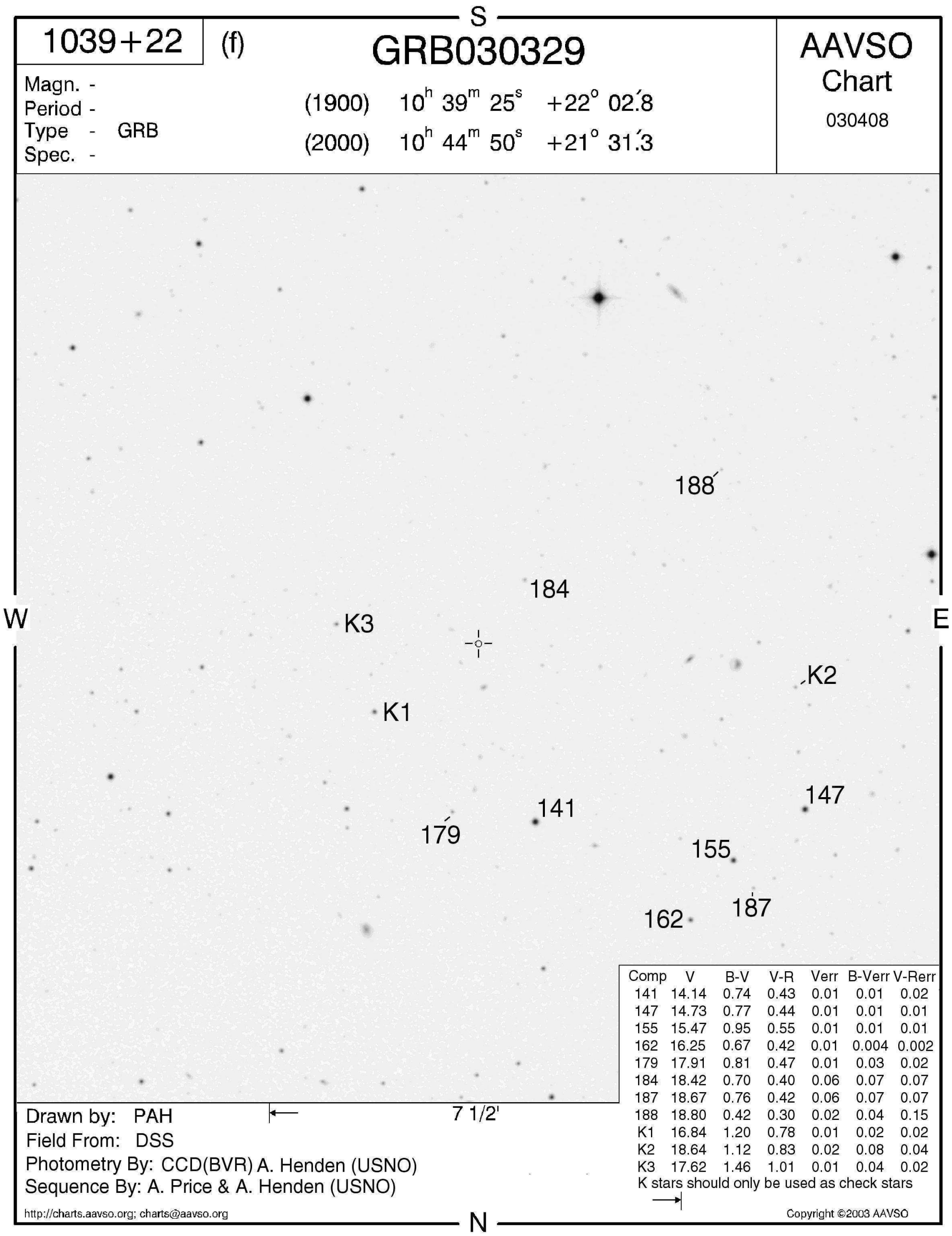


Figure 2. 75kHz signal strength reflecting a sudden ionospheric disturbance coincident with GRB030329. More data is available at `http://www.qsl.net/df3lp/projects/sid/`



Comp	V	B-V	V-R	Verr	B-Verr	V-Rerr
141	14.14	0.74	0.43	0.01	0.01	0.02
147	14.73	0.77	0.44	0.01	0.01	0.01
155	15.47	0.95	0.55	0.01	0.01	0.01
162	16.25	0.67	0.42	0.01	0.004	0.002
179	17.91	0.81	0.47	0.01	0.03	0.02
184	18.42	0.70	0.40	0.06	0.07	0.07
187	18.67	0.76	0.42	0.06	0.07	0.07
188	18.80	0.42	0.30	0.02	0.04	0.15
K1	16.84	1.20	0.78	0.01	0.02	0.02
K2	18.64	1.12	0.83	0.02	0.08	0.04
K3	17.62	1.46	1.01	0.01	0.04	0.02

Figure 3. Finder chart of the field of GRB030329 with comparison stars indicated and their photometry in the lower right hand corner.

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ON THE NATURE OF THE SUSPECTED DWARF NOVA, HP ANDROMEDAE†

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Seliwanow (1926) reported on a discovery of a variable star designated as 126.1925 at a photographic magnitude of 10.5 in one plate among four searched, and showed a hand-drawn chart. Brun and Petit (1957) listed this object as a suspected dwarf nova. The formal variable star name HP And was given in the 62nd Name List (Kukarkin et al., 1976). The object has been systematically monitored by a number of amateur astronomers (e.g. VSOLJ, VSNET members) since the publication on this object in the General Catalogue of Variable Stars fourth edition (Kholopov et al., 1985), but no secure outburst has been recorded.

The quiescent identification was done by Kato (1990, unpublished) by comparison with the POSS prints. A quiescent counterpart, selected by its relatively bright appearance on POSS O plate, has been suggested, and a CCD V-band chart marking on this object was distributed among world-wide observers. An attempt of spectroscopic confirmation of the dwarf nova nature by Zwitter, Munari (1994) failed due to its faintness ($V > 17.0$) at their observation. Misselt (1996) and Skiff (1998) gave secondary photometric standard stars around HP And. Downes et al. (2001) identified an object on a Digitized Sky Survey plate with HP And (`http://icarus.stsci.edu/~downes/cvcat/`). This variable star was not found in the 2MASS Second Incremental Data Release (Hoard et al., 2002).

The object has recently received special attention because the suggested outburst amplitude may be comparable to those of WZ Sge stars (e.g. Kato et al., 2001), if the object is indeed a dwarf nova.

To reveal the nature of this suspected dwarf nova HP And, we made an observation at the 8.2m optical-infrared Subaru telescope on Mauna Kea, Hawaii during spare time assigned to the proposal ID o02115. A non-filtered image was obtained with an exposure time of 30 sec at 2002 October 10.495(UT) by the Faint Object Camera and Spectrograph (FOCAS, see Kashikawa et al., 2002). The limiting magnitude of the image is estimated to be 25.0, or larger.

†Based on data collected at Subaru Telescope, which is operated by the National Astronomical Observatory of Japan.

Fig. 1 shows a chart around HP And extracted from the de-biased Subaru/FOCAS image. The suspected object is definitely a late-type galaxy with a relatively strong bulge condensation. The object certainly looks non-stellar on a DSS II image (Fig. 2), although it was not clear on POSS I plates. For comparison, we put the scanned chart in Seliwanow (1926) in Fig. 3. This galaxy is listed in the USNO-B1.0 catalog as ID 1314-0006148 with $B1 = 19.56, B2 = 18.78, R1 = 17.69, R2 = 16.99$, and is identified in the APM-North Catalogue (McMahon et al. 2000) with EO1243-0297148 which has a major axis diameter of 8.7 arcsec in R band and a ellipticity of 0.18.

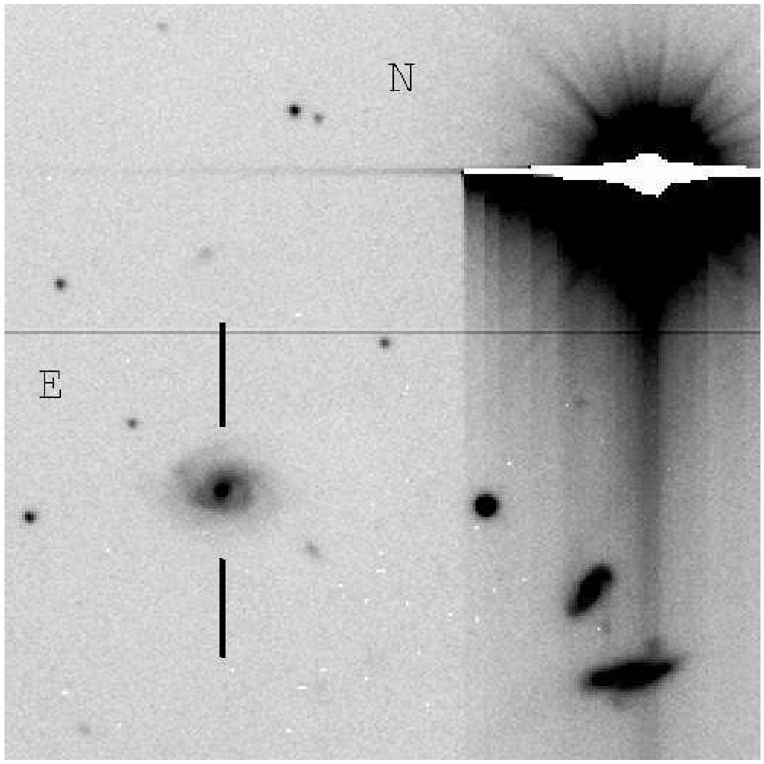

Figure 1. A Subaru/FOCAS image of HP And. The field of view (FOV) is about $1' \times 1'$. North is up, and East is left. The seeing is $0''.33$. The limiting magnitude is estimated to be 25.0 or larger. The object having been identified with HP And clearly has spiral arms, and thus is a galaxy.

If HP And is a variable star in our Galaxy, superposed on the anonymous galaxy, the amplitude must exceed 10 mag and be a nova, or a dwarf nova with a quite large amplitude. Since the galactic latitude is high ($-21°$), this should be one of the rare cataclysmic variable stars in the halo. If HP And is a transient object in the anonymous galaxy, a possibility of a supernova is not likely because the variable star at the maximum was too luminous compared to the host galaxy. A GRB afterglow similar to the nearby GRB 030329 might be caught by chance. The other possibilities are spurious detection, such as a ghost of a bright star, a plate defect, inaccuracy of the hand-drawn chart, and so on. Close examination of the original plate and the astrometry will yield a fruitful result.

We deeply thank Y. Ohyama and the support staffs for their help during the observation at Subaru telescope. This research has made use of an image of the Digitized

Figure 2. A chart taken from the Digitized Sky Survey 2nd in I band (Plate ID: A25N). The suspected object at the center looks non-stellar. The FOV is $5' \times 5'$.

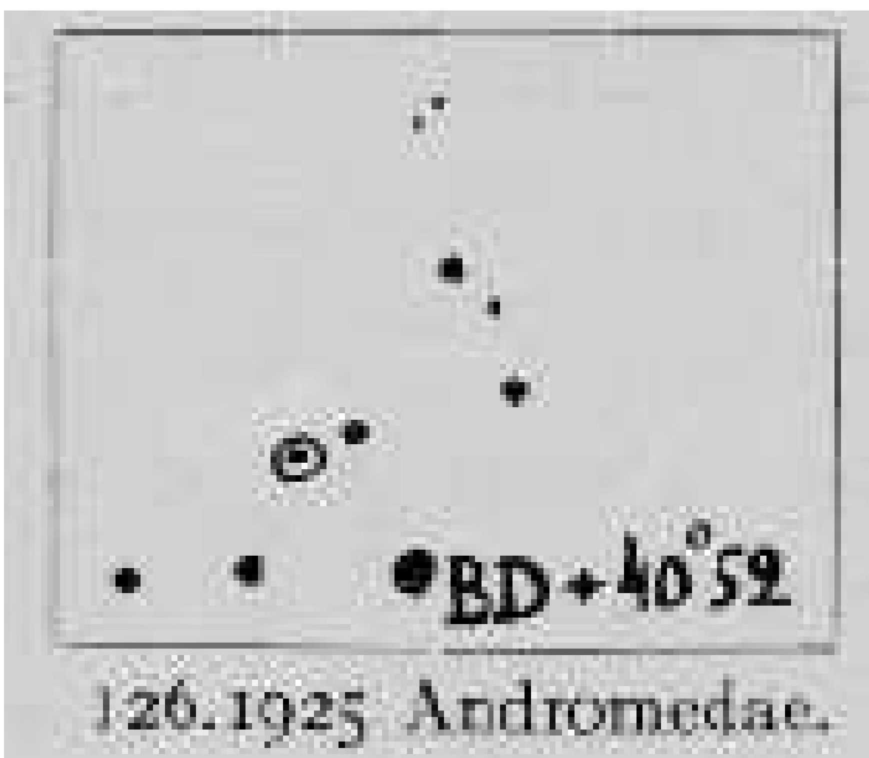

Figure 3. The scanned chart in Seliwanow (1926).

Sky Survey (http://www-gsss.stsci.edu/DSS/dss_home.htm), the USNOFS Catalogue Archive operated by the United States Naval Observatory, Flagstaff Station (http://www.nofs.navy.mil/data/fchpix/). This work is partly supported by a Research Fellowship of the Japan Society for the Promotion of Science for Young Scientists (MU), and by a grant-in-aid [13640239, 15037205 (TK), 14740131 (HY)] from the Japanese Ministry of Education, Culture, Sports, Science and Technology.

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NEW R CrB-TYPE STAR HadV98

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HadV98 = CoD $-22°12017$ = GSC 6825.253 is a variable star discovered by K. Haseda (Haseda and Kato, 2001). The variable had been almost constant until 2001 April, when it suddenly started fading. The object was suspected to be an R CrB-type star, from the time of the discovery alert, based on its light behavior and its Tycho-2 moderate color ($B-V$ ∼1.0). This star has been very recently confirmed to be a genuine R CrB-type variable from spectroscopy (Hasselbach et al., 2002).

We studied the variability of this object using Haseda's discovery material combined with the ASAS-3 survey data (Pojmanski, 2002). The light curve constructed from Haseda's observations and the ASAS-3 public data is presented in Figure 1. Haseda's observations were performed with a $D = 10$ cm f/4.0 telephoto lens and unfiltered T-Max 400 emulsions. The passband of observations covers the range of 400–650 nm. The photographic magnitudes were estimated using GSC stars. A 0.08 mag systematic correction was added to Haseda's photographic observations, in order to best match the ASAS-3 V magnitudes. The recorded range of variability in V was 10.7–13.4, but the true minimum seems to have been fainter.

The light curve shows a rapid decline and a slower recovery, which are characteristic to R CrB-type optical light curves (Clayton, 1996). The 2001–2002 fading was composed of at least two distinct minima (Figure 2), one lasting in 2001 May – 2001 July (JD 2452030–2452130) and another minimum suddenly starting from 2001 October (JD 2452190–), whose entire picture was not well observed because of the solar conjunction. Such an occurrence of closely spaced two minima is also sometimes seen in other R CrB-type fadings and other dust-forming objects (Kato et al., 2002).

We also searched for a pulsation signal, which is frequently seen in many R CrB stars, most notably recorded in RY Sgr and V854 Cen (cf. Clayton, 1996), using the ASAS-3 observations at maximum between JD 2452697 and 2452762 (20 measurements). No remarkable pulsation was found with an amplitude larger than 0.1 mag. This finding is consistent with the lack of remarkable variability in Haseda's observations before 2001. HadV98 apparently belongs to a group of R CrB stars showing less distinct pulsations at maximum.

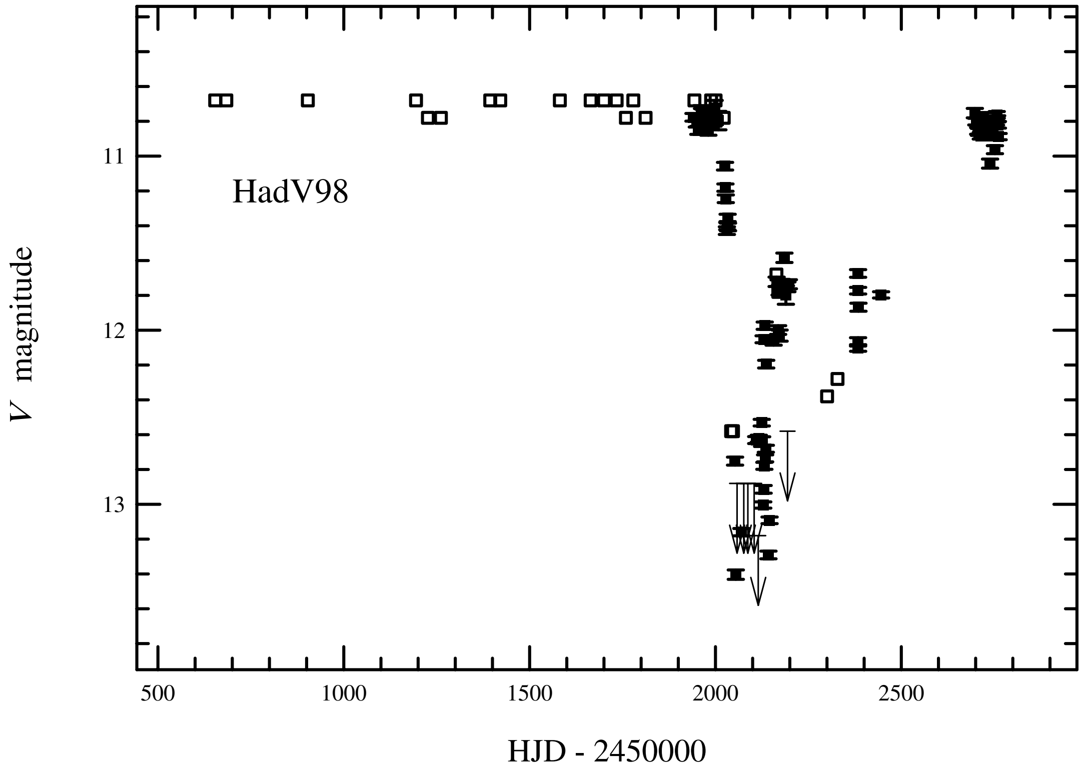

Figure 1. Light curve of HadV98 drawn from Haseda's photographic observations and the ASAS-3 V-band public data. The filled squares with error bars and open squares represent ASAS-3 data and Haseda's measurements, respectively. The arrows represent upper limit observations by Haseda.

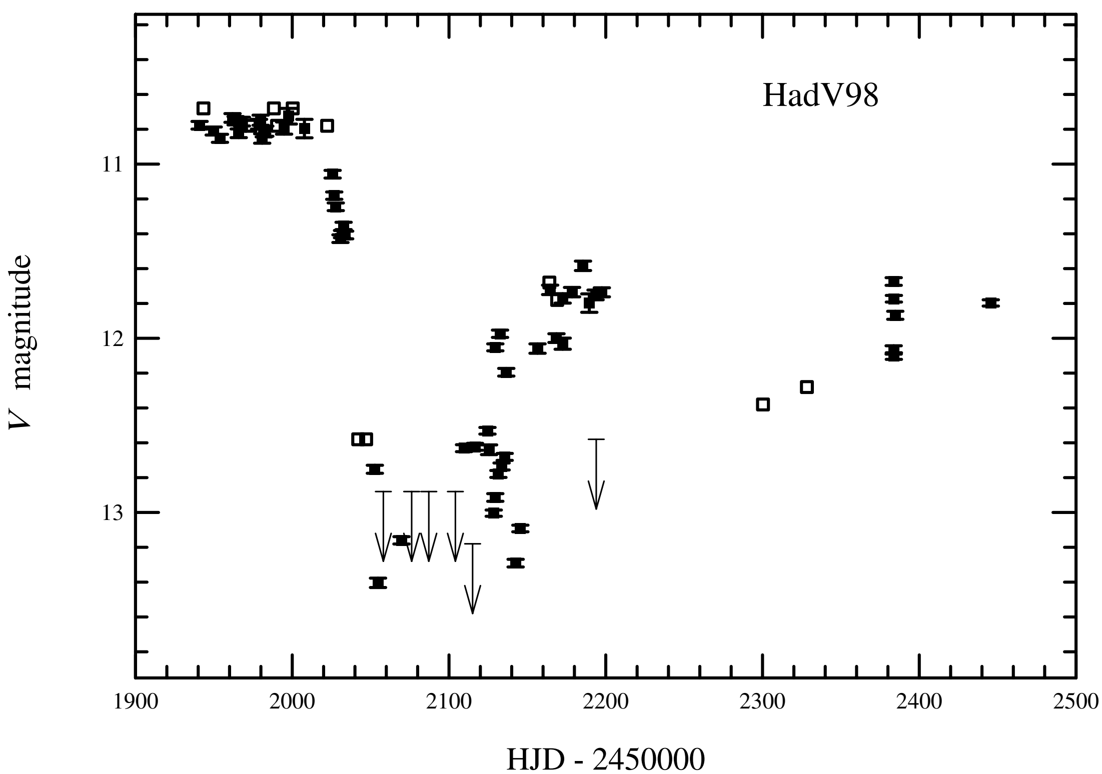

Figure 2. Enlargement of the fading starting in 2001 May. The symbols are the same as in Figure 1.

We are grateful to G. Pojmanski for making the ASAS-3 survey data publicly available, and generously allowing us for unlimited usage. This work is partly supported by a grant-in-aid (13640239, 15037205) from the Japanese Ministry of Education, Culture, Sports, Science and Technology.

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COMMISSIONS 27 AND 42 OF THE IAU
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CCD PHOTOMETRY OF U UMi

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Name of the object:
U UMi

Equatorial coordinates:	**Equinox:**
R.A.= $14^h17^m19\overset{s}{.}90$ **DEC.**= $66°47'39\overset{''}{.}10$	2000

Observatory and telescope:
L. Šmelcer: Valašské Meziříčí Observatory, astrocamera ZEISS 120/540 mm

Detector:	SBIG ST-7 camera

Filter(s):	V

Date(s) of the observation(s):
1999.05.09 – 2001.05.30

Comparison star(s):	GSC 4178 275 = PPM 18967 = SAO 16345 = BD +67°833; $V = 9.60$ mag, $B - V = 0.417$ mag

Transformed to a standard system:	No

Type of variability:	M

Remarks:
U Ursae Minoris (= GSC 4178 277 = HD 125 556) is a Mira type star, with spectral type varying between M6e and M8e and with range of optical light variations between visual magnitudes 7.1 and 13.0. In the fourth edition of the GCVS (Kholopov et al., 1985) a period of 330.92 days is given for its light variations. Altogether 385 measurements have been collected, with typical errors of 0.03 mag. Two maxima and two minima timings are determined using the Kwee and van Woerden (1956) method implemented in AVE (Barbera, 2000) and their values are given in Table 1. The light curve of U UMi is shown in Figure 1.

Table 1: Maxima timings of U UMi.

Geo. JD	Error
2451564.9	0.6
2451886.5	1.1

Table 2: Minima timings of U UMi.

Geo. JD	Error
2451718.6	1.0
2452032.1	1.2

Availability of the data:
Through the IBVS website as `5418-t3.txt`.

Acknowledgements: This work has made use of the SIMBAD database, operated at CDS, Strasbourg, France. The NASA ADS Abstract Service was used to access data and references.

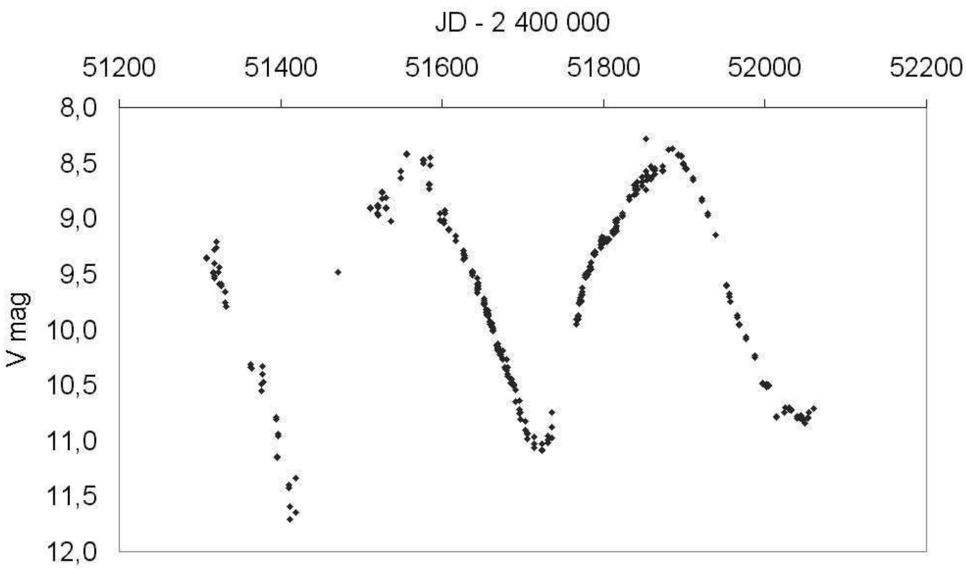

Figure 1.

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COMMISSIONS 27 AND 42 OF THE IAU
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2001 AND 2003 PHOTOMETRY OF WY CANCRI

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As part of an ongoing study of WY Cancri, (#82 in the catalog of Strassmeier et al. 1993) a short period eclipsing RS CVn system, I collected new optical photometry in 2001 and 2003. Heckert (2001) and Heckert et al. (1998) have collected annual light curves of WY Cnc since 1988. These works note secular luminosity increases of nearly 0.1 magnitudes in both 1988 and 1997, which may signal the onset of a new cycle in spot activity with a change in the direction of longitudinal spot migration. Kjurkchieva et al. (2003) report photometry and spectroscopy during 2001. They note a secular luminosity increase in February 2001, after my 2001 data were taken. Their spectroscopy also confirms recent detections (Pojmanski, 1998; Arévalo and Lázaro, 1999) of spectral lines from the secondary in this system, which has previously been classified as a single lined system.

I observed WY Cnc with the San Diego State University 61-cm telescope on Mt. Laguna. The 2001 light curves were obtained on the nights of December 30, 2000 and January 2, 3, & 6, 2001. The 2003 light curves were obtained on January 9, 10, 11, 13, 18, 21,& 24, 2003. I used SAO 80583 as the comparison star. The light curves, with 135 data points per filter in 2001 and 132 in 2003, are plotted in Figures 1 and 2. The data are differential magnitudes (var-comp) in the standard Johnson-Cousins system. I used the ephemeris of Hall and Kreiner (1980):

ϕ_0=2426352.3895+0.82937122 E.

I modelled the data using Budding and Zeilik's (1987) Information Limit Optimization Technique (ILOT). Initial values for stellar parameters were the same as those of Heckert et al. (1998) and Heckert (2001). I adopted temperatures of 5520K and 3500K for the primary and secondary stars. After the initial fit, the ILOT extracts a distortion wave which I then fit for two circular 0K spots. The fits for each color are performed independently. The reported longitude, latitude and radius of each spot are in degrees, and are given in Table 1.

Being more difficult to fit, the latitudes are less reliable than the other parameters. However the two spots during both years include both high and low latitudes. Heckert et al. (1998) note a tendency for spots in the 270° ALB to be at higher latitudes than those in the 90° ALB. This tendency appears to hold in the 2001 data. The 2003 data however show the reverse tendency. The 90° ALB spot is at higher latitude. By comparing the R or I data to the 0K spot solutions at B or V, the ILOT can estimate spot temperatures. Doing so I find an average value of the spot temperature of T_s=3993K±321K for 2001 and T_s=3930K±100K for 2003.

Kjurkchieva et al. (2003) modelled the spots in their light curves from November and December 2000. With spots at 220° and 345° longitude, their models differ from this

Table 1. Spot Fits

2001	B band	V band	R band	I band
$Longitude_1$	287.5±1.7	286.6±2.5	286.4±2.8	284.8±4.0
$Latitude_1$	59.8±3.8	57.8±8.0	60.0±9.5	60.3±17.5
$Radius_1$	26.1±2.4	22.3±3.8	21.5±4.5	19.7±7.3
$Longitude_2$	146.0±4.6	148.3±6.3	149.5±9.3	149.4±12.0
$Latitude_2$	0.0±14.5	0.0±23.8	0.0±19.7	0.0±20.1
$Radius_2$	9.3±0.5	8.7±0.6	8.3±0.7	8.1±0.8
χ^2	68.4	52.6	44.9	44.0
2003				
$Longitude_1$	93.2±4.1	87.5±4.7	90.2±6.6	91.3±7.9
$Latitude_1$	74.4±4.4	73.5±5.8	76.0±6.6	78.0±6.7
$Radius_1$	25.5±4.7	22.6±5.4	21.5±6.6	21.2±7.4
$Longitude_2$	299.7±4.6	302.0±6.8	303.7±9.1	305.4±10.5
$Latitude_2$	0.0±19.6	0.0±20.8	0.0±27.0	0.0±29.4
$Radius_2$	9.1±0.7	8.5±0.8	7.8±0.9	7.0±1.0
χ^2	161.4	110.5	91.4	70.3

work. To check my models for nonunique solutions, I tried using their spot solution as an initial guess for modeling my data. The solution converged to that reported here. Hence the spots changed rapidly. Noting that Kjurkchieva et al. (2003) observed a secular luminosity increase in February 2001, suggests that rapid changes in the spot structure occur just before the secular luminosity increases. If these luminosity increases result in some way from increased magnetic activity, such rapid changes would be expected. This magnetic activity could be either spot activity that disappears or a bright magnetic network similar to, but much more extensive than, that on the Sun. Figure 3 plots the estimated unspotted light level following Heckert (2001). The data from this work and Kjurkchieva et al. (2003) are added to Heckert's (2001) original figure. In addition to the original caveats, note that the Kjurkchieva et al. (2003) data are in the instrumental system. Hence the apparent brightness decrease from December 2000 to January 2001 is likely a calibration artifact. If so, the February 2001 secular luminosity increase is closer in brightness to those of 1997 and 1988 than it appears in the figure. Also note that the February 2001 data are very limited phase coverage. The secular luminosity increase seems to rise on a time scale of a few months.

After the spot fits, I performed clean fits to the light curves removing the effects of the distortion wave from the spot as modelled in that filter. The fits at each wavelength were done independently. The color independent parameters generally agree to within the quoted errors. Table 2 shows values for each filter and the mean for the wavelength independent parameters. Figure 4 shows the *V* band clean fits.

The quantities in Table 2 are as defined by Budding and Zeilik (1987). The fractional luminosities of the primary and secondary components, L_1 and L_2, are normalized to sum to approximately but not exactly 1. The sum can deviate from unity because the normalization is performed before the light curve is corrected for the spot effects, and subtracting the spot causes the out of eclipse intensity to be slightly more or less than 1. These results agree to within the errors with previous work. The mass ratio, q, has been a particular problem for WY Cnc. The results above compare with previous photometric values of q=0.31±0.23 and q=0.384±0.099 (Heckert, 2001 and Heckert et al., 1998). More recently it has been possible to determine this value from spectroscopy. The photometric mass ratios and inclinations for 2003 are very close to the spectroscopic values of q=0.59±0.07, i=87° and q=0.55±0.06, i=88° (Arévalo and Lázaro, 1999 and Kjurkchieva et al., 2003). The 2001 values however are closer to the previous lower photometric determinations of q and the corresponding inclinations of 90° for most of the data sets.

Table 2. Clean Fits

2001	B band	V band	R band	I band	Mean
L_1	0.961±0.004	0.956±0.005	0.940±0.005	0.912±0.005	
$k(=r_2/r_1)$	0.612±0.003	0.611±0.004	0.612±0.004	0.607±0.005	0.611
$\Delta\theta_0$	10.597±0.115	10.589±0.122	10.542±0.127	10.485±0.133	10.553
r_1	0.241±0.003	0.240±0.003	0.236±0.003	0.237±0.003	0.239
i(deg)	90.0±1.3	90.0±1.2	90.0±1.4	90.0±1.4	90.0
L_2	0.028±0.005	0.034±0.005	0.050±0.006	0.075±0.006	
$q(=m_2/m_1)$	0.326±0.054	0.326±0.070	0.335±0.094	0.313±0.124	0.325
χ^2	41.9	32.0	30.2	32.6	
2003					
L_1	0.995±0.004	0.972±0.004	0.951±0.004	0.924±0.004	
$k(=r_2/r_1)$	0.638±0.012	0.626±0.007	0.627±0.006	0.617±0.006	0.627
$\Delta\theta_0$	11.916±0.105	11.953±0.109	11.910±0.113	11.871±0.117	11.913
r_1	0.240±0.003	0.239±0.003	0.238±0.003	0.239±0.003	0.239
i(deg)	86.8±1.0	88.2±1.5	88.1±1.3	88.2±1.4	87.8
L_2	0.009±0.005	0.025±0.005	0.042±0.006	0.070±0.006	
$q(=m_2/m_1)$	0.534±0.052	0.550±0.067	0.594±0.084	0.593±0.100	0.568
χ^2	140.4	95.7	83.6	66.2	

I thank Paul Etzel for scheduling generous amounts of observing time at Mt. Laguna. I also acknowledge support from the Gaposchkin Research Fund of the American Astronomical Society Small Research Grant Program.

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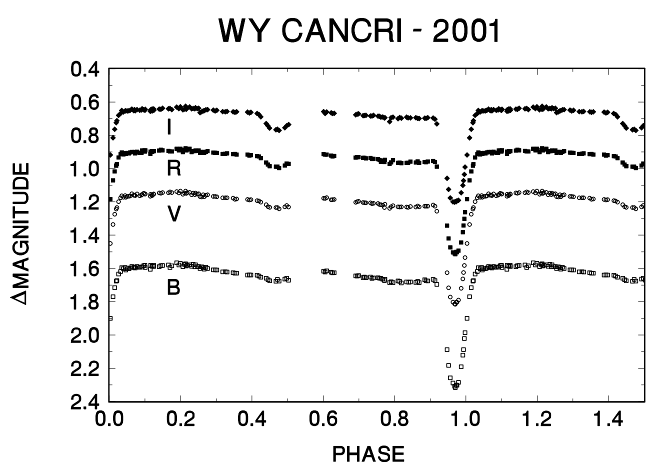

Figure 1. The light curve of WY Cnc in 2001, with 135 data points per filter.

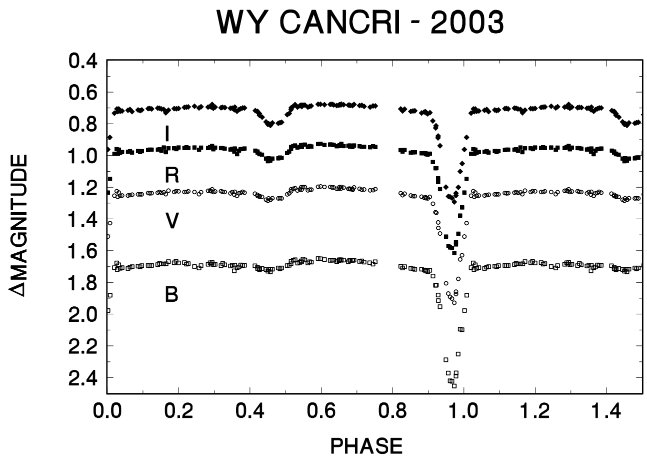

Figure 2. The light curve of WY Cnc in 2003, with 132 data points per filter.

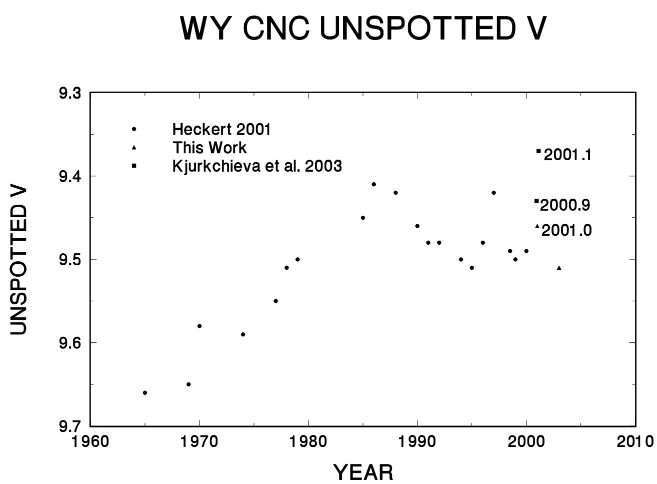

Figure 3.

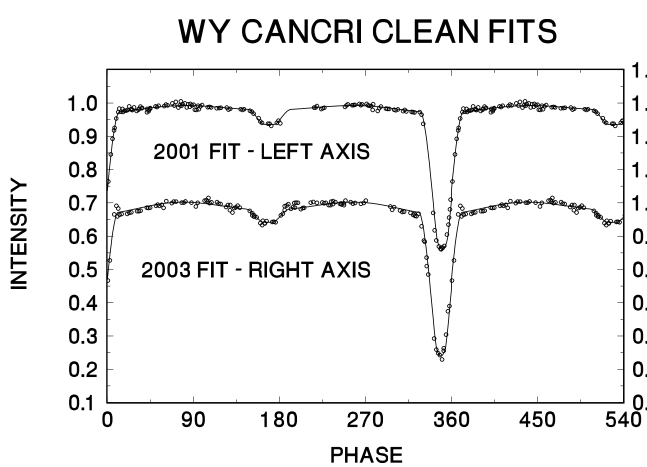

Figure 4.

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BVRI PHOTOMETRY OF DWARF NOVAE

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Dwarf Novae (DNe) are a subclass of cataclysmic variable stars, which are close binary systems in which matter transferred from a Roche-lobe filling secondary star is accreted by a primary white dwarf (Warner, 1995). In dwarf novae accretion proceeds through a disk which is the site of more or less regular outbursts. The recurrence time of these 2-6 mag outbursts can range from 10 days to several years. Dwarf novae can be divided into three subclasses: U Gem-type stars which have the most regular outburst cycles, SU UMa-type stars showing both short and very long outbursts (super-outbursts), and Z Cam stars. The last group is characterized by a “standstill” phenomenon: the decline from the outburst maximum is interrupted and the luminosity of the system settles to a value of ~ 0.7 mag lower than the peak luminosity. Such standstill may last from ten days to years and, after that phase, the system luminosity declines to the usual quiescent state.

In this brief paper we present B, V, R_c, I_c photometric observations of a sample of dwarf novae made in the years 1998-2002. We are mainly interested to obtain multi-color data of a large sample of DNe during all the outburst-cycle, a work that requires large availability of well-equipped small telescopes and generally good weather conditions for many days. Here we present the sporadic observations that do not cover the outbursts cycle because were obtained during the stand-still, or interrupted for persisting bad weather conditions. However, these informations are useful for a historical database of this class of sources, and because for many of them there are no optical color indices reported in the literature.

The photometric data were mainly obtained with the 0.72 m telescope of the Teramo Astronomical Observatory, and the 0.40 m Automatic Imaging Telescope of the Perugia University Observatory (Tosti et al., 1996). The instruments used and the photometric techniques have already been described in Spogli et al. (1998, 2000). We have also used the 0.24 m Schmidt-Cassegrain f/6.3 telescope equipped with an HISIS 23 CCD camera (Kodak 401-E, 768×512 pixels), and the 0.33 m Newtonian f/4.5 telescope equipped with an MX-916 CCD camera (768×512 pixels), of the “Subasio” astronomical station. Both the telescopes are endowed with a standard R_c Cousins broad-band filter. A comparison with results obtained with the other telescopes shows no relevant systematic difference within the typical standard deviation of each instrument. The data reported in Table 1 are obtained in differential photometry using the calibration stars reported in Misselt

(1996). Moreover, we calibrated these comparison stars with the I_c filter by observing, on photometric nights, several standard stars (Landolt, 1992) having $(B-V)$ from −0.2 to 1.4, over a wide range of airmass.

The selected dwarf novae have been observed in different phases of luminosity: a few of them were in outburst, others at minimum or in stand-still. For the dwarf novae that were in outburst at the time of the observations, we calculated the spectral index α (Table 2) using the same procedure described in Spogli et al. (1998) and neglecting interstellar reddening.

Table 1: BVR_cI_c magnitudes of some Dwarf Novae

Name	Type*	Date UT	JD (245+)	B	V	R_c	I_c
AR And	ug	98/08/28	1053.538		16.49±0.02	16.25±0.01	15.44±0.02
		98/08/31	1056.555	16.89±0.04	16.51±0.02	16.05±0.01	15.34±0.03
		98/09/01	1057.590	16.67±0.03	16.38±0.02	15.96±0.02	15.30±0.02
		98/09/02	1058.598	16.85±0.04	16.56±0.02	16.05±0.02	15.38±0.03
		98/09/03	1059.574	16.71±0.04	16.35±0.02	15.92±0.03	15.20±0.02
		98/09/03	1060.429	16.95±0.04	16.49±0.02	16.05±0.02	15.22±0.04
		98/09/06	1063.446		16.76±0.02		15.56±0.02
		98/09/10	1067.431	17.23±0.03	16.89±0.02	16.32±0.02	15.72±0.04
BV And	ug:	98/08/28	1053.501		18.1±0.2	17.9±0.2	17.7±0.2
DX And	ug	98/08/27	1053.489		15.01±0.02	14.34±0.03	13.87±0.05
		98/08/31	1057.402	15.55±0.02	14.76±0.02	14.11±0.02	13.68±0.04
		98/09/01	1058.397	15.52±0.02	14.68±0.02	14.17±0.03	13.72±0.03
		98/09/02	1059.457	15.26±0.02	14.58±0.04	13.99±0.06	13.61±0.05
FO And	ugSU	02/11/22	2601.429			14.81±0.05	
FS And	ugSU:	02/12/29	2638.281			16.8±0.1	
RX And	ugz	98/08/27	1052.547	11.87±0.02	11.77±0.02	11.63±0.02	11.38±0.02
		98/08/28	1053.563	11.88±0.03	11.78±0.02	11.65±0.02	11.39±0.02
		98/08/31	1056.537	11.99±0.02	11.85±0.02	11.66±0.02	11.43±0.02
		98/08/31	1056.611	12.03±0.02	11.84±0.02	11.67±0.02	11.42±0.02
		98/09/01	1057.542	11.90±0.03	11.77±0.03	11.62±0.02	11.34±0.02
		98/09/01	1057.621	11.96±0.02	11.82±0.02	11.67±0.02	11.41±0.02
		98/09/02	1058.523	11.97±0.02	11.84±0.02	11.62±0.03	11.42±0.02
		98/09/02	1058.618	12.03±0.02	11.78±0.02	11.65±0.03	11.38±0.02
		98/09/03	1059.527	12.08±0.02	11.87±0.02	11.67±0.02	11.45±0.02
		98/09/03	1059.528	12.06±0.02	11.82±0.02	11.70±0.02	11.46±0.02
		98/09/03	1059.621	12.04±0.02	11.90±0.02	11.73±0.02	11.42±0.02
		98/09/03	1060.411	12.14±0.04	11.95±0.02	11.76±0.03	11.48±0.02
		98/09/10	1067.379	12.17±0.03	12.02±0.02	11.86±0.02	11.53±0.02
		02/11/15	2594.405			13.47±0.05	
		02/11/22	2601.413			11.03±0.03	
		02/12/29	2638.237			13.98±0.03	
HT Cas	ugSU	98/09/02	1058.597	16.4±0.2	16.1±0.1	15.76±0.05	
V516 Cyg	ugSS	00/08/18	1775.463	14.43±0.08	14.12±0.08	13.93±0.08	
		00/08/23	1780.411		16.2±0.1	15.94±0.05	
		00/08/25	1782.328		16.5±0.1	16.2±0.1	15.75±0.03
		00/08/29	1786.323	14.6±0.1	14.33±0.05	14.21±0.08	14.03±0.03
V516 Cyg	ugSS	00/08/29	1786.491	14.51±0.08	14.19±0.05	14.05±0.08	13.92±0.03
		00/09/08	1796.428	15.43±0.08	15.21±0.05	14.93±0.05	14.68±0.04
		00/09/09	1797.452	14.12±0.07	14.05±0.05	14.01±0.08	13.89±0.03
		00/09/26	1814.493	16.9±0.1	16.3±0.1	16.1±0.1	15.60±0.05
V632 Cyg	ugSS	98/08/26	1052.398			16.9±0.2	
		98/09/01	1057.529		18.1±0.3	17.1±0.2	

*) from Downes et al. (2001)

Table 1: BVR_cI_c magnitudes of some Dwarf Novae (continues)

Name	Type*	Date UT	JD (245+)	B	V	R_c	I_c
V1028 Cyg	ugSU	98/08/26	1052.435			16.3±0.1	
V1032 Cyg	ug	98/08/26	1052.440			16.1±0.1	
V1052 Cyg	ugSS	98/08/26	1052.444			15.38±0.05	
V1060 Cyg	ugSS	98/08/26	1052.464			16.1±0.1	
V1316 Cyg	ugSU	98/09/01	1058.454		17.8±0.3	17.4±0.2	17.3±0.2
V1377 Cyg	ug:	98/08/26	1052.462			15.51±0.05	
MN Lac	ugz	98/08/30	1056.493		15.69±0.07	14.99±0.05	14.59±0.04
CN Ori	ugz	02/02/11	2317.327	12.68±0.07	12.77±0.05	12.68±0.04	12.41±0.04
		02/02/22	2328.329	15.92±0.09	15.31±0.05	14.91±0.05	14.34±0.05
		02/03/04	2338.326	13.48±0.09	12.99±0.05	12.85±0.04	12.55±0.04
		02/03/10	2344.361	17.4±0.2	16.1±0.1	15.44±0.05	14.59±0.05
CZ Ori	ug	98/03/10	0883.357		16.3±0.1	15.85±0.05	14.84±0.04
		98/03/14	0887.381			14.50±0.05	14.08±0.04
		98/03/16	0889.317	12.81±0.06	12.67±0.05	12.62±0.04	12.39±0.04
		98/03/17	0890.312	12.67±0.07	12.82±0.05	12.64±0.04	12.43±0.04
		98/03/18	0891.313	12.89±0.07	13.03±0.05	12.90±0.04	12.65±0.04
		98/03/27	0900.313	16.8±0.1	16.35±0.08	15.74±0.05	14.89±0.04
		98/03/29	0902.317		16.1±0.1	15.72±0.05	14.87±0.04
		99/03/01	1239.393		14.41±0.05	13.99±0.05	13.69±0.04
		99/03/03	1241.387			15.23±0.05	14.71±0.04
		99/03/10	1248.375			16.00±0.08	15.01±0.05
		99/03/11	1249.361		16.36±0.05	16.03±0.05	15.06±0.04
IP Peg	ug	98/08/28	1053.517	16.5±0.1	15.80±0.04	15.24±0.05	
RU Peg	ugSS	98/09/03	1059.501	12.53±0.02	12.11±0.02	11.82±0.02	
FO Per	ug	98/08/31	1056.628	14.01±0.05	13.77±0.05	13.57±0.05	13.29±0.04
		98/09/01	1057.562	14.11±0.05	13.86±0.05	13.57±0.05	13.36±0.04
		98/09/02	1058.637	14.42±0.03	14.19±0.03	13.91±0.03	13.62±0.03
		98/09/03	1059.614	14.98±0.04	14.81±0.02	14.57±0.04	14.24±0.03
		02/02/11	2317.309	15.06±0.06	15.03±0.03	14.82±0.05	14.49±0.03
		02/02/22	2328.306	13.92±0.04	13.75±0.03	13.62±0.05	
		02/02/24	2330.312	14.85±0.05	14.42±0.05	14.37±0.05	
		02/03/10	2344.311		14.03±0.03	13.86±0.05	13.57±0.04
		02/03/11	2345.291	14.19±0.03	14.03±0.03	13.86±0.05	13.58±0.04
		02/03/13	2347.286		16.2±0.2	15.79±0.05	15.43±0.06
		02/03/23	2357.297		17.3±0.3	17.0±0.2	16.2±0.1
		02/03/29	2363.293		13.61±0.03	13.38±0.04	13.20±0.05
		02/03/30	2364.294		13.65±0.05	13.53±0.05	13.21±0.05
KT Per	ugz	00/08/26	1782.515	12.84±0.05	12.75±0.05		
		00/08/29	1786.499	16.1±0.1	15.57±0.05	15.18±0.05	
		00/08/30	1786.560	15.89±0.05	15.47±0.05		
		00/09/09	1796.655	15.82±0.07	15.56±0.05	14.99±0.05	14.35±0.05
		00/09/11	1799.464		15.53±0.05	15.05±0.05	14.21±0.05
		00/09/23	1810.511	16.30±0.08	15.86±0.06	15.37±0.05	14.37±0.05
		00/09/27	1814.513	12.85±0.06	12.71±0.05	12.52±0.04	12.33±0.04
		00/09/27	1814.573	12.78±0.07	12.69±0.05	12.53±0.04	12.35±0.04
		00/09/28	1815.535	12.69±0.07	12.53±0.05	12.38±0.04	12.17±0.04
		00/10/12	1830.342				14.21±0.05
		00/10/28	1846.323				14.48±0.07
TU Tri	ug	98/09/03	1059.586				18.3±0.2
TX Tri	ugSS	98/09/03	1059.583				16.5±0.1
TW Tri	ugz	98/09/03	1059.603			16.7±0.1	16.4±0.1
SW Vul	ug	98/08/31	1056.509	19.1±0.3	18.4±0.3	17.9±0.2	17.7±0.2
VW Vul	ugSU	98/08/30	1056.413		18.1±0.2	17.7±0.2	16.4±0.1

*) from Downes et al. (2001)

Table 2: Mean spectral slope ($F(\nu) \propto \nu^{\alpha}$) of some DNe

Name	Type*	Magnitude Range*	Obs. Values	α
RX And	ugz	10.9 v – 12.6 v	V $\simeq$ 11.8	0.2 ±0.1
V516 Cyg	ugSS	13.8 p – 16.8 p	V $\simeq$ 14.1	0.3 ±0.2
CN Ori	ugz	11.9 v – 16.3 v	V $\simeq$ 12.8	0.5 ±0.2
CZ Ori	ug	11.2 V – 17.0 V	V $\simeq$ 12.7	0.4 ±0.2
FO Per	ug	11.8 v – 16.2 p	V $\simeq$ 13.8	0.0 ±0.2
KT Per	ugz	10.6 V – 16.1 V	V $\simeq$ 12.6	0.3 ±0.1

*) from Downes et al. (2001)

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TIMES OF MINIMUM FOR THE ECLIPSING BINARY BP Vul

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The eclipsing binary star BP Vul ($V = 9.82$) was discovered as a variable star by Hoffmeister (1935). It has a period of 1.94 days and a spectral type listed as A7, but has been largely neglected by observers. A partial light curve obtained by the Hipparcos mission (ESA, 1997) indicates that the system is well detached, with eclipse depths in the optical of about 0.7 mag for the primary and 0.4 mag for the secondary.

Times of minimum have been recorded for the binary by a number of authors since 1929 using a variety of techniques (photographic, visual, photoelectric/CCD). We report here additional timings determined from archival plates from the Harvard College Observatory, that go as far back as 1918.

More than 400 blue-sensitive patrol plates from the AC series at the Harvard College Observatory were measured by PRG using 4 comparison stars and a sequence of steps to estimate changes in brightness. These plates span the interval 1889–1954. Additionally, some 180 plates from the Damon series were inspected, covering the period 1965–1989. Table 1 lists the dates of the low-light levels recorded in the vicinity of the eclipse phases ("Type 1" and "Type 2" for the primary and secondary minima, respectively).

Table 1. Photographic times of minimum for BP Vul.

HJD−2,400,000	Type	Year	HJD−2,400,000	Type	Year
21787.723	1	1918.529	42386.456	1	1974.925
22144.750	1	1919.506	42666.772	2	1975.693
22637.569	1	1920.856	43317.780	1	1977.475
23607.741	1	1923.512	43423.529	2	1977.765
26465.843	1	1931.337	44875.875	1	1981.741
26535.718	1	1931.528	45636.490	1	1983.823
27965.784	1	1935.444	45785.882	1	1984.232
28460.527	1	1936.798	45855.778	1	1984.424
29073.744	1	1938.477	46385.508	1	1985.874
29857.637	1	1940.623	46534.864	1	1986.283
31318.694	1	1944.623	46709.547	1	1986.761
33854.692	1	1951.567	47026.696	2	1987.630
34209.792	1	1952.539	47064.618	1	1987.733

Because of the shallower secondary eclipse in BP Vul, most of the measurements correspond to the primary minimum. We estimate the uncertainties of these timings to be roughly 0.02–0.03 days. $O - C$ diagrams for all available primary and secondary minima in addition to ours (Huth, 1965; Lacy, Marcrum, & Ibanoglu, 1999; Agerer, Dahm,

& Hübscher, 2001; Lacy, 2002; Lacy, Straughn, & Denger, 2002; Kundera, 2003) are shown in Figure 1. A complete analysis of BP Vul including new CCD and spectroscopic observations will be reported elsewhere (Lacy et al., 2003).

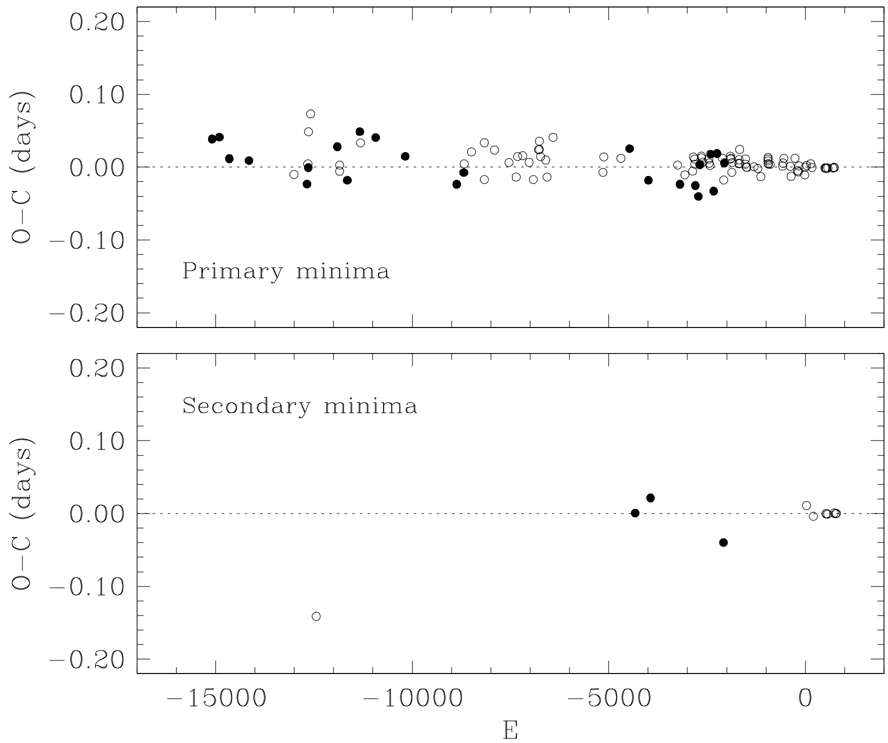

Figure 1. $O-C$ diagram based on the ephemeris by Lacy, Straughn & Denger (2002), and including all times of minimum for BP Vul. The new photographic timings from the Harvard plates, reported here, are represented by filled circles.

PRG would like to thank Alison Doane, curator of the Astronomical Photograph Collection at the Harvard College Observatory, for the use of the plates. This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France, and of NASA's Astrophysics Data System Abstract Service.

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THE 77TH NAME-LIST OF VARIABLE STARS

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The present 77th Name-List of Variable Stars, compiled basically in the manner first introduced in the 67th Name-List (IBVS No. 2681, 1985), contains all data necessary for identifications of 1152 new variables finally designated in 2003. The total number of designated variable stars, not counting designated non-existing stars or stars subsequently identified with earlier-designated variables, has now reached 38528.

The 77th Name-List consists of two tables and a list of references. Table 1 contains the list of new variables arranged in the order of their right ascensions (2000.0). The table gives the ordinal number and the designation of each variable; its equatorial coordinates for the equinox 2000.0 (we present right ascensions to $0^s.1$ and declinations to $1''$. The coordinates were found in the literature, taken from positional catalogues, including USNO A1.0/A2.0/B1.0, GSC2.2, GSC and 2MASS, or determined by the authors); the range of variability (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); and the system of magnitudes used ("p" are photographic magnitudes[1]; the symbol "Rc" designates magnitudes in Cousins's R system; the symbols "u", "b", "y" mean corresponding Strömgren's magnitudes; "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); 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, and one alteration described below; 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`); two references to the list of papers which follows Table 2 (the first reference is to the investigation of the star, 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

[1]In the 4th GCVS edition and the 67th–76th Name-Lists, upper-case "P" was used. The current electronic version of the GCVS contains no stars with P magnitudes of the old PV system, and we now have changed "P" into "p" globally in the GCVS.

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).

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. 76 and No. 77 upon request from the IAU Bureau of Astronomical Telegrams have GCVS names, within their constellation, not in their proper order by right ascension.

We continue to designate the system of magnitudes as "V" for numerous stars studied by amateur astronomers using photographs on T400 films, though the authors call their system "photographic". These films, together with the magnitudes of comparison stars used, reproduce a system resembling the traditional photovisual one, and at least a system far from the traditional photographic one.

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.

In the present Name-List, we change the designation for one of the variability types introduced earlier, in the 72nd Name-List (IBVS No. 4140, 1995). Namely, we have decided that the provisional designation "LBV", introduced there for comparatively long-period pulsating B stars, causes considerable confusion because many astronomers understand it as "Luminous Blue Variables" (type SDOR in our catalogues). From now on, we change the designation of our type for slowly-pulsating (periods in excess of one day) B-type stars into **LPB**. We introduce this change also for stars of the Name-Lists Nos. 72–76 at our web site.

A version of Table 1 given in the electronic supplement to this paper (file 5422-t1.txt) contains also coordinates for the equinox 1950.0. In the electronic table, no spaces are left between hours and minutes, minutes and seconds of right ascension or between degrees and minutes, minutes and seconds of declination.

Table 2 contains the list of variables arranged in the order of their variable star names within constellations. After the designation of a variable, its ordinal number from Table 1 is given, as well as identifications with several major catalogues and identifications necessary to find this star in the papers referred to in Table 1 or in the papers with the first (or independent) announcement of the discovery of its variability, referred to (in a small number of cases) in square brackets after the corresponding identification in Table 2. In variance with our earlier practice and in accordance with the style of Name-Lists Nos. 75 and 76, we did not include names of discoverers different from the name of the author(s) of the paper referred to. After the identifications, some minimal remarks are given if necessary. Table 2 and the list of references are also presented in the form of ASCII files in the electronic supplement to this paper (files 5422-t2.txt and 5422-t3.txt). The abbreviated names of the catalogues in Table 2 generally follow conventions of the GCVS or of the SIMBAD data base; in its electronic version, "Name" stands for non-standard names or abbreviations, mainly from discovery announcements, and "Rmrk", for remarks.

We would like to introduce a correction to the Name-List No. 72 (IBVS No. 4140, 1995). The object No. 72429 (V362 Vul), attributed there to the type NL, is actually a galaxy (type GAL). Corrections to the Name-List No. 76 (IBVS No. 5135, 2001) are given in the following small table.

Page	No.	Name	Printed	Should be
55	760652	V558 Pup	Tmz V432	Tmz V438
60	761047	V406 Vul	XTE 1859+226	XTE J1859+226

We also have to introduce new GCVS names for two variables first named long ago. Thanks to searches undertaken by Dr. M.L. Hazen in Harvard archives, these two stars were found at very large distances from their published positions and quite far from constellations they were originally believed to belong to. In both cases, we have decided to use the new name as the main one for the variable.

V1046 Cen = CO Hya. Found in Centaurus, in 10° to the south from the position published by the discoverer (*M. Huruhata,* Harv Bull No. 913, 1940). The accurate coordinates are: $12^{h}55^{m}53\overset{s}{.}0$ –37°42′05″(J2000.0).

NW Lup = W Cir. Found in Lupus, in 4° to the north from the position published by the discoverer (*J. Mohr,* Harv Bull No. 866, 1929). This star's accurate coordinates are: $15^{h}11^{m}26\overset{s}{.}6$ –51°38′06″(J2000.0).

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 many GCVS and NSV catalogue stars, taken from positional catalogues (referred to on the list) or measured by the GCVS team. The list 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 by 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 correct erroneous data necessary for this Name-List. Also, thanks are due for sending us corrections to our catalogues and Name-Lists. Special thanks are due to R.A. Downes, M.L. Hazen, and P. Schmeer. This study was supported in part by Russian Foundation for Basic Research through grant 02-02-16069, by the Russian Federal Scientific and Technological Programme "Astronomy", by the Programme "Unstable Processes in Astronomy" of the Presidium of Russian Academy of Sciences, and by the Support Programme for Leading Scientific Schools of Russia. Our research has made use of the USNOFS Image and Catalogue Archive operated by the United States Naval Observatory, Flagstaff Station (http://www.nofs.navy.mil/data/fchpix/) and of the NASA/IPAC Infrared Science Archive, which if operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

Table 1

No.	Name		R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.	
770001	V878	Cas	00 00 52.9 +62 25 15	15.6	16.0	B	DSCT	001	001
770002	V879	Cas	00 01 46.0 +62 25 28	15.4	16.3	B	DCEP	002	002
770003	EF	Tuc	00 01 55.1 -67 07 43	13.89	14.59	V	NL	003	GSC
770004	DX	Psc	00 22 16.3 +03 35 24	11.9	12.8	V	SR:	004	GSC
770005	DY	Psc	00 24 24.6 -01 58 20	15.1	(0.08)	I	BY	005	006
770006	ET	Cet	00 32 21.6 -18 39 09	12.0	13.0	V	SR:	004	GSC
770007	DZ	Psc	00 36 27.9 +21 32 14	10.86	11.32	V	EW	007	DM
770008	V428	And	00 36 46.4 +44 29 19	5.13	(0.06)	V	SRS	008	DM
770009	V429	And	00 42 42.4 +43 19 01	15.1	(0.02)	B	RPHS	009	USNO
770010	V880	Cas	00 55 33.9 +68 28 55	11.6	12.2	V	SR:	004	GSC
770011	V881	Cas	00 56 56.2 +64 27 01	12.9	13.9	V	SR:	004	GSC
770012	V882	Cas	00 57 18.6 +67 20 29	13.6	14.5	V	SR:	004	010
770013	V883	Cas	00 57 42.7 +64 08 35	12.4	13.4	V	SR:	004	GSC
770014	V884	Cas	00 59 09.1 +63 48 50	10.5	12.4	V	SR:	004	010
770015	EE	Psc	00 59 50.1 +12 25 04	13.9	(0.27)	R	EW	011	GSC
770016	V885	Cas	01 00 55.8 +67 20 42	12.4	13.5	V	SR:	004	GSC
770017	V886	Cas	01 01 19.8 +68 43 02	12.7	13.6	V	SR:	004	GSC
770018	V887	Cas	01 01 58.4 +57 59 49	8.1	8.8	I	SR	012	013
770019	V888	Cas	01 05 27.4 +65 59 00	9.3	11.5	*	SR:	004	USNO
770020	V889	Cas	01 06 25.0 +65 48 02	11.8	12.6	V	SR:	004	GSC
770021	EF	Psc	01 07 30.1 +29 26 13	10.8	11.6	V	SR:	004	GSC
770022	V890	Cas	01 07 44.6 +59 03 02	11.5	(14.0	*	M	004	g2.2
770023	V891	Cas	01 10 22.3 +66 07 13	11.8	12.7	V	SR:	004	GSC
770024	EG	Psc	01 11 02.1 +23 51 11	11.0	12.0	V	SR:	004	GSC
770025	BZ	Scl	01 11 43.2 -25 57 30	9.64	9.73	V	RS	014	DM
770026	V892	Cas	01 12 34.4 +65 54 09	13.2	14.0	V	SR:	004	GSC
770027	V893	Cas	01 14 13.9 +65 51 37	11.5	12.6	V	SR:	004	GSC
770028	V894	Cas	01 15 11.8 +66 39 54	11.6	12.6	V	SR:	004	GSC
770029	V895	Cas	01 16 18.3 +67 45 23	10.8	11.6	V	SR:	004	GSC
770030	V896	Cas	01 19 16.4 +66 15 48	12.8	13.6	V	SR:	004	GSC
770031	V897	Cas	01 20 13.7 +65 31 27	11.0	(13.6	*	M	004	USNO
770032	V898	Cas	01 20 18.3 +64 28 07	12.8	13.8	V	SR:	004	010
770033	V899	Cas	01 22 04.1 +66 50 12	11.5	12.2	V	SR:	004	GSC
770034	V900	Cas	01 23 00.6 +64 39 24	11.1	12.3	V	SR:	004	GSC
770035	V901	Cas	01 24 35.5 +65 41 01	11.1	12.1	V	SR:	004	GSC
770036	V902	Cas	01 25 58.4 +63 29 32	10.9	11.8	V	SR:	004	GSC
770037	V903	Cas	01 27 52.4 +67 47 12	12.6	13.6	V	SR:	004	GSC
770038	V904	Cas	01 27 57.2 +65 43 22	12.6	13.4	V	SR:	004	GSC
770039	EH	Psc	01 28 05.1 +28 31 35	11.6	13.0	V	LB:	004	GSC
770040	V905	Cas	01 29 35.1 +65 02 05	11.3	12.5	V	SR:	004	GSC
770041	AL	Tri	01 31 43.1 +30 23 28	14.1	(0.28)	V	EW	015	015
770042	V906	Cas	01 32 58.5 +67 48 54	13.4	14.2	V	SR:	004	GSC
770043	V907	Cas	01 34 56.9 +67 29 35	13.1	14.1	V	SR:	004	GSC
770044	V430	And	01 35 51.4 +36 10 25	11.7	13.3	V	SR:	004	GSC
770045	V908	Cas	01 36 20.4 +58 31 42	12.0	13.2	V	SR:	004	GSC
770046	V909	Cas	01 36 38.6 +61 25 54	10.7	(0.19)	R	BCEP	016	016

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 ° ' "	Max m	Min m		Type	Ref.	
770047	V910	Cas	01 37 01.3	+61 15 58	12.5	13.7	V	SR:	004	GSC
770048	V911	Cas	01 39 46.8	+59 42 30	12.1	13.0	V	SR:	004	GSC
770049	V912	Cas	01 40 08.3	+64 51 50	13.0	14.4	V	SR:	004	GSC
770050	V913	Cas	01 40 22.4	+62 40 22	12.5	13.5	V	SR:	004	GSC
770051	V914	Cas	01 41 18.8	+63 36 44	11.4	12.1	V	SR:	004	GSC
770052	V431	And	01 42 22.7	+48 57 35	11.1	12.1	V	SR:	004	GSC
770053	V915	Cas	01 42 38.3	+63 36 32	11.5	12.4	V	SR:	004	GSC
770054	V916	Cas	01 43 01.8	+63 22 06	14.3	15.2	V	SR:	004	GSC
770055	V917	Cas	01 43 36.4	+58 48 08	10.5	11.2	V	SR:	004	GSC
770056	V918	Cas	01 43 58.3	+58 41 05	12.1	13.3	V	SR:	004	GSC
770057	V919	Cas	01 47 31.1	+59 03 20	14.0	(15.3	V	SR:	004	GSC
770058	V920	Cas	01 48 16.3	+63 07 07	10.4	11.2	V	SR:	004	GSC
770059	AW	Ari	01 48 43.6	+13 04 12	13.66	14.33	*	EW/KW	017	GSC
770060	V432	And	01 49 15.6	+45 20 30	12.3	13.4	V	SR:	004	GSC
770061	V921	Cas	01 49 19.8	+56 12 22	11.7	13.4	V	SR:	004	GSC
770062	V922	Cas	01 50 10.6	+66 13 39	10.8	11.6	V	SR:	004	GSC
770063	V433	And	01 51 38.1	+39 15 44	9.8	10.9	V	SR:	004	GSC
770064	V434	And	01 53 20.8	+44 07 42	13.1	14.1	V	SR:	004	GSC
770065	V923	Cas	01 56 15.8	+60 01 04	12.4	13.8	V	SR:	004	GSC
770066	AM	Tri	01 56 19.4	+34 24 57	12.6	13.5	V	SR:	004	GSC
770067	V658	Per	01 56 19.9	+52 03 31	12.6	13.3	V	SR:	004	GSC
770068	AX	Ari	01 58 14.0	+22 34 12	12.4	13.2	V	SR:	004	GSC
770069	ES	Cet	02 00 52.2	-09 24 31	16.9	(0.15)	V	AM	018	019
770070	V924	Cas	02 00 57.1	+58 36 58	11.3	13.5	V	SR:	004	010
770071	V659	Per	02 01 44.1	+55 22 37	12.8	13.7	V	SR:	004	GSC
770072	V925	Cas	02 03 00.5	+58 36 13	11.8	12.5	V	SR:	004	GSC
770073	V660	Per	02 03 21.8	+50 24 10	11.0	12.9	V	SR:	004	GSC
770074	V661	Per	02 05 05.8	+58 16 23	13.5	14.2	V	SR:	004	GSC
770075	V662	Per	02 07 15.7	+54 13 31	11.9	13.2	V	SR:	004	GSC
770076	V926	Cas	02 07 51.5	+61 40 57	13.2	14.3	V	SR:	004	GSC
770077	V927	Cas	02 08 15.8	+59 15 56	10.9	11.8	V	SR:	004	GSC
770078	V928	Cas	02 11 40.6	+61 14 26	12.1	(14.1	*	M:	004	g2.2
770079	V435	And	02 12 49.4	+47 11 47	10.9	11.6	V	SR:	004	GSC
770080	AN	Tri	02 13 15.8	+33 57 51	12.4	13.4	V	SR:	004	GSC
770081	V663	Per	02 15 14.1	+56 13 04	13.1	18.0	I	M	012	013
770082	V929	Cas	02 15 15.3	+65 42 20	12.2	13.3	V	SR:	004	GSC
770083	V930	Cas	02 15 20.5	+62 13 50	13.3	14.2	V	SR:	004	GSC
770084	V931	Cas	02 15 23.8	+65 01 40	12.8	13.5	V	SR:	004	GSC
770085	V932	Cas	02 15 33.5	+64 16 10	12.8	14.3	V	SR:	004	GSC
770086	V664	Per	02 16 15.5	+54 48 37	11.9	12.7	V	SR:	004	GSC
770087	V665	Per	02 18 48.0	+57 17 08	9.51	(0.10)	V	BCEP	020	DM
770088	AO	Tri	02 19 29.4	+28 04 14	12.5	13.8	V	SR:	004	021
770089	V933	Cas	02 20 32.8	+62 32 02	11.7	13.8	V	SR:	004	GSC
770090	V436	And	02 21 02.7	+42 56 38	7.23	7.29	Hp	ACV	022	DM
770091	V934	Cas	02 21 14.9	+66 42 17	11.8	12.5	V	SR:	004	GSC
770092	V666	Per	02 21 47.7	+53 18 00	11.4	12.0	V	SR:	004	GSC

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s ° ′ ″	Max m	Min m	Type	Ref.
770093	V935	Cas	02 22 22.6 +66 51 29	12.9	14.0	V SR:	004 GSC
770094	V936	Cas	02 22 31.4 +66 59 40	13.9	14.7	V SR:	004 GSC
770095	V667	Per	02 25 25.8 +54 11 03	11.8	12.8	V SR:	004 GSC
770096	V668	Per	02 25 44.9 +58 04 46	13.0	13.8	V SR:	004 GSC
770097	AP	Tri	02 26 10.2 +36 51 31	13.3	14.1	V SR:	004 GSC
770098	V937	Cas	02 27 22.1 +62 38 26	13.7	14.5	V SR:	004 GSC
770099	V437	And	02 27 25.0 +42 59 59	11.0	11.9	V SR:	004 GSC
770100	V669	Per	02 27 50.5 +53 46 39	12.4	13.1	V SR:	004 GSC
770101	V938	Cas	02 29 11.7 +66 52 34	13.0	14.1	V SR:	004 GSC
770102	V939	Cas	02 31 12.9 +63 40 20	14.5	16.5	I M	012 013
770103	V670	Per	02 31 24.4 +53 17 05	13.0	13.7	V SR:	004 GSC
770104	V940	Cas	02 33 24.0 +64 25 02	13.3	14.1	V SR:	004 GSC
770105	V941	Cas	02 34 04.7 +60 59 15	12.5	13.3	V SR:	004 GSC
770106	V438	And	02 34 06.1 +43 31 36	11.5	12.4	V SR:	004 GSC
770107	V942	Cas	02 34 22.2 +65 18 49	12.8	13.6	V SR:	004 GSC
770108	V943	Cas	02 34 40.2 +63 00 04	12.6	13.6	V SR:	004 GSC
770109	V944	Cas	02 37 45.0 +64 48 57	13.0	13.9	V SR:	004 GSC
770110	AP	For	02 39 16.0 -29 27 20	12.2	13.0	V SR:	004 GSC
770111	V945	Cas	02 40 29.3 +62 16 20	13.5	14.4	V SR:	004 GSC
770112	AY	Ari	02 42 00.7 +30 56 09	6.82	(0.02)	V SRD	023 DM
770113	V946	Cas	02 44 19.4 +64 45 57	12.6	13.4	B DCEP	024 GSC
770114	V947	Cas	02 47 26.8 +63 58 23	9.0	12.1	I M	012 013
770115	V948	Cas	02 48 56.2 +67 00 12	12.6	13.9	V SR:	004 GSC
770116	AQ	Tri	02 49 27.5 +32 51 13	15.8	(0.15*)	V ZZA	025 g2.2
770117	V949	Cas	02 49 30.0 +61 42 37	11.4	13.8	* M:	004 GSC
770118	V671	Per	02 50 45.3 +55 49 01	9.9	12.5	I M	012 013
770119	V950	Cas	02 52 23.0 +67 07 55	13.2	14.8	V SR:	004 GSC
770120	V951	Cas	02 53 10.2 +66 15 18	13.0	13.9	V SR:	004 GSC
770121	V672	Per	02 56 18.0 +45 53 13	9.6	12.8	* M	004 GSC
770122	V952	Cas	03 02 20.7 +71 09 40	11.7	12.9	p EA	026 027
770123	V673	Per	03 05 52.9 +54 20 54	10.8	14.4	I M	012 013
770124	V953	Cas	03 12 24.1 +60 02 21	12.1	(13.9	* M:	004 g2.2
770125	V954	Cas	03 13 35.0 +59 48 04	15.0	18.9	I M	012 013
770126	KX	Cam	03 23 05.9 +56 52 44	12.4	14.7	I M	012 013
770127	KY	Cam	03 27 59.1 +60 44 55	15.0	17.6	I M	012 013
770128	AQ	For	03 34 25.4 -25 37 41	11.1	12.3	V SR:	004 GSC
770129	V674	Per	03 36 27.6 +36 22 27	16.9	(0.09*)	B EW:	028 USNO
770130	KZ	Cam	03 38 19.7 +56 55 58	6.28	6.30	V ACV	029 DM
770131	HZ	Eri	03 39 53.2 -13 37 50	11.6	12.4	V SR:	004 DM
770132	V675	Per	03 40 49.9 +49 41 54	16.3	19.4	I M	012 013
770133	V1209	Tau	03 43 13.8 +24 05 10	16.2	17.3	p NL	030 030
770134	V1210	Tau	03 47 04.2 +23 59 43	8.37	(0.03)	V GDOR	031 DM
770135	V1211	Tau	03 50 51.5 +23 19 45	12.9	14.4	U UV	032 GSC
770136	LL	Cam	03 51 04.2 +58 42 25	9.3	12.9	I M	012 013
770137	II	Eri	03 51 56.7 -30 32 58	11.9	12.7	V SR:	004 GSC
770138	V1212	Tau	03 51 57.0 +25 25 29	15.3	(21.5	B UGSU:	033 033

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.	
770139	LM	Cam	03 56 35.8 +57 20 27	9.5	13.9	I	M	012	013
770140	V676	Per	03 59 11.8 +44 13 10	16.5	19.2	I	M	012	013
770141	VX	Ret	04 04 05.9 -57 53 27	14.7	18.1	B	UG	003	GSC
770142	LN	Cam	04 05 47.3 +58 45 22	10.3	(0.04)	V	ELL:	034	DM
770143	LO	Cam	04 06 09.0 +58 48 31	11.67	12.84	B	DCEP	034	214
770144	IK	Eri	04 09 07.7 -16 23 58	8.14	8.16	V	GDOR	035	DM
770145	LP	Cam	04 09 40.4 +62 27 12	11.10	11.75	V	RRAB	036	214
770146	LQ	Cam	04 12 22.6 +53 55 06	7.3	11.5	I	M	012	013
770147	IL	Eri	04 17 04.3 -12 13 12	12.4	13.6	V	SR:	004	GSC
770148	V677	Per	04 24 40.4 +48 07 25	10.4	14.1	I	M	012	013
770149	IM	Eri	04 24 41.1 -20 07 12	11.6	13.0	B	NL	003	DM
770150	V1213	Tau	04 31 37.5 +18 12 25	19.5	(1.4)	V	IN	037	USNO
770151	IN	Eri	04 39 44.7 -29 45 58	11.9	12.7	V	SR:	004	GSC
770152	V524	Aur	04 40 28.0 +30 16 50	10.2	11.8	*	SR:	004	USNO
770153	V525	Aur	04 43 29.3 +34 32 19	9.5	12.9	I	M	012	013
770154	V1636	Ori	04 47 18.6 +05 03 35	15.2	(0.03)	B	RPHS	009	USNO
770155	V1214	Tau	04 50 13.4 +30 07 45	10.3	13.6	I	M	012	013
770156	V1637	Ori	04 53 08.6 -03 29 53	12.3	(1.12)	V	EA	038	215
770157	V1638	Ori	04 53 21.9 -03 22 55	11.5	(0.39)	V	EB	039	GSC
770158	IO	Eri	04 53 27.9 -05 34 49	10.25	11.10	V	SR	040	DM
770159	V526	Aur	05 01 47.6 +38 05 42	10.0	(0.10)	R	BY	041	GSC
770160	V527	Aur	05 02 07.9 +38 01 42	12.9	(0.10)	R	LB:	041	GSC
770161	V1639	Ori	05 02 53.7 +10 36 50	15.2	(0.31)	R	EW:	028	GSC
770162	AQ	Men	05 07 53.6 -79 51 24	15.06	(1.4)	B	NL+E	003	GSC
770163	V528	Aur	05 12 52.4 +46 43 03	8.1	11.2	I	M	012	013
770164	V1640	Ori	05 17 22.0 +10 18 28	12.38	12.93	V	RRC	042	GSC
770165	V1215	Tau	05 17 43.6 +25 24 59	9.9	13.6	I	M	012	013
770166	V1216	Tau	05 20 09.6 +19 28 49	14.3	16.1	p	SR:	043	GSC
770167	V529	Aur	05 23 39.9 +32 30 16	12.8	16.8	I	M	012	013
770168	V1641	Ori	05 24 27.8 -10 39 24	11.5	16.2	p	M	044	216
770169	V1642	Ori	05 29 20.6 +00 41 28	12.30	13.07	V	E	045	GSC
770170	BB	Dor	05 29 28.6 -58 54 47	14.3	(18.	B	NL	003	GSC
770171	V1217	Tau	05 30 18.2 +20 22 02	9.8	13.7	I	M	012	013
770172	V1643	Ori	05 32 34.5 -07 12 40	10.26	(0.03*)	V	DSCTC	046	DM
770173	AG	Pic	05 35 12.1 -58 01 08	12.1	(0.19)	R	DSCT	047	GSC
770174	V1218	Tau	05 40 02.7 +16 38 49	12.6	13.2	*	EA:	125	GSC
770175	LR	Cam	05 43 05.2 +68 40 07	10.7	(0.63)	V	EW	048	048
770176	V530	Aur	05 45 29.9 +29 07 06	9.4	12.4	I	M	012	013
770177	V1219	Tau	05 48 15.7 +20 01 59	13.7	15.9	I	M	012	013
770178	V531	Aur	05 51 46.4 +35 22 19	13.6	15.7	I	M	012	013
770179	AH	Pic	05 57 12.6 -59 35 26	14.0	14.4	B	NL	003	GSC
770180	LS	Cam	05 57 24.0 +72 41 52	16.7	19.3	B	NL	049	050
770181	V1644	Ori	05 58 07.5 +17 20 59	11.7	15.8	I	M	012	013
770182	LT	Cam	05 58 15.5 +59 46 23	14.5	(0.2)	V	EW	051	051
770183	LU	Cam	05 58 18.0 +67 53 46	14.0	(16.0	V	UG	052	050
770184	LV	Cam	05 59 25.7 +59 51 24	16.0	(0.4)	V	EW	051	051

Table 1 (continued)

No.	Name		R.A., 2000.0	Decl., 2000.0	Max	Min		Type	Ref.	
			h m s	o ’ "	m	m				
770185	V1645	Ori	06 01 07.3	-02 15 09	8.77	8.98	V	SR	053	DM
770186	V532	Aur	06 13 45.1	+52 25 40	12.0	(15.3	V	M	004	USNO
770187	V1646	Ori	06 15 42.4	+16 28 13	11.6	12.3	*	LB	125	GSC
770188	V533	Aur	06 20 21.4	+35 22 21	11.3	15.6	I	M	012	013
770189	V534	Aur	06 26 23.9	+27 56 44	10.4	(0.35)	V	EA	054	054
770190	V535	Aur	06 32 46.2	+46 23 33	12.73	13.17	V	EW	055	GSC
770191	V366	Gem	06 38 56.4	+25 29 39	11.3	13.2	V	SR:	004	GSC
770192	V350	CMa	06 42 46.0	-22 26 55	6.18	6.27	V	GDOR	035	DM
770193	V839	Mon	06 46 40.7	+08 21 47	7.5	(0.01b)	V	GDOR:	056	DM
770194	V367	Gem	06 46 43.6	+20 53 22	11.20	11.82	V	EA	057	057
770195	V840	Mon	06 47 25.0	+08 13 59	13.5	16.9	I	M	012	013
770196	V368	Gem	06 47 47.2	+16 36 33	10.6	13.2	I	M	012	013
770197	V841	Mon	06 48 15.7	+08 02 41	11.6	(13.1	V	M:	004	GSC
770198	V842	Mon	06 48 43.5	+05 02 01	9.74	10.08	V	EB	058	GSC
770199	V843	Mon	06 58 10.9	+10 13 58	12.4	(0.52)	V	EW	059	GSC
770200	V369	Gem	07 02 23.3	+25 50 46	7.95	8.12	V	RS	060	DM
770201	V838	Mon	07 04 04.8	-03 50 51	6.7	16.05	V	NC	061	GSC
770202	LW	Cam	07 04 10.0	+62 03 28	17.0	20.0	V	XM	062	062
770203	V351	CMa	07 23 06.6	-29 22 20	10.7	12.5	V	LB:	004	GSC
770204	V569	Pup	07 29 12.5	-19 27 50	1.85	2.74	K	LB	063	063
770205	V370	Gem	07 29 36.8	+16 38 02	12.2	12.6	*	LB	125	GSC
770206	V570	Pup	07 31 28.9	-26 16 51	10.4	12.4	*	SR:	004	USNO
770207	V571	Pup	07 32 19.4	-14 34 51	12.8	(15.0	p	EA	064	GSC
770208	DU	Lyn	07 46 39.3	+37 31 03	5.18	(0.13)	V	SRB	065	DM
770209	CW	CMi	07 50 45.5	-00 00 11	11.2	(0.43)	V	EW/K	066	GSC
770210	V844	Mon	07 54 19.3	-00 40 09	11.53	(0.20)	V	SRB	067	GSC
770211	V845	Mon	07 59 53.6	-10 45 47	14.38	14.69	V	DSCT	068	068
770212	V846	Mon	07 59 57.9	-10 47 20	14.65	14.83	V	DSCT	068	068
770213	V847	Mon	07 59 58.0	-10 45 56	13.64	13.73	V	DSCTC	068	068
770214	V572	Pup	08 12 28.3	-31 14 52	10.66	11.43	K	X	069	GSC
770215	V390	Hya	08 13 40.6	-01 12 22	11.86	13.77	V	EA	070	GSC
770216	DV	Lyn	08 19 17.7	+42 33 39	16.1	(0.02)	B	RPHS	071	USNO
770217	V573	Pup	08 21 35.7	-15 25 45	8.75	8.98	V	BY:	053	DM
770218	V384	Vel	08 35 22.4	-40 38 53	17.84	18.42	V	IN	072	072
770219	V385	Vel	08 35 40.7	-40 38 36	19.78	20.22	V	IN	072	072
770220	V386	Vel	08 35 45.1	-40 37 21	19.66	20.07	V	IN	072	072
770221	V387	Vel	08 35 47.8	-40 40 44	18.92	20.40	V	IN	072	072
770222	EG	Cha	08 36 56.2	-78 56 46	10.61	(0.07)	V	INT	073	074
770223	pi 1	UMa	08 39 11.7	+65 01 15	5.64	(0.08)	V	BY	075	DM
770224	CN	Pyx	08 39 41.9	-21 08 56	10.5	(14.5	V	M	217	GSC
770225	HI	Cnc	08 41 18.4	+19 15 40	7.92	(0.01)	V	DSCTC	076	DM
770226	EH	Cha	08 41 37.2	-79 03 31	14.33	(0.08)	V	INT	073	074
770227	EI	Cha	08 42 23.7	-79 04 04	12.73	(0.13)	V	INT	073	074
770228	EK	Cha	08 42 27.3	-78 57 49	15.20	(0.03)	V	INT	073	074
770229	EL	Cha	08 42 39.3	-78 54 44	14.08	(0.16)	V	INT	073	074
770230	EM	Cha	08 43 07.1	-79 04 53	10.84	(0.05)	V	INT	073	074

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 ° ' "	Max m	Min m		Type	Ref.	
770231	EN	Cha	08 44 16.6	-78 59 09	15.00	(0.38)	V	INT	073	074
770232	EO	Cha	08 44 32.4	-78 46 32	12.53	(0.26)	V	INT	073	074
770233	CO	Pyx	08 45 08.9	-25 59 08	12.5	(16.0	p	M	077	077
770234	EP	Cha	08 47 01.6	-78 59 35	11.13	(0.19)	V	INT	073	074
770235	EQ	Cha	08 47 57.2	-78 54 54	13.17	(0.20)	V	INT	073	074
770236	CP	Pyx	08 52 42.8	-25 14 44	13.2	(16.0	p	M	077	077
770237	HK	Cnc	08 59 02.7	+11 56 27	13.56	(0.04*)	V	RPHS	078	079
770238	HL	Cnc	09 01 22.8	+10 43 59	8.83	8.87	V	BY	080	DM
770239	CQ	Pyx	09 13 53.9	-24 51 25	4.71	7.36	K	M	081	2MASS
770240	KZ	UMa	09 31 42.1	+66 51 19	8.15	(0.02b)	V	DSCTC	082	DM
770241	LL	UMa	09 43 09.2	+70 00 09	15.43	(0.9 *)	V	EW	083	083
770242	VV	Sex	09 45 22.8	+03 57 33	11.6	(1.)	V	SR	067	GSC
770243	LM	UMa	09 46 00.6	+45 52 13	8.21	(0.06)	V	SRS	008	DM
770244	VW	Sex	10 01 45.6	-02 13 17	12.1	13.4	V	SR:	004	GSC
770245	VX	Sex	10 02 41.3	-01 33 38	10.7	12.2	V	SR:	004	GSC
770246	GM	Leo	10 04 08.4	+11 37 43	7.10	(0.04)	V	DSCTC	084	DM
770247	LN	UMa	10 04 34.8	+66 29 15	14.6	18.0	V	NL	085	218
770248	ER	Cha	10 05 13.6	-79 03 44	7.6	(0.08)	B	DSCTC	086	DM
770249	BE	Ant	10 18 00.2	-32 54 09	11.6	14.7	V	M	004	GSC
770250	GN	Leo	10 22 23.5	+25 29 58	8.97	(0.70)	V	SR	087	DM
770251	LO	UMa	10 29 51.9	+39 56 28	12.75	14.95	V	EA	088	088
770252	LP	UMa	10 33 57.9	+58 52 16	12.53	12.80	V	EW	089	GSC
770253	V572	Car	10 44 47.3	-59 43 53	8.66	9.07	V	EA	090	DM
770254	V573	Car	10 45 08.2	-59 40 49	9.45	10.00	y	EA:	091	091
770255	VY	Sex	10 50 29.7	-02 41 43	9.01	(0.34)	V	EW	092	DM
770256	V574	Car	10 51 39.1	-60 56 35	12.73	(0.05)	V	WR	093	093
770257	LQ	UMa	10 57 18.4	+39 41 38	13.6	14.5	V	LB:	004	GSC
770258	V391	Hya	10 58 27.5	-29 19 02	14.0	14.32	B	NL	003	GSC
770259	V392	Hya	10 58 56.4	-29 14 41	14.9	16.38	B	UG:	003	GSC
770260	V393	Hya	11 00 17.5	-29 51 59	15.5	15.89	B	NL:	003	USNO
770261	WY	Crt	11 10 22.2	-23 02 34	11.0	11.9	V	SR:	004	DM
770262	WZ	Crt	11 18 01.9	-21 35 14	12.1	13.4	V	SR:	004	GSC
770263	LR	UMa	11 22 51.2	+31 49 41	7.74	(0.07)	B	DSCTC:	094	DM
770264	XX	Crt	11 26 40.8	-19 36 14	11.8	12.5	V	SR:	004	GSC
770265	XY	Crt	11 27 16.6	-08 52 08	8.5	(0.01)	B	ACVO	095	DM
770266	XZ	Crt	11 29 30.7	-18 56 18	12.8	14.1	V	SR:	004	GSC
770267	YY	Crt	11 32 32.7	-19 11 58	11.6	13.2	V	SR:	004	GSC
770268	V394	Hya	11 37 31.8	-32 19 52	13.1	14.0	V	SR:	004	GSC
770269	YZ	Crt	11 41 20.3	-22 48 24	10.9	11.9	V	SR:	004	DM
770270	GO	Leo	11 42 15.7	+27 33 05	14.9	(0.18)	R	EW:	028	USNO
770271	ZZ	Crt	11 42 39.8	-11 33 49	11.9	13.0	V	SR:	004	GSC
770272	GP	Leo	11 45 45.5	+11 52 09	13.4	(1.2)	*	RRAB	096	GSC
770273	GQ	Leo	11 47 45.7	+12 54 03	9.7	(0.14)	R	BY:	097	097
770274	AA	Crt	11 48 04.8	-16 35 14	10.3	11.2	V	SR:	004	DM
770275	V1040	Cen	11 55 27.0	-56 41 53	12.5	(14.6	V	UG	098	USNO
770276	GR	Leo	11 57 28.9	+19 59 02	8.87	8.92	B	BY	053	DM

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0		Max	Min		Type	Ref.
			h m s	o ’ "	m	m			
770277	OW	Vir	11 59 14.6	-06 07 13	12.3	13.3	V	SR:	004 GSC
770278	VY	Crv	12 01 06.5	-17 25 02	13.5	(15.4	V	M:	004 GSC
770279	V395	Hya	12 01 24.4	-31 59 27	13.0	13.4	B	NL	003 GSC
770280	OX	Vir	12 05 35.0	-05 50 45	6.64	6.75	V	SRS:	053 DM
770281	DH	CVn	12 26 08.0	+35 55 59	12.72	13.24	*	EW	099 GSC
770282	LL	Dra	12 29 37.4	+68 38 08	9.44	9.51	V	SR	053 DM
770283	DI	CVn	12 32 01.5	+35 30 00	13.6	14.4	V	EB:	100 GSC
770284	LO	Com	12 32 05.0	+26 22 47	12.38	13.20	*	EW	099 GSC
770285	LP	Com	12 33 05.5	+27 08 04	12.76	13.37	*	EW	099 GSC
770286	DK	CVn	12 33 09.3	+37 58 22	12.7	13.2 :	V	EA	100 GSC
770287	LQ	Com	12 37 30.3	+26 04 52	12.8	13.3	V	EW	100 GSC
770288	LR	Com	12 45 06.9	+21 39 33	10.8	11.7	V	EA	004 GSC
770289	V1041	Cen	12 49 08.8	-41 12 26	12.4	(0.02)	V	DSCTC	101 GSC
770290	V1042	Cen	12 50 01.1	-52 01 26	8.9	12.7	R	M	102 219
770291	LS	Com	12 51 41.9	+27 32 27	4.87	4.97	V	FKCOM	103 DM
770292	DL	CVn	12 52 14.2	+38 56 31	12.0	12.3	V	EB	100 GSC
770293	LT	Com	12 52 41.8	+26 16 38	10.53	10.74	V	EB	104 DM
770294	LU	Com	13 00 16.5	+30 47 06	4.90	(0.15)	V	RS:	105 DM
770295	OY	Vir	13 00 30.2	+03 36 15	7.51	(0.06)	V	SRS	008 DM
770296	V396	Hya	13 12 46.4	-23 21 32	17.3	17.7	V	NL	106 107
770297	V1043	Cen	13 13 17.2	-32 59 12	14.62	16.38	V	XM	108 108
770298	OZ	Vir	13 14 47.5	-03 54 42	13.6	(0.30*)	R	EW:	028 GSC
770299	V1044	Cen	13 16 01.4	-37 00 11	10.7	11.7	V	ZAND	109 DM
770300	V1045	Cen	13 27 36.5	-47 46 40	17.42	18.65	V	RRAB	110 USNO
770301	DM	CVn	13 36 19.4	+29 23 41	12.5	13.2	V	EA	100 GSC
770302	FY	Boo	13 46 51.8	+22 57 13	13.1	13.8	V	EW	104 GSC
770303	V1039	Cen	13 55 41.2	-64 15 57	9.11	(20.	V	NA	111
770304	PP	Vir	14 04 48.9	+05 24 51	8.67	(0.01)	B	ACVO	112 DM
770305	FZ	Boo	14 06 12.9	+10 49 34	7.73	(0.10)	V	SRS	023 DM
770306	GG	Boo	14 09 16.6	+38 37 34	12.3	12.6	V	EW:	100 GSC
770307	GH	Boo	14 14 51.5	+27 34 16	11.9	12.3	V	EW	100 GSC
770308	NT	Lup	14 32 00.8	-44 26 29	11.11	11.12	V	DSCTC	113 DM
770309	GI	Boo	14 37 23.3	+38 04 42	11.3	11.8	V	EA	100 DM
770310	GK	Boo	14 38 20.7	+36 32 25	10.3	10.8	V	EA	100 DM
770311	GL	Boo	14 40 05.7	+26 34 02	10.8	11.2	V	EA	100 DM
770312	PR	Aps	14 44 17.2	-73 58 06	8.07	8.16	Hp	DSCTC	086 DM
770313	GM	Boo	14 47 26.6	+22 45 14	11.84	12.22	*	EW	114 GSC
770314	GN	Boo	14 50 07.8	+29 38 59	10.75	11.35	*	EW	114 GSC
770315	KQ	Lib	14 51 17.1	-11 09 43	11.6	11.9	*	EW	115 GSC
770316	GO	Boo	14 53 12.5	+28 42 22	12.0	12.4	V	EA	100 GSC
770317	GP	Boo	14 57 30.9	+24 02 51	11.1	11.4	V	EB	100 GSC
770318	GQ	Boo	14 59 36.7	+25 02 45	12.63	13.07	*	EW	114 GSC
770319	GR	Boo	14 59 54.5	+25 54 34	11.45	11.90	*	EW	114 GSC
770320	GS	Boo	15 00 29.6	+33 40 22	11.4	12.0	V	EA	100 DM
770321	GT	Boo	15 17 26.7	+38 13 36	12.1	12.4	V	EB	100 GSC
770322	V372	Ser	15 17 35.0	-01 05 17	10.85	11.69	V	RR(B)	116 116

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ’ "	Max m	Min m		Type	Ref.	
770323	GU	Boo	15 21 54.8	+33 56 10	13.1	13.7	V	EA	100	GSC
770324	KR	Lib	15 46 39.4	-29 52 52	12.8	14.4	V	SR:	004	GSC
770325	V373	Ser	15 52 35.1	-01 01 53	7.96	(0.02u)	V	ACV	117	DM
770326	V1179	Sco	15 53 56.6	-27 54 20	12.1	(15.3	V	M	004	GSC
770327	NU	Lup	15 57 33.9	-30 08 28	12.4	(14.6	V	M	004	g2.2
770328	V1021	Her	15 57 45.4	+49 27 55	13.69	(0.35R)	V	EA:	118	118
770329	V1022	Her	15 58 10.2	+49 27 08	11.90	(0.09R)	V	UV+BY	118	118
770330	V1023	Her	15 58 25.3	+49 26 51	11.97	(0.21R)	V	EW	118	118
770331	AL	CrB	15 58 30.5	+26 51 11	8.49	8.55	V	*	119	DM
770332	NV	Lup	16 02 53.6	-35 17 25	12.3	(14.2	V	M	004	USNO
770333	V1024	Her	16 10 05.1	+25 36 55	12.5	13.2	V	EA	100	GSC
770334	AM	CrB	16 10 50.4	+37 28 57	12.8	13.5	V	EA	100	GSC
770335	LM	Dra	16 19 27.0	+56 06 01	13.52	(0.01*)	V	RPHS	120	121
770336	V1025	Her	16 21 09.3	+25 39 23	12.1	(12.5	V	EA	100	GSC
770337	V1180	Sco	16 21 18.2	-34 19 22	12.6	(14.5	V	M:	004	GSC
770338	V1026	Her	16 31 53.6	+25 27 19	12.2	12.6	V	EB	100	GSC
770339	V1027	Her	16 32 13.5	+13 38 44	12.0	12.4	V	EA	100	GSC
770340	V1028	Her	16 35 16.7	+12 46 19	12.0	(12.2	V	EA	100	GSC
770341	V1029	Her	16 35 32.6	+03 59 40	12.2	12.7	*	SR:	122	GSC
770342	V1181	Sco	16 37 31.9	-30 06 03	11.6	(14.2	V	M:	004	USNO
770343	V1030	Her	16 45 03.7	+04 10 21	12.2	12.9	*	SR:	122	GSC
770344	V1031	Her	16 45 08.5	+20 37 00	12.1	12.5	V	EA	100	GSC
770345	V1032	Her	16 47 55.2	+35 17 57	13.4	13.7	V	EB	100	GSC
770346	V1182	Sco	16 49 33.5	-33 36 33	10.3	12.2	V	SR:	004	DM
770347	V1033	Her	16 50 39.9	+27 44 23	11.8	12.4	V	EW	100	GSC
770348	V2541	Oph	16 52 06.5	-15 38 08	13.2	(15.5	*	M	004	USNO
770349	V1034	Her	16 52 41.8	+12 49 05	12.88	13.98	V	EA/RS	123	GSC
770350	V1035	Her	16 52 52.8	+38 39 28	10.9	(11.4	V	EA	100	GSC
770351	V2542	Oph	16 54 10.6	-01 36 44	6.25	(0.02)	V	DSCTC	124	DM
770352	V2543	Oph	16 55 22.4	+07 22 00	12.9	13.3	*	LB	125	GSC
770353	V1036	Her	16 55 51.9	+24 53 36	11.6	12.1	V	EW	100	GSC
770354	V2544	Oph	16 56 12.2	+03 53 07	10.3	11.4	*	LB	125	GSC
770355	V1037	Her	16 56 57.0	+29 19 06	12.0	12.3	V	EA	100	GSC
770356	V1038	Her	16 58 19.8	+33 40 22	11.8	12.4	V	EW	100	GSC
770357	V1183	Sco	16 58 32.7	-33 10 01	11.5	(13.8	V	M	004	2MASS
770358	V1039	Her	16 59 24.0	+15 12 28	12.4	13.0	V	EA/RS:	100	GSC
770359	V1040	Her	16 59 31.0	+19 12 56	12.5	13.0 :	V	EA	100	GSC
770360	V1041	Her	17 01 01.2	+49 23 17	11.6	(12.1	V	EA	100	GSC
770361	V2545	Oph	17 02 22.7	+04 10 27	11.0	11.4	*	LB	125	GSC
770362	V1042	Her	17 02 50.5	+21 40 00	11.94	13.09	V	EB	126	GSC
770363	V2546	Oph	17 03 07.4	-15 27 15	10.3	12.7	*	M:	004	GSC
770364	V1043	Her	17 06 10.6	+49 55 24	13.3	(14.0	V	EA:	100	GSC
770365	V2547	Oph	17 07 25.7	-10 50 56	11.8	16.0	*	M	004	USNO
770366	V2548	Oph	17 07 58.1	-24 44 31	4.57	6.45	K	M	081	2MASS
770367	V2549	Oph	17 09 22.1	+12 39 57	11.8	12.3	V	EA	100	GSC
770368	V1044	Her	17 10 18.0	+38 26 42	12.5	13.3	*	EW	127	GSC

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s	o ' "	Max m	Min m		Type	Ref.	
770369	V1045	Her	17 10 59.9	+46 17 20	10.9	11.4	V	EB	100	DM
770370	V1046	Her	17 11 30.3	+23 14 12	12.5	12.95	V	EA	100	GSC
770371	V1047	Her	17 12 39.5	+33 08 00	12.26	12.78	*	EW	127	USNO
770372	V1048	Her	17 14 57.5	+42 10 24	17.9	19.3	B	SRB	128	USNO
770373	V1049	Her	17 16 42.0	+21 23 06	10.8	11.2	V	EB	100	DM
770374	V1050	Her	17 16 50.0	+38 21 59	12.4	12.9	V	EA:	100	GSC
770375	V1051	Her	17 17 27.8	+27 13 00	12.5	12.8	V	EB	100	GSC
770376	V1052	Her	17 18 24.8	+22 28 51	12.2	12.65	V	EW	100	GSC
770377	V1053	Her	17 18 40.0	+35 54 25	13.0	13.85	*	EW	127	GSC
770378	V2550	Oph	17 19 18.6	+04 03 24	11.7	12.1	*	LB	125	GSC
770379	V1054	Her	17 20 07.8	+13 39 58	11.9	12.3	V	EB	100	GSC
770380	V2551	Oph	17 20 17.0	-20 06 45	12.1	12.9	V	SR:	004	GSC
770381	V1055	Her	17 20 23.9	+41 15 13	11.11	11.55	*	EW	127	GSC
770382	V374	Ser	17 21 03.9	-14 39 36	12.9	(14.0	V	SR:	004	USNO
770383	V1056	Her	17 21 42.6	+40 54 24	10.2	10.3	V	EB	100	DM
770384	V1057	Her	17 23 03.6	+17 57 01	11.8	12.2	V	EA	100	GSC
770385	V2552	Oph	17 23 14.6	-22 52 06	10.5	13.6	V	RCB	004	GSC
770386	V2553	Oph	17 24 41.6	+13 53 58	11.3	11.8	V	EW	100	GSC
770387	V2554	Oph	17 25 11.8	-17 34 26	12.1	(14.5	V	M	004	GSC
770388	V2555	Oph	17 25 15.6	+04 01 08	11.3	11.7	*	LB	125	GSC
770389	V1058	Her	17 26 02.1	+30 47 13	12.6	13.8	V	EA	100	GSC
770390	V1059	Her	17 26 59.3	+24 41 48	11.9	12.4	V	EA	100	GSC
770391	V1060	Her	17 27 41.3	+27 45 03	12.1	12.8	V	EA	100	GSC
770392	V1061	Her	17 28 17.0	+21 15 56	11.4	12.0 :	V	EA	100	DM
770393	V1184	Sco	17 30 30.1	-39 40 11	9.6	10.8	V	SR:	004	DM
770394	V375	Ser	17 31 05.5	-16 02 57	11.7	13.1	V	SR:	004	GSC
770395	V1062	Her	17 34 54.3	+44 11 53	13.15	13.74	*	EW	129	GSC
770396	V2556	Oph	17 35 30.4	+04 05 39	11.0	11.4	*	LB	125	GSC
770397	V1063	Her	17 36 21.2	+30 32 14	10.8	11.0	V	EA	100	DM
770398	V2557	Oph	17 36 28.5	-18 28 49	11.0	13.1	V	SR:	004	GSC
770399	V2540	Oph	17 37 34.6	-16 23 23	8.5	(20.	V	NB	130	131
770400	V1064	Her	17 39 20.6	+35 42 11	11.3	11.6	V	EW	100	GSC
770401	V1065	Her	17 41 03.4	+27 34 34	11.5	12.1 :	V	EW	100	GSC
770402	V1066	Her	17 41 51.0	+47 51 04	11.8	12.3	V	EB	100	GSC
770403	V1067	Her	17 43 10.9	+43 27 09	12.58	13.21	*	EW	132	GSC
770404	V1068	Her	17 43 23.1	+47 51 41	12.4	13.0	V	EW:	100	GSC
770405	V1185	Sco	17 44 24.0	-31 55 35	3.41	4.47	L	M	081	2MASS
770406	V4746	Sgr	17 44 46.7	-28 51 08	8.5	9.7	K	M	133	2MASS
770407	V4747	Sgr	17 44 46.9	-29 02 21	8.2	9.3	K	SR:	133	2MASS
770408	V4748	Sgr	17 44 48.4	-28 59 07	7.8	8.9	K	M:	133	2MASS
770409	V4749	Sgr	17 44 48.8	-29 01 48	8.7	9.2	K	M	133	2MASS
770410	V4750	Sgr	17 44 49.4	-29 11 50	9.0	9.7	K	M:	133	2MASS
770411	V4751	Sgr	17 44 49.5	-29 03 16	9.0	9.6	K	M	133	2MASS
770412	V4752	Sgr	17 44 49.7	-29 07 22	9.3	10.6	K	M	133	2MASS
770413	V4753	Sgr	17 44 50.0	-28 57 09	9.9	10.6	K	M	133	2MASS
770414	V4754	Sgr	17 44 50.1	-28 58 03	9.6	10.7	K	M:	133	2MASS

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s o ' "		Max m	Min m	Type	Ref.
770415	V4755 Sgr	17 44 51.7	-29 08 03	9.5	10.2 K	M:	133 2MASS
770416	V4756 Sgr	17 44 53.5	-29 12 15	8.4	9.2 K	M:	133 2MASS
770417	V4757 Sgr	17 44 54.2	-29 06 30	9.1	10.3 K	M:	133 2MASS
770418	V4758 Sgr	17 44 54.4	-29 04 56	8.5	9.6 K	M	133 2MASS
770419	V4759 Sgr	17 44 54.9	-28 58 14	7.8	8.8 K	M	133 2MASS
770420	V4760 Sgr	17 44 55.1	-28 51 02	9.1	10.0 K	M:	133 2MASS
770421	V4761 Sgr	17 44 55.4	-28 59 47	8.1	8.8 K	M:	133 2MASS
770422	V4762 Sgr	17 44 55.8	-29 01 31	9.0	9.6 K	M	133 2MASS
770423	V4763 Sgr	17 44 56.0	-29 06 05	10.1	10.8 K	M	133 2MASS
770424	V4764 Sgr	17 44 56.1	-29 01 45	8.3	9.3 K	M:	133 2MASS
770425	V4765 Sgr	17 44 56.7	-29 04 42	8.8	9.4 K	M:	133 2MASS
770426	V4766 Sgr	17 44 56.7	-29 10 20	9.0	9.9 K	M:	133 2MASS
770427	V4767 Sgr	17 44 57.3	-28 56 07	10.4	11.2 K	M	133 2MASS
770428	V4768 Sgr	17 44 57.7	-29 00 12	8.9	9.8 K	M	133 2MASS
770429	V4769 Sgr	17 44 57.7	-29 01 56	9.0	9.5 K	M:	133 2MASS
770430	V4770 Sgr	17 44 58.8	-29 03 27	7.9	8.6 K	M:	133 2MASS
770431	V4771 Sgr	17 44 58.9	-29 09 11	8.0	9.6 K	M	133 2MASS
770432	V4772 Sgr	17 44 59.0	-28 57 02	8.7	9.6 K	M:	133 2MASS
770433	V4773 Sgr	17 44 59.2	-29 05 50	7.9	8.5 K	M	133 USNO
770434	V4774 Sgr	17 44 59.5	-29 09 26	7.9	9.1 K	M	133 2MASS
770435	V4775 Sgr	17 44 59.6	-29 11 15	8.0	8.8 K	M:	133 2MASS
770436	V4776 Sgr	17 45 00.8	-29 07 16	8.5	9.0 K	M:	133 2MASS
770437	V4777 Sgr	17 45 01.0	-29 01 15	9.0	10.0 K	M	133 2MASS
770438	V4778 Sgr	17 45 01.7	-28 59 16	8.6	9.5 K	M:	133 2MASS
770439	V4779 Sgr	17 45 01.7	-29 02 50	7.8	8.7 K	M	133 2MASS
770440	V4780 Sgr	17 45 01.8	-29 03 24	8.3	8.9 K	M:	133 2MASS
770441	V4781 Sgr	17 45 01.8	-29 00 56	8.5	9.5 K	M:	133 2MASS
770442	V4782 Sgr	17 45 02.3	-29 03 32	8.2	9.0 K	M:	133 2MASS
770443	V4783 Sgr	17 45 02.8	-29 06 52	5.4	6.0 K	M	133 2MASS
770444	V4784 Sgr	17 45 02.9	-29 08 28	7.6	8.4 K	M	133 2MASS
770445	V4785 Sgr	17 45 02.9	-29 02 50	9.9	10.7 K	M:	133 2MASS
770446	V4786 Sgr	17 45 03.0	-29 05 57	8.7	9.3 K	M	133 2MASS
770447	V4787 Sgr	17 45 03.7	-29 06 30	8.5	9.0 K	M:	133 2MASS
770448	V4788 Sgr	17 45 04.4	-28 59 31	6.8	7.8 K	M	133 2MASS
770449	V4789 Sgr	17 45 04.4	-29 06 25	10.0	11.2 K	M	133 2MASS
770450	V4790 Sgr	17 45 04.7	-29 01 25	8.0	9.0 K	M	133 2MASS
770451	V4791 Sgr	17 45 04.8	-29 05 48	8.0	8.7 K	M	133 2MASS
770452	V4792 Sgr	17 45 04.8	-29 06 22	8.8	9.8 K	M:	133
770453	V4793 Sgr	17 45 05.0	-29 06 53	8.4	9.4 K	M:	133 2MASS
770454	V4794 Sgr	17 45 05.2	-29 01 36	7.6	8.5 K	M	133 2MASS
770455	V4795 Sgr	17 45 05.8	-28 56 45	9.3	10.0 K	M	133 2MASS
770456	V4796 Sgr	17 45 06.0	-28 57 48	8.0	9.0 K	M:	133 2MASS
770457	V4797 Sgr	17 45 06.6	-29 01 00	8.6	9.4 K	M	133
770458	V4798 Sgr	17 45 07.2	-28 50 27	8.0	9.1 K	M	133 2MASS
770459	V4799 Sgr	17 45 07.2	-29 01 43	8.8	9.4 K	M:	133 2MASS
770460	V4800 Sgr	17 45 07.6	-29 10 23	9.5	11.6 K	M	133 2MASS

Table 1 (continued)

No.	Name	R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m		Type	Ref.
770461	V4801 Sgr	17 45 08.0	-29 09 01	9.4	9.9	K	M:	133 2MASS
770462	V4802 Sgr	17 45 08.2	-29 01 22	9.7	11.1	K	M:	133 2MASS
770463	V4803 Sgr	17 45 08.5	-29 11 05	8.1	8.8	K	M:	133 2MASS
770464	V4804 Sgr	17 45 09.1	-29 01 21	10.0	11.5	K	M:	133
770465	V4805 Sgr	17 45 09.2	-29 06 10	7.3	7.9	K	M	133 2MASS
770466	V4806 Sgr	17 45 09.5	-29 01 17	9.8	10.4	K	M:	133 2MASS
770467	V4807 Sgr	17 45 10.7	-29 09 56	8.8	9.5	K	M:	133 2MASS
770468	V4808 Sgr	17 45 10.9	-28 51 24	9.6	10.5	K	M:	133 2MASS
770469	V4809 Sgr	17 45 11.0	-29 09 18	8.5	8.8	K	M	133 2MASS
770470	V4810 Sgr	17 45 11.4	-29 11 42	7.9	8.7	K	M	133 2MASS
770471	V4811 Sgr	17 45 11.7	-28 56 18	8.4	9.3	K	M:	133 2MASS
770472	V4812 Sgr	17 45 11.9	-29 02 08	7.3	8.6	K	M	133 2MASS
770473	V4813 Sgr	17 45 12.1	-29 04 25	7.9	9.1	K	M	133 2MASS
770474	V4814 Sgr	17 45 12.1	-28 59 02	9.0	9.3	K	M	133 2MASS
770475	V4815 Sgr	17 45 12.2	-29 11 11	9.6	10.1	K	M	133 2MASS
770476	V4816 Sgr	17 45 12.5	-29 00 36	8.2	9.5	K	M	133 2MASS
770477	V4817 Sgr	17 45 12.9	-29 04 47	9.0	9.8	K	M	133 2MASS
770478	V4818 Sgr	17 45 13.3	-28 59 31	9.4	10.0	K	M	133 2MASS
770479	V4819 Sgr	17 45 13.4	-29 03 36	8.5	9.5	K	M:	133 2MASS
770480	V4820 Sgr	17 45 13.5	-29 05 27	7.3	8.3	K	M:	133 2MASS
770481	V4821 Sgr	17 45 14.2	-28 57 42	8.9	9.8	K	M:	133 2MASS
770482	V4822 Sgr	17 45 14.2	-28 56 45	10.2	13.0	K	M	133 2MASS
770483	V4823 Sgr	17 45 14.2	-29 10 45	9.5	10.5	K	M	133 2MASS
770484	V4824 Sgr	17 45 14.4	-28 57 44	9.9	10.8	K	M:	133 2MASS
770485	V4825 Sgr	17 45 14.6	-29 04 40	8.7	9.5	K	M:	133 2MASS
770486	V4826 Sgr	17 45 15.3	-28 51 50	9.5	10.8	K	M	133 2MASS
770487	V4827 Sgr	17 45 16.1	-29 09 20	8.5	9.2	K	M	133 2MASS
770488	V4828 Sgr	17 45 16.4	-29 11 16	9.1	10.0	K	M	133 2MASS
770489	V4829 Sgr	17 45 17.1	-29 01 34	10.0	11.8	K	M:	133 2MASS
770490	V4830 Sgr	17 45 17.1	-29 04 09	7.5	8.0	K	M	133 2MASS
770491	V4831 Sgr	17 45 17.4	-29 04 25	7.8	8.8	K	M	133 2MASS
770492	V4832 Sgr	17 45 17.9	-29 09 18	8.4	9.3	K	M:	133 2MASS
770493	V4833 Sgr	17 45 18.6	-29 00 36	9.0	9.5	K	M	133 2MASS
770494	V4834 Sgr	17 45 18.8	-28 49 20	9.2	10.0	K	M:	133 2MASS
770495	V4835 Sgr	17 45 19.0	-28 55 27	10.1	10.8	K	M:	133 2MASS
770496	V4836 Sgr	17 45 19.5	-29 03 25	8.9	9.5	K	M:	133 2MASS
770497	V4837 Sgr	17 45 19.7	-29 11 21	8.6	10.2	K	M:	133 2MASS
770498	V4838 Sgr	17 45 20.1	-29 02 08	9.2	10.1	K	M:	133 2MASS
770499	V4839 Sgr	17 45 20.1	-29 00 50	9.7	10.7	K	M:	133 2MASS
770500	V4840 Sgr	17 45 20.5	-29 07 19	10.1	11.4	K	M	133 2MASS
770501	V4841 Sgr	17 45 21.0	-29 08 45	10.5	11.8	K	M	133
770502	V4842 Sgr	17 45 21.4	-29 06 36	9.8	11.5	K	M	133 2MASS
770503	V4843 Sgr	17 45 22.6	-29 03 26	10.6	12.5	K	M	133 2MASS
770504	V4844 Sgr	17 45 22.7	-29 10 17	8.5	9.6	K	M	133 2MASS
770505	V4845 Sgr	17 45 22.8	-28 59 33	8.0	9.5	K	M	133 2MASS
770506	V4846 Sgr	17 45 22.9	-29 03 42	9.6	10.3	K	M	133 2MASS

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.	
770507	V4847 Sgr	17 45 23.1 -28 56 36	9.2	10.7	K	M	133	2MASS
770508	V4848 Sgr	17 45 23.8 -28 56 18	9.2	9.8	K	M:	133	2MASS
770509	V4849 Sgr	17 45 23.9 -28 55 38	9.3	10.8	K	M	133	2MASS
770510	V4850 Sgr	17 45 24.0 -28 51 27	11.1	11.8	K	M:	133	2MASS
770511	V4851 Sgr	17 45 25.5 -28 54 02	8.9	9.9	K	M:	133	2MASS
770512	V4852 Sgr	17 45 25.8 -29 04 19	8.5	9.4	K	M:	133	2MASS
770513	V4853 Sgr	17 45 25.9 -28 51 05	10.0	12.2	K	M	133	2MASS
770514	V4854 Sgr	17 45 26.2 -29 06 04	9.0	10.5	K	M	133	2MASS
770515	V4855 Sgr	17 45 26.3 -29 00 02	8.6	9.2	K	M:	133	2MASS
770516	V4856 Sgr	17 45 26.3 -29 09 24	9.0	10.9	K	M	133	2MASS
770517	V4857 Sgr	17 45 26.5 -28 50 35	9.5	10.4	K	M:	133	2MASS
770518	V4858 Sgr	17 45 26.7 -28 56 24	8.8	9.8	K	M:	133	2MASS
770519	V4859 Sgr	17 45 27.1 -28 59 18	9.0	9.5	K	M:	133	2MASS
770520	V4860 Sgr	17 45 27.5 -28 54 23	10.4	11.8	K	M	133	2MASS
770521	V4861 Sgr	17 45 27.5 -28 59 38	10.2	11.0	K	M:	133	2MASS
770522	V4862 Sgr	17 45 27.7 -28 58 53	8.5	9.1	K	M:	133	2MASS
770523	V4863 Sgr	17 45 27.8 -29 02 34	8.9	10.0	K	M	133	2MASS
770524	V4864 Sgr	17 45 27.8 -28 58 12	7.7	8.3	K	M	133	2MASS
770525	V4865 Sgr	17 45 28.0 -28 54 33	10.0	13.0	K	M	133	USNO
770526	V4866 Sgr	17 45 28.0 -29 00 16	9.3	10.3	K	M	133	2MASS
770527	V4867 Sgr	17 45 28.1 -28 49 40	10.5	11.7	K	M	133	2MASS
770528	V4868 Sgr	17 45 28.2 -28 53 31	8.9	9.3	K	M:	133	2MASS
770529	V4869 Sgr	17 45 28.4 -28 54 14	9.3	10.3	K	M	133	2MASS
770530	V4870 Sgr	17 45 28.4 -29 04 00	8.6	9.1	K	M	133	2MASS
770531	V4871 Sgr	17 45 28.6 -28 59 59	9.1	10.1	K	M:	133	2MASS
770532	V4872 Sgr	17 45 28.7 -29 01 46	7.7	9.4	K	M:	133	2MASS
770533	V4873 Sgr	17 45 28.8 -28 55 44	10.3	12.1	K	M	133	
770534	V4874 Sgr	17 45 29.0 -29 04 13	8.3	9.3	K	M:	133	2MASS
770535	V4875 Sgr	17 45 29.2 -29 07 04	9.5	11.0	K	M	133	2MASS
770536	V4876 Sgr	17 45 29.7 -28 56 11	9.5	10.2	K	M	133	2MASS
770537	V4877 Sgr	17 45 30.0 -29 05 10	7.8	8.7	K	M:	133	2MASS
770538	V4878 Sgr	17 45 30.4 -29 00 14	9.5	11.0	K	M	133	2MASS
770539	V4879 Sgr	17 45 30.4 -28 57 50	7.8	8.8	K	M	133	2MASS
770540	V4880 Sgr	17 45 30.5 -28 59 39	9.0	11.1	K	M	133	2MASS
770541	V4881 Sgr	17 45 30.7 -28 56 48	9.8	11.4	K	M	133	2MASS
770542	V4882 Sgr	17 45 30.7 -28 58 01	10.4	11.4	K	M:	133	2MASS
770543	V4883 Sgr	17 45 30.9 -29 01 41	9.5	11.0	K	M	133	2MASS
770544	V4884 Sgr	17 45 30.9 -29 05 20	8.4	8.9	K	M	133	2MASS
770545	V4885 Sgr	17 45 31.1 -29 00 30	9.6	10.5	K	M:	133	2MASS
770546	V4886 Sgr	17 45 31.6 -29 11 24	9.8	10.8	K	M:	133	
770547	V4887 Sgr	17 45 31.9 -28 57 47	8.4	9.8	K	M	133	2MASS
770548	V4888 Sgr	17 45 32.2 -29 02 09	8.5	9.2	K	M:	133	2MASS
770549	V4889 Sgr	17 45 32.2 -29 08 18	10.3	11.3	K	M:	133	2MASS
770550	V4890 Sgr	17 45 32.3 -29 02 05	9.7	11.7	K	M	133	
770551	V4891 Sgr	17 45 32.5 -29 01 59	9.2	10.3	K	M	133	2MASS
770552	V4892 Sgr	17 45 32.8 -29 05 23	8.5	9.2	K	SR:	133	2MASS

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.
770553	V4893 Sgr	17 45 33.0 -29 01 10	9.4	12.0	K	SR:	133
770554	V4894 Sgr	17 45 33.1 -29 11 11	9.6	10.1	K	M:	133 2MASS
770555	V4895 Sgr	17 45 33.1 -28 59 22	9.2	10.2	K	M:	133 USNO
770556	V4896 Sgr	17 45 33.2 -28 55 55	8.8	10.0	K	M	133 2MASS
770557	V4897 Sgr	17 45 33.3 -28 48 57	9.1	10.2	K	M	133 2MASS
770558	V4898 Sgr	17 45 33.7 -28 59 12	8.7	9.6	K	M:	133 2MASS
770559	V4899 Sgr	17 45 33.8 -29 02 35	9.4	10.1	K	M:	133 2MASS
770560	V4900 Sgr	17 45 34.2 -29 00 10	9.2	9.9	K	M:	133 2MASS
770561	V4901 Sgr	17 45 34.3 -29 02 08	9.7	10.3	K	M:	133 2MASS
770562	V4902 Sgr	17 45 34.3 -28 54 03	10.5	12.1	K	M:	133
770563	V4903 Sgr	17 45 34.7 -29 07 32	7.9	8.8	K	M:	133 2MASS
770564	V4904 Sgr	17 45 34.8 -29 01 54	8.7	9.4	K	M:	133 2MASS
770565	V4905 Sgr	17 45 35.3 -29 08 31	9.2	11.0	K	M	133 2MASS
770566	V4906 Sgr	17 45 35.6 -29 03 25	9.0	9.5	K	M:	133 2MASS
770567	V4907 Sgr	17 45 35.8 -28 57 40	9.0	9.7	K	M:	133 2MASS
770568	V4908 Sgr	17 45 36.1 -29 05 00	8.6	9.2	K	M	133 2MASS
770569	V4909 Sgr	17 45 36.4 -28 50 00	9.4	10.2	K	M	133 2MASS
770570	V4910 Sgr	17 45 37.2 -29 00 46	9.9	11.1	K	M	133
770571	V4911 Sgr	17 45 38.0 -29 01 02	9.2	11.2	K	M	133 2MASS
770572	V4912 Sgr	17 45 38.0 -28 56 22	7.4	8.4	K	M	133 2MASS
770573	V4913 Sgr	17 45 38.3 -28 57 02	8.4	9.5	K	M	133 2MASS
770574	V4914 Sgr	17 45 38.3 -29 09 04	9.0	10.0	K	M:	133 2MASS
770575	V4915 Sgr	17 45 38.5 -28 48 24	9.2	10.3	K	M	133 2MASS
770576	V4916 Sgr	17 45 38.5 -28 56 06	8.3	9.3	K	M:	133 2MASS
770577	V4917 Sgr	17 45 38.7 -29 06 10	9.7	10.5	K	M:	133 2MASS
770578	V4918 Sgr	17 45 38.8 -28 56 36	8.2	8.7	K	M:	133 2MASS
770579	V4919 Sgr	17 45 39.5 -28 57 30	9.2	9.6	K	M:	133 2MASS
770580	V4920 Sgr	17 45 40.4 -29 00 34	8.3	9.3	K	M:	133 2MASS
770581	V4921 Sgr	17 45 40.5 -29 08 12	8.9	9.7	K	M:	133 2MASS
770582	V4922 Sgr	17 45 40.5 -28 53 20	8.3	9.0	K	SR:	133 2MASS
770583	V4923 Sgr	17 45 40.8 -29 00 34	9.0	9.7	K	M:	133
770584	V4924 Sgr	17 45 41.1 -28 56 23	8.0	8.8	K	M:	133 2MASS
770585	V4925 Sgr	17 45 41.7 -28 52 36	8.7	9.7	K	M	133 2MASS
770586	V4926 Sgr	17 45 42.1 -28 56 37	8.7	9.7	K	M:	133 2MASS
770587	V4927 Sgr	17 45 42.3 -28 51 39	9.2	10.0	K	M:	133 2MASS
770588	V4928 Sgr	17 45 42.7 -28 59 58	7.6	8.3	K	M:	133 2MASS
770589	V4929 Sgr	17 45 43.0 -28 51 54	9.3	11.0	K	M	133 2MASS
770590	V4930 Sgr	17 45 43.0 -29 00 12	8.2	9.3	K	M	133 2MASS
770591	V4931 Sgr	17 45 43.2 -28 54 22	8.3	9.1	K	M	133 2MASS
770592	V4932 Sgr	17 45 43.3 -28 48 22	8.9	10.2	K	M	133 2MASS
770593	V4933 Sgr	17 45 44.3 -28 51 53	8.5	9.5	K	M:	133 2MASS
770594	V4934 Sgr	17 45 44.7 -28 58 15	7.8	9.0	K	M	133 2MASS
770595	V4935 Sgr	17 45 45.0 -28 52 34	9.7	10.7	K	M	133 2MASS
770596	V4936 Sgr	17 45 45.1 -28 57 41	8.1	9.2	K	M	133 2MASS
770597	V4937 Sgr	17 45 45.3 -28 53 46	8.6	10.5	K	M	133 2MASS
770598	V4938 Sgr	17 45 46.9 -28 57 00	8.5	9.5	K	M:	133 2MASS

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.	
770599	V4939	Sgr	17 45 47.1 -28 55 36	8.6	9.3	K	M:	133	2MASS
770600	V4940	Sgr	17 45 47.4 -29 04 24	11.0	12.1	K	M	133	2MASS
770601	V4941	Sgr	17 45 47.7 -28 55 29	10.1	11.3	K	M	133	2MASS
770602	V4942	Sgr	17 45 47.8 -28 56 25	9.1	9.8	K	M	133	2MASS
770603	V4943	Sgr	17 45 47.8 -28 53 04	8.4	10.1	K	M	133	2MASS
770604	V4944	Sgr	17 45 48.0 -28 55 21	8.5	9.3	K	M:	133	2MASS
770605	V4945	Sgr	17 45 48.0 -29 03 02	8.6	9.3	K	M	133	2MASS
770606	V4946	Sgr	17 45 48.2 -28 51 24	6.5	7.1	K	M	133	2MASS
770607	V4947	Sgr	17 45 48.6 -29 03 57	8.1	8.6	K	M:	133	2MASS
770608	V4948	Sgr	17 45 49.8 -28 56 51	7.6	8.5	K	M	133	2MASS
770609	V4949	Sgr	17 45 50.0 -28 52 48	10.8	12.3	K	M	133	2MASS
770610	V4950	Sgr	17 45 50.1 -28 53 38	9.8	11.0	K	M:	133	2MASS
770611	V4951	Sgr	17 45 50.4 -29 09 22	9.4	10.4	K	M:	133	2MASS
770612	V4952	Sgr	17 45 50.7 -28 54 00	9.6	10.5	K	M:	133	2MASS
770613	V4953	Sgr	17 45 50.8 -29 04 21	9.2	10.8	K	M	133	2MASS
770614	V4954	Sgr	17 45 51.0 -29 01 48	9.3	10.5	K	M	133	2MASS
770615	V4955	Sgr	17 45 51.4 -28 58 03	10.3	11.0	K	M:	133	2MASS
770616	V4956	Sgr	17 45 52.3 -28 51 31	8.5	10.5	K	M	133	2MASS
770617	V4957	Sgr	17 45 52.4 -29 02 02	9.5	11.0	K	M	133	2MASS
770618	V4958	Sgr	17 45 53.1 -29 04 28	9.7	11.0	K	M	133	2MASS
770619	V4959	Sgr	17 45 53.5 -28 49 49	8.3	9.6	K	M	133	2MASS
770620	V4960	Sgr	17 45 53.8 -28 56 35	9.1	9.8	K	M	133	2MASS
770621	V4961	Sgr	17 45 55.3 -29 10 06	8.4	9.5	K	M	133	2MASS
770622	LN	Dra	17 45 55.4 +52 38 05	12.0	12.6	V	EB	100	GSC
770623	V4962	Sgr	17 45 55.5 -28 50 11	8.2	9.5	K	M	133	2MASS
770624	V4963	Sgr	17 45 55.5 -29 06 28	9.6	10.7	K	M	133	2MASS
770625	V4964	Sgr	17 45 55.7 -29 01 28	9.0	9.5	K	M:	133	2MASS
770626	V4965	Sgr	17 45 55.8 -29 03 13	9.0	10.1	K	M	133	2MASS
770627	V4966	Sgr	17 45 56.2 -28 49 48	9.7	10.6	K	M	133	2MASS
770628	V4967	Sgr	17 45 56.3 -28 51 09	7.3	8.8	K	M:	133	2MASS
770629	V4968	Sgr	17 45 56.4 -28 49 27	8.8	9.4	K	M	133	2MASS
770630	V4969	Sgr	17 45 56.9 -29 06 31	8.2	9.3	K	M	133	USNO
770631	V4970	Sgr	17 45 57.1 -28 55 58	7.5	8.5	K	M	133	2MASS
770632	V4971	Sgr	17 45 57.6 -29 07 43	9.8	10.7	K	M:	133	2MASS
770633	V4972	Sgr	17 45 57.9 -29 07 36	9.6	10.2	K	M:	133	2MASS
770634	V4973	Sgr	17 45 58.4 -28 53 35	8.4	9.7	K	M:	133	2MASS
770635	V4974	Sgr	17 45 58.7 -29 08 07	8.1	8.6	K	M	133	2MASS
770636	V4975	Sgr	17 45 59.3 -29 12 00	8.3	9.4	K	M	133	2MASS
770637	V4976	Sgr	17 45 59.5 -28 54 44	8.8	9.3	K	M	133	2MASS
770638	V4977	Sgr	17 45 59.6 -28 54 11	8.4	10.2	K	M	133	2MASS
770639	V4978	Sgr	17 45 59.9 -29 02 12	9.1	10.1	K	M:	133	2MASS
770640	V4979	Sgr	17 46 00.5 -28 53 32	9.2	9.9	K	M:	133	2MASS
770641	V4980	Sgr	17 46 00.9 -28 54 51	8.9	9.5	K	M:	133	2MASS
770642	V4981	Sgr	17 46 00.9 -29 06 01	8.4	9.3	K	M	133	2MASS
770643	V4982	Sgr	17 46 01.0 -29 03 34	8.4	8.8	K	M:	133	2MASS
770644	V4983	Sgr	17 46 01.7 -29 06 55	8.7	9.9	K	M	133	2MASS

Table 1 (continued)

No.	Name	R.A., 2000.0 (h m s)	Decl., 2000.0 (o ' ")	Max (m)	Min (m)		Type	Ref.	
770645	V4984 Sgr	17 46 01.9	-29 01 38	9.5	10.6	K	M	133	
770646	V4985 Sgr	17 46 02.2	-28 53 15	8.8	9.8	K	M:	133	2MASS
770647	V4986 Sgr	17 46 03.4	-28 58 29	9.2	10.3	K	M	133	2MASS
770648	V4987 Sgr	17 46 03.5	-28 51 35	9.5	11.1	K	M	133	2MASS
770649	V4988 Sgr	17 46 03.6	-28 57 42	9.2	10.3	K	M	133	2MASS
770650	V4989 Sgr	17 46 03.6	-29 04 19	9.1	9.5	K	M:	133	2MASS
770651	V4990 Sgr	17 46 03.9	-28 56 57	9.6	10.4	K	M:	133	2MASS
770652	V4991 Sgr	17 46 04.0	-28 52 33	7.3	8.2	K	M:	133	2MASS
770653	V4992 Sgr	17 46 04.1	-28 56 25	8.9	9.6	K	M:	133	2MASS
770654	V4993 Sgr	17 46 04.2	-28 59 55	9.3	9.8	K	M:	133	2MASS
770655	V4994 Sgr	17 46 04.3	-28 57 37	7.0	7.4	K	M:	133	2MASS
770656	V4995 Sgr	17 46 04.6	-29 05 47	9.8	11.0	K	M	133	
770657	V4996 Sgr	17 46 04.7	-28 53 33	9.1	9.9	K	M:	133	2MASS
770658	V4997 Sgr	17 46 05.1	-29 03 55	8.2	8.8	K	M	133	2MASS
770659	V4998 Sgr	17 46 05.6	-28 51 32	6.3	7.4	K	SR:	133	2MASS
770660	V4999 Sgr	17 46 05.9	-29 06 32	8.7	9.4	K	M:	133	USNO
770661	V5000 Sgr	17 46 06.2	-28 50 00	8.9	10.2	K	M	133	2MASS
770662	V5001 Sgr	17 46 06.3	-29 00 00	8.8	9.7	K	M:	133	2MASS
770663	V5002 Sgr	17 46 06.4	-28 59 07	8.9	10.4	K	M	133	2MASS
770664	V5003 Sgr	17 46 06.6	-28 55 56	8.9	9.8	K	M:	133	2MASS
770665	V5004 Sgr	17 46 07.6	-29 10 43	8.5	9.7	K	M	133	2MASS
770666	V5005 Sgr	17 46 07.6	-29 04 53	8.6	9.4	K	M	133	2MASS
770667	V5006 Sgr	17 46 07.7	-28 57 34	9.0	9.8	K	M:	133	2MASS
770668	V5007 Sgr	17 46 07.8	-29 02 06	9.1	9.6	K	M:	133	2MASS
770669	V5008 Sgr	17 46 07.9	-29 04 23	9.7	11.0	K	M	133	2MASS
770670	V5009 Sgr	17 46 08.1	-28 48 49	7.2	7.8	K	M:	133	2MASS
770671	V5010 Sgr	17 46 08.6	-29 10 17	8.6	9.3	K	M	133	2MASS
770672	V5011 Sgr	17 46 09.8	-28 51 19	9.0	10.2	K	M	133	2MASS
770673	V5012 Sgr	17 46 09.9	-29 12 10	7.6	8.1	K	M:	133	2MASS
770674	V5013 Sgr	17 46 10.0	-28 54 10	9.2	10.4	K	M	133	2MASS
770675	V5014 Sgr	17 46 10.9	-29 02 08	9.3	10.0	K	M	133	2MASS
770676	V5015 Sgr	17 46 11.0	-28 58 45	9.9	10.5	K	SR:	133	2MASS
770677	V5016 Sgr	17 46 11.0	-28 57 23	9.5	10.8	K	M	133	2MASS
770678	V5017 Sgr	17 46 11.0	-28 49 51	7.4	9.0	K	M:	133	2MASS
770679	V5018 Sgr	17 46 11.1	-29 02 16	7.7	8.6	K	M:	133	2MASS
770680	V5019 Sgr	17 46 11.6	-29 01 57	9.1	10.0	K	M	133	2MASS
770681	V5020 Sgr	17 46 11.7	-28 59 32	8.7	10.2	K	M	133	2MASS
770682	V5021 Sgr	17 46 11.9	-28 52 56	7.5	8.3	K	M	133	2MASS
770683	V5022 Sgr	17 46 12.4	-28 55 19	9.1	10.5	K	M	133	2MASS
770684	V5023 Sgr	17 46 12.5	-28 48 49	8.4	9.5	K	M	133	2MASS
770685	V5024 Sgr	17 46 12.6	-29 08 25	7.6	8.2	K	M:	133	2MASS
770686	V5025 Sgr	17 46 12.7	-29 08 09	8.3	9.1	K	M:	133	2MASS
770687	V5026 Sgr	17 46 12.7	-29 10 12	8.0	9.0	K	M	133	2MASS
770688	V5027 Sgr	17 46 12.8	-29 06 26	9.3	10.3	K	M:	133	2MASS
770689	V5028 Sgr	17 46 12.8	-28 58 11	9.1	9.6	K	M:	133	2MASS
770690	V5029 Sgr	17 46 13.2	-28 55 40	9.2	10.0	K	M:	133	2MASS

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0 h m s	° ' "	Max m	Min m		Type	Ref.	
770691	V5030 Sgr	17 46 13.6	-28 52 31	9.0	9.6	K	M	133	2MASS
770692	V5031 Sgr	17 46 13.7	-28 55 14	7.7	8.4	K	M:	133	2MASS
770693	V5032 Sgr	17 46 13.8	-29 05 59	9.0	10.0	K	M	133	2MASS
770694	V5033 Sgr	17 46 14.2	-29 05 18	8.8	10.2	K	M	133	2MASS
770695	V5034 Sgr	17 46 14.3	-28 54 09	9.2	10.3	K	M	133	2MASS
770696	V5035 Sgr	17 46 14.9	-28 51 32	8.9	9.5	K	M:	133	2MASS
770697	V5036 Sgr	17 46 14.9	-28 57 09	9.8	10.5	K	M	133	2MASS
770698	V5037 Sgr	17 46 15.1	-28 54 26	8.9	9.7	K	M:	133	2MASS
770699	V5038 Sgr	17 46 15.2	-28 53 42	8.1	9.3	K	M	133	2MASS
770700	V5039 Sgr	17 46 15.7	-28 56 32	8.9	10.2	K	M	133	2MASS
770701	V5040 Sgr	17 46 15.8	-29 10 52	8.3	9.0	K	M:	133	2MASS
770702	V5041 Sgr	17 46 15.9	-29 11 38	8.9	9.6	K	M:	133	2MASS
770703	V5042 Sgr	17 46 16.4	-28 54 26	9.5	10.2	K	M:	133	2MASS
770704	V5043 Sgr	17 46 16.4	-28 58 59	8.5	9.5	K	M:	133	2MASS
770705	V5044 Sgr	17 46 16.5	-29 04 28	8.4	9.1	K	M	133	2MASS
770706	V5045 Sgr	17 46 16.6	-28 57 16	8.1	8.8	K	M:	133	2MASS
770707	V5046 Sgr	17 46 16.7	-28 56 14	8.9	10.4	K	M	133	2MASS
770708	V5047 Sgr	17 46 17.0	-29 04 08	8.5	9.5	K	SR:	133	2MASS
770709	V5048 Sgr	17 46 17.0	-29 00 06	9.0	10.1	K	M	133	2MASS
770710	V5049 Sgr	17 46 17.4	-29 02 23	8.7	9.9	K	M	133	2MASS
770711	V5050 Sgr	17 46 17.4	-29 05 17	8.3	9.0	K	M:	133	2MASS
770712	V5051 Sgr	17 46 17.5	-28 48 12	7.5	8.5	K	M	133	2MASS
770713	V5052 Sgr	17 46 17.5	-28 55 24	9.0	9.8	K	M	133	2MASS
770714	V5053 Sgr	17 46 18.0	-28 55 40	9.2	10.2	K	M:	133	2MASS
770715	V5054 Sgr	17 46 18.0	-28 57 16	9.8	11.3	K	M	133	2MASS
770716	V5055 Sgr	17 46 18.5	-29 03 37	8.4	10.2	K	M	133	2MASS
770717	V5056 Sgr	17 46 18.8	-29 10 01	9.0	9.7	K	M	133	2MASS
770718	V5057 Sgr	17 46 19.1	-28 55 19	8.5	10.0	K	M	133	USNO
770719	V5058 Sgr	17 46 19.2	-29 01 08	11.7	12.8	K	M	133	
770720	V5059 Sgr	17 46 19.4	-29 04 39	8.5	8.9	K	M:	133	2MASS
770721	V2558 Oph	17 46 19.5	+04 09 08	12.0	12.4	*	LB	125	GSC
770722	V5060 Sgr	17 46 19.5	-29 01 49	8.9	9.6	K	M	133	2MASS
770723	V5061 Sgr	17 46 19.9	-29 07 36	8.9	9.5	K	M:	133	2MASS
770724	V5062 Sgr	17 46 20.7	-28 53 20	11.6	12.2	K	M:	133	2MASS
770725	V5063 Sgr	17 46 20.9	-28 53 28	11.8	12.9	K	M	133	
770726	V5064 Sgr	17 46 21.0	-28 49 23	8.6	9.6	K	M:	133	2MASS
770727	V5065 Sgr	17 46 21.1	-29 08 46	9.3	10.5	K	M	133	2MASS
770728	V5066 Sgr	17 46 21.6	-28 58 40	10.5	12.3	K	M	133	2MASS
770729	V5067 Sgr	17 46 21.6	-29 03 21	8.5	9.1	K	M:	133	2MASS
770730	V5068 Sgr	17 46 22.0	-28 52 07	8.8	9.8	K	M:	133	2MASS
770731	V5069 Sgr	17 46 22.6	-29 03 05	9.7	10.3	K	M:	133	2MASS
770732	V5070 Sgr	17 46 23.0	-29 06 01	9.2	10.0	K	M	133	2MASS
770733	V5071 Sgr	17 46 23.2	-28 50 43	7.8	8.7	K	M	133	2MASS
770734	V5072 Sgr	17 46 23.3	-29 07 03	8.4	8.9	K	M:	133	2MASS
770735	V5073 Sgr	17 46 23.6	-29 06 19	7.3	7.8	K	M:	133	2MASS
770736	V5074 Sgr	17 46 24.4	-29 00 40	8.6	9.4	K	M	133	2MASS

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m	Type		Ref.	
770737	V5075	Sgr	17 46 25.5 -29 06 11	8.6	9.0	K	M	133	2MASS
770738	V5076	Sgr	17 46 25.6 -28 50 53	9.7	10.5	K	M:	133	2MASS
770739	V5077	Sgr	17 46 26.8 -28 53 57	9.7	12.4	K	M	133	2MASS
770740	V5078	Sgr	17 46 27.2 -28 48 57	8.8	9.7	K	M:	133	2MASS
770741	V5079	Sgr	17 46 27.9 -28 50 23	7.8	9.0	K	M	133	2MASS
770742	V5080	Sgr	17 46 28.2 -29 06 13	8.7	9.7	K	M	133	2MASS
770743	V5081	Sgr	17 46 28.4 -29 07 28	8.4	9.4	K	M	133	2MASS
770744	V5082	Sgr	17 46 28.8 -28 51 48	9.0	9.5	K	M:	133	2MASS
770745	V5083	Sgr	17 46 28.9 -29 02 08	9.3	10.0	K	M:	133	2MASS
770746	V5084	Sgr	17 46 29.3 -28 54 04	9.7	10.9	K	M	133	2MASS
770747	V5085	Sgr	17 46 30.6 -28 57 00	7.8	8.8	K	M	133	2MASS
770748	V5086	Sgr	17 46 31.6 -28 59 13	10.4	12.1	K	M	133	2MASS
770749	V5087	Sgr	17 46 31.8 -29 07 19	10.8	12.4	K	M	133	2MASS
770750	V5088	Sgr	17 46 32.0 -28 52 20	9.2	10.3	K	M	133	2MASS
770751	V5089	Sgr	17 46 32.5 -28 57 52	8.4	9.8	K	M	133	
770752	V5090	Sgr	17 46 32.5 -29 04 09	10.2	11.0	K	M:	133	2MASS
770753	V5091	Sgr	17 46 33.8 -29 07 35	8.6	9.2	K	M	133	2MASS
770754	V5092	Sgr	17 46 33.9 -28 54 04	8.6	9.9	K	M	133	2MASS
770755	V5093	Sgr	17 46 34.2 -28 56 30	9.7	10.4	K	M:	133	2MASS
770756	V5094	Sgr	17 46 34.3 -28 52 38	8.4	9.3	K	M:	133	2MASS
770757	V4744	Sgr	17 47 21.7 -23 28 23	9.7	(20.	R	NA	134	135
770758	V1069	Her	17 47 43.9 +46 32 32	12.3	13.0	V	EB	100	GSC
770759	V2559	Oph	17 49 46.5 -06 19 36	13.8	(15.0	V	M:	004	USNO
770760	V1070	Her	17 49 53.0 +37 08 40	12.0	13.5	V	EA	100	GSC
770761	V5095	Sgr	17 51 16.4 -23 09 32	11.5	12.9	V	SR:	004	GSC
770762	V5096	Sgr	17 53 57.3 -22 10 53	12.5	(13.2	V	SR:	004	GSC
770763	V2560	Oph	17 54 33.4 +04 11 46	12.2	12.7	*	LB	125	GSC
770764	V1178	Sco	17 57 06.9 -32 23 05	10.2	(18.	V	NA	136	137
770765	V1071	Her	17 58 52.8 +48 10 24	11.3	11.75	V	EB	100	GSC
770766	V1072	Her	17 59 09.6 +49 36 06	12.7	13.2	V	EA	100	GSC
770767	V4741	Sgr	17 59 59.6 -30 53 21	9.2	(18.	V	NA	138	
770768	V2561	Oph	18 01 48.8 +07 00 50	16.1	(18.5	*	UG	139	
770769	V5097	Sgr	18 02 04.2 -23 37 42	11.8	(14.5	V	WR	140	140
770770	V4742	Sgr	18 02 21.9 -25 20 32	8.0	(18.	V	NA	141	142
770771	LO	Dra	18 02 28.1 +50 46 28	13.5	14.4	V	IA	143	144
770772	V5098	Sgr	18 02 50.9 -24 16 17	12.04	13.71	V	INA	145	GSC
770773	V5099	Sgr	18 03 06.0 -27 30 45	15.46	19.89	V	UGSU	146	146
770774	V2562	Oph	18 03 06.3 +07 24 17	12.3	12.6	*	LB	125	GSC
770775	V5100	Sgr	18 04 11.2 -24 24 48	13.14	13.68	V	INA	145	GSC
770776	V2563	Oph	18 04 21.5 +00 36 24	11.6	13.0	*	E	147	GSC
770777	V2564	Oph	18 04 40.1 +03 46 45	7.34	(0.05)	V	LB:	023	DM
770778	V5101	Sgr	18 04 43.7 -21 09 31	11.4	14.7	V	WR	220	220
770779	V2565	Oph	18 05 22.0 +04 05 47	11.4	11.8	*	LB	125	GSC
770780	V1073	Her	18 08 35.8 +33 42 05	11.00	11.69	*	EW	148	GSC
770781	V376	Ser	18 09 51.2 -02 00 42	7.9	8.4	I	SR	149	GSC
770782	LP	Dra	18 09 55.5 +69 40 50	8.50	8.58	V	RS	119	DM

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.
770783	V2566	Oph	18 09 56.9 +00 33 36	12.6	14.4	*	SR:	004 USNO
770784	V4740	Sgr	18 11 46.0 -30 30 51	6.5	(18.	V	NA	150 151
770785	V1074	Her	18 12 10.8 +30 55 13	12.65	13.3	V	EA	104 221
770786	V569	Lyr	18 15 21.9 +39 05 46	11.9	12.3	V	EA	100 GSC
770787	V1075	Her	18 16 24.8 +50 14 16	8.94	8.98	V	BY	119 DM
770788	V5102	Sgr	18 16 26.1 -16 39 56	11.0	12.6	V	SR:	004 GSC
770789	V2567	Oph	18 17 19.8 +04 00 34	12.2	12.7	*	LB	125 GSC
770790	V570	Lyr	18 17 24.6 +42 36 16	11.1	15.8	V	M	143 144
770791	V2568	Oph	18 18 54.6 +04 11 57	11.3	11.7	*	LB	125 GSC
770792	V5103	Sgr	18 19 05.8 -30 19 06	11.5	(13.8	V	M	004 USNO
770793	LQ	Dra	18 19 41.8 +50 10 38	11.6	(13.0	V	EA	100 GSC
770794	V571	Lyr	18 21 02.0 +44 38 43	11.7	12.3	V	EA	100 GSC
770795	V572	Lyr	18 21 38.3 +42 10 08	10.6	11.0	V	EA	100 DM
770796	LR	Dra	18 21 48.4 +51 24 20	10.8	12.6	V	LB	143 144
770797	V5104	Sgr	18 22 34.7 -27 06 29	2.99	4.49	K	M	081 152
770798	V573	Lyr	18 23 01.3 +40 08 35	10.8	11.3	V	EW	100 DM
770799	V5105	Sgr	18 23 34.8 -27 40 10	11.3	(13.4	V	M	004 GSC
770800	V4739	Sgr	18 24 46.0 -30 00 41	7.2	(18.	V	NA	153 222
770801	LS	Dra	18 24 52.4 +57 47 23	15.6	(0.01)	B	RPHS	009 USNO
770802	V2569	Oph	18 25 23.0 +03 52 22	12.1	12.4	*	LB	125 GSC
770803	V1076	Her	18 26 05.8 +23 28 47	4.99	6.72	K	M	081 2MASS
770804	V574	Lyr	18 27 12.2 +36 14 37	12.01	12.68	*	EW	155 GSC
770805	V2570	Oph	18 28 10.8 +07 57 15	7.66	7.72	V	SRS:	053 DM
770806	V377	Ser	18 29 09.3 +04 51 18	12.3	13.5	*	SR:	156 USNO
770807	V2571	Oph	18 29 34.6 +03 28 12	12.0	14.1	*	SR:	156 g2.2
770808	V575	Lyr	18 29 43.2 +28 09 55	12.7	(0.30)	V	DSCT	157 GSC
770809	V2572	Oph	18 30 19.2 +03 47 52	12.7	14.0	*	SR:	156 g2.2
770810	V5106	Sgr	18 30 49.2 -18 12 44	11.8	(13.2	V	M:	004 USNO
770811	V468	Sct	18 33 08.6 -14 43 01	13.9	14.9	*	SR:	156 2MASS
770812	V469	Sct	18 33 34.8 -14 36 59	12.5	13.4	*	SR:	156 USNO
770813	V1077	Her	18 33 47.6 +19 02 15	10.8	12.3	V	SRA	158 GSC
770814	V470	Sct	18 34 29.7 -15 33 19	10.5	12.0	V	SR:	004 GSC
770815	V5107	Sgr	18 37 26.7 -17 45 40	11.7	(13.3	V	M:	004 USNO
770816	LT	Dra	18 37 41.1 +51 56 45	7.48	(12.6	V	RCB	159 DM
770817	V576	Lyr	18 39 07.8 +41 56 54	12.3	12.7	V	EB	100 GSC
770818	V4745	Sgr	18 40 02.6 -33 26 56	7.41	(17.	V	N	229 213
770819	V471	Sct	18 40 18.8 -10 07 29	11.4	(13.3	V	M	004 GSC
770820	V577	Lyr	18 42 41.4 +45 29 03	14.5	15.	p	EW	104 223
770821	V472	Sct	18 46 22.0 -05 02 34	8.5	(10.5	I	M	149 USNO
770822	V1549	Aql	18 46 32.1 -02 57 23	7.5	8.3	I	SR	149 GSC
770823	V473	Sct	18 46 43.3 -04 54 00	10.0	10.4 :	V	SR	149 DM
770824	V5108	Sgr	18 47 33.6 -24 07 20	11.8	(14.0	V	M:	004 USNO
770825	V578	Lyr	18 49 43.4 +40 57 49	12.2	14.2	V	LB	143 144
770826	V1550	Aql	18 50 43.4 -03 34 31	6.8	7.0	I	SR	149 GSC
770827	V579	Lyr	18 50 52.3 +43 40 12	12.77	13.25	*	EW	160 GSC
770828	V580	Lyr	18 51 10.4 +35 35 56	12.79	13.36	*	EW	160 GSC

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 ° ' "	Max m	Min m		Type	Ref.	
770829	V1551	Aql	18 52 35.9	-03 12 17	8.0	8.8	I	SR	149	USNO
770830	V581	Lyr	18 53 43.5	+37 23 36	12.7	13.0 :	V	EW	100	GSC
770831	V474	Sct	18 55 31.7	-14 19 47	12.4	(13.5	V	M	004	USNO
770832	V582	Lyr	18 55 38.2	+40 58 57	13.44	14.61	V	EW	161	GSC
770833	LU	Dra	18 59 01.9	+52 28 05	12.2	12.6	V	EA/RS	100	GSC
770834	V1552	Aql	18 59 11.0	+17 27 04	11.4	(14.3	V	M	004	2MASS
770835	LV	Dra	19 00 13.7	+50 32 00	5.31	5.34	Hp	ACV	162	DM
770836	V4743	Sgr	19 01 09.3	-22 00 06	5.0	16.8 :	V	NA	163	224
770837	V356	Sge	19 02 47.5	+20 52 40	12.5	13.9	*	SR:	156	g2.2
770838	V1553	Aql	19 02 56.8	+00 25 48	12.0	(13.8	V	M:	004	GSC
770839	V1554	Aql	19 03 36.6	+02 37 37	12.8	14.2	I	M:	164	g2.2
770840	V1555	Aql	19 03 40.4	+01 42 35	12.8	16. :	I	M	164	2MASS
770841	V1556	Aql	19 04 08.0	+02 41 54	11.5	14.9	I	M	164	USNO
770842	V1557	Aql	19 04 08.4	+01 58 56	12.5	15.5 :	I	M	164	g2.2
770843	V1558	Aql	19 04 18.3	+01 30 41	12.3	14.5	I	M	164	g2.2
770844	V1559	Aql	19 04 18.3	+02 51 12	11.2	14.4	I	M	164	g2.2
770845	V1560	Aql	19 04 34.2	+02 06 46	11.9	15.0	I	M	164	g2.2
770846	V1561	Aql	19 04 39.6	+01 22 18	10.0	13.1	I	M	164	g2.2
770847	V1562	Aql	19 04 42.8	+02 51 43	12.4	15.1	I	M	164	g2.2
770848	V1563	Aql	19 04 50.5	+02 22 30	10.7	11.8	I	LB	164	g2.2
770849	V1564	Aql	19 04 50.8	+02 33 20	11.8	15.2	I	M	164	USNO
770850	V1565	Aql	19 04 51.2	+01 31 42	11.3	14.5	I	M	164	g2.2
770851	V1566	Aql	19 04 51.8	+02 54 18	12.4	15.4 :	I	M	164	2MASS
770852	V1567	Aql	19 04 53.2	+02 08 40	10.9	15.1	I	M	164	g2.2
770853	V1568	Aql	19 04 54.0	+02 37 47	11.9	14.6	I	M	164	g2.2
770854	V1569	Aql	19 04 55.8	+01 21 29	11.9	15.8	I	M	164	g2.2
770855	V1570	Aql	19 05 04.6	+01 16 04	10.2	14.8	I	M	164	USNO
770856	V1571	Aql	19 05 09.7	+02 13 37	11.8	14.0	I	M	164	2MASS
770857	V1572	Aql	19 05 09.9	+02 18 00	11.9	15.1	I	M	164	g2.2
770858	V1573	Aql	19 05 10.3	+01 38 02	12.8	15.6	I	M	164	USNO
770859	V1574	Aql	19 05 14.6	+01 44 52	12.0	15.5	I	M	164	USNO
770860	V1575	Aql	19 05 14.7	+01 55 52	12.1	14.8	I	M	164	164
770861	V1576	Aql	19 05 17.3	+01 53 32	12.2	15.6 :	I	M	164	164
770862	V1577	Aql	19 05 18.5	+01 39 36	9.5	13.0	I	M	164	g2.2
770863	V1578	Aql	19 05 19.9	+02 27 41	11.8	15.5 :	I	M	164	g2.2
770864	V1579	Aql	19 05 21.8	+01 42 33	11.8	15.3	I	M	164	USNO
770865	V583	Lyr	19 05 33.8	+39 20 04	12.8	13.8	B	EA	225	144
770866	V1580	Aql	19 05 56.4	+02 56 51	11.4	15.2	I	M	164	g2.2
770867	V1581	Aql	19 06 01.5	+01 50 03	12.0	15.5	I	M	164	g2.2
770868	V1582	Aql	19 06 01.6	+02 08 58	12.6	15.0	I	M	164	USNO
770869	V1583	Aql	19 06 07.6	+01 22 02	10.1	13.6	I	M	164	g2.2
770870	V1584	Aql	19 06 17.1	+02 12 42	11.1	14.5	I	M	164	g2.2
770871	V1585	Aql	19 06 19.2	+01 57 02	12.5	15.5 :	I	M	164	g2.2
770872	V1586	Aql	19 06 23.7	+12 38 18	12.4	15.1	*	M:	156	g2.2
770873	LW	Dra	19 06 26.3	+68 29 02	10.9	(0.30)	V	SXPHE:	165	226
770874	V1587	Aql	19 06 27.9	+00 59 43	12.1	15.7	I	M	164	USNO

Table 1 (continued)

No.	Name	R.A., 2000.0	Decl., 2000.0	Max	Min	Type	Ref.
		h m s	o ’ "	m	m		
770875	V1588 Aql	19 06 28.4	+03 10 19	12.0	15.0	I M	164 USNO
770876	V1589 Aql	19 06 39.5	+03 26 22	11.4	14.8	I M	164 2MASS
770877	V1590 Aql	19 06 41.1	+03 02 21	13.0	15.4	I M	164 2MASS
770878	V1591 Aql	19 06 43.1	+03 17 12	12.9	15.4	I M	164 USNO
770879	V1592 Aql	19 06 45.4	+03 16 38	12.9	15.3	I M	164 USNO
770880	V1593 Aql	19 06 46.9	+03 25 22	11.5	14.5	I M	164 g2.2
770881	LX Dra	19 06 52.7	+68 26 26	11.02	11.36	V SR	166 GSC
770882	V1594 Aql	19 06 55.8	+02 59 44	12.1	15. :	I M	164 USNO
770883	V1595 Aql	19 06 58.2	+02 59 09	13.1	15.4	I M	164 g2.2
770884	V1596 Aql	19 07 01.2	+01 29 59	11.7	15.2	I M	164 g2.2
770885	V1597 Aql	19 07 03.2	+02 31 02	13.2	15.6	I M	164 g2.2
770886	V1598 Aql	19 07 11.6	-04 10 01	10.2	(12.0	I M	149 USNO
770887	V1599 Aql	19 07 12.9	+03 21 04	11.2	14.5	I M	164 g2.2
770888	V1600 Aql	19 07 13.2	+01 17 20	10.5	14.2	I M	164 USNO
770889	V1601 Aql	19 07 14.1	+03 25 06	11.8	15.0	I M	164 g2.2
770890	V1602 Aql	19 07 19.3	+01 49 34	11.2	15.5	I M	164 g2.2
770891	V1603 Aql	19 07 27.1	+02 24 34	11.0	14.4	I M	164 USNO
770892	V1604 Aql	19 07 28.3	+12 23 45	12.7	13.8	* SR:	156 g2.2
770893	V1548 Aql	19 07 28.4	+11 44 46	10.8	(18.	V N	167 168
770894	V1605 Aql	19 07 30.9	+02 33 42	11.5	14.6	I M	164 2MASS
770895	V1606 Aql	19 07 31.2	+12 23 58	13.4	15.9	* M:	156 g2.2
770896	V1607 Aql	19 07 34.1	+02 50 10	11.5	15.3	I M	164 USNO
770897	V1608 Aql	19 07 37.6	+03 29 27	12.6	15.5 :	I M	164 USNO
770898	V1609 Aql	19 08 06.3	+02 17 42	12.2	15.5	I M	164 g2.2
770899	V1610 Aql	19 08 07.0	+02 19 09	12.8	13.8	I SR	164 g2.2
770900	V1611 Aql	19 08 10.0	+02 31 50	12.4	15.6	I M	164 USNO
770901	V1612 Aql	19 08 18.4	+01 46 28	11.9	15.5 :	I M	164 USNO
770902	V1613 Aql	19 08 33.7	+01 55 53	11.9	15.0	I M	164 USNO
770903	V1614 Aql	19 08 45.8	+03 16 02	8.7	10.8	I SR	164 USNO
770904	V1615 Aql	19 08 48.1	+01 39 29	10.5	14.5	I M	164 USNO
770905	V1616 Aql	19 08 49.7	+02 50 44	12.0	15.5 :	I M	164 2MASS
770906	V1617 Aql	19 09 02.8	+03 06 25	12.5	15.2	I M	164 g2.2
770907	V1618 Aql	19 09 17.3	+02 54 52	10.4	14.0	I M	164 USNO
770908	V5109 Sgr	19 09 21.7	-17 03 59	11.8	14.0	V SR:	004 GSC
770909	V1619 Aql	19 09 31.3	+03 03 16	12.4	15.2	I M	164 g2.2
770910	V1620 Aql	19 09 40.9	+02 13 26	12.2	14.9	I M	164 g2.2
770911	V1621 Aql	19 09 53.0	+02 54 21	11.6	15.0	I M	164 USNO
770912	V1622 Aql	19 09 53.6	+02 46 27	10.8	14.0	I M	164 USNO
770913	V1623 Aql	19 09 58.9	+02 51 33	13.0	15.2	I M	164 USNO
770914	V1624 Aql	19 10 02.7	+03 03 51	12.0	16. :	I M	164 g2.2
770915	V1625 Aql	19 10 06.6	+03 43 28	11.8	14.2	I M	164 USNO
770916	V1626 Aql	19 10 07.0	+03 08 17	12.0	15.3	I M	164 g2.2
770917	V1627 Aql	19 10 08.6	+02 16 30	12.3	15.5 :	I M	164 g2.2
770918	V1628 Aql	19 10 12.3	+02 44 38	11.7	15.0	I M	164 USNO
770919	V1629 Aql	19 10 21.7	+02 58 08	12.8	15.5	I M	164 g2.2
770920	V1630 Aql	19 10 21.8	+02 24 20	13.1	15.5	I M	164 g2.2

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.	
770921	V1631	Aql	19 10 23.5 +02 25 25	12.8	15.3	I	M	164	g2.2
770922	V1632	Aql	19 10 25.6 +02 18 33	12.3	15.3	I	M	164	g2.2
770923	V584	Lyr	19 10 59.4 +28 56 39	15.68	(18.5	V	UG:	169	169
770924	V1633	Aql	19 11 10.9 +02 35 02	13.3	15.5	I	M	164	g2.2
770925	V1634	Aql	19 11 30.4 +02 50 24	13.0	15.3	I	M	164	g2.2
770926	V1635	Aql	19 12 00.7 +02 34 30	13. :	15.2 :	I	M	164	2MASS
770927	V1636	Aql	19 12 33.2 -03 08 36	9.8	10.6	I	SR	149	GSC
770928	V1637	Aql	19 13 48.6 -05 29 52	7.0	7.7	I	SR	149	GSC
770929	LY	Dra	19 13 51.5 +66 02 44	8.88	8.93	V	SRS	053	DM
770930	V585	Lyr	19 13 58.5 +40 44 09	14.9	17. :	B	UGSU:	170	170
770931	V2276	Cyg	19 15 18.9 +52 29 36	11.4	11.8	V	EA	100	GSC
770932	V586	Lyr	19 15 20.6 +39 58 50	11.0	(16.0	V	M	143	144
770933	V2277	Cyg	19 15 33.7 +44 37 01	10.5	11.1	V	EA	100	DM
770934	V2278	Cyg	19 16 34.6 +52 48 56	13.30	13.62	*	EW	171	GSC
770935	V587	Lyr	19 17 26.5 +37 10 41	14.3	(17.1	B	UG	170	170
770936	V1638	Aql	19 17 31.4 +08 27 18	12.8	(14.0	V	M:	004	USNO
770937	V1639	Aql	19 18 41.1 +07 24 03	11.8	12.1	*	LB	125	GSC
770938	V2279	Cyg	19 18 54.5 +43 49 26	12.2	14.0	V	RS:	143	144
770939	V588	Lyr	19 19 55.0 +40 52 40	12.5	14.0	V	SRA	143	144
770940	V1640	Aql	19 20 35.0 -03 57 51	11.9	(2.50)	R	M	172	172
770941	V1641	Aql	19 20 50.1 +07 23 15	12.8	13.2	*	LB	125	GSC
770942	V2280	Cyg	19 21 43.9 +48 03 57	13.32	14.08	*	EW	171	GSC
770943	V1642	Aql	19 21 57.3 +03 55 55	12.4	12.9	*	LB	125	GSC
770944	V1643	Aql	19 24 29.7 +04 56 40	11.4	12.9	*	SR:	156	USNO
770945	V1644	Aql	19 24 42.8 +04 06 56	12.1	12.7	*	LB	125	GSC
770946	V1645	Aql	19 24 48.3 -08 29 20	10.5	12.6	V	SR:	004	GSC
770947	V2281	Cyg	19 25 06.9 +45 56 03	12.1	12.6	V	EA	100	GSC
770948	V589	Lyr	19 25 31.8 +42 51 13	11.6	12.0	V	EW	100	GSC
770949	V2282	Cyg	19 25 37.9 +53 25 20	12.02	12.30	*	EW:	171	GSC
770950	V423	Vul	19 27 44.3 +24 23 28	10.4	12.3	*	SR:	156	USNO
770951	V2283	Cyg	19 28 39.0 +45 05 52	12.1	(16.0	V	M	143	144
770952	V424	Vul	19 29 42.4 +25 44 45	12.1	13.0	*	SR:	156	2MASS
770953	V2284	Cyg	19 29 55.0 +48 55 00	12.71	13.45	*	EW	161	GSC
770954	V425	Vul	19 30 06.6 +23 34 39	12.5	(14.9	*	M:	156	2MASS
770955	V2285	Cyg	19 30 32.9 +48 03 25	11.6	15.2	V	M	143	144
770956	V2286	Cyg	19 30 35.8 +31 58 48	7.51	(0.03)	V	LB	023	DM
770957	V426	Vul	19 30 53.9 +20 52 40	13.1	15.7	*	M:	156	USNO
770958	V427	Vul	19 31 11.3 +25 17 45	13.0	13.9	*	SR:	156	2MASS
770959	V2287	Cyg	19 32 07.7 +52 37 14	11.6	12.1	V	EB	100	GSC
770960	V428	Vul	19 32 09.9 +21 14 25	11.8	14.2	*	SR:	156	2MASS
770961	V429	Vul	19 32 50.6 +21 17 22	11.4	12.9	*	SR:	156	2MASS
770962	V2288	Cyg	19 33 10.6 +38 58 34	11.9	14.2	V	SRA	143	144
770963	V1646	Aql	19 34 21.5 +03 54 43	11.9	12.4	*	EA	125	GSC
770964	LZ	Dra	19 34 33.8 +74 03 06	12.4	(0.5)	V	EW/KW	173	227
770965	V2289	Cyg	19 34 36.2 +51 07 42	15.7	(19.0	V	UG	174	019
770966	V2290	Cyg	19 35 23.1 +48 03 01	13.61	15.24	V	EA	175	144

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.	
770967	V2291	Cyg	19 36 58.3 +47 48 31	11.5	11.8	V	EA:	100	GSC
770968	V2292	Cyg	19 37 38.5 +49 07 51	11.8	16.0	V	M	143	144
770969	V2293	Cyg	19 39 08.5 +43 23 50	12.2	13.9	V	SRA	143	144
770970	V5110	Sgr	19 39 45.2 −17 29 31	10.9	(15.0	V	M	004	GSC
770971	V5111	Sgr	19 40 00.6 −31 13 17	11.8	(0.04)	V	DSCTC	101	GSC
770972	V1647	Aql	19 40 08.3 −10 22 26	13.5	(0.46)	R	EW	176	GSC
770973	V2294	Cyg	19 40 29.4 +50 25 52	13.23	13.58	*	EW	177	GSC
770974	V1648	Aql	19 41 08.3 +02 02 31	10.95	11.22	V	*	178	GSC
770975	V357	Sge	19 41 38.3 +18 34 29	11.2	12.2	*	SR:	156	2MASS
770976	V2295	Cyg	19 42 06.6 +38 03 37	12.2	14.2	V	SR	143	144
770977	V2296	Cyg	19 42 08.4 +47 22 57	11.8	15.5	V	M	143	144
770978	V2297	Cyg	19 43 08.7 +41 34 14	12.6	14.7	V	SRA	143	144
770979	V2298	Cyg	19 44 15.7 +39 11 12	12.0	14.8	V	M	143	144
770980	V1649	Aql	19 45 06.6 +03 55 53	12.7	13.3	*	LB	125	GSC
770981	V2299	Cyg	19 47 15.8 +44 27 07	13.2	14.7	V	LB	143	144
770982	V2300	Cyg	19 47 58.8 +38 45 55	11.8	13.7	V	SRA	143	144
770983	V1650	Aql	19 48 14.9 +03 51 13	11.1	11.4	*	LB	125	GSC
770984	V1651	Aql	19 48 36.8 +07 21 17	12.7	13.2	*	LB	125	USNO
770985	V430	Vul	19 49 25.9 +22 34 05	12.5	13.2	*	SR:	156	USNO
770986	V2301	Cyg	19 49 26.4 +37 31 58	12.5	14.0	V	LB	143	144
770987	V1652	Aql	19 49 47.2 +04 07 24	13.0	13.6	*	LB	125	GSC
770988	V431	Vul	19 50 29.3 +23 14 42	12.5	13.3	*	SR:	156	2MASS
770989	V2302	Cyg	19 50 39.6 +50 42 23	11.8	14.8	V	M	143	179
770990	V2303	Cyg	19 52 06.7 +43 31 08	11.5	13.5	V	LB	143	144
770991	V5112	Sgr	19 52 52.7 −17 01 50	8.68	8.95	V	E:	178	DM
770992	V2304	Cyg	19 52 53.3 +46 21 46	11.8	13.5	V	LB	143	179
770993	V2305	Cyg	19 53 47.9 +47 11 44	11.4	14.6	V	M	143	179
770994	V1653	Aql	19 53 59.4 +07 14 45	12.0	12.4	*	LB	125	GSC
770995	V2306	Cyg	19 58 14.5 +32 32 42	15.16	(0.9)	U	XPM	180	180
770996	V2307	Cyg	19 58 28.3 +47 06 10	11.0	15.0	V	M	143	179
770997	V2308	Cyg	19 59 12.0 +48 43 33	11.4	15.2	V	M	143	179
770998	V2309	Cyg	19 59 39.0 +47 31 33	12.0	(16.1	V	M	143	144
770999	MM	Dra	19 59 44.4 +65 10 06	14.45	14.93	V	EW	181	181
771000	V432	Vul	20 00 15.5 +23 58 44	10.9	12.0	*	SR:	156	2MASS
771001	V433	Vul	20 00 32.6 +22 40 15	10.3	11.2	*	SR:	156	GSC
771002	V434	Vul	20 00 33.2 +22 43 41	11.4	12.3	*	SR:	156	GSC
771003	V435	Vul	20 01 01.4 +25 37 45	11.3	12.8	*	SR:	156	2MASS
771004	V1654	Aql	20 02 47.0 +03 19 34	7.48	(0.04b)	V	BY	182	DM
771005	V1655	Aql	20 03 02.8 +15 27 42	8.23	8.43	V	SR	183	DM
771006	V2310	Cyg	20 03 45.6 +47 42 17	13.2	(16.0	V	LB	143	179
771007	V2274	Cyg	20 07 17.9 +36 04 37	11.7	(18.	V	NA	184	185
771008	V358	Sge	20 07 36.2 +17 44 50	14.2	15.3	B	EA	186	186
771009	V1656	Aql	20 09 51.5 +15 57 34	13.4	14.8	B	EA/RS	187	187
771010	V1657	Aql	20 10 43.2 +04 55 52	13.9	(0.85)	Rc	SR:	188	188
771011	V1658	Aql	20 10 43.8 +04 54 49	9.50	(0.14Rc)	V	BY	188	188
771012	V1659	Aql	20 11 03.3 +04 55 10	9.00	(0.11Rc)	V	BY	188	188

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s o ' "	Max m	Min m		Type	Ref.	
771013	V2311	Cyg	20 11 52.9 +41 36 05	13.40	14.63	*	EA	189	USNO
771014	V2312	Cyg	20 12 03.7 +47 44 13	6.92	(0.08b)	V	LPB	190	DM
771015	V1660	Aql	20 14 48.7 +03 55 32	12.1	12.4	*	DSCT:	122	GSC
771016	V2313	Cyg	20 21 17.5 +30 34 41	10.46	10.87	V	SRB	191	GSC
771017	V2314	Cyg	20 22 10.2 +31 15 11	8.64	8.76	Hp	EA	192	DM
771018	MN	Dra	20 23 38.2 +64 36 27	15.7	19.4	R	UGSU	193	193
771019	MO	Dra	20 23 57.6 +63 02 33	12.93	14.45	V	EA	194	194
771020	NY	Del	20 25 15.7 +07 25 34	12.6	13.5	*	LB	125	GSC
771021	V436	Vul	20 27 18.6 +28 19 44	8.81	(0.05)	V	BE	119	DM
771022	CK	Mic	20 32 54.8 -35 43 30	10.1	11.7	V	SR:	004	DM
771023	CL	Mic	20 33 01.7 -33 55 28	9.8	10.8	V	SR:	004	DM
771024	V2315	Cyg	20 34 45.8 +32 48 13	11.3	13.3	V	SRA	144	144
771025	V1661	Aql	20 34 51.7 -02 42 55	12.6	13.6	V	SR:	004	GSC
771026	V1662	Aql	20 35 50.6 -01 36 20	11.1	13.1	V	SR:	004	GSC
771027	BZ	Cap	20 36 18.0 -24 18 14	10.4	11.0	V	SR:	004	DM
771028	CM	Mic	20 36 54.6 -43 22 31	14.9	15.9	B	NL	003	USNO
771029	V2316	Cyg	20 37 00.2 +33 54 09	13.0	16.0	V	M	144	144
771030	V2317	Cyg	20 37 01.2 +30 39 47	12.1	15.0	V	M	144	144
771031	V2318	Cyg	20 37 11.3 +34 22 15	12.4	14.5	V	SRA	144	144
771032	CN	Mic	20 37 18.5 -33 03 01	10.8	12.2	V	SR:	004	DM
771033	V2319	Cyg	20 38 19.8 +34 12 21	13.4	(16.0	V	LB:	144	144
771034	CO	Mic	20 38 41.9 -28 04 47	12.2	13.2	V	SR:	004	GSC
771035	V437	Vul	20 39 01.1 +27 29 33	13.3	15.0	V	SRA	144	144
771036	MP	Aqr	20 39 12.4 -09 23 10	10.2	10.9	V	SR:	004	DM
771037	MQ	Aqr	20 39 34.7 -06 50 04	12.7	13.6	V	SR:	004	GSC
771038	V2320	Cyg	20 39 50.1 +34 37 18	11.8	13.2	V	LB	144	144
771039	CP	Mic	20 40 17.6 -30 25 31	11.4	12.3	V	SR:	004	GSC
771040	CQ	Mic	20 41 13.1 -28 16 22	11.8	12.9	V	SR:	004	DM
771041	MR	Aqr	20 41 21.0 -05 45 03	12.2	13.1	V	SR:	004	GSC
771042	MS	Aqr	20 42 22.5 -02 54 42	10.6	11.3	V	SR:	004	GSC
771043	CR	Mic	20 42 46.4 -29 29 15	11.3	12.1	V	SR:	004	DM
771044	MT	Aqr	20 42 54.3 -10 11 08	10.0	10.8	V	SR:	004	DM
771045	V2321	Cyg	20 43 00.6 +33 24 44	13.7	(16.0	V	LB:	144	144
771046	V438	Vul	20 43 21.1 +26 24 37	12.5	(20.	V	M	144	144
771047	CC	Cap	20 44 09.8 -22 18 13	11.7	12.8	V	SR:	004	GSC
771048	V439	Vul	20 44 12.5 +26 12 46	12.0	15.8	V	M	144	144
771049	CS	Mic	20 44 40.7 -32 00 13	11.9	12.6	V	SR:	004	DM
771050	V440	Vul	20 45 01.2 +27 15 07	12.5	(16.0	V	M	144	144
771051	MU	Aqr	20 48 13.3 -01 29 26	11.2	(0.61)	R	EW	195	GSC
771052	V441	Vul	20 49 05.9 +23 21 52	13.1	(16.0	V	SR	144	144
771053	MV	Aqr	20 50 37.4 -13 50 13	12.3	13.0	V	SR:	004	GSC
771054	MW	Aqr	20 51 27.5 -02 52 39	11.6	12.1	V	SR:	004	GSC
771055	NZ	Del	20 51 44.6 +03 55 15	12.4	13.1	*	LB	125	GSC
771056	CD	Cap	20 52 35.9 -26 38 51	12.3	13.0	V	SR:	004	GSC
771057	MX	Aqr	20 52 46.0 -07 45 38	9.4	10.4	V	SR:	004	DM
771058	V2322	Cyg	20 53 09.5 +32 31 05	13.2	(16.2	V	M:	144	144

Table 1 (continued)

No.	Name		R.A., Decl., 2000.0 h m s ° ' "	Max m	Min m		Type	Ref.
771059	V2323	Cyg	20 53 48.0 +53 13 59	13.2	17.0	I	M	012 013
771060	V703	Cep	20 54 37.6 +56 05 34	16.4	18.9	I	M	012 013
771061	MY	Aqr	20 55 56.1 -01 21 14	11.5	12.5	V	SR:	004 GSC
771062	CT	Mic	20 57 15.9 -30 45 52	13.5	14.3	V	SR:	004 GSC
771063	V2324	Cyg	20 58 55.6 +49 31 13	11.58	11.80	V	*	178 GSC
771064	V442	Vul	20 59 09.6 +27 26 40	2.97	4.07	K	M	081 154
771065	V443	Vul	21 01 29.9 +25 03 43	12.0	15.0	V	M	144 144
771066	CE	Cap	21 02 42.8 -23 46 55	11.6	12.2	V	SR:	004 228
771067	V2275	Cyg	21 03 02.0 +48 45 53	6.66	(15.	V	NA	196 197
771068	CU	Mic	21 03 08.5 -39 30 06	12.8	13.5	V	SR:	004 GSC
771069	CF	Cap	21 03 31.6 -24 55 55	12.8	13.6	V	SR:	004 GSC
771070	V2325	Cyg	21 04 05.5 +32 30 13	11.0	15.5	V	SR	144 144
771071	V444	Vul	21 04 05.6 +26 32 12	12.2	15.0	V	M	144 144
771072	MZ	Aqr	21 05 13.0 -10 18 02	11.2	12.0	V	SR:	004 GSC
771073	V2326	Cyg	21 05 32.2 +35 25 06	12.8	14.2	V	EB:	144 144
771074	V2327	Cyg	21 07 55.7 +35 35 22	13.1	14.4	V	SRA	144 144
771075	V445	Vul	21 08 01.2 +23 43 45	10.5	14.4	V	M	144 144
771076	V446	Vul	21 09 01.2 +27 31 23	9.7	11.1	V	LB	144 144
771077	V2328	Cyg	21 10 14.8 +31 29 41	11.2	14.3	V	SRA	144 144
771078	V2329	Cyg	21 10 19.3 +33 28 54	11.3	14.6	V	M	144 144
771079	V2330	Cyg	21 10 47.7 +34 20 06	10.4	14.9	V	M	144 144
771080	V2331	Cyg	21 11 13.6 +34 19 14	12.5	14.6	V	L	144 144
771081	V2332	Cyg	21 11 20.0 +31 23 19	11.2	(15.0	V	M	144 144
771082	V447	Vul	21 13 43.6 +28 00 14	11.7	(16.0	V	M	144 144
771083	V2333	Cyg	21 14 12.3 +36 39 00	10.6	(14.7	V	M	144 144
771084	CV	Mic	21 14 45.4 -27 58 41	12.9	(14.7	V	M:	004 GSC
771085	V2334	Cyg	21 16 45.0 +29 13 40	12.2	(14.4	V	LB	144 144
771086	V2335	Cyg	21 17 09.6 +31 07 50	11.5	15.0	V	M	144 144
771087	CG	Cap	21 18 01.2 -23 27 50	13.2	14.1	V	SR:	004 GSC
771088	V2336	Cyg	21 18 34.7 +33 44 31	13.5	15.9	V	SRA	144 144
771089	CH	Cap	21 19 37.5 -22 42 27	11.8	12.6	V	SR:	004 DM
771090	V2337	Cyg	21 19 39.9 +35 00 12	12.1	13.3	V	LB:	144 144
771091	V2338	Cyg	21 19 53.0 +35 08 57	11.8	13.3	V	LB:	144 144
771092	V448	Vul	21 20 19.5 +28 08 58	12.4	14.1	V	LB	144 144
771093	V2339	Cyg	21 20 32.0 +33 07 18	10.7	13.2	V	SRA	144 144
771094	CI	Cap	21 22 01.6 -21 37 27	13.9	15.3	V	SR:	004 GSC
771095	V704	Cep	21 23 09.2 +55 49 15	9.0	11.7	I	M	012 013
771096	CW	Mic	21 23 51.2 -38 52 58	9.5	10.5	V	SR:	004 DM
771097	V449	Vul	21 25 18.9 +27 03 26	13.3	15.6	V	SRA	144 144
771098	V380	Peg	21 25 27.6 +22 25 42	11.9	13.4	V	SRA	144 144
771099	V381	Peg	21 28 30.2 +10 45 22	12.65	13.26	V	EW	198 GSC
771100	V2340	Cyg	21 28 44.9 +48 58 42	11.8	12.3	B	DCEP	199 GSC
771101	V382	Peg	21 29 55.8 +23 13 05	12.0	13.0	V	LB	144 144
771102	V383	Peg	21 31 17.6 +26 44 06	11.1	(15.0	V	M	144 144
771103	V2341	Cyg	21 31 54.7 +33 03 03	11.5	15.6	V	M	144 144
771104	XX	PsA	21 34 27.9 -25 42 33	10.7	12.3	V	SR:	004 DM

Table 1 (continued)

No.	Name		R.A., 2000.0 h m s	Decl., 2000.0 o ' "	Max m	Min m		Type	Ref.	
771105	V2342	Cyg	21 35 09.8	+31 11 36	12.7	14.8	V	SRA	144	144
771106	V2343	Cyg	21 36 04.2	+36 13 47	11.3	12.9	V	SR	144	144
771107	V2344	Cyg	21 39 32.3	+30 03 51	14.0	15.5	V	SRB	144	144
771108	V2345	Cyg	21 39 33.3	+50 56 30	14.1	16.8	I	M	012	013
771109	CK	Cap	21 39 53.4	-15 40 35	12.0	12.8	V	LB:	004	GSC
771110	V2346	Cyg	21 39 55.1	+31 19 16	12.5	16.0	V	M	144	144
771111	V2347	Cyg	21 43 00.1	+32 41 39	11.4	13.7	V	LB	144	144
771112	V2348	Cyg	21 43 10.3	+35 45 14	13.2	15.1	V	SR	144	144
771113	V2349	Cyg	21 43 43.6	+53 46 01	16.50	16.85	V	EA	200	200
771114	V2350	Cyg	21 43 50.3	+53 42 46	16.40	16.56	V	EA	200	200
771115	V2351	Cyg	21 43 51.3	+53 43 06	15.97	16.07	V	LPB:	200	200
771116	NN	Aqr	21 43 54.0	-00 13 41	13.47	14.14	R	EW	201	201
771117	V2352	Cyg	21 43 58.2	+53 42 45	16.16	16.28	V	LPB:	200	200
771118	V2353	Cyg	21 44 03.0	+53 42 12	13.16	13.19	V	BE	200	200
771119	V2354	Cyg	21 44 05.3	+53 42 36	14.39	14.43	V	LPB:	200	200
771120	V2355	Cyg	21 44 07.3	+53 41 56	14.26	14.31	V	E:	200	200
771121	V2356	Cyg	21 44 47.4	+34 27 16	10.8	(16.0	V	LB	144	144
771122	V2357	Cyg	21 46 09.7	+35 56 16	11.6	15.2	V	M	144	144
771123	V2358	Cyg	21 46 45.5	+50 03 59	15.9	17.6	I	M	012	013
771124	V705	Cep	21 46 52.6	+60 13 48	14.3	17.4	I	M	012	013
771125	V384	Peg	21 51 54.3	+09 01 21	16.5	(0.02)	B	RPHS	071	g2.2
771126	V385	Peg	21 51 55.4	+29 17 14	11.9	13.5	V	LB	144	144
771127	V386	Peg	21 52 58.6	+33 48 30	11.6	13.1	V	SR	144	144
771128	V387	Peg	21 54 18.7	+09 11 44	16.5	(0.02)	B	RPHS	009	121
771129	V2359	Cyg	21 56 27.8	+53 46 19	12.4	13.2	V	SR:	004	GSC
771130	V388	Peg	21 57 32.4	+08 55 16	16.7	(2.10)	R	XM	202	202
771131	V2360	Cyg	21 57 33.1	+53 47 48	11.8	12.7	V	SR:	004	GSC
771132	V389	Peg	21 59 40.7	+29 39 59	12.0	13.5	V	SR	144	144
771133	V390	Peg	22 02 15.1	+28 45 50	9.64	9.71	V	SR	053	DM
771134	V391	Peg	22 04 12.2	+26 25 08	14.3	(0.02)	B	RPHS	071	GSC
771135	V706	Cep	22 04 58.2	+54 07 40	13.8	14.5	V	SR:	004	GSC
771136	V392	Peg	22 07 09.9	+28 28 37	12.0	16.1	V	M	144	144
771137	V441	Lac	22 09 37.4	+52 34 16	12.2	(0.22*)	R	EW	203	GSC
771138	V707	Cep	22 40 59.8	+69 46 15	9.9	12.4	I	M	012	013
771139	V708	Cep	22 48 14.0	+69 58 29	7.7	11.0	I	M	012	013
771140	V393	Peg	22 48 45.2	+12 20 05	16.73	(0.18*)	y	ZZB	204	121
771141	V442	Lac	22 51 38.9	+51 50 42	12.26	(0.30)	V	*	205	GSC
771142	V394	Peg	22 56 46.1	+12 52 50	15.6	(0.07*)	V	ZZA	025	USNO
771143	XY	PsA	22 57 54.0	-26 59 54	10.5	12.2	V	SR:	004	DM
771144	V709	Cep	22 58 09.1	+66 21 12	12.63	20.6	*	N:	206	207
771145	V710	Cep	23 04 46.7	+64 05 25	7.41	7.75	V	EB	208	DM
771146	V711	Cep	23 05 15.0	+63 23 45	8.95	(0.23)	V	EA	209	209
771147	CC	Scl	23 15 31.9	-30 48 47	13.4	17.3	V	UGSU	210	USNO
771148	V395	Peg	23 20 23.2	+16 47 23	10.97	11.11	V	RS	119	DM
771149	EI	Psc	23 29 54.2	+06 28 11	12.5	16.5	V	UGSU	211	g2.2
771150	V396	Peg	23 32 32.6	+10 33 20	12.12	12.43	*	EW	212	GSC

Table 1 (continued)

No.	Name	R.A., Decl., 2000.0						Max	Min		Type	Ref.	
		h	m	s	o	'	"	m	m				
771151	V712 Cep	23	48	33.2	+68	50	14	13.1	14.9	V	LB	004	GSC
771152	V955 Cas	23	51	37.2	+63	00	37	15.7	22.0	I	M	012	013

Table 2

V428 And = 770008 = AFGL 89 = BD +43°113 = BS 0152 = GSC 2796.02404 = HD 3346 = HIP 002900 = IRAS 00340+4412 = IRC +40011 = NSV 15135 = PPM 043119 = SAO 036509.
V429 And = 770009 = FBS 0039+430 = HS 0039+4302.
V430 And = 770044 = GSC 2305.00952 = IRAS 01329+3555 = Tmz V783.
V431 And = 770052 = GSC 3287.02258 = IRAS 01392+4842 = Tmz V849.
V432 And = 770060 = GSC 3279.00401 = IRAS 01461+4505 = Tmz V845.
V433 And = 770063 = GSC 2816.00301 = IRAS 01486+3900 = IRC +40029 = Tmz V842.
V434 And = 770064 = GSC 2828.00395 = IRAS 01502+4352 = Tmz V844.
V435 And = 770079 = GSC 3285.01710 = IRAS 02096+4657 = Tmz V846.
V436 And = 770090 = BD +42°502 = GSC 2839.00214 = HD 14437 = HIP 010951 = PPM 045007 = SAO 037963.
V437 And = 770099 = GSC 2839.01779 = IRAS 02242+4246 = Tmz V847.
V438 And = 770106 = GSC 2844.01862 = IRAS 02308+4318 = Tmz V848.
BE Ant = 770249 = CCS-I 1656 = CCS-II 2739 = GSC 7187.01517 = Tmz V771.
PR Aps = 770312 = CoD –73°1000 = CPD –73°1340 = GSC 9269.00266 = HD 128862 = HIP 072055 = NSV 20161 = PPM 372382.
MP Aqr = 771036 = BD –09°5533 = GSC 5759.02122 = IRAS 20365–0933 = IRC –10543 = Tmz V810.
MQ Aqr = 771037 = GSC 5189.00071 = IRAS 20368–0700 = Tmz V811.
MR Aqr = 771041 = GSC 5189.01523 = IRAS 20387–0555 = Tmz V813.
MS Aqr = 771042 = GSC 5181.00642 = IRAS 20397–0305 = Tmz V817.
MT Aqr = 771044 = BD –10°5480 = GSC 5760.00963 = IRAS 20401–1021 = Tmz V809.
MU Aqr = 771051 = GSC 5178.01376 = NPM –01.1070.
MV Aqr = 771053 = GSC 5769.00810 = IRAS 20478–1401 = Tmz V808.
MW Aqr = 771054 = GSC 5182.00005 = IRAS 20488–0304 = Tmz V818.
MX Aqr = 771057 = BD –08°5503 = GSC 5757.00547 = IRAS 20500–0757 = IRC –10552 = Tmz V807 = NPM –07.2577 = PPM 204561 = RAFGL 5551S = SAO 144898.
MY Aqr = 771061 = GSC 5179.01984 = IRAS 20533–0132 = Tmz V819.
MZ Aqr = 771072 = BD –10°5591nf = GSC 5775.00988 = IRAS 21025–1030 = Tmz V820.
NN Aqr = 771116 = GSC 5209.00225 = Var "N" in Aqr.
V1548 Aql = 770893 = Nova Aql 2001 = TAV J1907+117.
V1549 Aql = 770822 = GSC 5118.00332 = IRAS 18439–0300 = IRC 00375 = Hassforther V44 = RAFGL 5293S.
V1550 Aql = 770826 = GSC 5118.00470 = IRAS 18481–0338 = IRC 00383 = Hassforther V43.
V1551 Aql = 770829 = IRAS 18499–0316 = IRC 00386 = Hassforther V42 = RAFGL 5311S.
V1552 Aql = 770834 = IRAS 18569+1722 = Mis V0200.
V1553 Aql = 770838 = AN 793.1936 = CSV 4501 = GSC 0462.02357 = HV 9582 = IRAS 19003+0021 = Had V69 = Prager 4959.
V1554 Aql = 770839 = 95 near NGC 6749.
V1555 Aql = 770840 = IRAS 19011+0138 = 39 near NGC 6749 = 148 near NGC 6749.
V1556 Aql = 770841 = IRAS 19016+0237 = 63 near NGC 6749.
V1557 Aql = 770842 = IRAS 19016+0154 = 2 near NGC 6749.
V1558 Aql = 770843 = 15 near NGC 6749 = 40 near NGC 6749.
V1559 Aql = 770844 = IRAS 19017+0246 = 44 near NGC 6749.
V1560 Aql = 770845 = 3 near NGC 6749.
V1561 Aql = 770846 = IRAS 19021+0117 = 36 near NGC 6749 = 151b near NGC 6749.
V1562 Aql = 770847 = IRAS 19022+0247 = 17 near NGC 6749.
V1563 Aql = 770848 = IRAS 19023+0217 = 19 near NGC 6749.
V1564 Aql = 770849 = IRAS 19023+0228 = 5 near NGC 6749.
V1565 Aql = 770850 = IRAS 19023+0127 = 92 near NGC 6749.
V1566 Aql = 770851 = IRAS 19023+0249 = 17b near NGC 6749.

Table 2 (continued)

V1567 Aql = 770852 = IRAS 19023+0204 = 7 near NGC 6749.
V1568 Aql = 770853 = IRAS 19024+0233 = 4 near NGC 6749.
V1569 Aql = 770854 = IRAS 19023+0116 = 36A near NGC 6749.
V1570 Aql = 770855 = IRAS 19025+0111 = 37 near NGC 6749.
V1571 Aql = 770856 = IRAS 19026+0209 = 6-12 near NGC 6749.
V1572 Aql = 770857 = IRAS 19026+0213 = 26 near NGC 6749.
V1573 Aql = 770858 = 41 near NGC 6749.
V1574 Aql = 770859 = 91 near NGC 6749.
V1575 Aql = 770860 = IRAS 19027+0151 = A-1 near NGC 6749.
V1576 Aql = 770861 = IRAS 19027+0148 = A-2 near NGC 6749.
V1577 Aql = 770862 = IRAS 19027+0134 = 42 near NGC 6749.
V1578 Aql = 770863 = IRAS 19028+0223 = 27 near NGC 6749.
V1579 Aql = 770864 = 10 near NGC 6749.
V1580 Aql = 770866 = IRAS 19034+0252 = 31b near NGC 6749.
V1581 Aql = 770867 = IRAS 19035+0145 = 4-3 near NGC 6749.
V1582 Aql = 770868 = 8 near NGC 6749.
V1583 Aql = 770869 = IRAS 19035+0117 = 37b near NGC 6749 = 60 near NGC 6749.
V1584 Aql = 770870 = IRAS 19037+0207 = 9 near NGC 6749.
V1585 Aql = 770871 = IRAS 19038+0152 = 12 near NGC 6749.
V1586 Aql = 770872 = Mis V0954.
V1587 Aql = 770874 = IRAS 19039+0055 = 37h near NGC 6749.
V1588 Aql = 770875 = 6-6 near NGC 6749.
V1589 Aql = 770876 = GSC 0466.00506S = IRAS 19041+0321 = 31ter near NGC 6749.
V1590 Aql = 770877 = GSC 0466.02783 = 20 near NGC 6749.
V1591 Aql = 770878 = 6-4 near NGC 6749.
V1592 Aql = 770879 = 6-4b near NGC 6749.
V1593 Aql = 770880 = 31 near NGC 6749.
V1594 Aql = 770882 = IRAS 19044+0254 = 20b near NGC 6749.
V1595 Aql = 770883 = 20c near NGC 6749.
V1596 Aql = 770884 = IRAS 19044+0125 = 51 near NGC 6749.
V1597 Aql = 770885 = 81 near NGC 6749.
V1598 Aql = 770886 = IRAS 19045–0414 = Hassforther V16.
V1599 Aql = 770887 = IRAS 19047+0316 = 30 near NGC 6749.
V1600 Aql = 770888 = IRAS 19046+0112 = 80 near NGC 6749.
V1601 Aql = 770889 = 6-2 near NGC 6749.
V1602 Aql = 770890 = IRAS 19047+0144 = 53b near NGC 6749.
V1603 Aql = 770891 = X-2 near NGC 6749.
V1604 Aql = 770892 = IRAS 19051+1218 = Mis V0955.
V1605 Aql = 770894 = IRAS 19049+0228 = X-1 near NGC 6749.
V1606 Aql = 770895 = Mis V0956.
V1607 Aql = 770896 = 19-II near NGC 6749.
V1608 Aql = 770897 = IRAS 19051+0324 = 32 near NGC 6749.
V1609 Aql = 770898 = 82b near NGC 6749.
V1610 Aql = 770899 = 82 near NGC 6749.
V1611 Aql = 770900 = 18 near NGC 6749.
V1612 Aql = 770901 = IRAS 19057+0141 = 53 near NGC 6749.
V1613 Aql = 770902 = IRAS 19060+0150 = 52b near NGC 6749.
V1614 Aql = 770903 = IRAS 19062+0311 = IRC 00414 = 25d near NGC 6749.
V1615 Aql = 770904 = IRAS 19062+0134 = 52 near NGC 6749.
V1616 Aql = 770905 = IRAS 19063+0245 = 83 near NGC 6749.
V1617 Aql = 770906 = 25 near NGC 6749.
V1618 Aql = 770907 = IRAS 19067+0249 = 33 near NGC 6749.
V1619 Aql = 770909 = IRAS 19069+0258 = 25b near NGC 6749.
V1620 Aql = 770910 = IRAS 19071+0208 = 22 near NGC 6749.
V1621 Aql = 770911 = IRAS 19073+0249 = 6-14 near NGC 6749.
V1622 Aql = 770912 = IRAS 19074+0241 = 45 near NGC 6749.
V1623 Aql = 770913 = IRAS 19074+0246 = 6-14b near NGC 6749.
V1624 Aql = 770914 = 0-2 near NGC 6749.
V1625 Aql = 770915 = IRAS 19076+0338 = 7-1 near NGC 6749.
V1626 Aql = 770916 = IRAS 19075+0303 = 25e near NGC 6749.
V1627 Aql = 770917 = IRAS 19076+0211 = 23 near NGC 6749.

Table 2 (continued)

V1628 Aql = 770918 = 34 near NGC 6749.
V1629 Aql = 770919 = 6-14a near NGC 6749.
V1630 Aql = 770920 = 44c near NGC 6749.
V1631 Aql = 770921 = 44b near NGC 6749.
V1632 Aql = 770922 = 24 near NGC 6749.
V1633 Aql = 770924 = 6C near NGC 6749.
V1634 Aql = 770925 = 6-16 near NGC 6749.
V1635 Aql = 770926 = IRAS 19094+0229 = 6d near NGC 6749.
V1636 Aql = 770927 = GSC 5133.02273 = IRAS 19099–0313 = Hassforther V14.
V1637 Aql = 770928 = GSC 5137.00507 = IRAS 19111–0535 = IRC –10495 = Hassforther V37.
V1638 Aql = 770936 = IRAS 19150+0821 = Had V61.
V1639 Aql = 770937 = GSC 0476.00421 = IRAS 19162+0718 = Brh V92.
V1640 Aql = 770940 = IRAS 19179–0403.
V1641 Aql = 770941 = GSC 0476.00575 = Brh V91.
V1642 Aql = 770943 = GSC 0472.01560 = IRAS 19194+0350 = Brh V54.
V1643 Aql = 770944 = IRAS 19220+0450 = Mis V0962.
V1644 Aql = 770945 = GSC 0473.05480 = IRAS 19222+0400 = Brh V77.
V1645 Aql = 770946 = GSC 5722.01587 = Had V77.
V1646 Aql = 770963 = GSC 0486.04828 = Brh V64.
V1647 Aql = 770972 = GSC 5728.00092.
V1648 Aql = 770974 = GSC 0483.00956 = IRAS 19386+0155 = NSV 24846. Brightening over 10 years, probably due to dissipating dust envelope, plus quasi-periodic variations.
V1649 Aql = 770980 = GSC 0488.03551 = Brh V80.
V1650 Aql = 770983 = GSC 0488.00800 = IRAS 19457+00343 = Brh V59.
V1651 Aql = 770984 = Brh V87.
V1652 Aql = 770987 = GSC 0488.03486 = Brh V79.
V1653 Aql = 770994 = GSC 0493.00629 = Brh V90.
V1654 Aql = 771004 = BD +02°4076 = GSC 0498.02720 = HD 190007 = HIP 098698 = IRAS 20002+0310 = PPM 169210 = SAO 125379.
V1655 Aql = 771005 = BD +15°4029 = GSC 1617.02068 = HD 190152 = IDS 1958.4N1512A = IRAS 20007+1519 = PPM 137505 = SAO 105602.
V1656 Aql = 771009 = GSC 1618.01655 = RX J2009.8+1557 = S 10947.
V1657 Aql = 771010 = USNO 900-19703132.
V1658 Aql = 771011 = BD +04°4364 = GSC 0503.00700 = HD 191616 = PPM 169495 = RX J201043+045449 = SAO 125526.
V1659 Aql = 771012 = BD +04°4369 = GSC 0503.01409 = HD 191674 = PPM 169505 = SAO 125531.
V1660 Aql = 771015 = GSC 0503.00827 = Brh V63.
V1661 Aql = 771025 = GSC 5180.00702 = IRAS 20322–0253 = Tmz V814 = NPM –02.1903.
V1662 Aql = 771026 = GSC 5176.01624 = IRAS 20332–0146 = Tmz V816.
AW Ari = 770059 = GSC 0628.00290.
AX Ari = 770068 = GSC 1757.01802 = IRAS 01554+2219 = Tmz V784.
AY Ari = 770112 = BD +30°433 = GSC 2325.01358 = HD 16761 = HIP 012600 = PPM 067638 = SAO 055792.
V524 Aur = 770152 = IRAS 04372+3011 = Toa V15.
V525 Aur = 770153 = IRAS 04402+3426.
V526 Aur = 770159 = HD 280340 = GSC 2895.01453 = RX J050147+380541.
V527 Aur = 770160 = GSC 2895.01173. Also might be a low-amplitude Cepheid.
V528 Aur = 770163 = IRAS 05091+4639 = NSV 16259.
V529 Aur = 770167 = IRAS 05204+3227 = NSV 16295.
V530 Aur = 770176 = IRAS 05423+2905 = NSV 16653.
V531 Aur = 770178 = IRAS 05484+3521 = NSV 16695.
V532 Aur = 770186 = Tmz V754.
V533 Aur = 770188 = IRAS 06170+3523 = NSV 16829.
V534 Aur = 770189 = BD +28°1117 = GSC 1887.01240 = HD 257012.
V535 Aur = 770190 = CSV 766 = GSC 3376.00287 = HV 7649 = NSV 03007 = Prager 2840.
FY Boo = 770302 = GSC 1999.00518 = ROTSE1 J134651.80+225714.7.
FZ Boo = 770305 = BD +11°2635 = GSC 0904.01256 = HD 123232 = HIP 068879 = IRAS 14037+1103 = NSV 20040 = PPM 130307 = SAO 100849.
GG Boo = 770306 = GSC 3034.00593 = ROTSE1 J140916.76+383732.0.

Table 2 (continued)

GH	Boo =	770307	= GSC 2013.01067 = NPM +27.1246 = ROTSE1 J141451.43+273415.3.
GI	Boo =	770309	= BD +38°2574 = GSC 3036.00930 = ROTSE1 J143723.34+380442.7.
GK	Boo =	770310	= BD +37°2556 = GSC 2560.00421 = ROTSE1 J143820.20+363225.6 = ROTSE1 J143820.24+363225.5.
GL	Boo =	770311	= BD +27°2407 = GSC 2018.00065 = ROTSE1 J144005.64+263401.6 = ROTSE1 J144005.69+263402.2.
GM	Boo =	770313	= GSC 2016.00830 = ROTSE1 J144726.56+224515.0.
GN	Boo =	770314	= GSC 2022.00079 = ROTSE1 J145007.78+293858.9.
GO	Boo =	770316	= GSC 2023.01133 = ROTSE1 J145312.48+284221.4.
GP	Boo =	770317	= GSC 2017.01099 = ROTSE1 J145730.93+240251.4.
GQ	Boo =	770318	= GSC 2020.00736 = ROTSE1 J145936.69+250244.9.
GR	Boo =	770319	= GSC 2020.00873 = ROTSE1 J145954.54+255434.1.
GS	Boo =	770320	= BD +34°2592 = GSC 2565.00667 = ROTSE1 J150029.61+334021.7.
GT	Boo =	770321	= GSC 3045.00520 = NPM +38.0716 = ROTSE1 J151726.64+381336.3.
GU	Boo =	770323	= GSC 2566.00776 = ROTSE1 J152155.16+335604.1.
KX	Cam =	770126	= IRAS 03192+5642 = NSV 15678.
KY	Cam =	770127	= IRAS 03238+6034 = NSV 15691 = RAFGL 4277S.
KZ	Cam =	770130	= BD +56°826 = BS 1094 = GSC 3724.00100 = GSC 3724.00499 = HD 22316 = HIP 016974 = PPM 028599 = SAO 024133.
LL	Cam =	770136	= IRAS 03469+5833 = NSV 15800.
LM	Cam =	770139	= IRAS 03525+5711 = NSV 15842.
LN	Cam =	770142	= BD +58°696 = GSC 3730.00797.
LO	Cam =	770143	= BV 0310 = CSV 6070 = GSC 3730.01400 = NSV 01450.
LP	Cam =	770145	= BV 0311 = CSV 6077 = GSC 4068.00447 = NSV 01470.
LQ	Cam =	770146	= IRAS 04085+5347 = NSV 15913.
LR	Cam =	770175	= CSV 635 = GSC 4344.00123 = NSV 02544 = Zi 0402.
LS	Cam =	770180	= HS 0551+7241.
LT	Cam =	770182	= GSC 3762.00283 = V31.
LU	Cam =	770183	= RX J05583+6753.
LV	Cam =	770184	= V32.
LW	Cam =	770202	= RX J0704.2+6203 = 1RX J070409.2+620330.
HI	Cnc =	770225	= ADS 06931 = BD +19°2078 = KW 385 (Praesepe) = HD 73890 = GSC 1395.02210 = NSV 04192 = PPM 125606.
HK	Cnc =	770237	= GSC 0814.00689 = PG 0856+121 = WD 0856+121.
HL	Cnc =	770238	= BD +11°1961 = GSC 0815.02116 = HD 77191 = HIP 044303 = PPM 126017 = SAO 098298.
DH	CVn =	770281	= GSC 2530.00488 = ROTSE1 J122607.59+355548.9.
DI	CVn =	770283	= GSC 2530.02276 = ROTSE1 J123201.49+352959.7.
DK	CVn =	770286	= GSC 3018.01509 = ROTSE1 J123309.33+375820.2.
DL	CVn =	770292	= GSC 3021.00507 = ROTSE1 J125214.17+385630.8.
DM	CVn =	770301	= GSC 2004.01075 = ROTSE1 J133619.29+292341.1.
V350	CMa =	770192	= ADS 05377A = BD –22°1505 = BS 2481 = CoD –22°3403 = CPD –22°1408 = GSC 5961.00649 = HD 48501 = HIP 032144 = IRAS 06406–2223 = NSV 03181 = PPM 250872 = SAO 172204.
V351	CMa =	770203	= GSC 6549.01898 = IRAS 07211–2916 = IRC –30089 = Had V76 = RAFGL 4597S.
CW	CMi =	770209	= GSC 4832.00400.
BZ	Cap =	771027	= CoD –24°16141 = CPD –24°7026 = GSC 6908.00085 = IRAS 20333–2428 = Tmz V821.
CC	Cap =	771047	= GSC 6343.00577 = IRAS 20412–2229 = Tmz V822.
CD	Cap =	771056	= GSC 6930.01182 = IRAS 20496–2650 = Tmz V806.
CE	Cap =	771066	= BV 1736 = CoD –24°16434 = GSC 6923.01250 = IRAS 20598–2358 = NSV 25429.
CF	Cap =	771069	= GSC 6927.00184 = IRAS 21005–2507 = Tmz V823.
CG	Cap =	771087	= GSC 6937.00787 = IRAS 21151–2340 = Tmz V805.
CH	Cap =	771089	= CoD –23°16836 = GSC 6937.00775 = IRAS 21167–2255 = Tmz V803.
CI	Cap =	771094	= GSC 6372.00256 = IRAS 21191–2150 = Tmz V802.
CK	Cap =	771109	= GSC 6362.00635 = IRAS 21371–1554 = Tmz V799.
V572	Car =	770253	= F 104 (Tr 16) = CoD –59°3303 = CPD –59°2603 = GSC 8626.02309 = LSS 1861 = NSV 18510.
V573	Car =	770254	= F 1 (Tr 16) = CPD –59°2628 = LSS 1871 = NSV 18512.

Table 2 (continued)

V574 Car = 770256 = GSC 8958.04143 = WR 30a [093] = WR 29a.

V878 Cas = 770001 = Antipin Var 71.

V879 Cas = 770002 = GSC 4018.01275 = Antipin Var 70.

V880 Cas = 770010 = CCS-I 40 = CCS-II 137 = GSC 4296.00758 = IRAS 00523+6812 = Tmz V936.

V881 Cas = 770011 = CCS-I 42 = CCS-II 143 = GSC 4025.02005 = IRAS 00538+6410 = Tmz V940.

V882 Cas = 770012 = GSC 4029.00904 = IRAS 00540+6704 = LD 92 = NSV 15209.

V883 Cas = 770013 = GSC 4025.00254 = IRAS 00545+6352 = Tmz V941.

V884 Cas = 770014 = CCS-I 43 = CCS-II 149 = GSC 4025.01404 = IRAS 00560+6332 = LD 93 = NSV 15216.

V885 Cas = 770016 = CCS-I 49 = CCS-II 159 = GSC 4029.00823 = IRAS 00576+6704 = Tmz V939.

V886 Cas = 770017 = CCS-I 50 = CCS-II 161 = GSC 4296.00812 = IRAS 00580+6826 = Tmz V935.

V887 Cas = 770018 = GSC 3676.02740 = IRAS 00589+5743 = NSV 15224.

V888 Cas = 770019 = IRAS 01022+6542 = Toa V14.

V889 Cas = 770020 = AFGL 154 = GSC 4029.01082 = IRAS 01031+6531 = IRC +70017 = Tmz V931.

V890 Cas = 770022 = IRAS 01046+5846 = Toa V8.

V891 Cas = 770023 = AFGL 163 = GSC 4042.00714 = IRAS 01071+6551 = IRC +70018 = Tmz V930.

V892 Cas = 770026 = GSC 4042.00472 = IRAS 01092+6538 = Tmz V929.

V893 Cas = 770027 = CCS-I 60 = CCS-II 190 = GSC 4042.00847 = IRAS 01109+6535 = Tmz V928.

V894 Cas = 770028 = AFGL 184 = GSC 4042.00579 = IRAS 01118+6623 = IRC +70020 = Tmz V933.

V895 Cas = 770029 = GSC 4297.00508 = IRAS 01128+6729 = Tmz V934.

V896 Cas = 770030 = GSC 4042.00474 = IRAS 01158+6600 = Tmz V927.

V897 Cas = 770031 = IRAS 01168+6515 = Toa V9.

V898 Cas = 770032 = GSC 4038.01343 = IRAS 01169+6412 = LD 98 = Tmz V926 = NSV 15284.

V899 Cas = 770033 = AFGL 203 = CSS-I 22 = CSS-II 29 = GSC 4042.00040 = IRAS 01186+6634 = IRC +70026 = ISV 0118+66 = Tmz V932.

V900 Cas = 770034 = GSC 4038.01743 = IRAS 01196+6423 = Q 1994/030 = Tmz V925.

V901 Cas = 770035 = GSC 4042.00836 = IRAS 01211+6525 = Tmz V918.

V902 Cas = 770036 = GSC 4035.00004 = IRAS 01226+6313 = Tmz V924.

V903 Cas = 770037 = GSC 4297.01382 = IRAS 01243+6731 = Tmz V920.

V904 Cas = 770038 = CCS-II 230 = GSC 4043.00498 = IRAS 01244+6527 = Tmz V917.

V905 Cas = 770040 = AFGL 5049 = GSC 4039.00205 = IRAS 01261+6446 = IRC +60052 = Q 1991/014 = Tmz V916.

V906 Cas = 770042 = GSC 4297.01416 = IRAS 01293+6733 = Tmz V921.

V907 Cas = 770043 = GSC 4043.00680 = IRAS 01313+6714 = Tmz V923.

V908 Cas = 770045 = GSC 3683.01598 = IRAS 01330+5816 = Tmz V862.

V909 Cas = 770046 = BD +60°282 = GSC 4031.00631.

V910 Cas = 770047 = GSC 4031.01391 = IRAS 01336+6100 = Tmz V864.

V911 Cas = 770048 = CSS-I 31 = CSS-II 40 = GSC 3683.00899 = IRAS 01364+5927 = Tmz V863.

V912 Cas = 770049 = CCS-II 245 = GSC 4039.01075 = IRAS 01365+6436 = Tmz V907.

V913 Cas = 770050 = GSC 4035.00462 = IRAS 01369+6225 = Tmz V913.

V914 Cas = 770051 = GSC 4035.00341 = IRAS 01378+6321 = Tmz V911.

V915 Cas = 770053 = CCS-I 75 = CCS-II 255 = GSC 4035.00101 = IRAS 01391+6321 = Tmz V909.

V916 Cas = 770054 = CCS-II 257 = GSC 4036.01602 = IRAS 01395+6306 = Tmz V910.

V917 Cas = 770055 = GSC 3683.01684 = IRAS 01402+5833 = IRC +60062 = Tmz V865 = RAFGL 4132S.

V918 Cas = 770056 = CCS-I 78 = CCS-II 262 = GSC 3683.00454 = IRAS 01406+5825 = Tmz V866.

V919 Cas = 770057 = CCS-I 83 = CCS-II 277 = GSC 3696.02549 = IRAS 01441+5848 = Tmz V867.

V920 Cas = 770058 = GSC 4036.01440 = IRAS 01447+6252 = Tmz V912.

V921 Cas = 770061 = GSC 3688.00823 = IRAS 01460+5557 = Tmz V869.

V922 Cas = 770062 = GSC 4044.00300 = IRAS 01464+6558 = Tmz V904.

Table 2 (continued)

V923 Cas = 770065 = GSC 4032.01186 = IRAS 01527+5946 = Tmz V870.
V924 Cas = 770070 = GSC 3697.02306 = IRAS 01574+5822 = LD 102 = NSV 15419.
V925 Cas = 770072 = GSC 3697.02779 = IRAS 01595+5821 = Tmz V871.
V926 Cas = 770076 = GSC 4033.00147 = IRAS 02042+6126 = Tmz V875.
V927 Cas = 770077 = GSC 3697.01182 = IRAS 02047+5901 = IRC +60073 = Q 1992/049 = Tmz V873 = RAFGL 0298S.
V928 Cas = 770078 = IRAS 02080+6100 = Toa V10.
V929 Cas = 770082 = GSC 4045.00578 = IRAS 02113+6528 = Tmz V898.
V930 Cas = 770083 = GSC 4037.02696 = IRAS 02116+6159 = Tmz V877.
V931 Cas = 770084 = GSC 4041.00788 = IRAS 02115+6447 = Tmz V896.
V932 Cas = 770085 = CCS-II 325 = GSC 4041.01762 = IRAS 02117+6402 = Tmz V895.
V933 Cas = 770089 = CCS-I 94 = CCS-II 330 = GSC 4050.02565 = IRAS 02167+6218 = Tmz V878.
V934 Cas = 770091 = GSC 4058.01019 = IRAS 02172+6628 = Tmz V899.
V935 Cas = 770093 = CCS-II 336 = GSC 4058.00831 = IRAS 02183+6637 = Tmz V900.
V936 Cas = 770094 = CCS-II 338 = GSC 4058.00391 = IRAS 02184+6645 = Tmz V901.
V937 Cas = 770098 = GSC 4050.01994 = IRAS 02235+6224 = Tmz V882.
V938 Cas = 770101 = GSC 4058.00821 = IRAS 02250+6639 = Tmz V894.
V939 Cas = 770102 = IRAS 02272+6327 = NSV 15533.
V940 Cas = 770104 = GSC 4054.01343 = IRAS 02294+6411 = Tmz V891.
V941 Cas = 770105 = GSC 4046.01190 = IRAS 02302+6046 = Tmz V881.
V942 Cas = 770107 = CCS-I 106 = CCS-II 367 = GSC 4055.00175 = IRAS 02303+6505 = Tmz V892.
V943 Cas = 770108 = GSC 4051.00748 = IRAS 02307+6246 = Tmz V888.
V944 Cas = 770109 = CCS-I 109 = CCS-II 377 = GSC 4055.01139 = IRAS 02337+6435 = Tmz V890.
V945 Cas = 770111 = CCS-I 114 = CCS-II 388 = GSC 4051.02343 = IRAS 02365+6203 = Tmz V887.
V946 Cas = 770113 = GSC 4055.01349 = Yarikov V6 = NSV 15563 = SVS 2683.
V947 Cas = 770114 = IRAS 02433+6345 = NSV 15573.
V948 Cas = 770115 = GSC 4059.00241 = IRAS 02446+6647 = Tmz V884.
V949 Cas = 770117 = CCS-I 123 = CCS-II 407 = GSC 4047.01706 = IRAS 02455+6130 = Toa V11.
V950 Cas = 770119 = GSC 4060.00006 = IRAS 02480+6655 = Tmz V883.
V951 Cas = 770120 = GSC 4060.00661 = IRAS 02488+6603 = Tmz V885.
V952 Cas = 770122 = BV 0264 = CSV 6008 = GSC 4317.00505 = NSV 01012.
V953 Cas = 770124 = IRAS 03084+5951 = Toa V13.
V954 Cas = 770125 = IRAS 03096+5936 = NSV 15649.
V955 Cas = 771152 = IRAS 23491+6243 = NSV 26156.
V1039 Cen = 770303 = Nova Cen 2001.
V1040 Cen = 770275 = RX J1155.4–5641.
V1041 Cen = 770289 = GSC 7775.01959.
V1042 Cen = 770290 = BV 1419 = GSC 8257.01390 = IRAS 12471–5144 = NSV 05973.
V1043 Cen = 770297 = GSC 7267.01189 = RX J1313.2–3259.
V1044 Cen = 770299 = CoD –36°8436 = GSC 7275.01500 = He-3 0886 = IRAS 13131–3644 = NSV 06160.
V1045 Cen = 770300 = OGLE GC 172/NGC 5139. Background field star.
V703 Cep = 771060 = IRAS 20532+5554 = NSV 25401.
V704 Cep = 771095 = IRAS 21216+5536 = NSV 25582.
V705 Cep = 771124 = IRAS 21453+5959 = NSV 25769.
V706 Cep = 771135 = GSC 3969.01289 = IRAS 22031+5353 = Tmz V790.
V707 Cep = 771138 = IRAS 22394+6930 = NSV 25942.
V708 Cep = 771139 = IRAS 22466+6942 = NSV 25963.
V709 Cep = 771144 = Mis V1181.
V710 Cep = 771145 = BD +63°1925 = GSC 4286.00080 = HD 218179 = NSV 26012 = PPM 024170 = SAO 020407.
V711 Cep = 771146 = ADS 16504 = BD +62°2167 = GSC 4282.00394. Variability refers to combined brightness of two nearly equal components at 5″ separation.
V712 Cep = 771151 = GSC 4479.00817 = IRAS 23461+6833 = Tmz V752.
ES Cet = 770069 = KUV 01584–0939 = Cet 3 [019] = NPM –09.0320.
ET Cet = 770006 = GSC 5847.00051 = IRAS 00298–1855 = Tmz V798 = NPM –18.0069.

Table 2 (continued)

EG	Cha =	770222	= REC X1 (η Cha) = CPD –78°367 = GSC 9402.00921 = RX J0837.0–7856.
EH	Cha =	770226	= REC X3 (η Cha).
EI	Cha =	770227	= REC X4 (η Cha) = GSC 9403.01083.
EK	Cha =	770228	= REC X5 (η Cha).
EL	Cha =	770229	= REC X6 (η Cha) = GSC 9403.00288.
EM	Cha =	770230	= REC X7 (η Cha) = RX J0842.9–7904.
EN	Cha =	770231	= REC X9 (η Cha).
EO	Cha =	770232	= REC X10 (η Cha) = GSC 9403.01279 = RX J0844.5–7846.
EP	Cha =	770234	= CPD –78°388 = BV 1051 = REC X11 (η Cha) = GSC 9403.01016 = IRAS 08487–7848 = NSV 04280.
EQ	Cha =	770235	= REC X12 (η Cha) = GSC 9403.00489 = RX J0848.0–7854.
ER	Cha =	770248	= CoD –78°405 = CPD –78°509 = GSC 9405.00094 = GSC 9405.01385 = HD 88278 = HIP 049416 = NSV 18334 = PPM 370586 = SAO 256681.
LO	Com =	770284	= GSC 1991.01390 = ROTSE1 J123204.87+262248.1.
LP	Com =	770285	= GSC 1991.01633 = ROTSE1 J123305.53+270803.4.
LQ	Com =	770287	= GSC 1990.01198 = ROTSE1 J123730.26+260451.8.
LR	Com =	770288	= GSC 1448.02869 = Tmz V772.
LS	Com =	770291	= BD +28°2156 = BS 4883 = 31 Com = GSC 1995.02586 = HD 111812 = HIP 062763 = IRAS 12492+2748 = NSV 19505 = PPM 102212 = SAO 082537.
LT	Com =	770293	= BD +27°2185 = GSC 1995.02249 = NPM +26.0604 = NSV 19516 = ROTSE1 J125241.77+261637.4.
LU	Com =	770294	= ADS 08731A = BD +31°2434 = BS 4924 = 37 Com = GSC 2532.02226 = HD 112989 = HIP 063462 = IRAS 12578+3103 = IRC +30244 = NSV 19571 = PPM 076857 = SAO 063288.
AL	CrB =	770331	= BD +27°2563 = EXO 155625.8+2659.7 = GSC 2037.01620 = HD 143271 = HIP 078234 = PPM 104473 = SAO 084109. Spotted rotating G-type giant.
AM	CrB =	770334	= GSC 2579.00069 = ROTSE1 J161050.39+372857.0.
VY	Crv =	770278	= GSC 6094.00089 = IRAS 11585–1708 = Tmz V768.
WY	Crt =	770261	= BD –22°3092 = CoD –22°8723 = GSC 6649.01063 = IRAS 11079–2246 = Tmz V762.
WZ	Crt =	770262	= GSC 6090.01661 = IRAS 11155–2118 = Tmz V763 = NPM –21.1276.
XX	Crt =	770264	= GSC 6088.00415 = IRAS 11241–1919 = Tmz V764.
XY	Crt =	770265	= ADS 08167 = BD –08°3173 = GSC 5509.01346 = HD 99563 = HIP 055890 = PPM 194490.
XZ	Crt =	770266	= GSC 6088.01200 = IRAS 11269–1839 = Tmz V765 = NPM –18.1207.
YY	Crt =	770267	= GSC 6088.00560 = IRAS 11300–1855 = Tmz V766 = NPM –18.1214.
YZ	Crt =	770269	= CoD –22°9057 = GSC 6652.00596 = IRAS 11388–2231 = Tmz V774.
ZZ	Crt =	770271	= GSC 5513.00669 = IRAS 11401–1117 = Tmz V769 = NPM –11.1150.
AA	Crt =	770274	= BD –15°3355 = GSC 6093.01282 = IRAS 11455–1618 = Tmz V767.
V2274	Cyg =	771007	= Nova Cyg 2001 No.1.
V2275	Cyg =	771067	= Nova Cyg 2001 No.2.
V2276	Cyg =	770931	= GSC 3554.00949 = ROTSE1 J191518.85+522933.9.
V2277	Cyg =	770933	= BD +44°3087 = GSC 3133.01149 = ROTSE1 J191533.92+443704.9.
V2278	Cyg =	770934	= GSC 3920.00882 = ROTSE1 J191635.07+524853.6.
V2279	Cyg =	770938	= GSC 3133.00385 = LD 349 = ROTSE1 J191853.61+434930.0 = 1RXS J191854.7+434927.
V2280	Cyg =	770942	= GSC 3547.00216 = ROTSE1 J192143.82+480356.3.
V2281	Cyg =	770947	= GSC 3543.01026 = ROTSE1 J192506.85+455603.1 = ROTSE1 J192506.86+455603.0.
V2282	Cyg =	770949	= GSC 3921.01531 = ROTSE1 J192537.72+532520.0.
V2283	Cyg =	770951	= GSC 3543.01107 = IRAS 19271+4459 = LD 351 = ROTSE1 J192838.56+450547.1.
V2284	Cyg =	770953	= GSC 3551.00081 = ROTSE1 J192954.62+485500.5.
V2285	Cyg =	770955	= IRAS 19291+4757 = LD 352 = ROTSE1 J193032.71+480327.0.
V2286	Cyg =	770956	= BD +31°3631 = GSC 2659.02713 = HD 183909 = HIP 095934 = IRAS 19286+3152 = PPM 083031 = SAO 068410.
V2287	Cyg =	770959	= GSC 3921.00991 = ROTSE1 J193206.64+523706.3.
V2288	Cyg =	770962	= IRAS 19314+3851 = LD 354 = ROTSE1 J193310.27+385830.6.
V2289	Cyg =	770965	= 1H 1933+510 = Cyg 2 [019].
V2290	Cyg =	770966	= GSC 3560.01804 = LD 355.

Table 2 (continued)

V2291 Cyg = 770967 = GSC 3560.01105 = ROTSE1 J193658.15+474828.1.
V2292 Cyg = 770968 = GSC 3564.02375 = IRAS 19362+4900 = LD 356
= ROTSE1 J193738.09+490751.9.
V2293 Cyg = 770969 = GSC 3147.01366 = IRAS 19375+4316 = LD 357
= ROTSE1 J193908.32+432345.2.
V2294 Cyg = 770973 = GSC 3564.03059 = ROTSE1 J194028.86+502554.7.
V2295 Cyg = 770976 = IRAS 19403+3756 = LD 358.
V2296 Cyg = 770977 = IRAS 19406+4715 = LD 359.
V2297 Cyg = 770978 = GSC 3144.00947 = IRAS 19414+4126 = LD 360.
V2298 Cyg = 770979 = LD 361.
V2299 Cyg = 770981 = LD 362.
V2300 Cyg = 770982 = IRAS 19462+3838 = LD 363.
V2301 Cyg = 770986 = IRAS 19476+3724 = LD 364.
V2302 Cyg = 770989 = IRAS 19492+5034 = LD 8 = NSV 24916.
V2303 Cyg = 770990 = GSC 3149.01648 = LD 365.
V2304 Cyg = 770992 = GSC 3558.01549 = IRAS 19513+4613 = LD 9 = NSV 24928.
V2305 Cyg = 770993 = CSS-I 627 = CSS-II 1172 = GSC 3562.01687 = LD 10 = NSV 24935.
V2306 Cyg = 770995 = 1WGA J1958.2+3232.
V2307 Cyg = 770996 = IRAS 19569+4657 = LD 11 = NSV 24955.
V2308 Cyg = 770997 = GSC 3562.00100 = IRAS 19577+4835 = LD 12 = NSV 24962.
V2309 Cyg = 770998 = IRAS 19581+4723 = LD 366.
V2310 Cyg = 771006 = LD 14 = NSV 24994.
V2311 Cyg = 771013 = Maffei 244 = NSV 25050.
V2312 Cyg = 771014 = BD +47°3045 = BS 7721 = GSC 3563.02401 = HD 192276 = HIP 099539
= NSV 25056 = PPM 059481 = SAO 049314. Erroneously called HD 192776
in [190].
V2313 Cyg = 771016 = GSC 2672.01449 = IRAS 20192+3025.
V2314 Cyg = 771017 = ADS 13760 = BD +30°4003 = GSC 2672.00976 = HD 193986 = HIP 100443
= NSV 25122 = PPM 084803 = SAO 069906.
V2315 Cyg = 771024 = GSC 2690.01071 = IRAS 20327+3237 = LD 367.
V2316 Cyg = 771029 = IRAS 20350+3343 = LD 368 = Toa V2.
V2317 Cyg = 771030 = IRAS 20349+3029 = LD 369.
V2318 Cyg = 771031 = IRAS 20352+3411 = LD 370.
V2319 Cyg = 771033 = IRAS 20363+3401 = LD 371 = Mis V1031.
V2320 Cyg = 771038 = GSC 2694.02096 = IRAS 20378+3426 = LD 373.
V2321 Cyg = 771045 = IRAS 20409+3313 = LD 374.
V2322 Cyg = 771058 = LD 379.
V2323 Cyg = 771059 = IRAS 20523+5302 = NSV 25393.
V2324 Cyg = 771063 = GSC 3583.00376 = IRAS 20572+4919. Possible brightening trend over
6 years, maybe due to dissipating dust envelope, plus quicker variations.
V2325 Cyg = 771070 = GSC 2705.00784 = LD 382.
V2326 Cyg = 771073 = GSC 2709.02776 = LD 384.
V2327 Cyg = 771074 = LD 385.
V2328 Cyg = 771077 = IRAS 21081+3117 = LD 388 = Wakuda Var 34.
V2329 Cyg = 771078 = Hiraga Var J211021+332912 = LD 389.
V2330 Cyg = 771079 = IRAS 21087+3407 = LD 390 = Q 2000/247.
V2331 Cyg = 771080 = LD 391.
V2332 Cyg = 771081 = GSC 2702.00676 = IRAS 21092+3111 = LD 392 = Mis V0768.
V2333 Cyg = 771083 = Hiraga Var J211412+363905 = LD 394.
V2334 Cyg = 771085 = GSC 2198.01085 = LD 395.
V2335 Cyg = 771086 = GSC 2702.01537 = IRAS 21150+3055 = LD 396.
V2336 Cyg = 771088 = LD 397.
V2337 Cyg = 771090 = GSC 2711.00059 = LD 398.
V2338 Cyg = 771091 = GSC 2711.00433 = LD 399.
V2339 Cyg = 771093 = CCS-II 5254 = GSC 2707.01462 = LD 401.
V2340 Cyg = 771100 = Platais 1083 (NGC 7092) = GSC 3598.00937 = NSV 25616.
V2341 Cyg = 771103 = GSC 2708.01539 = LD 407.
V2342 Cyg = 771105 = GSC 2704.00321 = LD 408.
V2343 Cyg = 771106 = GSC 2729.02282 = LD 409.
V2344 Cyg = 771107 = LD 410.
V2345 Cyg = 771108 = IRAS 21377+5042 = NSV 25724.

Table 2 (continued)

V2346	Cyg =	771110	= LD 411.
V2347	Cyg =	771111	= GSC 2721.01053 = LD 412.
V2348	Cyg =	771112	= GSC 2729.02394 = LD 413.
V2349	Cyg =	771113	= id718 (NGC 7128).
V2350	Cyg =	771114	= Johnson 94 (NGC 7128) = WEBDA 68 (NGC 7128).
V2351	Cyg =	771115	= Johnson 70 (NGC 7128) = WEBDA 1106 (NGC 7128).
V2352	Cyg =	771117	= Johnson 79 (NGC 7128) = WEBDA 1089 (NGC 7128).
V2353	Cyg =	771118	= Johnson 32 (NGC 7128) = WEBDA 1081 (NGC 7128).
V2354	Cyg =	771119	= Johnson 12 (NGC 7128) = WEBDA 12 (NGC 7128).
V2355	Cyg =	771120	= Johnson 11 (NGC 7128) = WEBDA 11 (NGC 7128) = GSC 3967.01770.
V2356	Cyg =	771121	= GSC 2725.01671 = IRAS 21426+3413 = LD 415.
V2357	Cyg =	771122	= GSC 2730.00323 = IRAS 21440+3542 = LD 416.
V2358	Cyg =	771123	= IRAS 21449+4950 = NSV 25767.
V2359	Cyg =	771129	= GSC 3968.01113 = IRAS 21546+5331 = Tmz V793.
V2360	Cyg =	771131	= CCS-I 3091 = CCS-II 5515 = GSC 3968.00437 = IRAS 21557+5333
			= Tmz V792.
NY	Del =	771020	= GSC 0509.00533 = IRAS 20228+0715 = Brh V86.
NZ	Del =	771055	= GSC 0520.01979 = IRAS 20492+0343 = Brh V56.
BB	Dor =	770170	= EC 05287–5857 = GSC 8530.00528.
LL	Dra =	770282	= BD +69°665 = GSC 4394.01339 = IRAS 12274+6854 = NPM +68.0224
			= PPM 018255 = SAO 015812.
LM	Dra =	770335	= GSC 3881.01670NE = PG 1618+563.
LN	Dra =	770622	= GSC 3889.01362 = ROTSE1 J174555.29+523805.8.
LO	Dra =	770771	= GSC 3536.00110 = LD 342.
LP	Dra =	770782	= BD +69°968 = EXO 181022.2+6939.9 = GSC 4433.00935 = HD 167605
			= HIP 089005 = LTT 15387 = PPM 020780 = SAO 017800.
LQ	Dra =	770793	= GSC 3533.01400 = ROTSE1 J181941.87+501037.3.
LR	Dra =	770796	= GSC 3537.01908 = LD 344 = StM 431 = ROTSE1 J182148.31+512419.2.
LS	Dra =	770801	= HS 1824+5745.
LT	Dra =	770816	= BD +51°2410 = GSC 3539.01298 = HD 172468 = HIP 091329
			= IRAS 18365+5154 = NSV 24534 = PPM 036735 = SAO 031077.
LU	Dra =	770833	= GSC 3553.01117 = ROTSE1 J185901.50+522814.9.
LV	Dra =	770835	= BD +50°2708 = BS 7210 = GSC 3549.02883 = HD 177003 = HIP 093299
			= PPM 037005 = SAO 031311.
LW	Dra =	770873	= BV 62 = CSV 8121 = GSC 4431.00546 = NSV 11766.
LX	Dra =	770881	= GSC 4431.01446.
LY	Dra =	770929	= BD +65°1332 = GSC 4229.00639 = IRAS 19136+6557 = PPM 021377
			= SAO 018321.
LZ	Dra =	770964	= BV 238 = CSV 8245 = GSC 4456.01244 = NSV 12223.
MM	Dra =	770999	= #5 for 1ES 1959+650.
MN	Dra =	771018	= Antipin Var 73.
MO	Dra =	771019	= GSC 4237.00719.
HZ	Eri =	770131	= BD –14°719 = GSC 5309.00696 = IRAS 03375–1347 = Tmz V777
			= NPM –13.0513.
II	Eri =	770137	= CoD –30°1531 = GSC 7029.01213 = IRAS 03499–3041 = Tmz V760.
IK	Eri =	770144	= BD –16°793 = GSC 5883.00256 = HD 26298 = HIP 019383 = PPM 213909
			= SAO 149411.
IL	Eri =	770147	= GSC 5316.00435 = IRAS 04147–1220 = Tmz V778 = NPM –12.0632.
IM	Eri =	770149	= CPD –20°562 = EC 04224–2014 = GSC 5896.00080 = NPM –20.0533.
IN	Eri =	770151	= CoD –30°1936 = GSC 6471.00883 = IRAS 04377–2951 = Tmz V761.
IO	Eri =	770158	= BD –05°1073 = CSV 454 = GSC 4745.01397 = HV 10413
			= IRAS 04510–0539 = NSV 01756.
AP	For =	770110	= CoD –29°966 = GSC 6436.01533 = IRAS 02371–2940 = Tmz V759.
AQ	For =	770128	= CoD –26°1346 = GSC 6450.00862 = IRAS 03323–2547 = Tmz V776.
V366	Gem =	770191	= CCS-II 1334 = GSC 1884.01590 = IRAS 06358+2532 = Tmz V755.
V367	Gem =	770194	= GSC 1342.01261.
V368	Gem =	770196	= IRAS 06448+1639 = NSV 17190.
V369	Gem =	770200	= BD +26°1435 = GSC 1899.00688 = HD 52452 = NSV 17281 = PPM 096933
			= RE J070222+255054 = SAO 078998.
V370	Gem =	770205	= GSC 1360.01358 = IRAS 07267+1644 = Brh V71.
V1021	Her =	770328	= GSC 3493.01158.

Table 2 (continued)

V1022 Her = 770329 = GSC 3493.00742.
V1023 Her = 770330 = GSC 3493.01097.
V1024 Her = 770333 = GSC 2038.00674 = ROTSE1 J161005.08+253654.9.
V1025 Her = 770336 = GSC 2047.00270 = ROTSE1 J162108.79+253924.1.
V1026 Her = 770338 = GSC 2048.00120 = ROTSE1 J163153.48+252717.2.
V1027 Her = 770339 = GSC 0972.00932 = ROTSE1 J163213.55+133847.6.
V1028 Her = 770340 = GSC 0968.00535 = ROTSE1 J163516.73+124618.9.
V1029 Her = 770341 = GSC 0390.01871 = IRAS 16330+0405 = Brh V45.
V1030 Her = 770343 = GSC 0392.02129 = IRAS 16425+0415 = Brh V46.
V1031 Her = 770344 = GSC 1528.00683 = ROTSE1 J164508.42+203701.5.
V1032 Her = 770345 = GSC 2588.00069 = ROTSE1 J164755.15+351756.5.
V1033 Her = 770347 = GSC 2066.01210 = ROTSE1 J165039.95+274420.0
= ROTSE1 J165039.99+274421.1.
V1034 Her = 770349 = GSC 0983.01044 = ROTSE1 J165241.80+124905.2.
V1035 Her = 770350 = GSC 3071.00260 = ROTSE1 J165252.60+383930.6
= ROTSE1 J165252.61+383930.4.
V1036 Her = 770353 = GSC 2063.00902 = ROTSE1 J165551.74+245335.9
= ROTSE1 J165551.78+245336.1.
V1037 Her = 770355 = GSC 2071.00671 = ROTSE1 J165656.96+291907.1.
V1038 Her = 770356 = GSC 2594.01289 = ROTSE1 J165819.76+334022.8
= ROTSE1 J165819.81+334022.2.
V1039 Her = 770358 = GSC 1522.00599 = ROTSE1 J165924.08+151220.7.
V1040 Her = 770359 = GSC 1530.01382 = ROTSE1 J165930.95+191256.1.
V1041 Her = 770360 = GSC 3504.00856 = ROTSE1 J170101.20+492314.7.
V1042 Her = 770362 = GSC 1534.00753 = ROTSE1 J170250.47+213959.0.
V1043 Her = 770364 = GSC 3504.00168 = ROTSE1 J170610.49+495523.6.
V1044 Her = 770368 = GSC 3073.00837 = ROTSE1 J171017.73+382639.0.
V1045 Her = 770369 = BD +46°2274 = GSC 3501.02083 = ROTSE1 J171059.94+461719.7.
V1046 Her = 770370 = GSC 2061.00529 = ROTSE1 J171130.30+231411.2.
V1047 Her = 770371 = ROTSE1 J171239.42+330800.2.
V1048 Her = 770372 = CCS-II 3801 = FHLCS J1714.9+4210.
V1049 Her = 770373 = BD +21°3079 = GSC 1548.00713 = PPM 105732
= ROTSE1 J171642.01+212305.9.
V1050 Her = 770374 = GSC 3073.01983 = ROTSE1 J171649.91+382159.8.
V1051 Her = 770375 = GSC 2069.00150 = ROTSE1 J171727.89+271301.9.
V1052 Her = 770376 = GSC 1548.00678 = ROTSE1 J171824.82+222850.0.
V1053 Her = 770377 = GSC 2604.01671 = ROTSE1 J171839.88+355423.8.
V1054 Her = 770379 = GSC 0990.00545 = ROTSE1 J172007.77+133956.4.
V1055 Her = 770381 = GSC 3094.00120 = ROTSE1 J172023.86+411515.3.
V1056 Her = 770383 = BD +41°2822 = GSC 3090.01337 = PPM 056133
= ROTSE1 J172142.55+405423.5 = SAO 046665.
V1057 Her = 770384 = GSC 1541.02560 = ROTSE1 J172303.57+175701.2.
V1058 Her = 770389 = GSC 2605.00545 = ROTSE1 J172601.97+304710.4.
V1059 Her = 770390 = GSC 2079.01360 = ROTSE1 J172659.31+244147.6.
V1060 Her = 770391 = GSC 2083.00557 = ROTSE1 J172741.29+274503.5.
V1061 Her = 770392 = BD +21°3132 = GSC 1550.01808 = ROTSE1 J172817.01+211557.0.
V1062 Her = 770395 = GSC 3099.00905 = ROTSE1 J173454.24+441152.2.
V1063 Her = 770397 = BD +30°3032 = GSC 2606.01006 = PPM 080387
= ROTSE1 J173621.16+303212.7 = SAO 066171.
V1064 Her = 770400 = GSC 2618.01282 = ROTSE1 J173921.13+354208.6.
V1065 Her = 770401 = GSC 2084.00777 = ROTSE1 J174103.55+273429.1.
V1066 Her = 770402 = GSC 3514.00790 = ROTSE1 J174150.84+475104.3.
V1067 Her = 770403 = GSC 3100.01616 = ROTSE1 J174311.02+432709.0.
V1068 Her = 770404 = GSC 3514.00864 = ROTSE1 J174323.11+475142.3.
V1069 Her = 770758 = GSC 3510.00396 = ROTSE1 J174743.80+463230.6.
V1070 Her = 770760 = GSC 2619.00833 = ROTSE1 J174953.04+370839.6.
V1071 Her = 770765 = GSC 3515.00865 = ROTSE1 J175852.80+481025.0.
V1072 Her = 770766 = GSC 3519.00401 = ROTSE1 J175909.41+493607.4.
V1073 Her = 770780 = GSC 2625.01563 = ROTSE1 J180835.74+334205.7.
V1074 Her = 770785 = GSC 2622.01151 = NSV 10369 = ROTSE1 J181210.81+305512.9 = S 8606.

Table 2 (continued)

V1075 Her = 770787 = BD +50°2552 = EXO 181511.2+5013.1 = GSC 3533.01354 = HD 234601 = PPM 036493 = SAO 030858.
V1076 Her = 770803 = AFGL 2155 = IRAS 18240+2326.
V1077 Her = 770813 = GSC 1578.01162 = Q1991/068 = TAV 1831+19 = NSV 24505.
V390 Hya = 770215 = GSC 4847.01513 = FASTT 0448.
V391 Hya = 770258 = EC 10560–2902 = GSC 6647.01323.
V392 Hya = 770259 = EC 10565–2858 = GSC 6647.01586.
V393 Hya = 770260 = EC 10578–2935.
V394 Hya = 770268 = GSC 7220.00509 = IRAS 11350–3203 = Tmz V770.
V395 Hya = 770279 = CSV 1812 = EC 11588–3142 = GSC 7235.01430 = HV 11655 = NSV 05428.
V396 Hya = 770296 = L 854-035 = CE 315.
V441 Lac = 771137 = GSC 3969.02430.
V442 Lac = 771141 = GSC 3633.00636 = HIP 112887 = IRAS 22495+5134 = Central star of the planetary nebula M2-54 = NSV 25967 = PK 104–6°1. Quasi-periodic brightness variations of a planetary nebula, possibly due to variable mass loss or pulsations.
GM Leo = 770246 = BD +12°2138 = GSC 0833.01307 = HD 87271 = HIP 049328 = NSV 18327 = PPM 127078 = SAO 098931.
GN Leo = 770250 = BD +26°2077 = GSC 1972.00454 = HD 89810 = IRAS 10196+2545 = IRC +30220 = NPM +25.0418 = NSV 04832 = PPM 100303 = RAFGL 4779S = SAO 081314.
GO Leo = 770270 = V16.
GP Leo = 770272 = GSC 0867.00545 = Brh V44.
GQ Leo = 770273 = BPM 87617 = GSC 0870.00798 = 2RE J114746+125404 = RX J114746+125408.
GR Leo = 770276 = BD +20°2661 = G 121-035 = GSC 1443.00873 = HD 103847 = HIP 058314 = LTT 13306 = NSV 19053 = PPM 128678 = SAO 082073.
KQ Lib = 770315 = GSC 5582.00545 = Brh V3.
KR Lib = 770324 = GSC 6790.00500 = IRAS 15435–2943 = Had V95.
NT Lup = 770308 = CoD –43°9127 = CPD –43°6590 = GSC 7818.01912 = VGS 19.
NU Lup = 770327 = Had V74.
NV Lup = 770332 = IRAS 15596–3509 = Had V86.
DU Lyn = 770208 = AFGL 1186 = BD +37°1769 = BS 2999 = GSC 2959.01907 = HD 62647 = HIP 037946 = IRAS 07433+3738 = IRC +40186 = NSV 03721 = PPM 073096 = SAO 060328.
DV Lyn = 770216 = FBS 0815+427 = HS 0815+4243 = KUV 08159+4243.
V569 Lyr = 770786 = GSC 3103.00919 = ROTSE1 J181521.80+390545.4 = ROTSE1 J181521.82+390544.8.
V570 Lyr = 770790 = IRAS 18158+4235 = LD 343 = ROTSE1 J181724.82+423614.8.
V571 Lyr = 770794 = GSC 3116.01047 = ROTSE1 J182102.31+443841.1 = ROTSE1 J182102.34+443840.5.
V572 Lyr = 770795 = BD +42°3060 = GSC 3112.00179 = ROTSE1 J182138.35+421008.6.
V573 Lyr = 770798 = BD +40°3354 = GSC 3108.01692 = ROTSE1 J182301.05+400833.0 = ROTSE1 J182301.06+400833.1.
V574 Lyr = 770804 = GSC 2636.01753 = ROTSE1 J182712.15+361436.8.
V575 Lyr = 770808 = GSC 2118.00297 = ROTSE1 J182943.22+280955.2.
V576 Lyr = 770817 = GSC 3113.01384 = ROTSE1 J183907.69+415653.5.
V577 Lyr = 770820 = GSC 3527.01195 = NPM +45.1249 = NSV 11259 = ROTSE1 J184241.47+452902.9 = S 9326.
V578 Lyr = 770825 = GSC 3122.02898 = IRAS 18480+4054 = LD 346 = StM 439.
V579 Lyr = 770827 = GSC 3131.00476 = ROTSE1 J185052.26+434007.1.
V580 Lyr = 770828 = GSC 2646.01938 = ROTSE1 J185110.44+353556.1.
V581 Lyr = 770830 = GSC 2650.01900 = ROTSE1 J185343.48+372338.0.
V582 Lyr = 770832 = GSC 3123.01618 = ROTSE1 J185538.25+405859.0.
V583 Lyr = 770865 = GSC 3120.01794 = LD 347.
V584 Lyr = 770923 = CV near RX J1910.8+2856.
V585 Lyr = 770930 = TK 4.
V586 Lyr = 770932 = GSC 3125.01819 = LD 348 = ROTSE1 J191520.86+395900.7.
V587 Lyr = 770935 = TK 5.
V588 Lyr = 770939 = GSC 3125.00632 = LD 350.
V589 Lyr = 770948 = GSC 3142.00528 = ROTSE1 J192531.82+425110.1.

Table 2 (continued)

AQ Men = 770162 = EC 05114–7955 = GSC 9373.00613.
CK Mic = 771022 = CoD –36°14221 = GSC 7467.01486 = IRAS 20297–3553 = Tmz V829.
CL Mic = 771023 = CoD –34°14457 = CPD –34°8753 = GSC 7464.01239 = IRAS 20298–3405 = Tmz V830.
CM Mic = 771028 = EC 20335–4332.
CN Mic = 771032 = CoD –33°15068 = GSC 7460.01038 = IRAS 20341–3313 = Tmz V831.
CO Mic = 771034 = GSC 6916.00677 = IRAS 20356–2815 = IRC –30433 = Tmz V835.
CP Mic = 771039 = GSC 7456.01417 = IRAS 20372–3036 = Tmz V832.
CQ Mic = 771040 = CoD –28°16847 = GSC 6933.00239 = IRAS 20381–2827 = Tmz V834.
CR Mic = 771043 = CoD –29°7273 = GSC 6933.01240 = IRAS 20397–2940 = Tmz V833.
CS Mic = 771049 = CoD –32°16171 = GSC 7461.00270 = IRAS 20415–3211 = Tmz V836.
CT Mic = 771062 = GSC 7458.00250 = IRAS 20542–3057 = Tmz V837.
CU Mic = 771068 = GSC 7969.00326 = IRAS 20599–3941 = Tmz V828.
CV Mic = 771084 = GSC 6945.01103 = IRAS 21117–2811 = Tmz V804.
CW Mic = 771096 = CoD –39°14236 = CPD –39°8936 = GSC 7979.00793 = IRAS 21207–3905 = Tmz V839.
V838 Mon = 770201 = GSC 4822.00039 = IRAS 07015–0346 = Peculiar variable in Monoceros.
V839 Mon = 770193 = BD +08°1487 = CCDM 06467+0822 = GSC 0747.02235 = HD 49015 = HIP 032475 = PPM 151219 = SAO 114392.
V840 Mon = 770195 = IRAS 06447+0817 = NSV 17188.
V841 Mon = 770197 = CCS-II 1404 = GSC 0747.02205 = IRAS 06455+0806 = Had V73.
V842 Mon = 770198 = GSC 0156.01365 = HD 264357 = PPM 151295.
V843 Mon = 770199 = GSC 0752.02349 = Brh V37.
V844 Mon = 770210 = GSC 4833.00174 = IRAS 07517–0032 = FASTT 0430 = NPM –0.0443 = NSV 03799.
V845 Mon = 770211 = V2 (NGC 2506) = GSC 5416.01502.
V846 Mon = 770212 = V3 (NGC 2506).
V847 Mon = 770213 = V1 (NGC 2506) = GSC 5416.02850.
V2540 Oph = 770399 = Had V105 = Nova Oph 2002.
V2541 Oph = 770348 = IRAS 16492–1533 = Toa V6.
V2542 Oph = 770351 = BD –01° 3268 = BS 6277 = GSC 5051.01355 = HD 152569 = HIP 082693 = IDS 1649.0S0127A = PPM 179954 = SAO 141427.
V2543 Oph = 770352 = GSC 0397.01417 = IRAS 16529+0726 = Brh V83.
V2544 Oph = 770354 = GSC 0393.02695 = IRAS 16537+0357 = Brh V74.
V2545 Oph = 770361 = GSC 0406.01063 = Brh V75.
V2546 Oph = 770363 = GSC 6219.00289 = IRAS 17002–1523 = Toa V7.
V2547 Oph = 770365 = IRAS 17046–1047 = Toa V5.
V2548 Oph = 770366 = AFGL 1922 = IRAS 17049–2440 = NSV 20950.
V2549 Oph = 770367 = GSC 0985.00811 = ROTSE1 J170922.13+123957.6.
V2550 Oph = 770378 = GSC 0408.01049 = Brh V76.
V2551 Oph = 770380 = GSC 6242.00067 = Had V90.
V2552 Oph = 770385 = GSC 6825.00253 = Had V98.
V2553 Oph = 770386 = GSC 1003.01915 = ROTSE1 J172441.74+135356.5.
V2554 Oph = 770387 = GSC 6238.02149 = IRAS 17222–1731 = Had V64.
V2555 Oph = 770388 = GSC 0409.00571 = Brh V72.
V2556 Oph = 770396 = GSC 0422.01393 = IRAS 17330+0407 = Brh V73.
V2557 Oph = 770398 = GSC 6252.02446 = Had V102 = Tmz V794.
V2558 Oph = 770721 = GSC 0424.01783 = Brh V49.
V2559 Oph = 770759 = IRAS 17470–0618 = Had V66.
V2560 Oph = 770763 = GSC 0425.01726 = Brh V81.
V2561 Oph = 770768 = SN 1999bs in UGC 11093. Not a supernova.
V2562 Oph = 770774 = GSC 0442.00382 = Brh V88.
V2563 Oph = 770776 = GSC 0430.01613 = NSV 10148 = S 9858.
V2564 Oph = 770777 = BD +03°3579 = GSC 0438.00437 = HD 165195 = HIP 088527 = IRAS 18021+0346 = PPM 165118 = SAO 123093.
V2565 Oph = 770779 = GSC 0438.01478 = Brh V78.
V2566 Oph = 770783 = IRAS 18073+0032 = Toa V1.
V2567 Oph = 770789 = GSC 0440.01426 = Brh V51.
V2568 Oph = 770791 = GSC 0440.00884 = IRAS 18164+0410 = Brh V82.
V2569 Oph = 770802 = GSC 0441.01696 = IRAS 18228+0350 = Brh V50.

Table 2 (continued)

V2570 Oph =	770805	= BD +07°3702 = GSC 1023.01281 = HD 170270 = IRAS 18257+0755 = PPM 165889 = SAO 123522.
V2571 Oph =	770807	= IRAS 18270+0326 = Mis V0958.
V2572 Oph =	770809	= IRAS 18278+0345 = Mis V0959.
V1636 Ori =	770154	= HS 0444+0458.
V1637 Ori =	770156	= AN 220.1943 = CSV 453 = GSC 4741.00842 = NSV 01754 = S 3545.
V1638 Ori =	770157	= GSC 4741.01263.
V1639 Ori =	770161	= GSC 0689.01745 = V13.
V1640 Ori =	770164	= GSC 0703.01930 = Brh V35.
V1641 Ori =	770168	= BV 1612 = CCS-II 937 = GSC 5336.01349 = IRAS 05221–1042 = NPM –10.0755 = NSV 01966.
V1642 Ori =	770169	= GSC 0101.01622 = 1RXS J052922.5+004112 = RX J0529.4+0041.
V1643 Ori =	770172	= BD –07°1112 = GSC 4778.00324.
V1644 Ori =	770181	= IRAS 05552+1720 = NSV 16737.
V1645 Ori =	770185	= BD –02°1441 = GSC 4786.01600 = HD 291070 = IRAS 05586–0215 = SAO 132747.
V1646 Ori =	770187	= GSC 1314.01193 = IRAS 06128+1629 = Brh V66.
V380 Peg =	771098	= GSC 1675.01355 = IRAS 21231+2212 = LD 404.
V381 Peg =	771099	= GSC 1123.01704 = Brh V28.
V382 Peg =	771101	= GSC 2188.00931 = LD 405.
V383 Peg =	771102	= IRAS 21290+2630 = LD 406.
V384 Peg =	771125	= HS 2149+0847.
V385 Peg =	771126	= GSC 2214.01992 = LD 417.
V386 Peg =	771127	= GSC 2726.01773 = LD 418.
V387 Peg =	771128	= HS 2151+0857 = PG 2151+089.
V388 Peg =	771130	= RX J2157.5+0855 = 1RXS J215731.4+085458.
V389 Peg =	771132	= GSC 2215.00401 = IRAS 21574+2925 = LD 419.
V390 Peg =	771133	= BD +28°4272 = GSC 2215.01657 = IRAS 21599+2831 = PPM 113938 = SAO 090186.
V391 Peg =	771134	= GSC 2212.01369 = HS 2201+2610.
V392 Peg =	771136	= GSC 2216.01795 = LD 420.
V393 Peg =	771140	= Gr 908 = PG 2246+121 = WD 2246+120.
V394 Peg =	771142	= EG 231 = GD 244 = LP 521-049 = NPM +12.2001 = WD 2254+126.
V395 Peg =	771148	= BD +16°4908 = GSC 1713.01195 = NPM +16.1308 = PPM 142416.
V396 Peg =	771150	= GSC 1172.01452 = Brh V30.
V658 Per =	770067	= GSC 3292.01500 = IRAS 01530+5148 = Tmz V851.
V659 Per =	770071	= GSC 3689.01766 = IRAS 01583+5508 = Tmz V853.
V660 Per =	770073	= GSC 3288.00131 = IRAS 02001+5009 = Tmz V856.
V661 Per =	770074	= GSC 3697.00526 = IRAS 02016+5802 = Tmz V872.
V662 Per =	770075	= GSC 3685.00962 = IRAS 02038+5359 = Tmz V855.
V663 Per =	770081	= IRAS 02117+5559 = NSV 15464.
V664 Per =	770086	= GSC 3690.02539 = IRAS 02127+5434 = Tmz V857.
V665 Per =	770087	= BD +56°508 = Oo 839 (NGC 869) = GSC 3694.02053 = PPM 027412 = SAO 023170.
V666 Per =	770092	= GSC 3686.00504 = IRAS 02183+5304 = Tmz V858.
V667 Per =	770095	= GSC 3686.00015 = IRAS 02219+5357 = Tmz V859.
V668 Per =	770096	= GSC 3694.00975 = IRAS 02221+5751 = Tmz V879.
V669 Per =	770100	= GSC 3687.01863 = IRAS 02243+5333 = NSV 15510.
V670 Per =	770103	= GSC 3687.01576 = IRAS 02279+5303 = Tmz V860.
V671 Per =	770118	= IRAS 02470+5536 = NSV 15588.
V672 Per =	770121	= GSC 3297.00083 = IRAS 02529+4541 = Toa V12.
V673 Per =	770123	= IRAS 03022+5409 = NSV 15632.
V674 Per =	770129	= V12.
V675 Per =	770132	= IRAS 03371+4932 = NSV 15734.
V676 Per =	770140	= IRAS 03557+4404 = NSV 15855.
V677 Per =	770148	= IRAS 04209+4800 = NSV 15967.
AG Pic =	770173	= GSC 8527.00373.
AH Pic =	770179	= EC 05565–5935 = GSC 8532.00218.
DX Psc =	770004	= GSC 0006.01478 = IRAS 00197+0318 = Tmz V797.
DY Psc =	770005	= L 585-086 = BRI 0021–0214 = BRI B0021–0214.
DZ Psc =	770007	= BD +20°75 = BV 0121 = CSV 5863 = GSC 1193.00972 = NSV 00223.

Table 2 (continued)

EE	Psc =	770015	= GSC 0608.00143.
EF	Psc =	770021	= GSC 1753.01577 = IRAS 01047+2910 = Tmz V780 = NPM +29.0053.
EG	Psc =	770024	= GSC 1747.01016 = IRAS 01083+2335 = Tmz V781.
EH	Psc =	770039	= GSC 1754.00267 = IRAS 01253+2816 = Tmz V782.
EI	Psc =	771149	= 1RXS J232953.9+062814.
XX	PsA =	771104	= CoD –26°15684 = GSC 6943.00765 = IRAS 21315–2555 = Tmz V758.
XY	PsA =	771143	= CoD –27°16125 = GSC 6974.00171 = IRAS 22551–2715 = Tmz V779.
V569	Pup =	770204	= AFGL 1131 = CCS-I 776 = CCS-II 1732 = GSC 5987.02384 = IRAS 07270–1921 = IRC –20131 = NSV 03610.
V570	Pup =	770206	= IRAS 07294–2610 = Toa V4.
V571	Pup =	770207	= GSC 5409.01201.
V572	Pup =	770214	= GSC 7121.02679 = LSS 992 = RX J0812.4–3114.
V573	Pup =	770217	= BD –14°2487 = GSC 5997.00597 = IRAS 08192–1516 = PPM 219998 = SAO 154153.
CN	Pyx =	770224	= BV 860 = GSC 6023.01214 = IRAS 08374–2058 = NSV 04182.
CO	Pyx =	770233	= AN 852.1936 = CoD –25°6520 = CSV 1359 = GSC 6575.02880 = HV 8155 = IRAS 08430–2548 = NSV 04234 = Prager 3224.
CP	Pyx =	770236	= AN 856.1936 = CSV 1376 = GSC 6576.01333 = HV 8163 = IRAS 08505–2503 = NSV 04286.
CQ	Pyx =	770239	= AFGL 5254 = IRAS 09116–2439 = NSV 18155.
VX	Ret =	770141	= EC 04030–5801 = GSC 8507.00160.
V356	Sge =	770837	= Mis V0981.
V357	Sge =	770975	= Mis V0982.
V358	Sge =	771008	= Standard 33 for WZ Sge.
V4739	Sgr =	770800	= Nova Sgr 2001 No.2.
V4740	Sgr =	770784	= Nova Sgr 2001 No.3.
V4741	Sgr =	770767	= Nova Sgr 2002 No.1.
V4742	Sgr =	770770	= Nova Sgr 2002 No.2.
V4743	Sgr =	770836	= Nova Sgr 2002 No.3.
V4744	Sgr =	770757	= Nova Sgr 2002 No.4.
V4745	Sgr =	770818	= Nova Sgr 2003.
V4746	Sgr =	770406	= GMCS 25-7.
V4747	Sgr =	770407	= GMCS 23-50.
V4748	Sgr =	770408	= GMCS 23-5.
V4749	Sgr =	770409	= GMCS 23-42.
V4750	Sgr =	770410	= GMCS 21-38.
V4751	Sgr =	770411	= GMCS 22-60.
V4752	Sgr =	770412	= GMCS 22-100.
V4753	Sgr =	770413	= GMCS 24-29.
V4754	Sgr =	770414	= GMCS 23-114.
V4755	Sgr =	770415	= GMCS 21-185.
V4756	Sgr =	770416	= GMCS 21-17.
V4757	Sgr =	770417	= GMCS 22-166.
V4758	Sgr =	770418	= GMCS 22-14.
V4759	Sgr =	770419	= GMCS 23-8.
V4760	Sgr =	770420	= GMCS 25-23.
V4761	Sgr =	770421	= GMCS 23-22.
V4762	Sgr =	770422	= GMCS 23-75.
V4763	Sgr =	770423	= IRAS 17417–2904 = GMCS 22-136.
V4764	Sgr =	770424	= GMCS 23-15.
V4765	Sgr =	770425	= GMCS 22-30.
V4766	Sgr =	770426	= GMCS 21-72.
V4767	Sgr =	770427	= GMCS 24-108.
V4768	Sgr =	770428	= GMCS 23-28.
V4769	Sgr =	770429	= GMCS 23-62.
V4770	Sgr =	770430	= GMCS 22-9.
V4771	Sgr =	770431	= GMCS 21-39.
V4772	Sgr =	770432	= GMCS 24-17.
V4773	Sgr =	770433	= GMCS 22-7.
V4774	Sgr =	770434	= GMCS 21-27.
V4775	Sgr =	770435	= GMCS 21-6.

Table 2 (continued)

V4776 Sgr = 770436 = GMCS 22-27.
V4777 Sgr = 770437 = GMCS 23-37.
V4778 Sgr = 770438 = GMCS 23-18.
V4779 Sgr = 770439 = GMCS 22-4 = OH 359.838+0.053.
V4780 Sgr = 770440 = GMCS 22-21.
V4781 Sgr = 770441 = GMCS 23-30 = OH 359.864+0.068.
V4782 Sgr = 770442 = GMCS 22-5.
V4783 Sgr = 770443 = GMCS 22-1.
V4784 Sgr = 770444 = GMCS 21-12.
V4785 Sgr = 770445 = GMCS 22-95.
V4786 Sgr = 770446 = GMCS 22-22.
V4787 Sgr = 770447 = GMCS 22-16.
V4788 Sgr = 770448 = GMCS 23-3305.
V4789 Sgr = 770449 = GMCS 22-120.
V4790 Sgr = 770450 = GMCS 23-10 = OH 359.864+0.056.
V4791 Sgr = 770451 = GMCS 22-11.
V4792 Sgr = 770452 = GMCS 22-31.
V4793 Sgr = 770453 = GMCS 22-35.
V4794 Sgr = 770454 = GMCS 23-7.
V4795 Sgr = 770455 = GMCS 24-28.
V4796 Sgr = 770456 = GMCS 24-2 = GMCS 23-1198.
V4797 Sgr = 770457 = GMCS 23-46.
V4798 Sgr = 770458 = GMCS 25-9.
V4799 Sgr = 770459 = GMCS 23-32.
V4800 Sgr = 770460 = GMCS 20-64.
V4801 Sgr = 770461 = GMCS 20-133.
V4802 Sgr = 770462 = GMCS 23-371.
V4803 Sgr = 770463 = GMCS 20-22 = GMCS 21-8.
V4804 Sgr = 770464 = GMCS 16-2993.
V4805 Sgr = 770465 = GMCS 19-2.
V4806 Sgr = 770466 = GMCS 16-227.
V4807 Sgr = 770467 = GMCS 20-34.
V4808 Sgr = 770468 = GMCS 18-22.
V4809 Sgr = 770469 = GMCS 20-25.
V4810 Sgr = 770470 = GMCS 20-11.
V4811 Sgr = 770471 = GMCS 17-5.
V4812 Sgr = 770472 = GMCS 16-1.
V4813 Sgr = 770473 = GMCS 19-3321.
V4814 Sgr = 770474 = GMCS 16-37.
V4815 Sgr = 770475 = GMCS 20-99.
V4816 Sgr = 770476 = GMCS 16-47.
V4817 Sgr = 770477 = GMCS 19-57.
V4818 Sgr = 770478 = GMCS 16-75.
V4819 Sgr = 770479 = GMCS 19-48.
V4820 Sgr = 770480 = GMCS 19-3.
V4821 Sgr = 770481 = GMCS 17-8.
V4822 Sgr = 770482 = GMCS 17-630 = OH 359.947+0.066.
V4823 Sgr = 770483 = GMCS 20-70.
V4824 Sgr = 770484 = GMCS 17-58.
V4825 Sgr = 770485 = GMCS 19-58.
V4826 Sgr = 770486 = GMCS 18-14.
V4827 Sgr = 770487 = GMCS 20-43.
V4828 Sgr = 770488 = GMCS 20-46.
V4829 Sgr = 770489 = GMCS 16-286.
V4830 Sgr = 770490 = GMCS 19-7.
V4831 Sgr = 770491 = GMCS 19-9.
V4832 Sgr = 770492 = GMCS 20-60.
V4833 Sgr = 770493 = GMCS 16-32.
V4834 Sgr = 770494 = GMCS 18-6.
V4835 Sgr = 770495 = GMCS 17-119.
V4836 Sgr = 770496 = GMCS 19-54.

Table 2 (continued)

V4837 Sgr = 770497 = GMCS 20-116.
V4838 Sgr = 770498 = GMCS 16-93.
V4839 Sgr = 770499 = GMCS 16-98.
V4840 Sgr = 770500 = GMCS 19-780.
V4841 Sgr = 770501 = GMCS 20-522.
V4842 Sgr = 770502 = GMCS 19-660.
V4843 Sgr = 770503 = GMCS 19-685 = OH 359.869–0.018.
V4844 Sgr = 770504 = GMCS 20-74.
V4845 Sgr = 770505 = GMCS 16-36.
V4846 Sgr = 770506 = GMCS 19-128.
V4847 Sgr = 770507 = GMCS 17-57.
V4848 Sgr = 770508 = GMCS 17-16.
V4849 Sgr = 770509 = GMCS 17-70.
V4850 Sgr = 770510 = GMCS 18-173 = OH 000.042+0.082.
V4851 Sgr = 770511 = GMCS 17-15.
V4852 Sgr = 770512 = GMCS 19-82.
V4853 Sgr = 770513 = GMCS 18-74 = OH 000.051+0.079.
V4854 Sgr = 770514 = GMCS 19-136.
V4855 Sgr = 770515 = GMCS 16-29.
V4856 Sgr = 770516 = GMCS 20-136 = OH 359.791–0.081.
V4857 Sgr = 770517 = GMCS 18-12.
V4858 Sgr = 770518 = GMCS 17-9.
V4859 Sgr = 770519 = GMCS 16-59.
V4860 Sgr = 770520 = GMCS 17-118.
V4861 Sgr = 770521 = GMCS 16-288.
V4862 Sgr = 770522 = GMCS 16-15.
V4863 Sgr = 770523 = GMCS 16-28.
V4864 Sgr = 770524 = GMCS 16-8.
V4865 Sgr = 770525 = GMCS 17-95.
V4866 Sgr = 770526 = GMCS 16-77.
V4867 Sgr = 770527 = GMCS 18-190.
V4868 Sgr = 770528 = GMCS 17-11.
V4869 Sgr = 770529 = GMCS 17-34.
V4870 Sgr = 770530 = GMCS 19-45.
V4871 Sgr = 770531 = GMCS 16-127.
V4872 Sgr = 770532 = GMCS 16-5.
V4873 Sgr = 770533 = GMCS 17-3762 = OH 359.990+0.030.
V4874 Sgr = 770534 = GMCS 19-64.
V4875 Sgr = 770535 = GMCS 19-613 = OH 359.830–0.070.
V4876 Sgr = 770536 = IRAS 17423–2855 = GMCS 17-59.
V4877 Sgr = 770537 = GMCS 4-6 = GMCS 19-23.
V4878 Sgr = 770538 = GMCS 3-271 = GMCS 16-80.
V4879 Sgr = 770539 = GMCS 2-3 = GMCS 16-24 = GMCS 17-1.
V4880 Sgr = 770540 = GMCS 3-266 = GMCS 16-49 = OH 359.938–0.010.
V4881 Sgr = 770541 = GMCS 2-145.
V4882 Sgr = 770542 = GMCS 3-2834.
V4883 Sgr = 770543 = GMCS 3-247.
V4884 Sgr = 770544 = GMCS 4-23.
V4885 Sgr = 770545 = GMCS 3-300.
V4886 Sgr = 770546 = GMCS 5-164.
V4887 Sgr = 770547 = GMCS 2-18 = GMCS 3-7655.
V4888 Sgr = 770548 = GMCS 3-49.
V4889 Sgr = 770549 = GMCS 5-158.
V4890 Sgr = 770550 = GMCS 3-1030 = OH 359.906–0.036.
V4891 Sgr = 770551 = GMCS 3-162.
V4892 Sgr = 770552 = GMCS 4-28.
V4893 Sgr = 770553 = GMCS 3-116.
V4894 Sgr = 770554 = GMCS 5-59.
V4895 Sgr = 770555 = GMCS 3-131.
V4896 Sgr = 770556 = GMCS 2-52.
V4897 Sgr = 770557 = GMCS 1-26.

Table 2 (continued)

V4898 Sgr = 770558 = GMCS 3-50.
V4899 Sgr = 770559 = GMCS 3-108.
V4900 Sgr = 770560 = GMCS 3-61.
V4901 Sgr = 770561 = GMCS 3-220.
V4902 Sgr = 770562 = GMCS 2-697 = OH 000.024+0.027.
V4903 Sgr = 770563 = GMCS 4-9.
V4904 Sgr = 770564 = GMCS 3-57.
V4905 Sgr = 770565 = GMCS 5-157.
V4906 Sgr = 770566 = GMCS 4-33.
V4907 Sgr = 770567 = GMCS 2-58.
V4908 Sgr = 770568 = GMCS 4-26.
V4909 Sgr = 770569 = GMCS 1-41.
V4910 Sgr = 770570 = GMCS 3-270.
V4911 Sgr = 770571 = GMCS 3-88.
V4912 Sgr = 770572 = GMCS 2-1.
V4913 Sgr = 770573 = GMCS 2-26.
V4914 Sgr = 770574 = GMCS 5-27.
V4915 Sgr = 770575 = GMCS 1-31.
V4916 Sgr = 770576 = GMCS 2-10.
V4917 Sgr = 770577 = GMCS 4-85.
V4918 Sgr = 770578 = GMCS 2-11.
V4919 Sgr = 770579 = GMCS 2-46.
V4920 Sgr = 770580 = IRAS 17424–2859×1 = GMCS 3-2753.
V4921 Sgr = 770581 = GMCS 5-35.
V4922 Sgr = 770582 = IRAS 17424–2852 = GMCS 2-13 = NSV 23734.
V4923 Sgr = 770583 = IRAS 17424–2859×2 = GMCS 3-72.
V4924 Sgr = 770584 = GMCS 2-9.
V4925 Sgr = 770585 = GMCS 1-46.
V4926 Sgr = 770586 = GMCS 2-27.
V4927 Sgr = 770587 = GMCS 1-42.
V4928 Sgr = 770588 = GMCS 3-5 = OH 359.956–0.050.
V4929 Sgr = 770589 = GMCS 1-182.
V4930 Sgr = 770590 = GMCS 3-16.
V4931 Sgr = 770591 = GMCS 2-28 = OH 000.037–0.003.
V4932 Sgr = 770592 = GMCS 1-19.
V4933 Sgr = 770593 = GMCS 1-37.
V4934 Sgr = 770594 = GMCS 3-2752 = OH 359.985–0.041.
V4935 Sgr = 770595 = GMCS 1-175.
V4936 Sgr = 770596 = GMCS 2-30.
V4937 Sgr = 770597 = GMCS 2-49.
V4938 Sgr = 770598 = GMCS 2-43.
V4939 Sgr = 770599 = GMCS 2-19.
V4940 Sgr = 770600 = GMCS 4-577 = OH 359.902–0.103.
V4941 Sgr = 770601 = GMCS 2-504 = OH 000.030–0.026.
V4942 Sgr = 770602 = GMCS 2-79.
V4943 Sgr = 770603 = GMCS 1-72 = GMCS 2-101.
V4944 Sgr = 770604 = GMCS 2-33.
V4945 Sgr = 770605 = GMCS 4-22.
V4946 Sgr = 770606 = GMCS 1-2.
V4947 Sgr = 770607 = GMCS 4-17.
V4948 Sgr = 770608 = GMCS 2-6329 = OH 000.014–0.046.
V4949 Sgr = 770609 = GMCS 1-391 = OH 000.072–0.011.
V4950 Sgr = 770610 = GMCS 2-320 = OH 000.060–0.018.
V4951 Sgr = 770611 = GMCS 5-91.
V4952 Sgr = 770612 = GMCS 2-147.
V4953 Sgr = 770613 = GMCS 4-253.
V4954 Sgr = 770614 = GMCS 3-226 = OH 359.946–0.092.
V4955 Sgr = 770615 = GMCS 3-2832. Close to the N of V4521 Sgr, the periods differ considerably.
V4956 Sgr = 770616 = GMCS 1-8 = GMCS 10-171.
V4957 Sgr = 770617 = GMCS 6-247.
V4958 Sgr = 770618 = GMCS 7-350.

Table 2 (continued)

V4959 Sgr = 770619 = GMCS 10-60.
V4960 Sgr = 770620 = GMCS 9-78.
V4961 Sgr = 770621 = GMCS 8-23.
V4962 Sgr = 770623 = GMCS 10-45.
V4963 Sgr = 770624 = GMCS 7-277.
V4964 Sgr = 770625 = GMCS 6-28.
V4965 Sgr = 770626 = GMCS 7-86.
V4966 Sgr = 770627 = GMCS 10-100.
V4967 Sgr = 770628 = GMCS 10-6 = OH 000.107–0.016.
V4968 Sgr = 770629 = GMCS 10-66.
V4969 Sgr = 770630 = GMCS 7-13.
V4970 Sgr = 770631 = GMCS 9-8.
V4971 Sgr = 770632 = GMCS 8-97.
V4972 Sgr = 770633 = GMCS 8-113.
V4973 Sgr = 770634 = GMCS 9-55.
V4974 Sgr = 770635 = GMCS 8-11.
V4975 Sgr = 770636 = GMCS 8-31.
V4976 Sgr = 770637 = GMCS 9-54.
V4977 Sgr = 770638 = GMCS 9-9.
V4978 Sgr = 770639 = GMCS 6-32 = OH 359.957–0.123.
V4979 Sgr = 770640 = GMCS 9-43.
V4980 Sgr = 770641 = GMCS 9-25.
V4981 Sgr = 770642 = GMCS 7-20.
V4982 Sgr = 770643 = GMCS 7-8.
V4983 Sgr = 770644 = GMCS 7-31.
V4984 Sgr = 770645 = GMCS 6-112.
V4985 Sgr = 770646 = GMCS 9-104.
V4986 Sgr = 770647 = GMCS 6-83.
V4987 Sgr = 770648 = GMCS 10-84 = OH 000.115–0.043.
V4988 Sgr = 770649 = GMCS 9-110.
V4989 Sgr = 770650 = GMCS 7-17.
V4990 Sgr = 770651 = GMCS 9-229.
V4991 Sgr = 770652 = GMCS 10-13.
V4992 Sgr = 770653 = GMCS 9-38.
V4993 Sgr = 770654 = GMCS 6-36.
V4994 Sgr = 770655 = GMCS 9-3.
V4995 Sgr = 770656 = GMCS 7-361.
V4996 Sgr = 770657 = GMCS 9-124.
V4997 Sgr = 770658 = GMCS 7-9.
V4998 Sgr = 770659 = GMCS 10-1.
V4999 Sgr = 770660 = GMCS 7-11.
V5000 Sgr = 770661 = GMCS 10-138.
V5001 Sgr = 770662 = GMCS 6-22.
V5002 Sgr = 770663 = GMCS 6-25.
V5003 Sgr = 770664 = GMCS 9-35.
V5004 Sgr = 770665 = GMCS 8-53.
V5005 Sgr = 770666 = GMCS 7-19.
V5006 Sgr = 770667 = GMCS 9-96.
V5007 Sgr = 770668 = GMCS 6-31.
V5008 Sgr = 770669 = GMCS 7-94.
V5009 Sgr = 770670 = GMCS 10-4.
V5010 Sgr = 770671 = GMCS 8-18.
V5011 Sgr = 770672 = GMCS 10-40.
V5012 Sgr = 770673 = GMCS 8-5.
V5013 Sgr = 770674 = GMCS 9-93.
V5014 Sgr = 770675 = GMCS 6-57.
V5015 Sgr = 770676 = GMCS 6-151.
V5016 Sgr = 770677 = GMCS 9-144.
V5017 Sgr = 770678 = GMCS 10-27.
V5018 Sgr = 770679 = GMCS 6-7.
V5019 Sgr = 770680 = GMCS 6-44.

Table 2 (continued)

V5020 Sgr = 770681 = GMCS 6-21 = OH 000.017–0.137.
V5021 Sgr = 770682 = GMCS 10-5.
V5022 Sgr = 770683 = GMCS 9-67.
V5023 Sgr = 770684 = GMCS 10-26.
V5024 Sgr = 770685 = GMCS 8-2.
V5025 Sgr = 770686 = GMCS 8-15.
V5026 Sgr = 770687 = GMCS 8-8.
V5027 Sgr = 770688 = GMCS 7-127.
V5028 Sgr = 770689 = GMCS 6-156.
V5029 Sgr = 770690 = GMCS 9-94.
V5030 Sgr = 770691 = GMCS 10-55.
V5031 Sgr = 770692 = GMCS 9-4.
V5032 Sgr = 770693 = GMCS 14-53.
V5033 Sgr = 770694 = GMCS 7-52 = GMCS 14-32.
V5034 Sgr = 770695 = GMCS 9-75 = GMCS 12-46.
V5035 Sgr = 770696 = GMCS 13-45.
V5036 Sgr = 770697 = GMCS 12-140.
V5037 Sgr = 770698 = GMCS 12-71.
V5038 Sgr = 770699 = GMCS 12-13.
V5039 Sgr = 770700 = GMCS 12-145 = OH 000.067–0.123.
V5040 Sgr = 770701 = GMCS 15-5.
V5041 Sgr = 770702 = GMCS 15-26.
V5042 Sgr = 770703 = GMCS 12-47.
V5043 Sgr = 770704 = GMCS 11-15.
V5044 Sgr = 770705 = GMCS 14-24.
V5045 Sgr = 770706 = GMCS 12-4.
V5046 Sgr = 770707 = GMCS 12-79.
V5047 Sgr = 770708 = GMCS 14-17.
V5048 Sgr = 770709 = GMCS 11-49.
V5049 Sgr = 770710 = GMCS 11-34 = GMCS 14-6233.
V5050 Sgr = 770711 = GMCS 14-12.
V5051 Sgr = 770712 = GMCS 13-13.
V5052 Sgr = 770713 = GMCS 12-65.
V5053 Sgr = 770714 = GMCS 12-42.
V5054 Sgr = 770715 = GMCS 12-352.
V5055 Sgr = 770716 = GMCS 14-6.
V5056 Sgr = 770717 = GMCS 15-36.
V5057 Sgr = 770718 = GMCS 12-21.
V5058 Sgr = 770719 = GMCS 11-4503.
V5059 Sgr = 770720 = GMCS 14-16.
V5060 Sgr = 770722 = GMCS 11-14.
V5061 Sgr = 770723 = GMCS 15-24.
V5062 Sgr = 770724 = GMCS 12-799.
V5063 Sgr = 770725 = GMCS 12-1236.
V5064 Sgr = 770726 = GMCS 13-64.
V5065 Sgr = 770727 = GMCS 15-47.
V5066 Sgr = 770728 = GMCS 11-241.
V5067 Sgr = 770729 = GMCS 14-8.
V5068 Sgr = 770730 = GMCS 13-95.
V5069 Sgr = 770731 = GMCS 14-105.
V5070 Sgr = 770732 = GMCS 14-38.
V5071 Sgr = 770733 = GMCS 13-25.
V5072 Sgr = 770734 = GMCS 14-15.
V5073 Sgr = 770735 = GMCS 14-2.
V5074 Sgr = 770736 = GMCS 11-6.
V5075 Sgr = 770737 = GMCS 14-11.
V5076 Sgr = 770738 = GMCS 13-117.
V5077 Sgr = 770739 = GMCS 12-129.
V5078 Sgr = 770740 = GMCS 13-44.
V5079 Sgr = 770741 = GMCS 13-16.
V5080 Sgr = 770742 = GMCS 14-27.

Table 2 (continued)

V5081	Sgr =	770743	= GMCS 14-18 = GMCS 15-6.
V5082	Sgr =	770744	= GMCS 13-49.
V5083	Sgr =	770745	= GMCS 11-27.
V5084	Sgr =	770746	= GMCS 12-228.
V5085	Sgr =	770747	= GMCS 12-6.
V5086	Sgr =	770748	= GMCS 11-2449.
V5087	Sgr =	770749	= GMCS 14-463.
V5088	Sgr =	770750	= GMCS 13-73.
V5089	Sgr =	770751	= GMCS 11-23.
V5090	Sgr =	770752	= GMCS 14-150.
V5091	Sgr =	770753	= GMCS 15-10.
V5092	Sgr =	770754	= GMCS 12-11.
V5093	Sgr =	770755	= GMCS 12-136.
V5094	Sgr =	770756	= GMCS 13-30.
V5095	Sgr =	770761	= GSC 6828.00703 = IRAS 17482–2308 = Had V103.
V5096	Sgr =	770762	= GSC 6262.00421 = IRAS 17509–2210 = Had V83.
V5097	Sgr =	770769	= AFGL 2048 = IRAS 17590–2337 = IRC –20417 = Had V82 = Ve 2-45 = WR 104.
V5098	Sgr =	770772	= Sagar 4 (NGC 6530) = van Altena, Jones 45 (NGC 6530) = Walker 303 (NGC 6530) = GSC 6842.01487.
V5099	Sgr =	770773	= SU UMa-type cv.
V5100	Sgr =	770775	= van Altena, Jones 151 (NGC 6530) = Walker 29 (NGC 6530) = GSC 6846.00272.
V5101	Sgr =	770778	= GSC 6263.01874 = HD 313643 = IRAS 18017–2109 = LSS 4628 = Had V84 = NSV 10152 = WR 106.
V5102	Sgr =	770788	= AFGL 2103 = GSC 6265.01611 = IRAS 18135–1641 = IRC –20454 = Had V99.
V5103	Sgr =	770792	= Had V100.
V5104	Sgr =	770797	= AFGL 2135 = IRAS 18194–2708 = NSV 24415.
V5105	Sgr =	770799	= GSC 6852.04636 = Had V101.
V5106	Sgr =	770810	= IRAS 18278–1814 = Had V63.
V5107	Sgr =	770815	= Had V104.
V5108	Sgr =	770824	= AN 934.1936 = CSV 4368 = HV 9528 = IRAS 18445–2410 = Had V81 = NSV 11337 = Prager 4880.
V5109	Sgr =	770908	= GSC 6287.02439 = Tmz V795.
V5110	Sgr =	770970	= GSC 6303.00716 = IRAS 19368–1736 = Tmz V753.
V5111	Sgr =	770971	= GSC 7426.02146.
V5112	Sgr =	770991	= BD –17°5779 = GSC 6317.00218 = HD 187885 = IRAS 19500–1709 = PPM 236631 = SAO 163075. A symmetrical minimum lasted for several months, with variations also outside it.
V1178	Sco =	770764	= Had V92 = Nova Sco 2001.
V1179	Sco =	770326	= GSC 6786.01255 = IRAS 15508–2745 = Tmz V788.
V1180	Sco =	770337	= GSC 7352.01203 = IRAS 16180–3412 = Had V96.
V1181	Sco =	770342	= Had V75.
V1182	Sco =	770346	= CoD –33°11472 = GSC 7363.01161 = IRAS 16462–3331 = Had V87.
V1183	Sco =	770357	= IRAS 16552–3305 = Had V97.
V1184	Sco =	770393	= CoD –39°11531 = GSC 7888.00046 = HD 323593 = IRAS 17270–3937 = Had V88.
V1185	Sco =	770405	= AFGL 5379 = IRAS 17411–3154.
BZ	Scl =	770025	= CoD –26°384 = CPD –26°103 = EXO 010919.0–2613.5 = EXOSAT 0109–2613 = GSC 6425.01882 = HD 07172 = NSV 15253 = PPM 243692 = SAO 166864.
CC	Scl =	771147	= EC 23128–3105 = RX J2315.5–3049 = 1RXS J2315–3048.
V468	Sct =	770811	= Mis V0952.
V469	Sct =	770812	= Mis V0953.
V470	Sct =	770814	= CSS-I 565 = CSS-II 1058 = GSC 6267.01171 = Had V93 = Tmz V824.
V471	Sct =	770819	= CSS-I 571 = CSS-II 1064 = GSC 5696.00165 = IRAS 18375–1010 = Had V65 = NSV 11168.
V472	Sct =	770821	= IRAS 18436–0505 = Hassforther V45.
V473	Sct =	770823	= BD –05°4754 = GSC 5122.00790 = IRAS 18440–0457 = Hassforther V46 = NSV 24584.

Table 2 (continued)

V474	Sct =	770831	= Had V78.
V372	Ser =	770322	= GSC 5002.00629 = FASTT 0687.
V373	Ser =	770325	= BD –00°3026 = GSC 5019.00783 = HD 142070 = HIP 077752
			= PPM 179672 = SAO 140814.
V374	Ser =	770382	= Had V94.
V375	Ser =	770394	= GSC 6235.00830 = IRAS 17282–1600 = Had V91.
V376	Ser =	770781	= GSC 5101.00214 = IRAS 18072–0201 = Hassforther V17.
V377	Ser =	770806	= IRAS 18266+0449 = Mis V0957.
VV	Sex =	770242	= AN 31.1927 = CSV 1498 = GSC 0239.01933 = NSV 04612 = Prager 0636
			= SVS 0128.
VW	Sex =	770244	= GSC 4903.00436 = IRAS 09592–0158 = Tmz V756.
VX	Sex =	770245	= GSC 4903.00512 = IRAS 10001–0119 = Tmz V757.
VY	Sex =	770255	= BD –01°2452 = GSC 4917.00022 = HD 93917 = PPM 178307
			= SAO 137825.
V1209	Tau =	770133	= NSV 15743 = Plf 484.
V1210	Tau =	770134	= BD +23°528 = HD 23585 = HII 1284 (Pleiades) = GSC 1800.01579
			= PPM 092879 = SAO 076185.
V1211	Tau =	770135	= CSV 100353 = GSC 1800.00586 = HII 2870 (Pleiades) = NSV 01377
			= Zi 0253.
V1212	Tau =	770138	= NSV 15820. Dwarf nova in Taurus.
V1213	Tau =	770150	= HH 30 IRS.
V1214	Tau =	770155	= IRAS 04470+3002 = NSV 16172.
V1215	Tau =	770165	= IRAS 05146+2521 = NSV 16280.
V1216	Tau =	770166	= CSV 540 = GSC 1304.00869 = HV 6900 = IRAS 05172+1925
			= NSV 01932 = Prager 2727.
V1217	Tau =	770171	= IRAS 05273+2019 = NSV 16320.
V1218	Tau =	770174	= GSC 1298.00457 = Brh V69.
V1219	Tau =	770177	= IRAS 05452+2001 = NSV 16678.
AL	Tri =	770041	= GSC 2293.01021.
AM	Tri =	770066	= GSC 2315.01403 = IRAS 01533+3410 = Tmz V840.
AN	Tri =	770080	= GSC 2317.01359 = IRAS 02102+3343 = Tmz V785.
AO	Tri =	770088	= GSC 1773.00343 = IRAS 02165+2750 = CTI 021845.9+280047 [021]
			= NSV 15484.
AP	Tri =	770097	= GSC 2335.01481 = IRAS 02231+3638 = Tmz V841.
AQ	Tri =	770116	= KUV 02464+3239 = WD 0246+326.
EF	Tuc =	770003	= EC 23593–6724 = GSC 8846.00365.
KZ	UMa =	770240	= BD +67 594 = GSC 4142.00723 = HD 81882 = HIP 046748 = PPM 017086
			= SAO 014907.
LL	UMa =	770241	= USNO 1575-03003814.
LM	UMa =	770243	= BD +46°1545 = GSC 3433.00392 = HD 84345 = HIP 047924
			= IRAS 09428+4606 = NSV 18264 = PPM 051468 = SAO 043022.
LN	UMa =	770247	= UMa 7 [218] = PG 1000+667.
LO	UMa =	770251	= GSC 3002.00454.
LP	UMa =	770252	= GSC 3822.01056.
LQ	UMa =	770257	= GSC 3009.00361 = Tmz V789.
LR	UMa =	770263	= BD +32°2142 = GSC 2520.00532 = HD 98851 = HIP 055563 = NSV 18759
			= PPM 075840 = SAO 062524.
pi 1	UMa =	770223	= π^1 UMa = BD +65°643 = BS 3391 = 3 UMa = Gliese 0311
			= GSC 4133.01971 = HD 72905 = HIP 042438 = IRAS 08347+6511
			= NSV 17937 = PPM 016705 = SAO 014609.
V384	Vel =	770218	= 4/refl. neb. NGC 2626.
V385	Vel =	770219	= 20/refl. neb. NGC 2626.
V386	Vel =	770220	= 22/refl. neb. NGC 2626.
V387	Vel =	770221	= 23/refl. neb. NGC 2626.
OW	Vir =	770277	= GSC 4938.00681 = IRAS 11566–0550 = Tmz V775.
OX	Vir =	770280	= BD –05°3416 = GSC 4945.00224 = HD 105036 = HIP 058981
			= IDS 1200.4S0518A = IRAS 12030–0534 = IRC –10262 = NSV 19185
			= PPM 195131 = SAO 138981.
OY	Vir =	770295	= BD +04°2683 = GSC 0301.00463 = HD 112975 = HIP 063487
			= IRAS 12579+0352 = PPM 159392 = SAO 119712.
OZ	Vir =	770298	= GSC 4961.00705 = V17.

Table 2 (continued)

PP	Vir	= 770304	= BD +06°2827 = GSC 0322.00116 = HD 122970 = HIP 068790 = PPM 160319 = SAO 120273.
V423	Vul	= 770950	= IRAS 19256+2417 = Mis V0968.
V424	Vul	= 770952	= IRAS 19276+2538 = Mis V0969.
V425	Vul	= 770954	= IRAS 19279+2328 = Mis V0970.
V426	Vul	= 770957	= IRAS 19287+2046 = Mis V0971.
V427	Vul	= 770958	= IRAS 19291+2511 = Mis V0972.
V428	Vul	= 770960	= IRAS 19300+2107 = Mis V0973.
V429	Vul	= 770961	= IRAS 19306+2110 = Mis V0974.
V430	Vul	= 770985	= Mis V0984.
V431	Vul	= 770988	= IRAS 19483+2306 = Mis V0976.
V432	Vul	= 771000	= IRAS 19581+2350 = Mis V0966.
V433	Vul	= 771001	= GSC 2141.01846 = IRAS 19583+2231 = Mis V0977.
V434	Vul	= 771002	= GSC 2141.01822 = IRAS 19583+2235 = Mis V0978.
V435	Vul	= 771003	= IRAS 19589+2529 = Mis V0979.
V436	Vul	= 771021	= BD +27°3738 = EXO 202513.7+2809.8 = GSC 2168.00778 = HD 334415 = IDS 2022.1N2800A = PPM 111171 = SAO 088699.
V437	Vul	= 771035	= LD 372.
V438	Vul	= 771046	= LD 375.
V439	Vul	= 771048	= IRAS 20420+2601 = LD 376.
V440	Vul	= 771050	= LD 377.
V441	Vul	= 771052	= LD 378.
V442	Vul	= 771064	= AFGL 2686 = GSC 2180.01004N = IRAS 20570+2714 = NSV 25412.
V443	Vul	= 771065	= GSC 2176.01341 = IRAS 20593+2451 = LD 380 = Mis V0967.
V444	Vul	= 771071	= IRAS 21019+2620 = LD 381.
V445	Vul	= 771075	= GSC 2173.00719 = IRAS 21057+2331 = LD 386 = Q 1991/078 = StM 536.
V446	Vul	= 771076	= GSC 2181.01309 = IRAS 21068+2719 = LD 387.
V447	Vul	= 771082	= GSC 2194.02252 = IRAS 21115+2747 = LD 393.
V448	Vul	= 771092	= LD 400.
V449	Vul	= 771097	= GSC 2195.01274 = LD 403.

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ERRATUM FOR IBVS 5422

Kazarovets, E.V., Kireeva, N.N., Samus, N.N., Durlevich. O.V.
The 77th Name-List of Variable Stars

The following corrections are needed to the list of identifications (Table 2).

V1657 Aql: the USNO identification should be USNO-A2.0 900-17903132

LY Dra: the SAO identification should be SAO 018231

DU Lyn: the AFGL identification should be AFGL 1187

OX Vir: the SAO identification should be SAO 138579

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DIRECT MASS RATIO DETERMINATION IN THE SB2 SYSTEMS HD 108642 AND HD 434

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The star HD 108642 (HR 4750, SAO 82326, HIP 60880, BD +27° 2138) is a well known SB1 type binary. Abt & Levato (1977) classified the spectrum as Am(A2/A7/F0) from hydrogen, metallic and CaII-K lines, respectively. HIPPARCOS introduced the trigonometric parallax (9.76 ± 0.79) mass and $V = 6.52$ mag (ESA, 1997). Abt & Morrell (1995) measured projected rotational velocity and obtained $v \sin i = 13$ km s^{-1}. Their measurements were rescaled by Royer et al. (2002) who obtained $v \sin i = 21$ km s^{-1}. Landstreet (1998) derived $v \sin i < 4.5$ km s^{-1}. The orbit was determined and improved by Harper (1926, 1935). More recently Abt & Willmarth (1999) derived new orbital elements: $P = (11.7843 \pm 0.0004)$ d, $e = 0$, $\gamma = -0.7$ km s^{-1}, $K = 41.14$ km s^{-1} which are in a good agreement with the Harper's results. Boesgaard (1987), using spectroscopic observations in the region of about 6700 Å, first noted the presence of a secondary spectrum and estimated the flux ratio value $L1/L2 = 7.7$. Recently, Shorlin et al. (2002) as a by-product of their magnetic field measurements derived from polarimetric least-squares deconvolution profiles $M1/M2 = 1.9 \pm 0.1$, $L1/L2 = 15$, $\gamma = (-2 \pm 2)$ km s^{-1}.

The star HD 434 (HIP 728, BD+ 27° 3, SAO 73772, $V = 6.47$mag) is also well known as an SB1 system. Latest orbital elements are those of Sreedhar Rao & Abhyankar (1992): $P = 34.25999$ d, $e = 0.475 \pm 0.034$, $\gamma = (2.6 \pm 0.6)$ km s^{-1}, $K = (24.1 \pm 0.9)$ km s^{-1}. Recently, Iliev et al. (2001a) discovered a very pronounced secondary spectrum (see the references therein). Here we present new observations of this fresh SB2 system.

Our spectroscopic observations were carried out with the 2m RCC telescope of the Bulgarian National Astronomical Observatory in the frame of our observational program on Am-stars in binary systems. The Photometrics AT200 camera with a SITe SI003AB 1024 × 1024 CCD chip, (24 μm pixels) was used in the Third camera of the coudé spectrograph to provide spectra in the 6400–6500 Å region with R = 32000. A typical S/N ratio is about 300. IRAF standard procedures have been used for the bias subtracting, flat-fielding and wavelength calibration. Telluric lines have been removed using spectra of hot, fast rotating stars. The wavelength calibration has the r.m.s. error of 0.005 Å. EQWREC2 code of Budaj & Komžík (2000) was used for continuum rectification and radial velocity measurements. The log of observations is listed in Table 1.

Small portions of our spectra in the vicinity of CaI 6439 which is most illustrative are depicted in the Figures 1 and 2. It is apparent that there are two systems of lines travelling and crossing in the spectra of both stars. For the mass ratio and gamma velocity of HD 108642 we obtained: $M1/M2 = 1.824 \pm 0.011$, $\gamma = -0.4$ km s^{-1}. Our gamma velocity is in a very good agreement with the value determined recently by Abt & Willmarth (1999) who measured only the radial velocities of the primary. This confirms and improves the results of Shorlin et al. (2002). For HD 434 we obtained: $M1/M2 = 1.19 \pm 0.06$, $\gamma = +12.0$ km s^{-1}. Moreover, we are able to put a serious constraint on the K value of the primary which is $K > 30.8$ km s^{-1}! Note that this K value and gamma velocity are not in agreement with the value determined by Sreedhar Rao & Abhyankar (1992). This underlines the statement of Iliev et al. (2001a) that the secondary spectrum causes so heavy blends that the previous orbit determinations must be revisited. Hube & Gulliver (1985) e.g. obtained preliminary and different orbital elements: $P = 34.26014$ d, $e = 0.405 \pm 0.033$, $\gamma = (6.9 \pm 0.7)$ km s^{-1}, $K = (35.5 \pm 1.7)$ km s^{-1} which were confirmed later by Margoni et al. (1992). They better satisfy our constraints on K value but their gamma velocity is still rather low.

Table 1: List of observations and the results: Date, HJD of the exposure beginning, effective exposure time in seconds, radial velocities of both components in km s^{-1}, the $M1/M2$ ratios and the γ velocities in km s^{-1}.

Sp. No.	Date	HJD (2450000+)	Eff. exp.	RV_a	RV_b	$M1/M2$	γ
HD 108642							
1	8.3.2001	1977.493	5400	−41.9	+74.5	1.824 ± 0.011	− 0.4
2	13.3.2003	2713.457	5410	+31.6	−58.2		
HD 434							
1	28.8.2002	2515.475	5410	+34.7	−17.0	1.19 ± 0.06	+ 12.0
2	21.10.2002	2569.348	4370	−26.9	+58.3		

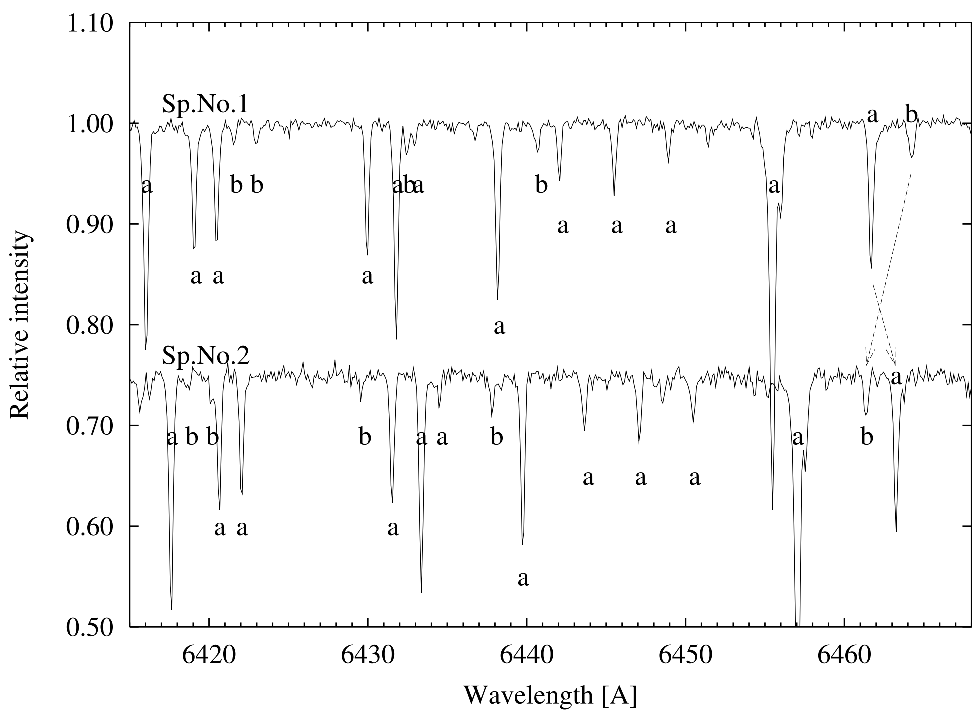

Figure 1. Two spectra of HD 108642 shifted by -0.25 in relative intensity and where a – denotes the lines of the primary and b – the secondary star.

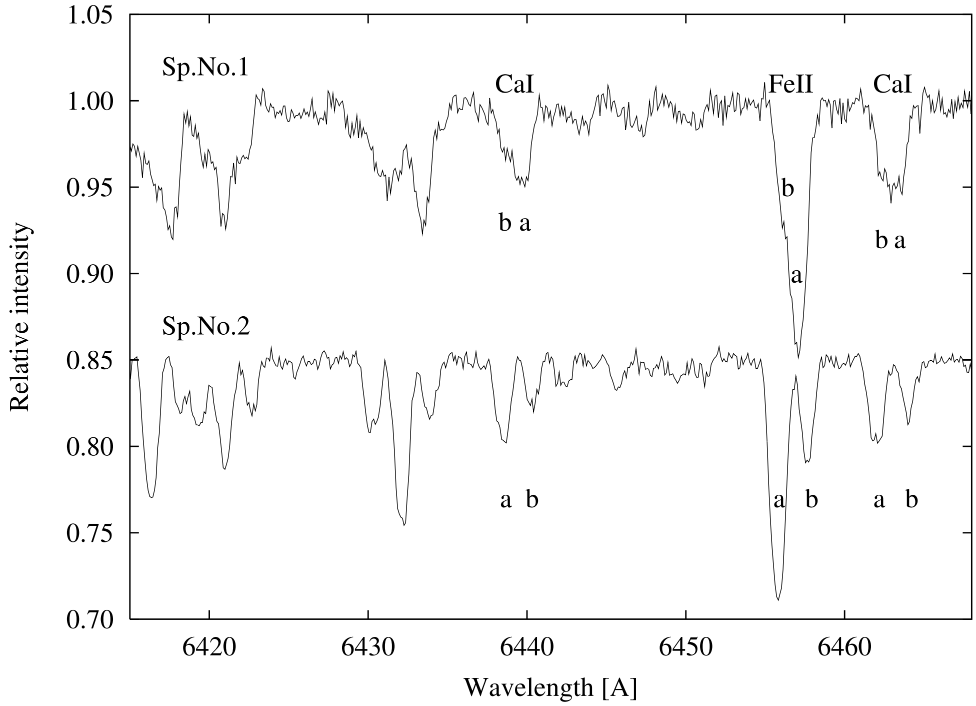

Figure 2. Two spectra of HD 434 shifted by -0.15 in relative intensity. Notation as in Fig. 1.

The $M1/M2$ ratios and absolute radial velocities listed in Table 1 above are not necessarily self consistent. It is because only one unblended line (Caɪɪ 6439) was used for absolute radial velocity measurements while more lines could be used for relative radial velocity changes and the $M1/M2$ determination. The Gaussian decomposition procedure of a few good lines was used to measure the relative radial velocities in the case of Sp. No.1. of HD 434 as the lines of the primary and secondary slightly overlap, otherwise, center of mass method was used. The estimated 1σ precision of our radial velocity measurements is about 1 $\mathrm{km\,s^{-1}}$. The estimated 1σ error of $M1/M2$ values is more or less formal error estimated from only 2 spectra. The true error may be slightly higher. This paper again illustrates that new CCD observations of many so far unresolved SB1 systems are highly desirable as they may lead to a discovery of secondary spectra and a subsequent direct mass ratio determination in even bright and well studied SB1 cases as demonstrated e.g. by Iliev et al. (2001a, 2001b) and Ryabchikova (1998).

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ELEMENTS FOR FOUR RED PULSATING STARS

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The variability of these stars was discovered on Sonneberg Observatory photographic plates by Hoffmeister (1967a,b) and Morgenroth (1934), respectively; no further observations or ephemeris were published until today. Recent estimations, made on photographic plates taken with the Sonneberg Observatory 40cm Astrograph during the years 1964-1994, have allowed to determine the type of variability as well as first elements (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 3. Individual data are available upon request.

Remarks:

V548 Her

Period varies; elements valid for J.D. 2437100-2440750 and J.D. 2442900-2449500, respectively. The period varies strongly but the shape of the light curve is rather stable.

V2066 Oph

Probably variable period; elements given are valid for J.D. 2437100-2449500. Including the first observed maximum (published by Hoffmeister) in a common ephemeris results in distinct larger scatter of the light curve and has been avoided for this reason.

NSV 7865

SRa type with respect of the relatively small amplitude.

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

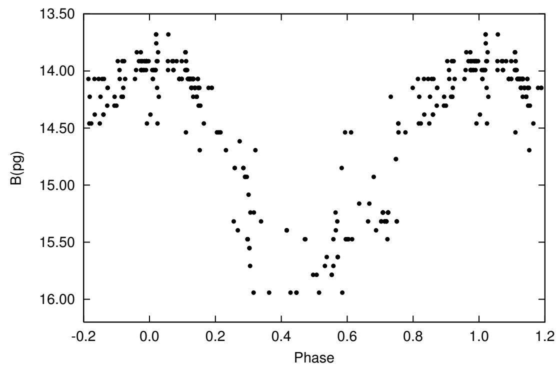

Figure 1. Combined light curve of V548 Her

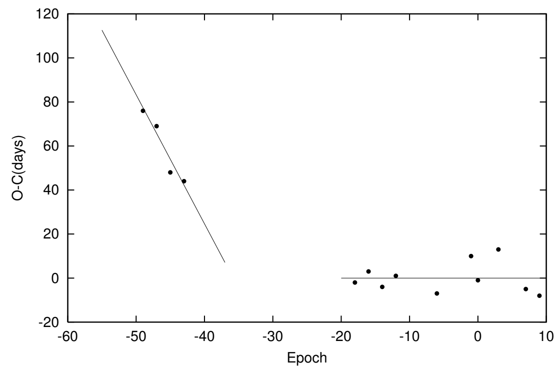

Figure 2. (O−C) diagram of V548 Her

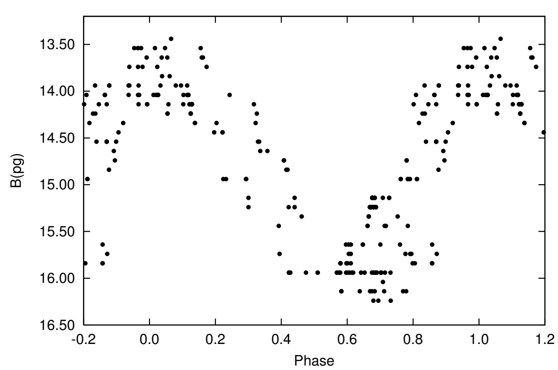

Figure 3. Light curve of V2066 Oph

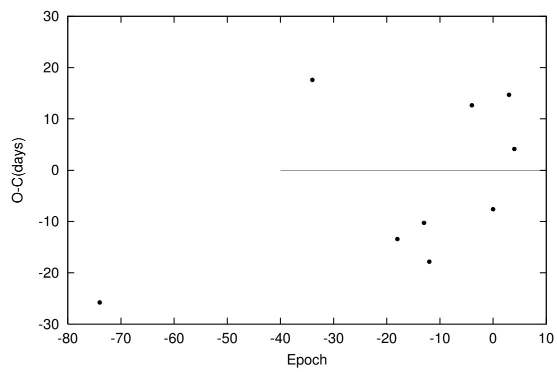

Figure 4. (O−C) diagram of V2066 Oph

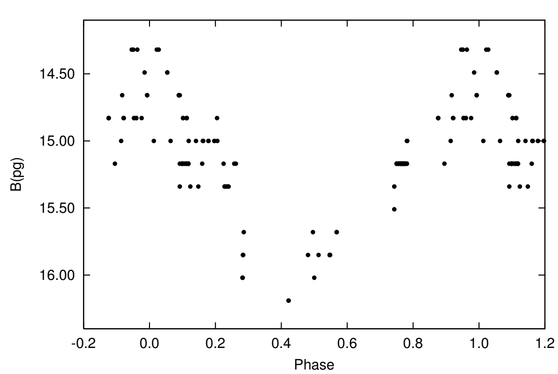

Figure 5. Light curve of NSV 7865

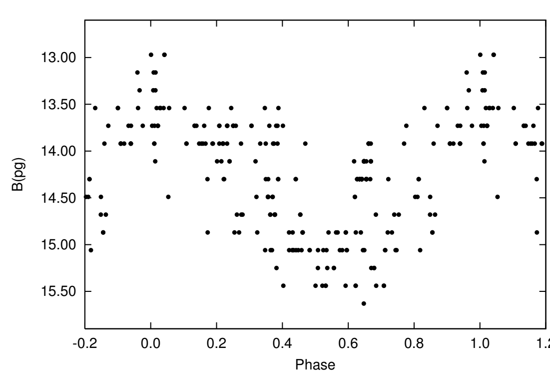

Figure 6. Light curve of NSV 8293

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	M−m	No. of Plates	Former classification
V548 Her(1)	M	38528.7 ±3.9	184.35 ±1.05	$13^m.7$	$15^m.8$	$0^P.45$	77	M:
V548 Her(2)	M	47771.6 ±2.8	190.21 ±.27				166	
V2066 Oph	M	48363.6 ±6.7	278.57 ±.44	$13^m.6$	$16^m.1$	$0^P.34$	239	Isb:
NSV 7865	M:	46609.2 ±3.4	157.09 ±.17	$14^m.3$	$16^m.0$	$0^P.50$	134	LB:
NSV 8239	SRa	38501.4 ±2.6	144.46 ±.06	$13^m.2$	$15^m.3$		242	L

Table 2. Individual maxima and $O-C$ values according to the elements derived in this paper

Star	JD (max.)	Epoch	$O-C$	Star	JD (max.)	Epoch	$O-C$
V548 Her(1)	38528	0	−1.0	V2066 Oph	47262	−4	12.6
	38901	2	3.3		48356	0	−7.6
	39261	4	−5.4		49214	3	14.7
	39637	6	1.9		49482	4	4.1
V548 Her(2)	44345	−18	−3.2	NSV 7865	39537	−45	−2.95
	44732	−16	3.4		42987	−23	−8.9
	45104	−14	−5.1		44266	−15	13.3
	45491	−12	1.52		44732	−12	8.1
	46623	−6	−7.7		45822	−5	−1.55
	47592	−1	10.2		46613	0	4.0
	47770	0	−2.0		46917	2	−6.2
	48356	3	13.4		48804	14	−4.3
	49098	7	−5.5				
	49475	9	−8.9	NSV 8293	38501.5	0	0.1
					38640.3	1	−5.6
V2066 Oph	27724*	−74	−25.7		38937.4	3	2.6
	38910	−34	17.6		45003.7	45	1.6
	43336	−18	−13.3		45441.5	48	6.0
	44732	−13	−10.3		46592.5	56	1.3
	45003	−12	−17.8		49475.5	76	−4.9

* Maximum published by Hoffmeister (1967a)

Table 3. Comparison stars and cross references

	V548 Her S 9722 GSC 962.0113		V2066 Oph S 9621 GSC 979.0217	
Comp. No.	GSC	m*	GSC	m*
1	962.0138	$13\overset{\mathrm{m}}{.}9$	979.2000	$14\overset{\mathrm{m}}{.}4$
2	962.0208	$14\overset{\mathrm{m}}{.}0$	966.1832	$15\overset{\mathrm{m}}{.}0$
3	962.0971	$14\overset{\mathrm{m}}{.}8$	966.1908	$15\overset{\mathrm{m}}{.}4$
4	962.1444	$14\overset{\mathrm{m}}{.}9$	966.1960	$16\overset{\mathrm{m}}{.}1$
5	962.0136	$15\overset{\mathrm{m}}{.}3$		
6	962.0141	$16\overset{\mathrm{m}}{.}2$		

	NSV 7865 S 9788 GSC 961.0982		NSV8293 69.1934 GSC 977.0665	
Comp. No.	GSC	m*	GSC	m*
1	961.0907	$14\overset{\mathrm{m}}{.}3$	977.0824	$12\overset{\mathrm{m}}{.}4$
2	961.1584	$15\overset{\mathrm{m}}{.}4$	977.0674	$14\overset{\mathrm{m}}{.}2$
3	961.0312	$16\overset{\mathrm{m}}{.}0$	977.0561	$15\overset{\mathrm{m}}{.}4$

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

References:

Hoffmeister, C., 1967a, *Astron. Nachr.*, **289**, 205
Hoffmeister, C., 1967b, *Astron. Nachr.*, **290**, 43
Morgenroth, O., 1934, *Astron. Nachr.*, **252**, 389

COMMISSIONS 27 AND 42 OF THE IAU
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ECLIPSING BINARIES DISCOVERED ON STARDIAL IMAGES

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The Stardial system, run by the University of Illinois at Urbana-Champaigne (McCullough and Thakkar, 1997), has been found useful for the discovery and follow-up of long period variables. This paper however reports on the discovery of ten short period eclipsing binaries on the images from this system.

The procedure used to reduce the images to star and magnitude lists was described by Wils (2003). For some stars 250 data points were obtained. For the brightest stars (mag. < 10), an internal accuracy of 0.03 mag could be obtained, depending on the quality of the night. For stars with more than 100 observations, the PDM technique (Stellingwerf, 1978) was used to search for periodic variability.

Since Stardial images are always taken when the region crosses the meridian, strong aliasing is present, and in fact it is impossible to distinguish between the genuine period and its aliases. The stars so discovered were then verified using the ASAS-3 archive (Pojmanski, 2002), which aided in establishing the correct period. Some of the stars were also followed for one or more nights at Rolling Hills Observatory (see Dvorak 2003 for a description of the instruments used). For three of the stars, V and I data were also available from the TASS Mk III survey (Richmond et al., 2000). For four others limited unpublished data from the TASS Mk IV data (Droege, 2003) provided further confirmation of the variability and the period.

The new eclipsing binaries are presented in Table 1. The first column gives the identification of the objects (HD, BD or GSC number). The following columns contain the type of variability, the epoch of minimum, period (in days) and the V range derived from the ASAS-3 database.

Phased light curves of these stars are presented in figures 1 and 2, with V data from the ASAS (open squares) and TASS (filled circles) surveys, and from Rolling Hills Observatory (crosses). The Stardial data (dashes) are taken through a non-standard red filter, and their zero-point was shifted to be in agreement with the available V data (which means that the amplitude may differ).

Acknowledgements: This research has made use of the SIMBAD and VizieR databases operated at the *Centre de Données Astronomiques (Strasbourg)* in France. The authors would like to thank Michael Richmond for providing the XVista and match programs to reduce the Stardial images. The Stardial, TASS and ASAS teams are acknowledged for providing public access to their archives.

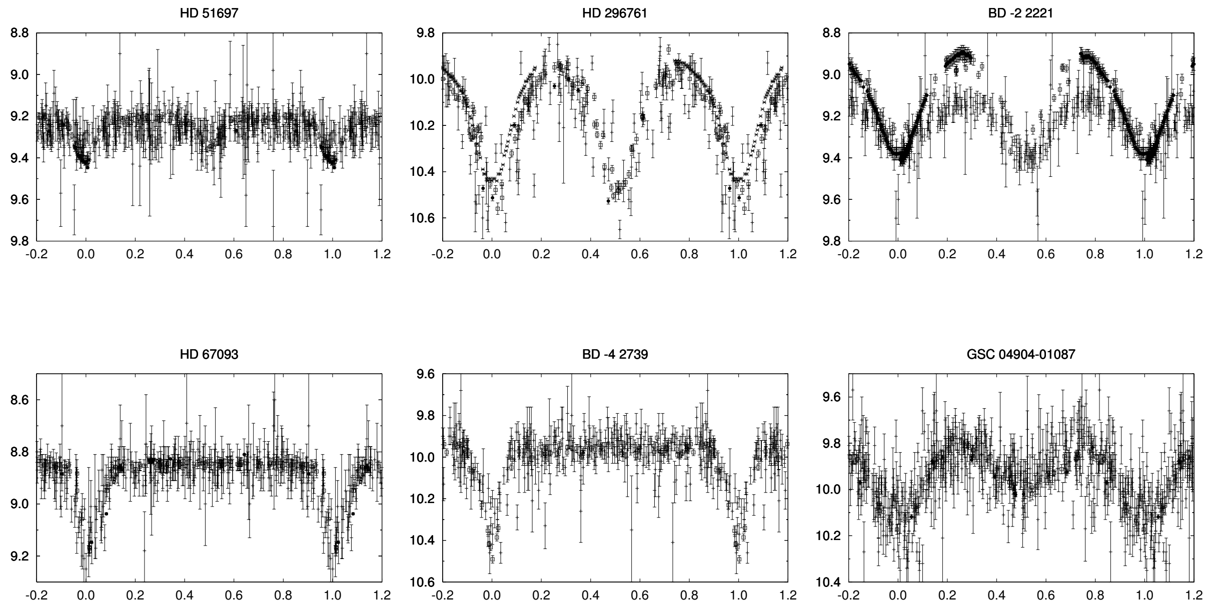

Figure 1. Phased light curves of six of the new eclipsing binaries.

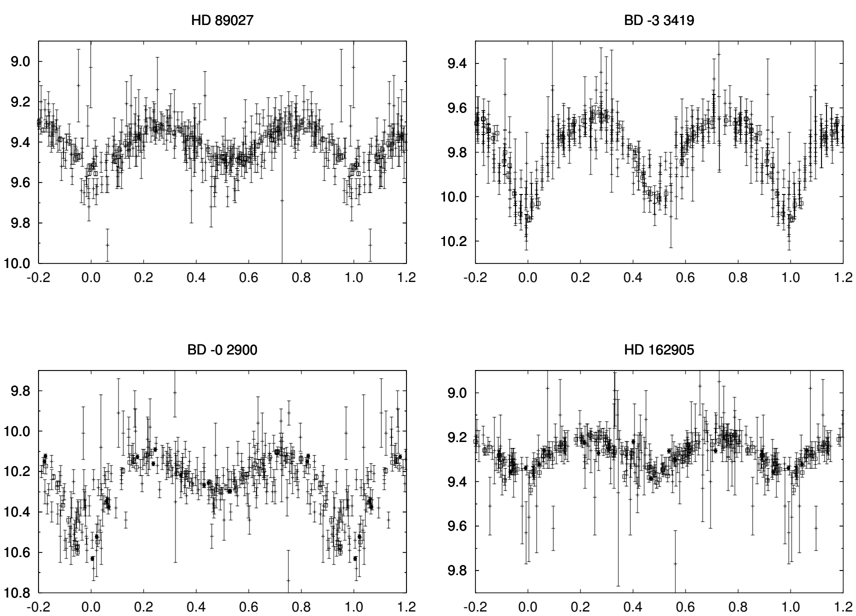

Figure 2. Phased light curves of the remaining four eclipsing binaries.

Table 1. Data on the new eclipsing binaries

Identification	Type	HJD Min −2450000	Period days	Max V	Min I V	Min II V	Remarks
HD 51697	EA	2684.68	2.51640	9.2	9.4	9.35	1
HD 296761	EW	2667.755	0.35843	9.9	10.6	10.5	2,3
BD −2 2221	EW	2681.731	0.63772	8.9	9.4	9.3	2,4
HD 67093	EA	2252.86	2.16780	8.8	9.2	–	5
BD −4 2739	EA	2705.73	0.71958	9.9	10.5	–	5,6
GSC 04904-01087	EB	2722.77	1.05917	9.8	10.2	10.0	
HD 89027	EW	2314.79	0.54011	9.3	9.55	9.5	
BD −3 3419	EW	1661.69	0.31125	9.6	10.1	10.0	7
BD −0 2900	EB	0938.73	0.58040	10.1	10.6	10.5	
HD 162905	EW	2369.95	0.42651	9.2	9.4	9.4	8

1 Visual pair (mag. 9.8 and 10.4) with 3″ separation (not separated on Stardial images)
2 Minimum measured at Rolling Hills Observatory
3 = 1RXS-F J071507.4-044437
4 Eclipse is probably total
5 No secondary minimum detected, period may be double the value given
6 = 1RXS J0950391.1-053029
7 = 1RXS J131032.4-040934
8 According to literature the spectral type is K0, so the given period may be too long

References:

Droege, T.F., 2003, *private communication*
Dvorak, S.W., 2003, *IBVS*, No. 5378
McCullough, P., Thakkar, U., 1997, *PASP*, **109**, 1264
Pojmanski, G., 2002, *Acta Astronomica*, **52**, 397
Richmond, M.W., Droege, T.F., Gombert, G., Gutzwiller, M., Henden, A.A., Albertson, C., Beser, N., Molhant, N., Johnson, H., 2000, *PASP*, **112**, 397
Stellingwerf, R.F., 1978, *ApJ*, **224**, 953
Wils, P., 2003, *IBVS*, No. 5401

ERRATUM FOR IBVS 5425

Geert Hoogeveen reported the following error:

IBVS No.	item	printed	correct
5425	identifier (BD -4°2739)	1RXS J0950391.1-053029	1RXS J095039.1-053029

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VY Scl-TYPE STAR V504 Cen

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V504 Cen is classified as a possible R CrB-type star in General Catalogue of Variable Stars (Kholopov et al., 1985). Almost nothing has been published on its nature of variability. Kilkenny and Lloyd Evans (1989), during the course of a systematic study of R CrB-type candidates, noticed that V504 Cen shows broad Balmer emission lines. From this spectroscopic feature, Kilkenny and Lloyd Evans (1989) concluded that V504 Cen is a cataclysmic variable (CV), and not a R CrB-type star. Although Kilkenny and Lloyd Evans (1989) proposed that this star may be a VY Scl-type CV, which is characterized by the presence of occasional deep fadings, the lack of long-term light curve with sufficient limiting magnitudes made the classification rather inconclusive. In spite of this report, the object has been largely neglected from the past CV research. The object has not been listed in any comprehensive CV catalogs, including the latest edition of the CV catalog by Downes et al. (2001).

We here present first-ever published light curve of V504 Cen, which clearly demonstrates the VY Scl-type nature. The light curve is drawn from visual observations (RS) and ASAS-3 V-band public data (Pojmanski, 2002). A 0.45 mag systematic correction was added to RS's visual observations based on the RASNZ comparison stars, in order to best match the ASAS-3 V magnitudes. Figure 1 shows the entire light curve between 1998 and 2003. A deep fading episode between JD 2452346 and 2452650 is apparent. The fading portion of this fading episode was not recorded because of the solar conjunction. Although not shown in the light curve, 49 ASAS-3 observations between JD 2452405 and 2452705 gave only negative detections. The object must have been fainter than V=13.6 during this period.

The duration (between 300 and 400 days) and depth (>2.0 mag) are typical for VY Scl-type fadings (Greiner, 1998). Figure 2 shows the enlarged light curve of the rising portion observed in early 2003. After reaching V=13.7, the object slowly returned to its maximum magnitude. The rising rate between JD 2452714 and 2452784 is 0.005 mag d^{-1}. Such a slow final rise to the maximum is characteristic to the VY Scl-type phenomenon (Greiner, 1998; Kato et al., 2002). In all aspects, V504 Cen is now firmly classified as a typical VY Scl-type CV.

Since there is no finding chart of V504 Cen readily available, we note the following identification: V504 Cen = GSC 7808.1570 located at $14^h12^m49^s.11$, $-40°21'37''.1$ (J2000.0, GSC 1.2).

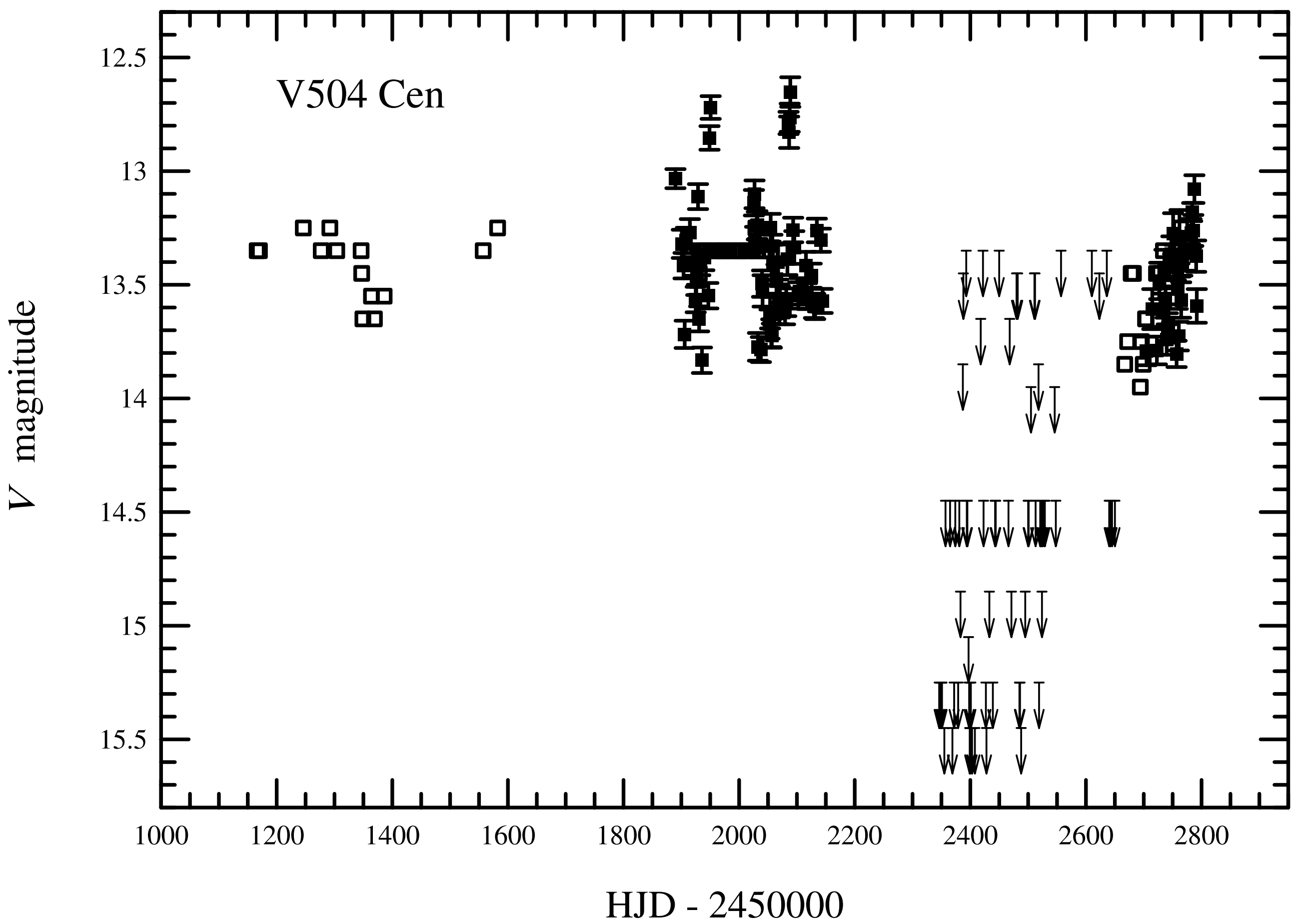

Figure 1. Light curve of V504 Cen from RS's visual observations and the ASAS-3 V-band public data. The filled squares with error bars and open squares represent ASAS-3 data and RS's measurements, respectively. (The straight bar between JD 2451936 and 2452041 represents RS's observations). The arrows represent upper limit observations by RS.

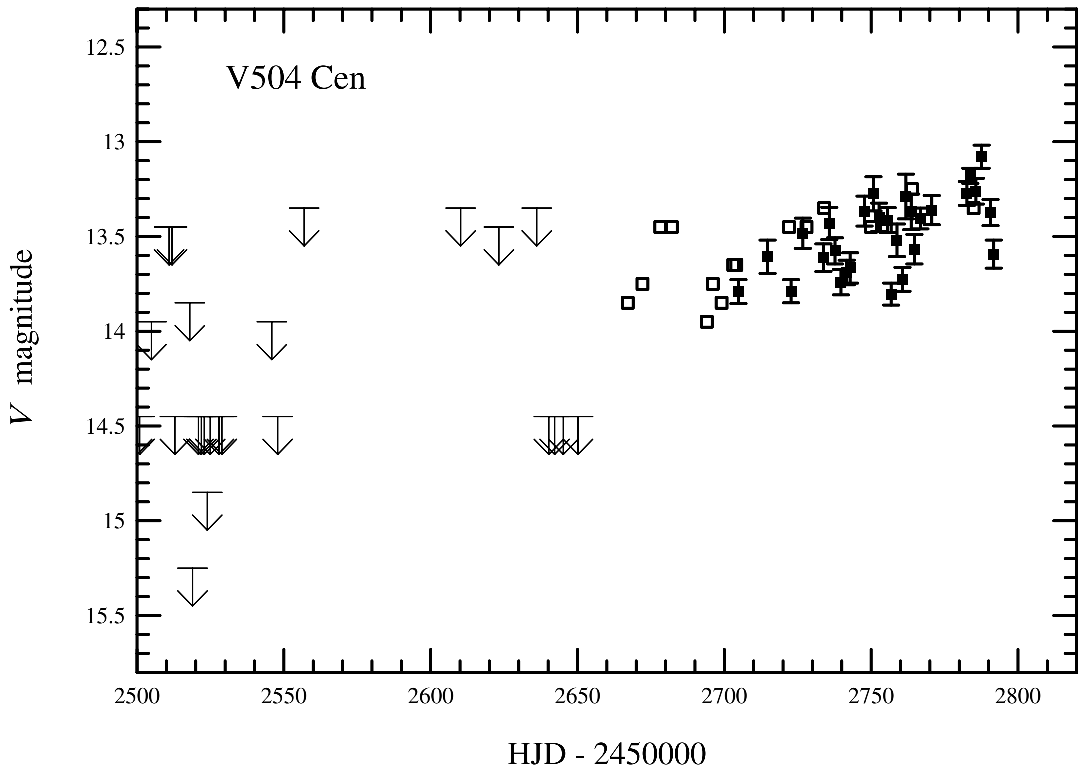

Figure 2. Enlarged light curve of the recovery stage from the deep fading. The symbols are the same as in Figure 1.

We are grateful to G. Pojmanski for making the ASAS-3 survey data publicly available, and generously allowing us for unlimited usage. This work is partly supported by a grant-in-aid (13640239, 15037205) from the Japanese Ministry of Education, Culture, Sports, Science and Technology.

References:

Downes, R. A., Webbink, R. F., Shara, M. M., Ritter, H., Kolb, U., Duerbeck, H. W., 2001, *PASP*, **113**, 764
Greiner, J., 1998, *A&A*, **336**, 626
Kato, T., Ishioka, R., Uemura, M., 2002, *PASJ*, **54**, 1033
Kholopov, P. N., Samus', N. N., Frolov, M. S., Goranskij, V. P., Gorynya, N. A., Kireeva, N. N., Kukarkina, N. P., Kurochkin, N. E. et al., 1985, *General Catalogue of Variable Stars*, fourth edition (Moscow: Nauka Publishing House)
Kilkenny, D., Lloyd Evans, T., 1989, *Observatory*, **109**, 85
Pojmanski, G. 2002, *Acta Astronomica*, **52**, 397

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X-RAY ROTATIONAL MODULATION IN VXR45

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VXR45 is a young very fast rotator star (RA (J2000) = $8^{\rm h}42^{\rm m}14\overset{\rm s}{.}8$, Dec (J2000) = $-52°56'01''$, V=10.70, $B-V$=0.81, photometric period =0.223 days (Patten & Simon, 1996)), member of IC2391 open cluster. The observation has been performed in November 20, 2001 with EPIC/PN on XMM-Newton satellite and covers, almost continuously, two photometric periods of VXR45. We extracted photon counts from a circular region centered on the VXR45 and selected in order to include $\sim$ 80% of the source photons (Ghizzardi, 2001; Saxon, 2002), corresponding to a radius of 37″. The total number of photon counts in the 0.3-7.8 keV band amounts to 7431; the local background has been determined from a source-free region near VXR45 for a total of 506 counts.

Fig. 1 shows the light-curve of VXR45 obtained in the 0.3-7.8 keV band (top) and that of the corresponding background (bottom). The X-ray rotational modulation, with a period very similar to the photometric one, is clearly evident. Note that other short-term variability not due to rotational modulation may also be present in the light-curve.

Fig. 2 shows the X-ray light-curve folded with the photometric rotational period. Phase-related variability is clearly evident; the amplitude of the variations in the X-ray light-curve is $\sim$ 30% of the average count-rate.

We find, for the first time, unambiguous evidence of rotational modulation of X-ray stellar coronal emission in a very fast rotating star in the "supersaturated" regime.

The detection of X-ray rotational modulation implies the presence of not uniformly distributed active regions on the star. Furthermore we do not find evidence of spectral changes as function of the phase, consistently with the hypothesis that the modulation we observe is mainly due to a coverage effect, and that at all times the emission is largely due to the same mixture of emitting structures, probably composed by active regions hosting several flares.

References:

Patten, B. M., & Simone, T., 1996, *ApJS*, **106**, 489
Ghizzardi, S., 2001, "EPIC-MCT-TN-011", Tech. rep., EPIC Milano Calibration Team
Saxon, R. D., 2002, "XMM-CCF-REL-116", Tech. rep., XMM-SOC

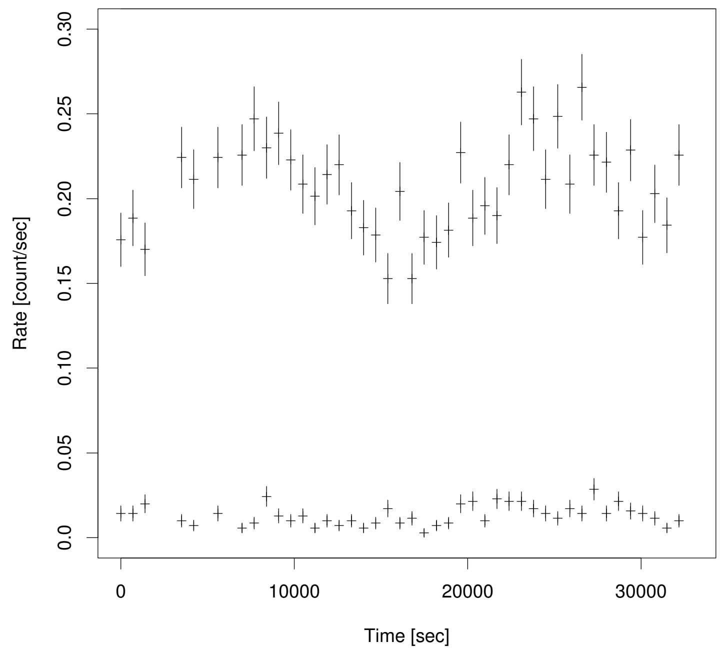

Figure 1. X-ray light-curve of VXR45 (top) and background (bottom) as seen with EPIC/PN in the 0.3-7.8 keV band, time bins are 700 sec long. The photometric rotational period of $\sim$ 19.3 ksec is well visible.

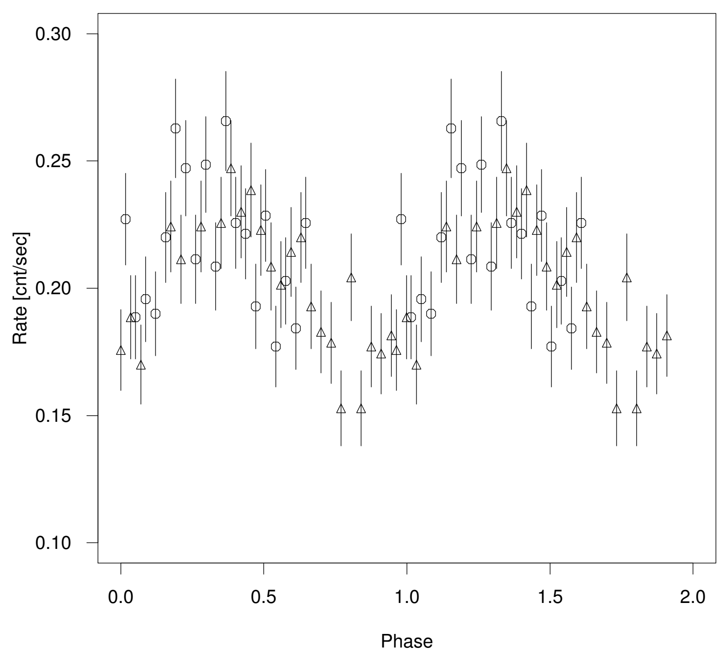

Figure 2. Folding of the X-ray data with the rotational period versus photometric period phase. Circles are points observed at $t < 0.223$ days (the photometric period) and triangles those observed at $t > 0.223$ days.

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EIGHT NEW W UMa VARIABLES

RINNER, C.[1]; STARKEY, D.[2]; DEMEAUTIS, Ch.[3]; CHARBONNEL, S.[4]; BERNASCONI, L.[5]; BEHREND, R.[6]

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Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
GSC 661-503	EW	$03^h53^m06\overset{s}{.}00$	$+10°26'45\overset{''}{.}0$	*
GSC 4948-989	EW	$12^h39^m48\overset{s}{.}54$	$-02°26'21\overset{''}{.}6$	*
USNO-A2.0 1050-19244897	EW	$21^h08^m53\overset{s}{.}74$	$+15°37'10\overset{''}{.}9$	*
GSC 843-262	EW	$10^h18^m53\overset{s}{.}46$	$+13°41'08\overset{''}{.}5$	*
GSC 1402-121	EB	$09^h16^m14\overset{s}{.}75$	$+16°15'25\overset{''}{.}7$	*
GSC 1402-52	EW	$09^h17^m16\overset{s}{.}09$	$+16°19'34\overset{''}{.}5$	*
GSC 1400-455	EW	$08^h55^m51\overset{s}{.}57$	$+20°03'38\overset{''}{.}3$	*
GSC 2495-1124	EW	$09^h02^m40\overset{s}{.}21$	$+34°19'46\overset{''}{.}6$	*

* R magnitudes of about ten USNO-A2.0 stars in the fields.

Observatory and telescope:

Ottmarsheim Obs. (IAU astrometric code 224), 0.305m Schmidt–Cassegrain; DeKalb Obs. (hereafter DKO), 0.355m Schmidt-Cassegrain; Village-Neuf Obs. (138), 0.20m Schmidt–Cassegrain; Durtal Obs. (949), 0.305m Schmidt–Cassegrain; Les Engarouines Obs. (A14), 0.212m Newton.

Detector:	KAF-1602E at 224 and 138; KAF-3200ME at DKO; KAF-1600 at A14; KAF-400E at 949.
Filter(s):	None, roughly R.

Availability of the data:

Upon request

Method of data reduction:

Standard CCD-frame reduction using `Prism`, except `AIP4win` at DKO.

Date(s) of the observation(s):	
GSC 661-503	2001–12–19, 20, 21, 22; 2002–1–11, 12 (A14)
GSC 4948-989	2002–5–12, 13, 14; 2003–5–4, 11, 30 (A14)
USNO-A2.0 1050-19244897	2002–8–11, 14, 15; 2002–9–11, 12 (138)
GSC 843-262	2003–3–23, 30 (A14); 2003–3–25, 26, 27 (224)
GSC 1402-121	2003–3–23, 30 (A14); 2003–3–25, 26, 27 (224); 2003–3–30; 2003–4–2 (DKO)
GSC 1402-52	2003–3–23, 30 (A14); 2003–3–25, 26, 27 (224)
GSC 1400-455	2003–3–23, 30 (A14); 2003–3–25, 26, 27 (224)
GSC 2495-1124	2003–3–30; 2003–4–4, 5 (A14); 2003–4–8 (949)

Table 1. Light curve parameters from the data analysis by the `CourbRot` software (Behrend, 2001). Uncertainties correspond to one standard-deviation.

Star name	HJD of a pr. min.	Period	Tot. var.	Type
GSC 661-503	$2452271^{d}.190$	$0^{d}.35240$	$0^{m}.168$	EW
	$\pm0^{d}.004$	$\pm0^{d}.00005$	$\pm0^{m}.010$	
GSC 4948-989	$2452407^{d}.514$	$0^{d}.2562555$	$0^{m}.141$	EW
	$\pm0^{d}.005$	$\pm0^{d}.0000014$	$\pm0^{m}.009$	
USNO-A2.0 1050-19244897	$2452506^{d}.488$	$0^{d}.29516$	$0^{m}.61$	EW
	$\pm0^{d}.008$	$\pm0^{d}.00003$	$\pm0^{m}.07$	
GSC 843-262	$2452721^{d}.528$	$0^{d}.33614$	$0^{m}.134$	EW
	$\pm0^{d}.004$	$\pm0^{d}.00013$	$\pm0^{m}.007$	
GSC 1402-121	$2452721^{d}.3126$	$0^{d}.50146$	$0^{m}.645$	EB
	$\pm0^{d}.0011$	$\pm0^{d}.00007$	$\pm0^{m}.012$	
GSC 1402-52	$2452721^{d}.4882$	$0^{d}.34781$	$0^{m}.576$	EW
	$\pm0^{d}.0019$	$\pm0^{d}.00007$	$\pm0^{m}.023$	
GSC 1400-455	$2452721^{d}.5705$	$0^{d}.267650$	$0^{m}.581$	EW
	$\pm0^{d}.0008$	$\pm0^{d}.000022$	$\pm0^{m}.014$	
GSC 2495-1124	$2452728^{d}.300$	$0^{d}.32678$	$0^{m}.283$	EW
	$\pm0^{d}.004$	$\pm0^{d}.00009$	$\pm0^{m}.019$	

Remarks:

The Simbad database reports no known variable star in the vicinity of these eight objects. All objects were found to be variable by L. B., except USNO-A2.0 1050-19244897 by C. D., in the course of asteroidal light curve determination.

Acknowledgements:

These researches used the Simbad database, operated by the CDS at Strasbourg, France.

Reference:

Behrend, R., 2001, *Orion*, **304**, 12

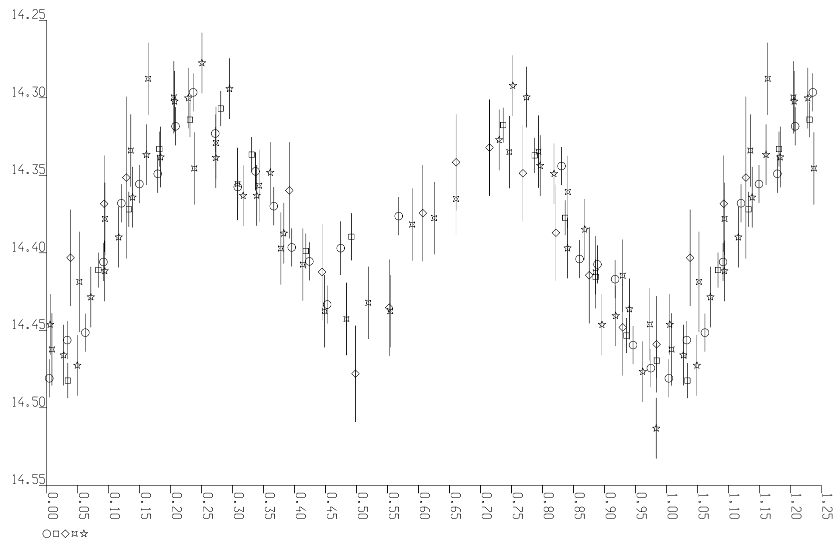

Figure 1. Unfiltered light curve of GSC 661-503, $P = 0\overset{d}{.}35240$. The small labels denote the chronologic order of the series of observations in Figs. 1-8.

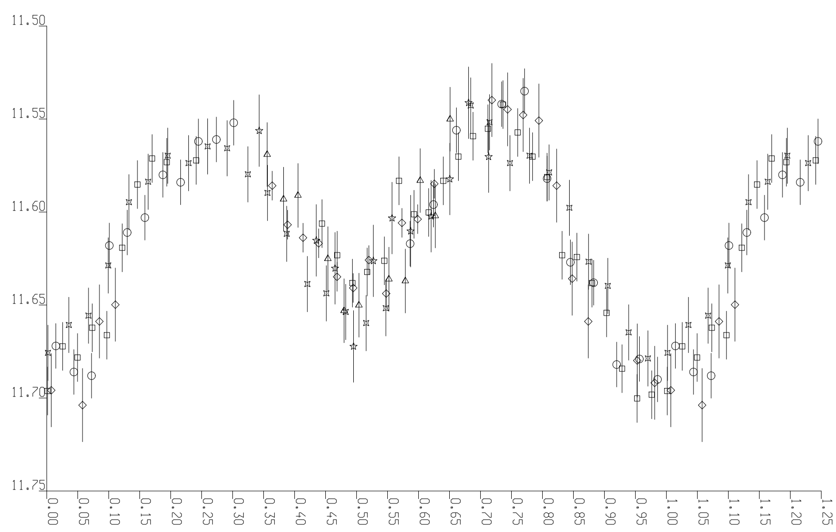

Figure 2. Unfiltered light curve of GSC 4948-989, $P = 0\overset{d}{.}2562555$.

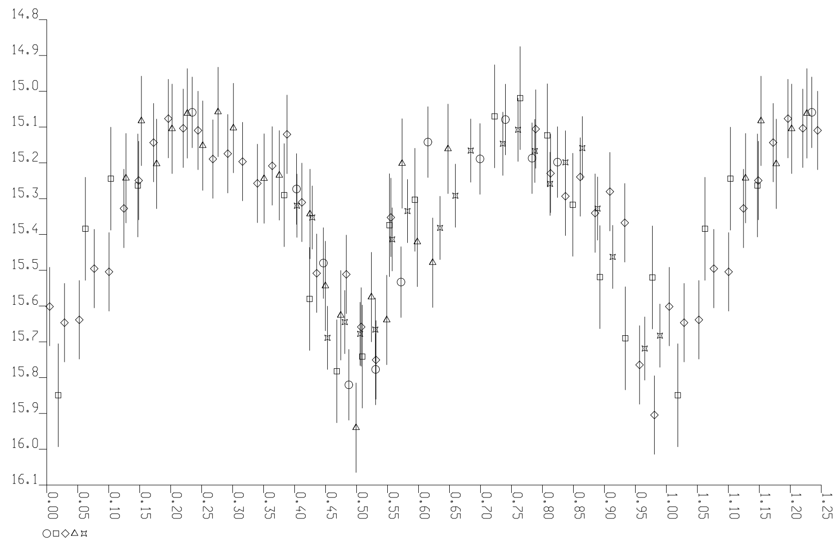

Figure 3. Unfiltered light curve of USNO-A2.0 1050-19244897, $P = 0^{\rm d}.29516$.

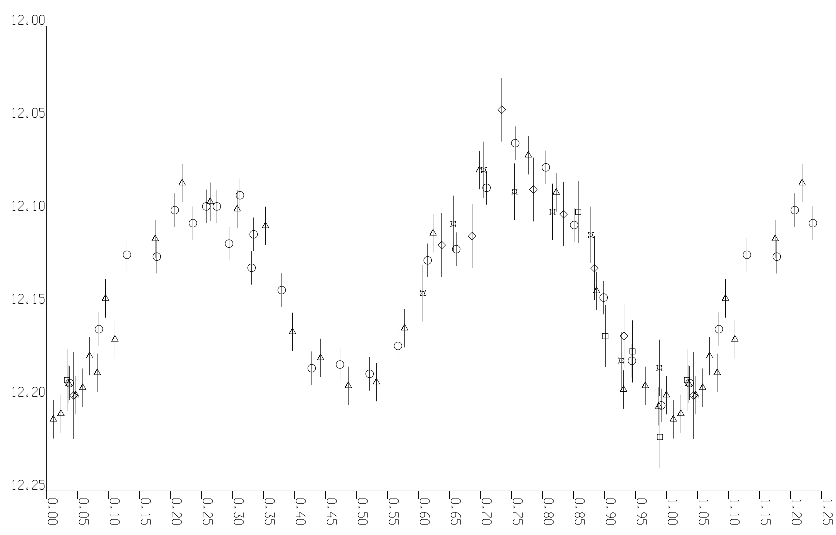

Figure 4. Unfiltered light curve of GSC 843-262, $P = 0^{\rm d}.33614$.

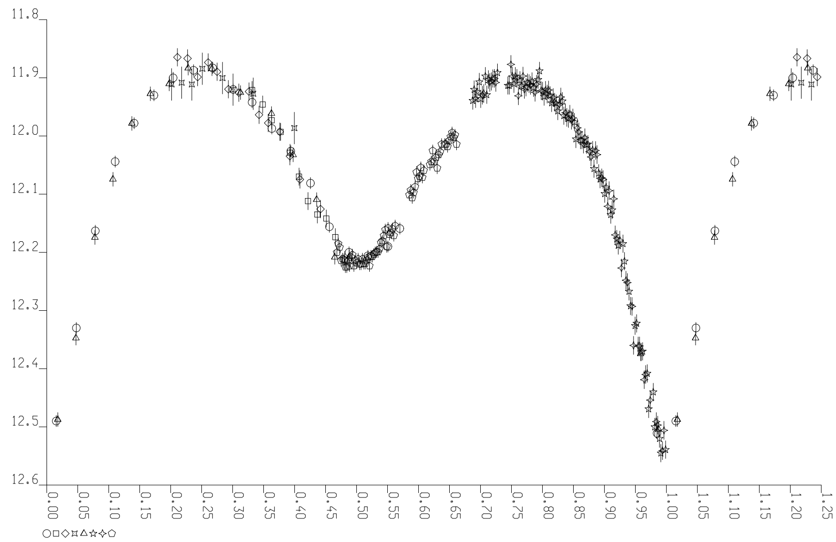

Figure 5. Unfiltered light curve of GSC 1402-121, $P = 0\overset{d}{.}50146$.

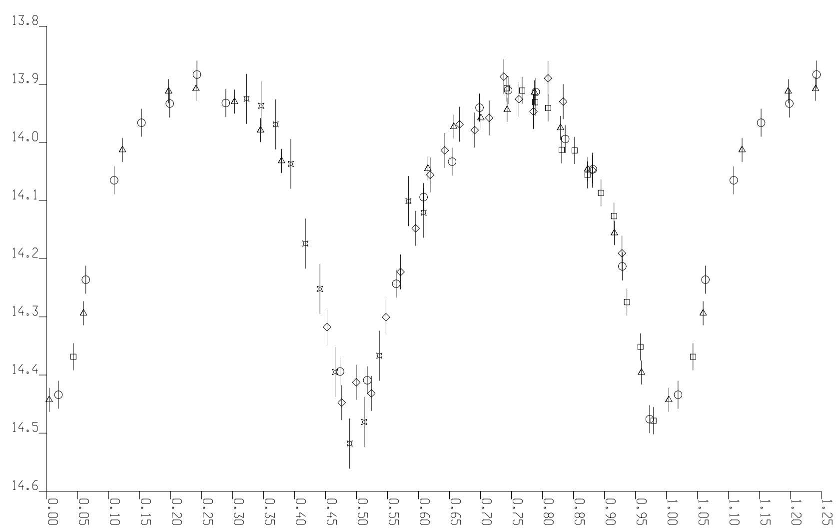

Figure 6. Unfiltered light curve of GSC 1402-52, $P = 0\overset{d}{.}34781$.

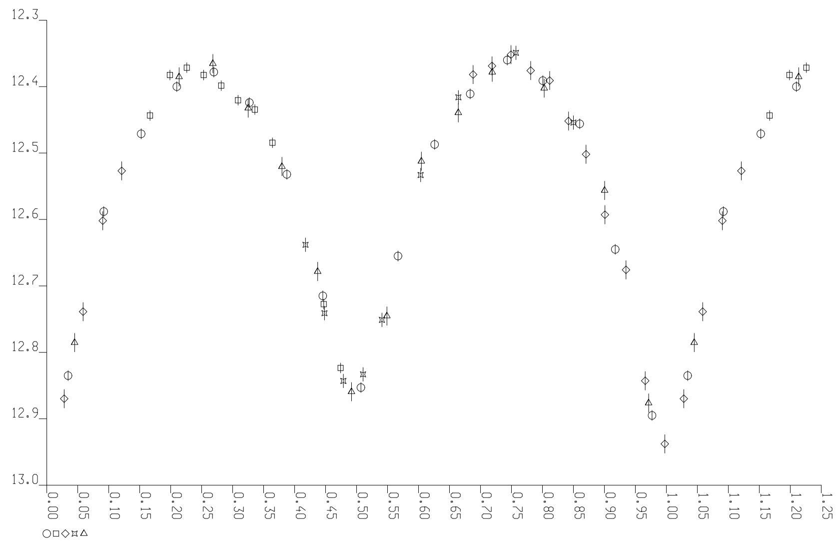

Figure 7. Unfiltered light curve of GSC 1400-455, $P = 0^{\rm d}.267650$.

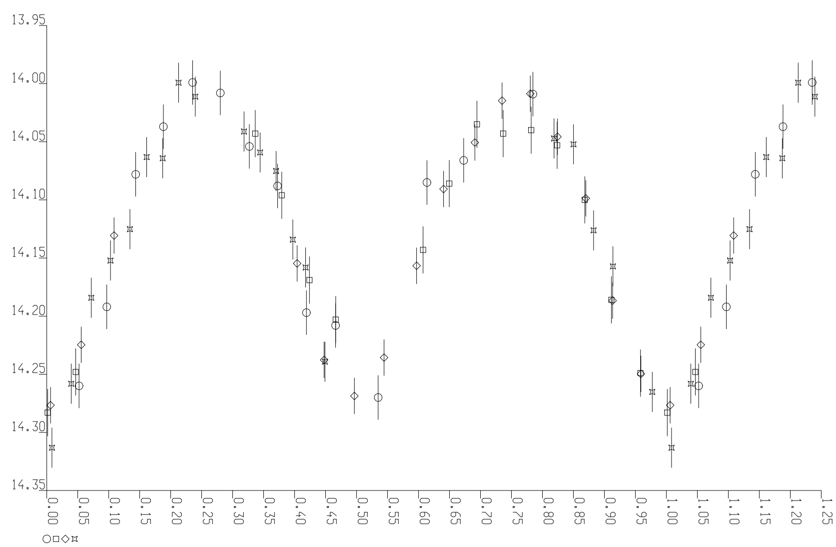

Figure 8. Unfiltered light curve of GSC 2495-1124, $P = 0^{\rm d}.32678$.

COMMISSIONS 27 AND 42 OF THE IAU
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FIVE NEW PULSATING VARIABLES

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Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
GSC 1649-6	RR Lyr	$21^h08^m57\overset{s}{.}98$	$+15°56'55\overset{''}{.}6$	*
USNO-A2.0 1050-1201364	RR Lyr	$04^h16^m50\overset{s}{.}81$	$+18°52'20\overset{''}{.}9$	*
GSC 2497-101	RR Lyr	$09^h30^m23\overset{s}{.}23$	$+33°53'10\overset{''}{.}7$	*
GSC 5569-389	HADS/SX Phe	$14^h46^m00\overset{s}{.}85$	$-10°13'15\overset{''}{.}6$	*
GSC 4998-854	RR Lyr	$14^h47^m51\overset{s}{.}52$	$-06°34'45\overset{''}{.}7$	*

* R magnitudes of about ten USNO-A2.0 stars in the fields.

Observatory and telescope:

F.-X. Bagnoud Obs. (IAU astrometric code 175), 0.60m Newton; Ottmarsheim Obs. (224), 0.305m Schmidt–Cassegrain; Village-Neuf Obs. (138), 0.20m Schmidt–Cassegrain; Les Engarouines Obs. (A14), 0.212m Newton.

Detector:	KAF-1600 at 175 and A14, KAF-1602E at 138 and 224
Filter(s):	None, roughly *R*.

Availability of the data:

Upon request

Method of data reduction:

Standard CCD-frame reduction using `IRAF` at 175, and `Prism` elsewhere.

Date(s) of the observation(s):

GSC 1649-6	2002–8–11, 14, 15; 2002–9–11, 12 (138)
USNO-A2.0 1050-1201364	2002–9–30 (175);
	2002–9–31; 2002–10–1; 2003–1–13 (224)
GSC 2497-101	2002–12–7; 2003–2–2, 8 (A14)
GSC 5569-389	2003–5–7, 11, 29, 30 (A14)
GSC 4998-854	2003–5–29, 30, 31 (A14)

Table 1. Light curve parameters from the data analysis by the `CourbRot` software (Behrend, 2001). M-m denotes the rising fraction of the light curve. Uncertainties correspond to one standard-deviation.

Star name	HJD of a max.	Period	Tot. var.	M-m	Type
GSC 1649-6	2452500ᵈ480 ±0ᵈ004	0ᵈ55259 ±0ᵈ00020	0ᵐ92 ±0ᵐ04	0.15	RR Lyr
USNO-A2.0 1050-1201364	2452547ᵈ535 ±0ᵈ004	0ᵈ266882 ±0ᵈ000009	0ᵐ391 ±0ᵐ020	0.4	RR Lyr
GSC 2497-101	2452678ᵈ292 ±0ᵈ005	0ᵈ420003 ±0ᵈ000025	0ᵐ665 ±0ᵐ026	0.25	RR Lyr
GSC 5569-389	2452766ᵈ4469 ±0ᵈ0013	0ᵈ0731905 ±0ᵈ0000022	0ᵐ469 ±0ᵐ021	0.25	HADS/SX Phe?
GSC 4998-854	2452788ᵈ569 ±0ᵈ005	0ᵈ3143 ±0ᵈ0006	0ᵐ456 ±0ᵐ013	0.3	RR Lyr

Remarks:

The Simbad database reports no known variable star in the vicinity of these five objects. They were found to be variable respectively by C. D., Y. R. and 3×L. B., in the course of asteroidal light curve determination.

Acknowledgements:

These researches used the Simbad database, operated by the CDS at Strasbourg.

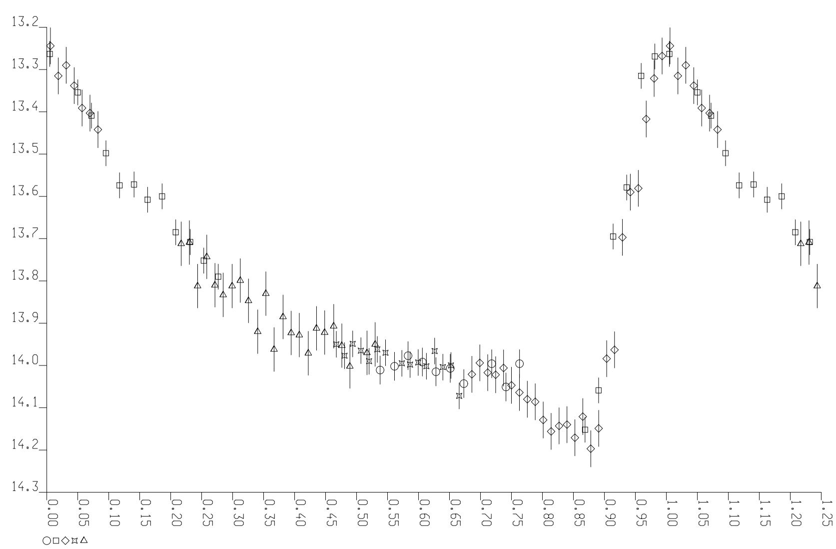

Figure 1. Unfiltered light curve of GSC 1649-6, $P = 0^{\rm d}.55259$. The small labels denote the chronologic order of the series of observations in Figs. 1-5.

Reference:

Behrend, R., 2001, *Orion*, **304**, 12

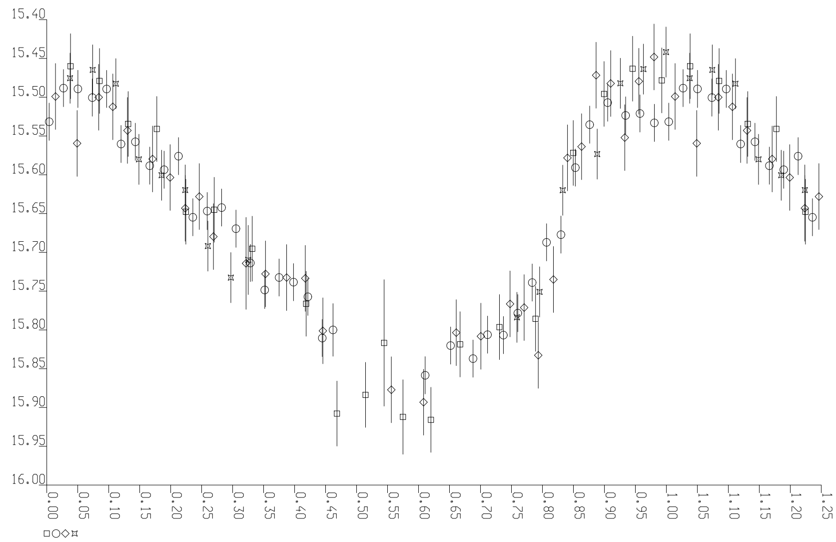

Figure 2. Unfiltered light curve of USNO-A2.0 1050-1201364, $P = 0\overset{\mathrm{d}}{.}266882$.

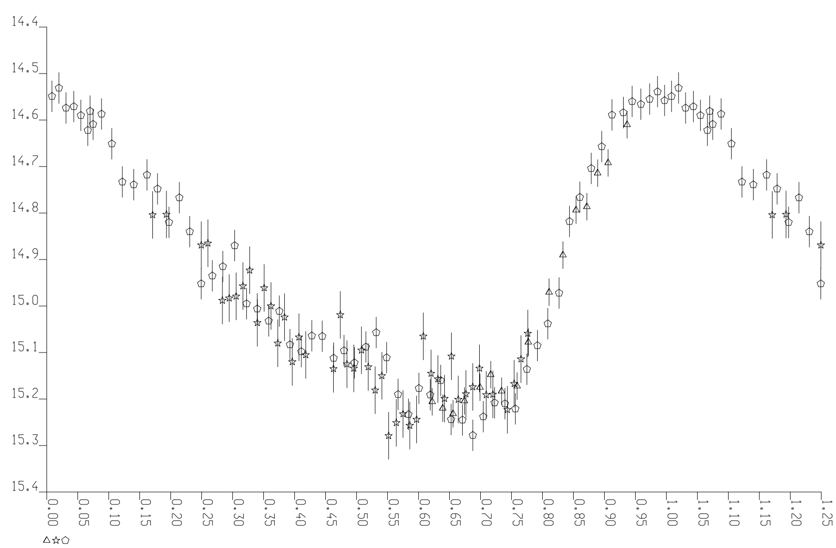

Figure 3. Unfiltered light curve of GSC 2497-101, $P = 0\overset{\mathrm{d}}{.}420003$.

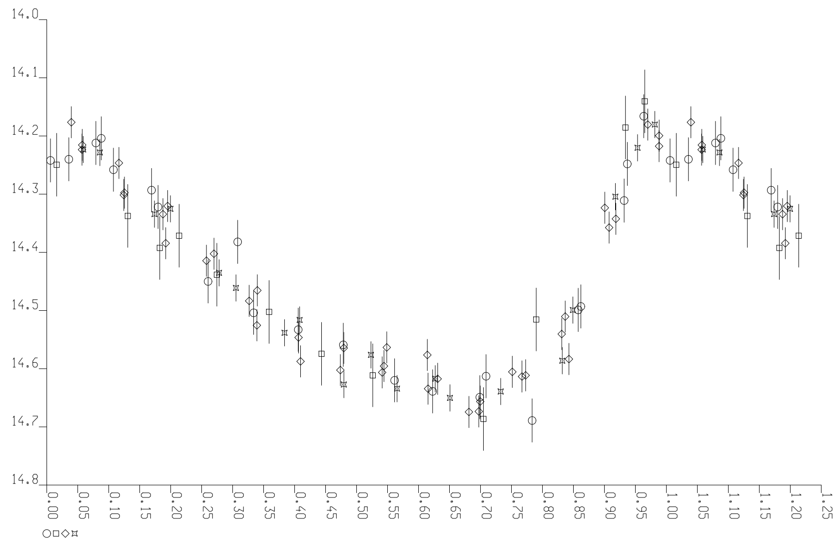

Figure 4. Unfiltered light curve of GSC 5569-389, $P = 0\overset{\mathrm{d}}{.}0731905$.

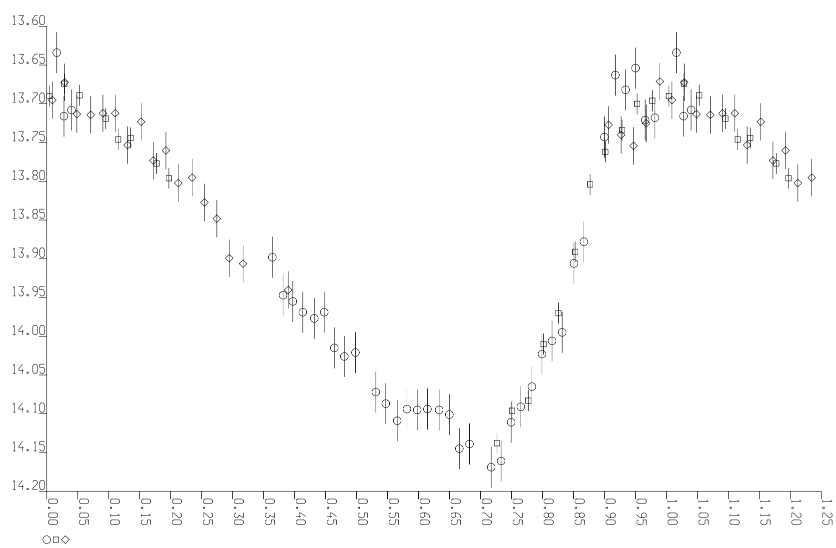

Figure 5. Unfiltered light curve of GSC 4998-854, $P = 0\overset{\mathrm{d}}{.}3143$.

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NEW OBSERVATIONS OF THE PULSATING DA WHITE DWARF G117-B15A

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[2] Konkoly Observatory, P.O.Box 67, H-1525 Budapest XII, Hungary

G117-B15A is a well observed pulsating DA White Dwarf or ZZ Ceti type star. It has 6 pulsation modes (Kepler et al., 1982) where the dominant mode has a period of 215.2s. In this paper we present the data of two nights of observation obtained during a one week observing run at the Konkoly Observatory in February 2002.
Our primary goal is to assist the derivation of the rate of change of the main pulsation period of the star, in particular to assist the work done by Kepler et al. over the past 20 years. Therefore we will present new light curves and the Fourier spectra of the star and the epochs of the light maxima.

We observed G117-B15A for two nights on the 1m-reflector of the Konkoly Observatory mountain station at Piszkéstető, Hungary. The telescope has a focal length of 13.5m and is equipped with a 1024×1024 Thomson TH7896M CCD chip, which has its maximum sensitivity in the visual band. In order to collect as much light as possible, no filter was used. Furthermore only a small area on the CCD frame was used to minimize the integration time. We collected 16 hours of data for our target.

RA (Eq. 2000):	$9^h24^m16^s$
Dec. (Eq. 2000):	$35°16'.9$
Spectral Type:	DAV (ZZ Ceti)
Magnitude (V):	15.54

Table 1: Coordinates, Spectral Type and Magnitude of G117-B15A

We used the IRAF package for image-processing and photometry. Two stars on the same frame were used as comparison stars (GSC2.2 N23332237260 and N2333223509). The significance level, shown in Figure 2, is based on an amplitude signal/noise ratio of ~ 4.0, which was proposed as a criterion to distinguish between pulsation and noise by Breger et al. (1993).

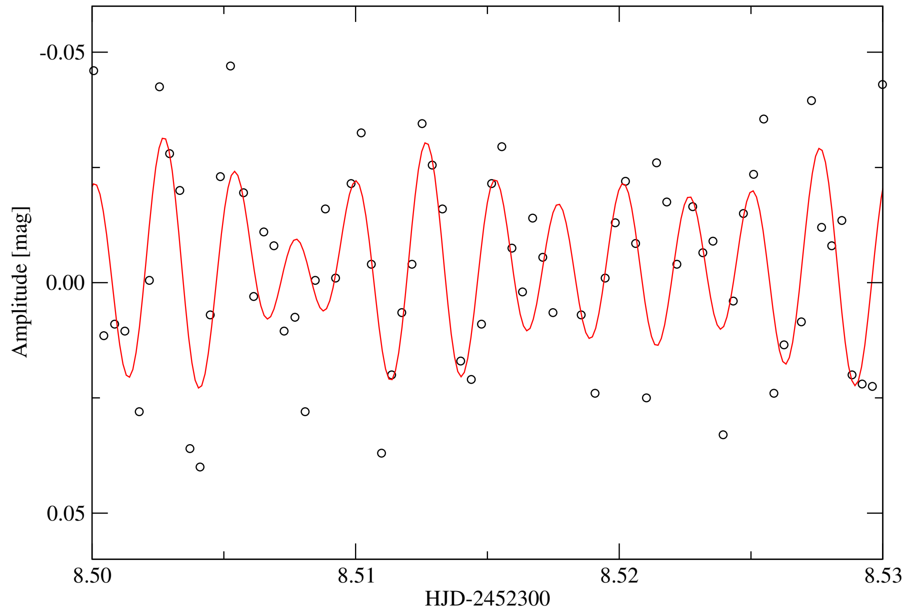

Figure 1. Part of the light curve of G117-B15A. Since the periods are short in respect to the amount of data, we chose a narrow region of the light curve for this presentation. The fitted curve represents the composite of the three detected frequencies.

During the two nights of observation 3 of the 6 previously detected frequencies (Kepler et al., 1982) could be derived. The values for the frequencies, amplitudes and phases are listed in Table 2. We also quote the values derived by Kepler et al. for comparison reasons.

Mode	Frequency	Amplitude	Epoch of maximum light	Frequencies and Amplitudes derived by Kepler et al. (1982)	
	mHz	mmag	HJD	mHz	mmag
		±0.86	245 2307+	±0.005	
f1	4.65	17.45	.498979	4.645	22.0
f2	3.29	6.17	.499047	3.285	7.5
f3	3.71	5.61	.497840	3.690	6.7
f4				9.295	1.6
f5				8.345	1.3
f6				7.925	1.4

Table 2: Table of derived frequencies, amplitudes and epoch of maximum light. We use the techniques of Breger et al. (1999) to derive the uncertainties in amplitude and epoch of maximum light. We assume therefore that the errors of the data points are not correlated in time.

Acknowledgements:
This investigation has been supported by the Austrian Fonds zur Förderung der wissenschaftlichen Forschung under project number P14546-PHY.

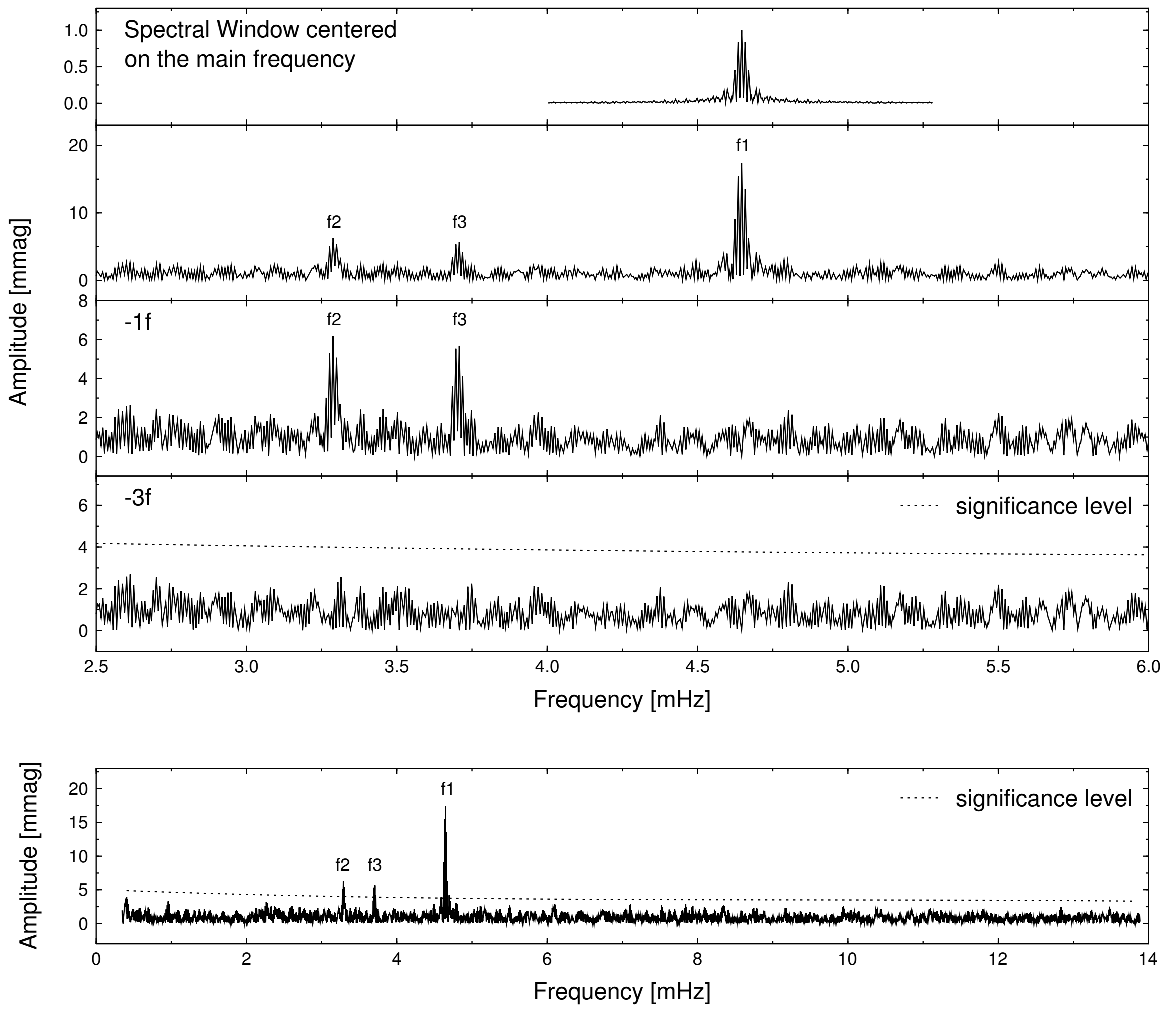

Figure 2. Amplitude spectrum of G117-B15A derived from Fourier analysis with the Period98 package (Sperl, 1998). Three of the six previously detected frequencies could be resolved. We show only a part of the spectra in the upper half of the figure to be able to resolve the spectral window completely.

References:

Breger, M., Stich, J., Garrido, R. et al. 1993, *A&A*, **271**, 482
Breger, M., Handler, G., Garrido, R. et al. 1999, *A&A*, **349**, 225
Kepler, S. O., Robinson, E. L., Nather, R. E., & McGraw, J. T. 1982, *ApJ*, **254**, 676
Sperl, M. 1998, Comm. in Asteroseismology (Vienna), 111, 1

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FOUR NEW SHORT-PERIOD ECLIPSING BINARY STARS

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e-mail: gm,kczart,aniedzi,agata@astri.uni.torun.pl

Four new eclipsing binary stars were discovered by the Semi-Automatic Variability Search[1]. Basic data for new variables are collected in Table 1. The observations were made at the Astronomical Observatory of the Mikołaj Kopernik University in Piwnice with the semi-automatic CCD camera equipped with a 135/2.8 telephoto lens. As a detector SBIG ST-7 CCD camera with KAF 400 chip was used. All brightness measurements were made in near-Johnson V filter. No transformation to a standard system was done. All given magnitudes are determined against comparison stars, which estimated V magnitudes were calculated from TYCHO-2 Catalogue (Høg et al., 2000) with formula: $V = V_T - 0.090(B_T - V_T)$. Times of minima were determined with the Kwee-van Woerden method (Kwee, van Woerden, 1956). Periods were found with the ANOVA method of Schwarzenberg-Czerny (1996). All four stars were also observed with the 0.9m Schmidt-Cassegrain telescope equipped with the Richardson spectrograph and Wright CCD camera. With 600 gr/mm grating we obtained spectra between 3500 and 5500 Å with 2 Å/pix reciprocal dispersion. These spectra, after standard reduction performed with IRAF package were used for spectral classification.

Table 1. Basic data for new eclipsing variables

Star name	R.A. (J2000)	DEC. (J2000)	Comp. stars	Type
HD 65498	$08^h00^m45\overset{s}{.}955$	$+42^\circ10'33\overset{''}{.}07$	HD 66174	EA
			GSC 02976-00001	
HD 67894	$08^h11^m53\overset{s}{.}503$	$+42^\circ54'36\overset{''}{.}20$	HD 67808	EB:
			HD 68195	
BD+20°2890	$13^h53^m53\overset{s}{.}848$	$+20^\circ09'43\overset{''}{.}18$	HD 120831	EW
			BD+20°2887	
GSC 03472-00641	$14^h21^m44\overset{s}{.}058$	$+46^\circ41'59\overset{''}{.}37$	BD+47°2136	EW
			BD+47°2141	

HD 65498 = BD+42°1795 = GSC 02976-01077 is recorded in Simbad database as a star of V=$9\overset{m}{.}75$ with $(B-V)$=$0\overset{m}{.}48$ and spectral type G. Our observations collected during 13 nights between February 23, 2003 and April 4, 2003 and consisting of 232 data points (Figure 1) show that HD 65498 is an algol-type variable (EA) with period of about 31.5 hour. In the primary minimum the observed brightness drops by Δm_V=$0\overset{m}{.}43$. The secondary minimum is $0\overset{m}{.}05$ shallower and appears exactly in phase 0.5 indicating circular orbit of the system. Both minima are of equal duration and last for about

[1]For further information on SAVS see http://www.astri.uni.torun.pl/~gm/SAVS/.

4 hours. Coordinates of HD 65498 coincide with those of an infra-red source 2MASS J0800459+421033. A preliminary ephemeris for the primary minimum is:

$$\begin{array}{l} \text{Min. I} = \text{HJD } 2452704.48836 + 1^{\rm d}\!\!.31324 \times E. \\ \qquad\qquad\quad \pm 0.00054 \pm 0.00006 \end{array} \qquad (1)$$

Our spectrum of HD 65498 shows features characteristic for a F5V star (see Figure 5).

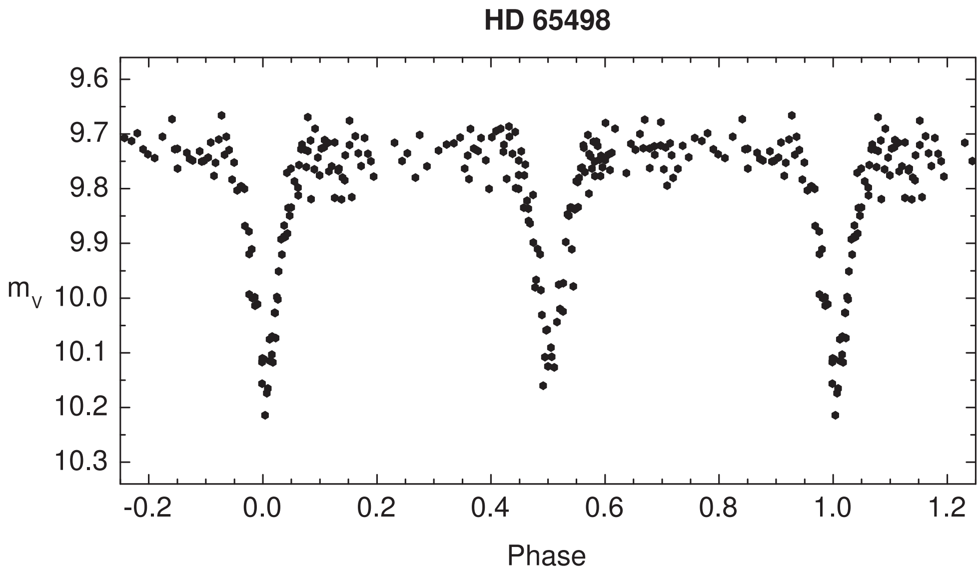

Figure 1. CCD light curve of HD 65498

Variability of HD 67894 = BD+43°1775 = GSC 02979-02218 was discovered during 23 nights between October 23, 2002 and April 10, 2002. 278 data points were collected in total. HD 67894 has V=9$^{\rm m}\!\!.$98 and $(B-V)$=0$^{\rm m}\!\!.$40, and is classified as a star of spectral type of G0 in Simbad. As it is seen in Figure 2, the difference between minima is considerable. The depth of the primary minimum is Δm_V=0$^{\rm m}\!\!.$28 and an amplitude of the secondary minimum is 0$^{\rm m}\!\!.$18. Therefore, despite of a short period and a late spectral type, we classified the system basing on the light-curve morphology as an eclipsing variable of β Lyrae type. Due to positions coincidence we identify HD 67894 with the IR source observed within 2MASS survey - 2MASS J0811535+425436. A preliminary ephemeris is:

$$\begin{array}{l} \text{Min. I} = \text{HJD } 2452722.47342 + 0^{\rm d}\!\!.378018 \times E. \\ \qquad\qquad\quad \pm 0.00035 \pm 0.000015 \end{array} \qquad (2)$$

Basing on spectrum presented in Figure 5 we classify HD 67894 as a F3V star.

BD+20°2890 = GSC 01473-01049 was noted as a variable star with an amplitude about 0$^{\rm m}\!\!.$2 by Oja (1985) during a photoelectric UBV photometry survey for stars located near the North Galactic Pole. The V magnitude for the star of interest is 10.4 and color indices $(B-V)$=0$^{\rm m}\!\!.$38 and $(U-B)$ = −0$^{\rm m}\!\!.$02 (Oja, 1985). Our photometric data (Figure 3) show that BD+20°2890 is an eclipsing binary of W UMa type changing its brightness with an

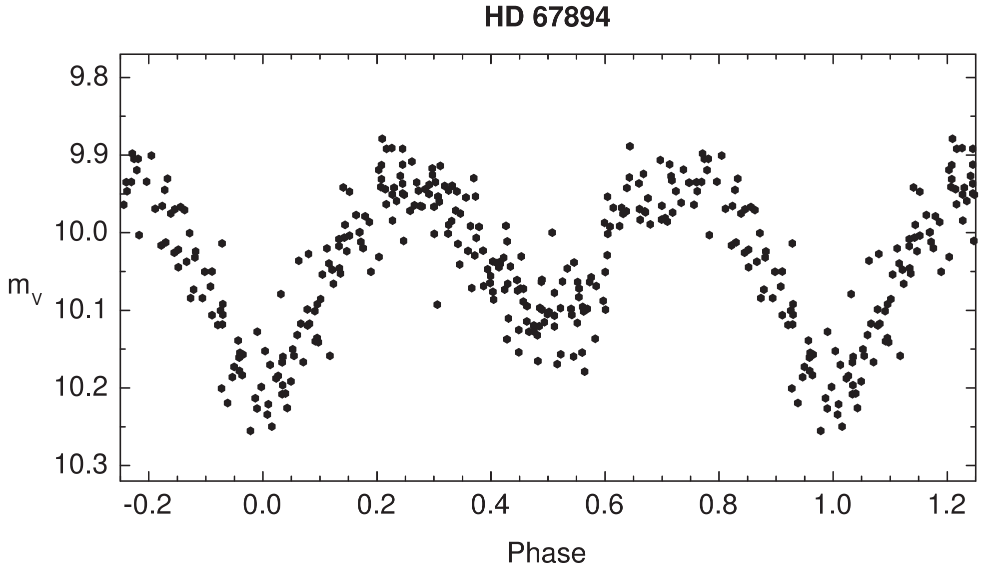

Figure 2. CCD light curve of HD 67894

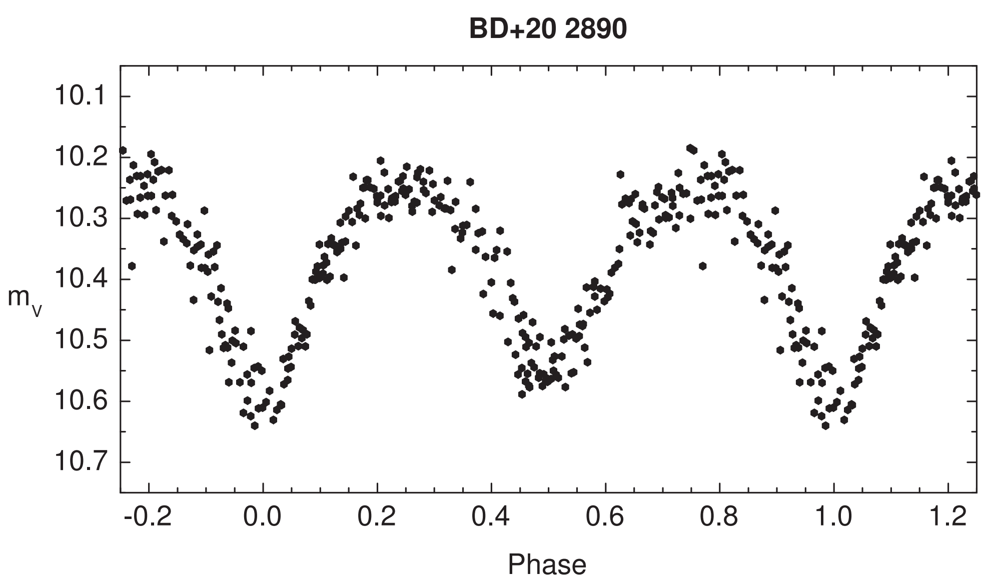

Figure 3. CCD light curve of BD+20°2890

amplitude in the primary minimum by Δm_V=0$^{\rm m}_{\cdot}$37 and with a period of just over a half of a day. The secondary minimum is 0$^{\rm m}_{\cdot}$07 brighter. Observations were performed during 14 nights between April 21, 2003 and June 1, 2003. 309 single photometric measurements were collected. In our data the object is blended with its fainter companion located 20 arc seconds south. The ephemeris of a primary minimum is given by formula:

$$\begin{array}{c} \text{Min. I} = \text{HJD } 2452788.42371 + 0^{\rm d}_{\cdot}53158 \times E. \\ \pm 0.00025 \pm 0.00002 \end{array} \qquad (3)$$

Optical spectrum (Figure 5) allows us to assign the A9III spectral type to BD+20°2890.

GSC 03472-00641 is the last new variable presented in this paper. Photometry from to TYCHO-2 Catalogue (Høg et al. 2000) gives V=11$^{\rm m}_{\cdot}$32 and $(B-V)$=0$^{\rm m}_{\cdot}$45. Our 214 data points collected during 12 nights between April 19, 2003 and May 7, 2003 show that GSC 03472-00641 is a W UMa system with a period of almost 8 hours. The obtained light curve is presented in Figure 4. The primary and secondary minima have an amplitude of Δm_V=0$^{\rm m}_{\cdot}$50 and Δm_V=0$^{\rm m}_{\cdot}$39 respectively. Due to positions coincidence we identify GSC 03472-00641 with the infra-red source 2MASS J1421440+464159. A preliminary ephemeris for the primary minimum is following:

$$\begin{array}{c} \text{Min. I} = \text{HJD } 2452764.50965 + 0^{\rm d}_{\cdot}318618 \times E. \\ \pm 0.00030 \pm 0.000081 \end{array} \qquad (4)$$

Presented in Figure 5 spectrum of GSC 03472-00641 is most similar to G5III type.

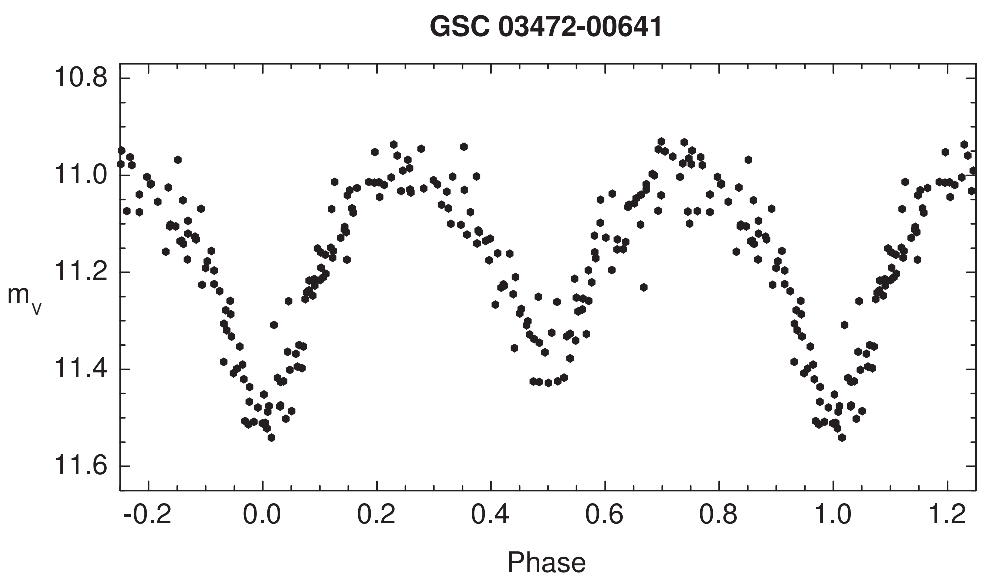

Figure 4. CCD light curve of GSC 03472-00641

Acknowledgements: This research made use of the SIMBAD data base, operated by the CDS at Strasbourg, France. This paper is based on observations collected at Piwnice observatory.

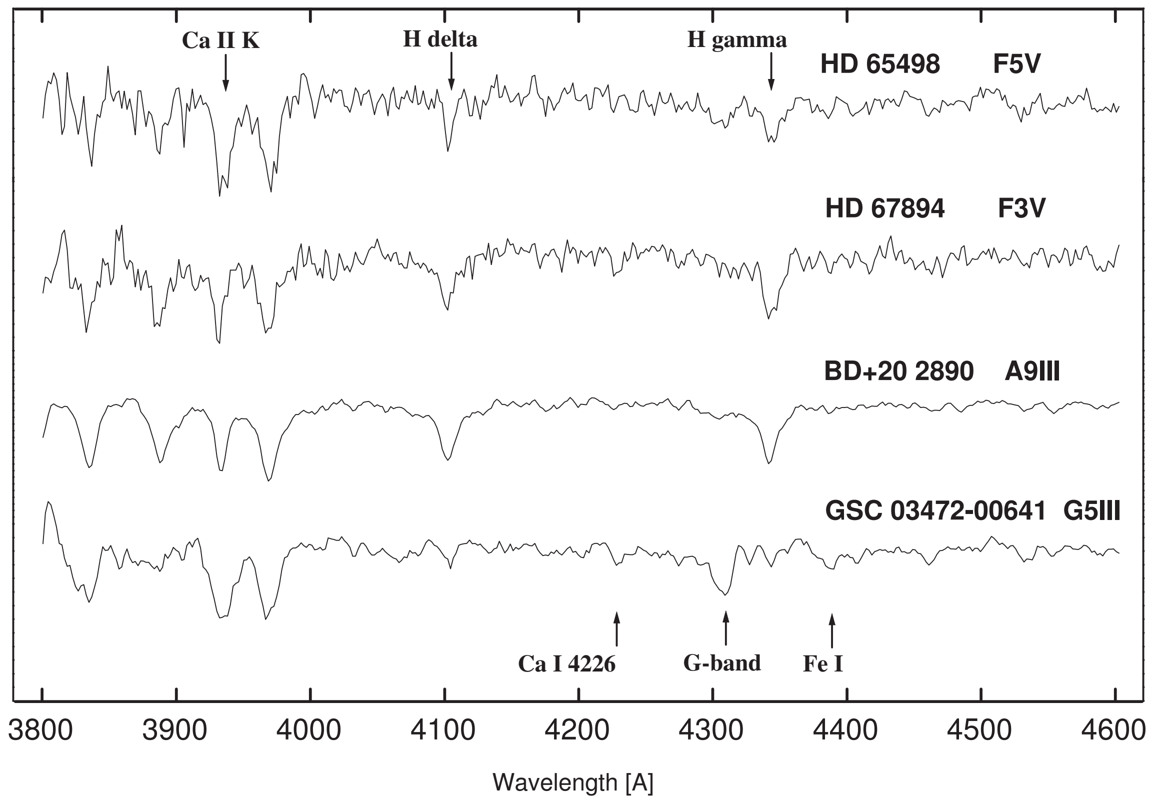

Figure 5. Optical spectra of the program stars in the blue. Positions of the most significant spectral features are indicated

References:

Høg, E., Fabricius, C., Makarov, V. V., Urban, S., Corbin, T., Wycoff, G., Bastian, U., Schwekendiek, P., Wicenec, A., 2000, *A&A*, **355**, L27

Kwee, K. K., van Woerden, H., 1956, *Bull. Astr. Inst. Netherlands*, **12**, No. 464, 327

Oja, T., 1985, *A&AS*, **61**, 331

Schwarzenberg-Czerny, A., 1996, *ApJ*, **460**, L107

ERRATUM FOR IBVS 5431

Geert Hoogeveen reported the following error:

IBVS No.	item	printed	correct
5431	RA (BD +20°2890)	$13^{h}53^{m}53\overset{s}{.}848$	$13^{h}53^{m}13\overset{s}{.}848$

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SPECTROSCOPIC CLASSIFICATION OF PZ NORMAE

SCHMIDTOBREICK, L.; SAVIANE, I.; POMPEI, E.

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PZ Nor is first mentioned as a variable star by Hoffmeister (1963). He and later Gessner & Meinunger (1975) describe the object as a slow irregular variable showing a constant brightness at a low level over several months and brighter values afterwards. The magnitudes they give range from $14\overset{m}{.}5$ to $15\overset{m}{.}5$. Cieslinski et al. (1997) found the object at V=$13\overset{m}{.}9$ and also determined its colours which showed the object to be rather red. Later, PZ Nor has been classified as probable cataclysmic variable (CV) showing frequent outbursts (Kinnunen, 2002) and is such listed in Downes et al. (2001).

We have recently performed spectroscopic observations with the aim to classify the object. Here, the results of this analysis are presented.

The data have been obtained on 2003-05-09 at ESO, La Silla, using EMMI at the NTT with grism #3 and a 1.0 arcsec slit for the low resolution spectrum and FEROS at the 2.2 for the high resolution spectroscopy. We get respective FWHM resolutions of 1 nm and 0.015 nm. Standard reduction has been performed with IRAF for the EMMI data. For FEROS, the data have been reduced with the provided MIDAS–pipeline. Further analysis of all data has been done with MIDAS only. Both data sets have been corrected for the instrument function and flux–calibrated via a spectrophotometric standard. However, due to very poor weather conditions, the absolute flux–values have to be regarded with caution.

The spectrum of PZ Nor is given in Fig. 1. It is dominated by the strong TiO absorption features and shows only very weak Balmer–lines in emission (see Fig. 2 for the high resolution spectrum of these lines, Table 1 for their properties). No other emission lines have been found in the spectrum. The FWHMs of these Balmer lines lie around 0.08 nm (see Table 1). This is about the minimum line width expected for CVs at an inclination $i = 0$ which makes this classification very improbable. If anyway a CV is assumed, the low equivalent widths of the lines and the strongly inverse Balmer decrement would indicate a very hot and dense accretion disc that would dominate the optical spectrum and subdue any sign of molecule bands which are instead very strong in the spectrum. We therefore conclude that PZ Nor cannot be classified as a cataclysmic variable (CV).

Instead, the spectrum reveals the object to be a late–M giant, best agreement is achieved with type M5 III (Silva & Cornell, 1992). To further check the CV classification, we have subtracted the normalised standard M5 III spectrum from the spectrum of PZ Nor. The result shows a flat continuum plus emission lines. In particular, no evidence is found for any additional blue component like white dwarf or accretion disc. This supports our conclusion that PZ Nor had been misclassified as a CV.

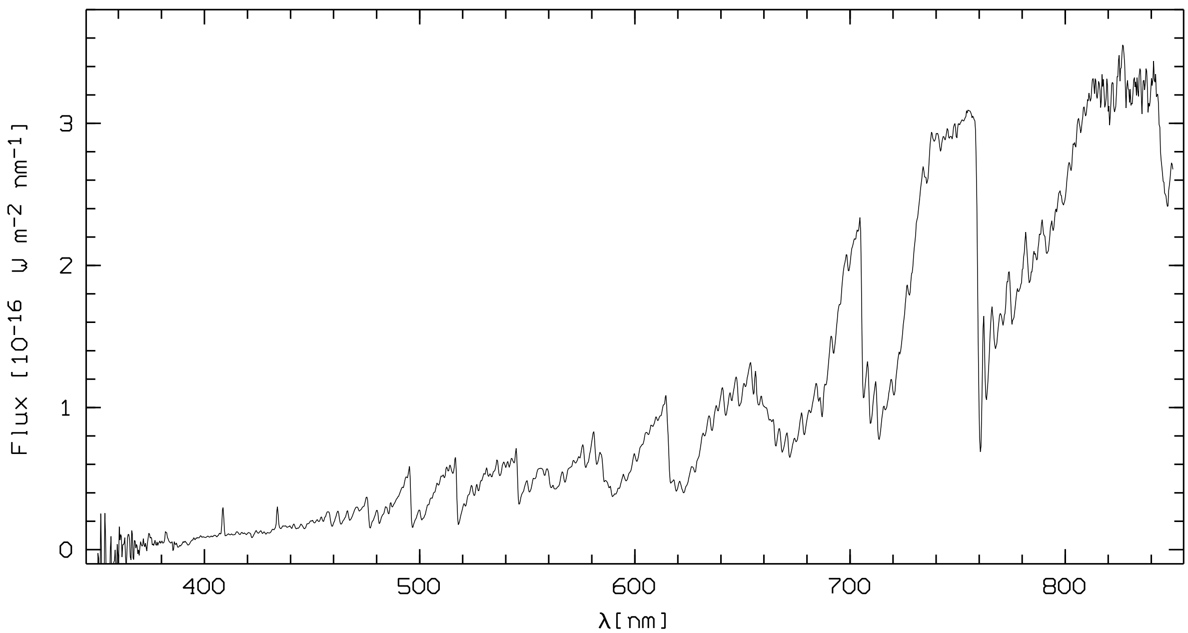

Figure 1. The low resolution spectrum of PZ Nor resembles that of an M-type giant.

The object has shown photometric variability on time scales of months, but no periodicity has been detected so far (Hoffmeister, 1963; Gessner & Meinunger, 1975). On our acquisition images the object appeared to be brighter compared to surrounding field stars than on the finding chart. Although we can give no numerical value for the brightness due to the poor weather conditions, we can assert that for these observations, the object was in or close to a high state phase. This fits with the presence of the Balmer lines which are expected for late–type variables with unstable atmospheres around maximum light. Also the decrement of $H\gamma/H\delta \approx 0.5$ points to a phase close to maximum light (Crowe & Garrison, 1988). We searched the high resolution spectrum for metal emission lines like SiI (410.295 nm), MgI (457.110 nm), and FeI (430.791 nm; 420.203 nm), which have been observed in Mira–type stars (Fox et al., 1984) but found none of them. Whether PZ Nor is actually a real Mira–type variable with a long - and hence not yet detected - period or some late–type semi–regular variable has yet to be investigated.

Table 1: FWHM, and equivalent widths of all identified emission lines are listed. The FWHM has been measured in the high resolution spectrum, as the lines are not resolved in the low resolution one. The equivalent widths in both spectra are the same within the errors. The line fluxes have not been included due to non–photometric weather conditions.

Transition	FWHM [nm]	$-W$ [nm]
$H\alpha$	0.082(1)	0.16(1)
$H\beta$	0.083(3)	0.15(2)
$H\gamma$	0.082(2)	1.12(8)
$H\delta$	0.075(4)	2.13(5)

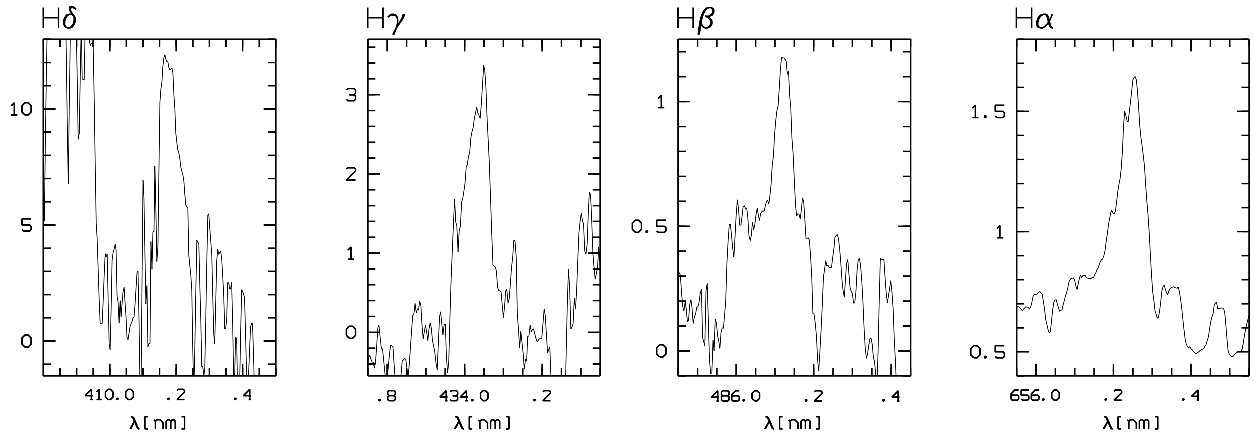

Figure 2. High resolution spectrum of PZ Nor around Hα, Hβ, Hγ, and Hδ (from right to left) in relative flux units (10^{-16}Wm^{-1}nm^{-1}). As in the low resolution spectrum, all four lines are clearly visible. The high resolution reveals the narrowness of the emission lines which have an average FWHM of 0.08 nm.

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V516 Cas, AN RRab STAR AT THE GALACTIC PLANE

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The variable star V516 Cas was discovered by Romano (1971) who classified it as an RR Lyrae type star. Although Simbad database includes this variable with an erroneous position due to the wrong coordinates given by the discoverer, on the base of Romano's finding chart it can be identified unambiguously and the electronic edition of the "GCVS with Improved Coordinates" (Samus et al., 2002) gives also the correct position: $\alpha_{2000} = 0^{h}35^{m}21\overset{s}{.}75$, $\delta_{2000} = 52^{\circ}59'53\overset{''}{.}8$.

Since no observations were published on this star, we wanted to verify its variability and type. We observed it during 4 nights using two different CCD cameras attached to the 1m RCC telescope of the Konkoly Observatory mountain station at Piszkéstető. On three nights in December 2002 a camera was used which had been built by Photometrics Inc. containing a Thomson TH7896M 16 bits chip with 1024×1024 pixels. It yields a $5' \times 5'$ field of view (FOV). On the night in February 2003 we used a camera made by Wright Instruments including an EEV CCD05-20 16 bits chip with 800×1200 pixels. This equipment yields abut $4' \times 6'$ FOV. For detailed technical description of the CCDs we refer to the paper of Bakos (2000). The observational log is shown in Table 1. The filters used were standard Johnson B, V and Cousins $I_{\rm C}$, and the exposure times were between 4-6 minutes for all colours, the value of typical seeing was between $1\overset{''}{.}5$–$3\overset{''}{.}5$.

The basic reduction steps: flat fielding, overscan correction were carried out by IRAF[1], similarly to the aperture photometry. Since the stars in our field were well separated, an aperture photometry was done. A relative photometry to the comparison star (comp) GSC-2.2 N311030314105 (=1425-00833847 USNO-A2.0, Monet et al., 1998), and check star (check) GSC-2.2 N311030313722 (=1425-00838472 USNO-A2.0) were done and no variability was found in our data over $\sigma = 0.01$ for all three bands. Therefore we have used the relative magnitudes V516 Cas minus comp. The extinction was corrected in the usual way taking into account the first order extinction coefficients. To tie the comparisons into the standard photometric system, we observed the open cluster M52 on two nights (09/12/02 and 10/12/02). We used photometric results of ~50 relatively bright and separated stars from the paper of Pandey et al. (2001) as reference magnitudes for all three colours. Applying the colour equations with the determined telescope constants and

[1]IRAF is distributed by the NOAO, operated by the Association of Universities for Research in Astronomy Inc., under contract with the NSF.

Table 1: Log of observations of V516 Cas

Date	No B V I_C	Camera
09/12/2002	20, 20, 20	Photometrics
10/12/2002	20, 20, 20	Photometrics
11/12/2002	14, 14, 13	Photometrics
02/02/2003	25	Wright

zero points, the magnitudes and colours for comparison and check stars are $V = 13\overset{\text{m}}{.}82$, $(B-V) = 0\overset{\text{m}}{.}516$, $(V-I_{\text{C}}) = 0\overset{\text{m}}{.}573$ and $V = 13\overset{\text{m}}{.}63$, $(B-V) = 0\overset{\text{m}}{.}775$, $(V-I_{\text{C}}) = 0\overset{\text{m}}{.}819$, respectively, where the estimated accuracies are ± 0.025.

A period search was done for V light curve using a Fourier-method realized by MUFRAN program package (Kolláth, 1990). The following ephemeris was obtained:

$$V_{\text{max}}(\text{HJD}) = 2452618.460 + 0.403913E.$$

The B, V and I_{C}-band light curves of the V516 Cas folded by the above period are shown in Fig. 1. The observational data are available by electronic form via the IBVS-website, as 5433-t2.txt, 5433-t3.txt, 5433-t4.txt The magnitude and intensity averaged mean magnitudes and colours are $\langle V \rangle = 14\overset{\text{m}}{.}652$, $\langle B-V \rangle = 0.523$, $\langle V - I_{\text{C}} \rangle = 0.721$, and $\overline{V} = 14\overset{\text{m}}{.}576$, $\overline{B-V} = 0.474$, $\overline{V-I_{\text{C}}} = 0.669$, respectively. Concerning the shape of the phase diagram and the period V516 Cas is truly an RR Lyrae star as it was suggested by Romano.

In the past years empirical relations have been found among the Fourier coefficients of V light curves and fundamental physical parameters of RRab stars. The calculated metal abundance of V516 Cas is [Fe/H]=-0.65 using the formula of Jurcsik & Kovács (1996), while the mean absolute magnitude is $\langle M_V \rangle = 0\overset{\text{m}}{.}88$ by Kovács & Walker (2001) with the zero point of Kinman (2002). Using the three parameter formula for reddening free $B-V$ colour index by Kovács & Walker (2001) and comparing them with the measured value we can determined the colour excess along the line of sight as $E(B-V) = 0.23$. It agrees well with the value of $E(B-V) = 0.24$ from dust map of Schlegel et al. (1998) constructed from IRAS and COBE/DIRBE data.

There is no object in the Galactic position of V516 Cas ($l = 120\overset{\circ}{.}46$, $b = -9\overset{\circ}{.}8$) in the "Catalogue of dust clouds in the Galaxy" (Dutra & Bica, 2002), so this considerable reddening should be caused by the diffuse interstellar matter. Our light curves allow us to calculate the selective interstellar absorption coefficients $R_V = A_V/E(B-V)$. Following Kovács & Jurcsik (1997)=KJ97 we have applied the formula $I_0 = \langle I_{\text{C}} \rangle - d - R_{I_{\text{c}}} E(B-V)$, where I_0 is the calculated averaged magnitude from the Fourier coefficients and $R_{I_{\text{c}}} = 0.751R_V - 0.485$. The distance modulus $d = X - X_0$, where $X = \langle I_{\text{C}} \rangle - \beta \langle V - I_{\text{C}} \rangle$, $\beta = R_{I_{\text{c}}}/(R_V - R_{I_{\text{c}}})$ and the reddening free quantity X_0 has also an expression containing Fourier parameters (see KJ97 for the details). The only unknown parameter is R_V which can be calculated from the above equations simply. We have found it as $R_V = 3.06 \pm 0.5$, which agrees with the widely used $R_V = 3.14$. The error given here is derived from the formal errors of the applied formulae so it may be overestimated. We have estimated the distance of V516 Cas from the previously obtained quantities: $r \approx 4.1$ kpc. All the above information shows that V516 Cas is a relatively young, metal rich RRab variable lying in the Galactic disk.

As we have seen, from BVI_C light curves of an RRab variable we can derive the colour excess and interstellar absorption coefficients, directly. In this manner we could scan the distribution of the interstellar matter at a much better angular resolution than that the known maps are yielded.

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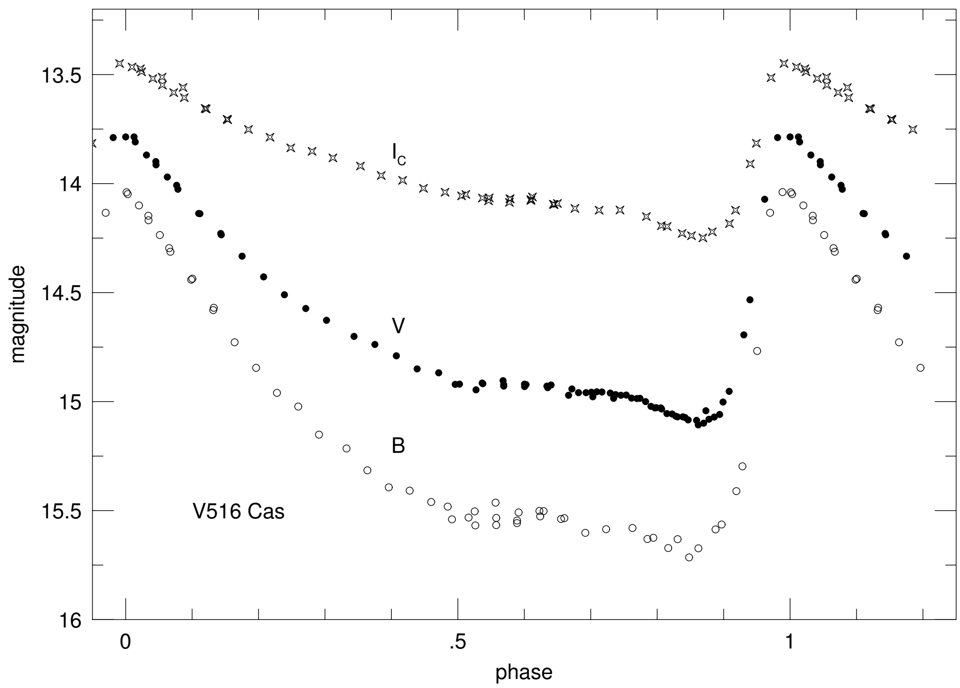

Figure 1. Phase diagrams of B, V and I_C-band photometric magnitudes of V516 Cas.

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NEW TIMES OF MINIMA OF ECLIPSING BINARY SYSTEMS

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Observatory and telescope:
50-cm $f/8.4$ Ritchey–Chrétien telescope of the Baja Astronomical Observatory (Hungary) (Ba50) 50-cm $f/15$ Cassegrain telescope (Pi50), 60/90/180 Schmidt telescope (Pi90), and 1m $f/13.3$ RCC telescope (Pi100) of the Konkoly Observatory at Piszkéstető Mountain Station (Hungary) 40-cm Cassegrain telescope (Sz40) of Szeged Observatory (Hungary)

Detector:	512×512 Apogee AP-7 CCD camera (Ba50) UBVRI Photometer (Pi50) 1536×1024 Photometrics CCD-camera (Pi90) 1536×1024 Photometrics CCD-camera (Pi100P) 1152×770 Wright Instruments CCD-camera (Pi100W) 512×512 SBIG ST9-E CCD camera (Sz40)

Method of data reduction:
Reduction of the CCD frames was made with a customly developed IRAF[1] package.

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).

[1] 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

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
XZ And	EA	01 56 52	+42 06 02	2824-1778	49313.53034	1.3572965	1
AB And	EW	23 11 32	+36 53 35	BD+36°5018	51534.2504	0.33189106	2
SS Ari	EW	02 04 15	+24 00 06	BD+23°277	52528.7093	0.40598385	3
HP Aur	EB	05 10 22	+35 47 47	2401-1128	46353.2360	1.4228191	4
IM Aur	EA	05 15 30	+46 24 21	HD 33732[a]	38327.7974	1.2472891	5
				3358-1208[b]			
IU Aur	EA	05 27 52	+34 46 58	HD 35619*	47469.5535	1.811474	6
				2411-1937**			
				HD 35669***			
VW Cep	EW	20 37 21	+75 35 57	BD+75°751	44157.4131	0.2783146	7
V477 Cyg	EA	20 05 28	+31 58 18	BD+31°3929	44189.2639	2.34699060	7
AK Her	EW	17 13 58	+16 21 01	1536-1834	42186.4600	0.42152201	7
GU Her	EA	16 32 05	+30 23 21	2581-2356	50983.46694	4.34320188	8
V861 Her	EW	16 51 13	+41 17 58	3079-0194	43684.3250	0.3446322	9
SW Lac	EW	22 53 42	+37 56 19	3215-1406	45275.3477	0.3207209	7
UV Leo	EA	10 38 21	+14 16 04	BD+14°2273	48617.5761	0.6000864	10
UZ Leo	EW	10 40 33	+13 34 01	0845-0996	47240.4180	0.6180508	11
V404 Lyr	EB	19 19 06	+38 22 00	3121-1597	35836.448	0.7309432	12
AG Per	EA	04 06 56	+33 26 47	BD+33°791	44584.5830	2.02870904	7
XY UMa	EA/RS	09 09 56	+54 29 18	HD 237784	52351.5911	0.47899511	3
DW UMa	EA	10 33 53	+58 46 54	3822-0070	46229.00691	0.13660653	13
LP UMa	EW	10 33 58	+58 52 16	3822-0070	50495.5212	0.30989069	14

Source(s) of the ephemeris:

1. Demircan et al., 1995
2. Pribulla et al., 2001
3. Pribulla et al., 2002
4. Wolf & Sarounová, 1996
5. Bartolini & Zoffoli, 1986
6. Drechsel et al., 1994
7. Kholopov et al., 1985
8. Borkovits et al., 2001
9. Antipin, 1996
10. Mikuz, et al., 2002
11. Hegedüs & Jäger, 1992
12. Csizmadia & Sándor, 2001
13. Bíró, 2000
14. Bíró & Borkovits, 2000

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
XZ And	52534.4460	1	I	R	0.0511	Bor/Ba50
AB And	52517.3162	1	I	R	0.0045	Bor/Ba50
	52517.4811	2	II	R	0.0034	Bor/Ba50
	52548.3470	4	II	B,V,R	0.0035	Bor+PK+Pál/Pi50
SS Ari	52528.5021	1	II	V	−0.0042	Bor/Ba50
	52547.3805	7	I	B,V,R	−0.0041	Bor+Pál+PK/Pi50
HP Aur	52606.5288	3	I	B,V,R	0.0029	Bír/Ba50
IM Aur	52567.4615	6	II	R	−0.0119	Bír/Ba50[a]
	52599.2683	3	I	V,R	−0.0110	Csiz+Bor/Pi100P[b]
	52607.372	3	II	V,R	−0.015	Bor/Ba50[a]
	52655.3973	3	I	V	−0.0100	Heg/Ba50[b]
	52723.377	:	II	R	−0.007	Bír/Ba50[b]
	52728.365	:	II	V	−0.009	Bor/Ba50[a]

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
IU Aur	52533.519	4	II	V	−0.010	Heg/Ba50*
	52553.451	3	II	B,V,R	−0.004	Bír/Ba50**
	52572.4699	9	I	B,V	−0.0059	Bor+Pál/Pi50*
	52572.4700	9	I	V,R	−0.0058	Bír/Ba50*
	52572.4706	2	I	V	−0.0052	Csák+Mész/Sz40*
	52602.3561	17	II	B,V,R	−0.0090	Bor/Ba50*
	52619.565	4	I	U,B,V,R	−0.009	Szab/Pi50*
	52641.3032	2	I	R	−0.0086	Bor/Ba50*
	52651.266	1	II	R	−0.009	Bor/Ba50**
	52669.3803	5	II	V	−0.0093	Bír/Ba50***
	52697.4660	13	I	B,V,R	−0.0015	Bor/Pi50*
	52698.3725	8	II	B,V,R	−0.0007	Bor/Pi50*
VW Cep	52787.3891	2	II	R	0.1360	Bír+Bor/Ba50
V477 Cyg	52767.4991	1	I	R	−0.0154	Pál/Ba50
AK Her	52747.4943	5	II	R	0.0111	Bor/Ba50
	52758.4549	1	II	R	0.0121	Bor/Ba50
	52766.4631	1	II	R	0.0114	Kós+Pál+Bor/Ba50
GU Her	52779.3942	6	II	R	0.0133	Bor/Ba50
V861 Her	52693.6196	4	I	V,R,I	0.0919	Csiz/Pi100W
	52696.5519	4	II	V,R,I	0.0949	Csiz/Pi100W
SW Lac	52518.424	1	I	R	−0.405	Bor/Ba50
UV Leo	52725.4682	2	II	V	0.0006	Bír/Ba50
UZ Leo	52767.3666	3	II	R	0.0293	Pál/Ba50
V404 Lyr	52765.4568	4	II	V,R	−0.0012	Bír/Ba50
AG Per	52555.473	1	I	R	0.092	Bor/Ba50
XY UMa	52693.5986	2	I	V	0.0050	Köny/Pi90
DW UMa	52607.5755	2	I	R	−0.0001	Bor/Ba50
	52709.3477	1	I	R	0.0002	Bor/Ba50
	52716.3139	1	I	R	−0.0005	Bor/Ba50
	52716.4508	1	I	R	−0.0002	Bor/Ba50
	52716.5871	1	I	R	−0.0005	Bor/Ba50
	52721.36905	6	I	R	0.00020	Bor/Ba50
	52721.50524	5	I	R	−0.00022	Bor/Ba50
	52721.6418	2	I	R	−0.0003	Bor/Ba50
	52724.37426	6	I	R	0.00006	Bor/Ba50
	52730.3851	1	I	R	0.0002	Bor/Ba50
	52730.5215	1	I	R	0.0000	Bor/Ba50
LP UMa	52607.595	1	II	R	0.014	Bor/Ba50
	52709.3980	3	I	R	0.0177	Bor/Ba50
	52716.376	:	II	R	0.023	Bor/Ba50
	52716.5258	8	I	R	0.0181	Bor/Ba50
	52721.3320	6	II	R	0.0210	Bor/Ba50
	52721.4828	1	I	R	0.0168	Bor/Ba50
	52724.4284	:	II	R	0.0184	Bor/Ba50
	52730.4698	3	I	R	0.0170	Bor/Ba50

Explanation of the remarks in the table:

Observer(s)/Instrument
(Superscripts ^{a,b} indicate the comparison stars used in the actual reduction for IM Aur, as well as asterisks have the same meanings for IU Aur, as labeled in Table ‘Observed star(s)’.)

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ON FIVE MIRA VARIABLES IN ORION AND CANIS MAJOR

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This study is a product of our large-scale work on the new versions of the General Catalogue of Variable Stars (GCVS) and the New Catalogue of Suspected Variable Stars (NSV) with accurate coordinates (cf. Samus et al., 2002, 2003). Even finding charts do not always guarantee easy identification of a faint variable star, and the situation becomes still more complicated for stars with no finding charts published. For Mira variables, searches are facilitated if an IRAS source, with high probability of variations indicated in the IRAS Point Source Catalogue, is present at a position close to that published for the variable. The final convincing solution is the recovery of an optically variable star using archive plates or images from electronic archives (the Digitized Sky Survey, Aladin Sky Atlas, the US Naval Observatory Image and Catalogue Archive – USNO ICA).

The stars discussed here (four stars in Orion and one, in Canis Major) are NSV stars recovered using images from the USNO ICA and then studied using all available material. We used plates taken with the old 9.7-cm and 16-cm astrographs of Moscow Observatory and with the 40-cm astrograph of the Sternberg Astronomical Institute's Crimean Laboratory. These plates reproduce B_{pg} magnitudes quite well; comparison stars were taken from GSC2.2 and the USNO A2.0 catalogue. The observations, obtainable from the authors upon request, were complemented with estimates from digitized sky images. All the five stars were found to belong to the Mira type, and light elements could be determined for the four Miras in Orion.

Our results for the four stars in Orion are summarized in Table 1. The column "N_1" contains the number of photographic plates estimated, and the column "N_2", the number of estimates using digitized surveys. The column "JD24..." presents the range of Julian dates covered by our estimates. Figure 1 displays the POSS-II R finding charts ($5' \times 5'$) for the variables in Orion. The light curves with the elements from Table 1. are shown in Figure 2.

Table 1. Summary of the results.

NSV	N_1	N_2	JD24...	Max B	Min B	Light elements Max JD =	Rem.
02904	81	4	14718–49341	12.7	$\leq$18.2	$2446496 + 624^{\rm d}.4 \cdot E$	1
02910	12	2	14718–49376	14.8	$\leq$19.8	$2446328 + 133^{\rm d}.4 \cdot E$	2
02911	66	3	33184–49353	15.2	$\leq$20.0	$2445054 + 324^{\rm d}.6 \cdot E$	3
02925	22	3	14343–49390	14.4	$\leq$19.8	$2449001 + 402^{\rm d}.8 \cdot E$	4

1. **NSV 02904** = Var Ross 156 = IRAS 06158+0206 (Var 99%)= GSC 0136.01416 (here and in the following, we indicate probability of infrared variations from the IRAS Point Source Catalogue after the IRAS number). It was suspected in variability by Ross (1927) who gave two photographic brightness estimates, 12^{m} and 15^{m}. R. Weber (private communication, 1956) could not confirm its variability. The coordinates of the variable from GSC2.2 are $06^{h}18^{m}24\overset{s}{.}85$, $+02°05'34\overset{''}{.}2$ (J2000.0, epoch 1990.826).

2. **NSV 02910** = Kord E_2 = IRAS 06162+0919 (Var 2%) = GSC 0731.01604. This variable was discovered by J.&Z. Kordylewski to vary from $14\overset{m}{.}0$ to fainter than $19\overset{m}{.}5$ pg (S. Arend, private communication, 1958). Until now, the star was not studied in detail. Our estimates used a very limited material, however covering a long time span. The GSC2.2 coordinates are $06^{h}18^{m}56\overset{s}{.}13$, $+09°18'20\overset{''}{.}0$ (J2000.0, epoch 1989.845).

3. **NSV 02911** = Var Ross 17 = IRAS 06165+1544 (Var 17%). It was suspected in variability by Ross (1925) from two photographic brightness estimates, 14^{m} and 17^{m}. Morgenroth (1935) and Hoffmeister (1944) could not confirm variability from their photographic plates. Bidelman and MacConnell (1998) report the spectral type M7 for NSV 02911. The GSC2.2 coordinates are $06^{h}19^{m}22\overset{s}{.}94$, $+15°43'04\overset{''}{.}0$ (J2000.0, epoch 1997.102).

4. **NSV 02925** = Kord E_1 = IRAS 06182+0752 (Var 93%). This variable was discovered by J.&Z. Kordylewski and found to vary from $15\overset{m}{.}0$ to fainter than $19\overset{m}{.}5$ pg (S. Arend, private communication, 1958). Until now, the star remained unstudied in detail. Its GSC2.2 coordinates are $06^{h}20^{m}57\overset{s}{.}34$, $+07°51'26\overset{''}{.}5$ (J2000.0, epoch 1989.845).

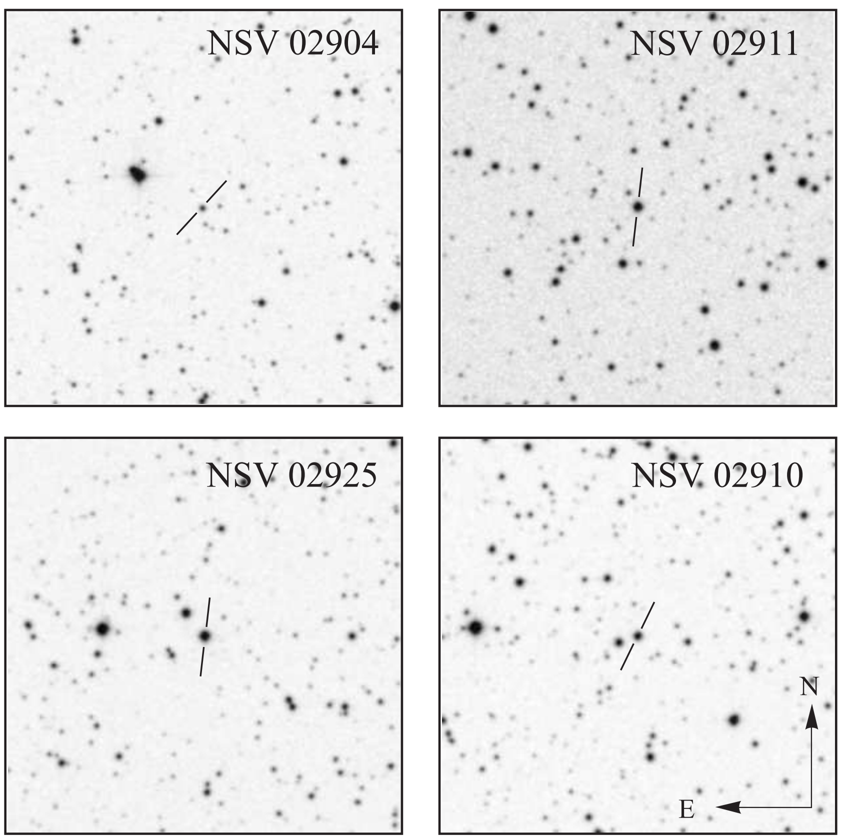

Figure 1. The finding charts for the Miras in Orion. Each chart shows a $5' \times 5'$ POSS-II field, in red light.

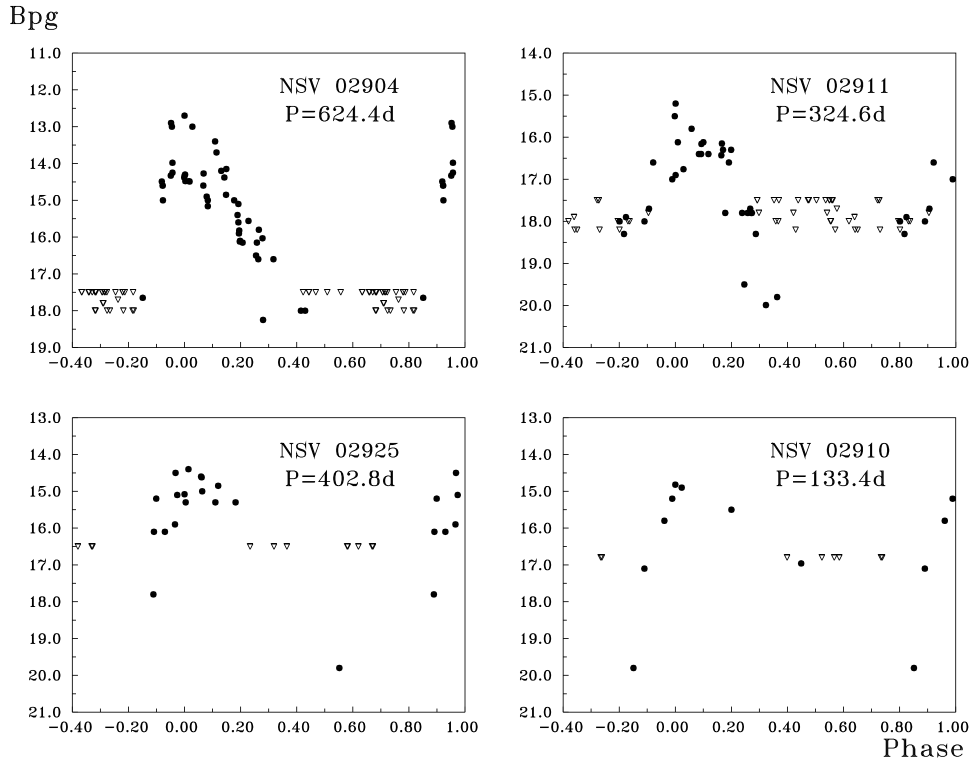

Figure 2. The light curves of the Miras in Orion, folded with the elements presented in the Table. Open triangles are plate limits.

We also recovered variability of **NSV 03025** (CMa) = IRAS 06308–2608 (Var 75%) = HV 8057 = CSS-II 229 = CoD–26°3109. This star was suspected in variability by Luyten (1937) who gave the photovisual range from $12\overset{\mathrm{m}}{.}0$ to $14\overset{\mathrm{m}}{.}0$. Stephenson (1976) lists NSV 03025 (CSV 777) as an S star. The variable's GSC2.2 position is $6^{\mathrm{h}}32^{\mathrm{m}}52\overset{\mathrm{s}}{.}30$, $-26^{\circ}10'24\overset{''}{.}0$ (J2000.0, epoch 1996.131). Its $5' \times 5'$ POSS-II *R* chart is shown in Fig. 3. Unfortunately there are no plates in our stacks for this unstudied variable. The USNO ICA provides two images in blue light and three, in red light. The corresponding magnitude ranges are $19\overset{\mathrm{m}}{.}0$ to fainter than $19\overset{\mathrm{m}}{.}5$ *B*, $13\overset{\mathrm{m}}{.}8$ to $16\overset{\mathrm{m}}{.}9$ *R*. The star is most probably a Mira.

Thanks are due to Dr. S.V. Antipin for his assistance during the preparation of the figures. Our variable star studies are supported, in part, by Russian Foundation for Basic Research through grant 02-02-16069, by the Russian Federal Scientific and Technological Programme "Astronomy", by the Programme "Unstable Processes in Astronomy" of the Presidium of Russian Academy of Sciences, and by the Support Programme for Leading Scientific Schools of Russia. Our research has made use of the USNOFS Image and Catalogue Archive operated by the United States Naval Observatory, Flagstaff Station (`http://www.nofs.navy.mil/data/fchpix/`).

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Hoffmeister, C., 1944, *Mitt. veränd. Sterne*, **1**, Nr. 80

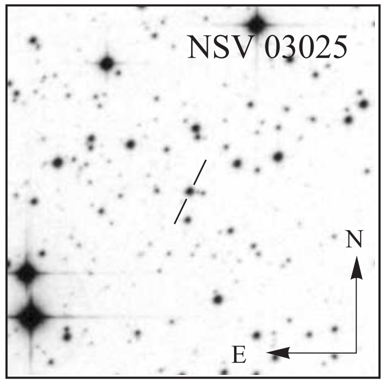

Figure 3. The finding chart for NSV 03025 (CMa) showing a $5' \times 5'$ POSS-II field, in red light.

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Samus, N.N., Goranskii, V.P., Durlevich, O.V. *et al.*, 2002, *Astronomy Letters*, **28**, 174
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CCD PHOTOMETRY OF 10 MIRA STARS

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Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
SZ Aur	M	05 41 56.6	38 55 56	GSC 2911 23		454.04	GCVS
VX Aur	M	07 28 30.5	40 58 13	GSC 2961 205		322.25	GCVS
RY Cep	M	23 21 14.7	78 57 33	GSC 4609 535		149.06	GCVS
W Dra	M	18 05 35.0	65 57 17	GSC 4213 1511		278.6	GCVS
ST Gem	M	23 21 14.7	78 57 33	GSC 2461 1414		246.23	GCVS
S Lac	M	22 29 00.7	40 18 58	GSC 3204 946		241.5	GCVS
RU Lyr	M	19 12 20.9	41 18 13	GSC 3125 334		371.84	GCVS
RW Lyr	M	18 45 10.3	43 38 07	GSC 3130 1591		503.75	GCVS
SX Peg	M	22 50 25.2	17 53 36	GSC 1702 1270		303.6	GCVS
RV Peg	M	22 25 37.9	30 28 22	GSC 2734 1070		396.8	GCVS

Observatory and telescope:
Valašské Meziříčí Observatory, Astrocamera ZEISS 120/540 mm, Schmidt-Cassegrain 280/1764 mm telescope

Detector:	SBIG ST-7 camera

Filter(s):	*V*

Transformed to a standard system:	No

Date(s) of the observation(s):
SZ Aur 1998.10.23 – 2003.05.06 VX Aur 1998.10.23 – 2003.05.06 RY Cep 2001.12.09 – 2002.04.07 W Dra 1998.10.26 – 2003.05.06 ST Gem 1999.01.17 – 2003.04.20 S Lac 1999.07.19 – 2003.03.10 RU Lyr 1999.05.09 – 2002.11.12 RW Lyr 2002.06.26 – 2002.11.12 SX Peg 1998.10.23 – 2003.01.19 RV Peg 1999.08.04 – 2003.02.02

Comparison stars:		
Variable	Comparison or check star	Photometry [magnitudes]
SZ Aur	GSC 2911 23	$V = 10.62$, $B-V = 0.235$
VX Aur	GSC 2961 205 = SAO 41791	$V = 9.23$, $B-V = 1.372$
RY Cep	GSC 4609 535 = HD 220140	$V = 7.52$, $B-V = 0.897$
W Dra	GSC 4213 1511 = BD +65 1242	$V = 9.38$, $B-V = 0.415$
ST Gem	GSC 2461 1414	$V = 10.63$, $B-V = 0.673$
S Lac	GSC 3204 946	$V = 10.24$, $B-V = 0.298$
RU Lyr	GSC 3125 334 = BD +40 3624	$V = 7.13$, $B-V = 1.543$
RW Lyr	GSC 3130 1591 = BD +43 3060	$V = 8.73$, $B-V = 1.428$
SX Peg	GSC 1702 1270 = BD +17 4818	$V = 7.44$, $B-V = 0.653$
RV Peg	GSC 2734 1070 = BD +29 4659	$V = 10.62$, $B-V = 0.990$

Remarks:
Maxima timings are determined using the Kwee and von Woerden (1956) method implemented in AVE (Barbera, 2000) and their values are given in Table 1.

Table 1: Maxima timings

Star name	Geo. JD	Error
SZ Aur	2451818.3	0.3
	2452282.9	0.2
	2452735.6	0.05
VX Aur	2451542.1	0.4
	2451866.7	1.1
RY Cep	2452321.3	0.1
W Dra	2451421.5	0.5
	2451671.7	0.5
	2451983.8	0.6
	2452246.4	0.2
	2452545.9	0.3
ST Gem	2451672.8	0.3
	2451936.2	0.3
	2452674.8	0.1
S Lac	2451484.8	0.2
	2451724.5	0.3
	2452696.8	0.1
RU Lyr	2451406.5	0.5
	2451774.3	0.5
	2452520.8	0.1
RW Lyr	2452511.3	0.9
SX Peg	2452594.3	0.2
RV Peg	2451766.1	0.3
	2451793.1	0.4 (double maximum)
	2452567.9	0.3

Availability of the data:
Through the IBVS-website as: 5436-t1.txt, 5436-t2.txt, 5436-t3.txt, 5436-t4.txt, 5436-t5.txt, 5436-t6.txt, 5436-t7.txt, 5436-t8.txt, 5436-t9.txt, 5436-t10.txt.

Acknowledgements:
This work has made use of the SIMBAD database, operated at CDS, Strasbourg, France. The NASA ADS Abstract Service was used to access data and references.

References:

Barbera, R., 2000, `http://www.astrogea.org/soft/ave/aveint.htm`

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Kwee, K. K. and Van Woerden, H., 1956, *BAN*, **12**, No. 464, 327

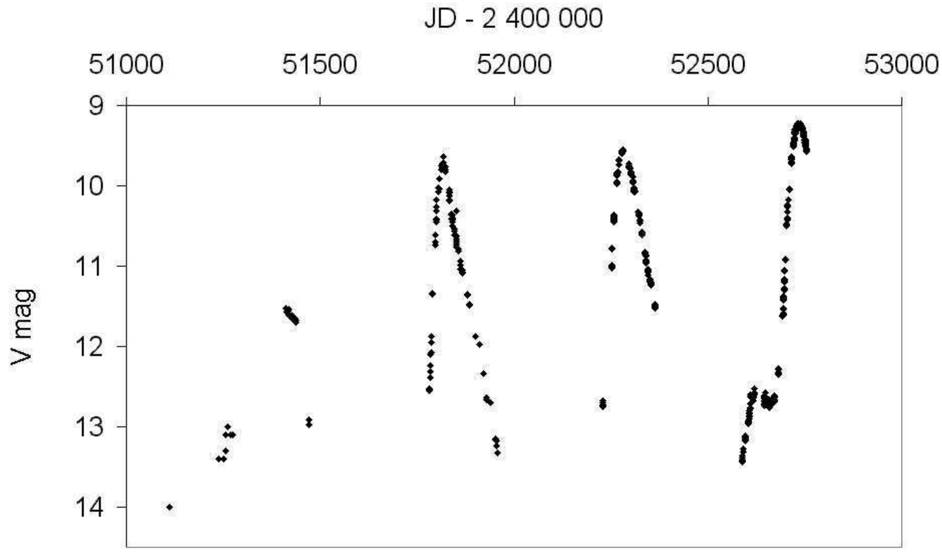

Figure 1. Light curve SZ Aur (filter V).

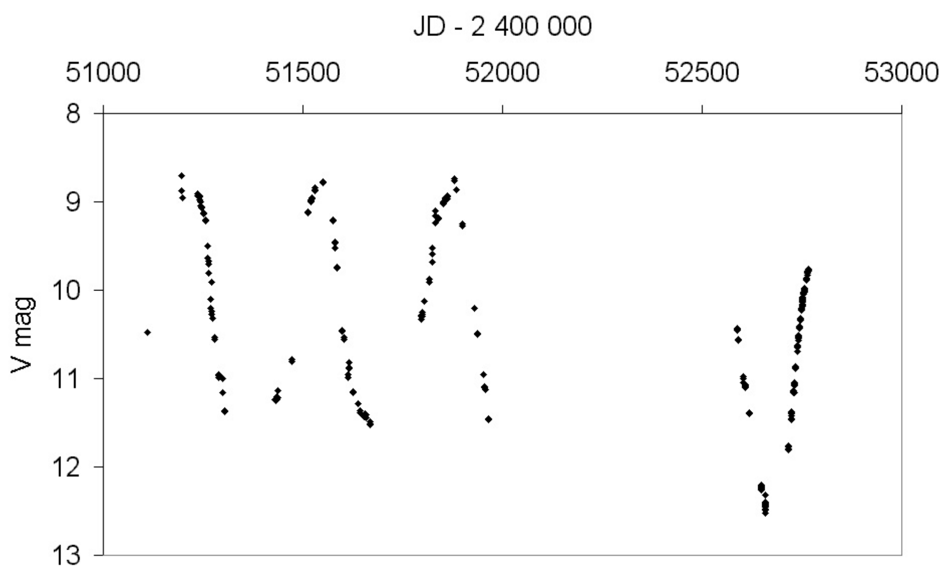

Figure 2. Light curve VX Aur (filter V).

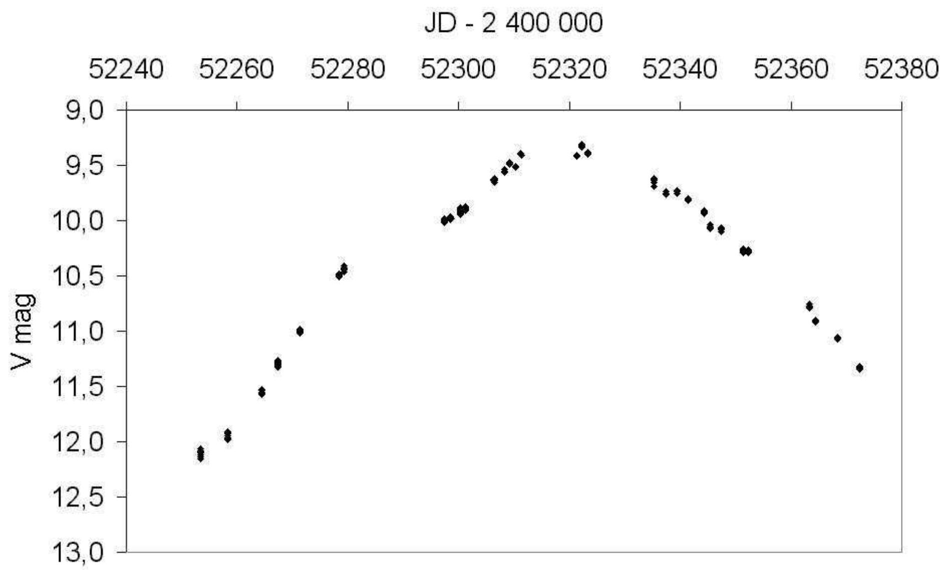

Figure 3. Light curve RY Cep (filter V).

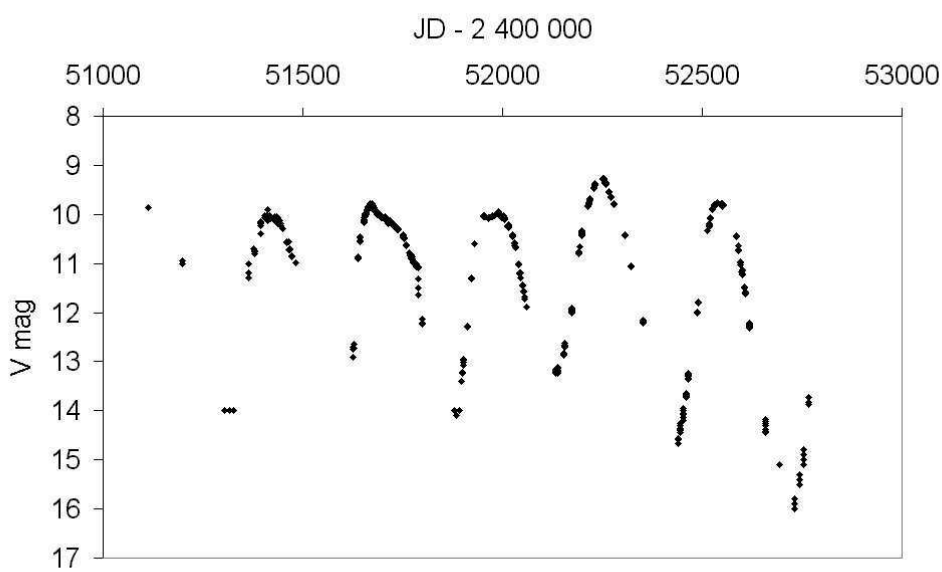

Figure 4. Light curve W Dra (filter V).

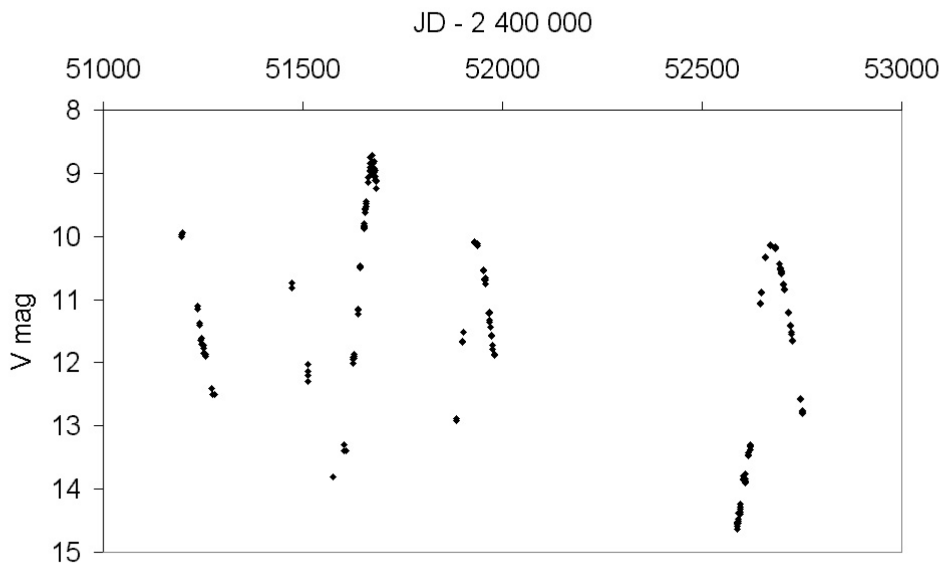

Figure 5. Light curve ST Gem (filter V).

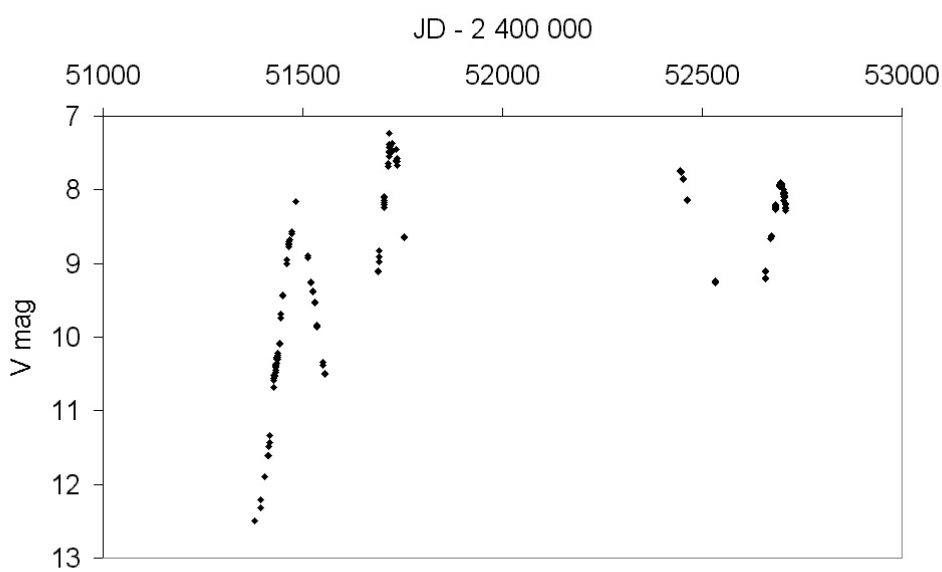

Figure 6. Light curve S Lac (filter V).

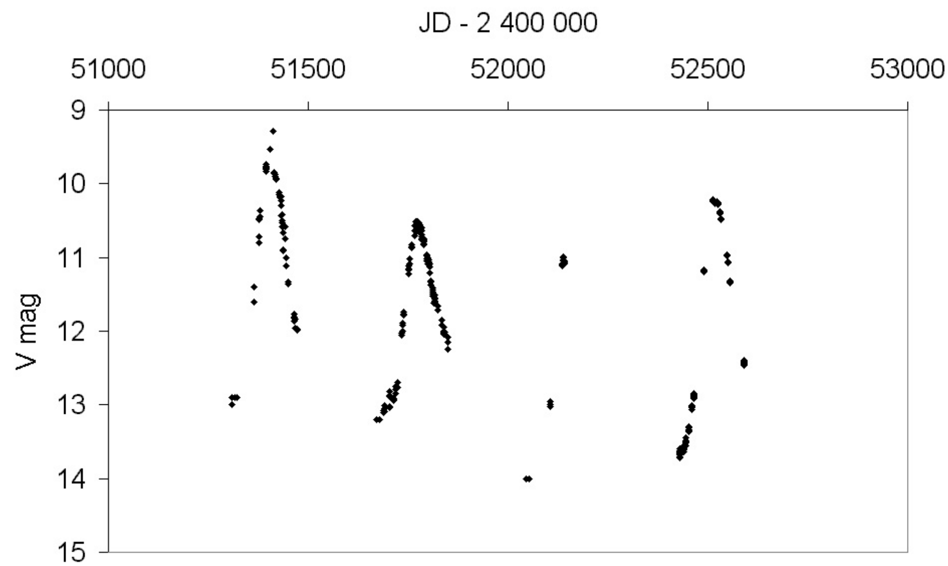

Figure 7. Light curve RU Lyr (filter V).

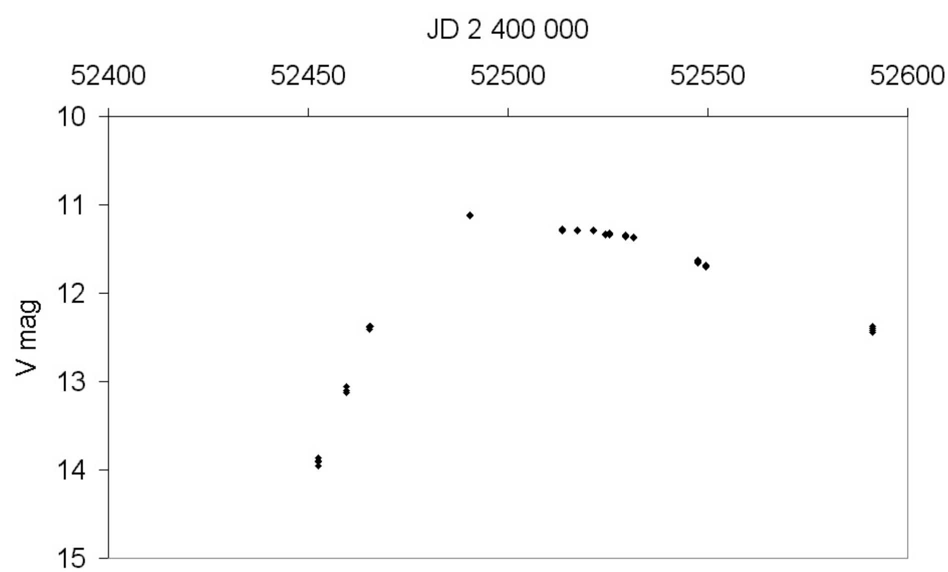

Figure 8. Light curve RW Lyr (filter V).

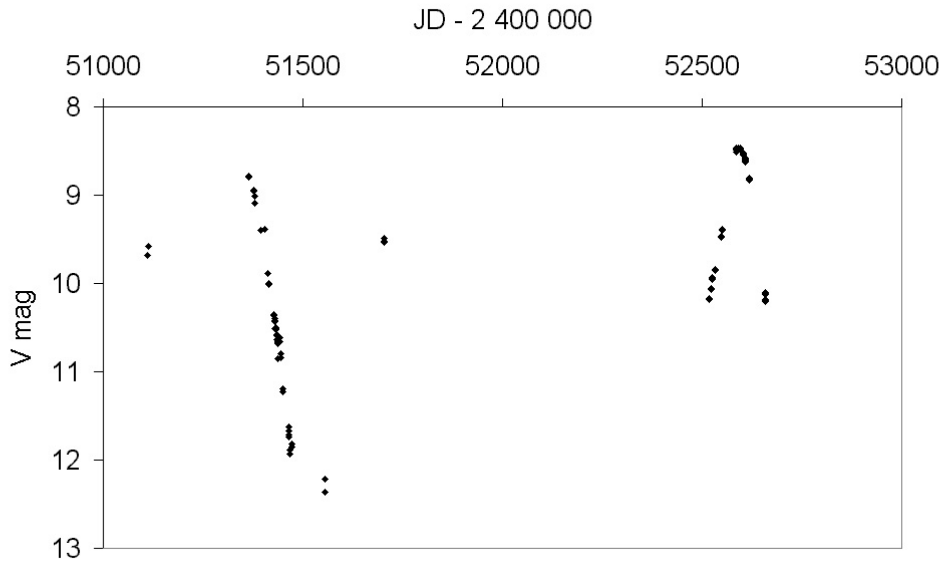

Figure 9. Light curve SX Peg (filter V).

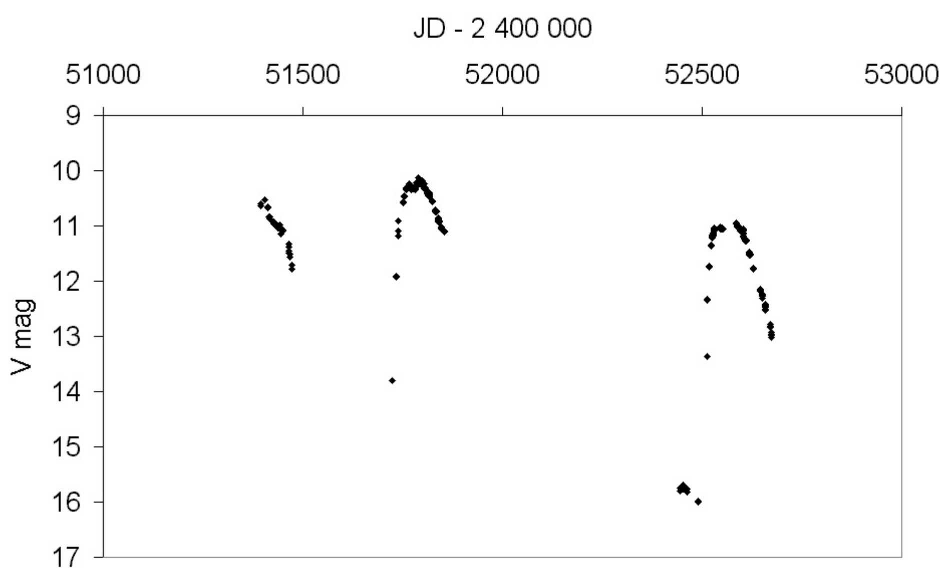

Figure 10. Light curve RV Peg (filter V).

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TWO NEW ECLIPSING BINARY SYSTEMS: GSC 0619-0232 AND GSC 3658-0076

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Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp./check star(s)
GSC 0619-0232	EW	$01^h18^m48\overset{s}{.}50$	$+13°21'07\overset{''}{.}81$	GSC 0619-0928
				GSC 0619-0432
				GSC-0619 0408
GSC 3658-0076	EB	$00^h26^m49\overset{s}{.}28$	$+55°27'23\overset{''}{.}95$	GSC 3658-0270
				GSC 3658-0042
				GSC 3657-0379

Observatory and telescope:
Torrecilla de Valmadrid Observatory: Schmidt-Cassegrain 20-cm
Rodeno: Schmidt-Cassegrain 20-cm
Hostalets de Pierola: Newtonian 41-cm
Monegrillo: Newtonian 41-cm

Detector:	SBIG ST-6 and Starlight Xpress CCD cameras

Filter(s):	*V*

Date(s) of the observation(s):
GSC 0619-0232: from 29 Dec 2002 to 8 Feb 2003
GSC 3658-0076: from 28 Dec 2002 to 8 Feb 2003

Method of data reduction:
Synthetic aperture differential magnitude extraction method using software package LAIA (Laboratory for Astronomical Image Analysis) by Joan A. Cano

Transformed to a standard system:	No

Availability of the data:
Upon request

Method of minimum determination:
Kwee – van Woerden algorithm

Ephemeris:

Star name	E 2400000+	P [day]	Source
GSC 0619-0232	52668.3010(4)	0.34396(8)	present paper
GSC 3658-0076	52668.3556(6)	0.75986(15)	”

Times of minima for GSC 0619-0232:

Time of min. HJD 2400000+	Error	Type	Epoch
52652.307	1	II	−46.5
52655.4006	5	II	−37.5
52663.3143	6	II	−14.5
52664.3471	2	II	−11.5
52665.3761	7	II	−8.5
52668.3010	4	I	0.0

Times of minima for GSC 3658-0076:

Time of min. HJD 2400000+	Error	Type	Epoch
52668.3556	6	I	0.0
52671.3945	9	I	4.0
52679.3671	8	II	14.5

Remarks:

The variability of GSC 0619-0232 (photovisual magnitude of 14.3) was discovered from Observatorio Rodeno while performing comet photometry and astrometry. To obtain a more accurate light-curve this star was observed from Hostalets de Pierola and Monegrillo observatories. The new photometric observations allowed to characterise GSC 0619-0232 as a new EW variable with a 8.26-hour period (Figure 1). This variable shows an average V amplitude of 0.40 mag, and an O'Connell effect (O'Connell, 1951) of +0.05 mag at phase 0.75. A preliminary analysis of the data by using Binary Maker 2.0 (Bradstreet, 1993), suggests that the components of this binary system present a large mass ratio between 6 and 8. The flat bottom at primary minimum is due to the transit of the less massive star across the disk of the other component.

The variability of GSC 3658-0076 (V=11.95, $B-V$=0.128, from Tycho) was discovered during a program for searching new variables performed from Monegrillo Observatory between 21 August and 20 November 2001. To characterise GSC 3658-0076 the star was monitored from Torrecilla de Valmadrid for 14 nights. The new observations indicate that this object is an EB eclipsing binary system whose primary and secondary minima are 0.36 mag and 0.16 mag deep respectively (Figure 2). A preliminary analysis of the photometric data by using Binary Maker 2.0 (Bradstreet, 1993), suggests that GSC 3658-0076 might be a semidetached system with a mass ratio q close to 0.3.

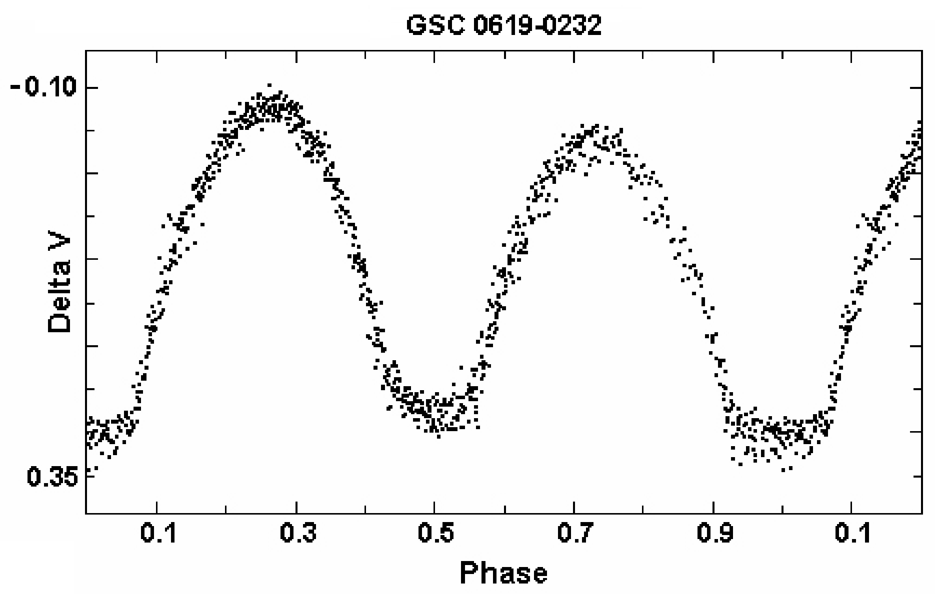

Figure 1. Light-curve of GSC 0619-0232 folded on a 0.34396-day period

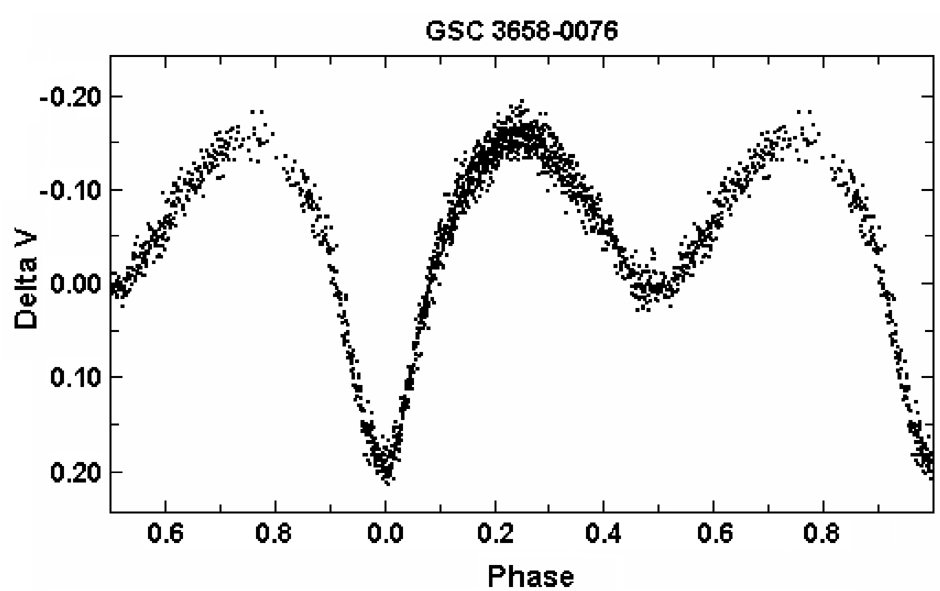

Figure 2. Light-curve of GSC 3658-0076 folded on a 0.75986-day period

Acknowledgements:
The authors wish to thank the members of Grup d'Estudis Astronòmics for their help, and J.M. Gómez-Forrellad and E. García-Melendo for their help to analyse the photometric data and prepare this paper.

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162-ND LIST OF MINIMA TIMINGS OF ECLIPSING BINARIES BY BBSAG OBSERVERS

(BBSAG Bulletin No. 129)

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BBSAG, Rennweg 1, CH–4118 Rodersdorf, Switzerland

The following Table 1 lists 508 timings of minima of eclipsing binaries secured both by photoelectric as well as by visual means by BBSAG observers, primarily obtained between September 2002 and June 2003. 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.

Table 1.

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
TT And	p	52531.5268	.0.0009	−0.0657	22	RD	CCD
UU And	p	52555.342	0.005	+0.048	5	KL	vis
WX And	p	52616.404	0.004	+0.083	37	APs	CCD
XZ And	p	52530.376	.0.003	+0.127	6	KL	vis
AS And	p	52548.5944	0.0020		20	RD	CCD; GCVS elem. erroneous
EP And	s	52535.372	0.003	−0.004	5	KL	vis; elem. IBVS No. 5184
FL And	p	52548.605	0.002	+0.059	11	RD	CCD
KN And	p	52547.5002	0.0007	+0.0045	20	RD	CCD; elem. BAV M. 36, 11
AT Aqr	s	52820.542	0.008	−0.001	5	KL	vis
CX Aqr	p	52568.260	0.003	+0.001	6	KL	vis
CZ Aqr	p	52530.443	0.003	−0.022	6	KL	vis
GK Aqr	s	52530.400	0.006	−0.036	5	KL	vis; elem. Per. Zv. 22, 327
XZ Aql	p	52800.581	0.005	+0.132	7	KL	vis
OO Aql	p	52548.408	0.004	+0.023	38	APs	CCD
	p	52576.2796	0.0010	+0.0212	21	EBl	CCD
OP Aql	p	52548.353	0.005	−0.066	22	APs	CCD
V343 Aql	p	52576.3174	0.0006	−0.0406	21	EBl	CCD
V417 Aql	s	52504.378	0.004	−0.010	18	APs	CCD; elem. AJ 113, 401
V479 Aql	p	52820.446	0.004	−0.013	9	KL	vis
V760 Aql	p	52576.2785	0.0009	−0.0181	16	EBl	CCD
	p	52576.284	0.005	−0.013	6	KL	vis
V803 Aql	p	52820.516	0.005	−0.043	6	KL	vis
V917 Aql	p	52576.2948	0.0017	+0.0944	17	EBl	CCD
V1096 Aql	p	52576.2861	0.0012	+0.2387	20	EBl	CCD
RZ Aur	p	52635.415	0.006	−0.126	6	KL	vis

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
TT Aur	p	52685.468	0.004	−0.005	72	APs	CCD
WW Aur	p	47618.441	0.007	+0.015	15	MMa	vis
	p	52706.337	0.010	−0.003	6	CPa	vis
ZZ Aur	p	52622.3237	0.0003	+0.0121	21	EBl	CCD
CL Aur	p	52689.310	0.003	+0.115	6	KL	vis
EM Aur	s	52658.324	0.005	−0.174	13	RD	CCD
IM Aur	p	49800.380	0.007	−0.038	21	MMa	vis
KU Aur	p	52576.636	0.005	+0.042	6	KL	vis
TU Boo	s	52618.695	0.004	+0.008	6	KL	vis; elem. A&AS 117, 105
XY Boo	p	52720.593	0.005	−0.015	7	RD	CCD; elem. AJ 76, 923
	s	52723.3732	0.0019	−0.0139	10	EBl	CCD
AQ Boo	p	52723.4063	0.0009	−0.0058	13	EBl	CCD; elem. IBVS No. 4871
AR Boo	s	52723.3454	0.0009	+0.0114	14	EBl	CCD; elem. IBVS No. 4601
	p	52723.5173	0.0007	+0.0110	14	EBl	CCD
EF Boo	p	52473.4921	0.0001	−0.0863	-	CY, SO	CCD; elem. IBVS No. 4811
	s	52474.5402	0.0002	−0.0897	-	CY	CCD
GSC2001:300 Boo	-	52691.419	0.004	+0.001	8	EBl	CCD; elem. IBVS No. 5269; min. asym.; pulsator
	-	52691.604	0.002	+0.0009	13	EBl	CCD
GM Boo	p	52763.3562		+0.0067	14	EBl	CCD; elem. IBVS No. 5125
GN Boo	p	52763.3901	0.0009	+0.0049	19	EBl	CCD; elem. IBVS No. 5125
GQ Boo	p	52763.347	0.003	+0.001	12	EBl	CCD; elem. IBVS No. 5125
GR Boo	p	52763.4844	0.0006	+0.0003	22	EBl	CCD; elem. IBVS No. 5125
Y Cam	p	52647.649	0.008	+0.242	5	KL	vis
WW Cam	p	52658.5464	0.0008	−0.0207	19	RD	CCD
AZ Cam	s	52658.4814	0.0012	+0.0244	26	RD	CCD
	p	52722.4623	0.0008	+0.0228	31	RD	CCD
CD Cam	p?	52658.425	0.002	−0.114	10	RD	CCD; elem. IBVS No. 3753
HW Cam	p	52722.4771	0.0011	+0.0292	16	RD	CCD; elem. IBVS No. 4526
TU Cnc	p	52667.474	0.007	−0.070	8	KL	vis
TX Cnc	s	52691.2952	0.0014	+0.0348	14	EBl	CCD
WW Cnc	p	52691.2765	0.0006	−0.4550	16	EBl	CCD
AB Cnc	p	52691.525	0.005	+0.006	8	KL	vis
AD Cnc	p	52691.294	0.002	−0.010	14	EBl	CCD
EH Cnc	s	52722.4539	0.0012	+0.0433	17	RD	CCD; elem. IBVS No. 2755
GQ Cnc	p	52691.2705	0.0006	-	16	EBl	CCD; period in need of correction
VV CVn	s	52601.664	0.003	+0.219	19	EBl	CCD
	s	52655.504	0.007	+0.213	10	EBl	CCD
	p	52691.490	0.003	+0.213	13	EBl	CCD
	s	52694.424	0.005	+0.215	14	EBl	CCD
BI CVn	p	52694.4851	0.0003	+0.0200	17	EBl	CCD; elem. IBVS No. 4554
DF CVn	p	52655.486	0.004	+0.016	9	EBl	CCD; elem. IBVS No. 5021
GSC2004:784 CVn	p	52655.489	0.002	+0.003	10	EBl	CCD; elem. IBVS No. 5269
DH CVn	p	52691.4376	0.0012	−0.0058	9	EBl	CCD; elem. IBVS No. 5149
	s	52691.625	0.003	−0.001	14	EBl	CCD
GSC2534:216 CVn	p	52601.6656	0.0010	−0.0002	20	EBl	CCD; elem. IBVS No. 5403
	p	52691.4366	0.0014	−0.0008	9	EBl	CCD
	s	52691.5599	0.0010	−0.0004	12	EBl	CCD
	p	52691.6833	0.0004	0.0000	18	EBl	CCD
	p	52694.3889	0.0007	+0.0002	20	EBl	CCD
	s	52694.5117	0.0008	0.0000	19	EBl	CCD
	p	52694.6339	0.0008	−0.0008	25	EBl	CCD
	s	52721.3208	0.0012	+0.0006	14	EBl	CCD
	p	52723.4119	0.0009	+0.0011	16	EBl	CCD
	s	52723.5335	0.0011	−0.0003	18	EBl	CCD

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC2536:122 CVn	p	52601.6482	0.0017	+0.0004	16	EBl	CCD; elem. IBVS No. 5403
	p	52655.511	0.003	−0.005	9	EBl	CCD
	p	52691.429	0.004	+0.001	9	EBl	CCD
	s	52691.5658	0.0016	−0.0024	12	EBl	CCD
	p	52691.7060	0.0013	−0.0025	17	EBl	CCD
	s	52694.3743	0.0011	+0.0005	15	EBl	CCD
	p	52694.5153	0.0006	+0.0012	21	EBl	CCD
	s	52694.6550	0.0004	+0.0006	21	EBl	CCD
	s	52721.3130	0.0014	+0.0051	14	EBl	CCD
	p	52723.4122	0.0020	+0.0001	13	EBl	CCD
	s	52723.5523	0.0005	−0.0001	17	EBl	CCD
GSC2548:936 CVn		52655.5242	0.0010	−0.0010	7	EBl	CCD; elem. IBVS No. 5403
	p	52691.5112	0.0016	0.0000	12	EBl	CCD
	s	52691.6429	0.0018	+0.0014	19	EBl	CCD
	p	52694.3801	0.0007	+0.0005	15	EBl	CCD
	s	52694.5094	0.0004	−0.0006	23	EBl	CCD
	p	52694.6420	0.0008	+0.0016	23	EBl	CCD
	s	52721.3689	0.0005	−0.0002	19	EBl	CCD
	p	52723.3241	0.0008	−0.0007	10	EBl	CCD
	s	52723.4541	0.0012	−0.0011	16	EBl	CCD
	p	52723.5856	0.0013	0.0000	8	EBl	CCD
	s	52813.418	0.008	−0.003	5	KL	vis
	p	52813.560	0.005	+0.009	6	KL	vis
	s	52814.465	0.005	+0.002	6	KL	vis
GSC3022:996 CVn	p	52601.583	0.002	+0.002	17	EBl	CCD; elem. IBVS No. 5403
	s	52691.4635	0.0015	+0.0006	13	EBl	CCD
	p	52691.6397	0.0010	−0.0018	24	EBl	CCD
	p	52694.4996	0.0007	−0.0010	29	EBl	CCD
	s	52694.6772	0.0006	−0.0021	23	EBl	CCD
	p	52721.3064	0.0014	+0.0022	14	EBl	CCD
	p	52723.4485	0.0010	0.0000	32	EBl	CCD
GSC3026:1046 CVn	s	52691.5461	0.0006	+0.0044	13	EBl	CCD; elem. IBVS No. 5269
RX CMa	p	52694.353	0.005	−0.123	10	KL	vis
RS CMi	p	51560.363	0.004	−0.022	250	APs	CCD; elem. BBSAG Bull. 112, 11; d=0.05 days; ampl.=2.45 mag
RY CMi	p	52730.437	0.005	−0.216	12	KL	vis; elem. IBVS No. 4874
TU CMi	p	52717.377	0.004	−0.087	12	RD	CCD
TX CMi	p	52692.361	0.003	+0.004	15	APs	CCD; elem. BBSAG Bull. 106, 7
AC CMi	s	52616.589	0.005	+0.024	33	APs	CCD
AK CMi	p	52590.622	0.002	−0.019	8	KL	vis
NSV3521 CMi	-	52627.651	0.003		11	APs	CCD
RZ Cas	p	47528.298	0.009	+0.003	31	MMa	vis
	p	47559.385	0.028	+0.013	29	MMa	vis
	p	47614.371	0.020	+0.017	35	MMa	vis
	p	47767.342	0.005	−0.003	35	MMa	vis
	p	52530.446	0.005	+0.042	21	CPa	vis
	p	52566.306	0.002	+0.044	13	KT	vis
	p	52578.259	0.003	+0.045	11	KT	vis
	p	52585.427	0.004	+0.041	12	CPa	vis
	p	52609.335	0.003	+0.044	8	KT	vis
	p	52615.312	0.003	+0.045	9	KT	vis
	p	52627.266	0.003	+0.047	8	KT	vis
	p	52633.241	0.003	+0.045	8	KT	vis
TW Cas	p	52489.406	0.010	−0.023	CPa	vis	
AB Cas	p	52568.322	+0.066	6	KL	vis	

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
AE Cas	p	52532.615	0.006	+0.070	5	KL	vis
AH Cas	p	52608.398	0.007	−0.188	6	KL	vis
BH Cas	p	52693.3352	0.0018	+0.0134	14	EBl	CCD; elem. IBVS No. 4482
BW Cas	p	52532.581	0.003	+0.013	7	KL	vis; elem. BBSAG Bull. 122, 8
CW Cas	p	52574.3001	0.0015	−0.0254	15	EBl	CCD; elem. JAAVSO 21, 34
EY Cas	s	52574.3434	0.0015	−0.0314	11	EBl	CCD
GR Cas	p	52535.5073	0.0009	−0.0363	14	RD	CCD
IR Cas	p	52574.346	0.006	+0.011	7	KL	vis
IS Cas	p	52535.5062	0.0008	+0.0502	23	RD	CCD
IT Cas	p	52547.5671	0.0006	−0.0006	17	RD	CCD; elem. AJ 114, 1206
IV Cas	p	52574.2409	0.0004	−0.0381	12	EBl	CCD
MT Cas	s	52574.321	0.002	+0.008	10	EBl	CCD
MY Cas	p	52574.281	0.003	+0.024	12	EBl	CCD
OR Cas	p	52535.459	0.002	−0.021	7	KL	vis
PV Cas	s	52658.363:	0.005	−0.003	18	RD	CCD; displ. secondary
V336 Cas	p	52693.3308	0.0012	−0.0130	12	EBl	CCD
V345 Cas	p	52548.5640	0.0003	−0.0231	15	RD	CCD
V350 Cas	p	52548.5773	0.0008	−0.0209	20	RD	CCD
V523 Cas	p	52536.364	0.004	+0.015	7	KL	vis; elem. MNRAS 317, 111
	s	52693.2855	0.0007	+0.0130	11	EBl	CCD
V860 Cas	p	52530.404	0.006	−0.007	6	KL	vis; elem. IBVS No. 5111
U Cep	p	51913.104	0.007	+0.108	9	KT	vis; norm. min.
	p	51988.452	0.005	+0.116	7	KT	vis
	p	52205.343	0.003	+0.112	10	KT	vis
	p	52382.354	0.003	+0.117	12	KT	vis; norm. min.
WZ Cep	s	52693.269	0.005	−0.033	7	EBl	CCD; elem. AAS 131, 7
BE Cep	s	52592.3044	0.0014	−0.0837	19	EBl	CCD
DP Cep	p	52693.2939	0.0012	−0.0655	14	EBl	CCD
EE Cep	p	52795	1	+3	12	KL	vis; shape as 1969, see IBVS No. 5412
GT Cep	p	52145.477	0.012	+0.127	27	KT	vis; norm. min.
HI Cep	p	52820.406	0.007	+0.007	8	KL	vis; elem. BBSAG Bull. 114, 12
IP Cep	p	52531.5189	0.0017	−0.0142	24	RD	CCD; elem. IBVS No. 5016
NR Cep	p	52693.2951	0.0007	−0.0352	15	EBl	CCD
V357 Cep	p	52591.468	0.008	−0.191	9	KL	vis; elem. Brno Contr. 28, 34
V358 Cep	p	52533.466	0.003	+0.028	6	KL	vis; elem. BBSAG Bull. 96, 10
TW Cet	s	52530.525	0.004	−0.016	6	KL	vis
VY Cet	p	52530.521	0.004	+0.010	6	KL	vis
RW Com	p	52753.3883	0.0011	−0.0247	13	RD	CCD
LL Com	p	52721.4763	0.0008	+0.1075	14	RD	CCD; elem. IBVS No. 4386
	p	52723.5104	0.0013	+0.1071	16	EBl	CCD
LO Com	p	52691.5579	0.0017	+0.0053	14	EBl	CCD; elem. IBVS No. 5052
LP Com	s	52691.5182	0.0019	−0.0039	9	EBl	CCD; elem. IBVS No. 5052
GSC1996:437 Com	p	52691.493	0.003	−0.007	13	EBl	CCD; elem. IBVS No. 5269
GSC2040:1361 CrB	s	52763.450	0.003	−0.002	10	EBl	CCD; elem. IBVS No. 5295
GSC2580:2086 CrB	s	52763.4367	0.0009	−0.0005	17	EBl	CCD; elem. IBVS No. 5295
W Crv	p	52609.694	0.005	+0.028	6	KL	vis
V Crt	p	52618.665	0.003	−0.012	6	KL	vis
UW Cyg	p	52817.394	0.006	+0.044	7	KL	vis
VV Cyg	p	52548.3610	0.0003	+0.0031	19	RD	CCD
WW Cyg	p	52766.484	0.003	+0.048	10	KL	vis
WZ Cyg	p	52587.318	0.003	+0.051	5	KL	vis
ZZ Cyg	p	52716.582	0.004	−0.042	6	KL	vis
BR Cyg	p	52687.690	0.003	−0.007	6	KL vis	

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
DO Cyg	p	52548.3470	0.0009	−0.0129	17	RD	CCD
V367 Cyg	p	51729.67	0.06	−0.03	86	KT	vis; norm. min.
	s	51739.04	0.17	+0.04	72	KT	vis; norm. min.
V370 Cyg	p	52792.499	0.002	−0.017	6	KL	vis
V502 Cyg	s	52585.3353	0.0013	+0.1021	17	EBl	CCD
V728 Cyg	p	52577.340	0.006	+0.051	7	KL	vis
V1019 Cyg	p	52547.3472	0.0012	+0.1056	10	RD	CCD
V1823 Cyg	p	47723.453	0.005	+0.054	23	MMa	vis; elem. IBVS No. 4997
	s	47797.516	0.006	+0.068	29	MMa	vis; elem IBVS No. 4997
	p	52792.543	0.004	−0.013	7	KL	vis
V1908 Cyg	p	52548.3422	0.0012	−0.2357	15	RD	CCD; elem. Per. Zv. 22, 359
V2280 Cyg	s	52820.467	0.009	+0.019	6	KL	vis; IBVS No. 4996
FZ Del	p	52783.531	0.006	−0.040	6	KL	vis
Z Dra	p	52598.619	0.003	−0.145	7	KL	vis
RR Dra	p	52722.597	0.002	+0.061	14	KL	vis
RZ Dra	s	52717.5076	0.0020	+0.0310	22	EBl	CCD
SX Dra	p	52697.604	0.009	+0.067	11	KL	vis
TW Dra	p	52506.350	0.006	+0.037	11	KT	vis, norm. min.
		52565.295	0.005	+0.038	5	KT	vis
UZ Dra	p	52717.4160	0.0011	+0.0014	14	EBl	CCD
XY Dra	p	52548.5801	0.0009	+1.2486	33	EBl	CCD
	s	52568.263	0.003	+1.260	16	EBl	CCD
AR Dra	p	52576.651	0.005	+0.009	5	KL	vis
AU Dra	p	52717.5008	0.0012	−0.0034	19	EBl	CCD; elem. IBVS No. 4587
AX Dra	p	52693.5314	0.0002	−0.0534	17	RD	CCD
BE Dra	p	52720.5739	0.0019	+0.1203	10	RD	CCD
CM Dra	p	52717.612	0.002	+0.001	8	RD	CCD
	p	52717.6129	0.0014	+0.0026	8	EBl	CCD
CV Dra	p	52717.4522	0.0019	−0.0048	17	EBl	CCD; elem. BAV Mitt. 69
	s	52721.4738	0.0011	+0.0024	16	RD	CCD
DW Dra	p	52524.560	0.006	+0.020	6	KL	vis; elem. BBSAG Bull. 118, 7
EF Dra	s	52568.3659	0.0010	−0.0775	23	EBl	CCD
	p	52717.4122	0.0016	−0.0788	15	EBl	CCD
	s	52717.618	0.009	−0.085	10	EBl	CCD
FU Dra	p	52715.4733	0.0011	−0.0152	17	RD	CCD; elem Hipparchos Cat.
	s	52717.4685	0.0012	−0.0136	21	EBl	CCD
	p	52717.6218	0.0010	−0.0137	9	EBl	CCD
IV Dra	s	52721.3860	0.0006		8	RD	CCD
	p	52721.5167	0.0008		9	RD	CCD
KK Dra	p	52708.503	0.002	+0.011	10	KL	vis; elem. JAAVSO 28, 91
GSC3549:929 Dra	p	52717.5115	0.0025	−0.0015	18	EBl	CCD; elem. IBVS No. 5232
RW Gem	p	52691.491	0.004	+0.004	8	KL	vis
SX Gem	p	52723.367	0.006	−0.054	66	APs	CCD
TX Gem	p	52667.358	0.007	−0.018	6	KL	vis
AF Gem	p	52655.3130	0.0011	−0.0613	15	EBl	CCD
	s	52719.357	0.003	−0.057	20	EBl	CCD
AH Gem	p	52719.342	0.002		19	EBl	CCD; elem. in need of revision
AI Gem	p	52719.3001	0.0013		19	EBl	CCD; elem. in need of revision
AZ Gem	s	52719.3295	0.0007	+0.0790	20	EBl	CCD
BD Gem	p	52533.599	0.004	−0.021	7	KL	vis
BT Gem	p	52717.368	0.004	−0.005	14	RD	CCD
CK Gem	p	52689.3223	0.0009	−0.0658	15	EBl	CCD

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
DP Gem	p	52622.2950	0.0012	−0.0144	15	EBl	CCD; elem. BBSAG Bull. 121, 7
	p	52689.3113	0.0011	−0.0123	14	EBl	CCD
EG Gem	p	52694.2963	0.0009	+0.2468	13	RD	CCD
EY Gem	s	52689.306	0.004	−0.224	14	EBl	CCD
FT Gem	s	52655.3194	0.0011	−0.0153	11	EBl	CCD
HR Gem	s	52719.2871	0.0012	+0.0139	18	EBl	CCD
KQ Gem	s	52655.313	0.003	−0.071	12	EBl	CCD
QW Gem	-	52655.2764	0.0011	−0.0190	16	EBl	CCD; elem Hipparcos
	-	52689.2991	0.0.0006	−0.0184	15	EBl	CCD; min. asymetric; pulsator
	-	52694.314	0.002	−0.018	12	RD	CCD; min. asymetric
SZ Her	p	52536.379	0.006	−0.018	5	KL	vis
TU Her	p	52526.324	0.004	−0.118	6	KL	vis
CC Her	p	52817.443	0.002 +0.135	7	KL	vis	
DP Her	p	52764.571	0.005	+0.061	6	KL	vis
DQ Her	p	52763.421	0.001	+0.003	6	KL	vis
FW Her	p	52717.6348	0.0011	+0.0617	15	RD	CCD
IT Her	p	52533.3581	0.0014	+0.1197	20	EBl	CCD; elem. IBVS No. 4663
MT Her	s	52526.3727	0.0017	+0.0173	20	EBl	CCD
	p	52536.372	0.004	+0.018	5	KL	vis
V856 Her	p	52717.577	0.002	−0.043	9	RD	CCD; elem. IBVS No. 4342
V1033 Her	s	52764.4316	0.0004	−0.0056	22	EBl	CCD; elem. IBVS No. 5146
V1034 Her	p	52792.489	0.003	+0.008	8	KL	vis; elem. IBVS No. 5231
V1036 Her	s	52764.4885	0.0005	+0.0001	24	EBl	CCD; elem. IBVS No. 5146
V1038 Her	p	52764.4273	0.0003	+0.0014	22	EBl	CCD; elem. IBVS No. 5146
V1039 Her	s	52764.4265	0.0011	+0.0019	23	EBl	CCD; elem. BBSAG Bull. 128, 10
V1044 Her	p	52526.331	0.005	+0.003	6	KL	vis; elem. IBVS No. 5192
	s	52590.217	0.004	−0.001	5	KL	vis
	s	52702.598	0.003	0.000	6	KL	vis
	s	52708.600	0.003	−0.014	6	KL	vis
	s	52745.4296	0.0008	−0.0021	9	EBl	CCD
	p	52745.5497	0.0020	−0.0023	13	EBl	CCD
	p	52753.495	0.005	+0.002	5	KL	vis
	p	52791.513	0.005	−0.001	6	KL	vis
	p	52792.473	0.004	−0.004	6	KL	vis
	p	52812.456	0.006	+0.006	6	KL	vis
V1047 Her	s	52745.4675	0.003	−0.001	11	EBl	CCD; elem. IBVS No. 5192
V1053 Her	p	52708.569	0.005	+0.028	6	KL	vis; elem. BBSAG Bull. 128, 10
	s	52745.5237	0.0018	+0.0010	15	EBl	CCD
	p	52752.604	0.004	+0.030	5	KL	vis
	p	52753.457	0.005	+0.020	5	KL	vis
	s	52783.514	0.006	+0.002	5	KL	vis
	s	52791.577	0.008	+0.007	6	KL	vis
	p	52812.453	0.006	+0.018	6	KL	vis
V1055 Her	p	52745.5391	0.0020	−0.0049	15	EBl	CCD; elem. IBVS No. 5192
V1062 Her	p	52746.4316	0.0014	−0.0058	11	EBl	CCD; elem. IBVS No. 4965
V1067 Her	s	52746.461	0.003	+0.003	10	EBl	CCD; elem. IBVS No. 4966
V1073 Her	s	52783.4093	0.0007	+0.0008	20	EBl	CCD; elem. IBVS No. 4975
GSC2056:117 Her	p	52702.658	0.007		5	KL	vis
	s	52708.568	0.004		6	KL	vis
	s	52764.515	0.006		6	KL	vis
	p	52766.490	0.004		6	KL	vis
	p	52813.512	0.005		5	KL	vis

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC2083:1870 Her	s	52746.4914	0.0008	+0.0001	21	EBl	CCD; elem. IBVS No. 5306
GSC2613:1412 Her	p	52746.5329	0.0017	+0.0036	15	EBl	CCD; elem. IBVS No. 5306
GSC2629:1932 Her	p	52502.4791	0.0005	−0.0004	14	EBl	CCD; elem. IBVS No. 5333
	p	52526.3716	0.0012	+0.0012	19	EBl	CCD
	s	52526.5155	0.0003	−0.0006	18	EBl	CCD
	p	52533.3634	0.0014	+0.0005	21	EBl	CCD
	s	52546.3279	0.0016	−0.0002	11	EBl	CCD
	s	52548.3670	0.0012	−0.0006	22	EBl	CCD
	p	52568.3254	0.0011	+0.0002	19	EBl	CCD
	p	52745.4681	0.0018	+0.0003	17	EBl	CCD
GSC3098:683 Her	s	52746.4208	0.0011	−0.0028	15	EBl	CCD; elem. IBVS No. 5306
GSC3098:1253 Her	s	52746.4919	0.0010	+0.0028	18	EBl	CCD; elem. IBVS No. 5306
GSC3528:44 Her	p	52495.4826	0.0025	+0.0001	10		CCD; elem. IBVS No. 5333
	p	52502.3709	0.0008	+0.0006	12	EBl	CCD
	p	52526.4760	0.0006	−0.0016	24	EBl	CCD
	p	52533.3651	0.0006	−0.0003	24	EBl	CCD
	p	52548.2893	0.0009	+0.0004	13	EBl	CCD
	s	52548.4812	0.0014	+0.0009	31	EBl	CCD
	s	52568.3786	0.0023	+0.0003	16	EBl	CCD
	s	52745.5495	0.0007	+0.0019	16	EBl	CCD
GSC3532:174 Her	p	52495.4374	0.0005	0	18	EBl	CCD; elem. IBVS No. 5333
	s	52502.3878	0.0008	+0.0002	11	EBl	CCD
	p	52502.5015	0.0006	−0.0001	11	EBl	CCD
	p	52509.3367	0.0002	−0.0012	9	EBl	CCD
	s	52526.3149	0.0017	+0.0002	11	EBl	CCD
	p	52526.4288	0.0014	+0.0002	14	EBl	CCD
	s	52526.5424	0.0017	−0.0001	14	EBl	CCD
	s	52533.3794	0.0013	+0.0006	19	EBl	CCD
	p	52533.4936	0.0011	+0.0008	12	EBl	CCD
	s	52536.3419	0.0016	+0.0007	13	EBl	CCD
	p	52548.3051	0.0012	+0.0004	12	EBl	CCD
	s	52548.4187	0.0004	0.0000	15	EBl	CCD
	p	52548.4324	0.0009	−0.0002	25	EBl	CCD
	p	52691.640	0.002	+0.001	10	KL	vis
	s	52702.688	0.006	−0.003	5	KL	vis
	s	52708.625	0.005	+0.009	7	KL	vis
	s	52730.496	0.004	+0.004	5	KL	vis
	p	52745.4198	0.0020	+0.0019	9	EBl	CCD
	s	52745.5317	0.0020	−0.0002	11	EBl	CCD
GSC3532:939 Her	s	52495.4335	0.0021	−0.0052	15		CCD; elem. IBVS No. 5333
	p	52502.3921	0.0011	+0.0008	14	EBl	CCD
	s	52526.3387	0.0010	−0.0005	15	EBl	CCD
	p	52526.4940	0.0007	+0.0003	21	EBl	CCD
	p	52533.2900	0.0013	−0.0018	9	EBl	CCD
	s	52533.4456	0.0013	−0.0007	22	EBl	CCD
	p	52546.2733	0.0020	+0.0033	6	EBl	CCD
	s	52548.2788	0.0013	+0.0002	12	EBl	CCD
	p	52548.4348	0.0008	+0.0017	27	EBl	CCD
	s	52548.5893	0.0009	+0.0017	25	EBl	CCD
	p	52745.576	0.002	+0.001	11	EBl	CCD
	p	52763.509	0.006	+0.009	10	KL	vis
AL Hya	p	52618.598	0.005	+0.451	7	KL	vis
DG Lac	p	52781.483	0.005	−0.200	5	KL	vis
OO Lac	p	52533.492	0.006	+0.124	6	KL	vis
	s	52592.3151	0.0014	+0.1238	18	EBl	CCD
V339 Lac	p	52548.437	0.005	+0.156	10	RD	CCD

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
V344 Lac	p	52531.5346	0.0010	+0.0026	19	RD	CCD; elem. BBSAG Bull. 127, 10
	p	52592.3311	0.0015	+0.0021	16	EBl	CCD
Y Leo	p	52590.598	0.002	+0.016	10	KL	vis
RW Leo	p	52750.365	0.003	−0.048	6	KL	vis
BL Leo	s	52697.439	0.005	−0.013	6	KL	vis
BW Leo	s	52722.297	0.010	−0.075	7	RD	CCD
	p	52722.467	0.003	−0.073	12	RD	CCD
CE Leo	s	52715.5310	0.0013	−0.0075	10	RD	CCD
RT LMi	p	52693.4750	0.0004	−0.0076	16	RD	CCD
RS Lep	p	52555.651	0.004	−0.005	7	KL	vis
BW Lib	p	52702.613	0.004	−0.003	11	KL	vis; elem. IBVS No. 5335
RY Lyn	p	52655.369	0.008	−0.037	5	KL	vis
UU Lyn	p	52691.2725	0.0010	−0.0028	16	EBl	CCD
AH Lyn	p	52717.3591	0.0019	−0.0037	10	RD	CCD; elem. AJ 87, 314
TT Lyr	p	52789.547	0.008	+0.001	9	KL	vis
UZ Lyr	p	52722.633	0.005	−0.027	12	KL	vis
EW Lyr	p	52815.487	0.003	+0.235	8	KL	vis
HT Lyr	p	52526.3448	0.0010	−0.0305	21	EBl	CCD
IP Lyr	p	52548.2770	0.0008	−0.0027	7	EBl	CCD
IW Lyr	p	52548.4372	0.0008	+0.2987	14	EBl	CCD
LZ Lyr	p	52536.3160	0.0007	+0.2364	15	EBl	CCD
V400 Lyr	s	52652.2468	0.0015	−0.0115	16	EBl	CCD; elem. IBVS No. 4995
V406 Lyr	p	52509.3662	0.0014	−0.0196	11	EBl	CCD; elem. IBVS No. 4132
	p	52533.4688	0.0007	−0.0190	24	EBl	CCD
V574 Lyr	p	52783.4267	0.0013	−0.0025	19	EBl	CCD; elem. IBVS No. 4976
V579 Lyr	s	52652.244	0.004	−0.003	13	EBl	CCD; elem. IBVS No. 4982
V580 Lyr	s	52783.3591	0.0012	−0.0015	10	EBl	CCD; elem. IBVS No. 4982
	p	52783.4991	0.0013	−0.0060	18	EBl	CCD
V582 Lyr	p	52652.2695	0.0009	+0.0129	16	EBl	CCD; elem. IBVS No. 4985
	s	52764.488	0.002	+0.020	6	KL	vis
β Lyr	p	46338.5		−5.2	112	MMa	vis; norm. min.
	s	46344.7		−5.5	112	MMa	vis; norm. min.
	p	46999.1		−3.3	88	MMa	vis; norm. min.
	s	47004.4		−4.5	88	MMa	vis; norm. min.
	p	51332.64	0.06	+0.08	96	KT	vis; norm. min.
	p	51694.99	0.08	+0.10	129	KT	vis; norm. min.
	p	52109.05	0.05	+0.06	95	KT	vis; norm. min.
	p	52471.37	0.07	+0.05	109	KT	vis; norm. min.
GSC2632:319 Lyr	s	52783.4066	0.0009	+0.0043	20	EBl	CCD; elem. IBVS No. 5232
GSC3104:1384 Lyr	p	52783.4486	0.0005	+0.0017	18	EBl	CCD; elem. IBVS No. 5232
GSC3540:85 Lyr	s	52783.3819	0.0015	+0.0036	14	EBl	CCD; elem. IBVS No. 5232
	p	52783.529	0.003	+0.001	9	EBl	CCD
RW Mon	p	52533.588	0.004	−0.037	7	KL	vis
UU Mon	p	52584.644	0.003	+0.002	8	KL	vis
XZ Mon	p	52691.331	0.004	+0.028	5	KL	vis
BM Mon	p	52695.392	0.006	+0.028	7	KL	vis
BO Mon	p	52655.412	0.002	−0.062	10	KL	vis
FH Mon	p	52730.336	0.003	−0.084	8	KL	vis
HK Mon	p	52717.397	0.002	+0.024	15	RD	CCD
V396 Mon	p	52689.3079	0.0015	−0.0552	16	EBl	CCD
V524 Mon	p	52717.324	0.005	−0.018	7	RD	CCD
V714 Mon	s	52689.3008	0.0.0014	−0.0064	17	EBl	CCD; elem. IBVS No. 4468
	s	52694.2975	0.0010	−0.0051	13	RD	CCD
V391 Oph	p	52812.470	0.006	+0.033	6	KL	vis
V449 Oph	p	52526.369	0.002	+0.060	5	KL	vis
V508 Oph	p	52535.391	0.004	−0.006	5	KL	vis

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
V566 Oph	p	52483.455	0.008	+0.083	31	APs	CCD
V913 Oph	p	52819.532	0.003	+0.182	6	KL	vis
V1016 Oph	s	52501.356	0.005	−0.067	17	APs	CCD; elem. BBSAG Bull. 99, 9
V1125 Oph	p	52717.627	0.002	−0.001	16	RD	CCD; elem. GEOS EB 28
EQ Ori	p	52534.581	0.003	−0.023	6	KL	vis
FL Ori	p	52635.508	0.005	+0.031	6	KL	vis
FZ Ori	p	47560.326	0.005	−0.014	17	MMa	vis
OS Ori	p	52608.414	0.005	−0.015	5	KL	vis
V343 Ori	p	52655.2689	0.0005	+0.1635	16	EBl	CCD
V392 Ori	p	52655.2768	0.0010	+0.0197	16	EBl	CCD; elem. Bull. A. S. I. 19
V640 Ori	p	52677.299	0.005	−0.110	7	KL	
V641 Ori	s	52622.332	0.002	+0.006	13	EBl	CCD
VW Peg	s	52547.5255	0.0005	−4.8172	29	RD	CCD; elem. IBVS No. 4916; displ. sec.
AY Peg	p	47767.394	0.005	−0.032	17	MMa	vis
	p	52535.5187	0.0011	−0.1760	26	RD	CCD
BX Peg	p	52501.6256	0.0001	−0.0960	-	TSa	CCD
	s	52514.6663	0.0001	−0.0949	52	TSa, CY	CCD
CW Peg	p	52819.540	+0.048	6	KL	vis	
EU Peg	p	52535.502	0.002	+0.035	11	RD	CCD
RT Per	p	52568.308	0.005	+0.049	5	KL	vis
RV Per	p	52658.372	0.009	−0.019	8	KL	vis
ST Per	p	52627.470	0.005	+0.166	77	APs	CCD
	p	52688.388	0.008	+0.173	8	KL	vis
WY Per	p	52533.516	0.008	−0.062	5	KL	vis
XZ Per	p	52530.479	0.006	−0.052	5	KL	vis
	p	52658.3078	0.0010	−0.0543	16	RD	CCD
AG Per	p	51796.695	0.033	+0.052	24	KT	vis; norm. min.
	s	51797.804	0.022	+0.146	35	KT	vis; norm. min.; displ. secondary
DK Per	p	52534.627	0.002	−0.030	6	KL	vis; elem. IBVS No. 3875
DM Per	p	52531.351	0.010	−0.022	12	CPa	vis
KW Per	p	52577.412	0.002	+0.008	7	KL	vis
PS Per	p	52524.525	0.007	+0.054	5	KL	vis
V436 Per	p	47349.504	0.005	+0.010	19	MMa	vis
	p	47764.428	0.008	−0.041	15	MMa	vis
β Per		51783.330	0.013	+0.051	9	KT	vis
	p	51803.386	0.005	+0.036	21	KT	vis
	p	51846.404	0.005	+0.044	13	KT	vis
	p	51869.323	0.005	+0.024	15	KT	vis
	p	51906.609	0.007	+0.036	12	KT	vis
	p	51912.345	0.005	+0.037	11	KT	vis
	p	51972.561	0.008	+0.039	10	KT	vis
	p	51978.286	0.008	+0.030	10	KT	vis
	p	52147.459	0.005	+0.032	11	KT	vis
	p	52150.347	0.006	+0.053	11	KT	vis
	p	52517.362	0.007	+0.052	20	KT	vis; norm. min.
TY Pup	s	49776.362	0.004	−0.087	MMa	vis	
	p	49783.342	0.003	−0.071	23	MMa	vis
XZ Pup		52694.472	0.002	+0.094	11	KL	vis
UZ Sge	p	52526.379	0.005	+0.041	7	KL	vis

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
GSC1621:2192 Sge	s	52526.304	0.005	−0.001	6	KL	vis; elem. BBSAG Bull. 128, 10
	p	52526.486	0.003	−0.003	6	KL	vis
	s	52530.363	0.004	−0.002	6	KL	vis
	p	52533.496	0.003	−0.007	7	KL	vis
	s	52574.298	0.006	+0.006	9	KL	vis
	p	52576.322	0.004	0.000	7	KL	vis
	s	52708.658	0.003	+0.002	7	KL	vis
	p	52764.582	0.003	+0.002	6	KL	vis
	p	52791.525	0.006	−0.001	7	KL	vis
	s	52813.489	0.004	0.000	5	KL	vis
	p	52814.411	0.004	−0.001	6	KL	vis
WX Sgr	p	52800.539	0.003	−0.106	7	KL	vis
XY Sgr	p	52817.493	0.003	+0.019	7	KL	vis
AK Ser	p	52813.409	0.003	+0.027	6	KL	vis
AO Ser	p	52574.252	0.004	−0.008	7	KL	vis
AU Ser	p	52652.622	0.006	−0.077	6	KL	vis
LX Ser	p	52730.504	0.001	+0.002	5	KL	vis
GSC2035:175 Ser	p	52763.4509	0.0002	+0.0058	17	EBl	CCD; elem. IBVS No. 5295
RW Tau	p	52567.354	0.003	−0.175	10	KL	vis
AH Tau	p	52532.607	0.003	−0.106	6	KL	vis
AM Tau	p	52652.379	0.003	−0.050	7	KL	vis
CR Tau	p	52622.3331	0.0012	+0.0009	14	EBl	CCD; elem. IBVS No. 4778
EQ Tau	p	52548.609	0.003	−0.026	18	APs	CCD
HU Tau	p	52673.401	0.010	+0.010	6	CPa	vis
V781 Tau	p	47550.322	0.005	+0.007	16	MMa	vis
	s	52622.3515	0.0007	−0.0375	16	EBl	CCD
	p	47552.363	0.005	−0.022	14	MMa	vis
	p	47560.314	0.005	−0.004	14	MMa	vis
V Tri	p	52555.405	0.005	+0.005	5	KL	vis
RV Tri	p	52635.403	0.006	−0.024	7	KL	vis
RW Tri	p	52691.293	0.001	−0.004	7	KL	vis
TX UMa	p	52610.476	0.004	+0.181	8	CPa	vis
		52708.476	0.006	+0.163	8	APs, CPa	vis
UX UMa	p	52590.671	0.001	+0.002	7	KL	vis
UY UMa	p	52693.5108	0.0011	+0.0804	15	RD	CCD
XZ UMa	p	52618.538	0.005	−0.071	6	KL	vis
	p	52722.4387	0.0008	−0.0672	14	RD	CCD
ZZ UMa	p	52715.389	0.002	0.000	7	KL	vis
AA UMa	s	52658.527	0.004	+0.024	22	RD	CCD
BM UMa	p	52715.385	0.005	+0.005	6	RD	CCD
	s	52715.5223	0.0011	+0.0063	10	RD	CCD
ES UMa	p	52658.497	0.002	−0.097	15	RD	CCD; elem. IBVS No. 3914
IW UMa	p	52721.4495	0.0011	+0.0099	15	RD	CCD; elem. IBVS No. 4402
GSC3002:454 UMa	p	52691.315	0.008	+0.056	7	KL	vis; elem. IBVS No. 5064
RT UMi	p	47775.384	0.005	+0.123	29	MMa	vis
UW Vir	p	52658.645	0.002	−0.038	6	KL	vis
VV Vir	p	52706.633	0.003	−0.037	10	KL	vis
FO Vir	p	47609.421	0.004	+0.001	14	MMa	vis
HW Vir	p	52647.705	0.001	+0.001	8	KL	vis; elem. AA 364, 199
GSC2850:1075 Vir	s?	52692.460	0.005		22	APs	CCD
	p?	52692.639	0.005		22	APs	CCD
AX Vul	p	52590.274	0.005	−0.024	6	KL	vis
AY Vul	p	52576.377	0.003	−0.032	8	KL	vis
BE Vul	p	52718.664	0.004	+0.030	7	KL	vis
BO Vul	p	52601.307	0.004	−0.008	7	KL	vis

Table 1. (continue)

Variable	Type	HJD 24...	±	$O-C$	n	Obs	Remarks
BP Vul	p	52724.589	0.008	−0.028	7	KL	vis
ER Vul	p	47012.445	0.016	+0.031	20	MMa	vis

Observers:

EBl :	E. Blättler	Wald, Switzerland
RD :	R. Diethelm	Rodersdorf, Switzerland
KL :	K. Locher	Grüt, Switzerland
MMa :	M. Martignoni	Magnago, Italy
SO :	S. Ozer	Akdeniz Univ., Turkey
CPa :	C. Pampaloni	Firenze, Italy
APs :	A. Paschke	Rüti, Switzerland
TSa :	T. Sahin	Akdeniz Univ., Turkey
KT :	K. Tikkanen	Oulu, Finland
CY :	C. Yesilyaprak	Akdeniz Univ., Turkey

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 5438, 5543, 5713

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

The Editors

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PHOTOELECTRIC MINIMUM TIMES OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
30-cm Maksutov telescope of the Ankara University Observatory and 40-cm Cassegrain telescope of the TÜBİTAK National Observatory.

Detector:	OPTEC SSP-5A photometer containing a side-on R1414 Hamamatsu photomultiplier and AP7p CCD camera.

Method of data reduction:
Reduction of the observations were made in the usual way (Hardie 1962).

Method of minimum determination:
Kwee and van Woerden (1956).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
AB And	EW	$23^h11^m32^s$	$+36°53'35''$	BD+35 4972	45502.1040	0.33188902	1
CG Cyg	EA/SP/RS	$20^h58^m14^s$	$+35°10'30''$	BD+34 4216	39425.1176	0.631143114	1
V1073 Cyg	EW/KE	$21^h25^m00^s$	$+33°41'15''$	BD+33 4248	38672.5749	0.78585749	1
VW LMi	EW	$11^h02^m52^s$	$+30°24'55''$	BD+31 2223	48500.1960	0.4775470	3
CC Lyn	EW	$07^h35^m56^s$	$+43°01'51''$	BD+42 1734	48500.3370	0.354622	3
AQ Psc	EW	$01^h21^m4^s$	$+07°36'22''$	BD+05 0177	44562.4691	0.47564	2
V1123 Tau	EB	$03^h34^m58^s$	$+17°42'38''$	BD+17 0568	48500.3570	0.399957	3

Source(s) of the ephemeris:
1. Kreiner et al., 2001; 2. Sarma and Radhakrishnan, (1982); 3. ESA, (1997)

† TÜBİTAK : The Scientific and Technical Research Council of Turkey

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
AB And	52536.3995	±0.0004	II	BV	0.0736	EA
	52550.3371	±0.0003	II	UBV	0.0720	RK
	52564.4445	±0.0002	I	UBV	0.0740	RK
	52578.3846	±0.0002	I	UBV	0.0748	RK
	52578.2177	±0.0003	II	UBV	0.0739	EA
	52599.2939	±0.0003	I	UBV	0.0751	RK
CG Cyg	52459.4916	±0.0001	I	UBV	0.0064	RK
	52473.3772	±0.0002	I	UBV	0.0068	RK
	52495.4671	±0.0001	I	$BVR*$	0.0067	RK
	52496.4114	±0.0002	II	$BVR*$	0.0043	LG
	52501.4657	±0.0004	II	BV	0.0095	RK
	52515.3479	±0.0004	II	BV	0.0066	RK
V1073 Cyg	52130.3446	±0.0008	I	UBV	−0.0398	SÇ
	52144.4867	±0.0005	I	UBV	−0.0431	RK
	52172.3871	±0.0003	II	UBV	−0.0407	RK
VW LMi	52725.3159	±0.0003	II	UBV	0.0219	RK
CC Lyn	52298.3900	±0.0014	I	BV	0.0514	SA
	52312.4016	±0.0009	II	BV	0.0554	RK
	52319.3128	±0.0010	I	BV	0.0515	RK
	52319.4866	±0.0011	II	BV	0.0479	RK
	52340.3922	±0.0010	II	BV	0.0309	RK
AQ Psc	52193.3573	±0.0004	II	UBV	−0.0421	RK
V1123 Tau	52606.4543	±0.0004	I	UBV	−0.0612	RK
	52634.4492	±0.0004	II	UBV	−0.0633	RK

Explanation of the remarks in the table:

*:AP7p CCD camera

Observers: RK: Rahşan KALCI, EA: Evren AYDIN, SÇ: Serhat ÇAKMAK, SA: Senay ANIL, LG: Levent GÜRDEMİR

Acknowledgements:

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Hα VARIATIONS OF THE SPOTTED G DWARF AP 149

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AP 149 is a rapidly rotating G dwarf with a rotation period of 0.32 days, $v \sin i$ of 102 km s^{-1} and an inclination of 30°(Barnes et al., 2001). It belongs to the α Persei cluster at a distance of 180–187 pc and an age of about 50 Myr. Barnes et al. (1998, 2001) and Jeffers et al. (2002) used the advantages of a multi-line cross-correlation technique to gain S/N in order to perform Doppler imaging of several α Persei cluster G dwarfs. Their image reconstructions demonstrated that these stars have high latitude and/or polar spots and low latitude features. The original aim of our work was to extend the work by Barnes et al. (1998, 2001) by studying the starspot distribution on a few α Persei cluster stars several yeas after their initial observation. In this paper, we present some first science verification data.

Spectroscopic observations of AP 149 were to be obtained with the 6m telescope of the SAO RAS on the nights of October 22 and 23, 2002. The 2K×1K CCD camera was used with the main stellar spectrograph in the Nasmyth focus. With an entrance slit of 1″, the spectral resolution was R=24,000. The spectral region from 6200 Å to 6610 Å was selected. It includes the 6400 Å – 6440 Å region often used for Doppler imaging as well as Hα at 6563 Å for the search for variations of its profile.

We intended to obtain full phase coverage for AP 149 during these two consecutive nights. Unfortunately, due to the weather conditions only 3 spectra of 30 min exposures each were obtained on October, 23. The heliocentric Julian Dates of the exposures are 2,452,571.2792, 2,452,571.3160, and 2,452,571.3417. They were supplemented by calibration spectra including Th-Ar, flat field, and bias, and two spectra of the comparison star HD 10780 (K0V). Data reduction was done at SAO with the MIDAS package. S/N ratio for the spectra of AP 149 is about 30-40. A fragment of the spectra of AP 149, as well as HD 10780, is shown in the left part of Fig. 1.

The most prominent spectral feature is the Hα emission line (Fig. 1). The range of variability in the emission line profiles can be estimated from the plot in the lower right panel of Fig. 1. A double-peaked profile is evident at the phases of our observations but, after the subtraction of the theoretical hydrogen line profile convolved with the appropriate rotational profile for AP 149 of 102 km s^{-1} (Barnes et al., 2001), the Hα profiles exhibit a triangular shape with additional features possibly connected with transients (Barnes et al., 2001). Synthetic spectra were calculated with the atmospheric parameters $T_{\rm eff}$=5500 K and $\log g$=4.0 from the Kurucz (1993) grid of models with solar metalicity.

The equivalent width of the Hα emissions is 4.2, 4.6 and 4.9 Å from the 3 spectra, respectively, with errors less, than 0.1 Å, thus we observed a real increase. Under the assumption of V=11$^{m}_{.}$71 (Barnes et al., 2001) the flux radiated in Hα is in the range of (0.26 – 0.31) 10^{-12} erg cm^{-2}s^{-1}Å^{-1}.

Acknowledgements:
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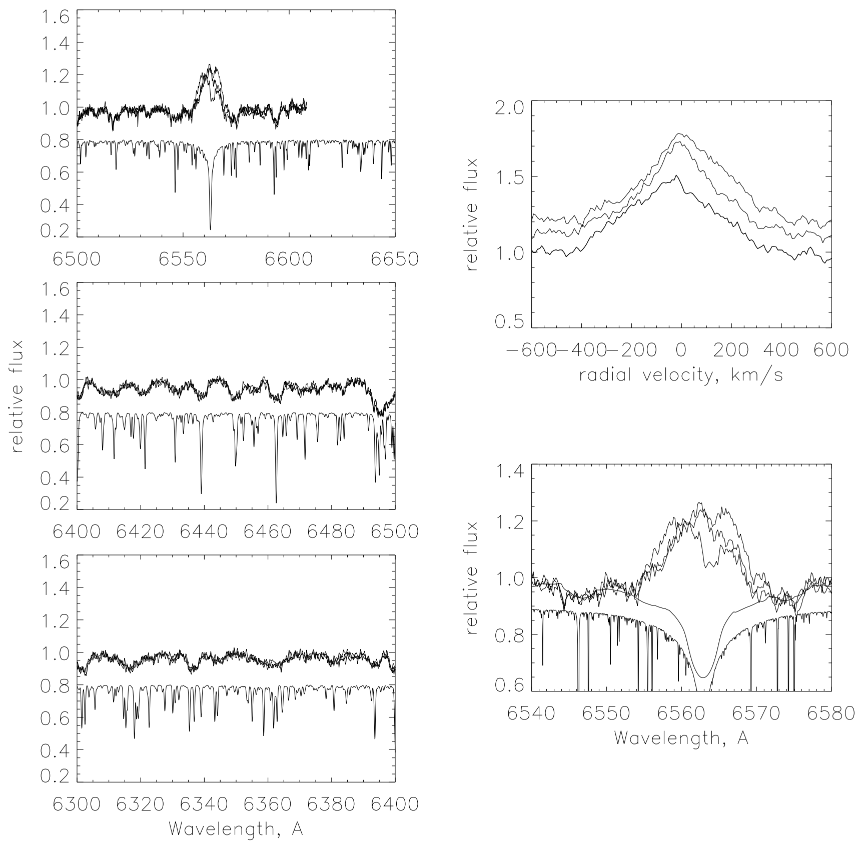

Figure 1. Left column: High-resolution spectra of AP 149 (top) and, for comparison, HD 10780 (bottom, shifted) in three wavelength ranges. Right column: Top: Residual Hα line profiles after subtraction of a synthetic spectrum for our 3 observation (profiles were arbitrarily shifted). Bottom: Hα profiles of AP 149 compared to the unbroadened synthetic spectrum (shifted by −0.1) and its broadened version.

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AY LACERTAE IS A CATACLYSMIC VARIABLE

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The variable star AY Lac = 207.1928 was discovered by Hoffmeister (1928a). He found the star, at maximum about $15^{\rm m}$ pg, visible only on several plates taken during late August to early September, 1927, and fainter than $16\overset{\rm m}{.}5$ on the rest of the available plates. The discoverer suggested that the star could be a long-period variable (Mira type, according to our current classification), a U Geminorum variable, or a Nova. The finding chart can be found in Hoffmeister (1928b). Himpel (1943) made 43 visual observations of the star in March to August, 1943. The star was invisible (fainter than $14\overset{\rm m}{.}0$–$14\overset{\rm m}{.}8$) on all occasions till August 3, when the star was fainter than $14\overset{\rm m}{.}8$; only the last observation, of August 5, was positive, at $14\overset{\rm m}{.}0$ vis. Himpel claimed AY Lac to be definitely Nova-like and noted that it was invisible on existing photographic atlases and reproductions, with limiting magnitudes from $15\overset{\rm m}{.}8$ to $17^{\rm m}$. With the only one unconfirmed visual observation, we cannot consider the outburst announced by Himpel quite reliable.

Geßner (1966) studied the star on 250 Sonneberg plates spanning JD 2425200–2427300, 2436800–2438000. She found an additional brightening of the star: AY Lac was found fading from $14\overset{\rm m}{.}5$ on JD 2437888 (August 11, 1962) to $16\overset{\rm m}{.}5$ on JD 2437906 (August 29, 1962). The star could not be found on the Palomar Sky Survey prints (fainter than $20^{\rm m}$). Considering the outburst from Himpel (1943) real, Geßner (1966) represented the three maxima, JD 2425125 (Hoffmeister), 2430942 (Himpel), and 2437885 (Geßner), with the formula Max $= 2437885 + 1159^{\rm d}/n \times E$. The fourth edition of the GCVS (Kholopov, 1985) reproduces these light elements and gives the type M:. The Downes & Shara (1993) catalogue lists the star as a non-cataclysmic variable. The on-line catalogue and atlas of cataclysmic variables (Downes *et al.*, 2003), nevertheless, lists the star with the type UG:/M and the following remark: "Although classified as M in the GCVS, Sumner (`ftp://ftp.nofs.navy.mil/pub/outgoing/aah/sequence/sumner/aylac.seq`) still considers this a possible UG". The chart in this atlas does not identify AY Lac definitely but shows a circle with several stars inside, at the formal position of the variable ($22^{\rm h}22^{\rm m}23^{\rm s}$, $+50°23'29''$, 2000.0), to the south of the correct position (see below).

During the preparation of the electronic version of the GCVS Volume II with accurate coordinates (Samus *et al.*, 2003), we noticed that there were no red stars near the position of AY Lac and thus its cataclysmic-variable classification was very probable. The plate stacks of the Sonneberg Observatory were studied once again. Only the two outbursts discovered by Hoffmeister (1928) and by Geßner (1966) could be confirmed, with no additional outbursts on newer plates (JD 2437936–2449625). After the date of the outburst reported by Geßner, the star is visible on two plates of the best quality, taken on JD 2437934 (September 26, 1962), near the plate limit ($17\overset{\mathrm{m}}{.}5$–$18^{\mathrm{m}}$). Thus, the duration of the bright state of 1962 was considerable. The star is under the plate limit on more than 120 plates of the Moscow plate collection taken with the Crimean 40 cm astrograph on JD 2445642–2450371, with the typical limiting magnitude of $17\overset{\mathrm{m}}{.}5$. Only five Moscow plates were taken earlier. Three of them (JD 2441174–2441177) do not show the star. The two remaining plates were taken during the descending branch of Geßner's outburst, on September 19/20, 1962 (JD 2437927). The position of AY Lac is at the very edge of these plates, and one of them apparently shows a star-like object near the plate limit ($\sim 17^{\mathrm{m}}$) that may be AY Lac, whereas the second one, of poorer quality, shows nothing. We can conclude that the outbursts of AY Lac are rare phenomena.

The Sonneberg plate GB715, taken with the 40 cm ($f = 2$ m) astrograph on August 12, 1962 (JD 2437889) and clearly showing the star in outburst, was scanned and then used to measure the coordinates of AY Lac, relative to twelve neighbouring stars from the US Naval Observatory A2.0 catalogue. The position we measured ($22^{\mathrm{h}}22^{\mathrm{m}}22\overset{\mathrm{s}}{.}1$, $+50°23'40''$, J2000.0, epoch 1962.612) is probably accurate to 1–2$''$ both in right ascension and in declination. Very close to this position, there is a faint (approximately 21^{m}) star in the POSS-II blue image. From nine GSC2.2 stars, we determined its coordinates as $22^{\mathrm{h}}22^{\mathrm{m}}22\overset{\mathrm{s}}{.}18$, $+50°23'40\overset{''}{.}0$, J2000.0, epoch 1987.792; these coordinates must have a subarcsecond accuracy, but we cannot be sure that they really refer to AY Lac and not to another faint star very close to AY Lac.

Figure 1 shows, approximately on the same scale, the field of AY Lac on the Sonneberg plate GB715 and in the POSS-II. The faint POSS-II star discussed in the text is not clearly visible in this reproduction.

We conclude that AY Lac is definitely a cataclysmic variable, most probably a recurrent Nova. If the brightening reported by Himpel (1943) is considered reliable, a dwarf-nova (WZ Sge) classification cannot be ruled out.

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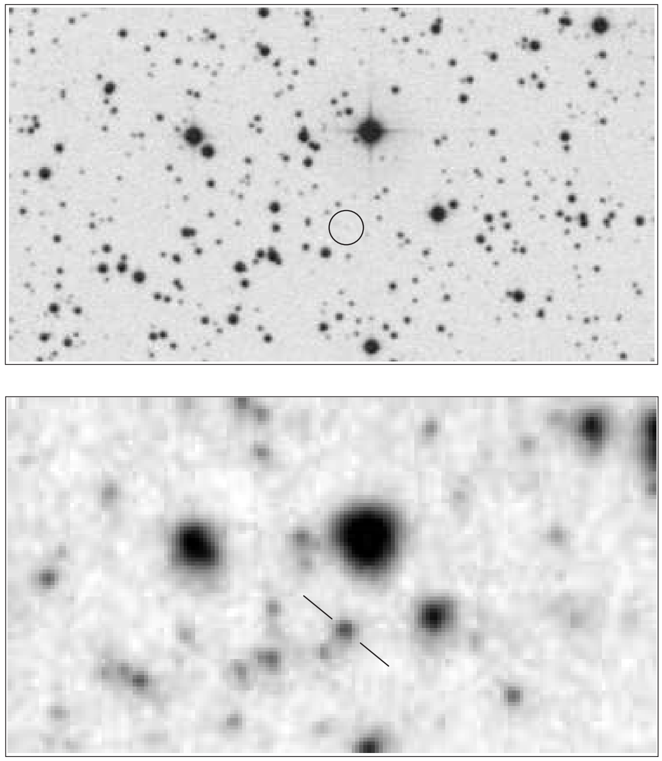

Figure 1. The field of AY Lac. Top: POSS-II (blue), $3\rlap{.}'5 \times 6\rlap{.}'6$, the position of AY Lac is circled; bottom: plate GB715, the bars mark AY Lac in outburst.

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A NEW DOUBLE-MODE HIGH-AMPLITUDE δ SCUTI STAR: GSC 2583-00504

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The star GSC 2583-00504 (= ROTSE1 J161331.84+323439.6; $\alpha_{2000} = 16^{\rm h}13^{\rm m}32^{\rm s}$; $\delta_{2000} = +32^\circ34'43''$) was detected as a variable by the ROTSE1 (Robotic Optical Transient Search Experiment 1) survey (Akerlof et al., 2000). The authors announced a Cepheid-like variable with a period of $1\overset{\rm d}{.}52315$ in the approximate magnitude range 12.3-12.5 (ROTSE1 unfiltered magnitudes). Close scrutiny of the ROTSE1 data however revealed that the true period of this star was probably much shorter.

The star was subsequently monitored on seven nights between February and April 2003 (12.7 hours, 566 data points) at Beersel Hills Observatory (BHO), and on five nights in May and June 2003 (28.5 hours, 744 data points) at SETEC Observatory. The instruments used were a 0.40-m telescope, equipped with a ST10 XME camera (an ST7E was used on one night), at BHO and a 0.30-m Meade LX-200 with a ST-8i CCD camera at SETEC. A V filter was used at both sites. The exposure times were approximately 120 seconds. The frames were respectively reduced with the aperture photometry procedure of the Mira AP software package† (BHO) and with the AIP4Win package (SETEC).

The brightness of the variable was measured with respect to GSC 2583-00463; GSC 2583-00438 served as a check star. Magnitudes from the Tycho-2 catalogue (Høg et.al., 2000) are given in Table 1. The nightly standard deviation of the magnitude differences between the comparison and the check star varied between $0\overset{\rm m}{.}007$ and $0\overset{\rm m}{.}019$, with average $\Delta V = -2.10$.

Table 1. Tycho-2 magnitudes for variable and comparison stars.

Star	GSC 2583	V_T	$B_T - V_T$
Variable	00504	12.00	0.17
Comparison	00463	12.31	0.37
Check	00438	10.17	1.01

It was soon obvious that the period of GSC 2583-00504 is indeed much shorter than the one mentioned by Akerlof et al. (2000). The light curve shown in Fig. 1 closely resembles

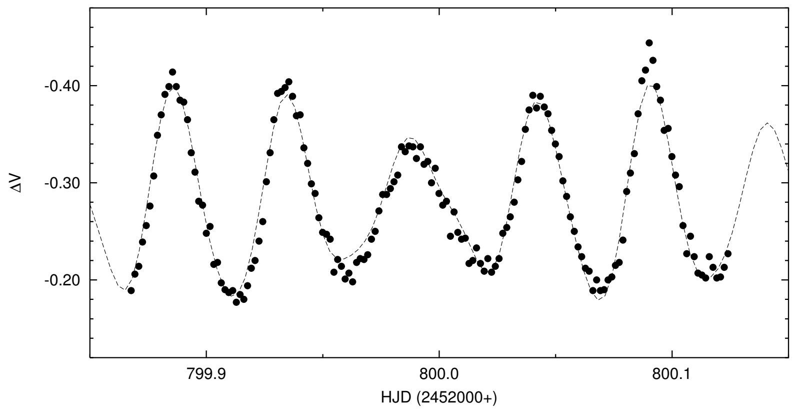

Figure 1. V light curve on the night of 8 June 2003, superimposed on a 3-frequency fit.

that of SX Phe, a double-mode radial pulsator and the prototype of its class, a subgroup among the high amplitude δ Scuti stars (HADS) of low mass and low metallicity.

Using the Fourier analysis program Period98 (Sperl, 1998), a period $P_0 = 0.05172$ days (see Fig. 2) with a peak-to-peak amplitude of $0^{m}_{.}17$ was found (frequency $f_1 = 19.335$ c/d). Note that only BL Cam among the known HADS has an even shorter period (see Table 2 in McNamara, 2000). A second frequency located at $f_2 = 25.005$ c/d with a total amplitude of $0^{m}_{.}06$ is also found in a straightforward way (the exact value of the frequency was determined after a first prewhitening). The errors in frequency correspond to 0.003 c/d, the half width at half maximum of the peaks in the Fourier spectrum.

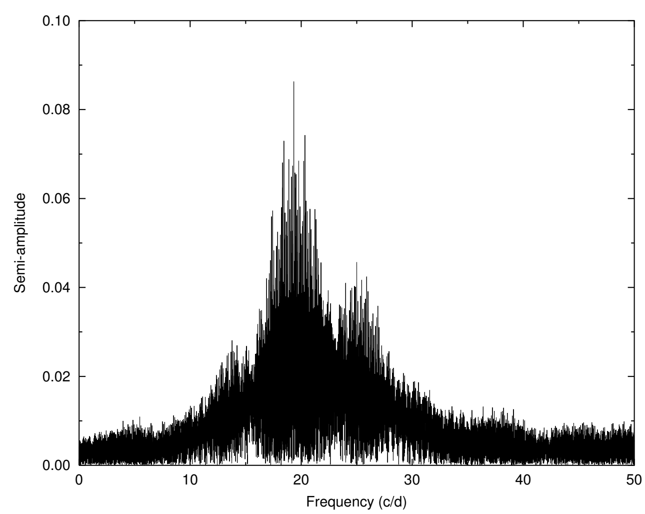

Figure 2. Fourier spectrum of GSC 2583-00504.

After prewhitening for both frequencies, the first harmonic of f_1 at 38.670 c/d with a total amplitude of $0^{m}_{.}02$, was detected in the subsequent periodogram (Fig. 3). The asymmetric mean light curve phased with respect to the main frequency is illustrated by Fig. 4. Finally also the combination $f_1 + f_2 = 44.339$ c/d is detectable in Fig. 3, with an

†The Mira AP software is produced by Axiom Research Inc.

amplitude just below 0$^{\rm m}_{.}$02. The signal-to-noise ratio of the latter frequency is however only 3.5.

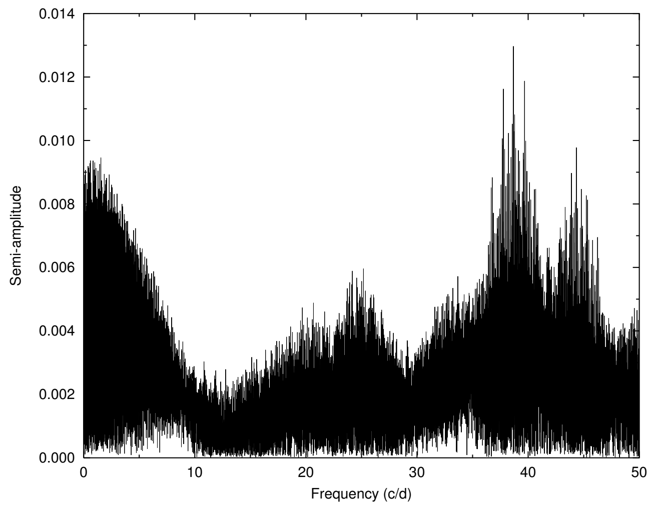

Figure 3. Fourier spectrum of GSC 2583-00504 after prewhitening for f_1 and f_2.

The ratio of 0.7732 between the second and the first period may be estimated with an accuracy of 0.0002 and agrees very well with the first overtone-to-fundamental mode period ratio as predicted by the models for radially pulsating HADS (Petersen and Christensen-Dalsgaard, 1996). GSC 2583-00504 is thus a new HADS and one of only about a dozen double-mode HADS exhibiting radial pulsation known in the galaxy (McNamara, 2000, and Van Cauteren and Wils, 2001). Though the resemblance with SX Phe is remarkable (Table 2), the amplitudes are smaller (cfr. the semi-amplitudes A_0 and A_1 in Table 2). Another distinct feature is that the period ratio P_1/P_0 is lower. Petersen and Christensen-Dalsgaard (1996) showed that the period ratio alone gives very little information on a particular variable star, except for the very short period range (P_0 less than 0.07 days). From their Fig. 3 and the properties of the stars of Table 2 in McNamara (2000), we may predict a low metal content for the new HADS, as there exists "a clear separation in P_1/P_0 after Z" in this period range.

In conclusion, the new ROTSE1 variable star has a very short main period (identified as the fundamental radial mode) and a light curve fully reminiscent of SX Phe, a double-mode radial pulsator of Population II, but with a period ratio P_1/P_0 which is somewhat lower. From a comparison with models and the known variables of this group, the new HADS probably has a lower than normal metallicity, making it a prime candidate for a double-mode radial pulsator of population II (or SX Phoenicis star) (not a member of a globular cluster). To check this assumption no information is however available in the literature to our knowledge. Therefore a photometric colour index related to metal content (Z) such as m_1 (Strömgren system) or m_2 (Geneva system) or, even better, a careful abundance analysis, would be most needed. Also, additional observations to refine the accuracy of the frequency determinations and the period ratio are planned in the future.

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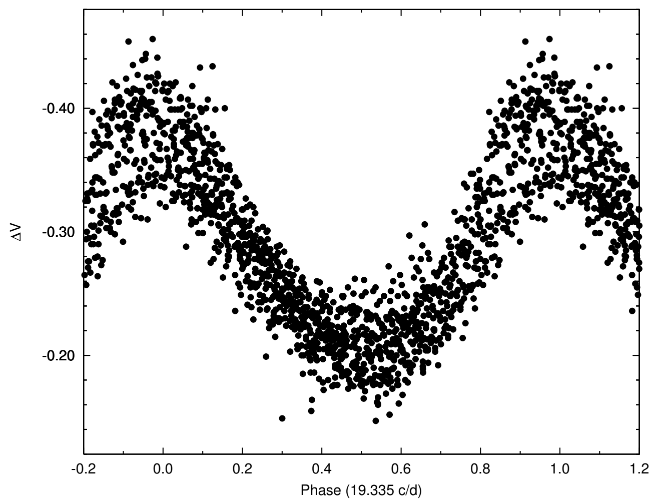

Figure 4. Phased light curve with respect to the main frequency.

Table 2. Comparison between SX Phe and the new HADS.

Star	$logP_0$	A_0	$logP_1$	A_1	P_1/P_0	Z
SX Phe	-1.260[1]	0.279[1]	-1.369[1]	0.099[1]	0.77819 ± 0.00001[2]	0.0007[3]
new HADS	-1.286	0.083	-1.398	0.029	0.7732 ± 0.0002	?

[1] Rolland et al., 1991 [2] Coates et al., 1982 [3] McNamara, 2000

thanks to a research fund financed by the Belgian National Lottery (1999). This research has made use of the VizieR database operated at the *Centre de Données Astronomiques* (Strasbourg) in France.

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PHOTOELECTRIC MINIMA OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
30-cm Maksutov telescope of the Ankara University Observatory.

Detector:	OPTEC SSP-5A photometer 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:
Times of minima were determined by the method of Kwee and van Woerden (1956).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
CN And	EW/KW	00 20 31	+40 13 34	BD+39 0069	50698.9591	0.46279372	1
OO Aql	EW/DW:	19 48 13	+09 18 33	BD+08 4220	49193.44180	0.5067888	2
VW Boo	EW/KW	14 17 26	+12 34 04	BD+13 2777	31173.4297	0.34232143	3
44i Boo	EW	15 03 47	+47 39 14	BD+50 2126	39852.4644	0.2678176	4
V523 Cas	EW/KW	00 40 05	+50 14 22	BD+49 0160	46708.7706	0.23368973	5
AM Leo	EW/KW	11 02 11	+09 53 43	BD+10 2235	39936.8217	0.36579760	6
UV Leo	EA/DW	10 38 21	+14 16 04	BD+14 2277	38440.72633	0.60008478	7
V839 Oph	EW/KW	18 09 21	+09 09 04	BD+09 3584	49536.39151	0.40900516	8
BX Peg	EW/DW:	21 38 53	+26 42 23	BD+25 4584	45651.3218	0.28042064	9
HW Vir	EA/D	12 44 21	−08 40 30	BD−08 3411	48294.886472	0.11671953	10

Source(s) of the ephemeris:

1.: Dworac (2003)
2.: Demircan and Gürol (1996)
3.: Binnendijk (1973)
4.: Rovithis and Rovithis-Livaniou (1990)
5.: Samec et al. (2001)
6.: Demircan et al. (1992)
7.: Rafert (1982)
8.: Akalın and Derman (1997)
9.: Samec (1990)
10.: Gürol (1994)

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
CN And	52185.42165	0.00019	I	B	−0.0830	Gd-Çğ
	52185.42196	0.00024	I	V	−0.0827	Gd-Çğ
OO Aql	52514.44841	0.00021	I	U	+0.0196	Gd-Kr
	52514.45084	0.00016	I	B	+0.0220	Gd-Kr
	52514.45026	0.00033	I	V	+0.0214	Gd-Kr
VW Boo	52794.39645	0.00013	I	B	−0.0548	Çğ-Gd
	52794.39815	0.00013	I	V	−0.0531	Çğ-Gd
44i Boo	52024.40249	0.00012	II	B	+0.0299	Gd-Ak
	52024.40244	0.00032	II	B	+0.0298	Gd-Ak
V523 Cas	52110.45530	0.00009	II	B	+0.0231	Gd-Çğ
	52110.45606	0.00045	II	V	+0.0238	Gd-Çğ
	52113.49366	0.00018	II	B	+0.0235	Gd
	52113.49298	0.00013	II	V	+0.0228	Gd
	52164.32051	0.00023	I	B	+0.0224	Gd-Çğ
	52164.32171	0.00054	I	V	+0.0236	Gd-Çğ
	52164.43830	0.00028	II	B	+0.0234	Gd-Kr
	52164.43805	0.00030	II	V	+0.0231	Gd-Kr
	52164.55616	0.00070	I	B	+0.0244	Gd-Çğ
	52164.55668	0.00062	I	V	+0.0249	Gd-Çğ
	52577.37302	0.00020	II	B	+0.0253	Gd-Ak
	52577.37292	0.00018	II	V	+0.0252	Gd-Ak
	52577.49068	0.00026	I	B	+0.0261	Gd-Ak
	52577.49096	0.00019	I	V	+0.0264	Gd-Ak
AM Leo	52339.37439	0.00014	I	U	+0.0022	Gd-Ak
	52339.37447	0.00064	I	B	+0.0022	Gd-Ak
	52339.37321	0.00060	I	V	+0.0010	Gd-Ak
	52339.55346	0.00014	II	B	−0.0017	Gd-Ak
	52339.55321	0.00023	II	V	−0.0019	Gd-Ak
UV Leo	52796.27241	0.00020	I	B	+0.01348	Çğ-Ak
	52796.27256	0.00034	I	V	−0.01363	Çğ-Ak
V839 Oph	52091.42968	0.00035	I	U	+0.0443	Gd
	52091.43135	0.00011	I	B	+0.0460	Gd
	52091.43113	0.00017	I	V	+0.0458	Gd
BX Peg	52815.44997	0.00020	I	B	−0.0583	Gd
	52815.44686	0.00018	I	V	−0.0615	Gd-El
HW Vir	51627.46019	0.00032	I	B	−0.0023	Gr-Gd
	51627.46021	0.00038	I	V	−0.0023	Gr-Gd
	51627.51807	0.00065	II	B	−0.0028	Gr-Gd
	51627.51876	0.00058	II	V	−0.0021	Gr-Gd
	52353.45546	0.00043	I	U	−0.0025	Gd-Tn
	52353.45522	0.00037	I	B	−0.0027	Gd-Tn
	52353.45529	0.00040	I	V	−0.0027	Gd-Tn
	52724.39018	0.00036	I	B	−0.0025	Çğ-Tn
	52724.39021	0.00043	I	V	−0.0024	Çğ-Tn
	52724.50683	0.00038	I	B	−0.0025	Çğ-Tn
	52724.50696	0.00040	I	V	−0.0024	Çğ-Tn
	52759.40634	0.00057	I	B	−0.0022	Çğ-Tn
	52759.40620	0.00048	I	V	−0.0023	Çğ-Tn

Explanation of the remarks in the table:

Gr: B. Gürol, Gd: L. Gürdemir, Kr: M. Kırca, Ak: U. Akçay, Çğ: A. Çağlar, Tn: A. Tunç, El: T. Elmas

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PERIOD CHANGE IN AN RS CVn BINARY - WHAT DRIVES CF Tuc?

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CF Tuc is an RS CVn eclipsing binary of period ~2.8 d. Its orbital period changes, as was first noted by Thompson, Coates and Anders (1991) and further discussed by Anders et al (1999) in terms of the mechanism proposed by Applegate (1992) for orbital period modulation of active close binaries. Anders et al. (1999) predicted that this mechanism would probably lead to a period shift for CF Tuc in the subsequent two years, and an increase in the spot-wave amplitude for the cooler stellar component.

We have timed two primary eclipses for CF Tuc in early 2000, via CCD photometry at Monash University, and have also obtained high-resolution spectra taken nine hours apart in 2002 June, as service observations using the University College London Echelle Spectrograph (UCLES) at the coude focus of the Anglo Australian Telescope (AAT). Initial measurements of the radial velocities of the stellar components using these spectra gives another epoch of primary eclipse.

The observations of 2000 yield an epoch of HJD 2451605.099±0.003, and those of 2002 June HJD 2452452.742±0.020. The second value was obtained independently by two of us, using cross-correlations between the spectrum of CF Tuc and that of a radial-velocity standard star (β Hyi). The Heliocentric radial velocities of the hotter star were determined to a precision of 2.0 km/s (sample standard deviation), which leads to a precision of 0.007 in the orbital phase, and which corresponds in time to 0.02 d. The radial velocity was converted to orbital phase using fits to the radial-velocity data of Collier Cameron (1987) and Balona (1987).

The figure shows the $O-C$ graph for CF Tuc using the ephemeris given in Anders et al. (1999): 2444219.270 + 2.797715 × E. The latest two data are obtained as above, the remainder are from Anders et al. (1999). The predicted shift in period has clearly not happened. The period remained essentially constant at 2.797492 d from about 1995 to mid 2002. Based on this information the current ephemeris would be: 2450351.825 + 2.797492 × E.

Clearly, more eclipse timings and multicolour photometry are needed for this interesting binary, so that the mechanisms involved in its period changes can be better understood. We encourage southern observers to include this system on their observing programmes.

We thank the AAO for the UCLES service observations used to obtain the radial velocity measurements, which were carried out by S. Ryder. The spectral analysis was performed using the IRAF package from the US National Optical Astronomy Observatories.

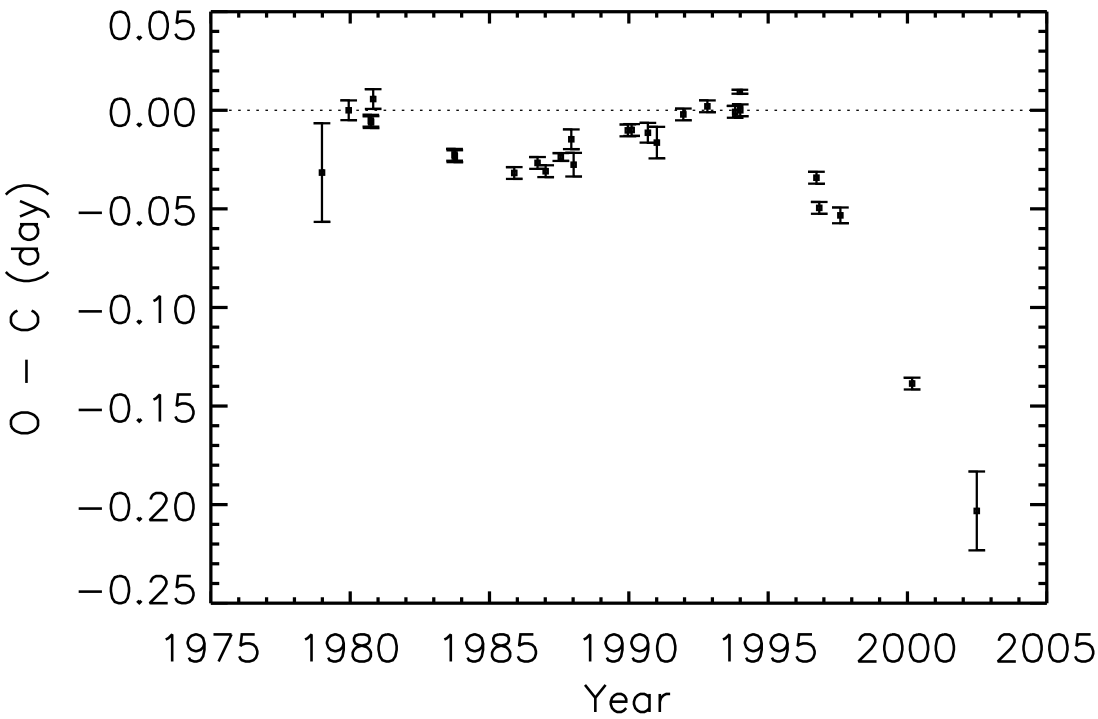

Figure 1. The O-C diagram for CF Tuc from 1978 to 2002

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MULTICOLOR OBSERVATIONS OF THE PRIMARY AND SECONDARY ECLIPSES OF OW GEMINORUM

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OW Gem is a unique, long-period, well-detached, eclipsing binary system, composed of two evolved supergiant stars. Their spectroscopic orbits are well known (Griffin & Duquennoy, 1993). The orbital period derived from observations of 11 eclipses between 1902 and 1991 is 1258.59 days, *i.e.* about 3.45 years (Williams & Kaiser, 1991). Griffin (1993) described 8 similar long-period systems, containing two comparable giants with known spectroscopic orbits, but only OW Gem shows eclipses, thus it remains the only system with precisely known masses for both components.

Terrell et al. (1994) mounted an international photoelectric campaign to observe this star during primary and secondary eclipses in 1995. We answered their appeal but unfortunately, the analysis of this campaign exclude our photometric data (Kaiser et al., 2002). In 1995 we observed OW Gem in *UBVri* bands with the 60 cm Cassegrain reflector at Piwnice Observatory near Toruń (Poland). We used a single-channel diaphragm photometer with an unrefrigerated EMI 9558B photomultiplier. Our *UBV* response curves were very close to the standard Johnson's system, whereas our broad *ri* bands had significantly shorter mean wavelengths: 6390Å and 7420Å, respectively. HDE 258848 was chosen as a comparison star and GSC 1332:0578 as a check star, both suggested by Terrell et al. (1994). The accuracy of our measurements was about $\pm0\overset{m}{.}03$ in U, $\pm0\overset{m}{.}02$ in BVr and $\pm0\overset{m}{.}01$ in i bands. Our observations during the primary eclipse in 1995 are presented in Fig. 1. Unfortunately, we only obtained a few observational points around the secondary eclipse in late 1995.

One year ago, Derekas et al. (2002) reminded us again of this star by their observations of the primary eclipse at the turn of 2001/2002. So we decided to observe the secondary eclipse, which took place only a few months later, in October 2002, thanks to the large orbital eccentricity ($e = 0.52$). Before the publication of Kaiser et al. (2002), only three V measurements, $0\overset{m}{.}1$ below the average brightness of the star outside the eclipse (Williams, 1989), were known as photometric signs of the secondary eclipse.

In 2002, we made 24 measurements during 22 nights between Sept. 2 and Dec. 9 which gave quite a good time coverage of the secondary eclipse. The data were obtained with the same telescope equipped with a cooled Burle/RCA C31034 photomultiplier. The standard Johnson-Cousins $UBV(RI)_C$ system and two intermediate-band interference filters (FWHM ≈ 100Å), "*h*"(located at H_β) and "*c*"(located in the continuum around 4804Å) were used.

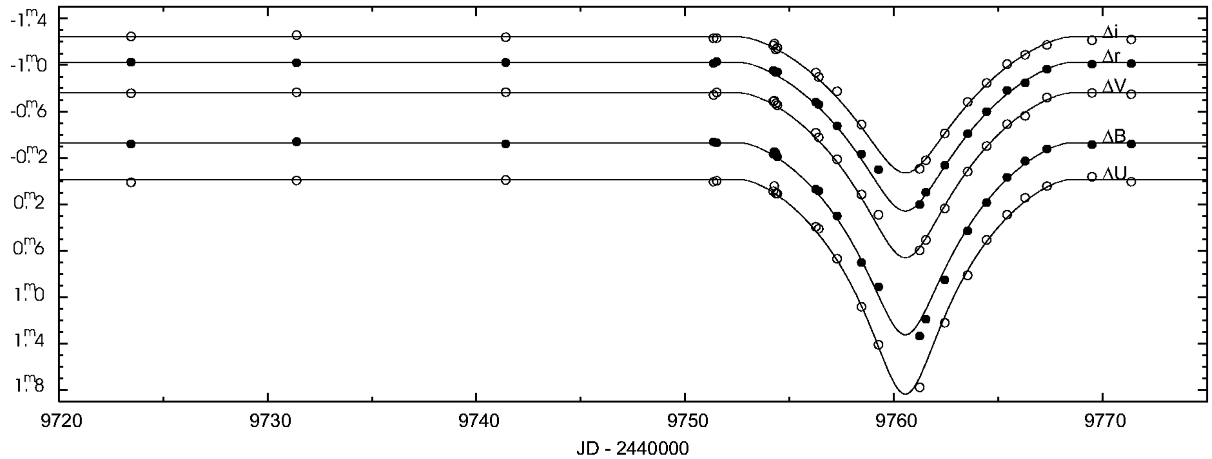

Figure 1. The *UBVri* light curves of OW Gem during the primary eclipse in 1995 with the best fit model ($T_{hot} = 7100\text{K}, T_{cool} = 4950\text{K}, i = 89°$). The neighbouring curves are shown with different (filled and open) circles for clarity.

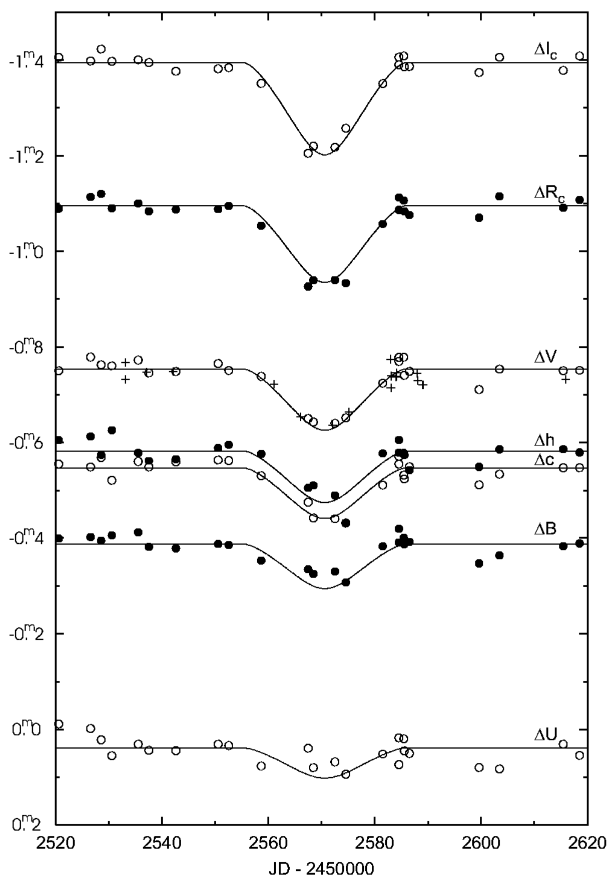

Figure 2. The *UBV(RI)*$_C$ light curves of OW Gem during the secondary eclipse in 2002 with the best fit model ($T_{hot} = 7100\text{K}, T_{cool} = 4950\text{K}, i = 89°$). The neighbouring curves are shown with different (filled and open) circles. Crosses in the *V* light curve correspond to Williams' (1989) observations shifted to epoch 2002 with period $1258.^{d}59$.

The accuracy of our measurements was $\pm 0^{\rm m}\!.03$ in "h" and "c", $\pm 0^{\rm m}\!.02$ in $UBVR_C$ and $\pm 0^{\rm m}\!.01$ in I_C bands. The same comparison and check stars were utilized as in 1995. Fig. 2. presents our light curves of the secondary eclipse. The time of the mid-eclipse was in an agreement with the ephemeris given by Williams (1989). The depth of the eclipse increases with increasing wavelength from about $0^{\rm m}\!.08$ in the B up to $0^{\rm m}\!.2$ in the I_C. Our data obtained during the primary eclipse in 1995 (Fig. 1) and especially during the secondary eclipse in 2002 (Fig. 2) are good complements of the observations previously collected by Kaiser et al. (2002) and Derekas et al. (2002).

We have tried to fit a very simple model to our light curves. The sizes of both stars were fixed at values given by Griffin & Duquennoy (1993): $R_{hot} = 30R_\odot$ and $R_{cool} = 35R_\odot$. The limb darkening was neglected and stellar fluxes were approximated as blackbodies. The adjustable parameters were the effective temperatures of the hotter (T_{hot}) and the cooler (T_{cool}) components and the impact parameter D which measures the projected distance between the centres of stellar discs in the mid-eclipse point. We took the timings from Kaiser et al. (2002): JD 2449760.6 for the primary in 1995 and JD 2452570.9 for the secondary in 2002.

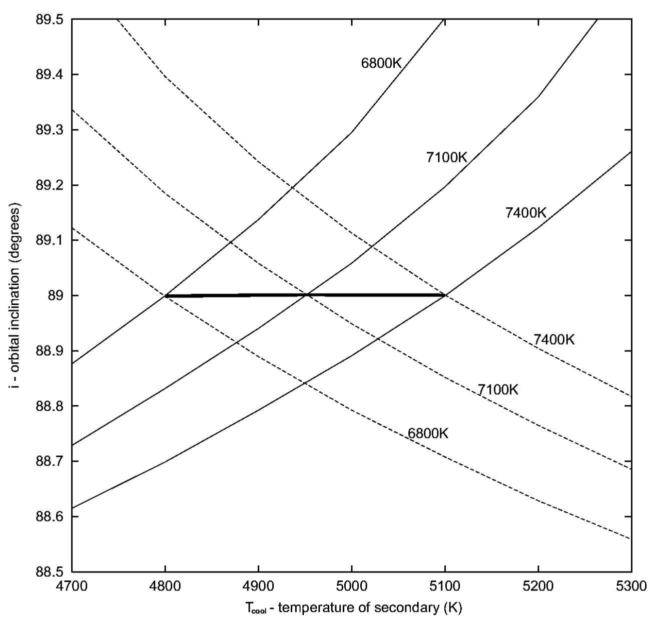

Figure 3. The best fits of orbital inclination $i = i_{oc}$ found for the primary (continuous lines) and $i = i_{tr}$ for the secondary (dashed lines) eclipses. Particular lines are signed by the temperature of the hotter component T_{hot}. The most probable solutions (thick line) are denoted by intersections between lines corresponding to opposite eclipses (when temperatures and inclination derived from both minima are the same).

We have adopted three reasonable temperatures T_{hot} for the F2 Ib-II component: 6800K, 7100K, 7400K. The temperature of the G8 IIb component T_{cool} has been changed from 4500 K to 5500 K with a step of 100K. For each pair of such temperatures we have found an impact parameter D giving the best fit to our observation in all $UBVri$ or $UBV(RI)_C$ bands simultaneously. As a best fit criterion we used the minimum of the sum of normalized standard deviations in five bands $\sigma^e_U/\sigma^o_U + \sigma^e_B/\sigma^o_B + \sigma^e_V/\sigma^o_V + \sigma^e_{r/R_C}/\sigma^o_{r/R_C} + \sigma^e_{i/I_C}/\sigma^o_{i/I_C}$, where indices '$e$' and '$o$' correspond to fits during and outside the eclipse, respectively. The narrow filters h and c were omitted in these calculations in order to keep the same weights for both minima.

The spectroscopic orbit of Griffin & Duquennoy (1993) gives the distance between the stars during transit to be about twice that during the occultation: $r_{oc} = 0.553a$ and $r_{tr} = 1.096a$, where a is semi-major axis. The orbital inclination i can be derived separately for each eclipse:

$$\tan i_{oc} = \frac{r_{oc} \sin i}{D_{oc}} = \frac{0.553a \sin i}{D_{oc}}$$

$$\tan i_{tr} = \frac{r_{tr} \sin i}{D_{tr}} = \frac{1.096a \sin i}{D_{tr}}$$

where D_{oc} and D_{tr} are impact parameters during the occultation and transit, respectively. Adopting a projected semi-major axis $a \sin i = 1052 R_\odot$ (Griffin & Duquennoy, 1993) we have found the inclination for different stellar temperatures fitted to both eclipses separately (Fig. 3). Of course, the inclination obtained from primary and secondary eclipses must be the same, *i.e.* $i = i_{oc} = i_{tr}$. This requirement corresponds to that shown in Fig. 3 at the intersection between the solutions $i = i_{oc}(T_{hot}, T_{cool})$ and $i = i_{tr}(T_{hot}, T_{cool})$ for occultation (primary) and transition (secondary), respectively. As a result, the orbital inclination $i = 89°$ is almost constant and independent of the stellar temperatures . This is a consequence of arbitrary assumed stellar dimensions from Griffin & Duquennoy (1993) who found the same inclination. They also estimated temperatures of both components of 7100K and 4800K. Nevertheless, our calculations show the temperature ratio $T_{hot}/T_{cool} \approx 1.43 \pm 0.01$, which is significantly smaller than $7100/4800 \approx 1.48$. Based on our values the secondary component is likely to be hotter (about $4900 - 5000$K) which agrees with the suggestion by Derekas et al. (2002). Synthetic light curves for our most probable parameters are presented together with observations in Figs. 1 and 2.

We will search for better radii of both stars with the Wilson-Devinney code, including limb darkenings and models of stellar atmospheres for the calculations. Unfortunately, we need more and better observations outside the eclipses, in particular, close to the periastron where small deformations of stars cannot be excluded. Additionally, hot and cool spots on the supergiants' convective surfaces are very likely, which can significantly affects the solutions.

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ELEMENTS FOR 5 VARIABLE STARS

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The discovery of the variability of these stars has been reported by Hoffmeister (1968), Morgenroth (1934, 1935) and Ross (1927) a long while ago; nevertheless there were no ephemerides published until today. Photographic plates of a field around κ Oph, taken with the Sonneberg Observatory 40cm Astrograph during the years 1964-1994, were used to determine the type of variability as well as first elements (see Table 1). The elements listed below were obtained by means of least-squares solutions. Photographic amplitudes were derived with respect to magnitudes of the comparison stars given in Table 3. Individual data are available upon request.

Remarks:

NSV 8001
This star is known to be an infrared source (IRAS 16490 +0823). The variability was also confirmed by the ROTSE experiment (ROTSE1 J 165124.98 + 081853.8; Akerlof et al., 2000) but no period could be derived. The shape of the light curve varies.

NSV 8184
Obviously the period varies. Elements given below are at least valid for an interval of JD 2442900-2449500. Unfortunately there were not enough older plates available to determine date of the period change as well as the value of the period acting in the time before the interval mentioned above.

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

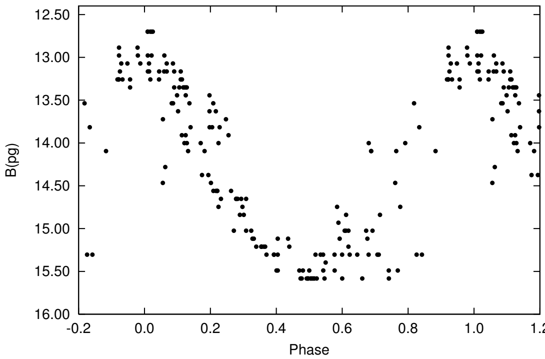

Figure 1. Light curve of NSV 8001

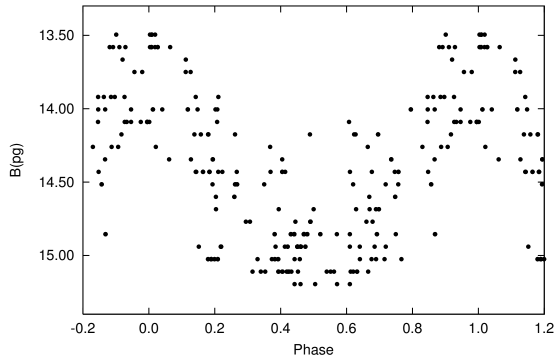

Figure 2. Light curve of NSV 8095

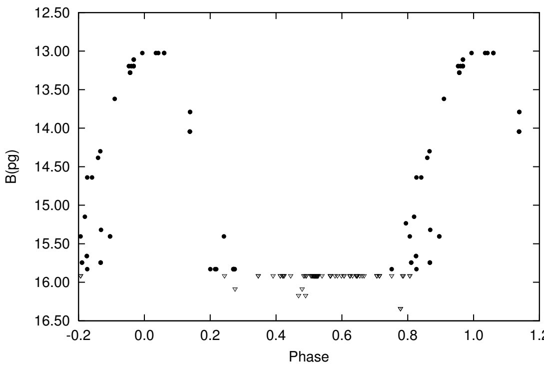

Figure 3. Light curve of NSV 8097. Triangles denote observations fainter than $15\overset{m}{.}9$

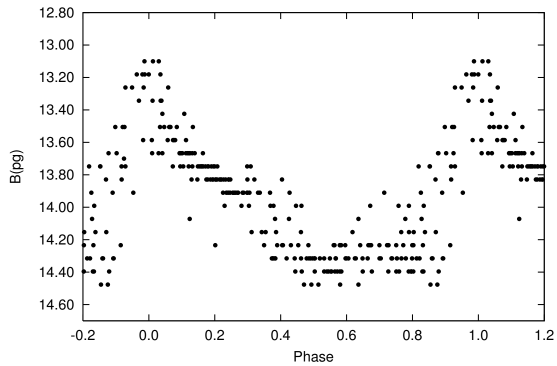

Figure 4. Light curve of NSV 8132

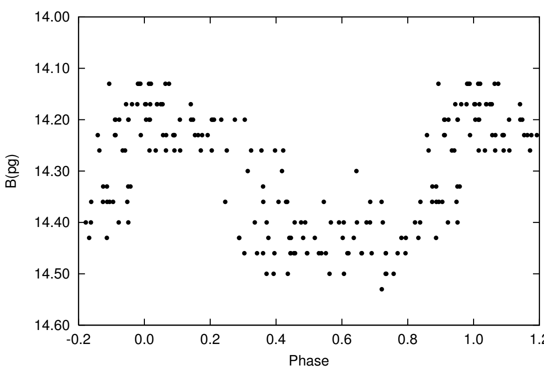

Figure 5. Light curve of NSV 8184 (JD 2442924-2449488)

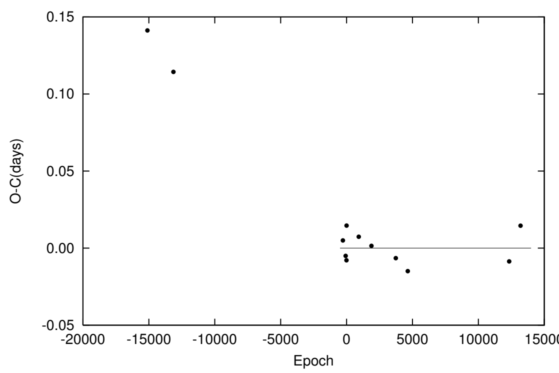

Figure 6. $(O-C)$ diagram for NSV 8184

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	M−m	No. of Plates
NSV 8001	M	42935.0	260.98	$12^{m}.9$	$15^{m}.6$	$0^{p}.30$	164
		±4.2	±.36				
NSV 8095	SRa	44024.5	101.21	$13^{m}.6$	$15^{m}.1$		249
		±2.2	±.07				
NSV 8097	M	45065.7	279.22	$13^{m}.0$	$>15^{m}.9$		152
		±9.8	±.72				
NSV 8132	RRab	44704.498	0.50480515	$13^{m}.2$	$14^{m}.4$	$0^{p}.17$	249
		±7	±72				
NSV 8184	RRc	44374.383	0.38749054	$14^{m}.1$	$14^{m}.5$		146
		±4	±71				(217 total)

Table 2. Individual maxima and $O-C$ values according to the elements derived in this paper

Star	JD (max.)*	Epoch	$O-C$	Star	JD (max.)*	Epoch	$O-C$
NSV 8001	38495	−17	−3.3	NSV 8132	39284.422	−10737	0.017
	39286	−14	4.7		39287.453	−10731	0.019
	39537	−13	−5.2		39288.461	−10729	0.018
	42953	0	18.0		39293.497	−10719	0.006
	44757	7	−4.9		39615.549	−10081	−0.008
	45003	8	−19.8		44704.491	0	−0.007
	45810	11	4.2		44749.419	89	−0.006
	46595	14	6.3		45441.498	1460	−0.015
NSV 8095	39266	−47	−1.6		45854.459	2278	0.015
	44024	0	−0.5		46173.487	2910	0.006
	45441	14	−0.4	NSV 8184	38521.480	−15105	0.141
	45854	18	7.7		39284.422	−13136	0.114
	47770	37	0.7		44266.666	−278	0.005
	48067	40	−5.9		44346.479	−72	−0.005
NSV 8097	38642	−23	−1.7		44372.438	−5	−0.008
	45077	0	11.3		44374.398	0	0.015
	46173	4	−9.6		44732.432	924	0.007
NSV 8132	38553.465	−12185	0.018		45104.417	1884	0.001
	38555.466	−12181	0.000		45822.429	3737	−0.007
	38556.466	−12179	−0.010		46173.487	4643	−0.015
	38557.467	−12177	−0.018		49154.458	12336	−0.009
	38882.544	−11533	−0.036		49488.498	13198	0.015

* Heliocentric times for the RR Lyr variables

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Table 3. Comparison stars and cross references

	NSV 8001 ROSS 208 GSC 975.1093		NSV 8095 ROSS 210 GSC 976.1649	
Comp. No.	GSC	m*	GSC	m*
1	975.0578	$12^{m}.7$	976.0814	$12^{m}.9$
2	975.0289	$13^{m}.3$	976.1546	$13^{m}.9$
3	975.0695	$13^{m}.3$	976.1023	$14^{m}.0$
4	975.0209	$14^{m}.8$	976.1645	$14^{m}.8$
5	975.0700	$15^{m}.3$	976.1234	$15^{m}.2$

	NSV 8097 67.1934 GSC 393.1531		NSV 8132 487.1934 GSC 976.1682	
Comp. No.	GSC/USNO	m*	GSC	m*
1	406.3241	$12^{m}.7$	976.0868	$13^{m}.2$
2	393.1517	$13^{m}.5$	976.1285	$14^{m}.3$
3	393.1891	$13^{m}.6$	976.0436	$14^{m}.4$
4	393.1293	$14^{m}.6$		
5	393.1281	$14^{m}.9$		
6	0900-09185651	$16^{m}.3$		

	NSV 8184 S 10327 GSC 410.1238	
Comp. No.	GSC	m*
1	410.1498	$14^{m}.0$
2	410.0316	$14^{m}.5$

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

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A NEW EUVE-DETECTED FLARE STAR (EUVE J0613–23.9B)

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Extreme Ultraviolet Explorer (EUVE) observations have provided detailed spectroscopic and timing studies of several flare stars, including AU Mic (Cully et al., 1993), AD Leo (Hawley et al., 1995), and EQ Peg (Monsignori-Fossi et al., 1995).

In this bulletin, we present the EUVE and optical follow-up observations of a newly detected flare star. This star was serendipitously discovered during an EUVE observation of the G star HD 43162 as part of the analysis for the 3rd EUVE Right Angle Program Catalog (Christian, 2002). Analysis of the EUVE spectra obtained during the largest flare (Fe XIX–XXIV emission and a strong 300–650 Å continuum) have been presented elsewhere (Christian et al., 2003). We present optical spectroscopy and results obtained at MT Stromlo Observatory to identify the optical counterpart in § 1, and the long-term EUVE Deep Survey light-curves in § 2.

There were 14 EUVE observations of EUVE J0613−23.9 between 20 Oct 2000 and 08 Dec 2000, and we obtained the EUVE data files from the Multimission archive at Space Telescope. We analysed all observations, but concentrated on the 9 observations that obtained data with the Deep Survey (DS; 60–200 Å) instrument. Two sources were clearly visible in the DS image of EUVE J0613−23.9, with a 2nd source 2.′5 SE of the guest observer target, HD 43162, which we call EUVE J0613−23.9B. We show the EUVE DS image from the 22 Oct 2000 observation in Figure 1a.

Searching of the SIMBAD database revealed no catalogued late-type stars near the EUVE-measured position of EUVE J0613−23.9B, and we obtained optical spectra of the source nearest this position. The optical finding chart for the field centered on HD 43162 is shown in Figure 1b. Surprisingly there is a source within 23″ of HD 43162 for which we also obtained an optical spectrum. This source coincides with 1RXS J061345.1−235205 (within 5″). The optical observations were conducted on 14 September 2002 using the Cassegrain spectrograph at the 74 inch telescope at Mount Stromlo Observatory. We used the 300 line/mm grating blazed at 5000 Å and the 2k×4k CCD camera binned 2×2. We obtained frequent comparison FeAr arc exposures of 120 sec and FeNe arc exposures of 5 sec. The spectra extend from 3900 to 7500 Å with a dispersion of 2.83 Å per pixel, and spectral resolution of $\approx$ 8 Å. The images were bias-subtracted and flat-fielded. The extracted spectra were flux-calibrated with the standard Feige 110, and wavelength-calibrated using NOAO's IRAF routines.

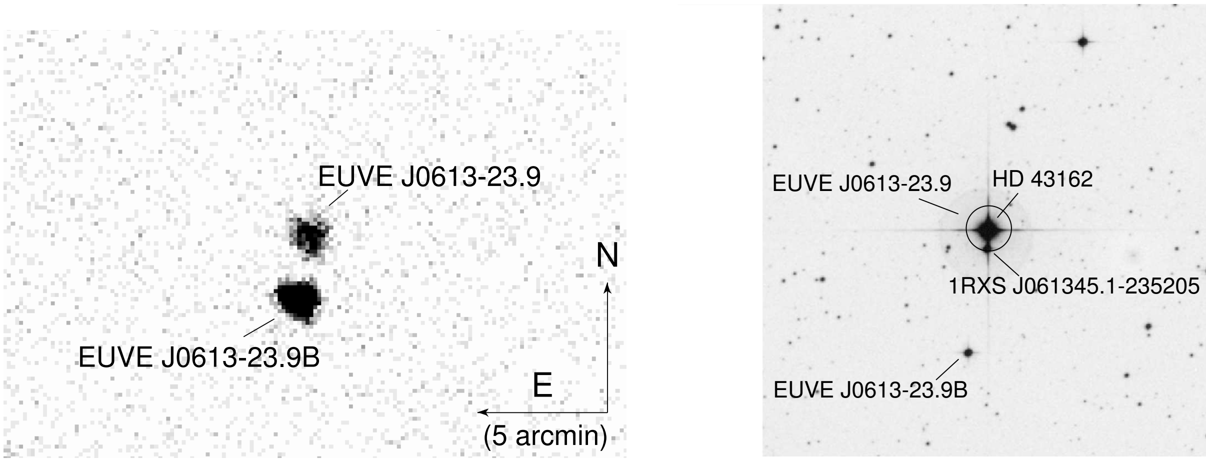

Figure 1. (*left*) EUVE Deep Survey image of EUVE J0613−23.9 from the 22 Oct 2000 observation. The new source, labelled EUVE J0613−23.9B can clearly be seen 2.5′ south of EUVE J0613−23.9. Each arrow is 5′ in length. (*right*) The DSS I-band (10′ × 10′) optical finding chart of the EUVE J0613−23.9 field centered on position of HD 43162. The EUVE positional uncertainty (60″) is indicated with a circle, and the candidates for EUVE J0613−23.9B and 1RXS J061345.1−235205 are indicated. In the EUVE image, HD 43162 and 1RXS J061345.1−235205 are not resolved.

The optical spectra of EUVE J0613-23.9B and 1RXS J061345.1−235205 show the molecular bands typical of late M-type stars. These spectra also show the Balmer series in emission as seen for active late-type stars selected from EUVE and ROSAT surveys. We present the measured strength and equivalent widths of the Balmer lines along with the depth of the TiO molecular band in Table 3. We used the strength of the TiO band at 7050 Å to determine the spectral types and absolute magnitudes using the relations given by Reid et al. 1995. The 7050 Å band is denoted as "TiO5" in the Reid et al. paper, and has upper and lower wavelength ranges of 7042−7046 Å and 7126−7135 Å, respectively. We derived a spectral type of dM3.5e ($M_V = 11\overset{m}{.}9$) for EUVE J0613−23.9B and dM4e ($M_V = 12\overset{m}{.}2$) for 1RXS J061345.1−235205.

Apparent visual magnitudes were calculated from the spectra using the IRAF SBANDS routine, giving visual magnitudes (m_v) of 12.7 and 12.5 for EUVE J0613−23.9B and 1RXS J061345.1−235205, respectively. Using these visual magnitudes and the absolute magnitudes from the Ti05 bands we calculated distances to EUVE J0613−23.9B and 1RXS J061345.1−235205 of 15^{+5}_{-4} and 12^{+4}_{-3} pc, respectively. The 0.5 mag uncertainty in the absolute magnitude derived from the TiO band (Reid et al., 1995) dominates the uncertainty in m_v, which we conservatively estimate at 0.2 magnitudes. The parallax for HD 43162 gives a distance of 16.7 pc (Perryman et al., 1997) and further observations are needed to determine if it and 1RXS J061345.1−235205 form a physical pair.

We present the DS Lexan (60–200 Å) light curves for EUVE J0613−23.9B and EUVE J0613−23.9 in Figure 3. The light curve of EUVE J0613−23.9 may be dominated by EUV emission from 1RXS J061345.1−235205, but it and HD 43162 are not resolved by EUVE. The EUVE J0613−23.9B Lexan light curve clearly shows a strong flare rising above quiescent near MJD 51839.9. We then examined the flare light curve on a smaller time-scale and present the DS Lexan light curve in Figure 4 using 200 sec bins. The flare had a peak count rate of 3.24±0.13 counts sec^{-1}, over 200-times that of the pre-flare quiescent count rate. The rise time of the flare is less than 1 ksec and the decay time is ≈28 ksec. The flare decay e-folding time-scale is short, at ≈3 ksec. We also present the

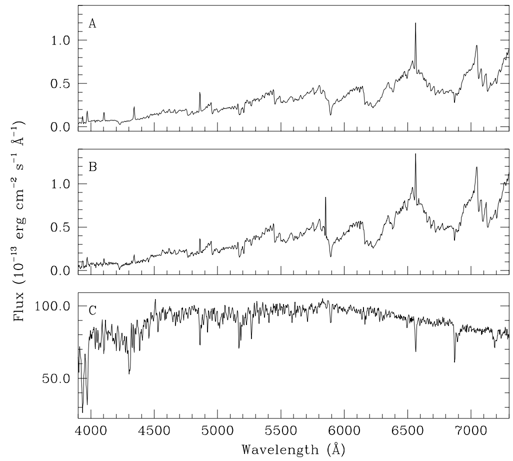

Figure 2. The optical spectra in the 3900−7300 Å range taken with the MSO 74 inch, for a. (*top*) EUVE J0613−23.9B, b. (*middle*) 1RXS J061345.1−235205, and c. (*bottom*) HD 43162.

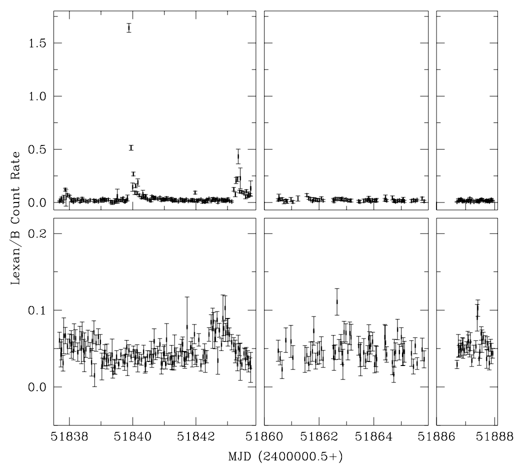

Figure 3. EUVE Deep Survey Lexan(60–200 Å) light curves of the entire observation for: (*top*) EUVE J0613−23.9B and (*bottom*) EUVE J0613−23.9. Bin sizes are 2000 seconds (the nighttime portion of an EUVE orbit).

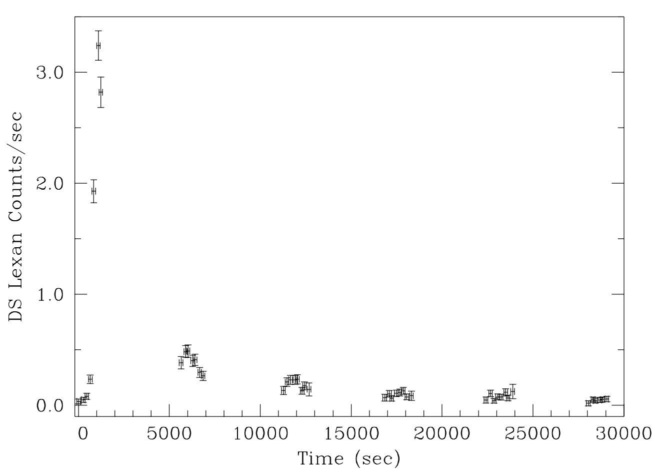

Figure 4. The EUVE DS light curve of EUVE J0613−23.9B with a bin size of 200 seconds.

Observed Optical Line Fluxes and Equivalent Widths

	EUVE J0613−23.9B	1RXS J061345.1−235205
RA_J2000:	06 13 47.2	06 13 45.4
DEC_J2000:	−23 54 26	−23 52 09
Line fluxes (10^{-14} erg cm^{-2} s^{-1}):		
Ca K	5.3	7.8
Ca H (+Hϵ)	11.0	7.7
Hα	40.0	42.0
Hβ	17.0	12.4
Hγ	12.4	10.0
Hδ	8.6	4.8
Equivalent widths (Å):		
Ca K	12.3	19.5
Ca H (+Hϵ)	18.7	14.8
Hα	6.0	5.3
Hβ	9.4	6.3
Hγ	13.8	12.3
Hδ	12.4	7.3
TiO (7050 Å)	0.44	0.42
Sp. Type	dM3.5e	dM4e
m_v	12.7	12.5
M_v	11.9	12.2
d (pc)	15^{+5}_{-4}	12^{+4}_{-3}

DS Lexan count rates using a 200 second time bin in a table which is available at the IBVS-website as `5447-t2.txt`. There was a second smaller flare on Oct 26 (MJD 51843.3) with peak count rate of 0.25±0.09 counts sec^{-1}, ≈13 times less than the larger flare. This smaller flare was only a factor of ≈3 over the quiescent emission and had a rise time of ≈1 ksec and a decay time of only 5 ksec.

Acknowledgements: This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France, the NASA/IPAC Extragalactic database (NED), which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with NASA, and the High Energy Astrophysics Science Archive Research Center (HEASARC), provided by NASA's Goddard Space Flight Center. The EUVE Deep Survey data sets were obtained from the Multimission Archive at the Space Telescope Science Institute (MAST). STScI is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555. Support for MAST for non-HST data is provided by the NASA Office of Space Science via grant NAG5-7584 and by other grants and contracts.

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ON TWO UNSTUDIED LARGE-AMPLITUDE VARIABLES DT Sco AND DV Sco

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Name of the object:
DT Sco = HV 4223 = CoD–26°11583

Equatorial coordinates:	**Equinox:**
R.A.= $16^h49^m55\overset{s}{.}34$ **DEC.=** $-26°25'26\overset{''}{.}7$	2000

Observatory and telescope:
Crimean Laboratory of Sternberg Astronomical Institute, 40-cm astrograph

Detector:	Photoplate

Filter(s):	None

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	Based upon comparison stars from the US Naval Observatory B1.0 catalog

Date(s) of the observation(s):
JD 2437130–2448454

Availability of the data:
Upon request

Type of variability:	M

Remarks:

The variable star DT Sco (HV 4223) was discovered by I. Woods (Swope, 1928). Variability between $15^{\rm m}.2$ and fainter than $16^{\rm m}.5$ pg was announced. Swope (1932) published a low-quality finding chart. No detailed study of the star was ever published. During our work on the new version of the GCVS with improved coordinates (cf. Samus *et al.*, 2002, 2003), we found the star due to its large-amplitude variability on images of digitized surveys available by Internet. The star is bright (J = 8.548, H = 7.655, K = 7.189) in the 2MASS catalog (Cutri *et al.*, 2003). It is definitely CoD–26°11583, though this identification was not suggested earlier either by GCVS or by SIMBAD. We estimated the star on 74 astrograph plates; 2 additional blue-light estimates were made on images from the US Naval Observatory Image and Catalog Archive. The star is beyond doubt a Mira, its magnitude in maximum light is $14^{\rm m}.1$, whereas in minimum it is $18^{\rm m}.0$ or fainter. The light elements are: Max = JD2448426 + $227^{\rm d}.0 \times E$. The finding chart is presented in Fig. 1 (left panel), the light curve is given in Fig. 2.

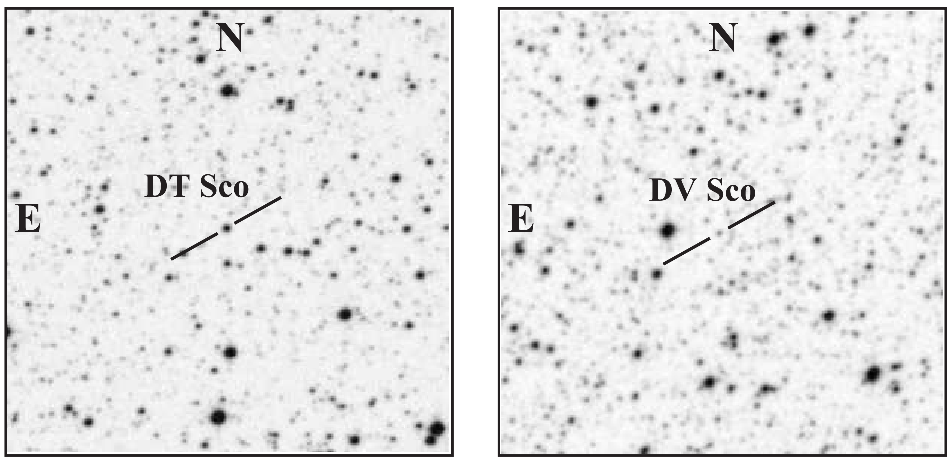

Figure 1. The finding charts for DT Sco (left) and DV Sco (right). Both charts show $5' \times 5'$ DSS-II fields, in red light.

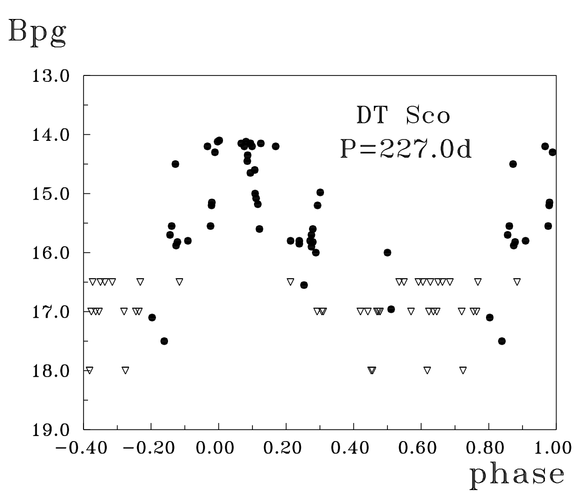

Figure 2. The light curve for DT Sco. The symbol “v” means that the star was fainter than shown.

Name of the object:
DV Sco = HV 4225

Equatorial coordinates:	**Equinox:**
R.A.= $16^h50^m27^s.88$ **DEC.=** $-28°07'58''.2$	2000

Observatory and telescope:
Crimean Laboratory of Sternberg Astronomical Institute, 40-cm astrograph

Detector:	Photoplate

Filter(s):	None

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	Based upon comparison stars from the US Naval Observatory B1.0 catalog

Date(s) of the observation(s):
JD 2437109–2448454

Availability of the data:
Upon request

Type of variability:	UG:

Remarks:
The variable star DV Sco (HV 4225) was discovered by Swope (1928). Variability between $14^m.5$ and fainter than $16^m.5$ pg was announced, with a possible period about 28 days. Swope (1932) published a low-quality finding chart. No detailed study of the star was ever published. During our work on the new version of the GCVS with improved coordinates (cf. Samus *et al.*, 2002, 2003), we found the star due to its variability on images of digitized surveys available by Internet. We estimated the star on 85 astrograph plates; 3 additional blue-light estimates were made on images from the US Naval Observatory Image and Catalog Archive. The star is not red, with $J = 14.602$, $H = 14.405$, $K = 14.306$ in the 2MASS catalog (Cutri *et al.*, 2003). Its color index estimated from POSS-I images is $B - R = 0.1$; however, the star was not in quiescence at that time (see Table 1) and could change its brightness during the interval between mid-exposures of POSS-I red and blue plates (about an hour). We do not confirm the 28-day period reported by Swope (1928). DV Sco is most probably a cataclysmic variable (UG type). Its magnitude in maximum is $13^m.8$ B_{pg}; from USNO Archive images, its magnitude in minimum is $18^m.4$ B_{pg} or fainter. We detected 8 outbursts (with only one to four observations per outburst, thus we cannot construct a reliable outburst light curve) making the star brighter than $16^m.0$. The star is also brighter than $16^m.0$ on two of the three blue-light images in the USNO Archive. The 10 brightenings are listed in Table 1, those from the USNO Archive are marked with asterisks after their numbers. The limited material does not permit us to derive the outburst recurrence cycle, but the outbursts seem to be not very rare. The star is brighter than 16^m on 16 of the 85 astrograph plates (19%), not quite typical of a U Gem variable. It definitely deserves a further detailed study. The finding chart is presented in Fig. 1 (right panel).

Table 1. The 10 detected brightenings of DV Sco

No.	JD24...	B_{pg}	No.	JD24...	B_{pg}
#1*	35956.478	15.8	#7	46240.472	15.3
				46256.371	< 16.2
#2	38940.368	14.9			
			#8	46944.457	15.9
#3*	42268.400	15.4		46945.450	15.2
				46977.348	< 17.2
#4	44430.360	15.7			
	44435.337	< 17.0	#9	47716.335	14.3
				47717.350	14.2
#5	45494.429	< 16.2		47740.342	15.2
	45496.418	16.0			
	45496.450	15.5	#10	48029.435	< 16.7
	45499.411	14.9		48033.444	14.7
	45523.376	< 16.2		48034.466	14.1
				48035.408	14.2
#6	45876.361	< 16.2		48037.393	13.8
	45884.373	14.2			

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BRIGHTNESS VARIATIONS OF SAO 84309

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The study of stars with active regions may further our understanding of the solar dynamo. These stars can be discovered by searching for X-ray sources with periodic photometric variations. The star SAO 84309 is catalogued as the X-ray source 1RXSJ162013.2+243606 by the ROSAT satellite (Voges et al., 1999). It is listed in the TYCHO Catalogue (ESA, 1997) as TYC 2047-320-1, which gives its parallax as 7 ± 14 mas, its V as $9.60 \pm .02$, its B as $10.91 \pm .04$ and its $(B - V)$ as $1.11 \pm .04$. 2MASS measurements of SAO 84309 reveal that J=7.55, H=6.99 and K=6.83 all with an uncertainty of ± 0.02. All these colour measurements are consistent with a spectral class of K5V$\pm$1 or K2III$\pm$2. A K5V star would have a parallax of about 36 mas so the giant classification is much more likely.

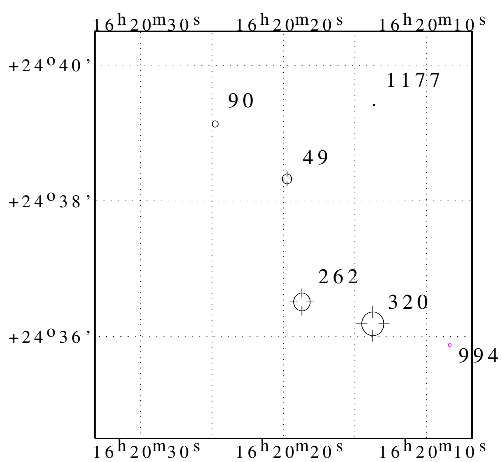

Figure 1. Finder chart labelled with the GSC identification numbers from region 2047. 320 is SAO 84309.

The observations were made with the University of Victoria automated 0.5m telescope, VRI filters and Star I CCD, and reduced in a fashion similar to that described in Robb and Greimel (1999). The field of stars observed is shown in Figure 1.

Table 1: Stars observed in the field of SAO 84309=GSC 2047-320

Star GSC Id	R.A. J2000	Dec. J2000	GSC Mag.	ΔR Mag.	Std Dev Between	Std Dev Within	Δ (V-I)	Std Dev Between
0320	$16^h20^m14^s$	$24°36'11''$	9.3	-1.536	0.045	0.004	0.513	0.063
0262	$16^h20^m19^s$	$24°36'31''$	10.8	–	–	–	–	–
0994	$16^h20^m08^s$	$24°35'53''$	14.3	3.891	0.012	0.046	1.462	0.043
1177	$16^h20^m14^s$	$24°39'25''$	14.7	4.285	0.022	0.078	1.121	0.082
0049	$16^h20^m20^s$	$24°38'19''$	12.7	2.376	0.005	0.013	0.341	0.007
0090	$16^h20^m25^s$	$24°39'08''$	13.5	2.648	0.009	0.013	0.433	0.010

The Julian Dates of observation (–2452800) are 16-19R, 23R, 24R, 26R, 27R, 32R, 37-39VRI, 41-45VRI, 47VRI, 48VRI, and 50-56VRI. Table 1 lists the stars' identification numbers, positions and magnitudes from the Hubble Space Telescope Guide Star Catalogue (GSC) (Jenkner et al., 1990) All observations were made using a filters identical to the Johnson V and the Cousins RI, but were not transformed to the standard system.

Our differential ΔR and $\Delta(V-I)$ magnitudes are calculated in the sense of the star minus GSC 2047-262. Brightness variations during a night were measured by the standard deviation of the differential magnitudes and are listed for the most photometric night in the last column as "Std Dev Within". A "Std Dev Within" one night of 0.004 sets an upper limit on variations of an hourly timescale. For each star the mean of the nightly means is shown as ΔR in Table 1. The standard deviation of the nightly means is a measure of the night to night variations and is called "Std Dev Between" in Table 1. The smallest "Std Dev Between" is 0.005 magnitudes. This excellent photometry shows that night to night variations in GSC 2047-262 must be less than a few millimagnitudes.

The star SAO 84309 did not vary significantly in brightness during any night but had obvious variations from night to night. The data were fit with sine curves using Period98 (Sperl, 1998), and two periods were found to be significant; 19.07 days and the first overtone (9.54 days) with amplitudes of 0.0588 and 0.0175 magnitudes respectively. Our best estimate of the ephemeris is:

$$\text{HJD of Maximum Brightness} = 2452819\overset{d}{.}8(9) + 19\overset{d}{.}1(2)\times \text{E}.$$

where the uncertainty in each final digit is given in brackets. In Figure 2 the differential ΔR_C magnitudes are plotted as filled circles with the Period98 fit plotted as a dark line. The differential V and I light curves are also plotted in Figure 2; shifted by an arbitrary amount and with line segments connecting the observations. Also in Figure 2 we plot the Δ(V-I) showing a small but significant variation, which is indicative of an effective temperature change during the last cycle.

SAO 84309 has a light curve which brightens more rapidly than it fades, so a possibility is that the star is a pulsating star similar to the small amplitude cepheid variables. The light curve is almost identical in period, shape and amplitude to V1658 Aql = HD191616 (Robb et al., 2001). However both stars also have a K spectral type and are X-ray sources, which is not consistent with Cepheid variability.

Stars with active regions and/or spots such as BY Dra or FK Comae stars can have light curves of almost any shape. Light curve differences between the two rotations are probably due to the active regions' area and/or position changes.

SAO 84309 seems to be a rotating, late type giant star with active regions covering

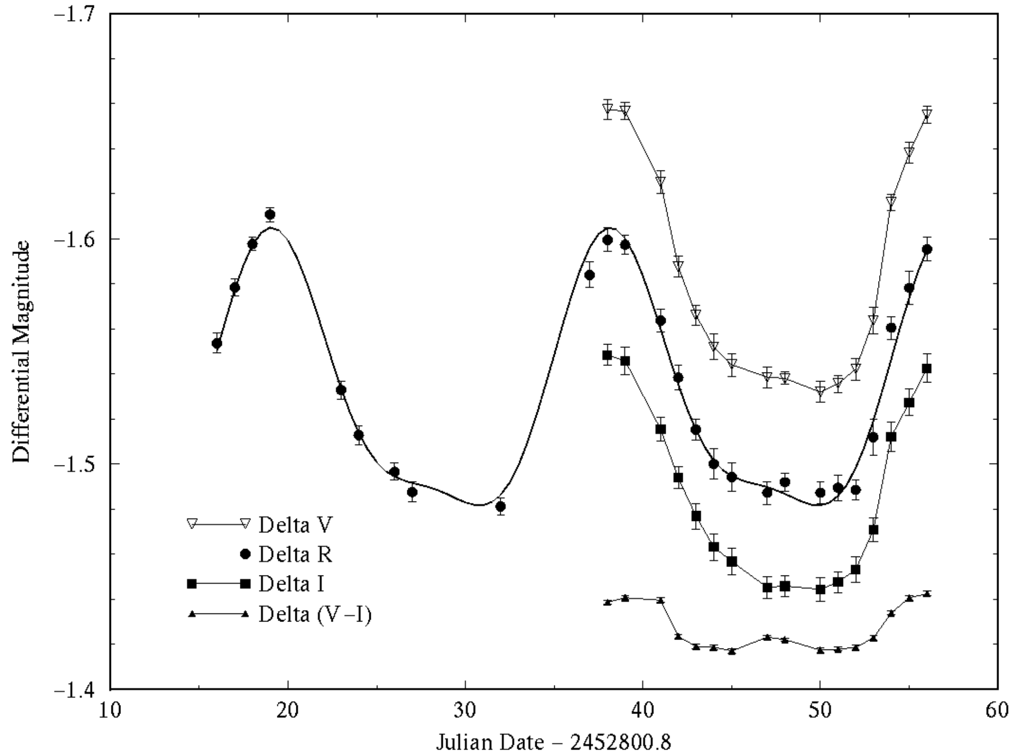

Figure 2. Differential VRI and $(V-I)$ filtered light curves of SAO 84309.

a significant part of its surface and energizing a hot corona producing X-rays. Further spectral observations will be of interest to see if there is Hα emission as found in V1658 Aql. Photometric observations will be important to tell if differential rotation will modify the period and/or shape of the light curve.

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V597 SCORPII AND ITS NEIGHBOUR: A DOUBLE MIRA STAR?

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The variable star V597 Sco (HV 10835) was discovered by Swope (1943) who had classified it as a Mira variable, with the light elements Max $= 2429460 + 216^{\mathrm{d}} \times E$ and the photographic range from $14^{\mathrm{m}}_{.}5$ to fainter than $17^{\mathrm{m}}_{.}0$, and published a low-quality photographic chart. During our work on the new version of the GCVS with improved coordinates (cf. Samus *et al.*, 2002, 2003), we found two variable objects near the published position of V597 Sco on images of the US Naval Observatory Image and Catalogue Archive. The existing finding chart did not permit us to decide which of the stars was the original Harvard variable, so we had to identify HV 10835 using the discoverer's notebooks and plates of the Harvard stacks.

The Figure shows the field of V597 Sco on two sky survey images in red light, retrieved from the USNO Image and Catalogue Archive. The variability of two stars is quite evident. Star 1 ($R = 10.7$, $V = 15.66$ in the GSC2.2 catalog) is the original V597 Sco = HV 10835. Star 2 ($R = 16.85$, $V = 17.06$) is the new variable. Their coordinates, based upon the GSC2.2 catalog, are the following.

V597 Sco = HV 10835	$17^{\mathrm{h}}02^{\mathrm{m}}28^{\mathrm{s}}_{.}44$	$-35^\circ14'47''_{.}8$	(2000.0)
New variable	$17^{\mathrm{h}}02^{\mathrm{m}}28^{\mathrm{s}}_{.}84$	$-35^\circ14'57''_{.}1$	(2000.0)

Thus, the two variables are only about $10''$ apart.

Note that, for the four red-light images (JD 2438559–2449097) available in the USNO Image and Catalog Archive, the phases computed with the light elements for V597 Sco from Swope (1943) are in a narrow range (0.912–0.125), whereas both stars exhibit strong variations of brightness (within 10.8–12.7 R for V597 Sco and 14.6–16.1 R for the new variable, roughly estimated using magnitudes of field stars from the GSC2.2 catalog). Thus, apparently the light elements are not quite valid for either of the stars.

Both stars are bright in the near-infrared range: in the 2MASS catalog, $K = 5.943$ for V597 Sco and $K = 5.348$ for the new variable. The new variable is also present in the IRAS Point Source Catalog (IRAS 16591–3510). Its colors make it a possible carbon star candidate.

In our opinion, both stars are probable Miras. The star associated with IRAS 16591–3510 seems to be too faint for Harvard plates, but it is not excluded that,

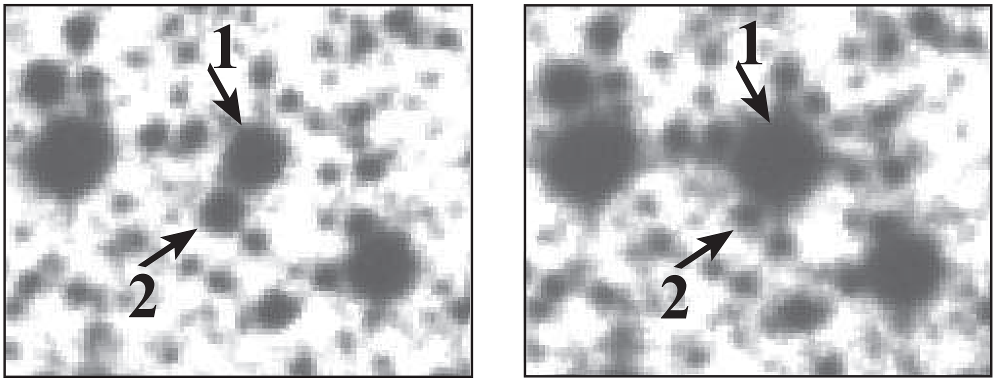

Figure 1. The field of V597 Sco on two sky survey images in red light from the USNO Image and Catalog Archive. Left panel: epoch 1986.2847; right panel: epoch 1993.2991. North is on top, east is to the left. The size of both images is 1′ from north to south.

near epochs of its maximum, it could contaminate Swope's estimates for V597 Sco, thus causing insufficient accuracy of the light elements in Swope (1943) (or even leading to spurious elements).

The work of the GCVS team is supported, in part, by grants from the Russian Foundation for Basic Research (grant 02-02-16069), The Federal Scientific and Technological Program "Astronomy", the program "Unstable Processes in Astronomy" of the Presidium of Russian Academy of Sciences, and the program of support for leading scientific schools of Russia (grant NSh-389-2003-2). This research has made use of the USNOFS Image and Catalogue Archive operated by the United States Naval Observatory, Flagstaff Station (`http://www.nofs.navy.mil/data/fchpix/`). Thanks are due to Dr. S.V. Antipin for his assistance during the preparation of the manuscript.

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ERRATUM FOR IBVS 5422

Kazarovets, E.V., Kireeva, N.N., Samus, N.N., Durlevich. O.V.
The 77th Name-List of Variable Stars

The following corrections are needed to the list of identifications (Table 2).

```
V1657 Aql: the USNO identification should be USNO-A2.0 900-17903132
LY Dra: the SAO identification should be SAO 018231
DU Lyn: the AFGL identification should be AFGL 1187
OX Vir: the SAO identification should be SAO 138579
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Thanks are due to Dr. F. Ochsenbein (Strasbourg) for turning our attention to the mistakes.

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PHOTOMETRY OF HR 1817 AT TWO SITES WELL SEPARATED IN LONGITUDE

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HR 1817 (HD 35850, HIP 25486) is a remarkably active, young, relatively close, rapidly rotating, single solar-type star, whose relative brightness invites more intensive study to help understand Sun-like stars. It has been estimated to have radius $1.18R_{\odot}$, mass $1.15M_{\odot}$, $v\sin i$ 50km/s, distance 26.8 pc and an age of $\approx$ 12Myr. This F7V star shows intense X-ray, extreme ultraviolet (EUV) emission and strong lithium abundance. (cf. e.g. Tagliaferri et al., 1997; Gagné et al., 1999). EUV data suggest that HR 1817 is in a state of continuous low-amplitude flaring (Mathioudakis & Mullan, 1999; Zuckerman et al., 2001).

Strong surface fields were also measured using Zeeman Doppler Imaging (ZDI), together with microwave emission that fits highly energized coronal models (Budding et al., 2002). These latter radio and spectrometric studies indicated a period of around 1 day, or a little less. Although HIPPARCOS photometry (ESA, 1998) confirms photometric variability, with an amplitude of up to 0.08m in V, a photometric period was not yet obtained. For "spot" type variability, with a period close to one whole day (Carter, 2003) (or, indeed, any integral number of days), it is difficult to establish a photometric period from any single observatory, since a prominent macula may change its position before enough time has elapsed for adequate phase coverage. In this situation, a useful approach is to combine photometry from sites that are widely separated in longitude.

We present here results of photometry of HR 1817, combining data from MLO (long. $\sim$8h W) and UAO (long. $\sim$2h E) during a short campaign carried out earlier this year. The diagrams show standardized BVR observations gathered at the two sites during the central interval Jan 14-25, 2003. They have been phased here with a 1-day trial period and confirm variability on this timescale, with an expected amplitude of around 0.05 mag (V). The fact that the next change is comparable in B and V, but definitely less in R, can be taken as a significant indicator of a maculation type variation.

The telescopes used in this campaign were the 40-cm f/10 Meade Cassegrain-Schmidt telescope of the Çanakkale Onsekiz Mart University Ulupinar Astrophysics Observatory (UAO), with Optec Mark III photometer and the 61-cm telescope of Mt. Laguna Observatory (MLO), using a Hamamatsu R943-02 pmt at 1450V. Reductions of the UAO instrumental source data were made with the ATMEX[1] software. Photometer calibration procedures have followed regular lines, as spelled out in, for example, Henden & Kaitchuck (1982) or Budding (1993). Individual points, at both observatories, were averaged from 2 or 3, 10s integrations. Comparison star and sky readings were checked after, typically 3 readings of HR 1817.

The UAO photometer has been calibrated with respect to a few dozen standard star observations in the early months of 2003, yielding calibration coefficients $\epsilon = -0.09 \pm 0.01$, $\mu(B-V) = +1.24 \pm 0.03$ and $\psi(V-R) = 0.90 \pm 0.03$, in typical terminology (cf. Hardie, 1962). Recent values for MLO are $\epsilon(V) = -0.09 \pm 0.01$, $\mu(B-V) = 1.02$ and $\psi(V-R) = 1.05$. Although HR 1817 has V magnitude 6.2-6.3, the count rates with the facilities used were at most an order of magnitude less than those ($\sim 10^6$ cts/sec), at which the instrument manual indicates dead time effects start to be detectable. Since both observatories used comparisons of similar magnitudes, differential effects of brightness-related non-linearity should be negligible.

The main reference stars were HD 35643 ($V = 7.28$, $B-V = 0.383$) and HD 35591 ($V = 6.55$, $B-V = 1.084$), the latter (closer in magnitude) being used more frequently at MLO and the former (closer in colour) being used more at UAO. Intercomparisons of the determinations on these stars allow us to believe that the longitude separated measures can be lined up at the 0.01 mag level of confidence. A similar project, involving joint monitoring of CG Cyg by MLO and another group in Turkey, allowed agreement about the magnitude of the then-used comparison (BD+34°4216) to within 0.01 mag (cf. also Milone et al., 1979).

Some additional short-term irregularity may also be present, as the scatter, for this bright a star, is greater than nominal photometric accuracies would suggest (~0.005 mag from simple Poissonian counting statistics). UAO data from 2 Nov 2002 and 2 Mar 2003 support variations of the same order and timescale, but, as yet, there appears insufficient high quality coverage to allow a clear photometric period to be established. The 2/3/03 data (also plotted in the light curves) show a rise similar to that in the phase range ~0.3-0.5, hence indicating a period quite close to one whole day, or ~30 min less than that, down to about 22 h, when coherence is lost among the separate data segments. The 2/11/02 data (not shown), do little other than confirm the general magnitudes and colours.

This two-site collaboration proved a useful experience in assessing the practical possibilities and qualities of the standardization of magnitudes. A third site, around, say, ~10-12h E, could have perhaps helped confirm if the descending branch of the apparent maculation effect observed at UAO ascended at the expected phase. Parallels could be drawn between HR 1817 and other active cool dwarfs; for example, AB Dor, where multi-site, multiwavelength studies have allowed the building up of 3-dimensional modelling of a stellar active region (Collier-Cameron & Robinson, 1989). Photometry has an important corroborative role to play in such studies, as well as providing independent data for model parameters.

Acknowledgements: We thank Prof. O. Demircan for active support and also Mr. A. Bulut for some calibration data. This work was partly supported by the Research Fund of Çanakkale Onsekiz Mart University. PH received support from the AAS Small Grants Program and generous amounts of observing time at MLO.

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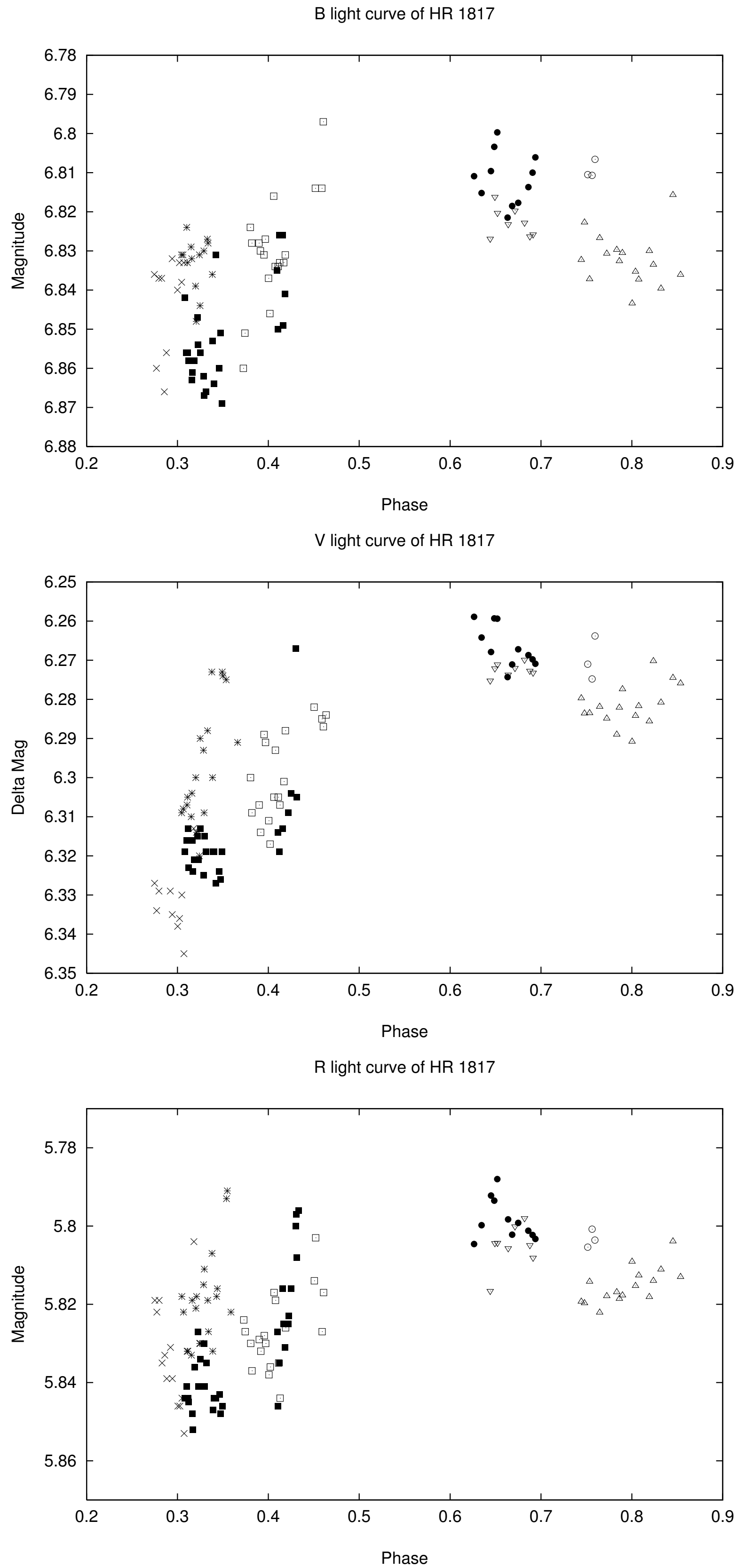

Figure 1. The MLO data appear here at later phases, as follows: triangle up, Jan 19; triangle down, Jan 22; circle, Jan 24; filled circle, Jan 26. The UAO data, at the left, are similarly: box, Jan 14; filled box, Jan 15; cross, Jan 17; star, Mar 2.

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NEW SX Phe VARIABLES IN THE INNERMOST REGION OF M15

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Only one of more than 150 known variables in the globular cluster M15 (Clement et al., 2001) is SX Phe star discovered by Jeon et al. (2001) at $r \approx 5'$ from the cluster's center. Recently, we (Zheleznyak & Kravtsov, 2003) have been successful in finding 28 new variables, among 83 stars with variability detected, in the central part of M15. Two of them we have classified as SX Phe stars. In accordance with their ordinal numbers in our list of the detected variables, they have been denoted as ZK62 and ZK68. Here we present basic observational properties of these stars.

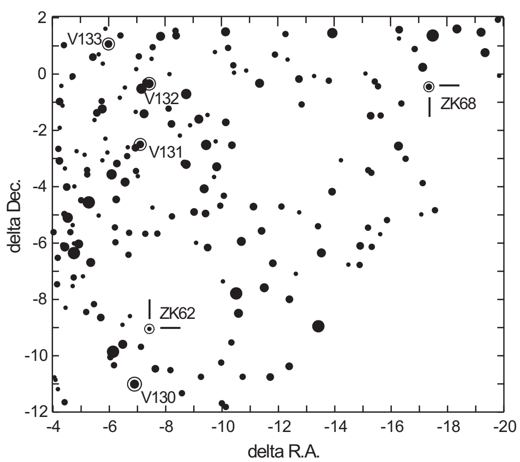

Figure 1. Identification chart for the two newly discovered SX Phe stars in the innermost part of M15, based on the data of van der Marel et al. (2002); four known variables are marked additionally for convenience of identification.

M15 was monitored with the 1.5 m AZT–22 telescope of the Maidanak observatory (Mt. Maidanak, Republic of Uzbekistan), during two sets on successive nights in 2001 July 31 and August 1. The upper culmination of the cluster fell on the middle of the time interval, equal approximately to 3 hr, of each set. More than two hundred cluster images were obtained under photometric conditions, in the R passband close to the standard Cousins' one, with angular resolution (FWHM) typically falling between $0\overset{''}{.}5 - 0\overset{''}{.}9$.

Table 1. Basic data on the newly discovered SX Phe stars in M15

$Name^{a}$	ID^{b}_{vdM}	α_{2000}	δ_{2000}	Period	Epoch of max.	ΔR
ZK62	10041	$21^{h}29^{m}57\overset{s}{.}76$	$+12°09'54\overset{''}{.}20$	$0\overset{d}{.}052$	2452122.0239	$0\overset{m}{.}25$
ZK68	10344	$21^{h}29^{m}57\overset{s}{.}05$	$+12°10'03\overset{''}{.}10$	$0\overset{d}{.}076$	2452121.9916	$0\overset{m}{.}20$

[a] According to notations in our list from Zheleznyak & Kravtsov (2003)
[b] Identification numbers in catalog of HST photometry in M15 by van der Marel et al. (2002)

Average resolution on the frames has been estimated to be $0\overset{''}{.}74$. The observations have been performed with 765×510 ST7 CCD camera attached to the telescope in its Ritchey–Chretien short ($f/7.7$) focus with the focal plane scale giving $0\overset{''}{.}15 \times 0\overset{''}{.}15$ per CCD pixel size of 9×9 μm. The cluster images were taken with exposure of 1 minute per frame, at a rate ~ 40 frames per hour.

Reduction of the raw CCD data included standard procedures, namely bias subtraction, dark subtraction, flatfielding operations using twilight sky exposures, and removing of cosmic rays. Also, the observational data were corrected for the effect of nonlinearity of the CCD camera.

Image processing was carried out with specially developed software based on idea of optimal image subtraction method proposed by Alard & Lupton (1998).

The positions, $\Delta\alpha''$ and $\Delta\delta''$, of the variables relative to the object AC 211 (identified with the X-ray source X2127+119 by Aurière et al. (1984)) were determined in equinox 2000 coordinates. We transformed the variables' pixel coordinates to the RA and DEC offsets relative to AC 211, using the respective coordinate data for reference stars from catalog by Yanny et al. (1994). The offsets ($\Delta\alpha''$, $\Delta\delta''$) of ZK62 and ZK68 have been determined to be ($-7\overset{''}{.}39$, $-8\overset{''}{.}70$) and ($-17\overset{''}{.}70$, $0\overset{''}{.}20$), respectively. Equatorial coordinates, α and δ, of the variables have been calculated from the offsets by accepting for AC 211 $\alpha_{2000} = 21^{h}29^{m}58\overset{s}{.}26$ and $\delta_{2000} = +12°10'02\overset{''}{.}90$ from the above paper by Yanny et al. (1994). The coordinates along with other basic data on the newly discovered SX Phe variables in M15 are given in Table 1.

We have been successful in identifying ZK62 and ZK68, within the accuracy $\sim 0\overset{''}{.}1 - 0\overset{''}{.}2$ on each coordinate, with stars from the recently published catalog of HST photometry in M15 by van der Marel et al. (2002), what is shown in the identification chart presented in Figure 1. According to photometric data from the same catalog, these stars are located in the cluster color-magnitude diagram about 2 mag. below the horizontal branch, between the subgiant branch and the extended blue horizontal branch. Thus, the stars very likely belong to blue stragglers. Other line of evidence that ZK62 and ZK68 are of SX Phe type of variables is the characteristics of their variability.

Figure 2 shows the observed light curves of ZK62 and ZK68, and Figure 3 demonstrates their phased light curves for the most probable periods of their variability. For convenience of representation, the light curves have arbitrarily been shifted along the ordinate axis, i.e. along the relative magnitude ΔR.

Periods and epochs of maximum of the variables under study have been determined by applying time series analysis package implemented in the MIDAS system. Since our observations cover a relatively limited time interval, values of the periods determined are accurate within several thousandths of a day. However, both the observed light curves and time series analysis show that the periods of ZK62 and ZK68 are consistent with typical periods of SX Phe variables.

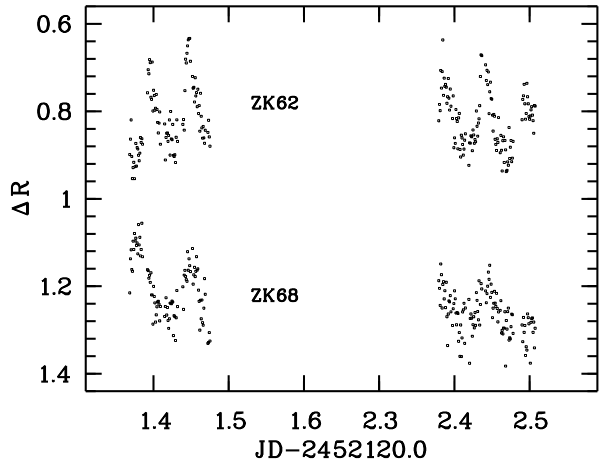

Figure 2. Observed light curves of the variables ZK62 and ZK68 in the *R* passband.

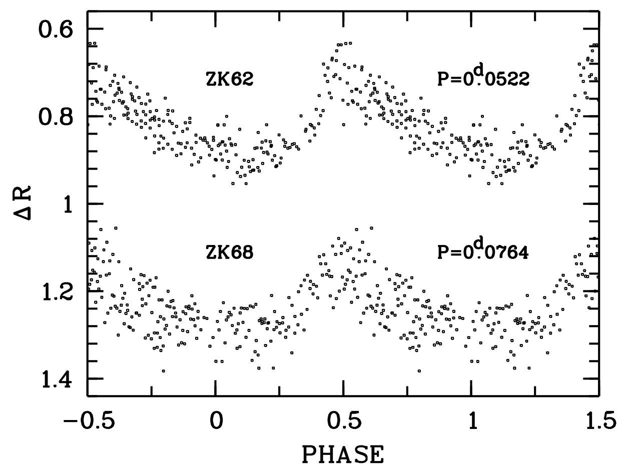

Figure 3. Phased light curves of the variables ZK62 and ZK68 in the *R* passband.

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THE R BAND LIGHT CURVES OF ECLIPSES OF U Gem IN OUTBURST

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U Gem is one of just a few known eclipsing dwarf novae (e.g. Krzeminski, 1965). Large variations of the eclipse profiles in quiescence and outburst offer a unique opportunity to study the changes in the disk and the interaction of the disk with the mass stream (bright spot). Here we report an analysis of the R band CCD observations of eclipses which occurred during the peak of the outburst. As far as we know, no photometric observations of eclipses of U Gem in the red spectral region during outburst were published previously.

The R-filter CCD images were obtained by Maksutov 180/1000 mm, SBIG ST-6 in the Astronomical Institute in Ondřejov during the February 2002 outburst and covered three eclipses. The exposure times were 90 and 70 sec. The star USNO-A2.0 1050-05472483 was used as the comparison star while USNO-A2.0 1050-05473287 served as the check star. The variable, the comparison star and the check star were placed on the same image. These CCD data are available at the IBVS website as `5453-t2.txt`.

The position of our CCD observations is shown in Fig. 1. The one-day means of the visual observations from the AFOEV database (CDS, Strasbourg, France) are superimposed and show that the CCD data were obtained during the peak of the outburst.

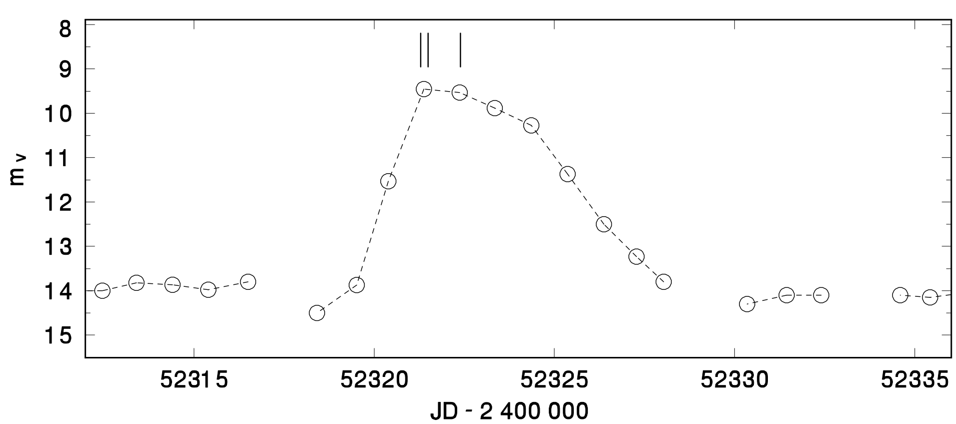

Figure 1. The profile of the February 2002 outburst of U Gem. The empty circles represent the one-day means of the AFOEV visual observations. The vertical lines mark the centers of the series of the R band CCD observations.

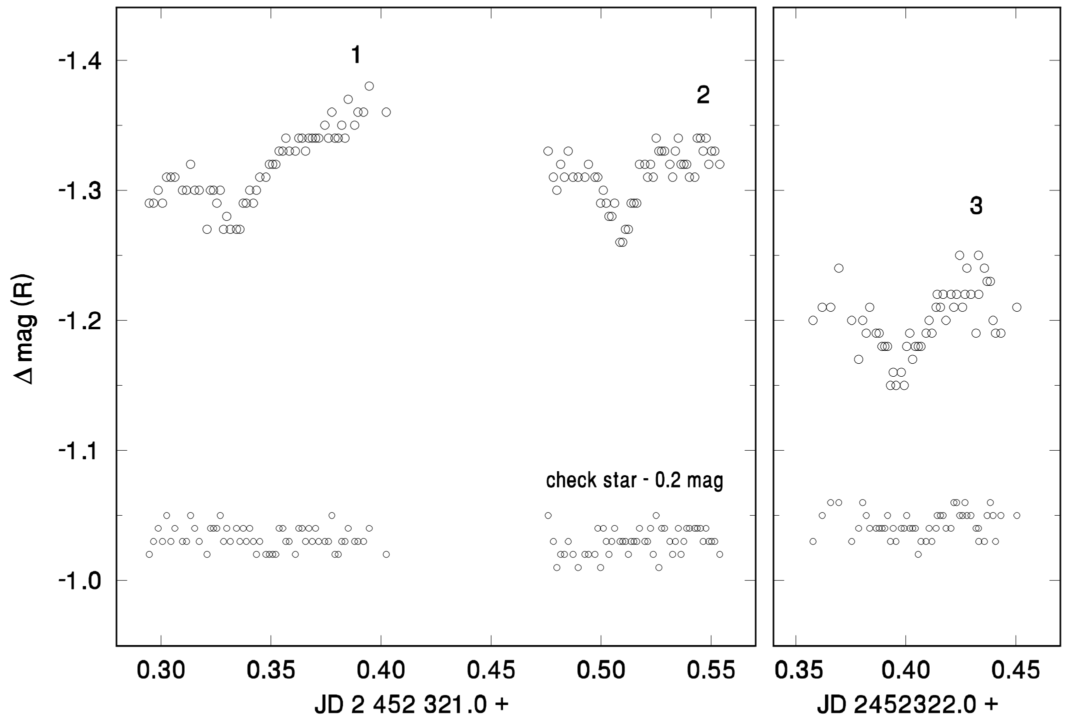

Figure 2. The profiles of the eclipses observed in the R band during the top of the February 2002 outburst of U Gem. The relative magnitudes for both the variable and the check star are plotted.

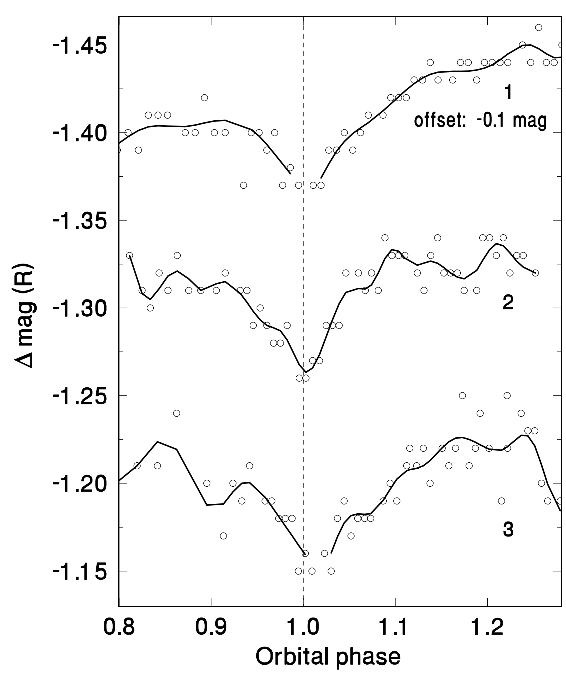

Figure 3. The details of the profiles of the eclipses observed during the February 2002 outburst of U Gem. The number at each curve refers to the label in Fig. 2. The smooth curves represent the fits by the code `HEC13`. The ephemeris of Smak (1993), valid for the moment of the mid-eclipse of the bright spot in quiescence, was used.

The profiles of the eclipses observed in the R band are shown in Fig. 2. The first eclipse might occur during the very late rise to the outburst maximum because a trend of an increasing brightness is superposed. The depth of the eclipses is very small, of the order of 0.05 mag(R). The light curves were therefore smoothed by the code HEC13, written by Dr. P. Harmanec and based on the method of Vondrák (1969 and 1977). This method can fit a smooth curve to a complicated course of the data. The descending and ascending branches of eclipses 1 and 3 were fitted separately.

The fits to the profiles of the individual eclipses are shown in detail in Fig. 3. The orbital phases were calculated according to the ephemeris of Smak (1993):
$T_{\rm min} = 2\,437\,638.82627 + 0.1769061898\ E$, which is valid for the moment of the mid-eclipse of the bright spot in quiescence.

We determined the timings of the three eclipses by the method of bisectors to take the asymmetry of the profiles into account. The minima determined from the observed and smooth curves, representing mainly the middle part of the eclipse depth, were in good agreement. A difference of approx. −0.005 days was found only for the first eclipse. The values of $O-C$ in Table 1 were calculated using the ephemeris of Smak (1993).

Table 1. Minima timings of U Gem determined from the smooth curves

JD	Epoch	$O-C$ (days)
2452321.3327	82996	0.0003
2452321.5097	82997	0.0004
2452322.3960	83002	0.0022

In quiescence, the deep, narrow eclipse of U Gem with a steep ingress and egress (Krzeminski, 1965) is caused by an occultation of the bright spot by the secondary star while the white dwarf and the inner disk region are not eclipsed (Warner and Nather, 1971). On the contrary, the profiles of the eclipses obtained at the peak of the 2002 outburst in the R band appear to be very broad, often with extended wings. In addition, there is no sign of a bump characteristic for the interval of the best visibility of the bright spot, which is very prominent in quiescence. This behaviour bears some resemblance to that observed in the V band by Naylor and la Dous (1997) during the 1995 April outburst.

Fig. 3 shows that the full width of eclipse can be as large as 0.2 phases. The very broad wings of the eclipses are characteristic for an eclipse of an expanded, highly brightened accretion disk. Nevertheless, the phases of mid-eclipse (Table 1) are close to the phase of the eclipse of the spot, not of a disk. The moment of the superior conjunction of the white dwarf in U Gem (i.e. when the mid-eclipse of the disk should occur) advances the moment of the mid-eclipse of the bright spot by 0.025 ± 0.005 phase in quiescence (Smak, 2001). The moment of minimum occurs earlier during outburst than in quiescence (Krzeminski, 1965). However, our observations show that the minima during outburst occur systematically later than suggested by the ephemeris of Smak (1993), and later than the course of the $O-C$ values in his Fig. 1. This can be explained by a recent increase of the period length $P_{\rm orb}$. We note that the minima observed by Naylor and la Dous (1997), when recalculated according to the ephemeris of Smak (1993), have negative $O-C$'s during the 1995 April outburst and $O-C \approx 0.0012$ day in the 1996 February quiescence.

Significant cycle-to-cycle changes of the modulation, mainly the slope of the ascending branches of the consecutive eclipses 1 and 2 and a sharper bottom part of eclipse 2, were detected. A similar asymmetry is apparent also in one night of the 1995 April outburst (Naylor and la Dous, 1997). Small changes of the disk profile can give rise to the asymmetry of a grazing eclipse. A comparison with the in-outburst Doppler tomography of He II λ4686 (Groot, 2001) reveals that the part of the disk on which a spiral shock arm is developing lies between the white dwarf and the observer between phases $\sim 0.0 - 0.15$. Large changes of the profile of the disk, connected with a non-uniform brightness distribution, may occur there. Another possibility could be a deformation of the disk around the impact of the stream (emerging from eclipse), caused by an increase of the mass outflow from the donor star due to an irradiation during outburst (Smak, 1995). Nevertheless, the spiral arms are a more likely explanation because they appear sooner than the heating of the donor (Fig. 2 in Groot, 2001). Variable, vertically extended structures of unclear origin are really known to be present in U Gem and to give rise to the X-ray dips at phases 0.15 and 0.7 (Mason et al., 1988) and UV dips at phase 0.1 (Naylor and la Dous, 1997). The spiral structure of the disk may be the common cause of the variations observed in various spectral regions during outburst but simultaneous multiwavelength observations are highly desired in this respect.

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OPTICAL SPECTRUM OF CI Aql IN THE PLATEAU PHASE

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CI Aql is a recurrent nova with two records of outbursts in 1917 and 2000. Recurrent novae are one of subclasses of cataclysmic variables (CVs; e.g., see Warner, 1995 for a review) known as very fast novae and characterized by considerably shorter intervals of outbursts compared with those of classical novae. In the 2000 outburst of CI Aql, however, the initial decline was noticeably slow, which was comparable to that of a moderately fast nova (Matsumoto et al., 2001), and the later plateau phase lasting 1.4–1.7 yr was exceptionally long (Lederle & Kimeswenger, 2003; Matsumoto et al., 2003). Kato et al. (2002) pointed out that a recurrent nova IM Nor, whose outbursts were recorded in 1920 and 2002, showed a similar timescale in the light-curve evolution in the 2002 outburst. These recent findings suggest the existence of a new class of recurrent novae with slower evolutions and longer intervals of outbursts, i.e., intermediates between classical novae and recurrent novae.

We obtained optical spectra of CI Aql on 2001 May 11, 375 days after the recorded maximum, by using a liquid-nitrogen cooled CCD (EEV CCD15-11/UV) attached to a classical Cassegrain telescope with a 101-cm aperture at Bisei Astronomical Observatory. Our low-dispersion mode derived a 162 Å mm^{-1} (corresponding to 4.5 Å $pixel^{-1}$) image scale and wavelength coverage of 4400 Å with center-wavelength of 5700 Å. The exposure time for the object was set to 1200 s, and four object frames were obtained in total (Table). The phase range of the exposures was between 0.82–0.90, using the ephemeris given in Mennickent & Honeycutt (1995). A marginal part of each frame (< 4500 Å), in which sensitivity of the CCD is extremely low, was trimmed prior to procedures of data reductions performed by using the IRAF[1]. Wavelength calibrations were made with an Fe-Ne lamp, and we used HR 7596 (= 58 Aql) as a standard for flux calibrations. Finally, all four spectra were averaged (Figure 1). The signal-to-noise ratio of the continuum determined over 5000 Å to 7000 Å was about 10.

The optical spectrum showed a mildly reddened continuum that was brighter than in the previous quiescence, which confirmed that the object was still over the quiescent level though close to it, as compared with the quiescent spectrum given in Greiner et al. (1996).

[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. See `http://iraf.noao.edu/` for more information.

Table 1: Log of the spectroscopic observation on 2001 May 11.

HJD at mid exposure	exp. time	orbital phase
2452041.1804	1200 s	0.82
2452041.1956	1200 s	0.85
2452041.2130	1200 s	0.88
2452041.2283	1200 s	0.90

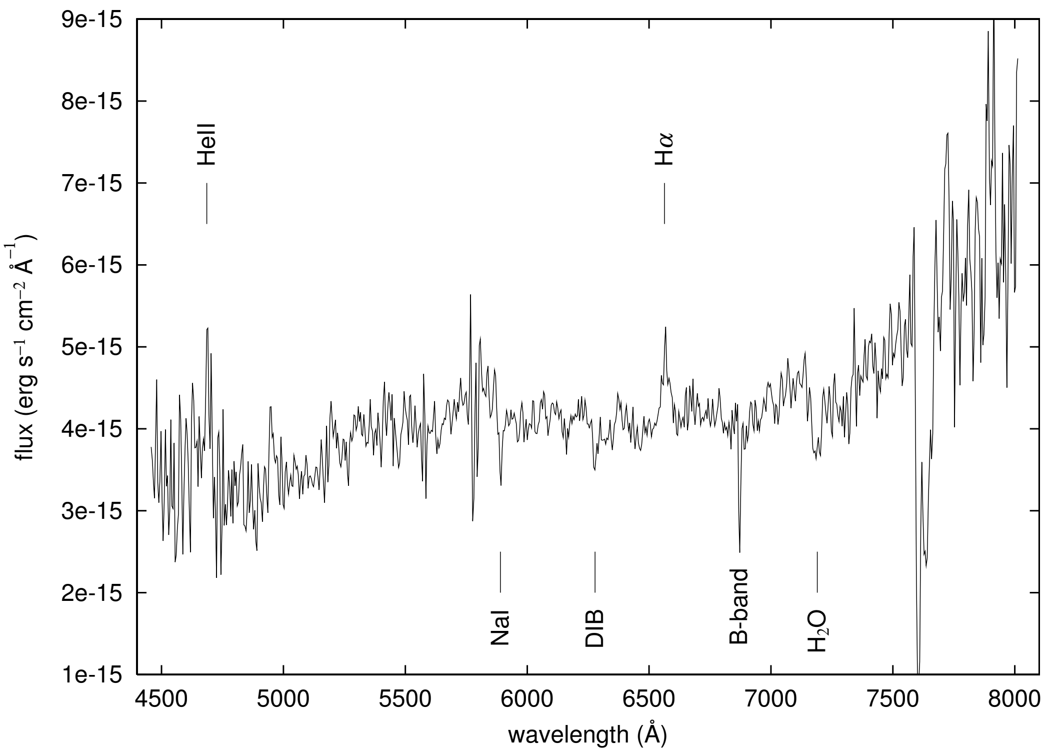

Figure 1. Averaged spectrum of CI Aql on 2001 May 11.

It is known that the optical spectrum of CI Aql in quiescence is characterized by absorption lines of the Balmer series which usually indicates non-CV nature, while HeII at 4686 Å and CIII–NIII complex at ∼ 4600 Å are observed as emission features, on a reddened continuum (Mennickent & Honeycutt, 1995; Greiner et al., 1996).

In our spectrum, Hα emission line was clearly identified. We found that the FWZI was about 4800 km s^{-1} and the equivalent width was −10 Å. The doubly-peaked emission feature which had been observed in an earlier phase of the 2000 outburst (Kiss et al., 2001; Matsumoto et al., 2001) became a single-peaked one in this later phase. Such evolution of the line profile is similar to those observed in outbursts of a recurrent nova U Sco (Anupama & Dewangan, 2000) suspected to have a similar configuration of the binary system to CI Aql (Hachisu et al., 2000; Hachisu et al., 2003 and references therein). The wing of the Hα was accompanied by a symmetric broad component, which likely reflects high-speed outflowing such as an expanding shell by the outburst, but contributions of [NII] emission lines at both sides of Hα (e.g., O'Brien & Cohen, 1998) are also possible. HeII λ4686 emission line was weakly present. CIII–NIII complex at ∼ 4600 Å was marginal. A probable emission line at ∼ 4946 Å met no firm identification. Hβ was not detected, which suggest this line was in transition from emission to absorption. Scatter at ∼ 5800 Å was likely caused by relatively noisy frames (the first and second ones) in the process of averaging.

Finally, the Na I λ5893 line was seen in absorption. The presence of DIB absorption features (e.g., at 6278 Å) suggests that the NaD line, originating from the secondary star, may have been significantly contaminated by interstellar or circumstellar matter causing the reddened continuum.

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SEVEN NEW ECLIPSING BINARY STARS AMONG THE FASTT1 VARIABLES

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We present here observations made in the V band of seven new eclipsing binary stars among the FASTT1 variables, found by Henden and Stone (1998) in the Sloan digital survey calibration fields. Table 1 lists the basic identification data for each star, Table 2 gives the observational log, and Table 3 characterizes the new eclipsing binary systems. Figure 1 shows the folded light curves.

Table 1. Basic data

GSC	FASTT1	Coordinates (J2000)	
		R.A.	Dec
0244-1292	0452	10 06 24.86	01 00 11.5
0263-0256	0498	11 12 16.86	01 19 05.5
0366-0475	0709	16 03 25.70	01 02 36.8
0568-1658	1555	22 49 43.00	00 46 01.3
4674-0967	0024	00 57 53.84	–00 46 34.8
4709-1250	0103	03 28 09.63	–00 18 05.4
4903-1476	0491	10 09 37.40	–00 56 28.4

Table 2. Observation log

GSC	Observation period	Comparison star (GSC)	Check stars (GSC)	Remarks
0244-1292	26 Mar 1997-9 May 1997	0244-1346	–	1
0263-0256	3 Apr 1997-9 May 1997	0263-0121	–	2
0366-0475	19 Jun 2001-20 Jul 2001	0366-0581	0366-0801	3
			0366-0646	
			0366-0082	

Table 2. Observation log (cont.)

GSC	Observation period	Comparison star (GSC)	Check stars (GSC)	Remarks
0568-1658	12 Aug 2001-23 Aug 2001	0568-1791	0568-1752	3
			0569-0325	
			0569-0378	
4674-0967	8 Nov 1998-13 Dec 1998	4674-0793	4674-0773	4
4709-1250	19 Jan 1999-7 Jan 2000	4709-1249	–	4,5
4903-1476	20 Feb 1998-25 Apr 1998	4903-1491	4903-1336	1,2
			4903-1370	

[1] Monegrillo Observatory, 41 cm Newtonian telescope, SX Starlight CCD camera.

[2] Mollet Observatory, 41 cm Newtonian telescope, SX Starlight CCD camera.

[3] Observatori Astronòmic de Mallorca, 25 cm Schmidt-Cassegrain telescope, MX5 Starlight CCD camera

[4] Piera Observatory, 41 cm Cassegrain telescope, SX Starlight CCD camera.

[5] Hostalets de Pierola Observatory, 41 cm Newtonian telescope, SX Starlight CCD camera.

Table 3. Variable characterization and minimum timings.

GSC	GCVS type	Ephemeris E 2400000+	Ephemeris P[day]	V amplitude	Times of minima HJD 2400000+	Error [days]	Type
0244-1292	EW	50544.4116(5)	0.428870(8)	0.34	—	—	—
0263-0256	EB	50552.3886(2)	0.311589(5)	0.80	50549.42923	0.00021	I
					50551.4537	0.0011	I
0366-0475	EW	52082.4980(7)	0.31295(1)	0.49	52083.43879	0.00081	II
					52087.50750	0.00056	I
0568-1658	EW	52135.5996(2)	0.301634(8)	0.21	52135.45007	0.00019	II
					52136.50462	0.00022	I
					52144.49867	0.00021	I
					52145.40394	0.00032	II
					52145.55447	0.00030	I
4674-0967	EW	51131.3749(9)	0.428299(7)	0.41	51132.44644	0.00051	II
					51143.37148	0.00086	I
					51153.43.46	0.00053	II
4709-1250	EB	51550.250(5)	1.06425(3)	0.30	—	—	—
4903-1476	EW	50928.4287(4)	0.368055(8)	0.36	50878.37199	0.00048	I
					50900.4545	0.0015	I
					50921.43570	0.00042	I

Acknowledgements: We would like to thank Joan A. Cano and Rafael Barberá for writing the software for obtaining and reducing the CCD frames.

Reference:

Henden, A. A., Stone R. C., 1998, *AJ*, **115**, 296

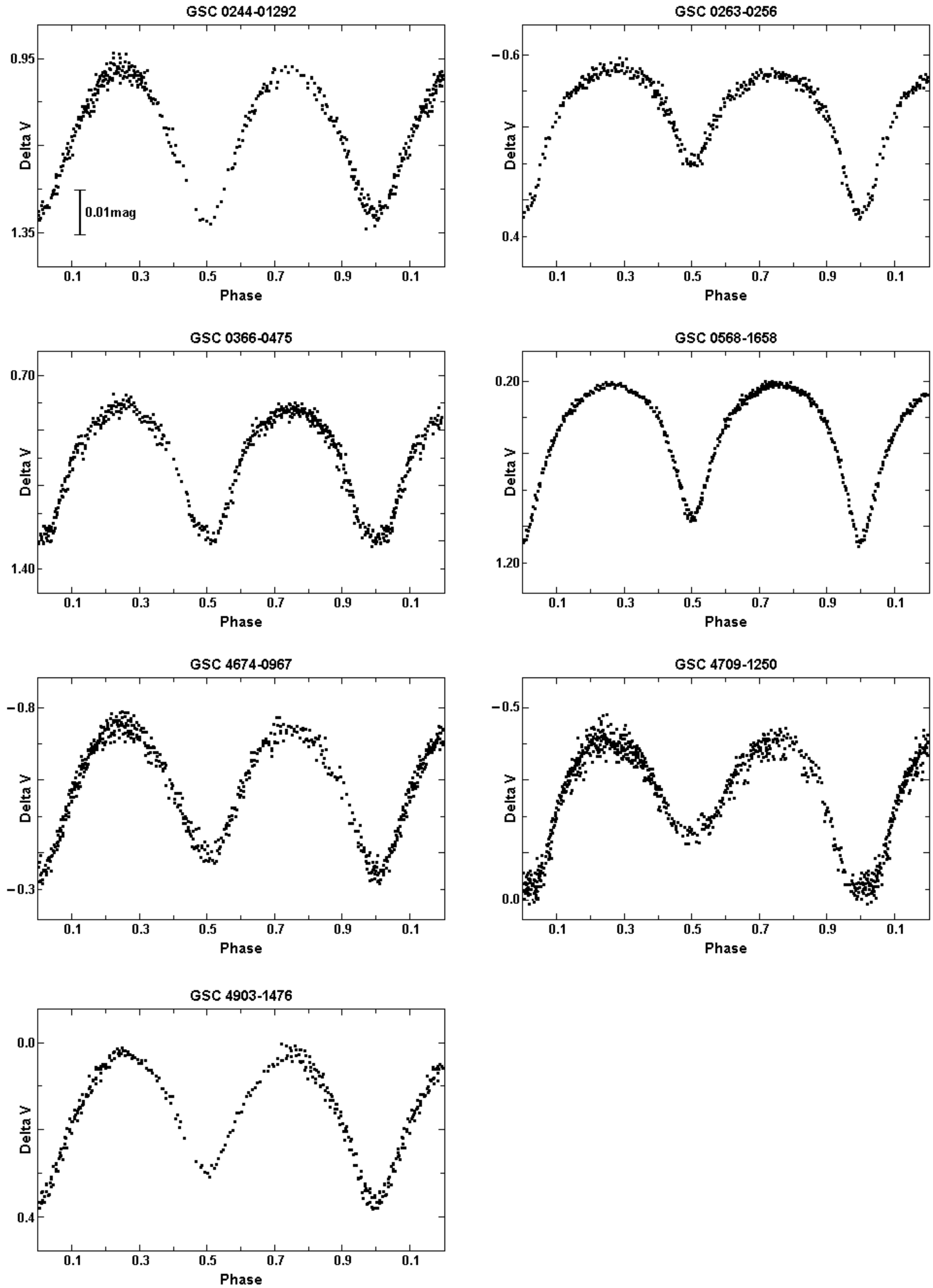
GSC 0244-01292
0.95
1.35
Delta V
0.01mag
0.1 0.3 0.5 0.7 0.9 0.1
Phase
GSC 0263-0256
−0.6
0.4
Delta V
GSC 0366-0475
0.70
1.40
GSC 0568-1658
0.20
1.20
GSC 4674-0967
−0.8
−0.3
GSC 4709-1250
−0.5
0.0
GSC 4903-1476
0.0
0.4

Figure 1.

ERRATUM FOR IBVS 5455

Geert Hoogeveen reported the following error:

IBVS No.	item	printed	correct
5455	Decl. (GSC 4709-1250)	-00 18 05.4	-01 18 05.4

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TIMES OF MINIMA OF ECLIPSING BINARY SYSTEMS DO Cas, V1143 Cyg, GO Cyg, AND VW Cep

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Observatory and telescope:
The photometric observations were made in B and V bands of Johnson's system with the 20″ Cassegrainian telescope of Biruni Observatory at Shiraz University, Shiraz, Iran (Longitude: 52°31′ E, Latitude: 29°36′ N).

Detector:	Unrefrigerated RCA4509 multiplier phototube.

Method of data reduction:
Reduction of data and atmospheric corrections were done using the REDWIP code developed by G. P. McCook.

Method of minimum determination:
Times of minima were calculated by fitting a Lorentzian function to the observed minima data points.

Observed star(s):

Star name	GCVS	Coordinates (J2000)		Comp. star	Ephemeris		Source
	type	RA	Dec		E 2400000+	P [day]	
DO Cas	EB	02 41 24	+60 33 11	HD 16088	33926.4573	0.6846661	1
V1143 Cyg	EA	19 38 41	+54 58 25	HD 185978	47087.5669	7.64075095	2
GO Cyg	EB	20 37 20	+35 26 10	HD 197292	33930.40561	0.71776382	3
VW Cep	EW	20 37 21	+75 36 01	HD 200039	51067.2820	0.2783140	4

Source(s) of the ephemeris:

1. Sky catalogue 2000.0
2. Burns et al. (1996)
3. Hall and Louth (1990)
4. Pribulla et al. (2000)

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
DO Cas	51910.24100	0.00230	II	B, V	−0.0015	
	51911.26098	0.00034	I	B, V	−0.0054	
	51912.28892	0.00110	II	B, V	−0.0044	
V1143 Cyg	52474.29443	0.00090	I	B, V	−0.0018	
	52472.30445	0.00382	II	B, V	−0.0007	
GO Cyg	52518.39534	0.00045	I	B, V	0.0600	
	52530.2414	0.0012	II	B, V	0.0630	
	52553.2102	0.0013	II	B, V	0.0633	
	52577.2540	0.0092	I	B, V	0.0621	
VW Cep	52529.25294	0.00031	I	B, V	−0.0125	
	52529.39839	0.00037	II	B, V	−0.0062	

References:

Burns, J. F., Guinan, E. F., and Marshall, J. J., 1996, *IBVS*, 4363
Hall, D.S. and Louth, H., 1990, *J. A&A*, **11**, 271
Hirshfeld, A. and Sinnott, R. W., *Sky Catalogue 2000.0*, 1985, Cambridge Univ. Press and Sky Publishing Corp., U.S.A.
Pribulla, T., Parimucha, S., and Vanko, M., 2000, *IBVS*, 4847

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CONFIRMATION OF VARIABILITY OF BIDELMAN-MACCONNELL SUSPECTED VARIABLES

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Bidelman and MacConnell (1973, hereafter BM) gave a number of lists of remarkable southern hemisphere stars, among which a list of 311 stars, selected on the presence of $H\gamma$ or $H\delta$ emission lines in their spectrum on top of an M type continuum. A large number of these stars were known or have been found to be Mira or semi-regular variables. The remaining 60 stars from the list (6 of which were suspected in variability by other sources as well) were catalogued in the NSV, as suspected Mira variables. Positions were given with an accuracy of $0^{\rm m}_{.}1$ in RA and $1'$ in declination. Most of the known variable stars were found within $4'$ radius, though three had large errors of up to 1° due to typographical errors.

This study will give more accurate positions for the NSV stars from the BM paper. Identifications were made based on either the presence of an IRAS source or a bright red star in the 2MASS survey ($J < 9$, $J - K_s > 1$), and in addition, on the variability shown by the publicly available data of the ASAS3 (Pojmanski, 2002) and the TASS (Richmond et al., 2000; Droege, 2003) surveys. The latter could only be used for stars near the equator.

In some cases, no obvious identification could be made in the close vicinity of the given positions. This may be due to a typographical error in the BM paper.

The positively identified variable stars are given in Table 1, while proposed but less certain identifications, with no candidate within a distance of $4'$ from the BM position, are given in Table 2. Probably the only way to verify the latter will be by the original plates. The first column of both tables gives the NSV number of the variable star. The following columns contain the IRAS identification if present, the position of the star as found from the 2MASS survey, maximum and minimum V magnitude (derived from the ASAS3 survey), the $J - K_s$ colour index (from the 2MASS survey), an epoch of maximum (JD – 2400000), the period (in days, found by use of the PDM method, Stellingwerf, 1978) and the type of variability as derived from the light curve (with "SR:" indicating that the star may be either a semi-regular or irregular variable). An asterisk in the first column indicates a comment below the table. Light curves (ASAS3: filled circles, TASS MkIII: asterisks, TASS MkIV: open squares), links to Simbad, and ASAS3 and TASS identifications are available in the tables of the electronic version of the IBVS.

Note that the given periods may not be very accurate, as in some cases only (part of) two cycles have been observed, and that the minimum magnitude may be fainter, as the minimum itself could not always be observed by ASAS3.

Table 1. Identifications for the BM variables

Star name		Coordinates (J2000)		V	$J-K_s$	Epoch	Period	Type
NSV	IRAS	RA	Dec	[mag]	[mag]	−2400000	[day]	
1043	03038-5229	03 05 21.31	−52 18 04.6	10.0−10.9	1.31			SR
3033	06325-6333	06 32 49.58	−63 35 49.8	11.7−15.7	1.26	52763	201	M
3245	–	06 50 54.86	−37 29 23.0	12.4−15.2	1.49	52566	148:	M
3286	06534-3603	06 55 12.44	−36 07 09.9	11.5−14.2	1.24	52628	286	M
3513	07152-3444	07 17 05.76	−34 49 39.7	11.6−14.6	1.82	52745	302	M
3539	07178-1925	07 20 04.06	−19 30 45.3	9.5−10.0	1.24	52702	274	SRA
3840	07569-2217	07 59 08.97	−22 26 12.3	11.5−13.9	1.75	52400	420	M
3873	08003-4838	08 01 49.42	−48 46 55.7	11.0−14.5	1.41	52254	317	M
3966	08133-0141	08 15 52.43	−01 50 49.3	12.0−14.2	1.40	52390		M
4052	08211-6047	08 22 03.68	−60 57 12.7	10.6−15.0	1.34	51875	206	M
4082*	08239-0307	08 26 26.81	−03 17 43.7	10.9−14.1	1.30	52776	313	M
4116	08286-3110	08 30 39.15	−31 20 26.3	13.3−14.4	1.86	52819		SR:
4574*	–	09 39 46.31	−41 04 03.0	10.7	0.85			BY:
4583*	09396-7419	09 39 55.10	−74 32 42.6	10.3−14.2	1.28	52192	185	M
4775	10092-5733	10 11 02.95	−57 48 13.9	9.6− 9.9	1.24	51953		SR:
5003	10508-4121	10 53 07.92	−41 37 27.7	11.4−14.8	1.43	52717	188	M
5271	F11348-5013	11 37 17.62	−50 30 23.2	10.7−11.9	1.11	52411	82	SRA
5273	11352-4347	11 37 43.22	−44 04 31.1	10.4−14.3	1.29	51906	240	M
5295	11390-7213	11 41 19.52	−72 30 38.5	11.0−14.4	1.67	52239	199	M
5924*	12428-4723	12 45 40.41	−47 40 04.6	12.0−14.8	1.31	52878	270	M
6040*	12559-4214	12 58 44.70	−42 30 42.5	10.4−11.7	1.44	52820	337	M
6071	13005-1547	13 03 10.64	−16 03 20.3	9.5−15.1	1.27	51995	253	M
6160*	13131-3644	13 16 01.38	−37 00 10.7	10.4−10.9	1.23	51886	101:	SR:
6288	13285-7556	13 32 52.52	−76 12 22.5	11.1−14.0	1.23	52731	166	M
6400	F13399-4821	13 43 01.28	−48 36 21.9	11.7−13.8	1.38	52724	248:	M:
6404	13408-1734	13 43 33.97	−17 49 37.6	9.3−11.1	1.38	52469	200	SRA
6453*	13464-4611	13 49 32.16	−46 26 10.6	10.6−11.4	1.62	52662	347:	M:
6494	13531-3014	13 55 58.21	−30 29 36.0	9.6−10.4	1.28	52893		SRB
6700	14303-1042	14 32 59.89	−10 56 03.6	11.8−14.9	1.54	52851	380:	M
6856	14530-2630	14 56 01.64	−26 42 38.5	12.4−15.5	1.40	52393	266	M
6929	15035-6953	15 08 19.97	−70 04 34.8	10.9−14.0	1.34	52786	314	M
7075	F15236+0042	15 26 10.69	+00 31 56.5	10.8−12.9	1.16	52765	170	SRA
7190*	15379-6529	15 42 25.72	−65 39 08.8	10.4−11.2	0.90	52713	247	SRA
7458	16046-2637	16 07 42.66	−26 45 08.0	11.2−13.1	1.26	52761	185	M
7884	16367-2046	16 39 41.39	−20 52 38.8	10.3−11.3	1.50	52388	281	SR
8761	–	17 29 25.10	−51 10 22.8	11.2−14.7	1.34	52406	186	M
8952	17273+0132	17 29 51.44	+01 29 46.1	10.1−11.9	1.20	52473	109	SRA
10943	18285-4439	18 32 13.89	−44 37 01.5	11.4−13.5	1.54	52546	320	M
10964	–	18 32 09.58	−29 55 46.9	11.0−13.2	1.23	52025	162	M
11320*	18435-4741	18 47 20.56	−47 38 05.6	10.5−13.0	1.61	52122	380	M
11330	–	18 47 21.78	−31 07 47.6	13.3−15.2	1.27	52088	191	M
11475	18508-2225	18 53 52.84	−22 22 03.9	11.8−14.6	1.79	52757	123	M
12041*	19249-2142	19 27 53.58	−21 35 52.6		1.39			?
12190	19335-2841	19 36 40.49	−28 35 04.1	11.8−15.1	1.45	52775	377	M
12294	19390-2853	19 42 08.96	−28 46 11.1	11.7−14.7	1.30	52812	216	M
12305	19395-2213	19 42 30.99	−22 06 11.9	11.3−15.0	1.44	52510	278	M
12313	–	19 42 25.86	−10 58 18.3	10.1−12.2	1.24	51996	157	SR
12652	19570-2306	19 59 58.04	−22 58 14.7	11.3−15.4	1.45	52757	284	M
13090	–	20 27 29.17	−30 48 37.3	12.6−15.0	1.34	52156	230	M
13131	20302-2350	20 33 10.51	−23 40 11.3	10.8−12.6	1.40	52156	242	SRA
13344	20480-3505	20 51 09.04	−34 53 53.3	11.1−15.3	1.27	52816	233	M
14283*	22403-4147	22 43 11.54	−41 31 58.3	9.9−14.4	1.30	52211	264	M

Table 2. Suggested identification for some BM variables

Star name NSV	IRAS	Coordinates (J2000) RA	Dec	V [mag]	$J-K_s$ [mag]	Epoch −2400000	Period [day]	Type
3357*	–	07 03 11.05	−24 51 05.7	11.8−12.1	1.32			SR
3611*	07229-8440	07 14 09.41	−84 45 47.0	10.8−14.8	1.15	52226	199	M
4314*	08536-6239	08 54 35.43	−62 50 37.3	13.1−13.8	1.45			SR
7500*	16077-6628	16 12 34.86	−66 36 35.9	10.5−13.0	1.29	52491	259	M
9654*	17444-5843	17 48 53.48	−58 44 43.1	8.4−14.7	1.26	52142	287	M
10851*	18255-1547	18 28 26.77	−15 45 17.5	10.0−10.3	1.45	52755	64	SRA
11632*	–	19 00 35.66	−16 25 22.9	11.8	1.15			Cst?
13567*	21070-4902	21 10 31.25	−48 49 59.2	11.0−12.4	1.42	52761	202	SRA

Notes on individual stars:
NSV 3357: 5′ from BM position
NSV 3611: 6′ from BM position
NSV 4082: See also Wils (2003)
NSV 4314: 8′ from BM position
NSV 4574 = Gliese 358 = LHS2166 = 1RXS J093945.7-410405: Long wave of 0.1 mag amplitude.
NSV 4583 = NSV 4586 = BV 1054. Large variation between cycles.
NSV 4775 = 2RXP J101103.0-574810 ?
NSV 5924: Position from Kato (1999)
NSV 6040: Component of close double, not separated by ASAS3. Fairly large range of magnitude at maximum.
NSV 6160 = V1044 Cen (ZAnd type)
NSV 6453: Component of close double, not separated by ASAS3.
NSV 7190: Position from Morel (1994). The flat bottomed minimum may be an indication for a close companion. There is however no indication of duplicity on NOFS images, nor in the 2MASS survey.
NSV 7500 = TbrV0117 (Tabur, 2003), 6′ from BM position
NSV 9654 = RZ Pav, 8′ from BM position
NSV 10851: 8′ from BM position
NSV 11320 = NSV11324 = BV1449
NSV 11632: 9′ from BM position , no other obvious candidate present.
NSV 12041: Position from Yamaoka (2000). No ASAS3 data available.
NSV 13567 = TbrV0117 (Tabur, 2003), 6′ from BM position
NSV 14283: Position from Demartino et al. (1996)

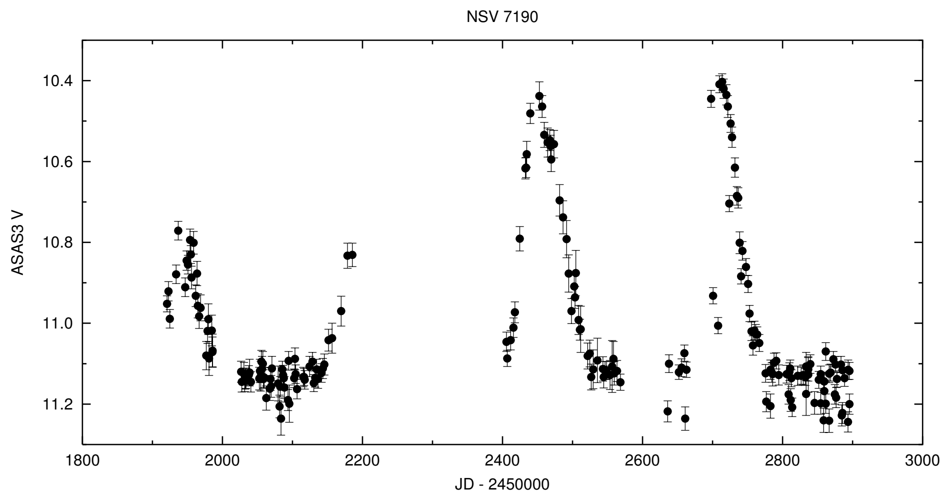

Figure 1. Light curve of NSV 7190 from ASAS3 data (Pojmanski, 2002).

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CONFIRMATION OF VARIABILITY OF FASTT SUSPECTED VARIABLES

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Henden and Stone (1998, 2000) presented two lists of suspected variable stars near the equator. These stars were found as an ancillary project from data obtained by the US Naval Observatory 0.2 m Flagstaff Astrometric Scanning Transit Telescope (FASTT) in support of the Sloan Digital Sky Survey. In the first paper (Henden and Stone, 1998) approximately 1500 newly discovered variables were listed, the second paper (Henden and Stone, 2000) provided 1000 variables (including some stars already on the first list).

In this study we verify the variability of the brighter stars of these lists by data obtained by the ASAS3 survey (Pojmanski, 2002) and the TASS Mk III (Richmond et al., 2000) and Mk IV (Droege, 2003) surveys. All data are publicly available. FASTT stars which are already named in the latest online combined GCVS (Samus and Durlevich, 2003) have not been included. However one exception, FASTT 199 = UV Mon, has been considered because the light curve and the presence of a faint X-ray source suggest it is an EW type eclipsing binary, and not an RR Lyr variable as catalogued in the GCVS.

The confirmed variable stars are presented in Tables 1 and 2. The first column gives the identification of the objects in the FASTT survey. The following columns contain the GSC identification, the position (as given in the original papers), maximum and minimum V magnitude (derived from ASAS3 and TASS), $V - I_c$ colour index (average value from TASS), $J - K_s$ colour index (from the 2MASS survey), an epoch (JD – 2450000) of minimum or maximum (respectively for eclipsing or pulsating stars), the period (in days, found by use of the PDM method, Stellingwerf, 1978) and the type of variability. An asterisk in the first column denotes a remark below the tables. Light curves (ASAS3: filled circles, TASS MkIII: asterisks, TASS MkIV: open squares), links to Simbad and ASAS3 and TASS identifications, are available in the tables of the electronic version of the IBVS.

Table 1. Confirmed variables from the FASTT survey (Henden and Stone, 1998)

Star name		Coordinates (J2000)		V	$V-I_c$	$J-K_s$	Epoch	Period	Type
N°	GSC	RA	Dec	[mag]	[mag]	[mag]	−2400000	[day]	
24	4674-0967	00 57 53.84	−00 46 34.8	11.6−12.0	0.59	0.28	1047.86	0.42829	EW
74	0066-0608	03 54 30.23	+01 24 19.2	11.7−12.0	3.41	1.32	–	2.0740	BY:
103	4709-1250	03 28 09.63	−01 18 05.4	11.9−12.5	0.63	0.31	1920.59	1.06426	EB
150	4734-0713	04 31 27.73	−00 43 52.2	12.2−12.8	0.42	0.25	–	0.31755	EW
196*	0165-0962	07 29 36.97	+01 01 41.2	11.8−12.4	2.94	1.30	–	213	SR
199*	0162-3042	07 02 59.91	+00 37 19.3	12.5−13.3	0.60	0.46	2661.72	0.41568	EW
201	0162-0673	07 05 33.38	+00 30 30.6	13.0−13.6	0.63	0.29	2373.53	0.67772	EW
229	0162-0717	07 04 11.01	+00 03 52.0	12.5−13.0	1.02	0.75	–	9.57	RS
297	4817-0087	07 25 18.95	−00 04 59.7	11.6−11.9	0.55	0.26	2605.93	0.64933	EW
310	4815-1795	07 14 55.55	−00 46 14.2	12.6−13.2	0.80	0.36	1869.79	0.50943	EW
350	4816-2928	07 17 10.24	−01 32 14.5	9.7− 9.9	0.04	−0.01	2776.48	6.013	EA
362*	0180-1251	07 51 08.00	+00 56 34.3	12.4−13.8	3.77	1.35	–	260	SRA
365	0181-0485	07 53 30.39	+01 18 52.5	13.1−13.6	0.46	0.27	2759.58	0.53361	EW
367	0181-1576	07 57 06.26	+01 17 19.8	12.8−13.5	0.67	0.38	2390.49	0.36253	EW
376	0195-0857	08 10 44.72	+01 03 30.3	12.9−13.4	0.82	0.53	–	0.63131	EW
379	0195-0658	08 13 01.35	+01 19 41.2	11.2−11.6	0.43	0.28	2213.80	0.93511	EW
380	0196-1325	08 19 20.18	+01 17 59.1	12.6−13.1	0.87	0.53	2652.73	0.31710	EW
381*	0181-0179	07 55 01.04	+00 23 36.7	10.9−11.3	1.67	1.26	–	182	SR
389	0195-1901	08 14 01.08	+00 22 55.5	13.0−13.5	0.49	0.30	2701.66	0.39539	EW
391	0196-0699	08 18 43.49	+00 28 50.7	11.8−12.4	0.61	0.38	2184.87	0.52829	EW
395	0181-0365	07 52 50.39	+00 14 10.0	12.3−12.6	0.57	0.28	2733.63	0.98383	EW
403	0195-1661	08 10 00.91	+00 10 21.8	12.1−13.0	1.22	0.73	2651.80	2.7253	EB
435	4846-0809	08 01 51.18	−00 33 26.3	13.0−13.6	0.55	0.27	2742.61	0.37709	EW
440	4847-0524	08 12 01.77	−00 32 59.8	11.2−11.5	0.38	0.19	2690.69	0.36299	RRc
449	4848-1493	08 15 39.94	−00 56 41.3	12.3−12.6	0.55	0.31	0872.64	0.88309	EW
452	0244-1292	10 06 24.86	+01 00 11.5	12.4−12.8	0.50	0.20	2697.75	0.42886	EW
491	4903-1476	10 09 37.40	−00 56 28.4	11.5−11.8	0.76	0.47	2615.97	0.36805	EW
498	0263-0256	11 12 16.86	+01 19 05.5	10.9−11.6	0.99	0.58	2740.68	0.31158	EW
599	4966-1341	13 38 48.89	−00 09 54.3	12.6−13.2	0.32	0.26	1919.85	0.71560	EW
648*	0337-0421	15 26 10.68	+00 31 56.4	10.8−12.3	2.10	1.16	–	175	SRA
730*	0367-0313	16 11 32.56	+00 31 10.4	10.8−12.0	2.70	1.21	–	145	SRA
734*	0369-0944	16 23 34.86	+00 24 30.0	11.8−12.2	1.43	0.85	–	0.50285	RS:
754	5032-0544	16 01 05.58	−00 13 07.5	12.4−12.9	2.11	1.18	–	–	SR
802*	5035-0723	16 28 32.93	−01 04 29.2	12.1−12.9	2.56	1.21	–	126	SR
823	0416-0831	17 46 32.64	+01 25 19.7	13.1−13.7	2.20	1.28	–	46	SR:
866*	0430-3101	18 03 28.46	+01 16 30.6	11.4−11.8	3.32	1.30	–	57	SR:
872	0430-0866	18 05 11.48	+01 29 55.6	12.7−13.2	0.65	0.27	2178.51	0.60128	EW
931*	0415-1270	17 43 02.89	+00 05 49.9	12.9−13.6	2.29	1.30	–	116	SR
1005	5096-0943	18 06 57.45	−00 24 55.9	12.8−13.7	2.70	1.36	–	67	SRA
1038	5082-0541	17 52 15.58	−00 38 46.1	11.5−12.2	2.34	1.27	–	309	SRA
1056	5083-1361	17 59 59.22	−00 41 13.7	13.0−13.6	2.03	1.07	–	96	SRA
1096	5082-0862	17 51 30.61	−00 51 51.7	13.3−14.0	2.68	1.31	–	82	SR
1142	5083-0810	17 53 14.90	−01 28 54.2	13.2−13.8	2.00	1.19	–	48	SR
1180*	0462-2402	19 02 39.63	+01 29 13.7	12.7−13.9	0.00	1.89	–	279	SR
1195	0449-0455	18 56 59.13	+00 28 11.7	12.2−12.8	0.85	0.32	2885.61	1.53002	EB
1269	5113-1089	18 40 10.12	−00 47 42.4	11.6−12.2	0.76	0.50	2813.78	0.43580	EW/KW
1380*	5115-0110	18 55 20.62	−01 05 31.6	12.3−13.0	4.01	1.56	–	61	SR
1407	–	19 01 56.26	−01 15 06.5	12.6−13.1	0.83	0.33	2562.55	2.2918	EA
1537	5210-0638	21 46 09.98	−01 06 47.8	12.4−13.1	0.80	0.66	2540.65	0.28514	EW
1545	5210-0437	21 46 48.03	−01 32 44.9	12.5−13.0	0.56	0.21	2854.65	1.07369	EA
1552	0568-1328	22 44 10.12	+00 58 53.8	12.4−13.0	0.90	0.54	2443.82	0.28466	EW
1599	5233-0327	22 39 27.29	−01 36 57.4	12.4−13.0	0.27	0.22	2082.85	0.43035	EW

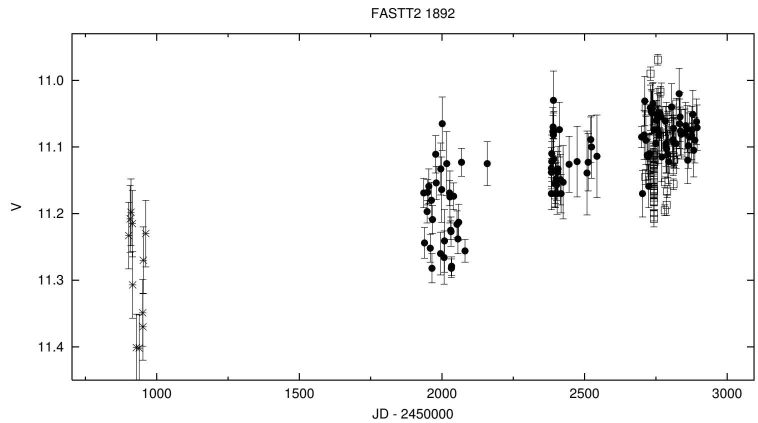

Figure 1. Gradual brightening of FASTT2 1892. Crosses represent TASS MkIII; filled squares TASS MkIV; filled circles ASA3 data.

Table 2. Confirmed variables from the second FASTT survey (Henden and Stone, 2000)

Star name		Coordinates (J2000)		V	$V-I_c$	$J-K_s$	Epoch	Period	Type
N°	GSC	RA	Dec	[mag]	[mag]	[mag]	−2400000	[day]	
102*	4716-0272	03 31 54.25	−01 38 21.5	11.3−11.7	0.25	0.20	2648.61	0.94264	EA
1891	0366-0196	16 05 25.62	+01 30 45.5	12.6−13.1	0.95	0.58	2742.88	0.27546	EW
1892*	0368-0141	16 22 26.32	+00 07 22.5	11.0−11.2	1.02	0.71	–	–	RS:

Notes on individual stars:
FASTT 196 = IRAS07270+0107
FASTT 199 = UV Mon = 2RXP J070300.3+003717: shows a very strong O'Connell effect.
FASTT 362 = IRAS07485+0104
FASTT 381 = IRAS07524+0031
FASTT 648 = NSV 7075: The full amplitude of this star may be larger, so it may be a Mira variable.
FASTT 730 = IRAS16090+0038
FASTT 734: No eclipses are seen.
FASTT 802 = NSV 7750
FASTT 866 = IRAS18009+0116
FASTT 931 = NSV 9569
FASTT 1180 = IRAS19001+0124
FASTT 1380 = IRAS18527-0109
FASTT2 102: The low amplitude secondary minimum may be slightly displaced from phase 0.5
FASTT2 1892 = 1RXS J162226.6+000721: On top of short period variations, this star shows a slow brightening of about 0.3 mag over the last 5 years, reminiscent of the secular variation due to solar type cycles that some RS CVn stars are known for.

Acknowledgements: The TASS and ASAS teams are gratefully acknowledged for providing public access to their archives. This publication makes use of data products from the Two Micron All Sky Survey, which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation. Use has been made as well of the SIMBAD and VizieR databases operated at the *Centre de Données Astronomiques (Strasbourg)* in France.

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ERRATA FOR IBVS 5458

Geert Hoogeveen reported the following errors:

IBVS No.	item	printed	correct
5458	identifier (FASTT 1195)	GSC 0449-0455	GSC 0449-0456
5458	Epoch column header	2400000	2450000

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REVISED [Fe/H] AND RADIAL VELOCITIES FOR 28 DISTANT RR LYRAE STARS

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We discuss 20 RR Lyrae stars found in the Anticenter fields of the Lick Survey (Kinman, Mahaffey and Wirtanen (1982) (KMW) and 8 RR Lyrae variables discovered by Saha (1984). Butler, Kemper, Kraft and Suntzeff (1982)(BKKS) have given abundances for the Lick Survey stars; Saha and Oke (1984)(SO) gave both abundances and radial velocities for 7 of the 8 Saha stars discussed here. We give both abundances and radial velocities for all these stars with improved accuracy and on a common system. Our spectra were obtained in 1983 with the intensified image dissector scanner (IIDS) attached to the Gold spectrograph on the KPNO 2.1-m telescope. For calibration we observed 18 brighter RR Lyrae stars for which Suntzeff, Kinman & Kraft (1991) (SKK) have given the Preston ΔS (Preston, 1959) and [Fe/H] on the Zinn-West system. The phases (ϕ) for the program stars were computed using the ephemerides of KMW and Saha (1984). The ephemerides for the brighter RR Lyrae stars were taken from the GCVS (`http://www.sai.msu.su/groups/cluster/gcvs`) and supplemented by those given in the Hipparcos Catalogue (Vol. 11) (1997) and by ephemerides derived from unpublished photometry by Kinman.

The abundances were determined by measuring the equivalent widths of the Ca II K-line, and the Balmer lines H_γ and H_δ. The Preston index ΔS was determined from these equivalent widths on a plot of the K-line equivalent width against the mean of the Balmer equivalent widths on which a grid of ΔS curves was superposed (see SO, Fig. 3). The grid was calibrated by using the 18 RR Lyrae stars whose ΔS is known from SKK. The ΔS for the program stars were then converted to [Fe/H] using the formula given by SKK (Eqn. 3). This formalism strictly applies only to the type *ab* RR Lyrae stars. We also applied it to the type *c* variables because our single calibrating star of type *c* (T Sex) showed no difference from those of type *ab* on the calibrating plot. The results are given in Table 1. The mean ΔS quoted from BKKS omits the spectra which they took on the rising branch; the number of their spectra (N) in col. (6) are only those in the range $0.00 \leq \phi \leq 0.85$. [Fe/H] was derived from their ΔS using the conversion of SKK. In the case of our data, we only derived ΔS from spectra whose ϕ was in the range 0.40 to 0.85 (i.e. near minimum) and (unlike BKKS) no phase correction was applied to our ΔS. The quality of our spectra and those of BKKH is similar, so our adopted [Fe/H] is the mean of our new [Fe/H] and those from BKKH data weighted by N the number of spectra. We adopted the [Fe/H] from our new data alone for the remaining stars.

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Table 1. Abundances of the RR Lyrae Variables.

Identification				Previous Data			New Data			
GCVS[1]	KMW[2]	Saha[3]	RR Type	ΔS Source	N	[Fe/H] Source	ΔS[4]	N	[Fe/H]	Adopted [Fe/H]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
LV And	01	···	ab	6.8(a)	3	−1.48(c)	7.7	3	−1.62	−1.55
MP And	12	···	ab	6.8(a)	2	−1.48(c)	8.0	2	−1.67	−1.57
MR And	14	···	c	5.6(a)	3	−1.29(c)	5.2	2	−1.23	−1.26
MU And	18	···	ab	7.2(aA)	4	−1.55(c)	7.7	2	−1.62	−1.57
MV And	20	···	ab	8.2(a)	3	−1.70(c)	9.3	3	−1.88	−1.78
DU And	21	···	ab	11.0(aA)	2	−2.15(c)	10.6	2	−2.08	−2.11
MX And	23	···	ab	7.6(aA)	2	−1.61(c)	6.4	2	−1.42	−1.50
MY And	24	···	ab	5.2(a)	3	−1.23(c)	6.7	2	−1.47	−1.32
VX Lyn	34	II v104	ab	7.4(a)	2	−1.58(c)	(8.0)	0	···	−1.58
VY Lyn	35	···	c	7.8(a)	3	−1.64(c)	6.0	1	−1.36	−1.57
VZ Lyn	36	···	c	6.8(a)	1	−1.48(c)	6.9	1	−1.50	−1.48
WX Lyn	38	II v208	ab	9.6:(a)	1	−1.92:(c)	7.0	1	−1.51	−1.72
YY Lyn	44	···	c	9.6(a)	1	−1.92(c)	9.0	1	−1.83	−1.87
ZZ Lyn	46	III v201	ab	6.4(a)	2	−1.42(c)	(5.8)	0	···	−1.42
RW Lyn	48	···	ab	7.1(a)	3	−1.53(c)	(7.4)	0	···	−1.53
AC Lyn	50	III v204	ab	6.2(aA)	2	−1.39(c)	7.8	2	−1.64	−1.50
AD Lyn	52	···	c	6.6(a)	1	−1.45(c)	6.7	1	−1.47	−1.46
AF Lyn	55	···	ab	7.0(a)	3	−1.51(c)	8.3	1	−1.72	−1.56
AK Lyn	60	···	ab	7.8(aA)	1	−1.64(c)	6.9	1	−1.50	−1.56
AL Lyn	61	···	ab	9.9(aA)	1	−1.97(c)	9.0	1	−1.83	−1.90
KO Peg	···	IV v103	ab	9.4(b)	1	−1.7 (b)	10.9	1	−2.13	−2.13
KM Peg	···	IV v104	ab	7.7(b)	1	−1.5 (b)	6.0	1	−1.36	−1.35
KL Peg	···	IV v106	ab	4.9(b)	1	−1.0 (b)	6.1	1	−1.37	−1.36
KN Peg	···	IV v107	ab	7.7(b)	1	−1.5 (b)	7.5	1	−1.59	−1.59
NO And	···	IV v108	c	···	···	···	8.0	1	−1.67	−1.67
NN And	···	IV v201	ab	8.8(b)	1	−1.6 (b)	6.0	2	−1.36	−1.35
NQ And	···	IV v301	ab	8.6(b)	1	−1.6 (b)	6.2	1	−1.39	−1.38
IQ Peg	···	IV v401	ab	6.9(b)	1	−1.3 (b)	7.0	1	−1.51	−1.51

[1] GCVS (http://www.sai.msu.su/groups/cluster/gcvs)
[2] Kinman, Mahaffey and Wirtanen (1982) (KMW)
[3] Saha (1984)
[4] Parentheses indicate ΔS derived from observations not at minimum light
Sources of Data:
(a) Butler, et al. (1982) (BKKS); (aA) adjusted from BKKS (see text)
(b) Saha and Oke (1984)
(c) Derived from ΔS using equation (3) in Suntzeff et al. (1991) (SKK)

The mean difference between the adjusted mean values of ΔS from BKKS and our new values is $+0.03\pm0.03$. The corresponding difference between the estimates of [Fe/H] is -0.00 ± 0.05.

Radial velocities were determined from the IIDS spectra by a Fourier method (Pier, 1983) in which the program spectra are cross correlated with that of a star of known velocity; the velocity in this case is defined by both the Balmer and weak metal lines. The velocity was also derived from the three strong lines (H_γ, H_δ and the Ca II K-line) and weights of 2, 1 and 0 were given if the σ_{rms} of a single line was < 40 km s^{-1}, between 40 and 70 km s^{-1} or >70 km s^{-1} respectively.

The γ-velocity was derived for type *ab* stars using the recipe given by Liu (1991). For type *c* stars, we scaled the velocity curve of T Sex by the relative V-amplitudes and got

Table 2. Radial Velocities of the RR Lyrae Variables.

Variable	RR Type	Saha & Oke (1984) Rad. Vel. km s^{-1}	N[1]	IIDS Spectra Rad. Vel.[2] km s^{-1}	Wt[3]	Rad.Vel.[4] km s^{-1}	Wt[3]	Adopted Rad. Vel. km s^{-1}
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
LV And	ab	···	···	−028.1	8	−038.4	4	−031.5
MP And	ab	···	···	−102.6	4	−104.1	4	−103.4
MR And	c	···	···	−081.7	4	−079.6	4	−080.6
MU And	ab	···	···	−099.6	4	−091.7	4	−095.6
MV And	ab	···	···	−066.1	8	−068.2	8	−067.2
DU And	ab	···	···	−343.0	4	−362.3	3	−351.3
MX And	ab	···	···	···	···	−187.8	2	−187.8
MY And	ab	···	···	−138.8	4	−130.3	4	−134.6
VX Lyn	ab	+48±23	1	−024.9	4	+027.5	4	+001.3
VY Lyn	c	···	···	+103.9	2	+125.1	2	+114.5
VZ Lyn	c	···	···	−167.4	2	−196.8	2	−182.1
WX Lyn	ab	+2±20	2	+020.2	4	+034.4	3	+026.3
YY And	c	···	···	−082.3	4	−103.9	4	−093.1
ZZ Lyn	ab	+255±54	1	+157.0	2	+137.5	2	+147.2
RW Lyn	ab	···	···	−140.7	4	−158.9	4	−149.8
AC Lyn	ab	···	···	−022.5	4	−029.0	4	−025.8
AD Lyn	c	···	···	+124.0	2	+123.2	2	+123.6
AF Lyn	ab	···	···	−108.0	2	−149.0	1	−121.7
AK Lyn	ab	···	···	+234.8	2	+243.1	1	−237.6
AL Lyn	ab	···	···	−058.0	4	−073.6	4	−065.8
KO Peg	ab	−272±25	1	−342.9	2	−331.1	2	−335.0
KM Peg	ab	−164±25	1	−230.1	2	−235.7	2	−233.8
KL Peg	ab	−342±35	1	−393.8	2	−376.9	2	−382.5
KN Peg	ab	−74±36	1	−194.9	2	−199.4	1	−196.4
NO And	c	···	···	−079.7	2	−064.2	1	−074.5
NN And	ab	−276±24	1	−293.5	4	−305.0	3	−298.4
NQ And	ab	−235±29	1	−247.7	2	−240.5	2	−242.9
IQ Peg	ab	−207±34	1	−203.5	2	−203.9	2	−20-3.7

Notes:
[1] No. of spectra [3] Weight as described in text
[2] Derived by Fourier method. [4] Derived from H_γ, H_δ and the Ca II K-line.

a correction from that. For the type *ab* variable SU Dra, the velocity amplitude of H_γ is about 100 km s^{-1} compared with 60 km s^{-1} for the weaker metal lines (Oke, Giver & Searle, 1962). The use of the Liu-correction could therefore produce systematic effects in the difference (D) between the velocity based on the strong lines and that based on the weaker lines: D should be positive just before phase zero and negative just after. We did not observe this and conclude that the effect is too small to affect our results. The mean difference $\langle D \rangle$ is -3.7 ± 4.9 km s^{-1} so there is no systematic difference between the two methods. The rms value of D for each star is 21 km s^{-1}; on average therefore, these adopted velocities have an error of about ±15 km s^{-1}.

In Table 3 we give the most recent coordinates for these variables. These have been taken from the USNO-B1.0 Catalog (Monet et al., 2003) and checked against the original finding charts using the Digital Sky Survey (`http://cadcwww.dao.nrc.ca/dss/`).

Table 3. Coordinates of the RR Lyrae Variables.

Variable	⟨V⟩ (mag.)	J2000 R.A.	J2000 Dec.	Variable	⟨V⟩ (mag.)	J2000 R.A.	J2000 Dec.
LV And	15.44	02 19 26.39	+41 45 57	RW Lyn	12.91	07 50 39.18	+38 27 15
MP And	16.13	02 24 13.74	+41 19 47	AC Lyn	16.38	07 54 42.16	+38 54 21
MR And	15.56	02 25 27.81	+40 57 26	AD Lyn	15.85	07 56 22.99	+39 22 59
MU And	16.00	02 29 26.44	+39 31 45	AF Lyn	16.12	08 35 57.43	+41 01 11
MV And	15.99	02 30 12.29	+40 53 15	AK Lyn	16.00	08 45 55.10	+39 14 55
DU And	13.59	02 30 31.33	+40 50 34	AL Lyn	16.52	08 49 13.07	+38 49 31
MX And	17.18	02 32 03.09	+42 08 31	KO Peg	16.03	00 02 15.33	+30 04 37
MY And	15.56	02 32 09.47	+43 04 47	KM Peg	17.67	23 55 45.11	+29 09 52
VX Lyn	17.01	07 31 51.83	+39 07 48	KL Peg	16.85	23 46 57.08	+29 51 02
VY Lyn[1]	15.75	07 32 26.04	+38 50 07	KN Peg	17.44	23 56 46.56	+31 40 23
VZ Lyn	16.20	07 32 40.75	+41 37 39	NO And	16.54	00 06 58.32	+32 02 07
WX Lyn	16.84	07 35 38.47	+39 15 27	NN And	16.68	00 06 55.84	+31 28 13
YY Lyn	14.98	07 45 30.07	+37 22 59	NQ And	16.31	00 11 32.68	+30 51 41
ZZ Lyn	15.80	07 50 21.77	+37 42 00	IQ Peg	16.11	00 06 05.68	+29 19 13

Notes:
[1] The catalog lists two stars of similar brightness close to this position. The DSS only shows one star.

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STRÖMGREN PHOTOMETRY OF THE BE STAR θ CrB: VARIABLE AGAIN IN 2003

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The Be star θ Coronae Borealis (= HR 5778 = HD 138749) has experienced periods of both activity and inactivity (see, e.g., Percy et al., 1988 and Percy & Attard, 1992). Fabregat & Adelman (1998), Adelman (1999), Percy & Bakos (2001), and Adelman (2002) presented photometry of this star from 1994 to 2002 at which time neither short term periodic variability with an amplitude $\geq$ 0.005 mag. nor long term variations $\geq$ 0.01 mag. were seen. Further in this period the Hipparcos observations of θ CrB show no evidence of short-term variability (Percy et al., 2002). Guerrero et al.'s (1992) observations obtained in 1989 show that this star was then in an active phase. But no data taken between 1990 and 1993 has appeared yet in the literature. Rivinius, Stefl, Stahl, & Baade (2003) recently reported that their spectroscopic observations of θ CrB indicate that it has become active again. Photometry reported in this contribution confirms this conclusion. Harmanec (1983) suggested that θ CrB might be a long period spectroscopic binary based on 19 published radial velocity measurements during the period 1904-1979. McAlister and his associates have obtained speckle observations of this star (e.g., McAlister et al., 1993).

The Four College Automated Photometric Telescope (FCAPT) began its 2002-03 observing season in February 2003 as its photometer had to be replaced. Sixty sets of u, v, b, and y measures were obtained. The observing sequences and the comparison (HD 136849 = 50 Boo) and check (HD 135502 = 48 χ Boo) stars were the same as in Adelman (1999), namely after obtaining the dark count, the telescope measures in each filter the sky-ch-c-v-c-v-c-v-c-ch-sky where sky is a reading of the sky, ch of the check star, c of the comparison star, and v of the variable star. The new photometer uses four new neutral density filters differing by 1.25 magnitudes while the old photometer used 2.5 magnitude neutral density filters. This photometry has a 1.25 mag neutral density filter difference between the variable and the comparison and check stars while previous values had a 2.5 mag neutral density difference. The c-ch values have not changed. For 2003, the standard deviations of the c-ch values are 0.006, 0.005, 0.006, and 0.006 mag. for u, v, b, and y, respectively, while the standard deviations of the respective v-c values are 0.011, 0.010, 0.010, and 0.010 mag. which indicate variability.

The differential photometry in the instrumental system is available at the IBVS website as `5460-t1.txt`. Figure 1 shows the u and the v photometry plotted against the date of observation; the left panel shows u(v-c) values (solid squares) as well as the ch-c values (x's) to which -0.20 has been added and the right panel the v(v-c) values (solid circles) as well as the ch-c values (plus signs) to which −0.06 mag. has been added. The v-c plots for b and y look similar to those for u and v. The u and the v data were examined with the Scargle periodogram (Scargle, 1982; Horn & Baliunas, 1986) and no frequencies in the range 0 to 10 cycles per day showed a power S/N for 1% significance. Given that for u the ch-c scatter is slightly less than the v-c scatter from HJD 2452700 to about HJD 2452800, at best θ CrB was then marginally variable in this filter. At this time the v(v-c) values are more suggestive of variability. However, beginning at HJD 2452800 in early June 2003 there was some sort of absorption event in both u and v (as well as in b and y). This is well after the event described by Rivinius et al. (2003) near JD 2452725. The photometry obtained at HJD 2452720.87 indicates the star was fainter then. But values taken the next two nights do not. It is unfortunate that simultaneous photometry is not available to add additional information about this event.

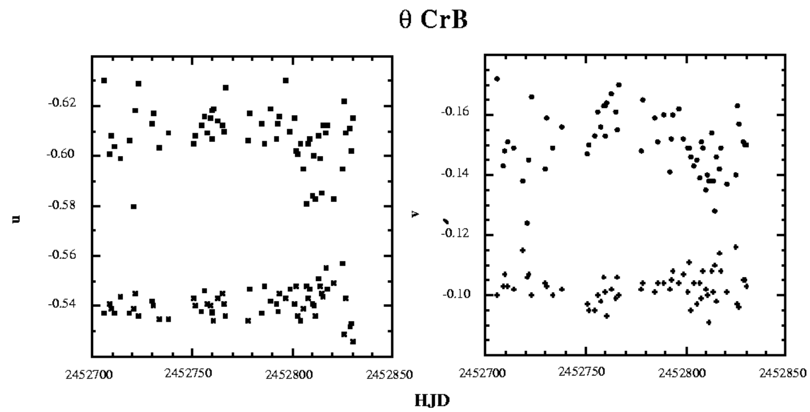

Figure 1.

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DISCOVERY OF TWO NEW DWARF NOVAE IN CEPHEUS AND CYGNUS

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Name of the object:
Var 75 Cep

Equatorial coordinates:	**Equinox:**
R.A.= $20^h46^m38\overset{s}{.}66$ **DEC.=** $+60°38'03\overset{''}{.}6$	2000

Observatory and telescope:
Crimean and Sonneberg 40-cm astrographs

Detector:	Photoplate

Filter(s):	None

Comparison star(s):	α (J2000)	δ (J2000)	B_{pg}
	$20^h46^m37\overset{s}{.}4$	$+60°37'34''$	$14\overset{m}{.}59$
	$20^h46^m47\overset{s}{.}4$	$+60°39'40''$	$15\overset{m}{.}25$
	$20^h46^m14\overset{s}{.}7$	$+60°39'23''$	$15\overset{m}{.}40$
	$20^h46^m31\overset{s}{.}7$	$+60°39'41''$	$15\overset{m}{.}78$
	$20^h46^m14\overset{s}{.}5$	$+60°39'00''$	$15\overset{m}{.}99$
	$20^h46^m24\overset{s}{.}4$	$+60°38'49''$	$16\overset{m}{.}20$
	$20^h46^m13\overset{s}{.}5$	$+60°39'53''$	$16\overset{m}{.}87$
	$20^h46^m36\overset{s}{.}6$	$+60°38'12''$	$16\overset{m}{.}90$
	$20^h46^m43\overset{s}{.}5$	$+60°37'46''$	$17\overset{m}{.}2$
	$20^h46^m28\overset{s}{.}4$	$+60°38'54''$	$17\overset{m}{.}3$
	$20^h46^m29\overset{s}{.}8$	$+60°39'00''$	$17\overset{m}{.}5$

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	Calibrated using the blue magnitudes of neighboring stars from the USNO-A2.0 catalogue (Monet *et al.*, 1998)

Date(s) of the observation(s):
1939–1993

Availability of the data:
Upon request

Type of variability:	UG

Remarks:

The variability of Var 75 Cep was discovered by one of the authors (S.V.A.) on plates of the Moscow archive. The star was in outburst on two plates only, which is not sufficient to classify the new variable definitively. One more brightening was found in our further study of Var 75 Cep on Sonneberg archive plates. Both the blue color in minimum brightness on Palomar prints (and in USNO-A2.0 catalogue) and the two outbursts that were found on archive plates permit us to consider Var 75 Cep as a new UG-type variable. The magnitudes of Var75 in minimum brightness in the USNO-A2.0 catalogue are b=17$^{\rm m}_{.}$6 and r=18$^{\rm m}_{.}$1. The outbursts on Sonneberg (S) and Moscow (M) plates:

#1	2445942.457	15.28	S	#2	47823.342	< 15.99	S
	2445942.471	15.32	S		47830.350	15.52	M
					47836.206	15.78	M

As a by-product of the study, we investigated FK Cep (S 7924) – a known eclipsing variable close in coordinates to Var 75 Cep – on the same plates (219 Sonneberg and Moscow plates taken on JD 2429376–49252) with the same comparison stars. The star was discovered by Hoffmeister (1963). But no light elements were published to the present. We found variations between the photographic magnitudes 15.8 and 16.9 with the following light elements:

$$\mathrm{JD_{min}} = 2448484.454 + 2^{\rm d}_{.}39055 \times E.$$

The phased light curve is shown in Fig. 1.

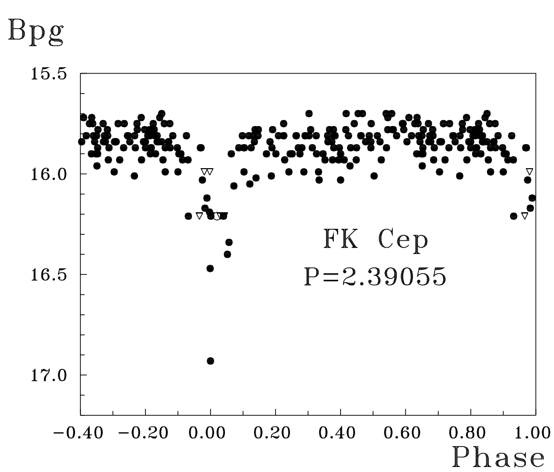

Figure 1. FK Cep. The phased light curve. Open triangles: brighter limits.

Name of the object:
Var 76 Cyg

Equatorial coordinates:	**Equinox:**
R.A.= $22^h02^m41^s.84$ **DEC.=** $+46°39'06''.9$	2000

Observatory and telescope:
Crimean and Sonneberg 40-cm astrographs

Detector:	Photoplate

Filter(s):	None

Comparison star(s):

α (J2000)	δ (J2000)	B_{pg}
$22^h02^m40^s.5$	$+46°40'25''$	$15^m.39$
$22^h02^m42^s.2$	$+46°39'32''$	$15^m.71$
$22^h02^m47^s.2$	$+46°39'47''$	$16^m.24$
$22^h02^m46^s.7$	$+46°39'20''$	$16^m.61$
$22^h02^m40^s.4$	$+46°39'19''$	$17^m.3$
$22^h02^m38^s.7$	$+46°39'06''$	$17^m.8$

Transformed to a standard system:	$B_{\rm pg}$
Standard stars (field) used:	Calibrated using the photoelectric standard sequence in NGC 7209 (Hoag *et al.*, 1961)

Date(s) of the observation(s):
1950–1994

Availability of the data:
Upon request

Type of variability:	UG

Remarks:

The new variable star was discovered by one of the authors (S.V.A.) on the plates of Moscow collection. Subsequently we estimated Var 76 Cyg by eye on 587 plates taken with Sonneberg and Crimean 40-cm astrographs for the interval JD24433483–49634. A total of seven outbursts have been revealed. The range of variability is $15\overset{\rm m}{.}7$–$<17\overset{\rm m}{.}8$. Note that the new variable star is not present in minimum brightness on the POSS I and II plates. So, the photographic magnitude of Var 76 Cyg in minimum is fainter than $21\overset{\rm m}{.}0$. The accurate position of the dwarf nova was derived from one of the Moscow plates (in outburst) relative to 10 neighboring stars, their coordinates taken from the USNO-B1.0 catalogue (Monet et al., 2003). The long duration of one of the outbursts (#3, see below) – more than 11 days – permit us to consider Var 76 as a candidate to UGSU-subtype variables. The outbursts on Sonneberg (S) and Moscow (M) plates (JD24...):

#1	40145.387	< 16.6	M	#4	44167.292	< 16.6	S
	40153.415	16.43	M		44173.320	15.82	S
	40156.409	16.39	M		44173.333	15.68	S
					44173.347	15.76	S
#2	41177.479	16.70	M		44173.361	15.82	S
	41182.461	< 16.6	S		44173.375	15.87	S
					44173.389	15.71	S
#3	42286.409	< 17.3	M		44174.412	16.03:	S
	42300.333	15.82	M				
	42301.368	15.82	M	#5	45583.479	16.50	S
	42302.417	15.76	M		45583.504	16.19	S
	42303.377	15.92	M		45585.466	16.28	S
	42305.298	16.03	M				
	42308.447	16.21	M	#6	46706.426	16.31	S
	42309.411	16.43	M		46708.408	< 17.3	S
	42310.401	16.61	M				
	42311.466	16.61	S	#7	47421.366	16.68	M
	42311.530	16.50	S				
	42313.333	< 16.6	M				

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PHOTOELECTRIC MINIMUM TIMES OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
40-cm Cassegrain telescope of the TÜBİTAK† National Observatory and 30-cm Maksutov telescope of the Ankara University Observatory.

Detector:	OPTEC SSP-5A photometer 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:
Kwee & van Woerden (1956).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
V436 Per	EA/D	01 51 59	+55 08 50	HD 12303	43562.859	25.935872	2
TT Aur	EB/DM	05 09 42	+39 35 11	HD 32989	48599.2964	1.332735	3
V459 Aur	EB	06 35 38	+32 34 36	HIP 31104	48500.827	1.062637	1
CI CVn	EB	13 13 33	+47 47 53	SAO 44619	48500.518	0.815877	1
YY CrB	EW	15 50 32	+37 50 08	HIP 77624	51674.3541	0.37656417	4
V994 Her	EA	18 27 46	+24 41 51	HIP 91568	48501.1239	2.08309	1
V478 Cyg	EA/DM	20 19 39	+38 20 09	HD 228807	44777.4779	2.880795	5
V401 Lac	EA	22 08 21	+49 13 16	HIP 109818	48501.790	1.9501	1
CO Lac	EA	22 46 30	+56 49 31	GSC 03992 02252	27534.0728	1.5422075	6
V821 Cas	EA	23 58 49	+53 40 20	HD 224814	48500.4459	1.76975	1

Source(s) of the ephemeris:
1.: Perryman et al. (1997); 2.: Harmanec et al. (1997); 3.: Simon (1999); 4.: Demircan et al. (2003); 5.: Sezer et al. (1983); 6.: Semeniuk (1967).

†TÜBİTAK : The Scientific and Technical Research Council of Turkey

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V436 Per	51058.3491	0.0001	I	*UBV*	0.0231	HA
TT Aur	52212.3446	0.0001	I	*UBV*	0.0036	NF, HA
	52541.5319	0.0001	I	*UBV*	0.0054	HA, EA
	52569.5185	0.0001	I	*UBV*	0.0046	AB, GS
V459 Aur	52583.4813	0.0003	I	*UBV*	0.0029	NF, AB
CI CVn	52373.4751	0.0001	I	*UBV*	−0.0111	HA, NF
	52737.3553	0.0002	I	*UBV*	−0.0120	HA, NF
	52765.5042	0.0002	II	*UBV*	−0.0108	NF, AB
YY CrB	52786.3493	0.0002	I	*UBV*	0.0017	HA, SS
	52793.5031	0.0002	I	*UBV*	0.0008	NF, SS
	52814.3996	0.0003	II	*UBV*	−0.0020	NF, EA
V994 Her	52451.4363	0.0004	I	*UBV*	−0.0572	NF, HA
V478 Cyg	52145.4006	0.0008	II	*UBV*	0.2895	HA, NF
	52155.4588	0.0008	I	*UBV*	0.2649	HA, NF
V401 Lac	52891.5075	0.0003	I	*UBV*	0.0424	EA, NF
	52898.4022	0.0007	II	*UBV*	0.1117	EA, HA
CO Lac	51107.4978	0.0005	II	*UBV*	0.0123	HA
	51108.2418	0.0004	I	*UBV*	−0.0149	HA
V821 Cas	52597.4220	0.0001	I	*UBV*	0.0048	NF, HA

Explanation of the remarks in the table:

Observers: HA: Hasan AK, NF: Nurten FİLİZ, EA: Erkan ATAMAN, AB: Akın BALKIŞ, GS: Gonca SALMAN, SS: Semih SEZGİN

Acknowledgements:

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PHOTOELECTRIC MINIMA OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:

30-cm Maksutov telescope of the Ankara University Observatory (ANK) and 40-cm Cassegrain telescope of the TÜBİTAK† National Observatory (TUG).

Detector:	OPTEC SSP-5A photometer containing a side-on R1414 Hamamatsu photomultiplier at ANK and R4457 Hamamatsu photomultiplier at TUG.

Method of data reduction:

Reduction of the observations were made in the usual way (Hardie, 1962).

Method of minimum determination:

Times of minima were determined by the method of Kwee and van Woerden (1956).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
V346 Aql	EA	20 09 59	+10 20 49	SAO 105777	41918.3840	1.106363	1
BW Boo	EA	14 37 05	+35 54 52	GSC 2560-0297	40362.9026	3.332821	1
BO CVn	EW	13 59 08	+40 49 09	SAO 044840	46895.4483	0.517462	2
CV Cyg	EW	19 54 21	+38 02 50	GSC 3137-0121	24454.4160	0.983431	3
AR Dra	EA	12 16 37	+64 52 45	GSC 4158-1275	42868.9114	0.675838	1
SV Equ	EW	20 57 19	+05 48 52	GSC 0525-1019	50324.0880	0.880972	4
AQ Psc	EW	01 21 03	+07 36 23	BD +06°0197	44562.4691	0.475640	5
EQ Tau	EW	03 48 13	+22 19 24	GSC 1260-0575	52230.1309	0.341347	6
V Tri	EB	01 31 47	+30 21 58	GSC 2293-1224	48573.6604	0.585206	7
GR Vir	EW	14 45 20	−06 44 04	GSC 4998-0877	45665.6415	0.346979	8
BS Vul	EB	19 37 27	+21 55 50	GSC 1614-0029	43271.5780	0.475971	1

Source(s) of the ephemeris:

1.: Kholopov et al., 1985; 2.: Albayrak et al., 2001; 3.: Hegedüs, 1991; 4.: Rucinski and Lu, 1999; 5.: Sarma and Radhakrishnan, 1982; 6.: Yang and Liu, 2002; 7.: Kreiner et al., 2001; 8.: Cereda et al., 1988

†TÜBİTAK : The Scientific and Technical Research Council of Turkey

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V346 Aql	52486.3536	0.0002	I	*BVR*	−0.0098	TÖ/TUG
BW Boo	52054.4301	0.0019	I	BV	−0.0086	ZM/ANK
	52454.3711	0.0008	I	UBV	−0.0061	ET/ANK
BO CVn	52740.4401	0.0011	II	UBV	+0.0034	ZM/ANK
CV Cyg	52838.4722	0.0023	I	*UBV*	+0.2765	ET/ANK
	52845.3675	0.0019	I	*UBV*	+0.2877	TT/ANK
	52859.3702	0.0023	II	*UBV*	+0.0307	ET/ANK
	52871.4231	0.0014	I	*UBV*	−0.2093	ZM/ANK
AR Dra	52340.4553	0.0016	II	*BV*	+0.0193	ZM/TUG
	52341.4594	0.0002	I	*UBV*	+0.0096	ZM/TUG
SV Equ	52109.3781	0.0032	II	*BV*	+0.0003	TÖ/TUG
	52489.5202	0.0027	I	*BV*	+0.0030	BG/TUG
AQ Psc	52189.5488	0.0016	I	*BVR*	+0.1923	ZM/TUG
	52194.5459	0.0012	II	*BV*	+0.1952	ET/ANK
EQ Tau	52592.3005	0.0010	I	*BV*	+0.0003	ZM/TUG
	52592.4722	0.0006	II	*BV*	+0.0013	ZM/TUG
	52593.3250	0.0004	I	*BV*	+0.0007	ZM/TUG
V Tri	52190.5292	0.0026	II	*BVR*	+0.0050	ZM/TUG
	52201.3504	0.0005	I	*BV*	−0.0002	BG/ANK
	52485.4720	0.0024	II	*BVR*	+0.0041	TÖ/TUG
	52490.4437	0.0003	I	*BVR*	+0.0015	BG/TUG
GR Vir	52761.3401	0.0008	II	*BV*	+0.1556	ET/ANK
	52761.5185	0.0011	I	*BV*	+0.1606	ET/ANK
	52782.4280	0.0025	II	*BV*	+0.0778	FK/ANK
	52796.3861	0.0006	II	*BV*	+0.1567	ET/ANK
	52824.3191	0.0006	I	*BV*	+0.1580	İÖ/ANK
BS Vul	52803.3674	0.0011	I	*UBV*	−0.0153	TT/ANK
	52817.4134	0.0018	II	*UBV*	−0.0104	İÖ/ANK
	52831.4485	0.0005	I	*UBV*	−0.0165	FK/ANK

Explanation of the remarks in the table:

Observer(s)/Instrument: TÖ: Özdemir, T.; ZM: Müyesseroğlu, Z.; ET: Törün, E.; TT: Tunç, T.; FK: Kaya, F.; İÖ: Özavcı, İ. / ANK: Ankara University Observatory; TUG: TÜBİTAK National Observatory

Acknowledgements:

The authors would like to thank the *TÜBİTAK National Observatory (TUG)* for the observing time.

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NEW TIMES OF MINIMA OF SOME SELECTED ECLIPSING BINARY SYSTEMS

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Ulupinar Astrophysics Observatory, Çanakkale Onsekiz Mart University, TR-17100, Çanakkale, Turkey, e-mail: bakisv@comu.edu.tr

Observatory and telescope:
40-cm f/10 Meade Cassegrain-Schmidt telescope of the Çanakkale Onsekiz Mart University Ulupinar Astrophysics Observatory 30-cm f/3.3 Meade Cassegrain-Schmidt telescope of the Çanakkale Onsekiz Mart University Ulupinar Astrophysics Observatory

Method of data reduction:
Reduction of the CCD frames was made with `MUNIPACK`[1] software, and reduction of photoelectric observations was made by `ATMEX`[2] software.

Method of minimum determination:
Kwee – van Woerden method (Kwee & van Voerden, 1952), and in some cases, depending on the nature of the data set, several procedures written by A. Gaspani (1995) based on artificial neural networks were used.

[1]Hroch, F., Novák, R., 1997, MUNIPACK, `http://munipack.astronomy.cz/`
[2]Keskin, V., 2001, ATMEX, `http://astronomy.sci.ege.edu.tr/~keskinv/Software.html`

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
OO Aql	EW	19 48 13	+09 18 32	GSC 1058:0409	39322.6916	0.50679190	1
V803 Aql	EW	19 00 46	−07 29 13	GSC 5140:0670	47684.8169	0.26342538	1
UW Boo	EA	14 20 59	+47 06 43	GSC 3472:0434	42404.7175	1.00471105	1
XY Boo	EW	13 49 10	+20 11 06	GSC 1466:0088	39953.6892	0.37055392	1
AC Boo	EW	14 56 28	+46 21 44	GSC 3474:0835	47641.5860	0.35243123	1
CV Boo	EA	14 35 03	+09 06 54	GSC 2570:0869	38883.4540	0.84699280	1
EF Boo	EW	21 58 33	+60 56 53	GSC 3479:0714	48500.3016	0.42051309	5
Y Cam	EA	07 41 11	+76 04 28	GSC 4527:1983	42962.0840	3.30554500	1
AB Cas	EA	02 37 32	+71 18 13	GSC 4320:0413	46849.2820	1.36687530	1
V821 Cas	EA	23 58 49	+53 40 20	GSC 4001:1839	51767.4106	1.76975340	7
EG Cep	EB	20 15 57	+76 48 36	GSC 4585:0165	45580.5580	0.54462152	1
GS Cep	EB	22 51 29	+57 00 20	GSC 3992:1648	47414.4350	1.47162500	6
V456 Cyg	EA	19 27 12	+28 56 50	GSC 3152:0097	29098.9145	0.89119355	1
V478 Cyg	EA	20 19 39	+38 20 09	GSC 3151:2338	44777.4835	2.88090320	1
V836 Cyg	EB	21 21 24	+35 44 11	GSC 2715:2996	44853.4914	0.65341148	1
V859 Cyg	EW	19 27 12	+28 56 50	GSC 2137:0260	34629.4119	0.40499999	1
Z Dra	EA	12 40 14	+66 17 08	GSC 4396:0455	43499.7300	1.35743190	1
RZ Dra	EB	18 23 06	+58 54 13	GSC 3916:1825	44177.5609	0.55087616	1
TZ Dra	EA	18 22 12	+47 34 05	GSC 3529:0778	33852.3331	0.86603452	1
AX Dra	EB	12 40 14	+66 17 08	GSC 4168:0342	26767.6886	0.56816285	1
FU Dra	EW	12 40 14	+66 17 08	GSC 4181:1726	50866.2770	0.30671686	2
SZ Her	EA	03 09 53	−06 53 50	GSC 2610:0821	34987.3959	0.81809569	1
EM Lac	EW	22 23 55	+54 01 07	GSC 3982:1143	38259.5490	0.38913405	1
PY Lyr	EW	19 20 26	+28 56 46	GSC 2136:1627	34980.4372	0.38576273	1
NN Mon	EA	06 50 11	+33 14 21	GSC 4816:2738	30131.2530	0.91233900	4
U Peg	EW	23 57 59	+15 57 13	GSC 1722:0413	50000.0227	0.37478124	3
AT Peg	EA	22 13 23	+08 25 32	GSC 1137:0492	45640.4590	1.14609013	1
BB Peg	EW	22 22 56	+16 19 59	GSC 1682:1530	43764.3416	0.36150147	1
BN Peg	EA	21 28 02	+05 00 12	GSC 0537:0590	33896.3700	0.71329807	1
V432 Per	EW	03 10 10	+42 51 21	GSC 2855:0199	48601.3776	0.38330910	1
AG Vir	EW	11 05 05	+05 09 06	GSC 0871:0261	33387.8656	0.64265009	1

Source(s) of the ephemeris:

1. Kreiner et al., 2001
2. Vanko, M., et al., 2001.
3. Pribulla, T.; Vanko, M., 2002.
4. Kholopov et al., 1985.
5. Özdemir, et al., 2001.
6. Hanzl, D., 1991.
7. Değirmenci, Ö. L., 2003.

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
OO Aql	52780.5145	2	I	–	−0.0360	ccd
	52781.5316	1	I	–	−0.0325	ccd
	52811.4324	1	I	–	−0.0324	ccd
V803 Aql	52837.3705	1	I	–	−0.0468	ccd
UW Boo	52777.3399	6	I	–	−0.0145	ccd
XY Boo	52717.4421	8	II	–	0.2084	ccd
	52777.4767	12	II	–	0.2132	ccd
AC Boo	52707.3704	5	II	–	0.1141	ccd
	52777.5058	2	II	–	0.1157	ccd
CV Boo	52770.3285	3	II	–	0.0040	ccd
EF Boo	52777.3450	4	I	–	0.0048	ccd
Y Cam	52862.5289	3	I	–	0.3376	ccd
AB Cas	52885.4421	4	I	–	0.0388	ccd
V821 Cas	52882.3561	4	I	–	0.0009	ccd
EG Cep	52906.2642	3	I	–	0.0021	ccd
GS Cep	52890.3508	5	I	–	−0.0008	ccd
V456 Cyg	52769.4771	5	II	B,V	0.0163	pe
	52904.4940	3	I	–	0.0174	ccd
V478 Cyg	52809.4233	9	I	–	−0.0183	ccd
V836 Cyg	52811.4093	3	I	–	0.0195	ccd
V859 Cyg	52819.4211	6	II	–	0.0421	ccd
Z Dra	52837.5226	2	I	–	0.0186	ccd
RZ Dra	52860.4679	1	I	–	−0.0030	ccd
TZ Dra	52917.2082	8	I	–	−0.0088	ccd
AX Dra	52721.3722	1	I	–	0.0046	ccd
FU Dra	52770.3762	2	I	–	0.0009	ccd
	52862.3919	4	I	–	0.0016	ccd
SZ Her	52770.3505	2	I	–	0.0085	ccd
EM Lac	52838.4791	3	I	–	0.0229	ccd
PY Lyr	52863.3103	4	I	–	0.0702	ccd
NN Mon	52721.3311	1	II	–	0.1083	ccd
U Peg	52906.3863	10	I	–	−0.0649	ccd
	52906.5725	2	II	–	−0.0661	ccd
AT Peg	52811.4762	3	I	–	−0.0687	ccd
	52904.3107	2	I	–	−0.0675	ccd
BB Peg	52838.4020	4	I	–	0.0120	ccd
BN Peg	52906.4719	3	I	–	−0.0050	ccd
V432 Per	52917.4605	2	I	–	0.0225	ccd
AG Vir	52415.4503	6	I	U,B,V	0.0008	pe
	52417.3784	5	I	U,B,V	0.0010	pe

Remarks:

The 31 stars, whose details are listed in Table 1, were observed using either conventional filtered Johnson standard (UBV) photoelectric photometry with the SSP-5A or unfiltered with the ST-237. 40 times of minima, primary and some secondary, are listed in Table 2, together with O-C values corresponding to the Table 1 ephemerides.

Availability of the data:
Upon request

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Değirmenci, Ö. L., Bozkurt, Z., Yakut, K., Demircan, O., Erdem, A., Çiçek, C., Özdemir, S., Bulut, İ., Soydugan, F., Soydugan, E., Esenoğlu, H., Hegedüs, T., Borkovits, T., Biró, I. B., 2003, *IBVS*, 5386

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ERRATUM FOR IBVS 5399

Time of minimum of AH Tau was given as 52578.4707, but it should be 52578.5104.

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THE γ DORADUS VARIABLE HD 19684 – A SPECTROSCOPIC BINARY

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[3] Visiting Astronomer, Kitt Peak National Observatory, National Optical Astronomy Observatory, operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

Determining the question of duplicity is crucial for the study of γ Doradus variables. These late-A and early-F type stars are a recently discovered class of variables defined by Kaye et al. (1999). Kumar, Ao, & Quataert (1995) and Willems & Aerts (2002) showed that the presence of a close companion produces tidal effects that can induce pulsation in a star. Thus, it is important to determine whether each γ Doradus variable is a single star with intrinsic pulsation or a close binary with pulsation periods perhaps induced by tidal interactions. As an example of the latter, Handler et al. (2002) recently found HD 209295 to be the first star that has light variability periods typical of both δ Scuti and γ Doradus variables. However, they noted that its γ Doradus pulsations are tidally excited.

Recent radial velocities combined with previously-published data from the literature show that the γ Doradus variable HD 19684 (Henry & Fekel, 2002) is a spectroscopic binary.

Henry & Fekel (2002) published a mean radial velocity from three observations. The individual spectra were obtained with the Kitt Peak National Observatory 0.9-m coudé feed telescope, coudé spectrograph, and a TI CCD detector. These spectra are centered at 6430 Å, have a wavelength range of about 80 Å, and a 2-pixel resolution of 0.21 Å. The typical signal-to-noise ratio for these spectra ranged from 150 to 250. The six older spectra from Fehrenbach et al. (1987), obtained at Haute-Provence Observatory have a dispersion of 80 Å mm^{-1}.

The velocities of Fehrenbach et al. (1987) range from 3 to -23 km s^{-1}. Our three KPNO velocities add to the temporal baseline and range from 0 to 20 km s^{-1}, enabling us to establish that this star is indeed a binary and determine a preliminary orbit.

With a total of nine velocities (Table 1) we searched for periods between 1 and 40 days. The results indicate several possible periods between 31 and 33 days. With weights of 1.0 and 0.2 for the KPNO and Fehrenbach et al. (1987) velocities, respectively, orbital solutions were obtained starting with the four best periods. An orbit with the eccentricity fixed at zero and a period of 31.9456 days resulted in the smallest sum of the squared residuals, and so we adopt it as the current best preliminary orbit of HD 19684. Table 2 lists the orbital elements of this solution and Figure 1 shows the velocities compared with the calculated orbit.

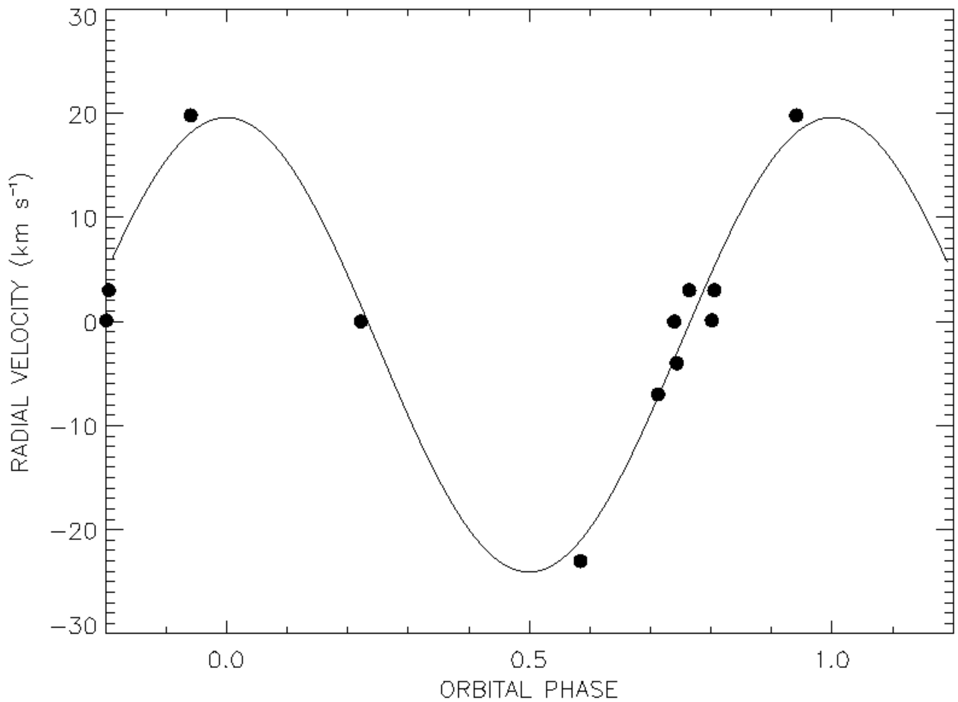

Figure 1. A phased radial-velocity curve of the primary star comparing the nine velocities with the computed orbit. Phase zero is the time of maximum radial velocity.

Table 1: Radial Velocities of HD 19684

HJD − 2,400,000	Phase	Velocity (km s $^{-1}$)	O−C (km s^{-1})
45697.3549	0.2211	0.0	−1.3
46001.5229	0.7425	−4.0	−0.4
46003.5118	0.8048	3.0	−1.7
46032.4868	0.7118	−7.0	0.7
46060.3410	0.5837	−23.0	−1.8
46321.6451	0.7634	3.0	3.8
52013.605	0.9400	19.8	2.3
52326.620	0.7384	0.0	4.2
52328.610	0.8007	0.1	−4.1

Table 2: Preliminary Circular Orbital Elements of HD 19684

Orbital Element	Value
Period (fixed)	31.9456 days
Time of maximum velocity	2,452,015.5 ± 0.7 days
Center of mass velocity	-2.3 ± 3.1 km s^{-1}
Semi-amplitude	21.8 ± 3.3 km s^{-1}
Mass Function	0.03 ± 0.02 $M_\odot$
$a \sin i$	0.06 ± 0.01 AU
σ	4.3 km s^{-1}

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ON THE POSSIBLE 9-DAY PERIODIC VARIABILITY OF DI Cep

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Despite numerous currently existing observations of individual T Tauri stars (TTSs), the principal causes of variability are not completely understood for this group of stars. Different variability mechanisms were suggested for classical TTSs (CTTSs) and weak-line TTSs (WTTSs) (Herbst *et al.*, 1994). There exists an opinion that while, most likely, CTTSs vary in brightness and spectrum because of changing parameters of their accretion zones, brightness variations of WTTSs arise from rotational modulation because of spotted photospheres. It can be possible to reveal common properties, needed to understand the nature of young stars, only from long-time observations. In this study, we report on periodic variability of the spectra and brightness of the classical T Tauri star DI Cep on the basis of its long-time photoelectric and spectroscopic observations.

For our analysis, we use the published results of spectroscopic observations by Grinin *et al.*, (1980) (the same data on these spectroscopic observations are repeated in Krasnobabtsev, 1982) and by the author (Ismailov, 1987a, 1987b, 1988, and four observations so far unpublished; for convenience, we repeat all our observations in the electronic table, its four last lines corresponding to the unpublished observations). All the spectra, obtained at the Crimean and Shemakha observatories, had approximately the same mean linear dispersion (93–100 Å/mm). The observations by Grinin *et al.* (1980) were obtained during the single season of 1975, and our observations, in 1975–1987.

Our search for possible periodicity in the light variations (see below) and the spectrum of the star made use of the Scargle (1982) periodogram method, in its later modification by Horne and Baliunas (1986) (the code we applied had been written by I. Antokhin). To preserve uniformity, the data from each season were processed separately. The search for the period was carried out within the 0–1 d^{-1} range of frequencies. Krasnobabtsev (1982) and Ismailov (1987a) suspected periodic variations in the spectrum of DI Cep, with a time scale about 16–18 days. Spectral variability with an 11-day period was suspected by Fernández and Eiroa (1996), Gómez de Castro and Fernández (1996). For this reason, we were mainly interested in the significant power spectrum peaks in the 0.025–1 d^{-1} range. The power spectra calculated using the spectroscopic data from Grinin *et al.* (1980) and from Ismailov (1987a) have shown significant peaks, exceeding the 3σ level, in the 0.1–0.2 d^{-1} frequency interval.

The results of our frequency analysis based upon the equivalent widths (W_λ) of the Hα and Hβ emission lines reveal that different data sets confidently show the frequency corresponding to the period $P = 9\overset{\mathrm{d}}{.}24 \pm 0\overset{\mathrm{d}}{.}07$. This spectral variability period is found in individual one-year data sets with high reliability.

The basic observational material for our frequency analysis of V magnitudes of DI Cep was the Herbst *et al.* (1994) data base, available in Internet. We used up to 450 measurements from this data base (mainly observations from Kardopolov and Filip'ev, 1985 and unpublished data by V.S. Shevchenko), including 58 measurements by the author (Ismailov, 1988, 1997) as well as 97 measurements from Grinin et al. (1980) averaged over individual nights of observations.

The power spectrum computed from all available photometric V-brightness data does not show any significant periods in the studied interval of frequencies. The reason can be that the complete data set consisted of measurements from different authors. The periodicity can be masked because of phase jumps, systematic and random mistakes of individual observers. To have the observing data uniform, we subdivided the set into 6 subsets, each consisting of data acquired during one year, and processed each subset separately.

This analysis has shown that the power spectrum for the V-brightness data often contains the frequency 0.053 ± 0.003 d^{-1}, corresponding to the period $18\overset{d}{.}28 \pm 1\overset{d}{.}75$. The power spectrum for the third subset contains a very significant peak at the frequency 0.028 d^{-1} that corresponds to the period $35\overset{d}{.}71$. A part of the photometric data from Grinin et al. (1980) reveals a significant peak near the 9-day ($8\overset{d}{.}91 \pm 0\overset{d}{.}82$) period. The frequency of the latter period was also confidently observed in our photometric data.

It should be noted that the 9-day period in the photometric data can be revealed only from carefully chosen homogeneous material, acquired during a short time interval. The period $18\overset{d}{.}28$, as well as the period $35\overset{d}{.}71$, are, within errors, multiples of the 9-day period. In the following, we accept the value $P = 9\overset{d}{.}24 \pm 0\overset{d}{.}07$ as the period of spectral and photometric variability of DI Cep.

The Figure shows a comparison of the behavior of equivalent widths and of photometry with the phase of the 9-day period. Upper panels correspond to spectroscopy, and lower panels, to photometry. Left panels are the data from Grinin et al. (1980), and right panels, those by the author. For all the plots, we adopted JD2442616.472 as the initial epoch. The amplitude of changes of equivalent widths with phase exceeds 100% of their minimal values. It appears from the Figure that there exists a phase shift between these data and the data set from Grinin *et al.* (1980).

The spectral type of DI Cep was estimated as G5 (Brodskaya, 1951), G8V (Herbig, 1977; Krasnobabtsev, 1982). Variation of the star's spectral type within F4–K5 (with the most probable spectral type G5–G7.5 $\pm$ 1.5 V) were found by Ismailov (2001). Using the adapted temperature scale from Cohen and Kuhi (1979), we find, for the effective temperature of a young G8V star, $T_{eff} = 5400$ K, and for its color index, $(B-V)_0 = 0\overset{m}{.}75$. Then, with the average observed color $\langle B-V \rangle = 0\overset{m}{.}88$, we obtain the color excess $E(B-V) = 0\overset{m}{.}13 \pm 0\overset{m}{.}25$. For the star's distance of 200 pc (Grinin *et al.*, 1980), the absolute magnitude is found to be $M_V = 4\overset{m}{.}0 \pm 0\overset{m}{.}3$, and, taking into account the bolometric correction, we find for the star's radius the value of $R_* = 1.8 \pm 0.2\ R_\odot$.

The projected rotation rate of DI Cep was estimated as $v \sin i = 28$ km/s (Bouvier *et al.*, 1986) and as 23 km/s (Gameiro and Lago, 1993). If the period we found is the period of the star's axial rotation, we can estimate the inclination of the rotation axis to the line of sight, $i = 27^\circ \pm 2\overset{\circ}{.}5$.

The analysis of rotational modulation for WTTSs shows that usually the initial epoch in such a cycle remains rather stable (Petrov *et al.*, 1994; Grankin, 1998). However, already Herbst *et al.* (1994) noted phase instability of the periodic light variability for CTTSs. In our opinion, the phase shift can be due to two reasons. First, the value of the

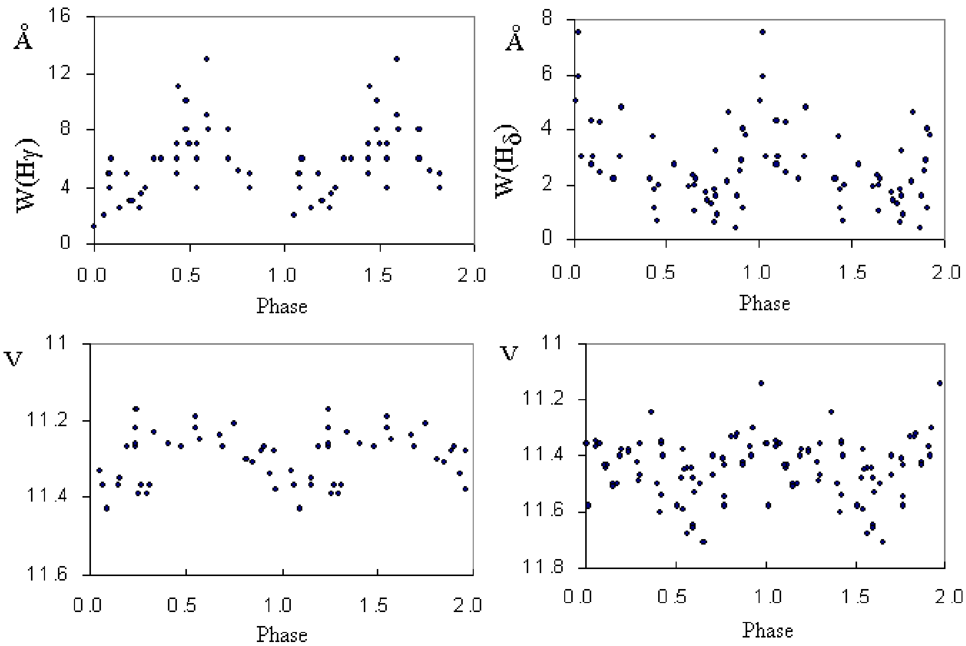

Figure 1. Top: the equivalent widths of emissions in the spectrum of DI Cep versus the phase of the 9-day period; the left panel corresponds to the data from Grinin *et al.* (1980), and the right panel, the author's data. Bottom left: photometry from Grinin *et al.* (1980). Bottom right: the author's photometry.

modulation period can be insufficiently accurate. In such a case, it can be corrected using the two different initial epochs, assuming that the active emission area (hot spot) in the atmosphere of the star does not move. The latter assumption seems rather improbable. Second, if the value of the 9-day period is precise enough, the displacement of the phase of the 9-day period is quite possible if the accretion process creating the hot spot is unstable.

The color variations of DI Cep are easily explained by the presence of the hot spot (Ismailov, 1988; Fernández and Eiroa, 1996), thus the observed 9-day modulation of the emission spectrum and brightness in absence of a correlation between the absorption and emission spectrum (Ismailov, 1987a) shows that the hot spot can be located in the excitation region of the hydrogen emission spectrum, *i.e.* in the circumstellar environment or in the disk of the star. To confidently follow possible displacements of the hot spot, long runs of continuous observations are needed.

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A CCD PHOTOMETRIC SEARCH FOR PULSATIONS IN SZ Her

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In a recent comprehensive catalogue of δ Scuti type pulsating stars there are 86 objects belonging to binary or multiple stellar systems (Rodríguez et al., 2000). Of those, only 9 stars are components of eclipsing binaries (Rodríguez & Breger, 2001). Recent surveys revealed a few more eclipsing binaries with pulsating components (e.g. Kim et al., 2003). These stars are desired compound for asteroseismology in order to identify pulsation modes through determination of fundamental physical parameters. Another interesting possibility is the study of tidal effects on oscillation (Willems & Aerts, 2002).

Inspired by this importance, we started a photometric survey of Algol-type eclipsing binaries for pulsating components. Since δ Scuti stars are main-sequence or slightly evolved A–F type stars in the lower parts of the instability strip, our targets were selected according to the spectral type of the components. Basic data were extracted primarily from the Hipparcos database (ESA 1997). In this paper we present the results obtained for SZ Herculis ($V=9\overset{m}{.}92$, $\Delta V=1\overset{m}{.}75$, mean spectral type F0V).

Photometric monitoring of this star began early (Dugan, 1923), the first visual minima are dated as back as 1902. According to light curve analysis of Giuricin & Mardirossian (1981), the system is semi-detached with a Roche-lobe filling subgiant secondary star. Cyclic O−C variations were noted as well (Mallama 1980, Zavala, 2002), although to our knowledge, there has not been any detailed period change study of the star.

We carried out standard Johnson–Cousins VRI filtered CCD observations on 9 nights in June and July of 2002. In order to obtain good time-resolution, the observations were single-filtered during the given night. The achieved photometric accuracy varies between 0.01–0.05 mag depending on the weather conditions. The bulk of the data was acquired with the 0.4m Cassegrain-telescope of the Szeged Observatory. This telescope was used with a cooled SBIG ST–9E CCD camera (512×512 20μm sized, 2×2 binned pixels, field of view was $6' \times 6'$). The exposure times were 30 second. One night of data was obtained with the 60/90/180 cm Schmidt-telescope of the Konkoly Observatory, equipped with a Photometrics AT200 CCD camera (1536×1024 KAF 1600 MCII coated CCD chip). The projected area is $29' \times 18'$ which corresponds to an angular resolution of $1\overset{''}{.}1$/pixel. Applying only a few second exposures – typically 5 seconds – we were able to accomplish

Table 1: Log of observations and times of minimum.

Obs. Date	Length [h]	Telescope	Filter	HJD_{min}	Type	O−C (day)
20.06.2002	5.76	0.4m Cass.	V	2452446.3795(2)	primary	0.0034
21.06.2002	6.48	0.4m Cass.	V			
24.06.2002	6.24	0.4m Cass.	V	2452450.4706(2)	primary	0.0040
05.07.2002	6.48	0.4m Cass.	R	2452461.5152(10)	secondary	0.0043
08.07.2002	5.28	0.4m Cass.	R	2452464.3777(3)	primary	0.0035
10.07.2002	6.24	0.4m Cass.	I	2452466.4207(3)	secondary	0.0013
11.07.2002	6.96	0.4m Cass.	I			
15.07.2002	7.20	0.4m Cass.	I			
21.07.2002	4.80	0.6m Schmidt	I	2452477.4705(1)	primary	0.0068

relatively fast photometry thus the resulting light curve consists of more than 1600 data points. The complete dataset contains of 3 V-filtered, 2 R-filtered and 4 I-filtered nights with 5481 individual points covering 55.4 hours (see Table 1). The dataset is available at the IBVS website as `5467-t2.txt`.

For differential photometry we used the nearby stars GSC 2610–1214 ($V=11\overset{m}{.}82$) and GSC 2610–1417 ($V=13\overset{m}{.}11$) as comparison and check stars, respectively. We were able to determine six epochs of minimum, four primaries and two secondaries by fitting low-order polynomials to selected parts of the light curves. We list the minima in Table 1. The O−C data were calculated using the ephemeris $HJD_{\rm min} = 2434987.3959 + 0.818095693E$, while the light curve was phased with $HJD_{\rm min} = 2452446.3795 + 0.8180644E$. The phased instrumental light curves in V,R and I are shown in Fig. 1. The light curve is characterized by large eclipse depths ($\Delta V=1\overset{m}{.}75$, $\Delta R=1\overset{m}{.}62$, $\Delta I=1\overset{m}{.}5$) and slight reflection effect or ellipsoidal variations of about $0\overset{m}{.}1$.

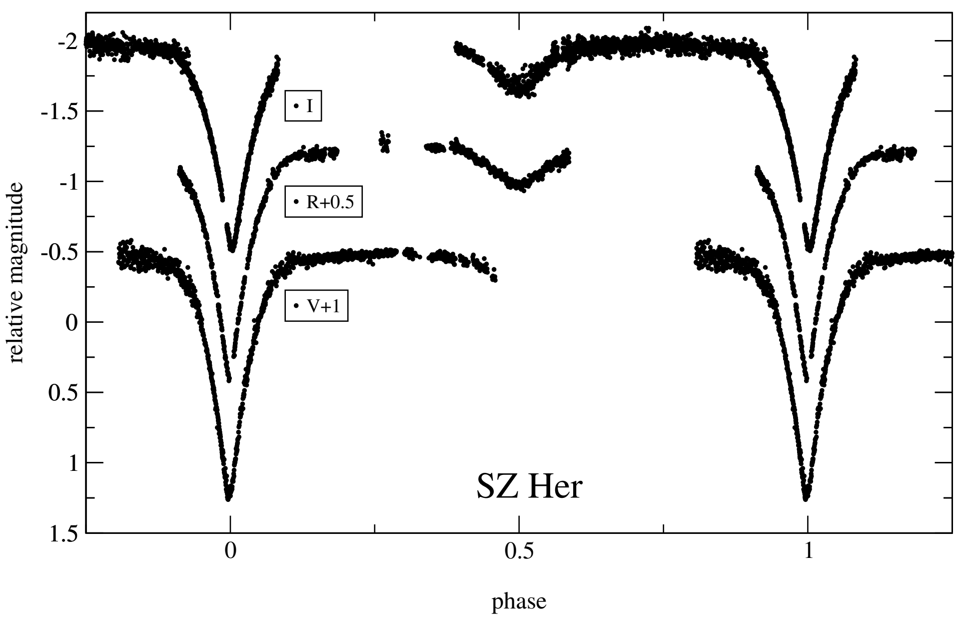

Figure 1. The VRI phase diagrams of SZ Her. The curves are shifted vertically for clarity.

At first sight the light curves did not show discernible light variations due to short period oscillation of any of the components. To assert more precisely the lack of short-term light variations, we performed frequency analysis of the individual light curves. For this, we calculated the binned phase diagram (the bin size was 0.01), which was transformed back to the time domain over the time span of observations. After subtracting these smooth data from the original observations, the residuals showed the deviations from the mean.

For this analyses, we used `Period98` written by Sperl (1998). The resulting Fourier spectra with the window functions are plotted in Fig. 2. We can summarize the results as follows. We could not identify any characteristic frequency produced by coherent oscillation in the residual light curves with amplitudes larger than $0\overset{m}{.}004$ in V and R and $0\overset{m}{.}007$ in I, respectively. We made simulations to estimate possible decrease of the Fourier-amplitude by the observational errors. Artificial datasets were created consisting of a low-amplitude single sine wave and different scatter levels mimicking our measurement errors. We found that the calculated amplitudes agreed very well with the initial value (within a few percent), so that our amplitude limits are only slightly affected by the noise. Thus we can certainly assert there is no δ Scuti-type pulsator in SZ Her with larger amplitudes of pulsation than these upper limits.

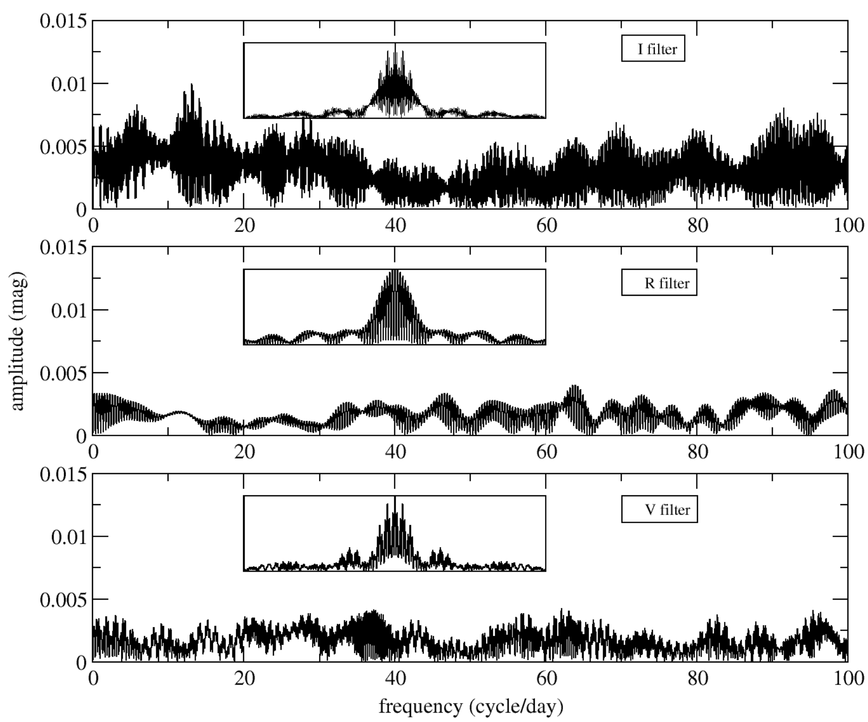

Figure 2. Frequency spectra of the residual light curves. The small inserts show the window functions.

In addition to this, we have checked the star's recent period change. The O−C diagram (Kreiner 2001)[1] plotted in Fig. 3 shows noticeable variations. Assuming that the changes are periodic, they can be approximated by a sine wave with $0\overset{d}{.}015$ amplitude and 66 year period.

A possible interpretation is the light-time effect produced by the binary system orbiting around a third component. Assuming these objects are orbiting approximately in the

[1] Available electronically at `http://www.as.wsp.krakow.pl/o-c/data/getdata.php3?SZ%20her`

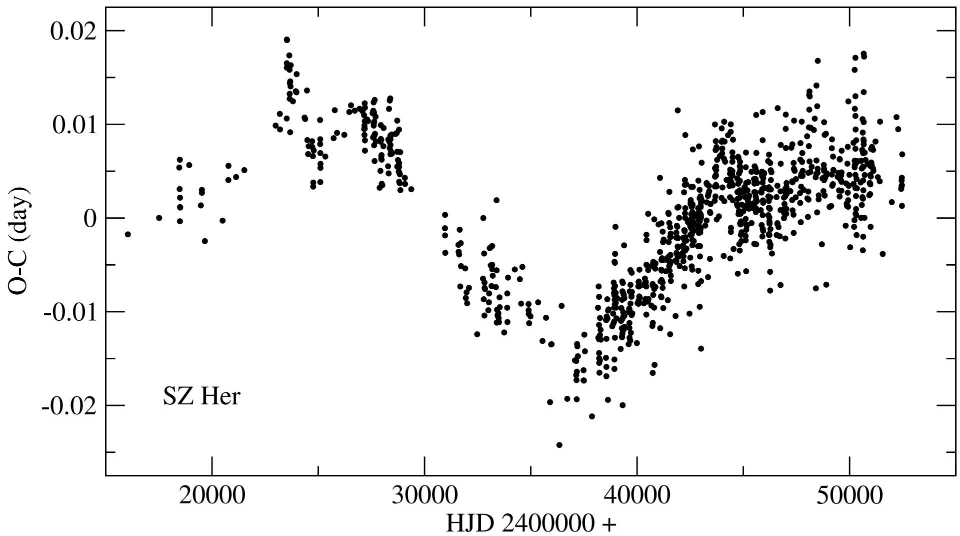

Figure 3. The O−C diagram of SZ Her.

same plane as the components of the binary system do (which is the usual assumption for hierarchic systems in celestial mechanics, and, consequently, the inclination is close to 90°), applying Kepler's third law, we can estimate the mass function of the third component (Zhou & Fu, 1998): $(\Delta tc)^3/P_{\rm orb}^2 = f(M_{3_{\rm min}})$, where Δt is the semi-amplitude of the O−C diagram, c is the speed of light and $P_{\rm orb}$ is the hypothetical orbital period, i.e 66 years. With parameters described above we can get $f(M_{3_{\rm min}}) = 0.004M_\odot$. According to this, the minimum mass of the accompanying object roughly equals four Jupiters. One possibility is that the object might be a giant planet or a brown dwarf star in case of smaller inclinations.

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DETECTION OF MAGNETIC FIELD VARIATIONS OVER THE PULSATION PERIOD OF THE roAp STAR γ Equ FROM Fe II 6149 LINE

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Several attempts recently have been made to investigate which magnetic variations occur over the pulsation cycle in roAp stars (Hubrig et al., 2003; Leone & Kurtz, 2003). For the first time we tried to find these variations from observations of the resolved Zeeman split Fe II λ 6149.2 Å spectral line in order to diagnose the line-intensity weighted average of the modulus of the magnetic field over the visible stellar hemisphere.

In our investigations we used spectra with a resolution of R=120000 obtained with the Coude Echelle spectrometer MAESTRO (Musaev et al., 1999). It was fed by the 2 meter telescope of the Observatory at Terscol Peak (Northern Caucasia). A Wright Instruments CCD 1242×1152 matrix camera with pixel size of 22.5 μm was used. Reduction of the spectra was done using the DECH code (Galasutdinov, 1992). 45 exposures of 80 s each were obtained at JD=2452103. The total time of one cycle was equal to 110 sec. S/N ratio of one spectrum was between 40–60. All details of our data reduction procedure, measurements of RV, etc. can be found in Malanushenko et al. (1998) and Savanov, Malanushenko & Ryabchikova (1999).

Basic results of our investigation are illustrated in Figure 1. Upper and middle panels of Figure 1 (left side) show phase diagrams for the RV variations of the Nd III λ 6145 Å and the Pr III λ 6160 Å lines. RV variations were fitted by a cosine curve using an IDL routine based on the non-linear least-squares Marquardt method (Bevington, 1969). Semi-amplitudes of RV variations are equal to 260 m/s for the Nd III line and 500 m/s for the Pr III line (with errors about 40–50 km/s).

Periods P were taken from a periodogram analysis which was performed with the PERDET code (Breger, 1990) (right panels of Figure 1). The highest peaks for the radial velocity data for Nd III, Pr III and magnetic data are at 1.37, 1.33 and 1.33 mHz, respectively. With our dataset we cannot resolve frequencies mentioned in our RV investigations (Savanov, Malanushenko & Ryabchikova, 1999) and in the photometric investigations by Martinez et al. (1996). The difference in the values of pulsation periods found from Nd III and Pr III lines is small but the same effect was also mentioned by Kochukhov & Ryabchikova (2001).

We also measured the difference ($\delta\lambda_c$) in wavelength between the central parts of the two components of the Fe II λ 6149.2 line and determined the corresponding magnetic field H_c (mean magnetic field modulus) derived from the relation

$$H_c = \delta\lambda_c/(g\ \delta\lambda_Z),$$

where g is the Lande factor and $\delta\lambda_Z$ is the Lorenz unit (see Mathys 1990 for details).

From our observations we found that the mean value of the difference in wavelength between the central parts of the two components of the Fe II line is equal to

$$\delta\lambda_c = 0.1808 \pm 0.0067$$

and the mean magnetic field modulus is equal to

$$H_c = 3792 \pm 140G.$$

These values can be compared with results published by Mathys (1990) for JD = 2447637.917: $\delta\lambda_c$ = 0.171 and H_c= 3.6 kG.

Another estimation of H_c yields values in the region of 3.4–3.6 kG and can be found in Mathys & Lanz (1992).

The bottom panels of Figure 1 illustrate the results on the variability of H_c. According to our estimations the amplitude of H_c variations is equal to 99 ± 53 G. The frequency of the oscillations coincides with the one of the RV variations of the Pr III λ 6160.24 Å line and is equal to 1.33 mHz (close to one of the photometric periods found by Martinez et al., 1996).

We confirm the existence of a small phase difference between the radial velocity variations and the magnetic variations at an order of 0.20-0.25 cycles (0.15 ± 0.05 cycles by Leone & Kurtz, 2003).

The RV variations of each of the Zeeman components of the Fe II λ 6149.2 Å line are below the limit of our detection (100-120 m/s). This is in agreement with the result by Kochukhov & Ryabchikova (2001) who found that the average of the component's semi-amplitude of RV variations is equal to 64 m/s and that the phase shift between RV variations of Fe II and Pr III, Nd III is about 0.5 of a cycle.

We suggest that oscillations of the mean magnetic field modulus determined from the components of the Fe II λ 6149.2 Å line cannot be connected with oscillation in spots or thick layer as in the case of double-ionized rare earth elements.

In the paper by Hubrig et al. (2003) first theoretical considerations of the magnetic field variations for magnetic roAp stars were presented. These estimations in the particular case of γ Equ imply magnetic field variations at a level of 8%. From their own observations Hubrig et al (2003) were only able to give an upper limit of 175 G. From polarimetric observations Leone & Kurtz (2003) detected magnetic variations over a pulsation cycle of γ Equ with an amplitude in the range of 112–240 G for the Nd lines. This is in agreement with theoretical models expecting 10% variations of the effective field strength which equal to 145 G.

From our analysis we have found that the amplitude of H_c is about 200 G which is 5% of the obtained mean magnetic field modulus H_c. However, an estimate for the expected field variations is tightly connected with the adopted RV data. In general, the available radial velocity data range implies the magnetic field variations in the atmospheres of roAp stars at a level of approximately 1 to 14 % (Hubrig et al., 2003).

We thank T. Granzer and S. Hubrig for the assistance during the preparation of the manuscript.

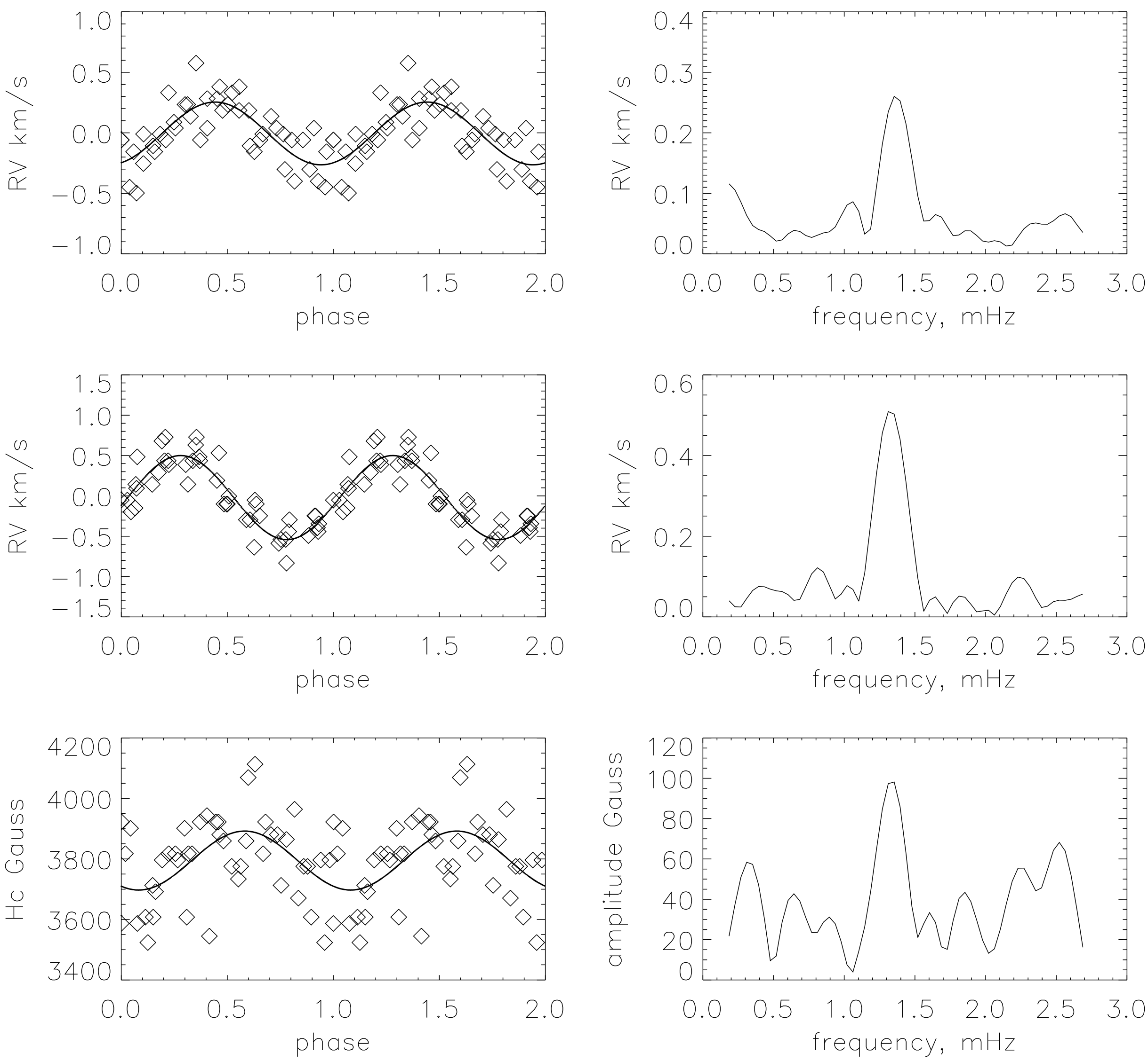

Figure 1. Left side: phase plots of the variability of the radial velocity from the Nd III λ 6145 Å , Pr III λ 6160 Å lines and the mean magnetic field modulus H_c (from top to bottom). Right side: the amplitude spectra for the radial velocity of the Nd III λ 6145 Å , Pr III λ 6160 Å lines and the mean magnetic field modulus H_c (from top to bottom).

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ERRATUM FOR IBVS 5407

We noticed an error in the minima of ET Leo which should be corrected as:

```
Mean time 52726.2809, Mean error 0.0004  Min I (BVR)
Mean time 52726.4513, Mean error 0.0002  Min II(BVR)
```

Taner TANRIVERDI

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CCD PHOTOMETRY OF DT UMa, V672 Her, V868 Oph AND GSC 3135 0673

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Name of the object:
DT UMa

Equatorial coordinates:	**Equinox:**
R.A.= $8^h53^m44^s.9$ **DEC.=** $49°18'40''$	J2000

Observatory and telescope:
Nicholas Copernicus Observatory and Planetarium, Brno CZ, 0.4 m Newt.telescope

Detector:	SBIG ST-7
Filter(s):	unfiltered

Date(s) of the observation(s):
8 nights between March 2002 and January 2003, total of 314 observations

Comparison star(s):	GSC 3420 1781, P_{mag}=13.6 (GSC)
Check star(s):	GSC 3420 1755, GSC 3420 1089
Transformed to a standard system:	No
Type of variability:	RRc

Remarks:

The variability of DT UMa (= GR 301) was discovered by Romano (1980) on Asiago photographic plates with range of variability between 14.3 and 15.8 mag. He suggested that it is an RR Lyr type variable star but wasn't able to give any ephemeris.

Table 1 gives maxima timings determined using Tintagel (Gaspani, 1995). Period of light variations was obtained using PerSea (Maciejewski, 2002). The ephemeris are:

$$\text{Max.} = \text{JD } \underset{\pm 0.0077}{2452339.4563} + \underset{\pm 0.000002}{0.321162} \times E.$$

The phased light curve is shown in Figure 1.

Name of the object:
V672 Her

Equatorial coordinates:	**Equinox:**
R.A.= $18^h44^m53\overset{s}{.}9$ **DEC.=** $13°41'16''$	J2000

Observatory and telescope:
Nicholas Copernicus Observatory and Planetarium, Brno CZ, 0.4 m Newt.telescope

Detector:	SBIG ST-7

Filter(s):	V$(RI)_C$

Date(s) of the observation(s):
12 nights between July 2002 and August 2003, total of 706 observations

Comparison star(s):	GSC 1037 0530, P_{mag}=13.3 (GSC)

Check star(s):	GSC 1037 0906, anonymous at $18^h44^m52.9^s$+13°42′44″ [J2000]

Transformed to a standard system:	No

Type of variability:	RRc

Remarks:

Hoffmeister (1949) revealed V672 Her (= S 4352) as a short period variable star. No ephemeris has been published.
Table 1 gives maxima timings determined using Tintagel (Gaspani, 1995). Period of light variations was obtained using PerSea (Maciejewski, 2002). The ephemeris are:

$$\text{Max.} = \text{JD } \underset{\pm 0.0082}{2452485.3986} + \underset{\pm 0.000004}{0.352456} \times E.$$

The phased light curves are given in Figure 2.

Name of the object:
V868 Oph

Equatorial coordinates:	**Equinox:**
R.A.= $17^h42^m31\overset{s}{.}1$ **DEC.=** $03°03'41''$	J2000

Observatory and telescope:
Nicholas Copernicus Observatory and Planetarium, Brno CZ, 0.4 m Newt.telescope

Detector:	SBIG ST-7

Filter(s):	V$(RI)_C$ and unfiltered

Date(s) of the observation(s):
17 nights between May 1998 and August 2003, total of 660 observations

Comparison star(s):	GSC 0419 0350, P_{mag}=13.6 (GSC)

Check star(s):	GSC 0419 0373, anonymous at $17^h42^m22\overset{s}{.}8$ $+03°02'16''$ [J2000]

Transformed to a standard system:	No

Type of variability:	RRc

Remarks:

Hoffmeister (1949) revealed V868 Oph (= S 4177 = HV 11025) as a short period variable star of RR Lyr type. According to Götz (1957) the star is an eclipsing binary with period of approx. 0.443 days. Although his light curve is obviously asymmetric, the classification persisted in the literature (e.g. Sahade & Dávila, 1963; Popova & Kraicheva, 1984). Locher (1977) suggested irregular variations possibly superimposed on eclipses. Our CCD observations prove the star to be an RRc type variable.

Table 1 gives maxima timings determined using Tintagel (Gaspani, 1995). Period of light variations was obtained using PerSea (Maciejewski, 2002). The ephemeris are:

$$\text{Max.} = \text{JD } \underset{\pm 0.0077}{2452836.4692} + \underset{\pm 0.000001}{0.287381} \times E.$$

The phased filtered light curves are given in Figure 3.

Name of the object:
GSC 3135 0673

Equatorial coordinates:	**Equinox:**
R.A.= $19^h39^m51\overset{s}{.}0$ **DEC.=** $38°21'08''$	J2000

Observatory and telescope:
Nicholas Copernicus Observatory and Planetarium, Brno CZ, 0.4 m Newt.telescope

Detector:	SBIG ST-7

Filter(s):	$V(I)_C$ and unfiltered

Date(s) of the observation(s):
4 nights in September 2003, total of 520 observations

Comparison star(s):	GSC 3135 0012, $V = 11.55$, $B - V = 0.76$ (Tycho)

Check star(s):	anonymous stars at $19^h39^m53\overset{s}{.}1$ $+38°25'08''$ and $19^h39^m53\overset{s}{.}8$ $+38°23'03''$ [J2000]

Transformed to a standard system:	No

Type of variability:	RRc

Remarks:

Variability of this star was discovered in the TASS data (Richmond et. al 2000; Wils, 2003).

Table 1 gives maxima timings determined using Tintagel (Gaspani, 1995). Period of light variations was obtained combining our and TASS data using PerSea (Maciejewski, 2002). The ephemeris are:

$$\text{Max.} = \text{JD } \underset{\pm 0.0034}{2452907.3267} + \underset{\pm 0.000008}{0.297224} \times E.$$

The phased light curves are given in Figure 4.

All data are available upon request.

Acknowledgements:

We acknowledge overall support and the use of the telescope with CCD camera of the Nicholas Copernicus Observatory and Planetarium and Tom Droege's TASS observations (`http://www.tass-survey.org`). We would like to thank L. Král and M. Brož for software support, A. Paschke for database help. This work has made use of the SIMBAD database, operated at CDS, Strasbourg, France. The NASA ADS Abstract Service was used to access data and references.

Table 1: Maxima timings of DT UMa, V672 Her, V868 Oph and GSC 3135 0673

Star	Hel. JD	Error	Filter	Epoch
DT UMa	2452339.4563	0.0077	unfiltered	0
DT UMa	2452346.5187	0.0081	unfiltered	22
DT UMa	2452640.3953	0.0073	unfiltered	937
DT UMa	2452651.6350	0.0038	unfiltered	972
V672 Her	2452485.4128	0.0069	I	0
V672 Her	2452485.4098	0.0088	R	0
V672 Her	2452485.3986	0.0082	V	0
V672 Her	2452817.4259	0.0051	I	942
V672 Her	2452817.4209	0.0042	R	942
V672 Her	2452817.4251	0.0064	V	942
V672 Her	2452841.3818	0.0044	I	1010
V672 Her	2452841.3779	0.0034	R	1010
V672 Her	2452841.3810	0.0050	V	1010
V868 Oph	2452031.5316	0.0025	unfiltered	−2801
V868 Oph	2452440.4588	0.0040	unfiltered	−1378
V868 Oph	2452836.4692	0.0077	unfiltered	0
V868 Oph	2452857.4544	0.0031	I	73
V868 Oph	2452857.4595	0.0024	R	73
V868 Oph	2452857.4707	0.0037	V	73
V868 Oph	2452862.3556	0.0028	I	90
V868 Oph	2452862.3536	0.0037	R	90
V868 Oph	2452862.3390	0.0038	V	90
GSC 3135 0673	2452907.3267	0.0054	I	0
GSC 3135 0673	2452907.3267	0.0034	V	0

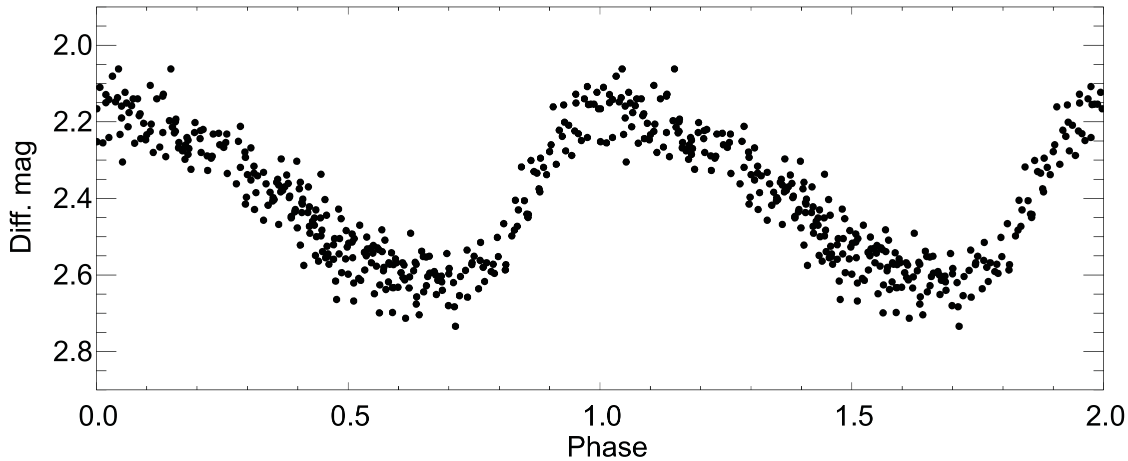

Figure 1. Unfiltered light curve of DT UMa.

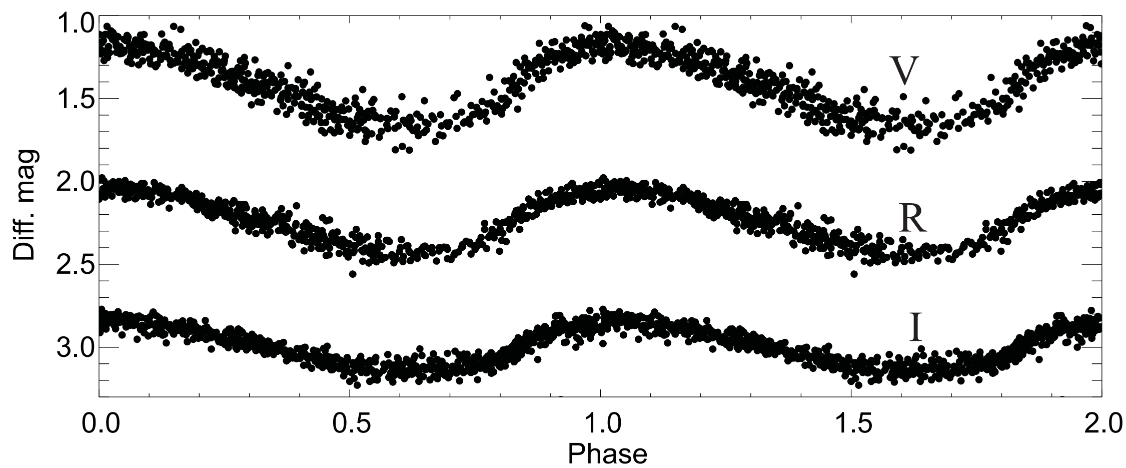

Figure 2. Light curves of V672 Her.

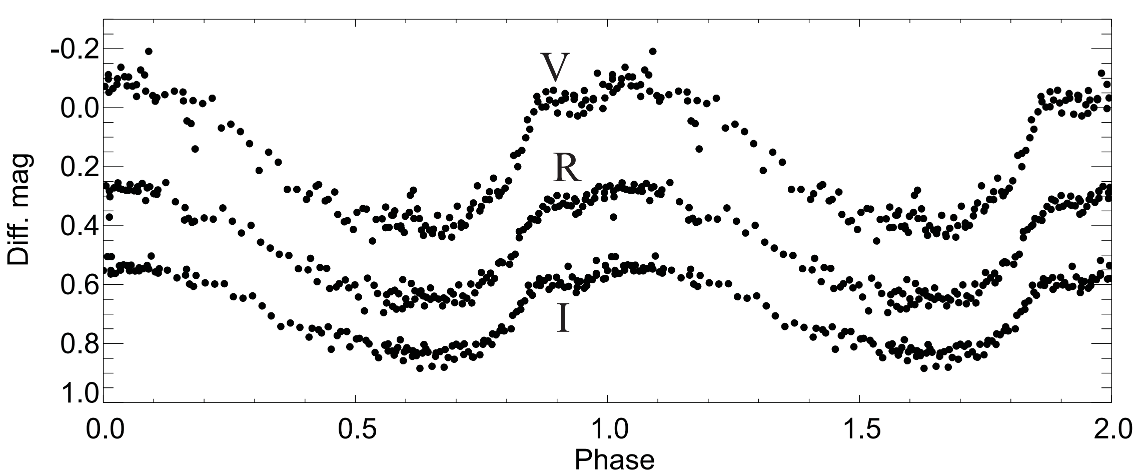

Figure 3. Filtered light curves of V868 Oph. The datasets were shifted for plot clarity.

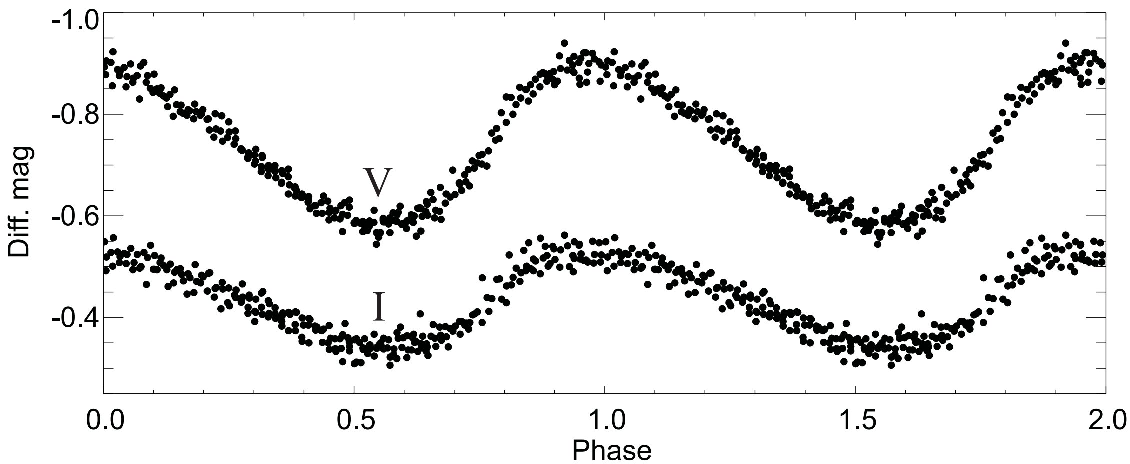

Figure 4. Light curves of GSC 3135 0673 from our data.

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ERRATUM FOR IBVS 5320

The coordinates of GSC 4988-707 and GSC 6328-971 were in error; the correct values are:

GSC 4988-707	14 30 56.52	-03 11 09.2
GSC 6328-971	20 21 53.99	-16 27 03.6

R. Behrend

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MINIMUM TIMES OF SEVERAL ECLIPSING BINARIES

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[2] SETI Institute, 2035 Landings Drive, Mountain View, CA 94043, USA

[3] SRI International, 333 Ravenswood Street, Menlo Park, CA 94025, USA

Observatory and telescope:

1.5m Carlos Sanchez Telescope **(TCS)**, Teide Obsv., Tenerife, Spain
36″Crossley Telescope **(CRO)** of Lick Observatory

Detector: **TCS**: Single channel NIR photometer equipped with an InSb detector and standard H (1.6 μm) filter, switching between source and sky every 10 seconds. **CRO**: CCD Kodak KAF4200 with Johnson-Cousins R filter, $12' \times 12'$ field of view.

Method of data reduction:

TCS: derivation of source magnitudes by on-line reduction. Nearby reference stars that were observed before and after the eclipses were used to remove any extinction slope. **CRO**: 'Vaphot'[1](Deeg & Doyle, 2001) differential photometry package for IRAF, using as references several stars visible in the same CCD field.

Method of minimum determination:

Unless noted otherwise, minimum times were determined with the Kwee-van-Woerden Algorithm (Kwee & van Woerden, 1956)

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
RT And	EA/DW/RS	23 11 10.1	+53 01 33	–	36697.8570	0.628930880	1
EE Aqr	EB/KE:	22 34 42.0	−19 51 35	–	40828.7804	0.50899590	1
44i Boo	EW/KW	15 03 47.3	+47 39 15	–	39852.4644	0.2678176	2
VW Cep	EW/KW	20 37 21.5	+75 36 01	–	51067.2820	0.2783140	3
XX Cep	EA/SD	23 38 20.3	+64 20 03	–	41539.5307	2.3373260	1
BV Dra	EW/KW	15 11 50.4	+61 51 25	–	45739.1151	0.350066568	1
FL Lyr	EA/DM	19 12 04.9	+46 19 27	–	38221.5535	2.17815381	1
TZ Lyr	EB/D	18 15 49.7	+41 06 38	–	20669.455	0.52882516	1
V566 Oph	EW/KW	17 56 52.4	+04 59 15	–	40418.540	0.40964360	1
UV Psc	EA/D:/RS	01 16 55.1	+06 48 42	–	44932.2977	0.86104716	1
ER Vul	EW/DW/RS	21 02 25.5	+27 48 26	–	40182.2593	0.69809479	1

[1]Code available from `ftp://ftp.iac.es/pub/users/hdeeg/tep_dist/`

Source(s) of the ephemeris:
1.: Kreiner et al., 2001; 2.: Rovithis & Rovithis-Livaniou, 1990; 3.: Pribulla et al., 2000

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
RT And	50328.6564	0.0001	I	H	−0.0196	TCS
	50329.6002	0.0002	II	H	−0.0192	TCS
	50330.5441	0.0001	I	H	−0.0187	TCS
	51340.9203	0.0001	II	R	−0.0199	CRO
	51379.9158	0.0002	II	R	−0.0182	CRO
EE Aqr	50654.6889	0.0002	II	H	−0.0029	TCS
44i Boo	50328.4390	0.002	I	H	0.0214	TCS,tp
	50655.4455	0.0003	I	H	0.0225	TCS
VW Cep	50271.7420	0.003	II	R	0.0206	CRO,tp
	51362.8508	0.0003	I	R	−0.0007	CRO
XX Cep	50285.7620	0.002	I	R	−0.0426	CRO,tp
	50993.9636	0.0002	I	R	−0.0507	CRO
	51346.8959	0.0001	I	R	−0.0547	CRO
BV Dra	50330.4145	0.001	II	H	0.0013	TCS,tp
	50653.5264	0.0001	II	H	0.0018	TCS
FL Lyr	50654.4547	0.0004	I	H	−0.0008	TCS
	50655.5427	0.0002	II	H	−0.0019	TCS
TZ Lyr	50657.5611	0.0003	I	H	0.0178	TCS
V566 Oph	50334.4103	0.0002	I	H	0.0373	TCS
	50652.5025	0.0001	II	H	0.0413	TCS
	50654.5506	0.0001	II	H	0.0411	TCS
UV Psc	50333.6434	0.0001	I	H	−0.0032	TCS
	50334.5051	0.0002	I	H	−0.0025	TCS
	50652.6656	0.0001	II	H	0.0011	TCS
	50655.6767	0.0001	I	H	−0.0015	TCS
ER Vul	50329.4115	0.0005	II	H	−0.0046	TCS

Explanation of the remarks in the table:
TCS, CRO indicate the telescope. *tp*: minimum determined by tracing paper. Used in cases where data were not apt for processing by Kwee-van-Woerden algorithm

References:

Deeg, H. J.; Doyle, L. R., 2001, *"Vaphot - A Package for Precision Differential Aperture Photometry"*, in proc. of "Third Workshop on Photometry", Eds. W. Borucki and L. E. Lasher, NASA/CP-2000-209614, p. 85

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PHOTOELECTRIC MINIMA OF SOME ECLIPSING BINARY STARS

SELAM, S. O.; ALBAYRAK, B.; ŞENAVCI, H. V.; TANRIVERDİ, T.; ELMASLI, A.; KARA, A.; AKSU, O.; YILMAZ, M.; KARAKAŞ, T.; ÇINAR, D.; DEMİRHAN, M.; ŞAHİN, Ş.; ÇEVİKER, S.; GÖZLER, A. P.

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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:
Times of minima were determined by the method of Kwee and van Woerden (1956).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
V363 And	EB	01 31 46	+36 05 38	BD+34° 0273	48500.3980	1.27799	1
OO Aql	EW/DW:	19 18 32	+09 18 32	BD+08° 4220	49193.4418	0.5067888	2
BI CVn	EW/KW	13 03 16	+36 37 01	BD+03° 2352	45769.538	0.3842059	3
BO CVn	EW	13 59 08	+40 49 09	BD+41° 2450	46895.4483	0.51746168	4
YY CrB	EW	15 50 32	+37 50 08	BD+38° 2701	50000.1496	0.37656416	5
AK Her	EW/KW	17 13 58	+16 21 01	BD+16° 3123	38176.5092	0.42152368	6
SW Lac	EW/KW	22 53 42	+37 56 19	BD+37° 4715	52505.5960	0.32071417	7
AM Leo	EW/KW	11 02 11	+09 53 43	BD+10° 2235	39936.8303	0.3657972	8
U Peg	EW/KW	23 57 58	+15 57 10	BD+15° 4916	36511.6663	0.3747809	9
V351 Peg	EW/KW	23 25 25	+15 41 19	BD+15° 4830	48500.493	0.593297	10
V781 Tau	EW/KW	05 50 13	+26 57 43	BD+27° 0886	52554.9210	0.344908	11
GR Vir	EW/KW	14 45 20	−06 44 04	BD−06° 4066	45665.6415	0.3469788	12

Source(s) of the ephemeris:
1.: ESA (1997); 2.: Demircan & Gürol (1996); 3.: Vandenbroere (1998); 4.: Albayrak et al. (2001); 5.: Pribulla & Vanko (2002); 6.: Bookmyer & Kaitchuck (1979); 7.: Pribulla et al. (2002); 8.: Demircan & Derman (1992); 9.: Maupome et al. (1991); 10.: Gomez-Forrellad et al. (1999); 11.: Nelson (2003); 12.: Cereda et al. (1988)

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V363 And	52855.2955	0.0002	II	*BV*	+0.1466	Tn-Ak
OO Aql	52497.4739	0.0002	II	*UBV*	+0.0225	El-Çn
	52574.2521	0.0006	I	*UBV*	+0.0222	Şn-Kr
	52575.2659	0.0002	I	*UBV*	+0.0224	El-Ak
	52498.4877	0.0001	II	*UBV*	+0.0227	Tn-Çn
BI CVn	52762.4909	0.0003	I	*BV*	+0.0213	Tn-Kr
BO CVn	52757.5142	0.0002	II	*BV*	+0.0013	Kt-Çn
	52813.3986	0.0052	II	*BV*	−0.0002	Kt-Kr
YY CrB	52814.4004	0.0001	II	*UBV*	−0.0015	Tn-Ak
AK Her	52806.5086	0.0004	II	*BV*	+0.0346	Şn-Krk
SW Lac	52863.5142	0.0004	I	*UBV*	+0.0012	Şn-Çv
	52909.5377	0.0002	II	*BV*	+0.0022	Şn-Çv
	52912.2629	0.0002	I	*BV*	+0.0013	Tn-Dm
	52912.4243	0.0004	II	*BV*	+0.0024	Tn-Dm
AM Leo	52727.4902	0.0003	II	*BV*	+0.0121	El-Şh
	52728.4046	0.0006	I	*BV*	+0.0120	Tn-Yl
	52729.3188	0.0004	II	*BV*	+0.0117	El-Şh
	52729.5008	0.0002	I	*BV*	+0.0108	El-Dm
U Peg	52917.4434	0.0003	II	*UBV*	−0.0694	Tn-Krk
V351 Peg	52924.4121	0.0002	II	*UBV*	+0.0000	Şn-Gz
V781 Tau	52924.4952	0.0001	II	*UBV*	+0.0053	Şn-Krk
GR Vir	52769.3237	0.0004	I	*BV*	−0.0148	El-Gz
	52769.4964	0.0004	II	*BV*	−0.0156	El-Gz
	52797.4277	0.0005	I	*UBV*	−0.0161	Şn-Yl
	52805.4052	0.0008	I	*UBV*	−0.0191	Şn-Yl

Explanation of the remarks in the table:

Observers: Ak: O. Aksu, Çv: S. Çeviker, Çn: D. Çınar, Dm: M. Demirhan, El: A. Elmaslı, Gz: A.P. Gözler, Kr: A. Kara, Krk: T. Karakaş, Kt: E. Kutdemir, Şn: H. V. Şenavcı, Şh: Ş. Şahin, Tn: T. Tanrıverdi, Yl: M. Yılmaz

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GSC 2139 2190 IS A SLOWLY CHANGING BE VARIABLE AND NOT A HOT LOW MASS POST ASYMPTOTIC GIANT BRANCH STAR

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GSC 2139 2190 ($\alpha_{2000} = 19^{h}42^{m}05\overset{s}{.}5$; $\delta_{2000} = +23^{\circ}18'59''$, Wyn Evans, 2003) is characterized in Gauba et al., (2003), following somewhat on earlier work, as being a possible hot low mass post asymptotic giant branch (post AGB) star of the pre planetary nebula ilk, based on its early spectral class (it is the OB star LS II +23 17; Stock et al., 1960), $H\alpha$ emission (HBHA 0038-54; Kohoutek and Wehmeyer, 1999) and supposed association with the adjacent infrared source IRAS 19399+2312's (Joint IRAS Science Working Group 1988) spectral distribution. The IRAS object may also be MSX5C_G059.3036+00.0819 (Egan et al., 1999).

During follow up work upon a list of prospective variable stars earmarked by T. Droege (2003) as part of his TASS Mk IV camera all sky survey (`http://www.tass-survey.org`), the distinct nature of this object from the usual 'run of the mill' variables was immediately apparent.

Utilising data for the object gleaned from the TASS Mk IV online database (Sallman and Droege, 2003+) it can be seen that it is indeed variable, showing a slow secular descend on the whole, and is nicely confirmed by ASAS3 data (Pojmanski, 2003+) both in general trend and at points of overlap, as well as during a small 'spike' event. This discovery of variability within this object in this way led to the current work. The data is repeated here as Figure 1.

Low amplitude, nonperiodic, variation over long intervals for luminous post AGB stars is not unprecedented in the literature (eg HD 213985 , Waelkens et al., 1987), so at first sight it seems that another candidate such object has been discovered.

However, several strong pieces of contradictory evidence go against this interpretation. The first area of uncertainty is the association of this star with the stated IRAS and MSX5C sources. Although these objects often have worse positional errors than the internal ones quoted in the catalogue, there are many other stars in this crowded Galactic area that could just as easily be associated with them. Indeed, it is not even certain if the infrared sources are the same as each other, and there is half the distance between their catalogue positions than either has to GSC 2139 2190. Further, the MSX5C source is only visible to band A of that experiment, usually interpreted as due to silicon emission, as can be found associated with evolved red giants.

In this context, the 2MASS $J-K_s$ colour of GSC 2139 2190 is given as +0.28, whereas there are several stars more adjacent to the IRAS and MSX5C source more than red enough in $J-K_s$ colour to be red giants. Further still, Reed B. Cameron (1998) gives

GSC 2139 2190 as having $U - B = -0.20$ and $B - V = +0.78$ for this star. Utilising the dereddening parameter $Q = (U - B) - 0.645(B - V)$ (Heintze, 1973), Q is –0.70, equivalent to spectral type B2, which agrees well with the listed spectral type of B1 III (eg Gauba et al., 2003), although B1 IIIe would be more appropriate given by Kohoutek and Wehmeyer (1999). This suggests an approximate $E(B - V)$ of ˜$1^{\rm m}$ for this early B star, suggesting that the difference between this object's $J - K_s$ colour and the $J - K_s$ colour for an early B star, a difference of about $0^{\rm m}.4$ numerically, can be comfortably attributed to reddening (given the lesser extinction rate at $J - K_s$ than $B - V$). Thus it seems unlikely for a star with no near infrared excess of any kind around the 2.2μm mark to be the same object as the approximately 10μm band A source in MSX5C, or the longer infrared wavelength's IRAS source.

The more telling point, however, is that this object cannot be a Population II Halo object presently lying coincident upon the Galactic Plane simply by the fact that, despite its position away from the main body of stars, it is a physical member of the open cluster NGC 6823, thus making it an evident Population I object. Strangely, this point is missed in SIMBAD, where the star is listed as two separate, unlinked, objects at the same position (ALS 10422 and NGC 6823 208), although both these objects' positional and photometric details make it quite evident that they are the same.

The association of this object with NGC 6823 (itself associated with the OB association Vulpecula OB1) based on proper motion consideration was first noted in Erickson (1971), and can be readily confirmed by comparison of the proper motions of the brightest OB stars central to the open cluster with that of GSC 2139 2190 using the latest UCAC2 values (Zacharias et al., 2003).

A simple independent check on this can be given via the objects spectral type and the $B - V$ of +0.8 (above) of this star being taken as giving $E(B - V)$ of 1.1, for a B1 giant which should have a $B - V$ of –0.3. Using the widely accepted relation of $A_v = 3.3E(B - V)$ gives $A_v = 3.6$, and using that as a correction to the distance modulus, i.e. $m - M - A_v$, taking the absolute magnitude of a B1 giant as being –4.4 (Jaschek and Jaschek, 1987), and representing the apparent V magnitude by 10.2, being the median of the V data in Figure 1, gives a distance modulus $m - M - A_v$ of 11.0, comparing well with the value of 11.5 given by Humphreys and McElroy (1984) for Vulpecula OB1.

GSC 2139 2190 is therefore a spectroscopic type Be star of GCVS variability type BE.

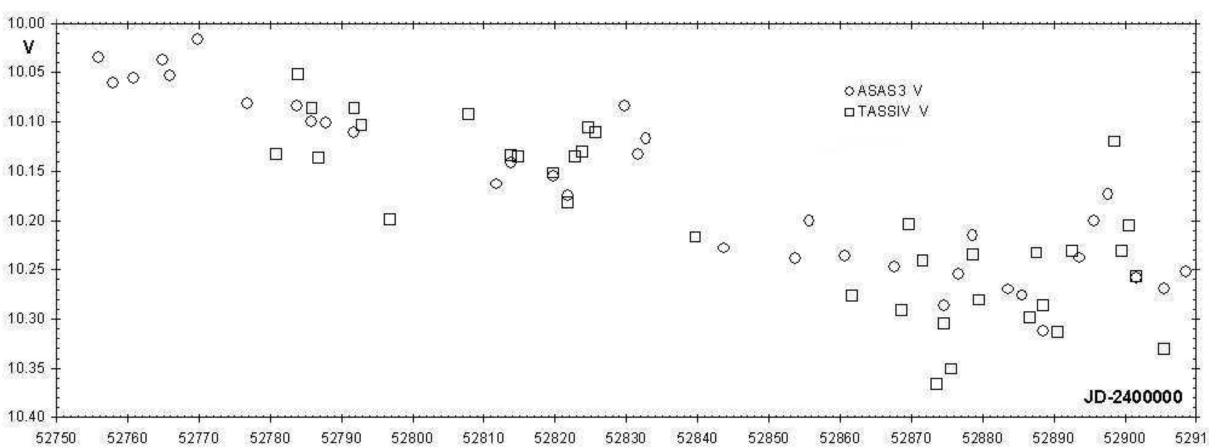

Figure 1. TASS Mk IV (squares) and ASAS3 (circles) V observations of GSC 2139 2190.

GSC 2139 2190 shows low amplitude variability on the time scale of hundreds of days, with at least one instance of a 0.1 V spike on a much shorter time scale. Although the literature suggests that this is a Population II Halo object, specifically a hot low mass protoplanetary nebula forming post asymptotic giant branch star, it is in fact a Population I Thin Disk object within an OB Association and a member of an open cluster. Given that high Galactic latitude Be stars are not unknown, and in fact are relatively common (usually being considered as 'runaway' objects expelled from binaries born in star forming regions), and that it seems the light curves of variable candidate post AGB and protoplanetary nebulae stars (ppn) are indistinguishable by morphology, re-examination of candidate hot low mass post AGB stars may be in order, to ensure their nature is assessed correctly. Formerly, theory led examinations of objects that have been published in the literature, including the star researched here, found evidence confirming GSC 2139 2190 as likely a candidate hot low mass post AGB / ppn star, whereas when the star was examined for its own sake in an object led appraisal, stimulated by a happenstance discovery of variability during an observational survey, its true nature and environment were readily evident.

It is also to be remembered, as noted by the CDS themselves, that SIMBAD is primarily a device for integrating catalogues. This does not necessarily assure that the data within the catalogues therein, nor the cross-relationships derived therefrom, are authoritative. There is no indication that the nearby IRAS and/or MSX5C sources are any more likely to relate to GSC 2139 2190 than any other object in the field.

A detailed spectroscopic analysis of the star would go far in clarifying and confirming the issue.

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OBSERVATIONS OF THE DWARF NOVA X LEONIS

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Dwarf Novae (DN) are a type of cataclysmic variable stars that undergo recurrent outbursts during which they increase in brightness by 2-8 magnitudes. X Leo is a dwarf nova that varies from 12.4 V to 16.5 V (Downes et al., 2001), and the recurrence time of two consecutive outbursts is approximately between 8 and 38 days (Ritter & Kolb, 1998). Brun and Petit (1952) considered X Leonis the prototype of a sub-group of DN characterized by asymmetrical maximum of outbursts, frequently of brief duration. The star was studied spectroscopically by Shafter & Harkness (1986), they found an orbital period of 0.1644 days. Multi-bands photometric observations were reported by Echevarria (1984), Sherrington & Jameson (1983), and Szkody (1987). Near-infrared intra-night observations indicate possible ellipsoidal variations (Szkody & Mateo, 1986), not confirmed in the optical (Howell & Szkody, 1988). The secondary star is classified as an M2 V (Ritter & Kolb, 1998).

We observed the variable from February 22 to June 04, 2003, for a total of 36 observational nights. Observations were done with the 0.33 m and 0.24 m telescopes at the Porziano Astronomical Observatory, and with the 0.40 m Automatic Imaging Telescope at the Perugia University Observatory. The instruments used and the photometric techniques have already been described in Spogli et al. (1998, 2003). The telescopes are endowed with standard BVR_cI_c broad-band filters. Inter-comparison among results obtained with the different instruments shows no relevant systematic difference within the typical standard deviation. The data reported in Table 1 are obtained in differential photometry using the calibration stars reported by Misselt (1996). Moreover, we calibrated these comparison stars with the I_c filter by observing, on two photometric nights, several standard stars (Landolt, 1992) having $(B-V)$ from -0.2 to 1.4, over a wide range of airmass. We followed the light curve in the R_c band, and obtained the color indices during the outburst phase.

Figs. 1 and 2 show the R_c light curve. Intra-night observations indicate the presence of variations in the order of few tenths of magnitude. Analyzing the spectral energy distribution in the optical region, obtained using the same procedure described in Spogli et al. (1998), we have verified the strong contribution of the late-type secondary star to the overall emission. The $(V-I_c)$ color index follows the outburst ranging from $\simeq 1.1$ at minimum to $\simeq 0.2$ during the maximum. The same trend is evident for the (R_c-I_c) color index (Fig. 1).

Table 1: BVR_cI_c magnitudes of X Leonis

Date UT	JD (2450000+)	B	V	R_c	I_c
03/02/22	2693.493			15.36±0.04	
03/03/07	2706.441			15.11±0.05	
03/03/08	2707.456			15.10±0.03	
03/03/12	2711.439			16.26±0.05	
03/03/14	2713.433			15.77±0.04	
03/03/28	2727.328	15.5±0.1	15.13±0.04	14.89±0.05	14.55±0.05
03/03/28	2727.452			15.13±0.04	
03/04/05	2734.530			15.55±0.03	
03/04/05	2735.399			15.72±0.02	
03/04/08	2738.298		15.98±0.08	15.40±0.04	14.88±0.04
03/04/11	2741.495			16.31±0.05	
03/04/14	2744.367		16.02±0.05	15.63±0.05	14.91±0.05
03/04/15	2745.358		15.88±0.08	15.52±0.04	15.00±0.04
03/04/22	2752.371		12.28±0.04	12.19±0.04	12.07±0.04
03/04/23	2752.504	12.56±0.05	12.40±0.03	12.16±0.03	12.03±0.04
03/04/24	2753.505			12.03±0.05	
03/04/24	2753.518			12.31±0.03	
03/04/24	2754.459	12.51±0.05	12.42±0.03	12.31±0.03	12.15±0.04
03/04/25	2755.416			12.20±0.03	
03/04/25	2755.425			12.23±0.04	
03/04/25	2755.443			12.25±0.04	
03/04/25	2755.453			12.42±0.04	
03/04/26	2755.505	12.80±0.05	12.55±0.05	12.37±0.03	12.29±0.04
03/04/27	2756.505			12.61±0.04	
03/04/27	2757.382			12.62±0.05	
03/04/27	2757.403			12.69±0.05	
03/04/27	2757.414			12.75±0.05	
03/04/28	2758.436	13.46±0.05	13.25±0.05	13.07±0.05	12.95±0.04
03/04/29	2759.436			13.52±0.05	
03/04/29	2759.443			13.41±0.05	
03/04/29	2759.445			13.48±0.05	
03/04/29	2759.451			13.58±0.05	
03/04/29	2759.467			13.47±0.05	
03/04/30	2760.474	14.6±0.1	14.33±0.04	14.03±0.05	13.72±0.04
03/04/30	2760.477			14.05±0.05	
03/04/30	2760.482			14.11±0.05	
03/05/01	2761.436			14.38±0.05	
03/05/01	2761.465			14.48±0.05	
03/05/01	2761.470			14.56±0.05	
03/05/01	2761.481			14.87±0.05	
03/05/02	2762.452			15.25±0.05	
03/05/03	2763.454			15.18±0.05	
03/05/04	2764.499			15.16±0.05	
03/05/05	2764.506			15.38±0.05	
03/05/05	2764.512			15.58±0.05	
03/05/05	2764.522			15.28±0.05	

Table 1: BVR_cI_c magnitudes of X Leonis (continued)

Date UT	JD (2450000+)	B	V	R_c	I_c
03/05/05	2765.428			15.61±0.05	
03/05/06	2766.427			15.12±0.05	
03/05/06	2766.445			15.35±0.05	
03/05/13	2773.415			12.74±0.05	
03/05/15	2775.431			13.32±0.05	
03/05/15	2775.442			13.24±0.05	
03/05/15	2775.449			13.39±0.05	
03/05/15	2775.457			13.29±0.05	
03/05/16	2776.467			13.52±0.05	
03/05/19	2779.438			15.14±0.05	
03/05/22	2782.433			15.12±0.05	
03/05/23	2783.457			15.35±0.05	
03/05/28	2788.438			15.11±0.04	
03/05/28	2788.447			15.42±0.04	
03/05/31	2791.459			15.45±0.04	
03/06/04	2795.445			12.99±0.06	

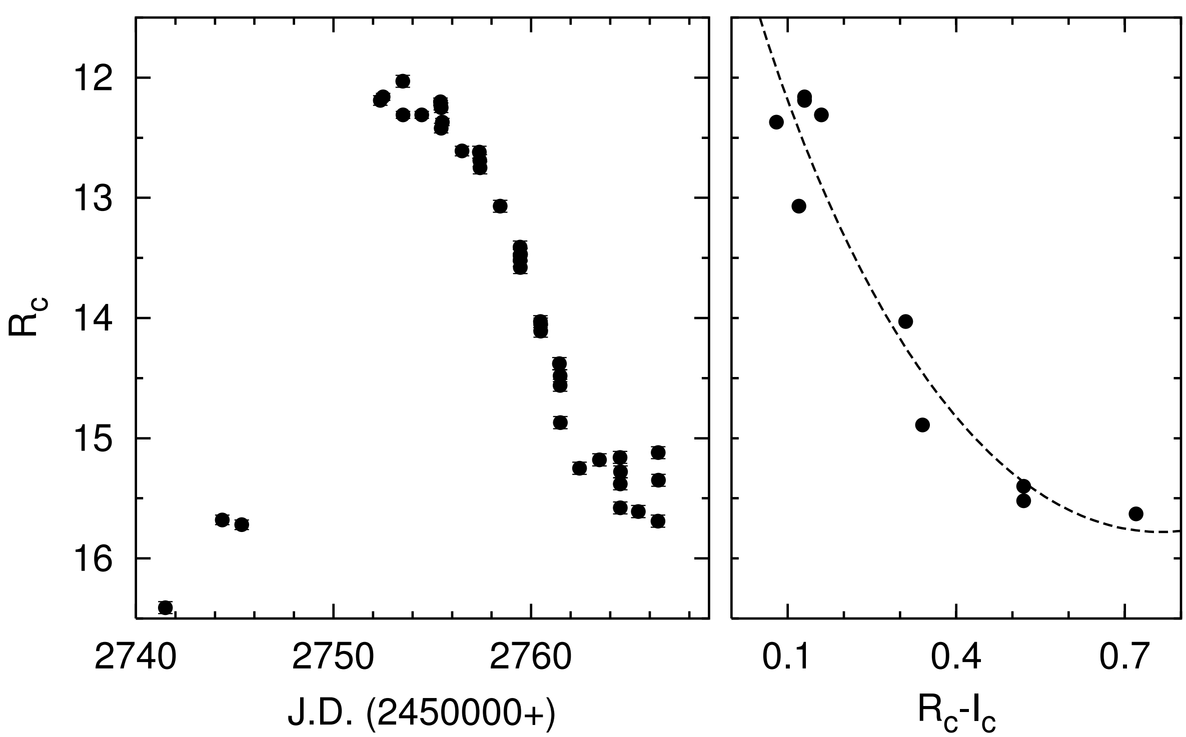

Figure 1. R_c light curve of X Leonis in April-May, 2003 (left panel). The R_c-I_c color index ranges from $\simeq 0.1$ to $\simeq 0.7$ mag (right panel).

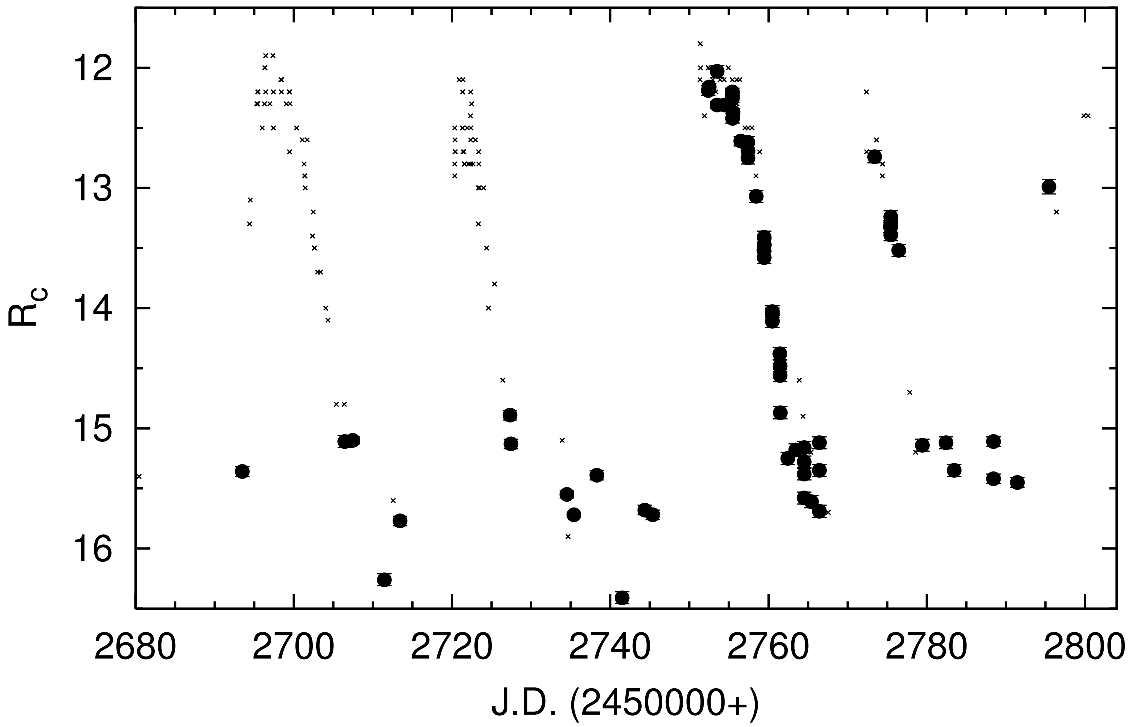

Figure 2. Overall R_c light curve of X Leonis. The small crosses represent visual estimates available in the VSNET web site *http://vsnet.kusastro.kyoto-u.ac.jp/vsnet/*.

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NEW VARIABLE STAR IN THE FIELD OF EM Cyg

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During the analysis of our photometric images in the field of EM Cyg, we have found an unidentified extremely red object ($V - I_c \simeq 5$) that shows variations of some tenths of magnitude. The position is RA = $19^{\rm h}38^{\rm m}48\overset{\rm s}{.}3$, DEC = $+30°28'58''$ (J2000); Fig. 1 shows the finding chart.

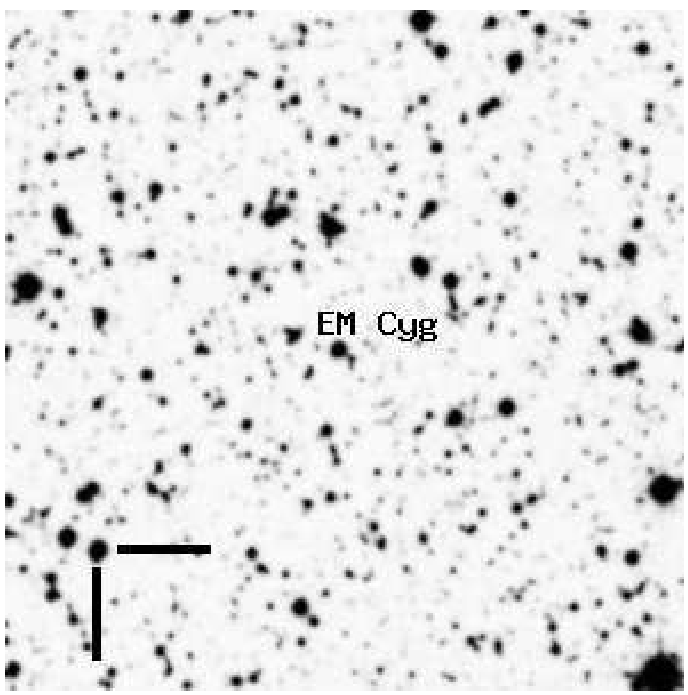

Figure 1. Finding chart of the new variable, centered on the dwarf nova EM Cyg. North is on the top, East on the left; the field is $5' \times 5'$ wide.

From the archival data of the Perugia and Teramo Observatories, we have verified that the object has been variable since the first CCD frames (in 1997) obtained for the monitoring of the dwarf nova EM Cyg. However, the identification is recent because of the slow variations.

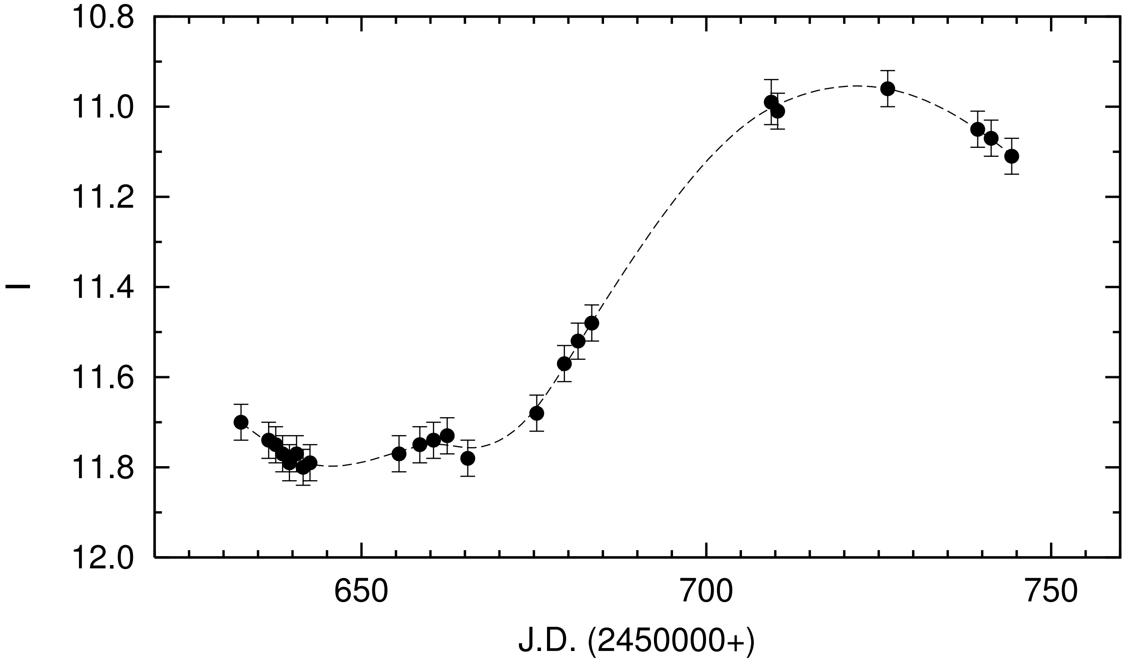

Figure 2. I_c light curve from July to October, 1997

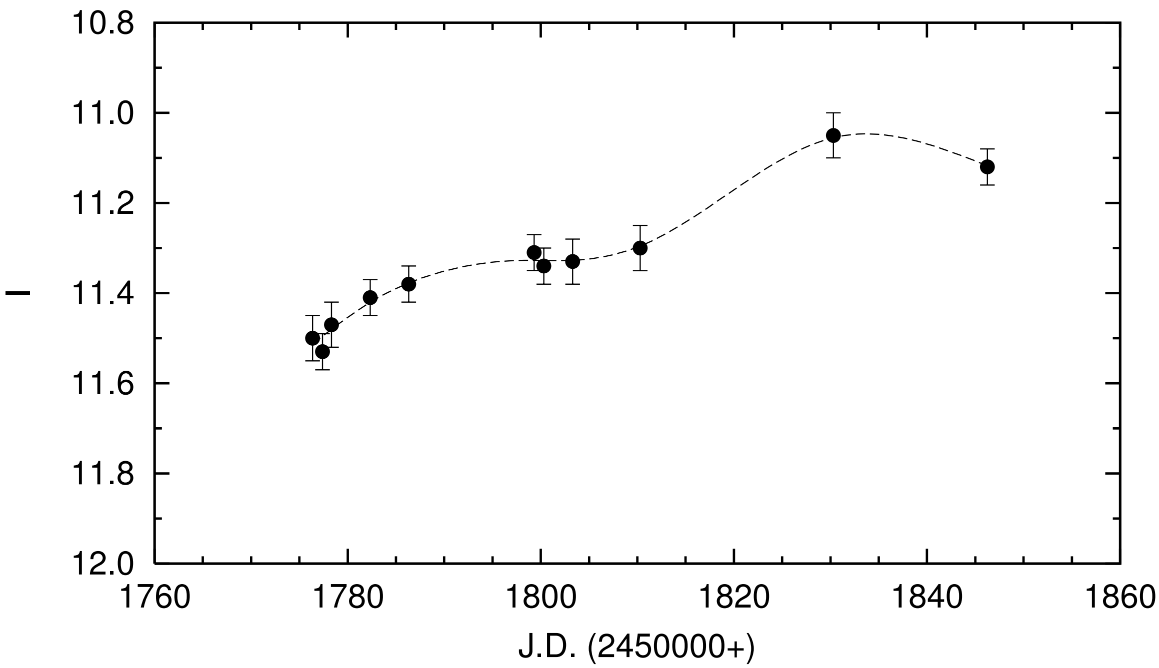

Figure 3. I_c light curve from August to October, 2000

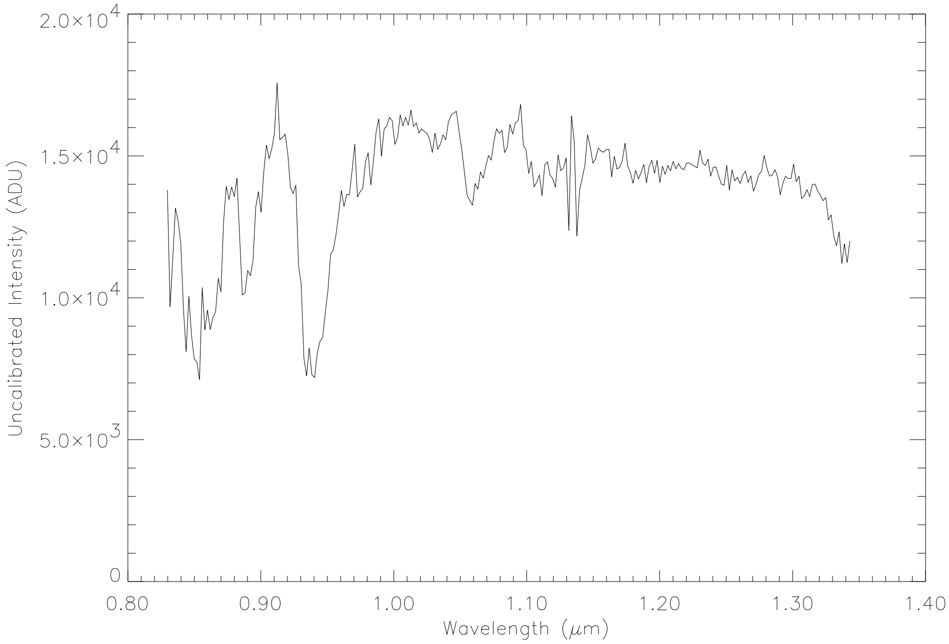

Figure 4. $I - J$ spectrum of the variable. We have identified the TiO 0.85μm, VO 1.06μm, TiO 1.10μm bands

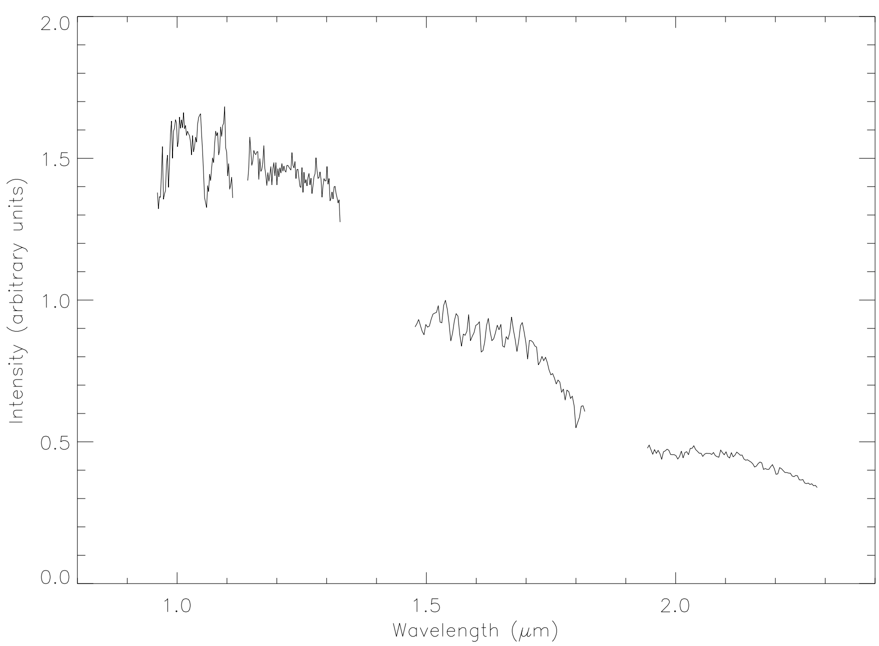

Figure 5. The spectral energy distribution of the variable is consistent with a 2800-3000 K star. In the H part of the spectrum we have identified the nine CO bands from 1.55 to 1.72 μm.

The photometric data were obtained with the 0.72 m telescope at the Teramo Astronomical Observatory, and the 0.40 m Automatic Imaging Telescope at the Perugia University Observatory. Both telescopes are equipped with CCD camera and BVR_cI_c Johnson-Cousins broad-band filters. The instruments used and the photometric techniques have already been described in Spogli et al. (1998, 2000). The data are obtained in differential photometry using the calibration stars reported by Misselt (1996), and Spogli et al. (2003). Figs 2 and 3 show the I_c light curve of the variable during 1997 and 2000. Variability is confirmed also with the sparse data obtained in 1998, and 2002. The R_cI_c extreme values and the mean color indexes are summarized in Table 1. Our V data do not cover all the variation amplitude, while in the B band the source is fainter than 18.5 mag. However, results are uncertain for the presence of a faint star near the variable.

Table 1

R_c max	R_c min	I_c max	I_c min	$\langle V - R_c\rangle$	$\langle R_c - I_c\rangle$	$\langle V - I_c\rangle$
13.7	14.8	11.0	11.8	2.0	3.1	5.1

From the maps of dust infrared emission (Schlegel et al., 1998) we can estimate the reddening: $A_B \simeq 2.2$, $A_V \simeq 1.7$, $A_R \simeq 1.3$, $A_I \simeq 1.0$. It is evident that the source is very red, and this reddening cannot be due to interstellar absorption alone. It was positively detected by 2MASS (J = 8.55±0.02, H = 7.56±0.02, Ks = 7.04±0.02, Cutri et al. 2003), and MSX (A = 0.20±0.02 Jy, Egan et al. 1999). There is also a radio source centered $\simeq$10 arcsecs near the variable, but it is not clear if the radio emission is correlated to the variable star. The NVSS Catalogue (Condon et al., 1998) reports an extended 1.4GHz source with major and minor axes less than 31.4 and 25.9 arcsecs, respectively. Also the WENSS Catalogue (de Bruyn et al., 1998) reports the presence of a 325 MHz source with a positional accuracy of 5-10 arcsecs.

For a proper identification of the variable, we have used the SWIRCAM low-resolution spectrometer ($R \sim 300$) at the AZT-24 1.1m telescope of the Campo Imperatore Observatory. The observations were made in September 4^{th}, 2002. Figs 4 and 5 show that the source is a cool-star (T_{eff} = 2800-3000 K), with large TiO, VO and CO absorption bands. Our conclusion is that the star is a long-period variable, probably a semi-regular. From the observations of this year we expect to have more constraints to find the average period.

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NSV 25610: A HIGH-AMPLITUDE δ SCUTI STAR

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NSV 25610 (= HD 204615 = BD+46°3325; $\alpha_{2000} = 21^{\rm h}28^{\rm m}24\overset{\rm s}{.}56$; $\delta_{2000} = +46°40'30\overset{''}{.}8$) was suspected of variability by Yoss et al. (1991). They derived a distance of 215 parsec, an absolute magnitude $M_v = 2.2$, and a total space velocity $S = 32$ with components $U = 5$, $V = 31$ and $W = -2$ (in km/s). They also determined $V = 8.86$ and $(B - V) = +0.27$ mag, which classifies this star as of spectral type F2. Piquard (2001) analysed the available Tycho data (Høg et al., 2000), and suggested it is a SX Phe variable star with a period of 0.094206 days.

This variable star was monitored on five nights in September and October 2003 at Beersel Hills Observatory (BHO) with a 40-cm telescope equipped with an ST10 XME camera (during three nights) and a 13-cm refractor with an ST7E camera (during two nights), using B and V filters. The total observation time was 28 hours, resulting in 622 V and 151 B data points. The frames were reduced with the aperture photometry procedure of the Mira AP software package.† The brightness of the variable was measured with respect to 10 stars in the immediate vicinity (with V and $B-V$ ranging from 8.2 to 10.6 mag and from 0.0 to 1.4 mag respectively). The magnitudes were then transformed to standard Johnson B&V magnitudes using the V and $B - V$ values from the Tycho catalogue (ESA, 1997). Standard deviations on the comparison stars data ranged between $0\overset{\rm m}{.}005$ and $0\overset{\rm m}{.}016$ mag.

Our data confirm that NSV 25610 is a high amplitude δ Scuti star (HADS), with the period given by Piquard (2001). The V magnitude varied between 8.53 and 8.97 mag, while the B magnitude varied between 8.82 and 9.38 mag. Due to its location near the galactic plane ($b = -3\overset{\circ}{.}13$) and its low space velocity, the star is most likely a Population I star, and not a SX Phe variable star. The following improved ephemeris could be derived:

$$\begin{array}{l}\text{Max.} = \text{HJD } 2452885.3992 + 0\overset{\rm d}{.}0942075 \times E. \\ \qquad\qquad\qquad\qquad \pm 0.0001 \pm 0.0000003\end{array}$$

The list of observed maxima, is given in Table 1. $O-C$ values are given with respect to the above ephemeris. A phase plot is shown in Fig. 1. Using Period98 (Sperl, 1998), the Fourier parameters presented in Table 2 were derived. These can be directly compared to those of other δ Scuti stars (Morgan, 2003). However, Fourier terms cannot aid to discriminate between these two stellar populations (Poretti, 2002).

†The Mira AP software is produced by Axiom Research Inc.

Table 1. Observed times of maximum.

HJD	E	$O-C$	Filter
2452885.3991	0	−0.0001	V
2452885.3993	0	0.0001	B
2452887.3777	21	0.0001	B
2452887.3778	21	0.0002	V
2452887.4720	22	0.0002	V
2452887.4720	22	0.0002	B
2452887.5656	23	−0.0003	V
2452887.5658	23	−0.0002	B
2452887.6599	24	−0.0002	V
2452928.2634	455	−0.0002	V
2452928.3582	456	0.0004	V
2452928.4520	457	−0.0001	V
2452928.5465	458	0.0003	V
2452929.2996	466	−0.0002	V
2452929.3940	467	−0.0001	V
2452929.4885	468	0.0002	V
2452929.5823	469	−0.0002	V
2452931.4667	489	0.0000	V

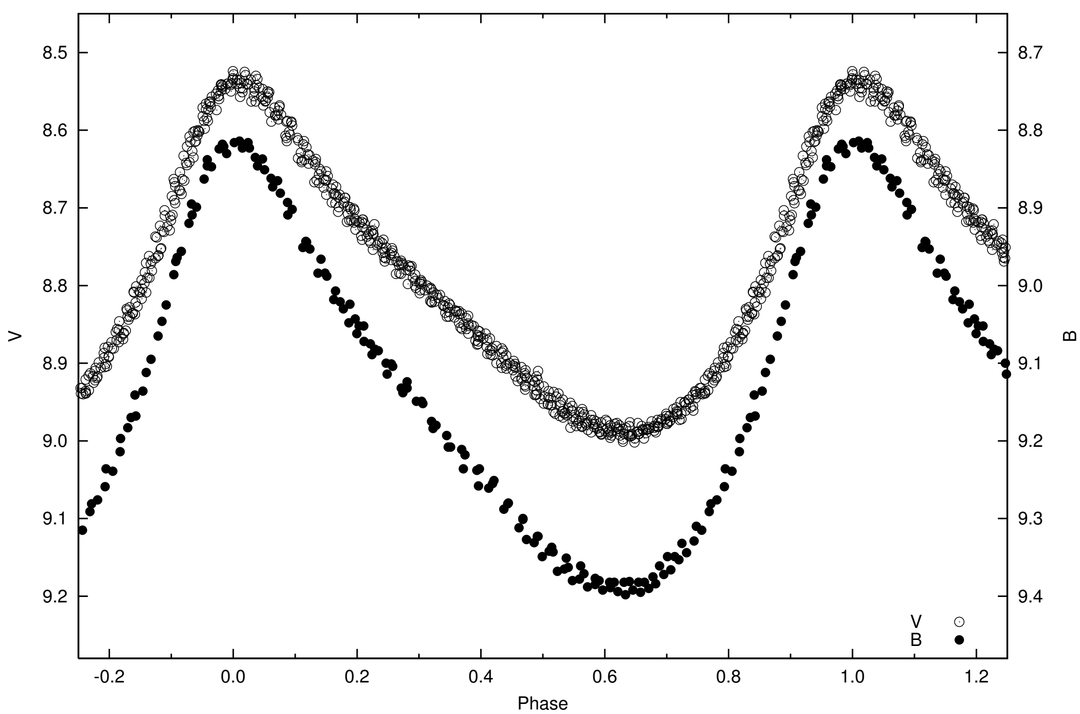

Figure 1. Phased B and V light curves of NSV 25610.

Table 2. Fourier parameters for the B and V data.

Parameter	B	V
A_0	9.15	8.80
R_{21}	0.269	0.276
R_{31}	0.095	0.099
R_{41}	0.039	0.043
Φ_{21}	4.17	4.20
Φ_{31}	1.48	1.51
Φ_{41}	5.30	5.37

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PHOTOELECTRIC MINIMUM TIMES OF SOME ECLIPSING BINARY STARS

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Observatory and telescope:
40-cm Cassegrain telescope of the TÜBİTAK† National Observatory and 30-cm Maksutov telescope of the Ankara University Observatory.

Detector:	OPTEC SSP-5A photometer 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:
Kwee & van Woerden (1956).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
MR Cyg	EA/SD	21 58 57	+47 59 00	BD +47°3622	50314.3217	1.6770343	1
V477 Cyg	EA/DM	20 05 28	+31 58 18	BD +31°3926	19468.3340	2.3469777	2
OX Cas	EA/DM	01 09 00	+61 28 15	BD +60°0170	46733.7696	2.48934608	2
V821 Cas	EA	23 58 49	+53 40 20	BD +52°3575	48500.4459	1.76975	3
V364 Lac	EA/DM	22 52 15	+38 44 45	BD +37°4736	49947.4091	7.3515258	4
V402 Lac	EA	22 09 15	+44 50 47	BD +44°4041	48500.9800	3.7820	3
UW LMi	EA	10 43 30	+28 41 09	BD +30°2060	50854.7742	3.874307	5
DN UMa	EA	11 55 06	+46 28 37	BD +47°1914	44275.6400	1.730411	6

Source(s) of the ephemeris:
1.: Linnell et al. (1998); 2.: Kreiner et al.(2001); 3.: ESA (1997); 4.: Torres et al. (1999); 5.: Clausen et al. (2001); 6.: García & Giménez (1986)

† TÜBİTAK : The Scientific and Technical Research Council of Turkey

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
MR Cyg	51056.4105	0.0004	II	*UBV*	0.0011	AUO
	51061.4446	0.0008	II	*UBV*	0.0041	TUG
V477 Cyg	51718.3976	0.0001	I	*UBV*	0.2430	TUG
	51721.4510	0.0003	II	*UBV*	−0.2240	TUG
	51728.4905	0.0004	II	*UBV*	−0.2255	TUG
	52117.3847	0.0001	I	*UBV*	0.2439	TUG
	52120.4372	0.0004	II	*UBV*	−0.2241	TUG
OX Cas	51722.3836	0.0007	I	*BV*	−0.0355	TUG
	52119.4910	0.0006	II	*UBV*	0.0212	TUG
V821 Cas	51720.3851	0.0009	II	*UBV*	−0.1209	TUG
	51721.3976	0.0003	I	*UBV*	0.0067	TUG
V364 Lac	49223.4067	0.0003	II	*UBV*	0.1229	AUO
	49234.3098	0.0003	I	*UBV*	−0.0013	AUO
	49256.3634	0.0004	I	*UBV*	−0.0023	AUO
	51057.4942	0.0003	I	*UBV*	0.0047	AUO
V402 Lac	51719.4730	0.0003	I	*UBV*	0.0110	TUG
	52115.4040	0.0004	II	*UBV*	0.7230	TUG
	52116.5720	0.0001	I	*UBV*	0.0000	TUG
UW LMi	51939.5807	0.0007	I	*UBV*	0.0005	TUG
DN UMa	51716.4305	0.0004	I	*BV*	0.0232	TUG

Explanation of the remarks in the table:

AUO: Ankara University Observatory, TUG: TÜBİTAK National Observatory

Acknowledgements:

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OPTICAL CCD OBSERVATIONS OF ETA CARINAE AT LA PLATA OBSERVATORY

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In 2003.5 Eta Carinae, suspected to be a binary system with a period of 5.53 years (cf. Damineli et al., 2000), was expected to undergo an X-ray eclipse (cf. Corcoran et al., 2001). In the framework of an international campaign to obtain multi-wavelength observations of this event, we have obtained optical CCD images of Eta Carinae. About 3000 images were acquired in 2003 between January and August. Here we present our data of Eta Car obtained before and during the X-ray eclipse.

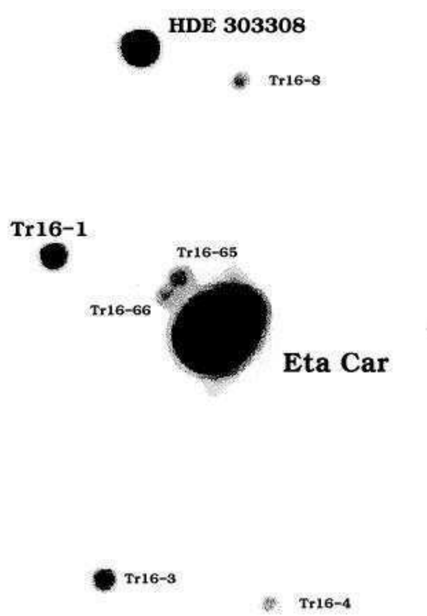

Figure 1. *V* image of the Eta Carinae region. North is up and East is to the left. Labels follow the nomenclature of Feinstein et al. (1973).

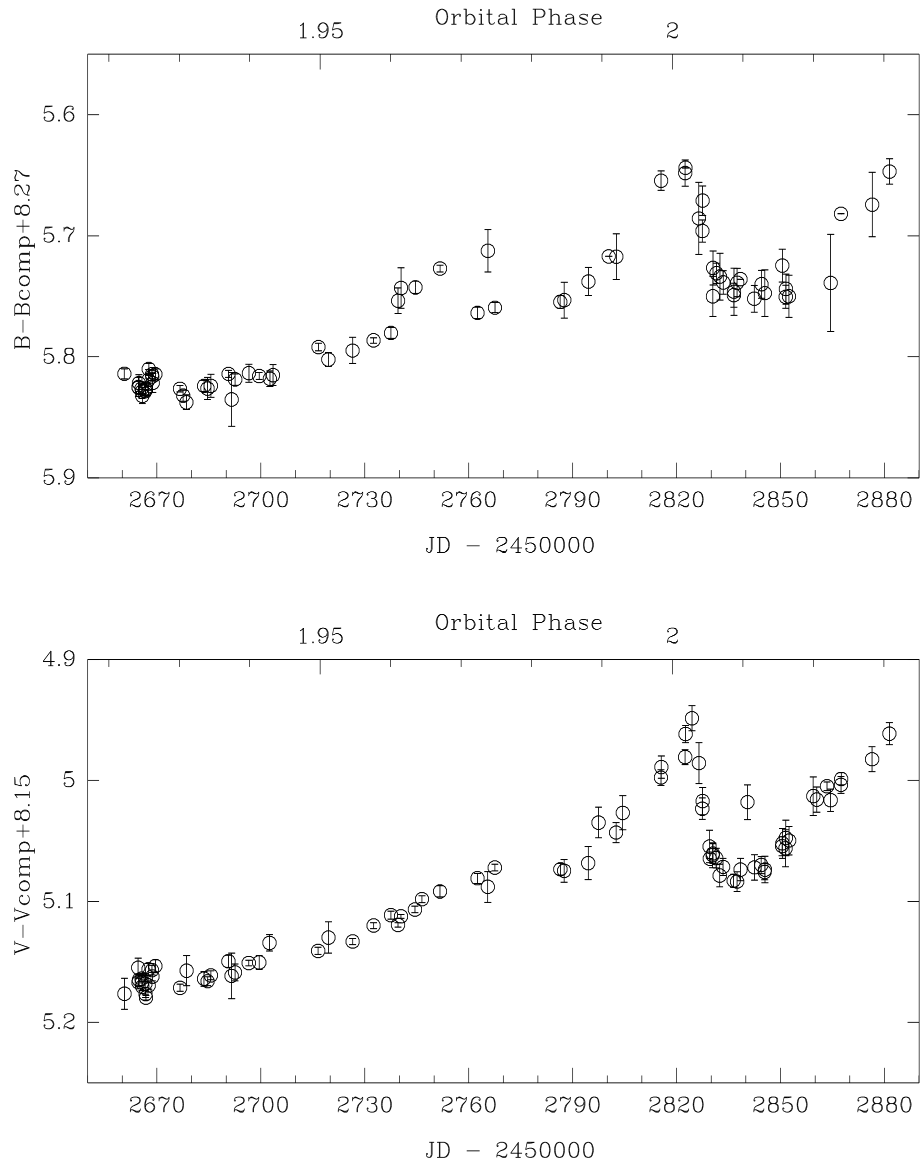

Figure 2. Relative B and V magnitudes of Eta Car observed between 20th January and 29th August, 2003. Bars represent the sample standard deviations. Along the top axis, orbital phases are indicated, calculated according to the ephemeris: heliocentric X-ray minimum = 1997.95 + 5.53609E (Corcoran 2003).

The images were acquired through Johnson-Cousins $BVRI$ filters with a Photometrics STAR I CCD camera attached to the 0.8-m reflector (f/20.06 Cassegrain) at La Plata Observatory, Argentina. The detector used is a Thomson-CSF TH7883 scientific-grade front-illuminated chip, Peltier cooled, of 384 × 576 pixels (23 μm square pixel). Our instrumental configuration results in $1\farcm9 \times 2\farcm8$ field images with an oversampled scale of $0\farcs3$ per pixel. $BVRI$ passbands used are those recommended by Bessell (1990) for coated CCDs. One of our images is reproduced in Figure 1, with identifications of the objects.

Differential photometry of Eta Car was determined using HDE 303308 as comparison star. This star was found to have constant light by Sterken et al (2001) and Freyhammer et al (2001). In order to give values approximate to the standard magnitudes of Eta Car, we have added to our relative magnitudes the $UBVRI$ Johnson-Kron-Cousins photometry of HDE 303308 by Feinstein (1982), i.e. $B = 8.27$, $V = 8.15$, $R = 8.01$ and $I = 7.85$.

Instrumental magnitudes of each star were determined by means of aperture photometry. In order to minimize small fluctuations, due to noise, the instrumental magnitudes, were calculated as an average of individual values determined in 6 apertures for Eta Car and 4 apertures for HDE 303308, selected constructing CCD growth curves (Howell et al., 1989) for the first observed frames. The radii of the apertures for Eta Car were between 80 and 105 pixels, and those for HDE 303308 between 40 and 60 pixels, with increments of 5 pixels. The values of the apertures were kept the same for all of the frames observed during the campaign.

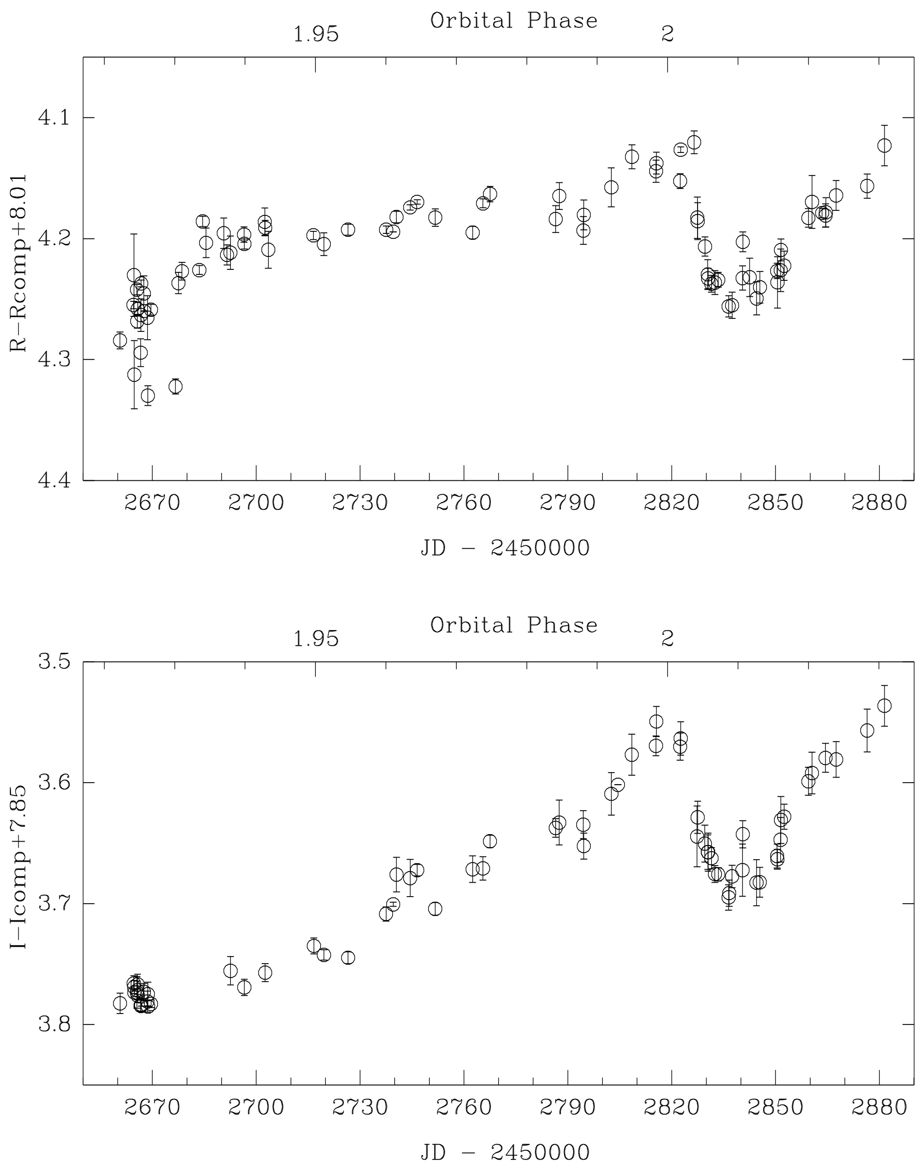

Figure 3. The same as Fig. 2 for relative R and I magnitudes.

Typical individual errors of B, V, R, I instrumental magnitudes are 0.008, 0.004, 0.006, and 0.01 mag respectively. Mean differential magnitudes of Eta Car were calculated from the instrumental magnitudes of a series of images obtained within intervals of 100-minutes ($\sim$ 0.000035 of orbital phase). Standard deviations were also calculated for each mean magnitude. These data are available through the IBVS-website as a table (`5477-t1.txt`) where, in successive columns we quote for each filter, the Julian Date of each observation, the mean differential magnitude, the standard deviation of the mean, and the number of images included in the mean values.

Variations of the observed *B, V, R, I* magnitudes of Eta Car from January to August, 2003, are shown in Figures 2 and 3. The optical variations seem to follow the behaviour of Eta Car observed in X-rays by RXTE, available on the web page of Dr. M. Corcoran (2003). We notice a fading of optical light about 10 days after the eclipse in X-ray was observed (phase 2.0 in the Figures 2 and 3). This fading is similar in shape to the infrared minimum observed during the previous X-ray eclipse of Eta Car (Feast et al., 2001).

An interpretation of this light fading as an optical eclipse of the Eta Car system is pending an analysis incorporating all the data collected during the multi-wavelength campaign of observations of this 2003.5 event.

The participation of the following students in obtaining the observations: Anabella Araudo, Gisela Romero, Ariel Sánchez Camus, Silvia Sicilia, Lautaro Simontacchi, Andrea Torres and Javier Vásquez is gratefully acknowledged. We thank the referee, Dr. C. Sterken, for valuable suggestions which improved the presentation of this paper.

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SIX SUSPECTED VARIABLE STARS IDENTIFIED AS ASTEROIDS

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In 1926-31, F. E. Ross published in the Astronomical Journal 10 lists of new variable stars he detected while blinking photographic plates during the search for his famous high-proper-motion stars. No classifications were given; his observations consisted of pairs of observations from plates he made and a series taken by E. E. Barnard about 15 years earlier. In the years since, most of his variables have been followed up or independently rediscovered and assigned permanent designations in the General Catalogue of Variable Stars (Kholopov et al., 1998). Ross' variables have been found to run the gamut of types: Miras, semi-regulars, RR Lyrae, Cepheids, and at least one active galaxy nucleus, SV* R 200[1] (Baumert and Cudworth, 1981).

A significant fraction of Ross' detections remain catalogued as suspected variables, or uncatalogued other than in Ross' original papers. Ross himself noted that some of his detections, particularly those detected at one epoch and not at the other, were "open to question" and possibly asteroids (1926b). He noted further that proving a detected variable was actually an asteroid "would be an exceedingly difficult matter". In 2003, this is no longer the case. The Solar System Dynamics Group of the Jet Propulsion Laboratory has made available via the Internet tools to rapidly identify small solar system bodies in a given field at any epoch after the year 1800, and to quickly calculate fully-perturbed n-body coordinates for any of over 71,000 objects (Chamberlin, 2002).

To search for possible asteroids misidentified as suspected variable stars, objects were selected from Ross' lists, with the following characteristics:

1. Only seen at one epoch
2. Not near an obvious candidate star on Digital Sky Survey images
3. Not associated with an IRAS or bright 2MASS source (possible LPV)
4. Not associated with a ROSAT X-ray source (possible CV)

Applying these criteria resulted in 24 candidates being selected. Of the 24, 6 (Table 1) were positively determined to be asteroids by comparing the suspected variable position with the results of a search for asteroids present near that position at the stated epoch. The positions given below for the asteroids are those of closest approach to Ross' position during hours of darkness at the observing site. All positions given are equinox J2000; all times and dates are UT.

[1]In order to avoid confusion with Ross' proper motion stars, I refer to his variables by the SIMBAD-style designation, SV* R NNN.

Table 1: Table 1: Ross Variables Identified as Asteroids

Ross No.	NSV No.	Asteroid	
SV* R 038	4748	(24)	Themis
SV* R 039	4796	(39)	Laetitia
SV* R 089	13752	(115)	Thyra
SV* R 136	308	(137)	Meliboea
SV* R 206	5338	(26)	Proserpina
SV* R 352	1982	(451)	Patientia

Details on specific objects:

SV* R 038 = NSV 4748. Not seen (to magnitude 15) on Barnard's plate, 1904 November 9[2]; seen on Ross' plate, 1925 March 31:

Datum	RA	Dec.	Magnitude
Ross (1926a)	$10^h08^m14^s$	$+12°28'.0$	10.0
(24) Themis at 01:00	$10^h08^m14^s.16$	$+12°28'01''.5$	11.44

SV* R 039 = NSV 4796. Not seen (to magnitude 15) on Barnard's plate, 1907 March 9; seen on Ross' plate, 1925 March 31:

Datum	RA	Dec.	Magnitude
Ross (1926a)	$10^h15^m27^s$	$+12°10'.5$	11.5
(39) Laetitia at 02:50	$10^h15^m27^s.26$	$+12°10'29''.3$	10.90

SV* R 089 = NSV 13752. Visible on Barnard's plate on 1904 June 20; not seen (to magnitude 15) on Ross' plate, 1925 August 20:

Datum	RA	Dec.	Magnitude
Ross (1926a)	$21^h31^m18^s$	$-17°47'.4$	11
(115) Thyra at 07:15	$21^h31^m18^s.85$	$-17°47'24''.1$	11.47

SV* R 136 = NSV 308 = SV* P 27 = CSV 96. Not seen on Barnard's plate, 1906 September 21, also not detected on 44 plates in the Sonneberg collection taken between 1930 October 19 and 1939 August 24 (Sandig, 1950); visible on Ross' plate, 1925 November 14:

Datum	RA	Dec.	Magnitude
Ross (1926b)	$00^h49^m19^s$	$+04°51'.4$	12
(137) Meliboea at 04:45	$00^h49^m19^s.17$	$+04°51'21''.9$	12.55

[2] Ross' papers give the local date of the observation.

SV* R 206 = NSV 5338. Visible on Barnard's plate, 1909 April 10; not seen on Ross' plate, 1927 April 6:

Datum	RA	Dec.	Magnitude
Ross (1927)	$11^h47^m43^s$	$+05°31'.1$	11
(26) Proserpina at 03:00	$11^h47^m43^s.07$	$+05°31'16''.5$	11.12

SV* R 352 = AAVSO 0520+26 = NSV 1982. Not seen (to magnitude 15) on Barnard's plate, 1906 October 13, visible on Ross' plate, 1927 February 22:

Datum	RA	Dec.	Magnitude
Ross (1929)	$05^h26^m37^s$	$+26°43'.5$	11
(451) Patientia at 03:00	$05^h26^m38^s.29$	$+26°43'24''.3$	11.12

The combination of absence on one plate, presence on the other and close correlation in time and magnitude to predicted asteroid positions demonstrate that these 6 suspected variables are not stars at all, but solar system objects in Barnard and Ross' fields.

A further 10 candidates (Table 2) were found *not* to be solar system objects using the same process, with no asteroid found. These 11 were relatively bright (magnitude 12 or less), and the population of asteroids this bright is well enough known to be considered complete.

Table 2: Table 2: Ross Variables Not Identified as Asteroids

SV* R 040	SV* R 166	SV* R 168
SV* R 199	SV* R 230	SV* R 243
SV* R 329	SV* R 349	SV* R 369
SV* R 376		

The remaining 8 (Table 3) had ambiguous search results, possibly due to position errors. Examination of the original plates and further database work will be required to positively identify the nature of these objects.

Table 3: Table 3: Ross Variables that Cannot be Characterized

SV* R 025	SV* R 029	SV* R 130
SV* R 160	SV* R 225	SV* R 231
SV* R 331	SV* R 344	

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This research has made use of the VizieR catalogue access tool and the Aladin interactive sky atlas, CDS, Strasbourg, France; NASA's Astrophysics Data System Bibliographic Services and JPL's HORIZONS On-Line Solar System Data and Ephemeris Computation Service.

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LIMITS ON PULSATIONS IN TWO ECLIPSING BINARIES: AY Cam AND RW CrB

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In the recent years, the interest in δ Scuti stars in eclipsing binary systems has been constantly increasing. There are a few ongoing surveys (e.g., Mkrtichian et al., 2002; Kim et al., 2003) aiming the identification of pulsating components in Algol systems of A-F spectral types. Our group has already published results of a similar survey (Kiss, 2002; Székely, 2003) and this paper presents an analysis for two other stars. The target objects were AY Camelopardalis (BD+77°328, sp. type A5−F5 (Lacy, 1987), $m_V = 9.69 - 10.26$ mag, $P \approx 2.735$d) and RW Coronae Borealis (HD 139815, sp. type F2V, $m_V = 10.22 - 10.78$ mag, $P \approx 0.726$d). The spectral types of these stars suggested there might be δ Scuti-like pulsations and these are the subjects of the present paper (RW CrB has already been investigated by Kim et al. (2003) with negative result).

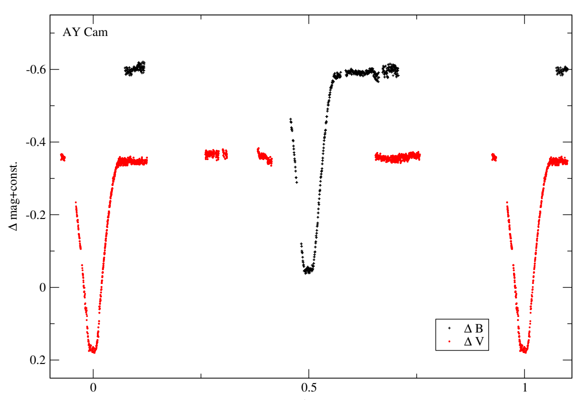

Figure 1. The phase diagrams of AY Cam in *B* and *V*. Note the very similar depths of the primary and the secondary minimum.

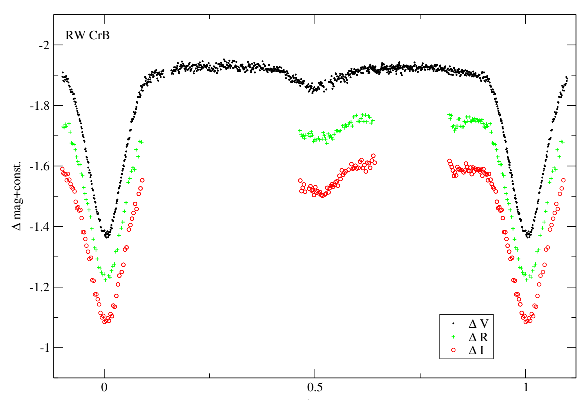

Figure 2. The phase diagrams of RW CrB in V(RI)$_C$ filters.

Our observations have been carried out at two observatories, on 15 nights in total. AY Cam was observed on nine nights between July 26 and December 31, 2001, while RW CrB on six nights between May 15 and June 21, 2002. The data of AY Cam were obtained at the Piszkéstető Station of the Konkoly Observatory using the 0.6m Schmidt-telescope

Table 1: Details of the observations and new times of minimum.

obs. date	hours	filter	HJD_{min}	obs. date	hours	filter	HJD_{min}
AY Cam				31/12/2001	2.93	B	–
26/07/2001	2.04	V	–	RW CrB			
28/07/2001	5.84	V	2452119.5240	15/05/2002	6.95	V	–
29/07/2001	0.65	V	–	16/05/2002	7.43	V	2452411.3455
30/07/2001	6.75	V	–	17/05/2002	7.31	V	2452412.4290
31/07/2001	7.25	V	–	18/05/2002	7.15	V	2452413.5231
01/08/2001	2.16	V	–	20/07/2002	3.14	V,R,I	–
27/12/2001	12.79	B	2452271.3097	21/07/2002	4.70	V,R,I	2452477.4488*
30/12/2001	10.00	B	–				

* mean epoch in three filters

equipped with a Photometrics AT200 CCD camera (1536×1024 pixels) and standard BV filters. The $V(RI)_C$ photometry of RW CrB was taken at the Szeged Observatory with the 0.4m Cassegrain telescope using an SBIG ST−9E CCD camera (512×512 pixels). The exposure times largely varied between 10 s and 60 s, depending on the filter, telescope, star and weather conditions. The journal of the observations is listed in Table 1.

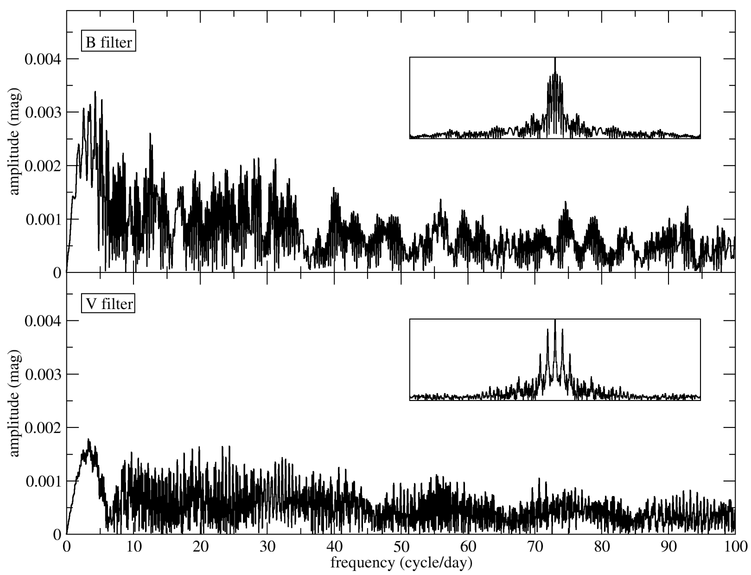

Figure 3. The amplitude spectra of AY Cam (top panel: B-filtered data, bottom panel: V-filtered data). Small panels show the window function on the same frequency scale.

The images were reduced with aperture photometry using IRAF[1]/digiphot. We chose close GSC stars as comparisons which did not show any significant brightness variations within ±0.02 mag (as judged from the comp−check scatter). To decrease the observational noise, we averaged all points taken within 60 s. All data were phased (Figs. 1-2) using the following ephemerides: AY Cam — $HJD_{\rm min} = 2452119.5240 + 2.7349658 \cdot E$; RW CrB — $HJD_{\rm min} = 2452411.3455 + 0.7264114 \cdot E$ (periods were taken from the GCVS).

We determined new times of minimum for both stars (Table 1). The epochs for AY Cam were adopted as the middle point of the flat minima, while for RW CrB, they were

[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.

calculated by fitting low-order (4-5) polynomials to the light curves around minima.

Since none of the individual light curves showed the absence of oscillations unambiguously, we examined the data with standard Fourier-analysis. For this, it was necessary to remove slow trends from the light curves caused by the variations outside eclipses. We fitted the lowest order polynomials to the light curves which reflected the trend but did not any of the faster and smaller variations (typically from linear to third-order). For the eclipses, polynomials were fitted separately to the ascending and the descending branches. After the trend subtraction, a period analysis of the residual light curve data was performed using Period98 of Sperl (1998). Fourier-spectra were calculated for the B and V (Figure 3) and the V (Figure 4) filtered data for AY Cam and RW CrB, respectively. The signal-to-noise ratios (S/N) of the highest peaks in the Fourier-spectra were determined and compared to the proposed limit of significance ($S/N > 4$) suggested by Breger et al. (1993).

The results are as follows. We could not detect any significant periodic signal in AY Cam with amplitudes greater than 3 mmag in B and 2 mmag in V. Similarly, we confirm the result by Kim et al. (2003) on the absence of oscillations in RW CrB by putting an upper limit of 2 mmag in V. We have also checked the noise effects on amplitude determination by injecting pure sine waves into the data with amplitudes close to the given limits. The calculated spectra revealed them with amplitudes smaller by about 10%. Therefore, the real upper limits might be larger by ~10%.

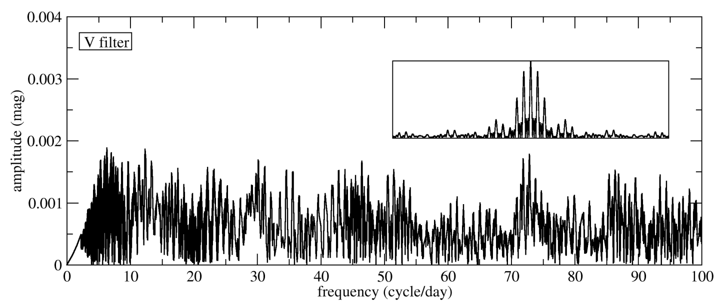

Figure 4. The amplitude spectrum of RW CrB in V. The small panel shows the window function on the same frequency scale.

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NEW ELEMENTS FOR 80 ECLIPSING BINARIES

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The public availability of the ASAS-3 database (Pojmanski, 2002) has given the opportunity of searching for variability in a large number of southern stars that lie between magnitudes 8 and 13, extending the range to 7-14 if proper care in analysing the data is taken. This study presents new elements for eclipsing binaries determined using ASAS-3 and Hipparcos (Perryman et al., 1997) databases. TASS data (Droege, 2003) were also used for some selected stars in equatorial zones. Some new eclipsing binaries are also presented. Two catalogues have been used to detect the candidates for this study: the Hipparcos Catalogue and the New Catalogue of Suspected Variable Stars (NSV) (Kukarkin and Kholopov, 1982) and its supplement (NSVS) (Kazarovetz et al., 1998). All stars showing mean Hp magnitudes close to the maximum Hp values in the Hipparcos Variability Annex were identified and their ASAS-3 data subsequently obtained. Some turned out to be constant, but most of them were bona-fide eclipsing binaries. This approach excludes the detection of EW-type binaries. Stars classified as possible eclipsing systems (of all types) in the NSV catalogues were also checked using the ASAS-3 database. Most of them turned out to be true eclipsing binaries and some were pulsating stars, mostly of the SR and RR-types. Also checked were stars with a spectral type between O and G that had no given classification within the NSV catalogues, often with positive results. The current paper features the first set of results of this study. The method of bisected chords was used to determine times of minima. The accuracy depends on the quantity and quality of the observations. Elements were found with AVE (Barberá, 1999) and a Microsoft Excel period search utility kindly provided by Patrick Wils (Wils, 2003). Suspect observations (saturated data in ASAS-3 and flagged observations in the Hipparcos Epoch photometry) were discarded before any analysis was undertaken. Hipparcos observations have been transformed to V using a table by the author (Otero, 2001). Table 1 shows the list of variables. The first column gives the variable star designation by alphabetical order according to the GCVS (blank for newly discovered variables). The following columns give another identifier; the brightness range of the variable, with the magnitude of secondary eclipse between brackets; the epoch of minimum light derived from the complete dataset; the period; the variability class and the spectral type with a note to the spectral type source.

Table 1. New elements for 80 eclipsing binary stars.

Star Name		Magnitude range	Epoch	Period	Type	Spectral type
Variable	Other ID	(V)	(HJD2440000+)	(days)		
AK For	HIP 016247	9.12–9.57 (9.33)	12655.671	3.98100	EA	K4V (4)
DK Tuc *	HIP 110842	6.85–7.06 (6.92)	8323.542	5.337933	EA	A1mA5-F0 (1)
DN Cru *	HIP 060786	8.76–9.05(9.04:)	12654.849	9.88134	EA	B8V (1)
DN Tuc *	HIP 114175	8.51–8.70 (8.68)	12068.780	5.85488	EA	F3V (1)
FM Leo	HIP 054766	8.44–8.94(8.93:)	8202.940	6.72863	EA	F7V (5)
	GSC 7915 0741	9.78–10.01 (9.99)	12470.531	0.841185	EW:	
	HD 101131	7.13–7.24 (7.17)	7964.840	9.64645	EA	O6.5 V((f))+O8.5 V (6)
	HD 174110	9.15–9.24 (9.22)	12104.641	29.717	EA	B8III (1)
IQ Lup	HIP 070840	10.31–10.66(10.43)	8682.838	3.54005	EA	G0 (12)
KT CMa *	HIP 032758	9.40–9.76 (9.6:)	8700.185	5.19010	EA	B7II/III (5)
MP TrA *	HIP 078526	7.79–7.92 (7.85)	8077.897	2.069719	EA	B7Ib/II (1)
NSV 00969	HD 017886	9.28–9.90 (9.32)	12564.723	2.59226	EA	A2/A3V (3)
NSV 03376	HD 053649	9.02–9.16 (9.13)	12785.566	3.5230	EB	B0.5III (8)
NSV 03526	GSC 7638 2163	12.39–13.56(12.52)	12183.820	2.15233	EA	
NSV 03589	HD 058872	7.82–8.23 (8.08)	12784.540	7.0508	EA	F2V (2)
NSV 03608	GSC 7116 1545	11.87–12.47(12.43)	12877.892	0.92015	EW	
NSV 03646	HD 060476	7.86–8.13(7.94:)	12763.433	2.6713	EA	B8II/III (4)
NSV 03688	HD 061961	7.98–8.33 (8.12)	12643.764	0.780408	EB	A3III (4)
NSV 03887	HD 066671	9.11–9.32 (9.25)	11928.652	7.2845	EA	A3V (4)
NSV 03934	HD 068296	8.72–9.09 (8.97)	11964.603	2.02218	EA/KE	B8V (3)
NSV 04120	GSC 7135 1108	11.11–11.59(11.37)	11965.577	1.49296	EB	
NSV 04419	GSC 5470 0539	10.48–11.11(10.58)	12732.719	3.15077	EA	A3 (14)
NSV 04542	GSC 8953 1247	10.87–11.50(11.45)	12615.737	0.80110	EW	
NSV 04561	HD 309731	10.38–11.18(11.06)	11948.606	3.16583	EA/KE	A5 (9)
NSV 04950	GSC 9219 1118	10.81–11.38(11.32)	11880.770	3.51151	EA	
NSV 05643	GSC 7242 0828	11.80–12.65(12.57)	11905.805	0.323464	EW	
NSV 05704	GSC 7246 1161	11.20–12.2(12.18:)	12454.529	0.3483075	EW	
NSV 07337	GSC 6191 1122	11.14–13.1 (11.22)	12845.597	1.238751	EA	
NSV 07597*	HIP 080022	8.67–8.86 (8.85)	8022.005	5.66215	EA	F6V (1)
NSV 07976*	HD 151475	8.00–8.22 (8.21)	12102.557	0.770478	EW/KE	B2V (13)
NSV 08117*	GSC 7372 0122	10.59–10.78(10.64)	12929.460	2.08355	EB:	A0 (11)
NSV 08266	GSC 6812 0691	11.55–12.7 (12.57:)	12726.1	53.05	EB	
NSV 08766	GSC 6235 2570	12.7–14.0:(14.0:)	12756.766	3.40949	EA	
NSV 09510	GSC 8343 1979	10.14–10.63(10.57)	12764.755	2.41887	EA	F8 (15)
NSV 09870	HD 163233	9.17–9.72 (9.70)	12441.669	4.24319	EA	A0IV (11)
NSV 10497	GSC 6265 0740	11.56–12.7 (11.86)	12442.697	4.11315	EB	
NSV 11243	HD 172666	10.05–10.52(10.27)	12104.601	6.4478	EA	A9IV (11)
NSV 12416	GSC 7451 0595	12.86–13.74:(13.6:)	12180.497	2.6954	EA	
NSV 13346	GSC 7968 1243	11.75–12.46(12.14)	12025.820	1.62873	EA	
NSV 13389	GSC 7968 0581	12.82–13.47:(13.45:)	12465.696	2.018848	EA	
NSV 13515	HD 200670	7.65–8.05 (8.00)	12623.549	0.410687	EW	F6/F7V (3)
NSV 13551	GSC 5779 0162	12.4–12.95:(12.85:)	12540.611	0.429583	EW	
NSV 13712	HD 204179	7.73–8.12 (8.04)	12437.798	0.753572	EW	F3IV/V (3)
NSV 13737	HD 204370	7.50–8.18(8.14:)	12854.862	5.9532	EA	A9V (2)
NSV 15107	HIP 002486	9.70–9.92 (9.75)	8635.666	2.277687	EA	F3V (3)
NSV 15203	HIP 004332	8.67–9.16 (8.90)	12227.588	11.03574	EA	G5V (3)
NSV 15212*	HIP 004505	9.99–10.18(10.04)	11881.544	1.577216	EA:	F2V (3)
NSV 17376*	HIP 034775	9.26–9.42 (9.39)	8496.256	1.60498	EB	F8 (11)
NSV 18844	HIP 057032	8.41–8.57:(8.53:)	8009.675	3.115733	EA	A2V+F6V (1)
NSV 20064*	HIP 069617	9.55–9.71(9.64:)	12738.708	2.20957	EA:	B2V (16)
NSV 20311*	HIP 075994	7.87–7.98 (7.90)	8574.241	1.086152	EB:	F3V (1)
NSV 20329	HIP 076254	8.57–8.76 (8.73)	8127.076	4.73065	EA	A4V (1)
NSV 20495*	HIP 078808	10.07–10.36(10.34:)	8657.588	3.97413	EA	F5 (15)
NSV 20579*	HIP 079970	8.86–9.04 (9.01)	7963.349	4.00305	EA	B9IV (2)
NSV 20831	HD 326440	10.09–10.52(10.35)	12481.518	3.92070	EA	B0.5V (8)
NSV 21910	HIP 085377	8.90–9.08 (8.96)	7921.793	1.859839	EB	B4III (2)

Table 1. New elements for 80 eclipsing binary stars.

Star Name		Magnitude range	Epoch	Period	Type	Spectral type
Variable	Other ID	(V)	(HJD2440000+)	(days)		
NSV 24609	HIP 092372	9.30–9.57 (9.35)	12760.834	2.59849	EB	A0:V: (17)
NSV 24630*	HIP 092943	8.09–8.40 (8.26)	12810.870	3.88181	EA	B9V (18)
NSV 24714	HIP 094482	8.91–9.01 (8.98)	12070.764	6.07195	EB	B6III (5)
NSV 24931*	HIP 098034	8.53–8.62 (8.61)	8404.165	2.69466	EB	F5/F6V (2)
NSV 24968	HD 189676	8.27–8.64 (8.43)	12527.618	3.40078	EA	B9 (11)
NSV 25330	HIP 102842	9.21–9.48 (9.34)	12845.852	2.47867	EA/RS:	G2/G3V (1)
NSV 25363*	HIP 102935	7.59–7.69 (7.64)	7985.661	0.806982	EB	F0V (4)
NSV 25590*	HIP 105915	9.18–9.33 (9.23)	11905.532	1.155466	EB	F5V (1)
NX Vel	HIP 042433	7.19–7.29 (7.26)	8256.485	2.91990	EA	O8V: (19)
RZ Cae *	HIP 021213	7.62–7.90 (7.78)	8092.281	2.486955	EA	A4V (3)
SW Pyx *	GSC 6569 3789	10.76–13.6: (10.88)	12056.450	2.98328	EA	
V340 Vel *	HIP 050463	7.83–7.96 (7.93)	11928.774	3.55953	EA	A3mA6-A7 (2)
V349 Vel *	HIP 051355	9.53–9.68 (9.67)	8710.806	3.02447	EA	F3(IVp Sr) (2)
V362 Pav	HIP 092330	7.39–7.62 (7.44)	8223.088	2.748435	EA	A2mA5-A9 (1)
V373 Nor *	HIP 080545	8.46–8.76 (8.64)	8997.670	4.94787	EA	B9V (1)
V414 Pup *	HIP 039229	8.79–9.12 (8.94)	12167.867	4.74922	EA+ACV	Ap Si (4)
V438 Pup *	HIP 041250	5.95–6.19 (6.17)	7976.370	4.9350	EA	B3V (2)
V963 Cen *	HIP 064941	8.60–8.98 (8.77)	11950.730	15.2693	EA+RS:	G2V (1)
V1046 Sco*	HIP 078919	9.25–9.66 (9.63)	8528.387	11.11641	EA	A1mA7-F0 (3)
V1082 Sco*	HIP 086163	10.0–10.48(10.34)	12096.300	23.446	EA	B0.5Ib (8)
V2365 Oph	HIP 083891	8.86–9.14 (8.94)	7909.540	4.86562	EA	A2 (11)
V2383 Oph*	HIP 086509	10.23–11.09(10.48)	12083.640	0.5022043	EA+BY	K7V (20)
VV Crt	HIP 056139	9.39–9.62 (9.6:)	8624.332	2.295599	EA/RS:	G2V (4)
WZ Pic *	HIP 026772	9.20–9.60 (9.27)	8836.287	1.21672	EA	A2mA7-A9 (1)

Sources of spectral type: (1) Houk and Cowley, 1975. (2) Houk, 1978. (3) Houk, 1982. (4) Houk and Smith-Moore, 1988. (5) Houk and Swift, 1999. (6) Gies et al., 2002. (7) Schalen, 1935. (8) Kennedy, 1983. (9) Nesterov et al., 1995. (10) Garrison et al., 1977. (11) Wright et al., 2003. (12) Perryman et al., 1997. (13) Whiteoak, 1963. (14) Kholopov et al., 2003. (15) Spencer and Jackson, 1939. (16) Feast et al., 1957. (17) Buscombe, 1998. (18) Buscombe, 1999. (19) Morgan et al., 1955. (20) Upgren et al., 1972.

Notes on individual stars:

DK Tuc = Visual binary. A= 6.9; B= 10.2. Sep. 2.″1 (Perryman et al., 1997)
DN Cru = Secondary eclipse might be the primary. Eccentric system.
DN Tuc = Period might be half the value given. Very short eclipses.
GSC 7915 0741 = CPD -38 7598. Might be an RRc-type star with half the period.
HD 101131 = HIP 56726 in the open cluster IC 2944. Eccentric. Slight apsidal motion. Period for primary eclipse given. Studied as a non-eclipsing system by Gies et al. (2002).
HD 174110 = BD-10 4817.
KT CMa = Wrong period suggested in the HIP catalogue. (9.480 d.)
MP TrA = Eccentric system. Visual binary. A= 8.5; B= 8.6 Hp. Sep. 0.″1 (Perryman et al., 1997).
NSV 07597 = Visual binary. A= 9.2; B= 10.0 Hp. Sep. 0.″6 (Perryman et al., 1997)
NSV 07976 = V magnitudes calibrated with GCPD data (Mermilliod et al., 1997). ASAS-3 data contaminated by companion.
NSV 08117 = Might be EA-type.
NSV 15212 = Might be EB-type.
NSV 17376 = Koen and Eyer (2002) give per= 0.8025 d.
NSV 20064 = Might be EB-type.

NSV 20311 = Might be EA-type. Koen and Eyer (2002) give per= 0.5431 d.
NSV 20495 = Visual triple. AB= 6″.8; AC= 10″.5 (Worley and Douglass, 1997).
NSV 20579 = Eccentric binary.
NSV 24630 = Eccentric. Slight apsidal motion. Period for primary eclipse given.
NSV 24931 = Koen and Eyer (2002) give per= 1.34736 d.
NSV 25363 = Handler (1999) wrongly classified it as a DSCT? with a 0.526 d. period.
NSV 25590 = Koen and Eyer (2002) give per= 0.57773 d.
RZ Cae = Visual binary. A= 7.8; B= 9.6. Sep. 3″.1 (Perryman et al., 1997).
SW Pyx = No period in the literature.
V340 Vel = Visual binary. A= 8.3; B= 9.2 Hp. Sep. 0″.3 (Perryman et al., 1997).
V349 Vel = Also an intrinsic variable? (ACV: or DSCT:). Binarity may have caused problems with HIP photometry. Visual binary. A= 10.0; B= 11.2 Hp. Sep. 1″.1.
V373 Nor = Eccentric system.
V414 Pup = Synchronous rotation. ACV and EA period are the same. ACV var. = 0.05 mag.
V438 Pup = Very eccentric. Multiple system. A= 6.9; a= 8.0; B= 7.0 (Tokovinin, 1997). Sep. AB= 0″.45; Aa= 0″.049 (Hartkopf et al., 1996). Period discovered by visual observations. HIP catalogue suggested 5.699 d.
V963 Cen = Very eccentric. 0.08 mag. scatter at maximum: possible RS-type.
V1046 Sco = Eccentric.
V1082 Sco = Very eccentric. Also possible ACYG-type.
V2383 Oph = Koen and Eyer (2002) give per= 0.12555 d.
V4386 Sgr = Too few observations of minima II. Secondary minimum might be the primary.
WZ Pic = Koen and Eyer (2002) give per= 0.60835 d.

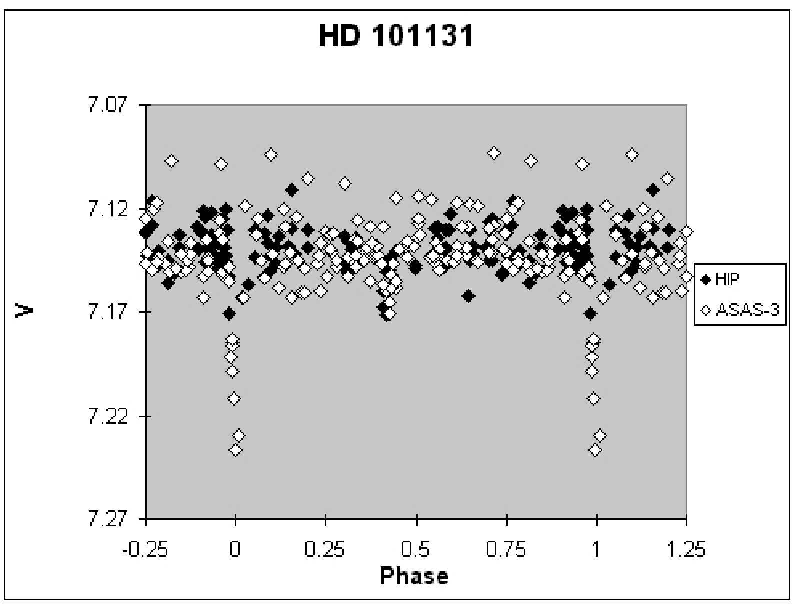

Figure 1. Lightcurve of HD 101131 showing Hipparcos and ASAS-3 observations.

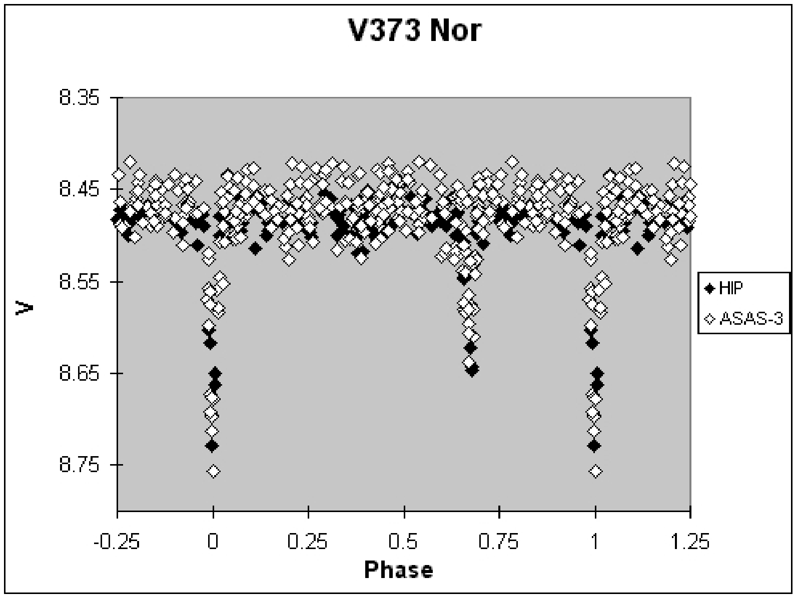

Figure 2. Lightcurve of V373 Nor showing Hipparcos and ASAS-3 observations.

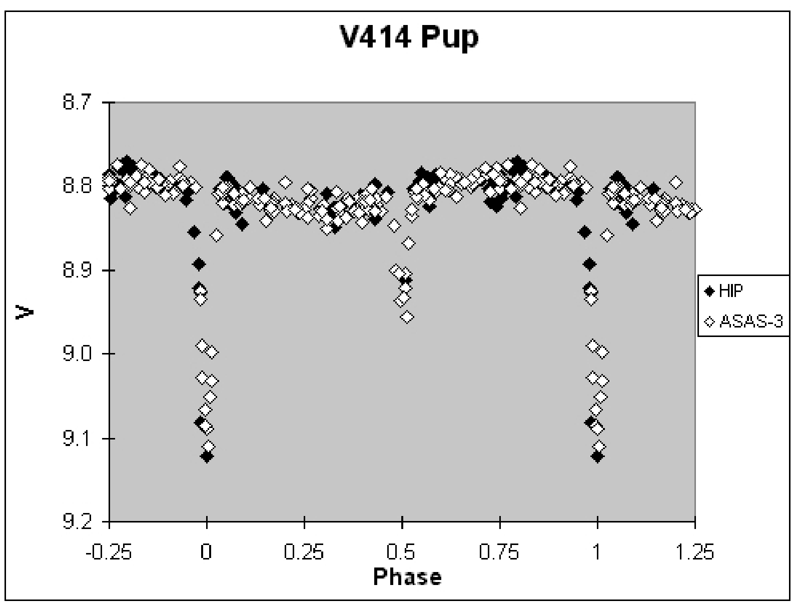

Figure 3. Lightcurve of V414 Pup showing Hipparcos and ASAS-3 observations.

Acknowledgements: The author wants to thank John Greaves for his collaboration and suggestions and Patrick Wils for providing his period search utility. This research has made use of the SIMBAD and VizieR databases operated at the Centre de Donnes Astronomiques (Strasbourg) in France.

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FOUR RR LYRAE STARS WITH VARIABLE PERIODS IN OPHIUCHUS

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The discovery of the variability of these stars has been reported by Hughes-Boyce and Huruhata (1942) and Hoffmeister (1966, 1967); but there were no ephemeris published until today. Photographic plates of a field centered around 67 Oph, taken with the Sonneberg Observatory 40cm Astrograph during three intervals spread over the years from 1938-1994, were used to check the behaviour of these objects (see Table 1). To avoid effects of cycle count ambiguities due to the somewhat inauspiciously distributed plates with large gaps in time, importance has been attached to get well-fitted composite light curves representing all available observations. Therefore the reported period changes represent the smallest value of period alteration suitable to achieve this aim. The elements listed below were obtained by means of least-squares solutions.

Photographic amplitudes were derived with respect to magnitudes of the comparison stars given in Table 2. Individual data are available upon request.

Remarks:

V823 Oph
Elements valid for J.D. 2429100-2441200 and J.D. 2444000-2449500 resp.

V825 Oph
Elements valid for J.D. 2429700-2441200 and J.D. 2443300-2449500 resp.

NSV 9820
Elements given below are at least valid for an interval of JD 2438200-2449500. Unfortunately there were not enough older plates available to determine the date of the period change as well as the value of the period acting in the time before the interval mentioned above. The star was announced by Hoffmeister to be an eclipsing binary of EB type.

NSV 10115
Elements valid for J.D. 2429100-2440500 and J.D. 2443300-2449500 resp.

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

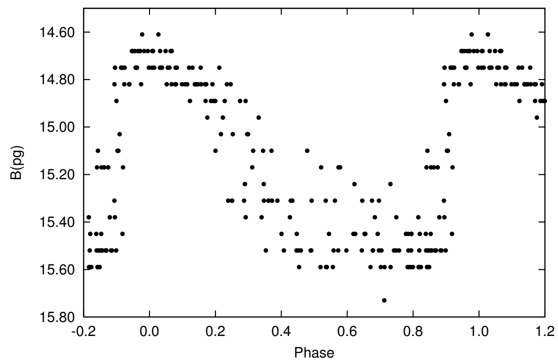

Figure 1. Composite light curve of V823 Oph

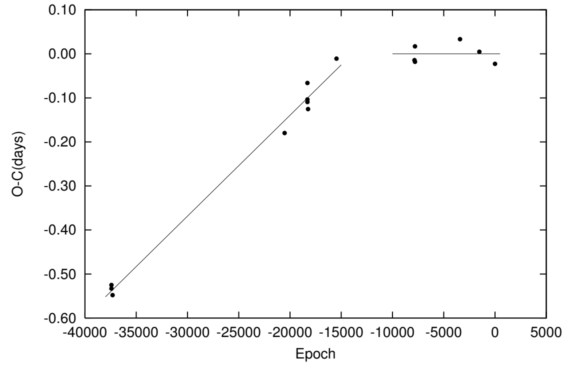

Figure 2. (O−C) diagram for V823 Oph

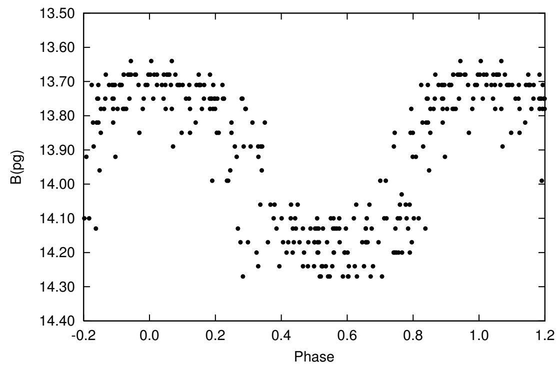

Figure 3. Composite light curve of V825 Oph

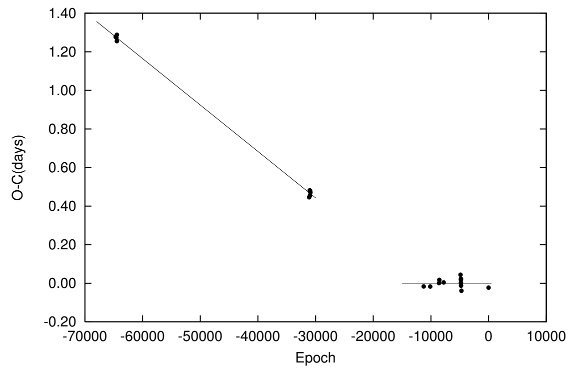

Figure 4. (O−C) diagram for V825 Oph

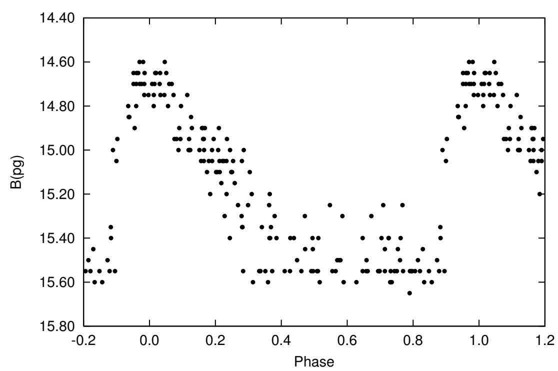

Figure 5. Light curve of NSV 9820 (J.D. 2438258 − 2449475)

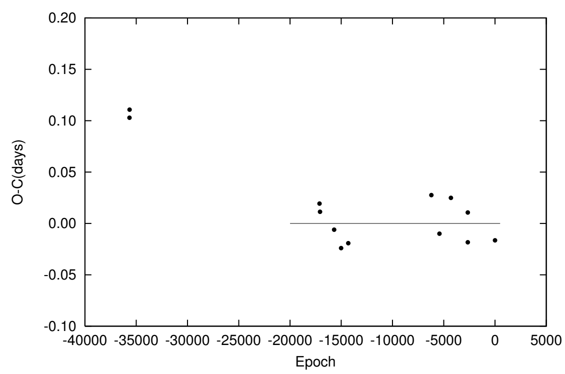

Figure 6. (O−C) diagram for NSV 9820

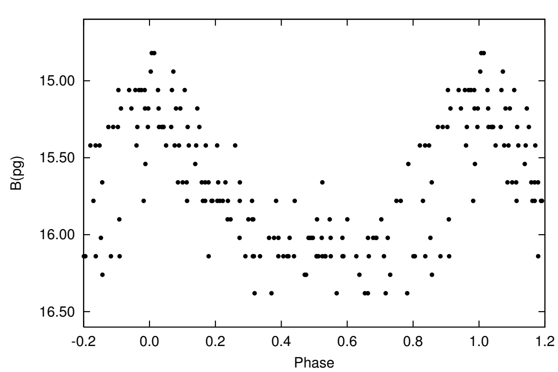

Figure 7. Composite light curve of NSV 10115

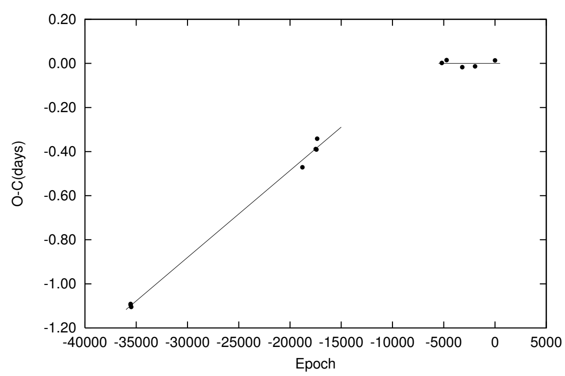

Figure 8. (O−C) diagram for NSV 10115

Table 1. Summary of this paper

Star	Type	Epoch 2400000+	Period (day)	Max.	Min.	M−m	No. of Plates
V823 Oph (1)	RRab	29785.481 ±13	0.5176480 ±8	$14\overset{m}{.}7$	$15\overset{m}{.}5$	$0\overset{p}{.}15$	103
V823 Oph (2)		49154.516 ±18	0.5176251 ±31				93
V825 Oph (1)	RRc	29816.434 ±6	0.2940934 ±3	$13\overset{m}{.}7$	$14\overset{m}{.}2$		114
V825 Oph (2)		48802.505 ±16	0.2941175 ±24				133
NSV 9820	RRab	48801.529 ±11	0.5326038 ±10	$14\overset{m}{.}6$	$15\overset{m}{.}5$	$0\overset{p}{.}12$	217
NSV 10115 (1)	RRab	29786.519 ±14	0.5440501 ±10	$15\overset{m}{.}0$	$16\overset{m}{.}1$	$0\overset{p}{.}13$	88
NSV 10115 (2)		49124.475 ±15	0.5440106 ±41				56

Table 2. Comparison stars and cross references

	V823 Oph HV 11044 USNO 0900-10538562		V825 Oph HV 11047 USNO 0900-10598218	
Comp. No.	USNO	m*	USNO	m*
1	0900-10551987	$14\overset{m}{.}3$	0900-10595254	$13\overset{m}{.}5$
2	0900-10540298	$15\overset{m}{.}0$	0900-10608192	$14\overset{m}{.}0$
3	0900-10538956	$15\overset{m}{.}3$		
4	0900-10541236	$15\overset{m}{.}7$		

	NSV 9820 S 9844 USNO 0900-10833595		NSV 10115 S 9287 USNO 0900-11413039	
Comp. No.	USNO	m*	USNO	m*
1	0900-10828563	$14\overset{m}{.}4$	0900-11409203	$15\overset{m}{.}4$
2	0900-10834041	$14\overset{m}{.}9$	0900-11412225	$16\overset{m}{.}1$
3	0900-10826923	$15\overset{m}{.}1$		
4	0900-10831651	$15\overset{m}{.}3$		

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

Table 3. Heliocentric times of maxima and $O-C$ values according to the elements derived in this paper; the more recent second set of elements was used in the cases with two given sets.

Star	JD (max.*)	Epoch	$O-C$	Star	JD (max.*)	Epoch	$O-C$
V823 Oph	29785.481	−37418	−0.539	V825 Oph	47388.390	−4808	0.002
	29786.522	−37416	−0.533		47390.470	−4801	0.023
	29843.446	−37306	−0.548		47391.347	−4798	0.018
	38528.528	−20528	−0.180		47395.434	−4784	−0.013
	39682.428	−18299	−0.066		47418.349	−4706	−0.039
	39683.420	−18297	−0.109		48802.482	0	−0.023
	39684.461	−18295	−0.104	NSV 9820	29808.450	−35660	−0.430
	39712.391	−18241	−0.125		29816.447	−35645	−0.422
	41150.468	−15463	−0.011		39685.503	−17116	0.019
	45087.521	−7857	−0.014		39708.397	−17073	0.011
	45115.486	−7803	−0.001		40444.438	−15691	−0.006
	47387.377	−3414	0.033		40803.395	−15017	−0.024
	48362.554	−1530	0.005		41179.418	−14311	−0.019
	49154.493	0	−0.023		45492.490	−6213	0.028
V825 Oph	29786.438	−64659	1.278		45916.405	−5417	−0.010
	29788.495	−64652	1.276		46507.630	−4307	0.025
	29816.433	−64557	1.273		47386.398	−2657	−0.003
	29843.474	−64465	1.255		48801.513	0	−0.016
	29844.389	−64462	1.288	NSV 10115	29785.438	−35547	−1.091
	39651.484	−31115	0.446		29786.522	−35545	−1.095
	39684.461	−31003	0.481		29816.433	−35490	−1.105
	39686.492	−30996	0.454		38901.500	−18791	−0.471
	39702.398	−30942	0.477		39611.517	−17486	−0.388
	39712.391	−30908	0.470		39648.507	−17418	−0.391
	45492.490	−11254	−0.017		39684.461	−17352	−0.342
	45822.489	−10132	−0.017		46298.342	−5195	0.002
	46272.507	−8602	0.001		46554.584	−4724	0.015
	46288.406	−8548	0.017		47387.432	−3193	−0.017
	46506.628	−7806	0.004		48067.449	−1943	−0.014
	47368.432	−4876	0.044		49124.489	0	0.014

* Mid-exposure times of plates with brightest observations

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HIPPARCOS ECLIPSING BINARIES SHOWING APSIDAL MOTION

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Combination of the publicly available Hipparcos data (Perryman et al., 1997) from 1989-1993 and ASAS-3 data (Pojmanski, 2002) from 2001 to the present allows the detection of apsidal motion in three eclipsing binaries discovered by the satellite. Table 1 lists the main parameters of the stars. The first column gives the variable star designation. The following columns show the V band range (with the secondary eclipse magnitude between brackets), the period of the primary and secondary eclipse respectively, and the variability and spectral types.

Table 1.

Star	V magnitude	Period I	Period II	Type	Sp
V366 Pup	8.07 −8.59 (8.47)	2.4840254	2.483898	EA	B9V*
PT Vel	7.02 −7.70:(7.37:)	1.8020075	1.802035	EA	A0V**
V466 Car	7.27 −7.55 (7.46)	3.455800	3.455887	EA	B8/9V*

*Houk & Cowley, 1975.
*Houk, 1978.

Hipparcos observations have been transformed to V using a table by the author (Otero, 2001). The method of bisected chords was used to determine times of minima. The accuracy depends on the quantity and quality of the observations. Wrong observations (random data points deviating >0.05 mag. from the mean folded light curve) were discarded before any analysis was made.

Table 2 show times of minima and residuals for all the stars based on the primary eclipse period to make the phase shift of the secondary eclipse evident.

Individual stars

1) V366 Puppis = NSV 3555 = HIP 35607 = HD 57897 is a known visual binary system (WDS07209-4831 AB), with an 8.4 mag. primary and a 9.6 secondary 7″ away according to the WDS (Worley et al., 1997). It was first suspected as a variable star (BV 438) back in 1964 (Strohmeier et al., 1964a). Its period could not be solved in the Hipparcos Catalogue. The primary is the eclipsing binary with the following light elements:

$$\mathrm{Min\,I} = \mathrm{HJD}2447860.351(\pm 0.001) + 2.4840254(\pm 0.0000020) \times \mathrm{E}$$
$$\mathrm{MinII} = \mathrm{HJD}2447861.900(\pm 0.100) + 2.4838980(\pm 0.0000050) \times \mathrm{E}$$

Table 2.

Star	HJD+2400000(σ)	$O-C$	Min	Source*
V366 Pup	47861.900(0.100)	0.000	II	H
	48635.365(0.010)	−0.002	I	H
	51905.708(0.030)	−0.185	II	A
	52033.514(0.010)	0.000	I	A
	52234.714(0.010)	−0.006	I	A
	52787.502(0.050)	−0.220	II	A
PT Vel	48294.360(0.020)	0.000	II	H
	52425.479(0.020)	−0.017	I	A
	52651.704(0.020)	0.090	II	A
	52789.521(0.020)	0.019	I	A
	52922.862(0.010)	0.012	I	A
V466 Car	48316.908(0.020)	0.017	I	H
	48779.943(0.020)	−0.025	I	H
	49047.376(0.020)	−0.002	II	H
	51931.658(0.010)	0.000	I	A
	51967.612(0.020)	0.083	II	A
	52539.853(0.020)	−0.025	I	A
	52940.765(0.020)	0.014	I	A

*H = Hipparcos; A = ASAS-3

Eclipse durations are very different, the secondary during 0.29 and the primary 0.11 days. The light curve can be seen in Figure 1a. The apsidal motion is fast and comparable to that of GL Carinae (Giménez & Clausen, 1986) which shows a 25 years-period. If we use the primary eclipse period as a reference, V366 Pup eclipse shifted from phase 0.63 in 1989 to phase 0.54 in 2003. Figure 1b shows this effect clearly.

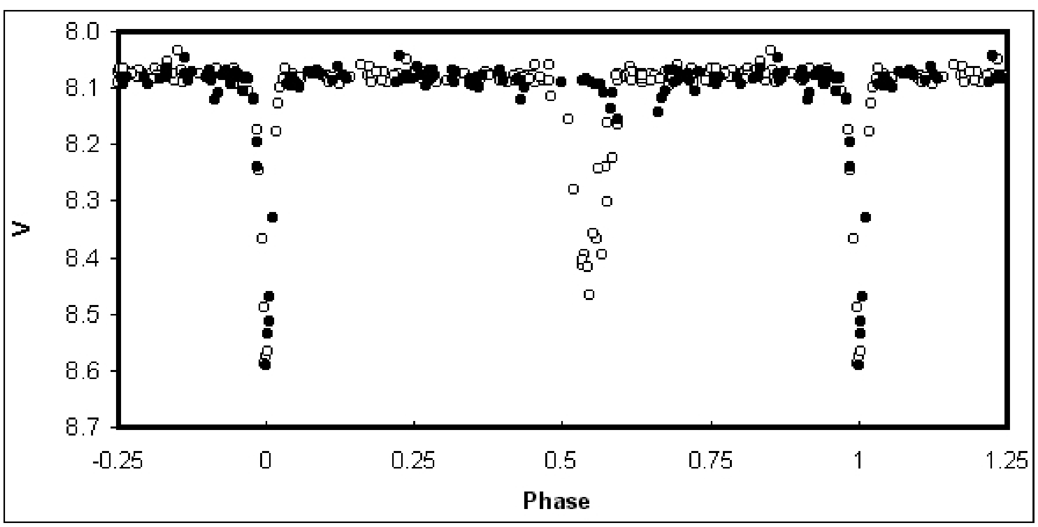

Figure 1. Light curve of V366 Pup showing Hipparcos (filled circles) and ASAS-3 observations (open circles).

2) PT Velorum = NSV 4409 = HIP 45079 = HD 79154 was first suspected of variability in 1964 and named BV 469 (Strohmeier et al., 1964b). Its eclipsing nature was discovered by Hipparcos which solved a period of 1.80201 days. Comparison with ASAS-3 data also

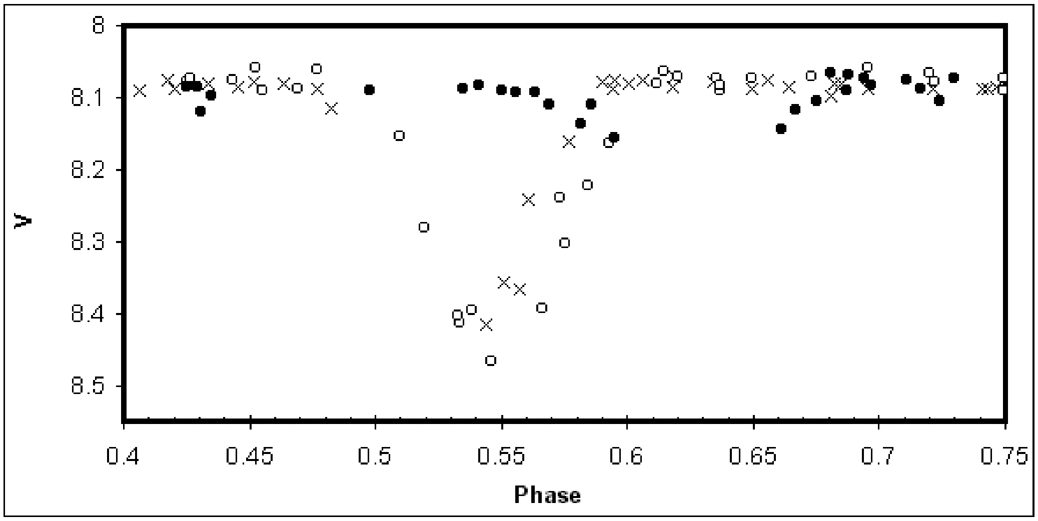

Figure 2. Phase shift in the secondary eclipse of V366 Pup. Filled circles are Hipparcos observations. Open circles and crosses are 2000-2001 and 2002-2003 data from ASAS-3 respectively.

revealed apsidal motion.

$$\mathrm{Min\,I} = \mathrm{HJD}2448293.493(\pm 0.001) + 1.8020075(\pm 0.0000010) \times \mathrm{E}$$

$$\mathrm{MinII} = \mathrm{HJD}2448294.360(\pm 0.020) + 1.8020350(\pm 0.0000010) \times \mathrm{E}$$

Primary eclipse lasts 0.23 days and secondary 0.17 days. The latter shifted from phase 0.48 to 0.53. Both eclipses lack observations at the instant of minimum light so more observations are needed to confirm the amplitude and nature of the eclipses.

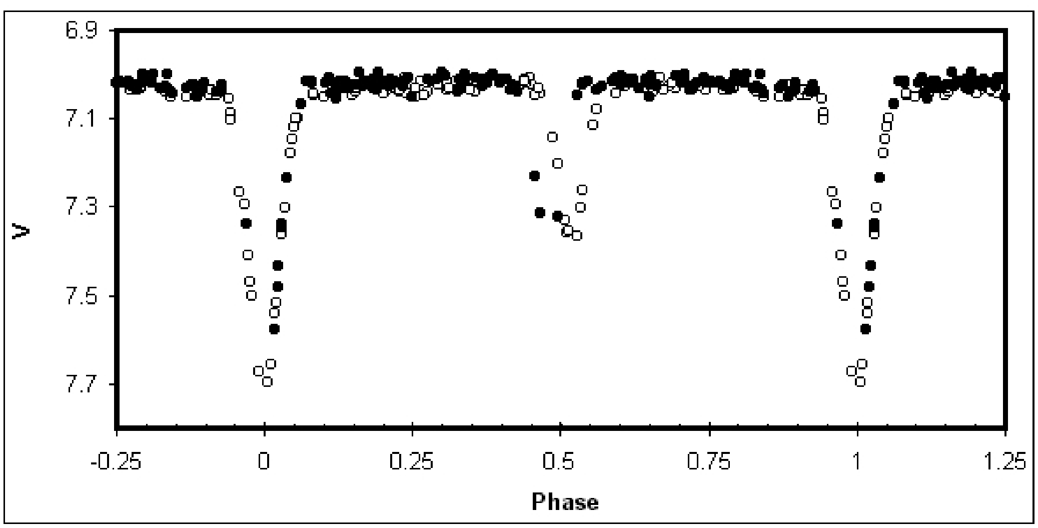

Figure 3. Light curve of PT Vel showing Hipparcos (filled circles) and ASAS-3 observations (open circles).

3) V466 Carinae = NSV 4003 = HIP 40666 = HD 70333 was first discovered to be variable by Strohmeier (1966) who designated it as BV 821. Its period was published in

the Hipparcos Catalogue. ASAS-3 data again show a slight displacement in the secondary eclipse over these ten years. However, this is small if compared with the previous cases and goes from phase 0.38 to 0.41. Light elements:

$$\mathrm{Min\,I} = \mathrm{HJD}2448036.971(\pm 0.02) + 3.455800(\pm 0.000001) \times \mathrm{E}$$

$$\mathrm{MinII} = \mathrm{HJD}2448038.284(\pm 0.05) + 3.455887(\pm 0.000002) \times \mathrm{E}$$

Eclipses seem to be total (this needs confirmation) and last 0.35 (primary) and 0.27 (secondary) days.

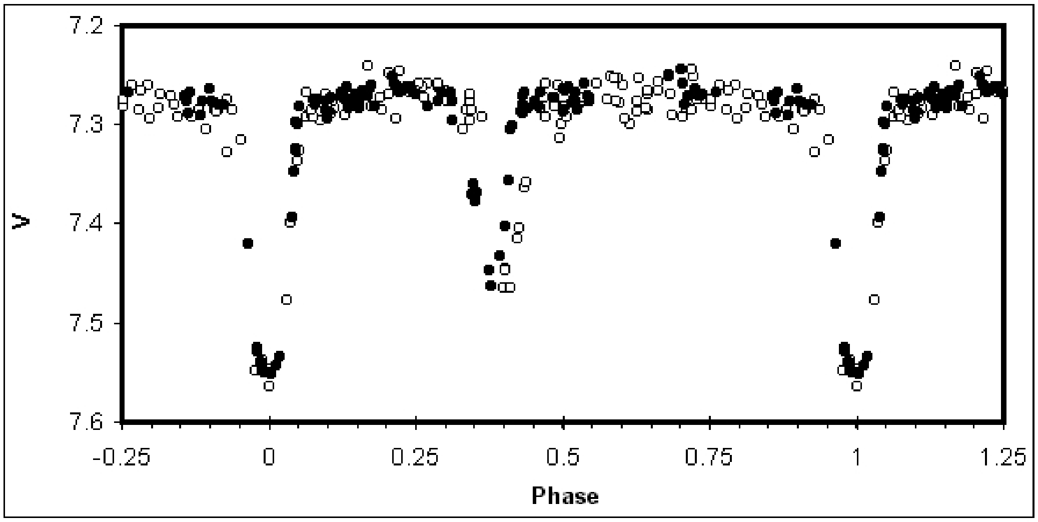

Figure 4. Light curve of V466 Car showing Hipparcos (filled circles) and ASAS-3 observations (open circles).

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A REVISED PERIOD FOR THE MIRA VARIABLE AW AURIGAE

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AW Aurigae – α:5$^{\rm h}$40$^{\rm m}$00$\overset{\rm s}{.}$7; δ:+28°42′49″.0 (J2000) – is listed in the GCVS as a Mira variable with a period of 695 days. The published period is one of the longest among the Miras, making AW Aurigae an object of some astrophysical interest. However, this period was considered preliminary by Kurochkin (1951), and the quoted $(O-C)$ values are very large. The star was among the 58 Mira variables studied by Whitney (1960) at the request of B.V. Kukarkin, to better determine their elements. Whitney did not revise the 695-day period for this star, though like Kurochkin he also noted very large residuals in his $(O-C)$ analysis. Although the star has been mentioned as part of several Mira population studies since then, no discussion or refinement of its period appears in the literature. As part of a larger project to study secular changes in Mira variable pulsations, I analyzed visual and CCD data from the American Association of Variable Star Observers (AAVSO) International Database (ID), along with Harvard College Observatory (HCO) photographic plate data for AW Aurigae, and compared the period determined using these data to the period given in the GCVS. I find that the period quoted in the GCVS is incorrect, and that the best-fitting period to the available data is 449.3 ± 0.7 days.

I used three separate data sets to determine the correct period: visual observations from the AAVSO ID (380 total observations, 148 positive observations), CCD V-band observations from the AAVSO ID (27 total observations, 24 positive), and blue-sensitive photographic plate observations from HCO (197 total observations, 46 positive). The visual observations span the longest period of time of the three data sets (JD 2439851 to 2452904; December 1967 to September 2003), and so were used for the Fourier analysis. I used the CLEANest program (Foster, 1996) to compute the Fourier transform shown in Figure 1. The strongest peak is centered on a period of 449.3 ± 0.7 days ($\nu = 2.225 \times 10^{-3}$ cyc/d). Although the data is noisy, the 449.3-day peak and its Fourier harmonic at 224.7 days are both stronger than any other peak in the spectrum. There is a weak signal at about 720 days, but given the noise level it may be spurious.

Based upon Fourier analysis of the visual data alone, the best ephemeris of AW Aurigae appears to be

$$\mathrm{Max} = \mathrm{JD}2445320 + 449.3 \cdot E. \qquad (1)$$

The post-1967 HCO plates agree with this ephemeris, as do the AAVSO V-band CCD observations. However, there is a significant phase shift between the maxima predicted by this ephemeris and the maxima obtained from the HCO photographic plate data from 1928 to 1952. Table 1 gives previously published dates of maximum for AW Aurigae as

Table 1: Dates of maxima of AW Aurigae. Dates taken from Kurochkin (1951) and Whitney (1960) are given without error bars. Dates derived from HCO plate data and AAVSO observations should be considered accurate to ±20 days.

JD Max	E	Source	JD Max	E	Source	JD Max	E	Source
2419447	−58	Kurochkin	2431540	−31	HCO	2445320	0	AAVSO
2424448	−47	Kurochkin	2432010	−30	HCO	2445790	1	AAVSO
2424857	−46	Kurochkin	2432440	−29	HCO	2446220	2	AAVSO
2425250	−45	HCO	2434712	−24	Whitney	2446670	3	AAVSO
2425700	−44	HCO	2435095	−23	Whitney	2447130	4	AAVSO
2426150	−43	HCO	2439920	−12	AAVSO	2447610	5	AAVSO
2426580	−42	HCO	2440360	−11	AAVSO	2448010	6	AAVSO
2427041	−41	Kurochkin	2440820	−10	AAVSO	2448470	7	AAVSO
2427490	−40	HCO	2441240	−9	AAVSO	2448900	8	AAVSO
2427960	−39	HCO	2441730	−8	AAVSO	2449370	9	AAVSO
2428380	−38	HCO	2442210	−7	AAVSO	2449850	10	AAVSO
2428820	−37	HCO	2442630	−6	AAVSO	2450270	11	AAVSO
2429283	−36	Kurochkin	2443090	−5	AAVSO	2450720	12	AAVSO
2429760	−35	HCO	2443540	−4	AAVSO	2451170	13	AAVSO
2430220	−34	HCO	2443960	−3	AAVSO	2451610	14	AAVSO
2430640	−33	HCO	2444450	−2	AAVSO	2452080	15	AAVSO
2431110	−32	HCO	2444900	−1	AAVSO	2452530	16	AAVSO

well as dates derived from the AAVSO and HCO data, and Figure 2 shows the resulting $(O-C)$ diagram. While the HCO and AAVSO visual data seem to be well-fit by a period of 449.3 days, the maxima derived from the 1928-1952 HCO plate data are offset in phase by nearly 150 days from the ephemeris given above.

The best-defined maximum of the HCO plate data lies at JD 2427490, and although we detected few maxima with the plate data, Kurochkin (1951) gives a date of maximum ($m = 12.3$) of JD 2427041 obtained by Shajn (1933). Assuming these two dates are actually maxima, then the period is 449 days, consistent with the 449.3-day period given the uncertainty of the maxima dates. Kurochkin lists another date of maximum of JD 2419447, and the time difference between these two maxima corresponds to 16.9 cycles of 449.3 days or exactly 17 cycles of 446.7 days, both results being reasonable given the measurement errors.

Figure 3 shows the AAVSO visual and V-band data and the 1928-1952 HCO photographic plate data folded with a period of 449.3 days. This folding period is an excellent fit to the data, though both the visual and plate data show significant scatter. All three data sets were folded with the GCVS period of 695 days, and the resulting folded light curves (not shown) were clearly incoherent. Therefore, it appears that the 449.3-day period matches all available data, with the only uncertainty being the reason for the discontinuity in $(O-C)$. There are only two data points in the 1952-1967 gap, published by Whitney (1960). The latter of these two points has a residual of around 100 days, much lower than the points preceeding it. While it suggests a possible trend downward in $(O-C)$, it may also be a random fluctuation. Analysis of other data archives besides the Harvard plate archives will be necessary to understand AW Aurigae's behavior during this time.

Though the revised period is likely the correct one, there is still substantial scatter in the $(O-C)$ residuals and in the folded visual light curve. In the case of the $(O-C)$ residuals, this may be due in large part to the scarcity of data and subsequent poor fitting of a mean curve to individual cycles. However, given the scatter in the folded visual data, it may also be due in part to intrinsic, cycle-to-cycle variations. Such behavior is observed in some other long-period Miras like Z Tau (Zijlstra & Bedding, 2003), and may indicate that AW Aurigae has a "meandering" period. Furthermore, the large jump in $(O-C)$ suggests that the star may not have maintained the 449.3-day period throughout the span of observations. Unfortunately, the data coverage is not sufficient to enable a more thorough analysis such as wavelet transformation, and it is difficult to more precisely determine the dates of maximum with the available data.

In summary, the period of the Mira variable AW Aurigae appears to be about 449.3 days, rather than the very long period of 695 days given in the GCVS. This period is still long relative to most Mira variables, but is not otherwise noteworthy. A discontinuity in the $(O-C)$ diagram suggests a possible temporary change in period or phase shift in pulsation, but both the 1967-2003 visual data and the 1928-1952 HCO plate data are both well-fit by a 449.3-day period. The $(O-C)$ residuals show some scatter, which could be attributed to poor determination of the dates of maxima or to real variations. The latter is observed in other Mira variables with similarly long periods, and better time-series coverage in future observations would be valuable in determining whether the period truly varies. Furthermore, the search for and analysis of archival data spanning the time between 1952 and 1967 will be necessary to understand the behavior of this star, and are encouraged.

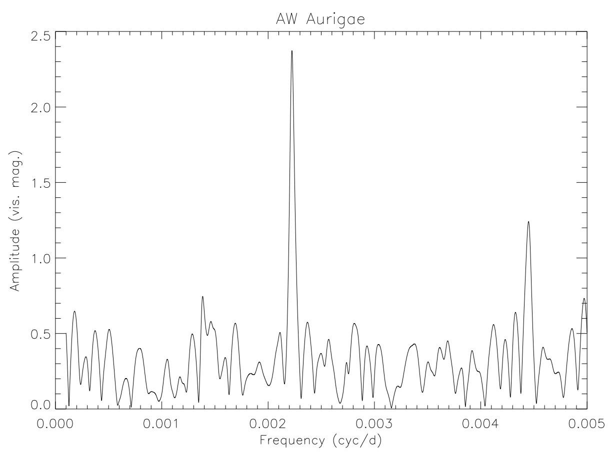

Figure 1. Fourier transform of AAVSO visual data for AW Aurigae. The strongest peak is centered on 449.3 days. The peak at 224.7 days (~ 0.00445 cyc/d) is the second Fourier harmonic of the main peak. There is a much weaker peak around 720 days, but this may be spurious.

I would like to thank Dr. Janet Mattei and Aaron Price for their assistance in the preparation of this paper, along with the 45 visual and 4 CCD observers of the AAVSO whose observations made this work possible. Thanks also to Alison Doane and the Harvard College Observatory for access to the Harvard photographic plate collection.

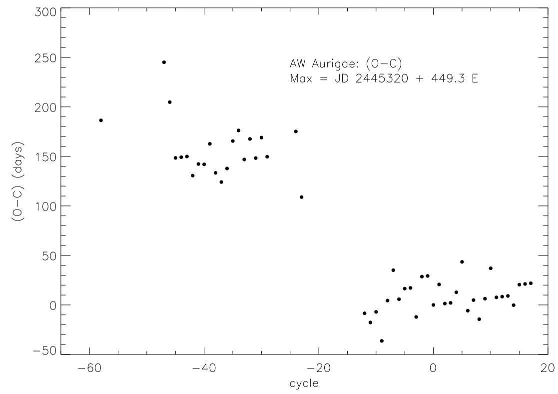

Figure 2. (O-C) diagram showing the dates of maximum derived from both the visual and HCO patrol plate data. There is a very large jump in (O-C) values between 1952 and 1967, suggesting either a temporary period change or a phase shift in the pulsations.

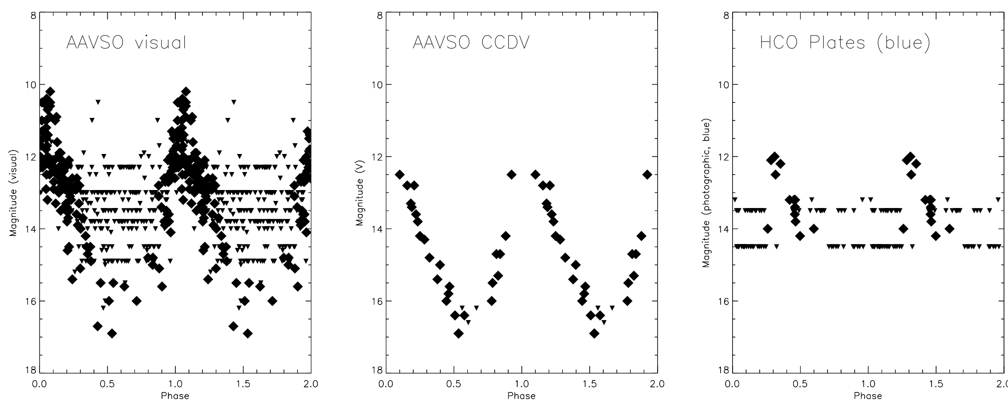

Figure 3. AAVSO visual data (left panel), AAVSO V-band CCD data (center panel), and HCO photographic plate data (right panel) of AW Aurigae, folded with a period of 449.3 days. The folding period is an excellent fit to the observations. Diamonds: positive observations; triangles: fainter-than observations.

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PHOTOELECTRIC MINIMA OF SELECTED ECLIPSING BINARIES

(BAV MITTEILUNGEN NO. 158)

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In this 49th compilation of BAV results, photoelectric observations obtained in the years 2002 till 2003 are presented on 247 variable stars giving 581 minima. All moments of the minima 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 light curves 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
XZ And	52321.3483	.0007	ATB	+0.1203		GCVS 85		1)
	52530.3718		SIR	+0.1230		GCVS 85	-Ir	10)
AP And	52530.3705	.0002	RAT RCR					1)
BL And	52188.3156	.0001	MS FR	−0.0013		GCVS 85		9)
OT And	51853.3856	.0070	HSR				V	17)
KP Aql	52093.4192	.0010	QU	−0.0124	s	GCVS 85	V	14)
OO Aql	52121.4337	.0002	QU	+0.0180	s	GCVS 85	V	14)
V418 Aql	52503.4095	.0003	AG					1)
V1355 Aql	52427.4208	.0006	AG					1)
V1542 Aql	52137.4040	.0007	QU	+0.0020	s	BAVM 138	V	14)
	52476.4430	.0003	QU	+0.0017	s	BAVM 138	V	14)
GSC0471.2133 Aql	52464.5607	.0011	FR	+0.0028		BAVM 156	-Ir	6)
	52475.4268	.0011	FR	−0.0055	s	BAVM 156	-Ir	6)
	52476.6038	.0013	FR	−0.0040	s	BAVM 156	-Ir	6)
	52484.5433	.0011	FR	+0.0000		BAVM 156	-Ir	6)
	52489.5389	.0028	FR	−0.0007	s	BAVM 156	-Ir	6)
	52504.5328	.0006	FR	+0.0042		BAVM 156	-Ir	6) red
	52535.3878	.0030	PRK FR	−0.0005	s	BAVM 156		6)
	52556.2603	.0004	FR	+0.0050		BAVM 156		6) red
SS Ari	52322.2640	.0008	MON	+0.0145		GCVS 85	V	1)
	52535.4050	.0002	QU	+0.0089		GCVS 85	V	14)
	52576.4098	.0005	QU	+0.0084		GCVS 85	V	14)
	52617.4140	.0007	QU	+0.0072		GCVS 85	V	14)
	52677.2976	.0017	ATB	+0.0068	s	GCVS 85		1)
RY Aur	52344.4266	.0001	RAT RCR	+0.0222		GCVS 85	-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
AP Aur	52321.5294	.0003	RAT RCR	+0.0298	s	BAVM 67		1)
	52345.4442	.0047	PC	+0.0311	s	BAVM 67	-Ir	12)
	52361.3865	.0003	RAT RCR	+0.0311	s	BAVM 67	23)	1)
	52367.3638	.0003	AG	+0.0300		BAVM 67	-Ir	1)
AP Aur	52712.4110	.0047	PC	+0.0399		BAVM 67	-Ir	20)
EM Aur	52290.2885	.0008	MON	+0.0079	s	SAC 73	-Ir	1)
	52290.2928	.0020	JU	+0.0122	s	SAC 73		4)
	52310.3337	.0012	MON	+0.0118	s	SAC 73	-Ir	1)
	52371.3813	.0020	JU	+0.0249		SAC 73		4)
	52533.5283	.0001	MS FR	+0.0203		SAC 73		9)
	52628.2682	.0003	FR	+0.0199		SAC 73		6)
	52648.3135	.0014	MON	+0.0240		SAC 73	V	1)
FP Aur	52280.5166	.0006	RAT RCR	−0.0650		GCVS 85		1)
GI Aur	52376.3673	.0010	RAT RCR				23)	1)
GX Aur	52306.5387	.0007	RAT RCR	+0.0066		BAVM 69		1)
HL Aur	52279.5971	.0001	RAT RCR	−0.0111		GCVS 85		1)
	52349.3176	.0003	RAT RCR	−0.0112		GCVS 85	23)	1)
	52372.3504	.0004	RAT RCR	−0.0112		GCVS 85	23)	1)
	52692.3230	.0002	WTR	−0.0066		GCVS 85		13)
HU Aur	52620.3610	.0003	RAT RCR	−0.0250		GCVS 85	-Ir	1)
IM Aur	52680.3421	.0001	DIE	−0.0823		GCVS 85		8)
IU Aur	52688.4045	.0005	FR	−0.0096		GCVS 85		21)
	52697.4643	.0005	FR	−0.0072		GCVS 85		21)
	52698.3692:	.0010	FR	−0.0080	s	GCVS 85		21)
KU Aur	52344.3752	.0002	JU	+0.0273		GCVS 85		4)
	52344.3754	.0010	MON	+0.0275		GCVS 85	V	1)
	52617.5265	.0010	JU	+0.0262		GCVS 85		4)
	52697.3621	.0090	JU	+0.0274	s	GCVS 85		4)
MO Aur	52617.4086	.0008	FR	+0.0865		BAVM 68		6)
V364 Aur	52619.4394	.0003	AG				-Ir	1)
SS Boo	52744.4272	.0015	AG	+0.0260		GCVS 85		1) red
TY Boo	52362.4000	.0003	AG	−0.0114	s	BAVM 68		1)
	52362.5587	.0001	AG	−0.0113		BAVM 68		1)
	52721.5738	.0001	AG	−0.0109		BAVM 68		1)
	52722.3656	.0016	AG	−0.0120	s	BAVM 68		1)
	52722.5250	.0014	AG	−0.0111		BAVM 68		1)
	52723.4767	.0007	AG	−0.0109		BAVM 68		1)
	52724.4277	.0007	AG	−0.0113		BAVM 68		1)
	52725.3788	.0006	AG	−0.0117		BAVM 68		1)
	52725.5374	.0011	AG	−0.0117	s	BAVM 68		1)
	52726.4882	.0009	AG	−0.0123	s	BAVM 68		1)
	52730.4535	.0003	PRK	−0.0114		BAVM 68		1)
	52730.4537	.0013	AG	−0.0112		BAVM 68		1)
	52743.4569	.0002	AG	−0.0112		BAVM 68		1)
	52746.4698	.0004	AG	−0.0112	s	BAVM 68		1)
	52747.4212	.0004	AG	−0.0113	s	BAVM 68		1)
	52747.5801	.0009	AG	−0.0109		BAVM 68		1)
	52764.3889	.0004	AG	−0.0111		BAVM 68		1)
	52764.5473	.0007	AG	−0.0113	s	BAVM 68		1)
TZ Boo	51879.7205	.0044	HSR PC	−0.0767	s	BAVM 68		17)
	52362.4515	.0013	AG	−0.0766		BAVM 68		1)
	52362.6012	.0006	AG	−0.0755	s	BAVM 68		1)
	52363.4880	.0006	RAT RCR	−0.0802	s	BAVM 68	23)	1)
	52715.4813	.0004	AG	−0.0689		BAVM 68	-Ir	1)
	52721.5731	.0009	AG	−0.0689	s	BAVM 68		1)
	52722.3135	.0022	AG	−0.0714		BAVM 68		1)
	52722.4634	.0015	AG	−0.0700	s	BAVM 68		1)
	52723.3531	.0013	AG	−0.0718	s	BAVM 68		1)
	52723.5044	.0011	AG	−0.0691		BAVM 68		1)
	52724.3955	.0011	AG	−0.0694		BAVM 68		1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
TZ Boo	52725.4339	.0012	AG	−0.0711	s	BAVM 68		1)
	52726.4758	.0014	AG	−0.0692		BAVM 68		1)
	52730.4872	.0008	AG	−0.0695	s	BAVM 68		1)
	52743.4138	.0011	AG	−0.0692		BAVM 68		1)
	52743.5619	.0004	AG	−0.0697	s	BAVM 68		1)
	52746.3852	.0009	AG	−0.0693		BAVM 68		1)
	52746.5323	.0005	AG	−0.0708	s	BAVM 68		1)
	52747.4237	.0003	PRK	−0.0709	s	BAVM 68		1)
	52747.4260	.0008	AG	−0.0686	s	BAVM 68		1)
	52747.5737	.0023	AG	−0.0695		BAVM 68		1)
	52764.3617	.0036	AG	−0.0708	s	BAVM 68		1)
	52764.5132	.0004	AG	−0.0679		BAVM 68		1)
UW Boo	52352.3448	.0001	DIE	−0.0098		GCVS 85		8)
	52361.3942	.0007	DIE	−0.0028		GCVS 85		8)
	52362.3942	.0013	DIE	−0.0075		GCVS 85		8)
	52364.4092	.0002	AG	−0.0020		GCVS 85		1)
VW Boo	52411.5187	.0005	AG	−0.0291	s	BAVR 32)	BV	1)
	52716.5208	.0004	AG	−0.0340	s	BAVR 32)	-Ir	1)
XY Boo	52395.4142	.0005	AG	−0.0215		GCVS 85	-Ir	1)
	52717.4439	.0019	AG	+0.0031		GCVS 85		1)
AC Boo	52073.4985	.0015	QU	+0.0169	s	GCVS 85	V	14)
	52367.4370	.0005	MS	+0.0293	s	GCVS 85		9)
	52372.3719	.0004	MS	+0.0302	s	GCVS 85		9)
	52410.4352	.0004	QU	+0.0311	s	GCVS 85	V	14)
	52784.3776	.0007	WTR	+0.0459	s	GCVS 85		13)
AQ Boo	51262.5888	.0012	AG				BV	1)
	51278.4144	.0004	AG					1)
	51278.5804	.0004	AG					1)
	51301.4008	.0002	AG					1)
	51301.5657	.0005	AG					1)
	52031.4740	.0004	AG					1)
	52371.4443	.0018	AG				-Ir	1)
	52716.4051	.0013	AG					1)
	52717.4065	.0007	AG					1)
CV Boo	51626.4623	.0018	HSR	−0.0119		BAVR 38)		16)
	52094.4274	.0005	QU	−0.0107	s	BAVR 38)	V	14)
	52363.3483	.0007	DIE	−0.0103		BAVR 38)		8)
	52407.3919	.0004	QU	−0.0103		BAVR 38)	V	14)
	52415.4377	.0004	JU	−0.0110	s	BAVR 38)		4)
	52415.4386	.0004	QU	−0.0101	s	BAVR 38)	V	14)
	52423.4844	.0035	JU	−0.0107		BAVR 38)		4)
	52685.6268	.0003	MON	−0.0128	s	BAVR 38)	V	1)
	52722.4733	.0004	AG	−0.0105		BAVR 38)		1)
	52723.3218	.0054	AG	−0.0090		BAVR 38)		1)
	52725.4379	.0005	AG	−0.0104	s	BAVR 38)		1)
	52730.5197	.0008	AG	−0.0105	s	BAVR 38)		1)
	52744.4952	.0007	AG	−0.0104		BAVR 38)	-Ir	1)
	52764.3992	.0001	AG	−0.0108	s	BAVR 38)		1)
	52767.3640	.0007	JU	−0.0105		BAVR 38)		14)
EW Boo	52362.4537	.0015	AG					1)
GN Boo	52370.4040	.0003	MS					9)
	52370.5560	.0003	MS					9)
SV Cam	52327.5277	.0011	JU	+0.0416		GCVS 85		4)
	52368.4530	.0009	JU	+0.0450		GCVS 85		4)
	52683.3713	.0013	JU	+0.0432		GCVS 85		4)
	52694.3391	.0025	JU	+0.0392	s	GCVS 85		4)
AL Cam	52344.5512	.0004	RAT RCR	−0.0238		GCVS 85	-Ir	1)
	52619.5178	.0006	RAT RCR	−0.0222		GCVS 85	-Ir	1)
	52680.6202	.0024	PC	−0.0231		GCVS 85	-Ir	19)
	52696.5602	.0001	AG	−0.0231		GCVS 85	-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
AZ Cam	52722.4622	.0002	AG	+0.0228		GCVS 85	-Ir	1)
WW Cnc	52693.5093	.0021	ATB	−0.0560		BAVR 31)		1)
WX Cnc	52322.5460	.0002	RAT RCR	+0.0102		GCVS 85	-Ir	1)
WY Cnc	52371.4026	.0021	ATB	−0.0208		GCVS 85		1)
	52376.3817	.0010	MZ	−0.0179		GCVS 85	-Ir	11)
FF Cnc	52339.5178	.0002	FR	−0.1028		BAVM 65	-Ir	6)
	52591.5708	.0019	FR	−0.1093	s	BAVM 65		6)
	52703.3726	.0011	PRK	−0.1135		BAVM 65		1)
GSC1377.0969 Cnc	51955.3906	.0002	MS FR	+0.0002	s	BAVM 150		9) 26)
	51956.3789	.0001	MS FR	−0.0005	s	BAVM 150		9) 26)
	51968.4933	.0005	FR	−0.0017		BAVM 150		6)
	52000.3928	.0010	FR	+0.0017	s	BAVM 150		6)
	52001.3793	.0010	FR	−0.0009	s	BAVM 150		6)
	52321.3295	.0003	MS	−0.0012	s	BAVM 150		9)
GSC1377.0969 Cnc	52338.3913	.0008	FR	−0.0002		BAVM 150	-Ir	6)
	52727.3253	.0006	FR	−0.0015	s	BAVM 150		21)
GSC1927.0862 Cnc	52704.2904	.0019	FR					21)
	52707.5122	.0006	FR					21)
RV CVn	52373.3897	.0005	AG					1)
	52373.5248	.0014	AG					1)
	52715.4699	.0015	AG					1)
BI CVn	52373.4775	.0003	AG	+0.0284		GCVS 85	-Ir	1)
GSC0766.1248 CMi	51924.4336	.0001	MS FR	+0.0003		BAVM 156		9) 26)
	51951.3623	.0020	MS FR	+0.0018		BAVM 156		9) 26)
	51955.2877	.0002	MS FR	+0.0003	s	BAVM 156		9) 26)
GSC0763.0572 CMi	52336.3877	.0001	MS FR	+0.0000		BAVM 156		9)
	52361.3322	.0001	MS FR	+0.0008	s	BAVM 156		9)
	52362.3947	.0015	MS FR	−0.0027		BAVM 156		9)
AB Cas	52140.4882	.0002	QU	+0.0638		GCVS 85	V	14)
	52535.5197	.0002	QU	+0.0687		GCVS 85	V	14)
BZ Cas	52505.5302	.0001	RAT RCR				-Ir	1)
CW Cas	52505.4286	.0001	RAT RCR	−0.0058		GCVS 85	-Ir	1)
	52698.3393	.0004	AG	+0.0038		GCVS 85		1)
	52698.4995	.0003	AG	+0.0045	s	GCVS 85		1)
IL Cas	52484.4868	.0019	MON	−0.0598		GCVS 85	V	1)
	52567.3305	.0033	JU	−0.0580		GCVS 85		4)
IT Cas	52483.4700	.0007	MON	+0.0019	s	SAC 69	V	1)
	52555.3605	.0009	JU	−0.0001		SAC 69		4)
MN Cas	52618.4604	.0006	AG	+0.0092		GCVS 85	-Ir	1)
OX Cas	52531.4146	.0024	MON	−0.0073		GCVS 85	V	1)
PV Cas	52489.4147	.0009	MON	+0.0009		SAC 73	V	1)
	52532.3272	.0011	MON	−0.0010	s	SAC 73	V	1)
V344 Cas	49643.2783	.0011	MS	−0.0844		GCVS 85		1)
	49644.2773	.0004	MS	−0.0862		GCVS 85		1)
	49645.2790	.0007	MS	−0.0852		GCVS 85		1)
	49690.353 :	.010	AG	−0.045		GCVS 85		1)
V359 Cas	52146.5333	.0002	MS FR	−0.0043		BAVM 132		9)
V361 Cas	52228.2872	.0002	MS FR	−0.1724		GCVS 85		9)
V473 Cas	52618.4293	.0011	AG	−0.0061	s	BAVM 115	-Ir	1)
	52618.6347	.0010	AG	−0.0084		BAVM 115	-Ir	1)
WW Cep	52556.3769	.0050	AG	+0.0013		BAVM 71	-Ir	1)
AV Cep	52368.5258	.0002	AG				-Ir	1)
CW Cep	52549.2981	.0009	MON	−1.3587		GCVS 85	V	1)
GW Cep	52502.5070	.0003	RAT RCR	−0.0175		BAVR 34)	-Ir	1)
NR Cep	52483.4502	.0008	RAT RCR	−0.0291		GCVS 85	-Ir	1)
NS Cep	52719.6031	.0005	AG	+0.1114	s	GCVS 85		1)
OT Cep	52718.5156	.0001	AG	−0.0014		BAVM 142		1)
RZ Com	52367.3278	.0003	RAT RCR	+0.0342		GCVS 85	23)	1)
	52370.3756	.0002	RAT RCR	+0.0355		GCVS 85	23)	1)
	52371.3908	.0002	RAT RCR	+0.0351		GCVS 85	23)	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
RZ Com	52747.4729	.0011	AG	+0.0370		GCVS 85	-Ir	1)
SS Com	52401.451	.001	AG	+0.082		BAVR 33)		1)
	52704.4616	.0006	AG	+0.0904		BAVR 33)		1)
	52743.4739	.0008	AG	+0.0923	s	BAVR 33)	-Ir	1)
CC Com	52721.3429	.0003	DIE	−0.0108		GCVS 85		8)
EQ Com	52704.5050	.0006	AG					1)
LL Com	52373.3572	.0022	AG					1)
	52373.5626	.0010	AG					1)
	52723.5088	.0014	AG				-Ir	1)
RW CrB	52721.5237	.0003	PRK	−0.0135		GCVS 85		1)
TW CrB	52373.4913	.0001	RAT RCR				-Ir	1)
WZ Cyg	52546.4087	.0007	WTR	+0.0546		GCVS 85		13)
ZZ Cyg	52520.4563	.0002	RAT RCR	−0.0392		GCVS 85	-Ir	1)
BR Cyg	52442.5056	.0002	QU	+0.0003		GCVS 85	V	14)
CV Cyg	52548.3739	.0025	JU	−0.0078	s	SAC 68		4)
KR Cyg	52411.4782	.0007	FR	+0.0071		GCVS 85	-Ir	6)
	52427.533	.001	QU	+0.004		GCVS 85	V	14)
	52531.4839	.0003	PRK FR	+0.0012		GCVS 85		6)
	52576.2812	.0005	FR	+0.0055		GCVS 85		6)
NZ Cyg	52530.5692	.0009	RAT RCR				-Ir	1)
V346 Cyg	52456.5073	.0043	PC	+0.0745		GCVS 85	-Ir	12)
V454 Cyg	52428.4463	.0016	AG					1)
V488 Cyg	52451.4659	.0005	FR	+0.0903	s	GCVS 85	-Ir	6)
	52509.4803	.0005	FR	+0.0916		GCVS 85		9)
	52511.4417	.0018	FR	+0.0911	s	GCVS 85		9)
V493 Cyg	50314.5607	.0002	AG					1)
	50712.3876	.0003	AG					1)
	52112.4347	.0009	AG					1)
V501 Cyg	52557.3452	.0018	AG	−0.1912		GCVS 85		1)
V505 Cyg	52557.3589	.0006	AG	+0.1060	s	GCVS 85		1)
V628 Cyg	52476.4366	.0003	AG	−0.0019		BAVM 89		1)
V651 Cyg	52476.3843	.0017	AG					1)
V704 Cyg	52476.4124	.0008	AG	+0.0311		GCVS 85		1)
V940 Cyg	52416.4064	.0003	AG					1)
V981 Cyg	52416.3853	.0007	AG					1)
V1196 Cyg	52455.4633	.0007	AG				-Ir	1)
V1411 Cyg	52503.4722	.0012	AG	+0.1941		GCVS 85	-Ir	1)
V2181 Cyg	50751.1944	.0004	FR	+0.0011		BAVR 46)		6) red
	50751.4748	.0013	FR	−0.0052	s	BAVR 46)		6) red
	50753.4875	.0003	FR	+0.0003		BAVR 46)		6) red
	50755.2083	.0003	FR	+0.0006		BAVR 46)		6)
	52095.4373	.0010	QU	+0.0036		BAVR 46)	V	14)
	52411.4263	.0012	FR	+0.0043		BAVR 46)	-Ir	6)
	52427.4843	.0004	QU	+0.0048		BAVR 46)	V	14)
	52448.4117	.0009	FR	+0.0002	s	BAVR 46)	-Ir	6)
	52495.4448	.0021	FR	+0.0078	s	BAVR 46)	-Ir	6)
	52509.4936	.0002	FR	+0.0063		BAVR 46)		9)
	52510.3574	.0019	FR	+0.0098	s	BAVR 46)		9)
	52524.4045	.0032	PRK FR	+0.0066		BAVR 46)		6)
	52526.4044	.0036	PRK FR	−0.0006	s	BAVR 46)		6)
	52536.4468	.0012	PRK FR	+0.0059		BAVR 46)		6)
	52576.3036	.0012	FR	+0.0057	s	BAVR 46)		6)
YY Del	52531.3496	.0006	DIE	+0.0078		GCVS 85		8)
TW Dra	52652.3007	.0028	SCI	+0.0319		GCVS 85		4)
TZ Dra	52747.4622	.0017	SCI	−0.0157		GCVS 85		4)
AI Dra	52366.660	.001	SCI	+0.007		GCVS 85		18)
	52721.5200	.0015	SCI	+0.0174		GCVS 85		4)
AR Dra	52409.3817	.0005	AG				-Ir	1)
	52689.5163	.0001	AG				-Ir	1)
AU Dra	52375.3631	.0005	MS					9)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
AU Dra	52375.6206	.0004	MS					9)
AX Dra	52409.4489	.0007	AG	−0.0040		BAVR 31)	-Ir	1)
	52722.5070	.0022	PC	−0.0039		BAVR 31)	-Ir	20)
	52726.4851	.0002	AG	−0.0029		BAVR 31)	-Ir	1)
BE Dra	52369.4544	.0003	AG	+0.1148		GCVS 85		1)
	52718.4818	.0003	AG	+0.1182		GCVS 85	-Ir	1)
BU Dra	52411.5144	.0001	AG	+0.0183		MVS 12,4	-Ir	1)
BX Dra	52401.4508	.0008	AG	+0.0087	s	BAVM 82	-Ir	1)
EF Dra	52369.4948	.0003	AG	+0.0205	s	BAVM 63		1)
	52718.4702	.0004	AG	+0.0242	s	BAVM 63	-Ir	1)
AH Gem	51901.3494	.0022	FR					6)
	51901.5217	.0015	FR					6)
	51901.6874	.0007	FR					6)
	51925.4319	.0004	FR					6)
	52672.3632	.0018	FR					21)
	52672.5344	.0009	FR					21)
	52680.2756	.0004	FR					21)
	52680.4470	.0009	FR					21)
	52691.3886	.0010	AG				-Ir	1)
	52692.3998	.0007	AG				-Ir	1)
	52716.3097:	.0020	AG				-Ir	1)
	52721.3612	.0004	AG					1)
AI Gem	51901.6658	.0015	FR					6)
	51925.5639	.0001	FR					6)
	52371.3208	.0008	FR				-Ir	6)
	52680.5519	.0004	FR					21)
	52691.4154	.0018	AG				-Ir	1)
	52707.3515	.0022	AG				-Ir	1)
	52716.4005	.0012	AG				-Ir	1)
AZ Gem	49398.4122		MS	+0.0687		GCVS 85		1)
	49723.4101		MS	+0.0695		GCVS 85		1)
	49793.3414	.0002	AG	+0.0711	s	GCVS 85		1)
	50105.2568		MS	+0.0698	s	GCVS 85		1)
	50845.3083	.0001	MS	+0.0737		GCVS 85		1)
	50848.3261	.0004	AG	+0.0729		GCVS 85		1)
	51176.3420	.0003	AG	+0.0732		GCVS 85		1)
	52313.3328	.0007	AG	+0.0772		GCVS 85	V	1)
EY Gem	52721.3213	.0011	AG	−0.2073	s	GCVS 85		1)
FG Gem	52690.3194	.0007	AG	−0.0323		GCVS 85	-Ir	1)
	52692.3728	.0016	AG	−0.0267	s	GCVS 85	-Ir	1)
	52694.4152	.0003	AG	−0.0321		GCVS 85	-Ir	1)
GX Gem	52722.3877	.0007	PRK	+0.0577		GCVS 85		1)
	52726.4250	.0030	JU	+0.0449		GCVS 85		4)
HR Gem	52308.2715	.0001	RAT RCR				-Ir	1)
KQ Gem	52690.4070	.0024	AG				-Ir	1)
	52691.4227	.0019	AG				-Ir	1)
	52692.4453	.0010	AG				-Ir	1)
	52694.2792	.0003	AG				-Ir	1)
	52694.4871	.0005	AG				-Ir	1)
	52707.3375	.0009	AG				-Ir	1)
	52716.3128:	.0034	AG				-Ir	1)
	52690.3810	.0005	AG	−0.0405	s	GCVS 85	-Ir	1)
	52690.5576	.0013	AG	+0.0268		GCVS 85	-Ir	1)
	52691.2757	.0009	AG	−0.0200	s	GCVS 85	-Ir	1)
	52691.4562	.0001	AG	+0.0512		GCVS 85	-Ir	1)
	52692.3516	.0009	AG	−0.0369	s	GCVS 85	-Ir	1)
	52692.5310	.0019	AG	+0.0333		GCVS 85	-Ir	1)
	52694.3242	.0012	AG	−0.0312	s	GCVS 85	-Ir	1)
	52694.5028	.0006	AG	+0.0381		GCVS 85	-Ir	1)
	52697.3714	.0022	AG	−0.0436	s	GCVS 85	-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
KV Gem	52707.4094	.0006	AG	+0.0505		GCVS 85	-Ir	1)
	52716.3731	.0009	AG	−0.0555	s	GCVS 85	-Ir	1)
	52721.3934	.0003	AG	+0.0475		GCVS 85		1)
MR Gem	52680.3852	.0023	FR					21)
TX Her	52100.4770	.0010	QU	+0.0014	s	GCVS 85	V	14)
AK Her	52513.3343	.0032	SG	+0.0066		GCVS 85	V	5)
DK Her	52425.3867	.0002	AG	−0.0854		GCVS 85	-Ir	1)
LT Her	52426.5059	.0011	AG	−0.0129		BAVM 69	-Ir	1)
MS Her	51323.5057	.0012	AG	−0.1272		GCVS 85		1)
	51386.4357	.0017	AG	−0.1445		GCVS 85		1)
	51389.4753	.0005	AG	−0.1313		GCVS 85		1)
	51675.4954	.0012	AG	−0.0977	s	GCVS 85		1)
	51705.4404	.0005	AG	−0.1132		GCVS 85		1)
	52119.4954	.0009	AG	−0.0579		GCVS 85		1)
V338 Her	52763.4638	.0004	PRK	+0.0641		GCVS 85		1)
V502 Her	52410.4754	.0005	RAT RCR				23)	1)
	52489.5014	.0004	RAT RCR				-Ir	1)
V718 Her	52408.4615	.0017	AG				-Ir	1)
V728 Her	52100.5578	.0010	QU	+0.0274		BAVM 51	V	14)
	52366.5992	.0003	AG	+0.0274	s	BAVM 51		1)
	52741.5110	.0010	AG	+0.0305		BAVM 51	-Ir	1)
V733 Her	52371.5551	.0005	RAT RCR				23)	1)
	52408.4989	.0029	AG				-Ir	1)
V842 Her	51326.4894	.0004	AG	−0.0030		BAVR 45)	BV	2)
	51430.419 :	.008	MZ	+0.005		BAVR 45)		7)
	51433.355 :	.005	MZ	+0.007		BAVR 45)		7)
	51786.387 :	.002	AG	−0.003	s	BAVR 45)	BV	2)
	52426.4670	.0006	JU	−0.0072		BAVR 45)		4)
	52452.4460	.0005	JU	−0.0088		BAVR 45)		4)
WY Hya	52306.3428	.0002	RAT RCR	+0.0208		GCVS 85	23)	1)
SW Lac	52584.4911	.0014	ATB	−0.0859		GCVS 85		1)
TW Lac	52195.4558	.0005	FR	+0.1765		GCVS 85	-Ir	6) red
	52368.5965	.0004	FR	+0.1845		GCVS 85	-Ir	6)
ZZ Lac	52197.5271	.0008	FR				-Ir	6)
	52483.6023	.0008	FR				-Ir	6)
	52486.4895	.0012	FR				-Ir	6)
AG Lac	52506.4428	.0042	AG				-Ir	1)
CO Lac	52485.4330	.0004	MON	−0.0024		SAC 73	V	1)
	52536.3248	.0011	MON	−0.0035		SAC 73	V	1)
	52546.3770	.0003	MON	+0.0243	s	SAC 73	V	1)
EM Lac	51385.4470	.0009	AG	+0.0432		GCVS 85		1)
	51780.4193	.0002	RAT RCR	+0.0451		GCVS 85		1)
	51926.3457	.0005	AG	+0.0465		GCVS 85		1)
	52146.4017	.0017	AG	+0.0475	s	GCVS 85		1)
	52146.594 :	.007	AG	+0.045		GCVS 85		1)
	52148.5412	.0036	AG	+0.0468		GCVS 85		1)
	52150.4857	.0005	AG	+0.0456		GCVS 85		1)
	52267.4212	.0009	AG	+0.0465	s	GCVS 85	-Ir	1)
HR Lac	52456.5173	.0070	AG				-Ir	1)
	52503.4985	.0023	AG				-Ir	1)
IM Lac	49606.358 :	.003	AG	−0.143		GCVS 85		1)
	51393.4507	.0004	AG	−0.1527		GCVS 85		1)
	51771.4184	.0011	AG	−0.1527		GCVS 85		1)
IM Lac	51814.5377	.0007	AG	−0.1572		GCVS 85		1)
	51816.4420	.0012	AG	−0.1554	s	GCVS 85		1)
	52133.5247	.0009	AG	−0.1597	s	GCVS 85		1)
	52194.4048	.0021	AG	−0.1603	s	GCVS 85		1)
IP Lac	52503.5797	.0116	AG				-Ir	1)
IU Lac	52621.3002	.0026	AG				-Ir	1)
IZ Lac	52503.4622	.0019	AG				-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
IZ Lac	52621.3090	.0036	AG				-Ir	1)
NR Lac	52280.2952	.0003	RAT RCR				-Ir	1)
V342 Lac	52505.4797	.0018	AG				-Ir	1)
	52621.4295	.0040	AG				-Ir	1)
V344 Lac	51786.4683	.0007	AG					1)
	51806.4738	.0002	RAT RCR					1)
	51817.4552	.0009	AG					1)
	51817.651 :	.005	AG					1)
	52123.4064	.0007	AG					1)
	52134.3950	.0022	AG					1)
	52134.586 :	.003	AG					1)
	52194.4006	.0018	AG					1)
	52194.5965	.0013	AG					1)
	52228.3320	.0018	AG					1)
	52228.5257	.0001	AG					1)
	52505.4496	.0007	AG				-Ir	1)
	52621.3567	.0010	AG				-Ir	1)
V441 Lac	52505.4952	.0020	AG	+0.0388		BAVM 135	-Ir	1)
	52617.3218	.0038	AG	+0.0457		BAVM 135	-Ir	1)
	52621.3363	.0023	AG	+0.0446		BAVM 135	-Ir	1)
Y Leo	52339.3704	.0001	RAT RCR	+0.0178		GCVS 85	-Ir	1)
	52371.4061	.0004	QU	+0.0176		GCVS 85		14)
	52693.4490	.0003	JU	+0.0150		GCVS 85		4)
	52720.4264	.0004	MON	+0.0148		GCVS 85	V	1)
UV Leo	52333.3112	.0005	DIE	+0.0001		BAVM 77		8)
	52339.3126	.0004	DIE	+0.0005		BAVM 77		8)
	52639.3610	.0003	DIE	+0.0058		BAVM 77		8)
	52696.3643	.0002	DIE	+0.0008		BAVM 77		8)
	52723.3672	.0005	DIE	−0.0002		BAVM 77		8)
WZ Leo	52703.3329	.0003	AG	−0.2301	s	GCVS 85	-Ir	1)
XX Leo	52703.3700	.0012	AG	−0.0408	s	GCVS 85	V	1)
	52719.3908	.0008	AG	−0.0405		GCVS 85	-Ir	1)
XY Leo	52721.3989	.0007	AG	+0.0141	s	GCVS 85	-Ir	1)
	52721.5408	.0005	AG	+0.0139		GCVS 85	-Ir	1)
XZ Leo	52322.3948	.0001	RAT RCR	+0.0320		GCVS 85	-Ir	1)
	52721.3633	.0004	AG	+0.0332		GCVS 85	-Ir	1)
	52721.6096	.0003	AG	+0.0356	s	GCVS 85	-Ir	1)
AL Leo	52721.4439	.0005	AG	+0.0102		BAVM 53	-Ir	1)
AM Leo	52322.3645	.0004	DIE	−0.0006		GCVS 85		8)
	52344.3147	.0005	DIE	+0.0017		GCVS 85		8)
	52373.3957	.0002	MZ	+0.0018	s	GCVS 85	-Ir	11)
	52683.4106	.0004	DIE	+0.0034		GCVS 85		8)
	52719.4402	.0022	SCI	+0.0020	s	GCVS 85		4)
	52724.3811	.0004	DIE	+0.0046		GCVS 85		8)
	52730.4154		BRN STK	+0.0032	s	GCVS 85	-Ir	14)
	52736.4516		BRN STK	+0.0038		GCVS 85	-Ir	14)
	52750.3516	.0003	DIE	+0.0035		GCVS 85		8)
CE Leo	52745.4189	.0009	AG				-Ir	1)
	52745.5708	.0010	AG				-Ir	1)
T LMi	52693.3436	.0005	AG	−0.0666		GCVS 85	-Ir	1)
RT LMi	52339.5564	.0003	RAT RCR	−0.0036		GCVS 85	-Ir	1)
	52693.4768	.0001	AG	−0.0058		GCVS 85	-Ir	1)
	52693.6635	.0005	AG	−0.0065	s	GCVS 85	-Ir	1)
	52744.4651	.0002	PRK	−0.0063		GCVS 85		1)
KQ Lib	52395.4616	.0017	FR	−0.0002	s	BAVM 137	-Ir	6)
SW Lyn	52280.6190	.0001	RAT RCR	+0.0315		GCVS 85	-Ir	1)
	52364.3487	.0005	DIE	+0.0329		GCVS 85		8)
SX Lyn	52368.4002	.0001	AG	−0.0112		GCVS 85		1)
	52372.4445	.0001	RAT RCR	−0.0118		GCVS 85	23)	1)
	52730.4242	.0004	AG	−0.0096		GCVS 85	-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
TY Lyn	52369.5219	.0005	AG	+0.0712		GCVS 85	-Ir	1)
	52746.3687	.0002	PRK	+0.0640		GCVS 85		1)
CD Lyn	52698.3853	.0010	JU	−0.0002		IBVS 4911		4)
	52723.4078	.0017	JU	+0.0002	s	IBVS 4911		4)
DE Lyn	52368.3574	.0004	AG					1)
	52368.5600	.0003	AG					1)
	52695.6163	.0003	AG				-Ir	1)
	52730.3656	.0006	AG				-Ir	1)
TZ Lyr	52363.5572	.0007	RAT RCR	+0.0008		GCVS 85	23)	1)
	52416.4408	.0009	AG	+0.0017		GCVS 85	-Ir	1)
	52526.4347	.0001	RAT RCR	−0.0004		GCVS 85	-Ir	1)
	52720.5171	.0002	PRK	+0.0025		GCVS 85		1)
EW Lyr	52513.4333	.0004	RAT RCR	+0.2330		GCVS 85	-Ir	1)
FL Lyr	52806.4725	.0002	QU	−0.0019		GCVS 85	V	14)
V406 Lyr	52416.4024	.0004	AG	−0.0188		BAVM 72	-Ir	1)
RW Mon	52680.3475	.0001	AG	−0.0468		GCVS 85	-Ir	1)
HM Mon	52683.3404	.0002	AG	−0.0013		GCVS 85	-Ir	1)
IZ Mon	52688.3091	.0002	AG				-Ir	1)
NS Mon	52680.3465	.0003	AG	+0.0068		BAVM 76	-Ir	1)
V395 Mon	52308.3600	.0032	MS FR					9)
V496 Mon	52695.3848	.0017	AG	−0.0280		GCVS 85	-Ir	1)
V714 Mon	52308.2734	.0001	MS FR					9)
	52695.3295	.0011	AG				-Ir	1)
U Oph	52489.4547		SG	+0.0012		GCVS 85	V	5)
V449 Oph	52483.5022	.0016	AG	+0.0791	s	GCVS 85	-Ir	1)
V2357 Oph	52426.5320	.0013	AG				-Ir	1)
EF Ori	52619.4200	.0006	FR					6)
EW Ori	52689.4144	.0005	QU	+0.0032		SAC 70	V	14)
FT Ori	52296.3852	.0004	JU	+0.0096		GCVS 85		4)
	52692.3848	.0019	MON	−0.0924	s	GCVS 85	V	1)
	52693.3383	.0003	MON	+0.0104		GCVS 85	V	1)
	52715.3913	.0001	QU	+0.0105		GCVS 85	V	14)
GU Ori	52619.5214	.0004	FR					6)
V648 Ori	52619.3879	.0002	RAT RCR	+0.0497		GCVS 85	-Ir	1)
V1633 Ori	52258.4868	.0004	MS	−0.2045		BAVM 125		9)
U Peg	52501.4415	.0005	QU	−0.0894	s	GCVS 87	V	14)
VW Peg	52547.5689	.0004	FR	−4.7739	s	BAVM 129		6)
BX Peg	52505.4453	.0021	AG	−0.0620	s	GCVS 87		1)
	52505.5859	.0009	AG	−0.0616		GCVS 87		1)
	52510.4923	.0008	AG	−0.0626	s	GCVS 87		1)
BY Peg	52505.4339	.0015	AG					1)
	52510.3941	.0014	AG					1)
	52510.5644	.0011	AG					1)
CC Peg	52505.3409	.0005	AG	−0.0018		BAVM 133		1)
	52510.4911	.0020	AG	+0.0008	s	BAVM 133		1)
CF Peg	52505.5070	.0034	AG					1)
	52510.4627	.0013	AG					1)
DI Peg	52530.3191	.0005	DIE	−0.0174		GCVS 87		8)
	52567.3312	.0021	SCI	−0.0198		GCVS 87		4)
DK Peg	52555.4779	.0003	QU	+0.0625		GCVS 87	V	14)
EU Peg	52150.4268	.0002	MS FR	+0.0346		GCVS 87		9)
KW Peg	52505.4998	.0012	AG					1)
	52510.3966	.0018	AG					1)
ST Per	52619.5239	.0006	SCI	+0.1647		GCVS 87		4)
AG Per	52685.3134	.0035	JU	+0.0006		SAC 69		4)
	52688.4111	.0005	JU	+0.0552	s	SAC 69		4)
	52689.3706	.0040	JU	+0.0004		SAC 69		4)
HW Per	52542.5111	.0001	MS FR	+0.0222		GCVS 87		9)
II Per	52696.4272	.0007	AG				-Ir	1)
IK Per	52696.3836	.0006	AG	−0.1213	s	GCVS 87	-Ir	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
IQ Per	52694.3605	.0003	QU	+0.0065		GCVS 87	V	14)
KW Per	52618.3890	.0002	RAT RCR	+0.0100		GCVS 87	-Ir	1)
PS Per	52531.5507	.0002	MS FR					9)
V462 Per	52279.4433	.0008	RAT RCR				-Ir	1)
V482 Per	52724.3527	.0005	AG	+0.1728		BAVM 68	-Ir	1)
AU Ser	52365.4503	.0005	RAT RCR				23)	1)
	52365.6449	.0005	RAT RCR				23)	1)
CC Ser	52410.4018	.0006	AG	−0.0016	s	GCVS 87	-Ir	1)
LX Ser	52410.4707	.0002	AG					1)
VY Sex	52309.4066	.0005	RAT RCR					1)
AH Tau	52689.2896	.0003	AG				-Ir	1)
AL Tau	52685.458	.002	QU				V	14)
AM Tau	52321.2627	.0006	DIE	−0.0504		GCVS 87		8)
	52695.3012	.0015	DIE	−0.0503		GCVS 87		8)
CU Tau	52319.3834	.0035	HSR	+0.0851		GCVS 87		15)
EN Tau	51569.552	.001	QU	−0.007		GCVS 87	-Ir	14)
	52279.5166	.0006	JU	−0.0064		GCVS 87		4)
	52652.4661	.0030	JU	−0.0046		GCVS 87		4)
	52688.3985	.0005	QU	−0.0041		GCVS 87	V	14)
	52693.3539	.0004	PRK FR	−0.0048		GCVS 87		1)
	52693.3543	.0005	QU	−0.0044		GCVS 87	V	14)
EQ Tau	52338.3396	.0003	MZ	−0.0247		GCVS 87	-Ir	11)
	52620.2916	.0002	RAT RCR	−0.0266		GCVS 87	-Ir	1)
GR Tau	52320.3132	.0001	DIE	−0.0255		BAVR 35)		8)
GSC0669.0674 Tau	52307.3134	.0006	FR	−0.0079	s	BAVM 150	-Ir	6)
	52320.3137	.0005	MS	−0.0010		BAVM 150		9)
GSC1830.1432 Tau	52717.3328	.0012	PRK					1)
RV Tri	52280.4293	.0001	RAT RCR	−0.0202		GCVS 87	-Ir	1)
W UMa	52009.3922		PTT	−0.0383		GCVS 87	-Ir	22)
	52032.4221		PTT	−0.0294		GCVS 87	-Ir	22)
	52041.4206		PTT	−0.0391		GCVS 87	-Ir	22)
	52289.3115		PTT	−0.0408		GCVS 87	-Ir	22)
	52309.3294		PTT	−0.0412		GCVS 87	-Ir	22)
	52310.3307		PTT	−0.0408		GCVS 87	-Ir	22)
	52323.3422		PTT	−0.0412		GCVS 87	-Ir	22)
	52347.3624	.0004	SCI	−0.0429		GCVS 87		18)
	52368.3822		PTT	−0.0422		GCVS 87	-Ir	22)
	52372.3856		PTT	−0.0425		GCVS 87	-Ir	22)
	52440.4476	.0010	SCI	−0.0425		GCVS 87		18)
	52451.4557	.0010	SCI	−0.0445		GCVS 87		18)
	52628.2832	.0025	SCI	−0.0448		GCVS 87		4)
	52628.4524	.0017	SCI	−0.0425	s	GCVS 87		4)
	52651.3044	.0035	SCI	−0.0446		GCVS 87		4)
	52651.4709	.0018	SCI	−0.0449	s	GCVS 87		4)
	52651.6374	.0021	SCI	−0.0453		GCVS 87		4)
	52684.3355	.0006	JU	−0.0436		GCVS 87		4)
	52747.3913	.0001	BRN STK	−0.0453		GCVS 87	-Ir	14)
	52747.5585	.0001	BRN STK	−0.0449	s	GCVS 87	-Ir	14)
TX UMa	52567.5770	.0035	SCI	+0.1679		GCVS 87		4)
TY UMa	52362.5442	.0002	RAT RCR	+0.0045		GCVS 87	-Ir	1)
UY UMa	52369.3812	.0010	RAT RCR	+0.0767		GCVS 87	-Ir	1)
	52408.4874	.0010	AG	+0.0772		GCVS 87	BV	1)
	52717.5758	.0007	AG	+0.0804		GCVS 87	-Ir	1)
	52746.5298	.0015	AG	+0.0812		GCVS 87	-Ir	1)
XY UMa	52368.3594	.0002	RAT RCR	+0.0201		GCVS 87	23)	1)
	52376.5033	.0002	RAT RCR	+0.0211		GCVS 87	23)	1)
XZ UMa	52527.5348	.0021	SCI	+0.6002		GCVS 87		4)
ZZ UMa	52308.4155	.0003	RAT RCR	−0.0041		GCVS 87	-Ir	1)
AA UMa	52361.4994	.0003	RAT RCR	+0.0224		GCVS 87	24)	1)
	52368.5215	.0003	RAT RCR	+0.0226		GCVS 87	23)	1)

Table 1: (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
W UMi	52369.4083	.0005	QU	−0.1309		GCVS 87	V	14)
RZ UMi	52308.6428	.0003	RAT RCR				-Ir	1)
	52363.4617	.0001	AG					1)
AH Vir	52386.4117		SIR	−0.0644		GCVS 87	-Ir	10)
AW Vir	52367.3867	.0002	RAT RCR	+0.0130		GCVS 87	23)	1)
BH Vir	52411.4236	.0004	QU	−0.0054		GCVS 87	V	14)
CG Vir	52409.4990	.0002	AG	+0.2008	s	GCVS 87	BV	1)
HW Vir	52764.4840	.0001	PRK					1)
	52764.5419	.0002	PRK					1)
BK Vul	49545.4104		MS	+0.1096		GCVS 87		1)
	49645.3930		MS	+0.1021	s	GCVS 87		1)
	49646.3054		MS	+0.1075	s	GCVS 87		1)
	50653.4538		MS	+0.0991	s	GCVS 87		1)
	51413.4598	.0005	AG	+0.0893	s	GCVS 87		1)
	52448.4886	.0049	PC	+0.0729		GCVS 87	-Ir	12)
FR Vul	52426.494	.003	AG	−0.010		GCVS 87		1)

Remarks:

AG : Agerer, F., Tiefenbach
BRN: Brauner, B., Herford
FR : Frank, P., Velden
JU : Jungbluth, Dr. H., Karlsruhe
MS : Moschner, W., Lennestadt
PC : Poschinger, K., Hamburg
PTT: Petter, Dr. G., Liegau
RAT: Rätz, M. Herges-Hallenberg
SCI: Schmidt, U. Karlsruhe
SIR: Schirmer, J., Fredenbeck
WTR: Walter, F., München
ATB: Achterberg, Dr. H., Norderstedt
DIE: Dietrich, M., Radebeul
HSR: Husar, Dr. D., Hamburg
MON: Monninger, Dr. G., Gemmingen
MZ : Maintz, G., Bonn
PRK: Proksch, W., Winhöring
QU : Quester, W., Esslingen
RCR: Rätz, Ch. Herges-Hallenberg
SG : Sterzinger, Dr. P, Wien (A)
STK: Strunk, J., Leopoldshöhe

: = uncertain
s = secondary minimum
E = CCD- or photoelectric observation
red = reduced results
1) = photometer ST-6 CCD 375 × 242 uncoated, filter V/ B
2) = photometer EMI 9781A, filter V=GG495,1mm B=BB12,1mm+GG385,2mm
3) = photometer Cryocam 80A, without filter
4) = photometer ST-7, filter V / R / -Ir=KG5/2 / Ic / or none
5) = photometer SSP5, without filter
6) = photometer OES-LcCCD11, filter -Ir or without filter
7) = photometer LC14, filter -Ir
8) = photometer pictor 1616XT, without filter
9) = photometer ST-9 chip 512*512
10) = photometer AlphaMaxi, filter -Ir
11) = photometer AlphaMini, filter -Ir
12) = photometer ST-8E, filter without, -Ir, V/R (Bessel type)
13) = photometer Pictor 416XT filter without
14) = photometer ST-7E filter V; R; -Ir=KG/2; without filter
15) = photometer ST-8E chip: KAF1602E without filter
16) = photometer ST-7 chip: KAF0400 without filter
17) = photometer apogee AP7 chip: SITe502a filter V; -Ir
18) = photometer ST-5 without filter
19) = photometer ST-10 without filter; filter -Ir
20) = photometer ST-10 XMR without filter; filter -Ir

Remarks (cont.)

21)	= photometer OES-LcCCd12 without filter
22)	= photometer AlphaMaxi chip: KAF401e
23)	= filter -Ir and Green
24)	= filter -Ir and Red
26)	= double maxima, determination of time is difficult
GCVS *yy*	= General Catalogue of Variable Stars, 4th ed. 19*yy*
IBVS *nnnn*	= Information Bulletin on Variable Stars No. *nnnn*
MVS vv,ppp	= Mitteilungen über Veränderliche Sterne; volume, page
SAC *vv*	= Rocznik Astronomiczny No. *vv*, Krakow (SAC)
BAVM *nnn*	= BAV Mitteilungen No. *nnn*
BAVM 51	= IBVS No. 3234
BAVM 53	= IBVS No. 3401
BAVM 63	= IBVS No. 3811
BAVM 65	= IBVS No. 3859
BAVM 67	= IBVS No. 3942
BAVM 71	= IBVS No. 4131
BAVM 72	= IBVS No. 4132
BAVM 76	= IBVS No. 4143
BAVM 82	= IBVS No. 4266
BAVM 89	= IBVS No. 4381
BAVM 115	= IBVS No. 4669
BAVM 132	= IBVS No. 5016
BAVM 133	= IBVS No. 5017
BAVM 135	= IBVS No. 5024
BAVM 137	= IBVS No. 5148
BAVM 138	= IBVS No. 5161
BAVM 150	= IBVS No. 5260
BAVM 156	= IBVS No. 5366
BAVR 31	= BAV Rundbrief 32, 36 f
BAVR 32	= BAV Rundbrief 32,122 f
BAVR 33	= BAV Rundbrief 33,152 f
BAVR 34	= BAV Rundbrief 33,160 f
BAVR 35	= BAV Rundbrief 35, 1 f
BAVR 38	= BAV Rundbrief 49,117
BAVR 45	= BAV Rundbrief 49,180
BAVR 46	= BAV Rundbrief 50, 45f

ERRATUM FOR IBVS 5484

(BAVM 158)

VW Peg	52547.5689 FR	correct time: 52547.5272
KQ Gem	52690.3810 AG	correct name: KV Gem
	52690.5576 AG	
	52691.2757 AG	
	52691.4562 AG	
	52692.3516 AG	
	52692.5310 AG	
	52694.3242 AG	
	52694.5028 AG	
	52697.3714 AG	

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PHOTOELECTRIC MAXIMA OF SELECTED PULSATING STARS

(BAV MITTEILUNGEN NO. 160)

AGERER, FRANZ; HÜBSCHER, JOACHIM

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In this 50th compilation of BAV results, photoelectric observations obtained in the years 2002 till 2003 are presented on 145 variable stars giving 360 maxima. All moments of the 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 light curves with evaluations can be obtained from the office of the BAV for inspection.

Table 1: Pulsating stars

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
SW And	52533.4760	.0004	JU	−0.0231	BAVM 78		4)
	52556.4733	.0053	PC	−0.0236	BAVM 78	-Ir	19)
	52680.3083	.0028	ATB	−0.0233	BAVM 78		1)
XX And	52195.3917	.0050	PS	+0.2127	GCVS 85		3)
	52323.3110	.0035	ATB	+0.2057	GCVS 85		1)
	52620.3580	.0012	JU	+0.2036	GCVS 85		4)
	52628.3126	.0012	MON	+0.2080	GCVS 85	V	1)
CI And	52195.5525	.0100	PS				3)
	52693.3587	.0006	MZ			-Ir	11)
	52693.3662	.0035	ATB				1)
DR And	52320.3019	.0028	ATB				1)
	52620.4385	.0035	ATB				1)
GP And	52489.4910	.0012	MON	+0.0025	GCVS 85	V	1)
OV And	52552.3779	.0009	JU	−0.0098	MVS11,133		4)
	52592.3764	.0009	JU	−0.0107	MVS11,133		4)
TY Aps	52394.580	.005	PS				4)
XZ Aps	52401.567	.005	PS				16)
SX Aqr	52548.3751	.0019	MON	+0.0145	BAVR 37)	V	1)
CY Aqr	52557.4373	.0002	MZ	+0.0108	GCVS 85	-Ir	11)
AA Aql	52552.3332	.0019	MON	+0.0041	BAVM 78	V	1)
V341 Aql	52133.583	.005	PS	+0.028	GCVS 85		3)
V625 Aql	52503.551	.002	AG				1)
RV Ari	52548.6381	.0018	MON	+0.0094	GCVS 85	V	1)
	52671.2767	.0014	ATB	−0.0019	GCVS 85		1)
TZ Aur	52188.5713		MS FR	+0.0087	GCVS 85		9)
	52321.3497	.0002	JU	+0.0094	GCVS 85		4)

Table 1: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
TZ Aur	52681.3027	.0012	MON	+0.0134	GCVS 85	V	1)
	52693.4454	.0014	SCI	+0.0142	GCVS 85		4)
BH Aur	52277.552	.002	HSR				15)
	52320.4043	.0020	HSR				15)
	52646.5071	.0024	ATB				1)
RS Boo	52474.4650	.0004	MZ	+0.0128	BAVR 36)	-Ir	10)
	52485.4087	.0009	MZ	+0.0137	BAVR 36)	-Ir	10)
	52745.3951	.0005	QU	+0.0138	BAVR 36)	V	14)
	52748.4146	.0002	MZ	+0.0145	BAVR 36)	-Ir	11)
	52754.4511	.0010	SCI	+0.0137	BAVR 36)		16)
ST Boo	52450.4714	.0010	MZ	−0.0005	BAVR 40)	-Ir	10)
	52722.409	.002	AG	−0.005	BAVR 40)		1)
	52725.520	.002	AG	−0.005	BAVR 40)		1)
	52730.502	.002	AG	−0.001	BAVR 40)		1)
SZ Boo	52767.4828	.0049	PC			-Ir	20)
TW Boo	52376.4693	.0004	JU	−0.0158	SAC 72		4)
	52746.398	.002	AG	−0.016	SAC 72		1)
UU Boo	52338.5841	.0005	JU	+0.1412	GCVS 85		4)
	52344.5225	.0005	JU	+0.1396	GCVS 85		4)
	52366.4514	.0004	JU	+0.1363	GCVS 85		4)
	52440.4726:	.0013	JU	+0.1364	GCVS 85		4)
	52451.4439	.0008	JU	+0.1416	GCVS 85		4)
	52721.496	.002	AG	+0.154	GCVS 85		1)
	52722.408	.002	AG	+0.152	GCVS 85		1)
	52723.323	.002	AG	+0.153	GCVS 85		1)
	52725.605	.003	AG	+0.150	GCVS 85		1)
	52726.521	.001	AG	+0.153	GCVS 85		1)
	52743.427	.002	AG	+0.152	GCVS 85		1)
	52747.539	.002	AG	+0.152	GCVS 85		1)
	52764.447	.000	AG	+0.154	GCVS 85		1)
UY Boo	51956.6768	.0007	MS FR	+0.0206	SAC 72		9)
	52749.5298	.0010	SCI	+0.0748	SAC 72		16)
XX Boo	52746.5681	.0093	PC	+0.0196	GCVS 85	-Ir	19)
	52767.4987	.0047	PC	+0.0197	GCVS 85	-Ir	20)
YZ Boo	52327.5535	.0010	MON	+0.0034	GCVS 85	V	1)
	52692.6016	.0019	MON	+0.0024	GCVS 85	V	1)
	52763.4876	.0012	MON	+0.0021	GCVS 85	V	1)
AG Boo	52373.585	.005	AG				1)
AY Boo	52371.384	.004	AG			-Ir	1)
BR Boo	52371.386	.010	AG			-Ir	1)
CG Boo	52361.6141	.0030	MS FR				9)
	52372.4990	.0006	MS				9)
CM Boo	52321.6621	.0016	MON	−0.0656	GCVS 85	-Ir	1)
	52373.4327	.0010	QU	−0.0668	GCVS 85	V	14)
	52764.4547		BRN STK	−0.0742	GCVS 85	-Ir	14)
CS Boo	52322.6861	.0017	MON	+0.0006	IBVS 2855	V	1)
	52424.5060	.0010	JU	−0.0025	IBVS 2855		4)
AH Cam	52681.3273:	.0003	MZ	+0.0582	GCVS 85	-Ir	11)
	52688.3205:	.0008	MZ	+0.0455	GCVS 85	-Ir	11)
RW Cnc	52371.3508	.0012	MON	+0.1834	GCVS 85	V	1)
	52684.3466	.0019	MON	+0.1814	GCVS 85	V	1)
	52696.3859	.0019	MON	+0.1823	GCVS 85	V	1)
	52742.3586	.0099	PC	+0.1903	GCVS 85	-Ir	19)
SS Cnc	52319.4657	.0014	ATB	+0.0436	GCVS 85		1)
	52689.3716	.0007	MZ	+0.0402	GCVS 85	-Ir	11)
	52704.4353	.0010	FR	+0.0430	GCVS 85		21)
	52707.3739	.0013	FR	+0.0430	GCVS 85		21)
TT Cnc	52327.3769	.0010	MON	+0.0825	GCVS 85	V	1)
	52327.3777	.0007	JU	+0.0832	GCVS 85		4)
	52337.5084	.0008	JU	+0.0718	GCVS 85		4)

Table 1: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
TT Cnc	52363.4272	.0021	JU	+0.0720	GCVS 85		4)
	52367.3704	.0042	ATB	+0.0710	GCVS 85		1)
	52367.3732	.0010	MZ	+0.0739	GCVS 85	-Ir	11)
	52722.3506	.0019	WTR	+0.0781	GCVS 85		13)
	52722.3542	.0065	PC	+0.0817	GCVS 85	-Ir	20)
AN Cnc	52367.4572	.0035	PC			-Ir	12)
AQ Cnc	52362.3676	.0036	JU	−0.0612	GCVS 85		4)
AS Cnc	52351.3968	.0048	PC			-Ir	12)
Z CVn	52367.5134	.0017	JU	+0.1620	GCVS 85		4)
	52367.5143	.0071	PC	+0.1629	GCVS 85	-Ir	12)
	52369.4836	.0015	JU	+0.1707	GCVS 85		4)
	52371.4329	.0008	MZ	+0.1585	GCVS 85	-Ir	11)
	52696.4198	.0010	JU	+0.1974	GCVS 85		4)
RR CVn	51920.6868	.0100	HSR PC				17)
RU CVn	52319.5821	.0020	HSR				12)
	52358.5645	.0015	HSR				12)
	52362.5766	.0020	HSR				12)
	52373.4696	.0030	HSR				12)
RZ CVn	52308.6529	.0010	MON	−0.1938	GCVS 85	-Ir	1)
	52358.5911	.0028	PC	−0.1879	GCVS 85	-Ir	12)
ST CVn	52767.4563	.0092	PC	−0.0384	GCVS 85	-Ir	20)
SV CVn	52358.3829	.0045	HSR				15)
	52386.4701	.0045	HSR				15)
SW CVn	52345.6482	.0019	PC			-Ir	12)
VW CVn	52373.390	.010	AG	+0.047	BAVR 40)		1)
	52715.477	.003	AG	+0.030	BAVR 40)		1)
XZ CVn	51920.664 :	.005	HSR PC	−0.043	GCVS 85		17)
BN CVn	52713.6338	.0031	PC	+0.0430	BAVM 75	-Ir	20)
Y CMi	52359.3212	.0080	PS	+0.1342	GCVS 85		3)
AA CMi	52693.3434	.0005	WTR	+0.0400	GCVS 85		13)
AD CMi	51598.3120	.0025	HSR	+0.0033	GCVS 85		16)
	52695.3662	.0006	MZ	+0.0026	GCVS 85	-Ir	11)
AL CMi	52699.3432	.0030	WTR	−0.1378	GCVS 85		13)
BK Cas	52698.403	.001	AG				1)
PS Cas	52618.299	.007	AG			-Ir	1)
RZ Cep	52185.3548	.0010	MON	−0.1250	GCVS 85		1)
DX Cep	52527.5534	.0025	PC			-Ir	12)
EZ Cep	52503.4201	.0050	MZ			-Ir	11)
	52617.4978	.0029	PC			-Ir	19)
U Com	52763.4120	.0008	WTR	+0.0347	GCVS 85		13)
RY Com	51934.638	.003	HSR PC	+0.021	GCVS 85		17)
	52351.5277	.0069	PC	+0.0111	GCVS 85	-Ir	12)
	52713.5601	.0039	PC	+0.0117	GCVS 85	-Ir	20)
ST Com	52342.5752	.0047	PC	−0.0204	GCVS 85	-Ir	12)
	52420.4329	.0010	MZ	−0.0234	GCVS 85	-Ir	11)
AO Com	52747.528	.010	AG			-Ir	1)
AT Com	52704.546	.001	AG				1)
AX Com	52704.624	.001	AG				1)
BT Com	52373.553	.004	AG				1)
IS Com	52723.437	.004	AG			-Ir	1)
RV CrB	52350.6019:	.0045	MS FR	−0.1357	GCVS 85		9)
	52362.5108	.0030	MS FR	−0.1631	GCVS 85		9)
	52520.3685	.0010	MZ	−0.1303	GCVS 85	-Ir	11)
SZ CrB	52453.4712	.0050	MZ	−0.1543	GCVS 85	-Ir	10)
TV CrB	52308.6510	.0016	MS FR	+0.0222	GCVS 85		9)
WW CrB	52367.444	.003	AG				1)
XX Cyg	52501.4487	.0002	MZ	+0.0015	GCVS 85	-Ir	11)
XZ Cyg	52440.5577	.0008	MON	+0.0153	BAVR 41)	V	1)
	52448.4842	.0008	MON	+0.0096	BAVR 41)	V	1)
DM Cyg	52476.4515	.0017	MON	+0.0446	GCVS 85	V	1)

Table 1: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
DM Cyg	52502.4854	.0019	PC	+0.0472	GCVS 85	-Ir	12)
	52584.3579	.0028	ATB	+0.0470	GCVS 85		1)
	52618.3684	.0003	MZ	+0.0488	GCVS 85	-Ir	11)
	52621.3054	.0035	ATB	+0.0468	GCVS 85		1)
V894 Cyg	52443.461	.004	MZ	+0.000	BAVR 39)	-Ir	10)
V939 Cyg	52416.419	.002	AG	−0.012	BAVM 92		1)
ZZ Del	52531.4054	.0010	MZ			-Ir	11)
CK Del	52531.4032	.0004	WTR				13)
DX Del	52501.4120	.0016	WTR	+0.0531	GCVS 85		13)
RW Dra	52338.6211	.0010	MON	+0.1499	GCVS 85	V	1)
	52448.476	.005	PS	+0.162	GCVS 85		3)
	52502.5126	.0007	JU	+0.1621	GCVS 85		4)
	52503.3935	.0007	JU	+0.1572	GCVS 85		4)
	52503.3974	.0003	WTR	+0.1611	GCVS 85		13)
SU Dra	52742.4690	.0074	PC	+0.0400	GCVS 85	-Ir	19)
	52746.4277	.0025	SCI	+0.0362	GCVS 85		16)
	52746.4300	.0038	PC	+0.0385	GCVS 85	-Ir	19)
SW Dra	52322.3564	.0011	MON	+0.0209	SAC 72	V	1)
	52359.3838	.0009	MZ	+0.0196	SAC 72	-Ir	11)
	52620.3019	.0030	SCI	+0.0286	SAC 72		4)
	52695.4952	.0010	JU	+0.0253	SAC 72		4)
	52720.5616	.0035	PC	+0.0262	SAC 72	-Ir	20)
VZ Dra	52360.4361	.0019	JU	−0.0972	GCVS 85		4)
	52361.3950	.0024	MON	−0.1014	GCVS 85	V	1)
	52411.4742	.0010	JU	−0.1030	GCVS 85		4)
	52412.4298	.0031	JU	−0.1105	GCVS 85		4)
	52455.4530	.0016	JU	−0.1054	GCVS 85		4)
	52680.5169	.0024	SCI	−0.0841	GCVS 85		4)
	52685.6144	.0035	SCI	−0.1231	GCVS 85		4)
	52690.4548	.0083	SCI	−0.0981	GCVS 85		4)
	52694.6175	.0049	SCI	−0.1088	GCVS 85		16)
	52734.4187	.0045	SCI	−0.1155	GCVS 85		16)
XZ Dra	52344.5521	.0010	MON	−0.0463	GCVS 85	V	1)
	52720.4918	.0010	SCI	−0.0628	GCVS 85		4)
BK Dra	52444.5056	.0025	JU	+0.0071	SAC 72		4)
	52508.4530	.0020	JU	+0.0104	SAC 72		4)
	52511.4096	.0021	SCI	+0.0066	SAC 72		4)
	52721.6031	.0019	MON	+0.0134	SAC 72	V	1)
DD Dra	52483.500	.002	AG	−0.030	BAVR 42)	V	1) 26)
	52691.4811	.0049	SCI	+0.1101	BAVR 42)		4) 26)
	52713.6935	.0018	MON	+0.1006	BAVR 42)	V	1) 26)
RR Gem	52319.5322	.0015	HSR	+0.1304	GCVS 85		15)
	52322.3094	.0005	JU	+0.1265	GCVS 85		4)
	52337.4062	.0005	JU	+0.1255	GCVS 85		4)
	52341.3772	.0008	MZ	+0.1234	GCVS 85	-Ir	11)
	52358.4590	.0010	ATB	+0.1208	GCVS 85		1)
	52619.4832	.0008	JU	+0.1119	GCVS 85		4)
	52648.4875	.0017	MON	+0.1126	GCVS 85	V	1)
SZ Gem	52308.4382	.0010	MON	−0.0444	GCVS 85	-Ir	1)
	52321.4699	.0003	JU	−0.0423	GCVS 85		4)
	52680.2815	.0020	JU	−0.0445	GCVS 85		4)
	52691.3059	.0009	JU	−0.0451	GCVS 85		4)
	52692.3072	.0017	SCI	−0.0461	GCVS 85		4)
	52696.3180	.0007	WTR	−0.0443	GCVS 85		13)
	52723.3774	.0005	QU	−0.0463	GCVS 85	V	14)
AK Gem	52707.325	.001	AG	+0.034	GCVS 85		1)
FV Gem	52707.387	.002	AG				1)
GI Gem	52692.3622	.0007	MZ	+0.0664	GCVS 85	-Ir	11)
GSC1893.0089 Gem	52723.397	.001	PRK				1)
VZ Her	52440.4089	.0012	MON	+0.0561	GCVS 85	V	1)

Table 1: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
AF Her	52530.3329	.0021	ATB	−0.1082	GCVS 85		1)
AG Her	52522.3669	.0040	MZ			-Ir	11)
AR Her	52090.5220	.0020	QU	+0.0261	SAC 72	V	14)
	52362.610	.004	HSR	−0.007	SAC 72		15)
	52371.5958	.0018	MON	+0.0492	SAC 72	V	1)
	52373.474	.000	MS	+0.047	SAC 72		9)
	52373.4815	.0070	HSR	+0.0549	SAC 72		15)
	52427.4738	.0008	JU	−0.0010	SAC 72		4)
DL Her	52484.4150	.0026	MZ	+0.0065	GCVS 85	-Ir	10)
IP Her	52531.3409	.0056	ATB				1)
LS Her	52054.4511	.0040	HSR	+0.0331	GCVS 85	-Ir	17)
V1013 Her	52369.6116	.0004	MS	+0.1201	BAVM 125		9)
	52411.5169	.0031	MS FR	+0.1232	BAVM 125		9)
UU Hya	52371.361	.003	AG				1)
UV Hya	52371.352	.003	AG				1)
DD Hya	52720.4004	.0004	WTR	−0.0250	SAC 73		13)
DH Hya	52674.6065	.0030	MZ			-Ir	11)
	52680.4746	.0024	MZ			-Ir	11)
CQ Lac	52618.3208	.0028	ATB				1)
	52649.3235	.0042	ATB				1)
CZ Lac	52505.405	.002	AG	−0.094	GCVS 85	-Ir	1)
	52556.3884	.0006	JU	−0.1112	GCVS 85		4)
	52617.330	.005	AG	−0.110	GCVS 85	-Ir	1)
	52617.3320	.0010	JU	−0.1085	GCVS 85		4)
DE Lac	52503.4101	.0012	MON	+0.0335	GCVS 85	V	1)
IV Lac	52503.355	.002	AG			-Ir	1)
	52505.364	.002	AG			-Ir	1)
	52506.558	.007	AG			-Ir	1)
RR Leo	52322.5040	.0010	MON	+0.0120	SAC 72	V	1)
	52347.3900	.0029	JU	+0.0162	SAC 72		4)
	52361.4155	.0042	JU	+0.0174	SAC 72		4)
	52365.4856	.0008	JU	+0.0160	SAC 72		4)
	52366.3899	.0003	WTR	+0.0155	SAC 72		13)
	52664.5201	.0010	JU	+0.0165	SAC 72		4)
	52683.5208	.0003	JU	+0.0165	SAC 72		4)
	52694.3772	.0055	PRK FR	+0.0154	SAC 72		1)
	52717.4458	.0001	BRN STK	+0.0118	SAC 72	-Ir	14)
	52722.4268	.0011	SCI	+0.0164	SAC 72		4)
	52746.4007	.0002	MZ	+0.0134	SAC 72	-Ir	11)
	52751.3823	.0023	PC	+0.0186	SAC 72	-Ir	19)
SS Leo	52737.3872	.0014	SCI	−0.0328	GCVS 85		16)
ST Leo	52628.6763	.0019	MON	−0.0162	GCVS 85	V	1)
	52697.5052	.0014	SCI	−0.0171	GCVS 85		4)
	52754.3868	.0006	WTR	−0.0156	GCVS 85		13)
SU Leo	51943.5236	.0022	HSR PC	−0.0673	GCVS 85		17)
GP Leo	51926.6054	.0003	MS FR	+0.0096	BAVM 136		9) 25)
	51941.5545	.0015	MS FR	+0.0121	BAVM 136		9) 25)
	52043.4536	.0011	FR	+0.0027	BAVM 136		6)
V LMi	52368.3714	.0004	WTR				13)
	52721.3705	.0003	MZ			-Ir	11)
	52752.3792	.0037	PC			-Ir	19)
EH Lib	52442.5104	.0007	MZ	+0.0058	GCVS 85	-Ir	10)
SZ Lyn	52308.3564	.0010	MON	+0.0115	GCVS 85	-Ir	1)
	52628.5058	.0011	MON	+0.0201	GCVS 85	V	1)
	52721.3220	.0012	WTR	+0.0244	GCVS 85		13)
TV Lyn	52680.5293	.0043	PC	+0.0276	GCVS 85	-Ir	19)
TW Lyn	52342.4393	.0026	PC			-Ir	12)
	52369.4240	.0021	ATB				1)
	52617.5816	.0044	PC			-Ir	19)
AN Lyn	52342.3455	.0012	MON			V	1)

Table 1: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
RZ Lyr	52416.4231	.0007	QU	−0.0187	GCVS 85	V	14)
	52440.4607	.0007	QU	−0.0095	GCVS 85	V	14)
	52464.4977	.0012	MON	−0.0009	GCVS 85	V	1)
	52547.3114	.0013	JU	−0.0084	GCVS 85		4)
	52720.6304	.0018	MON	−0.0006	GCVS 85	V	1)
AQ Lyr	52415.411	.002	AG				1)
EZ Lyr	52361.6265	.0017	MON	+0.0251	SAC 73	V	1)
	52411.5278	.0017	MON	+0.0264	SAC 73	V	1)
	52502.3991	.0005	WTR	+0.0272	SAC 73		13)
	52503.4513	.0029	PC	+0.0290	SAC 73	-Ir	12)
FN Lyr	52464.4664	.0009	MZ	+0.0131	GCVS 85	-Ir	10)
	52558.3494	.0021	ATB	+0.0195	GCVS 85		1)
IN Lyr	52416.487	.002	AG			-Ir	1)
IO Lyr	52360.6217	.0012	MON	−0.0265	GCVS 85	V	1)
	52464.5049	.0013	JU	−0.0254	GCVS 85		4)
	52527.4106	.0030	ATB	−0.0261	GCVS 85		1)
KX Lyr	52542.3141:	.0008	MZ			-Ir	11)
NQ Lyr	52502.4024	.0017	MZ	+0.0016	GCVS 85	-Ir	11)
NR Lyr	52451.4776	.0030	MZ			-Ir	10)
	52619.2495	.0056	ATB				1)
V535 Mon	52664.4399	.0020	MZ			-Ir	11)
V452 Oph	52425.373	.002	AG			-Ir	1)
	52527.3324	.0028	ATB				1)
AO Peg	52533.3817	.0020	MZ	−0.0114	BAVR 39)	-Ir	11)
AV Peg	52519.5613	.0032	PC	+0.0766	GCVS 87	-Ir	12)
BP Peg	52502.3879	.0018	MON	+0.0385	GCVS 87	V	1)
	52529.4468	.0006	PC	+0.0402	GCVS 87	-Ir	12)
BT Peg	52505.582	.002	AG	+0.055	BAVR 40)		1)
CG Peg	52484.4679		SIR	−0.0150	SAC 72	-Ir	10)
	52504.5518	.0018	MON	−0.0180	SAC 72	V	1)
	52535.3830	.0008	JU	−0.0180	SAC 72		4)
	52548.4671	.0017	SCI	−0.0138	SAC 72		4)
DH Peg	52555.3654	.0017	SCI	+0.0356	GCVS 87		4)
DY Peg	52225.4002	.0015	SCI	−0.0027	GCVS 87		18)
	52475.6090	.0012	MON	−0.0039	GCVS 87	V	1)
	52501.4248	.0012	MON	−0.0041	GCVS 87	V	1)
	52501.4978	.0011	MON	−0.0040	GCVS 87	V	1)
	52501.5712	.0011	MON	−0.0035	GCVS 87	V	1)
	52621.3148	.0008	MZ	−0.0049	GCVS 87	-Ir	11)
	52621.3882	.0008	MZ	−0.0045	GCVS 87	-Ir	11)
DZ Peg	52590.3721	.0012	MZ	−0.0155	SAC 72	-Ir	11)
	52646.2480	.0030	ATB	−0.0160	SAC 72		1)
ES Peg	52617.3964	.0027	MZ			-Ir	11)
IY Peg	52576.3895	.0040	MZ			-Ir	11)
	52617.3134	.0013	MZ			-Ir	11)
AR Per	52358.3897	.0004	MZ	+0.0424	GCVS 87	-Ir	11)
	52619.2573	.0024	SCI	+0.0485	GCVS 87		4)
	52681.3872	.0007	QU	+0.0483	GCVS 87	V	14)
	52724.369	.002	AG	+0.050	GCVS 87	-Ir	1)
RY Psc	52548.4688	.0019	MON	−0.1273	GCVS 87	V	1)
DF Ser	52450.4600	.0005	QU			V	14)
	52464.4693	.0007	QU			V	14)
BO Tau	52674.5154	.0008	MZ			-Ir	11)
	52691.4304	.0009	MZ			-Ir	11)
UX Tri	52257.3975	.0056	ATB				1)
	52277.5239	.0035	ATB				1)
	52308.3624	.0042	ATB				1)
	52309.2976	.0012	MON			-Ir	1)
	52322.3478	.0021	ATB				1)
	52502.5628	.0018	MON			V	1)

Table 1: (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
UX Tri	52558.5615	.0035	ATB				1)
	52576.3563	.0020	JU				4)
	52581.4790	.0024	ATB				1)
	52616.5055	.0042	ATB				1)
	52617.4385	.0041	PC			-Ir	19)
	52619.3018	.0025	JU				4)
	52646.3389	.0042	ATB				1)
	52696.3264	.0056	ATB				1)
RV UMa	52053.4277	.0013	SCI	+0.0009	SAC 73		18)
	52338.4774	.0010	QU	−0.0019	SAC 73	V	14)
	52338.4784	.0027	SCI	−0.0008	SAC 73		18)
	52344.5616	.0011	SCI	−0.0026	SAC 73		18)
	52681.5740	.0012	MON	+0.0020	SAC 73	V	1)
	52690.4644	.0005	QU	−0.0008	SAC 73	V	14)
	52704.5083	.0005	QU	+0.0011	SAC 73	V	14)
	52717.611	.002	AG	−0.002	SAC 73	-Ir	1)
	52747.5733	.0043	PC	+0.0040	SAC 73	-Ir	19)
SX UMa	52359.4756	.0050	SCI				18)
	52746.486	.002	AG			-Ir	1)
TU UMa	52347.3549	.0010	MON	−0.0278	GCVS 87	V	1)
	52367.4313	.0005	QU	−0.0272	GCVS 87	V	14)
	52367.4375	.0020	SCI	−0.0210	GCVS 87		18)
	52691.4319	.0005	QU	−0.0263	GCVS 87	V	14)
	52721.5498	.0080	PC	−0.0220	GCVS 87	-Ir	20)
	52744.4071	.0001	BRN STK	−0.0287	GCVS 87	-Ir	14)
	52764.4855	.0005	QU	−0.0260	GCVS 87	V	14)
AE UMa	52321.4089	.0008	MON	+0.0003	GCVS 87	-Ir	1)
	52371.3836	.0002	WTR	−0.0009	GCVS 87		13)
	52685.3460	.0012	MON	−0.0007	GCVS 87	V	1)
	52685.4369	.0012	MON	+0.0042	GCVS 87	V	1)
	52730.4187	.0004	SCI	−0.0010	GCVS 87		16)
	52739.3617	.0007	SCI	−0.0037	GCVS 87		16)
BN Vul	52592.2725	.0011	JU	−0.0145	SAC 73		4)
FH Vul	52519.3908	.0026	PC	−0.0329	BAVR 39)	-Ir	12)

Remarks:

AG : Agerer, F., Tiefenbach
BRN: Brauner, B., Herford
HSR: Husar, Dr. D., Hamburg
MON: Monninger, Dr. G., Gemmingen
MZ : Maintz, G., Bonn
PRK: Proksch, W., Winhöring
QU : Quester, W., Esslingen
STK: Strunk, J., Leopoldshöhe

ATB: Achterberg, Dr. H., Norderstedt
FR : Frank, P., Velden
JU : Jungbluth, Dr. H., Karlsruhe
MS : Moschner, W., Lennestadt
PC : Poschinger, K., Hamburg
PS : Paschke, A. Rüti (CH)
SCI: Schmidt, U. Karlsruhe
WTR: Walter, F., München

Remarks (cont.):

:	= uncertain
E	= CCD- or photoelectric observation
red	= reduced results
1)	= photometer ST-6 CCD 375 × 242 uncoated, filter V/ B
3)	= photometer Cryocam 80A, without filter
4)	= photometer ST-7, filter V / R / -Ir=KG5/2 / Ic / or none
6)	= photometer OES-LcCCD11, filter -Ir or without filter
9)	= photometer ST-9 chip 512×512
10)	= photometer AlphaMaxi, filter -Ir
11)	= photometer AlphaMini, filter -Ir
12)	= photometer ST-8E, filter without, -Ir, V/R (Bessel type)
13)	= photometer Pictor 416XT filter without
14)	= photometer ST-7E filter V; R; -Ir=KG/2; without filter
15)	= photometer ST-8E chip: KAF1602E without filter
16)	= photometer ST-7 chip: KAF0400 without filter
17)	= photometer apogee AP7 chip: SITe502a filter V; -Ir
18)	= photometer ST-5 without filter
19)	= photometer ST-10 without filter; filter -Ir
20)	= photometer ST-10 XMR without filter; filter -Ir
21)	= photometer OES-LcCCd12 without filter
25)	= evaluation: supported by the software MIRA AP
26)	= double maxima, determination of time is difficult
GCVS *yy*	= General Catalogue of Variable Stars, 4th ed. 19*yy*
IBVS *nnnn*	= Information Bulletin on Variable Stars No. *nnnn*
MVS vv,ppp	= Mitteilungen über Veränderliche Sterne; volume, page
SAC *vv*	= Rocznik Astronomiczny No. *vv*, Krakow (SAC)
BAVM *nnn*	= BAV Mitteilungen No. *nnn*

BAVM 136	= IBVS No. 5114
BAVR 36	= BAV Rundbrief 36,157 f
BAVR 37	= BAV Rundbrief 48, 57
BAVR 39	= BAV Rundbrief 49, 41
BAVR 40	= BAV Rundbrief 49,105
BAVR 41	= BAV Rundbrief 48,189
BAVR 42	= BAV Rundbrief 49, 6

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THE FIRST COMPLETE CCD LIGHT CURVES AND ORBITAL PERIOD CHANGE OF IK Per

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According to the 4th edition of the General Catalogue of Variable Stars (GCVS) (Kholopov et al., 1987), IK Per is a short-period eclipsing binary system with a period of $P = 0\overset{d}{.}67603467$ and belongs to EB/KE type. Although some visual, photographic and photoelectric times of light minimum have been published, it was a neglected system for study. Up to now, no complete photoelectric and CCD light curves were obtained. For understanding the properties of light variation and studying the period change of the system, we choose it as our object to observe.

Observations of the eclipsing binary system IK Per in B and V bands were carried out on December 2, 3, and 4, 2002, with the PI1024 TKB CCD photometric system attached to the 1.0-meter Cassegrain reflector telescope at the Yunnan Observatory in P. R. China. The field of view of the CCD image at the Cassegrain focus is 6.5×6.5 square arc minutes. The B and V filters used approximate the standard Johnson UBV photometric system. During the observations, the integration time for each image was 120 seconds. A total of 273 images in V and 273 images in B were obtained. Image reductions were done by using IRAF packages. One of the CCD images is displayed in Figure 1.

Table 1: The coordinates of the variable, comparison star and check star

Stars	year	α	δ
Variable (star 1)	2000	04:29:27.46	42:03:10.7
Comparison (star 2)	2000	04:29:26.53	41:58:53.1
Check(star 3)	2000	04:29:02.4	42:01:12.4

The observations obtained in the three days are plotted in Figure 2, where the phases were calculated with a new period of $0\overset{d}{.}67602324$ (Eq. 4). The light curves appear to exhibit a typical O'Connell effect, with Maximum I being 0.015 mag.(V) and 0.020 mag.(B) fainter than Maximum II. The light variation is continuous with a slightly large difference between the depths of the two minima. The secondary minimum is about 0.07 mag.(V) and 0.08 mag. (B) brighter than the primary minimum. With the observed data, one primary and two secondary times of light minimum are obtained by means of parabola fitting. The new determined times of light minimum and several recently published photoelectric minima times are given in Table 2.

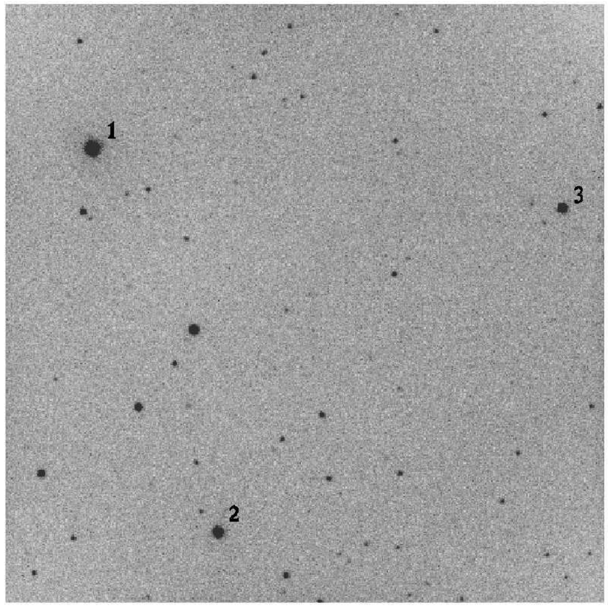

Figure 1. CCD image of IK Per, comparison and check stars.

The early times of light minimum for IK Per were compiled by Kreiner et al. (2000), which were kindly provided by Prof. Kim Chun-Hwey. The O–C curve calculated with the ephemeris given by Kreiner et al.,

$$\text{Min.I} = \text{HJD}2427397.534 + 0\overset{\text{d}}{.}67603467 \times \text{E}, \tag{1}$$

is shown in Figure 3 where solid dots refer to photoelectric or CCD (PEC) observations, and open circles to visual or photographic (VP) data. As displayed in the figure, although O–C values of the VP observations show a slightly large scatter (up to $0\overset{\text{d}}{.}03$), the general O–C trend reveals that the period of IK Per is variable.

Since no data is available between E=17348.5 and 31962.5, the properties of the period change are not clear. By assuming a long-term period decrease, a weighted least-squares solution with weights 10 to PEC data and 1 to VP observations yields the following ephemeris,

$$\text{Min.I} = \text{HJD}2427397.4934(51) + 0\overset{\text{d}}{.}67604353(3) \times \text{E} - 2.48(1) \times 10^{-10} \times E^2. \tag{2}$$

With the quadratic term in the ephemeris, a secular period decrease rate of $\mathrm{d}P/\mathrm{d}t = -2.68 \times 10^{-7}$ days/year is derived. On the other hand, the period change may not vary continuously. With the data before E=17348.5, the linear ephemeris,

$$\text{Min.I} = \text{HJD}2427397.5190(93) + 0\overset{\text{d}}{.}67603280(108) \times \text{E}, \tag{3}$$

is determined by a least-squares solution. For the observations after E=17348.5, the ephemeris

$$\text{Min.I} = \text{HJD}2427397.8995(149) + 0\overset{\text{d}}{.}67602324(42) \times \text{E}, \tag{4}$$

is derived, which can be used to predict the epochs of light minimum. The $(O-C)'$ values of all the PEC times respect to this ephemeris are also listed in table 2. The two linear ephemeris reveal that a sudden period decrease, $\Delta P = 1.329 \times 10^{-5}$ days=1.15 s, might occur around E=28000. In order to check the period variation of the system, more times of light minimum are required.

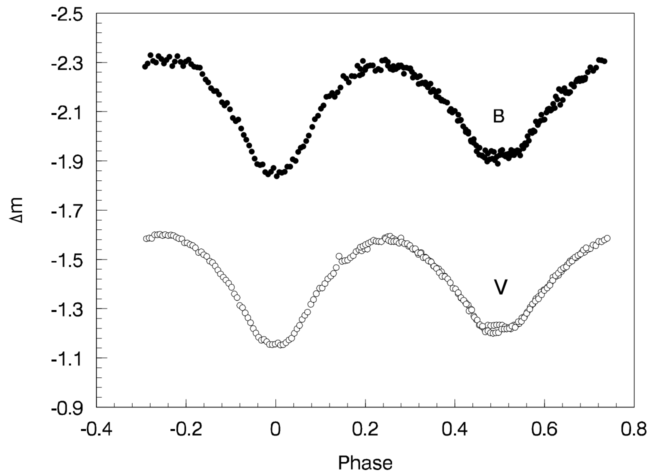

Figure 2. CCD light curves in V and B for IK Per, where the phases were calculated with the period ($p = 0\overset{\mathrm{d}}{.}67602324$) given in the new linear ephemeris.

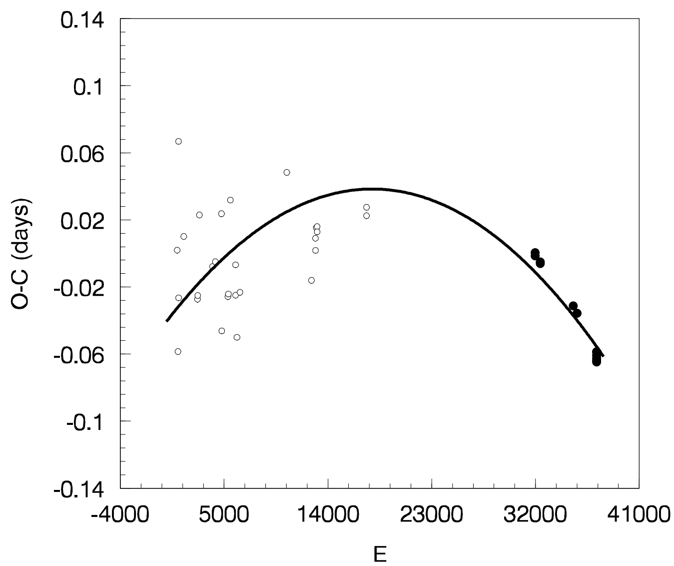

Figure 3. O-C plot in days for IK Per. Circles refers to the VP observations and solid dots to the PEC data. Also given in solid line is the quadratic fit.

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Table 2: CCD and photoelectric times of light minimum for IK Per.

JD (Hel.) +2400000	Error	Min.	Meth	Filter	E	$O-C$	$(O-C)'$	Ref.
49005.2917	±0.0015	II	pe	BV	31962.5	−0.0005	−0.0006	(1)
49310.5163	±0.0016	I	pe	BV	32414	−0.0056	−0.0005	(2)
51249.3580	±0.0012	I	pe		35282	−0.0312	+0.0065	(3)
51470.4169	±0.0070	I	pe		35609	−0.0357	+0.0058	(4)
52611.1995	±0.0009	II	CCD	BV	37296.5	−0.0616	−0.0008	(5)
52612.2164	±0.0004	I	CCD	BV	37298	−0.0587	+0.0021	(5)
52613.2250	±0.0007	II	CCD	BV	37299.5	−0.0642	−0.0033	(5)

References in Table 2: (1) Huebscher et al.(1993); (2) Huebscher et al. (1994); (3) Agerer & Huebscher (2000); (4) Agerer et al.(2001); (5) The present paper

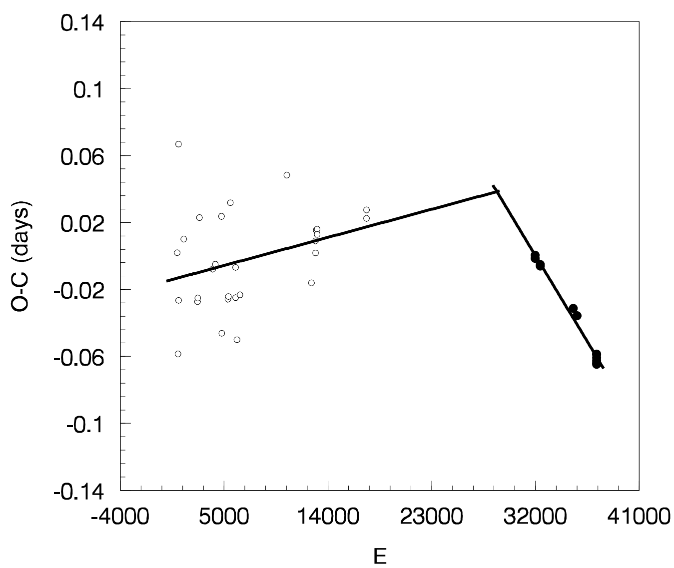

Figure 4. A possible sudden period decrease of IK Per occurred around E=28000. Symbols are the same as those in Figure 3.

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TIMES OF MINIMA OF ECLIPSING BINARY STARS

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Observatory and telescope:
URSA Observatory at the University of Arkansas (ursa.uark.edu); 10-inch Schmidt-Cassegrain reflector.

Detector:	1020×1530 pixels SBIG ST8EN CCD cooled to (typ.) −20 C; 1.15 ″square pixels; 20′(N-S) × 30′(E-W) FOV.

Method of data reduction:
Virtual measuring engine (Measure 1.97) written by C.H.S. Lacy (2003)

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

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
AP And	EA/DM	23 49 31	+45 47 21	03639 00767†	52898.62235	1.5872920	1
CO And	EA/DM	01 11 25	+46 57 49	03268 00400	52245.65158	3.655326	2
HP Aur	EA/DM	05 10 22	+35 47 47	02401 00760	52263.62901	1.4228192	2
KU Aur	EA/SD:	06 28 04	+30 23 34	02422 01381	52263.88113	1.319577	1
CV Boo	EA/DM	15 26 20	+36 58 53	02570 00511	52321.84559	0.8469935	2
SW Cnc	EA/SD:	09 09 00	+09 35 42	00812 00083	52339.81190	1.799211	2
MU Cas	EA/DM	00 15 52	+60 25 54	01331 04014	51876.5835	9.652926	3
V381 Cas	EA/DM	00 32 52	+49 19 39	03256 01906	52968.7011	1.7459455	1
V389 Cas	EA	01 14 05	+48 58 48	03272 00102	51469.4103	4.989514	1
V396 Cas	EA/DM	23 13 36	+56 44 06	01337 04006	52180.7074	5.50545	3
V459 Cas	EA/DM	01 11 30	+61 08 48	00792 04030	51144.6845	8.458294	3
V651 Cas	EA/DM	23 48 34	+57 44 57	04009 00049	52817.87187	0.9968096	1
VZ Cep	EA/DM	21 50 11	+71 26 38	01497 04470	52054.85215	1.18336356	1
V456 Cyg	EA/DM	20 28 51	+39 09 14	03152 00323	52836.7625	0.89119220	1
V1061 Cyg	EA/DM	21 07 21	+52 02 58	03600 00278	52015.90562	2.34663383	1
HD 23642	EA/DM	03 47 29	+24 17 18	01800 01908	36096.5204	2.46113329	4
LV Her	EA/DM	17 35 32	+23 10 31	02076 00580	52490.72613	18.4359348	1
RW Lac	EA/DM	22 44 57	+49 39 28	03629 02473	52253.6669	10.36922	2
V506 Oph	EA/DM	17 41 04	+07 47 04	00993 00762	52858.6752	1.0604262	1
FO Ori	EA	05 28 10	+03 37 23	00105 02342	52275.6149	18.80058	2
V648 Ori	EA/DM	04 52 33	+06 19 24	00096 00758	52934.92834	1.626468	1
IM Per	EA/DM	03 11 42	+52 12 42	03323 01163	52902.9245	2.25422	1
V482 Per	EA/DM	04 15 41	+47 25 20	03332 00388	52266.8056	2.4467549	2
V514 Per	EB/DM	03 19 39	+50 07 12	03319 01713	52261.5563	1.819159	1
RXJ0212.3	EA	02 12 19	−13 30 41	05283 01513	52634.6593	6.709914	1

†Comparison star designations refer to the GSC.

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
AQ Ser	EB/DM	15 22 15	+02 30 11	00340 00252	52834.6937	1.687391	1
CF Tau	EA/D	04 05 10	+22 29 48	01814 00104	51918.3467	2.75589	1
V1094 Tau	EA/DM	04 12 04	+21 56 51	01263 00925	49701.7059	8.988487	5
BP Vul	EA/DM	20 25 33	+21 02 18	01644 01837	52064.89085	1.9403494	6
BT Vul	EA/DM	20 23 05	+27 28 36	02164 00403	52831.72890	1.141200	1

Source(s) of the ephemeris:

1: This paper, 2: Lacy (2002), 3: Lacy et al. (2002), 4: Torres (2003), 5: Kaiser & Frey (1998), 6: Lacy et al. (2003)

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
AP And	52859.7334	0.0004	2	V	−0.0003	Sec. phase=0.5
	52897.82826	0.00010	2	V	−0.00044	
	52898.62235	0.00013	1	V	0.00000	
	52902.59047	0.00013	2	V	−0.00011	
	52936.71705	0.00010	1	V	−0.00031	
CO And	52826.8474	0.0005	1	V	−0.0010	
	52934.68220	0.00018	2	V	+0.00167	Sec. phase=0.5
	52965.7523	0.0003	1	V	+0.0015	
HP Aur	52630.7169	0.0003	1	V	+0.0005	
	52729.60329	0.00023	2	V	+0.00099	Sec. phase=0.5
	52935.91092	0.00015	2	V	−0.00016	
KU Aur	52263.88113	0.00016	1	V	0.00000	
	52250.68535	0.00020	1	V	−0.00001	
	52296.8700	0.0005	1	V	−0.0006	
CV Boo	52714.84970	0.00012	1	V	−0.00087	
	52720.7789	0.0003	1	V	−0.0006	
	52722.89684	0.00010	2	V	−0.00017	Sec. phase=0.5
	52731.79016	0.00008	1	V	−0.00028	
	52739.83638	0.00017	2	V	−0.00050	
	52742.80172	0.00014	1	V	+0.00036	
	52744.9185	0.0003	2	V	−0.00034	
	52750.84701	0.00014	2	V	−0.00079	
	52751.69380	0.00017	2	V	−0.00099	
	52756.77595	0.00015	2	V	−0.00080	
	52765.66967	0.00025	1	V	−0.00051	
	52778.79870	0.00020	2	V	+0.00012	
	52782.60989	0.00020	1	V	−0.00016	
	52787.69192	0.00012	1	V	−0.00010	
	52790.65638	0.00010	2	V	−0.00011	
SW Cnc	52688.8578	0.0006	1	V	−0.0010	
MU Cas	52876.81333	0.00024	2	V	+0.00026	Sec. E=52181.8024
	52905.7704	0.0003	2	V	−0.0015	
V381 Cas	52968.7011	0.0005	1	V	0.0000	
V389 Cas	52898.9432	0.0006	2	V	0.0000	Sec. E=52898.9432
	52928.8808	0.0004	2	V	+0.0005	
V396 Cas	52824.84721	0.00024	1	V	+0.00216	
	52835.8582	0.0003	1	V	+0.0023	
	52868.89072	0.00025	1	V	+0.00207	
V459 Cas	52827.8775	0.0004	1	V	−0.0075	
V651 Cas	52817.87187	0.00007	1	V	0.00000	
	52823.85279	0.00013	1	V	+0.00006	
VZ Cep	52809.8384	0.0003	1	V	+0.0003	
	52812.79737	0.00024	2	V	+0.00086	Sec. phase=0.5
	52818.7140	0.0006	2	V	+0.0007	
	52863.68060	0.00018	2	V	−0.00054	
	52877.8838	0.0006	2	V	+0.0023	
	52889.71630	0.00021	2	V	+0.00116	

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V456 Cyg	52831.86188	0.00014	2	V	+0.00094	Sec. phase=0.5
	52836.7625	0.0004	1	V	0.0000	
	52839.8814	0.0004	2	V	−0.0003	
	52869.7371	0.0003	1	V	+0.0005	
	52931.6733	0.0003	2	V	−0.0012	
V1061 Cyg	52786.7736	0.0004	2	V	−0.0012	Sec. phase=0.5
	52813.7610	0.0002	1	V	−0.0001	
	52834.8804	0.0004	1	V	−0.0004	
	52867.7336	0.0003	1	V	−0.0001	
	52887.6813	0.0004	2	V	+0.0012	
	52907.62597	0.00014	1	V	+0.00309	?
HD 23642	52931.9078	0.0020	2	V	+0.0051	Sec. phase=0.5
LV Her	52785.7012	0.0010	1	V	+0.0001	
RW Lac	52844.71005	0.00021	1	V	−0.00239	
	52927.66310	0.00018	1	V	−0.00310	
	52932.77471	0.00017	2	V	−0.00817	Sec. E=51076.6925
V506 Oph	52831.63476	0.00020	1	V	+0.00043	
	52858.6752	0.0005	2	V	0.0000	Sec. phase=0.5
FO Ori	52914.8345	0.0004	1	V	−0.0001	
V648 Ori	52908.9049	0.0006	1	V	+0.0000	
	52930.86274	0.00020	2	V	+0.00057	Sec. phase=0.5
	52934.92834	0.00025	1	V	0.00000	
IM Per	52902.9245	0.0006	1	V	0.0000	
	52910.8277	0.0007	2	V	0.0000	Sec. E=52910.8277
	52972.8038	0.0004	1	V	−0.0015	
	52980.7065	0.0006	2	V	−0.0020	
	52981.8219	0.0004	1	V	−0.0003	
V482 Per	52644.8308	0.0011	2	V	+0.0016	Sec. phase=0.5
	52907.8584	0.0004	1	V	+0.0030	
V514 Per	52974.6667	0.0005	1	V	+0.0001	
RXJ0212.3	52634.6593	0.0009	1	V	0.0000	
AQ Ser	52823.7250	0.0007	2	V	−0.0007	Sec. phase=0.5
	52834.6937	0.0005	1	V	0.0000	
CF Tau	52933.8960	0.0005	2	V	+0.0038	Sec. phase=0.5
V1094 Tau	52628.8429	0.0003	2	V	−0.0002	Sec. E=52601.8776
	52637.83153	0.00021	2	V	−0.00002	
BP Vul	52782.8192	0.0003	1	V	−0.0009	
	52814.7964	0.0005	2	V	−0.0009	Sec. E=52098.80834
	52817.74512	0.00010	1	V	−0.00130	
BT Vul	52831.72890	0.00024	1	V	0.00000	
	52839.71853	0.00020	1	V	+0.00123	
	52843.7114	0.0004	2	V	−0.0001	Sec. phase=0.5
	52908.7621	0.0004	2	V	+0.0022	
	52939.5741	0.0003	2	V	+0.0018	

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SUPERHUMPS IN THE 2003 UV Per SUPEROUTBURST

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UV Per, α=02^{h}10^{m}08^s.25 δ=+57°11′20″.6 (J2000), is a UGSU system with a magnitude range of 11.7V - 17.9V (Downes, 2003) and a variable and long supercycle. On Nov 03.810 (JD2452947.31) Schmeer observed UV Per's location and did not detect it to a limiting visual magnitude of 13.6. The next day it was detected in outburst by P. Schmeer on November 04.767, 2003 (JD2452948.267) UT at visual magnitude 11.5. Schmeer notified the AAVSO and an automatic notice was sent out to observers within 10 minutes (Price, 2003). Superhumps were first reported by A. Oksanen in observations that began on JD2452951.3330.

A total of 11,545 CCD observations were made during the decline of the superoutburst and reported to the AAVSO. Photometry was done by the individual authors and includes the application of flat and dark frames. Statistical uncertainty varies by observer and time and is available with the raw data by request to AAVSO Headquarters.

UBVRI field calibration was performed on multiple nights using the USNO-FS 1.0m telescope along with a large set of Landolt standards of wide color and airmass. In Table 1 we present the comparison stars used by observers and their V-R colors used to minimize the possibility that they may be variable. A complete table of field stars, including complete UBVRI data, is given in 5488-t3.txt.

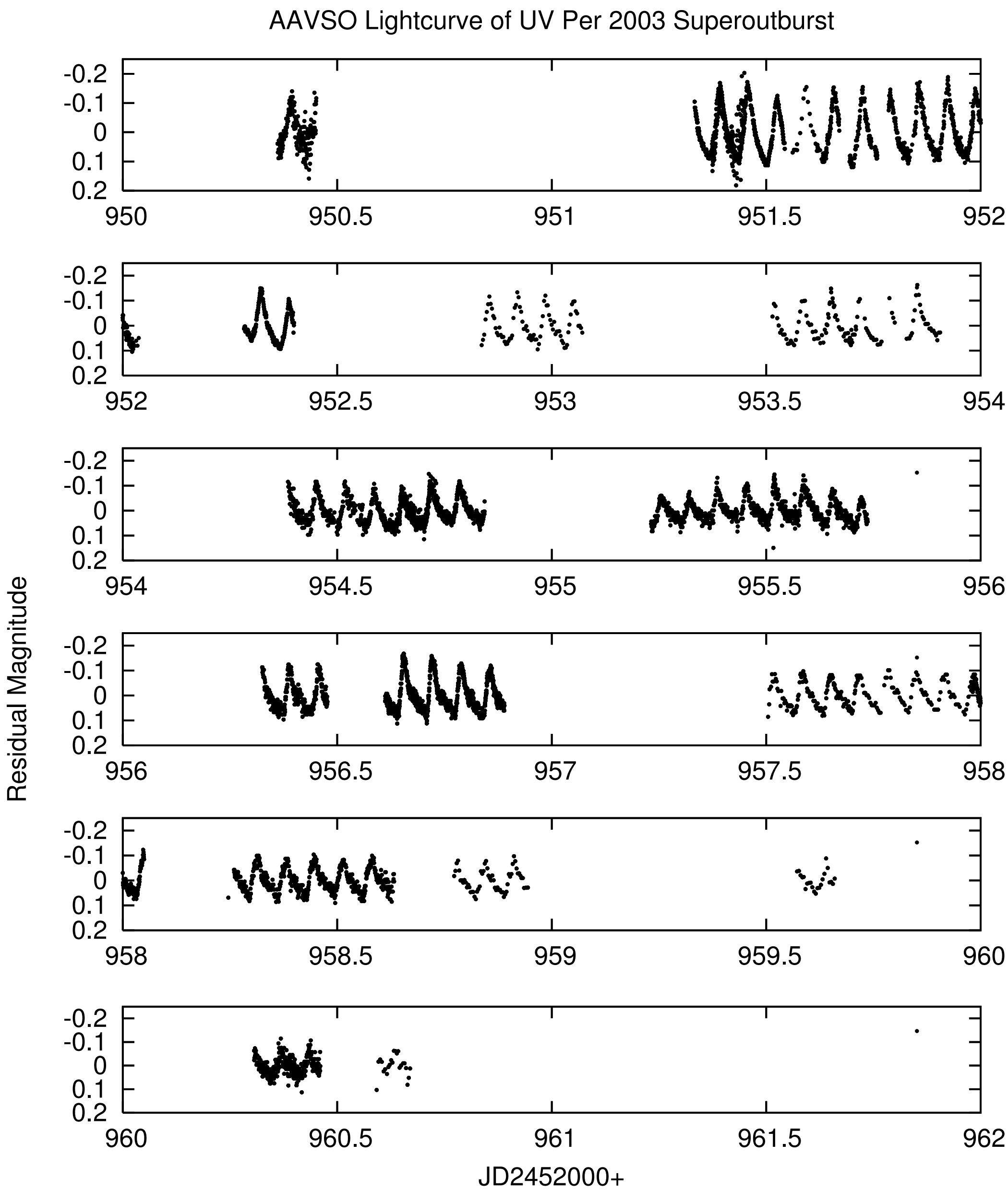

Figure 1. Light Curve of 2003 UV Per Superoutburst With Long Term Variation Removed

GSC ID	V	$V - R_c$	V error	$V - R_c$ error
3693-2068	10.981	0.213	0.058	0.032
3693-1862	12.715	0.260	0.013	0.014
3693-1760	13.309	0.821	0.018	0.017

Table 1: Comparison Star Photometry

A linear fit was applied to the datasets from each separate observing session to remove the overall fading behavior and zero point differences between filtered and unfiltered observers. The combined data were then put through a Date-Compensated Discrete Fourier Transform (Ferraz-Mello, 1981) and the results refined with the CLEAN algorithm (Foster, 1995). The analysis reveals an average superhump period of 95.92 ± 0.006 minutes (2σ). In addition, we analysed AAVSO data from the previous superoutburst in December 2000 using the same technique and detected a superhump period of 95.83 ± 0.12 minutes.

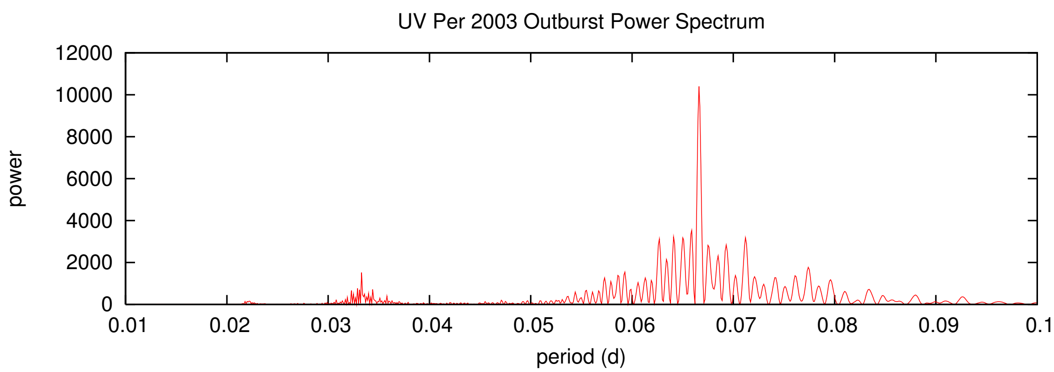

Figure 2. DCDFT & CLEAN Power Spectrum

A period of 95.63 ± 0.05 minutes has been previously published for the 1989 superoutburst. (Udalski, 1992) Timings of maxima were used to derive the 1989 superhump period and may explain the difference in results with our CLEAN algorithm which was specifically designed to mitigate the effect of gaps in the data. In addition, the quantity of data available now is much greater than that from the 1989 outburst, which consisted of 11 superhump cycles over a four-day period while this data set includes 71 cycles over a ten-day period. Finally, the superhump period of UV Per could be increasing in each supercycle.

Wavelet analysis (Foster, 1996) detects an increase in the superhump period of 0.001 minutes per day beginning from JD2452951 to JD2452956. Then the superhump period decreases by an average rate of 0.095 minutes per day from JD2452956 to JD2452961. Udalski and Pych did not detect a superhump period change in their data. The analysis also revealed an average amplitude decline of 3.13% per day for JD2452956 - JD2452961.

Visual and CCD observations following the outburst detected a period of post-superoutburst brightening.

Additionally, we have calculated a supercycle of 871 ± 379 days determined by averaging the last 19 superoutbursts in the AAVSO International Database since March 19, 1963 (JD2438108) and using the standard deviation as uncertainty. This projects to the next superoutburst window being March 10, 2005 (JD2453440) and April 7, 2007 (JD2454198).

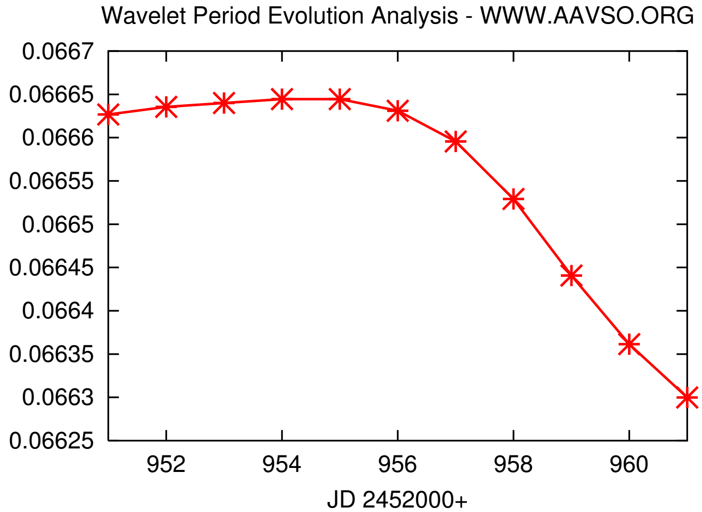

Figure 3. Wavelet Period Change Analysis

JD	*Mag*	*Method*	*Observer*
2452965.692	15.7	CCDV	Goff, Bill
2452966.2472	<14.1	Visual	Muyllaert, Eddy
2452966.335	13.5	Visual	Anderson, Bill
2452966.4424	13.7	Visual	Chaple, Glenn
2452966.7694	13.5	Visual	Scott, Tracy
2452967.531	<15.3	Visual	Poyner, Gary
2452967.8194	15.7	CCDV	Royer, Ron

Table 2: Observations of Post-Superoutburst Brightening

However, if past observations from JD2442119.53 - JD2444678.3 are removed because the superoutbursts could have been missed due to the solar gap, we calculate a supercycle of 758 $\pm$ 134 days which projects to the next superoutburst window being July 20, 2005 (JD2453572) to April 14, 2006 (JD2453840).

All data is available by sending a request to the AAVSO at `aavso@aavso.org`.

Acknowledgements: We would like to acknowledge the Curry Foundation for funding some equipment used in this campaign through the AAVSO International High Energy Network. We acknowledge the use of SIMBAD operated through the *Centre de Données Astronomiques* (Strasbourg).

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Price, A., and Waagen E., and Mattei, J. 2003. *AAVSO News Flash Special Notice* `http://www.aavso.org/publications/newsflash/sp10.shtml`

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COMMISSIONS 27 AND 42 OF THE IAU
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SIX NEW SOUTHERN CEPHEIDS

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In this paper six previously unknown Cepheid variables are presented. These have been found using ASAS3 survey data (Pojmanski, 2002), in a number of selected regions of the Southern sky. The strips of sky we examined ranged from 6h to 16h RA and 20 degrees deep (ASAS3 already having examined $0^{\rm h}$ to $6^{\rm h}$ RA), centered roughly upon –60° declination, to include as much Milky Way as possible. Also a large part of the sky near –33° was searched, as well as a few smaller areas. Throughout this work, long period variables and eclipsing binaries were picked up easily enough, as did ASAS before, but we deliberately set out to look for objects that would expand the statistical base for astrophysically meaningful objects. We only looked at objects with large standard deviations, ignoring close doubles that ASAS3 cannot easily resolve, and dismissing areas where we clearly saw problems with the data. We therefore cannot ascertain that we found all the stars of a given type in the studied regions, within the survey's limiting magnitude.

Table 1 lists the details of the new Cepheid variables: identity, coordinates (from UCAC2, Zacharias, et al., 2003), Galactic latitude b, V magnitude range (from ASAS3), 2MASS $J - K_s$ colour, GCVS variability type, epoch of maximum (JD – 2450000) and period in days. The electronic version of IBVS also provides a link to the source of the data. Phase plots of the data are provided in Figs. 1 to 6. Table 2 contains Fourier parameters and their formal errors for these stars, such as defined by Morgan (2003).

Notes on individual stars:

GSC 7758-1126: The Galactic latitude suggests that this is a Population II object, however the proper motion is quite small. A determination of the metallicity or m_1 index via Strömgren photometry would be necessary to distinguish for certain between the δ Cepheid or W Virginis types. $B - V = 0.74\pm$ 0.3 from Tycho2 $B_T - V_T$ (Høg et al., 2000).

GSC 8693-0661: POSS survey plate images reveal this star appears extended, and is in fact a pair of stars approximately 5″ apart in a mostly North-South orientation. ASAS3 will not resolve this pair, but the Northern star of the two appears to be several magnitudes fainter than the Southernmost star, and is thus likely beneath the ASAS3 threshold.

GSC 6771-1281: The Galactic latitude again suggests that this is a Population II object, however the proper motion is also quite small for this star. Preibisch et al. (1998)

give a K6 spectral type. Because its light curve more resembles W Vir itself, we classified it as a CWA type star, although with its period of less than 8 days it should be called a CWB star according to the GCVS definition. Since the shape of its light curve differs from most other Cepheids of its period (which is evident as well from a $log(P) - \Phi_{21}$ plot, such as in Morgan, 2003), GSC 6771-1281 is possibly a first overtone pulsator (GCVS type DCEPS), but with a larger amplitude and longer period than most other stars of this type known in the Galaxy (Mantegazza and Poretti, 1992).

GSC 5676-0131: NSV 10400. This star is located in a highly reddened region. A $B-V$ value of $+1.57 \pm 0.08$ (at phase 0.94) was measured at Beersel Hills Observatory.

Table 1. New Cepheid variables

GSC	RA (J2000)	Dec	b	V	$J{-}K_s$	Type	Epoch	Period
8606-0190	09 48 26.82	–58 01 05.4	–3.3	11.59-12.20	+0.81	DCEP	2655.9	4.151
6666-0796	11 53 01.96	–23 12 59.1	+37.7	12.37-13.21	+0.59	CWA	2640.1	15.55
7758-1126	12 38 03.82	–38 31 24.6	+24.3	11.83-12.52	+0.44	CWB	1885.1	4.321
8693-0661	15 05 46.46	–58 22 55.0	0.0	11.78-12.83	+1.09	DCEP	2437.2	16.71
6771-1281	15 22 16.27	–26 52 25.3	+25.0	11.74-12.40	+0.87	CWA:	2811.5	6.834
5676-0131	18 14 15.83	–09 20 20.6	+3.9	11.57-12.35	+0.94	DCEP	2415.9	5.121

Table 2. Fourier parameters for the new Cepheid variables.

GSC	R_{21}	Φ_{21}	R_{31}	Φ_{31}
8606-0190	0.35 ± 0.02	4.32 ± 0.07	0.12 ± 0.02	2.52 ± 0.09
6666-0796	0.11 ± 0.02	1.10 ± 0.13	0.10 ± 0.02	1.81 ± 0.08
7758-1126	0.36 ± 0.02	4.10 ± 0.06	0.18 ± 0.02	2.27 ± 0.11
8693-0661	0.29 ± 0.02	4.18 ± 0.08	0.19 ± 0.02	2.10 ± 0.10
6771-1281	0.17 ± 0.02	0.29 ± 0.11	0.04 ± 0.02	0.27 ± 0.40
5676-0131	0.34 ± 0.01	4.52 ± 0.04	0.15 ± 0.01	2.62 ± 0.06

Acknowledgements: This research has utilised the ASAS3 public photometry catalogue. It made use of data products from the Two Micron All Sky Survey, which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation. Use has been made as well of the SIMBAD and VizieR databases operated at the *Centre de Données Astronomiques (Strasbourg)* in France and the Guide 8 astronomical software package (`http://www.projectpluto.com`). P. Van Cauteren is grateful to the Royal Observatory of Belgium for putting at his disposal material acquired by project G.0178.02 from the Fund for Scientific Research (FWO) - Flanders (Belgium).

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Mantegazza, L., Poretti, E., 1992, *A&A*, **261**, 137

Morgan, S.M., 2003, *PASP*, **115**, 1250 (`http://nitro9.earth.uni.edu/fourier/`)

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Preibisch, T., Guenther, E., Zinnecker, H., Sterzik, M., Frink, S., Roeser, S., 1998, *A&A*, **333**, 619

Zacharias, N., Urban, S., et al., 2003, *Second US Naval Observatory CCD Astrograph Catalog (UCAC2)*, in preparation

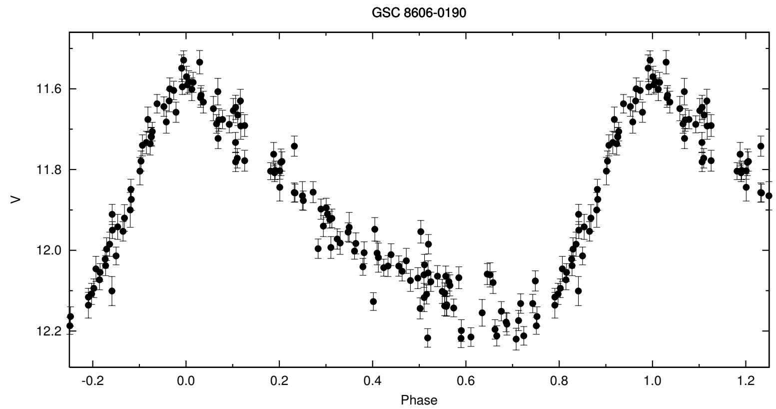

Figure 1. ASAS3 phased light curve for GSC 8606-0190

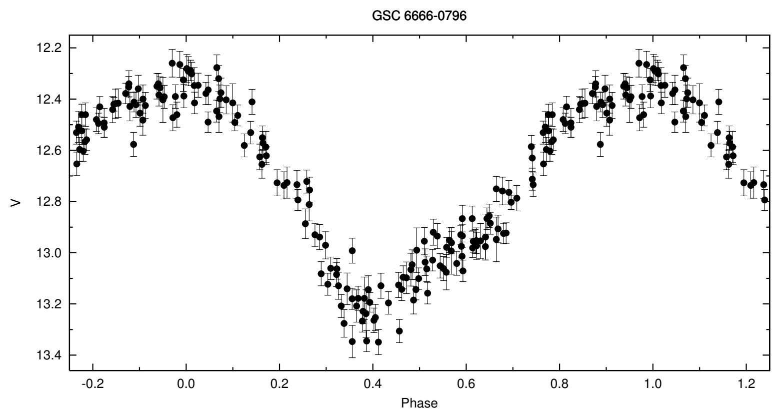

Figure 2. ASAS3 phased light curve for GSC 6666-0796

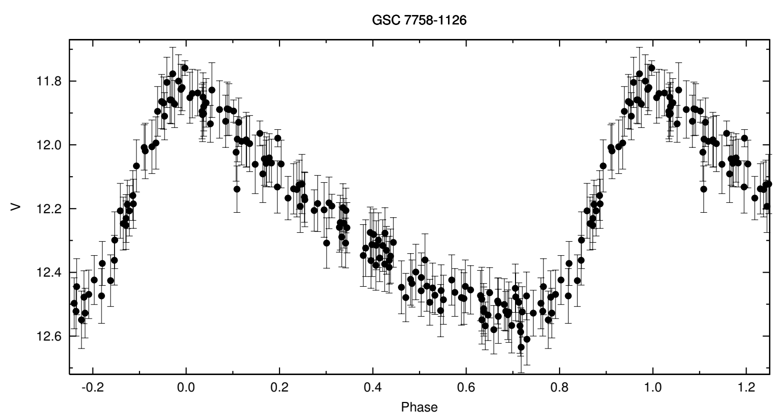

Figure 3. ASAS3 phased light curve for GSC 7758-1126

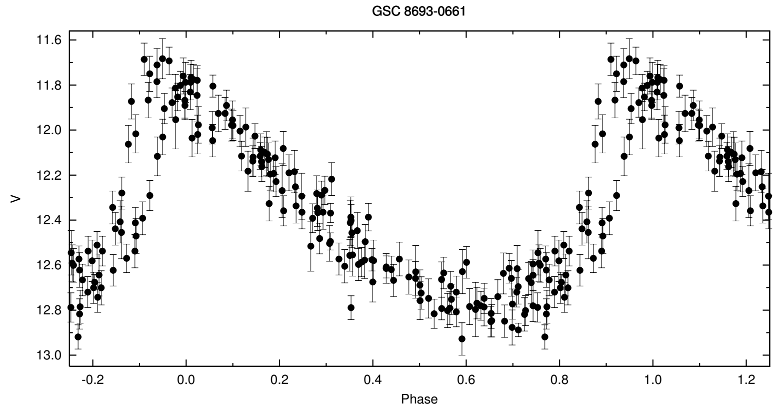

Figure 4. ASAS3 phased light curve for GSC 8693-0661

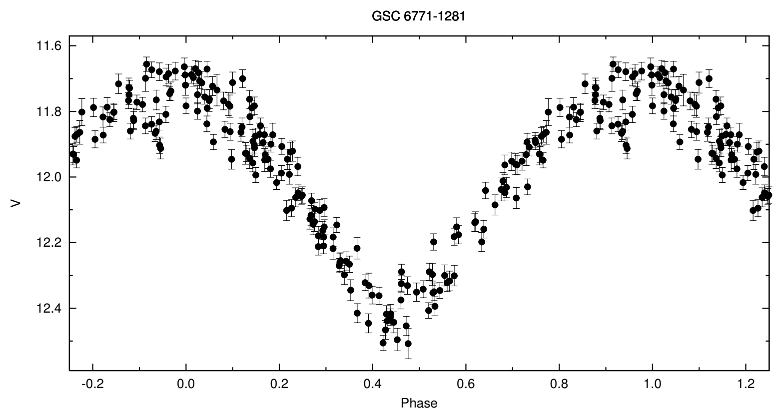

Figure 5. ASAS3 phased light curve for GSC 6771-1281

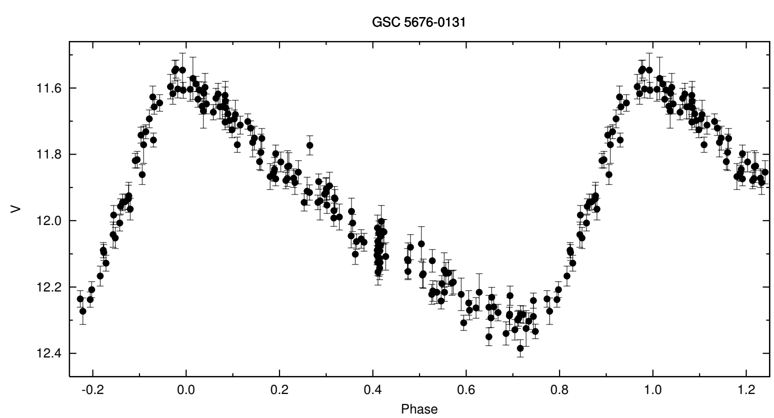

Figure 6. ASAS3 phased light curve for GSC 5676-0131 = NSV 10400

ERRATUM FOR IBVS 5489

Geert Hoogeveen reported the following error:

IBVS No.	item	printed	correct
5489	identifier	GSC 7758-1126	GSC 7758-1162

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FOUR NEW HIGH AMPLITUDE δ SCUTI STARS

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Using ASAS3 survey data (Pojmanski, 2002), a number of selected regions in the Southern sky has been examined for new variable stars. For more details, see Greaves et al. (2004). This revealed four previously unknown high amplitude δ Scuti variable stars (HADS). These are presented in Table 1, which lists the identity, coordinates (from UCAC2, Zacharias, et al., 2003), Galactic latitude b, V magnitude range (from ASAS3), 2MASS $J - K_s$ colour, epoch of maximum (HJD – 2450000) and period in days. An additional column in the electronic version of the IBVS also provides a link to the source of the data. Table 2 contains the invariant Fourier parameters to degree 3 (for the definition, see Morgan, 2003), calculated from the ASAS3 data. Figs. 1 to 4 provide phase plots for these new HADS variables.

Notes on individual stars:

GSC 7740-1289 and *GSC 6698-0302*: The Galactic latitude suggests that these are Population II objects, however the proper motions in both cases are very small. On the other hand, the periods are a little long for SX Phe stars, although neither the small proper motions nor the periods are unprecedented for such stars. Among the HADS, the only confirmed field SX Phe star with a period longer than 0.1 days is XX Cyg (Rodríguez and Breger, 2001). A determination of their metallicities or m_1 indices via Strömgren photometry is necessary to show whether these stars are of the SX Phe type instead. GSC 6698-0302 = NSV 6068, discovered by Hoffmeister (1933).

GSC 9024-0007: This star is probably reddened, as there are dark and bright nebulae nearby. Johnson UBV photometry would be useful in this regard.

GSC 7892-1411: NSV 9245, discovered by Strohmeier (1967). Spencer and Jackson (1939) give the spectral type $A3$, $B - V = +0.22$ (ESA, 1997).

Table 1. Positional and photometric details for the new HADS.

GSC	RA (J2000)	Dec	b	V	J–K_s	Epoch	Period
7740-1289	11 34 44.97	–38 25 49.1	+22.0	12.26-12.67	+0.14	1962.856	0.129485
6698-0302	13 02 45.49	–23 58 13.2	+38.8	10.84-11.46	+0.20	2432.684	0.158491
9024-0007	15 00 12.94	–62 54 03.2	–3.1	10.52-11.22	+0.23	2832.661	0.101565
7892-1411	17 37 41.71	–42 31 04.9	–5.8	10.01-10.58	+0.27	2057.700	0.117031

Table 2. Fourier parameters for the new HADS.

GSC	R_{21}	Φ_{21}	R_{31}	Φ_{31}
7740-1289	0.37 ± 0.05	4.13 ± 0.16	0.20 ± 0.05	2.35 ± 0.18
6698-0302	0.39 ± 0.01	4.08 ± 0.03	0.17 ± 0.01	2.29 ± 0.04
9024-0007	0.39 ± 0.01	4.18 ± 0.04	0.18 ± 0.01	2.13 ± 0.08
7892-1411	0.44 ± 0.01	4.03 ± 0.03	0.19 ± 0.01	1.76 ± 0.06

Acknowledgements: This research has utilised the ASAS3 public photometry catalogue. It made use of data products from the Two Micron All Sky Survey, which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation. Use has been made as well of the SIMBAD and VizieR databases operated at the *Centre de Données Astronomiques (Strasbourg)* in France and the Guide 8 astronomical software package (`http://www.projectpluto.com`).

References:

ESA, 1997, The Hipparcos and Tycho Catalogues, ESA SP–1200
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Hoffmeister, C., 1933, *AN*, **247**, 281
Morgan, S.M., 2003, *PASP*, **115**, 1250 (`http://nitro9.earth.uni.edu/fourier/`)
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Rodríguez, E., Breger, M., 2001, *A&A*, **366**, 178
Spencer, J.H., Jackson, J., 1939, His Majesty's Stationery Office, London, *Cape Catalog of 20554 Faint Stars, -40 to -52°*
Strohmeier, W., 1967, *IBVS*, No. 178
Zacharias, N., Urban, S., et al., 2003, *Second US Naval Observatory CCD Astrograph Catalog (UCAC2)*, in preparation

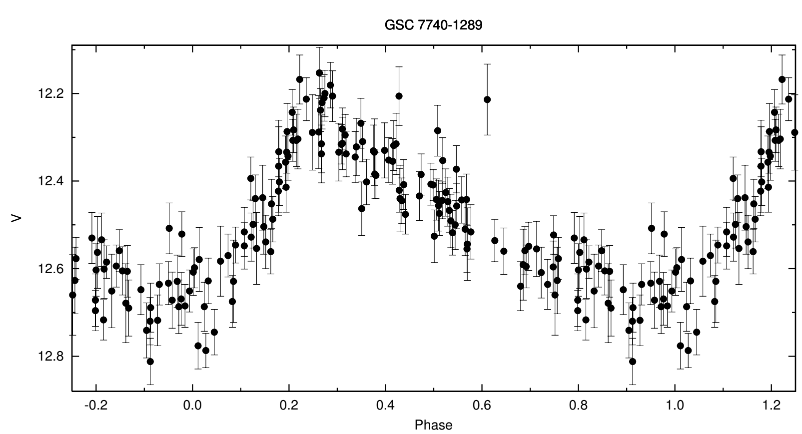

Figure 1. ASAS3 phased light curve for GSC 7740-1289

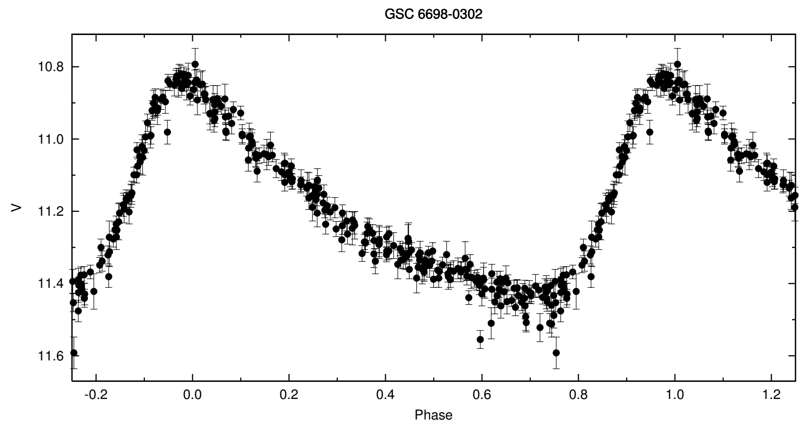

Figure 2. ASAS3 phased light curve for GSC 6698-0302 = NSV 6068

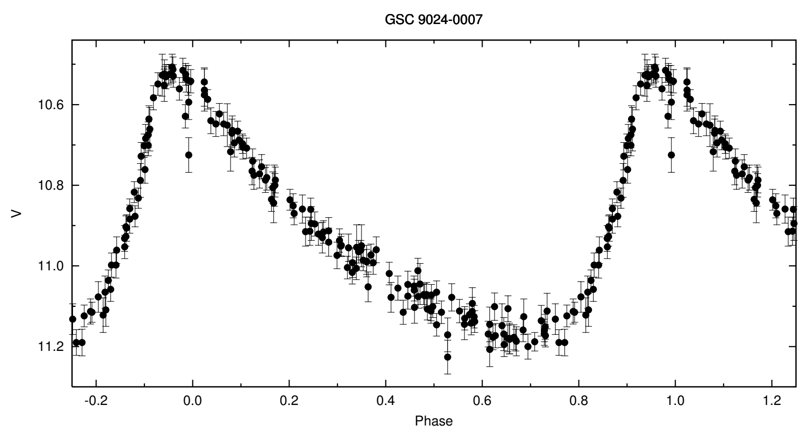

Figure 3. ASAS3 phased light curve for GSC 9024-0007

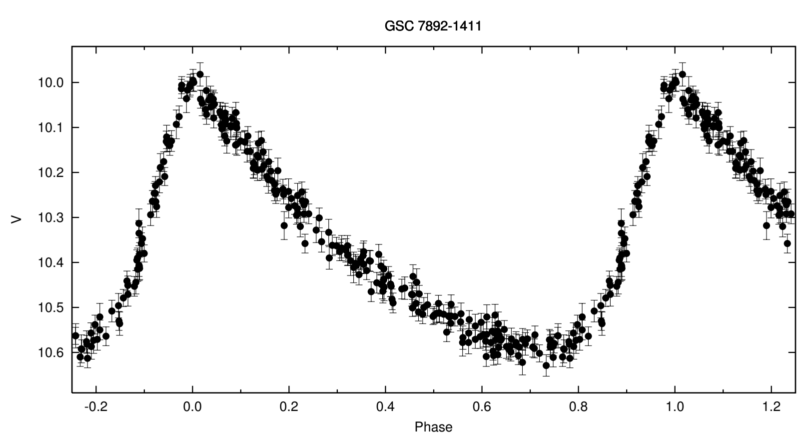

Figure 4. ASAS3 phased light curve for GSC 7892-1411 = NSV 9245

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FIFTEEN NEW SOUTHERN RR LYRAE STARS

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Selected regions in the Southern sky have been examined for new variable stars using ASAS3 survey data (Pojmanski, 2002), as described by Greaves et al. (2004). Fifteen new RR Lyrae stars (12 RRab and 3 RRc) were found in this way, of which the details are presented in Table 1: identity, coordinates and proper motions (in milliarcseconds per year) from UCAC2 (Zacharias, et al., 2003), Galactic latitude b in degrees, Johnson V magnitude range (from ASAS3), 2MASS $J - K_s$ colour, variability type, epoch of maximum (HJD – 2450000), period in days and the time to rise from minimum to maximum (M–m) in percentage of the period. The electronic version of the IBVS also provides a link to the source of the data in an additional column. Phase diagrams are provided at the end of the paper.

Of individual note is GSC 6730-0109 which may well be exhibiting the Blazhko effect in a period of around 26 days.

Acknowledgements: This research has utilised the ASAS3 public photometry catalogue. It made use of data products from the Two Micron All Sky Survey, which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation. Use has been made as well of the SIMBAD and VizieR databases operated at the *Centre de Données Astronomiques (Strasbourg)* in France and the Guide 8 astronomical software package (http://www.projectpluto.com).

References:

Greaves, J., Wils, P., Van Cauteren, P., 2004, *IBVS*, No. 5489

Pojmanski, G., 2002, *Acta Astronomica*, **52**, 397

Zacharias, N., Urban, S., et al., 2003, *Second US Naval Observatory CCD Astrograph Catalog (UCAC2)*, in preparation

Table 1: Positional and photometric details for the new RR Lyrae stars.

GSC	RA (J2000)	Dec	μ_α	μ_δ	b	V	$J-K_s$	Type	Epoch	Period	M−m
8946-2667	09 45 09.3	−63 27 26	−66.0	9.2	7.7	12.02−12.82	0.37	RRab	2707.711	0.60585	19
7744-0868	11 31 04.5	−41 07 03	−31.4	5.7	19.3	12.20−12.86	0.29	RRab	2662.232	0.35323	34
6722-1540	13 39 51.7	−26 52 17	−11.5	−16.3	34.8	11.45−11.99	0.23	RRab	2722.661	0.59606	22
7794-0682	13 58 56.8	−40 53 50	−29.0	−16.3	20.2	12.19−13.35	0.40	RRab	2089.131	0.61589	13
6730-0109	14 13 45.5	−22 54 42	− 9.6	− 9.7	36.3	12.12−12.87	0.14	RRab	2427.044	0.44795	42
7294-2242	14 21 08.1	−37 04 16	−58.4	−14.7	22.4	12.04−12.57	0.12	RRc	1947.337	0.28518	39
7298-0015	14 57 44.9	−30 26 39	−20.4	−17.7	25.0	12.37−13.36	0.29	RRab	2761.579	0.62168	14
8297-1427	15 03 27.4	−47 56 04	− 6.6	−21.2	9.3	11.62−12.23	0.42	RRab	2810.578	0.60059	18
7834-1438	15 17 06.5	−43 56 38	− 5.3	− 5.8	11.5	12.53−13.52	0.33	RRab	2642.415	0.60336	16
7317-0157	15 23 12.9	−32 26 42	− 0.8	−10.8	20.3	12.12−12.74	0.42	RRab	2087.583	0.50491	24
8722-0769	16 12 06.2	−59 42 49	−48.8	−38.3	− 6.1	11.57−12.04	0.23	RRc	2639.883	0.37537	42
6960-0506	22 03 23.6	−29 28 52	− 3.6	−10.8	−53.1	12.58−13.27	0.16	RRab	2203.060	0.75681	21
0570-0139	22 31 52.9	+02 37 25	0.5	−10.5	−45.1	13.08−14.06	0.30	RRab	2873.779	0.53601	14
6973-1172	23 15 49.9	−23 00 13	31.2	−18.4	−68.0	12.21−13.16	0.16	RRab	2396.451	0.55459	17
8831-0796	23 23 57.4	−53 18 11	−14.0	−29.2	−59.2	12.52−13.00	0.25	RRc	2069.798	0.36971	48

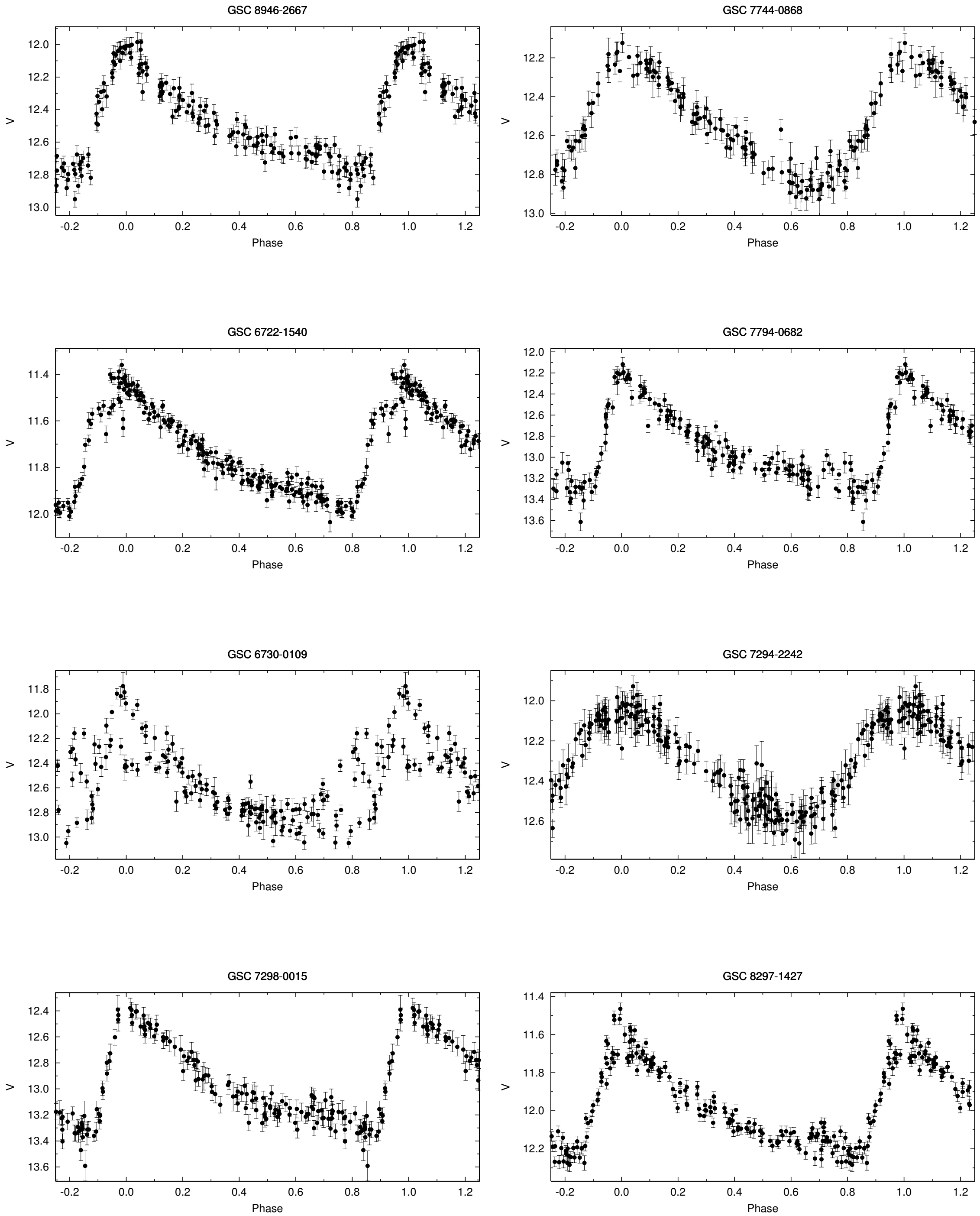

Figure 1. ASAS3 phased light curves for 8 new RR Lyrae variables.

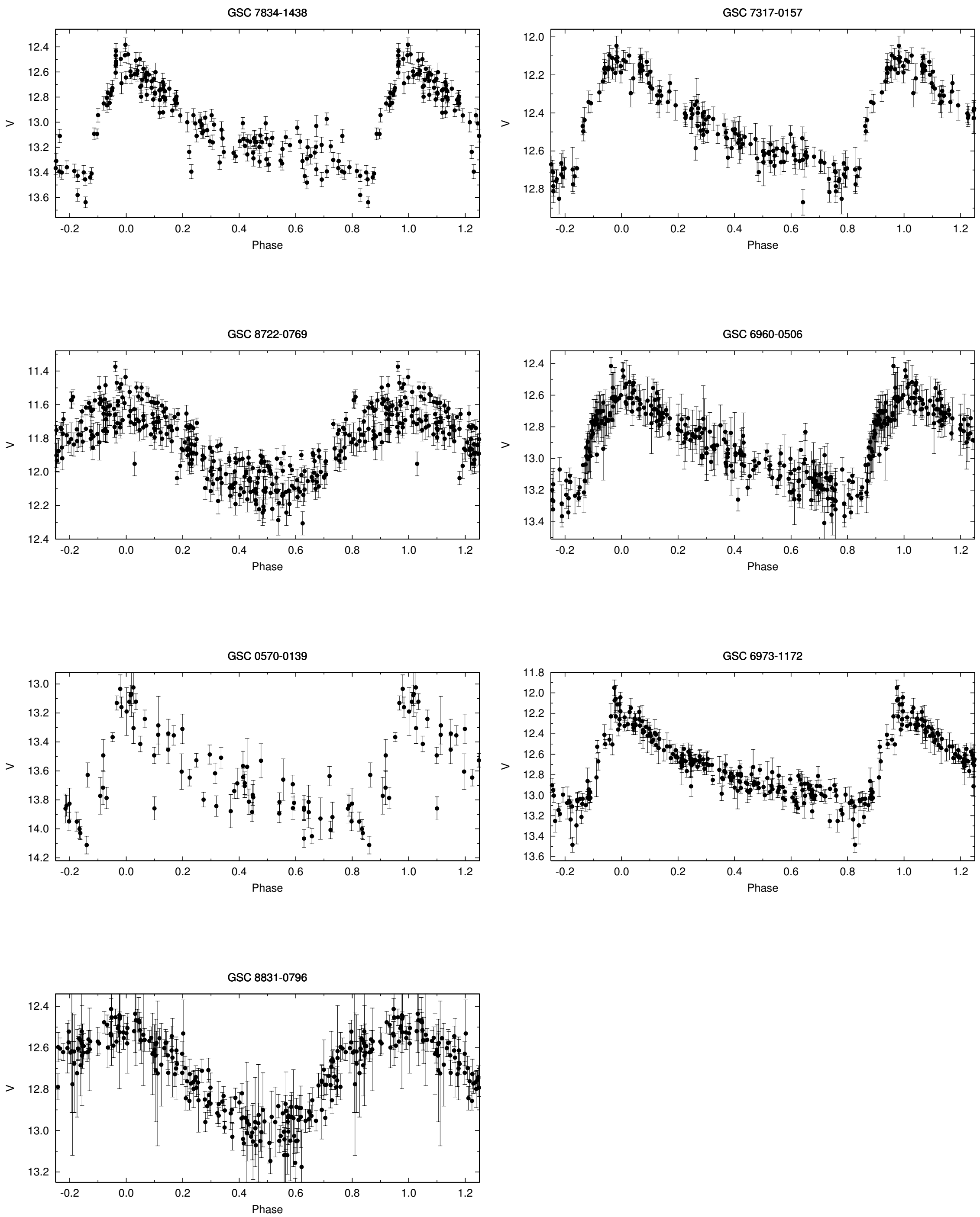

Figure 2. ASAS3 phased light curve for 7 new RR Lyrae variables.

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η Car RECOVERING FROM THE 2003.5 SPECTROSCOPIC EVENT

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The Luminous Blue Variable star Eta Carinae suffers spectroscopic events every 5.5 yr characterized by the fading of the high excitation lines of [Ar III], [Fe III], [Ne III], [N II] and [S III] (Damineli, 1996). The last of such events occurred around the end of June 2003 (Abraham et al., 2003). The line of highest excitation energy [Ne III] λ3868 vanished on June 23th, followed by the others of decreasing energy. The narrow component of HeI λ6678 vanished on June 29th, which implies a period of 2025 days, when comparing present data with previous observations. We adopt that date as the zero phase of cycle 11, in order that cycle 10 started in December 1997 and cycle 9 in June 1992. The ingress in the phase of totality for all lines occurred within days of the X-ray minimum (Corcoran, 2003).

As noted in previous spectroscopic events, different lines should recover from the minimum in different times, following a reverse sequence of excitation energy as during fading. Unfortunately, the star could not be observed from the ground through October-November, when the lower excitation lines like [N II] and [Fe III] were expected to be recovering. We succeeded to take spectra at the Observatório Pico dos Dias (LNA/Brazil) on 2003 December 12–14, corresponding to phase 0.08. We used the 1.6m telescope and Coudé focus to achieve spectral resolution of 0.6 Å and spectral coverage from 3800 Å to 11000 Å with S/N $>$ 100 in the stellar continuum. Such observations proved to be crucial, since all the lines that have faded are showing up again, except for [Ne III] λ3868. The line [Ar III] λ7135 is faint but definitively present, as can be seen in the left panel of Figure 1. This figure displays the present spectrum and another taken on August 15th, when the spectroscopic event was near the mid phase.

In the December spectrum, the narrow components of He I lines start to rise again, and the broad components are much stronger than those in August. The lines [S III] λ6312 and [Fe III] $\lambda\lambda$4658–4701 are mildly intense as compared to [N II] λ5755 that is almost half way of full recovery. HeI λ10830 is much stronger than in the minimum. Another remarkable feature of our data is that [Ne III] remains absent from the spectrum along the last 22 weeks, almost twice the duration of totality in X-rays (Corcoran, 2003). [Ne III] is expected to reappear in the next weeks, indicating that the time delay between different lines to egress from the event is spread over a time interval of one month. These time delays could be related with the recombination times and the progress of the ionization front in the circumstellar envelope.

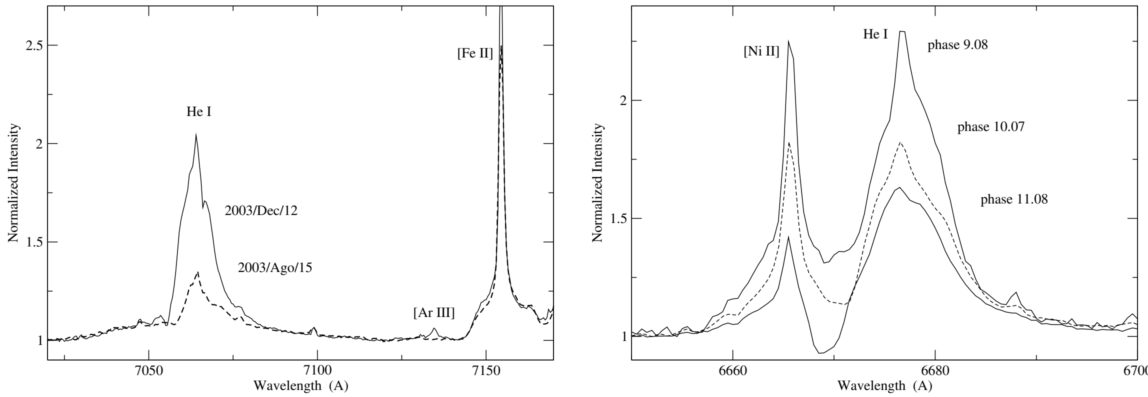

Figure 1. Left panel: He I, [Ar III] and [Fe II] lines near the center of the 2003.5 spectroscopic event (August 15th) and on December 12th, when it was ending. Right panel: comparison between line intensities in three subsequent cycles, around the same phase. We adopted the $P = 2025$ days and $T_0 = 2452820$ (June 29, 2003) as the starting point of cycle 11.

We have noticed previously that the spectrum is evolving secularly, in the sense that the high and intermediate excitation lines are becoming fainter and fainter from cycle to cycle (Damineli et al., 1999). In the right panel of Figure 1 we compare the lines of [Ni II] $\lambda6666$ and HeI $\lambda6678$ around phase 0.08 in the last three cycles. It can be seen that the secular fading is continuing, but the step between the previous (10) and present cycle (11) was smaller than from cycle 9 to 10. It is seen also that the P Cygni profile in He I$\lambda6678$ is deeper than previously. Other lines of He I and Si II show the same trend. Since the radial velocities of these P Cygni components are not changing, it seems that the stellar wind is becoming optically thicker.

References:

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CCD MINIMA FOR SELECTED ECLIPSING BINARIES IN 2003

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Observatory and telescope:
Sylvester Robotic Observatory (SRO): 33 cm f/4.5 Newtonian on Paramount GT-1100s mount

Detector:	SRO: SBIG ST7e, 1.24 pixels, 15.8 x 10.5 FOV, cooled $-10 < T < -30$ °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 and van Woerden (1956)

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
WZ And	EB/KE:	1.0143	38.0546	GSC 2799-0902	52974.6749	0.6956631	
XZ And	EA/SD:	1.5652	42.0602	GSC 2824-1778	52949.78266	1.3573206	
AB And	EW/KW	23.1132	36.5335	GSC 2763-0735	52936.6626	0.3318922	
AD And	EB/DW:	23.3645	48.4016	GSC 3641-0161	52950.6879	0.9862141	
DS And	EB/DM	1.5746	38.0428	GSC 2816-1250	52972.5956	1.0105187	
EP And	EW/KW	1.4229	44.4542	GSC 2827:0103	52885.7425	0.4041105	
V0346 Aql	EA/SD	20.1	10.21	GSC 1077:1496	52793.922	1.1063617	
AH Aur	EW/KW	6.2605	27.5956	GSC 1887:1240	52667.6405	0.4942796	
AP Aur	EA/SD:	7.235	36.2653	GSC 2464-0664	52986.8502	0.5693877	
HS Aur	EA/DM	6.5118	47.4024	GSC 3394:0370	52642.684	9.8153765	
IY Aur	E	5.4827	43.0458	GSC 2919:0468	52683.6681	2.7933771	
KU Aur	EA/SD:	6.2756	30.2324	GSC 2422-0020	52936.8623	1.3195723	
SU Boo	EA/DM:	14.2921	32.081	GSC 2553:0253	52667.2487	1.5612498	
TU Boo	EW/KW	14.0459	29.5958	GSC 2545:1000	52752.7789	0.3242813	
TY Boo	EW/KW	15.0047	35.08	GSC 2568:0997	52699.8482	0.3171502	
TZ Boo	EW/KW	15.0809	39.5813	GSC 3045:0892	52674.9175	0.2971604	
VW Boo	EW/KW	14.1726	12.3403	GSC 0908:1021	52716.8624	0.3423181	
XY Boo	EW/KW	13.4912	20.1125	GSC 1466:0038	52750.7945	0.370573	
CV Boo	EA	15.262	36.5853	GSC 2570:0869	52759.7411	0.8469938	
AO Cam	EW/KW	4.2813	53.0244	GSC 3732-0682	52943.82676	0.3298803	

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
ZZ Cas	EB/KE	0.333	62.304	GSC 4019-3762	52964.60807	1.243527	
AB Cas	EA+dSct	2.3732	71.1816	GSC 4320:0413	52647.6045	1.3668891	
BH Cas	EW:	0.2121	59.0908	[not GSC]	52865.8351	0.4058916	
BU Cas	EA/DM	1.2841	61.0755	GSC 4031-1893	52894.7099	2.2551869	
CW Cas	EW/KW	0.4554	63.0505	GSC 4020-1387	52975.5892	0.3188614	
DZ Cas	EB/KE	23.3951	55.5256	GSC 4004-1197	52890.8345	0.7848866	
KL Cas	EB/SD	0.5142	58.5148	GSC 3667-0726	52977.587	2.447425	
V0344 Cas	EW/KE	23.0735	57.2334	GSC 4006-1807	52893.694	1.0007436	
V0364 Cas	EA	0.5243	50.281	GSC 3270-0612	52949.6201	0.8176332	
V0387 Cas	EA/DM	1.0032	58.4146	GSC 3680-1741	52963.7008	1.6082162	
V0445 Cas	EB	0.3135	53.1312	GSC 3654-1529	52951.66811	0.6735235	
WZ Cep	EW/KW	23.2224	72.5524	GSC 4486:1402	52834.776	0.4174459	
RW Cet	EA/SD	2.1522	−12.1227	GSC 5283:0173	52641.5992	0.9752004	
UZ CMi	EW/DW	7.5053	3.3918	GSC 0184:1875	52667.8273	0.7619865	
TX Cnc	EW/KW	8.4002	18.5959	GSC 1395:1070	52647.8334	0.3828826	
EH Cnc	EW	8.2618	20.525	GSC 1391-1159	52999.8204	0.4180365	
RW Com	EW/KW	12.33	26.4258	GSC 1991:1659	52724.7854	0.2373455	
RZ Com	EW/KW	12.3505	23.2014	GSC 1990:3321	52693.8196	0.3385082	
SS Com	EW/KW	12.4939	18.4212	GSC 1452:0477	52705.9055	0.4128189	
CC Com	EW/KW	12.1206	22.3158	GSC 1986:1744	52648.958	0.2206856	
ZZ Cyg	EA/SD	20.2353	46.5515	GSC 3576:0964	52795.7866	0.6286158	
V0463 Cyg	EA/DM	19.4214	31.1802	GSC 2656:1627	52839.7805	2.1175658	
V0513 Cyg	EA/KE:	20.4557	40.3813	GSC 3170:0502	52866.7764	1.0561819	
V0874 Cyg	EW/KW	19.3	28.2155	[not GSC]	52862.737	0.4236445	
V1411 Cyg	EA	21.5824	49.4415	GSC 3613:0609	52769.8966	0.7767313	
EX Del	EW/KW	20.1568	15.5253	[not GSC]	52838.8285	0.3309878	
WW Gem	EB/KE	6.1206	23.3018	GSV 1877-1243	52964.8384	1.2378121	
AF Gem	EA/SD	6.504	21.2156	GSC 1343-2551	52964.9452	1.2434987	
AL Gem	EA/D:	6.5739	20.5332	GSC 1356-0980	52951.9411	1.3913467	
AZ Gem	EB/KE:	6.3433	14.2824	GSC 0745:0898	52694.6773	1.006186	
TT Her	EB/KE	16.5423	16.5013	GSC 1525:0805	52755.8687	0.912079	
V0728 Her	EW/KW	17.1805	41.5041	GSC 3081:1028	52760.8348	0.4712863	
DF Hya	EW/KW	8.5502	6.0538	GSC 0225-0943	52986.937	0.3306135	
FG Hya	EW/KW	8.2704	3.3052	GSC 0201:2026	52706.6829	0.3278286	
PP Lac	EW/KW	22.4238	53.2456	GSC 3984:1085	52859.8563	0.4011617	
XZ Leo	EW/KE	10.0234	17.0247	GSC 1412:0423	52705.7566	0.4877351	
DU Leo	EA/SD	9.4411	25.2111	GSC 1963-1353	52943.9318	0.6870923	
RT LMi	EW/KW	9.4948	34.2715	GSC 2505-0079	52997.9093	0.3749172	
SW Lyn	EW/DW	8.0742	41.4802	GSC 2976-1660	52947.87998	0.6440659	
UU Lyn	EA/DM	9.151	42.4211	GSC 2990:0019	52644.8922	0.4684598	
UV Lyn	EW/KW	9.0324	38.0554	GSC 2983-1629	52952.9535	0.4149843	
TZ Lyr	EB/D	18.155	41.0638	GSC 3107:1492	52761.766	0.5288271	
UZ Lyr	EA/SD	19.2109	37.5611	GSC 3134:0830	52716.965	1.8912109	
PY Lyr	EW/KW	19.2026	28.5644	[not GSC]	52741.9859	0.3857696	
V0396 Mon	EW/KW	6.3837	3.3618	GSC 0151-0295	52973.8783	0.396341	
V0530 Mon	EW	7.0316	3.1454	[not GSC]	52947.0313	0.4877529	
V0532 Mon	EW:/KW:	7.0431	−0.2107	GSC 4814:1947	52707.6689	0.4669855	
UW Ori	EB/KE	5.5553	20.1016	GSC 1320-0260	52974.8592	2.0381355	
ER Ori	EW/KW	5.1115	−8.3324	GSC 5330:0364	52644.7649	0.4233994	
FZ Ori	EW/KW	5.4121	2.3623	GSC 0119-0361	52949.8933	0.3999836	
V0392 Ori	EA/KE	6.1125	18.33	GSC 1318-0080	52998.7648	0.659284	
U Peg	EW/KW	23.5758	15.571	GSC 1722-0498	52950.6096	0.374777	
BO Peg	EA/KE:	21.3119	11.5654	GSC 1127:1439	52834.8796	0.5804301	
WY Per	EA/SD	3.3824	42.4039	GSC 2870-1440	53002.616	3.3270632	
BP Per	EB	3.3114	49.2447	GSC 3320:0009	52885.8533	1.9789127	
KW Per	EB/SD	1.5959	53.1332	GSC 3684:1840	52876.8165	0.931262	
NZ Per	EA/D	4.2759	37.5031	GSC 2879-0469	52973.744	0.9379161	
RV Psc	EA/DW	1.194	31.1144	GSC 2291-0189	52894.8267	0.5539896	
VZ Psc	EW/KW	23.2748	4.5124	GSC 0581-0207	52947.6473	0.2611872	

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
BI Ser	EA/SD:	15.5601	17.303	GSC 1499:0982	52717.8917	1.2048495	
AH Tau	EW/KW	3.4712	25.0702	GSC 1804:2470	52891.8882	0.3326717	
AM Tau	EA/SD	5.5221	16.1701	[ensemble]	52952.8319	2.0439011	
AQ Tau	EA/SD:	4.5558	27.5312	GSC 1840-0988	52972.7324	1.2158931	
CT Tau	EW/KE	5.585	27.0442	GSC 1871-0434	52948.8365	0.6668254	
CU Tau	EW/KW	3.4737	25.2312	GSC 1804-2270	52942.9257	0.4122048	
EQ Tau	EW/KW	3.4813	22.1924	GSC 1260-0575	52964.7111	0.3413479	
GR Tau	EB/SD:	4.0103	20.2524	GSC 1258-0303	52948.755	0.4298509	
GW Tau	EB/KE	4.301	25.3242	[not GSC]	52951.8502	0.6413219	
V0471 Tau	EA/D/RS+X	3.5025	17.1447	GSC 1252-0770	52975.66	0.5211834	
V0781 Tau	EW/KW	5.5013	26.5744	GSC 1870:0514	52648.736	0.344908	
X Tri	EA/SD	2.0034	27.5319	GSC 1763-1881	52943.75396	0.9715222	
RV Tri	EA/SD	2.1318	37.0102	GSC 2321-0072	52952.6982	0.7536622	
TY UMa	EW/KW	12.0902	56.0154	GSC 3836-0293	52973.9664	0.3545473	
UX UMa	EA/WD+NI	13.3641	51.545	GSC 3469:0516	52713.787	0.1966713	
UY UMa	EW/KW	13.4438	55.1316	GSC 3854:0010	52757.8106	0.37601927	
VV UMa	EA/SD	9.3807	56.0107	GSC 3810:1500	52674.648	0.6873702	
XZ UMa	EA/SD	9.3125	49.2812	GSC 3429:1027	52707.7708	1.2223017	
BH UMa	EW/KE	10.4556	52.1451	GSC 3449:0746	52704.807	0.6986821	
AW Vir	EW/KW	13.2733	3.0228	GSC 0303:0415	52734.83597	0.3539977	
AX Vir	EW/KE	13.2745	3.5227	GSC 0303:0289	52706.8384	0.7025278	
AZ Vir	EW/KW	13.4326	4.3657	GSC 0311:1491	52715.8774	0.3496638	
Z Vul	EA/SD	19.2139	25.3429	GSC 2128:2157	52786.847	2.4549328	
BE Vul	EA/SD	20.2534	27.2209	GSC 2164:0285	52891.7313	1.552047	
G0143-1718 A	EW	6.1348	5.5712	GSC 0143-1836	52948.9624	0.399806	
G0702-1892 A	EW	5.1245	10.151	GSC 0702-2174	52950.8087	0.2769553	
G2038:0674 D	??	16.1005	25.3655	GSC 2038:0040	52713.8809	0.5308274	
G2038:0674 E	??	16.1005	25.3655	GSC 2038:0410	52751.8347	0.5308274	
G2533:1563 C	??	12.4442	35.5756	GSC 2533:0959	52715.7932	0.3290529	
G3018:1509 A	??	12.3309	37.582	GSC 3018:1486	52693.9027	0.494967	

RA values are in the format HH.MMSS, Dec in DD.MMSS.

Source(s) of the ephemeris:

O−C charts using all available published times of minima. See Bob Nelson's O−C Files' in the references. The epochs are the latest and best times of minima (which usually coincide with the times newly reported here.)

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
WZ And	52974.6749	0.0002	I	clear		
XZ And	52949.78266	0.00005	I	clear		C-K slope
AB And	52936.6626	0.0001	II	clear		
AD And	52950.6879	0.0002	II	clear		
DS And	52972.5956	0.0001	I	clear		
EP And	52885.7425	0.0001	II	clear		
V0346 Aql	52793.922	0.00006	I	V		
AH Aur	52667.6405	0.0002	I	clear		
AP Aur	52674.8306	0.0001	I	clear		
AP Aur	52986.8502	0.0002	I	clear		
HS Aur	52642.684	0.0001	I	clear		Fog terminated run early
IY Aur	52683.6681	0.0003	I	clear		
KU Aur	52936.8623	0.0001	I	clear		

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
SU Boo	52667.2487	0.0001	I	clear		
TU Boo	52752.7789	0.0002	I	clear		
TY Boo	52699.8482	0.0003	II	clear		
TZ Boo	52674.9175	0.0002	I	R		K-C slope
VW Boo	52716.8624	0.0001	I	clear		
XY Boo	52750.7945	0.0001	II	clear		
AC Boo	52668.0725	0.0001	II	V		
CV Boo	52722.8971	0.0001	II	I		
CV Boo	52742.8017	0.0003	I	V		No check star
CV Boo	52759.7411	0.0001	I	V		
AO Cam	52943.82676	0.00005	II	clear		
ZZ Cas	52964.60807	0.00005	I	clear		
AB Cas	52647.6045	0.0001	I	clear		
BH Cas	52865.8351	0.0002	I	clear		
BU Cas	52894.7099	0.0002	I	clear		
CW Cas	52658.6417	0.0002	II	clear		
CW Cas	52975.5892	0.0001	II	clear		
DZ Cas	52890.8345	0.0004	I	clear		
KL Cas	52977.587	0.0001	I	clear		
V0344 Cas	52893.694	0.0001	I	clear		
V0364 Cas	52949.6201	0.0001	II	clear		
V0387 Cas	52963.7008	0.0002	I	clear		
V0445 Cas	52951.66811	0.00005	I	clear		
WZ Cep	52834.776	0.001	I	clear		
RW Cet	52641.5992	0.0003	I	clear		Very windy - check star not possible
UZ CMi	52667.8273	0.0004	I	clear		
TX Cnc	52647.8334	0.0001	I	clear		
EH Cnc	52999.8204	0.0001	I	clear		
RW Com	52724.7854	0.0002	II	clear		
RZ Com	52693.8196	0.00005	II	clear		
SS Com	52705.9055	0.0004	I	clear		
CC Com	52648.958	0.0001	I	clear		
ZZ Cyg	52795.7866	0.00006	I	“V,I”		
V0463 Cyg	52839.7805	0.0002	I	clear		
V0513 Cyg	52866.7764	0.0002	II	clear		
V0874 Cyg	52859.772	0.001	I	clear		
V0874 Cyg	52862.737	0.0001	II	clear		
V1411 Cyg	52769.8966	0.0002	II	clear		K-C slope
EX Del	52838.8285	0.0001	I	clear		
WW Gem	52964.8384	0.0003	I	clear		
AF Gem	52964.9452	0.0001	I	clear		
AL Gem	52951.9411	0.0001	I	clear		
AZ Gem	52694.6773	0.0004	I	clear		
TT Her	52755.8687	0.0001	I	clear		
V0728 Her	52701.9227	0.0001	II	clear		
V0728 Her	52760.8348	0.0001	I	“V, I”		
DF Hya	52986.937	0.0002	I	clear		
FG Hya	52706.6829	0.0001	II	clear		
PP Lac	52859.8563	0.0002	II	clear		
XZ Leo	52705.7566	0.0001	I	clear		
DU Leo	52722.688	0.0001	I	clear		
DU Leo	52943.9318	0.0001	I	R		
RT LMi	52997.9093	0.0003	I	clear		
SW Lyn	52947.87998	0.00005	I	V		
UU Lyn	52644.8922	0.0001	I	clear		
UV Lyn	52952.9535	0.00005	I	V		
TZ Lyr	52761.766	0.001	I	clear		Slight C-K slope
UZ Lyr	52716.965	0.0001	II	clear		
PY Lyr	52741.9859	0.0002	I	clear		

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
V0396 Mon	52973.8783	0.0001	I	clear		
V0530 Mon	52947.0313	0.0001	I	clear		
V0532 Mon	52707.6689	0.0002	I	clear		
UW Ori	52974.8592	0.0003	I	clear		Background difficult due to nearby bright star
ER Ori	52644.7649	0.0002	II	clear		Windy conditions
FZ Ori	52949.8933	0.0002	II	clear		
V0392 Ori	52998.7648	0.0002	I	clear		
U Peg	52950.6096	0.0001	I	V		
BO Peg	52834.8796	0.0002	II	clear		
WY Per	53002.616	0.001	I	clear		Clouds terminated run early
BP Per	52885.8533	0.0002	I	clear		
KW Per	52876.8165	0.0003	II	clear		
NZ Per	52973.744	0.0004	I	clear		
RV Psc	52894.8267	0.0004	I	clear		
VZ Psc	52947.6473	0.0001	I	clear		
BI Ser	52717.8917	0.0002	I	clear		
AH Tau	52891.8882	0.0001	I	clear		
AM Tau	52952.8319	0.00005	I	clear		Used ensemble for check star
AQ Tau	52972.7324	0.0002	I	clear		Clouds terminated run early
CT Tau	52948.8365	0.00015	I	clear		
CU Tau	52942.9257	0.0002	I?	clear		
EQ Tau	52964.7111	0.0001	I	clear		
GR Tau	52948.755	0.003	I	clear		C-K slope
GW Tau	52951.8502	0.0001	I	clear		
V0471 Tau	52649.6798	0.0001	II	R		No check star
V0471 Tau	52975.66	0.001	I	clear		
V0781 Tau	52648.736	0.0002	I	"V,I"		
X Tri	52943.75396	0.00005	I	clear		
RV Tri	52952.6982	0.00005	I	clear		
TY UMa	52657.8829	0.0005	II	clear		No check star
TY UMa	52973.9664	0.0001	I	clear		
UX UMa	52713.787	0.001	I	clear		
UY UMa	52757.8106	0.0004	I	clear		
VV UMa	52649.9027	0.0001	I	clear		
VV UMa	52674.648	0.0001	I	R		
XZ UMa	52707.7708	0.0001	I	clear		
BH UMa	52704.807	0.0003	I	clear		
AW Vir	52734.83597	0.00005	I	clear		
AX Vir	52706.8384	0.0004	I	clear		
AZ Vir	52715.8774	0.0002	II	clear		
Z Vul	52786.847	0.001	I	V		
BE Vul	52884.7467	0.0001	I	clear		
BE Vul	52891.7313	0.0003	II	clear		
GSC 0143-1718	52948.9624	0.0003	II	clear		
GSC 0702-1892	52950.8087	0.0001	II	clear		
GSC 2038:0674	52713.8809	0.0001	I	clear		C-K slope
GSC 2038:0674	52751.8347	0.0001	II	clear		
GSC 2533:1563	52715.7932	0.0003	I	clear		
GSC 3018:1509	52693.9027	0.0003	II	clear		

Explanation of the remarks in the table:

Check star(s) were used for almost all runs. In some cases, the fields were sparse and there were no suitable check stars. In other cases, the C−K (differential comparison-check magnitude) plots revealed some abnormal slope, thereby compromising accuracy. In these cases, the estimated error was adjusted upward.

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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 lear Sky Clocks, (see below). Much use was made of the Eclipsing Binary Ephemeris Generator; thanks Shawn. This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France (see references).

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COMMISSIONS 27 AND 42 OF THE IAU
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CCD TIMES OF MINIMA OF SOME ECLIPSING BINARIES IN 2003

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e-mail: `gm@astri.uni.torun.pl`, `agata@astri.uni.torun.pl`

Observatory and telescope:
Piwnice Observatory of the Nicholas Copernicus University, 135 mm f/2.8 semi-automatic CCD camera

Detector:	SBIG ST-7 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).

Observed star(s):

Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
CN And	EW/KW	$00^h20^m30^s$	$+40°13'33''$	HD 1547	46711.522	0.46279428	1
SX Aur	EB/KE:	$05^h11^m42^s$	$+42°09'55''$	HD 33911	18218.7639	1.21007910	1
BF Aur	EB	$05^h05^m03^s$	$+41°17'19''$	HD 33911	40628.3692	1.58321973	1
TY Boo	EW/KW	$15^h00^m47^s$	$+35°08'00''$	HD 132546	47612.6035	0.31714910	1
TZ Boo	EW/KW	$15^h08^m09^s$	$+39°58'12''$	HD 134303	43655.4984	0.29715954	1
XY Boo	EW/KW	$13^h49^m11^s$	$+20°11'24''$	SAO 83014	39953.6892	0.37055392	1
AC Boo	EW/KW	$14^h56^m28^s$	$+46°21'44''$	HD 132255	47641.586	0.35243123	1
AD Boo	EB/SD:	$14^h35^m14^s$	$+24°38'18''$	SAO 83425	44704.1934	2.06880519	1
CV Boo	EA	$15^h26^m19^s$	$+36°58'53''$	SAO 45022	38883.454	0.84699280	1
ET Boo	EB	$14^h59^m20^s$	$+46°49'04''$	HD 132255	52394.5564	0.6451	2
GSC 3472-641	EW	$14^h21^m44^s$	$+46°41'59''$	BD+47°2136	52749.5329	0.318665	3
AW Cam	EB/KE	$06^h47^m28^s$	$+69°38'12''$	HD 48026	38738.4514	0.77134661	1
XX Cas	EA/DM	$01^h29^m34^s$	$+60°58'04''$	HD 9722	36527.6183	3.06717750	1
CQ Cep	EB/DM/WR	$22^h36^m53^s$	$+56°54'20''$	HD 214220	32456.635	1.641251	1
DM Del	EB/KE	$20^h39^m37^s$	$+14°25'43''$	SAO 106358	45523.4283	0.84467445	1
LS Del	EW/KW	$20^h57^m10^s$	$+19°38'59''$	HD 199549	47790.4284	0.36383914	1
GSC 2511-167	EW	$10^h34^m12^s$	$+32°08'52''$	HD 91987	52366.884	0.4368897	4
RZ Lyn	EB/KE	$09^h36^m10^s$	$+41°16'54''$	SAO 42927	25643.311	1.1469174	1
SW Lyn	EA/DW	$08^h07^m41^s$	$+41°48'01''$	HD 66174	43975.3863	0.644066253	1
UV Lyn	EW/KW	$09^h03^m24^s$	$+38°05'54''$	GSC 2983-1974	40271.531	0.4149798	1
BG Lyn	EB	$07^h56^m15^s$	$+40°43'43''$	HD 66469	42776.961	1.199839	5
BX Peg	EW/KW	$21^h38^m53^s$	$+26°42'24''$	HD 206124	48174.533	0.28042200	1
GP Peg	EA	$23^h06^m45^s$	$+30°55'22''$	HD 218199	41238.330	0.97561472	1

[1]For further information on SAVS see `http://www.astri.uni.torun.pl/~gm/SAVS/`.

Observed star(s):							
Star name	GCVS type	Coordinates (J2000) RA	Dec	Comp. star	Ephemeris E 2400000+	P [day]	Source
V Tri	EB/SD	$01^h31^m47^s$	$+30°22'01''$	HD 9445	48573.6604	0.58520570	1
RS Tri	EA/DM	$01^h34^m49^s$	$+29°35'21''$	HD 9445	37940.490	1.9089234	1
AK Tri	EW	$02^h24^m39^s$	$+33°15'58''$	HD 15127	50416.41635	0.70170	6
W UMa	EW/KW	$09^h43^m45^s$	$+55°57'09''$	HD 83728	35918.417	0.3336374	1
TX UMa	EA/SD	$10^h45^m20^s$	$+45°33'58''$	HD 93471	49749.368	3.0632939	1
VV UMa	EA/SD	$09^h38^m06^s$	$+56°01'07''$	HD 83728	39245.394	0.68737571	1
XY UMa	EA/DW/RS	$09^h09^m55^s$	$+54°29'17''$	HD 78414	35216.5018	0.47899493	1
ZZ UMa	EA/D	$10^h30^m03^s$	$+61°48'41''$	HD 91007	35951.484	2.2992596	1

Source(s) of the ephemeris:

1. Kreiner et al., 2001;
2. Karska and Maciejewski, 2003;
3. Present paper;
4. Bernasconi and Behrend, 2003;
5. Boninsegna, 1990;
6. Gomez-Forrellad and Sanchez, 1997

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
CN And	52963.1468	0.0008	II	V	−0.0318	
	52963.3745	0.0016	I	V	−0.0354	
SX Aur	52671.5437	0.0013	II	V	+0.0127	
	52672.1509	0.0010	I	V	+0.0148	
BF Aur	52686.2141	0.0035	I	V	+0.0434	
	52685.398	0.003	II	V	+0.019	
TY Boo	52745.8427	0.0022	II	V	+0.0225	
	52745.9967	0.0009	I	V	+0.0179	
TZ Boo	52767.4793	0.0008	II	V	+0.0293	
XY Boo	52753.5771	0.0012	II	V	+0.0291	
	52753.7581	0.0016	I	V	+0.0248	
	52753.9478	0.0012	II	V	+0.0293	
	52754.1308	0.0007	I	V	+0.0270	
	52774.6988	0.0004	II	V	+0.0292	
	52774.8863	0.0003	I	V	+0.0315	
AC Boo	52717.7662	0.0011	I	V	+0.1132	
	52717.9422	0.0005	II	V	+0.1130	
AD Boo	52745.6521	0.0012	I	V	+0.0130	
CV Boo	52750.4242	0.0006	I	V	+0.0041	
ET Boo	52718.0421	0.0006	II	V	−0.0320	
	52718.3638	0.0010	I	V	−0.0328	
GSC 3472-641	52749.5328	0.0007	I	V	+0.0000	
AW Cam	52725.6605	0.0021	II	V	−0.0047	
	52726.0434	0.0025	I	V	−0.0074	
XX Cas	52947.8024	0.0027	II	V	+0.0494	
	52949.2971	0.0034	I	V	+0.0105	
CQ Cep	52858.962	0.004	I	V	−0.064	
DM Del	52854.7056	0.0026	II	V	−0.0746	
	52855.1382	0.0012	I	V	−0.0643	

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
LS Del	52854.9024	0.0011	II	V	+0.0151	
	52855.0924	0.0021	I	V	+0.0232	
GSC 2511-167	52997.9701	0.0018	I	V	+0.2174	
RZ Lyn	52727.7061	0.0014	I	V	−0.0593	
SW Lyn	52642.9195	0.0016	II	V	+0.0116	
	52643.2338	0.0008	I	V	+0.0038	
	52695.4032	0.0014	I	V	+0.0039	
	52712.1489	0.0005	II	V	+0.0039	
UV Lyn	52726.5818	0.0014	II	V	+0.0546	
	52726.7944	0.0018	I	V	+0.0597	
BG Lyn	52648.637	0.003	II	V	+0.001	
	52649.2322	0.0016	I	V	−0.0041	
BX Peg	52914.715	0.001	I	V	−0.072	
	52914.8564	0.0003	II	V	−0.0703	
GP Peg	52898.3872	0.0010	I	V	+0.0486	
V Tri	52944.2703	0.0011	II	V	+0.0011	
	52944.5625	0.0005	I	V	+0.0007	
RS Tri	52944.6149	0.0015	I	V	−0.0130	
AK Tri	52942.2337	0.0005	II	V	+0.0482	
	52942.5876	0.0008	I	V	+0.0513	
W UMa	52694.8466	0.0003	II	V	−0.0301	
	52695.0117	0.0003	I	V	−0.0319	
TX UMa	52702.3579	0.0005	I	V	−0.0254	
VV UMa	52694.5831	0.0009	I	V	−0.0041	
XY UMa	52694.3332	0.0035	II	V	+0.0249	
	52694.5580	0.0007	I	V	+0.0102	
	52979.556	0.002	I	V	+0.007	
ZZ UMa	52695.846	0.004	II	V	+0.004	

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NEW ELEMENTS FOR 80 ECLIPSING BINARIES II.

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The publicly available ASAS-3 database (Pojmanski, 2002), as well as Hipparcos (Perryman et al., 1997) and TASS (Droege, 2003) databases have been used to prepare this second list presenting new elements for eclipsing binaries. Four catalogues have been used to detect the candidates for this study: the Hipparcos Catalogue, the New Catalogue of Suspected Variable Stars (NSV) (Kukarkin and Kholopov, 1982) and its supplement (NSVS) (Kazarovetz et al., 1998) and the General Catalogue of Variable Stars (GCVS) (Kholopov et al., 2003). For more details on the selection of the candidate eclipsing binaries and data analysis, see Otero (2003). For this second list, stars with no period quoted in the GCVS were investigated too and when no period was found in the literature, they were included in the list of candidates. Elements were found with AVE (Barberá, 1999) and a Microsoft Excel period search utility kindly provided by Patrick Wils (Wils, 2003) Hipparcos observations have been transformed to V using a table by the author published electronically in IBVS No. 5482 (Otero, 2003b). Table 1 shows the list of variables. The first column gives the variable star designation according to the GCVS. The following columns give another identifier; the brightness range of the variable, with the magnitude of secondary eclipse between brackets; the epoch of minimum light derived from the complete dataset; the period; the variability class and the spectral type with a note to the spectral type source.

Table 1. New elements for 80 eclipsing binary stars.

Star Name		Magnitude range	Epoch	Period	Type	Spectral type
Variable	Other ID	(V)	(HJD2440000+)	(days)		
NSV 00470*	HIP 006200	8.77 – 9.14: (9.0:)	8736.140	19.9757	EA	F0V (2)
NSV 00675*	GSC 5858 1594	10.52–11.20(10.60)	11876.593	1.135238	EA	
NSV 00728*	GSC 8489 0651	10.86–11.31(11.30)	12222.632	0.750035	EW:	
NSV 01162*	HIP 016092	7.89 – 8.47 (8.43)	12898.794	14.21605	EA	F5V (1)
NSV 02571	GSC 6489 0506	10.71–11.5:(10.86)	12736.660	13.5166	EA	
NSV 02969*	GSC 6507 1121	9.57 – 9.79 (9.73)	11982.584	10.585	EB/GS:	
NSV 03180	HD 048419	8.22 – 8.98 (8.85)	12229.790	2.94626	EA	A1mA7-F2 (5)
NSV 03282*	HD 051082	8.28 – 8.72 (8.7:)	12896.884	2.18691	EA	A0V (22)
NSV 03305	HD 051569	9.08 – 9.7: (9.65:)	12739.532	2.85371	EA	B9V (5)
NSV 03308	GSC 7089 1282	10.60–11.05(10.76)	12967.757	0.877912	EB	

Table 1. New elements for 80 eclipsing binary stars.

Star Name		Magnitude range	Epoch	Period	Type	Spectral type
Variable	Other ID	(V)	(HJD2440000+)	(days)		
NSV 03433	GSC 5972 2564	10.06–10.55(10.25:)	11922.660	1.75690	EA	
NSV 03497	HD 056785	9.16 – 9.64 (9.60)	11878.748	0.472292	EW	F7IV/V (24)
NSV 03598*	GSC 7655 2601	11.30–12.00(11.98:)	12239.762	4.9370	EA	
NSV 03613*	HD 060023	8.37 – 8.69 (8.68)	12723.672	0.847434	EW/KE	A3IV/V (1)
NSV 03645	HD 060389	8.49 – 8.87 (8.83)	11873.806	2.54961	EA/KE:	A5 (24)
NSV 03682	HD 061829	8.12 – 8.44 (8.18)	12566.839	0.953865	EA	B7V (3)
NSV 03687*	HD 062177	9.50 – 10.18 (9.91)	12989.797	0.688714	EB/KE	A1/A2V (1)
NSV 03702*	GSC 5992 2140	10.35– 11.04(10.99)	12706.617	1.563405	EA/KE	B (25)
NSV 03812	GSC 7123 1250	10.47– 11.21(10.87)	11966.575	3.17970	EA	
NSV 03836*	GSC 8135 0975	10.25–11.00 (10.69)	12437.461	0.390386	EB/KW	
NSV 03877	HD 066475	9.73 – 10.22 (9.91)	12754.550	5.79935	EA	B5III (4)
NSV 03920	HD 067956	8.87 – 9.55 (9.55)	11884.718	0.967554	EW/KE	A0V (1)
NSV 04014*	GSC 7664 1448	11.28– 11.95:(11.5:)	12637.751	2.37050	EA	
NSV 04057*	GSC 6569 3827	10.25–10.95:(10.95:)	11924.692	5.4141	EA	
NSV 04237	GSC 7145 0019	10.09– 10.61(10.53)	12814.457	2.56769	EA	
NSV 04245	HD 074995	9.33 – 9.76 (9.70)	12752.556	3.09154	EA	A2IV (3)
NSV 04250*	GSC 7679 0649	9.63 – 10.09(10.0:)	11981.556	7.2027	EA	A0 (15)
NSV 04253	GSC 8934 0380	9.97 – 10.54(10.48)	12613.631	0.406614	EW	
NSV 04309*	GSC 9199 2849	10.60– 11.05(11.00)	12617.843	0.638940	EW	
NSV 04341	GSC 9203 0677	10.45– 11.34(10.85)	11928.634	12.4398	EA	
NSV 04387*	HD 078654	9.40 – 10.10 (9.50)	12662.738	2.0340	EA	B8V (2)
NSV 04451*	HD 081243	8.60 – 8.91 (8.65)	12658.760	3.81876	EA	A1V (24)
NSV 04484	HD 300036	9.62 – 10.07 (9.81)	12634.770	1.438215	EB	A2 (9)
NSV 04657	GSC 8954 0441	11.15– 12.00(11.95)	12783.535	0.2769435	EW	
NSV 04749*	HD 087982	8.86 – 9.35 (9.01)	12215.849	1.060168	EB	A5V (3)
NSV 04871*	GSC 8192 3556	11.03– 11.91(11.25)	12964.806	0.85496	EA:	
NSV 05115	GSC 6661 0968	11.05– 11.75(11.47)	11979.683	0.58413	EB/KE:	
NSV 05128	SAO 202195	9.68 –10.23(10.03:)	11966.704	2.69535	EA	A5 (11)
NSV 05352	HD 102682	8.13 – 8.55 (8.5:)	12434.486	5.0323	EA	F5V (2)
NSV 05369	HD 309220	9.91 – 10.27(10.19)	11971.701	0.876112	EB/KE	B5 (9)
NSV 05418	HD 104328	9.58 –10.23 (10.1:)	12414.567	3.3370	EA	A7/A8V (3)
NSV 05466*	HD 105355	8.84 – 9.18 (8.97)	12432.456	1.73106	EB	B5IV (1)
NSV 05525*	HD 106790	9.49 – 9.89 (9.82)	12106.482	5.90859	EA	A8/9IV (2)
NSV 05640*	HD 108627	9.54 – 10.01(9.98:)	12134.480	5.0244	EA	A0V (1)
NSV 05978*	HD 111505	9.01 – 9.37 (9.22)	12454.515	2.04388	EB:	B2/B3III (24)
NSV 06073	GSC 9413 0581	10.49–11.05(11.03:)	12093.488	2.68354	EA	
NSV 06635	GSC 7286 1252	10.71– 11.93(10.88)	11948.804	8.5366	EA	G6V (26)
NSV 06792*	HD 129860	7.68 – 7.98 (7.77)	12776.748	18.569	EA	A1IV (1)
NSV 06917	GSC 7821 0523	10.33–11.05:(10.95:)	12132.527	0.374131	EW	
NSV 06959	GSC 7320 0635	10.03– 10.39(10.37)	12840.696	0.360317	EW	
NSV 07118*	HD 138141	8.13 – 8.52 (8.40)	12452.533	1.298207	EA	B9+B7 (2)
NSV 07355*	HD 142634	8.64 – 8.89 (8.81)	12790.720	3.18423	EB	09.5IVn (10)
NSV 07377	HD 143085	9.11 – 9.54 (9.49)	12730.790	0.647878	EW	F2V (2)
NSV 07642	HD 147069	8.61 – 8.93 (8.85)	12442.602	1.58895	EA	B8V (2)
NSV 08029*	GSC 7880 0446	12.18–12.77:(12.72:)	12071.677	5.8082	EA	
NSV 08110	HD 153387	9.20 – 9.48 (9.3:)	11932.820	15.4908	EA	B8II/III (1)
NSV 08145*	HD 322718	11.73– 12.2:(12.1:)	12501.474	7.6945	EA	A2 (9)
NSV 08720	HD 157972	8.28 – 8.6: (8.59)	12030.779	3.3682	EA/KE	B9 (14)
NSV 08808	HD 157961	8.75 – 9.09 (9.07)	11966.816	0.899788	EW	F2IV/V (1)
NSV 10456*	HD 321578	10.39– 10.89(10.69)	12819.836	4.3028	EA	B9 (9)
NSV 10862*	HIP 090552	8.32 – 8.74:(8.52:)	12556.459	30.811	EA	B0.5Ib (23)
NSV 10915*	GSC 7406 0195	10.9 – 11.3:(11.05:)	12796.754	0.537745	EB/KW/RS:	
NSV 12222	GSC 8774 0632	11.36– 11.9 (11.4:)	12095.622	11.2359	EA	
NSV 12502*	GSC 8399 2069	11.25– 12.37(11.95)	12202.550	0.286829	EW/KW	
NSV 13263	HD 197415	9.43 – 9.87 (9.82)	12783.760	0.45364	EW	F6:V: (24)
NSV 13331	HD 198296	9.20 – 9.60 (9.59)	12227.514	0.586612	EW/KE	A5IV/V (4)

Table 1. New elements for 80 eclipsing binary stars.

Star Name		Magnitude range	Epoch	Period	Type	Spectral type
Variable	Other ID	(V)	(HJD2440000+)	(days)		
NSV 13694*	GSC 5785 1113	12.00–12.60(12.26:)	12032.833	0.586774	EB	
NSV 13702	HD 204059	8.82 – 9.21 (9.10)	12867.648	0.690808	EB/KE	A9V (4)
NSV 13749*	HIP 106234	8.38 – 8.8: (8.75:)	12625.750	26.921	EA	F7V (2)
NSV 14254	GSC 9118 0898	9.71 – 10.17 (9.92)	12875.786	1.23501	EB	F6 (11)
NSV 14780	GSC 8018 0185	11.25–11.81(11.37)	12502.749	1.40296	EA	
NSV 19977	HIP 067712	8.44 – 8.70 (8.51)	8509.652	2.482874	EA	F5V (3)
NSV 20517	HIP 079061	8.58 – 8.68 (8.61)	8510.607	1.7587	EB/GS	A0V+K0III (4)
NSV 20859	HD 152590	8.40 – 8.47 (8.46:)	12893.699	4.48886	EA	07.5V (21)
NSV 22125*	HD 158073	8.74 – 9.07 (9.07)	12452.597	1.297320	EB	B2V:+B2V: (10)
NSV 24021*	HIP 087511	9.50 – 9.78:(9.74:)	8744.810	4.39433	EA	F2/3V (5)
NSV 24084	HD 164516	7.77 – 7.99 (7.98)	12548.530	3.03868	EA/KE	B2V (17)
NT Vel *	HIP 042061	8.32 – 9.02 (9.00)	12709.677	9.255699	EA	B6V(n) (1)
V0722 Mon	HIP 030806	7.74 – 7.96 (7.87)	8508.119	1.421785	EA	F5V (5)
V4386 Sgr*	HIP 089404	8.45 – 8.67 (8.6:)	12498.443	21.5958	EA	B1Ib/II (3)

Sources of spectral type:
(1) Houk and Cowley, 1975. (2) Houk, 1978. (3) Houk, 1982. (4) Houk and Smith-Moore, 1988. (5) Houk and Swift, 1999. (9) Nesterov et al., 1995. (10) Garrison et al., 1977. (11) Wright et al., 2003. (14) Kholopov et al., 2003. (15) Spencer and Jackson, 1939. (17) Buscombe, 1998. (21) Walborn, 1972. (22) Claria, 1974. (23) Voigt, 1956. (24) Ochsenbein, 1980. (25) Wackerling, 1970. (26) Weis et al., 1981.

Notes on individual stars:

NSV 00470 = Slightly eccentric. Too few eclipses. More photometry needed. Primary eclipse might be the secondary. Two eclipses recorded but not classified as variable in the HIP catalogue.
NSV 00675 = Wrong period in the ASAS-3 catalog (Pojmanski, 2002): 2.2702 d.
NSV 00728 = Classified as RRc-type with a period of 0.37503 d. in the first ASAS-3 catalogue (Pojmanski, 2002). Light curve suggests an EW-type.
NSV 01162 = Hipparcos missed the eclipses. Very eccentric system.
NSV 02969 = O'Connell effect. Max. II = 9.59.
NSV 03282 = Primary eclipse might be the secondary.
NSV 03598 = Period might be half the value given.
NSV 03613 = O'Connell effect. Max. II = 8.40. Classified as DSCT with half the period by Piquard (2001).
NSV 03687 = O'Connell effect. Max. II = 9.52. Included in Piquard (2001) with uncertain type and a period of 0.098121 d.
NSV 03702 = Emission line star according to Wackerling (1970). V magnitude is contaminated by a nearby star and its real value is probably 0.2 mag. fainter.
NSV 03836 = Classified as RR/EB in the NSV (Kholopov et al., 2003)
NSV 04014 = B-V around 1.2 (Hog et al., 2000).
NSV 04057 = Eccentric binary. Primary eclipse might be the secondary.
NSV 04250 = Slightly eccentric.
NSV 04309 = Slight O'Connell effect. Max II = 10.62.
NSV 04387 = Light curve similar to that of NSV 04419 (Otero, 2003)
NSV 04451 = Houk and Swift (1999) give spectral type G6V.
NSV 04749 = Period discovered by Piquard (2001) but classified as EA.
NSV 04871 = Might be EB-type.
NSV 05466 = Might be EB-type.
NSV 05525 = Visual binary. B= 12.6. Sep.2$''$.8. (Worley and Douglass, 1997)

NSV 05640 = Period might be half the value given.
NSV 05978 = Might be EA-type.
NSV 06792 = Very eccentric system.
NSV 07118 = Combined brightness. Visual binary. A= 8.6; B= 9.3 V (Mermilliod et al., 1997). Sep= 3″ (Worley and Douglass, 1997)
NSV 07355 = One of the massive eclipsing binary candidates in Garrison et al., 1983.
NSV 08029 = Eccentric system.
NSV 08145 = Eccentric system. Uncertain eclipse depths.
NSV 10456 = Eccentric system.
NSV 10862 = Very eccentric.
NSV 10915 = Scatter specially during Min II. The primary is intrinsically variable.
NSV 12502 = Different minima but period too short for EB/KW. 2MASS colors indicate a late type star.
NSV 13694 = Scatter at secondary minimum.
NSV 13749 = Eccentric binary. Two HIP eclipses recorded but not classified as variable in the HIP catalogue.
NSV 22125 = EW-like light curve. Visual binary. A= 9.0; B= 11.8. Sep. 1″ (Dommanget & Nys, 2002).
NSV 24021 = Classified as G5 in Ochsenbein (1980).
NT Vel = Eccentric system.
V4386 Sgr = Too few observations of minima II. Secondary minimum might be the primary.

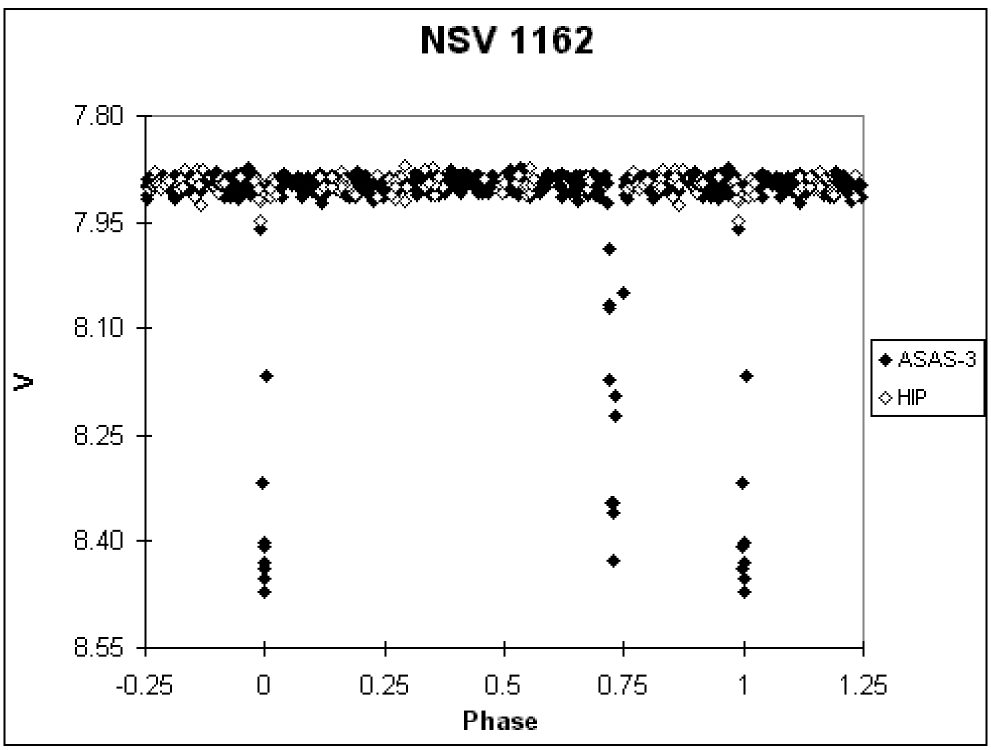

Figure 1. Light curve of NSV 01162 showing ASAS-3 and Hipparcos data.

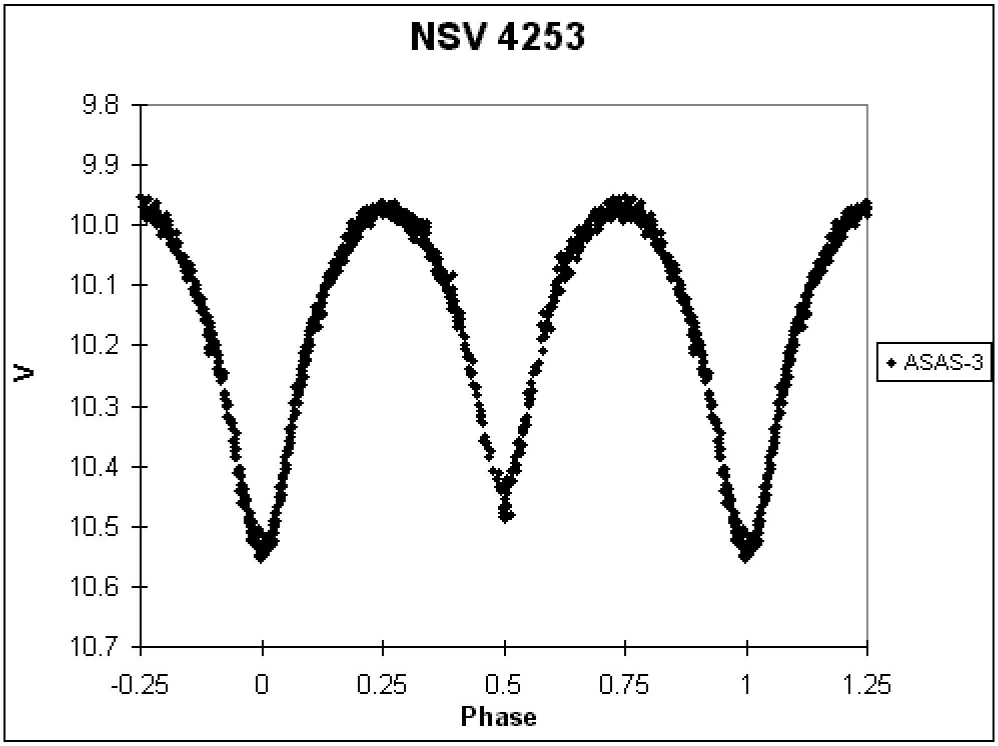

Figure 2. Light curve of NSV 04253 showing ASAS-3 data.

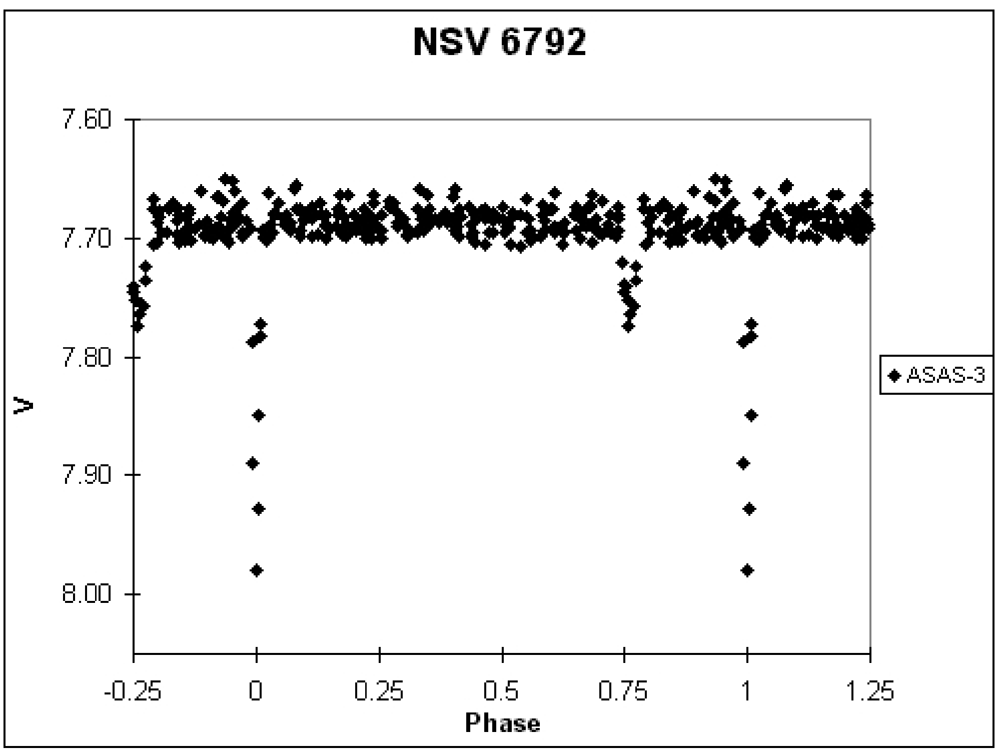

Figure 3. Light curve of NSV 06792 showing ASAS-3 data.

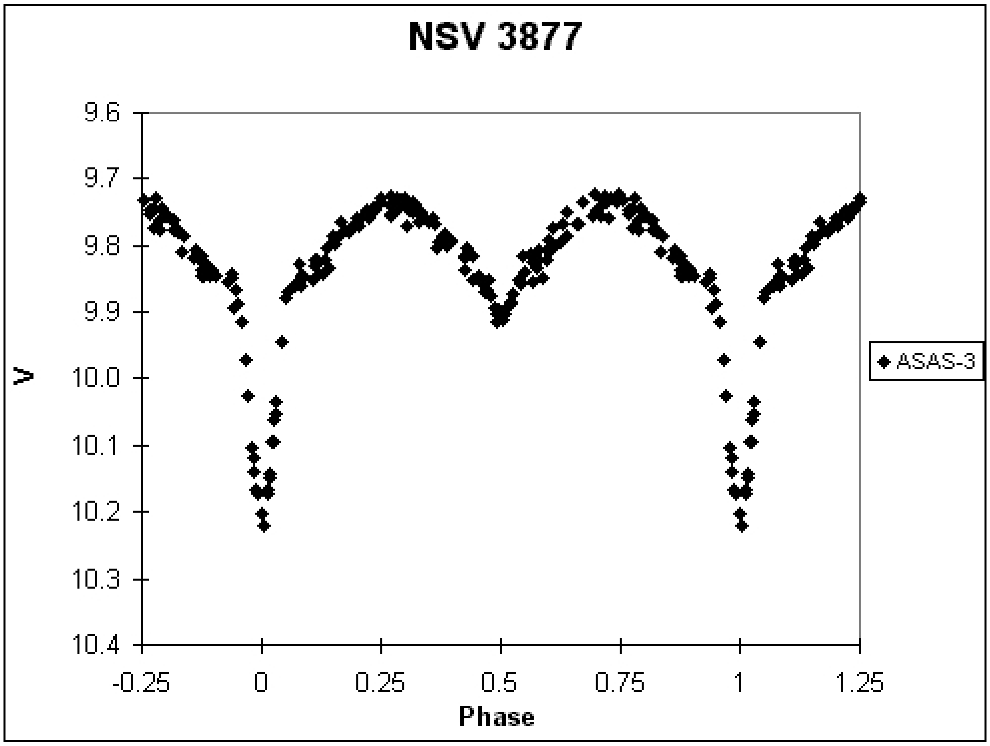

Figure 4. Light curve of NSV 03877 showing ASAS-3 data.

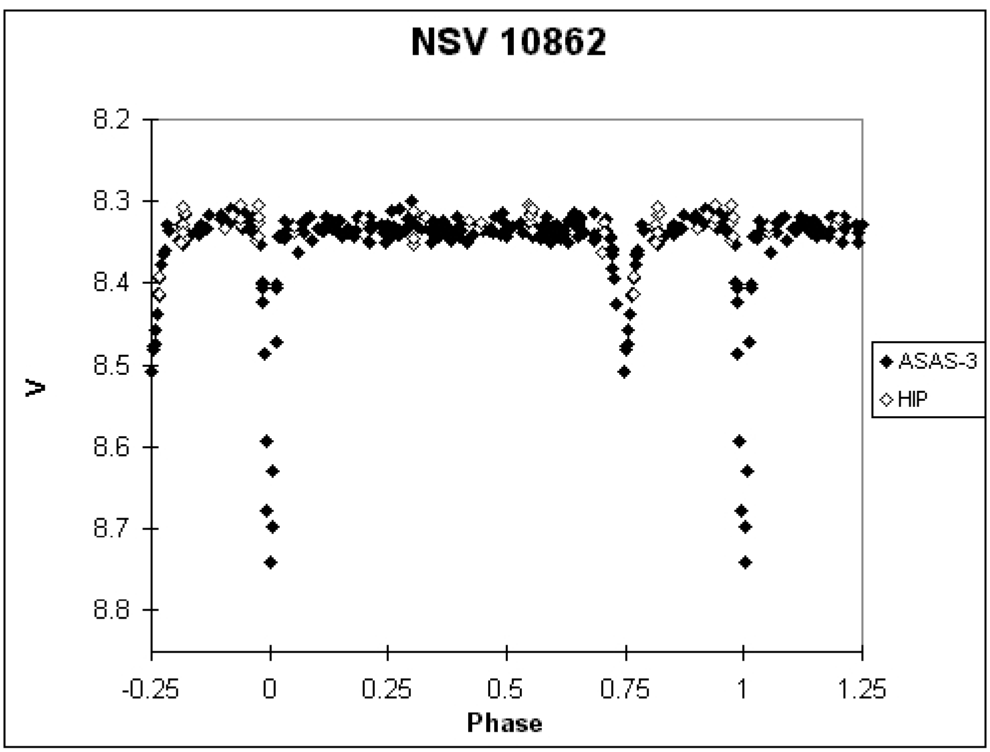

Figure 5. Light curve of NSV 10862 showing ASAS-3 and Hipparcos data.

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BVR PHOTOMETRY OF THE CONTACT BINARY STAR V829 HERCULIS

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V829 Her (GSC 02597-00679 = TYC 2597-679-1) was discovered serendipitously as an X-ray source during the Einstein Observatory Extended Medium Sensitivity Survey (Gioia et al., 1987). It was suspected to be a W UMa system by Fleming et al. (1989). Soon thereafter, Robb (1989) obtained photometric observations of the system and confirmed the W UMa variability type. He found a period of 0.35813 days, which was only approximate because of the short time span. Later, Agerer & Hübscher (1995, 1999, 2000) obtained some minima times. Lu & Rucinski (1999) observed this system spectroscopically and determined its spectroscopic orbit, suggesting that V829 Her is a W-type W UMa system, according to semi-amplitudes of the radial velocity curve of the system.

The system was observed photoelectrically at the Çanakkale Onsekiz Mart University (ÇOMU) Ulupınar Astrophysics Observatory. The observations were performed in the observational season of 2003. The 40-cm Cassegrain reflector equipped with the SSP5-A photometer and Hamamatsu R 6358 photomultiplier tube was used. All observations were made with the B, V and R filters of the Johnson $UBVRI$ system. BD $+38°2701$ and BD $+38°2708$ were used as comparison and check stars, respectively. During the observations no significant light variation of the comparison and check star was found. The atmospheric extinction coefficients in each colour for each observational night were calculated from the observations of the comparison star using conventional methods. Then, all the differential B, V and R magnitudes (in the sense variable minus comparison) were corrected for atmospheric extinction. The probable error of a single observation point was estimated to be ±0.01 for three filters.

During the observations, six primary and two secondary times of minimum light were obtained. These times of minima and their errors, which were determined by using the method of Kwee & van Woerden (1956), are presented in Table 1. The times of the minima given in Table 1 are averaged values of the eclipse times obtained in B, V and R colors during the same night. We have combined the epoch derived by previous authors with our values in order to derive a new epoch and period of the system (see Table 1). The $O-C$ values and epoch numbers E were calculated with the following light elements, given by Lu & Rucinski (1999):

$$\mathrm{HJD_{min\,I}} = 2447680.8910 + 0\overset{\mathrm{d}}{.}3581502 \times E. \qquad (1)$$

Table 1: Photometric minima times of V829 Her

JD Hel. 2400000 +	Method	Filter	Min Type	$O-C$	Reference
47680.8883	pe	VRI	I	−0.0027	Robb (1989)
47681.7883	pe	VRI	II	0.0019	Robb (1989)
47682.8607	pe	VRI	II	−0.0001	Robb (1989)
47684.8283	pe	VRI	I	−0.0024	Robb (1989)
47687.8751	pe	VRI	II	0.0002	Robb (1989)
47689.8448	pe	VRI	I	0.0001	Robb (1989)
48505.7163	pe	VRI	I	0.0054	Robb (1992), Lu & Rucinski (1999)
49545.4195	pe	BV	I	−0.0014	Agerer & Hübscher (1995)
50585.4816	pe	BV	I	−0.0075	Agerer & Hübscher (1999)
51294.4410	pe	BV	II	−0.0064	Agerer & Hübscher (2000)
52777.3698	pe	BVR	I	0.0015	this study
52797.4252	pe	BVR	I	0.0004	this study
52803.5168	pe	BVR	I	0.0035	this study
52821.4217	pe	BVR	I	0.0009	this study
52845.4178	pe	BVR	I	0.0009	this study
52846.3105	pe	BVR	II	−0.0018	this study
52846.4903	pe	BVR	I	−0.0010	this study
52885.3507	pe	BVR	II	0.0001	this study

The $O-C$ residuals versus E values are shown in Fig. 1. From Fig. 1, it is seen that the orbital period change could be sinusoidal with very small amplitude. A reasonable fit to the $O-C$ variation can be achieved by using the following sinusoidal ephemeris:

$$(O-C) = A_s \sin\left[\frac{2\pi}{P_s}(E-T_s)\right], \qquad (2)$$

where A_s is the semi-amplitude, P_s the period and T_s the time of minimum of the sinusoidal variation. A weighted least squares solution for T_0, P, and A_s, P_s and T_s are given in Table 2. The best sinusoidal fit, and also the residuals are plotted against epoch number in Fig. 1.

The differential B, V and R light, and $B-V$ and $V-R$ color curves in the instrumental system are shown in Fig. 2 folded using the elements from data with $E > 8000$:

$$\mathrm{HJD}_{\mathrm{min\,I}} = 2452797.4251(6) + 0\overset{\mathrm{d}}{.}3581516(2) \times E. \qquad (3)$$

The shape of the light curves is typical of W UMa type. There is no significant sign of any asymmetry at maximum lights (O'Connell effect) of the BVR light curves and the depths of secondary minima are deeper than that of primary minima in BVR light curves (see Table 3). This indicates that V829 Her is a W type W UMa eclipsing binary.

The photometric analysis of the light curves is in progress and will be published elsewhere.

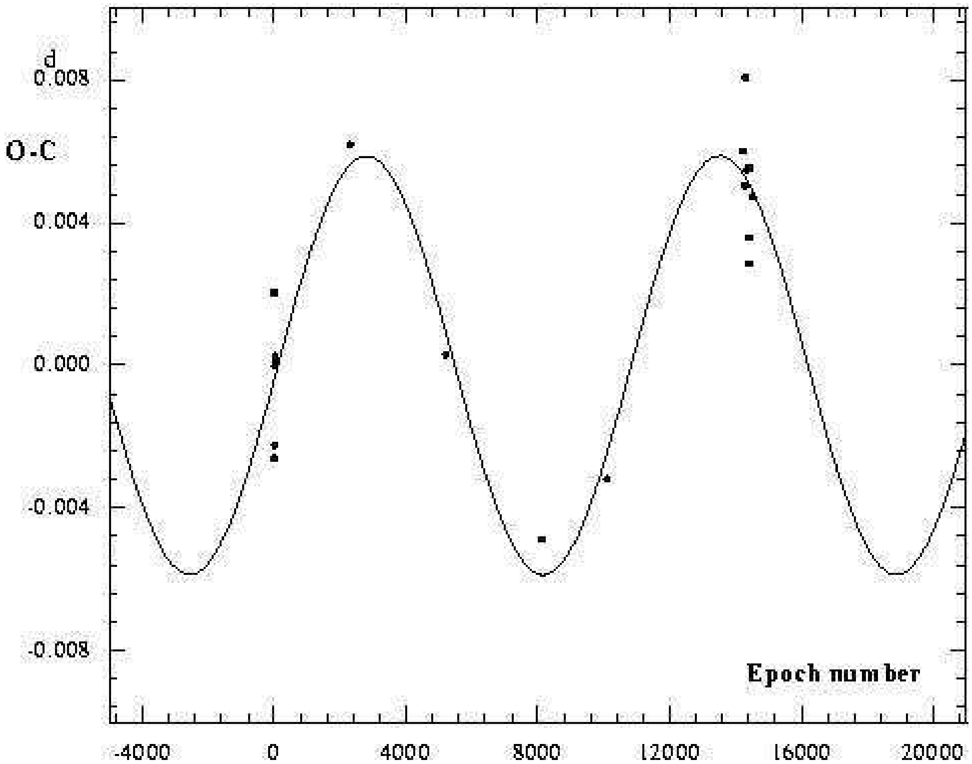

Figure 1. The O-C diagram for V829 Her

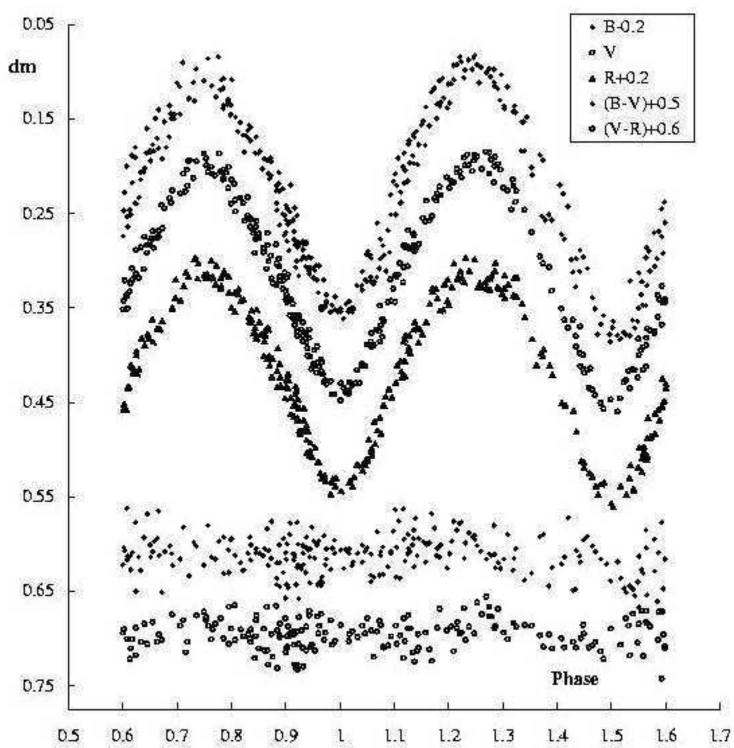

Figure 2. The light and color curves of V829 Her obtained in 2003. Phases were calculated with the ephemeris (3).

Table 2: Parameters for the O-C sinusoidal solution

Parameter	Value	Standard deviation
T_0 HJD	2447680.8909	0.0011
P (day)	0.3581499	0.0000001
A_s (day)	0.006	0.001
P_s (year)	10.5	0.5
T_s (cycle)	115	347
Σ W(O−C)^2(day^2)	3.3×10^{-5}	

Table 3: The light levels and their differences in the light curves of V829 Her

	B	V	R
Max. light at 0.75	0.300(9)	0.197(8)	0.110(5)
Max. light at 0.25	0.295(9)	0.194(8)	0.112(6)
Min. light at 0.00	0.555(9)	0.441(9)	0.340(7)
Min. light at 0.50	0.575(9)	0.455(9)	0.355(6)
Δmax. ($m_{0.75} - m_{0.25}$)	0.005	0.003	−0.002
Δmin. ($m_{0.00} - m_{0.50}$)	−0.020	−0.014	−0.015
Depth of Min. I	0.258	0.246	0.229
Depth of Min. II	0.278	0.260	0.244

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ERRATUM FOR IBVS 5496

Erratum for the paper IBVS No. 5496 titled *"BVR Photometry of the Contact Binary Star V829 Herculis"*: the comparison and check stars were given in the paper as BD+38°2701 and BD+38°2708, respectively. They should be BD+35°2882 for comparison and BD+35°2891 for the check star.

Volkan Bakis

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HeIIλ4686 OBSERVATIONS OF T CORONAE BOREALIS

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We present spectroscopic observations of the HeIIλ4686 line of the recurrent nova T CrB. We have secured 22 spectra on 16 nights between April 1997 and January 2002 with the Coudé spectrograph of the 2.0 m RCC telescope of the Bulgarian National Astronomical Observatory "Rozhen". The spectra cover ~ 100 Å (before 971010) and ~ 200 Å (after 990105) around λ4686, with resolution of ~ 0.2 Å pixel^{-1}. The S/N ratio achieved is 15-35. Two examples of our spectra are shown in Fig. 1. Journal of the observations is given in Table 1. The equivalent width (W) of the line is measured relative to the local continuum at $\lambda4677 - \lambda4690$ Å. The flux is calculated using B and V photometry. Typical errors in W and flux measurements are $\pm$15-20% and $\pm$20-30%, respectively. The radial velocity is measured at the top of the line and has an uncertainty of about ± 15 km s^{-1}.

T CrB consists of a red giant and a hot component (almost certainly a white dwarf). Iijima (1990) and Anupama & Mikolajewska (1999) reported the presence/absence of the HeII4686 line during the period 1987 – 1997. Combining their data with our new observations gives us the opportunity to discuss the appearance of the HeII emission during a period when the U brightness varies by more than 2 magnitudes (see Fig. 2). The times of HeIIλ4686 observations and detections are plotted on Fig. 2, together with the U band variability. We used our data, together with those of Iijima (1990) and Anupama & Mikolajewska (1999), as well as the long term light curve (Stanishev et al. 2003, and the references therein). As is apparent in Fig. 2, the appearance of HeIIλ4686 emission correlates with the U brightness of the object. Most of the detections clearly correspond to the short brightening in U of about ΔU$\sim$ 0.6 at JD2448050 and to the maximum at JD2450700. Variability in U reflects the changes is the mass accretion rate, provided that the spectral energy distribution does not change considerably, as is supposed from spectral fitting in high and low states (Stanishev et al. 2003).

The presence of a strong HeII line was reported in the period 1921 – 1946 (see Adams & Joy 1921, Minkowski 1943, Swings & Struve, 1943, among others). Bearing in mind that during the last decade the line was not strong and has been detected on a few occasions only, the older observations probably indicate a higher mass accretion rate during the 25 years preceding the 1946 outburst of Nova CrB (i.e. higher than the current value of about $2 \times 10^{-8}\, M_{\odot}\, yr^{-1}$ estimated by Selvelli et al. 1992).

In an attempt to detect the profile of the HeIIλ4686 line, we subtracted a template from the first 5 observations, when the line had W > 1Å, and seemed blue shifted. In practise, we used as templates epochs 000621, 010707, and 020123, where the HeII line was not detected. The upper limit ($W < 0.5$Å) was defined by comparing with (1) spectra of M giants from the library of stellar spectra of Le Borgne et al. (2003), (2) spectra of M4III stars (HD 4408 and HD 5316) observed with the same instrumental setup as T CrB.

The template was then shifted to match the observed red giant spectrum. The shifts have been calculated (i) via Fourier cross correlation, and (ii) using the orbital elements (from Stanishev et al. 2003). The shifted template has been subtracted from the 5 spectra from 970426 to 971010. Following this, the residual spectra have been shifted to the hot component velocity and averaged. The average profile of HeIIλ4686 obtained from these 5 template–subtracted spectra is plotted in Fig. 1b. The profile of Hα as observed in April 1997 (from Stanishev et al. 2003) is also plotted for comparison. The HeII profile is noisier than that of Hα because (i) the HeII line is weaker than Hα and (ii) the S/N of HeII spectra is lower than those in Hα.

As can be seen, the HeIIλ4686 profile is different from that of Hα. The HeII line is narrower (at half maximum), it does not exhibit double peak at the top, and it also seems to have an asymmetric profile with blue wing (Fig. 1b). We measured radial velocity in the higher flux regions of the line where it is practically symmetric. Part of the observational data (all cases when W > 1 Å) show that this velocity is negative relative to the orbital velocity of the hot component (the hot component orbital velocity is supposed to follow $V_h = -36.7 + 19.5\cos[2\pi(\phi - 0.563)]$ km s^{-1}, see Stanishev et al. 2003). Unfortunately, we cannot be sure whether we observe a blue wing and broad component close to the continuum level (like those detected in HeIIλ 1640 by Selvelli et al. 1992) because it is comparable with the noise and depends on the subtraction of the red giant flux. However, the blue shift at the peak and at half maximum seems to be detected. On the other two exposures (obtained on 990105) the line is weaker and its radial velocity coincides with the radial velocity of the hot component.

HeII lines are supposed to be formed in the immediate vicinity of the hot component. The blue shift of HeII4686 indicates a motion from the hot component toward the observer. The most plausible explanation is that it arises in an outflow from an accretion disk (most probably a disk wind at the high state of the system). A receding part of this outflow can also exist, but it has to be obscured by the disk itself.

In T CrB the main the accretion is the Roche lobe overflow from the giant. In addition to the flow via L_1, accretion from a stellar wind can supply about 15% of the total mass accretion rate (Selvelli et al. 1992). However, in nova–like cataclysmic variables at accretion rates $\sim 1 \times 10^{-8}\, M_{\odot}\, yr^{-1}$ (like that of T CrB) the accretion disk is expected to lose about 0.001 - 0.15 of the accreting material via an accretion disk wind (i.e. Vitello & Shlosman 1993; Long & Knigge 2002). It is worth noting that accretion disk winds in cataclysmic variables are best visible as absorption lines and P Cyg profiles in the UV (for example Prinja et al. 2003). The available UV spectra of T CrB are however too noisy for clear detection of the UV line profiles (see Selvelli et al. 1992 and IUE archive), but the profile of HeII4686 suggests the presence of an outflow (at least in high state).

We conclude, that the appearance of the HeII emission in T CrB is connected with U band variability, and probably therefore with epochs of higher mass accretion rate. Whether we have accretion disk wind or accretion from a stellar wind (in addition to Roche lobe overflow) could be answered by careful investigation with better optical and UV spectra. This could also help us to understand when and how accretion from stellar winds, in wind-fed symbiotics, can exist together with outflows from the accreting component.

Table 1: HeIIλ4866 line observations of T CrB. The date is in the format YYMMDD. The orbital phase (ϕ) is calculated using the ephemeris T_0=2447918.62+227.^{d}5687E (Fekel et al. 2000). The equivalent width (W), flux of the line and radial velocity are given. The flux is in units of 10^{-13} erg cm^{-2} s^{-1}. The non–detections (nd) of the line correspond to upper limits of about W <0.5 Å (equivalent to $< 0.6\times10^{-13}$ erg cm^{-2} s^{-1}). The calculated radial velocity of the hot component,V_h, is also given (see the text).

Date	HJD	ϕ	W [Å]	Flux	V_r km s^{-1}	V_h km s^{-1}	Date	HJD	
970426	50565.529	0.631	2.0	4.22	−67	−19.0	000516	51681.353	nd
970426	50565.543	0.631	2.7	5.70	−99	−19.0	000516	51681.368	nd
970427	50566.391	0.635	2.1	4.43	−75	−19.2	000621	51717.396	nd
971010	50732.219	0.364	1.4	3.31	−70	−30.6	000818	51775.320	nd
971010	50732.234	0.364	1.6	3.78	−75	−30.6	000917	51805.288	nd
990105	51184.632	0.352	0.9	1.78	−26	−32.0	010316	51985.438	nd
990105	51184.646	0.352	1.0	1.98	−22	−32.0	010407	52007.387	nd
990309	51247.438	0.628	nd	–	–		010502	52032.350	nd
990309	51247.452	0.628	nd	–	–		010707	52098.312	nd
990919	51441.325	0.480	nd	–	–		010904	52157.341	nd
990919	51441.343	0.480	nd	–	–		020123	52297.684	nd

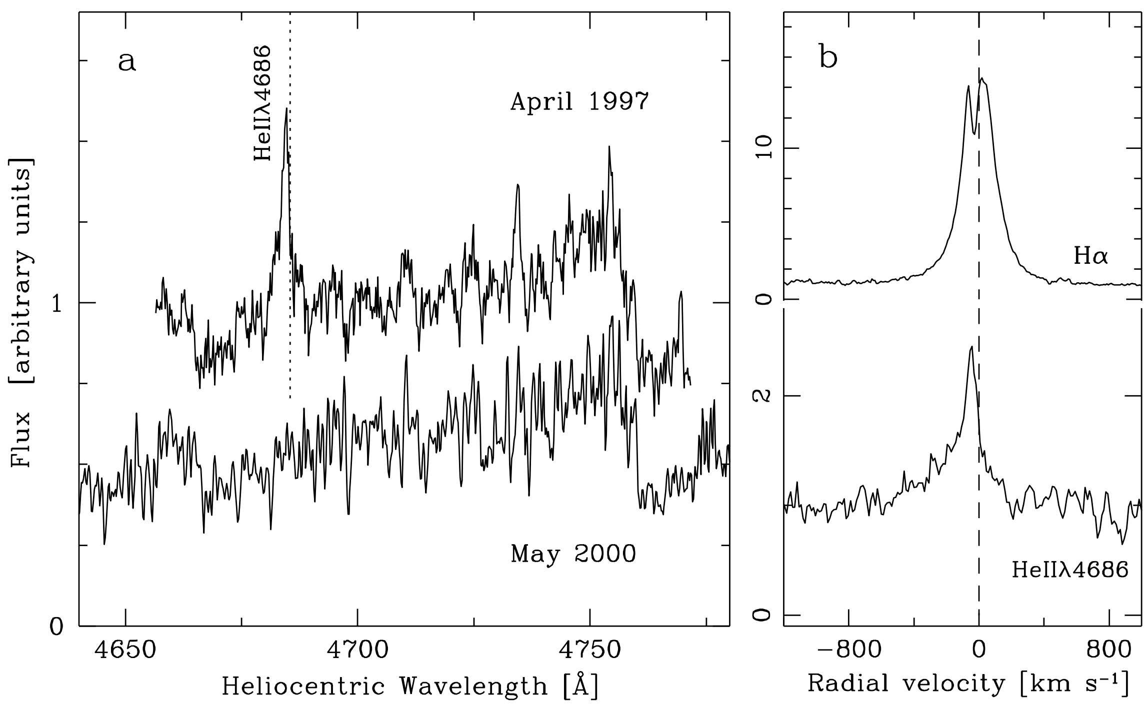

Figure 1. a) The region around the HeII line. The dotted line corresponds to the calculated radial velocity of the white dwarf (V_r=−19 km s^{-1}) **b)** Cleaned profiles of HeIIλ4686 and Hα. Both are normalised to the remaining hot component continuum, after the subtraction of the red giant spectrum. The zero of the X-axis corresponds to the calculated radial velocity of the hot component.

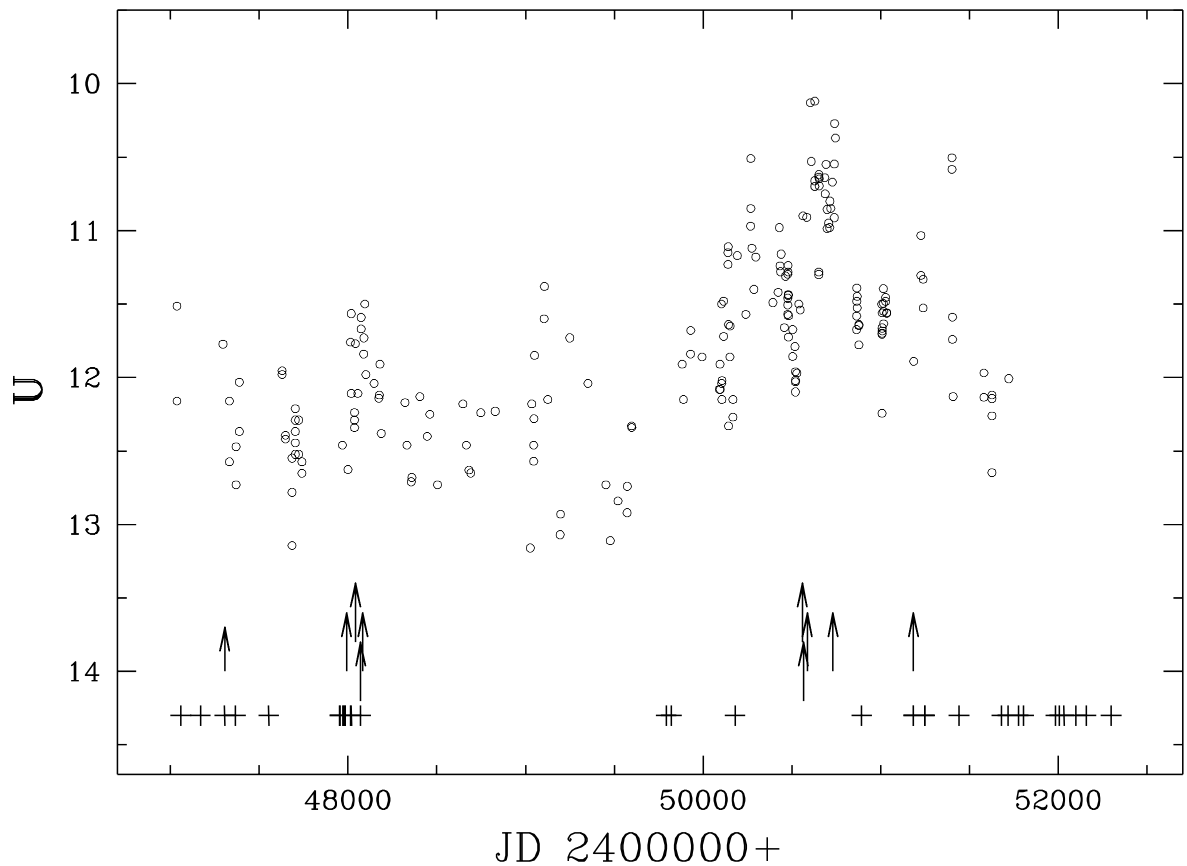

Figure 2. Johnson U band light curve of T CrB and observations of the HeIIλ4686 line. The arrows and crosses indicate the times of HeIIλ4686 observations. The arrows refer to detections, and crosses to non–detections of the HeIIλ4686 emission line.

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THE DATABASE ASAS AND THE PERIODS OF SEVERAL EARLY-TYPE BINARIES

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The database ASAS (Pojmański 2002) is quite important for studies of eclipsing binaries (Otero 2003). It allows to obtain minima of southern objects (as a matter of fact, by $+30^\circ$ declination) – such measurements have been quite rare last years. Here the database is used for six early-type binaries. The calculated times of minima are collected in Table 1.

EM Car is a well known O 8 type eclipsing binary with orbit of small eccentricity (Andersen & Clausen 1989, hereafter AC; Stickland et al. 1995). New times of minima should help to precise the period of apside line rotation. All known times of minima are displayed in Fig. 1. A minimum measured by the writer at La Silla during another project is included too (the first row of Table 1; observing details see Mayer et al., 1998). $O-C$ were calculated using the ephemeris by AC:

$$\text{Prim.Min.} = \text{HJD } 2445038.8001 + 3\overset{\text{d}}{.}4142765 \times E.$$

The best fit of minimum times gives the formula

$$O-C = 0\overset{\text{d}}{.}0132 - 0\overset{\text{d}}{.}0000016 \times E \pm 0\overset{\text{d}}{.}0132 \sin[2\pi * (E-1250)/4600];$$

$+$ sign is valid for primary, $-$ for secondary minima. Terms with E of power ≥ 2 are smaller than $0\overset{\text{d}}{.}0001$ and are not considered. Apparently the sidereal period is a little shorter ($3\overset{\text{d}}{.}4142749$) than given by AC; the apside line rotation period is 43 years, time of periastron passage JD 2449306, and eccentricity is unchanged: $e = 0.0120$. However, the errors of the new minimum times are rather large and the differences against values given by AC are not strongly constrained.

SV Cen is a binary with the largest rate of change of period among all binaries, see e.g. Drechsel & Lorenz (1995; hereafter DL). Since it might not be unambiguous to calculate the number of epochs even in an interval only a decade long (the interval between DL measurement and ASAS), we divided the ASAS data to two parts and calculated the period valid for the interval from the year 2000 to 2003, with the resulting value of the period $1\overset{\text{d}}{.}65764$. According to DL, the period in February 1993 was $1\overset{\text{d}}{.}65811$; calculating the epoch number with the period equaling the mean of these two values ($1\overset{\text{d}}{.}65788$), we got the numbers in Table; the corresponding $O-C$ are displayed in Fig. 2. The average period in the interval from 1993 to 2001 was then $1\overset{\text{d}}{.}65770$. The shortening of the period was considerable sometime around the year 1993.

Table 1: The times of minima

Name	HJD−2400000 (error)	Epoch	$O-C$ days	Source
EM Car	48686.9690(20)	1068.5	0.0145	see text
	52278.7712(12)	2120.5	-0.0022	ASAS
	52280.5022(26)	2121	0.0216	ASAS
SV Cen	51918.7470(17)	5178	2.1984	ASAS
	52634.8504(14)	5610	2.1754	ASAS
AQ Cir	28656.350	−21099	0.000	Hoffmeister
	49012.098	−3332	0.009	Mayer et al. (1998)
	51981.760	−740	0.004	ASAS
	52829.578	0	0.000	ASAS
TU Mus	48500.3080	0	0.0014	Hipparcos
	52402.7436	2813	0.0000	Terrell et al.
	52492.9188	2878	0.0016	ASAS
V431 Pup	52944.8168(30)	474		ASAS
V701 Sco	52081.5401(22)	7720.5	0.0161	ASAS
	52081.9210(15)	7721	0.0161	ASAS
	52729.1292(14)	8570.5	0.0134	ASAS
	52729.5081(6)	8571	0.0113	ASAS

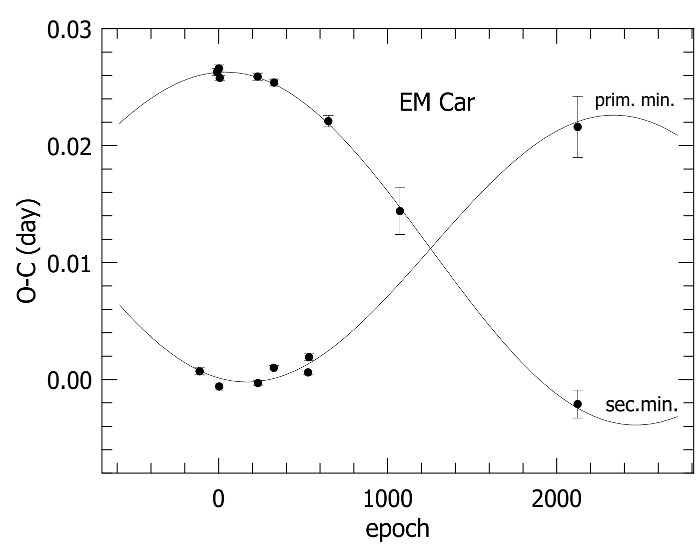

Figure 1. $O-C$ graph of EM Car. The curves correspond to the formula given in the text.

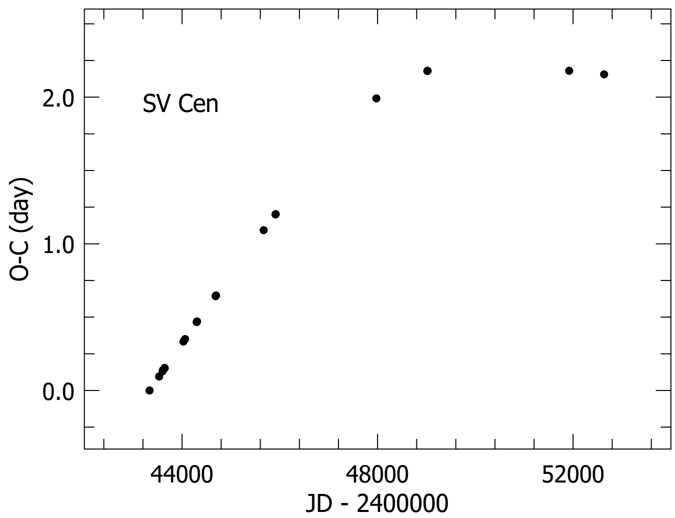

Figure 2. $O - C$ graph of SV Cen calculated with ephemeris Prim. min.= HJD 2443332.978 + $1\overset{d}{.}65770 \times E$

AQ Cir was classified by Lyngå (1964) as OB^-. Dividing the ASAS data into two time intervals, we got times of minima listed in Table 1, and fitting the La Silla measurement (made in B; Mayer et al. 1998) to the ASAS light curve (in V; therefore not too precise process, due to unknown $B - V$), another time of minimum was obtained. Then the accuracy of the period allowed to use also the original minimum time by Hoffmeister (1943). The resulting ephemeris is

$$\text{Prim.Min.} = \text{HJD } 2452829.5780(7) + 1\overset{d}{.}14570492(7) \times E.$$

TU Mus is one of several contact systems of early spectral type; a similar system is V382 Cyg. In Fig. 3, $O - C$ diagram for this star is plotted. The new minimum fits the ephemeris given by Terrell et al. (2003) quite well ($O - C = +0\overset{d}{.}0016$; the epoch of the time of a minimum marked "Terrell et al." in Table 1 has been estimated as the middle of the interval of Terrell's et al. observations). Terrell et al. concluded,that in the time interval covered by observations, the period was constant. But they did not consider the older times of minima by Oosterhoff (1928, 1930) and by Knipe (1971), see Fig. 3. These older minima support a conclusion that TU Mus period lengthens, albeit not regularly – similar behaviour is known for V382 Cyg (Mayer 1980).

V431 Pup is a variable found by the satellite HIPPARCOS. It is a rare member of a group of evolved binaries with eccentric orbits. Mayer et al. (2002) gave its period as $9\overset{d}{.}3434$; it depended on the estimation of the number of epochs between the HIPPARCOS minimum and radial velocities measured in thirties. According to the ASAS minimum it appears now that this number of epochs was underestimated by one. It is possible to identify the time of the ASAS minimum with the time of the deepest measurement, as HJD 2452944.8168; this, with the HIPPARCOS time, gives the period as $9\overset{d}{.}35928$.

V701 Sco was recently announced as a binary with a possible light time effect (Mayer & Wolf 2002). The ASAS material could be divided into two parts, and times of primary and secondary minima were obtained. These times not only confirm the time of a minimum published by Mayer & Wolf, they also confirm the trend of the period, i.e., its cyclic

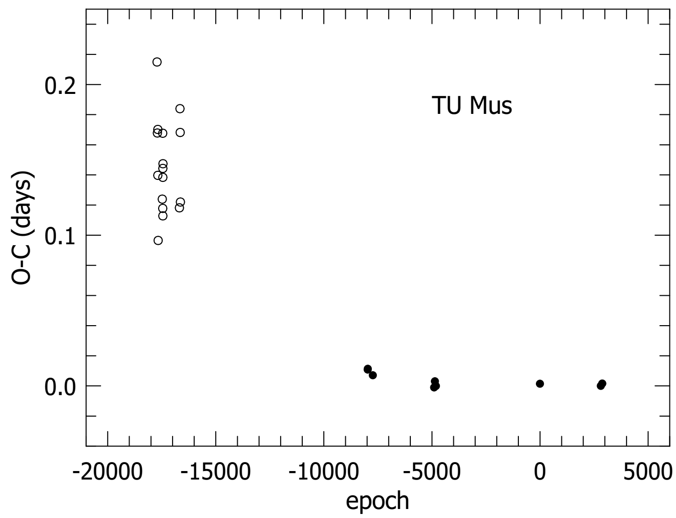

Figure 3. $O-C$ graph of TU Mus. Filled circles present the photoelectric minima, open circles the photographic ones. Ephemeris by Terrell et al. is used: Prim. Min. = HJD 2448500.3066 + $1\overset{d}{.}38728653 \times E$.

change. In Table 1, the ephemeris

$$\text{Prim.Min.} = \text{HJD } 2446199.4850 + 0\overset{d}{.}7618728 \times E.$$

is used.

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PHOTOMETRIC ORBITS OF KU AURIGAE AND SW CANCRI

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I am measuring light curves in the V filter of about 3 dozen eclipsing binary stars with the aim of providing photometric orbits for systems in which the light ratio is large enough to detect double lines in the spectra with existing spectrometers. The target list was selected in a number of different ways, and sometimes I find that a binary will not be suitable for the determination of absolute dimensions and masses because the light ratio is too large to show double lines. Still, it may be useful for future studies to publish a photometric orbit for these systems. In this paper are the photometric orbits of 2 such binaries selected from the list of Popper (1996). Popper gives an estimate of the spectral type of the combined light, but not the individual spectral types. I have estimated the individual spectral types by using the central surface brightness of the secondary component and the equation in Lacy et al. (1987) that relates the central surface brightness to the difference in visual surface brightness parameter Fv. Popper (1980) gives a calibration of the visual surface brightness parameter that allows the spectral type of the secondary to be estimated from the combined spectral type.

Observatory and telescope:
URSA Observatory at the University of Arkansas (ursa.uark.edu); 10-inch Schmidt-Cassegrain reflector.

Detector:	1020x1530 pixels SBIG ST8EN CCD cooled to (typ.) -20 C; 1.15 arcsec square pixels; $20'$(N-S)$\times 30'$(E-W) field of view.

Method of data reduction:
Virtual measuring engine (Measure 1.97) written by C.H.S. Lacy in 2003.

KU AURIGAE

Name of the object:
KU Aur = GSC 02422 00020

Comparison star(s):	GSC 02422 01381

Check star(s):	GSC 02422 00931

Eclipse ephemeris and source or method:
HJD Min I = 2451923.43191 + 1.31957012 E ±0.00010 ± 0.00000045
The ephemeris is a least-squares fit to primary minima of Agerer & Hubscher (2002), Nelson (2002), and Lacy (2003).

Light curve fitting technique and references:
Nelson-Davis-Etzel (NDE) model as implemented in the code EBOP (Etzel 1981; Popper & Etzel 1981).

Table 1: Auxiliary fitting parameters and sources:

Component	Hotter	Cooler	Reference
Limb-darkening coefficient	0.60	0.81	Diaz-Cordoves et al. 1995
Gravity-brightening coefficient	0.25	0.25	Claret 1998
Effective temperature (K)	6500	4000	Popper 1980
Spectral class	F5	K7	Popper 1996

Table 2: Fitted orbital parameters and uncertainties:

Parameter	Hotter	Cooler
Central surface brightness	1	0.069 ± 0.004
Radius	0.268 ± 0.002	0.231 ± 0.003
Ratio of radii	0.862 ± 0.015	
Angle of inclination (degrees)	88.0 ± 0.5	
Reflected light	0.001	0.008
Photometric mass ratio	0.167 assumed	
Luminosity	0.950 ± 0.014	0.050 ± 0.014
Third light	0.176 ± 0.017	
Standard error of residuals (mag)	0.006066	
Number of observations (9-pt normals)	150	

Availability of the data:
May be obtained from the author (clacy@uark.edu).

Remarks:
The secondary star appears to be a subgiant. The system is assumed to be semi-detached.

SW CANCRI

Name of the object:
SW Cnc = GSC 00812 00052

Comparison star(s):	GSC 00812 00083

Check star(s):	GSC 00812 00121

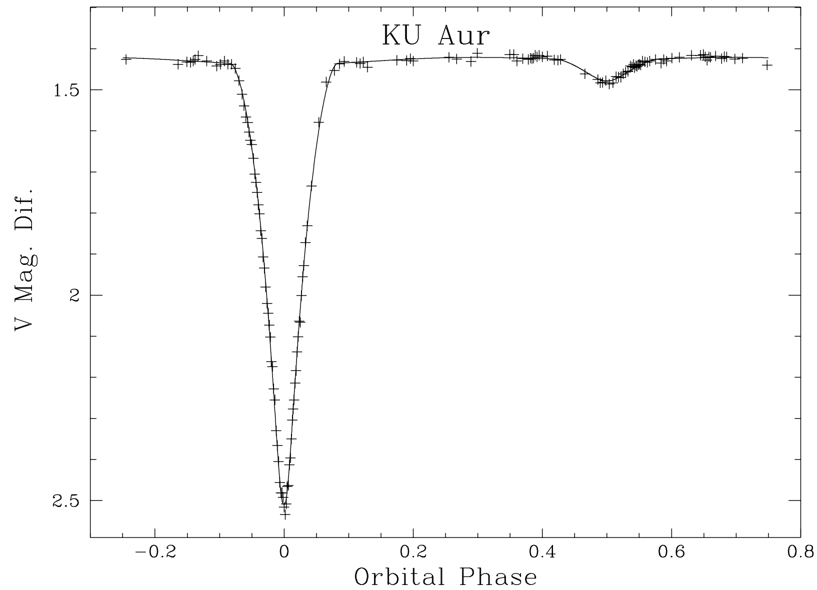

Figure 1. Fitted light curve and data plot (the data are 9-point normals).

Eclipse ephemeris and source or method:
HJD Min I = 2452598.89788 + 1.79920613 E
±0.00014 ± 0.00000040
The ephemeris is a least-squares fit to primary minima of Zejda (2002), Lacy (2002), and the epoch in the GCVS (1985).

Table 3: Auxiliary fitting parameters and sources:

Component	Hotter	Cooler	Reference
Limb-darkening coefficient	0.60	0.81	Diaz-Cordoves et al. 1995
Gravity-brightening coefficient	0.25	0.25	Claret 1998
Effective temperature (K)	6700	4000	Popper 1980
Spectral class	F2	K7	Popper 1996

Table 4: Fitted orbital parameters and uncertainties:

Parameter	Hotter	Cooler
Central surface brightness	1	0.1265 ± 0.0024
Radius	0.1931 ± 0.0022	0.1962 ± 0.0030
Ratio of radii	1.016 ± 0.019	
Angle of inclination (degrees)	85.26 ± 0.19	
Reflected light	0.002	0.004
Photometric mass ratio	2.89 ± 0.16	
Luminosity	0.889 ± 0.014	0.111 ± 0.014
Standard error of residuals (mag)	0.006730	
Number of observations (9-pt normals)	335	

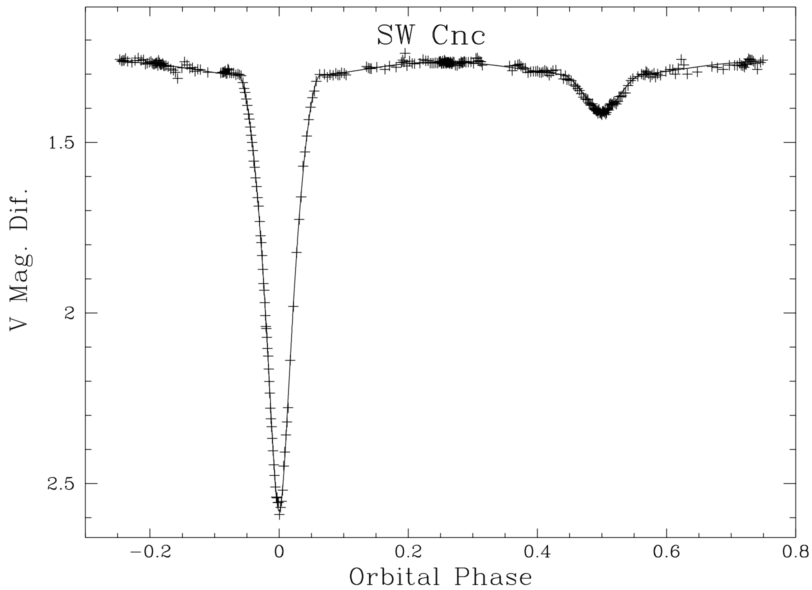

Figure 2. Fitted light curve and data plot.

Availability of the data:
May be obtained from the author (clacy@uark.edu).

Remarks:
The model would not converge with third light as a variable parameter. The secondary star appears to be a subgiant. The system is detached.

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REPORTS ON NEW DISCOVERIES

The last issue of the volume publishes a list of newly discovered variables. Figures (finding charts and light curves) and data files are available electronically.

The Editors

Date: 25 July 2003
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RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$00^h59^m23^s.46$	$-26°32'51''.9$	RR	17.28 R (GSC2.2)

Period	**Epoch**
$0^d.5974$:	–

Cross-identification(s):
USNO-A2.0 0600-00386907 = GSC2.2 S00111322304

Date: 10 October 2003
Observer(s) and affiliation(s): Bernhard, K. - Linz, Austria, kl.bernhard@aon.at Frank, P. - Velden, Germany, frank.velden@t-online.de Lloyd, C. - Rutherford Appleton Laboratory, UK, cl@astro1.bnsc.rl.ac.uk

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$19^h00^m16^s.8$	$-10°26'36''$	RRab	12.9-13.4 (V)

Period	**Epoch**
0.69839	2452846.53

Cross-identification(s):
GSC 5710.0553 = Brh V136

Date: 10 October 2003
Observer(s) and affiliation(s): Rinner, C. - Ottmarsheim Observatory, rinnerc@wanadoo.fr Bernasconi, L. - Les Engarouines Observatory, laurent.bernasconi.51@wanadoo.fr Demeautis, Ch. - Village-Neuf Observatory, sky.walker@wanadoo.fr Waelchli, N. - F.-X. Bagnoud Observatory, info@ofxb.ch Coquille, L. - F.-X. Bagnoud Observatory Matter, D. - Village-Neuf Observatory Cotrez, V. - Village-Neuf Observatory Behrend, R. - Geneva Observatory, raoul.behrend@obs.unige.ch

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$04^h17^m03\overset{s}{.}47$	$+18°52'31\overset{''}{.}2$	EW	14.5
Period	**Epoch**		
$0\overset{d}{.}30980520$	2452547.7597		
Cross-identification(s):			
GSC 1272-110			

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$20^h35^m10\overset{s}{.}23$	$-19°14'10\overset{''}{.}3$	EW	13.1
Period	**Epoch**		
$0\overset{d}{.}3927425$	2452508.676		
Cross-identification(s):			
GSC 6338-1083			

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$20^h19^m11\overset{s}{.}28$	$-16°39'58\overset{''}{.}5$	EW	14.6
Period	**Epoch**		
$0\overset{d}{.}3641660$	2452493.418		
Cross-identification(s):			
GSC 3328-163			

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$08^h01^m59\overset{s}{.}79$	$+13°49'43\overset{''}{.}9$	EW	15.8
Period	**Epoch**		
$0\overset{d}{.}350335$	2452678.419		
Cross-identification(s):			
USNO-A2.0 975-5664710			

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$09^h14^m25\overset{s}{.}96$	$+18°53'54\overset{''}{.}5$	EW	11.5
Period	**Epoch**		
$0\overset{d}{.}39858$	2452723.6127		
Cross-identification(s):			
GSC 1404-1687			

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$20^h19^m08\overset{s}{.}42$	$-16°47'59\overset{''}{.}4$	EW	13.8
Period	**Epoch**		
$0\overset{d}{.}32191$	2452846.475		

Cross-identification(s):
GSC 6328-223

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$21^h10^m24\overset{s}{.}90$	$+14°48'45\overset{''}{.}9$	EW	15.3

Period	**Epoch**
$0\overset{d}{.}2876145$	2452501.589

Cross-identification(s):
USNO-A2.0 975-20094153

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$21^h10^m44\overset{s}{.}91$	$+15°35'41\overset{''}{.}6$	EW	14.1

Period	**Epoch**
$0\overset{d}{.}3616427$	2452497.401

Cross-identification(s):
GSC 1649-1573

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$21^h00^m44\overset{s}{.}09$	$+15°19'54\overset{''}{.}6$	EW	12.1

Period	**Epoch**
$0\overset{d}{.}787193$	2452500.483

Cross-identification(s):
TYC 1648-525-1

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$21^h01^m27\overset{s}{.}74$	$+15°28'10\overset{''}{.}8$	EW	13.2

Period	**Epoch**
$0\overset{d}{.}452421$	2452853.4731

Cross-identification(s):
GSC 1648-845

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$21^h01^m34\overset{s}{.}53$	$+15°23'16\overset{''}{.}0$	EW	14.5

Period	**Epoch**
$0\overset{d}{.}381807$	2452853.428

Cross-identification(s):
GSC2.2 N031330127360

Date: 10 October 2003

Observer(s) and affiliation(s):
Bosch, J.-G. - Collonges Observatory, jean-gabriel.bosch@physics.unige.ch
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Matter, D. - Village-Neuf Observatory
Cotrez, V. - Village-Neuf Observatory
Behrend, R. - Geneva Observatory, raoul.behrend@obs.unige.ch

RA(J2000)	Dec(J2000)	type	Mag.
$22^h39^m54^s.27$	$+13°26'14''.1$	HADS/SX Phe (?)	12.4

Period	Epoch
$0^d.06455743$	2452885.4384

Cross-identification(s):
GSC 1158-921

RA(J2000)	Dec(J2000)	type	Mag.
$21^h00^m21^s.28$	$+15°48'35''.0$	RR Lyr	14.9

Period	Epoch
$0^d.5597298$	2452511.531

Cross-identification(s):
USNO-A2.0 1050-19031360

RA(J2000)	Dec(J2000)	type	Mag.
$21^h30^m48^s.07$	$+17°38'48''.4$	RR Lyr	14.2

Period	Epoch
$0^d.61291$	2452854.2965

Cross-identification(s):
GSC2.2 N03112224474

RA(J2000)	Dec(J2000)	type	Mag.
$20^h11^m59^s.46$	$-15°54'01''.2$	RR Lyr	14.6

Period	Epoch
$0^d.56793$	2452846.6159

Cross-identification(s):
GSC 6315-0727

Date: 18 November 2003

Observer(s) and affiliation(s):
Oksanen, A. - Nyrola Observatory, Finland, arto.oksanen@jklsirius.fi

RA(J2000)	Dec(J2000)	type	Mag.
$02^h10^m13^s.46$	$+57°11'25''.3$	DSCT (?)	10.14-10.19 V

Period	Epoch
$0^d.153$	2452951.49

Cross-identification(s):
GSC 3693-1720

Date: 24 November 2003

Observer(s) and affiliation(s):
Hajek, P. - Brno Observatory, e-mail: phajek@sci.muni.cz
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Kudrnacova K. - Brno Observatory, e-mail: jkudrnacova@centrum.cz
Motl D. - Brno Observatory, e-mail: dmotl@volny.cz

RA(J2000)	Dec(J2000)	type	Mag.
$23^h29^m42\overset{s}{.}18$	$+55°03'47\overset{''}{.}1$	EW (?)	15.3 R

Period	Epoch
$0\overset{d}{.}6625$	2452859.3088

Cross-identification(s):
USNO-A2.0 1425-15156364

RA(J2000)	Dec(J2000)	type	Mag.
$00^h11^m22\overset{s}{.}08$	$+42°05'39\overset{''}{.}4$	EW (?)	15.1 R

Period	Epoch
$0\overset{d}{.}3281$	2452859.5092

Cross-identification(s):
USNO A2.0 1275-00120038

RA(J2000)	Dec(J2000)	type	Mag.
$23^h27^m02\overset{s}{.}40$	$+52°14'47\overset{''}{.}5$	EW (?)	12.8-13.0 V

Period	Epoch
$0\overset{d}{.}6152$	2452857.4245

Cross-identification(s):
GSC 3649 825 = USNO A2.0 1350-18288664

RA(J2000)	Dec(J2000)	type	Mag.
$21^h30^m09\overset{s}{.}23$	$+25°10'42\overset{''}{.}8$	EW (?)	14.3 R

Period	Epoch
$0\overset{d}{.}3816$	2452874.5556

Cross-identification(s):
GSC 2192 1283 = USNO A2.0 1125-18452169

RA(J2000)	Dec(J2000)	type	Mag.
$23^h03^m49\overset{s}{.}51$	$+59°30'03\overset{''}{.}6$	EW (?)	14.1 R

Period	Epoch
$0\overset{d}{.}5770$	2452879.4490

Cross-identification(s):
USNO A2.0 1425-14529683

Date: 25 November 2003

Observer(s) and affiliation(s):
Shevchenko, V.G. - Kharkiv Nat. Univ., shevchenko@astron.kharkov.ua

RA(J2000)	Dec(J2000)	type	Mag.
$04^h07^m13\overset{s}{.}9$	$+22°09'31''$	DSCT	14.8 V

Period	Epoch
$0\overset{d}{.}16$	2452942.45

Cross-identification(s):
GSC 1262-555 = USNO-A2.0 1050-01146056

Date: 6 January 2004
Observer(s) and affiliation(s): Sorokin, P. - Moscow Astronomy Club Antipin, S. - Sternberg Astronomical Institute and Institute of Astronomy, Russian Academy of Sciences, antipin@sai.msu.ru

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$00^{h}40^{m}44\overset{s}{.}22$	$+58°50'53''\!.9$	EA or EB	11.7 - 12.8 pg

Period	**Epoch**
$0\overset{d}{.}9805$	2444377.35

Cross-identification(s):
TYC 3667 826 1 = GSC 03667-00826

Date: 9 January 2004
Observer(s) and affiliation(s): Nelson, R. H. - Sylvester Robotic Observatory, Prince George, BC, Canada, bob.nelson@shaw.ca

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$00^{h}51^{m}00\overset{s}{.}15$	$+58°48'35''\!.9$	EB?	14.1 B, 13.7 R (USNO A2.0)

Period	**Epoch**
$0\overset{d}{.}7427$	2452974.5862

Cross-identification(s):
GSC 2.2 N311332336840 = RHN-2

Date: 13 January 2004
Observer(s) and affiliation(s): Sokolovsky, K.V. - Sternberg Astronomical Institute Antipin, S.V. - Sternberg Astronomical Institute and Institute of Astronomy, Russian Academy of Sciences, antipin@sai.msu.ru

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$16^{h}14^{m}26\overset{s}{.}17$	$+34°47'14''\!.0$	RRAB	16.3 - 17.0 pg

Period	**Epoch**
$0\overset{d}{.}475637$	2442930.36

Cross-identification(s):
USNO-A2.0 1200-07798871

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$16^{h}13^{m}24\overset{s}{.}4$	$+34°25'51''\!.1$	RRAB	16.1 - 17.1 pg

Period	**Epoch**
$0\overset{d}{.}536324$	2442926.44

Cross-identification(s):
USNO-A2.0 1200-07792474

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$16^h15^m28\overset{s}{.}67$	$+26°11'02\overset{''}{.}6$	RRAB	15.9 - 17.1 pg

Period	**Epoch**
$0\overset{d}{.}454522$	2442890.44

Cross-identification(s):
USNO-A2.0 1125-07562489

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$16^h04^m41\overset{s}{.}75$	$+29°16'25\overset{''}{.}8$	RRAB	14.5 - 15.9 pg

Period	**Epoch**
$0\overset{d}{.}605660$	2442902.44

Cross-identification(s):
USNO-A2.0 1125-07492086

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$16^h35^m41\overset{s}{.}29$	$+28°24'47\overset{''}{.}8$	RRAB	14.5 - 15.5 pg

Period	**Epoch**
$0\overset{d}{.}635820$	2442718.20

Cross-identification(s):
GSC 02056-00419 = USNO-A2.0 1125-07713177

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$16^h32^m07\overset{s}{.}25$	$+28°47'16\overset{''}{.}6$	RRAB	14.7 - 15.9 pg

Period	**Epoch**
$0\overset{d}{.}570045$	2442519.43

Cross-identification(s):
GSC 02056-00812 = USNO-A2.0 1125-07685034

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$16^h35^m15\overset{s}{.}51$	$+26°55'43\overset{''}{.}0$	EW	14.9 - 15.5 pg

Period	**Epoch**
$0\overset{d}{.}335543$	2442301.30

Cross-identification(s):
GSC 02052-01108 = USNO-A2.0 1125-07709696

Date: 21 January 2004

Observer(s) and affiliation(s):
Koff, R. A. - Antelope Hills Observatory, Bennett, CO USA,
bob.koff@worldnet.att.net

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$08^h31^m25\overset{s}{.}25$	$+11°48'13\overset{''}{.}1$	EW	13.6 - 14.2 V

Period	**Epoch**
$0\overset{d}{.}3237$	2452642.9987

Cross-identification(s):
GSC 0804-0118 = USNO-B2.0 1018-0170646

Date: 21 January 2004

Observer(s) and affiliation(s):
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Merkulova, N. I. - Crimean Astrophysical Observatory, nelly@crao.crimea.ua
Sergeeva, E. A. - Crimean Astrophysical Observatory, selena@crao.crimea.ua

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$06^h51^m33\overset{s}{.}5$	$+74°23'35''$	EA	14.26 V

Period	**Epoch**
$0\overset{d}{.}952241$	2452727.3070

Cross-identification(s):
GSC 04371-0161

Date: 22 January 2004

Observer(s) and affiliation(s):
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Richwine, P. - University of Arizona, pebbler@email.arizona.edu

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$18^h38^m14\overset{s}{.}04$	$-05°31'15\overset{''}{.}1$	M	13.6 - ¡15 (V)

Period	**Epoch**
191^d	2452517

Cross-identification(s):
USNO
B1.0 0844-0397216 = 2MASS J18381408-0531148 = MSX6C G026.5153+00.4088

Date: 23 January 2004

Observer(s) and affiliation(s):
Koff, R. A. - Antelope Hills Observatory, Bennett, CO USA, bob.koff@worldnet.att.net

RA(J2000)	**Dec(J2000)**	**type**	**Mag.**
$06^h35^m40\overset{s}{.}52$	$+42°04'14\overset{''}{.}9$	EW?	13.4 - 13.8 V

Period	**Epoch**
$0\overset{d}{.}4388$	2453000.7148

Cross-identification(s):
GSC 2936 0478 = USNO-B1.0 1320-0191566

Date: 26 January 2004

Observer(s) and affiliation(s):
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Panagiotis Niarchos - University of Athens, Athens, Greece, pniarcho@cc.uoa.gr

RA(J2000)	Dec(J2000)	type	Mag.
$14^h19^m41^s$	$+05°54'06''$	EW	10.4 (V)

Period	Epoch
$0^d.56717$	2452767.3482

Cross-identification(s):
GSC 0323-0830

Date: 26 January 2004

Observer(s) and affiliation(s):
Koff, R. A. - Antelope Hills Observatory, Bennett, CO USA,
bob.koff@worldnet.att.net

RA(J2000)	Dec(J2000)	type	Mag.
$06^h53^m23^s.5$	$+19°10'24''.8$	EB?	13.6 - 14.3 V

Period	Epoch
$0^d.5997$	2452678.7571

Cross-identification(s):
USNO-A2.0 1050-04473675 = USNO-B1.0 1091-0130715

Date: 26 January 2004

Observer(s) and affiliation(s):
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RA(J2000)	Dec(J2000)	type	Mag.
$18^h43^m23^s.82$	$-21°20'37''.7$	EA	13.18-13.84

Period	Epoch
$1^d.6351$	2452875.9458

Cross-identification(s):
MisV0665 = GSC 6292-01507 = USNO-A2.0 0675.29051924

ERRATUM FOR IBVS 5500

Geert Hoogeveen reported the following error:

IBVS No.	item	printed	correct
5500	identifier (# 5)	GSC 3328-0163	GSC 6328-0163