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1989 V-BAND LIGHT CURVE OF RT AND

We report on the continuation of our long-term project at Capilla Peak Observatory of photometry of the chromospherically-active RS CVn stars. We have previously made single-channel observations of RT And (= BD + 52° 3383A) at UBVR in 1981 (Zeilik et al., 1982) and CCD observations in 1988 at BVRI (Zeilik et al., 1988). These latter data have been completely analyzed by Zeilik et al. (1989), who find a single spot group at longitude = 260°, latitude = 46°, radius = 9.7°, and a temperature difference relative to the photosphere of -1200 K. Our project aims at revealing how these starspot parameters change with time and hence the nature of any magnetic activity cycles.

We made V and I band observations on the 15, 17, 18, and 21 January 1989 UT of RT And (#163 in the catalog of Strassmeier et al., 1988). We used a CCD camera with an RCA SID501EX chip on our 61-cm telescope (Laubscher et al., 1988) in the mode of a multichannel photometer. The variable, sky, and comparison star (BD +52° 3384) were observed simultaneously and reduced with a software mask with an effective aperture of 34". We now have a new Schott glass filter set (Beckert and Newberry, 1989) in which the V-band filter has an effective wavelength of 551.1 nm and a bandpass of 74.2 nm; the I-band filter and effective wavelength of 815.1 nm with a 137.3 nm bandpass. Unfortunately, conditions of high and rapidly changing humidity rendered the I-band

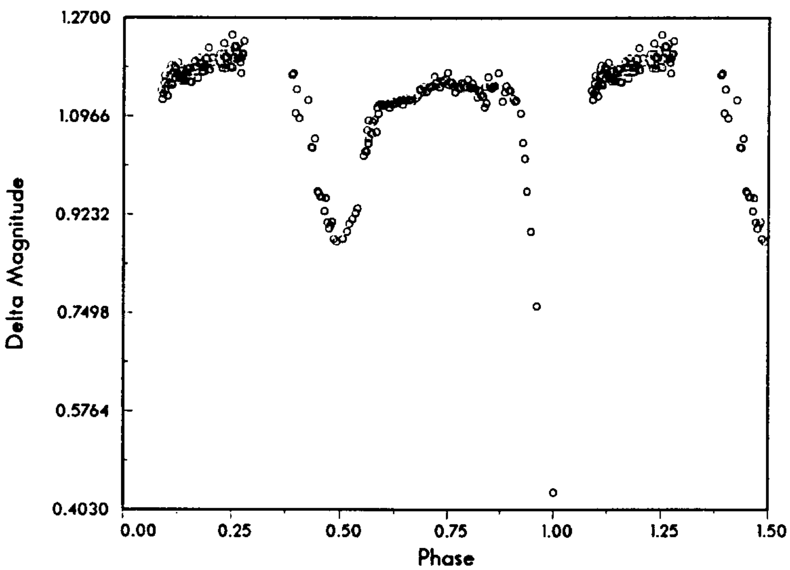

Figure 1. RT Andromedae, V-band, Capilla 1989

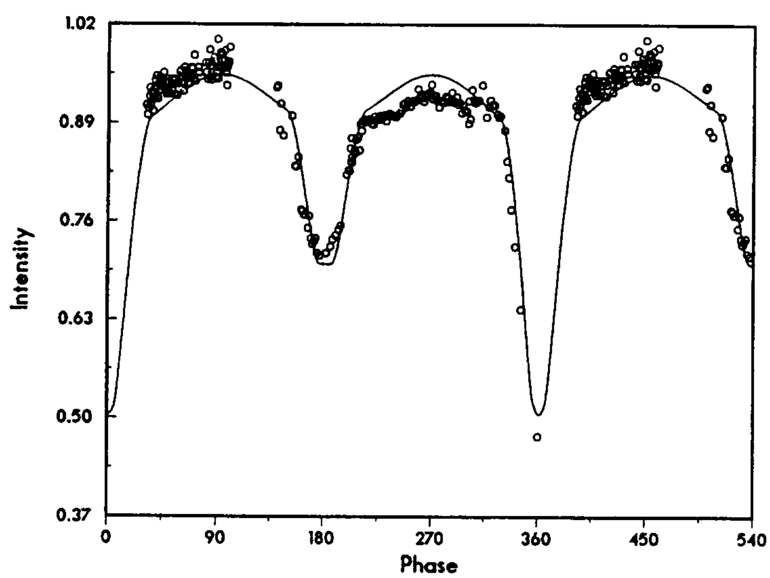

Figure 2. RT Andromedae, V-band, Capilla 1989

observations useless. The V-band data are acceptable, although the overall error is about 0.02 mag, about twice as large as we usually aim to achieve. Figure 1 shows the results in the instrumental system with the delta magnitude in the sense of (variable-comparison). Figure 2 shows an optimized model fit to the observations using the technique of Budding and Zeilik (1987). A fit of a single, black, circular spot to the distortion wave resulted in the following star spot parameters: longitude = 252°, latitude = 48°, radius = 16.5°. (The latitude optimization was barely acceptable by our curvature Hessian test.) We could not calculate a temperature because of the lack of the I-band data. We note that, compared to our 1987 data, the active region has not shifted significantly in position, but it has grown almost 3 times larger in effective area. Continuing observations will show if this trend continues.

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PHOTOELECTRIC OBSERVATIONS OF AP LEONIS AND ITS PERIOD CHANGES

AP Leo is a W UMa-type binary system (Mauder, 1967; Cristescu, 1979). The system was observed photoelectrically in B and V bands with the 60 cm reflector and the single channel photometer at the Xinglong station of Beijing Observatory during the 1983-1985 and the 1988 seasons.

The stars BD + 6°2400 and BD + 5°2437 were used as comparison and check star, respectively. The observations covered a number of orbital cycles. A total of 9 primary and 7 secondary minimum times were obtained. They are given in Table I.

From Table I, together with the other 112 minima collected from the literature (since 1899), the average period of AP Leo is found to be $0^{d}.4303572$. Figure 1 is the O-C diagram of the epochs of minimum light based on the average ephemeris:

$$\text{Min. I} = \text{JDhel.}2439536.542 + 0^{d}.4303572 \cdot E \qquad (1)$$
$$\text{m.e.} \qquad \pm 2 \qquad \pm 5$$

Table I. New light minima for AP Leo

JD hel. (V.)	m.e.	JD hel. (B.)	m.e.	min.
2440000+				
5441.0544	0.0008	5441.0533	0.0007	I
5444.0668	0.0003	5444.0668	0.0003	I
5470.0991	0.0005	5470.1006	0.0005	II
5756.2888	0.0001	5756.2899	0.0001	II
5787.0595	0.0010	5787.0599	0.0011	I
5787.2734	0.0009	5787.2735	0.0001	II
6092.1801	0.0004	6092.1786	0.0003	I
6139.0901	0.0017	6139.0870	0.0005	I
6139.3034	0.0002	6139.3041	0.0003	II
6143.1766	0.0005	6143.1778	0.0004	II
6146.1883	0.0008	6146.1883	0.0006	II
6153.2895	0.0003	6153.2891	0.0003	I
7236.0636	0.0003	7236.0642	0.0002	I
7236.2760	0.0010	7236.2766	0.0006	II
7266.1869	0.0004	7266.1861	0.0006	I
7267.0478	0.0003	7267.0479	0.0004	I

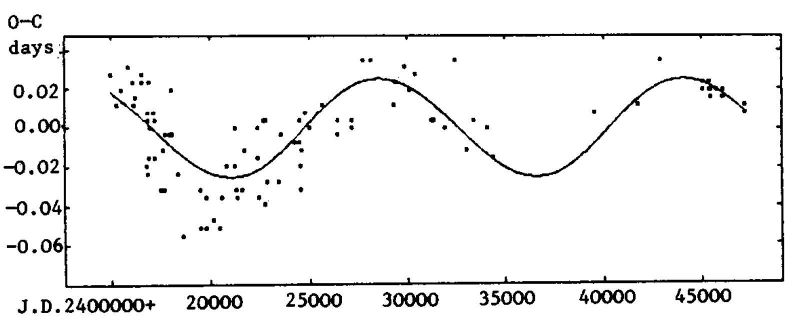

Figure 1. O-C diagram of minimum times

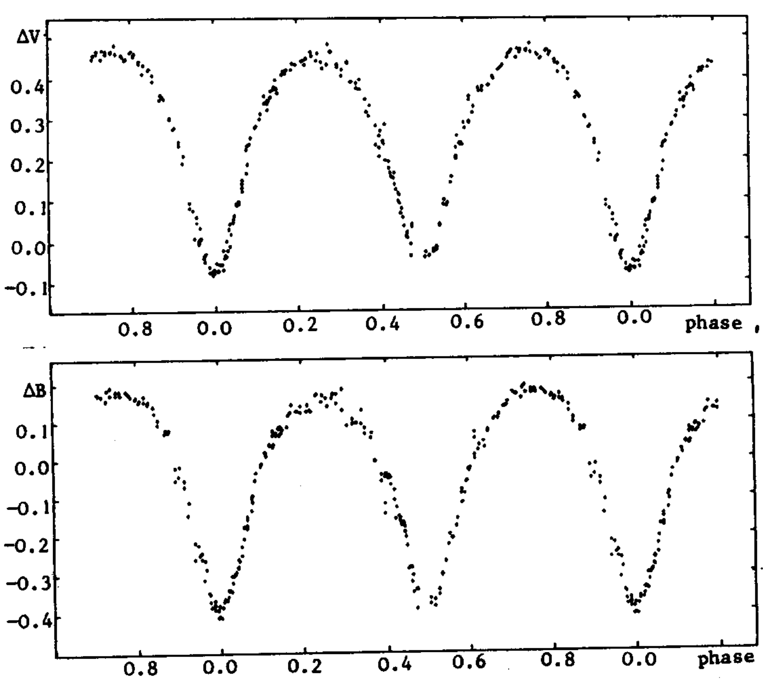

Figure 2. V,B light curves of AP Leo

Our analysis indicates that the period of AP Leo appears to exhibit sinusoidal changes. A new ephemeris of minimum times is derived as follows:

$$\text{Min. I} = \text{J.D.hel.}2439536.535 + 0\overset{d}{.}4303570 \cdot E + 0.025 \cdot \sin(2\pi \cdot 0.000064(0.4303570 \cdot E - 300.00))$$
$$\text{m.e.} \qquad \pm 4 \qquad \pm 1 \qquad \pm 2 \qquad \pm 2 \qquad \pm 2 \qquad (2)$$

The period indicated by the sinusoidal term is about 43 years. It is suggested that there could be a third body in the system which may be responsible for such long term changes in the period of AP Leo. The ephemeris for the prediction of forthcoming minima can be derived from the observations in Table I, as follows:

$$\text{Min. I} = \text{J.D.hel.}2447236.0621 + 0\overset{d}{.}4303546 \cdot E \qquad (3)$$
$$\text{m.e.} \qquad \pm 3 \qquad \pm 1$$

Using the ephemeris (3), the observations in 1988 were combined into B and V normal light curves as shown in Figure 2.

The photometric solution of the light curves together with a more detailed analysis of the period changes will be published in a forthcoming paper.

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A RELATION BETWEEN X-RAY SURFACE FLUXES AND U-BAND "TIME SIGNATURES" IN dMe STARS

Utilizing the MAC technique (Andrews 1988a) for analyses of photometric data in the Johnson U-band, we now have "time signatures" for seven dMe stars, which describe their brightness fluctuations in terms of rapid quasi-periodic oscillations. We have previously suggested that these time signatures (TS) are possibly related to the X-ray luminosities of the stars (Andrews 1988b). There are usually several TS's per star in the range investigated, from about 6 seconds to a few minutes, depending to some extent on the sampling times (usually continuous 1-second integrations collected over 10 to 20 minutes). When several TS's are present, the lower TS's may be harmonics, and, of course, are limited by the sampling Nyquist frequency, so we have examined the relationship of the maximum TS detected for each star with the X-ray luminosity. In Fig.1, we give a plot of $log\ L_X$ against $log\ (1/TS_{max})$, the logarithm of the maximum frequency of oscillations (in Hertz). We are presently looking for a connection with either non-radial oscillations or a possible link with the Ionson-Mullan hypothesis that convective motions in the presence of strong magnetic fields may contribute to coronal heating (Ionson 1984, Mullan 1984). Temporal and spatial coherence in a large coronal loop may allow detection of oscillations against the low surface brightness of a dMe star. There are no predicted values for asteroseismological p-mode oscillations in dMe stars. However, for comparison, we include in the plot the observed 10-minute "p-mode feature" for the K2 dwarf, epsilon Eridani, discovered in the variation of the strength of the CaII H and K lines (Noyes et al. 1984) This departs from the 4-minute asteroseismological period predicted for a K2 star by Christensen-Dalsgaard and Frandsen (1983). A value of $log\ L_X\ =\ 28.29$ for epsilon Eridani (= Gliese 144) is listed by Bookbinder (1985), and values for the dMe stars are available from Bookbinder (1985) and Pallavicini (1988). N.B. There is an error in $log(L_X)$ quoted previously for V1054 Oph (Andrews 1988b), where Gliese 644C was used instead of 644AB, and should be 29.08.

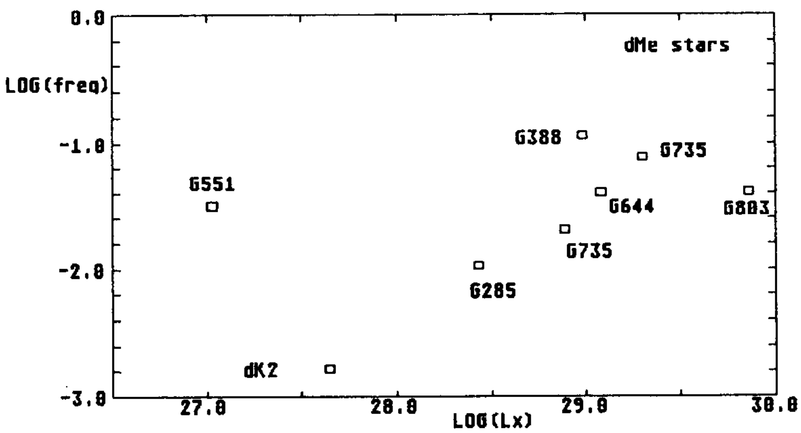

Figure 1

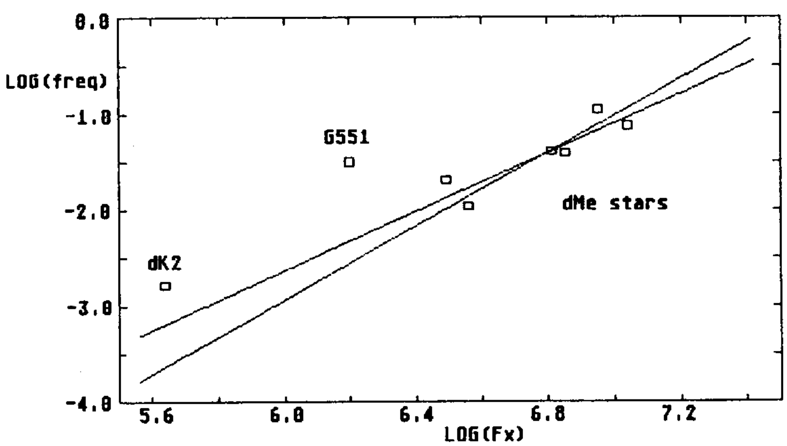

Figure 2

In the $log\ L_X$ versus $log\ (1/TS_{max})$ diagram we find considerable scatter, and V645 Cen (Gliese 551) which has a low X-ray luminosity destroys any relation if it exists. We have therefore examined the possible relation with the X-ray surface flux, F_X, (see Figure 2). V645 Cen (Prox Cen) is appreciably shifted in relation to the other stars due to its relatively small radius compared with those of the other dMe stars, but V645 Cen still stands out and may possess a larger TS. In Figure 2, we show two linear fits obtained by minimizing the square deviations in ordinate and abscissa. Excluding the dK2 star and V645 Cen, an approximate mean relation is found which is valid over $log\ F_X\ =\ 6.4\ to\ 7.0\ :\ log(1/TS_{max})\ =\ 1.75\ log\ F_X\ -\ 13.32$, where the time signature is in seconds, and the X-ray surface flux is in ergs per sq.cm per second. For the six stars the correlation coefficient is 0.89, and we have the power law : $frequency(Hz) \sim (F_X)^{1.75}$, for the U-band oscillations. We predict an X-ray surface flux of 6.0 for epsilon Eridani compared with 5.64 deduced from Bookbinder's (1985) observations. We urge flare star observers to examine especially their U-band monitoring for low X-ray emitters. Amongst the dMe stars, EZ Aqr= Gliese 866 ($log\ F_X = 5.66$), has a predicted modulation, TS_{max}, of 43 minutes in the U-band. The dM1.5 star, AX Mic (Gliese 825) is a good southern hemisphere candidate for a search due to its brightness ($V = 6.7\ mag$) and very low X-ray flux ($log\ L_X = 27.28$, $log\ F_X = 4.76$), which is predicted to modulate with an unlikely 27.1 hour period according to the above power law. This may be explicable by the fact that AX Mic is not a dMe star (no Balmer emission). We tentatively point out that the small-amplitude photometric oscillations of 5 to 30 hours in some K-type Pleiades members (van Leeuwen 1983) are possibly a phenomenon related to that suspected in the solar neighbourhood dMe stars.

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LIGHT CURVES FOR XY UMa

The variable nature of XY UMa was first noted by Geyer et al. (1955), after which Geyer began a prolonged series of photometric observations, the results of which he reported in 1976. He gave a general explanation of the peculiarities of the data by employing the concept of evolving starspots. This idea has been reinforced by a wealth of corroborating evidence in this and similar cool "short period RS CVn" stars. (See e.g. Baliunas and Vaughan, 1985). Indeed, XY UMa, in terms of its chromospheric surface flux, may well be the most active of such systems (Gurzadyan, 1987).

Recently Heckert and Zeilik (1988) have reported new observations of the star, which they analysed in terms of a single spot group centred at a longitude not far from 270°, a minimum radius of about 10° and appearing at some intermediate latitude (approx. 40°in an unspecified hemisphere).

The purpose of the present article is to report some similar studies on the BVR light curves of Jassur (1986), which he observed in Egypt during March 1979.

The starting parameters were taken from Budding and Zeilik (1987). Initial fits to the distorted light curves produced

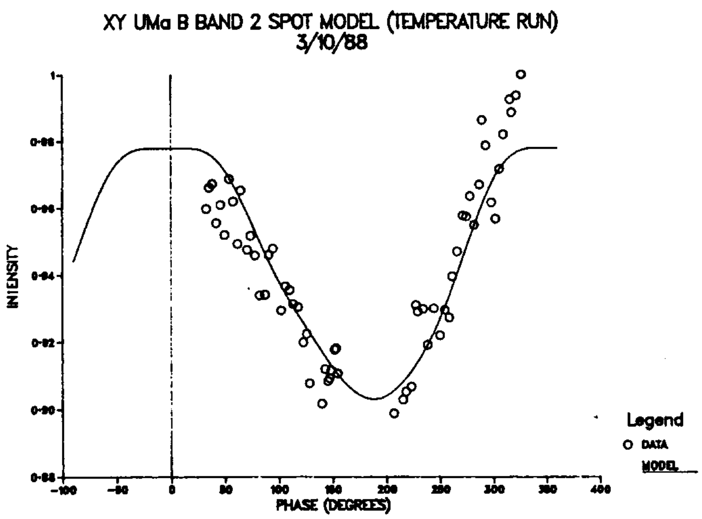

Figure 1: Model Maculation Wave Fit to the
Initial Fit Residuals.

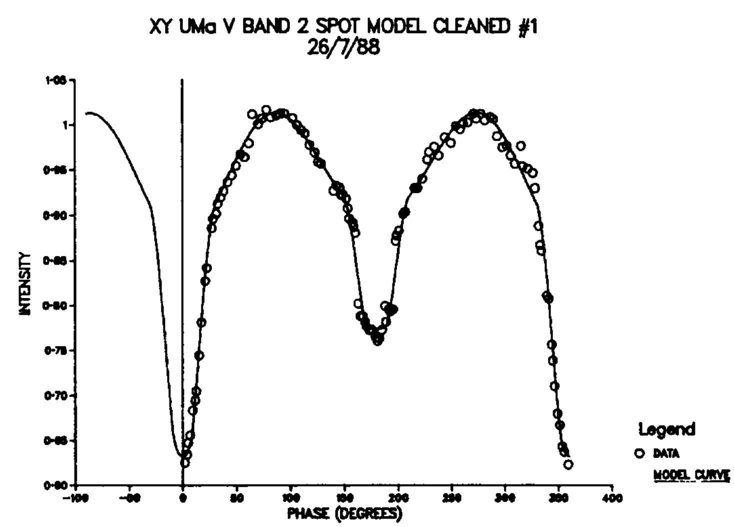

Figure 2: Final Fit to the corrected data. The "raw"
light curve can be seen in Jassur (1986).

Geometric parameters $r_1 = 0.346$, $r_2 = 0.175$ and $i = 83.2^o$, not too far, but significantly different from the values of Budding and Zeilik. The fractional sizes of the two stars are larger after the re-run, and the inclination lower.

We next looked at the difference curve after subtracting this first order model from the light curve. This is analysed for maculation ("starspot") effects. Two spot groups were used. They appear to be centred at around longitudes 132^o and 220^o. They are of comparable size (approx. 15^o in radius) and have been fixed at intermediate latitudes. These spots were given small, but non-zero surface fluxes in the three colours, unlike the minimum area black spots of Heckert and Zeilik.

Finally the "cleaned" light curves were formed by taking out the calculated maculation effects from the original data. The basic geometric parameters specifying the fit to this new light curve do not change by very much from the initial fits (r_1=0.345, r_2= 0.190, $i = 84.0^0$). Correlated errors calculated for these quantities are of the order of 1%. These geometric values only varied within the expected error estimates in the three wavelength ranges. Although these are closer to the "adopted" final values of Budding and Zeilik, there is still some appreciable difference (r_1= 0.327, r_2= 0.168, $i = 88.2^o$).

The curve-fits were also checked by the codes of Wilson and Devinney (1971). The geometric parameters derived for the fit to the "clean" curve are essentially similar to the ones we gave before (i.e. rather different from those derived by Budding and Zeilik), apart from the fractional luminosity values. Banks (1989) has noted some slight systematic difference between the fractional luminosities obtained in the Wilson-Devinney code from those of the Budding program in various curve fitting experiments for eclipsing binaries, though geometric parameters tend to be effectively similar. The difference in luminosity values may be related to differences in the roles of assigned temperatures in the two procedures.

The conclusion arising from these present efforts therefore seems to present some challenge to the expectation given by Budding and Zeilik (1987) that the derived geometric parameters for "clean" light curves of the same system should always be essentially the same. They expected this to provide a general confirmation of methodological adequacy. On the basis of these present results this cannot be confirmed. Perhaps some systematic effects are at play in the case of XY UMa other than those which the maculation wave and eclipsing binary variation separating procedure of Budding and Zeilik takes into account, at least with a single iteration of the procedure.

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Light Curves for CG Cygni

Since the discovery of its variability by Stanley Williams (1922), CG Cygni has been the object of intense study. More recently Milone has shown that the system clearly has a migrating maculation ("Starspot") wave in its light curve (see Milone *et al.*, 1979). This bulletin details a re-analysis of Jassur's (1980) 1979 BVR data, employing the method and computer programs outlined by Budding and Zeilik (1987) who analysed a 1981 V Band light curve of this star. Jassur only studied the eclipses in his study.

The starting parameters were taken from Budding and Zeilik, in the expectation that once the maculation wave has been accounted for, the geometric parameters will remain constant with time. Initital fits to the distorted light curves produced the following parameters :

Primary Radius r_1	=	0.214
Secondary Radius r_2	=	0.224
Primary Luminosity L_1	=	60.08 %

We fixed the inclination at the final Budding and Zeilik value of 82.8 degrees for this initial model.

We then examined the difference curve obtained by subtracting this initial model from the light curve, and attempted to model it as a maculation wave. Two middle latitude spot groups of similar sizes (about 18 degrees in radius) located around the longitudes 126° and 246° were found to fit the data best. Following the procedure of Budding and Zeilik the spot fluxes were set to zero, thus producing minimum area spots. When these results are compared with those of Budding and Zeilik it appears that while the first spot had remained static between 1979 and 1981, the second increased in both radius and longitude.

The final light curves were formed by subtracting the calculated maculation effects from the original data. The basic parameters specifying this fit are :

Primary Radius r_1	=	0.223
Secondary Radius r_2	=	0.238
Inclination i	=	84 °
Primary Luminosity L_1	=	61.9 %

The correlated errors calculated for these quantities are of order 1 %. At first glance these appear to be appreciably different from those found by Budding and Zeilik :

Primary Radius r_1	=	0.241
Secondary Radius r_2	=	0.226
Inclination i	=	83 °
Primary Luminosity L_1	=	74.5 %

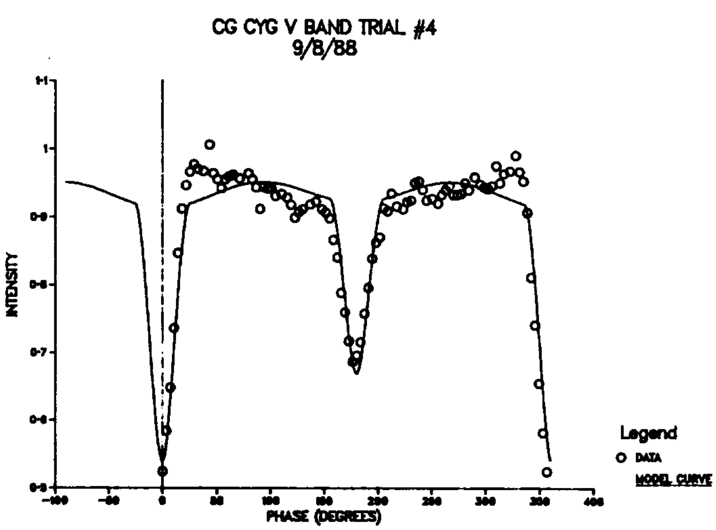

Figure 1 : The original V Band data is plotted against the best initial model fit (the straight line).

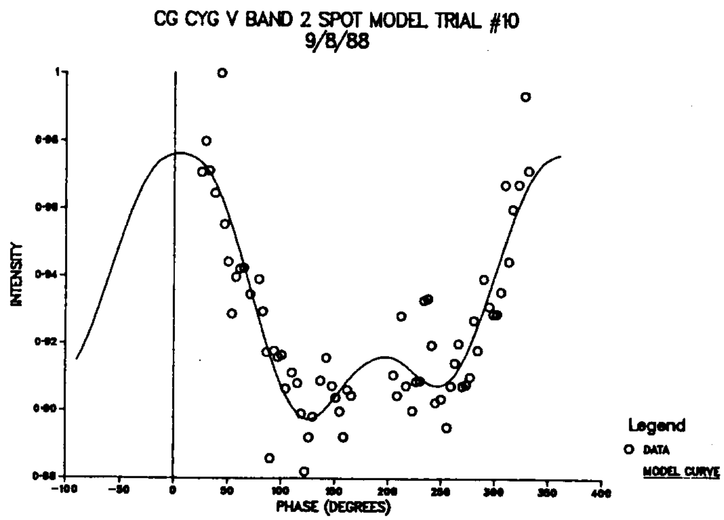

Figure 2 : The residuals from the initial V Band fit are plotted with the model light curve produced by the two dark spots discussed in the text.

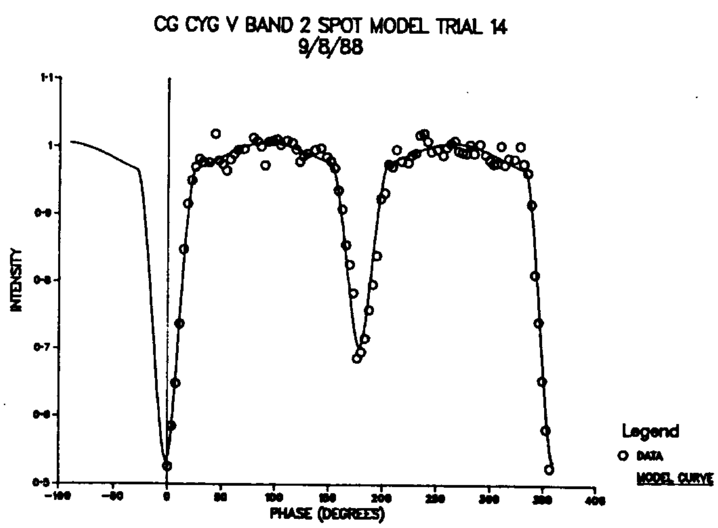

Figure 3 : The final model light curve is plotted against the spot corrected V Band data.

Mancuso *et al.* (1981) noted a genuine ambiguity between the transit and occultation hypothesis for systems with a mass ratio in the range between 0.79 and unity, as CG Cyg's does. They also showed that while all transit hypothesis minima could be at least roughly simulated by an occultation, the reverse is not true. In these ambiguous cases while the inclination of the system remains constant, the stellar radii are essentially transposed and the occultation Primary luminosity is that of the Transit case multiplied by the square of the ratio of the radii (r_2 / r_1). Thus the present study's results would be :

Primary Radius r_1	=	0.238
Secondary Radius r_2	=	0.223
Inclination i	=	83.0 °
Primary Luminosity L_1	=	70.5 %

These parameters were found to well within error of the results of Budding and Zeilik, and in view of the spectroscopically supported discussion of the Main Sequence-like character of the stars given by these authors, the transit solution would clearly give the preferable physical interpretation.

The results of this study can be seen to be in agreement with the transit model of Budding and Zeilik, and lends further support to their modeling procedure for RS CVn systems. However, the photometric evidence alone does show that the alternative occultation model (as considered by Jassur) is also feasible. The authors acknowledge Professor Zeilik's correspondence on this subject.

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PHOTOMETRIC VARIABILITY OF THE SPECTROSCOPIC BINARY HD 133822

The double-lined spectroscopic binary HD 133822 ($V=7.7$, $P=17^d.8\,?$) was investigated by Evans (1961) who derived spectral types of G5 IV and a set of orbital elements according to which eclipses were not excluded. Photometric variability is reported in the Seventh Catalogue of the orbital elements of spectroscopic binary systems (Batten et al., 1978). Were the system to be found eclipsing, it would be a most interesting late subgiant system with an eccentric orbit. At the suggestion of D.M. Popper and J. Andersen, we therefore included HD 133822 in our *uvby* observations with the Danish 50 cm telescope on La Silla, Chile, and obtained 87 observations in each colour on 28 nights during March-May 1984 (Table I). HR 5566 (G 3-5 V, $V=6.35$) and HR 5699 (G 3-5 V, $V=5.65$) were used as comparison stars.

Three unpublished CORAVEL observations from March 1984, kindly provided by J. Andersen, indicate slow rotation and confirm mass and luminosity ratios near one. When combined with Evans' data and assuming that his period is nearly correct, they lead to an improved spectroscopic ephemeris:

Min at HJD 243 6068.207 + $17^d.83792 \cdot E$

We found no indication of eclipses but we did find the system to be variable as indicated by the scatter given in Table II. We searched the interval from 17.7 to 18.2 days to see if any period here could describe the photometric variability, but with no success whatsoever. Visual inspection of a plot of the observations versus time showed a period near 7 days. Further period searches, covering the interval 6 to 8 days, revealed that only a period of 7.07 days (or possibly twice as large) fits the photometry. If we subtract cosine curves with this period and with amplitudes as given in Table II the residual scatter is near that expected from the photometry. Figure 1 shows the light curve in b and colour index curves for $(b-y)$ and c_1 with phases calculated from

HJD 244 5805.400 + $7^d.07 \cdot E$

Table I: Magnitude differences HD 133822 - HR 5566 in the instrumental system

HJD -2445000	u	v	b	y	HJD -2445000	u	v	b	y
784.65221	1.369	1.411	1.381	1.380	805.88398	1.363	1.409	1.382	1.378
.65739	1.371	1.417	1.388	1.387	.88626	1.362	1.412	1.380	1.382
.80836	1.365	1.414	1.386	1.380	807.64186	1.381	1.433	1.400	1.398
.81086	1.374	1.417	1.387	1.383	.64413	1.372	1.433	1.399	1.392
.88521	1.372	1.420	1.388	1.386	.74016	1.391	1.430	1.405	1.397
.88808	1.369	1.419	1.389	1.384	.74240	1.389	1.431	1.409	1.399
786.89100	1.395	1.441	1.411	1.404	.79553	1.380	1.431	1.402	1.396
.89362	1.401	1.441	1.410	1.401	.84714	1.397	1.433	1.406	1.403
787.86756	1.387	1.443	1.407	1.395	.84978	1.389	1.443	1.402	1.401
.87096	1.393	1.431	1.402	1.399	.89025	1.389	1.441	1.401	1.399
.88782	1.390	1.439	1.406	1.404	.89506	1.389	1.432	1.396	1.401
.89017	1.397	1.435	1.403	1.405	811.70062	1.368	1.419	1.389	1.388
788.69388	1.390	1.438	1.401	1.401	.70316	1.376	1.416	1.390	1.392
.69654	1.395	1.439	1.404	1.402	812.72032	1.369	1.406	1.382	1.377
.76857	1.386	1.432	1.399	1.401	.72291	1.372	1.413	1.384	1.384
.77103	1.390	1.439	1.401	1.400	813.83784	1.379	1.429	1.395	1.391
792.90256	1.384	1.421	1.395	1.388	.83988	1.385	1.422	1.391	1.391
.90480	1.388	1.429	1.393	1.393	814.75051	1.390	1.442	1.417	1.408
794.74611	1.406	1.446	1.408	1.408	.75298	1.386	1.439	1.404	1.402
.74854	1.402	1.441	1.407	1.406	815.75638	1.398	1.446	1.412	1.410
795.87532	1.398	1.437	1.406	1.401	.75938	1.403	1.449	1.414	1.410
.87753	1.386	1.435	1.403	1.397	.80181	1.397	1.445	1.411	1.409
797.83582	1.375	1.410	1.382	1.383	.80407	1.414	1.450	1.410	1.410
.83855	1.372	1.407	1.385	1.381	816.77490	1.403	1.450	1.413	1.406
798.58473	1.368	1.403	1.377	1.380	.77710	1.402	1.440	1.404	1.406
.58707	1.369	1.408	1.376	1.377	.85372	1.399	1.440	1.410	1.409
.62144	1.361	1.409	1.384	1.377	.85619	1.406	1.438	1.410	1.408
.62480	1.358	1.404	1.379	1.381	817.59730	1.391	1.427	1.401	1.394
.66323	1.359	1.406	1.378	1.376	.59962	1.384	1.432	1.399	1.394
.66553	1.361	1.411	1.376	1.378	.65992	1.386	1.421	1.400	1.397
.71901	1.362	1.409	1.373	1.379	.66233	1.389	1.430	1.394	1.397
.72119	1.365	1.407	1.378	1.374	818.72079	1.371	1.416	1.388	1.387
.76507	1.359	1.407	1.376	1.378	.72298	1.376	1.412	1.393	1.390
.76722	1.352	1.409	1.377	1.379	821.57493	1.396	1.441	1.398	1.396
.82225	1.363	1.399	1.379	1.378	.57716	1.393	1.432	1.398	1.397
.82538	1.362	1.407	1.382	1.376	822.61904	1.406	1.444	1.416	1.408
799.84860	1.376	1.422	1.401	1.390	.62099	1.404	1.453	1.411	1.409
.85087	1.373	1.425	1.398	1.390	826.74817	1.361	1.411	1.387	1.381
801.89213	1.408	1.443	1.411	1.407	.75057	1.369	1.406	1.383	1.385
.89440	1.406	1.448	1.411	1.405	830.64425	1.397	1.440	1.408	1.405
803.89312	1.383	1.421	1.391	1.393	.64735	1.406	1.445	1.410	1.407
.89556	1.384	1.425	1.400	1.391	831.74469	1.380	1.419	1.397	1.390
804.85754	1.352	1.415	1.374	1.379	.74701	1.375	1.421	1.394	1.390
.86005	1.370	1.412	1.384	1.389					

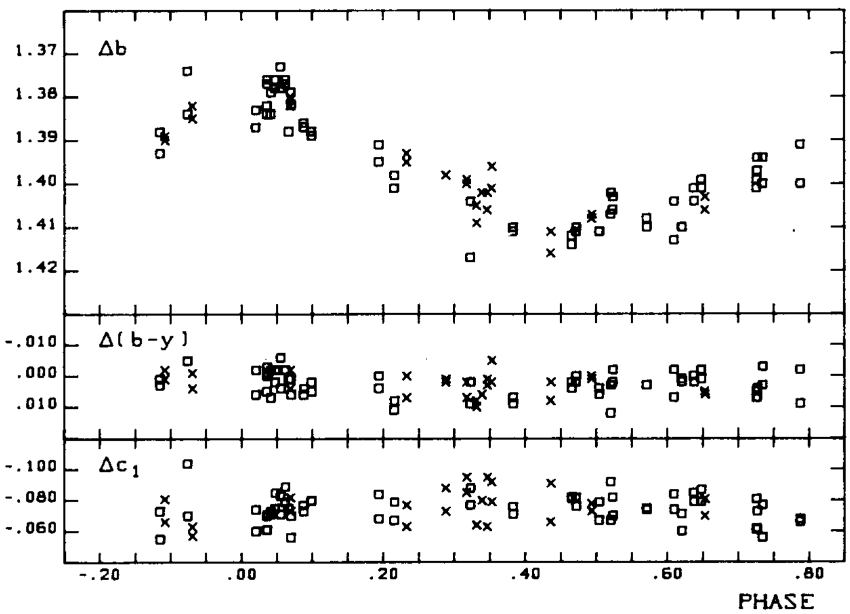

Figure 1. Light and colour curves of HD 133822, assuming a period of 7ᵈ07. If the period is doubled, observations plotted as crosses will lie in the phase interval from 0.0 to 0.5, squares from 0.5 to 1.0.

We derive the following average values for the Strömgren indices:

$$V = 7.742 \qquad b\text{-}y = 0.441$$

$$c_1 = 0.273 \qquad m_1 = 0.266$$

If we accept the spectroscopic result that the stars are indeed nearly identical all indices are compatible with the stars being main sequence stars of spectral type $G\,6$ - $G\,8$ while luminosity class IV is ruled out because of the low value of the c_1 index. We find M_v = 5.3, T_{eff} = 5500 K and [Fe/H] = -0.03. This is in agreement with a recent result of Lü and Tsay (1983) who find M_v = 5.4 and

Table II: Photometric variability of HD 133822

	scatter around mean value	amplitude of cosine curve	residual scatter after subtraction of cosine curve	mean errors from comparison star differences
y	0.011	0.013	0.004	0.002
b	0.012	0.015	0.004	0.003
v	0.014	0.018	0.005	0.003
u	0.015	0.018	0.006	0.005

spectral type G6 V. We suggest that the system consists of two normal main sequence stars of solar composition. For such a system eclipses would be very narrow, lasting less than 0.017 in phase (assuming Evans' period). In that case, we actually cannot completely exclude the possibility that the system is eclipsing, since the uncertainty in epoch is about 0.7 days.

Attempts have been made at fitting the spectroscopic observations to periods near 7 or 14 days, by applying changes of sign to whatever observations seemed to need it, but they have been unsuccessful. Considering the problems with component identification on the spectrograms which Evans reports, and noting the large scatter in his figure and the smooth run of the CORAVEL observations (obtained on consecutive nights), it is clear that a definitive ephemeris and radial velocity curve can be found from radial velocity spectrometer observations. Since few empirical mass and radius determinations for main sequence G stars exist, we urge observers with access to such an instrument to place the system on their observing list.

The question remains what is the cause of the photometric variability reported here. Two obvious possibilities are:

(1) One or both stars could be spotted and rotate (synchronously or nonsynchronously) with a period of 7.07 days, which means an equatorial rotational velocity of about 6 km/s, large enough that spots are likely to develop.

(2) The variability could be related to an orbital period near 14.14 days. Note, however, that ellipsoidal deformation must be negligible, because the relative radii are on the average only about 0.03.

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RAPID VARIATIONS OF THE X-RAY SOURCE KR AURIGAE IN U COLOUR

It was shown that flickering in cataclysmic variables is caused by mass transfer and accretion process (Robinson, 1976). The absence of flickering at minimum light observed in 1980 in MV Lyr was interpreted as cessing of the mass transfer (Robinson et al. 1981), because flickering is typical for maximum light in this star. With regard to explain the presence of occasional deep minima in the light curves of some other binaries with orbital periods also near the period gap ($2^h - 3^h$) it is worthwhile more information about the flickering activity of these stars and the changes of its rate with time to be obtained.

KR Aur, with an orbital period of 3^h54^m (Shafter, 1983) is one of the stars in this group. It was the first one, characterized according to its light curve with the term "anti-nova" (Popova, 1974). Taking, besides, into account the spectral features, Bond (1980) proposed this subtype of cataclysmic variables to be named "anti-dwarf novae".

Here we present results from observations of short time-scale variations of KR Aur at National Astronomical Observatory of Bulgarian Academy of Sciences. The observations were made on the night 3 Nov. 1986 using a photon counting photometer (Panov et al. 1982) attached to the 60 cm Cassegrain telescope. The integration time was 10 sec in U. The star was in maximum light during the observations.

Figure 1 shows the light curve beginning at UT $00^h52^m03^s$. The differences Δu in instrumental system are obtained with respect to the comparison star "c" from Popova's (1965) sequence. The standard deviation is $\pm0\overset{m}{.}06$.

The rapid variations in U colour of KR Aur are quite similar to the flickering displayed at maximum light in MV Lyr. So, the flickering activity of KR Aur indicates that mass transfer was taking place at the time of observations. It is very important to follow the changes of the rate of flickering activity of the object with the changes of the brightness, especially during the minimum light.

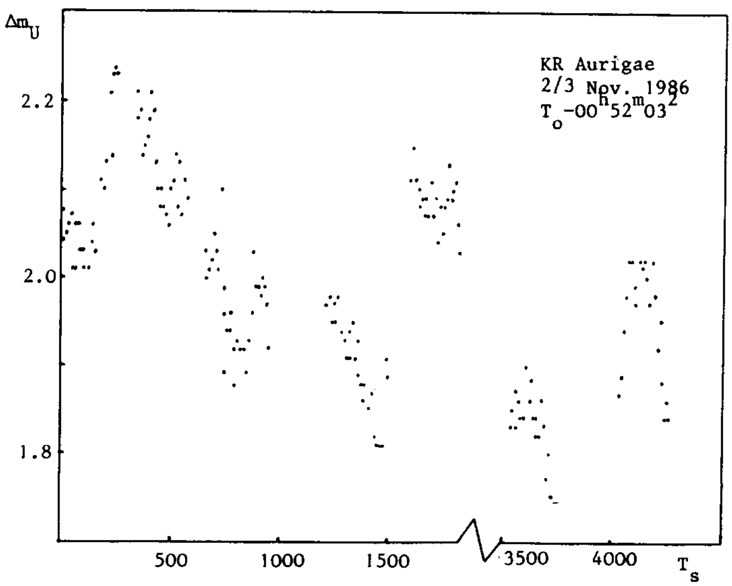

Figure 1

If the character of the photometric behaviour of KR Aur is continuing to be the same as in the last decades, the next deep minimum can be expected in the next 1 - 2 years.

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ON THE VARIABILITY OF VEGA

At present the question on the photometric stability of the radiation of Vega remains open. Investigators give contradictory results. For example, Johnson (1980), analysing the series of photometric observations, came to the conclusion that the V brightness changes with time in the range of $\pm 0\overset{m}{.}03$. However, Kozyrev et al. (1981) on the basis of measurements in B and V filters claim that the brightness of Vega is constant.

The most numerous spectrophotometric results are obtained in the visible spectral region and particularly at the wavelength of 5556 Å. In this spectral region the allowance for the atmospheric radiation attenuation is made the most correctly, and the estimated errors σ of the value of the spectral irradiance density E_λ are of the order of 1 - 2%.

Figure 1 shows the values of the spectral irradiance density E_λ produced by the emission of Vega, at the wavelength $\lambda = 5556$ Å at the outer limit of the Earth's atmosphere, published from 1960 to 1987 by Code (1) (1963); Wilstrop (2) (1965); Kharitonov et al. (3) (1967); Oke et al. (4) (1970); Hayes et al. (5) (1975); Terez et al. (6) (1976); Terez et al. (7) (1979); Mal'zev et al. (8) (1979); Tüg et al. (9) (1977); Boiko et al. (10) (1979); Arkharov (11) (1985); Vasil'yev et al. (12) (1988), respectively. A number near each point is a reference to the paper from which the value of E_{5556} is taken. The errors σ are assumed to be ±1.5 %.

The difference between the highest and lowest values of E_{5556} is $0.34 \cdot 10^{-9}$ erg$\cdot$cm$^{-2}\cdot$s$^{-1}\cdot$Å^{-1} or $0\overset{m}{.}10$ on the magnitude scale that makes an interval of 5-6 σ width which cannot be accounted for by pure photometric measurement errors.

In the first approximation the data can be fitted by a cosine curve with a period of about 23 years (see Figure 1). The maximum deviation is 5 % of an average $3.52 \cdot 10^{-9}$ erg$\cdot$cm$^{-2}\cdot$s$^{-1}\cdot$Å^{-1} value. There is little information after 1983 but the available data show a tendency of reducing the brightness of the star.

In our opinion, the resulting curve is of interest. The continuum variability of Vega either characterizes the intrinsic stellar variability or is due

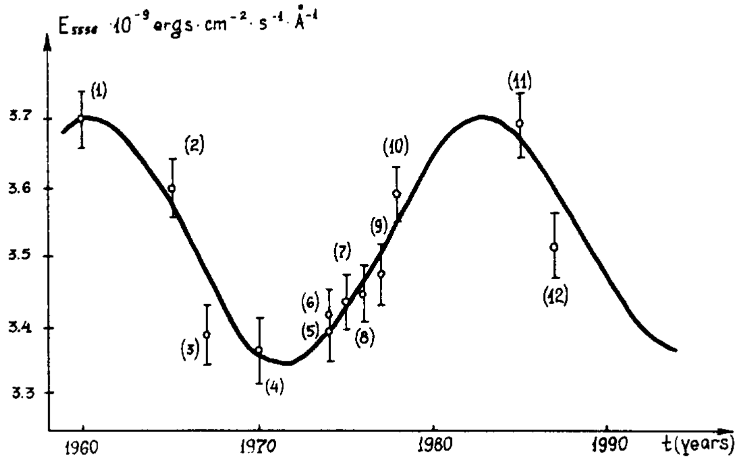

Figure 1

to the effect of systematic measurement errors not allowed for in using reference radiators. It is worthwhile to notice that there are some other data showing instability in Vega's radiation (Johnson and Wisniewski, 1979).

The interpretation of the curve shown in Figure 1 is given in the paper by Vasil'yev et al.(1988).

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V398 Cyg: period determination for an unusual EA system

V398 Cyg is a so far quite ignored variable star. The GCVS lists it as an EA eclipsing system with a possible period of $9^d.2122$ and a photographic magnitude range of 12.5 - >15.0.

V398 Cyg belongs to the field of Nova Cygni 1970, on which many plates have been exposed at Asiago Astrophysical Observatory with the two Schmidt telescopes. On all available, good quality B (103a-O + GG13) and V (103a-D + GG14) plates, we have estimated the magnitude of V398 Cyg with respect to the photometric sequence given by Kohoutek (1969) for the nearby slow nova V1329 Cyg. The results are given in Table I, where heliocentric Julian days are used.

We have examined the data in Table I with a Deeming code (Barbieri et al. 1977) to determine the eclipse period. The only admitted period is $2^d.4481$. The following ephemeris gives the instants of minima in our B light curve:

$$B_{min} = 2445227.396 + 2^d.4481 * E \qquad (1)$$

Linking our minimum to that listed in the GCVS should result in:

$$B_{min} = 2425157.27 + 2^d.4481735 * E \qquad (2)$$

A plot of the data in Tab.I with the period listed in the GCVS ($9^d.2122$) shows the points defining the B minimum uniformly distributed in phases.

The B and V light curves, using Tab.I and ephemeris (2), are presented in Fig.1. The eclipse in the B band is well defined. Its amplitude could be as large as 5 magn. In fact, the B>18.0 point comes from a good plate with no emulsion defect on the V398 Cyg expected position. The eclipse in the V band is much less well defined. Anyway it appears to be of much lower amplitude than the B one. Out of eclipse the B-V index is about 0.0, in agreement with a B&C+CCD red spectrum taken for us by J.Hron of Astron. Inst. of Vienna, showing an early type star. In eclipse the B-V color index largely increases, but no spectra are available for this phase.

Table I. B,V photographic photometry of V 398 Cyg

H.J.D.	B	V	H.J.D.	B	V	H.J.D.	B	V
2440508.341	13.2		41657.256	13.2		43753.472		13.2
40508.351		13.2	41658.260		13.2	43789.387	13.1	
40748.535	13.0		41919.479	13.0		43805.484		13.2
40748.547		13.1	41919.490		13.2	43806.414	13.1	
40749.553	13.3		41924.459	13.1		44015.532		13.9
40763.472		13.2	41924.474		13.1	44015.550	15.2	
40773.470	13.2		41927.384		13.3	44022.541	13.1	
40778.517	13.0		41927.400	14.0		44022.566		13.2
40778.532		13.1	42190.463	13.2		44023.517	13.2	
40794.498		13.2	42713.303	13.2		44023.539		13.3
40796.442	13.2		42713.315		13.2	44044.491	13.2	
40804.442		13.2	42716.396	13.2		44044.508		13.2
40804.458	13.2		43127.267	13.2		44136.466	13.2	
40824.406	13.1		43127.283		13.1	44166.366		13.1
40824.419		13.2	43259.569	13.3		44198.329	13.2	
40836.507	13.0		43284.567	13.3		44221.316	13.8	
40839.415	13.1		43313.473	13.2		44461.556	13.3	
40839.427		13.2	43337.522	14.2		44461.572		13.1
40916.276	16.5		43394.366	13.1		44812.517		13.2
40918.270		13.2	43398.378	13.3		44912.363	13.2	
40918.286	13.0		43405.411	13.2		44928.278	13.2	
41068.549	13.2		43420.379	13.2		44928.301		13.2
41099.559		13.2	43429.304	13.1		45118.541	13.2	
41099.572	13.0		43433.398	13.1		45118.573		13.2
41135.491	13.3		43433.490	13.2		45148.508		13.2
41163.519	16.6		43452.302	13.3		45148.536	13.2	
41178.439		13.2	43453.299	13.2		45201.368	13.2	
41178.453	13.1		43454.395	13.3		45201.389		13.2
41217.336	14.8		43456.393	13.3		45227.375		14.2
41245.385	13.3		43459.303	13.2		45227.396	>18.0	
41272.218		13.2	43462.346	14.8		45258.375		13.1
41296.289	13.3		43462.399	14.0		45259.378	13.5	
41486.550	13.3		43464.401	13.2		45315.325	13.2	
41572.371	16.6		43480.226	13.3		45383.399	13.2	
41595.367	13.2		43480.301	13.0		45551.441		13.2
41616.250	13.3		43482.228	13.3		45617.359	13.2	
41623.280	13.3		43483.270	13.1		45620.460	13.2	
41624.282		13.2	43732.557		13.2	45640.411	13.0	
41651.341	13.3							

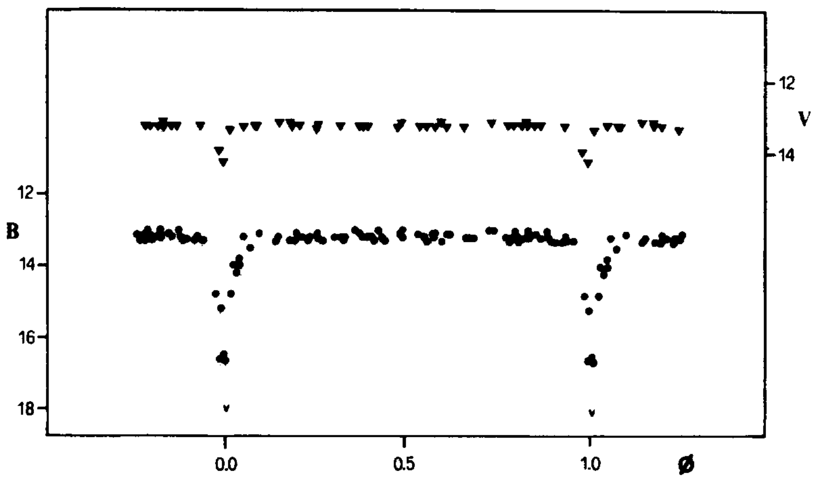

Figure 1. (top) Phase plot according to the ephemeris (2) of the V data in Table I. (bottom) Phase plot according to the ephemeris (2) of the B data in Table I. Note the "fainter than" mark on JD 2445227.396 near phase 0.0 .

A further puzzling feature comes from the analysis of 9 infrared plates (I-N + RG5). Only one of these plates has been exposed during a light minimum (HJD = 2444015.569, phase 0.008). On the V398 Cyg expected position on this plate no emulsion defect is visible and the star presents a deep minimum, while out of eclipse the star is bright and constant . A marked fall in the blue and in the infrared, while the visual is little affected, points towards a very strange eclipsing system.

Due to the very deep B minimum (5 magn. ?) this system should deserve further attention by the observers. Particularly useful should be an optical spectrum secured during a light minimum, to investigate the nature of the eclipsing star.

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THE DEPENDENCE OF THE EFFECTIVE TEMPERATURE UPON THE RADIUS VARIATION IN THE PULSATING VARIABLE STAR XZ Cyg

The Blazhko effect in the pulsating RR Lyrae - type variable stars can be interpreted by the interference of primary and perturbing variations in the radius (Zessevich, 1970; Romanov, 1975). In order to study the nature of the Blazhko effect it is of interest to consider the relationship between the main stellar parameters, T_e and R, responsible for the luminosity of the star and varying with the pulsation process.

Based upon observations the dependence of T_e on the radius variation of XZ Cyg is considered for four phases ψ covering a whole period of the Blazhko effect. When constructing the dependence $(T_e - \Delta R)_{\psi}$ the results of simultaneous photoelectric (Kinchev, 1974) and spectral observations (Romanov and Fenina, 1981) were used.

The effective temperature was determined from the B-V colour index corrected for the interstellar absorption. The interstellar absorption in the direction of XZ Cyg was taken equal to 0.05 mag (Romanov and Fenina, 1981).

The B-V colour index was converted into effective temperature by means of the effective temperature scale determined by Zaikova and Romanov (1978). When transforming B-V into T_e the ratio of the heavy element abundance of XZ Cyg (Z) and the population I stars (Z_I) was considered to be equal to 0.7 (Gadun et al., 1982). The influence of the shock wave effects was not taken into account.

The curves of radius variation ΔR in XZ Cyg at the level of continuous spectrum formation for four intervals of the Blazhko effect phases were constructed by transforming the radius curve variation ΔR_H at the level of hydrogen absorption line formation. It was supposed that the ratio of the amplitudes of the radius variation on that level was equal to 1.6 (Romanov, 1977), whereas the phase of the minimum radius coincided with that of the origin of the

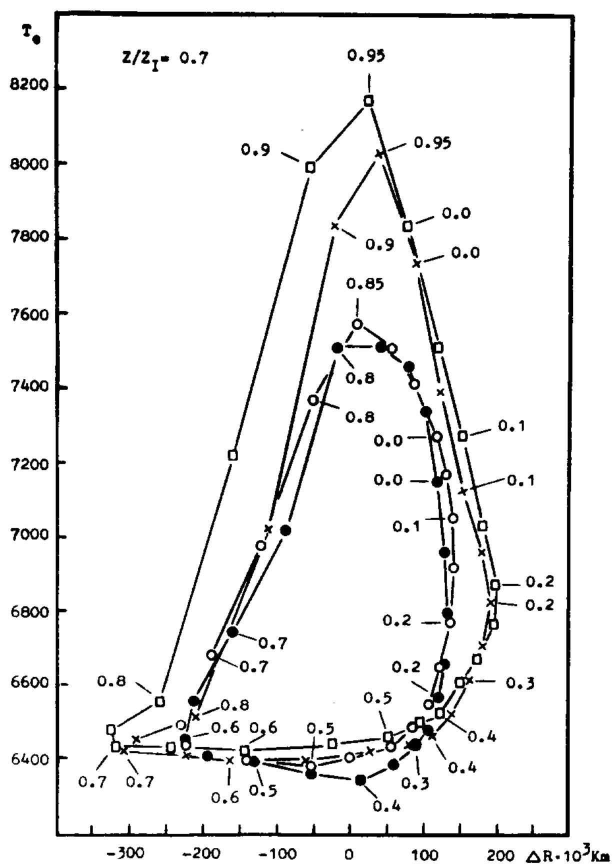

Figure 1. The dependence of the effective temperature upon the radius variation with the phase of the primary period. Phases of the primary period are plotted with the interval of 0.05 P, the values of some of these being indicated in the diagram for four phases of Blazhko effect: ψ=0.0 (rectangles), ψ=0.9 (crosses), ψ=0.6 (open circles), ψ=0.5 (filled circles).

ascending branch of the light curve (Romanov, 1974). The radius variations were obtained by Kinchev and Romanov by integrating the curves of radial velocity variations constructed from measurements of the hydrogen lines.

The $(T_e - \Delta R)_\psi$ diagram is given in Figure 1. The zero point of the ΔR scale coincides with the mean stellar radius. The diagram shows that the dependences $T_e - \Delta R$ represent closed loops. The loops near the Blazhko effect maximum cover a large area in the diagram and fully cover the loops near the Blazhko effect minimum.

The differences between the T_e values for the brightness minima at different phases of the Blazhko effect are insignificant, and when $Z/Z_I = 0.7$, the mean value of T_e is about 6400 K, this does not overlap the T_e values of the red edge of the instability strip for RR Lyrae - type stars (Deupree, 1977).

On the other hand, the decrease of the minimum radius, while the star is compressed, is followed by an increase of the amplitude of the effective temperature variation and the loop area in the diagram.

Future series of simultaneous photoelectric and spectral observations will make it possible to specify the set of dependences $(T_e - \Delta R)_{\psi}$ and use it for comparing with model calculations of pulsating RR Lyrae - type variable stars.

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PHOTOMETRIC STABILITY OF THE OXYGEN-RICH WOLF-RAYET STAR

ST 3 (= WR 142)

The star ST 3 is a key object for the observational test of radial or non-radial pulsations in Wolf-Rayet (WR) stars. The star (V = 12.98 mag, RA = $20^h 19^m 52^s$, DEC = +37°19'53" (1950), and number WR 142 in the catalogue of van der Hucht et al., 1981) was discovered by Stephenson (1966) as a carbon-type WR star. Sanduleak (1971) drew attention to the strong O IV 3811, 3834 A emission lines in its spectrum. In 1982 Barlow and Hummer introduced a sequence of oxygen-rich WR stars, WO1 to WO4, defined mainly by the relative strengths of O IV, O V, O VI. They attributed the spectral type WO2 to ST 3 and suggested that the star is in a late stage of core helium burning where α-particle capture by carbon enhances the oxygen abundance. - ST 3 is a probable member of the young open cluster Berkeley 87.

Maeder (1985) has tested numerically the stability of massive star models and found that WR stars should be vibrationally unstable, even in the WC and WO stages. Stimulated by these findings, Lamontagne and Moffat (1986) carried out high-speed photometric observations of ST 3. Their search for periodicities in the data did not reveal any signal above the noise, i.e. the star was found to be constant on time-scales of 1 - 70 minutes.

To further look for variability in ST 3, we started photometric observations with the two-channel photometer attached to the 1 m telescope of Hoher List Observatory. During the nights of 1984 August 21/22 and 22/23 we obtained 37 and 29 data points, respectively, in the Johnson V band. These data are plotted in Fig. 1, where the magnitude difference ΔV is in the sense: comparison star minus ST 3. For comparison we used the star c1 (see the finding chart, Fig. 2). Each point is the mean of three subsequent one-minute integrations. The mean error of each point is ~0.006 mag. Given the observational error, no real light variability can be found on time-scales of 18 - 300 minutes (Fig. 1). During 1985 - 1987 sporadic photoelectric observations were obtained with a photometer attached to the 60 cm telescope of the Rozhen National Astronomical Observatory in Bulgaria. Table I contains the magnitude differences in the sense: c1 minus ST 3 in the V band. The mean error of each measurement is 0.02 mag. No light variation is found in the data on time-scales of days or months with amplitude greater than 0.06 mag.

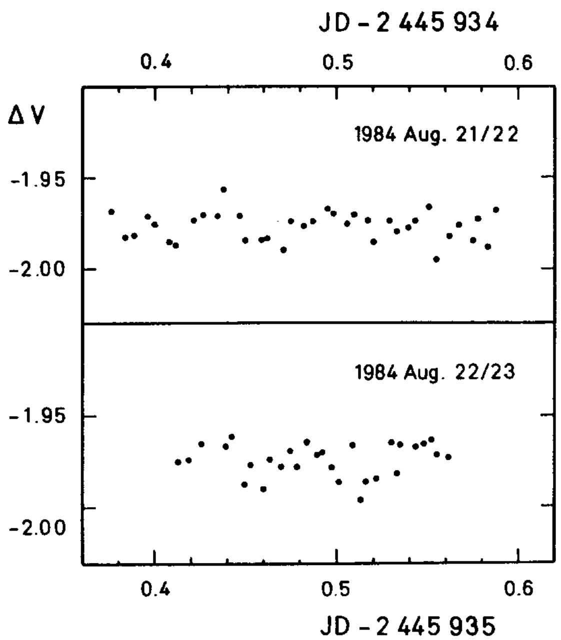

Fig. 1. Magnitude differences ΔV in the sense: comparison star minus ST 3

Table I. Journal of observations at Rozhen Observatory

Date			JD - 2400000	ΔV
1985	October	9/10	46348.3236	-2.00
1985	November	11/12	46381.2313	-1.95
1985	November	12/13	46382.2521	-1.88
1986	September	11/12	46685.3236	-1.98
1987	July	22/23	46999.5007	-2.06
1987	July	23/24	47000.5104	-1.94
1987	September	12/13	47051.3035	-1.96
1987	September	13/14	47052.2785	-2.00
1987	September	15/16	47054.2792	-2.00
1987	September	16/17	47055.2799	-2.00
1987	September	17/18	47056.2813	-1.99
1987	September	18/19	47057.2913	-1.95

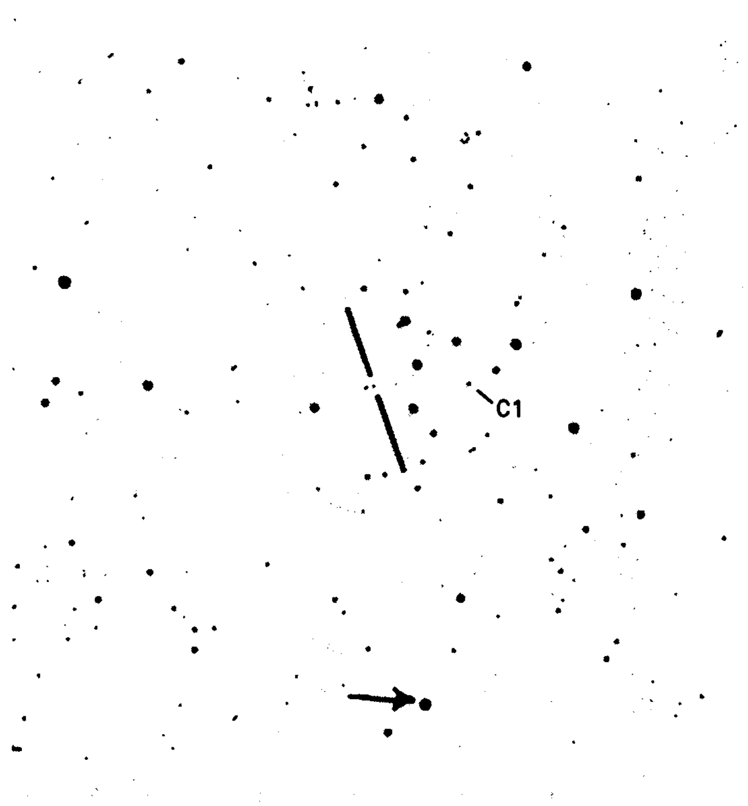

Fig. 2. Finding chart for the comparison star c1 taken from Stephenson (1966). The field dimension is 30'x 30'. The arrow indicates star BD +30°4027.

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V LIGHT CURVE AND ELEMENTS OF THE BINARY SYSTEM AH CEPHEI

The binary system AH Cephei was discovered and first studied as a spectroscopic binary system by Pearce (1925). Photoelectric light curves were obtained and the system was further studied by Zverev (1933), Stebbins (1934), Huffer and Eggen (1947), Whitney (1956), Nekrasova (1960), Guarnieri et al. (1975), Cester et al. (1978), Eaton (1979), Mayer (1980), Schaefer (1981), Raefert (1982), and Mayer and Tremko (1983).

AH Cephei was observed at Bucharest in 1985-1986. The observations were made with the 50 cm telescope and a photoelectric photometer housing an EMI photomultiplier. The observational points in V filter are indicated by dots in Figure 1. The star GC 31719 was used as the comparison star.

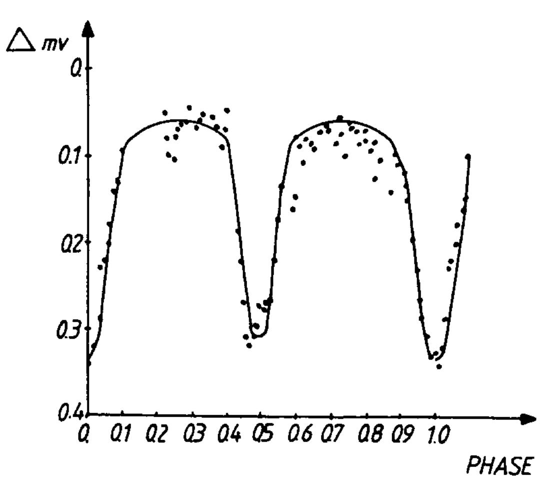

Figure 1

Table I

Year of observations	Source	Spectral region	amplitude primary min.	amplitude secondary min.
1930	Huffer and Eggen	B	$0^m.217$	$0^m.192$
1930	Zverev	V	0.230	0.160
1954	Nekrasova	B	0.223	0.178
		V	0.233	0.193
1970	Guarnieri	B		0.230
		V		0.236
1978	Mayer	B	0.270	
		V	0.267	
1985 - 1986	Bucharest	B	0.290	0.260
		V	0.308	0.260

We used a sphere-sphere model for the first calculation of the elements of the system. The elements were obtained simultaneously for the two minima using Horak's minimization method. The solution was improved using a Wood model after this first approximation.

The calculated elements of the system are:

$i=69^{\circ}.3$ $r_A=0.388$ $q=0.86$ $u=0.38$ $\beta=0.08$
$e=0$ $r_B=0.289$ $a_A=0.415$ $a_B=0.300$ $L_A=0.686$
$\omega=0$ $T_A=25000$ K $b_A=0.385$ $b_B=0.287$ $L_B=0.313$
$k=0.723$ $T_B=22174$ K $c_A=0.364$ $c_B=0.280$

The curve in Figure 1 has been calculated with these elements. Mayer (1980) observed that the amplitudes of the minima are increasing in time. The Bucharest observations confirm this conclusion (see Table I). The depth of the minima probably fluctuate due to the variable amount of circumstellar matter in the system. Variability of the comparison star can be ruled out.

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THREE NEW RED VARIABLES

A continuing nova patrol by Kaiser (MacRobert 1988) has resulted in the discovery of five variables with maxima brighter than 10.0 m_v. For convenient reference, information on all five stars is summarized in Table I. Observations of DHK 4 have already been reported by Kaiser et al. (1988) and by Kaiser (1988). DHK 3 will be discussed separately (Williams 1989). This report presents charts (Figure 1) and information for the remaining three.

TABLE I.

Var. Designation	RA (1950)	Dec (1950)	Range	Type	Period
DHK 1 = LD 103	$01^h57^m58^s$	+58°03'40"	10.0 - 13.8 v	M	360^d
DHK 2	00 36 53	+37 55 32	10.7 - 11.4 b	SR	375^d
DHK 3	05 24 17.0	+23 03 55	10.5 - 13.0 b	Insb	Irr.
DHK 4 = NSV 03005	06 28 47.7	+17 07 08	8.2 - 10.0 v	EA/GS	$1258\overset{d}{.}56$
DHK 5	03 44 56.8	+50 41 32	9.8 - 10.7 b	SR	60^d

DHK 1 = LD 103

DHK 1 is an independent discovery of a variable reported by Dahlmark (1986). The star is extremely red. In visual light the maxima are as bright as $10\overset{m}{.}0$, but the star is invisible on blue plates reaching to $13\overset{m}{.}5$. The amplitude indicates Mira type. Photographic and visual observations by Kaiser and Baldwin, 1987-1989, and inspection of 23 Harvard red plates, 1967-1980, by Williams result in the preliminary elements:

$$JD_{max} = 2447220 + 360^d E$$

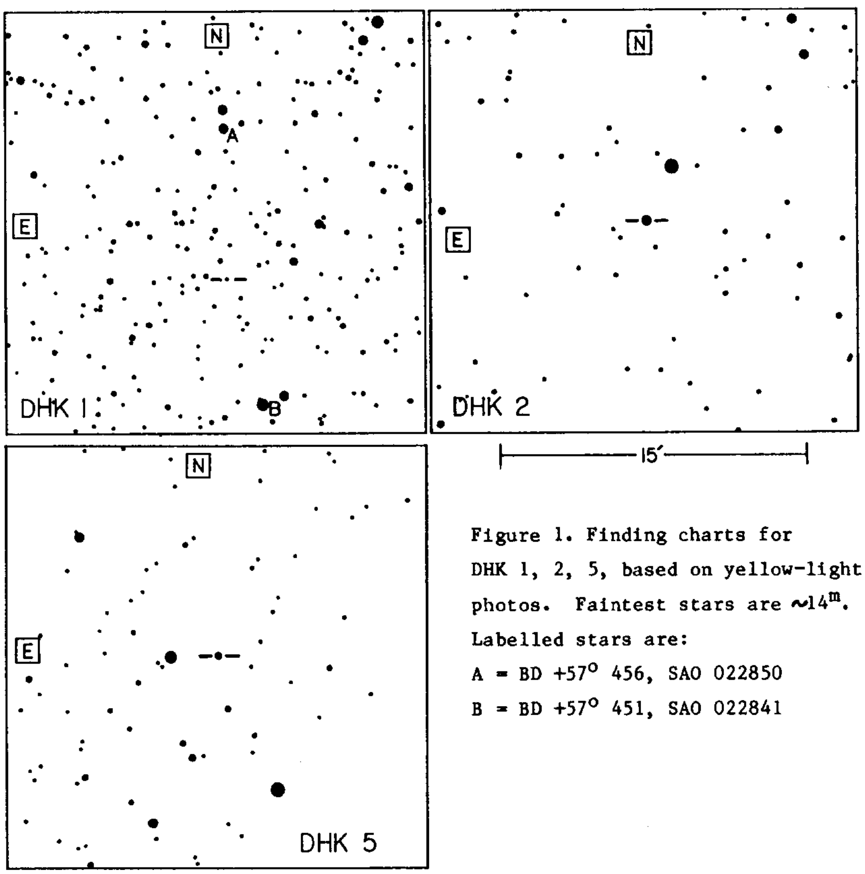


Figure 1. Finding charts for DHK 1, 2, 5, based on yellow-light photos. Faintest stars are ~14^m. Labelled stars are:
A = BD +57° 456, SAO 022850
B = BD +57° 451, SAO 022841

The variable is faint on the Palomar Observatory Sky Survey blue print, which shows a close companion of similar brightness. Observations are needed to determine which of these two stars is the variable. The finding chart in Figure 1 is less compressed and more legible than the chart in Dahlmark (1986).

DHK 2 = BD +37° 112

Observations by Kaiser on 120 Harvard blue plates, 1898-1915, indicate that DHK 2 is a variable of type SR with an amplitude of $0^m.7$. This

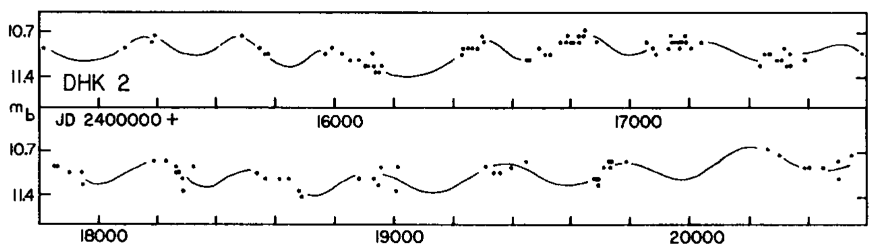
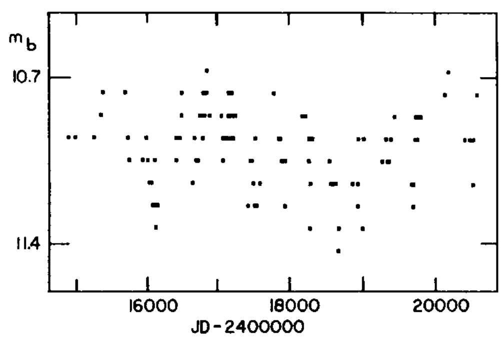


Figure 2. The semiregular variation of DHK 2, mean cycle length 375 days.

Figure 3. A compressed light curve of the same data, showing variation of the mean magnitude.



variable appears to be multi-periodic. Recent visual observations by Baldwin suggest that variations may occur in cycles as short as 70 - 100 days. The plates are not frequent enough to define individual cycles of this period, but do show a variation with a mean cycle length of 375 days (Figure 2). A compressed plot of the same data (Figure 3) shows variation of the mean magnitude with a possible 3300-day period and $0\overset{m}{.}3$ amplitude.

DHK 5 = BD +50° 829 = SAO 024237 = HD 232842 = IRC +50..106

The HD spectral type is M4, while Nassau and Blanco (1954) give M6 and Lahulla (1987) gives M5. Lahulla also measured the star at +8.51 V. New photoelectric measures by Williams from JD 2447447 - 569 (Figure 4) show the star varying from 8.82 - 9.01 V with a cycle length of 60 days.

Observations by Kaiser on 108 Harvard blue plates, 1969-1988, show that the variable can reach a full amplitude in blue of $0\overset{m}{.}9$. The plates

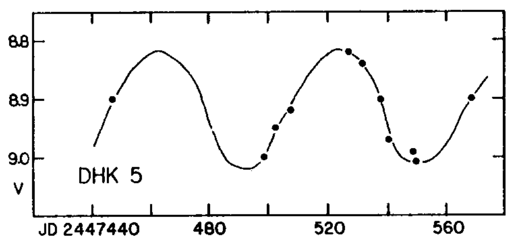


Figure 4. Photoelectric V measures of DHK 5, showing two cycles of 60-day length.

are not frequent enough to define individual 60-day cycles but do suggest that especially bright maxima recur at intervals of about 700 days.

We wish to thank curator Martha Hazen for permission to use the Harvard College Observatory photographic plate collection and Martin Burkhead, Indiana University Astronomy Department, for assistance in searching the literature and examining the Palomar Observatory Sky Survey.

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A BRIGHT NEBULAR VARIABLE IN TAURUS

The variability of DHK 3 (BD +22° 909, HD 243750, IRC 20186, sp. M7) at RA 5^h 24^m 17.0^s, Dec. +23° 03' 55.4" (1950), was discovered by Kaiser (1987), who noted changes from 9.0 - 10.0 m_v. I have now estimated DHK 3 on 702 Harvard blue plates of the AC and Damon series, spanning the years 1899-1952 and 1967-1988.

The plate estimates were made using a step sequence. The comparison star magnitudes were later estimated using a graded series of stellar images to compare the sequence stars with photoelectric B magnitudes in the cluster NGC 2129 (Hoag et al. 1961). An improved finding chart (Figure 1) includes fainter stars than the chart which appeared in the discovery report.

The light curve (Figure 2) shows irregular variations with a range from 10.5 - 13.0 m_b. DHK 3 normally remains near 11.0 m_b with variations of $0^m.5$ - $1^m.0$. The mean magnitude sometimes declines by $0^m.5$ - $1^m.0$ for intervals of 1000 - 3000 days. Recently (JD 2445000 - 47000) the variable has exhibited a series of deep minima. DHK 3 can vary by $0^m.5$ in as little as 5 days, and one series of plates exposed on the same night showed the variable brightening by $0^m.5$ in 4 - 5 hours.

No luminous nebulosity is associated with the star's image on the Palomar Observatory Sky Survey, but it does lie near the edge of a region of dark clouds. Based on the irregular and rapid light variations, late

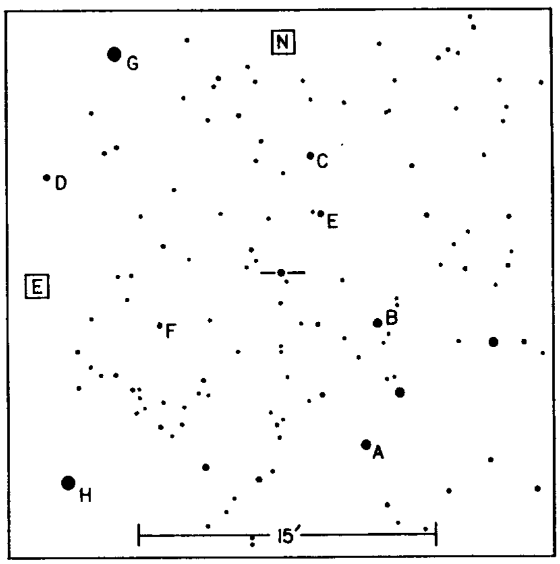

Figure 1. Finding chart for DHK 3 based on yellow-light photo. Faintest stars are $\sim 14^{m}$. Estimated blue magnitudes of the comparison stars are:

A = $10\overset{m}{.}6$:	C = 11.5	E = 12.6
B = 11.0	D = 12.3	F = 13.0

G = BD +23° 916, SAO 077187 H = BD +22° 912, SAO 077189

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spectral type, and proximity to dark nebulae, DHK 3 appears to be a variable of type Insb as defined by Kholopov et al. (1985).

DHK 3 should be examined for T Tauri spectral features. With a maximum of about $9\overset{m}{.}5$ V, this star might add to the very small number of bright T Tauri stars (see Weaver and Hobson 1988).

While making the estimates, I became dissatisfied with comparison star A (BD +22° 907, SAO 077178), which may vary by $\pm 0\overset{m}{.}1$. The spectral type is M0, so it could well be slightly variable. It is equally likely, however, that slight variation of the image of a star this red could

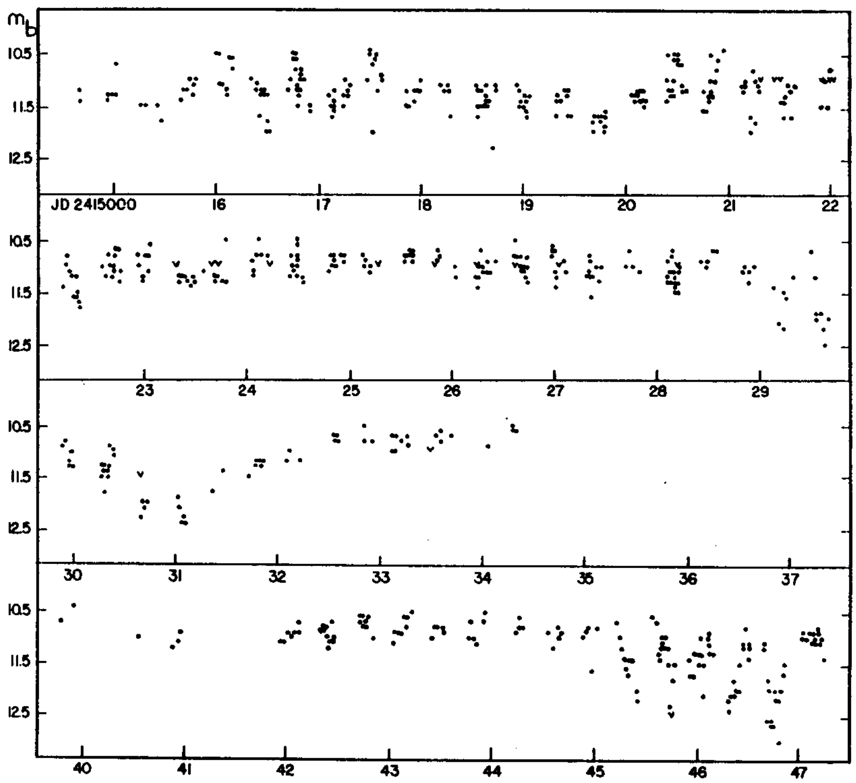

Figure 2. DHK 3 light curve, Harvard blue plates, 1899-1952, 1967-1988.

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result from different lenses, photographic emulsions, and exposure times used during the 89-year span of the plate collection. When the problem with this comparison star became apparent, I replaced it with a star of similar brightness that lies outside the limits of the finding chart.

I wish to thank Martha Hazen, curator of the Harvard Photographic Plate Collection, for access to this invaluable astronomical resource, and Martin Burkhead, Indiana University Astronomy Department, for

examining the variable on the Palomar Observatory Sky Survey and checking the literature on this star. Daniel H. Kaiser, the discoverer, provided the photograph on which the improved finding chart is based.

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CW Leo = IRC+10216 HAS RETURNED TO A HIGH LIGHT LEVEL

The dust-enshrouded variable carbon star CW Leo, best known as the infrared source IRC+10216 has been monitored in photographic red R(0.64) and infrared I(0.81) bands with the Schmidt telescope of the Radioastrophysical observatory. In addition to the Mira-type light variation a conspicuous long-term secondary variation was found. Due to the secondary variation the star faded by two magnitudes during 1974-1978 and remained at such a low light level up to 1986 (Alksnis et al., 1987). Further observations have shown that the star gradually brightened and in the season 1988/89 again reached the high light level in the photographic infrared.

According to all our I(0.81) observations the light curve elements for the periodic component are:

$$\text{Max J.D.} = 2441738 + 635^{d} \cdot E \quad .$$

The corresponding light curve for the periodic component is shown in Figure 1,

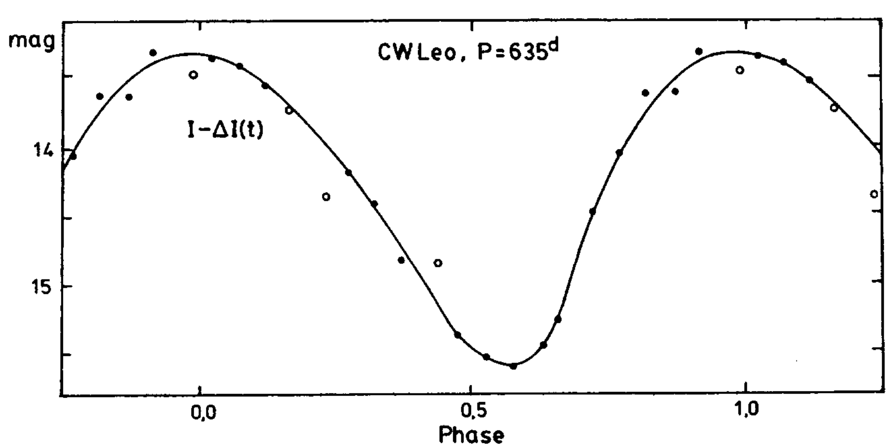

Figure 1. The curve of the periodic component of the light variation in photographic infrared I(0.81). Observed values (I) corrected for the secondary variation ΔI(t) and averaged over 0.05 phase intervals (filled circles) or single observations (open circles) vs. phase calculated according to the elements given in the text.

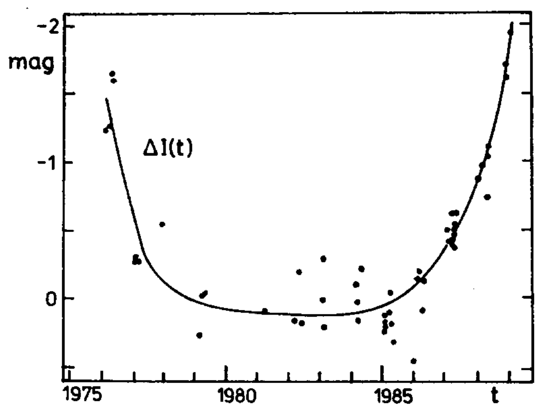

Figure 2. The curve of the secondary component of the light variation in I(0.81): deviation in mag of individual observed I(0.81) values from the curve of the periodic component (Fig.1) vs. time

and for the secondary component in Figure 2.

Similarly, in the red region, the secondary component of the light variation shows the brightening, although the high light level as observed about 15 years ago the star has not yet reached.

Possibly, during the last 15 years CW Leo has gone through a full cycle of the secondary variation. It seems important to study this object in other wavelength regions at this stage of high light level.

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Reference:

Alksnis, A., Alksne, Z., Ozolina, V., Začs, L. 1987, Investigations of the Sun and red stars, No.26, p.31.

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On the misclassification of CK Aquarii *

CK Aqr is classified in the General Catalogue of Variable Stars (1985) (here after GCVS) as a δ Sct star varying from 12.9 to 13.8p. The elements given in the GCVS were obtained by Tsesevich (1964,1969):

$$\mathrm{Min} = \mathrm{HJD}\ 2437547.319 + 0^{d}.12406245 \cdot E$$

The variability of this star was originally discovered by Shapley and Hugues (1935) who gave the same range of variation and period than in the GCVS but with the indication "cluster type" variable.

In the frame of our study of faint δ Sct stars, CK Aqr has been measured in the Johnson photometric system on 1984 October 21,22 and 27 with the 1 meter telescope of Pic du Midi Observatory (France) by J.F. Le Borgne and A. Figer and on 1987 July 2 and 3 with the 1 meter telescope of European Southern Observatory (La Silla, Chile) by E. Poretti. 57 measurements through Johnson U,B and V filters were obtained at Pic du Midi and 176 measurements through Johnson B and V filters at ESO. The resulting light curves are characteristic of a W UMa type eclipsing binary and not of a δ Sct star. The V magnitude varies from 12.86 to 13.47. There is a slight B-V variation from 0.70 to 0.78. Only a mean value of U-B can be obtained from Pic du Midi measurements: 0.08 $\pm$ 0.18.

The analysis of the light curves of the 5 nights allows to calculate the period without ambiguity, especially from the light minimum times given in the table below even if the large gap between the two series of observations does not allow to link Pic du Midi and ESO minima.

Date	Observatory	V minimum (HJD)
21 OCT 1984	Pic du Midi	2445995.368
22 OCT 1984	"	2445996.356
27 OCT 1984	"	2446001.318
02 JUL 1987	ESO	2446979.935:
03 JUL 1987	"	2446980.788
03 JUL 1987	"	2446980.929

List of V and B light minimum times of CK Aqr

The period obtained is 0.2833 $\pm$ 0.0002 day. The period given by Tsesevich is an alias of half the value of the true period. The two folded light curves are given in the figure. The V light curve is characterized by minima and maxima at different magnitude: V

* Based on observations collected in part at European Southern Observatory, La Silla, Chile

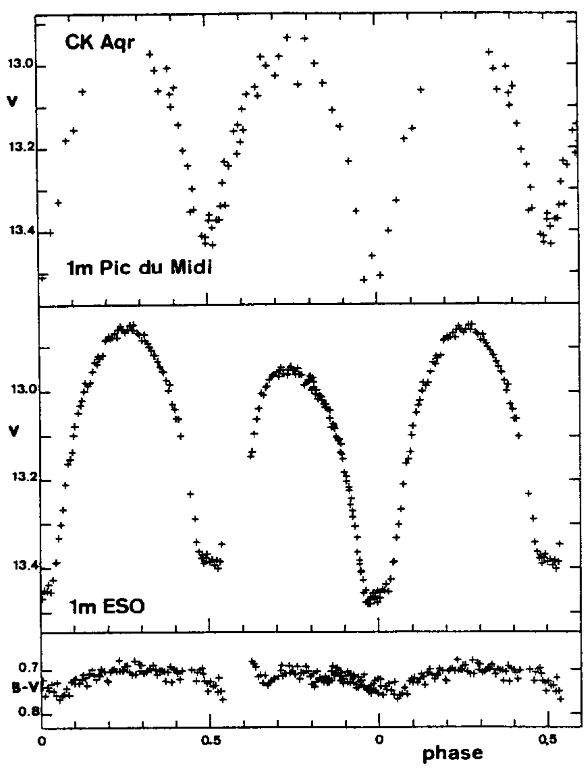

Figure 1

maxima at 12.86 and 12.95, minima at 13.38 and 13.47. Such a light curve is known to characterize binary systems with circumstellar matter. Note also that at the minima the light curve is not perfectly regular and that is why the minima of the B-V curve do not coincide with the V minima but occur during the ascending branches. Moreover, the eclipses may be total. The mean value of B-V, not corrected for interstellar reddening, is in good agreement with Eggen's (1967) period- colour relation. The colours of CK Aqr are compatible with the colours of unreddened G5-G8 stars.

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INTERNATIONAL COOPERATION AND COORDINATION IN VARIABLE STAR RESEARCH

The first European meeting of the American Association of Variable Star Observers (AAVSO) will be held in Brussels, Belgium, from July 24 to July 28, 1990. The conference will be dedicated to the topic of worldwide cooperation and collaboration between variable star observers.

Variable star photometry plays a vital role in collaborative multi-wavelength and multi-site ground-based and space programs. The purpose of the meeting is to bring together observers from around the world to review results of collaborative programmes, to define scientific Key Projects, and to promote and initiate collaborations between several teams. All presentations will be published in a Proceedings Volume.

This announcement both serves as an invitation to attend, and as a call for papers. For more information, please contact one of the undersigned.

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TWO PHOTOELECTRIC TIMES OF MINIMUM OF 44 i Boo

44 i Boo is a fascinating eclipsing variable due to its dramatically short period of 0.26781 day. The Yale Bright Star Catalogue suggests that this system may experience unusual variations in its light curve shape and its orbital period, perhaps as a result of mass transfer between its two components.

Photometry of this variable was obtained with the 24-inch Seyfert reflector at the A. J. Dyer Observatory in Nashville, Tennessee, on the nights of 1988 June 6-7 and 9-10. The detector was a 1P21 photomultiplier tube, cooled with dry ice and employing pulse-counting electronics. Filters to match the U, B, and V bandpasses were used on the first night of observation, while just the B and V filters were used on the second night, increasing the number of measurements possible. As a comparison star, nearby 47 Boo was used. The differential magnitudes were corrected for atmospheric extinction and transformed to the UBV system. Figure 1 shows the B and V light curves resulting from the second night.

We calculated the times of minimum with a novel approach which made use of the data at all phases of the light curve. Our differential magnitudes were fitted with the equation

$$l = A_0 + A_1 \cos \theta + A_2 \cos 2\theta, \qquad (1)$$

where θ is phase computed using a period of 0.26781 day. The above equation was solved successively by least squares with different assumed initial epochs to find the Julian date which gave the best fit, i.e., the smallest sum of the squares of the residuals. The results are given in Table 1, and refer to the primary minimum.

The uncertainties in Table 1 are the formal errors resulting from chi-squared analysis. They might underestimate the actual uncertainties because our fit with equation (1) assumes a shape to the entire light curve which is only an approximation.

Table 1. Times of primary minimum for 44 i Boo.

Filter	J.D. (hel.)
U	2447319.7446 ± $0^{d}.0040$
B	2447319.7495 ± 0.0038
V	2447319.7491 ± 0.0025
B	2447322.7008 ± 0.0012
V	2447322.6999 ± 0.0013

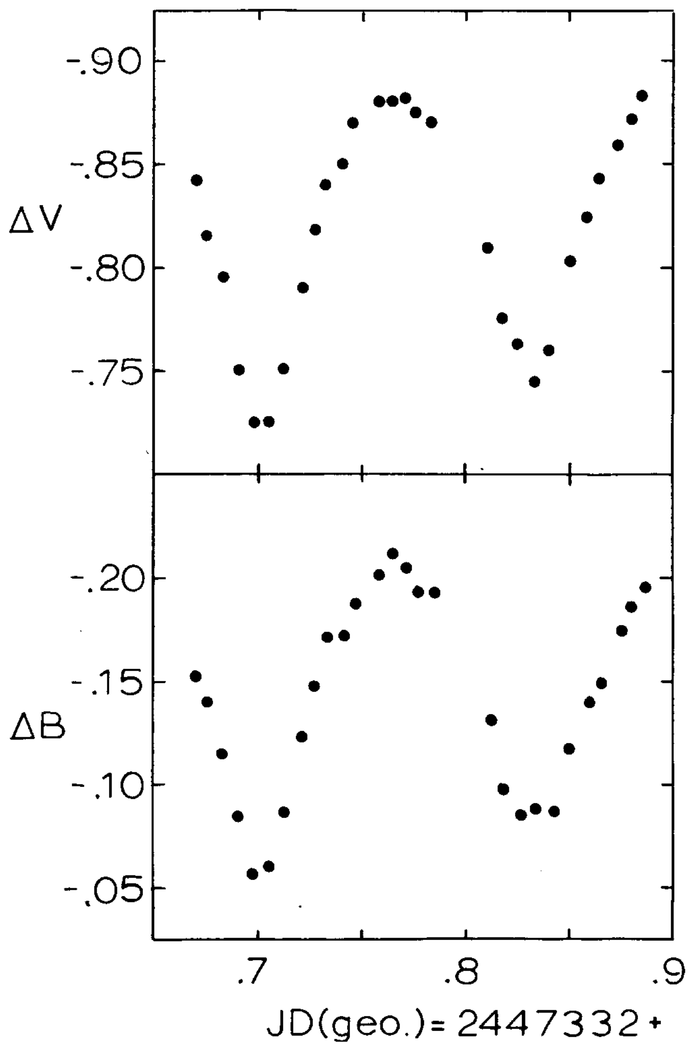

Figure 1. The B and V light curves from the night of June 9-10, 1988.

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HD 181219 : A SUSPECTED ECLIPSING BINARY

HD 181219 is a star with a K0 spectral type and a V = 7.86 magnitude, both taken from the Henry Draper Catalogue. It was serving as the comparison star during photometry of HD 181943 in an investigation by Hooten and Hall (1989) using the Vanderbilt 16-inch automatic telescope. HD 181943 had appeared earlier on a list of 40 suspected variables (Fekel and Hall 1985), where we see it has a G8 IV spectral type and a V = 9.3 magnitude. Hooten and Hall noticed, from several discordant differential magnitudes, that the comparison star was occasionally faint by about 0.1 magnitude.

HD 181219 itself was observed differentially with respect to the check star HR 7379 (A1 V, V = $6^{m}_{.}70$) from JD 2,447,277.93 to JD 2,447,434.62 and 70 differential magnitudes in V and B were obtained. These observations have been corrected for differential atmospheric extinction and transformed to the UBV system. Three times of diminished brightness (at Julian dates of 2,447,287.91, 2,447,316.83, and 2,447,424.63) were suspected of being in either primary or secondary eclipse. Initially we considered them belonging to the same (primary) eclipse. Different periods were used to compute phases beginning with periods around 29 days, the time elapsed between the first two minima in the data. Periods in this vicinity failed to bring all three points together in phase. Then, considering the data contained points from both the primary and the secondary eclipse, periods around twice the suspected 29-day value were explored.

A light curve for HD 181219 with the most likely period, P = $55^{d}_{.}1$, is shown in Figure 1. This representation permits eclipses no longer in duration than about 3.0 days for one eclipse and 3.5 days for the other eclipse. When computing phases, the deepest point, $\Delta V = 1^{m}_{.}18$ at JD 2,447,287.91, was used for the preliminary initial epoch. It is evident from the light curve that this cannot be the exact midpoint. A better approximation would be about a half day earlier. Thus the best available estimate for the current ephemeris of this newly discovered eclipsing binary would be

$$\mathrm{JD(hel.)} = 2,447,287.4 + 55^{d}_{.}1\ n . \qquad (1)$$

Relative to this ephemeris the other eclipse occurs at about phase 0.52. Thus there must be a slight eccentricity in the orbit.

A photometry project with a more continuous series of observations allowing for a period around 55 days will be needed to confirm the correctness of our ephemeris and define the shape of the light curve. Because our photometry is so scant, we cannot rule out the possibility that the eclipses are deeper than $0^{m}_{.}13$ nor that the eclipses are complete.

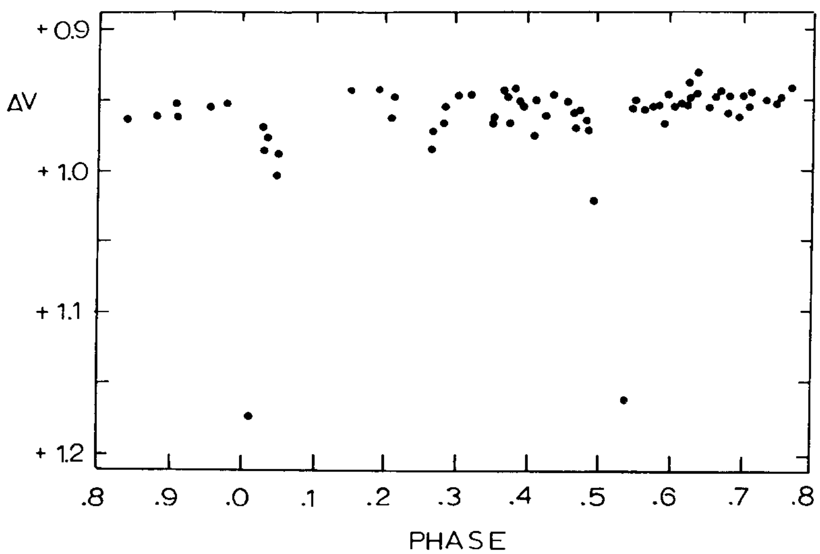

Figure 1. Light curve of HD 181219. The vertical axis is differential magnitude with respect to HR 7379. The horizontal axis is phase computed with the ephemeris in equation (1). We are not sure which eclipse is primary and which is secondary.

The Vanderbilt 16-inch automatic telescope was obtained with funds from N.S.F. research grant AST 84-14594 and its continued operation is made possible by N.A.S.A. research grant NAG 8-111.

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DECEMBER 1988 PHOTOMETRY ON AB DORADUS (HD36705)

We present (see Fig. 1) complete light curves in UBV colours and some Rc and Ic data for the fast rotating active chromosphere single star HD36705 (AB Dor). A cooled extended S–20 tube was used on the 0.6 m telescope at Siding Spring Observatory. The comparison and check stars used were HD35537 and HD37927. The phase was computed using epoch and period HJD 2444296.575 and 0.51479 in accordance with Innis et al. (1988). A summary of the V photometry on this star from 1978 is shown in Fig. 2.

The Dec. 1988 data were standardized from the instrumental values using a set of calibration equations previously obtained in August 1988 on the same instrument by Dr. D.W. Coates using the E region standards (Vogt et al. 1981). Unfortunately there was no U band calibration so these data are left as instrumental.

The scatter in the data particularly in u around phase 0.4 we believe is real and represents a change over two days of the stars magnitude at maximum.

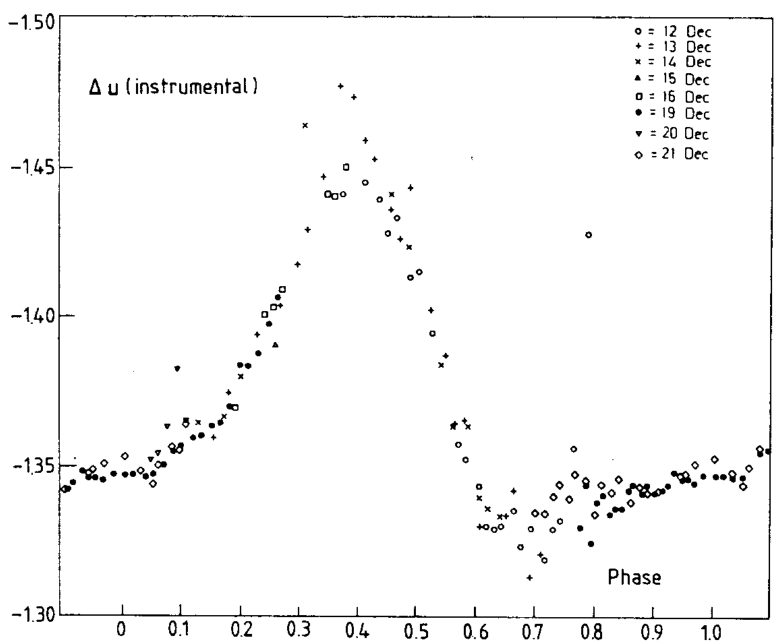

Fig. 1 (a)(b)(c)(d)(e): The light curve for AB Dor in December 1988 in Δu (instrumental), ΔB,ΔV,ΔRc and ΔIc. The phases are according to epoch 2444296.575 and period 0.51479 Innis et. al. (1988).

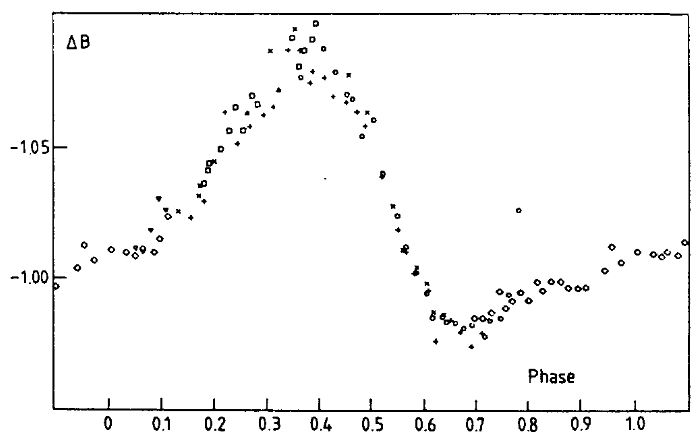
ΔB
-1.05
-1.00
Phase
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

Fig.1(b)

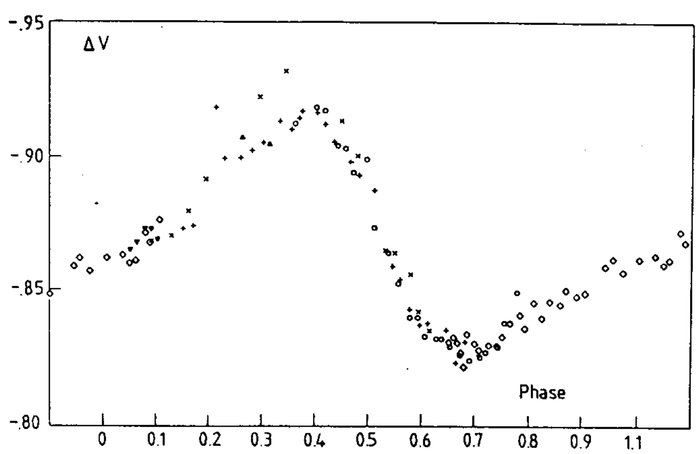
-.95
ΔV
-.90
-.85
-.80
Phase
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.1

Fig.1(c)

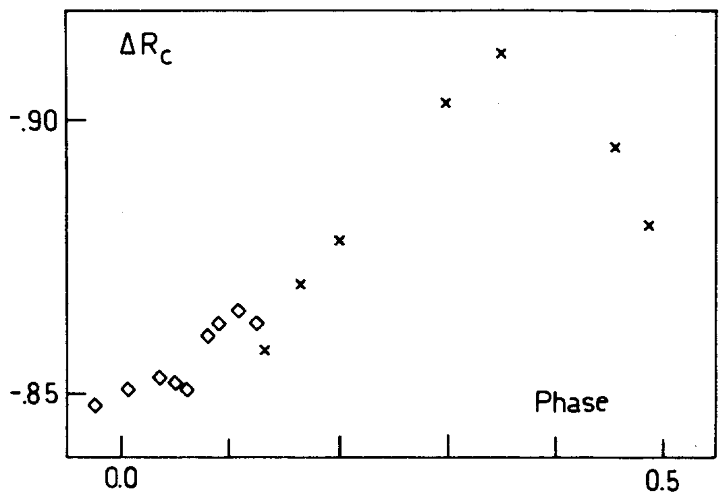

Fig.1(d)

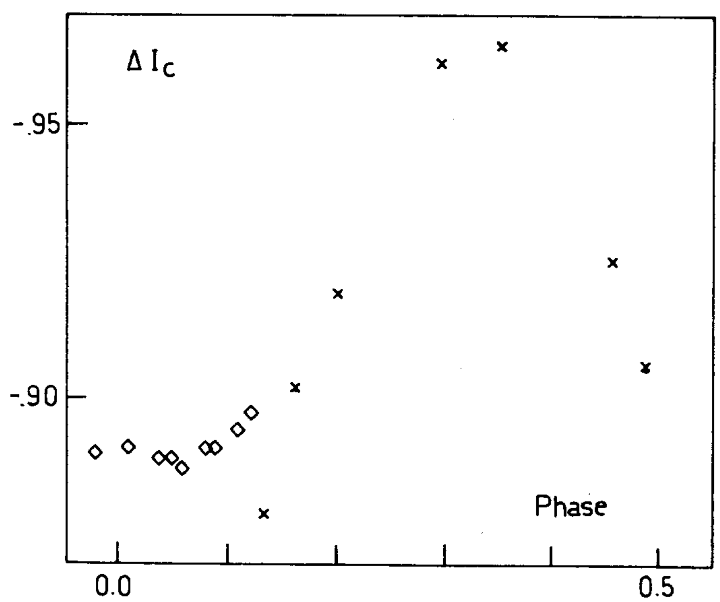

Fig.1(e)

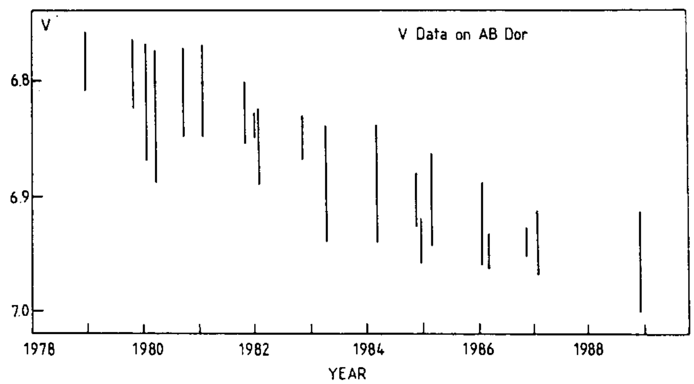

Fig. 2 The mean light level and variation of V for AB Dor from a wide variety of sources. For references see Innis et al. (1988). It is yet to be seen if this long term variation is part of a spot cycle on AB Dor.

There are two broadband flares, one at phase 0.09 on the 20 December and the larger at phase 0.78 on the 12 December. This latter flare occurred just at dawn was rising and only after a careful check on sky levels and sky subtractions is it believed to be real.

The flat portion of the curve from phase 0.65 to 0.15 indicates a spotted region rather than just two spots since they would be 0.5 phase apart. The night of the 15th was extremely poor photometrically and no great weight can be given to the odd data point which is noted on that night.

It is a pleasure to thank Dr. B. Carter for help on three of the observing nights.

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HD 17 978: A NEW δ SCUTI VARIABLE*

HD 17 978 is a 9.9 magnitude A2 star in the constellation Fornax. We used it as a comparison star in a photometric program, carried out in 1986 with the uvby photometer attached to the Danish 50 cm telescope. Ten observations made on two nights, November 29 and 30, indicate that HD 17 978 is a small-amplitude variable. Since we do not plan to observe the star in the future, we present here a brief account of the data we collected.

The period of the variation is short, certainly shorter than three hours. Unfortunately, it cannot be uniquely determined from our scarce data. Figure 1 (upper panel) shows the differential b magnitudes of the star in the sense "HD 17 978 minus the mean of HD 18 225 and HD 18 100" phased with a period of

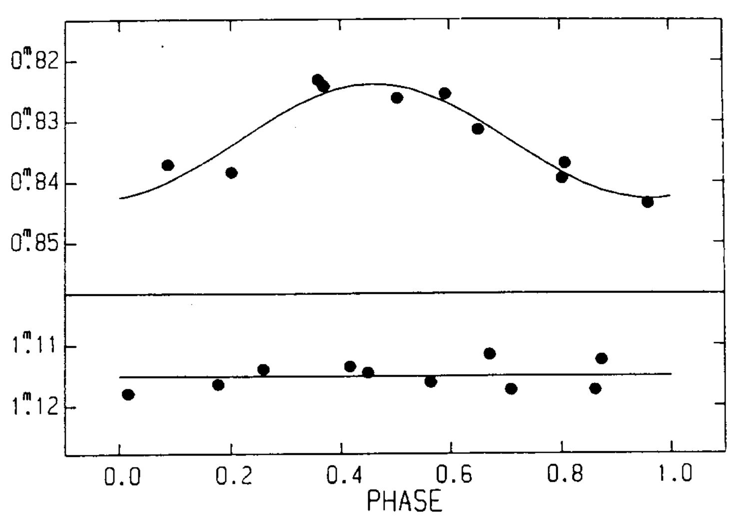

Figure 1. The differential b magnitudes of HD 17 978 (upper panel) and of the comparison stars (lower panel) plotted as a function of phase of the 0.0577 day period. Zero phase corresponds to JD_{hel} 2 446 750.

* Based on observations collected at the European Southern Observatory, La Silla, Chile

0.0577 days, which is one of the series of possible values. Zero phase corresponds to JD_{hel} 2 446 750. The differential magnitudes "HD 18 225 minus HD 18 100" are plotted in the lower panel of the figure. The sine curve (solid line) fitted to the variable star data by the method of least squares has an amplitude (half range) of 0.0094 ± 0.0012 mag. The maximum occurs at phase 0.460 ± 0.020 . Standard deviation of the fit amounts to 0.0026 mag. This can be compared with 0.0022 mag, the standard deviation with which the mean level line (horizontal straight line in the lower panel) fits the comparison stars' data. The amplitudes in u, v, and y amount to 0.0072 ± 0.0019 mag, 0.0101 ± 0.0017 mag, 0.0073 ± 0.0020 mag, respectively, and the phases of maximum in these bands do not differ significantly from the phase of maximum in b.

The time scale and the amplitudes of the light variation of HD 17 978, together with its spectral type of A2, indicate that the star is a δ Scuti variable.

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1987 BV PHOTOELECTRIC OBSERVATIONS OF CG Cyg

This eclipsing binary was observed from 7 July through 22 July 1987 with the 1.2 m Kryonerion telescope and a single channel photon counting photometer described by Dapergolas and Korakitis (1987). The photometer employs a high gain 9789 QB phototube and conventional BV filters. Its output is fed directly to a microcomputer enabling rapid data access.

Castle et al. (1977), Milone et al. (1979), Jassur (1980), Naftilan and Milone (1985), Sowell et al. (1987), and finally Dapergolas et al. (1988) have also presented photometric observations for this star.

The data reduction method is the standard one. The check and comparison stars are the stars a and b, respectively named by Yü (1923). The data were obtained with an accuracy of ±0.015 mag.

Table I lists the dates of observations and phases covered whereas Figures 1 and 2 summarize the results for B and V colours.

Table I

Date	Phase
7 July 1987	.24 - .44
8 July 1987	.68 - .03
9 July 1987	.31 - .44
10 July 1987	.88 - .21
16 July 1987	.45 - .72
22 July 1987	.88 - .08

In Table II the times of minima and the O-C values are listed for the V and B bands respectively. Times of minima are calculated using the method described by Kwee and van Woerden (1956) whereas the O-C values were determined from the linear ephemeris $T = 2\,439\,425\overset{d}{.}1221 + 0\overset{d}{.}631\,141 \cdot E$ given by Milone and Ziebarth (1974).

From the V light curve presented here, it can be suggested that there are irregularities outside the eclipses already reported by Milone et al. (1979).

The observed difference between the primary and secondary minima is 0.30 mag and 0.41 mag for the V and B colours respectively, whereas these values are reported as being 0.30 mag and 0.34 mag by Dapergolas et al. (1988) indicating that the variation in the depth is similar for both colours. The

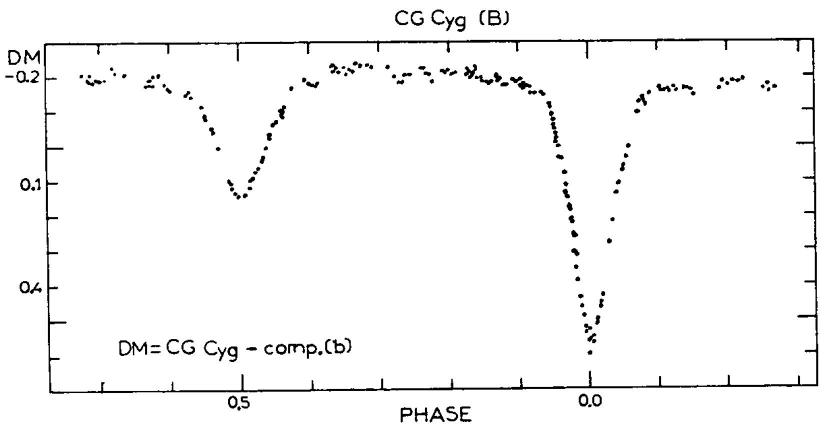

Figure 1

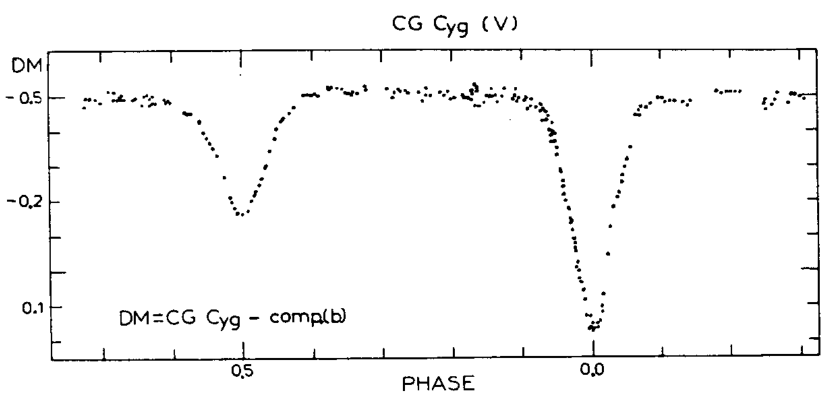

Figure 2

Table II

Type of minima	V Heliocentric Jul. Day	V (O–C) phase	B Heliocentric Jul. Day	B (O–C) phase
Primary	2446987.4749 ±0.0003	0.0339	2446987.4746 ±0.0003	0.0339
Secondary	2446993.4694 ±0.0003	0.5317	2446993.4687 ±0.0003	0.5305
Primary	2446999.4658 ±0.0002	0.0326	2445990.4655 ±0.0004	0.0322

observed variation of the differences between the primary and secondary minima is probably due to a variably asymmetric light curve already reported by Milone et al. (1979).

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Yü, C.S. 1923, Astrophys. J., 58, 75.

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THE 69th NAME-LIST OF VARIABLE STARS

The present 69th Name-List of Variable Stars compiled in the manner first introduced in the 67th Name-List (IBVS No.2681,1985) contains all data necessary for identification of 332 new variables finally designated in 1988. The total number of designated variable stars has now reached 30099.

The 69th Name-List consists of two Tables. Table 1 contains the list of new variables arranged in the order of their right ascensions. It gives the ordinal number and the designation of each variable; its equatorial co-ordinates for the equinox 1950.0; the range of variability and the system of magnitudes used (sometimes the column "Min" gives in parentheses the amplitude of light variation); the type of variability according to the system of classification described in the forewords to the first three volumes of the 4th GCVS edition (with the addition introduced in the 68th Name-List, IBVS No.3058,1987, and new addition described below); two references to the reference list which follows the Table 2 (the first reference indicates the investigation of the star, the second one indicates the paper containing a finding chart or the corresponding Durchmusterung - BD,CoD, or CPD - containing the variable).

One addition to the earlier described system of variable star classification has been introduced here. It becomes more and more clear that, although the majority of Be stars are photometrically variable, not all of them could be properly called GCAS variables. Quite a number of them show small-scale variations not necessarily related to shell events; in some cases the variations are quasi-periodic. By now we are not able to present an elaborated system of classification for Be variables, but we adopt a decision that in the cases when a Be variable cannot be readily described as a GCAS star we give simply BE for the type of variability.

In a small number of cases the value of the variability amplitude (column "Min", in parentheses) could not be expressed in the same system of magnitudes as the star's brightness; indicating the photometric band for the amplitude separately in such cases, we distinguish the Stromgren bands as "u", "v", etc.

Table 2 contains the list of variables arranged in the order of their names inside constellations. After the designation of a variable its ordinal number in Table 1 is given, as well as all identifications needed for its finding in the papers with the first (or independent) announcement of the discovery of its variability. References to these papers are given in square brackets after the corresponding identification. The name of the discoverer in its original transcription accompanies the reference only in the case of ts being different from the name of the author of the paper referred to.

In the case of the variable stars in the open cluster NGC 3766 (V843-V849 Cen), there is some ambiguity in their identification with the HD, CoD, CPD catalogues. In particular, we do not agree with the HD catalogue identification of HD 100856 with CPD-60°3102 and consider V843 Cen=CPD-60°3102 to be identical with HDE 306794; HD 100856=CPD-60°3112.

Two corrections to the 68th Name-List have been found. The declination of EI Cnc is +19°57'.4, not +17°57'.4 (1950). V955 Tau is not identical with B13 (ref. [260] in IBVS No.3058,1987 and [271] in the present paper); the real B13 is V999 Tau.

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Astronomical Council of the
USSR Academy of Sciences,
Sternberg State Astronomical
Institute of Moscow University

Table 1

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
001	V658	Cas	$00^h04^m33^s$	$+61^\circ32'$	11.5	14.0	V	M	065 065
002	V659	Cas	00 15 20	+58 53	13.5	<17.0	V	M	065 065
003	OV	And	00 18 11	+40 33.3	10.4	11.0	P	RRAB	002 003
004	BE	Phe	00 19 19	-40 33.9	6.41	7.04	J	M:	152 152
005	V660	Cas	00 31 33	+64 16	12.8	15.0	V	SR:	065 065
006	V661	Cas	00 43 54	+63 39.8	12.3	14.2	V	SRB:	010
007	AQ	Scl	00 45 01	-29 00.6	16.9	17.8	B	RRAB	254
008	AR	Scl	00 50 11	-29 17.8	15.9	17.3	B	RRAB	254
009	CM	Tuc	00 54 12	-73 34.7	11.62	12.8	V	SRB:	282 283
010	AS	Scl	01 03 10	-27 13.3	8.10	(0.03)	V	ELL:	255 CoD
011	V662	Cas	01 14 42	+65 01.5	11.06	(0.10:)	V	XP:	066 067
012	BB	Psc	01 22 40	+20 02.2	16.1	(0.1:)	B	ZZO	231 046
013	BL	Cet	01 36 25	-18 12.7		12.52	V	UV	092 093
014	OW	And	01 42 08	+37 15.3	13.7	14.2	P	LB	005 005
015	UX	Tri	01 42 50	+31 09.2	10.5	11.5	P	RRAB	005 005
016	UV	For	01 44 21	-24 15.9	7.97	8.07	V	RS	011 CoD
017	OX	And	01 49 46	+36 58	14.2	15.5	P	RRAB	005 005
018	UY	Tri	01 54 20	+32 53	15.1	16.4	P	RRAB	005 005
019	OY	And	01 55 06	+38 25.0	13.7	16.6	P	M	005 005
020	UZ	Tri	01 55 29	+33 17	]14.2	21.0:	P	N:	005 005
021	VV	Tri	01 58 02	+35 01	14.5	15.6	P	RRAB	005 005
022	VW	Tri	02 00 59	+32 36	13.9	14.4	P	EW/KW	005 005
023	OZ	And	02 03 51	+36 11	14.1	15.2	P	RRAB	005 005
024	VW	Ari	02 05 28	+14 54.8	15.2	16.2	B	UV+BY:	040 040
025	VX	Tri	02 07 03	+32 10	13.4	14.6	P	RRAB	005 005
026	PP	And	02 07 43	+38 03.8	14.3	16.6	P	EA/SD	005 005
027	VY	Tri	02 09 12	+33 41	15.0	15.6	P	LB	005 005
028	BQ	Hyi	02 17 20	-71 41.9	8.06	8.22	V	RS	011 CPD
029	VZ	Tri	02 18 37	+31 45	12.8	13.3	P	EW/KW	005 005
030	WW	Tri	02 20 14	+36 47	12.2	12.7	P	EA	005 278
031	WX	Tri	02 20 51	+33 41	14.0	14.8	P	LB	005 005
032	WY	Tri	02 22 13	+32 47	13.8	<17.0	P	UG	005 005
033	PQ	And	02 26 22	+39 49.3	10.1	19	V	NA	008 009
034	UW	For	02 32 27	-34 51.3	11.2	11.5	V	CWB	144 CoD
035	WW	Hor	02 34 32	-52 32.3	18.4	<23	B	E+XM	163 164
036	V493	Per	02 37 33	+56 31.0	10.6	(0.04)	V	WR	223 224
037	V663	Cas	02 37 50	+71 21.9	8.8	(0.04"v")	V	DSCTC	068 BD
038	UX	For	02 41 26	-38 08.3	7.97	8.11	V	RS	011 CoD
039	UY	For	02 42 08	-25 03.7	8.22	8.25	V	RS	011 CoD
040	VX	Ari	02 44 54	+10 23.2	14.8	15.4	V	NL	042 043
041	V494	Per	02 53 21	+48 13	13	14	P	ISB	225 225
042	V664	Cas	02 59 34	+64 41.8	14	(1.1)	B	R	069 070
043	V495	Per	03 07 18	+45 46.8	13.8	15.5	P	LB	226 226
044	EL	Eri	03 08 09	-05 35.0	7.92	8.20	V	RS	011 BD
045	V496	Per	03 31 56	+37 51.0	7.70	7.79	U	ACV	056 BD
046	UZ	For	03 33 19	-25 54.2	18.2	20.9	V	E+XM	146 147
047	V497	Per	03 39 17	+35 28.8	9.52	9.56	V	ACV	056 BD
048	V963	Tau	03 40 40	+23 22.8	10.69	10.76	V	BY	258 259
049	V964	Tau	03 40 58	+22 08.6	15.6	<18	U	UV	260 260
050	V965	Tau	03 41 03	+26 04.7	15.3	<18	U	UV	260 260
051	V966	Tau	03 41 14	+23 13.4	11.41	11.54	V	BY	258 259

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min	Type		References	
052	V967	Tau	03^{h}41^{m}27^s	+23°30'.5	15	(18	U	UV	260	260
053	V968	Tau	03 42 35	+25 59.2	13.3	16.2	U	UV	260	260
054	V969	Tau	03 42 40	+24 45.2	9.46	9.51	V	BY	258	259
055	V970	Tau	03 42 45	+26 08.6	14.8	(18	U	UV	260	260
056	V971	Tau	03 43 21	+23 47.6	4.18	(0.01)	V	BCEP	264	BD
057	V972	Tau	03 45 38	+26 09.1	15.6	17.5	U	UV	260	260
058	V498	Per	03 46 34	+35 27.0	8.96	9.04	B	ACV	056	BD
059	V973	Tau	03 47 41	+26 04.4	15.1	(18	U	UV	260	260
060	V974	Tau	03 47 43	+21 49.9	15.4	(18	U	UV	260	260
061	V975	Tau	03 47 55	+22 03.0	15.4	(18	U	UV	260	260
062	V976	Tau	03 48 13	+24 51.1	15.8	(18	U	UV	260	260
063	V977	Tau	03 48 44	+23 42.1	16.2	(18	U	UV	260	260
064	V499	Per	03 49 12	+34 18.9	9.96	10.01	U	ACV	056	BD
065	V978	Tau	03 49 17	+24 43.5	15	(18	U	UV	260	260
066	V979	Tau	03 49 21	+23 28.5	15.9	(18	U	UV	260	260
067	V980	Tau	03 49 29	+24 42.7	15.0	17.5	U	UV	260	260
068	V981	Tau	03 49 42	+22 18.6	15.2	17.8	U	UV	260	260
069	V982	Tau	03 51 35	+23 10.5	15.3	(18	U	UV	260	260
070	τ^{9}	Eri	03 51 35	-24 45.6	4.63	(0.03)	V	SXARI:	140	CoD
071	V983	Tau	03 54 03	+24 13.2	14.1	(18	U	UV	260	260
072	AG	Dor	04 06 12	-52 42.0	8.66	8.83	V	RS	011	CPD
073	V984	Tau	04 13 35	+21 47.1	9.15	(0.04)	V	BY	265	BD
074	BR	Hyi	04 15 08	-69 39.5	10.54	10.67	V	DSCT	173	CPD
075	V985	Tau	04 15 28	+15 58.1	9.60	(0.02)	V	BY	266	BD
076	V986	Tau	04 17 18	+19 06.9	7.47	(0.05)	V	BY	266	BD
077	EM	Eri	04 18 17	-07 42.6	5.84	(0.06)	V	*	140	BD
078	V987	Tau	04 18 53	+28 11.1	8.98	9.10	V	INT	268	BD
079	RR	Cae	04 19 36	-48 46.1	14.88	(3.3)	B	EA/WD	047	048
080	V988	Tau	04 20 27	+19 32.6	9.40	(0.05)	V	BY	266	BD
081	V989	Tau	04 20 35	+15 38.7	10.49	(0.03)	V	BY	266	BD
082	V990	Tau	04 21 23	+17 53.5	9.99	(0.03)	V	BY	266	BD
083	TU	Ret	04 21 35	-66 47.5	13.4	14.8	P	RRAB	133	131
084	V991	Tau	04 22 08	+16 52.1	10.30	(0.04)	V	BY	266	BD
085	BS	Hyi	04 22 51	-70 44.9	15.6	16.4	P	RRAB	133	131
086	V992	Tau	04 23 15	+15 24.7	7.49	(0.03)	V	BY:	266	BD
087	V993	Tau	04 24 45	+15 28.7	7.42	(0.02)	V	BY	266	BD
088	V994	Tau	04 25 59	+16 10.6	10.71	(0.04)	V	BY	266	308
089	V995	Tau	04 26 39	+16 08.0	10.32	(0.04)	V	BY	266	BD
090	V996	Tau	04 29 58	+15 54.1	8.94	(0.05)	V	BY	266	BD
091	V997	Tau	04 30 08	+15 42.9	8.66	(0.04)	V	BY	266	BD
092	V998	Tau	04 34 41	+15 02.8	7.54	(0.03)	V	BY	266	BD
093	V999	Tau	04 39 02	+25 17.3	15.1	17.2	B	UVN	272	273
094	V1000	Tau	04 39 03	+25 17.4	16.1	(2.3)	B	INT	272	273
095	AB	Men	04 42 46	-70 04.1	13.3	14.2	P	EA/SD	133	131
096	V1001	Tau	04 44 06	+16 57.3	13.0	14.6	V	INT	277	275
097	TV	Pic	04 47 32	-47 13.2	7.5	(0.12)	V	ELL	228	CoD
098	V1192	Ori	04 57 31	+03 12.8	7.50	7.57	V	RS	011	BD
099	V390	Aur	05 11 31	+47 06.9	7.0	(0.07)	V	BY	044	BD
100	UU	Lep	05 12 29	-26 15.8	6.91	7.02	V	RS	011	CoD
101	V1193	Ori	05 13 53	-00 15.5	13.95	14.28	V	NL	216	216
102	AC	Men	05 16 24	-70 39.8	13.8	15.1	P	RRAB	133	131

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
103	V1194	Ori	$05^h25^m38^s$	$-06^\circ55'.9$	13.9	19.3	B	UV	217
104	V1195	Ori	05 28 34	-04 35.8	15.0	(19.0	U	UV	217
105	V1196	Ori	05 29 17	-04 18.5	12.6	13.76	U	UV	217 218
106	AH	Dor	05 29 36	-66 57.7	14.7	16.9	P	SRC:	130 131
107	TW	Pic	05 34 02	-58 03.6	14.1	15.6	B	NL	096 096
108	TX	Pic	05 34 41	-47 20.6	6.08	6.12	V	RS	011 CoD
109	BY	Cam	05 38 16	+60 50.1	15.16	(17.0	B	XM	049 049
110	V1197	Ori	05 40 37	-01 38.1	6.30	(0.03)	V	ELL	154 BD
111	TX	Col	05 41 44	-41 03.2	14.5	15.8	B	XPM	096 096
112	AI	Dor	05 42 30	-66 37.4	14.7	15.3	P	RRAB	133 131
113	V391	Aur	05 56 04	+35 07.9	11.5	13.0	V	SRA	010
114	AD	Men	06 05 12	-71 24.9	15.0	16.6	P	UGSS	133 131
115	TY	Pic	06 06 57	-54 25.8	7.61	7.68	V	RS	011 CPD
116	V392	Aur	06 11 12	+28 08.8	12.4	13.8	V	SRB:	010
117	V682	Mon	06 25 43	-04 52.0	7.65	7.73	U	ACV	056 BD
118	AE	Men	06 26 33	-72 00.9	8.24	8.33	V	RS	011 CPD
119	OV	Gem	06 28 48	+17 07.1	9.0	10.9	B	EA/GS:	150 149
120	V683	Mon	06 29 46	-07 16.1	8.21	(0.40)	V	E	194 BD
121	TZ	Pic	06 30 22	-58 58.1	7.59	7.66	V	RS	011 CPD
122	V684	Mon	06 37 53	+09 50.1	8.44	(0.10)	V	EA/DM	195 196
123	V415	Car	06 48 46	-53 33.8	4.39	(0.06)	V	EA/GS	051 CPD
124	V685	Mon	07 18 22	-07 42.5	10.2	11.5	V	SRB:	010
125	V686	Mon	07 23 13	-03 00.4	11.5	(21	P	M	197 198
126	V343	Pup	07 30 40	-46 50.1	8.8	(0.04)	V	SXARI	233 CoD
127	BD	Lyn	07 31 29	+51 38.4	9.86	10.40	V	LB:	186 BD
128	V344	Pup	07 34 41	-44 50.7	6.88	6.99	V	RS	011 CoD
129	V416	Car	07 56 56	-60 38.9	10.57	10.64	V	DSCTC:	052 053
130	V417	Car	07 57 25	-60 30.7	10.70	(0.02)	B	DSCTC:	052 053
131	V418	Car	07 57 30	-60 41.3	11.29	(0.03)	B	DSCTC:	052 053
132	V419	Car	07 57 41	-60 29.4	10.87	(0.02)	B	DSCTC:	052 053
133	V420	Car	07 57 44	-60 41.3	10.53	10.56	V	DSCTC:	052 053
134	V421	Car	07 58 02	-60 31.9	10.73	10.82	V	DSCTC:	052 053
135	V422	Car	07 58 31	-60 40.7	9.08	9.13	V	ACV	056 053
136	KV	Vel	08 07 14	-49 21.0	7.84	7.98	U	ACV	056 CoD
137	LU	Hya	08 22 47	-07 00.4	7.34	7.39	V	RS	011 BD
138	VX	Pyx	08 31 01	-34 27.8	6.32	6.42	V	RS	011 CoD
139	EI	UMa	08 34 48	+48 48.6	13.4	14.9	P	NL	284 043
140	ϵ	Hya	08 44 08	+06 36.2	3.35	3.39	V	BY:	171 BD
141	KX	Vel	08 48 52	-46 20.5	4.87	(0.08"b")	B	E	287 CoD
142	KY	Vel	08 55 35	-52 03.9	10	(0.04)	V	ACV	233 CoD
143	BE	Lyn	09 14 58	+46 21.8	8.60	9.00	V	DSCT	188 BD
144	BF	Lyn	09 19 17	+40 25.2	7.72	(0.1)	V	BY	190 BD
145	SU	LMi	09 31 10	+36 37.2	4.54	(0.02)	V	RS:	181 BD
146	SV	LMi	09 32 40	+36 02.2	5.39	(0.04)	V	RS:	181 BD
147	KZ	Vel	09 51 24	-54 47.0	8.64	(0.07)	V	SRD	288 CPD
148	V423	Car	09 53 27	-57 08.7	6.9	(0.02)	B	ACV	057 CPD
149	SW	LMi	09 54 53	+34 14.0	16.8	(0.3)	B	ZZB	182 183
150	V424	Car	10 01 03	-59 43.3	9.58	9.66	U	ACV	056 058
151	β	Sex	10 27 44	-00 22.8	5.00	5.10	V	ACV:	140 BD
152	V425	Car	10 38 00	-58 17.6	8.61	11.48	J	M	060
153	V426	Car	10 45 58	-58 52.8	10.40	10.60	V	PVTEL	062 063
154	EK	UMa	10 48 34	+54 20.5	18	(19.5	V	XM	285 285

No.	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
155	AH Ant	$10^h50^m54^s$	$-32^\circ43'.4$	8.40	8.56	V	RS	011 CoD
156	V427 Car	10 51 04	-59 14.4	8.9	(0.015)	V	SXARI:	064 CPD
157	V428 Car	10 51 44	-59 14.7	10.7	(0.05)	V	E:/WR	064 CPD
158	SX LMi	10 51 45	+30 22.5	17	(0.35)	V	NL	184 204
159	EL UMa	10 52 19	+37 15.8	14	19	P	UG:	286 306
160	LL Vel	11 01 31	-51 05.0	6.71	6.76	V	ELL:	289 CoD
161	DT Leo	11 15 46	+15 50.0	16.1	(0.1)	B	ZZB	179 046
162	TT Crt	11 32 15	-11 28.9	12.5	15.3	V	UG	099 099
163	V843 Cen	11 33 35	-61 19.6	8.59	(0.12)	B	BE	073 074
164	V844 Cen	11 33 45	-61 18.2	10.1	(0.03)	B	BE:	073 074
165	V845 Cen	11 33 48	-61 22.1	10.0	(0.07)	B	BE	073 074
166	V846 Cen	11 33 50	-61 21.1	9.27	(0.04)	B	BE	073 074
167	V847 Cen	11 33 54	-61 21.0	9.7	(0.01)	B	BCEP:	073 074
168	V848 Cen	11 34 02	-61 19.9	10.4	(0.06)	B	BE	073 074
169	V849 Cen	11 34 11	-61 17.8	8.6	(0.06)	B	BE:	073 074
170	GT Mus	11 37 10	-65 07.2	5.08	5.21	V	E:/RS	011 201
171	LV Hya	11 54 31	-33 02.2	6.20	(0.03)	V	ACV:	140 CoD
172	CD Cru	12 40 53	-62 48.8	10.71	(0.11)	V	E:/WR	064 100
173	HV Vir	12 41 45	-08 24.1	10.5	(0.90)	V	EA/D	291 BD
174	CE Cru	12 41 53	-62 41.8	9.4	(0.03)	V	SXARI:	064 CPD
175	LV Hya	12 50 53	-22 36.1	9.56	9.63	V	R:	169 166
176	V850 Cen	12 58 12	-61 20.0	13.40	13.89	V	XP	075 076
177	HX Vir	13 29 21	-18 28.3	6.01	(0.02)	V	DSCTC	292 BD
178	V851 Cen	13 40 35	-61 06.9	7.78	7.88	V	RS	078 CPD
179	EK UMa	13 51 12	+48 55.1	16.4	(0.16)	B	ZZB	179 046
180	BV Cir	13 54 28	-64 29.4	16.9	(17.5	V	XN	095
181	V852 Cen	14 08 33	-51 12.3	6.7	(0.4)	K	M:	079 081
182	V853 Cen	14 26 25	-55 54.5	6.97	(0.02)	V	DSCTC	084 CPD
183	V854 Cen	14 31 42	-39 20.2	7.13	14.1	V	RCB:	086 087
184	CV Boo	14 56 07	+10 20.3	15.9	(0.10:)	B	ZZB	045 046
185	HK Lib	15 15 18	-22 33.8	15.0	16.1	B	RRAB	185 185
186	LS TrA	15 23 30	-62 50.8	7.30	7.53	V	RS	011 CPD
187	δ CrB	15 47 30	+26 13.2	4.57	4.69	V	RS:	098 BD
188	NN Ser	15 50 36	+13 03.6	16.6	17.2	V	NL	042 043
189	LT TrA	15 59 23	-62 33.3	10.2	(0.13)	V	VR	064 224
190	V347 Nor	16 09 56	-56 51.9	7.06	(1.0)	J	M:	079 081
191	V961 Sco	16 17 47	-25 16.5	10.17	10.25	U	ACV	056 CoD
192	V348 Nor	16 23 24	-43 41.2	7.87	7.96	V	BCEP:	037 CoD
193	V823 Her	16 49 48	+15 03.4	6.40	(0.03)	U	ACV	128 BD
194	V962 Sco	16 50 08	-41 42.6	10.01	(0.05)	B	BE	249 250
195	V963 Sco	16 50 44	-41 50.3	10.7	(0.014)	B	BCEP:	249 250
196	V964 Sco	16 50 48	-41 46.7	9.86	(0.02)	B	BCEP	249 250
197	V2212 Oph	16 51 50	-07 29.1	13.6	15.0	V	LB:	203
198	V824 Her	16 54 42	+16 01.0	16.2	(0.18)	B	ZZB	153 046
199	V2213 Oph	17 02 44	+00 46.5	6.01	(0.04)	V	BY	205 BD
200	V2214 Oph	17 08 51	-29 34.0	9.4	21	V	NB	207
201	V2215 Oph	17 13 09	-26 28.6	6.26	6.34	V	RS	011 CoD
202	V825 Her	17 17 01	+41 18.9	13.97	14.20	V	NL	042 043
203	DY Dra	17 17 06	+57 43.1	17.4	18.5	B	RR	134 134
204	V831 Ara	17 17 24	-45 56.0	7.79	7.85	V	BCEP:	037 CoD
205	V965 Sco	17 27 16	-33 37.0	8.46	8.67	V	RS	252 CoD

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
206	V2216	Oph	$17^h28^m50^s$	$-16^\circ55'.5$	16.4	(0.5)	B	XI	208 209
207	V966	Sco	17 32 01	-44 32.3	16.0	16.8	B	L	253
208	V967	Sco	17 32 02	-44 34.1	16.8	17.3	B	E	253
209	V2217	Oph	17 33 07	-23 47.5	14.8	17.1	R	SR	211 210
210	V2218	Oph	17 33 10	-24 14.8	14.7	17.5:	R	M	211 210
211	V968	Sco	17 33 11	-44 49.4	16.1	17.5	B	RRAB	253 253
212	V969	Sco	17 33 26	-44 43.0	15.7	17.1	B	RRAB	253 253
213	V2219	Oph	17 33 38	-23 35.8	14.0	(17.1	R	M	211 210
214	V2220	Oph	17 33 39	-23 47.5	]14.3	17.2:	R	M	211 210
215	V2221	Oph	17 34 01	-24 13.8	15.1	16.7	R	E:	211 210
216	V2222	Oph	17 34 31	-24 11.3	15.6	17.0	R	E:	211 212
217	V2223	Oph	17 34 57	-24 14.3	15.0	(17.1	R	M:	211 210
218	V2224	Oph	17 35 00	-23 54.4	14.6	17.0	R	M:	211 212
219	V2225	Oph	17 35 17	-24 16.5	]14.5	(17.1	R	M	211 210
220	V2226	Oph	17 35 18	-23 49.1	13.3	(16.3	R	M	211 212
221	V2227	Oph	17 35 18	-23 53.7	13.6	16.9	R	M	211 210
222	V2228	Oph	17 35 35	-23 50.6	]14.1	(18	R	M	211 210
223	V2229	Oph	17 35 39	-23 56.9	15.2	17.0	R	M	211 210
224	V2230	Oph	17 35 44	-23 45.6	15.6	(17.5	R	M:	211 212
225	V2231	Oph	17 36 07	-23 30.6	14.6:	17.5:	R	M	211 210
226	V2232	Oph	17 36 15	-24 03.7	14.2	(17.1	R	M	211 210
227	V2233	Oph	17 36 16	-24 08.6	13.5	17.1:	R	M	211 210
228	V970	Sco	17 36 25	-32 16.3	9.52	9.56	U	ACV:	056 CoD
229	DZ	Dra	17 36 45	+68 31.1	7.6	(0.03)	V	SRB:	136 BD
230	V2234	Oph	17 36 50	-23 35.6	13.0	(17.1	R	M	211 212
231	V2235	Oph	17 36 50	-23 27.1	14.5:	16.8	R	SRA	211 210
232	V971	Sco	17 36 57	-32 07.8	10.19	10.24	U	ACV	056 CoD
233	V2236	Oph	17 37 02	-24 17.7	15.5	17.0	R	SR	211 210
234	V2237	Oph	17 37 09	-24 14.6	14.8	17.0	R	SRA	211 210
235	V2238	Oph	17 37 17	-24 04.1	15.2	16.5	R	SR	211 210
236	V2239	Oph	17 37 40	-23 57.4	13.8	17.1	R	M	211 212
237	V2240	Oph	17 37 43	-23 32.5	13.3	17.5:	R	M	211 210
238	V2241	Oph	17 37 46	-24 15.7	14.1	17.1:	R	M	211 210
239	V2242	Oph	17 37 53	-23 33.4	14.3	16.4	R	SRA	211 210
240	ι	Her	17 38 03	+46 01.9	2.93	(0.02)	U	BCEP	161 BD
241	V2243	Oph	17 40 15	-18 16.8	9.61	9.76	V	BE	213 BD
242	V826	Her	17 44 19	+39 20.4	6.68	(0.028)	V	ELL	154 BD
243	V2244	Oph	17 48 51	-01 42.5	11.5	(0.09"y")	P	PVTEL	214 215
244	V4134	Sgr	17 55 22	-33 48.2	18.3	18.82	V	XI	237 238
245	V4135	Sgr	17 56 29	-32 16.2	10.4	(22	V	N	240 157
246	NO	Ser	18 01 24	-01 00.2	10.29	(0.08)	V	PVTEL:	257 BD
247	V832	Ara	18 03 12	-48 15.2	7.08	7.16	V	RS	011 CoD
248	V4136	Sgr	18 06 32	-23 26.0	11.81	12.42	V	IT:	241 242
249	V694	CrA	18 09 00	-37 45.8	7.95	(0.005 B)	V	ACVO	097 CoD
250	NP	Ser	18 13 11	-14 03.2	17.51	(0.5)	V	XB	301 302
251	V4137	Sgr	18 21 40	-24 52.7	15.0	19	B	M:	244 243
252	V827	Her	18 41 27	+15 16.3	7.5	18	V	NA	156 157
253	ο	Dra	18 50 28	+59 19.6	4.63	(0.10)	V	RS	137 BD
254	V828	Her	18 53 51	+17 55.7	6.15	(0.04)	U	ACV	128 BD
255	EE	Dra	18 59 12	+69 27.6	5.84	(0.05)	U	ACV	128 BD
256	V1402	Aql	19 01 20	-04 23.4	11.59	(0.14)	B	VR	021 BD
257	QV	Vul	19 02 32	+21 41.7	7.0	19	V	NA	294 009

No.	Name		α1950.0	δ1950.0	Max	Min		Type	References
258	V488	Lyr	19h03m38s	+30°09'.6	15.4	18.0	P	SRA:	191 191
259	V1403	Aql	19 04 48	+03 21.8	7.41	(0.08)	V	ACYG	022 BD
260	V1404	Aql	19 08 29	+04 45.7	12.25	12.39	V	SRB	023 023
261	QV	Vul	19 10 26	+24 16.3	9.94	(0.15)	V	ACV	295 BD
262	V1405	Aql	19 16 08	-05 19.7	21.00	21.66	B	XB+E:	025 304
263	V4138	Sgr	19 19 43	-20 44.3	6.57	6.85	V	RS	011 BD
264	V4139	Sgr	19 24 38	-40 56.2	8.40	8.69	V	RS	011 CoD
265	V1918	Cyg	19 24 55	+52 20.8	10.59	11.12	V	EW/KW	102 BD
266	V1919	Cyg	19 33 03	+33 41.1	6.66	6.73	V	LB	103 BD
267	QX	Vul	19 43 22	+27 43.6	15.7	(17.5	R	INS:	296 307
268	V1920	Cyg	19 43 24	+33 51.1	10.30	10.41	V	PVTEL	104 105
269	QW	Sge	19 43 36	+18 29.4	12	13	P	ZAND	033 081
270	QY	Vul	19 44 14	+28 08.9	10.43	10.53	B	E/VR	299 224
271	V1406	Aql	19 45 30	+04 07.2	14	(0.22)	U	UV	026 027
272	V1921	Cyg	19 50 06	+44 13.9	11.8	13.1	V	SRC:	106 106
273	V1407	Aql	19 54 31	-11 22.4	9.0	(13	V	M	029 030
274	V4140	Sgr	19 55 31	-39 04.1	15.5	18	P	EA+UGSU:	246 246
275	V1408	Aql	19 57 02	+11 34.2	18.68	18.98	V	XI	031 032
276	QX	Sge	19 57 25	+20 40.0	20.4	(23	V	E/PSR	236 236
277	V1409	Aql	19 59 11	+05 39	13.6	14.8	P	SR	034 033
278	V1410	Aql	19 59 35	+11 40	13.4	13.8	P	LB	034 033
279	V1411	Aql	19 59 37	+13 41	15.0	15.4	P	LB	034 033
280	QZ	Vul	20 00 43	+25 05.7	17.5	(20	B	XN	300
281	V1412	Aql	20 11 29	+06 34.1	15.67	18.3	V	E/VD	035 036
282	V1922	Cyg	20 14 53	+37 31.0	10.96	(0.03)	U	BCEP	107 108
283	AT	Cap	20 26 42	-21 17.6	8.87	9.18	V	RS	011 BD
284	V1923	Cyg	20 30 18	+40 38.3	12.3	(0.04)	V	WR	109 110
285	V1924	Cyg	20 52 00	+44 09	15.9	16.5	P	UVN	111
286	V1925	Cyg	20 52 19	+44 40.2	15.3	15.9	V	LB	112 112
287	V1926	Cyg	20 52 52	+43 47.8	16.2	(18	U	UVN	113 113
288	V1927	Cyg	20 54 57	+43 52.7	16.5	17.7	U	INT:	116 115
289	V1928	Cyg	20 55 18	+41 50	16.0	19.5	P	UVN	111
290	V1929	Cyg	20 55 48	+43 46	14.5	16.5	P	UVN	111
291	V1930	Cyg	20 58 39	+44 19.2	15.5	(18.5	U	UVN	113 113
292	V1931	Cyg	20 59 26	+45 57.5	5.33	5.48	V	E+BE	117 BD
293	BM	Mic	21 11 31	-30 57.9	8.23	8.45	V	RS	011 CoD
294	BN	Mic	21 11 52	-31 23.5	7.68	7.94	V	RS	011 CoD
295	V1932	Cyg	21 14 43	+36 06.8	14.7	15.7	B	EA/SD	118 118
296	AU	Cap	21 18 44	-15 22.1	7.98	8.02	V	RS	011 BD
297	V1933	Cyg	21 22 47	+40 31.0	15.0	(18	B	M	119 119
298	V1934	Cyg	21 23 10	+49 06.4	6.51	(0.02)	U	ACV	120 BD
299	V1935	Cyg	21 23 36	+38 00.9	13.2	14.1	P	INS	121 121
300	KP	Peg	21 24 17	+13 28.2	7.05	7.26	V	EB/KE	220 BD
301	V1936	Cyg	21 24 46	+38 29.6	14.0	(16.0	P	EA:	121 121
302	BH	Ind	21 24 51	-53 02.3	9.44	9.89	V	RS	011 CPD
303	V1937	Cyg	21 28 04	+39 00.1	14.7	(16.0	P	INS:	121 121
304	V1938	Cyg	21 28 28	+39 12.0	13.8	15.2	P	INS	121 121
305	V1939	Cyg	21 29 19	+37 03.5	13.2	14.6	P	L:	121 121
306	V365	Cep	21 29 23	+61 20.2	11.8	13.4	V	SRA	010
307	V366	Cep	21 40 56	+57 06.5	15.0	18.0	V	M:	088 088
308	V1940	Cyg	21 43 38	+40 03.8	14.8	18.0	B	M	122 122
309	V1941	Cyg	21 53 54	+42 48.1	13.3	13.8	P	E:	127 127

No.	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
310	V1942	Cyg	22^h00^m55	+44°24.5	5.47	(0.05)	U	ACV	128 BD
311	V368	Lac	22 11 30	+44 42.3	15.1	(16.2	P	EA/SD	127 127
312	V369	Lac	22 13 15	+43 50	14.3	15.8	P	EA/SD	177 176
313	HL	Aqr	22 17 54	+01 45.8	13.35	13.58	B	NL	012 013
314	V370	Lac	22 18 36	+49 08.0	13.8	14.9	P	LB:	127 127
315	CD	Gru	22 23 09	-45 29.5	2.48	2.86	K	M:	152
316	V371	Lac	22 28 42	+47 03.5	15.1	16.4	P	EA/SD	127 127
317	HM	Aqr	22 32 46	-17 31.0	9.31	(0.62)	U	ACYG:	015 BD
318	V372	Lac	22 33 54	+42 14.4	12.5	13.5	P	SRB:	127 127
319	HN	Aqr	22 34 54	-18 56	11.42	11.47	V	BCEP	016
320	V373	Lac	22 40 00	+48 49.7	14.0	14.4	P	LB:	127 127
321	KQ	Peg	22 40 01	+19 16.6	15.70	16.28	V	NL	042 043
322	V374	Lac	22 42 00	+43 29.7	15.4	16.6	P	L	127 127
323	TZ	PsA	22 57 42	-34 00.7	8.40	8.49	V	RS	011 CoD
324	V665	Cas	22 59 03	+58 36.6	23.5		B	XP	071 072
325	KR	Peg	23 03 51	+24 15.8	15.5	(0.06)	V	ZZA	221 046
326	V367	Cep	23 06 54	+62 32.7	8.24	8.91	B	L	089 BD
327	PR	And	23 13 05	+50 02.5	10.4	11.3	V	SRB:	010
328	V368	Cep	23 17 50	+78 43.7	7.7	(0.04 B)	V	RS	090 305
329	KS	Peg	23 35 25	+18 07.4	5.37	(0.12)	B	EB/KE	222 BD
330	KT	Peg	23 36 59	+27 58.0	7.04	(0.03)	V	RS	154 BD
331	HO	Aqr	23 44 01	-10 39.7	13.6	14.5	P	EA/SD	018 019
332	HP	Aqr	23 45 49	-14 25.7	13.0	14.7	P	RRAB	018

Table 2

OV And=003=BD+40°60(9.5)=
=BV 178 [001]=NSV 00134.
OW And=014=455.1934 [004]=NSV 00611.
OX And=017=S 10909 [005].
OY And=019=457.1934 [004]=NSV 00679.
OZ And=023=S 9515 [006]=NSV 00722.
PP And=026=458.1934 [004]=
=NSV 00737.
PQ And=033=Var in Andromeda [007,
McAdam]=TAV 0226+39 [008]=
=N And 1988.
PR And=327=S 727 [010].
AH Ant=155=CoD-32°7720(8.0)=CPD-32°
3002(8.8)=HD 94389(K2)[011].
HL Aqr=313=PHL 227 [012,013].
HM Aqr=317=BD-18°6151(8.7)=HD 213985
(B9)=HV3369[014, *Leavitt*]=NSV14231.
HN Aqr=319=PHL 346 [016].
HO Aqr=331=753.1933 [017]=КЗП 5788
[019]=NSV 14702.
HP Aqr=332=СПЗ 2858 [018, *Горанский*].

V1402 Aql=256=BD-4°4678(9.5)=
=HD 177230(Oc) [020].
V1403 Aql=259=BD+3°3902(8.1)=
=HD 178129(B2) [022].
V1404 Aql=260=C5[023]=СПЗ 2842.
V1405 Aql=262=4U 1915-05 [024].
V1406 Aql=271=BD+3°4138B[026]=
=ADS 12882B.
V1407 Aql=273=*Kuwano*'s object [028]=
=Stephenson 1175 [030].
V1408 Aql=275=4U 1957+11 [031].
V1409 Aql=277=S 8228 [033]=NSV 12697.
V1410 Aql=278=S 8232 [033]=NSV 12711.
V1411 Aql=279=S 8234 [033]=NSV 12712.
V1412 Aql=281=G24-9 [035].
V831 Ara=204=CoD-45°11411(8.1)=
=CPD-45°8479(8.0)=
=HD 156662(B5) [037,038].
V832 Ara=247=CoD-48°12280(7.0)=
=CPD-48°9658(7.8)=
=HD 165141(K0) [011].

VW Ari=024=EXO 020528+1454.8[039]=
=G035-027.
VX Ari=040=PG 0244+104 [041].
V390 Aur=099=BD+47°1117(7.0)=
=HD 33798(G5) [044].
V391 Aur=113=S 123 [010].
V392 Aur=116=S 139 [010].
CW Boo=184=PG 1456+103 [045].
RR Cae=079=LFT 349 [047]=LHS 1660.
BY Cam=109=H 0538+608 [049].
AT Cap=283=BD-21°5735(8.7)=
=CPD-21°7697(8.8)=
=HD 195040(K0) [050,011].
AU Cap=296=BD-15°5958(8.0)=
=HD 203251(K0) [011].
V415 Car=123=HR 2554 [051]=
=CoD-53°1613(4.3)=
=CPD-53°1168(6.3).
V416 Car=129=CoD-60°1950(10)=
=CPD-60°965(9.6)=
=Cox 42(NGC 2516) [052].
V417 Car=130=CoD-60°1968(10½)=
=CPD-60°983(9.6)=
=Cox 59(NGC 2516) [052].
V418 Car=131=CoD-60°1972(10)=
=CPD-60°987(9.7)=
=Cox 55(NGC 2516) [052].
V419 Car=132=CoD-60°1977(10)=
=CPD-60°992(9.6)=
=Cox 60(NGC 2516) [052].
V420 Car=133=CoD-60°1982(10)=
=CPD-60°997(9.6)=
=Cox 54(NGC 2516) [052].
V421 Car=134=CoD-60°1991(9.3)=
=CPD-60°1007(9.6)=
=Cox 51(NGC2516) [052].
V422 Car=135=CoD-60°2002(9.6)=
=CPD-60°1015(7.8)=
=HD 66295(A0)=
=Cox 26(NGC 2516) [054,055].
V423 Car=148=CoD-56°3030(6.9)=
=CPD-56°2646(6.9)=
=HD 86199(B9) [057].
V424 Car=150=CoD-59°2796(9.1)=
=CPD-59°1731(9.2)=
=HD 304842(B8)=
=NGC 3114-234 [056]=
=Lyngå 61(NGC 3114) [058].
V425 Car=152=OH/IR286.50+0.06[059,060].
V426 Car=153=CPD-58°2721(9.8) [061]=
=LSS 1922 [063].
V427 Car=156=CoD-58°3620(9.0)=
=CPD-58°2826(8.7)=
=HD 94465(B8) [064].
V428 Car=157=CPD-58°2845(9.8)=
=HD 94546(Oa) [064].
V658 Cas=001=LD 74 [065].
V659 Cas=002=LD 81 [065].
V660 Cas=005=LD 84 [065].
V661 Cas=006=S 10 [010].
V662 Cas=011=2S 0114+650 [066].
V663 Cas=037=BD+70°199(8.0)=HD 16439
(A0)=SAO 004710 [068].
V664 Cas=042=the nucleus of the plane-
tary nebula HFG 1 [069, *Bond, Grauer*]=136+5°1 [070].
V665 Cas=324=1E2259+586[071]; take notice
that in fact the variable is the
star D which is 2".2 south and
3".3 east of the star A in [072].
V843 Cen=163=CPD-60°3102(8.2)=
=HDE 306794(B)=
=Ahmed 1(NGC 3766) [073].
V844 Cen=164=CPD-60°3116(9.0)=
=Ahmed 7(NGC 3766) [073].
V845 Cen=165=CPD-60°3122(8.8)=
=Ahmed 88=(NGC 3766) [073].
V846 Cen=166=CPD-60°3126(8.5)=
=Ahmed 63(NGC 3766) [073].
V847 Cen=167=CPD-60°3133(8.9)=
=Ahmed 67(NGC 3766) [073].
V848 Cen=168=CPD-60°3149(9.4)=
=Ahmed 36(NGC 3766) [073].
V849 Cen=169=CoD-60°3633(9.0)=CPD-60°
=3157(8.4)=HDE 306791(B)=
=Ahmed 15(NGC 3766) [073].
V850 Cen=176=4U 1258-61 [075]=GX 304-1.
V851 Cen=178=CoD-60°4859(8.5)=
=CPD-60°4913(9.0)=
=HD 119285(K0) [077,011].
V852 Cen=181=He 2-104 [079,080].
V853 Cen=182=CoD-55°5689(7.3)=
=CPD-55°6025(7.6)=
=HD 126859(A5) [082,083].
V854 Cen=183=BV 520 [085]=NSV 06708.
V365 Cep=306=S 687 [010].
V366 Cep=307=New red var [088].
V367 Cep=326=BD+62°2173(7.0) [089]=
=HD 218673(K2)=CH3 2857.
V368 Cep=328=BD+78°826(7.7)=HD 220140
(G5)[090]=H 2311+77[305].
BL Cet=013=L 726-8A [091,092]=
=G 272-61A=NSV 00577.
BW Cir=180=X-ray Nova Ginga [094]=
=N Cir 1987.
TX Col=111=1H 0542-407 [096].
V694 CrA=249=CoD-37°12303(7.7)=CPD-37°
=7956(7.8)=HD 166473(A5) [097].

δ CrB=187=10 CrB=HR 5889 [098]=BD +26°2737(4.5)=HD 141714(G5).
TT Crt=162=FSV 113211 [099].
CD Cru=172=HDE 311884(O)= =3(Hogg 15) [100].
CE Cru=174=CoD-62°673(9.5)= =CPD-62°2914(8.8)= =HD 110736(B8) [064].
V1918 Cyg=265=BD+52°2426(9.5)=BV 313 [101]=NSV 12040.
V1919 Cyg=266=BD+33°3507(7.5)=IRC+30376= =HD 184827(Ma) [103].
V1920 Cyg=268=HD 225642(B)= =LSII+33°5 [104,*Landolt*].
V1921 Cyg=272=New red var in Cyg [106].
V1922 Cyg=282=7(IC 4996) [107].
V1923 Cyg=284=WR 145 [109]=СПЗ 2843.
V1924 Cyg=285=A2 [111].
V1925 Cyg=286=CSS 1250 [112]=СПЗ 2845.
V1926 Cyg=287=Z.B.46[113].This star is not identical with B 46[114] which is V1700 Cyg.
V1927 Cyg=288=LkH$_\alpha$ 184 [115]=2 [116]= =B 47 [114].
V1928 Cyg=289=A4 [111].
V1929 Cyg=290=A5 [111].
V1930 Cyg=291=Z.B.45 [113].This star is not identical with B 45[114].
V1931 Cyg=292=60 Cyg [117]=HR 8053= =BD+45°3364(5.7)=HD200310(B3)= =ADS 14549A.
V1932 Cyg=295=СПЗ 2830 [118,*Шугаров*].
V1933 Cyg=297=СПЗ 2828 [119,*Горанский*].
V1934 Cyg=298=HR 8206[128]=BD+48°3376 (6.5)=HD204131(A0)[120]=ADS14962A.
V1935 Cyg=299=4(V48) [121]=СПЗ 2849.
V1936 Cyg=301=3(V47) [121]=СПЗ 2850.
V1937 Cyg=303=2(V46) [121]=СПЗ 2851.
V1938 Cyg=304=1(V45) [121]=СПЗ 2852.
V1939 Cyg=305=5(V49) [121]=СПЗ 2853.
V1940 Cyg=308=СПЗ 2283[122,*Шугаров*];the identification of СПЗ 2283 with HY Peg [123] is wrong, HY Peg= =СПЗ 2829 [124], see [125].
V1941 Cyg=309=S 10902 [126].
V1942 Cyg=310=HR 8407 [128]=BD+43° 4119(6.0)=HD 209515(A0)= =ADS 15578.
AG Dor=072=CoD-52°858(8.2)=CPD-52° 497(8.4)=HD 26354(K0)[011].
AH Dor=106=HV 2586 [129];the identification with HV 2578 [130] is wrong.
AI Dor=112=HV 12643 [132].
DY Dra=203=A newly discovered distant RR Lyrae variable [134].
DZ Dra=229=BD+68°945(7.7) [135,136]= =HD 160832(K5)=IRC+70141= =NSV 09415.
EE Dra=255=HR 7224 [128]= =BD+69°1018(6.3)=HD 177410(B9).
ο Dra=253=ο Dra[137]=47 Dra=HR 7125= =BD+59°1925(4.3)=HD 175306(K0)= =ADS 11779A.
EL Eri=044=BD-5°592(7.8)= =HD 19754(K0) [138,011].
EM Eri=077=HR 1363=BD-7°798(6.3)= =HD 27563(B8) [139].
τ⁹ Eri=070=33 Eri=HR 1213=CoD-24° 1945(4.4)=CPD-24°483(4.3)= =HD 24587(B5) [141].
UV For=016=CoD-24°751(8.0)= =CPD-24°201(8.4)= =HD 10909(K0) [138,011].
UW For=034=CoD-35°886(10)=HV 8019 [142]=BV 988 [143]=NSV 00863.
UX For=038=CoD-38°899(8.0)=CPD-38° 218(8.2)=HD17084(G5)[011].
UY For=039=CoD-25°1083(8.0)= =CPD-25°314(8.4)= =HD 17144(K0) [138,011].
UZ For=046=EXO 033319-2554.2 [145, *Beuermann,Thomas*].
OW Gem=119=BD+17°1281(8.0) [148]= =HDE 258878(F2)=NSV 03005[149].
CD Gru=315=IRAS 22231-4529[151,152].
V823 Her=193=49 Her=HR 6268 [128]=BD +15°3066(6.1)=HD 152308(A0p).
V824 Her=198=PG 1654+160 [153].
V825 Her=202=PG 1717+413 [042].
V826 Her=242=HR 6626 [154,*Hall,Kirkpatrick,Seufert*]=BD+39°3219(6.0)= =HD 161832(K0)=ADS 10782.
V827 Her=252=N Her 1987 [155,*Sugano, Honda*].
V828 Her=254=HR 7147[128]=BD+17°3778 (7.0)=HD 175744(B9).
ι Her=240=ι Her[158,159,160]=85 Her= =HR 6588=BD+46°2349(4.0)= =IRC+70141=HD 160762(B3)= =КЗП 101670=NSV 09501.
WW Hor=035=EXO 023432-5232.3 [162].
LU Hya=137=BD-6°2585(8.0)= =HD 71071(G5)[138,011].
LV Hya=171=HR 4571=CoD-32°8413(6.4)= =CPD-32°3174(6.6)=HD 103789 (A0)[165].

LV Hya=175=BD-22°3467(9.0)[166,167]=
=CoD-22°9659(9.2)=
=CPD-22°5522(9.2)=
=Abell 35(central star) [168]=
=PK 303+40°1.

ε Hya=140=ε Hya [171]=11 Hya=
=HR 3482=BD+6°2036(3.5)=
=IRC+10193=HD 74874(F8) [170]=
=ADS 6993=NSV 04244.

BQ Hyi=028=CoD-72°107(8.7)=
=CPD-72°166(8.1)=
=HD 14643(G5) [050].

BR Hyi=074=CoD-69°209(10.0)=
=CPD-69°255(9.4)=HD 27503(A)=
=LB 3345 [172].

BS Hyi=085=HV 8033 [174]=BV 1026
[175]=КЗП 413=NSV 01601.

BH Ind=302=CoD-53°8860(8.6)=
=CPD-53°10073(9.2)=
=HD 204128(G5) [011].

V368 Lac=311=S 10903 [126].

V369 Lac=312=S 10901 [176].

V370 Lac=314=S 10904 [126].

V371 Lac=316=S 10905 [126].

V372 Lac=318=S 10906 [126].

V373 Lac=320=S 10907 [126].

V374 Lac=322=S 10908 [126].

DT Leo=161=PG 1115+158 [178].

SU LMi=145=10 LMi [180]=HR 3800=
=BD+37°2004(4.8)=
=IRC+40208=HD 82635(G5).

SV LMi=146=11 LMi [180]=HR 3815=
=BD+36°1979(5.5)=HD 82885(K0).

SW LMi=149=CBS 114 [182].

SX LMi=158=CBS 31 [184].

UU Lep=100=CoD-26°2085(7.0)=
=CPD-26°749(8.0)=
=HD 34198(K0) [138,011].

HK Lib=185=var [185,*Шугаров*]=
=СПЗ 2839.

BD Lyn=127=BD+51°1329(9.5) [186]=
=СПЗ 2838.

BE Lyn=143=BD+46°1490(8.5) [187]=
=HD 79889(A3).

BF Lyn=144=BD+40°2197(7.5)=
=HD 80715(K2) [189].

V488 Lyr=258=var [191]=СПЗ 2841.

AB Men=095=HV 12714 [132,*Boyce,
McKibben Nail*].

AC Men=102=HV 924 [129].

AD Men=114=HV 12703 [132]=
=HV 12866 [132,*Boyce,
McKibben Nail*]=XXV [192].

AE Men=118=CoD-71°342(9.4)=
=CPD-71°441(9.0)=HD 46291
(K0) [011].

BM Mic=293=CoD-31°18144(7.8)=
=CPD-31°6481(8.6)=
=HD 202077(G5) [193].

BN Mic=294=CoD-31°18145(7.7)=CPD
-31°6482(8.4)=HD 202134
(K0) [138,078,011].

V682 Mon=117=BD-4°1530(8.4)=HD 45583
(B8)[056]=NGC 2232-9.

V683 Mon=120=BD-7°1455(8.3)=
=HD 46282(B9) [189,194].

V684 Mon=122=BD+9°1332(8.5)=
=HD 47755(B9) [195]=
=Walker 74(NGC 2264).

V685 Mon=124=S 223 [010].

V686 Mon=125=McNaught's var [197,
McNaught]=TAV 0723-03.

GT Mus=170=HR 4492=CoD-64°554
(6.0)=CPD-64°1685(6.4)=
=HD 101379/80(G0/A0)=
=12G Mus [199]=BV 475 [200]=
=КЗП 101211 [201]=NSV 05283.

V347 Nor=190=He2-147[079,202]=
=PK 327-4°1.

V348 Nor=192=CoD-43°10792(8.0)=CPD-43°
7557(7.7)=HD 147985(B8)[037].

V2212 Oph=197=IRC-10350 [203].

V2213 Oph=199=HR 6349=BD+0°3629(6.3)=
=HD 154417(G0) [205].

V2214 Oph=200=var in Oph[206]=N Oph1988.

V2215 Oph=201=CoD-26°12036(6.8)=
=CPD-26°5863(8.0)=
=HD 156026(K2) [011].

V2216 Oph=206=GX9+9[208]=3U1728-16[209].

V2217 Oph=209=V5 [210]=NSV 09206.

V2218 Oph=210=V6 [210]=NSV 09207.

V2219 Oph=213=V14 [210]=NSV 09229.

V2220 Oph=214=V15 [210]=NSV 09230.

V2221 Oph=215=V18 [210]=NSV 09241.

V2222 Oph=216=V112 [212]=NSV 09259.

V2223 Oph=217=V29 [210]=NSV 09286.

V2224 Oph=218=V132 [212]=NSV 09290.

V2225 Oph=219=V35 [210]=NSV 09312.

V2226 Oph=220=V147 [212]=NSV 09314.

V2227 Oph=221=V36 [210]=NSV 09315.

V2228 Oph=222=V43 [210]=NSV 09337.

V2229 Oph=223=V46 [210]=NSV 09344.

V2230 Oph=224=V167 [212]=NSV 09351.

V2231 Oph=225=V60 [210]=NSV 09376.

V2232 Oph=226=V65 [210]=NSV 09391.

V2233 Oph=227=V66 [210]=NSV 09392.

V2234 Oph=230=V195 [212]=NSV 09419.
V2235 Oph=231=V75 [210]=NSV 09418.
V2236 Oph=233=V80 [210]=NSV 09432.
V2237 Oph=234=V82 [210]=NSV 09436.
V2238 Oph=235=V85 [210]=NSV 09443.
V2239 Oph=236=V210 [212]=NSV 09466.
V2240 Oph=237=V91 [210]=NSV 09469.
V2241 Oph=238=V92 [210]=NSV 09473.
V2242 Oph=239=V95 [210]=NSV 09484.
V2243 Oph=241=BD-18°4629(9.2)= =HD 160886(B5) [213].
V2244 Oph=243=LS IV-1°2 [214].
V1192 Ori=098=BD+3°733(8.5)= =HD 31993(K2) [138,011].
V1193 Ori=101=var [216].
V1194 Ori=103=B 31 [217]=СПЗ 2835.
V1195 Ori=104=B 33 [217]=СПЗ 2836.
V1196 Ori=105=BD-4°1157(9.5)= =HDE 294218(K0)=П 748= =B 36 [217]=СПЗ 2837.
V1197 Ori=110=HR 1970 [154, ***Hall, Kirkpatrick, Seufert***]= =BD-1°1012(7.8)= =IRC 00084=HD 38099(K2).
KP Peg=300=BD+13°4708(7.0)= =HD 204215(A2)= =ADS 14977A [219]=NSV 13708.
KQ Peg=321=PG 2240+193 [042].
KR Peg=325=PG 2203+243 [221].
KS Peg=329=75 Peg[222]=HR 8963=BD +17°4952(5.8)=HD 222133(A0).
KT Peg=330=BD+27°4588(6.8)= =HD 222317(G0) [154, ***Hall, Kirkpatrick, Hall***].
V493 Per=036=BD+56°686(9.1)= =HD 16523(Oa)[223]=WR 4[020].
V494 Per=041=S 10920 [225].
V495 Per=043=S 10921 [226].
V496 Per=045=BD+37°794(7.5)= =HD 22114(A0) [056].
V497 Per=047=BD+35°738(8.8)= =HD 22961(A) [056].
V498 Per=058=BD+35°751(9.1)= =HDE 279021(A2) [056].
V499 Per=064=BD+34°755(8.7)= =HDE 279110(B9) [056].
BE Phe=004=IRAS 00193-4033 [152].
TV Pic=097=CoD-47°1526(7.5)=CPD-47° 491(7.4)=HD30861(A0)[229, ***European Ap working group***; 227].
TW Pic=107=H 0534-581 [230].
TX Pic=108=HR 1927=CoD-47°1940(6.7)= =CPD-47°620(7.0)= =HD 37434(K0) [011].
TY Pic=115=CoD-54°1329(7.4)= =CPD-54°973(8.0)= =HD 42504(K0) [011].
TZ Pic=121=CoD-58°1471(7.7)= =CPD-58°718(8.1)= =HD 46697(K2) [011].
BB Psc=012=PG 0122+200 [231,232].
TZ PsA=323=CoD-34°15853(8.3)= =CPD-34°9207(8.4)= =HD 217344(G5) [011].
V343 Pup=126=CoD-46°3219(8.8)= =CPD-46°1548(8.2)= =HD 60431(B3) [233].
V344 Pup=128=CoD-44°3573(7.1)= =CPD-44°1710(7.8)= =HD 61245(K0) [011].
VX Pyx=138=HR 3385=CoD-34°4959 (6.8)=CPD-34°2644(7.5)= =HD 72688(K0) [011].
TU Ret=083=HV 12708 [132, ***Boyce, McKibben Nail***].
QV Sge=269=S 8321 [033]=MHα80-5 [234]=AS 360[081]=NSV 12383.
QX Sge=276=PSR 1957+20 [235].
V4134 Sgr=244=X 1755-338 [237]= =star 6 (2S 1755-338).
V4135 Sgr=245=Nova Sgr 1987 [239].
V4136 Sgr=248=LkHα 127[241]=СПЗ 2840.
V4137 Sgr=251=V7(NGC 6626) [243].
V4138 Sgr=263=BD-20°5516(7.0)= =CPD-20°7550(7.7)= =HD 181809(K0)[050,138,011].
V4139 Sgr=264=CoD-41°13525(8.3)= =CPD-41°9096(8.8)= =HD 182776(K0) [078,011].
V4140 Sgr=274=S 7273 [245]=NSV 12615.
V961 Sco=191=CoD-25°11483(8.6)= =CPD-25°5784(8.4)= =HD 147105(A0) [247,056].
V962 Sco=194=CoD-41°11007(9.3)= =CPD-41°7697(9.2)= =HDE 326327(B2) [248]= =Seggewiss 28(NGC 6231).
V963 Sco=195=CPD-41°7734(10.4)= =Seggewiss 80(NGC 6231)[249].
V964 Sco=196=CPD-41°7738(9.4)= =HDE 326330(B3)= =Seggewiss 238(NGC 6231)[249].
V965 Sco=205=CoD-33°12122(8.5)= =CPD-33°4425(8.8)=HD 158393 (K0) [251]=NSV 08931.
V966 Sco=207=F4 [253].
V967 Sco=208=F3 [253].
V968 Sco=211=F2 [253].

V969 Sco=212=F1 [253].
V970 Sco=228=CoD-32°13074(9.2)=
=CPD-32°4690(8.7)=
=HDE 318107(B8) [056].
V971 Sco=232=CoD-32°13103(9.5)=CPD-32°
4717(9.2)=HDE 318100(B9)[056].
AQ Scl=007=V35 [254].
AR Scl=008=V59 [254].
AS Scl=010=CoD-27°352(7.7)=CPD
-27°90(7.8)=HD 6491(F0)[255].
NN Ser=188=PG 1550+131 [042].
NO Ser=246=BD-1°3438(9.5)[256,257].
NP Ser=250=28[303]=G star [209]=
=3U 1813-14=GX17+2.
β Sex=151=30 Sex=HR 4119=BD+0°2663
(5.3)=HD 90994(B5) [165].
V963 Tau=048=Hz 152 [258]=СПЗ 2832.
V964 Tau=049=K [260].
V965 Tau=050=N [260].
V966 Tau=051=HII 296 [261].
V967 Tau=052=Q [260].
V968 Tau=053=O [260].
V969 Tau=054=BD+24°551(9.2)=
=HD 23386(G)[189]=Hz 739[258].
V970 Tau=055=I [260].
V971 Tau=056=23 Tau=HR 1156=
=BD+23°522(4.5)=HD 23480(B5)
[263]=323 [262]=NSV 01287.
V972 Tau=057=E [260].
V973 Tau=059=P [260].
V974 Tau=060=G [260].
V975 Tau=061=H [260].
V976 Tau=062=J [260].
V977 Tau=063=B [260].
V978 Tau=065=L [260].
V979 Tau=066=D [260].
V980 Tau=067=A [260].
V981 Tau=068=C [260].
V982 Tau=069=M [260].
V983 Tau=071=F [260].
V984 Tau=073=BD+21°612(9.0)=
=HDE 284253(G5)=VB 21 [265].
V985 Tau=075=BD+15°609(9.0)=
=HDE 285690(K0)=VB 25 [266].
V986 Tau=076=BD+18°623(7.9)=
=HD 27406(F8)=VB 31 [266].
V987 Tau=078=BD+27°657(8.7) [267]=
=HDE 283572(G0) [268].
V988 Tau=080=BD+19°708(9.0)=
=HDE 284414(K0)=VB 43 [266].
V989 Tau=081=BD+15°616(9.5)=
=HDE 285749(K5)=VB 173 [266].
V990 Tau=082=BD+17°715(9.5)=
=HDE 285720(K2)=VB 174 [266].
V991 Tau=084=BD+16°593(9.4)=
=HDE 285742(K0)=VB 175 [266].
V992 Tau=086=BD+15°624(7.7)=HD 28034
(G0)=VA 384[269]=VB 59[266].
V993 Tau=087=BD+15°627(8.2)=HD 28205
(G0)=VA 446[270]=VB 65[266].
V994 Tau=088=HDE 285806(K7)=VB 190
[266]=G7-234.
V995 Tau=089=BD+15°634(9.5)=
=HDE 285805(K5)=VB 181 [266].
V996 Tau=090=BD+15°646(8.8)=HD 28783
(K0)=VA 684 [269]=VB 91[266].
V997 Tau=091=BD+15°647(8.6)=HD 28805
(G5)=VA 692 [270]=VB 92[266].
V998 Tau=092=BD+14°728(7.9)=HD 29310
(G0)=VB 102 [269].
V999 Tau=093=33 [274]=B 13 [271]=
=1-C [272]=LkH$_\alpha$ 332/G2 [273]=
=СПЗ 2833.
V1000 Tau=094=34 [274]=1-B [272]=
=LkH$_\alpha$ 332/G1 [273]=СПЗ 2834.
V1001 Tau=096=37 [275]=H-R 73 [276]=
=NSV 01715.
UX Tri=015=456.1934 [004]=
=КЗП 164 [019]=NSV 00616.
UY Tri=018=S 10910 [005].
UZ Tri=020=S 10911 [005].
VV Tri=021=S 10912 [005].
VW Tri=022=S 10913 [005].
VX Tri=025=S 10914 [005].
VY Tri=027=S 10915 [005].
VZ Tri=029=S 10917 [005].
WW Tri=030=Vr 137 [278]=NSV 00814.
WX Tri=031=S 10918 [005].
WY Tri=032=S 10919 [005].
LS TrA=186=CoD-62°937(8.4)=
=CPD-62°4482(8.6)=
=HD 137164(G5) [050].
LT TrA=189=CoD-62°1009(9.0)=
=CPD-62°5141(8.8)=
=HD 143414(Ob) [279,280]=
=VR 71 [224]=NSV 07395.
CM Tuc=009=LV 60 [281].
EI UMa=139=PG 0834+488 [042].
EK UMa=154=1E 1048.5+5421 [285].
EL UMa=159=var [286]=CBS 132.
EM UMa=179=PG 1351+489 [179].
KW Vel=136=CoD-49°3370(8.3)=
=CPD-49°1513(8.1)=HD 68074
(B9) [056]=NGC 2547-5.
KX Vel=141=HR 3527 [287]=
=CoD-46°4661(5.6)=
=CPD-46°3120(5.3)=
=HD 75821(B0).

KY Vel=142=CoD-51°3378(9.8)[233]=
=CPD-51°1770(9.2)=
=HDE 298246(B9).

KZ Vel=147=CoD-54°3103(9.0)=
=CPD-54°2820(10.0)=
=HD 85891(K0) [288].

LL Vel=160=CoD-50°5641(7.1)=
=CPD-50°3903(7.7)=
=HD 96008(A5) [289].

HW Vir=173=BD-7°3477(9.4) [290, *Lynas-Gray*].

HX Vir=177=73 Vir [292]=HR 5094=
=BD-17°3877(6.4)=HD 117661(A3).

QV Vul=257=N Vul 1987 [293].

QW Vul=261=BD+24°3675(9.3) [295]=
=HDE 343872(B8).

QX Vul=267=? [296,307].

QY Vul=270=HD 186943(Oa)[297,298,020]=
=WR 127 [224].

QZ Vul=280=X-ray Nova Vul(Candidate B) [300].

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THE VARIABILITY OF HD73819

The star HD73819 is one of the UBV standard stars in the Praesepe cluster (Johnson 1952; Henden and Kaitchuck 1982). During a recent multi-site campaign, HD73819 was one of two comparison stars used for V filter photometry of the nearby δ Scuti star HD73756. Throughout the campaign, photometry carried out with the 0.5m telescope at the Devon Astronomical Observatory showed persistent variability in the V magnitude difference between HD73819 (C2) and HD73711 (C1) that appeared to be modulated over time. Attempts to attribute this variation to either changes in sky conditions or electronics have proven unsuccessful and we are led to suggest that HD73819 is intrinsically variable.

The following four panels illustrate the variability of V(C1) minus V(C2) on the nights of February 10/11, 16/17, 18/19 and 21/22, 1989. A least-squares spline has been fitted to the data and is shown on each panel. The variation in (C1-C2) is clearly modulated and significant with respect to the scatter in the data. Typical scatter was ± 2 mmag. Subsequent period searches within the data sets (Variable - C1), (Variable - C2) and (C1-C2) suggest that the variation in the (C1-C2) signal is due entirely to variability in HD73819. The fourier transform of the entire (C1-C2) set, spanning approximately 30 hours over 7 nights, reveals multiple significant frequencies centered at approximately 5.82 cycles/day. All of this indicates that HD73819 may, in fact, be a multi-mode variable which warrants further

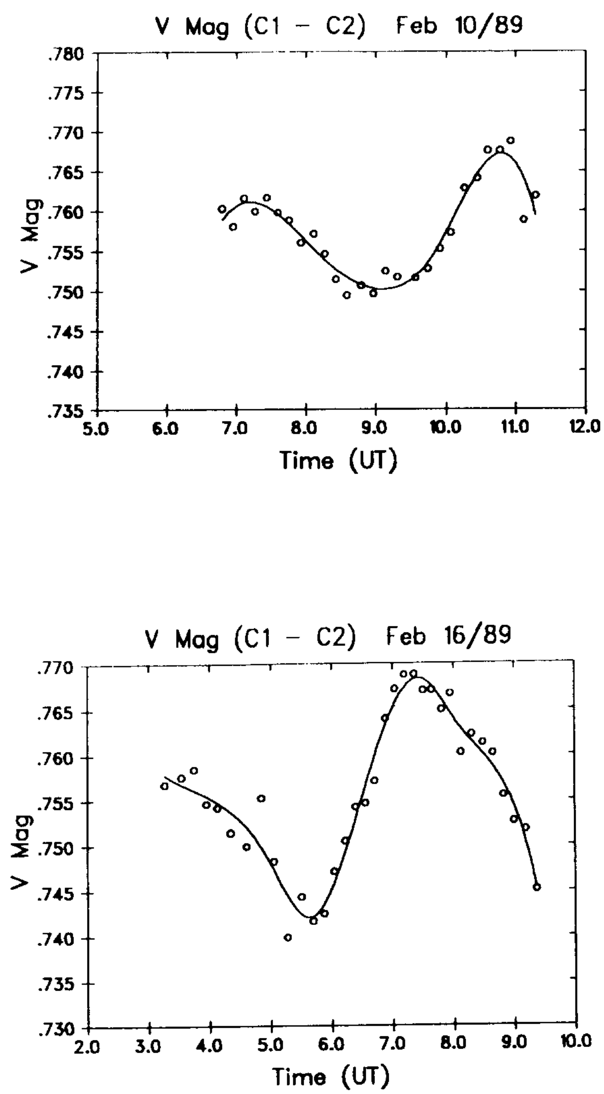
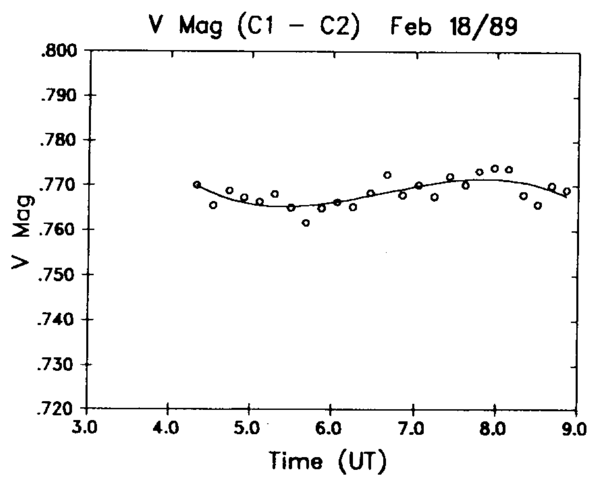

V Mag (C1 - C2) Feb 10/89
V Mag
.780
.775
.770
.765
.760
.755
.750
.745
.740
.735
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
Time (UT)
V Mag (C1 - C2) Feb 16/89
V Mag
.770
.765
.760
.755
.750
.745
.740
.735
.730
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Time (UT)

Figure 1



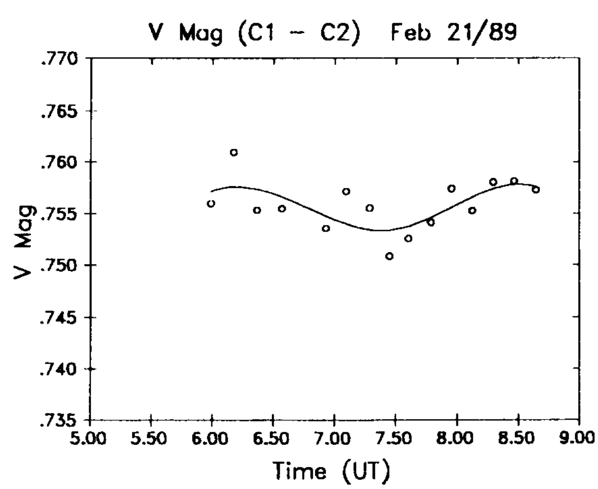


Figure 1 (cont.)

observations. A fundamental period of approximately 4.12 hours and a spectral type of A6 are suggestive of a δ Scuti variable.

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1987 LIGHT CURVES OF BX ANDROMEDAE

BX And (BD+40° 4421), a near-contact binary with the β Lyrae type light curves is the brighter companion of the visual binary ADS 1671. The system has been observed frequently, since 1950's by many authors (see Samec, Fuller and Kaitchuck (1988), and Castelaz (1979) for the references). Chou (1959) and Ahnert (1975) reported that BX And has undergone around 1950, a major period change of about 0.^{s}25. A new abrupt period change in 1981 has been reported by Gülmen et al.(1988) who also obtained the new light curves (in B and V) of the system. Having late type (F2 V) active components in near contact, the system's total light at maximum and/or minimum is expected to vary in time. To study the light curve variations, we thus included the system in our observing program.

The present observations were made on two nights in October, four nights in November, and two nights in December, 1987 using an EMI 9789QB photomultiplier attached to the 30 cm Maksutov telescope of the Ankara University Observatory. The differential observations in three colors were made with respect to the comparison star BD+39°0476. BD+39° 0484 was used as the check star. The third light (from the other component of the visual binary ADS 1671) could not be excluded in the brightness measurements of the variable star. Thus, 175 differential observations were obtained in each V, B and U filters. The observations were corrected for differential extinction and light time effects, and are shown in Figure 1. as Δm=(var.-comp.) versus phase. The light elements used in phase calculation were given by Chou (1959), as

$$\text{Hel. JD MinI} = 2436528.7777 + 0.^d61011534\ E$$

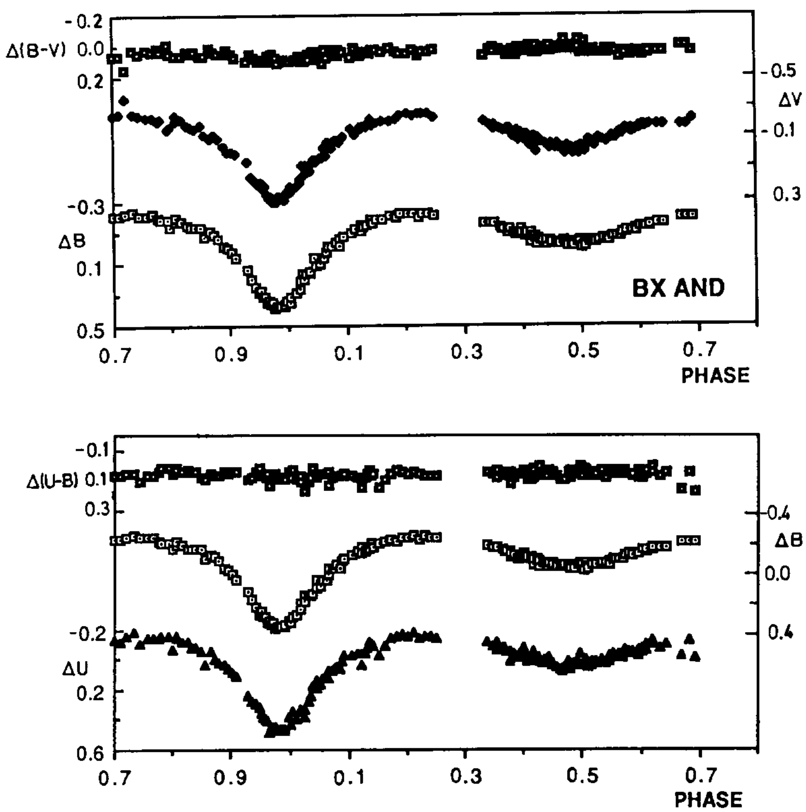

Figure 1. Light curves of BX And defined by the individual observations.

The times of two new primary and two new secondary minima (see Table.1) confirm the second abrupt decrease of 0.25 sec. in the period, which was reported by Gülmen et al. (1988). The light curve variation seems larger in the secondary minimum. The large difference between the depth of the minima and the reddening of the color curves in the primary minimum indicate considerably different temperatures for the component stars. Thus, at least one of the component stars of the system should not be completely contact with the first critical Roche lobe, and the common convective envelope (if present) around the component stars is not effective to equalize the temperatures.

Table 1. The new times of minima of BX And.

Hel.Min 244700+	No. of Obs.	Filter	Remark
093.5234 ± 0.0010	21	U	Min I
.5236 ± 0.0007	29	B	"
.5224 ± 0.0006	17	V	"
094.4408 ± 0.0023	35	U	Min II
.4409 ± 0.0010	33	B	"
.4367 ± 0.0006	34	V	"
116.4075 ± 0.0025	28	U	Min II
.4059 ± 0.0012	25	B	"
.4049 ± 0.0019	27	V	"
117.3202 ± 0.0004	16	U	Min I
.3185 ± 0.0005	16	B	"
.3191 ± 0.0007	16	V	"

We thank to M.Özçelik, for the generous help during the observations.

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PHOTOMETRIC OBSERVATIONS OF THE Be STAR ζ TAURI

The understanding of the physical behaviour of Be stars, from many points of view not yet clarified, is connected to the careful observations of single objects, during a time long enough to study quiescent and active phases. In this framework, we devoted much effort to the bright Be star ζ Tauri (HR 1910), collecting in these years a lot of spectroscopic and photometric data. Some spectroscopic conclusions, related to the period Jan 17-24, 1983, are reported in Guerrero et al.(1989); here we present the preliminary results about the photometric behaviour of this intriguing star.

ζ Tauri is a well-known binary system with $P=133^{d}.1$ (Jarad,1987), which displaied both long-term shell instabilities (Delplace and Chambon,1976) and short-term shell and photospheric variations (Guerrero et al.,1989). As regards the photospheric observations, several authors found brightness variations with amplitudes from some hundredths to about a tenth of magnitude (see, for example, Guo and Huang,1986; Harmanec et al.,1980; Alvarez and Schuster,1981). In particular, Bozic (1989) claims that the light variation time scale of ζ Tauri covers a range from several decades to few hours and that the periods for the rapid brightness variations are equal to $0^{d}.8$ and $1^{d}.6$.

We observed ζ Tauri with a digital photon-counting photometer attached to the 50cm reflector telescope of Merate Observatory, using Stromgren y and β-narrow filters. Comparison and check stars were HR 1860 and 121 Tauri respectively. The observations were obtained in the period Jan 26-Feb 15,1989: the excellent weather allowed us to collect 491 and 388 values of Δm (in the sense $m_{HR1860}-m_{\zeta Tauri}$) for y and β-narrow filters respectively.

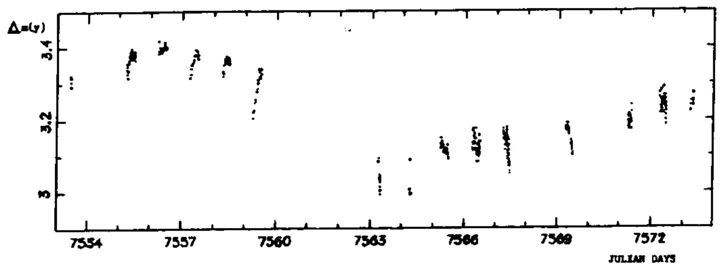

Figure 1

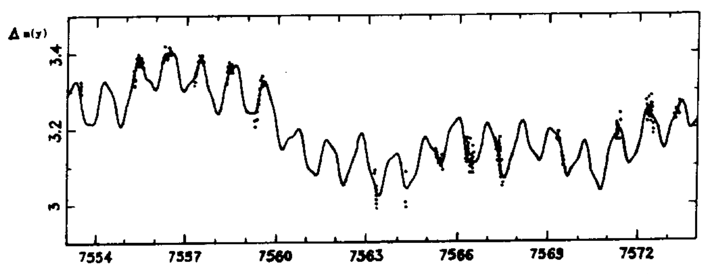

Figure 2

Figure 1 represents the Δm values in y filter versus Julian Days. As one can see right away, an oscillation with high amplitude (about $0^m.4$) and long period (several days) coexists with a shorter period and lower amplitude variation.

This lot of photometric data, besides very close in time, allowed us to perform a careful research of the possible periodicities. To this end, we used a method similar to that proposed by Vanicek (1971). The y and β -narrow data give the same

ν (c/d)	error y	error β-narrow	a (mag) y	±	a (mag) β-narrow	±	φ y	±	φ β-narrow	±
0.043 ($P=23^d.256$)	±.001	±.029	$0^m.106$	±.003	$0^m.088$	±.060	-1.96	±.02	-1.92	±.25
0.108 ($P=9^d.259$)	.001	.009	$0^m.058$	.002	$0^m.062$	.014	.22	.03	.01	.26
0.944 ($P=1^d.059$)	.001	.003	$0^m.055$	.003	$0^m.053$	.006	.90	.05	.90	.10
0.314 ($P=3^d.185$)	.002	.011	$0^m.023$	.003	$0^m.017$	.006	-.26	.11	-.18	.29
2.435 ($P=0^d.411$)	.011	.001	$0^m.0II$	.00I	$0^m.008$	.002	.61	.13	.41	.32
0.706 ($P=1^d.416$)	.010	.002	$0^m.010$	.002	$0^m.009$	.005	-1.97	.26	-1.29	.66

TABLE 1

values of the periods, except $P=1^d.416$, derived from the β-narrow data. Table 1 summarizes the found frequencies ν, with the oscillation amplitudes a and the phases φ referred to t_o=7564.7936, together with the related errors for the two filters. At last, Figure 2 represents the Δm(y) data with the synthesized light curve obtained for the six frequencies shown in Table 1.

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NEW BRIGHTENING OF CHANAL'S OBJECT IN THE ORION ASSOCIATION

The fuor-like variation in the brightness of Chanal's object (R.A.=$5^h32^m18^s$, D=$-5^o35'6''$ (1950)) was observed for the first time during 1982- 1985 (Marsden, 1983; Natsvlishvili, 1984; Parsamian and Gasparian, 1987). New brightening of Chanal's object was observed on 7 December 1988 with the 40" Schmidt telescope of the Byurakan observatory. The following magnitudes and colour indices were found:

U	B	V	U - B	B - V
15.5	16.0	14.6	-0.5	+1.4

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ON THE SPECTRUM OF BD+24° 676

Recently Weaver and Hobson (1989) reported on the presence of the Hα emission line in the spectrum in the spectrum of BD+24° 676 on Feb. 16, 1988. This line had been previously detected also on a plate of the late seventies/ early eighties by Stephenson (1986) in the course of one of his large surveys, and Weaver and Hobson concluded that the star might be a bright T Tauri object, particularly because the energy distribution in their spectra met a G to K star.

The object is present on several plates taken by W. Götz with the 7° and 3° objective prisms attached to the 50/70/172 cm Schmidt camera of Sonneberg Observatory. On two well-exposed blue sensitive 7° plates the Balmer lines Hγ to Hη are visible in absorption (Oct. 11, 1967, and Nov. 26, 1968); traces of Hδ and Hε seem also indicated on two further plates. This finding is not in crude contrast to the spectral type of F5, given in the HD extension (HDE283817), and of GO of the AGK3 catalogue (AG+24° 421), but certainly a more efficient spectral investigation is needed.

A good 7° IN plate exposed behind a Schott RG1 filter shows neither a trace of Hα in emission nor in absorption (Feb. 5, 1967). As to Hβ, no statement can be made because it lies outside or at the edge of the sensitivity range or inside the green gap of our plates. We conclude that on our plate the Hα emission just fills in the absorption line and we thus confirm the supposition of Weaver and Hobson (1989) who pointed to the fact that an Hα emission has not been discovered at this star by the Hα surveys for T Tauri stars in that sky region and that therefore the line strength must probably be considered as variable.

Although the star is situated in the merging area of several dark lanes extending from northwest to southeast, the question whether BD+24° 676 is truly related to the T Tauri class is still open, especially since its polarization behaviour is not different from the field stars of that region (Moneti et al., 1984).

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A part of this paper is based on the SIMBAD data retrieval system of the astronomical Data Center, Strasbourg, France.

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VARIABILITY OF THE RECENTLY DISCOVERED Be STAR NGC 6871-8

The star BD+35°3956 (star number 8 in NGC 6871) has recently been shown to be undergoing an emission phase by Grigsby & Morrison (1988). They reported that this B0.5 V star was highly variable in H-Alpha profile, changing from emission to absorption in approximately ten days time. Previous to their announcement, the star had not been known to undergo a Be phase. Its photometric history appears to reflect constancy (Delgado et al., 1984).

BD+35°3956 was added to the photometric monitoring program of Be stars of the Corralitos Observatory immediately upon its nature as an emission-line object having been noted. Twelve observations in BV colors were made utilizing the Corralitos 0.6-m. telescope and single channel photon-counting photometer (an EMI 9924A photomultiplier tube) and also the Kitt Peak Observatory #2 0.9-m. telescope and automated filter photometer (a 1P21 photocathode). Comparison stars used for the differential photometry included stars 1 - 9 of NGC 6871. The values of V and B-V for these stars were taken from Hoag et al. (1961) and verified using all-sky photometry at the Kitt Peak telescope. Star #1 was found to have a V magnitude brighter than that published by Hoag et al. (as well as being possibly variable?) and hence, was dropped from further analysis of Star No. 8. All the remaining magnitudes were consistent with Hoag et al.'s values with the exception of the star considered here, number 8, whose mean magnitude is now brighter than theirs and B-V color redder. There was excellent consistency in colors between the Kitt Peak and Corralitos telescopes with their being a magnitude difference of less than 0.003 in delta V and delta B-V between the values obtained at the two observatories. The magnitudes arrived at for Star No. 8 are simple means of those derived from the observed differences with all the remaining stars. The average standard errors in V for the standard stars were 0.029 and 0.025 in B-V.

Table I

JD	V	SE	B-V	SE
7303.89444	8.830	.024	+.261	.027
7312.92014	8.980	.010	.203	.013
7320.89513	8.615	.015	.217	.017
7321.86875	8.792	.017	.167	.005
7322.82916	8.403	.032	.231	.016
7412.75938	8.793	.028	.243	.023
7435.68160	8.847	.036	.202	.026
7436.63368	8.866	.010	.174	.025
7439.62569	8.846	.017	.218	.033
7441.63264	8.798	.030	.243	.028
7473.59965	8.800	.026	.235	.020
7478.57569	8.821	.025	.223	.028
MEAN	8.783	±.145	+.218	±.028

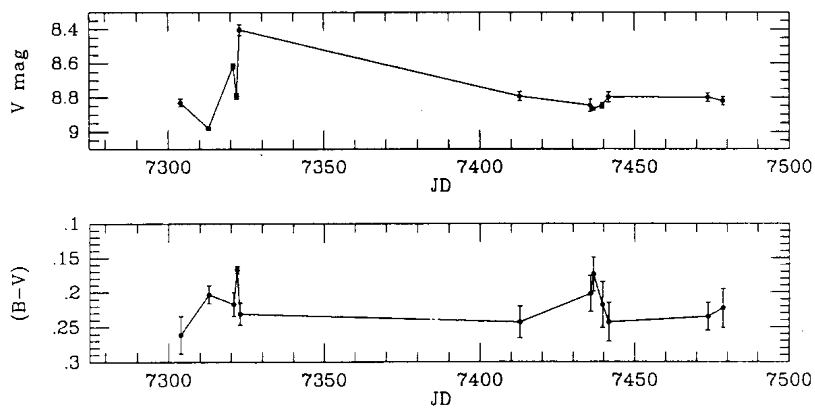

Figure 1

It soon became obvious that BD+35°3956 is highly variable in V magnitude over relatively short time periods. It was seen to undergo an overall range of variation of 0.577 magnitudes in V and 0.094 in B-V. The variation noted in B-V may not be significant. The difference in magnitudes reflected by its behavior on JD 2447312-22 reflects great activity, which became more quiescent in the second season after JD 2447412. A periodicity search of the data represented in Table I and Figure 1 over a range of periods of 0.9 - 87 days utilizing the Discrete Fourier Transform Method of Deeming (1975) revealed no likely periods. It is most likely that the photometric activity shown here is connected with shell activity rather than pulsation.

It is also of interest to note that Star No. 6 (also classified in the past as a Be star) has been constant in magnitude in the immediate past.

Further studies of the spectroscopic variations of this star would seem to be called for. It will be photometrically followed at the Corralitos Observatory in the future.

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1988-89 OBSERVATIONS OF II Peg

In 1988/9 we have pursued our observations of the RS CVn star II Peg, which were begun in 1986.

The present observations were made between November 14 and December 15 1988 (figure 1) and between January 13 and February 9 1989 using the 0.5m Mons reflector in the Instituto de Astrofísica de Canarias's Teide Observatory, with a solid-state photometer and Johnson B, V, R, I filters. From January 8 to February 10 observations were also taken with a solid-state photometer and also an uncooled 1P21 photomultiplier in the B and V bands using GEA's (Grup d'Estudis Astronòmics) 0.4m telescope in Mollet Observatory. A total of 118 points were taken, 37 in B, 43 in V, 19 in R and 19 in I. SAO 091577 (Teide Observatory) and SAO 091503 (Mollet Observatory) were used as comparisons, these having been used previously both by us and by other observers.

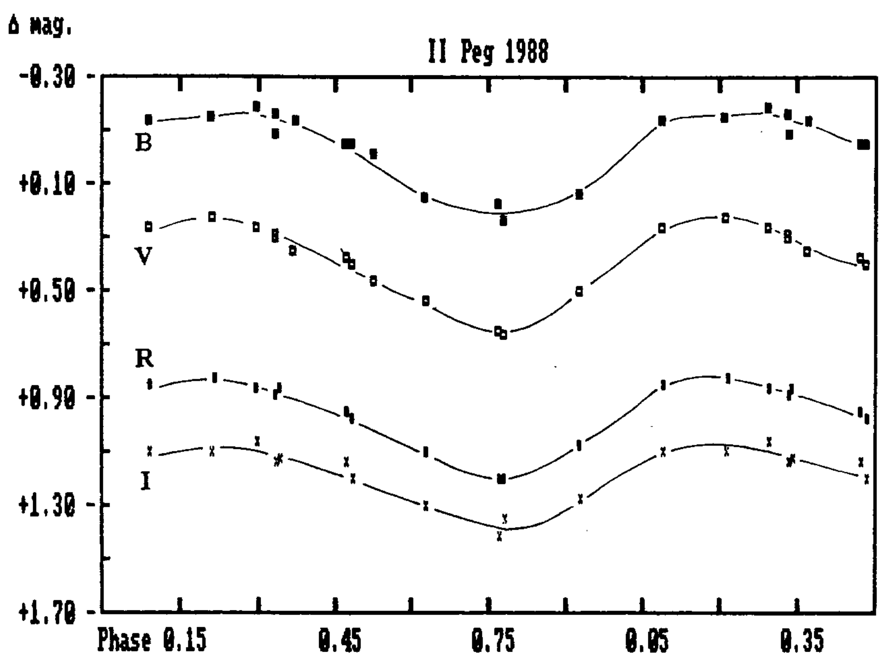

Figure 1

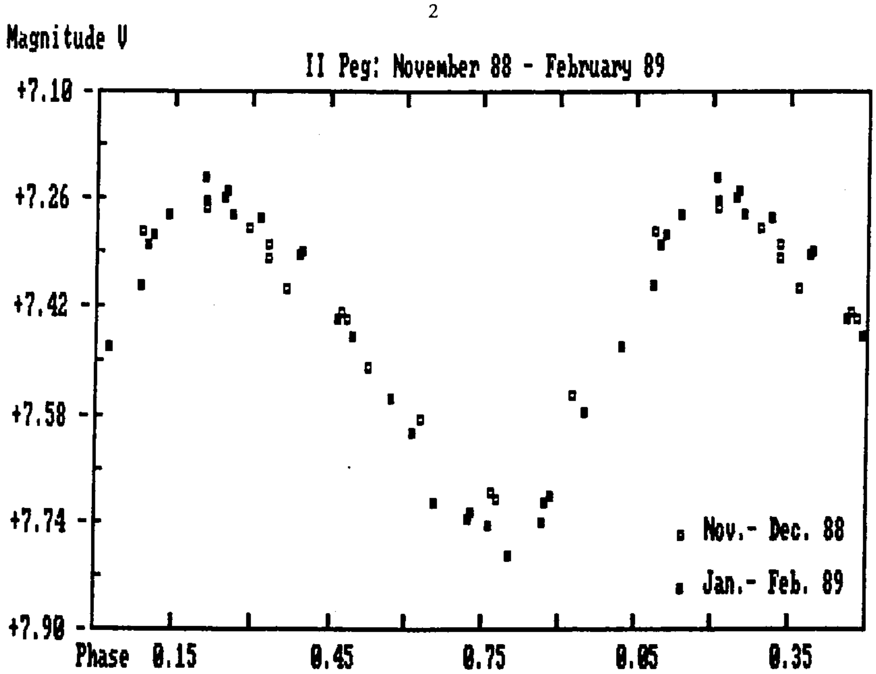

Figure 2

Unlike in 1987/8 when the amplitude of variation of the star was one of the lowest recorded in the last years, 0.15 magnitudes in V (Cano et al., 1987 and our additional unpublished data) during this period the amplitude is about 0.5 magnitudes in V and appeared to increase towards the end of the observations (see figure 2).

The orbital phases in figures 1 and 2 were calculated according to the ephemeris (Vogt, 1981):

$$HJD = 2443033.47 + 6.^{d}72422\ E$$

It must be mentioned that the maximum magnitude registered was approximately 7.25 in V, one of the highest measured since Chugainov (1976) and about 0.05-0.1 magnitudes brighter than normally accepted for the spotless stellar disc (Vogt, 1981; Poe and Eaton, 1985). The high brightness at maximum does not appear to be attributable to scaling errors, given that it was obtained independently with distinct instruments with different comparison stars.

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SEARCH FOR OPTICAL BRIGHTENINGS OF THE X-RAY TRANSIENT
EXO 0748 - 676

The transient X-ray source EXO 0748 - 676 detected by Parmar et al. (1985) was identified with a faint (≥17 mag.) but variable (Δm≥ 6 mag.) star by Wade et al. (1985). The optical object exhibits a spectrum resembling those of other low-mass binary X-ray transients and luminous cataclysmic variable stars, such as nova-like variables and dwarf novae in outbursts.

The error box of EXO 0748 - 676 was examined on 351 plates (representing roughly 350 h of monitoring time) taken at the southern stations of the Bamberg Observatory in the years 1963 - 1976. The typical limiting magnitudes on the plates are between 13 and 15 (m_B). The proposed optical candidate is invisible on all investigated plates and, similarly, no other variable optical phenomena were found. We conclude that either the brightenings of the object are infrequent or the maxima are fainter than $m_V \sim 14$.

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PHOTOMETRIC DETECTION OF ECLIPSE IN THE SPECTROSCOPIC BINARY HD 116 093

Quite recently Griffin (1988) pointed out the possibility of an eclipse in the spectroscopic binary HD 116 093. According to his prediction we carried out BV photoelectric observations of the system during the night of March 19, 1989, and successfully obtained an eclipsing light variation. These BV observations were made independently at two different places in Japan, Tamashima in Okayama Prefecture and Kakuda in Miyagi Prefecture.

Table I shows the individual instruments used. Throughout the observations BD+24°2570 ($V = 8^{m}.88$, $B-V = 0^{m}.97$, $U-B = 0^{m}.69$) was used as the comparison star, and it was occasionally checked against HD 116 234 (as a check star). Figure 1 shows the finding chart. In the photometric reduction, extinction correction and transformation to the standard BV system were made in a similar way as in our previous reports (Ohshima 1988, Ito 1988).

The individual observations obtained are listed in Table II where the magnitude differences are given in the sense $m_{var} - m_{comp}$. The Delta(B-V), Delta B and Delta V values are all plotted in Figure 2, where filled circles

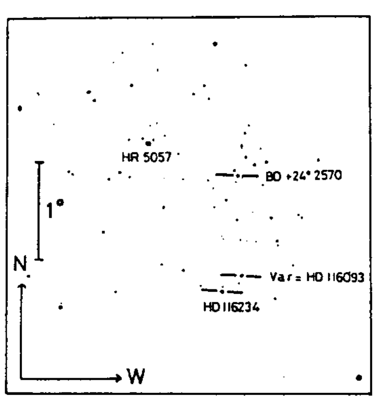

Figure 1. Finding chart of HD 116 093

	Name	R.A. (1950.0)	Dec.	Sp.
Var. star:	HD 116 093 = BD+23°2562	$13^{h}18^{m}39^{s}$	22°44!1	F3+F8
Comp. star:	SAO 82 795 = BD+24°2570	13 18 45	23 45.4	KO
Check star:	HD 116 234 = BD+23°2564	13 19 33	22 34.3	F8

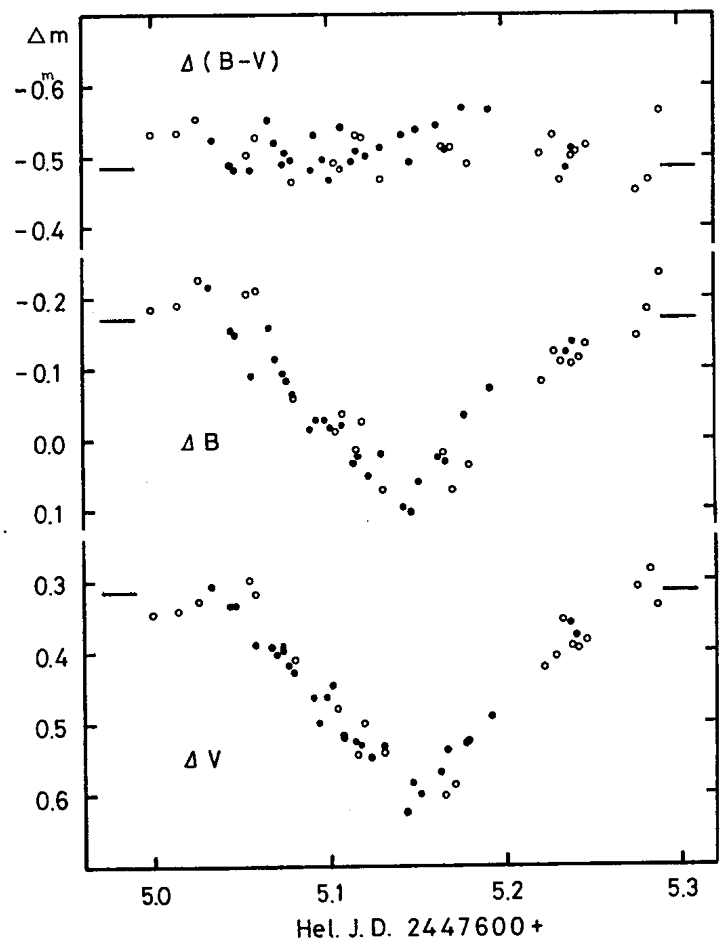

Figure 2. BV observations of the eclipse of HD 116 093 on March 19, 1989

Table I. Instrumentation

Observer:	O. Ohshima	Y. Ito
Telescope:	20-cm reflector	15-cm refractor
PMT:	R 647 - 04 (Hamamatsu)	1P21 (Hamamatsu)
Filters:	GG 495 (2-mm) for V	
	GG 385 (2-mm) + BG 12 (1-mm) for B	
Data acquisition:	Photon counter + PC	D.C. amplification + A/D converter + PC
Site:	Tamashima	Kakuda Girls Senior H.S.

Table II. Individual observations

No.	Hel. J. D. 2447600+	Delta V	Delta B	Delta(B-V)	Observer*
1	4.9986	0.347	-0.185	-0.532	I
2	5.0139	0.343	-0.191	-0.534	I
3	5.0259	0.328	-0.225	-0.553	I
4	5.0327	0.309	-0.215	-0.524	O
5	5.0429	0.336	-0.153	-0.489	O
6	5.0463	0.334	-0.148	-0.482	O
7	5.0538	0.299	-0.204	-0.503	I
8	5.0577	0.319	-0.211	-0.530	I
9	5.0595	0.273	-0.198	-0.471	O
10	5.0662	0.393	-0.158	-0.551	O
11	5.0694	0.404	-0.115	-0.520	O
12	5.0725	0.398	-0.094	-0.492	O
13	5.0759	0.419	-0.084	-0.503	O
14	5.0791	0.430	-0.064	-0.494	O
15	5.0798	0.410	-0.058	-0.463	I
16	5.0899	0.462	-0.017	-0.479	O
17	5.0931	0.500	-0.029	-0.529	O
18	5.0979	0.469	-0.029	-0.497	O
19	5.1012	0.448	-0.019	-0.467	O
20	5.1039	0.479	-0.012	-0.491	I
21	5.1076	0.517	-0.036	-0.481	I
22	5.1080	0.521	-0.022	-0.543	O
23	5.1143	0.525	0.033	-0.492	O
24	5.1160	0.546	0.016	-0.530	I
25	5.1172	0.530	0.022	-0.508	O
26	5.1198	0.499	-0.027	-0.526	I
27	5.1234	0.550	0.051	-0.499	O
28	5.1298	0.533	0.020	-0.513	O
29	5.1312	0.541	0.073	-0.468	I
30	5.1432	0.627	0.097	-0.530	O
31	5.1467	0.585	0.102	-0.483	O
32	5.1514	0.602	0.062	-0.539	O
33	5.1619	0.569	0.025	-0.544	O
34	5.1651	0.604	0.022	-0.513	I
35	5.1655	0.539	0.030	-0.509	O
36	5.1704	0.586	0.072	-0.513	I
37	5.1768	0.529	-0.038	-0.567	O
38	5.1795	0.526	0.037	-0.489	I
39	5.1917	0.491	-0.071	-0.562	O
40	5.2216	0.421	-0.082	-0.503	I
41	5.2283	0.405	-0.124	-0.529	I
42	5.2328	0.356	-0.111	-0.467	I
43	5.2371	0.361	-0.122	-0.482	O
44	5.2384	0.395	-0.106	-0.501	I
45	5.2407	0.376	-0.136	-0.511	O
46	5.2424	0.394	-0.115	-0.509	I
47	5.2469	0.384	-0.134	-0.518	I
48	5.2773	0.307	-0.145	-0.452	I
49	5.2827	0.284	-0.182	-0.466	I
50	5.2883	0.335	-0.228	-0.563	I

* O = Ohshima; I = Ito

Table III. Observational results

Minimum:	2447605.150 ± 0.001 (Hel. J.D.)
Depth:	0.265 mag in B , 0.297 mag in V
Duration:	0.210 days
Out of eclipse:	delta V = $0^{m}.314$ ± 0.010 (s.d.) for n=9
	delta B-V = -0.484 ±0.011 (s.d.) for n=9

represent Ohshima's observations while open circles Ito's ones. Figure 2 clearly indicates that the eclipse is partial. The characteristics of the eclipse is shown in Table III where the minimum epoch was determined with Hertzsprung's method (Henden and Kaitchuck 1982).

Combining the observed epoch of minimum in Table III with Griffin's (1988) time of conjunction J.D.2446328.619 , we can obtain a new ephemeris as follows:

$$\text{Min.} = \text{Hel.J.D.}\ 2447\,605.150 + 53^{d}.1887 \cdot E$$

In the present observations we used BD+24°2570 as the comparison star. However, HD 116 234 (see Figure 1) may be a better comparison for future observations because its position is nearer to the variable and its colour is also similar.

According to Griffin (1989), the secondary eclipse is also expected to occur in the following dates in 1990 and 1991:

Jan. 12.05 , March 6.23 , Apr. 28.42 , 1990,

Jan. 19.36 , March 13.54 , 1991 ,

for which photometric observations are highly desirable, as well.

We would like to express our gratitude to Dr. R.F. Griffin (the Observatories, University of Cambridge), for his suggestion of photometric observation and to Prof. M. Kitamura (National Astronomical Observatory of Japan) for his encouragement.

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BV OBSERVATIONS OF IU AURIGAE

The light variability of IU Aur (HD 35 652) was observed photoelectrically by Mayer (1965) who first found it to be an eclipsing binary. Since then, this star has been observed photoelectrically by various authors (e.g. Eaton 1979, Papousek and Vetesnik 1982, and Hui-song 1988), even though none of these observations could cover the whole light curve satisfactorily. In these previous observations some curiosity has been reported, such as temporal changes of the light curve, changes in the maximum brightness and increasing depth of the eclipse with time.

With the purpose to obtain a complete light curve, photoelectric observations in BV were carried out with the 40-cm reflector at the Science Museum

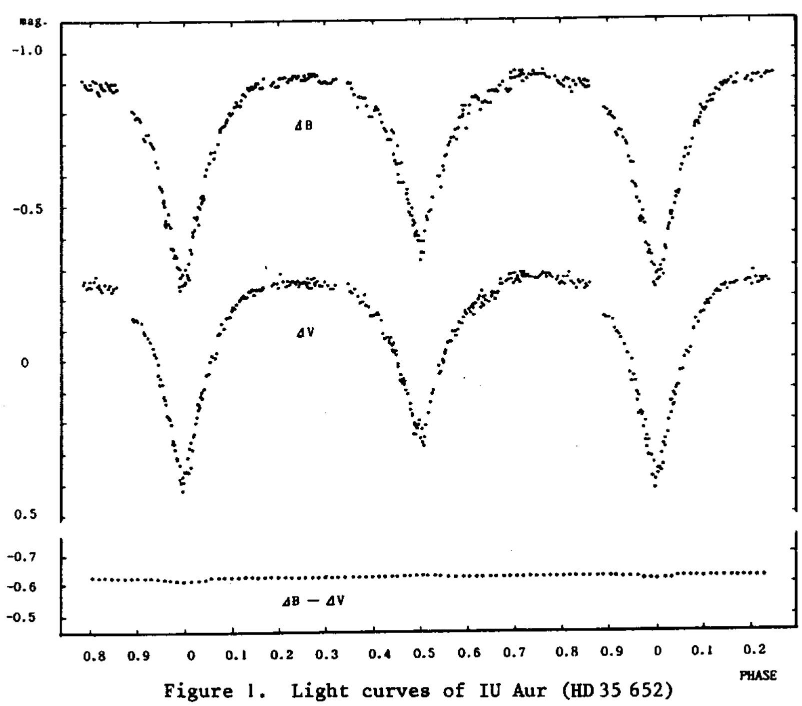

Figure 1. Light curves of IU Aur (HD 35 652)

of Kawasaki City during ten clear nights in 1987-88 . The photoelectric photometer was furnished with a Hamamatsu 1P21 photomultiplier tube. HD 35 619 was used as the comparison star, which is the same one as used by the previous photoelectric observers. In the present observations a total of 644 measurements were obtained in each colour.

During the present observations two primary minima could be covered as shown in Table I, where the O-C values are calculated with Mayer's (1987) ephemeris: J.D. 2438 448.4068 + $1^d.811475 \cdot E$.

Table I. Times of observed minima

Hel.J.D.	Epoch	O-C
2447156.1688	4807	$+0^d.0017$
2447167.0369	4813	+0.0009

Table II. Observed depths of both minima

Minimum \ Observer		Mayer (1964)	Eaton (1979)	Papousek and Vetesnik (1982)	Hui-song (1988)	present paper
Primary	B	$0^m.48$	-	$0^m.67$	$0^m.74$	$0^m.66$
	V	0.48	$0^m.68$	0.63	0.73	0.64
Secondary	B	0.37	-	-	0.58	0.52
	V	0.37	0.54	-	0.58	0.54

Taking into account the above O-C values, the ephemeris has been revised as:

Primary min. = Hel.J.D. 2438448.4068 + $1^d.8114754 \cdot E$.

All the measurements in $m_{var} - m_{comp}$ are plotted in Figure 1 and the depths of both minima are listed in Table II. In Table II, the corresponding values obtained from the previous light curves are also shown for comparison.

As is seen from Table II, the depths of minima in the present observations are decreased as compared with Hui-song's observations. In order to confirm this curious feature, further observations are highly desirable. The data of the present observations given in $m_{var} - m_{comp}$ (B,V) are available upon request.

I would like to express my thanks to Prof. M. Kitamura of National Astronomical Observatory of Japan for his suggestion of the programme and kind guidance.

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HD 147 491 - A NEW DELTA SCUTI VARIABLE STAR

HD147491 = G289 (Greenstein 1939) = L2202 (Lee 1977), a field star in the direction of the globular cluster M4, was measured photoelectrically as a secondary standard star by Lee (1977). The magnitude and colors of this star given by him are V=9.612, B-V=0.610, U-B=0.064 (n=6). Cacciari (1979) gave its V=9.679, B-V=0.627. While extending photoelectric BVRI standard sequence of eleven stars in the field of M4, Clementini found that for this star V=9.525, so the disagreement got by him with the previous values was quite large and the scatter among the individual measurements of this star was quite large too (±0.024). He suggested that the star is "likely to be a variable star" (Clementini 1987).

Actually, this star is a Delta Scuti variable star indeed. Its variability was found by us as a by-product when it was used as one of comparison stars to calibrate our new variable stars in M4 in 1979. Our formal photoelectric data were obtained with the conventional photoelectric photometer attached to the 60cm reflector at the Beijing Observatory. The photomultiplier EMI6256 plus d.c. amplifier plus strip recorder was used on July 13,1980. G544 (Alcaino 1975) (V=10.39, B-V=0.86) was the comparison star to get the difference G544-G289 through the V filter. The integration time was 10 seconds. Because the declination of the variable star is about $-26\overset{\circ}{.}3$ and the latitude of the Beijing Observatory is about $+40^{\circ}$, the zenith distance of the star is always as large as or larger than $66\overset{\circ}{.}3$, the seeing was large so we had to use a 37" diaphragm and accounted for the differential extinction even between

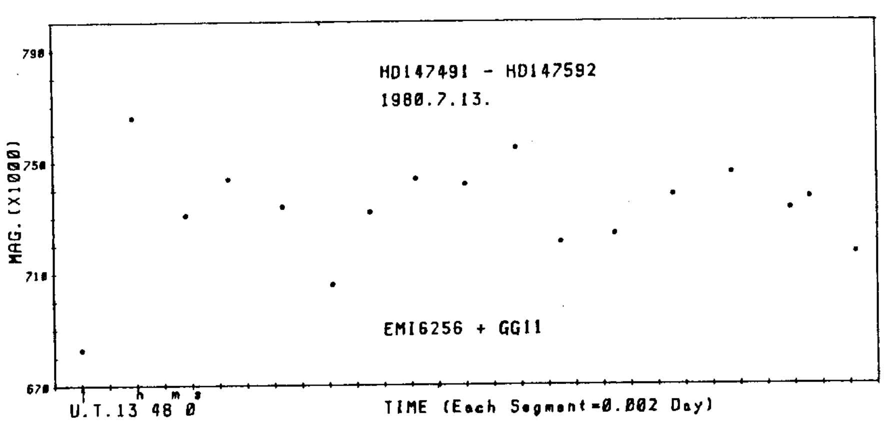

Figure 1

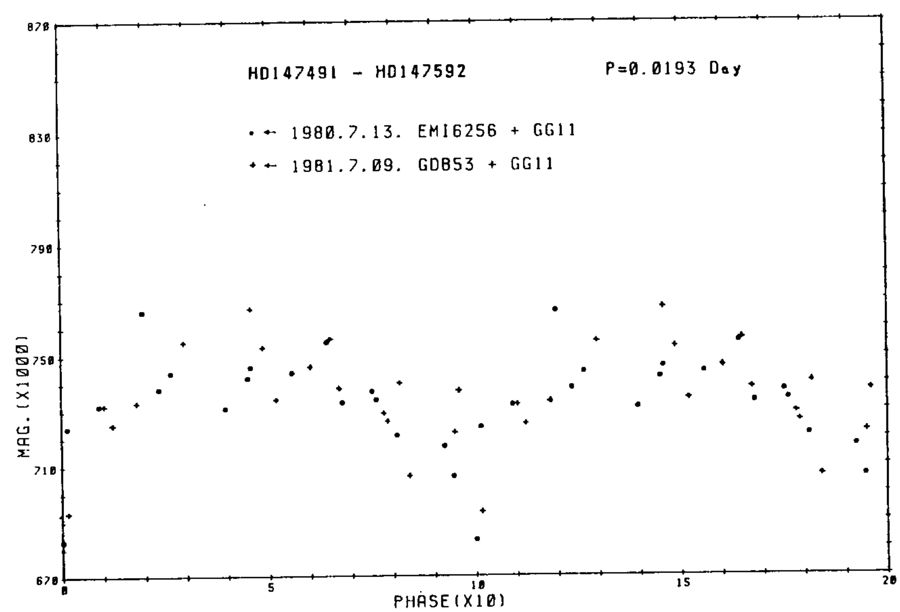

Figure 2

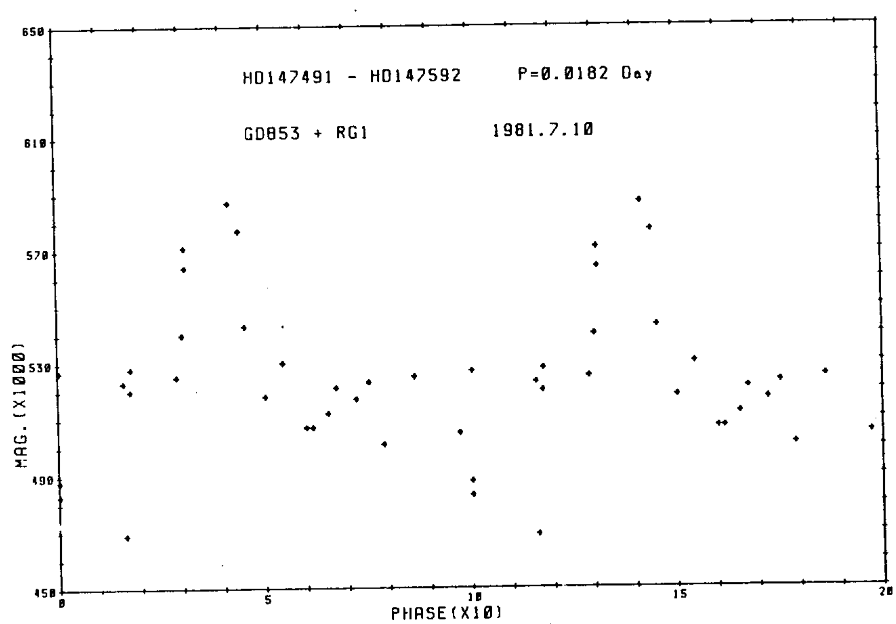

Figure 3

G544 and G289. However, from the observations a period around 25 minutes became readily apparent (Fig.1). The star was measured again on 1981 July 9, with a photomultiplier GDB53 (Sb-K-Cs cathode) plus photon counting system in V, at this time the star HD147592 (Lee 1977) (V=8.930, B-V=0.310) was used as the comparison star. We combined the data of these two nights by adding a zero point correction to the data of one night and a period of about 0.0193 day was derived using the L-K method. The light curve is given in Fig.2.

The interstellar reddening $E_{(B-V)}$ determined from the field stars in the direction of M4 by Alcaino and Liller (1984) was used to estimate the intrinsic colors of G289 to be $(B-V)_o$=0.18, $(U-B)_o$=-0.26, suggesting a spectral type of A6 instead of G0 given in the HD catalogue if it is a Pop I dwarf star. However, the $(U-B)_o$ is too blue.

In order to reduce the influence of differential extinction the star was observed once again on 1981 July 10 using the same equipment as that On 1981 July 9 but through the red filter RG1 instead of GG11. Because the wavelength range of the spectral response of GDB53 is about 3100-6200 Å, so the combination was somewhat similar to narrow-band photometry. Unfortunately,the star is not bright enough to give high signal to noise ratio. The light curve so calculated with a period 0.0182 day is shown in Fig.3. It is understandable that the scatter here is much larger than that in Fig.2.

Many Delta Scuti stars change the shape of their light curves from time to time and have multiple periods. For our accuracy it is not sure whether the period of this star is constant or not, or there are any other periods.

We attempted to observe this star at the Yunnan Observatory (ϕ=25°) but failed to do so due to bad weather and the limited observing time we were allocated. Now that this star is most suitable to be measured by southern hemisphere observers, we decided to stop observing it and publish the preliminary results only which may be useful for others.

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ON THE NATURE OF THE LIGHT VARIATIONS OF V564 OPHIUCHI

V564 Ophiuchi was discovered by Tsesevich (1952), who published a finding chart of its field and described it as an RV Tauri variable with a period of 70.6 days. Preston, Krzeminski, Smak and Williams (1963; hereafter, PKSW) obtained UBV photometry and low-dispersion spectrograms of the variable, finding V = 9.72 - 10.42 and B-V = 1.55 - 1.72 and a G8p - K2(M2) spectral range. DuPuy (1973) commented upon the poor repeatability of the light curves and found similar ranges in brightness and color. Erleksova (1975) reclassified V564 Oph as an SRd variable because of its erratic light curve and red color and derived elements of minimum light using published photometry. Dawson (1979) estimated [Fe/H] between -0.7 and -1.4 from DDO photometry and compared reddening estimates from PKSW, DuPuy, and Burstein and McDonald (1975) to obtain E(B-V) = 0.21 mag. This agrees well with the color excess (0.1 - 0.2 mag) found by FitzGerald (1968) from stars of types O through F. DuPuy, Allwright, Dawson and Africano (1983; hereafter, DADA) obtained Stromgren b, y photometry over roughly a 200-night span. Wahlgren (1985,1986) estimated a spectral type of K3-4 IIb and derived [Fe/H] = -1.05 (using synthetic spectra) from a spectrogram of 2.5 A resolution taken at the Perkin Observatory (Ohio State) on 22 June 1985 (J.D. 2,446,238). Part of the red color of V564 Oph comes from material between us and the star's photosphere; removing the effects of this material gives an intrinsic (B-V) around 1.4 - 1.5, which well matches the late G to early K spectral type range. Gehrz (1972) found only mild infrared excesses for V564 Oph in observations over several nights, which suggests that most of the star's reddening is interstellar and not circumstellar.

We decided to obtain and examine photometry of V564 Oph over many pulsation cycles, to redetermine its period, to study cycle-to-cycle variations, and to attempt to improve its classification.

Most of the data were obtained by two of us (Lines and Lines) at our observatory in Mayer, Arizona, during 1983, 1984 and 1987. We used a 50-cm Cassegrain telescope and an uncooled RCA 1P21 detector with calibrated UBV filters. Because V564 Oph is so red, the U signal was too weak for accurate photometry with our equipment; therefore, we restricted our work to V magnitudes and B-V colors. All measurements were made differentially with respect to SAO 122871 [= BD+07°3496], then corrected for extinction and transformed to the standard system. Sets of three individual comparisons were averaged to form nightly means; the standard deviations are no larger than 0.02 mag in V and B-V. On two nights in 1983, two nights in 1984 and one night in 1987, the magnitude and color of SAO 122871 was determined from comparisons with the secondary UBV standard SAO 122686 [= BD+05°3469 = HD 161242]; these observations show SAO 122871 to be constant within observational errors and to have V = 8.33, B-V = 1.13.

Two of us (Baird and Dawson) obtained UBV and Kron-Cousins RI observations of V564 Oph in 1985 at the Cerro Tololo Inter-American Observatory, as part of a larger survey of southern RV Tauri variables. The general results of this survey will be published elsewhere. We used the 41-cm Lowell reflector and UBVRI filter set #2 with a gallium arsenide (RCA C31034A) detector cooled with dry ice. The all-sky photometry has average nightly standard deviations of 0.013 mag in V and 0.006 mag in B-V.

One of us (AAVSO observer, Horowitz) observed V564 Oph visually on 97 nights from June, 1985 to November, 1986, using six nearby comparison stars to estimate brightness. The visual estimates are useful for maintenance of the cycle count and for monitoring the form of the pulsation over long times but are much less accurate than the photoelectric measurements because of the small amplitude of the variable.

The time intervals covered by the observations are listed in Table 1, and the photoelectric light curves are shown in Figures 1 through 6.

Table 1
Observations of V564 Oph

Observers	J.D. Range	Dates	Photometry
Preston et.al. (1963)	2,437,488 - 2,437,581	7/61 - 10/61	UBV
DuPuy et.al. (1983)	2,444,337 - 2,444,518	4/80 - 10/80	b,y
Lines and Lines (*)	2,445,440 - 2,445,560	4/83 - 8/83	BV
Lines and Lines (*)	2,445,831 - 2,445,950	5/84 - 9/84	BV
Dawson and Baird (*)	2,446,197 - 2,446,259	5/85 - 7/85	UBVRI
Lines and Lines (*)	2,446,965 - 2,447,079	6/87 - 10/87	BV
Horowitz (*)	2,446,237 - 2,446,741	6/85 - 11/86	visual

* = this paper

The first two figures reproduce the observations of PKSW and DADA. As noted by others, the light curves of V564 Oph show considerable variation from cycle to cycle. Minima can be symmetric (e.g., J.D. 2,447,067) or markedly asymmetric (e.g., J.D. 2,446,983). If the width of a deep minimum is measured from the average magnitude of the decline to the time when the same magnitude occurs on the subsequent rise, the widths of minima range from about 12 - 30 days. The depths of deep minima range from about 0.4 - 0.7 mag below average maximum brightness.

Julian dates of minimum light were estimated from the photoelectric light curves and are given in Table 2. DADA used the y and b filters of the four-color (Stromgren) system.

Using times estimated from photoelectric measurements of the four most symmetric and best-observed minima (J.D. 2,437,524, 2,445,509, 2,445,867 and 2,447,067) yields the linear ephemeris

$$J.D.(min) = 2,437,453.16 + 70.^{d}688 * E.$$

Using all the times of minima determined from photoelectric photometry except for the minimum at J.D. 2,444,503 gives the linear ephemeris

$$J.D.(min) = 2,437,452.85 + 70.^{d}666 * E.$$

The column labeled "E" in Table 2 contains the numbers used with our linear ephemerides, and O-C values [in days] computed with them are listed, respectively, as O-C(1) and O-C(2). We also computed O-C values [in days] from Erleksova's quadratic ephemeris:

$$J.D.(min) = 2,437,520 + 70.^{d}325 * E' + 0.^{d}0073 * (E' + 10)^{2}$$

Those values are listed in the table as O-C(3).

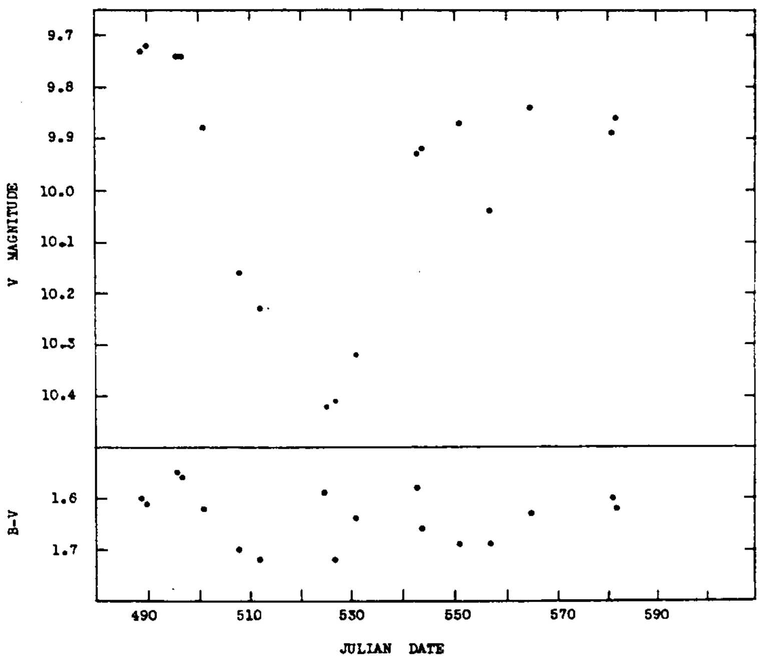


Figure 1. Johnson V magnitude and B-V color index. Add 2,437,000 to the abscissa values to obtain Julian dates. Data are from PKSW (1963).

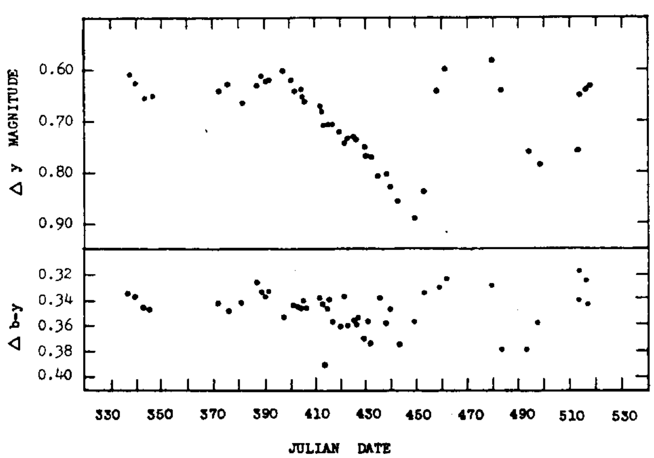
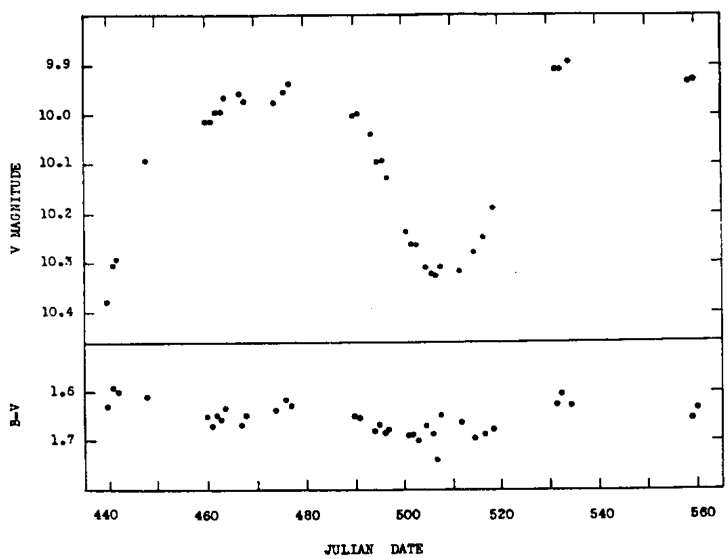


Figure 2. Differential Stromgren y magnitude and b-y color index. The comparison star was BD+07°3496. Add 2,444,000 to the abscissa values to obtain Julian dates. Data are from DADA (1983).



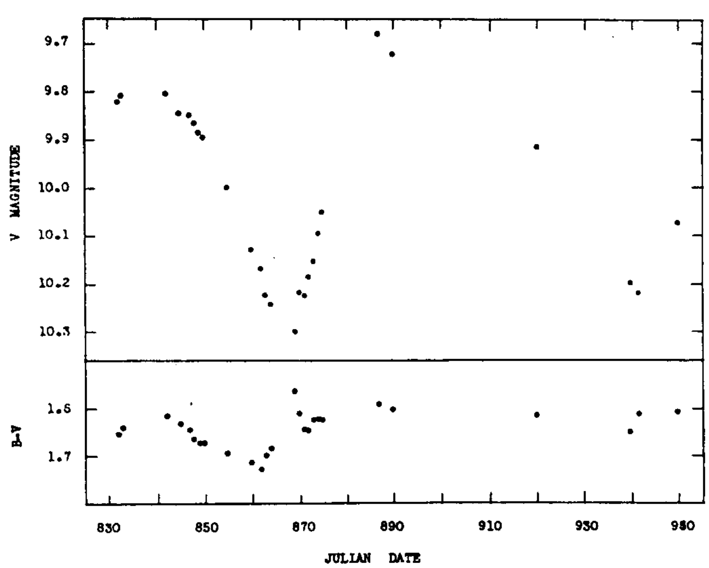


Figure 3. AND Figure 4. V magnitude and B-V color index. Add 2,445,000 to the abscissa values to obtain Julian dates. Data are from Lines and Lines (this paper).

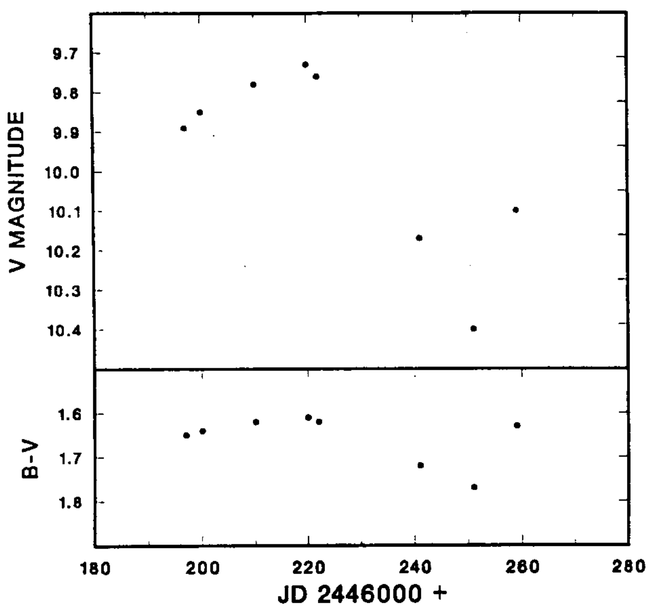


Figure 5. V magnitude and B-V color index. Add 2,446,000 to the abscissa values to obtain Julian dates. Data are from Dawson and Baird (this paper).

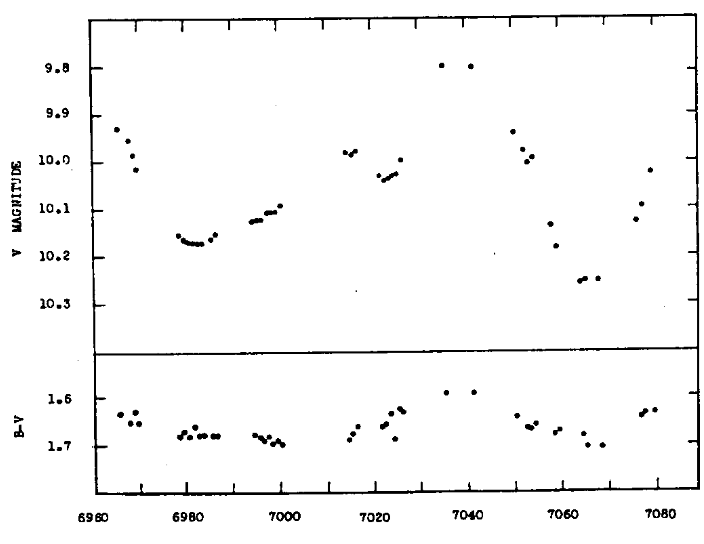


Figure 6. V magnitude and B-V color index. Add 2,440,000 to the abscissa values to obtain Julian dates. Data are from Lines and Lines (this paper).

Table 2
Observed and Calculated Times of Minima

J.D. (min)	E	E′	O-C(1)	O-C(2)	O-C(3)	Comments	Reference
2,437,524	1	0	+0.2	+0.5	+4.0		PKSW (1963)
2,437,557	1.5	0.5	-2.2	-1.8	+1.0	1 data point	PKSW
2,444,449	99	97.5	-2.3	+0.2	-12.0	v. asymmetric	DADA (1983)
2,444,503	99.5	98	+16.4	+18.9	+6.0		DADA
2,445,471	113.5	111.5	-5.2	-2.4	-2.0	v. shallow	This paper
2,445,509	114	112	-2.6	+0.2	+3.9		This paper
2,445,867	119	117	+2.0	+4.9	+1.2		This paper
2,445,942	120	118	+6.3	+9.2	+4.0	few points	This paper
2,446,251	124.5	122.5	-2.8	+0.2	-12.0	few points	This paper
2,446,983	135	132.5	-13.0	-9.8	-3.3	asymmetric	This paper
2,447,023	135.5	133	-8.4	-5.1	+0.5	shallow	This paper
2,447,067	136	133.5	+0.2	+3.6	+8.3		This paper

It is clear from an inspection of Table 2 that neither a linear nor a quadratic ephemeris completely describes the light variations of V564 Oph. Many of the O-C values are much larger than the uncertainty (typically ~2 days) in estimating times of minimum. The minimum of J.D. 2,444,503, which follows a very asymmetric one (see Figure 2), comes nearly 1/4 period late if we assign it E = 99.5, and the asymmetric minimum of J.D. 2,446,983 comes about 1/5 period early for E = 135. A deep minimum is seen for E = 124.5, and a moderately deep one was observed visually for E = 128.5, as though an interchange of minima had occurred earlier. Thereafter, the light curve shows lower amplitudes and a more sinusoidal character.

The behavior of B-V around times of V minimum light is interesting. For RV Tauri and some SRd variables, the star reaches its largest (reddest) B-V before deep V minimum light and its bluest color during the rise in brightness that follows. This behavior is seen for the minima in Figures 1 and 2, and for at least the first minimum shown in Figure 4, but it is not obvious for other minima. The variations in B-V are approximately in phase with the brightness changes for the other symmetric minima. B-V "spikes" toward bluer color seem to be present near the times of the well-observed minima in Figures 3 and 4, and possibly for the minimum of Figure 1; if they do not arise from observational errors, their physical significance is unclear. B-V is not reddest preceding the asymmetric minimum at J.D. 2,446,983, nor does it become bluer following that minimum, but it does become bluer following the minimum at J.D. 2,447,023.

Is V564 Oph an RV Tauri star? Its estimated [Fe/H] value is typical of that found for other RV Tauri variables but is somewhat metal-rich for those SRd variables which have had abundance analyses; [Fe/H] = -1.5 to -2 is a more typical range for them, and SRd variables are considered members of a Halo population. Alternating deep and shallow minima are not as strongly evident in V564 Oph as they are in well-known RV Tauri variables, and its maximum-to-minimum V amplitude (0.6 mag) and B-V amplitude (0.1 mag) are also low, but its minima display more symmetry than is usually found for SRd variables. The possible interchange of minima before J.D. 2,446,200 may be support for RV Tauri variation, but the presence of very asymmetric minima suggests that more than one process may be affecting the pulsation amplitudes.

V564 Oph sometimes shows RV Tauri characteristics, but it can also show Cepheid-like intervals or sudden brightness dips reminiscent of R Coronae Borealis stars. Its light variations resemble those of AR Puppis (a carbon-rich RVb) and AR Sagittarii (a variable which also shows some deep and shallow minima); see Figures 7 and 9 of Payne-Gaposchkin, Brenton and Gaposchkin (1943). Simultaneous UBV and infrared photometry for this variable could be very revealing.

Perhaps it is better, following Eggen (1986), to refer to V564 Oph as a 'pseudocepheid,' one of many late-type stars for which underlying stable pulsation is occasionally disturbed in different ways, until the nature of the disturbance can be better defined.

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A New Variable Star in Phoenix[1]

In an observational program of the star SX Phe, SAO 231769 was used as comparison star and SAO 231800 (HD 223480) as check star. The observing run was carried out during October and November 1988 with the 50 cm Danish telescope in the European Southern Observatory (La Silla, Chile) by using the simultaneous uvbyβ Strömgren photometer attached to this telescope. SX Phe and SAO 231769 was observed during six nights, but SAO 231800 only three ones, on the nights of October 30/31 and November 1/2 and 3/4, logging a total of 15 hours aproximately. The observations showed that while SAO 231769 kept a constant brightness, SAO 231800 presented a slight photometric variability. This last star is not present in any of the variable stars catalogues, hence it has to be considered as a new variable star.

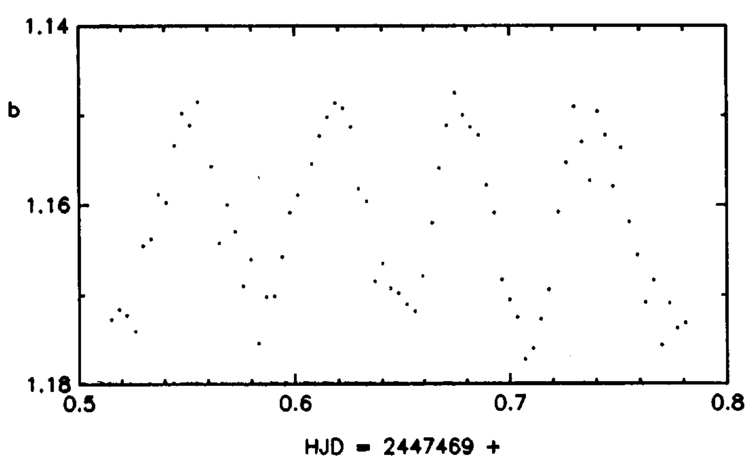

Figure 1

[1] Based on observations collected at European Southern Observatory, La Silla, Chile

Figure 1 shows the light curve in the b filter in the night 3/4 of November. The magnitudes are differences SAO 231800 - SAO 231769 in the standard system. From figure it can be seen that the period is about 0.063 days and the amplitude of the variation of luminosity is $0.^{m}02$ approximately, and on the other hand, the spectral type of this star is F0. Hence, due to the characteristics shown, we might conclude that this star is probably a δ Scuti type variable.

A more detailed study of this star will be published later.

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SAO 139 174 IS AN ECLIPSING BINARY STAR

SAO 139 174 (BD -1° 2777 = HD 114 125) was used as a check star during the observations performed on 18 and 19 March 1988 at Sierra Nevada Observatory in Spain. The star showed brightness variations which suggested that it might be an eclipsing binary (Rodriguez et al., 1988).

During 18 nights, from March 21 to April 22, 1989, SAO 139 174 was observed using a solid state photometer attached to the Cassegrain focus of the 0.5 m Mons telescope at Observatorio del Teide (Instituto de Astrofisica de Canarias Canary Islands, Spain).

SAO 139 171 was used as comparison 1, and SAO 139 131 (48 Vir) as comparison 2, while SAO 139 086 (44 Vir), SAO 139 139, SAO 139 186, and SAO 139 196 as check

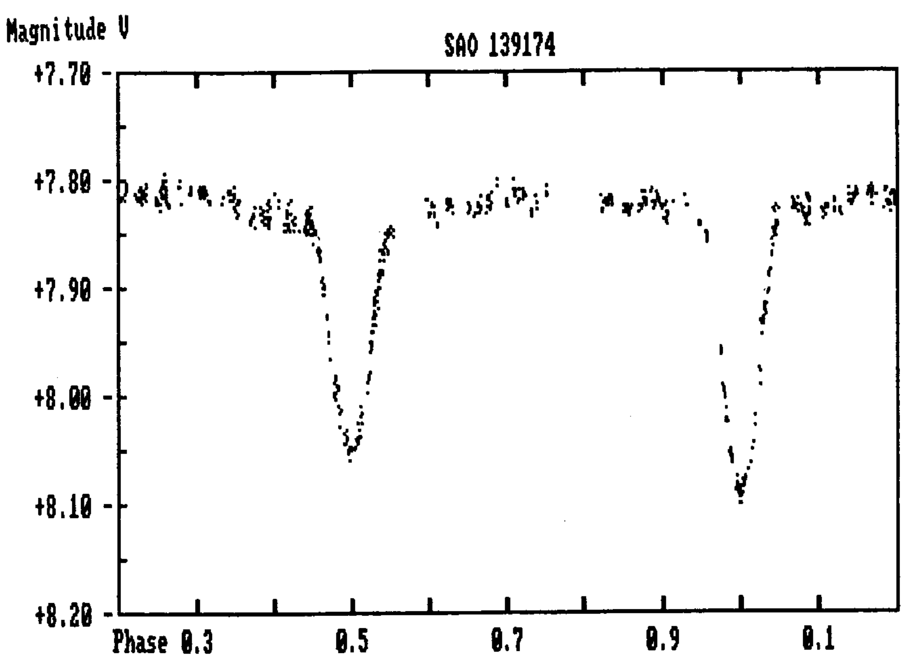

Figure 1

stars.

The results of this surveillance program proved that SAO 139 174 is an eclipsing binary star with a period close to 2.73 days. The star is a 7.81 magnitude (V) object at the maximum light that fades to 8.10 and 8.05 at the primary and secondary minima respectively. The eclipses last about 6.3 hours. Figure 1 shows the light curve obtained.

From our set of data we computed the tentative ephemeris for the primary minimum:

$$HJD = 2\,447\,240.97128 + 2\overset{d}{.}73236\,E$$
$$\pm.00006 \quad \pm.00002$$

After a quick first analysis of the light curve using the Russell-Merrill model according to Irwin (1962) we obtained the following elements:

$R_s = 0.15$ $\qquad L_s = 0.423$

$R_g = 0.19$ $\qquad L_g = 0.577$

$i = 80\overset{\circ}{.}1$

Additional photometric data are needed in order to compute more precise elements and ephemeris for this new binary system.

We would like to acknowledge the Instituto de Astrofisica de Canarias for allowing us to utilize their facilities. We would like to acknowledge also C. Gallart for her assistance in the observation during some nights, and E. Garcia-Melendo for his help in computing the elements of the system.

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FLARE OBSERVATIONS OF UV CETI

In order to study the structure of the flare light curves, synchronous photoelectric observations were made on UV Ceti at Maydanak high-mountain station of Tashkent Astronomical Institute, using two 60-cm telescopes. During 12 hours of observations 15 flares were detected in U-band, in October and November 1987. The synchronization of the two telescopes was as precise as 0.001 sec. The measurements were made by the photon counting method. The duration of each measurement was 2 seconds, and the time interval between two measurements was 0.4 s.

The results of the observations are presented in Table I: number of flare, date of flare in UT, the beginning moment of the flare (in UT), the rise time and the decay time (in seconds), and the amplitudes of the flares as measured with the two telescopes (ΔU_1 and ΔU_2 , respectively) are given. The light curves of the flares No.14 and No.15 are presented in Figure 1 for the illustration, where I_0 is the stellar intensity in normal state, and I_f is the additional intensity.

Table I

N	Date of flare (UT)	Beginning of the flare (UT)	Rise time (s)	Decay time (s)	ΔU_1	ΔU_2
1	18 Oct. 1987	$21^h08^m21^s$	3	51	$0^m.80$	$1^m.00$
2	19 Oct. 1987	17 58 24	6	120	0.78	0.80
3	19 Oct. 1987	18 27 57	21	354	1.04	1.10
4	19 Oct. 1987	18 47 09	6	51	1.06	1.16
5	19 Oct. 1987	19 47 48	3	36	2.35	2.35
6	19 Oct. 1987	19 53 00	-	420	2.05	2.19
7	16 Nov. 1987	16 04 54	15	144	1.38	1.53
8	16 Nov. 1987	16 21 12	30	135	1.34	1.19
9	16 Nov. 1987	16 49 30	48	465	2.91	2.86
10	16 Nov. 1987	18 25 09	33	198	1.26	1.16
11	16 Nov. 1987	18 30 15	27	255	1.70	1.63
12	16 Nov. 1987	18 36 33	9	198	3.04	2.94
13	16 Nov. 1987	18 56 00	15	105	1.75	1.79
14	16 Nov. 1987	19 05 21	30	187	1.66	1.70
15	17 Nov. 1987	16 25 03	12	435	1.68	1.66

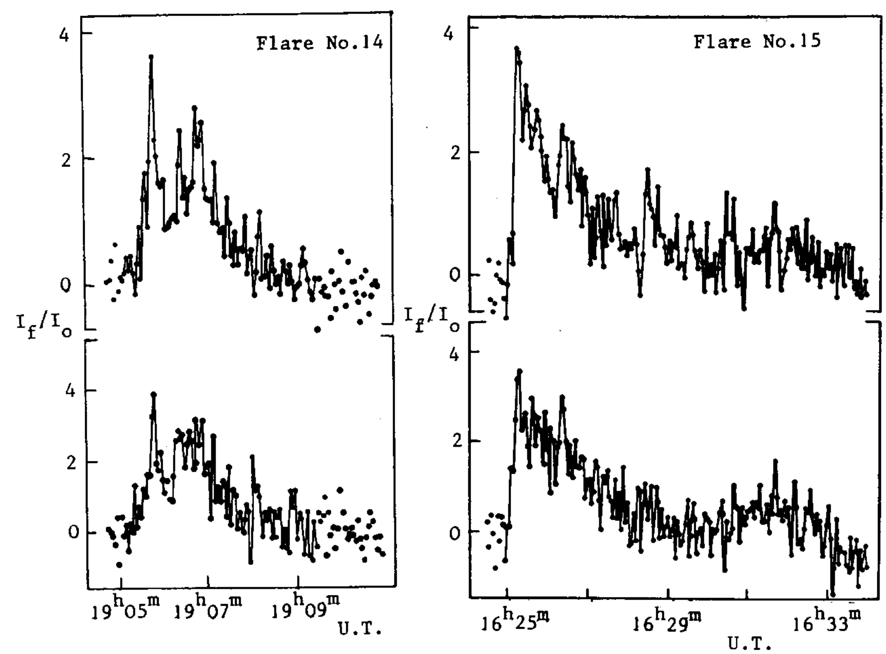

Figure 1

In addition to these 15 flares, four "spike-shaped" increases of the light were observed, duration of each one being less than or equal to two seconds. These four cases are illustrated in Figure 2. In all cases the "spike-shaped" increase of the brightness is registred only with one telescope. Such "spike-shaped" increases of the light were already detected during the EV Lac flare observations (Tovmasian and Zalinian, 1988; Tsvetkov et al., 1986a,b; and Zalinian and Tovmasian, 1986). Unlike the results for EV Lac, it seems to us that this kind of increase can be explained by the Poissonian distribution of the observational errors (the number of the points on our registrograms is more than 20000 on each telescope).

The authors are indebted to Prof. L.V. Mirzoyan for suggesting these observations.

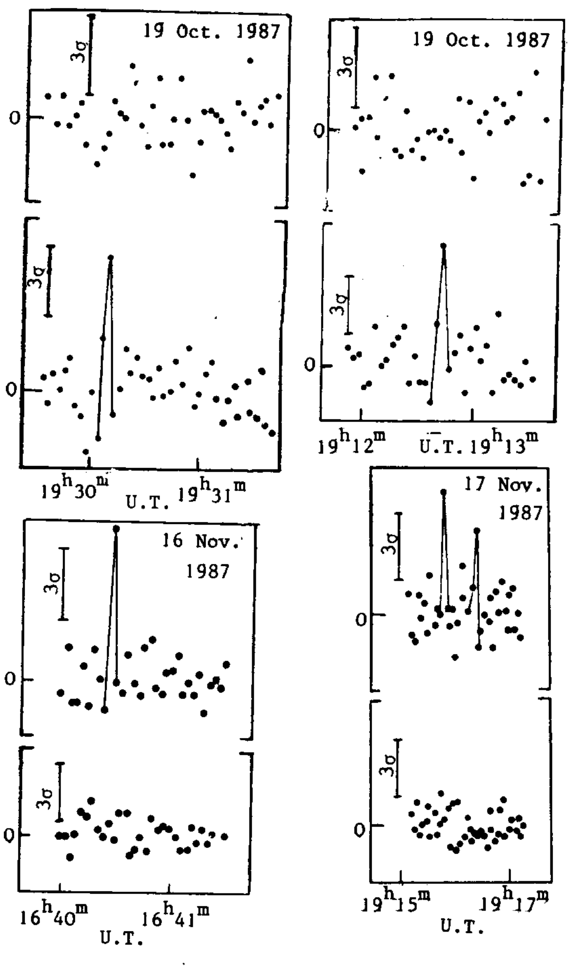

Figure 2

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NEW PHOTOELECTRIC MINIMA OF 44i BOOTIS

The close visual binary Σ1909 = ADS 9494 consists of the bright component A and the faint components B+C. The latter is a W UMa system which belongs to the W class in Binnendijk's (1970) classification.

According to Bergeat et al. (1972) its light curve presents "active" and "quiet" periods. We observed 44i Boo during its previous "active" period in 1978 (Rovithis and Rovithis-Livaniou, 1981), and we re-observed it during 1988. The corresponding light-curves will be published elsewhere in the near future. Here we give only the 9 new minima times obtained during our observations which were made between 21 and 25 March and between 25 and 29 June 1988.

The two-beam, multi-mode, nebular-stellar photometer, of the National Observatory of Athens, was used, attached to the 48 inch Cassegrain reflector at the Kryonerion Astronomical Station. The same comparison and check stars have been used as in our previous observations. Reduction of the observations has been made as usual and the pass bands of the B and V filters used are in close accordance to the standard ones.

The nine new minima times (5 primaries and 4 secondaries) obtained during our observations in 1988 were derived using Kwee and Van Woerden's (1956) method, and are the mean values of B and V colours. They are presented in Table I, the successive columns of which give: the Hel. J.D., the type of the minimum and the O-C residuals. In the latter, the C's have been calculated using the following ephemeris formulae:

(I) Min I = 2439852.4903 + $0\overset{d}{.}2678159 \cdot E$

Kholopov et al. (1985) (due to Duerbeck, 1975)

(II) Min I = 2443834.3769 + $0\overset{d}{.}2678172 \cdot E$

Lunel et al. (1985)

(III) Min I = 2439370.387 + $0\overset{d}{.}2678178 \cdot E$

SAC No.60 (due to Danielkiewicz-Krosniak, 1989)

As one can notice from Table I, the smallest differences between the observed and the calculated values are given using Danielkiewicz-Krosniak's (1989) ephemeris formula, indicating that the period of 44i Boo has increased

Table I

Hel. J.D. 2440000.+	Minimum Type	$(O-C)_I$ days	$(O-C)_{II}$ days	$(O-C)_{III}$ days
7242.4883	II	+0.0200	+0.0036	-0.0012
7242.6248	I	+0.0224	+0.0062	+0.0014
7245.4395	II	+0.0252	+0.0088	+0.0040
7245.5701	I	+0.0219	+0.0055	+0.0007
7338.3675	II	+0.0211	+0.0043	-0.0008
7338.5006	I	+0.0203	+0.0035	-0.0016
7340.3756	I	+0.0206	+0.0037	-0.0013
7341.3174	II	+0.0250	+0.0062	+0.0031
7341.4445	I	+0.0182	+0.0014	-0.0041

from $0\overset{d}{.}2678159$ (Duerbeck, 1975) to $0\overset{d}{.}2678178$ (SAC No.60, 1989). Of course, we must not forget that the used ephemeris formulae are simple and do not include the orbital light-time effect which has been taken into account by Hill et al. (1989).

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SPECTROSCOPY OF VW Hyi

Spectroscopic observations of VW Hyi during quiescence are presented in this study. The spectroscopic data were obtained between 1985 December 5, UT= 06^h45^m - 08^h18^m (10 spectra) and December 6, UT = 06^h32^m - 08^h23^m (13 spectra) with the Image Dissector Scanner (IDS) in the ESO 1.52 meter telescope equipped with the Boller-Chivens Cassegrain Spectrograph (Haefner and Schoembs 1987). Table I gives the journal of observations and radial velocity measurements.

Table I

HJD 2446400+	Hα v_r (km/s)	Hβ v_r (km/s)	Hγ v_r (km/s)
5.786	-81	76	-275
5.794	-74	2	42
5.801	-32	157	314
5.808	-72	-67	-68
5.816	-122	23	63
5.822	-128	50	-156
5.829	-101	140	77
5.836	-56	91	44
5.842	-72	167	195
5.849	-87	104	-36
6.775	-118	32	-18
6.782	-162	-45	-202
6.788	-120	-45	-307
6.795	-178	213	362
6.801	-12	179	343
6.807	-42	197	-224
6.814	11	213	85
6.820	-55	102	232
6.827	-60	22	-22
6.833	-69	157	256
6.840	-70	129	317
6.846	-74	37	-203
6.852	-115	-160	-129

The wavelength range λλ 3760 - 7180 was covered, with a dispersion of 172 A/mm. The exposure time was about 10 minutes on the first night and 8 minutes on the second night for each spectrum. The reduction was carried out

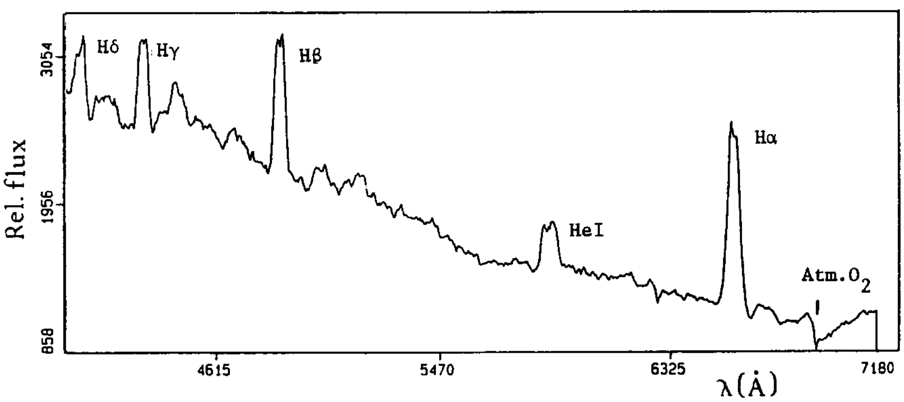

Figure 1

with the standard IHAP software in the ESO Headquarters in Garching. The wavelength calibration of the spectra was obtained from the helium-argon lamp (HEAR) exposure before and after the observations every night. No drift in these HEAR spectra was found. The probable wavelength errors were tested by the radial velocity variations of OI λ5017 , OI λ6100 A and beginning wavelength of the atmospheric oxigen band λ6878 A. The probable pixel-defects of the IDS were tested especially around the Hα emission lines. The calibration of this part of the spectra was repeated using a large number of calibration lines. There was not found any pixel defect. Absolute flux calibration was deduced from observations of the white dwarf standard star Feige 15. The reduction procedure was repeated at least two times.

The spectra were obtained at quiescence and, all spectra are dominated by Hα, HeI λ5876, Hβ, Hγ, Hδ emission lines. Since the sensibility of IDS is not enough for short wavelengths, the blue sides of the spectra are too noisy. The sum spectrum is given in Figure 1.

The Hα , Hβ , and Hγ Balmer emission lines were used for the determination of the radial velocity curves. The emission lines were fitted by a Gaussian profile (double Gaussian profile for Hα lines, single Gaussian profile for the relatively weak Hβ and Hγ lines).

Figure 2 shows the radial velocity curves of VW Hyi. The symbols refer to different observing nights: open circles to JD 2446405, and the dots to JD 2446406. The solid line is the fitted sine curve.

The phases refer to the elements: HJD (max) = $2440128.0222+0^{d}.0742711\cdot E$ (Vogt, 1974). The radial velocity amplitudes of Hα, Hβ and Hγ are

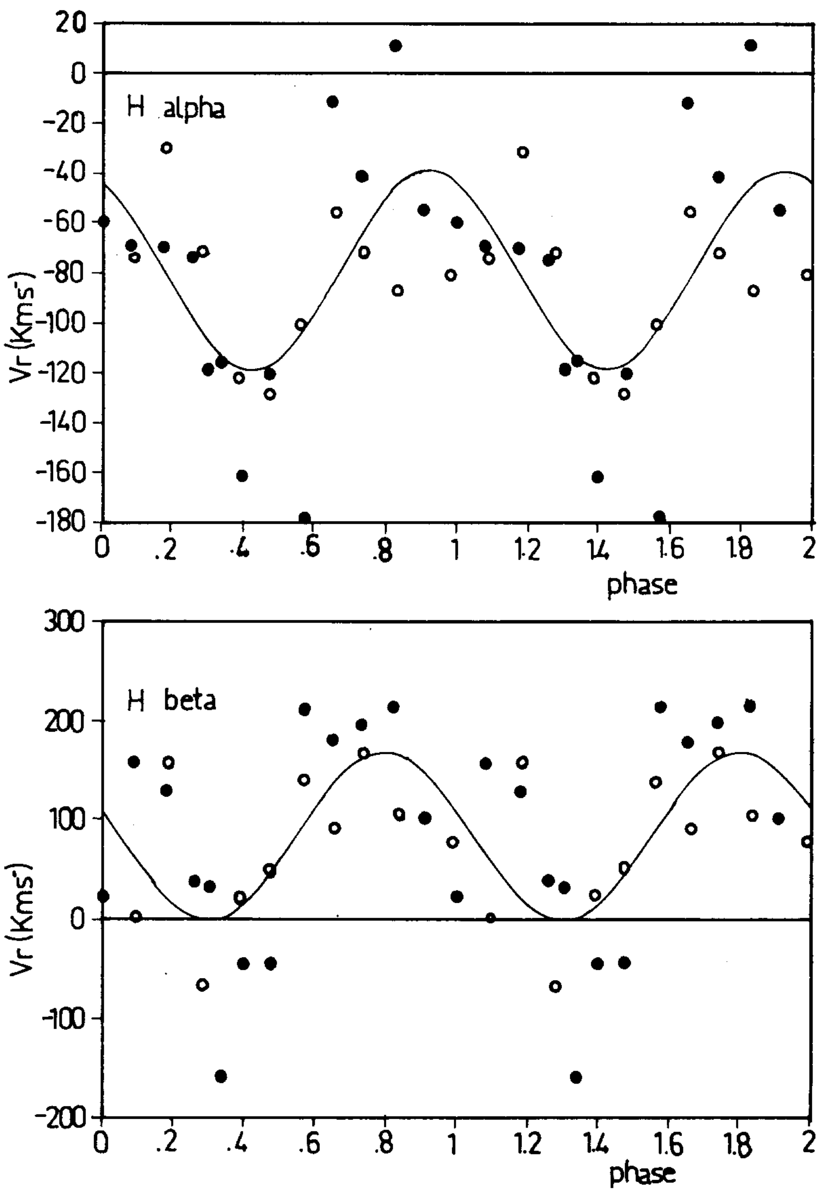

Figure 2

39 ± 11 km/s, 85 ± 23 km/s, 113 ± 59 km/s. The systemic velocities are -78.9 ± 8 km/s, 83.3 ± 17 km/s, 62.6 ± 24 km/s for these lines respectively. The earth velocity factor, -5 km/s, is not included in the radial velocities. In the earlier study of Schoembs and Vogt (1981) the semi-amplitude of the Hα line was obtained as 78 ± 14 km/s, and the systemic velocity was zero. Their observations were obtained at quiescence and during the late decline from an outburst. These observations are insufficient to account for the differences in radial velocity curves, because such differences might occur from time to time. A search for similar cases was carried out in other cataclysmic variables. In the UX UMa star PHL 227 Haefner and Schoembs (1987) found the values of K_1 and γ velocities from Hα and Hβ lines as follows: $K_{1\alpha}$ = 124 ± 20 km/s, $K_{1\beta}$ = 87 ± 15 km/s, γ_α = 43 ± 13 km/s, and γ_β = -58 ± 10 km/s, respectively. In V2051 Oph (Watts et al., 1986) the values of K_1 from the Hβ and Hγ lines are consistent with each other yielding the mean result K_1 = 111 ± 12 km/s ($K_{1\beta}$ = 108 ± 14 km/s, $K_{1\gamma}$ = 116 ± 23 km/s). The γ systemic velocities are significantly different by 90 km/s (γ_β = -55 ± 9 km/s , γ_γ = 35 ± 15 km/s). In RW Tri Kaitchuck et al. (1983) found a difference 115 km/s between the γ for the redshifted component of the Hβ and Hγ lines.

More spectroscopic observations with high dispersion are needed in order to understand these differences in the radial velocity curves and semi-amplitudes of VW Hyi.

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OBSERVATIONS OF THE SUSPECTED VARIABLE STAR τ CASSIOPEIAE

The star τ Cassiopeiae (τ Cas, HR 9008, HD 223165, SAO 35763, K1 III, V = 4.87 m) was observed at the University of Northern Iowa (UNI) Hillside Observatory from May 1988 until January 1989. We used a 0.4 meter Cassegrain telescope and a STARLIGHT-1 photon counting photometer with standard B and V filters.

τ Cas is listed in the *New Catalogue of Suspected Variable Stars* as a possible variable star (Kholopov, et al, 1982). Previous observations of τ Cas made at UNI indicate that it may be a variable star (Leiker and Hoff, 1988). HR 9010 (HD 223173, SAO 35761, K3 II, V = 5.51 m, B-V = 1.65) was used as the comparison star. The delta magnitudes were obtained in the sense of τ Cas - HR 9010 and are not corrected for color or extinction. Table 1 lists the mean delta magnitudes obtained for τ Cas. Each mean and standard deviation was calculated from three delta magnitudes. Standard deviation was calculated in the usual manner. See also Figures 1 and 2.

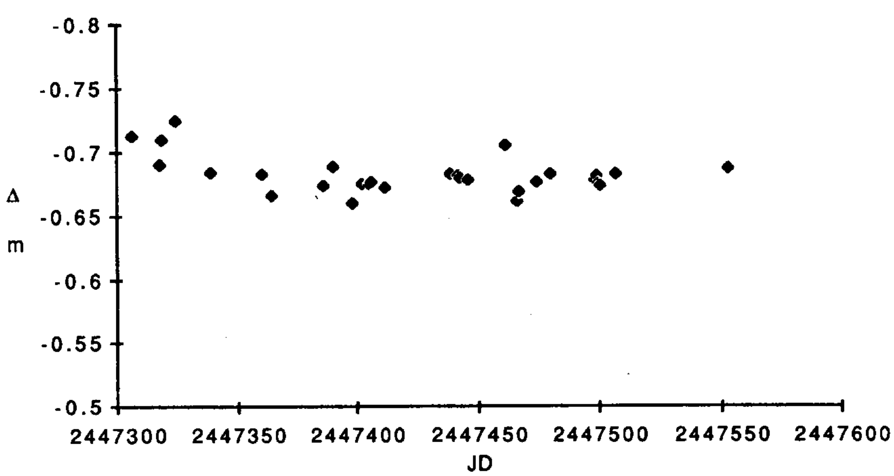

Figure 1
τ Cas Visual Delta Magnitudes

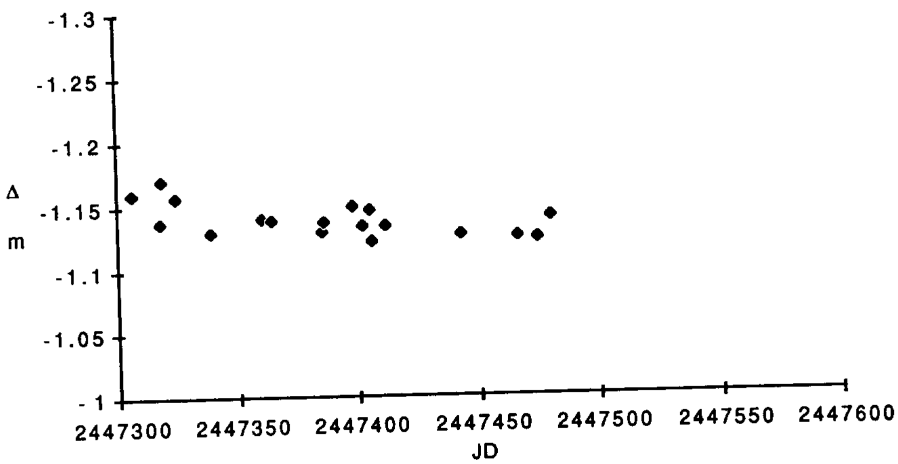

Figure 2
τ Cas Blue Delta Magnitudes

Table 1
τ Cas Visual and Blue Delta Magnitudes

JD	V mean	sd	JD	B mean	sd
2447306.683	-0.713	0.045	2447306.694	-1.160	0.018
2447317.690	-0.690	0.015	2447317.701	-1.137	0.013
2447318.675	-0.710	0.021	2447318.686	-1.170	0.012
2447323.682	-0.724	0.016	2447323.695	-1.157	0.015
2447338.681	-0.684	0.002	2447338.692	-1.130	0.004
2447359.673	-0.682	0.004	2447359.682	-1.140	0.009
2447363.711	-0.666	0.003	2447363.721	-1.138	0.002
2447384.641	-0.673	0.010	2447384.651	-1.129	0.011
2447385.642	-0.674	0.010	2447385.656	-1.136	0.018
2447389.659	-0.688	0.013	2447397.695	-1.149	0.006
2447397.684	-0.660	0.032	2447401.757	-1.133	0.006
2447401.746	-0.675	0.015	2447404.744	-1.146	0.002
2447404.734	-0.675	0.004	2447405.689	-1.122	0.001
2447405.678	-0.677	0.010	2447411.666	-1.133	0.004
2447411.650	-0.672	0.009	2447442.614	-1.127	0.011
2447438.656	-0.682	0.012	2447465.597	-1.125	0.000
2447441.656	-0.681	0.010	2447473.681	-1.123	0.003
2447442.603	-0.680	0.001	2447479.556	-1.140	0.004
2447445.617	-0.678	0.008			
2447460.674	-0.706	0.048			
2447465.588	-0.662	0.006			
2447466.682	-0.668	0.009			
2447473.670	-0.676	0.007			
2447479.546	-0.683	0.003			
2447497.509	-0.678	0.010			
2447498.725	-0.681	0.006			
2447499.548	-0.675	0.003			
2447500.524	-0.674	0.012			
2447506.511	-0.683	0.007			
2447553.531	-0.686	0.006			

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PHOTOMETRIC VARIATION OF ZETA AURIGAE

Zeta Aur is a prototype for a group of long period spectroscopic (and eclipsing) binary systems that consists of a K-type supergiant and a B-type main sequence companion. Before and after the eclipses in these systems, the light of the hot secondaries shine through the extended atmospheres of K-type supergiants. The Zeta Aur system has been studied in detail since Harper (1924) first discovered it to be an eclipsing binary. The primary is a K3 or K4 Ib or II type star (Wright 1970), and the secondary is a B7 V star (Wright 1970; Faraggiana and Hack 1980). For a more complete early bibliography on the system see Wilson (1960), Wright (1970), and Hack and Stickland (1987).

To investigate the nature of the photometric variations outside the eclipses of Zeta Aur, we have observed the system with UBV filters attached to the photoelectric photometer of the 30 cm Maksutov Telescope of Ankara University Observatory. Lambda Aur was taken as comparison star. A sequence; comparison-comparison sky-variable-variable sky-variable-comparison-comparison sky in each of the three filters was followed to secure on differential observation in the sense of variable minus comparison. Thus, altogether 56 differential magnitude measurements in each bandpass were obtained on 23 nights in 1982 and 1983. The individual differential magnitudes (a few measurements per night) were corrected for differential atmospheric extinction and the times of measurement were reduced to heliocentric Julian date. The nightly mean observations were listed in Table 1 and plotted in Figure 1 against the heliocentric Julian date.

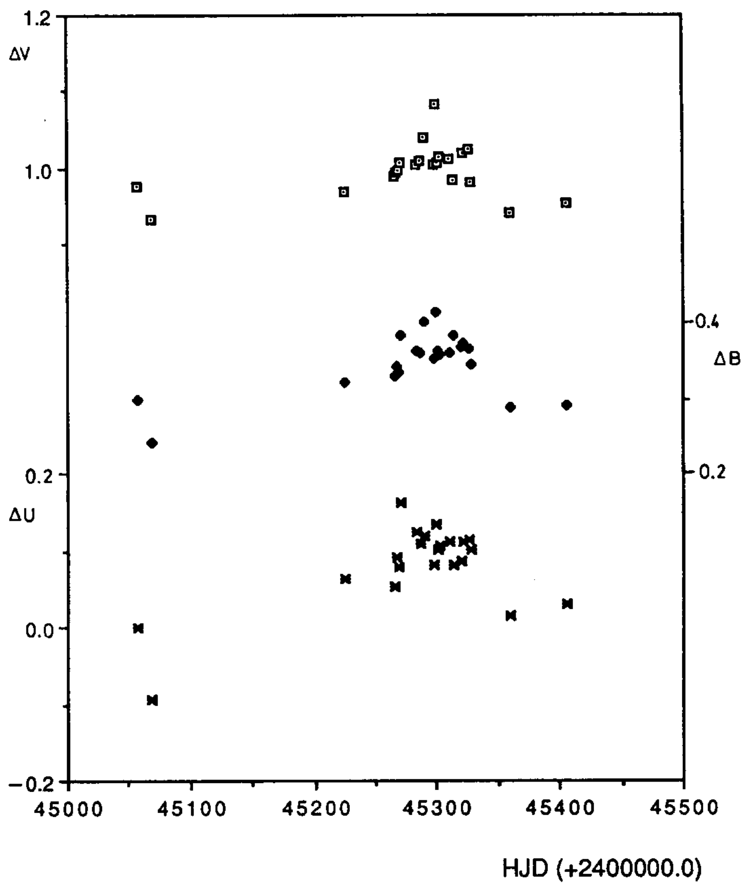

Figure 1. The nightly mean UBV observations of Zeta Aurigae.

Although we have no observations between HJD 2445069 and 2445224, a periodic light variation with an amplitude around $0^m.1$ in all three bandpasses is seen in Figure 1. It seems the amplitude of the variation increases towards the shorter wavelengths. The 1982 eclipse of the secondary by the supergiant occurred on 9 th August but unfortunately we have no observations during the eclipse. A preliminary period analysis of our observations for the low amplitude long term variation yields two probable periods: 151 days and its double 302 days. The true period is more probably around 300 days.

Table 1. The nightly mean UBV observations of Zeta Aurigae.

HJD	DV0	DB0	DU0
45057.2360	-0.977	-0.298	+0.000
45068.3055	-0.933	-0.241	+0.094
45224.5912	-0.969	-0.321	-0.065
45265.6013	-0.991	-0.328	-0.054
45267.4122	-0.996	-0.341	-0.093
45268.4956	-0.996	-0.333	-0.079
45271.3300	-1.007	-0.382	-0.164
45283.4022	-1.004	-0.360	-0.125
45286.3371	-1.010	-0.359	-0.110
45289.3310	-1.040	-0.398	-0.121
45298.4594	-1.004	-0.350	-0.082
45299.3175	-1.083	-0.412	-0.136
45300.4175	-1.008	-0.360	-0.101
45302.3812	-1.014	-0.355	-0.107
45311.2721	-1.012	-0.358	-0.113
45313.2580	-0.984	-0.380	-0.082
45320.2965		-0.366	-0.087
45321.2515	-1.019	-0.370	-0.111
45326.2642	-1.024	-0.364	-0.116
45327.2850	-0.981	-0.342	-0.103
45360.4640	-0.941	-0.287	-0.015
45405.2723	-0.954	-0.290	-0.031

Although Hutchings and Wright (1971) suggested that such light variations in these systems should come from the H-alpha emission region with a radius of 150 $R_{\odot}$, surrounding the Be components, we believe that a pulsation of cool supergiant in these systems is involved in the observed photometric variations. The K supergiant component of Zeta Aur is probably a semiregular low amplitude red variable, like α Herculis, with a pulsation period greater than 100 days.

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PHOTOMETRIC VARIATION OF DELTA SAGITTAE

Delta Sagittae is a well known long period spectroscopic binary of VV Cephei type. It consists of a cool M2 supergiant and a hot B9 dwarf which passes periodically behind the supergiant in every 10.2 years and shines through its extended atmosphere. The system must have an orbital inclination greater than 70°, since atmospheric eclipses have been observed. The last eclipse occurred around the beginning of March 1980 and lasted about 40 days. The last eclipse was observed with IUE by Reimers and Kudritzki (1980), and Reimers and Schröder (1983). The spectroscopic properties of the system have been reviewed by Hack and Stickland (1987).

To investigate the nature of the photometric variations outside the eclipses in Delta Sagittae we have observed the system with UBV filters on 21 nights in 1988. The differential observations with respect to the comparison star β Sge were made by using an EMI 9789 QB photomultiplier attached to the 30 cm Maksutov telescope of Ankara University Observatory. The differential brightness measurements of β Sge with respect to the check star α Sge were found to be sensibly constant during the observations: $\Delta V = 0.001 \pm 0.0014$, $\Delta B = -0.272 \pm 0.021$ and $\Delta U = -0.748 \pm 0.036$, where the errors are standard deviations of all measures from the means. Altogether 92 differential magnitudes of Delta Sge in each bandpass were obtained. The individual differential magnitude determinations with a number made on each night ranging from 2 to 14 were corrected for differential atmospheric extinction and light time effect. The observations in the sense variable minus comparison were plotted in Figure 1 against the heliocentric Julian date.

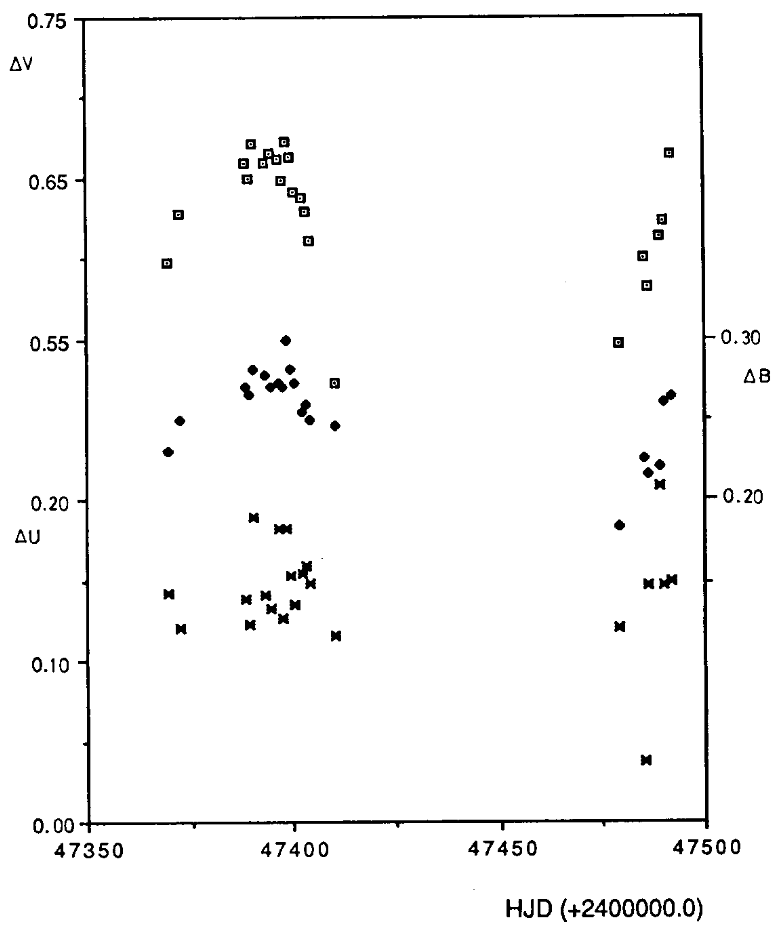

Figure 1. The UBV observations of Delta Sagittae.

Although the observations are not complete, Figure 1 shows that Delta Sge has a photometric light variation with an amplitude at least $0^{m}.15$ in all three bandpasses. The periodic nature of the variation is clearly seen especially in V and B observations. A preliminary period analysis yields two probable periods: 59 days and its double 118 days.

It is surprising that in VV Cephei, Baldinelli et al. (1970) found a semiregular variation with a period of approximately 58 days which is about half of the period of 118 days reported by Mc Cook and Guinan (1978) based on H-alpha observations. According to Hutchings and Wright (1971) such variations should come from the H-alpha emission region with a radius of 150 $R_{\odot}$, surrounding the Be star. However, we believe it is more likely that a pulsation (radial or non-radial) of cool supergiants in these systems is involved in the observed photometric variations. Being in the instability strip, the M supergiant component of Delta Sge is most probably a semiregular red variable like α Herculis with a pulsation period greater than 100 days. Thus the true photometric period of Delta Sge is expected to be around 118 days.

To derive the period of the low amplitude light variation more accurately, we continue the photometric observations.

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δSct like variability in the Am star 18 Vul

In this short communication the discovery of luminosity variations in the A3mIII star 18 Vulpeculae (HR7711) is reported, on the basis of rapid photometric observations performed looking for periodicities ranging from a few minutes to several hours. 18Vul is an already known magnetic variable star (Bertolini, Foschini and Piccioni, 1974) with a rotation period $\sim 9.^{d}31$. The Strömgren photometry (Hauck and Mermilliod, 1980) provides values of b-y=0.047 and C_1=1.149 which place it near the blue border of the δSct instability strip. It is member, and a possible blue straggler (BS) star, of the stellar cluster NGC6882.

18Vul was observed by Breger (1969) in a large search for δSct variables amongst stars within the instability strip. He observed it twice (for $0.^{h}4$ and $3.^{h}5$ long respectively) and concluded that the star was stable in the range of interest at a level of ~2 mmag. Manteiga and Martínez Roger (1988) observed it in a campaign to determine the IR colours of a large group of BS stars, finding a strange photometric behaviour; so it was decided to observe 18Vul again carefully also in the visible range.

In Table 1, we present the journal of the observations made in 3 consecutive nights in October 1988. Observations were performed through a B filter, using the IAC-UBV photometer (Belmonte, 1986), working in photon counting mode, attached to the Cassegrein focus of the 1.5m Carlos Sánchez Telescope (TCS) of the Observatorio del Teide (Tenerife, Spain). In the three nights, small light variations were evident in the light curves. The data were reduced via the standard fit to airmass, obtaining the residual data series, the standard deviation of the fit (σ) and the extinction coefficient (K_B) amongst other parameters. Both σ and K_B are listed in Table 1, showing the high photometric quality of the runs and hence of the data (notice that in σ any actual signal will be included).

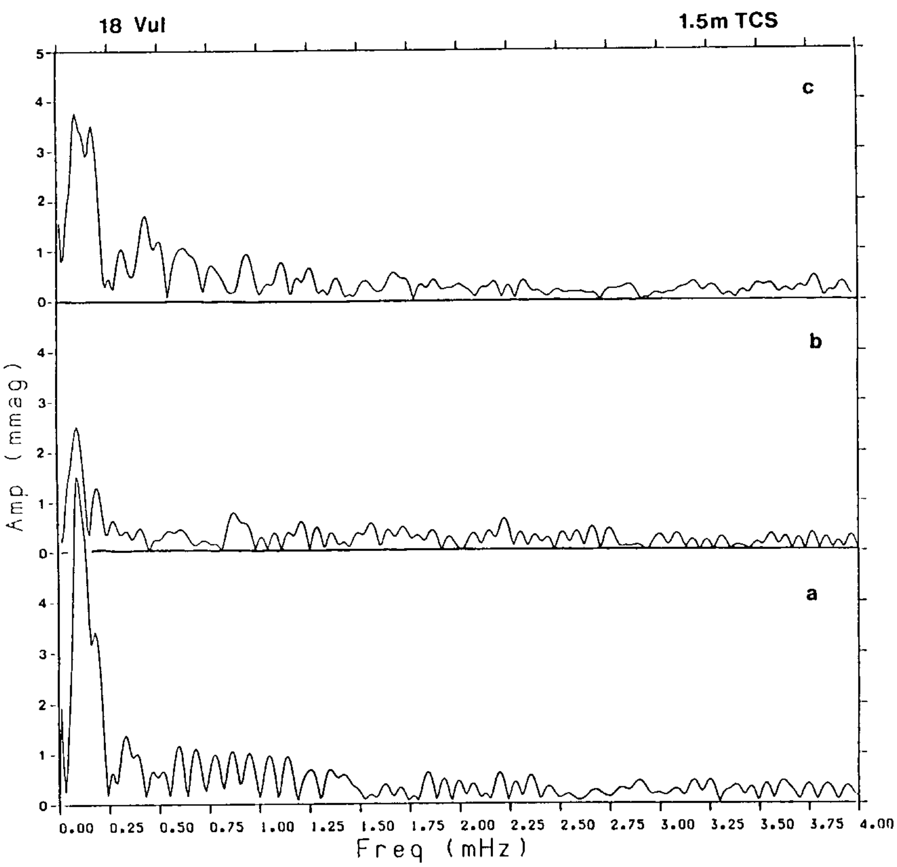

Figure 1: Amplitude spectra of the residual data series obtained on the star 18 Vul. Notice the double peak at frequencies between 0 and 0.25 mHz associated to an unresolved double mode pulsation of the star. **a**: For the night of October the 18^{th}, **b**: Id. 19^{th}, **c**: Id. 20^{th}.

Table 1: *Journal of the observations.*

Date	t	σ	K_B
	(hours)	(mmag)	(mag/am)
18/10/88	4.2	5.8	0.23
19/10/88	4.5	2.9	0.25
20/10/88	4.5	4.8	0.23

Nightly data series were analyzed via an Iterative Sine Wave Fitting (ISWF) procedure for unevenly spaced data (Ponman, 1981; Belmonte, 1986) to obtain, for each night, the amplitude spectrum. Figure 1 shows the results of the analysis. In all the plots two significant peaks are present at the low frequency range. The corresponding frequency, amplitude and phase are listed in Table 2.

Table 2: *Frequency, amplitude and phase of the two main peaks present in the amplitude periodogram of Figure 1. Origin for the phase 0^h UT October 18.*

Date	ν_1	A_1	ϕ_1	ν_2	A_2	ϕ_2
	(μHz)	(mmag)	(rad)	(μHz)	(mmag)	(rad)
18	90	6.3	0.3	180	3.4	2.8
19	90	2.4	0.1	200	1.3	1.9
20	90	3.8	0.3	180	3.5	2.4

In order to obtain more information, to decrease the noise and to increase the resolution, a single time series was produced using the 3 nightly series. This series was again analyzed via ISWF. The analysis, after *prewhitening* of the highest amplitude peak at the lowest frequency (95.3 μHz), yielded the following results:

P	ν	A	ϕ
(hours)	(μHz)	(mmag)	(rad)
2.9	95.3	3.83	1.1
1.4	201.3	1.50	0.3

From this analysis (see Figure 2), it was also obvious that 18Vul was stable in the range from 1 hour to a few minutes, at least, at a level of 0.5 mmag.

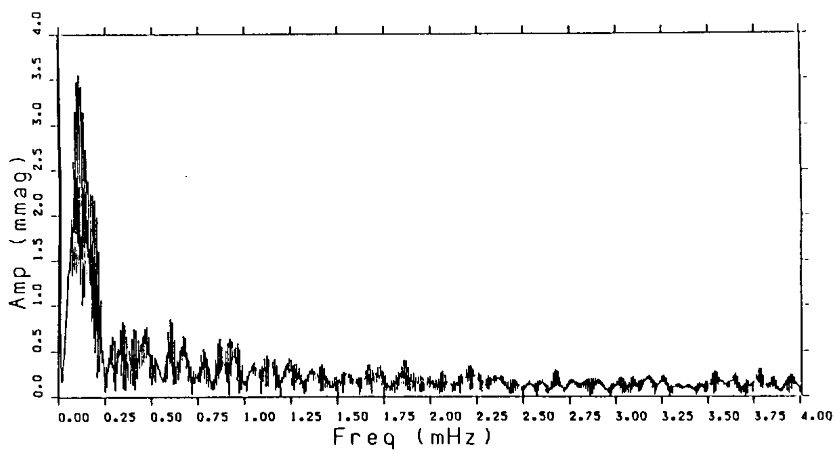

Figure 2: Amplitude spectrum of the whole residual series of the Am star 18Vul (18-19-20/10/88).

The main conclusion is that 18Vul is fluctuating (pulsating?) with, at least, a main period (95.3 μHz) and possibly its first harmonic (201.3 μHz). The very low amplitude of the variations could explain the non variability found by Breger in his short series of observations. From the analysis of the complete series, there are traces that more than two frequencies are in action at once in this star which, together with the seemingly amplitude modulation, has made us to include 18Vul in a future rapid differential photometric and spectroscopic campaign, to be soon performed.

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PHOTOELECTRIC PHOTOMETRY OF ρ CASSIOPEIAE

The peculiar variable star ρ Cassiopeiae (HR 9045, HD 224014, SAO 035879) was observed by two observatories using photoelectric photometers. Observations covered the period of time from December 1987 through February 1989. This paper represents a follow-up of photometric data on the same star presented in earlier bulletins (Leiker, et al., 1988 and Leiker and Hoff, 1987).

ρ Cas is a supergiant (F8pIA) star (Percy & Keith, 1985). ρ Cassiopeiae was discovered to be a variable in 1900 by Louise D. Wells (Pickering 1901). Much of the time this star was confined to a brightness between 4.1m and 5.1m (Bailey, 1978). Between August 1945 and June 1947 ρ Cas decreased in brightness more than a magnitude (Gaposchkin, 1949). After it recovered from this minimum, ρ Cas continued its irregular variation in brightness of 4.1m and 5.1m (Leiker 1987).

ρ Cas was observed by Leiker and Hoff at the University of Northern Iowa (UNI) Hillside Observatory from May 1988 until January 1989. A 0.4 meter Cassegrain telescope and a STARLIGHT-1 photon counting photometer with standard B and V filters was used. HR 9010 (HD 223173, SAO 35761, K3 II, V = 5.51 m, B-V = 1.65) was used as the comparison star. These delta magnitudes are not corrected for color or extinction. Standard deviation (σ) was calculated in the usual manner. Table 1 lists the ΔV and ΔB magnitudes. Figure 1 displays the visual data obtained by both Leiker, Hoff, and Milton. Figure 2 is a graphical representation of the blue data presented in Table 1.

Milton observed ρ Cas from December 1987 to February 1989 using a 0.2 meter Schmidt-Cassegrain telescope with a pulse counting photoelectric photometer. HR 9010 was used as the comparison star. Table 2 lists V delta magnitudes corrected for color and extinction. Milton's data is also displayed in Figure 1. Standard deviation was calculated in the usual manner. Milton also observed τ Cassiopeiae (HR 9008, HD 223165, SAO 35763, K1 III, V = 4.87 m) as a check star. The check star delta magnitudes are corrected only for extinction.

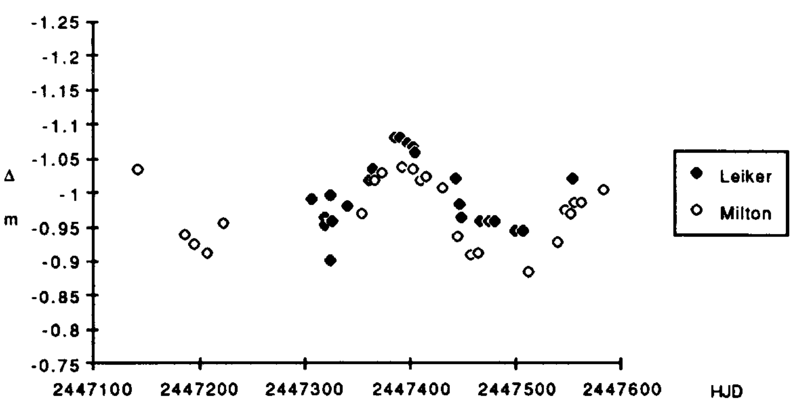

Figure 1. ΔV magnitudes of ρ Cas obtained by Leiker, Hoff, and Milton

Table I. ΔV and ΔB magnitudes of ρ Cas obtained by Leiker and Hoff

HJD	V Mean	σ	#
2447306.652	-0.990	0.029	3
2447317.663	-0.963	0.007	3
2447318.648	-0.951	0.008	3
2447323.646	-0.902	0.043	3
2447323.707	-0.995	0.008	3
2447324.688	-0.958	0.067	3
2447338.654	-0.980	0.018	3
2447359.648	-1.017	0.034	3
2447363.691	-1.034	0.012	3
2447384.616	-1.079	0.009	3
2447385.619	-1.079	0.009	3
2447389.610	-1.079	0.005	3
2447397.658	-1.071	0.004	3
2447401.717	-1.066	0.002	3
2447404.711	-1.059	0.002	3
2447442.626	-1.022	0.031	2
2447445.634	-0.982	0.004	3
2447448.576	-0.964	0.007	3
2447465.566	-0.959	0.004	3
2447473.693	-0.958	0.012	3
2447479.521	-0.958	0.002	3
2447497.522	-0.945	0.010	3
2447498.702	-0.944	0.003	3
2447506.522	-0.944	0.008	3
2447553.545	-1.020	0.008	3

HJD	B Mean	σ	#
2447306.6629	-1.204	0.015	3
2447317.6744	-1.208	0.005	3
2447318.6605	-1.203	0.007	3
2447323.6669	-1.246	0.014	3
2447338.6670	-1.252	0.016	3
2447359.6585	-1.320	0.006	3
2447363.7012	-1.335	0.003	3
2447384.6295	-1.380	0.018	3
2447385.6315	-1.407	0.012	3
2447389.6327	-1.394	0.003	3
2447397.6708	-1.390	0.009	3
2447401.7315	-1.380	0.021	3
2447404.7234	-1.400	0.032	3
2447445.6452	-1.280	0.028	3
2447448.5911	-1.264	0.006	3
2447465.5758	-1.251	0.007	3
2447473.7037	-1.256	0.006	3
2447479.5335	-1.244	0.001	3
2447498.7143	-1.229	0.003	3

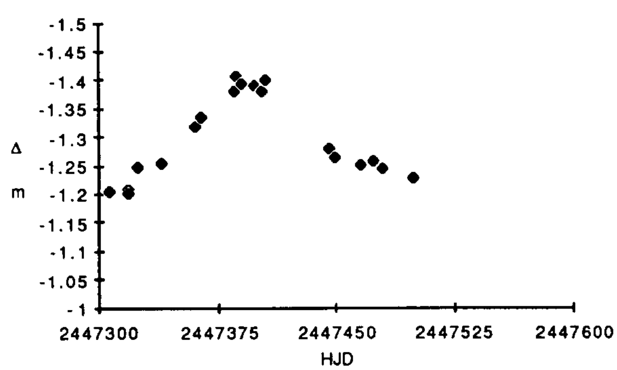

Figure 2. ΔB magnitudes of ρ Cas obtained by Leiker and Hoff

Table II. ΔV magnitudes of ρ Cas obtained by Milton

HJD	V Mean	σ	#	Check
2447141.831	-1.033	0.012	3	-0.703
2447185.723	-0.938	0.015	3	-0.665
2447193.654	-0.925	0.003	3	-0.688
2447206.666	-0.912	0.003	3	-0.666
2447222.665	-0.956	0.008	3	-0.700
2447352.845	-0.970	0.010	3	-0.679
2447365.787	-1.018		1	
2447372.845	-1.028	0.013	3	-0.674
2447392.819	-1.037	0.001	3	-0.689
2447401.757	-1.033	0.006	3	-0.685
2447408.816	-1.017	0.006	3	-0.673
2447415.696	-1.022	0.007	3	-0.670
2447430.667	-1.007	0.003	3	-0.680
2447444.685	-0.936	0.005	3	-0.675
2447457.649	-0.909	0.004	3	-0.672
2447464.664	-0.912	0.003	3	-0.686
2447510.692	-0.884	0.009	3	-0.689
2447538.651	-0.927	0.042	3	-0.665
2447545.692	-0.973	0.008	3	-0.691
2447551.688	-0.969	0.008	3	-0.692
2447555.660	-0.985	0.002	3	
2447562.668	-0.984	0.004	3	-0.690
2447582.675	-1.005	0.017	3	-0.661

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The Optical Variability of the X-Ray Source 1E1654+3515

The X-ray source 1E1654+3515 was discovered serendipitously in the Einstein Observatory Extended Medium Sensitivity Survey, and was suspected of being a W UMa system by Fleming et al. (1989). Its position at Right Ascension 16:53:59.3 and Declination 35:15:38 Epoch 1950 and brightness of 10.1 in the V band were given by Fleming et al. (1989). A finder chart adapted from Papadopoulos et al. (1980) is given for this star in Figure 1.

I observed this star using the 0.5 meter reflector of the Climenhaga Observatory at the University of Victoria on nine nights between 31 May 1989 and 11 June 1989. The telescope is computer controlled to the extent that it is pointed to each of the stars at the beginning of the night and then left to follow a program of observations until dawn the next day. Thus the data are gathered in a very consistent manner and at a minimum of effort by the observer. Due to the proximity of the variable, comparison and check stars both in position and color, mean extinction and transformation coefficients were used to correct the differential magnitudes to the Johnson V and Cousins R and I system (Landolt 1983). The observations of the variable star were bracketed by observations of the comparison star SAO 65642, whose constant brightness was checked with 22 observations of the check star, SAO 65670. The mean check star minus comparison star magnitude was $0.138 \pm .013$ in V and $0.520 \pm .010$ in (V-R) and $0.456 \pm .007$ in (R-I). The errors are standard deviations about the mean, assuring the constancy of the comparison and check stars at this level.

The R band light curve is plotted in Figure 2 folded with the ephemeris discussed below. This curve clearly shows the variation expected for a W UMa system as predicted by Fleming et al. (1989). The difference in height of the maxima and in depth of the minima indicate that the system is not a single spotted star like FK Com. The dispersion seen in the maxima and minima of the light curve is consistent with the amount of uncertainty seen in the check minus comparison values. However variations such as those seen at phase 0.2 are intrinsic to the system and are not unusual in W type W UMa systems. Spotted regions are the likely source of both light curve variations and the X-rays. The (V-I) color curve plotted in Figure 3 is constant, consistent with the system being a W UMa system and inconsistent with a light variation due to temperature changes, as would be expected from a hot compact object and a companion filling its Rochelobe such as Her X-1.

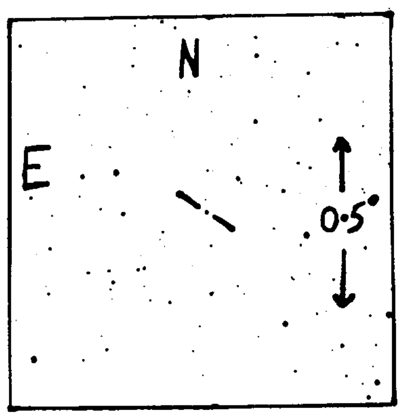

Figure 1.- Finder chart for X-ray source, 1E1654+3515; centred on Right Ascension 16:53:59.3 and Declination 35:15:38 (1950.0).

Table I. Heliocentric Julian Date of Extrema - 2440000.

Minima	Maxima
7680.8883	7678.8335
7681.7883	7680.7984
7682.8607	7681.8770
7684.8283	7682.7770
7687.8751	7683.8442
7689.8448	7685.8153

Times of minimum light were found using a program based on the method of Kwee and Van Woerden (1956) and checked using the tracing paper method. Observations in each color were treated individually, but since there were no significant differences between the times obtained, they were combined in a mean, weighted by the error in each color's determination. The heliocentric times of minimum based on all points within 0.03 days are given in Table 1. Similarly the times of maximum light are included, to help determine the period of the system. The best fitting ephemeris is found to be:

$$\text{Cycle} = (\text{JD} - 2447680.8912_{10}) / 0.35813_{9}$$

The errors in the times of extrema ranged from 0.0022 to 0.0004 days with the maxima and minima equally well determined. The average deviation of a time of extrema from this ephemeris is 0.0026 days, only slightly larger than the most poorly determined maxima. Therefore the use of the maxima has removed the aliases without adding noise to the period determination. No systematic difference was found in the (O–C)'s indicative of a displaced secondary minima or either maxima. This period is in good agreement with the period-color relation of Eggen (1967) for contact binaries.

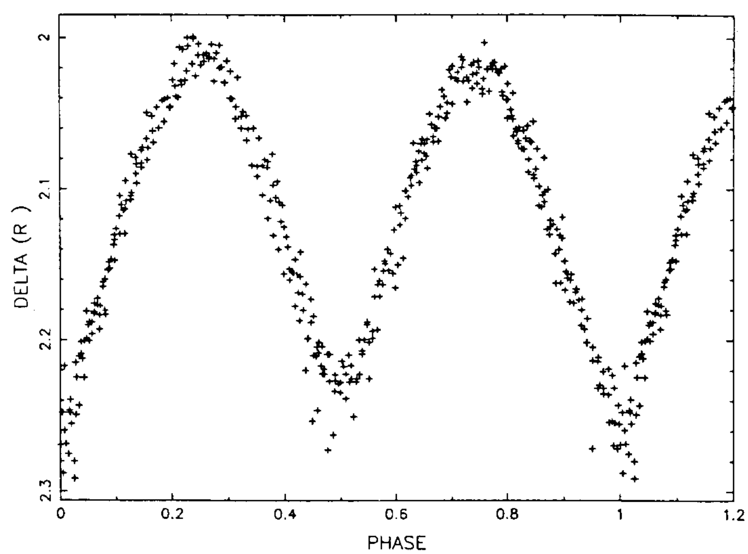

Figure 2. - R filter light curved plotted with PHASE = (JULIAN DATE - 2447680.8912) / 0.35813

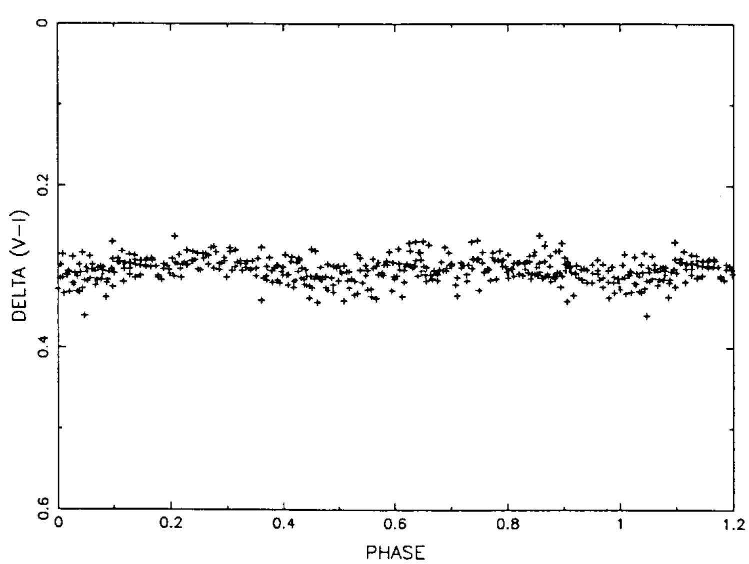

Figure 3. - Color (V-I) plotted as a function of Phase.

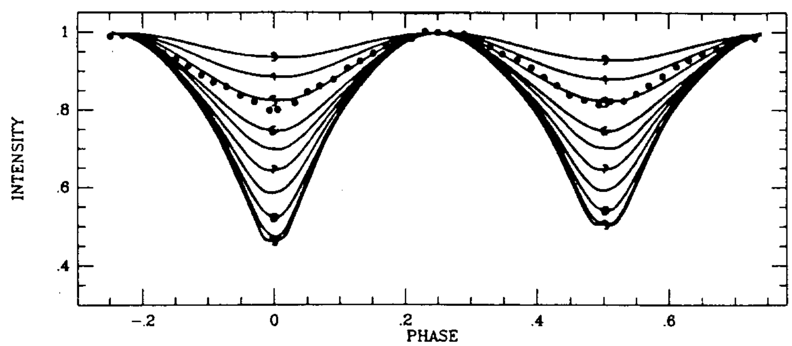

Figure 4. - Average of V, R and I normal points plotted with theoretical light curve from Anderson and Shu (1979) for a convective atmosphere with full limb darkening, a mass ratio of 0.6, and a filled fraction of 0.5. Curves are plotted in 10 degree increments of inclination.

An atlas of theoretical light curves of contact binary stars has been published by Anderson and Shu (1979), for different mass ratios, filled fraction, orbital inclination, and type of atmosphere. Since 1E1654+3515 has a G2 spectral type (Fleming et al. 1989), a convective envelope with full limb darkening was assumed. As shown in Figure 4 the best match was found for a filled fraction f of 0.5, mass ratio q of 0.6 and an inclination of 50. degrees. Nearly as good a match could be found for inclinations ranging from 40. degrees (f=1.0, q=1.0) to 60. degrees (f=0.0, q=0.4). These numbers must be regarded as preliminary values, since the theoretical light curves are for bolometric intensity and the data are the average of the V, R and I band normal points. The observed light curve also shows some asymmetry in the brightness of both the maxima and minima.

The X-ray source 1E1654+3515 is a W UMa system with a period of 0.358 days and an amplitude of 0.26 magnitudes. Spectroscopic observations of this system will be important to find the component masses and mass ratio. Further photometric observations will be important to refine the orbital period. Because this system is an X-ray source, it is to be expected that magnetic braking may be a source of period change.

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IS THE MK STANDARD η UMA AN INCIPIENT Be STAR?

η UMa (HR 5191, HD 120315) is a well-studied B3 V star with measured v sin i of 226 km s^{-1} (Bernacca and Perinotto 1971). The star is suspected to be a low amplitude photometric variable, and is listed as number 6450 in the New Catalog of Suspected Variable Stars. η UMa is frequently used as a standard star for spectral classification. Morgan and Keenan (1973) establish η UMa as an "MK dagger type", a star whose spectrum has been carefully examined and is used to define the MK system.

Over the past four years we have obtained a number of observations of the Hα region of η UMa using the echelle spectrograph and Reticon or CCD detectors at Ritter Observatory and Kitt Peak National Observatory. These spectral observations had resolving power of 20,000 or 10,000, and the signal to noise ratio was generally 50-100:1. A log of these observations is given in Table 1.

Our initial observations of η UMa were obtained to test our detector and acquire a series of observations of MK standards, and the first observations from April and May of 1986 showed the expected symmetric, rotationally broadened profile (Figure 1). However, observations the following year showed an Hα profile that appeared to be slightly distorted and asymmetric (Figure 2). Though some of these observations were complicated by the presence

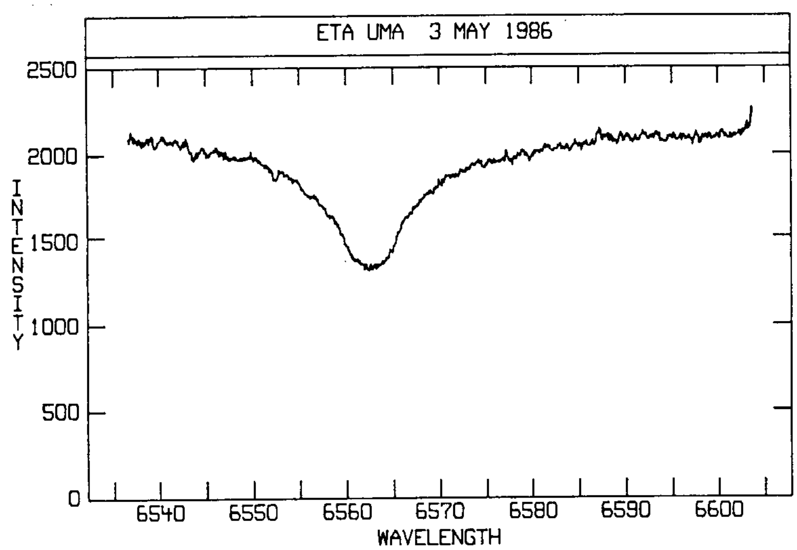

Figure 1: The Hα profile of η UMa in May 1986, obtained with an intensified Reticon detector at Ritter Observatory.

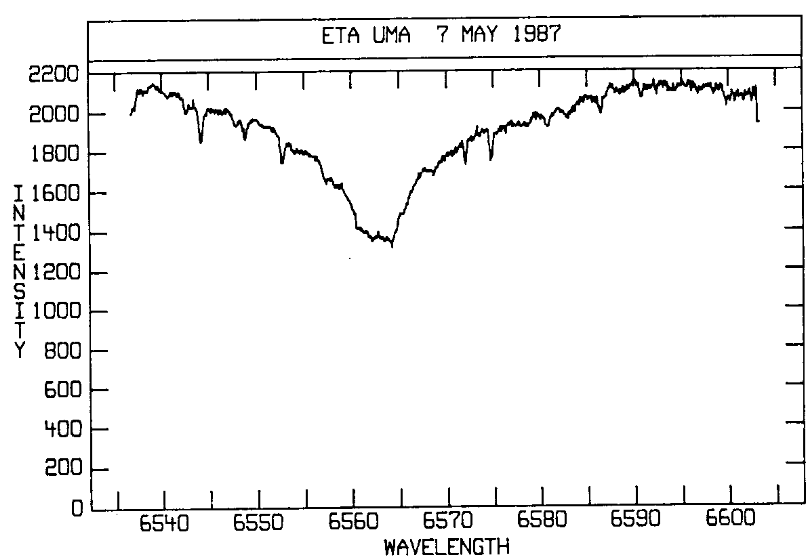

Figure 2: The Hα profile of η UMa in May 1987, showing a distorted and shallower line as compared with a year earlier.

of occasionally strong telluric water vapor lines, the asymmetry was present in scans from both Ritter and KPNO, bolstering our confidence that the effect was real. Additionally, the central

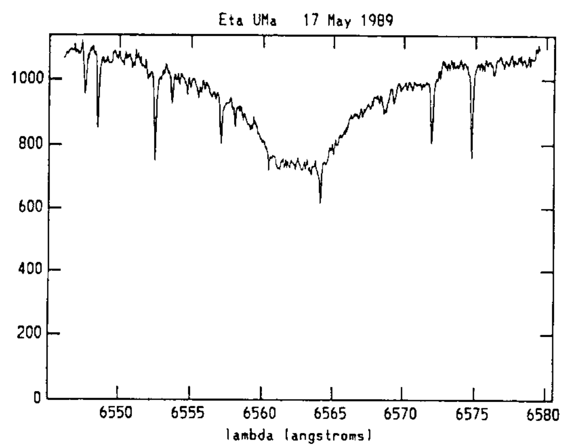

Figure 3: The Hα profile in May 1989, obtained with a CCD detector at Ritter Observatory. The line shows a shallow, flat-bottom profile and is presumably partly filled by emission.

Table 1 **Hα Observations of η UMa**

Date UT	Observatory/Detector	R(Hα)[1]
27 April 1986	Ritter/Reticon	0.628
3 May 1986	"	0.638
4 May 1986	"	0.640
3 June 1986	"	0.643
7 May 1987	"	0.663
23 May 1987	"	0.666
28 May 1987	KPNO/CCD	0.650
26 May 1988	Ritter/Reticon	0.646
8 June 1988	"	0.652
17 May 1989	Ritter/CCD	0.703

[1]Defined as the ratio of the central intensity of Hα to the continuum.

residual intensity of the Hα line, R(Hα), (Table 1) showed a slight increase from 1986 to 1987, as if the line were becoming slightly filled in by emission. This asymmetric profile persisted throughout 1988. Our most recent observation from May 1989 was obtained with our new CCD detector system at Ritter (Bopp *et al*. 1989) and showed an Hα line with a flat bottom (Figure 3), quite unlike the profile seen two years before. The residual intensity has increased again, suggesting a greater filling of the line by emission.

The profile variations that we have observed in the Hα line of η UMa are not unexpected if the star has weak and/or transient Be characteristics. Certainly the temperature and *v sin i* of η UMa make it a credible candidate for such activity. The behavior of η UMa may be reminiscent of that of Zeta Oph, an "ordinary" O9.5 star until 1973, when strong Hα emission unexpectedly appeared. Perhaps η UMa will surprise observers as well, and perhaps some small caution is appropriate before using it as a standard star.

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PHOTOMETRIC MULTIPERIODICITY OF THE Be STAR 120 TAURI

In the framework of our spectroscopic and photometric observations of Be stars, started on the beginning of eighties at the Brera-Merate Astronomical Observatory, we collected a rich harvest of photometric data of the star 120 Tauri (HR 1858). In our knowledge, there are very few papers devoted to the variability of this star: Hubert-Delplace and Hubert (1979) observed changes in emission lines during the period 1954-1975; Pavlovski and Bozic (1982) showed "large variations in continuum light, reaching about 0.1 mag. in V".

We measured 120 Tau in the period Jan. 23-Feb.15, 1989, using a digital photon-counting photometer attached to the 50 cm. reflector telescope of Merate Observatory. Comparison and check stars were HR 1860 and 121 Tauri respectively. We collected 581 and 201 values of Δm (in the sense $m_{HR1860}-m_{120Tauri}$) for y and β-wide filters. These photometric data have been analysed with a nonlinear least-squares period determination routine similar to the program PERDET (Breger, 1982).

Table 1 shows the results of this analysis: here the found frequencies ν, the oscillation amplitudes a and the phases φ, referred to T_0=7563.3703 J.D., are pointed out for y and β-wide filters and in order of decreasing amplitudes. Figs.1 and 2 represent the y and β-wide normal points (that is the averages of some Δm values) with the synthesized light curves obtained for the five frequencies shown in Table 1.

We can preliminary point out that:

1. taking into account the data errors of Table 1, the two sets of frequencies for y and β-wide filters can be considered as coincident;

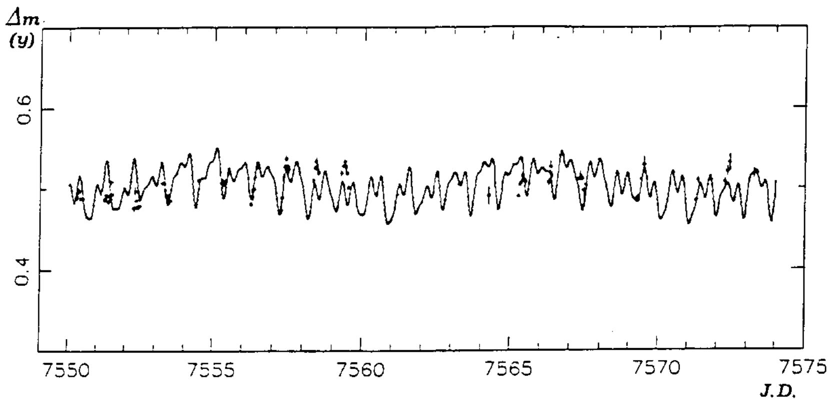

Figure 1

TABLE 1

β-wide FILTER

	ν (c/d)	a (mag)	φ
f_1	1.094 ± .005	0.023 ± .004	-2.60 ± .16
f_2	0.104 ± .005	0.022 ± .004	0.27 ± .15
f_3	2.143 ± .006	0.013 ± .003	-0.73 ± .23
f_4	3.122 ± .009	0.010 ± .003	0.38 ± .28
f_5	0.772 ± .009	0.004 ± .002	2.12 ± .37

y FILTER

	ν (c/d)	a (mag)	φ
f_1	1.085 ± .002	0.017 ± .002	-2.62 ± .12
f_2	0.093 ± .002	0.016 ± .002	-0.13 ± .12
f_3	2.156 ± .003	0.013 ± .001	-0.86 ± .11
f_4	3.131 ± .004	0.008 ± .001	0.07 ± .21
f_5	0.775 ± .002	0.008 ± .001	2.16 ± .11

2. against every appearance, we think that the four frequencies f_1, f_2, f_3 and f_4 are not due to aliasing; in fact: a) if we leave out even only one of them, the fit of the light curves gets worse remarkably; b) taking into account the error bars, we can not consider their differences as integers;

3. the great variation reported by Pavlovski and Bozic (1982) in V light is not confirmed;

4. the found multiperiodicity is consistent with the presence of multimodal non-radial pulsations: the range of frequencies

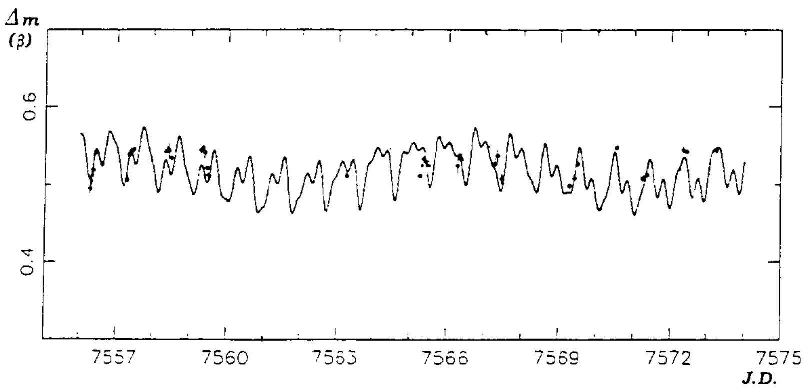

Figure 2

observed is reminiscent of the 53 Per variable stars which are surely non-radial pulsators (Smith, 1980);

5. an international photometric campaign on 120 Tau, with the aim to confirm these results, should be welcome.

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MINIMA AND THE PERIOD OF THE ECLIPSING BINARY DF HYDRAE

Minima of the eclipsing binary star DF Hya were published by Whitney(1959), by Koch et al.(1962) and by Hoffmann(1983), respectively. Whitney(1959) derived the elements:

$$\text{Min.} = \text{JD hel.}2431138.231 + 0\overset{d}{.}3305990E.$$

Hoffmann(1983) revised the period of this system and he suggested that the period of DF Hya be 0.3302005 days.

In 1985 photoelectric observations of DF Hya were carried out in B and V with the integrating photometer at the 100 cm telescope of Yunnan Observatory. The minima of DF Hya were determined from our observations by the quadratic fit method.

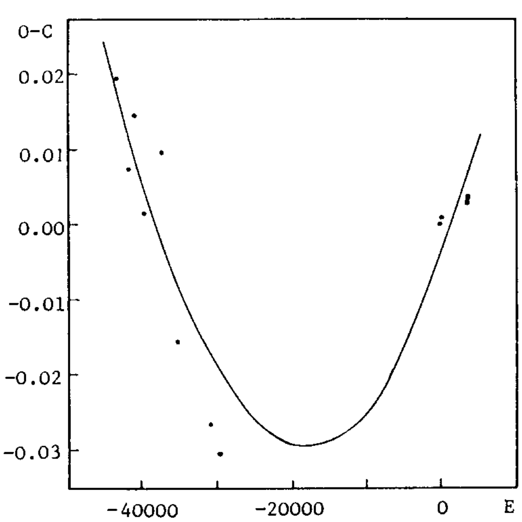

Fig. 1 o-c residuals of DF Hya

The list below contains seven minima obtained by Whitney (1959), one minimum given by Koch et al.(1962), two minima determined by Hoffmann(1983) and four minima derived from our observations. The columns contain: heliocentric time of minimum, phase of minimum, (o-c)I, (o-c)II and references.

Min.JD hel. 2400000+	phase	(o-c)I	(o-c)II	References
30677.048	I	-0.098	+0.020	Whitney (1959)
31204.677	I	-0.105	+0.008	Whitney (1959)
31497.927	I	-0.096	+0.015	Whitney (1959)
31937.615	I	-0.105	+0.002	Whitney (1959)
32675.856	I	-0.092	+0.010	Whitney (1959)
33382.658	I	-0.110	-0.015	Whitney (1959)
34847.708	II	-0.110	-0.026	Koch et al.(1962)
35242.608	I	-0.110	-0.030	Whitney (1959)
45021.3400	II	-0.0007	+0.0002	Hoffmann (1983)
45021.5060	I	0	+0.0009	Hoffmann (1983)
46115.1385	I	+0.0110	+0.0030	present paper
46115.3043	II	+0.0115	+0.0035	present paper
46117.1235	I	+0.0124	+0.0044	present paper
46117.2886	II	+0.0122	+0.0042	present paper

The values of (o-c)I were obtained by the following elements:

$$\text{Min.}=\text{JD hel.}2445021.5060 + 0^{d}.3305990E.$$

The values of (o-c)II were obtained according to the revised elements:

$$\text{Min.}=\text{JDhel.}2445021.5051 + 0^{d}.33060169E.$$

The accumulated effect of the o-c illustrated in figure 1 shows that the period of DF Hya was increasing in the years 1959 – 1985 and that the plot of o-c residuals can be well approximated with a parabola. Visual and photographic minima were assigned a weight of one while photoelectric minima were assigned a weight of five. Using the weighted least-squares method, a new ephemeris was derived as follows:

$$\text{Min. I} = \text{JD hel.}2445021.5009+0^{d}.33060443E+7^{d}.5*10^{-11}E^{2}.$$

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PHOTOELECTRIC PHOTOMETRY RESULTS OF THE ALGOL-TYPE ECLIPSING BINARY SYSTEM RS VULPECULAE

RS Vulpeculae is an Algol-type variable consisting of a middle to late B-type main sequence primary and a slightly larger secondary whose spectrum is difficult to measure (Payne-Gaposchkin and Gaposchkin, 1938). Previous investigators (Popper 1957, Hutchings and Hill 1971) have classified the the secondary as early as B9 to as late as G2. The secondary eclipse is slightly displaced toward primary eclipse (Dugan 1923a) and various relative orbital eccentricities have been reported, most of them near 0.05 (Plaskett 1922, Sahade and Struve 1945). Baglow's (1952) solutions of earlier light curves indicate the primary eclipse is an occultation, with mid-eclipse being only partial. Dugan (1923b) found the duration of the primary eclipse to be on the order of 15 hours out of the 4.5 day period.

The observations were made on 43 different nights from 1976 to 1981 using an uncooled 1P21 photometer, with standard BV filters, mated to the f/15 20-inch Cassegrain of the Lehigh Valley Astronomical Society, Allentown, PA. Variable readings were flanked by comparison star and sky readings. Once or twice a night readings were also taken of the check star. There were no transformations made to the standard system, so all results are instrumental. However, they closely match published values of visual magnitudes. The comparison and check stars used were HD 180889 and HD 180811, respectively. For the first nine nights HD 180811 was used as the comparison and HD 180889 was used as the check; data reduction methods took into account this switch.

In the plotted light curves the values of the deltas are in the sense of variable - comparison, taking into account differential extinction and color corrections. All sky and comparison readings were interpolated in the data reduction program written by the author. Heliocentric phase was computed using the epoch (Scarfe, 1973):

$$\text{J.D. Hel Min} = 24432808.257 + 4^{d}.477635E$$

The most obvious feature of the light curves is the large primary and shallow secondary amplitudes, indicating widely separated components based on current EA variable theory. In the visual light curve (Figure 1) the primary amplitude A1 is 0.97 magnitude, and the secondary A2 is 0.05 magnitude. These numbers are close to the A1 = 0.965 and A2 = 0.082 found by Dugan (1923a) but are slightly less than the A1 = 1.00 and A2 = 0.11 obtained by Keskin (1985). Primary and

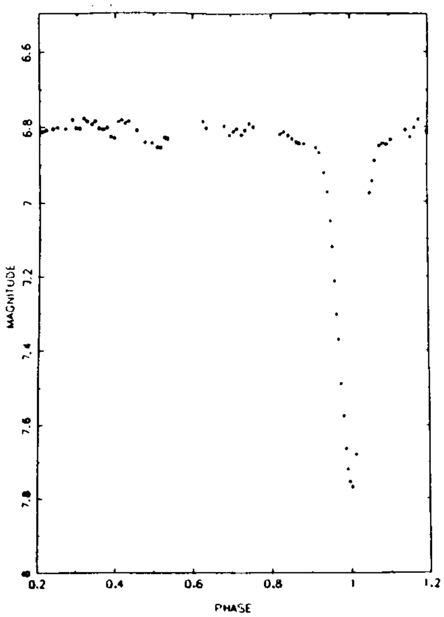

Figure 1 RS Vul visual

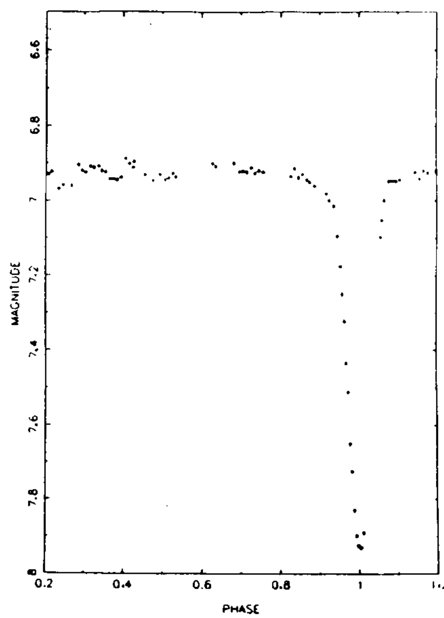

Figure 2 RS Vul blue

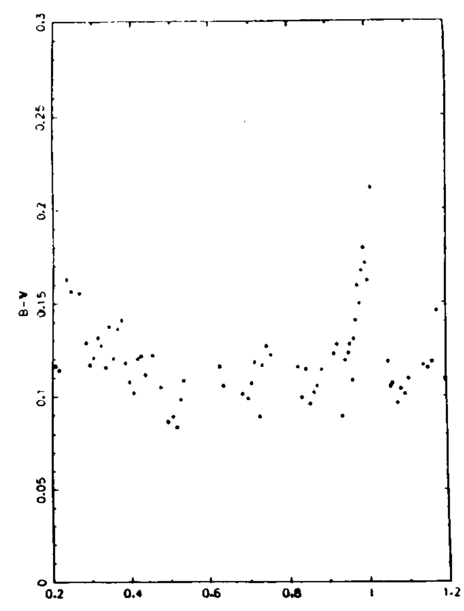

Figure 3 RS Vul color index

secondary amplitudes in blue light curve (Figure 2) were measured at A1 = 1.00 and A2 = 0.02 magnitude, again less than Keskin's values (A1 = 1.07, A2 = 0.10). In both cases, however, it can be seen that the blue primary amplitude is slightly greater than the visual primary amplitude.

The observed amplitudes are consistent with the B8 main sequence primary being the brighter component of the system as reported earlier (Dugan 1923b Lb = .804) and during primary eclipse most of its radiation being blocked off by the slightly larger subgiant secondary. This would indicate that primary eclipse is an occultation. Supporting this is the color index curve (Figure 3); leading up to primary eclipse (phase = 1.0) the color index becomes progressingly larger, indicating that the radiation from the hotter bluer star is being blocked by the secondary.

As seen from the visual curve the secondary is slightly displaced toward the primary by 0.01 in phase, or 1.0746 hours (0.045 days). This value is comparable to previous measurements of 0.03 to 0.04 days (Baglow 1952). The displaced secondary implies an elliptical orbit. The length of the primary eclipse seems to be slightly longer than 15 hours, in agreement with earlier measurements by Dugan. The rounded minimum implies a partial eclipse, suggesting a relatively highly inclined orbit. Previous estimates (Payne-Gaposchkin and Gaposchkin 1938, Baglow 1952) have inclinations of 78 and 79 degrees.

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Hα OBSERVATIONS OF THE RS CVN BINARY HR 7275 (V1762 CYG)

HR 7275 (V1762 Cyg, HD 179094) is an RS CVn binary with an orbital period of 28.6 days. Extensive photometry of HR 7275 (Seeds and Nations 1986, Nations and Seeds 1986) shows the star to have a highly variable amplitude, with changes evident on a timescale of one orbital cycle or less. An average photometric period of 27.78 days has been derived, but this value shows variability as well. A recent spectroscopic study of the Hα profile in HR 7275 by Eker (1989) reports that maximum emission occurred during photometric minimum for one orbital cycle in June/July 1984.

As part of a spectroscopic monitoring program of active chromosphere stars at Ritter Observatory, we observed HR 7275 in 1987 and 1988. We obtained 20 Reticon scans of the Hα region with spectral resolution 0.3 Å and signal to noise ratio about 50:1. On all the scans, Hα is seen as an absorption feature. The equivalent width (EW) of the feature is always lower (weaker) than what is seen in ordinary, inactive K1 III stars, and is variable by nearly a factor of two, indicating that the line is partly filled by variable emission. In contrast to the results reported by Eker (1989), we find no correlation of Hα EW with orbital phase (Figure 1). Since our observations extend over several rotational

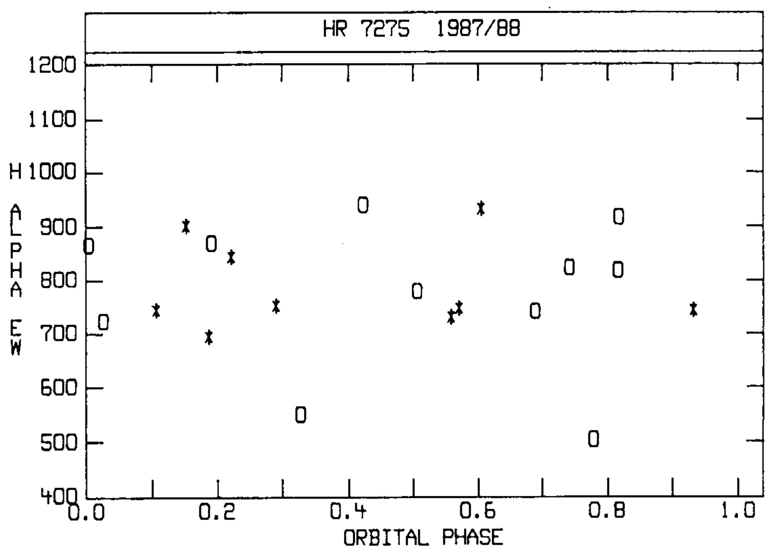

Figure 1: The Hα EW of HR 7275 in mÅ plotted versus orbital phase (Eker 1989). Data from 1987 are indicated by open circles and from 1988 by asterisks.

TABLE 1

Radial Velocities of HR 7275

HJD - 2,447,000	V_r (km s^{-1})
332.8141	-35.5
343.7598	+32.9
344.7417	+37.4
345.7522	+41.8
347.7168	+43.7
355.7221	-12.8
356.7318	-17.9
394.6311	-13.1
399.6491	+27.4
403.5994	+45.1
412.5718	-8.3
430.5464	+40.7

and orbital cycles, this presumably is a confirmation of the photometric behavior that indicates that activity on HR 7275 is strongly variable on timescales less than a month.

Examination of Figure 1 shows that the Hα feature usually has an EW of approximately 800 mÅ, with variations of ±10%. However, two observations from 1987, at phases 0.33 and 0.78, show an EW of only about 500 mÅ. This abrupt weakening of the line suggests a flare-like event as the cause.

Finally, Reticon data obtained during 1988 was used to derive radial velocities by cross-correlation with α Boo (Bopp and Dempsey 1989). The resulting velocities (with precision 1 km s^{-1} or better) are listed in Table 1. A least squares orbital solution using these data, along with the velocity measures given by Young (1944) and Eker (1989), confirm Eker's revised orbital elements: the orbit is found to be circular with a period of 28.5895 days.

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DETECTION OF NEW SHORT PERIOD OSCILLATIONS IN PG 1711+336 (V795 HER)

Long period light variations of the cataclysmic variable PG 1711+336 (V795 Her) were first noticed by Mironov et al.(1983a,b) who reported a photometric period of 0.115883 day for the system. Baidak et al., (1985) improved the ephemeris and refined the period to 0.114488 day (2.75 hour). If this period is interpreted as the orbital period, then the system is unique in that its orbital period falls within the period gap in the distribution of cataclysmic variables versus their orbital periods. The detection by Thorstensen (1986) of a spectroscopic period of 14.8 hours in the radial velocity data using H_{α} emission line of the system coupled with the lack of any evidence of the 2.75 hour period in the power spectrum of the radial velocity data has further deepened the mystery surrounding this object. In an attempt to study the time variabilities in the system, we carried out high speed photometric observations of the object.

The observations were carried out with the 1 meter telescope of the UP State Observatory at Nainital, and our two star photometer (Venkata Rao et al., 1989) on April 7 and April 10, 1989. PG 1711+336 was observed in white light in the main channel using an uncooled RCA 8850 PMT.

On April 7, we could collect only about 3600s of data. The fast variability of the star was evident during this run. On April 10, we collected about 9000s of data with an integration time of 5s.

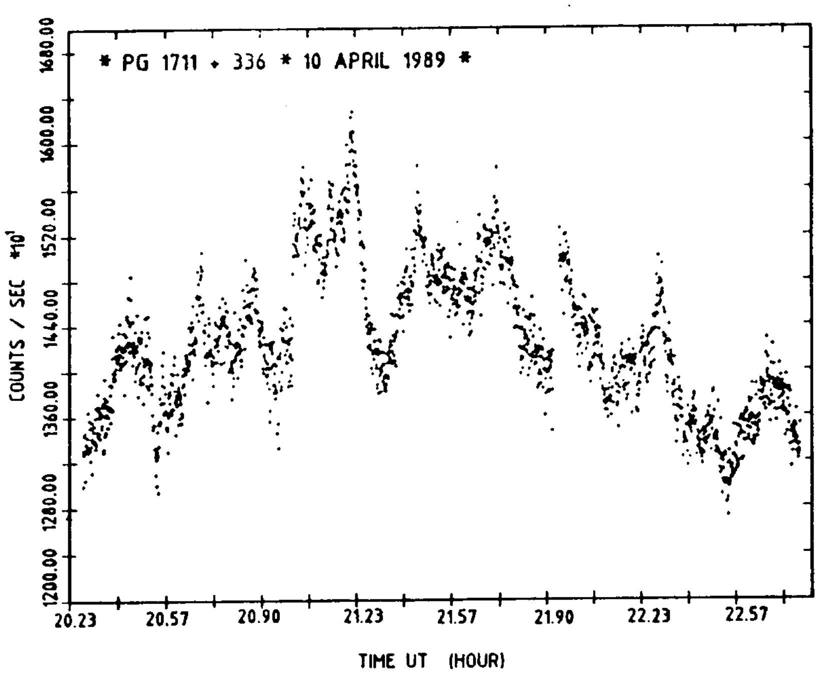

Figure 1

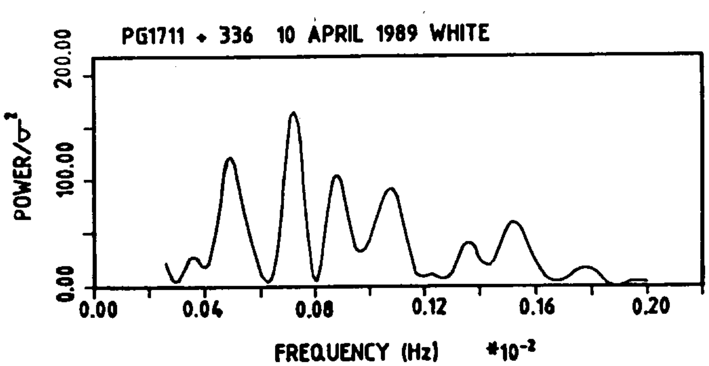

Figure 2

Fig.1 shows the sky subtracted light curve of the star on April 10. The 2.75 hour photometric variation is evident in the data. The maximum of the light curve occurs at about 21.23 hour UT. The phase of this maximum is 0.3 when calculated using the ephemeris of Baidak et al. This agrees well with the phase of the maximum of their folded light curve.

The short period, structured oscillations of the star within the primary 2.75 hour period are unmistakably evident in our data shown in fig 1 as well as in our April 7, 1989 data (not shown here). Also we were surprised to see similar short period variations of the star in one of our earlier runs on May 12, 1986 taken with a single star photometer under poor sky conditions.

Visual inspection of the raw light curve in fig. 1 while indicating the presence of more than one period, seems to reveal a period around 1400s. We have subjected the April 10, 1989 data to a DFT analysis after removing the clear 2.75 hour variation in it. The resulting normalised power spectrum is shown in fig.2. It shows a maximum around a period of 1389s and also a next significant power around 2040s. The width of the peak can be attributed to the limited resolution due to the finite data length. The power spectrum also reveals other peaks around 1136s, 935s, 735s, 658s and 562s. Eventhough the power around 562s is rather low,the power spectrum of our April 7, 1989 data had the maximum peak centred around this value. At present with the existing stretch of data we are not in a position to confidently pinpoint which of these peaks represent genuine periods.

As a check on the consistency of the 1389s period, we decided to split the data into two sets. A demarkation that divides the total data into two sets is provided by the relatively large dip in the data lasting about 10 minutes from 21.23 UT to 21.48 UT. This remarkable dip does not show the flickers present in the rest of the data. The dip also demarkates the data into an ascending and descending portion of the 2.75 hour variation. We therefore subjected the portion of the data upto 21.33 UT and the rest of the data separately to a DFT analysis. The excess power around 1389s was seen only in the first portion of the data. Also our data of 7 April did not show any excess power at this period on subjecting it to a DFT analysis thereby indicating that the 1389s period may be quasi-periodic in nature.

In conclusion, apart from confirming the 2.75 hour photometric variability (most probably due to orbital variations) our detection of very large amplitude (~0.2 magnitude), short period (tens of minutes) oscillations of the system makes PG 1711+336 an extremely interesting object for further detailed investigations.

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THE PHOTOMETRIC VARIABILITY (?) OF PHI CASSIOPEIAE

Phi Cassiopeiae (HR 382, HD 7927, F0Ia, V = 5.00) is a bright, luminous supergiant with a long history of suspected velocity variability. Adams et al. (1924) reported a total scatter of 10 km/s based on 13 spectra. Abt (1970) lists 20 velocities obtained at Mount Wilson in late 1929 which suggest that this star varies in velocity by 10 km/s on a time scale of about 40 days. There are, however, some large changes in velocity from night to night, which cast some doubt on this result. Abt (1957) himself observed a monotonic increase of 4 km/s in the velocity of this star over 10 nights, which suggests a time scale of a month or two. Arellano Ferro et al. (1988) recently reported variations in velocity of 6 km/s. There was no indication of a strict period longer than 15 days, though irregular variability on a longer time scale was not ruled out.

No detailed study of the photometric variability of this star has been carried out. It is not listed as a confirmed or suspected variable in the Yale Catalogue of Bright Stars. The 14 photometric observations by Moffett and Barnes (1979) show no unusual scatter. Arellano Ferro et al. (1988) obtained multi-colour photometry over 20 days, and found scatter of up to $0\overset{m}{.}06$, but they found similar scatter in the comparison stars.

Rosenzweig (1987, 1988) has carried out a detailed study of the energy distribution of this star, and has deduced the following parameters: $T_e = 7200 \pm 100$ K; log g = 0.4 ± 0.1; R = $263 \pm 34\ R_\odot$. These parameters imply a mass of $6.3 \pm 3.6\ m_\odot$ and a bolometric magnitude of -8.3 ± 0.3, which is consistent with the value derived by assuming that the star is a member of NGC 457. This membership, however, is in some doubt (Sowell, 1987).

The part of the H-R diagram occupied by ϕ Cas is characterized by average peak-to-peak photometric variations of $0\overset{m}{.}05$ and quasi-periods of 50 to 100 days (Maeder, 1980; Lovy et al., 1984). We have therefore been making sporadic photometric observations of ϕ Cas for many years, at Toronto (Percy and Welch, 1981) and Kitt Peak. Inspired by the report of Arellano Ferro et al. (1988), we used the Automatic Photoelectric Telescope (APT) Service

(Genet et al., 1987) to make intensive UBV observations of this star for several months in 1988-89. The sporadic observations are listed in Table I, which includes the Toronto observations (Percy and Welch, 1981) for completeness. Observations were corrected for extinction and transformation in the usual way. In particular, the procedures used by the APT Service are described in detail by Genet et al. (1987). The comparison and check star were HR 326 (HD 6676, B8V, V = 5.79) and HR 442 (HD 9408, G9III, V = 4.71) respectively; these were the comparison stars used by Arellano Ferro et al. (1988).

Table I. Photometric Observations of Phi Cassiopeiae

Julian Date 2440000 +	Magnitude	V/y	Observatory
4088.734	4.994	V	Toronto
4094.804	5.022	V	Toronto
4101.734	5.006	V	Toronto
4116.731	5.014	V	Toronto
4796.828	5.009	V	Kitt Peak
4918.733	4.982	y	Kitt Peak
4919.653	4.986	y	Kitt Peak
4920.863	4.989	y	Kitt Peak
4921.650	4.989	y	Kitt Peak
4924.640	4.985	y	Kitt Peak
4925.639	4.991	y	Kitt Peak
5715.667	5.001	V	Kitt Peak
5716.583	5.019	V	Kitt Peak

The APT observations are shown in Figure 1. There is no evidence for any significant variability on a time scale of a few days, either in Table I or Figure 1. Some of the possible variability in Table I is due to the fact that some observations were made through a V filter and others through a (Strömgren) y filter. There are, however, apparent variations in Figure 1 on a time scale of 50 to greater than 100 days, with amplitudes in V, B and U of $0^m.015$, $0^m.020$ and $0^m.030$ respectively. It is not possible to be specific about the time scale because the variations are small and irregular, and the time span of the observations is only a hundred days.

Some of the variability could be instrumental in nature. The differential magnitude of the check star shows no long-term variations larger than $0^m.005$ in V and $0^m.010$ in B. There is, however, a systematic variation of $0^m.030$ in U, which is similar to that seen in ϕ Cas. Expressed differently: if the magnitude

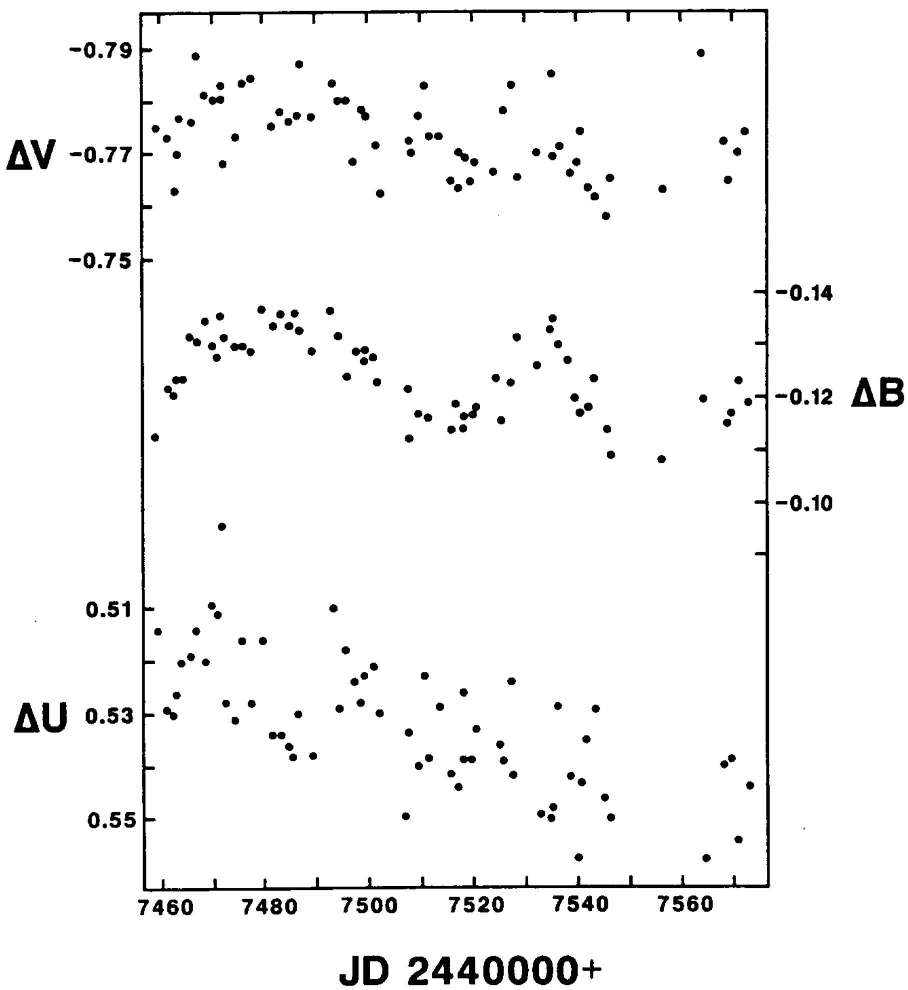

Figure 1. Photometric observations of Phi Cassiopeiae obtained in UBV with the Automatic Photoelectric Telescope Service telescope on Mt. Hopkins in Arizona. The comparison star is HR 326 (HD 6676, B8V, V = 5.79). The variations in V and B are probably real, but the variations in U are probably instrumental.

of the variable is expressed relative to the check star (which is more similar in colour), then the small variations in V and B persist, but those in U are lost in the noise.

Whether or not the variations are real, it is remarkable that they are so small. Other stars as luminous as ϕ Cas show more pronounced variations. Furthermore: if ϕ Cas were a Cepheid-like variable, then one might expect the velocity and light amplitudes to be related by: $2K = 54\ \Delta V = 35\ \Delta B$ km/s (Allen, 1973; Fernie, private communication). A velocity amplitude of 6 km/s (Arellano Ferro et al., 1988) would correspond to light amplitudes of $\Delta V = 0^{m}_{.}11$ and $\Delta B = 0^{m}_{.}17$, which are much larger than those observed. One must conclude that, either the velocity variations are not real, or ϕ Cas is not a Cepheid-like variable. Indeed, velocity variations have been found in other supergiants, such as Deneb, and ascribed to non-radial pulsation.

Any future photometric monitoring of ϕ Cas should be done carefully, on a long time scale, using comparison stars more suitable than the ones used in this paper.

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EPOCHS OF MINIMUM LIGHT FOR WY CANCRI, AM LEONIS, AND RR LEPORIS

An Optec photometer was used on the 41cm David Irons telescope at the observatory of the Charlotte Amateur Astronomers Club. Differential V measurements were made. B measurements were not attempted because B curves had much more scatter in previous observations. Clear (unfiltered) measurements proved to be unusable due to the contamination of light from passive red lighting and scattered light. V curves were used to find epochs of minimum light. The epochs are given as:

Star	Hel. J.D.	Method	E	(O-C)
WY Cancri	2447567.6998	Hertz.	1859	-0.0004
AM Leonis	2447567.9076	Hertz.	3875	-0.0005
	2447569.7349	Hertz.	3880	-0.0021
RR Leporis	2447472.7736	BIS.	3546	+0.0029

where Hertz. signifies the Hertzsprung method and BIS. stands for the bisection of chords technique.

The residuals for WY Cancri were computed using the light elements of Mullis and Faulkner (1988). Mullis and Faulkner presented two times of minimum light and a new set of light elements that indicated that the period had changed. The fact that the residual for WY Cancri presented here is small supports the period change noted by Mullis and Faulkner. A refined set of light elements was obtained by combining this epoch of minimum light with those of Mullis and Faulkner (1988) and Faulkner (1986):

$$\text{H.J.D. MIN.I} = \underset{\pm 1\ \text{p.e.}}{2446025.9019} + \underset{\pm 10\ \text{p.e.}}{0^{d}.82936960}\text{E.}$$

The epochs of minimum light used to get the above light elements, as well as the residuals, are given in the next table.

Hel. J.D.	E	(O-C)
2446025.9017	0	-0.0002
2446143.6726	142	+0.0002
2447202.7774	1419	0.0000
2447241.7580	1466	+0.0002
2447567.6998	1859	-0.0002

The residuals for AM Leonis were computed from the light elements of Rafert and Twigg (1980). It should be noted that the eclipse curve from which the second epoch of minimum light was obtained suffered from an asymmetry, particularly on the ascending branch. This caused the determined epoch to be slightly early, giving rise to its more negative residual. Since the residuals of the epochs presented here are relatively small, it can be concluded that the period of AM Leonis has remained constant since the observations of Rafert and Twigg.

The residual for RR Leporis was computed based on the light elements of Bookmyer *et al* (1986). Because the residual was about 4 minutes, a new set of light elements was obtained by combining this epoch of minimum light with those of Bookmyer *et al*:

$$\text{H.J.D. MIN.I} = \underset{\pm 5 \text{ p.e.}}{2444226.6627} + \underset{\pm 26 \text{ p.e.}}{0^{\text{d}}.91542890}E$$

Note that this period is 0.088 seconds shorter than that of Bookmyer *et al*. The epochs of minimum light used to get the above light elements, as well as the residuals, are given below.

Hel. J.D.	E	(O-C)
2444226.6635	0	+0.0008
2444231.6968	6	-0.0008
2447472.7736	3546	0.0000

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PHOTOELECTRIC MINIMA OF ECLIPSING BINARIES

The following table gives photoelectric minima obtained during the years 1987/88 at the Ege University Observatory, Izmir (Turkey) and the Nürnberg Observatory (Germany). Minima of eclipsing binaries observed at both observatories 1960-1986 were published in Astr. Nachr. 288, 69 (1964); 289, 191 (1966); 291, 111 (1968); I.B.V.S. No. 456 (1970), 530 (1971), 647 (1972), 937 (1974), 1053 (1975), 1163 (1976), 1358 (1977), 1449 (1978), 1924 (1981), 2189 (1982), 2385 (1983), 2793 (1985) and 3078 (1987).

The table gives the heliocentric minima, three different O-C's, the type of filter, UBV, the abbreviations of the names of the observers and the type of the instruments used (Izmir: 48 cm Cassegrain, Nürnberg: 34 cm Cassegrain, both with phototube 1P21).

Abbreviations of the observer's names:

Bk = B. Kilinc
Ca = M. C. Akan
Fr = P. Friedrich
Gd = N. Güdür
Gl = Ö. Gülmen
Gr = R. Gröbel
Hb = H. Baysal
Ib = C. Ibanoglu
Ls = G. Lichtschlag
Sk = S. Skaberna
Sn = S. Evren
Sr = C. Sezer
St = S. Strecker
Tn = Z. Tunca
Va = V. Keskin
Wk = M. Wieck
Wu = E. Wunder
Zk = Z. Eker

Remarks:

O-C (I): GCVS, Moscow 1985 - 1987.

O-C (II): SAC 60, Krakow 1988.

O-C (III): **BX And:** $2446359.5597+0^{d}.61011255 \cdot E$ (Z. Eker, N. Güdür, Ö. Gülmen, V. Keskin, B. Kilinc, C. Sezer, IBVS 3266, 1988)

V367 Cyg: $2434266.337+18^{d}.59773 \cdot E$ (C. Akan, Astrophys. Space Sci., 135,157, 1987)

Table

Star	Min. hel.	O-C (I)		O-C (II)		O-C (III)	Filt.	Observer	Instr.	Rem.
	244									
RT And	7016.4610	$-0^d.0007$		$-0^d.0031$			V	Wu	34	
BX And	7040.4438	-0.0111	=	-0.0111		$-0^d.0015$	B, V	Ca/Gd	48	
	7043.4947	-0.0108	=	-0.0108		-0.0012	B, V	Sr/Zk	48	
	7062.4079	-0.0111	=	-0.0111		-0.0015	B, V	Sr/Zk	48	
	7063.3246	-0.0096	=	-0.0096		+0.0001	B, V	Gl/Zk	48	Min II
	7439.460:	-0.010:	=	-0.010:		+0.001:	B, V	Bk/Gd/Gl	48	
	7440.3766	-0.0089	=	-0.0089		+0.0025	B, V	Sr/Zk	48	Min II
	7455.3223	-0.0110	=	-0.0110		+0.0005	B, V	Va/Zk	48	
OO Aql	6976.4984	-0.0007	=	-0.0007			V	Wu	34	Min II
	7263.5923	$-0^d.0025$	=	$-0^d.0025$			V	Wu	34	
	7326.4345	-0.0020	=	-0.0020			V	Wk/Wu	34	
SS Ari	7206.253:	-0.071:		-0.004:			V	Ls/Sk/Wu	34	
	7511.3531	-0.0752		-0.0018			V	Fr/St/Wu	34	Min II
TZ Boo	6909.391	-0.057	=	-0.057			V	Ls/Gr	34	
	7206.5461	-0.0636	=	-0.0636			V	Gr/Ls/Wu	34	
44 i Boo	6869.415	+0.014		-0.004			V	Ls/Wu	34	Min II
	6924.456	+0.019		0.000			V	Gr	34	
TW Cas	7467.4358:	-0.0058:	=	-0.0058:			V	Wu	34	
V367 Cyg	7359.056	-0.182		-0.003		-0.083	B, V	Ib/Sn/Tn	48	
V1073 Cyg	7326.4385	-0.0301		-0.0041	=	-0.0041	B, V	Sr/Zk	48	
	7348.4413	-0.0314		-0.0052	=	-0.0052	B, V	Bk/Gd	48	
	7350.4067	-0.0306		-0.0045	=	-0.0045	B, V	Hb/Sr	48	Min II
	7357.482:	-0.028:		-0.002:	=	-0.002:	B, V	Bk/Sr	48	Min II
	7377.5175	-0.0320		-0.0057	=	-0.0057	B, V	Sr/Zk	48	
V1425 Cyg	6692.3144	+0.0043	=	+0.0043		-0.0009	B, V	Gl/Zk	48	Min II
	6988.507	+0.007	=	+0.007			V	Ls/Sk	34	
	7035.4706	+0.0065	=	+0.0065		+0.0011	B, V	Gl/Zk	48	Min II
	7047.3698	+0.0080	=	+0.0080		+0.0026	B, V	Gd/Zk	48	
TZ Dra	7071.482	-0.004		-0.002			V	Ls/Sk/Wu	34	
CV Dra	7276.405:					-0.004:	V	Wk/Wu	34	
AK Her	7294.4624	-0.0013		-0.0129			V	Ls	34	
V450 Her	7239.5911	-0.2438		+0.0236			V	Gr	34	

Star	Min. hel.	O-C (I)	O-C (II)	O-C (III)	Filt.	Observer	Instr.	Rem.
	244							
RT Lac	7004.3813	$-0\overset{d}{.}0423$	$-0\overset{d}{.}0659$	$-0\overset{d}{.}0376$	B	Sn/Va	48	
	7004.4026	-0.0210	-0.0446	-0.0163	V	Sn/Va	48	
	7065.2953	-0.0157	-0.0399	-0.0107	B	Ib	48	
	7065.2911	-0.0199	-0.0441	-0.0149	V	Ib	48	
	7354.4996	-0.0266	-0.0537	-0.0201	B	Ca/Sn	48	
	7354.4980	-0.0282	-0.0553	-0.0217	V	Ca/Sn	48	
	7387.4686	-0.0382	-0.0737	-0.0316	B	Ca/Sn	48	Min II
	7387.4755	-0.0313	-0.0668	-0.0247	V	Ca/Sn	48	Min II
	7425.5274	-0.0340	-0.0619	-0.0272	B	Ca/Tn	48	
	7425.5279	-0.0335	-0.0614	-0.0267	V	Ca/Tn	48	
XY Leo	7275.4007	+0.0114 =	+0.0114		V	Ls/Sk	34	
XZ Leo	6910.4568	+0.0026	+0.0069		V	Ls/Sk/Wu	34	
AM Leo	6899.426:	+0.007: =	+0.007:		V	Ls/Wu	34	
FL Lyr	6925.4551	-0.0024	+0.0057		V	Ls/Wu	34	
U Peg	7070.3528	-0.0329	-0.0302		V	Ls/Sk/Wu	34	
RW Per	7207.426:	+0.013:	-0.017:		V	Gr/Ls/Wu	34	
β Per	7069.445	+0.014	+0.012		V	Wu	34	
UV Psc	7094.3872	-0.0047 =	-0.0047	-0.0021	B	Ca/Sn	48	
	7094.3877	-0.0042 =	-0.0042	-0.0016	V	Ca/Sn	48	
	7410.3932	-0.0034 =	-0.0034	-0.0006	B	Ca/Sn	48	
	7410.3956	-0.0010 =	-0.0010	+0.0018	V	Ca/Sn	48	
	7434.5021	-0.0039 =	-0.0039	-0.0010	B, V	Ca/Va	48	
V471 Tau	7064.39720	+0.00068		+0.00066	B	Ca/Sn	48	
	7065.43965	+0.00077		+0.00075	B	Ib	48	
	7066.48180	+0.00055		+0.00053	B	Tn	48	
	7448.50870	+0.00031		+0.00029	B	Ca/Ib	48	
V781 Tau	7206.436:	-0.004:			V	Gr/Sk	34	
W UMa	6828.3678	-0.0061 =	0.0061		V	Ls/Wu	34	
AG Vir	7262.3659	+0.0033	+0.0186		V	Wu	34	Min II
BD +13°4708	7385.3933			+0.0020	B	Ca/Va	48	
	7385.3975			+0.0062	V	Ca/Va	48	

V1073 Cyg: $2444502.8652+0^{d}.7858551\cdot E$ (Z. Aslan, T. J. Herczeg, IBVS 2478, 1984)

V1425 Cyg: $2440400.9457+1^{d}.2523877\cdot E$ (Z. Eker, N. Güdür, Ö. Gülmen, V. Keskin, C. Sezer, Astrophys. Space Sci., 146,283, 1988)

CV Dra: $2447305.437+0^{d}.617617\cdot E$ (F. Agerer, O. Lichtenknecker, IBVS 3213, 1988)

RT Lac: $2444873.3648+5^{d}.0739496\cdot E-2^{d}.7\cdot 10^{-8}\cdot E^2$ (A. Y. Ertan, S. Evren, C. Ibanoglu, O. Tümer, Z. Tunca, Astrophys. Space Sci., 93,431, 1983)

UV Psc: $2444932.2985+0^{d}.86104771\cdot E$ (C. Ibanoglu, Astrophys. Space Sci., 139,139, 1987)

V471 Tau: $2440610.06614+0^{d}.52118301\cdot E$ (S. Evren, C. Ibanoglu, IBVS 2573, 1984)

BD +13°4708: $2446730.18247+0^{d}.7272018\cdot E$ (R. L. Walker, IBVS 3160, 1988)

The (O-C)'s for secondary minima (Min II) were calculated on the supposition, that they are symmetric between primary minima (if no special data are given).

The sign = between O-C (I) and O-C (II) indicates that the elements (I) and (II) are equal.

The sign: means that the time of minimum (last decimal) is uncertain.

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B AND V OBSERVATIONS OF V728 HERCULIS
AND A CALL FOR TIMINGS OF MINIMUM LIGHT

The short period eclipsing binary system V728 Her (SVS 2086) was discovered by Kurochkin (1977). Ciardo et al. (1985) published photoelectric observations and one epoch of minimum light. An additional time of minimum light was determined by Faulkner (1986). Nelson et al. (1988) reported that they obtained both complete B,V, I light curves and spectroscopic observations. They determined a spectral type of F3 for this eleventh magnitude system, and three times of minimum light. In the same year, Agerer et al. (1988) published the first complete light curves for V728 Her and presented four photoelectric epochs of minimum light along with a period study. They also determined least square ephemerides and astrometrically determined its coordinates.

The present observations were made on 10, 12, 13 and 15 June, 1988. These were taken about a month before the observations of Agerer et al. (1988). At that time, we had no knowledge that the binary was under current study by other research groups. The 0.6-m Morgan F/13.5 reflector at Lowell Observatory in Flagstaff, Arizona was used with standard U,B,V filters and a thermoelectrically cooled EMI 6256 photomultiplier tube. The comparison and check star were those which were marked as star "d" and "b", respectively, on the finding chart provided by Kurochkin (1977). Approximately 850 observations were obtained in both B and V.

Three epochs of minimum light were determined, using an iterative technique based on the Hertzsprung method (1928), from observations made during two primary and one secondary eclipse. Our epochs along with the average of each of the B and V epochs of Agerer et al. (1988) are included in Table I.

TABLE I

JD Hel 2447300+	Cycles	$(O-C)_1$	$(O-C)_2$	Source
23.8030	793.5	+0.0033	+0.0003	Present Observations
26.8656	800	+0.0025	-0.0006	Present Observations
28.7507	804	+0.0025	-0.0006	Present Observations
53.4937	856.5	+0.0030	-0.0001	Agerer et al.
65.51245	882	+0.0040	+0.0009	Agerer et al.
66.4551	884	+0.0041	+0.0009	Agerer et al.
78.47295	909.5	+0.0042	+0.0010	Agerer et al.

Agerer et al. (1988) calculated two ephemerides. The first was determined from all available timings of minimum light including both photographic and photoelectric data, and the second from the photoelectric epochs only. Both are quite similar, however the second ephemeris is larger than the first by $+0^{s}.14$, thus indicating a possible period increase. Upon applying their first ephemeris to all available photoelectric epochs of minimum light, we noted the O-C residuals for epochs determined previous to ours are negative, while the residuals of subsequent epochs are positive and apparently increasing with time. Recent visual timings of minimum light (BBSAG #89) show that this trend is continuing. Thus we calculated two ephemerides, the first (1) based on all available epochs of minimum light previous to our observations. This data covers an interval of about 80 years and will help researchers determine the future period behavior of the system. A second (2) ephemeris was also determined in order to phase our present observations. To calculate this second ephemeris, all epochs of minimum light determined from photoelectric observations (our data included) were introduced with equal weights into a least-squares solution. This data spans the observing interval 1984-1988. The two resulting ephemerides are:

$$\text{JD Hel Min. I} = 2446949.8351 + 0^{d}.4712849 \cdot E \qquad (1)$$

4 1 (p.e.)

and,

$$\text{JD Hel Min. I} = 2446949.8370 + 0^{d}.4712864 \cdot E \qquad (2)$$

2 2 (p.e.)

The first ephemeris was used in calculating the $(O-C)_1$ residuals and the second ephemeris was used in determining the $(O-C)_2$ residuals given in Table I. The second ephemeris is very similar to the second one given by Agerer et al. (1988). The $(O-C)_1$ residuals in Table I indicate that a

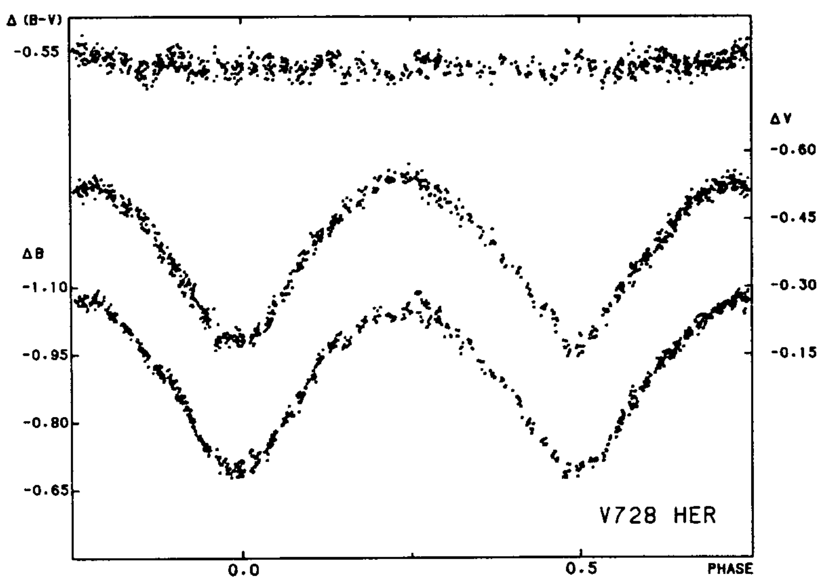

Fig. 1 - Light Curve of V728 Her defined by the individual observations.

rather substantial period increase has taken place. However since these data represent a very brief observing interval, no further details regarding the systems period behavior will be discussed here. Additional and immediate timings of minimum light are requested from all interested observers.

The B and V light curves of V728 Her defined by the individual observations are shown in Figure 1 as Δm versus phase. The analysis of the observations is underway.

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POSSIBLE 1990 ECLIPSE OF δ SGE

The bright star δ Sge displays a composite spectrum (M2II + B) and is a known spectroscopic binary with an estimated period of 3720 days (Reimers and Schröder 1983). McLaughlin et al. (1952) called attention to spectroscopic phenomena observed at the 1939 and 1949 conjunctions that suggest that the early-type component passes behind the atmosphere of the giant star. Similar phenomena were reported by Batten and Fisher (1981) shortly after the conjunction of 1979-80.' It is thus possible that the early-type component may be eclipsed at conjunctions. Even though present estimates suggest that such an eclipse is unlikely, it would be very useful to determine the matter by making photometric observations.

Because the longitude of periastron is very close to 270°, conjunctions almost coincide in time with periastron passage. The orbital elements derived by Reimers and Schröder give, for the time of periastron passage,

$$T = J.D.\ 2444271 + 3720E,$$

which predicts that the next such passage will be in the middle of May 1990. Radial-velocity measurements at Victoria have now been made over an interval of 3515 days. The radial velocity of the giant star passed through its minimum value close to the end of 1988 and is now increasing rapidly. The Victoria observations can be brought into better agreement with other high-dispersion observations from Lick and Mount Wilson, and be made more self-consistent, if a somewhat shorter value is chosen for the period. Provisionally, I adopt 3700 days, but the period could be shorter still. On the other hand, it must be more than 3650 days, since the time of periastron passage does occur a little bit later (in every tenth year) than the previous one. If the shorter period is correct, periastron passage, and conjunction, will be earlier than predicted by Reimers and Schröder - possibly as early as the beginning of March. Unfortunately, this is also just about as early in the year as

δ Sge can be conveniently observed from most observatories. It is desirable, however, that the system should be observed as late as possible this fall and as early as possible next spring.

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OUTBURSTS OF THE Be STAR ω ORIONIS DURING 1987 - 1989

The bright Be star ω Orionis (HR 1934; m_v = +4.50 mag; B3 IIIe; vsini= 160 kms^{-1}) was the subject of photoelectric observations at the Villanova University Observatory since 1981. A discussion of the properties of the star have been given in Guinan and Hayes (1984), Sonnenborn et al. (1988) and references therein. The photometric observations of ω Orionis reported here were conducted on 25 nights from 1987 October through 1989 April using the 38-cm reflector. The photoelectric photometer is equipped with a thermoelectrically cooled (-20C) EMI 9658 photomultiplier and a microprocessor-controlled integrating system (McCook and Maloney 1979). A pair of Hα intermediate- and narrow-band filters and two intermediate-band filters centered at λ4530 and λ5500 were used. The characteristics of the filters have been given previously by Guinan and Wacker (1985).

The observing sequence was the usual pattern of *sky - comparison - variable - comparison - sky* with each observation lasting 20 seconds. The stars were typically observed for about 45 minutes each night. The comparison star was 38 Ori (HR 1839; A2 V; m_v = +5.36), and 32 Ori (HR 1839; B5 V; m_v= +4.20) served as the check star. The effects of differential atmospheric extinction were removed, using seasonal mean extinction coefficients or directly determined extinction coefficients when the star was observed at high airmass. At a level of $^+$0.008 mag, no significant light variations were detected between the comparison and check stars on the several nights in which both stars were observed.

Nightly mean differential magnitudes were computed from the data. Also the differential color index, $\Delta(b-r)'$ was formed from the intermediate-band blue (λ4530) and red (λ6600) differential magnitudes and is given by: $\Delta(b-r)'_{v-c} = \Delta m_{\lambda 4530} - \Delta m_{\lambda 6600}$. The (b - r) color index is similar to the (B - R) or (B - V) color indices of the UBVRI system. The differential α-index was also formed from the Hα narrow- and intermediate-band observations and transformed to the standard Villanova α-system (see Baliunas et. al., 1975). The α-index provides a measure of the net strength of the Balmer Hα feature. Figure 1 shows a plot of the intermediate-band λ6600 observations and the $\Delta(b-r)'$ and $\Delta\alpha$ indices.

As shown in the figure, monitoring of the star began in Fall 1987 on JD 2447094 (October 12 UT 1987) with the star 0.1 mag brighter (in red) than the quiescent brightness level. The

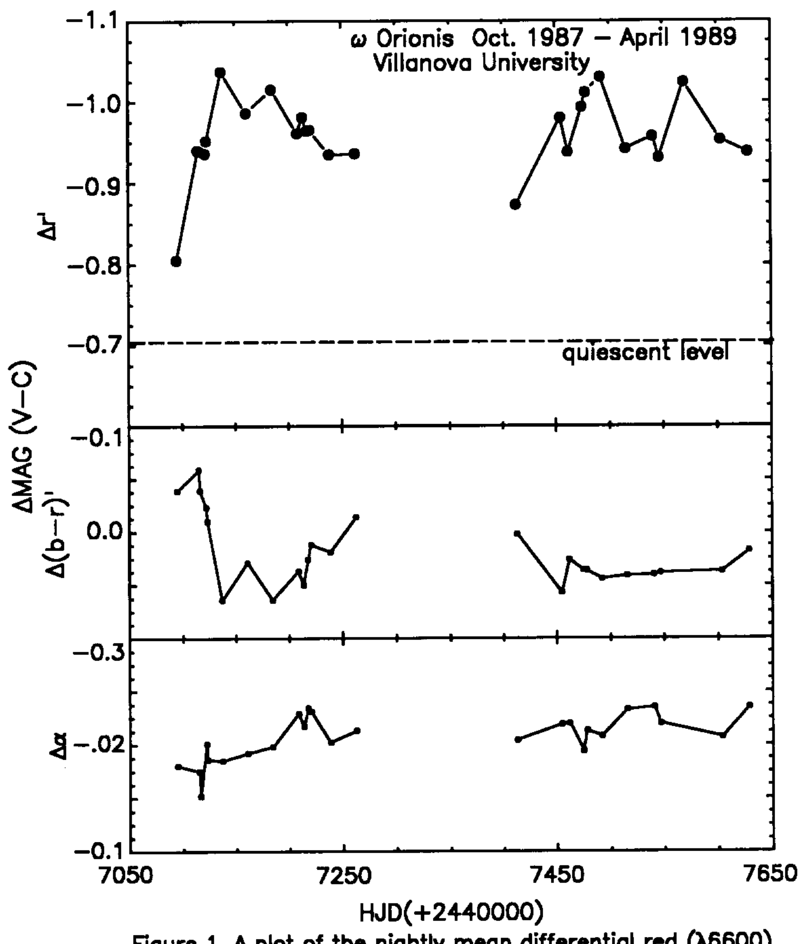

Figure 1. A plot of the nightly mean differential red (λ6600) magnitudes, (b − r) − colors, and α−indices of ω Ori is shown. The light level when the star is quiescent is indicated in the upper panel. A numerical decrease in the α−index indicates an increase in Hα emission.

quiescent brightness level was determined over the last 6 years of observations ($<\Delta r>_q$= -0.71 mag). Its brightness then increased during the next several weeks to a maximum value of Δr = -1.04 mag. After JD 7136 (December 7 UT 1987) the brightness of the star then decreased irregularly over the next four months to the end of the spring 1988 observing season. Several months later in September 1988 when observations resumed, the brightness of ω Ori was 0.06 mag fainter than the last observation of the previous season, but still 0.16 mag brighter than its quiescent value. After JD 7412 the brightness of the star increased until it achieved maximum brightness (Δr = -1.02 mag) on JD 7491 (November 26 UT 1988).

The brightness then decreased by about 0.09 mag until on JD 7569 (February 11 UT 1988) when a secondary event apparently occurred and the star's brightness increased (Δr = -1.02 mag). Afterwards the brightness of the star decreased slowly through the end of April 1989. From our data the two major outbursts were separated by 11 months. Observations made at Villanova since 1981 show a recurrence of outbursts with a mean interval of 10 months. However, the duration of the outburst observed in 1988/89 was longer and more complex than previous events monitored at Villanova, possibly because this outburst consisted of two separate events.

The $\Delta(b-r)'$ color index is plotted in the middle panel of Figure 1. It is apparent from the figure that there is a good correlation between the brightness and the color index in the sense that during the light maximum the star is reddest and when it is faintest the star is bluest. This indicates that the relative light augmentation is greater in red than in blue. If we assume that the increase in brightness of ω Orionis is due to a mass ejection episode, then the observed color change during the outburst indicates that the ejected gas is initially optically thick and cooler than the star's photosphere.

In the lower panel of Figure 1 the differential α-index is shown. From the definition of the $\Delta\alpha$-index, a numerically smaller value indicates a relative increase in the Hα emission line strength or a relative decrease in the absorption line strength. A value of the $\Delta\alpha =$ -0.10 corresponds to no net Hα emission for a star of the same spectral class of ω Ori. For the 1987/88 event as the brightness of the star increases there is no corresponding significant change in the $\Delta\alpha$-index. However, after maximum brightness the $\Delta\alpha$-index gradually decreases (indicating increased Hα emission) reaching a minimum value 70-90 days later. For the 1988/89 event the increase in Hα emission after the outburst is not as well defined possibly because of a second event taking place 100 days after the initial outburst. The apparent phase lag of the peak in the net Hα emission occurring 2-3 months after an outburst is apparent in the data obtained from prior years. Since in the envelope models for Be stars (e.g. Poekert and Marlborough 1978) the Hα emission arises further out in the envelope than does the continuum emission, it therefore may not be to surprising to see a temporal lag in the Hα emission. The increase in the net Hα emission a few months after the initial outburst could be caused by the thinning out of the ejected gas and a decrease in its optical depth with time.

These observations appear to be generally consistent with current models of Be stars (c.f. Underhill and Doazan 1982). The most interesting result of our long-term monitoring program is the 8-11 month interval seen between major outbursts. However, the mechanism producing the apparent cyclic recurrence of outbursts in ω Orionis still needs to be investigated theoretically.

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SPECTROSCOPY OF THE RS CVN BINARY HR 4430 (EE UMA)

HR 4430 (HD 99967, EE UMa) is a K2III star which is a spectroscopic binary with an orbital period of 74.9 days (Northcott 1947). Boyd, Genet, and Hall (1984) discovered HR 4430 to be a variable star with a small photometric amplitude, and suggested the variability was due to a combination of ellipticity and starspots. More extensive photometry extending over several observing seasons (Strassmeier et al. 1989a) has supported this interpretation. HR 4430 is apparently only a weakly active RS CVn-type binary, since Strassmeier et al. (1989b) find only weak Ca II H and K reversals, with emission surface fluxes only slightly higher than what is observed on the sun.

The spectroscopic observations reported here were obtained with the Cassegrain echelle spectrograph and intensified Reticon detector at Ritter Observatory (Bopp, Dempsey, and Maniak 1988). Fifteen spectra of the Hα region were obtained in 1988, having 0.3 Å resolution, and signal-to-noise ratio of 50-75:1. The Hα feature in HR 4430 (Figure 1) is an unremarkable absorption line; the metallic lines show a slight rotational broadening (Strassmeier et al. 1989a). The only possible abnormality of the Hα line is its slightly high residual intensity (Strassmeier et al. 1989b), which could indicate a small filling of the line core by emission. There is little or no evidence for any variability in the line profile or equivalent width.

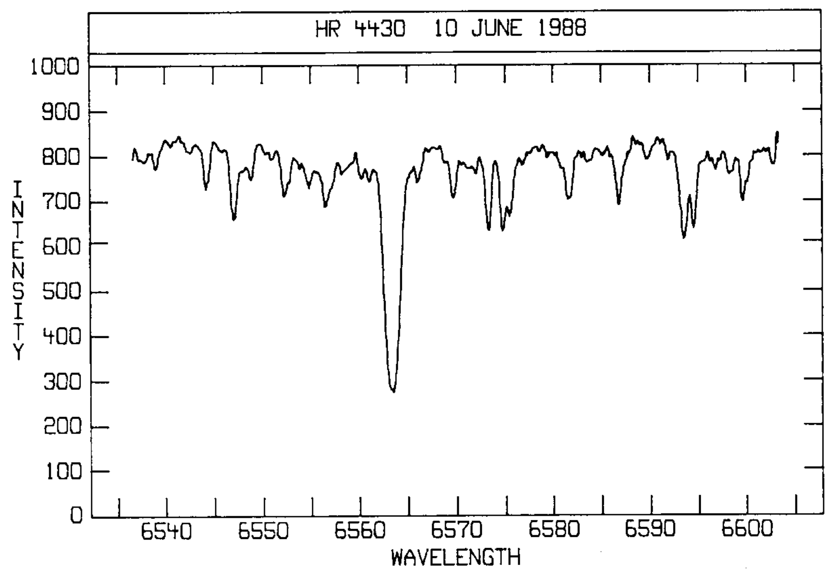

Figure 1: The Hα region of the RS CVn binary HR 4430 (EE UMa), from a Ritter Observatory Reticon scan.

Table 1

New Radial Velocity Measures of HR 4430

HJD-2,447,000	V_r(km s^{-1})
299.6159	+20.7
306.6397	+7.9
308.5986	+2.3
313.6402	-1.5
316.5966	-1.6
317.5965	-2.0
319.6405	-1.3
320.6025	+0.9
322.6090	+1.9
323.6353	+3.5
325.6265	+6.5
327.6107	+8.3
329.6273	+15.9
332.6031	+23.2
333.6096	+24.6

Table 2

Orbital Elements of HR 4430

P = 74.8737 ± 0.0013 days
K = 29.15 ± 0.30 km s^{-1}
γ = +27.58 ± 0.21 km s^{-1}
e = 0.024 ± 0.011
ω = 182 ± 49°
T = JD 2,447,316.4 ± 10.1
$\underline{a}$ sin $\underline{i}$ = 3.00 ± 0.0016 x 10^7 km

The orbital solution for HR 4430 was obtained over forty years ago, and phases using this solution are now subject to uncertainty that complicates photometric modelling. Accordingly, we measured our Hα scans of HR 4430 for radial velocity in order to update Northcott's orbit. We employed a cross-correlation procedure that has been described by Bopp and Meredith (1986), using β Gem or α Boo as standards. A listing of our new velocity measures is given as Table 1. A least squares orbital solution was derived using Northcott's published data and the new Reticon values, giving the latter double weight in the solution. The updated orbital elements are given in Table 2. Small improvements have been made in the mean errors of most elements and the period has been improved by a factor of ten.

The orbital eccentricity is small, and probably not significant, so in order to establish a phase for spot modelling, it is useful to establish a time of conjunction T_c, with the cooler (primary) component in front. For HR 4430, a modern T_c occurs at JD 2,447,334.269.

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PHOTOELECTRIC OBSERVATIONS OF THE ECLIPSING BINARY STAR BD +2°1855

The star BD +2°1855 (discovered by Hoffmeister, 1934, observed by Soloviev, 1955) is suspected to be a W UMa-type variable star in the New Catalogue of Suspected Variable Stars (1982), as NSV 03867.

Observations were carried out between March 1 and April 24, 1989 at the Mt. Suhora Astronomical Observatory of the Pedagogical University in Cracow using the 60-cm Cassegrain telescope with a two-channel photometer and EMI 9865B photomultipliers. Observations were carried out through yellow and blue filters close to the UBV Johnson-Morgan system.

BD +2°1852 was chosen as the comparison star. After the first observations, made on March 1, it turned out that the light curve of BD +2°1855 was strongly deformed. By examining the observations separately in both channels, it was found that the disfigurement is caused by the star placed in channel B - the comparison star. Due to the above reason another comparison star (BD +2°1856) was chosen. Its constancy was occasionally checked against BD +2°1857.

All observations, except for those made during the first night, were corrected for atmospheric extinction using the mean extinction coefficients for the observatory: $m_B = 0.35$ and $m_V = 0.25$. We were able to determine 3 moments of minima. They are given in Table I. All times of minima were found by determining the minimum of the parabola fitted to the observational points, making use of the least-squares method.

From the minima listed in Table I we calculated the tentative elements for BD +2°1855:

$$\text{Min I JD hel} = 2447587.3599 + 0^{d}.559355 \; E \qquad (1)$$
$$\pm 3 \qquad\qquad \pm 6$$

Table I. Observed moments of minima of BD +2°1855

Minimum	Comp. star	Moment of min. (JD_{hel})	Remarks
Pr.	BD +2°1852	2447587.3599 ±3	*
Sec.	BD +2°1856	2447594.3611 ±7	**
Sec.	BD +2°1856	2447641.3388 ±5	**

* - derived from observations in channel A only,

** - derived from two-channel observations.

In deriving the elements we assumed that the secondary minimum falls in the phase = 0.5.

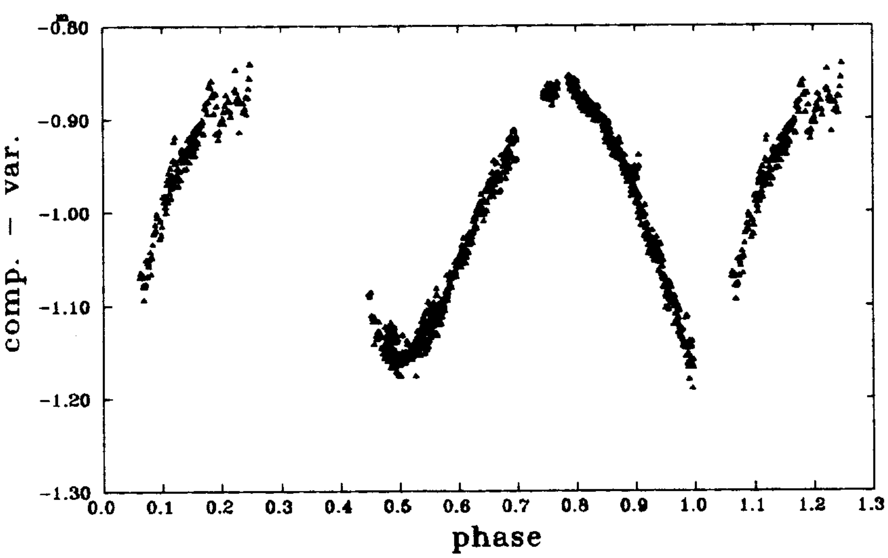

Figure 1. The light curve of BD +2°1855 in the yellow filter.

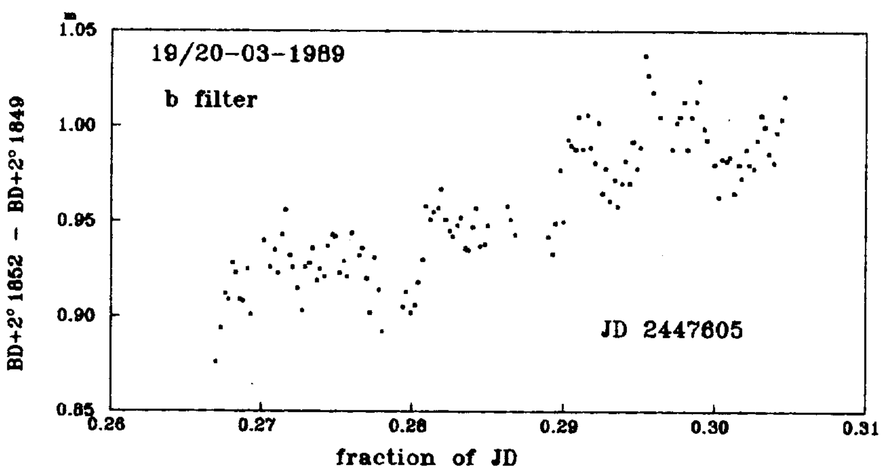

Figure 2. The observed light variation of BD +2°1852 during the night 19/20 March 1989.

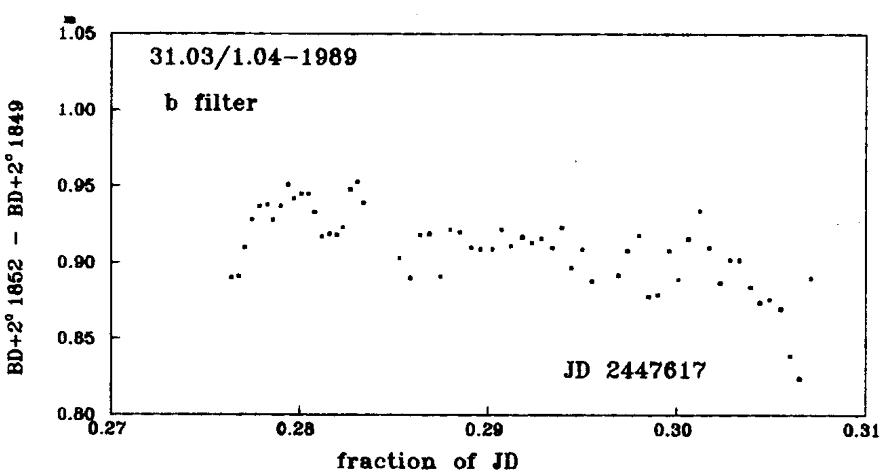

Figure 3. The observed light variation of BD +2°1852 during the night 31 March/1 April 1989.

The light curve of BD +2°1855 in the yellow filter is presented in Figure 1. Phases of the observational data collected after March 2 were calculated using the above elements. The light curve in the blue filter is not presented here because it covers only a small part of the orbital period. Although the light curve is not complete, its shape indicates that BD +2°1855 is a very close binary system, likely of W UMa type. The estimated depth of the secondary minimum (in the instrumental system) is about $0\overset{m}{.}32$ and $0\overset{m}{.}30$ in blue and yellow filters, respectively. The depth of the primary minimum in the yellow band should be larger by about $0\overset{m}{.}07$.

The variability of BD +2°1852 was confirmed during two nights, while the star was observed with BD +2°1849 as the comparison star and through the blue filter. The results are plotted in Figures 2 and 3. The star exhibited a light variation of about 0.1 magnitude during a one-hour observational run made on March 19 and about 0.06 magnitude on March 31.

We used a double-beam photometer donated by the European Southern Observatory following the initiative and through the action of Prof. Edward H. Geyer.

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AN IMPROVED PERIOD FOR THE ECLIPSING CATACLYSMIC VARIABLE UU AQUARII

UU Aqr, at $\alpha=22^h06^m29^s$, $\delta=-4°00'53''$ (1950.0) was first suggested to be a semiregular variable, with a period of 66.2 days (Kholopov, 1985). Stephenson (1986) included it in his list of Hα emission stars, giving it the designation S196. Volkov, Shugarov, and Seregina (1986) (hereafter VSS) found the star to be an eclipsing cataclysmic variable. They observed the star over a period of 54 days in 1985, and found the orbital period to be 0.1635806 days, with a zero epoch of HJD 2446347.2667. Downes and Keyes (1988) published a low-resolution spectrum of UU Aqr. The spectrum is typical for a cataclysmic variable. Figure 1 is a finder chart for UU Aqr (Photograph © 1960 National Geographic Society- Palomar Sky Survey).

We observed five eclipses of UU Aqr with a two-channel photometer mounted on the University of Washington's 0.8m. telescope at the Manastash Ridge Observatory in central Washington. The filter system used approximated the Johnson V band. The comparison star used was SAO 145900, a 9th magnitude K5 star 7.3 arcminutes from UU Aqr (see Figure 1). The observed eclipses occurred between September 10 and 18, 1988 UT (HJD 2447414 and HJD 2447422). Our derived period was consistent, within our timing uncertainty, with that found by VSS.

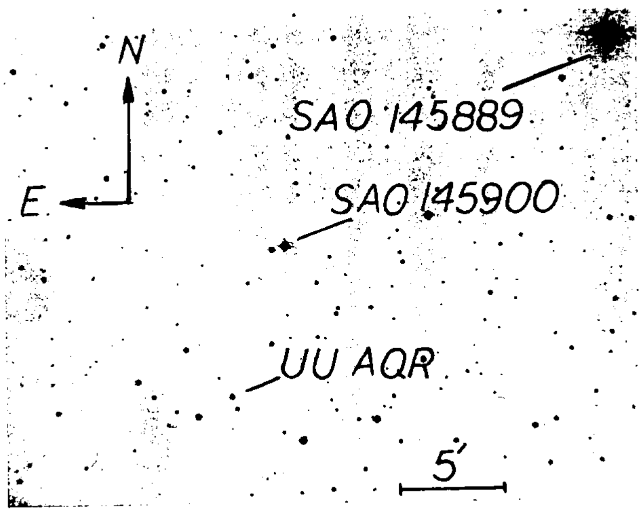

Figure 1

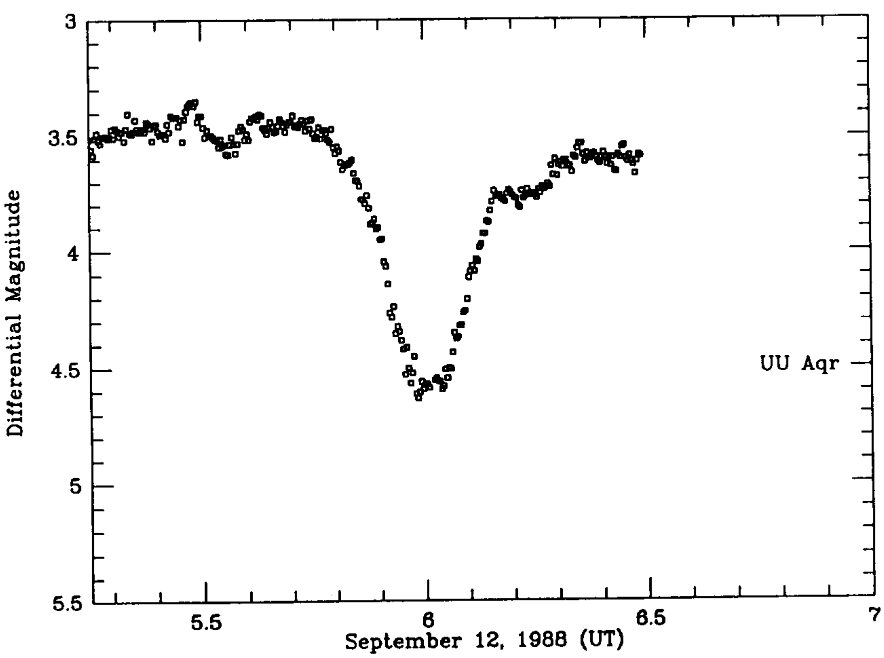

Figure 2

By combining our data with that of VSS, we determined that our first eclipse was within 0.0039 days of the predicted time for epoch 6523. Taking our uncertainty in the time estimate for minimum light of 0.0003 days and theirs, estimated at 0.0001 days, we derived an improved ephemeris:

$$HJD=2446347.2667+E\cdot(0.163579089\pm0.000000061)\text{ days.}$$

Figure 2 is a representative eclipse. The asymmetry seen on the egress side of the eclipse, and evident in the VSS light curves, is probably due to the eclipse of a hot spot on the accretion disk. This asymmetry is similar to that observed in the UX UMa system by Warner and Nather (1972).

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V 404 Cyg - A FURTHER OUTBURST IN 1956

V 404 Cyg had been known as Nova Cyg 1938 (Wachmann, 1948) until a second outburst in 1989 (several authors, see IAU Circ. Nos. 4782, 4783, 4786, 4787, 4790, 4793, 4794, 4796 and 4797) showed that it is the optical counterpart of the X-ray nova GS 2023 + 338.

1462 Sonneberg plates from 1928 to 1989 have been examined in order to search for further historical eruptions. As a result the 1938 and 1989 outburst could be confirmed, and a further outburst in 1956 was found. The dates are as follows:

	JD	blue mag.
1938	242 9193.34	$13^{m}.7$:
	9194.36	13.5
	9216.28	13.3
1956	243 5685.40	14.1::
	5691.41	14.3
	5694.52	14.5:
1989	244 7706.43	16.2
	.44	16.3
	.45	16.3
	.47	16.2

There is a slight indication that another eruption might have occurred in 1979 (244 4142.93; $13^{m}.4$?).

It cannot be excluded that there were more eruptions during time intervals not covered by plates (winter months, infavourable weather).

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Reference:

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NEW PHOTOELECTRIC OBSERVATIONS OF VW CEPHEI

VW Cep is a short period variable star (HD 197433 = BD + 75°752). It is the brightest member of contact binaries of W-type (Binnendijk, 1970). This system was discovered as a variable star by Schilt in 1926. It was the subject of intensive study by various investigators. The irregularities in its light curves and the changes in its period have led to different assumptions and explanations to understand this system. Small humps seem to appear close to the primary minimum. It is believed that these humps are produced by emissions from a hot spot formed by a gas stream impacting on a circumstellar shell around the hotter component (Pustylnik and Sorgsepp, 1976). Yamasaki (1982) attempted to explain the irregularities and peculiarities in the light curve of VW Cep in terms of star-spot model. According to his result the star-spot moves on the stellar surface toward decreasing longitude with a period of about 2 years. Also this system suffers from both erratic and periodic changes in the orbital period. These changes could be due to the distortion in the light curve or due to the light-time effect. Some other investigators attributed these changes to mass transfer between the two components (Karimie, 1983 and Niarchos, 1984).

The present observation of VW Cep were made on the nights of 23 and 26 of September, 1985. The 50 cm cassegrain telescope at Byurakan observatory in Armenia (U.S.S.R.) equipped with a single-channel photoelectric photometer furnished with an unrefrigerated RCAC 31034 A photomultiplier tube was used.

The stars chosen for comparison and check purposes are HD 195191 and 197665 respectively. The estimated uncertainties for the single observations are of order $0^m.006$ in B filter and $0^m.005$ in V filter. The points which define the B and V light curves and B-V colour curve are potted in Figure 1.

New times of minima have been obtained with Kwee and Van Woerden's method (1956). The following ephemeris formulae (Kukarkin et. al. 1974)

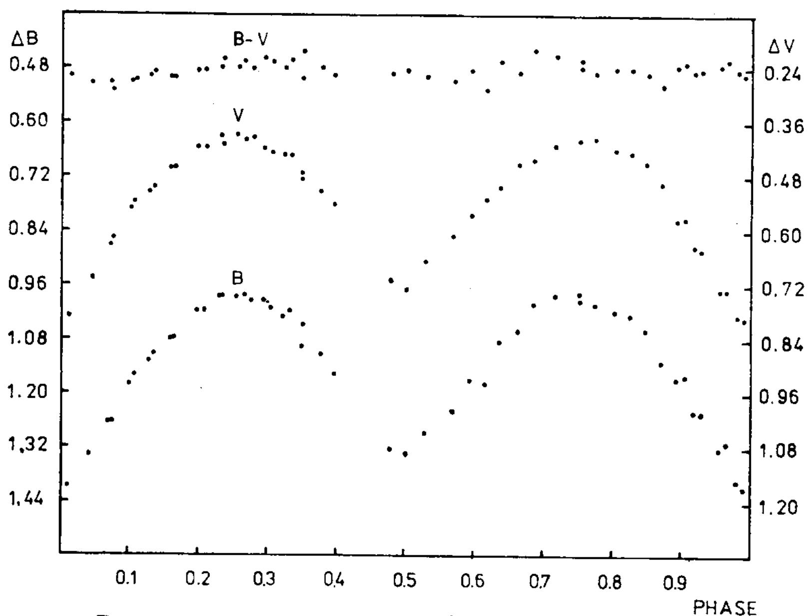

Fig. 1 Light curve of VW Cep in B and V

have been used:

Min I (Hel.) = 2439348.415 + $0^{d}.278314E$

The new moments of minima are as follows:

HJD	Min	O–C
2446333.4139	II	0.01328
2446336.3354	I	0.01249

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CALL FOR A CAMPAIGN OF LONG-TERM PHOTOMETRY OF SYMBIOTIC STARS

We suggest to launching an observing campaign for photometry of the selected 28 symbiotic stars (SS).

Long-term (weeks to decades) variations of the brightness (amplitudes 2 to 7 mag) related to the outbursts of SS and sometimes also to orbital motion of the components are commonly observed in many SS. In some cases short-term (minutes to hours) variations (amplitudes 0.01 to 1 mag) are seen, very probably caused by the physical effects in the accreted material around the compact component. The changes of brightness are sudden and unexpected, being the outcome of strong interaction among the components, although their very cause could be different for particular systems. Detailed information on SS one may find besides the quoted references also in the volume: "The Symbiotic Phenomenon", Proc. of the 103rd Colloquium of the IAU, Toruň, Poland, August 18 - 20, 1987, Edited by Mikolajewska, J., Friedjung, M., Kenyon, S. J. and Viotti, R., Dordrecht, Holland.

The proposed programme is aimed at long-term photometry mainly in the standard Johnson UBV system. Its purpose is

(i) Compilation and publication of the original photometric data.

Table I.

List of the chosen symbiotic stars

Star	$\alpha_{1950.0}$	$\delta_{1950.0}$	V	Sp
EG And	$00^h41^m52^s.7$	$40^\circ 24' 22''.6$	$7^m.5$	M2
AX Per	01 33 05.7	54 00 07	12	M
V741 Per	01 55 32.9	52 39 15		G2
UV Aur	05 18 33.3	32 27 50	7.9	C
BX Mon	07 22 52.7	-03 29 51	12	M4
TX CVn	12 42 17.9	37 02 14	9.3	M0
RW Hya	13 31 31.9	-25 07 29	10	M2
T CrB	15 57 24.5	26 03 39	10.0	M3
AG Dra	16 01 23.2	66 56 25	11.2	K3
Draco C-1	17 19 08.5	57 53 01	17.0	C1,2
RS Oph	17 47 31.6	-06 41 40	11.5	M2
AS 289	18 09 34.7	-11 40 55	10.5	M3
YY Her	18 12 25.9	20 58 20	12	M2
AS 296	18 12 33.0	-00 19 53	10.5	M5
V443 Her	18 20 02.9	23 25 47	11.5	M3
AS 338	19 01 32.0	16 21 47	11.5	M5
BF Cyg	19 21 55.2	29 34 34	12	M4
CH Cyg	19 23 14.2	50 08 31	7	M6
HM Sge	19 39 41.4	16 37 33	16	M
AS 360	19 43 35.7	18 29 23	11.0	M6
CI Cyg	19 48 20.6	35 33 23	11.1	M4
V1016 Cyg	19 55 19.8	39 41 30	16	M6
PU Vul	20 19 01.1	21 24 43	9	M4-5
V1329 Cyg	20 49 02.6	35 23 37	14	M5
V407 Cyg	21 00 24.1	45 34 41	15	M
AG Peg	21 48 36.2	12 23 27	9.4	M2
Z And	23 31 15.3	48 32 31	10.5	M2
R Aqr	23 41 14.3	-15 33 43	5.8	M7

(ii) Making sense to the observations of long-term variations of brightness for various SS and also for a single observer.

The aims of the programme could be well fulfilled by rather short (an hour) observations and therefore it is quite suitable for filling in the gaps between other planned observations. Thus the participation in the campaign could enhance the efficiency of using Your instrument without disturbing Your main research programme.

Everybody who wish to participate could select an arbitrary SS (not only those that are proposed by the undersigned) that could be most easily attached to his/her own programme.

All contributions will be gathered by the undersigned and subsequently published in Contr. Astron. Obs. Skalnaté Pleso annually (September dead-line). All astronomers who submit good quality data will become the coauthor of the paper and will receive its reprint.

The proposed list contains SS accessible from the northern hemisphere and bright enough for photometry with a small telescope. The data in our list were taken from the book by Kenyon (1986). The values of V magnitudes and spectral types serve for orientation only and describe predominantly the cold components of SS.

Moreover we prepared the finding charts for every programme SS after Bečvář (1962, 1964), POSS (1953), Dixon et al. (1985) and Allen (1984). We selected the comparison stars following the Catalogue by Blanco et al. (1968) and the SAO Star Catalog (1966). In all cases the comparison star S_1 was measured in all colours of the UBV system. We recommend to derive secondary comparison stars in cases when the angular distance between SS and S_1 is rather large. The observations should be reduced to the international colour system.

We are ready to submit complete campaign instructions to the participants upon request. Of course, all additions and suggestions from the participants are most welcome.

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SEARCH FOR VARIABLE STARS IN A FIELD IN THE LMC

The region $0\overset{\circ}{.}6 \times 0\overset{\circ}{.}9$ of the Large Magellanic Cloud centered near NGC 1854 (05^h10^m $-68^o.9$) was surveyed for new variable stars. 7 exposures of the LMC made in 1967-72 (JD 2439849-2441385) with the 50-cm Maksutov reflector of the Chilean Station of Pulkova Observatory and 7 plates obtained in September-October 1988 with the 66-cm astrograph at the Mount Stromlo Observatory by A.A. Tokovinin and A. Loggins were used.

The positive-negative ("Harvard") technique was used for the discovery of variable stars. The plates are of different quality and only 2-3 pairs could be selected for the comparison. The 16 stars not identified with known variables were suspected of variability. The identification charts for the suspected variables are given in Figure 1, north is up, the size of the squares is 3' if not indicated otherwise in the corner. Despite the use of the Harvard technique the variability is not certain at low amplitudes, such cases are marked with ?, e.g. VAR?-1.

The Table contains coordinates for 1950.0, magnitude estimates and ranges of variation in the color system close to B. Photoelectric standards from Tifft et al. (1971,1973) were used directly as comparison stars for the estimation of magnitudes. The moments of observation of some Chilean plates and of the 2 plates taken in Australia appear to be recorded with $\lesssim$ 1 day error. These moments were corrected from the lightcurves of known short-period cepheids, e.g. TU Dor and SZ Dor.

Most of the variable stars in this field are cepheids and the same applies to the newly discovered stars as well. Their periods must be in the 2-12 day range as estimated from the mean magnitudes. About 50 cepheids have been discovered previously in this field at the Harvard Observatory. The new stars have typically low amplitudes and low discovery probabilities. It is likely that no more than 50-75% of such stars have

Table I.

JD 24...	VAR?-1	VAR-2	VAR-3	VAR?-4	VAR?-5	VAR?-6	VAR-7	VAR-8
R.A.	050616	050644	050716	050745	050802	050805	050820	050913
Deo.	-6910.5	-6858.1	-6846.6	-6851.3	-6842.0	-6906.7	-6845.0	-6854.7
39849.9	16.40:	16.40	14.86	16.25	15.18	16.70	16.40	16.40
39852.75	16.58:	16.35	15.15	16.20	15.38	16.65	16.42	15.45
39948.6	16.82	16.35	14.85	15.96	15.40	16.80	16.25	15.18
40270.6	16.77	16.25	15.10	15.80	15.35	16.75	16.32	16.45
40272.55	16.58	15.93	15.18	15.80	15.15	16.70	16.35	15.70
40885.65	16.40	16.25	15.02	15.90	15.03	15.70:	15.75	16.23
41384.65	17.12	16.38	15.20	16.00	15.40	16.85	15.85	16.30
47410.125	-	15.50	15.13	15.83	15.12	-	15.70	15.98
47418.120	16.65	15.65	15.24	15.80	15.25	16.75	16.00	16.50
47423.172	16.82	16.20	15.20	15.90	15.13	16.40	16.45	16.18
47428.160	16.93:	16.12	15.30	15.95	14.90	16.63	15.67	15.16
47429.125	16.72	15.60	15.40	15.75	15.13	16.65	16.35	15.75
47441.169	-	15.58	15.12	16.00	15.16	-	16.60	15.12
47446.139	17.34	15.75	15.00	15.70	14.82	16.63	15.73	15.62
Max	16.4	15.5	14.85	15.7	14.8	15.7:	15.7	15.1
Min	17.3	16.4	15.4	16.25	15.4	16.85	16.6	16.5

	VAR-9	VAR-10	VAR-11	VAR-12	VAR-13	VAR?-14	VAR?-15	VAR-16
R.A.	051006	051021	051058	051352	051419	051450	051453	051457
Dec.	-6856.6	-6857.1	-6850.4	-6900.4	-6901.2	-6843.1	-6910.8	-6857.9
39849.9	16.00	16.30:	15.13	17.3:	15.97	15.85	15.10	16.90
39852.75	15.92	16.22	15.37	17.0:	15.63	16.05	15.15	16.95
39948.6	15.62	17.4::	15.14	16.90:	15.65	15.10	15.20:	15.76
40270.6	15.16	16.25	15.60	16.50:	16.17	15.70	15.15	15.84
40272.55	15.12	17.20	15.78	16.95:	16.30:	15.65	15.08	16.87
40885.65	15.70:	17.42:	15.50	17.10:	15.64	15.85	15.35	16.75
41384.65	15.9::	17.35:	15.26	15.50:	15.77	15.62	15.30	15.70
47410.125	15.23	17.05	15.57	-	-	-	-	-
47418.120	15.11	17.32:	15.25	16.52	15.87	15.20	15.45	16.67
47423.172	15.78	17.18:	15.70	16.95:	15.36	15.70	15.18	16.00
47428.160	15.72	17.15:	15.50	16.78:	-	-	-	-
47429.125	15.68	16.9:	15.44	16.82	-	-	-	-
47441.169	15.43	16.73:	15.57	-	-	-	-	-
47446.139	15.84	16.37	15.42	-	-	-	-	-
Max	15.1	16.2	15.1	15.5:	15.4	15.1	15.1	15.7
Min	16.0	17.4:	15.8	17.3:	16.3:	16.05	16.45	16.95

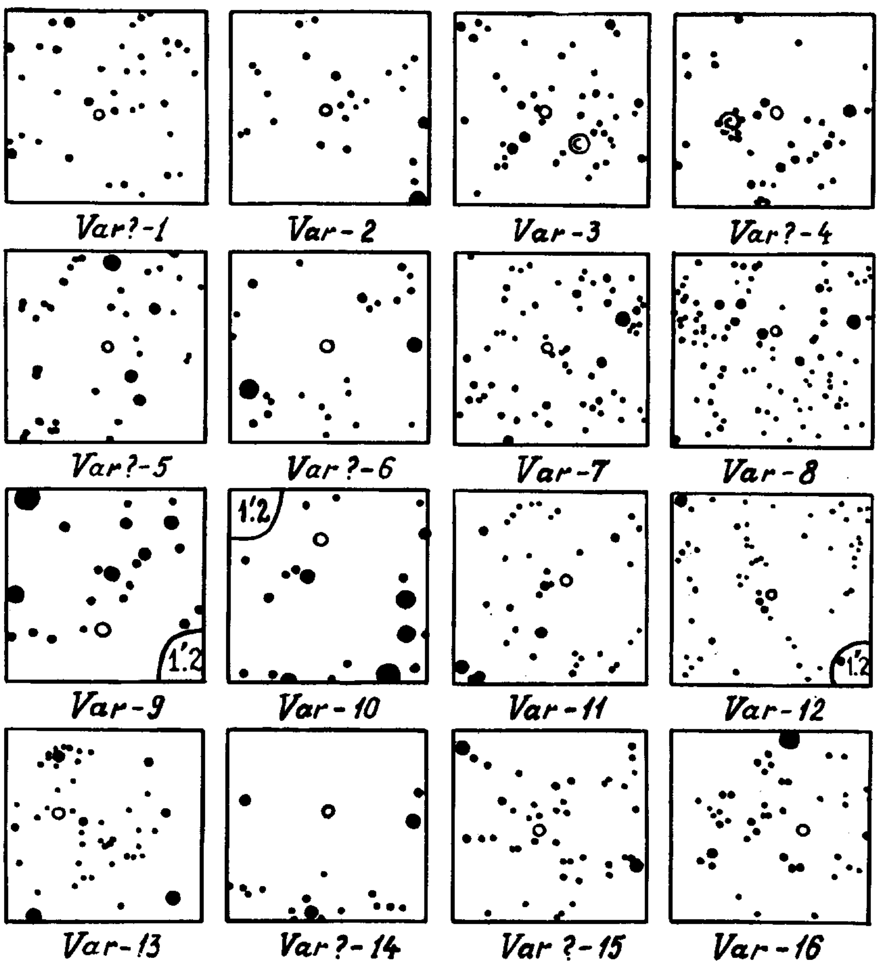

Figure 1

been discovered in the LMC. Further search for variable stars in LMC seems necessary.

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NOTE ON CROSS-IDENTIFICATION OF FLARE STARS IN THE PLEIADES

During analysis and supplementation of the machine-readable version of the Tonantzintla catalogue (TC) of Pleiades flare stars (Haro et al., 1982, Tsvetkov et al., 1987) a number of inconsistencies has been found which will be discussed in the following.

I. We have noticed multiple designations of the same stars in the General Catalogue of Variable Stars (GCVS) (Kholopov, 1985) as well as in the New Catalogue of Suspected Variables (NCSV) (Kholopov, 1982) to which we would like to draw attention. We also used the 67th, 68th and 69th Name List of Variable Stars (Kholopov et al., 1985, 1987, 1989), for updates of GCVS designations.

Table 1 lists all flare stars for which two different designations are given in the GCVS, and those for which designations are given in both the GCVS and the NCSV (in the case of LO Tau even two numbers in the NCSV). As communicated in the notes to the NCSV, such coincidences have been suspected for most of the stars listed in Table 1. They could, however, not be verified, because identification charts are often lacking in the publications announcing the discoveries of flare stars.

Table 1. Pleiades flare stars with multiple designations in the GCVS and the NCSV

TC No.	GCVS No.	Author Design. in Name Lists of Variable Stars	Name List of Variable Stars (No.)	NCSV No.	Author Designation in NCSV
80	LO Tau	T3	57	–	–
80	–	–	–	01231	A112
80	–	–	–	01290	K25
150	V 438 Tau	B179	58	–	–
150	–	–	–	01256	K7
263	V 539 Tau	T6b	59	–	–
263	–	–	–	01298	B424
298	V 336 Tau	T83	57	–	–
298	–	–	–	01308	K3
400	V 337 Tau	T164	57	–	–
400	–	–	–	01370	A128
412	V 464 Tau	B211	58	–	–
412	–	–	–	01378	K4
451	V 565 Tau	B233	59	–	–
451	V 715 Tau	A94	62	–	–
509	V 692 Tau	A113	60	–	–
509	–	–	–	01420	B423

II. Some Pleiades flare stars in the Tonantzintla catalogue (included only in the NCSV) have shown only one flare of small amplitude which does not satisfy the criterion $\Delta m > 5\sigma(m)$ (Tsvetkov et al., 1988) so that there is reasonable doubt that they belong to the class of UV Cet stars. They are listed in Table 2.

Table 2. Pleiades flare stars with single low amplitude flares, included only in the NCSV

TC No.	Author Designation	NCSV No.	min Pg	Δm Pg
1	A110	01202	$16^{m}.3$	$0^{m}.3$
99	A111	01235	15.8	0.4
120	A109	01242	16.2	0.3
293	B229	01314	17.0	0.5

III. Four flare stars from the TC, which have relatively large amplitudes and are identified on accompanying finding charts, have apparently neither GCVS nor NCSV designations. There are no well-founded reasons why these stars should not be included in the GCVS as UV Cet type stars. They are listed in Table 3. For the star TC87, which has shown two flares, the amplitude is given according to the original paper, because of a mistake in the TC.

Table 3. Pleiades flare stars included neither in the GCVS nor in the NCSV

TC No.	Author Designation	min U/Pg	Δm U/Pg
61	T69b	$15^{m}.8$U	$1^{m}.5$U
87	K*2	16.6U	1.6U
200	AB526	15.2	0.8
261	K*4	>20.0U	>3.2U

IV. Several stars are listed in the GCVS or NCSV with UV Cet identification, which are not included in the TC. They are given in Tables 4 and 5. For most of them, the GCVS lists the minimum brightness according to the photographic UBV photometry of Chavushian and Gharibjanian (1975). The maximum brightness is taken from the original papers. This procedures leads in some cases to larger amplitudes than those given in the original papers. We are inclined to think that this is caused by uncertainties in the determination of stellar magnitudes both at minimum and maximum brightness and is not due to an underlying type of variability. This effect may also apply to some of the remaining stars which are listed in the GCVS as UV Cet stars in the Pleiades region. In order to avoid systematic errors in amplitudes, the stellar magnitudes at minimum and the flare amplitudes were taken from the original papers, and are given in Table 4. The 5σ criterion was applied to the magnitudes of the stars in this table; 6 stars were found which did not satisfy the criterion. This result, and also the fact that they are not included in the TC, sheds doubts on the reality of their variability.

Table 4. Stars listed as UV Cet stars in the GCVS, but not in the TC

GCVS No.	Author Designation	H II	min Pg/U	Δm Pg/U	Notes
LL Tau	B128		$17^m_.0$	$>1^m_.0$	1
V 354 Tau	J&M	2082	15.31	0.88	2
V 385 Tau	B124		15.0	0.5	3,4
V 393 Tau	T59		15.5	0.7 U	1,3
V 394 Tau	B126		14.7	1.2	4
V 447 Tau	B206	1038	16.8	0.5	3
V 487 Tau	B261		17.7	0.7	3
V 496 Tau	B262		17.1	0.7	3
V 521 Tau	T22b	628	16.0 U	0.8 U	
V 525 Tau	B263		17.7	0.8	3
V 527 Tau	T4b	979	17.8 U	1.1 U	
V 529 Tau	T24b	1009	17.5 U	1.0 U	
V 560 Tau	B295	3065	14.2	0.8	
V 735 Tau	K**1		18.5 U	1.8 U	1
V 736 Tau	K**2		17.2 U	1.7 U	1
V 755 Tau	K**4		19.3 U	4.3 U	1
V 792 Tau	K#1		20.5 U	7.1 U	1
V 964 Tau	K*K		>18 U	>2.6 U	5
V 965 Tau	K*N		>18 U	>2.7 U	5
V 967 Tau	K*Q		>18 U	>3.0 U	5
V 968 Tau	K*O		16.2 U	2.9 U	5
V 970 Tau	K*I		>18 U	>3.2 U	5
V 972 Tau	K*E		17.5 U	1.9 U	5
V 973 Tau	K*P		>18 U	>2.9 U	5
V 974 Tau	K*G		>18 U	>2.6 U	5
V 975 Tau	K*H		>18 U	>2.6 U	5
V 976 Tau	K*J		>18 U	>2.2 U	5
V 977 Tau	K*B		>18 U	>1.8 U	5
V 978 Tau	K*L		>18 U	>3.0 U	5
V 979 Tau	K*D		>18 U	>2.1 U	5
V 980 Tau	K*A		17.5 U	2.5 U	5
V 981 Tau	K*C		17.8 U	1.6 U	5
V 982 Tau	K*M		>18 U	>2.7 U	5
V 983 Tau	K*F		>18 U	>3.9 U	5

Table 5. Stars listed as probable UV Cet stars in the NCVS but not in the TC

NCSV No.	Author Designation	H II	min V/Pg/U	Δm V/Pg/U	Notes
01238	T37b		$17^m_.2$ U	$0^m_.6$ U	1,3
01281		799	13.71V	0.15V	2
01300		1403	14.9	0.3	3
01320	P1		15.3 V	0.5 V	1,3
01329			>18.5	>3.7	1,6
01336			>18.5	>3.3	1,6
01350	B345		17.2	1.2	
01358	J&M	2407	13.6	0.8	2
01375			>18.5	>3.5	1,6

Notes to Tables 4 and 5:
1 Identification charts were not published.
2 Possible flare found during one photoelectric observation.
3 The amplitude of the flare does not fulfill the criterion $\Delta m > 5\sigma(m)$.
4 According to Ambartsumian et al. (1972) Haro was not convinced that B124 and B126 are flare stars.
5 UV type stars in the Pleiades region from the 69th Name List of Variable Stars. As a rule they all need more precise determination of the magnitude at minimum and of the amplitude.
6 Only one image is visible on the patrol plate and no star is found on the Palomar Observatory Sky Survey prints.

V. We conclude that at least 8 of the more than 500 reported flare stars in the Pleiades region need unification of their designations in the GCVS and the NCSV. Four Pleiades flare stars should be included in the GCVS. 47 stars merit better observations to confirm their membership in the UV Cet class of variables, for 11 of them identification charts are needed.

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MICROVARIABILITY OF RX CAS

RX Cas is a strongly interacting close binary system with an orbital period of $32^{d}.33$ and spectral type A2-5e + KO II-III.
Photometric monitoring observations were carried out between January 7 and February 12, 1986 with a one-channel WBVR photoelectric photometer attached to the 48-cm telescope of the Tien-Shan High Altitude Observatory of the Sternberg Astronomical Institute (Khaliullin et al., 1985). The observations were processed by a standard scheme: background - comparison star - variable - comparison star - background.
The comparison star was BD + $67^{o}248$ and check star - HD 6210. The integration time in each filter was 10-40 sec. It depends on both the filter and the orbital phase. Thus, the records from each filter were repeated every 1-2 minutes. The duration of each observational series and the number of records were changed in order to eliminate its influence on the periodogram analysis. Observing nights with high transparency and stability of seeing were chosen for the analysis. Khaliullin et al!s (1985) method was used for primary processing of the data. The observational data in the W filter are listed in Table I.

Table I

JD 2446400+	ΔT	N	φ	σ_{int}	$\sigma_{\Delta T}$	p>90%	p>80%
49	.112	21	.31	.012	.013		49min
50	.151	133	.34	.016	.022	40min	
51	.158	137	.37	.016	.026		95min
52	.132	115	.40	.015	.026		
53	.094	79	.43	.012	.024		
62	.162	117	.71	.012	.023	42min	
64	.208	103	.77	.010	.017		
65	.101	55	.81	.010	.017		86min
67	.100	37	.86	.020	.020		29min

Column JD contains the date, column ΔT - the interval of observation, column φ - the orbital phase, column σ_{int} - internal error of one observation, $\sigma_{\Delta T} = \sigma/\langle I \rangle$ is the relative variation over the entire time interval.

The analysis was carried out by Deeming's (1975) method. Frequencies in the interval 1-100 cycles/day were searched for. In Figure 1 the periodograms of JD 2446450 and 2446462 in filter W are shown. They are the only ones that show peaks with a significance of more than 90%.

On some periodograms of other observations different variations with periods of 20-90 minutes can be supposed. All of them are listed in the last two columns of Table I where "p>90%" contains the period in minutes

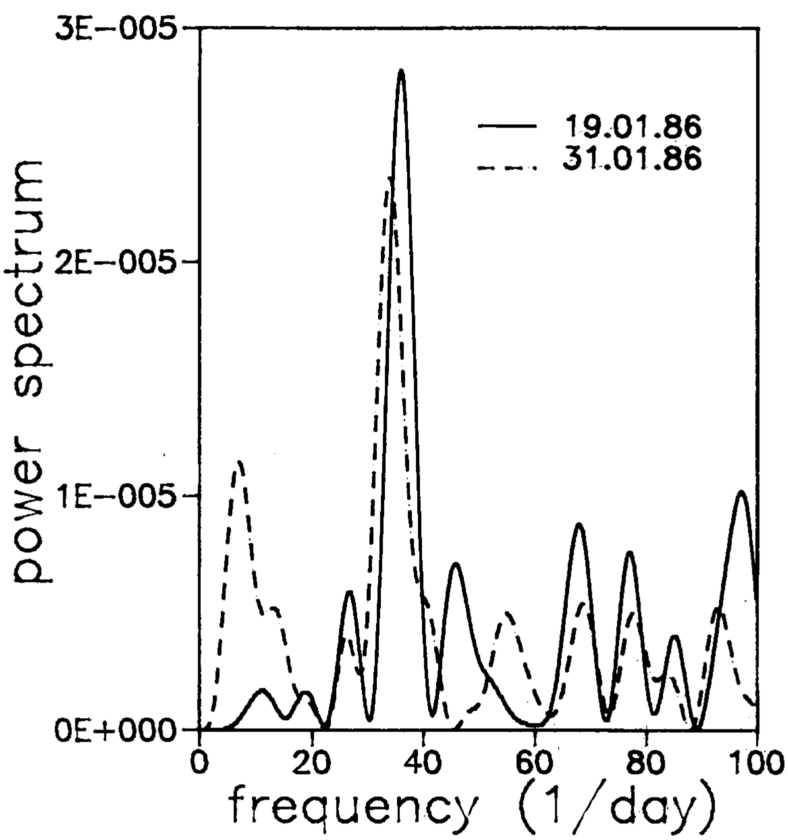

Figure 1

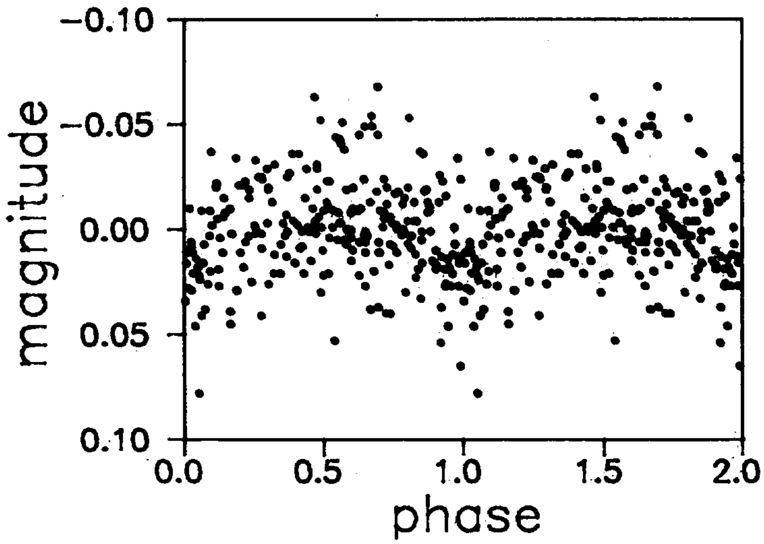

Figure 2

corresponding to the peaks on the periodogram with a significance of 90-95%, and "p>80%" - the respective periods with a significance 80-90%. The study of the comparison star does not show peaks with a significance of more than 20%.

The values of the periods are:

JD 2446450 $P_1 = 0^d\!.0278 \pm 0^d\!.0023$

JD 2446462 $P_2 = 0^d\!.0294 \pm 0^d\!.0023$

They coincide in phases and the following elements can be used:

$$T_{min} = \text{JD } 2446450.1534 + 0^d\!.0292 \cdot N$$
$$\pm\ 30 \qquad \pm\ 25$$

The average curve of brightness computed with these elements for the data of the two nights is shown in Figure 2. The amplitude of the variation is approximately $0^m\!.04$. Microvariability in the other filters (B,V,R) is not yet suspected.

It is interesting to mention that the dates JD 2446450 and 2446462 coincide with maxima of the $11^d\!.007$ period (Todorova and Khruzina, 1989), i.e. when the line of sight crosses the supposed active areas on the accretion disc. These active areas are likely to be "spots" or zones of shock waves originated from a superposition of non-radial variations. Before these phases and after them toward to the minima of the 11^d period the observed variations vanish.

To adopt or reject the hypothesis of a non-uniform distribution of the brightness on the surface of the accretion disc (Todorova and Khruzina, 1989) more observations are necessary.

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THE ELEMENTS OF THE BINARY SYSTEM 44i BOOTIS

The eclipsing variable 44i Bootis is the fainter component of the visual binary ADS 9494. 44i Bootis belongs to W UMa type.

The binary system 44i Bootis was introduced in the photometric observational program of the Bucharest telescope following the IAU indications (Dworak and Oblak, 1987).

The observations of 44i Bootis were made at Bucharest Observatory during 1987 using the 50cm telescope and a photoelectric photometer housing an EMI 9502B photomultiplier. Observations were made in V and B filters. The star FK4 1395 was used as the comparison star.

The mean light curves indicate a change in minima places of approximately $0^{P}.065$. A Wood program was applied for elements calculation making first a translation of the curve with $0^{P}.065$.

As initial values of i, T_A, k, r_A the values from Mauder's (1972) work were used.

The elements, calculated from V and B observations, are:

V filter:

$i=64^{\circ}.26$	$r_A=0.372$	$q=0.510$	$u=0.650$	$\beta=0.250$
$e=0$	$r_B=0.240$	$a_A=0.387$	$a_B=0.248$	$L_A=0.855$
$\omega=0$	$T_A=5250^{\circ}K$	$b_A=0.372$	$b_B=0.238$	$L_B=0.145$
$k=0.641$	$T_B=4460^{\circ}K$	$c_A=0.358$	$c_B=0.234$	

B filter:

$i=62^{\circ}.92$	$r_A=0.362$	$q=0.510$	$u=0.800$	$\beta=0.250$
$e=0$	$r_B=0.230$	$a_A=0.375$	$a_B=0.237$	$L_A=0.896$
$\omega=0$	$T_A=5250^{\circ}K$	$b_A=0.362$	$b_B=0.229$	$L_B=0.104$
$k=0.632$	$T_B=4378^{\circ}K$	$c_A=0.349$	$c_B=0.224$	

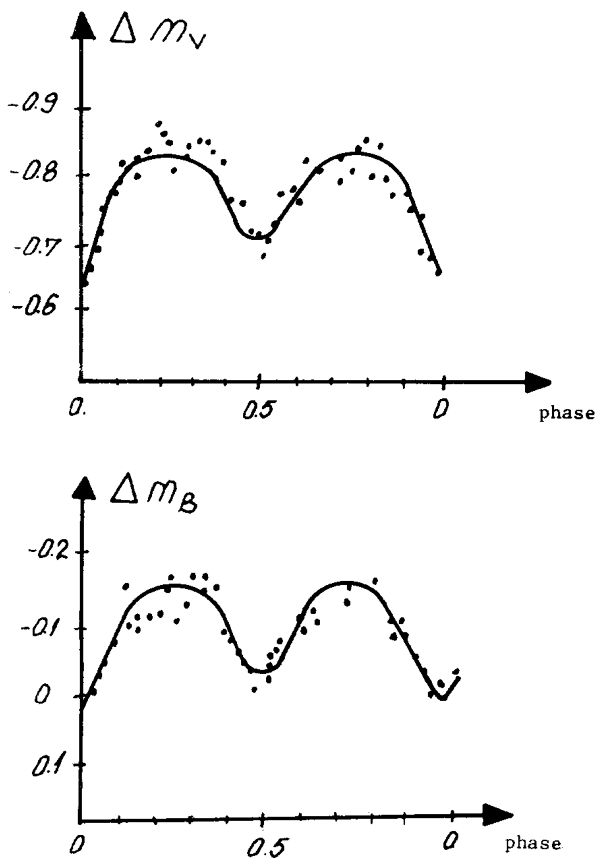

Figure 1

Figure 1 shows the mean observational points by dots and the theoretical values, obtained with Wood program, by curves.

From our observations (Table I) we have calculated four minima and the (O-C) values using: I - Pohl's (1967), II - Duerbeck's (1975) and III - GC 1976 ephemeris:

I Min I $= 2444366.52904 + 0^{d}.2678158E$

II Min I $= 2439852.4903 + 0^{d}.2678159E$

III Min I $= 2439370.4222 + 0^{d}.2678160E$

Table I

Date	(O-C) I	(O-C) II	(O-C) III	Min	σ	Filter	Obs.
244							
6973.3286	0.0145	0.0153	0.0119	II	0.0009	U	Oprescu G.
.3296	0.0155	0.0163	0.0129	II	0.0014	B	"
.3352	0.0210	0.0218	0.0184	II	0.0004	V	"
6977.3550	0.0237	0.0245	0.0211	II	0.0009	U	"
.3510	0.0197	0.0205	0.0171	II	0.0009	B	"
.3557	0.0243	0.0252	0.0218	II	0.0012	V	"
6984.3159	0.0214	0.0221	0.0188	II	0.0003	U	"
.3174	0.0229	0.0236	0.0203	II	0.0009	B	"
.3236	0.0291	0.0298	0.0265	II	0.0010	V	"
6986.3253	0.0221	0.0229	0.0196	I	0.0005	U	Suran M.
.3237	0.0205	0.0214	0.0181	I	0.0007	B	"
.3257	0.0224	0.0233	0.0200	I	0.0007	V	"

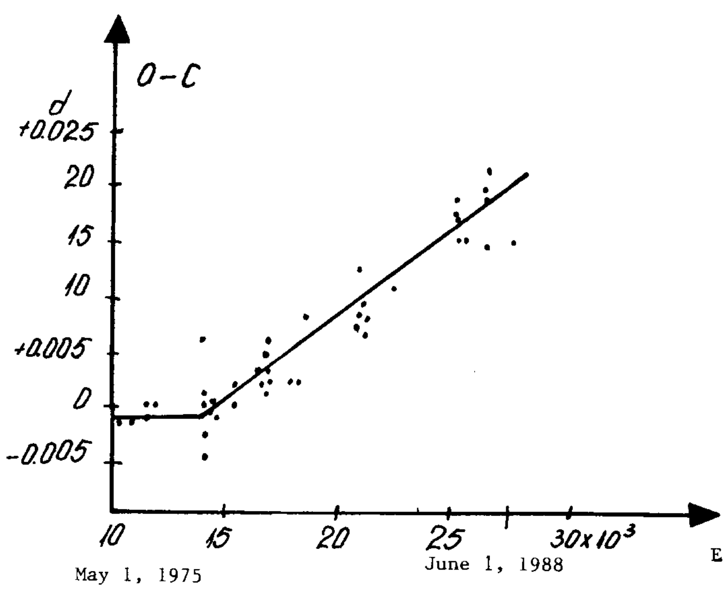

Figure 2

Many authors have pointed out sudden period changes for this star. Using Duerbeck's (1975) ephemeris we obtained the (O-C) values for a lot of minima between 1975-1988. Figure 2 shows a period jump in 1977-1978. The

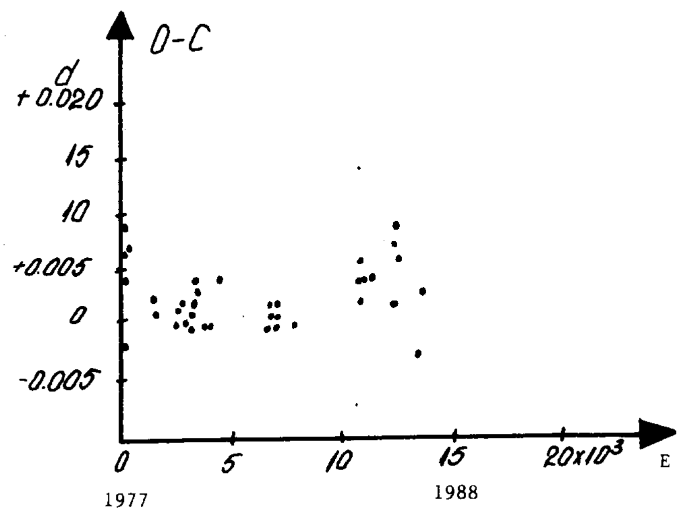

Figure 3

value of this sudden change we estimate to be $\Delta P = 1^d.63 \cdot 10^{-6}$. For the observations after 1977 we suggest a new period:

$$\text{Min I} = 2443604.5880 + 0^d.26781753E$$

Using this new ephemeris we reconsidered the (O-C) values, for the same observations as in Figure 2, beginning with 1977. Figure 3 shows the new (O-C) aspect. A sudden change in period is possible again between 1986 and 1988. More minima observations are needed in the future in order to point out the possible period change exactly.

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TIME OF MINIMUM DETERMINATION FOR AS CAMELOPARDALIS

AS Cam (HD 35311) is an important system in the study of relativistic apsidal motion. It is one of only a few binary systems with observed apsidal motion significantly less than what is predicted by general relativity and standard classical theory (Guinan et al., 1987a). Yet more binary systems are being found to behave in this fashion, such as V541 Cygni and V1143 Cygni as well as DI Her, the prototype apsidal motion system (Lines et al., 1989: Guinan et al., 1987b). This phenomenon is not yet completely understood, and may be more common in eccentric eclipsing binary systems than was initially thought.

I observed AS Cam on several nights in January 1989, and obtained two sets of data when the star was near the center of primary eclipse. I used the USAF Academy 61 cm telescope with an uncooled EMI 9789 photomultiplier tube to conduct standard ubv differential photometry. The stars HD 34463 and HD 34886 were used as comparison and check respectively, and neither one showed any sign of variability. On 27 Jan 1989 UT, AS Cam was observed from just prior to until approximately one hour after primary minimum. This data is plotted in Figure 1.

The data was reduced using estimated first order extinction coefficients, and curve fitting was accomplished using a second order polynomial fit to a fine-mesh cubic spline. Error bars are not included for individual points on the graph, but the maximum error for any point is 0.03 magnitude. As Figure 1 shows, the time of minimum is almost identical for all three filters, and analysis of the fit gives the average time of primary eclipse as:

$$T(\text{minimum}) = \text{HJD } 244\ 7553.6410 \pm 0\overset{d}{.}0022.$$

Using the ephemeris of Guinan et al., the $(O-C) = -0\overset{d}{.}0012$.
Unfortunately, all further attempts to observe AS Cam at minimum during the next two months were fruitless due to bad weather at my location.

AS Cam 27 Jan 1989 v, b, u filters

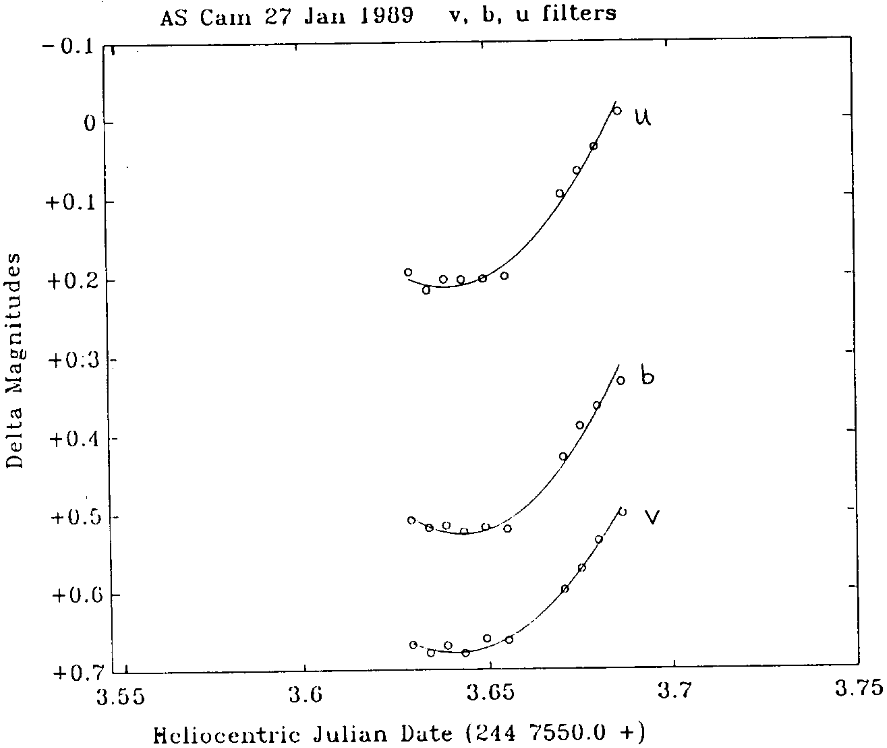

Figure 1

Hopefully other observers have obtained further timings of primary and secondary minimum, so that the motion of this system can be further refined.

I wish to thank Dr. Raymond Bloomer Jr. and Dr. Jamie Varni for their assistance in preparing this article.

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THE OPTICAL VARIABILITY OF THE X-RAY SOURCE 1E1806.1+6944

The X-ray source 1E1806.1+ 6944 was discovered serendipitously in the Einstein Observatory Extended Medium Sensitivity Survey, and was suspected of being a W UMa system by Fleming et al. (1989). Its position at Right Ascension 18:06:03.4 and Declination 69:44:51 (Epoch 1950), brightness of 10.5 in the V band and spectral class of F9 were given by Fleming et al. (1989). A finder chart adapted from Papadopoulos et al. (1980) is given for this star in figure 1.

We observed this star using the 0.5 meter reflector of the Climenhaga Observatory at the University of Victoria on ten nights between 22 June 1989 and 11 August 1989. The telescope is computer controlled to the extent that it is pointed to each of the stars at the beginning of the night and then left to follow a program of observations until dawn. Thus the data are gathered in a very consistent manner and with a minimum of effort by the observer. Due to the proximity of the variable, comparison and check stars both in position and color, mean extinction and transformation coefficients were used to correct the differential magnitudes to the Johnson V and Cousins R and I system (Landolt 1983). The observations of the variable star were bracketed by observations of the comparison star SAO 17785, whose constant brightness was checked with thirteen observations of the check star SAO 17740. The mean check star minus comparison star magnitude was 0.360±.013 in V and -0.219±.007 in (V-R) and -0.218±.014 in (R-I). The errors are standard deviations about the mean, and assure the constancy of the comparison and check stars at this level.

The V band light curve is plotted in figure 2 folded with the ephemeris discussed below. This curve clearly shows the variation expected for a W UMa system as predicted by Fleming et al. (1989). The difference in height of the maxima and in depth of the minima indicate that the system is not a single spotted star like FK Com. The dispersion seen in the maxima and minima of the light curve is larger than the amount of uncertainty seen in the check minus comparison values and is due in part to significant night to night differences. Variations such as these, seen clearly at phase 0.25 for example, are intrinsic to the system and are not unusual in W type W UMa systems. Spotted regions are the likely source of both light curve variations and the X-rays. The (V-I) color curve is plotted in figure 3 and shows only a small reddening at the primary minimum. This is consistent with the system being a W UMa system and inconsistent with a light variation due to temperature changes, as would be expected from a hot compact object and Roche lobe filling companion system such as Her X-1.

Times of minimum and maximum light were found using a program based on the method of Kwee and Van Woerden (1956) and checked using the tracing paper method. Observations in each color were treated individually, but since there were no significant differences between the times obtained,

Table I.
Heliocentric Julian Date of Extrema - 2440000.

Primary Minima	Secondary Minima	First Maxima	Second Maxima
7716.8710 ±3	7701.8201 5	7700.8605 ±8	7721.8459 ±6
7727.8971 ±3	7715.8125 ±4	7734.7863 ±6	7727.7916 ±10
7730.8650 ±4	7734.8902 ±5		7730.7622 ±5

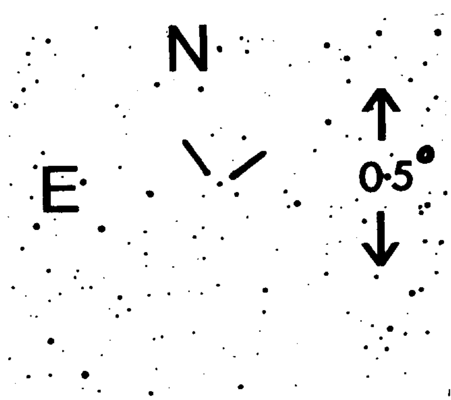

Figure 1. - Finder chart for X-ray source, 1E1806.1+6944; centred on Right Ascension 18:06:03.4 and Declination 69:44:51 (1950.0).

they were combined in a mean, weighted inversely by the error in each color's determination. The heliocentric times of extrema based on all points within 0.04 days of the extrema are given in Table 1. The times of maximum light were used to help determine the period of the system by removing the aliases. The ephemeris best fitting the minima is found to be:

$$\text{Helio. J.D. of Primary Minimum} = \underset{\pm 11}{2447700.7602} + \underset{\pm 2}{0.42400}\,E.$$

The average deviation of a time of minimum from this ephemeris is 0.0013 days. No systematic difference was found in the (O-C)'s indicative of a displaced secondary minimum or either maximum. This period is in good agreement with the period-color relation of Eggen (1967) for contact binaries.

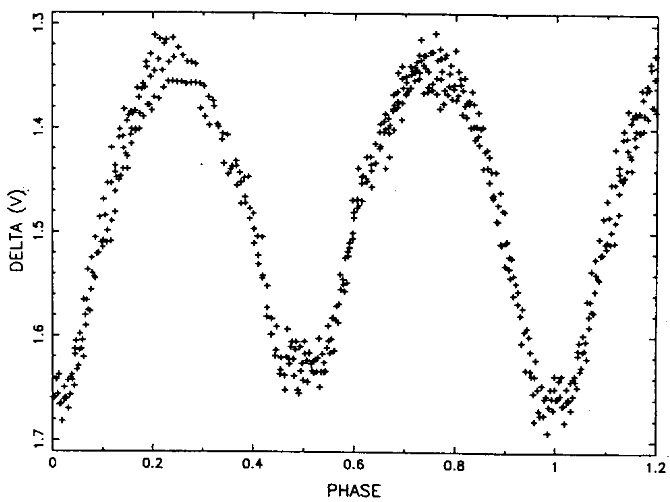

Figure 2. - V filter light curve plotted with PHASE=(JULIAN DATE-2447700.7602) / 0.42400.

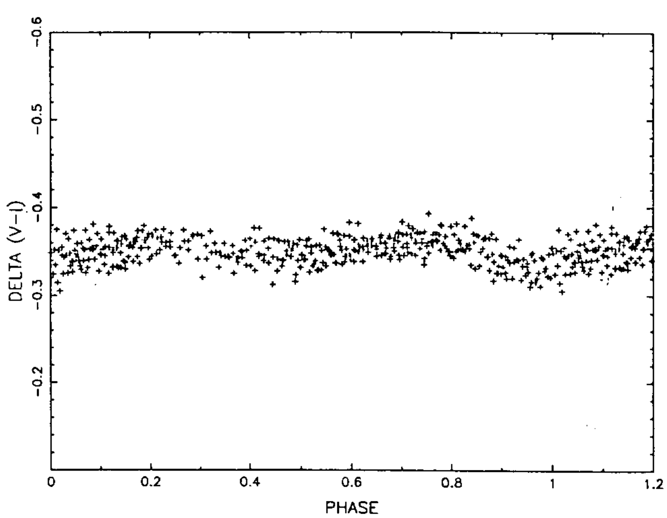

Figure 3. - Color (V-I) plotted as a function of Phase.

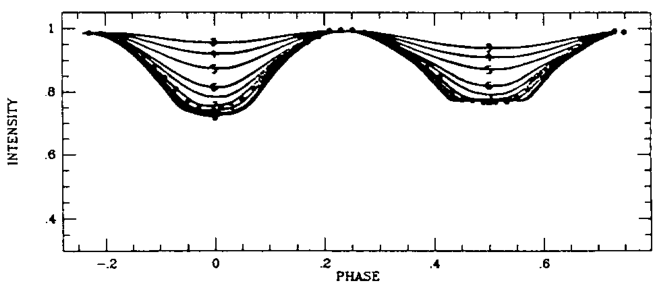

Figure 4. - Average of V, R and I normal points plotted with theoretical light curve from Anderson and Shu (1979) for a convective atmosphere with full limb darkening, a mass ratio of 0.1, and a filled fraction of 1.0. Curves are plotted in 10 degree increments of inclination.

An atlas of theoretical light curves of contact binary stars has been published by Anderson and Shu (1979), for different mass ratios, filled fraction, orbital inclination, and type of atmosphere. Since 1E1806.1+6944 has a F9 spectral type (Fleming et al. 1989), a convective envelope with full limb darkening was assumed. As shown in figure 4 the best match was found for a filled fraction f of 1.0, mass ratio q of 0.1 and an inclination of 80 degrees. These numbers must be regarded as preliminary values, since the theoretical light curves are for bolometric intensity and the data are the average of the V, R and I band normal points. The observed light curve also shows some asymmetry and night to night variation in the brightness of both the maxima and minima.

The X-ray source 1E1806.1+6944 is thus a W UMa system with a period of 0.424 days and an amplitude of 0.34 magnitudes. Spectroscopic observations of this system will be important to find the component masses and mass ratio. Further photometric observations will be important to refine the orbital period and to permit a more detailed solution than we have attempted here. For example sufficient observations in the maxima and minima are needed to give reliable averages of the scatter we have seen before a solution is undertaken.

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NEW OUTBURST OF THE SYMBIOTIC STAR CH Cyg

The gradual decrease of the star's brightness in the U-filter down to values of about 11 mag and the vanishing of its rapid fluctuations in the U,B,V filters, were observed from 1986 to September 1988. These facts were interpreted as a photometric evidence of the end of the active phase of CH Cyg (Skopal, 1988, 1989).

New photometric U,B,V observations were carried out at the Skalnaté Pleso Observatory with a single-channel photoelectric photometer installed in the Cassegrain focus of the 0.6/7.5 m telescope from September 1988 (JD 2 447 424) to August 1989 (JD 2 447 760). The data of the comparison (HD 184 786) and check (HD 184 960) star were published by Chochol et al. (1984). The average values of the U and V magnitudes during one night are shown in Figure 1.

The changes of the star's brightness in the U-filter photometrically best reflect the activity of this symbiotic star. The U magnitude reached the value of 11.1 mag from September 1988 till November 1988. No rapid changes were observed in that period. From December 17, 1988 to April 25, 1989, a small increase of about 0.2 - 0.5 mag in the U-filter was indicated. Its sudden increasing from April 25 (10.8 mag) till the recent observation in August 22 (8.8 mag) is observed. The U-B and B-V colors decreased from ~1.6 and ~1.8 to ~0.4 and ~1.4 respectively. This rapid change of the U magnitude, ~2 mag/4 months, can be classified as a new outburst of this symbiotic star. Moreover, the rapid fluctuations of the star's brightness in the U-filter were observed again. The V magnitude is still running approximately between 6.7 mag and 7.9 mag, and its changes have not been influenced yet by increasing of the blue continuum.

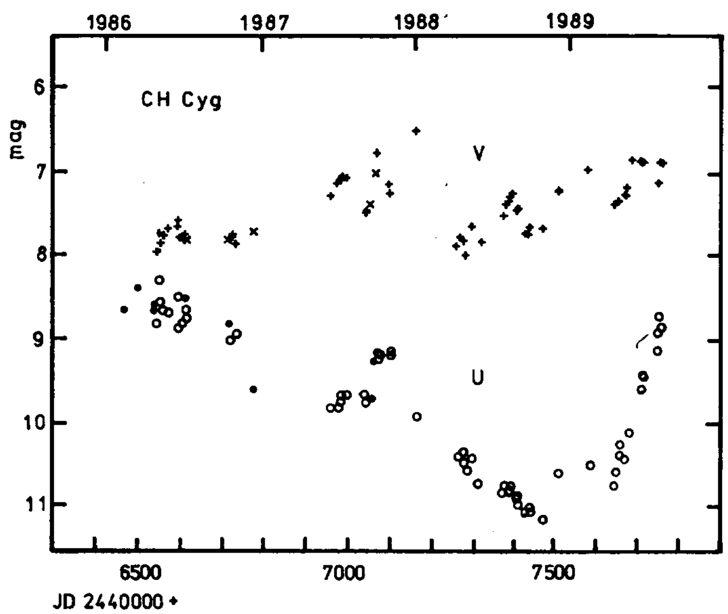

Figure 1. The U and V light curve of CH Cyg in 1986 - August 1989. Sudden increasing of the star's brightness in the U filter is observed in May - August 1989. • - U, x - V data taken from literature; o , + - observations carried out at the Skalnaté Pleso Observatory: Skopal (1987, 1989) and from JD 2 447 420 this paper.

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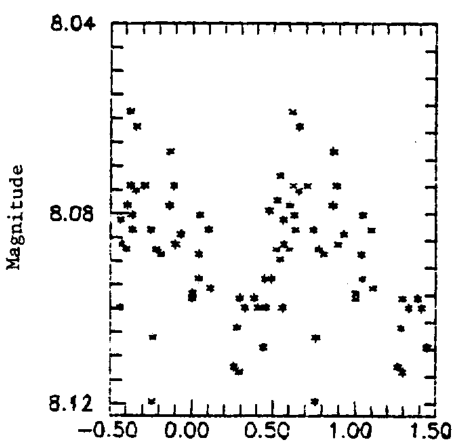
A NEW SHORT PERIOD IN THE WR STAR HD 191765

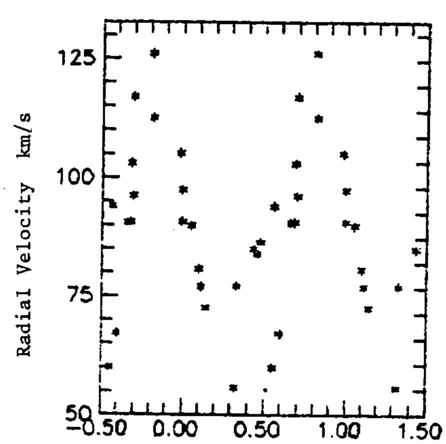
The Wolf - Rayet star HD 191765 is classified in the sixth catalog (Van der Hucht et al. 1981) as a "single" WN6 star. It is centered in ring nebula S109 and connected with it. It has been investigated by Antohin et al. (1982) and a variation in brightness and radial velocity with a period of $7\overset{d}{.}44$ was found. The authors have concluded that this is a binary WR with a compact companion.

Having in mind that Vreux et al. (1985) and Vreux (1985) have found periods less than $1\overset{d}{.}0$ at some WR stars, we searched for such a period in HD 191765. Applying Lafler - Kinman technique to data used by Antohin et al., we obtained a period of $0\overset{d}{.}935$ for B and V bands. In comparison with the $7\overset{d}{.}44$ period, the light curve with the new period (Fig.1) has lower dispersion. This points out to its higher reliability. The same analysis of radial velocity, using He II 4686 line, shows a period of $0\overset{d}{.}9$ (Fig.2).



Phase

Fig. 1



Phase

Fig. 2

Let us assume that HD 191765 is a binary system with $20M_{\odot}$ for WR and $1M_{\odot}$ for the compact object. In this case the semimajor axis is $11R_{\odot}$ and the eccentricity is 0.24. This large eccentricity does not agree with the rather rapid circularization of such a contact system. The optical depth of this value of semimajor axis (if we assume that mass loss rate is 10^{-5} $M_{\odot}$/yr) is 1.7. This value is insufficient to explain the absence of X-ray emission of this star (Sanders et al. 1981).

Finally, we may conclude that these data are insufficient to reliably identify HD 191765 as a binary WR with a compact companion. But the points with phases around 0.75 (Fig.1) look like a second minimum and do not support the pulsation hypothesis. Further investigation should possibly concentrate on confirming their existence.

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THE PULSATOR 21 COM

Short-time variations in the light flux of 21 Com (V = 5.46, Sp = A2p) with periods ranging from 30 to 39 min have recently been reported by many authors (see Weiss, 1983 and references therein). Musielok and Kozar (1982) found variations with periods around 6 min and no evidence of other periodicities. However the accuracy of their determination was questioned by Kurtz (1983) on the basis of an insufficient time resolution of their data. Periods of 6 and 24 min were subsequently reported by Garrido and Sanchez-Lavega (1983). The most recent information on the power spectrum of 21 Com was presented by Weiss (1983). He was unable to detect any variability with periods ranging from 6 to 30 min.

The need to clarify these discrepancies on the photometric variation periods of 21 Com has led us to carry out high-speed photometric observations of this star. The observations were carried out during 5 nights in the period February - April, 1987 using the cooled twin-beam photoelectric photometer "URSULA", (see De Biase et.al., 1988, for a complete description of the instrument) fed by the 91 cm Cassegrain telescope of Catania Astrophysical Observatory. We adopted an integration time of 20 sec, so that a total of 2598 data points,

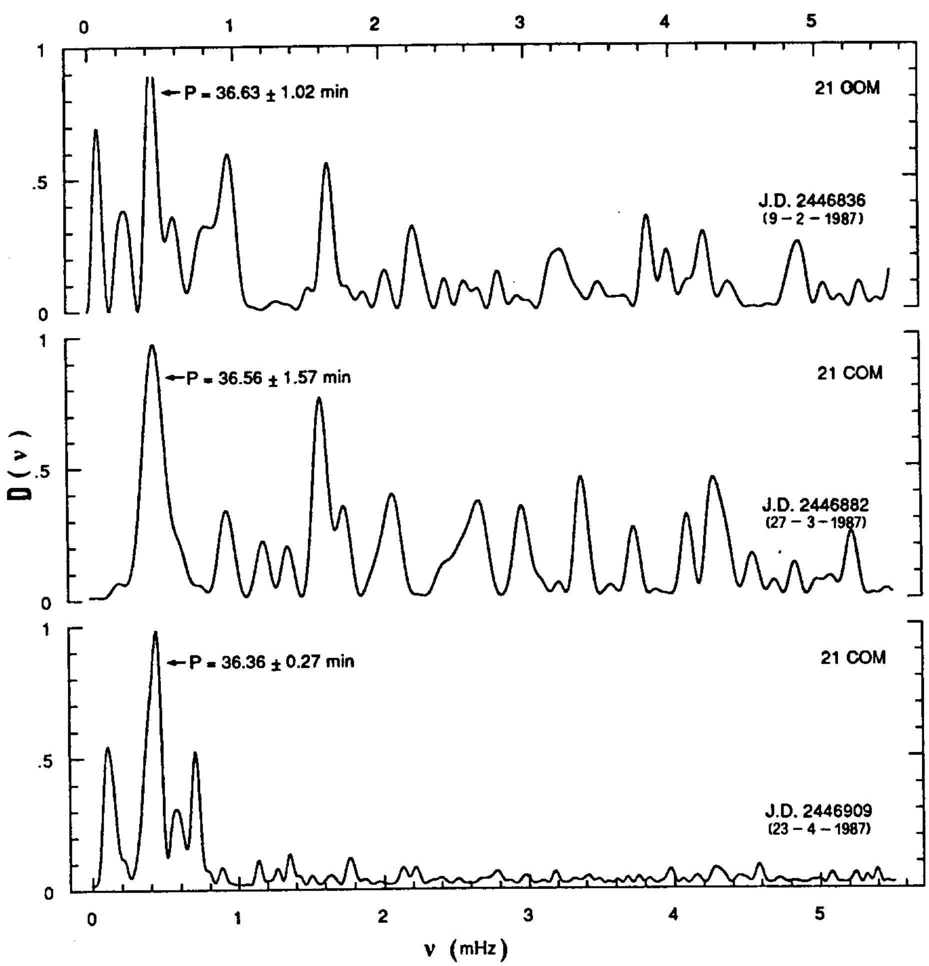

Figure 1 - Normalized power spectra derived from the data on each observation night. The spectra of the individual nights show a peak at a frequency close to 0.46 mHz (36 min).

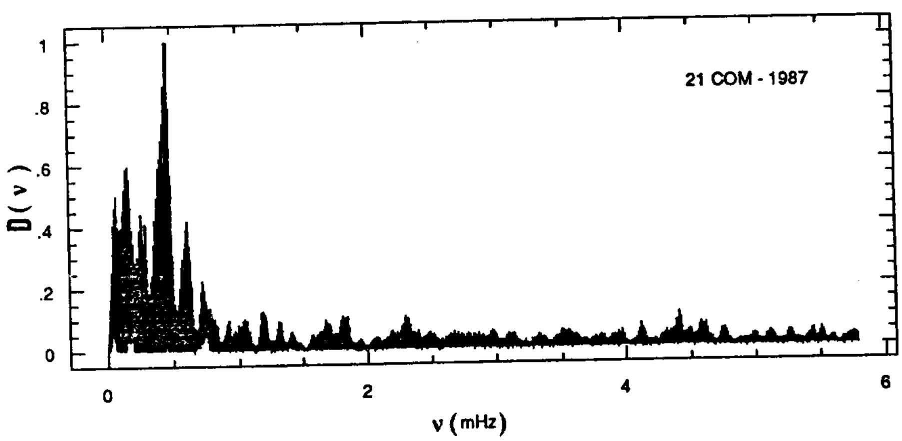

Figure 2 - Normalized power spectrum of all data sets obtained at Catania Observatory in the period February-April, 1987. The dominant frequency is 0.46 mHz (36.08 ± 0.05 min). At 3 mHz no significant power is apparent.

covering about 16 hours of observation, were collected. A neutral filter was used in order to reduce the flux coming from the bright star.

We performed a frequency analysis for each night, using the technique of Fourier transform for unequally spaced data (Deeming, 1975). Some of the normalized power spectra obtained for three different nights are shown in Fig.1. The dominant periods are close to 36 minutes and coincide, within the errors, for all the nights.

As a next step in the frequency analysis of 21 Com data, we processed together all the data sets. In Fig.2 the power spectrum in the range from 0 to 0.58 mHz is shown; it exhibits a significant peak at frequency 0.46 mHz (36.08 ± 0.05 min), which corresponds, within the errors, to the values derived from each single observation night. Moreover, the power spectra shown in Fig.1 and in Fig.2 indicate that no significant frequency appears at 3 mHz; this result is not in agreement with the conclusions of Musielok and Kozar (1982) and Garrido and Sanchez-Lavega (1983) and suggests that 21 Com is not a rapidly oscillating Ap star.

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PHOTOELECTRIC LIGHT CURVES AND MINIMUM TIMES OF XY UMa

XY UMa(BD+55°1317) is a binary system of RS CVn type with a period of 0.^{d}479. The star has been known to exhibit large and long-term changes of its light curve and brightness and this was interpreted by Geyer(1980) and Jassur(1986).

In order to monitor its light curve variations, we observed the system photoelectrically with the 60 cm reflector and a single channel photometer at the Xinglong Station of Beijing Observatory. The observations were made in two sets, during three nights from 7 to 9 March and again during four nights from 30 March to 2 April,1989. The stars BD+54°1278 and BD+54°1275 were used as the comparison and check star, respectively.

The first and second light curves sets and (B-V) color index curves are shown in Fig.1 and Fig.2, respectively. Five primary minimum times were obtained. They are given in Table 1.

Table 1. Times of minima of XY UMa

J.D.Hel.	Filter	m.e.
2447593.2492	B	0.0001
593.2489	V	0.0002
2447594.2069	B	0.0002
594.2067	V	0.0001
2447616.2404	B	0.0002
616.2398	V	0.0005
2447617.1979	B	0.0001
617.1978	V	0.0003
2447618.1553	B	0.0002
618.1556	V	0.0003

Comparing Fig.1 with Fig.2, we find the light curve in Fig.1 to be symmetrical, but that in Fig.2 is asymmetrical. There is a brightening of 0.04 mag around phase 0.25 within a month, which may be caused by asymmetric brightness distributions on the disk of the primary component.

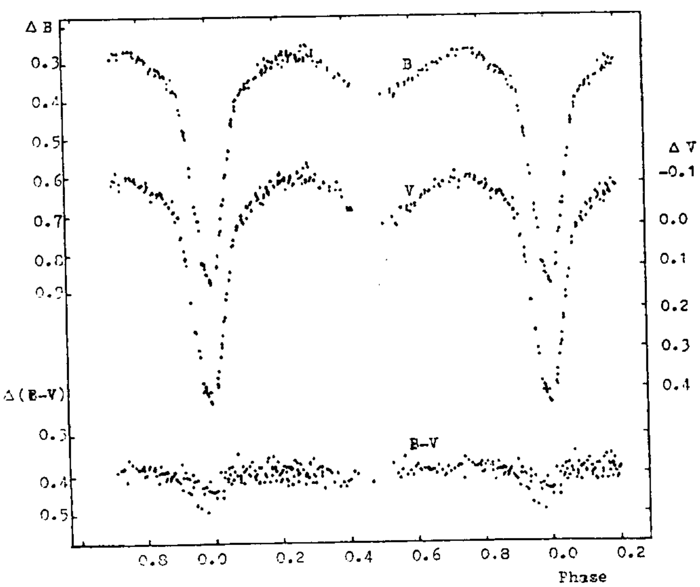

Figure 1

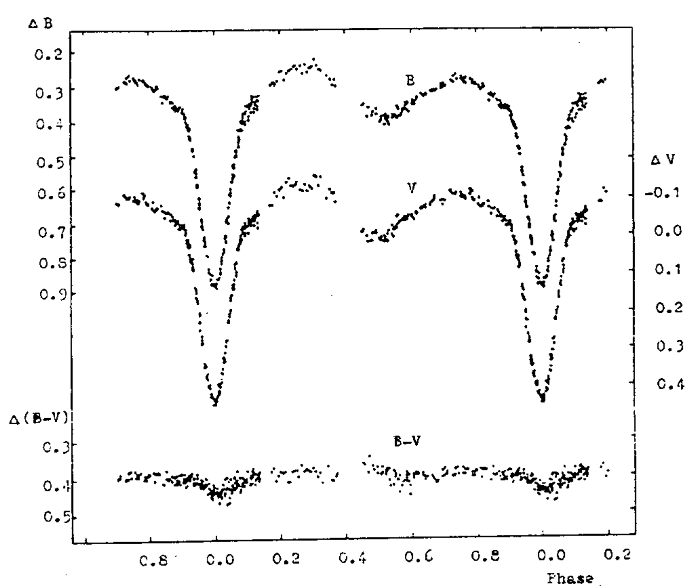

Figure 2

Combining Table 1 with the other 33 minima given by Hall and Kreiner (1980), we have derived the following linear and quadratic ephemerides:

$$Min.I(Hel.) = \underset{\pm 7}{2439913.5245} + \underset{\pm 5}{0.^d47899468}E \quad (1)$$

$$Min.I(Hel.) = \underset{\pm 10}{2439913.5216} + \underset{\pm 5}{0.^d47899478}E + \underset{\pm 3}{1.4} \times 10^{-11}E^2 \quad (2)$$

It is shown that the new average period of XY UMa is $0.^d47899468$ in ephemeris (1). However, the (O-C) residuals of the ephemeris (1) show a long-term change. Fitting with the quadratic ephemeris (2) we find that the period of XY UMa seems to be increasing at a rate of $\Delta P/P \sim 1.8 \times 10^{-3}$ sec/yr from 1931 up to the present.

The photometric analysis will be presented in another paper.

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The May–July 1989 crisis of V348 Sgr

V348 Sgr is a unique variable star apparently related to the R CrB group (see the recent studies by Pollacco 1989 and Houziaux *et al.* 1987). The star happens to spend most of its time either near maximum ($V \sim 12.5$) or near minimum ($V > 18$). It is imbedded in a faint emission nebula which may make measurement or even detection impossible in the minimum episodes.

The stable phases usually last for several months (typically 8 to 9), but much faster events have been detected. In the absence of a daily monitoring the coverage of such fast episods is essentially a matter of luck. For instance in August 1981 a complete minimum (including decline and recovery) took about three weeks (Heck *et al.* 1982), but only part of the decline could be monitored photoelectrically. The descent was then clocked at about 2 mag/day in V. A few other short lived minima were recorded (in August 67 for instance, Duruy 1970), but the data are very scarce.

Experienced visual observers noted that a similar event occured in 1989. It was first caught visually by McNaught (Marsden 1989a) who reported a fading from 12.5 in March and April to fainter than 13.9 on May 5. On May 17, the star was observed visually by Verdenet (Marsden 1989b) at $V = 15$, while as of June 3 it was seen back at the maximum by A. Pearce (Marsden 1989).

Remarkably enough this maximum did not last very long. In the beginning of July we were lucky to follow the first days of a new decline with the ESO 1m telescope on La Silla (Table 1). The ESO single channel photoelectric photometer was used in the Strömgren b band. The rate of variation was marginally slower than that observed in 1981. During the three hours period centered on JD 2,447,714.8 the decline rate $\Delta b/\Delta T$ is estimated to be about 1.35 mag/day while, in 1981, between JD 2,444,837 and 2,444,838, a value of 1.6 mag/day was observed in b. This should have lead to fainter than magnitude 18 by July 9.

Between June and August, several plates were taken with the Schmidt telescope at the Haute-Provence Observatory (Table 2). The second plate, obtained on July 14, and all subsequent ones, until August 31, show that V348 was effectively in its quiescent phase. Curiously enough, Marsden (1989b) reports a visual estimate of 14.0 by J. Bortle on July 9.13. If confirmed, this would imply an irregular descent with secondary maxima. On the other hand the field of V348 Sgr is very crowded,

Table 1. Strömgren b photometry of V348 Sgr

$JD_{\odot}$ +2,440,000.000	Strömgren b
7711.811	12.9206
7711.813	12.9226
7712.799	13.0468
7712.800	13.0270
7714.742	14.1530
7714.743	14.1536
7714.750	14.1667
7714.751	14.1722
7714.767	14.1604
7714.769	14.1701
7714.787	14.2187
7714.789	14.2513
7714.812	14.2899
7714.813	14.2847
7714.832	14.2705
7714.833	14.2443
7714.854	14.2903
7714.856	14.2883
7714.866	14.3191
7714.867	14.3350

Table 2. V348 Sgr magnitudes on Schmidt photographs. The star was often too faint to be recorded. The magnitudes obtained with IIIaJ plates and TP2415 sheet films are not directly comparable to Strömgren b. This is not too important in view of the large variations we are dealing with.

$JD_{\odot}$ +2,440,000.00	Emulsion	Magnitude
7685.06	IIIaJ	12.5
7722.96	IIIaJ	> 18
7736.96	IIIaJ	> 16
7765.84	IIIaJ	> 18
7766.88	IIIaJ	> 18
7767.84	IIIaJ	> 16
7768.92	TP2415	> 14
7769.85	TP2415	> 18

and closeby stars of magnitudes 14.4 and 14.8 have often be mistaken for V348 Sgr when at minimum.

The double event of May–July 1989 may be similar to what happened in August–October 1967. Unfortunately only a few visual observations were recorded. There is also some indications that an analogous behavior occured in September–November 1975. (See Fig. 1 of Heck *et al.*). It is quite probable that several other instances went unnoticed. Obviously a much more extensive coverage of the light-curve is needed before a clear understanding of the photometric variations is obtained.

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CAMPAIGN OF SIMULTANEOUS, MULTIWAVELENGTH OBSERVATIONS
OF THE FLARE/SPOTTED VARIABLE, CC ERI

A multiwavelength campaign is being mounted on 2 and 3 November 1989 to observe the 1.56 day period spectroscopic binary and flare/spotted variable, CC Eri (K7Ve + ≈dM4), continuously over its complete orbital period in order to locate and measure the ultraviolet and optical line emission from it's active regions, as well as its quiescent chromosphere and transition region, and to study flares which are likely to occur occur during the observing run. CC Eri is the second brightest member of the BY Draconis class of spotted cool dwarfs and, with its short orbital and rotational period is one of the fastest rotating. For these reasons it is a very active BY Dra/flare star and probably has one of the brightest ultraviolet line spectra of its class. Only one LW LORES IUE spectrum has so far been obtained of this important object and a very small number of optical spectra. We therefore propose to carry out a detailed study of its quiescent and flaring emission properties and request collaborative, simultaneous ground-based observations from as geographically widely spaced sites as possible.

With IUE we will obtain a continuous series of SWP-LO and LWP-LO spectra over the full orbital (= rotational) period in order to identify bright active regions (from the rotational modulation of emission line fluxes) and to correlate the location of these active regions with dark starspots obtained from contemporaneous optical photometry and spectroscopy. We will also study the time behavior of flares in different spectral lines with coordinated optical photometry and microwave observations. Flares with optical U-band enhancements greater than 1 magnitude are known to occur on average once per 12 hours. We plan to model the quiescent, active, and flaring atmospheres separately using emission measure diagnostics.

Observers interested in collaborating in this campaign should contact the undersigned.

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1989 BV PHOTOELECTRIC OBSERVATIONS OF BV Dra

BV Dra was detected as an eclipsing binary by Batten and Hardie (1965). Photoelectric observations by Wood (1970), Rucinski (1976), Yamasaki (1979), Rovithis and Rovithis-Livaniou (1982) indicate that the star is a normal W UMa system. BV Dra, which forms a visual binary (ADS 9535) with BW Dra, was observed from 20 May through 29 May 1989 with the 1.2m Kryonerion telescope and a single channel photon counting photometer described by Dapergolas and Korakitis (1987). The photometer employs a high gain 9789QB phototube and conventional BV filters. Its output is fed directly to a microcomputer enabling rapid data access.

The data reduction method is the standard one. The comparison star is the BD $+62^{\circ}$ 1395 and the accuracy of observations is ± 0.02 mag.

Table I lists the dates of observations and phases covered whereas Figures 1 and 2 summarize the results for B and V colours.

Table I

Date	Phase	
20 May 1989	.11	.38
	.55	.73
21 May 1989	.11	.72
25 May 1989	.33	.11
29 May 1989	.03	.26

In Table II the times of minima and the O-C values are listed for the B and V bands respectively. Times of minima are calculated using the method described by Kwee and van Woerden (1956) whereas the O-C values were determined from the linear ephemeris T= J.D.2442878.372 + $0\overset{d}{.}3500663$E (Geyer et al., 1982).

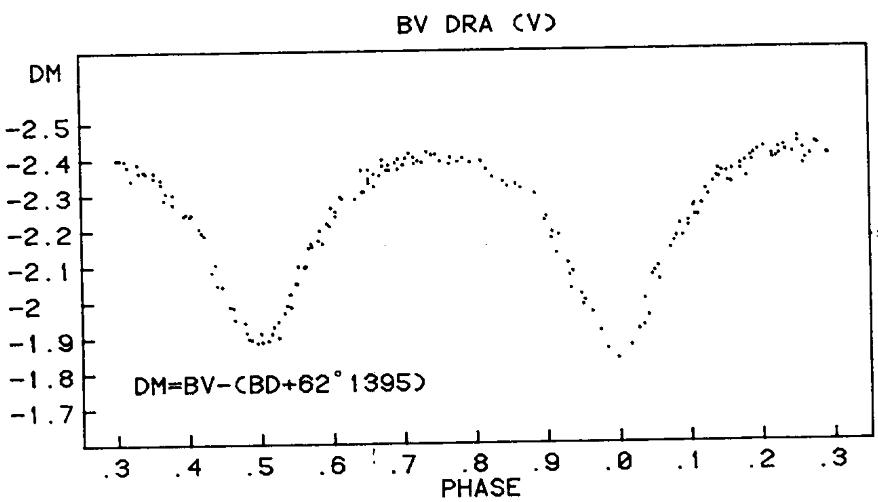

Figure 1

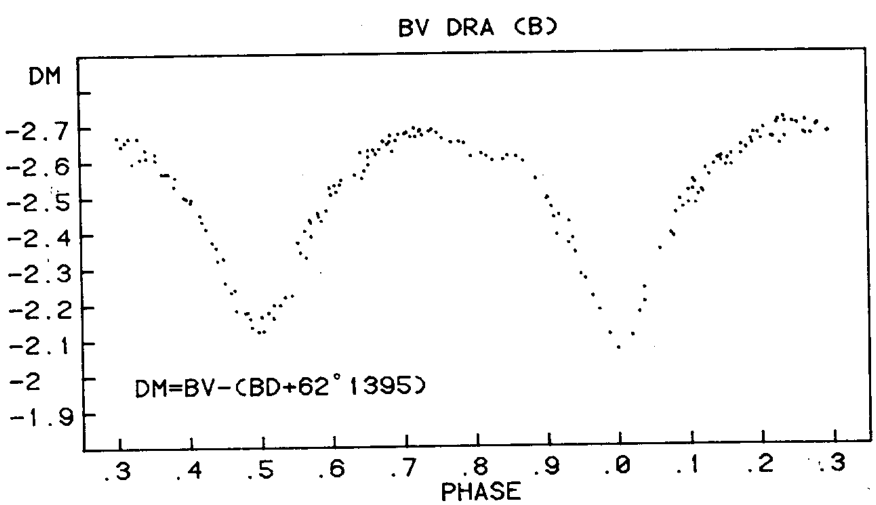

Figure 2

Table II

Type of minima	V COLOUR Heliocentric Jul. Day	(O-C) phase	B COLOUR Heliocentric Jul. Day	(O-C) phase
Secondary	2447668.5063	0.506	2447668.5069	0.507
	±0.0002	±.001	±0.0005	±.001
Secondary	2447672.3573	0.507	2447672.3549	0.500
	±0.0002	±.001	±0.0005	±.002
Primary	2447672.5316	0.005	2447672.5337	0.010
	±0.0006	±.002	±0.0005	±.002
Primary	2447676.3799	0.998		
	±0.0006	±.002		

From the Figures 1 and 2 it can be seen that the light curve is not fully symmetric, and the differences between primary and secondary minima are ~0.05 mag in B and ~0.02 mag in V.

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IS HR 6754 A δ SCUTI STAR AFTER ALL?

HR 6754 (HD 165373, V = 6.64, SpT F0 IV-V) is a star which Breger (1969) found to be located in the δ Sct instability strip but which he also found to be non-variable. This conclusion was based on the star being constant to within 0.002 mag over 2.7 hours.

By chance I subseqently used HR 6754 as a check star while studying the variability of 89 Her, and Table 1 of Fernie (1981a) reported ten sporadic observations of HR 6754 over three months which showed constancy to better than 0.02 mag.

However, I have continued to use the star as a check star for 89 Her in an on-going APT Service program, and in a recent routine examination of the data I noticed the HR 6754 results seemed less stable than those of check stars for other variables.

Figure 1 shows the V magnitudes of HR 6754 in 1988 as open circles, while the plusses represent the V magnitudes of HR 6641, the check star for HD 161796. The two stars are fairly close together on the sky and so are measured within minutes of each other on each night, yet it is clear there is significantly more scatter in the HR 6754 data.

No significant periodicites were revealed when these data were subjected to a Discrete Fourier Transform analysis, but of course the star's spectral type suggests any likely period would be a fraction of a day, *i.e.* at frequencies much above the Nyquist frequency of these once-a-day observations.

I therefore observed HR 6754 over about two hours on August 24/25 1989, using HR 6697 as a comparison star. Figure 2 illustrates the results, and variability is clearly present. A DFT analysis yields a period of 0.072 ± 0.008 days and amplitude 0.035 mag, although the unequal heights of the maxima in Figure 2 suggest that a much longer datastring would likely reveal other periods as well. In any case, the result is consistent with δ Sct variability.

The evidence is much against HR 6697 being the variable. Its spectral type of G2 V militates against detectable pulsation, and its period is much too short and its lightcurve too shallow for a W UMa system. (The Bright Star Catalog indicates it to be a spectroscopic binary with components resolved at about 0.1 arcseconds, which leads to a period ≥ 2 years.) Moreover, plotting the magnitudes of the two stars separately over the two hour run indicates greater variability in HR 6754. Finally, if HR 6697 were the variable the puzzle of Figure 1 would remain unanswered since this star is not involved there.

Why the star should have appeared constant at the 0.002 mag level when Breger observed it is difficult to say. (My own 1981 data are not precise enough to be more than marginally inconsistent with the present results.) One might argue that in a multiperiodic variable destructive interference may at times flatten the lightcurve, but it seems unlikely this could result in constancy to two millimagnitudes for 2.7 hours. Another possibility, dis-

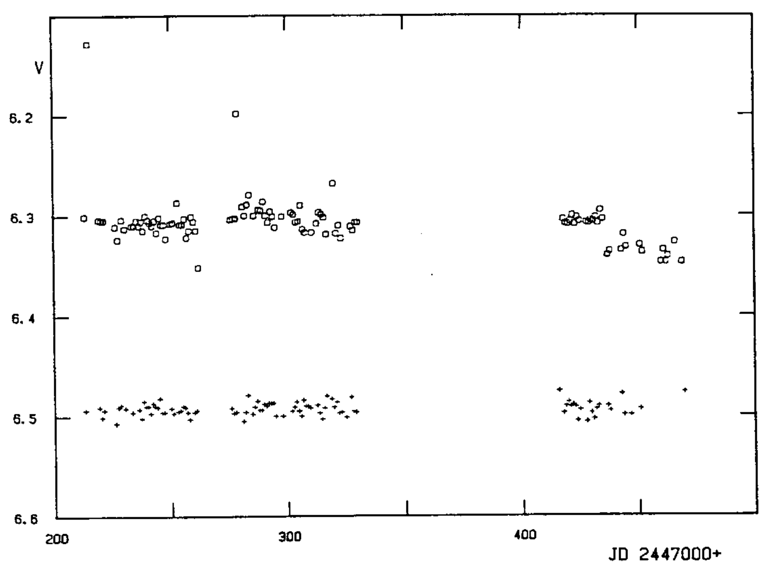

Fig. 1. Absolute photometry of HR 6754 (circles) and of HR 6641 (plusses) in 1988.

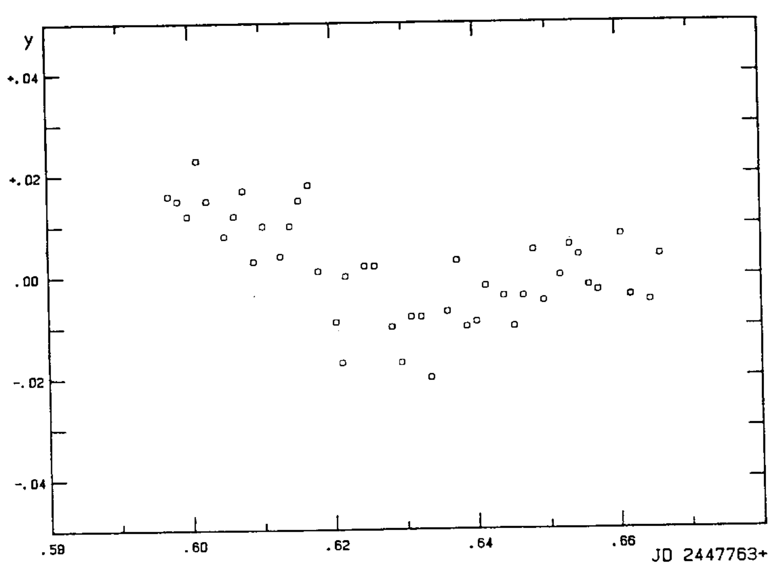

Fig. 2. Differential photometry, HR 6754 - HR 6697, during two hours on August 24/25, 1989.

cussed in Fernie (1981b), is that some stars in this region of the HR diagram are not continuously variable. The star would clearly repay further observation.

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UBV OBSERVATIONS OF II Peg IN 1988-1989

II Peg (=BD+27^{o}4662 = HD 224085 = SAO 91578) is a bright RS CVn-type single-line spectroscopic system (K2 IV-V). This very interesting spotted binary has been one of the most observed in the northern hemisphere (see Rodonò et al., 1986: Strassmeier et al. 1988 and references therein) and has shown highly variable light curve with peak-to-peak V-band amplitude up to 0.5 magnitude (Byrne 1986, Cutispoto et al. 1987).

We present UBV photometry obtained at Mt. Hopkins in 1988-89 by the Phoenix Automatic Photoelectric Telescope (APT) and BV data obtained middle 1989 at the mountain station of Catania Observatory on Mt. Etna. The observations were corrected for atmospheric extinction and nightly mean standard differential magnitudes (variable-comparison star) were computed.

The UBV APT data were obtained during 30 nights in the period October 1988 - January 1989 with an uncooled UBV photometer fed by a 0.25-m cassegrain telescope. Our comparison star was HD 244016 (V=8.52, B-V=0.776, U-B=0.49) while HD 223462 was used as check star. No significant variations between comparison and check star were observed.

The Catania BV observations were made during 7 nights in June-July 1989 with an uncooled simultaneous UBV photometer fed by a 0.61-m quasi-cassegrain telescope. Our principal comparison star was HD 224084 (V=8.245, B-V=1.281, U-B=1.356), while HD 224016 and BD+27^{o}4648 were used as check stars and were observed several times on each night. No significant variations between comparison and check stars were observed.

The V light and color curves of II Peg are shown in Figures 1 and 2 where the phases are reckoned from the spectroscopic ephemeris by Raveendran et al. (1981):

$$HJD = 2443030.396 + 6.724464 \times E$$

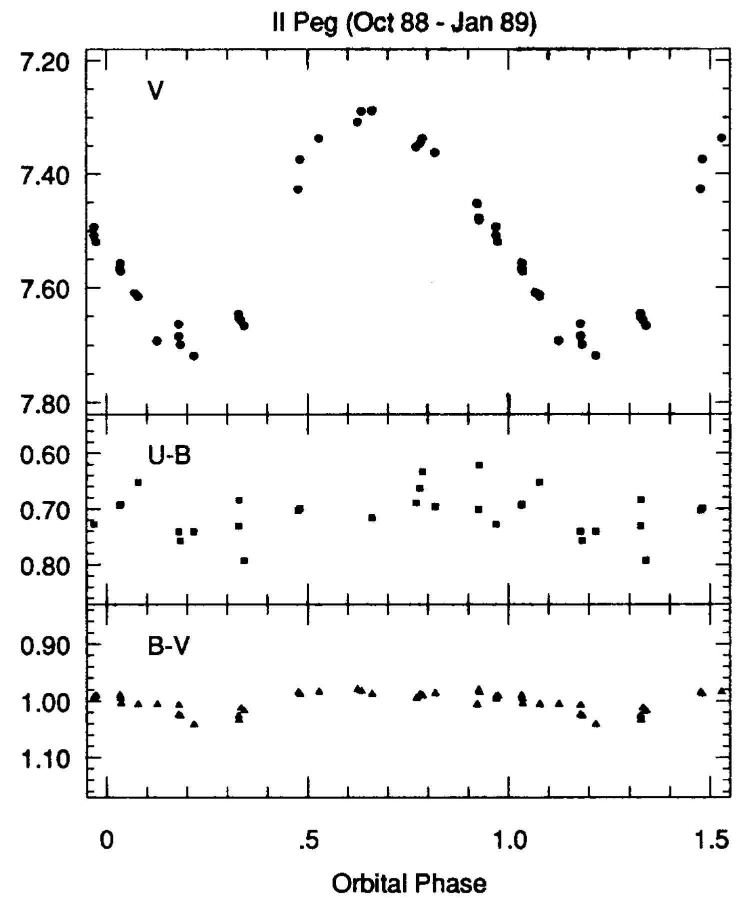

Fig.1.: V-light, U-B and B-V color curves of II Peg in October 1988 - January 1989. Phases are reckoned from the ephemeris: HJD = 2443030.396 + 6.724464 x E (Raveendran et al. 1981).

Typical nightly standard deviations for V, B-V and U-B data are 0.005, 0.01 and 0.01 mag. respectively. A listing of the individual data will be provided upon request to the first author.

In both observing periods the V light curve is single-peaked with the rising branch steeper than the descending one and has an estimated amplitude of about 0.43 mag. Small color variations show the star to be

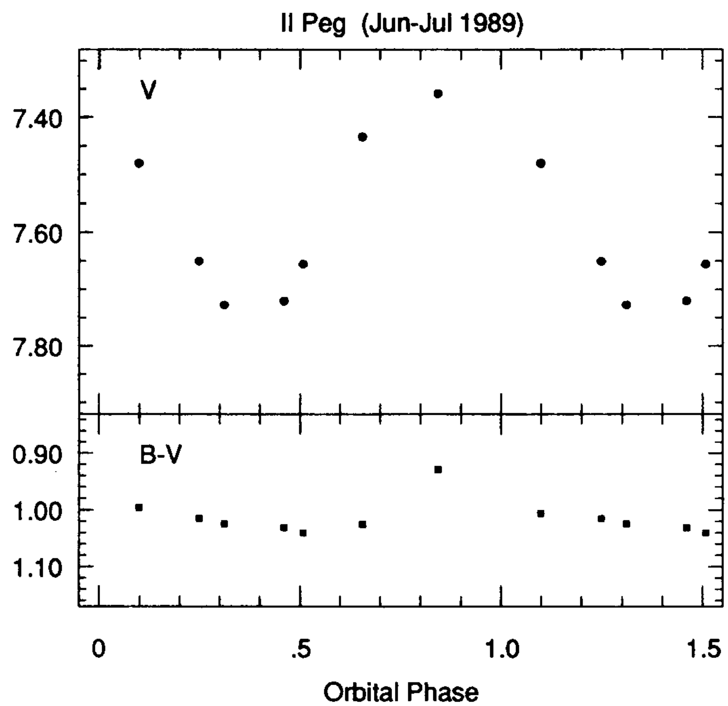

Fig.2.: V-light and B-V color curves of II Peg in June - July 1989. Phases are reckoned from the ephemeris:
HJD = 2443030.396 + 6.724464 x E (Raveendran et al. 1981).

bluer at light maximum, in agreement with the cool spot hypothesis. The APT data show that the light curve has remained considerably stable for more than 14 star rotations. In mid-1989 the star was fainter than in late 1988 - early 1989, indicating a global increase of II Peg's degree of spottedness.

In Figure 3 a collection of the published photometry of II Peg is reported, with the vertical bars indicating the peak-to-peak V amplitude of the light curve. There is a clear systematic decrease of the II Peg luminosity at light maximum and of its mean light level from 1974 to 1984, which is followed by a definite increase after 1984. This systematic trend could be suggestive of a spot cycle and once again stresses the importance of long-term systematic photometry of spotted stars.

We wish to thank Prof. Marcello Rodonò for suggesting us to carry out the present observations and for making available to us the APT data.

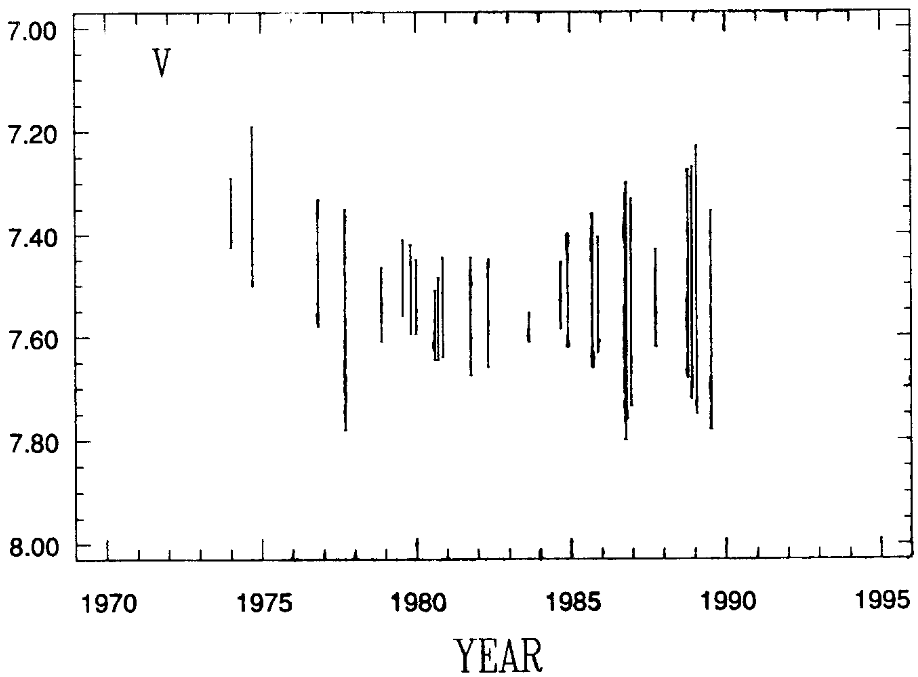

Fig.3.: Collection of the published photometry of II Peg. Vertical bars indicate the peak-to-peak amplitude of the V light curve.

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1989 BV PHOTOELECTRIC OBSERVATIONS OF CG Cyg

The eclipsing binary CG Cyg was observed from 24 July through 1 August with the 1.2m Kryonerion telescope and a single channel photon counting photometer described by Dapergolas and Korakitis (1987). The photometer employs a high gain 9789QB phototube and conventional BV filters. Its output is fed directly to a microcomputer enabling rapid data access.

Photometric observations for this star have been reported by us in 1988 and 1989 and other investigators listed by Dapergolas et al. (1989).

The data reduction method is the standard one and the BD +34^{o} 4216 was used as a comparison star. The constancy of the comparison star was verified by Milone et al. (1979). The data were obtained with an accuracy of $\pm$0.015 mag.

Table I lists the dates of observations and phases covered whereas Figures 1 and 2 summarize the results for B and V colours.

Table I

Date	Phase	
24 July 1989	.16	.53
25 July 1989	.83	.14
26 July 1989	.31	.73
27 July 1989	.96	.14
30 July 1989	.78	.08
31 July 1989	.22	.65
1 Aug 1989	.05	.22

In Table II the times of minima and the O-C values are listed for the V and B bands respectively. Times of minima are calculated using the method described by Kwee and van Woerden (1956) whereas the O-C values were determined from the linear ephemeris $T=2439425\overset{d}{.}1221 + 0\overset{d}{.}631141 \cdot E$ given by Milone and Ziebarth (1974).

From Figures 1 and 2 it can be seen that there are irregularities outside the eclipse already reported by Milone et al. (1979) and ten years later by Dapergolas et al. (1989).

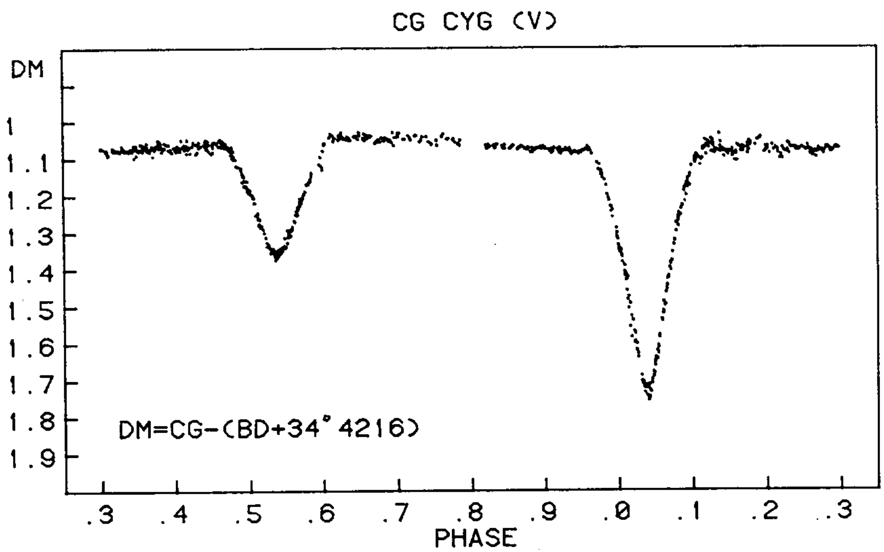

Figure 1

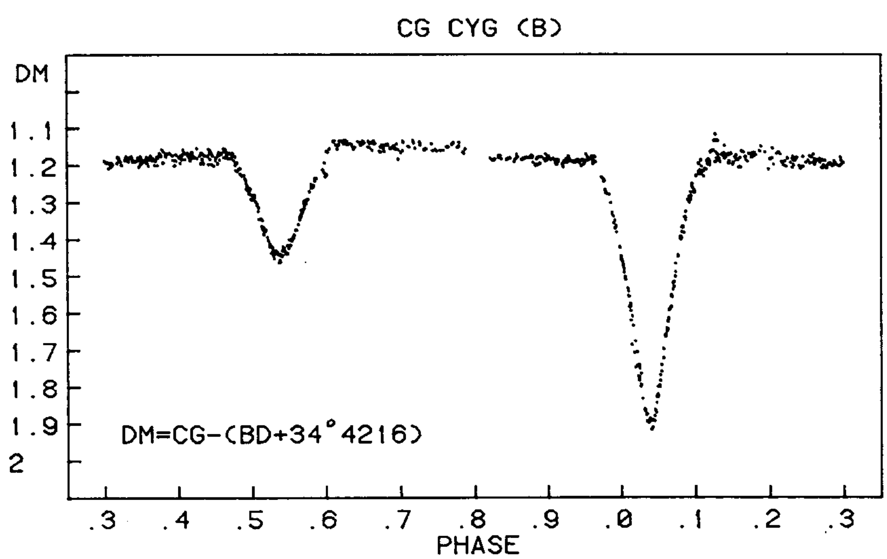

Figure 2

Table II

	V COLOUR		B COLOUR	
Type of minima	Heliocentric Jul. Day	(O–C) phase	Heliocentric Jul. Day	(O–C) phase
Primary	2447733.4867 ±0.0001	0.039	2447733.4865 ±0.0001	0.038
Secondary	2447734.4335 ±0.0001	0.539	2447734.4331 ±0.0002	0.538
Primary	2447735.3801 ±0.0001	0.039	2447735.3798 ±0.0001	0.038
Primary	2447738.5353 ±0.0003	0.038	2447738.5355 ±0.0003	0.038
Secondary	2447739.4826 ±0.0001	0.539	2447739.4826 ±0.0001	0.539

The observed difference between the primary and secondary minima is 0.45 mag for the B and 0.39 mag for V whereas these values for 1988 are 0.34 mag and 0.30 mag respectively (Dapergolas et al., 1988) and for the year 1987 0.41 mag and 0.30 mag (Dapergolas et al., 1989).

These values indicate that the differential variation of the two minima depths is similar for both colours (0.11 mag for B and 0.09 mag for V) for the years 1988 - 1989 but are quite different (-0.07 mag for B and 0.0 mag for V) for the years 1987 - 1988.

From the times of minima found here and those published by Dapergolas et al. (1989) and Milone et al. (1979) the O-C residuals show large variations which might be due to the continuous period variation of the system.

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RECENT PHOTOELECTRIC MINIMA OF THE ECLIPSING BINARY RZ Cas

Sometimes the bright eclipsing system RZ Cas (=BD+69°179 =HD 17138) has been reported to have a flat bottom near the centre of primary light minimum (Szafraniec 1960, Burke and Rolland 1966, Arganbright et al. 1988) and in some cases this behaviour was not observed (Chambliss 1976, Surkova 1988). Recently, Arganbright et al. (1988) published their experiences about the contradictions of different studies. They have measured a 22 minute long apparent totality, although theory yields a partial eclipse on the basis of very good geometrical elements of Chambliss (1976).

Our photometric measurements were made using the 40 cm Cassegrain telescope of Baja Observatory, with a Starlight-1 photoelectric photometer. The comparison star was BD+69°171. Eclipses were observed on 18/19 November and 12/13 December 1987, 2/3 January, 22/23 and 28/29 March 1989. We used only the "V" filter on the last two nights, and "V" and "B" on the previous ones. The minimum times of the first two nights have already been published (Hegedüs, 1987). The new values are:

Min.Hel.J.D. =	2447529.5011	(V)	n=24	O-C=+0.0102 days
(obs)	2447529.5010	(B)	n=24	O-C=+0.0101 days
	2447608.3867	(V)	n=28	O-C=+0.0095 days
	2447614.3628	(V)	n=42	O-C=+0.0093 days

where "n" is the number of individual points taken into account in the least squares parabolic fitting. The O-C values were computed with respect to the ephemeris taken from G.C.V.S. (Kholopov, 1985).

The shape of the eclipses of the first two nights is given in Figures 1 and 2. The stellar magnitudes are given in our instrumental system. The dots represent our measurements during the first nights, while the crosses are the data of Arganbright et al. (1988), shifted by a certain value of magnitudes (to compensate the difference between their and our photometric system). The descending and ascending branches of the two light curves are in good agreement with one another. The shift of the earlier measurements can be a legitimate procedure, since our photometric system is very close to the standard UBV system, and because

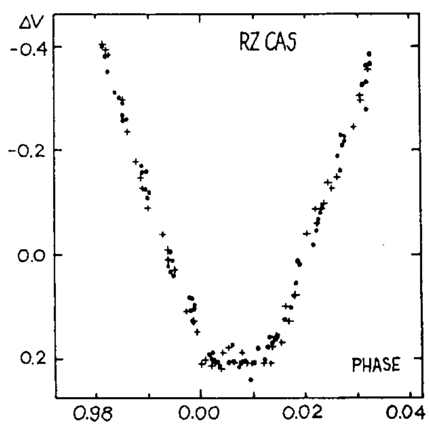

Figure 1

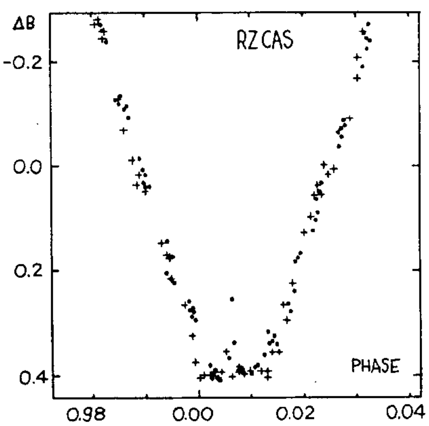

Figure 2

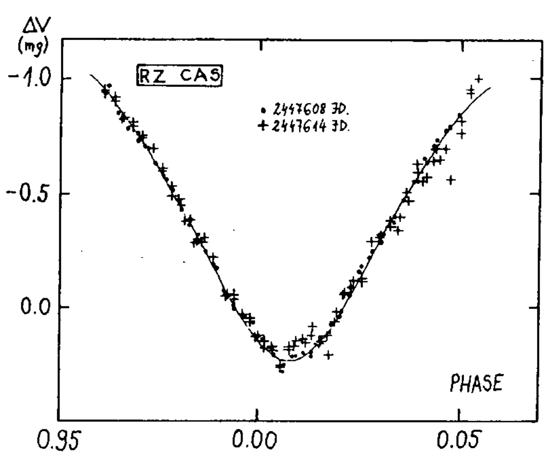

Figure 3

the depths of primary minima (1.570±0.015 in "V" and 1.665±0.026 in "B" from measurements made in 1987, and 1.550±0.021 in "V" from measurements made in 1989) are close to the corresponding values of Chambliss (1976) (1.55 in "V" and 1.64 in "B") and those of Arganbright et al. (1988).

The constant brightness of RZ Cas near the middle of the eclipse is well appreciable in "V" band but less evident in the "B" light. The length of this flat light minimum is found to be 18 (from our data plotted in Fig. 1), 15.5 (from our data plotted in Fig. 2) and 16 minutes (from our V-filter data of 22/23 March 1989). The light of the system seems to be constant within ±0.009, ±0.023, and ±0.019 magnitudes, for these three data set, respectively. So our data show the apparent totality with nearly the same accuracy, as the data of Arganbright et al. (1988).

Averaging our 213 individual "V" measurements (observed before 28/29 March 1989) into 40 points we constructed a normal light curve. This curve shows no sign of any asymmetry of primary minimum (in agreement with the conclusion of Nowak and Piotrovski, 1982). An estimation of the lower and upper limits of the possible length of the flat bottom also was made from this curve. We obtained 4 and 20 minutes for them, respectively. Arganbright's 22-minute long totality is slightly beyond our upper limit.

It should be also mentioned, that although Reed (1968) and Karle et al. (1975) did not treat this behaviour in their papers, a 19-minute long total eclipse (at JD 2439877, Reed, 1968) as well as a 17-minute long one (at JD 2442303, Karle et al. 1975) are well appreciable. Photometric studies of Stokes (1972) and Surkova (1988) contain very scanty data near the mid eclipse but the distribution of their individual measurements does not exclude an about 16, and 13 minute long totality, respectively.

We observed a short-term light change of 0.16 mag. in the "B" band, near the phase of 0.006 at JD 2447118 (see Fig. 2). Among Arganbright's data one can see also a light increase near this phase. In the earlier studies we couldn't see any evidence for such light jump. Thus, its reality is questionable, or it can be a rare event.

Finally, we call the attention to the eclipse of 28/29 March 1989. On that night we have measured a slow light increase near the bottom of the minimum. In Figure 3 our single measurements are given as crosses, the dots represent our observational data of 22/23 March 1989 and the continuous curve is the approximate theoretical light curve. This hump maybe seen also in the measurements of Burke and Rolland (1966). The presence of an additional light in the total phases of certain eclipsing variables is a known fact. Kudzej (1987) has studied this phenomenon from theoretical aspects and in the case of twelve close binaries. The eclipse of RZ Cas is not surely total and the hump is not always observable. Even if it were a real effect, the time dependence of the appearance and of the probable shape of the hump in the apparent total phase would make it probable that the reason of these phenomena is entirely different from the effect studied by Kudzej (1987). At this time we cannot exclude that the above mentioned effect can be a consequence of observational errors or of the variability of the comparison star.

Thus, it is clear that despite of RZ Cas is a frequently studied eclipsing variable, it would be advisable to observe this binary systematically, with a better time-resolution and higher precision, than it has been usually done. We can verify only in this manner what in the binary system RZ Cas happens.

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1989 BV PHOTOELECTRIC OBSERVATIONS OF BW Dra

BW Dra is a W UMa - type eclipsing system. Together with its companion, BV Dra, they form the visual binary ADS 9535. BW Dra is a short period variable and it was observed from 20 May through 29 May 1989 with the 1.2m Kryonerion telescope and a single channel photon counting photometer described by Dapergolas and Korakitis (1987). The photometer employs a high gain 9789QB phototube and conventional BV filters. Its output is fed directly to a microcomputer enabling rapid data access.

The data reduction method is the standard one. The comparison star is the BD +62°1395 and the accuracy of the observations is $\pm$0.02 mag.

Table I lists the dates of observations and phases covered, whereas Figures 1 and 2 summarize the results for B and V colours.

Table I

Date	Phase
20 May 1989	.92 .23
	.43 .64
21 May 1989	.49 .24
25 May 1989	.95 .88
29 May 1989	.78 .25

In Table II the times of minima and the O-C values are listed for the V and B bands respectively. Times of minima are calculated using the method described by Kwee and van Woerden (1956) whereas the O-C values determined from the linear ephemeris T=2442572^{d}.538 + 0^{d}.2921671E (Geyer et al., 1982).

From the Figures presented here it can be seen that BW Dra has symmetric light curves.

Considering all the O-C values found in literature (Wood (1970), Yamasaki (1979), Geyer et al. (1982), Rovithis and Rovithis-Livaniou (1987)), and those presented here it can be seen that there are large deviations which might be due to the variability of the individual light curves of the binary.

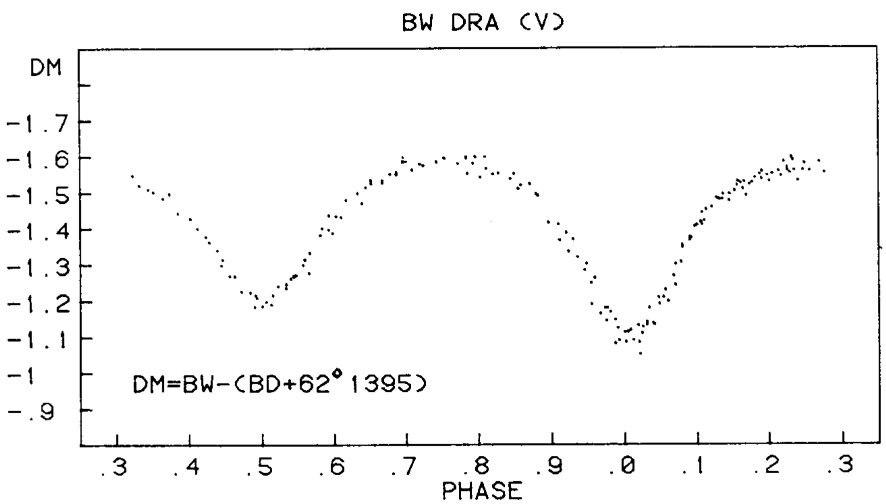

Figure 1

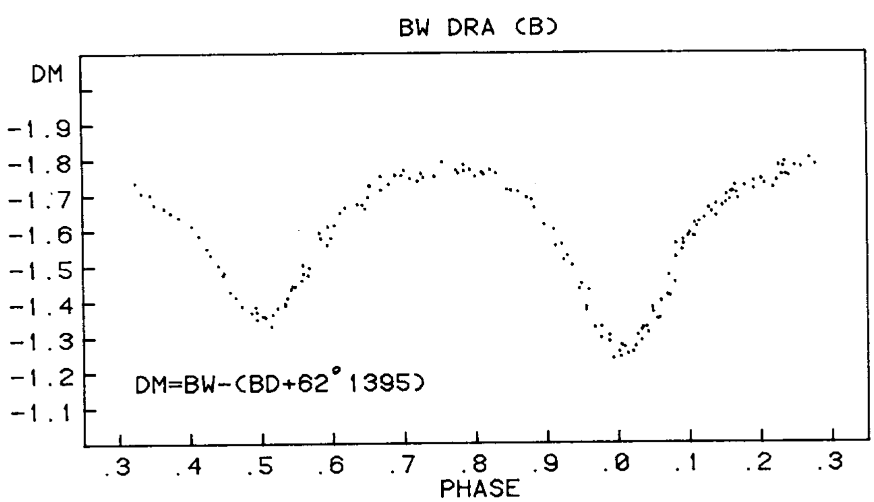

Figure 2

Table II

	V COLOUR		B COLOUR	
Type of minima	Heliocentric Jul. Day	(O-C) phase	Heliocentric Jul. Day	(O-C) phase
Primary	2447667.3488	0.003	2447667.3498	0.007
	±0.0004	±.001	±0.0007	±.002
Secondary	2447667.4988	0.516	2447667.4968	0.510
	±0.0010	±.003	±0.0004	±.001
Primary	2447668.5180	0.005	2447668.5175	0.003
	±0.0002	±.001	±0.0004	±.001
Primary	2447672.3171	0.008	2447672.3162	0.005
	±0.0004	±.001	±0.0003	±.001
Secondary	2447672.4611	0.501	2447672.4609	0.504
	±0.0002	±.001	±0.0004	±.002

From Figures 1 and 2 it can be also seen that the differences between the depths of the primary and the secondary minima are equal for both colours (~0.1 mag). The depth of the minima is variable up to 0.05 mag as it was reported previously by Geyer et al. (1982).

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ON THE INSIGNIFICANCE OF SOME CLAIMED OSCILLATION PERIODS

The recent IBVS entitled "Detection of new short period oscillations in PG1711+336 (V795 Her)" by Ashoka et al. (IBVS No.3352) demonstrates an elementary misunderstanding of the significance or otherwise of apparent periods in the light curves of cataclysmic variables (CVs). The short section of light curve of V795 Her obtained and illustrated by the authors shows the rapid brightness variations typical of CVs. Without implying any physical connection with solar or stellar flares, let us call the brightenings and fadings in the light curve "flares". The flares occur on a variety of timescales. If at least some fraction of the flares can be shown to occur repetitively, for many cycles, with a well defined period, then the claim of a periodicity can be made, and it is worthwhile enquiring the physical reason for such an eigenmode in the system. An extension to quasi-periodic oscillations can be made if there are sufficient oscillations that can be shown to occupy a relatively narrow range of period in the Fourier transform.

However, to claim, as Ashoka et al. do, that the occurrence of just three flares spaced nearly equally in time (during the time 20.23 to 21.33 of their Figure 1) constitutes the detection of a periodicity of 1389 secs, or even (because it was not present in the second half of their observing run) that it is quasi-periodic, is nonsense.

In a paper in press (A.W. Shafter, E.L. Robinson, D. Crampton, B. Warner and R.M. Preston - Ap.J. submitted) a total of 22 hrs of high speed photometry of V795 Her is presented: power spectra show no persistent short period oscillations. However, if the light curve were to be subdivided into sections as short as those used by Ashoka et al., any number of apparent "oscillation periods" would be found. This is true of most CVs. For example, the reader is invited to inspect the light curve of U Geminorum just prior to eclipse (p. 96 of I.A.U. Symposium No.73):

superficially there appears to be a periodicity in the flares, but power spectral analysis shows that there is none. If analysed in short sections, however, many apparent short-lived periodicities would emerge. There are hundreds of metres of plots of other CV light curves that could be similarly overinterpreted.

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1989 V AND K-BAND PHOTOMETRY OF WY Cnc

We report on new V and K band light curves of the short-period RS CVn star WY Cancri (= BD 27° 1706; #68 in the catalog of Strassmeier et. al, 1988). Very few complete light curves are available for this system. Chambliss (1965) presents observations from 1964-65; Sarma (1976) from 1973-74; Awadalla and Budding (1979) from 1978, and Naftilan (1987) from 1982. Oliver (1974) also provides a fairly complete set of data from 1969-70. We decided to reobserve this binary as part of our long-term project to ascertain the activity cycles of RS CVn systems.

We made observations on the nights of 19, 21, 22 and 23 April 1989 UT and 20 February 1989 with the 1.3-m telescope at Kitt Peak National Observatory. The infrared detector was OTTO; the visual one, the Mark III Ga:As photometer mounted in the side port of the infrared photometer. All observations used SAO 80598 (= BD 27° 1708) as the comparison star; 39 Cnc served as the infrared standard star (K = +4.23 on the KPNO infrared system). For the infrared, the aperture size was 32" in the infrared; 34" in the visual. Standard beam-switching techniques were used, with the beam separation set at 60", for both visual and infrared observations. We aimed at a S/N ≥100 for each datum; occasional K-band points have S/N ≃ 50. Phases were derived from the ephemeris in Strassmeier et al. (1988).

Figure 1 gives the V-band magnitude differences (comparison-variable) in the instrumental system, which is very close to Johnson V. Figure 2 shows the same data in normalized intensity units (circles) compared to an optimized light curve (solid line) generated by our fitting program with a 5500 K primary star and a 3500 K secondary (Budding and Zeilik, 1987). A minimum in the distortion wave appears near phase 90°; the optimized spot parameters are longitude = 108° ± 3°, latitude = 39.4° ± 17.9°, and radius = 11.7° ± 2.4°. Figures 3 and 4 present the K-band data in the same way as for

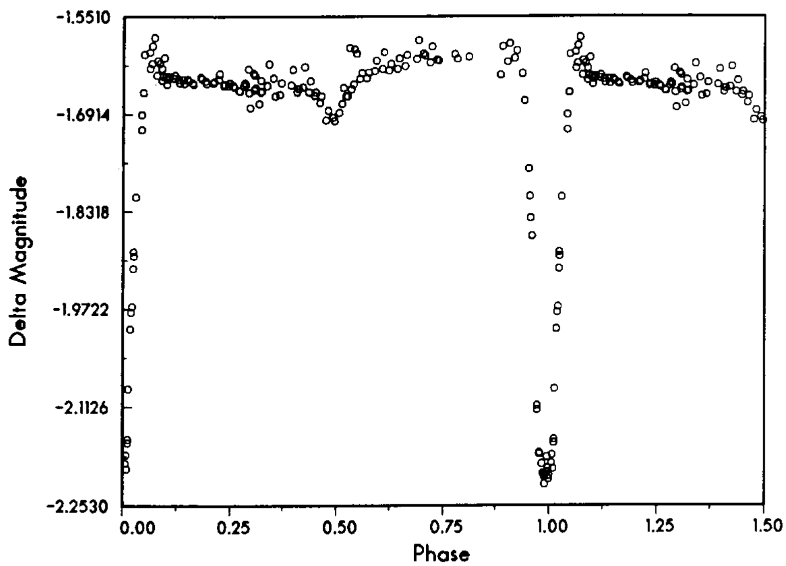

Fig. 1 WY Cnc Instr. V-Band KPNO 1989

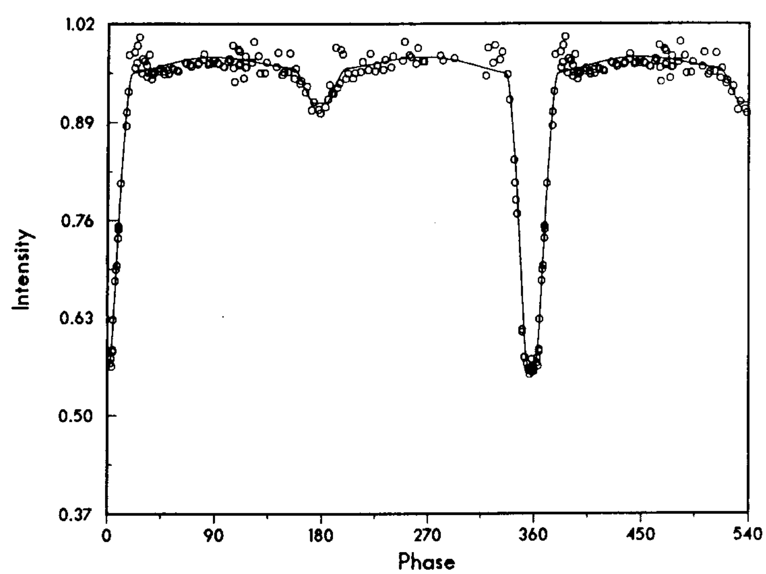

Fig. 2 WY Cnc Instr. V-Band KPNO 1989

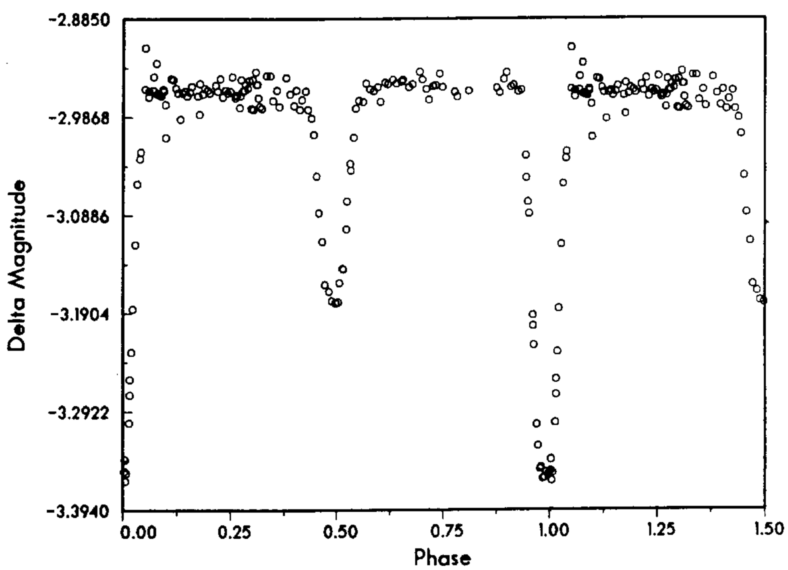

Fig. 3 WY Cnc Instr. K-Band KPNO 1989

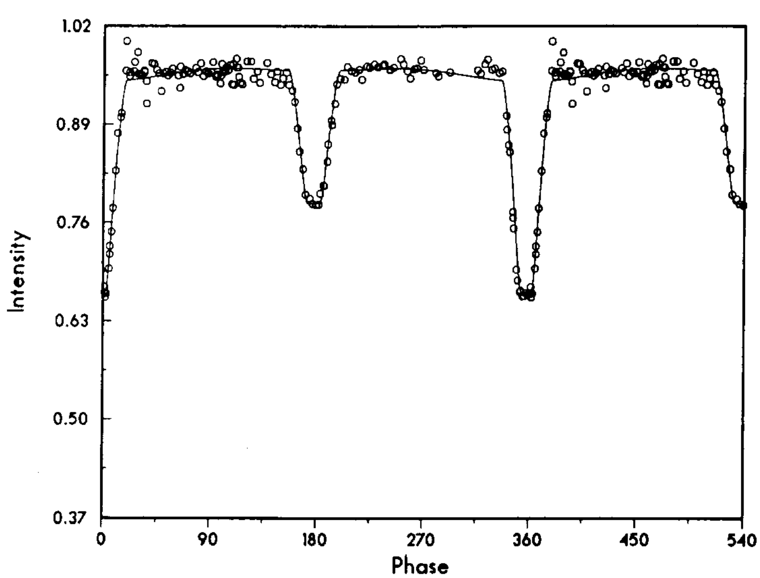

Fig. 4 WY Cnc K-Band KPNO 1989

the previous two figures. The trough of the distortion wave at this wavelength has the same longitude but only about half the amplitude as it does at V. Because the observations at V and K were simultaneous, we can directly infer a temperature for the dark, active region: 3970 ± 1550 K.

The observations were funded in part by the Small Grants program of the American Astronomical Society to MZ and by the Graduate Student Research Allocations Committee of UNM to ML.

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A SEARCH FOR VARIABLE POLARIZATION IN V3885 Sgr

In 1983 a number of polarimetric runs of the nova-like system V3885 Sgr with the variable brightness B = 9.6 - 10.3 (Ritter, 1987) were obtained with the old ESO polarimeter at the Bochum 62 cm telescope at La Silla. The aim was to search for any time dependent variations of the linear, as well as the circular polarization in order to get further information about the binary character of the system.

The polarimeter was equipped with two blue sensitive EMI 9789 photomultipliers. From the count numbers of V3885 Sgr measured without filters on the first night the polarimetric error of the system caused only by photon statistics was of the order of $\varepsilon(p)$ = 0.8% at the Bochum telescope assuming an integration time of one sec for each of the 16 steps of the rotating superachromatic half - or quarter wave plate in the old ESO two-channel polarimeter (Serkowski, 1974). Since it was known from measurements of other cataclysmic variables (e.g. Haefner and Metz, 1982, Metz, 1982) that the degree of the intrinsic polarization of those systems was expected not to exceed 0.1% and considering further the brightness of V3885 Sgr, no colour filters were used. In view of the necessary time resolution, an integration time of 10 sec was selected for each of the 16 steps referred for one rotation of the phase plate in the polarimeter. With a dead time of two sec for each step one single polarization measurement lasted about 3 min. From the photon statistics it was evident that only some hundreds of single measurements could detect the expected traces of correlation between intrinsic polarization and phase dependent variations of spectra and photometric behaviour. Because of the extremely bad weather conditions and some errors in the electronics of the polarimeter a special computer program was written to find the erroneous measurements and to determine the dummy periods caused by several gaps in the observations. As a general rule, only circular polarization measurements were performed after the moon had risen. After eliminating all erroneous measurements altogether 465 linear and 404 circular polarizations could be regarded as reliable observations.

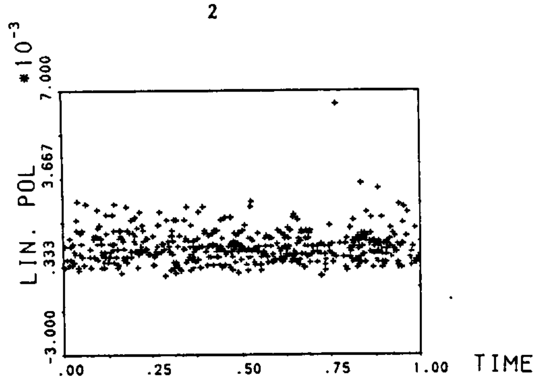

Figure 1. The measured linear polarization degree P folded with the spectroscopic period P_s

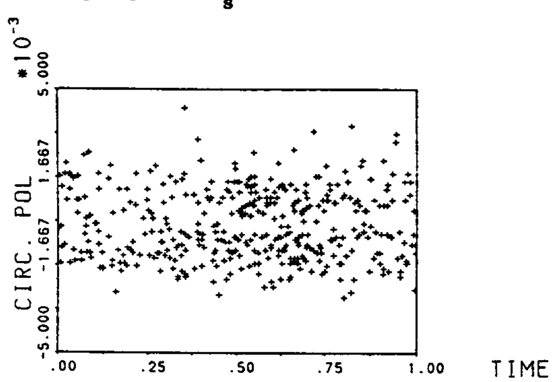

Figure 2. The measured circular polarization P_v folded with the spectroscopic period P_s

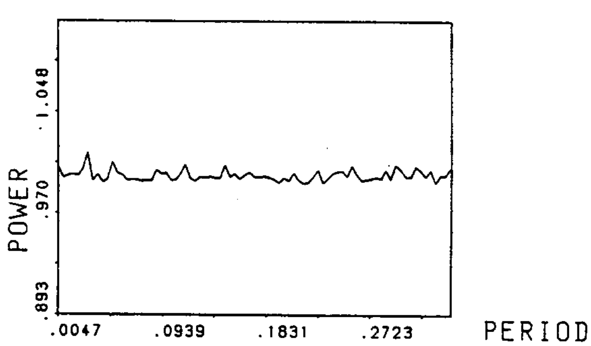

Figure 3. Periodogram of the linear polarization degree P

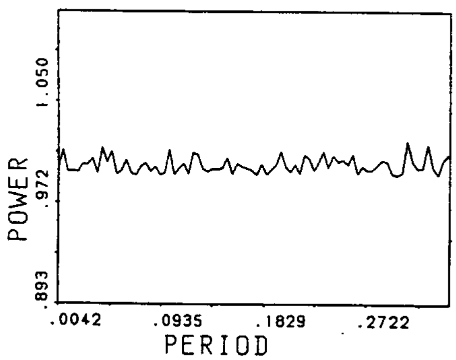

Figure 4. Periodogram of the circular polarization P_v

In Figure 1 the linear polarization degree $P = (P_x^2+P_y^2)^{0.5}$ where $P_x = Q/I$, $P_y = U/I$ are the normalized linear Stokes parameters, folded with the spectroscopic period $P_s = 0^d.2163$ is presented. P_s was found in spectra taken simultaneously with polarimetric measurements (Haefner and Metz, 1990).

Averaging all values of P_x and P_y in the equatorial coordinate system:

$P_x = 0.0002$ with $\varepsilon(P_x) = 0.0004$ (the mean error of the mean)
$P_y = 0.0002$ with $\varepsilon(P_y) = 0.0004$ (the mean error of the mean)

the mean linear polarization degree is: $P = 0.0003$
the mean position angle in degree is: $\theta_E = 21^\circ$
with the mean errors of the mean: $\varepsilon(P) = 0.0001$
$\varepsilon(\theta_E) = 10^\circ$

Figure 2 shows the circular polarization P_v, where $P_v = V/I$ is the normalized circular Stokes parameter, folded again with the spectroscopic period P_s.

Averaging all measurements of the circular polarization gives the mean circular polarization P_v(mean) = (V/I) (mean) = -0.0001 with the mean error of the mean $\varepsilon(P_v) = 0.0001$.

Considering the results of the extensive polarization measurements two points should be emphasized:

1) Since the distance of V3885 Sgr itself and that of several measured comparison stars is not very well known (Bond, 1978), it is, with respect to resulting errors, not useful to subtract a necessarily uncertain

interstellar component from the small linear and circular polarization determined here in order to get the intrinsic component of V3885 Sgr.
2) Since the standard deviations of the measured linear and circular polarization are surprisingly in accordance with the error estimated from the photon statistics, it was clear that no larger variation of the polarization with any period could be expected. This can also be derived from Figures 3 and 4 where periodogram analyses of P and P_v are presented. (Instead of P, the polarizations P_x, P_y were also tested, which gave the same result as the derived quantity P!)

Additionally, phase diagrams were constructed for various assumed values of the period P in the range of $0^d.00417$ to $0^d.3417$, rigorously averaging over intervals of P/10, in order to look for any periodic variation of the polarization. However, no periodic variation of the polarization could be found thus demonstrating that polarization measurements cannot help in understanding the character of V3885 Sgr.

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Be VARIABLE 59 Cyg
RAPID LIGHT VARIATIONS DETECTED

V832 Cyg (59 Cyg, HR 8047, HD 200120), a B1Ve star, is a member of the Cyg OB7 association and is the brightest component of a multiple system of stars ADS 14526. It forms a common-motion pair with component *B* (4.4^m fainter) at 20.1". Component *C* at 26" is optical, and there is also component *D* at 38". McAlister et al.(1984) discovered a speckle-interferometric component *a* at 0.21" and Tarasov and Tuominen (1987) suggested that V832 Cyg may be a spectroscopic binary with an orbital period of 29.14 days. V832 Cyg is also a famous spectral variable, for which correlated optical and UV long-term spectroscopic changes were documented (see Doazan et al. 1989 and references therein).

For a long time, V832 Cyg has been known as a long-term light variable. GCVS quotes a range from 4.5 to 4.9^m. Lynds (1959) observed a steady decline of brightness from 4.66^m to 4.76^m between June and October 1958 and there are some other photometric observations scattered in the astronomical literature.

We observed the star as one of the targets of the long-term observing campaign on bright Be stars initiated and organized by Harmanec, Horn and Koubský (1981). UBV observations were secured at Hvar in 1985 and 1988 and BV observations were obtained in Toronto in 1986, 1987, and 1988. The 1986 Toronto observations were already published by Percy et al. (1988).

In all cases,

HD 199311 $V = 6.689^m$, $B\text{-}V = +0.086^m$, $U\text{-}B = +0.086^m$

and

HD 199479 $V = 6.846^m$, $B\text{-}V = -0.033^m$, $U\text{-}B = -0.220^m$

served as the comparison and check (their UBV values quoted originating from the homogenized Hvar all-sky photometry). The check star was observed ***as frequently as*** the variable.

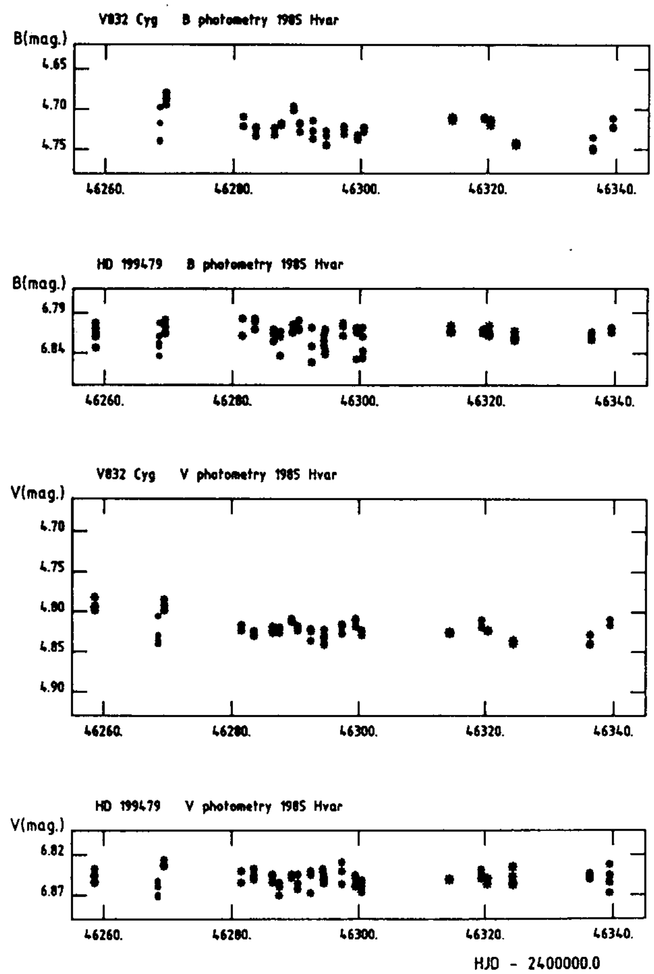

Figure 1

Figure 1 is the plot of the individual V and B observations of V832 Cyg and the check, HD 199479, versus time for the 1985 observing season. Figure 2 is the same diagram for the 1988 data (symbols * and □ are used to distinguish Hvar and Toronto data, respectively).

Although some of the data are somewhat noisier than usual, it is clearly seen that while the variable was relatively quiet on a time scale of days and shorter in 1985, rapid variations up to 0.1^{m} were detected in 1988. The 1986 and 1987 Toronto data show no significant variations *within* the seasons (i.e. σ(variable) = σ(check)), but the variable was

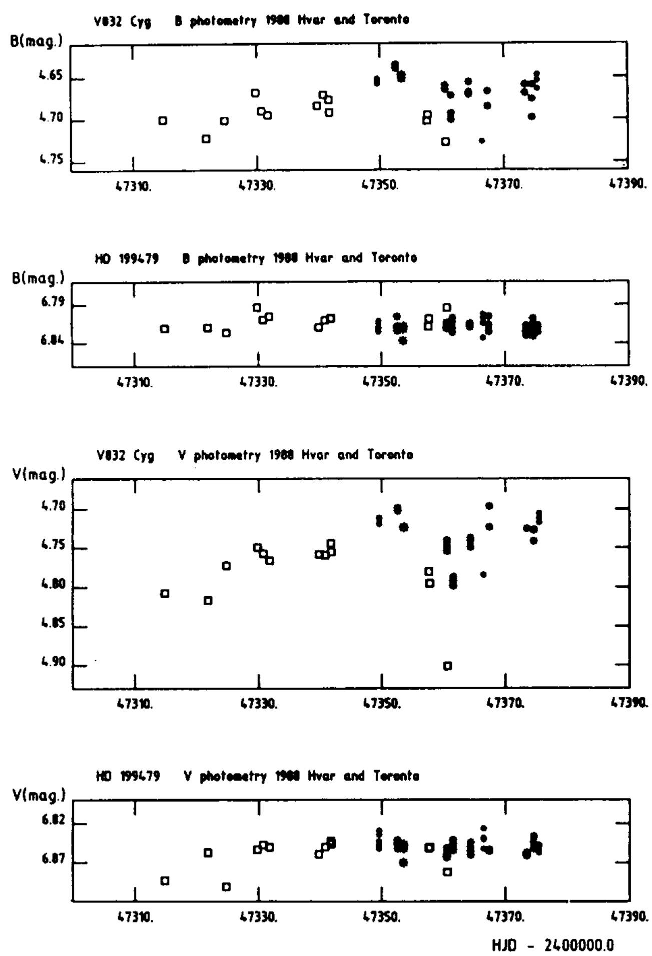

Figure 2

about 0.02^{m} brighter in V and B in 1987 relative to 1986. The corresponding mean values are

1986 $V = 4.780^{m}$, $B = 4.664^{m}$; 42 observations, and

1987 $V = 4.759^{m}$, $B = 4.645^{m}$; 7 observations;

typical r.m.s. error of the means being 0.0075^{m}. Our data thus clearly indicate a gradual secular brightening of the star from 1985 to 1988. They are not numerous enough and well distributed in time, however, to warrant a meaningful period analysis. We only want to alert the Be star observers that further monitoring of this intriguing object would be very desirable. We plan a detailed study of the photometric behaviour of V832 Cyg in the future.

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Hα SPECTROSCOPY OF THE Be STAR ω ORIONIS DURING 1986 - 1987

Between 1 April 1986 (JD 2,446,521) and 2 January 1988 (JD 2,447,162) we obtained 10 high-dispersion Reticon spectra of the Hα region in the B3 IIIe star ω Orionis (HR 1934). This star has recently been observed to exhibit variations in visual brightness, polarization, and UV line profiles (Sonneborn et al. 1988). While the polarization, photometric colors, and continuum flux in the UV show variations that are correlated, the Si IV and C IV resonance line profiles vary independently of the polarization. Both Guinan and Hayes (1984) and Bergin et al. (1989) discuss episodes of enhanced mass-loss in ω Ori where the star becomes dimmer and redder, and the broad-band polarization increases.

Our Hα spectroscopy of ω Ori was obtained at Ritter Observatory using the intensified Reticon system described by Bopp, Dempsey, and Maniak (1988). The spectral data have 0.3 Å resolution, and signal-to-noise ratio from 30-50:1. A log of the observations is given in Table 1.

While our data set is too small to permit us track the behavior of the Hα line in any detail, it may be useful to compare our profile, intensity, and equivalent width (EW) data with the occasional observations reported by others. The EW measures listed in Table 1 show the emission to have varied by more than a factor of two between April 1986 and October 1986. There was a further enhancement in EW that took place between March 1987 and January 1988, when the Reticon observations concluded. There also appear to be EW variations on timescales of days as well as weeks or months: four Reticon scans obtained during April 1986 show a variation of 50%, when the spectrophotometric precision of the data should be no worse than ±10%. Our EW values for ω Ori may be compared with those reported by Hanuschik et al. (1988) and Andrillat and Fehrenbach (1982) which range from 5.7 to 7.7 Å.

We illustrate some of our Hα profiles of ω Ori in Figures 1-6. The line shows profiles qualitatively similar to those illustrated by Andrillat and Fehrenbach (1982) and Hanuschik et al. (1988): it always shows blue and red emission peaks of essentially equal

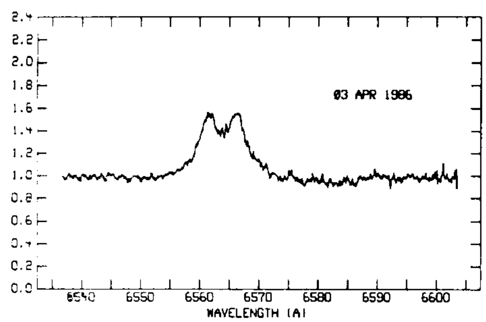

Figure 1

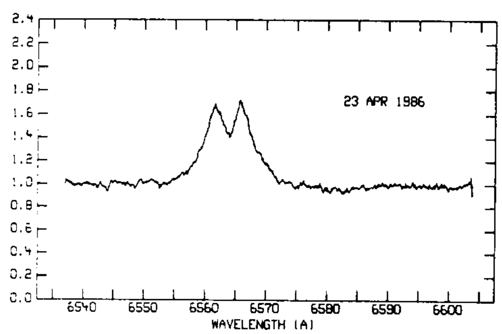

Figure 2

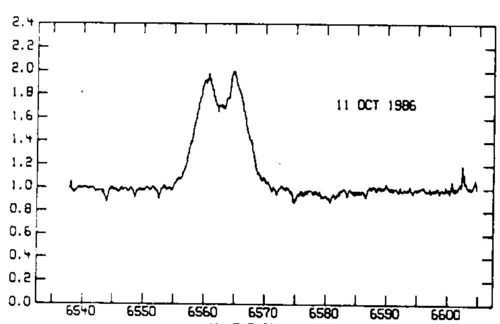

Figure 3

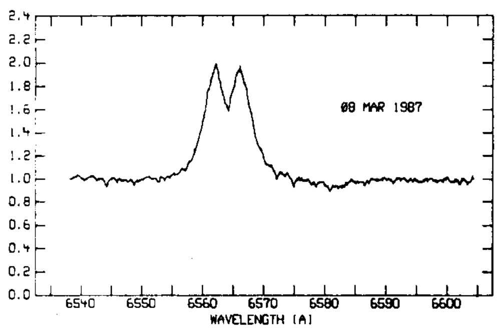

Figure 4

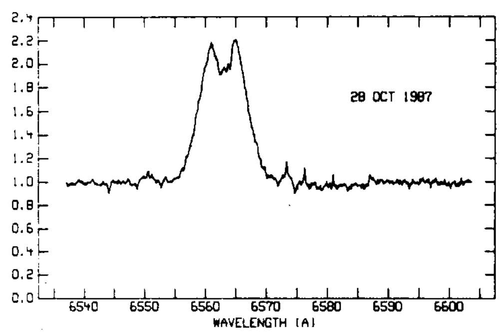

Figure 5

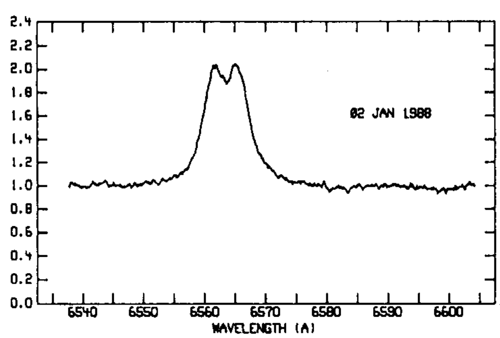

Figure 6

Figures 1-6: Ritter Observatory Reticon scans of the Hα region in ω Ori.

Table I Hα Observations of ω Ori

Date UT	JD (2440000+)	EW(Hα) (Å)
1 Apr. 1986	6521.53	4.18
3 Apr. 1986	6523.54	4.55
19 Apr. 1986	6539.57	3.70
23 Apr. 1986	6543.56	5.76
11 Oct. 1986	6714.88	8.34
8 Mar. 1987	6862.59	8.11
28 Oct. 1987	7096.73	10.00
4 Nov. 1987	7103.72	9.01
6 Nov. 1987	7105.70	9.82
2 Jan. 1988	7162.65	9.92

intensity, with a separation in velocity of 150-200 km s^{-1}. The change in EW of the line that we observe is the result of varying emission intensity, which is about 1.6 times the continuum level on 3 April 1986, rising to 2.2 times the continuum on 28 October 1987.

It would clearly be useful to monitor the Hα profile on an intensive basis, to establish a lower limit on the timescale of EW variability and to probe its behavior over the course of the 10 month outburst cycle suggested by Bergin et al. (1989).

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DETECTION OF THE 224-MIN ORBITAL PERIOD

OF THE CATACLYSMIC VARIABLE PG 0818+513

PG 0818+513 was detected as an UV - excess object ($V=15^{m}.58$, $B-V=0^{m}.15$, $U-B=-0^{m}.77$) by Green et al. (1982, 1986), who classified it as a cataclysmic variable (CV). Andronov (1986) discovered its photometric variability and suspected that it is an eclipsing CV. However, neither he, nor Richter (1989) were able to determine the period and attribute the object to some sub - class of CV's.

Here we report the results based on the photographic observations on Sky Patrol plates of Moscow (n=53) and Sonneberg (n=691) collections and on that specially made in Abastumani (n=115) and Kishinev (n=70). The latter series of observations show clear Algol-type eclipses up to $1^{m}.2$ (a lower value, because the exposure time was 8 and 12 min for Abastumani and Kishinev, respectively), which last $0.14(\pm 0.01)P \approx 31$ min and occur every 0.156 d. For the more precise determination of the value of the period, we used the moments of minima and 'faint' observations, which are listed in the Table 1. The moments of minima were determined from "seasonal" phase curves by using the parabolic fits to the shape of the eclipse. For the periodogram analysis, we used the test function $\sigma_{\varphi}(f)$, where f is the trial frequency (in d^{-1}), σ_{φ} - is the corresponding mean-squared deviation of the phases of minima from the 'zero' ones corresponding to the trial period's value (cf. Andronov, 1988). For uniform distribution of phases, one may achieve that $\sigma_{\varphi} \approx 12^{-1/2}$; the significantly lower values may indicate the periods in the signal and/or in 'observational windows'.

The 'best fit' linear ephemeris is the following :

$$\text{Min HJD} = 2447180.3364 + 0.15587490 * E \qquad (1)$$
$$\pm \quad 3 \qquad\qquad 2$$

The relatively good accuracy estimate of the period's determination is due to the use of the first 'season' moment derived from Sonneberg patrol plates. The accuracy of minima timings varied typically from 0.0003 to 0.0015 days, but we did not use the weights while obtaining the Eq. (1).

The total range of brightness variations is 13.7-$16^{m}_{.}3$ (comparison stars published by Andronov (1986)),but the mean brightness out of eclipse varied in the range 14.5 -$15^{m}_{.}1$, the brightness in mid-eclipse was $15^{m}_{.}5$ (Moscow plates with 30-min exposure time), $15^{m}_{.}9$ (Abastumani, 8 min), $16^{m}_{.}4$ (Kishinev, 12 min). This discrepancy may partly occur due to the difference in the photometric systems used; however, the variations in brightness level up to $0^{m}_{.}5$ seem to be real. No outbursts similar to those observed in dwarf novae were found on the used plates irregularly covering the time interval 1928-1988 yrs. However, many times the brightness was found to be 13.7 -$13^{m}_{.}8$ on Sonneberg plates, including the prominent 'flare' (or 'hump') observed at HJD 2436613.500-.542 (phases 0.50-0.78, according to Eq. (1)).

Because of slow brightness variations, the phase curves derived from the patrol plates, show larger scatter (up to $0^{m}_{.}3$); the longer exposure times make the observed eclipse shapes shallower and thus less prominent. The full duration of eclipse was found to be 0.146 P and 0.134 P for Abastumani and Kishinev,respectively; the eclipse depth was $1^{m}_{.}17$ and $1^{m}_{.}24$.

No secondary eclipse was found on phase curves, pointing out that the eclipsed region is much more bright as compared with the eclipsing one suggested to be a non-degenerate secondary star in a close binary. There is no evidence for strongly X-ray heated secondary, such as in PG 1550 + 131 (Haefner, 1989) ; or extreme 'hot spot' between the stars, as in V 361 Lyr (Andronov and Richter, 1987). The object photometrically resembles DW UMa (=PG 0830 + 591) (Kopylov and Somov, 1987; Shafter et al., 1988) and UU Aqr (Volkov et al., 1986). The spectral properties, as Green et al. (1986) pointed out, are similar to the eclipsing CV PG 1012 - 029 (=SW Sex) (Penning et al., 1984).

Thus the obtained results may allow us to allocate the system PG 0818+513 into the sub-group of eclipsing nova-like variables, possibly with relatively high accretion rate.

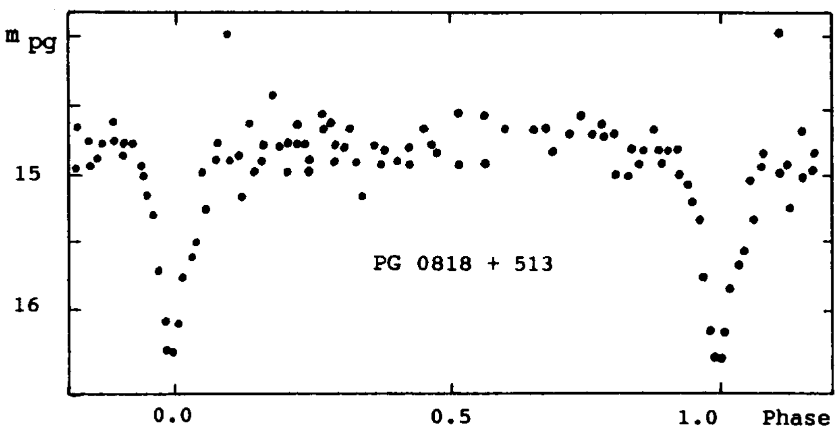

Fig. 1. Phase light curve for 75 observations obtained in Abastumani during JD 2447180 - 2447203.

Table 1

The moments of minima of PG 0818 + 513

HJD 2400000+	σ	n	E	O-C	Rem
38893.4036	0.0047	8	-53164	-0.0004	S
45376.388:	-	1	-11573	+0.0004:	M
45464.310:	-	1	-11009	-0.0082:	M
45758.2873	0.0015	18	- 9123	-0.0024	M
46764.460:	-	1	- 2668	-0.0022	S
47180.3363	0.0007	7	0	-0.0001	A
47180.4922	0.0007	7	1	-0.0001	A
47203.2505	0.0003	6	147	+0.0005	A
47203.4064	0.0003	6	148	+0.0005	A
47532.452:	-	1	2259	-0.0058	K
47592.3150	0.0006	7	2643	+0.0012	A
47592.4709	0.0006	7	2644	+0.0013	A
47643.2843	0.0008	6	2970	-0.0006	K
47643.4402	0.0008	6	2971	-0.0005	K
47664.3275	0.0014	6	3105	-0.0005	K

Remarks : the corresponding observations were obtained in Sonneberg (S), Moscow (M), Abastumani (A) and Kishinev (K); σ is the accuracy estimate, n is the number of the observations used (the 'lonesome' faint observations with n=1 were not used while obtaining the Eq. (1)), E - is the cycle number.

Co-ordinated multiwavelength photometric, polarimetric and spectral observations are needed to constrain the model of this interesting object, and they are planned to be done during February, 1990.

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CHANGES IN THE BRIGHTNESS AND THE SPECTRUM OF CH CYGNI

The longest active phase of the symbiotic star CH Cyg, of the three known so far, lasted 10 years and ended in 1987. The activity is characterized by the presence of strong, hot continuum, strong emission and absorption lines of HI, HeII, ionized metals, and emission lines of [FeII], [SII], and [OI] in its spectrum (Selvelli, 1988). Rapid brightness changes of various characteristic times and amplitudes were observed during the active phases of CH Cygni (Slovak and Africano, 1978; Skopal, 1987), whereas such variations were not observed only at the time of eclipse in the system in 1985 (Mikolajewski et al., 1987).

The star's behaviour, after the latest active phase ended, was typical for its "quiet" periods. The M6-type spectrum of the main star and faint emissions in Hα and Hβ (Hack et al., 1988; Bode and Meaburn, 1988) dominate the optical spectra. No rapid brightness changes have been observed. During July 1988, particularly, the variations were not larger than 3% in UBV (Garnavich and Goldader, 1988). According to Skopal (1988) the brightness in UBV is practically constant during each individual night.

Spectroscopic observations of CH Cygni have been carried out with the 2-m RCC telescope's Coudé spectrograph of the Bulgarian National Astronomical Observatory since 1981. The spectra discussed in this paper were obtained from July 1987 to July 1989; they cover the spectral range 3600-4900 Å with a dispersion of 18 Å/mm. Before July 1989, the spectra showed practically a normal M6 III spectrum, with no traces of any veiling hot continuum but a faint one-component Hβ emission line was superimposed on the red giant's spectrum. Its intensity, relative to the local continuum, during the period July 1987 - July 1989 is 3.0 ± 0.3. Significant changes were revealed in the spectrum obtained on July 11, 1989. The Hβ emission increased up to 5.0, but it was still one-component. Fainter, one-component emission Balmer lines up to H12 appeared, whereas only a weak emission FeII 4233 Å was present undoubtedly. The absorption line CaI 4227 Å and the TiO bands typical of an M giant spectrum had intensities showing that there was no obvious hot continuum longward 4000 Å.

In order to check if the spectral changes were coupled with photometric variations, observations of CH Cyg were performed during August 01-06, 1989, with the 1.2 m Kryonerion telescope of the Athens National Astronomical Observatory, using a single channel photon counting photometer (Dapergolas and Korakitis, 1987). UBV photometry has been made using HD182691 (V=$6^{m}.52$, B-V=-$0^{m}.08$, U-B=-$0^{m}.23$) as a standard star whereas the absolute calibration was made using the photoelectric sequences of Landolt (1973). Table I lists the dates, the corresponding number of observations, the average UBV-values for each night, and their standard deviations.

Table I

Date	(JD 2447700.0+)	No.	U	B	V
01-Aug-89	(40.31)	4	$9^{m}.59 \pm 0.09$	$9^{m}.18 \pm 0.06$	$7^{m}.96 \pm 0.03$
02-Aug-89	(41.32)	5	9.51 ± 0.05	9.11 ± 0.04	7.94 ± 0.03
04-Aug-89	(43.33)	6	9.44 ± 0.09	9.12 ± 0.05	7.92 ± 0.03
05-Aug-89	(44.32)	6	9.49 ± 0.06	9.13 ± 0.04	7.94 ± 0.02
06-Aug-89	(45.31)	4	9.62 ± 0.06	9.20 ± 0.03	7.98 ± 0.01

Additionally, a monitoring for U-flickering of CH Cygni was performed each night where BD+49^{o}2997 was used as a check star and HD182691 as a standard; the integration time was 10 seconds, the duration of each patrol was about 1 hour. Figure 1 shows the U-data for CH Cyg, for the check, and for the standard star (shifted by +$3^{m}.0$ in this figure) for two nights - 01 and 06 Aug. Significant continuous variations observed in the U-brightness can be considered as long- and short-term variations. The long-term ones show continuously increasing (Aug 01) or decreasing (Aug 02, 04), or nearly constant U-magnitude during the night, but different value from night to night (Aug 05, 06). The superimposed short-term variations show irregular decreases or increases in U with a duration from 1 to about 15 minutes and amplitudes up to $0^{m}.3$. Both variations, together, give changes in the U up to $0^{m}.5$. A periodogram analysis using a program of Deeming's method (Kreidl, 1980) was performed. No characteristic time of the variations can be seen in the "power spectra" obtained for each night, whereas from the observations of all the nights (about 1600 U-values) a doubtful maximum at about 15 minutes can be suggested in the periodogram.

The appearance of remarkable emission Balmer lines in the spectrum of CH Cyg and the rapid brightness variations only two years after the latest phase of enhanced activity are very interesting observational facts. Such

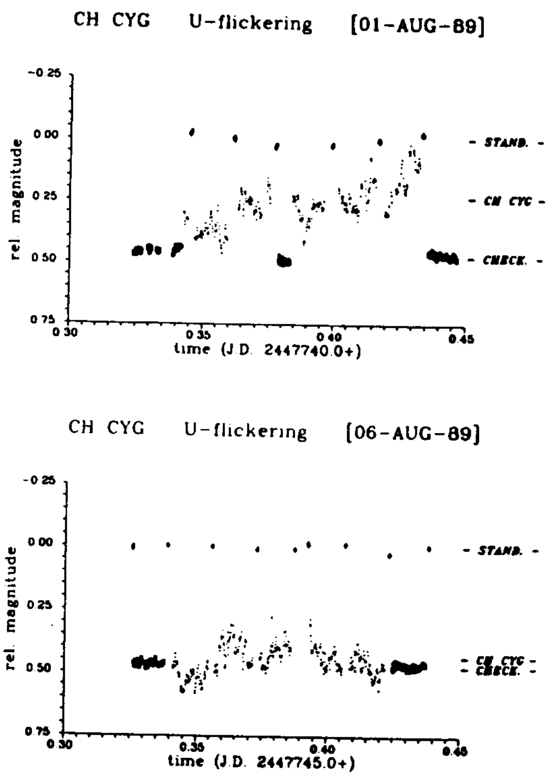

Figure 1.

phenomena seem not to be unique for this star. Relatively intense emission lines from Hα to Hε and HeI 5016Å (Rodriguez, 1984) and rapid brightness variations (Luud et al., 1977) have been observed between its active phases in 1974. For this period, JD 2442000 - JD 2442200, the light-curves in the V and, especially, in B-V and U-B show a local maximum (Luud et al., 1986).

The above mentioned and the fact that our recent observations do not show a noticeable hot continuum in the optical spectrum, make us to suppose that the spectral and the brightness changes of CH Cyg during July-Aug. 1989 are not associated with the beginning of a new active phase. It is more likely that this is only a short-duration increase of the activity like the one observed in 1974, most probably due to a temporary increase of the mass-transfer rate in the system of CH Cygni.

From our observations it has been realized once more that CH Cygni is an extremely interesting object that has to be observed during its "quiet" phases as intensively as it is during its high activity.

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RECENT MINIMA OF THE SUBDWARF ECLIPSING BINARY BD-7°3477 (=HW Vir)

During a photoelectric UBV survey of UV-bright objects, Menzies & Marang (1986) discovered the B-type subdwarf BD-7°3477 (=HW Vir) to be an eclipsing binary with a very short period of 2^h48^m. In a preliminary analysis, Menzies & Marang (1986) determined the temperature of the primary to be 26000K and the secondary probably ~4500K, the radii of both components to be near 20% of their separation, and plausible masses of 0.25 and 0.12 solar masses. This model suggests that the system could have passed through a "common envelope" stage and is probably similar in evolutionary status to AA Dor (e.g. Hilditch & Kilkenny 1980; Paczynski 1980; Kilkenny 1986).

Because of the possibility of eventually detecting the effects of gravitational radiation (only on timescales of a few hundred years) and, more realistically, of seeing the effects of mass loss or mass exchange, it has seemed worthwhile to establish accurate ephemerides for these evolved binaries by continued monitoring.

Menzies & Marang (1986) used 27 timings of primary minima obtained in 1984-85 to establish a rather accurate ephemeris for the HW Vir system and in this note we report four further timings from 1989. The data were obtained with the 0.5m telescope and modular photometer of the South African Astronomical Observatory. For each eclipse, a series of 20-second continuous observations with a Johnson B filter was made, with occasional breaks for sky background measurement; a typical primary eclipse result is shown in Figure 1. From these data, the following times of primary minima were determined:

HJD	Est.error	Cycle
2447684.32597	±0.00003	16739
7687.24396	0.00003	16764
7688.29443	0.00005	16773
7689.22817	0.00003	16781

where the cycle number is based on the Menzies & Marang (1986) ephemeris and the observation at cycle 16773 is less accurate because the early part of the descending branch of the eclipse was missed. A linear least squares

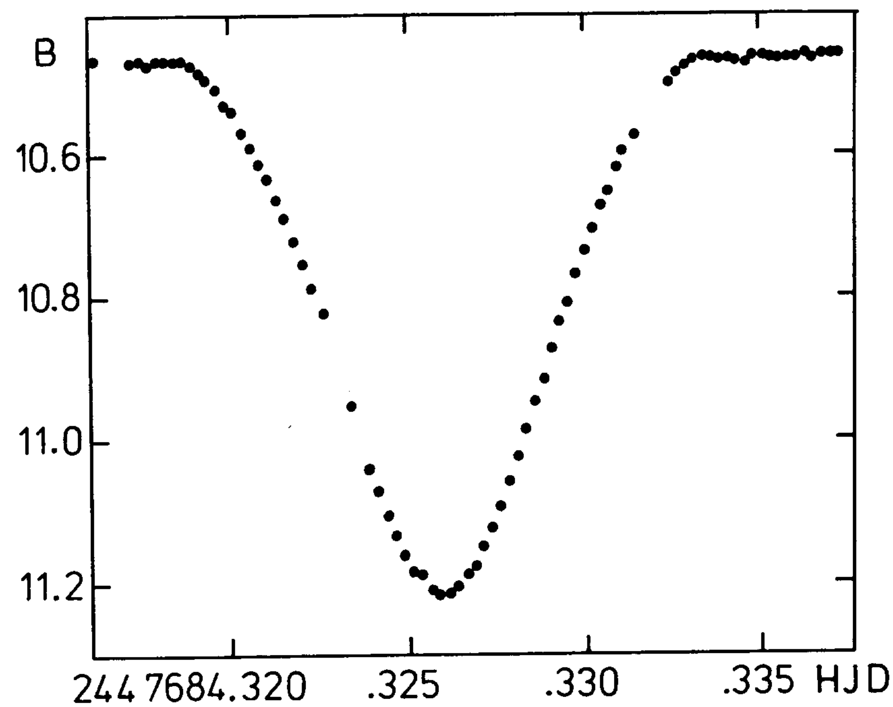

Figure 1. Primary minimum of HW Vir on HJD 2447684 observed with continuous 20-second integrations. Gaps occur where sky background measurements were made.

solution, including the Menzies & Marang data gives an ephemeris:

$$\text{HJD (primary min)} = 2445730.556074 + 0.1167196311 \cdot n$$
$$\pm\ 0.000014\ \pm\ 0.0000000024$$

Formally, a quadratic solution with a decreasing period term is a slightly better fit to the data, however this is a very weak result, probably not significant, and further observations over one or more years will be required to test this suggestion.

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UNUSUAL OUTBURST OF THE CATACLYSMIC BINARY MV LYRAE

The attention of cataclysmic binary specialists has been focused on MV Lyrae since its remarkable fading in 1979. Before that date the brightness of the star was usually in the "high" state ($\approx 12\overset{m}{.}5$): this was interrupted from time to time in a semiregular manner by phases of "intermediate" state (between 13^m and 15^m, cycle length of 325^d-455^d between minima). After 1979 the star predominantly remained in the "inactive" (or "low") state ($\gtrsim 17\overset{m}{.}0$), from which the brightness in irregular intervals rose to the intermediate level for one to several months. Some models start out from the assumption that MV Lyrae is entering or has entered the well-known gap of orbital periods.

For complete long term light-curves of the years 1928 to 1986 and a discussion see Wenzel and Fuhrmann (1983) and Andronov, Fuhrmann and Wenzel (1988). In 1987 a strong eruption reached almost $14\overset{m}{.}0$ pg, and after subsequent 600 days of quiescence the brightness even climbed to $13\overset{m}{.}6$ pg in the summer of 1989, probably the highest value observed since the fading in 1979. The ascent was accompanied by strong and very fast fluctuations (for instance from $15\overset{m}{.}3$ to $16\overset{m}{.}7$ during 16 minutes at JD 244 7648.4). In the figure we give the light-curve as a continuation of the curves mentioned earlier. It has been derived from observations on Sonneberg 40 cm astrograph plates and Sky Patrol plates and might be important for comparison with spectroscopic data or model considerations. It should be noted that the sporadic measurements of Kraicheva (1988) and Rosino (1989) are in good agreement with our observations. The B system of comparison star magnitudes of Andronov and Shugarov (1982) was used; smaller dots denote uncertain values, the arrows show upper limits of brightness when the star was invisible on the plates.

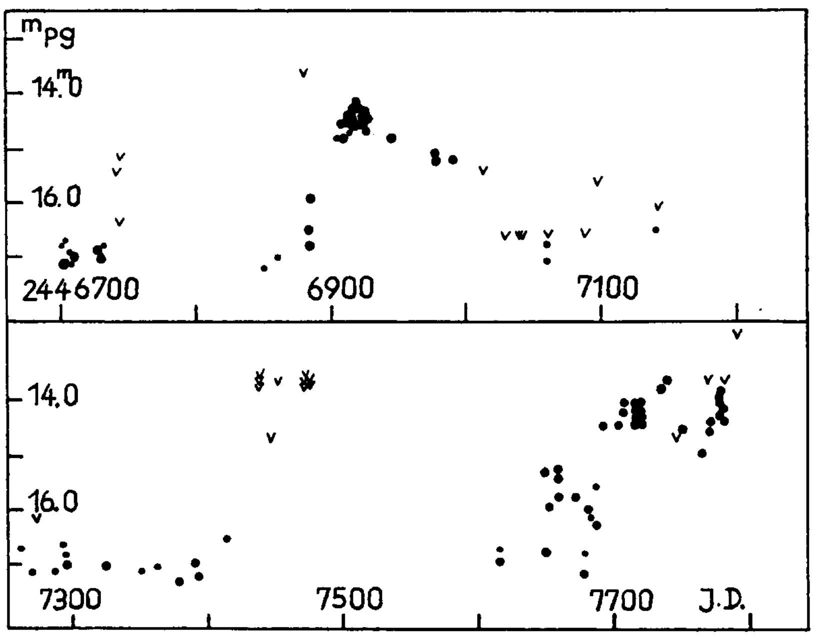

Figure 1

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NEW PHOTOELECTRIC OBSERVATIONS AND THE PERIOD BEHAVIOR OF BX PEGASI

Recently, I reported on photoelectric observations obtained in the fall of 1986 of the very short period system, BX Peg (Samec and Bookmyer 1987). The observing history for this system was summarized in that report.

The present observations were made on 20, 21 June and 11, 12, 15, and 16 October 1988. The 0.6-m Morgan F/13.5 reflector at Lowell Observatory in Flagstaff, Arizona was used with standard U, B, V filters and a thermoelectrically cooled EMI 6256 photomultiplier tube. The comparison and check stars were BD +25°4584 and BD +25°4582, respectively. The observations were transformed to the standard system from observations of eight stars in standard cluster Pleiades (Johnson and Morgan 1953, and Johnson and Mitchell 1958). More than 500 observations were obtained in both B and V.

Three epochs of minimum light were determined from observations made during one primary and two secondary eclipses. All minima were determined by an iterative technique based on the Hertzsprung method (1928). These are the last three epochs given in Table I.

TABLE I

JD Hel 2440000+	Minimum	Cycles	O-C	Source
3790.17075	I	-6637.0	+0.0008	Zhai and Zhang 1979
5651.3219	I	0.0	+0.0001	BAV #38 1984
6701.7787	I	3746.0	+0.0011	Samec and Bookmyer 1987
6703.7409	I	3753.0	+0.0003	Samec and Bookmyer 1987
6703.8797	II	3753.5	-0.0010	Samec and Bookmyer 1987
6704.7227	II	3756.5	0.0007	Samec and Bookmyer 1987
7333.8400	I	6000.0	-0.0057	Present Observations
7450.6339	II	6416.5	-0.0070	Present Observations
7451.7556	II	6420.5	-0.0070	Present Observations

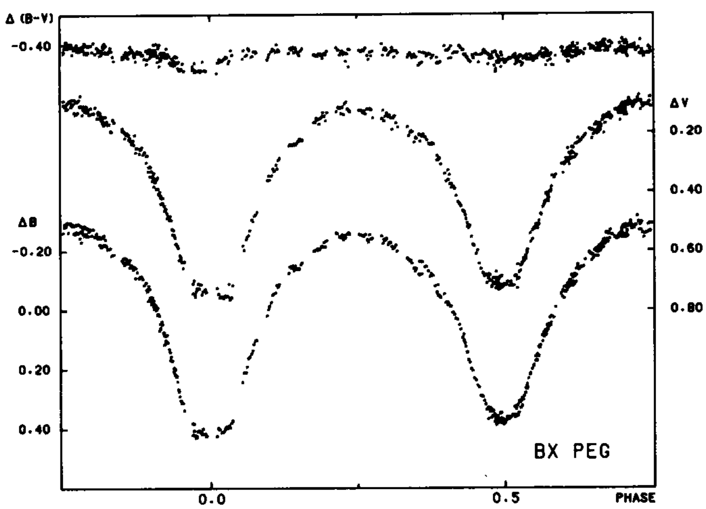

Fig. 1 - Standard Light Curves of BX Peg defined by the individual observations

All the published epochs of minimum light determined from photoelectric observations excluding the early determination by Chou (1966) and our present observations were introduced into a least squares solution to obtain the following improved ephemeris:

JD Hel Min. I = 2445651.3218 + 0.28042066 • E .

± 2 ± 4 (p.e)

This was used in calculating the O-C's of the timings of minimum light included in Table I. Apparently, the period of BX Peg has remained constant for over 10400 cycles previous to our 1986 observations. Earlier timings including the one by Chou indicate that a rather major period decrease took place about the time Zhai and Zhang (1979) made their observations. Indeed, our newly determined minima may indicate that yet another period decrease has taken place! Additional timings of minimum light are needed to confirm this preliminary result. Several combinations of timings of minimum light were introduced into least squares fits to obtain periods for possible use in phasing our observations. The period, $0^{d}.28042024(11)$ was found to produce the best fit. This was calculated by combining all the photoelectric epochs of minimum light subsequent to the one determined by Chou.

The B and V light curves of V728 Her defined by the individual observations are shown in Figure 1 as Δm versus phase. The analysis of the observations is underway.

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NEW BRIGHTENING OF V1143 Ori

The fuor-like object V1143 Ori found by Sugano (Marsden, 1983) and Natsvlishvili (Natsvlishvili, 1984) had several brightenings during 1982 - 1986 (Parsamian and Gasparian, 1987; Mirzoyan et al., 1988; Gasparian et al., 1987). The photographic magnitude of V1143 Ori at minimum is about 18^m.

A new brightening of V1143 Ori (m_{pg}=15.6) was detected in October 11, 1989. The observations were carried out on the 21" Schmidt telescope of Byurakan observatory.

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ANOTHER OPINION ON THE VARIABILITY OF TAU Cas

The bright star Tau Cas (HR 9008 = HD 223165; K1 IIIa) has been suspected to be a light and radial velocity variable. Commonly used as a comparison star for the variable supergiant star Rho Cas, Tau Cas has generated controversy insofar as light variations have been claimed by some observers, but not seen by others. The star is listed in the New Catalogue of Suspected Variable Stars (Kholopov et al., 1982) with a possible amplitude of 0.3 magnitudes in an unspecified color system. With this possible variation in mind, the British Astronomical Society's Variable Star Section has recommended against its usage as a comparison for Rho Cas, though the AAVSO continues to allow this. Percy (1985) has examined the history of claims of variability for Tau Cas, added some observations of his own, and has argued persuasively that there is no compelling evidence to believe that the star varies in either radial velocity or light output over any range larger than several hundredths of a magnitude. Recently, Leiker and Hoff (1988) and Leiker, Hoff and Tuttle (1989) have published observations of their own which they interpret to mean that Tau Cas is subject to a small degree of variability.

In an attempt to add some illumination to this question, the author has examined the observations of Tau Cas obtained at the Corralitos Observatory over the past three years in conjunction with the primary project of observing Rho Cas. All data was taken with Observatory's 0.6-m. telescope and single channel photon-counting photometer, utilizing an ambient temperature EMI 9924A photomultiplier tube. As a comparison star for both Tau and Rho Cas, HR 9010 (HD 223173; K3 IIb; V = 5.51; B-V = +1.65) was used. It should be noted that this is the same star used by Percy and Leiker et al. Forty-three values for V and B-V were obtained for Tau Cas. These are displayed in Table I and graphically in Figure 1. Also, Figure 1 superimposes those magnitudes published by Leiker and Hoff and Leiker, Hoff and Tuttle which correspond to nearly simultaneous observation by their group and the Corralitos.

Initially, a superficial examination of the diagram would seem to lend strength to the argument that Tau Cas is a variable star, particularly in

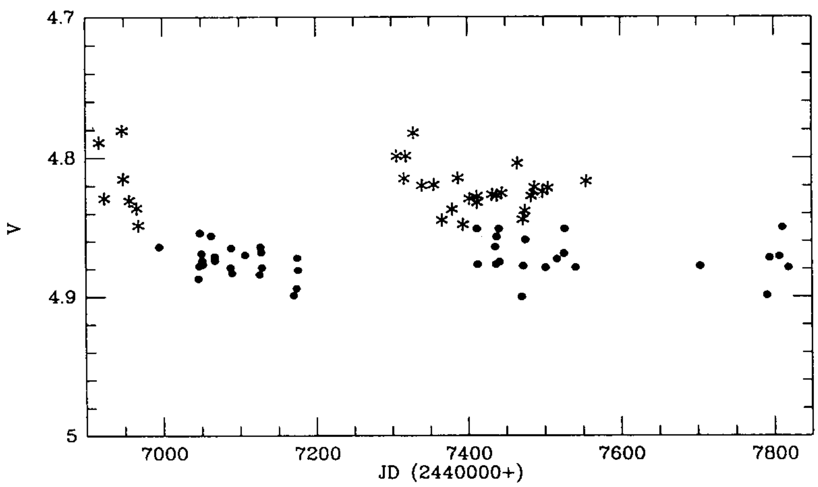

Figure 1 Magnitudes for Tau Cas. Asterisks represent those of Leiker and Hoff, filled circles those of Halbedel.

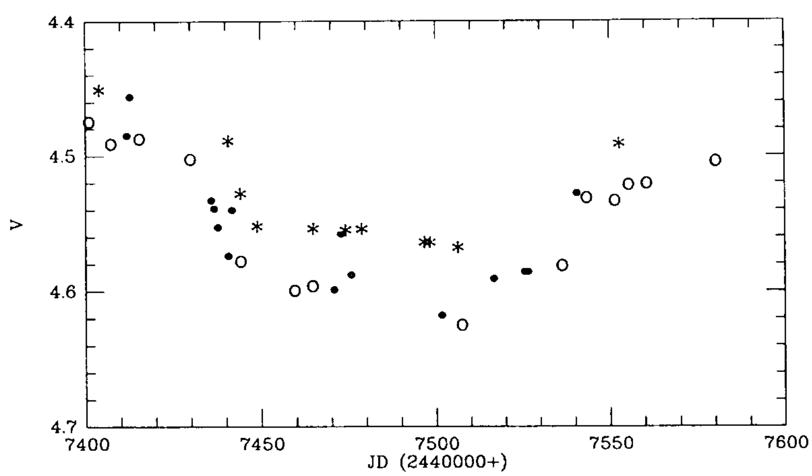

Figure 2 Magnitudes for Rho Cas. Asterisks represent those of Leiker and Hoff, open circles those of Milton, and filled circles those of Halbedel.

Table I

Julian Date (2440000 +)	V	B-V	Julian Date (2440000 +)	V	B-V
6994.9388	4.864	+1.072	7411.9007	4.851	+1.089
7045.8541	4.887	1.106	7412.7889	4.877	1.102
7046.8291	4.878	1.102	7435.8792	4.864	1.104
7047.8236	4.854	1.103	7436.7507	4.877	1.096
7049.7556	4.869	1.071	7437.7208	4.857	1.116
7050.8486	4.874	1.086	7440.7646	4.851	1.093
7051.7069	4.877	1.070	7441.7257	4.875	1.102
7062.8014	4.856	1.096	7470.6993	4.900	1.075
7066.7938	4.871	1.094	7472.6931	4.878	1.115
7067.6924	4.874	1.093	7475.6604	4.859	1.103
7087.8312	4.879	1.089	7501.6861	4.879	1.134
7088.7785	4.865	1.095	7516.6187	4.873	1.133
7089.6299	4.883	1.100	7525.6194	4.869	1.116
7106.7076	4.870	1.103	7526.6076	4.851	1.124
7125.6986	4.884	1.097	7540.5903	4.879	1.103
7126.6313	4.864	1.075	7703.9146	4.878	1.100
7127.6472	4.868	1.096	7790.7653	4.899	1.101
7128.6264	4.879	1.092	7793.8264	4.872	1.102
7170.6160	4.899	1.070	7806.7792	4.871	1.084
7173.6062	4.894	1.084	7810.7458	4.850	1.090
7174.5840	4.872	1.094	7818.7514	4.879	1.086
7175.5917	4.881	1.090			

MEAN V = 4.873 SE = 0.013 MEAN B-V = +1.096 SE = 0.015

the first observing season when the Leiker and Hoff magnitudes suggest a brightening early in the season and later are consistently brighter than those from the Corralitos. However, this trend continues in the second season and leads this investigator to conclude that it results from a difference in the color transformations or magnitude zero points between the two observatories. In order to investigate this idea further, same season values for Rho Cas made at the Corralitos were plotted against the previously published magnitudes by Leiker, Hoff and Milton (1989). Graphically, these appear in Figure 2. It can be seen that the Corralitos values are in substantial agreement with those of Milton, but that the Leiker and Hoff magnitudes are once again consistently brighter than those from the other two sources. Therefore, it would seem reasonable to conclude that their brighter magnitudes for Tau Cas probably do not reflect variability as such when integrated into a uniform data set with the Corralitos observations.

Working now solely from the Corralitos data, this author concludes that from those observations alone, Tau Cas has shown no variability over the time period JD 2446994 - 7818, in agreement with Percy's analysis. The mean magnitude of 4.873 is in accord with the published value of V = 4.87 for the star in the Bright Star Catalogue, and its standard error of 0.013 is consistent with the accuracies found for other stars with the Corralitos telescope - photometer system. While certainly not ruling out the possibility of variability for Tau Cas on a lower level than can be observed with the Corralitos system or at times other than when it was observed there, this author considers that the star is essentially constant and hence, will continue to use it as a comparison for Rho Cas in the future.

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NEW FLARE STAR IN PISCES

During examination of a U. K. Schmidt Telescope (UKST) plate for minor planets, the outburst of a new flare star was found (Fig. 1). The plate, (J13150) was tracked on the expected motion of comet P/Brorsen-Metcalf, (see Table 1), and the star was already fading rapidly at the start of the exposure. During the first 20 minutes of the exposure, the star faded around 1.5 mags, slowing to around 0.5 mags during the later 40 minutes. At the end of the exposure it was still about one magnitude above minimum. The position has been measured from from a UKST equatorial J survey plate (see Table 2 and Fig. 2). The author thanks the Anglo-Australian Observatory for access to the UKST plate archives, measuring machine and computing facilities.

Table 1, plate details

Plate:	J13150
Date :	1989 June 13
Start:	18h 34m 31s UT
End :	19h 34m 31s UT
Notes:	tracked on expected motion of comet P/Brorsen-Metcalf.

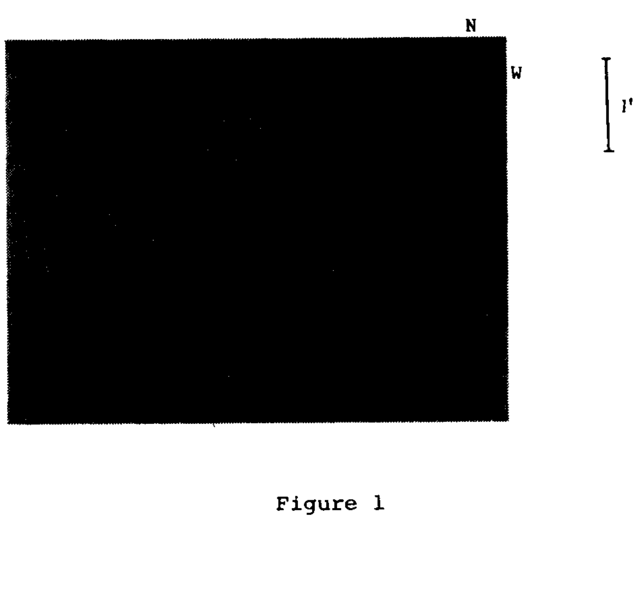

Figure 1

2

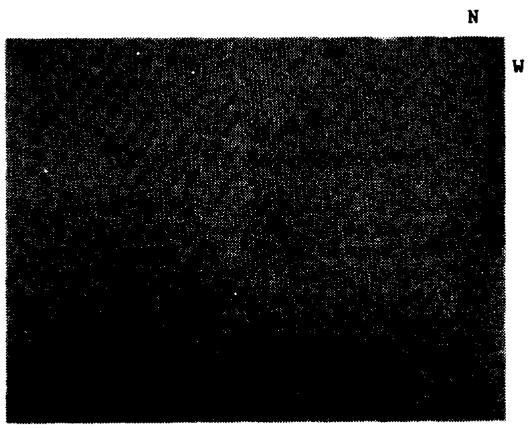

Figure 2

Table 2, star details

(1950) R.A. 22h 59m 28s.49 +/- 0".4
(1950) Dec. -02d 27' 48".7 +/- 0".4
Based on 10 Perth 70 stars, Epoch 1982.8
Range <18 - 21 mj

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ON THE VARIABILITY OF THE DUSTY CARBON STAR LP And

The infrared object IRC+40540 = AFGL 3116 = IRAS 23320+4316 = NSV 14623 (Schmitz, Mead and Gezari, 1987), a carbon star of spectral type C8,3.5 extremely reddened due to circumstellar dust shell (Cohen, 1979) was suspected to be variable in the course of the "Two-micron Sky Survey" (Neugebauer and Leighton, 1969), its infrared variations confirmed by Lockwood (1974) and time scale of variability 500-1000 days found by Strecker and Ney (1974). The object is named LP And in the General Catalogue of Variable Stars (1985).

To improve knowledge of the character of variability of LP And, the star was monitored photographically with the Schmidt telescope of the Radioastrophysical Observatory at Baldone using Kodak IN plates and red filter KC 19. During 1984-1989 30 estimates of I(0.81) magnitudes were made and a mean cycle length of approximately 625 days was found. If early observations in K-passband published by Neugebauer and Leighton (1969), Strecker and Ney (1974), Grasdalen et al. (1983) and Cohen (1984) are also taken into consideration, a mean cycle length of 614 days is obtained.

In Figure 1 (bottom) a mean light curve in photographic infrared I(0.81) for LP And is given according to the elements:

$$\text{Max. J.D.} = 2446340 + 614 \cdot E \qquad (1)$$

The amplitude of the mean light curve in I(0.81) is 1.5 mag. However the first observation made in 1978 shows the object 1 mag brighter than expected.

At the top of Figure 1 the K-magnitudes published by the authors cited are plotted versus phase based on elements (1). It seems that the range in K is nearly similar to that in I(0.81).

Thus the object LP And = AFGL 3116 belongs to the group of carbon stars with thick circumstellar shells and very long periods, whose other known members are CW Leo = IRC+10216 ($P=635^d$, Alksnis, 1989), RW LMi = CIT 6 ($P=605^d$, Alksnis and Khozov, 1987), as well as AFGL 971 ($P\approx 610^d$) and AFGL 1235 ($P\approx 590^d$) (Le Bertre, 1988).

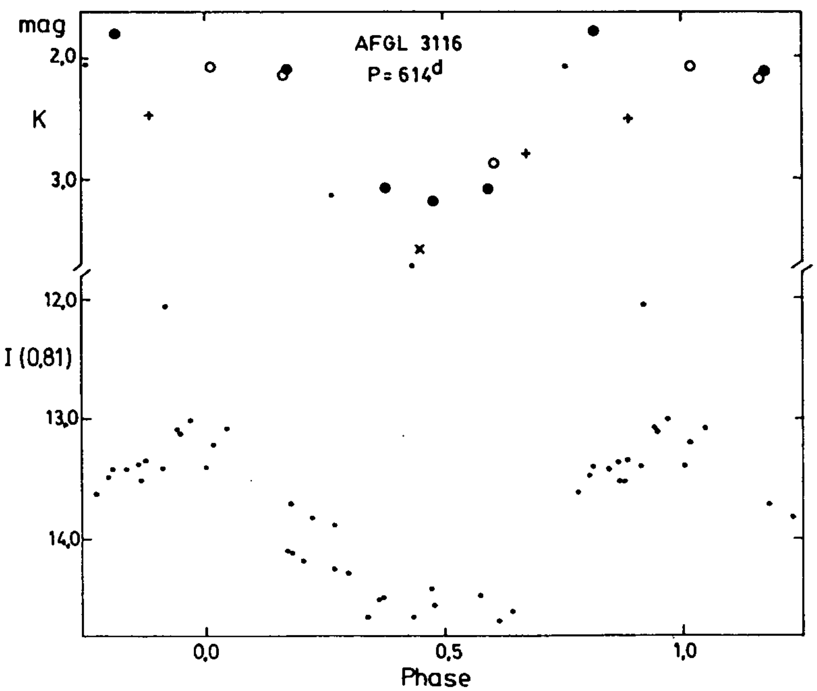

Figure 1. Mean light curves of LP And in K- (top) and in I(0.81)-(bottom) passbands: individual observed magnitudes plotted versus phase according to (1). K-magnitudes by authors cited are signed with different symbols: open circles - Neugebauer and Leighton; filled circles - Strecker and Ney; + signs - Grasdalen et al., x - Cohen (1984); dots are 104-magnitudes by Lockwood minus 6.1 mag.

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THE SPECTROSCOPIC VARIABILITY OF UU AQR

The H emission line object UU Aqr (= S196 = PB7088) was found to be an eclipsing cataclysmic variable by Volkov et al. (1985). They derived a photometric period which recently was improved by Goldader and Garnavich (1989) to be 0.163579089 d. A low resolution spectrum presented by Downes and Keyes (1988) shows, besides H, also weak He I and He II emission. To get some information on the phase dependent spectral behavior a few spectra were obtained at the ESO Observatory La Silla / Chile in 1987 and 1988 using the Boller & Chivens spectrograph and a CCD detector attached to the 3.6 m and 1.52 m telescope, respectively. The eight spectra recorded on July 31, 1987 cover the region around H_α (59.5 Å/mm, exp. time 4 min), whereas the 17 spectra taken during three consecutive nights in 1988 (June, 19-21) span the wavelength region from H_α to H_γ (172 Å/mm, exp.time 7-10min). In this note only the strong H_α emission is used for a first closer spectroscopic inspection of the system.

The line shape is variable and indicates several sources of emission within the system: Symmetrical profiles as well as strong asymmetries or even double peaks are present. Therefore, to get the motion of the white dwarf, positions of the broad wings (FWZI ~ 45 Å), representing material in the innermost disc, were measured and the corresponding (heliocentric) radial velocities were folded with the photometric period referring to mid-eclipse as phase zero. Fig. 1 shows the resulting radial velocity curve which indicates $K_1 \sim 160$ km/s and $\gamma \sim 20$ km/s. Spectroscopic and photometric period are obviously identical as judged from the data at hand. The phases of maximum (~0.9) and minimum radial velocity (~0.4 - 0.5) are shifted by about 0.15 with respect to the expected position. Such inconsistencies are known also for other cataclysmic variables. The line profile variations exhibit a quite consistent behaviour through the orbital cycle: A symmetrical shape (phases 0.17 to 0.4) is followed by an asymmetrical profile showing a strong blue component (phases 0.4 to 0.7) which lateron is fading out (phases 0.7 to 0.8). Then the line becomes again symmetrical (phases 0.80 to 0.88) and asymmetrical with a pronounced red

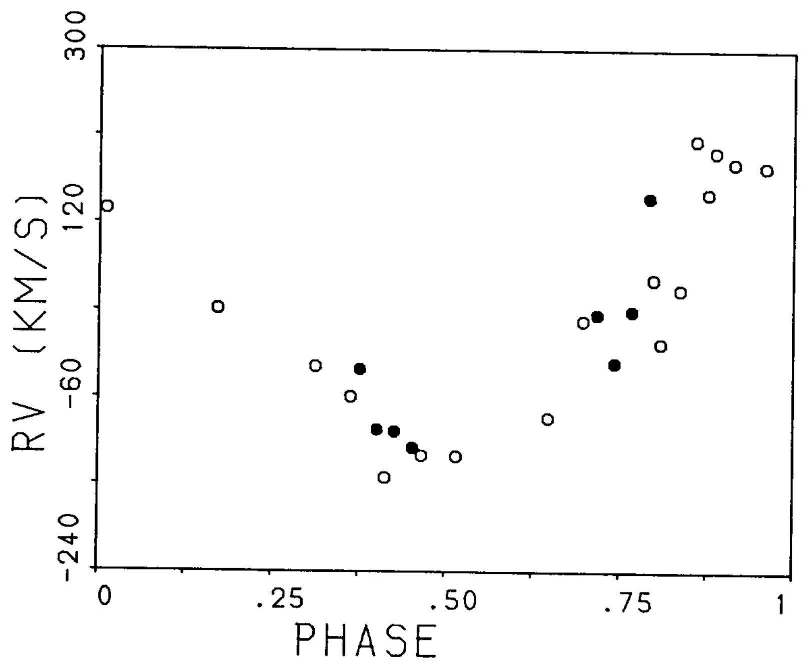

Fig. 1 Radial velocity curve of UU Aqr based on measurements of the broad wings of H_α. Phase zero corresponds to mid-eclipse. Filled circles: observations of 1987, open circles: observations of 1988.

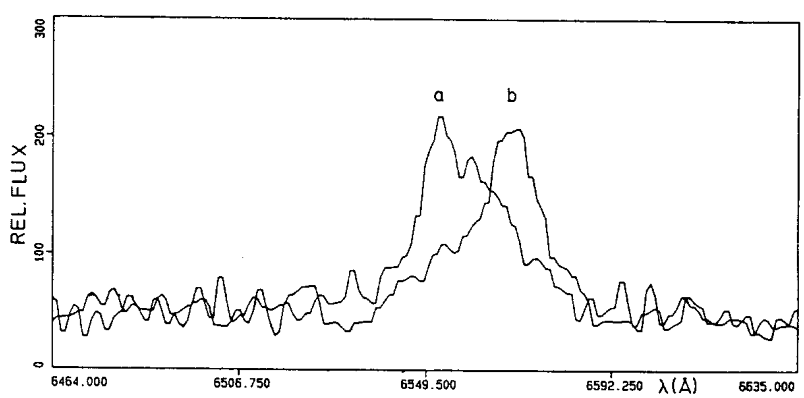

Fig. 2 Strong asymmetries of H_α shown for phases 0.47(a) and 0.01 (b).

component (phases 0.88 to 0.01). Fig. 2 presents two such asymmetrical profiles with a strong blue and red component, respectively. The peaks cover a velocity range of about ± 350 km/s. Whereas the line widths remain nearly constant all the time, the line strengths seem to be reduced by about 40% between phases 0.5 and 0.8 as compared with the average value for the remaining phases. No weakening is observed for the line at phases 0.96 and 0.01 which cover the eclipse. Using 0.37 $M_\odot$ for the mass of the secondary (empirical period - mass - relation, Patterson (1984)) and the mass function of 0.06941 ($\odot$) the mass of the white dwarf may be estimated to be in the range 0.4 to 0.5 $M_\odot$ (inclination between 70^0 and 90^0) which is far below the average white dwarf mass of about 0.9 $M_\odot$ found for cataclysmic variables.

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1989 BVR PHOTOMETRY OF CG CYGNI

CG Cygni (=BD +34° 4217 = #142 in the catalog of Strassmeier *et al.* 1988) is a member of the short-period RS CVn group as defined by Hall (1976). Since the discovery of its variability by Williams (1922), CG Cyg has been observed intensely at frequent intervals. Heckert and Zeilik (1989) presented 1987 V-band photometry; Dapergolas *et al.* (1989) collected complete 1987 light curves at B and V. We report here on 1989 BVR data, where the R-band allows us to estimate the temperature of the spotted regions.

Our observations were carried out at Capilla Peak Observatory (CPO) the nights of 18 July and 3-5 August 1989 UT. Our CCD camera (Laubscher *et al.*, 1989) was used in a multichannel mode to measure CG Cyg, the companion star (BD + 34° 4216), and the sky simultaneously. Our new filter set (Beckert and Newberry, 1989) matches closely Johnson BV and Kron-Cousins R-band response. The data were reduced with an effective aperture of 21 arcsec. Phases were calculated from the ephemeris in Strassmeier *et al.* (1988).

Figures 1-3 present the observational data in the instrumental system at BVR; note the coverage is complete and accomplished within a month. The statistical error in each datum is less than 0.01 magnitude. Note the small-scale "bumps" that appear on the shoulders of the light curve. They are clearly visible at all wavelengths. The weather was photometric on all nights, so we consider these features to be real, not observational artifacts. Such "bumps" are just discernable in Jassur's 1978 data (Jassur, 1980); they are not apparent in our 1987 light curve (Heckert and Zeilik, 1989).

Figure 4 presents an optimized binary model fit (solid line) to the V-band data (open circles). This comparison clearly reveals the maculation effect (near 90°), as well as the smaller variations. This fit follows the procedures of Budding and Zeilik (1987) and uses a

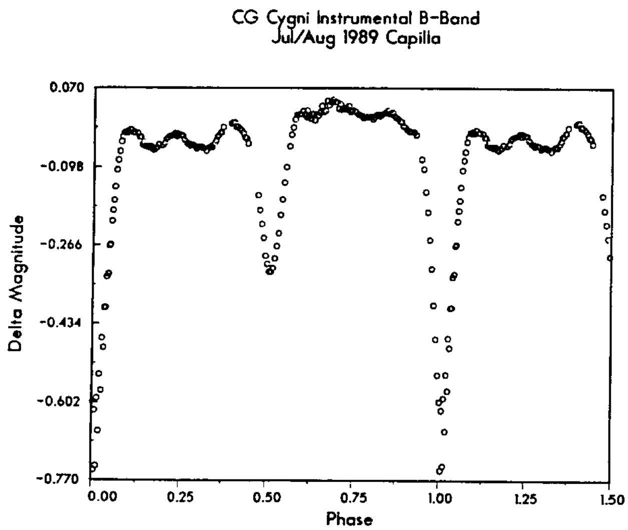

Figure 1

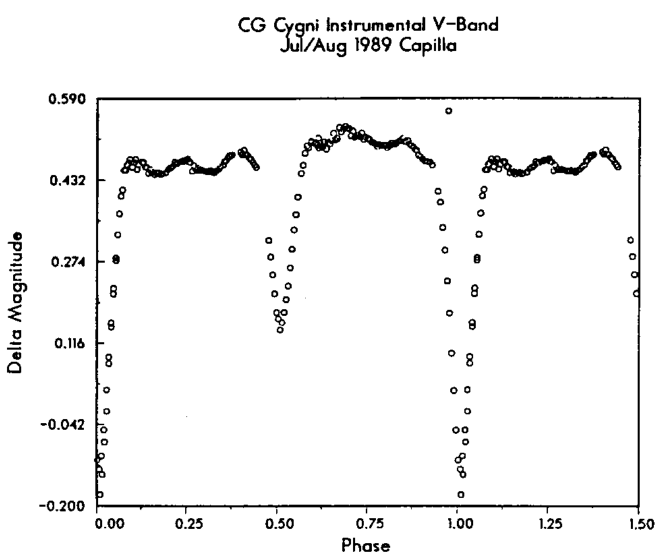

Figure 2

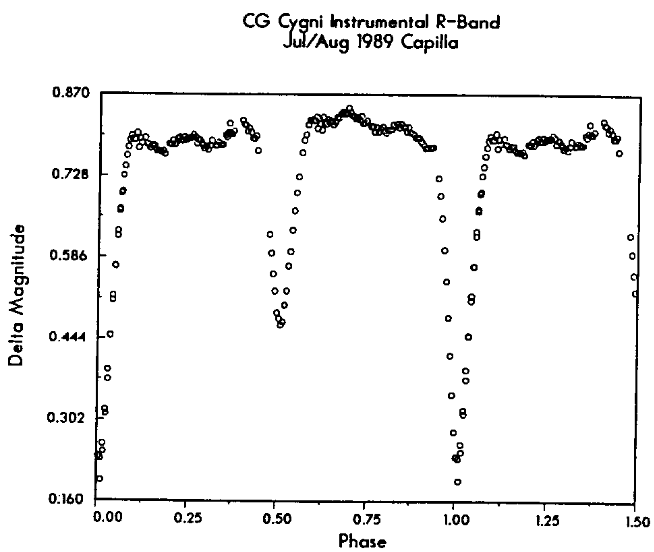

Figure 3

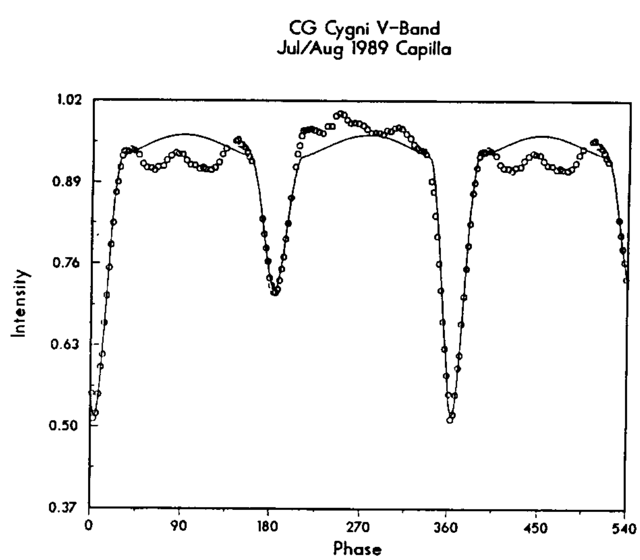

Figure 4

temperature of 5200 K for the primary star and 4400 K for the secondary. We fitted a single black, circular spot to the distortion wave and found these following optimized starspot parameters: longitude = 86.0° ± 3.4°, radius = 15.6 ± 0.5°, and latitude = 41.7 °. (The latitude fit was an indeterminate solution and so has no formal errors). Compared to our 1987 results, we find that the spotted region has moved to a lower longitude but stayed at about the same latitude. Its area has increased roughly 40%. Using the V and R data together, we estimate that the temperature difference of the spotted region compared to primary star's photosphere is 1140 K ± 160 K, or T_{spot} = 4060 K. for $T_{primary}$ = 5200 K.

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PROGRAM OF PARALLAX MEASUREMENTS FROM SPACE FOR THE NEAREST ECLIPSING BINARIES

The idea of making stellar parallax measurements from space was born ten years ago, after the preparation of "A Catalogue of Photometric Parallaxes of Eclipsing Binaries" (Dworak 1975). We selected a subset of 102 of the nearest eclipsing variables (all within 100 pc from the Sun) from the catalogue of Brancewicz and Dworak (1980). From our list, 95 stars have been selected by the HIPPARCOS Organizing Committee (Table I). We are in hope that we obtain positions and parallaxes for these stars as well as their brightness in the UBV system.

More precise and homogeneous measurements and trigonometric parallax determinations of eclipsing binaries are needed for the following reasons:
- to obtain the absolute geometrical and physical parameters of eclipsing systems which are necessary for theoretical studies of these systems;
- to more accurately determine the empirical mass-luminosity relationship for the components of close binary stars, especially those of luminosity class IV (Dworak 1975; Griffiths et al., 1988);
- to verify the method for determining photometric parallaxes of distant eclipsing binaries (Dworak 1975; Brancewicz and Dworak 1980) and of spectroscopic binaries (Dworak 1983);
- to obtain the space distribution of binary stars, important information for investigating the structure of Galaxy in the neighbourhood of the Sun (Oblak 1983);
- to verify the validity of the hypothesis of the nonexistence of single subgiants (Dworak 1985);
- to determine the zero-point of the photometric parallax scale (absolute magnitudes) which is necessary for determining extragalactic distances and for verifying the value of Hubble's constant (de Vaucouleurs 1983);
- to resolve some eclipsing systems which allow us to compare the parameters of visual double stars with the same parameters as close binary systems (Oblak and Chareton 1980).

Table I

BD	HD	ALPHA(1950)	DELTA(1950)	NAME	V	Sp. T
o		h m s	o ' "		m	
+08 19	1061	00 12 24.12	+08 32 36.3	UU Psc	5.9	F0IV+
+39 154	3765	00 38 04.31	+39 55 19.7		7.6	K2V
+74 27	4161	00 42 18.42	+74 42 54.6	YZ Cas	5.6	A2IV
+23 106	4502	00 44 40.96	+23 59 43.9	Zet And	4.0	K1IIe
-55 267	6882	01 06 17.24	-55 30 45.7	Zet Phe	3.8	B6V+
+06 189	7700	01 14 18.53	+06 32 53.0	UV Psc	9.5	G5
CD-50 410	9528	01 30 29.02	-49 47 01.4	AE Phe	7.9	G1/G2IV
SV*HV11634		01 49 12 00	-38 55 30.0	V572 Cen	11.0	?
+22 284	11763	01 53 03.35	+23 19 59.2	RR Ari	6.0	G8III
CD-23 737	12180	01 56 40.39	-23 09 43.5	AA Cet	6.5	F2...
+40 442	13078	02 05 59.31	+40 33 28.3	BX And	8.7	F2Vvar
+45 3813	21033	02 06 39.52	+45 29 45.0	AR Lac	6.4	G2IV+...
		02 33 47 00	-45 17 12.0	CO Eri	8.5	G0
+69 179	17138	02 44 22.77	+69 25 32.9	RZ Cas	6.3	A2V
+40 673	19356	03 04 54.35	+40 45 52.4	bet Per	2.2	B8V
+47 781		03 09 53.31	+47 55 23.2	LX Per	7.9	G4
+12 539	25204	03 57 54.37	+12 21 02.1	lam Tau	3.7	B3V+...
-10 858	26609	04 09 46.52	-10 35 43.6	YY Eri	8.2	G5
AN 4.1913		04 31 52 00	+15 09 48.0	TY Tau	11.9	K0
-08 1050		05 08 50.59	-08 36 59.8	ER Ori	9.4	G1V:
+19 886	34335	05 14 33.49	+20 04 47.8	CD Tau	6.8	F7V
+33 1002	34364	05 15 01.25	+33 42 55.1	AR Aur	6.0	B9V+...
SV*HV2435	269320	05 18 42 00	-68 16 36.0	RW Dor	10.0	K5
		05 31 47 00	-81 37 18.0	TY Men	7.6	A3
CPD-76329	37513	05 32 00.30	-15 34 54.8	V1010 Oph	6.5	A5V
+59 920	39220	05 50 28.95	+59 52 47.2	TU Cam	5.2	A2V
+44 1328	40183	05 55 51.57	+44 56 40.6	bet Aur	1.9	A2IV+...
+56 1125	44691	06 22 12.69	+56 18 51.5	RR Lyn	5.6	A3Vm
+32 1324	46052	06 29 11.43	+32 29 32.8	WW Aur	5.7	A3m+...
+82 174	44982	06 30 36.66	+82 18 46.3	SV Cam	9.3	G5V:+...
CSV 847	263139	06 42 49 00	+34 29 00.0	GX Gem	10.6	G5
		06 47 33 00	+47 44 00.0	HS Aur	10.4	G5
-16 1898	57167	07 17 12.31	-16 17 59.9	R CMa	6.2	F1V
CD -69 461		07 37 50 00	-69 25 48.0	W Vol	9.9	K
		08 28 13 00	+02 26 54.0	GK Hya	8.9	G4
CPD-78378	75747	08 44 58.11	-78 53 15.1	RS Cha	6.3	A7V
CD-276141	77137	08 57 34.04	-27 37 10.5	TY Pyx	6.9	G5V
+27 1706		08 58 58 00	+26 52 42.0	WY Cnc	9.3	G8V
+55 1317	237786	09 06 18.43	+54 41 40.0	XY UMa	9.8	G5
-28 7373	82610	09 30 06.99	-28 24 24.3	S Ant	6.9	A9V
-44 5573	82829	09 31 19.97	-44 59 10.8	S Vel	8.0	A5m...
+56 1400	83950	09 40 15.40	+56 10 56.3	W UMa	8.3	F8V:p+...
+20 2437		10 05 34.60	+20 14 56.0	YY Leo	9.6	M2
CPD-63134	307739	10 23 21 00	-63 23 00.0	EX Car	9.5	G0
+15 2230	92109	10 35 40.99	+14 31 39.5	UV Leo	8.0	G0V
+10 2234		10 59 34.18	+10 09 53.2	AM Leo	8.6	F8Vn
		11 02 29 00	+05 25 36.0	AP Leo	9.5	G0
+30 216	99946	11 27 25.57	+30 14 35.2	AW UMa	7.1	F0
+12 2437	106400	12 11 47.86	+12 05 55.3	AH Vir	8.8	K0V+...
-18 3437	110139	12 37 37.34	-18 31 32.4	SX Crv	9.1	F8
+36 2344	114519	13 08 17.86	+36 12 01.1	RS CVn	8.2	F4V+...
		13 29 44 00	+28 50 18.0	VZ CVn	9.3	G5
+26 2508	121648	13 53 51.75	+26 09 46.1	ZZ Boo	6.8	F2V
-49 8609	124784	14 13 40.21	-49 42 49.0	V636 Cen	9.0	F8/G0V
AN 29.193		14 15 01 00	+12 47 18.0	VW Boo	10.3	G5
-07 3938	132742	14 58 17.80	-08 19 18.1	del Lib	4.8	B9.5V
+48 2259	133640	15 02 08.28	+47 50 53.3	i Boo	6.4	G0Vnvar
+40 2857		15 06 18 00	+40 09 36.0	TZ Boo	9.7	G2V
+62 1393		15 10.50.38	+62 02 48.6	BW Dra	9.2	B0
+62 1393	135421	15 10 50.66	+62 02 32.9	BV Dra	8.1	F7V
+39 2849		15 11 39 00	+38 45 18.0	SS Boo	9.7	G5V:+...

Table I (cont.)

BD	HD	ALPHA(1950)	DELTA(1950)	NAME		V	Sp. T
o		h m s	o ' "			m	
+27 2512	139006	15 32 34.14	+26 52 54.7	alf	CrB	2.2	A0V
+00 3562	150484	16 38 47.78	+00 36 08.5	V502	Oph	8.2	G2V+...
+82 498	153751	16 51 00.90	+82 07 21.5	eps	UMi	4.7	G5III
+16 3130	155937	17 11 43.18	+16 24 27.6	AK	Her	8.4	F8Vvar
		17 33 51 00	-56 47 30.0	V535	Ara	7.5	A3
+05 3547	163611	17 54 24.33	+04 59 30.8	V566	Oph	7.5	F4V
+15 3311	163930	17 55 51.37	+15 08 31.4	Z	Her	7.1	F4IV-V
+13 3495		17 56 20.78	+13 53 12.7	V508	Oph	9.2	A2
+09 3584	166231	18 06 58.35	+09 08 28.3	V839	Oph	9.0	F8V
-15 4842	166126	18 06 58.30	-15 33 37.3	W	Ser	9.3	F5Iab:pe
+41 3021		18 14 14 00	+41 05 36.0	TZ	Lyr	9.8	F5V
+18 367	348635	18 23 26.70	+18 15 52.0	AW	Her	9.9	G2IV
-10 4814		18 46 25.72	-10 17 56.2	RS	Sct	10.1	G0
-3713001	175813	18 55 21.11	-37 10 28.0	eps	CrA	4.8	F2V
+10 3787	178125	19 04 37.31	+10 59 34.3	Y	Aql	4.9	B8III
+46 2641	179890	19 10 37.58	+46 14 18.2	FL	Lyr	9.0	G0V
+5421931	85912	19 37 33.73	+54 51 21.6	V1143	Cyg	6.2	F6Va
+47 3059	192909	20 13 55.49	+47 33 35.7	V1488	Cyg	4.3	K3IB+...
SV* SVS 309		20 17 31 00	+36 10 54.0	V346	Cyg	10.9	A5
+75 752	197433	20 38 03.01	+75 24 58.4	VW	Cep	7.4	K0Vvar
-4613749	198827	20 51 17.42	-45 55 16.6	SU	Ind	9.7	F5/F6V
CPD-702812	199005	20 53 51.33	-70 36 58.5	KZ	Pav	7.6	F2+...
-15 5848	199603	20 55 55.85	-14 40 38.0	DV	Aqr	6.2	F0IV
+27 3952	200391	21 00 16.43	+27 36 33.3	ER	Vul	7.6	G0V+...
		21 05 45 00	+51 50 48.0	V1061	Cyg	9.1	F8
-16 5943	207098	21 44 16.99	-16 21 18.4	del	Cap	3.0	A7IIIm
-16 6074		22 20 35 00	-15 35 06.0	BW	Aqr	10.0	F7
		22 31 59 00	-20 07 .0	EE	Aqr	8.1	F0
+37 4717	216598	22 51 22.54	+37 40 18.9	SW	Lac	10.1	K0Vvar
+52 3383	218915	23 08 52.33	+52 47 12.1	RT	And	7.2	O9.5Iab
+01 4695	219113	23 10 50.56	+02 24 10.0	SZ	Psc	7.0	K1IV-V+..

In order to obtain homogeneous results for the geometrical and physical parameters, new or additional observations of eclipsing binaries from the HIPPARCOS program are necessary, especially for the stars listed in Table I (for which only the spectral type of bright component is given). The solution of light curves from photoelectric observations is also needed for accurately determining the geometrical parameters of each eclipsing system. The determination of the spectral type and the luminosity class of the secondary components of some eclipsing binaries are especially needed.

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PHOTOMETRY OF SUSPECTED UU Her-STARS

Some years ago Sasselov (1984) published a list of suspected UU Her variables based on the spectral classification of Bartaya (1979). Some of these stars were included in a program to determine if they were really variable. A similar work was carried out by Arellano Ferro *et al.* (1989), who concluded that most of the stars in this list were not supergiants, i.e. do not belong to the UU Her-class.

The photometric observations were carried out in Piszkéstetõ with the 50-cm telescope of Konkoly Observatory in the *UBV* system during 1985-1988. The stars were not observed systematically, mainly because of the usual unfavourable spring weather. Table I contains the results of the observations.

TABLE I

star	comparison	number of observations	ΔV	$\Delta(B\text{-}V)$	$\Delta(U\text{-}B)$
HD 51832	HD 50864	4	−0.734±0.009	−0.037±0.003	+0.157±0.007
HD 56664	BD+61°968	2	+0.746±0.006	+0.071±0.004	+0.035±0.001
HD 58965	HD 59506	6	+1.258±0.017	−0.650±0.005	−0.972±0.009
HD 58966	HD 59506	6	+0.873±0.004	−0.665±0.009	−0.984±0.004
HD 102102	HD 101549	4	+0.117±0.002	+0.152±0.004	+0.008±0.012
HD 102570	HD 102482	4	−0.313±0.006	−0.539±0.004	−0.598±0.012
HD 130667	BD+47°2178	6	−0.967±0.007	−0.091±0.005	+0.066±0.012

It is clear that these stars are not variables. HD 58965 may be the only exception, but if the larger scatter is due to variability, it probably is not of the UU Her-type (the amplitude is smaller than 0.05 mag). There are only two measurements of HD 56664 with differences of 0.008 mag in *V*, 0.005 mag in *B-V* and 0.001 in *U-B*, but there is a three year long gap between them. Thus the *UBV* photometry of these stars supports the conclusion of Arellano Ferro *et al.* (1989) that these stars are definitely not UU Her-type variables.

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