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TIME OF LIGHT MAXIMUM OF BW VULPECULAE[1]

We report photometric observations of the β Cephei star BW Vul (HD 199140 = HR 8007, B2III, V = 6.55) obtained on June 17 and 18, 1993 at Jungfraujoch Observatory. The measurements were obtained in the V_1 filter band of the Geneva photometric system. The comparison stars were the same as C_1 and C_2 used by Sterken et al. (1986), viz. HD 198820 = HR 7996 (B3III, V = 6.44) and HD 198527 = SAO 089185 (B9.5V, V = 7.0).

On June 17, the observations were carried out according to the scheme $C_1, BW\,Vul, C_2, C_1, BW\,Vul, C_2, C_1, BW\,Vul, \ldots$ and on June 18 the scheme $C_1, BW\,Vul, C_1, BW\,Vul, C_1, BW\,Vul, C_1, \ldots$ was adopted, with additional measurements of C_2 during the first and last hours of the night. Each datapoint consisted of a measurement of about 1 minute duration. Sky background was measured about once every two cycles.

The data were corrected for sky background contribution, and for the effect of atmospheric extinction; the extinction coefficient k_{V_1} (0.256 and 0.183, respectively on June 17 and 18) was derived by application of the classical Bouguer method on the measurements of C_1 and C_2. The mean magnitude difference between C_1 and C_2 (in the sense C_1 *minus* C_2) was $-0^m.754 \pm 0^m.003$ for the first night, and $-0^m.761 \pm 0^m.001$ for the second. We assess the quality of our data as of weight 4 (on the scale given by Sterken et al. 1993) for June 17 and of weight 5 for June 18. Table 1 gives the differential V_1 magnitudes BW Vul *minus* C_1.

Sterken et al. (1987) argued that there are two reasons for using time of minimum instead of time of maximum for determining the variation of the pulsation period of BW Vul. First, due to the occurrence of the stillstand phenomenon (until about 30 minutes before the time of maximum light), the time base of data suitable for determining the time of maximum is more than two times smaller than it is at minimum light. Second, the disturbance of the stillstand on the shape of the light curve progressively increases towards infrared wavelengths (see Fig. 3 of Sterken et al. 1987), a circumstance that may seriously affect the result when data obtained with different filter systems are combined. However, due to the coincidence of the phase of minimum light and the end of astronomical twilight, and due to the very short duration of the night at this time of the year, no minimum of the light curve could be observed, but we did cover one phase of maximum on June 18, which yielded a time of maximum light $T_{max} = HJD2449157.4855$.

The linear ephemeris given by Sterken et al. (1993) is not directly applicable, so we calculated the $O - C$ values on the basis of the period $P = 0^d.2010443$ derived by these authors, and on the times of maximum given in Table 6 of their paper. That $O - C$

[1]BASED ON OBSERVATIONS COLLECTED AT THE HOCHALPINE FORSCHUNGSSTATION JUNGFRAUJOCH (SWITZERLAND)

diagram ($T_0 = 2428801^d9530 \pm 0^d0007$) is given in Fig. 1, the position corresponding to our new time of maximum is indicated by a solid circle.

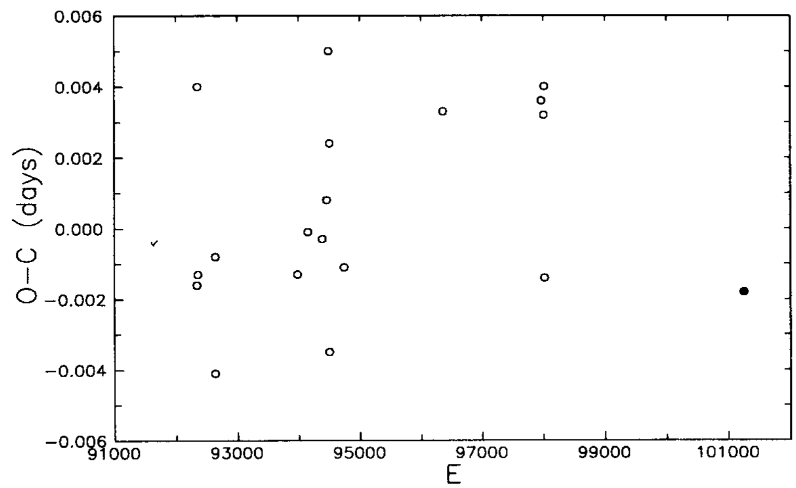

Figure 1: $O - C$ diagram for all available times of maximum since June 15, 1988 (the solid circle represents the new time of maximum reported in this paper) according to the cycle-count scheme given by Sterken (1993) and with $P = 0^d2010443$.

Table 1. Differential V_1 magnitudes of BW Vul *minus* HD 198820. HJD is heliocentric julian date *minus* 2,440,000.

HJD	ΔV_1	HJD	ΔV_1	HJD	ΔV_1	HJD	ΔV_1
9156.4806	0.017	9157.3936	0.224	9157.4655	0.075	9157.5124	0.106
9156.4901	0.047	9157.3992	0.212	9157.4707	0.056	9157.5155	0.112
9156.4965	0.072	9157.4047	0.191	9157.4745	0.046	9157.5239	0.141
9156.5028	0.089	9157.4102	0.186	9157.4778	0.040	9157.5324	0.163
9156.5083	0.114	9157.4158	0.166	9157.4808	0.028	9157.5370	0.175
9156.5140	0.123	9157.4216	0.145	9157.4845	0.024	9157.5427	0.194
9156.5393	0.190	9157.4272	0.125	9157.4874	0.027	9157.5472	0.210
9156.5455	0.208	9157.4322	0.112	9157.4906	0.029	9157.5507	0.219
9156.5511	0.217	9157.4377	0.101	9157.4940	0.045	9157.5571	0.234
9156.5583	0.236	9157.4445	0.091	9157.4976	0.050	9157.5612	0.241
9156.5636	0.240	9157.4511	0.093	9157.5003	0.064	9157.5652	0.239
9156.5686	0.235	9157.4545	0.086	9157.5033	0.079		
9156.5768	0.236	9157.4586	0.087	9157.5063	0.082		
9157.3861	0.235	9157.4619	0.085	9157.5097	0.098		

The "annual" mean $O - C$ values for the times of maximum yield an estimated mean error on one T_{max} of 0^d0027, whereas the estimated mean error on one T_{min} amounts to about 0^d0017. Our result indicates that no strong change in the period of BW Vul has occurred since September 1992. Evidently, more photometric data are needed to monitor the forthcoming changes of the period of BW Vul. For a detailed discussion on the interpretation of the period changes in BW Vul, we refer to Sterken (1993).

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THE FOUR BODY SYSTEM Y Cam?

The eclipsing binary system Y Cam ($V=10^m.50-12^m.24-10^m.60$; $P=3^d.31$; Sp:A9IV + (K1)) was discovered by Ceraski (1903). The photoelectric light curves were obtained in B and V filters by Broglia and Marin (1974). The authors state that the secondary minimum is at phase 0.5. Broglia and Conconi (1984) concluded that the long series of observed moments of minimum is represented satisfactorily by means of a double sine-curve that is "combining an apsidal motion of the binary system moving in an orbit with small eccentricity and a light time effect caused by a third body, or assuming a quadruple system. In both cases unreasonably high values for the mass of the third and fourth bodies are derived (the photometric solution does settle an upper limit to the light companions much smaller than the values expected for the massive calculated third and fourth components)".

The analysis of the O−C diagram for Y Cam calculated with the elements:

$$\text{Min I} = JD_{\odot}2424434.4806 + 3^d.30552340 \times E$$

suggests that third and fourth bodies moving in independent eccentric orbits are present in the system (see Figures 1 and 2). That is why we represented the O−C diagram by a sum of two independent parts:

$$O - C = \frac{a_3 \sin i_3}{c}(1 - e_3 \cos E)\sin(v + \omega_3) + \frac{a_4 \sin i_4}{c}(1 - e_4 \cos E')\sin(v' + \omega_4),$$

where v and E are true and eccentric anomalies respectively, c is the speed of light, and parameters of the binary system relative to the mass centres of the triple and the quadruple systems are in usual designations. The parameters of long period orbits were determined graphically by Woltjer's method and improved by a least squares fitting of a sum of two theoretical curves to the observed epochs E (Table 1).

Table 1
The parameters of the long period orbits
in the Y Cam system

$a_3 sin i_3=(5.22\pm0.12)\ 10^8$km	$a_4 sin i_4=(42.42\pm0.14)\ 10^8$km
$e_3=0.600\pm0.021$	$e_4=0.475\pm0.03$
$\omega_3=87^\circ.5\pm3^\circ.2$	$\omega_4=77^\circ.4\pm0^\circ.4$
$P_3=(39.4\pm0.3)$ years	$P_4=(86.03\pm0.08)$ years
$T_3=JD_{\odot}2419177.96\pm0.14$	$T_4=JD_{\odot}2417134.64\pm0.08$

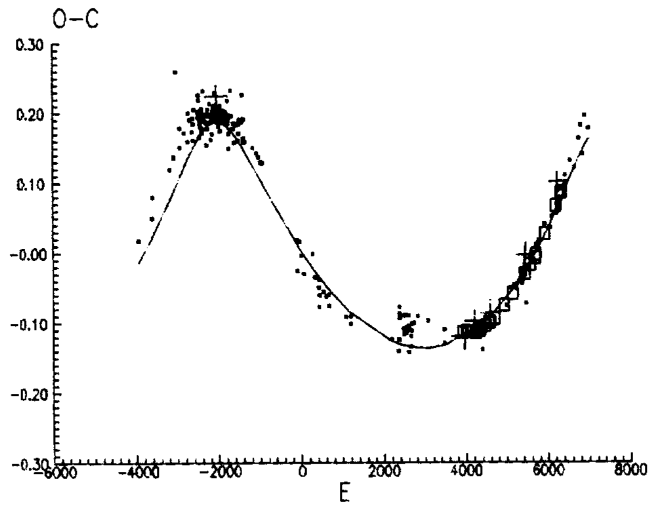

Figure 1
O−C for Y Cam (• - visual and photographic Min I, □ - photoelectric Min I, + - Min II, the solid line is the theoretical curve of the body on elliptical orbit, calculated with the fourth body's parameters from Table 1).

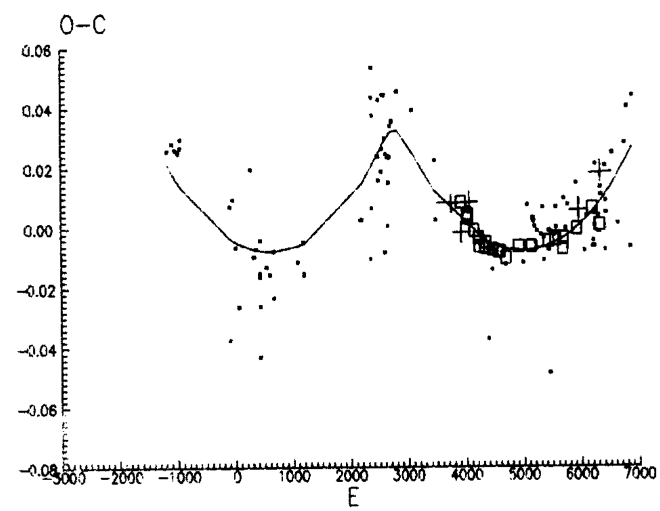

Figure 2
O−C for Y Cam, calculated with the same elements as in Figure 1, but with the values corresponding to the theoretical curve with the fourth body's parameters from Table 1 subtracted.

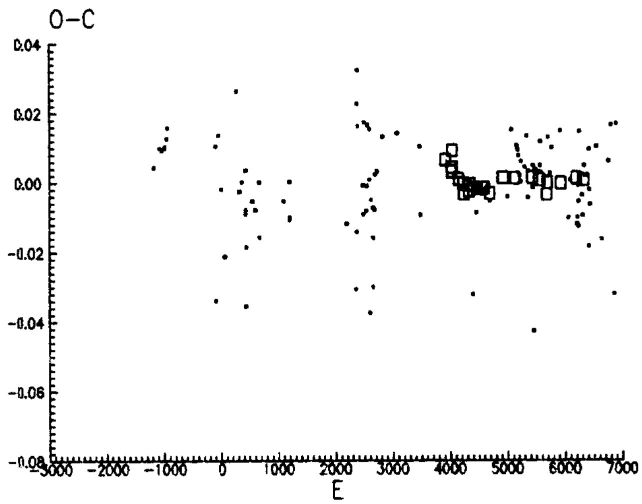

Figure 3
(O−C) for Y Cam, calculated with the same elements as in Figure 1, but with the values corresponding to the theoretical curve with the third and fourth bodies' parameters from Table 1 subtracted.

We solved the problem of the approximations by the third and fourth bodies for the 131 latest primary minima (Figure 2), because for the earlier 120 primary minima the residuals between O−C and values corresponding to the theoretical fourth body in an elliptical orbit vary very irregularly. It is probably caused by great errors in the determination of the moments of primary and secondary minima in early times. We assigned larger weight to the photoelectric observations as compared with the photographic and visual ones. The residuals in O−C after the approximations by the third and fourth bodies are nearly zero (Figure 3).

The derived parameters of the long period orbits enable us to compute a lower limit for the masses of the third and the fourth bodies. Supposing the main component mass $\mathcal{M}_1=1.53\mathcal{M}_\odot$ Svechnikov and Taidakova, 1984) and computing the secondary component mass from the mass function f(m)=0.015$\mathcal{M}_\odot$ (Struve et al., 1950) we have: $\mathcal{M}_3>0.55\mathcal{M}_\odot$, $\mathcal{M}_4>6.04\mathcal{M}_\odot$.

From the solution of the light curves in the filter V by differential correction method (Khaliullina and Khaliullin, 1984) using our observations and Broglia and Marin (1974) data, we obtained that the third light is present in the system: $L_3=0.10$ (Mossakovskaya, 1991). Assuming that only one main sequence star gives this third light, we can estimate its mass, using the mass-luminosity law: $L\sim\mathcal{M}^{3.99}\rightarrow\mathcal{M}_{max}=0.94\mathcal{M}_\odot$. That is, the photometric data do not contradict the assumption that a main sequence star with the mass $\mathcal{M}_3 > 0.55 \mathcal{M}_\odot$ is present in the system, but do not agree with the presence of a star with the mass $\mathcal{M}_4 > 6.04 \mathcal{M}_\odot$. We can reconcile the obtained results only if the fourth body is a relativistic object. Of course this is but a hypothesis. The system Y Cam needs continued photoelectric observations of the moments of both primary and secondary minima.

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TIMES OF MINIMUM OF ECLIPSING BINARIES WITH NON-CIRCULAR ORBITS

During April and May 1993, we enjoyed an observational stay at the Rosemary Hill Observatory, operated by the Department of Astronomy of the University of Florida, Gainesville, U.S.A. One of the observing programs consisted in the timing of minima of eclipsing binaries with non-circular orbits, the results of which are reported here.

The minimum times given in Table I were determined photoelectrically employing the 76 cm (30 inch) reflector of the Rosemary Hill Observatory, located near the town of Bronson in north-central Florida. This telescope is equipped with a standard one-channel photometer at its Cassegrain focus. An EMI6256S photomultiplier operated in the DC-mode and cooled with dry ice yields good photometric quality down to about 13th magnitude. The set of filters has been carefully chosen in order to reproduce the standard Johnson UBV system (Diethelm, 1993).

The times of minimum were deduced from differential photometry using comparison stars taken from the previous work on these variables. None of the comparison stars showed variability exceeding the accuracy of the photometric system. A field diaphragm of 32 arcseconds diameter was used throughout.

Table I
Times of minimum of eclipsing binaries with non-circular orbits

Star	Type	O JDhel	e.e.	O-C (GCVS 85)	n	Remarks
BW Boo	s	49099.73:	±0.05	-0.16	32	V, remark overleaf
EK Cep	p	49115.8081	±0.0003	+0.0058	36	V
V478 Cyg	p	49124.7720	±0.0030	+0.0197	32	V
V959 Cyg	p	49124.8123	±0.0015	-0.0340	14	V
V577 Oph	s	49105.7808	±0.0020	+0.4884	50	see Diethelm (1993)
EQ Vul	s	49113.82:	±0.02	-0.04	38	V, remark overleaf

Remarks to Table I:

BW Boo: The displaced secondary reported by Kurpinska (1975) is confirmed. Due to the small amplitude (about 0.025 mag in V) and the very slow variation, only an approximate time of minimum can be given.

EQ Vul: The night of JD 2449113 was not of photometric quality. The lightcurve therefore shows considerable scatter due to the changing sky conditions. Furthermore, the descending branch is very poorly covered. The time given in Table I is only an upper limit to the actual time of minimum.

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SPECTRUM OF THE ENVELOPE AROUND PRIMARY IN RX Cas

RX Cas is a strongly interacting binary with an orbital period of $32^{d}.33$ where the main component is completely hidden by a thick envelope or disk formed from outflowing gas from the cooler secondary component. In the optical region the spectrum of the cool star dominates. The envelope obscures the light of the primary star and only an absorption shell-spectrum with emissions from the Balmer lines and the lines of Fe II, Ti II, [FeII] and [FeIII] are seen (Alduseva, 1987).

Therefore we attempted to derive the spectral class and luminosity of the envelope which re-emits radiation of the primary. We chose the orbital phase of secondary minimum in the transition stage from maximum to minimum of the physical activity (which has a period of 516 days) when we observed an optically thick envelope. This is when the K-giant was completely eclipsed. Two spectrograms with a moderate dispersion (44 Å/mm), obtained by V. Alduseva at the cassegrain focus of the 125 cm reflector of the Krimean Station of Sternberg Astronomical Institute, were analyzed. The methods for deriving and measuring the spectrograms were described by Alduseva (1987).

We used the spectroscopic temperature and luminosity criteria recommended by Wright (1966) for F–K stars. We measured the line-ratio intensities of pairs of lines in the region 4045 Å to 4340 Å that were sensitive to luminosity and temperature. The determination of equivalent widths of lines in the spectrum of RX Cas is a very difficult task because of the uncertainties in determining the continuum. For that reason we used only line-pairs which were close in wavelength and constructed a local pseudo-continuum. These results are listed in Table 1.

On the other hand, according to the photometric data available at this time in the secondary minimum of light:

$$B=10^{m}.43,\ V=9^{m}.28,\ B-V=1^{m}.15.$$

(Johnson's BV, corrected for instrumental and atmospheric extinction). If $E(B-V)=0^{m}.45$, then $(B-V)_{o} \cong 0^{m}.7$ which corresponds to a G2 giant (Allen, 1977) for normal stellar atmospheres.

The results show that in the transition stage to the minimum of the physical activity the envelope around primary imitates a pseudo-photosphere of a G2 giant with a luminosity excess of -1^{m}. The effective temperature is $T_{eff} \cong 5500$K. These results agree with the value of T_{eff} derived from photometric observations (Andersen et al., 1989): 5500K for minimum and 6000K for maximum of the physical activity, as well as with the results of the observations in the far ultraviolet (Plavec et al., 1981; Koch, 1982): gG0. From the

Table 1

λ_1/λ_2	RX Cas $W_{\lambda1}/W_{\lambda2}$	Sp	L	M_v
4072FeI/4078SrII	0.60	G0-G5	II-III	$+0\overset{m}{.}6$
4216SrII/4251FeI	1.30	G3	II-III	$-1\overset{m}{.}0$
4247ScII/4251FeI	1.35	G0-G5	II	
4258FeII/4261FeI	0.59	G0-G5	II-III	
mean	G3 III-II,	$M_v=-0\overset{m}{.}2\pm 0\overset{m}{.}8$		

study 22 objective prism spectra, Todorova (1990) derived the energy distribution of the spectrum of the outer parts of envelope and this corresponds to spectral type gG2-5. The luminosity excess may be connected with possible active areas on the surface of the envelope.

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BV photoelectric photometry of SN 1993J in NGC 3031 = M 81

SN 1993J was discovered in NGC 3031 = M81 on March 28, 1993 by Garcia (1993). Being the brightest supernova for northern hemisphere observers over the last 21 years, SN 1993J prompted for an extensive, world-wide effort to monitor its evolution over the widest spectral range.

We have performed BV photometry of SN 1993J during the initial test period of the new photoelectric photometer for the AFAM 0.45 m reflector (Associazione Friulana di Astronomia e Meteorologia, Udine, Italy). The photometer houses an uncooled 1P21 photomultiplier and standard UBV Johnson filters. Photometer operation, data-storage and data-reduction are performed on-line via connection to a PC.

The accurate evaluation of the photometer peformances is still underway. Tests on equatorial Landolt (1992) standard fields and open clusters from the Hoag *et al.* (1961) 1P21 UBV survey, do not show appreciable color terms in any of the three UBV bands. The photometer did not show departure from linearity or any orientation effect.

The AFAM 0.45 m telescope is located in Remanzacco, a sea-level site in the outskirts of Udine. The present telescope tracking and average seeing conditions force to adopt a default 15 arcsec diaphragm. The severe light pollution limits the 1P21-based observations to stars brighter than V$\sim$12.6 and B$\sim$13.7 to maintain the internal standard error $<$0.06 mag. We stopped the observations when the supernova approached these limits. The variable atmospheric cut-off for a sea-level site during the spring season suggested not to observe in the U band the supernova, the latter spectrum being dominated by strong and broad emission lines.

The observations of SN 1993J have been performed against three local comparison stars: HD 86677 (V=7.88, B=8.39), GSC4383-0308 (V=11.78, B=12.47), GSC4383-0928 (V=11.90, B=12.40). Photoelectric intercomparison of the adopted standards did not show detectable variability of them. We are investigating their photometric stability over the last $\sim$30 years on Asiago Schmidt photographic patrol plates (Manzocco *et al.* 1993). The resulting SN 1993J B,V magnitudes are reported in Table 1 for the given UT dates. The SN was observed in five more nights, but data reduction showed the latter

Table 1: AFAM 1P21 photoelectric photometry of SN 1993J in NGC 3031

Date	JD	V	σ_V	n	B	σ_B	n	Notes
1993-03-31.97	2449078.47	10.94	0.04	2	11.31	0.04	2	IAUC 5750
1993-04-01.02	2449078.52	10.90	0.05	1	11.30	0.04	1	IAUC 5750
1993-04-08.86	2449086.36	11.45	0.04	3	11.94	0.04	2	
1993-04-09.85	2449087.35	11.35	0.04	1	11.81	0.04	1	
1993-04-16.92	2449094.42	10.93	0.01	3	11.46	0.06	3	
1993-04-17.91	2449095.41	10.87	0.04	5	11.35	0.02	5	
1993-04-18.89	2449096.39	10.88	0.06	1	11.40	0.06	1	
1993-04-19.86	2449097.36	10.91	0.04	2	11.43	0.05	2	
1993-04-20.92	2449098.42	10.95	0.05	6	11.48	0.08	3	
1993-04-21.85	2449099.35	11.02	0.06	1	11.70	0.05	1	
1993-04-22.86	2449100.36	11.10	0.01	2	12.03	0.04	2	
1993-04-23.91	2449101.41	11.18	0.04	4	12.27	0.21	4	
1993-04-26.90	2449104.40	11.44	0.01	5	12.63	0.05	5	
1993-05-09.86	2449113.36	12.14	0.03	4	13.29	0.01	2	
1993-05-10.89	2449118.39	12.13	0.06	1	13.37	0.05	2	
1993-05-13.90	2449121.40	12.30	0.07	2	13.37	0.05	2	
1993-05-14.90	2449122.40	12.30	0.09	2				
1993-05-16.86	2449124.36	12.33	0.05	2	13.49	0.02	3	
1993-05-17.89	2449125.39	12.31	0.13	6	13.40	0.05	2	
1993-05-19.92	2449127.42	12.38	0.09	2	13.50	0.07	2	
1993-05-20.94	2449128.44	12.40	0.08	2	13.54	0.08	2	
1993-05-21.99	2449129.49	12.31	0.03	2				
1993-05-22.90	2449130.40	12.38	0.04	2				
1993-05-25.87	2449133.37	12.37	0.04	2	13.69	0.12	1	
1993-05-26.91	2449134.41	12.49	0.08	3	13.65	0.08	2	

not to be photometric and they have not considered further on.

The typical observing routine in each band was composed by 4 to 6 individual 10 sec integrations on: dark current, sky background, two comparison stars, the SN, the same two comparisons, sky background, dark current. One cycle typically lasts for 20 minutes. In Table 1, n is the number of such cycles performed in the given band. The listed magnitudes are the weighted averages of the SN magnitudes obtained from all cycles during the given night. The reported standard errors are *internal* to the system.

For all observations, a 15 arcsec diaphragm was used. To evaluate the contribution from the underlying NGC 3031 galaxy, we made extensive mesurements of a large portion of the background galaxy around the SN. The results suggest that the contribution of the galaxy background to the SN 1993J measurements are irrelevant given the sky brightness we experience at the AFAM observatory.

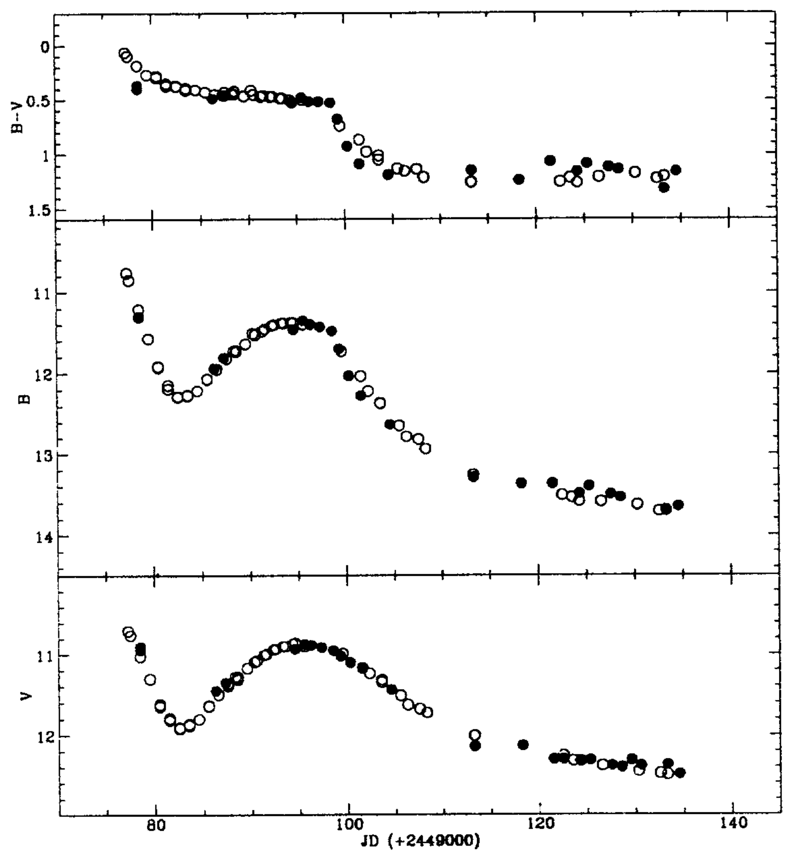

Figure 1. V, B and (B-V) lightcurves of SN 1993J. Filled circles: our data. Open circles: data from La Palma & RGO Observatories (Meikle *et al.* 1993).

The B,V and (B-V) lightcurves of SN 1993J are presented in Figure 1. The AFAM data are plotted as filled circles. For comparison, we have reported the measurements made at La Palma & Royal Greenwich Observatories (open circles) with a variety of telescopes and instruments as summarized by Meikle *et al.* (1993). The La Palma & RGO Observatories data have been retrieved via remote *ftp* connection to RGO as explained by Martin & Lewis (1993).

The agreement between the two sets of observations in Figure 1 is quite good in view of the peculiar, emission-line dominated spectrum of a supernova. The zero-points seem pretty similar. Some color differences are present at earliest phases and during the decline from second maximum. The noise in the observations contributes significantly to the differences at later phases.

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STRÖMGREN b, y PHOTOMETRY OF STARS IN THE FIELD OF MESSIER 81 (= NGC 3031)

Not long after the discovery of 1993J, it became apparent that observers were using a heterogeneous collection of magnitudes for comparison stars in the field of the galaxy to determine the brightness of the eruption. Some used magnitudes from the Space Telescope Guide Star Catalog (GSC), while others used values from the Thompson & Bryan (1990) "Supernova Search Charts and Handbook" chart of the region. Some of the latter were derived from published photoelectric data, but others were based only on eye estimates. Because of this mixture of systems, magnitudes published on the IAU Circulars in the first weeks after the event from CCD and photoelectric measures as well as visual estimates had unacceptably large scatter. This compromised astrophysical modelling of the eruption, which is constrained by the rise-time of the initial outburst and the date and magnitude of the peak brightness.

It was soon evident that the GSC magnitudes had a large zero-point error, amounting to about half a magnitude (the GSC values in this region are too bright). More photoelectric observations were clearly needed, nevertheless, to confirm the earlier photometry, and to get measures for several stars not previously observed accurately. Partly at the suggestion of Harold Corwin (IPAC/JPL), who observed many of the comparison stars some years ago, and at the specific requests of Daniel W. E. Green (Central Bureau for Astronomical Telegrams) and Gerard de Vaucouleurs (Univ. of Texas), I made observations of twelve stars in the field of the galaxy. They were most urgently required to calibrate visual and CCD observations made by amateurs at the time of the pre-maximum phase of the outburst. The earliest visual observations were made with respect to stars whose magnitudes turned out to be erroneous, and most of the CCD observations were made without using a filter in the light path, and so were not on a standard photometric system.

The photoelectric observations were made on 25 & 26 April and 8 & 9 July 1993 UT using the Lowell 53cm photometric telescope located on Mars Hill, in Flagstaff, Arizona. Strömgren y and b filters were used through a 19."4 diaphragm for the April observations and a 29."2 diaphragm for the July observations. On each night eight observations were made of five to eight uvby standard stars bracketing the measures of the M81 field.

The transformation from the instrumental values to the standard system was done by making a linear least-squares fit for both magnitude and color. The April observations were reduced using estimated values for extinction based on measurements taken on other nights near this time. The extinction was measured explicitly for the July observations, an important consideration given the high airmass (sec z$\sim$1.9) of this late-season data. The colors of the standard stars ranged over the interval $-0.07 < b-y < 0.87$ in April, and $0.02 < b-y < 1.09$ in July, extending well beyond the colors of the M81 field stars observed. The assumed values for the standards and the means from my observations are

Table 1. Standard Star Observations

Star	V (std)	b−y	V (obs)	b−y	n
HD 69994	5.817	0.688	5.811	0.685	2
HD 76151	6.008	0.410	6.012	0.403	2
HD 81524	6.574	0.868	6.577	0.871	1
HD 85217	6.236	0.306	6.239	0.308	4
HD 94180	6.374	0.045	6.374	0.058	2
HD100600	5.948	−0.066	5.945	−0.076	2
HD103095	6.429	0.483	6.429	0.485	2
HD122563	6.206	0.638	6.208	0.637	2
HD122866	6.163	0.020	6.160	0.023	2
HD134064	6.037	0.032	6.035	0.043	1
HD140850	8.806	1.089	8.801	1.094	3
HD143761	5.403	0.396	5.406	0.392	3
HD149845	7.964	0.815	7.964	0.821	1
BD−0°3353	9.332	0.967	9.340	0.958	1
HD161817	6.982	0.135	6.976	0.135	1
HD186427	6.230	0.417	6.238	0.410	1

shown in Table 1. The first set applies to the April series, and those in the second to the July series. "n" is the number of measurements.

My mean magnitudes and colors differ on average from the standard values by ±0.004 mag. in V and ±0.008 mag. in b−y for the April data, and 0.005 in V and 0.006 in b−y in July.

The results for the M81 field stars are shown in Table 2, listed in order of decreasing brightness. Four of the fainter stars were observed only on one night. Identification is made in the first column with the GSC in each case so that accurate positions can be found. On the second line of each entry is the rms uncertainty for each mean. For the stars observed on a single night, this is estimated from the uncertainty in the fit to the standard stars and the internal error of each measurement. For the remainder, the uncertainty is the standard deviation of the combined observations. The remarks include common star catalogue identifications and spectral types for the brighter objects.

I made four sets of differential measurements of the wide pair ADS 7565 = GSC 4383−1127 on two nights using a 12."5 diaphragm and judiciously off-centering the components in order to isolate them (the separation is about 9 arcseconds). These yielded a mean Δy=0.647±0.013; the eastern component is the brighter, consistent with observations by double-star observers.

There is scant evidence in these data that GSC 4383−0384 is large-amplitude variable, as claimed recently by Hanzl et al. (1993).

Results from single observations of some of the brighter stars have already been published on an IAU Circular (Skiff 1993). Three of the stars included here have been previously observed in the UBVRI system by Harold Corwin, and his V magnitudes are listed in the remarks as published on the IAU Circulars (Corwin 1993). These agree within our mutual uncertainties, and indicate that previously published photoelectric V magnitudes for faint stars in the region are reliable (cf. Brandt et al. 1972, and Sandage 1984).

Table 2. Photometry of stars in the field of M81

GSC 4383−	V	b−y	n	Remarks
0848ab	8.538	0.310	2	=HD 85458(F5)=ADS 7566AB
	.000	.004		
0738	9.197	0.643	2	=HD 85743(K)
	.006	.001		
1127ab	9.852	0.454	2	=BD+69°0541=ADS 7565AB(G)
	.006	.011		
0150	10.456	0.766	2	=BD+69°0540(K0)
	.015	.029		
0698	10.821	0.646	3	
	.002	.015		
0384	11.018	0.315	3	
	.031	.016		
0565	11.422	0.362	1	
	.020	.020		
0928	11.933	0.306	3	Corwin: V=11.90
	.007	.030		
0434	12.427	0.438	1	Corwin: V=12.45
	.030	.030		
0863	12.885	0.555	1	
	.030	.030		
1123	13.644	0.440	1	Corwin: V=13.65
	.040	.040		
0574	14.440	0.600	5	differential with respect to GSC 4383−0928
	.022	.050		

Finally, in Table 3 are measures of the supernova itself on several nights. The first of these was included on the IAU Circular with the comparison stars (Skiff 1993). These were made differentially with respect to star GSC 4383−0928. Despite being corrected for the strong color difference between the two stars, because of the evolving nature of the emission-line spectrum in the supernova, they cannot be considered to be strictly on the Johnson V system, and so are given as Strömgren "y" magnitudes.

Table 3. Differential observations of Supernova 1993J

1993 UT	y	σ
Apr 25.15	11.35	0.02
May 7.16	11.95	0.03
8.16	12.01	0.03
9.18	12.01	0.04
10.18	12.08	0.03
11.18	12.11	0.03
18.18	12.24	0.04 [poor night]
21.18	12.35	0.02
24.16	12.37	0.04

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I am grateful for the comments and encouragement of Harold Corwin and Gerard de Vaucouleurs. This work was facilitated by the use of SIMBAD, maintained by the Centre de Donnees astronomiques, Strasbourg, France.

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Identification of NSV Stars in the Hubble Space Telescope Guide Star Catalogue. II.

Following with a program conducted to improve the coordinates of southern variable and suspected variable stars (see Lopez and Girard, 1990), a cross-identification of suspected variable and Hubble Space Telescope Guide Star Catalogue (GSC) stars is herein presented.

For this note, we have followed the same procedure described in Lopez (1993).

Table I shows the identifications which have been found. The first column is the NSV number, the second one provides the GSC number (see Lasker *et al.* 1990 for a description of the GSC number format). The last two columns give the RA and Dec (B1950.0). We have preferred to express the positions extracted from the GSC in the 1950 equinox-instead of the J2000 of the GSC- since it is the standard one in the NSV.

The stars in Table I have been arranged according to their NSV number, which means, in fact, ascending RA. This is not the case, however, for NSV 12754 and 12760 whose order should be inverted if we consider their RA.

I would like to thank the Astronomical Data Center and the National Space Science Center A for Rockets and Satellites for providing a CD-ROM with the NSV among other very useful catalogues.

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TABLE I

Identification of NSV with GSC Stars

NSV	GSC	RA (1950.0) h m s			Dec ° ' "		
00029	6995.00681	0	3	48.01	-35	33	55.0
00336	7536.00245	0	51	12.67	-41	36	51.0
00646	5278.00260	1	50	31.67	- 8	19	7.6
01081	4708.00406	3	11	25.63	- 1	55	17.2
01754	4741.00842	4	50	38.74	- 3	34	46.1
01781	4749.00626	4	54	25.50	- 6	36	45.6
01855	5334.00355	5	7	34.96	- 9	40	38.9
02096	4770.00797	5	29	34.34	- 3	7	36.3
02592	5350.00429	5	40	13.79	-10	0	16.0
02871	4795.01414	6	10	23.85	- 6	12	21.1
03190	4803.01048	6	41	58.84	- 2	29	23.1
03270	4809.02563	6	51	59.10	- 4	16	56.4
03603	5400.02113	7	25	57.18	-10	53	0.0
03627	5401.00523	7	29	35.89	- 9	24	11.7
03775	5415.00892	7	50	20.94	-10	34	57.4
03811	4841.01247	7	52	57.29	- 3	38	17.2
03894	9205.01873	8	2	42.35	-74	24	58.1
04549	9196.03281	9	34	22.86	-68	10	26.3
04991	9220.00846	10	49	1.53	-72	28	40.3
05292	9515.00974	11	38	48.87	-86	52	48.3
05467	4945.00709	12	5	18.29	- 5	43	12.8
06052	8254.01530	12	58	4.15	-48	56	3.6
06067	8993.00070	13	0	5.02	-63	2	15.2
06100	8997.01684	13	4	47.71	-64	41	55.5
06122	9241.00824	13	8	4.94	-68	16	42.7
06169	8994.00555	13	14	43.48	-61	59	57.3
06203	8994.00991	13	18	33.46	-61	41	21.2
06276	8995.04687	13	27	11.63	-63	20	58.9
06280	9426.03715	13	28	35.15	-75	56	58.1
06285	9254.00001	13	28	36.69	-74	44	21.1
06970	9428.02825	15	7	48.88	-75	41	19.0

TABLE I (cont.)

NSV	GSC	RA (1950.0) h m s	Dec ° ' "
08128	5064.00040	16 59 19.98	− 0 40 1.9
08223	5069.01075	17 5 16.60	− 3 23 11.4
08236	5069.00146	17 6 34.44	− 2 30 45.5
08256	5073.01002	17 7 43.71	− 3 59 53.5
08351	5073.01000	17 11 15.66	− 3 56 22.8
08441	5066.00736	17 13 55.46	− 0 26 1.6
09151	5088.00340	17 30 28.46	− 4 7 17.1
09935	5087.01066	17 56 11.06	− 2 5 11.3
10539	5098.00585	18 15 44.43	− 0 8 9.0
10546	5098.00514	18 15 42.25	− 1 17 25.4
11496	8377.02574	18 51 27.38	−48 12 21.5
11845	5130.00079	19 12 42.17	− 1 25 4.5
12352	5153.01593	19 41 43.67	− 4 29 50.8
12424	5150.00762	19 46 18.88	− 2 58 52.1
12468	5150.02539	19 48 28.77	− 3 21 56.3
12469	5154.00683	19 48 35.35	− 5 24 9.7
12577	0481.02310	19 53 45.03	− 0 6 2.1
12642	5151.00071	19 56 41.83	− 2 1 4.8
12681	5164.00042	19 58 20.26	− 2 57 11.3
12733	5164.00426	20 0 30.31	− 2 20 2.4
12754	9532.01248	20 2 0.57	−87 52 24.1
12760	5160.00947	20 1 53.16	− 0 53 59.1
12769	5164.00607	20 2 32.33	− 2 27 18.2
13052	5171.00505	20 21 10.12	− 4 1 24.6
13302	7967.01220	20 45 34.16	−40 50 5.5
13923	5793.00822	21 51 4.50	− 9 56 34.8
14091	5806.00066	22 14 34.55	−11 44 41.7

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Identification of Variable Stars in the Hubble Space Telescope Guide Star Catalogue

Following with a program conducted to improve the coordinates of southern variable and suspected variable stars (see Lopez and Girard 1990), a cross identification of confirmed variables (extracted from the General Catalogue of Variable Stars -GCVS stars) and Hubble Space Telescope Guide Star Catalogue (GSC) is herein presented.

Most of the stars dicussed in this note are located either south of -67 degrees or in the Pav area, so this report could be considered as an extension of Lopez's (1991), and Lopez and Girard's (1990) surveys.

The identification of the variables and GSC stars has been made following the procedure used by Lopez (1993).

Table I shows the identifications which have been found. The first column is the designation of the variable, the second one provides the GSC number which follows the format given by Lasker *et al.* (1990). The last two columns give the RA and Dec (B1950). We have preferred to express the positions extracted from the GSC in the 1950 equinox–instead of the J2000 of the GSC–since it is the standard one in the GCVS.

We would like to thank the Astronomical Data Center and the National Space Science Center A for Rockets and Satellites for providing a CD-ROM with the GCVS among other very useful catalogues.

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Lopez, C.E., and Girard. T.M. 1990. Publ. Astron. Soc. of the Pacific **102**. 1018.

TABLE I

Identification of GCVS with GSC Stars

Variable	GSC	RA (1950.0) h	m	s	Dec °	'	"
RW Aps	9261.00164	14	27	4.13	-70	33	26.5
RX Aps	9261.00204	14	27	18.20	-70	34	5.3
RY Aps	9265.01877	14	28	30.64	-71	42	47.0
RZ Aps	9265.01797	14	28	36.50	-71	43	25.5
SS Aps	9265.01104	14	29	42.93	-72	42	35.1
SV Aps	9265.01665	14	33	57.50	-72	18	40.7
SW Aps	9265.02113	14	34	3.50	-71	5	46.7
SX Aps	9265.02226	14	34	18.53	-71	25	43.1
SY Aps	9265.00960	14	34	34.72	-72	36	39.2
TU Aps	9261.01416	14	35	44.75	-70	32	30.7
TX Aps	9266.01835	14	43	7.54	-72	35	6.1
TY Aps	9266.02648	14	44	6.03	-71	7	12.1
UX Aps	9262.01517	14	47	37.76	-70	41	16.3
AR Aps	9268.01019	15	38	52.25	-72	15	48.8
DX Aps	9444.01088	17	20	21.69	-76	36	9.9
AS Cha	9412.00496	12	27	2.65	-76	29	10.7
VV Hyi	9159.01575	3	58	47.34	-73	19	48.1
RT Oct	9533.01276	22	52	21.08	-87	19	15.2
SX Oct	9484.01042	23	11	55.57	-79	5	11.5
UU Oct	9464.00559	19	55	10.90	-77	18	17.5

TABLE I (cont.)

Variable	GSC	RA (1950.0) h	m	s	Dec °	'	"
BP Pav	9097.01105	19	53	16.27	-65	52	12.9
BQ Pav	9311.00866	19	54	57.80	-70	1	5.8
BT Pav	9104.00623	20	46	46.26	-63	52	44.7
DK Pav	8786.00140	19	37	21.87	-58	42	56.2
DH Pav	9078.00850	18	57	57.74	-64	50	28.9
DM Pav	9102.00966	21	17	4.70	-61	47	9.6
W Tuc	8845.00285	0	56	9.05	-63	39	55.0
UY Tuc	8840.00228	0	12	44.86	-60	30	5.1
UZ Tuc	8470.01028	0	13	15.55	-59	9	40.8
VX Tuc	8471.00935	0	24	.63	-59	30	18.6
VY Tuc	8841.01540	0	24	43.92	-61	5	2.4
WX Tuc	8842.00750	1	1	1.62	-62	2	10.0
WZ Tuc	8480.00869	1	13	9.08	-59	36	23.8
XX Tuc	8849.01424	1	14	57.42	-61	16	51.9
YY Tuc	8837.00411	23	8	3.14	-58	36	24.7
YZ Tuc	8834.01290	23	12	5.46	-57	29	33.8
ZZ Tuc	9120.00572	22	13	35.89	-64	8	3.8
AA Tuc	9117.01111	22	18	22.03	-60	42	21.7
AB Tuc	9132.00686	23	20	40.34	-66	38	23.6
AC Tuc	8838.00871	23	35	17.46	-59	43	6.7
AE Tuc	8845.00834	0	47	54.37	-62	54	26.5
AO Tuc	8470.00493	0	1	34.09	-59	45	47.3
BB Tuc	8849.00166	1	8	47.51	-60	35	23.5

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On the Cross-Identification of V577 CrA and V607 CrA

During the course of a program conducted to improve the coordinates of both confirmed and suspected variable stars located in the southern hemisphere (see Lopez and Girard 1990), a number of erroneous cross-identifications or multiple designations have been found. For a complete list of such cases see Kazarovets (1991), Lopez (1989), and Lopez and Girard (1990).

In this note, we want to call attention to two "old" variable stars in the CrA region, namely V577 CrA and V607 CrA. These two objects are identified with NSV 10726 and NSV 10829, respectively.

The cross-index below, which follows the format used in the variable star name-lists should be adopted:

V577 CrA = 146 (3513) = S 7853 (4001) = NSV 10726
V607 CrA = 164 (3513) = S 8863 (3776) = NSV 10829

Clearly, these two NSV stars should be deleted from the NSV Catalogue for they already have a final designation as confirmed variables, given in variable star name-list number 56 (Kukarkin *et al.* 1970).

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NOVA V360 HERCULIS (1892) IDENTIFIED

V360 Herculis is of considerable interest as an apparent example of a halo nova. Its discovery was announced by Baillaud and de Grandchamp (1927), who called attention to it on cliché 286 (1892 July 8), center R.A. 17^h12^m, Dec. $+24°$, in Volume I of the Paris zone of the Astrographic Catalogue (Observatoire de Paris 1902), where it is listed as No. 244 (magnitude 6.3) in that field. Each plate measured for the Astrographic Catalogue contained three images, spanning a range of exposure times, of a $2° \times 2°$ field. Baillaud and de Grandchamp noted that all three images of No. 244 are detectable on this plate, appear perfectly normal, and show the proper relative displacement. The star's equatorial coordinates, derived using the provisional plate constants and precessed to equinox 1950, are:

RA (1950)	Dec (1950)	Ep.
$17^h\ 14^m\ 34^s.19$	$+24°\ 30'\ 00''.2$	1892.55

Subsequent attempts to recover this object have proven fruitless, despite the existence of a precise position, and the star's high galactic latitude ($b = +30.96°$). Baillaud and de Grandchamp were unable to find it in the overlapping Oxford field at R.A. 17^h16^m, Dec. $+25°$ (Turner 1911), nor on the negative of the Paris field obtained on 1901 June 22 for the Carte du Ciel series itself, or on a negative obtained with the same instrument on 1927 July 29; each of these plates has a limiting magnitude of about 14. The nova was later included by Prager (1934) in his catalog of reportedly variable stars as No. 1230. Parenago (1947) could find no evidence of it on a series of 28 plates at the Shternberg State Astronomical Institute, and considered the Paris observation probably a plate defect, notwithstanding the three apparently normal images recorded on the Astrographic Catalogue plate. Ashbrook (1953) searched for it without success on Harvard patrol plates from 1890 June 30 through 9 August 1893, and on a deeper Yale plate, reaching magnitude 16, taken on 1951 March 31, but he was convinced of its reality. In 1958, it received the variable star designation V360 Herculis (Efremov and Kholopov 1958). Most recently, Duerbeck (1987) examined this field on the Palomar Observatory Sky Survey, identifying a star some 6" NW of the reported position of V360 Her as the best candidate for the nova system.

On a recent visit to the library of the U.S. Naval Observatory, I looked up the entry for AC +24°1712,244 in the Observatory's copy of the Paris zone of the Astrographic Catalogue, and was surprised to find the entire field extensively annotated in an anonymous hand. These annotations referenced a large number of corrections at the end of Volume III of the Paris zones (Observatoire de Paris 1911) reprinted from a paper by Pourteau and Baillaud (1910) - ironically, the same Jules Baillaud who later co-authored the discovery of V360 Her. This paper reported the discovery of a very large number of images on the Catalogue plate for this field which were not present on the corresponding Carte du Ciel plate. On further examination, Pourteau and Baillaud had found that the Catalogue plate in fact contained a superimposed triple exposure (cliché 280, taken 1892 June 11) of a field centered at $+24°16^h56^m$. They identified some 403 stars catalogued in the field nominally centered at $+24°17^h12^m$ which in fact belong to the field at $+24°16^h56^m$, among them No. 244 = V360 Her, and were able to derive provisional plate constants for the latter field.

From the (corrected) plate constants for cliché 280, and published plate coordinates of V360 Her, I derive the following position:

	RA (1950)	Dec (1950)	Ep.
AC +24°1712,244	$16^h\ 58^m\ 36^s.02$	$+24°\ 29'\ 01''.1$	1892.45

This position is in fact coincident with that of HD 153820 (A0, mag 8.1) = BD +24°3104 = SAO 084700 = AGK3 +24°1696, corrected for proper motion to the epoch of observation:

	RA (1950)	Dec (1950)	Ep.
SAO 084700	$16^h\ 58^m\ 35^s.88$	$+24°\ 29'\ 01''.3$	1892.45
AGK3 +24°1696	$16^h\ 58^m\ 35^s.95$	$+24°\ 29'\ 01''.2$	1892.45

There can be no doubt therefore that V360 Her is one and the same star as HD 153820, and not a classical nova.

I am indebted to the Brenda Corbin and Greg Shelton at the U.S. Naval Observatory library for the generous use of that resource, to the anonymous individual who diligently annotated the library copy of the Catalogue Photographique du Ciel, and to the Office of University Programs at Goddard Space Flight Center for a NASA/ASEE Summer Faculty Fellowship which made this opportunity possible.

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NEW SPECTROSCOPIC ELEMENTS FOR RX Cas

RX Cas is a strongly interacting close binary system belonging to the W Ser-type. It consists of a K1 giant and the primary star is hidden in a geometrically thick and optically dense accretion shell or disk. Despite repeated attempts by different investigators, the analyses of the orbital light and radial velocity curves have so far given contradictory results.

Therefore, orbital radial velocity curves of RX Cas were constructed from 52 moderate dispersion spectrograms (44 Å/mm) obtained by V. Alduseva and P. Todorova. The methods of measurement and analysis were described by Alduseva (1987).

We believe that the difficulty in deriving a reliable spectroscopic solution is due chiefly to the complex line profiles in spectrum of RX Cas. In the orbital phases at quadratures many lines of FeI, FeII, TiII, SrII and ScII arising in the envelope are divided into two components like the Balmer lines. The line profiles are clearly disturbed by emission. By moderate resolution (~1 Å) most of absorption lines develop into blends. On the other hand, in previous studies Todorova (1990, 1993) showed that the envelope around primary imitates a pseudo-photosphere of a giant G2-3 star. Obviously by measuring of these sort of lines, assuming an early spectral type for primary (Struve, 1944; Alduseva, 1987) really will result in measuring blends from lines of the K-giant and the envelope. This will result in the decreased amplitude of the radial velocity curves.

For the radial velocity curve of K-giant we measured the lines:

FeI: 4045.827, 4063.607, 4071.751, 4191.555, 4250.466, 4260.429, 4325.777, 4383.659, 4415.137, 4427.319 and 4494.575; FeI, CaI 4092.512; FeI, TiI 4404.745; FeI, NiI 4202.093; FeI, TiII 4307.914; FeI, MnI 4030.673; FeI, CoI 4118.702; CrI 4254.330; TiII: 4314.979, 4501.232, 4522.634 and 4571.971; TiII, FeII 4549.560; SrII 4215.524 and ScII 4246.879. For the primary star were used listed lines of FeI and CaII 3933.684, ScII 4246.829 and CrII 4558.66.

A correlation was found between the radial velocities of primary and the stage of physical activity which has a period of 516 days. All lines of envelope are subject of periodic Doppler blue shifts which reach a maximum during the transition stage to maximum light. It is of interest that the lines of CaII, ScII and CrII remained constant during the transition stage to the minimum of the physical activity (i.e. minimum of light). The mean velocity determined from these lines in the first half of orbital periods is -7.0 ± 0.9 km/s, identical with system's γ-velocity. Possibly periodic ejection of the outer layers of the envelope forms an extensive common envelope around the system. The results are shown in Figure 1.

After all of these considerations had been taken into account, we derived solutions in two models: a circular orbit and an elliptical orbit (see Table 1a, b).

Table 1

a. circular orbit solution

secondary		primary		
		FeI	Ca, Sc, Cr	all lines
γ(km/s)	-5.7 ± 0.3	-10.0	-2.2	-6.4 ± 0.7
K(km/s)	96.6 ± 1.5	29.2	31.5	30.3 ± 1.1
ϕ	$0^p.252 \pm 0^p.001$	$0^p.237$	$0^p.274$	$0^p.257 \pm 0^p.001$

b. elliptic orbit solution

secondary		primary		
		FeI	Ca, Sc, Cr	all lines
γ(km/s)	-6.0 ± 0.3	-7.7	-0.2	-4.3 ± 0.5
K(km/s)	97.4 ± 1.0	29.8	33.1	31.3 ± 1.0
ϕ	$0^p.979 \pm 0^p.001$	$0^p.251$	$0^p.084$	$0^p.200 \pm 0^p.001$
ω	$260^\circ.1 \pm 2^\circ.5$	$179^\circ.1$	$57^\circ.2$	$154^\circ.2 \pm 3^\circ.0$
e	0.097 ± 0.02	0.191	0.155	0.163 ± 0.112

The high eccentricity of primary's orbit is most likely the result of the absence of observations near $\phi_{orb}=0^p.9$ to $0^p.0$.

For deriving the absolute elements, we used photometric elements from Andersen et al. (1989) in which the secondary K1 III star fills its critical Roche lobe and there is an accretion disk around primary: i= 80°, R_{sec}=0.28, size of disk r_d=0.16 and z_d=0.03 in minimum of the physical activity and r_d=0.15 and z_d=0.04 in maximum.

The absolute elements are listed in Table 2. In view of the facts mentioned above we believe that an amplitude of 30 km/s for primary is a mean value or a lower limit. From these we derive lower limit for the masses.

Since the spectrum of primary was not observed (because it is completely obscured by the envelope), its radius must be smaller than $\sim 2.5 R_\odot$. If it is a main sequence star with mass $\sim 5 M_\odot$ it should have a spectral type of ~B5−A0.

Table 2. Absolute elements

		primary (+envelope) min	primary (+envelope) max	secondary
$R(R_\odot)$	z_d	2.5±0.03	3.3±0.04	23.0±0.28
	r_d	13.2±0.16	12.3±0.15	
$M(M_\odot)$		5.3±0.34		1.7±0.17
$a(R_\odot)$		19.65±0.97		62.65±0.97
q			0.31±0.05	

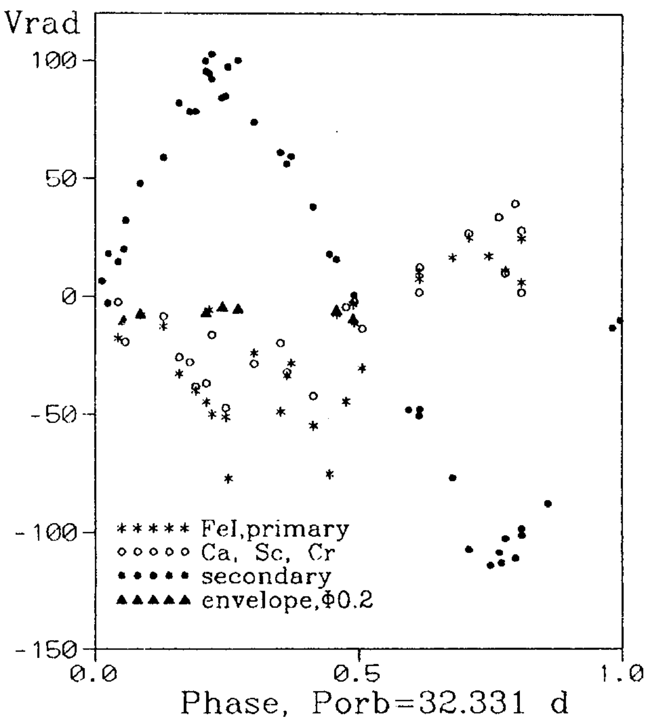

Figure 1. Curves of radial velocities

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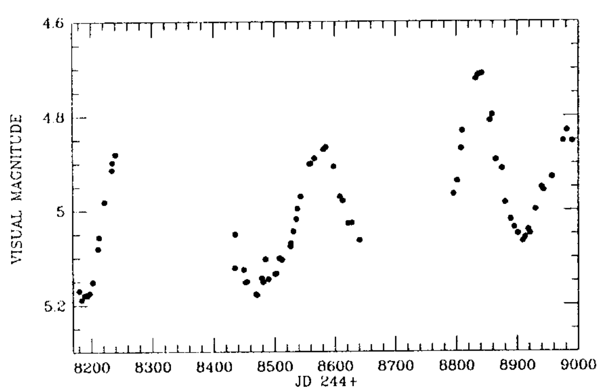
Photoelectric Photometry Of The Carbon Star TX Piscium

TX Piscium (HD 223075, BD +09°2785, SAO 120026, 19 Psc), along with Y CVn, ranks as the brightest carbon star in the sky. It has been one of the most observed stars of its type, and numerous papers have been published on the analyses of its spectrum. The current literature lists various spectral types, most notably C5 II (Hoffleit 1982, Richer 1971) or C6,2 (Johnson et al 1986, Hirshfeld and Sinnot 1985). Johnson et al (1986) describes TX Psc as an irregular Lb giant variable with a visual magnitude of approximately 5.0; this is in agreement with Hoffleit (1982) and Judge and Stencel (1991). Hoffleit (1982), Mendoza and Johnson (1964), and Mitton and McRobert (1989) also all agree on its color index of 2.60.

During the past three years the author has been conducting photoelectric photometry observations of TX Psc as part of the AAVSO Small Amplitude Red Variable (SARV) program. These observations were made to determine its periodicity, if any, and amplitude range. Despite the numerous spectral studies on this star, no published photometric light curve has been found in the existing literature. Additionally, the only data found that pertained to an amplitude range was that published by Mitton and McRobert (1989), who reported a visual amplitude range of 5.3 to 5.8. Hence it is thought that the light curve and supporting data could be the most complete set of data to date that shows indications of semi-well defined amplitude ranges and periodicities.

The observations were made on 71 separate nights from JD 2448180 (15 Oct 90) to JD 2448990 (02 Jan 93). The detector used was a silicon PIN photodiode in a solid-state SSP-3 photoelectric photometer, which was mated to an f/10 8-inch Schmidt-Cassegrain. The observations were made through a SSP-3 Schott visual filter, with the variable star measurements flanked by the comparison star and sky readings. A check star was observed on 68 of the 71 nights. The comparison and check stars used were HD 223719 (V=5.55, B-V=1.53, K4 II) and HD 222368 (V=4.13, B-V=0.51, K7 V), respectively. The mean magnitude difference between these two stars was -1.47 with a standard deviation of 0.02 magnitude. The data were reduced by a computer program written by the author, with all comparison and sky readings being interpolated. Also taken into account in the program were atmospheric extinction, mean transformation to the standard UBV system, and corrections to heliocentric time. The maximum internal standard error for all of the observations, calculated for each individual night, was 0.015 magnitude.

TX PISCIUM LIGHT CURVE



The photometric observations have revealed certain well defined minima and maxima points, which are summarized in Tables I and II, respectively. The resulting light curve is constructed from the data in Table III.

Table I: TX Piscium Minima Data

Times of Minima	Intervals Between Minima (Days)
JD 2448190	
	290
JD 2448480	
	215
JD 2448695 (int)	
	215
JD 2448910	

Table II: TX Piscium Maxima Data

Times of Maxima	Intervals Between Maxima (Days)
JD 2448580	
	260
JD 2448840	
	140
JD 2448980	

Note that Table I includes an interpolated minimum at JD 2448695, which is halfway between the observed minima at JD 2448480 and JD 2449910. Also the maxima

Table III: TX Piscium Light Curve Data

JD 244+	Visual Magnitude	JD 244+	Visual Magnitude
8180.547	5.17	8566.527	4.89
8184.536	5.19	8581.552	4.87
8189.514	5.18	8585.505	4.86
8191.563	5.18	8598.464	4.91
8193.550	5.18	8608.463	4.97
8197.539	5.17	8613.464	4.98
8202.495	5.15	8622.469	5.03
8211.506	5.08	8628.480	5.03
8213.533	5.06	8641.471	5.06
8222.473	4.98	8795.851	4.96
8234.461	4.91	8801.817	4.94
8235.471	4.90	8808.820	4.87
8240.475	4.88	8819.836	4.83
8434.860	5.12	8832.752	4.72
8435.817	5.05	8836.749	4.71
8449.816	5.12	8842.723	4.71
8452.810	5.15	8855.696	4.81
8454.813	5.15	8859.706	4.80
8469.804	5.18	8865.664	4.89
8471.756	5.18	8875.642	4.91
8479.750	5.14	8880.624	4.98
8481.806	5.15	8889.665	5.02
8485.724	5.10	8895.590	5.04
8490.733	5.14	8901.595	5.05
8501.683	5.13	8909.564	5.06
8503.690	5.13	8913.558	5.06
8508.667	5.10	8918.529	5.04
8512.641	5.10	8921.525	5.05
8526.595	5.08	8930.521	5.00
8527.611	5.07	8940.484	4.95
8531.616	5.04	8943.484	4.96
8536.586	5.02	8957.483	4.93
8538.590	5.00	8975.528	4.85
8543.565	4.97	8981.478	4.83
8558.583	4.90	8990.482	4.85
8560.516	4.90		

at JD 2448980 could be somewhat suspect, as further observations could not be carried out due to the normal end of the observational season. The average of all time intervals, both minima to minima and maxima to maxima, including the interpolated minimum, is 224 days. This value falls within one of two peak frequencies of period distributions for semi-regular SRb stars of spectral type C and S grouped together (Petit, 1982). Now while all researched references in the literature classify TX Psc as an Lb irregular giant variable star, one might be inclined to view TX Psc as a semi-regular variable of type SRb based on the above "fit" of the average period to that of Petit's period distribution. However, a characteristic of SRb stars is that of superimposed periods, and observations are still lacking to make any definite statements in that area. Hence, TX Psc could be possibly viewed as a semi-regular variable of type SRa, in addition to it being a SRb, instead of the current Lb irregular classification.

Supporting this argument is data regarding distribution of variable carbon star types by the C subclass and carbon content class. Alksne et al (1991) classify the spectrum of TX Psc as C7,2; according to his distribution data, this would denote TX Psc as an Lb irregular giant carbon variable. However, most literature references classify the spectrum of TX Psc as either C6,2 or C5 II, and this spectral type would denote a SR variability type, according to Alksne's distribution data.

Finally, it should be emphasized that, despite there being no one definite period, the observed light curve does show some degree of regularity in terms of periodic brightening and fading. It is not completely irregular, at least for the three observing seasons in which TX Psc was observed. It is possible that the variability of TX Psc is due to the existence of local density enhancements, or clumps, in the envelope around the star (Heske et al, 1989). These clumps could cause erratic outflow of matter in the envelope, producing the semi-regular variability as seen in the light curve. More observations will be needed to either further enhance the argument for TX Psc to be classified as a SR variable instead of a Lb irregular or to refute the above claims.

The amplitude range of TX Psc is also variable, with a total light curve range of 0.46 magnitude. This is in agreement with Mitton and McRobert (1989), who reported a range of 0.5 magnitude. However, while Mitton's value covered a visual magnitude range from 5.3 to 5.8, the visual magnitude observed by the author has been from 4.72 to 5.18. This is somewhat brighter than that reported by Mitton. Furthermore, except for the drop in last apparent maxima to visual magnitude 4.86 at JD 2448980, one can see an overall brightening trend in the light curve. Whether or not this trend continues can only be ascertained by more observations.

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DIFFERENTIAL UBV PHOTOMETRY OF THE CP3 STAR HD 89822

The CP3 star HD 89822 (HR4072, A0 HgSiSr) was selected from the paper of Gerbaldi, Floquet and Hauck (1985) to investigate the photometric period amongst Hg-Mn spectroscopic binaries. The membership of HD 89822 among the CP3 group has been definitely confirmed by Aikman (1976). Winzer (1974) found no evidence of significant variations and Catalano and Leone (1991) discovered a period of 7.5586 days which is substantially different from the known spectroscopic binary period of 11.5741 days. They used the same comparison stars as Winzer (HR 4026, HR 4215).

The observations have been carried out at Skalnaté Pleso and Stará Lesná observatories with the photoelectric photometers attached to 0.6 m reflectors. The comparison star was HD 88983 (HR 4026, A8III) and the observations were made in the sequence 3xS-3xV-3xS. Each observation of the star was followed by the sky background recording and the observations were corrected for differential extinction. The observations were made in overall number of 41 nights. Duration of a typical night run was 1.5 hour.

However, weather conditions enabled us to obtain quality observations needed for searching for periodicities of low amplitudes around 0.02-0.03 mag as few as 10 nights and 15 nights for Skalnaté Pleso and Stará Lesná observatories respectively. Table 1 lists the instrumental magnitudes in each filter. The night averages are given with corresponding rms errors. Raw data will be published elsewhere (Zboril 1994).

Catalano and Leone (1991) were able to fit their observations of HD 89822 by two sinusoidal light curves represented by the function

$$\Delta m = A_0 + A_1.sin(2\pi((t - t_0/p) + \phi_1))) + A_2.sin(2\pi((t - t_0/p) + \phi_2))) \qquad (1)$$

where:
Δm is the magnitude difference in each filter, t Julian date of the observation, t_0 is the initial epoch, p period in days and A_i, ϕ_i amplitudes and phases given in Table 2.

They also established ephemeris elements

$$JD(\Delta\, U_{min}) = 2441417.90 + 7.5586 \times E \qquad (2)$$

We determined the coefficients A_0 for our photometric systems as mean values of all nights considered in both observatories.

Figures 1,2 give our observations in U and B filters against light curve according to formula 1 with the coefficients given in the Table 2 phased with respect to the above ephemeris formula.

The largest amplitudes (around 0.03 mag) can be expected in U and B filters according to the values of A_1 in the Table 2 but we detect no variations within 0.01 mag in both filters respectively when data phased considering the period 7.5586 days. This goes for

Table 1: Journal of observations

Skalnaté Pleso JD = 244 00000+								
U filter			B filter			V filter		
8534.58	-1.253	±0.001	8534.58	-1.022	±0.001	8534.58	-0.833	±0.001
8562.64	-1.254	0.001	8562.64	-1.022	0.001	8562.64	-0.832	0.001
8588.65	-1.253	0.002	8588.65	-1.022	0.003	8588.65	-0.832	0.002
8625.51	-1.259	0.001	8625.51	-1.029	0.001	8625.51	-0.837	0.001
8643.57	-1.258	0.001	8643.57	-1.027	0.001	8643.57	-0.831	0.003
8680.57	-1.257	0.001	8680.57	-1.028	0.001	8680.57	-0.840	0.001
8723.45	-1.262	0.005	8723.45	-1.022	0.003	8723.45	-0.827	0.003
8758.41	-1.255	0.002	8758.41	-1.023	0.002	8758.41	-0.835	0.002
8759.39	-1.258	0.001	8759.39	-1.028	0.001	8759.39	-0.839	0.002
8993.69	-1.259	0.002	8993.69	-1.028	0.002	8993.69	-0.843	0.002
Stará Lesná JD = 244 00000+								
8274.54	-1.239	0.002	8274.54	-1.004	0.001	8274.54	-0.826	0.001
8331.43	-1.243	0.003	8331.43	-1.002	0.002	8331.43	-0.822	0.002
8350.54	-1.248	0.004	8350.54	-1.013	0.003	8350.54	-0.834	0.002
8645.71	-1.251	0.006	8645.71	-1.017	0.002	8645.71	-0.835	0.004
8646.63	-1.230	0.004	8646.63	-1.011	0.001	8646.63	-0.830	0.001
8683.52	-1.245	0.003	8683.52	-1.007	0.001	8683.52	-0.826	0.001
8691.53	-1.230	0.003	8691.53	-1.008	0.001	8691.53	-0.827	0.001
8692.52	-1.236	0.006	8692.52	-1.007	0.001	8692.52	-0.826	0.001
8701.53	-1.246	0.006	8701.53	-1.014	0.003	8701.53	-0.837	0.002
8993.63	-1.237	0.003	8993.63	-1.006	0.001	8993.63	-0.825	0.001
9023.36	-1.227	0.008	9023.36	-1.012	0.005	9023.36	-0.827	0.006
9030.66	-1.242	0.003	9030.66	-1.007	0.001	9030.66	-0.827	0.001
9031.37	-1.223	0.006	9031.37	-0.997	0.002	9031.37	-0.822	0.001
9149.44	-1.244	0.004	9149.44	-1.004	0.002	9149.44	-0.828	0.003
9178.43	-1.255	0.008	9178.43	-1.011	0.004	9178.43	-0.828	0.005

Skalnaté Pleso observatory (1783m above sea level), while the observations from Stará Lesná observatory are of larger scatter (900m above sea level). Since there is a gap around phase 0.45 the observations are being continued to improve the phase diagram. Anyhow, we should point out that we did not consider HR 4215 as another comparison star for its considerable distance from HD 89822. The quality of the data observed due to various altitudes warn us when searching for low amplitude variations.

Our data (Skalnaté Pleso) are probably consistent with the latest observations of Adelman and Pyper (1993) using Four College APT who considered both comparison stars as in Winzer's thesis. They also do not confirm the light variability of this star in Strömgren

Table 2: Parameters of the light curve fit

							A_0 coeff.	
Filter	A_0	A_1	A_2	ϕ_1	ϕ_2	σ	Sk. Pleso	St. Lesná
U	-1.23739	0.01629	0.00301	-0.229	-0.773	0.008	-1.240	-1.257
B	-1.01655	-0.01563	0.00209	0.220	0.111	0.007	-1.008	-1.025
V	-0.82746	-0.00955	0.00473	-0.320	0.863	0.008	-0.828	-0.835

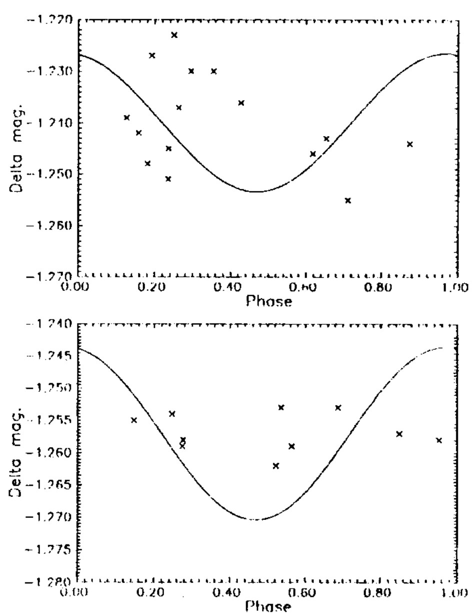

Figure 1: The U filter observations at Skalnaté Pleso (bottom) and Stará Lesná observatories

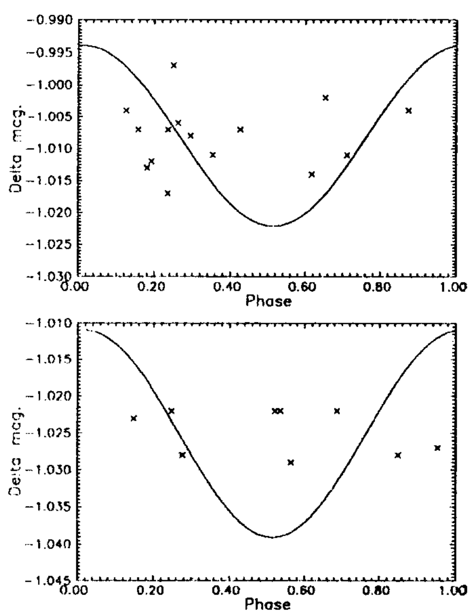

Figure 2: The B filter observations at Skalnaté Pleso (bottom) and Stará Lesná observatories

system. Thus, we cannot probably confirm the period of 7.5586 days predicted by Catalano and Leone (1991).

Moreover, Adelman and Pyper's (1993) observations of another Hg-Mn star (HR 1331) do not give evidence for photometric variability of CP3 stars and this provoke us to reconsider the constancy in light of these objects.

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PERIOD AND BV LIGHT CURVES OF A NEW W UMa VARIABLE GSC 4383.0384

The recent discovery of a new variable star GSC 4383.0384 by Kamil Hornoch, Jan Kyselý and Dalibor Hanžl has been announced in *IBVS*, No. 3879 (13 May 1993) [1].

The star was photometrically measured by means of the 0.4-m Nasmyth reflector of the N. Copernicus Observatory in Brno from 16th April to 25th May. The telescope was equipped with an unrefrigerated photomultiplier tube EMI 6256 with UBV filters of Johnson's standard system. An insufficient signal-to-noise ratio in the U band compelled us into using the reduced BV system only.

As the comparison star HD 86677 was adopted. The star is a very close visual double star (ADS 7611), the components of which are unresolvable by the instrument specified above. The basic BV data of the comparison star (V=7.876 mag, B−V=+0.510 mag), taken from *The Hipparcos Input Catalogue* [2], refer to the total light of this joint system. The light constancy of the star was confirmed by frequent observations of three check stars. (Basic data and BV photometry for the comparison and check stars will be published in [3]).

Observing the variable star GSC 4383.0384 in the course of 9 nights we obtained 244 and 239 individual photoelectric measurements in B and V, respectively (see Table 1).

Using the method of "trials and errors" we found a preliminary period of light variations: P=0.529 days. Both the corresponding BV light curves and the period rank the star among the W UMa type variables. The observed mean B−V index of +0.48 mag is also consistent with this classification. Then we improved the preliminary period applying a special gradient least square method [3] to the whole set of photometric data. We have arrived at the following formula predicting times of primary minima:

$$JD_{hel} = 2\,449\,104.3592 + 0\overset{d}{.}528904\ (E-19). \qquad (1)$$
$$\pm 6 \qquad \pm 25$$

As the reference minimum we have chosen the best observed primary minimum.

The period is obviously real, since all expected allied periods give much worse phase diagrams. The reality of the period given above has additionally been confirmed through independent visual observations of the star obtained by Kamil Hornoch [3], who did them without knowing any ephemeris.

The phase ϕ and the epoch E for an arbitrary JD_{hel} time can be evaluated through relations:

$$f=(JD-2\,449\,094.3100)/0.528904,\ \phi = \mathrm{Frac}(f),\ E=\mathrm{Int}(f). \qquad (2)$$

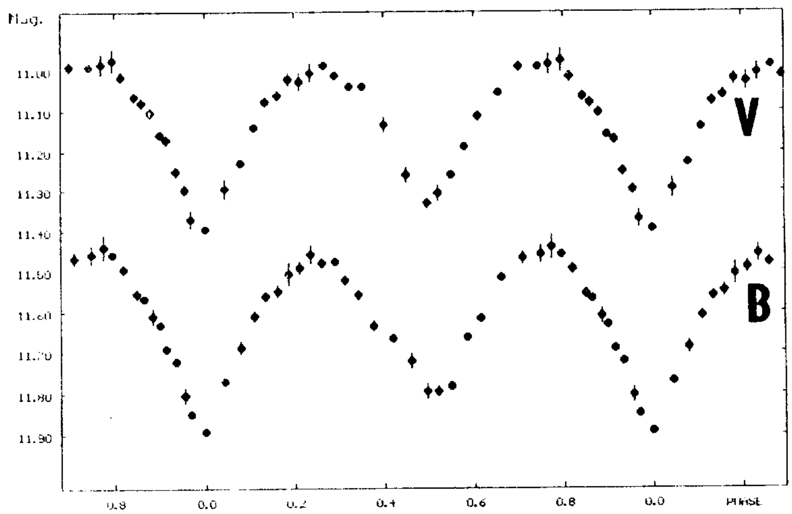

Figure 1

Table 1

night	1	2	3	4	5	6	7	8	9
JD-2449000									
begin.	94.33	95.32	98.31	101.32	102.51	104.31	121.34	125.34	133.37
end	.38	.36	.49	.51	.54	.54	.45	.50	.43
E + Φ									
begin.	0.03	1.90	7.57	13.26	15.50	18.91	51.10	58.66	73.85
end	0.12	1.98	7.90	13.61	15.57	19.35	51.31	58.98	73.96
B									
n_B	6	5	30	44	13	56	30	45	15
SD_B	.029	.037	.031	.063	.035	.027	.027	.020	.047
V									
n_V	6	5	30	38	13	56	30	45	16
SD_V	.038	.055	.031	.046	.046	.030	.033	.023	.056

Table 2

	B [mag]	V [mag]
Mean magnitude	11.614 ± 0.0035	11.132 ± 0.0025
Primary minimum	11.866 ± 0.011	11.382 ± 0.008
Secondary minimum	11.809 ± 0.012	11.328 ± 0.009
Maxima	11.455 ± 0.008	10.987 ± 0.006
Amplitude I	0.411 ± 0.014	0.395 ± 0.010
Amplitude II	0.354 ± 0.015	0.341 ± 0.011

Table 1 contains a review of our BV photoelectric observations. For individual nights they are listed here: JD_{hel} times of beginnings and ends of observations and corresponding values of sums $(E+\phi)$, and numbers of measurements n and standard deviations of one measurement in magnitudes (SD) in B and V colours, respectively.

The whole set of our BV photoelectric measurements embraces 74 cycles, both light curves are covered without gaps. Unfortunately, the accuracy of measurements is comparatively low (0.038 mag in B, 0.036 mag in V), which is due to both the faintness of the variable and generally bad observational conditions. That is why we have introduced normal points for the demonstration of lightcurves (see Figure). Each normal point of the light curve is a result of 7 individual consecutive dots of the phase diagram, the bar shows the expected error of the normal point.

The B band and V light curves exhibit two unequally deep light minima, the difference between their depths being (0.057 ± 0.015) mag and (0.054 ± 0.012) mag in B and V, respectively. The centre of the primary minimum has been put at the phase 0.000, the centre of the secondary seem to be placed at the phase 0.50. Both eclipses seems to be partial. The maxima, as we expected, occur near phases 0.25 and 0.75. The apparent unequality between them may be (at least in B) spurious. We have not found any pronounced variations of B$-$V so that it appears to be more or less constant within the whole cycle. The mean B$-$V is equal to $(+0.482\pm0.004)$ mag. Absolute values of magnitudes of the variable GSC 4383.0384 are given in Table 2.

More detailed information on the star including the whole photometric and visual observational material and the description of the light elements determination method will be published in [3]. The variable appeals for further observations.

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[3] *Contribution of the Nicolas Copernicus Observatory and Planetarium in Brno*, No. 31, 1993 (will be published)

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PHOTOELECTRIC PHOTOMETRY OF THE ECLIPSING BINARY STAR EG CEPHEI

EG Cep (BD+76°790=HD 194089=BV 200) was discovered by Strohmeier (1958) as an eclipsing binary with a period of P=$0^d.54$. The star was observed photoelectrically by Geyer (1961), Cochran (Wood, 1971), Van der Wal et al. (1972), Kaluzny and Semeniuk (1984). Kaluzny and Semeniuk analyzed their light curves with the Wilson-Devinney method. They found that EG Cep is most probably a semidetached system in the slow stage of case A mass exchange evolving to a contact configuration.

The system was observed photoelectrically at the Ege University Observatory. The observations were performed in the observational seasons of 1991 and 1992. The 48 cm (f/13) Cassegrain reflector equipped with an unrefrigerated EMI 9781A photomultiplier tube was used. All observations were made with the B and V filters of the UBV system. BD+76°791 and BD+76°789 were used as comparison and check stars respectively. The atmospheric extinction coefficients in each colour for every nights were calculated from the observations of the comparison star using conventional methods. Then, all the differential observations (variable minus comparison) were corrected for differential extinction.

A total of 550 observational points were obtained in each colour. During the observations moments of six primary and four secondary minima were obtained which are given in Table I. The $(O-C)_1$ values were computed using the following light elements given by Mallama (1980):

$$\text{Hel Min I JD}=2442594.3825+0^d.54462183\times E \qquad (1)$$

Table I. Times of minima of EG Cep

J.D. Hel.	Min	Method	Filter	E	(O-C)I	(O-C)II
2448483.3901	I	pe	B	10813	0.01175	0.00206
48483.3904	I	pe	V	10813	0.01205	0.00236
48489.3805	I	pe	V	10824	0.01131	0.00161
48489.3819	I	pe	B	10824	0.01271	0.00301
48495.3696	I	pe	B	10835	0.00957	-0.00014
48495.3709	I	pe	V	10835	0.01087	0.00116
48516.3389	II	pe	B	10873.5	0.01093	0.00117
48516.3395	II	pe	V	10873.5	0.01153	0.00177
48523.4174	II	pe	B	10886.5	0.00935	-0.00043
48523.4181	II	pe	V	10886.5	0.01005	0.00027
48810.4333	II	pe	V	11413.5	0.00954	-0.00091
48810.4323	II	pe	B	11413.5	0.00854	-0.00191
48841.4739	II	pe	V	11470.5	0.00670	-0.00383
48841.4760	II	pe	B	11470.5	0.00880	-0.00173
48843.3851	I	pe	V	11474	0.01172	0.00119
48843.3858	I	pe	B	11474	0.01242	0.00189
48850.4651	I	pe	V	11487	0.01164	0.00109
48850.4623	I	pe	B	11487	0.00884	-0.00171
48855.3652	I	pe	B,V	11496	0.01014	-0.00042

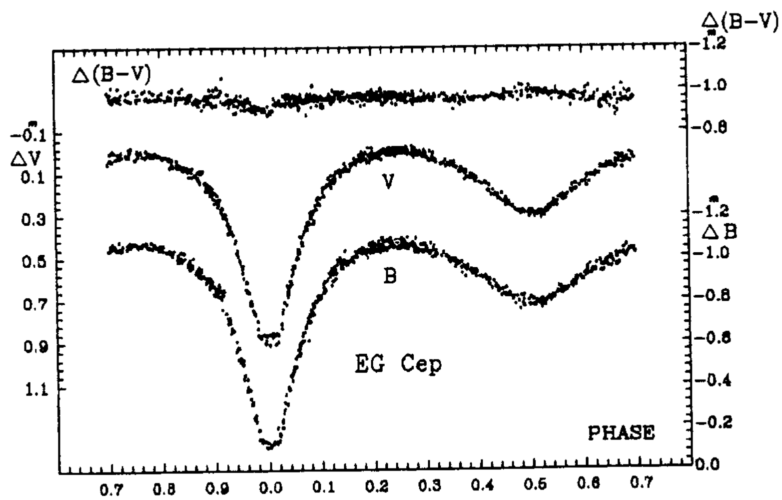

Figure 1. The O−C diagram for EG Cep

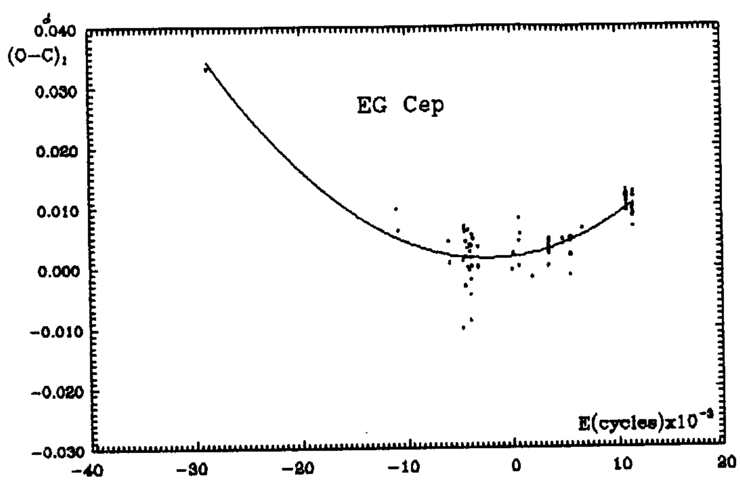

Figure 2. Differential B and V light and
B−V colour curves of EG Cep for 1991 and 1992

The $(O-C)_1$ diagram of EG Cep is shown in Figure 1. This diagram contains other times of minima which can be found from the literature. As it is clearly seen from the figure, EG Cep shows a parabolic variation indicating a continuous increase in the period. The period increase is found to be about 0.55±0.04 second per century. Using the times of minima plotted in Figure 1, quadratic light elements have been calculated by the least squares method as follows:

$$\text{HJD Min I}=2442594.3842+0^{d}.54462206\times E+0^{d}.473\times10^{-10}\times E^2 \qquad (2)$$
$$\pm4 \qquad \pm5 \qquad \pm35$$

The $(O-C)_2$ values in the table are calculated with these new light elements. However, the following linear ephemeris can be used in the near future:

$$\text{HJD Min I}=2448850.4640+0^{d}.54462314\times E \qquad (3)$$
$$\pm4 \qquad \pm5$$

Our individual differential observations in both colours and the B−V colour curve are plotted in Figure 2. The phases were calculated with the formula (3). The shape of the light curve is typical of β Lyr type. Kaluzny and Semeniuk (1984) found that the phase of the secondary minima in yellow is earlier than that of the secondary minima in blue, and the light curves of EG Cep are not quite symmetric. We could not see the same effects in our secondary minima nor in the light curves. The primary minimum is an annular eclipse. The amplitudes are about $0^{m}.945$ and $0^{m}.875$ at the primary, $0^{m}.275$ and $0^{m}.290$ at the secondary minimum in blue and yellow light, respectively. The colour curve in Figure 2 shows that the system is slightly redder at the primary and bluer at the secondary minimum. So, the spectral type of the secondary component is later than that of the primary.

The photometric analysis of the light curves is in progress and will be published elsewhere.

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BD +16°2766 IS NOT AN EW-TYPE STAR

BD +16°2766 = BV 137 ($\alpha_{1950} = 15^h17^m28^s$ $\delta_{1950} = +16°33.9'$) is a star designed as NSV 7028 in the New Catalogue of Suspected Variable Stars (Kukarkin *et al.*, 1982).

Its variability was suspected by Strohmeier, Kippenhahn and Geyer (1956). The star appeared in a list of 32 new suspected stars discovered by the authors.

The 84 visual estimates carried out between 1951 and 1956 by a Russian observer (Filatov, 1957), who had observed 26 stars of the above mentioned list, allowed him to conclude to a rapid variation for NSV 7028. The author gives a list of 8 times of minima and suggests an EW-type for the star, without proposing a first ephemeris.

From this paper the NSV Catalogue reports the following elements :

11.3-11.8 P   EW: Spectrum : K4

Despite the low amplitude of variation, a few GEOS observers have realized a visual survey tentative conducted by one of us (Walas, 1992) during four seasons (1987-90).

The 562 observations failed to show evidence of any significant variations, discouraging further visual monitoring.

In order to confirm the constancy in brightness of the star, BD +16°2766 was observed photoelectrically during the 1990 and 1991 runs at the Jungfraujoch Observatory (Switzerland) with the 76-cm Cassegrainian telescope fitted with a Geneva photometer (Dumont *et al.*, 1990, Dumont, 1990, 1991).

The B and V filter values of the Geneva system and the B-V ones have been converted into the Johnson and Morgan system using the formula suggested by Meylan and Hauck (1981).

The general theory for the data reduction is decribed in IBVS 3758 (Walas, Dumont, Remis, 1992) and a more complete one is presented in GEOS Circular RR7 (Dumont, 1983).

All the observations are listed in Table 1.

The complete analysis of the 1990 measurements gives an average of 10.219 ± 0.014 in the V-Band and 1.16 ± 0.02 for the B-V index. If any, the variation is smaller than 0.02 magnitude, but BD +16°2766 is more probably constant since the same value is obtained for the error bars.

Other observations collected in 1991 give a further confirmation of the constancy of the star.

NSV 7028 is not an EW-Type star as was suggested by Filatov and also seems not to be a variable. It could be looked on as a constant star with the following parameters :

$$V = 10.21 \pm 0.02 \qquad B-V = 1.15 \pm 0.04$$

No further observations are planned by the GEOS on this object.

Table 1 : BV data on BD +16°2766

JJ Hel.	Air-Mass	V	B-V
48121.3677	1.76	10.205	1.16
.3844	1.97	10.197	1.16
48122.3516	1.63	10.216	1.14
.3666	1.78	10.219	1.15
.3787	1.93	10.216	1.17
48123.3585	1.73	10.221	1.12
.3700	1.85	10.216	1.14
.3898	2.15	10.226	1.16
.4047	2.46	10.223	1.19
.4120	2.64	10.249	1.19
48478.3510	1.44	10.193	1.08
.3552	1.47	10.202	1.12
.3565	1.48	10.205	1.13

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FLARE STAR SEARCH IN THE ALPHA PERSEI CLUSTER

Parallel with the programme for the investigation of low–mass members in the open cluster Alpha Persei ($\sim 8 \times 10^7$ years) of Prosser (1991, 1992) on the basis of their proper motion determination the monitoring flare star observations were carried out at the Rozhen Observatory, Bulgarian Academy of Sciences. The monitoring has an aim to independently identify new red dwarf members of the cluster and to determine the flare activity of the stars in this intermediate–age cluster.

For the monitoring observations we used the 50/70/172 cm Rozhen Schmidt telescope. In the period November 1990 – March 1993, 98 monitoring multiple exposure plates (emulsion ORWO ZU21) with the centre – the star BD +48°920 ($03^h24^m29\overset{s}{.}1$, 48°53' 25" (1950)) were obtained. The total effective observational time is 93^h44^m. The data of the observing material are given in Table 1.

Table 1. Flare Star Monitoring in the Alpha Persei cluster.

Year	Number of plates	Total Exp Time	Number of exposures	Duration of the exposure	Light/ Filter
1990	1	1^h00^m	6	10^{min}	Pg/–
1991	39	38 20	230	10	U/UG1
	7	3 54	39	6	Pg/–
1992	26	25 30	153	10	U/UG1
1993	25	25 00	150	10	U/UG1
Total	98	93 44	578		

After the visual inspection of the observational material with CARL ZEISS blink–comparator we found two new flare stars in the cluster region, different from the known UV Cet type stars (Sediakina 1971 and Wang 1993). The data of the newly discovered flare stars are listed in Table 2. It seems that the low flare activity is charasteristic for this cluster.

Table 2. New Flare Stars in the Alpha Persei Cluster.

No.	R. A. 1950	DEC. 1950	Magnitude in Minimum mag(V)	mag(I)	Magnitude in Maximum mag(U)
1.	$3^h25^m17\overset{s}{.}6$	50°05' 55"	$16\overset{m}{.}17$	$13\overset{m}{.}91$	$14\overset{m}{.}1$
2.	3 23 46.7	47 47 02	18.7	15.3	12.7

The photometric CCD V,I –magnitudes (Kron system) in quiescence of the new flare stars were obtained with the Whipple Observatory 1.2 m telescope on Mt. Hopkins, Arizona. The (V, V–I) photometry of both flare stars makes them acceptable for membership in the cluster. Neither FS1 nor FS2 had been previously identified as candidate cluster members from proper motion surveys. Based on their photometry, FS1 appears to be a late K or early M dwarf, while FS2 is probably M5 or later. FS2 is therefore one of the lowest-mass candidate members of the Alpha Persei cluster identified to date.

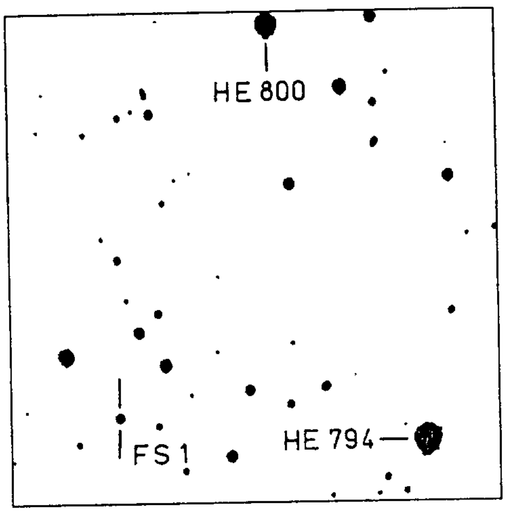
The rough photographic B–magnitude of FS1 in minimum measured on the direct plate obtained with the Rozhen Schmidt telescope is $17^{m}_{.}5$ (B). The magnitude of FS2 estimated on the Palomar Observatory Sky Survey O–print is about $20^{m}_{.}4$ (Bp).

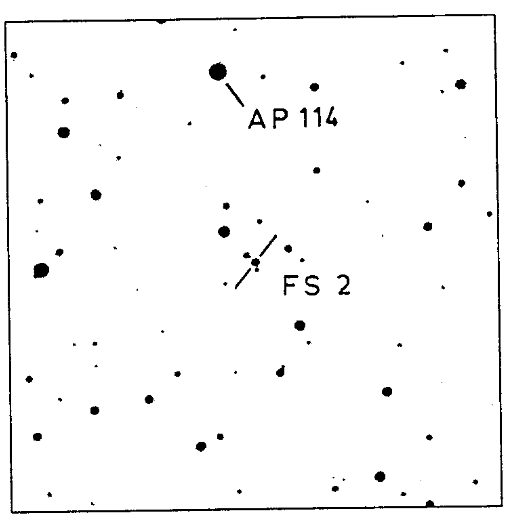
The amplitudes of FS1 and FS2 flare events registered, with the correspondence of their standard U–B colours (for spectral types M0 and M5) are $4^{m}_{.}6$ (U) and $\sim 9^{m}_{.}0$ (U) magnitudes. The very big amplitude of FS2 seems to be not exception for such active faint M–dwarfs, when we compare with similar flare stars in the Pleiades cluster (Haro et al. 1982).

Table 3. Photographic Photometry of the Discovered Flare Events.

FS No.	Plate No.	Exposure No.	J. D.	Magnitude mag (U)
1	5987	1	2448510.4257	>15.5
1	5987	2	.4330	>15.5
1	5987	3	.4403	>15.5
1	5987	4	.4476	>15.5
1	5987	5	.4549	14.8
1	5987	6	.4622	14.1
1	5988	1	.4716	14.2
1	5988	2	.4789	14.4
1	5988	3	.4861	14.7
1	5988	4	.4934	14.7
1	5988	5	.5007	14.6
1	5988	6	.5080	14.8
1	5989	1	.5174	15.0
1	5989	2	.5247	15.3
1	5989	3	.5320	>15.5
1	5989	4	.5393	>15.5
1	5989	5	.5466	>15.5
1	5989	6	.5539	>15.5
2	6134	1	2448628.3049	>15.5
2	6134	2	.3122	12.7
2	6134	3	.3195	13.0
2	6134	4	.3268	13.9
2	6134	5	.3341	13.6
2	6134	6	.3413	13.7

The identification maps of the FS1 and FS2 reproduced from the CCD I-frames (5 arcmin on a side) are given in Figures 1a and 1b. North is on the top, East – on the left.





Figures 1a, 1b. Identification maps of the new flare stars.

The future digitization of the observational material for an automatic detection of the flare– and other type variable stars is planned.

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CCD OBSERVATIONS OF A NEW T TAURI STAR IN CEPHEUS

The CCD observations of the new suspected T Tauri star in Cepheus, having a strong variability (Semkov 1993) were made on 24 September 1992 at the Rozhen Astronomical Observatory, Bulgarian Academy of Sciences.

The star is located in the dark clouds near the emission nebula NGC 7129 and it was also recognized as a very strong Hα emission star - No 7 from the list of Semkov and Tsvetkov (1986).

The observations were taken with the Focal Reducer and CCD P8603/B (576 × 385) camera of the Max-Planck-Institute for Aeronomy (Jockers 1992) attached to the Rozhen 2m RCC telescope. The CCD image of the star through a red broad band filter Gunn R is shown in Fig. 1a and through an interference narrow band filter IF 657 in Fig. 1b. In Figure 1 North is on the top, East is on the left and the scale is 1.3 arcmin on a side.

The observations showed that there is a small cometary nebula around the star, which is not visible on the Palomar Observatory Sky Survey prints. West of the star a more dense object is situated, which maybe a jet from the star. On the North there is a background enhancement probably connected with the nebulosity around the star.

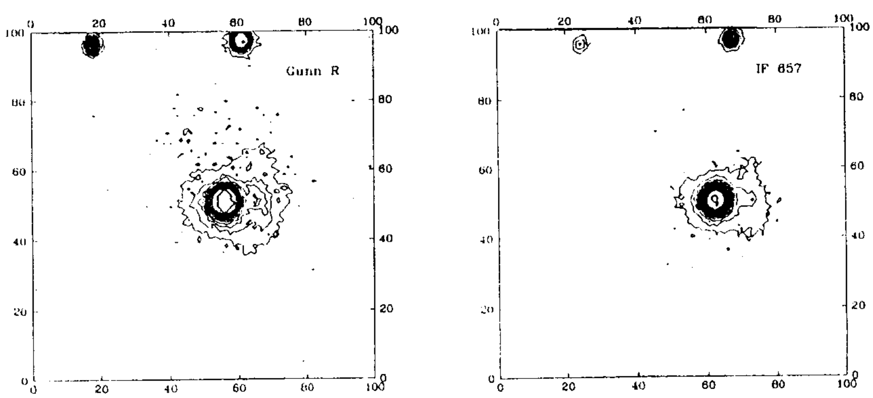

Figure 1. CCD frame of the new T Tauri star through Gunn R and IF 657 filters.

The spectra of the star were taken with a grating prism having a dispersion 0.469 nm/pixel (Fig. 2). The spectral observations exhibit strong emission line spectrum with the lines of HI, OIII, FeII, MgI and other metals. The Hα hydrogen line is very intense and it goes beyond the frame in Fig. 2.

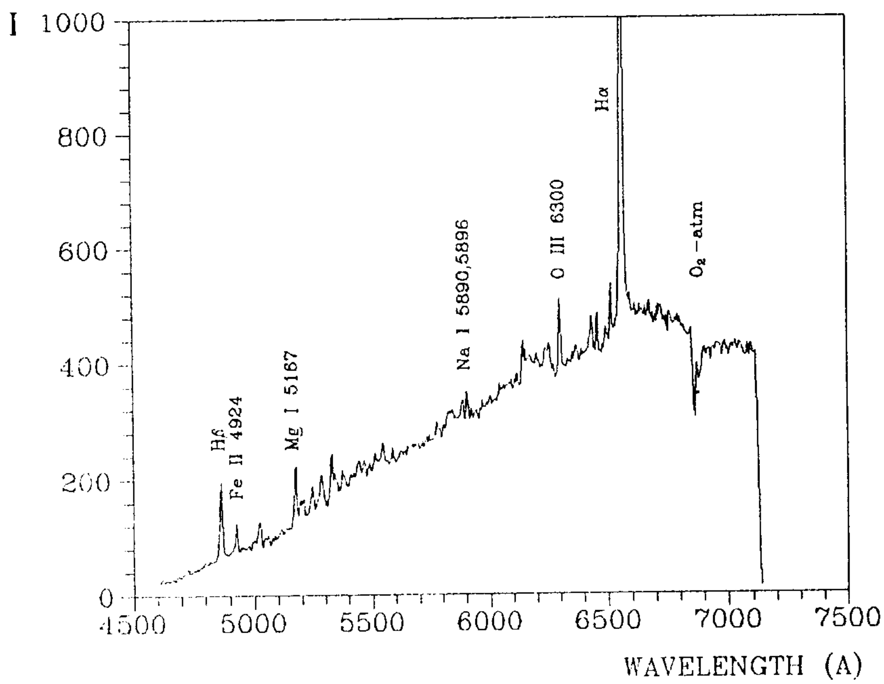

Figure 2. CCD spectrum of the new T Tauri star in Cepheus.

This kind of spectrum is typical of the very active T Tauri stars connected with nebulae according to Herbig's classification (1962).

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THE VARIABILITY OF HD 126246=ADS 9251

HD 126246=BD+11°2673=ADS 9251 was chosen in 1984 as a comparison star for a program seeking long-term luminosity variations in a set of sun-like stars (Radick et al., 1989, Lockwood et al., 1992). The pair turned out to be somewhat active on both short (night-to-night) and long (season-to-season) timescales. I report here briefly on its variations during the years 1984-1992.

The star was included in a trio involving HD 124570=HR 5323=14 Boo (the program star) and HD 125451=HR 5365=18 Boo (a second comparison star). The stars were observed using the Lowell 53 cm photometric telescope, which is fitted with a single-channel photoelectric photometer containing Strömgren b and y filters. On each night all three stars were measured twice in each filter using either a 29-arcsec or 49-arcsec diaphragm. Each measure consisted of six ten-second integrations on 'star' and two ten-second integration on 'sky'. The data were reduced to instrumental magnitudes, accounting for differential extinction using mean monthly extinction coefficients (cf. Lockwood & Thompson, 1986). During episodes of volcanically-induced enhancements, the extinction values were adjusted to compensate at least approximately for this on a nightly basis. Basic data for all the stars is given in Table 1, extracted from the SIMBAD database. The combined V magnitude for HD 126246 is derived from the mean differential y magnitudes of the present observations combined with the published V for HD 125451, compensating for the small color term in transforming from y to V using the published b−y colors.

Table 1
Basic Data for the Variable and Comparison Stars

Star	V	b−y	MK
HD 124570	5.536	0.343	F6IV
HD 125451	5.386	0.267	F5IV
HD 126246	6.780	0.371	F8V+G1V

Over the course of nine seasons – and 161 observations – the two comparison stars were nearly constant. Their seasonal mean differential magnitudes differed on average by 0.1323±0.0012 (sigma) in the y filter and 0.2062±0.0015 (sigma) in the b filter. The averaged Δy does not closely match the implied ΔV listed in the Table, but is within the range expected from the uncertainties in the variety of sources of V magnitudes given in SIMBAD. The Δ(b−y) is in very close agreement with the color difference implied in Table 1, which is based on data given by Perry (1969). HD 124570, incidentally, is suspected variable NSV 6579. But this appears to be based solely on the range of reported V magnitudes (0.06) in the USNO Photoelectric Catalogue (Blanco et al., 1968), and is almost certainly spurious.

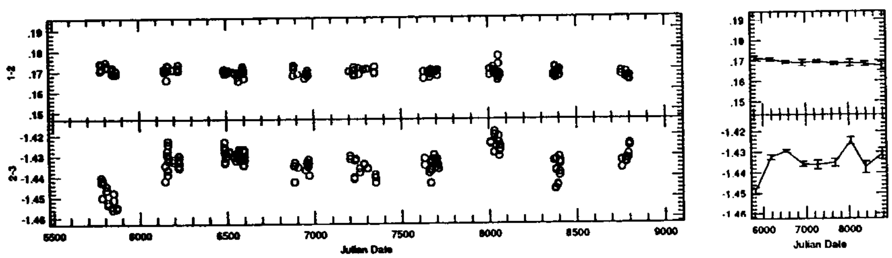

Figure 1. (upper) Differential magnitudes and seasonal means for the comparison stars HD 124570 minus HD 125451. (lower) Differential magnitudes and seasonal means for HD 125451 minus HD 126246, showing the variability in HD 126246.

The variable star is a wide pair, ADS 9251, whose separation is about 9 arcseconds. They appear to be a common-proper-motion pair (Halbwachs 1986). Both stars were always included in the photometer diaphragm. The magnitude difference was measured on five nights using a 12-arcsec diaphragm, and found to be $\Delta y=0.19\pm0.03$. The relatively large uncertainty is attributable to observational error at least as much as intrinsic variation in the two stars. V magnitudes of 7.44 and 7.63 are inferred from this measurement and the combined magnitude given in Table 1.

Figure 1 shows a plot of the nightly differential magnitudes (the two nightly pairs of b and y cycles averaged as b+y/2) for the comparison pair and for HD 125451 minus HD 126246. To the right of each data string are shown the seasonal means; the error bars are 95-percent confidence intervals. There is a slight drift in the mean magnitude for the comparison pair, amounting to about 0.004 magnitudes during the interval. This is most likely due to a change in one of the stars rather than an instrumental effect. A fourth star (HD 123845) was added to the group in 1988, which over five season shows the drift to be due to HD 124570.

The rather larger changes in HD 126246 are evident in the lower panel of Figure 1. Not only has the mean brightness varied over a range of about 0.024 magnitudes during the interval, but the dispersion in the seasonal groups indicates night-to-night variability as well. There are, unfortunately, not enough data in any one season to obtain reliable light curves, such as might be caused by rotation of spotted stars. This explanation for the variability is in fact the most likely, suggested by the small amplitude of the variations and spectral types of the stars. Assuming both stars to be contributing to the observed variability, the light curve would be complex in any case, since the two stars are always included in the diaphragm. The larger season-to-season shifts would be caused in this scenario by changes in the overall spottedness and chromospheric-activity level in the two stars.

Since the pair of stars is well separated, they are good candidates for spectroscopic study to examine their chromospheric activity in detail. However, untangling the short-term photometric variations in the individual stars, which appear to have full amplitudes less than 0.015 mag., will be a challenge observationally. We have dropped this variable pair from our program, but continue to monitor HD 124570 using the two remaining stable comparison stars.

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IS K1098 IN M15 A SHORT PERIOD RED VARIABLE STAR?

The red star K1098 (Küstner, 1921) in the globular cluster M15 was found by Yao to be a new suspected variable star. Now we have checked it with CCD photometry and confirmed its variability. According to our determination, its V=15^{m}67 and B−V=0^{m}97. The coordinates of the star relative to the cluster center are: x=332", y=90". The location of the star on the C−M diagram is shown in Fig.1. Neither radial velocity nor proper motion determinations are found in literature. Maybe it is a field star.

The star was observed by us with the RCA CCD ♯1 attached to the Cassegrain focus of the Zeiss 1-m reflector (f/13.3) at the Yunnan Observatory in December 1992 and with the RCA CCD ♯2 at the same telescope in May 1993. The CCD ♯1 contains 320×512 pixels at a scale of 0."47/pixel, thus covering a 2.'5×4' field and the CCD ♯2 512×512 pixels at the same scale covering a 4'×4' field. A total of 31 yellow and 4 blue 600 second exposures were obtained. The seeing was between 2."0 and 4."0 (FWHM). The reduction process was identical to that used before (Yao, 1990, 1993). The results are:

$$m(t) = m_o + \sum_{i=1}^{2} a_i sin(2\pi t/p_i + 2\pi\phi_i)$$

Here p_1=0^{d}5155, a_1=0.0566, ϕ_1=0.0050
p_2=0^{d}0927, a_2=0.0193, ϕ_2=0.3727

The m_o represents the mean magnitude difference between K1098 and the comparison star K1073, which is also a red star of similar color.

The folded light curves are given in Figures 2 and 3. Each light curve is plotted with the data prewhitened with the other frequency. Here the circles represent the observations on 16 December 1992, the open triangles on 17 December 1992, the x's on 23 May 1993, the squares on 24 May 1993 and the filled triangles on 26 May 1993.

The interstellar reddening in the direction of M15 is not large (E(B−V)=0.12), so the star K1098 is intrinsically red. Why does a red star pulsate with a short period? How long can the pulsations of these kinds persist?

Further observations are needed to determine the periods accurately and to check their possible variations.

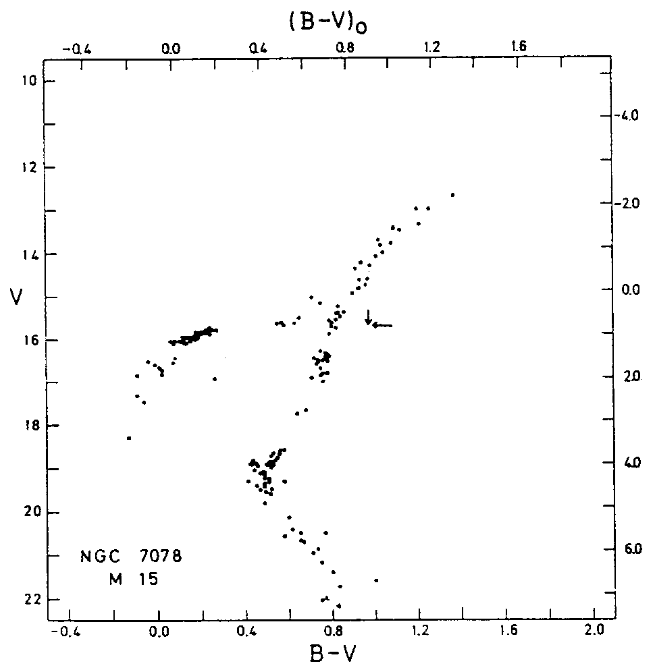

Figure 1

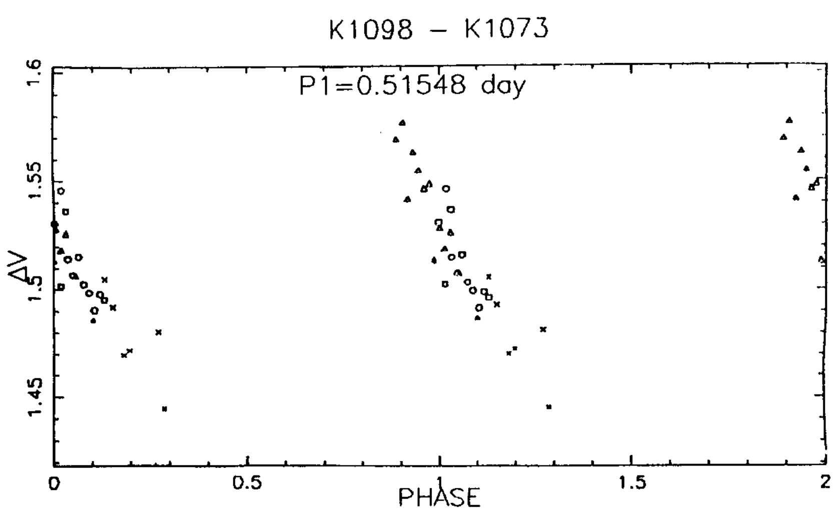

Figure 2

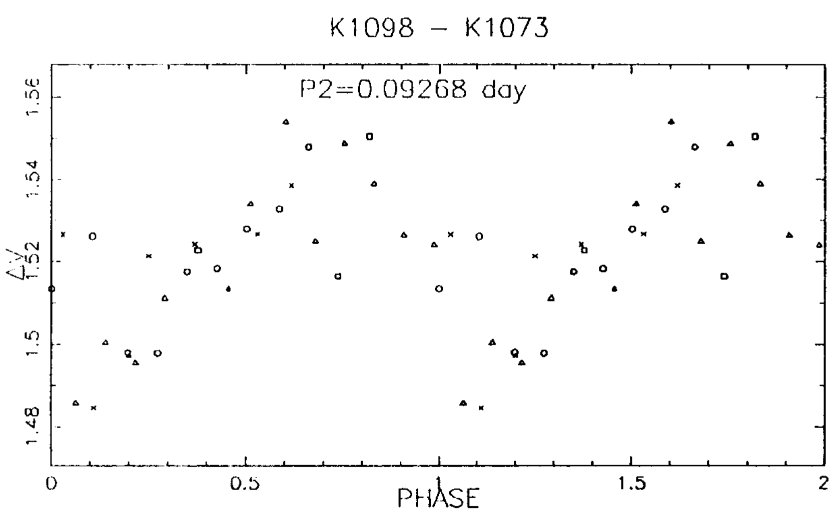

Figure 3

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OBSERVATIONS OF ERUPTIONS OF THE TRUE AK CANCRI

Since its discovery by Morgenroth (1933) on Sonneberg plates AK Cnc = 77.1933 has remained a rather mysterious object. In the course of time the following, partly contradictory, observational results have been reported:

- Short period pulsational variability probable (Morgenroth, 1933),
- U Geminorum type classification without particulars (Tsesevich, 1967),
- visually never seen, fainter than $\approx 13\overset{m}{.}6$ (AFOEV, 1987, ff),
- always visible near $13\overset{m}{.}6$ (AAVSO, 1988, ff),
- „blue star" on POSS (Vogt and Bateson, 1981; 1982),
- „no certain emissions" and no late-type bands showing (Williams, 1983),
- „spectral features and/or red continuum indicative of a late-type secondary evident" (Szkody and Howell, 1991),
- finding charts of Khruzina and Shugarov (1991) and Vogt and Bateson (1981; 1982) (see also Bateson and Morel, 1983) denote different objects.

I investigated the location of the star on 95 exposures of the Sonneberg 140/700 mm Triplet astrograph mainly taken in the years 1928 to 1934 and sporadically in the fifties and sixties - the discovery plates among them - and came to the following conclusions:

- The finding charts of Bateson and collaborators mark the correct star,
- the variable is indeed a cataclysmic dwarf nova,
- the range of variability in the blue range is $12\overset{m}{.}8$ to $\approx 19\overset{m}{.}0$ (POSS).

5 eruptions are visible on our plates:

1930	Dec.	23	$13\overset{m}{.}6$ pg
1931	March	8	12.8
		13	13.5
		15	13.5:
1931	Dec.	10	13.4
1932	Dec.	4	12.8
1967	Feb.	14	13.4

According to the statistical considerations of Wenzel and Richter (1986) the mean cycle length should be about 100 days. My brightness scale has been linked to the photometric sequence of the nearby M67 (Racine, 1971). Considering their scanty nature, the observations of the AFOEV are in agreement with ours.

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Szkody, P., and Howell, S. B., 1991, *Bull. American Astron. Soc.*, 23,943
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PLEIONE: A NEW Be PHASE

Phase transition is the most striking feature of the variability in Be stars. A few Be stars exhibited the phase transition of B→Be, B→Shell, and Be→Shell, and/or vice versa. Pleione is one of these stars. Since it was first discovered to be a Be star (Pickering, 1889), the star has undergone one B-star phase, two Be phases and two shell phases (Kogure, 1990). The shell strength of the last shell phase, which began in 1972-73, reached the maximum around 1981 (Goraya et al., 1987). Since 1986, a number of authors had pointed out that the shell phase was ending based on their own observations (Chauville and Ballereau, 1986, Goraya et al., 1987 and Guo Yulian, 1988).

Figure 1 illustrates a series of the Hα profiles, which were taken with the All-Fiber Coupler grating spectrograph of 2.16 m telescope at the Beijing Observatory in 1991 Dec.-1993 Jan. The detector used, the observational and data reduction techniques have already been described in detail elsewhere (Guo Yulian and Guo Xiaozhen, 1992). Table 1 lists the equivalent width (W_α) and the maximum intensity (I_{max}) of H_α emission lines, relative to the adjacent continuum. On the new and previous results obtained with the same reciprocal linear dispersion, 50Å/mm (Guo Yulian, 1988), it may be seen that the H_α emission line of Pleione exhibits conspicuous variations:

1. The appearance of the H_α profile has experienced prominent changes. The 1983-1987 profiles displayed distinct double emission peaks with visible central reversal but they appeared as single emission peaks after 1991 Dec. (see Figure 1 and Guo Yulian, 1988).

2. Since 1983, H_α emission has gradually strengthened. The intensity of H_α emission was 2.4 in 1983 Dec., 3.0 in 1987 Dec., 3.8 in 1991 Dec., and 5.2 in 1993 Jan. (see Table 1 and Guo Yulian, 1988).

Table 1

Date (U.T.)	No. of profiles	I_{max}	W_α (Å)
1991 Dec. 16	1	3.8	26.3
1991 Dec. 27	3	3.8	26.2
1992 Nov. 14	1	4.7	30.5
1993 Jan. 09	2	5.2	33.7

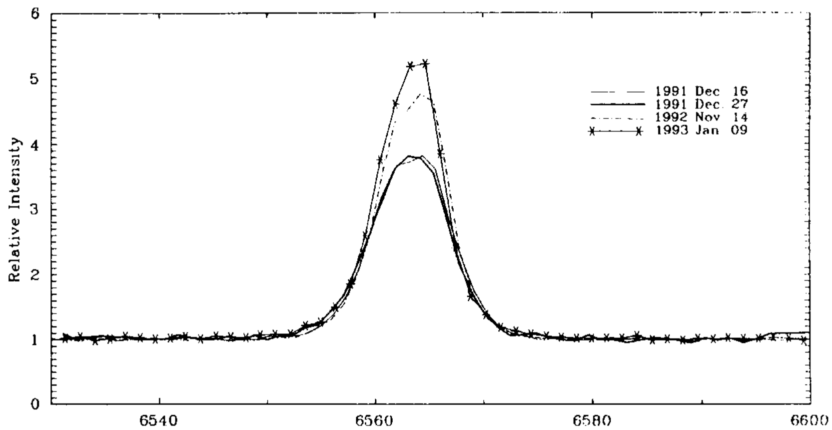

Figure 1. H_α profiles in Pleione.

Based on the earlier observations, it was known that, in the course of the transition from the shell phase, which began in 1938, to the Be phase, which began in 1955, the Balmer emission lines of Pleione (for example, H_β) gradually enhanced and the central reversal of the emission lines progressively became shallower (Gulliver, 1977 and Morgan et al., 1973). Recently observed variations of H_α show the same behavior as mentioned above for H_β. In addition, the equivalent width of the H_α emission line reached 25-35Å during 1960-64 emission maximum of the last Be phase (Hirata et al., 1976). The 1993 Jan. equivalent width of the H_α emission line already raised to about 33Å. From the above comparison it is inferred that Pleione has again entered into a Be phase since the end of 1991 or somewhat earlier, and its emission will continuously increase and is expected to reach the maximum before long. Consequently, continuous monitoring of its change at different wavelengths using various methods will be very interesting.

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DISCOVERY OF SOUTHERN VARIABLES.

For several years Paul J. Camilleri (PC) of Cobram, Victoria, Australia, has conducted a regular photographic patrol of the Southern Milky Way for novae. His equipment consists of an 85mm lens and T-Max 400 film. His search technique consists of laying two negatives (one new & one old) of selected areas of the Southern Milky Way on a light table. He searches each pair of negatives by stereo fusing them with a pair of 8x eye loupes, and any small difference will show itself very easily.

Nine novae have been discovered to date, using this technique (see Table 2). The other author of this paper (MM) collaborates with PC by searching published catalogues and datasets for supportive data e.g. photoelectric magnitude sequences, for each discovery, as well as preparing accurate finder charts. A useful byproduct of the nova patrol has been the discovery of variable stars of other types. This paper reports the discovery of ten such variables.

Table 1 lists the variables discovered. The first data field (column 1) gives the provisional designation. The second field gives the observed magnitude range. The third data field gives the Right Ascension and Declination (J2000), usually taken from the Guide Star Catalogue (GSC), or estimated relative to nearby GSC stars. The fourth data field gives the GSC number, if existing. The fifth data field gives names found in other catalogues, followed by spectral types in brackets. Notes at the bottom of the table are indicated by numbers in square brackets. The normal limiting magnitude of the nova patrol films is 12-13pv. A few stars have been observed down to fainter limits by R. McNaught at Siding Spring Observatory (1990),and the range given in Table 1 reflects this better coverage.

An extensive log of observations exists, which is available upon request from the senior author. The discovery films are of small scale and many of the observations are of limited accuracy. It is beyond the scope of this Bulletin to publish the dataset. On the original films the variations are quite distinct. The reality of these discoveries is attested to by the number of recoveries - stars previously suspected of variability. Three stars, PC4, PC5 and PC7 are in the NSV Catalogue (1982). PC3, PC7 and PC10 were also recorded as variable by McNaught (1990) in a photographic patrol in 1986/87. The variability of PC4 was also discovered independently by Wakuda (Japan). Most of the stars are red, with S type indicated for PC5 in the General Catalogue of S Stars (Stephenson, 1984); and carbon star types given for PC8 and PC9 in the Catalog of Cool Carbon Stars (Stephenson, 1973). The variations appear to be slow, of long period, but the lack of complete light curves makes classification difficult.

Fig. 1 provides finder charts for all of these variables, plotted from the GSC.

TABLE 1: POSITIONS AND IDENTIFICATIONS FOR PC VARIABLES.

PC #	Range	R.A. (J2000)	DEC.	GSC Ident.	Name; Sp.; Notes
	m (pv)	h m s	° ' "		
PC1	11-<13	17 21 56.2	-51 25 26	8353-00973	
PC2	10-13	16 35 38.7	-52 14 15	8337-01640	
PC3	11-17	16 39 18	-54 04.6	......	[1][2][4]
PC4	9.0-<12	08 36 48.9	-36 27 38	7148-03970	NSV 4154 [2]
PC5	9.5-12	10 03 29.9	-46 49 15	8182-00076 =8182-02311	GCSS 652 (S5,8e) NSV 4721 [2]
PC6	10-<12	10 00 48.8	-47 08 06	8186-00731	
PC7	11-15.2	14 51 06.5	-54 46 19	......	NSV 6825 [1][3]
PC8	10-12	12 40 15.2	-57 22 46	8655-03805	CCCS 2023 (C)
PC9	10.5-<12	11 33 58.0	-73 13 18	9233-02206	CCCS 1882 (C)
PC10	11-<15	07 58 25.9	-40 19 50	7650-01772	[1][2]

NOTES:

[1] Previously found by R. H. McNaught (1987).
[2] Mira type?
[3] Infra red excess.
[4] Very red (SR/I comparison).

TABLE 2: BASIC DATA FOR NOVAE DISCOVERED BY P.CAMILLERI.

# Name; Const.; Year	R.A. (B1950)	DEC.	Range (V)	Disc. Date
	h m s	° ' "		
1. V2264 Oph; 1991 #1	17 17 14.02	-26 43 27.1	9.8 - <21	11/4/91
2. V4160 Sgr; 1991	18 10 58.12	-32 13 23.6	7.0 - <21	29/7/91
3. V444 Sct; 1991	18 44 26.58	-08 24 12.0	10.5 - 20	30/8/91
4. V2290 Oph; 1991 #2	17 40 07.44	-20 05 35.0	9.3 - <21	28/10/91
5. V351 Pup; 1991	08 09 44.11	-34 58 29.2	6.5 - 20	27/12/91
6. V4157 Sgr; 1992 #1	18 06 28.68	-25 52 32.1	7.0 - 18	13/2/92
7. V992 Sco; 1992	17 03 42.69	-43 11 26.5	7.2 - 18	22/5/92
8. V4171 Sgr; 1992 #3	18 20 39.40	-23 01 05.2	7.5 - 20	13/10/92
9. .... Oph; 1993	17 22 04.41	-23 08 32.2	9.0 - <21	14/4/93

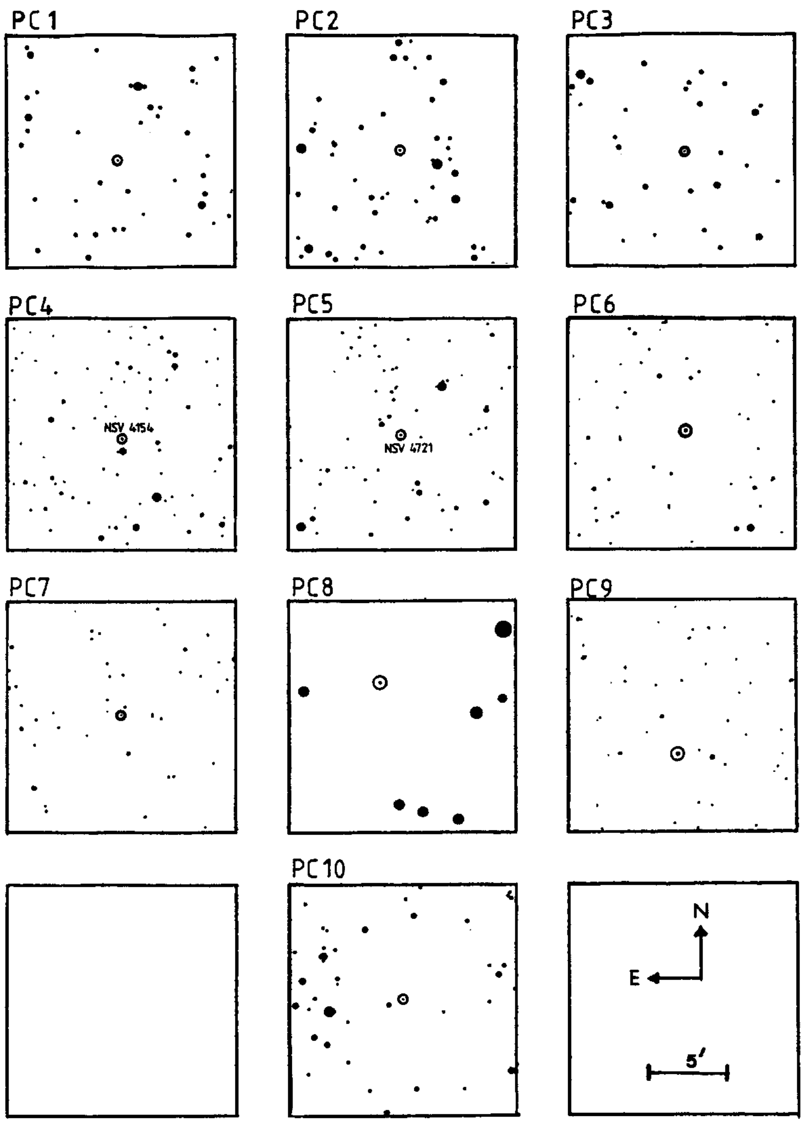

Fig. 1.
Finder charts for PC variables 1 to 10.
North is up, East at left. All charts are at the same scale as given by the scale bar.

Notes on Particular Stars. Many of the PC variables coincide with IRAS-PSC objects. These are :

PC1.	IRAS 17179-5122,	(1950)	17h17m59.4s	-51°22′33″.
PC2.	IRAS 16317-5208,	(")	16 31 43.7	-52 08 08 .
PC3.	IRAS 16353-5358,	(")	16 35 21.9	-53 58 45 .
PC4.	IRAS 08348-3617,	(")	08 34 53.7	-36 17 07 .
PC5.	IRAS 10015-4634,	(")	10 01 31.4	-46 34 42 .
PC6.	IRAS 09590-4656,	(")	09 59 04.2	-46 56 02 .
PC7.	IRAS 14474-5433,	(")	14 47 29.9	-54 33 58 .
PC8.	IRAS 12374-5706,	(")	12 37 24.3	-57 06 19 .

PC4 = NSV 4154. This star has been placed on the visual observing list of the Variable Star Section, Royal Astronomical Society of New Zealand. Charts have been published (Bateson and Morel, 1992).

We wish to acknowledge the previous work done in studying some of these variables by Robert H. McNaught, Siding Spring Observatory. We thank Minoru Wakuda for his observations of PC4 = NSV 4154. We also acknowledge the NASA-NSSDC Astronomical Data Center, for providing datasets (114 selected astronomical catalogues on CD-ROM) which have been very useful.

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DISCOVERY OF THE NATURE OF THE VARIATION OF HD 191706

The eighth magnitude A0V star, HD 191706, was reported to be variable by Vető, Schöneich, and Rustamov(1980). They had selected it as a comparison star for the study of the Ap star, HD 191980. They speculated that it might be an eclipsing binary of period 25 days. Since we were also observing that Ap star, we decided to determine the nature of the variation of HD 191706. Our comparison star was one they used, HD 191879.

We observed with the 16 inch reflecting telescope at Braeside Observatory near Flagstaff, Arizona, utilizing the photoelectric photometer with UBV filters, beginning in June 1992. The first hint that it might be a binary was obtained in early July, 1992. In May 1993, we obtained our first complete eclipse on JD 2449128. We determine a period of $1^{d}.035600$. Thus, the period is not 25 days, but is close to 1.04 days, which means that the whole eclipse can be observed from any one location for about two nights every twenty five days. This was the case, because, in June, in Arizona, the star did not rise high enough for photometric study until about 11:00 p.m. and the rest of the night was required to record all of the minimum. The eclipse appears to be total for about 1.87 hours, but the eclipse is very shallow, about 0.1 magnitudes in V. The observations of our first minimum can be seen in Figure 1.

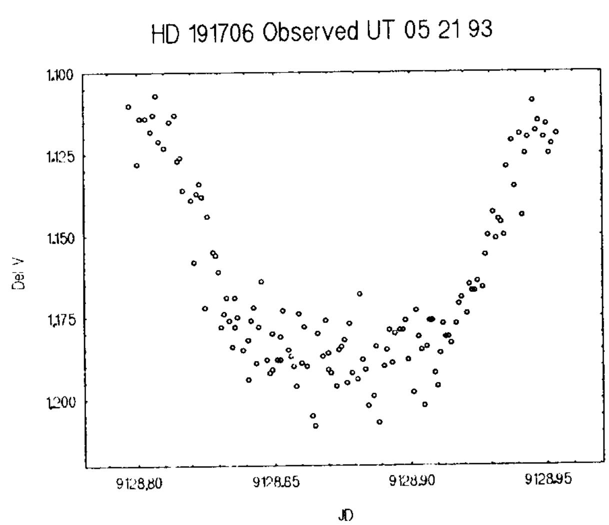

Figure 1.

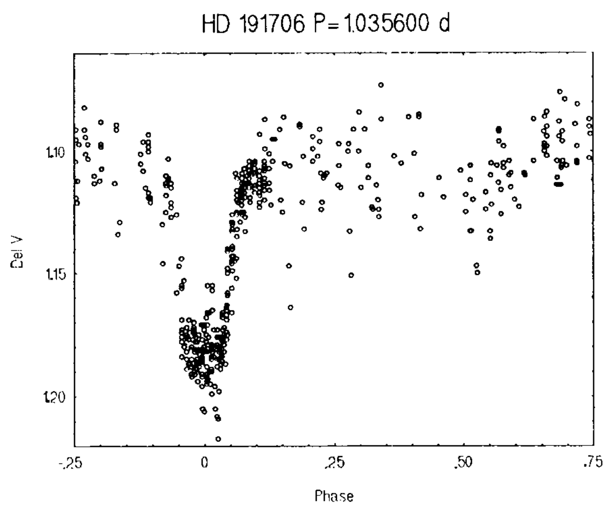

Figure 2.

There is some indication that the period may be twice the one quoted, or 2.071200 days. That is, on successive nights the depths of the minima seemed slightly different, which would indicate the presence of primary and secondary minima of almost identical depth. However, the scatter in these observations is great enough so that we cannot establish a significant difference between the possible different depths of the minima.

We propose the following ephemeris:

$$\text{JD Hel Min (V)}=2449128.877 + 1.035600 \times E$$
$$\pm .000013$$

A phase diagram with that period is shown in Figure 2.

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RED FLARES AT THE PRIMARY MINIMA OF THE ECLIPSING BINARY FF ORIONIS

The eclipsing variable FF Ori (=HD 288053=49.1929, m=10.2-11 pg, Sp=A1) was discovered by Hoffmeister (1929). After that, the star was observed only visually and photographically. The binary is situated in the region of the OB association Ori I.

Our UBVR photoelectric observations were made with 60cm telescope on Mt. Maidanak (Uzbekistan) in 1990/92. The star BD+2°1008 (V=10^{m}44, U−B=0^{m}14, B−V=0^{m}67, V−R=0^{m}38) was used as a comparison one. 106 in U, 176 in B, 179 in V and 174 in R measurements for the binary were made. The principal photometric characteristics of the light curves are presented in Table 1.

Table 1

	V	U−B	B−V	V−R
Max	11.23	−0.11	+0.15	+0.18
MinI	12.13	−0.05	+0.23	+0.25
MinII	11.32	−0.14	+0.13	+0.14

The amplitude of the primary minimum shows the most depth in U (1^{m}02) and the least one in R (0^{m}82). Both minima have the equal durations of 0^{P}145. They do not show flat bottoms. According to Kordylewski's (1948) ephemeris the phase of the primary minimum is moved by 0^{P}0103±0^{P}0002. On the base of the known times of minima listed in Table 2 we calculated the improved light elements of FF Ori using the method of least squares:

$$\text{Min I} = \text{JDH}\,2448916.658 + 1^d\!.8105251 \times E$$
$$\pm 0.003 \pm 0.0000004$$

This ephemeris was used to calculate the O−C values in Table 2.

The UBVR-curves are shown in Figure 1. The first three curves are typical for Algols, but the R-curve has a distortion after the primary minimum. We have reinspected carefully all our measurements of both the variable and the comparison star but not any mistake has been found. The phases of the curve were obtained on JD 2448556 (one point) and on JD 2448918 (8 points). 52 measurements of the binary were made on the second night and 44 of them did not show any anomalies. The bottom of the R-curve is plotted in detail in Figure 2 where the normal curve is drawn by the solid line. The distortion was 0^{P}014 or 36 minutes long and it got the peak of approximately 0^{m}10R. This peak brightness is considered to be due to the contribution of some third light equivalent to a star of 14^{m}6R. We have calculated $\Delta R = R_{nor} - R_{obs}$ where R_{nor} is the brightness of the binary on its normal curve and R_{obs} is that observed. Plotted in Figure 3 are ΔR values as a function of phase. It is seen from the Figure that the graph of the distortion resembles

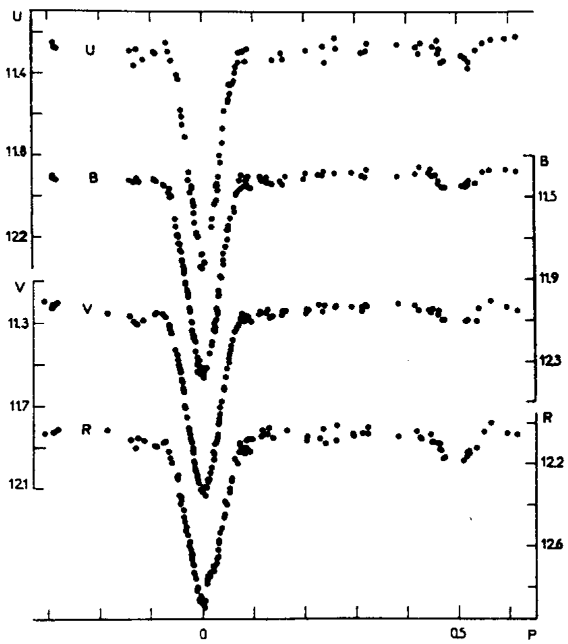

Figure 1. The light curves of FF Ori.

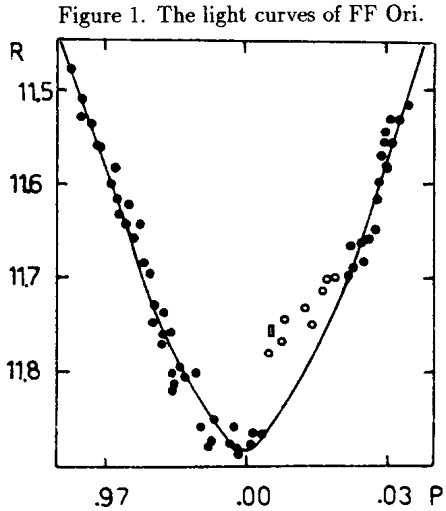

Figure 2. The R-curve bottom. (The distortion's points are denoted by empty symbols.)

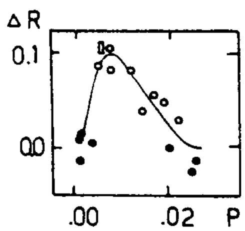

Figure 3. The light curve of the distortion.

Table 2.

J.D. 2400000+	E	O–C	Reference
25890.40	−12717	$+0^{d}.0011$	Schneller, 1938
30693.727	−10064	+0.0049	Whitney, 1948
31497.600	−9621	+0.0048	"
31772.793	−9469	−0.0020	"
32216.367	−9224	−0.0067	Kordylewski, 1948
42833.289	−3360	−0.0041	Kreiner, Mistecka, 1980
47553.335	−753	+0.0028	Danielkiewicz-Krosniak, 1990
48916.6576	0	−0.0008	Present paper

that of flares on the UV Cet type stars. We suppose these flares to occur on a cool secondary the spectrum of which we estimated to be K0. It is well known, however, that the flares of UV Cet stars reach the peak amplitude at short wavelengths. The flares observed do not show this important feature of these stars. The fact that only red flares (perhaps, regular) occur on FF Ori is difficult to understand.

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UBVR PHOTOMETRY OF THE ACTIVE ECLIPSING BINARY DN CEPHEI

Light variability of DN Cep (=SVS 894=VV 345; m=11.98−13.02pg; SP=B5) was described by Parenago (1938). Since, the only known observations of the binary have been made photographically by Miller and Wachmann (1971). The authors determined the light ephemeris of DN Cep. The secondary minimum was not seen on the curve. The binary is situated in the region of the Cep OB1 association.

In 1990/92 the observations of the DN Cep were made in UBVR filters with the 0.6 m telescope on Mt. Maidanak. The finding chart for the binary is shown in Figure 1, taken from Miller and Wachmann's paper. The comparison star BD+55°2706 (V=$9^m.21$, U−B=$0^m.10$; B−V=$0^m.19$; V−R=$0^m.08$) and the check one (V=$10^m.76$; U−B=+$0^m.21$; B−V=$0^m.35$; V−R=$0^m.33$) are denoted with s and c, respectively.

The probable error of a single observation of the binary was determined to be $0^m.029$ in U; $0^m.017$ in B; $0^m.019$ in V and $0^m.017$ in R. The numbers of the measured points are 188 in U; 300 in B; 307 in V and 299 in R filters, respectively.

According to Miller and Wachmann's prediction the time of the obtained normal minimum is shifted by $0^p.9890 \pm 0^p.0003$ and the improved ephemeris for the binary is

$$\mathrm{MinI} = \mathrm{JDH}\,2448953.078 + 3^d.3061560 \times E$$
$$\pm 0.001 \pm 0.00000002$$

The derived light curves for U, B, V, R colours are shown in Figure 2. From the Figure, it can be seen that light curves show a considerable brightness scatter, both at and out the minima. The clear-cut secondary minimum is seen only on the R-curve. We suppose that the photometric activity of DN Cep may be understood in term of the early stellar evolution. In this case the binary is to belong to Cep OB1 association. According to our elementary distance estimation the binary can be related to the association. DN Cep is expected to be an exceptionally interesting spectroscopic object.

Finally, the basic characteristics of the light curves are given in Table 1.

Table 1

	V	U−B	B−V	V−R
Max	11.98	−0.14	0.37	0.39
MinI	12.47	−0.11	0.41	0.37
MinII	12.05	−0.16	0.37	0.39

Note, that the amplitude in B colour is $0^m.5$ whereas the photographic one was near $1^m.0$.

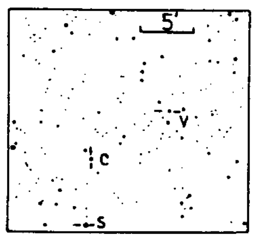

Figure 1. Finding chart for DN Cep.

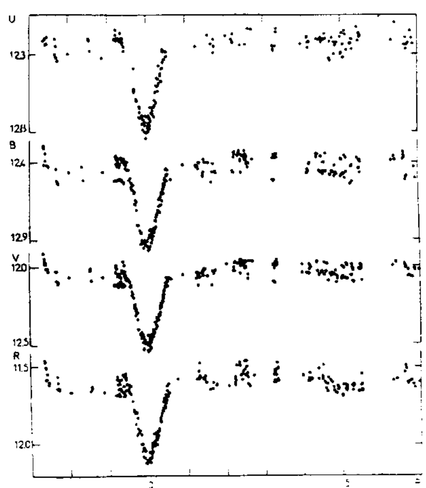

Figure 2. The light curves of DN Cep.

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PHOTOMETRIC INVESTIGATION OF THE SEMIDETACHED SYSTEM V836 CYGNI

Variable star V836 Cyg is a single-lined EB-type eclipsing binary with a short orbital period of 0.653 day. Communications about the instability of its light curves attracted our attention and we performed observations of the variable.

There are several observational studies of V836 Cyg in the last two decades (Wester, 1977, Breinhorst & Duerbeck, 1982). Photometric analyses of the observations, based on various LC-synthesis methods, yield almost contact configurations of the system with a mass ratio q from 0.4 to 0.5. The assumption that both components are MS stars together with its spectroscopic mass function (Duerbeck & Schumann, 1982) and the surface intensity ratio (from LC-solutions) indicate a lower value of q limited by the interval from 0.30 to 0.38 (Breinhorst & Duerbeck, 1982). Moreover Breinhorst et al. (1989) by evaluating of analysis of four-color Strömgren observations indicated the mass ratio near q=0.34.

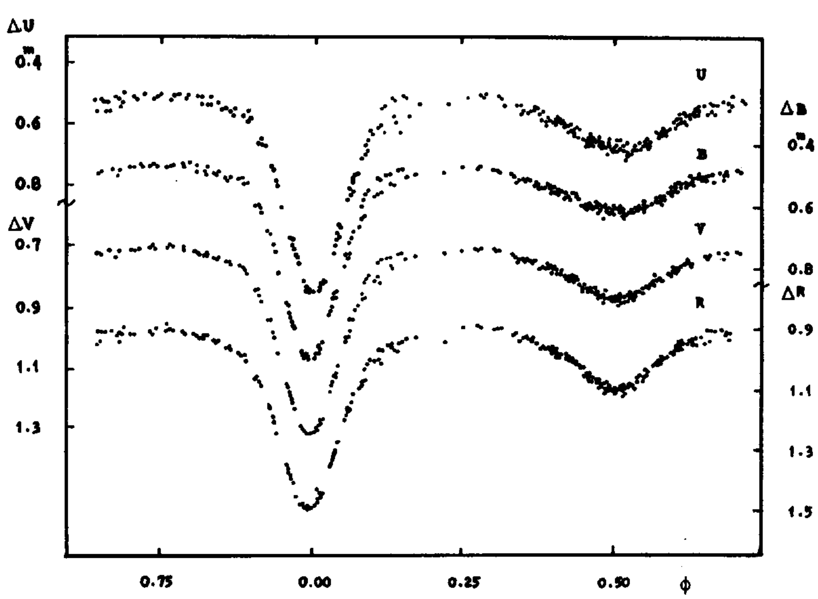

Figure 1. UBVR light curves of V836 Cyg. Magnitude differences are given in sense "variable minus comparison".

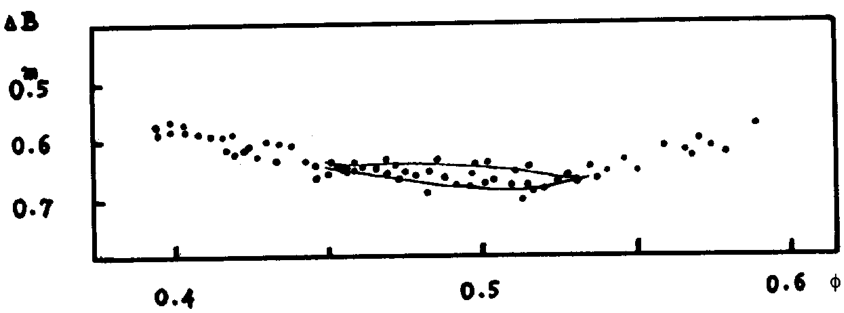

Figure 2. B-band's variations of the light curve in min II.
The observations obtained during the different nights are shown by lines
(upper – 13 August, lower – 28 August).

Consequently the system V836 Cyg should consist of MS-primary and oversized G-type secondary. From all these studies follows that the system has evolved through the stage of rapid mass exchange with mass ratio reversal.

Our observations were obtained in August 1989 with a single-channel UBVR photometer (Neizvestny & Pimonov, 1978) attached to the 60-cm Zeiss reflector of the Special Astrophysical Observatory of the Russian Academy of Science. BD+35°4461 was used as a comparison star and BD+35°4460 as a check one.

To eliminate short time-scale variations from light curve our set of observations covers a short interval about 30 cycles. However some variations of light curve may be revealed from our data, namely: distortion of min II and transient light deficiency in the phase 0.1-0.2 (see Figure 1 and Figure 2) even on very short time interval.

The moments of minima deduced by Kwee – van Woerden method (Kwee & van Woerden, 1956) are tabulated in Table 1.

Table 1.
Moments of minima of V836 Cyg (JD hel)

U	B	V	R	Min	E	$(O-C)_v$
2447749.4176	.4176	.4176	.4171	1	9963.0	+0.0105
±5	±1	±2	±3			
			761.5029	2	9981.5	+0.0077
			±14			
			763.4648	2	9984.5	+0.0100
			±7			
764.4462	.4463	.4461	.4457	1	9986.0	+0.0106
±3	±3	±2	±3			
			767.3829	2	9990.5	+0.0070
			±14			

The shape of the secondary minima has been distorted, therefore the moments of min II has low precision. In Table 1 the moments of these minima are presented as mean values from four ones. O−C values were calculated by linear light elements from Breinhorst & Duerbeck (1982). The authors satisfactorily represented O−C by parabola. In our opinion sinusoidal variations in the period are probable too.

The photometric analysis of our multicolor observations was based on light curve synthesis method performed in Sternberg Astronomical Institute (Balog, Goncharsky & Cherepashchuk, 1981). Received parameters of the binary are listed in Table 2.

Table 2.
Orbital elements of V836 Cyg

	U	B	V	R	Mean error
q	0.340	0.335	0.335	0.330	±0.005
μ_1	0.890	0.890	0.895	0.890	±0.005
μ_2	0.960	0.953	0.955	0.960	±0.005
i	81.5	81.0	81.0	81.5	±0.5
T_1	10800	10800	10800	10800	assumed
T_2	6900?	6600	6550	6500	±50
u_1	0.4	0.4	0.3	0.3	assumed
u_2	0.8	0.8	0.6	0.5	assumed

μ is the ratio of the polar radius of the star to the polar radius of the critical Roche-lobe.

The geometry of the system received from our solutions confirmed the suggestion that V836 Cyg is almost semidetached binary. But the secondary seems to be hotter than G1 as derived in previous investigations. In those cases the secondary's characteristics remained as an open question up to receiving more reliable data.

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LIGHT VARIATIONS OF KU Hya

KU Hya (HD 81009, HR 3724) is classified as an A3Vp (Sr-Cr-Eu) visual and spectroscopic binary with a photometric variation of 0.06 mag (Kholopov et al., 1985). It was also discovered to be one of those stars which have resolved Zeeman split lines (Preston, 1971; Mathys, 1990). This means that the star has strong magnetic field but the structure of this field has never been studied yet. In spite of the fact that this bright star (m_v=6.52) has been studied over 60 years, an accurate orbital period has not been obtained (too long!).

For rotation period, Wolff (1975) concluded that it has to be either 69 or 34.5 days from the 1973 January-May photometric observations. Hensberge et al. (1976) suggested it to be about $34^{d}_{\cdot}1 \pm 0^{d}_{\cdot}2$. Adding new observations, Hensberge et al. (1981) revised that the period should be $33^{d}_{\cdot}97 \pm 0^{d}_{\cdot}02$ with the ephemeris

$$\text{Min (in v)=HJD } 2441782.80 + 33.97 \times E$$

Waelkens (1985) got a most similar period of $33^{d}_{\cdot}96 \pm 0^{d}_{\cdot}01$ with an epoch of maximum brightness of JD 2444480.7±0.5.

In February 1993 we observed this star using Kurtz's (1982) rapid photometry method. Photometric measurements were made in Strömgren v band with 1 m RCC telescope of Yunnan observatory in Kunming. We adopted an integration time of 10 second, so that, a total of 694 data points, covering about 3 hours, could be collected in a good observation night.

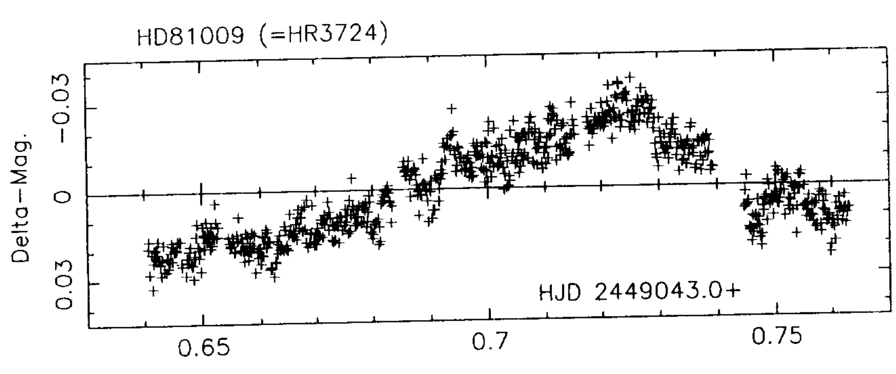

Figure 1

The light curve in Figure 1 clearly shows a large variation($\approx 0\overset{m}{.}04$). The data was only corrected for sky light and atmospheric extinction, using statistically determined mean absorption coefficients. Frequency analysis of short periods did not give us any significant result. But, we paid attention to the fact that an obvious light maximum occasionally appears in our observations at HJD 2449043.724. We can do some calculations as follows:

$$(2449043.724-2444480.7)\div 134=34.05$$
$$(2449043.724-2444480.7)\div 135=33.80$$
$$(2449043.724-2441782.80)\div 213.5=34.01$$
$$(2449043.724-2441782.80)\div 214.5-33.85$$

Which value should we choose? If we take the period of $33\overset{d}{.}80$ or $33\overset{d}{.}85$, it seems that the rotation period became shorter and shorter gradually (from $34\overset{d}{.}5$ to $34\overset{d}{.}1$, to $33\overset{d}{.}96$, to $33\overset{d}{.}8$). Does this star spin up?

Since there was so large variation (about 0.04 mag) in our about 3 hour observations, in addition, we could not verify that whether this light maximum is the maximum in whole rotation period or not, an alternative explanation is that possibly there are some short period variations in this star. Anyway, future photometric, especially differential photometric observations, are necessary to confirm those hypotheses.

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A NEW W UMa VARIABLE IN THE FIELD OF AN Gru [1]

In the course of a CCD photometric investigation on AN Gru, a Cataclysmic Variable candidate (Steiner, Cieslinski and Jablonski 1988) we discovered a new W UMa variable among the comparison stars. The object, labeled V in Fig. 1, has approximate coordinates $\alpha = 23^h05^m04^s$, $\delta = -47°43'.1$(epoch=1950.0). Offsets with respect to AN Gru are 6" to the West and 111" to the South.

The differential V magnitudes for several stars in the field of AN Gru were obtained from 1989 to 1993 with a Wright Instruments camera using a P8603 GEC chip (385 x 578 pixels, 0.58"/ pixel) at the 0.6 m telescope of CNPq/Laboratório Nacional de Astrofísica, Brazil. The data were reduced using the aperture photometry tasks of the APPHOT package of IRAF [2]. In some selected nights we calibrated the system with the aid of the photometric sequences of Graham (1982). This gives V=13.32±0.02 for the star labeled C1 in Fig. 1.

The period of the new eclipsing binary was obtained by means of standard power spectrum analysis followed by CLEAN deconvolution of the effects of an irregular sampling window. Fig. 2 shows 254 V measurements folded on the orbital period.

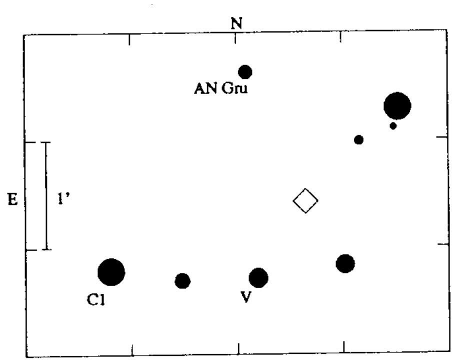

Figure 1: Finding chart for the new eclipsing binary.

[1] Based on observations made at CNPq/LNA, Brazil.
[2] IRAF is distributed by National Optical Astronomy Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc.

As one can see in Fig. 2, it is impossible to tell from the available data which minimum is deeper, so we arbitrarily chose the better observed one to be set as a reference epoch. With this convention an ephemeris for the subsequent times of primary minimum can be written as

$$T_{min} = \text{HJD}\,2{,}448{,}724.8689 + 0\overset{d}{.}33885744 \times E$$
$$\pm 0.0003 \pm 0.00000016$$

where E denotes the cycle number from the reference epoch. The uncertainties are quoted at the 1σ level.

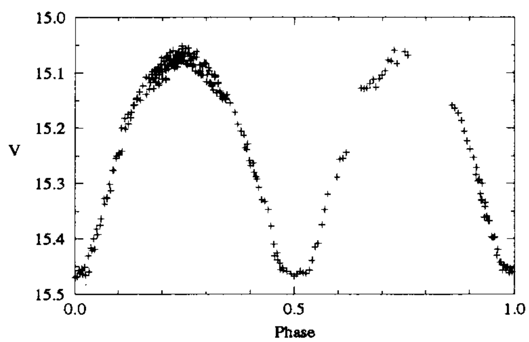

Figure 2: The phase diagram for the $0\overset{d}{.}33885744$ orbital period

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UBV PHOTOMETRY OF HR 1099 IN 1992

The chromospherically active binary HR 1099 (= V711 Tau= HD 22468) is one of the most interesting objects of RS CVn-type and has been observed intensively across the electromagnetic spectrum since its giant radio outburst was detected in 1978 (Feldman 1978). Recently, two extraordinarily strong optical flares were discovered independently by Zhang et al. (1990), Cutispoto (1990), as well as Henry and Hall (1991), on 1989 December 14/15 during the MUSICOS (Multi-site Continuous Spectroscopy) campaign. It gives not only the first strong indication that large broad-band flares do occur on these binary stars with evolved components more luminous than the Sun, but also shows that the star HR 1099 may happen to be in its current active phase. To monitor photoelectrically the variations of light curves and to detect possible flares over the years ahead are, therefore, of obvious importance in our effort to understand this active system better.

In co-ordination with the MUSICOS 1992 campaign, UBV photometry was carried out with the 60-cm telescope and the single channel photon-counting photometer at Beijing Astronomical Observatory from November 15 to December 15 in 1992. The star 12 Tau and 10 Tau were adopted as the comparison and check star, respectively. A total of 79 UBV observations were obtained on 7 nights. The observational data were transformed into the standard Johnson UBV system. The following ephemeris (Fekel 1983) was

$$T_{conj.} = J.D.(hel)2442766.080 + 2.^{d}83774 \cdot E$$

employed to combine all U, B and V observations into complete light curves as shown in Figure 1.

Despite their large scatter, the light curves did show some flare-like variation in U in excess of 0.055 mag on December 14/15, but exhibited no significant variation in B and V at or near the same phase. On the night of December 14/15 the accuracy of the differential photometry between the comparison and check stars was found to be $\sigma \sim 0.005$ mag in V,

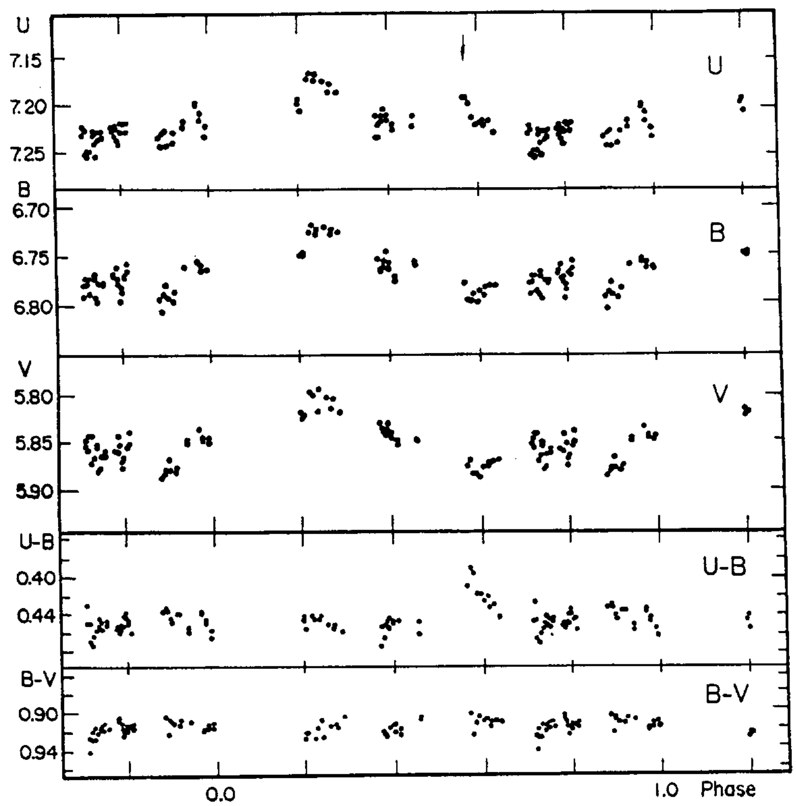

Figure 1. UBV light and color index curves of HR 1099 in 1992

0.009 mag in B, and 0.018 mag in U, respectively. On the remaining nights the sky was also good enough for the photoelectric observations. The large dispersion of the observations seems to be some special photometric behavior of HR 1099. It was found that, for the other binary systems observed for light variability during the same season, the results did not show such large scatter as was the case for HR 1099.

The amplitude of the distortion wave of HR 1099 was observed to be about 0.075 mag, only slightly smaller than that in 1989. However, there were two striking changes in the light curves of HR 1099 as compared with those secured in 1989. First, the average brightness of HR 1099 is derived to be V= 5.85, some 0.07 mag fainter than that in 1989 and approaching the faintest brightness recorded for HR 1099 in 1978 (cf. Dorren et al. 1986). As a result the maximum brightness

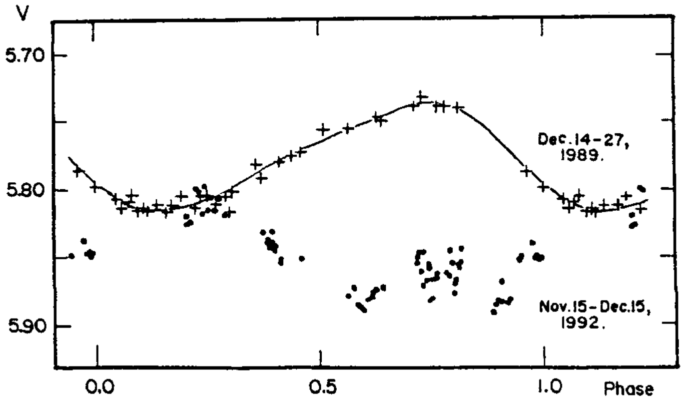

Figure 2. A comparison between the two V light curves of HR 1099 obtained in 1989 and 1992. The symbols '+' denote the combined points of observations in 1989 and the solid line is the theoretical light curve. Dots represent the observations in 1992.

of our 1992 light curve is found to be close to the minimum brightness in 1989. The second marked change is that, as is evident in Figure 2, both the maximum and the minimum light phases of the distortion wave in 1992 have shifted to some locations far away from those in 1989 . The 1992 V light curve looks indeed somewhat like a mirror image of the 1989 curve. Such major changes could be perhaps caused either by the migration of the distortion wave or by the possible large-scale re-distribution of spot-active region on stellar surface. As far as wave migration is concerned, it needs to be checked whether it has been moving towards decreasing or increasing phase. But the migration rate of distortion wave can be estimated simply by the phase differences between two minima or maxima of the light curves obtained in 1989 and 1992. It turns out to be ~ 0.17 phase per year, corresponding to a migration period of some 5.9 years. This indicates that the spot region was located in the latitude zone with a local rotation speed different from that of co-rotation. The striking decline of the average brightness of the system since 1989 may be due to the emergence of dark spots near the polar region. Because of the relatively low orbital inclination (i= 33°) of the binary, these polar spots had reduced substantially the average brightness of the system.

A detailed analysis of the 1992 UBV light curves based on spot model is in progress. The results will be published along with the spectroscopic observations made during the 1992 MUSICOS campaign.

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HIPPARCOS MEASUREMENTS OF THE NEAREST BRIGHT ECLIPSING BINARIES

A general idea of stellar parallax measurements from space was born twenty years ago (Dworak, 1973), when "A Catalogue of Photometric Parallaxes of Eclipsing Binaries" was prepared and then published (Dworak, 1975). It follows from this Catalogue that about 80 eclipsing systems with unknown trigonometric parallaxes are probably within 100 pc from the Sun. We need more precise and homogeneous data on the nearest and also bright eclipsing binaries for further investigating their geometrical and physical properties as well as for checking the modified mass-luminosity relation and the method for determining photometric parallaxes (Dworak, 1983; Griffiths et al., 1988). The results obtained for these stars can be extended to distant eclipsing variables and to eclipsing systems observed in other galaxies, so the method for determining photometric parallaxes can serve as an independent source for knowing the distances of extragalactic objects (Dworak, 1974). Unfortunately, at that time we had no possibility of measuring the heliocentric parallaxes from space for these new studies.

Such a possibility arose in Besançon in 1982. We discussed this problem with Prof. de Vaucouleurs. As a result of this discussion, we worked out a program for observing the nearest eclipsing binaries from the HIPPARCOS satellite. Our program has been accepted by the Selection Committee of the HIPPARCOS Project (project number 177). We chose 101 of the nearest eclipsing variables within 100 pc from the Sun) including also 21 eclipsing binaries for which the trigonometric parallaxes were determined earlier. We included them to obtain more accurate and homogeneous data. 95 stars of our list have been approved by the HIPPARCOS Selection Committee (Dworak and Oblak, 1989), including the star HD 3765 which is suspected in having a planet-like companion (Dworak, 1979). In addition to these stars, other 87 eclipsing systems have been included in the standard HIPPARCOS and TYCHO programs (Dworak and Oblak, 1984). We called them "the bright eclipsing binaries" because their magnitude $B<8^m$. Their parallaxes (spectroscopic, dynamic, group or trigonometric are known except for six stars of the b Persei (or Ell) type.

Moreover, we will be able to obtain the necessary data for other eclipsing systems (about 500) which have been included in special programs of several authors.

The first complete data of HIPPARCOS measurements will be available in 1994. Preliminary results of HIPPARCOS observations were published by Froeschlé (1992).

In order to obtain homogeneous results for the geometrical and physical parameters of stellar systems, new or additional observations of eclipsing binaries from the HIPPARCOS program are necessary, especially for 84 stars (Dworak and Oblak, 1987). The solution of light curves from photoelectric observations is also needed for accurately determining the geometrical parameters of each eclipsing system. The determination of spectral type and luminosity class for secondary components of some eclipsing binaries is especially necessary. The best way is to determine the effective temperature T of each component of the eclipsing binary directly from spectral observations.

It is well known that we are able to obtain semi-amplitudes K_1 and K_2 of radial velocity curve from spectral measurements. It is thus possible to determine the mass-ratio α of any given system:

$$\alpha = \mathrm{K_1/K_2 = m_2/m_1} \tag{1}$$

where $\mathrm{m_1}$ and $\mathrm{m_2}$ are the masses (in solar masses) of the components of the system.

We can obtain the value of $\sin i$, where i is the inclination of the orbital plane to the plane of the sky, from photometric observations and rectifications of light curve of any eclipsing binary. Then, by combining both spectroscopic and photometric observations, we determine:

$$a \sin i = 13751\sqrt{1-e^2}(K_1+K_2)P, \tag{2}$$

$$A^3 = 74.5P^2(m_1+m_2), \tag{3}$$

$$R_1 = Ar_1,\ R_2 = Ar_2, \tag{4}$$

where a is the separation in kms, e: the eccentricity of orbit, A: the separation of components in solar radii, P is the period of revolution in days, r_1 and r_2: the relative radii of the components, R_1 and R_2: the absolute radii (in solar radii) of the components of any eclipsing system.

Having R_1 and R_2 as well as, from spectroscopic measurements, the effective temperatures T_1 and T_2 (also in solar units, i.e. $T = T_\star/T_\odot$) it is possible to compute absolute bolometric magnitudes according to Stefan-Boltzmann's law:

$$L_1 = R_1^2 T_1^4, \qquad L_2 = R_2^2 T_2^4, \tag{5}$$

and here $L = L_\star/L_\odot$.

To obtain the absolute magnitudes M_{v1} and M_{v2}, we must know the bolometric corrections $(\mathrm{BC})_1$ and $(\mathrm{BC})_2$ because

$$M_v = M_{b\odot} - 2.5\log L - \mathrm{BC} \tag{6}$$

and $M_{b\odot}$ is the absolute bolometric magnitude of the Sun.

On the other hand, we can find the absolute magnitude M_v of an observed eclipsing binary from direct astrometric and photometric measurements of HIPPARCOS and TYCHO Project.

Finally, we should obtain the whole set of observational data (both spectroscopic and photometric) and calculated values.

1. Directly measured values, common for a whole system: parallax π, P, K_1 and K_2, V (or V_1 and V_2 if we observe total eclipse).
2. Calculated values, common for a system: α, A, e, i, M_v (or M_{v1} and M_{v2} if we observe total eclipse).
3. Parameters of each component:

$$m_1,\ r_1,\ R_1,\ T_1,\ L_1,\ (BC)_1,\ M_{v1};$$

$$m_2,\ r_2,\ R_2,\ T_2,\ L_2,\ (BC)_2,\ M_{v2}.$$

4. Other parameters: radii of Roche-lobes, surface brightness, limb darkening and other effects.

The parameters of 2. and 3. should be homogeneous and fulfil the following conditions (O'Connel, 1972; Dworak, 1974):

- Kepler's Third Law (3), i.e. dynamic condition;
- $M_{v,cal}=M_{v,obs}$ (or if we observe total eclipse $M_{v1,cal}=M_{v1,obs}$ and $M_{v2,cal}=M_{v2,obs}$) with the accuracy of measured values, of course, i.e. photometric condition.

We will be able to obtain the magnitudes V_1 and V_2 also in such a case when the resolution (the angular separation between components) is enough to measure directly the magnitude of each component of a resolved eclipsing system, i.e. a">0.002" (Dworak and Oblak, 1984).

The results obtained generally allow us to verify the method for determining photometric parallaxes for distant eclipsing binaries, the geometrical and physical properties of their components and to find some correlations and differences between visual (together with astrometric) double stars (Oblak and Chareton, 1980) and close binary systems (eclipsing and spectroscopic). We are then also able to give a better interpretation of phenomena observed in close binary systems, as well as to carry out statistical investigations.

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UBVRI MAGNITUDES FOR CATACLYSMIC VARIABLES, AF Vul AND COMPARISON STARS

Observations were made at 1.25m AZT-11 telescope of the Crimean Astrophysical Observatory equipped with an UBVRI photometer-polarimeter of the Helsinki University (Korhonen et al., 1984). The stars were linked to the UBVRI-standard stars HD 195919 (Neckel & Chini, 1980), HD 161261 and HD 171732 (Barnes & Moffett, 1979). The instrumental magnitude differences were transformed to the standard UBVRI system according to the expressions obtained by N. I. Shakhovskaya (private communication):

Table I

ΔU	=	$0.955\Delta U + 0.218\Delta$B	-0.173ΔV
ΔB	=	$1.173\Delta B - 0.173\Delta$V	
ΔV	=	$-0.104\Delta B + 1.104\Delta$V	
ΔR	=	$-0.104\Delta B + 0.153\Delta$V	$+0.951\Delta$R
ΔB	=	$-0.104\Delta B - 0.012\Delta$V	$+1.116\Delta$I

Moments of measurements of the variable stars are listed in Table 1 as well as references for finding charts. Because 3 standard stars were measured, we determined magnitudes by linking to each of them. Internal scatter of magnitudes is $0.^{m}07$, $0.^{m}07$, $0.^{m}05$, $0.^{m}04$ and $0.^{m}02$ for UBVRI, respectively. However, for colors one may obtain smaller values $0.^{m}01$ for U$-$B and R$-$I and $0.^{m}02$ for B$-$V and V$-$R. Deviations of colors of the two check stars BD+17°4103 and BD+11°4380 from that of Neckel & Chini (1980) are in a range from $0.^{m}01$ to $0.^{m}04$ which may possibly be explained by a systematic difference between the three instrumental UBVRI systems.

Table II

Star	HJD 244800	Reference for a finding chart
CM Del	451.469	Meinunger (1980), Vogt & Bateson (1982)
VW Vul	451.434	Vogt & Bateson (1982)
EW Aql	485.323	Shain (1929)
AF Vul	451.402	Wachmann (1966)
V603 Aql	446.448	Williams (1983)
QQ Vul	450.358	Andronov & Yavorskij (1983)
MV Lyr	451.514	Andronov & Shugarov (1982)

One may note an excellent coincidence of our B magnitudes for the comparison stars for AF Vul with the *pg* ones published by Wachmann (1966). However, there is a large difference in the value $m_{pg} = 14.^{m}8$ of the star "a" for QQ Vul (Andronov & Yavorskij, 1983) with B=$14.^{m}28$ which may indicate systematic shift of magnitudes of other comparison stars possibly appeared due to an increased background brightness near M71 (Arp & Hartwick, 1971) which was used for photographic measurements.

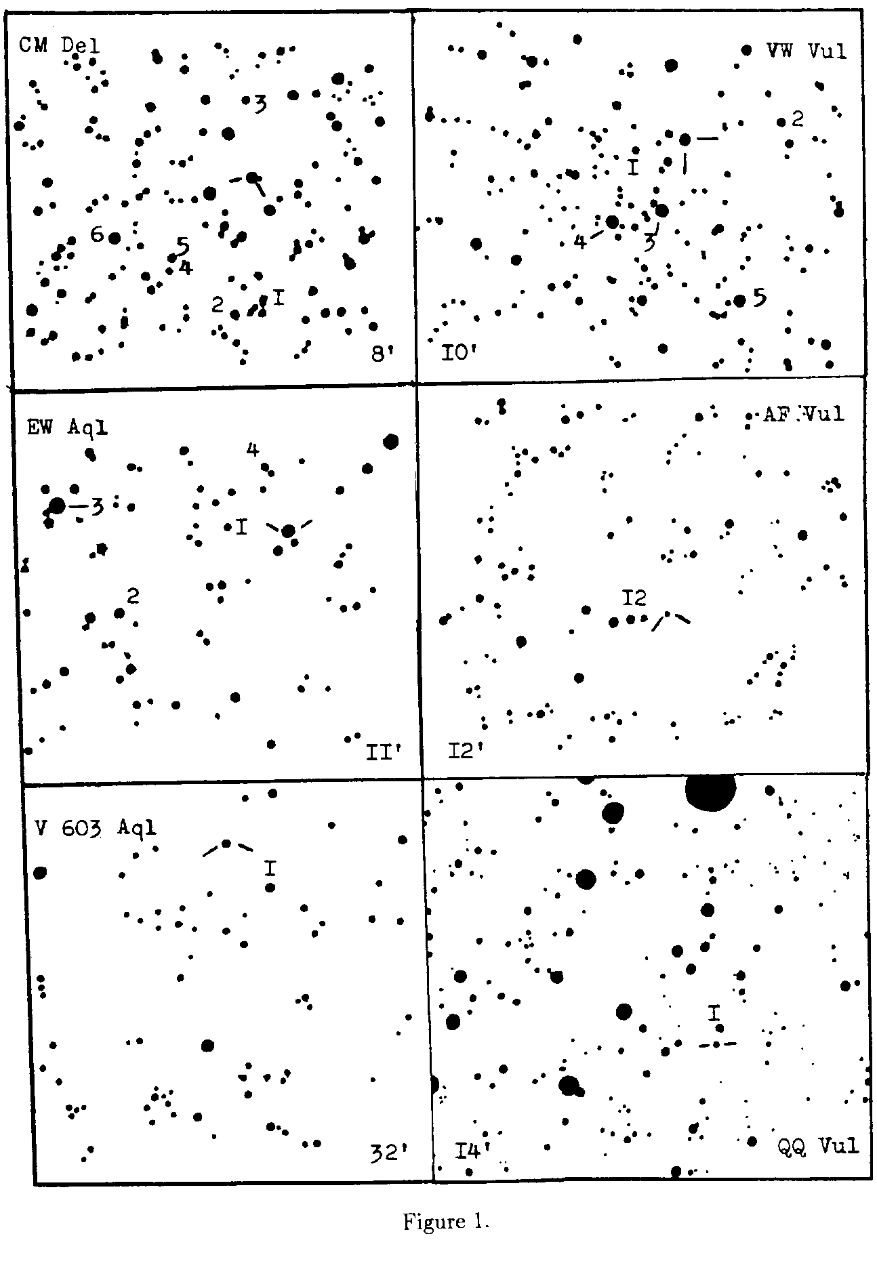

Figure 1.

Table III

Star	U	B	V	R	I	U−B	B−V	V−R	R−I
CM Del	13.26	13.87	13.75	13.59	13.48	−0.61	0.12	0.16	0.11
1	13.73	13.37	12.63	12.06	11.61	0.36	0.74	0.57	0.45
2	15.30	14.14	12.96	12.10	11.42	1.16	1.18	0.86	0.68
3	14.22	13.98	13.60	13.35	13.13	0.24	0.38	0.25	0.22
4	14.92	14.77	14.54	14.31	14.07	0.15	0.23	0.23	0.24
5	14.06	13.92	13.27	12.77	12.38	0.14	0.65	0.50	0.39
6	12.69	12.52	11.97	11.50	11.15	0.17	0.55	0.47	0.35
VW Vul	15.71	16.71	16.64	15.79	15.08	1.00	0.07	0.85	0.71
1	15.60	15.37	14.64	14.06	13.55	0.23	0.72	0.58	0.51
2	14.29	13.83	12.97	12.30	11.76	0.46	0.86	0.67	0.54
3	13.59	12.56	11.36	10.49	9.76	1.03	1.20	0.87	0.73
4	13.84	12.46	11.16	10.22	9.50	1.38	1.30	0.94	0.72
5	13.33	13.24	12.67	12.21	11.83	0.09	0.57	0.46	0.38
EW Aql	12.54	12.22	11.69	11.29	11.00	0.32	0.53	0.40	0.29
1a	14.71	14.29	13.52	12.87	12.37	0.42	0.77	0.65	0.50
1b	14.50	14.08	13.32	12.68	12.13	0.42	0.76	0.64	0.55
2	14.31	13.09	11.74	10.72	9.94	1.22	1.35	1.02	0.78
3	12.75	12.03	11.17	10.47	10.02	0.72	0.86	0.70	0.45
4	15.65	15.40	14.37	13.68	13.06	0.25	1.03	0.69	0.62
AF Vul	16.37	15.76	14.52	13.65	12.94	0.61	1.24	0.87	0.71
1	14.85	14.61	14.02	13.49	13.02	0.24	0.59	0.53	0.47
2	15.73	15.00	14.14	13.36	12.76	0.73	0.86	0.78	0.60
V603 Aql	10.93	11.67	11.63	11.49	11.43	−0.74	0.04	0.14	0.06
1	10.53	10.29	9.89	9.55	9.32	0.24	0.40	0.34	0.23
QQ Vul	15.09	15.98	15.66	15.36	14.76	−0.89	0.32	0.30	0.60
1	14.48	14.28	13.58	13.03	12.63	0.20	0.70	0.55	0.40
MV Lyr	11.76	12.56	12.60	12.55	12.53	−0.80	−0.04	0.05	0.02
4	14.60	13.58	12.49	11.69	11.05	1.02	1.09	0.80	0.64
c	12.49	12.41	12.08	11.76	11.53	0.08	0.33	0.32	0.23
8	13.68	13.60	13.05	12.61	12.24	0.08	0.55	0.44	0.37

Remark: Two brightness estimates of the comparison star "1" for EW Aql obtained on HJD 2448452.365 (a) and 85.330 (b) are different, despite the fact that for the star "3" they coincide within $\pm0^m.01$.

For MV Lyr we had measured 3 comparison stars designated by Andronov & Shugarov (1982), who published a finding chart with 19 comparison stars. One may note a large ($0^m.2$) systematic difference in U-magnitudes of the stars "c" and "8" as compared with that obtained with the same equipment by Andronov et al. (1992) by linking to another standard star BD+28°4211 (Neckel & Chini, 1980).

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UBVRI MAGNITUDES FOR FOUR MARGONI & STAGNI VARIABLES AND COMPARISON STARS FOR THEM

Margoni & Stagni (1984) published a list of new variables, and a range of their BV magnitudes. From this list we chose a few stars and studied them photographically to make a classification. Here we present results of the UBVRI measurements of the suspected variables and comparison stars for them. Observations were made at 1.25m AZT-11 telescope of the Crimean Astrophysical Observatory equipped with an UBVRI photometer-polarimeter of the Helsinki University (Korhonen *et al.*, 1984). The stars were linked to the UBVRI-standard stars HD 195919 (Neckel & Chini, 1980), HD 161261 and HD 171732 (Barnes & Moffett, 1979). Internal error of colors does not exceed $0^m_.04$. Results for other 7 variables obtained in the same way were published by Andronov *et al.* (1993).

Heliocentric dates of the observations are 2448 485.336 (V 58), 452.544 (V 91), 452.555 (V 92), 452.561 (V 95). No UV-excess was found in V 58, V 91 and V 92. The star V 95 is very red. Margoni et al. (1989) additionally noted that the star V 58 has a period of $< 1^d$. Results of the photographic study will be published elsewhere.

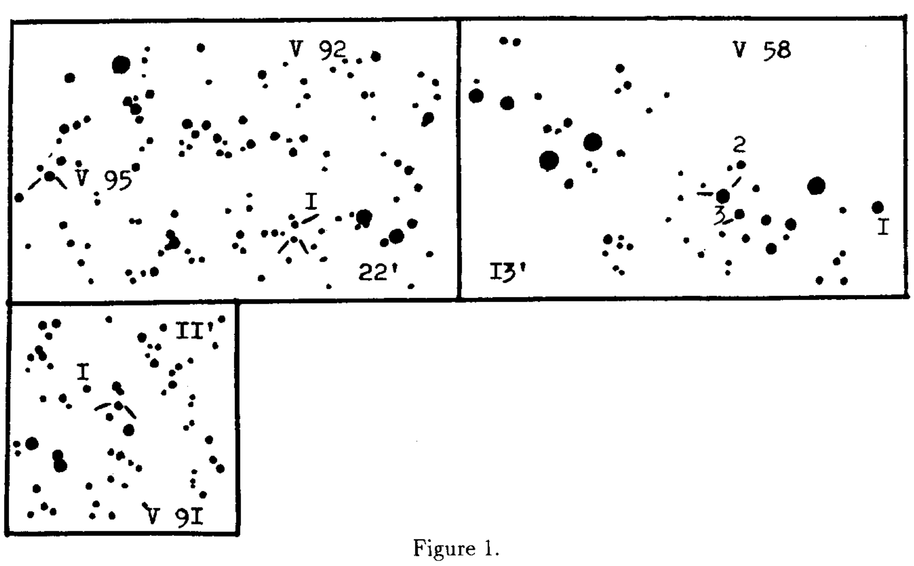

Figure 1.

Table 1

Star	U	B	V	R	I	U−B	B−V	V−R	R−I
V 58	12.12	12.10	11.65	11.25	10.94	0.02	0.45	0.40	0.31
1	11.53	11.40	11.05	10.77	10.52	0.13	0.35	0.28	0.25
2	12.93	12.69	12.05	11.54	11.11	0.24	0.64	0.51	0.43
3	14.21	12.94	11.66	10.72	10.00	1.27	1.28	0.94	0.72
V 91	14.71	14.48	13.72	13.08	12.46	0.23	0.76	0.64	0.62
1	12.92	12.31	11.40	10.69	10.11	0.61	0.91	0.71	0.58
V 92	15.25	15.16	14.61	14.14	13.70	0.09	0.55	0.47	0.44
1	14.10	14.02	13.46	12.97	12.57	0.08	0.56	0.49	0.40
V 95	14.31	12.99	11.13	8.81	6.56	1.32	1.86	2.32	2.25

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VZ CYGNI: A NEW SPECTROSCOPIC BINARY CEPHEID

According to the 4th edition of the GCVS, the classical Cepheid VZ Cyg has the period $4^d_.864453$ (period changes have been noted) and varies in the range $8^m_.60$--$9^m_.28$V. Its binarity was first suspected by Madore and Fernie (1980) from photometric data. Though some radial velocity measurements are available for the star in the literature (Joy, 1937; Barnes *et al.*, 1988), the star's spectroscopic binarity, to our knowledge, was not explicitly announced. Szabados (1991) notes possible γ-velocity changes but says that 'further radial velocity measurements are necessary to make a firm statement on this matter'.

Since 1992 we observe VZ Cyg in the frame of our programme (cf. Gorynya *et al.*, 1992) of Cepheid radial velocity measurements with Tokovinin's (1987) radial velocity meter. By early August, 1993 we have acquired 31 V_r measurements and found that VZ Cyg is a definite spectroscopic binary. Table 1 contains our V_r values, and Fig. 1 shows the radial velocity curve. Further observations are under way.

Table 1
Radial velocities of VZ Cygni

JD hel. 244...	V_r	σ	JD hel. 244...	V_r	σ
8822.510	-33.3	0.5	8869.495	-1.6	0.4
8824.511	-14.9	0.5	8870.448	-15.2	0.5
8825.510	-4.8	0.5	8879.518	0.1	0.8
8827.508	-33.9	0.3	8880.436	-26.7	1.8
8830.520	-2.7	0.5	8886.416	-30.0	1.0
8831.505	-15.3	0.5	9191.507	-16.3	0.5
8832.476	-33.1	0.5	9194.465	-6.7	0.4
8833.473	-23.4	0.4	9195.490	2.4	0.6
8834.451	-12.4	0.3	9196.490	-17.9	0.6
8838.428	-22.3	0.4	9197.457	-26.4	0.6
8839.464	-11.0	0.4	9198.446	-15.7	0.4
8861.496	-31.5	0.5	9199.457	-4.7	0.5
8862.492	-23.0	0.5	9200.486	5.8	0.5
8863.481	-12.7	0.3	9201.463	-21.5	0.5
8864.451	-3.2	0.3	9202.489	-24.5	0.4
8866.495	-30.3	0.6			

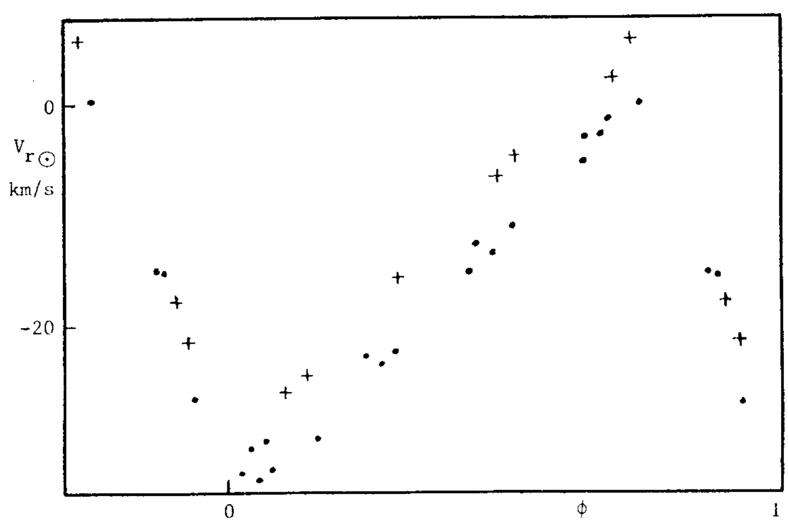

Figure 1. Radial velocity curve of VZ Cyg from our observations. Dots–1992, crosses–1993.

We are grateful to Dr. A. A. Tokovinin for the possibility to use his radial velocity meter. Thanks are due to the administration and the staff of the Simeiz Department of the Crimean Observatory for the telescope time and for assistance during observations. We also thank Mr. D. I. Neyachenko and Mr. O. S. Ugolnikov who helped at the telescope.

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NEW TIMES OF MINIMA OF W UMa TYPE STARS

The W UMa star systems ER Ori, YY Eri, and RZ Tau have been observed photoelectrically to obtain accurate times of minima in order to increase the time span of the minima reported. These stars were observed during several seasons as seen in Table I. The methodology followed in the observations and data reduction for the data obtained at the Observatorio Astronómico National at San Pedro Mártir, B.C., México (OAN-SPM),

Table I

STAR	HJD 2440000+	Type of minimum	Equipment	Observer
ER ORIONIS	6775.7990	I	A	1
	6777.9180	I	A	1
YY ERIDANI	6774.7457	I	A	1
	6774.9090	II	A	1
	6778.7648	II	A	1
	6798.6983	II	B	2
	6799.6610	II	B	2
	6818.6288	II	B	2
	7458.8953	I	B	3
	7459.8550	I	B	3
RZ TAURI	7827.9828	II	A	4
	7828.8143	II	A	4
	7835.8790	II	A	4
	7837.9562	II	C	1

Equipment: (A) A cooled photoelectric photometer with the Johnson's V filter attached to the 0.84m telescope of the OAN-SPM.
(B) Photoelectric photometer with the Johnson's V filter attached to the 0.50m telescope of the OJAB.
(C) uvby multiphotometer attached to the 1.50m telescope of the OAN-SPM.

Observers: (1) J.H. Peña and R. Peniche.
(2) M. Ríos H. and M. Ríos B.
(3) O. López and A. Montenegro.
(4) L. Maupomé and E. Rodríguez.

is described in Peña et al. (1993) while for the observations made at the Observatorio José Arbol y Bonilla at Zacatecas, Zac. México (OJAB), they are described in Peña et al. (1987). The times of minima were determined from the minima obtained from a mathematical fit to the light curves around the times of occultation.

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SPOT PHOTOMETRY OF AD Leo IN 1992 AND 1993

AD Leo (Gliese 388, dM4.5e) is a well known flare star. A magnetic field of 3800 G was found by Saar and Linsky (1985). Rotational modulation of light of the quiet star with a period of $2^{d}\!.7$ was revealed by Spiesman and Hawley (1986), probably due to starspots. However, the amplitude in the visual band was found to be only ~0.02 mag. Clearly, this result needs an independent confirmation.

In an attempt to confirm the spot modulation of light and the rotational period, spot photometry of AD Leo was carried out in 1992 and 1993 at the Bulgarian National Astronomical Observatory with the 60 cm telescope and the UBV photon-counting, computer controlled photometer. HD 89471 was the comparison star and BD+20°2475 served as a check. Table I contains the observations in the filters V and B as differential magnitudes: HD 89471−AD Leo. Differential observations were taken also in the U-filter, but only for the purpose of having an indication for flare activity during the time of spot photometry. The observations were taken with 10s integration and each individual observation (comparison-variable-comparison) was the mean of 4 consecutive integrations. The nightly mean points (data in Table I) were then obtained from 3-5 individual observations.

The light curves, plotted with the 2.7 day period, are shown in Figure 1 and Figure 2 for 1992 and 1993, respectively. The epoch was set at JD 2449099.498 (minimum light, i.e. maximum spot visibility), to calculate the phases. The amplitudes of the spot modulation in 1992 were ~0.02 mag, but they appear larger in 1993: ~0.04 mag in the visual and ~0.06 mag in the B filter. The observational errors can be estimated from the check star observations in 1992: σ=0.003 mag. Therefore, the amplitude of the spot modulation of AD Leo in 1992 was only marginal. In 1993 the check star BD+20°2475 exhibited light variability of the order of several percent (the reason is yet unknown) and an estimate of errors from that star was not possible. From the differential photometry of AD Leo in 1993 the errors are usually 0.005-0.008 mag. The light curves in 1993 look generally better, but there are some deviating points. Flare activity seems to affect the observations at three phases: 0.43 and 0.46 in 1992, and 0.41 in 1993. The point at phase 0.46 was not plotted because of its strong blue shift. For the other two phases (0.43 and 0.41), only the B-filter values (but not the V-filter) seem to be affected by flares.

Generally, these observations seem to support the $2^{d}\!.7$ period, but the amplitudes of spot modulation are near the detection limit. No search for other possible periods has been done. The variation of colour Δ(B−V) in 1993 with an amplitude of ~0.03 mag also seems to support the spot hypothesis: the star is redder, when fainter. Apparently, the small amplitudes of rotational modulation so far observed result from the small inclination of the rotational axis to the line of sight: 38°, according to Pettersen, Coleman, and Evans (1984). Recent study of Marcy and Chen (1992) confirms this result (33°<i<44°), provided that the $2^{d}\!.7$ rotational period is real.

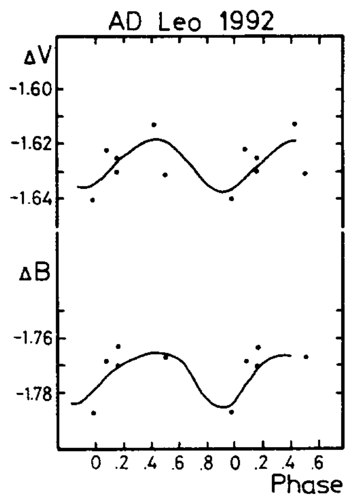

Figure 1

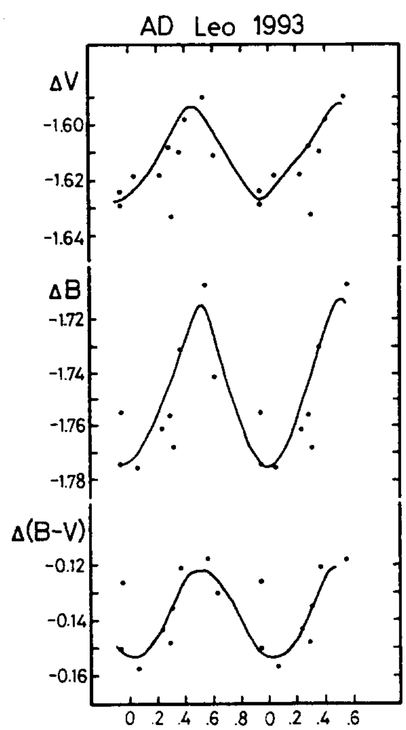

Figure 2

Table I
Differential observations: HD 89471–AD Leo

JD 2400000+	Phase	ΔV	ΔB	Δ(B–V)
1992				
48662.543	0.16	−1.630	−1.770	−0.140
48663.459	0.50	−1.631	−1.767	−0.136
48679.469	0.43	−1.613	–	flare?
48694.455	0.98	−1.640	−1.787	−0.147
48716.320	0.08	−1.622	−1.768	−0.146
48717.329	0.46	−1.583	−1.708	flare?
48754.321	0.16	−1.625	−1.763	−0.138
1993				
49018.393	0.96	−1.624	−1.774	−0.150
49019.364	0.32	−1.633	−1.768	−0.135
49038.422	0.38	−1.610	−1.731	−0.121
49062.343	0.24	−1.618	−1.761	−0.143
49063.385	0.62	−1.611	−1.741	−0.130
49098.327	0.57	−1.590	−1.708	−0.118
49099.390	0.96	−1.629	−1.755	−0.126
49100.317	0.30	−1.608	−1.756	−0.148
49102.328	0.05	−1.618	−1.775	−0.157
49103.309	0.41	−1.598	–	flare?

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THE LOW STATE OF Z CMa

Z CMa, a remarkable star, has been attracting the attention of observers for many years. Its photometric behaviour summarized at least twice recently (Covino et al., 1984, Kolotilov, 1991) often shows new details. After the period of a relative stability in early 80-es (Kilkenny et al., 1985, Herbst et al., 1987) two visual brightness increases of the star was observed. The first one occurred in 1985 (Shevchenko, 1989), and the second was in 1986-1987 (Miroshnichenko and Yudin, 1992). The mean brightness level in the U-band was near $9\overset{m}{.}3$ before 1985, and $8\overset{m}{.}7$-$8\overset{m}{.}8$ in maxima of the outbursts. Besides, we have observed an increasing polarization degree up to the level of 4-5 per cent during the second outburst. Unfortunately, we could not observe the development of the second brightening because of the invisibility of the object at our observational site between April and October. Our last observation of this event was on March 20, 1987. The next one occurred in November 1987 when the star showed V=$9\overset{m}{.}7$. By that time polarization decreased to 2 per cent. Strong variability was observed in the position angle between the end of 1987 and 1990. The star was slightly variable in the visible range between 1987 and 1991 with the mean V=$9\overset{m}{.}8$. During this period the mean polarization was typically about 1.5-2 per cent. Making observations of Z CMa in 1992 we detected a further weakening in the brightness of the star (see Table 1) and changes in the polarization (see Table 2).

All recent photometric UBVRI and polarimetric RI observations were carried out with the 1 meter telescope of the Astrophysical Institute of Kazakhstan Academy of Sciences (Assy Observatory) with a two-channel photometer-polarimeter (Bergner et al., 1988) using a 26" diaphragm. The photometric errors do not exceed $0\overset{m}{.}05$ in the U-band, and $0\overset{m}{.}02$ in other bands.

Table 1
Photometry of Z CMa

JD 244...	U	B	V	R	I
8652.23	–	11.19	9.97	8.65	7.56
8932.49	12.00	11.50	10.22	9.00	7.93
8933.45	12.28	11.55	10.32	9.11	8.09
8934.40	12.21	11.81	10.52	9.13	8.16
8935.47	12.19	11.51	10.28	9.14	8.10
8961.39	11.96	11.44	10.26	9.03	7.86
8996.26	–	11.29	10.14	8.93	7.95
8997.24	12.13	11.48	10.25	9.00	7.98
9000.23	12.15	11.40	10.22	8.95	7.80
9003.27	11.98	11.34	10.10	8.92	7.82

Table 2
Polarimetry of Z CMa

JD 244...	R		I	
	P,%	θ, deg	P,%	θ, deg
8933.47	0.70±0.28	156±9	–	–
8934.43	0.52±0.18	148±6	–	–
8935.49	0.36±0.15	165±9	–	–
9003.29	2.18±0.32	152±4	1.86±0.29	165±5

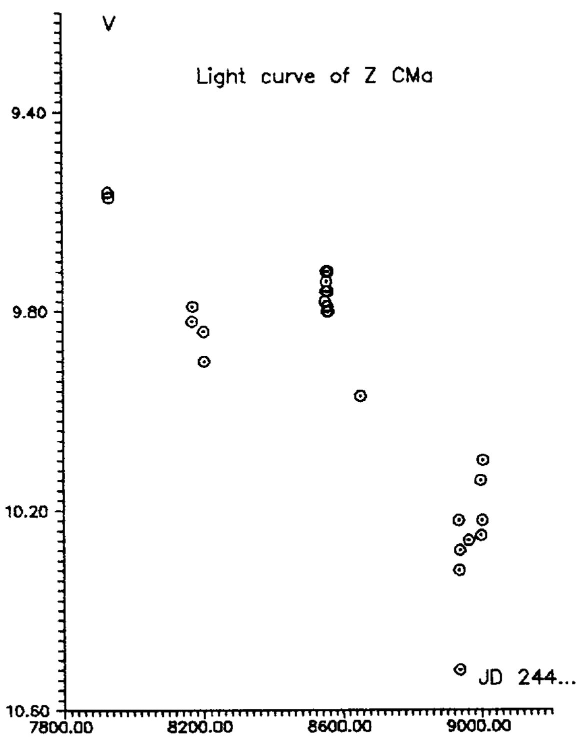

Figure 1

Z CMa is probably in an interesting phase of its evolution, and any observations of this object made by different methods are desirable.

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CHANGES IN THE LIGHT CURVES OF AP LEONIS

AP Leo is an over-contact binary system (Zhang et al., 1992). Its light curves showed large changes in the past ten years. Photoelectric observations were carried out by us in 1983, 1984, 1985, 1988 (Zhang et al., 1989), 1990, 1991 and 1993 seasons. Six annual BV light curves were obtained. We present three light curves observed in 1985, 1991 and 1993 as shown in Figures 1-3.

Table I lists the minimum times observed in the nineties.

Table I
New light minima for AP Leo

J.D. (Hel) V 2440000+	M.E.	J.D (Hel) B 2440000+	M.E.	Min
7925.2716	0.0020	7925.2723	0.0017	II
7928.2856	0.0006	7928.2867	0.0005	II
8310.2278	0.0005	8310.2284	0.0004	I
8311.3031	0.0003	8311.3033	0.0005	II
9037.0988	0.0005	9037.0980	0.0007	I
9037.3107	0.0002	9037.3117	0.0004	II

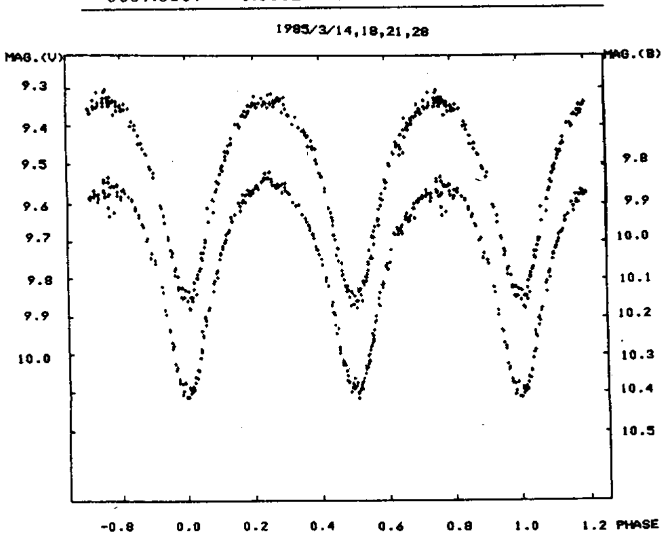

Figure 1. The light curves of AP Leo in 1985.

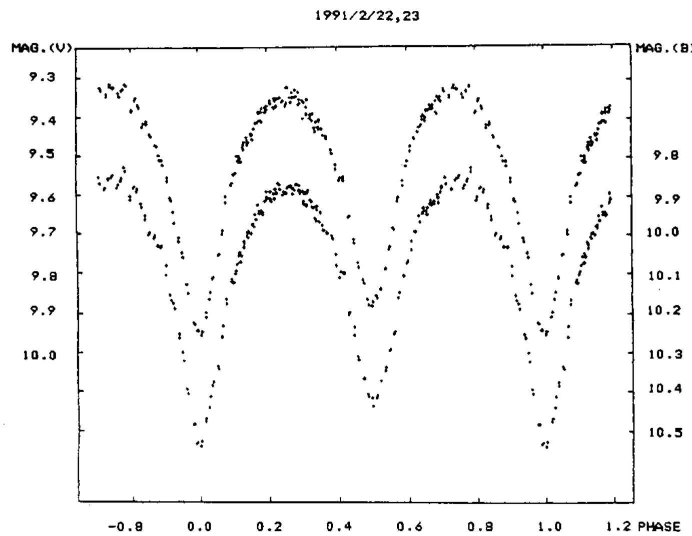

Figure 2. The light curves of AP Leo in 1991.

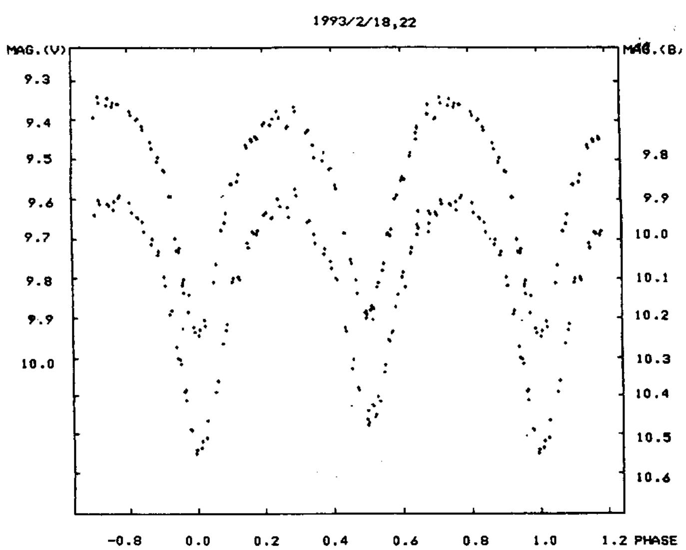

Figure 3. The light curves of AP Leo in 1993.

It is found that the depth of the primary minima of AP Leo changes as shown in Table II.

Table II
Eclipse depth of AP Leo

	Amplitude	1985	M.E.	1991	M.E	1993	M.E.
V	Min(I)-Max	$0^{m}.54$	$0^{m}.01$	$0^{m}.63$	$0^{m}.01$	$0^{m}.59$	$0^{m}.02$
V	Min(II)-Max	$0^{m}.53$	$0^{m}.01$	$0^{m}.54$	$0^{m}.01$	$0^{m}.53$	$0^{m}.02$
B	Min(I)-Max	$0^{m}.58$	$0^{m}.01$	$0^{m}.67$	$0^{m}.01$	$0^{m}.64$	$0^{m}.01$
B	Min(II)-Max	$0^{m}.58$	$0^{m}.01$	$0^{m}.56$	$0^{m}.01$	$0^{m}.56$	$0^{m}.01$

The detailed analysis will be published in a forthcoming paper.

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DATA BASE ON THE UV CETI TYPE FLARE STARS AND RELATED OBJECTS

We are preparing the data base on red dwarf flare stars that contains now the data on more than 230 objects and about 2100 references. It allows to pick out information by the name of the star, by authors and by key words. The supposed printed version will contain

a. all names and designations of each star,
b. their coordinates, optical photometry, X-ray, radio and IR data, fundamental and kinematical characteristics, and
c. references from available publications in chronological order.

The complete volume of the data base is about 0.7 MB.

In order to check our data base and to minimize unavoidable gaps, we ask researchers of objects under consideration to send us their list of publications on this topic. Their help is much appreciated.

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UBV PHOTOMETRY OF FK Com DURING 1990

The photometric behaviour of FK Com is similar to that observed in RS CVn stars but the observational data could be interpreted both as hot and cool surface spots (Panov and Antov, 1990). There are two alternative models regarding the configuration of FK Com: as a single star and as a binary system with low-mass companion. The evolutionary status in these cases is different too. A choice between the two alternatives can be made after prolonged observations of this object.

We observed FK Com in order to study its light variations during 1990 and to try to answer the question whether the spots on its surface are hot or cool.

Photoelectric UBVR observations of FK Com were carried out with a photon-counting photometer attached to the 60cm telescope of Belogradchik Observatory (Bulgaria) on 12 nights in March/July 1990. The comparison and check stars were HD 117567 and HD 117876 respectively. The integration time was 10 s. The observations were corrected for the atmospheric extinction and reduced to the standard photometric system.

We tried to phase our data by different periods and it turned out that the smoothest curve was obtained using a period value of $2^{d}41$. It coincides with the first one of Chugainov (1966). That is why our observational data are phased by his ephemeris

$$\text{J.D. (Min)} = 2447981.145 + 2.41 \times \text{E}.$$

The data are plotted in Figure 1. Every point here represents a mean value of at least five measurements. The mean errors are respectively $0^{m}01$ in V and B colours and $0^{m}02$ in U. It is seen that variations correlate in the different colours.

Figure 2 presents (B−V) residuals with respect to the same ephemeris. Although the scatter is large it is obvious that (B−V) variations show phase dependence and the maximum value of (B−V) corresponds to the brightness minimum.

The evident asymmetry of the light curves mean that at least two circular spots or an elongated spot are necessary to explain the observational brightness variations.

We tried to fit our observational data accepting a model with two circular spots and changing all parameters of the configuration:
inclination of the stellar rotation axis with respect to the line-of-sight i; spot temperatures T_1^{sp} and T_2^{sp}; spot angular sizes α_1 and α_2; latitudes of the spot centres $^1\beta_1$ and $^2\beta_2$; longitudes of the spot centres λ_1 and λ_2.

A number of good fits were obtained in the case of cool spots. Table 1 presents the parameters of some of them. The last column gives the ratio of the total spot area to the whole star surface. Figure 3 illustrates the fit with parameters shown on the third line of Table 1.

Table I

i	α_1	α_2	β_1	β_2	λ_1	λ_2	T_1^{sp}	T_2^{sp}	S^{sp}
45°	25°	15°	48°	52°	63°	310°	3860 K	3600 K	6.4%
55°	25°	15°	48°	60°	58°	310°	3910 K	3600 K	6.4%
65°	30°	15°	40°	50°	65°	314°	4025 K	3820 K	6.8%
75°	33°	15°	30°	50°	60°	315°	3890 K	3910 K	8.0%
84°.5	37°	22°	30°	30°	63°	320°	3600 K	3540 K	13.6%

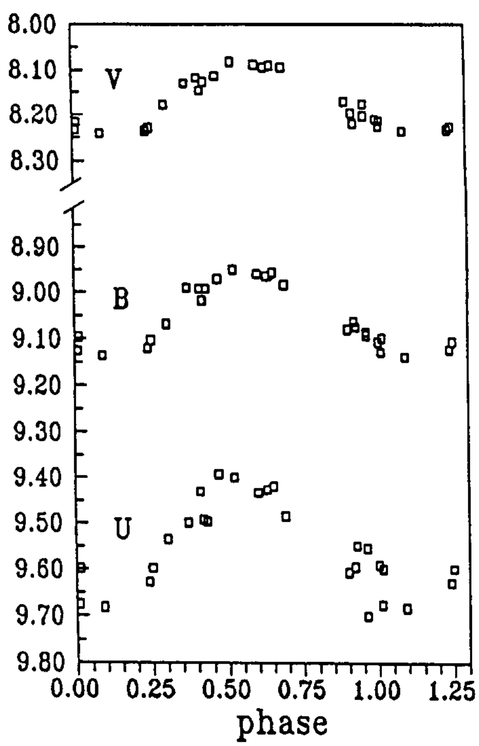

Figure 1.

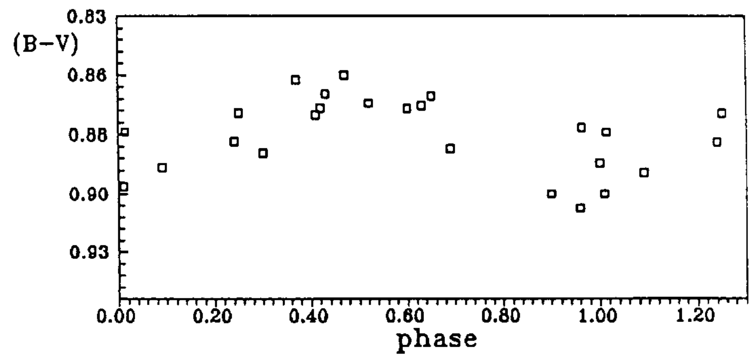

Figure 2.

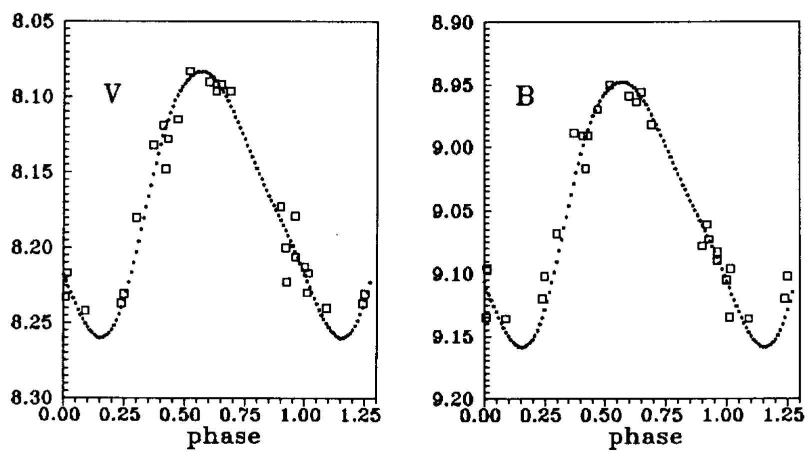

Figure 3.

In spite of the correlation of (B−V) residuals and V curve that might be explained only by a cool spot, we attempted to fit our observational B and V data by different parameters of hot spots also but there was not any result.

Our data strengthen once again the previous conclusions about the changing period and strongly variable amplitude of the light curve of FK Com. Besides it turned out that they could fit only by cool spots. This fact supports the concept that FK Com is a differentially rotating single star.

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NEW PHOTOELECTRIC OBSERVATIONS OF BF AURIGAE

BF Aur (= BD+41°1051, HD 32419) is an early type eclipsing binary system with two B5 V components and an orbital period of 1.5832 days. The variations in brightness were discovered by Morgenroth (1935) and the photoelectric light curves in BV and UBV were given by Schneller (1961) and Mannino et al. (1964), respectively. Mammano et al. (1974) published a spectroscopic investigation of BF Aur. Based on the observations of Mannino et al., the photometric solutions were carried out by Schneider et al. (1979) and Kallrath and Kamper (1992). They found that BF Aur is probably a semi-detached system with the more massive component in contact. The analysis of the period of this system was given by Guarnieri et al. (1975). It reveals that the orbital period of the system is increasing slowly.

During a joint observational program of close binary systems between the Beijing Observatory of China and the King Sejong University of Korea, BF Aur has been observed at the Xinglong station of Beijing Observatory. The observations were made photoelectrically in U, B, and V bands with the 60 cm reflector during the period of January 10-17, 1993. BD +41°1048 was used as a comparison star and BD +41°1046 as a check star, respectively. A total of 464 UBV observations covering two primary and secondary eclipses were obtained on six nights. All of the data were corrected for differential extinction and transferred to the Johnson's UBV system. Fifty five differential observations between the comparison and check stars give the mean accuracies $\sigma \sim 0^m.011$ in V, $0^m.013$ in B and $0^m.023$ in U band, respectively.

Four times of minimum light determined are listed in Table 1. The new minimum times, together with the recent p.e. times of minima collected by Guarnieri et al. (1975) and one visual given by Pietz (1989), are used to derive a linear ephemeris (1):

$$\text{Min.I(J.D.hel.)} = 2449002.02547 \pm 35 \quad + \quad 1.^d58322190 \pm 8 * E \qquad (1)$$

However, the O − C of the light minima based on the ephemeris (1) shows systematic deviations from the linear fitting. This means that the period of BF Aur is going on continuously increasing up to date. Therefore, a quadratic fitting of all the published observations of minimum times including the visual and photographic data (Mannino et al. 1964) is carried out with the weighted least squares method. We obtained the following ephemeris:

$$\text{Min.I(J.D.hel.)} = \underset{\pm\ 10}{2449002.0258} + \underset{\pm\ 25}{1.^d58322290} * E + \underset{\pm\ 13}{1.64} * 10^{-10} * E^2 \qquad (2)$$

Table 1. The times of minimum of BF Aur

JD.2440000+	m.e.	colour	Min.
8998.0678	0.0004	V	II
.0677	0.0004	B	II
9001.2344	0.0003	V	II
.2344	0.0002	B	II
9002.0267	0.0005	V	I
.0263	0.0001	B	I
9005.1921	0.0004	V	I
.1919	0.0004	B	I

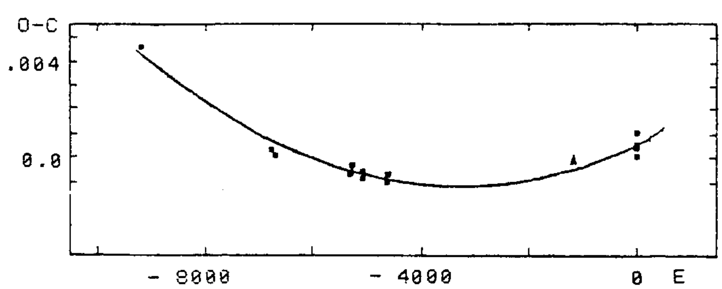

Figure 1. O−C diagram of recent minimum times of BF Aur

The quadratic term in the ephemeris (2) is nearly the same as that derived by Guarnieri et al. (1975), but the period P in the linear term is obviously the best representation of the present case of BF Aur. Therefore, a linear ephemeris T_0 (JD hel)= 2449002.0258+ $1.^{d}58322290 * E$ is employed to combine our observations in complete light curves in Figure 2.

The rate of the period changes is found to be $\Delta P/P = 0.00658$ sec/yr from the ephemeris (2). The period increases of BF Aur can be explained by the possible mass transfer from the less massive component to the more massive one as the case assumed in the most of

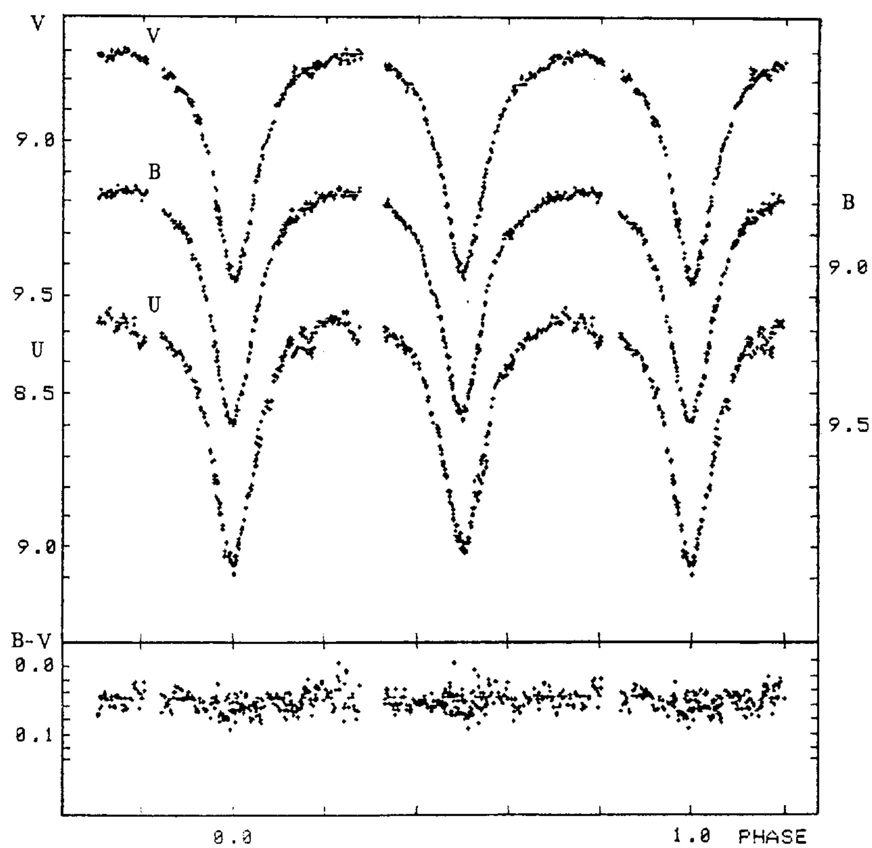

Figure 2. UBV light and color index curves of BF Aur in 1993

Algol systems. However, based on the old light curves many authors (Schneider et al. 1979 and Kallrath and Kamper 1992) argued that BF Aur is a semi-detached system with the more massive component in contact with its inner critical Roche lobe. This configuration is somehow discrepant with the assumed mass transfer direction suggested by the period changes. So it is important to carry out a new photometric analysis with our new observational data. A further investigation is in progress.

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RAPID CHANGE OF PERIOD OF AP AURIGAE

[BAV Mitteilungen Nr. 67]

The β Lyr–type system AP Aur was discovered by A.S. Williams (Williams 1931). When constructing the database of minima of eclipsing binaries, D. Lichtenknecker first recognized the rapid change of the period of this system (Lichtenknecker 1983). His study of 23 then available minimum timings led to the quadratic formula (Lichtenknecker 1986):

$$\mathrm{Min\,I} = \mathrm{HJD}\quad 2442443.620 + 0.5693473 \cdot \mathrm{E} + 8.08 \cdot 10^{-10} \cdot \mathrm{E}^2.$$

The period variation of AP Aur was studied recently by Zhang et al. (Zhang et al. 1993). Though 32 published minima timings were used together with new photoelectric ones, they could not match epoch numbers and observation properly. Jumps of half a period in their O–C–Diagram (Zhang et al., Fig 3a) are not real but a consequence of the collision between their theory and reality. A rather complicated system of ephemeris formulae resulted.

Stimulated by the note by Lichtenknecker, we put AP Aur on our observing program. Photoelectric observations were made at the private observatory of one of us (F.A.) with a 0.35 m automatic photoelectric telescope (Agerer 1988). The photometer was equipped with an uncooled EMI 9781A tube and Schott filters for B and V. One minimum (n. 86) was observed with a 20cm SC telescope, equipped with an uncoated CCD without filters. The minimum times are calculated using the Kwee – van Woerden method (Kwee, van Woerden 1956). 12 times of photoelectric minima were collected, which confirmed the ephemeris found. To expand our knowledge of period changes to the past, one of us (E.S.) investigated this star on 638 plates of the Sonneberg Sky Survey. 38 plates with weak images could be found. With this material at hand we were able to associate the epoch numbers and minimum timings without ambiguity (Table 1). There is one large gap remaining between the first two timings from the discovery plates and the visual observations by Williams. The normal minimum by Kukarkin (Kukarkin 1931) is not of great help. It is built up from 27 plate observations between 1919 and 1930. Moreover the author remarks, that 'die Zerstreuung der Beobachtungen sind gross' (the scatter of the observations is large). Therefore minima Nr. 1 – 3 were not used in calculating the new ephemeris. A least squares fit yealds the following quadratic ephemeris:

$$\begin{array}{llll} \mathrm{Min\,I} = \mathrm{HJD} & 2448273.5736 + & 0.56936859 \cdot \mathrm{E} + & 9.063 \cdot 10^{-10} \cdot \mathrm{E}^2 \\ & \pm 7 & \pm 29 & \pm 75 \end{array} \qquad (1)$$

Table 1: Observed times of minima for AP Aur, epochs and residuals computed with respect to the quadratic ephemeris derived in this paper.

N	JD hel. 2400000+	W	T*	Epoch	(O–C)	Lit	N	JD hel. 2400000+	W	T*	Epoch	(O–C)	Lit
1	15488.502	0	P::	-57586.5	-0.1328	[1]	44	42464.401	5	V:	-10203.0	0.0008	[8]
2	15846.517	0	P::	-56958.0	0.0993	[1]	45	42528.443	10	V	-10090.5	-0.0091	[9]
3	22842.95	0	F::	-44668.0	0.1243	[2]	46	42716.539	2	P	-9760.0	-0.0835	[20]
4	23080.520	10	V	-44250.5	0.0166	[1]	47	42756.490	2	P	-9690.0	0.0129	[20]
5	23399.340	10	V	-43690.5	0.0348	[1]	48	42782.370	10	V	-9644.5	-0.0125	[10]
6	23810.331	10	V	-42968.5	-0.0016	[1]	49	42831.332	2	P	-9558.5	-0.0147	[20]
7	24139.943	10	V	-42389.5	-0.0093	[1]	50	43250.340	2	P	-8822.5	-0.0498	[20]
8	26415.361	5	V:	-38392.5	-0.0649	[1]	51	43436.571	2	P	-8495.5	0.0028	[20]
9	26419.387	10	V	-38385.5	-0.0240	[1]	52	43933.332	2	P	-7623.0	0.0025	[20]
10	26771.233	10	V	-37767.5	-0.0051	[3]	53	44499.572	2	P	-6628.5	0.0183	[20]
11	26771.533	5	V:	-37767.0	0.0102	[3]	54	44631.369	2	P	-6397.0	0.0092	[20]
12	27760.679	20	F	-36029.5	-0.0055	[4]	55	45056.388	10	V	-5650.5	0.0027	[11]
13	27815.338	20	F	-35933.5	0.0004	[4]	56	45056.391	10	V	-5650.5	0.0057	[11]
14	28220.388	2	P	-35222.0	-0.0095	[20]	57	45254.425	2	P	-5302.5	-0.0971	[20]
15	28238.342	2	P	-35190.5	0.0114	[20]	58	45388.311	10	V	-5067.5	-0.0105	[12]
16	28425.617	2	P	-34861.5	-0.0149	[20]	59	45405.390	10	V	-5037.5	-0.0123	[12]
17	28494.522	2	P	-34740.5	0.0041	[20]	60	45648.515	2	P	-4610.5	-0.0040	[20]
18	28951.396	2	P	-33938.0	0.0097	[20]	61	45738.7672	40	E	-4452.0	0.0046	[13]
19	30622.613	2	P	-31002.5	0.0180	[20]	62	46377.8729	40	E	-3329.5	0.0020	[13]
20	31030.483	2	P	-30286.0	-0.0248	[20]	63	46436.8024	40	E	-3226.0	0.0024	[13]
21	31873.428	2	P	-28805.5	0.0493	[20]	64	46461.2810	40	E	-3183.0	-0.0016	[14]
22	35761.579	10	V	-21976.0	0.0118	[5]	65	46462.1380	40	E	-3181.5	0.0014	[14]
23	35778.652	2	P	-21946.0	0.0050	[20]	66	46464.1331	40	E	-3178.0	0.0037	[14]
24	35839.542	2	P	-21839.0	-0.0232	[20]	67	46716.637	2	P	-2734.5	-0.0050	[20]
25	35875.436	2	P	-21776.0	0.0031	[20]	68	46776.1381	40	E	-2630.0	-0.0024	[14]
26	36200.527	2	P	-21205.0	0.0068	[20]	69	47170.427	40	E	-1937.5	0.0016	[15]
27	36466.411	10	V	-20738.0	0.0135	[6]	70	47207.435	40	E	-1872.5	0.0009	[15]
28	36541.538	2	P	-20606.0	-0.0113	[20]	71	47469.623	20	F	-1412.0	-0.0040	[16]
29	36896.524	2	P	-19982.5	-0.0036	[20]	72	47526.2762	40	E	-1312.5	-0.0027	[14]
30	37018.361	2	P	-19768.5	-0.0038	[20]	73	47527.1318	40	E	-1311.0	-0.0011	[14]
31	37400.386	2	P	-19097.5	-0.0015	[20]	74	47541.371	20	F	-1286.0	0.0039	[16]
32	37562.601	2	P	-18812.5	-0.0467	[20]	75	47566.413	20	F	-1242.0	-0.0062	[16]
33	37636.625	2	P	-18682.5	-0.0362	[20]	76	47579.516	20	F	-1219.0	0.0014	[16]
34	37696.401	2	P	-18577.5	-0.0404	[20]	77	47586.3478	40	E	-1207.0	0.0008	[16]
35	37733.361	2	P	-18512.5	-0.0872	[20]	78	47592.3254	40	E	-1196.5	0.0000	[16]
36	38853.318	2	P	-16545.5	-0.0157	[20]	79	47803.5516	20	E:	-825.5	-0.0088	[17]
37	39352.574	2	P	-15668.5	-0.0703	[20]	80	47861.3520	40	E	-724.0	0.0008	[17]
38	39533.409	2	P	-15351.0	-0.0009	[20]	81	47861.6350	40	E	-723.5	-0.0009	[17]
39	40648.422	2	P	-13392.5	-0.0453	[20]	82	47947.3263	40	E	-573.0	0.0006	[17]
40	41217.576	2	P	-12393.0	0.0481	[20]	83	48273.5737	40	E	0.0	0.0001	[18]
41	41240.553	2	P	-12352.5	-0.0334	[20]	84	48308.3045	40	E	61.0	-0.0006	[18]
42	41717.371	2	P	-11515.0	-0.0435	[20]	85	48972.4712	40	E	1227.5	-0.0037	[19]
43	42443.609	10	V	-10239.5	-0.0099	[7]	86	49056.4591	40	E	1375.0	0.0020	[19]

[1]: A.Williams, [2]: B.Kukarkin, [3]: V.Tsesevich (1953), [4]: V.Nikonov, [5]: V.Tsesevich (1956), [6]: V.Tsesevich (1960), [7]: R.Diethelm(1975a),[8]: R.Diethelm(1975b),[9]: R.Diethelm(1975c), [10]: R.Diethelm(1976), [11]: Braune & Mundry (1982), [12]: Braune et al. (1983), [13]: D.Faulkner, [14]: R.Zhang et al., [15]: Hübscher & Lichtenknecker (1988), [16]: Hübscher et al. (1989), [17]: Hübscher et al. (1990), [18]: Hübscher et al. (1992), [19]: Hübscher et al. (1993), [20]: this paper

*) P denotes pg plate min., E photoel. min., F photographic series and V visual estimates. Those marked "::" were discarded.

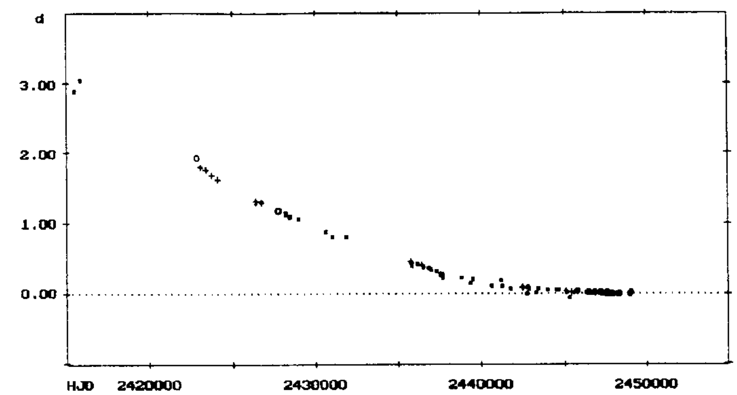

Figure 1: O–C–Diagram for AP Aur computed with respect to the linear ephemeris Min I = 2448273.5736 + 0.56936859 · E.
• represents photoelectric, o photographic series, + visual observations and □ photographic plate minima.

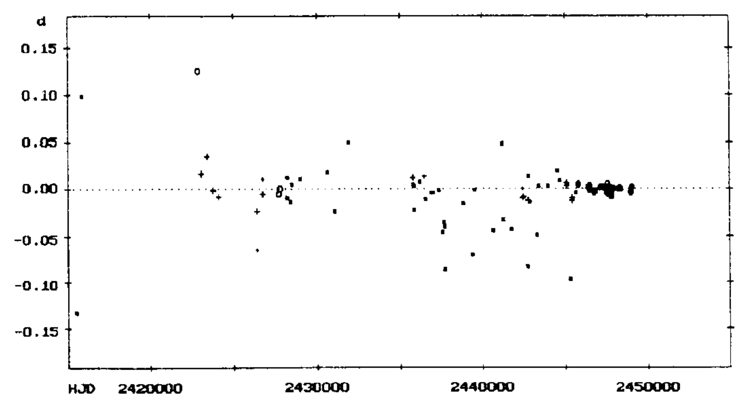

Figure 2: O–C–Diagram for AP Aur computed with respect to the new quadratic ephemeris (1). • represents photoelectric, o photographic series, + visual observations and □ photographic plate minima.

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A CATALOGUE OF SHORT PERIOD PULSATING VARIABLE STARS OF A AND F SPECTRAL CLASSES

Delta Scuti, SX Phoenicis, rapidly oscillating Ap stars and some bright RRc type RR Lyrae variables are collected in a new catalogue. The database contains 415 stars (version Oct. 11, 1993), listed by Hipparcos Input Catalogue number, i.e. according to 2000.0 equatorial coordinates.

The content of the columns:

1. HIC number (Hipparcos Input Catalogue)
2. HR number (Bright Star Catalogue)
3. HD number (Henry Draper Catalogue)
4. SAO number (Smithsonian Astr. Obs. Catalogue)
5. Right ascension (2000.0 if the star is included in HIC)
6. Declination (2000.0 if the star is included in HIC)
7. V magnitude (HIC)
8. B−V colour index (HIC)
9. U−B colour index (BSC)
10. Period of variation (only the most relevant, in days, approx.)
11. Amplitude of variation (in magnitude)
12. Spectral type and luminosity class (HIC)
13. Rotational velocity (v×*sini* in km/s)
14. Type of variability and binarity:
    - Delta Scuti.................DS
    - SX Phoenicis................SX
    - RR Lyrae....................RR
    - rap. oscill. Ap.............AP
    - suspected variable............?
    - α CVn variable.............a
    - visual binary.................v
    - spectroscopic binary..........s
    - eclipsing binary..............e
15. *: if the star is also found in the catalogue containing 298 stars of Garcia et al. (1993a, 1993b)

The main differences between the present database and the catalogue of Garcia et al. are: our catalogue also contains the suspected Delta Scuti type and roAp stars but it does not contain references and some astrophysical data (e.g. Strömgren photometry, radial velocity, parallax and GCVS remarks). The data of our collection are based on earlier catalogues and individual papers.

A list on 34 binary Delta Scuti stars can be found in Szatmáry (1990).

We hope, that the catalogue is useful not only for the Delta Scuti specialists, because it helps to keep out these stars at the selection of comparison stars.

The catalogue is available from the author via E-mail or on your own diskette (IBM 1.2 or 1.44 Mbyte floppy). A handling program in Turbo Basic code is also available, upon request, which makes a selection by name of stars, catalogue number, constellation, spectral type, pulsation and binarity type or according to a given interval of coordinates, magnitudes, period, amplitude and rotational velocity.

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Improved Positions of Southern NSV Stars. I

Following with a program conducted to improve the coordinates of southern confirmed and suspected variable stars, improved positions for New Suspected Variable (NSV) stars are herein presented.

Each of the stars presented in this note has been identified on the first-epoch plates of the SPM (van Altena *et al.* 1990) project. The x, y measurements were transformed into celestial coordinates using an average of 37 SRS stars kindly supplied by the late Dr. Clayton Smith of the US Naval Observatory. The average standard error of the transformation is 0.7" in both RA and Dec. More details can be found in Lopez and Girard (1990).

Table I lists the newly determined positions. The first column gives the NSV number; the second and third provide the RA and Dec (equinox B1950.0), respectively; the fourth column is the epoch of observation (given as epoch *minus* 1900); the last two columns list the differences between our new positions and those quoted in the NSV catalogue in minutes of time in RA and arc minutes in Dec. The differences are in the sense new position *minus* NSV coordinates.

The 96 objects listed in Table I added to the 368 already reported by Lopez and Girard (1990), bring to 464 the total number of NSV stars for which we have been able to improve their positions.

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TABLE I

Improved Positions of Southern NSV Stars

Star	RA h	m	s	(1950.0) Dec °	'	"	Epoch	ΔRA m	ΔDec '
07593	16	14	16.26	-57	1	45.3	69.38	-0.012	+0.345
07643	16	18	11.24	-57	39	33.5	69.38	-0.046	+0.442
07671	16	19	54.14	-55	47	50.7	69.38	-0.014	+0.054
07729	16	24	21.73	-59	39	18.7	69.37	-0.005	+0.188
07783	16	28	21.48	-58	58	59.8	69.37	+0.008	-0.297
07827	16	31	26.11	-60	26	8.2	69.37	+0.002	+0.163
07833	16	32	8.40	-55	33	33.9	69.38	-0.027	+0.635
07853	16	33	47.00	-59	38	38.5	69.37	0.000	-0.142
07886	16	37	4.84	-55	17	9.9	69.38	+0.031	+0.335
07921	16	40	7.23	-57	45	50.9	69.38	+0.004	-0.449
07959	16	44	12.99	-58	55	57.0	69.37	+0.016	-0.249
07965	16	44	52.40	-55	12	39.9	69.79	-0.010	+0.334
07975	16	46	4.39	-56	41	47.3	69.79	-0.010	+0.012
07988	16	47	34.30	-54	47	45.6	69.79	-0.062	+0.339
08002	16	49	4.75	-61	19	1.7	69.37	+0.013	-0.029
08007	16	49	26.00	-57	13	38.3	69.65	-0.017	+0.661
08008	16	49	27.30	-56	22	38.1	69.79	-0.012	+0.266
08013	16	50	15.84	-59	22	41.4	69.37	+0.014	-0.090
08025	16	50	49.39	-57	12	36.5	69.38	-0.010	-0.409
08043	16	52	4.20	-55	50	57.5	69.79	+0.003	+0.241
08049	16	52	32.55	-60	19	36.6	69.37	+0.026	+0.290
08050	16	52	35.46	-60	25	3.5	69.37	+0.024	+0.442
08053	16	52	44.74	-61	46	59.0	69.37	-0.004	+0.017
08054	16	52	56.83	-57	59	26.0	69.65	+0.014	-0.533
08074	16	55	16.48	-53	35	0.8	70.19	-0.042	+0.287
08080	16	55	49.22	-56	35	41.4	70.19	-0.046	-0.089
08083	16	56	9.27	-57	21	4.6	69.37	-0.062	-0.376
08089	16	57	0.53	-61	55	13.4	69.37	+0.009	+0.177
08105	16	57	52.72	-61	1	4.7	69.37	+0.012	+0.621
08109	16	58	12.15	-59	26	33.3	69.37	-0.031	+0.045

TABLE I (cont.)

Star	RA h	m	s (1950.0)	Dec °	'	"	Epoch	ΔRA m	ΔDec '
08118	16	59	3.14	-59	25	22.0	69.37	-0.031	+0.033
08120	16	59	9.00	-61	26	3.3	69.37	+0.017	+0.545
08125	16	59	17.01	-63	20	22.9	66.54	-0.033	+0.318
08130	16	59	22.27	-54	48	10.1	70.19	-0.029	+0.032
08139	17	0	40.00	-59	28	15.4	69.37	-0.017	-0.057
08172	17	2	17.57	-57	38	50.1	69.78	+0.009	-0.335
08181	17	2	52.76	-55	34	19.0	70.19	-0.287	-0.217
08196	17	3	54.37	-55	27	58.6	70.19	-0.027	-0.377
08212	17	4	49.29	-62	26	17.4	69.37	+0.038	-0.089
08221	17	5	9.18	-57	40	52.0	69.78	-0.030	-0.267
08230	17	6	7.55	-58	1	28.3	69.78	+0.026	-0.372
08242	17	6	54.72	-60	1	29.2	69.37	-0.005	+0.014
08245	17	7	5.28	-60	10	57.7	69.37	+0.088	-0.061
08314	17	10	8.51	-63	8	32.5	66.54	-0.042	-0.242
08341	17	10	52.47	-56	57	24.2	69.78	+0.041	-0.504
08390	17	12	1.27	-55	8	11.8	70.19	-0.045	-0.096
08427	17	13	9.27	-61	34	50.8	69.37	-0.046	+0.254
08443	17	14	4.89	-55	6	33.0	70.19	-0.002	+0.150
08452	17	14	27.95	-57	43	22.0	69.37	-0.001	-0.167
08475	17	15	14.42	-56	28	8.4	69.37	-0.026	+0.261
08507	17	16	27.05	-56	7	48.1	69.37	-0.016	+0.298
08565	17	19	24.48	-63	59	6.4	66.54	-0.025	-0.007
08621	17	22	33.80	-44	49	32.2	69.63	-0.003	-0.137
08806	17	25	52.89	-51	51	25.3	69.08	-0.018	-0.122
08846	17	26	14.64	-51	35	48.5	69.08	-0.006	-0.009
09166	17	31	24.18	-48	39	9.9	68.55	+0.003	+0.135
09203	17	33	1.61	-63	40	14.7	68.35	-0.040	-0.144
09245	17	34	7.02	-42	29	19.9	69.63	+0.017	-0.032
09348	17	35	41.24	-52	36	26.0	68.55	+0.004	-0.134
09460	17	37	33.63	-65	52	46.4	68.35	-0.023	-0.273
09477	17	37	46.81	-64	35	24.9	68.35	-0.020	-0.016
09495	17	38	13.30	-45	32	47.9	69.63	+0.222	+0.201
09510	17	38	13.33	-45	32	48.9	69.63	+0.022	+0.086

TABLE I (cont.)

Star	RA h	m	s	(1950.0) Dec °	'	"	Epoch	ΔRA m	ΔDec '
09514	17	38	22.55	-49	0	56.7	68.55	+0.076	+0.255
09523	17	38	38.79	-49	54	18.1	68.55	-0.037	-0.401
09525	17	38	49.04	-51	50	50.5	68.55	+0.001	+0.158
09529	17	38	54.56	-66	8	54.2	68.35	-0.024	-0.203
09541	17	39	27.59	-47	19	51.1	69.09	+0.026	-0.152
09542	17	39	27.49	-52	20	22.3	68.55	-0.009	-0.172
09552	17	40	2.22	-47	17	1.7	69.09	+0.020	-0.028
09553	17	40	1.60	-49	4	14.3	68.55	+0.010	-0.039
09554	17	40	2.99	-48	28	42.1	68.55	0.000	-0.002
09556	17	40	10.97	-49	20	55.6	68.55	-0.034	-0.127
09560	17	40	12.10	-50	1	25.9	68.55	-0.082	-0.231
09575	17	40	37.22	-53	37	40.8	68.55	+0.004	-0.780
09578	17	40	42.17	-48	18	21.2	68.55	+0.019	-0.053
09611	17	41	50.07	-47	58	5.9	68.91	+0.018	-0.398
09616	17	41	53.26	-49	17	8.1	68.54	+0.004	+0.366
09647	17	43	9.69	-46	40	4.4	69.09	-0.005	-0.173
09649	17	43	18.31	-51	40	23.8	68.54	+0.005	+0.203
09650	17	43	19.16	-46	32	44.5	69.09	+0.003	+0.158
09651	17	43	22.07	-51	27	47.7	68.54	+0.035	-0.096
09652	17	43	24.42	-51	53	6.9	68.54	+0.024	-0.015
09662	17	43	45.87	-51	35	45.0	68.54	+0.014	+0.250
09677	17	44	33.49	-51	12	36.8	68.54	+0.008	+0.286
09680	17	44	38.56	-49	52	3.1	68.54	-0.007	+0.248
09685	17	44	52.32	-45	59	39.0	69.09	-0.011	-0.651
09695	17	45	19.91	-51	19	40.4	68.54	-0.001	+0.426
09701	17	45	38.44	-46	31	34.0	69.09	+0.041	+0.134
09718	17	46	21.57	-48	56	18.5	68.54	-0.007	+0.191
09746	17	47	29.68	-46	57	13.6	68.91	+0.011	-0.527
09758	17	48	4.96	-51	54	48.2	68.54	+0.016	-0.703
09761	17	48	9.27	-47	46	39.2	68.82	+0.005	-0.453
09763	17	48	22.38	-47	11	2.9	68.82	-0.044	-0.048
09770	17	48	50.52	-49	24	50.9	68.54	+0.042	+0.352
09771	17	48	47.76	-46	24	56.5	69.09	-0.021	-0.041

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A NULL DETECTION OF RAPID OSCILLATIONS IN THE Ap STAR ET And

Panov (1985) reported the possible detection of rapid oscillations in the CP2 (Ap) star ET And (HD 219749, HR 8861), a B9p variable with a rotation period of approximately 1.62 days and also a short-period pulsational variable with periods most recently determined to be 0.09919 and 0.14795 day (Weiss *et al.* 1994). Panov's claimed detection of periods between 7 and 16 min prompted the need for additional observations to look for rapid oscillations.

Photoelectric photometry was obtained on three consecutive nights with the Lowell Observatory 0.8-m reflector. The journal of observations is given in the table below. Each integration was 20 sec through a narrow-band (4060Å, FWHM=70Å) filter with a central wavelength similar to Strömgren v. Breaks were taken only for sky measurements and recentering of the 20" aperture.

Table 1. Journal of observations of ET And.

UT date	Julian Day	Npts	σ	Δt [hr]
93-Sep-21	2449251	503	.0023	2.89
93-Sep-22	2449252	532	.0022	3.09
93-Sep-23	2449253	539	.0024	3.11
		Σ1574	<.0028>	Σ9.09

The times of observation were transformed to heliocentric Julian Day to 1-sec accuracy, and mean magnitudes were subtracted from each night's data after counts were corrected for dead time and sky-subtracted.

Analysis was performed via discrete Fourier transform (DFT) using Kurtz' (1985) modified version of Deeming's (1975) algorithm. Fig. 1 shows the amplitude spectrum of each night separately, and in the bottom panel, the combined data for all three nights. It should be emphasized that here, the y-scale is in *milli-magnitudes*, so the height of each separate panel is approximately 1.0 mmag. In particular, in the frequency range 90–205 c/d, corresponding to periods of 7–16 min, note the absence of any significant power. The upper limit is about 0.6 mmag for any individual night. It was about 0.45 mmag for all three nights combined. This is also the 5% false alarm probability level (Scargle 1982; Horne and Baliunas 1986).

Given that rapid oscillations in Ap stars are proportional to the magnetic field strength, the phase of the magnetic field and hence the star's rotation phase can play a significant role. With a rotation period of 1.61887 days (Scholz *et al.* 1985), it can readily be calculated that these data were obtained at *relative phases* of 0.0, 0.10, and 0.71 and so the maximum gap in phase is about 0.6. This precludes completely missing any more than about half the portion of the the phase where the magnetic field strength is at a maximum, and even less if there is magnetic polarity reversal. From only two magnetic field measurements published by Bohlender *et al.*(1993), it is unclear whether polarity reversal takes place or not.

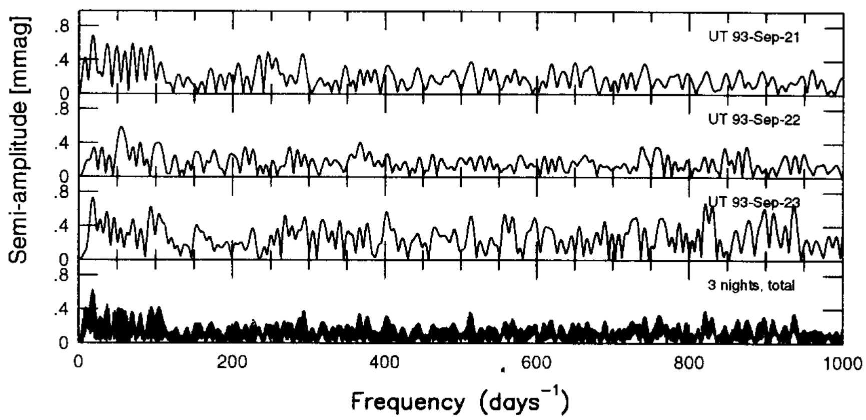

Fig 1. Amplitude spectra of the data from Table 1 for each separate night, and at the bottom, for all three nights combined.

We conclude that there is no evidence of rapid variability in ET And, and that if data are not obtained under excellent photometric conditions, spurious peaks in the period range reported by Panov (1985) could easily show up.

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NSV 7457 Her: A PROBABLE W UMa STAR

The variability of NSV 7457 Her (=CSV 007268=BV 0103=BD+50°2255) was discovered by Geyer (Geyer et al., 1955) when he examined photographic observations made in Bamberg; the star was announced to be about $9^{m}_{\cdot}7$ (p) at maximum with an amplitude of 0.7 magnitude and rapid variations. Filatov (1960) mentions that the star has a short period and is probably of the RR type. After inspection of photographic plates taken from 1939 to 1959 at the Tadjikistan observatory, he gives a list of 17 times at which the star was at its maximum brightness.

To confirm the results obtained by GEOS (Groupe Européen d'Observations Stellaires) from visual estimates, NSV 7457 Her was photoelectrically measured during GEOS missions at the Jungfraujoch station. The measures were made with a cooled photometer equipped with filters on the Geneva photometric system, attached to the Observatory's 76 cm telescope. 204 measures in B and 204 in V were obtained between April 1991 and December 1992.

The first period searches were made in 1990 using 252 estimations of the author. The PDM (Stellingwerf, 1978) and Fourier (Horne and Baliunas, 1986) methods programmed by Patrick Wils were used. At this time, 0.2095 day was the more probable period but the double period was already foreseen as well. In fact, the sinusoidal shape of the light curve allowed to suppose that NSV 7457 Her could be as well a pulsating star as an eclipsing star (of the EW type).

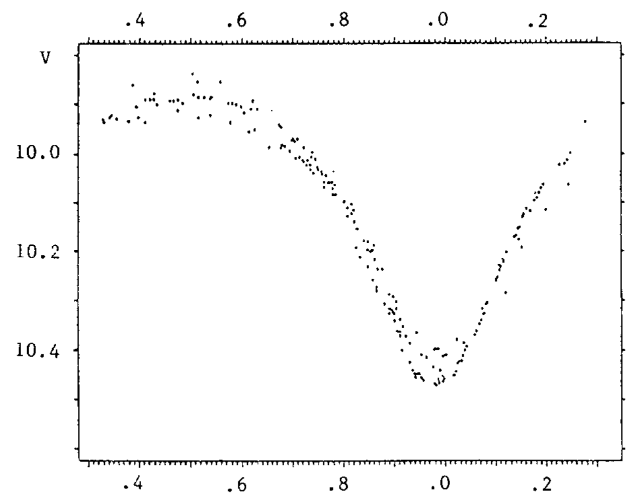
The following step was the determination of the larger possible number of extrema's instants from the photoelectric measures and the visual estimates of the GEOS members. 53 extrema (50 visual and 3 photoelectric) have been used in the linear regression giving the elements that now suit best to NSV 7457 Her (a triple weight has been given to the photoelectric moments). These elements are the following:

$$\text{Min JD hel} = 2447643.1786 + 0^{d}_{\cdot}4190306 \times E \qquad (1)$$
$$\pm 0.0023 \pm 0.0000025 \qquad \text{(confidence 95\%)}$$

The 204 photoelectric measures in V were also studied with the method of period search PDM from Patrick Wils. The more obvious periods obtained are 0.2095156 day and the double one.

The mean amplitude is 0.56 mag in V and M−m=0.50. It is clear that the light curve is not perfectly repetitive: the differences go up to nearly 0.1 magnitude, which is larger than the measures' accuracy (±0.03 mag).

Period=$0^{d}.2095156$



Min JD hel 2447643.1786+$0^{d}.4190306\times$E

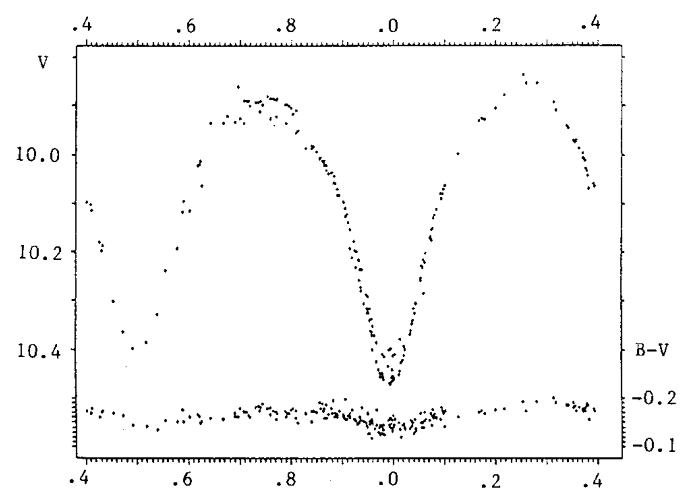


Figure 1. Composite light curves of the photoelectric measures

Filatov (1960) published 17 moments at which NSV 7457 Her was at maximum of light between 1943 and 1959. The accuracy of the period in ephemeris (1) theoretically just allows to go back to these years. Unfortunately, the tests came to a failure. In contrary a slight modification of the period of the present days came to a period suiting well enough the photographic maxima and the linear regression gives the following ephemeris:

$$\text{Max JD hel}=2430850.002+0\overset{d}{.}2095038\times E \quad (2)$$
$$\pm 0.013 \pm 0.0000017 \quad \text{(confidence 95\%)}$$

The period found is a little shorter than those suiting the current extrema and the photoelectric measures. A possible period change might have occurred.

This list of all the photoelectric measures of NSV 7457 Her can be obtained from the author. The B−V values corresponding to the Johnson and Morgan's system were calculated from the transformation formulae described by Meylan and Hauck (1981) using the star's class III.

If we plot the light curve of NSV 7457 Her with the period of $0\overset{d}{.}4190306$, its characteristics can be summarized as follows:

a. The magnitude of NSV 7457 Her varies from 9.85 to 10.45 in V.
b. Its primary minimum is generally a little deeper than its secondary.
c. Its maxima are clearly more rounded than its minima, but the ascending branches of the light curve are of the same length than the descending ones.
d. Its colour index B−V goes from 0.62 to 0.68.
e. It is always redder when it is less luminous.
f. The maxima and minima of the B−V colour curve are a little shifted compared with the ones of the V curve.

The period and the shape of the light curve of NSV 7457 Her are typical for eclipsing stars of the EW type. Nevertheless three peculiarities are to be examined in its case.

Firstly, the shape of the light curve varies and the maxima and minima do not have always the same shape. This is characteristic of binary stars having dark or luminous spots on the surface of at least one component. VZ Piscium is such a star (Maceroni et al., 1990).

Secondly, the B−V index mimics the V behaviour: the star is bluer when it is brighter in V. This can be found in contact binaries: if the binary star has a hot spot located near the contact point the star is bluer at maximum light when the spot is visible. CK Aqr has such a B−V colour curve (Le Borgne et al., 1989).

Thirdly, if we consider the period found with the moments of the Tadjikistan observatory's plates we can suppose that the period increased since the years 1943-59. This is the case when matter escapes from the system or when there is matter exchange between the components. In fact there is about the same number of W-type systems with an increasing period than with a decreasing one, whereas a few systems are alternating their tendency (Sarna, 1991).

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EF DRACONIS IS A TRIPLE SYSTEM

EF Draconis (1E1806.1+6944) was discovered serendipitously as an X-ray source in the Einstein Observatory Extended Medium Sensitivity Survey (Gioia et al. 1987). Fleming et al. (1989) made three radial-velocity measurements of the object and suggested that the object is probably a W UMa-type variable. Shortly after Fleming et al.'s work, Robb & Scarfe (1989) published their VRI light curves of the variable and confirmed that it is a W UMa system. In 1989, Plewa et al. (1991) independently observed the system and analysed their data. They concluded that EF Dra is an A-subtype of W UMa binaries, with a mass ratio of 0.125. Wunder & Agerer (1992) also made B & V photometry of the variable and refined its orbital period.

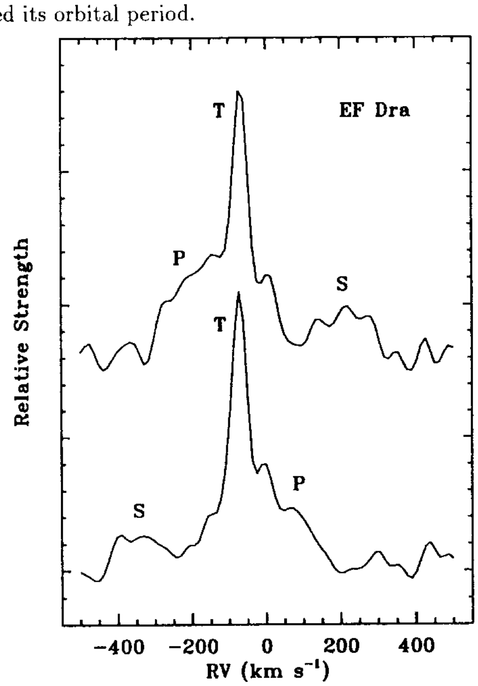

Figure 1. Broadening fuction profiles of EF Dra.
The letters P, S, and T indicate the profiles of the primary, secondary, and third components of the system, respectively.

I observed the variable spectroscopically in 1991 and 1992 using the Cassegrain spectrograph and CCD detector on the 1.9-m telescope at David Dunlap Observatory. A total of 43 spectra was obtained. The data were reduced for radial velocities by means of the Spectral Broadening Function Method (Rucinski, 1992). It is interesting to discover that this variable is actually a triple system. Two broadening function profiles obtained at the two quadratures are shown in Fig.1, in which P, S, and T indicate the profiles of the primary, secondary, and third components of the system, respectively. The light of the third component clearly revealed as a narrow component in the broadening function profiles and must be included as "third light" in the light curve solution. A spectroscopic orbit has been determined for the close pair, whose mass ratio was found to be small but significantly different from the one derived by Plewa et al. The close pair indeed belongs to the A-subtype of W UMa stars. The velocity of the third component was constant during the two periods of observations. It has a value of -38 km/sec comparative to the systemic velocity of -42 km/sec of the contact binary in the triplet, which suggests that the third component is physically related to the contact binary. A combined analysis of the radial-velocity and existing light curves is in progress and will be published in the near future.

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TIMES OF MINIMA OF SOUTHERN ECLIPSING BINARIES

Here are presented photoelectric minima for AG Phe and LT Pav. Observations were made at Cerro Tololo Interamerican Observatory in Chile[1] with the 60 cm Lowell Telescope, standard UBVRI filters and photon counting techniques.

Kwee and Van Woerden (1956) method for determining times of minimum light was used for the observations of AG Phe while the sliding integrals algorithm (Ghedini, 1981) was used for LT Pav. The determined minima are listed in the following tables together with the standard deviation given in brackets in units of $0^d.0001$.

Minima for AG Phe

Min	V	R	I
		HJD 2440000+	
I	5986.6300(04)	5986.6299(06)	5986.6297(06)
I	5988.8961(06)	5988.8963(03)	5988.8963(04)
II	5990.7840(11)	5990.7855(11)	5990.7861(09)

Minima for LT Pav

Min	U	B	V
		HJD 2440000+	
I	4841.5579(02)	4841.5579(02)	4841.5582(02)
II	4843.7228(03)	4843.7233(04)	4843.7232(03)
I	5225.7807(08)	5225.7802(06)	5225.7804(06)
I	5233.6563(07)	5233.6565(05)	5233.6568(06)
I	5237.5909(07)	5237.5908(06)	5237.5911(06)
II	5986.5507(07)	5986.5512(06)	5986.5515(07)
I	5987.5370(02)	5987.5362(02)	5987.5363(02)
I	5989.5041(32)	5989.5040(28)	5989.5035(28)
II	5991.6700(01)	5991.6704(01)	5991.6702(01)

A period study and the light curve analysis of these systems will be published elsewhere.

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BVRI AND SPECTROSCOPIC OBSERVATIONS OF SY Cnc

SY Cnc (α(J2000)=$9^h1^m34^s\!.1$; δ(J2000)=$17°53'55''\!.1$) is one of the brightest dwarf novae of Z Cam subtype. The visual magnitude varies between 10.8-11.1 at maximum and 13.5-14.5 at minimum with mean time between outbursts of 27 days (GCVS).

Many visual observations of SY Cnc have been reported in literature but continuous BVRI observations during a complete excursion from maximum to minimum are rare.

We observed photometrically the star with the 0.40 m automatic telescope at Astronomical Observatory of Perugia from 1993.02.03 to 1993.03.30. The telescope was equipped with a CCD camera and BVRI filters of Cousins. The instrumental magnitudes were transformed into the standard system observing equatorial Landolt's stars.

Spectroscopic observations were also obtained during an observational run at the 1.82 m telescope of the Asiago Astrophysical Observatory. The spectrograph used was a Boller and Chivens + CCD with 300 lines/mm grating (~4 Å/pixel). A hollow cathode Fe-Ar lamp was used for wavelength calibration.

Figure 1 shows the spectrum of SY Cnc from 4000 to 8000 Å. This spectrum is a combination of three exposures with different inclinations of grating. It was taken on 1993.03.15 (J.D. 2449062.3) when the star was in the initial phase of decline from the outburst. The Balmer series is in emission with the intensity of single lines decreasing from Hα to Hδ; there are also some lines of HeI weakly in emission λ=6678 Å and λ=7065 Å) and the line λ=4686 Å of HeII is in emission too. All identified lines are strongly redshifted. The spectrum is typically of a dwarf nova in outburst as we can see from the comparison with spectra taken by Williams (1983).

Table 1 lists the dates of photometric observations, magnitudes and standard deviations. A series of exposures with BVRI filters last ~20 minutes and we have reported the mean Julian Date. Care must be taken using color indices because this object exhibits flickering of about 0.1 mag on time scales of minutes (Pezzuto et al., 1992) and the observations are not simultaneous.

In Figure 2 are drawn the BVRI light curves during the decline from an outburst probably verified on 1993 March 10/11 (Bulletin de l'AFOEV No.65). The amplitude of variation from maximum to minimum decreases from B to I: in the B filter SY Cnc varies of $\approx$2.5 magnitudes while in the I filter $\approx$1.5 magnitudes. Theoretical models of CVs predict an accretion disk emitting a continuum spectrum of type $F(\nu)\propto\nu^{\alpha}$ with α=0.33.

From our BVRI data, transformed in flux using the relations reported in Bessel (1979), we have calculated a variation of spectral index α from $\cong$ 0.6 (at observed maximum) to $\cong$−0.08 (at observed minimum). This behaviour may be explained considering the relative importance of the disk emission and white dwarf emission at the maximum, and the secondary star (classified as G8/9 V (Ritter 1990)) and the bright spot emission at the minimum.

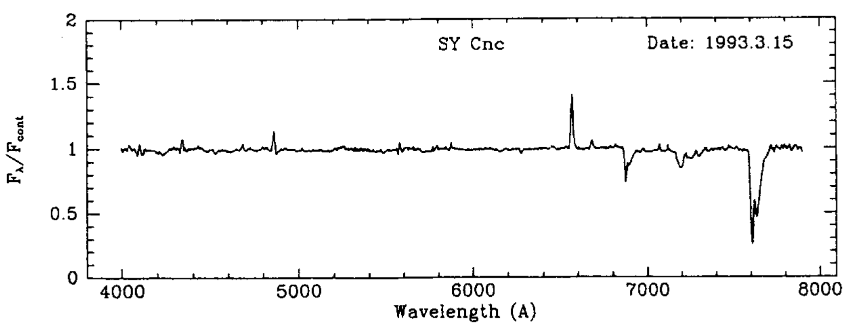

Figure 1

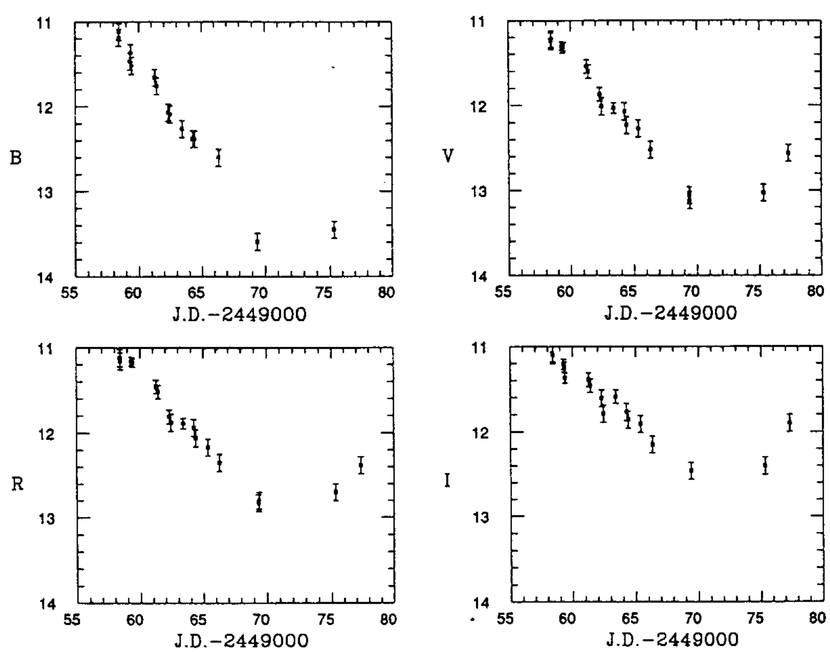

Figure 2

Table I

J.D. (2449000+)	B	V	R	I
22.385	13.26 ±0.10	12.92 ±0.05	12.65 ±0.05	-------
58.419	11.19 ±0.10	11.24 ±0.10	11.12 ±0.10	11.08 ±0.10
58.437	11.12 ±0.10	11.22 ±0.10	11.16 ±0.10	11.10 ±0.10
59.299	11.47 ±0.10	11.30 ±0.05	11.16 ±0.05	11.21 ±0.06
59.350	11.37 ±0.10	11.33 ±0.05	11.17 ±0.05	11.24 ±0.06
59.416	11.52 ±0.10	11.31 ±0.05	11.18 ±0.05	11.37 ±0.06
61.267	11.66 ±0.10	11.54 ±0.08	11.46 ±0.08	11.39 ±0.08
61.414	11.76 ±0.10	11.60 ±0.08	11.52 ±0.08	11.46 ±0.08
62.308	12.07 ±0.10	11.87 ±0.08	11.81 ±0.08	11.61 ±0.10
62.444	12.09 ±0.10	12.01 ±0.10	11.88 ±0.10	11.79 ±0.10
63.405	12.26 ±0.10	12.03 ±0.06	11.89 ±0.06	11.59 ±0.08
64.264	12.38 ±0.10	12.07 ±0.10	11.94 ±0.10	11.77 ±0.10
64.404	12.38 ±0.10	12.23 ±0.10	12.06 ±0.10	11.86 ±0.10
65.370	-------	12.27 ±0.10	12.17 ±0.10	11.91 ±0.10
66.324	12.60 ±0.10	12.52 ±0.10	12.35 ±0.10	12.15 ±0.10
69.391	13.59 ±0.10	13.06 ±0.10	12.83 ±0.10	12.46 ±0.10
69.410	-------	13.12 ±0.10	12.80 ±0.10	-------
75.326	13.45 ±0.10	13.03 ±0.10	12.70 ±0.10	12.40 ±0.10
77.340	-------	12.56 ±0.10	12.38 ±0.10	11.90 ±0.10

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PHOTOELECTRIC MINIMA TIMES OF THE ECLIPSING VARIABLES AB ANDROMEDAE, 44i BOOTIS AND GO CYGNI

The aim of the present report is to give the photoelectric minima times of AB And, 44i Boo and GO Cyg obtained from our observations made either at the Kryonerion Astronomical Station or at the Bucharest Observatory.

The photoelectric observations of AB And were made during 1990 with the two-beam, multi-mode, nebular-stellar photometer of the National Observatory of Athens, Greece, attached to the 48-inch Cassegrain reflector at the Kryonerion Astronomical Station. While those of 44i Boo and GO Cyg were made during 1989, 1990 and 1993 with an EMI 9502 B type photocell, attached to the 50 cm telescope of the Bucharest Observatory.

The filters used are in close accordance with the standard UBV and the reduction of the observations has been made in the usual way (Hardie, 1962).

From our observations 5 new minima times were derived for AB And, 6 for 44i Boo and 3 for GO Cyg, which are presented in Tables I, II and III, respectively. The times of minima as well as the mean errors σ have been computed using Kwee and Van Woerden's method (1956).

Table I
Photoelectric minima times of AB And

Hel. JD	$(O-C)_I$ days	$(O-C)_{II}$ days	$(O-C)_{III}$ days	σ	Obs
2440000.+					
8173.3591	0.0734	0.0327	−0.0020	0.0003	R&R
8174.3509	0.0695	0.0289	−0.0059	0.0005	R&R
8176.3420	0.0693	0.0286	−0.0061	0.0006	R&R
8176.5104	0.0717	0.0310	−0.0037	0.0004	R&R

where the residuals $(O-C)_I$, $(O-C)_{II}$ and $(O-C)_{III}$ have been calculated according to the following ephemeris formulae:

$$\text{Min I}=2425502.11989+0^{d}.331886486\times E$$
(Oosterhoff, 1950)

$$\text{Min I}=2436109.578+0^{d}.33189122\times E$$
(Kukarkin et al., 1969)

and

$$\text{Min I}=2436109.57928+0^{d}.33189215\times E$$
(Kholopov et al., 1985)

and they are the mean values of our B and V observations. From the O−C values, given in Table I for AB And, it is obvious that its period continues to change. A detailed study of its behaviour will appear elsewhere (Rovithis-Livaniou et al., 1994).

Table II
Photoelectric minima times of 44i Boo

Hel. JD	$(O-C)_I$ days	$(O-C)_{II}$ days	$(O-C)_{III}$ days	σ	Obs	Filter
2440000.+						
9099.4042	0.0345	0.0015	−0.0159	0.0003	D	V
9149.3581	0.0406	0.0074	−0.0102	0.0021	D	U
9149.3664	0.0489	0.0157	−0.0018	0.0006	D	V
9159.4094	0.0487	0.0156	−0.0021	0.0010	D	U
9162.3508	0.0442	0.0110	−0.0066	0.0006	D	U
9162.3503	0.0436	0.0105	−0.0072	0.0005	D	V
9168.3732	0.0408	0.0075	−0.0102	0.0007	D	U
9168.3729	0.0405	0.0072	−0.0105	0.0008	D	B
9168.3740	0.0416	0.0083	−0.0094	0.0006	D	V
9177.3478	0.0435	0.0102	−0.0076	0.0005	D	U
9177.3482	0.0439	0.0106	−0.0071	0.0007	D	B
9177.3479	0.0436	0.0103	−0.0075	0.0005	D	V

For 44i Boo the residuals $(O-C)_I$, $(O-C)_{II}$ and $(O-C)_{III}$ have been computed using the following ephemeris formulae, respectively:

$$\text{Min I} = 2439852.4903 + 0.^{d}2678159 \times E$$
(Duerbeck, 1975)

$$\text{Min I} = 2439852.4644 + 0.^{d}2678176 \times E$$
(Rovithis et al., 1990)

and

$$\text{Min I} = 2443604.5880 + 0.^{d}26781856 \times E$$
(Oprescu et al., 1989)

Since the O−C values for 44i Boo were found to be quite different for the various filters used, in Table II we give them separately and not a mean value, as we did in the case of AB Andromedae.

Table III
Photoelectric minima times of GO Cyg

Hel. JD	$(O-C)_I$ days	$(O-C)_{II}$ days	$(O-C)_{III}$ days	σ	Obs
2440000.+					
7802.3114	0.0255	0.0444	0.0116	0.0003	O&D
8176.2725	0.0221	0.0399	0.0060	0.0011	O&D
8180.2689	0.0307	0.0482	0.0146	0.0012	O&D

In the case of GO Cygni the residuals $(O-C)_{I}$, $(O-C)_{II}$ and $(O-C)_{III}$ have been computed according to the following ephemeris formulae, respectively:

$$\text{Min I}=2446351.328+0^{d}.717763\times E$$
(SAC, 1992)

$$\text{Min I}=2433930.40561+0^{d}.71776382\times E$$
(Kholopov et al., 1985)

and

$$\text{Min I}=2445865.4056+0^{d}.71776707\times E$$
(Sezer et al., 1985)

and they are the mean values of our B and V observations. A detailed study of the period behaviour of GO Cygni will be made later on.

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CH CYGNI IN 1992–1993: HIGH LEVEL OF ACTIVITY

CH Cyg is a long-period (5700^{d}) symbiotic binary consisting of an M type semiregular variable and a white dwarf probably possessing strong magnetic field (Mikolajewski et al., 1990). At least four activity periods or outbursts have been observed since 1963. The most conspicuous active phase took place from 1977 to 1987. Since 1989 the star has again shown some episodes of erratic activity with the strongest episode in 1992 (Mikolajewski et al., 1992b and references therein; Kuczawska et al., 1992; Panov & Ivanova, 1992). In 1993 the activity seems to be still increasing. In the present paper some preliminary results of new photometric and spectroscopic observations of CH Cyg obtained at Tartu observatory in 1992–1993 are described.

Photoelectric UBV observations of CH Cyg at Tartu observatory were carried out with a 0.5-m telescope using HD 182691 ($V=6^{m}.525$, $B-V=-0^{m}.078$, $U-B=-0^{m}.240$) as a comparison star (see Leedjärv, 1990). U, B and V magnitudes of CH Cyg from 1992 to 1993 are shown in Fig. 1. Variations in the U magnitude are the most prominent ones.

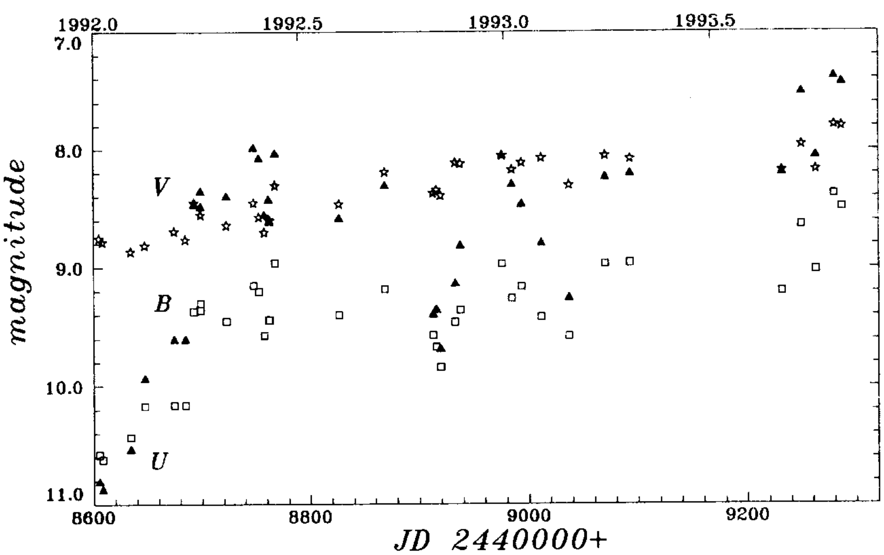

Figure 1. U, B and V light-curves of CH Cyg from 1992 to 1993.
U magnitudes are shown by filled triangles, B – by open squares, V – by pentagons.

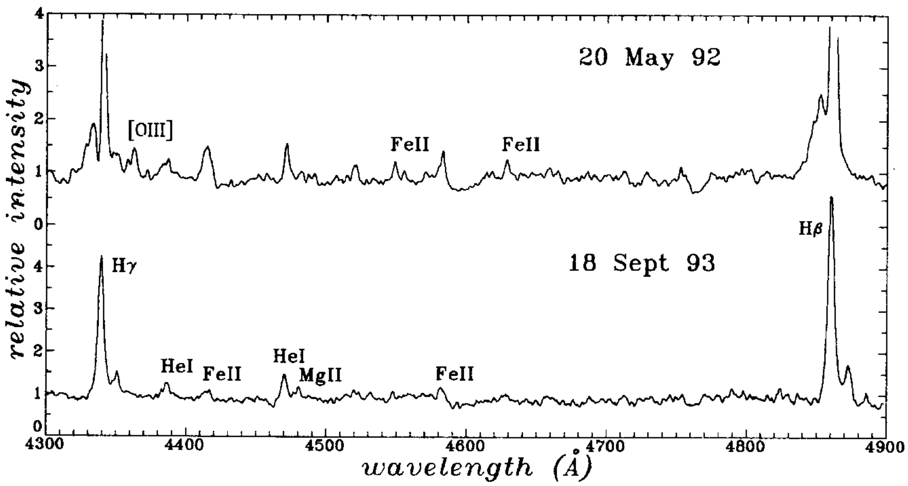

Figure 2. Examples of the spectra of CH Cyg. On the spectrum from 20 May 92 the Hγ and Hβ lines have been truncated.

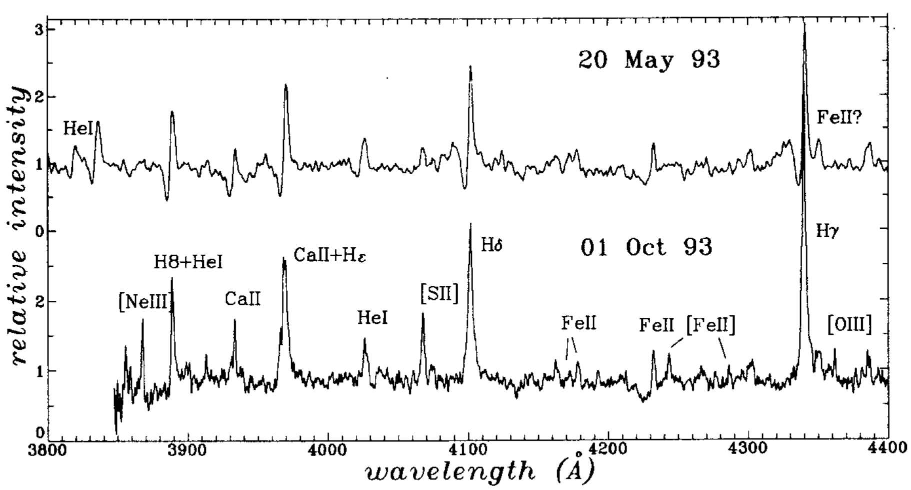

Figure 3. Examples of the spectra of CH Cyg.

Being at quite low level in the beginning of 1992, the U brightness began to increase, reaching U ≈ $8^{m}_{.}0$ by May 1992. The high U brightness has persisted till the present days, being interrupted by short period minima in October 1992 and February 1993. The latest observations on Oct. 18 and 25, 1993 have shown U=$7^{m}_{.}38$ and U=$7^{m}_{.}43$, respectively. Unfortunately, no observations have been made from May to August 1993, but at least in the beginning of June the star was very bright with U=$7^{m}_{.}57$ (Skopal et al., 1993).

The 100-day pulsations of the M giant (see Mikolajewski et al., 1992a) are not well visible in our quite sparse V data. In part, also, strong hot continuum masks the behaviour of the M giant in the V filter bandpass. The 770-day periodicity in the V brightness of CH Cyg has been ascribed by Mikolajewski et al. (1992a) to the rotation of the giant's photosphere covered with a large dark spot. Presently the spot is thought to be turning away from us; Kuczawska et al. (1992) have predicted the next maximum of this cycle for the end of 1993. This prediction seems to be confirmed by our observations as in September and October 1993 the V brightness has risen above 8th magnitude for the first time since October 1989.

Spectroscopic observations of CH Cyg have been carried out by the 1.5-m telescope and Cassegrain spectrograph ASP-32. Spectra in 1992–1993 have been recorded on Kodak 103aO and 103aF plates, except the spectrum from May 20, 1992 which has been recorded on ORWO ZU-21 plate. The blue-region spectra have dispersion about 86 or 37 Åmm^{-1} (at Hγ) and the spectra at Hα about 75 or 28 Åmm^{-1}. All spectra of CH Cyg in 1992 and 1993 show more or less pronounced hot continuum and a wide variety of permitted and forbidden emission lines.

Hydrogen Balmer emission lines are the most prominent ones in the spectrum of CH Cyg. On May 20, 1992 these lines show weak blue-shifted emission peaks besides strong emission components, with a sharp absorption component between them. In higher members of Balmer series such profiles remind of P Cygni profile, while in Hβ, Hγ and Hδ the two emission peaks are clearly visible (Fig. 2). Average radial velocities of the red emission, the absorption and the blue emission were about +30, −257 and −492 kms^{-1}, respectively. Similar Balmer line profiles are visible in all our spectra obtained till May 20, 1993, with variable radial velocities and intensities of the components (Fig. 3). However, as announced by Kuczawska et al. (1992), in September 1992 the Balmer lines have demonstrated weak red-shifted emission peaks. Also, our spectrum from Sept. 18, 1993 shows red-shifted emission components with mean radial velocity +678 kms^{-1} (Fig. 2). One can suspect that in our low-dispersion spectra the possible red emission component of Hγ may be contaminated by the FeII λ 4351 line. But on Sept. 18, 1993 the Hβ line demonstrates very pronounced emission at λ 4872 Å, where no known emission line exists, so we consider the emission at λ 4350 Å as belonging mostly to Hγ provided that all FeII emission lines in that spectrum are weak. Balmer lines on Oct. 1, 1993 have one-component asymmetrical emission profiles without any noticeable absorption or additional emission.

At the same time, Hα has been quite symmetric single emission line. For instance, Aufdenberg et al. (1993) have seen blue-shifted emission components of Hα only since Oct. 8, 1993. Up to this time Hα has been a single strong emission line with essentially constant profile. This is confirmed by our Hα observations on Apr. 3, May 12 and Sept. 20, 1993. To a first approximation, the blue-shifted components of Balmer lines can be explained as arising in a matter, expelled out from the white dwarf's magnetosphere by the propeller mechanism (Mikolajewski et al., 1990; Kuczawska et al., 1992). Origin of the red-shifted components as well as different behaviour of Hα is not so clear. Probably, at times we can see the matter just falling onto the white dwarf's magnetosphere, or, alternatively, ejected out in bipolar jets.

Intensity of forbidden lines varies during the time interval considered. At least [SII] λ 4068 lines are visible in all spectra. In most of the spectra, also [FeII], [NeIII] λ 3869 and [OIII] lines are present. All forbidden lines are single emission lines having radial velocities close to the γ-velocity of the CH Cyg system -58 kms^{-1}. This indicates that forbidden lines have their origin in an extended rarefied gaseous nebula surrounding the whole system.

Unpredictable behaviour of CH Cyg has surprised astronomers for several times. Continuing observations, especially in UV and X-ray regions must show whether the activity episode in 1992–1993 is a transient phenomenon or the beginning of a new extended active period.

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IMPROVED PERIOD OF BH CMi

BH CMi (BD +2°1855) was discovered to be variable by Hoffmeister (1934). Recent photoelectric observations were made by Zakrzewski and Zola in 1989. The incomplete light curve obtained by them shows that the components of the binary system must be very distorted, the configuration probably to be contact. Thus Zakrzewski and Zola (1989) confirmed the classification, made by Soloviev (1955), of BH CMi being a variable of W-UMa type.

We decided to observe the star in 1991 in order to obtain a complete coverage of the light curve and to improve the photometric elements since the ones given by Zakrzewski and Zola were derived on the basis of only a few minima, determined during few months. New photoelectric observations were made at Mt. Suhora observatory of the Pedagogical University. The double beam photometer with Johnson-Morgan filters was used. In the period between Jan. 16 to Jan. 19 a complete light curve of BH CMi in B and V bands was obtained. BD +2°1856 served as the comparison star while BD +2°1857 was used as the check star. The light curves are presented graphically in Figure 1, where magnitude denotes the difference between the variable and comparison stars. From the new data we determined 4 times of minima, 2 moments of the primary minimum and 2 of the secondary one. These times of minima are listed in Table 1.

Table 1. New times of minima of BH CMi.

JD Hel	2448274.4066±0.0002	primary
JD Hel	2448275.5247±0.0002	primary
JD Hel	2448273.5662±0.0003	secondary
JD Hel	2448276.3628±0.0004	secondary

The new moments of minima combined with those known previously allowed to improve the period of BH CMi:

$P = 0^d.5594839 \pm 0^d.0000025$ (from the primary minima)
$P = 0^d.5594869 \pm 0^d.0000023$ (from the secondary minima)
$P = 0^d.5594848 \pm 0^d.0000022$ (both primary and secondary)

Since there are complete B and V light curves available, it is possible to obtain physical parameters of the system by means of light curve modeling. In order to do this reliably, spectroscopic observations are also needed.

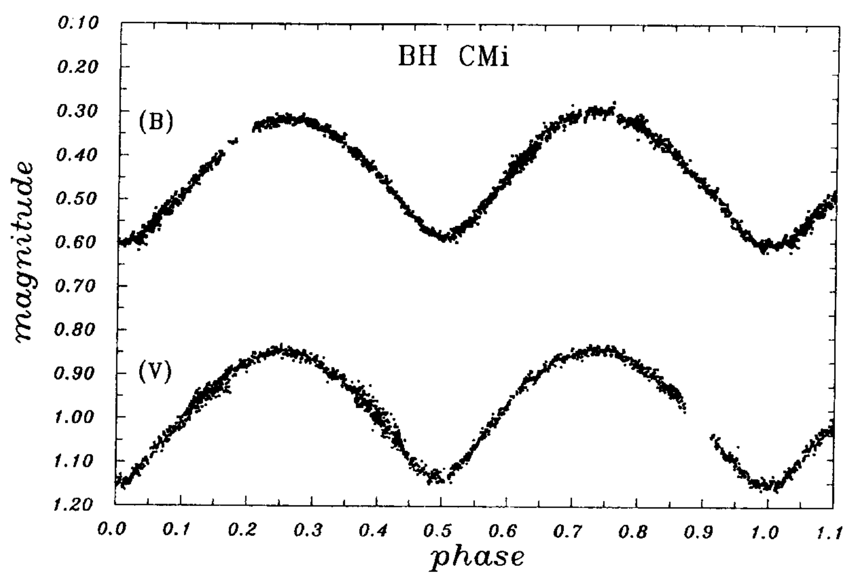

Figure 1

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1992 PHOTOMETRY OF UZ LIBRAE

Heckert and Hickman (1991) and Heckert (1992) report light curves of UZ Librae (= #102 in the catalog of Strassmeier *et al.* 1988) from 1988 to 1991. Grewing *et al.* (1989) deduce properties of the components and the period.

I present new photometry on 12, 13, 20 and 27 May, 25 July, and 3, 4, and 10 August 1992. I used the San Diego State University 24 inch telescope at Mount Laguna Observatory. During May the photometer was equipped with a Hamamatsu GaAs phototube and UBVRI filters. During July and August this tube was replaced with a less red sensitive EMI 9789 tube equipped with UBV filters only. The data are transformed to the standard Johnson-Cousins UBVRI system. The comparison and check stars are BD -07° 4044 and BD -08° 3998. The check star data show no systematic differences between the transformed data taken with the different tubes. Following Grewing *et al.* (1989) I computed the orbital phase using: ϕ=2445428.88 + 4.767885 E.

TABLE 1

Julian Day	Phase	ΔU	ΔB	ΔV	ΔR	ΔI
2448754.893	0.587	-0.614	-0.352	-0.316	-0.340	-0.416
2448755.875	0.793	-0.605	-0.341	-0.309	-0.341	-0.423
2448762.840	0.253	-0.598	-0.357	-0.316	-0.350	-0.419
2448769.814	0.716	-0.587	-0.315	-0.280	-0.311	-0.391
2448828.714	0.070	-0.586	-0.335	-0.298		
2448837.679	0.950	-0.624	-0.335	-0.300		
2448838.726	0.169	-0.616	-0.346	-0.314		
2448844.673	0.417	-0.746	-0.449	-0.399		

Table 1 shows the differential magnitudes in the sense star - comparison, and the B and V light curves are in Figure 1. The light curves show a double peaked structure similar to the 1983 to 1990 light curves, but with the larger and smaller maxima interchanged (Heckert and Hickman 1991 and Heckert 1992). The single peaked light curve in 1991 seems to be a transition stage where the larger and smaller maxima are switching places. In terms of the spot structure, I

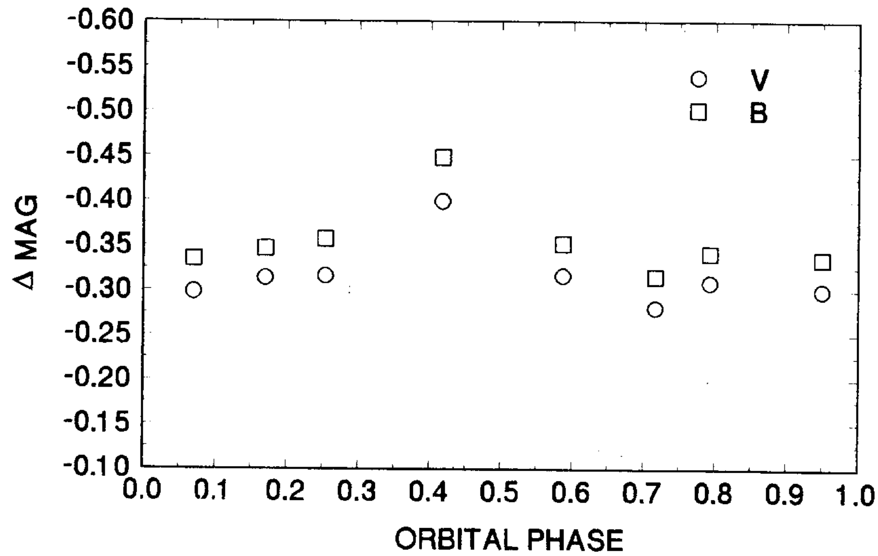

Figure 1. UZ Librae-1992

interpret these data as showing the larger spot at roughly phase 0.1 to 0.2 and the smaller spot at roughly phase 0.5 to 0.6 from 1988 to 1990. In the transition year, 1991, the spot at phase 0.1 to 0.2 had broken up, leaving only the spot at phase 0.6. In 1992 this spot became the larger spot at roughly phase 0.7 and a smaller spot reappeared at roughly phase 0.0 to 0.1.

Ron Angione scheduled very generous amounts of time on the Mt. Laguna 24" telescope for this work. The Research Corporation provided support for this work.

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1992 UBVRI PHOTOMETRY OF FK COMAE

Heckert and Maloney (1992) and Heckert Maloney and Stewart (1992) present photometry from 1988 to 1991 of FK Comae Berenices (HD 117555), the prototype star of the FK Comae class of variable stars. In this paper, I continue this work with 1992 photometry.

I performed new photometry on seven nights between 12 and 27 May 1992 and on 25 July and 4 August 1992. I used the 24 inch telescope at Mount Laguna Observatory operated by San Diego State University. During May the photometer was equipped with a Hamamatsu GaAs phototube operating at -1450V. During July and August this tube was replaced with an EMI 9789 tube operating at -1200V. The Hamamatsu tube was equipped with UBVRI filters, but the less red sensitive EMI tube was equipped with UBV filters only. The data are transformed to the standard Johnson-Cousins UBVRI system. HD 117567 was the comparison star, and HD 117876 was the check. The check star data show neither systematic differences between the transformed data taken with the different tubes nor evidence for variability in the comparison star. For reasons discussed by Heckert and Maloney (1992), we used the 2.400^d period of Chugainov (1976) to calculate the phases.

TABLE 1

Julian Day	Phase	ΔU	ΔB	ΔV	ΔR	ΔI
2448754.851	0.378	1.434	0.985	0.522	0.285	0.078
2448755.839	0.789	1.451	0.974	0.522	0.289	0.075
2448757.844	0.625	1.461	0.986	0.527	0.297	0.081
2448759.829	0.452	1.425	0.964	0.518	0.282	0.077
2448760.841	0.873	1.449	0.977	0.521	0.287	0.078
2448762.804	0.691	1.482	0.994	0.536	0.297	0.091
2448769.781	0.598	1.472	0.999	0.542	0.301	0.095
2448828.687	0.143	1.333	0.892	0.476		
2448838.696	0.313	1.380	0.927	0.492		

The differential magnitudes are in Table 1, and the B and V light curves are in Figure 1. Minimum light is at about phase 0.65. This phase of minimum light compares to 0.6, 0.15, 0.17, and 0.3 in 1988, 1989, 1990, and 1991 (Heckert and Maloney 1992, Heckert, Maloney, and Stewart 1992). In terms of the starspot model, the major spot group migrates in the sense

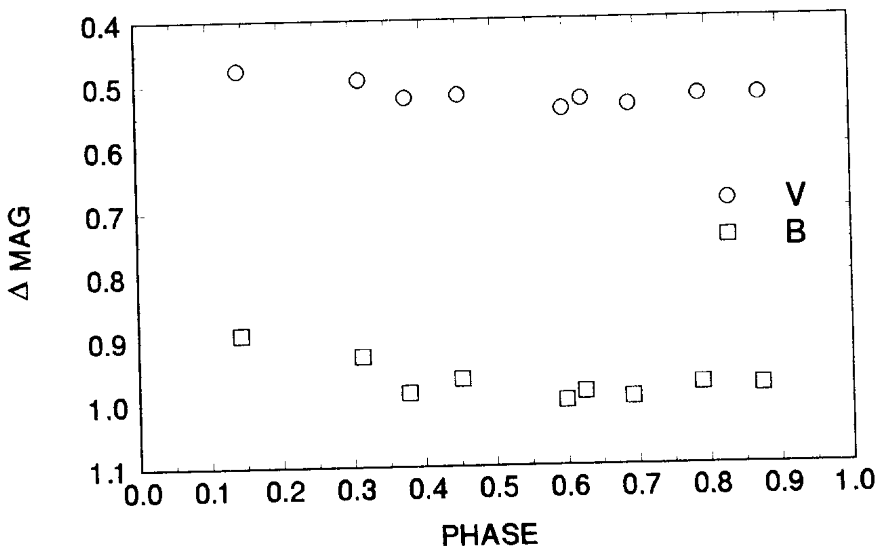

Figure 1. FK Comae-1992

of increasing phase considerably in longitude on time scales of less than one year, but the migration rate seems to vary from year to year. The amplitude of variation in V is about 0.15 magnitudes for 1988, 1989, and 1990 (with small year to year fluctuations), about 0.11 magnitudes in 1991, and about 0.07 magnitudes in 1992. The level of light in V at maximum is about the same for both 1992 and 1990, which is about 0.02 magnitudes brighter than in 1988, 1989, and 1991. I conclude that the major spot group became smaller in 1991 and continued to shrink during 1992. From the levels of maximum light I conclude that there are often smaller spots spread around the star that disappeared or decreased in both 1990 and 1992.

Ron Angione scheduled generous amounts telescope of time on the Mt. Laguna 24" telescope for this work. I also acknowledge generous support from The Research Corporation.

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vZ1140 – A NEW UNUSUAL VARIABLE STAR IN M3

vZ1140 (von Zeipel 1908)=II-54 (Sandage 1953) is nearly located at the intersection of the horizontal branch and red giant branch in the C−M diagram of the globular cluster M3 (see Figure 1). The star positions in second of arc relative to the cluster center are: x=75, y=250. The magnitude and colors of this star are V=15.13, B−V=0.75, U−B=0.23 (Johnson and Sandage, 1956). According to Zhukov (1971), the proper motion of the star belongs to Ebbighausen class 3, showing that it is a cluster member.

Here we report the unusual light variation of II-54.

The star was observed by Yao Bao-an and Chen Fu-xiang with the TH-7882 CCD at the Cassegrain focus of the 2.16-meter reflector (f/9) at the Beijing Observatory in March 1993. This detector contains 576×384 pixels (pixel size 23×23 μm) at a scale $0\farcs244$/pixel, thus covering a $2\farcm43\times1\farcm56$ field. Four series of 300-second or 600-second exposures taken in rapid succession over an interval of about 5.0, 4.2, 6.2 and 4.6 hours were obtained on 1993 March 16, 17, 18 and 19 (90 yellow, 5 blue). The seeing was between $1\farcs3$ and $3\farcs2$ (FWHM). After deleting 6 poorly guided exposures, 84 yellow CCD frames were used to analyse the light variation. The star AO (V=14.70, B−V=0.72) (Johnson and Sandage, 1956) was used as the comparison star. It is constant to at least within 0.01 mag by comparing with other stars during the nights we observed. Because the distance between II-54 and AO is only $83\farcs6$ and the difference of B−V is only 0.03, as well as the observations were obtained with the air mass less than 1.3, so the differential extinction correction can be neglected. The CCD frames were reduced by DAOPHOT (Stetson, 1987) in IRAF which is mounted in the Sun 4/65 workstation of Shanghai Observatory. Only the aperture photometry was used because it is not a crowded star field for these stars. Scargle's (1982) modified periodogram was used to analyse the unevenly sampled data. A frequency $\nu_1\cong2.93$ was searched out with extremely low false alarm probability. After prewhitened with ν_1, the above procedure was repeated again in order to search for other possible period and a closely spaced frequency $\nu_2\cong2.62$ was found with low false alarm probability too. Then Breger's (1991) program PERIOD was used to run nonlinear least squares fitting to improve the values of the frequencies found above simultaneously.

The results so obtained are:

$$m(t) = Zeropoint + \sum_{i=1}^{2} a_i sin(2\pi t/p_i + 2\pi\phi_1)$$

Here $P_1=0\fd35165$, $a_1=0.04808$, $\phi_1=0.4187$,
$P_2=0\fd35840$, $a_2=0.04054$, $\phi_2=0.2049$,
Zeropoint=0.476

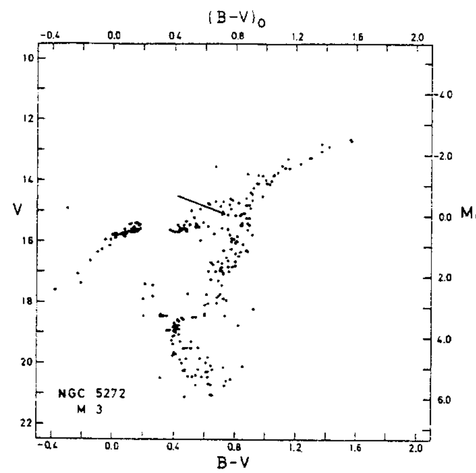

Figure 1

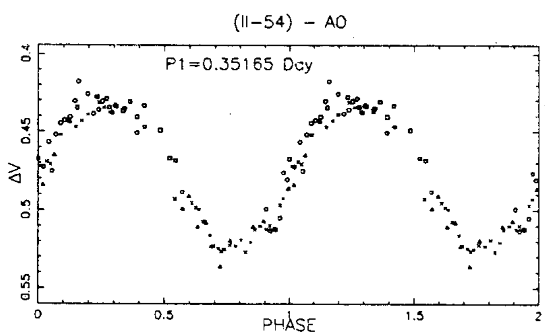

Figure 2

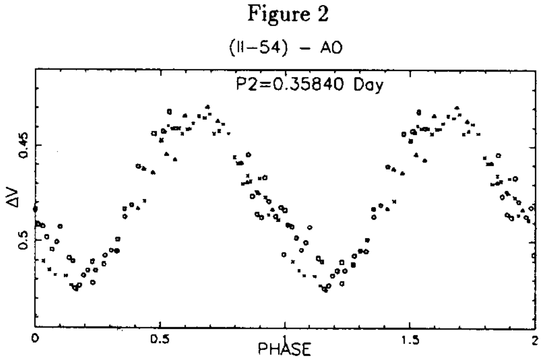

Figure 3

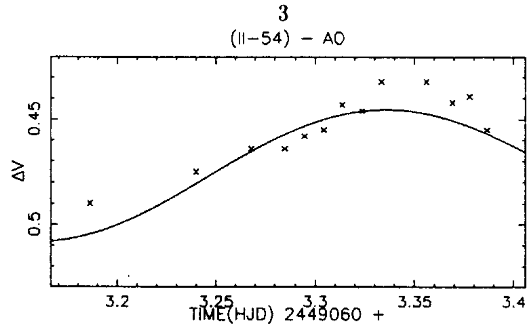

Figure 4

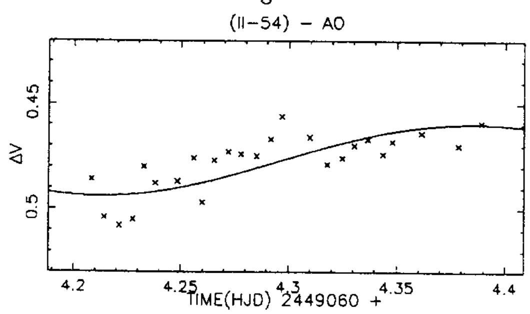

Figure 5

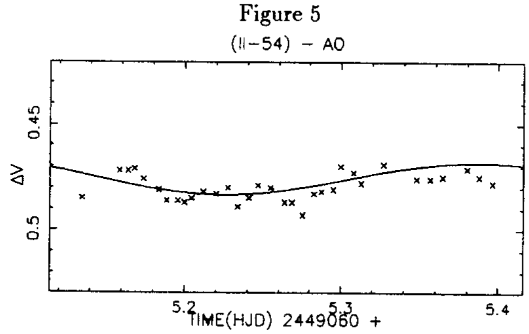

Figure 6

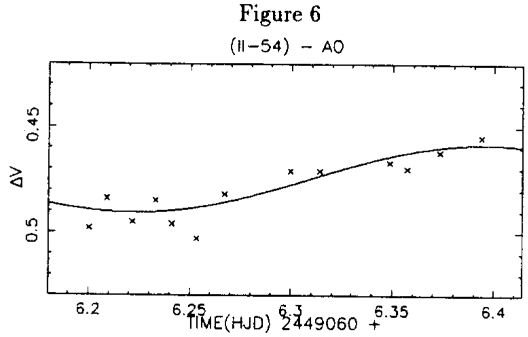

Figure 7

The zeropoint 0.476 represents the mean magnitude difference between II-54 and AO. The folded light curves are given in Figures 2 and 3. Each light curve is plotted with the data prewhitened with the other frequency.

Here the squares refer to observations on 1993 March 16, the circles on March 17, the X's on March 18 and the triangles on March 19. The "real time" light curves are given in Figures 4, 5, 6 and 7 where the continuous curves represent the calculated ones using the formula given above. Time refers to the heliocentric Julian date.

We note that the scatter in the folded light curves in Figures 2 and 3 can be reduced if a third frequency ν_3=3.269 is included with an amplitude of about 0.005 mag. However, a ν_3=6.547 seems to fit the observations too, so we will not include ν_3 into the calculation until more observations are obtained. Obviously, further observations are urged.

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UBV PHOTOMETRY FOR THREE NEW VARIABLE STARS

From November 23 to December 3, 1992 and during March 7-11, 1993 UBV photoelectric photometry of several bright M type stars was carried out.

The 60 cm reflector of Beijing Astronomical Observatory is equipped with a DC photoelectric photometer. Standard UBV filters are employed by this photoelectric system. During the run of observations differential determination of brightness of the program stars was used. Information about our program, comparison, and check stars is given in Table 1.

Table 1. Properties of program (V), comparison (CO), and check (CH) stars.

Star	SAO	V	Sp.	R.A.(1950.0)	Dec.
V	037673	7^m9	M8	$1^h55^m37^s.3$	45°11' 33"
CO	037668	8.0	K5	1 55 26.1	44 52 48
CH	037657	8.1	G5	1 55 0.3	45 15 14
V	056225	7.5	MA	3 8 11.5	37 52 53
CO	056202	7.1	K0	3 6 17.5	37 6 44
CH	056178	7.6	G0	3 4 28.7	36 25 45
V	024927	6.9	M0	4 52 48.8	59 2 34
CO	025088	6.4	K0	5 10 47.0	59 20 57
CH	025003	6.4	K0	5 1 50.6	58 57 15

At each night three sets of stars listed in Table 1 were observed and UBV photoelectric observations of each set of stars (V, CO, CH) were usually made several times at different zenith distances. Therefore the observations of more than two comparison or check stars can be used for calculation of atmospheric extinction coefficients in UBV bandpasses. Average value of extinction coefficients derived from more than two stars was used to correct for extinction for each observation. For the first and second sets of stars in Table 1, differential magnitude was determined by subtracting the mean magnitude of comparison and check stars from magnitude of program star. For the last set of stars, because check star SAO 025003 is a variable (Wahlgren G., 1992, *AJ*, **104**, 1174) only one comparison star was used in reduction, therefore differential magnitude was magnitude difference between the program and comparison star. The resulting data were reduced to Johnson system through transformation equation given later. Light curves in V bandpass for three program stars are shown in Figures 1, 2 and 3. In Figures 1 and 2 filled circles show differential magnitudes of program stars and open circles magnitude differences between comparison and check stars. In Figure 3 filled circles indicate differential magnitudes of program star, open circles magnitudes of the comparison star. The light curves with open

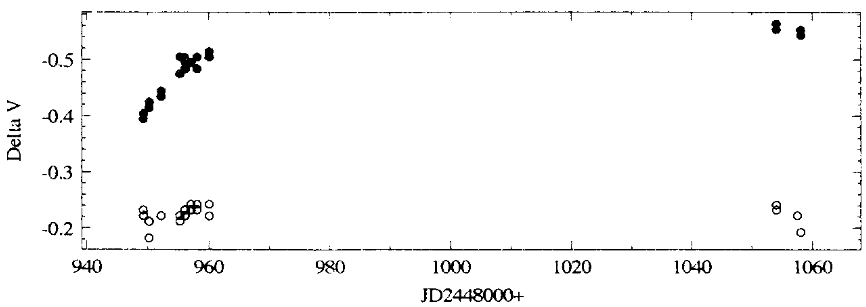

Figure 1. V light curve for SAO 037673.

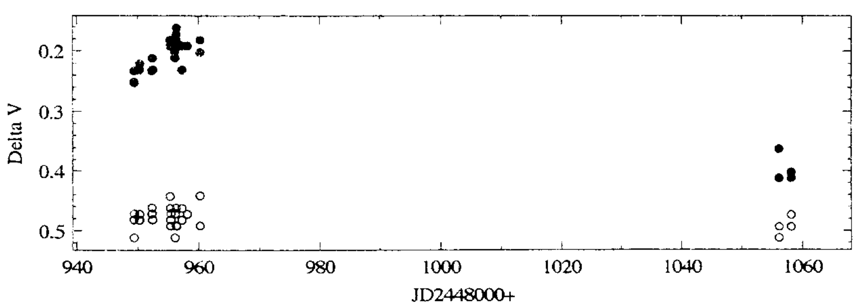

Figure 1. V light curve for SAO 056225.

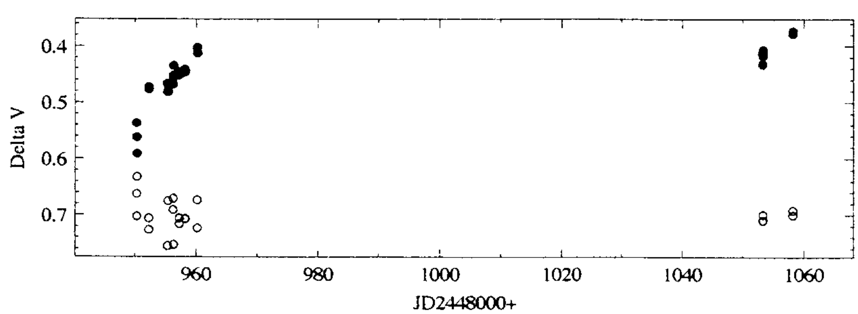

Figure 1. V light curve for SAO 024927.

Table 2. Photometric data for SAO 037673.

JD2448000+	U	B	V
949.184	9.784	9.043	7.449
949.200	9.786	9.048	7.454
949.213	9.784	9.043	7.449
950.125	9.723	8.991	7.401
950.134	9.793	9.026	7.436
950.142	9.808	9.026	7.446
952.080	9.778	8.986	7.404
952.084	9.753	8.976	7.414
955.196	9.704	8.948	7.359
955.204	9.675	8.973	7.369
955.213	9.695	8.963	7.364
955.992	9.630	8.902	7.317
956.000	9.685	8.922	7.342
956.113	9.809	9.027	7.407
956.121	9.784	9.002	7.392
957.050	9.710	8.946	7.361
957.059	9.709	8.926	7.346
958.009	9.724	8.941	7.356
958.017	9.704	8.941	7.352
960.030	9.710	8.933	7.349
960.038	9.690	8.919	7.329
1053.980	9.732	8.963	7.297
1053.992	9.628	8.938	7.282
1057.988	9.717	8.933	7.297
1057.996	9.663	8.948	7.302

Table 3. Photometric data for SAO 056225.

JD2448000+	U	B	V
949.309	10.885	9.028	7.309
949.321	10.880	9.033	7.314
949.334	10.980	9.033	7.299
950.184	10.790	9.018	7.301
950.196	10.790	9.008	7.286
950.209	10.979	9.028	7.282
952.200	11.053	9.040	7.295
952.209	11.063	9.025	7.290
952.329	10.914	9.000	7.275
952.363	10.825	8.990	7.294
955.238	10.826	9.004	7.254
955.250	10.959	9.004	7.264
955.292	10.840	8.984	7.239
955.300	10.850	8.949	7.224
955.363	10.826	8.974	7.254
955.371	10.850	8.964	7.249
956.046	10.844	8.924	7.200
956.059	10.884	8.968	7.240
956.205	10.924	9.018	7.255
956.217	10.969	9.063	7.300
956.280	10.904	9.023	7.260
956.288	10.874	8.968	7.240
957.155	10.931	9.000	7.249
957.171	10.921	9.020	7.299
958.096	10.953	8.992	7.259
958.109	10.978	8.987	7.249
960.129	10.758	8.989	7.247
960.142	11.045	8.999	7.262
1056.050		9.156	7.390
1056.092		9.262	7.510
1058.050	10.981	9.179	7.464
1058.059	11.055	9.190	7.474

Table 4. Photometric data for SAO 024927.

JD2448000+	U	B	V
950.246	10.235	8.369	6.696
950.259	10.205	8.349	6.681
950.271	10.225	8.344	6.681
952.221	10.058	8.304	6.636
952.230	10.093	8.294	6.660
955.259	10.098	8.335	6.694
955.267	10.088	8.320	6.679
955.338	10.023	8.259	6.614
955.342	10.008	8.245	6.604
956.159	9.995	8.254	6.601
956.167	10.035	8.244	6.597
956.254	10.080	8.294	6.646
956.259	10.115	8.324	6.666
957.184	10.079	8.268	6.625
957.196	10.063	8.272	6.610
958.117	10.052	8.254	6.611
958.125	10.067	8.250	6.606
958.155	10.087	8.270	6.611
960.155	9.991	8.204	6.543
960.163	10.051	8.254	6.583
1053.150	10.206	8.258	6.599
1053.163	10.072	8.213	6.578
1053.188	9.845	8.238	6.574
1053.200	10.012	8.208	6.573
1058.071	10.112	8.209	6.535
1058.079	10.147	8.209	6.521

circles in all figures were shifted vertically to compare clearly with light curves of program stars.

For scientific analysis of photoelectric observations from different observers it is necessary to reduce the observations of these variables with longer timescales to the standard system. In the run of our observations 12 Johnson standard stars in Praesepe were also observed on three nights. After correcting for extinction, least squares fit was applied to the observations of these 12 standard stars. The following equations were obtained.

$$V=v+(0.012\pm0.018)(B-V)+(7.823\pm0.012)$$
$$B-V=(0.985\pm0.006)(b-v)+(0.552\pm0.002)$$
$$U-B=(0.991\pm0.011)(u-b)-(1.105\pm0.017),$$

where U, B and V are magnitudes in the standard system, u, b and v instrumental magnitudes after correction for extinction. Our photometric observations were finally reduced to Johnson system by the above equations. The UBV magnitudes are listed in Tables 2, 3 and 4 respectively.

Our limited observations have well indicated that stars SAO 037673, SAO 056225 and SAO 024927 are variable stars. The standard error of a typical observation in V bandpass is about 0.01 mag., however, the observations in U show larger scatter than that in B and V. The UBV light curves of stars SAO 037673, SAO 056225 and SAO 024927 derived from our observations show significant variations. They are small-amplitude red variables with period probably greater than 30 days.

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AO AQUARII AND ITS GCVS CHART REFERENCE

It has been shown that large errors do exist in the published positions of some variable stars (Lopez, 1989; Lopez and Girard, 1990). While continuing the work around the South Galactic Pole Region it was noted that the survey machine centered on a star image. The location of this image did not agree with the chart listed in the GCVS reference. A question therefore arose as to whether or not this chart was correct for this star.

AO Aquarii=CoD −23°17297=HV 3368=HV 4974 was first announced by Pickering in 1913 and was rediscovered in 1931 by Emily Hughes. A chart by Shapley and Swope (1931) for HV 4974 was located. This chart did identify the variable as the star image the survey machine centered. I now had two charts each identifying AO Aquarii as two different stars. In correspondence with Dr. Dorrit Hoffleit it was determined that the chart referenced by the GCVS might have interchanged the variable position and the comparison star (b) position.

Measurements by the author are given in epoch 1950 with an accuracy of 0.″7 referenced to the system of the SRS.

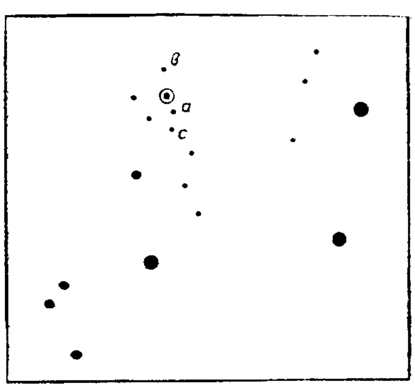

Figure 1. GCVS refers to this identification chart (Tsessevitch, 1954) where AO Aqr and comparison star b are intercharged

GCVS reference chart, comparison star b (believed to be AO Aquarii)

R.A. = $22^h08^m45\overset{s}{.}1$

DEC.= $-23°02'06\overset{''}{.}4$

GCVS reference chart, variable position (believed to be comparison star b)

R.A. = $22^h08^m45\overset{s}{.}2$

DEC.= $-22°56'52\overset{''}{.}7$

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References:

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THE MASSIVE ECLIPSING Be STAR BINARY V 505 MONOCEROTIS

HD 48914 = V 505 Mon, a member of the association Mon OB2, is an eclipsing binary with a B4 or B5 supergiant primary component showing $H\alpha$ emission, sometimes with narrow central shell absorption (Boulon et al. 1974; Turner, 1976). Its orbital period of about $53^{\rm d}.8$ has been determined by means of photoelectric photometry (Chochol and Kučera 1981; Chochol et al. 1985). The light curve shows secondary minima so pronounced that Chochol and Kučera (1981) could not single out whether the period was $26^{\rm d}.9$, or whether it was $53^{\rm d}.8$. But the radial-velocity curve by Stagni et al. (1982)—the only hitherto published spectroscopic study of V 505 Mon—and the work of Chochol et al. (1985) confirm that the longer period is the correct one.

Stagni et al. (1982) derive the radial-velocity orbits of both components, and estimate the system parameters, including masses of the order of 50 and $27m_\odot$. For a rediscussion of these parameters, see De Greve et al. (1983).

The purpose of this study is to give an improved ephemeris of this very interesting massive Be star binary, based on photoelectric *uvby* photometry obtained in the framework of the LTPV project at ESO. A total of 248 differential *uvby* measurements, obtained between October 1992 and February 1993 at the ESO 50 cm and the Danish 50 cm telescopes at the La Silla Observatory in Chile, were used. Most of the observations were obtained in an observing sequence APB, where P is the program star V 505 Mon, and A (=HD 48434) and B (=HD 49567) are the comparison stars. Their mean magnitudes (and corresponding standard deviations) in the four Strømgren channels are listed in Table 1. The y channel magnitudes correspond to the Johnson V standard, the b, v and u magnitudes were derived from the definition of the Strømgren indices. Part of the photometric data were published by Manfroid et al. (1991) and by Sterken et al. (1993), to which we refer for the journal of observations, and for details on the data reduction procedures.

Table 1. Program and Comparison Stars: Average Magnitudes and Standard Deviations

HD	Name	Sp	$\overline{u}$ σ_u	$\overline{v}$ σ_v	$\overline{b}$ σ_b	$\overline{y}$ σ_y
48914	V 505 Mon	B4Ib	7.874 .198	7.360 .112	7.283 .111	7.253 .110
48434	HR 2479	B0 III	6.055 .021	6.033 .014	5.950 .011	5.876 .011
49567	HR 2517	B3 II-III	6.495 .017	6.148 .012	6.122 .012	6.172 .013

In order to utilize the differential photometry, we determined, for each sequence and for each comparison star, the difference between the actual measurements and the overall general average given in Table 1, and corrected the u, v, b and y data of 505 V Mon with the corresponding deviation from the mean. In such a way the magnitudes of the variable were corrected according to the observed deviations of the comparison stars from their overall mean values.

Table 2. Times of Eclipse Minima of V 505 Mon. Times of minimum marked with : were not used in the determination of ephemeris (1)

	E	u HJD -244 0000	u $O-C$ d	vby HJD -244 0000	vby $O-C$ d
Primary Minima	0	5252.5	-1.3	5253.8	0.0
	8	5685.3:	+1.3	5685.8:	+1.8
	14	6005.1:	-1.5	6005.2:	-1.4
	21	6382.6	-0.4	6382.7	-0.3
	22	6436.0	-0.8	6436.6	-0.2
	23	6490.4	-0.2	6490.5	-0.1
	35	7137.2	+1.4	7136.1	+0.3
	37	7244.4	+1.0	7243.3	-0.1
	41	7458.6	+0.1	7458.6	+0.1
	48	7835.6	+0.7	7835.0	+0.1
	49	7889.4	+0.7	7888.7	0.0
Secondary Minima	15.5	6087.2	-0.1	6887.5	+0.2
	16.5	6140.7	-0.3	6140.9	-0.1
	21.5	6410.1	+0.2	6410.0	+0.1
	35.5	7163.0	+0.3	7162.9	+0.2
	43.5	7592.5	-0.4	7592.6	-0.3
	56.5	8291.6	-0.4	8291.6	-0.4

The observed times of all primary and secondary minima are given in Table 2, together with their cycle numbers. Unfortunately, the authors of the published photoelectric data did not give individual times of eclipse minima. However, their zero-epochs HJD 244 1328.06 (Chochol et al. 1985) and HJD 244 4635.318 (Chochol and Kučera 1981) respectively refer to cycle numbers $E = -73$ and $E = -11.5$ of Table 2. A least-squares fit using these two times of reference, as well as 9 primary and all 6 secondary minima of Table 2 yields an improved ephemeris for the primary eclipse minimum

$$\text{HJD (minimum)} = \underset{\pm 6}{244\ 5253.71} + \underset{\pm 17}{53^{d}.7745}\ E \qquad (1)$$

Two primary minima ($E = 8$ and 14) have not been used for deriving (1), because of the corresponding excessively-large $O - C$ deviations. The original light curves are, in fact, not very complete and have rather large gaps in the coverage of ingress and egress, and the associated times should be considered as uncertain. The 1300-day cycle in $O - C$, as announced previously (Vogt and Mennickent 1993), depends entirely on these two uncertain times of minimum, and the reality of its existence cannot be established from the data available at this moment.

Our light curves indicate that there is a strong variability in the shape of the primary eclipse minima, especially in their width, and that there are also some irregular variations during the phases outside eclipses. In y, b and v, the depth of primary and secondary eclipses are nearly the same, while primary eclipses normally last longer. Their similarity of eclipse depths explain why, in the discovery paper, the authors were not able to distinguish between the 27-day and 54-day period solutions. However, in the u band, the primary eclipses are much deeper than the secondary eclipses, another confirmation that the 54-day period is the correct one.

Presently we are analyzing the light curves in order to determine the relative shapes of the stellar components, together with some basic parameters of the emitting envelope. A more detailed study is in preparation.

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FG SAGITTAE HAS BEEN A CARBON STAR SINCE 1981

Numerous works have been made on the post-AGB peculiar variable star FG Sge. Its spectral type changed from B4 I in 1955 to A5 Ia in 1967 then F6-7 I in 1980 (e.g. Langer et al. 1974; Montesinos et al. 1990, and references therein). The luminosity in the optical region started to decline suddenly in August 1992 (e.g. Papousek 1992; Guinan et al. 1992; Jurcsik 1992). The spectral variation of this object has been monitored at Asiago Observatory since 1979 using the prismatic spectrograph Camera VI with RCA S-20 image tube mounted on the 120 cm reflector. The spectral range is from 380 to 770 nm, and the resolution is about 0.4 nm at Hγ. The spectra were digitized using the PDS microdensitometer of the Astronomical Observatory of Padua. Log-intensity tracings of some selected spectra are shown in Fig. 1, where the ordinate is an arbitrary scale.

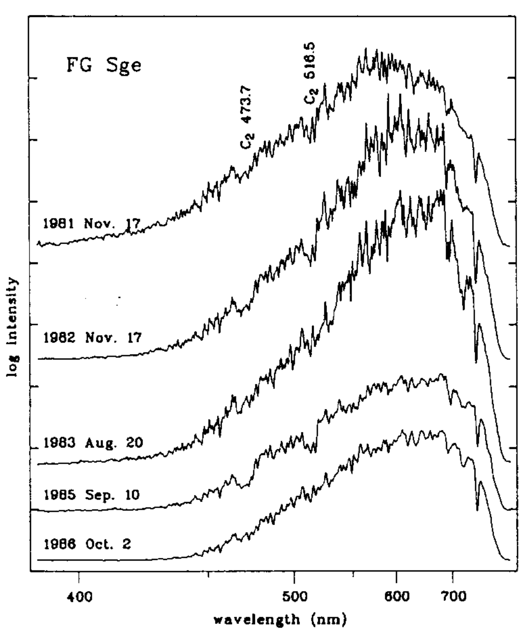

Figure 1. Log-intensity tracings of spectra of FG Sge taken on (from top to bottom) 1981 Nov. 17, 1982 Nov. 17, 1983 Aug. 20, 1985 Sept. 10, and 1986 Oct. 2

The first clear profiles of the C_2–Swan bands at 473.7 and 516.5 nm were detected on the spectra taken in November 1981 (Fig. 1). These bands were prominent in 1982 and 1985, while were weak in 1983 and 1986 (Fig. 1). They were again prominent in 1988 and in 1992 before the beginning of the light decline (Iijima et al. in preparation). It may be obvious that FG Sge has been a carbon star, but with a very unstable atmosphere, in the last decade.

The sudden light decline of this object in 1992 may have been due to, as suggested by several astronomers (e.g. Guinan et al. 1992; Iben & Livio 1993; Stone et al. 1993; Woodward et al. 1993), a condensation of carbon dust which is not a rare phenomenon in the atmosphere of hydrogen deficient carbon stars (Warner 1967). This scenario is consistent with the increasing of the infrared flux and the lack of the emission feature of silicate dust observed by Woodward et al. (1993). Since FG Sge ejected the planetary nebula He 1–5 about 6000 years ago (e.g. Flannery & Herbig 1973), its atmosphere could be hydrogen deficient. However, the absorption features of $C^{12}C^{13}$ 474.4 and $C^{13}C^{13}$ 475.2 nm, which are usually not detectable in spectra of hydrogen deficient carbon stars (Bidelman 1953; Warner 1967), are seen on our spectra. Even if it is difficult to see them on the tracings (Fig. 1), they are visible on the original plates. This phenomenon may be related to the overabundance of s–process elements of this object (Langer et al. 1974).

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THE PERIOD AND LIGHT CURVE OF V1028 ORI

The variability of V1028 Ori (HDE 255930, BD +10° 1104) was discovered by Turner (1976a) during a study of OB stars in Northern Monoceros. From these first observations the star was classified as a β Lyrae type eclipsing variable with an estimated period of 3 days.

Additional photoelectric UBV observations of V1028 Ori were obtained by AMH in 1975-1978 during several observing runs at Kitt Peak National Observatory. The variable was measured differentially with respect to HD 46223 on 11 nights and with respect to HD 43526 on 17 nights; however, the final differential values were all adjusted to HD 46233. The differential data have been corrected for atmospheric extinction and transformed to the UBV system via observations of Praesepe standard stars. The errors in these KPNO differential observations range from about ±0.002 to ±0.007 mag in V, ±0.003 to ±0.010 mag in B–V, and ±0.004 to ±0.013 mag in U–B.

The new UBV observations are presented in Table 1. Values of V = 7.28, B–V = +0.22 and U–B = –0.78 for HD 46223 (Heiser 1977) were used to obtain the magnitudes and colours from the differential data.

The analysis of variance technique (Schwarzenberg-Czerny 1989) was applied to the data to determine a more accurate value for the period of the system. The new ephemeris for V1028 Ori is:

$$\text{JD Hel Min I} = \underset{\pm 1}{2442359.659} + \underset{\pm 3}{3.011428} \times E.$$

The V, B–V and U–B light curves for V1028 Ori are presented in Figure 1. The observations of Turner (1976a) are marked by open circles and those from Table 1 by filled circles. The discordance of a few of the original observations by Turner (crosses) from the mean light curve can be attributed to problems arising from incomplete corrections for a seasonal dust extinction component (due to nearby open pit mining) which can affect the skies over Cerro Las Campanas in Chile.

Table 1. New UBV photoelectric photometry for V1028 Ori

JD Hel 2443000+	V	B–V	U–B	JD Hel 2443000+	V	B–V	U–B
102.0049	9.874	0.111	–0.605	224.6398	9.753	0.113	–0.581
102.9665	9.779	0.121	–0.586	225.6377	9.851	0.124	–0.622
103.8616	9.814	0.117	–0.593	226.6379	9.841	0.132	–0.585
104.8891	9.848	0.121	–0.622	482.8743	9.916	0.114	–0.574
105.9334	9.774	0.112	–0.575	483.8814	9.747	0.119	–0.602
106.9548	9.802	0.111	–0.593	484.8882	9.779	0.123	–0.612
107.9130	9.852	0.119	–0.618	485.8814	9.924	0.111	–0.582
108.8823	9.751	0.126	–0.594	488.8854	9.921	0.118	–0.567
127.8092	9.848	0.119	–0.589	489.8692	9.749	0.118	–0.598
128.8400	9.814	0.129	–0.611	602.6434	9.738	0.121	–0.586
156.8316	9.749	0.123	–0.588	603.6454	9.848	0.113	–0.594
157.7190	9.930	0.126	–0.583	604.6431	9.822	0.119	–0.605
158.7250	9.766	0.100	–0.596	605.6479	9.745	0.128	–0.582
222.6475	9.841	0.126	–0.603	609.6507	9.859	0.095	–0.572

The shape of the light curve, the period and the spectral type of B2 IV (Turner 1976b) all confirm the original classification of V1028 Ori as a β Lyrae type system. The system undergoes partial eclipses, and the amplitude of the brightness variation is relatively small: 0.19 magnitude in V. The parameters for the light curve of V1028 Ori are summarized in Table 2.

Table 2. Parameters for the light curve of V1028 Ori

V_{max} = 9.74	$(U-B)_{min}$ = –0.62 (at secondary eclipse)
$V_{min\,I}$ = 9.93	$(U-B)_{max}$ = –0.58 (at primary eclipse)
$V_{min\,II}$ = 9.86	<B–V> = 0.12

The amplitude of the U–B light curve is only 0.04 mag; nevertheless it exhibits a pronounced maximum at secondary eclipse and a minimum at primary eclipse, which indicates that the secondary is of later spectral type than the primary. The B–V colour index, on the other hand, does not appear to pass through obvious maxima or minima throughout the cycle; it varies about a mean <B–V> = 0.12, with a dispersion of ~0.01 magnitude. This difference can be explained by the stronger dependence of the U–B index on temperature for early spectral types.

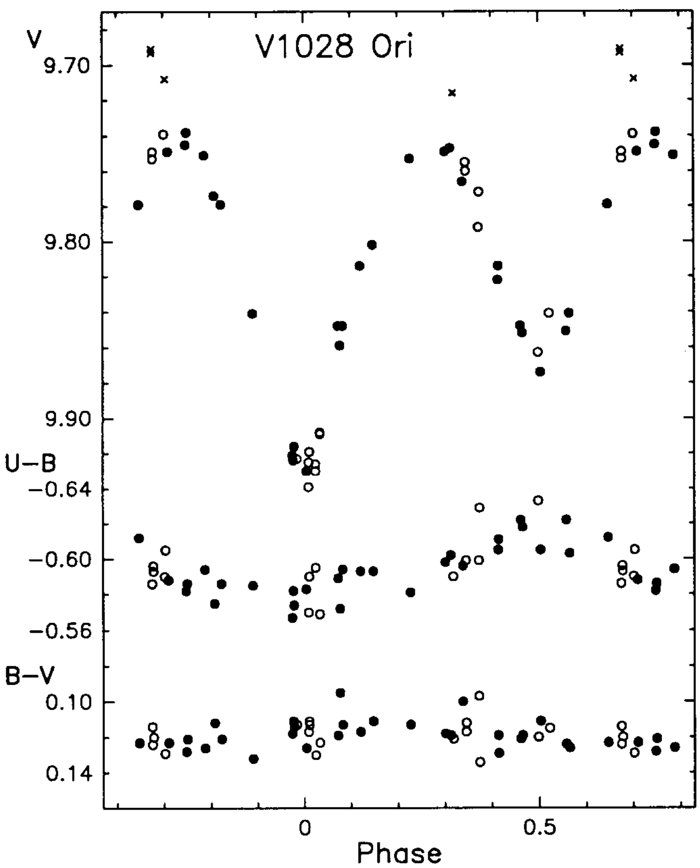

Figure 1. V, U−B and B−V light curves for V1028 Ori

The original classification spectrogram for this star was the basis for its assigned spectral type of B2 IV, although there was some suggestion of diffuseness in the spectral lines which might arise from rotation or mild line doubling. This was not sufficient to warrant a classification of B2 IVn for the variable, but, in the light of the star's duplicity, this should be investigated further with higher dispersion spectra.

Because of the somewhat uneven phase coverage, we did not attempt to construct a complete model of the binary. Rough estimates of the properties of the system show an overall consistency between the observed and derived parameters, even though the estimated separation of the stars in this system, based on their likely masses and the orbital period, is only slightly larger than the calculated dimensions of a subgiant B2 star.

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Hα-PROFILE IN THE SPECTRUM OF PLEIONE IN THE BEGINNING OF THE NEW Be PHASE

Guo Yulian (1993) reported about significant variations of the Hα-profile of Pleione (BU Tau) in the beginning of a new Be-phase (December 1991). He draw the conclusion that the Hα-profile with double emission peak turned into a single emission peak after December 1991.

Observations of the Hα-emission line were also carried out by the authors during the same period (September 1991-January 1992) using the Coudé-spectrograph with CCD of the 2.6 m-telescope of Crimean Astrophysical Observatory. (A detailed description of this CCD-camera is given in Beriozin et al., 1991.) The linear dispersion of the obtained spectra was 6 Å/mm (0.105 Å/pixel), the spectral interval 60 Å. For one spectrum (1991 December 13) the linear dispersion was 3 Å/mm (0.05 Å/pixel), the spectral interval 30 Å. The S/N-ratio at the continuum was >100. The data reduction was done by using the software of Crimean Astrophysical Observatory. Figure 1 illustrates the obtained Hα-profiles. All profiles show double emission peaks certainly. In Table 1 the main parameters of the Hα-profiles are summarized.

Table 1

No.	Date	W(Å)	FWHM(Å)	I_b	I_r	I_b/I_r	I_{abs}	$\Delta\lambda$(Å)
1	1991 September 4	28.98	6.92	4.45	4.96	0.90	3.94	2.76
2	1991 December 13	32.86	6.99	5.27	5.38	0.98	4.02	2.81
3	1991 December 14	29.20	6.94	4.70	4.92	0.96	3.91	2.84
4	1992 January 11	30.94	6.81	4.75	5.38	0.88	4.07	2.77

W -equivalent width relative to the adjacent continuum
FWHM -full-width-half-maximum intensity of the common Hα-profile
I_b, I_r, I_{abs} -intensities of the blue, red and central absorption components relatively to the continuum, respectively
I_b/I_r -ratio of the intensities of the blue and red peaks
$\Delta\lambda$ -separation of the blue and read peaks

Our observational data led to the following conclusions:

1. In the beginning of the new Be-phase the double peak of the Hα-emission line remained. The single emission peak obtained by Guo Yulian (1993) is obviously the result of the insufficient spectral resolution of his observations (D=1.15Å/pixel).

2. The equivalent width of the Hα-emission line does not differ very much from those published by Guo Yulian (W=26Å). The intensity of the Hα-emission line of our observations is higher than that of Guo Yulian (I_{max}=3.8).

3. Our observations also confirm that the intensity of the Hα-emission line has increased since the beginning of the new Be-phase.

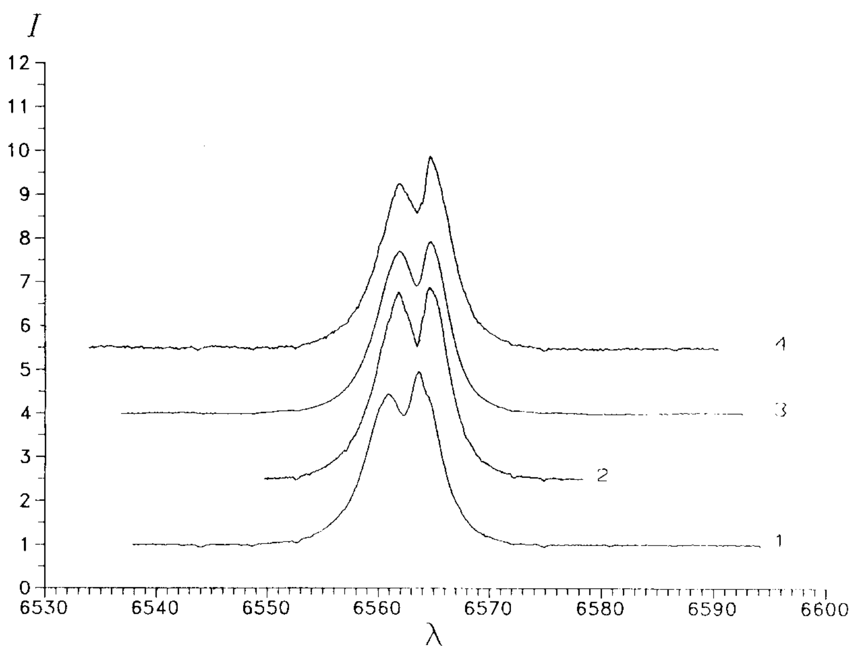

Figure 1. Hα-profiles of Pleione.

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vZ1055=AQ – A NEW HORIZONTAL BRANCH VARIABLE STAR REDWARD OF THE RR LYRAE GAP IN THE GLOBULAR CLUSTER M3

vZ1055 (von Zeipel, 1908) is a horizontal branch star redward of the RR Lyrae instability strip in the globular cluster M3 (see Figure 1). The proper motion study (Cudworth, 1979) shows that vZ1055 is a cluster member (membership probability Pc=0.99). The position of the star in seconds of arc relative to the cluster center is: x=48", y=264". The magnitude and color listed in Table III by Cudworth (1979) are V=15.67, B−V=0.40. From our CCD photometry its V=15.69 and B−V=0.48. On the other hand, Johnson and Sandage (1956) give AQ (one of their photometric standards) V=15.68, B−V=0.48. From the identification chart and the photometric value we judge that vZ1055=AQ.

Here we report the light variation of vZ1055. The CCD data we used are the same as that used for analysing the variation of vZ1140=II−54, i.e., it was observed by Yao Bao-an and Chen Fu-xiang with the TH-7882 CCD attached to the Cassegrain focus of the 2.16-meter reflector (f/9) at the Beijing Observatory in March 1993. This detector contains 576×384 pixels (pixel size 23×23μ) at a scale 0."244/pixel, thus covering a 2.'43×1.'56 field. Four series of 300- or 600-second exposures taken in rapid succession over an interval of about 5.0, 4.2, 6.2 and 4.6 hours were obtained on March 16, 17, 18 and 19 (90 yellow, 5 blue). The seeing was between 1."3 and 3."2 (FWHM). After deleting 6 poorly guided exposures, 84 yellow CCD frames were used to analyse the light variation. The same star AO (V=14.70, B−V=0.72) (Johnson and Sandage, 1956) was used as the comparison star. The distance between AQ and AO is 77."8 and the difference in B−V is 0.24, in addition, the observations were obtained with the air mass less than 1.3 so the differential extinction correction was neglected.

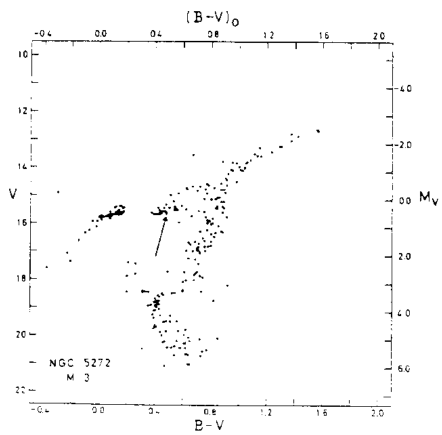

Figure 1

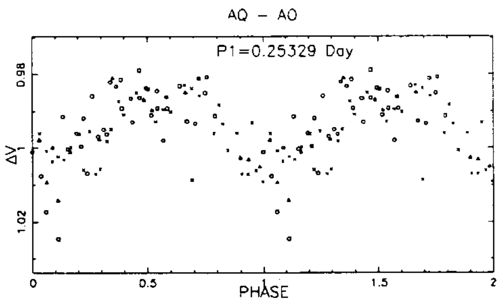

Figure 2

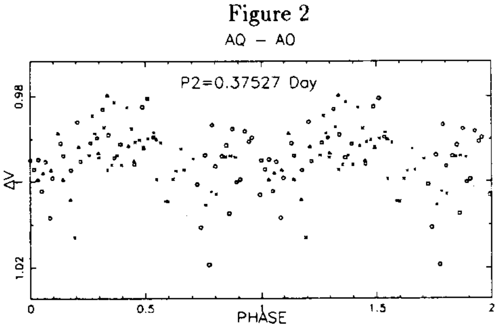

Figure 3

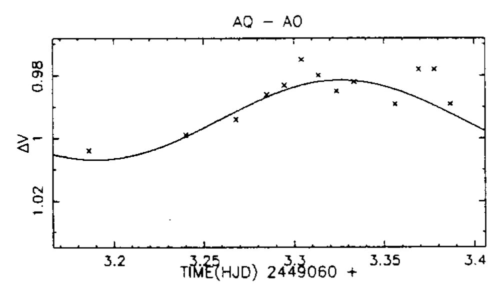

Figure 4

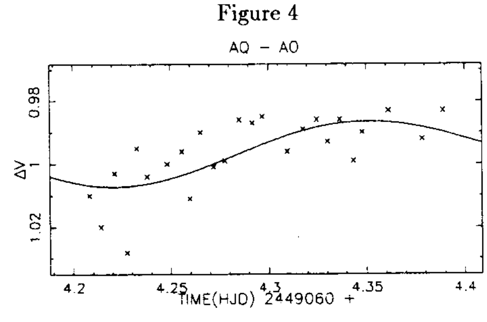

Figure 5

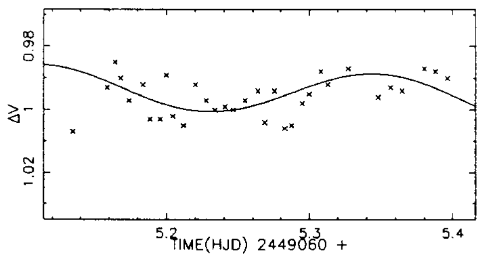

Figure 6

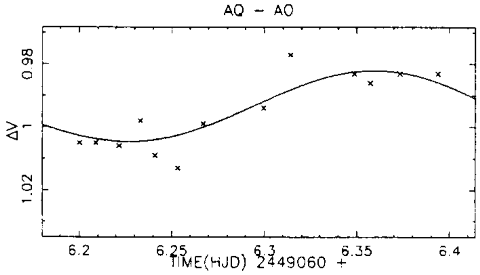

Figure 7

The CCD frames were reduced by DAOPHOT (Stetson, 1987) in IRAF which is mounted in the Sun 4/65 sparc workstation of Shanghai Observatory. Only the aperture photometry was used because it is not a crowded star field for these stars. Scargle's (1982) modified periodogram was used to analyse the unevenly sampled data.

A frequency of $\nu_1 \cong 3.961$ with a height of z=19.54 in the periodogram was first searched out. Though the number of the independent frequencies N_j is unknown, the false alarm probability $F=1-[1-e^{-z}]^{N_i}$ must be extremely low, no matter how to estimate N_j. For example, if N_j is calculated according to the formula 13 given by Horne and Baliunas (1986), then $N_j=100$ and $F=3.27\times10^{-7}$, so it is impossible that the period found here is an illusion!

After prewhitening with ν_1, the above procedure was repeated in order to search for other possible periods. Another frequency $\nu_2 \cong 2.64$ with a height of 6.24 was found (F=0.17, if we still let N_j equal the overestimated number 100). Assuming that the ν_2 is real then Breger's (1991) PERIOD program was used to run nonlinear least squares fitting to improve the values of the frequencies found above simultaneously. The results so obtained are:

$$m(t) = Zeropoint + \sum_{i=1}^{2} a_i sin(2\pi t/p_i + 2\pi\phi_i)$$

Here $P_1=0^d.25329$, $a_1=0.00943$, $\phi_1=0.6196$,
$P_2=0^d.37527$, $a_2=0.00416$, $\phi_2=0.8842$,
Zeropoint=0.995

The zeropoint 0.995 represents the mean magnitude difference between AQ and AO. The folded light curves are given in Figures 2 and 3. Each light curve is plotted with the data prewhitened with the other frequency. Here the squares refer to observations on 1993 March 16, the circles on March 17, the X's on March 18 and the triangle on March 19. The "real time" light curves are given in Figures 4, 5, 6 and 7 where the continuous curves represent the calculated ones using the formula given above. Time refers to the heliocentric Julian Date.

No we repeat what we have published before (Yao, 1987): M3 is a typical Oosterhoff I cluster. Early in the 1940's, Martin Schwarzschild found that the RR Lyrae stars in M3 are confined to a small compact region in the C−M diagram. It is very important to check how sharply the boundaries of this instability strip are defined; does pulsation stop entirely at a given point in the C−M diagram, or do variations of small amplitude persist on either side of the supposed limits of the strip? If this is the case, then an accurate determination of these boundaries would be very important for testing theoretical concepts as well as for practical purposes, e.g. for the estimate of interstellar reddening. The check was done 38 years ago by Roberts and Sandage (1955) with photographic photometry and by Walker (1955) with photoelectric photometry. "All stars lying within the region are variable and no variable stars are found outside the region with amplitudes $A_{pg} \geq 0.07$" was the conclusion of the photographic method and "the boundaries of the gap are extremely sharp, and that beyond the edges of the gap, no light variations occur with ranges greater than 0.02 magnitude" was Walker's conclusion.

Just because we have found a group of suspected low amplitude variables beyond the instability gap in the globular cluster M4 in 1975, and have confirmed some of them with CCD photometry in recent years, we always try to observe M3 to check this important classical conclusion too. Thanks to the use of the 2.16-m reflector plus the CCD detector, we have succeeded in doing so. Obviously, it is a challenge to the theory. We will continue to observe M3 and hope that our results will be checked by other observers.

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CCD PHOTOMETRY OF V1500 CYGNI IN 1993

In a continuing program to monitor V1500 Cygni (Nova Cygni 1975), thirty "V" CCD images with an integration time of 300 seconds were obtained by J. R. Rohde, D. Pascu, and J. A. DeYoung using the U.S. Naval Observatory 1.55-meter astrometric reflector at Flagstaff, Arizona. The Caltech Mark IV 800x800 charge-coupled device camera, with a Space Telescope F569WV wide "V" filter was used to make the observations. The comparison star used was C1 as defined by (Kaluzny and Semeniuk, 1987).

Figure 1 shows the differential instrumental V magnitude versus phase light curve for September 14, 1993. Vertical bars are standard errors from DAOPHOT aperture photometry (Stetson, 1987), while the horizontal bars indicate the length of each 300-second exposure. The mean magnitude was $17^m_.8$ ($\pm 0^m_.1$) which is fainter by $0^m_.07$ from our 1989 photometry with the same system (Schmidt, DeYoung, and Wagner, 1989). The maximum magnitude was $17^m_.3$ ($\pm 0^m_.1$) and the minimum magnitude was $18^m_.3$($\pm 0^m_.1$) . This is a drop of $0^m_.36$ magnitude in amplitude from our 1987 and 1989 observations. The general shape of the light curve is sinusoidal and shows no evidence of the flickering observed previously near minimum. The following linear ephemerides were used in the reductions:

$$\text{Max (HJD)} = 2443369.7116 + 0.1396131 * E \qquad (1)$$
$$\text{Min (HJD)} = 2443369.6490 + 0.1396131 * E \qquad (2)$$

The times of maximum and minimum were determined by the method of (Kwee and van Woerden, 1956) with the results shown in Table I. No correction is required at this time in the above ephemerides. The period continues to remain stable. A finder chart prepared from a 61-inch V band image is given in Figure 2.

Table I. The observed heliocentric times of maximum and minimum of V1500 Cygni.

HJD	Type	Cycle	(O-C)
2449244.7770	Max.	42081	$+0^d_.0065$
2449244.8434	Min.	42082	$-0^d_.0015$

The Sept. 14, 1993 V filter light curve of V1500 Cygni (V-C1)

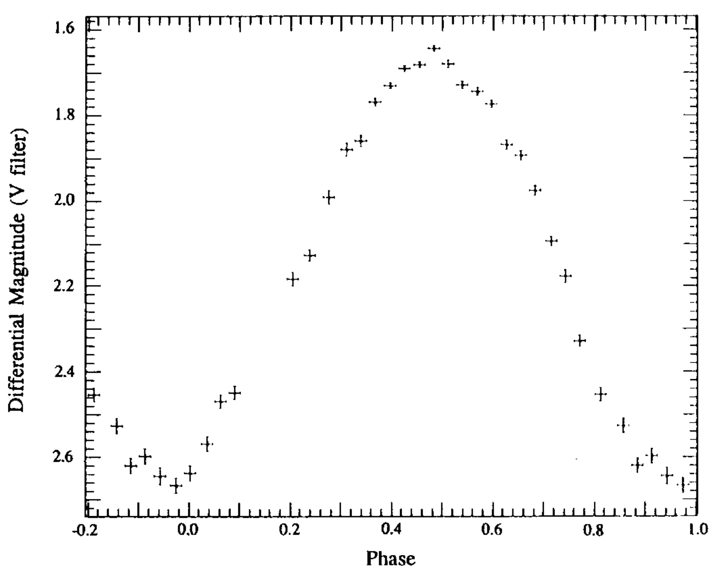

Figure 1

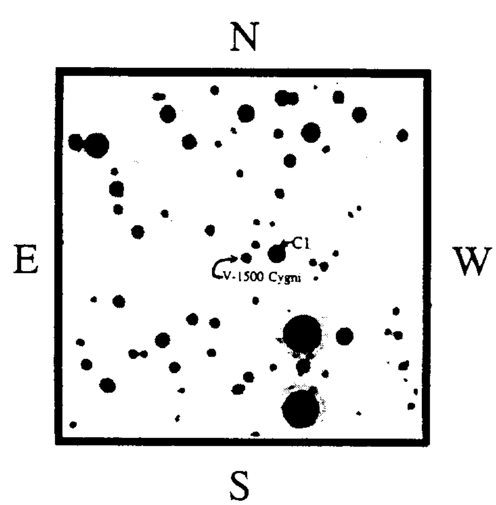

Figure 2. A two arc minute per side "V" band finder chart for V1500 Cygni.

Thanks are due to Lowell Observatory for use of the 2:1 reimaging coronograph and to the staff of the U.S. Naval Observatory Flagstaff Station for allowing time on the telescope and for assistance during the observing run.

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FIRST ANNOUNCEMENT OF

IAU COLLOQUIUM No. 151 "FLARES AND FLASHES"

IAU Colloquium 151, Flares and Flashes: a multi-wavelength approach to short-term phenomena, in honour of the 65th birthday of G.A. Richter and W. Wenzel, will be held in Sonneberg (Thuringia), Germany, from December 5–9, 1994. IAU Commissions 27, 42, 44 support the colloquium.

The scientific organizing committee consists of H.W. Duerbeck (Germany), G. Fishman (USA), R. Gershberg (Ukraine, chair), J. Greiner (Germany), M. Kato (Japan), A. King (UK), J.-P. Lasota (France), M. Rodonò (Italy), J.I. Smak (Poland) and M.K. Tsvetkov (Bulgaria). The local organizing committee consists of the members of Sonneberg Observatory, H.-J. Bräuer, B. Fuhrmann, P. Kroll, R. Luthardt (chair), S. Rößiger.

The conference aims to bring together specialists from different fields who have a common interest in observing and interpreting short-term (seconds to minutes) events near and on stellar surfaces and in stellar interiors. It will provide a platform for the discussion of flare and flash events observed at all accessible wavelengths, and for the exchange of views on the nature of the physical processes involved. At the same time, the conference should stimulate discussions on how to make existing sky surveys better available for general use and to define the characteristics of future sky patrols – wavelength regions, sensitivities, and time resolutions – which promise best returns according to our present understanding of the phenomena. The programme outline is:

1. Review talks (without contributed papers)

Solar flares – Gamma-ray bursts

2. Flares (reviews and contributions)

Flares in late type stars, RS CVn stars and T Tau stars (observational studies across the electromagnetic spectrum) – Theory of flares

3. Flashes (reviews and contributions)

Stellar variability in late evolutionary stages – Radio flashes from transients, cataclysmic variables, Cyg X-3 – Rapid X-ray variability in AM Her systems – X-ray bursts

Modelling of high energy flashes – Disk instability models of dwarf novae and X-ray transients – Overflow models

4. Flickering (reviews and contributions)

Flickering in cataclysmic variables – Quasi-periodic oscillations in low-mass X-ray binaries and transients – Flickering at high energies

5. Instrumental developments / Sky monitoring / Flash search (reviews and contributions)

Plate collections of the world – The Harvard plate collection – The present and future of the Sonneberg Sky Patrol – Future of optical sky patrols – Results of all-sky monitoring at X- and gamma-rays

Techniques of flash searches (gamma-ray bursts, supernovae, gravitational micro-lensing) – Techniques and results of rapid follow-up observations of gamma-ray bursts

More information is available from:

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A SEASONAL LIGHT CURVE AND NEW EPHEMERIS OF VW CEPHEI

VW Cephei (HD 197433 = BD +75°752 = SAO 9828) is a famous, popular and well-studied EW-type eclipsing binary – its popularity is well demonstrated by the fact that this star has been the most frequently studied object dealt with in the IBVS since 1961. VW Cep does deserve this particular interest, because it shows quite complex variations in its light curve. The main light variation is a usual eclipsing light curve of contact binaries – the primary minimum is due to occultation, so this is a W-type system according to Binnendijk's (1970) definition.

There are some changing perturbations superimposed on the eclipsing light curve – these are probably due to the intensive surface activity of the primary, more massive component, which is a usual phenomenon among the W-type W UMa-systems (e.g. Rucinski, 1985). The observed time scale of the perturbations extends from 24 hours (Kreiner & Winiarski, 1981) to 44 years (Karimie, 1983). The study of the short-time-scale changes was the aim of an international observational campaign organized by P. Hendry (Univ. of Toronto, Canada) and one of us (J.V.) in August, 1992. The analysis of those observations is currently underway, a preliminary result indicates a changing asymmetry of the light curve on a time scale of about one week.

As far as the long period modulations are concerned, the activity maximum was in 1986, according to e.g. Bradstreet & Guinan (1988), then it decreased considerably after 1988-89. The 6-8 year-long cycle length proposed by Bradstreet & Guinan indicates that the next maximum is expected to occur in 1992-94. Therefore we decided to monitor the behavior of the system during this period.

We measured the system photoelectrically on 3 nights in August and September, 1993 at Konkoly Observatory with the 50 cm Cassegrain telescope installed at Piszkéstető Mountain, and at Szeged Observatory, Szeged, Hungary, with a 40 cm Cassegrain reflector. A complete photoelectric light curve in Johnson V and B bands was obtained and it is presented in Figure 1. The comparison star was HD 199476 = SAO 9899 which was used previously by many observers. Table 1 contains the heliocentric times of minima calculated from parabolic least-squares fit to the bottom of the minima. The asymmetries of the light curves do not exceed 0.02 mag indicating that VW Cep is still in the less active phase.

Table 1

T Min (Hel.J.D.)	type	O−C (days)
49213.465	I	−0.089
49252.4306	I	−0.0879
49253.4050	II	−0.0877

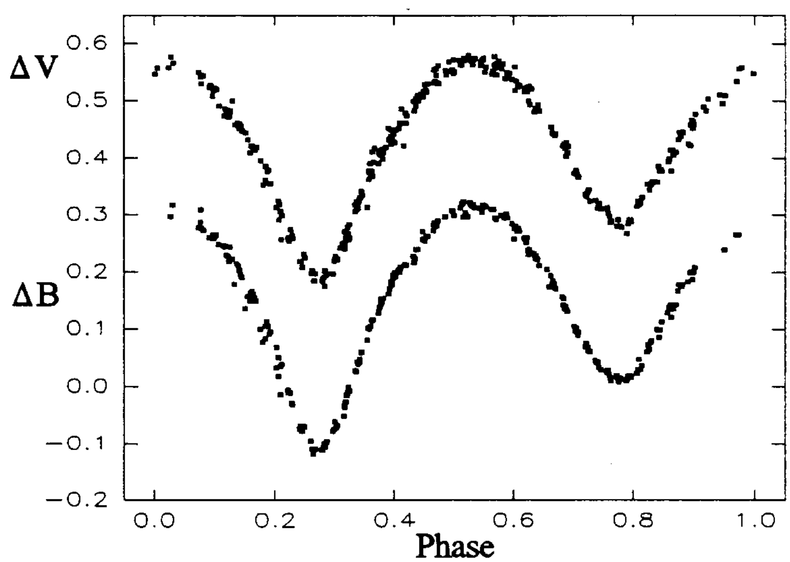

Figure 1

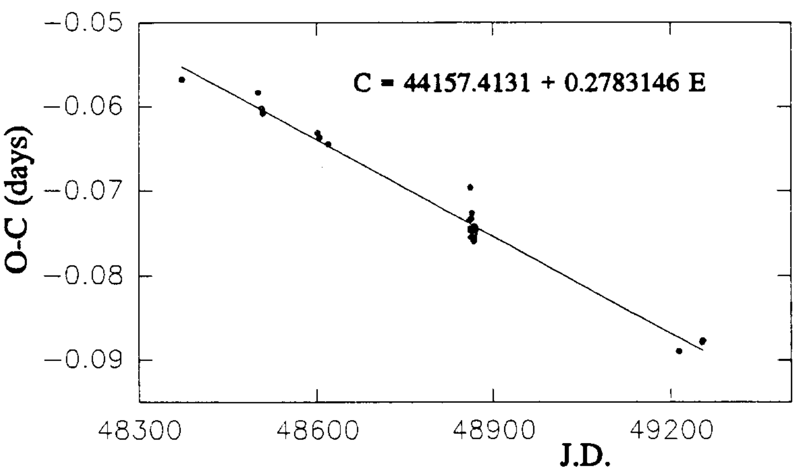

Figure 2

Table 1 also contains the O−C values calculated from the ephemeris given in the GCVS. In Figure 2 we plotted our new times of minima on the O−C diagram (based on the most recent measurements available for us including the data from the 1992 campaign which will be published in a separate paper). The O−C of secondary minimum was calculated so that its cycle number (E) was half-integer.

The O−C curve in Figure 2 can be approximated with a straight line indicating a nearly constant period (smaller than its previous value) during the past few years. From the slope of the fitted line the current photometric period of VW Cep can be calculated and the following ephemeris has been derived:

$$\text{Min I Hel J.D.} = 2449252.4306 + 0.2783040 \times E \qquad (1)$$

which can be used for predicting new times of primary minima in the next couple of years.

Since VW Cep is a member of a triple system (Hershey, 1975), its period is modulated by the light-time effect. A detailed analysis of the period variation has been presented recently by Lloyd, Watson & Pickard (1992). They derived a photometric period of 0.2783099 day which agrees quite well with the new period presented above.

The list of individual observations is available via e-mail from vinko@sol.cc.jate.u-szeged.hu (Internet).

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DISCOVERY OF 10.5-MINUTE OSCILLATIONS IN THE Ap SrEu STAR HD 9289

Martinez (1993) has obtained Strömgren photometry for all of the Ap SrCrEu stars in the first four volumes of the Michigan Spectral Catalogue, along with selected stars classified by Bidelman & MacConnell (1973) north of declination -12°. Using this photometry we have been conducting a systematic survey for new rapidly oscillating Ap (roAp) stars. In this note we announce the 11th one found as part of the survey, the 26th now known.

Table 1. The 26 rapidly oscillating Ap stars

HD	y	$b-y$	m_1	δm_1	c_1	δc_1	β
6532	8.445	0.088	0.214	-0.014	0.879	-0.051	2.880
9289	9.383	0.138	0.225	-0.018	0.826	-0.012	2.833
12932	10.235	0.179	0.228	-0.024	0.765	-0.035	2.810
19918	9.336	0.169	0.216	-0.010	0.822	-0.058	2.855
24712	6.001	0.191	0.211	-0.023	0.626	-0.074	2.760
42659	6.768	0.124	0.257	-0.050	0.765	-0.076	2.834
60435	8.891	0.136	0.240	-0.034	0.833	-0.047	2.855
80316	7.782	0.118	0.324	-0.118	0.599	-0.283	2.856
83368	6.168	0.159	0.230	-0.024	0.766	-0.062	2.825
84041	9.330	0.177	0.233	-0.026	0.797	-0.061	2.844
101065	7.994	0.431	0.387	-0.204	0.002	-0.370	2.641
119027	10.022	0.257	0.214	-0.034	0.557	-0.076	2.731
128898	3.198	0.152	0.195	0.012	0.760	-0.077	2.831
134214	7.464	0.216	0.223	-0.029	0.620	-0.108	2.774
137949	6.673	0.196	0.311	-0.105	0.580	-0.236	2.818
150562	9.816	0.301	0.212	-0.015	0.659	-0.087	2.783
161459	10.326	0.245	0.246	-0.040	0.679	-0.141	2.820
166473	7.923	0.208	0.321	-0.118	0.514	-0.268	2.801
176232	5.89	0.150	0.208	-0.004	0.829	0.031	2.809
190290	9.912	0.289	0.293	-0.091	0.466	-0.306	2.796
193756	9.195	0.181	0.213	-0.008	0.760	-0.040	2.810
196470	9.721	0.211	0.263	-0.059	0.650	-0.144	2.807
201601	4.68	0.147	0.238	-0.032	0.760	-0.058	2.819
203932	8.820	0.175	0.196	0.004	0.742	-0.020	2.791
217522	7.525	0.289	0.227	-0.056	0.484	-0.015	2.691
218495	9.356	0.114	0.252	-0.049	0.812	-0.098	2.870

HD 9289 was classified by Bidelman & MacConnell (1973) as Ap SrEu. Martinez (1993) measured V = 9.383, $b-y$ = 0.138, m_1 = 0.225, c_1 = 0.826 and β = 2.833. The calculated metallicity and luminosity indices are δm_1 = -0.018 and δc_1 = -0.012, both of which indicate strong metallicity and heavy line-blocking in the v band - characteristics we have come to associate with roAp stars. The dereddened Strömgren indices, $[m_1]$ = 0.250 and $[c_1]$ = 0.798, lead to $[\delta m_1]$ = -0.043 and $[\delta c_1]$ = -0.046 which even more strongly suggests to us a roAp star. In Table 1 we list the 26 known roAp stars along with their Strömgren indices.

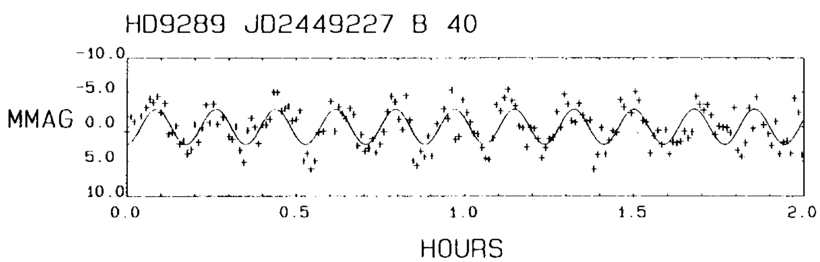

Figure 1

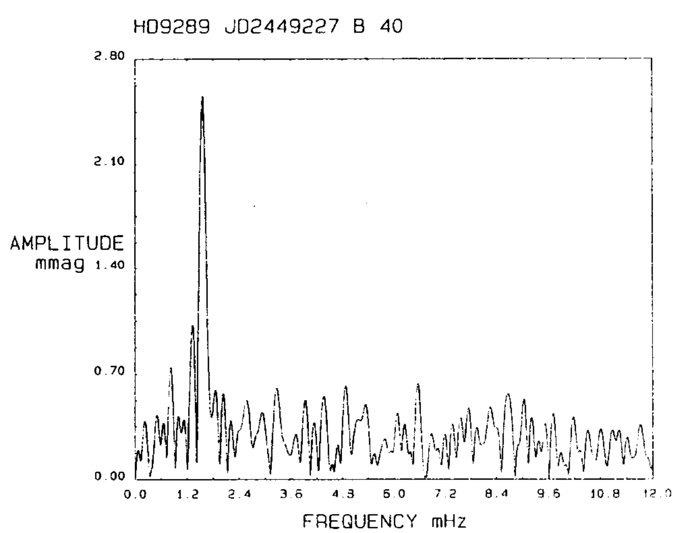

Figure 2

On the night of 27/28 August 1993 we obtained 2 hours of continuous 10-s photometric integrations of HD 9289 through a Johnson B filter using the 1-m telescope of the Sutherland Station of the South African Astronomical Observatory. The observations were corrected for coincidence losses, sky brightness, extinction and reduced to 40-s integrations. Fig. 1 shows the light curve for those two hours and Fig. 2 shows the amplitude spectrum. The 10.5-min oscillations are obvious in both. No comparison star was used, but sky transparency variations, scintillation, and photon statistics produced noise of a maximum amplitude of about 0.7 mmag at the frequencies of interest, as can be seen in the amplitude spectrum.

We have continued to observe this star and, as of this writing, have over 70 hours of observations obtained on 17 nights. The amplitude of the light curve is strongly modulated. The star is multiperiodic and may also show rotational amplitude modulation. We will continue to observe it for the rest of this season, then present a complete frequency analysis. HD 9289 appears to be of considerable asteroseismological interest.

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PHOTOMETRY OF STARS IN THE FIELD OF THE MIRA V418 CASSIOPEIAE

The variable V418 Cassiopeiae was discovered by Hoffmeister (1966), who noted rapid, nova-like rises to maximum brightness despite its long-period nature. Gessner and Meinunger (1973) determined a period of about 480 days from Sonneberg plate material. More recently, Kaiser and Collins (1991) independently discovered the variable and its rapid brightenings in the course of photographic sky patrols. Their surveys showed one rise in excess of 0.1 magnitudes per day, and a maximum possibly as bright as mag. 10. The two used magnitudes from the Guide Star Catalog (GSC) for their comparison stars. These are well known to have occasionally large zero-point offsets, internal scatter, as well as a significant color term. Thus at the request of Charles Scovil of the American Association of Variable Star Observers, I observed several stars in the field of this variable to provide a comparison sequence for visual observers. The sequence covers the range $10.9 < V < 13.3$, so will be useful when the star is bright.

The Lowell 53cm photometric telescope was used to observe the field on 26 and 28 August 1992 UT. The telescope is fitted with a single-channel photometer containing Strömgren filters. Six and four standard stars, respectively, were observed on these nights along with the program stars using a 19-arcsec diaphragm. Each observation consisted of a minimum of four 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers of integrations for fainter stars. All the standard stars are from the lists of Landolt (1983, 1992). The V magnitudes were adopted directly, and $b-y$ colors were determined using same telescope against primary Strömgren four-color standards with data available up to time of these observations. (The colors have since been improved somewhat.) The data for each night was reduced separately using linear transformations. Atmospheric extinction was measured on one of the nights and the same values were used in the reductions on the other night. Average per star residuals (standard deviation) were ±0.006 in V and ±0.002 in $b-y$ on the 26th, and ±0.004 and ±0.004 on the 28th.

The standards observed are listed in Table 1 along with the adopted and observed V and $b-y$ colors, and the number of observations 'n'. The mean deviations of the observed averages from the assumed values listed in Table 1 are: $V = 0.000 \pm 0.004$; $b-y = 0.000 \pm 0.002$. The small residuals are mostly due to the small number of standards observed, but are nevertheless indicative of a close match at least to the V system. The faint, red, and reddened stars in this low-latitude field necessitated the use of standards other than the canonical ones defining the four-color system. The main goal was V magnitudes for use of visual observers, so the $b-y$ colors were needed solely to determine the color term in the instrumental V magnitudes, and not for temperatures or other indices ordinarily derived from Strömgren photometry. Despite the use of three fairly red standards, stars in the program field were redder still, and required (assumed linear) extrapolations of the transformations. In any case, these uncertainties are greatly outweighed by the errors in the program star observations, which are dominated by photon-counting errors.

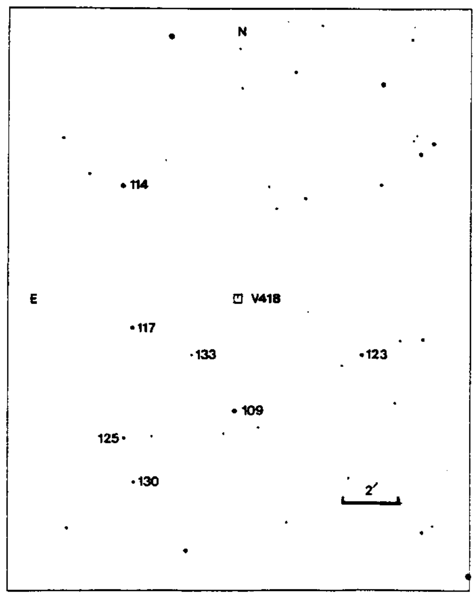

Figure 1. The field of V418 Cas showing stars from the GSC. V magnitudes are indicated to the nearest tenth of a magnitude with the decimal point omitted.

Table 1. Standard Star Observations

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 5319	8.046	0.601	8.042	0.602	2
HD 7615	6.693	0.023	6.688	0.026	2
BD−0°0288	8.831	0.711	8.832	0.709	1
HD 215141	9.239	0.962	9.240	0.960	1
HD 218155	6.783	−0.005	6.787	−0.007	3
HD 222732	8.857	0.735	8.861	0.737	1

The results for the V418 Cas field are given in Table 2, listed in order of decreasing brightness. Since all the stars are fainter than mag. 10, none appear in the common star catalogues. Identifications and J2000 positions from the Guide Star Catalog are provided instead. Except for GSC 4034-0841, the stars were observed on only one night. The uncertainties listed in the second line of each entry are thus the rms errors on each batch of integrations; these should be representative of the external uncertainties. Because the stars are fairly faint for the telescope involved and since they were observed on only one night, the data are given to a precision of two decimals instead of three, as is usual for Strömgren photometry.

Table 2. Photometry of stars in the field of V418 Cassiopeiae

Name	RA (2000)	Dec (2000)	V	$b-y$	n
GSC 4034-0775	$1^h12^m58^s.9$	+62°06'56"	10.91	0.44	1
			.03	.03	
GSC 4034-0673	1 13 34.3	+62 15 05	11.39	0.98	1
			.02	.02	
GSC 4034-0841	1 13 31.1	+62 09 56	11.63	0.71	2
			.00	.03	
GSC 4034-0873	1 12 19.4	+62 08 57	12.26	1.12	1
			.03	.04	
GSC 4034-1602	1 13 33.5	+62 05 56	12.53	0.78	1
			.03	.04	
GSC 4034-1203	1 13 30.5	+62 04 21	12.95	0.53	1
			.04	.04	
GSC 4034-1542	1 13 12.5	+62 08 57	13.27	0.68	1
			.04	.06	

For the convenience of observers, a chart based on the GSC is shown in Figure 1. The chart is centered at $1^h12^m58^s$+62°11'.0 (2000), the approximate location of V418 Cas. There is no precise position for V418 Cas in the literature, nor does the star appear in the GSC. The GSC is incomplete beyond mag. 12 to 13, so the field is much more crowded with stars than the chart suggests. The comparison stars are indicated by their magnitudes rounded to the nearest tenth of a magnitude (decimal point omitted) in the style of visual variable-star charts.

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PHOTOMETRY OF STARS IN THE FIELDS OF AV CYGNI AND DV CYGNI

AV Cygni and DV Cygni are two variables lying in a field containing several other variables near the Lyra border. Both are on the program of the American Association of Variable Star Observers (AAVSO), but lack adequate comparison sequences for visual observers. AV Cygni is a poorly-studied star of the SRd class, having a spectral type of mid-G and showing emission lines. DV Cygni is a garden-variety semi-regular variable of spectral type M2 with a cycle length of about five months. At the request of Charles Scovil of the AAVSO, I observed several stars near each variable to improve preliminary magnitude sequences on a series of AAVSO charts.

Neither star has accurate coordinates published in the literature, but both appear in the Guide Star Catalog (GSC) at the following positions:

	RA (2000)	Dec(2000)
AV Cygni	$19^h20^m41^s.1$	+29°30' 21"
DV Cygni	19 21 44.8	+29 45 30

I observed the stars using the Lowell 53cm photometric telescope on 8 October 1992, and 10 and 11 May 1993 UT. Strömgren y and b filters were used with either a 19-arcsec or 29-arcsec diaphragm. Each observation consisted of at least four 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers on fainter stars. Because the field was observed at two different seasons, the collection of standards is fairly large. Since the main goal was determination of V magnitudes and since the colors of randomly-selected low-latitude stars can be quite red, the standards were drawn from a variety of sources. V magnitudes were taken mostly from the lists of Landolt (1983a, 1983b, 1992), supplemented by values from Menzies et al. (1991). Strömgren $b-y$ colors were taken from the primary four-color standards list of Perry, Olsen, and Crawford (1987), plus much-observed stars from lists by Olsen (1983, 1993), Anthony-Twarog et al. (1991), and Stetson (1991) - in that order of preference. Some V magnitudes come from these sources as well. Several of the Landolt stars, such as the very red standard HD 172829 = Landolt SA 110-502, have $b-y$ values determined using the Lowell 53cm telescope. The data for each night were reduced separately using linear transformations. Atmospheric extinction was estimated on these nights from measurements taken on other nights near this time.

Because of the mix of standards, Table 1 shows both the adopted and observed mean V and $b-y$, and the number of observations 'n'. The V data for two stars (in parentheses) were omitted from the transformations. The mean deviations of the observed averages from the assumed values from this group of data are: V = -0.001 ± 0.006; $b-y = 0.000 \pm 0.005$.

Table 1. Standard Star Observations

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 126273	7.188	1.070	7.195	1.072	2
HD 137006	6.113	0.150	6.116	0.160	2
HD 143761	5.403	0.396	5.405	0.390	2
HD 160471	6.155	1.162	6.155	1.162	1
BD +04°3508	9.326	1.179	(9.359)	1.188	1
HD 162596	6.342	0.717	6.336	0.717	1
HD 165401	6.801	0.393	6.805	0.387	1
HD 165462	6.336	0.700	6.332	0.702	1
HD 172365	6.369	0.510	6.357	0.510	1
HD 172829	8.474	1.383	8.475	1.369	1
HD 182239	6.657	0.167	6.658	0.165	2
HD 184914	8.178	0.799	8.186	0.804	1
HD 184965	8.529	0.306	8.533	0.308	2
HD 186427	6.230	0.417	6.234	0.414	1
HD 187203	6.448	0.614	6.440	0.615	1
HD 190299	5.666	0.825	5.665	0.826	1
BD −00°4073	9.905	0.776	9.892	0.781	1
HD 199280	6.583	−0.030	6.583	−0.039	1
HD 209960	5.254	0.897	5 252	0.897	1
HD 218155	6.783	−0.004	6.779	−0.001	1
BD −00°4557	9.695	0.399	9.690	0.401	1
HD 222732	8.860	0.735	(8.835)	0.733	1

The results for the AV Cygni field are given in Table 2, listed in order of decreasing brightness. Identifications (from the BD or GSC) and J2000 positions are provided along with V and $b-y$. Uncertainties (σ) are listed for the stars observed on more than one night. A few of the brighter stars have rough spectral types drawn from the SIMBAD database.

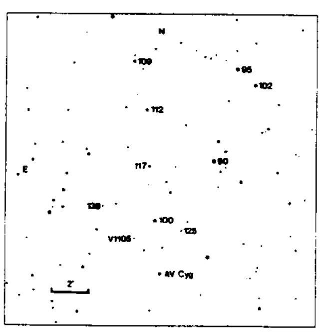

Figure 1. The field of AV Cygni showing stars from the GSC. The plot is centered at: $19^h20^m41^s.0$ +29°36' 00" (2000). V magnitudes are indicated to the nearest tenth of a magnitude with the decimal point omitted.

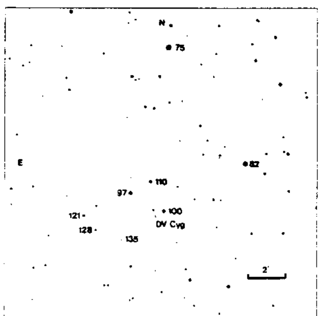

Figure 2. The field of DV Cygni showing stars from the GSC. The plot is centered at: $19^h21^m43^s.0$ +29°48' 00" (2000). V magnitudes are indicated to the nearest tenth of a magnitude with the decimal point omitted.

Table 2. Photometry of Stars in the AV Cygni Field

Name	RA (2000)	Dec	V	$b-y$	n	spec
BD +29°3561	$19^h20^m27^s.7$	+29°36' 28"	$8^m.955$	$0^m.639$	2	G5
			.015	.004		
BD +29°3560	19 20 22.0	+29 41 30	9.540	0.717	1	K0
BD +29°3563	19 20 42.3	+29 33 15	9.987	0.935	2	
			.002	.001		
BD +29°3560p	19 20 17.4	+29 40 36	10.194	0.737	1	K0
GSC 2136-2434	19 20 47.7	+29 41 53	10.851	0.701	1	
GSC 2136-1082	19 20 44.4	+29 39 14	11.193	0.402	1	
GSC 2136-1490	19 20 43.8	+29 36 11	11.677	0.867	2	
			.011	.006		
GSC 2136-2526	19 20 35.9	+29 32 41	12.496	0.431	2	
			.033	.022		
GSC 2136-1450	19 20 55.3	+29 34 02	13.767	0.368	1	

Results for the field around DV Cygni are shown in the same format in Table 3. The faintest star does not appear in the GSC, and a name is assigned based on the truncated, approximate J2000 position, following the precepts of the IAU (1990). The M-giant star BD+29°3570 has two published UBV measures by Neckel (1974), where the star is mistakenly identified as DV Cygni. Our five V magnitudes are as follows:

	UT	V
Neckel:	1968 May 24	$9^m.87$
	1969 Aug 20	9.77
Skiff:	1992 Oct 08	9.712
	1993 May 10	9.711
	1993 May 11	9.744

These suggest (without convincing!) that the star is possibly a low-amplitude variable, which would not be surprising for an early-M giant. In addition, GSC 2136-0358 is similarly red, which together with DV Cygni makes three red stars in this small field.

Table 3. Photometry of Stars in the DV Cygni Field

Name	RA (2000)	Dec	V	$b-y$	n	spec
HD 182057	$19^h21^m41^s.1$	$+29°54'19''$	$7^m.471$	$0^m.082$	1	A2
BD +29°3566	19 21 21.8	+29 48 01	8.217	0.963	2	K2
			.016	.003		
BD +29°3570	19 21 50.4	+29 46 26	9.722	1.131	3	M2
			.019	.018		
GSC 2136-0358	19 21 42.2	+29 45 26	9.954	1.106	1	
GSC 2136-0019	19 21 45.5	+29 47 02	10.955	0.364	2	
			.000	.008		
GSC 2136-0574	19 22 02.0	+29 45 12	12.123	0.669	2	
			.023	.044		
GSC 2136-0340	19 21 59.1	+29 44 26	12.832	1.156	1	
J192152+2944.1	19 21 52	+29 44.1	13.541	0.607	1	

For the convenience of observers, charts based on the GSC are shown in Figures 1 and 2. The comparison stars are indicated by their V magnitudes rounded to the nearest tenth of a magnitude (decimal point omitted) in the style of visual variable-star charts. The approximate location of the faint long-period variable V1105 Cygni is also shown on the AV Cygni chart.

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OPTICAL LIGHT VARIABILITY OF LS 3074

We report detection of optical light variations of LS 3074, a luminous object in the southern coal-sack zone (Marraco and Orsatti, 1982).

Morrell and Niemela (1990) discovered its binary nature and derived preliminary orbital elements based on the velocity curves of both components which were classified as O4f+ and O6-7(:). The very low values of $M \times \sin^3 i$ for both components (8 and 9 $M_\odot$, later on corrected to 9.5 and 10 $M_\odot$ by Niemela et al. (1992) would imply a low inclination of the system. But trying to determine the inclination by means of linear polarization measurements Niemela et al. (1992) derived a value of 75°. This is by far too high to put the masses at the expected level about 20-30 $M_\odot$ (Herrero et al., 1992). That procedure of fixing the inclination was questioned by the authors themselves because it could be affected by additional polarization in the system.

Since empirical masses of early O type stars are very poorly known it seemed worthwile to look for photometric variations of LS 3074 to possibly get a better estimate of the inclination. During an observing stay at the ESO Observatory La Silla/Chile at the beginning of April 1991 some UBVRI measurements could be obtained using the standard single-channel photometer at the ESO 50 cm telescope. Folding the data with the spectroscopic period (P=2.185 d) given by Niemela et al. (1992) clearly revealed ellipsoidal variations. Figure 1 shows the resulting V light curve with a full amplitude of about 0.15 mag. Open squares represent measurements obtained under less favourable weather conditions. Their estimated error amounts to about 0.04 mag whereas the error of the more reliable measurements (filled squares) is around 0.02 mag. For comparison with UBV values compiled by Marraco and Orsatti (1982) we give here colours measured at V=11.74 (11.73): B−V=1.13 (1.17), U−B=−0.10 (−0.10), V−R=0.81, V−I=1.59 (data by Marraco and Orsatti in brackets). The values are affected by the strong reddening towards the coal-sack region.

Preliminary photometric elements were determined using the GRADUS-code (Simon et al., 1994), a light curve synthesis program which employs Roche geometry and allows a careful treatment of heating and scattering effects. Instead of a limb darkening law the angular distribution of radiation generated by non-LTE model atmospheres is applied. With the fixed temperature of 46 000K for the O4f+ star and 40 000K for the O6-7 star (Kudritzki and Hummer, 1990), and with the fixed spectroscopic parameters (radial velocity amplitudes (222 and 218 km/s) and $M \times \sin^3 i$) we found reliable light curve fits for inclinations around 50°. This yielded (nearly identical) masses for both components around 20-21 $M_\odot$ and polar radii around 8.7-8.8 $R_\odot$. With these parameters LS 3074 constitutes a contact system. Increasing the inclination results in a synthetic light curve showing first evidence for a grazing eclipse which cannot be recognized in the present photometric data. Nevertheless, this might unveil itself in high quality measurements. The fit for e.g. an inclination of 55°is still acceptable (but worse than that for 50°) so

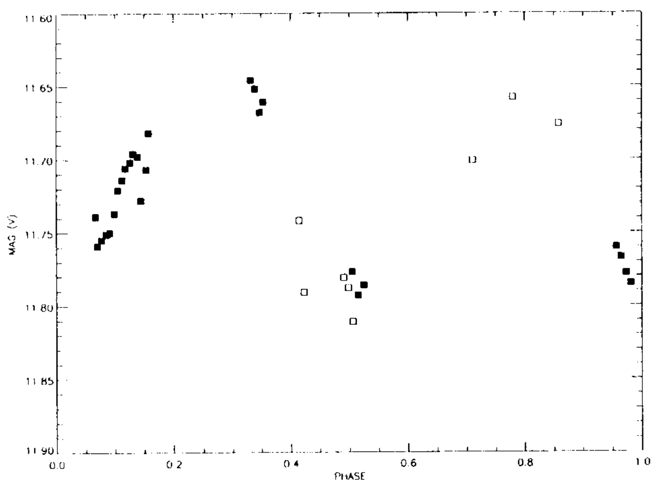

Figure 1. V light curve of LS 3074. Phases were calculated according to the ephemeris HJD 244 8348.619+2^d.185×E. For further explanation see text.

that at present no clear decision can be made. The corresponding parameters are: 17-18 $M_\odot$, 7.6-8.3 $R_\odot$, semidetached system. For inclinations below 50° no acceptable fit to the light curve could be found. We conclude that inclinations between 50° and 55° represent best the spectroscopic and photometric measurements available at the moment thus restricting the masses of LS 3074 to about 17-21 $M_\odot$. This result is in line with the masses for galactic O stars derived from spectroscopic analysis by Herrero et al. (1992) which are systematically lower than those obtained from evolutionary calculations.

Better spectroscopic (spectral types, radial velocity amplitudes) as well as photometric (grazing eclipse) data is needed to analyse this system with the high accuracy appropriate to the importance of the problem in question.

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NEW TIMES OF LIGHT MAXIMA FOR CY Aqr

CY Aqr is an SX Phe type variable whose magnitude in V band varies from $10^{m}_{.}42$ to $11^{m}_{.}16$. Its spectral type varies from A2 to A8. The star was one of the most extensively observed SX Phe type stars which had detectable period variations in the last sixty years. There are many different interpretations for its variations (Kamper, 1985, etc.). In order to know the real situation, we observed it on September 28, 1984 and got a new moment of light maximum. After that during October 19 to 22, 1993 we observed the star again and obtained eight new times of light maxima. The data showed an obvious systematic delay with respect to the times calculated from the formula given by Pena et al. (1987). To check the reliability of the differences we performed new observations on December 7, 1993 which showed that these new times of light maxima were reliable. The ten new times of light maxima for CY Aqr are as follows:

No	T_{max} (HJD 2400000.0+)
1	45972.1828
2	49280.0396
3	49281.0776
4	49281.1390
5	49282.0540
6	49282.1150
7	49282.1760
8	49283.0313
9	49283.0915
10	49328.9938

At first we used the times of light maxima got before 1993 including those published in the literature (Zissel, 1991; Rodriguez et al., 1990, etc.) and the first new time listed above to obtain a linear fit in the form of:

$$T_{max}=T_{01}+P_{01}\times E \tag{1}$$

and a quadratic fit as:

$$T_{max}=T_{02}+P_{02}\times E+0.5\beta\times E^2 \tag{2}$$

We got T_{01}, P_{01}, T_{02}, P_{02} and β of the variable star as below:

star	T_{01}(HJD)	P_{01}(days)	T_{02}(HJD)	P_{02}(days)	β(day/cycle)
CY Aqr	2434308.4299	0.061038330	2434308.4280	0.061038410	-3.72×10^{-13}
	±2	±1	±1	±1	$\pm6.5\times10^{-15}$

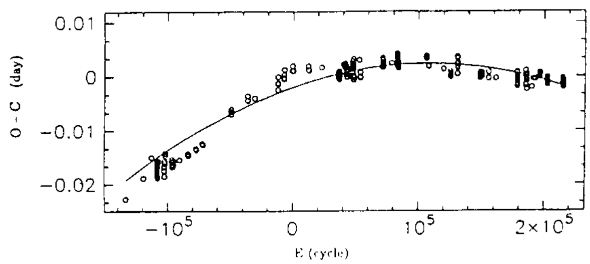

Figure 1. The O−C diagram of CY Aqr derived from the linear ephemeris (1) with the data before 1993.

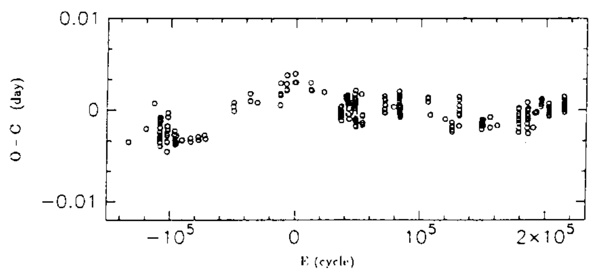

Figure 2. The O−C diagram of CY Aqr derived from the quadratic ephemeris (2) with the data before 1993.

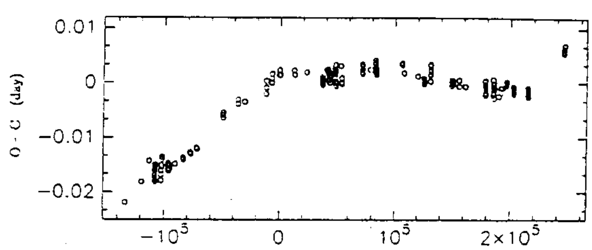

Figure 3. The O−C diagram of CY Aqr derived from the linear ephemeris (1) with the whole data.

Figure 1 shows the O−C diagram obtained by using Eq. (1). Figure 2 shows the O−C diagram as obtained from the quadratic fit. The negative rate of period change, β, means that the period of light variations was decreasing. From Figure 2 we can suspect roughly a quasi-periodic variation.

Then our all new times of light maxima were combined with the old ones to get a whole data set. The results of the linear fit are

T_0=2434308.4296±0.0002,

P_0=0.061038333±0.000000001 days. Figure 3 shows the O−C diagram using linear fit with the whole data. From Figure 3 we can find a new variation.

There are two possible interpretations for the new variation. One of them is a light-time effect caused by the orbital motion of CY Aqr around the mass center of a binary system with an unseen companion. The orbital period would be about 50 years. The other explanation that the rate of period change had a jump from a negative value to a positive value. If we cut the whole data at about 1970 ($E\sim10^5$) to obtain two parts, their rates of period changes would be about -5.4×10^{-13} day/cycle for the first part and 1.05×10^{-12} day/cycle for the second part according to the fits with parabolic curves. Because our new times of light maxima cover rather short time span, any kind of further fit cannot provide more reliable information about the real period variation. More regular observations are needed to check which one is real.

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PHOTOMETRY OF STARS IN THE FIELD OF THE MIRA YZ DRACONIS

YZ Draconis (= IRC +70156 = IRAS 19243+7135 = GSC 4452–0864) is a Mira variable that has been relatively well studied at infrared and millimeter wavelengths. The star was found to be a water maser by Crocker and Hagen (1983), who also gave the first accurate position, which was measured by S. G. Kleinmann and R. R. Joyce. The visual light curve exhibits a cycle length near 348 days, with maxima around mag. 10. The spectrum has been classified by Vyssotsky (1946) as M8e.

There are three accurate positions in the literature for the star, which are summarized here for equinox 2000:

	RA (2000)	Dec (2000)	
YZ Draconis:	$19^h23^m45^s.3$	+71°41' 14"	(Crocker & Hagen 1983)
	19 23 45.5	+71 41 12	(IRAS)
	19 23 45.2	+71 41 14	(Guide Star Catalog)

At the request of Charles Scovil of the American Association of Variable Star Observers, I made photoelectric observations of several stars in the field to improve the magnitudes of a comparison sequence on a preliminary AAVSO chart for the variable.

I observed the stars using the Lowell 53cm photometric telescope on 8 October 1992, and 20 and 21 May 1993 UT. Strömgren y and b filters were used through either a 19- or 29-arcsec diaphragm. Each observation consisted of at least four 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers for stars fainter than about mag. 10. The range of colors found among randomly-selected field stars is usually well outside the limits of the primary four-color standards, which include no K-giant stars fainter than V = 5.0. Thus a set of secondary standards was adopted to enable the calibration of V magnitudes of red and reddened stars, which occur in abundance all over the sky. V magnitudes were taken mostly from the lists of Landolt (1983a, 1983b, 1992), supplemented by values from Menzies et al. (1991). Strömgren $b-y$ colors were taken from the primary four-color standards list of Perry, Olsen, and Crawford (1987), plus much-observed stars from lists by Olsen (1983, 1993), Anthony-Twarog, et al. (1991), and Stetson (1991) – in that order of preference. Some V magnitudes come from these sources as well. Several of the Landolt stars have $b-y$ values determined using the Lowell 53cm telescope. The data for each night were reduced separately using linear transformations. Atmospheric extinction was estimated on these nights from measurements taken on other nights near this time.

Because of the mix of standards, Table 1 shows both the adopted and observed mean V and $b-y$, and the number of observations 'n'. The stars are listed in RA order. The

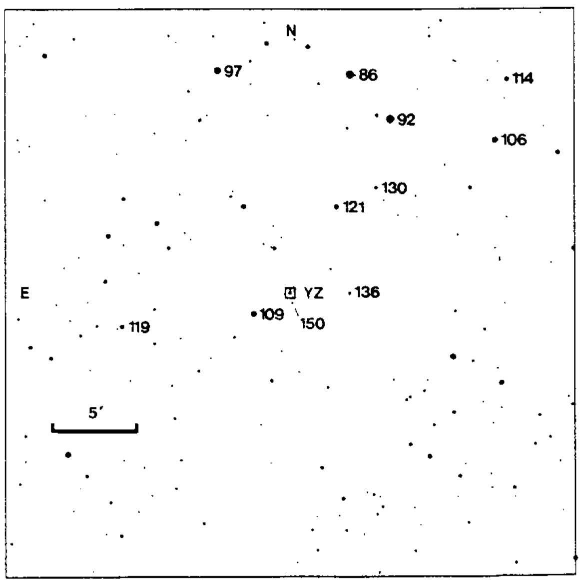

Figure 1. The field of YZ Draconis showing stars from the GSC.
V magnitudes are indicated to the nearest tenth with the decimal point omitted.

Table 1. Standard Star Observations.

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 143761	5.403	0.396	5.406	0.393	2
HD 149382	8.944	−0.146	8.955	−0.145	1
HD 153847	7.241	0.244	7.238	0.247	1
HD 160233	9.095	0.031	9.100	0.032	1
HD 160471	6.155	1.162	6.158	1.164	2
HD 161817	6.982	0.137	6.969	0.139	1
BD +04°3508	9.326	1.179	(9.359)	1.188	1
HD 162596	6.342	0.717	6.342	0.717	1
HD 172365	6.369	0.510	6.362	0.511	1
HD 172829	8.474	1.383	8.475	1.369	1
HD 182239	6.657	0.167	6.653	0.168	1
HD 184914	8.178	0.799	8.186	0.804	1
HD 184965	8.529	0.306	8.534	0.300	1
HD 186427	6.230	0.417	6.230	0.415	3
BD −00°4073	9.905	0.776	9.892	0.781	1
HD 199280	6.583	−0.030	6.583	−0.039	1
HD 209960	5.254	0.897	5.253	0.897	1
HD 218155	6.783	−0.004	6.779	−0.001	1
HD 222732	8.860	0.735	(8.835)	0.733	1

V data for two stars (in parentheses) were omitted from the transformations. The mean deviations of the observed averages from the assumed values in this group of data are: V = −0.001 ± 0.007; $b-y$ = 0.000 ± 0.005.

Results for the stars near YZ Dra are shown in Table 2, listed in order of decreasing brightness. The stars are identified by HD, BD, or GSC number; positions come from either astrometric catalogues (for the brighter stars) or the GSC. Rough spectral types are available for a few brighter stars, obtained from the SIMBAD database. The stars fainter than mag. 12.0 were observed on two nights, and the standard deviations of the means are shown in the second line of each entry. The faintest star in the list, GSC 4452-1050, is well beyond the comfortable limits of Strömgren photometry with the 53cm telescope. Thus although the V magnitudes on the two nights are felicitously consistent, a more realistic estimate of the true uncertainty can be found under the $b-y$ color, whose error is in line with that expected from photon statistics.

Table 2. Photometry of Stars in the Field of YZ Dra.

Name	RA (2000)	Dec (2000)	V	$b-y$	n	spec
HD 183382	$19^h22^m59^s.0$	+71°54' 15"	8.575	0.193	1	A5
HD 183278	19 22 28.0	+71 51 34	9.185	0.237	1	F0
BD +71°0954	19 24 40.4	+71 54 27	9.676	0.164	1	
GSC 4452-0994	19 21 07.9	+71 50 15	10.648	0.689	1	
BD +71°0952	19 24 12.8	+71 39 59	10.874	0.255	1	A0
GSC 4452-0852	19 20 58.4	+71 53 52	11.357	0.246	1	
GSC 4452-1132	19 25 51.6	+71 39 12	11.866	0.386	1	
GSC 4452-1508	19 23 09.5	+71 46 21	12.135	0.912	2	
			.009	.010		
GSC 4452-1492	19 22 39.5	+71 47 30	13.030	0.547	2	
			.019	.013		
GSC 4452-1098	19 24 52.1	+71 41 12	13.622	0.599	2	
			.013	.024		
GSC 4452-1050	19 23 43.6	+71 40 39	15.017	0.841	2	
			.012	.158		

For the convenience of observers, a chart derived from the GSC is shown in Figure 1. The comparison stars are indicated by their V magnitudes rounded to the nearest tenth (decimal point omitted) in the style of visual variable-star charts.

The photometric data herein were reduced using a clever IDL routine written by Laura Woodney with help from Eliza Fulton and Hugo Spencer. Preparation of this report was facilitated by the use of SIMBAD, maintained by the Centre de Données astronomiques, Strasbourg, France.

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PHOTOMETRY OF STARS IN THE FIELD OF THE MIRA XY AQUILAE

XY Aquilae (= IRC +00147 = IRAS 19123+0409) is a Mira variable with a cycle length of about 423 days and a maximum brightness of about visual magnitude 9.5. A spectral type of M8 was determined by Cameron and Nassau (1956) from objective-prism plates in the red region. A precise position and finder chart was published by Wolf and Wolf (1905) in the paper announcing the discovery of variability. The position is confirmed by measures appearing in the IRAS catalogue and Guide Star Catalog, as summarized below:

	RA (2000)	Dec (2000)	source
XY Aquilae:	$19^h14^m51^s.2$	+4°14' 31"	Wolf & Wolf (1905)
	50.9	29	IRAS
	51.0	31	GSC

At the request of Charles Scovil of the American Association of Variable Star Observers, I made photoelectric measurements of several stars in the field in order to improve the comparison sequence on a preliminary AAVSO chart for the variable. The existing sequence was based mostly on eye estimates, and contained substantial scatter and a scale error.

I observed the stars using the Lowell 53cm photometric telescope on 8 October 1992, and 20-23 May 1993 UT. Strömgren y and b filters were used through either a 19- or 29-arcsec diaphragm. Each observation consisted of at least four 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers for stars fainter than about mag. 10. The range of colors found among randomly-selected field stars is usually well outside the limits of the primary four-color standards, which include no K-giant stars fainter than V = 5.0. Thus a set of secondary standards was adopted to enable the calibration of V magnitudes of red and reddened stars, which occur in abundance all over the sky. V magnitudes were taken mostly from the lists of Landolt (1983a, 1983b, 1992), supplemented by values from Menzies et al. (1991). Strömgren $b - y$ colors were taken from the primary four-color standards list of Perry, Olsen, and Crawford (1987), plus much-observed stars from lists by Olsen (1983, 1993), Anthony-Twarog, et al. (1991), and Stetson (1991) – in that order of preference. Some V magnitudes come from these sources as well. Several of the Landolt stars have $b - y$ values determined using the Lowell 53cm telescope. The data for each night were reduced separately using linear transformations. Atmospheric extinction was estimated on these nights from measurements taken on other nights near this time. Because of the mix of standards, Table 1 shows both the adopted and observed mean V and $b - y$, and the number of observations 'n'. The stars are listed in RA order. The V data for two stars (in parentheses) were omitted from the transformations. The mean deviations of the observed averages from the assumed values in this group of data are: V = −0.001 ± 0.006; $b - y$ = 0.000 ± 0.004.

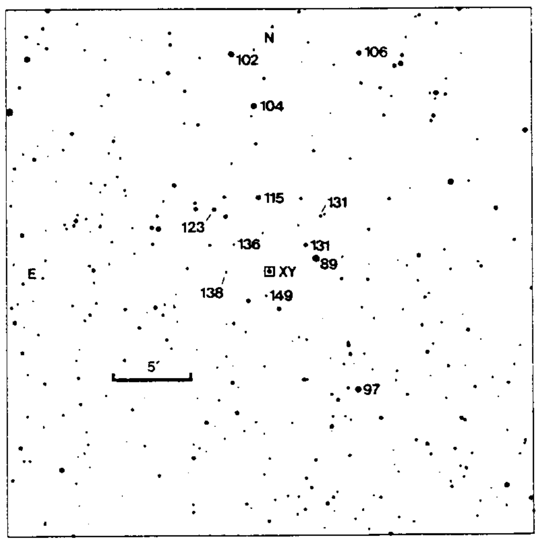

Figure 1. The field of XY Aquilae showing stars from the GSC.
V magnitudes are indicated to the nearest tenth with the decimal point omitted.

Table 1. Standard Star Observations.

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 143761	5.403	0.396	5.406	0.393	4
HD 149382	8.944	−0.146	8.952	−0.144	2
HD 153847	7.241	0.244	7.239	0.249	2
HD 160233	9.095	0.031	9.100	0.032	1
HD 160471	6.155	1.162	6.160	1.165	4
HD 161817	6.982	0.137	6.969	0.139	1
BD +04°3508	9.326	1.179	(9.359)	1.188	1
HD 162596	6.342	0.717	6.338	0.716	2
HD 165462	6.336	0.700	6.333	0.696	1
HD 172365	6.369	0.510	6.359	0.514	2
HD 172829	8.474	1.383	8.473	1.378	3
HD 182239	6.657	0.167	6.653	0.168	1
HD 184914	8.178	0.799	8.186	0.804	1
HD 184965	8.529	0.306	8.533	0.308	2
HD 186427	6.230	0.417	6.232	0.415	4
HD 187203	6.448	0.614	6.443	0.611	1
HD 190299	5.666	0.825	5.666	0.821	1
BD −00°4073	9.905	0.776	9.892	0.781	1
HD 199280	6.583	−0.030	6.583	−0.039	1
HD 209960	5.254	0.897	5.253	0.897	1
HD 218155	6.783	−0.004	6.779	−0.001	1
HD 222732	8.860	0.735	(8.835)	0.733	1

Results for the stars near XY Aql are shown in Table 2, listed in order of decreasing brightness. The stars are identified by HD or GSC number; positions come from either astrometric catalogues or the GSC. Rough spectral types are available for the two brighter stars, obtained from the SIMBAD database. Some of the fainter stars were observed on two or three nights, and the standard deviations of the means are shown in the second line of each entry.

HD 179989 has been used as a standard for observations of Cepheid variables by Moffett and Barnes (1984), who give the values V = 8.882 and B−V = 1.288 from the means of many observations.

The very red star GSC 0471-2225 showed no signs of variability beyond that expected from observation error, but the observations were made on three consecutive nights. It is worth noting that the magnitude and color required large extrapolations (assumed linear) of the calibration coefficients, despite including HD 172829 as a standard star (it is the reddest Landolt standard brighter than mag. 10).

The faintest star in the list is well beyond the comfortable limits of Strömgren photometry with the 53cm telescope. The uncertainty expected from photon statistics is about 0.08 mag., but uncertainty in the sky readings on the night this star was measured adds an additional source of error. The values for this star should therefore be regarded as approximate.

Table 2. Photometry of Stars in the Field of XY Aquilae.

Name	RA (2000)	Dec (2000)	V	$b-y$	n	spec
HD 179989	$19^h14^m38\overset{s}{.}9$	+4°15' 22"	8.865	0.845	1	K2
HD 179969	19 14 28.3	+4 06 56	9.665	0.407	1	F2
GSC 0472-1448	19 15 00.6	+4 28 32	10.244	0.546	1	
GSC 0471-1431	19 14 54.9	+4 25 12	10.384	0.497	1	
GSC 0471-0744	19 14 27.7	+4 28 36	10.610	0.312	1	
GSC 0471-1092	19 14 53.7	+4 19 18	11.510	0.340	1	
GSC 0472-0297	19 15 05.1	+4 18 33	12.270	0.343	2	
			.008	.003		
GSC 0471-2225	19 14 41.7	+4 16 14	13.089	1.768	3	
			.036	.019		
GSC 0471-1679	19 14 37.8	+4 18 06	13.143	0.692	1	
J191500+0416.2	19 15 00	+4 16.2	13.566	0.628	1	
J191500+0414.3	19 15 00	+4 14.3	13.798	0.561	2	
			.054	.004		
J191415+0412.5	19 14 15	+4 12.5	14.882	0.425	1	

For the convenience of observers, a chart derived from the GSC is shown in Figure 1. The comparison stars are indicated by their V magnitudes rounded to the nearest tenth (decimal point omitted) in the style of visual variable-star charts.

The photometric data herein were reduced using a clever IDL routine written by Laura Woodney and Eliza Fulton. Preparation of this report was facilitated by the use of SIMBAD, maintained by the Centre de Données astronomiques, Strasbourg, France.

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PHOTOMETRY OF STARS IN THE FIELD OF THE MIRA EL LYRAE

EL Lyrae is a little-studied Mira having a maximum brightness around visual magnitude 11 and a period near 234 days. At the request of Charles Scovil of the American Association of Variable Star Observers, I observed several stars in this field as a check on an existing comparison sequence on the AAVSO chart for the variable. The new sequence covers the magnitude interval 10.2 < V < 13.7 with ten stars.

The observations were made on 25 August and 5 September 1992 UT using the Lowell Observatory 53cm photometric telescope. The stars were observed through a 19-arcsec diaphragm with Strömgren y and b filters. Each observation consisted of a minimum of four 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers of integrations for the fainter stars. All the standard stars are from the lists of Landolt (1983a, 1983b, 1992). The V magnitudes were adopted directly, sometimes supplemented with values from Menzies et al. (1991). The $b-y$ colors were determined using same telescope against primary Strömgren four-color standards. The data for each night was reduced separately using linear transformations. Atmospheric extinction was estimated on these nights from measurements taken on other nights near this time. Average per star residuals (standard deviation) were ± 0.004 in V and ± 0.006 in $b-y$ on 25 August, and ± 0.006 and ± 0.001 on 5 September.

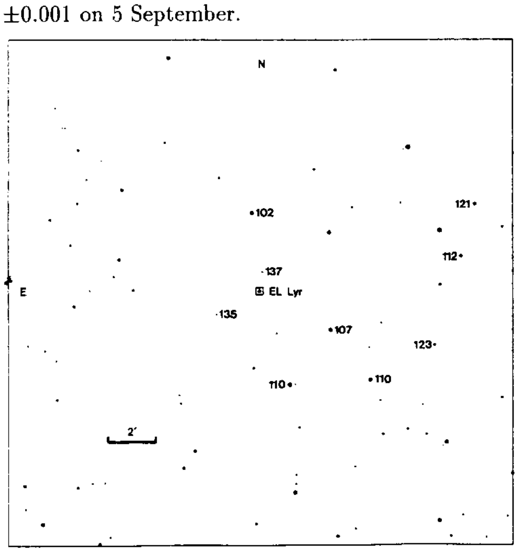

Figure 1. The field of EL Lyrae showing stars from the GSC. V magnitudes are indicated to the nearest tenth of a magnitude with the decimal point omitted.

Table 1. Standard Star Observations

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 315	6.440	−0.078	6.444	−0.074	1
HD 5319	8.046	0.601	8.043	0.601	2
BD −00°3353	9.332	0.967	9.324	0.967	1
HD 161817	6.982	0.135	6.981	0.133	2
BD +04°3508	9.326	1.188	9.324	1.187	1
HD 172829	8.465	1.385	8.472	1.386	1
HD 175544	7.395	0.144	7.400	0.142	1
HD 184914	8.178	0.799	8.176	0.795	1
BD −00°4073	9.905	0.776	9.907	0.779	2
HD 200340	6.509	−0.031	6.510	−0.046	1
HD 209796	8.933	0.734	8.943	0.742	1
HD 215141	9.239	0.962	9.238	0.960	2
HD 218155	6.783	−0.005	6.782	−0.000	3

Table 2. Photometry of Stars in the Field of EL Lyrae

Name	RA (2000)	Dec (2000)	V	$b-y$	remarks
BD +31°3510	$19^{h}13^{m}22^{s}.3$	+32°06' 35"	10.17	1.04	M0; n=2
			.01	.02	
GSC 2657-2001	19 13 06.8	+32 01 41	10.68	0.68	
			.02	.02	
GSC 2657-2310	19 13 14.8	+31 59 23	10.99	0.78	
			.01	.03	
GSC 2657-2081	19 12 58.9	+31 59 35	10.99	0.73	
			.02	.03	
GSC 2657-1594	19 12 41.1	+32 04 46	11.17	0.35	
			.02	.03	
GSC 2657-1946	19 13 20.8	+32 03 18	11.88	1.48	= EL Lyr,
			.03	.03	1992 Aug 25.2 UT
GSC 2657-2313	19 12 38.3	+32 06 56	12.12	0.79	
			.02	.03	
GSC 2657-2465	19 12 46.4	+32 01 02	12.35	0.37	
			.03	.03	
anon	19 13 29	+32 02.5	13.54	0.35	
			.05	.05	
GSC 2657-1986	19 13 20.3	+32 04 06	13.72	0.39	
			.02	.03	

The standards observed are listed in Table 1 along with the adopted and observed V and $b-y$ colors, and the number of observations 'n'. The mean deviations of the observed averages from the assumed values listed in Table 1 are: V = 0.001 ± 0.005; $b-y$ = 0.000 ± 0.006. The red stars in this field necessitated the use of standards other than the canonical ones defining the four-color system. The main goal was V magnitudes for use of visual observers, so the $b-y$ colors were needed solely to determine the color term in the instrumental V magnitudes, and not for temperatures or other indices ordinarily derived from Strömgren photometry. Among the stars observed here, only EL Lyrae itself is redder than the reddest standard; linear extrapolations of the transformations were used to determine its magnitude and color. Since the transformations appear to be linear over the range $-0.08 < b-y < 1.38$ (avoiding dwarfs later than about K0), there would seem to be little concern in extrapolating them by a tenth of a magnitude.

The results for the EL Lyrae field are given in Table 2, listed in order of decreasing brightness. Only the brightest star appears in a common star catalogue. Identifications and J2000 positions from the Guide Star Catalog are provided for the remainder. Except for BD +31°3510, the stars were observed on only one night. The uncertainties listed in the second line of each entry are thus the rms errors on each batch of integrations; these should be representative of the external uncertainties. Because the stars are fairly faint for the telescope involved and since they were observed on only one night, the data are given to a precision of two decimals instead of three, as is usual for Strömgren photometry.

The M-giant star BD +31°3510 showed no variation beyond observational errors in the ten days between the two observations.

For the convenience of observers, a chart based on the GSC is shown in Figure 1. The comparison stars are indicated by their magnitudes rounded to the nearest tenth of a magnitude (decimal point omitted) in the style of visual variable-star charts.

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PHOTOMETRY OF STARS IN THE FIELD OF WZ CASSIOPEIAE

WZ Cassiopeiæ is a bright, thoroughly-studied carbon star that varies irregularly over a range of about 1.5 magnitudes. It has recently been made a spectral-type standard by Keenan (1992) for carbon stars showing strong lithium lines.

I made photoelectric measurements of several stars near the variable in order to provide a check on the comparison sequence on an AAVSO chart for the star. The existing sequence, although tried-and-true, has not been re-evaluated since photometric scales became standardized in the post-War era.

I observed the stars using the Lowell 53cm photometric telescope on two nights with strong moonlight, 10 September 1992 and 30 December 1993 UT. Strömgren y and b filters were used through a 29-arcsec diaphragm. Each observation consisted of at least three 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers for stars fainter than about mag. 9. A set of secondary standards was adopted to enable the calibration of V magnitudes of red and reddened stars beyond the color limits of primary Strömgren standards. V magnitudes were taken mostly from the lists of Landolt (1983a, 1983b, 1992), supplemented by values from Menzies et al. (1991). Strömgren $b - y$ colors were taken from the primary four-color standards list of Perry, Olsen, and Crawford (1987), plus much-observed stars from lists by Olsen (1983, 1993), Anthony-Twarog, et al. (1991), and Stetson (1991) – in that order of preference. Some V magnitudes come from these sources as well. Several of the Landolt stars have $b - y$ values determined using the Lowell 53cm telescope. The data for each night were reduced separately using linear transformations. Atmospheric extinction was estimated on these nights from measurements taken on other nights near this time.

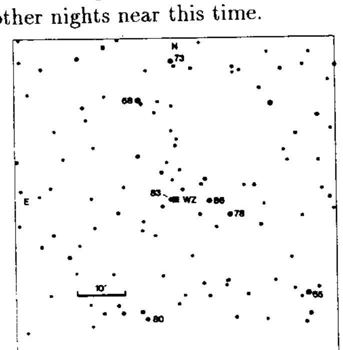

Figure 1. The field of WZ Cassiopeiae showing stars from the GSC brighter than mag. 11. V magnitudes are indicated to the nearest tenth with the decimal point omitted.

Table 1. Standard Star Observations

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 224930	5.748	0.430	5.754	0.440	1
HD 225003	5.699	0.200	5.710	0.205	1
HD 315	6.440	−0.078	6.450	(−0.097)	1
HD 4790	6.624	0.862	6.622	0.867	2
HD 5319	8.046	0.607	8.043	0.600	2
HD 6479	6.363	0.258	6.349	0.252	1
HD 6480	7.267	0.321	7.259	0.318	1
HD 7615	6.693	0.025	6.691	0.027	2
HD 13421	5.635	0.361	5.634	0.356	2
HD 16581	8.195	−0.033	8.203	−0.036	1
HD 22211	6.487	0.408	6.496	0.399	1
HD 22695	6.189	0.585	6.185	0.588	2
HD 24482	8.188	1.256	8.192	1.256	2
HD 26462	5.707	0.231	5.713	0.233	1
HD 205556	8.313	−0.024	8.309	−0.018	1
HD 215141	9.239	0.962	9.245	0.960	2
HD 218155	6.783	−0.004	6.781	−0.003	3
HD 222732	8.860	0.735	8.858	0.736	2

Because of the mix of standards, Table 1 shows both the adopted and observed mean V and $b-y$, and the number of observations 'n'. The stars are listed in RA order. The $b-y$ data for HD 315 (in parentheses) were omitted from the transformations. The mean deviations of the observed averages from the assumed values in this group of data are: V = +0.001 ± 0.007; $b-y$ = 0.000 ± 0.005.

Results for the stars near WZ Cas are shown in Table 2, listed in order of decreasing brightness. The stars are identified by HD number; positions come from astrometric catalogues via SIMBAD, which is also the source of the spectral types from the literature. Stars observed on two or three nights have the standard deviation of the means listed in the second line of each entry.

Since all the stars are fairly bright, several have V or $b-y$ previously published, and these are listed in the remarks. Several stars deserve special mention:

The color of WZ Cas is far outside the range of colors of the standards, and so the values listed should be considered to be on a natural extension of the instrumental system as defined by the standards. The data for this star were taken on 1993 December 30.15 UT.

HD 224869, the optical companion to WZ Cas, has been considered a suspect small-amplitude variable by Halbedel (1987). The two M-giant stars, HD 224980 and HD 224754, are also likely to be somewhat variable, but the limited photometric evidence here is not compelling in either case.

For the convenience of observers, a chart derived from the GSC is shown in Figure 1. The comparison stars are indicated by their V magnitudes rounded to the nearest tenth (decimal point omitted) in the style of visual variable-star charts.

Table 2. Photometry of Stars in the Field of WZ Cas

Name	RA (2000)	Dec (2000)	V	$b-y$	n	Sp.	remarks
HD 224404	$23^h57^m33^s.4$	+60°01' 25"	6.459	0.059	2	B9III-IV	V=6.47, $b-y$=0.051
			.007	.001			
HD 224980	0 02 17.7	+60 42 12	6.791	1.175	2	M0	V=6.73
			.015	.008			
HD 224855	0 01 15.6	+60 21 19	7.067	2.162	1	C-N7III:	= WZ Cas; V=7.16
HD 224868	0 01 21.6	+60 50 22	7.265	0.168	2	B0Ib	V=7.25,7.27
			.011	.002			
HD 224655	23 59 43.3	+60 18 08	7.835	0.711	2	K2	
			.001	.011			
HD 224940	0 02 03.7	+59 56 23	7.964	0.605	1	G9III	V=7.96
HD 224869	0 01 23.5	+60 21 20	8.346	0.084	2	B2ne	V=8.29,8.30
			.007	.000			
HD 224754	0 00 18.1	+60 21 02	8.638	1.409	1	M5	

The photometric data herein were reduced using a clever IDL routine written by Laura Woodney and Eliza Fulton. Preparation of this report was facilitated by the use of SIMBAD, maintained by the Centre de Données astronomiques, Strasbourg, France.

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SHORT PERIOD PHOTOMETRIC OSCILLATIONS IN V 795 HERCULIS

We present results of CCD photometry of the cataclysmic variable V 795 Herculis (=PG 1711 + 336) obtained on three nights in May 1992. At least on one night the photometric variability is time resolved and shows a pronounced preferred time-scale of 0.48 hours. This behaviour is similar to the one reported by Zhang et al. (1991).

The peculiar binary system V 795 Her presents a rare example of a cataclysmic variable inside the so called period gap (Shafter et al. 1990). Its spectroscopic period of 2.598 hour is 12 minutes shorter than the photometric one. This led Shafter et al. to classify the system as an intermediate polar. In this model the spectroscopic period represents the true orbital period of the system, while the photometric period results from a beat between the orbital period and the rotation period of the white dwarf. We note that V 795 Her may be peculiar with respect to this model, because it is not known as a (strong) X-ray source as many other polar emission stars are. On the other hand, it has been pointed out (Zhang et al. 1991) that the tight correlation between polar emission stars and X-ray sources may be a selection effect. It is also quite interesting to note, that a weak X-ray source has recently been detected in the direction of V 795 Her by ROSAT (Prinja & Rosen 1993).

In addition to photometric variability with the 2.7957 hour period, the object shows pronounced flickering on shorter time-scales. In 1989 Ashoka et al. claimed a detection of several quasi periods. Warner (1989) justly criticized this interpretation as not sufficiently supported by available data. Subsequently Shafter et al. (1990) confirmed the flickering, but found no significant enhancement of power at periods shorter than 1 hour. However Zhang et al. (1991) suggest that "the rapid variations (in light curves of V 795 Her) have a preferred time scale of 10-20 minutes and may be quasiperiodic." The coherence time of these variations was found to be of the order of 10 cycles. It is clear, that more observations are needed in order to elucidate the nature of these so far contradictory conclusions about the properties of photometric flickering.

In this paper we present the results of CCD photometry in the V photometric band obtained with the 0.36-m, f/11 Schmidt-Cassegrain telescope at the observing station Črni Vrh (Slovenia). On each of the three nights a sequence of 2 minute exposures was obtained. The CCD camera built by Wright Instruments contains a front-side illuminated EEV P86000 (574 × 385 pixel) chip which is cooled to $-76\ ^{o}C$ by a four stage Peltier cooler. The linearity and cosmetics of the chip are very good and the dark current is low (0.06 e^{-}/sec/pixel). The V filter made of Schott glass conforms to the Johnson standard (Bessell 1990). Data was collected by a PC and then transferred to a Vax mainframe, where it was reduced with the Daophot II package. This same hardware and software setup has been tested against the M67 sequence (Chevalier & Ilovaisky 1991) and no systematic errors were detected.

Relative photometry of V 795 Her vs. Star I.
Time at mid-exposure is given in units of JD−2,448,700.

56.4213	1.90	56.4840	1.91	56.5397	1.75	68.4755	1.77	71.3809	1.75
56.4228	1.87	56.4855	1.95	56.5412	1.76	68.4770	1.70	71.3827	1.84
56.4324	1.88	56.4870	1.94	56.5427	1.78	68.4785	1.73	71.3842	1.84
56.4342	1.89	56.4885	1.94	56.5444	1.77	68.4803	1.73	71.3858	1.84
56.4364	1.77	56.4901	1.88	56.5459	1.83	68.4819	1.68	71.3873	1.80
56.4379	1.82	56.4916	1.88	56.5475	1.82	68.4834	1.74	71.3889	1.78
56.4394	1.88	56.4931	1.89	56.5490	1.73	68.4849	1.77	71.3904	1.83
56.4410	1.85	56.4946	1.86	56.5505	1.76	68.4865	1.84	71.3919	1.82
56.4425	1.84	56.4962	1.82	56.5521	1.76	68.4880	1.80	71.3934	1.88
56.4440	1.82	56.4978	1.74	56.5536	1.83	68.4895	1.68	71.3950	1.84
56.4455	1.81	56.4994	1.74	56.5555	1.80	68.4911	1.80	71.3965	1.72
56.4471	1.86	56.5024	1.78	56.5571	1.70	68.4926	1.72	71.3980	1.87
56.4486	1.80	56.5039	1.82	56.5586	1.72	68.4941	1.68	71.3996	1.81
56.4501	1.87	56.5055	1.87	56.5601	1.74	68.4959	1.81	71.4011	1.74
56.4516	1.79	56.5070	1.87	56.5617	1.71	68.4974	1.79	71.4026	1.84
56.4532	1.78	56.5085	1.78	68.4384	1.60	68.4989	1.71	71.4041	1.90
56.4547	1.78	56.5101	1.74	68.4399	1.66	68.5005	1.69	71.4057	1.91
56.4562	1.82	56.5116	1.78	68.4415	1.71	68.5020	1.65	71.4072	1.86
56.4577	1.82	56.5132	1.78	68.4430	1.76	68.5040	1.65	71.4088	1.83
56.4593	1.81	56.5148	1.82	68.4445	1.71	68.5056	1.72	71.4103	1.86
56.4608	1.73	56.5163	1.76	68.4462	1.74	68.5072	1.75	71.4118	1.87
56.4623	1.76	56.5178	1.72	68.4477	1.81	68.5087	1.78	71.4133	1.84
56.4638	1.78	56.5194	1.70	68.4493	1.74	68.5105	1.82	71.4149	1.86
56.4654	1.83	56.5211	1.68	68.4557	1.78	68.5120	1.82	71.4164	1.72
56.4669	1.79	56.5226	1.73	68.4572	1.82	68.5136	1.76	71.4179	1.73
56.4684	1.84	56.5242	1.78	68.4588	1.81	68.5151	1.79	71.4195	1.74
56.4700	1.83	56.5257	1.84	68.4603	1.77	68.5166	1.91	71.4210	1.89
56.4715	1.88	56.5272	1.85	68.4618	1.83	68.5184	1.86	71.4225	1.88
56.4730	1.82	56.5289	1.83	68.4643	1.77	68.5200	1.81	71.4241	1.84
56.4745	1.82	56.5304	1.71	68.4659	1.79	71.3676	1.72	71.4256	1.84
56.4761	1.77	56.5319	1.75	68.4674	1.80	71.3695	1.74	71.4271	1.84
56.4776	1.78	56.5334	1.74	68.4689	1.75	71.3710	1.73		
56.4791	1.79	56.5350	1.75	68.4704	1.75	71.3726	1.84		
56.4806	1.84	56.5366	1.74	68.4724	1.73	71.3741	1.73		
56.4824	1.89	56.5382	1.79	68.4739	1.71	71.3756	1.73		

The field of view of the CCD is $9' \times 12'$ and contains several suitable comparison stars. Our prime standard, the 10^m star I, lies 7' N and 1' W of V 795 Her at the GSC coordinates $\alpha_{2000} = 17^h12^m\,52^s\!.5$, $\delta_{2000} = 33^o34'45"$. Checking star I against the secondary standard star located 5' E of V 795 Her, we found the flux from Star I to be constant to within 0.017 mag. The standard deviation for relative photometry of V 795 Her versus star I was found to be 0.02 mag. It was derived on the basis of the relative photometry of a star fainter than V 795 Her located 2' SE of it (i.e. the bright star seen at the lower edge of the finding chart published by Downes & Shara 1993). Throughout this paper the absolute photometric V magnitude of V 795 Her is calculated from relative photometric data assuming the V magnitude 10.52 for Star I, as given in the HST GSC catalogue.

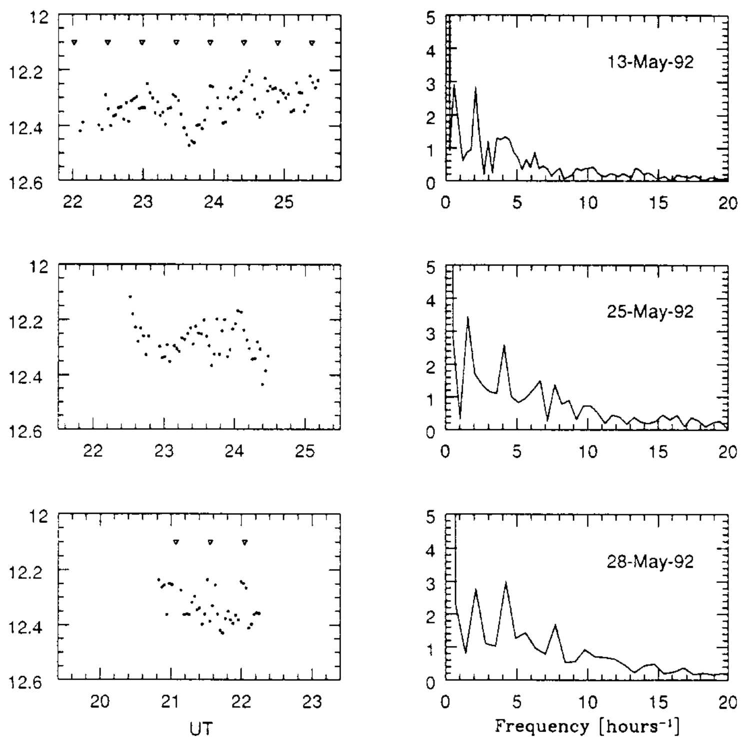

Figure 1. V band light curves of V 795 Herculis
and their power spectra. See text

The results are presented in Figure 1. Graphs on the left show V magnitudes of V 795 Her for each of the three nights. The graphs on the right show the corresponding power spectra where the intensity unit is one per cents of the continuum intensity (0.01^m). Each night is labelled by its evening date. All spectra show significant power peaks. The lowest frequency peaks in the spectra of the first two nights have poorly defined frequencies and are most likely harmonics of the 2.8 hour photometric period. However the peaks at the frequency of 2.1 ± 0.1 h^{-1} in the spectra of May 13 and May 28 are not harmonics of either the photometric 2.8-hour or the spectroscopic 2.6-hour period. We cannot exclude the presence of variability with this frequency on the night of May 25 though the power is clearly much lower. Power peaks at the frequency of ~ 4 h^{-1} can be interpreted as the first harmonic of the 2.1 h^{-1} frequency.

The properties of the window function have been studied with an artificial data set assuming that a constant intensity was measured at the actual observing times. The corresponding power spectra show no power enhancement at or near the 2.1 h^{-1} frequency. Moreover the reality of the 0.48 hour timescale can be checked by visual inspection of positions of triangles in the first and the last graph on the left which mark the times of maxima of the 0.48 hour sinusoid.

Powers around the 0.48 hour time-scale and its first harmonic are comparable. Time span of observations obtained on each of the nights is rather short so we cannot exclude the possibility that the preferred timescale is actually the first harmonic with the period of $\sim 0.48/2$ hour. If so, the observed flickering is similar to the one reported by Zhang et al. (1991) who claimed a detection of QPO oscillations with periods between 970 and 1240 seconds.

To conclude, our results agree with the claim by Zhang et al. (1991) that short timescale photometric variability can have a coherence time of a few hours so that the corresponding power spectrum shows significant power enhancements. However absence of such behaviour in other published power spectra and differences between the spectra we obtained on different nights exclude the possibility of a pronounced and stable photometric period between a few minutes and one hour.

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MARKED AND SHORT TIME-SCALE CHANGES IN THE CH Cyg EMISSION LINE PROFILES OBSERVED IN NOVEMBER 1993

CH Cyg has been known for a long time as a bright (m_{vis} ~7 mag) M-type semi-regular variable. It has been only after 1963 that it started to show an increasing level of activity which manifested through five distinct *bright* or *outburst* phases (Deutsch 1964; Mikolajewski *et al.* 1990; Skopal *et al.* 1993). CH Cyg is a binary system composed of an M6-7 giant and a probably magnetic WD, the latter being eclipsed every 16 yr (Mikolajewski *et al.* 1987). CH Cyg is usually associated with the symbiotic stars.

The 5^{th} and still ongoing bright phase has begun in the summer of 1989 (Tomov *et al.* 1989; Mikolajewski *et al.* 1990; Tomov and Mikolajewski 1992; Kuczawska *et al.* 1992). CH Cyg is presently still rising in brightness (Mikolajewski *et al.* 1992; Skopal *et al.* 1993; Leedjärv 1993). Large amplitude flickering has been observed in U as well as in B and V bands, and marked variations in the emission line spectrum have been announced. Particularly interesting are the reports of large line profile changes over a few days time interval and the presence of emission and/or absorption components of Balmer lines with radial velocity of several hundred km/s (Aufdenberg *et al.* 1993; Leedjärv 1993).

CH Cyg has been regularly monitored at the Asiago Astrophys. Obs. with CCD spectrograph since 1986. We have a large collection of low resolution, absolutely calibrated spectra over the region 3350-11000 Å as well as high resolution Echelle spectra. The results of this long term monitoring will be presented elsewhere. However, prompted by the mentioned reports of large and short time-scale emission line profile variations, in this note we briefly describe the results of our search for such events over a 48 hour time interval in late November 1993. The observations of Hα and Hβ profiles presented in Figure 1 were secured on Nov. 25 and 27 1993, with the Echelle+CCD spectrograph attached to the Asiago 1.82 m telescope. The spectral resolution (from the width of thorium comparison lines) is ~0.3 Å FWHM for the Hα region and 0.2 Å FWHM for the Hβ region. The S/N ratio of the continuum in the original spectra varies from 135 to 60. The wavelength scale of the Asiago Echelle+CCD spectrograph is particularly well suited for accurate radial velocity works as demonstrated in the model study of Munari & Lattanzi (1992).

The profiles presented in Figure 1 show two basic facts: (a) there are features whose intensities and radial velocities remain pretty well fixed (like the main emission peak and the absorption component with the less negative velocity) and (b) there are other features – those at most extreme |RV| values – which present dramatic changes over time scales of hours or very few days. The latter fact is particularly evident in the region of Hβ profiles where the broad emission seen centered at λ_o 4853 Å on 25.11.93 is missing two days later and the deep absorption centered at λ_o 4857 Å on 27.11.93 was not visible two days earlier. The lack of corresponding features in the Hα profiles (recorded simultaneously with Hβ) is quite puzzling and questions the direct link of these features with high speed hydrogen clouds.

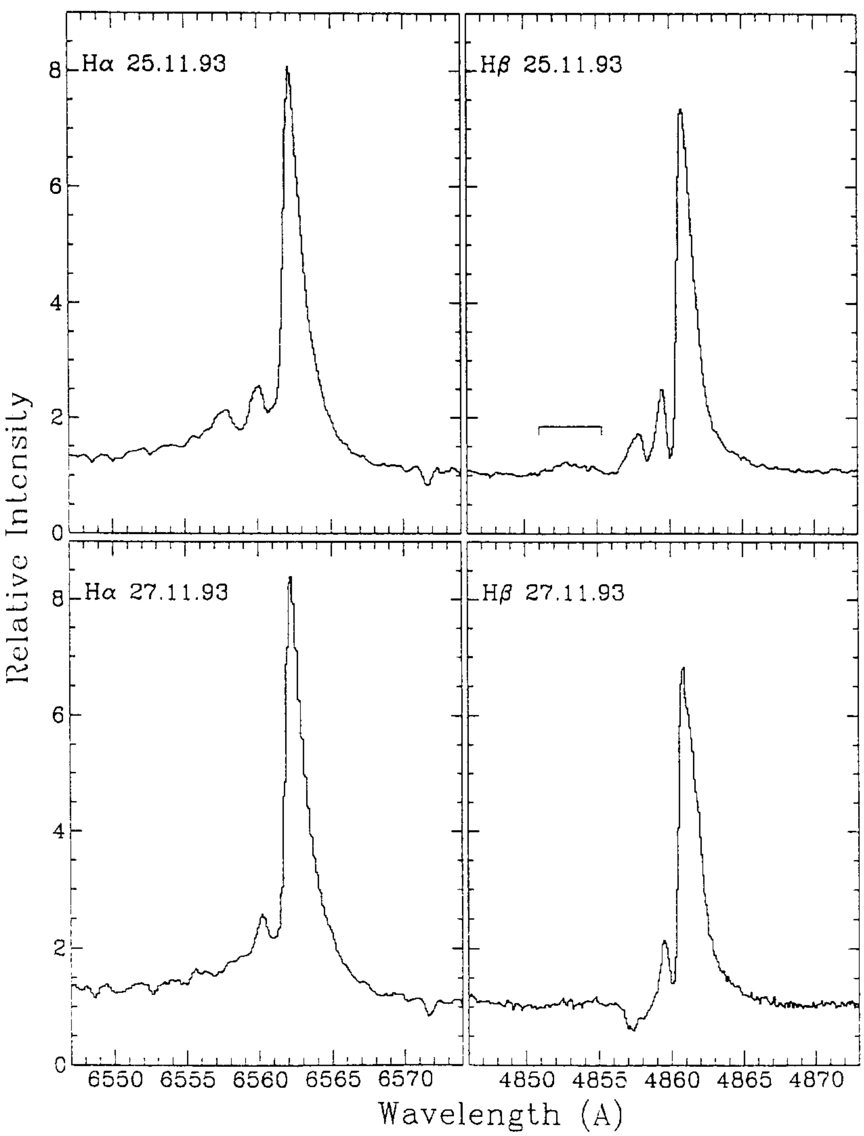


Figure 1. Comparison between the Hα and Hβ profiles of CH Cyg observed at Asiago on 25.11.1993 and 27.11.1993. The wavelength scale is heliocentric and the fluxes are scaled to the local continuum normalized to 1.0. The wavelength range is the same for all panels.

Table 1
$RV_{\odot}$ (km/s) of the peak of each individual feature observable in the Hα and Hβ profiles of Figure 1.

line	date	UT	Individual profile peaks				
Hα	25.11.93	18.35	–234 (em)	–193 (abs)	–138 (em)	–106 (abs)	–42 (em)
	27.11.93	18.00			–129 (em)	–94 (abs)	–39 (em)
Hβ	25.11.93	18.35	–224 (em)	–187 (abs)	–125 (em)	–91 (abs)	–42 (em)
	27.11.93	18.00			–122 (em)	–85 (abs)	–39 (em)

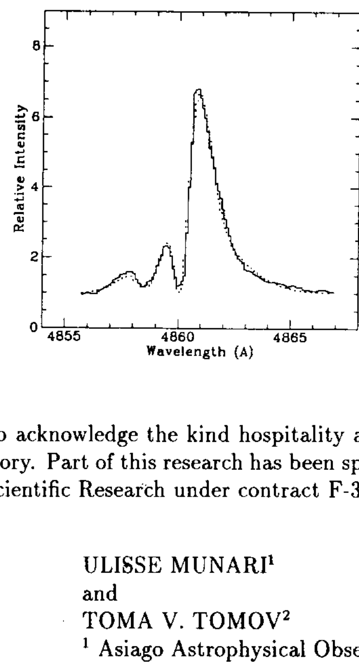
The interpretation of the profiles is *in toto* dependent on the physical assumptions of the adopted model (*e.g.* absorption instead of emission components) and any de-convolution into individual components may be performed in many different ways. A sample fitting to the 25.11.93 Hβ profile, using two emission and two absorption components, is presented in Figure 2. Similarly good fits can be however achieved with different combinations of gaussian components. For sake of quick-look comparison with other published profiles, in Table 1 we list the $RV_{\odot}$ of the peak of each individual feature observed in the profiles presented in Figure 1.

Kuczawska et al. (1992) and Leedjärv (1993) have presented observations that may suggest the presence of emission components in CH Cyg with |RV| up to 1000 km/s. They have proposed that such high-velocity components are produced by material expelled from the system via precessing jets. In an eclipsing system like CH Cyg (*e.g.* seen edge-on), however it is difficult to accept the idea that the the precession angle is so large to bring – during the precession cycle – the direction of the ejection close to the line-of-sight in order to produce the observed high-velocity components (if one discards the idea of ejection velocities approaching the speed of the light). Even larger difficulties would be encountered by any model which would invoke precessing jets to explain high velocity absorption components, for the obvious reason that the jets in this case must be closely aligned with the line-of-sight (whatever large their ejection velocity could be).

A possible way-out to explain *both* the high-velocity emission and absorption components in the CH Cyg system (seen edge-on), is to admit that a *propeller effect* is at work (Lipunov 1992). The accreted material infalling toward the WD is partially ionized by the hard radiation field of the latter. When this infalling and ionized material reach a distance to the WD of the order of the Alfven radius, it is trapped into the magnetic field which co-rotates with the WD and it is accelerated up to the escape velocity from the system. Ejection in the form of discrete blob can then take place with velocity vectors uniformly oriented with respect to the line-of-sight.

Finally, it may be worth noting that so far the most energetic active phase ever observed in CH Cyg began in 1977, *i.e.* 16 years $\equiv$ 1.0 orbital period ago. If the strength of active phase is regulated in some way by the orbital phase, in the coming years we could witness the formation of an optically thick envelope surrounding the CH Cyg hot component as it was observed during the 4^{th} activity period which started in 1977 and peaked in the years 1981-1984.

Figure 2. Example of multicomponent gaussian fitting to the CH Cyg Hβ profile of 25.11.93 shown in Fig.1. Solid line = observed profile; dotted line = gaussian fit. To fit the profile, two emission and two absorption components were used. Their heights (in unit of the underlying continuum), widths (in Å) and heliocentric wavelengths (in Å) are respectively:
(1^{st} em) 4.14/1.45/4860.79
(2^{nd} em) 1.78/4.29/4860.74
(1^{st} abs) -3.96/0.69/4860.14
(2^{nd} abs) -0.75/0.91/4858.70



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PHOTOMETRY OF THE PROGENITOR OF NOVA CASSIOPEIAE 1993 ON ASIAGO SCHMIDT ARCHIVE PLATES

Nova Cassiopeiae 1993 was discovered by K. Kanatsu on Dec. 7, 1993 (*cf.* IAU Circ. 5902).

It has been well known since Kraft's (1964) paper that *classical* novae are short period binary systems (with an orbital period of a few days to a few hours). The current picture is that classical novae are semi-detached binaries in which a Roche lobe filling secondary (usually a main sequence K-M star) transfers mass to a WD companion. Pre- or post-outburst novae can then be classified among the *cataclysmic variables*, which are known to show a large variety of photometric activity, including outbursts with an amplitude of some magnitudes. So far, observations of pre-nova objects have been supplied only from general sky surveys or patrol programs. For the majority of the novae, the progenitor was fainter than plate limits. However, a modest body of data exists from which pre-nova light curves for a dozen or so objects can be reconstructed (*e.g.* Robinson 1975). Fast novae - like GK Per or V1500 Cyg - show that there was a significant rise in brightness for 1 to 5 years prior to the outburst (Warner 1989).

Nova Cas 1993 lies in a region of the Milky Way for which many plates exist in the archive of the 67/92 cm Schmidt telescope of the Asiago Astrophysical Observatory. We have gone through the archive and found 21 plates in the B,V and I bands deep enough to have the nova progenitor recorded. The plates are listed in Table 1. In order to facilitate the correct identification, we took some V band plates with the same Schmidt telescope on UT Dec. 12.85, 1993 and compared them with the archival ones. On the new plates the nova shines at V=6.7±0.1. Our identification of the progenitor is shown in Figure 1. The progenitor is a member of a very close double star (separation of the order of a very few arcsec and components of similar brightness) which on all plates but the one reproduced in Figure 1 appears as a merged pair. Skiff (1993, IAU Circ. 5904) measured the progenitor image on the POSS-I prints and concluded that the progenitor is a member of a very close double star appearing merged on the POSS-I prints (he estimated ~2 arcsec separation). He indicated the northern component as the true progenitor.

With the Iris microphotometer of the Asiago Astrophysical Observatory we have measured the progenitor merged pair against a set of 16 nearby reference stars on the B and V plates listed in Table 1 (we choose such a large number of comparisons in order to reduce any influence by possible variability of any of them). We did not have a well calibrated and faint enough photometric comparison sequence around the progenitor. However, we had a known relation between image diameter and *relative* magnitudes derived from measurements made on some open cluster fields with the same equipment used for Nova Cas 1993. We applied this calibration to the 16 reference stars and set the zero point by adopting the values B=15.0 and V=14.0 for the star labelled *A* in Figure 1. When actual B,V magnitudes for this star are obtained, all the magnitudes in Table 1 can be scaled accordingly.

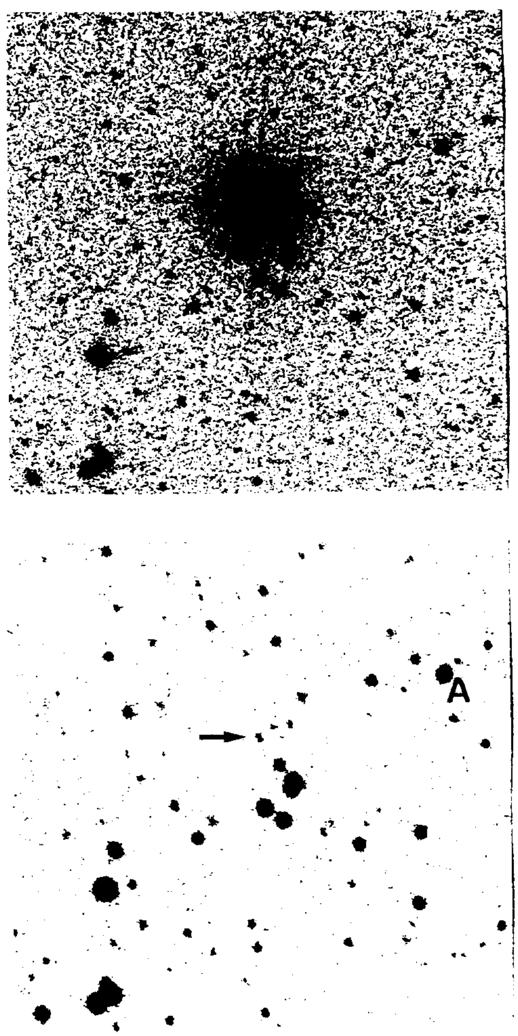

Figure 1. Comparison of the Nova Cas 1993 field as seen in V band on UT Dec. 11.85, 1993 (top panel) and on UT Oct. 11.93, 1985 with the 67/92 cm Schmidt telescope of the Asiago Astrophysical Observatory. The progenitor appears to be the northern component of a very close double star (arrowed). North is up and East is to the left. Each panel covers 6 arcmin on a side.

Table 1

List of Asiago Schmidt plates on which the progenitor of Nova Cas 1993 is recorded and that have been measured in search for brightness variations of the latter during the quiescence period. For the zero point of the magnitude scale in both B and V bands see the text. *a* = progenitor visible but of a brightness too close to the plate limit for meaningful measurement.

date		UT (start)	Exp. time (min)	Plate type	Filter	B	V	Notes
Nov. 4	1978	21.29	20	103a-D	GG14		17.5	
Dec. 3	1980	25.14	30	103a-D	GG14		17.1	
Dec. 23	1984	20.23	30	103a.D	GG14		17.1	
Aug. 18	1985	23.25	30	103a-D	GG14		17.4	
Oct. 11	1985	22.10	30	103a-D	GG14		17.0	
Nov. 6	1985	21.26	30	103a-D	GG14		17.1	
Oct. 5	1970	22.50	30	103a-O	GG13	18.5		
Nov. 26	1970	20.32	30	103a-O	GG13	18.4		
Nov. 4	1978	21.02	20	103a-O	GG13	18.0		
Nov. 1	1981	21.16	30	103a-O	GG13	18:5		
Nov. 20	1981	22.15	30	103a-O	GG13	18.3		
Aug. 21	1985	23.38	30	103a-O	GG13	18.1		
Oct. 5	1970	23.32	40	I-N	RG5			*a*
Nov. 2	1970	24.23	40	I-N	RG5			*a*
Nov. 4	1978	22.01	30	I-N	RG5			*a*
Oct. 1	1980	23.16	30	I-N	RG5			*a*
Nov. 1	1981	21.56	30	I-N	RG5			*a*
Nov. 20	1981	22.51	30	I-N	RG5			*a*
Jan. 2	1982	21.45	30	I-N	RG5			*a*
Jan. 7	1984	21.13	30	I-N	RG5			*a*
Dec. 23	1984	19.43	30	I-N	RG5			*a*

The observations reported in Table 1 started ~23 yrs and stopped ~8 yrs before the nova outburst. We can conclude from the data in Table 1 that during this time interval:

- no erratic or outburst-like variability with an amplitude larger than 0.2-0.3 mag affected the nova progenitor in quiescence
- no systematic and long-term trend in the mean brightness was observable in quiescence.

This also holds true for the I-N + RG5 infrared observations. We did not measure these plates because the progenitor was too close to the plate limit. However, eye inspection of these plates at the microscope (made in a separate and independent way by all of us) confirmed that no variability larger than 0.3 mag affected the progenitor in the infrared during the quiescence period covered by the observations reported in Table 1.

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THE Am STAR HD 43478 IS AN ECLIPSING BINARY

The star HD 43478 = BD +32°1246 was classified A3-F2-F5 from the Ca II K line, the H Balmer lines and the metallic lines respectively by Osawa (1965). It had been earlier classified A3p SiSr by Bertaud (1959) and was, for that reason, included in a CORAVEL survey of radial velocities of cool Ap stars. CORAVEL measurements made with the 1m Swiss telescope at Observatoire de Haute-Provence (France) in 1986 showed this star is a double-line spectroscopic binary. The orbital period is

$$P = 5.46414 \pm 0.00013 \text{ days},$$

the excentricity is negligible and the masses are

$$M_1 \times sin^3 i = 1.76 \pm 0.02, \quad M_2 \times sin^3 i = 1.59 \pm 0.02 M_{\odot}.$$

This star had been observed in the Geneva photometric system at the same telescope and was suspected of variability, so it was reobserved at the 76cm telescope of the Jungfraujoch Observatory (Switzerland), especially in 1987, 1988 and 1989. Although bad weather prevented a complete and dense phase coverage to be obtained, two well-defined minima could be observed at both phases 0.25 and 0.75, which coincide with the epochs of zero radial velocity (relatively to the systemic velocity). The lightcurve is shown in Figure 1. HD 43478 is therefore an eclipsing binary, although the minima are no deeper than 0.1 magnitudes.

The [U-B] and [B-V] indices do not vary in a significant way, showing that both components have nearly the same effective temperature. Since the components seem nearly identical, it is not irrelevant to estimate their physical parameters from the colour indices of the system. HD 43478 has been measured in the $uvby\beta$ system by two different groups and the average indices, found in the database of Hauck et al. (1990), give $E(b-y) = 0.029$, $T_{\rm eff} = 6970$ K and $\log g = 3.71$, using the calibration by Moon & Dworetsky (1985) with the correction on $\log g$ for Am stars (Dworetsky & Moon 1986). Taking $E(B2-V1) = 1.15\,E(b-y) = 0.033$ and using the calibration of Kobi & North (1990), the Geneva indices give $T_{\rm eff} = 6850$ K, $\log g = 3.72$ and $M = 1.82\,M_{\odot}$. The results from both photometric systems are in perfect agreement, the effective temperature is exactly that expected for the hydrogen spectral type (F2) and the mass estimated from the Geneva colours matches the spectroscopic masses extremely well. The components of this system appear to be somewhat evolved on the main sequence. Combining the photometric mass and surface gravity leads to a radius $R = 3.1\,R_{\odot}$.

The projected rotational velocities, estimated from the widths of the autocorrelation peaks measured with CORAVEL, are 29.2 ± 0.9 and 20.5 ± 0.7 km s^{-1} for the primary and the secondary component respectively. If the axial rotation of both components is synchronized with the orbital period, then the radius of the primary is *exactly* that inferred from photometry, while the secondary has $R = 2.2\,R_{\odot}$, implying $\log g = 4.0$. From the depths of the minima, a rough estimate gives $i \approx 80°$, so the masses of the primary and of the secondary may be about 1.84 and 1.66 $M_{\odot}$ respectively.

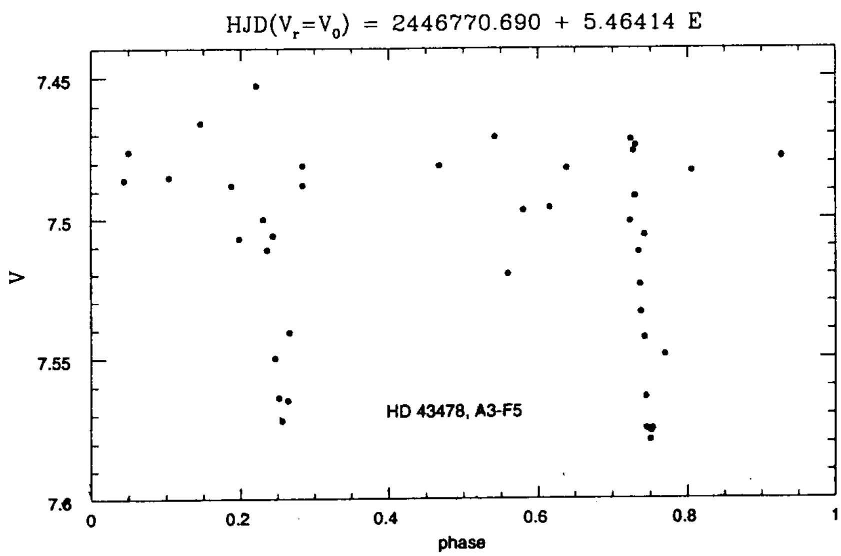

Figure 1: V magnitude of HD 43478 as a function of phase, according to the ephemeris given on top of the figure. The zero phase corresponds here to the quadrature, not to an eclipse.

The discovery of this SB2 system tends to confirm the high rate of SB2 binaries among Am stars, noticed by Abt & Levy (1985).

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UBV OBSERVATIONS OF SU INDI

The southern eclipsing binary system SU Ind (= HD198827, SAO 230428) has received relatively little attention hitherto. It was included in the short period EB-type list in Budding (1981) with the G5 spectral classification carried over from the Finding list of Wood *et al.*, (1980). That catalogue also gave the secondary minimum, at 0.2 mag, to be half the depth of the primary – which presumably derives from the old photographic light curve of Hoffmeister (1956), on which the secondary minimum is quite incomplete.

Giuricin *et al.* (1983), give the binary an *'a'* type classification, suggesting thereby some incipient evolutionary activity — mass exchange or Algol-like characteristics. This might also go with the appreciable squared term in the ephemeris equation of Wood and Forbes (1963), though those authors listed SU Ind in a group prone to relatively large errors on this specification, due to insufficient time of minima data. In fact, the *prima facie* evidence of the recent light curves shown below, for which Hoffmeister's old period 0.986323 d was used, indicates any change in this value over a thirty year interval to be fairly small.

The GCVS of Kholopov (1985) lists SU Ind with an F5-6 spectral type, which certainly accords better with the $b - y = 0.314$ value of Wolf and Kern (1983) than did the earlier G5. The earlier type implies that the star is more distant than originally considered (~100 pc) by Dworak (1976).

SU Ind was observed from the Black Birch outstation of Carter Observatory for some nights in 1983, 1989 and again in 1993, but the near unity day period value hindered rapid collection of complete light curves. It was placed also on the target list of the recently commissioned automatic photometric telescope (APT) of the Kotipu Place Observatory (Hudson *et al.*, 1992), and observed on 12 good nights during a period from August to October 1993, using UBV filters as provided with the commercial SSP 5 photometer manufactured by Optec Inc.

The data have been reduced on PCs using in-house software (cf. Budding, 1993), and are presented in Figure 1 as essentially raw results. These light curves are almost complete from the APT, though a little contemporaneous data from Black Birch has been added to properly locate the bottoms of the primary minima, which were not completely observed by the APT. Observations of standard stars with this instrument indicate the V filter to be quite close to the Johnson standard ($\epsilon = 0.02$), though the B filter is slightly longward of standard ($\mu = 1.14$). The less reliably determined U calibration also indicates that U is close to the standard specification ($\psi = 0.98$).

The light curves of Figure 1 are the first worked through set obtained with our SSP 5 photometer, and give a good indication of the APT's performance as a 0.36m telescope

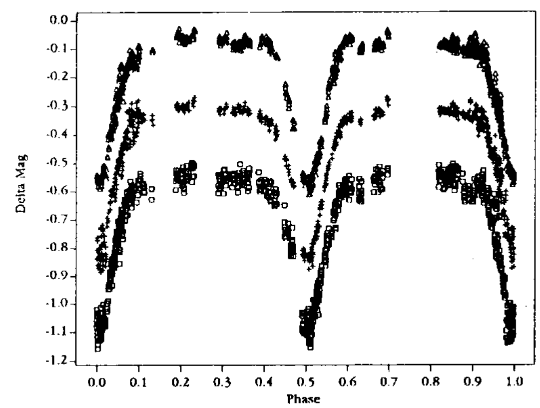

Figure 1. SU Ind – Delta Mag against Phase

on a ~ 9.5 mag star in the dark suburban environment of Kotipu Place. They show the two minima to be of essentially equal depth, and a noticeable, though not pronounced, level of 'β-Lyrae type' proximity effect interaction between the components. These are probably a pair of very nearly equal, dwarf, F-type stars. Further processing and detailed analysis, including the backlog of Black Birch data, can be expected to follow this initial report.

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PHOTOMETRIC OBSERVATIONS OF R CrB DURING THE 1985 MINIMUM

R Coronae Borealis is a prototype of a group of stars that exhibits drops in brightness. The times of minima of R CrB stars are irregular and completely unpredictable at present. Moreover, the depth and duration of the minima are irregular. They typically last a year or so. A 'normal' minimum comprises a comparatively rapid fade followed by a period of extreme faintness and a gradual rise to maximum. This outline, however, should not be accepted too rigidly, as many deviations from it occur. There have been broad-band photometric studies for a number of declines in light of a few brightest members of this class. Photometrically, these declines showed some degree of similarity in their overall behaviour. But it is clear from the available observations that the colour behaviour differed markedly for the various declines. It is necessary that a more thorough study of the phenomenon be performed.

This paper discusses the 1985 decline of R CrB. In Figure 1 we show the light and colour curves for this event. Circles represent the author's observational data. These data of R CrB (listed in Table 1) were obtained at an altitude of 3100 m Terscol Peak (the Caucasus) with the 0.5 m reflector, using an automatic single channel photometer. The magnitudes and colour indices of the comparison and check stars for differential observations have been reported by Goncharova (1992). In addition, in Figure 1 we plot the photoelectric magnitudes and colours which were obtained from various sources in the literature: crosses represent data taken from Fernie et al. (1986) and asterisks denote data taken from Ashoka et al. (1986).

As seen from Figure 1, the star reached a minimum of 10.3 mag., before a recovery to V$\sim$7 mag., prior to another fade to a decline with lower amplitude. It is also clear from these observational data that the colour behaviour during the 1985 minimum differed from one of the other declines of R CrB. The event shows that, in the initial stage, both U$-$B and B$-$V colour indices increased in values (i.e. reddened) from the decline onset. As the brightness continued to fall toward the deepest minimum, however, the U$-$B index curve showed a rapid blueward trend and the initial reddening of the B$-$V index curve was followed by a plateau before finally reddening at the rising branch. In contrast, the changes in V$-$R and R$-$I colour indices occur essentially in phase with the change of V mag. Thus, at a phase of the deepest minimum the star becomes bluer in U$-$B and redder in B$-$V, V$-$R and R$-$I colour indices than at maximum light. At an early stage of the rising branch, all colours of R CrB became redder than at maximum light, as they usually do. Moreover, V$-$R and R$-$I colour indices reached reddest values near the phase of extreme light minimum, whereas the greatest values of U$-$B and B$-$V colour indices occurred at the rising branch.

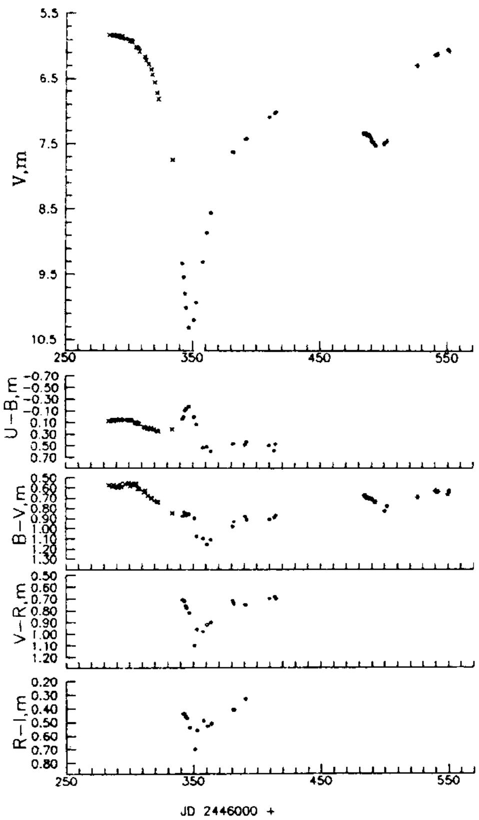

Figure 1

Cottrell et al. (1990) analysed colour curves of several declines of R CrB itself and other R CrB stars and identified two extreme types of colour behaviour: 'bluer' declines, where the U−B and B−V colour indices become substantially bluer before finally reddening, and 'red' declines, where the star reddens from the onset of the decline so that the changes in these colour occur in phase with the decline in light. The 1985 minimum of R CrB was termed as a 'red'-type by Cottrell et al. (1990), since both colour indices initially moved to redder values.

As seen from Figure 1, the real situation for the 1985 minimum of R CrB is more complex: during the initial fade in light the colour indices redden, but, as the star approaches to the extreme faintness, the U−B colour index shows blueward trend before finally reddening (i.e. 'blue'-type decline according Cottrell et al. (1990)).

It is also clear from observations (Goncharova, 1992) that the distinctive feature of the 1983 minimum of R CrB was an appreciable reddening occurred at visible wavelengths at an early stage of descending branch of the light curve.

Table 1
Photometry of R CrB

JD†	V	U-B	B-V	V-R	R-I	n
342.21	9.33±0.01	.04±0.03	0.82±0.02	.71±0.01	.44±0.02	3
343.19	9.54±0.01	.00±0.01	0.84±0.01	.72±0.01	.44±0.01	2
344.21	9.79±0.01	−.11±0.02	0.85±0.01	.76±0.01	.46±0.02	4
345.21	10.01±0.01	−.14±0.02	0.87±0.02	.78±0.01	.47±0.01	3
347.21	10.31±0.01	−.18±0.01	0.86±0.01	.82±0.01	.54±0.01	3
351.18	10.2 ±0.1	0±0.1	0.9 ±0.1	1.1 ±0.1	.7 ±0.1	3
353.19	9.93±0.01	.13±0.01	1.08±0.01	.96±0.01	.56±0.01	6
358.19	9.31±0.02	.53±0.02	1.10±0.02	.98±0.02	.49±0.02	3
361.18	8.86±0.01	.52±0.04	1.16±0.02	.92±0.01	.53±0.01	5
364.17	8.55±0.01	.59±0.02	1.11±0.01	.90±0.01	.51±0.01	4
381.15	7.62±0.01	.47±0.02	0.98±0.01	.72±0.03	.41±0.03	2
382.14	7.62±0.01	.46±0.03	0.93±0.02	.74±0.01	.41±0.01	4
391.13	7.42±0.01	.48±0.02	0.88±0.02	.75±0.01	.33±0.01	2
392.13	7.41±0.01	.43±0.01	0.91±0.01	-	-	2
409.62	7.08±0.01	.49±0.02	0.91±0.02	.70±0.01	-	3
413.63	7.02±0.01	.58±0.02	0.89±0.01	.68±0.01	-	4
414.62	7.00±0.01	.47±0.03	0.87±0.02	.70±0.02	-	3

† JD=2446000+...

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BV LIGHT CURVES OF BY Dra IN 1993

Photometry in BV was obtained for the spotted star BY Dra (BD +51°2402) during 1993 at Bucharest Obsrevatory. The observations were carried out with a 50 cm Cassegrain telescope during the period 10 July-27 November 1993, on 23 nights. An EMI 9502B unrefrigated photomultiplier and filters V (Schott 1mm GG11) and B (Schott 1mm BG12+Schott 1mm GG13) were used. The data were obtained by a paper milli-voltmeter recorder. Our comparison star was HD 172268, V=7.89, B−V=1.27 (Rodono et al., 1986).

Mean JD, V magnitudes and B−V colours are presented in Table I and Figure 1. The phases are calculated using the ephemeris given by Rodono et al. (1986).

$$\mathrm{Min=J.D.}\ 2438983.612+3\overset{d}{.}836\times E$$

No significant B−V variation is observed, the mean value being $1\overset{m}{.}20$. However, at minimum the star seems to be a little redder, which is consistent with the maximum visibility of the spot at that phase. From our observations it is difficult to determine the light curve amplitudes precisely. A rough estimate shows that the amplitudes lie around of $0\overset{m}{.}08$ in both colours.

The observed minimum is at phase ~0.5 with respect to the ephemeris used by us. Comparing our data with those obtained in 1991 by Panov and Ivanova (1993) our observations indicate no spectacular changes in the light curves. However, a mean brightness increase of about $0\overset{m}{.}15$ is evident in both colours.

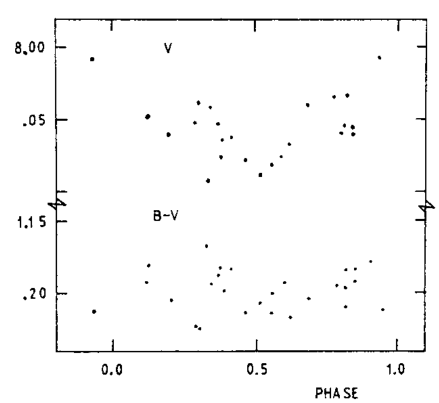

Figure 1. V, B−V light curves of BY Dra obtained at Bucharest Observatory during the period July-November, 1993.

Table 1

Photometric observations of BY Dra (N, σ_V, σ_B represent the number of individual points which form the mean value, and average standard deviations in V and B respectively).

JD	N	Phase	V	B−V	σ_V	σ_B
2449000.0 +						
178.4417	3	0.6717	8.040	1.205	.004	.012
206.3179	1	0.9387	8.008	1.210	–	–
212.3063	3	0.5000	8.087	1.207	.001	.008
213.3208	3	0.7643	8.034	1.194	.010	.008
215.2950	2	0.2791	8.048	1.222	.009	.001
217.3213	2	0.8073	8.035	1.208	.010	.017
217.4138	3	0.8315	8.055	1.189	.011	.025
220.3194	1	0.5888	8.075	1.190	–	–
223.2916	3	0.3636	8.075	1.181	.009	.017
223.3229	4	0.3717	8.064	1.197	.015	.009
230.2846	4	0.1866	8.059	1.202	.004	.012
242.3333	2	0.3276	8.093	1.165	.007	.017
245.3054	1	0.1024	8.046	1.190	–	–
247.2396	3	0.6066	8.067	1.215	.006	.008
248.2917	2	0.8800	8.059	1.177	.008	.010
288.1875	5	0.2812	8.052	1.223	.007	.007
289.1870	5	0.5419	8.079	1.198	.011	.030
290.1804	5	0.8008	8.056	1.183	.010	.018
292.2150	2	0.3313	8.040	1.191	.016	.022
300.1754	4	0.4064	8.061	1.181	.007	.011
304.2000	1	0.4556	8.077	1.212	–	–
317.1666	2	0.8357	8.059	1.182	.018	.007
319.1660	4	0.3571	8.051	1.178	.014	.005

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PHOTOMETRY OF STARS IN THE FIELD OF THE DWARF NOVA KU CASSIOPEIAE

KU Cassiopeiae is a relatively faint dwarf nova that reaches mag. 13 during outbursts, which occur about every two months. A precise position and large-scale identification chart are provided by Bruch et al. (1987). The position for KU Cas is: $1^h31^m02^s\!.6$ +57°54' 14" (J2000), which differs significantly from the (precessed) position in the GCVS4.

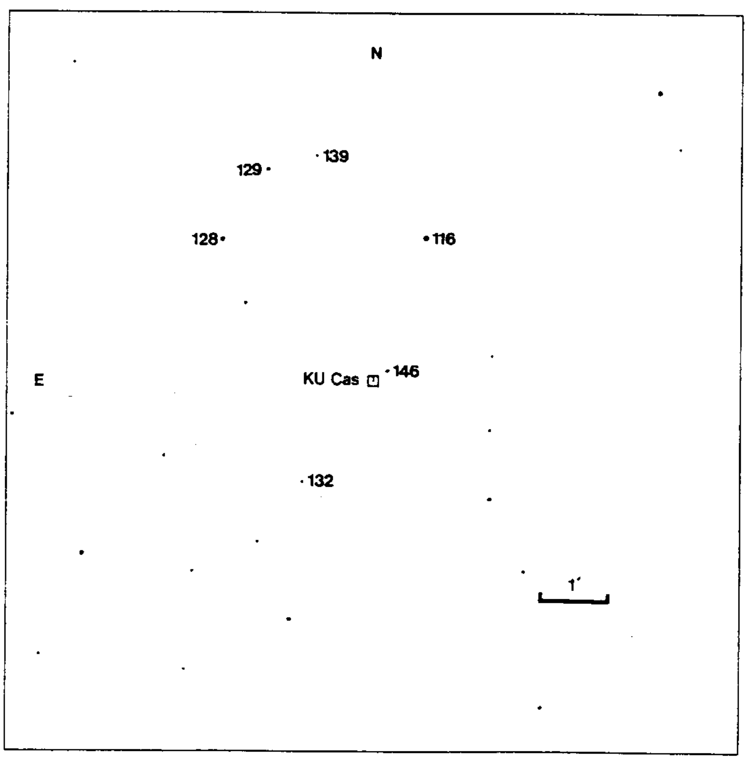

Figure 1. The field of KU Cas showing stars from the GSC. V magnitudes are indicated to the nearest tenth of a magnitude with the decimal point omitted.

At the request of Charles Scovil of the American Association of Variable Star Observers, I made photoelectric measurements of several stars in the field to improve the magnitudes for an existing sequence of comparison stars on an AAVSO chart. Since the quiescent brightness is quite faint (about mag. 18), the sequence stars concentrate on those likely to be useful during eruptions; the six stars span the range $11.6 < V < 14.6$.

The observations were made on 4 and 7 September 1992 UT using the Lowell Observatory 53cm photometric telescope. The stars were observed through a 19-arcsec diaphragm with Strömgren y and b filters. Each observation consisted of a minimum of four 10s integrations of 'star' and two 10s integrations on 'sky', with greater numbers of integrations for the fainter stars. All the standard stars are from the lists of Landolt (1983a, 1983b, 1992). The V magnitudes were adopted directly, sometimes supplemented with values from Menzies et al. (1991). The $b - y$ colors were determined using the same telescope against primary Strömgren standards. The redder Landolt stars were necessary in order to properly calibrate the red and reddened stars commonly found in low-latitude fields such as this one. The data for each night was reduced separately using linear transformations. Atmospheric extinction was estimated on these nights from measurements taken on other nights near this time. Average per star residuals (standard deviation) were ± 0.003 in V and ± 0.003 in $b - y$ on 4 September, and ± 0.006 and ± 0.005 on the 7th.

The standards observed are listed in Table 1 along with the adopted and mean observed V and $b - y$ colors, and the numbers of observations 'n'. The mean deviations of the observed averages from the assumed values listed in the table are: $V = 0.001 \pm 0.004$; $b - y = 0.000 \pm 0.004$.

Table 1. Standard Star Observations

Name	V (std)	b−y (std)	V (obs)	b−y (obs)	n
HD 315	6.440	−0.078	6.439	−0.080	1
HD 5319	8.046	0.601	8.046	0.596	1
HD 7615	6.693	0.023	6.688	0.027	2
BD−00°0288	8.831	0.711	8.831	0.710	3
HD 11983	8.192	0.959	8.191	0.963	1
HD 16581	8.195	−0.033	8.203	−0.038	1
HD 218155	6.783	−0.005	6.784	−0.002	1
HD 222732	8.857	0.735	8.860	0.737	1

The results for the KU Cas field are given in Table 2, listed in order of decreasing brightness. Identifications and J2000 positions are provided for all except the very faintest star from the Guide Star Catalog. Each star, again except the faintest, was observed on two nights. The uncertainties listed in the second line of each entry are the standard deviations of the means of the two observations; for the faint star it is the standard deviation on the batch of integrations taken. The two measures of GSC 3678-0321 differed by 0.1 magnitudes, indicating a possible variable. The $b - y$ color suggests the star could be a δ Scuti-type variable.

Table 2. Photometry of Stars Near KU Cas

Star	RA (2000)	Dec (2000)	V	$b-y$	n	Remarks
GSC 3678-0321	$1^h30^m57^s.0$	+57°56' 18"	$11^m.648$	$0^m.236$	2	suspect var
			.073	.001		
GSC 3678-0036	1 31 19.0	+57 56 16	12.830	0.914	2	
			.013	.000		
GSC 3678-0187	1 31 14.1	+57 57 16	12.931	0.381	2	
			.011	.016		
GSC 3678-1147	1 31 11.5	+57 50 50	13.150	0.539	2	
			.006	.001		
GSC 3678-0002	1 31 08.8	+57 57 28	13.867	0.608	2	
			.021	.028		
anon	1 31 01	+57 54.3	14.645	0.964	1	not in GSC: lies
			.042	.078		15" NW of KU Cas

For the convenience of observers, a chart based on the GSC is shown in Figure 1, centered on the Bruch et al. position of the variable. The comparison stars are indicated by their V magnitudes rounded to the nearest tenth of a magnitude (decimal point omitted) in the style of visual variable-star charts.

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PHOTOMETRY OF STARS IN THE FIELD OF NOVA CASSIOPEIAE 1993

Nova Cassiopeiae 1993 was discovered by Kanatsu (1993) on 7 December 1993 UT. The nova reached a fairly bright maximum near visual mag. 5.5 about 18 December following a standstill at mag. 6.5. In order to provide visual observers with a sequence of comparison stars as the eruption faded, I measured a number of stars in the field. The results were distributed quickly via e-mail over the "nova net" maintained by members of the Arizona State University Department of Physics and Astronomy. This report gives the details of the observations.

I observed the stars using the Lowell 53cm photometric telescope on 13 and 30 December 1993, and 4 January 1994 UT. Strömgren y and b filters were used through a 29-arcsec diaphragm. Each observation consisted of at least three 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers for stars fainter than V$\sim$9.0. In addition to primary four-color standards (Perry, Olsen, and Crawford 1987), I have adopted a set of secondary standards to enable the calibration of V magnitudes of red and reddened stars beyond the color limits of the primary Strömgren standards. V magnitudes were taken mostly from the lists of Landolt (1983a, 1983b, 1992), supplemented by values from Menzies et al. (1991). Strömgren $b-y$ colors were taken from lists by Olsen (1983, 1993),

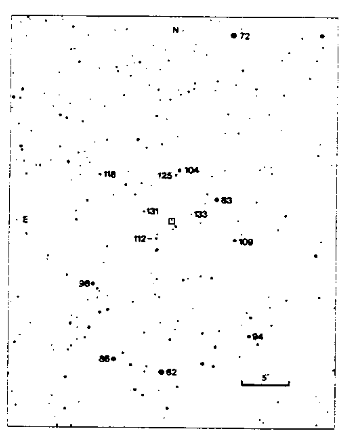

Figure 1. The field of Nova Cassiopeiae 1993 showing stars from the GSC. V magnitudes are indicated to the nearest tenth with the decimal point omitted.

Table 1. Standard Star Observations

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 224930	5.748	0.430	5.746	0.439	2
HD 225003	5.699	0.200	5.700	0.209	2
HD 315	6.440	−0.078	6.450	(−0.097)	1
HD 4790	6.624	0.862	6.622	0.867	2
HD 5319	8.046	0.607	8.046	0.592	1
HD 6479	6.363	0.258	6.349	0.252	1
HD 6480	7.267	0.321	7.259	0.318	1
HD 7446	6.031	0.650	6.032	0.654	1
HD 7615	6.693	0.025	6.691	0.029	3
HD 11577	7.707	0.112	7.708	0.101	1
HD 13421	5.635	0.361	5.637	0.355	3
HD 16581	8.200	−0.033	8.203	−0.036	1
HD 22211	6.487	0.408	6.496	0.399	1
HD 22695	6.189	0.585	6.185	0.588	2
HD 24482	8.188	1.256	8.189	1.257	4
HD 26462	5.707	0.231	5.713	0.233	1
HD 33021	6.165	0.398	6.170	0.391	1
HD 42824	6.627	0.025	6.619	0.034	1
HD 43261	6.090	0.553	6.091	0.541	1
HD 44974	6.524	0.563	6.534	0.562	1
HD 209960	5.254	0.897	5.256	0.902	2
HD 213119	5.584	0.998	5.586	0.995	1
HD 217014	5.454	0.415	5.454	0.410	2
HD 218155	6.783	−0.004	6.780	−0.001	3
HD 221950	5.690	0.306	5.688	0.303	1
HD 222732	8.860	0.735	8.852	0.735	2

Anthony-Twarog, et al. (1991), and Stetson (1991) – in that order of preference. Some V magnitudes come from these sources as well. Several of the Landolt stars have $b-y$ values determined using the Lowell 53cm telescope. The data for each night were reduced separately using linear transformations. Atmospheric extinction was estimated on the nights involved in these observations.

Because of the mix of standards, Table 1 shows both the adopted and observed mean V and $b-y$, along with the number of observations 'n'. The stars are listed in equinox 2000 RA order. The $b-y$ data for HD 315 (in parentheses) were omitted from the transformations. The mean deviations of the observed averages from the assumed values in this group of data are: V = 0.000 ± 0.006; $b-y$ = 0.000 ± 0.007.

Results for the stars near Nova Cas 1993 are shown in Table 2, listed in order of decreasing brightness. The stars are identified by HD, BD, or GSC number; positions come from astrometric catalogues via SIMBAD or the GSC. SIMBAD is also the source of the spectral types from the literature. Uncertainties (sigma) are shown in the second line of each entry. For three fainter stars measured on only one night I give the internal uncertainty (in parentheses) of the batch of integrations plus the uncertainty in the fit of the standards taken in quadrature, which provides an estimate of the true errors. The uncertainties are greatly dominated at these light levels by photon statistics.

Table 2. Photometry of Stars in the Field of Nova Cas 1993

Star	RA (2000)	Dec (2000)	V	$b-y$	n	sp.	remarks
HD 222618	23 41 54.4	+57 15 36	6.249	0.628	2	G8III	= HR 8985
			.004	.003			
N Cas 1993	23 41 47.2	+57 31 01	6.461	0.557	1		1993 Dec 13.1 UT
HD 222514	23 41 00.7	+57 50 19	7.215	0.107	2	Am	
			.003	.007			
HD 222543	23 41 13.1	+57 33 18	8.280	0.182	2	A3	
			.004	.006			
HD 222671	23 42 31.2	+57 16 54	8.559	0.088	2	A0	
			.013	.018			
HD 240359	23 40 47.7	+57 19 19	9.353	0.166	2	A0	
			.005	.001			
BD +56°3072	23 42 47.8	+57 24 37	9.796	0.197	2	A0	
			.006	.011			
BD +56°3064	23 41 41.9	+57 36 16	10.366	0.300	3		
			.009	.013			
GSC 4008-1356	23 40 59.1	+57 29 08	10.915	0.555	2		
			.006	.005			
GSC 4008-1427	23 41 59.3	+57 29 16	11.170	0.178	1		
GSC 4008-0539	23 42 43.5	+57 35 48	11.829	0.579	1		
			(.017)	(.019)			
GSC 4008-0687	23 41 44.3	+57 35 47	12.523	1.504	2		
			.033	.027			
GSC 4008-1393	23 42 08.9	+57 32 02	13.090	1.119	1		
			(.031)	(.036)			
GSC 4008-1712	23 41 32.3	+57 31 46	13.281	0.443	1		= Munari "A"
			(.043)	(.037)			

The photometry of the nova itself included here was first reported on an IAU Circular (Skiff 1993b). Because of the strong emission-line nature of the spectrum, the values cannot be said to be strictly on the standard system. The faintest star in the list is called star "A" in a recent study by Munari et al. (1994) of archival Asiago plates showing the progenitor. Their independent identification of the pre-nova matches the one visible on the POSS-I prints (Skiff 1993a) and the best available position for the nova in eruption (Argyle and Morrison 1994).

For the convenience of observers, a chart derived from the GSC is shown in Figure 1. The comparison stars are indicated by their V magnitudes rounded to the nearest tenth (decimal point omitted) in the style of visual variable-star charts.

The photometric data herein were reduced using a clever IDL routine written by Laura Woodney and Eliza Fulton. Preparation of this report was facilitated by the use of SIMBAD, maintained by the Centre de Données astronomiques, Strasbourg, France.

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PHOTOMETRY OF STARS IN THE FIELD OF V345 AND V553 AQUILAE

V345 and V553 Aquilae are two Mira variables lying east of the galactic plane near the bright Cepheid η Aquilae. V553 Aql was added to the program of the American Association of Variable Star Observers (AAVSO) in 1991. However, no magnitudes were available for any comparison stars in the field. Thus, at the request of AAVSO chartmaker Charles Scovil, I observed several stars as faint as V = 14.0 on the chart covering the region, which includes the similarly-bright Mira V345 Aql.

There are no precise positions for these stars in the ordinary literature. However, V345 Aql appears in the IRAS catalogue, and V553 Aql is in the Guide Star Catalog:

	RA (2000)	Dec(2000)
V553 Aql = GSC 0484−1036:	$19^h51^m52^s.0$	+2°48'18"
V345 Aql = IRAS19512+0251:	19 53 47.5	+2 59 29

The IRAS identification IRAS19494+0240 for V553 Aql (end figures $55^s.4$ and 27" for equinox 2000) might not be valid, since the variable lies just outside the error ellipse of the IRAS position. By means of the POSS-I prints and a plot of nearby GSC stars, I find that the position for V345 Aql reported by Hoffmeister (1933) in the paper announcing the discovery of variability is in error by −1' in Declination. Correcting this allows the IRAS identification to be made.

I observed the stars using the Lowell 53cm photometric telescope on six nights in autumn 1992 and spring 1993. Strömgren y and b filters were used through either a 19" or 29" diaphragm. Each observation consisted of at least four 10s integrations on 'star' and two 10s integrations on 'sky', with greater numbers for stars fainter than V∼9.0. In addition to primary four-color standards (Perry, Olsen, and Crawford 1987), I have adopted a set of secondary standards to enable the calibration of V magnitudes of red and reddened stars beyond the color limits of the primary Strömgren standards. V magnitudes were taken mostly from the lists of Landolt (1983a, 1983b, 1992), supplemented by values from Menzies et al. (1991). Strömgren $b-y$ colors were taken from lists by Olsen (1983, 1993), Anthony-Twarog, et al. (1991), and Stetson (1991) – in that order of preference. Some V magnitudes come from these sources as well. Several of the Landolt stars have $b-y$ values determined using the Lowell 53cm telescope. The data for each night were reduced separately using linear transformations. Atmospheric extinction was measured on some nights and estimated on others.

Table 1. Standard Star Observations

Name	V (std)	$b-y$ (std)	V (obs)	$b-y$ (obs)	n
HD 109995	7.600	0.048	7.594	0.051	1
HD 118579	9.176	0.168	9.179	0.172	1
HD 120066	6.336	0.401	6.335	0.395	1
HD 122563	6.206	0.638	6.201	0.637	1
HD 125489	6.189	0.120	6.195	0.122	1
HD 126273	7.188	1.070	7.187	1.080	1
HD 129975	8.363	0.963	(8.344)	0.968	1
HD 132833	5.520	1.097	5.509	1.107	1
HD 139308	7.779	0.799	7.781	0.792	1
HD 140850	8.806	1.093	8.822	1.098	1
HD 143761	5.403	0.396	5.408	0.392	3
HD 149382	8.944	−0.146	8.944	−0.141	2
HD 149845	7.964	0.822	7.965	0.826	1
HD 153847	7.241	0.244	7.240	0.248	1
HD 160233	9.095	0.031	9.093	0.035	1
HD 160471	6.155	1.162	6.158	1.164	6
HD 161817	6.982	0.137	6.974	0.141	2
BD +04°3508	9.326	1.179	(9.359)	1.188	1
HD 162596	6.342	0.717	6.333	0.716	5
HD 165401	6.801	0.393	6.799	0.381	2
HD 172365	6.369	0.510	6.360	0.515	2
HD 172829	8.474	1.383	8.470	1.381	4
HD 175544	7.395	0.140	7.399	0.137	1
HD 182239	6.657	0.167	6.671	0.178	1
HD 184914	8.178	0.799	8.189	0.799	2
HD 184965	8.529	0.306	8.532	0.307	3
HD 185378	8.302	1.158	8.314	1.149	1
HD 186427	6.230	0.417	6.234	0.414	5
HD 190299	5.666	0.825	5.666	0.822	2
HD 191067	5.969	0.621	5.983	0.623	1
BD −00°4073	9.905	0.776	9.892	0.774	2
HD 199280	6.583	−0.030	6.583	−0.039	1
HD 218155	6.783	−0.004	6.779	−0.001	1
HD 222732	8.860	0.735	(8.835)	0.733	1

Because of the mix of standards, Table 1 shows both the adopted and observed mean V and $b-y$, along with the number of observations 'n'. The stars are listed in equinox 2000 RA order. The V data for three stars (in parentheses) were omitted from the transformations. The mean deviations of the observed averages from the assumed values in this group of data are: V = 0.001 ± 0.007; $b-y$ = 0.001 ± 0.006.

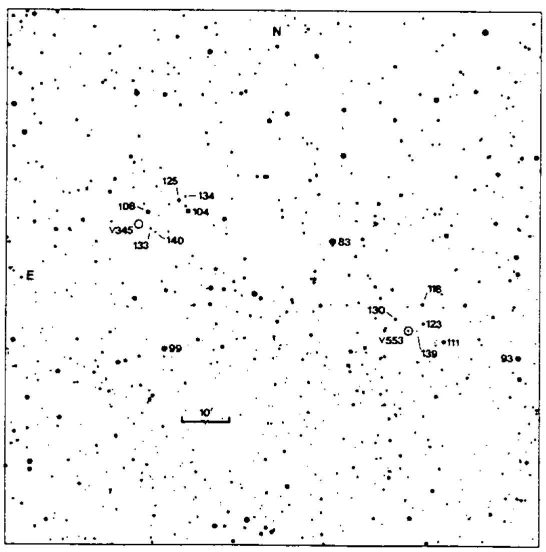

Figure 1. The field of V345 and V553 Aql showing stars from the GSC. V magnitudes are indicated to the nearest tenth with the decimal point omitted.

Table 2. Photometry of Stars in the Field of V553 Aql

Name	RA (2000)	Dec (2000)	V	$b-y$	n	Sp.
HD 187928	$19^{h}52^{m}24^{s}.1$	+2°57'48"	8.309	0.955	2	K2
			.030	.011		
HD 357395	19 51 04.7	+2 45 24	9.357	0.700	2	G
			.014	.013		
GSC 0484-1774	19 51 36.9	+2 47 07	11.055	0.622	1	
GSC 0484-1694	19 51 45.8	+2 51 03	11.780	0.451	1	
GSC 0484-1746	19 51 45.6	+2 49 01	12.268	0.734	2	
			.024	.025		
GSC 0484-0657	19 51 57.4	+2 49 31	13.037	0.800	2	
			.023	.045		
GSC 0484-2639	19 51 48.4	+2 48 17	13.864	0.498	3	
			.027	.005		

Results for the stars near the variables are shown in Tables 2 and 3, listed in order of decreasing brightness. The stars are identified by HD or GSC number; positions come from astrometric catalogues via SIMBAD or the GSC. SIMBAD is also the source of the spectral types from the literature. For stars observed on more than one night, uncertainties (sigma) are shown in the second line of each entry.

Table 3. Photometry of Stars in the Field of V345 Aql

Name	RA (2000)	Dec (2000)	V	$b-y$	n	Sp.
HD 188140	$19^h53^m36\overset{s}{.}0$	+2°46'14"	9.857	0.777	2	K0
			.027	.000		
HD 357390	19 53 26.1	+3 00 57	10.449	0.735	1	K2
HD 357391	19 53 43.5	+3 00 47	10.807	0.801	2	K5
			.011	.022		
GSC 0485-0649	19 53 30.0	+3 02 04	12.460	0.796	2	
			.006	.085		
GSC 0485-0784	19 53 27.2	+3 02 31	13.343	0.411	2	
			.005	.031		
GSC 0485-0961	19 53 42.3	+2 59 02	13.367	0.417	2	
			.009	.020		
GSC 0485-3213	19 53 40.3	+2 58 40	13.995	0.597	2	
			.022	.038		

For the convenience of observers, a chart derived from the GSC is shown in Figure 1. The comparison stars are indicated by their V magnitudes rounded to the nearest tenth (decimal point omitted) in the style of visual variable-star charts.

The photometric data herein were reduced using a clever IDL routine written by Laura Woodney and Eliza Fulton. Preparation of this report was facilitated by the use of SIMBAD, maintained by the Centre de Données astronomiques, Strasbourg, France.

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THE DECEMBER 1993 LIGHT CURVE OF AB Dor

The variable nature of the photometric light curve of AB Doradus (HD 36705) has been the subject of several studies in recent years. There exists an extensive history of optical observations of this K0/K1 object, with the first long-term light curve analysis presented by Innis, Thompson & Coates (1988). The star has also been studied at radio, microwave, X-ray and Hα wavelengths. More recently, Anders, Coates & Thompson (1992) applied a two-spot modelling procedure to all the available photometric data for AB Dor from 1980 to 1992. The trend of the mean stellar magnitude during this period seems to suggest a cyclic phenomenon.

In a two-week observing program in November and December 1993, a total of 21 data points were recorded over three nights in each of the B,V,R_c,I_c filters used at the Monash Observatory. Observations were made with the 0.45 meter telescope, using a thermo-electrically cooled S-20 photomultiplier tube with an extended red response. Comparison and check stars were HD 37297 and HD 35537 respectively, and the variation in magnitude differences between these stars was less than 0.011 in all cases. The data, after calibration to the standard UBV system, are given below. Phases have been calculated with respect to a period of 0.51479 days and an epoch 2444296.575 (Innis, Thompson & Coates, 1988).

Figure 1 shows the V-band light curve for AB Dor. Despite the relatively small number of data points, there exists a clear sinusoidal-like variation in the stellar brightness, presumably due to the presence of one or more large starspot regions. Recent high-resolution Hα spectra obtained in late November 1993 (Cameron, private communication), indicates a gradual trend in the underlying stellar profile to go from weak absorption to moderate emission throughout the night. This suggests a strong contrast in plage coverage between the opposing hemispheres of the star, which would be in agreement with the photometric data shown in Figure 1.

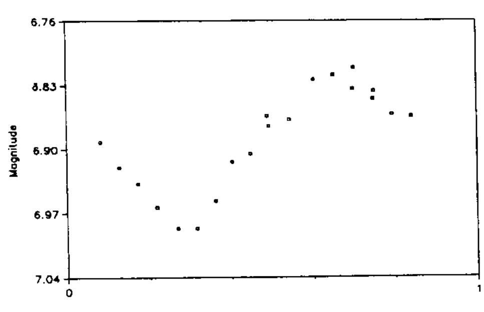

Figure 1. November/December 1993 V-band light curve for AB Dor

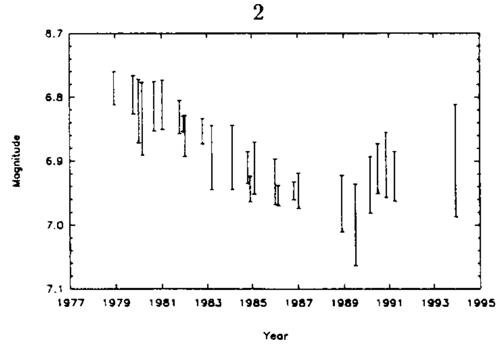

Figure 2. The trend in the mean light level of AB Dor since 1980

Table 1

HJD(−2440000.000)	(Phase)	B−V	V−R	V−I	V
9317.013	0.700	0.822	0.483	0.943	6.811
9317.038	0.749	0.841	0.484	0.961	6.836
9319.995	0.493	0.827	0.492	0.967	6.875
9320.021	0.543	0.795	0.532	0.994	6.868
9320.051	0.602	0.816	0.473	0.941	6.824
9320.076	0.650	0.823	0.488	0.953	6.819
9320.100	0.697	0.824	0.482	0.959	6.834
9320.126	0.747	0.791	0.495	0.986	6.845
9320.150	0.794	0.838	0.491	0.968	6.862
9320.174	0.841	0.835	0.499	0.975	6.864
9326.991	0.083	0.813	0.503	0.965	6.892
9327.014	0.128	0.829	0.500	0.966	6.920
9327.037	0.172	0.844	0.499	0.973	6.938
9327.060	0.217	0.842	0.506	0.984	6.964
9327.086	0.267	0.842	0.512	0.990	6.987
9327.110	0.314	0.858	0.510	0.990	6.987
9327.134	0.361	0.846	0.510	0.989	6.957
9327.156	0.403	0.852	0.493	0.972	6.914
9327.179	0.448	0.816	0.508	0.983	6.905
9327.200	0.489	0.828	0.491	0.957	6.864

The range in V for this light curve is approximately 0.18, which is the largest yet seen for AB Dor. These data are plotted in Figure 2, which shows the behaviour of the mean light level of the star since 1980. Since reaching a minimum level around 1989 the magnitude of AB Dor has been steadily increasing, and the 1993 light curve is consistent with this trend. Future photometric observations will be important in establishing the existence of cyclic activity on this well-studied star.

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DETECTION OF VARIABILITY IN THE λ Boo STAR HD 142703

The λ Bootis stars are a group of apparently metal poor population I, early A-type stars. They are characterized by a CaIIK line which is too weak in respect to the otherwise classical A type and luminosity class V spectrum. HD 142703 (m_V=6.1, HR 5930, BD-14^o 4314) was classified by Gray and Corbally as kA1hF0mA1 Va λ Boo, 1993. Astrophysical parameters derived from Geneva-photometry (Kobi & North 1990) are:

$$log\,g = 3.85, \quad T_{\rm eff} = 7208\,\mathrm{K}, \quad [\mathrm{M/H}] = -1.99$$

and from the Strömgren-photometry (Moon & Dworetsky 1985):

$$log\,g = 3.88, \quad T_{\rm eff} = 7180\,\mathrm{K}, \quad \delta \mathrm{m}_0 = 0.07$$

Observations were done as part of a survey for pulsation among λ Boo type stars at ESO, La Silla, in June/July 1993. The single channel photometer at the 50 cm ESO telescope was used with Strömgren b and v filters. Two nights of differential photometry were obtained with an integration time of 10 seconds. HD 142640 (C1, m_V=6.4, HR 5927, BD-13^o 4290, F6V) was used as a comparison star during both nights, and HD 143333 (C2, m_V=5.5, HR 5954, F7V) in addition during the first night.

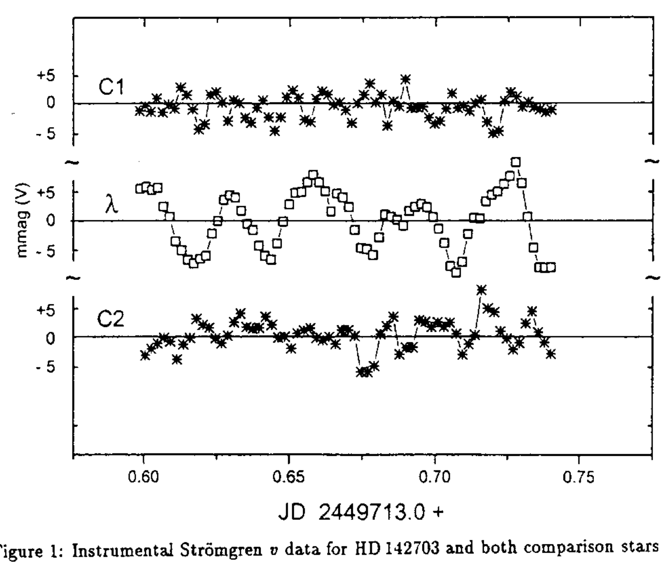

Figure 1: Instrumental Strömgren v data for HD 142703 and both comparison stars

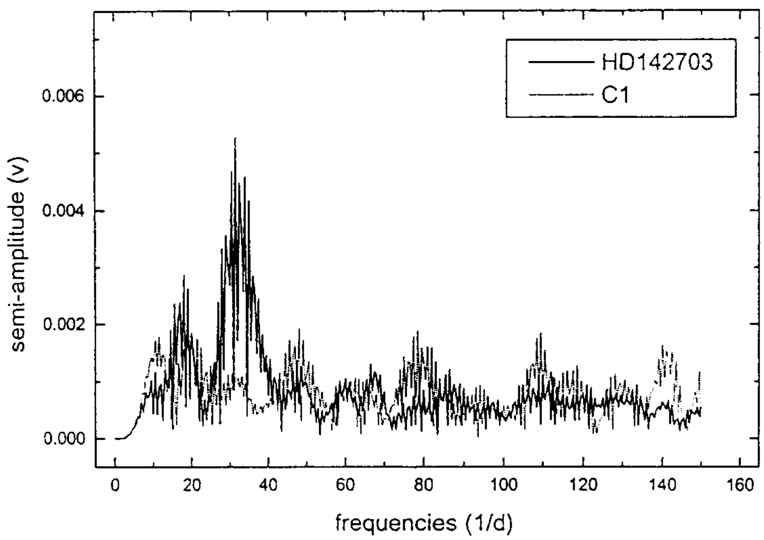

Figure 2: Amplitude spectra (v) for HD 142703 and the comparison star C1

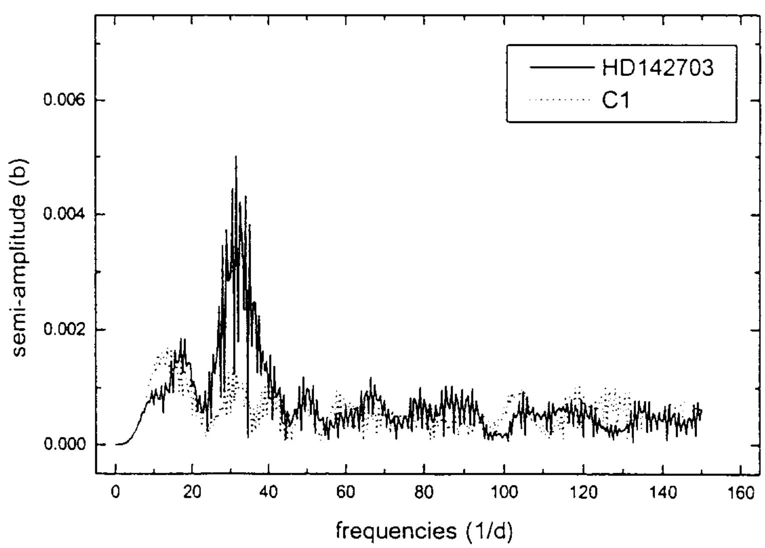

Figure 3: Amplitude spectra (b) for HD 142703 and the comparison star C1

The averaged intensities of the comparison stars provided us with a synthetic 'super'–comparison star data set which was smoothed in such a way that atmospheric drifts with periods larger than one hour were removed. Figure 1 shows the differential photometry for the λ Boo star and both comparison stars in instrumental Strömgren v, obtained during the first night (JD 2449173) and relative to the synthetic comparison star. The light curve for our program star has a smaller scatter, because it was observed at least twice as frequently as the comparison stars and two consecutive observations were averaged.

In both nights and for both colors we find a peak in the amplitude spectrum for HD 142703 at the same frequency. The evidence for variability of the λ Boo star and the constancy of the comparison stars (in the frequency domain of interest for this investigation) is corroborated by the amplitude spectrum of the entire data sets of two nights (fig. 2 and 3).

Nevertheless, a dedicated observing campaign which includes at least one other observatory at a different longitude is needed to firmly establish the variability of HD 142703 and to determine the frequencies involved.

A least squares sine-fit to the combined data of both nights results in an amplitude of 10.6 mmag for v and 10.0 mmag for b, with a frequency of 31.5 d^{-1} (46 min).

HD 142703 increases the sample of probably pulsating λ Boo candidate stars to eight (Weiss, Paunzen, Kuschnig, Schneider, 1994). This star is the second λ Boo star after HD 142994 for which we have discovered evidence for pulsation as a result of our photometric λ Boo survey and may be an analogon in period and amplitude to the pulsating λ Boo star HD 192640 (Weiss et al. 1994).

It is important to discover pulsation among λ Boo stars, because pulsation allows to derive stellar structure parameters by applying the tools of asteroseismology. This aspect is particularly interesting for λ Boo stars, because their location in the HR–diagram, and hence their evolutionary status, still is controversial.

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UBVR OBSERVATIONS OF THE DOUBLE-MODE CEPHEID TU Cas

Recently one of us (Berdnikov, 1992) has decomposed available photoelectric observations of all double-mode Cepheids into two oscillations. It was pointed out as well that the number of the existing observations is not sufficient for certain investigation of light curve variations of the majority of these stars. Therefore we continue to carry out the observations of the all accessible double-mode Cepheids.

Photoelectric observations of double-mode Cepheid TU Cas were carried out in summer-autumn 1993. The 60-cm reflector of the Mt. Maidanak observatory of the Tashkent Astronomical Institute was used and 99 UBVR measurements (Table 1) were obtained.

Table 1

JD hel 2440000+	V	U−B	B−V	V−R	JD hel 2440000+	V	U−B	B−V	V−R
9199.4587	7.824	.354	.668	.580	9211.4567	7.641	-	.517	.492
9201.4275	7.681	.326	.559	.528	9212.3348	7.698	-	.585	.533
9202.3738	7.970	-	.692	.610	9212.4531	7.742	-	.601	.545
9202.4582	7.982	.391	.695	.601	9218.3364	7.326	-	.431	.408
9203.3170	7.294	.297	.396	.397	9219.2904	8.003	-	.722	.628
9203.4053	7.407	.329	.460	.443	9219.3935	8.032	-	.737	.622
9203.4635	7.470	.327	.479	.464	9219.4960	8.069	-	.743	.635
9204.3068	8.029	.430	.731	.625	9220.2852	7.353	-	.410	.411
9204.3917	8.050	.418	.734	.635	9220.4262	7.521	-	.501	.476
9204.4688	8.059	-	.739	.627	9221.3362	7.982	-	.707	.615
9205.3160	7.492	.305	.473	.460	9221.4357	7.999	-	.707	.619
9205.3994	7.560	.330	.506	.490	9221.4958	8.009	-	.704	.620
9205.4651	7.610	.313	.542	.504	9222.2874	7.627	-	.531	.482
9206.3392	7.915	-	.676	.595	9222.4131	7.608	-	.508	.494
9208.4036	7.934	-	.673	.605	9222.4993	7.587	-	.501	.494
9208.4685	7.941	-	.690	.600	9224.2996	7.789	-	.581	.529
9207.3247	7.659	-	.531	.494	9224.4228	7.178	-	.353	.361
9207.4061	7.540	.303	.479	.475	9225.2659	7.876	.383	.687	.591
9207.4692	7.459	-	.450	.445	9225.4146	7.948	-	.719	.610
9209.3728	7.195	-	.361	.352	9225.4976	7.984	-	.719	.620
9210.3410	7.933	.396	.698	.608	9226.2677	7.767	-	.558	.532
9210.4273	7.955	-	.710	.610	9226.4096	7.492	-	.444	.440
9211.3143	7.756	-	.574	.523	9226.4975	7.450	-	.446	.437

Table 1 (continued)

JD hel 2440000+	V	U−B	B−V	V−R	JD hel 2440000+	V	U−B	B−V	V−R
9227.2613	7.785	-	.626	.564	9236.2306	7.996	-	.726	.625
9227.4113	7.819	-	.635	.568	9236.4180	8.025	-	.727	.626
9227.5031	7.831	-	.644	.586	9236.5038	8.044	-	.737	.630
9228.2699	7.975	.400	.674	.607	9237.2246	7.515	-	.469	.452
9228.4252	7.951	-	.655	.586	9237.4086	7.574	-	.510	.482
9228.5009	7.918	-	.633	.577	9238.2822	7.823	-	.640	.567
9229.2607	7.556	.318	.512	.498	9238.4102	7.869	-	.646	.588
9229.4226	7.697	-	.583	.547	9239.2181	7.912	-	.645	.569
9229.5009	7.758	-	.625	.561	9239.4039	7.554	-	.483	.467
9230.2657	8.091	-	.730	.630	9239.5115	7.232	-	.374	.366
9230.4017	8.112	-	.729	.630	9240.2295	7.806	-	.643	.581
9230.4995	8.056	-	.692	.613	9240.3416	7.881	-	.689	.597
9231.2656	7.651	-	.589	.516	9240.5125	7.967	-	.721	.621
9231.4090	7.768	-	.632	.561	9241.2317	7.933	-	.647	.575
9231.4989	7.821	-	.653	.571	9241.3623	7.478	-	.450	.432
9232.2514	7.996	-	.696	.608	9241.5133	7.278	-	.379	.379
9232.4005	7.979	-	.681	.600	9242.3301	7.877	-	.668	.590
9232.4991	7.940	-	.661	.582	9242.4162	7.892	-	.687	.587
9233.2564	7.526	-	.484	.475	9243.2117	7.937	-	.656	.581
9233.4038	7.519	-	.488	.473	9243.3614	7.880	-	.631	.562
9234.2528	7.942	-	.692	.605	9244.2354	7.525	-	.516	.470
9234.4191	8.009	-	.710	.618	9244.3904	7.632	-	.559	.519
9234.4986	8.043	-	.702	.627	9244.5094	7.703	-	.606	.531
9235.2473	7.165	-	.352	.339	9245.2323	8.052	-	.730	.621
9235.4187	7.423	-	.466	.443	9245.3672	8.072	-	.729	.619
9235.5030	7.518	-	.508	.483	9298.1402	7.924	-	.695	.600
					9298.2965	8.095	-	.626	.710

The authors wish to express their thanks to Dr. V.S. Shevchenko for allocation of observing time.

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BVR OBSERVATIONS OF THE DOUBLE-MODE CEPHEID AS Cas

Recently one of us (Berdnikov, 1992) has decomposed available photoelectric observations of all double-mode Cepheids into two oscillations. It was pointed out as well that the number of the existing observations is not sufficient for certain investigation of light curve variations in the majority of these stars. Therefore we continue to carry out the observations of the all accessible double-mode Cepheids.

Photoelectric observations of double-mode Cepheid AS Cas were carried out in summer-autumn 1993. The 60-cm reflector of the Mt. Maidanak observatory of the Tashkent Astronomical Institute was used and 101 BVR measurements (Table 1) were obtained.

Table 1

JD hel 2440000+	V	B−V	V−R	JD hel 2440000+	V	B−V	V−R
9198.4712	12.362	1.447	1.289	9212.3315	12.262	1.336	1.244
9199.4535	12.389	1.273	1.254	9212.4507	12.275	1.357	1.260
9201.4332	12.386	1.454	1.297	9218.3324	12.151	1.304	1.196
9202.3661	12.114	1.251	1.214	9219.2867	12.486	1.414	1.338
9202.4537	11.984	1.219	1.118	9219.3909	12.461	1.454	1.293
9203.3105	12.132	1.323	1.219	9219.4887	12.448	1.485	1.271
9203.3992	12.162	1.339	1.269	9220.2814	12.306	1.362	1.227
9203.4606	12.269	1.375	1.258	9220.4235	12.229	1.370	1.194
9204.3027	12.479	1.472	1.279	9221.3329	12.106	1.274	1.200
9204.3872	12.502	1.406	1.310	9221.4335	12.065	1.291	1.171
9204.4662	12.472	1.499	1.283	9222.2835	12.272	1.369	1.233
9205.3122	12.230	1.340	1.185	9222.4105	12.326	1.406	1.260
9205.3956	12.175	1.339	1.155	9224.2962	11.940	1.217	1.127
9205.4625	12.231	1.343	1.218	9224.4204	12.049	1.271	1.208
9206.3354	12.072	1.258	1.147	9225.2618	12.486	1.474	1.322
9206.4005	12.109	1.305	1.182	9225.4116	12.527	1.482	1.326
9206.4636	12.117	1.290	1.191	9225.4933	12.545	1.450	1.312
9207.3223	12.310	1.367	1.254	9226.2641	12.360	1.360	1.253
9207.4015	12.369	1.393	1.261	9226.4068	12.238	1.278	1.201
9207.4657	12.384	1.441	1.293	9226.4928	12.118	1.290	1.162
9209.3689	12.058	1.305	1.172	9227.2572	12.159	1.337	1.178
9210.3373	12.530	1.487	1.338	9227.4087	12.252	1.345	1.248
9210.4233	12.502	1.492	1.288	9227.4982	12.278	1.388	1.211
9211.3106	12.204	1.329	1.197	9228.2669	12.328	1.406	1.282
9211.4542	12.049	1.266	1.146	9228.4228	12.325	1.375	1.272

Table 1 (continued)

JD hel 2440000+	V	B−V	V−R	JD hel 2440000+	V	B−V	V−R
9228.4967	12.310	1.405	1.265	9237.4061	12.262	1.405	1.221
9229.2579	12.416	1.416	1.282	9237.5045	12.371	1.401	1.296
9229.4200	12.432	1.428	1.327	9238.2782	12.536	1.478	1.296
9229.4966	12.441	1.424	1.293	9238.4077	12.570	1.475	1.314
9230.2620	11.803	1.173	1.088	9239.2142	11.773	1.172	1.054
9230.3991	11.862	1.190	1.108	9239.4014	11.954	1.212	1.139
9230.4947	11.903	1.221	1.119	9239.5074	12.049	1.266	1.169
9231.2631	12.367	1.409	1.318	9240.2257	12.428	1.457	1.310
9231.4051	12.357	1.512	1.286	9240.3369	12.457	1.475	1.284
9231.4941	12.465	1.499	1.327	9240.5081	12.540	1.550	1.277
9232.2475	12.554	1.502	1.266	9241.2275	12.461	1.387	1.263
9232.4033	12.489	1.405	1.282	9241.3597	12.383	1.354	1.255
9232.4948	12.338	1.392	1.227	9241.5091	12.274	1.383	1.217
9233.2538	12.069	1.261	1.183	9242.3273	12.172	1.313	1.211
9233.4012	12.065	1.338	1.190	9242.4123	12.209	1.354	1.242
9234.2489	12.445	1.493	1.270	9242.5087	12.213	1.363	1.186
9234.4167	12.453	1.404	1.305	9243.2081	12.287	1.369	1.249
9234.4941	12.441	1.463	1.251	9243.3588	12.310	1.361	1.278
9235.2435	12.334	1.370	1.231	9243.5112	12.339	1.423	1.243
9235.4161	12.323	1.313	1.283	9244.2311	12.410	1.415	1.277
9235.4982	12.299	1.361	1.230	9244.3877	12.438	1.424	1.273
9236.2265	12.197	1.283	1.216	9244.5049	12.460	1.440	1.283
9236.4155	12.103	1.273	1.183	9245.2288	11.874	1.183	1.113
9236.4993	12.077	1.261	1.164	9245.3646	11.838	1.146	1.116
9237.2221	12.238	1.305	1.243	9298.1243	12.394	1.408	1.291
				9298.2933	12.452	1.410	1.349

The authors wish to express their thanks to Dr. V. S. Shevchenko for allocation of observing time.

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UBVR OBSERVATIONS OF THE DOUBLE-MODE CEPHEID EW Sct

Recently one of us (Berdnikov, 1992) has decomposed available photoelectric observations of all double-mode Cepheids into two oscillations. It was pointed out as well that the number of the existing observations is not sufficient for certain investigation of light curve variations in the majority of these stars. Therefore we continue to carry out the observations of the all accessible double-mode Cepheids.

Table 1

JD hel 2440000+	V	U−B	B−V	V−R	JD hel 2440000+	V	U−B	B−V	V−R
9197.3698	7.948	-	1.730	1.601	9220.2711	8.266	-	1.854	1.692
9198.2252	7.881	1.404	1.697	1.576	9221.3253	7.820	-	1.689	1.543
9198.3195	7.892	1.375	1.704	1.578	9222.2742	7.752	-	1.647	1.541
9199.3265	7.926	1.368	1.737	1.600	9224.2848	8.126	-	1.833	1.654
9200.2336	7.935	1.389	1.722	1.592	9225.2462	8.088	1.438	1.792	1.636
9201.2402	7.956	1.430	1.742	1.612	9226.2482	7.991	1.402	1.744	1.607
9201.3581	7.948	1.360	1.751	1.609	9227.2403	8.000	1.400	1.762	1.607
9202.2454	8.071	1.460	1.795	1.650	9228.2499	7.885	1.383	1.684	1.575
9202.3606	8.098	-	1.817	1.656	9229.2403	7.808	1.376	1.687	1.562
9203.2287	8.201	1.545	1.824	1.669	9230.2433	7.902	-	1.748	1.599
9203.3499	8.199	1.483	1.843	1.673	9231.2446	8.149	-	1.853	1.664
9204.2258	7.885	1.359	1.684	1.560	9232.2318	8.253	-	1.847	1.684
9204.3484	7.852	1.349	1.662	1.568	9233.2339	7.812	-	1.653	1.544
9205.2293	7.672	1.337	1.610	1.522	9234.2333	7.725	-	1.628	1.540
9205.3585	7.704	1.276	1.625	1.541	9235.2271	7.975	-	1.804	1.613
9206.2559	7.894	-	1.751	1.597	9236.2112	8.172	-	1.873	1.669
9206.3683	7.947	-	1.755	1.620	9237.2034	8.152	-	1.826	1.655
9207.2359	8.194	-	1.823	1.690	9238.1957	7.928	-	1.730	1.598
9207.3527	8.186	-	1.889	1.682	9239.1998	7.913	-	1.707	1.588
9209.2200	7.942	1.391	1.706	1.592	9240.2122	7.925	-	1.721	1.592
9209.3607	7.910	-	1.650	1.566	9241.2145	7.930	-	1.720	1.602
9210.2900	7.812	1.355	1.665	1.552	9243.1931	8.117	-	1.825	1.658
9211.2675	7.964	-	1.757	1.612	9244.2177	8.188	-	1.827	1.658
9212.2708	8.040	-	1.777	1.636	9245.2152	7.779	-	1.638	1.545
9218.2849	7.923	1.386	1.726	1.607	9298.1021	7.744	-	1.631	1.530
9219.2760	8.177	-	1.858	1.685					

Photoelectric observations of double-mode Cepheid EW Sct were carried out in summer-autumn 1993. The 60-cm reflector of the Mt. Maidanak observatory of the Tashkent Astronomical Institute was used and 51 UBVR measurements (Table 1) were obtained.

The authors wish to express their thanks to Dr. V.S. Shevchenko for allocation of observing time.

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BVR OBSERVATIONS OF THE DOUBLE-MODE CEPHEID CO Aur

Recently one of us (Berdnikov, 1992) has decomposed available photoelectric observations of all double-mode Cepheids into two oscillations. It was pointed out as well that the number of the existing observations is not sufficient for certain investigation of light curve variations in the majority of these stars. Therefore we continue to carry out the observations of the all accessible double-mode Cepheids.

Photoelectric observations of double-mode Cepheid CO Aur were carried out in summer-autumn 1993. The 60-cm reflector of the Mt. Maidanak observatory of the Tashkent Astronomical Institute was used and 18 BVR measurements (Table 1) were obtained.

Table 1

JD hel 2440000+	V	B−V	V−R	JD hel 2440000+	V	B−V	V−R
9225.4822	7.811	.708	.668	9235.4884	7.574	.611	.589
9226.4821	7.477	.584	.562	9236.4894	7.790	.686	.646
9227.4864	7.890	.733	.673	9237.4853	7.703	.673	.625
9228.4872	7.662	.646	.623	9239.4964	7.728	.679	.633
9229.4861	7.701	.650	.619	9240.4977	7.502	.585	.561
9230.4830	7.742	.687	.642	9241.4983	7.870	.738	.676
9231.4843	7.618	.628	.591	9242.4983	7.498	.588	.565
9232.4831	7.767	.698	.646	9243.5007	7.847	.713	.657
9234.4835	7.889	.753	.676	9244.4946	7.659	.854	.617

The authors wish to express their thanks to Dr. V.S. Shevchenko for allocation of observing time.

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BVR OBSERVATIONS OF THE DOUBLE-MODE CEPHEID V367 Sct

Recently one of us (Berdnikov, 1992) has decomposed available photoelectric observations of all double-mode Cepheids into two oscillations. It was pointed out as well that the number of the existing observations is not sufficient for certain investigation of light curve variations in the majority of these stars. Therefore we continue to carry out the observations of the all accessible double-mode Cepheids.

Table 1

JD hel 2440000+	V	B−V	V−R	JD hel 2440000+	V	B−V	V−R
9197.3653	11.770	1.867	1.755	9220.2672	11.768	1.917	1.757
9198.2323	11.525	1.785	1.677	9221.3206	11.705	1.890	1.711
9198.3152	11.501	1.761	1.664	9222.2706	11.685	1.869	1.733
9199.3218	11.347	1.766	1.616	9224.2812	11.496	1.810	1.677
9200.2285	11.597	1.890	1.734	9225.2417	11.478	1.781	1.678
9201.3534	11.887	-	1.824	9226.2434	11.625	1.852	1.730
9202.2407	11.932	1.926	1.841	9227.2354	11.867	1.918	1.842
9202.3558	11.927	1.994	1.812	9228.2448	11.895	1.987	1.803
9203.2251	11.714	1.854	1.726	9229.2357	11.559	1.825	1.662
9203.3454	11.677	1.905	1.708	9230.2385	11.314	1.707	1.610
9204.2220	11.431	1.765	1.656	9231.2409	11.584	1.813	1.708
9204.3444	11.417	1.757	1.616	9232.2282	11.807	1.932	1.794
9205.2256	11.522	1.832	1.676	9233.2299	11.859	1.927	1.792
9205.3538	11.567	1.811	1.713	9234.2295	11.754	1.874	1.775
9206.2525	11.679	1.885	1.750	9235.2232	11.564	1.843	1.708
9206.3647	11.645	1.932	1.732	9236.2080	11.558	1.795	1.690
9207.2329	11.710	1.859	1.746	9237.1994	11.610	1.808	1.742
9207.3490	11.666	1.923	1.714	9238.1924	11.585	1.796	1.720
9209.2162	11.759	1.896	1.759	9239.1965	11.640	1.852	1.740
9209.3562	11.751	1.965	1.746	9240.2080	11.829	1.909	1.803
9210.2858	11.701	1.823	1.732	9241.2094	11.833	1.908	1.773
9211.2639	11.501	1.770	1.669	9243.1895	11.321	1.734	1.613
9212.2673	11.376	1.761	1.638	9244.2140	11.617	1.856	1.739
9218.2807	11.584	1.837	1.721	9245.2053	11.811	1.972	1.794
9219.2718	11.737	1.891	1.759	9298.0968	11.777	1.947	1.750

Photoelectric observations of double-mode Cepheid V367 Sct were carried out in summer-autumn 1993. The 60-cm reflector of the Mt. Maidanak observatory of the Tashkent Astronomical Institute was used and 50 BVR measurements (Table 1) were obtained.

The authors wish to express their thanks to Dr. V.S. Shevchenko for allocation of observing time.

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BVR OBSERVATIONS OF THE DOUBLE-MODE CEPHEID BQ Ser

Recently one of us (Berdnikov, 1992) has decomposed available photoelectric observations of all double-mode Cepheids into two oscillations. It was pointed out as well that the number of the existing observations is not sufficient for certain investigation of light curve variations in the majority of these stars. Therefore we continue to carry out the observations of the all accessible double-mode Cepheids.

Table 1

JD hel 2440000+	V	B-V	V-R	JD hel 2440000+	V	B-V	V-R
9197.3755	9.632	1.547	1.338	9220.2735	9.341	1.375	1.231
9198.2273	9.778	1.590	1.365	9221.3286	9.378	1.440	1.260
9198.3235	9.773	1.566	1.378	9222.2763	9.648	1.572	1.334
9199.3321	9.207	1.318	1.203	9224.2880	9.479	1.472	1.271
9200.2375	9.429	1.442	1.280	9225.2501	9.455	1.430	1.277
9201.2437	9.726	1.571	1.364	9226.2522	9.420	1.425	1.275
9201.3630	9.735	1.586	1.358	9227.2446	9.573	1.539	1.323
9202.2491	9.633	1.542	1.303	9228.2541	9.755	1.583	1.356
9202.3635	9.616	1.512	1.320	9229.2445	9.221	1.330	1.199
9203.2318	9.414	1.414	1.262	9230.2469	9.421	1.458	1.289
9203.3535	9.424	1.433	1.270	9231.2479	9.726	1.595	1.365
9204.2292	9.477	1.456	1.284	9232.2356	9.673	1.533	1.350
9204.3528	9.475	1.459	1.293	9233.2373	9.359	1.389	1.244
9205.2326	9.502	1.462	1.311	9234.2370	9.499	1.486	1.293
9205.3627	9.516	1.474	1.302	9235.2304	9.536	1.507	1.304
9206.2591	9.615	1.539	1.338	9236.2145	9.601	1.505	1.328
9206.3721	9.633	1.551	1.321	9237.2066	9.640	1.524	1.319
9207.2389	9.681	1.515	1.341	9238.1978	9.242	1.356	1.216
9207.3558	9.624	1.486	1.306	9239.2023	9.474	1.485	1.297
9209.2223	9.484	1.489	1.294	9240.2145	9.772	1.609	1.372
9209.3636	9.521	1.505	1.330	9241.2169	9.578	1.489	1.308
9210.2941	9.772	1.606	1.372	9243.1952	9.577	1.529	1.324
9211.2693	9.559	1.476	1.288	9244.2201	9.640	1.545	1.339
9212.2726	9.348	1.396	1.267	9245.2177	9.559	1.496	1.317
9218.2878	9.558	1.503	1.332	9298.1059	9.353	1.382	1.247
9219.2781	9.805	1.589	1.389				

Photoelectric observations of double-mode Cepheid BQ Ser were carried out in summer-autumn 1993. The 60-cm reflector of the Mt. Maidanak observatory of the Tashkent Astronomical Institute was used and 51 BVR measurements (Table 1) were obtained.

The authors wish to express their thanks to Dr. V.S. Shevchenko for allocation of observing time.

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Improved Positions of Southern NSV Stars. II.

This is the second in a series of notes aimed to provide accurate coordinates of southern NSV stars.

Details and general procedures on the program may be found in Lopez and Girard (1990) and Lopez and Lepez (1993).

Table I lists the newly determined positions. The first column gives the NSV number; the second and third provide the RA and Dec (equinox B1950.0), respectively; the fourth column is the epoch of observation (given as epoch *minus* 1900); the last two columns list the differences between our new positions and those quoted in the NSV catalogue in minutes of time in RA and arc minutes in Dec. The differences are in the sense new position *minus* NSV coordinates.

The 94 objects listed in Table I added to the 464 already reported by Lopez and Girard (1990) and Lopez and Lepez (1993), bring to 558 the total number of NSV stars for which we have been able to improve their positions.

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References:

Lopez, C.E., and Girard, T.M. 1990. Publ. Astron. Soc. of the Pacific **102**, 1018.

Lopez, C.E., and Lepez, H.S. 1993. Inf. Bull. Var. Stars. No. 3944.

TABLE I
Improved Positions of Southern NSV Stars

Star	RA (1950.0) h	m	s	Dec °	'	"	Epoch	ΔRA m	ΔDec '
09778	17	49	7.45	-56	55	48.7	68.91	-0.126	-0.012
09779	17	49	15.98	-46	21	3.7	69.09	-0.034	+0.139
09782	17	49	21.78	-44	56	47.5	69.09	-0.020	+0.008
09784	17	49	23.81	-46	47	43.8	69.09	-0.020	+0.070
09792	17	49	49.09	-49	42	19.2	68.54	+0.002	-0.020
09811	17	50	31.53	-46	18	15.6	69.09	-0.024	+0.241
09819	17	51	2.49	-43	22	5.1	69.09	-0.009	+0.015
09826	17	51	22.11	-48	0	29.5	68.82	-0.015	+0.008
09829	17	51	39.70	-49	45	24.1	68.54	+0.095	-0.502
09837	17	51	51.28	-55	40	4.4	69.04	+0.005	+0.126
09848	17	52	22.72	-48	30	49.3	68.54	-0.005	-0.021
09849	17	52	31.39	-54	57	30.6	69.04	+0.023	-0.409
09852	17	52	36.33	-53	38	13.4	69.04	+0.022	-0.124
09862	17	53	10.68	-47	39	11.5	68.82	-0.022	-0.391
09879	17	53	56.52	-49	45	42.4	68.54	+0.042	-0.707
09880	17	53	55.25	-45	57	34.5	68.56	-0.012	-0.076
09896	17	54	59.37	-51	37	11.9	68.54	+0.006	-0.098
09900	17	55	5.60	-45	43	11.9	68.56	-0.023	-0.099
09906	17	55	14.01	-46	46	57.0	68.56	0.000	-0.050
09917	17	55	31.10	-55	41	55.1	69.04	-0.048	+0.182
09923	17	55	41.40	-42	34	30.5	68.56	-0.010	+0.393
09924	17	55	40.66	-47	43	11.2	68.55	-0.022	+0.313
09925	17	55	41.74	-45	54	44.7	68.56	-0.021	-0.145
09933	17	56	8.59	-63	24	44.4	70.17	-0.007	-0.140
09936	17	56	15.91	-53	48	57.5	69.04	-0.001	-0.259
09948	17	56	52.18	-66	1	47.8	70.17	+0.003	-0.096
09953	17	57	6.39	-53	23	26.3	69.04	-0.010	+0.161
09960	17	57	28.84	-53	9	57.9	69.54	-0.003	+0.334
09969	17	57	55.43	-46	29	33.4	68.56	+0.124	-0.057
09972	17	57	53.20	-44	48	43.2	68.56	-0.163	-0.220

TABLE I (cont.)

Star	RA h	m	s (1950.0)	Dec °	'	"	Epoch	ΔRA m	ΔDec '
09978	17	58	24.54	-47	16	46.3	68.55	-0.008	+0.029
09998	17	58	53.94	-54	3	39.9	69.54	-0.018	-0.665
10021	17	59	29.09	-47	27	9.3	68.55	+0.035	-0.055
10049	17	59	55.65	-47	43	11.8	68.55	+0.044	-0.496
10105	18	1	6.94	-45	0	50.8	68.56	+0.016	-0.446
10155	18	1	56.59	-46	49	51.6	68.56	+0.010	-0.059
10164	18	2	15.02	-47	31	44.9	68.55	-0.016	-0.049
10175	18	2	48.38	-53	13	2.9	69.54	+0.023	-0.048
10177	18	2	56.38	-45	41	51.7	68.56	+0.040	+0.038
10197	18	3	32.91	-46	49	7.4	68.56	-0.001	-0.124
10212	18	4	6.56	-47	58	19.8	68.55	-0.024	+0.071
10216	18	4	17.47	-63	9	16.9	70.17	-0.042	-0.182
10229	18	4	51.28	-45	59	37.0	68.56	+0.021	-0.017
10230	18	4	52.04	-51	58	58.2	69.04	+0.034	-0.070
10259	18	5	58.18	-44	31	59.6	68.56	+0.003	-0.394
10273	18	6	30.37	-49	8	57.9	68.54	+0.023	-0.664
10283	18	6	46.74	-54	50	25.7	69.54	+0.046	-0.029
10288	18	7	9.68	-44	45	43.8	68.57	-0.005	-0.130
10307	18	7	40.46	-53	2	20.1	69.54	-0.009	+0.265
10313	18	7	54.66	-42	7	25.4	68.57	-0.006	+0.077
10321	18	8	1.09	-48	29	24.1	68.54	-0.032	+0.299
10323	18	8	2.88	-45	57	43.5	68.57	-0.019	-0.125
10325	18	8	7.89	-45	49	46.2	68.57	-0.019	+0.129
10332	18	8	26.53	-46	21	6.4	68.57	-0.024	-0.707
10338	18	8	48.54	-46	13	13.5	68.57	-0.024	-0.024
10350	18	9	16.64	-47	55	6.6	68.56	-0.006	+0.090
10352	18	9	23.87	-49	55	53.3	68.54	+0.015	+0.012
10354	18	9	31.19	-45	26	57.8	68.57	+0.020	+0.037
10373	18	10	19.26	-46	22	58.5	68.57	-0.012	-0.275
10383	18	10	46.40	-54	18	30.5	69.54	+0.007	+0.091
10440	18	12	42.10	-49	29	28.6	68.54	+0.002	+0.024
10441	18	12	42.99	-49	32	45.4	68.54	+0.017	+0.244

TABLE I (cont.)

Star	RA (1950.0)			Dec			Epoch	ΔRA	ΔDec
	h	m	s	°	'	"		m	'
10465	18	13	30.78	-45	55	31.3	68.57	-0.004	-0.122
10568	18	15	54.90	-46	48	6.4	68.57	-0.002	-0.107
10583	18	16	4.74	-47	42	24.7	68.56	-0.004	-0.012
10600	18	16	23.46	-45	23	38.5	68.57	+0.008	-0.241
10628	18	17	7.13	-61	31	27.1	68.64	+0.002	+0.348
10630	18	17	5.13	-63	2	15.9	70.30	-0.048	+0.334
10634	18	17	13.05	-56	25	39.4	69.54	+0.018	-0.057
10654	18	17	51.78	-46	23	34.8	68.56	-0.020	-0.179
10663	18	18	13.22	-62	13	18.3	69.62	-0.030	+0.394
10678	18	18	50.48	-63	39	44.9	70.30	+0.008	+0.251
10702	18	19	42.64	-47	56	14.9	68.57	-0.006	+0.251
10703	18	19	44.16	-61	30	1.2	69.62	-0.031	+0.380
10708	18	19	57.01	-45	55	27.8	68.57	+0.034	-0.363
10726	18	20	49.15	-43	58	36.5	68.57	+0.036	-0.408
10737	18	21	23.59	-62	59	31.5	70.40	-0.007	-0.025
10751	18	21	59.51	-62	54	4.7	70.21	-0.025	+0.422
10759	18	22	23.01	-60	34	47.6	69.62	0.000	-0.094
10769	18	22	50.19	-43	15	7.5	68.57	+0.020	-0.225
10795	18	23	43.10	-45	28	42.1	68.57	+0.018	-0.102
10811	18	24	18.28	-46	56	42.3	68.57	+0.021	-0.205
10813	18	24	20.85	-47	8	6.2	68.57	+0.031	-0.104
10820	18	24	30.64	-61	51	11.7	69.80	-0.039	+0.205
10828	18	24	49.36	-47	33	19.7	68.57	+0.023	+0.071
10829	18	24	51.50	-44	52	50.5	68.57	+0.025	-0.241
10838	18	25	1.86	-52	56	1.8	69.54	-0.002	-0.030
10840	18	25	8.31	-46	13	46.8	68.57	+0.039	-0.280
10859	18	25	42.80	-43	47	17.0	68.57	+0.047	-0.284
10878	18	26	9.00	-60	9	45.7	70.59	-0.100	+0.038
10885	18	26	35.58	-46	29	1.8	68.57	+0.010	-0.231
10887	18	26	41.07	-46	58	15.1	68.57	+0.018	-0.051
10901	18	27	12.49	-45	25	13.5	68.57	+0.058	-0.125
10904	18	27	13.50	-43	39	7.7	68.57	+0.025	-0.229

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STARSPOT ACTIVITY ON THE G0 III STAR 31 COMAE

31 Comae is a rapidly rotating, single G0III star with rather weak Ca II H and K emission lines due to large rotational broadening (Wilson 1966) but with very high chromospheric line fluxes of $\log \mathcal{F}(K) \geq 6.6$ erg cm^{-2}s^{-1} (Strassmeier et al. 1990). It is one of the few stars found within the Hertzsprung gap in the H-R diagram. IUE observations by Simon (1984) show the presence of bright chromospheric and transition-region lines. On the contrary, Bopp et al. (1988) and Strassmeier et al. (1990) found no sign of chromospheric emission at Hα nor does the equivalent width vary on time scales ranging from days to years (Bopp et al. 1988). An IUE search for rotational modulation of ultraviolet line fluxes was negative too (Simon 1986). Photometric monitoring of 31 Com with an Automatic Photoelectric Telescope in the years 1983–1986 (Strassmeier & Hall 1988) also did not show any variability greater than ± 0.009 mag in V. Is the convection zone of 31 Com too shallow for large spots or has it just a symmetric spot distribution so that no rotational modulation would occur?

In this IBVS paper we report the discovery of photospheric line profile deformations, most likely caused by cool starspots, and also present some evidence that the profile shape is varying. We interpret these changes to be due to rotational modulation. Additionally, a single spectrum of the spectral region around 6700 Å shows the presence of a strong Li I 6707 Å resonance line. The observations in this paper were obtained with the Canada-France-Hawaii Telescope in December 1993. We used the 600 l/mm mosaic grating in first order with the f8.2 camera. The instrumental resolution was 27,000 and the 2048^2 Lick CCD allowed for a wavelength coverage of 200 Å and S/N up to 500:1.

Figure 1 shows the profiles of four photospheric lines with different values for the excitation potential and $\log gf$: Ca I 6439 (χ = 2.51 eV, $\log gf = +0.4$), Fe I 6430 (χ = 2.18 eV, $\log gf = -1.85$), Fe I 6411 (χ = 3.65 eV, $\log gf = -0.1$), and Fe I 6393 (χ = 2.43 eV, $\log gf = -1.62$). The upper profile in the panels in Fig. 1 is from 23 Dec. 1993 and the lower profile from 29 Dec. 1993 and the exact time difference between the two exposures is 6.045 days. The characteristic "emission bumps", signatures of an inhomogeneous surface temperature distribution, are seen in all four lines. Note that the Fe I line at 6430Å is blended with the strong Fe II line at 6432Å. The measured line ratio Fe I/Fe II is 1.42±0.05, in good agreement with the G0 classification. The other three lines in Fig. 1 (6439, 6411, 6393Å) are basically unblended and have equivalent widths of 185, 130, and 160 mÅ, respectively. From their average FWHM of 2.08±0.05 Å we compute a projected rotational velocity for 31 Com of 57.0±1.5 km s^{-1}, assuming a macroturbulence of 5 km s^{-1}. With this $v \sin i$ measure, and a typical stellar radius for a G0III star of 6 $R_{\odot}$ (Schmidt-Kaler 1982), and correcting for $< \sin i > = \pi/4$, we estimate a rotational period of approximately 4.2 days. Thus, our line

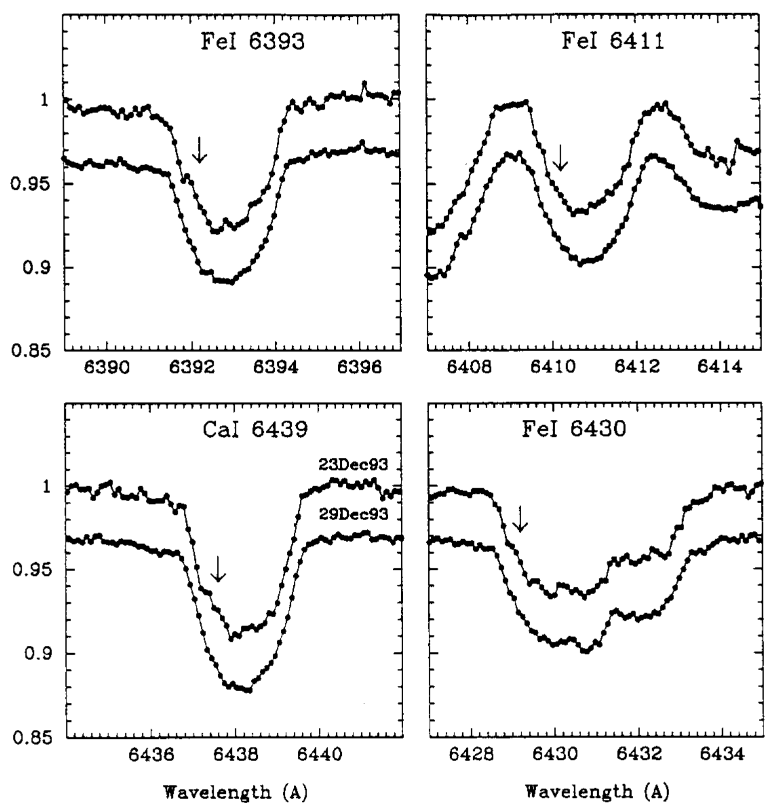

Figure 1: Four line profiles of 31 Comae. The four lines are Ca I 6439, Fe I 6430 (blended with Fe II 6432), Fe I 6411, and Fe I 6393. Each panel shows two observations taken 6 days apart. The arrow marks an "emission bump" typical for cool starspots.

profile from "29Dec93" most likely shows the opposite side of the star as compared to the profile from "23Dec93". If we believe that the line profile deformations are indeed real and due to spots, 31 Comae would be one of the "earliest" stars with cool surface spots.

We have also obtained a single spectrum of the 6700-Å region (Fig. 2) to search for the presence of the resonance line of neutral lithium at 6707Å. The presence of lithium would suggest a fairly young stellar system that had not had time yet to deplete its surface lithium. However, it is still not fully clear whether stellar magnetic activity affects the amount of observed surface lithium, but there is some evidence now that the effects of surface activity are less pronounced than previously thought (Pallavicini et al. 1993).

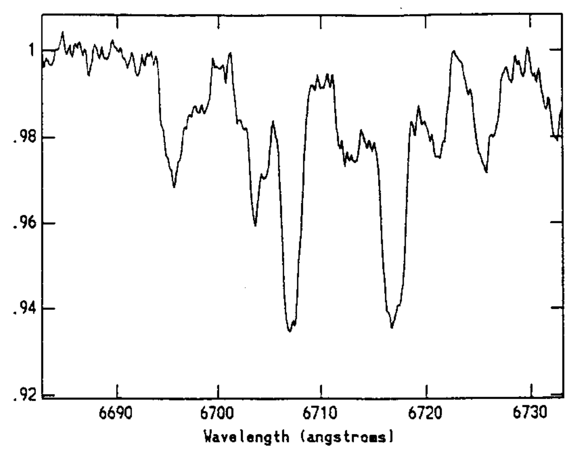

Figure 2: A spectrum of the 6700-Å region of 31 Comae. The spectrum shows a strong Li I 6707 absorption line comparable to the strength of the nearby Ca I 6717 line. We measured a lithium abundance of $\log n(\mathrm{Li}) = 3.0$, indicating that 31 Com must be a relatively young giant.

A multicomponent Gaussian fit to the 6700-6710 Å region of 31 Com yields an equivalent width of 135±10 mÅ for Li I 6707 and similarly 160±10 mÅ for Ca I 6717. The Li I equivalent width is converted to an abundance of $\log n(\mathrm{Li}) = 3.0$ using the curves of growth of Pallavicini et al. (1987) for $T_{\mathrm{eff}} = 5760$ K and $\log g = 3.0$ (Bell & Gustafsson 1989).

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VARIABLE STARS OBSERVED IN THE CARNEGIE SOUTHERN HEMISPHERE OBJECTIVE-PRISM SURVEY

In 1977 S. A. Shectman and G. W. Preston began an objective-prism survey designed to discover stars of low metal abundande in the galactic halo by making photographic observations of a relatively small region of the spectrum centered on the H and K lines. Originally the 46-cm Palomar Schmidt was used, but soon the work was transferred to the 61-cm Curtis Schmidt on Cerro Tololo. In the ensuing years a very large number of weak-metal candidates and probable horizontal-branch A stars have been picked up, for many of which accurate position, photometry, and additional spectroscopy were obtained.

It seems likely that an appreciable number of known RR Lyrae stars would have been noted in this work, but the investigators did not, at least at first, check their lists for such. The writer has done so; and a considerable number of known RR Lyrae and suspected variables are in fact included in their lists. The objects involved are contained in Table 1, where the numbers given after the plate numbers refer to the following papers:

1. Pier, J. R., 1982, *AJ*, **87**, 1515
2. Beers, T. C., Preston, G. W., and Shectman, S. A., 1985, *AJ*, **90**, 2089
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4. Beers, T. C., Preston, G. W., and Shectman, S. A., 1989, *ApJS*, **70**, 679
5. Preston, G. W., Shectman, S. A., and Beers, T. C., 1991, *ApJS*, **76**, 1001
6. Beers, T. C., Preston, G. W., Shectman, S. A., Doinidis, S. P., and Griffin, K. E., 1992, *AJ*, **103**, 267
7. Beers, T. C., Preston, G. W., and Shectman, S. A., 1992, *AJ*, **103**, 1987

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Table 1.
Variable Stars Noted in the Carnegie Objective-Prism Survey

Name	Pl. No.	Ref.
YZ Aqr	29512-32	7
BP Aqr	22893-40	3
FV Aqr	22886-13*	7
GL Aqr	22886-50	6
GR Aqr	22886-63	3
UV Cap	22944-47	3
VV Cap	22898-21	3
AN Cap	22955-99	6
CC CrA	22936-63	3
AC Eri	22169-25	5,6
SX Gru	22951-111	3,7
TY Gru	22881-71	2,5,7
UY Gru	22875-17	2,5,7
AQ Gru	29513-24	3
KS Hya	22874-6	5,7
XX Ind	22940-90	3
CX Lib	22884-82	3
SV Mic	22943-149	7
AA Mic	22879-143	7
AI Mic	22937-29	3
AN Mic	22937-45	7
AS Mic	22937-46	7
V689 Oph	22872-10	3,5
V729 Oph	22872-128	5,6
V1017 Oph	22872-9	5,6
V1020 Oph	22872-12	3,5
V1042 Oph	22872-138	6
ST Pav	22897-7	5,6
FV Pav	22873-54	3,6
GK Pav	22873-52	5,7
LU Pav	22873-25	3
LV Pav	22873-46	3
V337 Pav	22940-64	3
SX PsA	29493-9	6
SS Ret	29529-53	3
ST Ret	29529-110	3
V373 Sgr	22936-45	3
V393 Sgr	22936-268	1,3,5
V407 Sgr	22936-332	3
V436 Sgr	22939-5	3
V464 Sgr	22936-204	3
V467 Sgr	22936-176	3
V471 Sgr	22936-232	3
V476 Sgr	22936-271	3
V2194 Sgr	22964-33	7
V2198 Sgr	22964-91	3,4
V2202 Sgr	22964-61	5,7
V2208 Sgr	22964-106	1,3,4,5
V2231 Sgr	22964-196	3,4
V2244 Sgr	22885-19	3
V2245 Sgr	22885-22	3
V2262 Sgr	22885-202	3
V2272 Sgr	22943-119	3
V2274 Sgr	22943-135	3
V2279 Sgr	22885-153	3
RW Scl	29514-38	3,5
TV Scl	22966-73	3,5
VX Scl	29504-26	3
AE Scl	29518-2	3,5
EZ Ser	22890-32	5,6
NZ Tel	22947-208	5
X Tuc	22938-19	2,5,6
WX Tuc	22953-2	3
BB Tuc	22953-19	3
HK Vir	22877-28	6
NSV 215	29527-35	3,5
382	22953-8	6
581	29504-32	7
1573	22186-20	3
11784	22891-57	3,5
11804	22947-110	3
13399	22880-128	3
13687	22937-90	7
13791	22948-23	3
13844	29495-54	3
13999	22951-123	3
14322	22938-21	6
14712	22941-52	3,5
14743	22876-16	7

*Also 29512-13 7

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AE AQUARII IN 1993: CESSATION OF THE 33^s OSCILLATIONS?

AE Aqr is normally classified as a novalike variable. However, in many ways it is a rather unique object (Bruch 1991). It is also the intermediate polar with the shortest known rotation period of the compact object. Patterson (1979) detected very stable oscillations with a period of 33^s.08 and a second harmonic at half this value. It is supposed to be due to radiation from two magnetic poles with different intensities rotating with the primary of AE Aqr. This view is supported by the detection of x-ray emission with the same period by Patterson et al. (1980). More recently, Eracleous et al. (1993) presented a comprehensive study of the UV and optical characteristics of the 33^s oscillations based on simultaneous *HST* and earthbound observations.

The 33^s oscillation of AE Aqr is a persistent characteristic of the system. Most power spectra of light curves with a sufficient time resolution clearly show a prominent peak at both the fundamental frequency and the first harmonic (Patterson 1979). In less numerous cases one of the peaks dominates over the other while even more rarely one or both of them hide among a quasi continuum of peaks caused by quasi-periodic oscillations (QPOs) close to the characteristic frequency. However, as we will show in this small contribution, the oscillations of AE Aqr can also vanish below a detectable limit.

In July and August 1993 we performed time resolved photometry of AE Aqr at the 6m–telescope of the Special Astrophysical Observatory at Nizhnij Arkhyz, Russia, and at the 60cm–telescope of the Laboratório Nacional de Astrofísica on Pico dos Dias, Brazil. The 6m–telescope data consisted of three sets per night with a duration of either 30^{m}or 1^h, separated by intervals of about the same size. An ultraviolet filter was used, and the sampling time was 0^s.5. The 60cm–telescope data consist of light curves with durations between 2 and 6 hours, obtained quasi-simultaneously in white light and the Cron–Cousins *UBVRI* system at a sampling time of 5^s. Table 1 contains a journal of observations.

As a typical example, the unfiltered light curve of Aug. 26 is displayed in Fig. 1. It is quite characteristic for AE Aqr in showing a phase of violent activity which is followed without any noticeable transition by a quiescent phase. This kind of photometric behaviour is not observed in any other cataclysmic variable (Bruch 1991). While a study of the flaring activity is currently underway, we will concentrate here on the behaviour of the 33^s oscillation in AE Aqr.

We have calculated power spectra using discrete Fourier transforms for all our data sets. Surprisingly, none of them contained a clear signature of either a period of 33^s.08 or of 16^s.04. Not even a recognizable enhancement of power around the corresponding frequencies, indicating QSOs, is present. While in some power spectra peaks at approximately

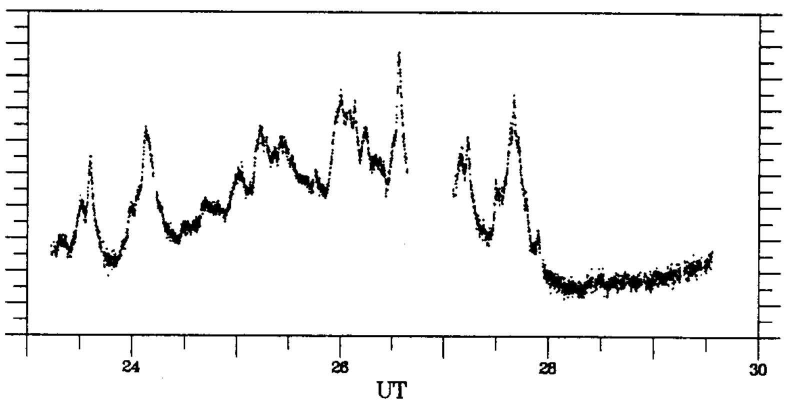

Figure 1. Unfiltered light curve of AE Aqr on 1993, August 26

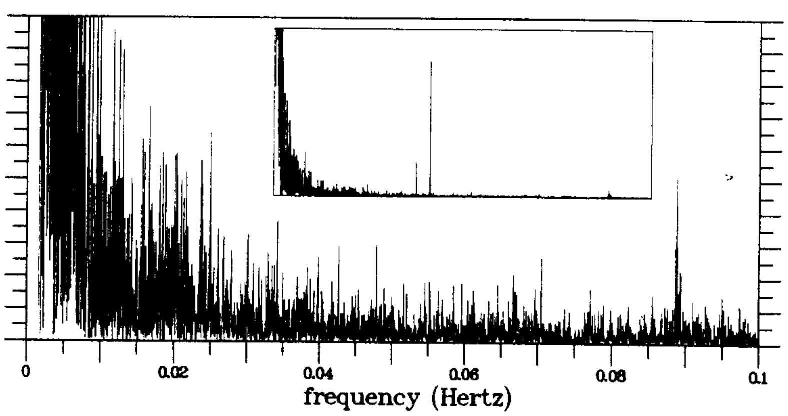

Figure 2. Power spectrum of the light curve of AE Aqr on 1993, August 26. The inset contains the power spectrum of the same light curve to which two tracer signals have been added.

Table 1 : Journal of observations

Date (1993)	Start time	End time	No. of integr.	Time resolution (sec)
Jul. 28	1^h20^m	4^h11^m	9000	0.5
Jul. 28	23^h0^m	27^h19^m	17340	0.5
Aug. 13	23^h12^m	25^h8^m	1215	5.0
Aug. 18	0^h42^m	2^h55^m	1517	5.0
Aug. 26	23^h13^m	29^h33^m	3978	5.0

the expected frequencies occur, they are not higher than numerous peaks at neighbouring frequencies and can thus not be considered as reliable detections of the 33^s oscillation or its harmonic. In Fig. 2 the power spectrum of the light curve of Aug. 26 is shown. The other power spectra look similar. In order to test the reliability of this surprising result we added tracer signals of amplitude $0\overset{m}{.}01$ (period 21^s) and $0\overset{m}{.}005$ (period $26\overset{s}{.}3$) to the light curve and repeated the calculations. In all resulting power spectra the tracer signals appear as strong features (see inset in Fig. 2 for the case of Aug. 26).

In order to investigate if this behaviour is unprecedented or not, and to test the proper performance of our reduction software we calculated power spectra of 46 light curves of AE Aqr obtained between 1978 and 1992 (kindly made available to us by Profs. Nather and Robinson). Among these are several of the light curves used by Patterson (1979) in his original detection of the 33^s oscillations, and the optical light curve used in the study of Eracleous et al. (1993). In order to make sure that the absence of oscillations in our data is not just due to our procedures not being sensitive enough, we added tracer signals of different strengths of several of these light curves and binned them in various ways in order to simulate different time resolutions. These tests clearly showed that the oscillations would have been detected in our data if they had been comparable in strength to those in the test light curves.

Among the 46 light curves we found only two cases (observed with a separation of only a few hours on 1978, Aug. 27) where neither the typical coherent oscillations nor QPOs at the corresponding frequencies could be detected. Thus, the 33^s oscillation of AE Aqr falling below the detection threshold – while possibly not being unprecedented – appears to be at least a rare event. The only report about such an event of which we are aware is given by van Paradijs et al. (1989). They suspect, however, that their inability to detect the oscillations may well be due to an insufficient sensitivity of their measurements.

There are no strong limits on the duration of the undetectability of the 33^s oscillations. They remained unseen for at least 4 weeks (provided that no variations on shorter time scales occur). The last detection before our observations was reported by Eracleous et al. (1993). We do not know of observations obtained after those described here.

The power spectrum of Aug. 26 contains an interesting feature which is not observed during the other nights, namely an enhancement of power close to 8.88×10^{-2} Hz, indicating QPOs at approximately $11\overset{s}{.}26$ (see Fig. 2). This is close to, but significantly different from the third harmonic of the 33^s oscillations. Regarding the flaring and the quiescent parts of the light curve separately, it is found that while the fundamental oscillation and its first harmonic remain invisible in both cases, these QPOs are definitely stronger when AE Aqr is flaring, but are also detectable in quiescence.

In order to explain the temporal variations of the relative strength of the 33^s oscillations and its first harmonic, Eracleous et al. (1993) discuss variations in the height of the shock above the surface of the central body. In an extreme case, i.e. if the shock height over both poles is very low it appears conceivable that the oscillations cease to be detectable. Their alternative explanation, that one of the magnetic poles becomes inactive does not really solve the problem but shifts it only to the question as to why it stops to be active. Moreover, a cessation of the oscillations would imply inactivity of both poles. Also their third alternative – the optical light being dominated by reprocessed UV/X-radiation from the vicinity of the central body – cannot easily explain the complete absence of the oscillations.

Other explanations might invoke precession of the rotational axis of the primary – as in the case of Her X–1 – of a warped accretion disk causing "on" and "off" stages of the x–ray pulsations. In this case the cessation of the oscillations in AE Aqr must be a periodic phenomenon. The light curves available to us are very unequally spaced in time which makes it difficult to check this consequence.

However, more appealing than the analogy to Her X–1 might be the idea that the oscillating light source is temporarily screened from view by surrounding matter. If it is possible that matter in the accretion disk near the Alfvén surface is drawn out of the equatorial plane not only locally but around the entire azimuth, it appears possible that one or both (depending on the details of the geometry) of the magnetic poles become invisible, causing the observed variations of the strength of the 33^s oscillations and its harmonic or even leading to their temporary cessation. Moreover, temporal and spatial stochastic variations of the optical depth of the screening matter may even explain the QPOs which are sometimes observed to replace the coherent oscillations.

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PHOTOMETRIC OBSERVATIONS OF VW CEPHEI

VW Cep (SAO 9828, BD+75°0752, HD 197433) is a W UMa type eclipsing binary. This system was discovered as a variable star by Schilt in 1926 (Vinkó, 1989).

The observations of VW Cep were made on the two nights 25/26 and 27/28 August 1992, with a 0.4m telescope type Nasmyth at N. Copernicus Observatory and Planetarium in Brno, Czech Republic. The telescope was used with the standard U, B, V filters and uncooled EMI 6256B photomultiplier. The integration time of one measurement was ten seconds.

The comparison and check stars are SAO 9911 (HD 200039) and SAO 9917 (HD 200251), respectively. Photometric data for comparison star was taken from The Bright Star Catalogue (Hoffleit et al., 1982) (V=6.05, B−V=+0.93), and the U−B index was derived from photometry of ϵ Draconis (V=3.82, B−V=+0.89, U−B=+0.52, (Iriarte et al., 1965)) as +0.66 mag. The 105 points obtained in each colour are plotted in Figure 1. Figure 2 shows the 220 points of the color indices.

The following ephemeris was used for computing of the O−C values because elements in GCVS 1985 indicate very poor agreement with my observations. The analysis of these data will be published in a future paper.

$$JD_{hel}MinI = 2448862^{d}.5255 + 0^{d}.27831460 \times E$$

The new times of minima were calculated using the Kwee – van Woerden's (1956) method and are given in Table I.

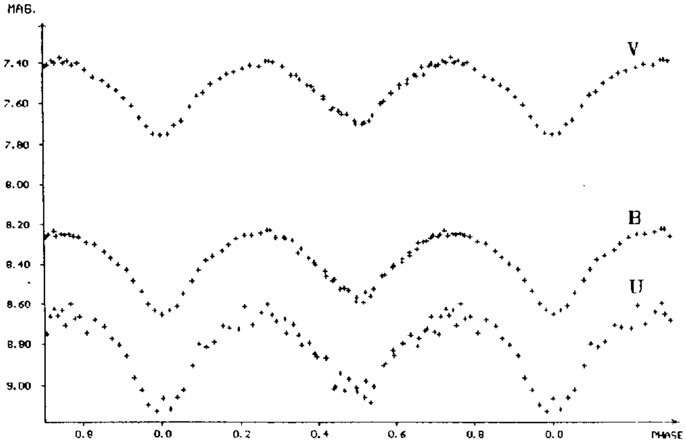

Figure 1. The light curves of VW Cephei

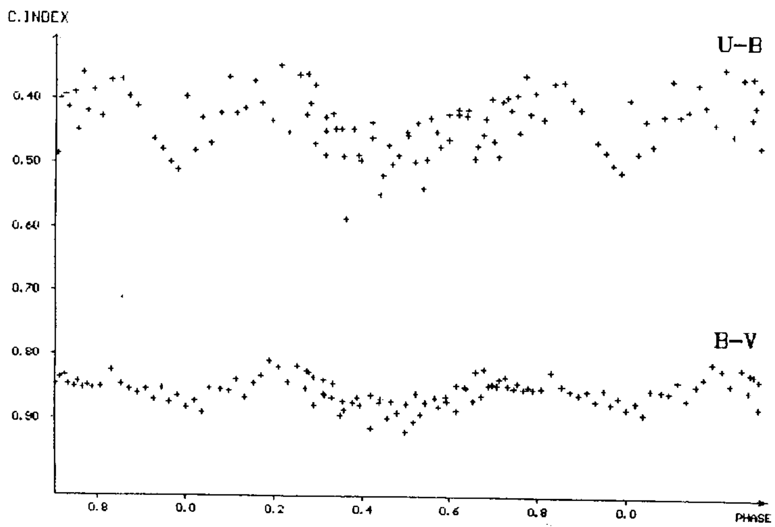

Figure 2. The U−B and B−V colour curves

Table I

J.D. Hel 2400000+		Filter	Type of Min.
48860.4386	±0.0003	V	II
48860.4378	±0.0003	B	II
48860.4364	±0.0004	U	II
48862.3862	±0.0004	V	II
48862.3870	±0.0004	B	II
48862.3868	±0.0010	U	II
48862.5257	±0.0002	V	I
48862.5256	±0.0002	B	I
48862.5252	±0.0004	U	I

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Kwee, K. K., van Woerden, H., 1956, *Bull. Astron. Inst. Neth.*, **12**, No. 464

Vinkó, J., 1989, *Inf. Bull. Var. Stars*, No.3291

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PHOTOELECTRIC PHOTOMETRY OF THE ECLIPSING BINARY STAR CQ CEPHEI

CQ Cephei (HD 214419=BD+56°2818) is an eclipsing binary system with a period of ~1.64 days. The binary nature of CQ Cep was discovered by McLaughlin and Hiltner (1941). First photoelectric light curves were obtained by Hiltner (1950). Leung et al. (1983) analyzed Hiltner's V light curve and their NIV 4058 Å radial velocity curve with the Wilson - Devinney method. Their analysis showed that the system has a contact configuration. One component is a WN7 and the other is probably a massive early type star (O7).

This eclipsing binary was observed photoelectrically at the Ege University Observatory on 19 nights in 1991 and 12 nights in 1992. The observations were made with the 48 cm Cassegrain reflector. An unrefrigerated EMI 9781A photomultiplier tube and B, V filters which are very close to the standard UBV system were used. BD+56°2815 was selected as comparison and BD +56°2813 as check star. The comparison star was found to be constant in brightness during the period of observations. A total 1511 observational points were obtained in each colour. All the differential magnitudes (in the sense variable minus comparison) were corrected for the atmospheric extinction.

Gaposchkin (1944) discovered the changes of period and analysed photographic observations made in the years 1901 to 1942. He interpreted the shortening of period as the effect of a third body. Semeniuk (1968) proved the shortening of period, however, she pointed out the linear light elements which satisfy the observations made in the interval 1945-65. The period variation and possible causes of it was discussed and interpreted due to the mechanism of mass transfer and loss from the WR component by several authors (Kreiner and Tremko, 1983, 1985). According to their analyses, the period of CQ Cep was decreasing over a long time.

During the observations 7 primary and 3 secondary times of minima were obtained which are given in Table I. These primary times of minima with other photographic and photoelectric ones taken from Kreiner and Tremko (1983, 1985) are used in O−C analysis. The $(O-C)_1$ values were computed using the following light elements given by Kreiner and Tremko (1983):

$$\text{Hel. Min. I J.D.} = 2432456^{d}.668 + 1^{d}.6412438 \times E \qquad (1)$$

The $(O-C)_1$ diagram of CQ Cep is shown in Figure 1. As it is clearly seen from the figure, CQ Cep shows a parabolic variation indicating a continuous decrease in the period. Using the times of minima plotted in Figure 1, quadratic light elements have been calculated by the weighted least squares method as follows:

$$\text{Hel. Min. I J.D.} = \underset{\pm 2}{2432456^{d}.694} + \underset{\pm 2}{1^{d}.6412481} \times E - \underset{\pm 36}{9.29 \times 10^{-10}} \times E^2 \qquad (2)$$

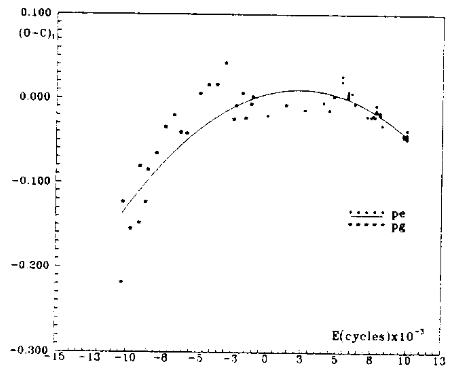

Figure 1. O−C diagram for CQ Cep

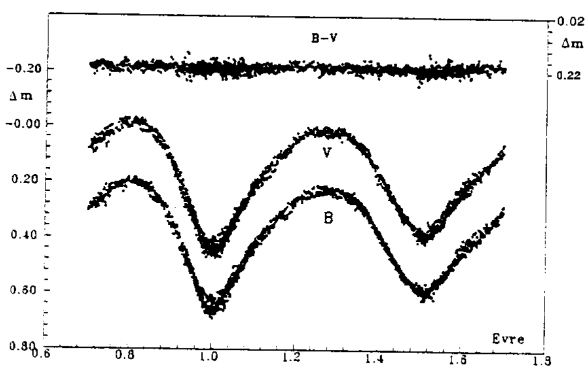

Figure 2. Differential B and V light and B−V colour curves of CQ Cep

Table I
Times of minima of CQ Cephei

J.D. Hel. 2400000+	Method	Min	E	$(O-C)_1$	$(O-C)_2$
48437.4352	pe	I	9737	−0.0437	−0.0026
48506.3667	pe	I	9779	−0.0444	−0.0027
48515.4053	pe	II	9784.5	—	—
48524.4189	pe	I	9790	−0.0459	−0.0040
48826.4066	pe	I	9974	−0.0471	−0.0026
48844.4651	pe	I	9985	−0.0422	0.0023
48849.3938	pe	I	9988	−0.0373	0.0073
48872.3633	pe	I	10002	−0.0452	−0.0003
48876.4868	pe	II	10004.5	—	—
48881.4112	pe	II	10007.5	—	—

Table II. B and V magnitudes of comparison and check stars

Star	V	B	Spectral T.
BD+56°2815 (comparison)	$8\overset{m}{.}66\pm0.01$	$8\overset{m}{.}86\pm0.01$	A0
BD+56°2813 (check)	$8\overset{m}{.}26\pm0.01$	$8\overset{m}{.}66\pm0.01$	A3

Table III. B and V magnitudes of CQ Cep

Colour	Min. I.	Max. I	Min. II	Max. II
V	$9\overset{m}{.}09$	$8\overset{m}{.}68$	$9\overset{m}{.}05$	$8\overset{m}{.}64$
B	$9\overset{m}{.}51$	$9\overset{m}{.}09$	$9\overset{m}{.}45$	$9\overset{m}{.}06$

The period of the system is decreasing with the amount of 0.0036±0.001 second per year.

The light and colour curves are given in Figure 2. The phases in Figure 2 were calculated with the following linear light elements:

$$\text{Hel Min. I J.D.} = \underset{\pm 2}{2448524\overset{d}{.}423} + \underset{\pm 2}{1\overset{d}{.}6412299} \times \text{E} \qquad (3)$$

These elements were obtained from quadratic light elements and may be used in near future. The shape of light curve is typical of β Lyrae type. The magnitudes of comparison, check and variable stars were transformed to standard UBV system and given in Tables II and III.

There are large asymmetries in the light curves. The primary and secondary maxima occur at phases ~0.27 and ~0.81, respectively. Primary eclipse is narrower than the secondary. Secondary minimum occurs at phase ~0.511. In 1992 observations, the primary minimum is deeper by $\sim 0\overset{m}{.}02$ than that of the 1991 observations. In Figure 1, the scattering of our observations near the primary is $\sim 0\overset{m}{.}05$.

The photometric analysis of the V light curve is in progress and will be published elsewhere.

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ERRATUM

In the No. 3950 issue of the IBVS one of the references was incorrectly given. On page 2, the third ephemeris is based on Oprescu et al. (1991) and the correct reference is:

Oprescu, G., Suran, D. M., and Popescu, N., 1991, *Inf. Bull. Var. Stars*, No. 3560

G. OPRESCU

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AN IMPROVED PERIOD FOR DU LEONIS

The 9th-magnitude eclipsing variable DU Leonis (BD +26°1996, HD 84207, SAO 80992) was discovered by Kaiser (1990). The system has a G0 spectrum and two nearly equal minima 0.7 magnitude deep. An approximate period of 1.3742 days was found by Williams et al. (1990). The official designation DU Leonis was assigned in the 71st Name List (Kazarovets et al., 1993). Popper (1993) reported preliminary results from radial velocity measures in a program to determine accurate masses for G-K main sequence stars.

I have examined DU Leo on almost 700 Harvard patrol plates from the intervals 1899-1953 and 1968-1989. Table I lists 40 times when DU Leo was estimated to be at or very near minimum light. Due to long exposure times and accidental errors of estimation, the uncertainty in the photographic minima is about 0.03 day. I have also obtained additional R-band photoelectric observations, using the same equipment described previously (Williams et al., 1990). From this data, one new time of minimum is included in the Table. The photoelectric observations were affected by low signal to noise ratio, and the estimated uncertainty of the minimum is ±0.002 day.

Table I

HJD		Min.	O-C	HJD		Min.	O-C	HJD		Min.	O-C
2414973.835	pg	I	-0.003	22042.603	pg	I	-0.041	28919.778	pg	II	+0.028
15169.618	"	II	-0.042	22382.729	"	II	-0.025	29988.880	"	II	+0.014
15711.801	"	I	+0.025	22422.627	"	II	+0.021	31146.630	"	I	+0.014
16519.785	"	I	-0.011	22729.745	"	I	+0.009	44376.596	"	II	+0.018
16939.626	"	II	+0.017	22782.650	"	II	+0.008	45812.574	"	II	-0.027
16961.587	"	II	-0.009	24905.783	"	II	+0.026	45823.586	"	II	-0.008
17171.852	"	II	+0.005	25603.863	"	II	+0.020	46139.663	"	II	+0.006
17321.659	"	II	+0.026	25954.905	"	I	-0.042	46519.592	"	I	-0.027
20111.936	"	I	+0.022	26016.775	"	I	-0.010	46846.676	"	I	+0.001
20131.853	"	II	+0.013	26069.674	"	II	-0.017	47208.782	"	II	+0.010
20246.595	"	I	+0.011	26447.563	"	II	-0.029	47511.799	"	I	+0.019
20575.715	"	II	+0.013	28139.918	"	I	+0.018	47537.884	"	I	-0.005
21010.609	"	I	-0.022	28221.661	"	II	-0.003	48348.658	pe	I	0.000
21251.783	"	II	-0.017	28550.773	"	I	-0.009				

I have also used a photoelectric timing of minimum published by Diethelm (1991), HJD 2448362.401 ±0.003, in the calculation of improved light elements.

Entering all 42 times into a least squares solution with weight 1 for photographic data and 10 for photoelectric, the following improved light elements were derived:

$$\text{Min I} = \text{HJD } 2448348.658 + 1^{d}.37418454 \times E \qquad (1)$$
$$\pm.002 \qquad\qquad \pm 6$$

The O−C residuals in Table I were calculated from this ephemeris. The period has been constant.

Scatter in the photoelectric data (Figure 1) prevents a precise determination of the small difference in depth between the two minima. But in the R-band the primary minimum appears to be no more than 0.03 magnitude deeper than the secondary minimum; the estimated amplitudes are 0.73 and 0.70 magnitude, respectively.

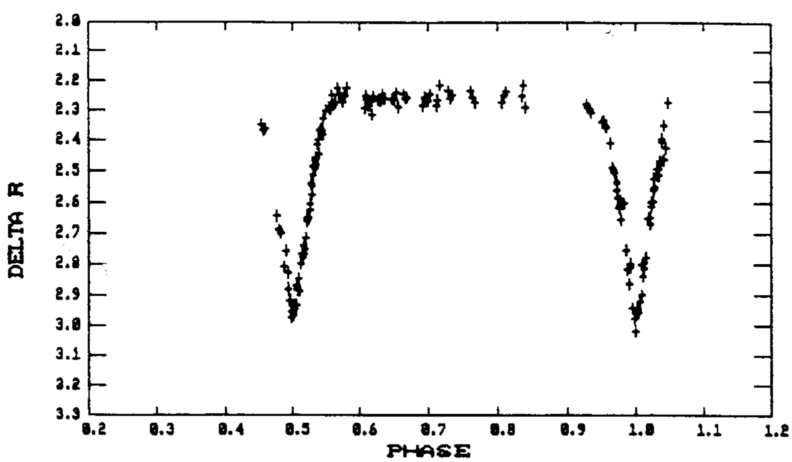

Figure 1. R-band photoelectric light curve of DU Leo.

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THE VARIABLE STAR BD +31°0849

The star BD +31°0849 (R.A.=$5^h02^m15^s$, Decl.=+31°15'49", 2000.0) was discovered as variable during routine photoelectric UBV observations of astrometric standard stars (Oja, 1991). It was put on the observation programme of the Kvistaberg 40 cm Cassegrain telescope (T40), and later it was observed also with the 60 cm Cassegrain telescope (T60) of the Royal Swedish Academy of Sciences at Observatorio Astrofísico del Roque de los Muchachos on la Palma, and a few times with the 2.5 m Nordic Optical Telescope (NOT), also on La Palma. At the small telescopes conventional one-channel photometers, equipped with UBV filters, were used, while at NOT the Turku Observatory five-channel UBVRI photo-polarimeter was utilized.

The nearby B9 star BD +31°0845 = HD 32036 (R.A.=$5^h01^m46^s$, Decl.=+31°46'41", 2000.0) was chosen as local standard, and it was always observed immediately before or after the variable (except the five earliest observations that established the variability). The observations were made interspersed with observations of other stars belonging to other programmes; for every night extinction coefficients were derived in magnitude as well as the colours by means of primary standards with well-known magnitudes and colours. The data have been transformed to the normal UBV system (Johnson, 1955); the red and infrared colours observed with NOT are on Landolt's (1983) system. Altogether 120 observations were gathered between Nov. 19, 1988 and March 12, 1992.

The resulting data for the local standard BD +31°0845 are

V=7.719,
B−V=0.131,
U−B=−.114,
V−R=0.112,
R−I=0.126.

The V measurements of BD +31°0849 have been referred to the measurement of the local standard nearest in time (except the five first measurements, when no local standard was yet chosen); the colour indices are referred to all standards measured during the actual nights. The mean errors of the measurements, as calculated from the deviations of the individual measurements from their means for constant stars measured during the same runs, are given in Table 1. The individual data have been deposited as file No. 281E in the archives of unpublished data of IAU Commission 27.

The observations were run through a period-searching program (Oja, 1987). The best period found is 0.603500 days; half that value also satisfies the data quite well. The light curve of BD +31°0849 is shown in Figure 1, where the phase is defined as the decimal part of (HJD −2448000)/0.603500.

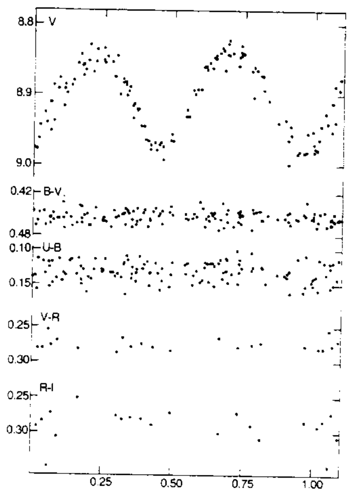

Figure 1. The light-curve of BD +31°0849

Table I. Mean error of a single measurement

	V	B−V	U−B	V−R	R−I
T 40	.014	.009	.011		
T 60	.009	.007	.010		
NOT	.010	.007	.008	.007	.018
Average	.011	.008	.010	.007	.018

Table II. Characteristics of the light-curve

Phase of primary minimum	0.455,	magnitude	8.979
Phase of secondary minimum	0.954,	magnitude	8.977
Phase of first maximum	0.696,	magnitude	8.837
Phase of second maximum	0.233,	magnitude	8.848
Total amplitude	0.142		

A Fourier fit to the data yields

$$V = 8.905 + 0.0064 \times cos(F) - 0.0670 \times sin(2F) + 0.0048 \times sin(3F) + 0.0029 \times cos(3F) + 0.0018 \times sin(4F) - 0.0061 \times cos(4F) \quad (1)$$

F=phase−29.8°

The mean errors of the coefficients of the trigonometric terms are about 0.0017, the dispersion of the observations 0.012. This value is very near the average for a V measurement of a field star (Table 1), but a lower value would be expected here, because the measurements are relative to a close-by standard. Probably minor variations of the light-curve are involved, but there is no obvious trend depending on observing season. The maxima and minima (as derived from eq.(1)) are characterized in Table 2. The minima are very similar and occur with a phase difference of 0.5, while the maxima seem to differ in form. Appointing the marginally deeper minimum for primary minimum, the resulting ephemeris is

$$\text{HJD (primary minimum)}=2448384.1004+0.603500\times \text{E} \quad (2)$$

The colours of the star show no change with time; the averages are $\langle B-V\rangle=0.454\pm.001$, $\langle U-B\rangle=0.132\pm.001$, $\langle V-R\rangle=0.276\pm.002$, $\langle R-I\rangle=0.286\pm.004$. The corresponding mean errors of a single measurement are $\pm.009$, $\pm.014$, $\pm.008$, and $\pm.018$ in good agreement with the data in Table 1, except for U$-$B where probably transformation difficulties are responsible for the higher value. The constancy of the colours excludes pulsation (with half the period adopted) as cause of the variability; the star obviously is an EW eclipsing variable. The equal depth of both minima indicates a system of two equal components, the low amplitude an inclination considerably below 90°.

Objective prism spectra of BD +31°0849 were secured with the 100/135/300 cm Schmidt telescope at the Kvistaberg Observatory. Altogether five prism-crossed-by-grating exposures are available, two taken on Dec. 30, 1991, three on Dec. 28, 1992. The spectra were recorded in a self-recording microphotometer, and line-depths in the Uppsala system (Ljunggren and Oja, 1961) were derived. The mean result is

$$\begin{aligned} &H\gamma=38.1\pm2.9 \\ &H\delta=40.6\pm3.0 \\ &G=15.5\pm3.2 \\ &K=67.7\pm5.0 \\ &G/Hr=0.42\pm.09. \end{aligned} \quad (3)$$

There is some indication of variations in the line-intensities, as the lines come out fainter in 1992 than in 1991. The result (3) corresponds to spectral type F2, $(B-V)_0=.36\pm.03$, $E(B-V)=.09$; hence $E(U-B)=.06$ and $(U-B)_0=.07$. The star is located just below the Hyades (B$-$V) versus (U$-$B) relation, indicating a slightly negative $\delta(U-B)$ ($\delta(U-B)= -.04\pm.04$, corresponding to $(B-V)\approx.34$ for a Hyades star, if one extrapolates the correction table by Wildey et al., 1962). The data satisfy Eggen's (1967) period–colour relation near its lower boundary.

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