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GSC 4004_1211: A NEW VARIABLE IN THE FIELD OF V360 CASSIOPEIAE

WOLFGANG MOSCHNER[1], ENRIQUE GARCIA-MELENDO[2]

[1] Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D-12169 Berlin, Germany, e-mail: wolfgang.moschner@t-online.de

[2] Esteve Duran Observatory, El Montanya-Seva, 08553 Seva, Barcelona, Spain,
e-mail: duranobs@astro.gea.cesca.es

Name of the object:
GSC 4004_1211

Equatorial coordinates:	**Equinox:**
R.A.= $23^h34^m17^s$ **DEC.=** $+55°53'58''$	2000.0

Observatory and telescope:
Private Observatory in Lennestadt, 0.32-m Ritchey-Chretien telescope; Esteve Duran Observatory, 0.6-m Cassegrain telescope

Detector:	CCD

Filter(s):	*V*

Comparison star(s):	GSC 4008_809

Check star(s):	GSC 4004_1159, GSC 4004_1259

Transformed to a standard system:	No

Availability of the data:
Through IBVS Web-site as 4701-t1.txt

Type of variability:	DSCT:

Remarks:

The variability of GSC 4004_1211 was found while being used as comparison star for V360 Cas. CCD observations show that this object has light variations with an amplitude in the V band close to 0.1 magnitude and a period of 0.129701 ± 0.000002 days. The shape of the light curve indicates that this variable is not an ellipsoidal nor eclipsing binary system. Although the period has remained stable for almost a year, from 31 October 1997 to 7 October 1998, the light curve shows instabilities from cycle to cycle similar to those of a Delta Sct star. To derive more information about GSC 4004_1211, its average $B - V$ color index was estimated using the TYCHO star GSC 4004_0715. Photometric data showed that $B - V = 0.61 \pm 0.07$. This value is redder than the typical one for a Delta Sct variable, but GSC 4004_1211 is near the Galactic plane and it might be affected by interstellar extinction. Figure 1 shows the light curve of GSC 4004_1211 folded according to the given period. To construct Figure 1 and due to light curve instabilities, the zero epoch was arbitrarily fixed.

Acknowledgements:

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

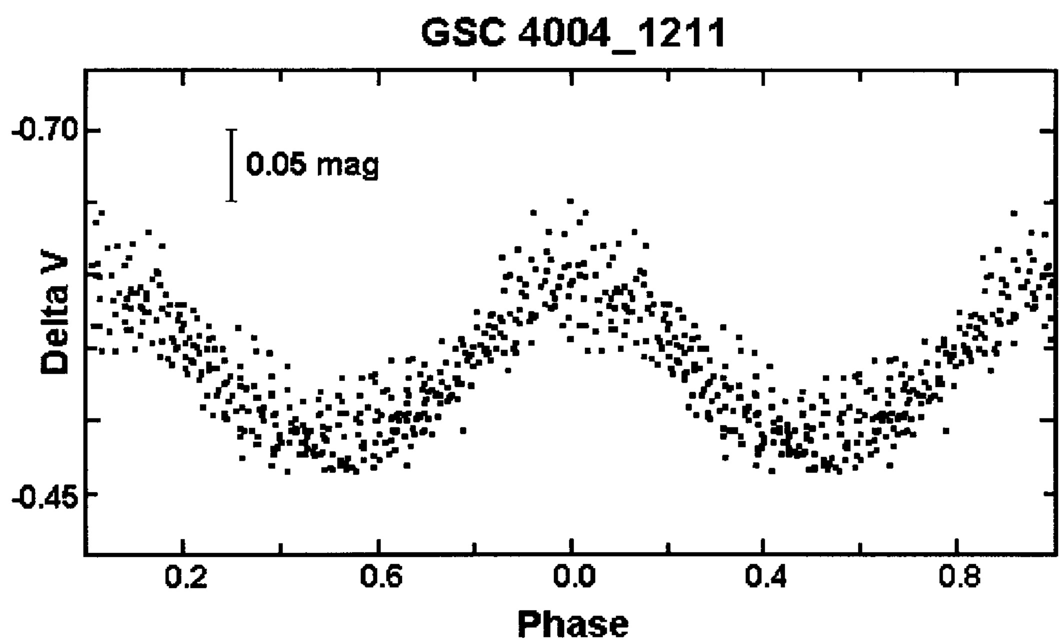

Figure 1.

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OBSERVATIONS OF SELECTED HIPPARCOS VARIABLES

J.M. GOMEZ-FORRELLAD[1], E. GARCIA-MELENDO[2], J. GUARRO-FLO[1], J. NOMEN-TORRES[1], J. VIDAL-SAINZ[1]

[1] Grup d'Estudis Astronomics, Apartado 9481, 08080 Barcelona, Spain, e-mail: jmgomez@astro.gea.cesca.es

[2] Esteve Duran Observatory Foundation, El Montanya-Seva, 08553 Seva, Barcelona, Spain, e-mail: duranobs@astro.gea.cesca.es

New photometric observations of nine HIPPARCOS variables, performed between 1997 and 1998, are presented. Most of these stars were selected on the basis of a new analysis of the satellite data, which suggested that the actual type of variability could be different from the originally listed in the HIPPARCOS and TYCHO catalogues (ESA, 1997). In the 74th Special Name-list (Kazarovets et al., 1999), some of these observed stars were correctly reclassified, but the new data showed that still some of them are improperly classified. In all cases observations allowed to improve the existing satellite light curve and ephemeris. Table 1 lists the observational log for these objects whereas Table 2 summarizes the obtained results.

Table 1

HIP	Observational interval	Comparison	Check star(s)	Remarks
8821	23 Nov 1997–24 Jan 1998	SAO 004489	SAO 004515	1
13221	09 Oct 1997–27 Feb 1998	SAO 4750	HD 17785	2
23809	05 Jan 1998–24 Jan 1998	PPM 175726	PPM 701984	3
51677	27 Dec 1997–18 Mar 1998	SAO 099182	—	4
89972	24 Mar 1998–12 Jul 1998	SAO 103639	GSC 1572_1341	5
90972	02 Aug 1997–03 Oct 1997	GSC 3917_1556	—	6
95547	19 Jun 1998–04 Oct 1998	SAO 124627	—	4
110464	21 Aug 1997–27 Sep 1997	SAO 127488	—	4
115627	30 Sep 1997–09 Oct 1997	SAO 108599	SAO 108577 SAO 108586	7

Remarks to Table 1:

1 Piera Observatory, 14-cm telescope
2 Mollet del Valles Observatory, 8-cm telescope
3 Monegrillo Observatory, 41-cm telesope
4 Mollet del Valles Observatory, 41-cm telescope
5 Esteve Duran Observatory, 60-cm telescope
6 L'Estelot Observatory, 18-cm telescope
7 Esteve Duran Observatory, 6-cm telescope

V776 Cas. Catalogued as an EW: in the 74th Special Name-List. This object was also included in a list of low amplitude EW system candidates by Duerbeck (1997). New photometric observations confirm the binary nature of this star: an EW undergoing marginal

Table 2

HIP	GCVS-Name	V mag. range*	Spectral type	Variable type
8821	V776 Cas	0.156—0.137	F0	EW or ELL
13221	V793 Cas	0.254—0.252	B8	EA
23809	V1363 Ori	0.214—0.179	F8	EW or ELL
51677	ET Leo	0.136—0.104	G5	EW or ELL
89972	—	0.18 —0.03	A0	EA
90972	HI Dra	0.189—0.170	F8	EB or ELL
95547	V1454 Aql	0.161—0.033	A2	EA
110464	PU Peg	0.103—0.079	F0	EB
115627	V351 Peg	0.32	A9III	EW

* When two magnitude ranges are given, the first one corresponds to minimum I and the second one to minimum II.

eclipses or an ellipsoidal variable (Figure 1).

$$\begin{array}{ll}\text{Min. I} = \text{HJD } 2448500.0850 + 0\overset{\text{d}}{.}440413 \times E. \\ \qquad\qquad\qquad\pm 0.0001 \ \ \pm 0.000001\end{array}$$

V793 Cas. Classified as an EB eclipsing binary system, the new photometric data indicate that this object is actually an Algol-type variable (Figure 2) and confirm the original HIPPARCOS ephemeris. The following primary minimum timing was derived:

$$\begin{array}{l}\text{Min. I} = \text{HJD } 2450810.4740, \quad \text{epoch} = 1398.0. \\ \qquad\qquad\qquad \pm 0.0005\end{array}$$

V1363 Ori. This star was classified as EW? with a period of 0.431915 days and brightness variation from $10\overset{\text{m}}{.}346$ to $10\overset{\text{m}}{.}590$ in the V band (ESA, 1997). In the 74th Special Name-List, the star was catalogued as an EW. New data show that this object is an EW or ELL variable (Figure 3). A $-0\overset{\text{m}}{.}01$ O'Connell effect (Max. I – Max. II, Max. I is the maximum following the primary minimum), also present in the folded HIPPARCOS light curve, was detected.

$$\begin{array}{ll}\text{Min. I} = \text{HJD } 2448500.0288 + 0\overset{\text{d}}{.}431921 \times E. \\ \qquad\qquad\qquad\pm 0.0001 \ \ \pm 0.000001\end{array}$$

ET Leo. Initially listed as an unknown variability type, with a period of 0.1732510 days and a brightness variation from $9\overset{\text{m}}{.}5494$ to $9\overset{\text{m}}{.}721$ in the V band (ESA, 1997). In the 74th Special Name-List, the star was catalogued as an EW:. The object was also included in a list of EW binary stars candidates of low amplitude by Duerbeck (1997). Observations show that it is a W UMa star undergoing marginal eclipses or an ELL (Figure 4).

$$\begin{array}{ll}\text{Min. I} = \text{HJD } 2448499.9714 + 0\overset{\text{d}}{.}346503 \times E. \\ \qquad\qquad\qquad\pm 0.0010 \ \ \pm 0.000002\end{array}$$

HIP 89972. This object was catalogued as an unsolved variable with a brightness variation from $10\overset{\text{m}}{.}260$ to $10\overset{\text{m}}{.}490$ (ESA, 1997). Photometric observations showed that it is an Algol-type object (Figure 5). The position of the secondary minimum at phase 0.488, also suggests that the orbit might not be circular.

$$\begin{array}{ll}\text{Min. I} = \text{HJD } 2451002.5657 + 0\overset{\text{d}}{.}920505 \times E. \\ \qquad\qquad\qquad\pm 0.0004 \ \ \pm 0.000004\end{array}$$

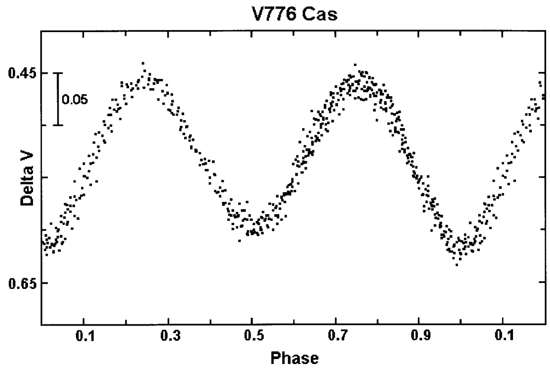

Figure 1.

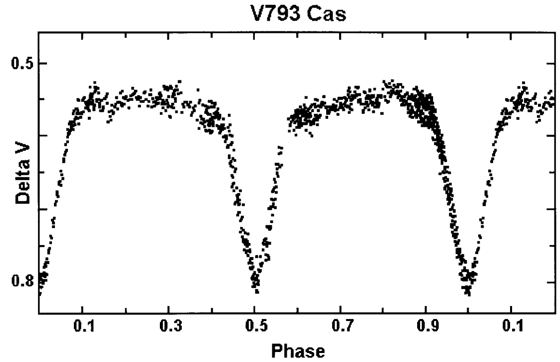

Figure 2.

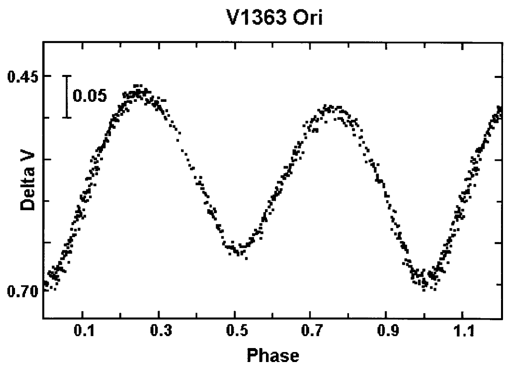

Figure 3.

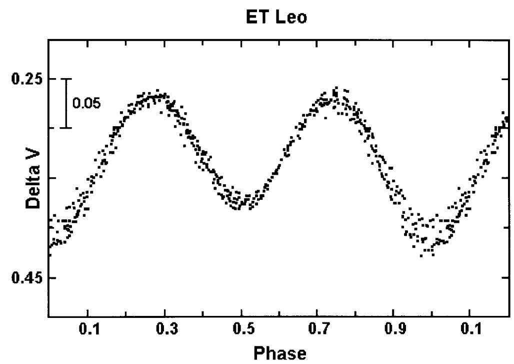

Figure 4.

HI Dra. Star listed in the HIPPARCOS catalogue and later classified in the 74th Special Name-List as an RRc variable. An analysis of the satellite data indicated that this object was probably an ellipsoidal or Beta Lyrae variable. New photometric observations confirmed that light variations are due to binarity (Figure 6). In addition, the folded light curve shows an O'Connell effect of $0\overset{\mathrm{m}}{.}02$, also present in the folded HIPPARCOS light curve.

$$\text{Min. I} = \text{HJD } 2448500.3186 + 0\overset{\mathrm{d}}{.}597417 \times E.$$
$$\pm 0.0010 \quad \pm 0.000003$$

V1454 Aql. In the 74th Special Name-list of Variable Stars this object is listed as E:. An analysis of the photometric satellite data allowed to determine that it is an Algol-type eclipsing binary star. New photometric observations confirmed this point (Figure 7).

$$\text{Min. I} = \text{HJD } 2451010.49765 + 1\overset{\mathrm{d}}{.}049648 \times E.$$
$$\pm 0.00032 \quad \pm 0.000002$$

PU Peg. Light curve is depicted in Figure 8.

$$\text{Min. I} = \text{HJD } 2448500.05048 + 0\overset{\mathrm{d}}{.}862014 \times E.$$
$$\pm 0.00010 \quad \pm 0.000064$$

V351 Peg. Star catalogued as an RRc variable in the HIPPARCOS catalogue, and in the 74th Special Name-list. An analysis of the satellite data and new photometric observations showed that this star is not an RRc Lyrae star but an EW eclipsing binary system (Figure 9). Minimum I and II cannot be unambiguously distinguished from the observations. In the given ephemeris the best observed minimum was taken as the primary one.

$$\text{Min. I} = \text{HJD } 2448500.493 + 0\overset{\mathrm{d}}{.}593297 \times E.$$
$$\pm 0.001 \quad \pm 0.000001$$

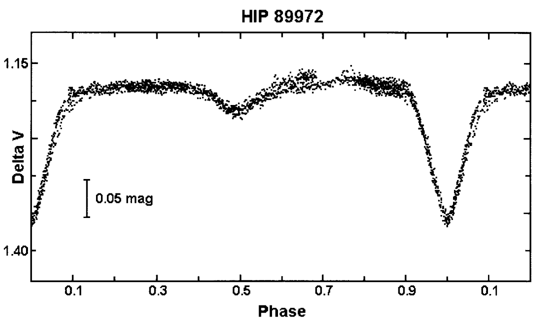

Figure 5.

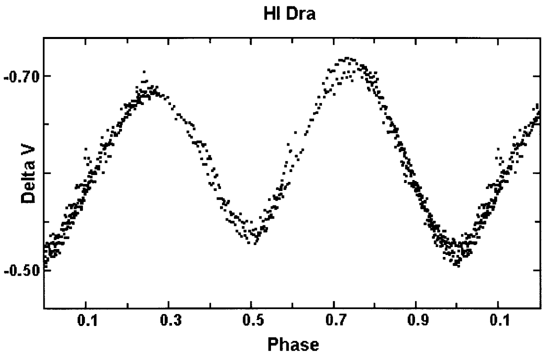

Figure 6.

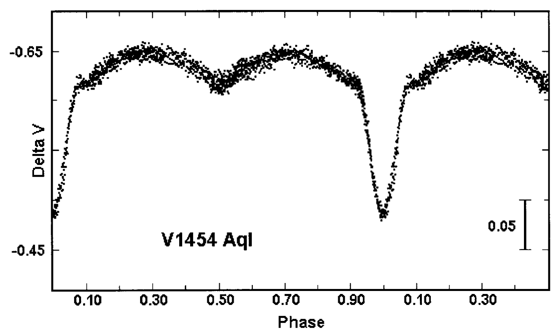

Figure 7.

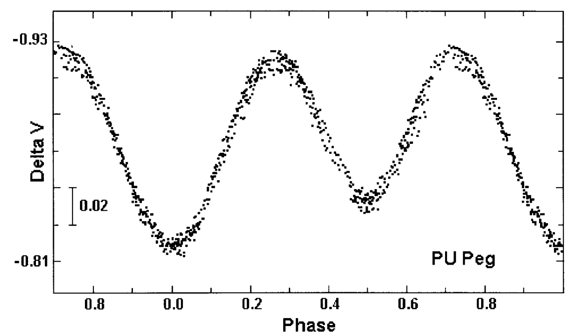

Figure 8.

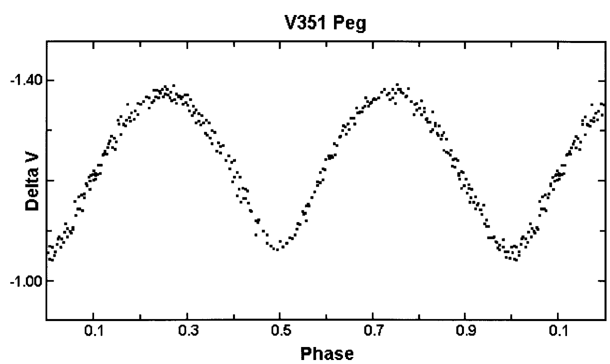

Figure 9.

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Kazarovets, A.V., Samus, N.N., Durlevich, O.V., Frolov, S.V., Antipin, S.V., Kireeva, N.N., Pastukhova, E.E., 1999, IBVS No. 4659

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HD 182844: A NEW LOW AMPLITUDE VARIABLE STAR

J.M. GOMEZ-FORRELLAD

Grup d'Estudis Astronomics, Apartat 9481, 08080 Barcelona, Spain, e-mail: jmgomez@astro.gea.cesca.es

Name of the object:
HD 182844 = SAO 124629 = PPM 167860 = BD +03°4021 = AGK +03°2464 = = GSC 469_2661

Equatorial coordinates:	**Equinox:**
R.A.= $19^{\rm h}26^{\rm m}34\overset{\rm s}{.}5$ **DEC.=** $+03°31'51\overset{''}{.}5$	2000.0

Observatory and telescope:
Mollet del Valles Observatory, 0.4-m Newtonian telescope

Detector:	CCD

Filter(s):	V

Comparison star(s):	HD 182810 = SAO 124627 = PPM 167855 = = BD +03°4018 = AGK +03°2463 = GSC 469_690

Check star(s):	No suitable check star was available within the CCD frames

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	Unknown

Remarks:

HD 182844 is a B8 or B9 star with a V magnitude of 9.4. It was found variable while used as comparison star for V1454 Aql. Photometric observations show a brightness variation of 0.033 magnitudes with a period of 0.96 days. The light curve is slightly asymmetric and it is not possible to establish the type of variability. Data cannot be satisfactorily overlapped after being folded with a double period, so it is probably not an ellipsoidal variable. Another possibility is a 53 Per (SPB) pulsating object. Nevertheless, the prewhitened light curve after removing the main frequency component does not show additional periodicities. According to Waelkens (1993), 53 Per stars sometimes must be observed for more than one season to detect multiperiodicity. It may also be a Bp star, but there is insufficient spectral information to support this hypothesis. The following ephemeris was computed:

$$\text{Max} = \text{HJD } 2\,451\,012.4826 + 0\overset{\text{d}}{.}962 \times E.$$
$$\pm 0.0030 \quad \pm 0.003$$

Acknowledgements:

For this research the SIMBAD database, operated by CDS, Strasbourg, France, has been utilized

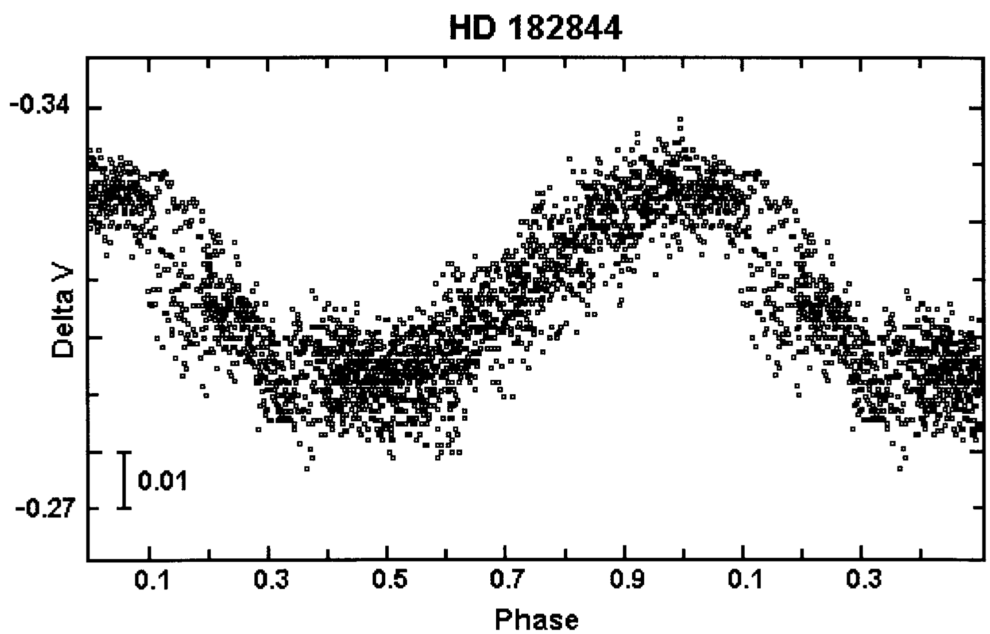

Figure 1.

Reference:

Waelkens, C., 1993 in *New Perspectives on Stellar Pulsation and Pulsating Variable Stars*, Nemec, J.M. and Matthews, J.M. editors, Cambridge University Press, p. 180

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NEAR-IR PHOTOMETRY AND OPTICAL SPECTROSCOPY OF THE HERBIG Ae STAR AB AURIGAE

M.E. VAN DEN ANCKER[1], A.W. VOLP[1], M.R. PÉREZ[2], D. DE WINTER[3]

[1] Astronomical Institute, University of Amsterdam, Kruislaan 403, 1098 SJ Amsterdam, The Netherlands
E-mail: mario@astro.uva.nl

[2] SM&A Corp., 9315 Largo Drive West, Suite 250, Largo MD 20774, USA

[3] Instituto de Astrofísica de Canarias, C/ Via Láctea s/n, 38200 La Laguna, Tenerife, Spain

AB Aur (HD 31293; A0Ve+sh) is often considered prototypical of the class of Herbig Ae stars, optically visible pre-main sequence stars of intermediate mass surrounded by circumstellar disks of dust and gas. Its photometric and spectral properties are well studied over a wide wavelength range (e.g. Böhm & Catala 1993; Grady et al. 1999; van den Ancker et al. 1999; Catala et al. 1999). Although photographic measurements in the beginning of this century (Gaposchkin 1952 and references therein) showed the star to be strongly variable, it has remained nearly constant (Herbst et al. 1994; van den Ancker et al. 1998) until a fading of ≈ 1 magnitude in brightness from Nov. 30 to Dec. 1, 1997, reported by amateur observers (Kawabata et al. 1998 and references therein). Such an event had not been observed since the start of photoelectric measurements of AB Aur, more than 30 years ago. Although puzzling, this report did not trigger immediate response from the astronomical community since such irregular photometric behaviour is known to occur in other Herbig Ae stars and is attributed in these systems to variable extinction towards the central star by dust clouds moving in and out of our line of sight. However, a recent IAU circular (Ashok et al. 1999) reports that in January 1999, the near-infrared brightness of AB Aur, due to thermal emission from dust in the circumstellar disk, has decreased by more than a magnitude, and the Paβ and Brγ lines, known to be prominent from literature (Harvey 1984; Evans et al. 1987; Nisini et al. 1995; Rodgers & Wooden 1998), are no longer present in emission. These observations suggest that the optical event at the end of 1997 might be related to an EXOR event (after the prototype EX Lup; Herbig 1977; Herbst et al. 1994), in which a considerable part of the inner circumstellar disk, seen nearly edge-on, was accreted, as opposed to an UXOR event (after UX Ori; Bibo & Thé 1990; Grinin et al. 1998), in which matter moves in and out of our line of sight, but in which the total amount of dust does not change.

To further investigate the changes in the AB Aur system, we have obtained new near-IR photometry of AB Aur using the 1.5-m Carlos Sanchez Telescope (CST) at the Izaña observatory on Tenerife on April 24, 1999 (JD 2451292.862). The data were taken through a 20″ diaphragm and reduced in a standard fashion. The resulting magnitudes ($J = 6.25 \pm 0.06$, $H = 5.36 \pm 0.05$, $K = 4.51 \pm 0.05$) are about a magnitude brighter than the ones reported by Ashok et al. (1999) and are only marginally fainter than older

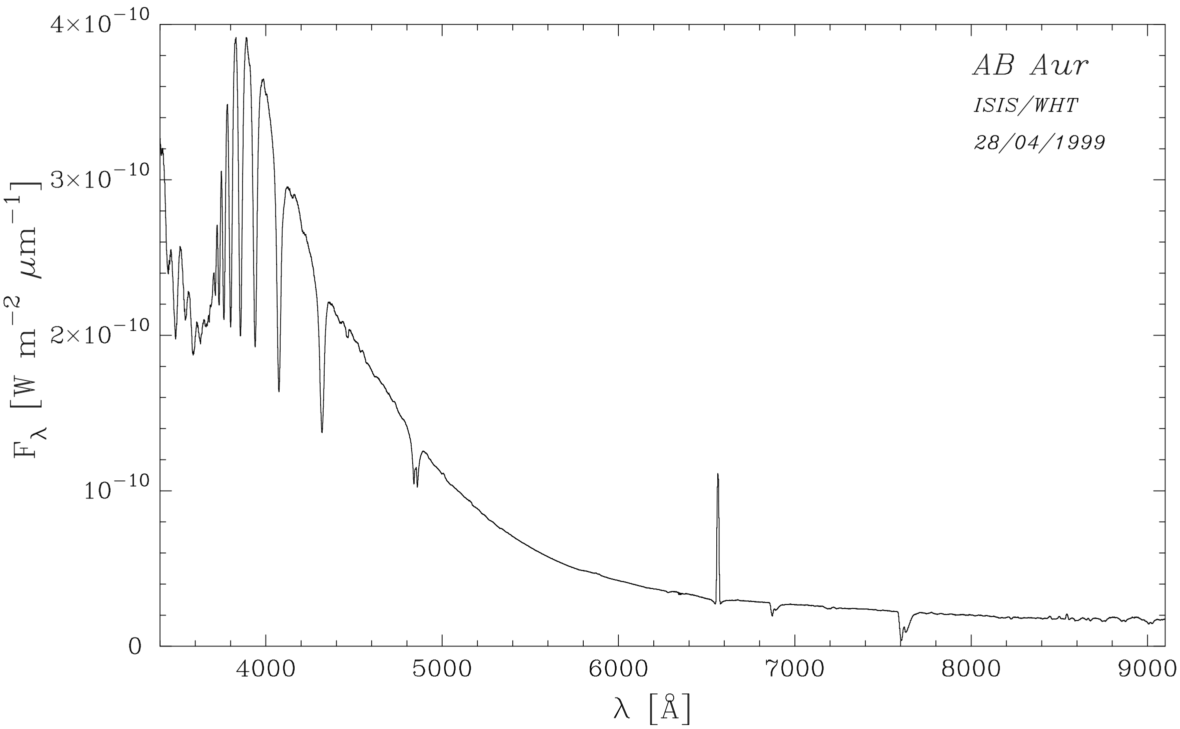

Figure 1. Merged optical spectra of AB Aur taken on April 28, 1999 with ISIS at WHT.

literature values (Strom et al. 1972; Cohen & Schwartz 1976; Lorenzetti et al. 1983; Berrilli et al. 1987). On April 28, 1999, optical spectra of AB Aur in the 3000–8200 Å (at JD 2451297.359; 1.9 Å pixel^{-1}) and 6100–9100 Å (at JD 2451297.362; 2.7 Å pixel^{-1}) wavelength ranges were obtained in service mode with the ISIS spectrograph on the 4.2-m William Herschel Telescope (WHT) at La Palma. The spectra were reduced with the usual steps of bias subtraction, flatfielding, background subtraction and spectral extraction, and wavelength and flux calibration. Since the night in which the spectra were taken was not of photometric quality, the absolute fluxes of the spectra were scaled to photometric literature values, and they were merged into one single spectrum (Fig. 1). A plot in which the continuum has been normalized to 1 and in which some of the features are identified is shown in Fig. 2.

In our new AB Aur spectral data, emission components are clearly present in H I (Hβ, Hα and the Paschen lines up to P12), He I, Na I, O I and the red Ca II triplet. Except for the chromospheric He I emission at 5875 and 6678 Å, which appears somewhat stronger, the relative strength of all spectral features are within errors equal to those given in the spectral atlas of AB Aur by Böhm & Catala (1993). Strong variability of the He I emission strength was already noted by those, as well as by other authors (Catala et al. 1993, 1997, 1999). Our He I line strengths are within the range of values found in literature.

The new near-IR photometry and optical spectroscopy of AB Aur presented here shows that if the reported infrared variability is real, the system has returned to its normal, inactive, state within 100 days of the measurements taken by Ashok et al. (1999). If the previous active phase was due to an EXOR-like enhanced accretion episode, the mechanisms responsible for keeping the circumstellar disk stable must therefore have replenished the inner disk material with material from the outer disk within this period.

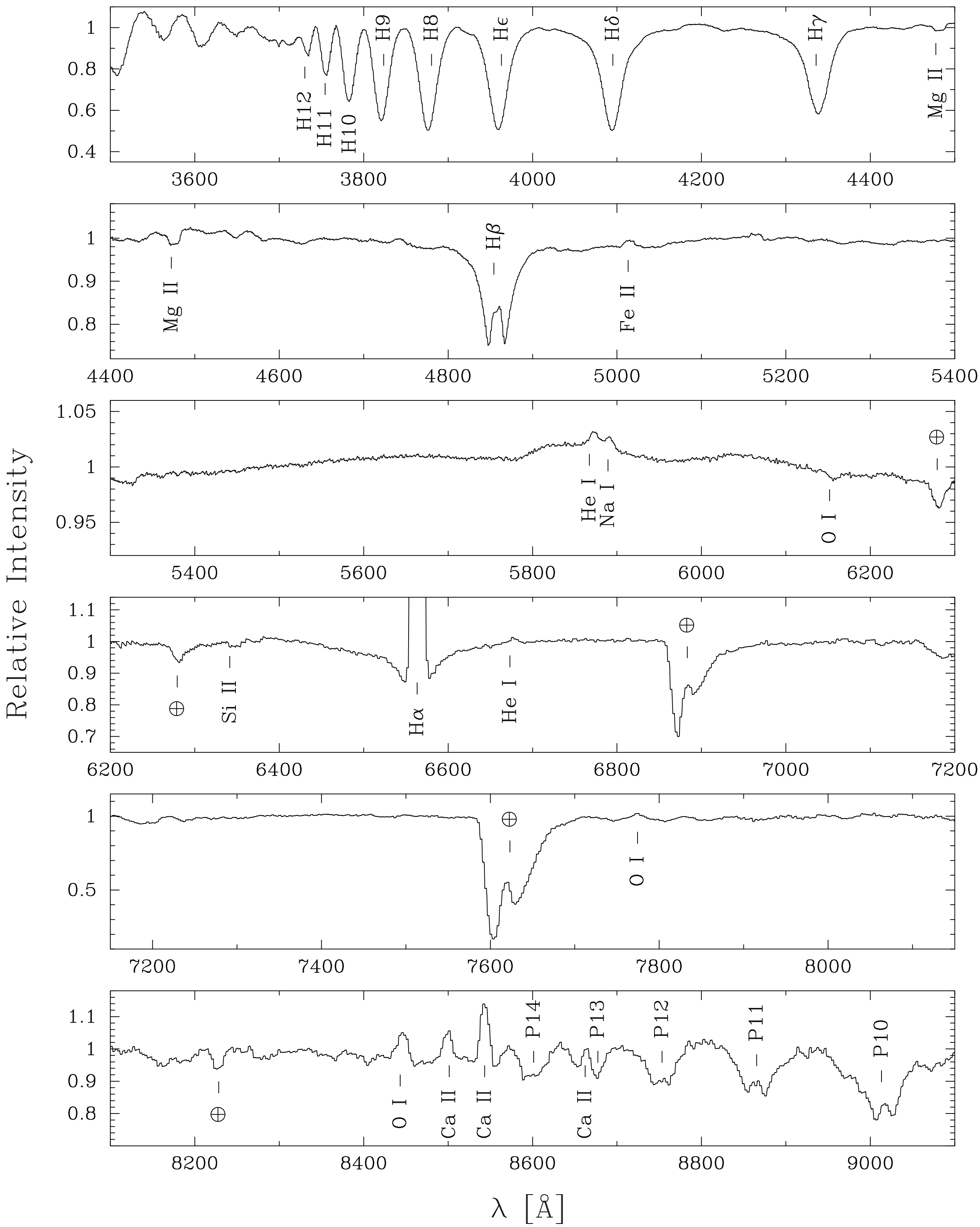

Figure 2. Normalized optical spectra of AB Aur with the most prominent features identified.

Acknowledgements. MvdA acknowledges financial support through NWO/NFRA grant 614.41.003. The WHT is operated on the island of La Palma by the Isaac Newton Group in the Spanish Observatorio del Roque de los Muchachos of the Instituto de Astrofísica de Canarias

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γ Dor CANDIDATES IN THE OPEN CLUSTER M34

KEVIN KRISCIUNAS[1] AND BRIAN M. PATTEN[2]

[1] Department of Astronomy, University of Washington, Box 351580, Seattle, WA 98195, USA, e-mail: kevin@astro.washington.edu

[2] Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA, e-mail: bpatten@cfa.harvard.edu

The γ Dor stars are early F-type stars located on or near the main sequence in the HR diagram, either at or just redward of the cool (red) edge of the δ Scuti instability strip. γ Dor variables, as a class, are non-radial, gravity-mode pulsators (Krisciunas 1998). In 1997, Krisciunas & Crowe suggested that six early F-type stars in the open cluster M34 (NGC 1039) showed evidence for photometric variability over the course of a given night or from night to night. From 27 September to 5 October 1997 (UT) we obtained CCD time-series photometry for four of these six stars in two overlapping 11.5×11.5 arcmin fields (which we call A and B) in the central region of M34. The data were taken with the USNO 1-m reflector, located near Flagstaff, Arizona, using a 1024×1024 CCD and broad-band filters with effective wavelengths of 4825 Å and 6161 Å. These filters, designated g' and r', are identical to those being used for the Sloan Digital Sky Survey (Fukugita et al. 1996). In this paper, we shall refer to the M34 stars by their "UVa" numbers (Ianna & Schlemmer 1993).

The primary goal of our time-series survey was to characterize the relative levels of variability amongst M34 member stars, not to measure absolute photometry. To that end, we elected to use an ensemble averaging technique where the mean magnitude of a set of demonstrably constant stars at each of the sky positions was used as the reference magnitude for differential photometry. In order to select a set of constant stars for each position, we used an iterative approach where we started by using all of our program stars in each position for the ensemble average (39 stars in position A and and 65 stars in position B) and then rejecting those stars with the largest variations with respect to the reference magnitude. In the end we selected 9 stars in position A and 12 stars in position B for the ensemble average determinations. These stars show variations of ± 5.5 mmag with respect to the ensemble average in their positions and thus set the limit for the amplitude of variations we are able to detect in the remaining program stars.

We note that two previously suspected variable stars, UVa 161 and UVa 162 (Krisciunas & Crowe 1997), are now believed to be constant. In fact, both of these stars are used as a part of the reference ensemble for position A in M34. Welch & Stetson (1993) have devised a simple index for determining whether a star is variable. If the variability is due to a temperature effect (e.g., pulsations or rotational modulation due to star spots), the variations observed in one broad-band filter should be correlated with the variations in another filter. For noiseless photometry of an ideal temperature-variable star using two wavelength-adjacent filters (such as g' and r'), the Welch-Stetson variability index would be +1.00. If two-filter photometry gives a Welch-Stetson index of 0.00 for a given star, then it is not temperature-variable. For our two ensemble average stars and former suspected variables, UVa 161 and 162, we derive Welch-Stetson variability indices of +0.11 and +0.20. This result, when combined with a visual inspection of the light curves and a lack of any strong peaks in their Fourier power spectra show that these stars are demonstrably constant.

Our time-series campaign revealed a number of new variable stars. The γ Dor candidates are discussed here while the cooler variables (likely spotted stars) will be the subject of a separate paper (Patten & Krisciunas 1999). The two γ Dor candidates are UVa 144 (located in position A of the survey) and UVa 224 (located in position B of the survey).

UVa 144 has a Welch-Stetson variability index of +0.69 and shows evidence for two periods, $P_1 = 0.6587$ and $P_2 = 0.7812$ days, with false alarm probabilities of 0.0012 and 0.060, respectively. The 1997 g' data are characterized by sinusoids with amplitudes (i.e. half of peak-to-peak) of 12.3 ± 1.5 and 6.7 ± 1.4 mmag, respectively. We have combined the V-band data of 1996 with the g' data of 1997, normalizing each to the mean values of the two observing runs. In Figure 1 we show the combined data for the two observing seasons, folded by P_1, but *without* pre-whitening by P_2. For those γ Dor stars which have been well-characterized, it has been found that while the photometric *amplitudes* of individual stars may be variable, the periods are often quite stable. Figure 1 shows that this holds true for UVa 144. That the combined photometry folds well strongly suggests that we have measured the true principal period and not settled on an alias of this period.

UVa 224 was our best γ Dor candidate in M34 from scanty observations made in September 1996. The two-filter photometry of 1997 yields a Welch-Stetson variability index of +0.45, not a particularly large value. However, we believe part of the explanation for this value lies in the low amplitude of variability of this star in 1997, as compared to the 1996 light curve. The photometric amplitude from the 1997 g' data is 6.5 ± 1.2 mmag. The 1996 data indicate a V-band amplitude of 25 ± 6 mmag. Since the photometric amplitude of γ Dor stars diminishes from 4400Å to 5500Å, and presumably continues to diminish at even longer wavelengths, the combination of photometric noise with low amplitudes might reasonably give a smaller Welch-Stetson index. The biggest peak in the power spectrum of UVa 224 yields a period of 0.9295 days, with a false-alarm probability of 0.0076. If we assume the period determined from the 1997 data is close to the true period and we also assume that period is stable, we find that the 1996 data also fold reasonably well to the 1997 period.

It is possible that the true second period of UVa 144 is the one day alias of the value given above, or $(1 + 1/P_2)^{-1} \approx 0.439$ d. Similarly, for UVa 224 the one day alias of the period given above (≈ 0.482 d) might be its true principal period. These values are not unheard of for γ Dor stars (e.g. BS 8799; Zerbi et al. 1999). Only a multi-longitude photometric campaign or extensive single-site photometry over the course of a full season could decide the matter.

We feel confident that we have identified two γ Dor candidates in M34. We call these stars *candidates*, not *bona fide* γ Dor stars, because we have no spectroscopic evidence (i.e. radial velocity and/or line profile variations) to prove conclusively that these two stars are non-radial pulsators. The evidence to date suggests that the γ Dor phenomenon occurs in young stars (Krisciunas et al. 1995 and references therein). While no γ Dor variables have been found in the Hyades (age about 625 Myr; Perryman et al. 1998), the much younger (100 Myr) open cluster NGC 2516 has several γ Dor candidates (Zerbi et al. 1998). M34 has an age of about 250 Myr (Ianna & Schlemmer 1993). Under the assumption that

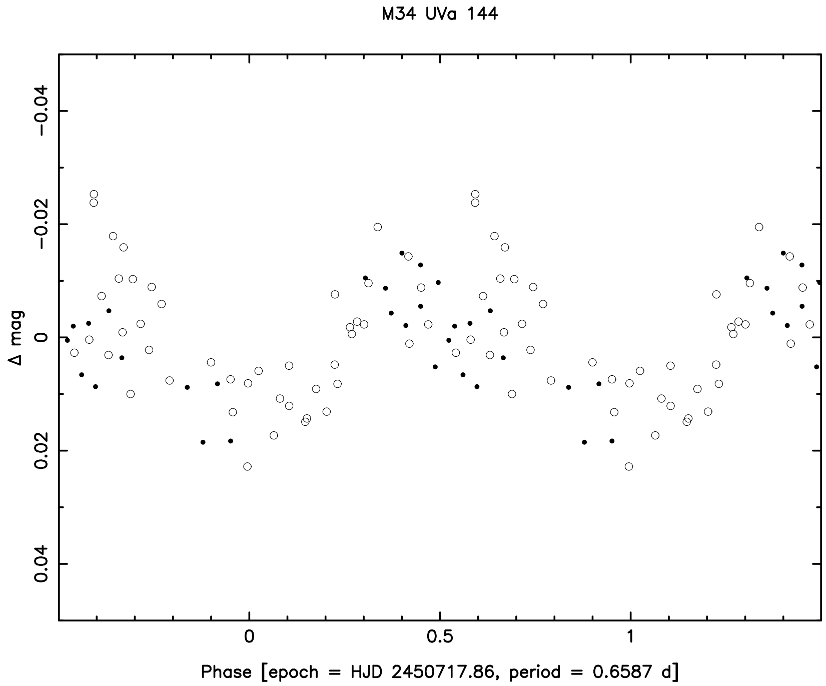

Figure 1. Folded light curve of the M34 star UVa 144. The V-band data of 1996 (dots) and the g'-band data of 1997 (open circles) have been folded with a period of $P_1 = 0.6587$ days. The data have *not* been pre-whitened by the sinusoid with $P_2 = 0.7812$ days.

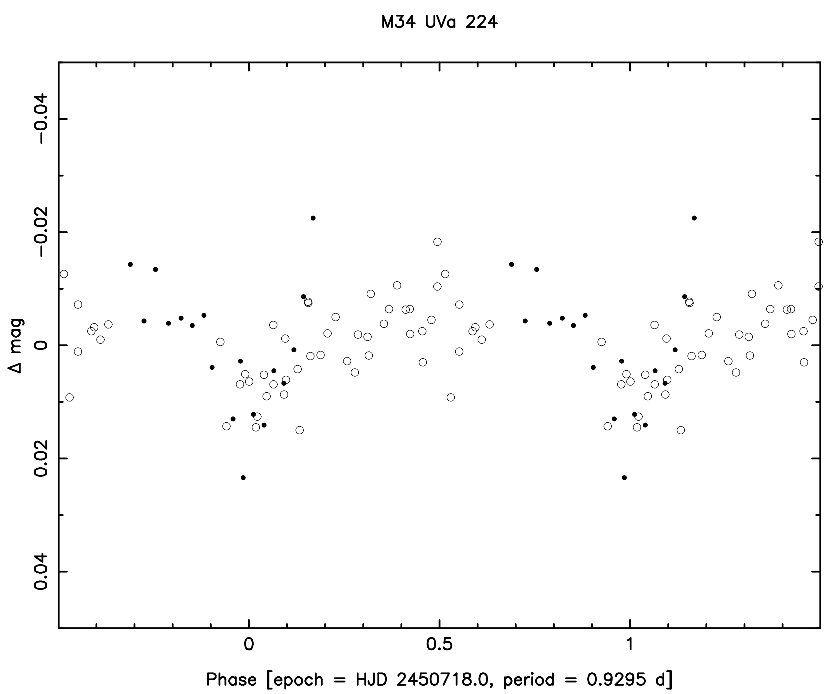

Figure 2. Folded light curve of the M34 star UVa 224. The V-band data of 1996 (dots) and the g'-band data of 1997 (open circles) have been folded with a period of 0.9295 days.

γ Dor-type variability is just a phase in the life of an early F-type star which ends when its thin convection zone develops, we have shown that the γ Dor phenomenon can persist at least until such a star is 250 Myr old.

Acknowledgments: We thank Hugh Harris of the U. S. Naval Observatory for arranging the telescope time; Bruce Margon and the Sloan Digital Sky Survey project for travel support; and Lowell Observatory for accommodations.

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V500 Aql: AN ECLIPSING CLASSICAL NOVA

R. HAEFNER

Universitäts–Sternwarte, Scheinerstr. 1, 81 679 München, Germany

V500 Aql (Nova Aquilae 1943) experienced little observing attention. The rather incomplete outburst light curve (e.g. Payne–Gaposchkin, 1957) nevertheless allowed the classification as a moderately fast nova ($t_3 = 42^{\rm d}$). After reaching the maximum brightness of about 6.1 mag (photographic) the system faded to 17.8 mag. Its distance amounts to 4.9 kpc (e.g. Shafter, 1997). From a spectrum taken about 170 days after maximum the expansion velocity was determined to be $\sim$ 2800 km s^{-1} (Sanford, 1943). Based on the presence of [Ne III] and [Fe VII] lines in this spectrum Della Valle and Livio (1998) suggest this nova to be a member of the He/N class. Further information (e.g. coordinates, finding chart, literature) may be found in the catalogues published by Duerbeck (1987) or Downes et al. (1997).

The present photometric observations were obtained in August 1994 using the CCD camera on the 0.9-m Dutch telescope at the European Southern Observatory. Since the star appeared quite faint ($\sim$ 20 mag) the measurements were performed in integral light. Table 1 gives the observing log.

Table 1: Journal of observations. Start is the time for the midpoint of the first exposure. The observation interval includes also gaps due to any interruption of the exposure series.

Date (1994)	Start (UT)	Interval (h)	Int. Time (min)	Frames No.	Obs. Run
14 Aug.	0:59:09	5.705	5	60	1
17 Aug.	0:20:38	6.262	5	67	2

Differential instrumental magnitudes were derived relative to nearby comparison stars on the same CCD image. Fig. 1 presents the resulting light curve obtained during the first night (run 1). Two eclipses (depth $\sim$ 0.4 mag, duration $\sim$ 25 min) about 3.5 hours apart are easily recognizable. Also shown are the measurements of a comparison star of comparable brightness. The larger scatter in the V500 Aql data hints at flickering activity in the nova system. Two further eclipses could be recorded during the second night (run 2) when the system was $\sim$ 0.15 mag brighter. Further, the eclipse profiles had changed to a somewhat shallower shape. All this indicates that V500 Aql was probably met at the beginning of a (dwarf nova) outburst, a behaviour shared with some further classical novae. Unfortunately, the data of the second night suffer from worse meteorological conditions resulting in a larger scatter. After allowing for the 0.15 mag difference the combined data

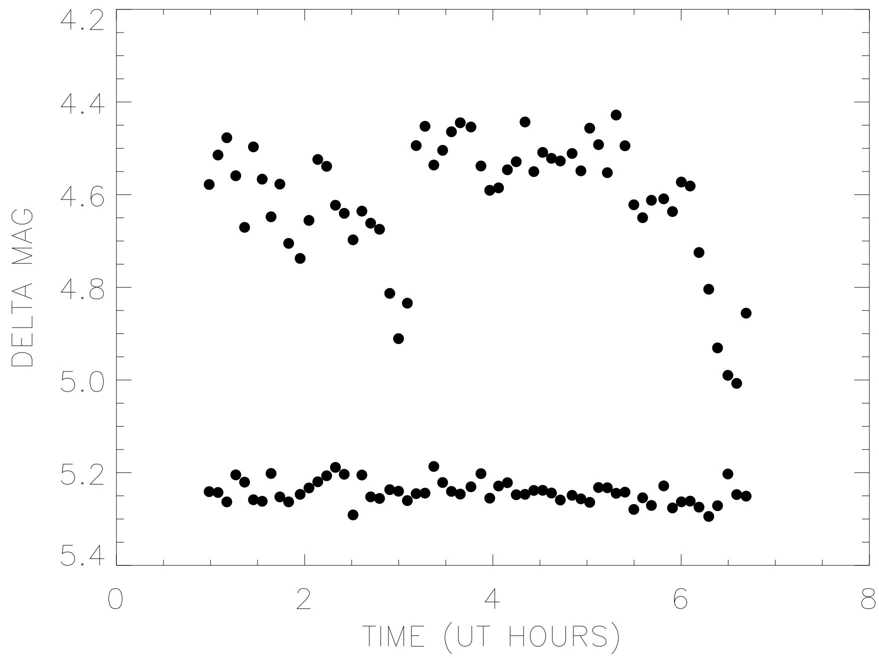

Figure 1. The light curve of V500 Aql (top) compared with a constant star (bottom). The measurements were obtained on 14 August 1994.

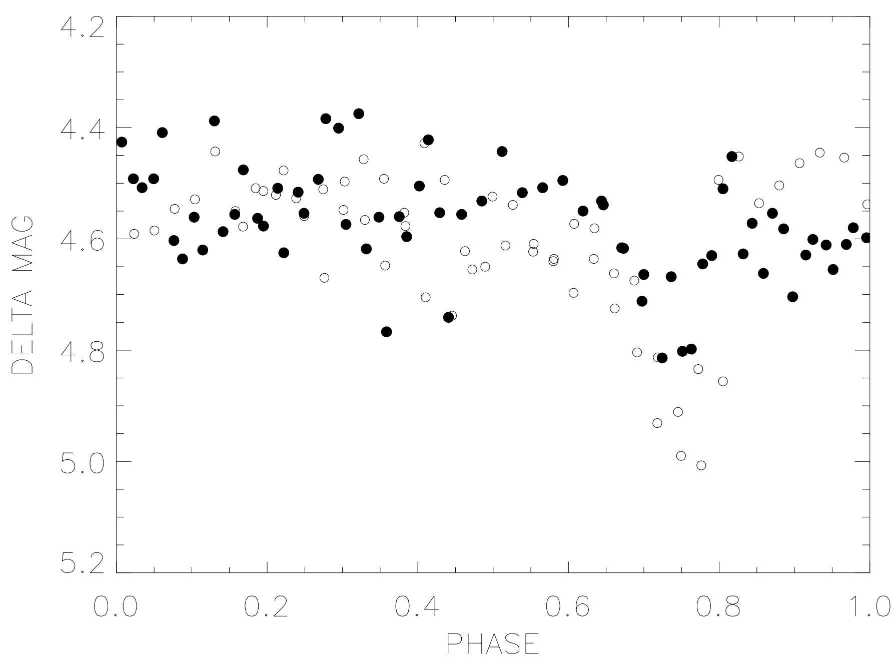

Figure 2. The phased light curve of V500 Aql based on an orbital period of 3.485 hours. Open circles: data of run 1, filled circles: data of run 2.

set was subjected to a periodogram analysis yielding an orbital period of 3.485 $\pm$ 0.02 hours. Fig. 2 shows the resulting phase diagram. The large scatter during the eclipse phase is due to the different eclipse profiles and the enhanced scatter of run 2.

The present data set does not allow to derive more detailed parameters but it is sufficient to demonstrate the eclipse phenomenon in the V500 Aql system.

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THE DUST SHELL AROUND SAKURAI'S OBJECT

T. KIPPER

Tartu Observatory, Tõravere, 61602, Estonia, e-mail: tk@aai.ee

In our recent paper (Kipper & Klochkova 1999) we analysed the spectra of the born–again giant Sakurai's object (V4334 Sgr) whose evolution has been extraordinarily rapid. We found that the effective temperatures of the object derived using spectral and photometric methods were quite consistent until March 1997. Later results diverge noticeably. The natural explanation for that is the increased circumstellar reddening and an extra radiation from hot dust clouds as the star starts to show R CrB–type brightness drops. In this note we try to model this situation.

The most comprehensive photometric data for June, September and October of 1997 in $UBVJHKLM$ colours were obtained from Arkhipova et al. (1998). Further data for May, 1997 in JHK were taken from Kamath & Ashok (1999) and from the near–IR spectrum figures of Eyres et al. (1998) for April and July, 1997. Shorter wavelength data ($UBVRi$) for April, 1997 were taken from Duerbeck et al. (1997). For dereddening the $E(B-V) = 0.53$ (Duerbeck & Benetti 1996) and for the flux calibration the zero point fluxes by Straižys (1977) were used. The derived fluxes are plotted in Fig. 1. As could be seen, the data for near–IR deviate from each other quite noticeably. This reflects both the large observation errors and the variability as the plotted data cover the half a year time span.

For modelling the dust shell the publicly available code DUSTY, developed by Ivezić, Nenkova & Elizur (1997), was used.

For the input radiation from the central star the model spectra of H–deficient stars were used. Particularly for June 1997 and later we chose the model with $T_{\rm eff} = 5750$ K, $\log g = 0.3$ and C/He = 0.1. This was the model giving the best fit for the C_2 bands in 1998 spectra of Sakurai's object. We have earlier found that the line spectrum had not changed from 1997 (Kipper & Klochkova 1999). With assumed stellar mass of 0.8 $M_\odot$ this corresponds to $\log L/L_\odot = 4.03$ and $R_* = 104\ R_\odot$.

According to Zubko (1997) the most probable grain type acting in R CrB stars envelopes are the graphite grains. We used the optical properties of graphite grains by Draine & Lee (1984). In the course of modelling we found that only single size grains with radii around $a \approx 0.055\ \mu$m allow to explain UBV observations of 1997. This is in accord with Zubko's (1997) findings that in the case of R CrB stars the size distributions of dust grains have peak–like form with typical sizes $0.02 \div 0.07\ \mu$m. The constant dust density in quite narrow shell thickness $\Delta R/R_{\rm in} = 0.25$ was adopted as the shell formed during very short time.

The dust temperature $T_{\rm d}$ at the inner shell boundary $R_{\rm in}$ was estimated from the observed spectral shape and the location of the peak in near–IR region.

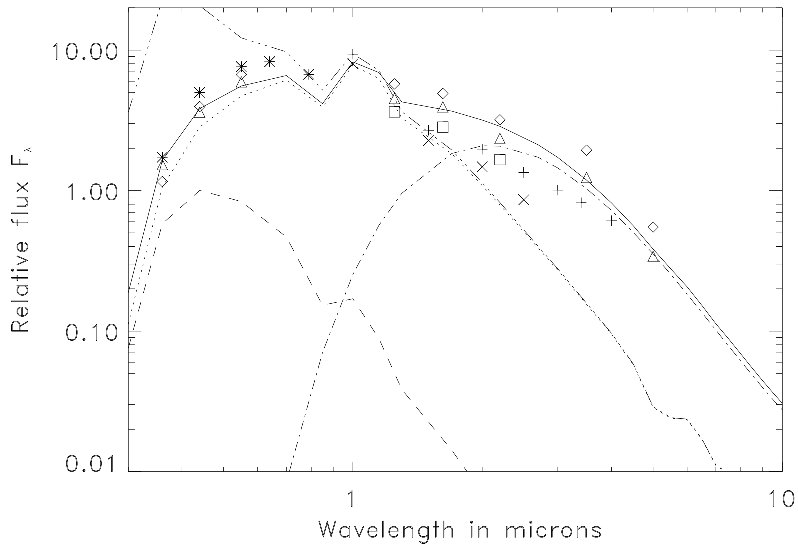

Figure 1. Modelling of circumstellar dust shell around Sakurai's object in 1997. Triangles – Arkhipova et al. (1998) for June; diamonds – ibid., for September and October; asterisks – Duerbeck et al. (1997) for April; squares – Kamath & Ashok (1999) for May; slanted crosses – Eyres et al. (1998) for March, crosses – ibid. for July. The model spectra for June and July of 1997 are plotted with lines: full line – total emerging flux, dotted line – contribution of the attenuated input radiation, dashed line – contribution of the scattered radiation, dash–dotted line – dust emission, and dash–dot–dot line – input stellar photospheric spectrum

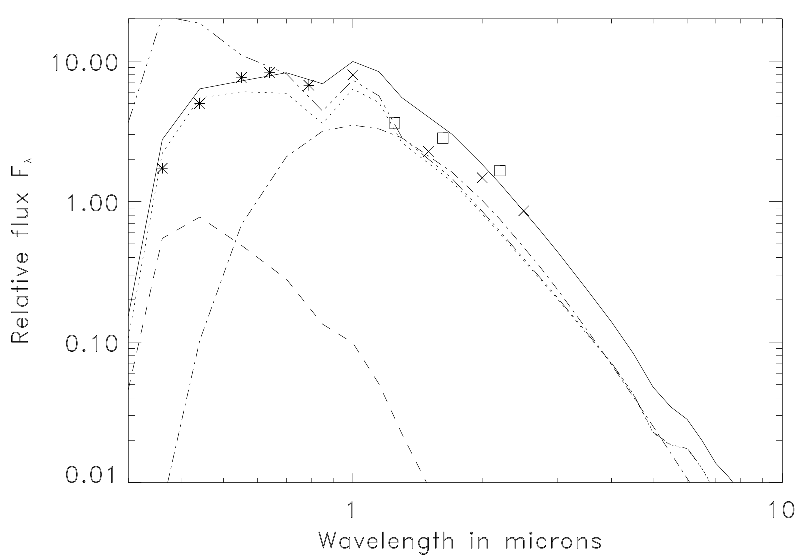

Figure 2. The same as in Fig. 1 but the model spectra are plotted for April 1997

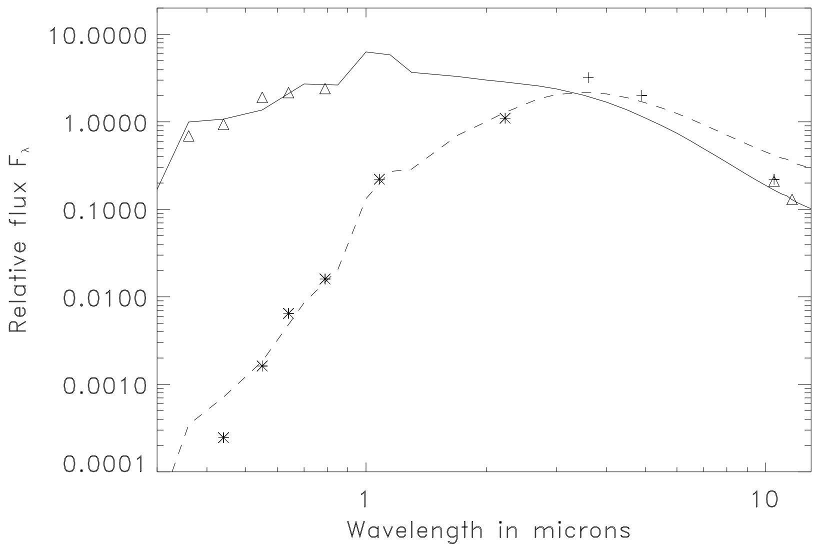

Figure 3. Modelling of circumstellar dust shell around Sakurai's object in 1998 and 1999. Triangles – Jacoby & De Marco (1998) and Kaeufl (1998) (near–IR) for June 1998; crosses – Lynch et al. (1998) for March 1888; asterisks – Jacoby (1999) for March 1999. Full line – model total flux for March – July 1998, dashed line – model flux for March 1999

In that way for June and July of 1997 the following model was found: visual optical depth, $\tau_V = 0.95$, dust temperature, $T_d(R_{in}) = 1200$ K, inner radius of dust shell, $R_{in} = 68\ R_*$. This model is plotted also in Fig. 1. In this modelling the data by Arkhipova et al. (1998) was given the highest weight.

For April 1997 higher stellar temperature, $T_{eff} = 6000$ K, smaller grain size, $a = 0.04\ \mu$m, visual optical depth, $\tau_V = 0.6$, and rather high dust temperature, $T_d = 2500$ K at $R_{in} = 8\ R_*$ were needed (Fig. 2). The speed of the changes in the envelope parameters between these two dates is in the order of the time–scale of gas acceleration found by Fadeyev (1988) for R CrB dust envelopes.

For the autumn of 1997 the model with spherical distribution of dust is impossible as both optical and near–IR flux have risen. The fit is possible only if the luminosity of the star was higher by about 20% or there was a hole in dust towards the observer with smaller extinction. It should be noted that, according to AAVSO data, the observed V magnitudes vary rather erratically up to $0\overset{m}{.}5$.

In 1998 the star suffered deeper brightness drops. At the end of February the weakening in V amounted to 2^m, but the star almost recovered by the end of July when another, much deeper weakening started. For the first weakening the photometry by Jacoby & De Marco (1998), Kaeufl (1998) and Lynch et al. (1998) is plotted in Fig. 3. These observations could be approximated with the model having $\tau_V = 3.5$, $T_d = 1250$ K. In this case in addition larger grains up to $a = 0.15\ \mu$m with standard IS distribution, $n(a) \propto a^{-3.5}$, and larger relative thickness of the shell $\Delta R/R_{in} = 10$ are needed. Inclusion of larger grains allows to model much flatter output spectrum at the shorter wavelengths. Larger relative thickness gives better fit in near–IR region. The luminosity of the star should be higher by 20% compared to July 1997.

The weakening which started in July 1998 has not yet stopped and by March 1999 the star was already as weak as $V = 20.08$ (Jacoby 1999). These last data could be approximated with the model having $\tau_V = 11.0$ and T_d not higher than 900 K. The (1023–2230) colour alone corresponds to a blackbody with temperature of 1285 K (Jacoby 1999). This very deep and longlasting minimum indicates that Sakurai's object could share the fate of another final helium shell flash star V605 Aql which after four years of fadings and brightenings disappeared from the sky (Clayton & De Marco 1997).

The presented models follow from very crude approximations. The state of the system is not steady but highly dynamical. The outpuffs of dust are probably related to a pulsational cycle of the central star. This means that the input stellar radiation rapidly changes. The gas in which the dust grains condense is ejected rather in cones with semi-angle of about 20° (Feast 1986) than in spherical symmetry. Nevertheless, such modelling allows to explain why the effective temperatures of the star determined from colours and spectral data do not coincide and the spectral energy distribution of the system for 1997 and later could be explained with the constant effective temperature of central star, $T_\mathrm{eff} = 5750$ K.

Acknowledgements. The work on this note was supported by Estonian Science Foundation grant 3166. We have used, and acknowledge with thanks, the data from the AAVSO International Database.

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HU ISSN 0374 – 0676

BV PHOTOMETRY OF SX Phe BLUE STRAGGLERS IN THE GLOBULAR CLUSTER NGC 5466

JENNWOOD CHEN, T. MICHAEL CORWIN

UNC Charlotte, Charlotte, NC 28223, USA [e-mail: mcorwin@uncc.edu]

Name of the object:
Blue stragglers NH 27, NH 29, NH 35, NH 38, NH 39, NH 49 in the globular cluster NGC 5466.

Equatorial coordinates:	**Equinox:**
R.A.= $14^h03^m.2$ **DEC.**= $+28°46'$	1950

Observatory and telescope:
The images were obtained with the No. 1 0.9-meter telescope at Kitt Peak National Observatory.

Detector:	The 800×800 TI#2 CCD with a pixel scale of 0.43 arcsec (1991) and the 2048×2048 T2KA CCD with a pixel scale of 0.69 arcsec (1992, 1993, 1995, 1997).

Filter(s):	The Harris B and V filters were used, with exposure times of 300 s for the V frames and 500 s for the B frames.

Comparison star(s):	Four stars in the field were selected as local magnitude standards for relative photometry (185, 272, 276, and 281 Buonanno et al. 1984).

Transformed to a standard system:	*UBV*
Standard stars (field) used:	Twenty-nine standard stars selected from Landolt (1983) with a range in $(B-V)$ from -0.186 to $+2.527$ mag were observed.

Availability of the data:
Through IBVS Web-site as 4708-t1.txt, 4708-t2.txt, 4708-t3.txt, 4708-t4.txt, 4708-t5.txt, and 4708-t6.txt.

Type of variability:	SX Phe

Remarks:

We present a new photometric study of the six SX Phe blue stragglers in NGC 5466 discussed by Nemec et al. (1994). The images used in this study were obtained during May 1991, May 1992, April 1993, June 1995, and June 1997. The raw data frames were processed and reduced following standard procedures using ALLSTAR in DAOPHOTX in IRAF. The resulting ephemerides for maxima are: NH 27: 0.050697 day, epoch 2448383.934 ± 0.005 days; NH 29: 0.040295 day, epoch 2450618.753 ± 0.005 day; NH 35: 0.049848 day, epoch 2448383.921 ± 0.002 days; NH 38: 0.055078 day, epoch 2448383.760 ± 0.005 day; NH 39: 0.050480 day, epoch 2448382.686 ± 0.002 day; and NH 49: 0.045070 day, epoch 2448383.668 ± 0.005 day.

The light curves are for the *B* data. The filled squares are 1991 data, open squares are 1992 data, filled triangles are 1993 data, open triangles are 1995 data, and filled circles are 1997 data. The finding chart is published in Nemec and Harris (1987).

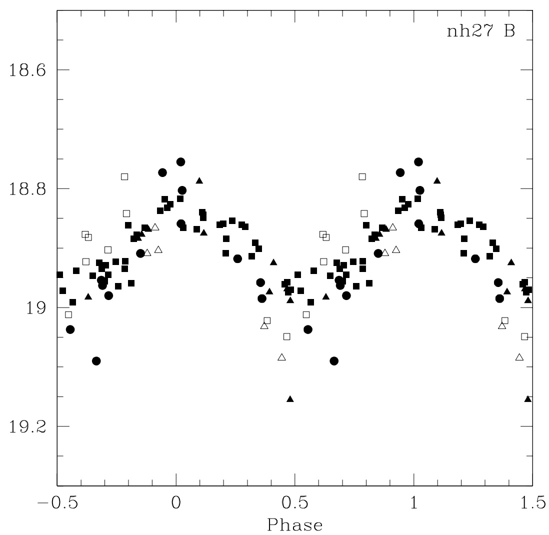

Figure 1.

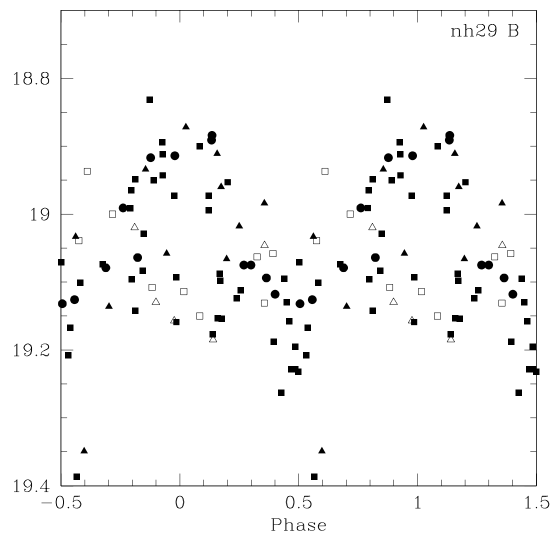

Figure 2.

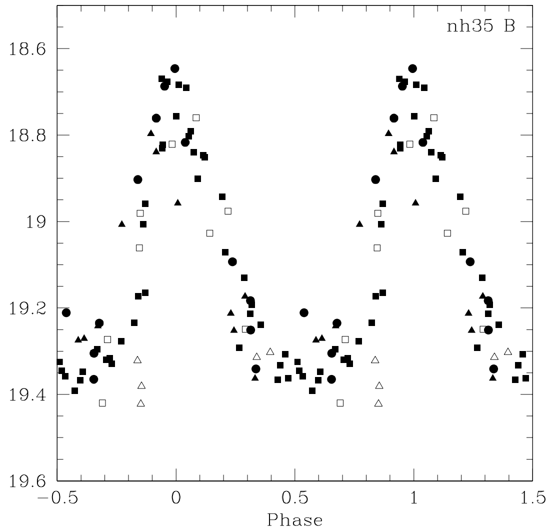

Figure 3.

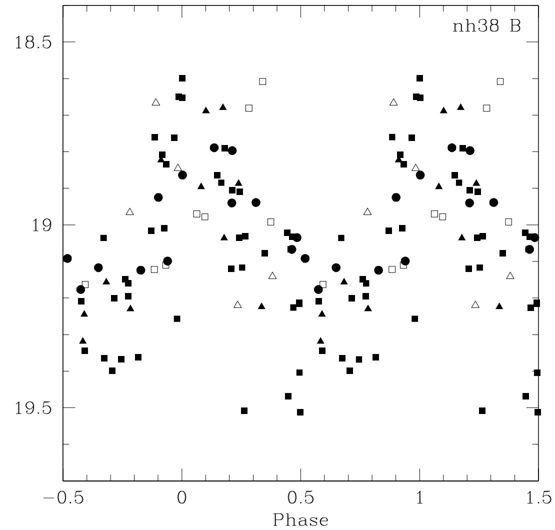

Figure 4.

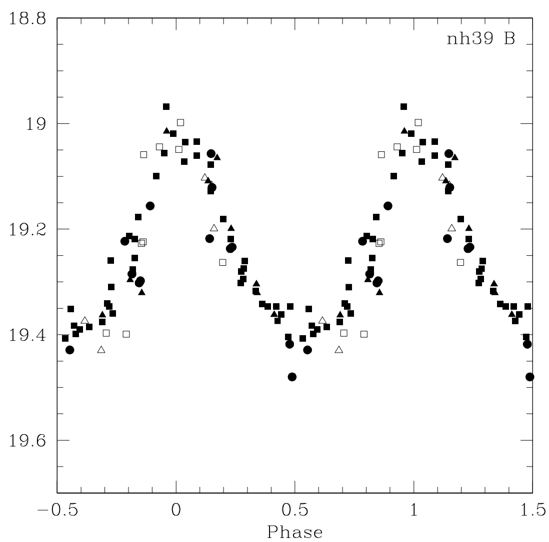

Figure 5.

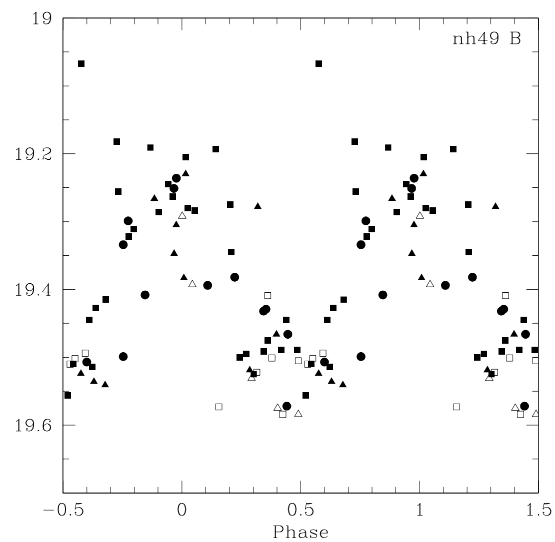

Figure 6.

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BD –02°5436, A NEW UU HERCULIS VARIABLE?

GLENN GOMBERT

1041 Yorkshire Place, Dayton OH, 45419 USA, gleng@infinet.com

Name of the object:
BD −02°5436 = PPM 204765 = GSC 5196-0130

Equatorial coordinates:	**Equinox:**
R.A.= $21^h03^m57\overset{s}{.}0$ **DEC.=** $-2^\circ10'04''$	J2000

Observatory and telescope:
Dayton TASS MkIII camera system: three CCD cameras, each using 135-mm f/2.8 lenses, operated serially in drift-scan (time-delay integration) mode.

Detector:	Kodak KAF-0400, 14 arcsec/pxl

Filter(s):	Johnson *V*

Transformed to a standard system:	Johnson *V*
Standard stars (field) used:	First order transformation coefficients were calculated using Landolt standard stars in the Declination zone $-1\overset{\circ}{.}5$ to $-4\overset{\circ}{.}5$. Nightly zero points were set with Tycho stars present in each image. Per-observation internal uncertainties are expected to be $0\overset{m}{.}020$–$0\overset{m}{.}025$ at the magnitude of the variable. An analysis of the photometric accuracy for a larger dataset has been performed by Richmond (1998).

Availability of the data:
Through IBVS Web-site as 4709-t1.txt

Type of variability:	SRd, possibly UU Herculis type

Remarks:

BD $-02°5436$ was found to be variable in data taken with the Dayton, Ohio TASS MkIII camera system (Gombert & Droege 1998). The star is not present in the 'Combined General Catalogue of Variable Stars' (GCVS 4.1, Kholopov *et al.* 1998). The star was observed 32 times between UT dates 11 July 1997 and 23 October 1998. During this interval the star showed a well-defined periodicity of 105 days. The Tycho $B-V$ color of the star corrected to the standard system is 0.53 ± 0.06. This, combined with the small-amplitude, sawtooth-shaped lightcurve, suggests the star is of the UU Herculis type. This is a rare class of high-latitude F-type supergiants exhibiting sometimes varying modes of pulsation, but whose fundamental characteristics are enigmatic (*cf.* Klochkova *et al.* 1997, Fernie & Seager 1995). A period of about 52.5 days (more characteristic of UU Herculis type variables) could not be established from the data collected to date.

Acknowledgements:

I would like to thank Michael Richmond (Rochester Institute of Technology) for his help and advice in preparing this report, and for preparing Figure 1. I would like to thank Brian Skiff of Lowell Observatory for his help in determining a preliminary classification for this new variable as well as reformatting this paper for publication.

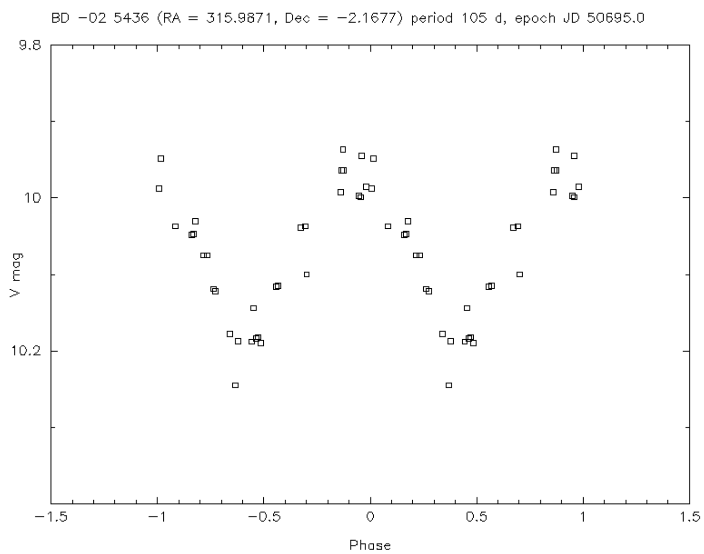

Figure 1. Photometry of BD $-02°5436$ phased for a period of 105 days.

References:

Fernie, J. D., and Seager S., 1995, *Publ. Astron. Soc. Pac.*, **107**, 853

Gombert, G. J., and Droege, T. R., 1998, *Sky & Telescope*, **25**, No. 2, 42 (February 1998)

Henden, A. A., and Kaitchuck, R. H., 1990, *Astronomical Photometry*, Willmann-Bell, Richmond

Kholopov, P. N., et al., 1998, *Combined General Catalogue of Variable Stars*, edition 4.1, Moscow (`http://vizier.u-strasbg.fr/cgi-bin/VizieR?-source=II/214A`)

Klochkova, V. G., Panchuk, V. E., and Chentsov, E. L., 1997, *Astron. Astrophys.*, **323**, 789

Richmond, M. W., 1998, TASS Technical Note 45, "An Analysis of Dayton TASS Data Reduced With Flatcomp Program", `http://a188-L009.rit.edu/tass/technotes/tn0045.html`

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

Number 4710

Konkoly Observatory
Budapest
20 May 1999

HU ISSN 0374 – 0676

CCD PHOTOMETRY OF V541 CASSIOPEIAE

PETR MOLÍK, MIROSLAV BROŽ, MAREK WOLF

Astronomical Institute, Charles University Prague, CZ-180 00 Praha 8, V Holešovičkách 2, Czech Republic, E-mail: P.Molik@vupp.cz, miroslav.broz@usa.net, wolf@mbox.cesnet.cz

Name of the object:
V541 Cassiopeiae = CSV 5990 = GR 75 = GSC 4051.1764 = FL 199

Equatorial coordinates:	**Equinox:**
R.A.= $2^{\rm h}34^{\rm m}29\overset{\rm s}{.}2$ **DEC.=** $+63°20'28''$	J2000.0

Observatory and telescope:
Hradec Králové Observatory, Czech Republic, 0.25-m Newtonian telescope

Detector:	SBIG ST-5 CCD camera

Filter(s):	None

Comparison star(s):	GSC 4050.0957

Check star(s):	GSC 4050.1131

Transformed to a standard system:	No

Availability of the data:
Through IBVS Web-site as 4710-t1.txt

Type of variability:	EA

Remarks:

New times of minimum light: HJD 2451157.5434, HJD 2451189.3872. New light elements:

$$\text{Pri. Min.} = \text{HJD } 2445962.3062 + 0\overset{\rm d}{.}9098488 \times E.$$
$$\pm 0.0002 \quad \pm 0.0000001$$

$O-C$ diagram with respect to the new elements is plotted in Fig. 1., corresponding times of minima are available in electronic form through IBVS Web site.

Our observations suggest, in accordance with the previous photoelectric measurements by Zhang et al. (1985, 1987), that V541 Cas should be classified as a short-period Algol. The depth of primary and secondary minima of V541 Cas are equal within the observational errors, therefore the choice of reference epoch in the above given elements is arbitrary.

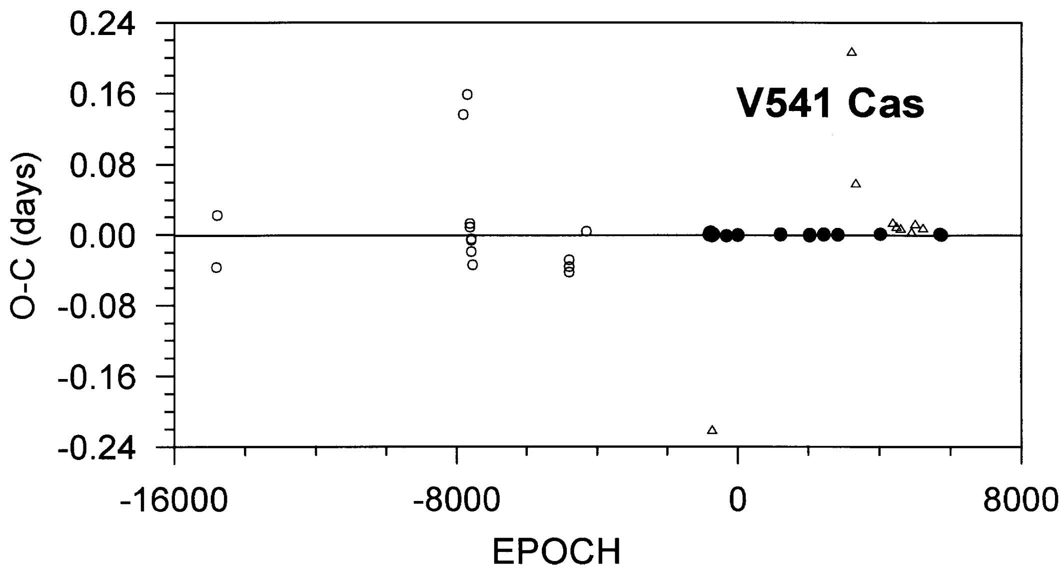

Figure 1. $O-C$ diagram of V541 Cas. The individual photoelectric and CCD observations are denoted by dots, the photographic measurements by circles and visual estimations by triangles.

References:

Zhang J.T., Zhang R.X., Li C.S., Zhai D.S., 1985, Inf. Bull. Var. Stars, No. 2652
Zhang R.X., Zhang J.T., Li Q.S., Zhai D.S., 1987, Acta Astron. Sinica, 28, 131

COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4711

Konkoly Observatory
Budapest
21 May 1999

HU ISSN 0374 – 0676

PHOTOELECTRIC MINIMA OF SELECTED ECLIPSING BINARIES

(BAV MITTEILUNGEN NO. 117)

FRANZ AGERER, JOACHIM HÜBSCHER

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D–12169 Berlin, Germany

In this 38th compilation of BAV results, photoelectric observations obtained in the years 1998 and 1999 are presented on 108 variable stars giving 180 minima and maxima. All moments of minima and maxima are heliocentric. The errors are tabulated in column '±'. The values in column '$O-C$' are determined without incorporation of nonlinear terms. The references are given in the section 'Remarks'. All information about photometers and filters are specified in the column 'Rem'. The observations were made at private observatories. The photoelectric measurements and all the lightcurves with evaluations can be obtained from the office of the BAV for inspection.

Table 1: Eclipsing binaries

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
RT And	51076.4564	.0003	QU	−0.0032		GCVS 85	V	3)
	51103.5007	.0003	QU	−0.0029		GCVS 85	V	3)
	51179.3440	.0003	QU	+0.0544	s	GCVS 85	V	3)
AA And	50013.3710	.0022	AG	−0.0806		GCVS 85	BV	2)
AB And	51178.2972	.0010	ATB	−0.0154	s	GCVS 85		1)
BL And	50727.3182	.0011	MS	+0.0067	s	GCVS 85		1)
KN And	50692.5064	.0009	MS	+0.0716		BAVR 3)		1)
EK Aqr	50717.4960	.0003	KI	+0.0253		GCVS 85		1)
EL Aqr	51080.4443	.0008	KI	+0.0053		GCVS 85		1)
OO Aql	51040.4440	.0002	QU	+0.0081	s	GCVS 85	V	3)
V343 Aql	51032.3968	.0005	KI	−0.0285		GCVS 85		1)
V415 Aql	50692.4053	.0010	AG	+0.0029		BAVM 69	BV	2)
V417 Aql	51016.4534	.0003	KI	−0.0444	s	BAVR 2)		1)
V694 Aql	51078.3432	.0005	KI	+0.0016		BAVM 97		1)
GSC 1062.33 (Aql)	51043.3877	.0004	QU				Ir	3)
RX Ari	51146.3969	.0006	KI	+0.0277		GCVS 85	I	1)
EM Aur	50831.5881	.0004	FR	−0.1369	s	GCVS 85		4)
HU Aur	50425.2786	.0024	MS	−0.0199		GCVS 85		1)
IM Aur	51165.504:	.002	AG	+0.544		GCVS 85	BV	2)
	51177.3620	.0002	AG	−0.0707		GCVS 85	BV	2)
KO Aur	50825.3487	.0004	AG	+0.0448		GCVS 85	BV	2)
V404 Aur	50706.5120	.0018	MS					1)
	50749.5073	.0003	MS					1)
	50799.2904	.0007	MS					1)
TY Boo	50556.3910	.0006	MS	−0.0054		BAVM 68		1)
VW Boo	50953.4088	.0003	KI	−0.0273		BAVR 1)		1)
XY Boo	50547.3679	.0006	AG	+0.0335	s	GCVS 85	BV	2)
	50547.5532	.0008	AG	+0.0335		GCVS 85	BV	2)
CK Boo	50597.4577	.0004	KI	+0.0398	s	GCVS 85		1)
	50926.5076	.0004	KI	+0.0431		GCVS 85		1)

Table 1 (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
FF Cnc	50844.4064	.0021	FR	−0.0581		BAVM 65		4)
	50846.3918	.0003	FR	−0.0575	s	BAVM 65		4)
	50848.3768	.0002	FR	−0.0572		BAVM 65		4)
	50850.3603	.0007	FR	−0.0584	s	BAVM 65		4)
BO CVn	50570.4605	.0004	AG				BV	2)
XZ CMi	50897.3279	.0004	KI	−0.0077		GCVS 85		1)
YY CMi	50896.3794	.0035	ATB	+0.0155	s	GCVS 85		1)
AK CMi	50881.3429	.0011	KI	+0.2780		GCVS 85		1)
	50896.3307	.0002	KI	−0.0135		GCVS 85		1)
	51185.5041	.0006	AG	−0.0137		GCVS 85	BV	2)
AM CMi	50514.4794	.0042	ATB	+0.1287		GCVS 85		1)
BH Cas	51123.5502	.0003	AG					1)
	51171.2388	.0011	AG					1)
	51171.4442	.0005	AG					1)
DZ Cas	50692.3721	.0009	AG	−0.1399		GCVS 85		1)
EN Cas	50695.5156	.0036	MS	+0.2375		GCVS 85		1)
	50744.3272	.0002	MS	+0.2339		GCVS 85		1)
V357 Cas	50000.4614	.0006	AG	−0.0233		GCVS 85		1)
	51043.4235	.0006	AG	−0.0454		GCVS 85		1)
V361 Cas	50779.3259	.0006	MS	−0.1604		GCVS 85		1)
	50784.2410	.0032	MS	−0.1612		GCVS 85		1)
V385 Cas	50752.2475	.0018	MS	−0.6597		GCVS 85		1)
V387 Cas	50678.4248	.0009	MS	+0.0384		GCVS 85		1)
V445 Cas	50751.2736	.0038	MS	−0.0023		BAVM 69		1)
V651 Cas	50001.388:	.003	AG	+0.003	s	BAVM 55	BV	2)
WW Cep	50573.4126	.0001	AG	+0.0014		BAVM 71		1)
	50688.4321	.0002	AG	−0.0002		BAVM 71		1)
EG Cep	50899.3352	.0002	DIE	+0.0145		GCVS 85		4)
	50924.3869	.0004	DIE	+0.0135		GCVS 85		4)
	51034.4029	.0001	DIE	+0.0159		GCVS 85		6)
	51040.3910	.0004	DIE	+0.0132		GCVS 85		6)
	51100.3016	.0007	DIE	+0.0154		GCVS 85		6)
	51107.3796	.0001	DIE	+0.0133		GCVS 85		6)
	51198.3324	.0006	DIE	+0.0142		GCVS 85		6)
OT Cep	50850.3762	.0005	AG	−0.0551	s	GCVS 85		1)
RW Cet	50716.5647	.0003	KI	+0.0030		GCVS 85		1)
TT Cet	50750.4538	.0004	KI	−0.0356	s	GCVS 85		1)
TX Cet	50741.4574	.0002	KI	+0.0166		GCVS 85		1)
	51078.5389	.0005	KI	+0.0158		GCVS 85		1)
VV Cet	51137.3383	.0009	KI	+0.0877	s	GCVS 85	I	1)
SS Com	50944.4045	.0007	KI	+0.0458	s	BAVR 2)		1)
CC Com	50881.4817	.0002	KI	−0.0105		GCVS 85		1)
NSV 6177 (Com)	50425.6619	.0011	MS	+0.0082		BAVM 88		1)
	50848.4465	.0001	MS	+0.0265		BAVM 88		1)
KR Cyg	50703.4230	.0004	FR	+0.0035		GCVS 85		4)
	50750.3193	.0033	FR	−0.0062	s	GCVS 85		4)
	50948.5166	.0001	FR	+0.0031		GCVS 85		4)
	51033.4436	.0021	FR	−0.0077	s	GCVS 85		4)
	51036.4121	.0004	FR	+0.0028		GCVS 85		4)
V477 Cyg	50699.4784	.0008	AG	−0.3271		SAC 58	BV	2)
V488 Cyg	50700.4395	.0003	FR	+0.1065	s	GCVS 85		4)
	50703.5189	.0014	FR	+0.1031		GCVS 85		4)
	50745.2825	.0004	FR	+0.1085	s	GCVS 85		4)
	50750.3258	.0003	FR	+0.1071	s	GCVS 85		4)
	50751.4475	.0008	FR	+0.1078	s	GCVS 85		4)
	50753.4152	.0009	FR	+0.1137		GCVS 85		4)
	50754.2490	.0002	FR	+0.1067	s	GCVS 85		4)
	50755.3704	.0005	FR	+0.1072	s	GCVS 85		4)
	50944.5411	.0007	FR	+0.1047		GCVS 85		4)
	50948.4671	.0014	FR	+0.1071		GCVS 85		4)

Table 1 (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V488 Cyg	51032.5394	.0017	FR	+0.1025		GCVS 85		4)
	51033.3800	.0015	FR	+0.1023	s	GCVS 85		4)
	51034.5027	.0012	FR	+0.1040	s	GCVS 85		4)
	51036.4688	.0011	FR	+0.1082		GCVS 85		4)
	51040.3909	.0013	FR	+0.1067		GCVS 85		4)
V501 Cyg	50702.4527	.0011	MS	−0.1372		GCVS 85		1)
V505 Cyg	51034.4242	.0002	AG	+0.1312	s	GCVS 85		1)
V513 Cyg	50669.3898	.0011	MS	−0.2875		GCVS 85		1)
V628 Cyg	51120.3145	.0014	AG	+0.0034		BAVM 89		1)
V700 Cyg	49999.3024	.0003	AG	+0.0106		GCVS 85		1)
	49999.4474	.0002	AG	−0.0144	s	GCVS 85		1)
V725 Cyg	50745.2837	.0008	FR	+0.1978		GCVS 85		4)
	51033.5446	.0030	FR	+0.2004		GCVS 85		4)
	51036.4825	.0017	FR	+0.2118		GCVS 85		4)
V859 Cyg	51041.4433	.0011	AG	−0.0418	s	GCVS 85		1)
V1004 Cyg	50718.3446	.0011	MS	−0.0993		GCVS 85		1)
V1187 Cyg	51165.2517	.0004	AG	−0.0142		BAVM 73		1)
V1191 Cyg	51165.2414	.0007	AG	+0.0016		GCVS 85		1)
TY Del	51079.4063	.0005	KI	+0.0493		GCVS 85		1)
AV Del	50714.3478	.0003	KI	+0.0299		GCVS 85		1)
DM Del	50717.3117	.0005	KI	−0.0488		GCVS 85		1)
EX Del	51107.2642	.0006	KI	−0.0712		GCVS 85	Ir	1)
FZ Del	51031.4907	.0003	KI	−0.0337		GCVS 85		1)
GG Del	51025.4734	.0003	KI	−0.0169		GCVS 85		1)
BX Dra	50547.4042	.0004	AG	−0.0020		GCVS 85		1)
	50904.3743	.0003	AG	+0.0500		GCVS 85		1)
	50945.4868	.0005	AG	−0.0851	s	GCVS 85		1)
EF Dra	50571.4095	.0007	AG	+0.0087		BAVM 63	BV	2)
BV Eri	51165.3913	.0006	KI	−0.0640	s	GCVS 85	Ir	1)
WW Gem	50859.3343	.0004	QU	+0.0274		GCVS 85	Ir	3)
	51177.4541	.0004	QU	+0.0298		GCVS 85	V	3)
YY Gem	50896.3199	.0001	HSR	−0.0090		GCVS 85		3)
	51163.4047	.0003	QU	−0.0089		GCVS 85	Ic	3)
	51165.4400	.0003	QU	−0.0093	s	GCVS 85	Ic	3)
EY Gem	51176.4544	.0005	AG	−0.1879		GCVS 85		1)
GX Gem	50824.5567	.0003	FR	−0.2961	s	GCVS 85		4)
UX Her	50720.3377	.0080	MZ	+0.0271		GCVS 85		5)
HS Her	50688.4034	.0005	AG	−0.0112		GCVS 85	BV	2)
V728 Her	50948.4841	.0004	AG	+0.0142	s	BAVM 51		1)
V829 Her	50585.4816	.0009	AG				BV	2)
V857 Her	50571.3716	.0011	MS					1)
	50851.5382	.0006	MS					1)
	50859.5637	.0008	MS					1)
	50885.5546	.0012	MS					1)
	50896.4479	.0011	MS					1)
V878 Her	50573.4298	.0009	AG				BV	2)
AV Hya	51165.6373	.0004	KI	−0.0506		GCVS 85	Ir	1)
EU Hya	50862.4728	.0004	KI	−0.0142		GCVS 85		1)
VY Lac	50000.504:	.002	AG	−0.141	s	GCVS 85	BV	2)
CN Lac	50659.4623	.0011	MS	+0.0897	s	GCVS 85		1)
	50666.4702	.0011	MS	+0.0865	s	GCVS 85		1)
FL Lac	50594.4080	.0011	MS	−0.0617		GCVS 85		1)
	50605.4822	.0011	MS	−0.0607		GCVS 85		1)
IM Lac	51036.4130	.0004	AG	−0.1504	s	GCVS 85		1)
	51081.4401	.0007	AG	−0.1497		GCVS 85		1)
V364 Lac	49995.3088	.0020	AG	+0.1122	s	BAV unp.	BV	2)
UV Leo	50851.3979	.0002	MS	+0.0182	s	GCVS 85		1)
UX Leo	50896.4469	.0003	KI	+0.0154		BAVM 68		1)
XY Leo	50916.3738	.0004	KI	−0.0014		GCVS 85		1)
XZ Leo	51163.5287	.0004	QU	+0.0245		GCVS 85	V	3)

Table 1 (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
AL Leo	50849.4099	.0055	MS	+0.0055		BAVM 53		1)
AP Leo	50926.3561	.0003	KI	−0.0301		GCVS 85		1)
RT LMi	50898.3730	.0004	MS	−0.0022		GCVS 85		1)
SW Lyn	51177.3359	.0007	DIE	+0.0289		GCVS 85		6)
	51197.3050	.0004	DIE	+0.0321		GCVS 85		6)
UZ Lyr	50952.4199	.0014	HSR	−0.0088		GCVS 85	Ir	3)
QU Lyr	51037.4224	.0005	AG	−0.0022		GCVS 85		1)
V404 Lyr	50593.4582	.0011	MS	−0.0696		GCVS 85		1)
	50894.6115	.0007	MS	−0.0660		GCVS 85		1)
BO Mon	51155.5941	.0002	KI	−0.0816		GCVS 85	Ir	1)
V442 Mon	50753.6478	.0011	MS	+0.0308		GCVS 85		1)
V453 Mon	50508.3216	.0011	MS	−0.1435	s	GCVS 87		1)
	50743.6388	.0011	MS	−0.1325		GCVS 87		1)
	50799.5922	.0005	MS	−0.1717	s	GCVS 87		1)
	50824.3763	.0004	MS	−0.1205	s	GCVS 87		1)
	50825.3996	.0003	MS	−0.1277		GCVS 87		1)
	50839.4500	.0002	MS	−0.1613	s	GCVS 87		1)
	50855.2917	.0002	MS	−0.1212	s	GCVS 87		1)
	51165.4676	.0001	MS	−0.1372		GCVS 87		1)
V514 Mon	50863.328:	.002	KI	−0.058	s	GCVS 85		1)
	51138.6780	.0009	MS	−0.0502	s	GCVS 85		1)
	51139.5115	.0005	MS	−0.0527		GCVS 85		1)
	51178.5267	.0008	KI	−0.0536		GCVS 85	Ir	1)
V527 Mon	50855.4057	.0012	MS	−0.0182		GCVS 85		1)
V528 Mon	51199.4747	.0004	MS					1)
V530 Mon	50841.4280	.0064	MS	+0.1085		GCVS 85		1)
	50848.5118	.0008	KI	+0.0977	s	GCVS 85		1)
V532 Mon	50749.6404	.0011	MS	+0.0773		GCVS 85		1)
V634 Mon	50845.397:	.001	MS	+0.067		GCVS 85		1)

Remarks:

AG: Agerer, F., Tiefenbach
ATB: Achterberg, Dr. H., Norderstedt
DIE: Dietrich, M., Radebeul
FR: Frank, P., Velden
HSR: Husar, Dr. D., Hamburg
KI: Kleikamp, W., Marl
MS: Moschner, W., Lennestadt
MZ: Maintz, G., Bonn
QU: Quester, W., Esslingen

: = uncertain;
s = secondary minimum
1) = photometer CCD 375 × 242 uncoated, filter: V/Ir
2) = photometer EMI 9781A, filter: V = GG495, 1 mm; B = BG12, 1 mm + GG385, 2 mm
3) = photometer ST-7, filter: V or Ir = KG/2
4) = photometer OES-LcCCD11, without filter
5) = photometer LC14, without filter
6) = photometer pictor 1616XT
BAVM 51 = BAV Mitteilungen No. 51 = IBVS No. 3234
BAVM 53 = BAV Mitteilungen No. 53 = IBVS No. 3401
BAVM 55 = BAV Mitteilungen No. 55 = IBVS No. 3554
BAVM 63 = BAV Mitteilungen No. 63 = IBVS No. 3811
BAVM 65 = BAV Mitteilungen No. 65 = IBVS No. 3859
BAVM 71 = BAV Mitteilungen No. 71 = IBVS No. 4131
BAVM 73 = BAV Mitteilungen No. 73 = IBVS No. 4133
BAVM 88 = BAV Mitteilungen No. 88 = IBVS No. 4386
BAVM 89 = BAV Mitteilungen No. 96 = IBVS No. 4381
BAVM 97 = BAV Mitteilungen No. 97 = IBVS No. 4481
BAVM *nn* = BAV Mitteilungen No. *nn*
BAVR 1) = BAV Rundbrief 32, 122
BAVR 2) = BAV Rundbrief 33, 152
BAVR 3) = BAV Rundbrief 39, 19
BAV unp. = BAV unpublished
GCVS *nn* = General Catalogue of Variable Stars, 4th ed. 19*nn*
SAC *xx* = Rocznik Astronomiczny No. *xx*, Krakow (SAC)

[From IBVS 4912]

Corrections to IBVS No. 4711

RT	And	instead of	51179.3440	QU	correct is	51178.3440
V477	Cyg		50699.4784	AG		50693.4784

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PHOTOELECTRIC MINIMA OF SELECTED ECLIPSING BINARIES AND MAXIMA OF PULSATING STARS

(BAV MITTEILUNGEN NO. 118)

FRANZ AGERER, MICHAEL DAHM, JOACHIM HÜBSCHER

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D–12169 Berlin, Germany

In this 39th compilation of BAV results, photoelectric observations obtained in the years 1998 and 1999 are presented on 115 variable stars giving 172 minima and maxima. All moments of minima and maxima are heliocentric. The errors are tabulated in column '±'. The values in column '$O-C$' are determined without incorporation of nonlinear terms. The references are given in the section 'Remarks'. All information about photometers and filters are specified in the column 'Rem'. The observations were made at private observatories. The photoelectric measurements and all the lightcurves with evaluations can be obtained from the office of the BAV for inspection.

Table 1: Eclipsing Binaries

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
V449 Oph	50977.4734	.0003	KI	+0.0356		GCVS 85		1)
V508 Oph	50950.5658	.0002	KI	+0.0056		GCVS 85		1)
	50987.4582	.0003	KI	+0.0052		GCVS 85		1)
V839 Oph	50985.4927	.0004	KI	−0.0711		GCVS 85		1)
DZ Ori	50754.5893	.0011	MS	−0.2699		GCVS 85		1)
	50813.3486	.0004	MS	−0.2670		GCVS 85		1)
ER Ori	50845.3071	.0003	KI	+0.0205	s	GCVS 85		1)
	51138.5131	.0003	KI	+0.0229		GCVS 85	I	1)
FH Ori	50849.2846	.0005	KI	−0.2561		GCVS 85		1)
	51137.5314	.0003	KI	−0.2647		GCVS 85	I	1)
FR Ori	50862.3705	.0001	KI	+0.0191		GCVS 85		1)
FT Ori	50850.3423	.0002	QU	+0.0071		GCVS 85	Ir	4)
FZ Ori	51178.3646	.0006	KI	−0.0540	s	GCVS 85	Ir	1)
GU Ori	50863.4275	.0003	FR					5)
	50865.3103	.0005	FR					5)
	50897.3183	.0003	FR					5)
V343 Ori	50859.3746	.0006	KI	+0.1243	s	GCVS 85		1)
	51166.4424	.0007	AG	+0.1288		GCVS 85	BV	2)
U Peg	51146.2454	.0003	KI	−0.0759	s	GCVS 87	I	1)
AT Peg	51077.4580	.0008	KI	+0.0053		GCVS 87		1)
BB Peg	51078.4304	.0004	KI	+0.0058	s	GCVS 87		1)
CC Peg	51035.5428	.0005	AG	+0.0980		GCVS 87		1)
DO Peg	50771.2495	.0005	KI	−0.0194		GCVS 87		1)
EU Peg	50671.4216	.0011	MS	+0.0342		GCVS 87		1)
EY Peg	49947.626	.001	AG					1)
	51080.4514	.0007	AG				V	1)
GH Peg	51140.2461	.0004	KI	+0.0046		GCVS 87	I	1)
HW Per	50756.4168	.0024	MS	+0.0165	s	GCVS 87		1)
	51197.3119	.0006	MS	+0.0236		GCVS 87		1)

Table 1 (cont.)

Variable	Min JD 24...	±	Obs	$O-C$			Fil	Rem
KL Per	51077.4389	.0004	AG				V	1)
	51166.3595	.0003	AG					1)
V432 Per	50718.4086	.0006	AG	+0.0000		BAVM 61	BV	2)
	50718.6009	.0004	AG	+0.0007	s	BAVM 61	BV	2)
V449 Per	51138.3650	.0011	MS	+0.0318		GCVS 87		1)
V482 Per	51185.3277	.0011	AG	+0.0909		BAVM 68	BV	2)
V505 Per	51171.4393	.0013	AG	+0.0032	s	IBVS 3479	BV	2)
UV Psc	50756.4201	.0001	KI	−0.0098		GCVS 87		1)
CU Sge	51020.4911	.0004	KI	+0.0142		GCVS 87		1)
DK Sct	51036.3879	.0004	KI	+0.0299		GCVS 87		1)
BI Ser	50562.4168	.0004	AG	+0.1887		GCVS 87		1)
CC Ser	50546.4804	.0005	AG	−0.1086	s	GCVS 87	BV	2)
Y Sex	50897.4562	.0007	HSR	+0.0223		BAVR 1)		4)
	50904.3837	.0004	KI	+0.0227	s	BAVR 1)		1)
RZ Tau	50824.3861	.0002	KI	+0.0283		GCVS 87		1)
	50848.2882	.0002	KI	+0.0291	s	GCVS 87		1)
	51155.4725	.0003	KI	+0.0298	s	GCVS 87	Ir	1)
CU Tau	50672.5366	.0011	MS	+0.0572		GCVS 87		1)
	50673.5678	.0011	MS	+0.0579	s	GCVS 87		1)
	51184.2912	.0004	AG	+0.0407	s	GCVS 87		1)
GR Tau	50013.5295	.0014	AG	−0.0058	s	BAVR 2)	BV	2)
	51139.5145	.0004	KI	−0.0194		BAVR 2)	I	1)
	51198.4049	.0005	QU	−0.0188		BAVR 2)	V	4)
V1112 Tau	50464.3023	.0011	MS					1)
	50841.2966	.0014	MS					1)
	51140.5268	.0007	KI				I	1)
X Tri	51081.3423	.0003	HSR	−0.0345		GCVS 87	V	4)
UY UMa	50570.5012	.0003	AG	+0.0572		GCVS 87		1)
	50898.3909	.0003	AG	+0.0609		GCVS 87		1)
	50898.5770	.0003	AG	+0.0590	s	GCVS 87		1)
	50944.4471	.0006	AG	+0.0552	s	GCVS 87		1)
AW Vir	50904.4927	.0002	KI	+0.0114	s	GCVS 87		1)
AZ Vir	50916.5061	.0005	KI	−0.0122	s	GCVS 87		1)
BH Vir	50948.4075	.0002	KI	−0.0045		GCVS 87		1)
GR Vir	50947.371:	.001	KI	−0.064	s	GCVS 87		1)
HW Vir	50927.3774	.0002	HSR				Ir	4)
	50943.3678	.0001	KI					1)
	50943.4262	.0002	KI					1)
	50943.4843	.0002	KI					1)
	50946.4024	.0005	QU					4)
	50948.3866	.0006	QU					4)
HI Vul	50680.4438	.0007	AG	−0.0496		GCVS 87		1)

Table 2: Pulsating stars

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
SW And	51125.317	.005	PS	−0.005	BAVM 78		3)
	51178.3804	.0014	ATB	−0.0141	BAVM 78		1)
XX And	51139.4344	.0035	ATB	−0.0586	SAC 60		1)
GP And	51158.4139	.0028	ATB	+0.0006	GCVS 85		1)
	51165.2591	.0003	KI	+0.0004	GCVS 85	Ir	1)
OV And	51169.3449	.0021	ATB	−0.0052	MVS 11,133		1)
BR Aqr	51139.3024	.0004	KI	−0.1159	GCVS 85	I	1)
CP Aqr	51080.3324	.0004	KI	−0.0743	GCVS 85		1)
CY Aqr	51129.2612	.0003	KI	+0.0094	GCVS 85	Ir	1)
	51129.3222	.0003	KI	+0.0094	GCVS 85	Ir	1)
AA Aql	51077.3211	.0004	KI	−0.0006	BAVM 78		1)
V341 Aql	51105.2728	.0008	KI	+0.0157	GCVS 85	Ir	1)
RV Ari	50755.3547	.0027	MAR	+0.0038	GCVS 85		1)
	50755.4412	.0023	MAR	−0.0028	GCVS 85		1)

Table 2 (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
RW Ari	51139.246:	.003	HSR	−0.170	GCVS 85		4)
SY Ari	51168.2669	.0012	KI			Ir	1)
TZ Aur	50540.4034	.0012	ATB	+0.0076	GCVS 85		1)
	50874.5016	.0012	ATB	+0.0074	GCVS 85		1)
RS Boo	50951.5260	.0014	ATB	+0.0122	BAVR 3)		1)
TW Boo	50891.4370	.0008	HSR	−0.0273	GCVS 85		4)
UU Boo	50881.4293	.0002	HSR	+0.1058	GCVS 85		4)
UY Boo	50942.5448	.0028	HSR	+0.1177	SAC 68	Ir	4)
	50944.4946	.0021	HSR	+0.1149	SAC 68	Ir	4)
YZ Boo	50950.4164	.0080	MZ	−0.0024	GCVS 85		6)
CG Boo	50863.4415	.0006	MS				1)
CM Boo	50871.4631	.0005	QU	−0.0127	BAVM 75		4)
	50882.4210	.0004	QU	−0.0182	BAVM 75		4)
	50893.3843	.0006	HSR	−0.0184	BAVM 75		4)
	50949.4209	.0008	BK	−0.0170	BAVM 75		4)
CQ Boo	50941.4827	.0010	QU	+0.0584	MVS 10,39		4)
	50945.4535	.0035	HSR	+0.0828	MVS 10,39	Ir	4)
	50948.5485	.0031	BK	+0.0772	MVS 10,39		4)
CS Boo	50926.4878	.0015	HSR	−0.0048	IBVS 2855	Ir	4)
	50926.4901	.0016	BK	−0.0026	IBVS 2855		4)
AH Cam	50859.4999	.0004	QU	+0.1485	GCVS 85	Ir	4)
	51136.3799	.0006	HSR	+0.1088	GCVS 85		4)
VZ Cnc	50885.3455	.0003	KI	+0.0033	GCVS 85		1)
RZ CVn	50152.4870:	.0160	KRW, ZAU	−0.1980	GCVS 85		4)
	50577.4670	.0052	KRW, ZAU	−0.2088	GCVS 85		4)
	50585.4100	.0042	KRW, ZAU	−0.2095	GCVS 85		4)
X CMi	50863.3626	.0033	BK	+0.0063	BAVR 6)		4)
Y CMi	50845.437	.005	PS	+0.238	GCVS 85		3)
HU Cas	51185.4689	.0002	AG				1)
GSC 4004.1211 (Cas)	50772.2947	.0024	MS				1)
	50772.4188	.0009	MS				1)
	50772.5389	.0018	MS				1)
RR Cet	51155.3689	.0007	KI	−0.0027	GCVS 85	Ir	1)
RZ Cet	51138.3887	.0005	KI	−0.0839	GCVS 85	I	1)
S Com	50896.4364	.0006	HSR	+0.0143	SAC 60		4)
	50927.5277	.0035	ATB	+0.0165	SAC 60		1)
U Com	50950.469	.010	PS	+0.020	GCVS 85		3)
RY Com	50950.3741	.0012	BK	+0.0894	GCVS 85		4)
ST Com	50934.4920	.0035	ATB	−0.0224	GCVS 85		1)
SZ CrB	50562.4870	.0011	MS	−0.2094	GCVS 85		1)
	50898.5166	.0022	MS	−0.1955	GCVS 85		1)
XZ Cyg	51017.4287	.0007	HSR	−0.0247	BAVM 78	Ir	4)
DX Del	51033.4554	.0007	KI	+0.0440	GCVS 85		1)
RT Equ	51055.471	.005	PS	+0.030	GCVS 85		3)
RX Eri	50863.344	.005	PS	−0.003	GCVS 85		3)
BK Eri	51184.2689	.0012	KI	−0.0957	GCVS 85	Ir	1)
SZ Gem	51221.4798	.0007	QU	−0.0378	GCVS 85	V	4)
	51222.4832	.0010	QU	−0.0367	GCVS 85	V	4)
KV Gem	51165.4878	.0012	KI	−0.0241	GCVS 85	Ir	1)
VX Her	50935.4667	.0021	ATB	−0.0249	BAVR 4)		1)
DY Her	50975.4435	.0004	KI	−0.0159	GCVS 85		1)
RR Leo	50896.5410	.0010	ATB	+0.0268	GCVS 85		1)
	50898.353	.003	PS	+0.029	GCVS 85		3)
SS Leo	50824.558	.005	PS	−0.007	GCVS 85		3)
	50925.3889	.0046	MAR	−0.0176	GCVS 85		1)
ST Leo	50849.625	.005	PS	−0.009	GCVS 85		3)
	50863.4866	.0025	HSR	−0.0099	GCVS 85		4)
SW Leo	50571.4811	.0013	FR	+0.0018	GCVS 85		5)
WW Leo	50553.378	.013	PS	+0.021	GCVS 85		3)
TV Lib	50950.4543	.0003	KI	−0.0034	GCVS 85		1)

Table 2 (cont.)

Variable	Max JD 24...	±	Obs	$O-C$		Fil	Rem
CN Lyr	50947.5176	.0021	HSR	+0.0031	BAVR 5)	Ir	4)
CM Ori	51136.4893	.0007	HSR	−0.0431	GCVS 85		4)
VV Peg	51035.5247	.0005	KI	−0.0281	GCVS 87		1)
BF Peg	51035.4653	.0005	HSR	+0.1398	GCVS 87		4)
	51036.4574	.0021	HSR	+0.1402	GCVS 87		4)
	51037.4465	.0031	HSR	+0.1377	GCVS 87		4)
BP Peg	51015.4428	.0004	HSR	+0.0352	GCVS 87	Ir	4)
	51081.3876	.0006	KI	+0.0349	GCVS 87		1)
DH Peg	51020.5068	.0035	HSR	+0.0280	GCVS 87	Ir	4)
	51138.2935	.0011	KI	+0.0243	GCVS 87	I	1)
DY Peg	50453.2928	.0008	ATB	−0.0010	GCVS 87		1)
	51137.2674	.0003	KI	−0.0022	GCVS 87	I	1)
	51158.4139	.0007	ATB	−0.0043	GCVS 87		1)
SS Psc	51156.393	.004	ATB	−0.066	GCVS 87		1)
AN Ser	50969.4383	.0008	KI	+0.0039	GCVS 87		1)
AR Ser	50948.5198	.0012	KI	−0.0012	GCVS 87		1)
CW Ser	50944.4831	.0006	KI	+0.0229	GCVS 87		1)
DY Ser	50953.5204	.0011	KI	−0.0121	GCVS 87		1)
RV UMa	50865.4766	.0011	HSR	+0.0634	GCVS 87		4)
AE UMa	50862.3840	.0035	MAR	−0.0033	GCVS 87		1)
ST Vir	50945.5825	.0018	BK	+0.1327	GCVS 87		4)
UU Vir	50942.4064	.0006	KI	−0.0168	GCVS 87		1)
AF Vir	50949.4746	.0004	KI	+0.0742	GCVS 87		1)
AT Vir	50947.4275	.0042	BK	−0.1580	GCVS 87		4)
AV Vir	50951.4639	.0042	HSR	+0.0133	GCVS 87	Ir	4)
BC Vir	50951.4006	.0005	KI	−0.0023	GCVS 87		1)
FU Vir	50865.5034	.0003	MS	+0.1763	GCVS 87		1)

Remarks:

AG: Agerer, F., Tiefenbach
ATB: Achterberg, Dr. H., Norderstedt
BK: Birkner, C., Hagen
FR: Frank, P., Velden
HSR: Husar Dr. D., Hamburg
KI: Kleikamp, W., Marl
KRW: Krawietz, A., Kurort Hartha
MAR: Martignoni, M., Busto Arsizio (I)
MS: Moschner, W., Lennestadt
MZ: Maintz, G., Bonn
PS: Paschke, A., Rueti (CH)
QU: Quester, W., Esslingen
ZAU: Zaunick, H., Radebeul

: = uncertain
s = secondary minimum
1) = photometer CCD 375 × 242 uncoated — filter: V/Ir
2) = photometer EMI 9781A — filter: V = GG495, 1 mm; B = BG12, 1 mm + GG385, 2 mm
3) = photometer Cryocam 80A — without filter
4) = photometer ST-7 — filter: V or Ir = KG/2
5) = photometer OES-LcCCD11 — without filter
6) = photometer LC14 — without filter
BAVM 61 = BAV Mitteilungen No. 61 = IBVS No. 3797
BAVM 87 = BAV Mitteilungen No. 87 = IBVS No. 4332
BAVM *nn* = BAV Mitteilungen No. *nn*
BAVR 1) = BAV Rundbrief 32, 36
BAVR 2) = BAV Rundbrief 35, 1
BAVR 3) = BAV Rundbrief 36, 157
BAVR 4) = BAV Rundbrief 39, 9
BAVR 5) = BAV Rundbrief 43, 57
BAVR 6) = BAV Rundbrief 44, 162
GCVS *nn* = General Catalogue of Variable Stars, 4th ed. 19*nn*
SAC *xx* = Rocznik Astronomiczny No. *xx*, Krakow (SAC)
IBVS *xxxx* = Information Bulletin on Variable Stars No. *xxxx*
MVS *xx*, *xxx* = Mitteilungen über Veränderliche Sterne *xx*, *xxxx*, Sonneberg

[From IBVS 4912]

Correction to IBVS No. 4712

UY	UMa	instead of	50944.4471	AG	correct is	50944.4531

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ON THE ORBITAL PERIOD CHANGES OF AK HERCULIS

H. ROVITHIS-LIVANIOU[1], A. KRANIDIOTIS[1], E. FRAGOULOPOULOU[1], N. SERGIS[1], P. ROVITHIS[2]

[1] Section of Astrophysics, Astronomy and Mechanics, Dept. of Physics, University of Athens, Panepistimiopolis, GR-157 84 Zografos, Athens, Greece, e-mail: elivan@cc.uoa.gr

[2] Astron. Inst., National Obs. of Athens, P.O. Box 20048, Athens 118 10, Greece, e-mail: rovithis@astro.noa.gr

AK Her is a contact eclipsing binary of W UMa-type and the brighter component of the double star ADS 10408. Its companion is about 4 magnitudes fainter than the eclipsing pair and lies very close to it: at a distance of $4\farcs7$ in position angle 322°.

The variability of AK Her was reported by Pickering (1917) and the system has been observed photoelectrically many times (for details see at Tunca et al. 1987 and the references therein). The system exhibits variable light curve and an obvious O'Connell effect. Besides, AK Her is an X-ray source (Cruddace & Dupree, 1984).

So far, many studies have been made concerning its period variations and the detected periodicities are extended from 58 to 78 years. This is mainly due to the available observational material at the time of analysis, and secondly to the fact that the search for periodicities was based on the $O-C$ diagram, which depends on the ephemeris used. So, Schmidt & Herczeg (1959) found a periodicity of 64 yr; Woodward & Wilson (1977) of 58 yr; Barker & Herczeg (1979) of 78.03 yr; Glownia (1985) of 65.95 and Tunca et al. (1987) of 75.72 years. In this report besides the unpublished times of minimum light of AK Her that we present, we also examine its orbital period changes, which was found not to follow the sinusoidal variation proposed some years ago.

Our photoelectric observations of AK Her were carried out during 3 nights in 1985, 3 in 1986 and 4 in 1987 with the 1.2-m Cassegrain reflector at the Kryonerion Astronomical Station of the Athens National Observatory, Greece. Standard B and V filters and a two-beam, multi-mode, nebular-stellar photometer were used. The stars BD +16°3123 and BD +16°3124 were used for comparison and checking respectively, and reduction of the observations was made in the usual way (Hardie, 1962; Henden & Kaitchuk, 1987). The derived 10 new times of minimum light are presented in Table 1 the successive columns of which give the Hel. JD., the type of minimum and the $O-C$, where the C's were computed using the Kwee & van Woerden (1956) method; they are the mean values from the B & V observations and Woodward's (1942) light elements were used:

$$\text{Min I} = 2422977.254 + 0\overset{\text{d}}{.}42152207 \times E.$$

In order to construct the $O-C$ diagram of AK Her (Fig. 1), Tunca's et al. (1987) list of minimum light was used, together with our data (Table 1), and the list was completed

Table 1: The times of minimum light of AK Her, as derived from our photoelectric observations.

Hel. JD 2440000.+	Min. Type	Epoch	$O-C$ (days)
6210.3050	I	55117	0.0191
6210.5153	II	55117.5	0.0186
6212.4140	I	55122	0.0205
6597.4725	II	56035.5	0.0185
6598.3146	II	56037.5	0.0175
6977.4748	I	56937	0.0189
6978.5262	II	56939.5	0.0163
6979.3711	II	56941.5	0.0181
7011.4056	II	57017.5	0.0170

with up to date data, which are given in Table 2. In Fig. 1, the best fitted polynomial (for details see Kalimeris et al., 1994), used to describe the data, is presented by the heavy continuous line, while the sinusoidal term found by Tunca et al. (1987) is denoted by the dashed line.

The real orbital period variation $P(E)$, and its rate of change, were also computed, as it is described by Kalimeris et al. (1994, 1995), and from the Fourier spectrum of the $P(E)$ function, two periodicities were detected: viz. 76.17 ± 0.06 yr and 38.1 ± 0.1 yr, with amplitudes of 0.071 ± 0.002 sec and 0.077 ± 0.002 sec, respectively. The first periodicity is close to this of 78.03 yr found by Barker & Herczeg (1979) and to that of 75.72 yr found by Tunca et al. (1978); but, since it corresponds to the time interval for which observational data exist, it might not be true.

From the present analysis, which includes the most recent available data, it is shown, (Fig. 1), that the orbital period of AK Her *does not follow a sinusoidal variation.* This could not be detected from the observational material available at the time of the previous analyses and shows clearly that the period variations cannot be predicted. As regards the second periodicity of 38.1 yr it had not been detected before; but, since it is half of the long one more data are needed to assure its existence.

Acknowledgements: This work was partly financial supported by Athens University (grant no. 70/4/3305).

Table 2: Photoelectric times of minimum light of AK Her, from the literature.

Hel. JD.	$O-C$ (days)	Epoch	Reference
2435933.576	0.0019	30737	AA 12, 200, 1962
2437168.412	−0.0148	33666.5	BAC 14, 1963
2437172.418	−0.0132	33676	BAC 14, 1963
2437356.643	0.0066	34113	BAV No. 15
2437505.427	−0.0067	34466	BAV No. 15
2437824.519	−0.0184	35358	BAV No. 15
2437881.413	−0.0069	35823	BAC 15, 1964
2438227.511	0.0100	36179	AN 188, 1964
2438590.454	0.0225	37040	BAC 16, 1965
2438595.503	0.0133	37052	BAC 16, 1965
2438614.479	0.0208	37097	BAC 16, 1965
2438620.372	0.0125	37111	BAC 16, 1965
2443717.426	0.0216	49203	AN 302, 1981
2443744.412	0.0302	49267	AN 302, 1981
2444372.4713	0.0216	50757	BBSAG 48, 1980
2446224.4309	0.0240	55150.5	IBVS 3078, 1987
2446228.4330	0.0215	55160	IBVS 3078, 1987
2446230.332	0.0238	55164.5	IBVS 3078, 1987
2446234.334	0.0213	55174	IBVS 3078, 1987
2446243.3987	0.0233	55195.5	IBVS 3078, 1987
2446244.4510	0.0218	55198	IBVS 3078, 1987
2446612.4410	0.0230	56071	IBVS 3078, 1987
2448100.4112	0.0203	59601	IBVS 3615, 1991
2450248.4941	0.0267	64697	IBVS 4472, 1997
2450259.45353	0.0266	64723	IBVS 4670, 1999
2450275.4751	0.0303	64761	IBVS 4555, 1998
2450310.4578	0.0267	64844	IBVS 4555, 1998
2450508.574	0.0275	65314	IBVS 4555, 1998
2450512.5802	0.0293	65323.5	IBVS 4555, 1998
2450635.6645	0.0291	65615.5	BBSAG 115, 1997
2450865.6038	0.0281	66161	IBVS 4633, 1998
2450866.6681	0.0386	66163.5	IBVS 4633, 1998
2450903.5413	0.0286	66251	IBVS 4633, 1998
2450971.4060	0.0282	66412	IBVS 4633, 1998

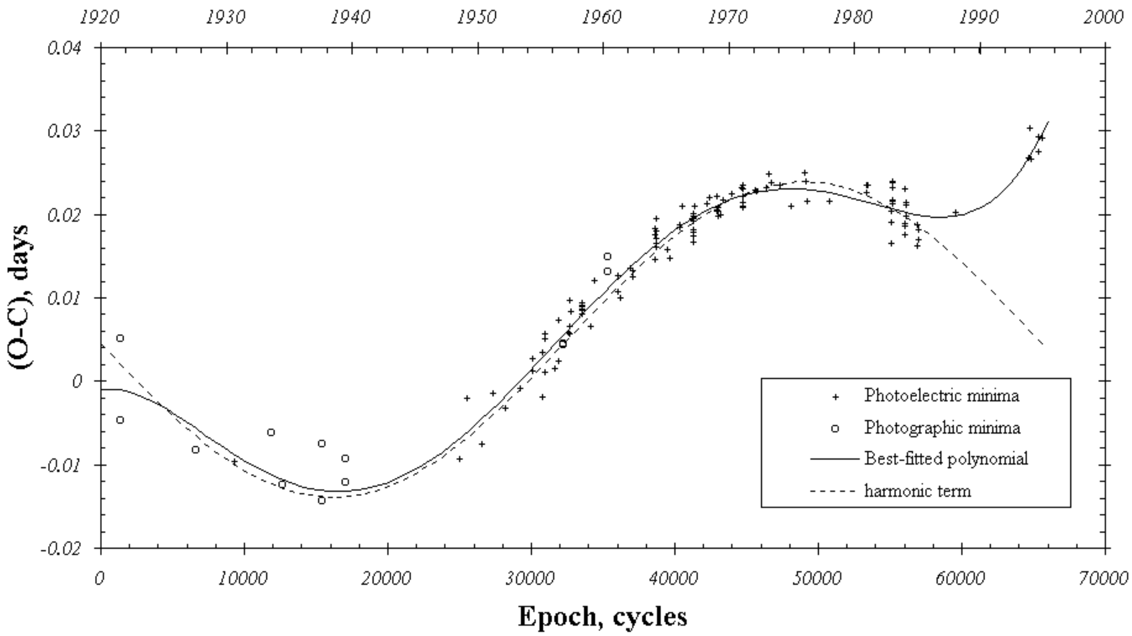

Figure 1. The $O-C$ diagram of AK Her and the best fitted polynomial (continuous line). The sinusoidal variation (dashed line), proposed by Tunca et al. (1987) is also given.

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DISCOVERY OF THE OPTICAL VARIABILITY OF THE STAR GSC 2003_139 = 1RXS J133146+291631

R.M. ROBB[1], D.D. BALAM[2] AND R. GREIMEL[1]

[1] Guest User, Canadian Astronomy Data Centre, which is operated by the Herzberg Institute of Astrophysics, National Research Council of Canada

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

Climenhaga Observatory, Dept. of Physics and Astronomy, University of Victoria, Victoria, BC, Canada, V8W 3P6, Internet: robb@uvic.ca, cosmos@uvvm.uvic.ca, greimel@uvastro.phys.uvic.ca

The star 1RXS J133146+291631 (Hünsch et al. 1999) = GSC 2003_139 (Jenkner et al. 1990) = G 165-8 (Giclas et al. 1980) was found to have significant X-ray emission in a survey by the ROSAT satellite (Bade et al. 1998). Beers et al. (1994) discovered the star to have Ca H&K lines in emission. It was classified as an M4 star by Henry et al. (1994) with an apparent magnitude of $V = 11.95$, and $B-V = 1.57$ as measured by Weis (1991). As part of a search for radial velocity variations of nearby M dwarfs, Delfosse et al. (1998) observed the hydrogen lines to be in emission, measured the radial velocity to be 8 km/s, with a $v \sin i$ of 55 km/s, and concluded that the star had a space motion consistent with it being a member of the young disk at a distance of 7.9 ± 1.2 pc.

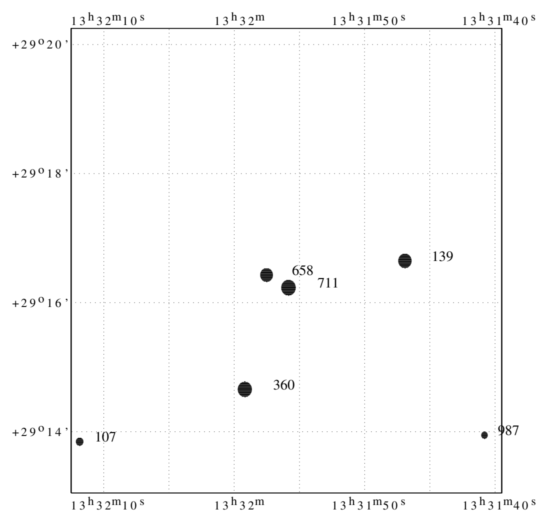

Figure 1. Chart of our observed field, labeled with the GSC numbers from Region 2003.

Table 1: Stars observed in the field of GSC 2003_139

ID No.	R.A. J2000	Dec. J2000	Cat. Mag.	ΔR Mag.
1RXS J133146+291631 =				
= GSC 2003_139	$13^h31^m47^s$	$+29°16'39''$	11.8	$-0.434 \pm .005$
GSC 2003_360	$13^h31^m59^s$	$+29°14'39''$	11.5	—
GSC 2003_711	$13^h31^m56^s$	$+29°16'14''$	11.3	$-0.065 \pm .003$
GSC 2003_658	$13^h31^m58^s$	$+29°16'26''$	12.1	$0.641 \pm .011$
GSC 2003_987	$13^h31^m41^s$	$+29°13'57''$	14.7	$2.995 \pm .115$
GSC 2003_107	$13^h32^m12^s$	$+29°13'51''$	14.3	$3.161 \pm .034$

The field of stars observed with the automated 0.5-m telescope is plotted in Figure 1. The data were reduced in a fashion identical to that described in Robb et al. (1997). The stars' identification numbers, coordinates and magnitudes from the Hubble Space Telescope Guide Star Catalog (GSC) (Jenkner et al. 1990) are included in Table 1. The standard deviation of the differential magnitudes from point to point during a night ranged from $0\overset{m}{.}004$ for bright stars on a good night to $0\overset{m}{.}300$ for the faintest star on poor nights. This measures the precision of the brightness variations on the time scale of a few minutes.

We measure the night to night precision of the data by calculating the standard deviation of the nine nightly means. The run means and standard deviations are tabulated in Table 1 as ΔR, in the sense of star minus GSC 2003_360. The high precision of these data can be seen from the standard deviation of the ΔR, in the sense of GSC 2003_711 minus GSC 2003_360, which is $0\overset{m}{.}003$ and shows that these two stars are constant at this level of precision. The star GSC 2003_987 has a large standard deviation making us suspect it of variability, however our data are inconclusive. The star GSC 2003_139 had obvious variations of approximately $0\overset{m}{.}03$ peak to peak.

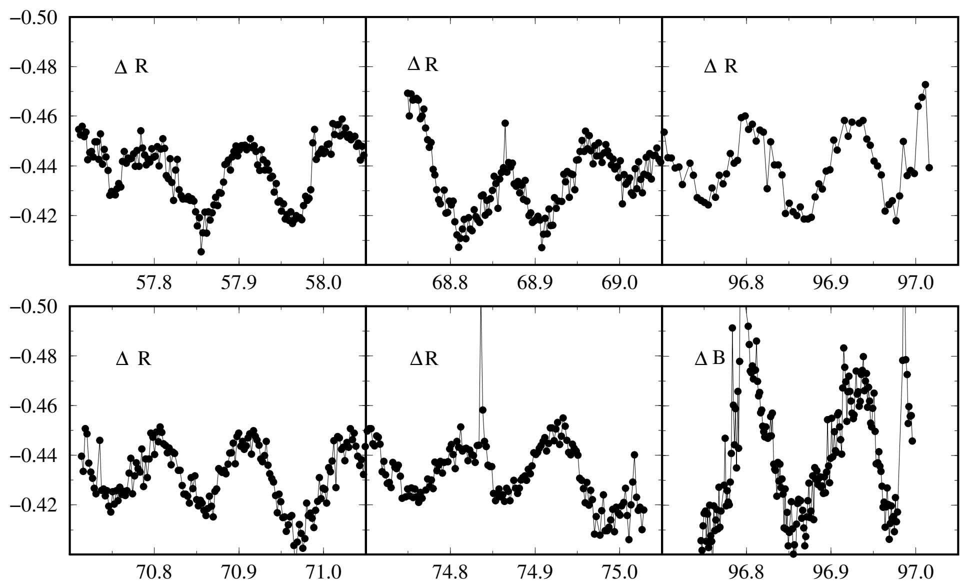

Figure 2. Individual nights' (HJD − 2451200) data for 1RXS J133146+291631

Examples of individual nights' data are all plotted at the same scales in Figure 2 with the ΔB data shifted by -1.86. The abscissa is the Julian Date $-$ 2451200.0 and the rightmost plots were observed simultaneously on Julian Date 2451296. The telescope at the University of Victoria was used to measure in the R and I filters and the 1.82-m telescope of the National Research Council of Canada was used to observe the B data. The light curve amplitude in B ($0\overset{m}{.}07$) is double the amplitude in R ($0\overset{m}{.}03$), which is double the amplitude in I ($0\overset{m}{.}015$). Neither the maxima nor minima were consistent in brightness, during a night. Flares were observed at HJD = 2451274.836, 2451296.793 and 2451296.986 indicating that this is a UV Ceti type star.

The nine nights were searched for periodicity by fitting a single sine curve of various frequencies to the data. In Figure 3 we have plotted the RMS deviation of a point from a single sine curve as a function of frequency.

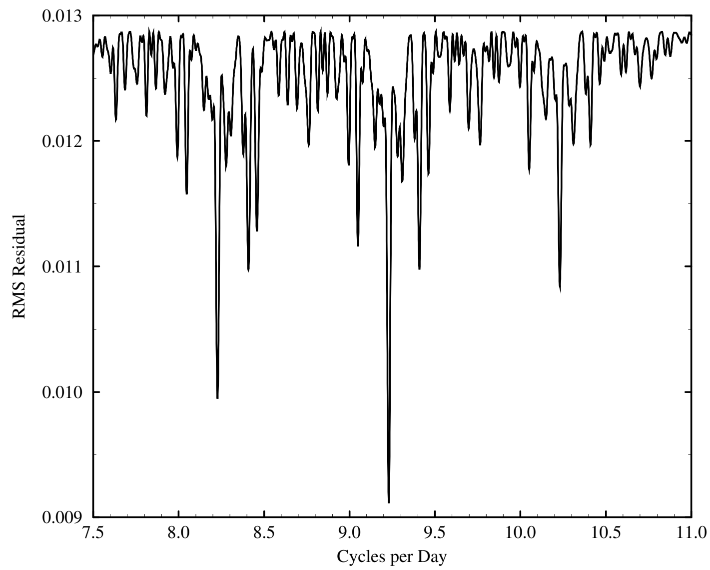

Figure 3. Periodogram for 1RXS J133146+291631 for 1999

Thirteen times of maximum brightness were found using the method of Kwee and van Woerden (1956) to be (HJD − 2451200) 57.9104, 58.0211, 68.8669, 69.8295, 70.8040, 70.9081, 74.9227, 91.8291(I), 91.8242, 96.8058, 96.9255, 96.8061(B), and 96.9266(B). The last two observations were made in B filter and are not significantly different from the second last two which were made in R, considering our uncertainty of approximately $\pm 0\overset{d}{.}0014$.

The photometric period and epoch of GSC 2003_139 are unambiguously determined to be:

$$\text{HJD of Maxima} = 2451257\overset{d}{.}6952(28) + 0\overset{d}{.}10836(2) \times E.$$

where the uncertainties in the final digits are given in brackets.

Using this ephemeris, the differential (GSC 2003_139 − GSC 2003_360) R magnitudes of all the nights are plotted in Figure 4 with different symbols for each of the nights. Plots at multiples of this period yielded no improvement in the scatter. From the variation in the brightness of successive maxima and minima we suspected a second periodicity would be found. Therefore the best fitting sine curve was subtracted from the data and another search for periodicities was performed. No significant periods were found.

Although we considered a pulsating model and a "superhumper" cataclysmic system, we suspect that this variation is due to a hot spot, whose projected area changes as the star rotates. The amplitude of the curves in B, R, and I are well fit by a spot approximately 3.5

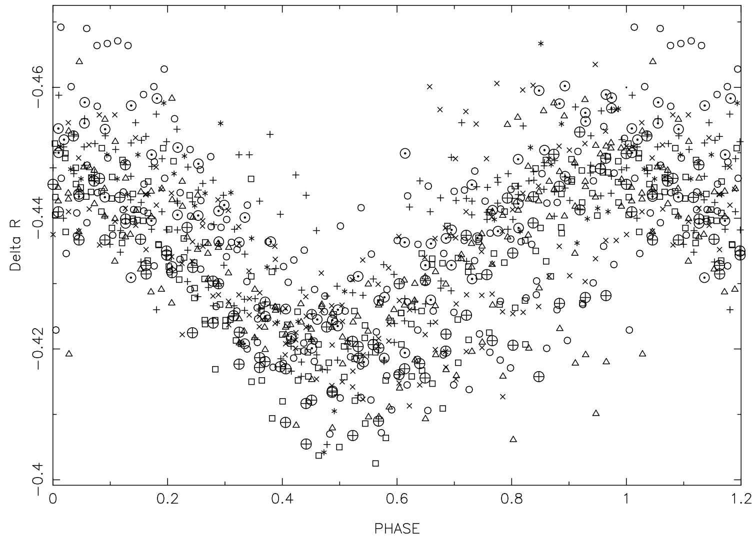

Figure 4. R band light curve of 1RXS J133146+291631 for 1999

degrees in projected radius with a temperature of 1.3 times the surrounding photosphere. The variation in the brightness of the maxima and minima could be caused by changes in the size or temperature of the spot(s). Our rotation period, a radius of 0.3 $R_\odot$, and the $v \sin i$ of Delfosse et al. (1998) give an inclination of $21 \pm 3°$ for the axis of rotation. The quoted uncertainty does not include a contribution from differential rotation, which could be significant.

Therefore we believe RX133146+291631 to be a very rapidly rotating M4Ve star with active regions generating an X-ray bright corona and emission lines and a hot spot modulating the light curve. For this star to rotate so rapidly we expect it to be orbited by a close companion and have begun spectroscopic observations to look for evidence of its existence.

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VARIABLE STARS NEAR V1333 Aql (= Aql X-1)

T. J. REYNOLDS, J. R. THORSTENSEN, AND N. D. SHERMAN

Dept. of Physics and Astronomy, Dartmouth College, 6127 Wilder Laboratory, Hanover, NH 03755-3528, USA
e-mail: john.thorstensen@dartmouth.edu

We monitored V1333 Aql (Aql X-1) in the I-band between 1997 June 19 and 25 using the 1.3-m telescope at MDM observatory, obtaining 178 usable 600-second exposures. Results for Aql X-1 itself were reported by Shahbaz et al. (1998); we refer the reader to that paper for further instrumental detail. Here we report on variable stars serendipitously detected in our 8.7 arcmin square field.

Using the DAOPHOT implementation in IRAF, we selected 6104 stars on one of our best images, and measured magnitudes through point-spread function fitting on all the images. We used observations of Landolt (1992) standard star fields to transform the magnitudes to approximate Kron-Cousins I, to an estimated accuracy of ± 0.05 mag. The measured stars ranged from $12.32 \leq I \leq 20.65$. Not all stars were measurable on all images, because of variations in centering and seeing. After collating the measurements automatically and adjusting the instrumental magnitudes to a common differential scale, we searched for variables by plotting the standard deviation σ of each star's measurements against the mean magnitude. At $I = 13.5$ we examined stars with $\sigma > 0.07$; this degraded to $\sigma = 0.10$ at $I = 17.5$ and finally to $\sigma = 0.33$ near our limit of $I = 20.5$. Light curves of ~ 105 candidate variables were examined by eye and correlated with the direct

Table 1: Variable Stars

number	RA[a]	Dec[a]	I_{max}	I_{min}	P (d)	Type
1	$19^h11^m05\overset{s}{.}88$	$+00°39'06\overset{''}{.}1$	17.6	18.1	0.347	EW
2	$19^h11^m18\overset{s}{.}34$	$+00°37'12\overset{''}{.}0$	16.6	17.1	0.385	EW
3	$19^h11^m23\overset{s}{.}54$	$+00°36'05\overset{''}{.}0$	16.2	16.6	0.300	EW
4	$19^h11^m14\overset{s}{.}15$	$+00°34'45\overset{''}{.}9$	15.2	15.6	0.533	EW
5	$19^h11^m28\overset{s}{.}82$	$+00°32'48\overset{''}{.}5$	16.9	17.7	0.317	EW
6	$19^h11^m09\overset{s}{.}24$	$+00°31'54\overset{''}{.}0$	15.5	15.7	0.342	EW
7	$19^h11^m02\overset{s}{.}97$	$+00°39'38\overset{''}{.}0$	17.3	17.7	0.388	EW
8	$19^h11^m24\overset{s}{.}76$	$+00°38'20\overset{''}{.}2$	18.5	19.1	0.308	EW
9	$19^h11^m17\overset{s}{.}66$	$+00°33'34\overset{''}{.}5$	17.5	18.1	...	EA

[a]: ICRS (essentially J2000), Referred to USNO A2.0

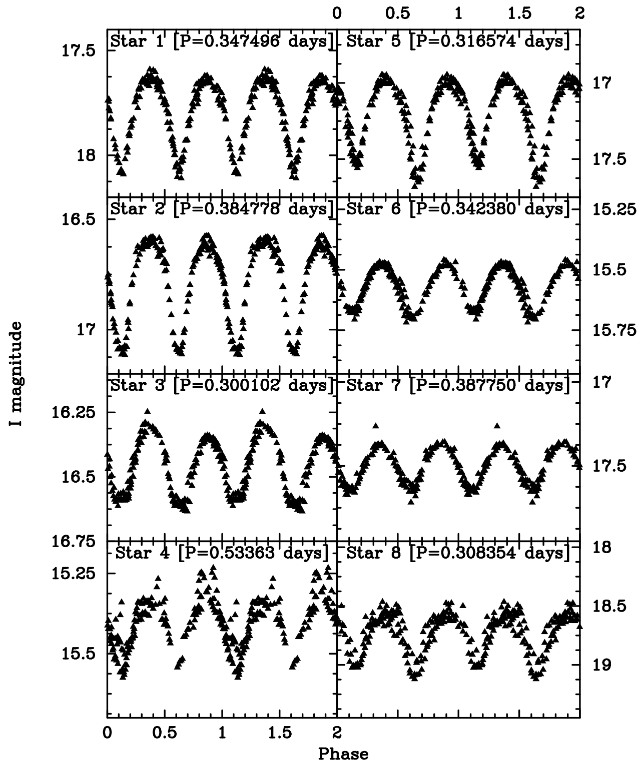

Figure 1. Light curves.

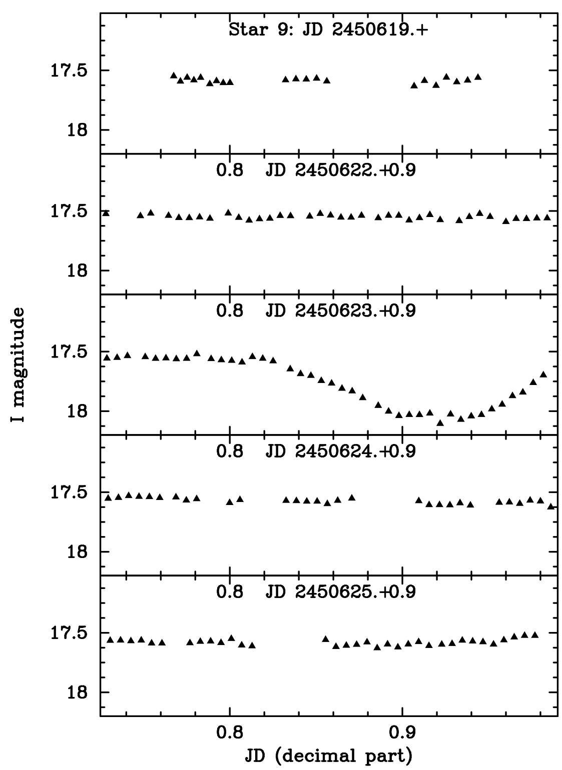

Figure 2. Nightly light curves of the eclipsing variable (Number 9).

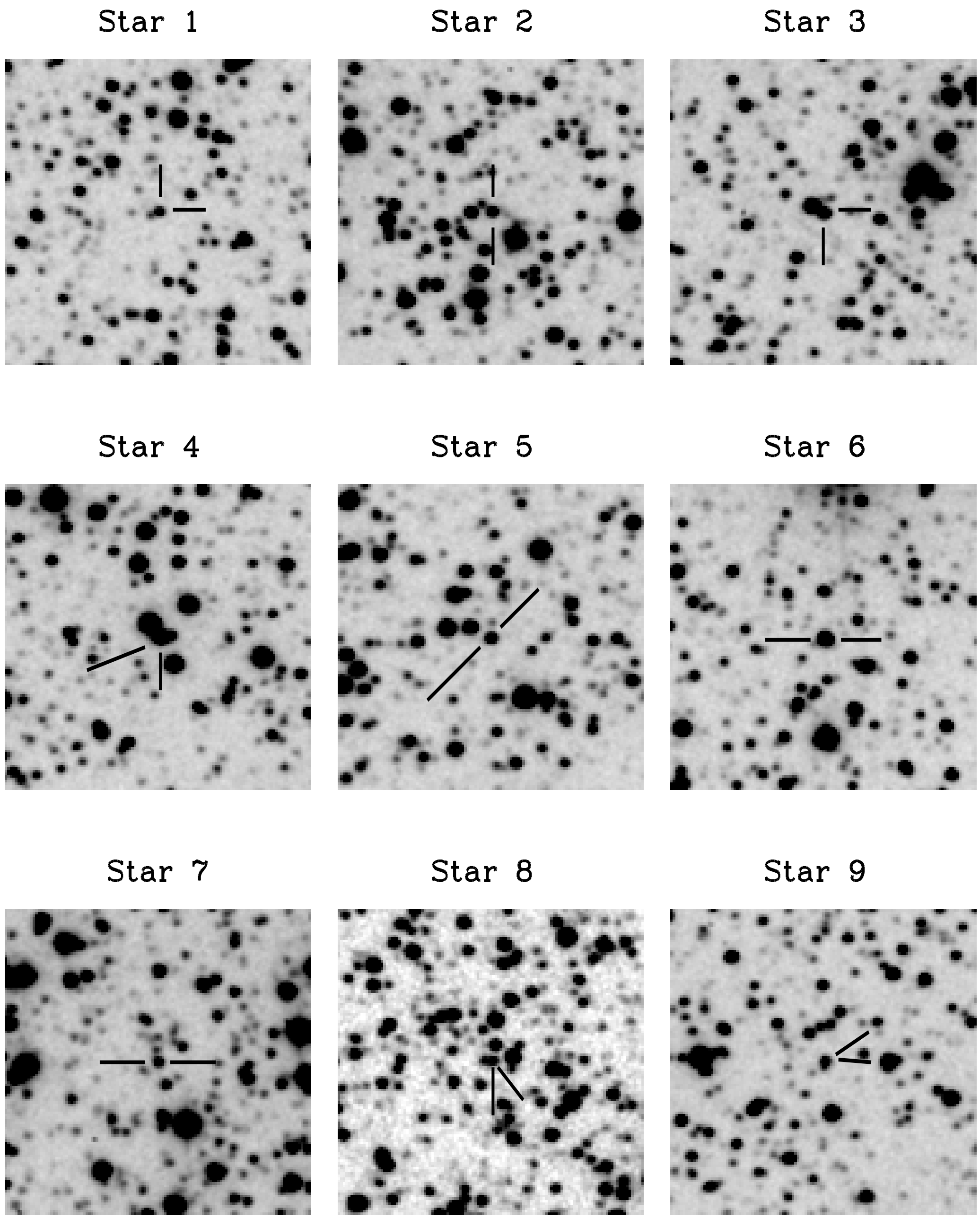

Figure 3. *I*-band finding charts for the nine variable stars. Each panel is 61″ square with north at the top and east to the left.

image; in most cases the variations were found to be spurious, largely because of varying contributions from very bright stars or proximity to the edge of the field.

Nine variables proved to be genuine, and none of these appear to be catalogued. In eight of the nine stars the variations are periodic. Their light curves are shown in Fig. 1. Because the light curves appear consistent with W UMa stars, the plots and periods are constructed assuming two minima per orbit. The remaining variable star showed a single dip consistent with an eclipse, and Fig. 2 shows its light curve during four nights. Table 1 summarizes the information about these variables; the celestial coordinates are derived from a fit to numerous USNO A2.0 catalog stars (Monet et al. 1996), and are estimated accurate to $\sim 0\farcs3$. The periods in Table 1 should typically be accurate to ~ 0.001 d, given the length of the data stream. Fig. 3 shows finding charts.

We are clearly not sensitive to variable stars with periods much longer than our week-long observation window, but our census should be fairly complete for shorter-period variations.

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A SUSPECTED VARIABLE OBJECT IN THE FIELD OF 3C371

CHULHEE KIM

Dept of Earth Science Education, Chonbuk National University, Chonju, 561-706 (South) Korea, kimastro@moak.chonbuk.ac.kr

Equatorial coordinates:	**Equinox:**
R.A.= $18^h07^m29^s$ **DEC.=** $69°49'.1$	1950

Observatory and telescope:
BOAO (Bohyun Astronomical Observatory), 1.8-m reflector

Detector:	Thinned back illuminated TEK 1024×1024 chip
Filter(s):	*B*
Comparison star(s):	See Figure 1
Check star(s):	See Figure 1
Transformed to a standard system:	No

Availability of the data:
Through IBVS Web-site as 4716-t1.txt

Type of variability:	ZZ Ceti?

Remarks:
In order to monitor the intraday variability, the blazar 3C371 was observed with the BOAO (Bohyun Astronomical Observatory) 1.8-m reflector. As a byproduct, this variable object was found. We carried out aperture photometry via the APPHOT program in the IRAF package in order to determine the differential photometric magnitudes. The exposure time was about five minutes. The light curve is similar to that of the variable white dwarfs classified as ZZ Ceti stars.

Acknowledgements:
The present study was partly supported by the Korea Research Foundation, Project 1998-015-D00287

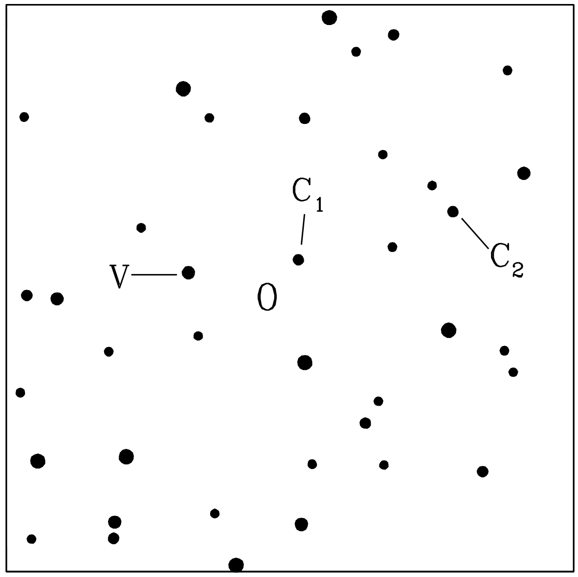

Figure 1. Finding chart of the new variable. The blazar 3C371 is denoted by 0.

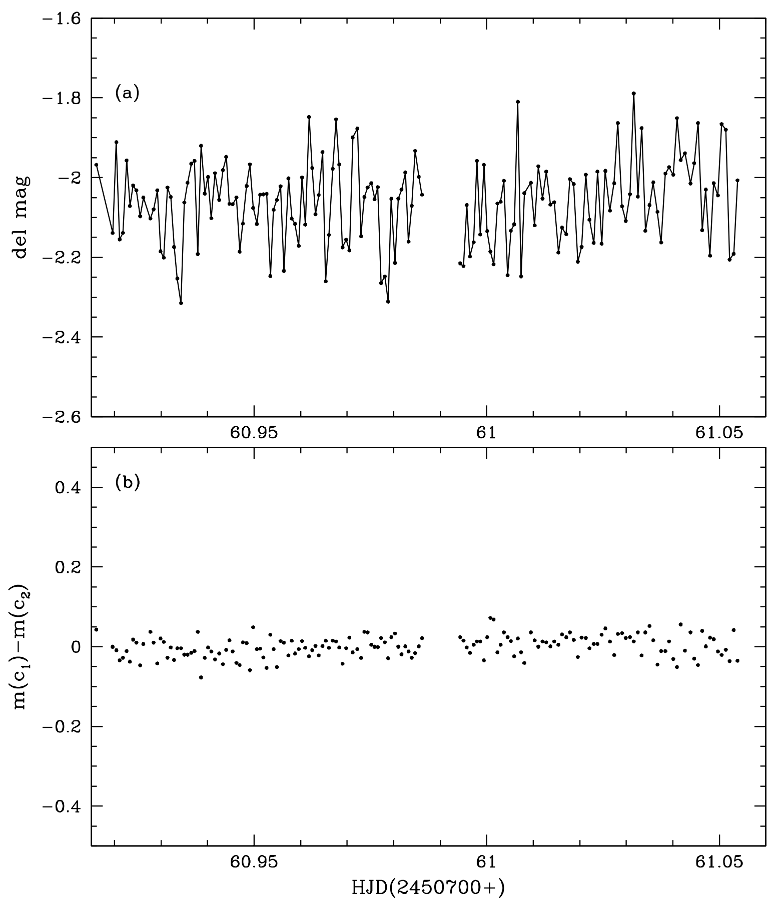

Figure 2. *a*) light curve of the new variable; *b*) magnitude differences between the comparison and check stars.

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GSC 729.01321: A NEWLY DISCOVERED VARIABLE STAR

R. DIETHELM

BBSAG, Rennweg 1, CH-4118 Rodersdorf, Switzerland

Astronomisches Institut der Universität Basel, Venusstrasse 7, CH-4102 Binningen, Switzerland;
e-mail: diethelm@astro.unibas.ch

Name of the object:
GSC 729.01321

Equatorial coordinates:	**Equinox:**
R.A.= $06^h05^m35\overset{s}{.}1$ **DEC.=** $+13°58'54''$	J2000.0

Observatory and telescope:
R. Szafraniec Observatory, Metzerlen, Switzerland; 35-cm RC telescope

Detector:	SBIG ST-6 CCD camera
Filter(s):	None
Comparison star(s):	GSC 729.00764
Check star(s):	GSC 729.00592
Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	Unknown

Remarks:
In the course of an ongoing study aimed at securing the light curve and the elements of variation for the eclipsing binary DW Ori, we found the nearby star GSC 729.01321 (GSC magnitude: 13.35) to be variable with an amplitude of at least 0.65 mag. While the observations secured during one night do not show variability above the accuracy of the photometry (0.02 mag), a brightening was found during the interval covering 66 days. This leads us to conclude, that GSC 729.01321 probably belongs to a class of slowly varying stars.

Acknowledgements:
Photometry at the R. Szafraniec Observatory is supported by the "Emilia Guggenheim-Schnurr Foundation".

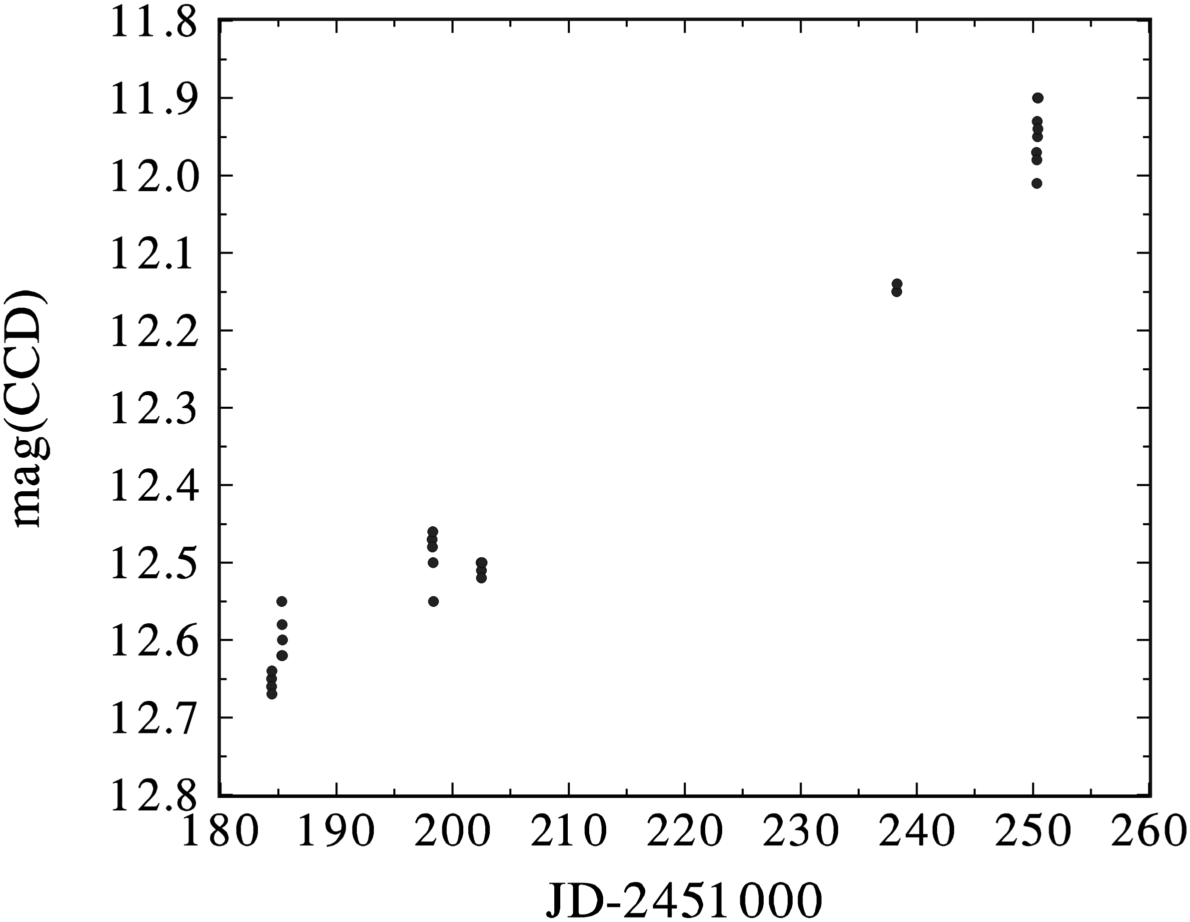

Figure 1. CCD light curve of GSC 729.01321

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THE RADIAL VELOCITY OF DOUBLE-MODE CEPHEID BD –10°4669

S.V. ANTIPIN[1], N.A. GORYNYA[2], M.E. SACHKOV[2], N.N. SAMUS[2], L.N. BERDNIKOV[1], A.S. RASTORGOUEV[1], E.V. GLUSHKOVA[1]

[1] Sternberg State Astronomical Institute, Universitetsky Ave. 13, Moscow 119899, Russia
[2] Institute of Astronomy, Russian Academy of Sciences, Pyatnitskaya Str. 48, Moscow 109017, Russia

CEP(B)-type variability of BD $-10°4669$ was recently discovered by Antipin (1997). The star was bright enough to include it in our programme of Cepheid radial velocity measurements, so the new variable became the sixth beat Cepheid in our observations along with CO Aur, TU Cas, EW Sct, V367 Sct, and BQ Ser. In 1997–98 we obtained 70 V_r measurements at the 60-cm and 1-m reflectors of Simeiz Observatory equipped with the correlation spectrometer (Tokovinin, 1987). Table 1 contains HJD, heliocentric V_r values and their internal r.m.s. errors. The value of gamma-velocity from these observations is $V_\gamma = -5.6 \pm 0.4$ km/s.

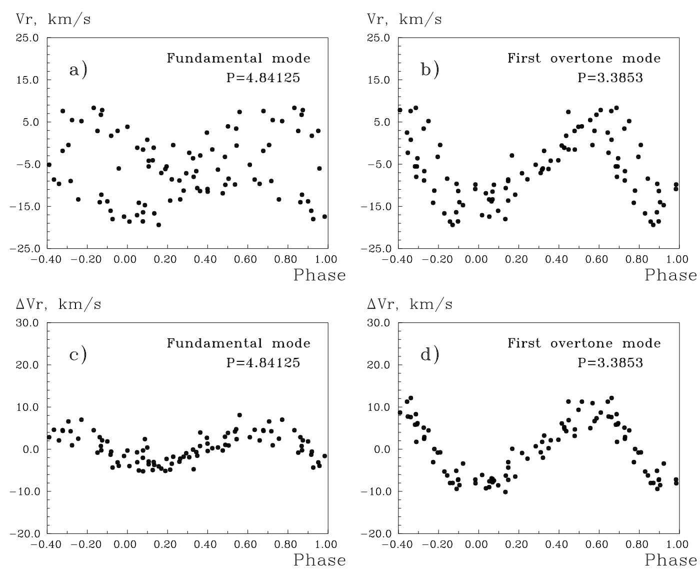

Figure 1. The phased radial-velocity variations. See description in text

In Figure 1 we present phased V_r curves for the elements taken from Antipin (1997):

$$\mathrm{JD_{max}} = 2447733.42 + 4\overset{\mathrm{d}}{.}84125 \times E \quad \text{(fundamental mode Fig. 1ac) and}$$
$$\mathrm{JD_{max}} = 2441177.37 + 3\overset{\mathrm{d}}{.}3853 \times E \quad \text{(first overtone mode Fig. 1bd).}$$

Figures 1ab are based on original measurements. Figures 1cd are constructed for deviations from the mean phased curve of the other oscillation (from the first overtone for

Table 1: Radial velocities of BD -10°4669

HJD 24...	V_r, km/s	σ	HJD 24...	V_r, km/s	σ	HJD 24...	V_r, km/s	σ
50614.441	0.8	0.7	50732.202	−1.5	0.5	51020.391	2.9	0.9
50617.468	5.5	0.4	50976.417	6.7	0.7	51021.383	−19.4	0.7
50621.430	3.4	0.5	50977.433	−16.4	0.8	51022.384	−2.9	1.1
50623.439	−6.0	0.6	50981.416	−13.8	0.5	51023.335	7.4	0.6
50625.398	−11.4	0.6	50982.413	−4.2	0.6	51024.363	5.2	0.8
50634.434	−0.5	0.9	50983.388	−2.3	0.7	51025.388	−17.4	1.0
50636.397	−8.6	0.7	50987.389	−16.7	0.6	51026.387	−6.1	0.9
50640.352	−6.3	0.6	50988.427	−10.7	0.6	51027.386	2.5	0.8
50642.344	−14.0	1.6	50989.372	−0.6	1.3	51039.365	−12.2	0.8
50645.364	−3.3	1.1	50992.400	−7.1	0.5	51040.369	−1.5	0.6
50648.366	−5.5	0.8	50996.423	3.9	0.4	51045.257	−14.7	0.8
50690.238	−13.3	0.6	50998.360	−11.5	0.8	51046.252	−7.1	0.7
50705.224	2.9	0.3	51000.450	8.3	1.2	51047.261	4.0	0.5
50706.222	−14.1	0.6	51002.334	−8.6	0.5	51048.255	−0.4	0.8
50707.222	−13.3	0.5	51006.340	−1.1	0.5	51051.258	−3.6	0.9
50709.228	7.6	0.7	51007.360	−8.9	0.7	51069.273	−17.1	0.6
50713.227	−8.4	0.6	51008.404	−11.9	0.6	51072.230	−9.7	0.5
50714.259	−9.0	0.5	51009.384	−1.8	0.5	51075.238	−11.3	0.6
50715.236	1.7	0.4	51010.338	7.8	1.7	51076.243	−9.9	0.4
50726.257	−5.5	0.6	51011.317	−18.6	0.6	51083.203	−18.0	0.8
50727.243	−10.9	1.6	51015.380	−16.0	0.6	51084.199	−1.1	0.4
50728.264	−5.1	0.9	51016.396	−4.1	0.8	51085.225	−6.6	0.9
50730.201	−18.6	0.4	51017.383	−8.0	1.0			
50731.185	−13.6	0.4	51018.383	−9.8	1.2			

Fig. 1c and from the fundamental mode for Fig. 1d); additionally, the frequency connected with non-linear interaction of the two main modes ($1/P_0 + 1/P_1$, $P = 1^{\rm d}.9922$) has been whitened. The first overtone mode strongly dominates in variations of radial velocity as well as in light variations. The semiamplitudes of V_r are $K_0 = 4.3$ km/s and $K_1 = 9.4$ km/s.

Using the modification of Balona's (1977) method described in Sachkov (1997), we derived the radius of BD −10°4669 from the radial-velocity measurements (Table 1) and 164 photoelectric BVI measurements obtained in JD 2450541–51286 by one of the authors (L.N.B.). Two color indices, $B-V$ and $V-I$, were used as indicators of the effective temperature; the results from them are in excellent agreement and with low *formal* errors ($57 \pm 1\ R_\odot$ from $B-V$ and $58 \pm 1\ R_\odot$ from $V-I$). The resulting $\log R$ value is 1.76, in agreement with the value 1.73 predicted from the period–radius relation derived by Sachkov (1997).

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COORDINATES AND IDENTIFICATIONS FOR SONNEBERG VARIABLES – I

BRIAN A. SKIFF

Lowell Observatory, 1400 West Mars Hill Road, Flagstaff AZ 86001-4499, USA, e-mail: bas@lowell.edu

This report contains identifications and accurate positions for 89 variables discovered by Hoffmeister (1959). Most are short-period variables in the constellation Hercules. The working methods were similar to previous lists (*e.g.* Skiff 1999), which involves comparing the source charts against computer-screen plots of the GSC or USNO–A2.0 star catalogues, with Digitized Sky Survey images, and making bibliographic comparisons using the Strasbourg 'VizieR' utility and SIMBAD.

The list is divided into four tables as given by Hoffmeister from differing plate material. The tables show Sonneberg serial numbers and GCVS designations in the first two columns. An asterisk by the GCVS name indicates a note following the tables. The star positions are from either the ACT (Urban *et al.* 1998) or USNO–A2.0 (Monet *et al.* 1998). The source of the position is given in column 's': A = USNO–A2.0, T = ACT. Several of the stars in Table 1 have precise coordinates previously published by de Martino *et al.* (1996) as part of the Yale southern proper-motion program. GSC names are given as available. A few new IDs with external catalogues are given in the remarks or the notes.

Table 1: Variables on southern sky-patrol plates

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 5219	NSV 14530	23 22 46.5	−46 41 32	A		
S 5220	TU Phe	23 35 23.7	−55 03 06	T	8835-0869	
S 5221	NSV 14643	23 37 21.4	−33 36 22	T	7518-1036	HD 222024
S 5222	NSV 29*	0 06 20.8	−35 17 13	A	6995-0681	
S 5223	NSV 207	0 34 18.6	−43 00 04	A	7531-0512	
S 5224	NSV 336	0 53 33.0	−41 20 34	A	7536-0245	
S 5225	NSV 508	1 25 46.4	−39 56 11	T	7541-0649	

Table 2: Variables in the 73 Herculis astrograph field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 5226	V364 Her	17 04 03.7	+20 50 01	A		
S 5227	V366 Her	17 07 04.9	+27 37 47	A	2068-0675	
S 5228	V368 Her	17 10 31.1	+22 23 09	A		
S 5229	V369 Her	17 11 40.8	+24 57 32	A		
S 5230	V465 Her	17 12 28.2	+20 52 19	A	1548-2099	
S 5231	V370 Her	17 12 33.0	+20 32 24	A		
S 5232	V372 Her	17 13 16.9	+20 57 32	A		
S 5233	V374 Her	17 13 34.1	+24 04 29	A	2061-0146	
S 5234	V375 Her*	17 13 40.7	+27 59 20	A		
S 5235	V376 Her	17 14 15.7	+20 52 03	A		
S 5236	V379 Her	17 14 35.4	+22 23 42	A	1548-1804	
S 5237	V380 Her*	17 15 43.0	+25 15 45	A	2065-1222	
S 5238	V381 Her	17 16 11.1	+20 51 19	A	1548-0530	
S 5239	V382 Her	17 16 17.2	+22 01 05	A		
S 5240	V383 Her	17 16 28.2	+20 58 45	A		
S 5241	V385 Her	17 16 26.6	+28 05 57	A	2069-1646	
S 5242	V386 Her	17 17 24.4	+26 48 42	A		
S 5243	V473 Her	17 17 43.6	+20 24 20	A	1544-1368	
S 5244	V389 Her	17 19 16.2	+19 10 35	A		
S 5245	V394 Her	17 22 38.7	+17 53 05	A	1541-1279	
S 5246	V395 Her	17 22 34.0	+24 45 01	A	2078-1484	galaxy VII Zw 476
S 5247	V398 Her	17 23 00.4	+27 44 02	A		
S 5248	V399 Her	17 23 33.0	+26 08 58	A		
S 5249	V401 Her	17 26 44.9	+25 43 25	A		
S 5250	V402 Her	17 27 14.2	+24 02 44	A		
S 5251	V403 Her	17 27 26.6	+22 13 36	A	1549-2079	
S 5252	V404 Her	17 27 43.3	+26 57 04	A		
S 5253	V405 Her	17 27 53.9	+26 52 56	A	2083-1272	
S 5254	V407 Her	17 29 27.9	+23 25 28	A	2075-0105	
S 5255	V411 Her	17 30 49.3	+19 14 31	A	1546-1824	
S 5256	V410 Her	17 30 37.7	+19 37 07	A	1546-2098	
S 5257	V415 Her*	17 31 57.3	+21 46 56	A		
S 5258	V413 Her	17 31 35.6	+26 42 03	A	2083-1605	
S 5259	V418 Her	17 32 13.1	+18 14 00	A	1542-0747	
S 5260	V416 Her	17 31 57.5	+23 08 13	A		
S 5261	V419 Her	17 32 45.7	+18 56 29	A		
S 5262	V420 Her	17 32 32.2	+27 26 08	A	2083-2021	
S 5263	V422 Her	17 33 17.0	+22 59 39	A		
S 5264	V496 Her	17 33 35.7	+18 45 32	A	1546-1465	
S 5265	V423 Her	17 33 56.0	+26 48 46	A	2083-1814	
S 5266	V426 Her	17 35 29.1	+23 01 28	A	2076-0046	
S 5267	V425 Her	17 35 21.7	+26 52 21	A	2084-0596	
S 5268	V427 Her	17 37 15.0	+21 12 30	A	1563-0908	
S 5269	V428 Her	17 37 14.6	+24 49 10	A		
S 5270	V429 Her	17 37 33.4	+24 43 45	A		
S 5271	V430 Her	17 38 06.2	+24 39 05	A		
S 5272	V431 Her	17 38 32.8	+24 37 24	A	2080-1229	
S 5273	V434 Her	17 40 33.1	+22 49 03	A	2076-3262	
S 5274	V433 Her	17 40 24.8	+25 25 49	A	2080-2529	
S 5275	V435 Her	17 41 11.5	+25 18 58	A	2080-3105	
S 5276	V438 Her	17 42 04.8	+20 11 45	A		
S 5277	V440 Her	17 43 18.2	+23 30 25	A		

Table 3: Variables in the 73 Herculis Schmidt field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 5278	V367 Her	17 08 20.8	+25 20 48	A		
S 5279	V371 Her	17 12 51.2	+23 54 02	A		
S 5280	V373 Her	17 13 08.3	+24 36 59	A		
S 5281	V377 Her	17 14 07.6	+25 45 57	A		
S 5282	V378 Her	17 14 42.3	+25 23 28	A		
S 5283	V384 Her	17 16 30.9	+23 34 21	A	2061-1959	
S 5284	V388 Her	17 18 45.2	+23 37 48	A		
S 5285	V390 Her	17 20 28.4	+25 48 15	A		
S 5286	V391 Her	17 21 07.5	+19 02 49	A		
S 5287	V477 Her	17 20 57.9	+26 18 20	A	2082-2362	
S 5288	V392 Her	17 20 51.4	+26 32 20	A	2082-2371	
S 5289	V396 Her	17 22 41.3	+24 36 19	A		quasar, $z = 0.175$
S 5290	V482 Her	17 25 09.6	+18 43 43	A		
S 5291	V400 Her	17 25 42.4	+19 33 27	A	1545-1008	IRAS 17235+1935
S 5292	V406 Her	17 28 18.0	+21 16 30	A	1550-2250	
S 5293	V408 Her	17 29 29.7	+25 35 35	A		
S 5294	V409 Her	17 30 27.9	+18 06 38	A		
S 5295	V412 Her	17 30 30.5	+25 54 15	A	2079-0509	
S 5296	V414 Her	17 31 43.0	+22 38 41	A		
S 5297	V417 Her	17 31 55.6	+23 50 58	A		
S 5298	V424 Her	17 34 44.0	+17 57 17	A	1542-1209	
S 5299	V432 Her	17 39 39.3	+25 13 15	A		
S 5300	V513 Her	17 40 22.0	+24 15 47	A	2076-1720	
S 5301	V436 Her	17 41 26.2	+19 09 49	A		
S 5302	V516 Her	17 41 22.9	+24 51 50	A	2080-3094	
S 5303	V437 Her	17 41 26.7	+24 44 36	A		
S 5304	V439 Her	17 42 04.8	+23 48 37	A	2076-2131	CCDM J17421+2349A

Table 4: Variables in high-latitude fields

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 5305	DI UMa	9 12 16.1	+50 53 55	A		
S 5306	TZ Com	12 30 09.9	+13 53 55	A		
S 5307	CV Vir	12 30 58.1	+12 18 31	A	0877-0233	

Notes:

NSV 29 BPS CS 22876-0034 = SB 36.

V375 Her star marked is not red.

V380 Her assumed to be the southeastern star of a pair.

V415 Her assumed to be the eastern star of a pair.

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COORDINATES AND IDENTIFICATIONS FOR SONNEBERG VARIABLES – II

BRIAN A. SKIFF

Lowell Observatory, 1400 West Mars Hill Road, Flagstaff AZ 86001-4499, USA, e-mail: bas@lowell.edu

The lists below give accurate coordinates for some 290 designated and suspected variables in several fields described by Hoffmeister (1963). The working methods were similar to previous lists (*e.g.* Skiff 1999), which involves comparing the source charts against computer-screen plots of the GSC or USNO–A2.0 star catalogues, with Digitized Sky Survey images, and making bibliographic comparisons using the Strasbourg 'VizieR' utility and SIMBAD.

The tables are arranged as previously, divided by region as in Hoffmeister's lists. The Sonneberg serial number and the GCVS designations appear in the first two columns. An asterisk by the GCVS name indicates a note, which appear at the end of the tables. The positions are taken mostly from USNO–A2.0 (Monet *et al.* 1998); for some bright stars the ACT (Urban *et al.* 1998) is adopted, and for a few crowded stars positions have been estimated ($\pm 2''$) using large-scale Digitized Sky Survey frames from the Goddard SkyView facility (McGlynn *et al.* 1996). The source of the position is coded in column 's' as follows: A = USNO–A2.0, S = SkyView, T = ACT. Many of the NSV stars in the 'ι CMa' field have been dealt with previously by Lopez (1993), who gives accurate coordinates for southern NSV stars.

I made the match-up with the GSC using 'VizieR', and found the various IDs in the Remarks and Notes using SIMBAD. The IDs are listed only if they are new, in the sense of being either not present or not linked in the same entry in SIMBAD.

A few stars defeated my attempts to identify them. Given that some of the stars I did find have positions as much as $10'$ in error, it is likely that these 'lost' ones have similar errors of some kind.

Table 1: h & χ Persei field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7715	KX Per	2 10 23.4	+58 13 09	A	3697-0151	
S 7716	NSV 734	2 10 41.9	+56 00 03	A		
S 7717	KY Per	2 14 30.2	+56 24 02	A		
S 7718	KZ Per	2 15 07.6	+58 03 37	A		
S 7719	LL Per	2 14 51.5	+57 29 34	A		
S 7720	NSV 810	2 23 09.9	+56 08 21	A		
S 7721	NSV 811	2 23 14.8	+56 09 36	A		
S 7722	LM Per	2 23 56.7	+56 17 19	A		
S 7723	LN Per	2 25 57.5	+55 47 44	A		
S 7724	NSV 830					not found
S 7725	LO Per	2 31 10.4	+56 20 48	A		
S 7726	LP Per	2 31 19.9	+56 51 10	A		
S 7727	LQ Per	2 31 27.7	+56 31 40	S		
S 7728	LR Per	2 32 46.4	+56 29 27	A		

Table 2: North Galactic Pole fields

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7729	BI UMa	10 47 11.6	+46 17 40	A	3443-0854	
S 7730	AG UMa	10 48 56.3	+42 40 15	A	3011-1742	
S 7731	AH UMa	10 49 39.2	+46 42 21	A		
S 7732	BK UMa	10 50 19.0	+42 34 09	A	3011-1600	
S 7733	AI UMa	10 52 16.3	+46 39 09	A		
S 7734	AK UMa	10 53 13.2	+41 19 02	A		
S 7735	CC UMa	10 53 40.6	+42 28 13	T	3011-0281	IRAS 10508+4244
S 7736	AL UMa	10 55 51.2	+44 27 41	A		
S 7737	AM UMa	11 03 35.5	+45 59 19	A		
S 7738	AN UMa	11 04 25.8	+45 03 16	A		
S 7739	BL UMa	11 07 25.8	+41 15 58	A		
S 7740	AO UMa	11 07 39.8	+40 33 57	A		FBS B 77 ?
S 7741	AP UMa	11 10 24.3	+42 48 54	A	3012-1664	
S 7742	BM UMa	11 11 20.5	+46 25 49	A	3444-0164	
S 7743	AQ UMa	11 12 59.5	+42 48 42	A		
S 7744	AR UMa	11 15 44.9	+42 58 23	A		CSO 1153
S 7745	BN UMa	11 16 22.8	+41 14 02	A	3010-2127	
S 7746	AS UMa	11 16 42.5	+44 07 04	A	3012-0170	
S 7747	BO UMa	11 16 57.0	+42 05 19	A		
S 7748	BP UMa	11 18 57.5	+47 04 12	A		
S 7749	AT UMa	11 19 48.3	+41 37 52	A		
S 7750	AU UMa	11 21 14.1	+44 14 17	A		
S 7751	BQ UMa	11 21 29.9	+44 18 35	A	3015-0510	
S 7752	BR UMa	11 24 04.6	+42 56 54	A	3015-0195	
S 7753	BS UMa	11 25 41.7	+42 34 52	A	3015-1285	
S 7754	BV Leo	11 27 51.6	+24 44 06	A	1982-1006	
S 7755	AV UMa	11 29 40.5	+42 44 25	A		
S 7756	AT Leo	11 30 07.4	+21 02 10	A		
S 7757	BT UMa	11 30 53.7	+44 14 32	A	3015-0686	
S 7758	BU UMa	11 31 01.4	+44 21 31	A	3015-0794	
S 7759	AY Leo	11 35 06.9	+20 57 45	A		
S 7760	NSV 5274	11 37 58.2	+17 56 09	A	1438-0082	ID uncertain

Table 2: North Galactic Pole fields (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7761	CD Leo*	11 43 01.3	+19 03 05	A		
S 7762	BI Leo	11 43 13.4	+21 08 10	A		
S 7763	CE Leo	11 44 24.2	+23 21 23	A	1985-1209	
S 7764	NSV 5324	11 46 39.0	+19 46 30	A		
S 7765	CG Leo	11 49 10.4	+21 36 54	A		
S 7766	CH Leo	11 49 14.9	+24 10 00	A	1985-2497	
S 7767	BO Leo	11 51 37.1	+21 52 43	A	1443-1405	
S 7768	BP Leo	11 53 10.3	+23 16 54	A	1985-1491	
S 7769	BS Leo	11 55 49.5	+19 20 38	A	1443-0488	
S 7770	VX Com	11 58 40.2	+22 23 09	A		
S 7771	BV Com	12 02 24.3	+17 34 59	A	1442-1498	
S 7772	BW Com	12 04 16.7	+18 53 13	A	1444-1988	
S 7773	WZ Com	12 07 34.0	+20 06 10	A	1444-0983	
S 7774	NSV 5545	12 18 48.5	+21 22 24	A	1447-1432	
S 7775	CM Com	12 19 25.3	+21 20 59	A	1447-1001	
S 7776	AC Com	12 20 53.3	+22 10 30	A	1447-0793	BPS BS 16933-0049
S 7777	AD Com	12 21 45.8	+17 34 57	A		
S 7778	CQ Com	12 22 21.5	+16 17 34	A	1445-1536	
S 7779	CR Com	12 23 26.3	+16 05 01	A	1445-1651	
S 7780	AF Com	12 23 45.2	+21 40 39	A	1447-1786	
S 7781	AG Com*	12 24 36.7	+24 59 11	A	1989-0553	
S 7782	CU Com	12 24 46.6	+22 24 29	A	1447-1098	
S 7783	NSV 5626	12 27 23.4	+17 40 38	A		
S 7784	CY Com	12 28 20.0	+24 57 19	A	1989-0299	
S 7785	CZ Com	12 28 52.0	+25 06 42	A	1989-0542	BPS BS 16031-0016
S 7786	AK Com	12 29 53.5	+23 15 15	A	1989-2475	
S 7787	NSV 5669	12 30 47.0	+18 05 55	A	1445-0448	
S 7788	DI Com	12 33 18.9	+23 44 42	A		
S 7789	AM Com	12 33 28.3	+22 28 40	A	1448-0959	Ton 1545
S 7790	DK Com	12 33 54.7	+22 10 33	A	1448-2933	
S 7791	DM Com	12 35 38.3	+16 32 21	A		
S 7792	AO Com	12 36 10.0	+22 23 43	A	1448-2222	
S 7793	DO Com	12 38 43.1	+18 32 42	A	1446-0375	
S 7794	DP Com	12 39 09.8	+20 45 18	A	1448-2052	
S 7795	AP Com	12 39 18.8	+22 03 16	A	1448-2449	
S 7796	DR Com	12 40 38.4	+22 22 01	A	1448-1294	
S 7797	EH Com	12 48 37.7	+18 10 26	A	1452-0572	
S 7798	AX Com*	12 50 37.2	+18 18 37	S	1452-0587	
S 7799	BC Com	12 54 40.6	+19 48 03	A		
S 7800	BB Com	12 54 27.3	+21 54 51	A	1455-0656	
S 7801	EQ Com	12 59 02.9	+18 02 45	A	1453-0601	
S 7802	EU Com*	13 03 59.8	+19 42 19	A	1453-0022	
S 7803	FF Com	13 18 47.0	+22 31 10	A		
S 7804	BL Com	13 28 11.8	+17 51 05	A	1461-0645	
S 7805	BO Com*	13 31 05.6	+16 36 22	A	1459-0813	
S 7806	FL Com	13 35 05.1	+19 50 19	A		
S 7807	BQ Boo	13 39 20.3	+18 12 06	A		
S 7808	BT Boo	13 43 28.6	+23 56 09	A		
S 7809	AP Boo	13 44 57.3	+19 41 03	A		
S 7810	AY Boo	13 53 12.9	+17 12 46	A	1467-1073	BPS BS 16550-0003

Table 3: 33 Cygni field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7820	NSV 12233	19 37 04.3	+56 55 20	T	3942-1958	IRAS 19360+5648
S 7821	V939 Cyg	19 38 24.3	+56 32 24	A	3942-1682	
S 7822	NSV 12278	19 39 15.5	+52 47 38	A		
S 7823	V940 Cyg	19 38 49.0	+57 40 22	A	3942-0568	
S 7824	NSV 12281	19 39 12.4	+58 20 32	A	3946-1406	
S 7825	V949 Cyg	19 41 23.0	+51 42 47	A	3569-1499	IRAS 19400+5135
S 7826	BL Dra	19 40 24.6	+60 55 12	A	4230-0991	
S 7827	V958 Cyg	19 42 12.8	+52 05 27	A	3569-0880	IRAS 19409+5158
S 7828	V966 Cyg	19 42 42.9	+55 54 41	A		
S 7829	V972 Cyg	19 43 23.9	+55 22 51	A		
S 7830	V978 Cyg	19 44 28.0	+55 41 12	A		
S 7831	BM Dra					not found
S 7832	NSV 12378	19 44 08.0	+58 21 13	T	3946-1977	
S 7833	V981 Cyg	19 45 03.6	+56 24 52	A	3942-1662	
S 7834	V982 Cyg	19 45 44.5	+55 23 48	A	3938-0991	IRAS 19446+5516
S 7835	NSV 12400	19 45 40.8	+58 48 56	A		
S 7836	V985 Cyg	19 46 19.4	+56 34 29	A		
S 7837	V988 Cyg	19 46 53.4	+53 38 15	A	3935-1891	
S 7838	V993 Cyg	19 47 38.5	+52 57 54	A	3935-1558	IRAS 19463+5250
S 7839	V997 Cyg	19 48 05.1	+52 51 16	A	3935-2233	
S 7840	BN Dra	19 47 08.1	+61 22 13	A	4231-1158	
S 7841	V1002 Cyg	19 48 41.0	+56 14 55	A	3939-1173	
S 7842	V1005 Cyg	19 49 25.5	+51 39 54	A		
S 7843	V1003 Cyg	19 49 11.2	+52 47 18	A		
S 7844	V1006 Cyg	19 48 47.1	+57 09 22	A		
S 7845	V1168 Cyg	19 55 32.2	+52 47 13	A	3935-2395	IRAS 19542+5239
S 7846	V1167 Cyg	19 55 07.4	+56 40 52	A	3943-2215	IRAS 19540+5632
S 7847	V1015 Cyg	19 56 02.8	+55 30 33	A	3939-0652	
S 7848	V1017 Cyg	19 56 15.8	+53 19 12	A		
S 7849	BP Dra	19 57 43.3	+60 00 54	A	4231-1877	
S 7850	BQ Dra	19 58 28.0	+60 01 57	A	4231-1309	IRAS 19575+5953
S 7851	V1026 Cyg	19 59 28.3	+57 27 25	A		
S 7852	BR Dra	19 59 06.7	+60 18 36	A		
S 7853	NSV 12720	20 00 54.2	+54 27 27	A	3940-0412	
S 7854	V1028 Cyg	20 00 56.5	+56 56 37	A		
S 7855	V1029 Cyg	20 01 36.9	+53 35 02	A		
S 7856	V1030 Cyg	20 02 21.0	+55 22 23	A	3940-0825	IRAS 20011+5513
S 7857	V1031 Cyg	20 02 28.2	+56 53 10	A		
S 7858	V1032 Cyg	20 02 40.1	+57 16 27	A		
S 7859	NSV 12777	20 04 31.6	+53 03 45	A		
S 7860	GX Cep	20 04 32.1	+59 53 31	A		
S 7861	V1035 Cyg	20 05 41.4	+58 02 49	A		
S 7862	V1176 Cyg	20 07 01.2	+52 31 15	A	3936-0071	
S 7863	V1175 Cyg	20 06 15.9	+57 59 36	A		
S 7864	GY Cep	20 05 51.5	+60 39 17	T	4232-2973	IRAS 20049+6030
S 7865	NSV 12816	20 06 23.4	+59 26 11	A	3948-2138	
S 7866	V1038 Cyg*	20 07 53.8	+51 58 32	A		
S 7867	NSV 12822	20 06 36.1	+60 23 38	A		
S 7868	V1178 Cyg	20 08 53.0	+53 38 28	A		
S 7869	V1040 Cyg	20 08 41.5	+54 14 30	A		
S 7870	V1179 Cyg	20 08 54.4	+57 47 46	A		

Table 3: 33 Cygni field (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7871	NSV 12852*	20 08 46.3	+58 23 02	S	3948-1581	
S 7872	V1041 Cyg	20 08 48.4	+58 50 55	A		
S 7873	V1180 Cyg	20 10 15.3	+52 03 44	A	3571-1478	IRAS 20088+5154
S 7874	V1181 Cyg	20 10 25.8	+54 38 44	A		
S 7875	V1182 Cyg	20 11 00.6	+54 52 26	A	3940-0930	
S 7876	NSV 12899	20 11 36.3	+59 00 45	A		
S 7877	NSV 12915	20 12 41.7	+53 24 30	A		
S 7878	V1184 Cyg	20 12 33.1	+54 16 16	A		
S 7879	NSV 12922	20 12 52.5	+55 25 17	A	3940-1354	
S 7880	V1186 Cyg	20 13 43.4	+56 22 05	A	3945-1352	IRAS 20125+5612
S 7881	V1044 Cyg	20 14 49.6	+52 41 46	A		
S 7882	V1045 Cyg	20 15 00.4	+52 37 21	A		
S 7883	NSV 12959	20 14 47.2	+54 17 28	A	3937-0175	
S 7884	NSV 12957	20 14 21.8	+59 18 00	A		
S 7885	V1189 Cyg	20 16 06.9	+51 56 26	A	3584-1600	
S 7886	V1188 Cyg	20 16 07.1	+52 08 25	A		
S 7887	NSV 12964	20 14 32.0	+61 04 26	A	4232-0317	IRAS 20136+6055
S 7888	V1190 Cyg	20 16 20.5	+54 09 16	A	3937-0363	IRAS 20150+5400
S 7889	V1047 Cyg	20 17 38.0	+52 58 47	A		
S 7890	NSV 12992	20 17 50.7	+54 31 54	A		
S 7891	NSV 13016	20 18 58.9	+56 36 19	T	3945-1423	
S 7892	NSV 13015	20 18 59.0	+59 55 46	A	3949-0257	
S 7893	HH Cep	20 18 43.7	+60 36 14	A		IRAS 20177+6026
S 7894	V1192 Cyg	20 20 19.7	+56 13 16	A		
S 7895	V1193 Cyg*	20 21 11.4	+59 36 03	A	3949-0797	
S 7896	V1048 Cyg*	20 22 57.1	+52 32 48	A	3937-2100	
S 7897	V1195 Cyg*	20 24 01.9	+55 12 57	A		
S 7898	V1196 Cyg	20 24 41.3	+54 30 00	A	3941-0807	
S 7899	V1516 Cyg	20 25 31.7	+52 20 34	A		IRAS 20241+5210
S 7900	NSV 13081	20 24 32.6	+57 35 31	A		
S 7901	V1049 Cyg	20 25 53.4	+53 46 43	A	3937-0772	
S 7902	OW Cep	20 26 03.9	+61 35 22	A	4233-0463	IRAS 20251+6125
S 7903	NSV 13107	20 28 34.6	+52 38 01	A	3950-0817	
S 7904	V1050 Cyg*	20 29 16.7	+54 30 15	A		
S 7905	NSV 13108	20 28 08.0	+61 24 51	A	4233-1215	IRAS 20272+6114
S 7906	V1518 Cyg	20 29 49.9	+53 02 31	A	3950-0345	
S 7907	V1197 Cyg	20 30 57.2	+56 46 32	A		
S 7908	V1520 Cyg	20 31 13.9	+55 28 05	A	3954-0055	
S 7909	V1051 Cyg	20 31 00.6	+56 46 32	A		
S 7910	V1198 Cyg	20 32 22.3	+52 19 42	A		
S 7911	NSV 13141	20 32 04.0	+60 06 33	A		
S 7912	V776 Cyg	20 33 41.9	+55 19 44	A		
S 7913	V1199 Cyg	20 34 08.0	+53 02 03	A	3950-1617	
S 7914	NSV 13159	20 33 29.7	+58 32 54	A	3962-0034	
S 7915	V1200 Cyg	20 33 52.1	+57 40 21	A		
S 7916	V1052 Cyg	20 36 06.4	+54 31 42	A		
S 7917	NSV 13183	20 36 20.4	+59 08 48	A		
S 7918	V1053 Cyg	20 38 53.0	+52 57 37	A		
S 7919	V1202 Cyg	20 39 01.0	+53 31 34	T	3950-1400	
S 7920	HK Cep	20 39 32.7	+56 49 04	A	3958-1416	
S 7921	V1054 Cyg*	20 40 37.1	+54 15 21	A		
S 7922	V1055 Cyg	20 44 16.0	+53 23 50	A		
S 7923	FL Cep	20 46 50.2	+56 54 28	A		
S 7924	FK Cep	20 46 07.8	+60 38 36	A		
S 7925	OX Cep	20 46 55.8	+58 43 12	A	3963-0966	

Table 4: ν Geminorum field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7926	V1025 Ori					not found
S 7927	V667 Ori	6 09 08.8	+16 35 09	A	1314-0491	
S 7928	IW Gem	6 11 53.4	+24 14 02	A	1877-1204	IRAS 06088+2414
S 7929	HR Gem	6 12 13.3	+24 42 42	A	1881-1297	
S 7930	V644 Ori	6 14 06.4	+18 12 20	A		
S 7931	V645 Ori	6 15 30.0	+15 34 26	A	1314-1306	
S 7932	NSV 2884	6 15 42.4	+18 23 59	A	1318-0673	
S 7933	V646 Ori	6 17 59.7	+20 24 37	A	1323-0361	
S 7934	V673 Ori	6 20 06.4	+19 42 34	A	1323-1993	
S 7935	NV Gem	6 25 39.5	+18 05 04	A		
S 7936	HU Gem	6 27 24.6	+23 49 31	A		
S 7937	HV Gem	6 28 51.7	+24 02 09	A	187901503	IRAS 06258+2404
S 7938	IY Gem					not found
S 7939	HW Gem	6 29 21.1	+22 11 02	A		
S 7940	NSV 2982	6 29 39.7	+17 18 08	A	1332-0024	IRAS 06267+1720
S 7941	NW Gem*	6 30 06.6	+23 28 43	T	1879-0828	BD+23°1377
S 7942	NX Gem*	6 30 54.6	+23 27 29	T	1879-1745	IRAS 06278+2329
S 7943	HY Gem					not found
S 7944	KM Gem	6 34 31.2	+19 58 29	A		
S 7945	HZ Gem	6 35 26.9	+25 13 08	A		
S 7946	II Gem*	6 35 28.5	+23 12 23	S		
S 7947	IL Gem	6 39 40.9	+20 32 33	A		
S 7948	IM Gem	6 40 23.5	+21 43 35	A	1342-1408	
S 7949	NR Gem	6 40 40.4	+15 33 05	A		
S 7950	IN Gem	6 40 50.9	+17 30 57	A		
S 7951	IO Gem	6 42 18.9	+20 23 04	A		
S 7952	KP Gem	6 42 11.5	+16 17 26	A		
S 7953	KQ Gem	6 43 47.3	+15 54 22	A	1330-0649	
S 7954	KR Gem	6 44 05.8	+19 17 44	A		
S 7955	IP Gem	6 44 54.0	+22 16 35	A		
S 7956	NSV 3191	6 45 05.0	+21 29 07	A	1342-0640	
S 7957	MP Gem*	6 48 33.4	+19 37 15	A		
S 7958	NS Gem	6 48 36.9	+20 01 00	A		
S 7959	NT Gem	6 50 06.2	+16 42 10	A	1331-0989	IRAS 06472+1645

Table 5: α Persei field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7960	LU Per	3 00 55.2	+50 48 39	A		
S 7961	LV Per	3 03 52.0	+45 11 43	S		IRAS 03005+4459
S 7962	LW Per	3 07 25.6	+50 57 48	A	3322-0670	IRAS 03038+5046
S 7963	LZ Per	3 33 41.6	+48 59 42	A	3320-1607	IRAS 03301+4849

Table 6: ι Canis Majoris field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7964	EI CMa	6 35 29.4	−17 55 20	A	5952-0136	
S 7965	EK CMa	6 36 49.7	−15 06 28	A	5948-2638	IRAS 06345-1503 ?
S 7966	EL CMa	6 37 39.0	−20 01 13	A	5956-0249	
S 7967	NSV 3087	6 40 04.2	−20 37 56	A		
S 7968	NSV 3100	6 40 17.4	−17 50 15	A	5953-2223	
S 7969	NSV 3109	6 40 11.3	−20 36 55	A	5957-0357	
S 7970	EM CMa	6 40 49.5	−13 46 55	A		
S 7971	EN CMa	6 40 54.0	−19 23 46	A		
S 7972	NSV 3169	6 41 08.1	−20 09 05	A	5957-0499	CGCS 1356
S 7973	NSV 3182	6 42 58.3	−17 20 17	A	5953-1422	IRAS 06407-1717
S 7974	EO CMa*	6 44 23.0	−20 49 37	A		
S 7975	EP CMa	6 46 43.0	−15 42 03	A		IRAS 06444-1538
S 7976	NSV 3207	6 46 24.0	−21 33 29	A		
S 7977	EQ CMa	6 48 51.6	−16 18 03	A	5950-1323	
S 7978	EX CMa	6 51 43.2	−13 29 50	A	5391-1000	
S 7979	ER CMa	6 52 01.1	−12 45 44	A	5387-1038	
S 7980	NSV 3251	6 52 05.7	−13 29 57	A	5391-1022	
S 7981	NSV 3256	6 52 32.0	−19 07 14	A	5958-1164	
S 7982	NSV 3267*	6 54 04.8	−19 29 54	A	5958-2547	IRAS 06518-1925
S 7983	NSV 3274*	6 54 38.7	−13 27 07	A		
S 7984	ES CMa	6 56 28.8	−16 11 06	A		
S 7985	NSV 3295	6 56 40.7	−15 28 00	A	5963-1234	
S 7986	ET CMa	6 56 46.0	−15 38 16	A	5963-1685	
S 7987	NSV 3320	6 58 32.5	−17 08 44	T	5967-1093	
S 7988	NSV 3342	7 01 47.6	−16 12 25	A		
S 7989	NSV 3362	7 03 55.1	−17 52 48	A	5967-0817	
S 7990	NSV 3366	7 04 32.3	−19 37 46	A	5972-2429	
S 7991	EU CMa	7 05 41.0	−16 08 45	S		position uncertain
S 7992	NSV 3451*	7 11 45.4	−16 13 02	A	5964-0360	IRAS 07094-1607
S 7993	NSV 3465	7 13 13.5	−13 18 33	A	5406-2125	
S 7994	NSV 3471	7 14 01.7	−14 36 01	T	5406-0728	CSS 323
S 7995	NSV 3475	7 14 20.3	−19 40 22	A	5973-0742	IRAS 07121-1935
S 7996	NSV 3488	7 15 26.3	−14 26 57	A	5406-1967	
S 7997	NSV 3496	7 16 03.2	−20 10 53	A		

Table 7: Northern winter fields

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 7998	NSV 1093	3 17 06.4	+40 10 00	A		
S 7999	NSV 1109	3 21 50.2	+41 46 15	A		
S 8000	NSV 1110	3 21 48.0	+40 28 21	A		
S 8001	NSV 1866	5 12 11.3	+6 06 19	A	0111-1682	merged pair on DSS
S 8002	NSV 1884	5 14 42.2	+3 41 28	A	0103-1548	
S 8003	NSV 1907	5 16 51.3	+3 33 11	A		
S 8004	V532 Ori	5 17 00.8	+3 31 18	A		
S 8005	V675 Ori	5 19 18.2	+5 29 04	S	0108-0168	IRAS 05166+0525
S 8006	IZ Aur	5 53 36.4	+52 25 56	A	3373-0518	
S 8007	NSV 2712	5 55 24.2	+52 38 56	A	3750-0462	
S 8008	NSV 2730	5 56 31.0	+51 55 19	A		
S 8009	NSV 2763*	6 01 48.7	+51 45 04	A		
S 8010	KL Aur	6 04 37.3	+51 54 30	A	3386-0676	
S 8011	KM Aur*	6 05 42.2	+50 20 27	A		
S 8012	KN Aur*	6 05 31.2	+49 32 06	S		
S 8013	NSV 2828	6 07 30.8	+51 06 53	A	3386-0209	

Notes:

KM Aur	northeastern star of a pair.
KN Aur	on northeast side of and very close to BD+49°1446.
EO CMa	verified on POSS-I prints.
AG Com	[SS59] II 141 = BPS BS 16031-0007.
AX Com	northwestern star of pair, *cf.* Meinunger (1976).
BO Com	ID uncertain, bluer star chosen.
EU Com	IRC +20253 = IRAS 13015+1958.
V1038 Cyg	southwestern star of a pair.
V1048 Cyg	assumed to be brighter/western star of a pair.
V1050 Cyg	assumed to be northeastern star of a pair.
V1054 Cyg	ID somewhat uncertain, assumed to be brighter star at chart location.
V1193 Cyg	IRAS 20201+5926 probably corresponds to the galaxy superposed on west side of star (60μ peak).
V1195 Cyg	IRAS 20227+5503 = IRC +60289.
II Gem	IRAS 06324+2314 probably applies both to this star and to the brighter red star immediately west.
MP Gem	double, position is for southern star.
NW Gem	also IRAS 06270+2330.
NX Gem	also IRC +20149.
CD Leo	superposed on faint galaxy.
NSV 2763	southwestern star of a pair.
NSV 3267	IRAS error ellipse very large, so possibly includes other objects.
NSV 3274	ID uncertain, position is for northern star of a pair.
NSV 3451	almost certainly the variable is mismarked on chart, and the nearby red star (and IRAS source) intended.
NSV 12852	southern star of a pair.

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COORDINATES AND IDENTIFICATIONS FOR SONNEBERG VARIABLES – III

BRIAN A. SKIFF

Lowell Observatory, 1400 West Mars Hill Road, Flagstaff AZ 86001-4499, USA, e-mail: bas@lowell.edu

The lists below give accurate coordinates for over 500 designated and suspected variables in several fields described by Hoffmeister (1964). The working methods were similar to previous lists (*e.g.* Skiff 1999), which involves comparing the source charts against computer-screen plots of the GSC or USNO–A2.0 star catalogues, with Digitized Sky Survey images, and making external bibliographic comparisons using the Strasbourg 'VizieR' utility and SIMBAD.

The tables are arranged as previously, divided by region as in Hoffmeister's lists. A few additional known variables that appear in the finder charts are given for completeness. The Sonneberg serial number and the GCVS designations appear in the first two columns. An asterisk by the GCVS name indicates a note, which are collected at the end of the tables. The positions are taken mostly from USNO–A2.0 (Monet *et al.* 1998); for some brighter stars the GSC or ACT (Urban *et al.* 1998) was adopted, and for a few crowded stars positions have been estimated ($\pm 2''$) using large-scale Digitized Sky Survey frames from the Goddard SkyView facility (McGlynn *et al.* 1996). The source of the position is coded in column 's' as follows: A = USNO–A2.0, G = GSC v1.2, S = SkyView, T = ACT.

I made the match-up with the GSC using 'VizieR', and found the various IDs in the Remarks and Notes using SIMBAD. The IDs are listed only if they are new, in the sense of being either not present or not linked in the same entry in SIMBAD.

A few stars defeated my attempts to identify them. Given that some of the stars I did find have positions several arcminutes in error, it is likely that these 'lost' ones have similar errors of some kind. The extremely crowded fields of Aquila and Sagitta made matching the finder charts with the sky a challenging task.

Table 1: North galactic pole fields – I

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8014	AR Leo	11 26 26.0	+23 48 39	A		
S 8015	AU Leo	11 30 14.3	+23 48 09	A		
S 8016	CP Leo	11 30 17.4	+23 49 27	A	1982-0626	
S 8017	AV Leo	11 31 10.6	+25 37 15	A		
S 8018	AW Leo	11 31 48.3	+16 56 53	A	1438-0727	
S 8019	BW Leo	11 32 16.5	+17 19 25	A	1438-1465	
S 8020	CQ Leo	11 34 56.1	+17 46 09	A	1438-0683	
S 8021	AZ Leo	11 36 51.8	+21 22 53	A		
S 8022	BB Leo	11 38 16.2	+23 33 59	A	1982-1872	
S 8023	BC Leo	11 38 36.0	+20 43 35	A		
S 8024	BD Leo	11 39 45.9	+15 47 41	A	1438-2727	
S 8025	BE Leo	11 40 16.8	+18 41 27	A		
S 8026	BY Leo	11 40 49.9	+19 55 44	A		
S 8027	BG Leo	11 41 46.3	+23 12 03	A	1982-1885	
S 8028	BH Leo	11 42 44.1	+24 06 22	A		
S 8029	BL Leo	11 45 38.4	+24 46 51	A	1985-0173	
S 8030	CR Leo	11 45 33.1	+16 50 06	A	1441-1286	
S 8031	CF Leo	11 46 32.6	+16 13 53	A	1441-1539	
S 8032	BM Leo	11 47 05.3	+24 41 08	A		
S 8033	BN Leo	11 48 03.3	+18 58 04	A	1443-0459	
S 8034	CS Leo	11 48 49.4	+22 44 45	A	1985-0823	
S 8035	CI Leo	11 49 33.8	+23 06 07	A	1985-0805	
S 8036	CT Leo	11 50 21.2	+21 36 19	A	1443-0771	
S 8037	CU Leo	11 51 17.6	+18 29 27	A	1441-0957	
S 8038	CV Leo	11 53 58.8	+20 29 24	T	1443-1364	BD+21°2373
S 8039	BQ Leo	11 53 44.2	+21 30 58	A	1443-2361	
S 8040	CK Leo	11 55 15.6	+24 04 55	A	1985-1255	
S 8041	CL Leo	11 55 17.2	+22 00 04	A		
S 8042	CM Leo	11 56 14.3	+21 15 31	A	1443-1180	BPS BS 16936-0048
S 8043	VY Com	11 59 03.8	+17 00 23	A	1441-2096	
S 8044	VZ Com	12 01 05.2	+22 12 56	A		
S 8045	NSV 5427	12 01 14.3	+17 23 05	A	1442-0287	
S 8046	WW Com	12 03 57.1	+22 28 10	A		
S 8047	WX Com	12 05 45.0	+22 01 22	A		
S 8048	WY Com	12 06 47.9	+16 17 11	A	1442-0959	
S 8049	XX Com	12 08 02.2	+16 10 49	A	1442-1072	
S 8050	XY Com	12 07 46.7	+21 37 42	A		= BX Com (S 8488)
S 8051	XZ Com	12 09 05.8	+23 45 16	A		
S 8052	YY Com	12 10 49.4	+20 17 41	A	1444-1238	
S 8053	CE Com	12 12 46.8	+21 00 24	A		
S 8054	SN 1963x*	12 13 03.3	+21 01 27	A	1444-0343	
S 8055	CH Com	12 13 47.1	+22 20 42	A		
S 8056	ZZ Com	12 16 17.3	+23 34 53	A		
S 8057	AA Com	12 16 10.1	+25 01 21	A		
S 8058	FN Com	12 19 06.5	+18 21 22	A	1445-1087	1RXS J121906.1+182119
S 8059	AE Com	12 23 41.2	+21 57 11	A		BPS BS 16933-0062
S 8060	DD Com	12 28 46.3	+21 43 34	A	1447-2002	
S 8061	AH Com	12 28 55.7	+16 45 03	A		BPS BS 16984-0003
S 8062	DG Com	12 30 10.1	+21 00 18	A	1447-2315	
S 8063	AN Com	12 35 43.5	+18 03 08	A		
S 8064	AQ Com	12 42 42.7	+21 52 18	A	1448-1046	
S 8065	AR Com	12 43 43.4	+16 57 15	A	1446-2242	

Table 1: North galactic pole fields – I (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8066	AT Com	12 45 40.3	+18 12 48	A		
S 8067	AV Com	12 46 58.6	+15 10 11	A		
S 8068	AY Com	12 51 12.8	+20 17 13	A		
S 8069	BE Com	12 58 02.6	+19 54 02	A		
S 8070	BF Com	13 02 13.6	+24 14 20	A	1993-1883	BPS BS 15622-0039
S 8071	FR Com	13 06 12.8	+21 11 16	A	1456-0487	
S 8072	BG Com	13 19 44.7	+18 18 26	A		
S 8073	FG Com	13 20 33.7	+22 26 55	A	1464-0265	
S 8074	BH Com	13 21 58.7	+16 42 19	A	1458-0217	BPS BS 16972-0032
S 8075	NSV 6214	13 22 55.4	+20 25 52	A	1464-0861	BD+21°2521
S 8076	FH Com	13 24 25.7	+16 00 07	A	1458-0958	
S 8077	FI Com	13 25 32.8	+16 49 44	A	1458-0227	
S 8078	BK Com	13 28 09.9	+20 13 34	A	1464-0992	
S 8079	BM Com	13 28 22.3	+15 50 08	A	1458-0916	
S 8080	BP Com	13 31 19.4	+22 54 32	A		
S 8081	BR Com	13 34 02.8	+18 24 48	A		
S 8082	BU Com	13 35 17.4	+20 30 49	A	1465-0339	
S 8083	AF Boo*	13 36 02.9	+21 29 33	A		
S 8084	AH Boo	13 36 54.7	+22 30 47	A	1998-0765	BPS BS 16467-0030
S 8085	AI Boo	13 38 09.4	+15 38 56	A	1459-0050	
S 8086	AL Boo	13 38 55.9	+18 42 42	A		
S 8087	AM Boo	13 38 54.5	+23 45 49	A	1998-0489	
S 8088	AN Boo	13 39 47.7	+15 35 34	A	1459-1004	
S 8089	BR Boo	13 40 38.0	+16 06 31	A	1459-0704	
S 8090	NSV 6439	13 46 48.4	+23 01 13	A	1999-0388	
S 8091	AQ Boo	13 47 26.9	+17 18 24	A	1460-0578	
S 8092	AT Boo	13 49 06.5	+16 22 22	A	1460-0333	
S 8093	AU Boo	13 49 43.6	+16 09 00	A		
S 8094	AV Boo	13 51 06.9	+17 39 06	A	1463-0611	
S 8095	AW Boo	13 51 28.5	+20 14 55	A		
S 8096	AX Boo	13 52 03.5	+18 33 40	A		
S 8097	AZ Boo	13 53 18.3	+15 28 34	A	1467-0984	

Table 2: γ Aquilae field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8099	NSV 12008	19 25 28.4	+11 23 40	A	1063-0905	
S 8100	V972 Aql	19 25 55.9	+7 11 55	A		
S 8101	NSV 12027	19 26 44.9	+9 27 37	A	1059-0123	
S 8102	V1302 Aql	19 26 48.1	+11 21 17	A	1063-2082	
S 8103	V973 Aql	19 27 12.7	+11 32 57	A		
S 8104	NSV 12059	19 28 24.4	+9 36 42	A	1059-1800	
S 8105	NSV 12075	19 29 11.9	+12 02 49	A		
S 8106	V974 Aql*	19 30 06.3	+7 40 08	S		
S 8107	V975 Aql	19 30 03.0	+11 16 28	A		
S 8108	NSV 12095	19 30 38.1	+7 21 08	A		
S 8109	V976 Aql	19 30 18.5	+11 23 36	A		
S 8110	V977 Aql*	19 31 17.6	+10 48 52	A		
S 8111	NSV 12110*	19 31 25.5	+10 10 45	S	1059-1032	
S 8112	V980 Aql*	19 32 28.4	+7 13 49	A		IRAS 19300+0707
S 8113	V982 Aql	19 33 24.3	+6 52 00	A		
S 8114	V1137 Aql*	19 33 01.8	+13 44 42	G	1068-2115	IRAS 19307+1338
S 8115	V983 Aql	19 33 46.0	+10 26 07	A		

Table 2: γ Aquilae field (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8116	V984 Aql	19 34 05.9	+11 34 03	A		
S 8117	NSV 12162	19 34 18.8	+5 53 13	A		LF 1 A 49
S 8118	V986 Aql	19 34 29.9	+6 08 15	S		IRAS 19320+0601
S 8119	NSV 12160	19 34 20.5	+10 06 49	A		
S 8120	V985 Aql	19 34 19.1	+10 47 27	A		
S 8121	V988 Aql					not found
S 8122	V987 Aql	19 34 22.5	+12 05 07	A		IRAS 19320+1158
S 8123	V989 Aql	19 34 54.9	+7 53 57	A		
S 8124	NSV 12177	19 35 00.8	+7 52 53	G	1056-3302	
S 8125	V991 Aql	19 35 34.9	+6 33 46	A		
S 8126	NSV 12182	19 35 23.5	+11 45 14	A	1064-1800	
S 8127	NSV 12187	19 35 38.4	+7 30 56	A		
S 8128	NSV 12192	19 36 06.6	+13 35 51	A		IRAS 19337+1329
S 8129	V994 Aql	19 36 33.1	+10 02 47	A		IRAS 19341+0956
S 8130	V996 Aql	19 37 22.1	+5 38 08	G	0490-2383	IRAS 19348+0531
S 8131	V995 Aql*	19 37 05.9	+10 34 22	G	1060-3308	IRAS 19347+1027
S 8132	V1371 Aql	19 37 18.1	+9 19 13	A		
S 8133	V998 Aql	19 37 04.7	+13 41 14	S		IRAS 19347+1334
S 8134	NSV 12225	19 37 59.6	+9 24 27	A	1060-0074	
S 8135	NSV 12230	19 38 16.0	+9 39 49	A		IRAS 19358+0932
S 8136	V1372 Aql	19 38 36.7	+8 24 41	A		crowded
S 8137	V1002 Aql	19 38 46.8	+5 07 04	A		
S 8138	V1001 Aql	19 38 44.2	+9 25 34	A		IRAS 19363+0918
S 8139	NSV 12244	19 38 47.9	+8 26 28	T	1056-0891	BD+08°4173
S 8140	V1003 Aql	19 39 07.7	+9 15 43	A		
S 8141	V1373 Aql	19 39 12.3	+13 37 49	A		
S 8142	V1005 Aql	19 39 41.3	+11 37 13	A		crowded
S 8143	NSV 12274*	19 40 05.5	+12 47 39	A		IRAS 19377+1240 ?
S 8144	V1374 Aql	19 41 25.5	+8 19 04	A	1057-0492	IRAS 19390+0811
S 8145	V1010 Aql	19 41 22.7	+9 36 38	A		
S 8146	V1375 Aql*	19 41 22.6	+13 13 53	A	1069-3650	IRAS 19390+1306
S 8147	V1380 Aql*	19 41 25.4	+14 53 55	A		IRAS 19390+1446
S 8148	V1011 Aql	19 41 33.7	+11 36 17	A		
S 8149	V1014 Aql	19 42 04.7	+6 33 46	A		
S 8150	V1381 Aql	19 42 06.0	+8 01 12	A	1057-0562	
S 8151	V1013 Aql	19 41 43.4	+14 30 38	A		
S 8152	V1382 Aql	19 42 18.8	+9 59 37	A	1061-1975	IRAS 19398+0952
S 8153	V1015 Aql	19 42 09.1	+13 46 23	A		
S 8154	V1383 Aql	19 42 41.1	+7 51 49	A		
S 8155	V1016 Aql	19 42 16.2	+11 37 36	A		IRAS 19399+1130
S 8156	NSV 12330	19 42 59.8	+6 43 03	A		
S 8157	V1019 Aql	19 42 28.3	+15 21 29	A		IRAS 19401+1514
S 8158	V1384 Aql	19 43 10.3	+6 39 45	A	0491-2277	IRAS 19407+0632
S 8159	V1020 Aql	19 43 29.9	+6 18 30	A		IRAS 19410+0611
S 8160	V1385 Aql					not found
S 8161	V1021 Aql	19 43 22.0	+12 19 13	A		IRAS 19410+1212
S 8162	V1023 Aql	19 43 46.0	+13 41 24	A		
S 8163	NSV 12357	19 44 23.2	+6 05 49	A	0491-1971	
	V665 Aql	19 44 18.1	+6 06 04	A		IRAS 19418+0558
S 8164	V1024 Aql	19 43 54.9	+15 23 23	A		
S 8165	V1025 Aql	19 44 16.8	+11 21 33	A		

Table 2: γ Aquilae field (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8166	V1027 Aql	19 44 27.4	+10 18 17	A		IRAS 19420+1010
S 8167	V1386 Aql	19 44 26.0	+13 46 58	A		
S 8168	V1026 Aql	19 44 09.0	+14 44 37	A		
	V462 Aql	19 44 17.6	+14 43 33	G	1069-1157	IRAS 19419+1436
S 8169	V1388 Aql	19 44 56.9	+8 01 30	A	1057-0986	
S 8170	V1387 Aql	19 44 32.2	+15 27 57	A	1615-2514	IRAS 19422+1520
S 8171	V1030 Aql	19 45 54.9	+14 29 52	A		
S 8172	V1389 Aql	19 46 10.3	+11 49 25	A	1065-2974	IRAS 19438+1142
S 8173	V1390 Aql	19 46 45.4	+6 23 58	A	0492-0034	IRAS 19443+0616
S 8174	V1033 Aql	19 46 44.8	+14 21 57	A		
S 8175	V1034 Aql	19 47 16.1	+7 46 32	A		
S 8176	V1035 Aql	19 47 29.3	+8 59 43	A		
S 8177	V1391 Aql	19 47 42.3	+12 34 13	A		
S 8178	V1036 Aql	19 47 55.2	+15 07 31	A		
S 8179	V1037 Aql	19 48 42.2	+14 48 08	A		IRAS 19463+1440
S 8180	V1038 Aql	19 49 27.8	+10 08 17	A		IRAS 19470+1000
S 8181	V1393 Aql	19 49 56.0	+7 12 03	A	0492-1999	IRAS 19474+0704
S 8182	V1392 Aql	19 49 48.9	+8 04 31	A	1058-0052	IRAS 19473+0756
S 8183	V1040 Aql	19 50 01.6	+9 49 44	A		
S 8184	V1042 Aql	19 50 01.6	+14 12 23	A		
S 8185	V1041 Aql	19 49 56.9	+14 41 58	A	1070-1029	
S 8186	V1394 Aql	19 50 04.3	+14 51 57	A		
S 8187	V1043 Aql	19 50 19.7	+12 05 40	A		IRAS 19479+1157
S 8188	V1395 Aql	19 50 29.1	+14 15 01	A		IRAS 19481+1407
S 8189	V1396 Aql	19 51 07.9	+11 56 31	A	1066-1227	
S 8190	V1044 Aql	19 51 15.0	+12 54 37	S		
S 8191	V1047 Aql	19 51 31.1	+10 57 22	A		
S 8192	V1049 Aql	19 51 51.1	+8 33 13	A		
S 8193	V1048 Aql	19 51 33.4	+10 46 33	A		
S 8194	V1050 Aql*	19 51 43.2	+10 51 14	A		IRAS 19493+1043
S 8195	V1052 Aql	19 52 16.8	+6 02 59	A	0492-1846	IRAS 19498+0555
S 8196	V1055 Aql	19 52 28.7	+6 56 02	A		
S 8197	V1397 Aql	19 52 12.3	+11 33 57	A	1066-1132	IRAS 19498+1126
S 8198	V1056 Aql	19 52 14.8	+14 10 27	A		
S 8199	V1398 Aql*	19 52 15.0	+14 30 39	A	1070-1537	IRAS 19499+1422
S 8200	NSV 12510	19 52 54.1	+6 40 55	A	0493-0997	
S 8201	V1057 Aql	19 52 49.9	+11 22 12	A		
S 8202	NSV 12507	19 52 39.1	+14 15 55	A		
S 8203	NSV 12506	19 52 36.8	+15 05 55	A		
S 8204	V1058 Aql	19 53 03.1	+13 13 58	A		
S 8205	V1399 Aql	19 53 13.0	+12 33 09	A		
S 8206	V1059 Aql	19 53 49.6	+6 45 05	A		southeastern of pair
S 8207	NSV 12533	19 54 23.2	+5 43 05	A	0493-0066	
S 8208	V1062 Aql	19 54 33.6	+5 40 59	A	0493-0476	IRAS 19520+0533
S 8209	V1061 Aql	19 54 20.8	+7 01 31	A		
S 8210	V1063 Aql	19 54 33.1	+6 21 57	A		
S 8211	V1400 Aql	19 54 24.5	+14 32 30	A	1070-3932	
S 8212	NSV 12553	19 54 53.4	+15 17 40	A		southern of pair
S 8213	V1065 Aql					not found
S 8214	NSV 12572	19 55 42.9	+14 30 11	A		
	V498 Aql	19 55 54.1	+14 30 15	A		IRAS 19535+1422
S 8215	V1066 Aql	19 56 28.3	+9 02 32	S		

Table 2: γ Aquilae field (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8216	NSV 12587	19 56 47.6	+9 53 32	T	1075-3110	
S 8217	NSV 12584	19 56 39.5	+14 58 46	A	1083-1847	IRAS 19543+1450
S 8218	V1068 Aql	19 57 18.8	+7 20 15	A		
S 8219	NSV 12605	19 57 24.5	+14 27 49	G	1083-2225	crowded
S 8220	V1070 Aql	19 58 23.0	+8 14 25	A		southern of two
S 8221	NSV 12624	19 58 10.0	+10 47 07	S		IRAS 19557+1038
S 8222	V1071 Aql	19 59 19.9	+9 40 56	A		crowded, ID uncertain
S 8223	V1072 Aql	19 59 10.3	+14 49 07	A		southwestern of pair
S 8224	V1073 Aql	19 59 27.9	+12 12 49	A		
S 8225	V1074 Aql	19 59 37.4	+11 57 27	A		
S 8226	NSV 12667	20 00 12.1	+8 49 43	A		
S 8227	NSV 12686	20 01 15.3	+8 54 40	A		
S 8228	V1409 Aql	20 01 32.9	+5 47 33	A	0506-1396	
S 8229	V1077 Aql	20 01 44.7	+9 54 14	A		
S 8230	NSV 12707	20 01 43.7	+10 20 00	A		
S 8231	V1078 Aql	20 01 57.0	+9 37 43	A		IRAS 19595+0929
S 8232	V1410 Aql	20 01 58.4	+11 46 06	A	1079-3413	
S 8233	V1079 Aql	20 01 49.1	+14 29 06	A		
S 8234	V1411 Aql	20 01 59.2	+13 49 02	A		
S 8235	V1081 Aql	20 02 38.7	+9 03 45	A		
S 8236	V1080 Aql	20 02 27.7	+9 59 12	A		
S 8237	NSV 12724	20 02 13.3	+11 44 38	A		
S 8238	V1083 Aql	20 02 55.0	+10 13 13	A		
S 8239	V1082 Aql	20 02 35.4	+14 24 35	A	1084-2008	
S 8240	NSV 12747	20 03 38.5	+14 23 59	A		
S 8241	V1087 Aql	20 04 36.9	+11 39 55	A		
	V774 Aql	20 04 43.4	+11 41 27	A	1080-1097	IRAS 20023+1132
S 8242	V1088 Aql	20 04 44.7	+11 53 00	A	1080-2270	
S 8243	V1089 Aql	20 04 59.7	+10 36 50	A		
S 8244	NSV 12775	20 05 16.6	+11 52 09	A		
S 8245	V1091 Aql	20 05 44.7	+13 17 05	A		IRAS 20033+1308
S 8246	V1092 Aql	20 06 27.4	+13 59 45	A		IRAS 20041+1350

Table 3: 62 Aquilae field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8247	V1028 Aql	19 45 45.3	−0 58 03	A		
S 8248	V1031 Aql	19 46 36.2	−3 59 07	A		
S 8249	V1032 Aql	19 46 45.2	−4 00 17	A		
S 8250	V1039 Aql	19 49 57.6	+1 11 04	A		
S 8251	NSV 12448	19 50 12.6	−1 07 46	A	5146-0910	IRAS 19476-0115
S 8252	NSV 12551	19 55 12.4	−4 25 47	A		
S 8253	NSV 12550	19 55 02.9	−0 29 01	A	5147-0575	IRAS 19524-0037
S 8254	NSV 12579	19 56 28.7	−1 47 23	A	5147-1939	IRAS 19538-0155
S 8255	V1327 Aql	19 56 19.0	+1 46 44	A		
S 8256	V1069 Aql*	19 57 18.5	+3 34 32	A	0485-0462	double
S 8257	NSV 12694	20 01 34.2	+2 10 52	A	0498-2133	
S 8258	NSV 12704	20 01 57.8	−3 42 39	A		
S 8259	V1076 Aql	20 02 02.8	−0 37 54	A		
S 8260	V1084 Aql	20 03 43.5	+0 53 38	A		

Table 3: 62 Aquilae field (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8261	V1085 Aql	20 03 45.8	+3 03 20	A		
S 8262	V1090 Aql	20 05 58.5	+3 23 58	A		
S 8263	NSV 12803	20 06 55.0	−0 12 08	A	5160-1924	
S 8264	V1093 Aql	20 07 05.2	+0 10 23	A		
S 8265	NSV 12833	20 09 01.7	+2 19 52	A	0499-2148	
S 8266	NSV 12841	20 09 38.7	−5 28 08	A	5169-1699	CGCS 4689
S 8267	NSV 12858	20 10 40.2	+3 34 21	A	0499-1384	
S 8268	V1099 Aql	20 12 27.7	−0 41 12	A		
S 8269	NSV 12898	20 13 01.7	−0 43 15	A	5161-0284	PPM 708235
S 8270	V1100 Aql	20 13 26.7	−1 54 12	A		
S 8271	V1102 Aql	20 15 04.0	−1 56 28	A	5166-1326	
S 8272	NSV 13018	20 20 35.7	−0 47 50	A	5162-1012	
S 8273	NSV 13035	20 21 48.8	−0 52 28	A	5162-1356	
S 8274	V865 Aql	20 23 54.6	+0 56 45	H	0497-0974	

Table 4: NGC 188 field – I

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8275	GV Cep	23 51 40.0	+84 20 42	A		
S 8276	NSV 14753	23 53 49.1	+85 51 10	A		
S 8277	EN Cep	0 24 41.1	+83 26 19	A		
S 8278	EQ Cep	0 47 33.5	+85 16 24	A		
S 8279	ER Cep	0 50 27.8	+85 15 09	A		
S 8280	ES Cep	0 50 50.7	+85 16 13	A		
S 8281	ET Cep	1 02 23.0	+85 23 49	A		
S 8282	NSV 395	1 08 12.9	+84 38 06	A		
S 8283	EV Cep					not found
S 8284	EW Cep					not found

Table 5: β Delphini field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8285	KR Del	20 23 05.9	+11 36 30	A		IRAS 20207+1126
S 8286	KS Del	20 23 06.9	+16 06 28	A		
S 8287	GH Del	20 23 48.3	+13 58 31	A		
S 8288	KT Del	20 25 45.3	+15 47 12	A	1632-0985	IRAS 20234+1537
S 8289	KU Del	20 26 20.7	+11 30 20	A	1095-0088	
S 8290	KV Del	20 27 22.9	+12 10 34	A		
S 8291	GI Del	20 30 20.9	+12 40 40	A		
S 8292	FK Del	20 30 42.7	+12 17 57	A		
S 8293	GK Del	20 33 25.0	+13 41 29	A		
S 8294	GL Del	20 34 34.9	+11 33 49	A		
S 8295	KX Del*	20 36 42.6	+12 29 47	A	1096-1258	IRAS 20343+1219
S 8296	HW Del	20 39 31.1	+16 13 08	A		
S 8297	GM Del	20 39 54.3	+16 30 15	A		
S 8298	GN Del	20 40 14.4	+15 51 24	A		
S 8299	GO Del	20 40 44.0	+14 09 54	A		
S 8300	GP Del	20 40 55.9	+14 39 35	A		

Table 5: β Delphini field (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8301	HY Del	20 42 54.9	+17 44 32	A	1638-0396	
S 8302	GQ Del	20 43 51.2	+16 12 36	A		
S 8303	GR Del	20 45 52.2	+15 26 53	A		
S 8304	GS Del	20 46 43.1	+15 01 19	A		
S 8305	GT Del	20 47 13.0	+19 31 43	A	1642-2794	
S 8306	LM Del	20 48 57.9	+14 54 26	A		
S 8307	GV Del	20 50 31.6	+12 37 31	A		
S 8308	GX Del	20 56 29.1	+17 52 51	A		

Table 6: NGC 7789 field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8309	NSV 14695	23 45 23.8	+57 53 59	A		
S 8310	NSV 14741	23 53 36.2	+56 06 04	A		

Table 7: γ Sagittae field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8311	V1007 Aql	19 39 47.6	+16 11 25	A		
S 8312	DN Sge	19 40 16.7	+18 07 25	A		ID uncertain
S 8313	FX Vul	19 41 30.8	+24 07 44	A		IRAS 19394+2400
S 8314	UU Sge*	19 42 10.3	+17 05 16	A		PN G053.8-03.0
S 8315	MO Vul	19 42 39.9	+19 52 59	A	1080-2270	
S 8316	DO Sge	19 43 09.6	+17 35 08	A		
S 8317	GK Vul	19 43 58.9	+24 09 42	A	2139-0720	IRAS 19418+2402
S 8318	GL Vul	19 44 56.8	+20 12 17	A		
S 8319	DQ Sge	19 45 05.6	+16 40 06	A		southwestern of pair
S 8320	V1029 Aql	19 45 26.9	+15 54 42	A		IRAS 19431+1547
S 8321	QW Sge*	19 45 49.6	+18 36 50	G	1619-1911	
S 8322	GS Vul	19 48 26.5	+21 32 15	A		
S 8323	NSV 12435	19 49 13.5	+14 39 37	A	1070-1982	
S 8324	NSV 12428	19 48 51.7	+23 08 12	A	2140-2761	IRAS 19467+2300
S 8325	GT Vul	19 48 54.9	+20 56 08	A		
S 8326	NSV 12441	19 49 26.6	+18 51 24	T	1623-0866	HD 350668
S 8327	NSV 12447	19 49 50.4	+16 46 43	A		IRAS 19475+1639
S 8328	NSV 12451	19 50 03.1	+16 50 13	A		
S 8329	GW Vul	19 51 37.2	+20 28 58	C		
S 8330	GZ Vul	19 52 20.1	+19 54 02	A		
S 8331	NSV 12538	19 54 17.7	+16 29 17	A		
S 8332	NSV 12555	19 55 06.5	+15 39 26	A	1616-1912	IRAS 19528+1531
S 8333	HM Vul	19 55 39.3	+23 25 08	S		
S 8334	HN Vul	19 55 53.2	+22 05 47	A		
S 8335	NSV 12581	19 56 29.5	+17 19 00	A		
	AS Sge	19 56 38.7	+17 19 40	S		
S 8336	V1067 Aql	19 56 49.7	+15 39 12	A		
S 8337	DZ Sge	19 57 02.0	+16 06 45	A		double
S 8338	NSV 12588	19 56 35.1	+23 20 40	A	2140-2615	
S 8339	NSV 12596	19 57 05.1	+17 05 09	A		
S 8340	EF Sge	19 57 18.8	+17 45 54	A		

Table 7: γ Sagittae field (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8341	EE Sge	19 57 20.2	+18 20 27	S		not NSV 12602
S 8342	NSV 12604	19 57 10.5	+23 03 24	A	2140-0051	
S 8343	EG Sge	19 57 58.6	+17 06 30	A	1620-2241	
S 8344	HO Vul	19 58 53.5	+24 23 43	A	2145-0344	
S 8345	EK Sge	20 00 27.3	+20 02 52	A		
S 8346	EN Sge	20 03 04.1	+16 12 04	A		
S 8347	EO Sge	20 03 03.4	+17 26 23	A		
S 8348	NSV 12742	20 03 29.3	+21 05 12	A		
S 8349	V1086 Aql*	20 04 09.4	+14 42 34	G	1084-2217	
S 8350	NSV 12755	20 03 49.7	+17 24 32	A		
S 8351	HT Vul	20 03 54.7	+22 36 54	A		
S 8352	NSV 12763	20 04 30.2	+21 13 57	A		
S 8353	EP Sge	20 04 51.7	+17 28 02	A	1621-0519	
S 8354	EQ Sge	20 04 51.7	+16 45 37	A	1617-0728	southern of close pair
S 8355	EX Vul	20 04 47.5	+22 19 22	A	1629-3369	
S 8356	HV Vul	20 05 26.6	+22 13 22	A		
S 8357	HU Vul	20 05 27.2	+22 25 03	A		
S 8358	NSV 12793	20 06 04.1	+17 13 47	A		
S 8359	NSV 12810	20 07 23.7	+21 33 13	A	1629-0316	
S 8360	NSV 12813	20 07 24.1	+19 43 50	A		
S 8361	ET Sge*	20 09 06.3	+17 43 38	A		
S 8362	NSV 12845	20 09 35.4	+17 34 45	A	1622-1106	
S 8364	EV Sge	20 10 05.4	+19 18 34	A	1626-1486	crowded
S 8365	V1098 Aql	20 10 49.0	+15 07 46	S		IRAS 20085+1458
S 8366	EW Sge	20 10 52.6	+16 18 04	A		
S 8367	EY Sge	20 10 54.2	+21 26 59	A		
S 8368	HZ Vul	20 12 26.7	+22 02 38	A		
S 8369	FK Sge	20 13 15.5	+16 38 04	A		
S 8370	FQ Sge	20 15 24.4	+18 44 06	A		
S 8371	II Vul	20 15 52.1	+22 15 04	A	1630-2808	
S 8372	FR Sge	20 15 57.9	+19 22 08	A		
S 8373	NSV 12971	20 16 53.9	+16 55 26	A		
S 8374	NSV 12991	20 18 46.6	+17 53 37	A	1635-0729	

Table 8: ρ Cygni field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8375	NSV 13542	21 06 19.5	+46 48 49	A		
S 8376	V1551 Cyg	21 07 29.8	+46 19 20	A	3588-2883	
S 8377	V1663 Cyg	21 08 43.0	+46 32 20	A	3588-7238	IRAS 21069+4620
S 8378	V1552 Cyg	21 09 37.2	+43 22 45	A	3180-2482	
S 8379	V1063 Cyg	21 10 09.6	+48 42 58	A		
S 8380	V1064 Cyg	21 10 04.7	+48 36 33	A		
S 8381	V1480 Cyg	21 13 24.9	+44 01 25	A		
S 8382	V1066 Cyg	21 17 03.3	+44 00 29	A	3181-5418	
S 8383	V1332 Cyg	21 17 13.4	+44 54 51	A	3181-1481	IRAS 21153+4442
S 8384	V1067 Cyg	21 18 48.3	+41 00 01	A		
S 8385	V1069 Cyg	21 21 10.4	+40 54 58	A		
S 8386	V1071 Cyg	21 22 50.5	+42 21 22	A		
S 8387	V1072 Cyg	21 22 40.2	+46 53 56	A		
S 8388	V1336 Cyg	21 23 48.5	+45 29 23	A		not IRAS 21219+4516 ?
S 8389	V1562 Cyg	21 24 34.0	+42 59 59	A		
S 8390	V1074 Cyg	21 26 18.2	+42 08 01	A		

Table 8: ρ Cygni field (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8391	NSV 13722	21 27 14.0	+42 57 42	A		
S 8392	V1565 Cyg	21 27 32.3	+42 41 31	A		IRAS 21256+4228
S 8393	V1075 Cyg	21 29 18.4	+42 19 18	A		
S 8394	V1076 Cyg	21 29 12.7	+47 52 53	A		Cl* NGC 7092 PLAT 1357
S 8395	V1078 Cyg	21 29 21.6	+47 49 43	A		southern of pair
S 8396	V1077 Cyg	21 29 23.1	+49 06 36	A	3598-0815	Cl* NGC 7092 PLAT 1588
S 8397	V1079 Cyg	21 30 03.5	+46 47 57	A		
S 8398	V1080 Cyg	21 34 27.3	+42 59 32	A		
S 8399	V1567 Cyg*	21 34 41.7	+42 00 33	A		IRAS 21327+4147
S 8400	V1081 Cyg	21 34 15.8	+49 11 26	A		
S 8401	V1082 Cyg	21 37 03.7	+43 21 17	A	3195-0834	
S 8402	V1084 Cyg	21 37 51.6	+47 36 47	A		
S 8403	V1085 Cyg	21 38 27.3	+47 40 16	A		
S 8404	V1569 Cyg	21 39 50.2	+42 15 05	A		
S 8405	V1086 Cyg	21 40 15.8	+47 59 22	A		
S 8406	NSV 13849	21 41 54.3	+45 30 02	A		
S 8407	V1087 Cyg	21 42 10.1	+46 10 39	A		
S 8408	V1573 Cyg	21 42 28.1	+43 15 58	A		
S 8409	V1574 Cyg*	21 43 22.0	+48 55 34	A	3599-1997	IRAS 21415+4841
S 8410	V1340 Cyg	21 43 49.1	+45 46 14	A		IRAS 21419+4532
S 8411	V1089 Cyg	21 44 17.5	+47 54 52	A		
S 8412	V1091 Cyg	21 45 59.5	+44 25 00	A		IRAS 21440+4411
S 8413	V1575 Cyg	21 50 16.4	+47 59 21	A		
S 8414	V1092 Cyg	21 50 51.2	+47 48 13	A		IRAS 21489+4734
S 8415	V1576 Cyg	21 51 59.6	+49 17 34	A		
S 8416	NSV 13922	21 52 58.2	+44 00 55	A	3197-1023	
S 8417	V1093 Cyg	21 53 29.3	+44 05 05	A	3197-0543	
S 8418	V1094 Cyg	21 54 29.8	+44 49 14	A		
S 8419	V1096 Cyg	21 55 52.2	+41 35 47	A		
S 8420	V1095 Cyg	21 55 42.0	+47 20 02	A		
S 8421	V1097 Cyg	21 56 58.8	+45 21 54	A		
S 8422	V1098 Cyg	21 57 42.9	+46 46 38	A		
S 8423	V1099 Cyg	21 57 44.5	+45 54 23	A		
S 8424	V1100 Cyg	21 58 36.5	+45 18 43	A		
S 8425	NSV 13990	21 59 23.9	+43 53 22	A	3197-0357	
S 8426	FU Lac	22 00 26.8	+43 51 20	A		
S 8427	V351 Lac	22 00 48.2	+42 30 43	A	3206-0663	
S 8428	V352 Lac	22 01 11.7	+43 07 33	A	3210-1466	
S 8429	V1101 Cyg	22 02 00.5	+48 03 26	A		

Table 9: ρ Puppis field – I

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8430	HQ Pup	7 50 44.1	–22 41 51	G	6553-0141	
S 8431	NSV 3819	7 56 03.1	–21 57 03	A	5994-0168	IRAS 07538-2149
S 8432	NSV 3842	7 59 12.2	–26 41 57	A	6562-0429	
S 8433	NSV 3849	7 59 42.1	–20 53 27	A	5994-3338	
S 8434	HX Pup	8 00 26.0	–27 12 31	A	6562-2846	
S 8435	HY Pup	8 02 13.6	–23 35 42	A		
S 8436	NSV 3868	8 02 06.9	–26 12 52	A	6558-3172	
S 8437	NSV 3875	8 03 01.5	–24 16 33	G	6554-1861	
S 8438	HZ Pup	8 03 22.9	–28 28 29	A		Nova Pup 1963
S 8439	II Pup	8 03 25.7	–27 55 26	A		IRAS 08013-2746
S 8440	FG Pup	8 04 31.7	–24 02 54	A	6554-0963	

Table 9: ρ Puppis field – I (cont'd.)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8441	IP Pup	8 07 43.1	–23 16 55	A		
S 8442	NSV 3919	8 08 20.5	–23 18 34	A		
S 8443	IQ Pup	8 11 28.3	–21 19 15	A		
S 8444	LZ Pup	8 12 10.9	–23 43 49	A		
S 8445	IS Pup	8 11 58.8	–28 15 36	A		
S 8446	NSV 3955	8 14 04.4	–27 42 01	A	6564-0405	
S 8447	NSV 3961	8 14 26.6	–25 51 41	A	6560-4892	
S 8448	IW Pup	8 18 06.0	–26 33 02	A		
S 8449	NSV 4038	8 22 07.3	–21 15 31	A	6009-4253	IRAS 08199-2105
S 8450	NSV 4054	8 23 34.9	–21 57 49	A	6009-5581	IRAS 08213-2148
S 8451	NSV 4065	8 25 08.3	–23 58 27	A	6569-0930	IRAS 08229-2348

Table 10: ϕ Cassiopeiae field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8452	V383 Cas*	0 43 43.5	+62 00 09	A		
S 8453	NSV 274	0 44 17.0	+60 42 20	A	4016-0347	IRAS 00413+6025
S 8454	V386 Cas	0 59 11.3	+55 57 20	A	3672-1961	
S 8455	V387 Cas	1 00 31.8	+58 41 46	A	3680-1475	
S 8456	V456 Cas	1 06 18.1	+54 03 24	A	3668-1863	IRAS 01033+5347
S 8457	V467 Cas	1 22 16.3	+57 23 06	A	3678-1023	IRAS 01191+5707
S 8458	V390 Cas	1 28 37.2	+62 16 38	A	4035-2349	IRAS 01252+6201
S 8459	V470 Cas	1 32 18.2	+56 29 58	A	3678-0712	
S 8460	V472 Cas	1 33 32.0	+60 32 48	A	4031-0602	IRAS 01301+6017
S 8461	V473 Cas	1 34 52.4	+56 39 09	A	3679-1417	
S 8462	V349 Per	1 36 29.2	+53 49 26	A	3671-1906	
S 8463	KU Per	1 50 43.6	+54 51 23	A		
S 8464	V394 Cas	2 02 02.1	+62 41 31	A	4037-1145	

Table 11: NGC 2158 field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8465	HL Gem	6 02 10.4	+22 58 12	A		
S 8466	HM Gem	6 03 08.8	+25 14 48	A		
S 8467	HN Gem	6 05 56.5	+24 20 20	A		
S 8468	HO Gem	6 07 30.6	+24 42 14	A		
S 8469	HP Gem	6 11 46.9	+24 51 37	A		
S 8470	HQ Gem	6 12 04.5	+25 28 33	A		
S 8471	HS Gem	6 15 23.6	+23 49 54	A		
S 8472	HT Gem	6 15 44.7	+24 00 51	A		
S 8473	NSV 2889	6 16 12.8	+25 39 56	A		

Table 12: NGC 188 field – II

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8474	EP Cep	0 46 54.2	+85 21 44	A		
S 8475	EU Cep	1 20 52.0	+84 54 06	A		

Table 13: Perseus/Auriga (4^h35^m +40°)

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8476	NV Per	4 19 36.0	+35 05 45	A	2379-1645	
S 8477	NW Per	4 22 21.4	+41 47 39	A	2887-0329	IRAS 04188+4140
S 8478	OP Per	4 30 02.4	+42 56 38	A		
S 8479	NSV 1707	4 45 18.7	+35 58 15	A	2386-0814	IRAS 04419+3552
S 8480	HV Aur	4 53 16.8	+38 16 38	A		
S 8481	NSV 1753	4 53 40.1	+37 18 44	A	2399-0737	IRAS 04503+3713

Table 14: North galactic pole fields – II

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8482	NSV 5287*	11 40 14.6	+16 58 16	A		
S 8483	BF Leo	11 41 12.4	+21 17 52	A		
S 8484	BZ Leo	11 42 18.5	+22 46 46	A		
S 8585	BK Leo	11 44 28.8	+21 36 33	A		
S 8486	BR Leo	11 54 17.8	+15 59 21	A		
S 8487	NSV 5464	12 07 19.4	+22 44 54	A	1986-1864	
S 8488	BX Com	12 07 46.7	+21 37 42	A		= XY Com (S 8050)
S 8489	CC Com	12 12 06.2	+22 31 58	G	1986-2106	1RXS J121205.5+223207
S 8490	YZ Com	12 13 07.6	+21 56 50	A		
S 8491	AB Com	12 18 46.7	+23 38 43	A	1989-0857	
S 8492	DF Com	12 29 12.6	+20 04 55	A	1447-2048	double
S 8493	DY Com	12 44 41.3	+17 22 13	A		
S 8494	AS Com	12 45 23.6	+16 40 53	A		
S 8495	AU Com	12 45 57.6	+19 50 16	A		
S 8496	AZ Com	12 53 50.1	+22 18 40	A	1455-0265	
S 8497	BI Com	13 22 44.7	+23 40 43	A		
S 8498	BN Com*	13 29 08.3	+17 19 02	A		
S 8499	AK Boo	13 38 39.2	+24 11 05	A		
S 8500	BS Boo	13 41 43.0	+23 35 01	A		
S 8501	BV Boo	13 42 03.9	+22 54 50	A	1998-1020	
S 8502		13 42 26.8	+28 11 13	A	2004-1535	Cl* NGC 5272 SAW V113
S 8503	AO Boo	13 44 28.5	+22 17 21	A		
S 8504	BB Boo	13 53 37.6	+21 50 47	A		
S 8505	BE Boo	13 55 38.4	+17 52 53	A	1470-0441	
S 8506	BU Boo	14 01 42.6	+22 30 16	A	2006-0750	

Table 15: ρ Puppis field – II

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8507	HT Pup	7 53 58.4	−26 14 36	A		
S 8508	NSV 3807	7 54 32.3	−23 50 20	A	6553-2103	IRAS 07524-2342
S 8509	NSV 3821	7 56 17.3	−23 27 04	A		
S 8510	IL Pup	8 04 26.1	−20 53 22	G	6007-2906	
S 8511	IO Pup	8 06 57.9	−25 49 08	A	6559-0238	
S 8512	NSV 3910	8 07 37.0	−19 47 05	A	6003-0283	IRAS 08054-1938
S 8513	NSV 3944	8 12 47.2	−26 45 08	A	6563-2205	IRAS 08107-2636
S 8514	NSV 3964*	8 14 59.2	−21 56 24	A	6008-0356	IRAS 08127-2147
S 8515	NSV 3972	8 15 54.6	−22 58 24	A	6556-0649	IRAS 08137-2249
S 8516	NSV 4001	8 19 02.3	−25 19 15	A		
S 8517	NSV 4042	8 22 19.6	−20 09 39	A	6005-4164	
S 8518	NSV 4050	8 23 28.4	−21 09 16	G	6009-3746	
S 8519	NSV 4055	8 23 38.9	−21 09 02	G	6009-2857	
S 8520	KK Pup	8 23 54.4	−28 36 36	A	6581-2102	
S 8521	KL Pup	8 24 23.3	−23 21 10	A		
S 8522	NSV 4097	8 28 36.4	−24 49 30	A	6573-4492	
S 8523	TW Pyx	8 28 42.5	−25 37 41	A	6573-2741	

Table 16: AE Aurigae field

Sonne.	GCVS	RA (2000)	Dec	s	GSC	Remarks
S 8524	EW Aur	4 51 24.8	+38 11 19	A	2894-2717	
S 8525	IK Aur	5 08 13.2	+33 47 52	A		
S 8526	IL Aur	5 14 09.1	+37 14 45	A	2401-0273	
S 8527	IO Aur	5 15 51.4	+38 34 37	A	2896-1572	
S 8528	IP Aur	5 17 30.2	+36 59 48	A		
S 8529	IR Aur*	5 21 52.1	+39 14 11	A		
S 8530	NSV 1943	5 22 00.6	+32 53 53	A		IRAS 05187+3251
S 8531	NSV 1983	5 26 52.4	+34 47 15	A		
S 8532	IT Aur	5 27 38.2	+32 12 33	A		
S 8533	IV Aur	5 30 49.8	+35 54 45	A		
S 8534	IW Aur	5 32 35.1	+33 21 54	A	2407-2050	

Notes:

V974 Aql	faint on POSS-I, bright on POSS-II.
V977 Aql	ID uncertain, alternate candidate at end-figures $16^{s}.8/56''$.
V980 Aql	crowded.
V995 Aql	GSC position offset in Dec from crowding.
V1050 Aql	southwestern star of pair; evidently *not* a dwarf nova, but a Mira, *cf.* Gessner (1984, 1986).
V1069 Aql	GCVS4.1 position $8'$ in error.
V1086 Aql	double, Hoffmeister suggests variable is the southeastern component.
V1137 Aql	= NSV 12135.
V1375 Aql	GSC/A2.0 positions slightly skewed by companion; variable is the eastern star of pair.
V1380 Aql	IRAS position has large error ellipse.
V1398 Aql	northeastern star of pair.
IR Aur	not double as per Hoffmeister.
AF Boo	superposed on the faint galaxy NGP9 F380-1183661.
V383 Cas	Cl* NGC 225 LMM 102; star marked is not red.
BN Com	ID uncertain, northwestern star of pair.
V1567 Cyg	northern/brighter star of pair.
V1574 Cyg	also = CGCS 5427.
KX Del	star marked is red IRAS source.
UU Sge	SIMBAD position somewhat in error.
ET Sge	Downes *et al.* (1997) position adopted.
QW Sge	southern star of pair: companion at end-figures $49^{s}.6/54''$(A); V=13.14, B–V=0.45, F0V, *cf.* Munari & Buson (1991).
NSV 3964	also = IRC –20161.
NSV 5287	ID uncertain, is possibly fainter star at end-figures $14^{s}.5/23''$.
NSV 12110	northeastern star of pair, GSC position is for mean of pair.
NSV 12274	coincident with IRAS 19377+1240, but large error ellipse.
SN 1963x	position is for host galaxy, which is IRAS 12105+2118 and = Anon 1210+21.

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FASTT VERSUS IRAS

BRIAN A. SKIFF

Lowell Observatory, 1400 West Mars Hill Road, Flagstaff AZ 86001-4499, USA, e-mail: bas@lowell.edu

In the course of work on the Wachmann SA 98 variables (Skiff 1999a) and the Chavira infrared stars (Skiff 1999b), I noticed numerous identifications within SIMBAD involving a list of suspected variables found by Henden & Stone (1998) using the USNO–Flagstaff 20-cm transit circle, dubbed 'FASTT' (Flagstaff Astrometric Scanning Transit Telescope). Although about 100 of the 1600 stars were accurately matched within the GCVS (see Henden & Stone's Table 3), other external identifications were not made.

I have compared the list against the IRAS point-source and IRAS "faint-source" catalogues using the Strasbourg 'VizieR' facility. The table shows the 160-odd match-ups found within 20″ of the high-precision FASTT coordinates. This search radius is similar to the major axis of the typical IRAS position error-ellipse. In fact, the great majority of the IRAS sources were within $\sim$5″ of the FASTT star. All but a few of these correspond to cool AGB variables, where the 12/25 μm IRAS flux ratios are ≥ 1.5, with generally *no* detection at 60 μm or 100 μm (*cf.* Figure 1 of Zijlstra *et al.* 1990). The only two IRAS coincidences having odd IRAS 'colors' are two extragalactic objects: one is a quasar (FASTT 159), the other is the center of a nearby galaxy (FASTT 543 = NGC 4653). Since the FASTT astrometric reference frame included extragalactic radio sources (*cf.* Stone 1997), high-z objects were commonly on the observing program.

The table preserves the precise ($\sim$50 mas) coordinates of the on-line version of the original file. (I have made the positive Declination signs explicit, however.) The next column shows IRAS names. While all the ordinary IRAS point-sources are present in SIMBAD, most of the "faint-source" catalogue objects are not unless there is some published study of them. The last column shows various 'new' IDs, specifically names not linked with the FASTT stars in SIMBAD. If the IRAS name is already linked with a variable-star name in SIMBAD, then the GCVS name alone is given. This is to emphasize the GCVS name as a primary identifier for the object. A few longer notes are given at the bottom of the list.

I appreciate the comments of Arne Henden on the results of this search.

Table 1: Identifications for FASTT suspected variables

FASTT	RA (2000)	Dec	IRAS	Identifications
32	00 47 53.1434	–01 18 58.884		SX Cet
74	03 54 30.2308	+01 24 19.155	03519+0115	
104	03 28 18.6865	–01 32 58.175	F03257–0143	
109	04 15 20.2203	+01 18 00.209	04127+0110	NSV 15930
112	04 21 27.2441	+01 29 13.293	04188+0122	[TI98] 0418+0122
132	04 33 44.9156	+00 01 36.565		BD Eri
135	04 17 07.8421	–00 25 06.634	F04145–0032	
159	04 23 15.7858	–01 20 33.320	04207–0127	Ohio A 129; quasar
166	07 02 59.4231	+01 09 53.852	07004+0114	V529 Mon
167	07 03 31.2546	+01 01 37.802	07009+0106	
175	07 07 06.5880	+00 46 35.045	07045+0051	
182	07 14 06.4834	+00 57 46.885	07115+0103	
187	07 18 42.9948	+01 11 11.122	07161+0116	
193	07 29 20.9854	+00 49 55.576	07267+0056	
196	07 29 36.9737	+01 01 41.164	07270+0107	
202	07 08 18.0761	+00 41 12.978	07057+0046	
215	07 25 28.5258	+00 35 12.196	07229+0041	
233	07 05 10.3269	–00 00 04.009	07026+0004	
267	07 03 39.6407	–00 16 05.930	07011–0011	
276	07 08 56.4741	–00 17 24.450	07063–0012	CGCS 1568 = C* 677
291	07 20 06.8815	–00 06 26.843	07175–0000	
296	07 25 04.6868	–00 24 23.206	07225–0018	GSC 4817-0788
303	07 03 46.0795	–00 37 28.989	07012–0032	
308	07 13 53.0339	–00 30 59.792	07113–0025	
309	07 14 16.1709	–00 32 17.875	07117–0027	
312	07 19 25.9116	–00 43 28.583	07168–0037	
316	07 25 52.1458	–00 40 36.849	07233–0034	
318	07 28 28.1777	–00 45 04.412	07259–0038	
323	07 04 06.0017	–01 07 29.365	07015–0102	
336	07 24 33.3033	–00 56 40.028	07220–0050	CGCS 1697 = C* 748
342	07 11 05.9770	–01 18 17.679	07085–0113	
344	07 12 23.4642	–01 24 52.332	07098–0119	MW Mon
352	07 18 38.9907	–01 16 52.135	07161–0111	[LRS87] 45
358	07 23 24.5557	–01 20 22.284	07208–0114	
362	07 51 08.0034	+00 56 34.266	07485+0104	
364	07 52 56.0964	+01 09 40.624		AE CMi
366	07 55 11.0387	+01 27 55.012	07526+0135	
369	08 01 01.7891	+01 20 15.742	F07584+0128	
381	07 55 01.0419	+00 23 36.725	07524+0031	
382	07 59 38.9088	+00 30 28.021	07570+0038	AF CMi
405	08 12 37.5712	–00 02 14.347	08100+0006	
415	07 57 24.1364	–00 09 29.495	07548–0001	
430	07 54 19.3442	–00 40 08.572	07517–0032	NSV 3799
434	07 57 43.2547	–00 41 06.397	07551–0032	see note
511	10 52 46.9340	–01 10 46.623		SY Leo
537	12 34 41.6025	–00 14 14.125	12321+0002	StM 172
543	12 43 50.9177	–00 33 40.685	12412–0017	NGC 4653; galaxy nucleus
615	13 28 35.2976	–01 05 54.441	13260–0050	WX Vir
648	15 26 10.6800	+00 31 56.443	F15236+0042	NSV 7075
727	16 02 49.1800	+00 36 40.478	16002+0044	DW Ser
730	16 11 32.5571	+00 31 10.394	16090+0038	
745	16 15 19.8039	+00 13 45.820		CL Ser
757	16 07 08.1700	–00 18 53.780		AI Ser
780	16 16 55.4144	–00 50 42.626	16143–0043	NSV 7594

Table 1: Identifications for FASTT suspected variables (cont'd.)

FASTT	RA (2000)	Dec	IRAS	Identifications
811	16 19 37.2845	–01 15 47.359	16170–0108	CM Ser
817	17 42 40.1407	+00 56 10.211	17401+0057	
819	17 43 21.8610	+01 02 00.378	17408+0103	V1070 Oph
820	17 45 22.5865	+01 07 17.430	F17428+0108	
825	17 46 51.2143	+00 56 08.247		V377 Oph
826	17 47 37.1640	+01 32 37.494	17450+0133	V458 Oph
837	17 55 47.1611	+00 56 38.666	17532+0057	V472 Oph
845	17 57 55.7259	+00 58 23.449		V474 Oph
847	17 58 38.8167	+01 26 20.564		V984 Oph, see note
863	18 02 27.2489	+01 03 16.928	F17598+0103	
866	18 03 28.4574	+01 16 30.610	18009+0116	
871	18 04 07.4571	+01 17 55.618	18015+0117	
873	18 05 18.6545	+01 05 42.243	18027+0105	
879	18 10 04.7573	+00 45 56.229	18075+0045	
881	18 10 54.5518	+00 48 20.463	18083+0047	
882	18 11 06.0895	+01 03 31.248	18085+0102	V402 Oph
895	17 46 00.9548	+00 39 30.781	F17434+0040	
899	17 52 12.2087	+00 25 30.357	F17496+0026	
900	17 52 22.6824	+00 35 01.126	17498+0035	
901	17 53 41.4645	+00 35 11.462	17511+0035	
907	18 00 00.2026	+00 32 19.821	F17574+0032	V1082 Oph
908	18 01 07.0345	+00 41 44.912	17585+0041	V482 Oph = IRC +00334
915	18 09 48.8309	+00 39 48.726	18072+0039	
937	17 46 25.7490	+00 15 23.653	17438+0016	
945	17 53 54.8518	+00 00 04.850		V384 Oph
973	18 10 00.2548	+00 05 53.519	18074+0005	
974	18 10 05.2329	+00 17 52.865	18075+0017	
978	18 11 52.3788	+00 00 02.165	18093–0000	
985	17 47 39.4879	–00 03 34.320	F17451–0002	
990	17 51 37.3809	–00 17 58.092	17490–0017	
997	18 02 30.9173	–00 05 59.038		AX Ser
999	18 03 21.6779	–00 25 51.742	F18008–0026	NSV 10095
1004	18 05 37.6780	–00 26 19.377	18030–0026	EQ Ser
1009	18 09 17.6603	–00 18 45.635	18067–0019	YZ Ser
1022	18 01 58.6797	–00 12 16.357	F17594–0012	
1024	18 03 18.0429	–00 11 57.630	18007–0012	
1034	17 48 03.2524	–00 41 05.988		KT Oph
1036	17 49 19.6661	–00 28 39.842	17467–0027	
1040	17 52 49.9225	–00 32 40.108	F17502–0032	
1041	17 52 53.1267	–00 39 12.009	F17503–0038	
1042	17 53 16.9721	–00 28 07.869	F17506–0027	V467 Oph, see note
1046	17 57 39.2992	–00 46 24.568	17550–0046	
1050	17 58 21.5248	–00 39 32.955	17557–0039	
1051	17 58 23.8998	–00 39 21.896	F17558–0039	
1055	17 59 56.9239	–00 32 20.466	17573–0032	
1060	18 00 16.0424	–00 42 28.243	F17576–0042	
1063	18 00 55.2952	–00 38 17.528		XY Ser
1072	18 05 19.1262	–00 30 10.678	18027–003	
1074	18 05 48.6384	–00 43 05.721		VZ Ser
1082	18 12 21.3856	–00 28 01.824	18097–0028	
1087	18 09 45.1566	–00 32 41.693	18071–0033	
1101	17 54 26.5275	–01 00 24.907	17518–0059	V385 Oph
1104	17 55 52.2434	–01 02 36.240	17532–0102	
1108	17 57 03.6086	–01 06 33.187	F17544–0106	

Table 1: Identifications for FASTT suspected variables (cont'd.)

FASTT	RA (2000)	Dec	IRAS	Identifications
1133	18 06 44.9449	−00 52 19.488	18041−0052	
1136	17 44 45.1927	−01 31 47.686		V935 Oph = IRC +00318
1138	17 48 27.1099	−01 31 15.152	17458−0130	
1141	17 51 37.9303	−01 32 21.662	17490−0131	V463 Oph
1143	17 56 23.7921	−01 17 28.503	17538−0117	NSV 9877
1145	17 57 54.5980	−01 25 26.713	F17553−0125	
1146	17 58 05.8084	−01 37 21.820	F17554−0137	
1152	18 00 47.7425	−01 33 35.187	F17582−0133	
1153	18 01 04.4135	−01 20 51.984		XZ Ser
1161	18 08 52.7727	−01 30 28.786	18062−0131	
1162	18 09 08.4981	−01 14 40.372	18065−0115	
1165	18 35 13.7974	+01 24 49.898	18326+0122	
1167	18 37 10.0260	+01 24 05.004	18346+0121	
1171	18 45 17.2881	+00 56 29.886	18427+0053	
1172	18 45 35.5724	+00 57 58.415	18430+0054	
1176	18 53 34.2286	+00 48 55.589	18510+0045	
1178	19 02 04.9601	+00 57 48.999	18595+0053	
1179	19 02 21.1236	+01 30 41.135	18598+0126	
1180	19 02 39.6317	+01 29 13.653	19001+0124	
1184	18 36 37.3952	+00 36 35.331	18340+0034	
1186	18 43 24.1459	+00 39 14.132	18408+0036	
1187	18 44 47.7892	+00 22 30.559	18422+0019	
1193	18 55 41.6988	+00 20 49.093	18531+0016	
1194	18 56 30.1236	+00 30 32.783	18539+0026	
1196	19 02 41.5626	+00 36 12.680	19001+0031	
1200	18 44 18.8382	−00 00 09.374	18417−0003	
1211	18 54 02.2636	+00 15 34.845	18514+0011	
1215	18 56 24.1583	+00 14 48.389	18538+0010	
1216	18 56 26.1954	−00 04 26.487	18538−0008	
1217	18 59 12.2597	+00 14 16.264	18566+0010	
1218	19 00 13.6357	−00 04 34.734	18576−0008	
1230	18 41 28.4685	−00 12 10.704	18389−0015	
1231	18 42 38.2593	−00 08 31.188	18400−0011	
1267	18 37 05.1096	−00 28 39.106	18345−0031	
1268	18 37 36.1267	−00 40 46.521	18350−0043	
1270	18 45 04.1981	−00 46 47.339	18424−0050	
1271	18 49 11.7071	−00 41 43.431	18466−0045	
1272	18 50 31.7898	−00 43 24.834	18479−0047	
1286	18 53 03.7156	−00 40 46.440	18504−0044	
1296	18 54 27.9018	−00 36 46.858	18518−0040	
1300	18 54 44.2514	−00 49 09.864	18521−0053	
1309	18 56 08.7053	−00 28 33.897	18535−0032	IRC +00395
1326	19 00 59.8551	−00 48 46.145	18584−0053	
1330	19 02 12.8037	−00 44 21.301	18596−0048	
1332	19 02 25.7121	−00 30 14.740	18598−0034	
1346	18 34 14.7470	−00 58 43.529	18316−0101	IRC +00357
1360	18 51 53.8026	−00 58 45.016	18493−0102	
1379	18 55 18.4894	−01 00 48.226	18527−0104	
1380	18 55 20.6223	−01 05 31.560	18527−0109	

Table 1: Identifications for FASTT suspected variables (cont'd.)

FASTT	RA (2000)	Dec	IRAS	Identifications
1427	19 00 03.4187	−00 50 59.648	18574–0055	
1442	18 41 07.1615	−01 35 10.384	18385–0138	
1443	18 41 21.2270	−01 25 28.476	18387–0128	
1444	18 41 28.7498	−01 27 04.275	18388–0130	
1455	18 54 55.9321	−01 21 22.100	18523–0125	
1461	18 58 38.0914	−01 30 17.282	18560–0134	
1463	18 59 11.2937	−01 19 09.753	18565–0123	V886 Aql
1466	19 00 09.6063	−01 34 56.970		VX Aql
1530	22 05 36.9379	−00 49 38.997	22030–0104	

Notes:

434 CGCS 1960 = C* 961, but *not* HIP 38915, whose coordinates are for another star (*i.e.* Hipparcos missed the carbon star).

847 evidently not IRAS 17561+0126 (outside position error ellipse).

1042 SIMBAD position in error, *cf.* Manek (1997).

References:

Henden, A. A., and Stone R. C., 1998, *Astron. J.*, **115**, 296;
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Skiff, B. A., 1999a, *IBVS*, No. 4676

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COORDINATES AND IDENTIFICATIONS FOR KUROCHKIN'S VARIABLES NEAR M56

BRIAN A. SKIFF

Lowell Observatory, 1400 West Mars Hill Road, Flagstaff AZ 86001-4499, USA, e-mail: bas@lowell.edu

The tables below show identifications and accurate coordinates for about 90 variables studied by Kurochkin (1968, 1970, 1971, 1972) in a $10° \times 10°$ region around the globular cluster Messier 56. Most of the variables were newly discovered. Additional follow-up work on the same stars was published much later (Kurochkin 1985). Although some of the variables have precise positions published in more recent literature, most do not.

The format is identical to recent previous lists, and broken into the four parts in which they were published. The first column shows SVS numbers, and the second the GCVS designation. An asterisk by the GCVS name indicates a note following the tables. Nearly all the positions come from USNO–A2.0, but a few are from either the GSC v1.2 or from large-scale Digitized Sky Survey images from the Goddard SkyView facility. The source is coded in column 's' as follows: A = USNO–A2.0, G = GSC v1.2, S = SkyView. Many objects were verified using DSS images and other sources. All but one or two were unambiguously identified from Kurochkin's charts.

The present list was integrated into SIMBAD before publication by Fabienne Woelfel (CDS-Strasbourg). She independently found the V1506/V923 Cyg mix-up, which I had missed. Nikolai Samus (Sternberg Institute, Moscow) provided the earlier Makarenko citation for this correction. I am grateful to them both for their interest in this work.

Table 1: Positions and identifications – I

SVS	GCVS	RA (2000)	Dec	s	GSC	Remarks
1510	V397 Lyr	19 07 11.0	+30 57 04	A		
1511	V364 Lyr	19 09 40.0	+30 05 51	A		
1512	V369 Lyr*	19 11 55.3	+32 12 03	S		
1513	V373 Lyr	19 17 12.2	+31 44 40	A		
1514	V376 Lyr	19 20 25.4	+31 39 30	A		
1515	NSV 11940	19 21 16.6	+31 41 46	A		
1516	NSV 11948	19 21 48.2	+32 07 02	A		
1517	V1111 Cyg	19 23 09.2	+30 10 53	A		
1518	V383 Lyr	19 25 03.0	+30 25 34	A		
1519	V1122 Cyg	19 28 25.1	+30 54 12	A		
1520	V1255 Cyg	19 28 36.6	+31 10 49	A		
1521	V869 Cyg	19 29 11.8	+31 11 17	A		
1522	V873 Cyg	19 29 20.8	+31 46 52	A		
1523	NSV 12103	19 30 37.7	+30 25 04	A		
1524	V1260 Cyg	19 31 20.2	+31 22 07	A		
1525	NSV 12125	19 32 17.3	+30 20 19	A		
1526	NSV 12175	19 34 23.9	+30 41 38	A		
1527	NSV 12184	19 35 07.1	+30 53 40	A		
1528	V1267 Cyg	19 38 54.8	+30 30 46	A		
1529	V1139 Cyg	19 39 21.7	+30 57 15	A		

Table 2: Positions and identifications – II

SVS	GCVS	RA (2000)	Dec	s	GSC	Remarks
1579	NSV 11621	18 58 41.2	+34 32 20	A	2647-1168	
1580	NSV 11651	19 00 35.9	+28 31 33	A		
1581	V409 Lyr	19 00 55.9	+26 20 19	A		
1582	V410 Lyr	19 01 35.3	+29 00 07	A		
1583	V412 Lyr	19 06 48.5	+29 16 40	A	2134-1116	
1584	V419 Lyr	19 10 14.0	+29 06 15	A		
1585	V420 Lyr	19 10 17.0	+28 30 08	A		
1586	V421 Lyr	19 10 39.1	+26 30 29	A		
1587	V423 Lyr	19 11 55.4	+33 13 07	A		
1588	V424 Lyr	19 12 52.0	+26 15 55	A		
1589	V426 Lyr	19 13 17.4	+26 59 49	A		
1590	V427 Lyr	19 13 41.7	+28 02 11	A		
1591	NSV 11950	19 21 57.2	+26 44 11	A		
1592	NSV 11954	19 22 21.0	+25 47 51	A	2128-0303	
1593	NSV 11962	19 22 38.2	+26 15 39	A	2132-0613	
1594	NSV 12002	19 24 51.7	+29 47 30	A		
1595	MN Vul	19 26 25.6	+26 57 32	A		
1596	V1345 Cyg	19 31 28.6	+29 46 23	A		
1597	V907 Cyg	19 35 30.4	+29 45 46	A		
1598	V1348 Cyg	19 38 03.9	+29 23 45	A		
1599	HW Cyg	19 40 18.1	+32 46 02	G	2660-2881	

Table 3: Positions and identifications – III

SVS	GCVS	RA (2000)	Dec	s	GSC	Remarks
1636	V408 Lyr					not found
1637	V411 Lyr	19 06 27.6	+34 40 21	A		
1638	V413 Lyr	19 07 16.4	+30 19 26	A		
1639	V414 Lyr	19 07 55.8	+26 20 17	A		IRAS 19059+2615
1640	V415 Lyr	19 08 03.9	+31 23 55	A		
1641	V416 Lyr	19 08 26.4	+29 21 55	A		
1642	V417 Lyr	19 08 39.1	+30 43 09	A		
1643	V418 Lyr	19 08 33.5	+33 18 35	A		
1644	LY Vul	19 09 36.2	+25 40 06	A		
1645	V422 Lyr	19 11 25.3	+27 15 19	A	2131-2071	IRAS 19093+2710
1646	V425 Lyr	19 12 54.2	+33 13 02	A		
1647	V428 Lyr	19 13 32.8	+33 36 51	A	2657-0767	
1648	V429 Lyr	19 13 37.6	+34 29 10	A		
1649	V430 Lyr	19 14 14.8	+26 19 01	A	2131-1140	
1650	V431 Lyr	19 14 00.4	+33 35 38	A		
1651	AI Lyr	19 14 35.6	+27 49 46	A		
1652	V432 Lyr	19 16 50.3	+29 10 52	A	2136-3343	
1653	V433 Lyr	19 16 53.6	+30 49 56	A		IRAS 19149+3044
1654	OY Lyr	19 17 01.9	+29 00 25	A	2136-1363	
1655	V434 Lyr*	19 16 53.6	+32 36 12	S		
1656	LZ Vul	19 18 24.4	+25 25 18	A		
1657	V436 Lyr	19 18 12.5	+32 11 26	A	2657-2048	
1658	V437 Lyr	19 19 52.2	+32 29 58	A		
1659	V438 Lyr	19 21 14.5	+31 57 52	A		IRAS 19193+3152
1660	V405 Lyr	19 21 24.4	+34 01 20	A		
1661	MM Vul	19 22 02.8	+27 23 01	A		
1662	V439 Lyr	19 21 59.7	+32 46 15	A	2658-0964	
1663	V440 Lyr	19 21 59.4	+34 31 30	A		IRAS 19201+3425
1664	V843 Cyg	19 22 57.1	+29 41 09	A		
1665	V441 Lyr	19 23 42.4	+32 07 56	A		

Table 4: Positions and identifications – IV

SVS	GCVS	RA (2000)	Dec	s	GSC	Remarks
1775	NSV 11910	19 19 29.1	+25 45 35	A	2128-1767	
1776	MP Vul	19 24 51.8	+27 32 42	A	2133-1149	
1777	MQ Vul	19 25 12.7	+26 42 16	A		
1778	V456 Lyr	19 26 02.4	+31 53 08	A		IRAS 19241+3147
1779	MR Vul	19 27 08.0	+26 03 05	A	2129-1437	
1780	V1436 Cyg	19 28 43.3	+27 59 01	A		
1781	MS Vul	19 28 49.5	+26 53 20	S		IRAS 19267+2647
1782	V1437 Cyg	19 28 45.2	+31 23 25	A		
	V1257 Cyg	19 29 45.6	+28 16 12	S		
1783	MT Vul*	19 30 03.0	+27 35 34	A		IRAS 19280+2729
1784	V1438 Cyg	19 30 48.8	+28 54 39	A	2137-0608	
	V903 Cyg	19 34 44.1	+31 15 19	A		
	V911 Cyg	19 35 54.8	+27 59 03	A		
	EK Cyg	19 37 49.0	+31 50 23	A	2655-0115	
	V1506 Cyg*	19 38 03.8	+31 49 20	A	2655-0544	
	V1349 Cyg	19 38 05.1	+32 44 49	A		IRAS 19361+3237
	V925 Cyg*	19 38 27.1	+28 32 51	A		
1785	NSV 12252	19 38 40.3	+26 25 29	A	2146-3856	IRAS 19366+2618

Notes:

V369 Lyr	Downes *et al.* (1997) identification adopted.
V434 Lyr	verified on POSS-I, not visible on O (blue) print.
MT Vul	red variable with P $\sim 172^d$, not an eclipser as first suspected; *cf.* Kurochkin (1985).
V1506 Cyg	given erroneously as V923 Cyg by Kurochkin (1972); corrected by Makarenko (1974).
V925 Cyg	southern star of a pair.

References:

Downes, R. A., Webbink, R. F., and Shara, M. M., 1997, *Publ. Astron. Soc. Pac.*, **109**, 345
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Makarenko, E. N., 1974, *Perem. Zvezdy Prilozh.*, **2**, 117

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PHOTOELECTRIC BVI$_C$ OBSERVATIONS AND NEW ELEMENTS FOR THE CEPHEID V898 CENTAURI

L. N. BERDNIKOV[1,2], V. V. IGNATOVA[3,4], D. G. TURNER[5]

[1] Sternberg Astronomical Institute, 13 Universitetskij prosp., Moscow 119899, Russia

[2] South African Astronomical Observatory

[3] Tashkent University, Department of Astronomy

[4] Astronomical Institute, 33 Astronomicheskaya st., Tashkent 700052, Uzbekistan

[5] Saint Mary's University, Halifax, Nova Scotia, B3H 3C3, Canada

Name of the object:
V898 Cen = GSC 8620.0280 = HIP 54659

Equatorial coordinates:	**Equinox:**
R.A.= $11^h11^m20^s$ **DEC.=** $-54°33'25''$	2000

Observatory and telescope:
South African Astronomical Observatory, 0.5-m reflector

Detector:	Photomultiplier Hamamatsu
Filter(s):	BVI_c
Comparison star(s):	No. We conducted "all sky photometry"
Check star(s):	No. See above

Transformed to a standard system:	BVI_c
Standard stars (field) used:	Standard stars from E-regions

Availability of the data:
Through IBVS Web-site as 4724-t1.txt

Type of variability:	DCEPS

Table 2

Max JD hel 2400000+	Uncertainty	E	$O-C$	Number of observations	Reference
48019.577	±0.013	−460	0.009	49	HIPPARCOS data
48446.386	±0.012	−339	0.010	63	HIPPARCOS data
48841.413	±0.020	−227	−0.025	39	HIPPARCOS data
51268.253	±0.008	461	0.005	51	This paper

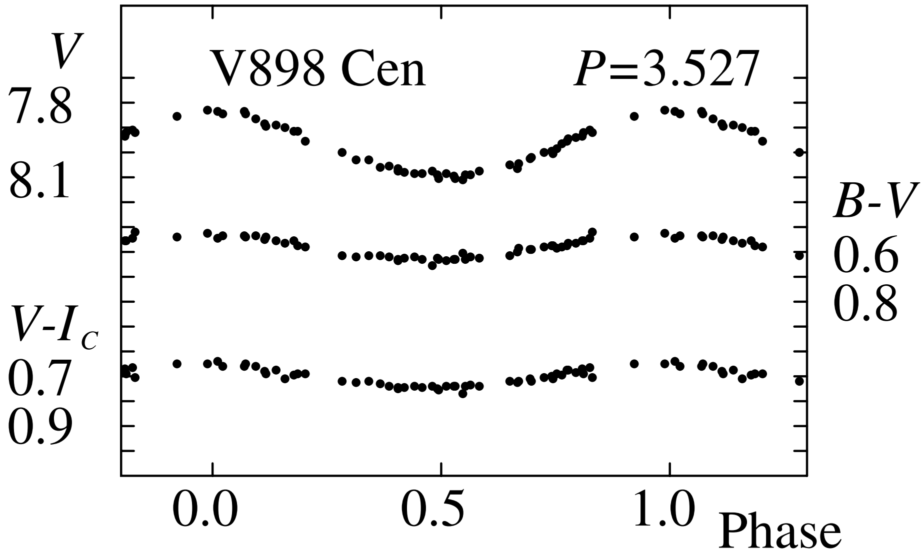

Figure 1.

Remarks:

Variability of V898 Cen was announced by Strohmeier et al. (1964). According to HIPPARCOS data this star (HIP 54659) is a Cepheid variable with elements

$$\text{Max JD}_{\text{hel}} = 2448502.836 + 3\overset{\text{d}}{.}52692 \times E.$$

The accuracy of our individual data is near $0\overset{\text{m}}{.}01$ in all filters. We analysed all existing observations by Hertzsprung's method (Berdnikov, 1992), and the derived epochs of light maximum are given in Table 2. The times of light maximum were introduced into a linear least-squares program that resulted in the following improved ephemeris:

$$\text{Max JD}_{\text{hel}} = 2449642.144 + 3\overset{\text{d}}{.}527340 \times E.$$
$$\pm 0.011 \quad \pm 0.000029$$

This ephemeris was used to calculate the $O - C$ values in Table 2, as well as for plotting the light and colour curves in Figure 1.

Acknowledgements:

The research described here was supported in part by the Russian Foundation of Basic Research and the State Science and Technology Program "Astronomy" to LNB and through NSERC Canada to DGT. We would also like to express our gratitude to the administrations of SAAO for allocating a large amount of observing time.

References:

Berdnikov, L.N., 1992, *Sov. Astron. Lett.*, **18**, 207
Strohmeier, W., Knigge, R., & Ott, H., 1964, *IBVS*, No. 66

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PHOTOELECTRIC VI$_C$ OBSERVATIONS AND NEW CLASSIFICATION FOR RV NORMAE

L. N. BERDNIKOV[1], D. G. TURNER[2]

[1] Sternberg Astronomical Institute, 13 Universitetskij prosp., Moscow 119899, Russia
e-mail: berdnik@sai.msu.su

[2] Saint Mary's University, Halifax, Nova Scotia, B3H 3C3, Canada

Name of the object:
RV Nor = GSC 8714.0914

Equatorial coordinates:	**Equinox:**
R.A.= $16^h04^m10^s$ **DEC.=** $-56°04'48''$	2000

Observatory and telescope:
South African Astronomical Observatory, 0.5-m reflector

Detector:	Photomultiplier Hamamatsu

Filter(s):	VI_c

Comparison star(s):	No. We conducted the "all sky photometry"

Check star(s):	No. See above

Transformed to a standard system:	VI_c
Standard stars (field) used:	Standard stars from E-regions

Availability of the data:
Through IBVS Web-site as 4725-t1.txt

Type of variability:	RV

Remarks:

RV Nor is listed in the GCVS-IV as a type II Cepheid with the elements:

$$\text{Max JD} = 2444119.43 + 32\overset{d}{.}333 \times E,$$

that are used in Figure 1 for plotting our data. The accuracy of the individual observations is near $0\overset{m}{.}01$ in all filters. It is obvious that these elements are not valid, and if RV Nor is periodic variable, it is most probably an RVTAU type star with a period near twice of above one. Using Harris' (1980) observations, we obtained the following ephemeris:

$$\text{Min JD} = 2444138.5 + 64\overset{d}{.}77 \times E.$$

This ephemeris is used in Figure 2.

Acknowledgements:

The research described here was supported in part by the Russian Foundation of Basic Research and the State Science and Technology Program "Astronomy" to LNB and through NSERC Canada to DGT. We would also like to express our gratitude to the administrations of SAAO for allocating a large amount of observing time.

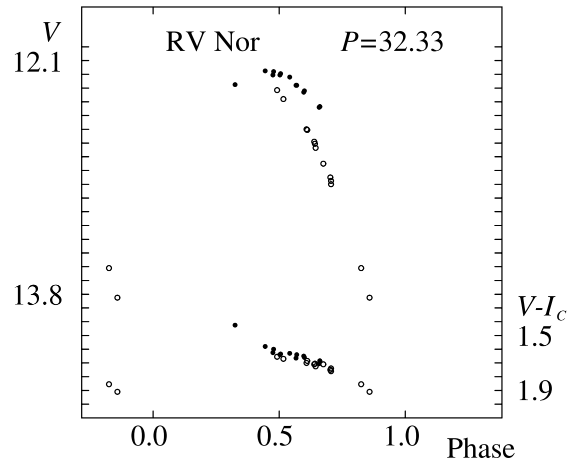

Figure 1. Observations obtained before and after JD 2451270 identified by circles and dots respectively.

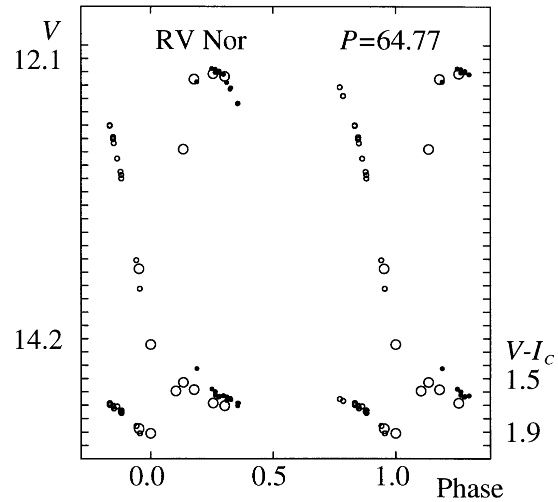

Figure 2. Small circles and dots represent our observations, large circles represent data from Harris (1980), whose intermediate-band measurements were converted to $V - I_c$, using formulae from Coulson et al. (1985).

References:

Coulson, I.M., Caldwell, J.A.R., & Gieren, W.P., 1985, *Astrophys. J. Suppl. Ser.*, **57**, 595
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NSV 13826: A β LYRAE TYPE ECLIPSING BINARY

J. VANDENBROERE

Groupe Européen d'Observations Stellaires (GEOS), 3 Promenade Venezia, F-78000 Versailles.
E-mail: j.vandenbroere@skynet.be

NSV 13826 ($\equiv$ GSC 2189.704 $\equiv$ HV 06152 $\equiv$ P 5616) is catalogued as a possible eclipsing or irregular variable from a list published by Shapley and Hughes (1934) and from irregular variations detected by Sandig (1950) on photographic plates. The β Lyrae shape of its light curve was obvious from the visual estimates of several GEOS members and its orbital period appeared to be 1.0803 days (Vandenbroere, 1996).

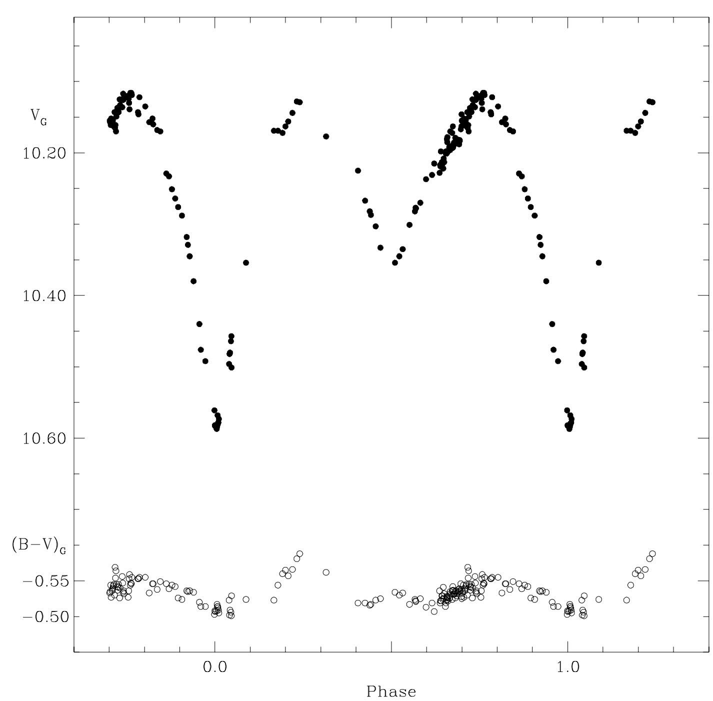

Figure 1. V and $B-V$ (Geneva system) light curves of NSV 13826

This value was used to collect new and more accurate photoelectric data. Therefore, NSV 13826 ($2^h39^m28^s$, $+23°01'.5$, 2000.0) was measured with the 76-cm telescope of the Jungfraujoch station through the B and V filters of the Geneva system. 144 measurements were obtained in each filter between January 1995 and December 1998. The folded V and

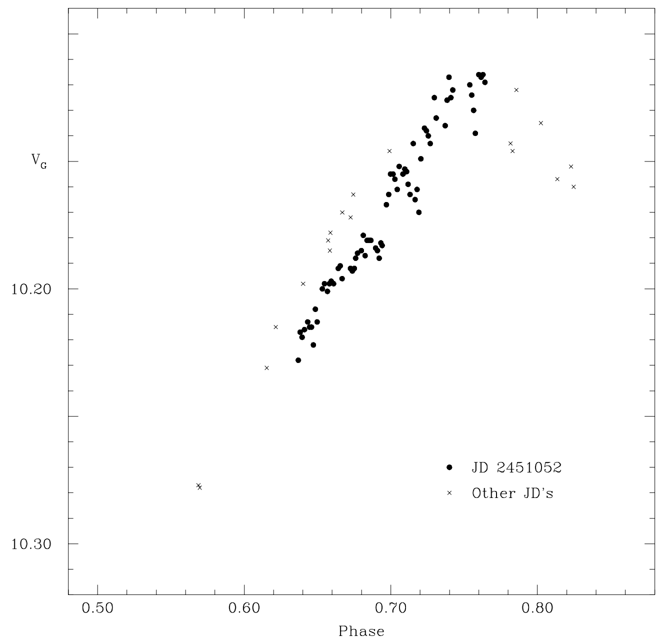

Figure 2. Different behaviours were observed in the 0.65–0.73 phase interval

$B-V$ light curves are shown in Fig. 1. NSV 13826 is a β Lyrae star with $V = 10^{\mathrm{m}}.12$ at maximum light, a primary minimum as faint as $V = 10^{\mathrm{m}}.59$ and a secondary one going down to $V = 10^{\mathrm{m}}.35$. The $(B-V)_G$ colour indices vary slightly from -0.59 to -0.50, which corresponds to a $(B-V)_J$ index of 0.31 to 0.38 after transformation with the formulae described by Meylan and Hauck (1981) and using the luminosity class III.

A more accurate orbital period was calculated by means of the primary and secondary photoelectric minima and of 30 instants extracted from the visual estimates of three GEOS members. The result of the linear regression, giving a triple weight to the photoelectric moments, is:

$$\text{Min I} = \text{HJD } 2449639.835 + 1^{\mathrm{d}}.080313 \times E.$$
$$\pm 0.012 \quad \pm 0.000033$$

A close inspection of Fig. 1 shows irregularities in the shape of the light curve, particularly on the shoulders before both maxima. Note also the related behaviour of the $B-V$ curve which mimics the V one. Probably the star is undergoing mass exchanges and short-time scale variability is responsible for the scatter around the 0.65-0.73 phase interval, as better evidenced in Fig. 2.

The author wishes to thank N. Beltraminelli, R. Boninsegna, G. Dine-Zepter and J. Remis for helping in obtaining the photoelectric data, D. Dalmazio and A. Manna for their visual estimates.

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V3, V5 AND FOUR NEW VARIABLE STARS IN THE FIELD OF M56

T. RUSSEVA

Institute of Astronomy, Bulgarian Academy of Sciences, 72 Tzarigradsko shosse bld., BG - 1784 Sofia, Bulgaria, email: russevat@astro.bas.bg

M56 (NGC 6779) is a galactic globular cluster lying on a rich stellar field at $\alpha = 19^{\rm h}14^{\rm m}_{\cdot}39$, $\delta = +30°05'_{\cdot}45$ (1950), $l = 62^\circ_{\cdot}66$, $b = +8^\circ_{\cdot}34$.

The Third Catalogue of Variable Stars in Globular Cluster (Sawyer-Hogg, 1973) contains three red variable stars V2, V3 and V5 in M56 with unknown periods. These stars are physical members of the cluster according to their proper motions (Rishel et al., 1981) and the position in the colour–magnitude diagram (Barbon (1965) and Russev (1998)). We have investigated the variability of these three variables as well as 10 red giants. The latter fall on the red giant branch (RGB) in the colour–magnitude diagram of M56 at $B - V > 1^{\rm m}_{\cdot}0$.

This study is based on 115 blue plates (ZU21 emulsion + GG385 filter) and 15 plates in system V (103a-D emulsion + GG495 filter) taken with the 2-m telescope of the NAO "Rozhen" (Bulgaria) and with the 60-cm reflector of the Belogradchic Astronomical station (Bulgaria) during 15 years, from 1977 to 1993. All plates were measured with an iris diaphragm photometer using Barbon's (1965) standard sequence and a photoelectric sequence kindly placed at our disposal by Russev (unpubl.). The photometric error is ± 0.05 mag.

New Variables. As a variability criterion of the investigated program stars we have adopted the mean error $\left(\varepsilon = \dfrac{B_i - \overline{B}}{n}\right)$ of their mean magnitudes ($\overline{B}$), obtained from the available individual measurements (B_i). It was assumed that we could suspect in variability those stars, which have ε larger than the accuracy of the photometry. Table 1 lists the stars suspected in variability. The columns 1, 2 and 3 give Küstner (1920), Barbon (1965) and Rosino (1951) numbers of the stars, respectively. The next columns give the average values of the blue magnitudes ($\overline{B}$), the number of their measurements, the mean error (ε) and the average values of colours ($\overline{B} - \overline{V}$).

Stellingwerf's (1978) PDM method was used for searching the periods of the program stars. We have not found any evidence for variability of the stars with Nos. 166, 179, 224, 244, 247, and 304 in Küstner's (1920) catalogue. The analysis has shown that K 204, K 235, K 251 and K 343 are undoubtedly variable stars. The light curve elements are:

$$\begin{aligned}
\text{Max} &= \text{JDH } 2443283.53 + 32^{\rm d}_{\cdot}55 \times E \quad \text{for K 204,}\\
\text{Max} &= \text{JDH } 2443290.14 + 29^{\rm d}_{\cdot}91 \times E \quad \text{for K 235,}\\
\text{Max} &= \text{JDH } 2443284.52 + 26^{\rm d}_{\cdot}18 \times E \quad \text{for K 251,}\\
\text{Max} &= \text{JDH } 2443292.88 + 22^{\rm d}_{\cdot}18 \times E \quad \text{for K 343,}
\end{aligned}$$

Table 1: A list of the investigated red giants and red variable stars in M56.

K No.	B No.	R No.	$\overline{B}$	n	$\overline{B}-\overline{V}$	lg P	A_B	$\triangle f$
166	I 77	–	15.02	113	1.50	–	–	–
179	I 66	881	15.19	115	1.41	–	–	–
204	I 140	–	14.95	111	1.57	1.51	0.24	0.45
224	–	–	15.20	110	1.37	–	–	–
235	–	–	14.85	101	1.48	1.48	0.52	0.43
244	–	–	15.08	85	1.35	–	–	–
247	I 60	871	15.07	115	1.52	–	–	–
251	–	–	14.76	60	1.08	1.42	0.60	0.42
304	–	–	14.70	101	1.27	–	–	–
343	–	–	14.98	100	1.33	1.35	0.52	0.33
V2	–	–	15.24	115	1.34	–	–	–
V3	–	–	14.86	112	1.97	1.62	0.30	0.50
V5	–	–	14.92	102	1.94	1.50	0.48	0.45

and their phase curves are shown in Fig. 1. From the average light curves we obtained the amplitudes A_B and asymmetry parameters, $\triangle f = f_{min} - f_{max}$, of the stars (Table 1, columns 8 and 9).

The question of the membership of the investigated ten red giants is very important. The stars K 179 and K 247 are cluster members according to their proper motions (Rishel et al., 1981) and K 166 and K 204 – according to the radial velocity measurements (Harris et al., 1983). The rest stars, including the three new variables, probably belong to the cluster by their positions in the colour–magnitude diagram and their distances from the cluster center (for K 235: 41.″7, K 251: 19.″3 and K 1343: 32.″8). It should be noted, however, that any solution of the problem of the cluster membership for the new variable stars has to await from the results of the other two criteria, such as proper motion and radial velocity measurements.

V2, V3 and V5. The light curves of V3 and V5, constructed with help of the following elements:

$$\text{Max} = \text{JDH } 2443288.40 + 42.^{\text{d}}12 \times E \quad \text{for V3,}$$
$$\text{Max} = \text{JDH } 2443295.40 + 31.^{\text{d}}33 \times E \quad \text{for V5,}$$

and their phase curves are shown in Fig. 2. Two periods seem to fit the observations of V3. The alternative period, $34.^{\text{d}}86$ produced a better light curve for Wehlau and Sawyer Hogg's (1985) data from OHP and UWO plates. We consider the light curve of V3 as preliminary and requiring specification. The scattering in the light curves (Fig. 1 and 2) is probably due to sudden changes in brightness or shifting of the light curve maxima similar to those observed for L70 and L973 in M13 by Russev and Russeva (1979) and Russeva and Russev (1980).

The analysis of the data for V2 has not indicated any variability.

The variables V3 and V5 are the brightest ($\overline{V} = 12.^{\text{m}}89$ for V3 and $12.^{\text{m}}98$ for V5) and the reddest ($\overline{B}-\overline{V} = +1.^{\text{m}}98$ and $+1.^{\text{m}}94$ for V3 and V5 respectively) stars in M56. According to their periods, amplitudes and shape of the light curves the variables V3, V5 and K 204 fall in the group of the smaller amplitude variables in the globular clusters with periods from 30^{d} to 45^{d}. As it is known, such stars are found comparatively rarely among the variables of this type in such aggregates. The comparison with the red variable stars in M13 and in other globular clusters in our Galaxy is necessary.

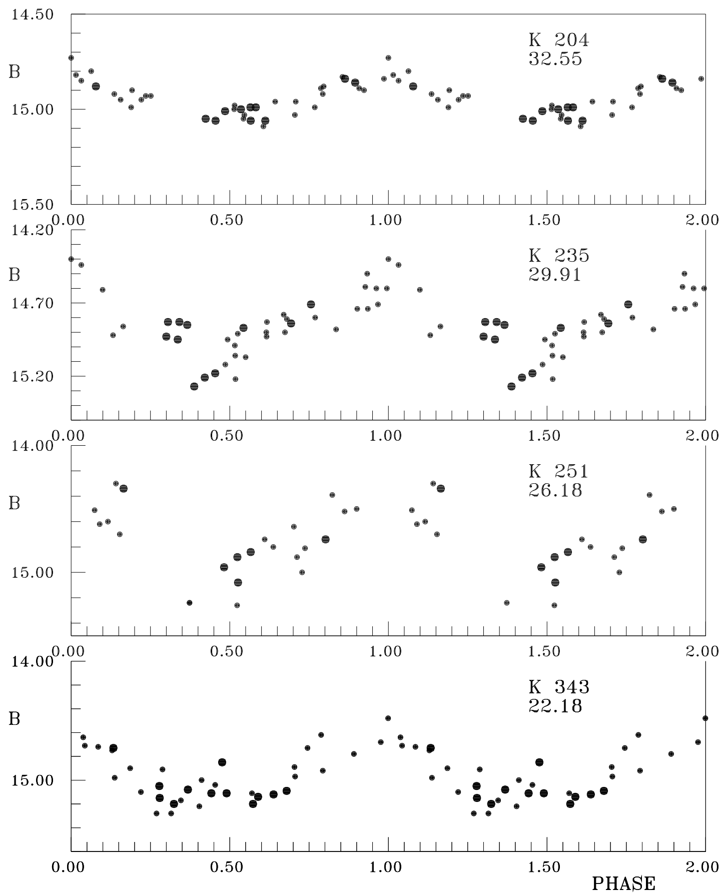

Figure 1. Light curves of new red variables in the field of M56. The size of the symbols is proportional to the number of observations per night.

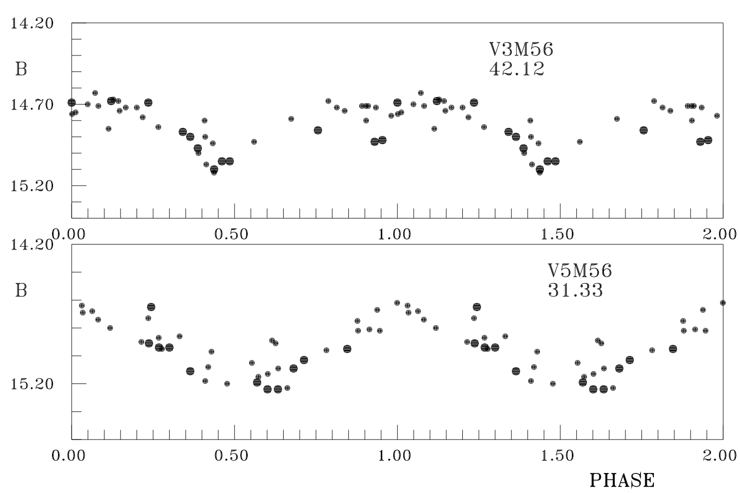

Figure 2. Light curves of V3 and V5. The size of the symbols is the same as in Fig. 1.

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GSC 2137:3085 – A SUSPECTED NEW VARIABLE

PRISCILLA J. BENSON AND DEMERESE M. SALTER

Whitin Observatory, Wellesley College, Wellesley, MA 02481-8203,
e-mail: pbenson@wellesley.edu, dsalter@wellesley.edu

Name of the object:
GSC 2137:3085

Equatorial coordinates:	**Equinox:**
R.A.= $19^h23^m48^s$ **DEC.=** $29°42'27''$	2000

Observatory and telescope:
Sawyer 24" telescope at Whitin Observatory, Wellesley College

Detector:	Photometrics PM512 CCD for observations from 1994 June through June 1997 and Photometrics TK 1024AB CCD Camera beginning July 1997

Filter(s):	Johnson and Cousins *BVRI*

Comparison star(s):	GSC 2137:2083

Check star(s):	GSC 2137:2326

Transformed to a standard system:	Yes
Standard stars (field) used:	Transformations of differential data use M67 as standards. Transformation of Mt. Hopkins data used Fields SA 94 (stars 392, 394, 305, 308) and SA 111 (stars: 773, 775, 1925, 1965, 1969) of Landolt 1973, 1983, 1992

Type of variability:	Possibly Small Amplitude Red Variable

Remarks:

The variability was discovered while monitoring the activity of symbiotic star BF Cygni using differential photometry at Whitin Observatory. It was noticed during the analysis that one of the comparison stars for BF Cygni was showing a larger variation in brightness than the other comparison stars. The magnitudes of the comparison stars in the field were obtained using the Smithsonian 48" telescope with a standard $BVRI$ filter set at Whipple Observatory on Mt. Hopkins 1995 September 11. All sky photometr y was done using Landolt (1992) standard stars in the SA 94 and SA 111 fields. The field is shown in Figure 1 with BF Cygni, the suspected new variable, the comparison star, and the check star all identified. The magnitudes of the four identified stars fr om the Whipple Observatory data are given in Table 1. We note that the suspected variable had a $B-V$ color of 1.84 on that date.

From the differential photometry taken at Wellesley College, we find the suspected new variable varies from about $13^{\rm m}\!.61$ to $13^{\rm m}\!.86$ in V ($0^{\rm m}\!.25$ amplitude), $12^{\rm m}\!.63$ to $12^{\rm m}\!.78$ in R ($0^{\rm m}\!.15$ amplitude), and $11^{\rm m}\!.56$ to $11^{\rm m}\!.70$ in I ($0^{\rm m}\!.14$ amplitude). The standard deviation of the differential magnitude between the suspected variable and the comparison star is about three times larger than that for the differential magnitude between the comparison and check stars as can be seen in the light curves in Figure 2. No evidence of periodicity was found.

Table 1

Star	RA (2000)	Dec (2000)	B [mag]	V [mag]	R [mag]	I [mag]
BF Cygni	$19^{\rm h}23^{\rm m}53^{\rm s}\!.5$	$29°40'29''$	13.08	12.36	11.16	9.54
NSV = GSC 2137:3085	$19^{\rm h}23^{\rm m}48^{\rm s}\!.1$	$29°42'27''$	15.56	13.72	12.64	11.53
Comp = GSC 2137:2086	$19^{\rm h}23^{\rm m}46^{\rm s}\!.2$	$29°43'59''$	13.47	12.96	12.65	12.41
Check = GSC 2137:2326	$19^{\rm h}23^{\rm m}56^{\rm s}\!.4$	$29°43'58''$	13.79	13.28	12.95	12.72

Acknowledgements:

This research made use of the SIMBAD database operated by the CDS, Strasbourg, France and the NASA Astronomical Data Center. We thank the Fairchild Foundation Grant to Wellesley College for a summer internship (DMS) and W. M. Keck Foundation for support o f astronomy at Wellesley College through the Keck Northeast Astronomy Consortium. This research was also partially supported by funds from the National Science Foundation (AST9417359), and the Wellesley College Brachman Hoffman Fellowship (PJB).

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Landolt, A. U. 1973, *Astron. J.*, 78, 959
Landolt, A. U. 1983, *Astron. J.*, 88, 439
Landolt, A. U. 1992, *Astron. J.*, 104, 340

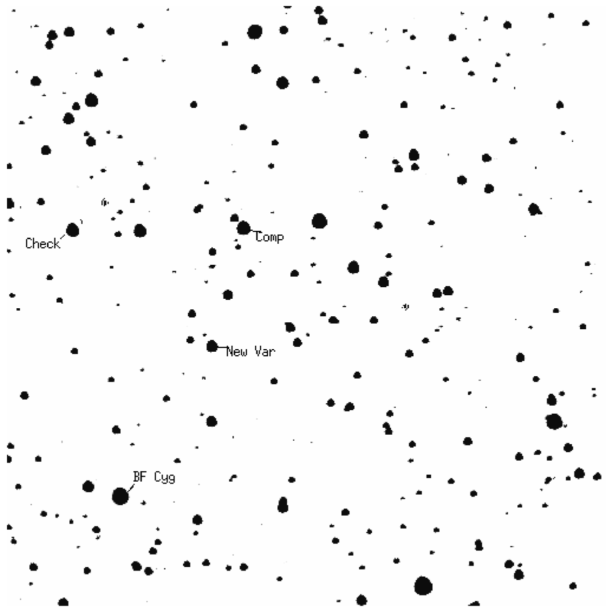

Figure 1. The finder chart for the new variable. North is up and East is left. The size of the field shown is about 9 arcminutes square.

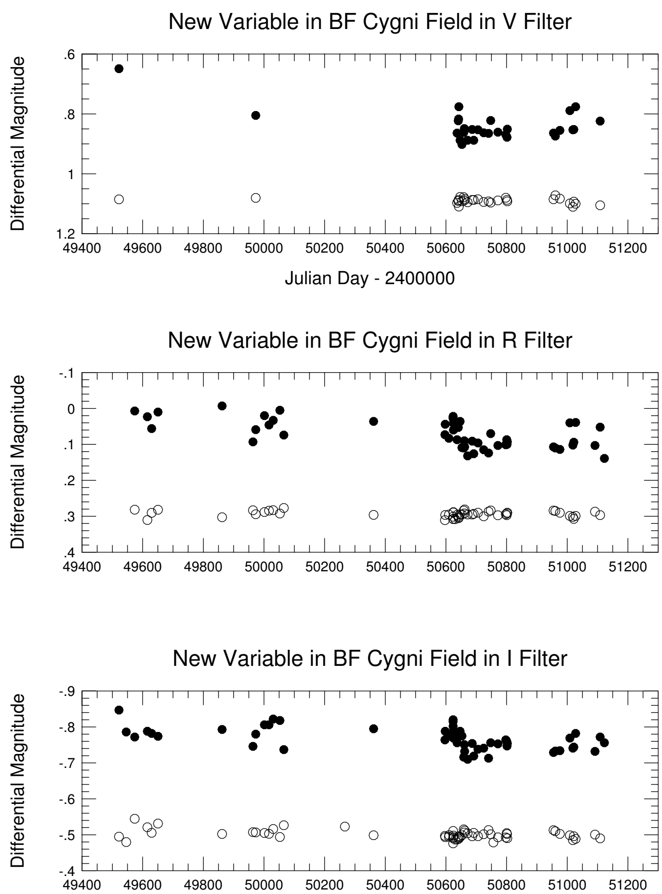

Figure 2. Light curves for the new variable (filled circles). Open circles denote the magnitude difference between the comparison and the check star.

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STRÖMGREN PHOTOMETRY OF THE Be STAR θ CrB: 1996–1999

SAUL J. ADELMAN

Department of Physics, The Citadel, 171 Moultrie Street, Charleston, SC 29409, USA,
e-mail: adelmans@citadel.edu

Fabregat & Adelman (1998) presented differential Strömgren *uvby* photometry from the Four College Automated Photoelectric Telescope (FCAPT) of the Be star θ Coronae Borealis (= HR 5778 = HD 138749) obtained during February and March 1994 and during March through July 1995. No short term periodic variability with an amplitude greater than $0\overset{m}{.}005$ nor long term variations greater than $0\overset{m}{.}01$ were seen. A review of the literature shows that θ CrB has had periods of both activity and inactivity (see, e.g., Percy et al. 1988 and Percy & Attard 1992). Thus the photometric observations with the FCAPT were continued to see how long the period of inactivity would last.

The FCAPT operated on Mt. Hopkins, AZ for six years until July 1996 and since then at nearby Washington Camp, AZ. During the 1995–96, 1996–97, 1997–98, and 1998–99 observing seasons an additional 26, 26, 45, and 44 high quality observations, respectively, were made with the FCAPT. Table 1 summarizes the photometry (the values are not identical with those of Fabregat & Adelman (1998) as a few values were deleted). After the dark count, the telescope measures the sky$-ch-c-v-c-v-c-v-c-ch-$sky in each filter with sky being a reading of the sky, *ch* of the check star, *c* of the comparison star, and *v* of the variable star. Table 2 contains group (a variable along with two supposedly non-variable stars, the comparison and check, against which the brightness of the variable is compared) information (Hoffleit 1982, ESA 1997). The comparison and check stars were chosen from supposedly non-variable stars in the vicinity of the variable on the sky that had similar V magnitudes and $B-V$ colors. Their stability was checked using Hipparcos photometry (ESA 1997) by Adelman (1998). The Hipparcos photometry standard errors and amplitudes of θ CrB are the same as those of the comparison and check stars, which are considered to be non-variable. It is usually difficult to find stars of a given type with smaller standard errors and amplitudes especially close to a given position in the sky.

The consensus of the users of the FCAPT is that its differential photometry has an accuracy of order $0\overset{m}{.}005$ for properly exposed stars. Thus apparent systematic differences of this magnitude must be regarded with caution. Further one must be careful of any changes occurring at the time the telescope was moved as they might be due to small errors in the extinction such as those in u. The y photometry of θ CrB is the most stable. The largest changes were in b where the $v-c$ values brightened by about $0\overset{m}{.}008$ between 1997 and 1998, but this might be due to the comparison star.

The study of Be stars, which are not always variable, should be able to yield important information about this class. The formation and dispersion of the equatorial disk is the

Table 1: Summary of photometry for θ CrB.

Heliocentric	u		v		b		y	
Julian Date	$v-c$	$c-ch$	$v-c$	$c-ch$	$v-c$	$c-ch$	$v-c$	$c-ch$
1993–94, 66 observations								
average	−1.741	−0.348	−1.309	−0.044	−1.260	0.051	−1.242	0.101
std. dev.	0.008	0.009	0.004	0.004	0.004	0.004	0.004	0.004
1994–95, 148 observations								
average	−1.738	−0.347	−1.306	−0.044	−1.259	0.051	−1.240	0.101
std. dev.	0.008	0.005	0.006	0.003	0.006	0.003	0.006	0.003
1995–96, 26 observations								
average	−1.741	−0.348	−1.308	−0.046	−1.261	0.049	−1.242	0.101
std. dev.	0.005	0.005	0.003	0.004	0.003	0.003	0.003	0.003
1996–97, 26 observations								
average	−1.746	−0.344	−1.308	−0.044	−1.261	0.046	−1.242	0.099
std. dev.	0.005	0.003	0.005	0.004	0.004	0.003	0.005	0.003
1997–98, 45 observations								
average	−1.742	−0.341	−1.304	−0.042	−1.268	0.044	−1.242	0.099
std. dev.	0.006	0.004	0.008	0.005	0.004	0.003	0.004	0.003
1998–99, 44 observations								
average	−1.742	−0.342	−1.302	−0.043	−1.269	0.043	−1.241	0.099
std. dev.	0.006	0.006	0.005	0.005	0.005	0.003	0.004	0.004
all observations								
average	−1.740	−0.346	−1.306	−0.044	−1.262	0.048	−1.241	0.100
std. dev.	0.008	0.006	0.006	0.004	0.006	0.005	0.005	0.004

Table 2: Main data for the stars involved.

		Star	V	Spectral Type	Hipparcos std. error	amplitude
Var.	HD 138749	θ CrB	4.14	B6Vnne	0.0005	0.02
Comp.	HD 136849	50 Boo	5.37	B9Vn	0.0005	0.02
Check	HD 135502	χ Boo	5.26	A2V	0.0005	0.02

source of the variability on various time scales. By obtaining long term photometric data one can derive information on the nature of the variability and its relationship to variability at other wavelengths. Since observations of how a variability episode begins in θ CrB should be most enlightening, this series of observations will be continued. As this star has been inactive since about 1990 (Percy & Attard 1992) it might become variable in the next few years. But the FCAPT photometry has not yielded any information about changes in its current non-variable state as the standard deviations of the means so far have reflected mainly the observing conditions under which the data was taken.

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GSC 614.01209 IS A NEW VARIABLE STAR

YURIJ N. KRUGLY

Kharkiv Observatory, 35, Sumska str., Kharkiv 310022, Ukraine, krugly@astron.kharkov.ua

Name of the object:
GSC 614.01209

Equatorial coordinates:	**Equinox:**
R.A.= $01^h30^m26\overset{s}{.}9$ **DEC.=** $+08°41'34''$	J2000.0

Observatory and telescope:
Astronomical Observatory of Kharkiv State University, 70-cm telescope

Detector:	ST-6V CCD

Filter(s):	*V*

Transformed to a standard system:	*V* (close to the standard Johnson's system)
Standard stars (field) used:	Field P-528 from Lasker et al. (1985)

Availability of the data:
Through IBVS Web-site as 4730-t1.txt

Type of variability:	SXPHE

Remarks:

Discovered as a by-product of CCD observations of the asteroid 2100 Ra-Shalom. Image reductions and photometry: AstPhot package (Mottola et al., 1995). The star shows rapid, Delta Scuti-like variations between $13\overset{m}{.}66$ and $14\overset{m}{.}41$ V. Preliminary light elements (from two maxima, the first of them incompletely covered):

$$\text{Max hel} = 2450698.50525 + 0\overset{d}{.}05875 \times E.$$

The star is at a high galactic latitude ($b = -53°$), so the star probably belongs to the SX Phe subtype of Delta Scuti variables.

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Lasker, B.M., Sturch, C.R., Lopez, C. et al. 1988, *Astrophys. J. Suppl. Ser.*, **68**, 1
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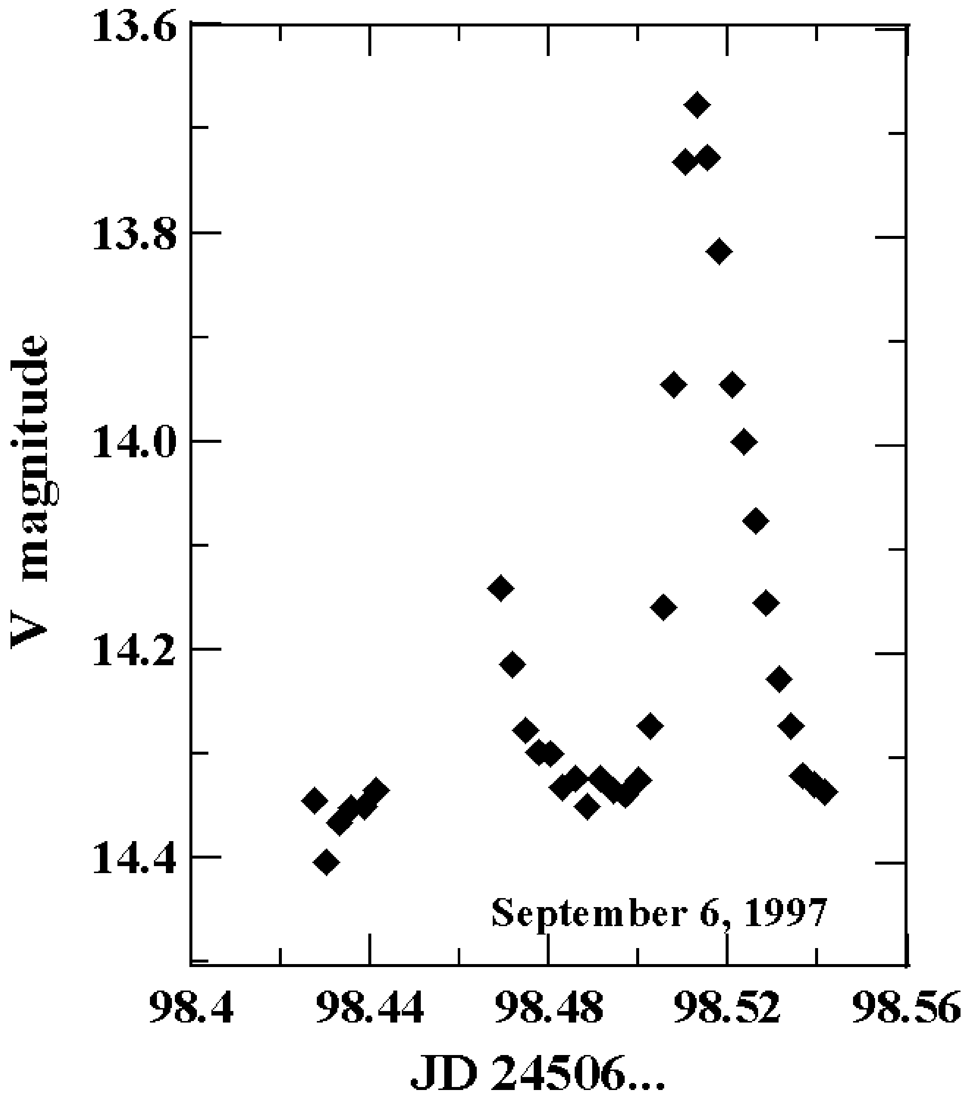
13.6
13.8
14.0
14.2
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V magnitude
September 6, 1997
98.4
98.44
98.48
98.52
98.56
JD 24506...

Figure 1.

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HIPPARCOS PARALLAXES OF CATACLYSMIC BINARIES AND THE QUEST FOR THEIR ABSOLUTE MAGNITUDES†

HILMAR W. DUERBECK

University of Brussels (VUB), Pleinlaan 2, B-1050 Brussels, Belgium, e-mail: hduerbec@vub.ac.be

Hipparcos proposal No. 67, submitted in 1982 by N. Vogt, Th. Schmidt-Kaler, and the present author, suggested several novae, novalike stars and dwarf novae for measurements of parallaxes and proper motions. Unfortunately, SS Cyg, the only dwarf nova of the proposal, was not observed due to a misidentification. A comparison between the Catalogue of Cataclysmic Variables (Downes, Shara and Webbink 1997) and the Hipparcos catalogue produced no additional cataclysmic variables, identified after completion of the Hipparcos Input Catalogue, that might have been included by chance in the target list.

Table 1: Parallaxes and distances of Hipparcos novae and novalike systems

HIP	Object	parallax π [″]	$\varepsilon\pi$ [″]	distance d ($\pm$ error) [pc]
Novae				
31481	RR Pic	−0.00246	0.00209	
78322	T CrB	−0.00161	0.00150	
92316	V603 Aql	+0.00421	0.00259	237 (+380, −90)
102190	HR Del	−0.00800	0.00357	
Novalike systems				
40430	IX Vel	+0.01038	0.00098	96 (+10, −8)
50581	RW Sex	+0.00346	0.00244	289 (+691, −120)
54226	QU Car	+0.00164	0.00150	610 (+6530, −292)
97394	V3885 Sgr	+0.00911	0.00195	110 (+30, −20)
101991	AE Aqr	+0.00980	0.00284	102 (+42, −23)

Table 1 lists the parallaxes in milli-arcseconds of the nine cataclysmic variables, as given in the Hipparcos catalogue (ESA 1997), and their derived distances. It should be noted that the objects were selected because of apparent brightness, not because of the potentially large parallax. Most cataclysmic variables at minimum light, even potentially near ones, are below the magnitude limit of the Hipparcos satellite. The following discussion confronts the Hipparcos results with other present-day information.

Novae: RR Pic: The Yale parallax catalog (van Altena, Lee and Hoffleit 1995) gives $\pi(\mathrm{abs}) = -0.0002 \pm 0.0101$ ($N = 2$) with the quality mark 'good agreement'. This is within the errors of the Hipparcos result.

†Based on data from the ESA HIPPARCOS astrometry satellite

V603 Aql: The Yale parallax catalog gives $\pi(\mathrm{abs}) = +0.0039 \pm 0.0057$ ($N = 7$) with the quality mark 'good agreement'. This is in excellent agreement with the HIPPARCOS result.

Novalike systems: IX Vel: Berriman, Szkody and Capps (1985) give a distance of 51 pc, while Eggen and Niemela (1984) derive 33 pc. Beuermann and Thomas (1990) carried out a careful analysis of this brightest UX UMa type system and derived the distance $d = 95 \pm 12$ pc from Bailey's method. This value is in excellent agreement with the HIPPARCOS result.

RW Sex: The Yale parallax catalog gives $\pi(\mathrm{abs}) = +0.0097 \pm 0.0069$ ($N = 2$) with the quality mark 'good agreement'. Beuermann, Stasiewski and Schwope (1992) use Bailey's method, which results in a rough estimate $d \approx 150$ pc, consistent with Osvald's trigonometric parallax $\pi = 0.007 \pm 0.04$, as quoted by Cowley, Crampton and Hesser (1977). The HIPPARCOS parallax is consistent with these statements; in spite of the large error, we assume that the true parallax is not much smaller than the value 0.00346 mas.

QU Car: Gilliland and Phillips (1982) derive $d > 500$ pc. They state that the spectrum is dominated by light from the accretion disk or the primary, and that the high rate of mass transfer indicates an old nova or novalike variable. The spectroscopic appearance, He II emission as strong as N III/C III 4640, supports this. The HIPPARCOS parallax is in agreement with the above distance estimate, without being able to improve it.

V3885 Sgr: A spectroscopic analysis by Haug and Drechsel (1985) shows anticyclic He I absorption which cannot be attributed to the secondary star. They assume an inclination $i = 70°$, which is likely too large. Warner (1987) gives $i = 30°$ and derives $M_V = 4.0$ from the surface brightness method; with $m_V = 10.4$ and $A_V = 0.16$, this results in the distance $d = 280$ pc. The HIPPARCOS parallax indicates that this distance is overestimated. An inclination $i > 30°$ would make the discrepancy even worse.

AE Aqr: The Yale parallax catalog gives $\pi(\mathrm{abs}) = +0.0352 \pm 0.0141$ ($N = 1$), i.e. $d = 28$ $(+19, -8)$ pc, which appears to be too small. The best distance estimate is that of Welsh, Horne and Oke (1993). The spectral type of the secondary is most likely K4-K5 V. It contributes between 64% and 86% to the light at 500 nm. Using the Barnes–Evans relation and the equivalent Roche lobe radius of the secondary, Welsh et al. estimate the distance $d \approx 95$ pc if the disk is hot, and ≈ 125 pc if the disk is cool. The HIPPARCOS distance lies comfortably in this range, without being of use in deciding between the two cases. An extensive discussion of the parallax of this system, and the question whether the secondary is a main sequence star, was given by Friedjung (1997).

Most trigonometric parallaxes of novae are small or vanishing; the positive result of V603 Aql is in agreement with the nebular expansion parallax, $d = 330$ pc (Duerbeck 1987).

The absolute magnitudes M_V of four novalike stars were derived from the HIPPARCOS parallaxes. Apparent magnitudes V were taken from the list of Bruch and Engel (1994), interstellar extinction A_V was estimated using the programme of Hakkila et al. (1997). Absolute magnitudes of three dwarf novae at maximum were calculated from the Hubble Space Telecope fine guidance sensor parallaxes of Harrison et al. (1999), and absolute magnitudes of 8 novae, in the interval of orbital periods of the dwarf novae and novalike systems considered here, were derived from nebular expansion parallaxes (Duerbeck 1999). Information on inclinations i and orbital periods P is taken from Ritter and Kolb (1998). All absolute magnitudes M_V were corrected for inclination effects using the prescription of Warner (1987), and listed as M_V^{corr} in Table 2. In the case of unknown inclination, i was assumed to be 44°.

Table 2: Absolute magnitudes of cataclysmic variables, as derived from trigonometric and nebular expansion parallaxes

Object	period [days]	V	d [pc]	A_V	M_V	i [°]	M_V^{corr}
Dwarf novae at outburst							
SS Aur	0.1828	10.5	200	0.19	3.8	38	4.4
SS Cyg	0.2751	8.7	166	0.13	2.5	38	3.1
U Gem	0.1729	9.8	96	0.01	4.9	70	4.2
Novalike systems							
AE Aqr	0.4117	11.5	102	0.11	6.3	58	6.3
V3885 Sgr	0.2163	10.3	110	0.07	5.0	< 50	5.7
RW Sex	0.2451	10.6	290	0.05	3.3	34	4.0
IX Vel	0.1939	9.6	96	0.04	4.6	60	4.5
Novae at postoutburst minimum							
V603 Aql	0.1381	11.9	330	0.48	3.8	17	4.7
T Aur	0.2044	15.0	960	1.29	3.8	57	3.8
V1500 Cyg	0.1396	17.4	1500	1.85	4.7	?	5.1
HR Del	0.2142	12.2	760	0.34	2.5	40	3.0
DQ Her	0.1936	14.3	400	0.16	6.1	86	3.2
V533 Her	0.1469	14.9	560	0.94	5.2	?	5.6
BT Mon	0.3338	15.6	1800	0.89	3.4	82	1.4
RR Pic	0.1450	12.35	600	0.17	3.3	65	2.9

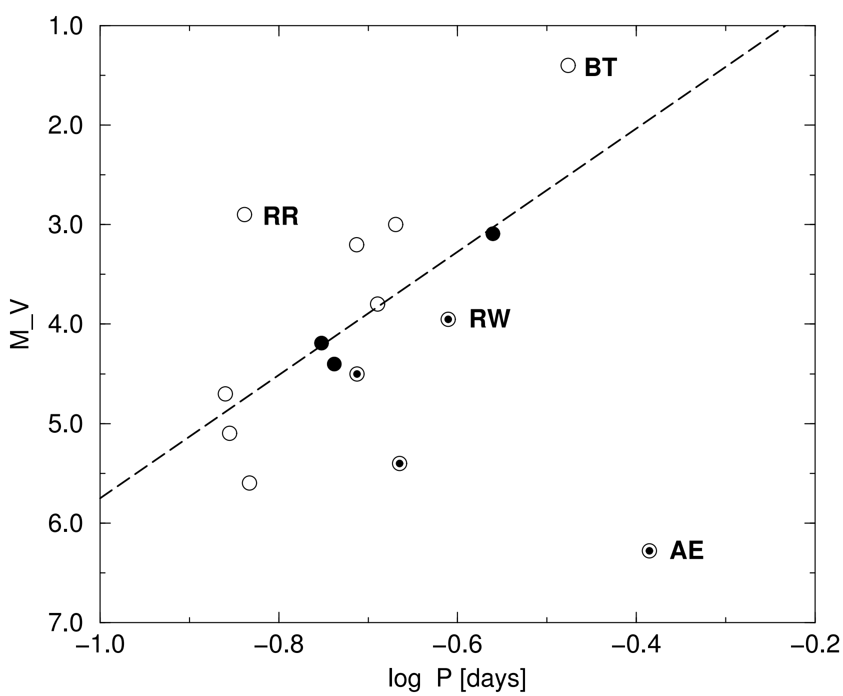

Figure 1. Absolute V-magnitudes as a function of orbital period (in days). Open circles: postnovae from expansion parallaxes; filled circles: dwarf novae at outburst from HST parallaxes; circles with central dot: novalike stars from HIPPARCOS parallaxes. A few systems are identified; the absolute magnitude of RW Sex is uncertain by more than $\pm 1^{m}$. The regression line $M_V^{corr} = -6.2 \log P - 0.45$ is shown.

The results are shown in Fig. 1. There is no obvious difference between the absolute magnitudes of dwarf novae *in outburst*, novalike stars, and novae a few decades after outburst. If the point in the lower right (the peculiar system AE Aqr, which has no fully developed accretion disk) is not taken into account, the remaining points indicate that systems with longer periods have brighter accretion disks. The data, however, are too scarce to draw definitive conclusions. We have omitted from our discussion "outlying" novae of very short as well as very long period: CP Pup and GK Per, which have absolute magnitudes $M_V^{\rm corr} = 3.5$ and 4.5, respectively, would mask this possible period dependence.

The conclusion is: In the interval 0.1 – 0.4 day, an absolute magnitude – orbital period relation $M_V^{\rm corr} = -6.2 \log P - 0.45$ seems to exist for all types of cataclysmic systems (novae at minimum, novalike systems, dwarf novae at outburst), where angular-momentum-loss controlled mass loss from the main sequence star feeds an accretion disk.

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PHOTOMETRIC OBSERVATIONS OS NSV 07180

P. MERCHÁN-BENíTEZ[1], M. JURADO-VARGAS[1], F. SÁNCHEZ-BAJO[2]

[1] Departamento de Física, Facultad de Ciencias, Universidad de Extremadura, Ctra de Elvas 06071, Badajoz (Spain), e-mail: pedromer@unex.es, mjv@unex.es

[2] Departamento de Electrónica e Ingeniería Electromecánica, Escuela de Ingenierías Industriales. Universidad de Extremadura, Ctra de Elvas 06071, Badajoz (Spain), e-mail: fsanbajo@unex.es

Name of the object:
NSV 07180 = CSV 002403

Equatorial coordinates:	**Equinox:**
R.A.= $15^h39^m23^s.3$ **DEC.=** $-12°06'47''$	2000.0

Observatory and telescope:
Observatorio del Departamento de Física de la Universidad de Extremadura, Reflector Newton 0.4-m f/4.5

Detector:	Starlight Xpress CCD Camera (based in the chip SONY ICX027BL 6.4 × 4.35 mm^2, 500 × 256 pixels)

Filter(s):	V (Kron-Cousins system)

Comparison star(s):	GSC 5604.231

Check star(s):	GSC 5604.564

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	RR Lyr

Remarks:

The results of the observations carried out show that NSV 07180 seems to be an RR Lyrae star with a period close to 7 hours. Although the data display a high dispersion, the star shows an almost symmetric light curve ($\varepsilon = 0.48$) and a 0.5 magnitude amplitude in the V band. We have derived the following ephemeris for the maximum:

$$\text{Max} = \text{HJD } 2451342.4375 + 0^d.2850 \times E.$$
$$\pm 0.0036 \quad \pm 0.0001$$

Acknowledgements:

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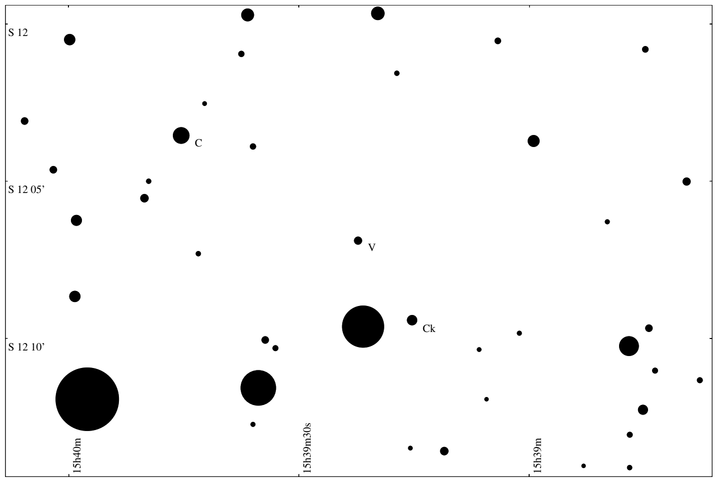

Figure 1. Identification chart of NSV 07180. C = comparison star, Ck = Check star, V = NSV 07180. North is on the top.

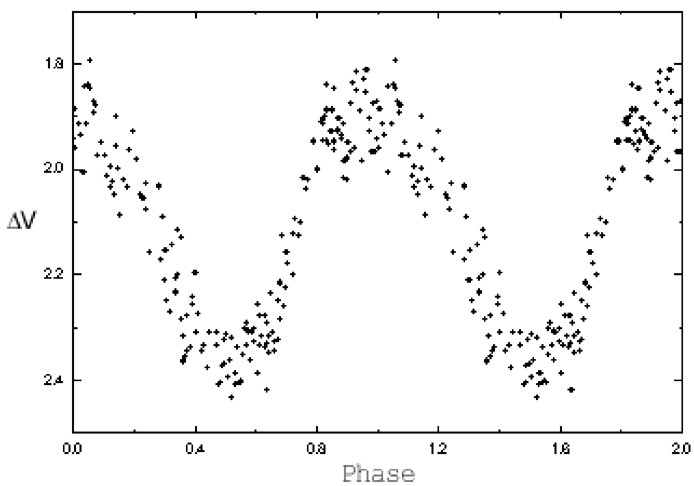

Figure 2. The *V* light curve obtained for NSV 07180. Delta magnitudes (variable minus comparison) are plotted versus phase, where the phases are computed using the ephemeris calculated in this work.

Reference:

Kukarkin et al. 1982, New Catalogue of Suspected Variable Stars, Moscow

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A PHOTOMETRIC UPDATE ON δ CORONAE BOREALIS

J.D. FERNIE

David Dunlap Observatory, University of Toronto, Canada, e-mail: fernie@astro.utoronto.ca

δ CrB (HR 5889, HD 141714) is a G5 giant star that has the unexpected property of being chromospherically active. Maggio et al. (1990) found it to be one of only two single giants out of 380 giants and supergiants studied that have an X-ray flux as high as RS Canum Venaticorum stars, while Young, Ajir, and Thurman (1989) report it to have one of the highest Ca II H and K reversal fluxes among the many stars they surveyed. Evans (1987) found it to show ultraviolet emission lines, such as C IV λ1549, that were similar to though less strong than those in λ And, a chromospherically active G8 III star.

Some years ago I accidentally discovered δ CrB to be variable in light with a V amplitude of about 0.06 mag and a quasi-period near 50 days (Fernie 1987, 1989, 1990, 1991). Since the fundamental radial pulsation period of such a star would be much less than 1 day, and since the star is chromospherically active, these results were interpreted in terms of a starspot model in which a few large spots on a limited region of the stellar surface modulate the light as the star rotates. The photometric data were in the UBV system, and the fact that the amplitude was (at least to first order) the same in each filter lent support to this interpretation. The fluctuating period was interpreted as due to starspots forming in and/or drifting to different stellar latitudes which presumably have different rotation rates. Choi et al. (1995) found similar photometric results, and provide Ca II flux measures (which vary strongly and inversely with visual brightness) as well as an extended discussion on the nature of the star. It might also be noted that O'Neal and Neff (1997), in a study of other active stars, used δ CrB as one of their 'inactive' comparison stars.

δ CrB has remained on my Automatic Photometric Telescope program, and I report here briefly on the star's photometric behaviour since my last published data nearly a decade ago. The complete file of individual UBV observations is available from the IAU Commission 27 archives of unpublished data as file no. 339E.

The data were analysed by annual season, this being a compromise between using enough data to get meaningful results (since the variability is small in the presence of relatively noisy data) on the one hand, while minimizing the effects of the known period instability on the other. Light curves for the seasons of higher amplitude are shown in the above cited papers.

All the data for a given season were plotted against Julian Date, and where a light curve was discernible a simple first-order sine curve was fitted. The amplitude, mean V magnitude, period, and time of maximum light as determined by this fit were then recorded. In the 1991, 1993, 1994, 1995, and 1996 seasons, however, no light curve was

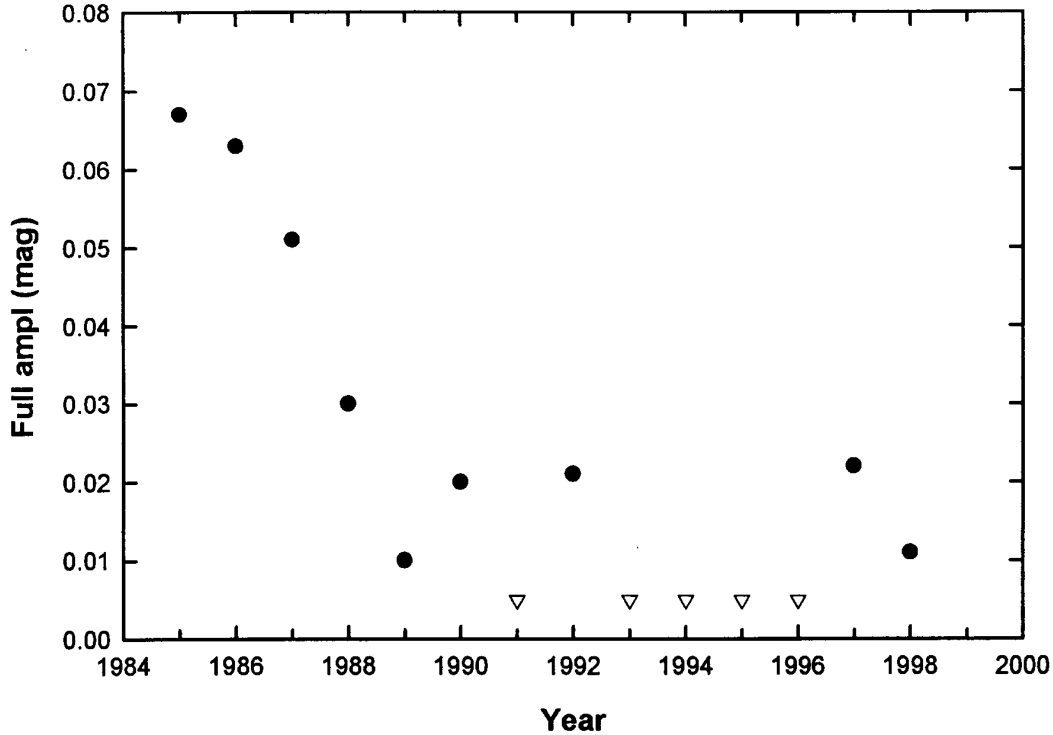

Figure 1. The changing V amplitude of δ CrB with time. The open symbols represent upper limits. Standard errors of the filled circles are approximately the size of the circles.

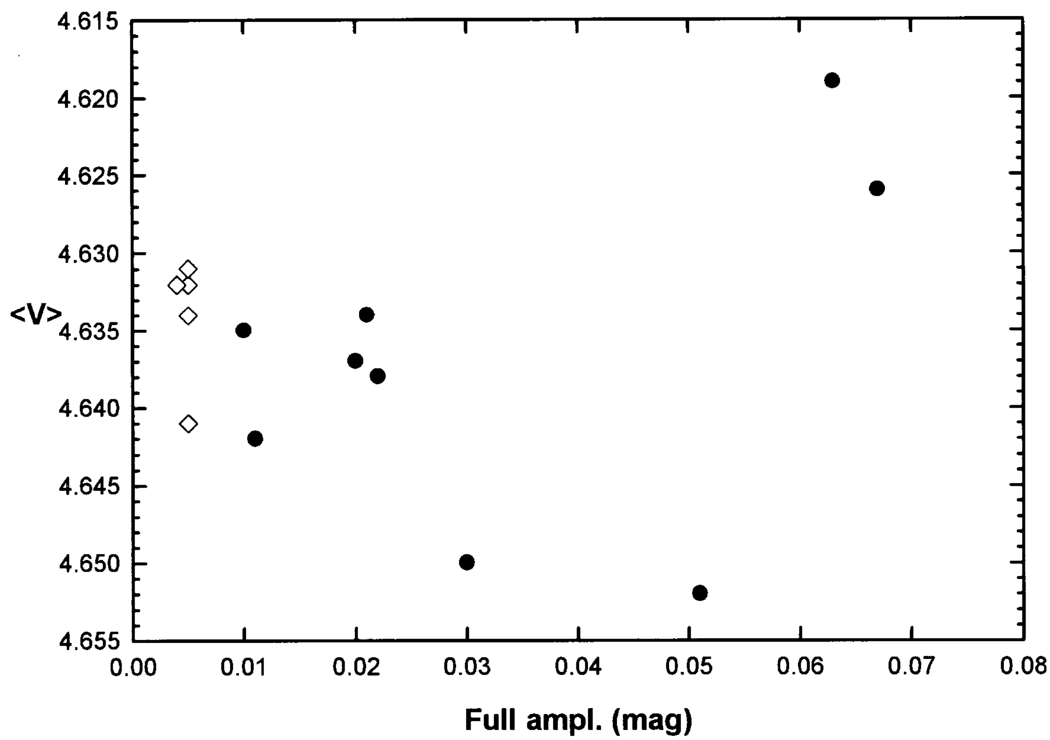

Figure 2. The change in mean magnitude with amplitude. The open symbols represent upper limits on the detectible amplitude.

Table 1: Amplitude & mean mag.

Year	Ampl.	$\langle V \rangle$
1985	0.067	4.626
1986	0.063	4.619
1987	0.051	4.652
1988	0.030	4.650
1989	0.010	4.635
1990	0.020	4.637
1991	< 0.005	4.632
1992	0.021	4.634
1993	< 0.004	4.632
1994	< 0.005	4.631
1995	< 0.005	4.641
1996	< 0.005	4.634
1997	0.022	4.638
1998	0.011	4.642

seen above the noise, and only the arithmetically averaged V magnitude was recorded, and an upper limit on the amplitude estimated.

For a spotted star only a characteristic period of variability can be given because of the differential rotation and the probably ever-changing spot pattern near the stellar surface. This problem is aggravated by the small amplitude and long time-scale of the variation observed in the case of δ CrB. For this giant star, summing up the photometric and spectroscopic observations obtained so far, we may adopt a characteristic period of the light variations (and hence, the rotation) as 58-59 days.

Figure 1 illustrates the change in amplitude over the 14 seasons. It steadily declined during the first 5 seasons, since when it has remained at a barely detectable or undetectable level. Thus if δ CrB has a spot cycle analogous to that of the sun, these data suggest it is longer than 15 years. It is also notable that whereas the solar cycle, having reached minimum, immediately starts up towards maximum again, in δ CrB it appears to remain at minimum for many years. There may, of course, be structure in Fig. 1 during the later years that is hidden by the noisy data, but if the cycle is sinusoidal then a discernible rise should have become apparent well before 1998. This extended interval near minimum was probably a factor which contributed to this 4th magnitude star not having been found earlier to be variable.

Figure 2 addresses the question of whether the overall brightness of the star varies with amplitude, that is, with degree of activity. The mean magnitude in this plot is derived from a sinusoidal fit to the light curve, or, in seasons of no discernible light curve, from an average of all the season's V measurements. The internal standard error of each point is about the size of the symbol in the figure, so there does seem to be a slight but definite change in brightness with amplitude, although the functional relationship is unclear and likely involves other parameters as well. At minimum amplitude the star is very close to $V = 4.633$, and as activity begins there is an initial fading towards $V = 4.653$ possibly caused by the increasing area of dark spots. When most active, however, the star is brighter than usual, perhaps because bright plages overwhelm the dimming effect of the spots.

It is a pleasure to thank the APT managers for their inestimable services. I am also grateful to Dr. Katalin Oláh for her suggestions as referee.

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NEW VARIABLE STARS IN ANDROMEDA AND CASSIOPEIA

LENNART DAHLMARK

Residence Jeanne d'Arc, 166A Avenue Majoral Arnaud, F-04100 Manosque, France

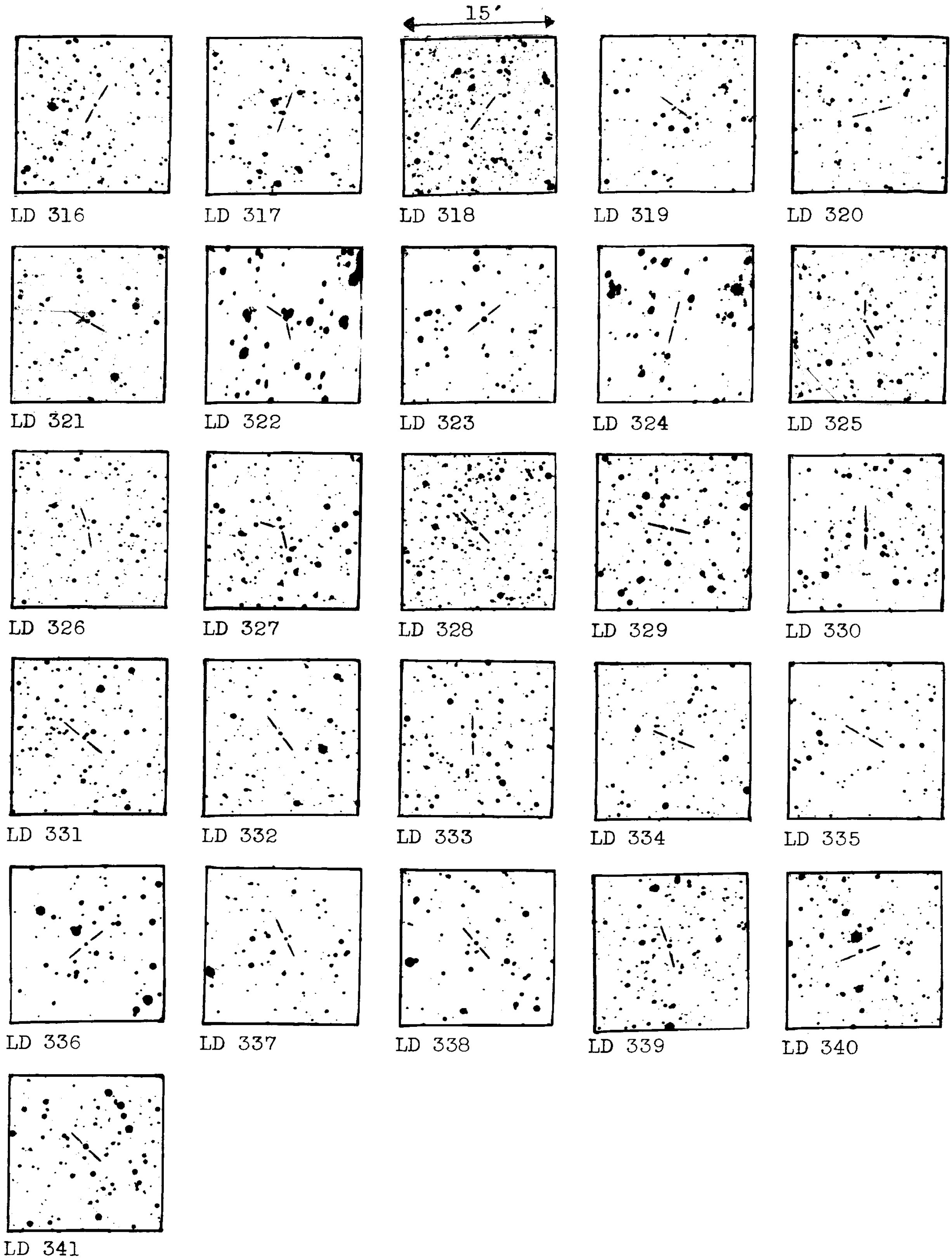
This report summarizes the results of a variable-star search in the 20° × 15° area centered at $0^{\rm h}30^{\rm m}/+45°$ (1950). Six similar fields have been previously described (Dahlmark 1982, 1986, 1996, 1997, 1998). The two earliest reports describe the camera systems used for the survey.

Seventeen yellow/blue plate pairs (Kodak 103a-D + GG11 filter and 103a-O unfiltered) were exposed between 1967 and 1981, and forty-seven films (Kodak TechPan 4415 + GG495 filter) taken in the years 1987 to 1999. Six exposures with a 200/210/300-mm Schmidt camera taken 1987–1998 on TechPan without a filter were also examined and used to prepare finding charts. Ten plate or film pairs were scanned for variables with a blink comparator and with four stereo comparators used in tandem. Magnitudes were determined in a stereomicroscope using comparison stars taken from the Guide Star Catalogue (GSC, Lasker *et al.* 1990). The yellow-light magnitudes '$m_{\rm v}$' shown in Table 2 are thus tied to the GSC (northern) magnitude scale and will be systematically somewhat brighter than standard Johnson V.

In this field twenty-six variables were found, one of which appears only on two photos taken on the same night. Table 1 shows positions and identifications. The coordinates were drawn mostly from the comprehensive USNO–A2.0 catalogue (Monet *et al.* 1998); one star appears only in the GSC, and another was estimated ($\pm 2''$) using the Digitized Sky Survey via the Goddard SkyView facility. The source of the positions is coded in column 's' as follows: A = USNO–A2.0, G = GSC v1.2, S = SkyView.

The elements of variation are collected in Table 2. An asterisk by the star name indicates a note at the bottom of the table. The lightcurve determinations are based usually on sixty-eight magnitude estimates for each star. From these the magnitude range, provisional variability type, epoch of maximum, and period have been determined. For several of the long-period variables it appeared that the variations, though well-marked, were not always consistent from cycle-to-cycle. The period ranges found for such stars from photos taken over a 30-year interval are given in the last column. The column '$b-r$' shows star colors from USNO–A2.0; these are not well calibrated to any standard system, but serve to indicate in a qualitative way the sorts of stars involved.

The star LD 324 is listed as a possible dwarf nova candidate, and deserves some discussion. It was observed on two simultaneous exposures centered on 1996 Sept. 9.92 UT (JD 2450336.42) at $m_{\rm v} = 13.8$. The star is, however, not present on sixty other plates from 1967 to 1999. A semi-accurate position, reliable to within $10''$ radius, is shown


15′
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LD 341

Figure 1.

in Table 1. Arne Henden (USNO/USRA) kindly obtained BV photometry of the field on 23 June 1999 UT with the USNO–Flagstaff 1-meter telescope. The results are posted at: `ftp://ftp.nofs.navy.mil/pub/outgoing/aah/sequence/dahl1.dat`. There are no blue objects in the immediate vicinity of the object shown on the 1996 photographs. The objects closest to the candidate are three mag. 19–20 stars with $B-V$ color corresponding to K dwarfs or giants, and some very faint galaxies. Although no known asteroids were in the field at the time of the exposures, the possibility remains that the object photographed is a satellite glint of extremely short duration (completely circular image), or some exotic object, as with recently-observed visible transients of gamma-ray bursts.

The finder charts show a field of $15' \times 15'$ centered on the variables; north is up and east to the left.

I would like to thank Arne Henden for his effort to identify LD 324 in quiescence. Brian Skiff (Lowell Observatory) aided in obtaining identifications and precise positions for the stars.

Table 1: Positions and identifications, LD 316 – LD 341

Name	RA (2000)	Dec	s	GSC	IRAS	Remarks
LD 316	23 38 21.2	+51 30 53	A			
LD 317	23 44 57.4	+43 31 22	A			
LD 318	23 53 44.9	+50 59 19	G	3651-0927	23512+5042	
LD 319	0 05 29.3	+52 52 58	A			
LD 320	0 06 42.7	+52 27 33	A		00041+5210	
LD 321	0 09 36.9	+37 47 32	A	2781-1738	00070+3730	FBS 0007+375
LD 322	0 09 39.8	+53 10 11	A		00070+5253	
LD 323	0 10 55.1	+48 15 33	A	3250-0239	00083+4758	
LD 324	0 12 42	+52 47.4				
LD 325	0 12 55.6	+50 55 37	A	3259-1582		
LD 326	0 19 10.7	+52 02 03	A		00164+5145	
LD 327	0 21 20.7	+51 21 39	A		00186+5104	
LD 328	0 26 49.1	+49 40 36	A	3256-0458		
LD 329	0 29 21.3	+49 38 42	A			
LD 330	0 36 22.7	+48 21 49	A	3253-0615		
LD 331	0 38 40.2	+53 16 12	A		00358+5259	
LD 332	0 38 51.8	+45 33 50	A			at minimum on POSS-I
LD 333	0 45 01.1	+48 41 03	A	3266-1137	00422+4824	
LD 334	0 46 24.8	+47 41 33	A	3266-1510	00436+4725	
LD 335	0 50 43.3	+46 30 32	S		00479+4614	
LD 336	0 53 32.8	+44 02 27	A	2810-0523		
LD 337	0 54 09.2	+46 21 49	A			
LD 338	1 10 30.4	+45 06 12	A	3264-0924	01076+4450	
LD 339	1 16 04.7	+50 11 45	A	3272-0151	01131+4955	
LD 340	1 17 11.2	+42 02 04	A	2808-1655		
LD 341	1 30 05.8	+50 10 01	A	3286-2177	01270+4954	StM 10 (M8)

References:

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Dahlmark, L., 1986, *IBVS*, No. 2878
Dahlmark, L., 1993, *IBVS*, No. 3855
Dahlmark, L., 1996, *IBVS*, No. 4329

Table 2: Elements of variation, LD 316 – LD 341

Name	max	min	$b-r$	type	epoch	period	period range
	(m_v)				JD 2400000+	(days)	1967–1999
LD 316	13.0	14.4	2.9	I			
LD 317*	12.6	14.8	0.1	Ia			
LD 318	13.5	15.3		SR	51071	381	360–400^d
LD 319*	12.6	>16.0	3.3	M	50611	266	
LD 320	12.5	14.8	3.6	SR	51193	305	278–330^d
LD 321	12.4	15.5	2.6	M	50691	288	
LD 322	12.5	>15.2	4.1	M	50863	446	
LD 323	10.7	11.9	2.4	L			
LD 324*	13.8	>19.5		UG?			
LD 325	13.8	>16.0	0.7	Ia			
LD 326	13.0	15.3	6.4	SR	51193	370	355–390^d
LD 327	10.5	15.5	2.3	M	51101	383	
LD 328*	12.4	13.8	0.7	E	51223	≤38	
LD 329	13.1	13.8	1.7	L			
LD 330	11.6	12.8	3.0	SR		440?	
LD 331	11.0	>16.0	3.8	M	51071	376	253–413^d
LD 332	11.9	16.1	1.2	M	51163	394	
LD 333	10.7	13.1	6.3	SR	51071	358	
LD 334*	11.0	14.8	7.7	Lb			
LD 335	13.0	>16.0		SR	51071	460	401–593^d
LD 336	13.4	14.5	0.8	L			
LD 337	13.5	14.4	0.9	Lb			
LD 338	11.7	>14.7	3.3	M	50611	359	
LD 339	11.1	14.7	2.6	M	51129	281	238–304^d
LD 340	12.6	14.5	0.7	Isa			
LD 341	11.3	14.4	3.2	M	51161	305	288–320^d

Notes:

LD 317 blue; from 1995 minima a period of $\sim 400^d$ is suggested.
LD 319 two maxima in 1998 expected but not observed.
LD 324 see text.
LD 328 six minima observed, eclipse duration $< 24^h$; period is probably some fraction of 38^d.
LD 334 perhaps a very long period: maxima observed in 1968, 1987, 1993, and 1999, but not 1974 or 1980 (one observation only, however).

Dahlmark, L., 1997, *IBVS*, No. 4458

Dahlmark, L., 1998, *IBVS*, No. 4642

Lasker, B. M., Sturch, C. R., McLean, B. J., Russell, J. L., Jenkner, H., Shara, M. M., 1990, *Astron. J.*, **99**, 2019

McGlynn, T., Scollick, K., and White, N., 1996, `http://skview.gsfc.nasa.gov`; see also *SkyView*: The Multi-Wavelength Sky on the Internet; in McLean, B. J. *et al.*, "New Horizons from Multi-Wavelength Sky Surveys", IAU Symposium No. 179, p. 465, Kluwer

Monet, D., Bird, A., Canzian, B., Harris, H., Reid, N., Rhodes, A., Sell, S., Ables, H., Dahn, C., Guetter, H., Henden, A., Leggett, S., Levison, H., Luginbuhl, C., Martini, J., Monet, A., Pier, J., Riepe, B., Stone, R., Vrba, F., Walker, R., 1998, USNO–A2.0; U.S. Naval Observatory, Washington DC; see also `http://www.nofs.navy.mil/projects/pmm`

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

Number 4735

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13 July 1999

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DISCOVERY OF A NEW MIRA VARIABLE

P.K. ABOLMASOV[1], S.YU. SHUGAROV[2]

[1] Moscow City Palace for Youth's Creativity, 17, Kosygina Str., Moscow 117978, Russia

[2] Sternberg Astronomical Institute, 13, Universitetskij Av., Moscow 119899, Russia, e-mail: shugarov@sai.msu.ru

Name of the object:
IRAS 17506+3411 = USNO A1.0 1200.08799479

Equatorial coordinates:	**Equinox:**
R.A.= $17^h52^m24\overset{s}{.}1$ **DEC.=** $+34°11'12''$	J2000.0

Observatory and telescope:
40-cm astrograph in Crimea

Detector:	Photoplate
Filter(s):	None
Comparison star(s):	See Fig. 1
Check star(s):	None

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	B-band standard sequence in SA 62 (Prieser, 1974)

Availability of the data:
Upon request

Type of variability:	M

Remarks:

The variability of the star was discovered by S. Antipin (priv. comm.). 160 estimates in interval JD2433031–49634 show variations typical of Mira type variable with the following light elements:

$$\mathrm{JD_{max}} = 2445197 + 261\overset{d}{.}3 \times E.$$

The range of variability is $13\overset{m}{.}8$–$17\overset{m}{.}5$.

Acknowledgements:

The authors would like to thank Dr. V.P. Goranskij for his help and useful discussion.

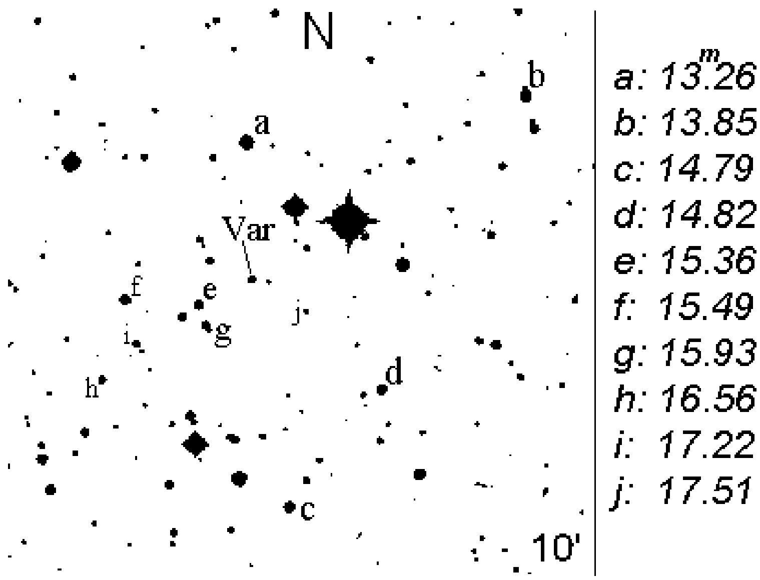

Figure 1. Finding chart and comparison stars.

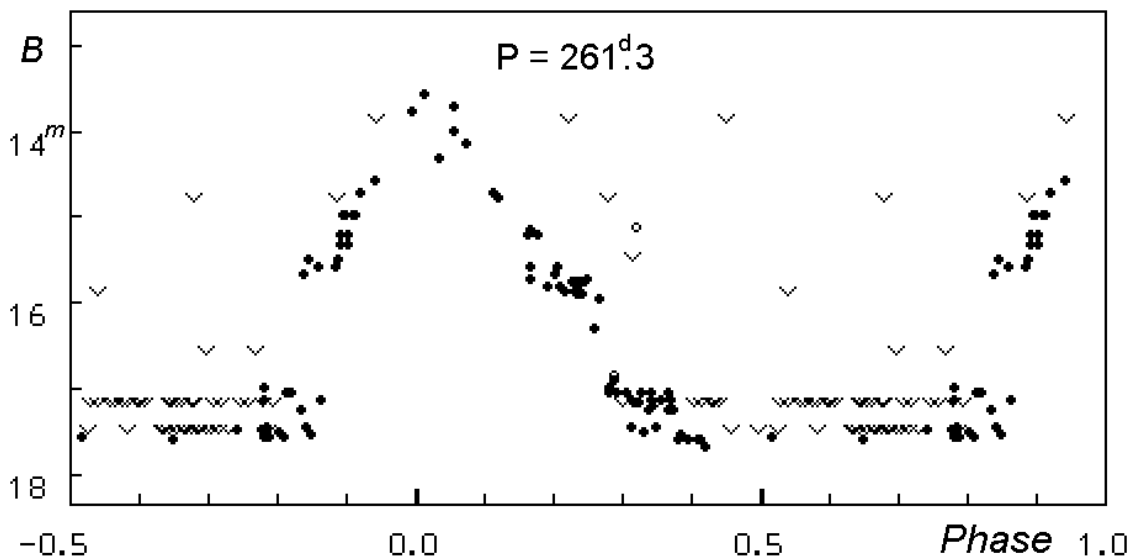

Figure 2. Phased light curve. Uncertain estimates are shown as open circles, "v" symbols represent upper limits.

Reference:

Prieser, J.B. 1974, Naval Observ. Publ., vol. XX, p. VII, Washington

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

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Budapest
21 July 1999

HU ISSN 0374 – 0676

PHOTOMETRY OF THE 1999 OUTBURST OF U SCORPII

SEIICHIRO KIYOTA

Variable Star Observers League in Japan, 1-401-810 Azuma, Tsukuba, 305-0031 Japan,
e-mail: skiyota@abr.affrc.go.jp

Name of the object:
U Sco

Equatorial coordinates:	**Equinox:**
R.A.= $16^h22^m31\overset{s}{.}2$ **DEC.=** $-17°52'41''$	2000.0

Observatory and telescope:
25-cm Schmidt Cassegrain (F/6.3)

Detector:	Apogee AP-7 CCD camera (SITe SIA502AB, 512 × 512)

Filter(s):	Johnson-Cousins BVR_c

Comparison star(s):	GSC 6206_320 = BD −17°4559 = PPM 23163, $V = 10.68$, $B - V = 0.496$ (based on Tycho catalog), $V - R = 0.25$ (calculated from $B - V$ value)

Transformed to a standard system:	No

Availability of the data:
Through IBVS Web-site as 4736-t1.txt

Type of variability:	NR

Remarks:
Patrick Schmeer (1999) reported the 6th recurrent outburst of U Sco (9.5 m_V on Feb. 25.1940, 1999) (Vsnet-alert 2688, IAUC 7113). L. Shaw reported that U Sco reached the maximum of 7.6 m_V at Feb. 25.562 (IAUC 7113). I began to observe this outburst immediately after maximum. The lightcurve consists of 3 parts; the 1st fast fading phase, plateau around Mar. 12–22, the 2nd fast fading. $B - V$ was steeply decreasing after maximum but almost constant in the plateau phase. The plateau around 15 days after the maximum was also reported at the outburst during 1987 (Sekiguchi et al., 1988).

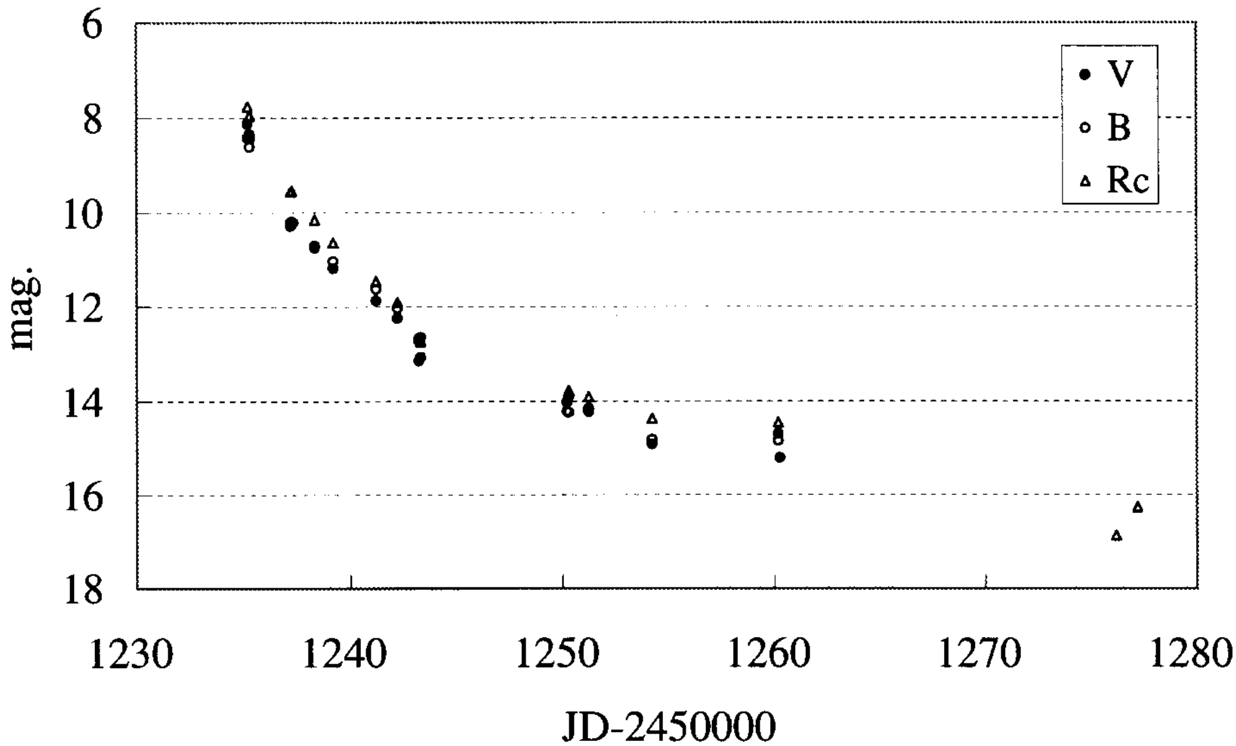

Figure 1.

Acknowledgements:
I thank Dr. Taichi Kato, Kyoto University for useful discussion and advice.

References:

Schmeer et al., 1999, IAUC 7113
Sekiguchi, K., Feast, M.W., Whitelock, P.A., Overbeek, M.D., Wargau, W., Jones, J.S., 1988, MNRAS, 234, 281

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TIMES OF MINIMA OF ECLIPSING BINARIES

CLAUD H. SANDBERG LACY[1], KYLE MARCRUM[1], CAFER IBANOGLU[2]

[1] Department of Physics, University of Arkansas, Fayetteville, Arkansas 72701, USA

[2] Astronomy & Space Sciences Department, Ege University, Izmir, Turkey

We report times of minima of eclipsing binaries derived from photometric observations made by CI at the Ege University Observatory in Turkey in Johnson B, V filters, and at the University of Arkansas (unfiltered CCD observations made by KM). Heliocentric times of minima were estimated for each filter by using the method of Kwee and van Woerden (1956) as adapted to a Macintosh computer. The adopted time of minimum was then the average over both filters for Ege data. In all cases the times of minima in different filters were concordant. Uncertainties in the times of minima were estimated from the values of standard error computed by the method and from differences in times derived from the various filters used. In Table 1, primary eclipses are designated as type 1 eclipses, and secondary eclipses as type 2.

Table 1

Star	JD of Min − 2400000	Type	Observatory	Notes
WW Cam	51134.7232 ± 0.0004	1	Arkansas	
V459 Cas	51144.6845 ± 0.0005	1	Arkansas	
WW Cep	51141.6161 ± 0.0005	2	Arkansas	1
RW Lac	51076.6925 ± 0.0005	2	Arkansas	2
V530 Ori	51199.2593 ± 0.0005	1	Ege	3
BP Vul	51063.6717 ± 0.0003	1	Arkansas	
	51128.645 ± 0.005	2	Arkansas	
	51129.646 ± 0.001	1	Arkansas	

Notes:

1. The period listed in the GCVS is almost exactly 1/3 of the true period found by Torres (1998) from spectroscopic observations as 4.600843 ± 0.000054 days. From dates of minima found in the eclipsing binary minima database at the web site

`http://www.oa.uj.edu.pl/ktt/index.html`

we find

$$\text{Min I} = 4.600841 \times n + 2449218.4631.$$

From the zero epoch in the GCVS and our observation, assuming a circular orbit (consistent with published dates of minima), we find a period of 4.600849 days, in agreement with the spectroscopic value. The origin of the error in the GCVS period is unknown.

2. Recent spectroscopic observations by Torres (1998) indicate that secondary eclipse now occurs at a phase of 0.491 ± 0.001 due to an eccentric orbit. Our observed time of secondary eclipse is in agreement with this prediction. The eccentricity is approximately 0.014 based on the spectroscopic data.

3. Our observation may be combined with the observations of Lacy & Fox (1994) to yield an orbital period of 6.110777 ± 0.000002 days (assuming a constant period). This appears to be consistent with the period listed in the GCVS, but is more accurate.

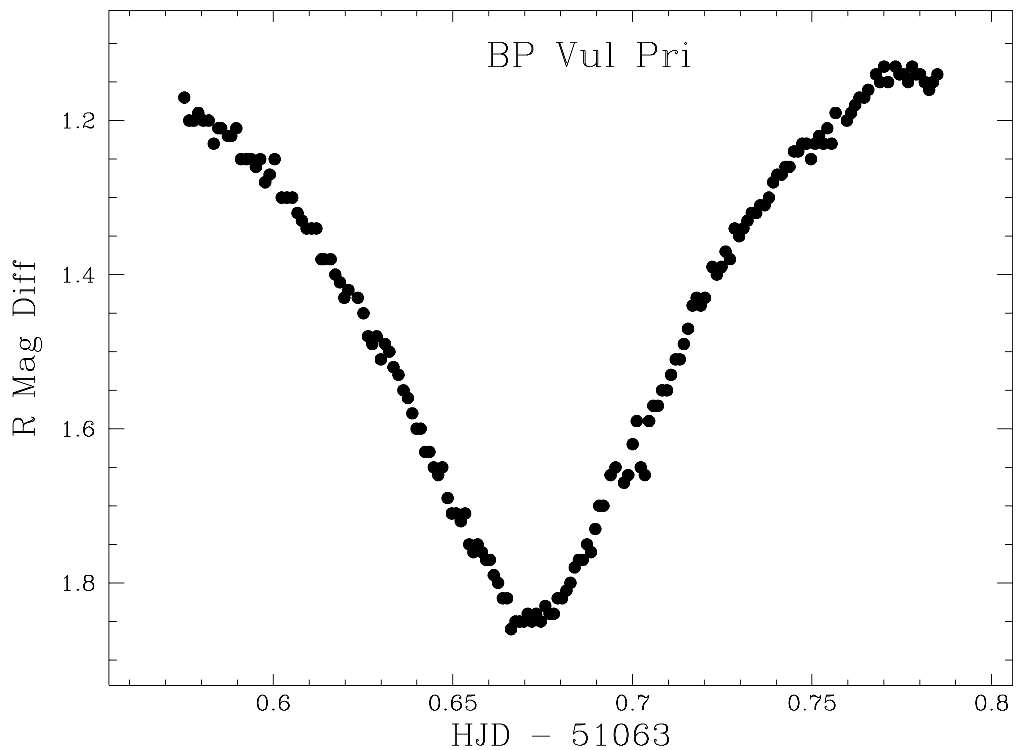

Figure 1. A typical observation of a primary eclipse

References:

Kwee, K.K., and van Woerden, H. 1956, BAN, 12, 327
Lacy, C.H.S., & Fox, G.W. 1994, IBVS, No. 4009
Torres, G. 1998, private communication

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CCD LIGHTCURVES AND MINIMA TIMES OF THE ECLIPSING BINARY RZ Cas

F. J. CLARKE, T. A. LISTER

School of Physics & Astronomy, University of St Andrews, North Haugh, St Andrews, Fife, KY16 9SS, U.K., e-mail: fjc3@st-and.ac.uk, tal@st-and.ac.uk

The bright eclipsing binary RZ Cas has been studied by many groups over the years, yet no completely satisfactory explanations for the system's odd behaviour have been presented.

Narrow band (~10 Å centred at 5300 Å) CCD observations were made with the 0.94-m James Gregory Telescope at the University of St Andrews Observatory on the nights of 1997 December 2-3 (818 frames) and 1998 January 14-15 (471 frames). Relative magnitudes were determined via differential aperture photometry, using the star GSC 4317-1578 as a comparison. GSC 4317-1437 was used as a check star. Times of minimum light for the two primary eclipses observed were calculated via the method of bisecting chords and were found to be:

$$\text{JD } 2450785.37278 \pm 0.00103,$$
$$\text{JD } 2450828.40257 \pm 0.00050.$$

The lightcurves obtained from our observations are shown in Figure 1. It is clear that RZ Cas displays both partial and "total" eclipses. Several researchers have shown that flat bottomed profiles are unlikely to be due to genuine total eclipses, as they do not meet the correct colour & depth criteria (Chambliss, 1974).

Ohshima et al. (1998) suggest that the flat bottomed profiles are due to superpositions of eclipses and δ Scuti type oscillations in the primary (A3V (e.g. Maxted et al., 1994)). The 20.6 minute "totality" observed in January 1998 can be explained as a δ Scuti maximum occurring near the time of minimum light. This is compatible with the 22.4 minute period Ohshima et al. (1998) give for the δ Scuti oscillations. Reports in previous literature of totalities up to 22 minutes (e.g. Arganbright et al., 1988) are also agreeable with this hypothesis. Unfortunately, our data are too noisy to allow a significant detection of the δ Scuti oscillations. It also proved difficult to obtain an accurate estimate of the relative depth of each eclipse due to a poor determination of the maximum light level in January 1998.

Further coordinated monitoring of both minima times and eclipse profiles is needed to establish whether the changes in the light curves are periodic, and if they are correlated with any other phenomena in the system.

Data were reduced at the St Andrews node of the PPARC Starlink project. This research made use of the SIMBAD database operated at CDS.

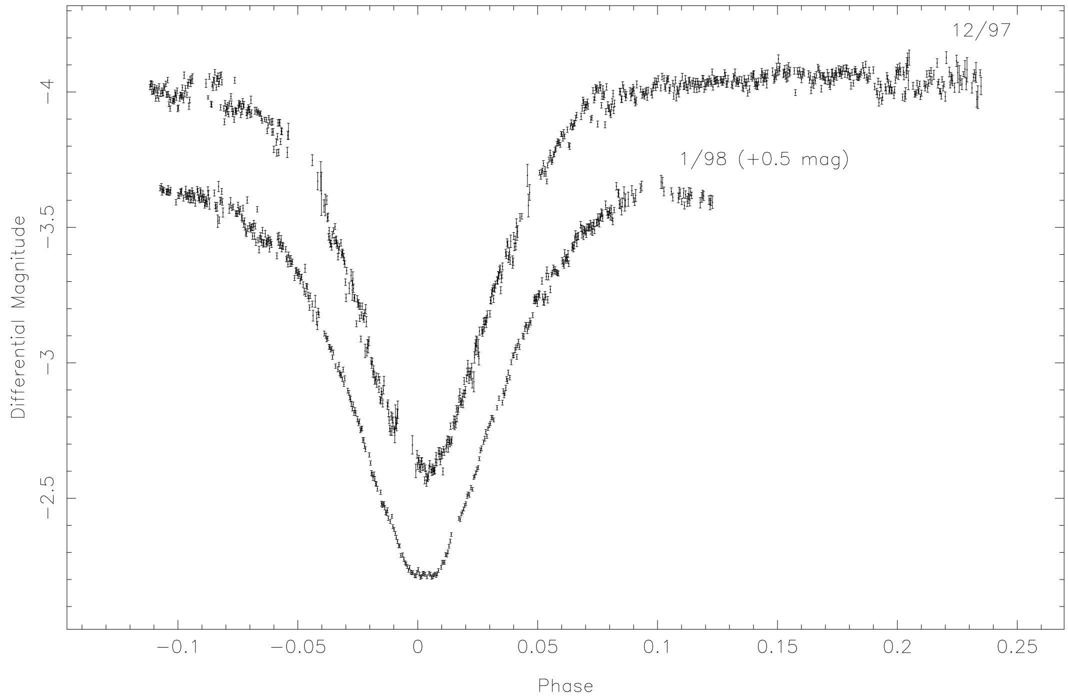

Figure 1. Eclipse lightcurves of RZ Cassiopeiae during 2-3 December 1997 (top) and 14-15 January 1998 (bottom). The lower (January) lightcurve has been shifted by 0.5 mags to make the diagram clearer. The change in profile between the the two data sets is apparent.

References:

Arganbright, D.V., Osborn, W. and Hall, D.S., 1988, *IBVS*, No. 3224

Chambliss, C., 1974, *IBVS*, No. 883

Maxted, P.F.L., Hill, G. and Hilditch, R.W., 1994, *Astron. Astrophys.*, **282**, 821

Ohshima, O., Narusawa, S., Akazawa, H., Mitsugu, F., Kawabata, T. and Ohkura, N., 1998, *IBVS*, No. 4581

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TIMES OF MINIMA OF SOME SOUTHERN ECLIPSING BINARIES

Z. KVÍZ †[1], M. ZEJDA[2], L. KOHOUTEK[3], J. GRYGAR[4]

[1] Observatoire de Genève, 1920 Sauverny, Switzerland

[2] N. Copernicus Observatory and Planetarium, Kraví hora 2, 616 00 Brno, Czech Republic

[3] Hamburg Observatory, Gojenbergsweg 112, 21029 Hamburg, Germany

[4] Institute of Physics, Na Slovance 2, 180 40 Praha 8 – Libeň, Czech Republic

Moments of minima were derived for eight southern eclipsing binaries from photoelectric observations made with the seven channel photometer in the Geneva photometric system by one of the authors (Z. Kvíz) in the years 1977–1988. The photometer was attached to the 0.7-m Swiss reflector operating at the European Southern Observatory, La Silla (Chile). The reason for these observations was to study the interesting systems, especially to investigate the possible period changes of these short period binaries (see e.g. Kvíz, Rufener, 1981). Unfortunately, Zdeněk Kvíz was not able to continue this programme.

The programme stars are listed in Table 1, where the columns are as follows: name of the star, brightness of the binary outside the eclipse and in the centre of the primary minimum, system of magnitudes used (the letter P means photographic magnitudes and the letter V denotes visual or photovisual magnitudes), equatorial co-ordinates (1950.0) and orbital elements $M(0)$ and P of the systems given in GCVS (Kholopov et al., Samus' et al., 1998), used in Table 2.

The results are given in Table 2, where HJD are the heliocentric JD of the respective minima together with their mean errors, and n is the number of individual observations used. We also give the respective phases and the epochs (see Table 1 for the orbital elements).

The times of the 21 minima were determined using the programme TINT4 (Gaspani, 1995) based on the artificial neural network. The presented error is similar to the standard deviation of the time of minimum. The programme uses measurements made in all colours and the V-magnitudes were weighted separately from the magnitudes of six colour indices. The calculated phases of the minima differ significantly from 0.0 and 0.5, respectively, so that small changes of periods can be expected with most of the mentioned stars.

We wish to acknowledge the help of G. Burki who gave us important information, and of A. Gaspani for the possibility of using the programme TINT4. We thank the director of the Geneva Observatory for supporting the work of Z. Kvíz at La Silla.

Table 1: List of programme stars.

Star	Brightness [mag] Max	Min I	Branch	RA (1950.0)	DEC	$M(0)$ (JD − 2400000)	P [days]
U Col	10.40	11.00	P	06 13 02	−33 03 36	28521.774	1.24617466
V Lep	9.60	10.10	V	06 08 50	−20 12 00	18873.723	1.0701048
RS Lep	9.91	10.38	V	05 57 09	−20 13 36	36191.148	1.2885439
RU Lep	11.23	12.12	V	06 01 50	−24 54 00	43516.670	4.459601
UX Men	8.80	9.57	P	05 31 59	−76 17 00	41984.64388	4.181100
ζ Phe	3.91	4.42	V	01 06 17.3	−55 30 46	41643.6890	1.6697671
BQ Sgr	9.40	11.87	V	19 10 54.4	−36 19 51	22224.378	8.019537
CW Vel	10.10	11.12	V	09 00 49.2	−52 38 36	44248.7584	2.360927

Table 2: Times of minima.

Star	Type of minima	HJD (−2400000)	Error*	n	Epoch	Phase	Note
U Col	prim	44993.676	0.001	28	13218.0	0.973	normal min. (3 nights)
	sec	43482.691	0.007	46	12005.5	0.474	normal min. (2 nights)
	sec	44945.696	0.006	23	13179.5	0.471	
V Lep	prim	43478.727	0.003	36	22993.0	0.079	normal min. (2 nights)
	sec	43471.774	0.001	13	22986.5	0.582	
RS Lep	prim	45678.702	0.004	32	7363.0	0.004	
	sec	45680.633	0.010	9	7364.5	0.502	
RU Lep	prim	43516.670	<0.001	11	0.0	0.000	
	prim	45670.654	<0.001	9	483.0	0.999	
	prim	45719.727	0.002	30	494.0	0.003	
	prim	45728.648	0.002	24	496.0	0.003	
	prim	46058.654	0.003	49	570.0	0.003	normal min. (3 nights)
	sec	45699.662	0.021	45	489.5	0.504	normal min. (7 nights)
UX Men	prim	43485.659	0.003	23	359.0	0.000	
ζ Phe	prim	43473.755	0.010	43	1096.0	0.001	normal min. (5 nights)
	sec	43469.593	0.001	18	1093.5	0.508	
	sec	43474.605	0.002	31	1096.5	0.510	normal min. (2 nights)
BQ Sgr	prim	47253.07	0.10	10	3121.0	0.96	normal min. (10 nights)
	sec	47305.54	0.08	7	3127.5	0.51	normal min. (7 nights)
CW Vel	prim	46491.639	0.002	31	950.0	0.000	normal min. (6 nights)
	sec	46485.745	0.002	35	947.5	0.504	normal min. (6 nights)

* The error given in TINT4 (a version of TINAGEL) is very similar to a standard deviation and it describes the true uncertainty of $t(0)$ better, than only the statistical properties of the data set would do.

References:

Gaspani A., 1995, private communication

Kholopov P.N. (ed.) et al., Samus' N. N. (ed.) et al., 1998, *General Catalogue of Variable Stars*, electronic edition v4.1 (ftp://ftp.sai.msu.su/pub/groups/clusters/gcvs/gcvs)

Kvíz Z., Rufener F., 1981, *IBVS* No. 2014

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

RZ CEPHEI — PERIOD VARIATION

IOAN TODORAN, RODICA ROMAN

Astronomical Observatory, Cluj-Napoca, Romania

The variability of RZ Cephei was discovered by Leavitt in 1907. This is an $R\mathrm{R_C}$-type star and its observation is important for at least three reasons: (i) the period variability; (ii) a pre-maximum hump in the light curve and (iii) its high space velocity. For a more detailed historical information we recommend the article written by Cester and Todoran (1976).

Here only the period variability is concerned. In Table 1 we report a series of 25 observed maxima (7 maxima observed by Alania and Abuladze (1980, 1986) and 18 maxima observed by Todoran). The times of maxima were determined by Roman.

Even if the observations are performed with photoelectric photometers, having in view the varying shape of the light curve in the vicinity of its maximum, Pogson's method and "mean" light curve were used in order to determine the heliocentric times of maxima. The results are given in Table 1. Here the corresponding $O-C$ differences were computed by using the linear ephemeris:

$$\mathrm{Max} = \mathrm{HJD}\ 2410000.38 + 0\overset{\mathrm{d}}{.}30866671 \times E \tag{1}$$

and could be affected by the variability of the corresponding light curve.

In their study referring to the period variation, Cester and Todoran (1976) postulated a cycle of 50 years, while Todoran (1976) has written: "we can say that RZ Cephei is at least a triple periodic variable star".

Now, in order to have a general image about period variation of RZ Cephei, we have also used the observed maxima listed by Todoran (1974), Cester and Todoran (1975, 1976), Maintz (1992) and Seifert (1993).

For all the above mentioned maxima, the $O-C$ residuals are displayed in Fig. 1, where the cyclic variation is evident, but at least a critical remark could be relevant. The amplitude of the period variation is about twice the length of the period. We consider that such a situation is determined by the fact that we have here, in the same time, two unknown parameters: the length of the period and the corresponding cycle number E.

Therefore, it is evident that RZ Cephei must be observed in the future and the period variation to be connected with the changes observed in the shape of the light curve.

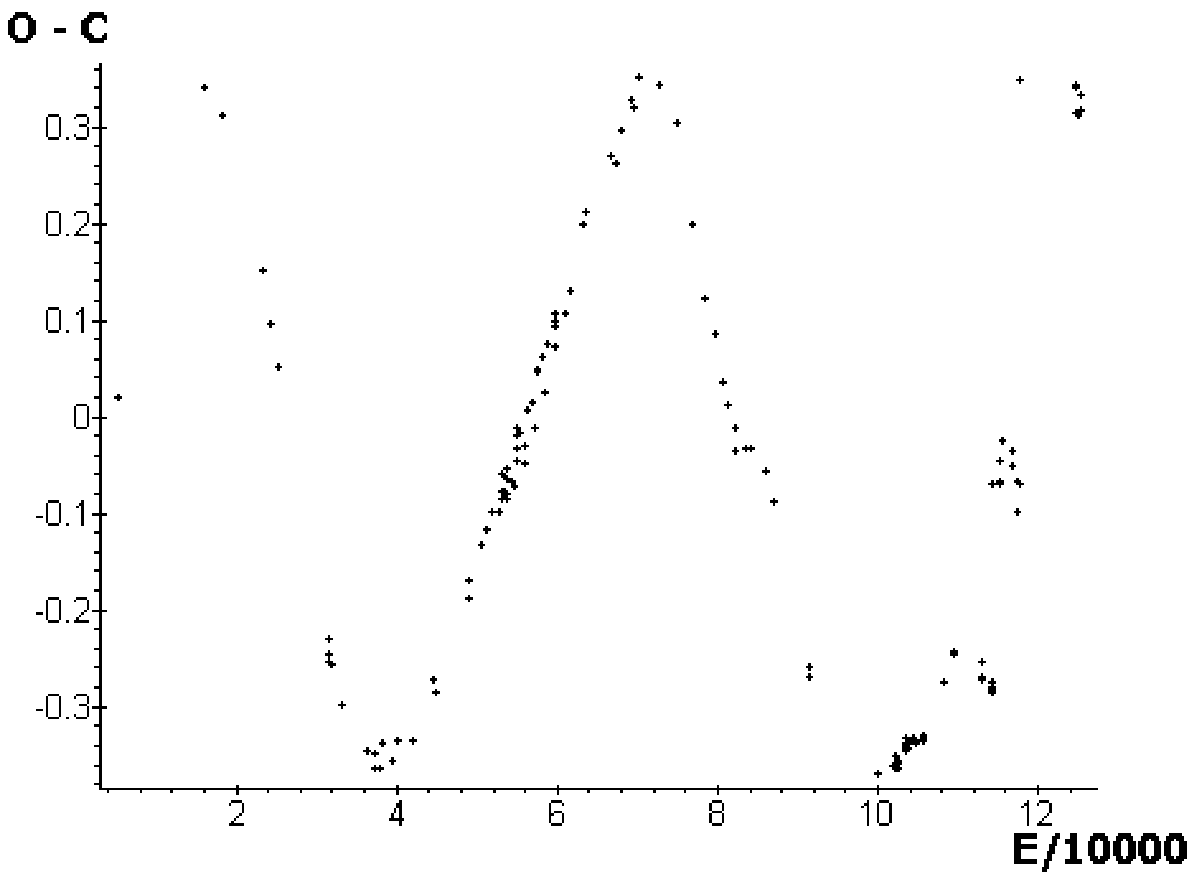

Figure 1.

Table 1: Observed maxima of RZ Cephei

HJD 244...	n	$O-C$	E	Observer
3378.398	41	$-0^{\mathrm{d}}.274$	108137	Alania; Abuladze
3759.322	69	$-0^{\mathrm{d}}.245$	109371	Alania; Abuladze
3772.286	87	$-0^{\mathrm{d}}.245$	109413	Alania; Abuladze
3783.401	108	$-0^{\mathrm{d}}.242$	109449	Alania; Abuladze
3791.426	54	$-0^{\mathrm{d}}.242$	109475	Alania; Abuladze
4842.425	100	$-0^{\mathrm{d}}.253$	112880	Todoran
4900.436	9	$-0^{\mathrm{d}}.271$	113068	Alania; Abuladze
4901.365	59	$-0^{\mathrm{d}}.269$	113071	Alania; Abuladze
5219.276	65	$-0^{\mathrm{d}}.284$	114101	Todoran
5221.440	20	$-0^{\mathrm{d}}.281$	114108	Todoran
5266.196	23	$-0^{\mathrm{d}}.282$	114253	Todoran
5286.265	75	$-0^{\mathrm{d}}.275$	114318	Todoran
5299.230	70	$-0^{\mathrm{d}}.275$	114360	Todoran
5300.152	65	$-0^{\mathrm{d}}.273$	114363	Todoran
5578.470	120	$-0^{\mathrm{d}}.070$	115264	Todoran
5580.325	80	$-0^{\mathrm{d}}.068$	115270	Todoran
5606.250	90	$-0^{\mathrm{d}}.070$	115354	Todoran
5609.340	90	$-0^{\mathrm{d}}.046$	115364	Todoran
5622.302	67	$-0^{\mathrm{d}}.068$	115406	Todoran
6019.290	75	$-0^{\mathrm{d}}.025$	116692	Todoran
6034.404	16	$-0^{\mathrm{d}}.036$	116741	Todoran
6284.410	30	$-0^{\mathrm{d}}.050$	117551	Todoran
6293.345	48	$-0^{\mathrm{d}}.067$	117580	Todoran
6328.194	27	$-0^{\mathrm{d}}.097$	117693	Todoran
6346.433	95	$-0^{\mathrm{d}}.069$	117752	Todoran

References:

Alania, J.F., Abuladze, O.P., 1980, Bull. Abastum. Astrophys. Obs., 53, 13
Alania, J.F., Abuladze, O.P., 1986, Bull. Abastum. Astrophys. Obs., 61, 15
Cester, B., Todoran, I., 1975, IBVS, No. 1047
Cester, B., Todoran, I., 1976, Mem. Soc. Astron. Ital., 47(2), 217
Maintz, G., 1992, BAVM, No. 60
Seifert, K., 1993, BAVM, No. 62
Todoran, I., 1974, IBVS, No. 915
Todoran, I., 1976, Multiple Periodic Variable Stars, IAU Colloquium No. 29, ed. W.S. Fitch, Vol. 2, Akadémiai, Budapest, p. 215

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PHOTOMETRY OF THE δ SCUTI STAR HR 2100

LIU Y.Y.

Beijing Astronomical Observatory, Chinese Academy of Sciences, Datun Road 20A, Chaoyang District, 100012, China, e-mail: lyy@class1.bao.ac.cn

HR 2100 was discovered to be a δ Scuti star by Breger (1973). Its reported period is 0.054 days. No observation has been done since that time. This star has a δ Del like spectrum (Cowley et al., 1969) and is the primary of a visual binary system. Moreover, the pulsating variable HR 2100 also belongs to a spectroscopic binary. Strömgren v and y rapid photometry was carried out with the 85-cm reflector during 26 and 30 January in 1999 at Xinglong of Beijing astronomical observatory. Chevreton six-channel photometer (Michel, 1992) was used. This system allows a high-speed data acquisition with good accuracy, one record per second. Light from the stars is divided into v and y parts by means of a dichroic filter so that two bands can be simultaneously monitored through two identical photomultipliers. Therefore four of the channels are used for the program and comparison stars in v and y respectively. The sky background was obtained by the other two channels using standard v and y filters separately. The observational field is around 15 arcmin. The comparison star was SAO 113304, no variability has been reported on it. Finally, successive 5 day data were obtained. Due to bad weather, data on Jan. 29 was excluded in v dataset. Light curve of last night is not perfect, but the variability is obvious.

The instrumental magnitude of the variable can be obtained by dividing their photon counts after removing the sky background. Effect of response for the different channels has been taken into account. A polynomial fitting was applied to remove the effects from intrinsic variability, transparency turbulence and the instrumental drift caused by the temperature changes of photomultipliers. The final light curves in two filters are shown in Fig. 1 and 2. These data have been averaged so that each point represents one minute.

The pulsation period was analyzed through Fourier transform to v band data using code MFA (Hao 1991) because larger scatter exists in y. A frequency $f = 16.461$ c/d is found. It fits both v and y datasets well as displayed in Figure 1 and 2. Spectral window and power spectra are outlined in Figure 3. Table 1 lists the relevant parameters.

HR 2100 was firstly observed almost thirty years ago, the 6 hours data resulted in an estimation of frequency being 18.52 c/d that cannot be approved by new observation. This value fails to interpret new light curves. Its amplitude has also decreased. From the Hipparcos observation, absolute magnitude of HR 2100 is derived as $M_v = 0.72$. Effective temperature and gravity are obtained by means of the photometric calibration according to Domingo & Figueras (1999) giving $\log T_{\rm eff} = 3.883$, $\log g = 3.64$. The Q-value was calculated $Q = 0.0124$ ($B.C. = -0.1$) implying a non-radial mode. The phase

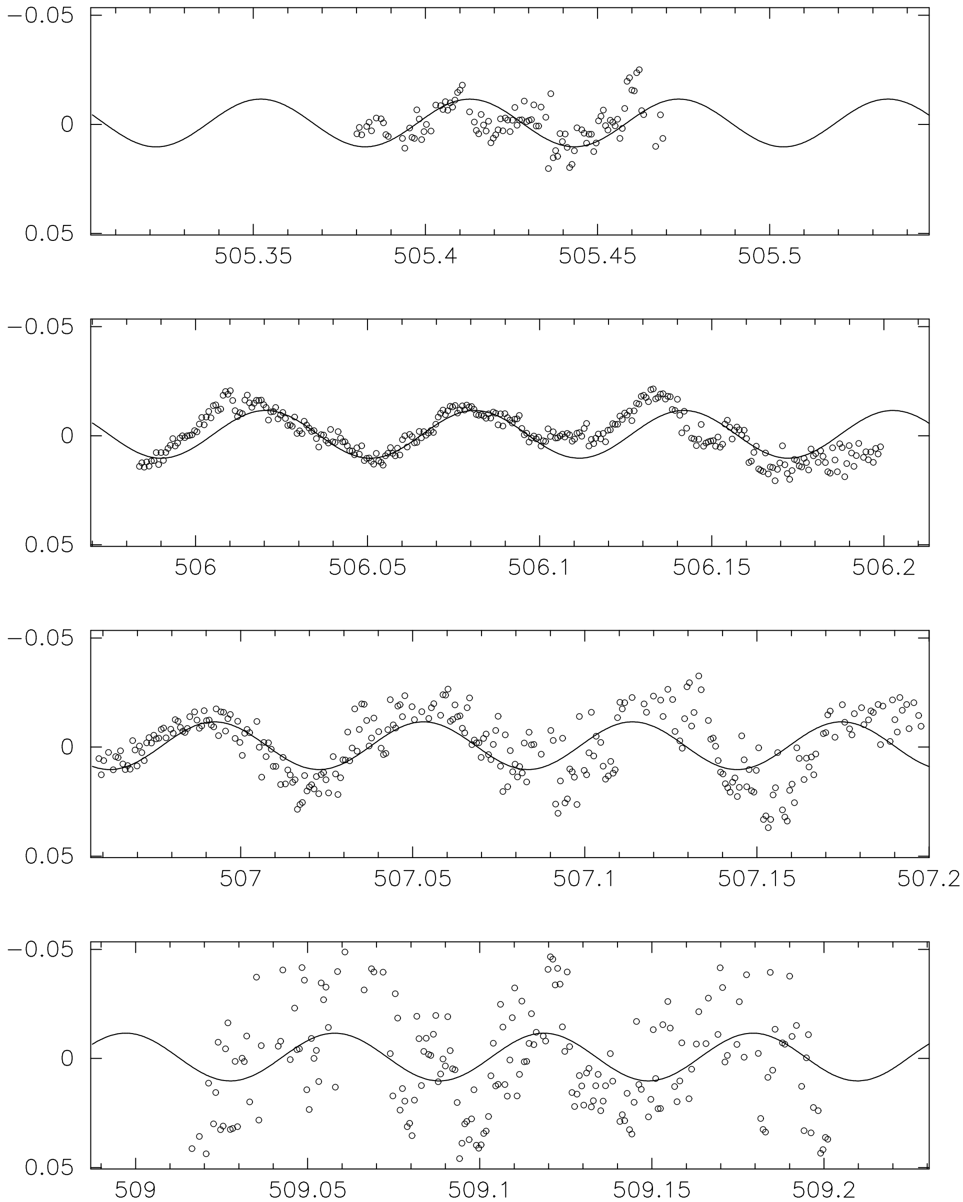

Figure 1. Observed light curves of HR 2100 in v band. The solid lines are the least-squares fit with the frequency listed in Table 1. The abscissa is HJD 2450700 +, and the ordinate in mag.

Table 1: Properties of the light curve of HR 2100 in v and y bands

frequency (c/d)	Amp. (v) (mmag)	Phase (v) (rad)	Amp. (y) (mmag)	Phase (y) (rad)
16.461 ± 0.007	10.93 ± 0.63	0.211 ± 0.015	8.05 ± 0.58	0.192 ± 0.012
	$\sigma = 0.013$		$\sigma = 0.013$	

shift and amplitude ratio can be used to have insight about the pulsation modes. However, considering the short data base and low amplitude, the phase shift is uncertain and may not give meaningful explanation. In fact, unknown frequency can be hidden in the light curves, a second frequency around 17.701 c/d is probably an intrinsic one. More observation covering long time base is strongly needed to confirm it and then to understand the

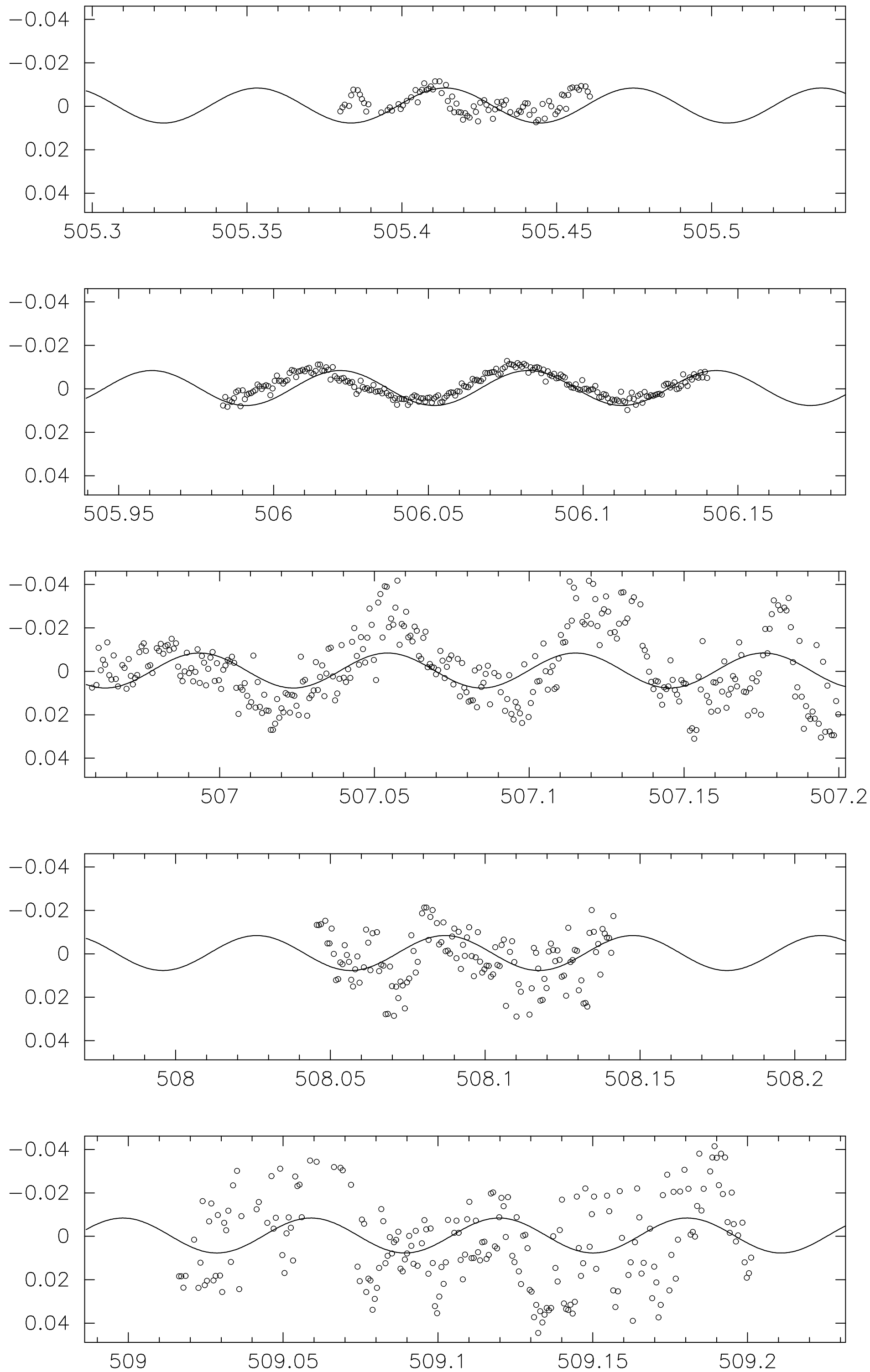

Figure 2. Same as Fig. 1 but in y band.

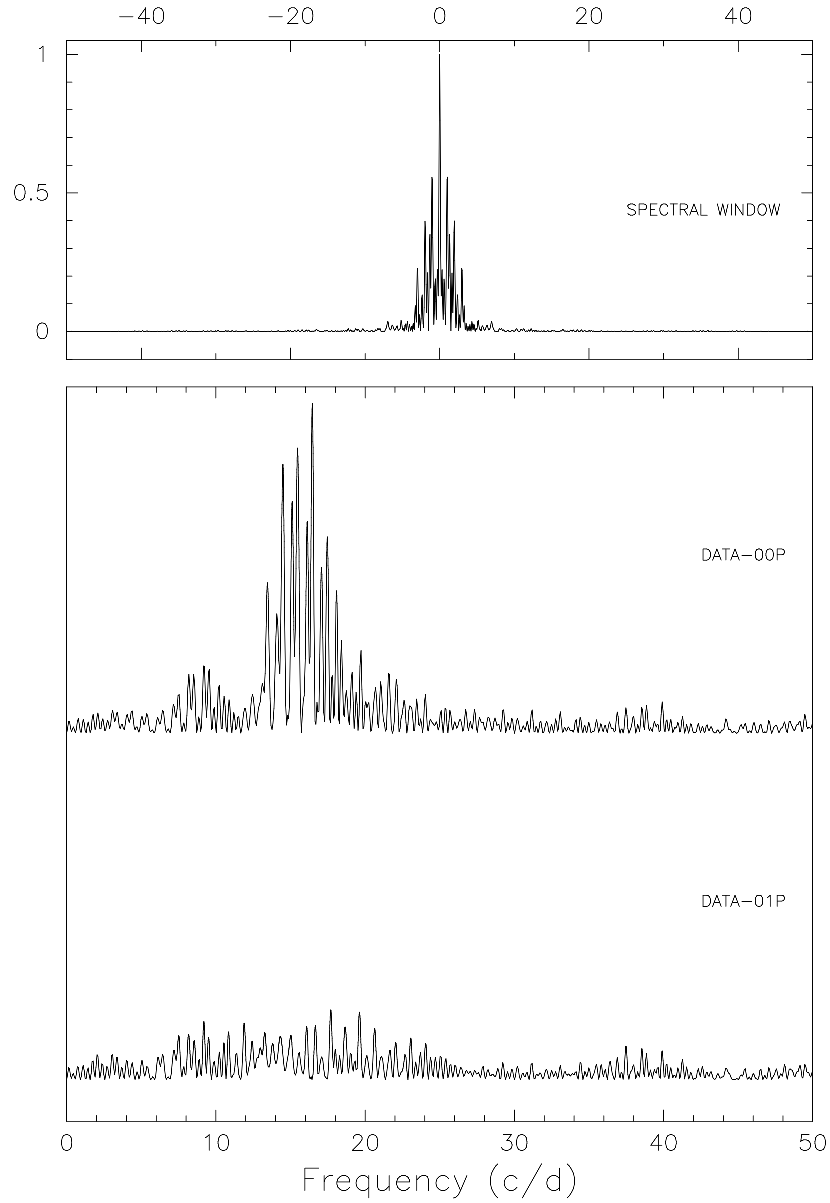

Figure 3. Spectral window and power spectra of HR 2100 in v band.

pulsation character of this star.

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IRAS 19035-0134: A NEW MIRA VARIABLE

B. HASSFORTHER[1,2], U. BASTIAN[3]

[1] Ringstr. 27, 69115 Heidelberg, Germany, e-mail: bela1996@aol.com

[2] Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D-12169 Berlin, Germany

[3] Astronomisches Rechen-Institut, Mönchhofstr. 14, 69120 Heidelberg, Germany,
e-mail: s01@ix.urz.uni-heidelberg.de

The *Stardial* project of the University of Illinois at Urbana-Champaign provides a sky patrol of a declination band just south of the equator, using a drift-scan robotic CCD camera. All the images are immediately made available on the world-wide web under http://www.astro.uiuc.edu/stardial/. While "blinking" *Stardial* frames in a search for new variables, the star IRAS 19035-0134 = USNO–A2.0 0825-14421517, located at $19^{\rm h}06^{\rm m}05\overset{\rm s}{.}65 \quad -01^\circ29'59\overset{''}{.}0$ (J2000, from USNO–A2.0), was found to vary between about 10 and fainter than 12.5 in unfiltered CCD magnitudes.

The *Stardial* lightcurve from all 181 usable frames (collected over 4 observing seasons) indicated Mira-type variability with a period of about 250 days. Fig. 1 shows positive magnitude measurements relative to GSC 5128-945 as solid diamonds, and upper limits from non-detections as very small triangles. There is a clear-cut maximum around JD 2 450 620, and an incomplete one at about JD 2 451 360. In between, a minimum is indicated by a decline around JD 2 450 950 and a rise around JD 2 451 060. The minimum itself is indicated by the large number of non-detections (small symbols) around JD 2 451 000. In addition, there is a rise around JD 2 450 330, given by a group of non-detections followed by a group of positive observations.

This interpretation of the *Stardial* data is corroborated by 14 frames from *The Amateur Sky Survey* (TASS, another public CCD sky patrol project, see http://www.tass-survey.org/). I-band magnitudes derived from the 14 frames are displayed as crosses in Fig. 1. Due to the larger optics compared to *Stardial*, the TASS data give positive observations even close to the minimum.

From Fig. 1 the following rough ephemeris can be derived:

$$\mathrm{JD\ (Max)} = 2450620 + 247 \times E.$$

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

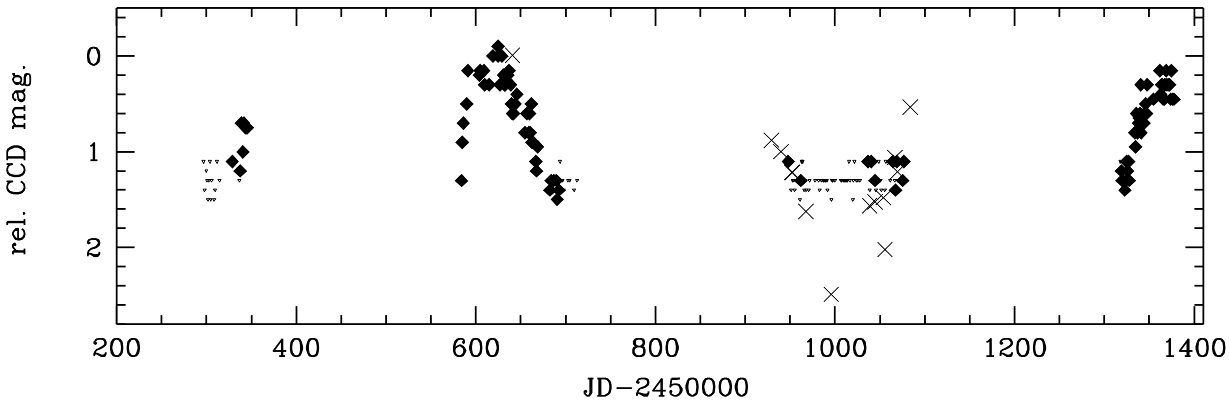

Figure 1. Lightcurve of IRAS 19035-0134. Symbols are explained in the text.

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LS II +22°8 – A NEWLY RECOGNIZED CLASSICAL Be STAR

A.S. MIROSHNICHENKO[1], K.S. KURATOV[2], T.A. SHEIKINA[2], D.B. MUKANOV[3]

[1] Ritter Observatory, Dept. of Physics & Astronomy, University of Toledo, Toledo, OH, 43606, USA, e-mail: anatoly@physics.utoledo.edu

[2] Fesenkov Astrophysical Institute, Kamenskoye plato, 480068, Almaty, Kazakhstan

[3] Al-Farabi Kazakh National University, 480000, Almaty, Kazakhstan

LS II +22°8 was discovered by Stock et al. (1960) as a possible luminous early-type star with emission in the Hα line. Later it was listed in the Henize (1976) catalog of emission-line stars as Hen 1764. Pesch (1963) estimated its spectral type as B9 Ia or B2–5 V (with less likelihood) from his UBV photometry (see Table 1), which also implies the interstellar extinction $A_V \sim 2\overset{m}{.}0$ assuming no circumstellar contribution. Allen (1973) obtained near-IR photometry of the star ($H = 9\overset{m}{.}90, K = 9\overset{m}{.}60$). These data indicate a very weak near-IR excess radiation (see Fig. 1) taking into account the above A_V, a total-to-selective interstellar extinction ratio, R =3.1, and intrinsic color-indices for the above spectral types (Strajzhys 1977). This excess can be explained by free-free emission of the circumstellar gas or of a faint cool companion. Its weakness and shape ($E_{V-K} \sim 0\overset{m}{.}2$, dereddened $H-K = 0\overset{m}{.}15$) rules out the presence of hot dust around the star.

Dong & Hu (1991) identified LS II +22°8 with the IRAS PSC source 19381+2224. However, the IRAS fluxes detected at 12, 25, and 60 μm (10.43, 7.10, and 3.64 Jy respectively) imply a very strong flux rise between 2 and 12 μm, which is inconsistent with the assumption about a late-type companion (see Fig. 1). Such a rise might be due to the radiation of dust with the highest temperature of nearly 300–500 K. Moreover, a steep decrease of these IRAS fluxes with wavelength is consistent with either a small extent of the dusty structure or with a different illuminating source for the dust. The first suggestion along with the absence of the hot dust leads to a conclusion that the dust is concentrated in a rather thin remote shell, while the second one points that either the optical object is a binary system or it is not associated with the IRAS source.

Thé et al. (1994) pointed out that there is a 54″ offset between the optical position of LS II +22°8 and that of the IRAS source. This is well outside the IRAS positional error ellipse, which has major axes of 22″ and 5″ and a position angle of 70°. A faint star, that is located very close to the position of IRAS 19381+2224, is seen in the Space Telecope Institute Digital Sky Survey image of a field around LS II +22°8. It seems to be a more appropriate optical counterpart of this IRAS source. The mid-IR spectrum of IRAS 19381+2224 taken by the IRAS Low-Resolution Spectrometer (LRS) shows a weak emission feature at 11.3 μm (Olnon et al. 1986), which is probably due to the SiC dust particles usually observed in the spectra of carbon stars. Therefore, LS II +22°8 and IRAS 19381+2224 are most likely different sources.

The simultaneous $UBVRI$ observations of LS II +22°8 in the Johnson photometric system were obtained with two 1-meter telescopes at the Assy and Tien-Shan Observatories of the Fesenkov Astrophysical Institute in Kazakhstan equipped with a two-channel photometer-polarimeter (Bergner et al. 1988) between June 1993 and August 1998 through the 26″ diaphragm (Table 1). Its brightness varies with an amplitude of $\sim 0\overset{m}{.}3$ in the VRI-bands, while it reaches $0\overset{m}{.}6$ in the U-band. Such a behaviour might be due to free-bound emission of the circumstellar gas which gives the strongest contribution shortward of the Balmer jump and manifests itself by the peculiar spectrum (see below). The averaged color-indices $U-B$ and $B-V$ are consistent with those of a reddened B8±1 giant or dwarf ($A_V = 2.3 \pm 0\overset{m}{.}2$, R =3.1), which displays an excess radiation longward of 0.5 μm. The latter increases from about $0\overset{m}{.}1$ in the R-band to $0\overset{m}{.}4$ in the K-band (according the data by Allen 1973). It can be explained by free-free emission of the envelope as in classical Be stars (e.g. Dougherty et al. 1991).

Table 1. Photometric observations of LS II +22°8.

JD 2400000+	V	$U-B$	$B-V$	$V-R$	$R-I$
[a]	11.78	0.37	0.54		
49165.39	12.04	0.38	0.68	0.69	0.41
49232.33	12.05	0.27	0.70	0.66	0.45
49612.14	11.97	0.20	0.72	0.58	0.32
49942.28	11.95	0.21	0.57	0.69	0.36
49944.26	11.81	0.43	0.63	0.58	0.34
49960.20	12.02	0.17	0.59	0.69	0.36
51043.28	11.74	0.09	0.54	0.61	0.45
51052.25	11.73	0.11	0.57	0.58	0.40

[a] data from Pesch (1963)

The spectroscopic observations were obtained at the 6-meter telescope of the Russian Academy of Sciences with a photoelectric TV-scanner (Balega et al. 1979) on 1993 July 10 in the spectral regions 3933–4960 and 5852–6900 Å with a resolution of 2 Å. The most prominent features in the spectrum are a double-peaked Hα emission (Fig. 2) and Fe II absorption lines. The Hβ line is mostly filled in with emission, while Hγ and Hδ show only weak signs of it. Other emission lines, which are seen in the spectrum, can be identified with Fe I transitions, usually blends of several lines. The Na I $D_{1,2}$ and Si II 6347 and 6371 Å absorption lines certainly contain circumstellar contribution as their equivalent width ratios are different from those of pure interstellar and photospheric, 1.33 and 1.22, respectively. The observed diffuse interstellar bands at 6278 and 6283 Å are rather strong and are consistent with the reddening derived above from the photometric data.

The strong influence of the circumstellar material makes it difficult to estimate the MK type of the star from our spectral data. The observed Hδ line wings are consistent with the theoretical ones for the temperatures not higher than 12000 K, that corresponds to a B8 spectral type. Since the Hα emission line is not very strong and hardly affects the Balmer jump (Doazan 1982), we can assume that our photometric estimate of the object's MK type is correct.

The Hα line profile and strong Fe II absorption lines are similar to those of classical Be-shell stars, where they are formed in a dense circumstellar disk viewed at a high inclination angle (close to edge-on, Hanuschik 1994). The observed ratio of the Hα peak intensities $V/R > 1$ is also seen in many classical Be stars and is thought to be due to rotating one-armed density waves in the disk (e.g. Okazaki 1991). The optical brightening accompanied with the blueing observed in August 1998 (two last lines in Table 1) may be due to the shell strengthening, which is usual for classical Be stars (e.g. Doazan 1982).

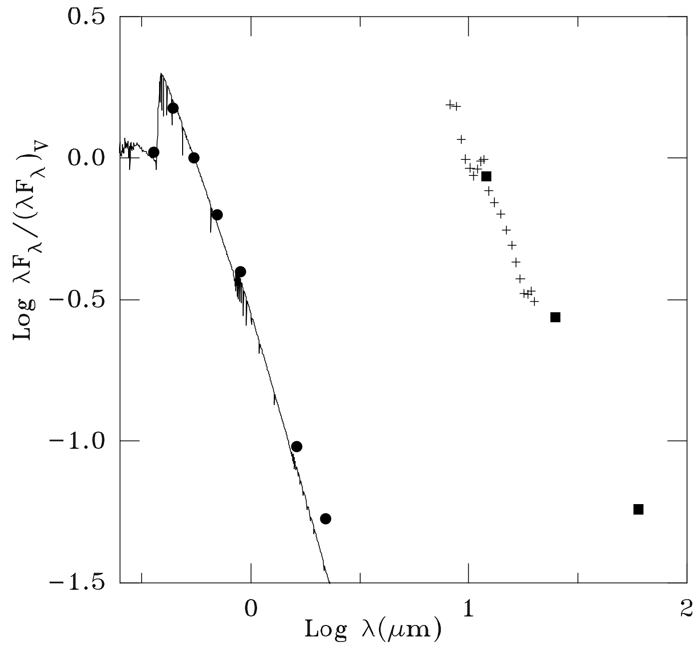

Figure 1. The dereddened SEDs of LS II +22°8 constructed from the averaged *UBVRIHK* photometric data (filled circles) along with that of IRAS 19381+2224 (filled squares – IRAS photometry, crosses – IRAS LRS spectrum). A Kurucz (1994) model atmosphere for $T_{\rm eff}$ = 12000 K and log g = 3.5 is shown by a solid line.

The separation between the Hα emission peaks, 290$\pm$60 km s^{-1}, implies a rotational velocity of the envelope of at least 100 km s^{-1} if one assumes that rotation is the main mechanism of the line formation. Subtraction of the photospheric profile from the observed Hβ line profile reveals a double-peaked emission similar to that in the Hα line.

If we suggest a typical luminosity of a late B-type classical Be star for the object, log $L_{\rm bol}/L_\odot \sim 2.5$ (e.g. Zorec & Briot 1991), a distance of $\sim$ 2 kpc can be derived. An assumption that the object is a supergiant is not consistent with the derived spectral type and intrinsic color-indices of the star. Furthermore, the presence of a disk-like gaseous envelope is a feature of B[e] supergiants (Zickgraf et al. 1986), which also exhibit a strong near-IR excess not seen in LS II +22°8. Balmer line profiles similar to those of the object also display pre-main-sequence Herbig Ae/Be stars (Finkenzeller & Mundt 1984). However, such a strong emission-line spectrum in these stars is usually acompanied by a noticeable near-IR excess that rules out the pre-main-sequence nature of LS II +22°8. The collected observational data do not allow us to consider other possible options (e.g., binary system with different types of the secondary component).

Thus, both photometric and spectroscopic properties of LS II +22°8 suggest that it is most likely a classical Be-shell star. Its emission in the Hα line is one of the strongest among those of Be stars with nearly similar spectral types. It is similar to that of Pleione during its shell phase (Doazan 1982). New photometric and spectroscopic variations of

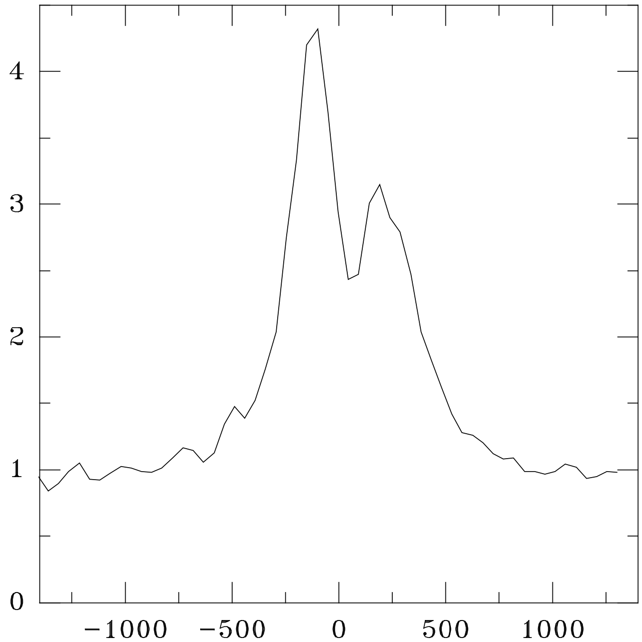

Figure 2. The Hα line profile in the spectrum of LS II +22°8. The heliocentric velocity is given in $\mathrm{km\,s^{-1}}$, the intensity is normalized to the continuum.

LS II +22°8 are, therefore, expected in the future. The IRAS source 19381+2224 is most likely associated with a cool nearby star.

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RISE FROM THE LOW STATE OF THE BINARY V SAGITTAE

V. ŠIMON[1], S. SHUGAROV[2]

[1] Astronomical Institute, Academy of Sciences, 251 65 Ondřejov, Czech Republic, e-mail: simon@asu.cas.cz

[2] Sternberg Astronomical Institute, Moscow State University, Universitetsky Prospect 13, 119899 Moscow, Russia, e-mail: shugarov@sai.msu.ru

V Sge is a peculiar eclipsing binary ($P_{\rm orb} = 0\overset{\rm d}{.}514$) (Herbig et al. 1965). The spectrum consists of a hot continuum with strong emission lines and resembles the type WN5. Recently, there have been accumulated several lines of evidence (existence of the high-excitation emission lines (Patterson et al. 1998); X-ray variations (Greiner and van Teeseling 1998); the character of the long-term activity (Šimon and Mattei 1999)) which strongly support the model of the mass accreting white dwarf primary from a massive companion, originally suggested by Williams et al. (1986). V Sge appears to be a promising candidate for the super-soft X-ray source (SSXS) (Steiner and Diaz 1998; see van den Heuvel et al. 1992 for definition of SSXS).

V Sge displays very strong photometric activity (Herbig et al. 1965, Šimon 1996, Robertson et al. 1997, Šimon and Mattei 1999). The character of the activity changed from relatively isolated outbursts, seen in 1930's, to alternating high (HS) and low (LS) states, separated by transitions often of significantly shorter duration than the states. HS/LS behaviour is the most common kind of activity in V Sge during the last more than about 20 years.

We report on UBV observations of the rise from LS to HS which occurred in August 1997. The measurements were obtained with the 700/10500 mm Cassegrain telescope at Moscow Observatory of Sternberg Astronomical Institute. The star $V = 10.70$, $B-V = 0.29$, $U-B = 0.32$ located $1\overset{\prime}{.}3$ N, $6\overset{\prime}{.}7$ E from V Sge was used as the comparison star. The check star was $V = 9.49$, $B-V = 0.15$, $U-B = 0.32$ ($0\overset{\prime}{.}7$ N, $18\overset{\prime}{.}7$ W from the variable). Series of densely spaced measurements, covering up to several hours, were secured in most nights.

This rise was sufficiently slow to be resolved; it gave a rare opportunity to follow variations of the light curve through the LS/HS transition. The course in V-filter can be seen in Fig. 1a. The associated $U-B$ and $B-V$ indices are included in Fig. 1bc. The dots in Fig. 1bc are the individual measurements while the empty circles denote the nightly means. The horizontal lines in Fig. 1b and 1c mark the average color index for the whole transition, the mean $U-B$ and $B-V$ being -0.89 and -0.01, respectively. On average, the points in Fig. 1c are grouping at progressively bluer $B-V$ index as the system brightens during the transition while $U-B$ does not exhibit any noticeable trend. Examination showed that orbital variations of the color (if any) are significantly smaller than those invoked by the long-term activity.

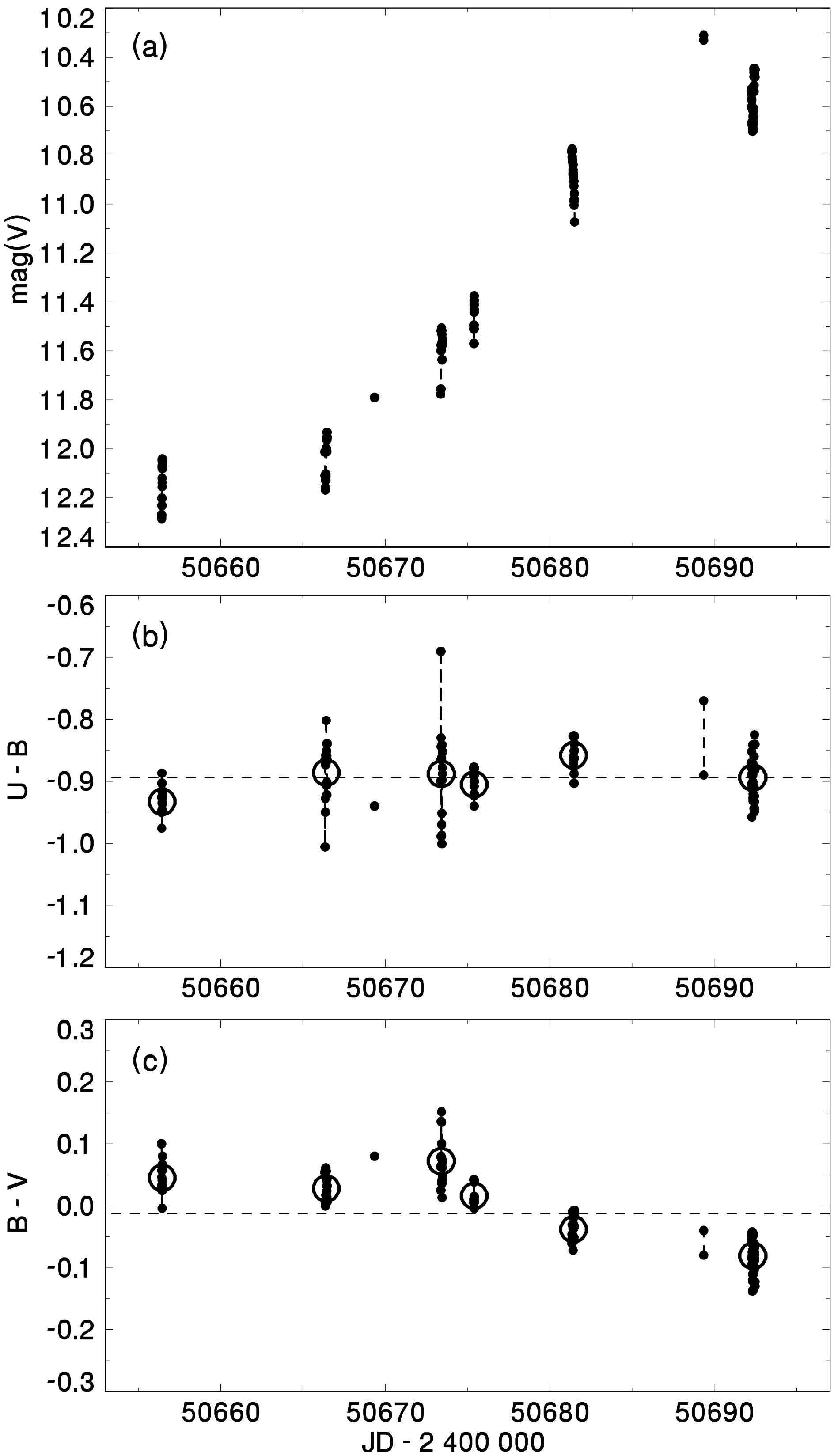

Figure 1. Rise from the low to the high state of V Sge. Observations obtained within a given night (dots) are connected by line. The empty circles in Fig. b and c mark the nightly means, the horizontal lines denote the mean color index for the whole transition.

No previous color changes for the LS/HS transition in V Sge have been published. Only Herbig et al. (1965) listed *UBV* observations of an outburst which occurred in the beginning of sixties — they therefore represent a kind of activity which has changed during the last decades (see Šimon and Mattei 1999). Both average color indices, determined from our data, agree within 0.03 mag with those of Herbig et al. (1965). Also the fact that $B-V$ decreases by ≈ 0.1 mag in the upper part of the rise to HS is similar to the behaviour of this index at the peak of the outburst observed by Herbig et al. (1965). It therefore appears that although the character of the activity in V Sge has changed since 1960's, the colors and their variations with the brightness level remained similar.

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CCD PHOTOMETRY OF BF ERIDANI — A LOW-AMPLITUDE DWARF NOVA?

T. KATO

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

BF Eri was originally classified as a slowly varying variable star. The fourth edition of General Catalogue of Variable Stars listed it as a semiregular variable star with a range of 13.5-15.5 pg. However, the likely identification of the Einstein survey source 1ES 0437-046 with BF Eri (Elvis et al. 1992) and optical spectroscopy (Schachter et al. 1996) led to the correct identification as a cataclysmic variable. The source was also detected during the course of the ROSAT All-Sky Survey (1RXS J043929.5-043605, 1RXP J043927-0434.3) and pointed observations (1WGA J0439.4-0433). The ROSAT identification of the Einstein source also led to an identification as a cataclysmic variable of unknown type (Chisholm et al. 1999). Independently noting the identification of BF Eri with the ROSAT source, the VSOLJ (Variable Star Observers' League in Japan) and the author started visual and CCD monitoring of this object. The first result of visual monitoring (Watanabe 1999) led to a conclusion that BF Eri is a dwarf nova with a recurrence period of 40–50 d, and the range of 13.2–14.7 m_v. I here report long-term and short-term variation by CCD photometry.

The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java^{TM}-based aperture photometry package developed by the author. The differential magnitudes of the variable were measured against GSC 4743.801 (USNO r-magnitude 11.7), whose constancy was confirmed by comparison with GSC 4743.797 (USNO r-magnitude 12.3). Table 1 summarizes nightly averaged magnitudes relative to GSC 4743.801.

The long-term light curve of BF Eri is shown in Figure 1. Each point represents a nightly averaged magnitude, with an error bar indicating the standard error. The initial part of the light curve corresponds to the final declining stage of the second outburst reported by Watanabe (1999). Around JD 2451230 (1999 February 20), another distinct brightening (outburst) was observed. The outburst smoothly decayed in the following five days, with an average rate of 0.19 mag d^{-1}. The combination of overall CCD observation and the visual monitoring (Watanabe 1999) indicates that the typical amplitude of outbursts is ~1 mag. The discovery observation may indicate the amplitude can be as large as 2 mag. The overall behavior of this star resembles those of low-amplitude dwarf novae, or of some NL-type variables. The likely existence of outburst periodicity (Watanabe 1999) prefers the dwarf nova interpretation.

Table 1: CCD observation of BF Eri

JD start[a]	JD end[a]	N^b	mag[c]	error[d]
51196.132	51196.198	140	1.96	0.01
51197.080	51197.154	61	1.96	0.04
51199.113	51199.139	20	2.05	0.03
51201.111	51201.137	33	2.05	0.02
51205.064	51205.112	77	2.14	0.01
51206.079	51206.115	36	2.00	0.03
51207.043	51207.099	97	2.05	0.01
51208.048	51208.050	3	1.93	0.12
51209.046	51209.101	118	2.20	0.01
51210.042	51210.069	23	2.02	0.06
51211.038	51211.060	48	2.05	0.02
51212.031	51212.073	82	2.34	0.02
51214.034	51214.035	3	1.95	0.12
51216.021	51216.098	190	2.21	0.01
51217.040	51217.088	117	2.19	0.01
51218.026	51218.083	138	2.13	0.01
51219.014	51219.081	100	1.99	0.02
51223.061	51223.079	11	2.17	0.14
51224.078	51224.082	8	2.24	0.05
51225.076	51225.078	5	1.96	0.08
51226.116	51226.117	2	2.20	0.17
51229.053	51229.055	5	1.72	0.04
51230.087	51230.089	5	1.58	0.03
51231.031	51231.033	6	1.70	0.07
51231.984	51231.985	4	1.86	0.03
51232.931	51232.933	4	2.02	0.05
51234.901	51234.903	5	2.49	0.04
51236.920	51236.920	1	2.58	-
51237.903	51237.905	5	2.28	0.05
51238.909	51238.910	5	2.18	0.03
51240.906	51240.907	5	2.25	0.10
51242.917	51242.918	3	2.32	0.06
51243.906	51243.908	5	2.19	0.06
51247.912	51247.914	5	1.96	0.05
51248.913	51248.915	7	2.17	0.04
51249.910	51249.912	4	2.16	0.16
51253.913	51253.915	5	1.99	0.09
51260.915	51260.917	4	2.46	0.06

[a] JD − 2400000
[b] Number of frames
[c] Magnitude relative to GSC 4743.801
[d] Standard error of nightly average

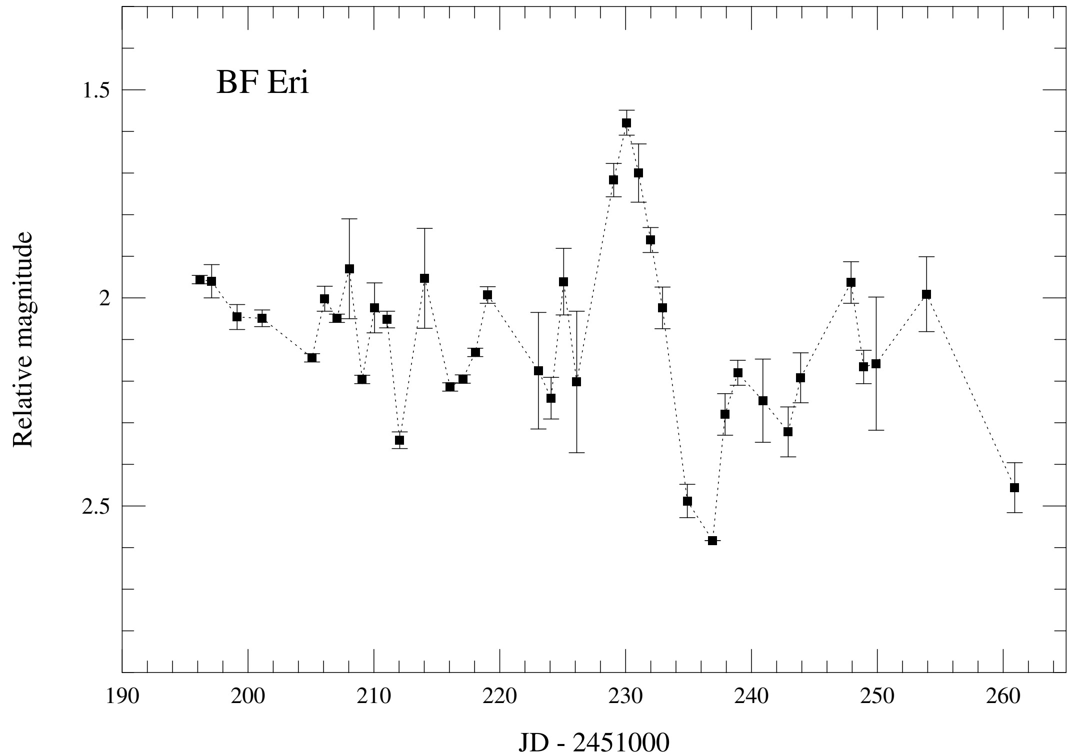

Figure 1. Long-term light curve of BF Eri

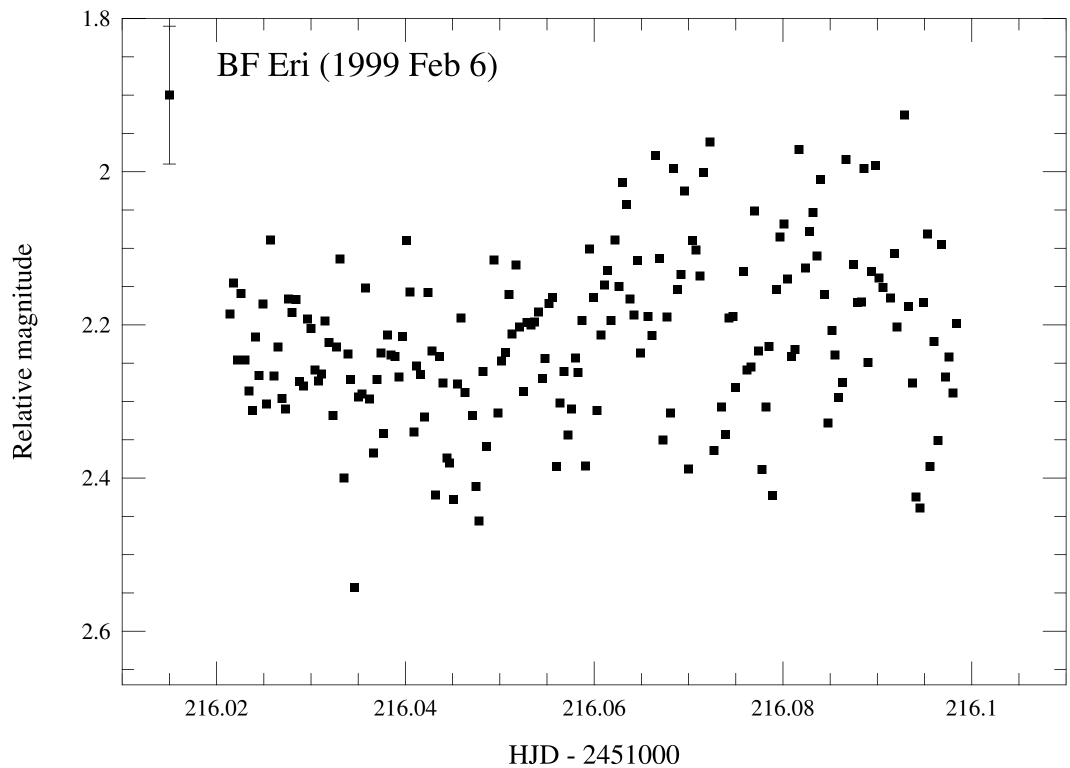

Figure 2. Short-term variability on 1999 February 6

Figure 2 illustrates a representative short-term light curve of BF Eri, where each point represents a single measurement. Slow modulations with a typical time-scale of 1–2 hours usually exist, with possible superposition of shorter time-scale modulations. However, Fourier analysis of the longer data sets, after subtracting the nightly trend, did not yield a stable periodicity between 0.05 d and 0.2 d.

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NEW VARIABLE STARS DISCOVERED IN THE MISAO PROJECT I: MisV0001–MisV0100

SEIICHI YOSHIDA[1], KENICHI KADOTA[2]

[1] MISAO Project, 1065-16 Miyawada Fujishiro-machi Kitasoma-gun Ibaraki 300-1514, Japan,
e-mail: seiichi@muraoka.info.waseda.ac.jp

[2] MISAO Project, 77-1-3-12-204 Koshikiya Ageo City Saitama 362-0064, Japan,
e-mail: kenic-k@astroarts.co.jp

This report describes the 100 new variable stars (MisV0001–MisV0100) discovered in the course of the MISAO Project.

The goal of the MISAO Project, standing for Multitudinous Image-based Sky-survey and Accumulative Observations, is to discover new celestial objects or to obtain photometric data from multitudinous astronomical images. The details are described on the MISAO Project Home Page:

`http://www.info.waseda.ac.jp/muraoka/members/seiichi/misao/`

Here we use only the unfiltered CCD images taken by KenIchi Kadota in Ageo City, Japan, for new variable stars survey. The images were taken between 1998 December and 1999 June, mainly with a 0.18-m f/5.5 reflector and 0.16-m f/3.3 reflector. The CCD chip is Kodak KAF-1600.

We used the PIXY system for the survey. The PIXY system, standing for Practical Image eXamination and Inner-objects Identification system, is developed and distributed by Seiichi Yoshida. It automatically detects stars from images, measures the position and magnitude, identifies them with known variable stars in the GCVS, etc., and outputs candidates of new objects and new variable stars. After the PIXY system output candidates of variable stars, Seiichi Yoshida and KenIchi Kadota manually checked each of them on our CCD images. Then we found 100 objects are really variable and previously unknown. We judged only ones whose variability is surely evident as new variable stars.

Here is the list of 100 new variable stars (Table 1). The position and magnitude are measured with USNO–A1.0 catalog. Because the pixel size is 3.7 arcsec/pixel or 6.9 arcsec/pixel, astrometric errors may sometimes exceed 2 arcsec, except for stars identified with data in the Guide Star Catalogue or the USNO–A1.0 catalog. The magnitude is based on a preliminary V magnitude calculated from R and B magnitude in the catalog based on Taichi Kato's (1998) equation:

$$V = R + 0.375(B - R)$$

So the value is somewhat shifted from magnitude in the standard system. But it does not matter for range of variability. Because they were observed on a few nights, the period is quite uncertain. The preliminary type is attached for some objects observed for several nights. Most of them were observed twice or more during a few month interval and the magnitude difference is over 1 mag, so most of them will be long period variable stars (M or SR type). The latest list, being updated with our follow-up observations, is available at the MISAO Project Home Page. The finding charts are available electronically as 4746-f[*nnn*].eps, where [*nnn*] refers to the serial number assigned to the star in the first column of Table 1.

We would like to thank Dr. Taichi Kato for checking known variable stars, his advice on type of variability, and many informative discussions.

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Taichi Kato, 1998, `http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-chat/msg00700.html`

Table 1: List of New Variable Stars

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Unfiltered CCD Mag. Min	Type	Identified with
MisV0001	$17^h52^m26.^s59$	$-17°40'00.''7$	13.9	16.9	M	
MisV0002	07 24 03.56	+41 26 02.0	13.3	14.7	E:	GSC 2965.0210 USNO 1275.06972791
MisV0003	17 52 44.93	−17 24 01.4	12.5	13.7	SR:	
MisV0004	17 53 13.59	−17 28 44.2	12.1	14.8	M:	
MisV0005	16 59 28.08	−13 23 14.1	12.3	14.1	?	USNO 0750.10268837
MisV0006	17 56 05.00	−31 15 20.9	11.7	13.2	?	
MisV0007	17 00 05.99	−16 04 14.3	12.7	13.8	?	USNO 0675.11655030
MisV0008	17 55 53.96	−31 14 43.2	14.1	15.9	?	
MisV0009	18 59 11.39	−01 34 10.9	11.5	13.4	?	USNO 0825.13934695 IRAS 18565-0138
MisV0010	17 55 13.12	−31 14 51.8	13.0	15.8	?	USNO 0525.24816214
MisV0011	17 50 40.92	−17 40 38.1	12.0	13.6	SR:	IRAS 17477-1739
MisV0012	17 56 44.26	−31 04 01.5	11.8	14.1	SR?	IRAS 17534-3103
MisV0013	17 56 48.87	−31 01 48.7	12.7	15.0	?	
MisV0014	17 56 37.90	−31 00 45.7	12.6	16.3	?	
MisV0015	17 56 26.80	−31 11 01.1	12.8	14.1	?	USNO 0525.24950305
MisV0016	17 56 39.69	−30 59 28.7	13.4	16.3	?	
MisV0017	17 57 22.16	−30 54 57.3	11.1	14.1	M:	
MisV0018	17 54 48.31	−31 02 20.2	11.8	14.7	?	
MisV0019	17 54 56.77	−31 02 25.8	14.0	[16.5	?	IRAS 17516-3101
MisV0020	17 54 52.49	−31 02 48.3	13.2	15.6	?	

Table 1 (cont.)

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0021	$17^h55^m31^s.57$	$-31°05'23''.0$	11.9	15.0	?	
MisV0022	17 55 28.00	−31 04 25.0	12.9	17.0	?	
MisV0023	17 55 53.13	−31 02 24.8	15.0	16.3	?	
MisV0024	17 55 58.13	−30 47 10.7	13.1	16.2	?	
MisV0025	17 56 33.46	−30 46 29.0	13.1	14.8	?	
MisV0026	17 57 08.98	−30 58 22.8	13.5	14.8	?	
MisV0027	17 54 44.64	−31 05 39.9	12.8	[16.5	?	
MisV0028	17 55 17.97	−31 00 32.8	13.9	[16.0	?	
MisV0029	17 54 44.64	−30 53 40.2	13.2	[15.9	?	
MisV0030	17 56 37.14	−30 51 05.4	13.8	16.4	M?	USNO 0525.24967963
MisV0031	17 54 24.43	−31 05 34.1	14.5	16.0	?	USNO 0525.24729694
MisV0032	17 54 37.67	−30 53 27.4	13.9	16.9	?	
MisV0033	18 57 42.22	−10 49 04.0	11.7	12.7	?	
MisV0034	17 55 52.15	−30 48 38.8	15.5	[17.5	?	
MisV0035	17 56 44.25	−30 49 46.8	14.3	16.2	?	USNO 0525.24980364
MisV0036	17 56 38.72	−30 53 18.4	14.7	[16.5	?	
MisV0037	18 02 29.85	−28 14 13.3	12.1	13.5	?	
MisV0038	16 51 24.64	−28 21 54.5	10.8	12.7	?	
MisV0039	16 52 24.02	−28 15 48.9	11.1	13.8	?	
MisV0040	17 53 39.87	−17 38 43.5	12.7	16.5	?	USNO 0675.14692405
MisV0041	17 59 49.03	−29 35 40.5	12.6	14.6	?	GSC 6853.4327
						USNO 0600.14864584
						IRAS 17566-2935
MisV0042	19 00 40.53	−09 51 47.4	12.8	14.0	SR:	IRAS 18579-0956
MisV0043	18 01 49.51	−30 15 48.9	12.4	13.4	SR?	
MisV0044	18 01 45.26	−30 05 00.9	13.1	14.2	SR?	
MisV0045	18 01 35.80	−30 15 57.1	13.7	15.0	?	USNO 0525.25491989
MisV0046	18 00 20.27	−29 42 58.4	13.3	14.4	SR?	
MisV0047	17 59 59.90	−29 34 20.6	12.7	13.8	SR?	
MisV0048	17 58 02.28	−29 44 39.7	13.7	15.2	?	IRAS 17548-2944
MisV0049	18 01 13.80	−30 20 36.3	13.9	15.1	?	
MisV0050	18 00 44.22	−29 53 14.8	12.9	15.0	SR?	
MisV0051	19 01 09.98	−10 03 30.2	12.5	14.0	SR?	USNO 0750.16201845
MisV0052	18 09 13.80	−27 12 00.0	14.2	16.0	?	USNO 0600.15381676
MisV0053	18 09 02.56	−27 25 40.9	13.9	14.9	?	
MisV0054	18 07 36.96	−27 33 48.2	12.7	14.7	?	
MisV0055	18 23 30.51	−27 27 14.5	13.6	16.4	?	
MisV0056	18 22 21.19	−27 29 52.2	12.8	13.5	?	IRAS 18192-2731
MisV0057	18 22 08.54	−27 31 06.9	13.4	14.8	?	
MisV0058	18 21 50.91	−27 28 04.6	12.8	14.0	?	
MisV0059	18 21 26.89	−27 43 41.4	12.9	14.0	?	
MisV0060	17 54 47.58	−31 01 25.9	12.3	14.3	SR?	

Table 1 (cont.)

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0061	17h57m28.s21	−31°15′30.″1	12.4	15.0	M?	
MisV0062	17 59 20.99	−31 09 19.0	14.0	[15.7	?	
MisV0063	18 02 34.53	−31 19 35.1	13.8	15.2	?	
MisV0064	17 55 12.07	−31 01 14.4	11.7	13.7	SR?	
MisV0065	18 02 33.86	−31 25 19.8	12.2	14.3	SR?	
MisV0066	17 57 36.24	−30 59 50.4	11.3	13.9	?	
MisV0067	17 54 53.08	−30 57 36.1	13.5	14.8	SR?	
MisV0068	18 02 24.98	−31 24 07.2	14.1	15.9	?	
MisV0069	17 55 54.00	−31 11 19.9	14.2	[16.1	?	IRAS 17526-3110
MisV0070	18 01 02.50	−31 14 25.4	12.5	15.4	M?	USNO 0525.25432269
MisV0071	17 54 23.46	−30 57 50.2	14.1	15.3	SR?	USNO 0525.24728130
MisV0072	17 54 53.12	−31 16 15.2	13.6	15.3	?	
MisV0073	17 51 41.20	−17 36 07.1	14.2	15.3	L	USNO 0675.14585664
MisV0074	17 56 23.92	−31 10 47.9	14.8	[16.1	?	IRAS 17531-3110
MisV0075	17 57 25.34	−30 49 08.7	13.7	15.4	?	IRAS 17542-3049
MisV0076	17 55 33.09	−30 46 33.1	13.3	15.8	M?	IRAS 17523-3046
MisV0077	18 00 43.16	−31 15 40.3	12.2	15.2	?	IRAS 17573-3115
MisV0078	18 06 26.93	−27 29 21.2	14.3	15.2	?	USNO 0600.15154453
MisV0079	17 56 54.33	−30 48 50.1	14.1	16.1	?	
MisV0080	18 01 14.28	−31 05 42.8	11.6	13.0	?	
MisV0081	17 57 46.39	−31 20 06.9	12.9	14.2	?	
MisV0082	17 57 08.21	−30 04 28.6	13.0	14.3	?	USNO 0525.25021831
MisV0083	17 59 42.50	−31 22 37.7	12.8	14.7	?	USNO 0525.25291095
MisV0084	17 59 48.12	−31 22 47.2	12.9	14.8	SR?	USNO 0525.25302138
MisV0085	17 58 31.37	−31 14 46.3	11.8	13.2	SR?	
MisV0086	17 59 40.48	−29 37 56.5	12.5	13.6	SR?	
MisV0087	17 58 45.86	−29 56 08.7	11.4	12.9	SR?	
MisV0088	17 59 37.33	−29 38 30.2	11.6	13.2	SR?	
MisV0089	18 00 42.98	−30 13 06.2	12.6	13.8	?	
MisV0090	18 00 00.97	−29 28 56.1	12.1	13.9	?	IRAS 17568-2928
MisV0091	18 05 29.22	−27 48 22.5	12.7	14.2	SR?	USNO 0600.15079523
MisV0092	18 00 39.72	−28 31 46.3	13.2	14.8	?	IRAS 17575-2831
MisV0093	18 00 04.49	−29 50 09.0	12.7	14.7	SR?	IRAS 17568-2950
MisV0094	17 54 20.48	−30 47 50.2	13.6	15.2	?	IRAS 17511-3047
MisV0095	17 57 13.50	−30 06 16.8	12.7	13.8	?	
MisV0096	17 55 05.29	−30 56 11.5	13.3	14.6	?	USNO 0525.24802319
MisV0097	18 01 30.15	−31 32 15.9	14.8	16.2	?	
MisV0098	18 01 15.93	−31 34 05.8	13.1	14.2	?	
MisV0099	17 59 36.96	−31 24 47.1	13.2	[15.4	?	
MisV0100	17 58 41.05	−31 15 17.2	13.2	16.6	?	

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THE LIGHT CURVES OF SX Phe STARS IN NGC 6752

E. PORETTI

Osservatorio Astronomico di Brera, Via E. Bianchi 46, I-23879 Merate (LC), Italy
E-mail: poretti@merate.mi.astro.it

Recently, attention has been paid to short period ($P < 0.07$ d) pulsating stars located in globular clusters. Poretti (1999) re-analyzed the data collected by the OGLE team on 34 new SX Phe stars in ω Centauri: Fourier decomposition extended the $\varphi_{21} - P$ relationship toward shorter periods. The existing progression (Antonello et al. 1986; Poretti et al. 1990) is continued in a natural way, even if some peculiarities were found: a group of deviant points around 0.038 d, a change in the slope around 0.050 d and a single, unusual light curve (OGLEGC 26, $P = 0.038$ d).

Thompson et al. (1999) reported on CCD photometry of 11 new variable stars in the field of another globular cluster, NGC 6752. Among them, there are three new SX Phe stars. Their light curves look very different from each other and the classification of their properties (pulsation mode, membership in the cluster, ...) are considered to be problematic. It is interesting to examine the properties of their light curve to verify the results obtained in ω Cen.

First, we confirmed the previously found periods using an independent frequency analysis; we note that the spectral window is good since aliases at ± 1 c d^{-1} are below the 60 % of the central peak. Then, we applied the Fourier decomposition. Three V–light curves deserve attention:

Star 13 ($P = 0.046877$ d) — The full amplitude is only 0.08 mag, but the light curve is very well defined. A 2$^{\rm nd}$–order fit leaves a residual of only 0.010 mag and an accurate φ_{21} value can be derived (3.43 ± 0.17 rad), in excellent agreement with the expected value. Contrary to the doubts expressed by Thompson et al. (1999), there is no problem in considering this star as one which pulsates in its fundamental mode.

Star 7 ($P = 0.059076$ d) — Its φ_{21} value is well defined (3.76 ± 0.10 rad) and very close to the expected one. The large amplitude allows a 3$^{\rm rd}$–order fit. The φ_{31} value (1.36 ± 0.52 rad) is in excellent agreement with the φ_{31} values reported by Poretti (1999; Table 1), which in turn are very coherent with those of large-amplitude galactic variables.

Star 12 ($P = 0.040895$ d) — It is the most interesting star since its period falls in the region where Poretti (1999) found some deviant φ_{21} values. Unfortunately, the light curve has a full-amplitude of only 0.05 mag and the derived Fourier parameters are a little uncertain. However, the φ_{21} value is actually higher than expected (4.0 ± 0.4).

Fig. 1 shows the φ_{21} values of the pulsating stars found in the Galaxy (open squares with 0.06 d$< P <$0.08 d correspond to CY Aqr, ZZ Mic and V831 Tau), in ω Cen (filled dots) and in NGC 6752 (crosses). The points related to OGLEGC 26 and OGLEGC 62

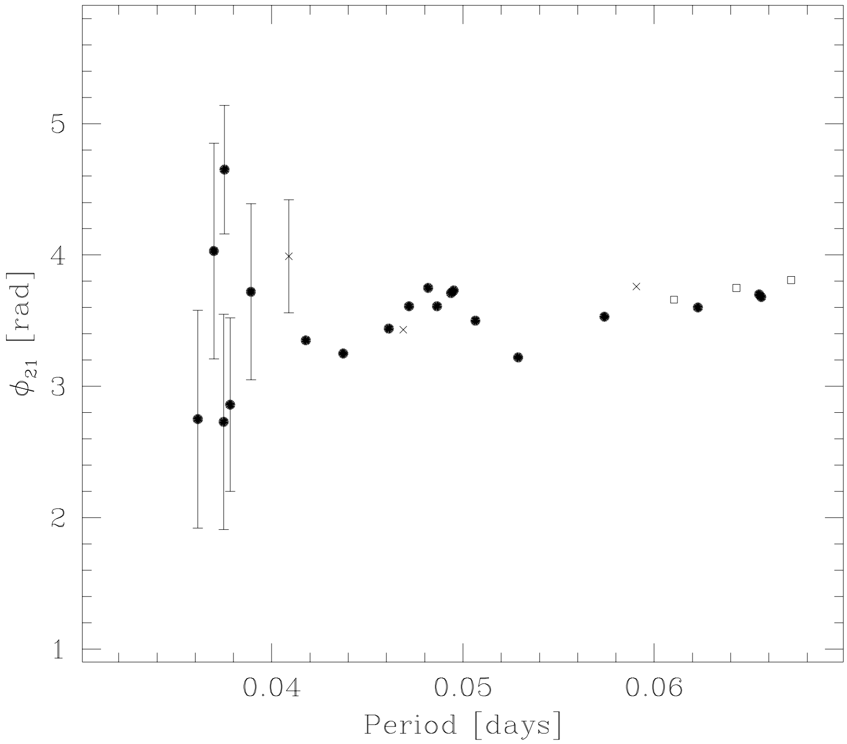

Figure 1. The $\varphi_{21} - P$ plot for pulsating variables observed in the Galaxy (squares), in ω Cen (filled dots) and in NGC 6752 (crosses). Error bars are reported for the small amplitude stars suggesting two separated groups at $P < 0.042$ d.

are omitted (see Poretti 1999 for discussion). From Fig. 1 it is quite evident that we find pulsating stars with only $P < 0.06$ d in globular clusters. As an additional example, the shortest period observed in the OGLE database is 0.056 d (V116 in the BW8 field; Udalski et al. 1995).

It should be noted that the dispersion of the φ_{21} values for stars with $P < 0.042$ d is much larger than for stars with $P > 0.042$ d. Of course, this can result from the larger errors related to the small amplitudes (less than 0.08 mag) of the shortest period variables; error bars are shown in Fig. 1 for this purpose. However, the working hypothesis of two different pulsation modes (fundamental or first overtone radial modes, non-radial modes) should be fruitfully investigated on the basis of new, more accurate data.

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DIFFERENTIAL UBV PHOTOMETRY OF TWO CP3 STARS: 11 Her AND 6 Her

M. ZBORIL & J. BUDAJ

Astronomical Institute, Tatranská Lomnica, 059 60, Slovakia, e-mail: zboril@ta3.sk, budaj@ta3.sk

The chemically peculiar star 11 Her (φ Her, HR 6023, HD 145389, HIP 79101, SAO 45911, B9p HgMn, $m_V = 4.3$) was selected from the paper of Catalano (1991) to investigate the photometric periods amongst Hg-Mn spectroscopic binaries. The object is an SB1 system with long orbital period of 560.5 days (Aikman 1976). Winzer (1974) found no evidence of significant photometric variations. Rakosch and Fiedler (1978) reported on period $7\overset{d}{.}832$ in the U filter with the amplitude 0.015 mag but state that the star is constant in B and V filters above the semiamplitudes 0.002 and 0.006 mag, respectively (based on UBV observations made in 1963-64 season). Since then, no undoubtful periodicity has been reported and especially as $7\overset{d}{.}832$ concerns. Catalano and Renson (1998) for example give the Rakosch and Fiedler (1978) period $7\overset{d}{.}832$ with question mark. Harmanec et al. (1994) mentioned that there might be some microvariability but not with the period after Rakosch and Fiedler (1978). Recently, very tiny light variations with the amplitude 0.007 mag from 4.219 to 4.226 mag were reported by ESA (1997) in the Hipparcos data. However, Adelman (1998) argues that the star is constant, the amplitude contains the contribution from noise for example.

The chemically peculiar star 6 Her (υ Her, HR 5982, HD 144206, HIP 78592, SAO 45865, B9IIIp, HgMn, $m_V = 4.6$) was used as comparison star by Rakosch & Fiedler (1978) and no variability has been reported as yet, including the Hipparcos observations.

Stellar spectra of both stars were studied and perhaps reported firstly by Slettebak (1954).

The UBV observations have been carried out at Stará Lesná observatory with the photo-electric photometer attached to 0.6 m reflector. The comparison stars were: already mentioned 6 Her (standard) and SAO 48568 (check, HD 144248, A5, $m_V = 7.6$), and the observations were made in the sequence 3 times comp. — 3 times var. — 3 times check. Each observation of the star was followed by recording the sky background. The observations were corrected for differential extinction. The standard star was identical with that from Rakosch and Fiedler (1978). The observations were made in overall number of 19 nights covering the season January 1991 up to September 1993. Duration of a typical night run was 1.5 hour.

The weather conditions enabled us to obtain good observations needed for the search for periodicities of low amplitudes around 0.02–0.03 mag as much as 12 nights on average. Tables 1 and 2 list the instrumental magnitudes in each filter. The night averages are given with corresponding *rms* errors and column entitled 'n' stands for number of individual measurements in particular night.

Table 1: 11 Her − 6 Her, JD = 2 400 000 +

JD	ΔU	±	n	JD	ΔB	±	n	JD	ΔV	±	n
—	—	—		48274.686	−0.454	0.003	6	48274.686	−0.490	0.001	6
48276.703	−0.372	0.001	8	48276.703	−0.449	0.001	8	48276.702	−0.484	0.001	8
48331.610	−0.364	0.003	10	—	—	—		48331.610	−0.480	0.002	10
48350.583	−0.370	0.005	9	48350.581	−0.454	0.004	10	48350.581	−0.486	0.004	9
48369.575	−0.367	0.004	9	48369.575	−0.444	0.004	9	—	—	—	
48436.409	−0.368	0.005	15	48436.409	−0.451	0.003	15	48436.408	−0.485	0.002	15
48646.678	−0.361	0.006	8	48646.678	−0.446	0.001	8	48646.678	−0.480	0.001	8
48691.589	−0.373	0.007	9	48691.589	−0.439	0.007	9	48691.589	−0.481	0.001	9
48692.547	−0.359	0.007	5	48692.547	−0.444	0.004	5	48692.547	−0.477	0.004	5
—	—	—		48841.431	−0.451	0.006	6	48841.429	−0.480	0.003	6
48993.702	−0.360	0.006	5	48993.703	−0.439	0.008	5	48993.701	−0.474	0.005	5
49030.668	−0.372	0.002	10	49030.617	−0.447	0.001	10	49030.617	−0.480	0.001	10
49253.347	−0.371	0.006	18	49253.347	−0.449	0.002	18	49253.346	−0.481	0.002	18

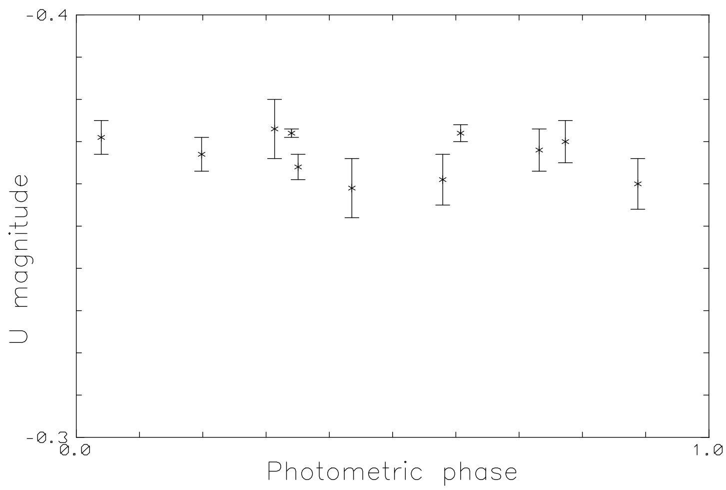

Figure 1. Phase diagram based on equation (1); U filter; 11 Her − 6 Her.

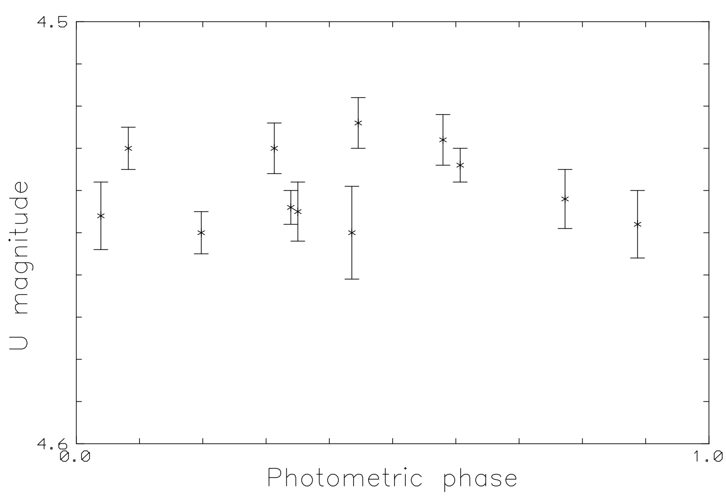

Figure 2. Phase diagram based on equation (1); U filter; 11 Her − Check.

Table 2: 11 Her − Check, JD = 2 400 000 +

JD	ΔU	±	n	JD	ΔB	±	n	JD	ΔV	±	n
48274.682	4.530	0.005	6	48274.681	4.134	0.003	6	48274.680	3.841	0.003	6
48276.697	4.544	0.004	8	48276.697	4.131	0.002	8	48276.700	3.830	0.002	8
48331.605	4.545	0.007	10	48331.605	4.129	0.003	10	48331.605	3.832	0.003	10
48350.577	4.542	0.007	9	48350.577	4.128	0.004	9	48350.577	3.830	0.004	9
48369.570	4.550	0.005	9	—	—	—		—	—	—	
—	—	—		—	—	—		48436.410	3.840	0.003	15
48646.682	4.528	0.006	8	48646.681	4.131	0.001	8	48646.681	3.835	0.002	8
48691.586	4.530	0.006	9	48691.586	4.131	0.001	8	48691.586	3.837	0.001	9
48692.545	4.550	0.011	5	48692.545	4.131	0.003	5	48692.544	3.836	0.004	5
48841.435	4.524	0.006	6	48841.435	4.118	0.003	6	48841.435	3.826	0.002	6
48993.699	4.548	0.008	5	48993.700	4.134	0.005	5	48993.698	3.846	0.004	5
49030.666	4.534	0.004	10	49030.614	4.133	0.001	10	49030.614	3.835	0.002	10
49253.344	4.546	0.008	18	49253.342	4.122	0.002	18	49253.343	3.842	0.004	18

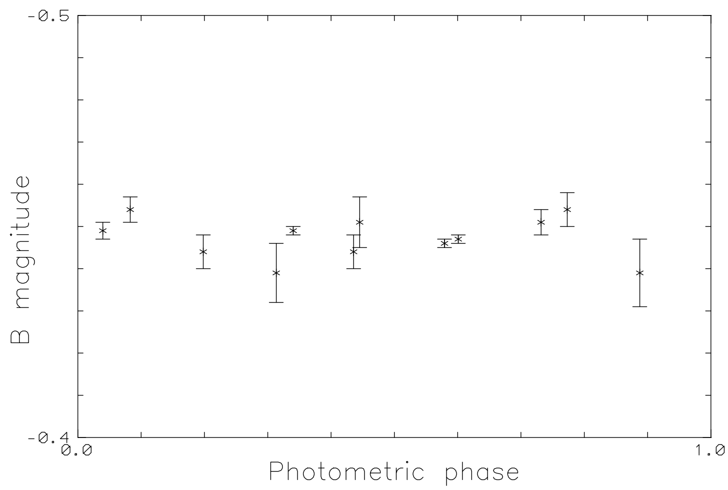

Figure 3. Phase diagram based on equation (1); B filter; 11 Her − 6 Her.

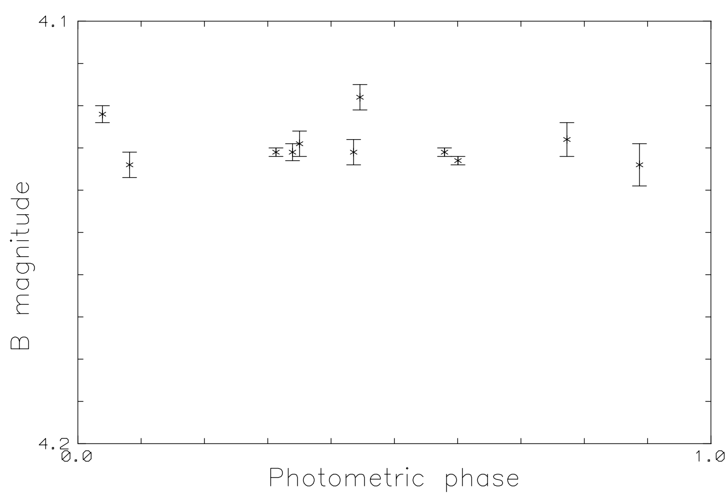

Figure 4. Phase diagram based on equation (1); B filter; 11 Her − Check.

We primarily focused the effort to verify the period of 7.832 days resulting from the ephemeris by Rakosch and Fiedler (1978):

$$\mathrm{JD}(\Delta U_{\mathrm{min}}) = 2438523.2 + 7.832 \times E. \quad (1)$$

Figures 1, 2 give magnitude differences vs. phase in U and B filters respectively. We did not find any outstanding period and the star seems to be constant. The power spectra enabled us to put the following constraints on the constancy (the semi-amplitudes) of the variable star: 7, 5, 4 mmag in U, B and V filters respectively. Consequently, we cannot confirm the period $7\overset{d}{.}832$ suggested by Rakosch and Fiedler (1978). Using 6 Her as standard star might not be a good practice but it was motivated by comparison stars option by Rakosch & Fiedler. As a byproduct we can state that the same constraints on the constancy are also valid for another CP3 star 6 Her, this time in agreement with the Hipparcos satellite observations.

Our UBV observations questioned the variability of 11 Her and suggest light constancy beyond 0.01 mag limit in the season 1991–1993. The same limit for light variability goes for comparison star and another CP3 star 6 Her. Similarly to Adelman (1993), Adelman et al. (1994) and Zboril and Budaj (1993) we added another star to a list of 'constant' HgMn stars (above 0.01 mag limit) which were originally reported as variable stars. However, we still welcome new observations since: *i*) we cannot exclude low amplitude variability below 0.01 mag such as that reported by ESA (1997), *ii*) the star was reported by Babcock (1958) as magnetic star and *iii*) the star might have changed the period or amplitude.

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THE SPECTRUM, PERIOD, AND PROPER MOTION OF V893 SCORPII

J. R. THORSTENSEN

Dept. of Physics and Astronomy, Dartmouth College, 6127 Wilder Laboratory, Hanover, NH 03755-3528, USA
e-mail: john.thorstensen@dartmouth.edu

The dwarf nova V893 Sco was recently recovered by Kato et al. (1998). Because its identification was obscure for so long, little is known about its outburst characteristics. I obtained spectra in 1999 June with the 2.4 m Hiltner telescope at MDM Observatory on Kitt Peak; details of the instrumentation, reduction and analysis were essentially identical to those in Thorstensen et al. (1998). There are 30 exposures of ~ 180 s each.

Fig. 1 shows the mean spectrum, and Table 1 lists the spectral features detected. He II $\lambda\,4686$ is somewhat stronger than usual for a dwarf nova, reminiscent of the X-ray emitter VZ Pyx (Remillard et al. 1994, Thorstensen 1997), and indeed Kato et al. (1998) note that V893 Sco is the likely counterpart of a ROSAT bright source. The emission lines are all double-peaked, with separation ~ 1200 km s^{-1} in He I $\lambda5876$. The dips in the central cores of the emission lines appear somewhat deeper than usual, with the cores of HeI extending down to the continuum in some exposures. The FWHM of the Hα emission is 43 Å. The continuum flux, which is uncertain by ~ 30 percent, implies $V = 15.5$.

I measured radial velocities of Hα (Table 2) using a convolution method (Schneider and Young, 1980). The convolution function used had positive and negative Gaussians of 14 Å FWHM separated by 56 Å. This emphasized the steep sides of the line profile. Fig. 2 shows the period search 'residual-gram' (Thorstensen et al. 1996). It indicates a period near 0.0760 d, though a daily cycle count alias at 0.0822 d is possible. The Monte Carlo test of Thorstensen & Freed (1985) indicates that the $0^{\rm d}\!.0760$ period is preferred at the ~ 98 per cent confidence level, so the choice is fairly secure but not definitive. Table 3 gives sinusoidal fits to the two aliases, of the form

$$v(t) = \gamma + K \sin[2\pi(t - T_0)]$$

Fig. 3 shows the velocities folded on each of the two best periods.

In addition to the spectra I acquired three 15-second V-band direct frames 1999 June 7.25 UT. Fig. 4 shows a finding chart. A fit of this image to the USNO A2.0 catalogue (Monet et al. 1996) and the Digital Sky Survey revealed significant proper motion since the plate from which these were derived (epoch 1977.5). The implied motion is 0.067 arcsec yr^{-1} in position angle 223 degrees, with an uncertainty of approximately 0.015 arcsec yr^{-1}.

All dwarf novae with periods similar to V893 Sco are SU UMa stars, which show superoutbursts and superhumps. As the photometric properties of V893 Sco are explored, it is very likely that it too will follow this pattern. The substantial proper motion and bright apparent magnitude both suggest a relatively small distance.

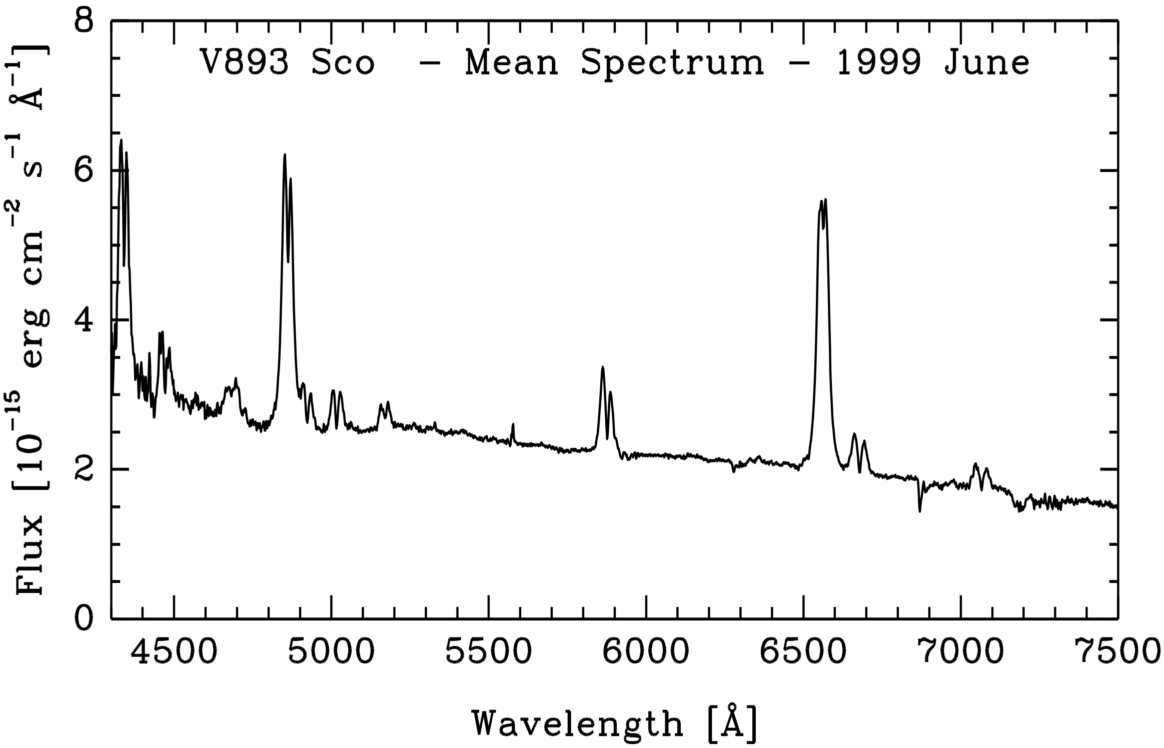

Figure 1. Mean spectrum of V893 Sco at minimum light.

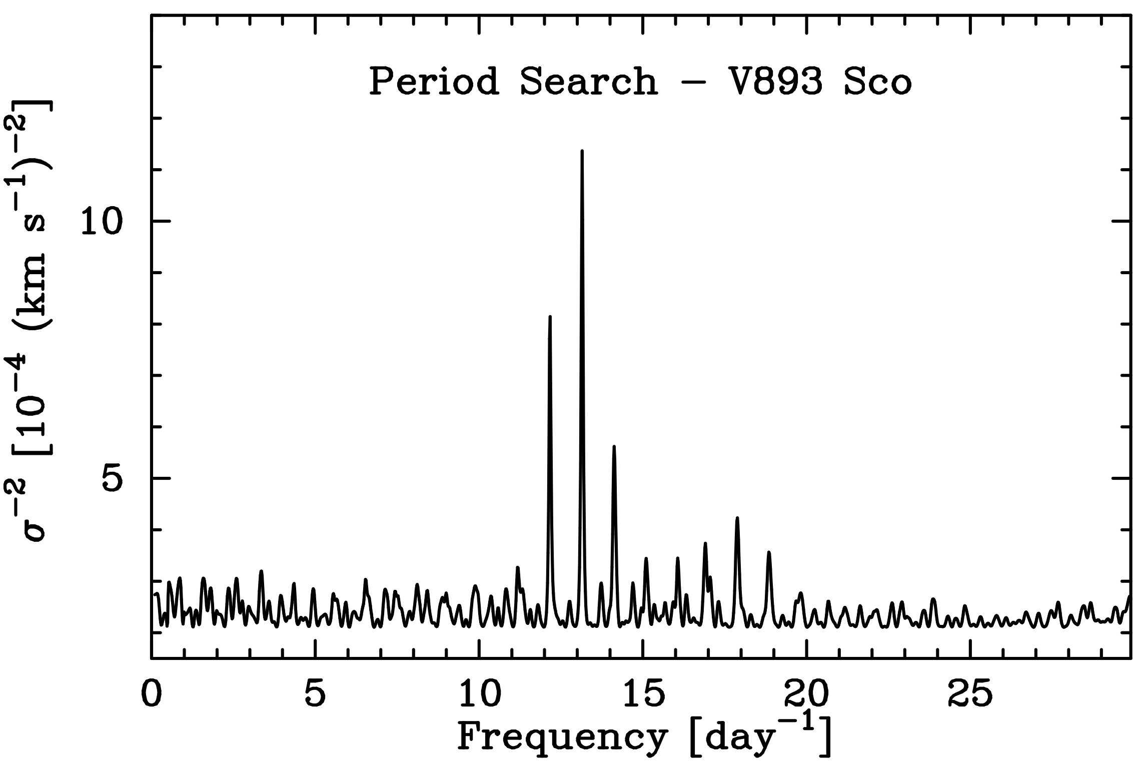

Figure 2. Periodogram of the Hα velocities.

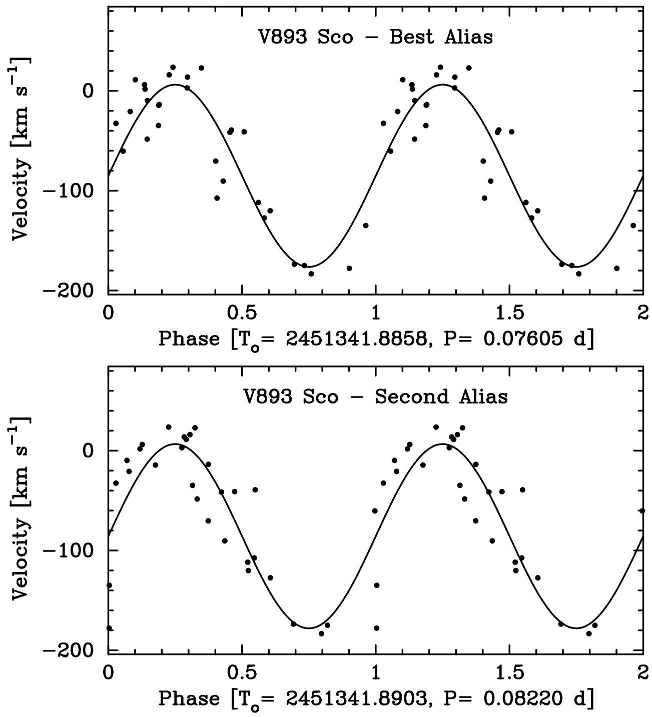

Figure 3. Velocities folded on the best period (upper panel) and on the second-best alias (lower panel). All points are shown twice for continuity.

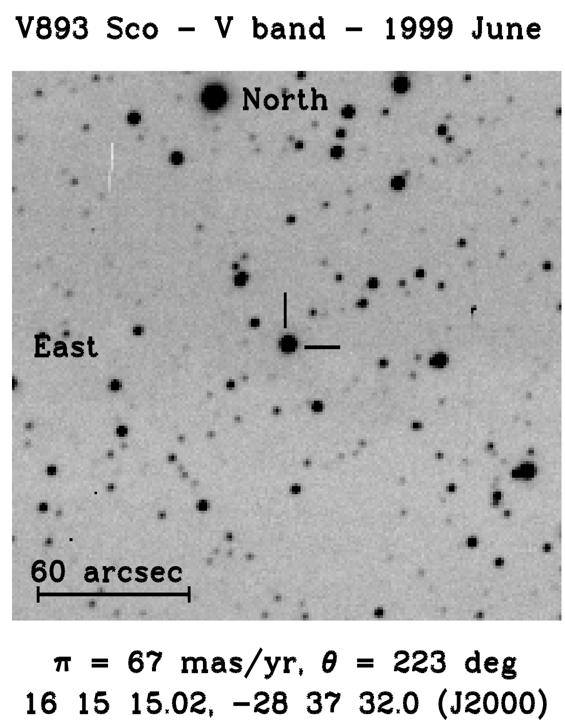

Figure 4. Finding chart for V893 Sco derived from a 1999 June *V*-band image. Orientation and scale are indicated, as is the position derived from a fit to USNO A2.0 stars.

Table 1: Spectral Features

Line	EW (Å)	F_λ^{a}
Hγ	41	1.2×10^{-13}
HeI 4471	8:	2.4×10^{-14}
HeII 4686	9	2.5×10^{-14}
Hβ	59	1.5×10^{-13}
HeI 4921	4:	1.2×10^{-14}
HeI 5015	7	1.7×10^{-14}
HeI 5876	18	3.9×10^{-14}
Hα	84	1.7×10^{-13}
HeI 6678	11	2.1×10^{-14}
HeI 7027	7	1.1×10^{-14}

[a] Uncertain by ~ 30 per cent, in erg cm^{-2} s^{-1} Å^{-1}

Table 2: Radial Velocities of Hα

HJD[a]	v[b]	HJD	v	HJD	v	HJD	v
1338.7901	14	1340.8314	2	1342.6608	−14	1343.8856	3
1338.8547	−10	1341.6885	−107	1342.7574	−39	1343.8897	23
1339.7534	−135	1341.7262	−178	1342.8513	−174	1343.8937	−70
1339.7890	−90	1341.7510	16	1343.8654	−33	1343.8978	−41
1339.8784	−120	1341.7914	−183	1343.8694	−21	1343.9018	−41
1340.6832	−35	1341.8900	−60	1343.8734	6	1343.9059	−112
1340.7247	−175	1342.6540	11	1343.8775	−14		
1340.7893	−127	1342.6574	−48	1343.8816	24		

[a] Heliocentric Julian date of mid-integration, minus 2450000. [b] Units of v are km s^{-1}.

Table 3 Fits to Hα Velocities

T_0^{a}	P (d)	γ (km s^{-1})	K (km s^{-1})	σ (km s^{-1})
1341.8858 ± 0.0012	0.07605 ± 0.00006	91 ± 9	-85 ± 6	30
1341.8903 ± 0.0014	0.08220 ± 0.00007	92 ± 11	-86 ± 7	36

[a] Heliocentric Julian date minus 2450000.

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CCD PHOTOMETRY OF THE ECLIPSING BINARY V1193 CYGNI

ROGER DIETHELM[1], MAREK WOLF[2]

[1] Astronomical Institute, University of Basel, CH - 4102 Binningen, Venusstrasse 7, Switzerland
E-mail: diethelm@astro.unibas.ch

[2] Astronomical Institute, Charles University Prague, CZ-180 00 Praha 8, V Holešovičkách 2, Czech Republic
E-mail: wolf@mbox.cesnet.cz

The eclipsing binary V1193 Cygni (= S 7895 Cyg = GSC 3949.0797 = FL 3046; $\alpha = 20^{\rm h}21^{\rm m}11\overset{\rm s}{.}48$, $\delta = +59°36'3\overset{''}{.}5$, J2000; $V_{\rm max} = 12.7 mag$) was discovered photographically in the field of the star 33 Cygni by Hoffmeister (1963) in Sonneberg. Later Gessner (1966) recognized the W UMa-type and derived the first light elements of low accuracy

$$\text{Pri. Min.} = \text{HJD } 2\,437\,668.228 + 0.674 \times E. \tag{1}$$

The CCD photometry of V1193 Cyg presented here was carried out during eight nights in August and November 1998 at the R. Szafraniec Observatory, Metzerlen, Switzerland, with the 35-cm Schmidt-Cassegrain telescope and an unfiltered CCD camera (SBIG ST-6). Additional measurements were done during the night of JD 2451361 with the same equipment. The standard error of the measurements varies from 0.01 mag to 0.02 mag. The stars GSC 3949.0039 (V = 11.0 mag) and GSC 3949.0271 (V = 12.1 mag) on the same frame as the variable served as comparison and check star, respectively (Figure 1). It is also remarkable, that V1193 Cyg is superimposed on a faint galaxy ($\sim$ 16 mag), whose nucleus lays slightly west of the variable. This galaxy as well as V1193 Cyg could be also identified with the source IRAS 20201+5926 ($\alpha = 20^{\rm h}21^{\rm m}12\overset{\rm s}{.}8$, $\delta = +59°36'19''$, J2000). Altogether 247 frames of this field were obtained and analysed. Table 1 contains three new epochs for minima, N denotes the number of measurements used for the precise determination of minimum time.

Our CCD observations confirm the W UMa-type of this eclipsing binary, but we find a substantially shorter orbital period of about 0.50376 days. This period also fits the minima of Gessner (1966) better, the corresponding new cycle counts are given in Table 1. A recalculation of the light elements using the 8 original times of minimum published by Gessner (1966) and our new epochs gives the following result:

$$\text{Pri. Min.} = \text{HJD } 2\,437\,668.2323 + 0.5037599 \times E. \tag{2}$$

Our photoelectric light curve was solved independently using a method of treating photometric data described by Mikulášek at al. (1995), which is a weighted LSM iterative

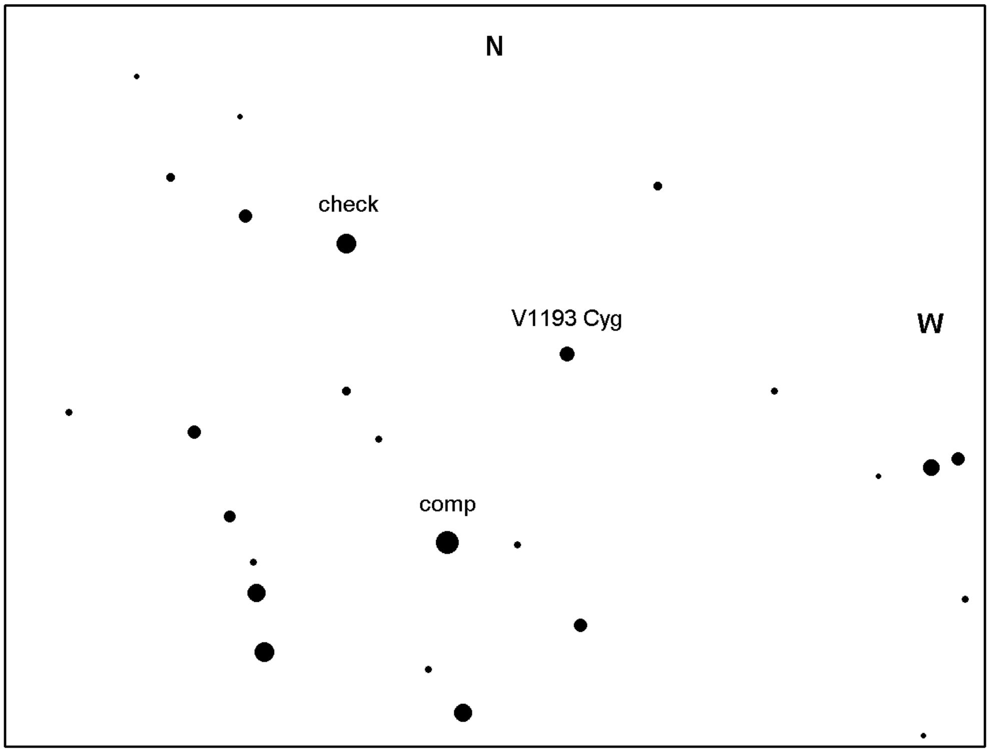

Figure 1. Finding chart of V1193 Cyg with the size of the field 8 × 6 arcmin.

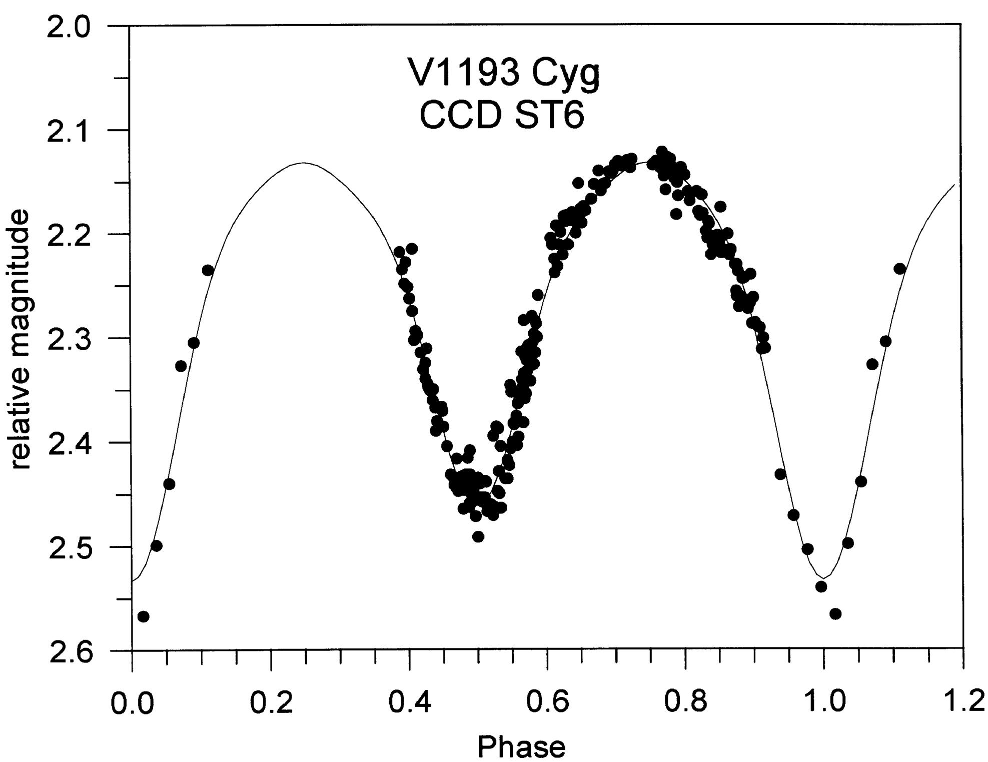

Figure 2. Composite light curve of V1193 Cyg for the period of 0.50376471 days.

Table 1: Times of minimum of V1193 Cyg.

HJD – 2 400 000	Epoch Gessner (1966)	Epoch this paper	
37668.228	0.0	0.0	
37669.224	1.5	2.0	
37898.455	341.5	457.0	
37906.516	353.5	473.0	
37917.585	370.0	495.0	
37944.557	410.0	548.5	
37964.441	439.5	588.0	
38348.316	1009.0	1350.0	
	Error [days]	Epoch	N
51052.3768	0.0003	26568.5	38
51107.2871	0.0005	26677.5	12
51361.4369*	0.0011	27182.0	14

* *published also in BBSAG Bull. No. 120*

procedure. Using this method we derive the current light elements, which could be used in the near future:

$$\begin{array}{rl}\text{Pri. Min.} = \text{HJD } 2\,451\,361.4371 & + \; 0.50376471 \times E. \\ \pm 0.0001 & \pm 0.00000005\end{array} \qquad (3)$$

Figure 2 shows the light curve folded with this period. The light amplitude for the primary minimum according to our measurement is $A_1 = 0.41 \pm 0.03$ mag, for the secondary minimum we find $A_2 = 0.33 \pm 0.01$ mag.

The difference of both derived periods ($\sim 5\times10^{-6}$ day) and a number of epochs elapsed since the first observations ($\sim$ 27 000) gives value of 0.135 days, which is smaller than the value of period P or $P/2$. Our newly determined epochs and the cycle count given in Table 1 is correct, which might hints towards the existence of a period change in the time interval between Gessner's data and ours. Further observations of this eclipsing system are necessary in order to establish a better value of the orbital period and/or its probable changes. Also, an investigation on photographic plates could help solve this questions.

Acknowledgements. This work has been supported in part by the Swiss National Science Foundation. M.W. is very grateful for the use of the facilities and the hospitality at the Astronomical Institute of University Basel in the August 1998. R.D. wishes to thank the "Emilia Guggenheim-Schnurr Foundation" for financial support.

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ERRATUM

In the Table of IBVS No. 4612 all spectral types MS should read M5. Therefore M5 spectral type is assigned to XX CMa, TU Car, DL Cen, BS Mon, HW Mon, W Mus, BO Pup, ES Pup, AD Vel, and NSV 5061. The original manuscript was correct. The errors occurred when the OCR software was utilized. With our apologies

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PHOTOELECTRIC MINIMA OF SOME ECLIPSING SYSTEMS

T. PRIBULLA, D. CHOCHOL, Š. PARIMUCHA

Astronomical Institute of the Slovak Academy of Sciences, SK 059 60 Tatranská Lomnica, Slovakia

We present 61 new minima times of 10 RS CVn and W UMa systems taken from August 1997 to July 1999 as a part of the program of the full light-curve coverages.

The U, B, V and R photoelectric observations were taken at the Skalnaté Pleso (SP) and Stará Lesná (SL) observatories of the Astronomical Institute of the Slovak Academy of Sciences. In both cases the 0.6-m Cassegrain telescope equipped with a single-channel pulse-counting photoelectric photometer was used. For all observations a 10 second integration was used. Data reduction, the atmospheric extinction correction and transformation to the standard system were carried out in the usual way.

We have calculated the times of minima separately fo all filters using the Kwee and Van Woerden's method, parabola fit, sliding integration method, tracing paper and "center of mass" method which were described in detail by Ghedini (1982). The computer codes were kindly provided by Dr. R. Komžík (1999). The average times of the primary (I) and secondary (II) minima and their probable errors found by these methods are given in Table 1.

Table 1: Times of minima of observed systems

System	HJD 2400000+	σ	Min. type	Filter	Obs.
RT And	50682.4317	0.0002	II	B	SP
	50682.4319	0.0003	II	V	SP
	50682.4321	0.0002	II	R	SP
	50708.53357	0.00010	I	U	SL
	50708.53319	0.00006	I	B	SL
	50708.53328	0.00009	I	V	SL
	50709.4757	0.0016	II	U	SL
	50709.47792	0.00012	II	B	SL
	50709.4781	0.0002	II	V	SL
	51041.5495	0.0024	II	B	SP
	51041.5499	0.0003	II	V	SP
	51041.5494	0.0002	II	R	SP
	51066.3935	0.0001	I	U	SL
	51066.3943	0.0002	I	B	SL
	51066.3944	0.0002	I	V	SL
	51142.49384	0.00009	I	B	SP
	51142.49359	0.00003	I	V	SP
	51142.49379	0.00004	I	R	SP
	51150.35510	0.00012	II	V	SP
	51150.35522	0.00009	II	R	SP
	51160.4160	0.0001	II	B	SL
	51160.4164	0.0004	II	V	SL

Table 1 (cont.)

System	HJD 2400000+	σ	Min. type	Filter	Obs.
44i Boo	50902.3649	0.0004	I	U	SL
	50902.3664	0.0007	I	B	SL
	50902.3665	0.0002	I	V	SL
	50902.4994	0.0010	II	U	SL
	50902.5037	0.0002	II	B	SL
	50902.5029	0.0007	II	V	SL
	50926.3413	0.0005	II	U	SP
	50926.3407	0.0002	II	B	SP
	50926.3402	0.0005	II	V	SP
	50926.3420	0.0003	II	R	SP
	50937.4540	0.0001	I	U	SL
	50937.4548	0.0001	I	B	SL
	50937.4569	0.0003	I	V	SL
	50939.4627	0.0007	II	U	SL
	50939.4626	0.0005	II	B	SL
	50939.4628	0.0007	II	V	SL
	50945.3570	0.0002	II	V	SL
	50945.49039	0.00005	I	V	SL
	51017.3936	0.0007	II	U	SL
	51017.3954	0.0004	II	B	SL
	51017.3969	0.0005	II	V	SL
	51256.4271	0.0001	I	B	SP
	51256.4295	0.0002	I	V	SP
	51256.4286	0.0002	I	R	SP
	51256.5635	0.0003	II	B	SP
	51256.5626	0.0003	II	V	SP
	51256.5627	0.0002	II	R	SP
SV Cam	50839.51107	0.00011	I	U	SL
	50839.51065	0.00017	I	B	SL
	50839.51054	0.00008	I	V	SL
	50849.3004	0.0008	II	U	SL
	50849.3002	0.0003	II	B	SL
	50849.2992	0.0002	II	V	SL
	50849.59314	0.00014	I	U	SL
	50849.59299	0.00006	I	B	SL
	50489.59289	0.00006	I	V	SL
	51158.2894	0.0005	II	V	SP
	51158.2919	0.0003	II	R	SP
	51160.36419	0.00006	I	B	SP
	51160.36412	0.00010	I	V	SP
	51160.36408	0.00007	I	R	SP
	51166.29450	0.00028	I	B	SP
	51166.29441	0.00014	I	V	SP
	51166.29418	0.00008	I	R	SP
	51166.5977	0.0008	II	B	SP
	51166.5939	0.0002	II	V	SP
	51166.5963	0.0008	II	R	SP
	51179.34403	0.00015	I	B	SP
	51179.34337	0.00022	I	V	SP
	51179.34303	0.00013	I	R	SP
EG Cep	51131.3400	0.0002	I	B	SP
	51131.3411	0.0002	I	V	SP
	51131.3416	0.0003	I	R	SP
VW Cep	51067.4198	0.0002	II	U	SL
	51067.4196	0.0002	II	B	SL

Table 1 (cont.)

System	HJD 2400000+	σ	Min. type	Filter	Obs.
VW Cep	51067.4202	0.0002	II	V	SL
	51067.5593	0.0005	I	U	SL
	51067.5597	0.0006	I	B	SL
	51067.5609	0.0001	I	V	SL
	51150.3595	0.0005	II	U	SL
	51150.35993	0.00005	II	B	SL
	51150.3609	0.0003	II	V	SL
	51151.33309	0.00009	I	U	SL
	51151.33378	0.00009	I	B	SL
	51151.33240	0.00014	I	V	SL
	51378.43746	0.00018	I	U	SL
	51378.43798	0.00016	I	B	SL
	51378.43771	0.00023	I	V	SL
WY Cnc	51150.57409	0.00018	I	U	SL
	51150.57324	0.00003	I	B	SL
	51150.57297	0.00008	I	V	SL
AW UMa	50927.4228	0.0005	II	U	SL
	50927.4226	0.0003	II	B	SL
	50927.4223	0.0003	II	V	SL
	51142.61804	0.00012	I	U	SP
	51142.61777	0.00026	I	B	SP
	51142.61698	0.00012	I	V	SP
	51142.61668	0.00008	I	R	SP
W UMa	50855.34850	0.00003	I	U	SL
	50855.34763	0.00028	I	B	SL
	50855.34804	0.00008	I	V	SL
	50863.35545	0.00007	I	U	SL
	50863.35554	0.00003	I	B	SL
	50863.35553	0.00002	I	V	SL
	50863.52428	0.00031	II	U	SL
	50863.52392	0.00009	II	B	SL
	50863.52311	0.00013	II	V	SL
	50872.36282	0.00015	I	U	SP
	50872.36285	0.00006	I	B	SP
	50872.36285	0.00013	I	V	SP
	50872.36292	0.00006	I	R	SP
	50890.38050	0.00007	I	U	SL
	50890.37998	0.00006	I	B	SL
	50890.38010	0.00001	I	V	SL
	51137.6050	0.0002	I	U	SL
	51137.6038	0.0002	I	B	SL
	51137.6045	0.0003	I	V	SL
	51150.44867	0.00003	II	B	SL
	51150.44866	0.00002	II	V	SL
XY UMa	51130.63588	0.00009	I	U	SL
	51130.63560	0.00006	I	B	SL
	51130.63569	0.00008	I	V	SL
	51141.65151	0.00004	I	B	SP
	51141.65114	0.00006	I	V	SP
	51141.65141	0.00004	I	R	SP
	51150.5089	0.0006	II	B	SP
	51150.5072	0.0010	II	V	SP
	51150.5100	0.0005	II	R	SP
	51158.41620	0.00004	I	B	SP
	51158.41647	0.00004	I	V	SP

Table 1 (cont.)

System	HJD 2400000+	σ	Min. type	Filter	Obs.
XY UMa	51158.41654	0.00005	I	R	SP
	51158.6505	0.0012	II	B	SP
	51158.6523	0.0010	II	V	SP
	51158.6546	0.0002	II	R	SP
	51177.57551	0.00003	I	B	SP
	51177.57570	0.00008	I	V	SP
	51177.57579	0.00008	I	R	SP
	51183.32611	0.00015	I	B	SP
	51183.32460	0.00012	I	V	SP
	51183.32435	0.00022	I	R	SP
	51200.5682	0.0003	I	U	SL
	51200.56779	0.00013	I	B	SL
	51200.56777	0.00005	I	V	SL
	51203.44184	0.00003	I	U	SL
	51203.44187	0.00006	I	B	SL
	51203.44206	0.00003	I	V	SL
	51237.4496	0.0001	I	B	SP
	51237.4508	0.0003	I	V	SP
	51250.38380	0.00005	I	B	SP
	51250.38368	0.00008	I	V	SP
	51250.38325	0.00009	I	R	SP
	51256.3719	0.0003	II	V	SP
	51256.3734	0.0004	II	R	SP
	51273.3757	0.0010	I	U	SL
	51273.37539	0.00023	I	B	SL
	51273.37538	0.00016	I	V	SL
	51274.33421	0.00026	I	U	SL
	51274.33334	0.00028	I	B	SL
	51274.33357	0.00025	I	V	SL
	51278.4121	0.0009	II	U	SL
	51278.4104	0.0009	II	B	SL
	51278.4118	0.0020	II	V	SL
ER Vul	51032.3975	0.0002	II	U	SL
	51032.4003	0.0004	II	B	SL
	51032.39722	0.00008	II	V	SL
	51034.4925	0.0004	II	U	SL
	51034.4923	0.0002	II	B	SL
	51034.4921	0.0003	II	V	SL
	51041.4737	0.0004	II	U	SL
	51041.4726	0.0001	II	B	SL
	51041.4739	0.0002	II	V	SL

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RECENT LIGHT CURVES AND PERIOD STUDY OF THE CONTACT BINARY W URSAE MAJORIS

J.M. DEPASQUALE, J.J. BOCHANSKI, E.F. GUINAN

Astronomy & Astrophysics Department, Villanova University Villanova, PA, USA

W Ursae Majoris (HD 83950) is a well-known F8V+F8V eclipsing binary system and is the prototype for W UMa-type contact binaries. A recent determination and discussion of its properties is given by Linnell (1991). W UMa was recently observed at the Villanova Observatory by J. DePasquale, C. Henry, I. Nadalin, and M. Stump on the nights of 30, 31 March, and 06, 13, 14, 15 and 25 April UT, 1999. The observations were obtained by using the same equipment and filters as described in Morgan et al. (1997). Over 800 new observations were recorded. The comparison star was HD 83728 ($V = +8.89$; $B-V = +1.07$; K2) and HD 83784 ($V = +8.88$; $B-V = +0.90$; K0) served as the check star. These were the same stars used previously at Villanova (since 1982) and found to be constant in brightness. The observations were reduced in the usual way with corrections for differential atmospheric extinction applied. However, because of the angular proximity of the comparison and variable stars, the extinction corrections were very small. Also, the UT times were converted to heliocentric Julian Day number.

The yellow and red observations were formed into light curves and are shown in Figure 1. In the figure the differential magnitudes, in the sense of variable *minus* comparison star (V − C), are plotted against orbital phase. The phases were computed using updated light elements so that recent primary minima occur at 0.0 phase:

$$T(\min \mathrm{I}) = \mathrm{HJD}\ 2451268.7233 + 0.33363808 \times E. \qquad (1)$$

As can be seen in the figure, the light curves are well defined and show the characteristic continuous light variations that are typical for W UMa-type binaries. The light variations arise from the mutual eclipses of the component stars as well as from chiefly tidal distortion and reflection effects. The light curves are similar (but not identical) to the ones reported earlier by Morgan et al. (1997) using the same equipment and filters. As is usually the case for W UMa, the light curves show small asymmetries that change with time. The maximum at 0.25 phase is about 0.031 mag fainter than the maximum at 0.75 phase in the y-bandpass and about 0.015 mag fainter in the red bandpass. As shown in Fig. 1, there is also a noticeable distortion in the light curve near the bottom of primary eclipse. These asymmetries and photometric anomalies most likely arise from the presence of starspots on one or both stars of the system (see e.g., Guinan & Bradstreet 1988). W UMa, and typically most W UMa-type stars with cool components, display the manifestations of strong magnetic-dynamo activity such as: enhanced chromospheric emissions, strong coronal X-ray emission, and photometric anomalies in their light curves

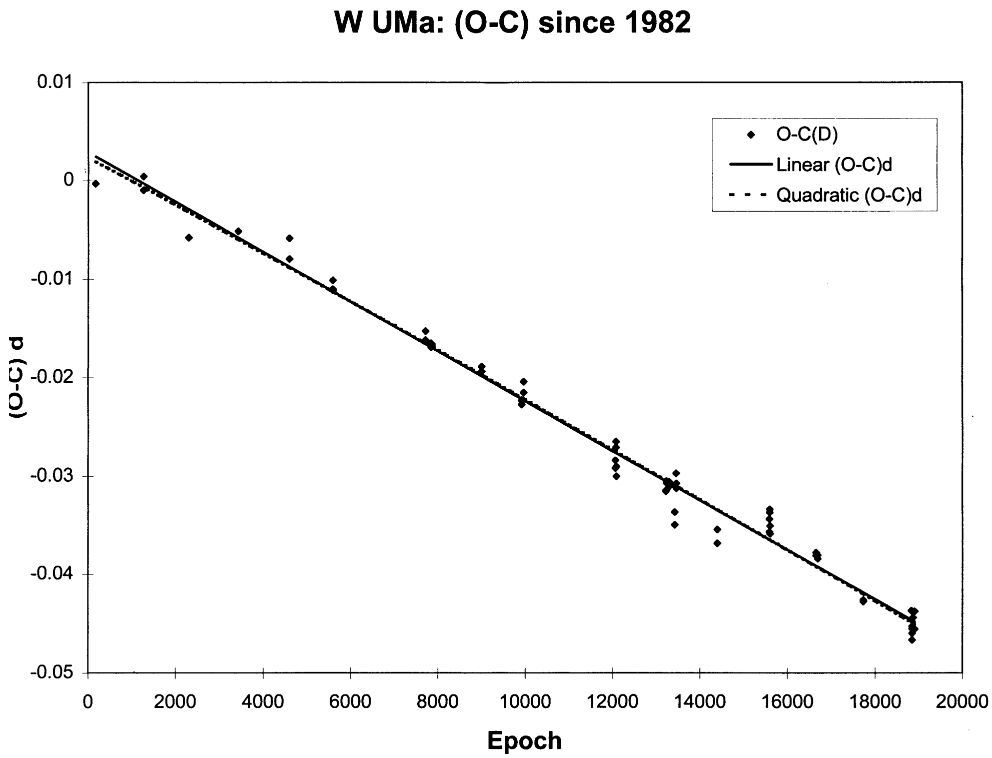

Figure 1.

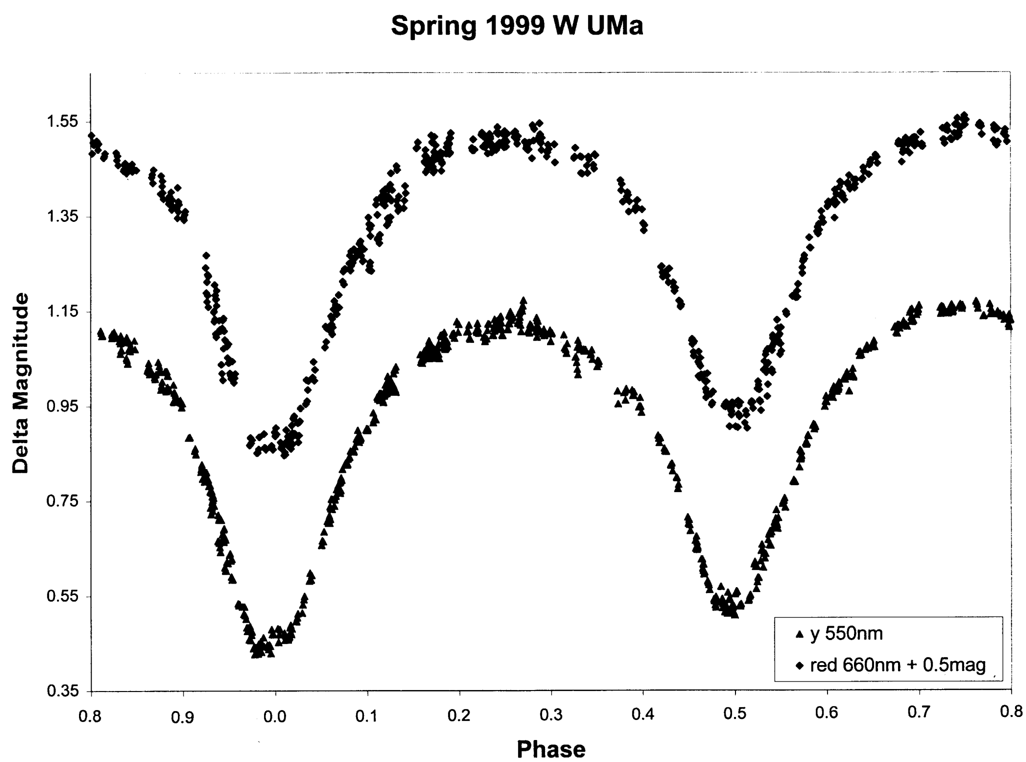

Figure 2.

produced by large starspots (see e.g., Guinan & Giménez 1993). Preliminary analyses of the March-April 1999 light curves indicate the presence of at least two spot regions on the stars. One extended spotted region is most visible near 0.20–0.30 phase and produces the small depression in the light curves seen during the quadrature near 0.25 phase.

Several primary and secondary minima were observed during 1999. Times of minimum light were determined from least squares parabolic fits to the eclipse data. Also, timing determinations were made by reflecting the ingress and egress branches of the eclipses to check the least squares fits. Both methods yielded consistent results when the observations in the lower half of the eclipses were used in the analyses. Times of minimum light were independently determined for the yellow and red data but no systematic differences were found. However, the yellow data had less scatter and yielded somewhat higher precisions to the timings. The new minima are given in Table 1. Additional eclipse timings were obtained from unpublished observations made at Villanova during 1996, 1997, 1998. These additional determinations are listed in Table 1 as well.

Table 1: Times of Primary and Secondary Eclipses of W UMa (1996–1999)

Filter	Type	JD Hel (2450000+)	Observer
r	I	0188.7466	S. Margheim
$b(n)$	I	0188.7453	”
r	I	0191.7487	S. West
$b(n)$	I	0191.7479	”
r	II	0191.5836	”
$b(n)$	II	0191.5832	”
y	II	0543.5673	R. Mittal
r	II	0543.5670	”
y	II	0554.5771	R. Slevinsky
r	II	0554.5767	”
y	I	0901.7228	P. Dituro
r	I	0901.7229	”
y	I	1268.7229	J. DePasquale
r	I	1268.7238	”
y	II	1274.5606	I. Nadalin
r	II	1274.5608	”
y	I	1274.7263	”
r	I	1274.7270	”
y	II	1281.5670	J. DePasquale
r	II	1281.5681	”
y	I	1293.7448	M. Stump
r	I	1293.7465	”

r = 660 nm; $b(n)$ = 453 nm; y = 550 nm

Morgan et al. (1997) have carried out a period study of W UMa from observations collected at Villanova from 1982 to 1995 and found that the period has been relatively constant during that interval. In Figure 2, we extend this study to 1999 by combining the minima given here with those already published by Morgan et al. (1997). In the figure the $O-C$ values are plotted against the number of cycles elapsed (E). $O-C$ values were calculated with the ephemeris used previously by Morgan et al. (1997). Linear (solid line) and parabolic (dotted curve) least squares fits were made to the data, but as shown in the figure, there is little difference between them. Thus, for this interval of time we adopt a linear fit and the mean period during this time interval is $P_{(1982-1999)} = 0.33363554$ d. This is the same value found by Morgan et al. 1997. However, W UMa has a long history of complicated changes in apparent period over time (see e.g., Hamzaoğlu et al. (1982) and Morgan et al. (1997) and that the relatively *constant* period found over the last 15-20 years is probably transitory. However, the light elements given above may be used to predict eclipses over the next few years.

A closer examination of the Figure 2 also reveals possible small (~ 0.002 d) systematic residuals of the $O-C$ values from the linear or quadratic ephemeredes. These short-term variations could arise from asymmetries in the light curve caused by the presence of dark starspots that skew the shape of the minima and produce apparent shifts in the measured mid-eclipse times. The residuals also could be produced from dynamical effects either from small changes in the orbital period or from the light-time effect of a third body. However, if a third body were present then the resulting residuals would be periodic in nature. This does not appear to be the case from the present data. As pointed out by Morgan et al. (1997), the present period is about 22 sec shorter than previous values. The apparent decrease of the period with time could arise from angular momentum loss from magnetic braking or could be due to mass transfer between the components.

Additional photoelectric photometry of W UMa is planned at Villanova University Observatory. This research is supported in part from a NSF/RUI grant AST-9315365 to Villanova University, which we gratefully acknowledge. For this research, we utilized the SIMBAD database, operated by CDS, Strasbourg, France.

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UBV OBSERVATIONS OF THE MASS EXCHANGING SOLAR-TYPE BINARY, BE CEPHEI

RONALD G. SAMEC[1,3], N.W. GOTHARD[1], B.C. PARKER[1], T.W. SAVAGE[1], S.D. ANDERSON[1], DANNY R. FAULKNER[2,3]

[1] Department of Physics, Bob Jones University, Greenville, SC 29614 USA, rsamec@bju.edu

[2] University of South Carolina-Lancaster, Lancaster, SC 29721 USA, faulkner@gwm.sc.edu

[3] Visiting Astronomer, Lowell Observatory

Recently, we began an observation program aimed at obtaining precision multiband photometry of short period solar type binaries in the $0^{\rm d}\!.3$ to $0^{\rm d}\!.5$ period range. In this group, we expected to find some eclipsing binaries in a very near a state of contact, with one component experiencing Roche-lobe overflow. Systems with unambiguous EB light curves, and complicating asymmetries were targeted. BE Cephei (SVS 925 Cep, GSC 3996-75, RA(2000) = $22^{\rm h}40^{\rm m}51^{\rm s}\!.59$, DEC(2000) = $58°40'7''\!.5$) is such a candidate.

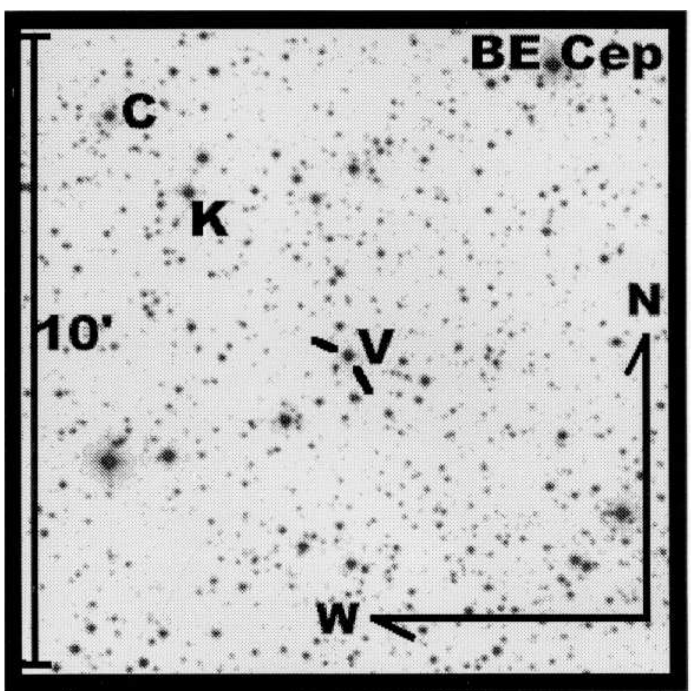

Figure 1. Finding chart (from The Palomar Sky Survey) of BE Cephei, V, the comparison star, C, and the check star, K.

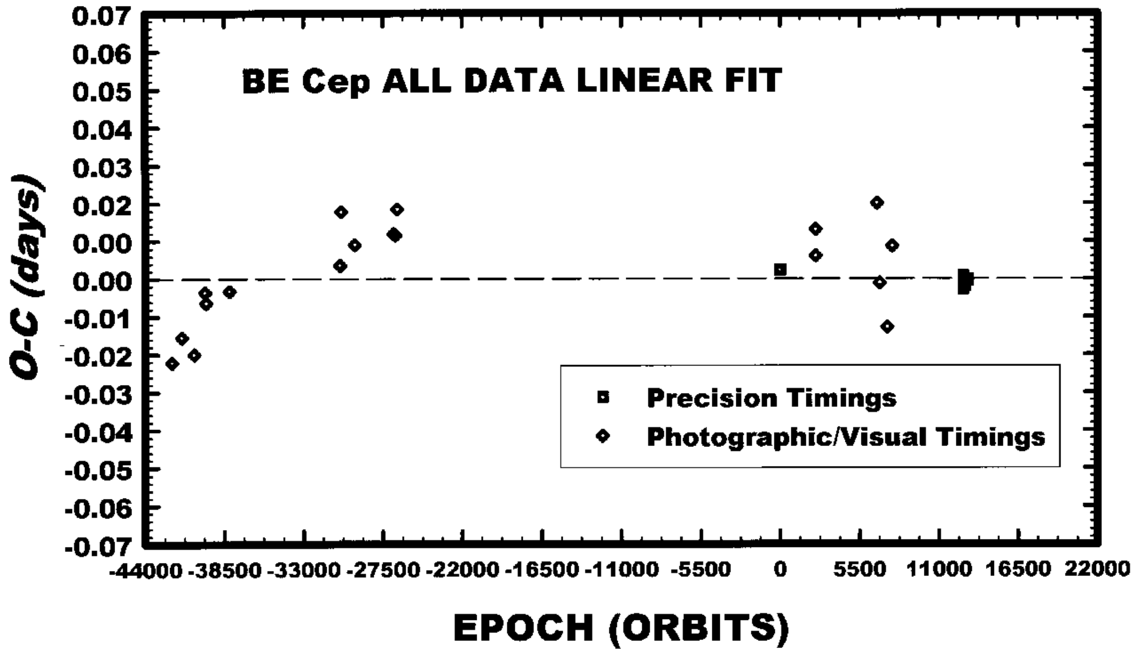

Figure 2. $O-C$ residuals for all available timings of minimum light as calculated from Equation (1).

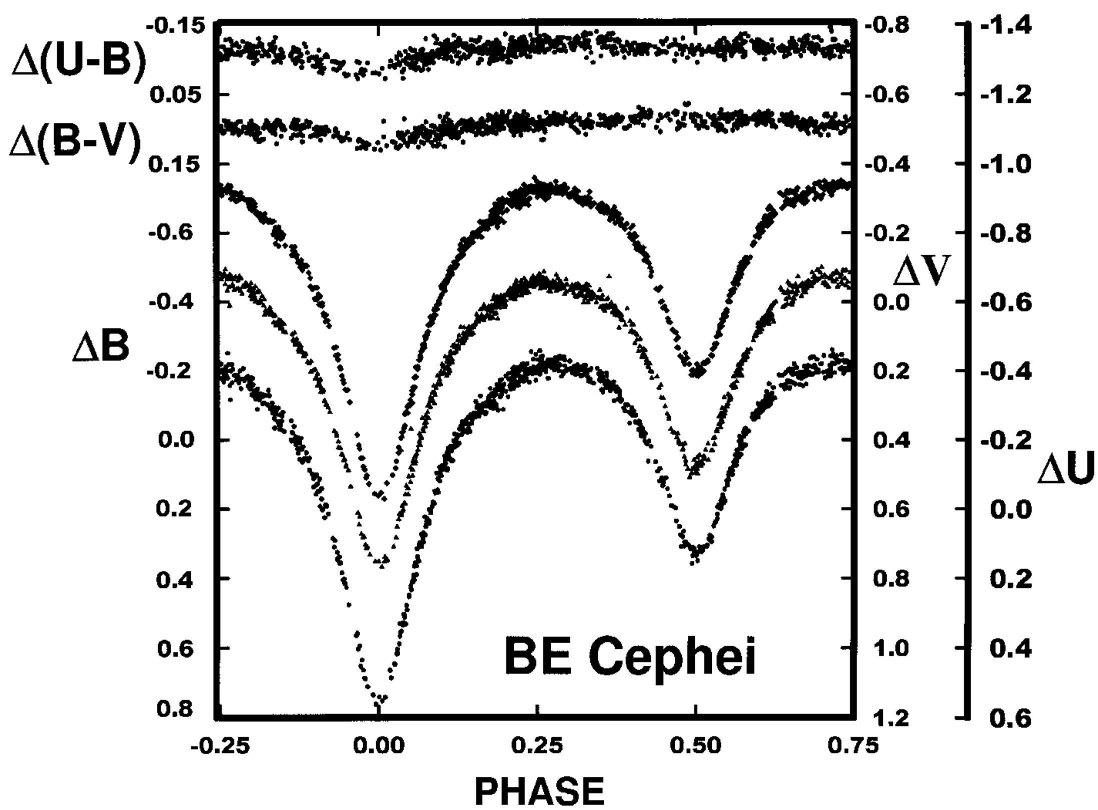

Figure 3. U, B, V light curves and $U-B$, $B-V$ color curves for BE Cephei as standard magnitude differences, variable minus comparison star.

Table 1: Epochs of Minimum Light, BE Cep

JD Hel. 2400000+	Cycles	$(O-C)_1$	$(O-C)_2$	Source
45647.3090	0.0	0.0021	−0.0036	KL
51021.8381(2)	12664.0	0.0008	0.0020	PO
51022.8970(5)	12666.5	−0.0013	−0.0001	PO
51069.7933(2)	12777.0	−0.0006	0.0008	PO
51070.8534(4)	12779.5	−0.0014	−0.0001	PO
51074.6725(4)	12788.5	−0.0019	−0.0006	PO
51074.8854(2)	12789.0	−0.0012	−0.0002	PO
51156.3698	12981.0	−0.0005	−0.0010	BE
51162.3117	12995.0	−0.0001	0.0014	BE

Sources: KL = Kaluzny (1986),
BE = BBSAG #118, #119, E. Blatte,
PO = Present Observations.

BE Cep was discovered by Florija (1950), whose light curve is of EB-type with an difference of eclipse depths of 0.11 mag. He calculated the following light elements:

$$\text{J.D. Hel Min I} = 2428751.314 + 0.424400 \times E.$$

Hoffman (1984) took B, V photoelectric observations and archived them. Kaluzny (1986) used the observations to determine two timings of minimum light and to calculate a B curve solution from phase-binned averages. He performed a "grid of solutions" with nonphysical albedoes (3 to 6), and gravity darkening (fixed at 0), to accommodate the light curve distortions. Subsequent times of minimum light have been published by Romano (1958), Ashbrook (1952, 1953), Borovicka (1986), Kolarova (1986), and in the BBSAG issues #98, #99, #101 and #102, all by Kurt Locher, and the BBSAG #118 and #119 by Ernst Blatter with CCD.

Our present UBV observations were taken with the Lowell 0.79-m reflecting telescope on the nights of July 25–27, 29–30 (RGS and DRF) and September 11–13, and 17 (DRF), 1998 with a thermoelectrically blue-enhanced, S-13 cathode, PMT. About 850 observations were taken at each filter. The comparison (GSC 03996-637, RA(2000) = $22^h40^m51\overset{s}{.}59$, DEC(2000) = $58°40'7\overset{''}{.}5$), and check star (GSC 03996-1524, RA(2000) = $22^h41^m01\overset{s}{.}25$, DEC(2000) = $58°38'59\overset{''}{.}1$) are shown as C, and K in Figure 1 along with the variable, V. The V − C magnitudes averaged 0.12 mags and 0.10 mags in $\Delta(B-V)$ and $U-B$, respectively. Preliminary photometric transformations yield $B-V=0.74$, which corresponds to a G7 spectral type for the primary component. The magnitude range is 11.80–12.51 in V.

Six mean epochs of minimum light were determined from the observations made during three primary and three secondary eclipses by our undergraduate researchers using the bisection of chords technique. These precision epochs of minimum light are given in Table 1 along with their standard errors in parentheses. Linear and quadratic ephemerides were calculated using the available 31 epochs of minimum light:

$$\text{J.D. Hel Min I} = 2445647.3068(22) + 0.42439438(15) \times E, \quad (1)$$

$$\text{J.D. Hel Min I} = 2445647.3126(12) + 0.424394036(71) \times E - 1.6(3) \times 10^{-11} \times E^2. \quad (2)$$

Equations 1 and 2 were used to calculate the $(O-C)_1$ and $(O-C)_2$ residuals, respectively, in Table 1. The linear residuals are shown in Figure 2.

The UBV light curves and the $B-V$ and $U-B$ color curves of the variable are shown as Figure 3 as differential standard magnitudes (V − C) versus phase. The probable error of a single observation was 8, 9, and 10 mmag in U, B and V, respectively. A near contact solution with a stream impact spot and cool spot has been computed using the Wilson Code (Wilson 1994, 1990, Wilson & Devinney 1971). The final parameters include: $T_1 - T_2 = 460$ K, $m_2/m_1 = 0.680(6)$, and fill-out-factor = 98.5 %. The impact spot parameters are co-latitude = 90(4), longitude = 350(1), Spot Radius = 8(2), T-Factor = 1.21(5).

We wish to thank Lowell Observatory for their allocation of observing time for the travel support from the University of South Carolina, and Bob Jones University, particularly Dr. James Roach, physics chair, for allowing us to include binary star analysis as a part of our regular department curriculum.

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COMMENTS ON THE LIGHT CURVE OF V878 Her

RAYMOND H. BLOOMER, JR., ISSA R. NGWELE

King College, 1350 King College Road, Bristol, TN, 37620, USA
e-mail: rhbloome@king.edu, ingwele@king.edu

Kaiser (1994) reported on the eclipsing system V878 Her = SAO 46698 = BD +49°2630 = GSC 3516-00047 = DHK 40. Kaiser et al. (1996) later published a period and V light curve that showed Beta Lyrae-like variations for this $V = 9\overset{m}{.}4$ star. During June 1999 we recorded 76 V and 44 R images with a liquid nitrogen-cooled Photometrics CCD attached to the Air Force Academy's 0.61-m reflector. Images were bias subtracted and flat fielded, and magnitudes of the variable and several nearby stars were extracted using IRAF routines. The check star (GSC 3516-00161, $V = 14\overset{m}{.}4$) and the comparison star (GSC 3516-00768, $V = 12\overset{m}{.}7$) were within the $3\overset{\prime}{.}7$ field. We found the 76 differences in magnitude between these two stars in V light had a standard deviation of $0\overset{m}{.}025$ and the 44 differences in R had a standard deviation of $0\overset{m}{.}037$ indicating their reasonable stability. The check star may be slightly variable, however.

Using the method of Kwee–Van Woerden we established one new time of secondary minimum light:

$$\text{Min. II} = \text{HJD } 2451338.7938 \pm 0.0040$$

Using a linear least squares fitting routine and weighting all the times given by Kaiser and the current paper by the inverse square of their standard errors (estimating the standard error of the old photographic times as $0\overset{d}{.}05$), we found new light elements hardly significantly different from Kaiser's:

$$\begin{array}{rl} \text{Min. I} = \text{HJD } 2449922.70700 + & 0\overset{d}{.}5294771 \times E. \\ \pm 0.00008 & \pm 0.0000007 \end{array}$$

The $O - C$'s indicate no definite period changes over the 14315 epochs used for this period study.

The V and R magnitudes were converted to intensities and were then formed into normal points by averaging over phase bins 0.02 wide.

To achieve a preliminary solution, the intensity normal ponts were fitted with a theoretical curve using the program *Binary Maker 2.0* by David Bradstreet. We assumed a temperature of 6100 K for the F8 primary star. Figure 1 shows the fit for the V light curve when the inclination is set at 62°, the secondary star has a temperature of 4450 K, and the "near contact" configuration suggested by Kaiser. We concur with Kaiser that the maximum at phase 0.25 is slightly brighter than that at 0.75, by approximately $0\overset{m}{.}02$. There was too little R data to determine a solution, though is not inconsistent with that given here for V. The depths of the eclipses relative to the brighter maximum are $0\overset{m}{.}47$

and $0\overset{m}{.}21$ in V, and approximately $0\overset{m}{.}42$ and $0\overset{m}{.}23$ in R light. We hope to acquire more photometric data, especially in the R, so that we can find a more definitive solution for the system.

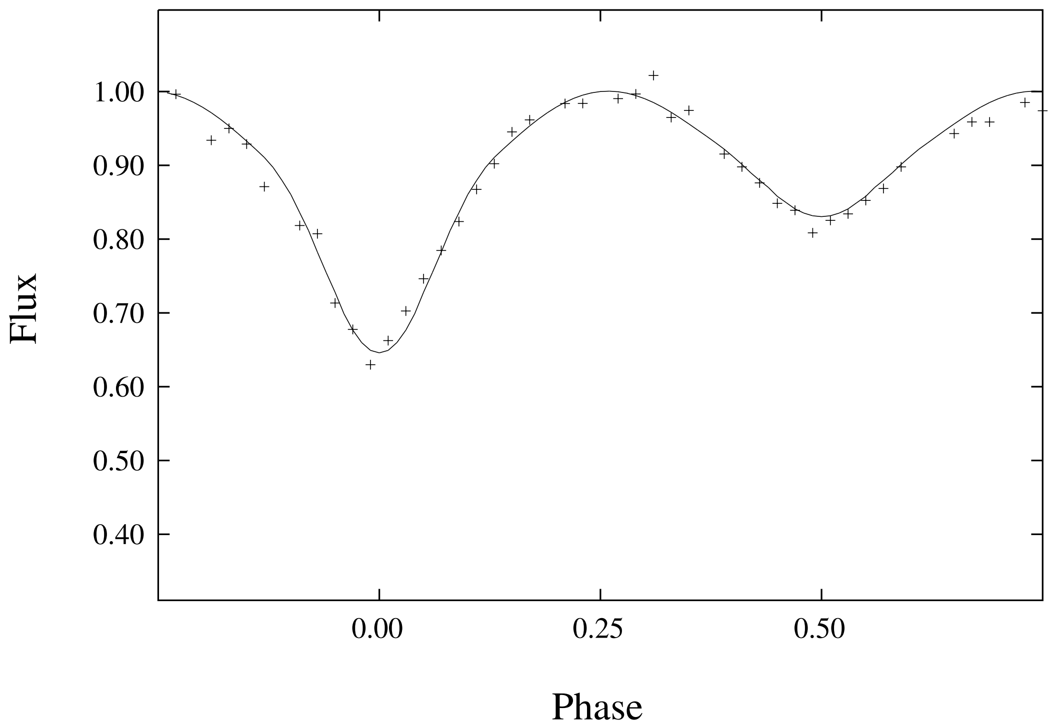

Figure 1. V Intensity Light Curve and Binary Maker Fit

Acknowlegements: We thank the Air Force Academy for generous telescope time and Drs. Jack Wetterer and Shane Burns for their able assistance. We thank the Appalachian College Association for a Student/Faculty Research Grant that made this work possible. This research made use of the SIMBAD database operated by the CDS, Strasbourg, France.

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ABSOLUTE PROPERTIES OF ZZ URSAE MAJORIS

CLAUD H. SANDBERG LACY AND JEFFREY A. SABBY

Department of Physics, University of Arkansas, Fayetteville, AR 72701 USA

Radial velocities have been measured on 27 spectrograms obtained with the Kitt Peak National Observatory coude-feed CCD spectrometer between May 1989 and May 1999. A typical spectrogram is shown in Fig. 1. Radial velocities were obtained by cross-correlation with suitably broadened spectra of the radial velocity standard β Vir (RV = 4.3 km/s, Mayor & Maurice 1985). The radial velocities are listed in Table 1.

We have adopted an eclipse ephemeris based on the dates of minima of Mallama (1980) and Hanzl (1991):

$$\begin{array}{ll}\text{Min I} = 2\overset{\text{d}}{.}2992599n & + \text{ JD } 2447967.4134 \\ \pm 0.0000005 & \pm 0.0004\end{array}$$

We have fitted a circular spectroscopic orbit, given in Table 2. The fitted orbit is displayed in Fig. 2. The residuals from both the primary and secondary orbits were 1.1 km/s. We have combined our spectroscopic orbits with the photometric orbit of Clement et al. (1997); the results are shown in Table 2.

Table 1: Heliocentric radial velocities of ZZ UMa.

HJD − 2400000	RV (km/s) Primary	RV (km/s) Secondary	HJD − 2400000	RV (km/s) Primary	RV (km/s) Secondary
47651.6661	18.7	−165.2	51246.8659	−154.6	38.0
47652.7547	−144.8	24.7	51246.9082	−149.5	33.8
47655.6915	−109.7	−14.4	51247.9057	28.8	−176.7
47656.7073	5.3	−149.0	51248.9040	−154.2	40.1
48013.6395	−124.1	3.8	51249.9436	9.2	−153.4
48017.7156	2.8	−141.0	51309.7210	9.1	−151.3
48018.7101	−154.2	39.4	51309.8099	21.6	−165.0
49485.7416	−140.7	23.3	51312.6475	−18.6	−120.2
49486.7165	27.6	−175.0	51313.6480	−140.6	25.1
49488.7593	17.3	−162.1	51313.6900	−133.3	16.7
50938.7165	−157.9	44.0	51313.7331	−124.9	8.0
50939.6885	26.4	−172.4	51314.7072	22.7	−169.3
50940.7404	−147.1	31.4	51315.7079	−160.5	47.2
50944.7106	−7.4	−133.0			

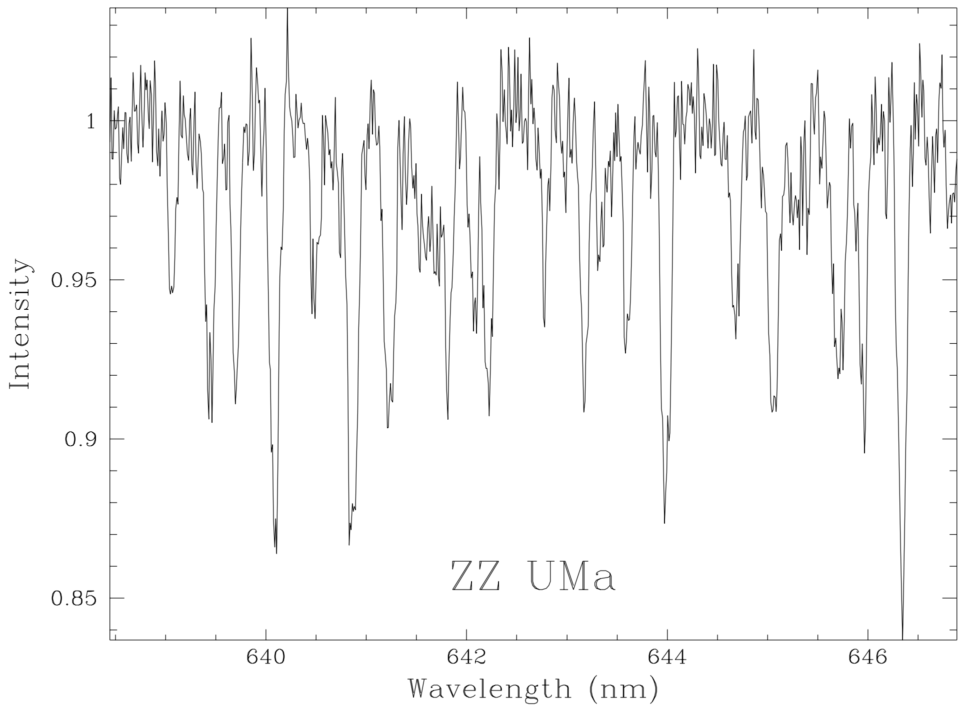

Figure 1. Typical spectrogram of ZZ UMa near 643 nm. Lines of the secondary component are displaced to the left (blueward) at the phase shown.

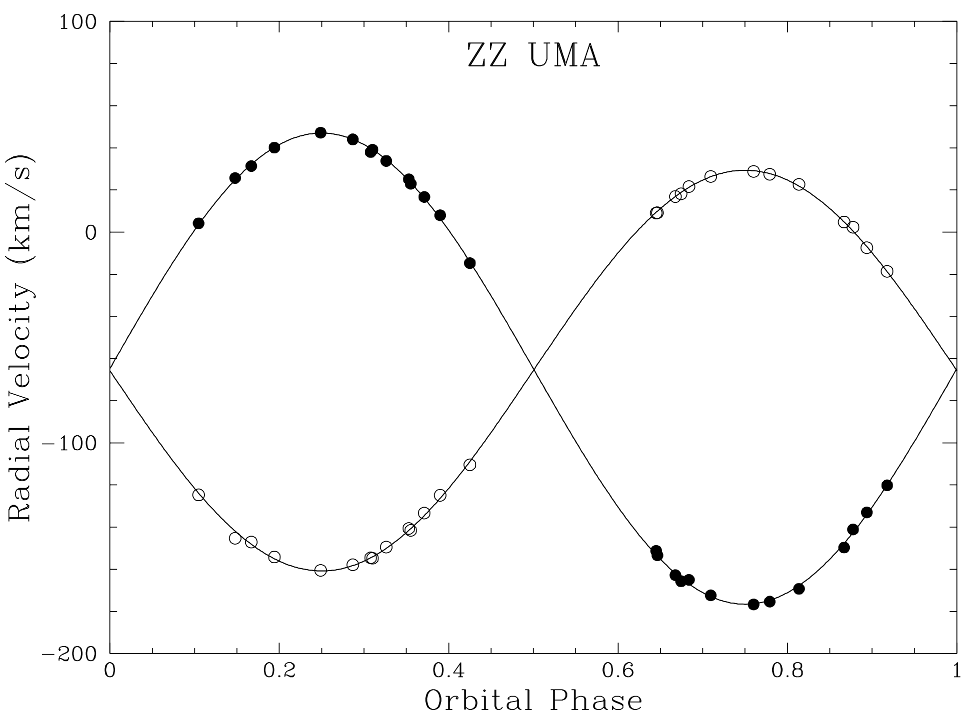

Figure 2. Spectroscopic orbits of the components of ZZ UMa. The primary (hotter and more massive) component is represented by open circles, the secondary by filled circles.

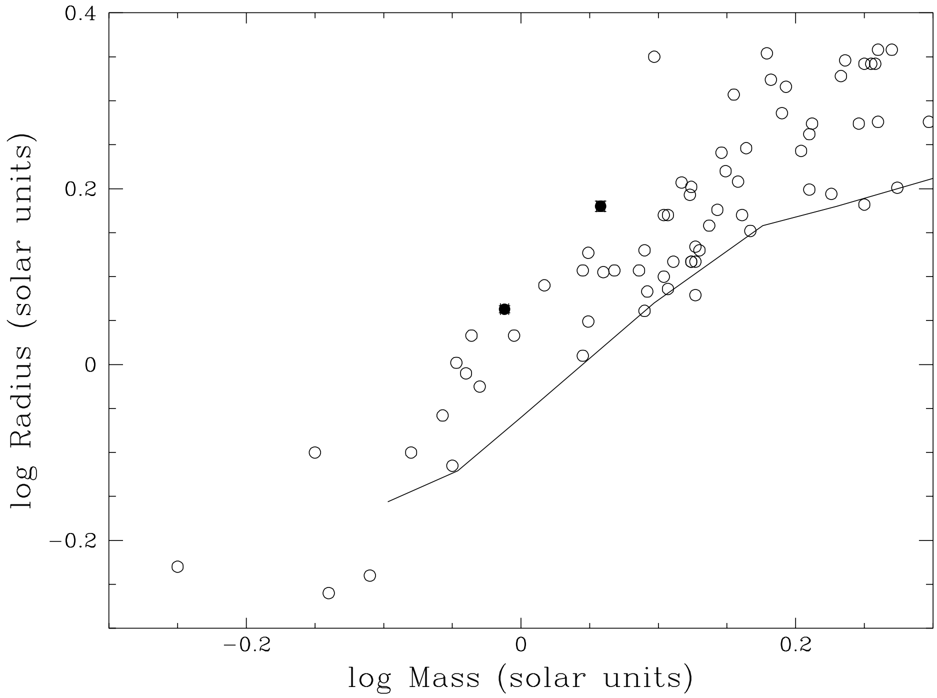

Figure 3. The components of ZZ UMa (solid circles with error bars) in the mass-radius plane. Open circles correspond to accurately-known components of eclipsing binaries. The curve is the theoretical ZAMS of Schaller et al. (1992).

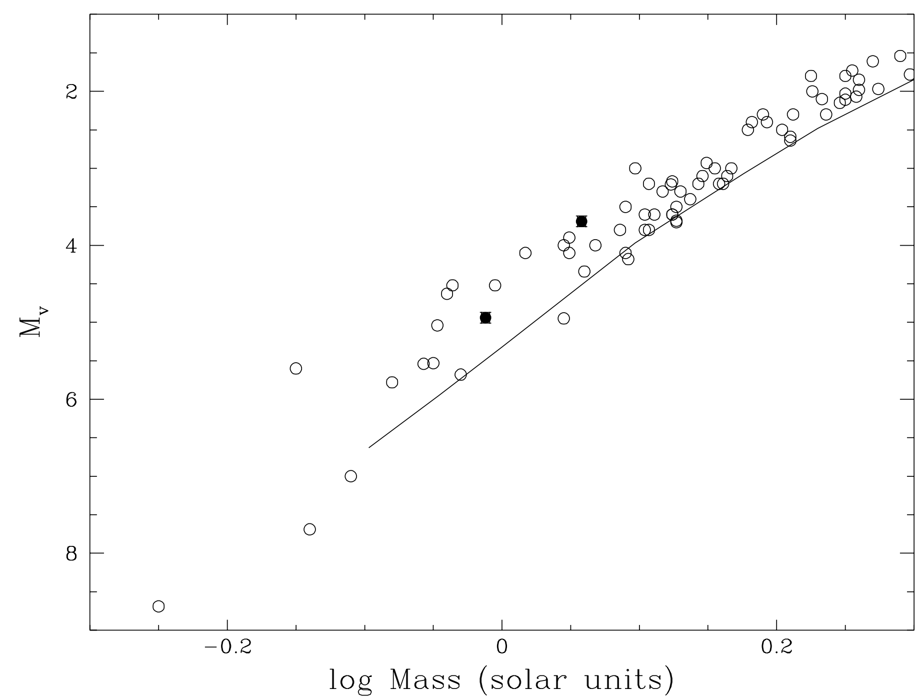

Figure 4. The components of ZZ UMa in the mass-luminosity plane. The symbols are the same as in Fig. 3.

Table 2: Absolute properties of ZZ UMa.

Parameter	Symbol	Primary	Secondary
Relative radius	r	0.161 ± 0.002	0.123 ± 0.001
Orbital inclination (degrees)	i	88.01 ± 0.07	
Visual central surface brightness	$J_{\rm v}$	1.0	0.556 ± 0.006
Intrinsic color index (mag.)	$(b-y)_0$	0.374 ± 0.012	0.479 ± 0.012
Temperature (K)	T	5960 ± 70	5270 ± 90
Radial velocity semi-amp. (km/s)	K	95.1 ± 0.3	111.8 ± 0.3
Center-of-mass radial vel (km/s)	γ	-65.7 ± 0.2	-64.8 ± 0.2
Observed rotational vel (km/s)	$v \sin i$	32 ± 2	26 ± 2
Mass (solar units)	M	1.142 ± 0.007	0.972 ± 0.007
Radius (solar units)	R	1.51 ± 0.02	1.16 ± 0.01
Surface gravity (cm/s^2)	$\log g$	4.135 ± 0.011	4.299 ± 0.007
Synchronous rotational vel (km/s)	$v \sin i$	33.3 ± 0.4	25.5 ± 0.2
Luminosity (solar units)	$\log L$	0.42 ± 0.02	-0.03 ± 0.03
Absolute visual mag.	$M_{\rm v}$	3.69 ± 0.07	4.94 ± 0.07
Distance (pc)		195 ± 10	

The results are displayed in Figs. 3 & 4. Our results differ from those of Clement et al. (1997) due to improved accuracy of the spectroscopic orbits, and due to a significantly redder adopted color index for the secondary component. Our color index is based on the visual central surface brightness of the secondary, which is a parameter of the photometric orbit, through the equation in Lacy et al. (1987): $\delta F_{\rm v} = 1/4 \log J_{\rm c}$. Popper's (1980) calibration (his Table 1) was used to convert from surface brightness parameters into effective temperatures. The primary component parameters are well fitted by theoretical models such as those of Schaller et al. (1992) or Claret & Gimenez (1992) for solar composition at an age of about 5–6 $\times$ 10^9 yr, but the secondary component can not be well fitted by any of the current models because it is cooler than predicted by the models. The origin of this discrepancy is unknown.

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NSV 07109, AN RR LYRAE TYPE STAR IN LIBRA

P. MERCHÁN-BENÍTEZ[1], M. JURADO-VARGAS[1], F. SÁNCHEZ-BAJO[2]

[1] Departamento de Física, Facultad de Ciencias, Universidad de Extremadura, Avda de Elvas s/n, 06071, Badajoz (Spain), e-mail: pedromer@unex.es, mjv@unex.es

[2] Departamento de Electrónica e Ingeniería Electromecánica, Escuela de Ingenierías Industriales. Universidad de Extremadura, Avda de Elvas s/n, 06071, Badajoz (Spain), e-mail: fsanbajo@unex.es

Name of the object:
NSV 07109 = CSV 002352

Equatorial coordinates:	**Equinox:**
R.A.= $15^h29^m56^s.7$ **DEC.=** $-12°53'14''$	2000.0

Observatory and telescope:
Observatorio del Departamento de Física de la Universidad de Extremadura, 0.4-m f/4.5 Newtonian Reflector

Detector:	Starlight Xpress CCD Camera (based in the chip SONY ICX027BL 6.4×4.35 mm^2, 500×256 pixels)
Filter(s):	V (Kron-Cousins system)
Comparison star(s):	GSC 5603.63
Check star(s):	GSC 5603.49
Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	RR Lyr

Remarks:

The results of the observations carried out show that NSV 07109 seems to be an RR Lyrae star with a period close to 9 hours. The star shows an almost symmetric light curve ($(M-m)/P = 0.42$) and a 0.6 magnitude amplitude in the V band. From the timing of four minima (see Table 1) obtained according to the Kwee–Van Woerden (1956) method, the following ephemeris for the maximum was derived:

$$\text{Max} = \text{HJD } 2451359.4510 + 0^d.3811 \times E.$$
$$\pm 0.0005 \quad \pm 0.0001$$

Table 1

HJD 2451000 +	Epoch	$O-C$
359.448	0	−0.003
364.407	13	+0.002
375.455	42	−0.002
380.412	55	0.000

Acknowledgements:
This research was supported by the Consejería de Educación y Juventud (Junta de Extremadura) and Fondo Social Europeo under project IPR98A047.

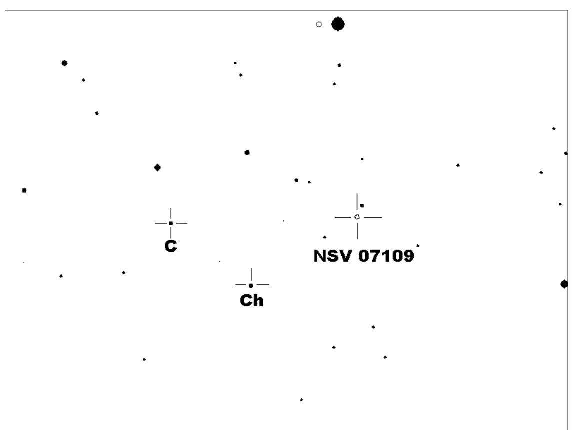

Figure 1. Identification chart of NSV 07109. C = Comparison star, Ch = Check star. North is on the top.

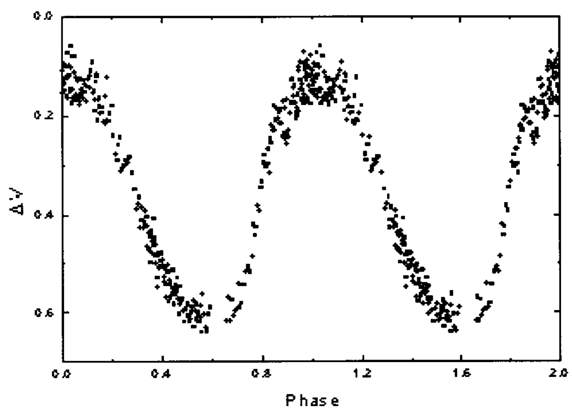

Figure 2. The V light curve obtained for NSV 07109. Magnitude differences (variable minus comparison) are plotted versus phase, where the phases are computed using the ephemeris calculated in this work.

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CCD PHOTOMETRY OF THE 1999 FEBRUARY OUTBURST OF CI Gem

T. KATO[1], P. SCHMEER[2]

[1] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

[2] Bischmisheim, Am Probstbaum 10, D-66132 Saarbrücken, Germany, e-mail: extpasc@rz.uni-sb.de

CI Gem is a variable star discovered by Hoffmeister (1943, 1947). He proposed the nova-like or dwarf nova-type classification based on the single outburst. Duerbeck (1987) proposed the possible quiescent counterpart, and suggested the dwarf nova nature based on the small outburst amplitude. Wenzel (1990) examined Sonneberg plates and found three additional outbursts between 1963 and 1986. From the existence of long and short outbursts, Wenzel (1990) suggested the SU UMa-type classification.

An additional outburst of CI Gem was detected by P. Schmeer (1999) on an unfiltered CCD image taken on 1999 February 18.185 UT (the discussion on the outburst detection is also given in Schmeer and Duerbeck (1999)). He reported the object as magnitude 15–16. Schmeer (1999) reported the incorrect quiescent identification by Duerbeck (1987), the precise coordinates are given by Schmeer and Duerbeck (1999). Schmeer (1999) reported nothing down to magnitude 21 was visible on the POSS blue print at this location.

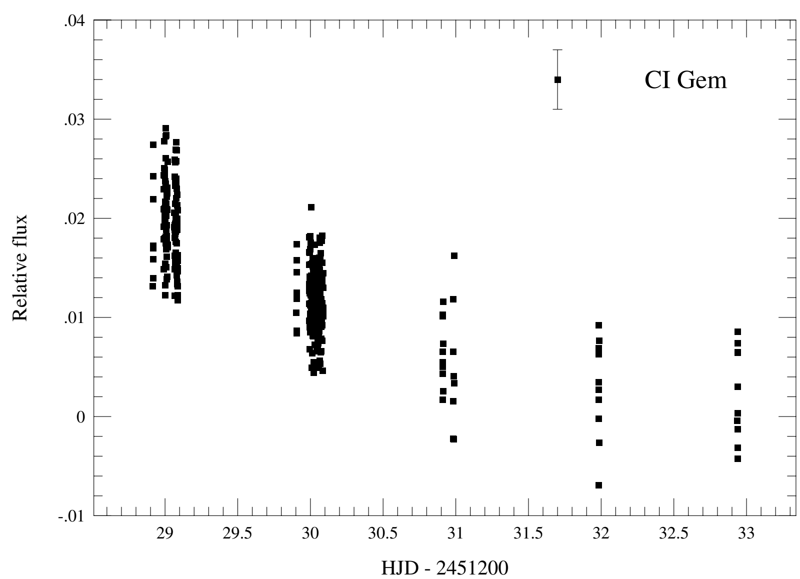

Figure 1. Overall light curve of CI Gem

Table 1: Nightly averaged magnitudes of CI Gem

mid-HJD[a]	mag[b]	error[c]	N^d
51229.035	4.279	0.020	129
51230.032	4.829	0.019	231
51230.944	5.597	0.217	18
51231.984	6.381	0.618	10
51232.939	6.592	0.695	10

[a] HJD − 2400000
[b] Magnitude relative to GSC 1340.657
[c] Standard error of nightly average
[d] Number of frames

The observations were done on five nights between February 19 and 23, using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java^{TM}-based PSF photometry package developed by the author (TK). The location of the PSF center was adjusted using Schmeer's astrometry. The flux of the variable was measured relative to GSC 1340.657 (USNO r-magnitude 11.5), whose constancy was confirmed by comparison with GSC 1340.1349 (USNO r-magnitude 11.9).

Figure 1 illustrates the overall light curve of the present observation. The fluxes are given relative to GSC 1340.657. Table 1 summarizes the nightly averaged magnitudes.

As seen in Table 1 and Figure 1, CI Gem was already fading rather rapidly. By adopting the USNO r-magnitude of the comparison, CI Gem was estimated to be ~15.8 on February 19 and ~18.1 on February 23. The last part of the light curve, however, may have been affected by the nearby star. The average decline rate (0.55 mag d^{-1}) of the initial part of the observation precludes the superoutburst. However, the decline rate seems to be a little slower than those of normal outbursts of SU UMa stars (usually exceeding 1 mag d^{-1}). Period analysis of February 19 and 20 observations, spanning 4.1 and 4.5 hr respectively (occasionally interrupted by gaps), could not yield positive periodicities between 0.05 and 0.15 d to a limit of 0.1 mag. Although this negative result does not preclude a normal outburst of an SU UMa star, the present observation seems to suggest a longer orbital period system, possibly an SS Cyg-type dwarf nova.

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Wenzel, W., 1990, *IBVS*, No. 3440

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THE FEBRUARY 1999 OUTBURST OF THE DWARF NOVA CI Gem

PATRICK SCHMEER[1] AND HILMAR W. DUERBECK[2]

[1] Am Probstbaum 10, 66132 Saarbrücken, Germany, e-mail: extpasc@rz.uni-sb.de

[2] WE/OBSS, University of Brussels (VUB), Pleinlaan 2, 1050 Brussels, Belgium, e-mail: hduerbec@vub.ac.be

CI Gem (S3428) is a poorly known cataclysmic variable. It was discovered by Hoffmeister on Sonneberg plates as a dwarf nova or novalike star; it reached a maximum of $m_{\rm pg} = 14.7$ on 1940 Jan 3, declined by about $1^{\rm m}$ in the subsequent 10 days, and dropped below the plate limit after 16 days. The light curve is shown in Ahnert et al. (1947) and Wenzel (1990). A hand-drawn finding chart was published by Hoffmeister (1957). On this basis, Duerbeck (1987) tentatively identified CI Gem at its minimum stage with a fairly blue star of 18–$19^{\rm m}$. This star is listed as 1050-03707552 in the USNO–A2.0 catalog (CDS VizieR service).

Wenzel (1990) reported three additional outbursts on 1963 October 15 ($m_{\rm pg} = 16.5$), 1966 February 23 ($m_{\rm pg} = 16.5$), and 1986 December 3 ($m_{\rm pg} = 14.5$).

A new outburst was found by one of us (P.S.) on an unfiltered CCD frame taken 1999 February 18.185 (UT) by Mark Parker with the UC Santa Barbara Celestron-14 telescope. On a unfiltered frame taken February 16.172 (UT) with the University of Iowa 0.5-m IRO robotic telescope, the object was still below (or at?) $R \approx 18.6$. Aperture photometry of the discovery image yields $R \approx 15.8$, using a local sequence by Duerbeck (in preparation). On 1999 February 18.98 (UT), Pepe Vilchez and Peter Sorensen used the wide field camera at the prime focus of the 2.5 m Isaac Newton telescope (INT). They obtained one B and two R frames which show the object at $B = 15.85, R = 15.76$ (Fig. 1). Additional images from IRO yield $R \approx 16.4$ and 16.8 on February 20.178 and 21.160 (UT), respectively. According to Kato and Schmeer (1999; see also

http://www.kusastro.kyoto-u.ac.jp/vsnet/LCs/index/gemci.html),

CI Gem was at $V = 15.9$ on 1999 February 19.5 (UT), and dropped by $2^{\rm m}$ in three days.

Its position was determined on the INT-frames, using seven nearby stars selected from the USNO–A2.0 catalog, with the aid of the MIDAS/ASTROMET package:

$$\mathrm{RA} = 06^{\rm h}30^{\rm m}05\overset{\rm s}{.}86, \quad \mathrm{Decl.} = +22^\circ 18' 50\overset{''}{.}7 \quad \text{(equinox J2000.0)}.$$

It lies about $7\overset{''}{.}5$ south of 1050-03707552.

Archival CCD frames of the field, taken 1989 January 11 with the ESO/Danish 1.54-m telescope at La Silla, clearly show a fairly red object at the exact place of CI Gem, with $V = 21.66, B-V = 0.8, V-R = 0.91$ (Fig. 1). In B, the object is at the limit of visibility, and the error in the colour index may amount to several $0\overset{\rm m}{.}1$.

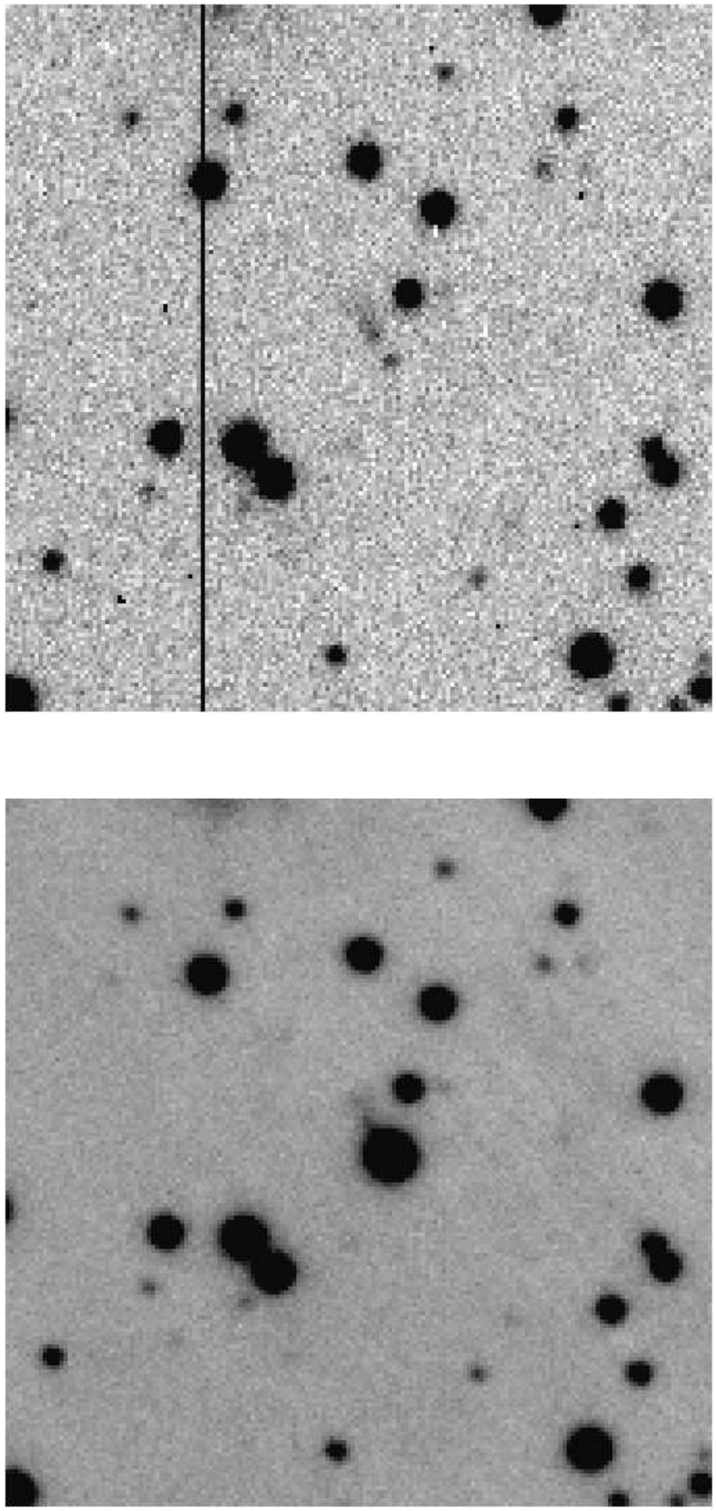

Figure 1. The field of CI Gem in 1989 and in 1999, taken in the R band with the ESO/Danish 1.54-m telescope and the Isaac Newton 2.5-m telescope, respectively. North is up and west to the right. The field is about $80'' \times 80''$. The outburst image of 1999 coincides with a faint starlike object in the centre of the image. Some nonstellar objects are found in its vicinity

The galactic extinction was estimated using the routine EXTINCT by Hakkila et al. (1997). It reaches a maximum value of $A_V = 0.39 \pm 0.20$ at 2 kpc. Thus, the red colour of CI Gem cannot be due to interstellar reddening. Several neighbouring objects are clearly galaxies – also an indication of low reddening in this direction. The starlike appearance of the object at minimum makes the identification quite certain.

The 1940 eruption was a bright outburst, which lasted more than 18 days. The 1986 outburst listed by Wenzel was also bright, but of unknown duration, while the 1999 outburst was definitively fainter and shorter (5...7 days). The 1963 and 1966 outbursts were also faint, but too fragmentarily observed to permit any conclusions on their character.

We are reluctant to classify this object as an SU UMa-type dwarf nova, as was done by Wenzel (1990). Kato and Schmeer (1999) analyzed photometry carried out during the recent outburst and found no periodicities below 3.6 hours. A more important criterion is the colour: At minimum, SU UMa-type systems tend to have $B-V$-values around 0.10, while SS Cyg-type systems usually appear redder, with $B-V$-values around 0.45 (Bruch and Engel 1994). SS Cyg-type systems may also show long and short outbursts (e.g. SS Cyg itself has preferred outburst lengths of 8 and 14.5 days), amplitudes of $5-6^{\rm m}$, as well as outburst intervals of several 100 days (Warner 1995). Vogt (1981) established a statistical relation between orbital period and $B-V$ colour at minimum; the colour of CI Gem indicates a period of 8...10 hours.

The outburst characteristics of CI Gem, in combination with its red colour at minimum, favour its classification as SS Cyg-type dwarf nova. Only time-resolved photometry during a long outburst can establish the subtype beyond doubt.

Acknowledgment. We thank Mark Parker (UCSB), Robert Mutel and his students (University of Iowa), Pepe Vilchez (IAC), and Peter Sorensen (ING) for carrying out the observations.

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THE FEBRUARY 1999 SUPEROUTBURST OF THE SU UMa-TYPE DWARF NOVA CG CMa

HILMAR W. DUERBECK[1], PATRICK SCHMEER[2], JOHAN H. KNAPEN[3], DON POLLACCO[4]

[1] WE/OBSS, University of Brussels (VUB), Pleinlaan 2, 1050 Brussels, Belgium, e-mail: hduerbec@vub.ac.be

[2] Am Probstbaum 10, 66132 Saarbrücken, Germany, e-mail: extpasc@rz.uni-sb.de

[3] University of Hertfordshire, Department of Physical Sciences, Hatfield, Herts AL10 9AB, UK, e-mail: knapen@star.herts.ac.uk

[4] Isaac Newton Group, Santa Cruz de La Palma, Tenerife 38780, Spain, e-mail: dlp@ing.iac.es

CG CMa is a poorly known cataclysmic variable. It was discovered by C. Verlooy on Franklin-Adams plates taken in January 1934. Maximum light, $m_{\rm pg} = 13.7$, was observed on 1934 January 12; the object had been below the plate limit of $15\overset{\rm m}{.}5$ four days before. It declined $2^{\rm m}$ in about 25 days, and subsequently fell below the plate limit. Van Hoof (1948) published a discovery note with the light curve and a hand-drawn finding chart. He classified it as "apparently a faint nova". Payne-Gaposchkin (1977) noted the unusual position of this "nova" near the galactic anticentre at a large galactocentric distance (if a typical nova luminosity is assumed), and commented "CG CMa might prove to be a U Gem star or a recurrent nova".

On the basis of the finding chart and an additional Harvard photograph of quite insufficient plate scale, Duerbeck (1987) tentatively identified CG CMa at its minimum stage with a star of $m_{\rm pg} = 15.9$. This star is listed as 0600-04772139 in the USNO-A2.0 catalog (CDS VizieR service), with magnitudes $B = 16.5$, $R = 16.5$. Because of the apparently small outburst amplitude, dwarf nova variability was suspected. A spectroscopic investigation by Zwitter and Munari (1995) yielded an A type spectrum, and the authors suspected white dwarf characteristics.

The discovery of a new outburst on 1999 February 22.494 (UT) by R. Stubbings (1999) lead us to reconsider the case. B, V, R and I frames of the field were obtained (by J.H.K.) at the Cassegrain focus of the 1.0-m Jacobus Kapteyn telescope at La Palma on 1999 March 7.87 (UT). They show the object as a close companion to 0600-04772139. Using a local sequence by Duerbeck (in preparation), CG CMa yields the following magnitude and colours at this late stage of the outburst: $V = 15.95, B-V = 0.10, V-R = 0.00$. Its position and that of the USNO star were determined, using sixteen nearby stars selected from the USNO-A2.0 catalog, with the aid of the MIDAS/ASTROMET package:

CG CMa	RA = $07^{\rm h}04^{\rm m}05\overset{\rm s}{.}225$	Decl. = $-23°45'34\overset{''}{.}3$	(equinox J2000.0)
0600-04772139	RA = $07^{\rm h}04^{\rm m}05\overset{\rm s}{.}04$	Decl. = $-23°45'34\overset{''}{.}6$	(equinox J2000.0)

CG CMa lies about $2\overset{''}{.}55$ east of 0600-04772139. The coordinates of both stars are in very good agreement with those measured by Henden (1999).

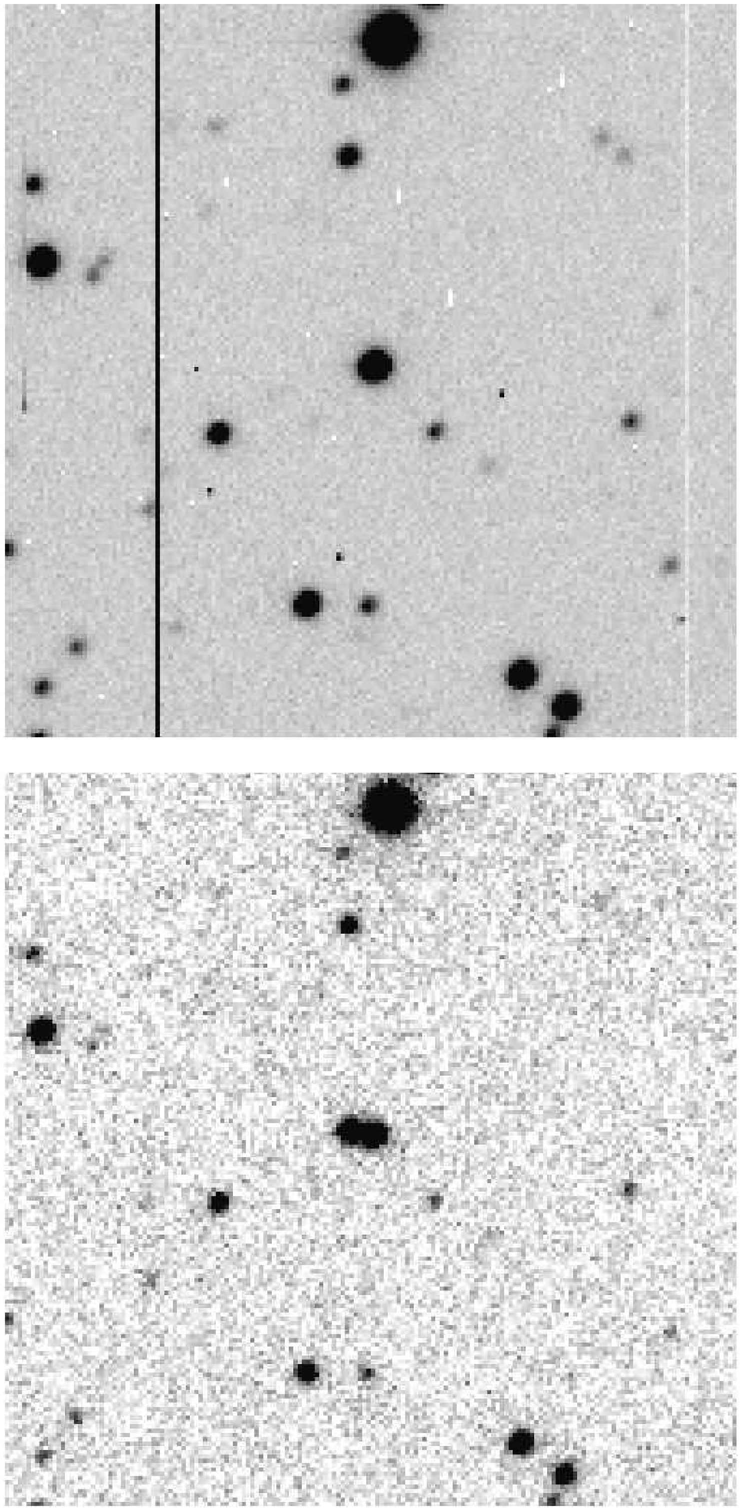

Figure 1. The field of CG CMa in 1989 (R band, at minimum) and in 1999 (I band, at outburst). North is on top and west to the right. The dwarf nova is the eastern component of the close double star in the centre of the image. The field size is about $80'' \times 80''$. At minimum, no counterpart is seen down to $R = 22^{\rm m}$

CG CMa was below $V = 15.0$ on 1999 February 21.493 (UT), it reached $V = 13.7$ on 1999 February 22.5, and had fallen by $2^{\rm m}$ around 1999 March 5, according to data published in VSNET

(http://www.kusastro.kyoto-u.ac.jp/vsnet/LCs/index/cmacg.html).

Thus the decline ($2^{\rm m}$ in 11 days) is faster than that of 1934. The brightness declines must always be treated with caution, because they are based on the combined light of both stars.

Archival CCD frames of the field, taken 1989 January 10 with the ESO/Danish 1.54-m telescope at La Silla (by H.D.), show no trace of CG CMa at minimum. 0600-04772139 yields $V = 16.39$, $B - V = 0.54$, $V - R = 0.33$. The 1989 and 1999 frames are shown in Fig. 1. Using IRAF/DAOPHOT, the profile of the companion star was subtracted on the 1989 frame, but the residual image also does not show a trace of the cataclysmic variable. We estimate a *bright limit* of about $22^{\rm m}$ in V and R, and about $21^{\rm m}$ in B for CG CMa at minimum.

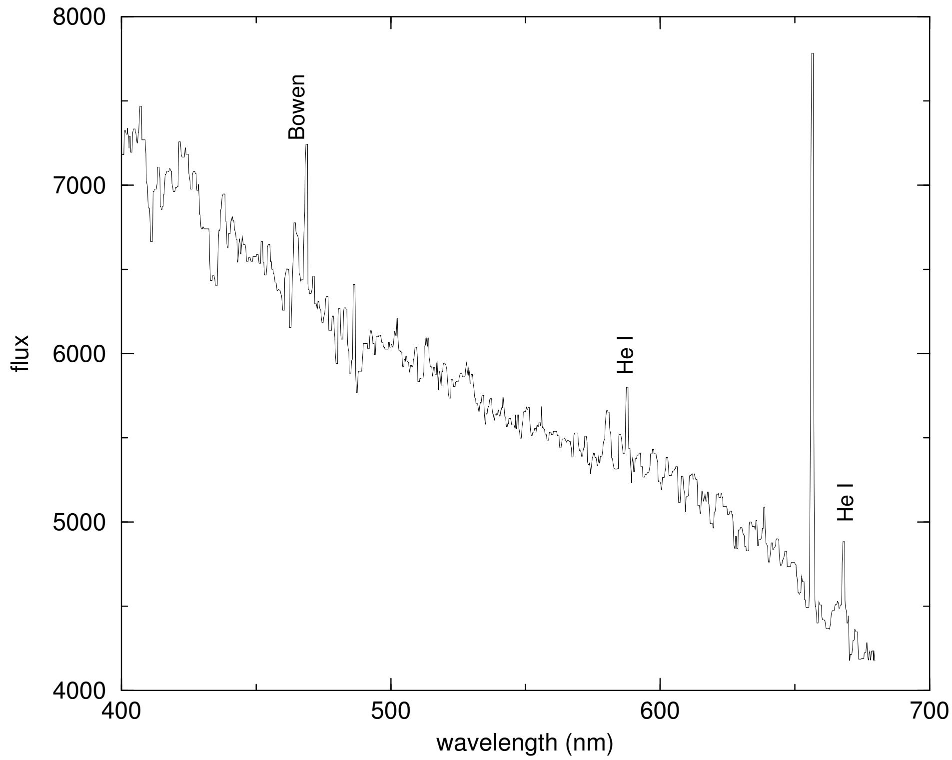

Figure 2. The spectrum of CG CMa on 1999 February 22.94 (UT), in the early stages of the outburst. A few spectral features are marked

A spectrum of CG CMa was obtained (by D.P.) with the 2.5-m Isaac Newton telescope on 1999 February 22.94 (UT), in the early stages of the outburst, with an exposure time of 300 sec (Fig. 2). Superimposed on a strong continuum which rises towards shorter wavelengths, Hα 6563 appears as a strong emission line, surrounded by a broad absorption trough, whose full width corresponds to 1550 km/s. Hβ 4861 also appears as an emission embedded in a broad trough (full width 3800 km/s), but it is so weak that it hardly reaches the continuum level. Higher Balmer lines may show a similar structure. The Bowen complex, He II 4686, C III/N III 4650, appears as a strong emission, and lines of

He I at 587.6 and 667.8 nm are also in emission. The full width at half maximum of the emission lines Hα, Hβ and He II 4686 is about 570 km/s. The spectrum is quite typical of SU UMa-type dwarf novae at superoutburst; see e.g. the descriptions of RZ Leo and HV Vir (Cristiani et al. 1985, della Valle et al. 1992).

The brightness at maximum of GC CMa is about $B = 13.75$, if one takes van Hoof's maximum observation $m_{\rm pg} = 13.7$ at face value, and estimates $B = 13.8$ from Stubbings' visual observations, by applying the $B - V$ colour index observed later in the outburst. Thus the amplitude is larger than $7^{\rm m}$. Brightness modulations with a superhump period of 0.0636 days were observed in the last days of 1999 February (Kato et al. 1999). These facts, together with the spectral appearance and the apparently long recurrence time, make CG CMa a certain member of the SU UMa group of dwarf novae, possibly of WZ Sge subtype. Such objects have absolute visual magnitudes at minimum between $8^{\rm m}$ and $11^{\rm m}$, and in extreme cases may be as faint as $13^{\rm m}$ (Warner 1995). The galactic extinction, as estimated using the routine EXTINCT by Hakkila et al. (1997), is very low ($A_V = 0.08$ at 1 kpc). Assuming a value $13^{\rm m}$ for the absolute magnitude, a lower limit of about 600 pc can be set to the distance of CG CMa.

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CCD PHOTOMETRY OF THE 1999 OUTBURST OF CG CMa

T. KATO[1], K. MATSUMOTO[1], R. STUBBINGS[2]

[1] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp, katsura@kusastro.kyoto-u.ac.jp

[2] 19 Greenland Drive, Drouin 3818, Victoria, Australia e-mail: stubbo@qedsystems.com.au

CG CMa was discovered by Verlooy on Franklin-Adams plates taken in 1934. According to Duerbeck (1987), the maximum was reached on 1934 January 12. The object had been considered as a possible classical nova, one of most distant in our Galaxy. However, Duerbeck (1987) identified the possible quiescent counterpart, and discussed the possibility of a dwarf nova, based on the outburst amplitude. The cataclysmic classification, however, became less likely when Zwitter and Munari (1995) took the spectrum of the suggested quiescent counterpart, yielding shallow absorption lines resembling those of an isolated white dwarf.

The major breakthrough in understanding the nature of this object was brought by visual monitoring by R. Stubbings. His second historical outburst detection on 1999 February 22 (Stubbings 1999) provided a unique opportunity in unveiling the enigmatic object. The reported magnitude was $m_v = 13.7$ on February 22.494 UT. On February 21, the object was invisible below mag 15.0.

The CCD observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\rm TM}$-based PSF photometry package developed by one of the authors (TK).

Soon after the initial observation, we realized the outbursting object is slightly offset from the suggested quiescent counterpart. Using eight GSC 1.1 stars (mean residual $0''.3$), we obtained the coordinates of $07^{\rm h}04^{\rm m}05^{\rm s}.28$, $-23^\circ45'34''.2$ (J2000.0). Using the 1997 December 27 image taken at Ouda Station, we yielded the coordinates of the proposed quiescent counterparts as $07^{\rm h}04^{\rm m}05^{\rm s}.01$, $-23^\circ45'34''.8$ (J2000.0) on the same reference frame. The latter coordinates being within $1''$ of the USNO A1.0 position, it is now evident the outbursting object is different from Duerbeck's (1987) candidate. The finding was confirmed by Henden (1999) and Duerbeck et al. (1999), who actually resolved the two components. We, in the following analysis, consistently used the newly obtained coordinates of the outbursting object for locating the aperture and PSF, but because of the small separation of two components being always smaller than the seeing size, the obtained fluxes should be considered as the combined light. At the brightest epoch of CG CMa, the contribution of the fainter companion was estimated as 8 %. The flux of the variable was measured relative to GSC 6523.3618 ($V = 11.65$, $B - V = 1.07$, Sumner

Table 1: Nightly averaged magnitudes of CG CMa

JD start[a]	JD end[a]	mean mag[b]	error[c]	N^d
51232.074	51232.146	2.964	0.014	141
51232.897	51232.970	3.222	0.019	74
51234.904	51235.160	3.574	0.010	622
51236.935	51237.113	3.735	0.026	174
51237.907	51238.124	3.872	0.015	486
51238.912	51239.120	4.107	0.030	489
51240.911	51241.124	4.221	0.028	506
51242.080	51242.083	4.670	2.380	2
51242.920	51243.061	4.139	0.119	159
51243.910	51244.131	4.375	0.044	415
51247.915	51247.919	5.186	0.732	10
51248.917	51248.920	4.275	0.241	10
51249.913	51249.917	4.088	0.238	9
51253.917	51253.920	4.660	0.187	10
51255.084	51255.091	5.044	0.816	18
51260.926	51260.929	5.633	0.678	10

[a] JD − 2400000
[b] Magnitude relative to GSC 6523.3618
[c] Standard error of nightly average
[d] Number of frames

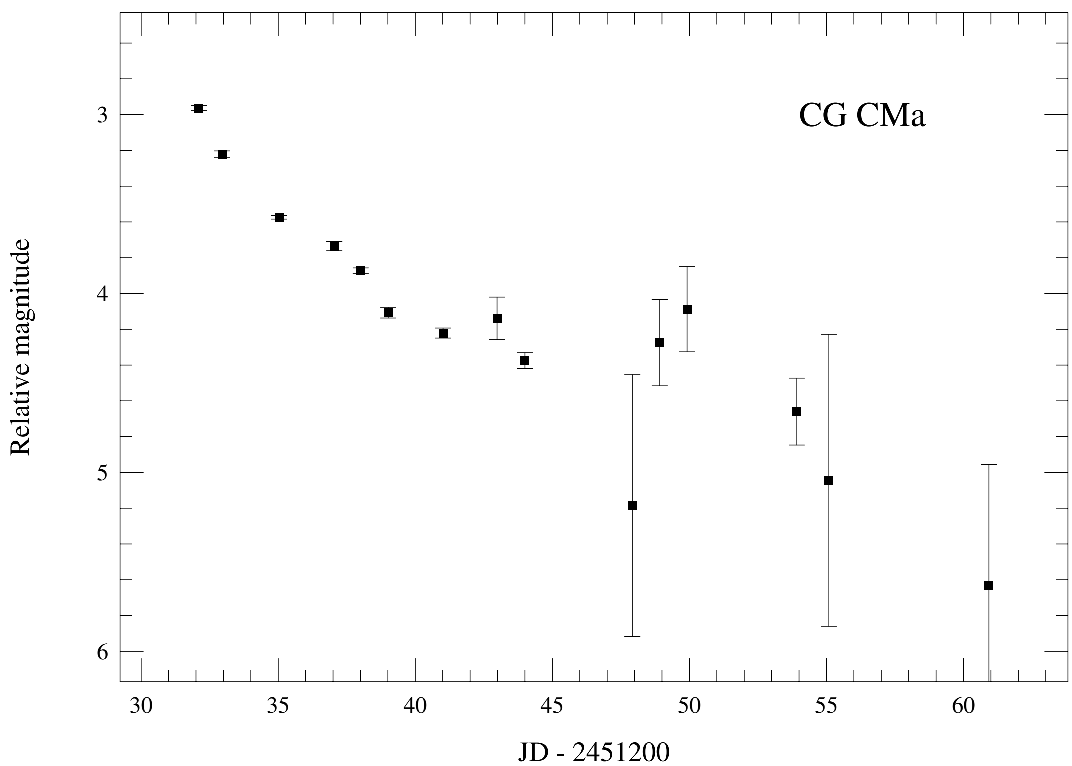

Figure 1. Overall light curve of CG CMa

and Henden 1999), whose constancy was confirmed by comparison with GSC 6523.1912. Table 1 summarizes the observations.

Figure 1 illustrates the overall light curve of the 1999 outburst of CG CMa. We consider the JD 2451260.9 point as the representative brightness of the companion (= quiescent brightness). The star initially declined at a rate of 0.17 mag d^{-1} for seven days, then the decline became slower. Even after 22 days after the outburst maximum, the object remained significantly brighter than quiescence. The outburst thus lasted more than 22 days. The overall light curve strongly resembles those of WZ Sge-type dwarf novae (eg. AL Com, Nogami et al. 1997). A possible fading, although the error was large due to the weather, at JD 2451247.9 (16 day past maximum) may correspond to a "dip" observed in AL Com (Nogami et al. 1997).

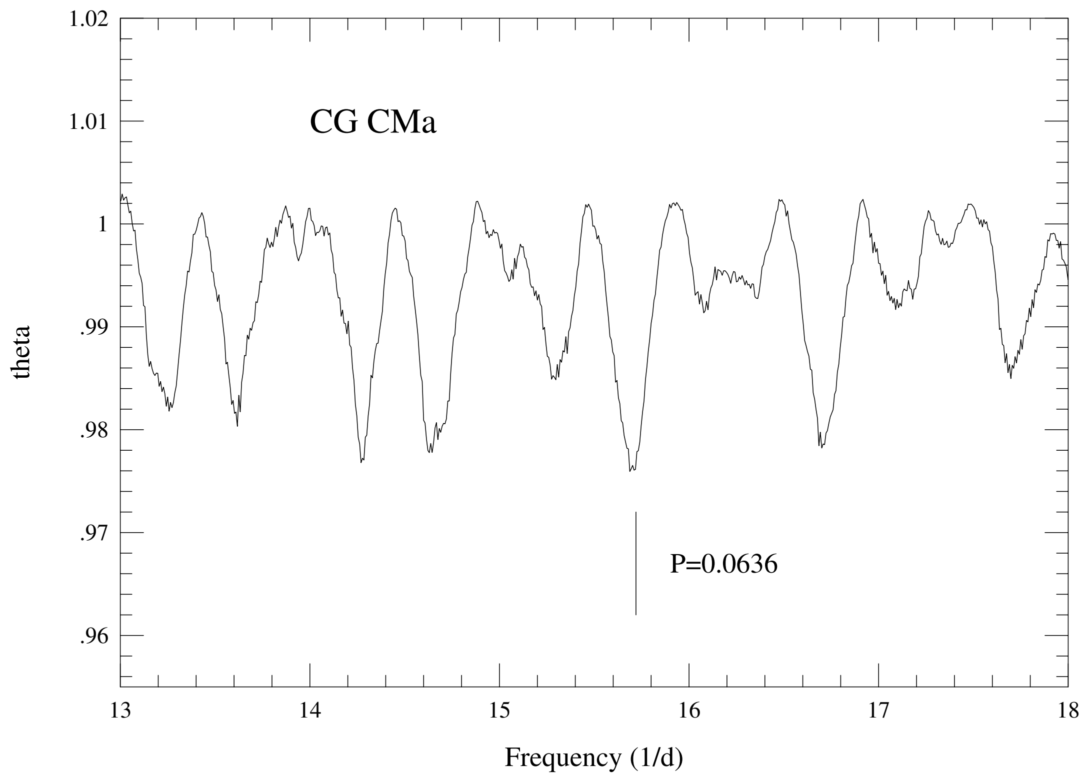

Figure 2. Period analysis of CG CMa

We searched for superhump modulations in the time-series data. There was no marked oscillation for the first two nights, but the wave emerged on February 25 (JD 2451235). The Phase Dispersion Minimization (PDM, Stellingwerf 1978) analysis was applied for the February 25–28 data, after removing the steadily declining trend. The resultant theta diagram is shown in Figure 2. The best period was 0.0636 ± 0.0001 d.

The superhump profile folded by this period is shown in Figure 3. The profile is that of typical, well-developed superhump. The full amplitude is 0.15 mag.

From the typical appearance of superhumps, we conclude CG CMa is a short period SU UMa-type dwarf nova, rather than a classical nova. The long duration and the profile of the outburst particularly suggest a WZ Sge-type classification, which rarely show outbursts. The inferred large outburst amplitude, which is a characteristic of WZ Sge-type dwarf novae, does not contradict with the astrometric implications (Henden 1999).

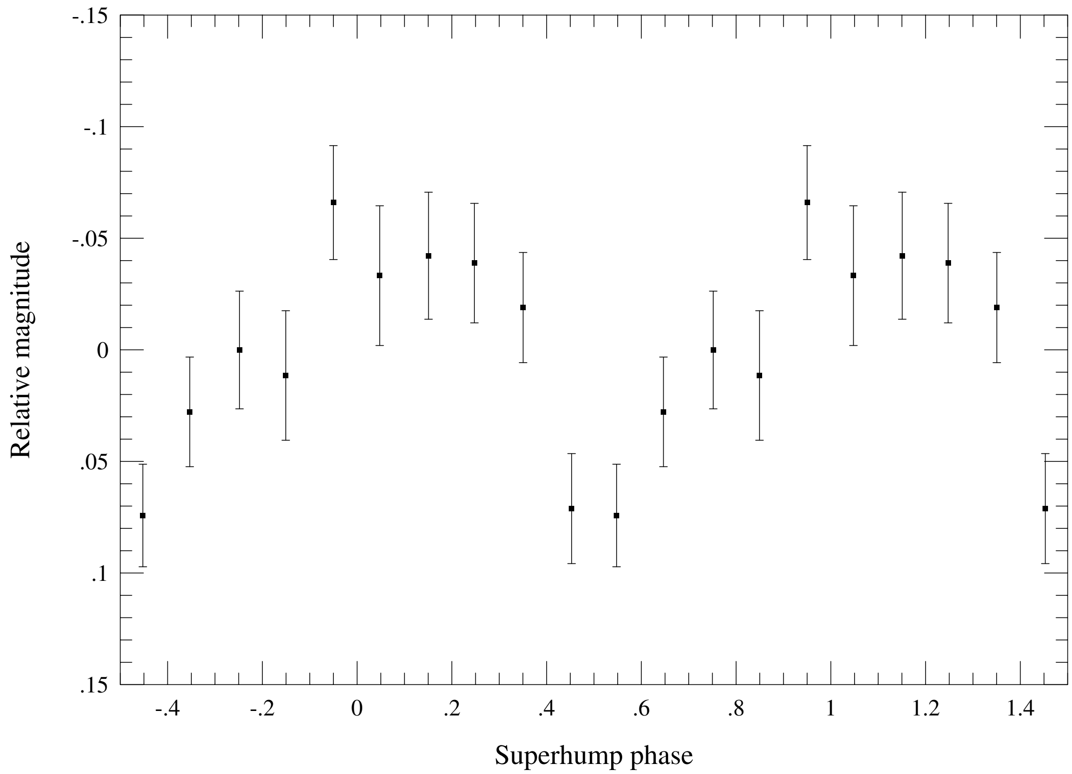

Figure 3. Superhump profile of CG CMa

This work is partly supported by the Grant-in-Aid for Scientific Research (10740095) of the Japanese Ministry of Education, Science, Culture, and Sports (TK). Part of this work is supported by a Research Fellowship of the Japan Society for the Promotion of Science for Young Scientists (KM).

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PRECISE COORDINATES OF VARIABLE STARS (1)

T. KATO

Dept. of Astronomy, Faculty of Science, Kyoto University, Kyoto 606-8502 Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp

This report contains accurate positions for variable stars discovered by Hoffmeister (1962). The variable stars listed in Table 1 were identified against computer plots of GSC and USNO A1.0 catalogs. The color information and IRAS PSC identification were also examined in identifying red variables. The source of identification in column 'source': GSC = GSC 1.1, GSC mean = average of GSC 1.1 multiple entries, USNO = USNO A1.0, USNO mean = average of USNO–A1.0 multiple entries.

PY Tel (S 7657): given as M-type in GCVS. Hoffmeister classified as "short-period, possibly RR Lyr-type". The USNO color is not red.

V2044 Sgr (S 7671): brighter one of two candidate stars.

Detailed information of identifications, other catalog identifications are available from the VSNET archive (vsnet 1197–1201,
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01197.html,
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01198.html,
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01199.html,
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01200.html and
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01201.html).

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Reference:

Hoffmeister, C., 1962, *Astron. Nach.*, **287**, 59

Table 1: Precise coordinates of variable stars

Desig.	R.A.	Decl.	source
	(J2000.0)		
NSV 00056	$00^{h}09^{m}14^{s}.65$	$-46^{\circ}32'28''.7$	GSC mean
NSV 00232	00 37 51 58	−39 51 59 6	GSC
NSV 00254	00 40 18 95	−36 50 30 1	GSC mean
NSV 00370	01 01 07 94	−44 16 20 9	GSC
NSV 00443	01 13 39 35	−26 17 07 5	GSC
VX Scl	01 35 23 51	−35 07 42 0	GSC
NSV 00690	01 59 30 18	−31 29 18 5	GSC
NSV 00736	02 09 25 06	−52 10 10 8	GSC mean
NSV 00782	02 17 57 24	−26 48 21 2	GSC mean
SY For	02 53 14 43	−37 46 14 5	GSC mean
NSV 01120	03 20 09 56	−71 36 09 9	GSC
CR Eri	03 54 17 91	−43 06 38 5	GSC
NSV 01422	03 56 19 58	−32 28 57 2	GSC mean
NSV 01486	04 09 11 22	−43 40 22 8	GSC
NSV 01499	04 10 17 88	−53 18 17 1	GSC mean
NSV 01511	04 12 02 25	−43 12 53 4	GSC
VY Dor	04 48 13 26	−53 48 05 6	GSC
NSV 01856	05 08 38 65	−56 02 56 8	GSC
SS Col	05 41 43 31	−38 57 00 3	USNO
ST Col	05 59 03 80	−39 27 28 2	GSC
NSV 03252	06 51 11 46	−48 21 56 1	GSC
HM Pup	07 19 37 67	−48 39 12 5	GSC mean
NSV 03836	07 58 09 10	−46 48 31 3	GSC
V796 Cen	14 17 06 11	−56 31 58 1	GSC
FR Lup	14 41 02 53	−53 50 24 0	GSC mean
AW Cir	14 50 11 01	−64 32 42 4	GSC
FS Lup	14 52 16 38	−51 25 23 4	GSC mean
YY Aps	15 02 34 48	−72 45 10 2	GSC mean
V749 Cen	15 01 44 63	−36 21 24 3	USNO
NSV 06916	15 05 01 50	−45 03 22 3	GSC
FU Lup	15 09 23 70	−43 19 37 3	GSC mean
FV Lup	15 23 00 35	−53 31 14 7	GSC
NSV 07070	15 26 14 23	−41 28 35 1	GSC mean
FY Lup	15 32 11 38	−44 58 50 0	GSC
IR Nor	15 48 52 70	−44 05 40 0	GSC
EX Lup	16 03 05 48	−40 18 25 9	USNO
NSV 07467	16 09 51 31	−62 12 00 5	GSC mean
NSV 07514	16 14 40 34	−73 48 26 5	GSC mean
NSV 07563	16 15 55 57	−51 07 15 1	GSC mean
BS Aps	16 20 51 60	−71 40 15 2	GSC mean
NSV 07708	16 26 20 29	−34 17 12 3	GSC

Table 1 (cont.)

Desig.	R.A. (J2000.0)	Decl. (J2000.0)	source
HO TrA	$16^h44^m53\overset{s}{.}15$	$-69°59'22\overset{''}{.}3$	GSC mean
V761 Sco	16 43 47 75	−35 48 25 0	GSC
FW TrA	16 54 03 64	−64 59 33 6	GSC
V633 Ara	17 17 01 00	−52 14 06 0	GSC
V530 Ara	17 28 00 30	−49 16 37 1	GSC
V531 Ara	17 28 05 69	−49 29 55 6	GSC
V532 Ara	17 29 11 77	−51 05 40 4	GSC
V904 Sco	17 29 56 75	−41 03 23 1	GSC
V536 Ara	17 40 14 33	−53 50 32 6	GSC
NSV 09477	17 42 40 84	−64 36 51 6	GSC
NSV 09510	17 41 55 06	−45 34 14 9	GSC
NSV 09677	17 48 30 36	−51 13 34 7	GSC mean
V538 Ara	17 49 18 66	−53 20 13 7	GSC
V760 Ara	17 49 30 57	−48 26 42 2	GSC mean
NSV 09837	17 56 02 90	−55 40 31 6	GSC mean
NSV 09917	17 59 42 94	−55 42 05 7	GSC mean
V762 Ara	17 58 55 69	−46 49 53 0	USNO
V763 Ara	17 59 08 21	−47 45 26 8	GSC mean
V641 Ara	18 00 59 46	−47 36 22 4	GSC mean
NSV 10283	18 10 55 22	−54 49 47 1	GSC
NW Pav	18 13 34 62	−65 14 12 1	GSC
PY Tel	18 22 36 36	−48 45 31 4	GSC mean
V2537 Sgr	18 23 00 24	−32 34 04 1	GSC mean
NSV 10751	18 26 43 16	−62 52 18 0	GSC mean
NSV 11053	18 40 48 66	−79 53 55 7	GSC mean
V441 CrA	18 29 54 62	−41 06 56 2	USNO
NSV 10906	18 30 55 07	−44 43 28 8	GSC mean
V622 CrA	18 31 06 15	−38 21 07 4	GSC mean
NSV 10991	18 34 26 69	−63 12 05 3	GSC
V1999 Sgr	18 32 32 14	−34 58 40 6	USNO
V445 CrA	18 37 38 22	−44 30 31 3	GSC
NSV 11135	18 39 15 02	−44 43 09 4	GSC
NSV 11262	18 44 55 73	−47 13 24 8	GSC mean
OU Tel	18 45 15 46	−49 13 58 6	GSC mean
NSV 11328	18 47 40 40	−48 36 03 2	GSC mean
V2044 Sgr	18 49 44 04	−34 00 29 4	GSC
HI Tel	18 55 22 57	−52 45 04 3	GSC mean
DR Pav	19 02 52 62	−63 08 57 9	GSC
HK Tel	19 06 49 91	−52 29 43 3	GSC mean
NSV 11853	19 17 05 63	−51 37 05 5	GSC mean

Table 1 (cont.)

Desig.	R.A. (J2000.0)	Decl. (J2000.0)	source
V1266 Sgr	$19^{\rm h}21^{\rm m}08^{\rm s}.50$	$-29°49'38''.9$	GSC
NSV 11936	19 22 38 94	−45 40 23 2	GSC mean
V2144 Sgr	19 25 51 02	−43 56 34 0	GSC mean
NSV 12094	19 32 52 75	−65 04 07 7	GSC
HL Tel	19 31 05 60	−50 23 46 5	GSC
QR Pav	19 35 40 16	−61 19 17 6	GSC
HM Tel	19 34 10 39	−49 10 46 0	GSC
NSV 12283	19 42 17 07	−45 46 21 6	GSC
V2173 Sgr	19 44 02 38	−33 19 33 6	GSC
FO Pav	19 51 42 26	−62 44 05 9	GSC mean
NSV 12502	19 53 49 80	−50 03 28 0	GSC
NSV 12592	19 58 25 11	−54 30 53 4	GSC
NSV 12644	20 00 18 70	−46 42 38 0	GSC mean
NSV 12849	20 11 15 42	−50 18 12 6	GSC
PP Tel	20 16 56 47	−51 15 11 1	GSC mean
IS Tel	20 21 42 69	−49 48 54 5	GSC mean
SW Ind	20 30 26 17	−48 14 57 6	GSC
V337 Pav	20 48 06 59	−62 04 47 2	GSC mean
V338 Pav	21 08 34 20	−63 28 06 1	GSC
NSV 13809	21 38 29 71	−49 00 52 7	USNO
SX PsA	21 39 43 27	−30 53 39 2	GSC mean
NSV 13835	21 41 21 39	−38 24 54 2	GSC
AT Gru	21 42 38 27	−41 39 34 2	GSC mean
SY PsA	21 42 34 96	−32 12 10 6	USNO
NSV 13906	21 55 10 47	−76 56 26 4	GSC mean
SV Gru	21 58 49 44	−44 19 29 8	GSC
AO Ind	22 00 29 14	−50 29 39 6	GSC
AQ Ind	22 07 55 15	−59 52 29 3	GSC
UW Gru	22 20 13 21	−54 33 28 4	GSC mean
AZ Ind	22 33 30 78	−69 33 43 2	GSC
WZ Gru	22 44 45 95	−42 21 42 1	GSC mean
SZ PsA	22 51 40 50	−27 51 13 8	GSC mean
NSV 14355	22 54 55 64	−52 49 13 0	GSC mean
AE Gru	22 55 51 71	−40 40 16 5	GSC
NSV 14467	23 15 23 70	−50 18 28 1	GSC mean
AQ Gru	23 22 18 02	−42 05 24 4	GSC mean
NSV 14546	23 25 20 92	−67 50 05 5	GSC mean
AK Scl	23 36 56 52	−37 22 20 2	GSC mean
NSV 14697	23 46 02 87	−35 35 21 2	GSC

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PRECISE COORDINATES OF VARIABLE STARS (2)

T. KATO

Dept. of Astronomy, Faculty of Science, Kyoto University, Kyoto 606-8502 Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp

This report contains 307 accurate J2000.0 positions for variable stars discovered by Hoffmeister (1965). The variables stars listed in Table 1 were identified against computer plots of GSC and USNO A1.0 catalogs. The color information and IRAS PSC identification were also examined in identifying red variables. The source of identification in column 'Cat.': G = GSC 1.1, GM = average of GSC 1.1 multiple entries, U = USNO–A1.0, UM = average of USNO–A1.0 multiple entries.

V575 Her (S 8609), V555 Ara (S 8669), V581 Ara (S 8713), V453 CrA (S 8745), FS Aps (S 8905), CY Mus (S 8965), DX Mus (S 9015), V1106 Aql (S 9051): brightest or most likely candidates are given.

V543 Ara (S 8634): no good candidate. Object listed may be too faint.

DY Mus (S 9016): position corrected in GCVS. Comparison with the original article supports the identification in the table.

MY Per (S 8548), NS Per (S 8554), V1060 Cyg (S 9108), V1062 Cyg (S 9110), V1065 Cyg (S 9113): identical identifications in Downes et al. (1997). However, the cataloged range of position for V1065 Cyg indicates a blank field on POSS. The true identification should be checked by astrometry during outburst.

Detailed information of identifications, other catalog identifications are available from the VSNET archive (vsnet 1158–1173, 1176 and 1177, http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01158.html etc.)

The author is grateful to the USNO PMM team for making USNO A1.0 CD-ROMs available to the author. This work is partly supported by the Grant-in-Aid for Scientific Research (10740095) of the Japanese Ministry of Education, Science, Culture, and Sports.

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Downes, R., Webbink, R. F, Shara, M. M., 1997, *PASP*, **109**, 345
Hoffmeister, C., 1965, *Astron. Nach.*, **289**, 1

Table 1: Precise coordinates of variable stars

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
MN Per	$03^{h}45^{m}57^{s}.14$	$+50^{\circ}16'52''.7$	U	MO Per	$03^{h}45^{m}56^{s}.89$	$+46^{\circ}48'27''.1$	G
MP Per	03 48 40.72	+43 25 33.7	G	MQ Per	03 49 48.40	+46 08 27.7	U
MR Per	03 50 46.91	+48 12 37.1	GM	MS Per	04 01 12.22	+49 33 11.8	G
MT Per	04 01 59.43	+51 22 07.1	G	MU Per	04 02 45.12	+52 12 17.6	U
V415 Per	04 03 21.60	+45 45 33.7	U	MV Per	04 03 55.88	+44 28 18.4	G
V416 Per	04 08 08.92	+45 24 10.8	G	MY Per	04 09 11.27	+48 22 05.3	U
MZ Per	04 11 23.91	+46 21 04.3	U	V481 Per	04 13 08.79	+49 42 35.3	G
NO Per	04 15 41.82	+48 40 42.4	G	V482 Per	04 15 41.32	+47 25 20.5	G
NQ Per	04 16 22.21	+50 06 10.4	U	NS Per	04 18 44.48	+51 07 31.1	U
V417 Per	04 18 29.20	+48 12 36.1	G	V418 Per	04 19 00.80	+47 10 42.4	G
NT Per	04 19 30.77	+52 19 12.6	U	NU Per	04 19 42.62	+50 07 26.5	G
NX Per	04 23 39.35	+49 57 26.3	U	AO Cam	04 28 13.61	+53 02 45.4	G
OO Per	04 28 57.76	+45 53 02.5	U	OR Per	04 32 13.26	+48 28 48.5	U
OS Per	04 36 29.33	+49 16 20.6	U	OT Per	04 38 37.94	+47 44 24.2	U
OU Per	04 40 55.89	+44 30 06.5	U	OV Per	04 43 39.99	+50 14 19.5	U
KR Pup	07 35 07.11	−16 20 32.6	GM	HQ Cep	23 12 46.89	+61 26 32.7	U
V433 Cas	23 25 12.08	+61 19 29.1	G	V378 Lac	22 03 27.92	+45 34 06.0	GM
GN Lac	22 06 51.53	+43 22 56.7	G	GP Lac	22 12 17.54	+45 30 51.7	U
GR Lac	22 19 56.49	+46 19 21.6	U	GT Lac	22 30 30.06	+45 49 41.9	U
FY Lac	22 32 35.46	+45 31 46.5	G	GU Lac	22 34 35.15	+45 04 15.2	U
V661 Her	17 42 13.31	+28 37 28.5	GM	V559 Her	17 49 16.58	+28 18 21.2	GM
V560 Her	17 50 17.80	+25 58 11.4	G	V561 Her	17 51 30.13	+28 22 12.7	U
V664 Her	17 53 54.01	+31 53 31.7	U	V563 Her	17 58 07.29	+28 35 58.8	GM
V666 Her	18 01 41.52	+31 25 48.8	G	V569 Her	18 09 48.85	+29 03 19.2	U
V572 Her	18 11 38.40	+25 54 38.5	U	V670 Her	18 13 07.68	+29 35 11.2	G
V574 Her	18 13 35.88	+28 29 53.0	U	V575 Her	18 14 35.45	+29 44 40.4	U
V576 Her	18 18 38.17	+28 25 13.3	G	V671 Her	18 20 02.46	+29 17 31.5	U
V799 Her	17 19 03.61	+14 44 38.1	GM	V801 Her	17 20 23.89	+13 32 39.9	G
V2073 Oph	17 25 01.50	+10 51 28.6	U	V658 Her	17 28 36.69	+15 31 17.1	G
V1062 Oph	17 29 58.42	+12 52 24.0	U	V659 Her	17 30 53.09	+14 21 48.9	GM
V1064 Oph	17 34 32.76	+09 44 51.3	U	V1065 Oph	17 38 53.08	+10 23 32.0	G
V555 Her	17 39 29.18	+15 43 25.1	U	V556 Her	17 44 53.55	+14 40 56.7	U
V1073 Oph	17 46 24.37	+13 53 25.0	U	V1075 Oph	17 50 21.76	+13 27 03.2	G
V540 Ara	17 39 04.47	−54 51 38.1	U	V544 Ara	17 39 36.54	−54 08 52.7	U
V542 Ara	17 39 43.67	−52 54 31.1	U	V543 Ara	17 41 43.10	−52 20 45.4	U
V544 Ara	17 42 02.47	−52 42 58.2	U	V545 Ara	17 42 29.78	−48 53 38.6	U
V546 Ara	17 42 59.43	−50 27 46.6	U	V548 Ara	17 44 45.69	−51 59 39.3	UM
V547 Ara	17 44 12.54	−47 06 13.5	U	V549 Ara	17 44 51.62	−50 07 39.3	U
V550 Ara	17 44 43.38	−47 18 49.2	U	V551 Ara	17 45 21.72	−50 04 14.2	U
V552 Ara	17 45 51.69	−53 37 31.0	U	V553 Ara	17 46 27.25	−49 50 07.6	U
V554 Ara	17 46 34.54	−50 11 40.1	U	V555 Ara	17 47 10.01	−46 30 33.1	U
V556 Ara	17 47 28.24	−50 19 52.4	U	V557 Ara	17 47 34.45	−49 12 20.0	U
V558 Ara	17 48 10.39	−50 11 21.6	U	V559 Ara	17 48 37.88	−51 23 25.0	U
V560 Ara	17 48 16.30	−47 59 19.0	U	V561 Ara	17 48 55.74	−52 29 31.8	U
V562 Ara	17 49 23.29	−55 19 15.2	U	V563 Ara	17 49 15.48	−52 25 22.5	UM
V564 Ara	17 49 55.73	−54 51 51.2	U	V565 Ara	17 49 59.00	−53 42 23.9	U
V566 Ara	17 49 20.78	−46 50 13.7	U	V567 Ara	17 50 35.06	−53 48 54.6	U
V568 Ara	17 51 24.71	−46 05 10.1	U	V569 Ara	17 51 30.99	−46 32 13.8	U
V570 Ara	17 53 12.50	−55 09 33.2	U	V571 Ara	17 53 04.72	−52 31 26.6	UM
V572 Ara	17 53 15.94	−50 07 34.1	U	V573 Ara	17 53 23.30	−50 22 51.3	U
V828 Sco	17 52 51.38	−45 14 06.6	U	MQ Ara	17 53 10.24	−46 48 03.1	U
V574 Ara	17 53 43.69	−49 15 45.0	U	V576 Ara	17 54 27.52	−53 02 45.5	U

Table 1 (cont.)

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V578 Ara	$17^h54^m21^s.02$	$-50°01'37''.1$	U	V577 Ara	$17^h53^m59^s.30$	$-47°42'47''.5$	G
V579 Ara	17 54 33.96	−51 22 36.8	U	V581 Ara	17 54 40.95	−51 16 02.8	U
V580 Ara	17 54 14.59	−46 58 10.5	U	V582 Ara	17 54 33.44	−46 42 40.8	U
V834 Sco	17 54 43.70	−45 30 48.4	U	V584 Ara	17 55 39.68	−52 47 15.9	U
V583 Ara	17 54 58.94	−46 02 04.5	G	V585 Ara	17 55 53.24	−52 06 08.7	U
V586 Ara	17 56 00.06	−46 30 08.9	U	V839 Sco	17 55 52.52	−44 56 05.7	U
V761 Ara	17 56 16.80	−45 55 28.8	U	V587 Ara	17 56 50.57	−48 46 19.0	U
V588 Ara	17 57 32.28	−47 18 21.5	U	V589 Ara	17 58 39.53	−55 05 21.5	U
V590 Ara	17 57 42.76	−45 33 22.7	U	V847 Sco	17 57 46.32	−44 41 58.7	U
V591 Ara	17 58 59.81	−47 38 39.6	U	V764 Ara	17 59 47.02	−53 16 16.8	U
V453 CrA	17 59 32.52	−45 14 15.6	U	V654 CrA	17 59 52.09	−45 18 17.5	G
V592 Ara	18 01 10.72	−48 55 48.9	U	V594 Ara	18 02 02.72	−48 44 29.4	U
V595 Ara	18 02 21.64	−47 12 57.8	U	V596 Ara	18 03 03.24	−50 07 48.8	U
V597 Ara	18 03 09.65	−47 20 02.0	UM	V765 Ara	18 03 34.64	−47 14 42.4	U
V598 Ara	18 03 58.78	−47 47 09.1	U	V599 Ara	18 05 18.43	−47 58 44.9	U
V600 Ara	18 05 19.01	−47 39 57.3	U	V601 Ara	18 05 32.11	−47 08 31.9	U
V602 Ara	18 05 40.94	−48 21 50.1	U	V613 Ara	18 07 43.41	−54 26 21.9	U
V603 Ara	18 07 28.01	−47 15 21.4	U	V604 Ara	18 07 42.40	−45 48 28.2	U
V605 Ara	18 07 45.64	−45 31 12.8	U	V606 Ara	18 08 02.82	−48 19 15.8	U
V607 Ara	18 09 01.54	−51 44 08.8	U	V608 Ara	18 09 14.57	−48 57 55.8	U
V497 CrA	18 08 58.93	−44 35 21.1	U	KM Tel	18 09 43.06	−49 41 01.0	U
KN Tel	18 10 14.65	−54 02 16.7	U	KP Tel	18 10 19.64	−51 20 35.6	U
KO Tel	18 09 57.48	−47 04 59.0	U	V500 CrA	18 10 00.29	−44 44 05.7	U
KQ Tel	18 10 52.84	−48 58 35.8	U	KR Tel	18 11 38.71	−53 00 32.4	U
V505 CrA	18 11 07.21	−45 08 52.9	U	V507 CrA	18 11 29.34	−45 17 15.2	U
KS Tel	18 12 32.60	−52 32 14.4	U	KT Tel	18 12 46.50	−46 18 16.7	U
V510 CrA	18 12 03.33	−45 02 38.6	U	KU Tel	18 13 21.31	−48 39 09.7	U
KV Tel	18 14 25.26	−50 38 19.3	U	KW Tel	18 14 16.79	−46 54 30.7	U
KX Tel	18 14 34.78	−46 18 17.8	U	V676 CrA	18 14 42.04	−45 02 32.1	U
KY Tel	18 15 45.95	−50 23 23.5	U	LL Tel	18 16 07.57	−49 10 48.6	U
KZ Tel	18 15 57.88	−47 13 54.5	U	LM Tel	18 17 24.21	−46 20 17.5	U
LN Tel	18 17 42.78	−45 42 02.1	U	LO Tel	18 18 00.28	−46 17 11.1	U
LP Tel	18 18 49.78	−51 56 49.6	U	LQ Tel	18 18 34.90	−46 57 33.7	U
LR Tel	18 18 47.48	−46 45 47.8	U	LS Tel	18 20 08.73	−45 38 13.1	U
LT Tel	18 20 49.79	−50 53 14.0	U	V418 CrA	18 20 45.40	−44 44 50.7	U
LU Tel	18 21 08.21	−46 32 56.5	G	V562 CrA	18 21 31.01	−44 20 43.8	U
LV Tel	18 23 04.32	−48 20 34.5	U	V565 CrA	18 22 46.16	−44 46 22.4	U
LW Tel	18 22 57.70	−46 23 10.0	U	LX Tel	18 23 27.13	−46 59 17.4	U
LY Tel	18 24 40.09	−49 29 41.8	U	MM Tel	18 26 18.90	−48 22 09.1	U
MN Tel	18 26 57.80	−47 19 18.0	U	MO Tel	18 27 20.90	−49 56 17.8	U
V607 CrA	18 28 31.28	−44 50 53.0	GM	MP Tel	18 30 06.88	−49 02 33.2	U
MQ Tel	18 30 18.07	−47 09 02.1	U	MR Tel	18 31 03.73	−51 59 16.5	U
MS Tel	18 31 09.43	−48 51 10.4	U	EU Tel	18 33 30.06	−49 54 19.2	G
FS Aps	14 29 28.58	−70 34 25.0	U	BI Cir	14 32 50.10	−69 26 43.4	U
FT Aps	14 35 29.35	−72 19 04.9	U	BK Cir	14 34 53.49	−66 22 06.4	U
AY Cir	14 35 36.36	−68 38 44.7	U	FF Aps	14 38 17.08	−71 47 49.6	U
AZ Cir	14 38 22.50	−66 14 44.1	U	LX Aps	14 45 45.80	−70 56 00.1	U
BL Cir	14 49 56.66	−69 20 51.1	G	BM Cir	14 49 58.47	−66 02 31.9	U
BC Cir	14 51 26.37	−70 29 25.7	U	EM TrA	14 56 33.26	−68 08 34.3	GM
GU TrA	15 01 57.54	−69 44 50.2	G	FG Aps	15 06 42.44	−72 13 21.6	U
FZ Aps	15 06 03.49	−65 43 22.4	U	IX TrA	15 18 33.17	−68 53 28.3	U
BH Cir	15 17 51.25	−64 00 57.4	U	GG TrA	15 19 10.98	−67 08 32.6	U

Table 1 (cont.)

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
GV TrA	$15^h19^m25^s.17$	$-65°48'55''.6$	U	GH TrA	$15^h22^m10^s.98$	$-66°44'02''.6$	U
GW TrA	15 24 25.93	−67 23 56.9	U	LZ Aps	15 27 03.52	−71 48 15.5	U
GX TrA	15 27 14.59	−65 32 14.5	U	FH Aps	15 31 39.64	−72 40 17.7	U
FI Aps	15 32 58.63	−73 13 43.4	U	FK Aps	15 37 13.51	−72 11 22.3	U
GI TrA	15 41 37.48	−68 26 41.9	U	FL Aps	15 42 48.49	−71 07 08.8	G
GK TrA	15 41 02.98	−64 51 35.7	U	GL TrA	15 43 30.12	−65 26 56.6	U
GM TrA	15 43 52.60	−64 40 27.8	U	GY TrA	15 46 20.62	−66 41 14.4	G
FU Aps	15 49 25.07	−71 19 08.8	U	FM Aps	15 51 10.35	−72 26 15.7	U
FN Aps	15 51 33.42	−72 22 22.2	GM	GO TrA	15 52 06.57	−66 31 09.2	U
GZ TrA	15 54 26.91	−69 10 56.4	G	HH TrA	15 59 20.49	−67 15 56.7	U
GP TrA	16 01 00.65	−69 35 15.9	U	CU Mus	11 27 05.81	−74 28 27.5	U
CV Mus	11 44 28.99	−70 42 55.9	GM	CW Mus	11 47 16.56	−69 56 19.8	G
CY Mus	11 50 40.03	−67 05 47.8	U	DP Mus	11 54 52.36	−73 31 43.4	U
CZ Mus	11 59 49.75	−70 31 08.7	G	DQ Mus	12 00 22.06	−68 29 34.4	UM
DR Mus	12 00 37.59	−70 55 51.4	G	EI Mus	12 01 57.86	−72 14 02.7	G
DD Mus	12 14 39.94	−68 32 35.4	U	DE Mus	12 14 59.21	−68 45 20.9	U
DF Mus	12 17 31.99	−67 29 32.8	G	DG Mus	12 18 28.23	−70 57 59.4	U
DS Mus	12 22 08.86	−70 44 38.4	U	IQ Mus	12 38 15.68	−68 24 29.2	U
DT Mus	12 39 07.82	−69 46 17.3	U	DU Mus	12 40 59.95	−67 06 45.7	U
EP Mus	12 43 14.59	−69 03 23.1	GM	DH Mus	12 44 41.99	−71 54 05.9	U
DI Mus	12 50 16.62	−69 49 14.2	U	DV Mus	12 50 38.47	−68 56 29.3	U
DK Mus	12 52 05.19	−68 48 37.5	U	DL Mus	12 52 17.24	−69 05 07.2	U
ER Mus	12 53 01.75	−71 13 24.2	U	DM Mus	13 08 33.93	−68 25 42.9	U
DX Mus	13 13 22.87	−70 22 15.5	U	DY Mus	13 16 58.04	−67 52 30.8	GM
DN Mus	13 23 34.88	−74 33 42.2	G	BY Cha	13 34 48.83	−76 45 55.2	U
V580 Her	18 53 03.73	+15 33 22.4	U	V582 Her	18 55 54.56	+13 54 26.6	U
V583 Her	18 56 22.81	+14 53 17.5	G	V584 Her	18 57 12.98	+16 34 07.5	U
V1186 Aql	19 02 25.87	+14 22 36.0	U	V1187 Aql	19 02 56.23	+15 33 21.0	U
V1104 Aql	19 03 40.20	+14 44 16.9	U	V1106 Aql	19 04 25.52	+14 13 32.8	U
V1105 Aql	19 04 14.11	+16 37 46.4	U	V1107 Aql	19 04 37.81	+14 49 53.9	G
V1108 Aql	19 05 27.18	+15 58 07.9	U	LL Vul	20 31 43.31	+25 38 36.2	U
NW Vul	20 32 06.17	+23 56 50.9	U	LM Vul	20 34 52.37	+23 11 37.6	U
LN Vul	20 35 07.42	+22 53 30.4	U	LQ Vul	20 39 14.16	+24 20 44.3	U
LR Vul	20 40 43.14	+24 54 40.0	U	LS Vul	20 44 38.26	+23 11 15.5	U
V1327 Cyg	20 39 52.54	+32 30 27.7	U	V1203 Cyg	20 42 12.59	+32 51 21.8	U
V1205 Cyg	20 44 51.41	+34 49 14.7	U	V1206 Cyg	20 45 15.52	+34 37 30.4	U
V1207 Cyg	20 45 54.58	+34 39 21.0	U	V1208 Cyg	20 46 27.52	+32 49 33.4	U
V1209 Cyg	20 46 56.70	+33 21 13.0	U	V1210 Cyg	20 46 58.92	+33 00 44.5	U
V1211 Cyg	20 47 10.15	+35 04 56.4	U	V1213 Cyg	20 49 05.23	+34 31 51.7	U
V1214 Cyg	20 49 17.63	+34 56 05.0	U	V1215 Cyg	20 49 21.69	+34 44 11.3	U
V1216 Cyg	20 49 51.38	+35 27 58.5	U	V1217 Cyg	20 50 30.18	+34 37 12.4	U
V1328 Cyg	20 50 52.89	+33 12 04.7	U	AN Cyg	20 51 22.38	+33 48 19.8	U
V1218 Cyg	20 52 25.33	+34 55 15.7	U	V1804 Cyg	21 07 29.79	+37 10 44.7	G
V1226 Cyg	21 07 23.89	+38 24 50.7	U	V1060 Cyg	21 07 42.21	+37 14 09.0	U
V1062 Cyg	21 08 12.14	+36 49 27.1	U	V1230 Cyg	21 10 03.74	+36 54 42.5	U
V1065 Cyg	21 10 59.06	+38 57 12.6	U	V1233 Cyg	21 11 47.02	+38 17 37.1	U
V1235 Cyg	21 14 19.83	+38 00 58.1	U	V1237 Cyg	21 17 26.90	+37 34 46.5	U
V1556 Cyg	21 18 07.66	+39 17 30.3	U	V1238 Cyg	21 19 02.32	+36 54 07.6	U
V1333 Cyg	21 18 57.47	+39 03 37.0	U	V1239 Cyg	21 19 45.35	+38 21 57.2	U
V1240 Cyg	21 22 28.69	+37 39 43.1	G				

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CCD PHOTOMETRY OF THE 1999 FEBRUARY SUPEROUTBURST OF CY UMa

T. KATO, K. MATSUMOTO

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

CY UMa was discovered as a dwarf nova by Goranskij (1977). Following the initial claim of visual and photographic superhump detection by Kato et al. (1988), CCD observations independently revealed the presence of superhumps (Kato 1995; Harvey, Patterson 1995).

During the 1999 February superoutburst, starting on 1999 February 10 (E. Muyllaert, $m_{\rm v} = 12.5$, VSNET), we undertook time-resolved CCD photometry of CY UMa.

The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\rm TM}$-based aperture and PSF photometry package developed by one of the authors (TK). The flux of the variable was measured relative to GSC 3446.96 (Tycho $V = 10.84$, $B - V = 0.38$; USNO r-magnitude 10.1), whose constancy was confirmed by comparison with GSC 3446.384 (USNO r-magnitude 12.4).

Figure 1 illustrates the overall light curve of the present observation. Before February 22 (JD 2451232) individual observations are plotted; after the decline, nightly averages with error bars are plotted instead. The superoutburst plateau stage (February 13–20) was analyzed, after subtracting the linear decline trend (0.14 mag d^{-1}), using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978).

The result of period analysis is given in Figure 2. Although unavoidable one-day aliases exist, we can safely choose, with the help of previous period determinations, the correct period of 0.0722 ± 0.0001 d, corresponding to the frequency of 13.85 d^{-1}. The present best period agrees with previous reports within respective errors: 0.0719 ± 0.0005 d (Kato 1995) and 0.07210 ± 0.00003 d (Harvey, Patterson 1995).

Besides superhumps, we examined the post-superoutburst behavior, during which some SU UMa-type dwarf novae are known to show rebrightenings. No evidence of rebrightening was observed, both in our CCD monitoring until 12 d past the steep decline, and visual monitoring reported to VSNET.

Figure 3 shows enlarged light curves of nightly runs. The typical error of a single measurement was 0.01 mag on February 13 and 0.02 mag on other nights. The amplitude of superhumps was the largest (0.30 mag) on February 13, and gradually decayed. On the declining branch from the superhump maximum on February 13, quasi-periodic oscillations (QPOs) with a period of 10–15 m were visible. This modulation quickly decayed on subsequent nights.

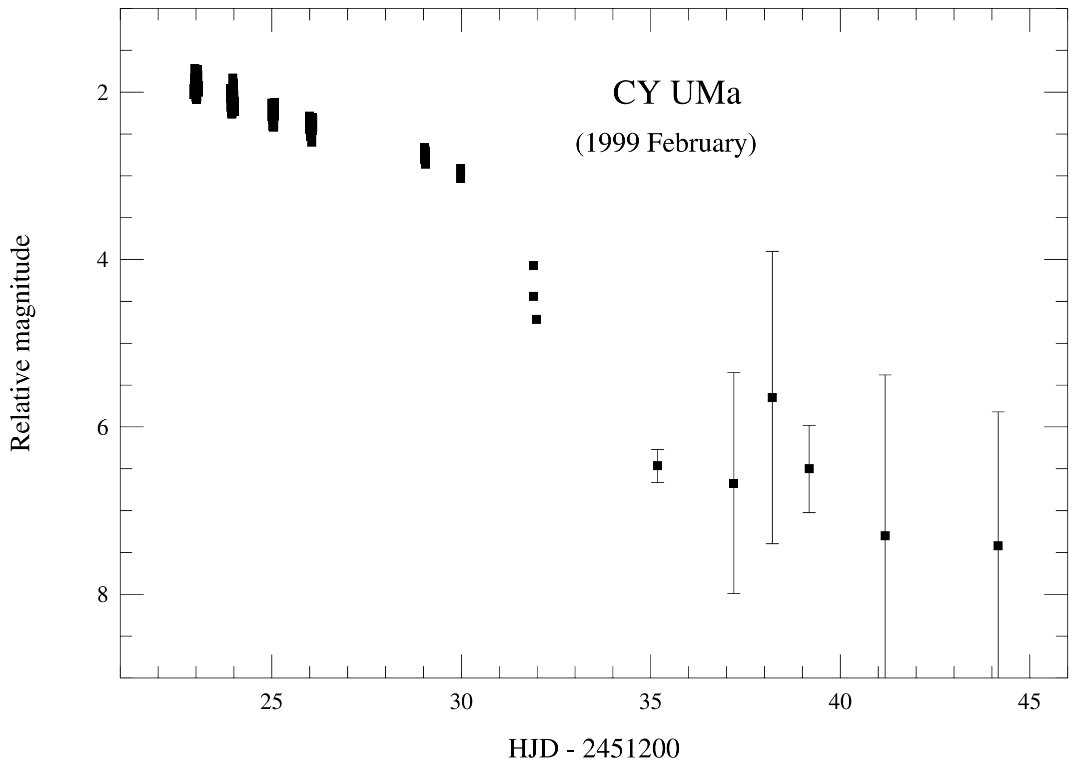

Figure 1. Overall light curve of CY UMa

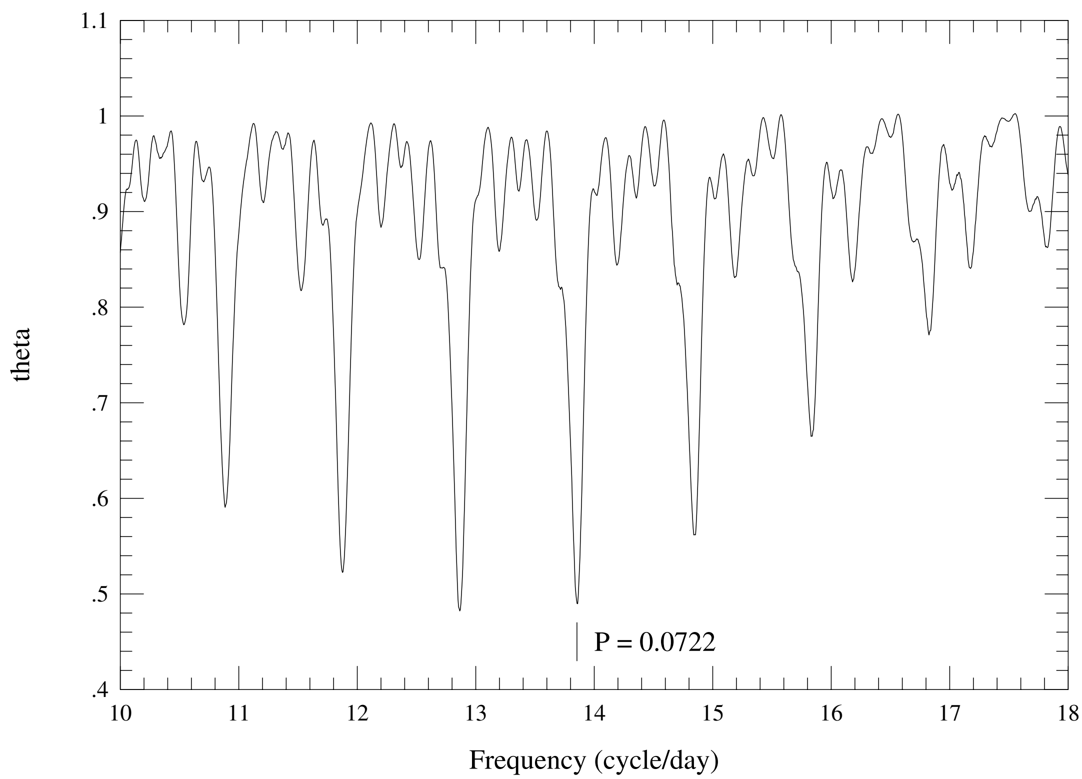

Figure 2. Period analysis of CY UMa

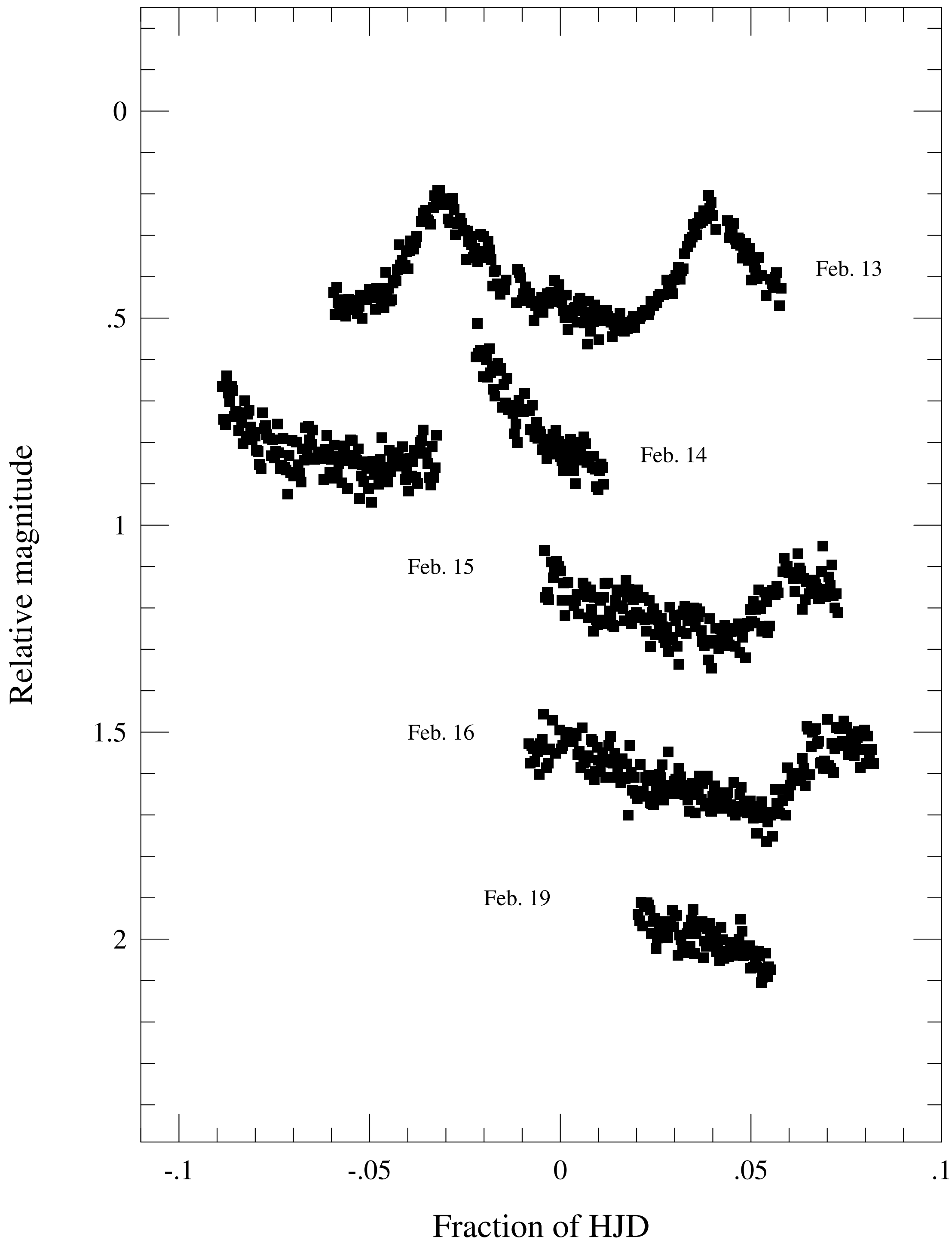

Figure 3. Nightly light curve of CY UMa

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PRECISE COORDINATES OF VARIABLE STARS (3)

T. KATO

Dept. of Astronomy, Faculty of Science, Kyoto University, Kyoto 606-8502 Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp

This report contains 246 accurate J2000.0 positions for variable stars discovered by Hoffmeister (1965). The variable stars listed in Table 1 were identified against computer plots of GSC and USNO A1.0 catalogs. The color information and IRAS PSC identification were also examined in identifying red variables. The source of identification in column 'Cat.': G = GSC 1.1, GM = average of GSC 1.1 multiple entries, U = USNO A1.0, UM = average of USNO A1.0 multiple entries.

PY Per (S 9160): correctly identified in Downes et al. (1997). Known to have a close 16-th mag companion.

V336 Per (S 9180): Downes et al. (1997) points a USNO star, probably close to the real object; however Hoffmeister's description corresponds to a blank region on POSS. We should probably need further astrometry during outburst.

KZ Gem (S 9208): identification in Downes et al. (1997) probably correct. Coordinates given correspond to those by Downes et al. (1997).

V372 Lyr (S 9358): appears very bright both on GSC and USNO A1.0. Hoffmeister's plot suggests a bright star, which is in conflict with the reported range of variability (16–17 m_{pg}) by Hoffmeister.

V439 Cas (S 9482): double star in USNO, no mentioning by Hoffmeister (1965). Redder component given.

Detailed information of identifications, other catalog identifications are available from the VSNET archive (vsnet 1141, 1142, 1147, 1148, 1149–1155, 1157,
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01141.html etc.)

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Table 1: Precise coordinates of variable stars

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V448 Cas	$00^{h}47^{m}07^{s}.79$	$+60°21'14''.2$	U	V413 Cas	$00^{h}47^{m}16^{s}.68$	$+55°08'24''.4$	G
V365 Cas	01 00 53 16	+56 36 45 3	G	V417 Cas	01 07 19 87	+53 38 03 8	GM
V553 Cas	01 08 08 64	+62 15 20 8	U	V457 Cas	01 09 53 01	+55 13 30 7	U
V418 Cas	01 12 59 89	+62 10 47 6	U	V463 Cas	01 15 40 03	+58 05 27 7	G
V471 Cas	01 32 20 48	+55 12 19 7	G	OY Per	01 34 53 76	+53 39 31 4	U
V421 Cas	01 37 52 41	+57 19 58 0	U	V422 Cas	01 40 39 25	+59 25 26 7	G
V475 Cas	01 41 18 46	+56 25 45 0	G	V424 Cas	01 47 03 56	+56 47 37 8	UM
V350 Per	01 52 35 11	+57 50 18 9	G	V442 Per	02 44 57 58	+38 15 30 4	G
PW Per	02 45 05 46	+36 13 59 5	U	V443 Per	02 46 42 29	+37 17 49 1	G
PX Per	02 47 15 58	+35 55 37 7	U	V444 Per	02 47 38 89	+40 53 35 8	G
V445 Per	02 47 38 69	+39 39 35 7	GM	V446 Per	02 49 18 73	+35 00 30 8	U
PY Per	02 50 00 14	+37 39 23 1	U	V447 Per	02 50 34 12	+35 24 19 8	U
V426 Per	02 59 25 29	+41 20 03 1	G	V450 Per	02 59 15 35	+41 45 23 5	G
V451 Per	03 01 34 08	+40 44 10 4	U	V428 Per	03 02 35 94	+41 12 04 5	G
QS Per	03 05 01 46	+36 24 44 6	U	V429 Per	03 05 36 78	+42 43 24 8	G
QU Per	03 05 54 71	+40 41 12 7	G	V454 Per	03 06 44 39	+38 02 15 4	U
V431 Per	03 09 34 27	+42 19 45 9	G	QV Per	03 09 31 84	+38 21 15 4	G
V456 Per	03 10 11 95	+40 02 15 6	G	V457 Per	03 11 14 08	+36 59 25 6	GM
QW Per	03 12 43 08	+38 57 55 8	G	V458 Per	03 12 46 96	+38 47 50 0	GM
V433 Per	03 14 35 16	+43 14 46 9	U	QX Per	03 15 11 60	+39 34 48 1	GM
V434 Per	03 21 35 97	+40 19 23 0	G	V416 Tau	05 34 43 54	+25 50 24 6	GM
LZ Aur	05 39 04 23	+29 55 34 3	G	MM Aur	05 39 19 93	+28 59 29 9	U
IZ Tau	05 44 34 76	+28 17 59 0	U	V422 Tau	05 48 40 08	+26 28 28 4	G
MQ Aur	05 51 53 27	+31 51 20 0	U	MS Aur	05 56 38 56	+31 51 55 5	G
LR Aur	06 00 14 06	+28 35 56 3	U	LN Gem	06 04 00 25	+26 52 23 1	GM
LQ Gem	06 06 39 92	+23 32 43 9	U	V669 Ori	06 17 37 64	+19 22 45 1	U
V670 Ori	06 17 48 43	+19 43 12 8	U	IX Gem	06 20 01 92	+24 19 00 1	U
IZ Gem	06 29 25 98	+16 58 41 2	U	KL Gem	06 30 57 94	+16 00 32 2	U
KW Gem	06 50 07 75	+24 35 12 7	U	KU Gem	06 45 50 49	+17 01 34 2	U
KX Gem	06 51 48 92	+15 38 55 8	U	KZ Gem	06 53 02 76	+16 39 50 3	U
MR Gem	06 55 24 17	+16 17 18 2	U	LL Gem	07 03 29 55	+13 18 02 8	U
LM Gem	07 05 05 69	+10 36 45 8	U	NO Gem	07 05 30 17	+10 32 22 5	G
AS CMi	07 44 10 31	+08 17 14 8	U	AT CMi	07 49 36 96	+01 57 40 3	U
AU CMi	07 50 37 97	+06 12 29 1	U	LU Pup	08 01 18 82	−28 34 58 8	G
CC Leo	11 42 26 79	+17 30 36 4	U	BY Com	12 08 17 73	+15 25 44 1	U
DD Vir	12 09 59 82	+13 16 37 3	U	CF Com	12 13 09 12	+23 04 07 2	U
CS Com	12 24 18 80	+17 52 52 8	U	CW Com	12 25 42 73	+22 05 27 6	G
DE Com	12 29 04 80	+18 40 06 3	U	DH Com	12 31 35 50	+21 29 33 0	G
DN Com	12 35 40 52	+17 28 50 1	U	DQ Com	12 40 08 97	+17 44 23 0	U
DZ Com	12 46 13 47	+18 28 07 8	G	DP Vir	12 15 03 69	+07 47 29 7	U
DF Vir	12 22 33 47	+11 17 39 9	U	V680 Her	16 10 22 73	+21 48 26 4	U

Table 1 (cont.)

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V683 Her	$16^h12^m22^s.46$	$+22^\circ13'19''.2$	U	V684 Her	$16^h13^m11^s.69$	$+19^\circ06'45''.7$	U
V537 Her	16 13 38 46	+22 41 44 5	U	V538 Her	16 14 06 81	+23 53 13 9	G
V688 Her	16 15 05 61	+23 56 45 9	U	V539 Her	16 17 44 49	+18 47 17 0	U
V540 Her	16 19 43 23	+23 16 57 9	U	V541 Her	16 24 05 14	+18 48 25 0	U
V695 Her	16 26 02 03	+17 41 56 0	U	V650 Her	16 29 07 78	+19 06 22 6	G
V698 Her	16 29 31 15	+18 29 43 9	G	V542 Her	16 30 12 43	+19 00 47 8	U
V701 Her	16 31 40 73	+20 10 58 7	U	V545 Her	16 38 49 46	+24 51 47 1	G
V711 Her	16 48 33 48	+23 35 03 0	G	V1067 Oph	17 41 28 38	+00 01 42 5	U
V1070 Oph	17 43 21 85	+01 02 00 1	G	V1071 Oph	17 43 55 50	+07 05 53 0	U
V1078 Oph	17 53 37 10	+04 25 52 6	G	V2079 Oph	17 56 23 01	+01 45 54 4	U
V1080 Oph	17 56 48 43	+06 26 12 3	U	V2032 Oph	17 57 31 14	+01 24 34 1	U
FF Ser	17 58 21 51	−00 39 34 0	G	V1081 Oph	17 58 27 71	+02 11 52 5	U
V2083 Oph	17 59 01 37	+02 06 00 6	U	V1082 Oph	18 00 00 19	+00 32 19 5	U
V1083 Oph	18 00 19 92	+03 06 17 8	U	V1085 Oph	18 01 02 24	+03 47 24 4	U
V2034 Oph	18 01 12 36	+05 42 14 0	U	V1086 Oph	18 02 32 08	+03 05 11 0	UM
V1088 Oph	18 04 51 84	+01 32 10 6	U	V2338 Oph	18 05 28 94	+07 54 21 0	G
V1091 Oph	18 07 08 69	+01 34 33 0	U	V2085 Oph	18 08 06 46	+00 46 08 9	GM
V1092 Oph	18 08 06 74	+01 56 06 2	GM	V1093 Oph	18 08 33 42	+00 10 02 2	U
V2086 Oph	18 09 59 01	+05 03 06 7	U	V2087 Oph	18 11 16 40	+05 15 32 6	U
V1099 Oph	18 16 55 62	+01 10 52 7	U	V1100 Oph	18 17 23 39	+02 23 33 9	U
V564 Her	17 58 17 43	+38 21 17 1	U	V667 Her	18 02 30 81	+35 22 20 8	U
V565 Her	18 03 33 24	+34 43 21 8	U	V568 Her	18 09 15 41	+32 25 23 2	U
V570 Her	18 10 02 04	+35 24 12 0	U	V571 Her	18 10 32 96	+36 38 16 5	U
V392 Lyr	18 25 35 77	+33 05 29 3	UM	V443 Lyr	18 29 31 46	+33 58 41 5	G
V463 Lyr	18 31 17 43	+36 14 24 0	U	V337 Lyr	18 33 46 62	+40 54 04 8	G
V464 Lyr	18 35 07 90	+31 32 31 2	G	V468 Lyr	18 35 38 04	+36 05 15 5	U
V338 Lyr	18 37 18 71	+35 55 14 9	U	V340 Lyr	18 39 57 04	+32 50 08 8	G
V573 Her	18 11 26 30	+29 56 32 5	U	V339 Lyr	18 38 55 76	+41 33 53 1	U
V342 Lyr	18 43 32 80	+39 46 42 2	U	V345 Lyr	18 45 13 88	+42 02 41 4	U
V346 Lyr	18 46 08 58	+44 23 12 9	U	V347 Lyr	18 47 09 05	+41 22 20 7	U
V349 Lyr	18 49 24 39	+42 44 46 0	U	V351 Lyr	18 49 26 01	+42 58 50 8	U
V350 Lyr	18 49 08 35	+46 11 54 7	U	V353 Lyr	18 52 01 79	+45 18 31 1	U
V357 Lyr	18 57 58 03	+43 08 06 2	U	V396 Lyr	18 59 50 68	+45 21 40 5	G
V360 Lyr	19 01 58 60	+46 26 45 4	U	V361 Lyr	19 02 28 13	+46 58 57 3	GM
V366 Lyr	19 09 40 67	+46 17 18 2	U	V368 Lyr	19 10 53 41	+43 24 55 1	U
V370 Lyr	19 13 27 29	+42 14 53 2	G	V1103 Cyg	19 14 57 69	+46 10 01 8	U
V372 Lyr	19 16 12 42	+41 54 20 3	G	V1253 Cyg	19 18 57 04	+44 57 23 3	U
V1107 Cyg	19 19 45 29	+47 06 04 2	U	BZ Dra	18 47 17 85	+53 56 47 3	U
DT Dra	18 49 57 29	+50 35 13 9	G	CD Dra	18 54 51 68	+52 28 43 8	U
CE Dra	19 06 11 35	+55 50 20 8	U	CF Dra	19 06 47 53	+53 22 57 3	G
CG Dra	19 07 32 79	+52 58 28 8	U	V1104 Cyg	19 18 00 42	+50 45 18 1	U

Table 1 (cont.)

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V1106 Cyg	$19^h19^m01^s.52$	$+53°25'15''.8$	U	V1108 Cyg	$19^h19^m24^s.07$	$+54°34'09''.4$	U
V1109 Cyg	19 19 32 42	+53 41 20 6	U	V1113 Cyg	19 22 42 07	+52 44 00 1	U
V1116 Cyg	19 24 03 32	+51 39 54 1	U	V1118 Cyg	19 24 43 05	+52 32 51 3	U
V1119 Cyg	19 25 44 54	+51 09 32 2	UM	CI Dra	19 25 32 38	+56 43 32 1	U
V1121 Cyg	19 26 18 33	+53 53 28 6	U	V1127 Cyg	19 32 05 76	+51 17 48 6	UM
V1137 Cyg	19 36 54 85	+51 03 44 8	U	V1148 Cyg	19 44 42 70	+52 55 35 1	U
V1149 Cyg	19 44 40 81	+54 39 14 0	U	V1188 Aql	19 06 05 46	−01 12 13 8	G
V1112 Aql	19 07 39 15	−00 23 07 1	U	V1114 Aql	19 10 10 63	−01 26 35 3	G
V1192 Aql	19 11 22 40	+02 08 01 2	U	V1195 Aql	19 13 35 74	+02 39 38 1	G
V1116 Aql	19 15 50 36	−01 28 09 0	U	V1201 Aql	19 16 25 75	−00 20 42 4	U
V1118 Aql	19 17 51 57	+02 27 03 9	U	V1119 Aql	19 17 58 61	+00 13 55 9	U
V1120 Aql	19 19 00 06	+03 30 46 9	U	V1122 Aql	19 19 45 42	+02 23 50 6	U
V1210 Aql	19 20 22 70	+04 55 50 9	G	V1125 Aql	19 21 52 86	+07 21 49 9	U
V1215 Aql	19 22 25 22	+01 28 03 3	U	V1218 Aql	19 22 49 18	+00 23 50 8	GM
V1126 Aql	19 22 46 83	+07 26 55 8	G	V1127 Aql	19 24 00 11	+01 41 48 9	U
V1222 Aql	19 24 16 57	−00 20 02 0	U	V1223 Aql	19 24 18 80	−00 13 08 6	U
V1225 Aql	19 24 25 91	+02 01 51 7	GM	V1226 Aql	19 24 21 06	+05 51 05 6	U
V1128 Aql	19 24 44 04	+03 17 49 1	U	V1337 Aql	19 25 48 87	+07 20 34 1	G
V1231 Aql	19 25 55 82	+07 36 05 6	G	V1130 Aql	19 26 34 58	−01 30 26 1	U
V1232 Aql	19 26 55 96	+06 30 08 6	U	V1131 Aql	19 27 36 89	+03 23 11 8	U
V1132 Aql	19 28 02 86	+04 12 54 4	U	V1241 Aql	19 29 02 83	+05 38 18 3	U
V1242 Aql	19 29 22 20	+03 28 20 2	U	V1243 Aql	19 29 29 63	+05 37 13 1	GM
V1135 Aql	19 31 04 19	−00 18 46 1	U	V1245 Aql	19 30 51 54	+02 27 45 4	U
V1134 Aql	19 30 39 66	+07 50 14 0	U	V1247 Aql	19 31 22 48	+04 36 15 9	GM
V1250 Aql	19 32 07 60	+06 49 45 8	G	V1252 Aql	19 32 46 13	+02 34 39 4	U
V1136 Aql	19 32 53 59	+06 25 36 4	U	V1256 Aql	19 33 50 77	+01 07 01 3	GM
V1138 Aql	19 33 46 89	+02 57 44 5	U	V1139 Aql	19 33 47 96	+03 26 41 0	UM
V1260 Aql	19 34 51 29	−00 46 06 9	U	V1259 Aql	19 34 32 45	+04 01 59 5	U
V1261 Aql	19 34 43 61	+07 08 45 4	G	V1263 Aql	19 35 12 52	+02 05 20 9	GM
V1264 Aql	19 35 38 64	+04 08 45 9	U	V1265 Aql	19 35 39 54	+05 11 48 7	U
V1266 Aql	19 35 58 18	+05 00 53 6	U	V1267 Aql	19 36 29 80	+01 20 19 4	U
V1274 Aql	19 37 11 94	+04 53 13 1	GM	V1142 Aql	19 37 10 77	+07 36 28 5	U
V1144 Aql	19 39 30 98	+04 45 37 0	U	V1145 Aql	19 39 46 42	+02 43 55 8	U
V1147 Aql	19 40 42 93	−00 11 19 0	U	V1146 Aql	19 40 28 33	+05 17 43 0	U
V1150 Aql	19 42 35 00	+01 15 50 2	GM	V1151 Aql	19 42 32 97	+04 04 33 3	U
V1280 Aql	19 42 35 02	+06 24 55 7	G	V1152 Aql	19 43 21 66	+00 05 00 3	U
V1153 Aql	19 43 27 33	+01 13 25 8	U	V1282 Aql	19 43 30 01	+01 42 15 5	GM
V1283 Aql	19 44 13 51	+01 04 38 4	U	V1154 Aql	19 44 43 03	+04 36 12 1	U
V1533 Cyg	20 51 27 88	+46 18 13 3	G	V1543 Cyg	21 00 15 83	+48 26 58 0	G
V1222 Cyg	21 03 01 94	+40 24 52 7	U	V1223 Cyg	21 04 42 87	+41 12 45 1	G
V439 Cas	23 38 03 52	+52 47 38 6	U	V442 Cas	23 40 14 82	+53 57 34 3	G

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CCD OBSERVATION OF THE 1998 OCTOBER SUPEROUTBURST OF PU Per: CONFIRMATION AS AN SU UMa-TYPE DWARF NOVA

T. KATO, K. MATSUMOTO

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan,
e-mail: tkato@kusastro.kyoto-u.ac.jp, katsura@kusastro.kyoto-u.ac.jp

PU Per is a dwarf nova discovered by Hoffmeister (1967). The historical record of outbursts, suggesting the SU UMa-type, is reviewed in Kato and Nogami (1995). Kato and Nogami (1995) made time-resolved photometry of the short outburst in 1995 October. On the rapidly decaying stage of the outburst, they detected possible hump-like features with a period of ∼0.06 d. The confirmation of the SU UMa-type nature has been thus awaited for.

On 1998 September 25, T. Kinnunen reported the detection of a bright ($m_{\rm v}$ = 14.8) outburst. Upon this alert, we observed PU Per on three nights of October 2–4. The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\rm TM}$-based PSF photometry package developed by one of the authors (TK). The flux of the variable was measured relative to GSC 2337.27 (USNO r-magnitude 12.1), whose constancy was confirmed by comparison with GSC 2337.614 (USNO r-magnitude 12.4). The fluxes given in figures of this note are expressed relative to GSC 2337.27.

Figure 1 illustrates the overall light curve of the present observation. The light curve shows a steady decline characteristic of superoutbursts. After subtracting the linear declining trend, the light curve was analyzed using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978) and LANCELOT (period analysis using artificial neural networks, Gaspani 1995a,b). The resultant theta diagram (PDM) and G(f) function (LANCELOT) are shown in Figure 2. The minimum and maximum points respectively correspond to the best estimates of the period.

The selection of the best superhump period suffers from some difficulties owing to the low signal-to-noise ratio and the gaps caused by clouds. From the three one-day alias candidate periods (0.0686, 0.0733 and 0.0640 d), we have chosen the period 0.0733 ± 0.0001 (corresponding to the frequency of 13.64 d^{-1}) as the best-determined period, based on the independent superhump detection information (Kemp and Vanmunster, private communication). However, there still remains the possibility for other aliases from the present data set.

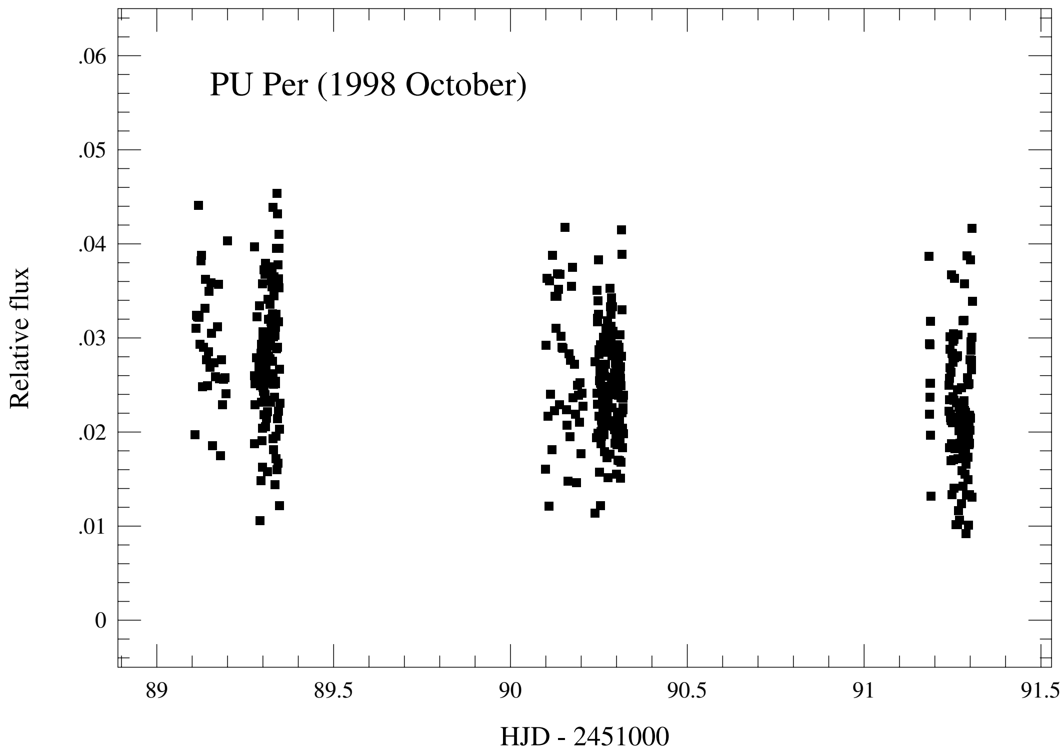

Figure 1. Overall light curve of PU Per

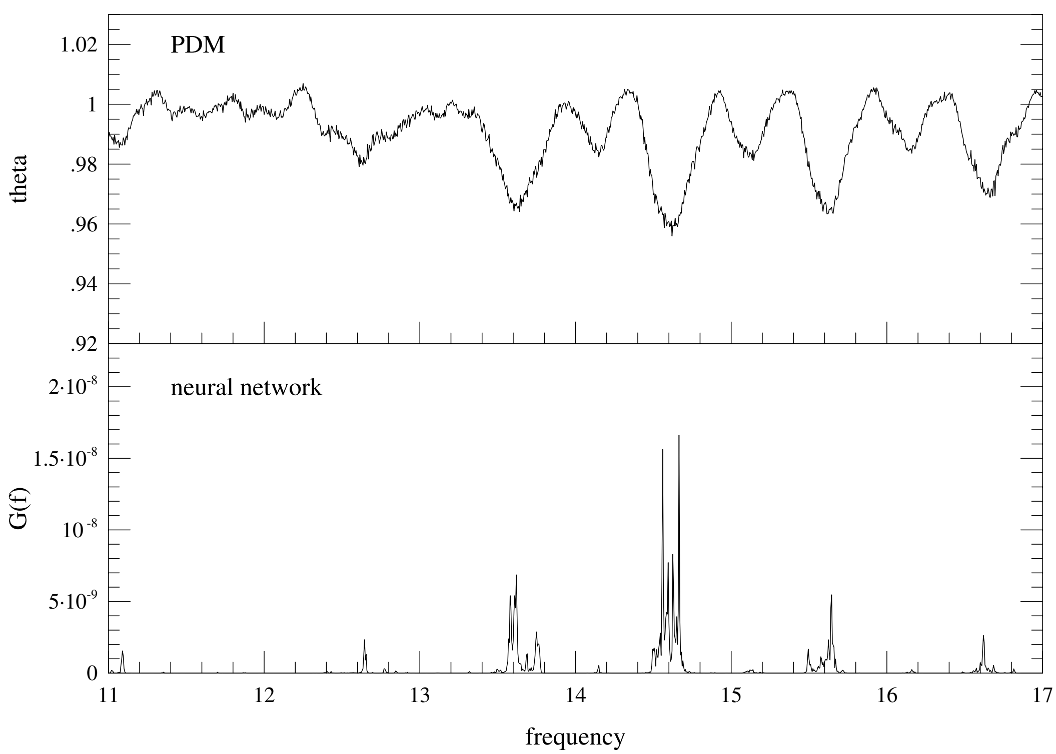

Figure 2. Period analysis of PU Per

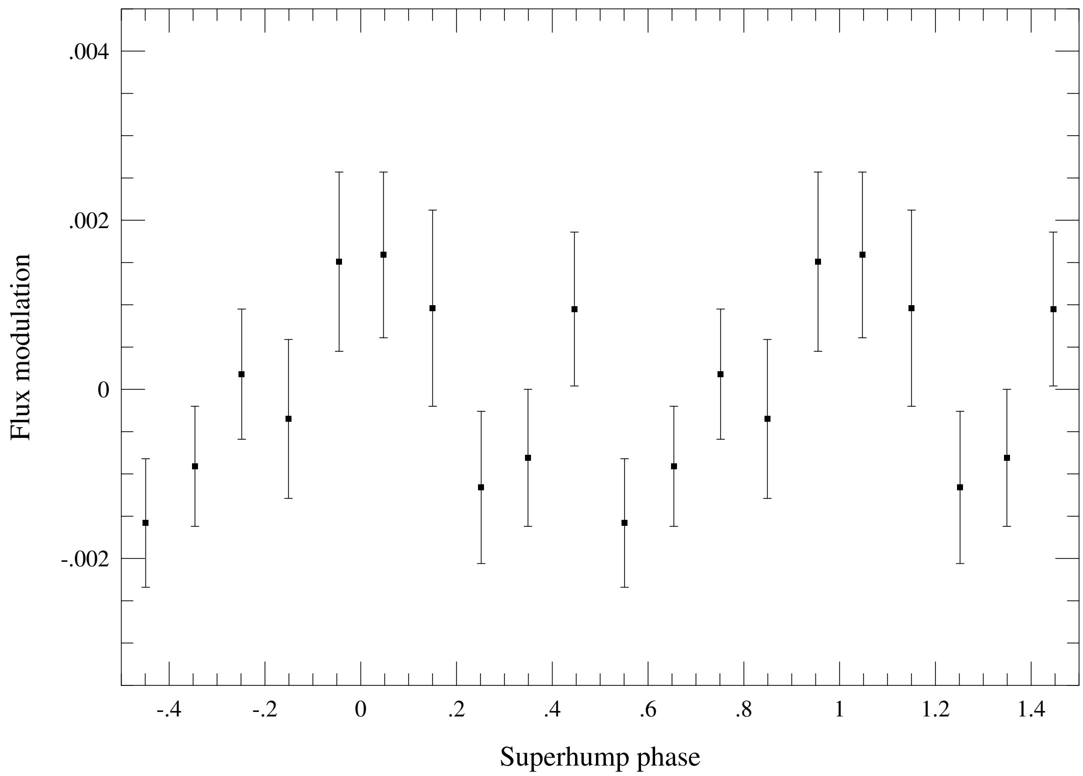

Figure 3. Superhump profile of PU Per

Figure 3 shows the averaged superhump profile, folded by the period of 0.0733 d. The mean superhump amplitude is ~0.2 magnitude. PU Per can now be safely classified as an SU UMa-type dwarf nova.

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CYCLIC VARIABILITY OF V1101 Aql

T. KATO, D. NOGAMI, H. BABA

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

V1101 Aql, originally discovered as an irregular variable, has been regarded as a Z Cam-type dwarf nova (Meinunger 1965; Vogt and Bateson 1982). Pastukhova and Shugarov (1994) dealed with the long-term behavior of this star, showing the presence of occasional fadings. Downes et al. (1995) presented low-resolution spectroscopy, which supported the cataclysmic nature of the star, but the possibility of being a Herbig Ae/Be star remained. Masetti and Della Valle (1998) obtained time-resolved CCD photometry, which indicated possible orbital periods of 3.46 or 4.00 hr.

Our observations were done using a CCD camera (Thomson TH 7882, 576×384 pixels, on-chip 2×2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 30–90 s, depending on the transparency of the sky. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based automatic-aperture photometry package developed by one of the authors (TK). The relative V magnitudes of the variable were determined against GSC 1618.977, whose magnitude was determined as $V = 11.96$ using the local comparison stars by Misselt (1996). The constancy of the comparison was confirmed using GSC 1618.1649 ($V = 13.51$). The summary of observations is given in Table 1.

The overall light curve is given in Figure 1. The light curve shows the quasi-periodic cyclic variation with a period of $\sim$14 d, and an amplitude of 0.7 mag. The coverage by Pastukhova and Shugarov (1994) was not dense enough to clearly illustrate this modulation. Though the period of the modulation is close to that typical of Z Cam-type dwarf novae, the amplitude is rather small. The presence of short excursions to faint states (Pastukhova and Shugarov 1994) is also unusual for Z Cam-type dwarf novae. However, the light modulation is reminiscent of FY Vul, which bears spectroscopic similarity to V1101 Aql (Downes et al. 1995). There may be a previously unrecognized group of low-amplitude dwarf novae. The Herbig Ae/Be classification may better explain the presence of occasional fadings, and the possibly associated nebulosity (Masetti and Della Valle 1998), but 0.7-mag cyclic variation seems to be unusual for this class of objects. Another object exhibiting similar activities is FY Per, whose cyclic variations, with a typical period of 20–30 d, and a full amplitude of $\sim$1.2 mag have been recently established (Watanabe and Maehara 1999), and whose nature has been also discussed as either a cataclysmic variable or a Herbig Ae/Be star (Okazaki 1993). More observations are needed to clarify the nature of this intriguing object.

Table 1: CCD observation of V1101 Aql

JD start[a]	JD end[a]	mag[b]	error[c]	N^d
50291.999	50292.003	2.360	0.032	4
50293.115	50293.118	2.320	0.013	5
50294.109	50294.112	2.462	0.018	5
50295.053	50295.057	2.506	0.042	5
50296.094	50296.098	2.281	0.019	5
50301.109	50301.120	2.018	0.004	9
50302.148	50302.172	2.140	0.005	20
50303.133	50303.144	2.310	0.006	10
50304.156	50304.159	2.449	0.014	5
50305.176	50305.176	2.425	0.007	2
50307.137	50307.140	2.423	0.007	5
50313.077	50313.081	2.214	0.004	5
50314.107	50314.110	1.915	0.006	5
50316.089	50316.092	2.018	0.008	5
50321.054	50321.054	2.557	-	1
50331.949	50331.952	2.023	0.010	3
50333.994	50333.995	2.331	0.008	2
50334.960	50334.962	2.519	0.017	3
50337.918	50337.920	2.307	0.023	3
50340.965	50340.967	2.340	0.006	3
50341.937	50341.938	2.270	0.005	3
50342.949	50342.951	2.065	0.016	3
50401.879	50401.881	2.408	0.023	3
50403.872	50403.872	2.782	-	1
50629.113	50629.114	2.015	0.004	3

[a] JD $-$ 2400000
[b] Magnitude relative to GSC 1618.977
[c] Standard error of nightly average
[d] Number of frames

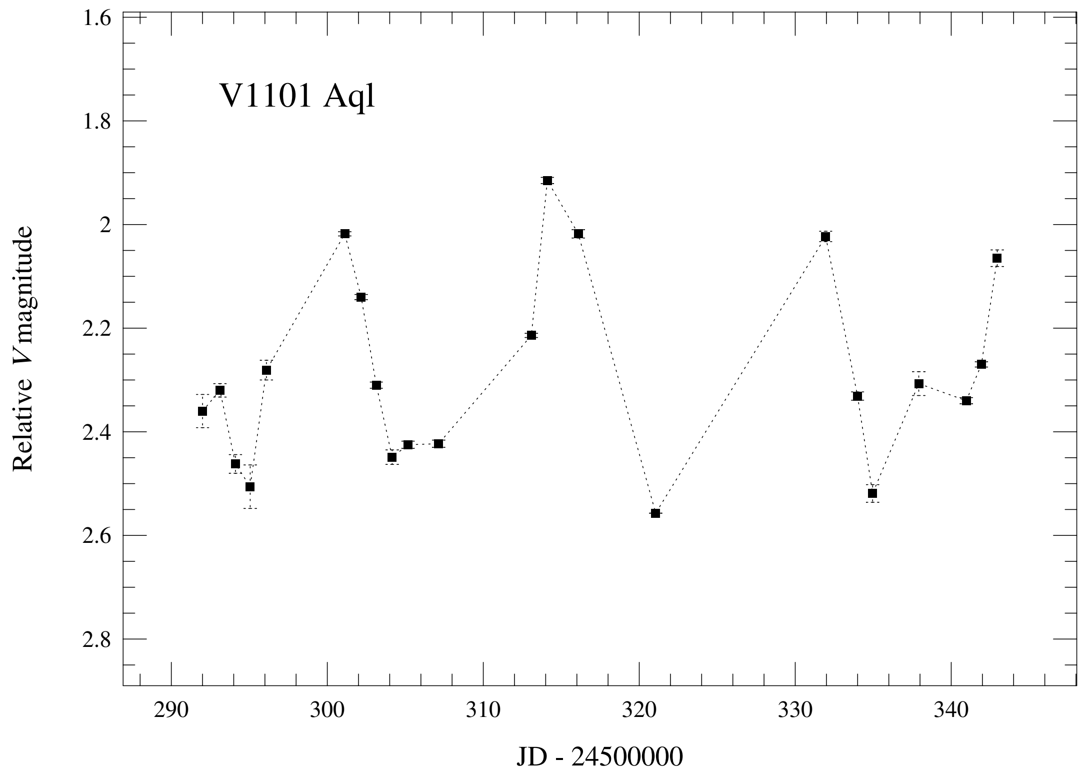

Figure 1. Light curve of V1101 Aql

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CCD PHOTOMETRY OF THE 1998 DECEMBER OUTBURST OF AQ Eri

T. KATO, K. MATSUMOTO

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan,
e-mail: tkato@kusastro.kyoto-u.ac.jp, katsura@kusastro.kyoto-u.ac.jp

AQ Eri is an SU UMa-type dwarf nova (Kato 1991), whose superhump period was reported to be $0\overset{d}{.}06225$. Thorstensen et al. (1996) yield a spectroscopic orbital period of $0\overset{d}{.}06093$, which places AQ Eri among short orbital period systems. The relatively short orbital period and the relative low frequency of outbursts make AQ Eri a candidate for an intermediate system between usual SU UMa-type dwarf novae and WZ Sge-type stars (cf. Nogami et al. 1996 for the discussion of CT Hya).

The outburst was detected by Hers (1998) on 1998 December 18.332 at $m_{\rm v} = 13.5$. The lack of detected superoutburst since 1995 and the brightness of the outburst prompted our time-series CCD observations.

The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\rm TM}$-based PSF photometry package developed by one of the authors (TK). The magnitudes of the variable was measured relative to GSC 4758.784 (Tycho $V = 10.79$, $B - V = +0.62$), whose constancy was confirmed by comparison with GSC 4758.334 ($V = 10.93$, $B - V = +1.24$). Table 1 summarizes the observations.

Figure 1 illustrates the overall light curve of the present observation. Nightly averaged relative magnitudes and estimates of errors are plotted for the last two nights. The light curve shows a steep decline characteristic of a normal outburst. The data of the first two nights, when the variable was in outburst, were analyzed, after subtracting the linear declining trend, using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978). The result gave no very convincing periodicity, but seemed to have a weak signal around the reported orbital period, and not around the superhump period.

In order to more closely examine the potential orbital modulation, the data of the first two nights were phase-averaged using the reported period of 0.06093 d. The result is shown in Figure 2, which shows the existence of a double-wave modulation in one orbital cycle. The amplitude of the modulation was $\sim$0.10 mag. The data on December 21 (the third night) were analyzed in the same way, giving the upper limit of the orbital modulation of $\sim$0.05 mag, indicating that the modulation during outburst decayed as the system faded. It is noteworthy that similar doubly humped (orbital) modulations during early outburst have been observed in the early stage of WZ Sge-type outbursts, and are considered as one of defining characteristics of WZ Sge-type phenomenon (e.g. Matsumoto

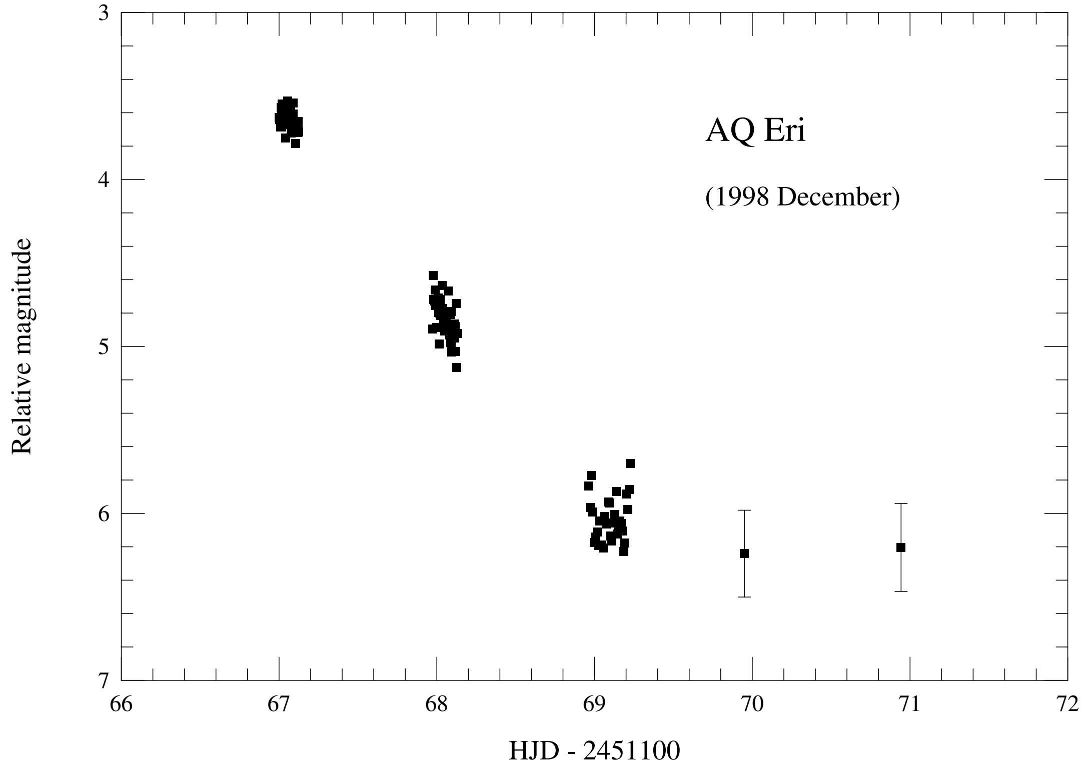

Figure 1. Overall light curve of AQ Eri

Table 1: Summary of observations

JD start[a]	JD end[a]	N[b]
51167.001	51167.130	247
51167.970	51168.121	244
51168.960	51169.238	635
51169.923	51169.969	95
51170.942	51170.944	5

[a] JD − 2400000
[b] Number of frames

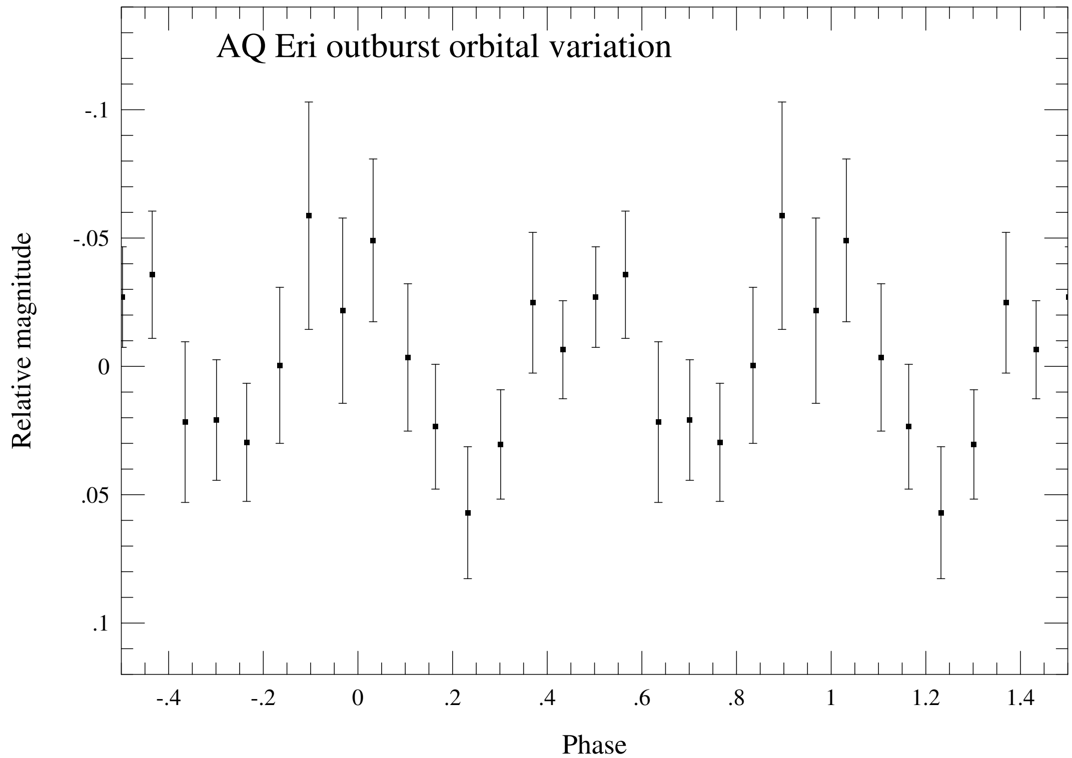

Figure 2. Hump profile of AQ Eri

et al. 1998). The present outburst of AQ Eri may have been followed the similar course of WZ Sge-type outburst, but failed to trigger a superoutburst. More extensive studies of outbursts, of similar systems with infrequent outbursts, are thus encouraged.

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Nogami, D., Kato, T., Hirata, R., 1996, *PASJ*, **48**, 607
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Thorstensen, J. R., Patterson, J., Shambrook, A., Thomas, G., 1996, *PASP*, **108**, 73

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CCD PHOTOMETRY OF THE 1999 MARCH OUTBURST OF BZ UMa: DETECTION OF QUASI-PERIODIC OSCILLATIONS

T. KATO

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

BZ UMa is a dwarf nova whose orbital period has been determined as $0^{\mathrm{d}}.0679$ (Ringwald et al. 1994; Jurcevic et al. 1994). Although the orbital period shorter than the period gap strongly suggests the SU UMa-type classification, no confirmed superoutburst has been yet observed (Jurcevic et al. 1994).

Upon the alert of a bright outburst on 1999 March 9, reaching $m_{\mathrm{v}} = 10.4$ (Muyllaert 1999), we started time-resolved CCD photometry. The outburst rivaled the brightest recorded historical outbursts (cf. Jurcevic et al. 1994).

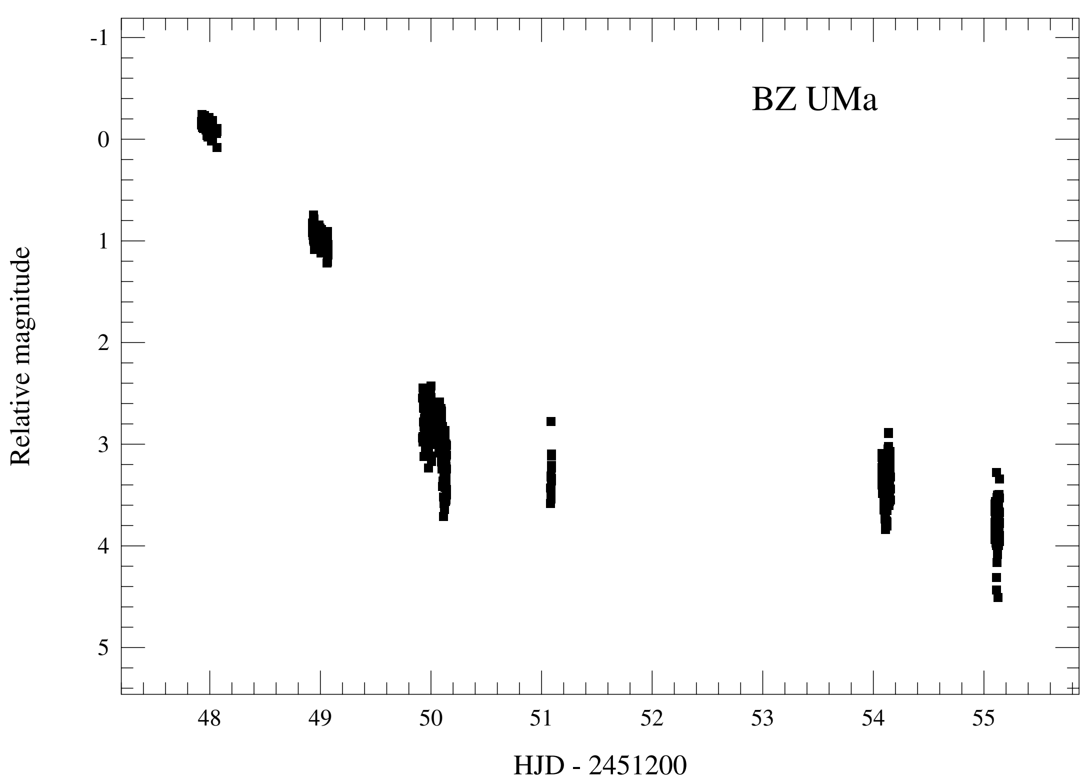

Figure 1. Overall light curve of BZ UMa

The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt–Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java^{TM}-based PSF photometry package developed by the author. The differential magnitudes of the variable were measured against GSC 3811.976 (USNO r-magnitude 11.3), whose constancy was confirmed by comparison with GSC 3811.1354 (USNO r-magnitude 11.9).

The overall light curve is shown in Figure 1. The magnitudes are given relative to GSC 3811.976. The outburst was, despite its brightness, a short, rapidly fading one. No detectable superhumps were observed. However, on its decline, the object showed unusual short time-scale oscillations. Figure 2 shows the best exemplification of the wave (the first fragment of the 1999 March 12 run).

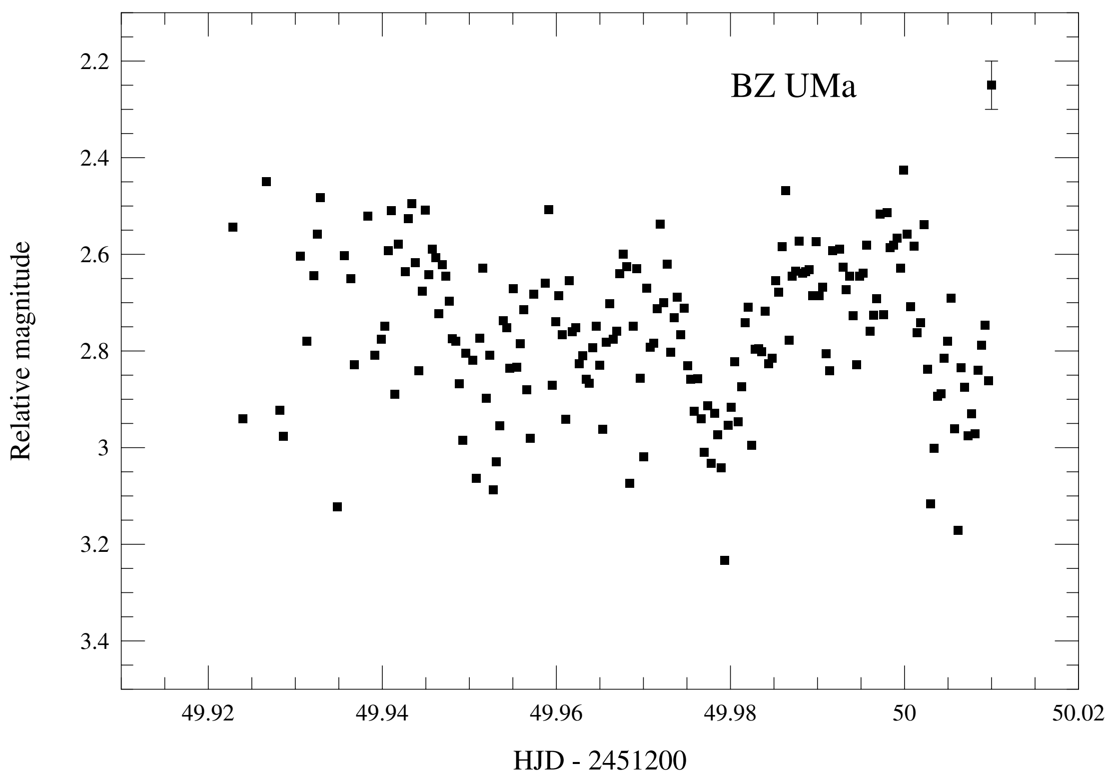

Figure 2. Enlarged light curve on March 12

The period of modulations was close to $0\overset{d}{.}03$; the amplitude of the signal was as large as $0\overset{m}{.}3$, the profile was double-waved to this period. Figure 3 shows the result of the period analysis by applying the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978) to the March 12 data, after removing the long-term trend. The best period was $0\overset{d}{.}0271$, but as is evident from the broad signal in the theta diagram, the modulations were quasi-periodic in nature. Superposition of different periodicities is also possible. The significant deviation from the orbital period may suggest that the modulation can be caused by the intermediate polar, or QPO-like phenomenon. The relative strength of high-excitation lines (Ringwald et al. 1994; Jurcevic et al. 1994), and the relatively strong X-ray emission (= 1RXS J085343.5+574846) may also support a weakly magnetic white dwarf. If the intermediate polar nature of BZ UMa can be confirmed by future observations, it may be a clue to understanding the apparent lack of superoutbursts.

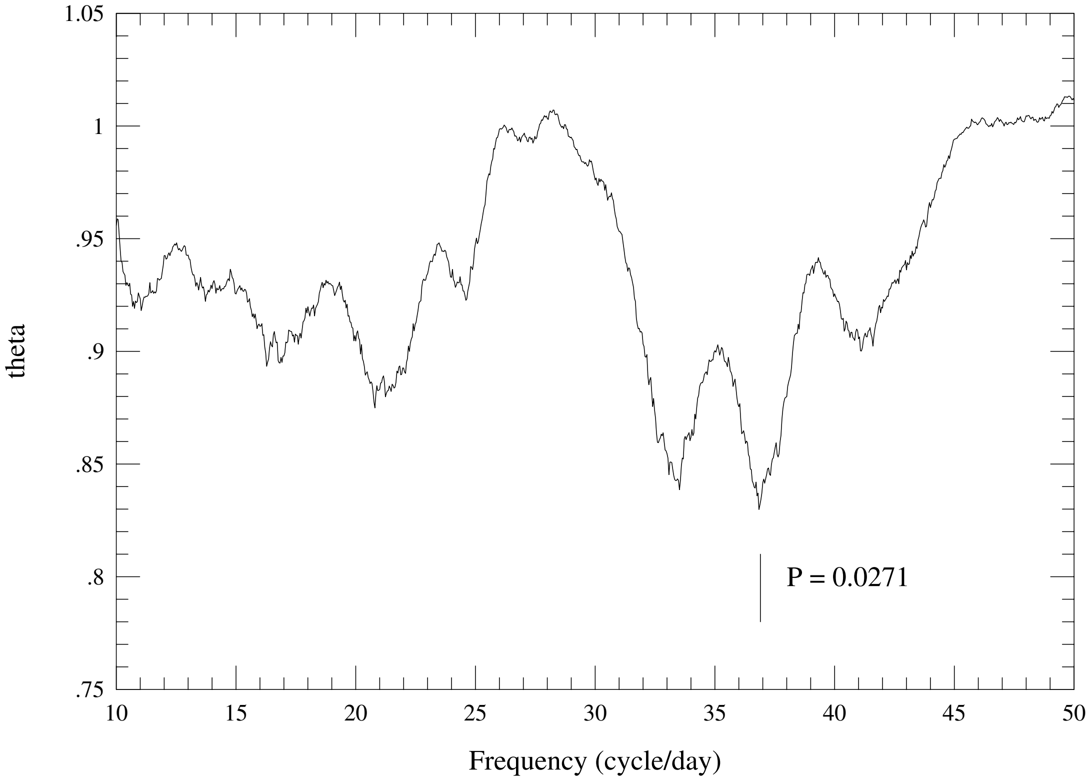

Figure 3. Periodogram of BZ UMa

This work is partly supported by the Grant-in-Aid for Scientific Research (10740095) of the Japanese Ministry of Education, Science, Culture, and Sports.

References:

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Muyllaert, E., 1999, *vsnet alert circulation*, No. 2757 (also available at
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-alert/msg02757.html).
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Stellingwerf, R. F., 1978, *ApJ*, **224**, 953

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ORBITAL MODULATION DURING THE STANDSTILL OF VW Vul

T. KATO

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

Since the work by Shafter (1985) VW Vul had long been suspected as an ultrashort orbital period (0.0731 d) dwarf nova, until the correct orbital period 0.16870 ± 0.00007 d was revealed by Thorstensen et al. (1998). The new orbital period is consistent with the observed presence of standstills, which are a signature of Z Cam-type dwarf novae.

During the 1995 standstill of VW Vul, we performed time-resolved CCD photometry, initially intending the detection of possible periodicity associated with the claimed short orbital period.

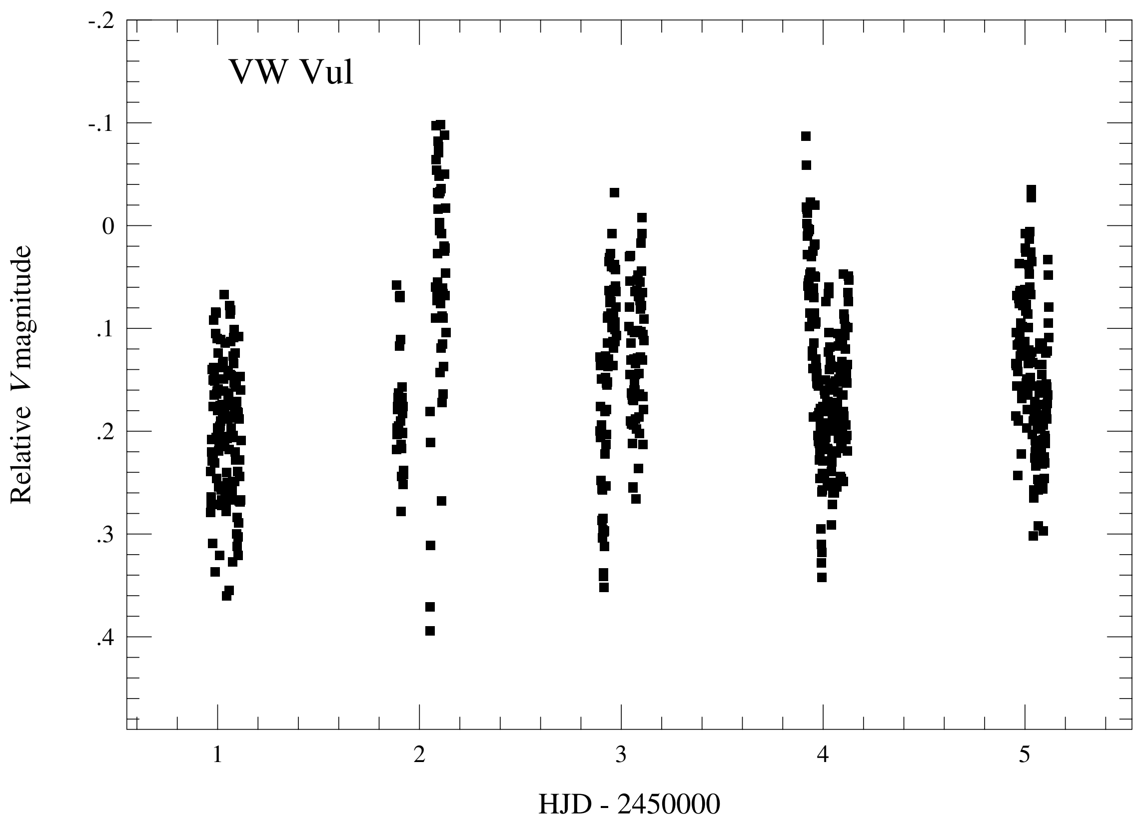

Figure 1. Light curve of VW Vul during the 1995 standstill

The observations were done on five successive night between 1995 October 10 and 14, using a CCD camera (Thomson TH 7882, 576×384 pixels, on-chip 2×2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (focal length = 4.8 m) at Ouda Station, Kyoto University (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 90 s. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based automatic-aperture photometry package developed by the author. The relative V magnitudes of the variable were determined against USNO–A1.0 1125.17783216 ($20^{h}57^{m}47^{s}.00$, $+25°30'36''.5$, J2000.0), whose magnitude was determined as $V = 14.54$ using the local comparison stars by Andronov et al. (1993). The constancy of the comparison was confirmed using GSC 2176.943. Figure 1 illustrates the overall light curve. The observed averaged magnitude during this standstill was $V = 14.66$.

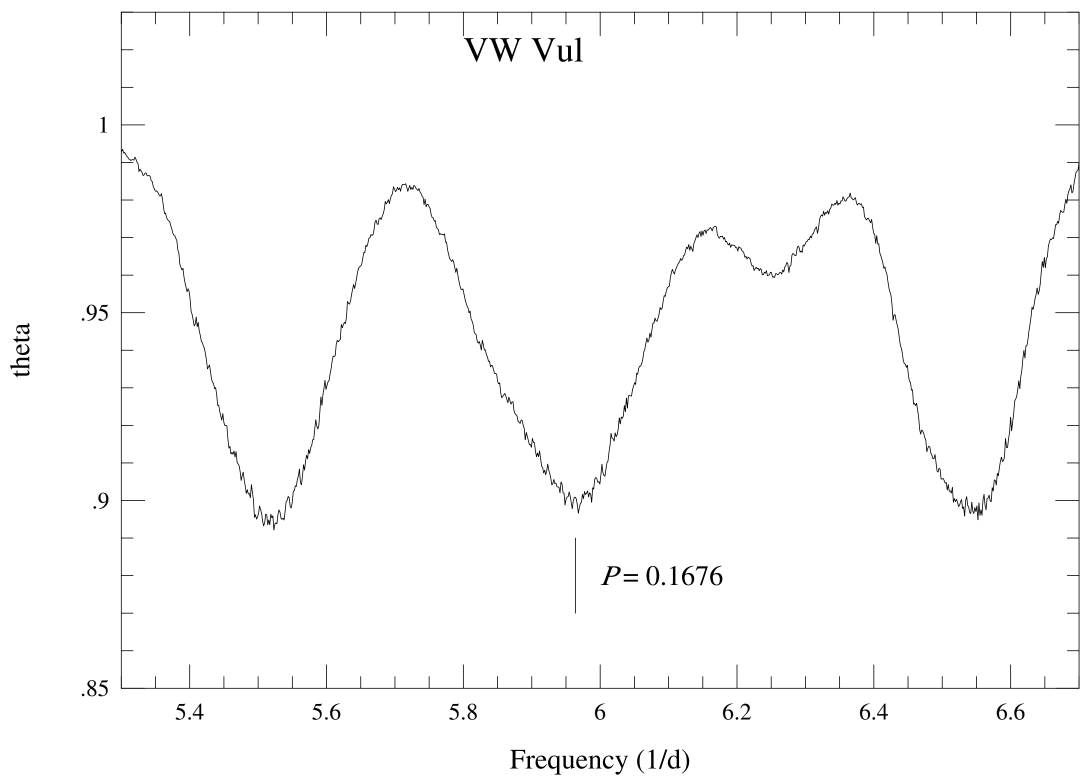

Figure 2. Period analysis of VW Vul

The light curve was analyzed using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978). The theta diagram is shown in Figure 2. While one-day aliases are unavoidable due to the limited run lengths, the existence of periodicity very close to the orbital period strongly implies the presence of orbital modulation. The significance level of the period is 8% using F-tests. The best period (assuming this alias selection) determined from the PDM analysis is 0.1676 ± 0.0006 d. The period is very close to the orbital period, but can be $0.6 \pm 0.4\%$ shorter.

The folded hump profile by the 0.1676 d period is shown in Figure 3. The profile is singly peaked, suggesting the orbital humps as the origin. The amplitude of the hump is $\sim$0.10 mag. The epochs of hump maxima during this period can be expressed by the following ephemeris.

$$\mathrm{Max(HJD)} = 2450000.089 + 0^{d}.1676 \times E. \quad (1)$$

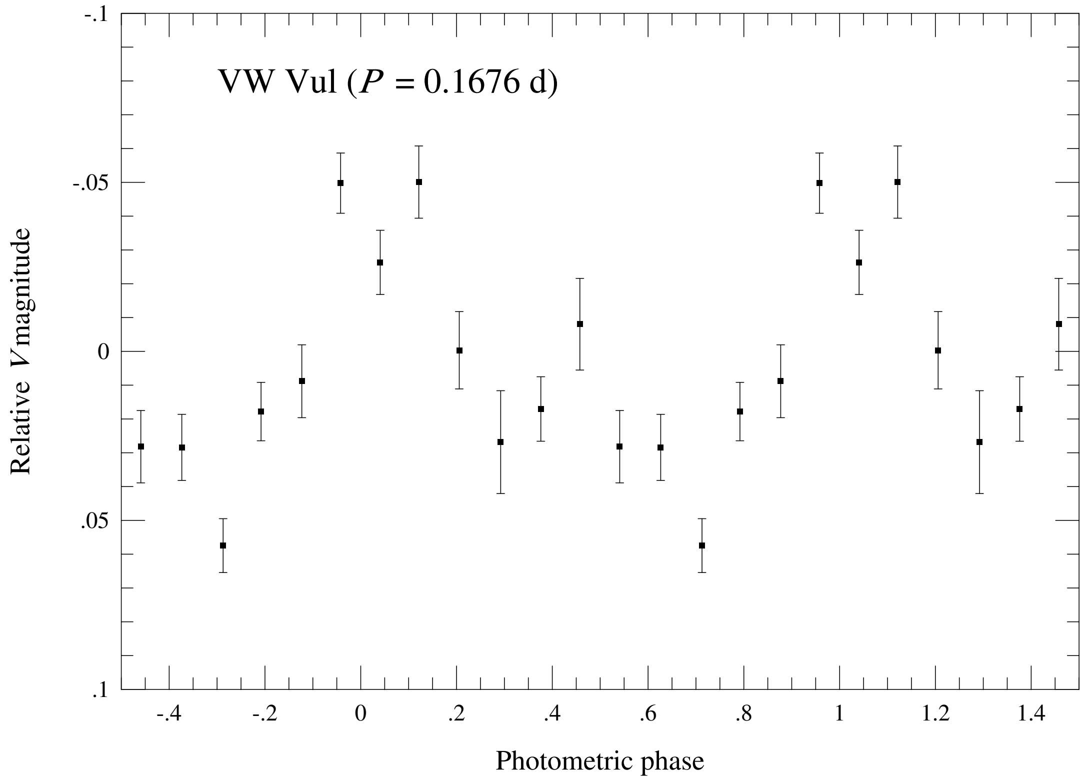

Figure 3. Hump profile of VW Vul

This work is partly supported by the Grant-in-Aid for Scientific Research (10740095) of the Japanese Ministry of Education, Science, Culture, and Sports.

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Andronov, I. L., Borodina, I. G., Kolesnikov, S. V., Shakhovskoy, N. M., Shvechkova, N. A., 1993, *IBVS*, No. 3932

Ohtani, H., Uesugi, A., Tomita, Y., Yoshida M., Kosugi, G., Noumaru, J., Araya, S., Ohta, K., 1992, *Memoirs of the Faculty of Science, Kyoto University, Series A of Physics, Astrophysics, Geophysics and Chemistry*, **38**, 167

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Stellingwerf, R. F., 1978, *ApJ*, **224**, 953

Thorstensen, J. R., Taylor, C. J., Kemp, J., 1998, *PASP*, **110**, 1405

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NEW VARIABLE STARS DISCOVERED IN THE MISAO PROJECT II: MisV0101–MisV0150

SEIICHI YOSHIDA[1], KENICHI KADOTA[2], TAICHI KATO[3]

[1] MISAO Project, 1065-16 Miyawada Fujishiro-machi Kitasoma-gun Ibaraki 300-1514, Japan,
e-mail: seiichi@muraoka.info.waseda.ac.jp

[2] MISAO Project, 77-1-3-12-204 Koshikiya Ageo City Saitama 362-0064, Japan,
e-mail: kenic-k@astroarts.co.jp

[3] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

This report describes 50 new variable stars (MisV0101–MisV0150) discovered in the course of the MISAO Project.

These objects are detected automatically by the PIXY system as candidates of variable stars from unfiltered CCD images taken by Kadota between 1999 March and August, then confirmed by Yoshida and Kadota. Further details are same as described in Yoshida and Kadota (1999).

The list of 50 new variable stars is given in Table 1. The position and magnitude are measured with USNO-A1.0 catalog. The magnitude is based on a preliminary V magnitude calculated from R and B magnitude in the catalog based on Kato's (1998) equation:

$$V = R + 0.375(B - R)$$

The finding charts are available electronically as 4770-f[nnn].eps where [nnn] refers to the serial number assigned to the star in the first column of Table 1.

MisV0120 is 54 arcsec from V1465 Cyg, a rapidly changing irregular variable, at R.A. $20^{\rm h}01^{\rm m}49\overset{\rm s}{.}98$, Decl. $+33^\circ14'24\overset{''}{.}3$ (2000.0) in the GCVS. But MisV0120 is identified with IRAS 20000+3305, so it is probably Mira type or semi-regular type. Considering the large distance and the type difference, we concluded that MisV0120 is another new variable star. However, no star brighter than 14.6 mag was detected on our unfiltered CCD images taken on JD 2451299.20, 2451367.18, 2451392.11 and 2451394.16 at the position of V1465 Cyg. Therefore, it cannot be completely ruled out that the position of V1465 Cyg is inaccurate and MisV0120 is identical with V1465 Cyg.

MisV0130 is identified with HS 1332, one of the variable stars discovered by FASTT, Flagstaff Astrometric Scanning Transit Telescope (cf. Henden and Stone 1998).

NSV 11661 is 1.7 arcmin from MisV0134. No star brighter than 15.2 mag was detected at the position of NSV 11661 on our unfiltered CCD images taken on JD 2451298.21, 2451330.22 and 2451367.17. However, considering the large angular distance, MisV0134 is probably another variable object.

References:

Henden, A. A., Stone, R. C., 1998, *AJ*, **115**, 296
Kato, T., 1998,
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-chat/msg00700.html
Yoshida, S., Kadota, K., 1999, *IBVS*, No. 4746
Yoshida, S., 1999, in preparation

Table 1: List of New Variable Stars

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0101	$18^h59^m20^s.75$	$+11°38'53''.3$	13.7	[15.1	?	
MisV0102	20 02 07.62	+35 23 24.2	13.8	[15.0	?	
MisV0103	20 57 03.25	+44 56 16.0	14.0	15.3	?	
MisV0104	19 58 09.93	+34 14 51.4	11.9	13.5	?	USNO-A1.0 1200.14207004
MisV0105	20 57 03.21	+39 16 51.9	11.9	13.0	?	
MisV0106	21 00 37.23	+37 28 54.8	12.6	14.0	?	USNO-A1.0 1200.17031953
MisV0107	21 03 40.38	+43 40 18.8	12.3	13.6	?	
MisV0108	19 02 22.55	+19 56 55.9	11.8	13.6	?	USNO-A1.0 1050.12897426 IRAS 19002+1952
MisV0109	18 59 40.03	+19 30 10.0	12.7	14.2	?	IRAS 18574+1925
MisV0110	18 59 38.64	+19 58 59.7	10.9	12.7	?	IRAS 18574+1954
MisV0111	18 57 29.84	+20 05 27.3	10.5	11.7	?	IRAS 18553+2001
MisV0112	18 59 12.58	+20 14 38.5	11.6	13.5	?	USNO-A1.0 1050.12690142 IRAS 18570+2010
MisV0113	19 01 09.49	+15 38 57.0	11.6	13.3	?	IRAS 18588+1534
MisV0114	18 59 06.54	−00 00 44.6	13.8	[14.8	?	IRAS 18565-0004
MisV0115	19 01 18.95	+20 33 31.3	12.3	13.3	?	GSC 1593.0681 USNO-A1.0 1050.12825355 IRAS 18591+2029
MisV0116	19 01 13.17	+10 42 55.1	10.4	11.9	?	USNO-A1.0 0975.14088010 IRAS 18588+1038
MisV0117	19 00 32.83	+11 36 11.6	10.6	11.4	?	USNO-A1.0 0975.14055676 IRAS 18581+1131
MisV0118	18 57 21.59	+18 53 51.8	11.6	12.4	?	USNO-A1.0 1050.12566015 IRAS 18551+1849
MisV0119	20 03 03.17	+31 12 43.8	10.2	11.3	?	USNO-A1.0 1200.14506260 IRAS 20010+3103
MisV0120	20 01 54.11	+33 14 07.6	12.0	13.1	?	USNO-A1.0 1200.14440980 IRAS 20000+3305
MisV0121	18 59 13.76	+16 54 47.2	12.6	13.8	?	USNO-A1.0 1050.12691375
MisV0122	20 56 38.73	+32 56 05.9	11.6	12.8	?	GSC 2692.1817 USNO-A1.0 1200.16805212 IRAS 20545+3244
MisV0123	20 02 56.93	+38 07 49.1	12.6	13.7	?	USNO-A1.0 1275.13401299
MisV0124	19 02 27.83	+18 12 36.4	12.3	13.1	?	USNO-A1.0 1050.12903675 IRAS 19002+1808
MisV0125	19 00 08.87	+18 24 48.1	12.7	13.7	?	USNO-A1.0 1050.12748967

Table 1 (cont.)

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0126	$19^h56^m49\overset{s}{.}94$	$+31°43'10\overset{''}{.}0$	12.3	13.4	?	USNO-A1.0 1200.14114676
						IRAS 19548+3135
MisV0127	19 00 59.36	+13 57 36.6	12.4	13.6	?	USNO-A1.0 0975.14076767
						IRAS 18586+1353
MisV0128	19 58 14.84	+35 43 22.1	12.4	13.6	?	GSC 2682.1684
						USNO-A1.0 1200.14212791
MisV0129	21 55 46.94	+56 12 36.9	14.0	15.7	?	USNO-A1.0 1425.12660249
MisV0130	19 02 25.63	−00 30 14.5	10.8	12.0	?	USNO-A1.0 0825.14192122
						IRAS 18598-0034
						HS 1332
MisV0131	18 01 45.22	−31 20 04.3	12.0	12.8	?	IRAS 17585-3120
MisV0132	17 59 07.42	−29 30 27.3	11.8	13.0	SR?	IRAS 17559-2930
MisV0133	18 57 49.93	+20 31 37.1	13.0	14.2	?	USNO-A1.0 1050.12598950
						IRAS 18556+2027
MisV0134	19 01 38.64	+15 43 08.0	13.5	14.4	?	IRAS 18593+1538
MisV0135	18 58 52.63	−09 41 06.6	11.5	12.7	SR?	IRAS 18561-0945
MisV0136	18 59 29.49	−00 41 55.1	12.9	14.5	?	IRAS 18569-0046
MisV0137	18 57 26.66	−03 34 34.3	11.8	13.5	SR?	USNO-A1.0 0825.13779108
						IRAS 18548-0338
MisV0138	19 01 20.23	−01 24 12.1	12.2	13.3	?	
MisV0139	18 59 28.17	−04 25 34.2	13.8	16.5	?	
MisV0140	19 01 08.68	−06 07 52.6	12.6	13.7	?	USNO-A1.0 0825.14092766
MisV0141	19 02 15.91	−02 24 16.3	13.1	15.3	?	
MisV0142	19 00 49.48	−01 53 40.8	12.1	13.3	?	USNO-A1.0 0825.14069645
MisV0143	19 00 17.64	−02 02 36.6	12.3	13.4	?	USNO-A1.0 0825.14031033
MisV0144	19 00 29.32	−01 54 50.8	12.2	13.8	?	USNO-A1.0 0825.14046017
MisV0145	19 59 37.89	+22 18 45.1	12.8	15.2	?	USNO-A1.0 1050.16326536
MisV0146	19 59 40.42	+23 44 17.7	13.4	15.3	?	
MisV0147	19 00 43.07	−07 42 37.2	11.9	13.6	?	USNO-A1.0 0750.16160471
						IRAS 18580-0747
MisV0148	19 56 56.06	+44 35 24.2	12.6	14.0	?	
MisV0149	19 58 08.52	+30 06 29.3	11.1	11.9	SR?	IRAS 19561+2958
MisV0150	19 00 27.09	−08 47 52.6	11.4	12.6	?	USNO-A1.0 0750.16135617
						IRAS 18577-0852

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NEW VARIABLE STARS DISCOVERED IN THE MISAO PROJECT III: MisV0151–MisV0200

SEIICHI YOSHIDA[1], KENICHI KADOTA[2], TAICHI KATO[3]

[1] MISAO Project, 1065-16 Miyawada Fujishiro-machi Kitasoma-gun Ibaraki 300-1514, Japan,
e-mail: seiichi@muraoka.info.waseda.ac.jp

[2] MISAO Project, 77-1-3-12-204 Koshikiya Ageo City Saitama 362-0064, Japan,
e-mail: kenic-k@astroarts.co.jp

[3] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

This report describes 50 new variable stars (MisV0151–MisV0200) discovered in the course of the MISAO Project.

These objects are detected automatically by the PIXY system as candidates of variable stars from unfiltered CCD images taken by Kadota between 1999 April and August, then confirmed by Yoshida and Kadota. Further details are same as described in Yoshida and Kadota (1999).

Here is the list of 50 new variable stars (Table 1). The position and magnitude are measured with USNO-A1.0 catalog. The magnitude is based on a preliminary V magnitude calculated from R and B magnitude in the catalog based on Kato's (1998) equation:

$$V = R + 0.375(B - R)$$

The finding charts are available electronically as 4771-f[nnn].eps where [nnn] refers to the serial number assigned to the star in the first column of Table 1.

MisV0163 is identified with a carbon star CS 4613.

V2000 Cyg is 4.3 arcmin from MisV0173. V2000 Cyg was detected on our unfiltered CCD images at around 14 mag. No variability was found on our images. However, considering the large distance, MisV0173 is probably another new variable star.

References:

Yoshida, S., Kadota, K., 1999, *IBVS*, No. 4746
Yoshida, S., Kadota, K., Kato, T., 1999, *IBVS*, No. 4770
Yoshida, S., 1999, in preparation
Kato, T., 1998,
`http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-chat/msg00700.html`

Table 1: List of New Variable Stars

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0151	$19^h01^m16\overset{s}{.}53$	$-08°41'17\overset{''}{.}2$	12.3	13.3	SR?	USNO-A1.0 0750.16212024
						IRAS 18585-0845
MisV0152	19 00 32.57	−07 47 42.1	10.2	11.8	?	GSC 5706.2015
						USNO-A1.0 0750.16144451
						IRAS 18578-0751
MisV0153	19 01 01.49	−06 53 46.0	11.6	13.1	?	IRAS 18583-0658
MisV0154	19 02 26.85	−06 45 11.6	11.8	12.6	?	USNO-A1.0 0825.14193678
						IRAS 18597-0649
MisV0155	19 01 39.61	−06 46 23.1	12.2	14.3	SR?	USNO-A1.0 0825.14132591
						IRAS 18589-0650
MisV0156	18 58 10.29	−05 44 58.4	12.3	13.3	SR?	USNO-A1.0 0825.13844799
						IRAS 18554-0549
MisV0157	19 00 17.69	−06 06 57.5	11.7	14.5	M?	USNO-A1.0 0825.14031079
						IRAS 18576-0611
MisV0158	18 59 55.40	−05 37 29.8	12.7	14.6	?	USNO-A1.0 0825.13998175
						IRAS 18572-0541
MisV0159	18 58 17.70	−03 38 56.1	13.2	14.1	?	IRAS 18556-0343
MisV0160	18 57 45.40	−03 30 04.2	12.6	13.4	?	IRAS 18551-0334
MisV0161	18 59 11.08	−01 38 50.1	13.2	[14.6	SR?	IRAS 18565-0143
MisV0162	19 02 42.87	−01 42 50.8	12.7	14.5	SR?	IRAS 19001-0147
MisV0163	20 01 55.78	+23 29 18.6	12.7	14.3	?	IRAS 19597+2320
						CS 4613
MisV0164	19 02 15.88	−00 33 17.8	11.8	14.0	?	IRAS 18597-0037
MisV0165	19 02 36.50	−00 47 39.6	12.8	13.8	?	IRAS 19000-0052
MisV0166	20 01 37.41	+23 09 39.8	12.6	14.6	?	IRAS 19594+2301
MisV0167	19 00 46.76	−10 26 42.8	12.0	13.3	?	IRAS 18580-1031
MisV0168	19 02 53.69	−10 26 42.9	11.6	12.6	?	USNO-A1.0 0750.16353170
						IRAS 19001-1031
MisV0169	19 02 39.37	−10 22 49.4	12.0	13.1	?	USNO-A1.0 0750.16332903
MisV0170	20 03 26.27	+46 01 03.6	12.5	13.6	?	IRAS 20018+4552
MisV0171	20 02 12.13	+45 53 17.2	11.3	13.1	?	USNO-A1.0 1350.11725980
						IRAS 20006+4544
MisV0172	19 57 43.16	+30 36 41.1	13.7	[15.5	?	IRAS 19557+3028
MisV0173	19 57 43.76	+30 46 20.5	12.4	13.7	SR?	USNO-A1.0 1200.14177493
						IRAS 19557+3038
MisV0174	20 02 12.95	+30 57 55.6	12.2	13.4	?	USNO-A1.0 1200.14458946
						IRAS 20002+3049
MisV0175	19 56 57.62	+34 09 53.2	12.5	14.4	SR?	USNO-A1.0 1200.14124349
						IRAS 19550+3401

Table 1 (cont.)

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Unfiltered CCD Mag. Min	Type	Identified with
MisV0176	$18^h57^m30\overset{s}{.}09$	$+08°33'16\overset{''}{.}6$	13.4	14.3	?	IRAS 18550+0829
MisV0177	18 59 51.45	+08 16 47.2	12.1	13.3	?	IRAS 18574+0812
MisV0178	19 02 34.74	+08 23 29.2	12.7	14.4	?	IRAS 19001+0819
MisV0179	18 57 20.68	+09 09 41.6	13.6	14.9	?	USNO-A1.0 0975.13903831 IRAS 18549+0905
MisV0180	18 57 41.83	+10 26 25.1	12.8	14.2	?	USNO-A1.0 0975.13922551 IRAS 18553+1022
MisV0181	18 57 10.97	+10 06 18.3	13.0	14.0	?	USNO-A1.0 0975.13895406 IRAS 18548+1002
MisV0182	17 57 28.86	−04 30 22.4	13.8	15.0	?	IRAS 17548-0430
MisV0183	19 01 16.36	+10 31 23.2	13.8	14.6	?	IRAS 18588+1026
MisV0184	18 59 08.15	+10 51 00.1	13.4	14.2	?	USNO-A1.0 0975.13990989 IRAS 18567+1046
MisV0185	19 00 03.79	+11 22 45.0	13.6	14.3	?	USNO-A1.0 0975.14031748 IRAS 18576+1118
MisV0186	18 58 20.91	+11 20 33.9	13.4	15.0	?	USNO-A1.0 0975.13955476 IRAS 18560+1116
MisV0187	18 58 28.04	+11 11 48.8	13.4	14.2	?	IRAS 18560+1107
MisV0188	18 59 52.20	+07 05 10.6	13.4	14.4	?	IRAS 18574+0700
MisV0189	19 01 27.71	−08 23 14.0	11.6	13.7	?	USNO-A1.0 0750.16229344 IRAS 18587-0827
MisV0190	18 58 56.52	−05 09 30.0	12.5	13.7	?	USNO-A1.0 0825.13911930 IRAS 18563-0513
MisV0191	19 02 31.57	−05 18 17.3	12.0	13.7	?	USNO-A1.0 0825.14199618 IRAS 18598-0522
MisV0192	19 01 03.95	−07 24 14.2	11.4	12.3	?	IRAS 18583-0728
MisV0193	18 58 58.13	−07 23 36.5	12.1	13.8	?	IRAS 18562-0727
MisV0194	17 58 58.55	−15 12 35.9	11.9	12.7	?	USNO-A1.0 0675.14946535 IRAS 17561-1512
MisV0195	18 00 22.45	−10 31 21.9	12.7	13.6	?	USNO-A1.0 0750.12537644 IRAS 17576-1031
MisV0196	21 57 20.44	+55 35 41.0	13.8	15.0	?	USNO-A1.0 1425.12702542 IRAS 21556+5521
MisV0197	21 56 00.94	+56 19 28.2	13.1	14.2	?	USNO-A1.0 1425.12666448 IRAS 21543+5605
MisV0198	22 00 50.98	+52 51 55.7	12.7	14.7	?	USNO-A1.0 1425.12790776 IRAS 21590+5237
MisV0199	19 01 01.45	+14 01 25.0	12.9	14.4	?	USNO-A1.0 0975.14078431 IRAS 18587+1356
MisV0200	18 59 10.96	+17 27 04.3	11.5	12.5	?	IRAS 18569+1722

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A NEW CLASSICAL CEPHEID IN SAGITTA

S.V. ANTIPIN

Sternberg Astronomical Institute, 13, Universitetskij Prosp., Moscow 119899, Russia,
e-mail: antipin@sai.msu.ru

Name of the object:
Var 69 = GSC 1609.1624

Equatorial coordinates:	**Equinox:**
R.A.= $19^{h}35^{m}44\overset{s}{.}8$ **DEC.=** $+18^{\circ}56'42''$	J2000.0

Observatory and telescope:
40-cm astrograph in Crimea

Detector:	Photoplate
Filter(s):	None
Comparison star(s):	See Fig. 1
Check star(s):	None

Transformed to a standard system:	B_{pg}
Standard stars (field) used:	B-band standard sequence in NGC 6802 (Hoag et al., 1961)

Availability of the data:
Upon request

Type of variability:	DCEP

Remarks:

The star was estimated on 410 plates taken during JD 2437136–49104. Periodic variability with a light curve typical of a classical Cepheid was found. The light elements are the following:

$$\mathrm{JD}_{\max} = 2441566.32 + 32\overset{d}{.}071 \times E.$$

The range of variability is $14\overset{m}{.}7$–$15\overset{m}{.}6$. $M - m = 0\overset{P}{.}30$.

Acknowledgements:

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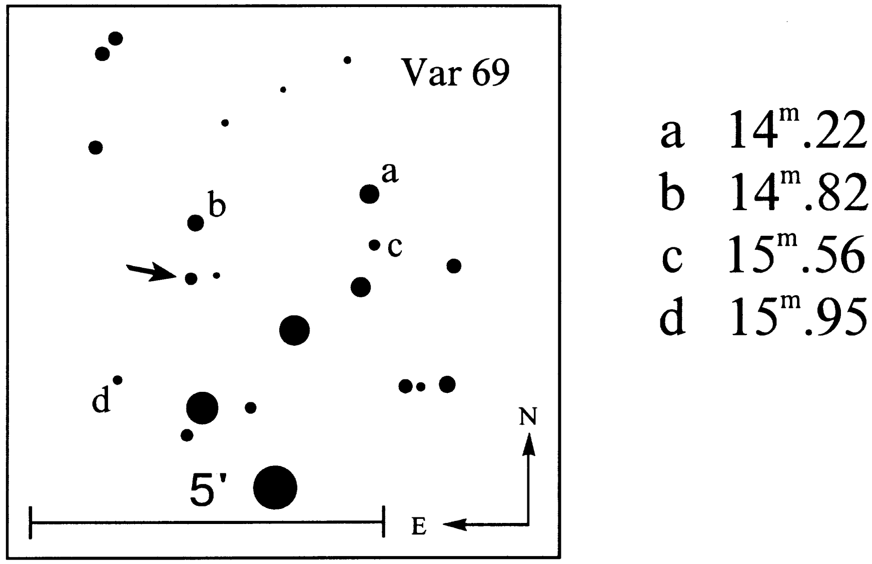

Figure 1. The finding chart and the comparison stars.

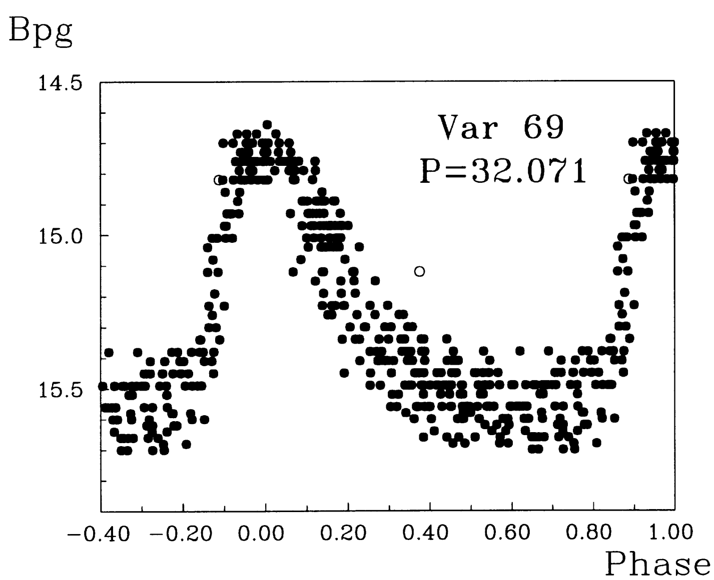

Figure 2. The phased light curve. Uncertain estimates are shown as open circles.

Reference:

Hoag, A.A., Johnson, H.L., Iriarte, B., Mitchell, R.I., Hallam, K.L., Sharpless, S., 1961, *Publ. of the US Naval Obs.*, vol. XVII, part VII, Washington

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LOST VARIABLES ON NANTUCKET PLATES

N.N. SAMUS[1,2], L. HAYTHE[3,2], S. HORNSTEIN[4,2], L.J. JISONNA JR.[5,2], E. LU[6,2]

[1] Institute of Astronomy, Russian Academy of Sciences, 48, Pyatnitskaya Str., Moscow 109017, Russia [samus@sai.msu.su]

[2] Maria Mitchell Observatory, 3, Vestal Str., Nantucket, MA 02554, USA

[3] American School in London, London, UK [moon53186@aol.com]

[4] Virginia Polytechnical Institute and State University, 315 Miles Hall, Blacksburg, VA 24060, USA [shornste@vt.edu]

[5] University of Arizona, Tucson, AZ 85721, USA [ljj@u.arizona.edu]

[6] Wesleyan University, Box 4792, 222 Church Str., Middletown, CT 06459, USA [elu@wesleyan.edu]

For the reasons discussed by Hazen and Samus (1999), it is important to recover Harvard variables lacking finding charts. This problem can be most effectively solved using the Harvard plate collection, where many plates still hold ink marks left by the discoverers. However, much can be done using plate collections of other observatories. In particular, the plate collection of the Maria Mitchell Observatory (MMO), containing especially many plates of the Scutum cloud, can be used with success to recover "lost" Harvard variables in this part of the sky.

In 1999 we have successfully recovered 7 "lost" Harvard variable stars on Nantucket plates. The main results are presented in Tables 1 and 2. The columns of Table 1 contain: GCVS name; preliminary Harvard designation (HV – Harvard Variable); GSC number (if available); the star's right ascension and declination (equinox 2000.0); source of coordinates (A2.0 means the US Naval Observatory A2.0 catalog, Monet et al. 1998; DSS means coordinates measured by us on a DSS image, relative to several reference stars with coordinates from the USNO A2.0 catalog). The columns of Table 2 contain: GCVS name; the star's type found in our study; light elements (epoch and period) if they could be derived from our Nantucket and Moscow data (epochs refer to minimum light for eclipsing variables and to maximum light for other types; for Algols, the elements are heliocentric).

We would like to discuss the case of one more star, the "lost" Cepheid IU Aql, in greater detail. It was discovered by Walton (1927) as varying between $13\overset{\mathrm{m}}{.}7$ and $15\overset{\mathrm{m}}{.}2$ on Nantucket plates. Walton writes that, at the MMO, 22 plates of the M 11 region were taken in 1918–1926, 16 of them showing "stars of magnitude 15.5 or fainter", obviously too optimistic an opinion about old Nantucket plates. Harwood (1931) classified the star as a possible Cepheid, with light elements

$$\mathrm{Max} = \mathrm{JD}\ 2415661 + 22^{\mathrm{d}} \times E.$$

Near the position given by Walton, there is only one star bright enough, namely GSC 5129.00219 ($19^{\mathrm{h}}14^{\mathrm{m}}33\overset{\mathrm{s}}{.}53$, $-0°56'51\overset{''}{.}6$, 2000.0). The only published finding chart (Bateson et al. 1981) is not sufficiently detailed but does not contradict the above GSC identification. However, this GSC star is definitely not a Cepheid and probably does not vary at all according to modern photoelectric and CCD data (Berdnikov 1999).

Table 1: Identifications and Coordinates

Name	HV	GSC	$\alpha_{2000.0}$	$\delta_{2000.0}$	Source
BC Sgr	3116	5414.00438	$18^h59^m32\overset{s}{.}29$	$-11°58'19\overset{''}{.}4$	GSC
BY Sgr	3654		19 11 15.18	–13 30 20.9	A2.0
CU Sgr	3125		19 06 33.39	–12 16 28.1	A2.0
UW Sct	3643	5710.00841	18 56 33.16	–10 32 59.1	GSC
ZZ Sct	3821		18 44 37.74	–10 12 50.1	A2.0
AE Sct	3826		18 47 10.93	–07 43 54.6	A2.0
BC Sct	3838		18 56 05.4	–07 49 46	DSS

Table 2: Types and Light Elements

Name	Type	Epoch, JD 24...	Period
BC Sgr	M:	44490	200^d
BY Sgr	SR:		
CU Sgr	SR:		$\sim$ 1 yr?
UW Sct	LB	48151	
ZZ Sct	EA	47739.703	$2\overset{d}{.}199127$
AE Sct	EA	35246.779	$4\overset{d}{.}664022$
BC Sct	M	46662	$254\overset{d}{.}30$

Notes on individual stars

BC Sgr The provisional elements in Table 2 are based on 13 maxima after JD 2439000.

ZZ Sct Elements have been slightly modified from those published by Delhaye (1948) taking into account timings of 14 fadings on Moscow plates and one, comparatively recent, fading on Nantucket plates.

AE Sct We have found the star faint on 23 plates (JD 2435246–2448422); these fadings are in poor agreement with the light elements from Oosterhoff (1943). Our new elements (see Table 2) give $O-C=-0\overset{d}{.}376$ for Oosterhoff's epoch 2427884.521, so the period has probably really changed.

BC Sct According to the discoverer, Cannon (1924), the following star in a close pair varies. The star found variable on MMO plates is definitely a pair in the DSS. Its following component, not contained in the USNO A1.0/2.0 catalog, is red and comparatively faint on POSS prints, whereas it is brighter than the preceding component in the DSS. The epoch of the DSS plate (JD 2446668) nearly coincides with the brightest maximum observed by us (JD 2446662).

The MMO possesses a copy of a PhD dissertation by Marjorie Williams (1941) containing some unpublished results of probably the last study of IU Aql on Nantucket plates. A photographic finding chart in the dissertation clearly identifies IU Aql with the star now known as GSC 5129.00219. No individual measurements are given for the star, and the conclusion is the following:

"**IU Aql.** At first this star was thought to have a period of less than one day, and later was thought to be a Cepheid with a period of about 22 days. Only 87 observations were made in the present study, and it is felt that they are not very reliable, as the star was usually near the edge of the plates and the images were diffuse. Not enough observations in one day were obtained to tell whether it is a cluster-type or a typical Cepheid."

We have located Dr. Williams's working notebooks at the MMO. Most estimates show IU Aql fainter than 14^{m}; Williams estimated it brighter only on 8 plates. We have reexamined these 8 plates and, at least for 7 of them, could not reliably confirm the maximum. We conclude that the MMO plates studied by Williams show few maxima, if any, and do not definitely confirm variability. Harwood (1931) must have studied IU Aql on Harvard, not MMO, plates because her light elements give the initial maximum not represented in the MMO plate collection, and IU Aql is not mentioned in M. Harwood's MMO notebooks. Either the actual variable was lost soon after Harwood's study, or it ceased variations as early as in the 1920ies. M. Walton Mayall's MMO notebook, found by Dr. V. Strelnitski, does not contain finding charts.

Thanks are due to Vladimir Strelnitski for his help and attention. This study was supported, in part, by grants from the National Science Foundation (AST 9820555) and from Russian Foundation for Basic Research (99-02-16333).

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LIGHT CURVES FOR NOVA Mus 1998 AND NOVA Oph 1998

WILLIAM LILLER[1], ALBERT JONES[2]

[1] Instituto Isaac Newton, Casilla 5022, Reñaca, Chile, email: wliller@compuserve.com

[2] Carter Observatory, 31 Ranui Road, Stoke, Nelson, New Zealand, e-mail: afjones@voyager.co.nz

In an earlier Bulletin (Liller & Jones 1999) we described and discussed light curves for Nova Sgr 1998 and Nova Sco 1998. Here we consider the light curves of the two other known galactic novae of that year, Nova Mus and Nova Oph. As before, Jones made visual observations while Liller used both photography and a CCD with a "minus-IR" filter, a combination that results in a broadband V system extending from about 420 nm to 720 nm and thus includes the Hα line.

Nova Oph was discovered by Takamizawa (1998) on T-Max 400 film on June 15.6, and Nova Mus was found by Liller (1998a) on Technical Pan film taken through an orange filter on Dec 29.3. The light curves, shown in Figures 1 and 2, are similar in that both show a relatively smooth, steady decline. Because of the very rapid fading of Nova Oph, poor weather in New Zealand and a brief hiatus of observations in Chile, we have augmented Fig. 1 with additional V magnitudes reported by Hanzl (1998).

As for N Mus, a casual report by Seronik (1999) establishes that N Mus was photographed by O'Meara "two nights before the nova was first spotted. The star itself appears somewhat brighter [than the discovery image]." From the print of O'Meara's color photograph, one would estimate a magnitude of 8.0 ± 0.2, shown in Fig. 1 as a triangle at JD 2451177.0. Using this observation, we estimate that for Nova Mus, $t_3 \approx 5.2$ days for the visual observations and ≈ 16.9 days from the broadband V measurements. This difference and the clear separation of the two light curves starting a few days after discovery can be understood from the differing response of the two detectors to Hα: the broadband V filter is near peak sensitivity at that wavelength, whereas the eye responds only weakly to Hα. Indeed a spectrum taken of Nova Mus the day after discovery showed "Hα to be exceptionally bright (≈ 7.3 times brighter than the neighboring continuum)". (Liller 1998b). Because the strength of Hα relative to the neighboring continuum increases steadily after the nova brightness has peaked, the visual observations would be expected to show a slower rate of decline. Perhaps puzzling is the coming together of the broadband V and the visual observations after about JD 2451210. The cause may be the presence of a faint star or stars at or near the position of the nova which biased the visual magnitude estimates, or it may just be that at this level of brightness, the visual magnitudes are systematically too bright.

For Nova Oph we estimate from Fig. 2 that $t_3 \approx 8.2$ days for Hanzl's V magnitudes and ≈ 11.7 days for the visual observations. Again, this difference can be understood from the differing response to Hα: the standard V filter is designed block the light from this

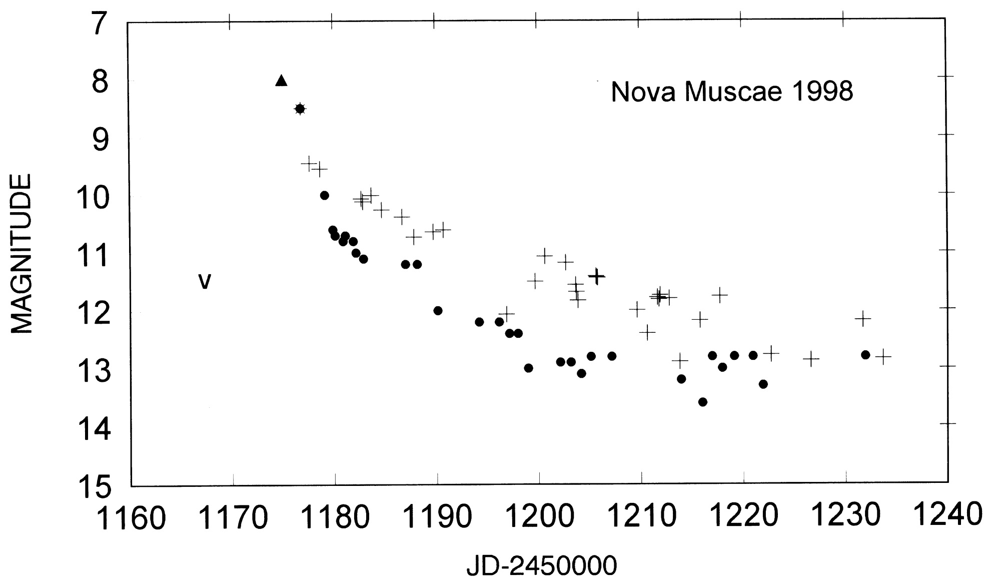

Figure 1. Light curves of Nova Mus 1998 showing Jones' visual estimates as filled circles and Liller's broadband V magnitudes as plus signs. The triangle shows the approximate values derived from O'Meara's pre-discovery color photograph. Two photographic magnitudes by Liller are indicated by a filled circle with rays – from the discovery photograph – and by a "v" denoting a fainter-than pre-discovery observation.

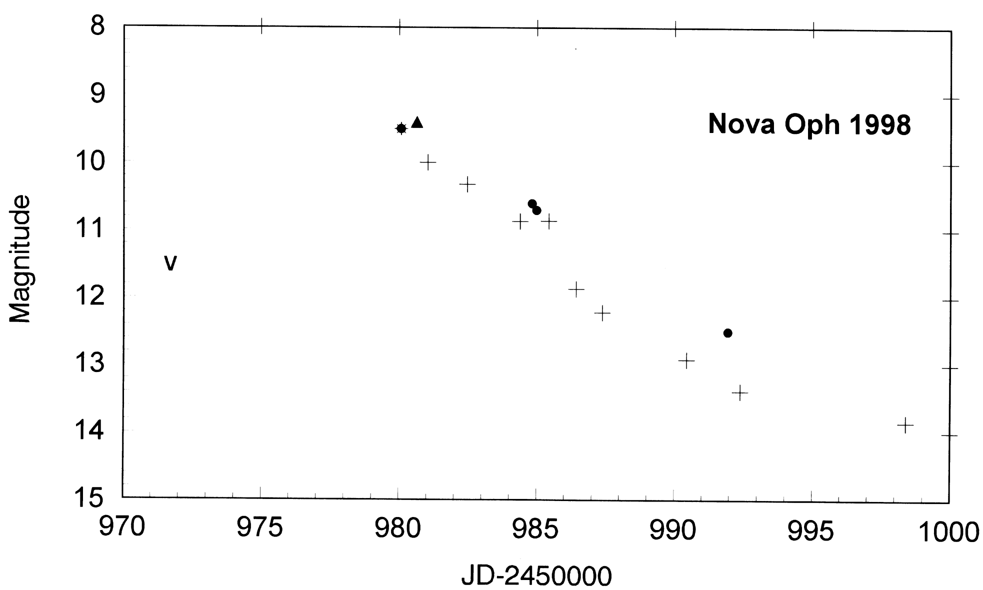

Figure 2. Light curves of Nova Oph 1998 showing Jones' visual estimates as filled circles and Hanzl's CCD-V magnitudes as plus signs. Takamizawa's photographic discovery is indicated with a filled circle with rays, and two unpublished photographic magnitudes by Liller show as a triangle and as a "v" denoting a fainter-than pre-discovery observation.

strong emission, whereas the eye retains some sensitivity at that wavelength. Filippenko et al. (1998) reported that CCD spectra of Nova Oph showed "strong emission lines of H", and their note implies that Hα was the strongest line recorded.

As usual, uncertainty in the values of t_3 arises from the imperfectly known time and magnitude when peak brightness was reached. We note that for N Oph, 8.4 days elapsed between the discovery date and the preceding patrol of the area, while for N Mus, the interval between when O'Meara's photograph was taken and the preceding negative observation of the area was 7.3 days.

Finally, we reiterate the conclusion reached in our earlier report (Liller & Jones 1999), namely that although classically, the value of t_3 should be evaluated using blue-sensitive photographic emulsions, the values derived from visual observations should agree quite well with the "classical" values, and they are certainly superior in this regard to standard V observations.

We again wish to thank Drs. Nikolai Samus and Hilmar Duerbeck for their interest and for encouraging us to publish our nova light curves.

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A NEW γ Dor CANDIDATE IN CRUX

T. ARENTOFT AND C. STERKEN

Vrije Universiteit Brussel (VUB), Pleinlaan 2, B-1050 Brussel, Belgium,
e-mail: tarentof@vub.ac.be, csterken@vub.ac.be

In January and March 1999 the Dutch 91-cm telescope at ESO, La Silla, was used for *uvby* CCD observations of the Wolf–Rayet star WR 46. The observations were carried out with a few data points each night during 28 nights distributed over three observing runs. During the data reduction process we found that one of the other stars in the field showed variability. This star is not listed as variable in SIMBAD or in the GCVS (Kholopov et al. 1985–88), including the subsequent name-lists (Kholopov et al. 1985, 1987, 1989; Kazarovets & Samus 1990, 1995, 1997; Kazarovets et al. 1993). The observed field is shown in Figure 1, where the new variable star is marked by an arrow. Its coordinates are $\alpha_{2000} = 12^{\rm h}05^{\rm m}19^{\rm s}$ and $\delta_{2000} = -62°03'45''$. A light curve from March 1999 is shown in Figure 2, together with the difference between the comparison stars. The overall *rms*–scatter in the comparison star light curve is about 3.5 mmag.

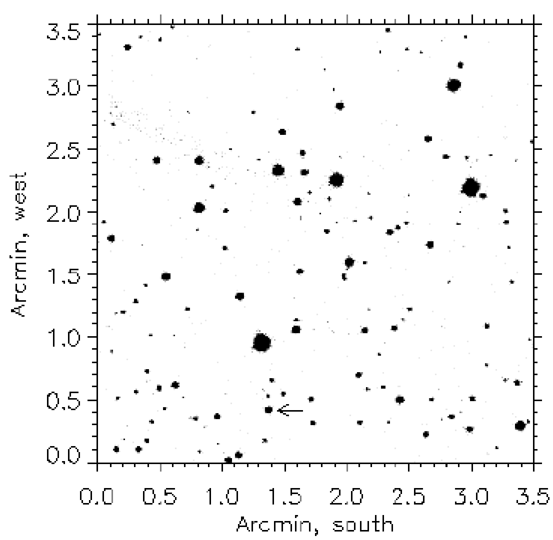

Figure 1. CCD frame covering the region where the new variable has been found (arrow). The bright star 0.′5 north of the new variable is WR 46.

At least two of the nights had photometric conditions. We used the star HD 303308, in the nearby η Car region, to determine the zero–point shift to the standard system using the photometry of Kaltcheva & Georgiev (1993). The average colour indices with estimated errors are:

$$y = 14.54 \pm 0.02$$
$$(b-y) = 0.43 \pm 0.02$$
$$m_1 = 0.04 \pm 0.03$$
$$c_1 = 0.71 \pm 0.05$$

The errors on the observed indices are rather large, mainly due to observational noise, but also due to the variability of this faint object. The Strömgren colour indices are consistent with a late A or early F star.

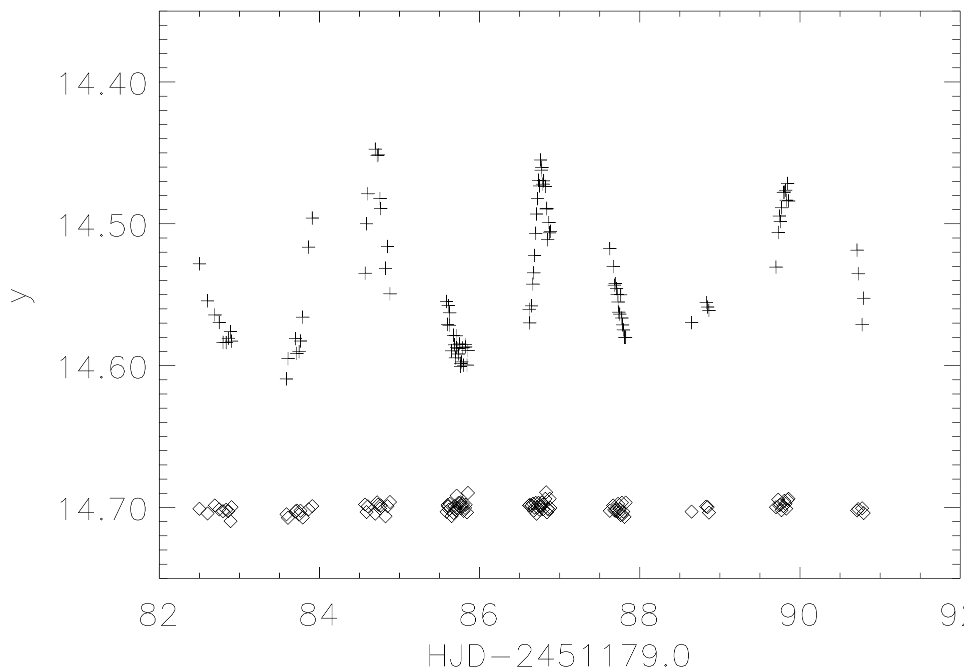

Figure 2. Light curve of the new variable. Crosses are the variable minus the average of two comparison stars, diamonds the difference between the two comparison stars (with shifted zero–point).

Fourier analysis of the y light curve reveals the presence of two frequencies. The first is at 15.77 μHz (1.363 c/d), corresponding to a period of $17^{\rm h}36^{\rm m}30^{\rm s}$, and with a semi–amplitude of 45.7 mmag. The second has a frequency of 17.93 μHz (1.549 c/d, $P = 15^{\rm h}29^{\rm m}38^{\rm s}$) and a semi–amplitude of 23.5 mmag. No excess power is left in the amplitude spectrum after these two frequencies have been subtracted from the light curve. The noise level at low frequencies in the residual spectrum is about 4.2 mmag. No peaks higher than about 2 mmag are present in the amplitude spectrum of the comparison stars. The spectral class, the multiperiodicity, and the periods and amplitudes of the variations, lead us to suggest that we are dealing with a variable star of the γ Doradus class.

γ Doradus variables are a new class of pulsating stars consisting of nonradial g-mode pulsators with periods between 8 hours and about three days. In the H–R diagram they cluster around the intersection of the red edge of the classical instability strip with the main sequence (Handler 1999). Fig. 3 is the observational H–R diagram for the 11 γ Dor stars for which $uvby\beta$ photometry is available, with $(b-y)_0$ and M_V determined by the method of Moon & Dworetsky (1985). All known γ Dor stars have $2.705 < \beta < 2.767$ with an average $\beta = 2.730 \pm 0.022$. Using these limits for the reddening–free β index we obtain for the new variable average $(b-y)_0 = 0.21 \pm 0.01$, $M_V = 2.8 \pm 0.6$ and $T_{\rm eff} \sim 7100$ K, leading to the position in the H–R diagram shown by the open symbol.

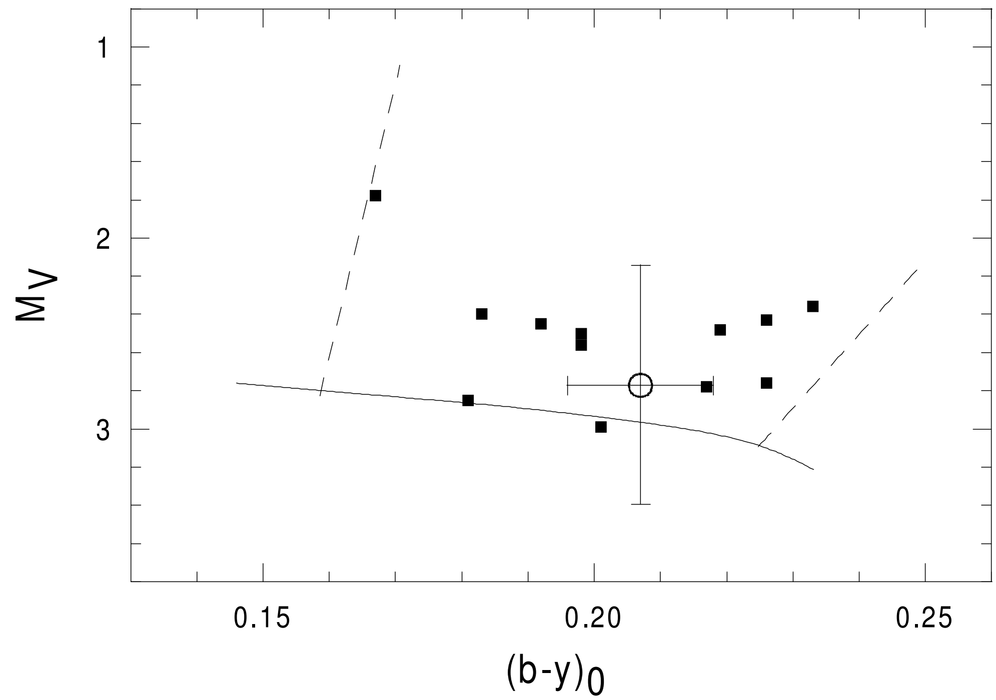

Figure 3. Observational H–R diagram: filled symbols are the positions for known γ Doradus stars, the open symbol denotes the location of the new γ Dor candidate. The error bars reflect the uncertainty due to the expected β range. The full line is the ZAMS line given by Crawford (1979), the dotted lines are the empirical borders of the γ Dor locus as given by Handler (1999).

Our colour indices also yield a surprisingly high $\delta_{m_0} \sim 0.07$ (a measure of blanketing for a given β that correlates well with metallicity [Fe/H]), the largest positive δ_{m_0} value known for γ Dor stars.

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CCD OBSERVATION OF THE 1997 NOVEMBER OUTBURST OF V364 Peg: AN SU UMa-TYPE DWARF NOVA WITH A LONG ORBITAL PERIOD?

T. KATO, K. MATSUMOTO

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp, katsura@kusastro.kyoto-u.ac.jp

V364 Peg is a dwarf nova discovered during the supernova survey at the Beijing Astronomical Observatory (Qiu et al. 1997a). Qiu et al. (1997b) reported another bright outburst at $R = 15.0$ on 1997 November 14.44 UT. The reported amplitude exceeding 5 mag and the rapid decline (1.3 mag d^{-1}) rate at the time of make the object a good candidate for an SU UMa-type dwarf nova (Kato 1997). During this bright outburst, we observed the variable in order to detect possible superhumps.

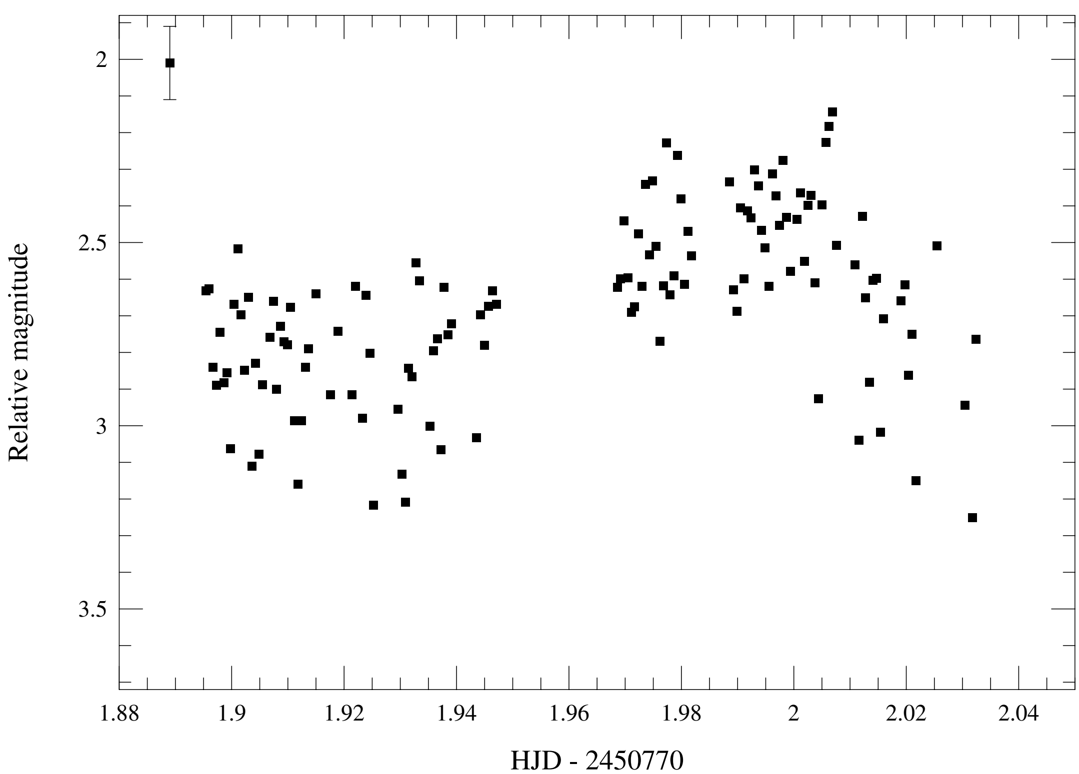

Figure 1. Light curve of V364 Peg

The observations were done on 1997 November 19 using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 40–45 s. The images were dark-subtracted, flat-fielded, and analyzed using a microcomputer-based aperture photometry package developed by one of the authors (TK). The flux of the variable was measured relative to GSC 1113.1775 (USNO r-magnitude 12.9), whose constancy was confirmed by comparison with GSC 1113.499 (USNO r-magnitude 13.2). The magnitudes given below are expressed relative to GSC 1113.1775.

Figure 1 illustrates the light curve of the present observation. Although the run was not long enough to confirm the periodicity, there was a hump-like feature with an amplitude of 0.3 mag around HJD 2450771.996. We consider this is a superhump, by taking into account the considerable duration of the outburst (the object was still in outburst on 1997 Dec. 1, at mag 16.6, by L. T. Jensen), the brightness of the outburst, and the usual lack of modulations of this amplitude in SS Cyg-type dwarf novae. The superhump period seems to be longer than 2.5 hours, as the length of the observation was $\sim$ 3 hours. Although this periodicity should be confirmed by future observations, the potential period makes V364 Peg as a candidate of the longest orbital-period SU UMa-type dwarf novae (cf. Nogami et al. 1997), or even may be the second dwarf nova in the period gap (Nogami et al. 1998). Future monitoring of outbursts and intensive time-resolved photometry are needed.

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PREOUTBURST ACTIVITY OF V4641 Sgr = SAX J1819.3-2525: POSSIBLE EXISTENCE OF 2.5-DAY PERIOD

T. KATO[1], M. UEMURA[1], R. STUBBINGS[2], T. WATANABE[3], B. MONARD[4]

[1] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan,
e-mail: tkato@kusastro.kyoto-u.ac.jp, uemura@kusastro.kyoto-u.ac.jp

[2] 19 Greenland Drive, Drouin 3818, Victoria, Australia, e-mail: stubbo@qedsystems.com.au

[3] VSOLJ, 117 Shirao dormitory, 1414 Oonakazato, Shizuoka 418-0044, Japan, e-mail: jcc00212@nifty.ne.jp

[4] PO Box 70284, Die Wilgers 0041, Pretoria, South Africa e-mail: LAGMonar@csir.co.za

Goranskij (1978, 1990) discovered an eruptive variable star in the close vicinity of the nominal position of Luyten's variable (HV 4048). [Goranskij's object once took over the GCVS nomenclature, GM Sgr, of HV 4048. However, recent studies (Morel 1999; Hazen 1999) suggest they are two independent variables. We use the new GCVS designation of 'V4641 Sgr' (Samus 1999) for Goranskij's object throughout this paper. Readers please pay special attention because several references already list the X-ray transient as 'GM Sgr'.] Goranskij (1978, 1990) reported a single short outburst in 1978 recorded on Moscow photographic plates, reaching $B = 12.4$. Goranskij (1990) also suggested the possible presence of a periodicity of 0.7365 day from the analysis of the quiescent data.

V4641 Sgr began receiving attention since this star was proposed as the possible optical counterpart of the faint flaring X-ray transient SAX J1819.3-2525 (in 't Zand and Heise 1999) based on the positional coincidence. The optical behavior of V4641 Sgr, however, was rather overlooked, until the discovery of a new optical outburst in 1999 August (Watanabe 1999). After a period of apparently increasing activity, the object went into a giant optical outburst reaching $m_{\rm V} = 8.8$ on 1999 September 15 (Stubbings 1999), which was followed by an intense X-ray flare (Smith et al. 1999).

In this paper, we report on the unusual optical activity prior this giant optical and X-ray outburst. The CCD observations were done using an unfiltered ST-7 camera attached to a 25-cm Schmidt-Cassegrain telescope at Kyoto University. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\rm TM}$-based aperture photometry package developed by one of the authors (TK). The magnitudes of V4641 Sgr were determined using the GSC 6848.3882 (Tycho $V = 9.30$, $B - V = +0.49$), whose constancy was confirmed by comparison with GSC 6848.3606. The estimated $R_{\rm C}$ magnitude 9.05 was used to calculate unfiltered CCD magnitudes of V4641 Sgr. The small difference of the reported color of V4641 Sgr (Goranskij 1990) and that of the comparison will make unfiltered CCD magnitudes a good approximation of $R_{\rm C}$ magnitude of the variable. Visual observations were made using 32-cm telescopes by Stubbings, Watanabe and Monard. All visual observations used the V-magnitude sequences. The comparison of quasi-simultaneous visual and CCD observations has confirmed the consistency between

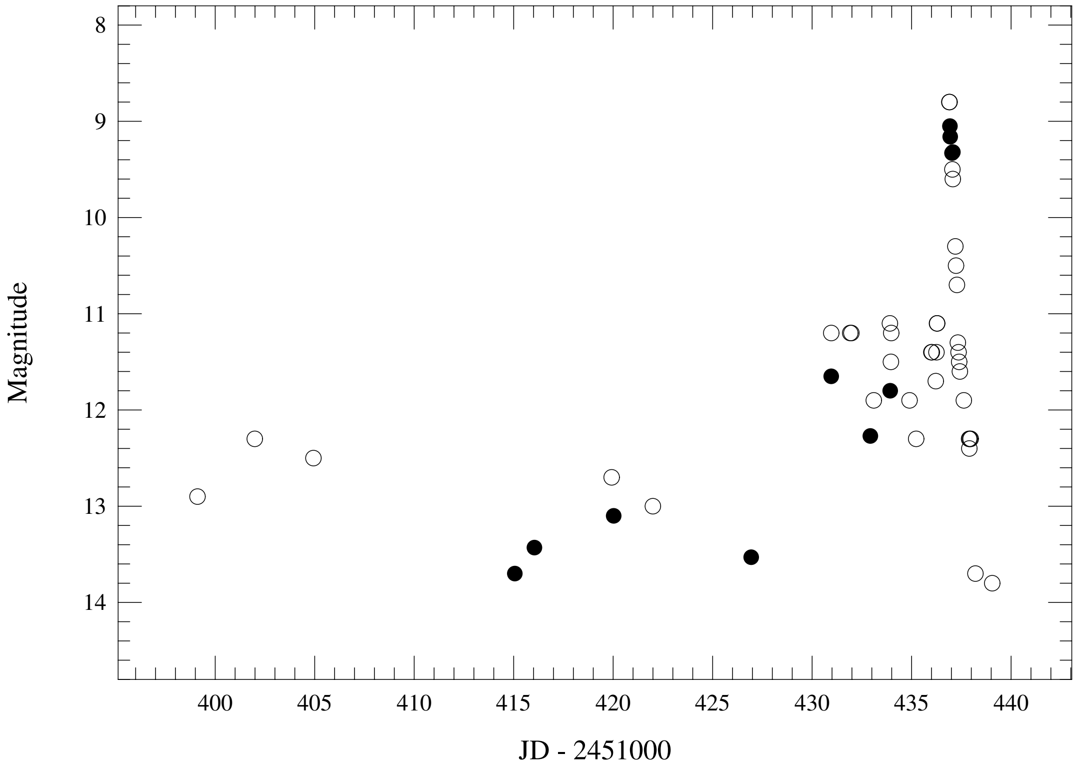

Figure 1. Light curve of V4641 Sgr

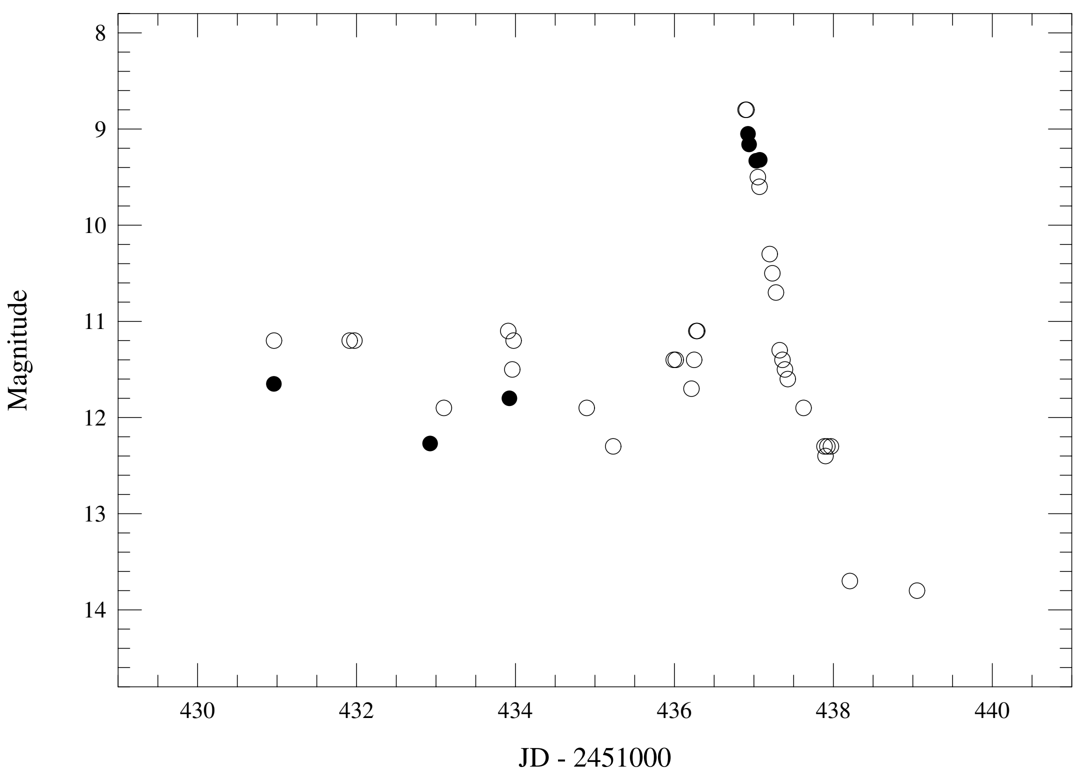

Figure 2. Enlarged light curve of V4641 Sgr showing quasi-periodic modulation prior to the giant outburst

visual and CCD measurements. The estimated error (0.1–0.2 mag) of visual estimates does not affect the following discussion.

Figure 1 represents the summary of present observation, including the later giant outburst for clarity. Filled and open circles represent CCD and visual observation, respectively. Some visual observations reported to VSNET have been supplemented for constructing the fading part of the outburst. V4641 Sgr rose gradually since the detection by Watanabe (1999). The most remarkable feature was the presence of high-amplitude modulation (Figure 2) since JD 2451431 (six days before the giant outburst). The modulation had an amplitude of ~ 1 mag, with a quasi-period of 2.5 days. This periodicity does not fit any of candidate periods by Goranskij (1990). The observed periodicity can be either interpreted as arising from the modulation of the source activity, or as reflecting the underlying binary period. Since the examination of the RXTE monitoring of the galactic-center region has revealed that the X-ray from V4641 Sgr was already detected for this pre-outburst period (Markwardt et al. 1999), the optical modulation may have caused by the reflection effect by the X-ray heating on the secondary. In this interpretation, the 2.5-day period corresponds to the orbital period, which awaits confirmation by future radial velocity studies. Otherwise, the cause of previously unrecorded recurrent quasi-periodic brightening should be sought.

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NEW ELEMENTS AND LIGHT CURVE OF CR TAURI

(BAV MITTEILUNGEN NO. 123)

FRANZ AGERER

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D–12169 Berlin, Germany

Name of the object:
CR Tau = S3949 Tau

Observatory and telescope:
Private Observatory, 20-cm SCT

Detector:	SBIG ST6 camera
Filter(s):	None
Comparison star(s):	GSC 1862.1685
Check star(s):	GSC 1862.1725
Transformed to a standard system:	No

Remarks:

CR Tau was discovered by Hoffmeister (1949a). 15 photographic minima were used to derive the first elements (Hoffmeister 1949b). These elements are listed in the GCVS. Recently we could observe photoelectrically ten new minima, which showed the GCVS-ephemeris to be a spurious one. The minimum times are calculated according to the Kwee–van Woerden method (1956). Using all available photoelectric minima, a weighted least squares fit led to the new ephemeris:

$$\text{Min I} = \text{HJD } 2451195.4818 + 0\overset{\text{d}}{.}68270353 \times E.$$
$$\pm 2 \qquad\qquad \pm 15$$

Acknowledgements:

Data from the Lichtenknecker Database were used

Table 1: Observed times of minima for CR Tau, epochs and residuals computed with respect to the linear ephemeris derived in this paper.

JD hel. 2400000+	Type*	Epoch	$O-C$	Ref.	JD hel. 2400000+	Type*	Epoch	$O-C$	Ref.
26004.38	P	−36899.0	−0.02	[1]	31449.65	P	−28923.0	+0.00	[1]
26313.70	P	−36446.0	+0.03	[1]	49688.756	E:	−2207.0	+0.001	[2]
26355.27	P	−36385.0	−0.04	[1]	49726.307	E:	−2152.0	+0.003	[2]
26634.51	P	−35976.0	−0.03	[1]	49734.4942	E	−2140.0	−0.0020	[2]
26662.48	P	−35935.0	−0.05	[1]	49756.3431	E	−2108.0	+0.0003	[2]
26718.45	P	−35853.0	−0.06	[1]	50428.4626	E	−1124.5	−0.0018	[2]
26987.51	P	−35459.0	+0.01	[1]	50464.3073	E	−1071.0	+0.0010	[2]
27342.51	P	−34939.0	+0.01	[1]	50849.3518	E	−507.0	+0.0007	[2]
27368.45	P	−34901.0	+0.00	[1]	50863.3450	E	−487.5	−0.0015	[2]
27394.39	P	−34863.0	+0.00	[1]	50864.3710	E	−485.0	+0.0004	[3]
27396.41	P	−34860.0	−0.03	[1]	50864.3711	E	−485.0	+0.0005	[2]
27535.36	P	−34657.5	−0.01	[1]	51185.2412	E	−15.0	−0.0000	[4]
27688.60	P	−34432.0	−0.03	[1]	51195.4821	E	0.0	+0.0003	[2]
31447.63	P	−28926.0	+0.03	[1]					

* P denotes photographic minima (weight 1) and E CCD observed minima (weight 10). Those marked with ':' got reduced weight (5).
[1]: Hoffmeister (1949b), [2]: Agerer: this paper, [3]: Diethelm (1998), [4]: Diethelm (1999)

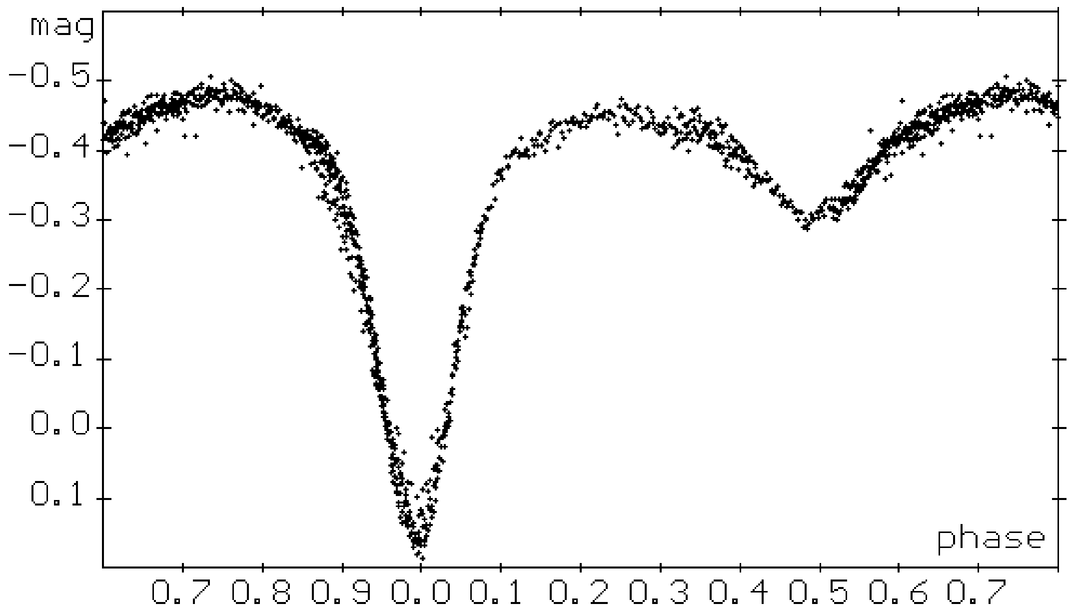

Figure 1. Differential light curve of CR Tau, drawn with the new ephemeris

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DIFFERENTIAL PHOTOMETRY OF SUSPECTED CATACLYSMIC VARIABLES

N. BENNERT[1], I. KÖNIG[1], E. MANTHEY[1], H. BLEUL[1], K. FIEGER[2], M. HESS[2], A. HOVEST[5], W. HOVEST[1,2], T. JÜRGES[1], J. KLEIMANN[1], C. KRIEGESKORTE[1], E. KRUSCH[1], D. MÜNSTERMANN[2], D. REYMANN[2,4], K. RÖSLER[1], M. NIELBOCK[1], M. POHLEN[1], L. SCHMIDTOBREICK[1,3], C. TAPPERT[1,3], R. VANSCHEIDT[1]

[1] Astronomisches Institut, Ruhr–Universität Bochum, Universitätsstraße 150, D–44780 Bochum, Germany
email: hlist_users@astro.ruhr-uni-bochum.de

[2] Universität Dortmund, Otto–Hahn–Straße 4, D–44227 Dortmund, Germany

[3] Osservatorio Astronomico di Padova, Viccolo dell'Osservatorio 5, I–35122 Padova, Italy

[4] Universität Heidelberg, Albert–Überle–Straße 11, D–69120 Heidelberg, Germany

[5] Südring 31, D–48231 Warendorf, Germany

We here present differential photometry of the four suspected cataclysmic variables (CVs) HM Aur, FBS 0827+738, FBS 1614+711 and NSV 7956, and of the three known CVs HQ And, RX And and FO Per. The target objects were selected from the CV catalogue of Downes et al. (1997) (hereafter DWS 97), searching for not yet confirmed CVs and poorly observed systems with unknown orbital periods. Therefore the list of Ritter & Kolb (1998) was used to exclude objects with known periods. To evaluate the significance of our results, we included three systems with a certain CV classification.

The data were taken at Hoher List Observatory on March 9, 10, and 12, on October 8, 1998, and on March 10, 1999 in the framework of the *Astronomisches Beobachtungspraktikum* of the Ruhr–Universität Bochum. We used an astrograph ($D = 0.3\,\mathrm{m}$, $f = 1.5\,\mathrm{m}$) and a Cassegrain reflector ($D = 1.06\,\mathrm{m}$, $f = 3.68\,\mathrm{m}$) equipped with Ford Loral FA2048 CCDs and Johnson V-filters. In order to resolve the CV-typical short-term variation (flickering), the integration time was limited to 120 sec., thus constraining the accessible V-magnitude to 17.0. Table 1 lists the details of the observations.

Standard reduction was performed with IRAF[1] packages using overscan and dome- or skyflats for the 1.06 m telescope, biasframes and skyflats for the astrograph data. Aperture photometry was done with the DAOPHOT package. On each image frame we chose all non-saturated comparison stars comprising a S/N-ratio greater or equal to the S/N-ratio of the target object. For $j = 1, \ldots, n$ let $I_j(t)$ denote the instrumental intensity of comparison star j at time t. For $t_{\mathrm{begin}} \leq t \leq t_{\mathrm{end}}$ all differential lightcurves $I_k^j(t) := I_j(t) - I_k(t),\ j,k \in \{1,\ldots,n\},\ j \neq k$ were calculated. For $t_{\mathrm{begin}} \leq t \leq t_{\mathrm{end}}$ the average lightcurve $I_{\mathrm{av}}(t)$ was computed as the arithmetic mean of all comparison star intensities. Then, differential magnitudes were calculated according to $I_{\mathrm{av}}^j(t) := I_j(t) - I_{\mathrm{av}}(t)$. All comparison stars with brightness variations above the noise level were easily discriminated

[1]IRAF is distributed by the National Optical Astronomy Observatories.

Table 1: List of observations. The coordinates in columns 2 and 3 have been taken from DWS 97. Column 4 shows the instrument used, while columns 6 and 7 give the number of data points (lightcurves of observations marked with a * have been omitted in this paper) and the total time coverage per night, respectively.

Object	RA_{2000}	DEC_{2000}	Instrument	Date	n_{data}	t_{obs} [h]
HM Aur	07 29 06.76	+40 40 57.2	astrograph	10.03.98	*19	0.5
				12.03.98	132	2.4
				10.03.99	*31	0.7
FBS 0827+738	08 32 45.57	+73 37 08	1.06 m telescope	09.03.98	*7	0.3
				12.03.98	76	2.4
FBS 1614+711	16 14 23.19	+70 58 18.6	1.06 m telescope	12.03.98	30	1.2
NSV 7956	16 29 24	+86 26 03	astrograph	09.03.98	224	3.6
				12.03.98	*52	0.8
HQ And	00 31 35.89	+43 49 05.1	1.06 m telescope	08.10.98	57	1.4
RX And	01 04 35.5	+41 17 58.6	astrograph	08.10.98	54	1.8
FO Per	04 08 35.03	+51 14 48.8	1.06 m telescope	08.10.98	151	2.5

and subsequently excluded from the average lightcurve. In an iterative process only comparison stars with constant brightness within the noise level contributed to the average lightcurve.

HM Aur: This system has been discovered by Geyer et al. (1955) who described it as a long-period variable showing irregular waves spanning over 50–100 days with an amplitude of 0.5–1.1 mag. However, Vogt (1989) suspected a quiescent nova, while DWS 97 list it as nova-like with photographic magnitudes 11.3–12.4. To our knowledge, no spectrum has been published.

FBS 0827+738 and FBS 1614+711: Both objects have been reported as possible CVs by Abramyan & Mikaelyan (1994, 1995) as discoveries of the First Byurakan Objective Prism Survey. The authors do not present finding charts. Therefore, charts published by DWS 97 are based on the published coordinates only. The reported magnitudes are $V = 15.9$ for FBS 0827+738 and $B = 16.4$ for FBS 1614+711, respectively. While for FBS 0827+738, a spectrum is not available, FBS 1614+711 has recently been studied by Liu et al. (1999) who classified it as a DAB type white dwarf.

NSV 7956: NSV 7956 is listed in the NSV catalogue of Kholopov (1982) as a possible dwarf nova. No spectrum has been published so far and therefore this classification remains uncertain. DWS 97 give a magnitude range of $V = 9$–11.5.

HQ And: HQ And is listed as a CV in DWS 97 with a magnitude range of $m_{phot} =$ 15.0–16.2. Meinunger (1975) first classified HQ And as a rapid irregular star and revised it later (1980) in favour of a CV classification. She already suspected a possible polar nature which was subsequently strengthened by the polarimetry of Andronov & Meinunger (1987).

RX And: RX And is a well-known dwarf nova of subtype Z Cam with a magnitude range of $V = 10.9$–12.6 (DWS 97). Spectroscopic studies were conducted e.g. by Kaitchuck et al. (1988) and Smith et al. (1995), while Verbunt et al. (1984) present a lightcurve. The orbital period has been determined to $P = 5.04$ hours by Kaitchuck (1989).

FO Per: According to Howarth (1976) and Gessner (1978) FO Per is a dwarf nova with a mean outburst cycle length of roughly 10 days. The spectrum published by Bruch (1989) shows the typical strong emission lines of such a system and thus supports this classification. DWS 97 give a maximum visual magnitude of 11.8 and a photographically

Table 2: Results of the differential photometry are given in this table. Column 3 shows the average magnitude of the differential lightcurve for the target and the comparison stars (CS1–CS7). Comparison stars marked with a * are used to calculate the average lightcurve.

HJD	Object	V_{diff}
2450882	HM Aur	-0.740 ± 0.073
	CS2*	–
	CS3	0.911 ± 0.075
	CS4	0.781 ± 0.048
	CS5	1.042 ± 0.095
2450884	HM Aur	-0.803 ± 0.011
	CS2*	–
	CS3	0.871 ± 0.024
	CS4	0.740 ± 0.023
	CS5	1.011 ± 0.024
2451248	HM Aur	-0.804 ± 0.006
	CS2*	–
	CS3	0.935 ± 0.006
	CS4	0.734 ± 0.006
	CS5	1.181 ± 0.005
2450881	FBS 0827+738	1.954 ± 0.020
	CS2	1.807 ± 0.027
	CS3	1.883 ± 0.024
	CS4*	–
2450884	FBS 0827+738	1.937 ± 0.036
	CS2	1.782 ± 0.036
	CS3	1.892 ± 0.037
	CS4*	–
2450884	FBS 1614+711	0.462 ± 0.047
	CS1*	-0.021 ± 0.031
	CS3*	-0.229 ± 0.030
	CS4*	0.035 ± 0.032
	CS5	0.216 ± 0.031

HJD	Object	V_{diff}
2450881	NSV 7956	-0.858 ± 0.009
	CS3*	0.402 ± 0.007
	CS4*	-0.402 ± 0.007
2450884	NSV 7956	-0.855 ± 0.010
	CS3*	0.403 ± 0.006
	CS4*	-0.403 ± 0.006

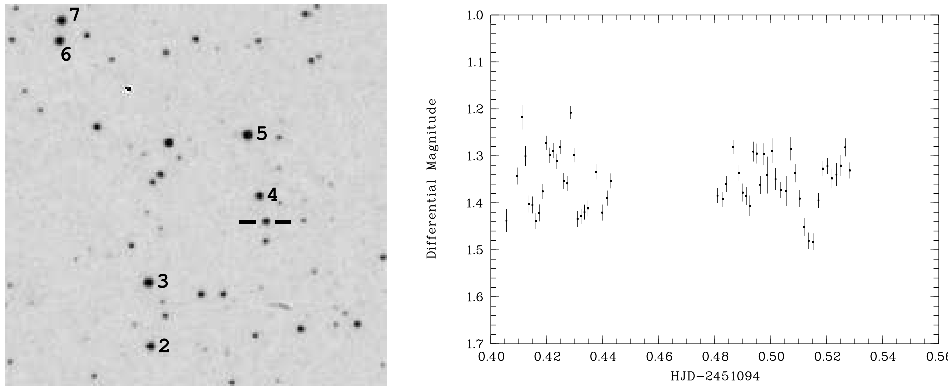
HJD	Object	V_{diff}
2451094	HQ And	1.354 ± 0.060
	CS2*	0.626 ± 0.009
	CS3*	-0.048 ± 0.005
	CS4	0.932 ± 0.014
	CS5*	-0.580 ± 0.007
	CS6*	0.248 ± 0.007
	CS7*	-0.245 ± 0.006
2451094	RX And	1.074 ± 0.135
	CS1*	-1.241 ± 0.038
	CS3*	1.241 ± 0.038
2451094	FO Per	0.771 ± 0.024
	CS2	-1.672 ± 0.010
	CS3*	0.528 ± 0.007
	CS4*	-1.034 ± 0.006
	CS5	-0.957 ± 0.011
	CS6	0.870 ± 0.014
	CS7*	0.507 ± 0.007

determined minimum value of 16.2.

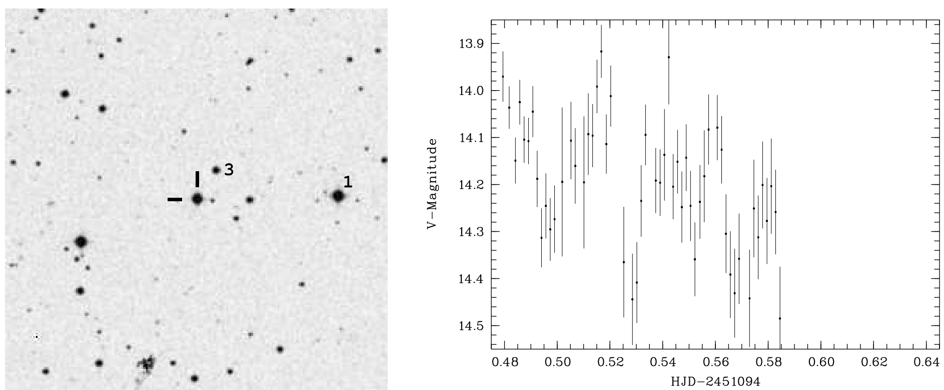
In Table 2 we give the mean differential magnitudes together with their standard deviation over the night. Figure 1 shows the lightcurves of the program stars as plots of the differential magnitude (except for FO Per and RX And, where the calibrated V-magnitude was available) against time in units of the Heliocentric Julian Date (HJD). All magnitude-axes cover a range of 0.7 mag, while all HJD-axes cover a time of 0.17 d, thus rendering all lightcurves directly comparable. The finding charts on the left side of Figure 1 give the location of the objects as well as of all comparison stars referred to in Table 2 for which differential lightcurves were computed.

Known CVs: HQ And, RX And and FO Per

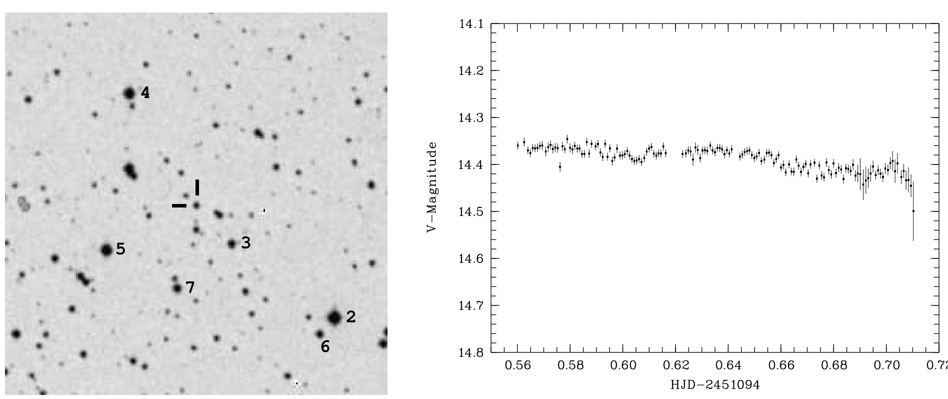
It is evident from Table 2 that the standard deviation of the differential lightcurve is much higher than those of the comparison stars. The differential lightcurves of HQ And and RX And show the characteristic flickering while the lightcurve of FO Per shows a slow descent. Furthermore, we can derive a calibrated magnitude for FO Per and RX And, as several comparison stars have been measured as secondary standards by Misselt (1996).



HQ And

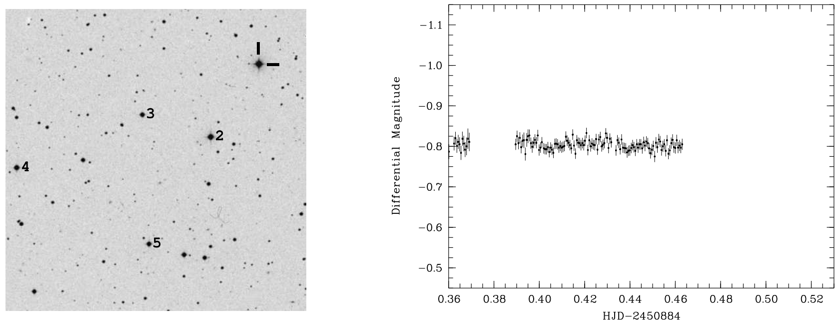


RX And

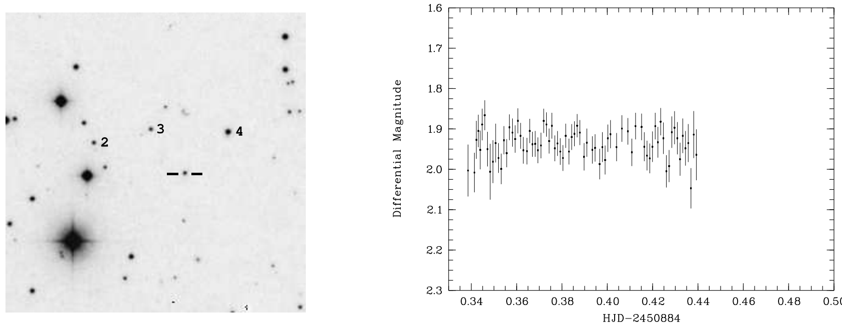


FO Per

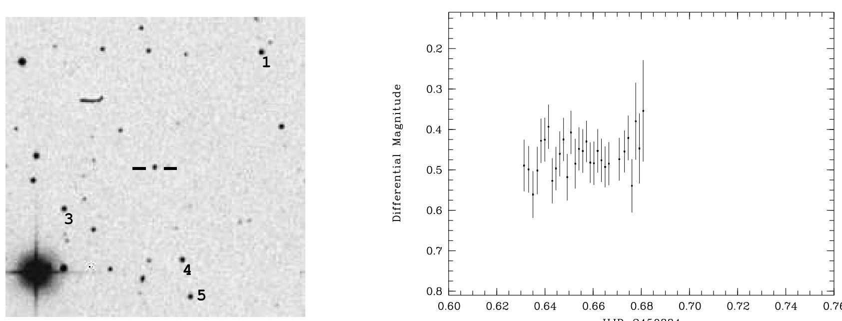
Figure 1. On the left side, we present the finding charts for the analyzed stars. On the right side, the corresponding lightcurves (Magnitude vs. HJD) are displayed. Scales were chosen to be directly comparable. Finding charts: HM Aur (dimensions: $13' \times 13'$), FBS 0827+738 ($7' \times 7'$), FBS 1614 ($6' \times 6'$), NSV 7956 ($13' \times 13'$), HQ And ($6' \times 6'$), RX And ($7' \times 7'$), and FO Per ($7' \times 7'$). North is up, East is to the left. Numbers correspond to the comparison stars.



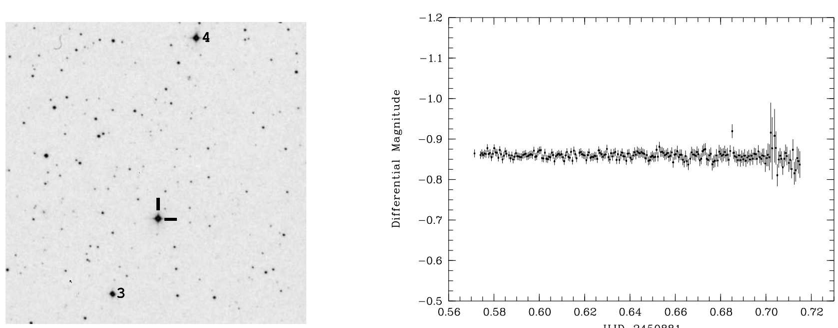
HM Aur



FBS 0827+738



FBS 1614+711



NSV 7956

Figure 1. (cont.)

For RX And, we thus obtain a visual magnitude of $V = 13.92(6)$–$14.48(11)$ and for FO Per $V = 14.35(1)$–$14.50(6)$. The latter value lies almost exactly in the middle of the above mentioned magnitude range. We therefore conclude that our observation must have taken place shortly after an outburst while the CV was still in its decline.

Candidate CVs: HM Aur, FBS 0827+738, FBS 1614+711, and NSV 7956
In the cases of HM Aur, FBS 0827+738, and NSV 7956 the resulting lightcurves show a straight line at a constant magnitude. None of the targets shows a standard deviation significantly higher than those of the comparison stars. Furthermore, all objects which could be observed in more than one night always show the same average magnitudes within the errors. We therefore conclude that a CV nature seems unlikely for these objects. As for FBS 1614+711, due to the large uncertainties and the short time interval we do not consider our lightcurve to provide sufficient information to speak in favour or against a CV classification. However, the very recently published spectrum by Liu et al. (1999) clearly lacks any CV characteristic. We thus take the fact that the most doubtful lightcurve was obtained from an object which was proven afterwards not to be a CV to strengthen our conclusions on the other three candidates, although spectroscopic observations will be required to finally clarify their status.

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NEW VARIABLE STARS DISCOVERED IN THE MISAO PROJECT IV: MisV0201–MisV0250

SEIICHI YOSHIDA[1], KENICHI KADOTA[2], TAICHI KATO[3]

[1] MISAO Project, 1065-16 Miyawada Fujishiro-machi Kitasoma-gun Ibaraki 300-1514, Japan, e-mail: seiichi@muraoka.info.waseda.ac.jp

[2] MISAO Project, 77-1-3-12-204 Koshikiya Ageo City Saitama 362-0064, Japan, e-mail: kenic-k@astroarts.co.jp

[3] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

This report describes 50 new variable stars (MisV0201-MisV0250) discovered in the course of the MISAO Project.

These objects are detected automatically by the PIXY system as candidates of variable stars from unfiltered CCD images taken by Kadota between 1999 April and July, and a few in 1998 November, then confirmed by Yoshida and Kadota. Further details are same as described in Yoshida and Kadota (1999).

Table 1 lists 50 new variable stars. The positions and magnitudes were measured using USNO-A1.0 catalog. The magnitude is based on a preliminary V magnitude calculated from R and B magnitude in the catalog based on Kato's (1998) equation:

$$V = R + 0.375(B - R)$$

The finding charts are available electronically as 4780-f[nnn].eps where [nnn] refers to the serial number assigned to the star in the first column of Table 1.

V393 Cyg is 3.4 arcmin from MisV0205, that was detected on our unfiltered CCD image as a 10 mag star. MisV0205 is thus another new variable star.

BL Sct is 4.1 arcmin from MisV0212. No star brighter than 14.7 mag was detected at the position of BL Sct on our unfiltered CCD images on Apr. 14 and May 20. However, considering the large angular distance, MisV0212 is probably another variable object.

NSV 12624 is 1.0 arcmin from MisV0217. No star brighter than 14.8 mag was detected at the position of NSV 12624 on Apr. 30 and July 24. Therefore, MisV0217 may be identified with NSV 12624.

NSV 12646 is 2.9 arcmin from MisV0231, that was detected on our unfiltered CCD image as a 8.5 mag star. Therefore, MisV0231 is another new variable star.

NSV 11612 is 4.6 arcmin from MisV0244, that was detected on our unfiltered CCD image. It was fainter than 14.7 mag on Apr. 14, but 11.5 mag on July 24. Therefore, MisV0244 is another new variable star.

Table 1: List of New Variable Stars

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0201	$19^{h}00^{m}03\overset{s}{.}67$	$+13^{\circ}28'09\overset{''}{.}5$	14.1	14.9	?	USNO-A1.0 0975.14031654 IRAS 18577+1323
MisV0202	18 58 55.45	+13 09 54.2	13.1	14.0	?	USNO-A1.0 0975.13981491 IRAS 18566+1305
MisV0203	18 58 43.65	+12 56 12.6	14.2	[15.0	?	IRAS 18564+1252
MisV0204	19 56 10.87	+45 20 58.4	11.4	13.5	?	USNO-A1.0 1350.11536931 IRAS 19545+4512
MisV0205	19 58 47.87	+43 14 18.1	12.8	14.0	?	IRAS 19571+4305
MisV0206	20 01 19.86	+41 18 35.5	12.8	14.6	?	USNO-A1.0 1275.13311186 IRAS 19596+4110
MisV0207	20 01 55.39	+41 24 46.5	12.4	13.9	?	USNO-A1.0 1275.13343377 IRAS 20001+4116
MisV0208	17 57 25.99	−27 46 05.1	12.4	13.4	?	IRAS 17542-2745
MisV0209	18 01 10.56	−29 30 37.5	12.4	13.2	?	IRAS 17579-2930
MisV0210	17 30 29.18	−04 34 50.8	14.0	14.8	?	IRAS 17278-0432
MisV0211	21 01 15.36	+47 56 14.1	13.1	14.0	?	IRAS 20595+4744
MisV0212	18 58 32.73	−14 06 42.6	12.1	12.9	?	USNO-A1.0 0750.15949786 IRAS 18556-1410
MisV0213	18 57 40.72	−13 13 36.5	12.8	13.6	?	IRAS 18548-1317
MisV0214	18 58 09.43	−10 41 02.8	13.9	[15.2	?	USNO-A1.0 0750.15910558 IRAS 18553-1045
MisV0215	19 02 41.98	+12 45 59.3	13.8	15.1	?	IRAS 19003+1241
MisV0216	18 57 06.07	+12 58 33.8	10.5	11.5	?	IRAS 18547+1254
MisV0217	19 58 09.99	+10 47 03.5	12.0	13.0	?	IRAS 19557+1038
MisV0218	19 59 13.54	+11 29 30.9	12.5	16.1	?	IRAS 19568+1121
MisV0219	19 59 56.42	+11 51 45.5	11.7	13.4	?	USNO-A1.0 0975.17729028 IRAS 19575+1143
MisV0220	20 00 38.54	+13 31 33.6	11.0	11.8	?	IRAS 19583+1323
MisV0221	19 57 25.57	+21 47 07.3	12.9	14.3	?	USNO-A1.0 1050.16159620 IRAS 19552+2138
MisV0222	19 57 47.27	+24 12 22.5	13.4	14.5	?	IRAS 19556+2404
MisV0223	20 00 33.55	+24 06 05.5	13.4	15.1	?	IRAS 19584+2357
MisV0224	20 02 05.63	+24 14 19.5	11.4	13.0	?	IRAS 19599+2405
MisV0225	19 57 23.74	+25 21 07.0	12.4	13.4	?	IRAS 19552+2512
MisV0226	19 59 01.12	+24 41 29.9	11.1	12.3	?	USNO-A1.0 1125.15025417 IRAS 19569+2433
MisV0227	19 59 52.20	+24 38 54.4	13.4	15.1	?	IRAS 19577+2430
MisV0228	20 01 06.14	+25 14 02.1	13.3	14.8	?	IRAS 19589+2505
MisV0229	20 00 11.19	+25 16 26.1	12.8	14.0	?	USNO-A1.0 1125.15075844 IRAS 19580+2508
MisV0230	19 59 27.61	+21 34 15.2	11.2	12.3	?	GSC 1628.3082 USNO-A1.0 1050.16313718 IRAS 19572+2126

Table 1 (cont.)

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0231	$19^h58^m36^s.35$	$+26°52'35''.4$	13.2	14.9	?	IRAS 19565+2644
MisV0232	20 01 57.04	+27 02 57.5	13.5	15.0	?	IRAS 19598+2654
MisV0233	19 59 36.10	+29 26 31.1	13.7	15.2	?	USNO-A1.0 1125.15050710
						IRAS 19575+2918
MisV0234	19 00 04.55	−05 24 56.9	12.3	13.2	?	GSC 5136.1861
						USNO-A1.0 0825.14011333
MisV0235	19 02 25.52	−07 56 50.7	11.3	13.4	SR?	USNO-A1.0 0750.16313017
MisV0236	19 02 21.06	−07 55 42.0	12.3	13.3	?	USNO-A1.0 0750.16306936
MisV0237	18 58 35.04	−07 47 57.6	12.9	13.9	?	
MisV0238	19 02 36.02	−07 01 33.6	11.1	13.2	SR?	GSC 5140.0687
						USNO-A1.0 0825.14205647
MisV0239	18 59 55.06	−10 10 59.0	12.5	13.9	SR?	USNO-A1.0 0750.16083633
MisV0240	18 57 59.56	−09 24 51.0	10.6	11.6	?	USNO-A1.0 0750.15893095
MisV0241	18 58 27.07	−08 59 06.8	11.6	13.1	?	IRAS 18557-0903
MisV0242	19 59 35.26	+21 26 57.7	12.1	13.5	?	USNO-A1.0 1050.16323294
MisV0243	19 00 29.00	−06 14 57.6	12.5	13.7	?	USNO-A1.0 0825.14045646
MisV0244	18 59 30.32	−05 35 48.6	12.3	13.1	?	GSC 5123.3092
						USNO-A1.0 0825.13961843
MisV0245	20 57 41.75	+38 17 33.0	11.6	12.4	?	USNO-A1.0 1275.14637874
MisV0246	20 01 46.90	+24 47 31.8	12.4	13.9	?	
MisV0247	19 01 25.83	−05 29 39.6	10.9	12.7	?	IRAS 18587-0534
MisV0248	18 58 34.53	−04 04 51.0	13.7	14.4	SR?	IRAS 18559-0408
MisV0249	18 59 53.85	−03 14 33.9	10.5	[13.1	M:	IRAS 18572-0318
MisV0250	18 57 51.03	−01 59 00.8	10.7	11.6	SR?	USNO-A1.0 0825.13815862
						IRAS 18552-0203

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VARIATIONS IN THE EFFECTIVE TEMPERATURE AND THE BALMER JUMP OF THE Ap STAR 41 Tauri

N.A. SOKOLOV

Central Astronomical Observatory at Pulkovo, St. Petersburg 196140, Russia, e-mail: sokolov@gao.spb.ru

The magnetic Ap-Si star 41 Tau (GS Tau, B9p Si) was found to be variable by Rakoš (1962) with a period of around 12 days. Blanco and Catalano (1972) also confirmed this periodicity. Subsequently, Abt and Snowden (1973) discovered the spectroscopic binarity of 41 Tau and determined an orbital period of $7^{\rm d}.227424$, a value also adopted by Wolff (1973). The investigation of the visible spectrum by Wolff established the synchronism between rotation and revolution for this star. Moreover Wolff (1973) recorded Zeeman spectrograms of this star and determined the variations of the effective magnetic field, suggesting a maximum near phase 0.6. These spectrograms also yielded variations of Si II, Sr II and Ti II lines and showed that the Si II minimum, near phase 0.4, coincides approximately with the maximum brightness whereas Sr II and Ti II minima occur near phase 0.0. Moreover Artru and Freire-Ferrero (1988), who observed 41 Tau with the IUE satellite, confirmed the results of Wolff (1973). They showed that the minimum of silicon absorption occurs at phase 0.47, just before the gallium maximum at phase 0.59. More recently, Gonzalez and Artru (1994) used the visible spectra to derive variations of the O I lines at $\lambda\lambda$ 7771.95, 7774.17 and 7775.39 Å and found that there must be an accumulation of oxygen around the positive magnetic pole of 41 Tau.

A new method of determination of the effective temperature ($T_{\rm eff}$) of the chemically peculiar stars using the Balmer continuum slope near the Balmer jump was proposed by Sokolov (1998). Using this method it is possible to measure the size of the Balmer jump (D) as well (see Sokolov 1995). To check the reliability of this method the star 41 Tau was selected, because there is evidence for variability in the size of the Balmer jump for this star (Adelman 1983). Fourteen continuum energy distributions in the spectra of 41 Tau were taken from the paper Adelman (1983). The scans have seven measurements in the Balmer continuum that allowed to calculate the $T_{\rm eff}$ from the slope of spectra in the Balmer continuum with reasonable accuracy. To determine the continuum shape at both sides of the Balmer jump, an iterative procedure was used. The Balmer jumps of 41 Tau were calculated, by extrapolating the two fitted curves to $\lambda = 3700$ Å, as described by Sokolov (1995). The errors on effective temperatures and on size of the Balmer jumps were computed according to the formula for the standard error propagation theory. The phases for the observational data in our investigation were computed using the ephemeris adopted by Abt and Snowden (1973).

The variations in the effective temperature and Balmer jump of 41 Tau are plotted on the middle and bottom panels of Fig. 1, respectively. As one can see from Fig. 1, both

$T_{\rm eff}$ and D reveal clear variation with phase for 41 Tau. Although the statistical error of the $T_{\rm eff}$ determinations for individual scans is large enough (up to 800 K). In order to find the amplitude of the $T_{\rm eff}$ and D variations a linearized least-squares method was used, which was described by North (1987). A least-squares fit by one-frequency cosine curve was applied both to the $T_{\rm eff}$ and to the D variations. The fitted curves are plotted as the solid lines in Fig. 1. The computations give the minimum of the $T_{\rm eff}$ (12650 K) and D (0.292 dex) at the phases 0.45 and 0.42, respectively. Also, the maximum of the $T_{\rm eff}$ (13240 K) is at phase 0.95 and is consistent with the maximum of D (0.319 dex) at phase 0.92.

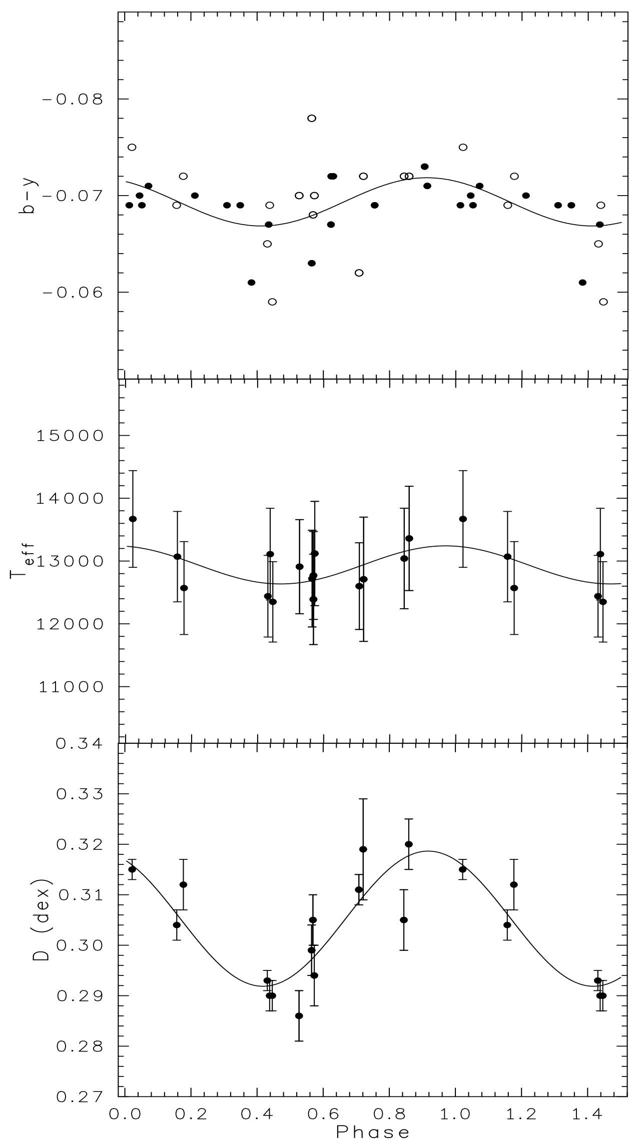

Figure 1. The variations in the $b-y$ color index, effective temperature and Balmer jump for 41 Tau. The top panel shows the $b-y$ color index variations observed by Wolff (1973) (filled circles) and synthesized from spectrophotometry by Adelman (1983) (open circle s). The middle panel shows the effective temperature variations. The bottom panel displays the Balmer jump variations. The solid lines are least squares fit.

It is well-known that the $u-b$ and $b-y$ color indices of Strömgren photometry measures the size of the Balmer jump and the slope of the Paschen continuum, respectively. Adelman (1983) established the changes in the size of the Balmer jump from the $u-b$ index variations and two scan comparisons. Moreover he noted that the $b-y$ index can be described as constant although the values suggest low amplitude variability, but the slope of the Balmer continuum is not quite correct.

To test the validity of the obtained phase diagrams of the $T_{\rm eff}$ and the D variations, the $u-b$ and $b-y$ indices were used. The correlation between the D and the $u-b$ index variations is excellent, as is illustrated by Fig. 1 and by Fig. 4 from the paper by Adelman (1983). It should be noted that the minimum of D corresponds to the maximum of the light both in the Paschen continuum and in the Balmer continuum (see Wolff 1973).

The slope of the Paschen continuum is a good estimator of $T_{\rm eff}$ for hot CP stars in the visual spectral region. To investigate the correlation between variations of the slope of the Paschen continuum and the variations of $T_{\rm eff}$ derived from the slope in the Balmer continuum the $b-y$ color index was used. The top panel of Fig. 1 shows the $b-y$ index variations of 41 Tau. The solid line is a least squares fit by a one-frequency cosine curve. The fitted curve confirms the low amplitude variability of the $b-y$ color index for this star, although the scattering of the points in the top panel of Fig. 1 is large. The correlation between the slope in the Paschen continuum and the $T_{\rm eff}$ derived from the slope in the Balmer continuum variations appears to be very good, as is illustrated by Fig. 1. The minimum of the $b-y$ index is at phase 0.42 and is consistent with the minimum of the $T_{\rm eff}$. This supports the reliability of the obtained phase diagram for the $T_{\rm eff}$ variations. On the other hand, the minimum of the $T_{\rm eff}$ corresponds to the maximum light. Moreover the observations of 41 Tau show that Si minimum coincides with maximum light at the phase 0.4 (Wolff 1973). However Mantegazza et al. (1990) found that the shape of the light curve of 41 Tau is variable on the timescale of a few years.

In conclusion, the present analysis of 41 Tau shows that the method proposed by Sokolov (1998) is of sufficient accuracy to study the effective temperature and the Balmer jump variations with phase for Ap stars.

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NEW ANALYSES OF V909 CYGNI LIGHT CURVES

CLAUD H. LACY[1], MAMNUN ZAKIROV[2], G.C. ARZUMANYANTS[2], N.R. BAIRAMOV[2], A.S. HOJAEV[2]

[1] Department of Physics, University of Arkansas, Fayetteville, AR 72701, USA

[2] High Altitude Maidanak Observatory, Astronomical Institute, Tashkent 700052, Uzbekistan

Lacy (1997) reanalyzed the photometry of Gülmen et al. (1988) and combined the results with his spectroscopic orbit to determine the absolute properties of this triple star. He found anomalies in the absolute properties of this system. The primary component appeared to be very small for its mass, and the secondary appeared to be less massive, but considerably larger than the primary, which seemed to imply it might be a pre-main-sequence object. A new set of B,V light curves is now available for this system. They were obtained at the High Altitude Maidanak Observatory in Uzbekistan with a 0.6-m reflector. Times of minima derived from these data have been reported (Lacy et al. 1998). From these times of minima and those of Gülmen et al. (1988) we find an improved ephemeris: Min I $= 2.80538720(60)n + 2450305.3731(20)$, where the uncertainty in the last digits is shown in parentheses. We have now fit an orbit to these new data and find significant differences with the previous photometric orbit.

The new data were analyzed with the NDE model (Etzel 1981, Popper & Etzel 1981) as were the older data. The results are presented in Table 1 and shown in Fig. 1 and 2.

Table 1: Analyses of V909 Cyg Light Curves

Parameter	Gülmen et al. (1988) Data		Maidanak Data	
	B	V	B	V
J_s	0.719 ± 0.006	0.760 ± 0.007	0.744 ± 0.009	0.798 ± 0.008
r_p	0.117 ± 0.002	0.113 ± 0.001	0.122 ± 0.002	0.125 ± 0.001
k	1.01 ± 0.04	1.08 ± 0.02	0.95 ± 0.03	0.93 ± 0.02
i (deg)	89.1 ± 0.2	89.5 ± 0.5	89.7 ± 0.7	89.9 ± 1.9
L_A	0.447 ± 0.016	0.401 ± 0.008	0.473 ± 0.017	0.454 ± 0.009
L_C	0.230 ± 0.008	0.248 ± 0.008	0.218 ± 0.012	0.234 ± 0.011
u_A	0.550	0.500	0.280	0.470
u_B	0.599	0.539	0.315	0.498
s.e. (mag)	0.010627	0.011908	0.024486	0.020515
N	720	696	523	536

Note: $L_A + L_B + L_C = 1$.

Some of the parameters are consistent across all analyses: the orbital inclination i, and the third light L_C. All other parameters differ significantly. The ratio-of-radii, for instance, is less than 1 in the analysis of the newer data, which would remove the anomalies found by Lacy (1997). Internally estimated uncertainties of the fitted parameters are comparable in both analyses, although the residual standard errors (s.e.) are smaller for the light curves of Gülmen et al. (1988).

Our conclusion is that the individual radii are much more poorly known than are implied by the internal errors of the model fits. Although the sum-of-radii is well-determined, the ratio-of-radii is poorly known. A much more accurate set of light curves will be needed to definitively determine the radii of the components of this binary star.

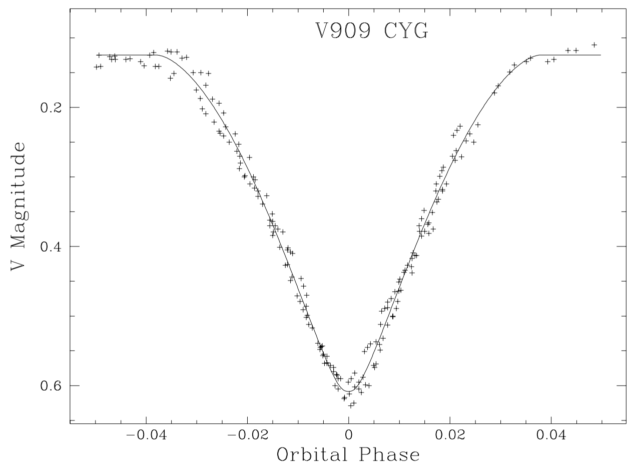

Figure 1. Light curve of Gülmen et al. (1988) with fitted orbit

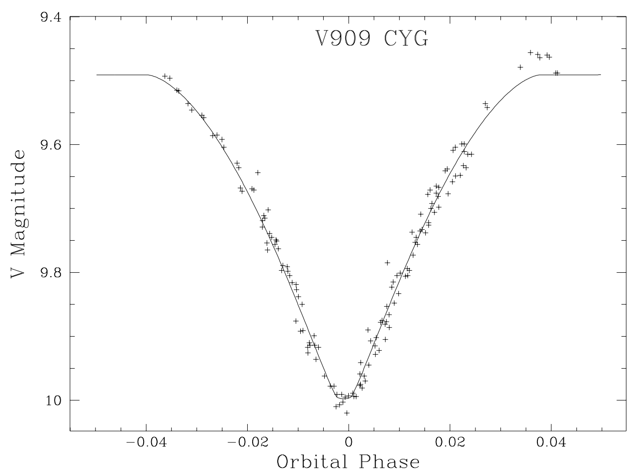

Figure 2. Light curve obtained at Maidanak Observatory and fitted orbit

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NSV 09100 IS A SHORT PERIOD VARIABLE IN OPHIUCHUS

ENRIQUE GARCIA-MELENDO[1], FLORENTINO SÁNCHEZ-BAJO[2]

[1] Esteve Duran Observatory, El Montanya-Seva, 08553 SEVA, Barcelona, Spain,
e-mail: duranobs@astro.gea.cesca.es

[2] Departamento de Electronica e Ingeniería Electromecánica, Escuela de Ingenierías Industriales, Universidad de Extremadura, Ctra de Elvas s/n, 06071 Badajoz, Spain, e-mail: fsanbajo@unex.es

Name of the object:
NSV 09100, HV 10963, CSV 003244, GSC 992:1096

Equatorial coordinates:	**Equinox:**
R.A.= $17^h31^m35^s$ **DEC.=** $+08°09'13''$	2000.0

Observatory and telescope:
Esteve Duran Observatory, 0.6-m Cassegrain telescope; Extremadura University Observatory, 0.4-m Newton telescope

Detector:	CCD

Filter(s):	*V*

Comparison star(s):	GSC 992:972

Check star(s):	GSC 992:1077, GSC 992:987, GSC 992:911

Transformed to a standard system:	No

Availability of the data:
Upon request

Type of variability:	RRc:

Remarks:

PNSV 09100 was first announced as a variable star by Hughes-Boyce and Huruhata (1942), who indicated that this object was an RR Lyr with a photographic magnitude variation between 13.8 and 14.3. Our observations show that NSV 09100 is a short period variable with a very symmetric light curve, probably of the RRc type, although we do not exclude the possibility of this object being a binary system. The amplitude is 0.40 magnitudes in the V band. The following ephemeris has been computed:

$$\text{Max. JD} = 2451290.98(\pm 0.03) + 0\overset{d}{.}34196(\pm 0.00006) \times E.$$

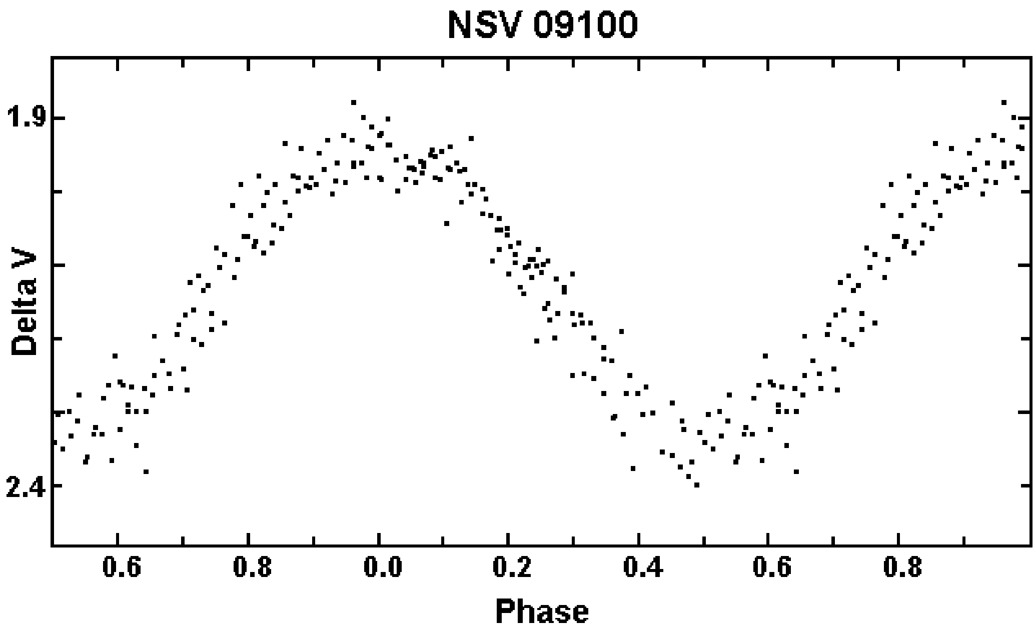

Figure 1.

Reference:

Hughes-Boyce, E., Huruhata, M., 1942, HA, 109, No. 4

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UBV PHOTOELECTRIC TIMES OF MINIMA OF THE ECLIPSING VARIABLE TV CASSIOPEIAE

F. FAGHIHI[1,2], N. RIAZI[1,3], A. DARIUSH[1]

[1] Biruni Obs., Shiraz University 71454, Shiraz, Iran, e-mail: faghihi@phys11.susc.ac.ir

[2] The Islamic Azad University of Firoozabad, Firoozabad, Iran

[3] Physics Dept., Shiraz University 71454, Shiraz, Iran

TV Cas is a short period semi-detached eclipsing binary that consists of a nearly spherical, more massive B9V star, and a larger, cooler and tidally distorted G5 IV-III component whose surface is in contact with its Roche lobe. The orbital period of TV Cas is 1.812596 days (de Landtsheer, 1983). The orbital and physical properties of TV Cas have been determined by Khalesseh et al. (1992) from the analysis of its light and radial velocity curves.

TV Cas was observed by us during 1994 and 1995 observing seasons with the 51-cm Cassegrainian telescope of the Biruni Observatory (Latitude = 29°36′ N, Longitude = 52°31′48″ E). We used an unrefrigerated RCA4509 photomultiplier tube and the observations were made through UBV filters which are closely matched to the standard UBV system. The comparison and the check stars were BD +58°24 and BD +58°22, respectively the same as used by Grauer et al. (1977).

As is frequently the case for Algol systems, the observations show evidence from phase shifts of primary and secondary minima. Figure 1 shows the UBV light curves of TV Cas where the phases were computed using the light elements of Grauer et al. (1977). Also, the depths of the primary and secondary minima are given in Table 1.

The probable errors of the individual observation were estimated to be about $0\overset{m}{.}02$ in the B and V filters, and $0\overset{m}{.}03$ in the U filter. These precision estimate were made from an examination of the scatter in the outside eclipse portions of the light curves. Table 2 contains observed minimum times, cycle number, and the $O-C$ values of the primary minimum after recalculating the other available $O-C$s reports according to Grauer et al. ephemeris. Finally the $O-C$ curve is plotted in Figure 2.

Our times of mid-eclipses were determined by making least-square parabolic fits to the observations inside the eclipses. The minimum times are the mean values of three different filters; the $O-C$ residuals were calculated using the ephemeris

$$\text{Min. I} = \text{HJD } 2443043.6265 + 1\overset{d}{.}8126066 \times E$$

of Grauer et al. A new ephemeris, based on the recent timing, is

$$\text{Min. I} = \text{HJD } 2450049.3011 + 1\overset{d}{.}812593 \times E.$$

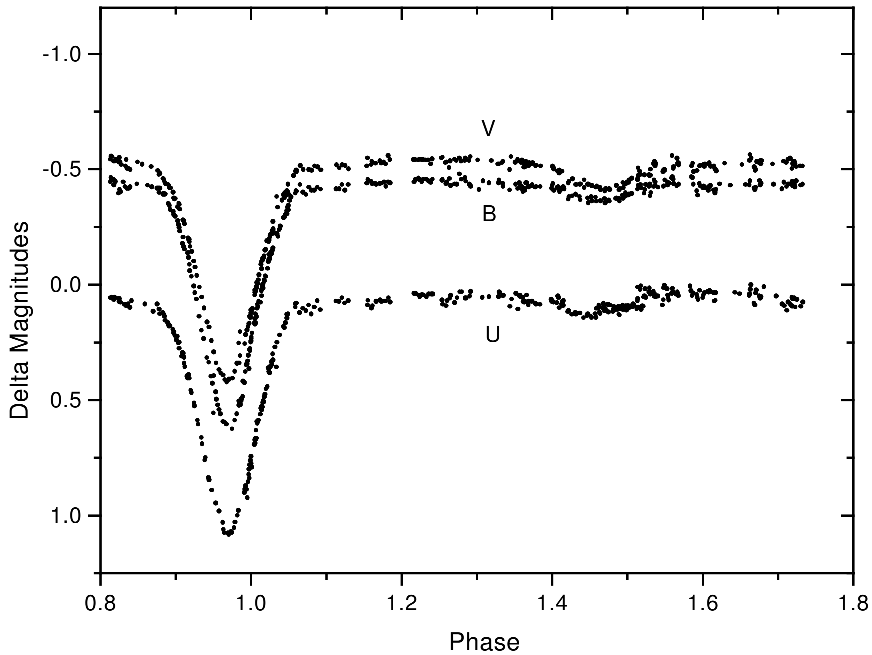

Figure 1.

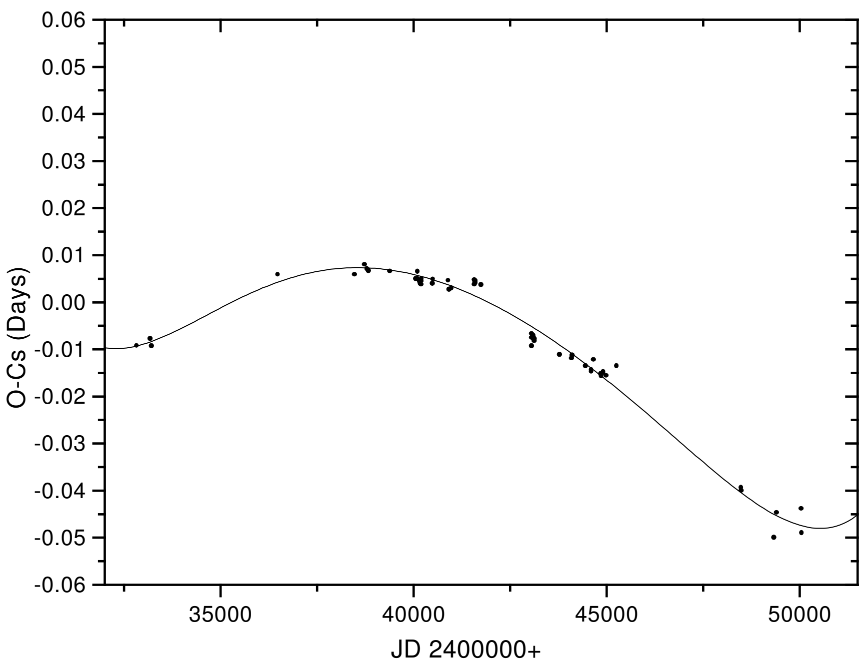

Figure 2.

Table 1: The depth of minima, according to the present study.

Filter	Min. I	Min. II
U	$1\overset{m}{.}08 \pm 0.02$	$0\overset{m}{.}13 \pm 0.02$
B	$1\overset{m}{.}04 \pm 0.01$	$0\overset{m}{.}10 \pm 0.01$
V	$1\overset{m}{.}04 \pm 0.01$	$0\overset{m}{.}19 \pm 0.01$

Table 2: The photoelectric times of primary minimum used in the $O-C$ curve.

Hel. JD 2400000+	E	$O-C$ (days)	Source
32827.7665	−5636	−0.0092	Huffer & Kopal (1951)
33184.8515	−5436	−0.0077	Huffer & Kopal (1951)
33213.8516	−5436	−0.0093	Huffer & Kopal (1951)
36483.8091	−3619	+0.0059	Chou (1959)
38472.2386	−2522	+0.0059	Lavrov (1966)
38733.2560	−2378	+0.0080	Bakos & Tremko (1973)
38791.2585	−2346	+0.0071	Lavrov (1966)
38829.3230	−2325	+0.0068	Lavrov (1966)
38840.1985	−2319	+0.0067	Lavrov (1966)
39389.4182	−2016	+0.0066	Bakos & Tremko (1973)
40056.4558	−1648	+0.0050	Frieboes-Conde & Herczeg (1973)
40105.3960	−1621	+0.0050	Frieboes-Conde & Herczeg (1973)
40105.3977	−1621	+0.0065	Frieboes-Conde & Herczeg (1973)
40154.3360	−1594	+0.0044	Bakos & Tremko (1973)
40183.3372	−1578	+0.0039	Bakos & Tremko (1973)
40194.2127	−1572	+0.0038	Bakos & Tremko (1973)
40201.4632	−1568	+0.0038	Bakos & Tremko (1973)
40203.2765	−1567	+0.0045	Bakos & Tremko (1973)
40203.2770	−1567	+0.0050	Frieboes-Conde & Herczeg (1973)
40493.2930	−1407	+0.0040	Frieboes-Conde & Herczeg (1973)
40502.3569	−1402	+0.0049	Frieboes-Conde & Herczeg (1973)
40899.3175	−1183	+0.0046	Frieboes-Conde & Herczeg (1973)
41575.4190	−810	+0.0038	Papousek (1974)
41595.3579	−799	+0.0041	Papousek (1974)
41595.3581	−799	+0.0043	Papousek (1974)
41595.3584	−799	+0.0046	Papousek (1974)
41604.4210	−794	+0.0041	Papousek (1974)
41604.4214	−794	+0.0045	Papousek (1974)
43063.3585	11	−0.0067	Grauer et al. (1977)
43063.5577	11	−0.0075	Grauer et al. (1977)
43063.5559	11	−0.0093	Grauer et al. (1977)
43090.7471	26	−0.0072	Grauer et al. (1977)
43090.7467	26	−0.0076	Grauer et al. (1977)
43130.6234	48	−0.0082	Grauer et al. (1977)
43130.6239	48	−0.0077	Grauer et al. (1977)
43130.6237	48	−0.0079	Grauer et al. (1977)

Table 2: (cont.)

Hel. JD 2400000+	E	$O-C$ (days)	Source
43786.7841	410	−0.0111	de Landtsheer (1981)
44094.9264	580	−0.0119	de Landtsheer (1981)
44114.8657	591	−0.0113	de Landtsheer (1981)
44453.8209	778	−0.0135	de Landtsheer (1981)
44602.4534	860	−0.0147	de Landtsheer (1981)
44602.4537	860	−0.0144	de Landtsheer (1982)
44662.2719	893	−0.0122	Borkovits & Hegedüs (1996)
44843.5296	993	−0.0152	de Landtsheer (1982)
44859.8426	1002	−0.0157	Margrave (1982)
44910.5965	1030	−0.0147	de Landtsheer (1982)
44912.4089	1031	−0.0150	de Landtsheer (1982)
44990.3503	1074	−0.0156	de Landtsheer (1982)
45256.8056	1221	−0.0135	Margrave (1983)
48481.4069	3000	−0.0394	Wolf & Diethelm (1992)
48490.4693	3005	−0.0400	Wolf & Diethelm (1992)
49333.3267	3470	−0.0500	Present study
49402.2066	3508	−0.0477	Present study
50040.2385	3860	−0.0438	Present study
50049.3011	3865	−0.0490	Present study

Grauer et al. conclude that an approximate 39 years periodicity exists in the $O-C$ curve of TV Cas. Our observations lend some support to this idea.

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THE PRECURSOR OF NOVA AQUILAE 1999 = V1493 Aql

D. MORO[1], U. MUNARI[1], T. TOMOV[1], A. HENDEN[2]

[1] Padova and Asiago Astronomical Observatories, I-36012 Asiago (VI), Italy

[2] Universities Space Research Association/U. S. Naval Observatory Flagstaff Station, P. O. Box 1149, Flagstaff AZ 86002-1149, USA

Nova Aql 1999 (V1493 Aql) was discovered in outburst by A. Tago (cf. IAU Circ No. 7223) on July 13.6, 1999. Detailed spectral observations by Tomov et al. (1999) for the days immediately following the maximum brightness set the expansion velocity of the nova at ~ 1700 km sec^{-1}; note the strong NaI D interstellar lines which suggest a large reddening and classify the nova among the *Fe II class* of Williams (1992).

A detailed photometric monitoring of the nova evolution has been provided by VSNET. It shows the nova reached a maximum brightness $V \sim 9$ mag and has had a complex decline over three months to $V \sim 15.5$ mag.

An important parameter for any nova is the identification of the precursor and consequently the measure of the outburst amplitude. An accurate position for the nova ($\alpha_{\rm J2000} = 19^{\rm h}7^{\rm m}36\overset{\rm s}{.}90$, $\delta_{\rm J2000} = +12^\circ 31' 26\overset{''}{.}6$) has been provided independently by N. James and G. Masi (cf. IAU Circ No. 7228). This corresponds to an empty position both in DSS-1 and DSS-2, with the closest stars at $4''$ and $8''$ distance, as shown in Figure 1. The corresponding Palomar plates were taken on May 25, 1952 and May 31, 1987 respectively. The 35 year time span is long enough to detect large proper motions of the field stars and to extrapolate their position to the year 1999. The matching of the two plates does not reveal for any nearby star a proper motion large enough to bring it to the position of the nova for the epoch 1999.

The precursor of Nova Aql 1999 must have been fainter than the plate limits for both DSS-1 and DSS-2, which set the amplitude of the outburst in the $\Delta m \geq 12$ mag range. However, the precursor may have become bright enough to show up on Schmidt patrol plates if it underwent the smaller amplitude outbursts that characterize dwarf novae (DN). A tight link between the binary system properties of DN and classical novae is widely accepted in literature and there are classical novae (for example GK Per = Nova Per 1901) that once back to quiescence conditions are showing DN outbursts (cf. Warner 1995). This note describes the results of our search for such DN outbursts of the precursor of Nova Aql over some decades before the 1999 eruption, by inspection of archive plates from the two Schmidt telescopes of the Padova and Asiago Astronomical Observatories.

The two Schmidt telescopes (40/50 and 67/92 cm) have collected more than 35,000 plates since 1955. In their plate archive we have found 40 plates covering the field of Nova Aql 1999. The basic parameters for the plates are summarized in Table 1. The limiting magnitude of the plates has been derived by comparison with a deep $UBVRI$ comparison sequence calibrated at USNOFS by one of us (AH) which will be published elsewhere.

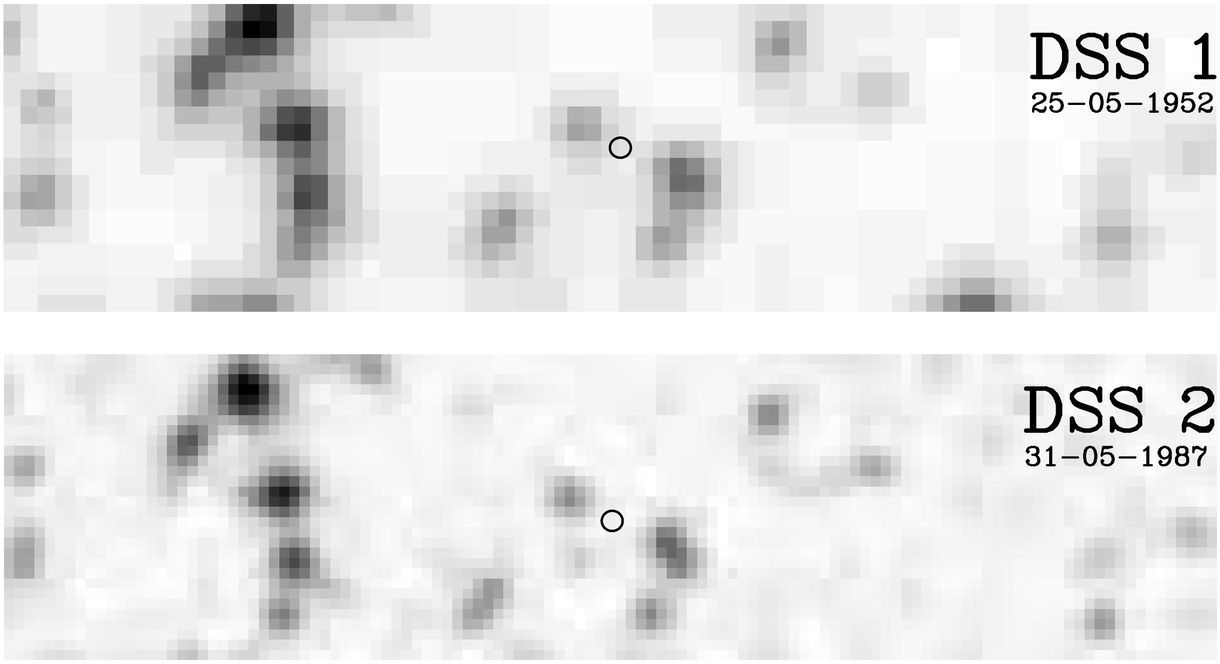

Figure 1. Comparison of the same 120 × 30 arcsec region around the position of Nova Aql 1999 (indicated by the empty circle in the center) from the Palomar DSS-1 and DSS-2.

The progenitor was too faint in quiescence to be recorded by the 1.2-m Palomar Schmidt, and so it has been for the smaller Asiago Schmidt telescopes. Also, no outburst of the progenitor of Nova Aql 1999 has been recorded on the Asiago plates, whose limiting magnitudes cluster around 17.5 mag as shown in Table 1.

There are two basic possibilities to account for the negative detection of DN outbursts for the progenitor of the Nova Aql 1999:

- the progenitor did not experience DN outbursts in the decades preceding its eruption as a classical nova;
- the progenitor indeed went through DN outbursts, but they have not been recorded on the patrol plates because:
    - they were of limited amplitude and the progenitor never became bright enough to be recorded on the plates, or
    - the DN outbursts of the progenitor were of normal amplitude but the progenitor itself is so faint in quiescence that even at outburst maximum it is still too faint to be recorded on the plates, or finally
    - the outbursts are normal but rare and took place when we were not observing.

With the data in hand it is not possible to distinguish among these different possibilities. However it seems fair at least to conclude that the nova progenitor did not have frequent outbursts of large amplitude.

We have already performed a similar investigation for the precursor of Nova Cas 1993 which was bright enough in quiescence to be easily recorded by the Asiago patrol plates (Munari et al. 1993). As in the current study of Nova Aql 1999, the search for DN outbursts in Nova Cas 1993 before its eruption as a classical nova gave negative results.

Table 1: Schmidt plates from the Asiago archive containing the field of Nova Aql 1999. The last column gives the limiting magnitude of the plate (in the band of the $UBVRI$ system closest to the emulsion+filter combination) estimated against a deep $UBVRI$ sequence (see text).

plate #	date	emulsion	filter	exp. t.	lim. mag
2666	14/03/1962	103a-O	–	10^m	18.0
2923	02/07/1962	103a-O	–	8^m	17.7
2943	07/07/1962	103a-O	–	8^m	17.9
2960	09/07/1962	103a-O	–	8^m	17.5
4145	16/10/1963	103a-O	–	12^m	17.9
4163	19/10/1963	103a-O	–	10^m	18.0
4223	07/11/1963	103a-O	–	10^m	17.5
4240	17/11/1963	103a-O	–	10^m	18.0
4956	05/11/1964	103a-O	GG 13	15^m	18.2
5585	23/10/1965	103a-O	GG 13	20^m	18.3
5938	16/07/1966	103a-O	–	15^m	18.0
6030	22/09/1966	103a-O	GG 13	10^m	16.9
6369	30/06/1967	103a-O	–	15^m	18.0
6381	04/07/1967	103a-O	GG 13	20^m	17.9
6436	24/11/1967	103a-O	–	15^m	18.0
6752	22/07/1968	Pan.Royal	GG 13	15^m	18.0
6775	24/08/1968	103a-O	GG 13	10^m	18.1
6807	24/09/1968	103a-O	GG 13	15^m	17.9
6930	22/11/1968	103a-O	GG 13	15^m	17.5
7373	17/08/1969	Pan.Royal	GG 14	20^m	16.4
7408	11/09/1968	Pan.Royal	GG 14	20^m	15.7
7409	11/09/1969	103a-O	GG 13	6^m	17.5
7557	29/10/1969	103a-O	GG 13	15^m	17.9
7562	01/11/1969	Pan.Royal	GG 14	20^m	16.2
7619	28/11/1969	103a-O	GG 13	14^m	17.7
8125	05/07/1970	Tri-X	GG 14	20^m	16.4
8162	09/09/1970	103a-O	GG 13	15^m	17.5
8314	26/10/1970	Tri-X	GG 14	15^m	17.9
8315	26/10/1970	103a-O	GG 13	10^m	17.9
8741	30/03/1971	103a-O	GG 13	10^m	15.8
8969	29/08/1971	Tri-X	GG 14	15^m	15.7
9128	20/10/1071	Tri-X	GG 14	20^m	16.7
A 1611	13/09/1974	103a-O	GG 13	8^m	18.0
9519	05/06/1978	103a-D	OG 2	30^m	17.5
9520	05/06/1978	103a-E	RG 1	30^m	17.9
13998	19/06/1979	Tri-X	GG 14	15^m	16.4
13999	19/06/1979	103a-O	GG 13	5^m	17.5
14637	29/06/1981	103a-O	GG 13	8^m	17.5
14658	03/08/1981	103a-O	GG 13	10^m	17.5
14877	20/07/1982	Tri-X	–	15^m	17.5

Our understanding of the physics of the eruptions of classical novae would undoubtedly benefit from a broader knowledge of the photometric behaviour of their progenitor in quiescence. For example the detection, frequency and brightness of DN outbursts may be used to estimate the mass-transfer rate onto the accreting white dwarf prior to the nova eruption (cf. Cannizzo 1993).

The Schmidt telescopes in use around the world generally have sufficiently faint limiting magnitudes to be of interest in the study of nova progenitors, as we have shown for Nova Cas 1993 and Nova Aql 1999, and such investigations on the largest possible set of novae should be encouraged.

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CCD OBSERVATION OF THE 1999 FADING OF LQ Peg

T. KATO, M. UEMURA

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan,
e-mail: tkato@kusastro.kyoto-u.ac.jp, uemura@kusastro.kyoto-u.ac.jp

LQ Peg (= PG 2133+115) was discovered as a UV-excess object, which was subsequently confirmed as a cataclysmic variable (Green et al. 1982, 1986; Ferguson et al. 1984). A spectroscopic period of 2.9 hr was suggested by Ringwald (1993). Little had been known about its light variability until the discovery of a dramatic fading recorded on photographs taken in 1969 (Sokolov et al. 1996). Although the object can be a potential candidate for the shortest period VY Scl-type star, the lack of the corresponding GCVS type has partly made LQ Peg overlooked even after receiving the variable star designation (Kazarovets and Samus 1997).

The second historical fading of LQ Peg was detected by Watanabe (1999). The object was seen fainter than 14.6 on 1999 July 9.716 UT. Upon this alert, we started CCD photometry to follow the fading episode.

The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java^{TM}-based PSF photometry package developed by one of the authors (TK)#. The relative magnitudes of the variable were measured against GSC 1128.64 (R_C-magnitude 13.03, Henden and Honeycutt 1997), whose constancy was confirmed by comparison with GSC 1128.678 (USNO r-magnitude 14.0).

The resultant light curve is shown in Figure 1. Each point represents a nightly averaged magnitude, with an error bar indicating the standard error. There was a slow brightening trend after the apparent minimum on August 24 (JD 2451415). The faintest observed magnitude corresponds to 16.32, which is slightly brighter than the 1969 minimum (Sokolov et al. 1996). Then the brightness of the object rose linearly with a rate of 0.036 mag d^{-1} until September 23 (JD 2451445). The rising became slower thereafter. The general pattern and time-scale of the recovery from minimum closely resemble those observed in 1969 (Sokolov et al. 1996), and are consistent with the general characteristics of VY Scl-type novalike variables. The object has been sparsely monitored by the VSOLJ (Variable Star Observers Leagues in Japan) since 1997 without other noticeable fadings. Together with photographic and photoelectric observations by Sokolov et al. (1996), this object seems to spend most of the time in bright states, with relatively short excursions to faint states.

This work is partly supported by the Grant-in-Aid for Scientific Research (10740095) of the Japanese Ministry of Education, Science, Culture.

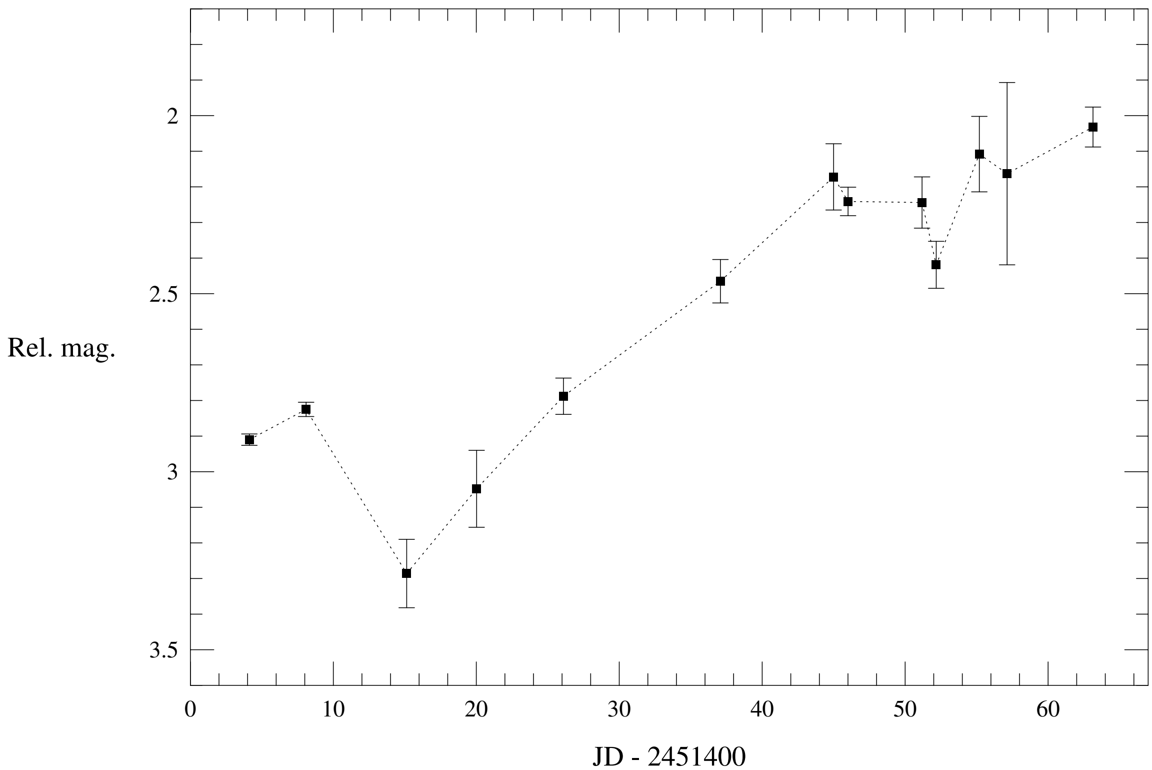

Figure 1. Light curve of LQ Peg

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CCD OBSERVATION OF THE 1999 SEPTEMBER OUTBURST OF TY Vul

T. KATO, M. UEMURA

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan,
e-mail: tkato@kusastro.kyoto-u.ac.jp, uemura@kusastro.kyoto-u.ac.jp

TY Vul is a rather obscure dwarf nova. Downes et al. (1997) presented an identification based on the chart by Meinunger (1980). This identification suggests a very faint quiescent counterpart. Bond (1978) reported the spectral type of F8:, which apparently refers to the close companion described below.

Schmeer (1999a,b) reported the apparently first-ever outburst since the study by Meinunger (1980). The reported maximum magnitude was $V = 14.6$ on 1999 September 1. We started time-resolved CCD photometry upon this alert. The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\mathrm{TM}}$-based PSF photometry package developed by one of the authors (TK). The relative fluxes of the variable were measured against GSC 2174.1749 (USNO r-magnitude 11.9), whose constancy was confirmed by comparison with GSC 2174.319 (USNO r-magnitude 12.5). The astrometry of the outbursting object based on GSC 1.1 gave $20^{\mathrm{h}}41^{\mathrm{m}}43\overset{\mathrm{s}}{.}89$, $+25°35'08\overset{''}{.}6$ (J2000.0), which agrees with the cataloged position of USNO 1125.16991372 ($20^{\mathrm{h}}41^{\mathrm{m}}43\overset{\mathrm{s}}{.}82$, $+25°35'08\overset{''}{.}9$, J2000.0). However, Schmeer (private communication) pointed out that TY Vul and USNO 1125.16991372 make a close pair on his CCD image. The astrometric coincidence in our measurement may have partly been caused by the distortion of the GSC 1.1 astrometric grid of this region.

TY Vul and the companion being unresolved on our CCD images, our measurements give the combined light of the two stars. Table 1 and Figure 1 show the nightly averaged fluxes.

TY Vul rapidly faded on the night of 1999 September 2 (JD 2451424), and the combined flux was virtually constant after September 4 (JD 2451426). We determined the averaged flux, as representing the flux of the companion, between the September 5 and 12 observations and subtracted it from the outburst observations. The rate of decline determined from the first two nights' observations was 1.1 mag d^{-1}.

Figure 2 shows the enlarged light curve (combined light) on 1999 September 2. A general decline consistent with the above rate was observed during the run, but no apparent light modulation was detected.

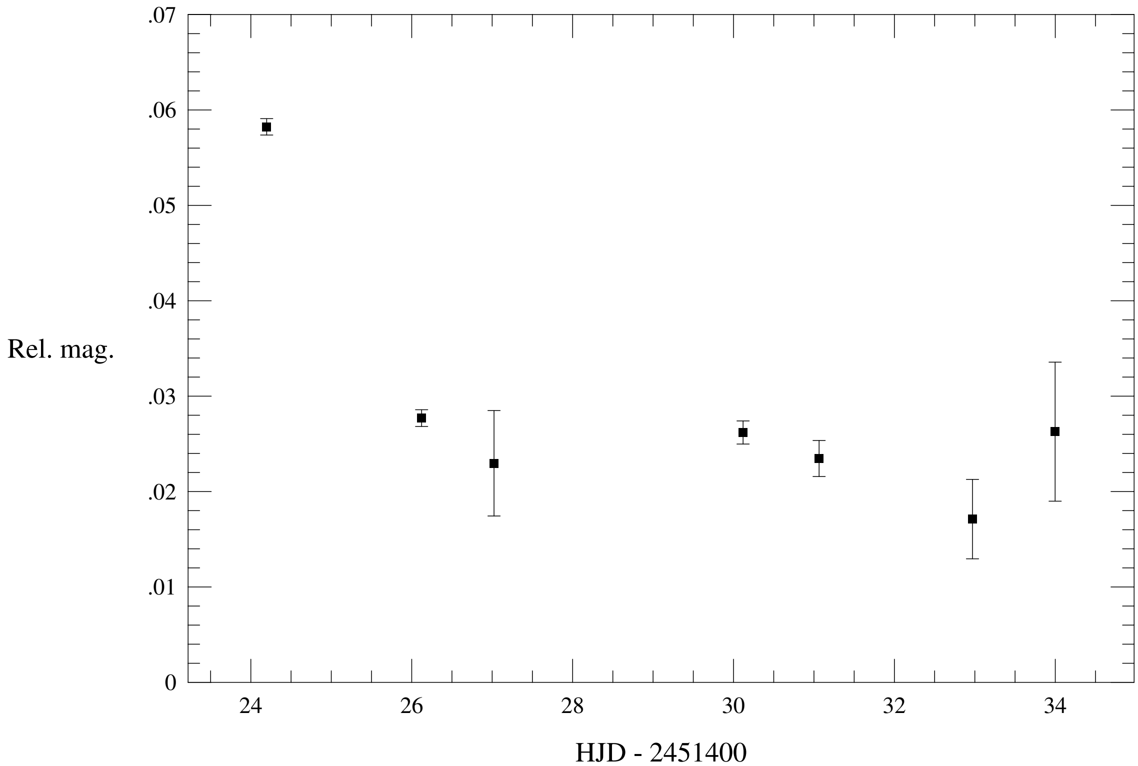

Figure 1. Light curve of TY Vul

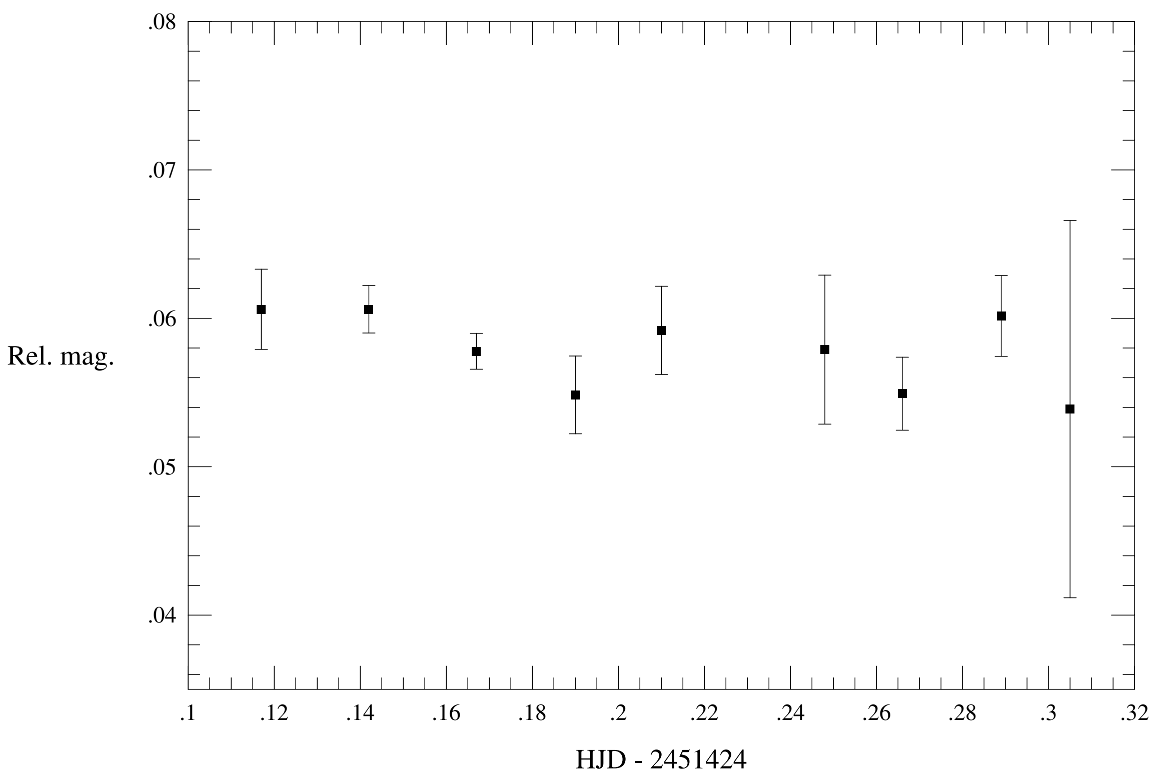

Figure 2. Light curve of TY Vul on 1999 September 2

Table 1: Nightly averaged fluxes of TY Vul

JD start[a]	JD end[a]	mean flux[b]	error[c]	N^d
51424.101	51424.302	0.0582	0.0009	351
51426.102	51426.138	0.0277	0.0009	50
51426.978	51427.038	0.0230	0.0055	48
51430.103	51430.126	0.0262	0.0012	60
51431.046	51431.090	0.0235	0.0019	61
51432.961	51432.974	0.0171	0.0042	32
51433.992	51433.996	0.0263	0.0073	10

[a] JD − 2400000
[b] Combined flux (TY Vul and companion) relative to GSC 2174.1749
[c] Standard error of nightly average
[d] Number of frames

The relatively large rate of decline, the lack of light modulation and the large outburst amplitude suggest the present outburst may be a normal outburst of an SU UMa-type dwarf nova.

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Bond, H. E., 1978, *PASP*, **90**, 526
Downes, R., Webbink, R. F, Shara, M. M., 1997, *PASP*, **109**, 345
Meinunger, I., 1980, *Veröff. Sternwarte Sonneberg*, **9**, 197
Schmeer, P., 1999a, *vsnet-alert circulation*, No. 3434, (http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-alert/msg03434.html).
Schmeer, P., 1999b, *vsnet-alert circulation*, No. 3435, (http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-alert/msg03435.html).

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PRECISE COORDINATES OF VARIABLE STARS (4)

T. KATO

Dept. of Astronomy, Faculty of Science, Kyoto University, Kyoto 606-8502 Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp

This report contains 133 accurate J2000.0 positions for variable stars discovered by Hoffmeister (1966). The variables stars were identified against computer plots of GSC and USNO A1.0 catalogs. The color information and IRAS PSC identification were also examined in identifying red variables. The source of identification in column 'Cat.': G = GSC 1.1, GM = average of GSC 1.1 multiple entries, U = USNO A1.0. The table has been sorted in the increasing order of J2000.0 right ascensions.

V650 Ori (S 9560): A suspected UG star. The coordinates given in Downes et al. (1997) do not agree well with the Hoffmeister's chart. The identification given here may be more likely (apart from the lack of corresponding description by Hoffmeister, and the relatively red color).

LN Aur (S 9582): Two positions are given. The first position refers to a red star near the position, whose magnitude agrees with Hoffmeister's description on the blue POSS plate. However, the second identification (LN Aur*) agrees better with Hoffmeister's finding chart, but has a rather blue color. More examination is needed.

Detailed information of identifications, other catalog identifications are available from the VSNET archive (vsnet 1135–1140,
http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01135.html etc.).

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References:

Downes, R., Webbink, R. F, Shara, M. M., 1997, *PASP*, **109**, 345
Hoffmeister, C., 1966, *Astron. Nach.*, **289**, 205

Table 1: Precise coordinates of variable stars

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
FH And	$00^h47^m38\overset{s}{.}11$	$+37^\circ49'55\overset{''}{.}2$	G	V344 Per	$04^h23^m32\overset{s}{.}59$	$+44^\circ41'17\overset{''}{.}7$	U
V414 Cas	00 48 09.99	+53 34 01.7	G	IQ Tau	04 29 51.57	+26 06 45.4	G
NS And	00 49 03.75	+35 13 10.8	GM	IR Tau	04 31 05.08	+20 40 05.8	U
V550 Cas	00 51 38.01	+58 48 50.4	G	IW Tau	04 41 04.68	+24 51 06.9	GM
V415 Cas	00 54 31.08	+59 24 00.0	U	V1368 Ori	05 21 13.36	+07 21 19.0	G
FI And	00 56 39.94	+37 15 48.2	G	V1015 Ori	05 28 54.21	+05 39 27.5	GM
VV Psc	01 01 44.84	+30 48 14.1	U	V364 Aur	05 30 27.48	+46 20 14.7	G
V416 Cas	01 01 59.20	+57 15 19.6	GM	V650 Ori	05 31 08.77	+09 45 27.6	U
V461 Cas	01 13 09.54	+59 51 09.4	GM	V367 Aur	05 38 13.62	+43 10 43.2	G
VW Psc	01 14 27.75	+32 41 40.0	GM	LM Aur	05 38 17.23	+47 00 12.0	G
V420 Cas	01 31 14.16	+58 47 28.6	U	V1021 Ori	05 38 41.72	+09 14 34.2	U
V480 Cas	01 47 51.54	+55 28 15.4	G	V369 Aur	05 42 31.13	+49 36 23.6	G
OZ Per	01 52 51.19	+52 11 10.2	G	V661 Ori	05 45 14.90	+07 21 22.3	G
V481 Cas	01 56 45.11	+59 18 43.7	G	V663 Ori	05 47 20.24	+10 11 54.1	U
RY Tri	02 01 10.79	+33 47 15.5	GM	V664 Ori	05 47 48.37	+07 33 20.6	G
RZ Tri	02 09 18.68	+33 49 08.1	GM	V1023 Ori	05 48 59.05	+08 35 19.3	U
SS Tri	02 10 26.33	+31 59 26.3	G	PY Aur	05 49 50.40	+41 39 52.6	U
PQ Per	02 18 58.05	+55 17 12.2	U	LN Aur*	05 51 29.16	+44 16 36.7	U
V363 Per	02 41 07.83	+55 12 59.8	U	LN Aur	05 51 29.18	+44 16 27.3	U
ST Tri	02 41 32.87	+35 43 30.6	GM	V371 Aur	05 52 20.21	+43 36 55.2	U
PT Per	02 42 51.21	+56 41 31.9	U	PZ Aur	05 53 21.77	+43 11 12.6	U
V483 Cas	02 45 41.05	+59 03 56.1	GM	V372 Aur	05 54 42.98	+41 52 12.5	GM
V449 Per	02 57 33.48	+35 14 00.8	G	LO Aur	05 57 23.90	+48 22 41.6	U
QR Per	03 00 48.56	+56 14 09.9	G	LQ Aur	06 00 10.81	+47 59 14.8	U
V452 Per	03 03 50.16	+42 12 59.2	G	LS Aur	06 07 47.02	+40 45 56.9	U
QZ Per	03 17 58.05	+37 34 17.9	U	V375 Aur	06 11 29.30	+42 19 24.8	G
V463 Per	03 28 14.94	+40 22 19.7	G	V376 Aur	06 12 01.77	+46 06 40.4	G
V338 Per	03 43 28.21	+32 01 59.1	U	LT Aur	06 13 14.00	+43 14 54.7	G
V341 Per	04 02 22.02	+32 54 30.1	U	LU Aur	06 13 25.03	+42 03 41.0	G
IL Tau	04 07 13.88	+29 18 32.9	G	QS Aur	06 14 22.68	+47 45 30.3	G
V394 Per	04 09 36.99	+33 29 37.3	GM	MX Aur	06 16 09.67	+44 11 26.9	G
V342 Per	04 09 42.29	+47 13 31.6	U	QT Aur	06 16 27.60	+39 53 23.8	G
V408 Tau	04 15 29.12	+26 07 34.0	GM	V378 Aur	06 20 33.32	+46 49 59.9	U
V343 Per	04 23 05.62	+50 14 48.4	U	V380 Aur	06 21 23.09	+41 13 13.1	G

Table 1: cont.

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V381 Aur	$06^h22^m13^s.88$	$+46°04'36''.2$	G	V1946 Cyg	$19^h19^m44^s.85$	$+49°23'08''.0$	G
LX Aur	06 28 02.25	+48 45 54.4	U	V1947 Cyg	19 21 06.39	+55 38 05.9	GM
V537 Mon	07 18 56.53	−07 06 30.1	U	V1948 Cyg	19 29 12.80	+50 06 16.7	U
HR Hya	08 35 01.80	+02 59 30.8	G	V1123 Cyg	19 29 34.63	+49 17 35.8	U
HT Hya	08 59 17.88	+01 47 39.3	G	V1949 Cyg	19 30 12.45	+50 48 20.6	G
IU Hya	09 06 17.78	+05 45 45.4	G	V1263 Cyg	19 31 56.11	+52 01 59.7	G
V546 Her	16 41 22.36	+12 25 10.7	G	V1950 Cyg	19 37 32.87	+50 43 00.9	G
V651 Her	16 45 02.14	+08 48 32.6	GM	V1952 Cyg	19 38 53.44	+48 12 44.6	GM
V2066 Oph	16 51 05.92	+10 20 51.7	G	V1953 Cyg	19 40 58.05	+50 52 01.6	G
V1056 Oph	16 59 23.93	+06 20 15.6	U	V1954 Cyg	19 49 20.02	+55 33 32.5	G
V1058 Oph	17 01 25.13	+07 22 49.3	U	GR Sge	20 20 30.29	+18 23 47.5	U
V1059 Oph	17 07 54.54	+08 04 15.8	U	GZ Del	20 22 24.55	+10 34 07.4	U
V1060 Oph	17 12 16.23	+07 41 24.9	U	HH Del	20 25 25.42	+17 54 24.7	G
V1061 Oph	17 14 30.00	+10 43 08.2	U	HV Del	20 33 19.51	+11 32 01.6	U
V674 Her	18 10 27.19	+39 52 15.0	U	HX Del	20 42 29.97	+17 27 07.9	GM
V676 Her	18 13 39.66	+37 28 38.8	G	HZ Del	20 47 31.78	+14 05 28.4	G
V462 Lyr	18 28 36.85	+38 03 21.8	G	II Del	20 50 01.18	+19 11 43.3	U
V469 Lyr	18 40 53.27	+36 38 47.4	U	IK Del	20 52 08.88	+15 43 47.4	U
V343 Lyr	18 44 30.76	+41 41 52.3	U	HT Del	20 54 39.55	+17 12 02.3	U
V348 Lyr	18 48 23.86	+45 02 15.0	U	LN Del	20 57 12.62	+16 54 04.0	G
V354 Lyr	18 52 50.33	+41 33 49.1	U	V1402 Cyg	21 56 14.50	+54 31 38.4	GM
CC Dra	18 53 03.33	+51 58 40.5	G	GO Lac	22 11 06.11	+47 37 15.8	U
V355 Lyr	18 53 25.89	+43 09 15.9	U	GQ Lac	22 17 56.63	+54 45 45.0	U
V356 Lyr	18 56 00.52	+39 29 17.0	G	HN Cep	22 25 22.53	+57 15 56.5	U
EG Dra	18 58 04.92	+54 08 57.3	G	GS Lac	22 26 20.15	+53 16 15.9	U
EH Dra	19 04 53.48	+52 39 24.5	G	HO Cep	22 34 21.88	+62 36 03.5	U
V363 Lyr	19 08 51.62	+43 00 31.9	U	GW Lac	22 45 41.78	+53 14 34.3	U
V365 Lyr	19 09 03.26	+45 17 27.8	U	GY Lac	22 47 46.19	+55 18 13.4	U
V1102 Cyg	19 10 37.07	+52 13 14.9	U	V425 Cas	23 03 46.63	+53 17 15.2	U
CH Dra	19 10 52.68	+56 31 02.7	U	V428 Cas	23 06 35.28	+56 22 59.1	U
V1943 Cyg	19 13 01.07	+49 53 17.4	G	V429 Cas	23 15 51.26	+54 35 41.1	U
V1944 Cyg	19 13 55.42	+51 20 19.4	GM	V437 Cas	23 33 50.06	+55 18 22.4	U
V1945 Cyg	19 15 01.55	+54 17 29.1	G				

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PRECISE COORDINATES OF VARIABLE STARS (5)

T. KATO

Dept. of Astronomy, Faculty of Science, Kyoto University, Kyoto 606-8502 Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp

This report contains 326 accurate J2000.0 positions for variable stars discovered by Hoffmeister (1967). The variables stars were identified against computer plots of GSC and USNO A1.0 catalogs. The color information and IRAS PSC identification were also examined in identifying red variables. The source of identification in column 'Cat.': G = GSC 1.1, GM = average of GSC 1.1 multiple entries, U = USNO A1.0, UM = average of USNO A1.0 multiple entries. The table has been sorted in the increasing order of J2000.0 right ascensions.

V1111 Oph (S 9911), V1227 Cyg (S 10084): doubtful identification, one of possible candidates.

HQ Sge (S 9964): double star. The south-eastern (bluer) component is selected.

KO Vul (S 10032): doubtful identification, one of candidates. Hoffmeister's description is slightly ambiguous.

V1421 Cyg (S 10033): the identity of S 10033 with V1421 Cyg is slightly unclear.

Detailed information of identifications, other catalog identifications are available from the VSNET archive (vsnet 1223–1233, 1248–1251, http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01223.html etc.).

The author is grateful to the USNO PMM team for making USNO A1.0 CD-ROMs available to the author. This work is partly supported by the Grant-in-Aid for Scientific Research (10740095) of the Japanese Ministry of Education, Science, Culture, and Sports.

Reference:

Hoffmeister, C., 1967, *Astron. Nach.*, **290**, 43

Table 1: Precise coordinates of variable stars

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
NSV 00016	$00^h05^m05^s.43$	$+59°39'01''.6$	U	CI Com	$12^h14^m11^s.27$	$+14°01'49''.2$	GM
NSV 00061	00 09 41.88	+63 30 22.7	U	DE Vir	12 15 59.30	+09 07 39.2	G
V633 Cas	00 11 25.97	+58 49 29.1	G	NSV 05617	12 26 08.69	+10 15 00.6	G
V408 Cas	00 13 14.51	+55 54 30.4	U	DH Vir	12 39 56.55	+06 04 44.9	G
V409 Cas	00 22 37.99	+57 26 37.6	G	DG Vir	12 39 59.57	+11 30 36.4	U
V410 Cas	00 23 27.64	+61 46 28.8	U	GN Vir	12 43 48.63	+10 36 07.5	G
NSV 00157	00 24 42.60	+63 50 08.9	GM	DI Vir	12 45 21.97	+08 45 30.9	U
V536 Cas	00 25 41.84	+56 42 51.1	U	NSV 07865	16 37 38.36	+08 37 21.3	GM
NSV 00167	00 27 34.07	+63 52 55.4	GM	V544 Her	16 38 05.38	+08 37 58.0	U
NSV 00169	00 28 15.60	+55 57 55.1	GM	NSV 07891	16 39 45.34	+09 16 37.3	G
NSV 00172	00 28 49.10	+62 28 36.3	GM	V547 Her	16 43 30.18	+07 50 47.3	GM
V411 Cas	00 30 11.27	+56 07 47.7	U	V549 Her	16 44 03.53	+12 11 38.4	U
V548 Cas	00 38 10.00	+62 53 45.7	U	V548 Her	16 44 06.51	+08 07 30.4	GM
NSV 00265	00 42 38.43	+56 54 04.5	G	V1057 Oph	17 01 06.77	+11 03 17.7	U
NSV 00267	00 43 36.26	+60 10 51.3	G	NSV 08286	17 11 56.55	+09 47 03.0	G
V447 Cas	00 43 43.81	+59 50 12.9	G	NSV 08436	17 16 00.00	+09 38 32.5	U
NZ Cas	00 43 48.41	+60 12 10.1	G	NSV 08503	17 18 43.56	+13 06 18.8	G
NSV 00309	00 49 40.20	+60 27 57.9	G	NSV 08550	17 20 50.61	+15 51 15.9	G
PU Per	02 42 16.16	+35 40 46.6	U	V550 Her	17 24 46.23	+16 42 26.3	U
PV Per	02 42 53.45	+38 04 03.4	U	V551 Her	17 27 46.73	+14 25 09.5	U
V399 Per	02 47 55.89	+36 22 40.2	G	V2074 Oph	17 28 12.49	+10 26 25.4	G
V448 Per	02 52 03.10	+38 28 45.6	G	V552 Her	17 30 11.84	+14 22 34.0	GM
PZ Per	02 52 25.83	+36 41 30.0	U	V553 Her	17 32 02.64	+16 47 51.1	G
V460 Per	03 22 31.31	+42 05 56.6	G	NSV 09195	17 34 59.09	+17 21 08.1	G
NSV 01497	04 11 42.34	+26 27 17.8	G	V554 Her	17 35 52.46	+16 03 10.0	U
IP Tau	04 24 57.06	+27 11 57.0	GM	V622 Her	17 38 36.46	+15 56 15.0	G
V651 Ori	05 32 46.46	+05 24 58.3	G	NSV 09500	17 40 30.40	+01 56 26.5	G
V365 Aur	05 36 06.97	+48 56 51.5	U	V1066 Oph	17 41 10.37	+00 40 51.0	U
LL Aur	05 36 08.49	+47 25 32.1	U	V1068 Oph	17 41 11.09	+12 25 41.0	G
V366 Aur	05 36 17.23	+48 59 29.7	U	V623 Her	17 43 15.84	+16 45 52.3	G
V660 Ori	05 38 29.26	+15 16 44.0	GM	NSV 09639	17 45 18.48	+17 15 32.7	G
PX Aur	05 43 27.79	+42 22 42.6	U	V557 Her	17 45 49.02	+15 07 18.2	G
V632 Ori	05 44 44.65	+09 23 18.5	U	V1072 Oph	17 46 07.64	+08 49 26.6	U
V662 Ori	05 45 46.44	+11 40 54.0	U	NSV 09696	17 47 31.57	+16 49 49.8	G
V665 Ori	05 51 07.91	+12 13 49.4	U	V558 Her	17 48 36.66	+14 36 56.0	U
V666 Ori	05 54 06.51	+17 56 18.3	U	NSV 09727	17 49 10.61	+08 44 58.9	G
LP Aur	05 57 25.46	+41 39 12.9	G	V1074 Oph	17 50 02.63	+12 35 35.1	U
V374 Aur	06 09 52.40	+44 30 55.2	U	V2077 Oph	17 50 07.92	+05 12 25.9	U
NSV 02848	06 09 54.80	+22 57 37.0	G	V1076 Oph	17 51 02.09	+06 27 39.3	U
OO Gem	06 11 47.91	+22 10 21.3	G	NSV 09781	17 51 48.95	+02 07 43.9	GM
V377 Aur	06 13 49.54	+44 17 03.5	G	NSV 09793	17 52 11.82	+04 54 38.8	G
LV Aur	06 18 08.37	+48 01 20.4	G	V562 Her	17 53 16.03	+16 17 02.3	U
V671 Ori	06 18 39.73	+21 02 35.1	U	V1079 Oph	17 54 03.48	+03 19 59.3	U
V672 Ori	06 19 52.65	+19 24 54.1	U	V2029 Oph	17 54 37.46	+06 13 50.3	U
V379 Aur	06 21 30.20	+41 51 01.0	U	NSV 09905	17 57 42.66	+02 31 19.5	G
LW Aur	06 25 22.23	+44 07 01.5	GM	V2082 Oph	17 57 59.54	+05 52 17.5	U
OP Gem	06 27 50.47	+17 00 29.8	G	NSV 09966	18 00 09.81	+01 44 40.4	G
KK Gem	06 30 47.37	+18 32 40.8	G	NSV 09995	18 01 24.02	+00 00 06.5	G
OQ Gem	06 38 39.20	+19 53 39.2	U	EP Ser	18 01 24.49	−00 00 50.8	U
KO Gem	06 42 00.66	+24 23 56.4	U	V1087 Oph	18 03 36.35	+03 04 18.6	U
OR Gem	06 44 47.55	+21 26 38.9	G	V2084 Oph	18 03 53.98	+02 37 24.1	U
KT Gem	06 45 21.20	+19 04 47.5	U	NSV 10129	18 03 54.80	+07 34 28.7	G
NSV 03212	06 47 59.96	+19 18 35.6	G	NSV 10202	18 06 05.39	+06 47 22.7	G
NSV 03882	08 03 18.19	−25 30 05.1	G	V1090 Oph	18 06 48.76	+07 53 34.3	U
NSV 03940	08 11 44.60	−24 44 37.2	GM	V1089 Oph	18 06 50.47	+04 01 53.6	GM

Table 1: cont.

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
NSV 10232	$18^h07^m31\overset{s}{.}53$	$+04°15'32\overset{''}{.}2$	G	V1149 Aql	$19^h41^m59\overset{s}{.}04$	$+14°12'07\overset{''}{.}1$	G
V1093 Oph	18 08 33.42	+00 10 02.2	U	V1281 Aql	19 43 19.21	−00 21 33.0	G
V1094 Oph	18 08 38.44	+00 08 55.2	G	V1155 Aql	19 44 49.87	+05 20 13.7	U
V673 Her	18 10 43.26	+33 18 06.1	U	V1156 Aql	19 45 05.18	+02 33 45.4	U
V675 Her	18 11 03.30	+36 29 16.0	U	V1157 Aql	19 46 10.33	+07 25 03.1	U
V668 Her	18 11 27.33	+32 57 57.1	U	FU Sge	19 46 14.78	+16 54 45.6	U
V1095 Oph	18 11 29.28	+05 48 10.2	U	FV Sge	19 46 35.02	+16 57 08.4	G
NSV 10387	18 13 15.12	+03 46 02.5	GM	V1158 Aql	19 47 47.42	−03 36 05.8	U
V1096 Oph	18 13 28.21	+03 58 57.4	U	V1322 Aql	19 47 59.30	+02 19 10.8	U
NSV 10426	18 14 46.91	−00 15 04.4	U	NSV 12424	19 48 55.62	−02 51 19.1	GM
AZ Ser	18 14 50.93	−00 13 16.7	G	V1159 Aql	19 49 25.73	+02 31 30.3	U
V335 Lyr	18 15 49.12	+35 27 49.6	G	V1160 Aql	19 49 59.57	+03 09 08.2	G
V1097 Oph	18 16 28.82	+02 36 01.7	G	NSV 12453	19 50 25.68	+03 26 00.5	G
V1098 Oph	18 16 40.08	+05 04 10.7	U	NSV 12461	19 50 34.00	+00 54 38.0	GM
V1101 Oph	18 17 37.36	+04 38 10.5	U	V1323 Aql	19 50 50.40	+01 32 45.9	U
V1102 Oph	18 17 41.70	+05 31 10.7	U	NSV 12468	19 51 05.93	−03 14 14.3	G
NSV 10539	18 18 18.30	−00 06 54.9	GM	NSV 12471	19 51 18.68	+00 25 50.1	GM
V466 Lyr	18 18 46.92	+32 04 05.8	G	FW Sge	19 51 41.17	+18 04 48.0	U
V1103 Oph	18 22 27.13	+11 12 46.3	U	HO Sge	19 51 58.67	+18 14 24.8	U
V1104 Oph	18 24 01.02	+07 23 08.9	U	KL Vul	19 53 25.56	+22 34 25.4	U
V2039 Oph	18 27 02.97	+07 20 21.9	U	V1163 Aql	19 53 48.65	−02 57 57.6	U
V336 Lyr	18 27 47.37	+33 02 24.2	UM	FX Sge	19 54 20.29	+18 46 39.3	U
V578 Her	18 28 39.02	+12 54 43.2	U	KM Vul	19 54 25.68	+21 13 52.8	G
V1105 Oph	18 29 13.70	+11 14 28.8	U	HP Sge	19 54 29.94	+18 25 57.2	U
V1106 Oph	18 30 23.37	+07 48 16.2	U	V1164 Aql	19 54 39.18	−01 43 27.3	G
EY Ser	18 30 49.81	+05 30 17.8	U	HQ Sge	19 55 00.76	+18 47 10.2	U
V1107 Oph	18 31 44.34	+07 53 15.2	U	V1166 Aql	19 55 53.35	+02 32 40.4	U
V1108 Oph	18 32 15.82	+06 43 21.1	U	FY Sge	19 56 11.03	+16 27 17.5	U
V2092 Oph	18 35 49.18	+10 11 24.1	U	V1170 Cyg	19 57 01.41	+30 43 48.0	U
V1110 Oph	18 36 03.00	+07 27 01.3	U	FZ Sge	19 57 14.35	+20 16 38.6	U
V2093 Oph	18 37 02.10	+07 20 02.8	U	KO Vul	19 57 15.66	+29 05 59.8	U
V1111 Oph	18 37 19.57	+10 25 33.1	U	V1167 Aql	19 57 28.60	+00 29 14.8	U
V579 Her	18 37 36.93	+13 09 55.4	U	GG Sge	19 59 54.32	+20 21 34.3	U
V1113 Oph	18 39 16.87	+08 39 42.5	U	V1169 Aql	20 00 08.96	−02 13 28.7	U
V465 Lyr	18 40 14.00	+35 49 26.2	G	NSV 12681	20 00 56.92	−02 48 51.4	GM
V1114 Oph	18 40 47.70	+08 49 19.9	U	V1170 Aql	20 01 11.94	+03 31 29.9	U
V1115 Oph	18 40 56.32	+09 46 56.0	U	V1171 Aql	20 01 24.04	+04 24 44.5	U
V2043 Oph	18 42 15.98	+10 33 58.5	U	V899 Aql	20 01 29.41	+04 25 36.3	G
V1116 Oph	18 42 17.13	+07 34 07.3	U	V1421 Cyg	20 01 48.08	+33 28 47.2	GM
V341 Lyr	18 42 54.85	+38 45 15.8	U	V1172 Aql	20 02 23.00	−00 32 08.9	U
V1117 Oph	18 43 15.37	+07 06 57.3	U	V1027 Cyg	20 02 27.37	+30 04 25.6	G
V1118 Oph	18 44 17.58	+11 18 17.7	U	GH Sge	20 02 56.80	+21 33 07.6	G
V2044 Oph	18 45 07.39	+09 02 43.5	GM	V1173 Aql	20 03 31.59	+02 14 19.5	U
NSV 11444	18 52 09.60	+09 37 42.6	U	V1174 Cyg	20 03 56.00	+31 15 40.3	G
V581 Her	18 53 13.75	+12 26 59.7	G	GI Sge	20 04 19.61	+20 46 34.1	U
V1121 Aql	19 19 12.71	+00 47 14.1	U	V1174 Aql	20 05 07.19	−04 24 27.7	G
V1123 Aql	19 19 52.38	+06 53 56.1	U	NSV 12769	20 05 08.43	−02 18 42.9	GM
NSV 11959	19 22 56.98	+01 30 46.9	GM	NSV 12770	20 05 17.59	−04 22 49.1	U
NSV 12039	19 27 19.45	+08 20 52.2	G	GK Sge	20 05 35.01	+16 49 29.4	U
V1237 Aql	19 28 46.86	+07 24 54.5	G	V1175 Aql	20 05 54.77	+02 17 15.9	U
V1251 Aql	19 32 13.04	+05 36 53.8	GM	V1364 Cyg	20 07 29.48	+35 20 46.8	G
V1255 Aql	19 33 39.00	+04 51 02.2	G	NSV 12811	20 07 43.89	−01 36 10.4	G
V1143 Aql	19 38 00.83	+13 50 35.7	U	GM Sge	20 07 46.81	+19 23 05.1	U
V1279 Aql	19 40 47.58	+02 29 28.7	GM	V1176 Aql	20 07 54.97	+03 00 56.6	U
V1148 Aql	19 41 41.10	+12 19 26.2	U	NSV 12826	20 08 39.05	+01 53 44.5	U

Table 1: cont.

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
NSV 12839	$20^h08^m47^s.97$	$+33°07'12''.5$	U	V1219 Cyg	$20^h54^m07^s.41$	$+41°34'57''.7$	U
V1423 Cyg	20 09 15.15	+35 12 39.3	G	V1542 Cyg	20 59 23.25	+47 44 42.8	G
NSV 12853	20 10 27.86	−02 09 25.2	GM	V1220 Cyg	21 00 07.63	+47 48 40.5	U
NSV 12870	20 10 46.25	+33 48 05.0	G	V1221 Cyg	21 01 02.84	+39 32 49.0	U
NSV 12886	20 11 42.63	+21 51 07.2	G	NSV 13506	21 04 05.86	+39 32 59.7	GM
V1177 Aql	20 11 46.37	−03 19 20.0	U	V1224 Cyg	21 04 40.30	+44 57 18.0	U
KQ Vul	20 12 00.05	+22 23 59.0	U	NSV 13520	21 05 07.62	+45 33 46.2	U
NSV 12889	20 12 00.12	+19 34 50.8	G	V1227 Cyg	21 08 26.81	+45 49 00.0	U
NSV 12893	20 12 38.05	+04 19 17.6	GM	V1231 Cyg	21 09 47.55	+46 16 08.4	U
NSV 12925	20 13 46.66	+28 22 13.5	GM	V1232 Cyg	21 11 23.81	+44 13 19.9	U
NSV 12928	20 13 56.24	+35 19 41.6	G	NSV 13599	21 12 27.37	+45 08 13.0	U
NSV 12936	20 14 19.96	+28 32 29.7	G	V1234 Cyg	21 12 49.50	+41 23 28.6	U
NSV 12950	20 15 41.68	+04 04 18.9	GM	NSV 13636	21 16 54.18	+41 33 56.3	U
GP Sge	20 15 49.40	+21 07 57.5	G	V1337 Cyg	21 24 28.39	+42 37 34.7	U
KS Vul	20 17 10.85	+24 21 07.1	U	V1242 Cyg	21 24 48.66	+45 00 55.0	U
GQ Sge	20 17 16.02	+16 21 47.6	GM	V1243 Cyg	21 25 43.95	+45 32 32.8	U
KT Vul	20 17 37.05	+26 33 43.8	U	NSV 14308	22 45 44.64	+50 46 34.8	U
V1178 Aql	20 18 10.85	−00 51 19.8	G	NSV 14341	22 52 32.55	+51 13 50.2	G
V1284 Aql	20 18 38.02	+02 16 16.5	GM	NSV 14357	22 54 13.99	+56 52 38.1	U
NSV 12988	20 18 59.49	+01 09 15.5	GM	NSV 14359	22 54 31.26	+57 25 59.4	G
NSV 12996	20 19 01.97	+13 21 14.0	U	HH Lac	22 56 32.05	+55 02 42.9	U
V1179 Aql	20 19 23.59	−01 21 02.6	U	GZ Lac	22 56 39.23	+53 48 26.7	U
KU Vul	20 19 37.93	+23 33 02.8	U	HI Lac	22 56 48.65	+53 47 47.7	U
KV Vul	20 20 15.90	+25 45 24.7	U	V356 Lac	22 56 51.40	+53 33 12.2	U
KW Vul	20 21 05.55	+27 59 58.6	U	V702 Cas	23 00 37.41	+54 39 42.3	U
KX Vul	20 22 58.85	+27 26 53.5	U	NSV 14393	23 01 50.43	+50 53 10.7	GM
V1180 Aql	20 24 18.18	+02 12 52.4	G	NSV 14414	23 03 53.22	+55 34 56.8	G
V1194 Cyg	20 24 31.69	+29 43 05.1	U	V426 Cas	23 05 47.74	+56 56 41.5	U
NSV 13070	20 24 50.08	+28 01 16.2	G	V430 Cas	23 15 39.04	+56 13 42.1	U
NSV 13078	20 25 35.33	+28 33 18.0	U	V431 Cas	23 19 21.99	+54 26 26.9	U
HI Del	20 25 57.67	+17 56 43.0	U	V484 Cas	23 21 14.66	+56 43 03.2	U
KY Vul	20 26 39.17	+28 45 20.4	U	NSV 14525	23 21 55.46	+48 57 46.1	U
KW Del	20 27 43.05	+19 16 50.0	G	FY And	23 23 28.65	+50 15 57.9	U
HL Del	20 29 21.91	+18 09 25.8	U	FZ And	23 25 34.99	+53 07 50.6	U
HK Del	20 29 22.19	+13 11 11.6	U	V564 Cas	23 27 07.63	+52 53 09.6	U
KZ Vul	20 30 06.55	+29 14 20.2	U	V434 Cas	23 28 55.46	+55 21 46.9	U
V1517 Cyg	20 30 54.95	+32 31 19.5	U	V435 Cas	23 31 23.39	+59 25 16.3	U
NSV 13132	20 32 11.94	+31 45 31.8	G	V438 Cas	23 36 00.10	+62 03 12.3	U
NSV 13134	20 32 21.04	+30 40 33.3	G	NSV 14645	23 37 38.63	+53 07 17.0	G
HN Del	20 33 45.14	+11 03 41.2	U	V440 Cas	23 38 04.82	+51 25 54.3	U
NSV 13157	20 34 39.89	+27 40 06.6	GM	V531 Cas	23 38 23.80	+61 54 20.9	G
NSV 13172	20 35 51.85	+32 57 14.0	G	V441 Cas	23 39 58.92	+63 20 55.1	GM
HO Del	20 36 55.49	+14 03 09.5	U	NSV 14662	23 40 28.29	+50 33 00.3	U
V1201 Cyg	20 38 58.62	+45 05 33.0	U	V443 Cas	23 41 37.88	+51 32 35.0	U
NSV 13231	20 41 04.91	+33 34 22.2	GM	V520 Cas	23 42 07.35	+55 54 37.8	G
HQ Del	20 41 26.38	+18 59 37.1	U	NSV 14688	23 44 16.08	+53 46 08.5	U
V1975 Cyg	20 43 50.48	+34 28 48.9	G	NSV 14710	23 48 30.56	+61 09 46.4	G
KY Del	20 43 57.83	+17 56 45.7	GM	NSV 14725	23 50 40.24	+60 28 54.4	GM
V1204 Cyg	20 44 10.83	+46 49 03.5	U	NSV 14732	23 52 11.06	+64 00 56.0	GM
KZ Del	20 44 38.94	+15 18 47.4	G	NSV 14734	23 52 15.82	+54 38 44.7	GM
LL Del	20 45 18.43	+15 15 57.9	G	NSV 14740	23 53 10.08	+59 37 47.3	GM
V1662 Cyg	20 51 00.85	+43 08 23.9	GM	V444 Cas	23 54 05.17	+56 56 11.2	U
HS Del	20 53 24.308	+17 10 23.2	U	NSV 14778	23 57 45.76	+56 06 20.2	G

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

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PRECISE COORDINATES OF VARIABLE STARS (6)

T. KATO

Dept. of Astronomy, Faculty of Science, Kyoto University, Kyoto 606-8502 Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp

This report contains 214 accurate J2000.0 positions for variable stars discovered by Hoffmeister (1968). The variables stars were identified against computer plots of GSC and USNO A1.0 catalogs. The color information and IRAS PSC identification were also examined in identifying red variables. The source of identification in column 'Cat.': G = GSC 1.1, GM = average of GSC 1.1 multiple entries, U = USNO A1.0, UM = average of USNO A1.0 multiple entries. The table has been sorted in the increasing order of J2000.0 right ascensions.

V567 Mon (S 10246), MT Pup (S 10269), V2030 Oph (S 10353), GU Sge (S 10369): Hoffmeister's chart is distorted. Possible candidate is given.

V610 Her and V611 Her (S 10311 and S 10312): original charts were interchanged. Downes et al.'s (1997) position for V610 Her is slightly different from that of the possible USNO counterpart given in the table.

Detailed information of identifications, other catalog identifications are available from the VSNET archive (vsnet 1252–1254, 1256–1259, http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01252.html etc.).

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References:

Downes, R., Webbink, R. F, Shara, M. M., 1997, *PASP*, **109**, 345
Hoffmeister, C., 1968, *Astron. Nach.*, **290**, 277

Table 1: Precise coordinates of variable stars

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V372 Per	$02^h56^m39^s.66$	$+37°08'23''.5$	U	V913 Ori	$05^h55^m15^s.60$	$+15°09'32''.2$	UM
V432 Per	03 10 10.81	+42 52 09.0	G	MT Aur	05 57 26.94	+30 42 05.4	U
V373 Per	03 14 44.01	+42 22 52.1	G	MU Aur	05 57 45.39	+29 35 08.3	U
NSV 01226	03 41 26.70	+30 04 09.0	G	MV Aur	05 58 12.38	+30 29 19.4	G
OV Tau	03 46 06.26	+29 41 14.7	U	V914 Ori	06 00 19.14	+15 45 30.5	G
V377 Per	03 51 24.24	+36 15 28.5	G	V915 Ori	06 01 13.91	+16 33 24.3	G
NSV 01383	03 51 52.48	+30 25 24.9	G	LO Gem	06 04 11.69	+25 19 59.7	G
V379 Per	03 57 57.43	+31 22 36.9	G	LP Gem	06 05 05.12	+26 40 52.7	G
NSV 01473	04 08 48.01	+31 30 53.5	G	V538 Mon	06 24 16.04	+05 36 32.6	U
V381 Per	04 10 30.73	+32 56 17.4	U	V548 Mon	06 31 57.87	+05 16 12.0	U
NSV 01531	04 15 40.66	+35 31 58.6	G	LV Gem	06 33 54.08	+15 55 06.9	G
V674 Ori	05 17 13.44	+12 32 18.8	U	LW Gem	06 34 46.65	+12 58 37.6	U
NSV 01963	05 24 39.21	+08 36 28.8	G	NSV 03038	06 35 42.06	+02 08 58.2	U
NSV 01977	05 25 57.18	+04 50 40.7	GM	FG CMa	06 36 12.42	−19 52 13.7	G
V417 Tau	05 34 43.07	+18 32 18.1	U	NSV 03046	06 36 39.38	−16 59 34.8	GM
V743 Ori	05 34 58.38	+14 25 26.5	U	V558 Mon	06 36 39.89	+05 36 01.7	U
V769 Ori	05 35 35.09	+13 36 35.4	G	V559 Mon	06 37 36.52	+10 13 16.9	U
V418 Tau	05 35 44.57	+18 56 42.3	U	NSV 03057	06 38 24.54	−01 39 03.0	G
V809 Ori	05 36 21.19	+09 29 28.8	U	NSV 03070	06 39 08.92	−15 55 15.5	U
V877 Ori	05 39 17.31	+09 42 07.3	U	FI CMa	06 39 33.56	−13 27 16.4	U
V903 Ori	05 42 27.94	+10 24 35.4	G	LX Gem	06 40 05.00	+15 06 40.1	G
V419 Tau	05 42 47.97	+18 04 27.7	U	LY Gem	06 43 00.20	+17 58 45.9	U
NSV 02614	05 45 11.46	+19 10 42.7	G	LZ Gem	06 44 06.00	+14 32 22.9	U
NSV 02617	05 45 20.46	+19 07 52.3	G	NSV 03190	06 44 29.70	−02 32 31.1	GM
MO Aur	05 45 20.56	+31 54 31.5	U	MM Gem	06 45 27.48	+17 48 37.4	U
MP Aur	05 46 46.19	+31 42 40.2	U	MN Gem	06 46 10.75	+14 47 52.6	U
V420 Tau	05 47 35.04	+13 03 30.0	U	MO Gem	06 46 54.08	+11 55 59.7	G
V910 Ori	05 47 47.10	+07 53 13.2	U	V561 Mon	06 50 53.66	+05 37 26.0	U
V911 Ori	05 48 30.93	+08 27 06.7	U	V562 Mon	06 51 25.52	+08 33 48.6	G
V912 Ori	05 48 45.40	+10 17 10.7	U	MQ Gem	06 53 39.37	+15 19 55.0	U
MR Aur	05 51 33.68	+31 06 51.7	U	FK CMa	06 53 50.21	−13 44 15.7	U
NSV 02672	05 51 38.34	+15 08 24.1	GM	V563 Mon	06 53 53.85	+09 49 20.8	G
NSV 02686	05 52 35.47	+15 32 36.3	U	NSV 03270	06 54 27.92	−04 20 47.0	G
V423 Tau	05 52 49.06	+24 24 43.3	U	MS Gem	06 57 55.47	+15 46 01.5	U
NSV 02697	05 53 09.70	+16 04 23.4	U	V565 Mon	06 58 02.80	−07 56 42.0	GM
V424 Tau	05 54 52.13	+26 48 23.1	GM	MT Gem	06 58 21.40	+18 24 25.5	U

Table 1: cont.

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
MU Gem	$06^h59^m24\overset{s}{.}19$	$+14°04'50\overset{''}{.}8$	G	NSV 03750	$07^h49^m13\overset{s}{.}15$	$-17°43'21\overset{''}{.}8$	GM
FL CMa	07 00 02.92	−14 09 38.7	U	NSV 03751	07 49 21.83	−13 47 13.8	GM
MV Gem	07 00 53.33	+12 51 20.6	U	V576 Mon	07 52 47.86	−10 26 44.4	G
NSV 03336	07 01 03.98	−18 51 35.8	G	MU Pup	07 54 08.10	−16 47 29.6	GM
V567 Mon	07 01 56.94	−01 46 26.2	U	MT Pup	07 54 11.93	−14 39 17.1	U
NSV 03348	07 02 29.76	−15 39 20.3	G	MV Pup	07 54 22.02	−17 13 07.4	GM
MW Gem	07 02 51.99	+17 31 16.3	U	NSV 04369	09 04 48.59	+05 30 08.0	G
MX Gem	07 04 19.38	+15 35 24.4	U	DQ Vir	12 18 23.25	+05 30 41.1	G
MZ Gem	07 04 35.31	+10 42 13.3	U	DR Vir	12 21 42.48	+07 53 26.3	G
NN Gem	07 05 43.52	+17 12 35.0	G	DS Vir	12 27 26.97	+07 48 49.8	G
FO CMa	07 08 33.91	−16 28 13.1	U	V677 Her	16 08 04.19	+24 59 20.4	G
AV CMi	07 09 10.85	+12 11 18.9	GM	V678 Her	16 08 16.65	+24 42 13.7	G
FP CMa	07 10 12.23	−15 32 05.3	G	V586 Her	16 09 02.23	+17 23 17.0	U
V570 Mon	07 10 17.33	−01 56 00.9	U	V687 Her	16 14 21.61	+23 42 38.2	G
AW CMi	07 12 47.79	+08 33 08.4	U	V686 Her	16 14 23.27	+17 56 35.1	G
AX CMi	07 13 05.23	+08 44 11.2	GM	V691 Her	16 20 17.00	+17 45 47.6	G
NSV 03466	07 13 18.27	−14 34 47.2	GM	NSV 07670	16 21 58.28	+31 37 53.5	GM
AY CMi	07 13 54.48	+08 25 45.3	G	V589 Her	16 22 07.18	+19 22 36.6	U
NSV 03483	07 14 45.89	−17 29 51.4	U	V692 Her	16 22 18.17	+26 22 32.7	GM
NSV 03501	07 16 34.12	−15 42 13.2	G	V693 Her	16 23 24.39	+18 13 26.5	G
NSV 03519	07 18 04.75	−14 15 14.3	U	V590 Her	16 25 12.66	+33 33 07.9	G
V572 Mon	07 22 25.23	−03 39 01.0	U	V694 Her	16 25 32.26	+22 05 05.0	U
V573 Mon	07 26 58.58	−10 59 48.7	U	NSV 07786	16 30 25.03	+38 49 20.3	G
NSV 03603	07 28 18.92	−10 59 11.9	G	V593 Her	16 31 42.46	+18 12 38.1	U
MP Pup	07 31 08.49	−13 14 25.1	GM	V594 Her	16 32 21.36	+19 48 20.4	U
NSV 03627	07 31 59.35	−09 30 38.6	GM	V595 Her	16 32 27.74	+19 03 38.9	U
NSV 03630	07 32 02.78	−18 22 54.8	GM	V596 Her	16 32 34.20	+30 20 38.5	G
V574 Mon	07 34 14.52	−09 39 34.3	G	V704 Her	16 34 32.04	+22 45 40.4	U
NSV 03657	07 35 56.87	−18 45 03.0	GM	V598 Her	16 35 03.62	+18 52 40.5	U
NSV 03658	07 36 18.56	−12 58 02.4	U	NSV 07851	16 35 32.20	+34 04 35.2	G
NSV 03668	07 38 16.06	−16 34 17.9	U	NSV 07859	16 36 00.96	+36 30 25.9	G
MR Pup	07 39 25.26	−16 14 33.1	U	V706 Her	16 36 21.08	+23 02 32.9	G
MS Pup	07 41 45.83	−13 59 13.6	U	V601 Her	16 36 48.87	+24 10 03.2	G
NSV 03707	07 43 45.66	−11 54 19.8	G	V602 Her	16 38 40.43	+32 02 17.9	U
NSV 03709	07 44 12.86	−11 51 58.8	U	V603 Her	16 39 50.52	+19 46 40.3	G
V575 Mon	07 48 59.18	−11 02 28.4	U	V604 Her	16 40 05.85	+18 41 09.4	G

Table 1: cont.

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V605 Her	$16^h40^m41^s.81$	$+11°51'58''.2$	G	V625 Her	$17^h44^m23^s.55$	$+15°46'29''.2$	U
V607 Her	16 40 54.50	+26 22 09.9	G	V2025 Oph	17 44 37.43	+11 09 03.1	U
NSV 07910	16 41 10.65	+08 51 06.2	GM	V2026 Oph	17 44 47.61	+13 06 24.7	U
NSV 07913	16 41 19.32	+08 28 01.6	GM	NSV 09676	17 46 44.02	+15 42 02.1	G
V608 Her	16 42 49.22	+23 31 48.5	U	V2027 Oph	17 47 43.10	+13 17 08.5	U
V610 Her	16 43 38.43	+22 31 30.2	U	V2028 Oph	17 48 24.26	+11 08 07.4	U
V612 Her	16 45 06.97	+09 02 34.1	G	NSV 09752	17 50 10.56	+09 02 35.0	G
NSV 07967	16 46 37.78	+39 03 25.8	G	NSV 09769	17 50 59.61	+09 44 38.1	G
V613 Her	16 48 21.00	+10 02 51.0	U	NSV 09804	17 52 41.90	+03 04 43.9	GM
V617 Her	16 49 32.59	+35 46 33.8	U	NSV 09845	17 54 29.51	+14 47 43.2	G
V615 Her	16 49 35.91	+05 45 59.9	G	V626 Her	17 54 37.73	+14 48 40.3	G
NSV 07980	16 50 13.06	+08 59 10.5	G	V2030 Oph	17 54 52.20	+02 28 26.5	U
V1122 Oph	16 53 44.99	+12 24 47.1	U	V665 Her	17 54 55.41	+17 01 29.5	GM
V1123 Oph	16 54 01.28	+08 57 15.1	U	V2031 Oph	17 56 14.29	+06 28 41.9	U
V1125 Oph	16 55 06.01	+11 33 02.3	G	V2033 Oph	17 57 37.80	+04 51 16.3	U
V1130 Oph	16 55 51.01	+10 49 40.8	U	NSV 09935	17 58 47.22	−02 05 22.2	GM
V618 Her	16 58 53.86	+34 28 58.6	G	NSV 10006	18 01 43.48	+07 23 05.0	G
NSV 08102	17 00 00.57	+11 51 08.5	G	NSV 10072	18 02 47.77	+07 54 00.8	U
NSV 08129	17 01 14.38	+30 04 08.2	G	V2035 Oph	18 04 54.90	+02 59 51.3	GM
NSV 08131	17 01 58.78	+06 55 28.2	G	V2036 Oph	18 08 39.37	+06 15 38.2	G
V1322 Oph	17 03 43.25	+11 51 55.8	U	V2037 Oph	18 11 53.32	+02 20 20.8	GM
NSV 08179	17 05 26.50	+14 13 58.3	G	V2038 Oph	18 13 14.47	+04 15 09.4	GM
NSV 08184	17 05 43.59	+06 25 41.6	G	FG Ser	18 15 07.06	−00 18 53.0	GM
V619 Her	17 06 21.19	+31 53 18.9	G	NSV 12411	19 47 29.33	+21 18 32.5	G
V1429 Oph	17 07 15.16	+05 15 08.2	GM	NSV 12442	19 49 26.98	+21 34 44.7	GM
V1600 Oph	17 11 41.48	+07 32 09.7	U	NSV 12457	19 50 21.85	+16 15 48.0	U
V621 Her	17 17 34.21	+16 35 26.4	U	GS Sge	19 53 12.98	+18 03 44.3	U
NSV 08529	17 19 48.55	+13 00 18.4	U	GT Sge	19 58 04.15	+16 51 04.8	U
NSV 08613	17 24 32.08	+15 53 38.5	G	GU Sge	19 59 04.88	+21 07 55.9	U
NSV 08639	17 25 41.31	+12 05 26.0	U	NSV 12748	20 03 31.35	+19 13 14.4	U
NSV 09102	17 31 26.30	+16 04 24.1	G	NSV 12752	20 03 51.13	+19 45 07.9	U
NSV 09152	17 33 04.52	+15 54 31.9	U	NSV 12779	20 05 47.47	+15 24 32.3	GM
NSV 09171	17 34 04.77	+14 45 14.7	U	GW Sge	20 06 59.31	+20 52 11.1	U
V2023 Oph	17 40 34.29	+11 44 41.1	U	NSV 12903	20 12 54.40	+18 13 32.3	U
NSV 09550	17 42 20.21	+10 20 03.8	G	NSV 12962	20 15 52.20	+23 30 59.0	GM

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PRECISE COORDINATES OF VARIABLE STARS (7)

T. KATO

Dept. of Astronomy, Faculty of Science, Kyoto University, Kyoto 606-8502 Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp

This report contains 152 accurate J2000.0 positions for variable stars discovered by Hoffleit (1972). The variables stars were identified against computer plots of GSC and USNO A1.0 catalogs. The color information and IRAS PSC identification were also examined in identifying red variables. The source of identification in column 'Cat.': G = GSC 1.1, GM = average of GSC 1.1 multiple entries, U = USNO A1.0. The table has been sorted in the increasing order of J2000.0 right ascensions.

The identifications for the following stars are slightly uncertain because of the high density of stars and/or chart distortions: V1656 Sgr, V1657 Sgr, V2331 Sgr, V2332 Sgr, V2343 Sgr, V2357 Sgr, V2378 Sgr, V2383 Sgr, V2520 Sgr, V2524 Sgr, V2543 Sgr, V2544 Sgr, V2548 Sgr, V2557 Sgr, V2558 Sgr, V2562 Sgr, V2585 Sgr, V2586 Sgr, V2589 Sgr, V2592 Sgr, V3800 Sgr, V3802 Sgr, V3812 Sgr, V3831 Sgr, V3832 Sgr, V3836 Sgr, V3842 Sgr, V3845 Sgr, V3850 Sgr.

Detailed information of identifications, other catalog identifications are available from the VSNET archive (vsnet 1181–1184, 1188–1190, 1192–1193, http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet/msg01181.html etc.).

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Reference:

Hoffleit, D., 1972, *IBVS*, No. 660

Table 1: Precise coordinates of variable stars

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V3796 Sgr	$18^h14^m05^s.24$	$-27°00'23''.0$	GM	V1656 Sgr	$18^h25^m12^s.44$	$-26°26'04''.6$	G
V3797 Sgr	18 14 39.63	−18 54 41.8	G	V3817 Sgr	18 25 53.17	−24 21 55.6	U
V3798 Sgr	18 15 25.73	−19 39 15.1	U	V2546 Sgr	18 26 04.62	−23 01 01.1	U
V2331 Sgr	18 17 06.82	−23 57 51.0	G	V3818 Sgr	18 26 17.17	−23 10 14.5	G
V3799 Sgr	18 17 34.01	−25 54 51.6	G	V3820 Sgr	18 26 22.33	−24 14 15.9	G
V2513 Sgr	18 17 47.41	−27 49 27.6	GM	V3821 Sgr	18 26 23.17	−22 04 11.9	U
V2520 Sgr	18 19 07.98	−27 32 53.3	U	V2548 Sgr	18 26 27.34	−22 02 13.7	U
V2333 Sgr	18 19 40.34	−23 16 28.1	G	V3822 Sgr	18 26 29.60	−22 46 23.1	G
V3801 Sgr	18 19 42.66	−18 54 37.5	G	V2346 Sgr	18 26 45.86	−21 07 40.1	GM
V2524 Sgr	18 19 52.68	−23 54 03.4	U	V3823 Sgr	18 26 47.15	−24 11 15.9	U
V2525 Sgr	18 19 56.95	−22 12 37.2	U	V2344 Sgr	18 26 49.97	−23 25 38.0	U
V3802 Sgr	18 20 02.59	−23 51 03.1	U	V3824 Sgr	18 26 56.24	−24 18 16.4	U
V3800 Sgr	18 20 03.03	−26 40 50.9	G	V2549 Sgr	18 27 00.72	−22 17 32.0	U
V2527 Sgr	18 20 06.11	−22 55 52.0	GM	V3825 Sgr	18 27 05.54	−26 08 32.6	G
V3803 Sgr	18 20 12.23	−23 20 49.9	G	V3826 Sgr	18 27 08.34	−23 36 06.0	U
V2534 Sgr	18 21 13.20	−23 05 41.8	GM	V3827 Sgr	18 27 14.70	−24 35 11.8	U
V3805 Sgr	18 22 09.97	−24 22 41.6	U	V2552 Sgr	18 27 29.45	−24 42 57.7	U
V3806 Sgr	18 22 20.46	−23 16 00.4	U	V1662 Sgr	18 27 34.23	−22 00 46.3	U
V3809 Sgr	18 22 25.78	−22 37 11.9	U	V1988 Sgr	18 27 57.37	−27 37 23.3	GM
V3808 Sgr	18 22 32.00	−25 07 31.8	G	V3828 Sgr	18 28 02.01	−27 38 42.2	G
V3807 Sgr	18 22 36.05	−27 31 49.8	GM	V3829 Sgr	18 28 19.30	−23 17 15.6	G
V1864 Sgr	18 22 38.99	−27 34 42.4	GM	V2557 Sgr	18 28 21.44	−22 06 43.1	U
V1868 Sgr	18 23 12.75	−24 37 17.9	U	V2558 Sgr	18 28 24.89	−22 13 40.2	U
V3811 Sgr	18 23 28.94	−21 53 08.8	U	V2348 Sgr	18 28 30.63	−23 13 00.6	U
V3812 Sgr	18 23 40.70	−23 29 19.7	U	V3830 Sgr	18 28 45.47	−23 31 52.5	U
V2332 Sgr	18 23 44.44	−23 19 48.6	U	V3831 Sgr	18 28 52.66	−21 59 41.0	U
V2338 Sgr	18 23 48.72	−25 26 19.4	U	V2350 Sgr	18 28 54.67	−25 47 20.2	G
V2339 Sgr	18 24 07.49	−23 18 25.7	G	V2562 Sgr	18 28 59.13	−22 47 25.1	U
V3814 Sgr	18 24 09.39	−25 54 19.1	G	V3832 Sgr	18 29 00.84	−24 36 39.2	G
V3813 Sgr	18 24 10.17	−27 19 44.5	GM	V3833 Sgr	18 29 06.16	−26 37 55.4	U
V514 Sgr	18 24 20.96	−25 53 25.6	G	V2352 Sgr	18 29 11.86	−22 02 44.6	G
V2341 Sgr	18 24 32.07	−23 47 04.5	U	V3835 Sgr	18 29 14.29	−25 21 50.1	G
V2343 Sgr	18 24 41.14	−23 19 57.5	U	V3837 Sgr	18 29 17.82	−22 33 03.4	U
V2543 Sgr	18 24 59.57	−26 29 01.6	G	V3836 Sgr	18 29 18.48	−24 33 40.8	U
V3816 Sgr	18 25 01.82	−23 08 08.8	G	V2565 Sgr	18 29 19.53	−24 32 42.3	G
V1657 Sgr	18 25 01.93	−23 05 25.5	U	V2353 Sgr	18 29 28.44	−24 23 51.4	G
V2544 Sgr	18 25 04.02	−26 35 47.9	U	V3838 Sgr	18 29 58.94	−23 10 57.5	G
V3815 Sgr	18 25 09.78	−26 26 36.5	G	V3839 Sgr	18 30 06.73	−23 15 14.8	U

Table 1: cont.

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
V2354 Sgr	$18^h30^m11^s.65$	$-24°52'26''.3$	G	V3854 Sgr	$18^h35^m20^s.48$	$-23°24'31''.2$	GM
V2570 Sgr	18 30 13.01	−23 09 43.8	U	V2369 Sgr	18 35 25.20	−22 22 45.7	U
V3840 Sgr	18 30 17.25	−23 59 10.1	U	V2007 Sgr	18 35 26.56	−23 47 30.8	U
V2357 Sgr	18 30 26.46	−22 23 32.9	U	V2592 Sgr	18 35 29.50	−23 45 08.4	U
V3842 Sgr	18 30 41.29	−23 57 48.5	U	V1698 Sgr	18 36 04.64	−22 39 48.9	U
V2358 Sgr	18 30 42.22	−23 38 19.2	G	V3855 Sgr	18 36 10.10	−24 05 48.2	GM
V3843 Sgr	18 30 48.64	−23 38 33.7	U	V2370 Sgr	18 36 10.81	−20 43 31.3	G
V2571 Sgr	18 30 49.41	−23 05 51.2	U	V2598 Sgr	18 36 36.66	−22 47 11.2	U
V3844 Sgr	18 30 59.70	−26 29 25.6	U	V3856 Sgr	18 36 51.29	−22 15 36.4	U
V2573 Sgr	18 31 15.09	−21 47 33.7	G	V2600 Sgr	18 37 18.35	−21 29 19.6	U
IK Sgr	18 31 32.76	−24 47 38.1	U	V3857 Sgr	18 37 20.62	−24 42 12.2	U
V2576 Sgr	18 31 49.87	−26 18 52.8	G	V3858 Sgr	18 37 32.64	−22 34 07.4	U
V3845 Sgr	18 31 51.37	−25 12 48.9	U	V2372 Sgr	18 37 36.28	−22 12 35.4	U
IM Sgr	18 32 02.35	−25 13 22.5	U	V2601 Sgr	18 38 02.06	−22 41 51.3	U
V2580 Sgr	18 32 06.64	−23 54 34.7	U	V2374 Sgr	18 38 09.63	−27 41 28.4	U
V3846 Sgr	18 32 11.31	−22 02 29.8	U	V3860 Sgr	18 38 18.66	−21 24 17.7	U
V1680 Sgr	18 32 28.13	−23 16 35.2	U	V2376 Sgr	18 38 24.74	−25 32 55.9	G
V2363 Sgr	18 32 35.29	−23 14 03.6	G	V3859 Sgr	18 38 32.31	−27 42 05.3	GM
V2584 Sgr	18 33 05.01	−25 11 46.0	U	V4033 Sgr	18 38 44.74	−23 05 16.6	GM
V4066 Sgr	18 33 09.57	−23 04 21.1	GM	V3862 Sgr	18 38 45.55	−22 40 43.3	U
V1684 Sgr	18 33 13.13	−25 05 18.0	G	V3861 Sgr	18 38 54.62	−26 48 26.6	U
V2585 Sgr	18 33 22.79	−21 49 08.2	U	V3718 Sgr	18 39 04.70	−21 08 47.4	U
V3847 Sgr	18 33 23.85	−22 14 03.4	U	V2378 Sgr	18 39 59.64	−18 38 40.7	U
V2586 Sgr	18 33 35.99	−23 17 16.5	U	V2606 Sgr	18 40 06.67	−21 22 27.3	U
V3848 Sgr	18 33 47.06	−23 43 36.0	G	V3863 Sgr	18 40 12.34	−24 31 04.7	G
V2588 Sgr	18 33 53.45	−20 57 40.1	U	V3864 Sgr	18 40 51.69	−26 47 21.6	G
V1686 Sgr	18 34 00.21	−25 05 57.1	G	V2608 Sgr	18 40 56.03	−26 05 03.6	G
V3849 Sgr	18 34 05.84	−23 32 26.0	G	V3865 Sgr	18 41 10.55	−23 16 27.4	U
V3850 Sgr	18 34 09.20	−23 19 38.8	U	V2380 Sgr	18 41 25.46	−25 43 05.3	G
V2364 Sgr	18 34 09.88	−24 25 13.5	GM	V3866 Sgr	18 42 03.18	−19 46 36.0	G
V2589 Sgr	18 34 29.31	−23 01 37.5	U	V2383 Sgr	18 42 49.87	−19 01 36.9	U
V2365 Sgr	18 34 37.68	−21 55 58.0	U	V1710 Sgr	18 43 24.08	−21 12 49.1	U
V2366 Sgr	18 34 42.21	−21 56 49.3	U	V3868 Sgr	18 43 27.77	−21 11 41.5	U
V2367 Sgr	18 34 52.09	−23 52 55.3	GM	V3869 Sgr	18 43 36.83	−22 56 29.1	G
V3851 Sgr	18 34 59.24	−25 18 31.9	U	V3870 Sgr	18 44 09.04	−22 54 14.5	U
V2591 Sgr	18 34 59.51	−21 34 21.7	U	V3787 Sgr	18 44 20.98	−20 15 53.4	U
V3853 Sgr	18 35 03.46	−23 51 14.7	U	YY Sgr	18 44 35.83	−19 23 23.4	GM
V3852 Sgr	18 35 06.49	−25 02 49.8	U	V3871 Sgr	18 44 40.69	−19 22 59.7	U

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POSSIBLE IDENTIFICATION OF MisV0106 AND NSV 25425

SEIICHI YOSHIDA[1], KENICHI KADOTA[2], TAICHI KATO[3]

[1] MISAO Project, 1065-16 Miyawada Fujishiro-machi Kitasoma-gun Ibaraki 300-1514, Japan,
e-mail: seiichi@muraoka.info.waseda.ac.jp

[2] MISAO Project, 77-1-3-12-204 Koshikiya Ageo City Saitama 362-0064, Japan,
e-mail: kenic-k@astroarts.co.jp

[3] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

This report discusses the possible identification of MisV0106, one of new variable stars discovered in the course of the MISAO Project, and NSV 25425, one of the suspected variable stars in the NSV catalog (New Catalogue of Suspected Variable Stars) Supplement 1.0 (Kazarovets et al. 1998).

In the course of variable star survey based on the MISAO Project observations, the variable brightness of USNO-A2.0 1200.16773850, R.A. = $21^{\rm h}00^{\rm m}37\overset{\rm s}{.}223$, Decl. = $+37°28'55\overset{''}{.}08$ (2000.0), 14.5 mag(R), 17.8 mag(B), was discovered and named as MisV0106 (Yoshida et al. 1999).

NSV 25425 is 52 arcsec from MisV0106. At the position of NSV 25425, there is a star USNO-A2.0 1200.16771307, R.A. = $21^{\rm h}00^{\rm m}34\overset{\rm s}{.}472$, Decl. = $+37°29'36\overset{''}{.}80$ (2000.0), 13.9 mag(R), 15.4 mag(B) (see Figure 1).

Table 1 shows the photometry of these two stars, obtained automatically by the PIXY system from unfiltered CCD images taken by Kadota between 1999 May and September. The magnitudes were measured using the USNO-A1.0 catalog based on a preliminary V magnitude calculated from R and B magnitude in the catalog based on Kato's (1998) equation:

$$V = R + 0.375(B - R)$$

Further details are the same as described in Yoshida and Kadota (1999). These observations confirmed the variability of USNO-A2.0 1200.16773850, while USNO-A2.0 1200. 16771307 was constant within the error.

In order to confirm the color of the two stars, we measured relative colors of these stars by comparing images with an R60-filter and an IR-blocking filter (Table 2). Red stars are relatively fainter through an IR-blocking filter. The data in the USNO-A2.0 catalog of these two stars implies both stars are red. Our observations confirm that USNO-A2.0 1200.16773850 is evidently red, while USNO-A2.0 1200.16771307 is not red.

The finding chart of NSV 25425 is given in Margoni and Stagni (1984). The star labelled as NSV 25425 on the chart is identical with USNO-A2.0 1200.16771307. However, there is a remark on NSV 25425 that "*is very bright in the infrared*". This does not agree with the result of our observations.

Table 1: Photometry (unfiltered CCD)

JD	USNO-A2.0 1200.16773850	USNO-A2.0 1200.16771307
2451300.25	12.7	15.3
2451367.20	14.0	15.4
2451408.22	14.4	15.4
2451426.12	13.4	15.2

Table 2: Photometry (filtered CCD)

Filter	USNO-A2.0 1200.16773850	USNO-A2.0 1200.16771307
none	13.4	15.2
R60	13.2	15.1
IR-blocking	15.6	15.3

As a conclusion, the identification of NSV 25425 with USNO-A2.0 1200.16771307 is possibly a mistake and USNO-A2.0 1200.16773850 (MisV0106) is the true NSV 25425.

Because the finding chart of Margoni and Stagni (1984) was based on a blue photographic plate, USNO-A2.0 1200.16773850, a red star, was too faint to be visible on the chart. This may explain why Margoni and Stagni (1984) labelled the wrong star as the variable.

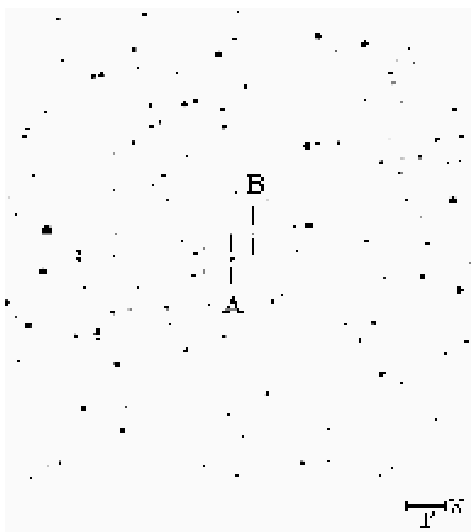

Figure 1. A: USNO-A2.0 1200.16773850 (MisV0106)
B: USNO-A2.0 1200.16771307

References:

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NEW VARIABLE STARS DISCOVERED IN THE MISAO PROJECT V: MisV0251–MisV0300

SEIICHI YOSHIDA[1], KENICHI KADOTA[2], TAICHI KATO[3]

[1] MISAO Project, 1065-16 Miyawada Fujishiro-machi Kitasoma-gun Ibaraki 300-1514, Japan,
e-mail: seiichi@muraoka.info.waseda.ac.jp

[2] MISAO Project, 77-1-3-12-204 Koshikiya Ageo City Saitama 362-0064, Japan,
e-mail: kenic-k@astroarts.co.jp

[3] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan, e-mail: tkato@kusastro.kyoto-u.ac.jp

This report describes 50 new variable stars (MisV0251–MisV0300) discovered in the course of the MISAO Project.

These objects are detected automatically by the PIXY system as candidates of variable stars from unfiltered CCD images taken by Kadota between 1999 April and August, then confirmed by Yoshida and Kadota. Further details are same as described in Yoshida and Kadota (1999).

Table 1 contains the list of 50 new variable stars. The position and magnitude are measured using USNO-A1.0 catalog. The magnitude is based on a preliminary V magnitude calculated from R and B magnitude in the catalog based on Kato's (1998) equation:

$$V = R + 0.375(B - R)$$

The finding charts are available electronically as 4793-f[nnn].eps where [nnn] refers to the serial number assigned to the star in the first column of Table 1.

NSV 12738 is 4.4 arcmin from MisV0251. However, it was detected on our unfiltered CCD image as around 16 mag. Therefore, MisV0251 is another new variable star.

EM Oph is 4.5 arcmin from MisV0261. QY Oph is 4.0 arcmin from MisV0263. IN Sco is 4.7 arcmin from MisV0265. No star brighter than 14 mag was detected at these positions on our unfiltered CCD images. However, considering the large distance, MisV0261, MisV0263 and MisV0265 are probably new variable objects.

MisV0297 is located at a distance of 129 arcsec from the cataloged position of the obscure nova DZ Ser. A slight uncertainly of the coordinates reported among existing references (Duerbeck 1987) may have led to a possible identification. More extensive study of the new variable and the comparison with the discovery material of DZ Ser are needed to clarify the situation.

References:

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Yoshida, S., Kadota, K., Kato, T., 1999, *IBVS*, No. 4780
Yoshida, S., 1999, in preparation

Table 1: List of New Variable Stars

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0251	$20^h02^m23^s.74$	$+45°31'48''.0$	11.4	12.4	?	USNO-A1.0 1350.11732426 IRAS 20008+4523
MisV0252	18 02 20.11	−03 40 43.9	12.9	14.1	?	USNO-A1.0 0825.11795307 IRAS 17596-0340
MisV0253	18 57 42.25	+11 12 57.3	11.6	12.3	?	IRAS 18553+1108
MisV0254	17 57 23.02	−18 02 45.8	12.6	13.4	?	IRAS 17544-1802
MisV0255	19 01 32.35	+15 00 21.7	11.8	12.7	?	IRAS 18592+1455
MisV0256	18 59 47.58	+13 28 44.5	12.6	13.3	?	USNO-A1.0 0975.14019473 IRAS 18574+1324
MisV0257	20 03 12.50	+32 21 57.8	13.6	14.7	?	USNO-A1.0 1200.14514625 IRAS 20012+3213
MisV0258	21 00 41.79	+38 49 59.4	11.6	12.3	?	USNO-A1.0 1275.14728592 IRAS 20587+3838
MisV0259	19 59 44.71	+26 52 03.5	14.2	15.2	?	USNO-A1.0 1125.15056625 IRAS 19577+2643
MisV0260	20 00 27.38	+27 12 27.3	12.7	13.6	?	USNO-A1.0 1125.15087259 IRAS 19584+2704
MisV0261	16 59 35.06	−25 54 29.0	11.8	13.9	?	
MisV0262	16 59 36.49	−27 47 36.4	11.2	13.2	?	USNO-A2.0 0600.22839578
MisV0263	17 02 59.91	−29 06 44.0	11.9	[14.1	?	USNO-A2.0 0600.23335362
MisV0264	16 57 01.88	−29 14 14.9	12.7	13.9	?	USNO-A2.0 0600.22499831
MisV0265	17 00 31.51	−30 20 54.9	12.0	13.4	?	
MisV0266	17 59 53.52	−07 50 18.1	13.6	15.0	?	
MisV0267	17 57 39.59	−02 48 19.9	13.1	15.0	SR?	USNO-A2.0 0825.11617631
MisV0268	18 58 29.87	+22 58 20.5	12.1	13.5	?	USNO-A2.0 1125.10932827
MisV0269	18 57 18.98	+24 53 50.5	13.0	[15.1	SR?	USNO-A2.0 1125.10869563
MisV0270	16 59 41.97	−22 50 13.0	11.7	13.4	?	USNO-A2.0 0600.22852019 IRAS 16566-2245
MisV0271	17 01 48.55	−23 01 15.3	10.7	11.7	?	USNO-A2.0 0600.23151309 IRAS 16587-2256
MisV0272	17 01 34.34	−22 44 47.6	12.2	14.5	?	USNO-A2.0 0600.23118070 IRAS 16585-2240
MisV0273	16 59 45.19	−24 12 49.8	13.0	13.8	?	IRAS 16567-2408
MisV0274	17 00 04.55	−23 56 41.8	11.9	14.0	?	USNO-A2.0 0600.22904491 IRAS 16570-2352
MisV0275	17 01 37.70	−23 38 44.0	11.0	13.1	?	GSC 6811.0931 USNO-A2.0 0600.23126044 IRAS 16585-2334

Table 1 (cont.)

Code	R.A. (J2000.0)	Decl.	Unfiltered CCD Mag. Max	Min	Type	Identified with
MisV0276	$16^h58^m22^s.42$	$-25°48'46''.9$	11.7	[13.1	?	IRAS 16552-2544
MisV0277	16 58 52.97	−27 58 03.7	11.7	12.8	?	USNO-A2.0 0600.22739287 IRAS 16557-2753
MisV0278	16 56 57.13	−30 01 10.1	10.7	11.7	?	USNO-A2.0 0525.24992420 IRAS 16537-2956
MisV0279	16 57 12.82	−12 51 22.7	11.1	12.0	SR?	USNO-A2.0 0750.10195334 IRAS 16544-1246
MisV0280	16 58 46.73	−12 43 46.7	11.2	[14.2	M?	GSC 5651.1718 USNO-A2.0 0750.10225820 IRAS 16559-1239
MisV0281	18 02 43.59	−02 52 45.1	13.9	14.8	SR?	IRAS 18001-0252
MisV0282	17 59 30.06	−04 10 50.8	14.0	14.9	?	IRAS 17568-0410
MisV0283	17 58 11.47	−05 45 13.3	14.0	14.9	?	IRAS 17555-0545
MisV0284	18 02 49.22	−06 32 36.0	13.9	14.7	?	IRAS 18001-0632
MisV0285	18 00 00.16	−05 54 11.1	13.5	14.4	?	USNO-A2.0 0825.11696058 IRAS 17573-0554
MisV0286	18 01 51.07	−06 30 15.2	12.9	15.5	?	IRAS 17591-0630
MisV0287	18 01 13.99	−06 08 42.5	12.8	15.2	?	USNO-A2.0 0825.11733574 IRAS 17585-0608
MisV0288	17 58 08.32	−07 17 42.2	13.7	16.3	?	USNO-A2.0 0825.11634411 IRAS 17554-0717
MisV0289	18 00 07.51	−07 02 35.4	13.0	14.8	?	IRAS 17573-0702
MisV0290	18 00 38.43	−07 14 20.0	13.5	15.7	?	IRAS 17579-0714
MisV0291	17 59 17.66	−06 57 51.5	12.4	14.5	?	USNO-A2.0 0825.11673408 IRAS 17565-0657
MisV0292	17 58 19.70	−07 31 55.4	13.2	14.6	?	USNO-A2.0 0750.12420588 IRAS 17556-0731
MisV0293	18 00 07.23	−08 07 45.0	12.5	13.5	?	IRAS 17573-0807
MisV0294	18 00 10.41	−08 09 54.3	13.5	15.3	?	USNO-A2.0 0750.12483760
MisV0295	17 59 36.57	−09 28 32.5	11.0	13.3	?	IRAS 17568-0928
MisV0296	17 59 01.18	−08 32 06.9	12.9	14.5	?	IRAS 17563-0831
MisV0297	18 00 53.02	−10 32 36.0	12.3	14.6	SR?	USNO-A2.0 0750.12507224 IRAS 17581-1032
MisV0298	17 58 13.22	−09 47 54.5	11.9	[14.5	?	USNO-A2.0 0750.12417014 IRAS 17554-0947
MisV0299	18 58 29.95	+20 06 35.5	9.8	10.6	?	USNO-A2.0 1050.12423588 IRAS 18563+2002
MisV0300	18 57 26.51	+19 48 47.6	11.1	12.6	SR?	GSC 1593.1782 USNO-A2.0 1050.12354776 IRAS 18552+1944

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CCD PHOTOMETRY OF THE 1999 FEBRUARY SUPEROUTBURST OF CT Hya

T. KATO[1], S. KIYOTA[2], R. NOVÁK[3], K. MATSUMOTO[1]

[1] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan,
e-mail: tkato@kusastro.kyoto-u.ac.jp, katsura@kusastro.kyoto-u.ac.jp

[2] Variable Star Observers League in Japan, 1-401-810 Azuma, Tsukuba, 305-0031 Japan,
e-mail: skiyota@abr.affrc.go.jp

[3] Nicholas Copernicus Observatory, Kraví hora 2, Brno 616 00, Czech Republic,
e-mail: rudolfn@physics.muni.cz

CT Hya was discovered as a dwarf nova by Hoffmeister (1936). The SU UMa-type nature of this dwarf nova was first revealed by Nogami et al. (1996), who discovered superhumps with a period of $0\overset{d}{.}06505$, although there remained some ambiguity in the alias selection. Nogami et al. (1996) suggested that CT Hya is an intermediate object between ordinary SU UMa stars and WZ Sge stars. Upon the alert of a bright outburst on 1999 February 14 (R. Stubbings, VSNET), we undertook a time-resolved CCD photometry campaign. Table 1 summarizes the observation runs.

The observations at Kyoto were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java™-based aperture and PSF photometry package developed by one of the authors (TK). The magnitude of the variable was measured relative to GSC 216.709 (Tycho $V = 10.11$, $B - V = +1.06$), whose constancy was confirmed by comparison with GSC 216.417 (Tycho $V = 11.43$, $B - V = +0.37$).

Brno observations were performed on a 40-cm Newtonian telescope using an ST-7 camera and an I-band Kron-Cousins filter. During the outburst, when star was fading we changed exposure times, which are given in Table 1. Images were dark-subtracted, flat-fielded and analyzed using Munidos photometry package (Novák 1998). The magnitude of variable was determined relative to GSC 216.18 which shows no variability up to 0.1 mag limit. Due to cloudy weather some of the CCD frames were omitted from final datasets and in some cases the instrumental magnitude error was quite large. These observations were also omitted.

Tsukuba observations were done using an AP-7 CCD attached to a 25-cm Schmidt-Cassegrain telescope. A Johnson V filter was adopted. The comparison star GSC 216.417 was used to calibrate the magnitude. The constancy of the comparison was confirmed by using a check star GSC 216.18.

All the observations were first shifted by constant magnitudes to best match the Tsukuba V-system. The differences in passbands will not seriously affect the period

Table 1: Summary of observations

start JD[a]	end JD[a]	observatory	band[b]	N^c	t^d
51224.924	51224.990	Kyoto	C	170	30
51225.899	51226.169	Kyoto	C	320	30
51225.948	51226.209	Tsukuba	V	151	120
51226.483	51226.564	Brno	I_C	85	50
51226.901	51227.108	Kyoto	C	471	30
51227.124	51227.217	Tsukuba	V	46	180
51228.317	51228.350	Brno	I_C	23	60
51228.919	51229.232	Kyoto	C	362	30
51229.906	51230.222	Kyoto	C	237	30
51230.386	51230.574	Brno	I_C	100	60
51230.912	51230.975	Kyoto	C	119	30
51230.938	51231.152	Tsukuba	V	88	180
51233.278	51233.475	Brno	I_C	43	70
51234.432	51234.491	Brno	I_C	8	120
51235.122	51235.175	Kyoto	C	10	30
51237.194	51237.197	Kyoto	C	8	30
51239.153	51239.169	Kyoto	C	38	30
51241.158	51241.168	Kyoto	C	27	30
51242.132	51241.171	Kyoto	C	66	30

[a] JD − 2400000
[b] C for unfiltered CCD
[c] Number of frames
[d] Exposure time (s)

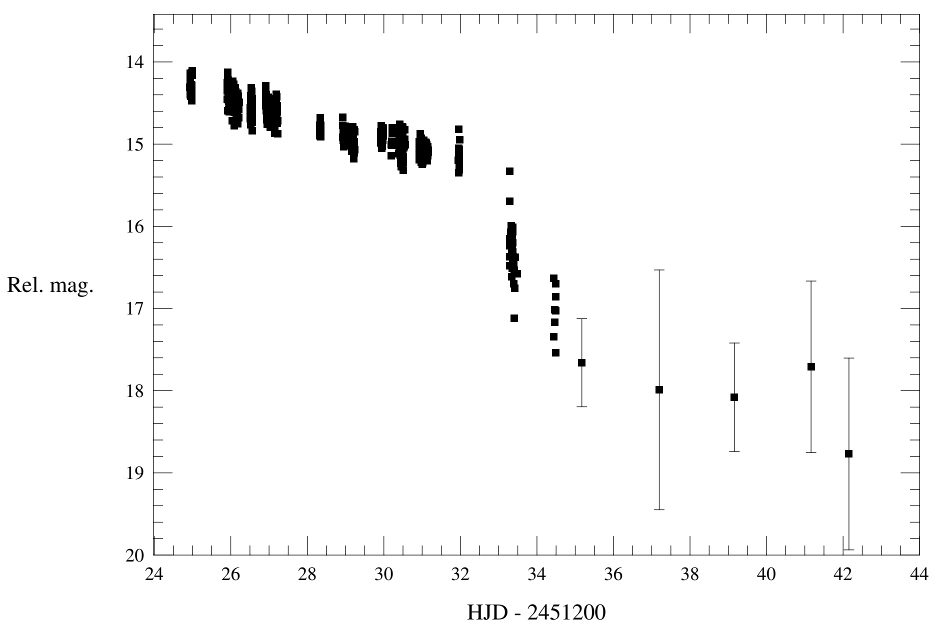

Figure 1. Overall light curve of CT Hya

analysis of outbursting dwarf novae, whose colors are known to be close to $B - V = 0$. Figure 1 illustrates the resultant overall light curve of the present observations. Five consecutive Kyoto observations were averaged to get one point, corresponding to an effective exposure time of 150 s. Before February 22 (JD 2451232) individual observations are plotted; after the decline, nightly averages with error bars are plotted instead. The superoutburst plateau stage (February 15–20) was analyzed, after subtracting the linear decline trend, using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978).

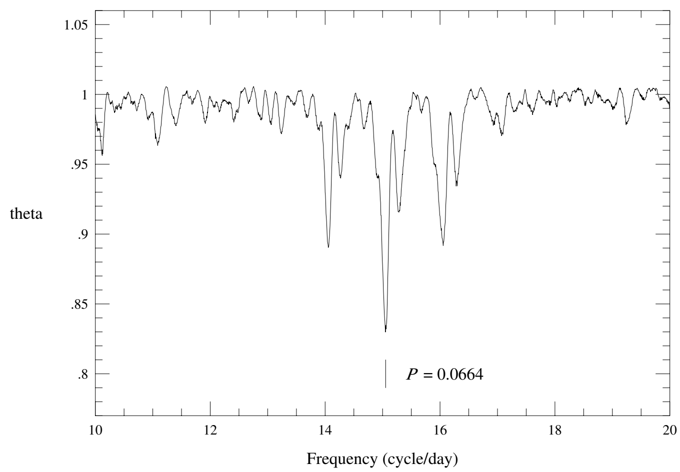

Figure 2. Period analysis of CT Hya

The result of period analysis is given in Figure 2. The period analysis was applied to Kyoto and Tsukuba data, since some ambiguity remained in Brno observations caused by clouds or potential unsolved problem (as described later). The best-determined superhump period is 0.06643 ± 0.00006 d, which corresponds to the longer one-day alias given by Nogami et al. (1996).

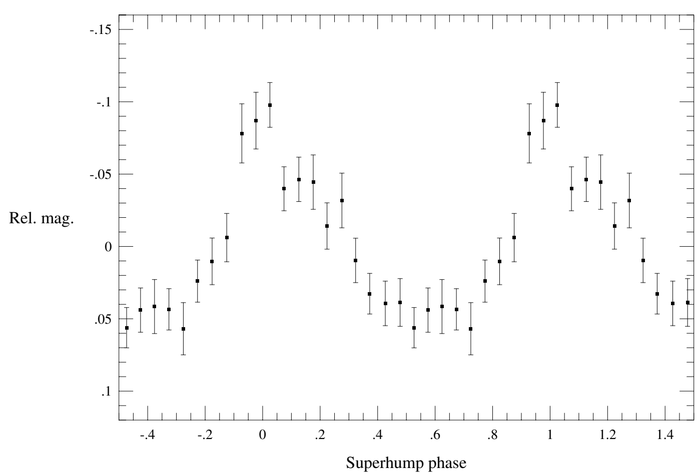

Figure 3. Superhump profile of CT Hya

Figure 3 shows the averaged superhump profile.

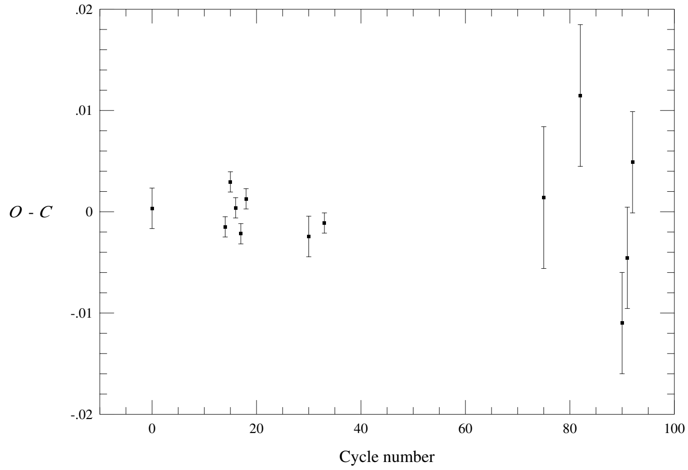

Figure 4. Superhump $O-C$ diagram

Superhump maxima times were measured by eye, and the least-squares fitting yielded the quadratic polynomial equation.

$$\mathrm{Max(HJD)} = 2451224.989(4) + 0.066637(28)E - 0.8(2.7)\times 10^{-6}E^2, \qquad (1)$$

where E is the cycle number (see also Figure 4). The change in the superhump period was negligible, in contrast to usual SU UMa stars which show a rather common superhump period decrease at a rate of $\dot{P}/P \sim -5\times 10^{-5}$. This lack of period decrease is another common property of short-period SU UMa stars (Kato et al. 1998). We must note the Brno observations on HJD 2451226 were disregarded in this $O-C$ analysis, because this observation showed a nearly reversed superhump phase. The reason is left unsolved, either there was a large change in period or phase, or there may have been an unknown problem in time recording. The problem should be solved in the next superoutburst.

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IDENTIFICATION AND CCD PHOTOMETRY OF LUYTEN'S GM Sgr

T. KATO, M. UEMURA

Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp, uemura@kusastro.kyoto-u.ac.jp

There have been confusion in the correct identification of Luyten's variable (HV 4048), which was originally given the GCVS name, GM Sgr. Goranskij (1978, 1990) discovered an eruptive variable star in its close vicinity, which once took over the GCVS nomenclature, GM Sgr. The variable, the flaring X-ray transient, was later given a new variable star name, 'V4641 Sgr' (Samus 1999).

In this paper, we provide the identification chart and CCD photometry of 'Luyten's' GM Sgr = USNO-A1.0 0600.16547185 (Hazen 1999; Morel 1999), based on our CCD images used for photometry of V4641 Sgr (Kato et al. 1999). The CCD observations were done using an unfiltered ST-7 camera attached to a 25-cm Schmidt-Cassegrain telescope at Kyoto University. The exposure time was 10–30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java$^{\rm TM}$-based aperture photometry package developed by one of the authors (TK). The magnitudes of GM Sgr were determined using the GSC 6848.3882 (Tycho $V = 9.30$, $B - V = +0.49$), whose constancy was confirmed by comparison with GSC 6848.3606.

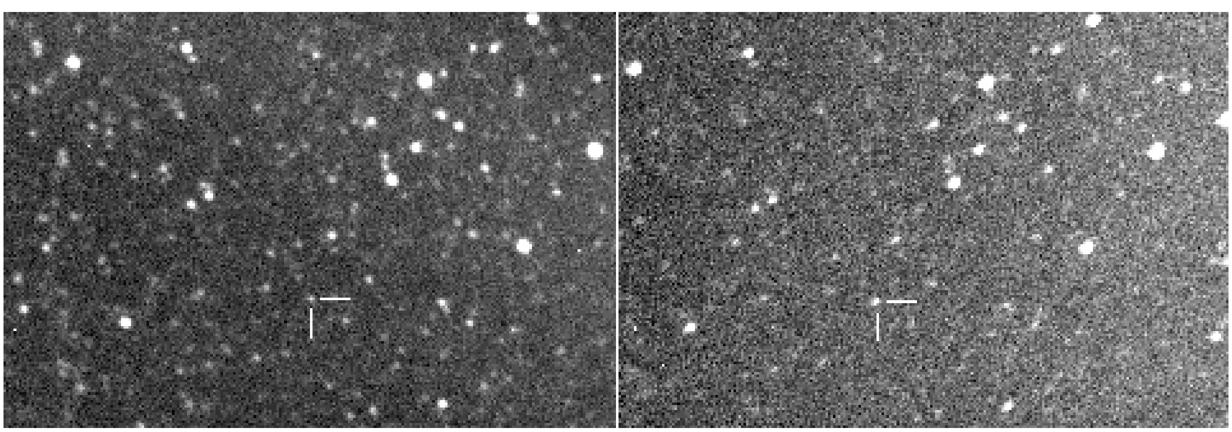

Figure 1. Identification chart of Luyten's GM Sgr

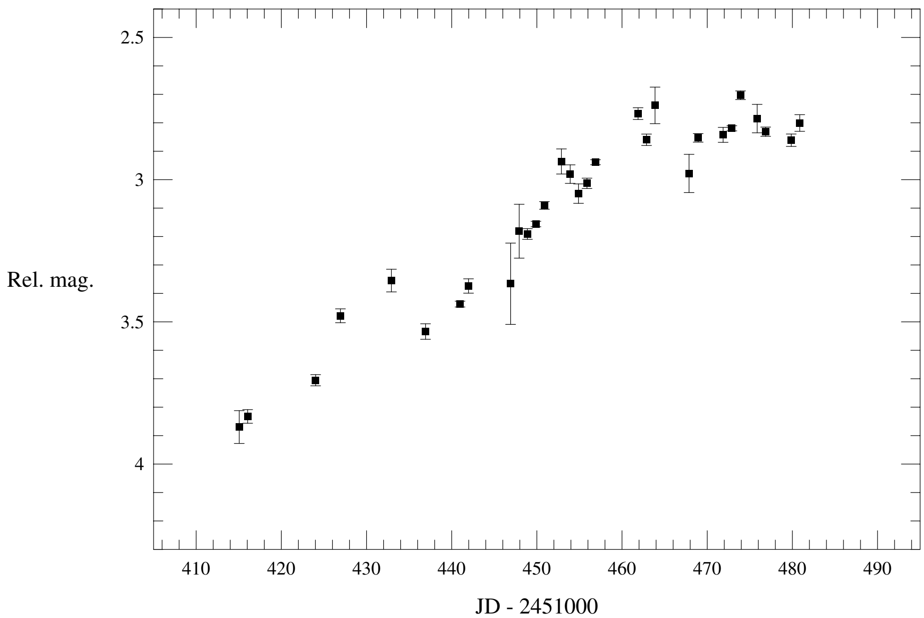

Figure 2. Light curve of GM Sgr

Figure 1 shows the comparison of CCD images taken on 1999 August 24 (left) and 1999 October 29 (right). North is approximately up. The object markedly brightened between these two exposures.

Figure 2 represents the light curve of GM Sgr. The magnitudes are shown relative to GSC 6848.3882. A monotonous rise of 1.0 mag during 65 d is evident. The object seems to have reached a maximum in late October. Using the estimated R_{C} magnitude 9.05 of the comparison, the observed range of GM Sgr becomes 11.9–12.9 (R_{C}), though the actual minimum can be fainter. From the observed light variability, we have confirmed the Luyten's original classification as a long-period variable.

This work is partly supported by the Grant-in-Aid for Scientific Research (10740095) of the Japanese Ministry of Education, Science, Culture, and Sports (TK).

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REDUCED AMPLITUDE OF V959 OPHIUCHI

ERIC G. HINTZ, MAUREEN L. HINTZ, MICHAEL D. JONER, AND LISA A. JONER

Brigham Young University, Dept. of Physics & Astronomy, Provo, Utah, 84602, USA
e-mail: doctor@shapley.byu.edu, romana@tardis.byu.edu, master@tardis.byu.edu

V959 Ophiuchi ($\alpha_{2000} = 18^{\rm h}11^{\rm m}02\overset{\rm s}{.}9$, $\delta_{2000} = +03°10'36\overset{''}{.}8$, GSC 00435-00926) was first reported as a variable star (S4211 Oph) by Götz (1957). The star was observed on photographic plates over a span of 60 d. From the data Götz classified the star as an RRc variable with a period of $0\overset{\rm d}{.}084857$, an amplitude of $0\overset{\rm m}{.}7$ and an average magnitude of $m_p = 12.7$. Götz (1957) found that V959 Oph had two distinct amplitudes for the maxima of 0.4 and 0.7 mag. From the description in Götz (1957) the star may have shown oscillations similar to those found in stars like SX Phoenicis, or other multiperiodic variable stars. Since that time, the star has received effectively no attention.

Because of its high amplitude and possible similarity to SX Phe, we chose to observe V959 Oph in August 1997. These observations were made with the Burrell Schmidt Telescope (hereafter BST) at Kitt Peak National Observatory, with the S2KA CCD camera through a V filter modeled after Bessell (1990). Four nights of supplemental data were obtained with the David Derrick 16″ Telescope of the Orson Pratt Observatory at Brigham Young University (hereafter DDT). These data were secured with a Pictor 416 XT CCD mounted at the Newtonian focus of the DDT through the same V filter mentioned above. The four nights ranged from 31 May until 19 July 1998. The CCD field for the DDT is shown in Fig. 1.

All frames were reduced using standard IRAF functions. Differential magnitudes were determined using the eight comparison stars and the methods detailed in Hintz et al. (1997). A mean apparent magnitude of $\langle m_V \rangle = 11.4$ was determined for V959 Oph from one night of data on which observations of SA 110 (Landolt 1992) were also secured. This is different from the published photographic magnitude of $m_p = 12.7$, even with a reasonable color correction. We were confident in our identification of V959 Oph from the finder in Götz (1957), but carefully checked all surrounding stars of similar brightness to determine if the star had been mis-identified. However, no other short period variables were found in the region. We concluded that we indeed monitored the correct star.

Using the Period98 package the first term of a Fourier series was fit to all five nights of data. From this we determined a period of $0\overset{\rm d}{.}09880 \pm 0\overset{\rm d}{.}0005$ and an amplitude of 0.0075 ± 0.0010. This is clearly different than the period reported by Götz (1957). From the times of maximum light list in Götz (1957) we used a linear regression to re-calculate the period. A period of $0\overset{\rm d}{.}093042 \pm 0\overset{\rm d}{.}00001$ was found.

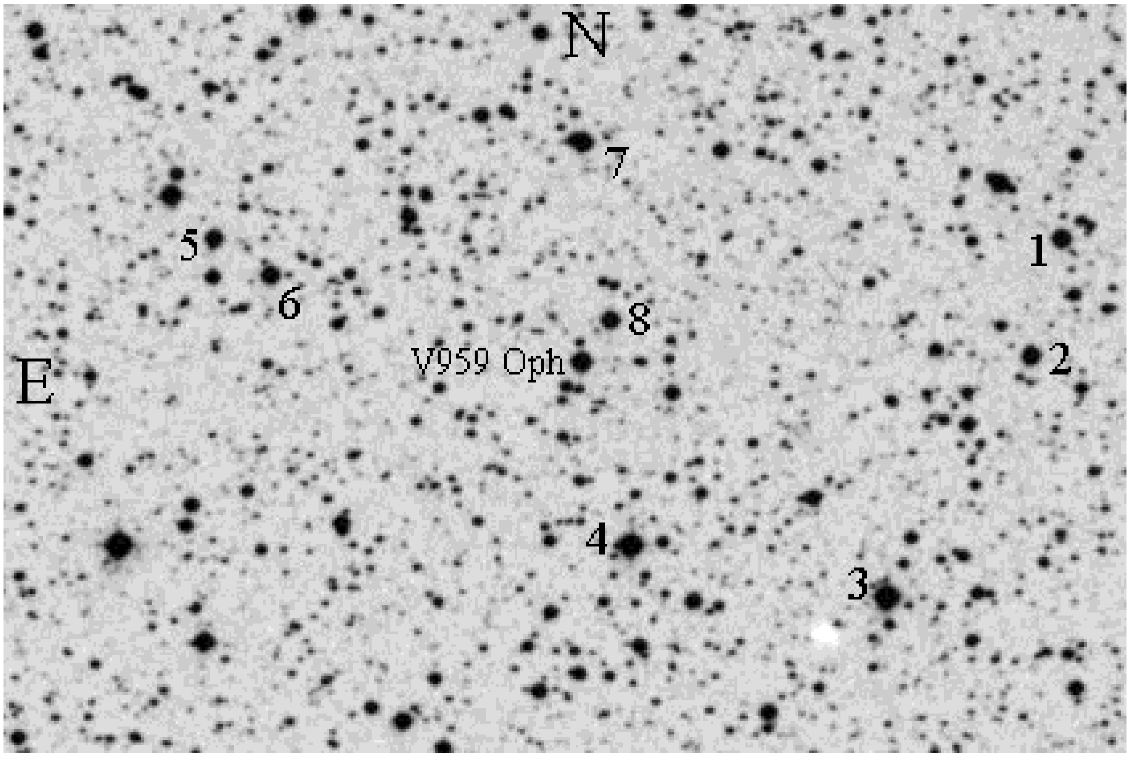

Figure 1. CCD field of V959 Oph with comparison stars labeled. The field of view is $8' \times 12'$.

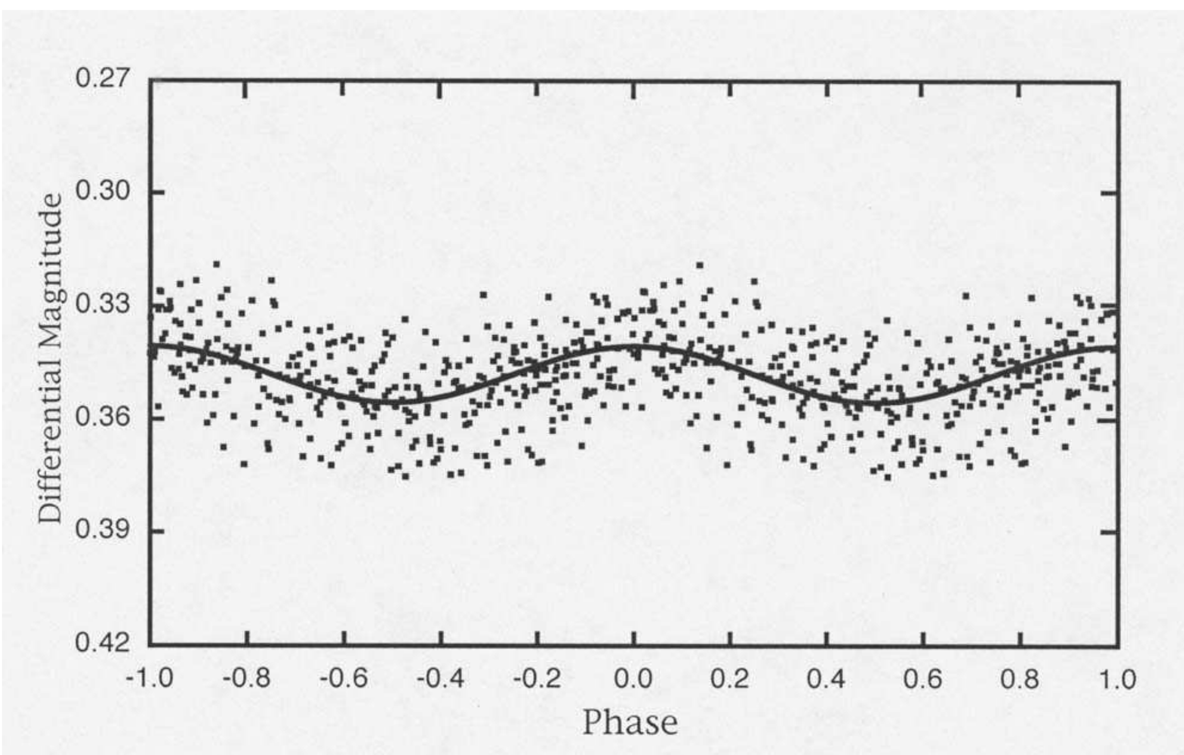

Figure 2. Phased light curve of V959 Ophiuchi. The solid line is the first term of a Fourier fit.

Table 1: New Times of Maximum Light for V959 Ophiuchi

HJD 2400000.0+	Telescope	Detector	Cycle
50665.797	BST	S2KA	0
50964.779	DDT	Pictor 416	3027
50964.880	DDT	Pictor 416	3028
50965.767	DDT	Pictor 416	3037
50985.718	DDT	Pictor 416	3239
51013.773	DDT	Pictor 416	3523

This period is different than both the Götz (1957) value and that given by our Fourier fit. Using the period from the Fourier fit all five nights of new data were phased, as shown in Figure 2. Matching each night's data to the phased curve six times of maximum light were determined. These times are collected in Table 1. From these six times of maximum light a new ephemeris for V959 Oph was determined as given in Eq. 1.

$$\mathrm{HJD}_{\mathrm{max}} = 2450665.7968 + 0.098772(\pm 0.000001) \times E. \tag{1}$$

This agrees with the value from the Fourier fit, but is clearly different than the value from the Götz data. The exact nature of the period change in V959 Oph is unclear due to the lack of available data. However, there has been a change at some point during the last 40 years.

In addition to the period change there was a substantial decrease in the amplitude of V959 Oph. A less dramatic example of a similar effect was seen in V1162 Orionis by Hintz et al. (1998). For comparison with V1162 Ori two pieces of information would be useful, Strömgren indices and the rotational velocity. The Strömgren indices would give V959 Oph's position with respect to the instability strip. The rotational velocity of V959 Oph should be compared to the values for other high amplitude δ Scuti stars. Solano & Fernley (1997) found a rotation velocity for V1162 Ori of 46.4 km s^{-1}. This is the highest measured rotation rate for any high amplitude δ Scuti star. The difference in rotation velocities between high and low amplitude δ Scuti stars has been discussed by Breger (1980), Andreasen (1983), and McNamara (1985). Perhaps the disparity in the relative number of high and low amplitude δ Scuti stars can be traced to the rotational velocity. Perhaps more stars started as high amplitude stars but have become low amplitude stars.

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DISCOVERY OF THE VARIABILITY OF GSC 140.1831, GSC 959.1397 AND GSC 396.1710

C. LLOYD[1], K. BERNHARD[2,5], P. FRANK[3,5], W. MOSCHNER[4,5]

[1] Space Science Department, Rutherford Appleton Laboratory, Chilton, Didcot, Oxon. OX11 0QX, UK, e-mail: cl@astro1.bnsc.rl.ac.uk

[2] Kafkaweg 5, A-4030 Linz, Austria, e-mail: klaus.bernhard@vpn.at

[3] D-84149 Velden, Germany, e-mail: frank.velden@t-online.de

[4] D-57368 Lennestadt, Germany, e-mail: wolfgang.moschner@t-online.de

[5] Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D-12169 Berlin, Germany

Introduction

The new variable stars reported here have been found as part of a programme to discover and classify new variables using CCD observations of selected fields on the edge of the northern Milky Way (eg. Bernhard et al. 1997, Bernhard 1999). In this paper the observations of three new variables resulting from this programme are reported. GSC 140.1831 is an EA binary with a period of 1.14962 days. GSC 959.1397 and GSC 396.1710 are both a-type RR Lyrae variables with periods of 0.64465 and 0.77892 days respectively. These stars have previously been referred to as BeV13, BeV14 and BeV15. The observations were made using a 20-cm Schmidt-Cassegrain telescope and an unfiltered Starlight Xpress SX CCD camera. The CCD camera uses a Sony ICX027B chip which has a very broad response, peaking near 5500 Å, giving approximate V-band magnitudes, depending on the colour of the star. Further details are given by Lloyd & Bernhard (1999). Additional unfiltered observations of GSC 140.1831 have also been obtained with an SBIG ST6 camera on a 32-cm Ritchey-Chrétien telescope (WM)

GSC 140.1831

GSC 140.1831 ($06^{h}18^{m}56\overset{s}{.}2$, $+04^{\circ}09'20''$, J2000, 12.1 mag) has been observed nearly 300 times, mostly during the March 1999. The magnitudes are given relative to GSC 140.1277 (12.1 mag) and the second comparison star used was GSC 140.2015 (12.6 mag). The magnitude difference between the two comparisons stars, 0.542 ± 0.046, is remarkably consistent with the GSC magnitudes. The three sets of observations from the three instruments described above have been brought on to this magnitude scale by applying small shifts to the two less extensive sets. For the out of eclipse observations the shift is well determined, but for the other set, which lies wholly within the secondary eclipse, it

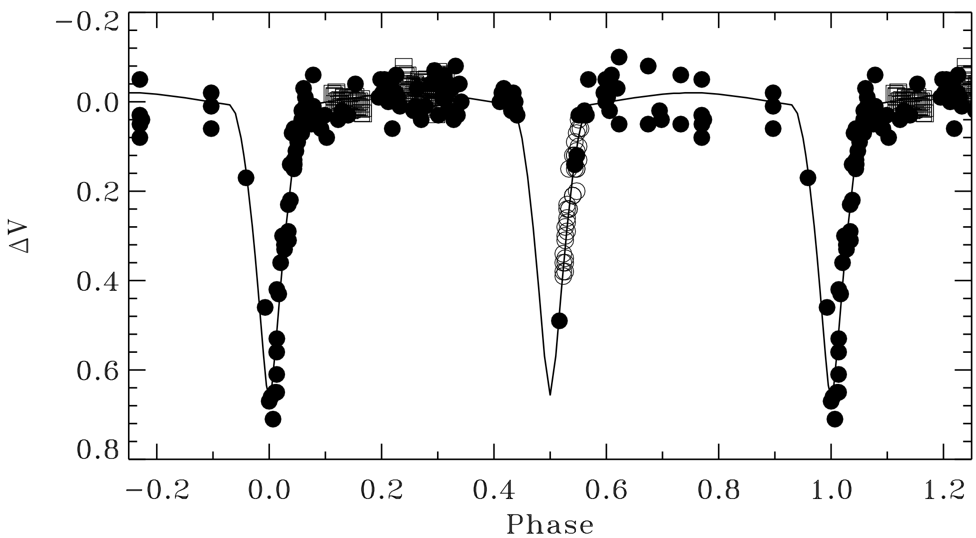

Figure 1. The observed light curve of GSC 140.1831 relative to GSC 140.1277 (12.1 mag) with the three sets of observations indicated thus, filled circles (KB), open circles (PF) and open squares (WM). The light curve solution assuming two similar A-type stars with $T_1 = T_2 = 8000\,\mathrm{K}$, $R_1/a = 0.21$, $R_2/a = 0.20$ and $i = 87.7$ deg.

is less certain. To some extent the shift depends on the period chosen but this has no material effect on the light curve.

From a period analysis of the observations and the times of minimum only one clear period emerges, 0.5748 days. However, for this type of light curve such a period is physically unrealistic so the true period is taken to be twice this value. The observations show GSC 140.1831 to be an eclipsing binary with primary and secondary eclipses of ~ 0.7 and 0.5 mag respectively, although it is clear that the secondary minimum has not been completely covered (see Figure 1). There is no spectroscopic information and the USNO A2.0 magnitudes of $b = 12.7$ and $r = 12.0$ do not provide any real constraint on the system. The ephemeris of primary minimum is

$$\mathrm{JD(I)} = 2451264.27\ (\pm\, 0.02) + 1.14962\ (\pm\, 0.00005) \times E.$$

An attempt has been made to model the system using the LIGHT2 code of Hill et al. (1989). A number of solutions have been made using a wide range of temperatures, and a range of mass ratios around unity. The derived parameters are very insensitive to both temperature and mass ratio, and not surprisingly suggest two stars of equal temperature and equal size. So, with $T_1 = 6000\,\mathrm{K}$ (fixed) and $q = 1.0$ (fixed), $T_2 = 5960 \pm 90\,\mathrm{K}$, $R_1/a = 0.21 \pm 0.04$, $R_2/a = 0.20 \pm 0.03$ and $i = 88 \pm 1$ deg. These values are representative of a range of temperatures. Given the uncertainty in the temperatures of the stars and the lack of observations around one of the minima it is possible that further observations will redefine which is the primary eclipse. From the relative radii it is possible to derive an internally consistent set of the parameters, P, M and R for a pair of late A-type main-sequence stars, giving $M \sim 1.9\,\mathrm{M}_\odot$, $R \sim 1.5\,\mathrm{R}_\odot$ and $T \sim 8000\,\mathrm{K}$. The solution with the stars it this temperature is shown in Figure 1.

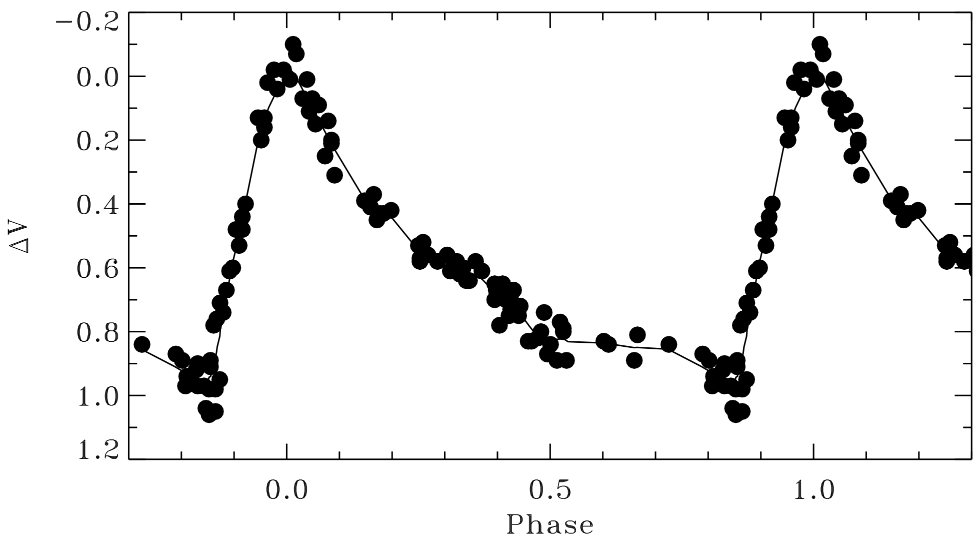

Figure 2. The light curve of GSC 959.1397 folded with a period of 0.64465 days with a high-order harmonic fit superimposed. The magnitudes are given relative to GSC 959.803 (12.6 mag)

GSC 959.1397

GSC 959.1397 ($16^h24^m49\overset{s}{.}7$, $+08°04'15''$, J2000, 12.9 mag) has been observed 109 times mostly in June and July 1999. Initially the observation were quite sparse but when the short-period nature of the variation became clear several runs of approximately 20 observations were made. The magnitudes are given relative to GSC 959.803 (12.6 mag) which proved constant relative to the second comparison star, GSC 959.1049 (12.1 mag). The period analysis suffers from some aliasing problems but ultimately only one possible period emerges. The light curve, plotted in Figure 2, is clearly that of an a-type RR Lyrae and the ephemeris of maximum light is

$$\mathrm{JD(max)} = 2451355.457\ (\pm\ 0.005) + 0.64465\ (\pm\ 0.00012) \times E.$$

The co-ordinates of this star place it well above the galactic plane at $l = 23$ and $b = 36$. Adopting a mean magnitude, $V = 13.2$ and $M_{\rm V} = 0.5$, and assuming $A_{\rm V} = 0.3$ mag kpc^{-1} yields a distance of 2.5 kpc and a height above the galactic plane of 1.4 kpc. Combined with the period this distance places this star firmly in the field halo population.

GSC 396.1710

GSC 396.1710 ($16^h51^m29\overset{s}{.}9$, $+06°22'27''$, J2000, 13.1 mag, USNO A2.0 r: 12.6, b: 13.2) has been observed 159 times, mostly in August 1999. After the initial observations the vast majority were taken in eight long runs. The magnitudes are given relative to GSC 396.2221 (12.5) and GSC 396.1863 (12.5) was used as the second comparison star. The observed magnitude difference of 0.20 mag is consistent with the GSC magnitudes. The periodogram shows one clear period at 0.77892 days with relatively strong one-day aliases, although there is no real confusion. The light curve is unmistakably that of an a-type RR Lyrae variable, with an amplitude of $\sim$ 0.7 mag. The light curve is plotted in Figure 3.

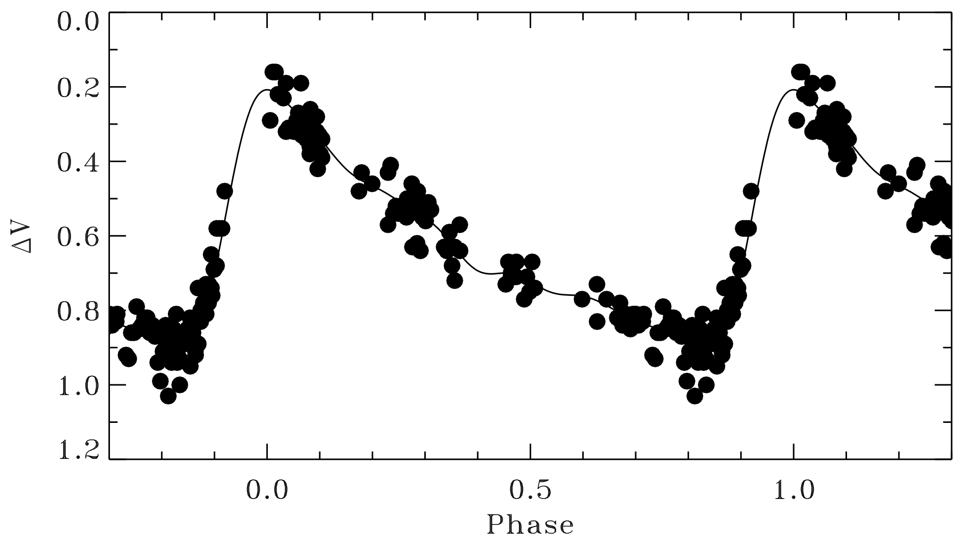

Figure 3. The light curve of GSC 396.1710 folded with a period of 0.77892 days with a high-order harmonic fit superimposed. The magnitudes are given relative to GSC 396.2221 (12.5 mag)

The ephemeris of maximum light is

$$\mathrm{JD(max)} = 2451410.835\ (\pm\ 0.004) + 0.77892\ (\pm\ 0.00009) \times E.$$

The galactic co-ordinates, $l = 24$ and $b = 29$, and mean magnitude, GSC ~ 13.1, of GSC 396.1710 are similar to the other RR Lyrae star reported here, GSC 959.1397, and the same analysis also points to GSC 396.1710 belonging to the field halo population.

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THE VARIABLE PERIOD OF V366 CASSIOPEIAE

BAV MITTEILUNGEN NR. 116

FRANZ AGERER[1], THOMAS BERTHOLD[1], PETER KROLL[1,2]

[1] Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D–12169 Berlin, Germany, E-mail: agerer.zweik@t-online.de, berthold.mtl@t-online.de

[2] Sternwarte Sonneberg, Sternwartestr. 32, D–96515 Sonneberg, Germany, E-mail: pk@stw.tu-ilmenau.de

V366 Cas (spectr. G1) = GSC 3681.494 = CSV 122 = S 3875 was discovered by Hoffmeister (1949). He announced it as a short periodic variable star between $10^{m}_{.}5$ and $11^{m}_{.}0$ (pg.). Further investigations on sky patrol plates were done by Perova (1957). She found the star to be of W UMa type and gave first elements including a period of $0^{d}_{.}7292714$. These elements could be confirmed in an early paper by Berthold (1978). Using the minima given by Perova and 17 new ones using sky patrol plates of Hartha Observatory, the following refined ephemeris has been derived:

$$\text{Min I} = \text{HJD } 2435075.461 + 0^{d}_{.}72927425 \times \text{E}. \tag{1}$$

With these elements V366 Cas is listed in the fourth edition of the GCVS (Kholopov et al., 1985).

F.A. recently made CCD photometry with a SBIG ST6 camera without filters attached to a 20-cm SC–telescope, from which 14 minima times using the Kwee–van Woerden algorithm (Kwee, van Woerden 1956) could be derived. We also obtained a CCD–based light-curve given in Fig. 2. Since the amplitudes in Min I and Min II differ less than the scattering from night to night, we were not able to unambiguously distinct between the respective minima. We therefore left the definition of the primary minimum (Min I) unchanged.

In order to check the long–term behaviour of the period and to bridge the gap between the Hartha plates and the CCD measurements, additional observations on 279 sky patrol plates of Sonneberg Observatory were performed by T.B. They cover a period of time between J.D. 2441039 and 2450370. In order to obtain more accurate minimum times, we calculated mean lightcurves of 5 consecutive subsections using ephemeris (1) and thus, derived times of normal minima.

As comparison stars the ones given in the paper of Perova were used. However, we derived new photographic magnitudes based on the Harvard–Groningen SA8:

Perova	GSC	mpg	Perova	GSC	mpg
a	3681.374	11.40	b	3681.1033	12.44
c	3681.493	12.64	d	3681.988	12.98

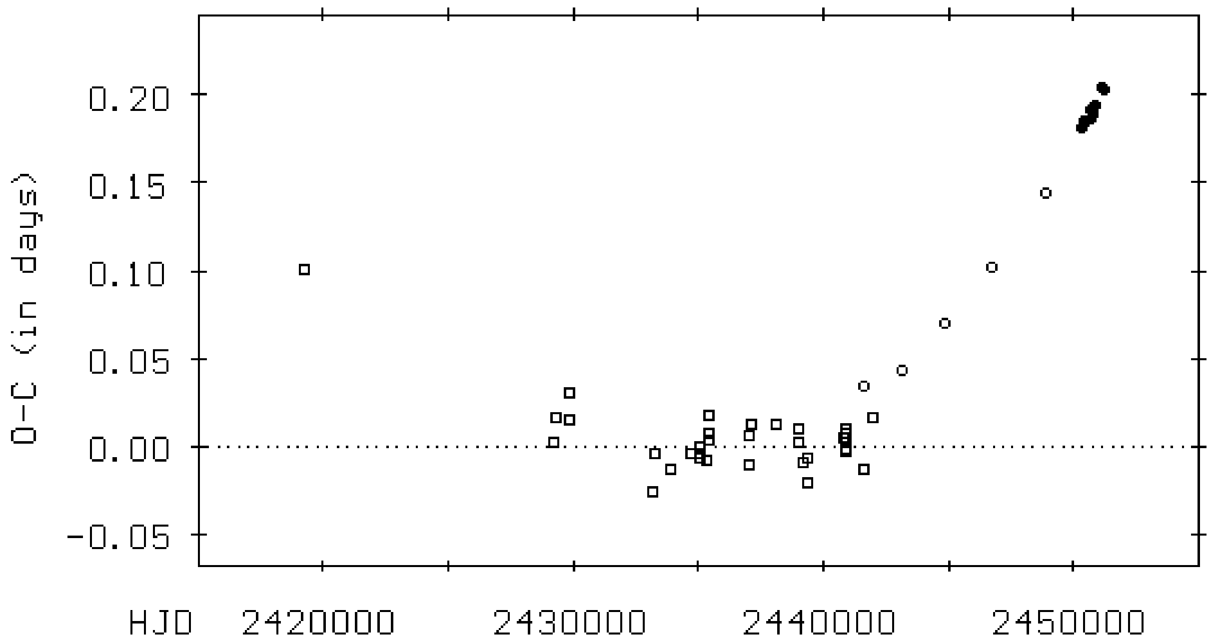

Figure 1. $O - C$ diagram of all available minima according to ephemeris (1). Symbols are identified as follows: □ : Photographic minima, ∘ : Photographic normal minima of Berthold (this paper) and • : CCD minima.

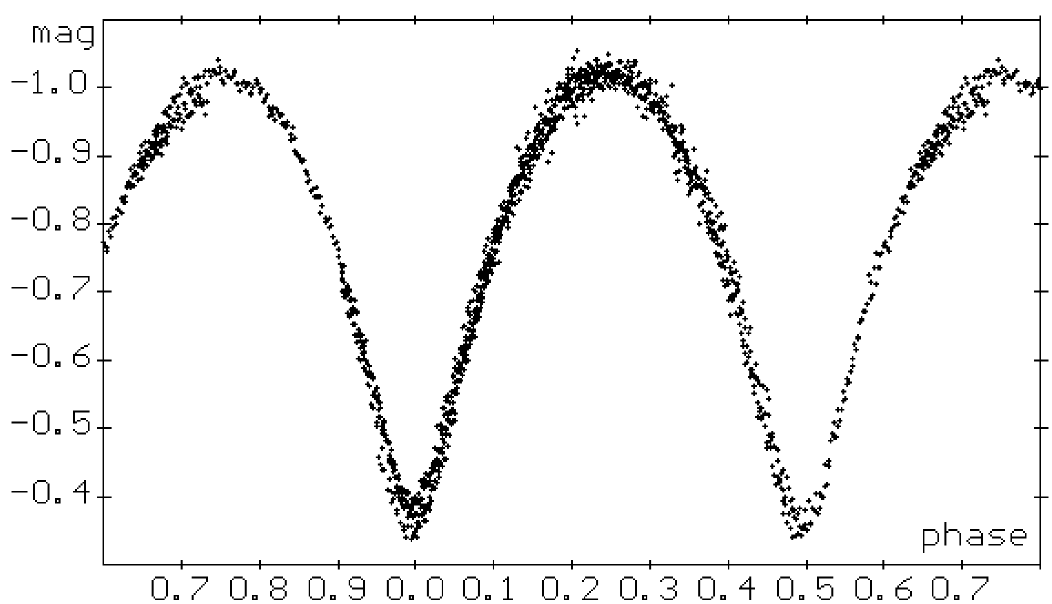

Figure 2. CCD light curve of V366 Cas, according to elements (3).

Table 1: Times of minima for V366 Cas, epochs and residuals computed according to the ephemeris (2) and (3), respectively.

JD hel. 2400000+	W	T*	Epoch$_2$	$O-C_2$	Ref.	JD hel. 2400000+	W	T*	Epoch$_3$	$O-C_3$	Ref.
19255.415	1	P	−21693.0	+0.089	[1]	41567.495	2	F	−11976.0	+0.024	[3]
29166.519	1	P	−8102.5	−0.004	[1]	41598.442	1	P	−11934.5	−0.024	[2]
29287.228	1	P	−7937.0	+0.011	[1]	41973.318	1	P	−11420.5	−0.002	[2]
29848.419	1	P	−7167.5	+0.025	[1]	43138.360	2	F	−9822.0	+0.001	[3]
29879.397	1	P	−7125.0	+0.009	[1]	44847.442	2	F	−7479.5	−0.005	[3]
33183.333	1	P	−2594.5	−0.030	[1]	46706.393	2	F	−4930.5	−0.010	[3]
33209.244	1	P	−2559.0	−0.008	[1]	48888.424	2	F	−1938.5	−0.010	[3]
33856.466	1	P	−1671.5	−0.017	[1]	50301.4298	10	E	0.0	−0.0013	[4]
34681.285	1	P	−540.5	−0.006	[1]	50379.4651	10	E	107.0	+0.0001	[4]
35075.455	1	P	0.0	−0.009	[1]	50380.5592	10	E	108.5	+0.0003	[4]
35076.190	1	P	1.0	−0.003	[1]	50423.2229	10	E	167.0	+0.0006	[4]
35077.280	1	P	2.5	−0.007	[1]	50716.3925	10	E	569.0	−0.0038	[4]
35363.517	1	P	395.0	−0.010	[1]	50718.5845	10	E	572.0	+0.0003	[4]
35394.522	1	P	437.5	+0.001	[1]	50728.4295	10	E	585.5	−0.0001	[4]
35401.455	1	P	447.0	+0.006	[1]	50739.3669	10	E	600.5	−0.0020	[4]
35431.365	1	P	488.0	+0.015	[1]	50754.3192	10	E	621.0	−0.0001	[4]
37016.431	1	P	2661.5	+0.005	[2]	50755.4130	10	E	622.5	−0.0002	[4]
37044.492	1	P	2700.0	−0.011	[2]	50756.5069	10	E	624.0	−0.0003	[4]
37082.437	1	P	2752.0	+0.011	[2]	50863.3481	10	E	770.5	+0.0002	[5]
38142.437	1	P	4205.5	+0.012	[2]	51100.373	5	E:	1095.5	+0.006	[4]
39024.484	1	P	5415.0	+0.002	[2]	51177.3098	10	E	1201.0	+0.0031	[4]
39035.430	1	P	5430.0	+0.009	[2]	51185.3316	10	E	1212.0	+0.0028	[4]
39146.261	1	P	5582.0	−0.010	[2]						
39381.441	1	P	5904.5	−0.020	[2]						
39389.476	1	P	5915.5	−0.007	[2]						
40825.429	1	P	7884.5	+0.005	[2]						
40851.312	1	P	7920.0	−0.001	[2]						
40853.503	1	P	7923.0	+0.002	[2]						
40856.426	1	P	7927.0	+0.008	[2]						
40863.357	1	P	7936.5	+0.011	[2]						
40924.238	1	P	8020.0	−0.002	[2]						

* P denotes photographic minima, F photographic normal minima and E CCD observed minima. Those marked with ':' got reduced weight.
[1]: Perova (1957), [2]: Berthold (1978), [3]: Berthold: this paper, [4]: Agerer: this paper, [5]: Diethelm (1998)

As it is clearly to be seen, the period of V366 Cas is significantly changing. For describing such a behaviour, two different approaches can be made: (1) we assume the period was constant during certain periods of time with distinct period jumps in between, (2) we apply a continuously increasing changing period with a quadratic $O-C$ fit.

Assuming two consecutive constant periods, the following set of linear elements can be derived:

From JD 2427500 (approx.) to JD 2441000 (approx.):

$$\begin{array}{c}\text{Min I} = \text{HJD } 2435075.464 + 0\overset{\text{d}}{.}72927385 \times E. \\ \pm 2 \qquad\qquad \pm 42\end{array} \tag{2}$$

From JD 2441000 (approx.) to JD 2451185 (last observed minimum):

$$\begin{array}{c}\text{Min I} = \text{HJD } 2450301.4311 + 0\overset{\text{d}}{.}72928857 \times E. \\ \pm 3 \qquad\qquad \pm 13\end{array} \tag{3}$$

If Perova's first moment of minimum is correct, it is obvious that a further change has occurred sometimes in the first third of this century.

Alternatively – and the $O-C$ diagram suggests this strongly – a weighted quadratic least squares fit is also possible to achieve that yields the following elements:

$$\text{Min I} = \text{HJD } \underset{\pm 1}{2435075.449} + \underset{\pm 15}{0\overset{\text{d}}{.}72927554} \times E. \qquad (4)$$

Based on the quadratic elements we can derive the rate of change of the period as $dP \sim 7\overset{\text{d}}{.}6 \times 10^{-10}$ per orbital revolution. Under the assumption that this change is caused by mass exchange between the stars, the mass transfer proceeds from the less massive component to the more massive component since the period increases. If we knew the stellar masses we were able to derive the mass transfer rate $|\delta m|$ using the well-known relation (Kopal, 1978)

$$\frac{dP}{P} = 3\left(1 - \frac{m_1}{m_2}\right)\frac{|\delta m_1|}{m_1}, \qquad (5)$$

where m_1 (more massive component) and m_2 represent the stellar masses. Although the CCD light-curve (Fig. 2) clearly indicates a close binary system and that one or both stars must be heavily distorted, an estimate of the mass ratio is hard to achieve. Provided the stars are similar and, thus, assuming a mass ratio in the order of 0.9 and (roughly) a solar mass for both components (spectrum G1), we obtain a mass transfer rate of $1.75 \times 10^{-6} M_{\odot}$/yr.

The improved electronic version of the GCVS (Kholopov et al. 1998) lists only 4 other objects of similar periods (0.65...0.85 days) and spectra between F8 and G5 showing W-UMa-like lightcurves: VY Cnc, UZ CMi, RS Col, and ER Vul. Although described as EW/DW, this classification is erroneous in at least one case (RS Col). Insufficiently studied until today, UZ CMi might be also a contact binary (Giuricin, Mardirossian and Mezzetti 1983). ER Vul, on the contrary, is a short-period RS CVn-type star. This makes V 366 Cas an interesting case to which more attention should be paid. We therefore suggest time-resolved spectroscopy and multicolor CCD photometry of this object.

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PRECISE COORDINATES OF VARIABLE STARS (8)

T. KATO

Dept. of Astronomy, Faculty of Science, Kyoto University, Kyoto 606-8502 Japan
e-mail: tkato@kusastro.kyoto-u.ac.jp

This report contains 264 accurate J2000.0 positions for variable stars discovered by Hoffmeister (1965), as a supplement to Kato (1999). The variables stars were identified against computer plots of GSC and USNO A1.0 catalogs. The color information and IRAS PSC identification were also examined in identifying red variables. The table has been sorted in the increasing order of J2000.0 right ascensions. The source of identification in column 'Cat.': G = GSC 1.1, GM = average of GSC 1.1 multiple entries, U = USNO A1.0.

NSV 05651, NSV 05924, NSV 09577, NSV 09578, NSV 10089, NSV 10177, NSV 10222, NSV 10288, NSV 10684, NSV10765, NSV 11501, V1109 Aql: identifications are somewhat ambiguous due to the chart distortion or crowding. The most likely candidate has been selected.

NSV 06163 and NSV 06166 (S 9017 and S 9018): charts are interchanged.

NSV 10321 and NSV 10325: identity with NSV 10317 and NSV 10327, respectively, should be checked.

Two identifications of NSV stars with GCVS variables are found: NSV 06274 = GG Mus and NSV 14144 = V384 Lac.

Detailed information of identifications, other catalog identifications are available from the VSNET archive (vsnet-id 103–110, http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-id/msg00103.html etc.).

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Kato, T., 1999, *IBVS*, No. 4762

Table 1: Precise coordinates of variable stars

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
MW Per	$04^h05^m57^s.66$	$+50°05'28''.5$	G	NSV 06820	$14^h52^m04^s.76$	$-72°58'12''.5$	U
NSV 01586	04 24 17.95	+47 52 13.0	U	NSV 06826	14 52 39.73	−71 04 26.5	U
NSV 03510	07 17 23.11	−11 53 23.8	G	NSV 06851	14 55 58.22	−65 55 52.1	U
NSV 03663	07 36 47.50	−11 52 32.4	G	NSV 06863	14 59 37.81	−72 45 54.9	G
NSV 05275	11 37 38.94	−72 11 10.1	GM	NSV 06865	14 59 43.80	−72 16 48.9	U
NSV 05300	11 42 29.60	−74 58 46.8	GM	NSV 06871	15 00 55.09	−73 29 49.8	U
NSV 05343	11 48 19.23	−68 38 50.8	GM	NSV 06893	15 03 56.62	−64 13 42.4	U
NSV 05350	11 48 56.66	−69 19 07.7	G	NSV 06891	15 04 04.05	−69 53 23.9	G
NSV 05361	11 50 40.50	−67 49 56.0	U	NSV 06923	15 07 11.54	−65 09 37.2	G
NSV 05387	11 55 15.38	−70 05 18.2	U	NSV 06920	15 07 53.15	−72 17 38.5	U
NSV 05390	11 55 37.66	−76 53 59.2	U	NSV 06930	15 08 12.43	−69 50 34.0	U
NSV 05413	12 00 09.07	−73 30 38.3	U	NSV 06957	15 10 28.11	−63 54 22.2	U
NSV 05419	12 00 53.88	−71 54 37.7	U	NSV 06985	15 15 40.92	−71 41 16.9	G
NSV 05443	12 03 52.26	−69 30 54.4	G	NSV 06994	15 15 55.17	−64 52 50.7	U
NSV 05533	12 18 22.52	−70 57 04.2	U	NSV 06997	15 17 16.74	−71 26 07.3	U
NSV 05560	12 20 52.00	−67 57 09.5	U	NSV 07014	15 19 30.09	−64 13 25.7	U
NSV 05577	12 22 44.22	−70 28 26.1	G	NSV 07041	15 24 15.79	−65 48 28.7	U
NSV 05648	12 29 37.02	−75 04 31.2	GM	NSV 07049	15 25 33.27	−68 35 54.0	U
NSV 05651	12 29 53.12	−68 16 43.0	U	NSV 07097	15 30 55.37	−67 07 54.5	GM
NSV 05779	12 37 13.41	−67 16 22.0	GM	NSV 07112	15 31 51.73	−63 35 05.4	U
NSV 05838	12 40 36.03	−70 08 46.5	GM	NSV 07122	15 33 49.15	−64 12 46.0	U
NSV 05857	12 42 02.66	−70 34 26.6	U	NSV 07136	15 35 28.26	−64 37 48.7	U
NSV 05897	12 43 56.87	−67 23 55.1	G	NSV 07159	15 38 55.90	−65 32 44.3	U
NSV 05924	12 45 40.37	−47 40 04.7	U	NSV 07171	15 40 55.93	−68 26 11.8	U
NSV 05932	12 46 38.47	−69 12 34.3	U	NSV 07186	15 42 49.35	−71 43 03.2	U
NSV 05951	12 48 41.82	−68 29 55.8	U	NSV 07214	15 45 44.93	−70 50 24.8	U
NSV 06033	12 57 43.50	−67 35 08.6	U	NSV 07229	15 47 38.48	−70 53 00.0	U
NSV 06035	12 58 22.91	−71 27 37.6	U	NSV 07237	15 47 50.76	−64 27 35.2	UM
NSV 06076	13 04 05.39	−70 34 59.7	U	NSV 07245	15 48 19.88	−64 06 27.3	U
NSV 06099	13 07 49.54	−70 48 39.2	U	NSV 07289	15 52 26.28	−67 02 39.4	U
NSV 06119	13 11 19.92	−73 37 22.6	U	NSV 07317	15 56 11.17	−67 58 45.8	U
NSV 06124	13 12 25.01	−73 43 36.8	U	NSV 07324	15 56 26.80	−64 59 44.4	U
NSV 06130	13 12 35.09	−72 00 31.2	U	NSV 07367	16 00 30.15	−69 13 55.9	U
NSV 06163	13 17 08.33	−68 58 05.7	U	NSV 07381	16 02 27.80	−67 29 10.1	GM
NSV 06166	13 17 48.60	−69 33 12.6	U	NSV 07390	16 04 12.07	−69 10 01.1	G
NSV 06251	13 28 51.68	−75 37 18.3	G	NSV 08177	17 05 10.68	+22 30 28.7	G
NSV 06274	13 30 44.81	−72 51 03.5	U	NSV 08744	17 27 31.68	+11 32 13.3	U
NSV 06665	14 27 55.49	−72 52 30.5	G	NSV 09121	17 32 15.06	+11 49 45.1	G
NSV 06709	14 36 19.67	−71 33 22.1	U	NSV 09442	17 39 04.57	+31 34 52.6	UM
NSV 06744	14 39 55.59	−65 28 39.0	U	NSV 09545	17 41 59.66	+14 26 10.3	U
NSV 06760	14 42 23.19	−71 45 56.5	U	NSV 09521	17 42 10.00	−44 42 55.1	U
NSV 06722	14 43 43.63	−66 48 43.7	U	NSV 09514	17 42 13.04	−49 02 22.3	U
NSV 06801	14 48 55.97	−70 29 01.9	U	NSV 09523	17 42 31.72	−49 55 41.3	U
NSV 06814	14 51 09.43	−73 04 57.0	GM	NSV 09525	17 42 47.55	−51 52 14.0	U

Table 1: cont.

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
NSV 09576	$17^h42^m52^s.84$	$+14°18'04''.8$	G	NSV 09842	$17^h54^m06^s.36$	$+25°35'18''.8$	U
V663 Her	17 43 08.75	+29 31 41.6	U	NSV 09811	17 54 15.23	−46 18 48.6	U
NSV 09541	17 43 13.60	−47 21 12.1	GM	NSV 09810	17 54 21.41	−48 34 17.5	U
NSV 09533	17 43 18.16	−53 57 27.5	U	NSV 09826	17 55 10.23	−48 00 57.7	U
NSV 09596	17 43 38.48	+13 55 18.4	G	NSV 09829	17 55 32.59	−49 45 50.8	U
NSV 09552	17 43 48.16	−47 18 19.0	U	NSV 09848	17 56 12.27	−48 31 13.4	U
NSV 09554	17 43 52.05	−48 29 58.8	U	NSV 09849	17 56 40.44	−54 57 53.3	U
NSV 09553	17 43 52.27	−49 05 33.1	U	NSV 09852	17 56 40.89	−53 38 36.1	U
NSV 09556	17 44 02.44	−49 22 11.7	U	NSV 09862	17 56 57.86	−47 39 32.7	U
NSV 09560	17 44 05.45	−50 02 42.1	U	NSV 09880	17 57 38.14	−45 57 52.3	U
NSV 09564	17 44 11.97	−47 43 59.3	U	NSV 09879	17 57 49.43	−49 45 59.6	U
NSV 09577	17 44 26.33	−47 43 00.2	U	NSV 09900	17 58 48.67	−45 43 18.4	UM
NSV 09578	17 44 31.39	−48 19 09.8	U	NSV 09906	17 58 59.06	−46 47 08.0	G
NSV 09575	17 44 41.43	−53 38 56.1	U	NSV 09912	17 59 06.34	−45 54 14.7	U
NSV 09611	17 45 37.76	−47 59 16.3	U	NSV 09925	17 59 24.55	−45 54 54.7	U
NSV 09616	17 45 44.58	−49 18 18.0	U	NSV 09924	17 59 28.00	−47 43 22.0	U
NSV 09674	17 46 25.42	+34 08 45.4	G	NSV 09932	17 59 41.01	−45 43 55.8	U
NSV 09647	17 46 54.14	−46 41 09.1	U	NSV 09936	18 00 21.11	−53 49 05.8	U
NSV 09636	17 46 55.28	−51 55 07.3	U	NSV 09953	18 01 10.13	−53 23 29.9	U
NSV 09650	17 47 03.29	−46 33 48.5	U	NSV 09960	18 01 31.85	−53 10 00.8	U
NSV 09686	17 47 06.77	+14 44 12.5	G	NSV 09972	18 01 33.40	−44 48 43.5	U
NSV 09649	17 47 16.56	−51 41 28.0	U	NSV 09969	18 01 39.69	−46 29 32.5	U
NSV 09651	17 47 19.73	−51 28 51.0	U	NSV 09978	18 02 10.81	−47 16 44.4	U
NSV 09652	17 47 23.20	−51 54 10.3	U	NSV 09998	18 02 59.85	−54 03 35.4	U
NSV 09662	17 47 43.82	−51 36 46.7	GM	NSV 10021	18 03 15.72	−47 27 03.0	U
NSV 09666	17 47 52.44	−49 19 36.4	U	NSV 10023	18 03 17.94	−47 26 29.8	U
NSV 09715	17 47 54.33	+29 23 42.3	G	NSV 10036	18 03 27.47	−47 13 02.3	U
NSV 09680	17 48 31.57	−49 52 59.8	U	NSV 10049	18 03 43.00	−47 43 03.1	U
NSV 09685	17 48 35.22	−46 00 35.2	U	NSV 10089	18 04 28.48	−45 44 24.4	U
NSV 09739	17 49 03.52	+29 50 31.6	U	NSV 10091	18 04 32.65	−46 12 18.9	U
NSV 09695	17 49 17.16	−51 20 35.6	U	NSV 10105	18 04 47.58	−45 00 35.5	U
NSV 09701	17 49 22.64	−46 32 27.6	U	NSV 10124	18 05 07.68	−46 49 30.4	U
NSV 09750	17 49 38.72	+30 10 02.0	U	NSV 10155	18 05 41.64	−46 49 34.3	U
NSV 09718	17 50 11.97	−48 57 09.3	U	NSV 10222	18 06 25.70	+32 37 22.0	U
NSV 09746	17 51 15.00	−46 57 58.5	U	NSV 10177	18 06 38.19	−45 41 40.2	U
NSV 09761	17 51 56.68	−47 47 23.0	U	NSV 10175	18 06 51.44	−53 12 40.5	U
NSV 09758	17 52 04.03	−51 55 30.4	U	NSV 10197	18 07 17.92	−46 48 42.8	GM
NSV 09763	17 52 08.28	−47 11 43.8	U	NSV 10212	18 07 54.47	−47 57 53.9	U
NSV 09771	17 52 31.78	−46 25 36.1	U	NSV 10211	18 07 56.41	−45 28 17.2	U
NSV 09770	17 52 42.43	−49 25 30.2	U	NSV 10229	18 08 34.22	−45 59 06.3	U
NSV 09779	17 52 59.82	−46 21 41.6	U	NSV 10230	18 08 51.15	−51 58 27.5	U
NSV 09782	17 53 02.31	−44 57 25.3	U	NSV 10259	18 09 37.65	−44 31 25.0	U
NSV 09784	17 53 08.75	−46 48 21.4	U	NSV 10273	18 10 21.40	−49 08 20.4	U
NSV 09794	17 53 45.12	−48 51 59.7	G	NSV 10288	18 10 49.56	−44 45 04.2	U

Table 1: cont.

Desig.	R.A.	Decl.	Cat.	Desig.	R.A.	Decl.	Cat.
NSV 10323	$18^{h}11^{m}45^{s}.59$	$-45^{\circ}56'59''.6$	U	NSV 11664	$19^{h}01^{m}33^{s}.68$	$+14^{\circ}56'09''.5$	U
NSV 10325	18 11 50.29	−45 49 03.3	G	NSV 11687	19 02 49.44	+16 21 34.8	U
NSV 10321	18 11 50.33	−48 28 40.9	U	NSV 11694	19 03 27.01	+13 27 01.0	U
NSV 10331	18 12 08.68	−47 40 12.3	U	NSV 11700	19 03 51.50	+14 33 41.7	U
NSV 10332	18 12 10.27	−46 20 21.8	U	NSV 11701	19 03 56.68	+14 12 24.3	G
NSV 10369	18 12 10.85	+30 55 13.3	G	NSV 11704	19 03 58.85	+16 19 31.5	U
NSV 10338	18 12 31.96	−46 12 27.5	U	NSV 11705	19 04 17.79	+14 07 02.6	U
NSV 10350	18 13 04.25	−47 54 17.9	U	NSV 11727	19 05 36.26	+14 07 54.1	U
NSV 10354	18 13 12.68	−45 26 07.9	G	V1109 Aql	19 05 39.15	+14 12 43.4	U
NSV 10355	18 13 22.70	−48 20 59.9	U	NSV 13156	20 34 28.19	+24 46 56.3	U
NSV 10373	18 14 03.11	−46 22 05.6	U	NSV 13194	20 38 19.26	+24 35 23.0	U
NSV 10383	18 14 52.84	−54 17 34.5	U	LP Vul	20 39 04.91	+24 05 10.7	U
NSV 10440	18 16 33.92	−49 28 24.1	U	NSV 13218	20 40 09.15	+25 03 29.7	U
NSV 10441	18 16 34.94	−49 31 40.8	U	NSV 13221	20 40 35.77	+23 58 05.4	U
NSV 10465	18 17 13.39	−45 54 24.8	U	NSV 13252	20 42 58.01	+25 16 25.9	U
NGC6584 V8	18 18 55.52	−52 13 34.9	U	V1524 Cyg	20 43 15.20	+34 44 54.5	U
NGC6584 V25	18 18 56.82	−52 11 12.3	U	NSV 13268	20 44 28.88	+23 05 04.4	U
NGC6584 V7	18 19 01.21	−52 11 54.8	U	NSV 13279	20 44 55.07	+33 27 57.3	U
NSV 10508	18 19 04.61	−46 39 28.0	U	NSV 13287	20 46 29.61	+32 34 47.6	U
NSV 10568	18 19 39.57	−46 46 49.4	U	NSV 13306	20 47 44.17	+33 48 39.5	U
NSV 10583	18 19 51.73	−47 41 06.1	U	NSV 13338	20 49 39.78	+35 09 55.2	U
NSV 10621	18 20 33.09	−45 21 42.4	U	NSV 13362	20 51 29.85	+33 50 08.2	U
NSV 10654	18 21 35.56	−46 22 10.6	U	NSV 13374	20 51 54.40	+34 04 17.1	UM
NSV 10684	18 22 44.58	−48 07 19.0	U	NSV 13371	20 51 57.75	+33 52 31.9	UM
NSV 10702	18 23 30.33	−47 54 39.2	GM	NSV 13385	20 53 15.34	+32 26 32.4	U
NSV 10708	18 23 39.38	−45 53 53.3	U	NSV 13547	21 06 57.58	+39 12 21.0	U
NSV 10735	18 25 18.24	−51 34 18.9	U	NSV 13550	21 06 59.36	+37 48 01.8	U
NSV 10765	18 26 27.61	−49 00 00.0	U	NSV 13555	21 07 54.84	+38 49 29.5	U
NSV 10811	18 28 02.95	−46 54 46.7	U	V1229 Cyg	21 09 38.00	+38 12 45.3	G
NSV 10813	18 28 06.02	−47 06 11.8	U	NSV 13589	21 11 11.21	+37 52 18.3	G
NSV 10840	18 28 51.30	−46 11 49.0	U	NSV 13591	21 11 24.57	+37 35 03.6	U
NSV 10855	18 29 32.01	−51 10 11.4	U	NSV 13607	21 13 08.26	+38 40 00.5	U
NSV 10885	18 30 19.06	−46 26 57.2	U	NSV 13625	21 15 37.22	+38 02 27.2	U
NSV 10887	18 30 25.75	−46 56 10.7	U	NSV 13641	21 17 26.87	+36 54 52.8	U
NSV 10955	18 32 35.66	−48 32 59.2	U	NSV 13652	21 18 39.34	+39 08 43.3	U
NSV 10965	18 32 44.55	−48 42 00.0	U	NSV 13659	21 19 18.14	+37 59 22.1	U
NSV 11501	18 54 00.72	+16 11 47.5	U	NSV 13661	21 19 25.38	+39 14 17.6	U
NSV 11537	18 55 18.59	+14 18 46.1	G	NSV 13989	21 59 00.78	+44 43 49.3	G
NSV 11550	18 55 34.79	+14 55 32.2	U	NSV 14048	22 08 56.39	+49 11 07.4	U
NSV 11587	18 57 19.12	+14 47 38.5	U	NSV 14131	22 21 00.68	+48 26 00.8	U
NSV 11595	18 57 47.32	+14 26 42.8	U	V384 Lac	22 23 28.93	+47 44 32.2	U
S 9034	18 58 13.38	+15 06 22.1	U	NSV 14161	22 26 50.44	+44 41 12.6	U
NSV 11629	18 59 53.36	+15 11 56.0	U	NSV 14220	22 34 30.67	+44 16 35.1	U
NSV 11653	19 00 59.65	+15 18 28.1	U	NSV 14606	23 32 39.01	+63 04 09.8	G

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PHOTOMETRY OF THE ECLIPSING BINARY STAR GSC 0008_324 = 1RXS J001309+053550

R.M. ROBB[1], J. WAGG, A. BERNDSEN, AND L. DESROCHES

[1] Guest User, Canadian Astronomy Data Centre, which is operated by the Herzberg Institute of Astrophysics, National Research Council of Canada

Climenhaga Observatory, Dept. of Physics and Astronomy, University of Victoria, Victoria, BC, Canada, V8W 3P6, e-mail: robb@uvic.ca

The star GSC 0008_324 (Jenkner et al., 1990) was found to have Ca H&K emission in a survey by Beers et al. (1994). Also called 1RXS J001309+053550, it was found to have significant X-Ray emission in a survey by the ROSAT satellite (Bade et al., 1998). In a survey of high proper motion stars it was classified as a K4-5 star by Stephenson (1986). Robertson and Hamilton (1987) measured $V = 10.59$, $B - V = 1.20$ and $V - I = 1.43$.

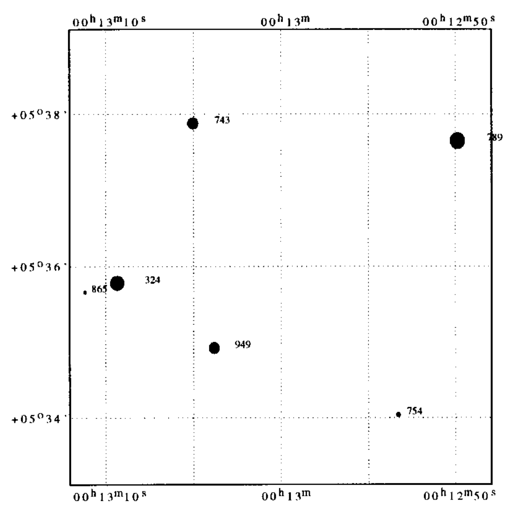

Figure 1. Finder chart labeled with the GSC numbers.

Plotted in Figure 1 is the field of stars observed with the automated 0.5-m telescope and reduced in a fashion identical to that described in Robb et al. (1997). Tabulated in Table 1 are the star's identification numbers, coordinates (J2000) and magnitudes from the Hubble Space Telescope Guide Star Catalog (GSC) (Jenkner et al., 1990). Our differential ΔR magnitudes are calculated in the sense of the star minus GSC 0008_789. 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

Table 1: Stars observed in the field of GSC 0008_324

GSC No.	R.A. J2000	Dec. J2000	GSC Mag.	ΔR Mag.	Std Dev Between	Std Dev Within
0008_324	$00^h13^m09^s$	$+05°35'47''$	10.3	0.913	0.019	0.067
0008_789	$00^h12^m50^s$	$+05°37'39''$	9.9	—	—	—
0008_743	$00^h13^m05^s$	$+05°37'53''$	11.4	1.872	0.007	0.005
0008_949	$00^h13^m04^s$	$+05°34'56''$	11.6	2.303	0.012	0.007
0008_754	$00^h12^m53^s$	$+05°34'02''$	13.8	4.789	0.005	0.024
0008_865	$00^h13^m11^s$	$+05°35'40''$	14.2	5.179	0.018	0.034

"Std Dev Between" in Table 1. Brightness variations during a night were measured by the standard deviation of the differential magnitudes during a night. The best night is tabulated in Table 1 as "Std Dev Within". The star GSC 0008_324 had obvious variations during a night and is thus a new eclipsing binary star.

There is no ambiguity in the determination of the orbital period of GSC 0008_324 since three of the nights included more than one cycle. Using data points within $0^d.02$ of the minimum, and the method of Kwee and van Woerden (1956), the heliocentric Julian Dates of minimum were found and are tabulated in Table 2. On some nights observations were made in more than one color and the separate times of minima are indicated.

Table 2: Times of Minimum (− 2451400) of GSC 0008_324

JD	JD	JD	JD	JD
51.8770 R	54.9620 R	55.8858 I	60.9756 I	61.9009 R
53.8792 R	55.7301 I	55.8883 V	60.9758 B	74.7081 R
54.8043 R	55.7302 V	60.8232 I	61.7499 R	

A fit to these times gives the ephemeris:

$$\text{HJD of Minima} = 2451451^d.7204(7) + 0^d.30855(3) \times E.$$

where the uncertainties in the final digit are given in brackets and the mean square error of the fit is $0^d.0016$.

The differential (GSC 0008_324 − GSC 0008_789) R magnitudes phased at this period are plotted in Figure 2 with different symbols for each of the nights. The asymmetry in the maxima is indicative of star spots, distributed asymmetrically over the surface of the star(s).

CCD frames of the field were obtained with B, V and I_C filters to ascertain the temperature and brightness of the variable star. The star GSC 0008_789 has B and V magnitudes measured by the Hipparcos satellite (ESA 1997) to be $V_T = 9.832 \pm .032$ and $(B-V)_T = 1.412 \pm .083$. Measurements of GSC 0008_324 relative to this star give $V = 10.64 \pm .05$ and $B - V = 1.07 \pm .20$ at maximum light. This $(B-V)$ is in agreement with the measurements of the Hipparcos satellite (ESA 1997) and also with Robertson and Hamilton (1987). From this color we estimate the spectral class of GSC 0008_324 to be approximately K4V (Cousins 1981) in agreement with Stephenson (1986).

The light curve leads us to expect this to be a near-contact system. Using Binmaker 2.0 (Bradstreet 1993), an example model light curve was made, assuming the temperature

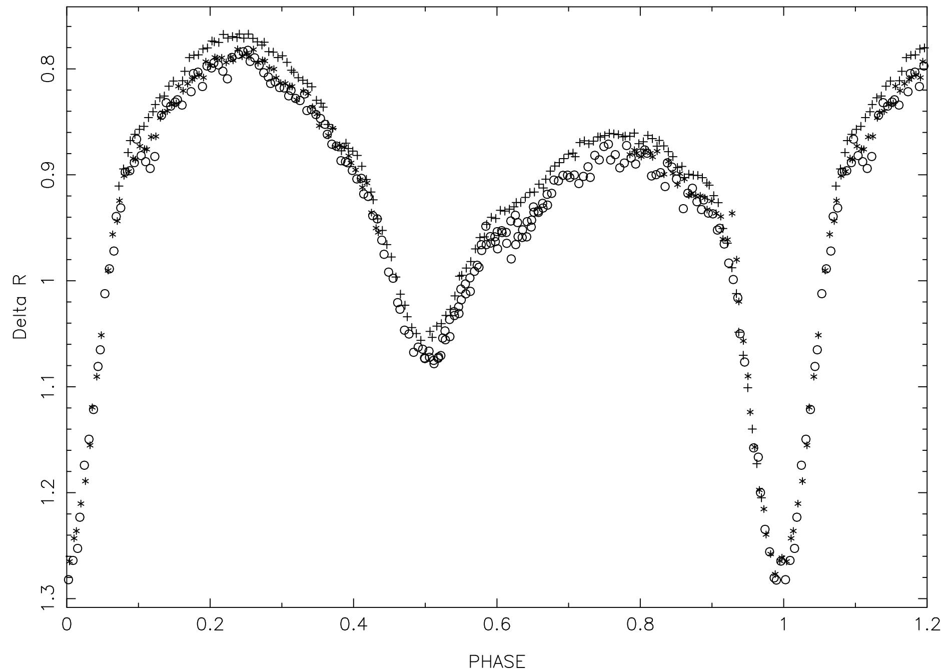

Figure 2. *R* band light curve of GSC 0008_324 for 1999

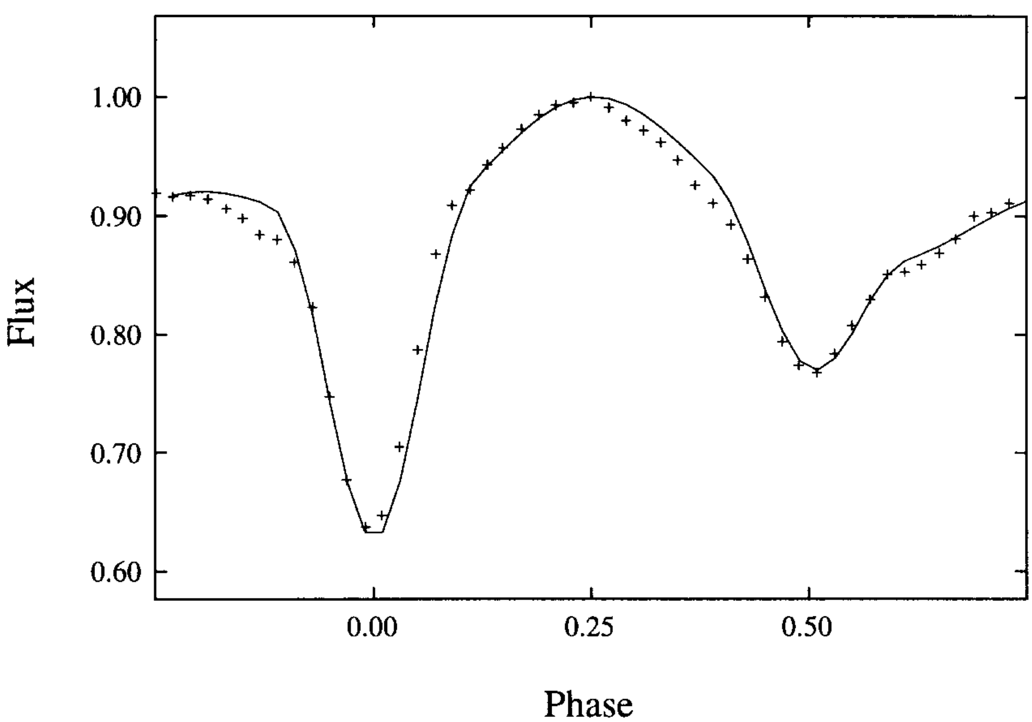

Figure 3. *R* band normal points with curve from an example model of the eclipsing system

of the hot star to be 4300 K the mass ratio of 0.83 and the latitude of the spot of 0°. The data are best fitted with an inclination of 71° and relative radii of 0.36 and 0.38. The temperature of the cool star was adjusted to 3650 K and a spot 20° in radius at a longitude of 270° was added to get the fit seen in Figure 3. Considering the cycle to cycle variations seen in the light curve, this is a satisfactory fit. The uncertainty in the inclination is about ±3° and the difference in temperature and spot diameter are known to about ±10%.

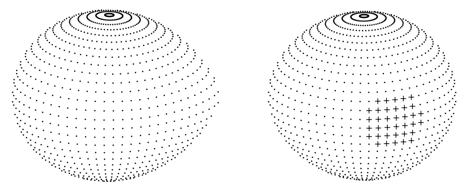

Figure 4. Three-dimensional model of the near-contact system at phase 0.75

The relative sizes and shapes of the components of the system and the spot are shown in Figure 4, again using Binmaker 2.0 (Bradstreet 1993).

The star GSC 0008_324 is therefore a near-contact eclipsing system with late-type components and at least one spot. Photometric observations should be continued to monitor light curve changes due to spot migration, flares, and period changes. Spectroscopic observations have been started to determine a precise spectral class for the system and to measure radial velocities to determine the masses and the scale of the system.

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