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OPTICAL PHOTOMETRY OF A0538-66 DURING QUIESCENCE*

The periodic recurrent transient source A0538-66, which undergoes X-ray and optical outbursts every 16.6 days when it is in an active state [1-4] also shows extended periods of inactivity [5]. It has been in such an off-state since the end of 1982 [6].

We report here on photometric observations of this source which have been made since 1983, to detect the onset of a new cycle of activity, and to study its off-state behaviour, e.g., to detect possible orbital light variations.

The observations were made with the five-colour Walraven photometer [7] on the 90-cm telescope at ESO. Each observation consisted of 4 to 16 integrations of 32 seconds, preceded and followed by 4 such integrations of the sky background (taken ~15" east of A0538-66). A diaphragm of 11.6" diameter was used, which excluded contamination of the signal by a nearby 13.4 mag. star, located 13" south of A0538-66 (star R on the finding chart given in [3]). All measurements were taken relative to the Walraven standard star HD 39844; corrections for differential atmospheric extinction were applied. A total of 228 observations on 147 nights were made between 1983 (JD 2445656) and 1985 (JD 2446293). From the spread of the results of individual observations obtained during a single night we estimate the r.m.s. accuracy of a single observation to be ±0.09 mag in V, ±0.03 mag in V-B, and ±0.05 mag in B-U.

An overview of the quiescent behaviour of A0538-66 is shown in Fig. 1, in which the long-term histories of the V magnitude (transformed to the Johnson system using the transformation formula (eq. 4) given in [8]), and of the Walraven colours V-B and B-U are displayed. In this Figure we have also included previously discussed off-state data [6].

It appears that the source remained near a quiescent magnitude V ~ 14.8, with small irregular brightness variations (with a total range of ~

*Based on observations made at the European Southern Observatory

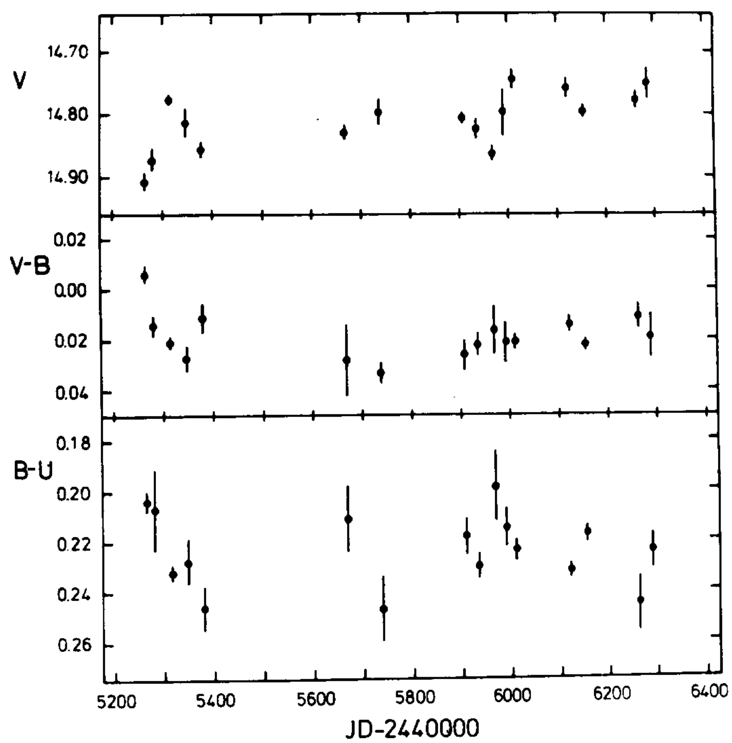

Figure 1: Long-term quiescent behaviour of A0538-66. The upper diagram shows the V-Johnson magnitude averaged over time intervals of ~20 days. The middle and lower diagrams show the corresponding behaviour in the Walraven colours V-B and B-U respectively.

0.1 mag) occurring on a time scale of tens of days. Also on longer time scales the visual brightness (averaged over time intervals of ~200 days) shows a small secular increase, from V = 14.85 ± 0.01 (m.e.) near JD 2445300 to V = 14.77 ± 0.01 near JD 2446300.

The off-state colours of A0538-66 show moderate variations over time scales of tens of days with r.m.s. deviations of the average colours of 0.015 mag in V-B, and 0.03 mag in B-U; except during the beginning of the off state (between JD 5225250 and 5225400 [6]) no significant correlation is present in the colour-magnitude, and colour-colour variations.

In order to look for the possible presence of periodic variations of

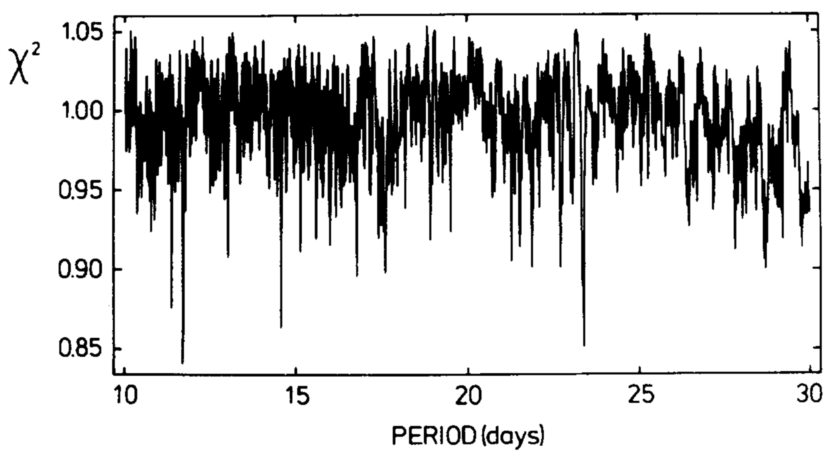

Figure 2: Periodogram of A0538-66 in the neighbourhood of the orbital period of the binary, 16.6515 days [4]. Residuals of the V magnitude, with respect to the long-term trend, are folded. Shown in the diagram is chi-square of the folded data with respect to the standard deviation of the unfolded data.

the brightness of A0538-66 at the 16.6 day orbital period we have made an epoch-folding period search in the residuals of the V, B, and U magnitudes with respect to the smoothed long-term trend, mentioned above. (In case of observations performed during an isolated period of about one month we have simply subtracted the average magnitude during that month).

The resulting periodogram for the V-band data (Fig. 2) shows that there is no evidence in our data for a modulation of the brightness of A0538-66 (at the 16.6 day outburst period) during its off state. By adding artificial sinusoidal signals, with various amplitudes between 0.01 and 0.10 mag., to the data we estimate that any periodic signal in the V-band has an amplitude less than ~ 0,02 mag. Similar upper limits have been obtained for the B and U passbands.

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NFORMATION BULLETIN ON VARIABLE STARS

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SPECTRAL ESTIMATION OF LUMINOSITY AND OTHER CHARACTERISTICS OF THE DELTA SCUTI STARS AI CVn (= 4 CVn) AND δ Ser

In June 1976 we obtained a series of spectrograms of two Delta Scuti variables - AI CVn (4 CVn, HD 107 904, HR 4715) and δ Ser (HD 138 917, HR 5788) - with a reciprocal dispersion of 37 Å/mm and 15 Å/mm, respectively; the spectral range was 3600 - 4900 Å. The observations were performed by means of a diffraction spectrograph ASP-11 attached to the 122-cm telescope of the Crimean Astrophysical Observatory (USSR). More details of observations as well as results obtained from the spectroscopic investigation of these stars are given in Tsvetkov (1977a, b).

In the present note we apply a method based on spectral observations only, in order to estimate the luminosities of the both stars. Our results are listed in Table I. The spectral types of the stars were determined by means of calibrations connecting equivalent widths or ratio of equivalent widths of chosen spectral lines with the spectral type according to the two-dimensional spectral classification (based on the MKK classification) developed and elaborated in the Crimean Astrophysical Observatory. We measured and used equivalent widths of hydrogen, calcium, and iron lines (H_γ, H_δ, Ca II K Ca I λ 4227, Fe I λ 4046, Fe II λ4385) and derived the same estimations of spectral type, for a given star (Table I). We found, furthermore, the last hydrogen line (of Balmer series) observed in the spectrograms: $n_m = 21$ for both stars. Then, we estimated their absolute visual magnitudes:

$$M_V = (M_V)_{A0} + \Delta M_V.$$

$(M_V)_{A0}$ was derived from a $n_m - (M_V)_{A0}$ calibration for stars of spectral type A0 (Gerashchenko, 1970); this calibration is mainly based on trigonometric parallaxes for $(M_V)_{A0}$ determinations. ΔM_V is a correction to $(M_V)_{A0}$ for estimating M_V of a star of another (O9-F2) spectral type, by using a Sp-ΔM_V calibration (Gerashchenko, 1970) based also on trigonometric parallaxes.

Table I

M_V estimates of AI CVn and δ Ser

Star	Sp	n_m	$(M_\Delta)_{AO}$	ΔM_Δ	M_Δ
AI CVn	F2	21	$-0\overset{m}{.}6$	$+1\overset{m}{.}6$	$+1\overset{m}{.}0$
δ Ser	F0	21	-0.6	+1.4	+0.8

Table II

Several characteristics of AI CVn and δ Ser

Star	P (days)	V	$\log \frac{L}{L_\odot}$	T_e (K)	$\frac{R}{R_\odot}$	r (pc)	Iben M_e	Iben t	Paczynski M_e	Paczynski t	M_Q	Mode
AI CVn	0.209	$5\overset{m}{.}90$	1.50	6950	3.88	95.5	1.98	8.21	2.13	5.95	1.50	F
δ Ser	0.134	4.23	1.58	7500	3.65	48.5	2.06	7.21	2.21	5.29	1.88	1H

The M_V estimations in Table I may be compared with those derived in other ways: $0\overset{m}{.}95$ (Baglin et al., 1973), $0\overset{m}{.}71$ (Breger and Bregman, 1975), $0\overset{m}{.}62$ (Breger 1975), $0\overset{m}{.}62$ (Breger, 1979) for AI CVn; $0\overset{m}{.}8$ (Eggen, 1970) for δ Ser. There is a relatively good agreement between our and other M_V values, bearing in mind that the mean observational error in M_V is $\pm$ 0.2 for dwarfs (Breger, 1979) and, probably, up to $\pm\ 0\overset{m}{.}5$ for giants (Baglin et al., 1973). Hence, the method used in the present note gives an independent and relatively accurate luminosity estimation, provided that spectrograms with a sufficiently high dispersion are available.

Table II lists a number of physical characteristics of the stars studied. The periods P and the mean visual magnitudes $\bar{V}$ are taken from Breger (1979). The luminosities L are derived from the M_V values in Table I neglecting the very small (|B.C.| $\lesssim$ $0\overset{m}{.}04$) bolometric corrections for Delta Scuti stars. The effective temperature T_e of AI CVn is taken from Tsvetkov (1985); T_e of δ Ser is estimated by comparing the observed profile of the line H_γ in our spectrograms with a set of theoretical profiles of this line, which are computed for various effective temperatures (Mihalas, 1965).

The radii R are derived from these L and T_e estimates. The distances r (in parsecs) to the stars are evaluated from $\bar{V}$ and M_V, neglecting the small interstellar absorption of light. Using T_e and L, the evolutionary masses M_e (in units of the solar mass) and the ages t (in units of 10^8 years) are interpolated from Iben's (1967) and Paczynski's (1970) evolutionary tracks; both stars are in the phase of shell hydrogen burning. Adopting the P, L, T_e and R values in Table II, pulsation masses M_Q (expressed also in solar masses) are calculated by means of Faulkner's (1977) fitting formulae for a chemical composition (X,Y,Z) = (0.70,0.28,0.02). In Table II, the pulsation mass of each star is listed for this radial pulsation mode (F for AI CVn, 1H for δ Ser), for which M_Q is closest to the evolutionary mass M_e.

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1985/86 MULTI-COLOR PHOTOELECTRIC OBSERVATIONS OF THE STARSPOT ACTIVITY ON V711 TAURI (HR 1099)

Multi-color, intermediate and narrow band photoelectric photometry of the active, non-eclipsing RS CVn-type binary V711 Tauri (HR 1099, HD 22468, ADS 2644 A: K1 IV + G5 V; <V> = +5.8 mag; P = 2.84 days) has been obtained on 21 nights from 1985 September 7 UT through 1986 January 12 UT. The observations were carried out at the Villanova University Observatory using the 38 cm Cassegrain telescope which utilizes a photoelectric photometer that is equipped with a refrigerated EMI 9658 photomultiplier tube, and a microprocessor controlled data acquisition system. The characteristics of the intermediate band blue (λ4530), yellow (λ5500) red (λ6600), and narrow band red (λ6568) filters, as well as the observing procedure, data reduction technique, and explanation of the differential color and Hα indices have been given elsewhere (Guinan and Wacker 1985). All measures of the variable star included the fainter visual companion ADS 2644 B. The comparison star was 10 Tauri (HR 1101, HD 22484; F9 V; V = +4.28 mag). Unpublished observations obtained at Villanova during the 1983/84 and 1984/85 observing seasons which have monitored 10 Tauri with respect to 12 Tauri (HR 1115, HD 22796; gG6 ; V = +5.57 mag) indicate both stars are of constant brightness. Nightly mean differential magnitudes were computed, in the sense variable minus comparison, for the blue, yellow, and red observations, from which corresponding differential color and Hα indices were determined. The mean seasonal errors for the nightly $\lambda\lambda$4530, 5500, 6600, 6568, Δ(b-r) , Δ(b-y) , and $\Delta\alpha$(V-C) data sets are, respectively: 0.008, 0.006, 0.007, 0.012, 0.011, 0.010, and 0.014 mag.

The top panel of Figure 1 presents the nightly mean differential λ5500 magnitudes. The orbital phases were determined according to the ephemeris of Bopp and Fekel (1976).

$$HJD = 2442766.069 + 2\overset{d}{.}83782E$$

where zero phase corresponds to conjunction with the more active (K1 IV) component nearest the earth.

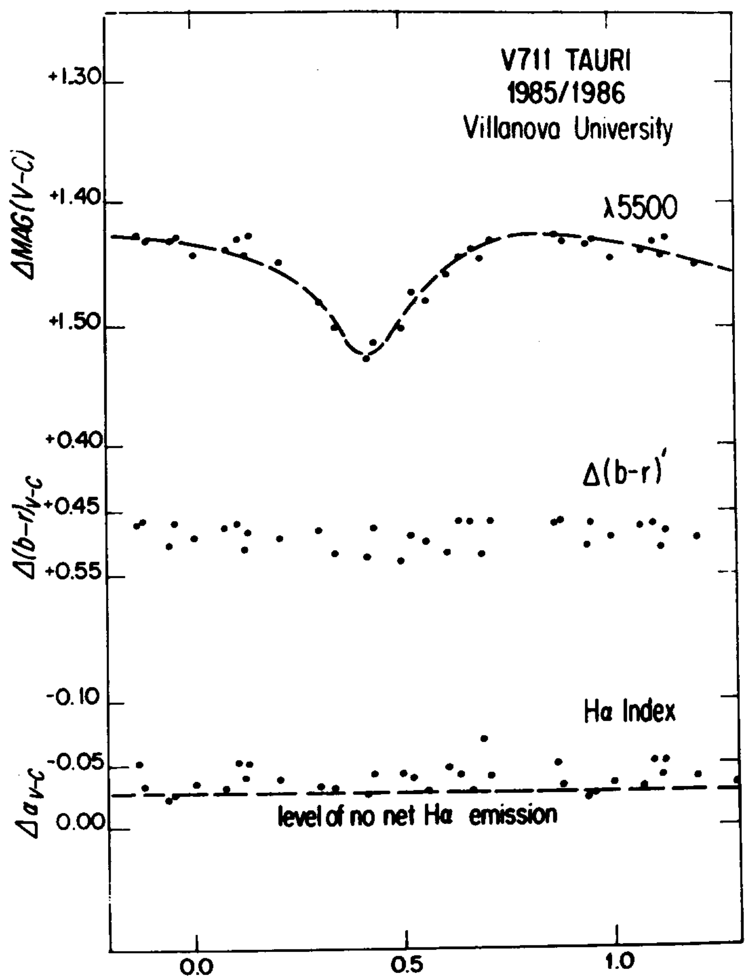

Figure 1. The 1985/86 photoelectric observations of V711 Tauri made with respect to the comparison star, 10 Tauri are plotted. The top panel is a plot of the nightly mean differential yellow magnitudes. The middle panel is a plot of the differential color index formed from the blue and red observations. The bottom panel is a plot of the differential H-alpha index, where more negative values indicate greater net H-alpha emission.

The differential yellow light curve possesses a broad, perhaps flat-topped, maximum extending from ≈ 0.70P to ≈ 0.15P, with minimum light occurring in the vicinity of 0.41P. Maximum, mean, and minimum light have the following approximate values, respectively (all expressed differentially relative to 10 Tauri): +1.430, 1.475, and 1.520 mag. The corresponding light amplitude is about 0.09 mag. The red light curve (not shown) is identical in shape, and has an amplitude of about 0.08 mag. Also not shown is the blue light curve whose shape is similar to the yellow and red light curves. The amplitude of the blue light curve is about 0.095 mag, but has an uncertainty of ±0.015 mag due to large scatter in the observations.

The middle and bottom panels of Figure 1 present the differential color curve, $\Delta(b-r)$, and the differential Hα index, $\Delta\alpha(V-C)$, respectively. No apparent phase dependency exists for both of these curves. The mean value for the $\Delta(b-r)$ data set ≈ +0.468 mag. The mean value for the $\Delta\alpha(V-C)$ data set ≈ -0.039 mag. Based upon the spectral types of the variable and comparison stars, $\Delta\alpha(V-C)$ ≈ -0.035 mag corresponds to the level of zero net Hα emission. When these Δα measures are compared with measures made in previous years at Villanova using the same equipment and filters, it appears that the overall level of Hα emission has significantly diminished. It would, however, be useful to verify this with direct spectroscopic observations of the Hα feature.

V711 Tauri is a constituent of the classical group of RS CVn-type binaries, a class of chromospherically active stars whose light variability is believed to be due to the rotational modulation of starspots located on the surface of the cooler component.The photometric behavior of V711 Tauri has been thoroughly monitored since 1976. The light curves often change dramatically from season to season in both shape and amplitude, as well as in mean, maximum and minimum light. Dorren et al. (1981), and Dorren and Guinan (1982) have successfully interpreted these seasonal photometric variations in the context of the starspot model, incorporating two large circular spots that are cooler than the surrounding photosphere. Unpublished observations obtained at Villanova during 1984/85 indicate the light curve of V711 Tauri at this time was quasi-sinusoidal in shape, with maximum light occurring near 0.78P and minimum light occurring at about 0.40P. At λ5500, the light amplitude had a value of 0.15 mag, with maximum, mean, and minimum light having the following values, respectively: +1.35, 1.43, and 1.50 mag (measured differentially relative to 10 Tauri). Comparing these values with those reported here for the 1985/86 light curve reveals that during the intervening six months the light curve of V711 Tauri experienced a large transition.

Although the phase of minimum light remained virtually unchanged, maximum, mean, and minimum light became considerably fainter, while the shape and amplitude of the light curve changed markedly.

Exploratory starspot modeling of the light curves of V711 Tauri obtained at Villanova over the past three observing seasons indicate the presence of two large circular spots located on the visible hemisphere approximately 1100 ± 150 K cooler than the surrounding photosphere. This temperature difference between the photosphere and the spots is in excellent agreement with the value of 1200 K derived by the Doppler-imaging study of V711 Tauri by Vogt and Penrod (1983), and with the lower limit of 1000 K determined from the TiO band spectroscopic measurements of Ramsey and Nations (1980). To reproduce the 1985/86 light curve, our preliminary modeling necessitates a large polar spot region, the majority of which always remains in view, accompanied by a smaller spot located close to the equator, and thus passing completely out of view as the star rotates. Furthermore, the decrease in the mean light level between the 1984/85 and 1985/86 light curves of 0.05 mag is indicative of an appreciable increase in the total spotted surface area of the active component. A more detailed analysis of these observations is in process and will be published elsewhere.

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STRÖMGREN uvby-H_β PHOTOMETRY OF THE SOLAR TYPE STAR HD 206860

An observational program is currently being developed to obtain accurate four color uvby-H_β photometry of some selected Ca II emission solar type stars (Wilson 1978,Vaughan et al. 1981). They have been monitored to check the existence of correlation between the chromospheric Ca II variability and the optical output in the shorter time scale (stellar rotation).

The existence of photometric variations in the group of stars given by Wilson have been reported by Dorren et al. (1982), Radick et al.(1982, 1983), showing the correlations between the chromospheric phenomena and the light fluctuations due the existence of spots associated to the activity centers on the stellar surface.

In this note we present the photometric results of the Ca II variable star HD 206860 = HR 8314 that shows a well defined light curve with a photometric period equal to the previously reported Ca II period (Vaughan et al. 1981).

The observations were carried out from July 21 to 31, 1985, using the 1.5m telescope at the Calar Alto Observatory (Almeria-Spain), located at 2165 m above the sea level. A multipurpose UBVRI single channel, pulse-counting photometer was used. A general description of this instrument is given by Lahulla (1982).

Observations were made in each of the four Strömgren passbands and the Crawford H_β filters with 16 integration time in each band, followed by sky-background deflections. The observing sequence was the familiar pattern of sky-comparison-variable-comparison-sky.

The effects of differential atmospheric extinction were removed and the data reduced to differential magnitudes with respect to the comparison star HR 8313. Due to the close angular proximity of the comparison, the extinction effects were removed using the mean coefficients for each night. Only one comparison was used due to the nature of standard uvby of the HR 8313 (Crawford and Barnes 1970).

The transformations to the Crawford-Barnes standard system have been determined for stars of spectral type from A2 to G0 and luminosity class V (Reglero et al. 1986) and they can be used to transform the differential photometry to the standard system. In this particular case, the standard transformation could be affected by non negligible errors due to the uncertainties associated with the spectral type and luminosity class of the comparison star HR 8313 G0Ib. In order to preserve the intrinsic quality of the data, the results are given in the instrumental system.

One hour of observations was typically obtained each night and normal points were formed by averaging the individual measurements.

In Table I we list the nightly mean RMS dispersions ($\bar{\sigma}$) for the normal points in the y band and (b-y),m_1,c_1 indices. The night-to-night RMS dispersion (σ) is also given.

Table I

	y	b-y	m_1	c_1	H_β
$\bar{\sigma}$	.005	.004	.006	.009	.008
σ	.015	.005	.005	.005	.006

The y instrumental magnitude differences of HD 206860 with respect to the HR 8313 is plotted in Figure 1. The plot shows a well defined sinusoidal light curve with an amplitude Δy=.04 mag., that corresponds to eight times the $\bar{\sigma}$ confidence level for the y band. Period determinations give us a value of P=4.7 days equal to that previously obtained by Vaughan et al.(1981) with the Ca II emission-line measurements. This photometric period is in good accordance with the spectroscopically determined value of V sin i = 11 Km/s obtained by Kraft (1967).

Small (b-y) color variations can be deduced from Figure 1, with an amplitude of Δ(b-y) = .012 mag. This amplitude is correlated with the variations in y in the sense "redder when darker", that is consistent with the model of stellar activity due to the presence of dark spots on the stellar surface.

No noticeable variations are found in the m_1 and c_1 indices below the 3σ confidence level.

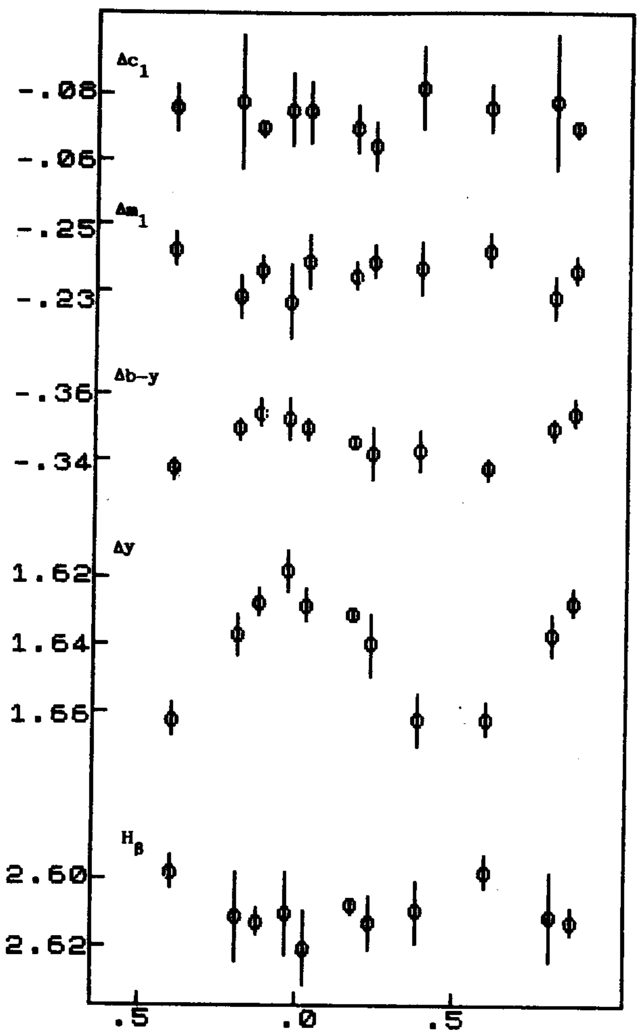

Figure 1: **Photometric variations of HD 206860 vs phase.**

Simultaneous H_β photometry was made to check the beaviour of the Balmer hydrogen β-line against stellar rotation. The measurements were transformed to the Crawford standard system (Reglero et al. 1986). The plot H_β versus orbital phase is shown in the lower curve in Figure 1. A mean value of H_β = 2.610 with a night-to-night dispersion σ = .006 mag. is computed. Following the H_β calibration from Crawford and Mander (1986), this value is consistent with the GOV spectral type given by Kraft (1967) for HD 206860.

Further observations of this star and others in Wilson's group are required to establish the nature of the photometric variations.

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THE PROPER MOTION OF VX Sgr DERIVED FROM LIBRARY MATERIAL

An approximate value of the proper motion of this star has been derived by Soulié and Baudry (1983) ($\mu\alpha*\cos\delta=-0''.008$/yr, $\mu\delta=+0''.003$/yr) using as a first-epoch position the one quoted in the GCVS which is not the best source for the astrometric position of any variable star. In order to get a more reliable first-epoch position, I have rereduced plate 1821 of the Hyderabad southern part of the Astrogrphic Catalogue (A.C.) (epoch 1921.75) where VX Sgr was identified with object 60855. The reference stars were taken from the SAOC which gives a mean error of $\pm$ 0''.36 in α and $\pm$ 0''.33 in δ.

The second epoch position has been taken from Soluié and Baudry's paper in which the epoch of observation is 1979.75 and a mean error of $\pm$ 0''.15 in α and $\pm$ 0''.20 in δ has been assumed (see Soulié and Baudry, 1983).

I have declined to use plate 2077 of the Hyderabad A.C. in which VX Sgr (object 68680) lies near the edge of the plate.

With the available material the following annual proper motion, in the system of the SAOC, is derived:

$\mu\alpha*\cos\delta = +0''.010 \pm 0''.007$ (me) ; $\mu\delta = +0''.022 \pm 0''.007$ (me)

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Reference:

Soulie, G., Baudry, A.: 1983, Astron.Astrophys. Suppl. Ser. 52, 299.

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PHOTOMETRIC OBSERVATION OF VISUAL DOUBLE STAR ADS 9537 (BV Dra, BW Dra) BY AREA SCANNING TECHNIQUE

The two W UMa-type stars, BV Dra and BW Dra, members of the visual binary system ADS 9537, have been observed during eleven nights between February 8, 1984 and April 24, 1984. Photoelectric B, V observations were made with the 45 cm reflector at the Urals University observatory with the aid of the area scanning technique, proposed by Rakosch (1965) and Franz (1966).

The diameter of the seeing disk of the star image during the observational nights was 8" - 15". The angular separation of the visual binary system being about 16".3 (Yamasaki, 1979), the diameter of the seeing disk was of the same size or smaller than the separation of components. That is why it was necessary to use the area scanning technique.

The scanning of the stellar images was realized by rotation of the four-side glass prism. The slit width used was 15". The scans, each consisting of 64 ten ms integrations of pulses arriving from the pulse-amplifier, were stored in the computer's memory. The profile data were typically obtained by summing of 80 scans by the method adopted by Warner et al. (1983). Reduction of the profile was made by the method similar to that described by Franz (1970, 1973).

The comparison star was BD+62° 1385. A total of 171 observations in V and 108 in B for both BV Dra and BW Dra were obtained. The scatter of the individual magnitudes m = m(var.)-m(comp.) near their mean light curves corresponds to standard deviations of $\pm 0^{m}.015$ and $\pm 0^{m}.016$ magnitudes in V and B, respectively.

The times of minima that were obtained by present observations are represented in Table I for BV Dra and Table II for BW Dra respectively.

The successive columns contain the heliocentric JD, the type of minimum, the O-C residuals for our minima times in two cases: using Yamasaki's ephemeris, $O-C_I$ and our $O-C_{II}$.

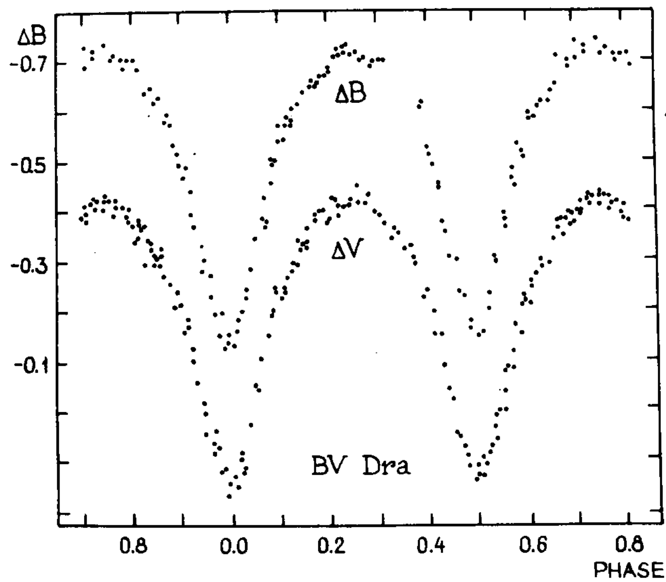

Figure 1

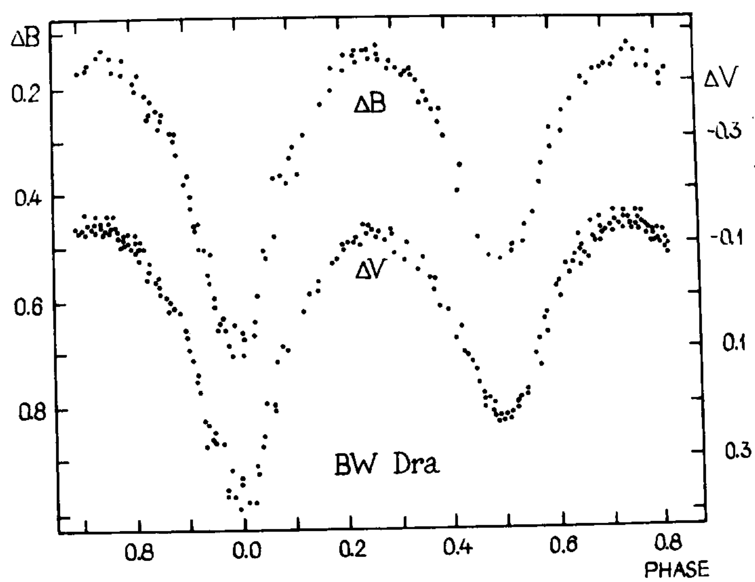

Figure 2

Table I

$JD_{\odot}$	type min.	$O-C_I$	$O-C_{II}$
2445000 +			
739.2897	II	$+0^d.0052$	$+0^d.0002$
740.3394	II	+0.0046	+0.0003
740.5131	I	+0.0032	-0.0017
753.2920	II	+0.0048	-0.0004
761.5191	I	+0.0054	+0.0001
762.2192	I	+0.0054	-0.0001
762.3937	II	+0.0048	-0.0006
763.2731	I	+0.0091	+0.0037
802.3026	II	+0.0063	+0.0003
813.3291	I	+0.0057	-0.0005
814.3792	I	+0.0056	-0.0006

Table II

$JD_{\odot}$	type min.	$O-C_I$	$O-C_{II}$
2445000 +			
740.3621	II	$+0^d.0195$	$+0^d.0016$
740.5052	I	+0.0165	-0.0014
753.3615	I	+0.0175	-0.0004
761.2500	I	+0.0175	-0.0003
762.2726	II	+0.0175	-0.0004
762.4190	I	+0.0179	-0.0001
763.2956	I	+0.0180	+0.0001
782.4332	II	+0.0187	+0.0008
802.3007	II	+0.0190	+0.0012
814.2782	II	+0.0177	-0.0001
814.4234	I	+0.0168	-0.0010

The times of minima do not agree well with the epochs given by Yamasaki (1979) for those two stars.

New period and epochs were determined as follows:

$$JD_{\odot} minI = 2445739.1145 + 0^{d}.350071\ E$$

for BV Dra and

$$JD_{\odot} minI = 2445740.2144 + 0^{d}.292165\ E$$

for BW Dra respectively. Figure 1 and 2 represent B and V light curves for BV Dra and BW Dra respectively.

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VARIATIONS OF THE LIGHT CURVE OF VW Cep

VW Cep(HD 197433 :G5; 7.2) is an eclipsing binary system of the W UMa type.

This system shows some peculiar light variations, like asymmetries on both sides of the maximum, sporadic changes of the level of two consecutive maxima (see Fig. 2) small humps on both sides of both minima , asymmetry of the (B-V) curve , and finally intrinsic light variations.

The system also shows the Kwee effect (that is a delay or advance of the primary minimum according to which maximum , II or I , is the higher). This effect was interpreted by Kwee (1966) as produced by an inhomogeneous and absorbing cloud of circumstellar matter, rotating around the double star with a period of little longer than the orbital period of the binary system.

Van't Veer (1973) has proposed that the Kwee effect is originated by gas flows from regions in the neighbourhood of the first Lagrangian point L_1 to the outer envelope of the system. Walter (1979) has associated this event with the precessional periods of the rotational axes of the components.

Pustylnik and Sorgsepp (1976) proposed a model for VW Cep which consisted of a thin gas shell in the form of a disk and a hot spot produced by a gas stream, impacting on a circumstellar shell.

Linnel (1980) reported X-ray emissions for this system. In same way, this one could be the origin for the cited humps near the minima of our measurements during the night 12/13 August, 1985. It was observed like two small humps, near the secondary minimum, at phases 0.45 and 0.53 (see Fig.3). During these nights, the colour index (b-v) was unusually elevated , as it is shown by the dispersion of the points of the observation carried out in the Mojon de Trigo Observatory, Sierra Nevada (see Fig. 1).

The photometric observations were obtained at the Mojon de Trigo Observatory at 2616 m height , during the nights of 30/31 July , 10/11 August, and 12/13,13/14 October 1985.We have employed the 32 cm Cassegrain telescope (f/14)

2

FIG. 2

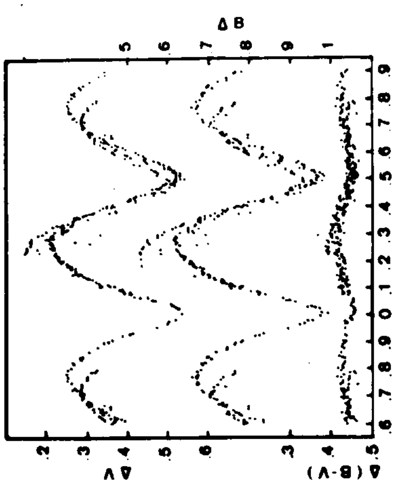


FIG. 3

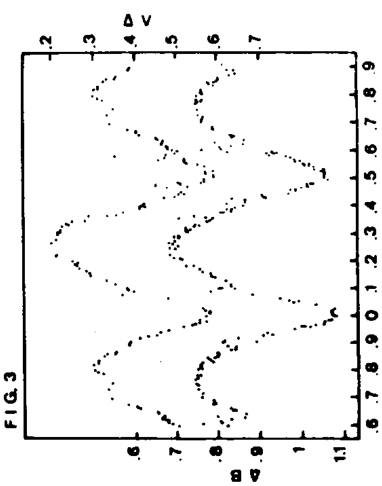
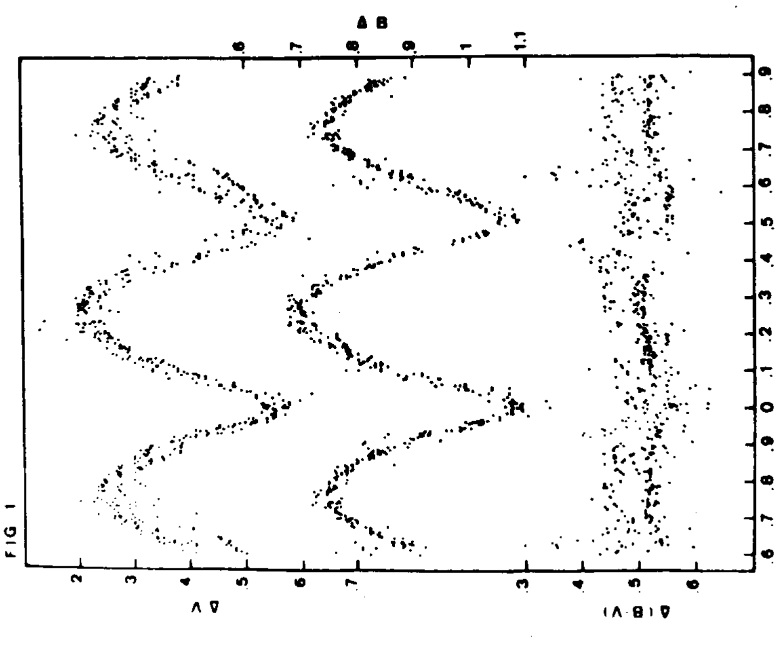


FIG 1



equipped with photoelectric photometer using an EMI 6256A photomultiplier. We used the B, V Johnson filters. The 450 points obtained in each colour are plotted in Figure 1. The acquisition system used was a voltage-frequency converter linked to a Vic 20 personal computer, using a pulse counting program.

Additionally a second set of observations was made at Calar Alto Observatory in Almeria (Spain) employing the 1.23 m telescope (f/8) and one photometer using the RCA 3134 photomultiplier, during the nights of 30/31 August, 31 August to 1 September and 1/2 September. We used the standard UBV Johnson filters. Figure 2 shows the 285 points measured at Calar Alto in each colour. We always used HD 197665, SAO 9836 as comparison star.

In total, using the Mojon de Trigo plus Calar Alto observations, we determined 14 times of minima, of which 8 are primary and 6 are secondary ones listed in Table I.

The O-C residuals and the epoch are also given in this Table.

The O-C residuals have been calculated using Kwee's ephemeris :

Min. I = HJD 2433898.4410 + $0\overset{d}{.}2731793$ x E

or Min II with E+0.5 .

The epoch was evaluated with the ephemeris given by Hopp et al.(1979)

Min. I = HJD 2443410.4180 + $0\overset{d}{.}2783148$ x E

Table I

HJD 2446000 +	EPOCH	O-C	TYPE MIN.
277.5912	44479	-0.1530	I
287.6104	44515	-0.1533	I
288.4439	44518	-0.1547	I
288.5885	44518.5	-0.1493	II
289.4221	44521.5	-0.1507	II
289.5565	44522	-0.1554	I
308.6248	44590.5	-0.1519	II
309.4612	44593.5	-0.1505	II
309.5963	44597	-0.1545	I
310.5768	44597.5	-0.1481	II
350.5087	44741	-0.1548	I
351.4888	44744.5	-0.1489	II
351.6213	44745	-0.1555	I
352.4563	44748	-0.1555	I

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PHOTOELECTRIC OBSERVATIONS OF R CrB DURING THE RECENT LIGHT MINIMUM

The photoelectric observations of R CrB were made with the 34 cm telescope at Kavalur observatory during February and March 1986 and with the 51 cm telescope at Leh site survey observatory during April and May 1986, altogether on 17 dights. During this time the star underwent a minimum and recovered close to its normal brightness. This fading followed the deep minimum of the star which started in August 1985.

All the observations were obtained using standard UBV filters and an uncooled 1P21 photomultiplier. The star BD $+28^{o}$ 2475 (V=7.45, B-V=0.44, U-B=0.02) was used as the comparison.

The nightly means of individual differential magnitudes (variable-comparison) have been converted to standard V and B-V and are shown in the figure (filled circles) against the corresponding J.D.. The published V magnitudes of the star obtained during this period (IAU Circ, No. 4192, 4199, 4214) are also plotted (open circles) along with our observations. The B-V variation follows the variation in V and becomes reddest at the time of minimum. Comparison with the colours at maximum light shows that the ratio of total to selective absorption ($\Delta V/ \Delta(B-V)$) during the decline seems quite high ($\approx$7).

Table : Photoelectric Observations of R CrB

J.D. 2440000+	V	B-V	J.D. 2440000+	V	B-V
6484.445	7.33	0.68	6500.489	7.48	0.83
6485.434	7.33	0.68	6502.477	7.44	0.78
6486.495	7.35	0.70	6526.267	6.28	0.69
6487.427	7.34	0.70	6540.334	6.12	0.63
6488.477	7.35	0.70	6541.209	6.11	0.64
6489.406	7.39	0.71	6542.361	6.10	0.64
6490.443	7.44	0.71	6550.275	6.04	0.66
6492.450	7.48	0.74	6551.202	6.06	0.63
6493.456	7.51	0.74			

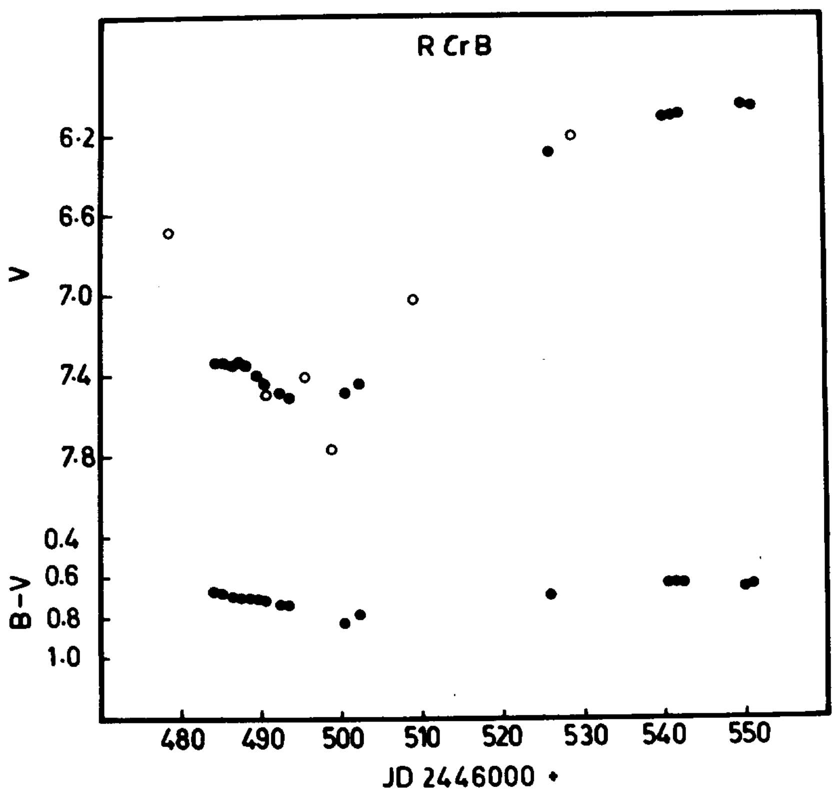

Figure 1

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E R R A T U M

Figure 1 of the No. 2891 issue of the IBVS was in error. The correct version of this figure is given below.

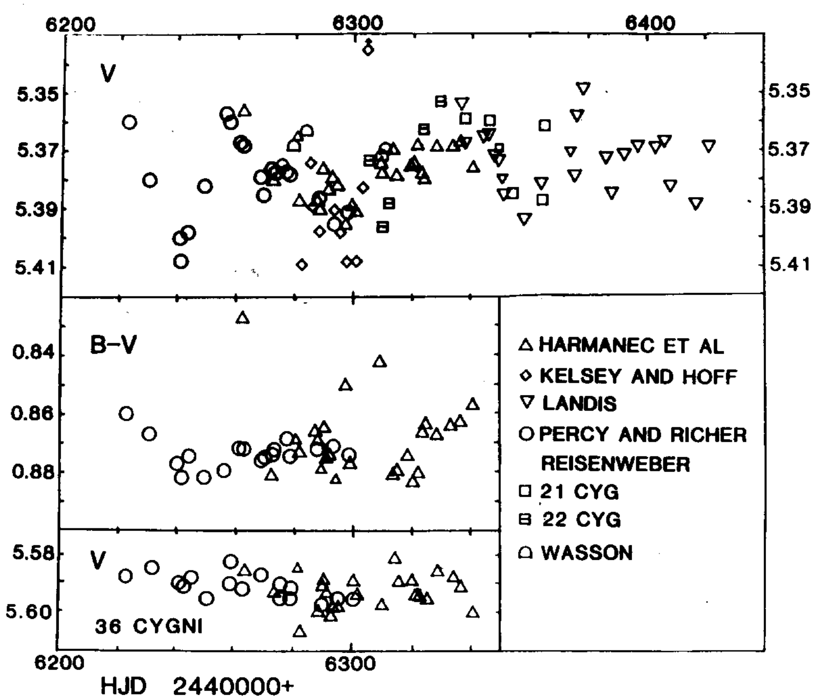

Figure 1: The light and colour curves of 27 Cyg (upper and middle panel) and the light curve of the comparison star 36 Cyg (lower panel). The constancy of the latter shows that the primary comparison star 22 Cyg is also constant. Slightly smaller symbols represent points of slightly lower accuracy.

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ONCE AGAIN: ON THE IDENTITY OF AK CANIS MINORIS

In this Bulletin Robb et al. (1986) reported on difficulties in locating AK CMi. Therefore I would like to direct the attention of the readers to the recent paper of Fuhrmann (1984) where AK CMi has been comprehensively treated. Fuhrmann succeeded in gathering 113 minima of several authors and in improving the then existing elements: he also gave a chart and pointed to the fact that obviously some of the observed minima are spurious. It is not very probable, however, that this fact can be explained by wrong identification of the star by the authors quoted by Fuhrmann. Indeed, the map given by the Brno observers (Pokorny, 1975), which is also cited in the Moscow GCVS (Kholopov et al., 1985), shows the right star. The variability has been independently discovered by Strohmeier et al. (1957). They already were aware of the identity of their star with the object announced by Hoffmeister (1934) and designated by him as BD + $4^{o}1778$ and by the Moscow catalogue compilers as CSV 1102. In the NSV Catalogue (Kukarkin et al., 1982) I cannot find an object numbered 102 559 as given by Robb et al. (1986).

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INFRARED EXCESS OF CEPHEID BINARIES

Two recent papers (Deasy and Butler, 1986; McAlary and Welch, 1986) have drawn attention to the fact that the IRAS observations (see Beichman et al., 1985) indicated considerable mass loss from classical Cepheids. The mass loss would be the most natural way to put an end to some of the existing Cepheid mass discrepancies (see e.g. Burki, 1984).

If the infrared flux is due to the thermal radiation of the Cepheid, then the observed flux ratio F(25μm)/F(12μm) would be about 0.25 for the effective temperature range of the Cepheids (see Deasy and Butler, 1986). Presence of circumstellar matter and/or a near-by companion star would, however, alter the value of the flux ratio.

The aim of this note is to show that Cepheids belonging to binary systems have, on average, a larger flux ratio than the single ones.

Because the rate of binaries among them is 25-35 % (Burki, 1984), one might expect a number of Cepheids belonging to binary systems to appear in the IRAS Point Source Catalog. This catalog contains about 60 classical Cepheids (McAlary and Welch, 1986). For eight definitely binary stars from this sample, and for seven stars for which duplicity can be excluded, the catalog contains accurate fluxes both at 12 and 25 μm. The duplicity of the former eight stars is established beyond doubt using spectroscopic and photometric evidence (see Table I). The most significant reference (not necessarily the discovery) about the presence of the companion is also given in Table I. "Probable" and "possible" binaries are excluded from this study. In the case of the seven single Cepheids "single" means that extensive spectroscopic and photometric investigations have failed to detect any companion. A list of references relating to the negative results on their duplicity would be too long so it is omitted from Table II, which table lists these latter stars as well as their log P and flux ratio. Unfortunately the infrared fluxes for other known Cepheid binaries are not accurate enough to be included.

Table I

Binary Cepheids

	log P	F_{25}/F_{12}		Reference
SU Cas	0.29	0.31 ±	0.06	Evans (1985)
α UMi	0.60	0.23	0.02	Roemer (1965)
AH Vel	0.63	0.29	0.05	Gieren (1980)
FF Aql	0.65	0.26	0.04	Lloyd Evans (1968)
AX Cir	0.72	0.43	0.12	Lloyd Evans (1982)
η Aql	0.86	0.24	0.04	Mariska et al. (1980)
S Sge	0.92	0.27	0.05	Lloyd Evans (1968)
S Mus	0.99	0.30	0.06	Lloyd Evans (1982)

Table II

Single Cepheids

	log P	F_{25}/F_{12}	
δ Cep	0.73	0.28 ±	0.06
β Dor	0.99	0.23	0.02
ζ Gem	1.01	0.23	0.03
X Cyg	1.21	0.29	0.06
Y Oph	1.23	0.24	0.04
l Car	1.55	0.24	0.03
RS Pup	1.62	0.35	0.04

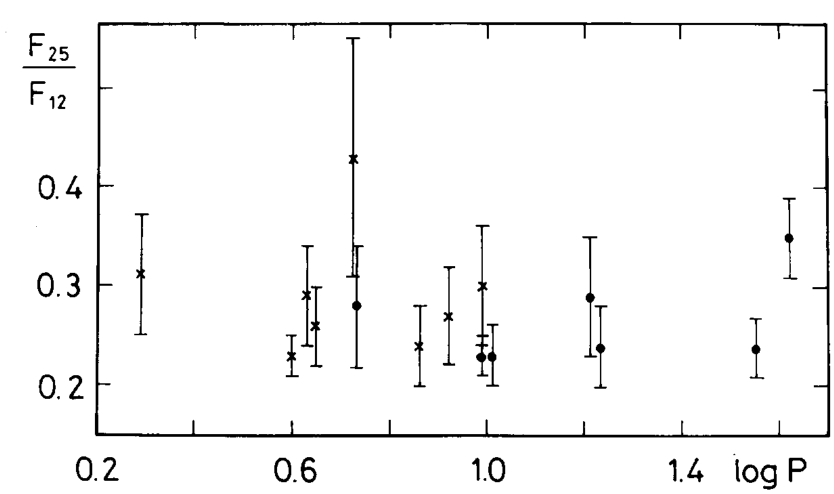

Figure 1

Figure 1 shows the ratio of the 25 μm and 12 μm fluxes as a function of the logarithm of the pulsation period. Cepheids belonging to binary systems are marked by × , dots denote single Cepheids. The error bar for each ratio is also shown. It is clear from the figure that most of the binary Cepheids have a larger infrared excess than do their single counterparts. The longest period single Cepheids evolve more rapidly, therefore a higher mass loss rate is expected. The case of RS Pup is a good illustration of this. Since the companion stars of the binary Cepheids are mostly blue stars (e.g. η Aql, AX Cir, S Mus), infrared excess cannot be explained by thermal radiation of the companion. Mass loss triggered by the pulsation (see Willson and Bowen, 1984) — enhanced due to the presence of the companion and/or free-free transition radiation in the circumstellar matter around the blue component — might be the possible cause of this infrared behaviour. Obviously, the binary Cepheids in the infrared band deserve increased attention, too.

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A NEW BURST OF ACTIVITY IN U CEPHEI

After several years of relative inactivity, large disturbances have reappeared at all phases in the light curve of the totally-eclipsing Algol binary U Cephei. Five-color uvbyI observations made with the 1.0-m Prairie reflector at Mount Laguna Observatory show appreciable anomalies from 2/3 through 11/12 June 1986. Typical photometric anomalies in primary eclipse have included excess light near internal contacts, particularly in the ultra-violet (where the normal flat-bottomed eclipse turns partial in appearance). At the same time outside eclipse, light levels usually fell, by up to 0.6 or 0.7 mag near phase 0.6 (Olson, 1978, 1985).

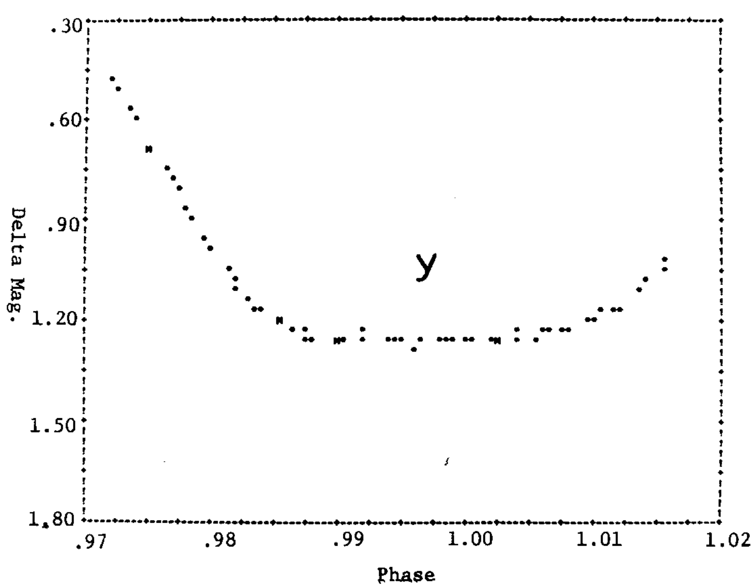

Figure 1/a

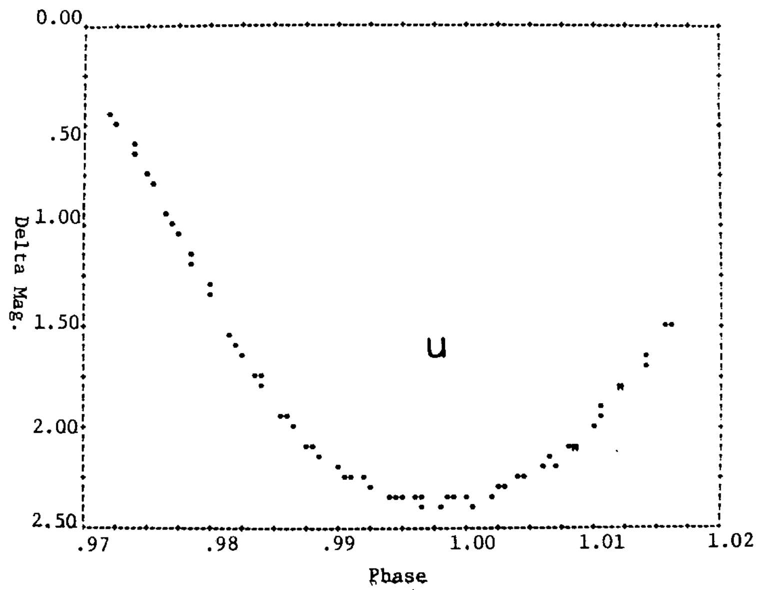

Figure 1/b

Spot checks on seven nights outside primary eclipse during the above run showed that the ultraviolet brightness closely matched the lower envelope of observations made in 1975, when activity was high (Olson, 1978, Figure 3a and 3b). Whatever photospheric changes give rise to these light losses, they appear to repeat in major bursts. Light curves of primary eclipses on 3/4 and 8/9 June were moderately to fairly highly disturbed, in the author's experience with this binary. A very slight decline in disturbance was noted in the later eclipse. Yellow and ultraviolet eclipses for 8/9 June are shown in the accompanying Figures. The ephemeris used to calculate orbital phases was taken from Olson et al. (1985).

The author thanks the U. S. National Science Foundation for continued support of research on interacting binaries, and the Director and staff of the Mount Laguna Observatory for their assistance.

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A NEW BRIGHT Be VARIABLE AND SUSPECTED ECLIPSING BINARY

60 Cyg /HR 8053, HD 200310, MWC 360, $\alpha_{1950} = 20^h59^m26^s$, $\delta_{1950} = +45^o57'31''$/ is an interesting bright Be star, suspected spectroscopic binary /Plaskett and Pearce 1931/ and the brighter component of the visual binary ADS 14549 /the other component, 4.5^m fainter, is 2.6" away/. According to a recent determination /Slettebak 1982/, its spectral type is B1 Ve and v sin i = 300 km/s. Various available records /c.f., e.g., Hubert-Delplace and Hubert 1979, Slettebak 1982, etc./ clearly indicate long-term variations of the hydrogen emission lines and occasional presence of the Balmer shell lines.

To our best knowledge, 60 Cyg has neither been known nor suspected to be a variable star. Yet, its variability seems probable from an inspection of available records. Mendoza /1958/ obtained $V = 5.43^m$, $B-V = -0.22^m$, $U-B = -0.92^m$ /the date of his observation is unknown/. Beljakina and Chugainov /1960/ derived $B-V = -0.191^m$, $U-B = -0.928^m$ from 5 observations in summer 1957. Häggkvist and Oja /1966/ determined $V = 5.36^m$, $B-V = -0.25^m$ from 3 observations secured between May 1964 and December 1965. The most convincing evidence of variability comes from two differential observations of the star by Haupt and Schroll /1974, and priv. comm./:

	V	B-V	U-B
JD 2440449.5	5.341^m	-0.174^m	-0.961^m
JD 2440451.5	5.479^m	-0.168^m	-0.949^m .

Their comparison star was HD 199986, for which we assume $V = 7.03^m$, $B-V = 0.21^m$, $U-B = 0.09^m$ to derive the above values for 60 Cyg.

We have secured 55 UBV observations of 60 Cyg during 17 nights in August - September 1985 as a part of the on-going international observing campaign on bright Be stars /Harmanec et al. 1980/. All the observations were obtained using the 0.65-m reflector installed at the Hvar Observatory, Yugoslavia. Obligatory campaign comparison and check star, HD 199311 and HD 199479, respectively, were used. The data were corrected for extinction and carefully reduced to the standard UBV system.

Differentially derived V, B-V, and U-B values /averages of 3 to 5 individual observations/ of 60 Cyg and of HD 199479 are plotted versus heliocentric Julian date in Fig. 1. Rapid light variations of 60 Cyg, with the amplitude as large as 0.1^m, have clearly been detected. Any accompanying colour variations, if present at all, have amplitudes below 0.02^m.

A period search, using Stellingwerf's /1978/ technique, indicated a family of frequencies of 0.42 /$P = 2.4^d$/, 1.42, 2.42, etc. cycles per day in the individual V observations but the analysis seems unwarranted considering the scarcity and limited number of the data.

As the range of the radial-velocity variations observed is rather large /almost 80 km/s/, we decided to compile 21 radial-velocity observations available in the astronomical literature and analyse them with Morbey's /1978/ period-finding technique. The following possible periods were detected: 22.55^d, 13.797^d, 5.8868^d, 4.62463^d, 3.51389^d, 2.48257^d, and 1.31997^d. Formal orbital solutions, with the allowance for different systemic velocities of different spectrographs, indicated

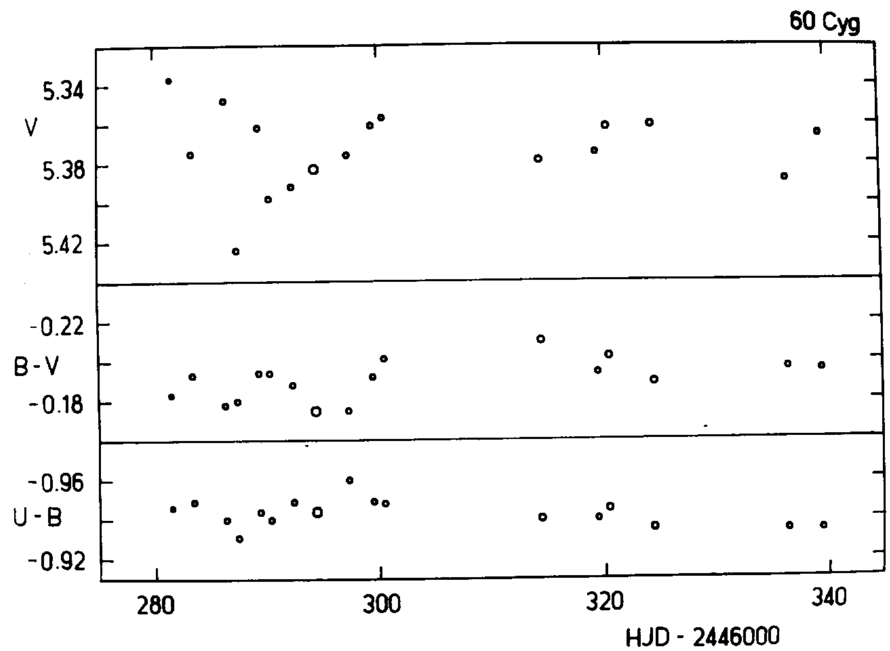

Figure 1/a

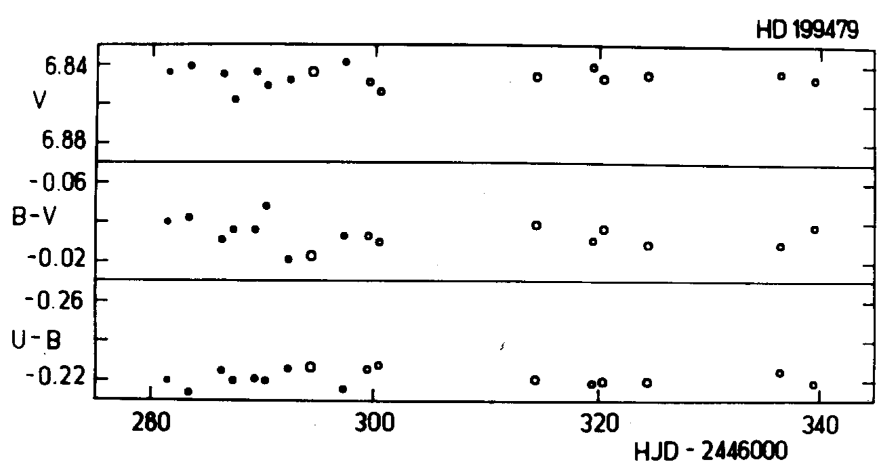

Figure 1/b

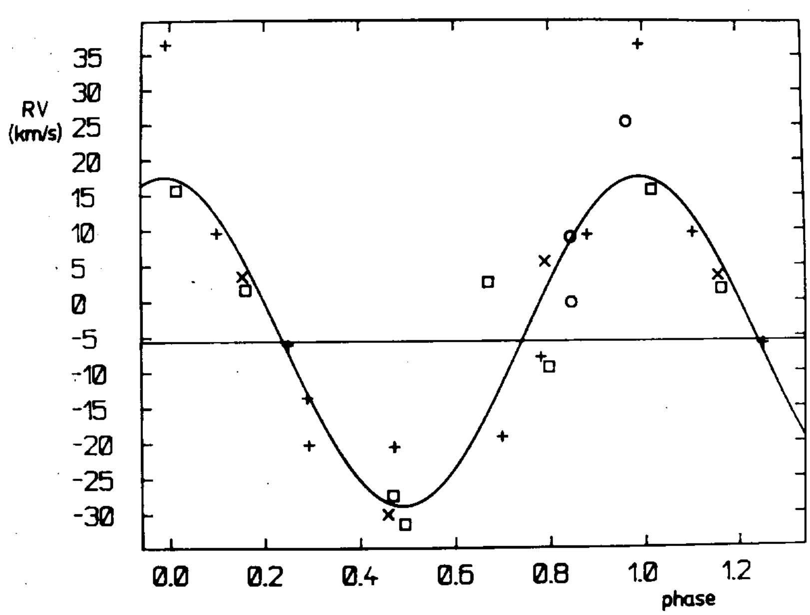

Figure 2

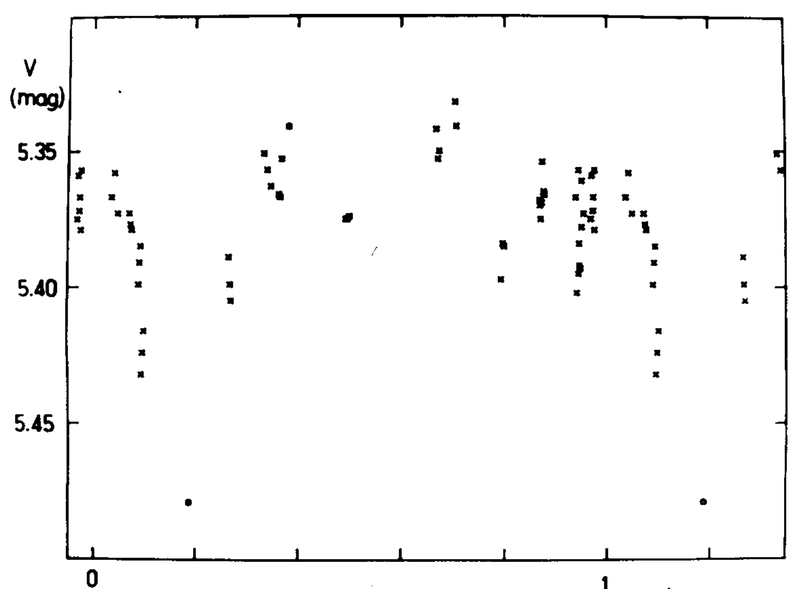

Figure 3

P = 2.48257 ± 0.00002 days as the most probable period. The orbit is probably circular, with K = 23 ± 2 km/s, $T_{inf.conj.}$ = JD 2424411.298 ± 0.039, f/M/ = 0.00320 solar masses, and a sin i = 1.14 solar radii. Reasonable fits were also obtained for some other of the above-listed values of the period. The radial-velocity curve for the 2.48-day period is shown in Fig. 2.

Considering this result, we repeated the period search in the neighbourhood of the 2.48-day in the photometric data, including now also the two differential observations by Haupt and Schroll. We have indeed found significant periods 2.48347^d, 2.48242^d, 2.48138^d, and 2.48032^d. The light curve for the period of 2.48242^d /which is close to the spectroscopically determined value/ is shown in Fig. 3. It is reminiscent of a light curve of an eclipsing binary, though with some scatter. It is clear, however, that the evidence rests mainly on one observation by Haupt and Schroll. It is easy to verify that neither the parameters of the orbital solution nor the amplitude of the light curve contradict to the binary interpretation.

The following conclusions can be drawn:

1. 60 Cyg is certainly variable in light on a time scale of days or shorter.
2. The possibility that 60 Cyg is a spectroscopic binary with an orbital period of 2.48^d /certainly not longer than 22.55 days/ appears quite plausible. The data presented here indicated that it even can be an eclipsing binary, the extra scatter of the light curve being possibly caused by the intrinsic light variations of the B1e primary. We warn, however, that this result must be considered a fortuitous coincidence only - unless more numerous data confirm or disprove it.
3. 60 Cyg is an interesting object, easily observable from Northern Hemisphere, and its continuing study is certainly warranted.

Acknowledgement

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UBV PHOTOMETRY OF HR 8752. II

HR 8752 (=HD 217476=V509 Cas) is a highly luminous G-type hypergiant. Recent photoelectric photometry was done by Halbedel (1985, 1986) and Zsoldos and Olah (1985).

This paper presents observations made between December 1984 and January 1986 with the 50-cm and 1-m telescopes of Konkoly Observatory in Piszkéstető. The comparison star was HR 8761 (V=6.20, B-V=1.50 and U-B=1.53). It did not show any variation during the last three years (Halbedel, 1986). Reductions and transformations into the UBV system were made by the usual way. The observations are listed in Table I.

Table I

J.D.	V	B-V	U-B
2446038.355	4.885	1.295	0.985
6039.276	4.882	1.292	
6181.590	4.983	1.340	
6182.560	4.990	1.360	1.012
6196.577	4.947	1.395	
6198.553	4.968	1.383	1.049
6228.536	4.947	1.354	1.094
6276.554	4.843	1.271	1.081
6281.392	4.840	1.252	1.042
.548	4.836	1.251	1.030
6283.468	4.826	1.241	0.975
6299.397	4.801	1.197	
6300.438	4.793	1.202	0.942
6301.485	4.795	1.213	1.011
6302.467	4.792	1.204	0.985

Table I (cont.)

J.D.	V	B-V	U-B
6303.471	4.791	1.205	1.020
6311.527	4.772	1.200	0.981
6315.427	4.785	1.191	
6318.478	4.777	1.199	
6319.395	4.776	1.200	
6327.444	4.738	1.184	
6364.418	4.804	1.235	1.046
6452.253	4.956	1.322	1.115

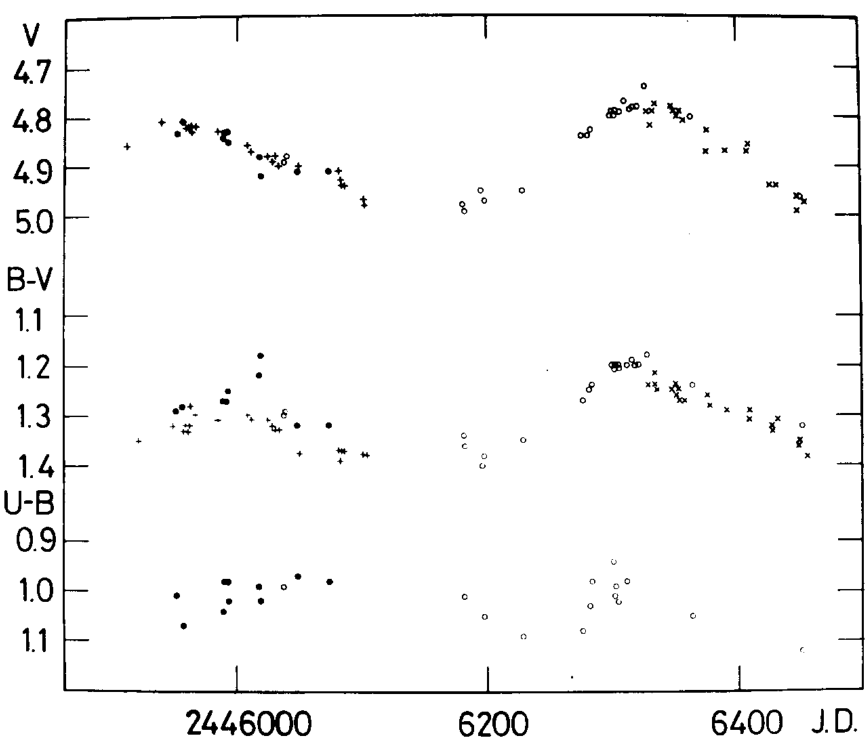

Figure 1: Light and colour curves of HR 8752 in 1984-85. Symbols: plus signs - Halbedel (1985), crosses - Halbedel (1986), dots - Zsoldos and Olah (1985), circles - present paper.

Figure 1 shows the light and colour curves since 1984 (for the light curve between 1979 and 1985 see Zsoldos and Oláh (1985)). Period analysis by neither the Lafler-Kinman nor the Deeming method yielded any period, though a characteristic timescale of about 1 year is present. The cycle length seems to become shorter, this, however, is not certain because of the small number of observed cycles.

HR 8752 shows alternating brighter and fainter maxima (see Figure 1 here and that in Zsoldos and Oláh (1985)). This may be the result of the interaction of pulsation and mass loss in the star (Zsoldos, 1986). Further photometric and spectroscopic observations are needed to have a better understanding of the behaviour of HR 8752.

I wish to thank Dr. K. Oláh, Mr. A. Mizser and Mr. I. Tóth for obtaining some of the observations presented here.

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MAGNITUDES OF BRIGHT VARIABLES IN THE DRACO DWARF GALAXY

Magnitudes for several of the brighter variables in the Draco dwarf spheroidal galaxy have been measured on a series of plates (IIa-O or 103a-O + GG385 filter) which are centered on several regions in the vicinity of the galaxy. These magnitudes are listed in Table I in which those plates prefixed with an "A" were taken with the University of Western Ontario 1.2-m telescope and the remaining plates were taken with the 1.5-m telescope of the Observatoire du Mont Megantic of the Université de Montréal. The plates were measured on the UWO iris photometer using a standard sequence given by Stetson (1979). Because the plates cover somewhat different regions all the variables do not appear on some of the plates.

TABLE I

Blue magnitudes of Draco variables

		V36	V134	V141	V157	V194	V203
Period (days)		0.625463	0.592284	0.900868	0.936465	1.59013	----
PLATE	HEL.JD	MAGNITUDES					
A 569	41161.708	---	19.4 :	19.3	19.6 :	---	18.9
A1545	44432.785	19.75	18.8	19.3	19.3	18.75	19.0
A1546	44433.641	20.5 :	19.3	19.3	19.4	18.35	18.8
A1550	44459.628	19.85	19.3	19.05	19.75	18.7	18.85
A1552	44459.835	19.9 :	19.2	19.4	19.5	18.9	18.85
A1553	44460.622	---	18.75	19.2	19.5	18.35	18.9
341	44469.651	19.3	---	19.3	---	---	---
375	44691.703	19.65	19.2	20.2	19.5	18.75	19.25
A1585	44816.783	20.25:	19.15	20.05	19.3	18.2	19.3
A1586	44816.830	19.75:	19.25	---	18.5	18.3	---
460	45082.780	---	19.65	19.95	18.55	18.9	19.4
593	45791.832	20.4	19.65	19.8	19.0	18.55	19.5
594	45792.586	---	18.65	---	18.9	18.4 :	---
595	45792.686	---	18.6	---	18.8	18.15	---
596	45792.773	---	---	---	19.35	18.3 :	---
598	45793.672	---	19.05	---	18.9	18.65	19.5
599	45793.751	19.75	---	19.6	19.0	19.0	19.3
600	45793.840	20.0	18.7	19.1	19.35	19.35	19.5
602	45794.692	---	19.5	19.3	19.2	18.3	19.5
603	45794.803	---	19.55	19.2	19.35	19.35	19.5

Four of the measured stars, variables 134, 141, 157, and 194, have been shown to be anomalous Cepheids while V36 is an RR Lyrae star. Variable 203, although blue in color, was reported by Baade and Swope (1961) to show a slow variation of half a magnitude. The star was not observed to vary on the plates of Zinn and Searle (1976) but our observations confirm the type of variation reported by Baade and Swope.

The periods given in Table I are those which best fit both our data and the data of Baade and Swope as well as the data of Zinn and Searle. The periods are close to those given by Baade and Swope with the exception of V134 for which our data confirm the new period found by Zinn and Searle.

The authors would like to thank Philip Rice for iris measures of some of the plates. A.W. would like to thank the staff of the Observatoire du Mont Megantic for their helpful assistance. We also gratefully acknowledge the financial support of the Natural Sciences and Engineering Research Council of Canada.

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B, V OBSERVATIONS OF RED STARS IN THE NEIGHBOURHOOD OF OPEN CLUSTERS

During 1979-1983 the group of stars of late spectral classes in the neighbourhood of open clusters was observed photoelectrically with the 20-inch reflector of Ural University Observatory. Variability of M4 star signed P by Barkhatova and Vasilevsky (1967) in NGC 6819 (C 1940+4004) was confirmed. The amplitude was found equal to $0^m.32$ for V and $0^m.29$ for B colour. Stars in NGC 129 (C 0027+5957) signed No.2 and No.3 by Hoag et al. (1961) and Arp et al. (1959) and in NGC 1664 (C 0448+4337) No.3 by Hoag et al. (1961) were suspected in B variability. Root mean square errors for a single observation are equal to $\pm 0^m.010$, $\pm 0^m.013$ for V, B colour bands.

Results of observations are given in Tables I - III. First column contains the heliocentric times $JD_{\odot}$ of observations and instrumental differences B and V estimations are in the next columns. The photometric system is close to that of Johnson, Morgan (see Kozhevnikov et al., 1984).

Table I

Photometry of NGC 6819

$JD_{\odot}$ 2444...	ΔV_{P-O}	ΔB_{P-O}	$JD_{\odot}$ 2444...	ΔV_{Q-O}	ΔB_{Q-O}
172.2654	−0.029	0.372	172.2612	0.170	−0.740
.2738	−0.020	0.390	.2891	0.145	−0.741
.2848	−0.029	0.395			
186.1459	−0.008	0.426	186.1409	0.166	−0.803
.1541	0.010	0.424	.1819	0.170	−0.751
.1625	0.011	0.441			
290.4954	−0.004	0.415	290.4904	0.133	−0.687
.5043	0.080	0.414			
.5322	−0.078	0.425			
379.3002	0.096	0.493	379.2967	0.105	−0.771
.3065	0.106	0.575	.3169	0.158	−0.754
.3141	0.080	0.502			
497.2990	0.277	0.660	497.2941	0.182	−0.730
.3073	0.288	0.675	.3115	0.194	−0.739
.3157	0.275	0.676			

$JD_{\odot}$	ΔV_{P-O}	ΔB_{P-O}	$JD_{\odot}$	ΔV_{Q-O}	ΔB_{Q-O}
2444...			2444...		
837.3379	0.088	0.496	837.3343	0.159	−0.760
.3447	0.098	0.478	.3482	0.170	−0.774
838.2498	0.099	0.493	838.2456	0.181	−0.749
.2568	0.100	0.478	.2601	0.190	−0.749
.2636	0.102	0.482			
840.2388	0.085	0.489	840.2353	0.171	−0.749
.2458	0.076	0.465	.2549	0.172	−0.752
.2514	0.074	0.490			
841.2869	0.068	0.453	841.2819	0.172	−0.725
.2945	0.061	0.411	.2980	0.182	−0.743
.3022	0.052	0.432			
842.3715	0.053	0.442	842.3680	0.190	−0.708
.3798	0.025	0.449	.3840	0.192	−0.686
.3875	0.050	0.465			
843.3672	0.074	0.485	843.3512	0.288	−0.600
.3797	0.044	0.476	.3957	0.142	−0.748
.3901	0.047	0.469			
2445...			2445...		
183.3846	0.147	0.580	183.3794	0.187	−0.728
.3959	0.158	0.570	.4118	0.194	−0.709
.4068	0.164	0.573			
208.4123	0.264	0.633	208.4061	0.037	−0.812
.4241	0.124	0.552	.4412	0.090	−0.829
.4355	0.172	0.642			
223.1992	−0.032	0.394	223.1970	0.186	−0.788
.2025	−0.034	0.383	.2080	0.170	−0.775
.2065	−0.037	0.401			

Note.- P is the variable star, O - comparison star, Q - check star, (See Barkhatova and Vasilevsky, 1967)

Table II

Photometry of NGC 129

$JD_{\odot}$	ΔV_{2-5}	ΔB_{2-5}	ΔV_{3-5}	ΔB_{3-5}	ΔV_{7-5}	ΔB_{7-5}
2444...						
172.3238	−0.300	0.625				
.3293			−0.115	0.693		
.3389	−0.298	0.626				
.3431			−0.115	0.702		
186.2163					0.415	−0.058
.2218	−0.261	0.687				
.2259			−0.138	0.628		
.2351	−0.273	0.663				
.2391			−0.133	0.633		
.2483	−0.276	0.664				
.2524			−0.144	0.635		
.2566					0.429	−0.051

Table II (continued)

$JD_{\odot}$	ΔV_{2-5}	ΔB_{2-5}	ΔV_{3-5}	ΔB_{3-5}	ΔV_{7-5}	ΔB_{7-5}
2444...						
263.1269					0.416	−0.083
.1372			−0.152	0.637		
.1518	−0.294	0.714				
.1560			−0.132	0.709		
.1651	−0.301	0.686				
.1692			−0.134	0.675		
.1755					0.405	−0.092
264.1213					0.465	−0.030
.1269	−0.267	0.704				
.1304			−0.124	0.695		
.1379	−0.271	0.680				
.1421			−0.146	0.667		
.1498	−0.283	0.660				
.1532			−0.136	0.659		
.1617	−0.314	0.646				
.1651			−0.155	0.647		
.1685					0.449	−0.020
276.1947					0.438	−0.028
.2017	−0.282	0.645				
.2059			−0.146	0.621		
.2156	−0.303	0.612				
.2196			−0.161	0.588		
.2245					0.384	−0.091
277.1282					0.412	−0.074
.1326	−0.279	0.653				
.1371			−0.124	0.638		
.1458	−0.274	0.674				
.1504			−0.146	0.630		
.1597	−0.280	0.649				
.1639			−0.155	0.605		
.1687					0.403	−0.061
290.2238					0.413	0.015
.2288	−0.284	0.685				
.2335			−0.136	0.645		
.2447	−0.253	0.658				
.2524			−0.122	0.640		
.2620	−0.265	0.645				
.2670			−0.118	0.638		
.2718					0.430	−0.041
497.3669					0.432	−0.044
.3711	−0.284	0.639				
.3745			−0.126	0.641		
.3850	−0.278	0.644				
.3892			−0.144	0.832		
.3981	−0.283	0.637				
.4023			−0.129	0.646		
.4066					0.419	−0.046
678.4114					0.410	−0.038
.4156			−0.142	0.601		
.4191	−0.276	0.612				
.4378			−0.144	0.590		
.4414	−0.286	0.606				
.4497			−0.133	0.586		

Table II (continued)

$JD_{\odot}$	ΔV_{2-5}	ΔB_{2-5}	ΔV_{3-5}	ΔB_{3-5}	ΔV_{7-5}	ΔB_{7-5}
2444...						
678.4539	−0.286	0.592				
.4580					0.413	−0.042
837.3831	−0.291	0.748				
.3864			−0.184	0.589		
.3942	−0.303	0.627				
.3968			−0.187	0.579		
838.3380					0.420	−0.042
.3512	−0.283	0.627				
.3539			−0.161	0.580		
.3601	−0.285	0.652				
.3630			−0.108	0.644		
.3730	−0.335	0.585				
.3733			−0.197	0.544		
.3769					0.606	−0.018
840.3249					0.385	−0.096
.3284	−0.290	0.612				
.3326			−0.175	0.598		
.3387	−0.270	0.687				
.3470			−0.162	0.593		
.3540	−0.259	0.670				
.3561			−0.164	0.599		
.3597					0.445	−0.029
841.3264					0.402	−0.057
.3306	−0.282	0.620				
.3339			−0.148	0.598		
.3430	−0.286	0.625				
.3464			−0.155	0.595		
.3548	−0.292	0.630				
.3577			−0.148	0.601		
.3618					0.425	−0.050
2445...						
318.1791					0.444	−0.020
.1875	−0.284	0.645				
.2074	−0.280	0.662				
.2147			−0.138	0.642		
.2269	−0.273	0.666				
.2321			−0.132	0.658		
.2378					0.421	−0.049

Note.- Variable stars are No.2, No.3, the comparison star is No.5, check star is No.7. (See Hoag et al. 1961)

Table III

Photometry of NGC 1664

$JD_{\odot}$	ΔV_{3-4}	ΔB_{3-4}	$JD_{\odot}$	ΔV_{1-4}	ΔB_{1-4}
2444...			2444...		
276.2603	-0.004	1.557	276.2493	-1.314	-1.446
.2930	-0.000	1.562	.3118	-1.345	-1.484
.3076	-0.008	1.546			
277.2119	0.008	1.562	277.1987	-1.346	-1.508
.2271	0.001	1.536	.2522	-1.387	-1.559
.2452	-0.022	1.511			
290.3580	-0.020	1.502	290.3489	-1.372	-1.532
.3760	0.000	1.508	.3940	-1.355	-1.518
.3900	-0.000	1.510			
304.2215	0.005	1.533	304.2133	-1.347	-1.544
.2333	0.009	1.563			
.2452	0.035	1.528			
313.2894	-0.050	1.456	313.2823	-1.364	-1.518
.2997	-0.058	1.451	.3130	-1.379	-1.546
.3088	-0.035	1.439			
678.3421	-0.001	1.495	678.3331	-1.359	-1.514
.3609	0.024	1.499	.3775	-1.358	-1.516
.3741	-0.003	1.457			
841.3943	-0.053	1.411	841.3867	-1.363	-1.520
.4083	-0.069	1.407	.4248	-1.365	-1.507
.4201	-0.062	1.422			
2445...			2445...		
403.3630	0.018	1.410	403.3500	-1.341	-1.513
.3825	0.006	1.491	.3879	-1.363	-1.535
426.2809	-0.024	1.433	426.2776	-1.332	-1.510
.2853	0.012	1.474	.2910	-1.316	-1.606
.2898	-0.045	1.428			

Note.- Star No.3 is the variable star, No.4 - comparison star, No.1 - check star (See Hoag et al., 1961).

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PHOTOELECTRIC MINIMA TIMES OF HD 197433 (VW CEPHEI)

The short period eclipsing binary HD 197433 (BD +75° 752, VW Cephei) is always in our observational programme because of its peculiarities. Here, we are reporting the new minima times coming out from our photoelectric observations of VW Cep during 1984 and 1985.

The observations were carried out with a two-beam, multi-mode, nebular-stellar photometer attached to the 48-inch Cassegrain reflector at the Kryonerion Astronomical Station of the National Observatory of Athens. The stars HD 192889 and HD 192635 were used for comparison and checking, respectively. The two indermediate pass bands of the filters used, B and V, are in close accordance to the international system. Our results are presented in the following Table the successive columns of which give : the Hel. JD, the residuals $(O-C)_I$ and $(O-C)_{II}$ and the type of minimum.

Table

Hel. JD 2440000.+	$(O-C)_I$ days	$(O-C)_{II}$ days	Min Type
5946.3996	-0.1463	+0.0412	I
5948.3428	-0.1508	+0.0361	I
5948.4762	-0.1307	+0.0304	II
6257.4104	-0.1558	+0.0294	II
6333.4046	-0.1423	+0.0423	II
6333.5527	-0.1334	+0.0513	I
6334.3658	-0.1556	+0.0194	I
6334.5027	-0.1578	+0.0271	II

The minima times were calculated using Kwee and Van Woerden's method (1956) and are the mean values of B and V observations; while the differences $(O-C)_I$ and $(O-C)_{II}$ were found using Kwee's (1966) and Kukarkin's et al. (1976) ephemeris formulae respectively.

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INFRARED PHOTOMETRY OF THE DWARF NOVA AH Her

The variability of the dwarf nova AH Her (type Z Cam) was first reported by Jacchia (1941). Its magnitude shows a range of variation between 10.2 and 14.7 in visible (Kukarkin 1969), and a mean outburst period of 19.6 day (Beyer 1967).

We present infrared measurements during the rise to the outburst that took place in the third week of April 1986.

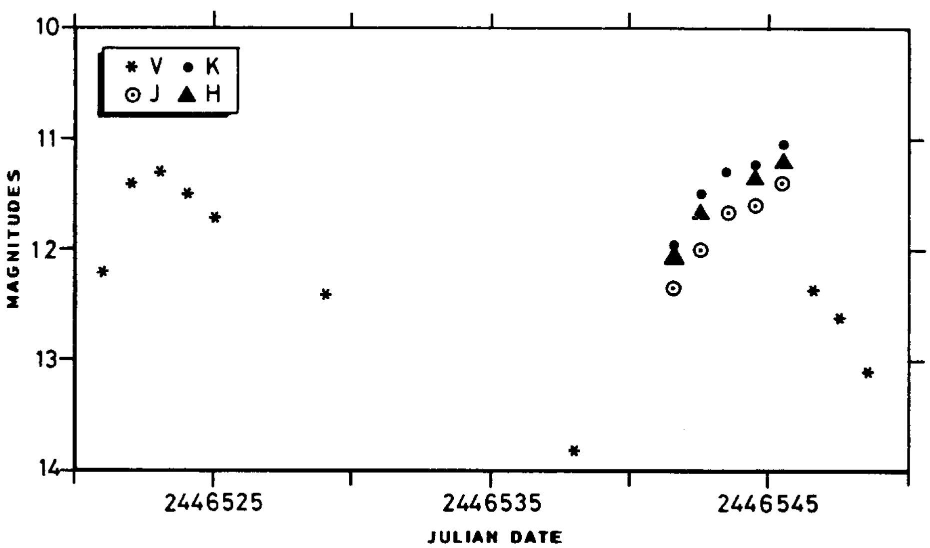
The observations were made with the 1.5 m Infrared Flux Collector at the Observatorio de Izaña (Tenerife) during a period of 5 nights from 20 to 25 April 1986, using the infrared single-channel photometer with an InSb detector cooled with liquid-Nitrogen and the broad-band filters J,H,K.

This photometer has a double beam, chopped at 10 Hz to monitor the sky. The star was exposed for 10 sec. in alternate beams until a good signal/noise was achieved. The uncertainty in each infrared measurement is about 0.07 magnitudes. The observed magnitudes were corrected for extinction by observation of standard stars and placed on Johnson's system.

Table I shows the initial and final Julian Date for each night of observation, the magnitud J, and the J-H, J-K colours.

Table I

JD_{init} 2446000+	JD_{fin}	J	J-H	J-K
541.639	541.683	12.39	0.33	0.49
542.660	542.718	12.02	0.34	0.50
543.726	543.741	11.64	-	0.28
544.716	544.743	11.61	0.29	0.34
545.630	545.666	11.49	0.24	0.34



In the figure the values of J, H, K magnitudes are plotted vs. the Julian Date along with the V magnitudes for the whole April given by 'The Astronomer' magazine.

It is important to point out that there are significant changes of colour during the rise to maximum and it is noted that the maximum in the IR could be delayed compared to the visible.

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BEHAVIOUR OF AT CANCRI IN THE SEASON 1985/86

The cataclysmic star AT Cancri was measured on 46 blue-sensitive plates (ORWO-ZU21-GG13+BG12) from 12 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 17 November 1985 and 12 April 1986, using the sequence of comparison stars given in the IBVS No. 2363. The observations are listed in Table I.

Table I

J.D.hel 244....	m_B	J.D.hel 244....	m_B	J.D.hel 244....	m_B
6387.596	$12^m.37$	6469.480	$15^m.52$	6476.449	$12^m.35$
6387.616	12.32	6469.499	15.98	6476.472	13.22
6387.635	12.34	6469.518	15.34	6476.495	12.81
6387.654	12.42	6469.537	15.84:	6476.523	12.92
6387.673	12.35	6469.556	15.49	6489.361	15.58
6440.488	15.79	6473.542	16.36:	6491.368	12.49
6440.507	15.67	6473.563	16.38:	6491.388	12.44
6440.526	14.95	6474.358	15.98	6491.407	12.57
6463.381	12.29	6474.378	15.87	6491.426	12.46
6466.401	12.78	6474.399	15.69	6491.445	12.54
6469.356	15.67	6474.419	15.10	6506.518	13.02
6469.377	15.57	6474.438	15.83	6533.364	14.74
6469.397	15.13	6474.463	16.38	6533.384	14.61
6469.419	15.03	6474.483	16.25	6533.404	14.73
6469.440	15.51	6476.429	12.89	6533.423	15.02
6469.460	15.48				

The long-term light curve of AT Cnc, which is given in Figure 1, shows variations between $m_B = 16^m.38$ and $m_B = 12^m.29$. Some remarkable changes in brightness were observed with $\Delta m_B = +2^m.89$ within 2.955 between 4 February and 7 February and $\Delta m_B = -3^m.09$ within 2.071 and 2.007 respectively between 12 February and 14 February and between 27 February and 1 March 1986.

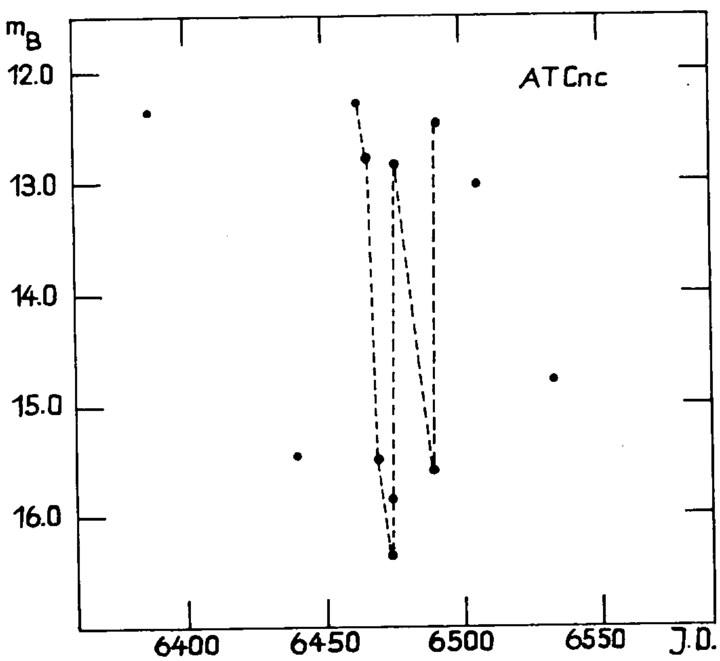

Figure 1

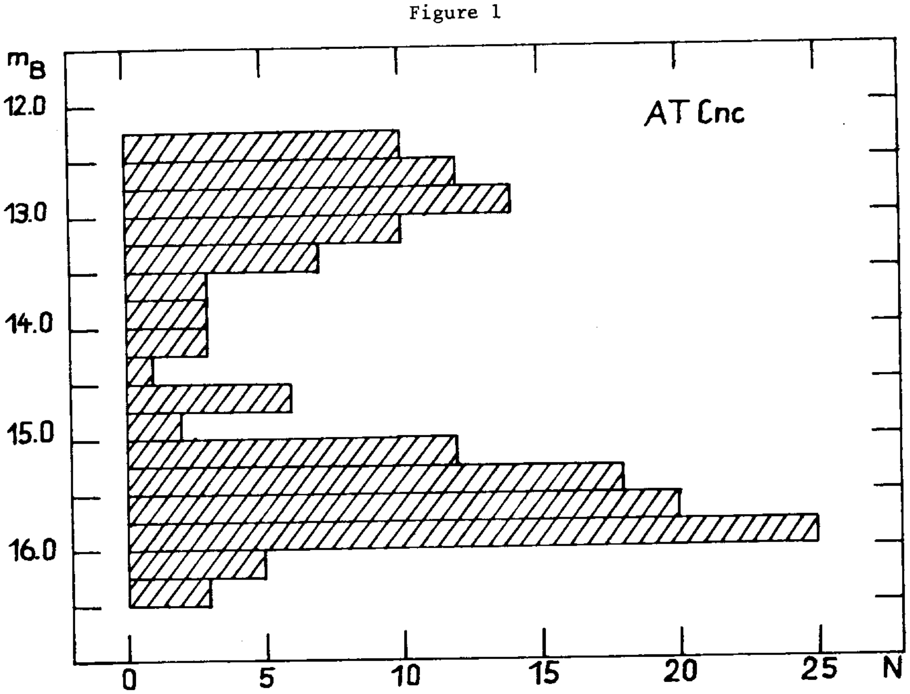

Figure 2

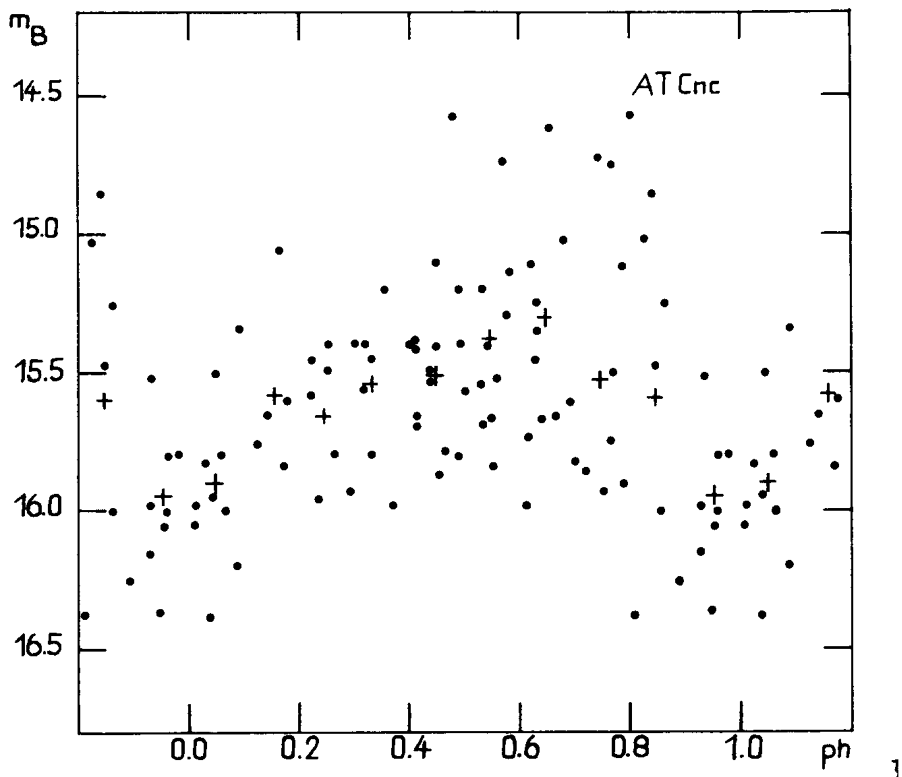

Figure 3

The brightness distribution of the star from all series of observation given in the IBVS No. 2363, No. 2526, No. 2734 and in Table I is shown in Figure 2. It can be seen there that AT Cnc prefers two states of brightness, the high ($m_B \approx 12^m.75$) and the low ($m_B \approx 15^m.75$) one.

Small short time-scale variations of the star can be observed in all series. They are regular and refer to orbital light changes. The observations from the season 1985/86 confirm this statement which was first announced in the IBVS No. 2734. Reducing all observations from all series to one common epoch the preliminary orbital elements given there could be improved to

$$\mathrm{Min.}_{\mathrm{hel.}} = 244\ 6110.504 + 0^d.2386913 \cdot E \ .$$

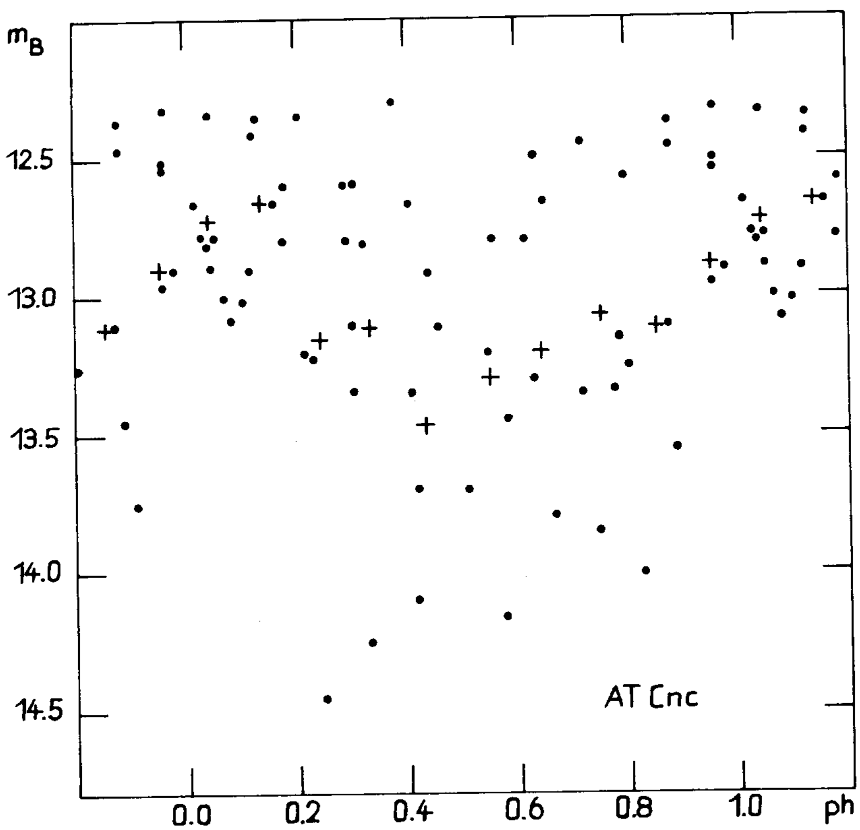

Figure 4

The results are given in Figures 3 and 4 where the magnitudes m_B from observations of the low ($14^m.5 < m_B < 16^m.4$) and the high ($12^m.3 < m_B < 14^m.5$) state of brightness obtained between the years 1982 and 1986 are plotted against the phases. The mean values are marked by crosses there. Comparing Figures 3 and 4 it can be seen that in the high state the minimum phase is displaced to phase ≈ 0.5 rather than phase 0.75 as was provisionally stated in the IBVS No. 2734.

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SOME NEW POSSIBLE VARIABLE STARS

The Corralitos Observatory is at present involved in the photometric monitoring in BV colors of some 253 Be stars. In the course of the first year of this campaign it has been found that some of the comparison stars chosen for differential photometry of the Be stars may be variable in themselves. Normally two comparison stars are utilized for each potentially variable Be star in the event that one might prove to be inconstant in magnitude.Twenty-nine of these stars can no longer be used since they show deviations from mean magnitudes which suggest variability.

The criterion for variability in a comparison star was decided upon in the following way. Mean differences in V magnitude were found for (Comparison 1 - Comparison 2) and for each comparison star separately with the program Be star. Since 70% of the Be program stars appear to be nonvariable, it was usually easy to determine which of the comparison stars might be variable when the residuals from the means of all these differences were calculated. For the comparison stars whose magnitudes were considered to be constant, the average residual from the mean was found to be 0.008 magnitudes in V. For the purposes of this communication a comparison star was considered to be unusable for that purpose (and hence potentially variable in its own right) if the average residual from the mean was 0.020 magnitudes or greater. In those instances where the average residuals from the mean for both the comparison stars from each other and also from the program Be star were unacceptably great, it was indeterminable which comparison is potentially variable since the Be star may also be variable. Therefore, these stars are denoted with an asterisk in the table following.

The paucity of data and the non-uniform time intervals between observations prevent any statement on periodicity or total magnitude range from being made. The stars considered as possible variables and their spectral types follow. Spectral types are from the SAO CATALOG unless otherwise noted.

Table I

STAR	SP. TYPE	STAR	SP. TYPE
HD 27749	Alm, Fl IIImVs (1)	HD 166053	B9p Si (3)
31342	A0	172948	A2
32318	A2	177559	B6 Vn (2)
32640	A2	181414	A2
34986	B8	192538*	A0 III (1)
34974*	A0	192605*	B9 V (1)
34986*	B8	198959*	G0
37200	A3	203169	A2
40254*	B8	204008	A2
40366*	A3	BD+60 2231	G5 V (4)
50325	A2	+54 2431*	G5
50772*	A0 V (2)	+26 809	A2
51331*	B8	+26 987	A0
57297	A	+24 934	A2
158440	B8		

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AUTUMN 1981 PHOTOELECTRIC OBSERVATIONS OF THE STARSPOT ACTIVITY ON UX ARIETIS

UX Arietis (BD +28° 0532, HD 21242; <V> = +6.50 mag) is an active, non-eclipsing RS CVn-type binary which, along with V711 Tauri (HR 1099), II Pegasi, and DM Ursae Majoris, always exhibits Hα in emission. This double-line spectroscopic binary (K0 IV + G5 V) was observed photoelectrically on 13 nights from October 10 UT through December 01 UT 1981 at Villanova University Observatory using the 38 cm Cassegrain telescope. A photoelectric photometer equipped with a refrigerated RCA C31034A gallium-arsenide photocell was used and the data were recorded on a microprocessor controlled digital integrating system. The characteristics of the intermediate band blue (λ4530), red (λ6585), far red (λ7790), and narrow band red (λ6568) filters, as well as a description of the observing procedure, data reduction method, and explanation of the differential color and Hα indices, is given elsewhere (Dorren, Guinan, and McCook 1984). The comparison star was 62 Ari (BD +27° 500, HR 1012; G5 III, V = +5.52 mag), which previous photometric studies have demonstrated is constant in light. Nightly mean differential magnitudes were computed, in the sense variable minus comparison, for the observations in each of the four filters, from which nightly mean differential color and Hα indices were determined. The average seasonal errors for the nightly λλ4530, 6585, 6568, 7790, Δ(b-r)', and Δα(V-C) data sets are, respectively: 0.010, 0.005, 0.007, 0.006, 0.012, and 0.009 mag.

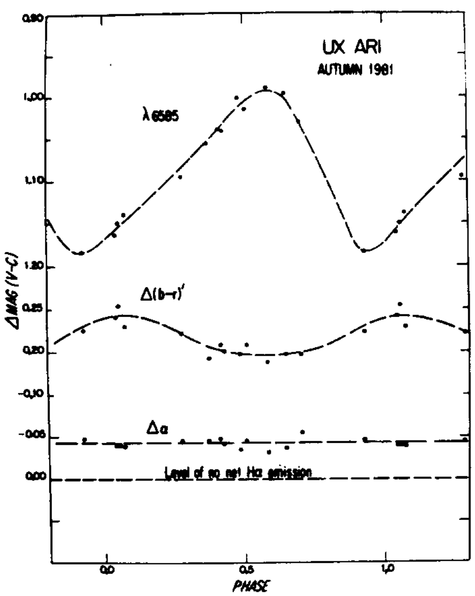

Figure 1

Figure 1 : The autumn 1981 photoelectric observations of UX Ari, made with respect to the comparison star 62 Ari, are presented. The upper panel is a plot of the nightly mean differential red magnitudes. The middle panel is a plot of the differential color index formed from the blue and red observations. The lower panel is a plot of the differential H-alpha index, where more negative values indicate greater net H-alpha emission.

The top panel of Figure 1 presents the autumn 1981 light curve of UX Ari formed by the intermediate band red observations. The orbital phases were computed according to the ephemeris quoted by Hall, Montle, and Atkins (1975):

$$HJD = 2440133.76 + 6\overset{d}{.}43791E$$

which is taken from the spectroscopic study of Carlos and Popper (1971), where zero phase coincides with the more active (K0 IV) component nearest to the earth. The amplitude of the red light curve is about 0.20 mag, with maximum light occurring around 0.61P and minimum light occurring in the vicinity of 0.94P.

Maximum, mean, and minimum light have, respectively, the following approximate values (measured differentially relative to 62 Ari): +0.99, 1.09, and 1.19 mag. The shapes of the $\lambda\lambda$4530 and 7790 light curves (not shown) are similar to the red light curve. The light variation is wavelength dependent, with the blue light amplitude ≈ 0.15 mag (the λ7790 light amplitude is essentially the same as for the λ6585 curve).

The middle panel of Figure 1 displays the differential color index, $\Delta(b-r)'$, computed from the intermediate band blue (λ4530) and red (λ6585) differential magnitudes. Inspection of the color curve shows a definite phase dependency, with the index being reddest when the light curve is brightest. The same correlation exists for the color index formed from the $\lambda\lambda$4530 and 7790 observations. The mean value of the $\Delta(b-r)'$ data set = −0.215 mag.

The bottom panel of Figure 1 displays the differential Hα index, $\Delta\alpha(V-C)$. No apparent phase correlation exists, and the Hα emission is present at all orbital phases. Based upon the spectral types of the variable and comparison stars, $\Delta\alpha(V-C) = 0.00 \pm 0.01$ mag corresponds to the level of zero net Hα emission. The mean value for the $\Delta\alpha(V-C)$ data set = −0.044 mag which indicates the presence of weak to moderate Hα emission during the observing interval.

Two photometric studies of UX Ari were undertaken contemporaneously with our observations by independent investigating teams (Zeilik et al. 1982, Sarma and Prakasa Rao 1984). The shape of the light curves, in particular the phase of minimum light, determined by Zeilik et al., Sarma and Prakasa Rao, and this study, are all in accord. Furthermore, the UBVR light curves of Zeilik, et al. confirm the phase dependency of the color curve and the wavelength dependency of the light amplitudes of our observations. This wavelength dependence is unusual since most RS CVn-type stars show the opposite behavior in which they are typically reddest when they are faintest, and vice versa. In the case of UX Ari, the observed decrease in light amplitude with decreasing wavelength is explicable from the increased contribution to the total systemic light at short wavelengths from the hotter (G5 V) component.

Unfortunately, at the present time the fractional contribution of the light of the hotter component to the total light of the binary is not well known. Until this is better determined, the light curves cannot be satisfactorily modeled to determine the properties of the starspots most likely present on the surface of the active, cooler component.

We would like to thank Michael Davis and Craig Harris for contributing to these observations while undergraduate astronomy students at Villanova University.

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CH Cyg - STILL IN ACTIVITY

The last active phase of CH Cyg has continued for nine years yet. One of the most interesting periods began in July/August, 1984 when the decrease in brightness (Panov et al. 1985) was accompanied by significant variations in the ultraviolet spectrum (Selvelli and Hack 1985), optical spectrum (Tomov 1984, Mikolajewski and Biernikowicz 1986) and radio outburst with expanding radio jets (Taylor et al. 1986). The changes in the brightness and spectrum of CH Cyg from mid 1984 to September 1985 are described by Mikolajewski and Tomov (1986).

A new increase in the star's activity has started since 1985 (Fernie 1985). This paper is a follow-up of the work of Mikolajewski and Tomov (1986), giving some photometric and spectral observations of CH Cyg from November till end of April, 1986.

The observations were carried out at the Observatory of the Nicolaus Copernicus University in Torun, Poland and at the Rozhen National Astronomical Observatory of the Bulgarian Academy of Sciences. The spectra in the blue and red region were of dispersion 18 Å/mm.

In the beginning of the new increase in activity in November/December, 1985 the magnitude of CH Cyg in the V-filter was about $7^m.5-7^m.6$. More significant were the changes in the colour indices. On November 6 and December 8 and 27 the B-V were respectively $+1^m.18$, $+1^m.00$ an $+0^m.82$, while the U-B were $+0^m.35$, $+0^m.20$ and $-0^m.21$ (Mikolajewski and Mikolajewska 1985, Mikolajewski and Wikierski 1986). On April 23 and 24, 1986 the V-magnitude was about $7^m.8-7^m.9$, while the B-V were $+0^m.78$ and $+0^m.79$, and the U-B were $+0^m.05$ and $-0^m.01$.

The observations carried out from the beginning of November, 1985 till end of April, 1986 have shown significant variations in the absorption and emission spectrum of the star. The [FeII] emissions were still the most numerous and bright lines in the spectrum. In April their intensity increased by three times as compared to November. The FeII emission lines which were much more weaker than the [FeII] lines also increased in intensity by about four times. Their profiles were not any longer so narrow and sharp as during the period from May to September, 1985. On the spectra obtained in the end of April some of the strongest FeII lines, for example 4233Å, showed an absorption component in the red emission wing.

The nebular lines [NeIII] 3868Å, [OIII] 4959 and 5007 Å, and [SII] 4068Å were strong and probably due to the blending of two or three components and emission wings of about 500-600 km/s. Although weaker, the line [OIII] 4363Å was also visible.

The emission lines of HeI 4026Å, 4471Å and 4713Å had gradually increased their intensity and also showed emission wings of about 600 km/s in width.

The presence of veiling blue continuum (Tomov 1986) is the reason for the drop in intensity of the TiO absorption bands and yet, they could be well observed in the CH Cyg spectrum.

The absorption lines of FeI, TiI, VI, CrI and MnI were much weaker than the time-interval when the absorption spectrum of M6III was dominating.

The absorption line CaI 4227Å was weaker in November than in the summer of 1985, showing merely a wide profile typical of M stars. From December till April its intensity did not change much. Its central depth throughout the period was approximately 0.4-0.5. A shell-component appeared which was particularly strong and sharp in April.

The H and K lines of CaII showed once again 3-4 absorption components of varying intensity.

From the absorption lines of ionized metals there were lines of TiII and ScII with $\lambda<3640$Å, while after $\lambda<3640$Å, only the strongest absorptions of SrII and ScII could be definitely identified.

We should like to discuss in more details the variations in the Balmer lines of HI. Their intensity strongly increased. Two-component emissions and wide emission wings were again observable. Particularly interesting were the intensity variations of the violet (V) and red (R) emission components. In the beginning of November the relation of the intensities of these components was V>R for H_β, while for H_γ it was $V \lesssim R$. The violet components of H_β and H_γ remained more intensive towards the end of February, 1986. Between February 22 and 26 the intensity relation had changed (R>V) and the red component was more intensive than the violet one for a period of about one month. The V>R relation was again restored between March 18 and 24.

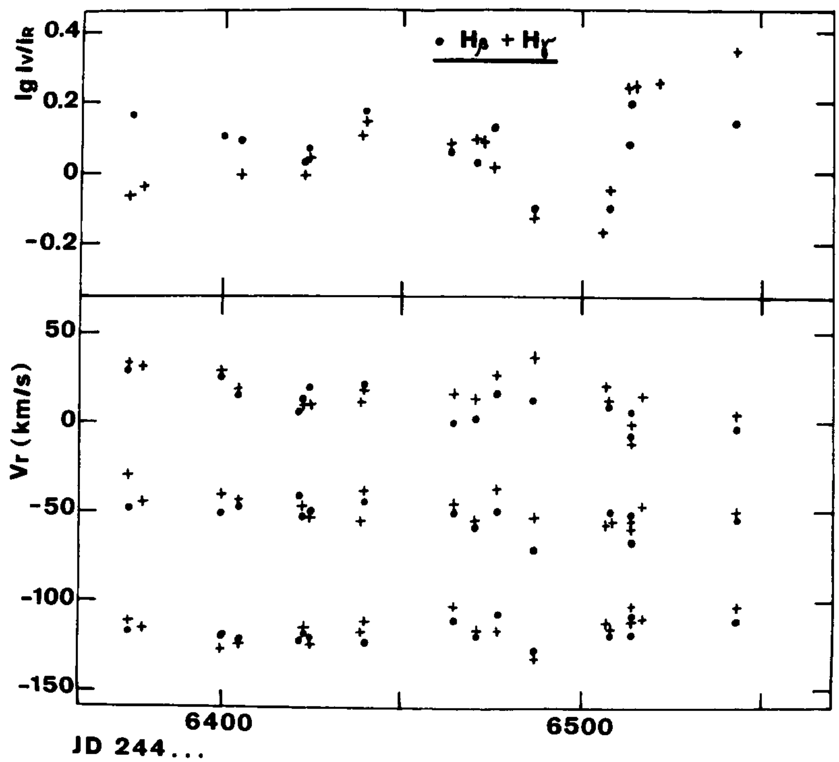

Figure 1

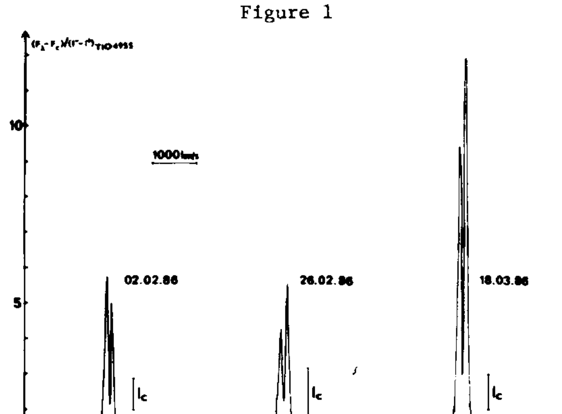

Figure 2

Figure 1 shows the variations of the intensity relation of the violet and red H_β and H_γ emission components and the radial velocities of the two emission peaks and absorption component of the same lines within the period from November, 1985 to April, 1986. It is obvious that the intensities of the emission components are not accompanied by great variations of the radial velocities.

The absolute intensity of the Balmer emission lines had significantly increased during the period when the red component was more intensive. At the same time, an increase of the intensity of the continuum by about 1.5 times was observed. This is shown in Fig. 2 where the H_β profiles on the different dates are reduced to the intensity of the TiO bands by the methods of Mikolajewski and Biernikowicz (1986). The intensity of the continuum in the same scale is also indicated for each profile.

The spectra obtained in the red region after November, 1985 are only three. We are not able to follow in detail the changes in the H_α profile, but it is worth noting that in the end of December the violet component was more intensive than the red one, while in the end of March and April it was the opposite (R>V).

The wide emission wings had also changed. Their width in November/December was about 2400 km/s, while in March it was more than 3000 km/s. Besides, the careful comparison of the H_β profiles obtained at different times suggests that the hydrogen lines are composed of a very wide and not particularly intensive emission and a superimposed two-component emission line of a considerably smaller width. The asymmetry of the profiles also shows that this wide emission has sometimes a violet shift and sometimes a red shift. Very significant is the asymmetry of the H_β profile of April 22. It can be judged by the profile that the shift of the wide emission to the violet was about 800-900 km/s.

Another important event during the period under consideration is the reappearance of rapid flickering in the brightness of CH Cyg. The observations carried out at the Asiago Observatory by one of us (J.M.) with the 122 cm telescope and the two-channel photometer for a period of 68 min. did not show fast changes of the amplitude greater than $0^m.01$ in the U-filter. This was also proved by the observations in September carried out by Luud et al.(1986). On April 23 and 24, 1986 monitoring observations in the U-filter were carried out at the National Astronomical Observatory. For a comparison star the HD 182691 was used and for a check star the SAO 031628 was used. During the two nights fast light variations of CH Cyg were observed.

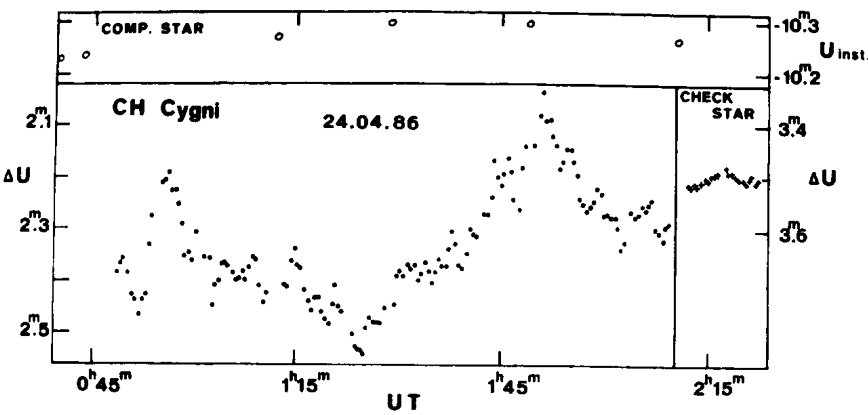

Figure 3

Figure 3 shows the results of the observations during the second night. It is obvious that there is flickering of an amplitude of $0^{m}.05$-$0^{m}.1$ and characteristic durations of the order of 0.5 to 2 min., as well as changes in the amlitude of about $0^{m}.2$-$0^{m}.4$ and characteristic durations of approximately 10 to 30 min.

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1986 J,K LIGHT CURVES OF II Peg

II Peg (HD 224085, SAO 091578) was observed during 6 nights from 19 to 26 June 1986, with the 1.5m. Infrared Flux Collector at the Observatorio de Izaña (Tenerife), using the IR single-channel photometer with an InSb detector cooled with liquid-nitrogen and the broad band filters J and K.

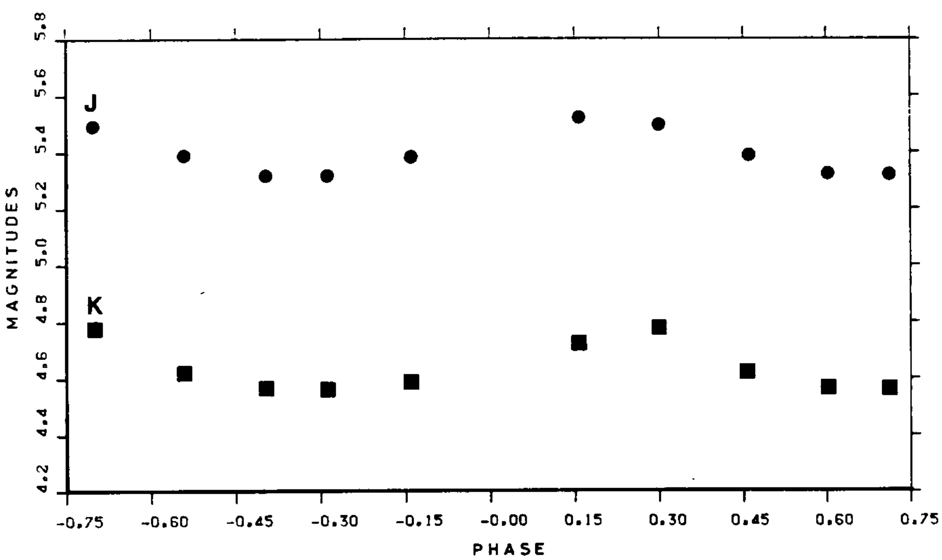
In order to check errors in the photometry we observed also the closest comparison star (SAO 091577).

The observed magnitudes were corrected for extinction by observation of standard stars (Koorneeff 1983) and reduced to Johnson's system. The dispersion in the comparison star was 0.01 magnitudes.

Table I gives the Julian heliocentric date, the J magnitude and the J-K colour, for each observation.

Table I

JHD 2446000+	J	J-K
601.707	5.32	0.76
602.707	5.39	0.80
604.708	5.52	0.79
605.662	5.49	0.71
606.728	5.39	0.77
607.703	5.32	0.75



In the Figure we have plotted J and K magnitudes against phase calculated using the ephemerides of Rucinsky (1977):

$$JD = 2443033.10 + 6.724183E$$

It is interesting to note the clear delay between the minima in both filters. The minimum in J occurred near phase 0.15 while it was at about 0.30 in K.

A more detailed study of these light curves complemented by data in other filters is in preparation.

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PHOTOGRAPHIC OBSERVATIONS OF V651 Mon

The central star of NGC 2346 was observed from October, 1982 until the end of last observing season, 1986, during which 270 photographs were taken with 25cm camera of 120cm focal length and Tri-X emulsion. A yellow-green filter was used to get the brightness very close to visual magnitude.

All the measurements are shown in Figure 1 in smaller scale, and the drastic change of the star in four observational periods is shown in Figure 2, obtaining mean light curves in appropriate periods, usually one or two months. In Figure 2, the first light curve by L. Kohoutek (1982) is shown as curve 1. The others are all from the results of the writer. The values fainter than about $14^{m}.5$ are not reliable because of interference by the faint nebulosity. There would be much possibility that the real brightness is more or less below $15^{m}.0$, as was pointed out by Kohoutek (1983).

Since February, 1986, the brightness variation seems to be ceased and stays at maximum brightness having not more that $0^{m}.1$ amplitude. This suggests the end of the drastic change in last five years.

I determined the time of some maxima which had enough observations around them. The observations by L. Kohoutek, (1982, 1983) R.H. Mendes et al. (1985), B.F. Marino and H.O. Williams, (1983, 1984) were also used. The mean period in these years is obtained as follows.

$$\text{Max.} = \text{J.D. } 2445001 + 16^{d}.089E$$

The O-C values are shown in Figure 3. It seems to have cyclic change of roughly four year period. However, this would not be regarded as the O-C changes in normal eclipsing binaries, considering the nature of the obscuring cloud of this system. This change might have caused by irregular movement of dark cloud, or by uneven distribution of the cloud surrounding the system.

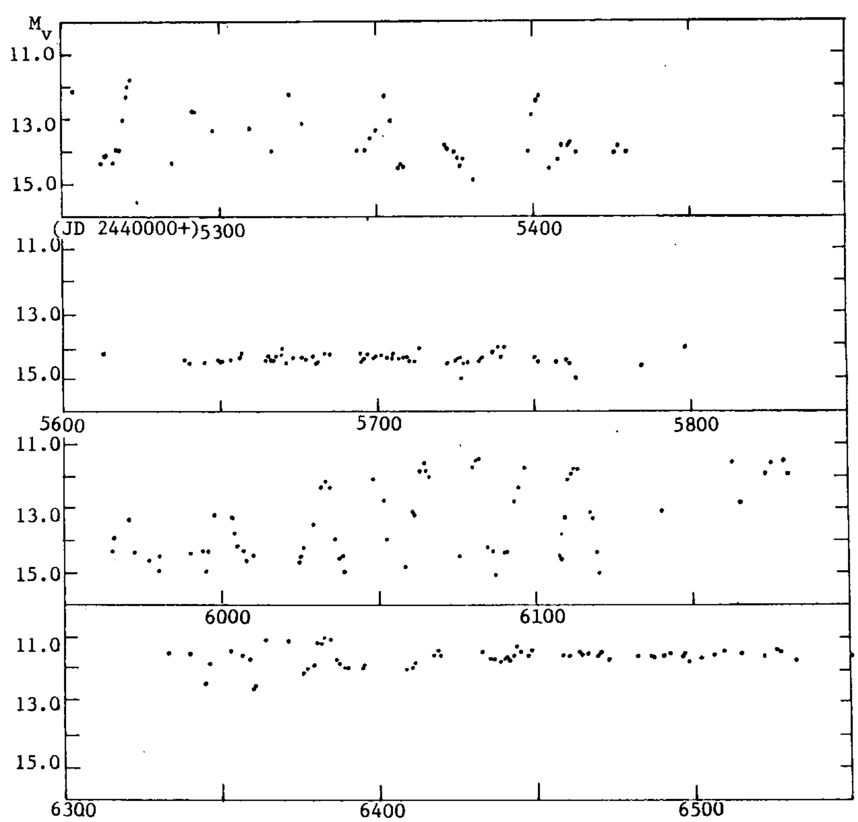

Figure 1

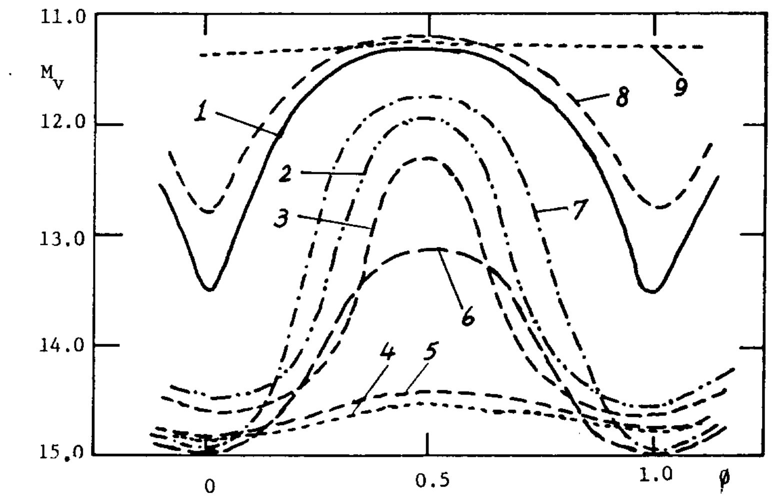

Figure 2. Mean light curves in appropriate periods

Curve No.	Period	Curve No.	Period
1(kohoutek)	1982 Feb	6	1984 Oct
2	82 Oct-Nov	7	85 Jan-Feb
3	83 Jan-Feb	8	85 Oct-Nov
4	83 Nov-Dec	9	86 Feb-Mar
5	84 Jan-Feb		

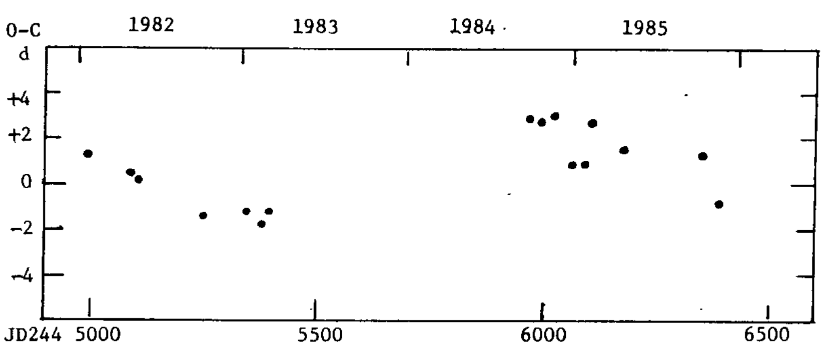

Figure 3. O-C values

The detailed report will be published elsewhere.

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UBV PHOTOMETRY OF YZ Cas

The bright ($V_{max}=5^{m}.66$), northern hemisphere eclipsing binary YZ Cas (HD 4161, V0042+746 (1950.0), BS 192, BD+74°27, 21 Cas, ADS 624A) lends itself favourably to differential photometry with small telescopes. When we started our joint observing program in 1983, only one published set of photoelectric measurements was known to us, namely the data of Kron (1939, 1942). Since Kron's observations, depicted in Figure 1 of Lacy (1981), were marred by night-to-night variations in the observational set-up (see Lacy, 1981), we decided to secure a new set of two-colour BV photometry (Johnson system), in order to facilitate the determination of the photometric elements of this eclipsing binary. All determinations of these elements up to that point by various authors (Kron, 1942; Kitamura, 1965; Cherepashchuk et al., 1968; Budding, 1973; Shulberg and Murnikova, 1974; Demircan, 1978; Kurutac, 1978; Mezzetti et al., 1980) have rested on Kron's data.

In the meantime, an extensive set of observations in the four colours of the Utrecht photometric system has been published by de Landtsheer (1983) together with a thorough discussion of the physical properties of YZ Cas.

We obtained 305 differential measurements in B and V as well as 135 differential observations in U, B and V (Johnson system) with two small telescopes. RL used an uncooled 1P21 photomultiplier tube along with a standard UBV filter set on his 52 cm Cassegrain reflector, while RD employed a commercial Starlight-1 photometer (EMI 9924A tube) with appropriate BV filters on a 35 cm Schmidt-Cassegrain type reflector. Each observation consists of at least three deflections in each colour and is corrected for differential extinction and transformed to the standard Johnson UBV system by the usual reduction procedures. Our data has been deposited in the I.A.U. archives of unpublished observations as file no. 194 (Breger, 1985).

The primary comparison star used by both observers was HD 4382 (23 Cas: $V=5^{m}.42$, $B-V=0^{m}.01$ (97 obs.)) situated very close to the variable and of similar spectral type. HD 6163 served as check star, RL determined the brightness of the comparison and check star given in Table I from numerous differential observations with HD 3366.

From our data, the time of minimum light of two primary and one secondary eclipse was determined employing the method of Kwee and van Woerden (1956). Table II contains the information on these minima, where the $0-C_1$ values refer to the elements

$$JD_{hel} = 2445561.4545 + 4\overset{d}{.}467224 * E \qquad (1)$$

while the $0-C_2$ values are calculated from the elements of de Landtsheer (1983):

$$JD_{hel} = 2444632.2685 + 4\overset{d}{.}4672234 * E \qquad (2).$$

No appreciable change of the period over the last 50 years is apparent.

In Figure 1, we have plotted our V and B-V measurements according to the elements (1). The agreement of this light curve with the ones given by Kron (1939, Figure 1 of Lacy, 1981) and de Landtsheer (1983) is very good, as expected for this well detached binary system (see Figure 4 of Lacy, 1981). Nevertheless, the out-of-eclipse light curve shows more scatter than expected from the observational statistics of this bright star. A similar behaviour was noted by Kron (1939) and interpreted as nightly variation in the optical path. De Landtsheer (1983) also found larger scatter than expected ($\pm 0\overset{m}{.}025$) in his data, and this fact was assigned to the atmospheric conditions at the observing site. We believe, that both these arguments are not sufficient to account for the scatter in our data, especially not for the observations of RL, which comprises the bulk of the current material, and a secondary source of variability remains as possible alternative. Either the comparison star (HD 4382=23 Cas) or one of the components of the binary system might show slight variability at the $0\overset{m}{.}03$ level.

In order to check these possibilities, RL observed the primary comparison star frequently against the check star HD 6163, finding no variation exceeding the observational scatter.

This leaves a slight variability of one of the binaries components as most probable source of the excessive scatter, and the metallic line characteristics of the primary (B9.5 IVm, de Landtsheer, 1983) might point to this source. Unfortunately, the accuracy of our data does not lead to a positive result. More observations with a simultaneous two-channel photometer might clarify the question.

An analysis of our data was not attempted, as the currently available photometric elements (Lacy, 1981; de Landtsheer, 1983) show excellent agreement

Table I: BV data for the comparison and the check star

Star	V [mag]	B-V [mag]	n
HD 4382	5.42	+0.01	97
HD 6163	6.82	+0.11	9

Table II: Times of minimum light of YZ Cas

JD_{hel} [d]		n	Col	Type	$O-C_1$ [d]	$O-C_2$ [d]	Obs
2445583.7863	± 0.0009	12	V	p	-.0043	+.0092	RL
.7867	0.0004	12	B	p	-.0039	+.0096	
2445621.748	0.005	26	V	s	-.014	-.010	RL
.756	0.004	26	B	s	-.006	-.002	
2445990.297	0.004	7	V	p	-.011	-.007	RD
.305	0.006	7	B	p	-.003	+.001	

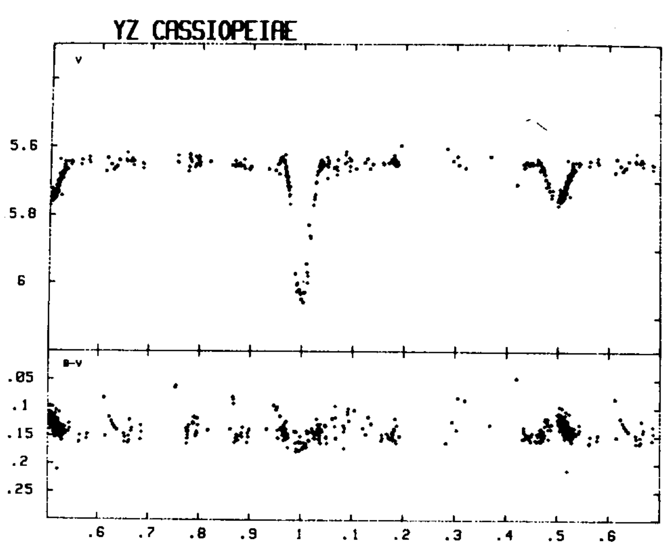

Figure 1

and could hardly be enhanced with our data.

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PHOTOMETRY OF THE VV CEPHEI-TYPE STAR V641 Cas (=BD+63°0003)

During a photometric study of the peculiar O8fe star HD108, the nearby red star BD+63°0003 was discovered to be variable in brightness by Guinan, McCook and Weisenberger (1982). Subsequently, its light variability has been independently verified by Berthold (1983) from sky-patrol photographic plates taken during 1959-1982. Recently BD+63°0003 appears in The 67th Name-List of Variable Stars as V641 Cas (Kholopov, et al. 1985). Shortly after the publication of our photometry, Dr. William Beidelman of Warner and Swasey Observatory pointed out that V641 Cas previously had been identified spectroscopically by Barbier (1971, 1975) as a VV Cephei-type star. As shown by Barbier, the optical spectrum of the star shows emission lines chiefly of [Fe II] and hydrogen superimposed on the absorption spectrum of a M3 Iab star. As discussed by Cowley (1969), VV Cephei-type stars are long period interacting binary systems consisting typically of a M supergiant and an O- or early B-type companion. Although the orbital period of V641 Cas is still unknown, the presence of the hot component of the system has been ascertained from ultraviolet observations made with the International Ultraviolet Explorer satellite by Shaw and Guinan (1985, 1986).

Photoelectric photometry of V641 Cas has been carried out at Villanova University Observatory on 67 nights from late 1979 until early 1986. A description of the instrumentation has been given elsewhere (e.g. Guinan, et al. 1982). A pair of narrow- and intermediate-band interference filters, centered near the rest wavelength of the Balmer H alpha line at 6563A was used along with an intermediate band blue filter with λmax = 4530A. The characteristics of the filters are given by Guinan and Wacker (1985). However, only the observations made with

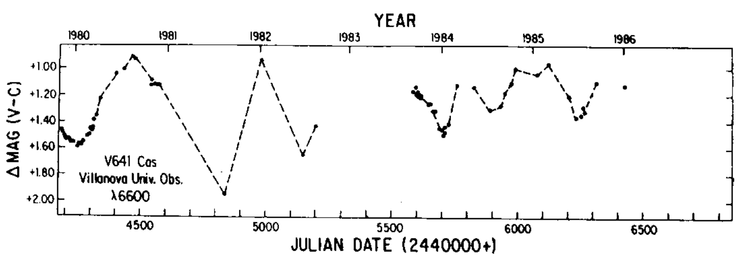

Figure 1. The intermediate-band red observations of V641 Cas are plotted against Julian Date and calendar year. The observations were made with respect to the comparison star HD 371. The points are nightly means.

the H alpha intermediate-band filter cover the entire ≈ 6 year observing interval. The bandwidth of this filter is broad enough (FWHM = 260A) so that the included H alpha emission line feature does not contribute significantly to the flux measure. Thus, the red intermediate bandpass measure is essentially that of the continuum centered at 6600A.

Differential photometry of V641 Cas was made relative to a nearby comparison star, BD+62°0005 (HD 371; V = +6.42 mag; B-V = +1.03; G2 II). The observing procedure and data reduction are the same as discussed earlier by Guinan, McCook, and Weisenberger (1982). Nightly mean differential magnitudes were formed from the data, and the intermediate band red observations are plotted in Figure 1. As shown in the figure, the light variation is semi-regular both in amplitude and period. The interval of time between successive light minima or light maxima ranges from a maximum of 500-600 days during 1980-1982 to 200-350 days during 1983-1985. The range in brightness was as large as ≈1.0 mag during 1980-1982 and ≈0.2-0.4 mag during 1983-1985. From the limited amount of data, it appears that the light amplitude is largest when the period is longest. Blue observations obtained during 1983-1984 indicate that there is little or no wavelength dependence of the light variation. Since the M supergiant of the system dominates the light at visible wavelengths, the observed light variations arise chiefly from this star. All VV Cep-type stars that have been investigated photometrically show semi-regular light variations of a few tenths of a magnitude and with characteristic periods of one hundred to several hundred days (Cowley 1969). The light amplitude of ≈1.0 mag found for V641 Cas during 1980/1981, however, is the largest reported for any VV Cep-type star. These semi-regular light variations observed at optical wavelengths appear to arise from pulsational instabilities and possible surface activity of the red supergiant component. Similar light variations are observed for single M supergiants such as Alpha Ori (e.g. Guinan 1984) and Mu Cephei (e.g. Polyakova 1974, 1975).

VV Cephei has been monitored photometrically at Villanova since 1975 and it shows semi-regular light variations similar to those observed for V641 Cas, but with smaller light amplitudes (e.g. Guinan, et al. 1982). VV Cep is an eclipsing binary with an eccentric orbit (e = 0.35), however, and it appears that the light variations of the M supergiant are strongly influenced by the tidal effects of its hot companion near periastron passage (Guinan, et al. 1986). The change in the period and amplitude of the light curve of V641 Cas observed from 1979 through 1985 could, in part, be produced from binary system interaction effects as in the case of VV Cep. Unfortunately, the orbital period and elements for V641 Cas have yet to be determined. Observations of V641 Cas made with the other filters are less numerous and cover the interval from 1979-1984. Color and H alpha indices were computed from all the data when possible to study possible correlations with the brightness changes and also to search for possible eclipse effects. These results will be presented in a separate study (see Dombrowski and Guinan 1986).

We plan to continue to observe V641 Cas at Villanova for the next few years. It would be valuable, however, to obtain radial velocity measures of the star and from these to determine its orbital parameters. The large light variations exhibited by the M supergiant component of the system could indicate large pulsationally induced mass outflows which would interact strongly with the hot companion.

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Number 2926

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IDENTIFICATIONS AND ASTROMETRIC POSITIONS OF CATACLYSMIC BINARIES AND RELATED OBJECTS

The catalogue by Ritter (ref. 1) contains many variables with semi-precise positions and inadequate finder charts in the published literature. The following positions for some of these stars were measured on a Coradograph measuring machine at the RGO using glass copies of the PSS. An average of 19 AGK3 stars within a 2 degree square centred on the variable were used in the reductions, but in the cases of MT Ser, V794 Aql and VW Pyx, SAO positions were used. Photographic finder charts are included for five of these stars.

Full details and an extensive bibliography for all but two of these stars are given in ref. 1.

STAR DESIGNATIONS

Five of the stars in ref. 1 plus Huruhata's star in ref. 4 have been designated in the 67th name list (ref. 24) and are given their new designations in the table. The list below gives the designations used in ref. 1.

V363 Aur	=	Lanning 10
SW Sex	=	PG1012-029
DO Dra	=	PG1140+719
V795 Her	=	PG1711+336
MT Ser	=	Abell 41

NOTES ON INDIVIDUAL STARS

EG Cnc

The discovery of this star was reported by Masaaki Huruhata in ref. 4. Only one maximum to m_v 11.9 in Nov. 1977 is known. A photo showing the star in outburst was kindly supplied by Huruhata, allowing an unambiguous identification of the star on the PSS. The approximate magnitudes on the PSS prints are 18.6 (red) and 18.0 (blue). The magnitudes given by

STAR	TYPE[1]	R.A.(1950.0)			RMS[2]	DEC.(1950.0)			RMS	EPOCH	IDENT[2]
		h	m	s	"	o	'	"	"	1900+	
TY Psc	DN,SU	01	22	50.38	±.3	+32	07	34.9	±.2	49.97	(2)*
V363 Aur	NL,UX	05	30	09.77	.3	+36	57	29.4	.3	54.90	(3)
EG Cnc	(DN?)	08	40	03.26	.4	+28	02	39.2	.3	53.94	(4)*
AC Cnc	NL	08	41	41.70	.3	+13	03	26.1	.3	51.91	(5)*
BZ UMa	(DN)	08	49	52.36	.4	+58	00	03.9	.3	54.91	(6)
VW Pyx	PN,DS	08	55	38.57	.5	-28	45	58.0	.5	56.19	(7)
SW Sex	NL,UX	10	12	37.22	.7	-02	53	35.1	.5	52.09	(8)
DO Dra	NL,XS	11	40	48.88	.4	+71	57	58.5	.4	53.28	(9)*
UX CVn	DS,DE	12	12	17.71	.4	+36	55	29.7	.3	56.35	(10)
Case 1	DS	12	13	16.30	.2	+52	47	47.8	.4	55.29	(11)
LX Ser	NL,UX	15	35	45.00	.3	+19	01	48.6	.3	50.29	(12)
V795 Her	NL	17	11	05.73	.3	+33	34	48.5	.3	54.51	(8)
MT Ser	PN,DS	17	26	10.26	.5	-15	10	43.1	.5	54.58	(13)
V380 Oph	NL	17	47	46.91	.2	+06	06	17.5	.2	53.61	(14)*
V477 Lyr	PN,DS	18	29	18.43	.2	+26	53	59.2	.2	51.53	(15)
UU Sge	PN,DS	19	39	54.99	.5	+16	58	07.5	.5	50.54	(16)
RZ Sge	DN,SU	20	01	02.31	.2	+16	54	23.3	.3	51.72	(17)
V794 Aql	NL,UX,AD	20	14	56.57	.3	-03	49	11.9	.2	51.51	(17)
CM Del	DN,UG	20	22	39.93	.4	+17	08	07.0	.4	51.52	(17)
V751 Cyg	NL,UX,AD	20	50	26.65	.3	+44	08	04.5	.3	54.51	(18)
V425 Cas	-	23	01	34.91	.4	+53	01	04.5	.5	53.83	(19)

1 - Type as given in Ritter (ref. 1). See below. Brackets indicate stars not in his catalogue, i.e. stars with no established orbital period.

2 - References to the published charts used to identify the variable. An asterisk indicates a photographic finder chart in this paper.

TYPE
- AD - Anti-dwarf nova = VY Scl object, subtype of NL
- DE - Doubly evolved system i.e. both components are highly evolved
- DN - Dwarf nova
- DS - Detached system
- NL - Nova-like variable
- PN - Central star of a planetary nebula
- SU - SU UMa star, subtype of DN
- UG - Dwarf nova of either U Gem or SS Cyg subtype
- UX - UX UMa star, subtype of NL
- XS - X-ray source

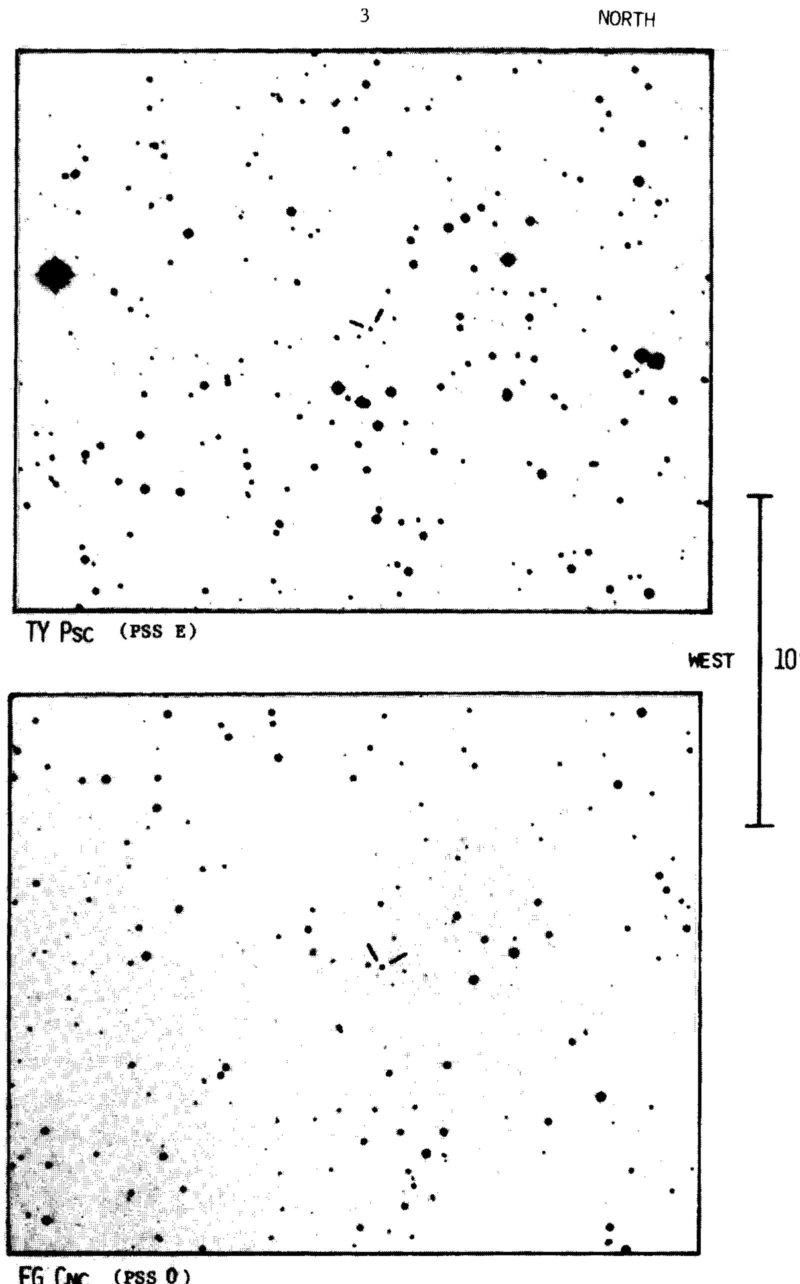

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Fig. 1

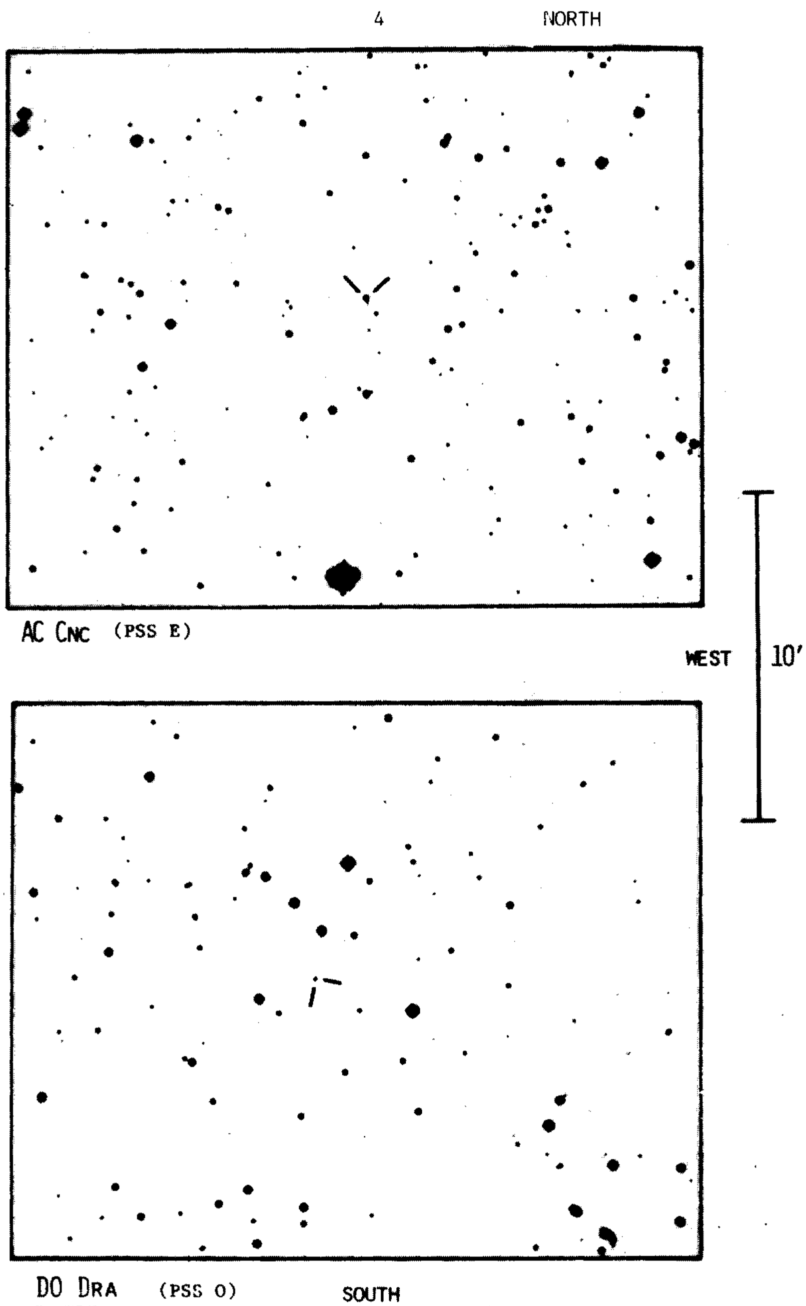

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Fig. 2

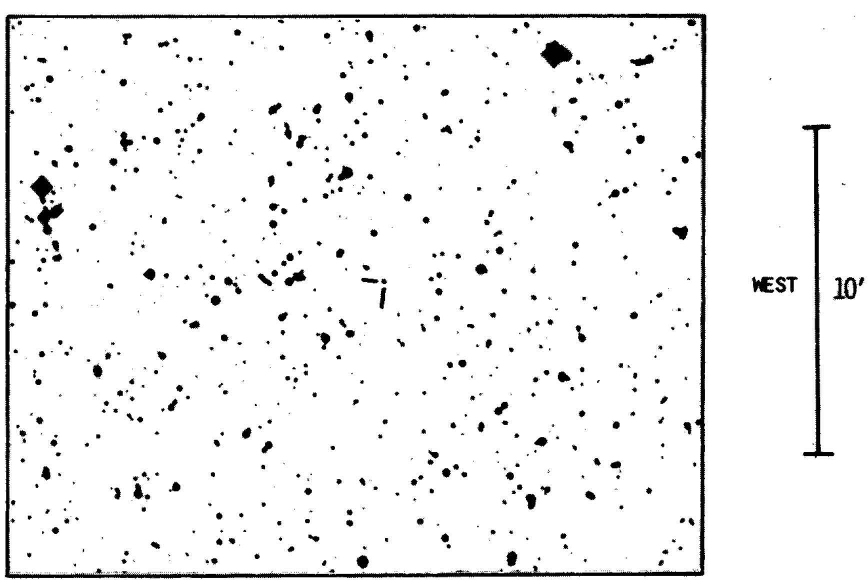

Fig. 3

Huruhata in ref. 4 seem to refer to a star 26"E and 3"N of the variable. From the rate of decline of 2 magnitudes in 20 days, a range of over 6 mags., and the blue colour on the PSS, a similarity to WZ Sge, UZ Boo and WX Cet is suggested (see ref. 20). A photographic chart is published here.

V363 Aur = Lanning 10

It is noted that the declination of this star is some 0.5 arcminute south of the position given in refs. 1 and 3, and that the R.A. in ref. 1 is grossly different. However as ref. 3 provides an identification chart and the measurement was checked against a second plate, it is believed that the positions in refs. 1 and 3 are in error.

DO Dra = PG1140+719 = 3A1148+719 = 2A1150+719 ≠ YY Dra

The initial confusion between this star and the "lost" variable YY Dra (discovered by Tsesevich on Pulkova plates of Z Dra) has been cleared by Wenzel (refs. 9,21). Examination of plates at the epoch of Tsesevich's discovery may reveal the identity of YY Dra. A photographic chart of DO Dra is published here.

Case 1

Ref. 11 notes a total proper motion of 0.11 arcseconds/year.

Outbursts of up to 0.7 mag. in B are reported in ref. 23.

CHARTS

All charts are from the Palomar Sky Survey. The scale and orientation are the same for all charts and is indicated. Charts copied from the blue prints are labelled (PSS O) and those from the red (PSS E). (Figs. 1 - 3).

I acknowledge the valuable help of Bob Argyle and Dave King and thank the RGO for access to the facilities.

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LILLER'S NOVA-LIKE OBJECT
IN CENTAURUS

In 1986 Feb, Bill Liller reported his discovery of a nova-like object which reached maximum near 1986 Jan 13 at about magnitude 7 (Liller, 1986). No other information on this star has come to our attention. Accordingly, we have searched our nova and fireball patrol photographs for images of the variable during its outburst.

A photograph by Dawes from Sydney on 1986 Jan 11.54 U.T. records the variable at magnitude 7.0 . The estimate is complicated by the proximity to the mv 6.0 star (SAO 240765) 2.6 arcminutes to the north, and by the Ektachrome 400 emulsion with a Kodak Wratten 32 (Magenta) filter, used as an experiment to combat sky pollution. The 55mm focal length lens just separates the variable from the nearby star.

The fish-eye lens fireball and nova patrol camera operated by McNaught from Siding Spring Observatory does not have the resolution to separate the variable, the focal length being only 15mm. However, near maximum, the variable became sufficiently bright that the combined brightness was clearly brighter than mv 6.0 . Eyeball estimates of the brightness of SAO 240765 from the photos show a scatter of around 0.2 mag around a mean of m 6.0 in early and late January. However on Jan 11, 12 and 13 the images of SAO 240765 were significantly raised indicating that the variable was near maximum.

	U.T. Period covered by photos	Combined magnitude change	No. of photos.	Derived mean mag. of the variable.
86 Jan 11	1612 - 1752	-0.2	6	7.7::
12	1325 - 1829	-0.5	12	6.6
13	1228 - 1804	-0.4	11	6.9:

The magnitudes will be affected by the slight separation of the two stars and the comatic images. However on several frames the image appears somewhat brighter than on the preceding and following frames and these may represent real variations. The brightest frames are detailed below.

	U.T. of mid.exp.	Durn. min.	Combined magnitude change	Derived mag. of the variable
86 Jan 11	1742	20	-0.6	6.3
12	1435	20	-1.0	5.5
12	1545	20	-0.8	5.9
12	1605	20	-0.8	5.9
12	1705	20	-1.3	5.1
13	1716+/-20	20	-0.8	5.9

It is not known what significance should be placed on these individual observations, but it does appear that maximum was reached on Jan 12 at mag 6.6 and possibly somewhat brighter.

The magnitudes are approximately pv, based on unfiltered HP5 emulsion. No patrol photos were taken in the period Jan 8 - 10 or Jan 14 - 17.

Liller's nova-like object in Centaurus

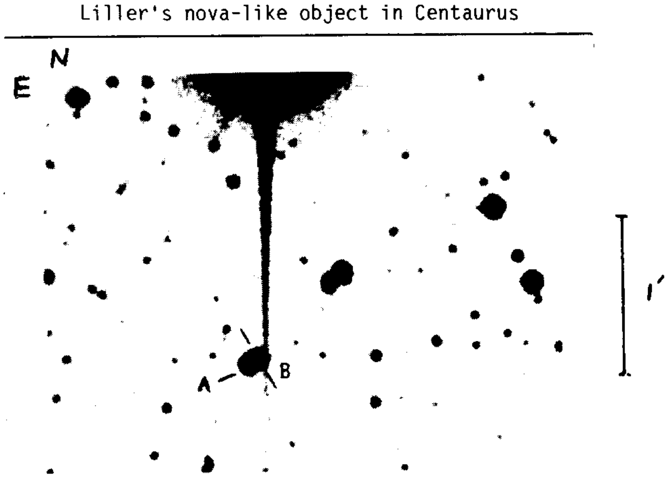

Figure 1 From a J survey plate of the U.K. Schmidt Telescope.
copyright: Royal Observatory, Edinburgh

By enlarging the Dawes' photo and overlaying it on a schmidt survey plate, it was clear that a pair of mag 14 stars are the best candidates for the variable in quiescence. The pair (labelled A and B) are shown in Fig. 1, this being the same identification as that suggested by Liller (ref. 1) of a faint star on the Papadopoulos "True Visual Magnitude Photographic Star Atlas".

Examination of several atlases showed no evidence of variability although the Papadopoulos atlas has the star some 0.5 magnitudes brighter than appears visually in a telescope. The data from the atlases searched is as follows

Union	1929 May 27	fainter than	13 B
Union	29 Jul 5	" "	12 B
Canterbury	66 Apr 21	at minimum	14 B
Stellarum	70 Apr 5	"	14 B
Papadopoulos	73 May 5	at minimum?	13.5: V
ESO B	74 Feb 25	at minimum	14 B
SERC J	76 Apr 22	"	14 J
SERC SR/I	80 Mar 7	"	
ESO R (5617)	?	"	

The SERC red/IR plate pair do not show any stars in the vicinity of the variable that are significantly coloured, nor does comparison of ESO B and R plates. On the colour photo by Dawes the star appears white (after allowance for the filter). It is certainly not red at maximum or minimum.

Visual monitoring of the candidate pair has been carried out regularly by McNaught. In 1986 March, observations on 15 nights showed no evidence of variability. Weekly observations subsequently until 1986 Aug 1 gave no change. Usually the pair are not resolved, but star A is the brighter. In good seeing, there is no evidence of a relative change of brightness in the pair.

Astrometry of the two candidate stars was carried out by McNaught on a SERC J film copy based on 11 Perth 70 stars within 1.5 degrees of the variable using the Bolton measuring machine at UKSTU, Siding Spring.

	R.A. (1950.0)			Dec. (1950.0)		
	h	m	s	o	'	"
Star A	13	17	42.57	-55	34	32.1
B	13	17	42.31	-55	34	30.0

The RMS error is 0.4 arcsec in both coordinates. Plate epoch is 1976.31.

The use of the UKSTU and AAT facilities at Siding Spring is gratefully acknowledged by McNaught. Particular thanks go to Tom Cragg who generously allows me access to his 32cm reflector.

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Reference :

Liller, W., 1986, IAUC 4180

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NSV 6708

This star was rediscovered by Dawes on 1986 July 6, on patrol photos taken on 1986 July 5 (McNaught, 1986). The star was then at mag 7.5. The NSV catalogue gives only a maximum of mpg 9.7 and a range of 0.8 mag. It lies 33 arcsecs due north of a mag 11 star. According to the NSV catalogue the star (originally BV 520) is identical to CoD -39,9021 , but examination of the nearby CoD stars suggests that CoD -39,9021 may be the mag 11 star as it is of similar brightness to the faintest CoD stars. However, the measured position of NSV 6708 more closely agrees with the coordinates of the CoD star than with the mag 11 star.

Dawes comparison photo used in the blink was taken in early 1985 and shows no image at the position of the variable, it then being fainter than mag 12. Subsequent examination of schmidt survey plates by McNaught show that it has a range of from mag 7.5 to 15.5 . The small range reported in the NSV is presumably due to merging of the variable with the mag 11 star. Details of the individual plates are as follows

Union	1928 May 28	not recorded	(14.5:	B
Canterbury	66 Jul 9		15:	B
Stellarum	70 Mar 6		14:	B
Papadopoulos	74 May 11	not recorded	(14.5:	V
ESO B	75 Jul 6		9:	B
ESO B	75 Jul 9		9:	B
SERC J	76 May 6		12.9	J
SERC J	77 Mar 18		7.6	J
SERC J	77 Jun 6		8.5	J
SERC R	78 May 2		16:	R
SERC R	79 Mar 26		16:	R
SERC J	79 May 1		15.4	J

On two fields of the Whiteoak extension of the PSS, the variable is mag 7.5 .

The J magnitudes are based on uncalibrated measures of the image diameters, the other survey measures being guesstimates aided by Ann Savage of the UKSTU. It was fortunate that the variable appeared on the overlap of four fields.

A photographic finder chart showing the star when faint is given in Fig. 1 .

NSV 6708

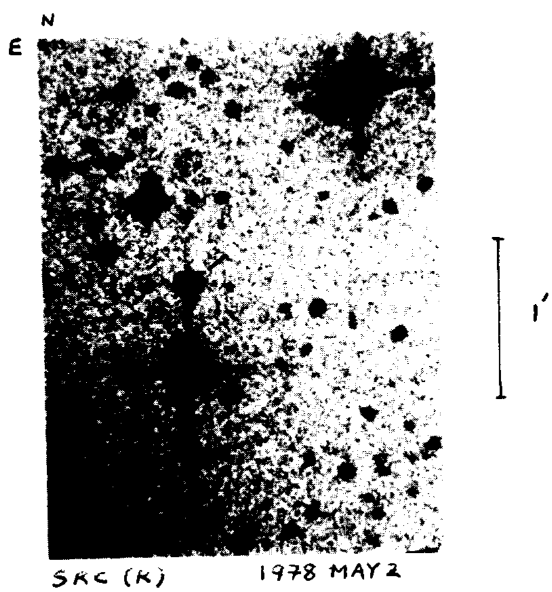

Figure 1 From an R survey plate of the U.K. Schmidt Telescope.
copyright: Royal Observatory,Edinburgh

Patrol photographs by McNaught are detailed below

1985 Jun 16	11: appears marginally resolved from star?
85 Dec 12	8 (on limit)
86 Jan 18	7.5:

From mid Feb onwards, the variable has been recorded at mag 7.5 on numerous patrol photographs. Subsequent to the rediscovery, the star has been closely monitored visually by Australian and New Zealand amateurs. The observations suggest possible slight variability around mv 7.5 .

No colour information is available from the schmidt survey plates, but colour photographs by McNaught and Steven Burns on 1986 Apr 11 show the variable to be white. On that date, the tail of P/Halley crossed the variable.

Astrometry was carried out by McNaught on an SERC J film copy using the Bolton machine at UKSTU, Siding Spring and the measures are based on 10 Perth 70 stars within 1.5 degrees of the variable.

R.A. (1950.0)	Dec. (1950.0)
h m s	o ' "
14 31 41.54	-39 20 13.2

The RMS error 0.4 arcsec in R.A. and 0.5 arcsec in Dec.
The epoch of the plate is 1977.43

The use of the UKSTU and AAT facilities at Siding Spring is gratefully acknowledged by McNaught.

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Reference :

McNaught, R.H. 1986, IAUC 4233

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HU ISSN 0374-0676

NEW FLARE STARS IN ORION

We have continued the survey for flare stars in the Orion nebula region. We discovered seven flare stars around the Orion nebula on the plates taken in 1985 with the 40" Schmidt telescope of Byurakan Observatory and from the revision of our old plates.

The effective time of observations is about 12 hours (5 hours in B, and 7 hours in U light). ORWO ZU 21 plates with the combination of Schott filters GG385 and UG1 were used. The revisions were carried out on the plates with effective time of observations about 60 hours.

Table I gives the data for the seven flare stars found. In the columns of Table I the following data on flares are presented respectively: the Byurakan number of star, coordinates, magnitude at minimum, amplitude, the date of flare, telescope and the identification. The coordinates and magnitudes are approximate.

Table I

N	α (1900.0)	δ (1900.0)	M_u	ΔM_u	Date	Telescope	Ident.
B31	$5^h23^m.2$	-6° 58'.5	$19^m.3$B	[illegible]^m.4B	24.10.85	40"	
B32	31.0	-6 11.0	20.5	6.0	22.10.85	40"	
B33	26.1	-4 38.2	(19.0	>4.0	02.12.80	40"	
B34	31.2	-4 31.8	18.1	2.4	01.12.80	40"	
B35	22.8	-6 52.1	16.2	2.7	26.02.79	40"	
B36	26.7	-4 21.1	13.8	1.2	07.03.75	40"	N22*
B37	34.8	-3 28.6	14.5Pg	1.3Pg	08.03.75	21"	TZ Ori

* Andrews , A.D. 1970. Bol. Obs. Tonantzintla-Tacubaya, 34, 195

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AN ATTEMPTED CONFIRMATION OF ARCHER VARIABLES NEAR THE COMA STAR CLUSTER

Archer (1959) announced the discovery of 24 variable stars in the vicinity of the Coma star cluster. Faulkner (1983) previously identified Archer's star Number 5 with RZ Com. Tan et al. (1984) made photometric observations of Archer's star numbers 3, 4, 7, 14, 16, 17, 18, 19, 21, 22, and 23, and concluded that these 12 stars are not variable. Because Archer published coordinates, but no Finder Charts, it is difficult to positively identify some of the stars that he studied. Comparison of his coordinates with the Palomar Sky Survey prints produced what the present author feels are the best identifications of 14 of the 24 Archer stars. These stars are listed in Table I along with their BD numbers. The remaining 10 stars could not be identified with any confidence.

Table I

Archer No.	BD No.
1	+29° 2252
3	+26° 2333
7	+27° 2151
9	+28° 2087
10	+27° 2152
12	+24° 2457
13	+26° 2347
14	+28° 2077
19	+30° 2281
20	+26° 2338
21	+26° 2332
22	+23° 2483
23	+27° 2129
24	+22° 2485

The 14 stars listed in Table I were observed photoelectrically on six nights during 1983, and on one night each in 1984 and 1985. UBV differential observations relative to nearby comparison stars were made with the 41 cm. telescope of the Morgan-Monroe Station of the Goethe Link Observatory. The method of observations has been described elsewhere (Faulkner, 1986). None of the 14 stars displayed any variations beyond the observational error of ± 0.02 magnitude. Archer suggested a period of about 2 days for Star 1, gave no period for Stars 12 and 24, and suggested very short periods for the remaining 11 stars observed. The variability of these latter stars should have been easily detected, leading to the conclusion that they are not variable. Combining these results with those of Tan *et al.* shows that 15 of the 24 Archer variables, if properly identified, *are not* variables. This casts doubt upon the remaining Archer variables.

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Tan, H., Zhang, Z., and Zhang, Y. 1984, *Inf. Bull. Var. Stars* No. 2537.

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PHOTOELECTRIC LIGHT CURVES OF TY BOOTIS

The eclipsing binary system TY Boo was discovered by Guthnick and Prager (1926). Carr (1972) published the first photoelectric light curves and determined seven times of minimum light. He attempted a Russel-Merrill solution of the system but stated that nonrectifiable distortions in this W Ursae Majoris-type light curve limited the accuracy of his results. One subsequent photoelectric minimum has been determined (1982)since Carr's observations.

The present observations of TY Boo were made on five nights during June, 1986. The 31 inch F/16 telescope at Lowell Observatory was used with standard B,V filters and a thermoelectrically cooled EMI 6256 photomultiplier. The comparison and check star were those designated by Szafraniec (1953) as "f" and "g" respectively. The positional information is given in Table I. Neither TY Boo, nor the check or comparison star, has a catalogue identification. Approximately 350 observations were obtained at each effective wavelength.

Table I

STAR	R.A. (1950)	Dec. (1950)
TY Boo	$14^h\ 58^m\ 47^s$	35° 19!8
Comparison	$14^h\ 58^m\ 54^s$	35° 16!1
Check	$14^h\ 58^m\ 05^s$	35° 22!0

Four epochs of minimum light were determined from the observations made during two primary and two secondary eclipses using the Hertzsprung technique (1928). These are given in Table II.

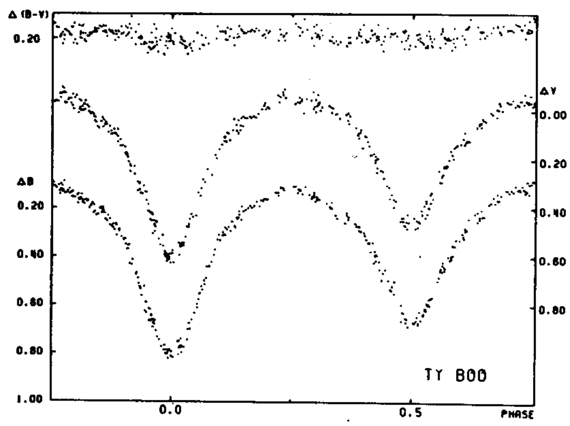

Fig. 1 - Light curve of TY Boo defined by the individual observations.

Table II

JD Hel 2446500+	Minimum	Cycles	(O-C)
87.7281	II	-6.5	-0.0011
88.8392	I	-3.0	-0.0000
89.7908	I	0.0	-0.0000
91.8510	II	6.5	-0.0012

These four minima along with the eight other photoelectric minima were introduced with varying weights into a least squares solution to obtain the following improved ephemeris:

$$\text{JD Hel Min.I} = 2446589.7907 + 0^{d}.31714964$$
$$\pm 5 \qquad \pm 3 \text{ (p.e.)}$$

This emphemeris was used in calculating the O-C's in Table II.

The B and V light curves of TY Boo 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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B AND V LIGHT CURVES OF THE MASSIVE CLOSE BINARY DH CEPHEI

DH Cep (= HD 215835; SAO 34810; <V> = +8.58) is a double-lined, massive spectroscopic binary consisting of a pair of O5-6 V stars having an orbital period of 2.111 days. The spectrographic radial velocity study of Pearce (1949) indicates an orbital eccentricity of $e = 0.13$ and values of $M_1 \sin^3 i = 23.4 M_\odot$ and $M_2 \sin^3 i = 19.1 M_\odot$. Photoelectric photometry of DH Cep was carried out by Hill, Hilditch and Pfannenschmidt (1976) in which small ($\approx$ 0.05 mag) light variations were observed but the data were too few to define a light curve. In agreement with this photometry, observations of the star in the ultraviolet($\lambda\lambda$1550–3300) made with the *ANS* satellite during 1975 and 1976 show only low amplitude brightness changes which appear to arise from the distorted figures of the binary components (Wu and Eaton 1981). The membership of DH Cep in the young open cluster NGC 7380 (Hoag and Applequist 1965; Underhill 1969) and the inferred large masses of the stellar components make this an interesting and important binary system. Moreover, if the orbital eccentricity found from the early radial velocity study of Pearce (1949) is real, then DH Cep would be expected to have large apsidal motion from classical and relativistic effects.

Photoelectric photometry of DH Cep was conducted on 24 nights during 1985 August and September at Lines Observatory (Mayer, Arizona). The observations were made by H. C. L. and R. D. L. using the 20-inch reflecting telescope equipped with a 1P21 PMT and filters closely matched to the *UBV* system. Differential photometry of DH Cep was made with respect to the nearby comparison star, HD 215714 (= SAO 34785; V = +7.58; F8:) and HD 215868 (= SAO 34816; V = +8.41; B9) served as a check star. On the several nights on which the check star was observed, no significant light variations were detected between the check and comparison stars. Because of the angular proximity of the comparison check, and variable stars, the differential extinction corrections were very small. The familiar ***sky-comparison-variable-comparison-sky*** observing sequence was used. Differential extinction corrections were applied and the differential measures were transformed to Δ V and Δ B of the standard UBV system. The observations are plotted in Fig. 1 against orbital phase using the ephemeris,

$$T_{min} = \text{HJD}2446291.7784 + 2.^{d}11104.E,$$

in which the period is the spectrographic orbital period given by Pearce while the epoch is from the present observations and refers to the mid-point of the deeper light minimum. The deeper light minimum occurs within about 0.15P of the time of conjunction in which the more massive component is most distant from the observer according to Pearce's spectrographic elements. It should be recalled, however, that Pearce's study was carried out over 37 years ago and that small errors in the published period and possible period changes could cause the ephemeris to yield uncertain results.

As shown in the figure, the light curves are well defined and display two minima and two maxima within an orbital cycle. The two maxima of each light curve are equal in brightness within $\pm$ 0.005 mag while the corresponding minima are slightly different. For the V light curve the depth of deeper minimum and shallower minimum are 0.042 mag and 0.037 mag respectively, while for the B observations the depths of the deeper and shallower minima are 0.045 mag and 0.039 mag, respectively.

The small light amplitudes and the cos2Θ dependence of the brightness variation on the orbital phase indicate that DH Cep is an ellipsoidal variable star. As described by Morris (1985), ellipsoidal variable stars are close binaries whose components are distorted by their mutual gravitation, but have orbital inclinations that are too small to produce eclipses. Therefore, the observed brightness variations

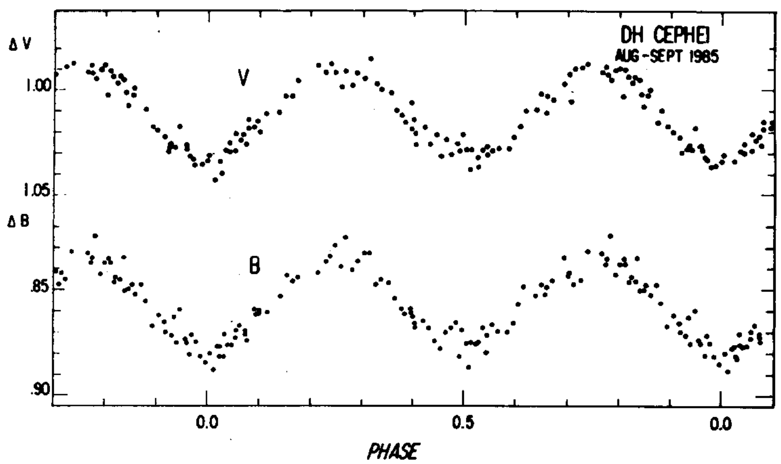

FIGURE 1. The differential B and V observations of DH Cep are plotted against orbital phase. The phases were computed with the light elements given in the text.

occur from the changing aspects of the tidally distorted stars as they undergo orbital motion.

A closer examination of the light curves reveals that the two minima of each light curve are about 0.50P apart. Unless we are viewing the binary system along its major axis so that the longitude of the periastron, ω, is nearly equal to 90° or 270°, so that $e\cos\omega \approx 0.0$, then it appears that the orbital eccentricity found by Pearce is too large or even spurious.

As shown in the figure, the shapes of the minima at 0.0P and 0.5P appear slightly different. The deeper minimum at 0.0P is sharper and narrower than the corresponding minimum at 0.5P in each wavelength. This behavior could be produced by the eccentric orbit if periastron and apastron occur near the conjunctions of the orbit at 0.0P and 0.5P, respectively. This would be consistent with values of the longitude of periastron of $\omega \approx= 90^\circ$ or 270°, implied from the occurence of the two minimum nearly one half period apart. The difference in the shapes of the two minima arise chiefly from the changes in orbital velocity between periastron and apastron. The observed differences in shape are small, however, and could be produced by other effects such as circumstellar gas or streams.

Exploratory modeling of the light curves was carried out using the Wilson-Devinney computer program (Wilson and Devinney 1971). We found that we could not fit the present light curves with an orbital eccentricity greater than about ≈ 0.05. The preliminary modeling also indicated that both stars are inside their Roche lobes and that the orbital inclination appears to lie between 45° and 55°. If we adopt Pearce's values of $M\sin^3 i$ obtained from the radial velocity study, then the masses of the two components are $42M_\odot \leq M_1 \leq 65M_\odot$ and $35M_\odot \leq M_2 \leq 54M_\odot$. With a total systemic mass of $77M_\odot \leq M_{1+2} \leq 119M_\odot$, DH Cep is one of the *most* massive binary systems discovered so far.

Additional photometric observations of DH Cep are planned at Lines Observatory and also at Villanova University Observatory. These observations should provide a check on the orbital eccentricity of the system, since, if the orbit is eccentric, the rate of apsidal motion is expected to be quite large from classical and relativistic effects($\dot{\omega}^{theor}_{CL+GR} \approx 30$deg/yr.). If this is the case, then a measurable displacement of the shallower minimum from the deeper minimum should be observed. A more detailed analysis of DH Cep will be made after the new light curves are obtained.

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A POSSIBLE NOVA IN CYGNUS

A possible Nova was discovered by Wakuda in Cygnus on Aug. 4 on the patrol film taken with a camera of focal length 40cm. The brightness was then 9.1. The star was in the field of photos taken by Huruhata for CI Cyg, and some brightnesses around the outburst were measured. All the photos were taken with Kodak Tri-X films with the yellow-green filter which gives brightness very close to visual magnitude. The results are shown in Table I and Figure 1. In the table, observer F is S. Fujino (Hamamatsu).

Table I.

1986(U.T.)	m_V	Obs.	1986(U.T.)	m_V	Obs.	1986(U.T.)	m_V	Obs.
July 18.47	[13.5	H	Aug. 6.55	9.6	H	Aug. 9.71	9.0	H
28.59	13.0:	H	.72	9.7	W	10.40	10.0	F
29.69	[11.1	W	7.71	8.8	W	.60	10.2	W
31.47	10.6	H	8.48	8.6	F	.70	10.7	H
.75	11.0	W	.63	8.5	W	11.68	10.9	H
Aug. 4.72	9.1	W	.73	9.6	H	13.64	10.5	H
5.45	9.7	H	9.49	8.7	W	.74	9.9	W
.47	9.7	W	.50	8.9	H			
6.48	9.4	F	.62	8.5	F			

It is noticeable that very rapid fluctuations were observed sometimes, amounting to more than one magnitude in a few hours.

Three spectra with objective prisms were taken by Wakuda on Aug. 5.6, 8.6, and 9.6, using the cameras of focal lengths 20 and 47.5cm. They all showed continuous spectra without any emission lines. Approximate blue magnitude measured photographically by Huruhata on Aug. 8.7 was 9.5.

The star was examined on some seven hundred photos taken by Huruhata since July, 1979 around CI Cyg, and no image brighter than $13^{m}.0$ could not be found. This suggests that the star would not be an common UG type.

Preliminary visual magnitudes of comparison stars determined by Huruhata are shown in Table II.

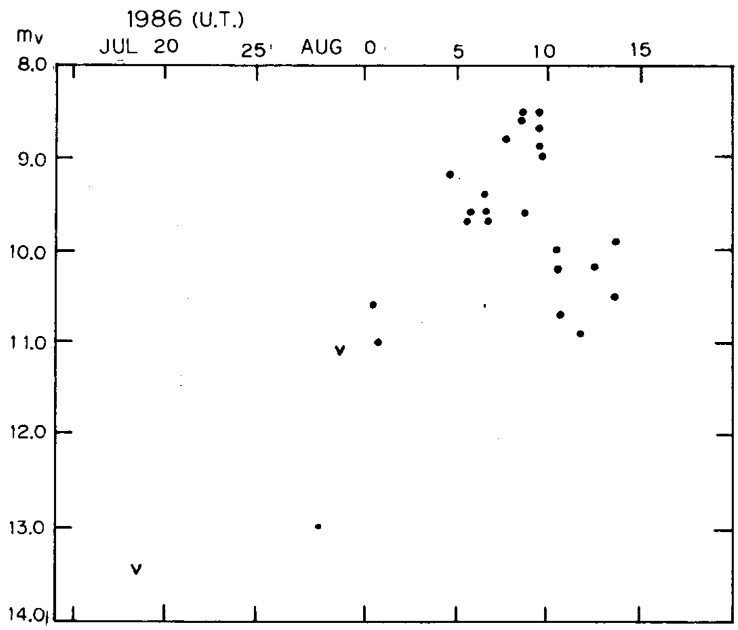

Fig. 1.

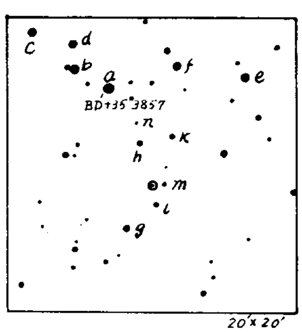

Fig. 2. Finding chart.

Table II.

a	8.7	*g*	11.1
b	9.4	*h*	11.8
c	9.6	*k*	11.8
d	9.7	*l*	12.2
e	9.8	*m*	12.3
f	10.8	*n*	13.5

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PHOTOELECTRIC OBSERVATION OF THE ECLIPSING BINARY u HERCULIS

The eclipsing binary u Her (68 Her, HR 6431 , HD 156 633, BD+ 33^{o} 2864, GC 23 359, SAO 65 913) was detected as an optical variable in 1869 (Schmidt, 1869). In 1903 it was found to be a spectroscopic binary (Frost and Adams, 1903), and in 1908 an eclipsing variable with a period of 2.051 days. The first set of photoelectric light curves for u Her was obtained in 1922 (Baker, 1926).

This eclipsing binary was observed photoelectrically with the 40 cm Cassegrain telescope of Al-Battani Observatory (Iraq, Tarmiya, latitude +33^{o}47'32" N, longitude 44^{o}28!6 E) during 26 nights between May-September 1985.

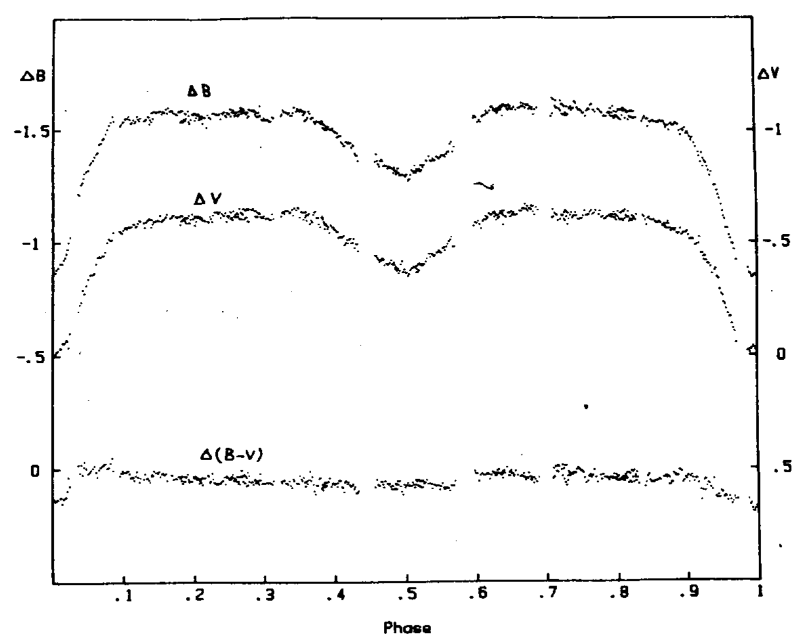

Figure 1. Light curve of the eclipsing binary u Her

The photometer was furnished with an uncooled 1P21 photomultiplier tube and UBV filters in close accordance with the standard Johnson's filters (Kadourie et al., 1986). The observations were only made in B and V lights. The star 72 Her (HD 157 214 or SAO 65 963) was used as a comparison star, and the check star was HD 158 261 or SAO 66 054. The estimated uncertainties for a single observation are of the order of $\pm 0\overset{m}{.}05$ in V and $\pm 0\overset{m}{.}06$ in B. The extinction coefficients have been calculated from the comparison star observations.

A total of 598 observations were obtained in each filter which are presented in Figure 1, where the phases are calculated according to Koch and Pfeiffer (1977):

$$\text{Min.I. (hel.)} = 240\ 5830.033 + 2\overset{d}{.}051\,02\,70\,E$$

In the following table the observed heliocentric times of minima with the O-C values from the above ephemeris are presented.

Type	J.D.	O-C
Min. I	244 6315.24147	-0.0104
Min. II	244 6314.22640	0.0

The strong asymmetry in the secondary minimum provides strong evidence for the reflection effect and indicates the existence of a gaseous stream in the system (Al-Naimiy and Budding, 1977). The analysis of the light curves will be published elsewhere.

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PHOTOMETRY AND SPECTROSCOPY OF CH CYG IN 1985

CH Cygni is a well-known symbiotic star comprising an M7 giant and a hot component that is probably a white dwarf surrounded by an accretion disk. Taylor, Seaquist, and Mattei (1986) discovered that the system underwent a violent radio outburst in 1984-85 which produced a multi-component jet and concomitantly a decline is visual brightness. At the request of Dr. Seaquist we monitored the star photometrically and spectroscopically during the second half of 1985, and report our results here.

Our photometry was done with a two-telescope photoncounting system that allows the simultaneous measurement of the variable and a comparison star. HR 7381 was used as a comparison star, for which five nights of absolute photometry gave (y, b-y, m1, c1, β, V-R, V-I)=6.512, -0.019, 0.106, 0.820, 2.766, 0.009, -0.075) with internal standard errors all less than 0.007 mag. V-R and V-I are on the Cousins system.

Using these values the differential observations of CH Cyg were converted to absolute ones and are shown in Table I. Each is the mean of three observations, and the internal standard errors are all less than 0.01 mag, except for c1, where it is typically 0.03 mag.

Figure 1 shows the trend of the data with time. At the longer wavelengths, shown at the top of the diagram, the M-star is dominant and shows generally stable behaviour with a slight decline in light towards the end of our observations in early November 1985. Throughout this time the visual magnitude remained steady to within about 0.05 mag, but as one goes down the diagram to shorter wavelengths considerable brightening of the hot component becomes evident. The flux in the u-band increased sharply, reaching outburst proportions in October and November, and was 250% greater at the end of our observations than at the beginning. The β-index shows that Balmer emission, while steady during the earlier months, also increased dramatically in October/November.

Table I
PHOTOMETRY OF CH CYGNI IN 1985

HJD	y	b-y	m1	c1	β	V-R	V-I
2446000+							
199.704	7.631	1.686	-1.424	2.773	2.435	1.990	4.075
241.691	7.500	1.642	-1.263	2.411	2.416	1.942	3.949
258.685	7.552	1.632	-1.280	2.444	2.457	1.965	4.020
294.692	7.469	1.625	-1.197	2.238	2.439	1.919	3.952
354.530	7.603	1.552	-1.128	2.328	2.276	1.890	3.959
364.514	7.541	1.448	-1.036	1.971	2.155	1.833	3.870
377.607	7.565	1.347	-0.947	1.550	1.953	1.820	3.800

Between April 30 and November 11, spectra of CH Cygni were obtained in the blue from 3700-4950 Å (reciprocal dispersion 8 Å/mm on vacuum sensitized IIaO plates) and in the red from 5000-7000 Å (reciprocal dispersion 16 Å/mm on vacuum sensitized 098 plates) with the cassegrain spectrograph attached to the 1.88 meter telescope at the David Dunlap Observatory. Calibration plates were taken using the local version of the Latham (1969) spot sensitometer. The spectra were digitized with the Observatory's PDS microdensitometer and the digitized spectra were reduced to intensity versus heliocentric wavelength using standard techniques.

During this period, the spectrum of CH Cygni was that of a late M star on which a strong emission line spectrum was superimposed.

On our blue plates, hydrogen emission is apparent down to H11. (It may be present farther down but the exposures are weak in this region.) Relatively speaking, these emission lines are still fairly wide - excluding the spectra taken after the renewed photometric activity began, the basal width of the Hβ emission is 400 to 600 km/sec - but are much narrower than those reported by Tomov (1984) for 1984. Figure 2 shows the development of Hβ as seen on our material. Between May 4 and June 7,

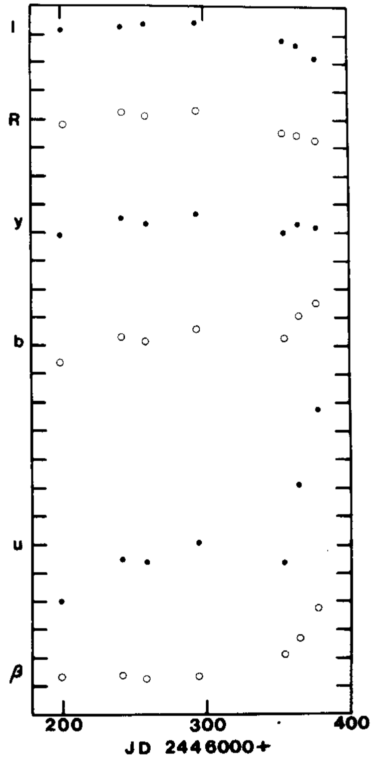

Figure 1. Brightness of CH Cyg in the Stromgren u,b,y and Cousins R,I bands during 1985. Tick marks on the vertical axis are 0.2 mag apart with brightness increasing upwards.

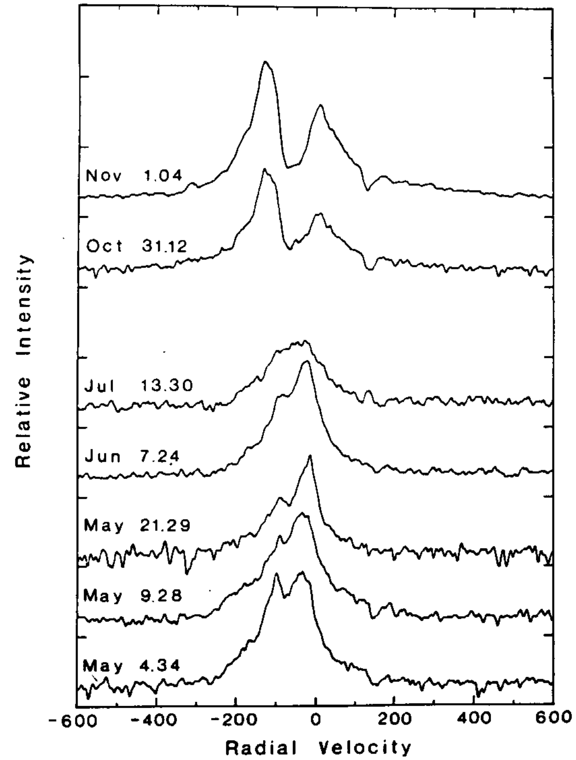

Figure 2. Hβ profiles observed in 1985 plotted against radial velocity. The profiles have been scaled so that the apparent continuum is similar on all the plots. The spectra were not normalized because the plates are weakly exposed at the continuum level and the continuum itself may be variable. The baseline for each plot is indicated by the tick marks immediately below it.

the central reversal became less noticeable as the violet component of the emission weakened. Subsequently, the red component appears to have weakened and on spectra taken July 13, 16 and 21, Hβ is essentially single. No further blue spectra were obtained until October 31. On this plate and one taken November 1, Hβ displays a strong central reversal and the violet component of the emission is stronger than the red. These latter two profiles are similar to those shown by Tomov (1984) for Hδ but lack the very broad emission wings found by Mikolajewski and Mikolajewski (1985) on spectra taken several days later. On October 31, the basal width of the Hβ emission was about 750 km/sec; on November 1, it had increased to about 900 km/sec. Throughout the period, Hα displayed a double-peaked profile. The V/R ratio was variable - prior to early August,

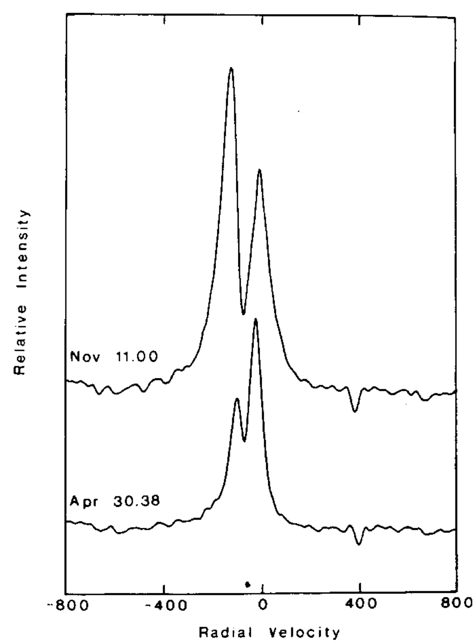

Figure 3. Two Hα profiles observed in 1985 plotted against radial velocity. The exposure level at the continuum was similar on these plates. Extrapolation of the calibration curve was not required to represent the emission peaks. No extensive emission wings are present.

it was <1; between mid-August and early October, the ratio tended to be >1 although on one occasion it reversed between exposures taken two nights apart; on our only November exposure, V/R was >1. (Unfortunately, many of these exposures are so strong at Hα that at least one of the the emission peaks is not well calibrated.) The velocity of the central absorption stayed around -70 km/sec. When compared with the pre-activity material (see Figure 3), the central reversal at Hα is more evident on the November plate and the basal width of the emission is slightly wider, about 550 km/sec. No extensive emission wings are apparent on this plate.

In addition to hydrogen, there are numerous other emission lines. Strong sharp lines of Fe II, [Fe II], [S II], [Ne III] and [O I] are present. There are no indications of any significant velocity differences between these lines. For our spectra, the mean velocities ranged from -50 to -60 km/sec. Weaker sharp lines of [O III] λ4363 and λ5007 are also present. Very weak He I λ3819 may be present on a couple of plates. The non-hydrogen emission line spectrum is similar on all our material.

Throughout the period, the late M-type absorption spectrum was visible. Mean velocities, measured mainly from the Fe I absorption lines, followed those of the sharp emission lines fairly well but were systematically more negative by 1-4 km/sec. (This may have arisen because most of the absorption lines are blended.)

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OBSERVATIONS OF SUSPECTED VARIABLES IN THE FORNAX CONSTELLATION

In a 5x5 degree field centered on the dwarf spheroïdal galaxy Fornax (2^h38^m -34°39' [1950]) there is no known variable stars. This field contains, however, three stars listed in the 1982 edition of the New Catalogue of Suspected Variable Stars (NSV). They are no. 863, 917 and 919.

During the course of a photographic survey of the red variables of the Fornax system; twenty one UK Schmidt IIaD + GG495 plates, were measured with the APM in Cambridge UK. Because the three above suspected variables are on our plate, we investigated their variability.

We therefore present our findings for these three stars. The newly determined coordinates are accurate to 2 arc seconds. The quoted (B-V) colors are based on only one B measure.

NSV #863 RA = $2^h38^m28.^s0$ dec = -34°51'25" (1950)

Identification with CoD -35 886 is confirmed. This star is a low amplitude Population II Cepheid with a period P = 7.60146 days <V>= 11.31 (B-V) = 0.4. Its light curve is presented in Fig. 1 and its visual magnitudes are listed in the Table I.

TABLE I

V Magnitudes of Suspected Variables

JD 2440000.0+	NSV 863	NSV 917?	NSV 919
4458.20	11.25	16.92	9.81
4482.23	11.31	16.98	9.95
4511.17	11.16	16.93	9.89
4844.29	11.35	16.96	9.98
4869.25	11.16	16.93	9.90
4931.15	11.29	17.04	9.97
4940.02	11.46	17.01	9.93
4956.95	11.46	17.07	9.98
4967.97	11.22	17.02	9.97
5194.29	11.24	16.91	9.97
5202.29	11.19	16.94	9.95
5212.28	11.27	16.98	9.91
5280.07	11.18	17.03	9.99
5641.11	11.38	16.87	9.79
5664.02	11.41	16.91	9.89
5676.98	11.37	17.02	9.94
5695.98	11.25	17.01	9.92
5915.28	11.35	17.03	9.85
6019.05	11.43	16.88	9.91
6047.00	11.26	16.93	9.86
6074.96	11.44	17.07	9.98

NSV #917 = HV 11094 no magnitudes given

This star was discovered by Mayall (1951) who gives a spectral type Me and calls it a long period variable. A note states: "South preceding CoD -36 1043". The arrow on the finding chart points toward this CoD star and there is no obvious south preceding star (which should be, if

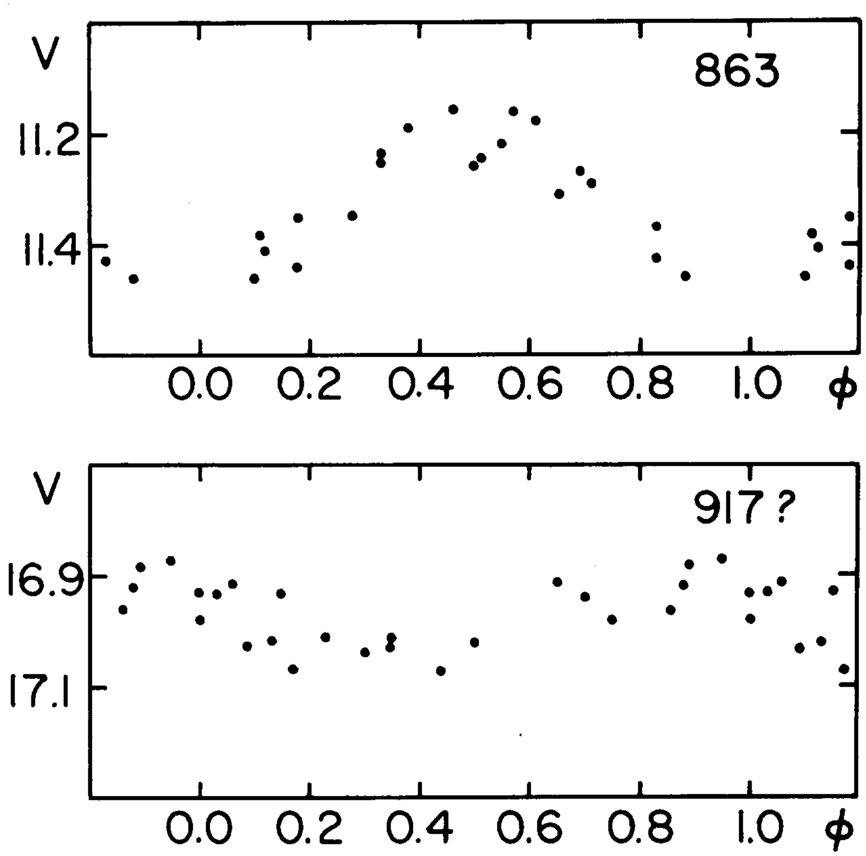

Figure 1

present, under the arrow). All the stars on Mayall finding chart have been measured on our plates. The reddest star in this small field is 109" southwest of CoD −36 1043. This "south preceding" star has an apparent visual magnitude of 17 and it appears, to us, very unlikely that the Harvard 10-inch objective prism patrol would have picked up such a faint object. We therefore cannot confirm that this faint star is indeed #917. This red star shows very low amplitude variations, a period P = 194.8775 days fits the data. The light curve is shown in Fig. 1. Its position is: RA = $2^h42^m59.^s7$ dec = −36°29'2" (1950) $\langle V \rangle$ = 16.97 (B-V) = 1.6

NSV #919 = CoD −36 1043 RA = $2^h44^m4.^s0$ dec = 36°27'27" (1950)

V= 9.92 (B−V) = 0.1

A search in the interval $0.15^d < P < 100^d$ did not yield a period for this star. Our photographic photometry shows that this star does not vary more than the other 10^{th} magnitude stars in the field. If this star is at all variable, its amplitude is below our detection threshold. We, therefore, cannot confirm Bloomer's (1971) observations.

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H-ALPHA AND LiI OBSERVATIONS OF THE RS CVn TYPE BINARIES : σ Gem, α Aur, 93 Leo and HR 6469

Variations in the H-alpha line profiles of RS CVn binaries have been reported by numerous authors, but only a few objects are known where the H-alpha variations are correlated with orbital phase. Weiler et al. (1978) suggested such a correlation for V711 Tau (P=2.838 days) whereas Bopp and Talcott (1978) do not. On the other hand Bopp and Talcott report coherent Hα variations with orbital phase in UX Ari (P=6.438days). Vogt (1981) monitored the Hα region of II Peg (P=$6^{d}.724$) and found a correlation between enhanced Hα emission and spot visibility in this well-studied RS CVn star.

The evidence of a LiI 6707.8 line is a qualitative indicator of stellar age. Lithium abundances have been used to estimate rough ages of solar-type stars, but deriving quantitative ages is much more difficult (Soderblom,1983). The main reason is that the depletion time scale is extremely sensitive to stellar mass. Consequently, we only give equivalent widths. Because of RS CVn's are post-main sequence binaries (Popper and Ulrich,1977) the amount of LiI should be very small.

The observations were obtained on 1985 Feb. 5, 7 and 8, May 10, 11 and 14 and Oct. 28 with the Cassegrain echelle spectrograph (Weiss et al., 1981) of the 1.5 m Vienna RC telescope. The detector used was a dual,liquid nitrogen cooled, Reticon CP-1001 array with 936 pixel each row (Schalk et al., 1985). The 79 g/mm echelle grating used with the 900 lines/mm cross disperser gave a reciprocal dispersion of 10 Å/mm at Hα in the 34th order which covered a spectral range of ∿ 250 Å centered at 6602 Å.

The mean FWHM of the Neon comparison lines covers about 2 pixels, corresponding to a resolution of ∿0.65 Å. In our averaged observing conditions (seeing ∿ 3", slit width 300μm) the integration times varied from 20-60 minutes for a uniform signal-to-noise ratio of typically ∿ 200 (except of α Aur, where SNR ∿ 400 with 2min).

Table I

Hα data

	$EW^{(a)}$ [mÅ]	$\frac{\text{counts}(\lambda_c)}{\text{counts(cont.)}}$	FWHM [km/s]
σ Gem (S1)	-1022	0.53	91
σ Gem (S2)	- 943	0.51	82
σ Gem (S3)	- 950	0.51	76
α Aur	-1445	0.36	91
93 Leo	-1249	0.48	87
HR 6469	-1360	0.38	74
V 711 Tau	+ 685	1.24	132
HR 5110 (H1)	- 780	0.77	100
HR 5110 (H2)	- 650	0.75	87
φ UMa	-1069	0.32	59

(a) Note that these are actually measured equivalent widths from the composite spectrum.

σ Gem (= HR 2973 = HD 62044): The single-line spectrum shows rotationally broadened lines. The Hα feature is clearly filled in by chromospheric emission as was mentioned by Smith and Bopp (1982). These emission is present during our February run as well as in the May-data, five epochs later. But there are still not enough data to look for season-to-season changes of these emissions.
All H-alpha data are summarized in Table I.
The LiIλ6707.8 line seems to be present in all spectra but is strongly blended (W_λ∿ 31 ± 10 mÅ).

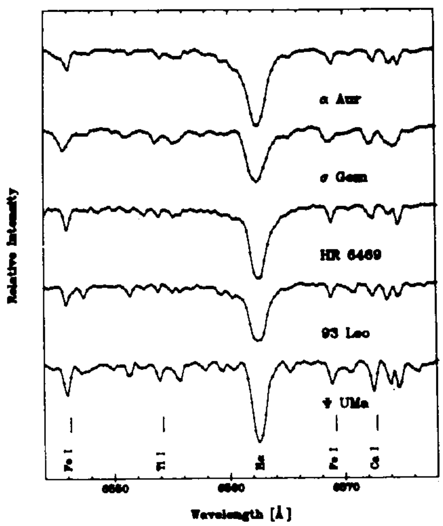

Fig. 1: Enlarged view of the Hα region for our program stars along with the nonactive single star ψUMa. The spectra were shifted to be in accordance with the ψUMa spectrum. σGem, HR6469 and 93 Leo show chromospherically filled in absorption cores.

αAur (= HR 1708 = HD 34029) is a double-line spectroscopic binary consisting of a G6III primary and an active F9III secondary. Shen et al. (1985) fitted two Gaussians to the line profiles to deconvolve both components from the composite spectrum near conjunction and found for the relative "dip"-strength G6/F9 = 1.7 ± 0.2. In our high SNR, 10 Å/mm-spectrum taken at phase 0.091, the secondary spectrum can be clearly seen, but all lines (except of LiI) were blended by these broad F9-lines in a way which corresponds to a relative "dip"-velocity shift of ∿30 km/s to the blue. The derived relative "dip"-strength is 1.69 ± 0.05 using the NiIλ6643 line.

The composite Hα absorption feature reaches down to ∿0.4 that of the continuum. If any emission occurs it is surely a weak one, not comparable with σGem.

A visual comparison of the LiIλ6707.8 region (Fig.2) with the two spectra given by Boesgaard (1971) in her Figure 2, p.513, showed a remarkable different intensity ratio between the nearby FeI lines from the G-component and the LiIλ6707.8 line from the F-component. But this is probably due to larger blending in our spectrum. No LiI line from the G-star is seen, it is fully blended by the broad F-line and an FeI-line at 6707.44 Å. The measured equivalent widths were corrected for the effect of composite continuum by multiplying with 1.67 for the G-star and 2.50 for the F-star.

93 Leo (= HR 4527 = HD 102509) exhibits a composite spectrum of a A7V and an G5III-IV component, with the presence of moderately strong emission in the H and K lines from the G-star. All lines are sharp and belong to the late-type component which contributes 0.67 of the total light in V. This corresponds to V-magnitudes of $5^{m}_{.}52$ for the A-, and $5^{m}_{.}09$ for the G-star. The actually measured equivalent widths were multiplied by a factor of 1.46 for correction of the composite continuous spectrum.

The Hα line of the G-star is fully blended by the broad and shallow Hα feature of the A-component. The slight asymmetry of the blue wing is in accordance with a velocity shift of $\sim$25 km/s relative to the G-component at phase 0.060.

We used a Hα spectrum of Vega (AOV), also at 10 Å/mm, to substract it from the composite 93 Leo spectrum (after the Vega-spectrum was shifted to be in accordance with the early type component in 93 Leo). From this and from the composite spectrum follows that the high Hα core intensity is not due to rotational effects but indicating that the normal absorption line is filled

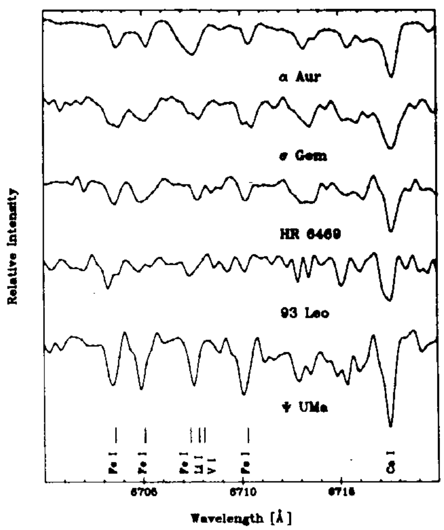

Fig. 2 : Reticon spectra of the LiIλ6707 region (10 Å/mm original dispersion and 0.65 Å resolution). The spectra were shifted to be in accordance with the CaIλ6717 line of ψUMa.

in by emission.

As seen in Figure 2 , a weak blended) LiI line (W_λ = 74 ± 10 mÅ) from the G-star is observable. We derived a ratio EW (Liλ 6707)/EW(Ca λ6717) = 0.44 and a relative abundance of [Li/Ca] = 1.2.

Recently, Walter (1985) reported that the G-component is the X-ray source in the 93 Leonis system.

HR 6469 (= HD 157482) is a double-lined F7V + ? + G5IV binary with a third spectroscopic component. Two components were resolved by McAlister et al. (1983) at 0".04 seperation using speckle interferometry techniques.

We are not able to resolve the second component in our 10 Å/mm-spectrum, although we have a good SNR, we are limited by a spectral resolution of ∿25 km/s. The photospheric lines are sharp and similar to the lines of the G-star in 93 Leo. In comparison with the F9III secondary of the α Aurigae system, HR 6469 shows a very weak LiI λ6707.8 feature ($W_\lambda \sim$ 61 ± 15 mÅ).

Visual inspection of the H α profile displayed in Figure 1 reveals a weak emission.

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LINEAR POLARIMETRIC MEASUREMENTS OF 55 CYGNI

In the last several years the investigation of Be stars came into prominence. Their polarimetric measurements may provide additional data to our understanding of the physics of these stars.

In the past 20 years I have carried out polarimetric observations of a number of Be stars. Because these observations may be of some interest I plan to publish the data in a series of papers.

55 Cygni (=BD + 45°3291 = HD 198 478) was previously recommended as a polarimetric standard star (Serkowski, 1974). Hsu and Breger (1982) showed that 55 Cyg underwent definite polarimetric variations on a short time scale in the position angle while the amount of the polarization changed only marginally.

Our polarimetric observations of 55 Cyg were made in August 1967 and July - August 1974. The measurements are given in Table I. The observations obtained in 1967 (J.D. 2439 733 -741) were carried out in V light with a two-channel integrating polarimeter attached to the 50 cm Cassegrain telescope of Konkoly Observatory. The 974 observations (J.D. 2442 250 -279) were made with the same polarimeter in UV light at the 60 cm Cassegrain telescope of the Haute Provence Observatory.

The 1967 observations in V light did not indicate any noticeable changes in the polarization values, whereas the 1974 observations in UV light definitely show small irregular changes in the amount of polarization between 2.0 and 2.6%. Small changes in the position angle were also observed within only a few days. This result is in accord with that of Hsu and Breger (1982).

I would like to thank Dr. Marie Therese Martell for her help and encouragement. I also thank the granted observing time at Haute Provence Observatory.

Table I. Polarimetric observations of 55 Cygni

J.D.	p %		θ		filter
2439733.344	2.54	± 0.34	169.3	± 1.9	V
734.333	2.57	0.34	169.4	1.9	V
735.354	2.53	0.34	169.5	1.9	V
738.437	2.38	0.32	173.6	1.9	V
739.385	2.51	0.33	170.9	1.9	V
741.313	2.44	0.33	171.0	1.9	V
2442250.438	2.57	0.19	0.6	1	UV
250.465	2.54	0.18	2.0	1	UV
250.479	2.56	0.17	1.9	1	UV
250.528	2.52	0.17	2.3	1	UV
250.542	2.37	0.20	3.3	1	UV
250.552	2.30	0.22	1.7	1	UV
251.535	2.44	0.19	0.0	1.1	UV
251.563	2.40	0.16	1.7	1	UV
252.542	2.41	0.24	2.1	1.4	UV
273.500	2.39	0.23	8.1	1.3	UV
274.514	2.43	0.26	2.7	1.5	UV
275.493	2.21	0.20	3.7	1.2	UV
275.521	2.02	0.21	179.9	1.4	UV
276.507	2.06	0.22	1.2	1.4	UV
279.507	2.36	0.26	0.5	1.5	UV

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UBVRI OUTBURST OF THE DWARF NOVA AH Her

AH Her is a cataclysmic variable, of type Z Cam, with a mean outburst period of 19.6 days (Beyer, 1967). Its magnitude varies within the range 10.2 to 14.7 (Kukarkin, 1969).

We present further UBVRI photometry of AH Her during the outburst of the second week of June 1986.

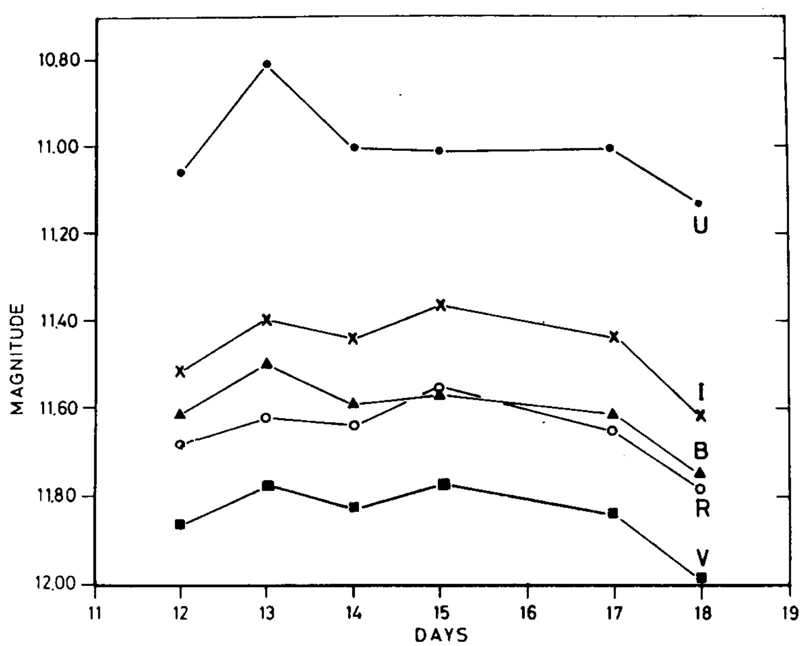
The star was observed during the week of the 11th to 18th June 1986. The observations were obtained at the Cassegrain focus of the 1m telescope at the Observatorio del 'Roque de los Muchachos',in La Palma (Canary Islands), using the People's photometer, a two channel photoelectric photometer and UBVRI filters in the Cousins System (Jones D., 1984).

The star was exposed in alternate channels with simultaneous sky measurements. The integration time was 17 sec in each filter. The average output of the two channels was used to reduce the data. Standard stars, selected from the available list in the Observatory, were observed to determine the atmospheric extinction, and used to reduce the magnitudes to a standard system. Our error is 0.01 magnitude.

We list in Table I the date, the mean universal time, the V magnitude ad U-B,B-V,V-R,V-I colours for each observation.

TABLE I

Date	UT(h m)		V	U-B	B-V	V-R	V-I
12	1	12	11.87	-0.55	-0.26	0.18	0.35
13	4	38	11.78	-0.72	-0.25	0.16	0.38
14	1	25	11.84	-0.59	-0.23	0.20	0.40
15	1	38	11.78	-0.53	-0.22	0.21	0.40
16	22	24	11.85	-0.60	-0.24	0.19	0.41
18	1	45	11.99	-0.61	-0.24	0.20	0.37



In the graph, the U,B,V,R,I magnitudes are plotted against the date.

The existence of two maxima, whose behaviour depends on the wavelength is clear. A more detailed study, which includes IR measurements, is being prepared.

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THE PROPER MOTION OF THE AGK3 VARIABLE STARS. II.
SS Vir

This is the second note on a program conducted to check the proper motion of the AGK3 variable stars which seem to be affected by systematic errors. In note I (Lopez, 1986), CR Gem (AGK3 +16 639) was discussed. The case of SS Vir = AGK3 +1° 1462 = BD +1° 2694 = HD 108105 is herein presented.

The first-epoch position is based on the published material of the Algier Astrographic Catalogue (AC) where SS Vir was identified with object 41 on plate 2053 (zone +1 epoch 1909.25). The second-epoch position has been obtained from a new plate (epoch 1986.50) taken with the Double Astrograph of El Leoncito Station. Both plates were treated in the same way and reduced using the surrounding AGK3 stars as a reference system. The mean error for the AC plate is $\pm$ 0.''20 in α and $\pm$ 0.''25 in δ, while for the second-epoch it is $\pm$ 0.''28 in α and $\pm$ 0.''26 in δ.

The resulting annual proper motion is:

$\mu\alpha*\cos(\delta)$ = 0.''000 $\pm$ 0.''004 (me) ; $\mu\delta$ = -0.''002 $\pm$ 0.''005 (me)

The values quoted in the AGK3 are: $\mu\alpha$=-0.''176, $\mu\delta$=-0.''137.

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Lopez, C.E.: 1986. IAU Inf. Bull. Var. Stars No. 2864

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UBV OBSERVATIONS OF R ARAE

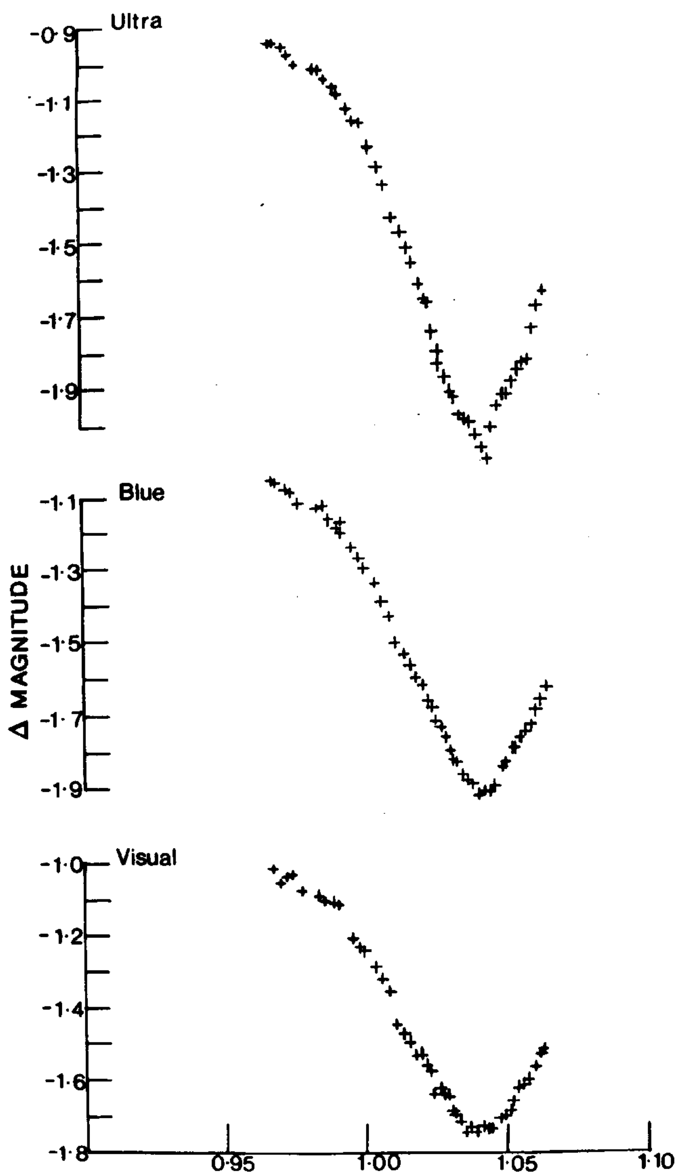
Kondo et. al, (1984) and McCluskey and Kondo (1983, 1984) have drawn attention to peculiarities of the relatively bright (~ 7th magnitude) eclipsing binary R Arae (HD 149730 = HJ 4866), generally on the basis of satellite observations which suggest irregular high energy processes, possibly connected to "mass transfer" events.

Peculiarities are, in fact, hinted at by the ostensible photometric characteristics of the system: though originally designated an Algol type (Roberts, 1894), Gaposchkin's (1953) light curve clearly shows a rounded out-of-eclipse variation, which is more in keeping with a β Lyrae type light curve. The system's 4.4 day period also gives an indication of possible interaction effects, when seen in context of a β Lyrae type light curve (Paczynski, 1971), (although we should remark that the notion of a standard β Lyrae type variation may well be an oversimplification for R Arae).

In this present note, we report a primary minimum of the variable, which was observed using the Ruth Crisp 41cm telescope, at Carter Observatory's Black Birch outstation (near Blenheim, New Zealand). The minimum was followed using the three colour U, B, V photometric system (see e.g., Budding 1985). The main comparison star was HD147977, which was checked regularly against HD150745. A time of minimum was calculated for each colour using the "folding paper method". An estimate of the error in time was obtained from a standard statistical procedure on the various measurements. The time of minimum thus obtained was:

Primary minimum at HJD2446585.161 ± 0.001

More time of minimum observations are urged for this binary. Apart from the evidence such data might have to



bear on the mass transfer process, as discussed by Kondo et al., (*op.cit.*) and McCluskey and Kondo (*op.cit*), there is, more simply, a need to clarify the value of the period. The following values have been either deduced, quoted or used in past literature:

Roberts	(1894,1901)	deduced	$P=4^{d}.42509$	:
Hertzsprung	(1942)	deduced	$P=4^{d}.42507\pm0.00003$	:
Payne-Gaposchkin	(1945)	quoted(?)	$P=4^{d}.42509$	:
Gaposchkin	(1953)	deduced	$P=4^{d}.425115$	:
Sahade	(1952)	used	$P=4^{d}.42509$	:
McCluskey and Kondo	(1983,1984)	used	$P=4^{d}.42509$	:

Thus, if Hertzsprung's or Gaposchkin's periods represent improved values, on the basis of more observations, it seems odd that later workers have not bothered with them; although Hertzsprung's value has been quoted by Sahade (1952) and McCluskey and Kondo (*op.cit*).

In this present work the value quoted by Payne-Gaposchkin has been used for the calculation of phases. From figure (1) we can see that the minimum is appreciably displaced from phase = 1.00. If we use the epoch of Payne-Gaposchkin, as quoted by McCluskey and Kondo (1983) we may derive a mean period, over the last fifty years or so, of $4^{d}.425132$, bearing out the suggestion of an increase given by Gaposchkin (1953) and noticeably greater than the period used as representative for the first fifty years after discovery. Unfortunately though, there appears to be too little data on times of minimum to enable a thorough study of O-C history of the binary hitherto.

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PERIOD OF THE ECLIPSING BINARY V382 Cyg

Several years ago it was shown (Mayer, 1980) that the measured minima times of the massive O-type binary V382 Cyg fit an ephemeris with a parabolic term, and, except for the two earliest minima, also a linear ephemeris. Some new minima were obtained recently, and they are listed together with the older photoelectric data in Table I. The 65 cm telescope of the Charles University at the Ondrejov Observatory and the 62 cm telescope at the Sarajevo Observatory were used.

All the new minima occurred sooner than predicted by the quadratic ephemeris, so that a linear ephemeris is to be preferred. The column $O-C_1$ in Table I was calculated using the linear ephemeris by Landolt (1975):

$$\text{Pri.Min.} = \text{J.D.hel. } 2436814.7735 + 1\overset{d}{.}8855121 \text{ E} . \qquad (1)$$

The up-to-date linear ephemeris presents a little longer period:

$$\text{Pri.Min.} = \text{J.D.hel. } 2436814.7703 + 1\overset{d}{.}8855152 \text{ E} ; \qquad (2)$$

the corresponding O-C differences are given in the column $O-C_2$ and plotted in Fig. 1.

Generally, the $O-C_2$ differences are larger than would correspond to the accuracy of the data, so there should be an unknown factor affecting the minima times. Perhaps a periodic term due to the light-time effect is present. When the ephemeris is changed to

$$\text{Pri.Min.} = \text{J.D.hel. } 2436814.7703 + 1\overset{d}{.}8855160 \text{ E} \qquad (3)$$

(the resulting differences are shown in the column $O-C_3$), a term with a period of 1375 P - i.e., 7.10 years - and amplitude of about $0\overset{d}{.}0050$ is observed. The value E/1375 (fraction only) is given in the column Phase, and the differences are plotted in Fig. 2.

In an abstract published by Bloomer et al. (1979), 18 new minima were mentioned and the following ephemeris was given:

$$\text{Pri.Min.} = \text{J.D.hel. } 2442940.8071 + 1\overset{d}{.}8855143 \text{ E} . \qquad (4)$$

The zero point of this ephemeris corresponds to the epoch E = 3249 according to the other ephemeris presented here.

Very probably, the measurements by Bloomer et al. began at the time of this zero point (June 1976) and had to end not later than in about November 1978. Hence, the O-C differences given in Table I were calculated for E = 3475, the expected arithmetical mean of the mentioned time interval, with the "observed" time of minimum following from eq. (4). The time interval June 1976 to November 1978 also corresponds to a limited phase interval of the period 1375 P, see Table I. Therefore, in both graphs the O-C differences could be represented by a horizontal abscissa. As follows from Fig. 2, the minima times by Bloomer et al. lend strong support to the suggested periodic

Table I

Photoelectric minima times of V382 Cyg

J.D.hel. 2400000+	m.e.	Epoch	$O-C_1$	$O-C_2$	$O-C_3$	Phase	Note
36814.77247	.001	0	-.0010	+.0022	+.0022	.000	1
38987.8298	.001	1152.5	+.0036	+.0036	+.0023	.838	1
40385.931	.003	1894	-.0024	-.0045	-.0066	.378	1
40386.87609	.0004	1894.5	-.0001	-.0022	-.0043	.378	1
40387.81731	.0011	1895	-.0016	-.0037	-.0058	.378	1
41129.76980	.00022	2288.5	+.0019	-.0013	-.0039	.664	1
42651.3844	.0014	3095.5	+.0082	+.0027	-.0007	.251	2
43366.9333		3475	+.0053	-.0023	-.0051	.36-.69	3
45598.4426	.0007	4658.5	+.0110	+.0011	-.0040	.388	4
46274.3971	.0020	5017	+.0094	-.0015	-.0070	.649	5
46325.3087	.0009	5044	+.0122	+.0012	-.0043	.668	5
46668.4782	.0006	5226	+.0185	+.0070	+.0013	.801	4

Notes: 1 - Landolt (1975); 2 - Mayer (1980); 3 - Bloomer et al. (1979), see text; 4 - this paper (Ondřejov); 5 - this paper (Sarajevo).

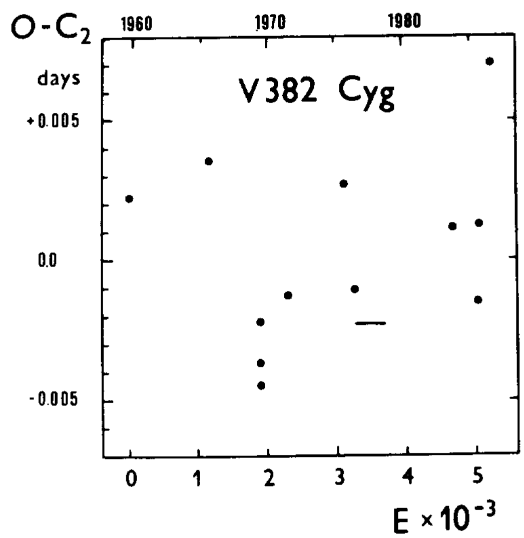

Figure 1. O-C differences for V382 Cyg according to ephemeris (2). The horizontal line marks the probable time interval and mean O-C for the minima times by Bloomer et al.

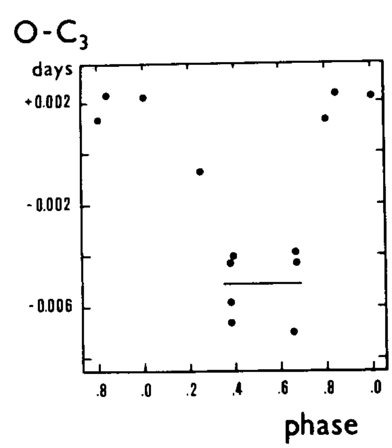

Figure 2. O-C differences for V382 Cyg according to ephemeris (3), phased with the period of 1375 P. The horizontal line marks the probable phase and mean O-C for the minima times by Bloomer et al.

term. In spite of this agreement, the number of measurements is rather low and the periodic term cannot be considered as proven at present.

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POSSIBLE METAL-POOR VARIABLE STARS

We have been observing high-velocity and metal-poor stars in the uvbyβ photometric system at the San Pedro Martir Observatory, Baja California, Mexico and at the European Southern Observatory, La Silla, Chile. To date more than 700 program stars have been observed. Five program stars and one intended standard star have shown some evidence of photometric variability. These are listed in Table I, where column 1 gives the HD or Giclas numbers of the stars. Columns 2, 4, 6, 8, and 10 give the average observed values for V, b-y, m_1, c_1 and Hβ, respectively; beneath each V value is given in parentheses the number of uvby observations and beneath the Hβ value the number of Hβ observations. In columns 3, 5, 7, 9 and 11 are given the internal rms errors of one observation; beneath each of these errors are found in parentheses the measured internal rms errors for non-variable standard or program stars from the same observing period.

In Table II we give additional information for these stars. Columns 2 and 3 contain other identifying numbers, column 4 spectral types from several sources, and columns 5 and 6 preliminary values for the metal abundances and effective temperatures of the stars. The metal abundances,[Fe/H] 's, follow from the calibrations of Ardeberg el al. (1983), Olsen (1984) and from a new calibration that we are deriving; the effective temperatures from the calibrations of Olsen (1984) and Saxner and Hammarbäck (1985).

Our observations alone do not show variability for HD 33449. However, our c_1 value is 0.036 magnitude larger than that given by Olsen (1983). This difference is more than three times the combined mean errors. We have taken much care to transform well our uvby data for the F and G-type dwarf and subdwarf stars onto Olsen's system.

HD 34328 shows definite variability in the V magnitude. Consecutive good photometric nights in October 1984 gave values differing by 0.092 mag., 9.522 and 9.430.

In Table I the uvby and Hβ observations of HD 47147 were not made during the same observing period; the uvby observations during May 1985 at the Danish 50 cm telescope and the Hβ observations during October 1984 at the Danish 1.5 m telescope. HD 47147 shows variability in V and in c_1; the two observations of Table I are V = 9.174 and 9.109 and c_1 = .739 and .807, respectively. A single previous observation in uvby at the 1.5 m telescope during October 1984 gave V = 9.128, b-y = .291, m_1 = .045 and c_1 = .775. HD 47147 may be either a metal-poor, slightly variable F-type giant star, or an RR Lyrae variable. In the latter case all three uvby observations were made at nearly the same phase. (For example, near minimum light the RR Lyrae variables of Siegel (1982) give colors similar to those of HD 47147).

TABLE I

Photometry of the Stars

HD	V	m.e.	b-y	m.e.	m_1	m.e.	c_1	m.e.	Hβ	m.e.
33449	8.488	.004	.423	.006	.201	.010	.273	.007	2.564	.005
	(4)	(.006)		(.003)		(.007)		(.008)	(3)	(.006)
34328	9.476	.060	.371	.012	.060	.006	.205	.003	2.567	.001
	(2)	(.006)		(.006)		(.009)		(.008)	(2)	(.006)
47147	9.142	.039	.286	.001	.051	.004	.771	.042	2.610	.016
	(2)	(.008)		(.005)		(.008)		(.007)	(2)	(.006)
197192	9.390	.047	.574	.012	.356	.006	.217	.007	--	--
	(4)	(.008)		(.005)		(.008)		(.007)	(0)	--
218396	5.960	.023	.188	.006	.137	.005	.689	.017	2.742	.004
	(21)	(.008)		(.005)		(.007)		(.007)	(32)	(.005)
G190-15	11.013	.026	.489	.026	.052	.020	.074	.009	2.536	.034
	(5)	(.008)		(.005)		(.007)		(.007)	(5)	(.008)

TABLE II

Additional Information

HD	DM	Other	Sp	[Fe/H]	T_{eff} (°K)
33449	$-7^{\circ}989$	LTT 2189	G0	- 0.35	5600
34328	$-59^{\circ}1024$	LTT 2211	F6VI,G5VI	- 2.00	5600
47147	$-45^{\circ}2613$		sdF WLE, A2/5 W	- 2.50:	6300:
197192	$-66^{\circ}2415$	LTT 8207	K3V-VI, K0V	- 0.90	4700
218396	$+20^{\circ}5278$	HR 8799	A5V,A5IV	- 0.55:	7100:
G190-15	$+38^{\circ}4955$	LTT 16828	sdG8,sdG3, sdF6	- 2.20	4800

The star HD 197192 is definitely variable in V with values ranging from 9.318 to 9.436. Smaller variations in b-y may be correlated, with brighter magnitudes corresponding to bluer colors.

HD 218396 was selected to be used as a photometric standard star, but showed both negative and positive transformation residuals, some as large as 0.05 in V and as large as 0.03 in c_1. Also, the variations in V and c_1 are correlated, brighter magnitudes corresponding to larger values for c_1. HD 218396 is interesting as a candidate for being a slightly metal-poor, low amplitude δ Sct star, with approximate amplitudes of 0.08 in V and 0.05 in c_1.

The variations of G190-15 are not understood and may possibly be due to atmospheric or instrumental effects. Four uvbyβ observations in July 1985 showed good agreement. One observation the night of October 23/24, 1985 indicates variability with significant changes in y and in Hβ . Also, using 20 second integrations rapid variations of about 8% in y and 2% in b were measured over a period of two minutes during this October observation; in contrast the u and v measures remained nearly constant. Since we normally monitor only the u counts, these variations were not noticed until later. Most perplexing, four "sky" measures, two approximately 1' north of the star and two approximately 1' south-south-east, showed rapid variations in y and to a lesser degree in b but not in u and v. These observations were made with a simultaneous six-channel uvbyβ photometer using a 20" diaphragm. The sky was clear of clouds, and the moon, four days before full, was approximately 50° from G190-15. This star shows no nebulosity on the Palomar prints, and no other star before or since has shown a similar behavior.

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PHOTOMETRIC STUDIES OF THE ECLIPSING VARIABLE V 368 Cas

The eclipsing binary star V 368 Cas (BD+59°0607=HD 19644)was photoelectrically observed during 1980 to 1982 in BV and during 1983 in UBVR with the 0.5-m telescope of Ural University Observatory. The spectral type is B_3 III according to GCVS III. There were obtained 520 photometric measurements in BV and 80 ones in UR with root mean square errors $\pm 0^m.016$;$\pm 0^m.008$;$\pm 0^m.008$; $\pm 0^m.009$ for UBVR accordingly. BD+58°0567 was used as comparison star. The observations were published by Polushina (1984), and yielded four times of minima, which are given in Table I. Using the above new photoelectric minima together with the photographic minimum given by Strohmeier (1959), the new ephemeris has been derived as follows :

$$JD_o\,I\ min = 244\ 5435.3089 + 4^d.4516321 \cdot E.$$

The observations are illustrated in Figure 1.

Table I

V 368 Cas times of minima

JD(hel) 244 5000+	filter	min	$(O-C)_{GCVS}$
326.2437	B,V	II	$-0^d.0442$
386.3409	B,V	I	-0.0442
386.3407	U,R	I	-0.0444
435.3089	U,B,V,R	I	-0.0443

Each light curve has been considered as an independent source of information. The Russell-Merill method was used for calculation. Least-squares solutions were made for the light at the maxima according to the formula

$$l = A_o + A_1 Cos\theta + A_2 Cos2\theta.$$

Fourier coefficients as well as the number of points outside the eclipse are given in Table II. The solution was obtained in a completely automatized manner with Layroy's computer program (1982) for "Nairi-K" computer. Because of the small number of U,R observations in minima, B,V light curves were used for calculate the photometric elements. The main variable parameters for the solution are the orbital inclination angle i, the unperturbed

Table II

Fourier coefficients for the light curves at the maxima

	U	B	V	R
A_o	0.9505	0.9629	0.9566	0.9358
	±48	±5	±5	±32
A_1	−0.0476	−0.0515	−0.0550	−0.0613
	±53	±7	±6	±35
A_2	−0.0077	−0.0120	−0.0134	−0.0188
	±62	±9	±7	±41
n	36	364	364	36

relative radius of the less component r_2, the ratio of the unperturbed radii $k=r_2/r_1$. A circular orbit has been adopted. Photometric elements together with corresponding errors are listed in Table III. According to value p eclipse in the system is partial. The theoretical light curve in V is illustrated in Figure 1 with the aid of a solid line. The agreement between the theoretical light curve and observations seems to be very good. There is, however, a discrepancy with orbital elements published by Cristescu et al. (1984).

Table III

Photometric elements of V 368 Cas

	V	B		V	B
i	77°.9	78°.8	a_2	0.262	0.247
	±1.0	±1.0		±30	±44
k	0.924	0.873	b_2	0.254	0.241
	±75	±55			
a_1	0.283	0.283	L_1	0.816	0.864
				±25	±15
b_1	0.275	0.276	x_1	0.35	0.17
				±.27	±.26
c_1	0.269	0.271	x_2	0.53	0.27
				±.30	±.44
p	−0.317	−0.302			

The spectral type A1 for the cooler component follows from the ratio of surface brightnesses. Effective temperatures by Popper (1980) were used. The star is greater in size for its spectral type, i.e. it is obvious that it has already evolved. In fact V 368 Cas evolved through mass exchange.

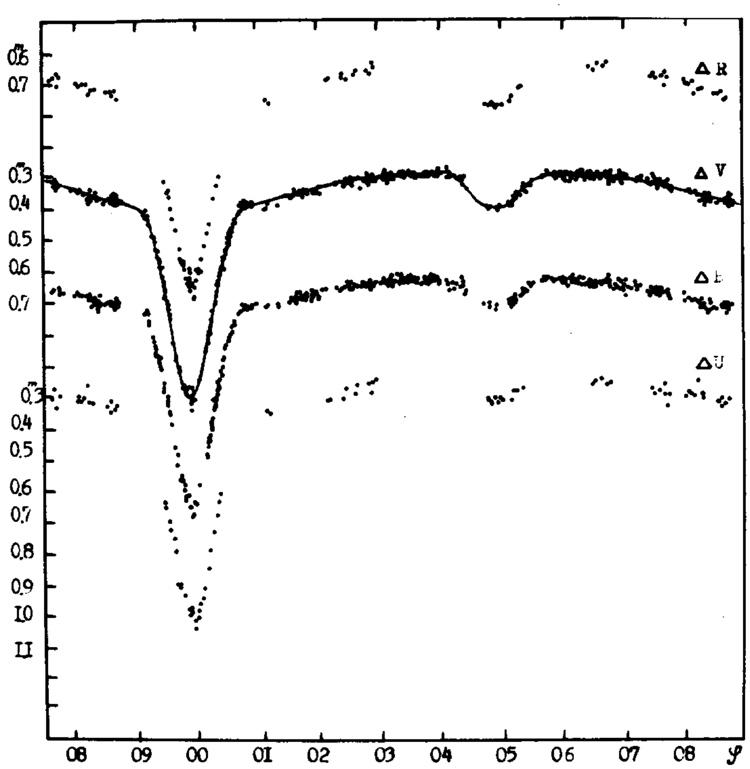

Figure 1. Light curves of V 368 Cas

Assuming an A-star filling its Roche-lobe, it was possible to estimate the absolute parameters of the orbit. We have obtained these for mass ratio q=0.24, using the empirical spectral type-mass and mass-radius relations for main sequence stars by Svechnikov et al. (1984 a,b):

$$R_B = 6.4R_\odot; \quad M_B = 6.7M_\odot$$

$$R_A = 5.7R_\odot; \quad M_A = 1.7M_\odot$$

$$A = 23.04R_\odot$$

Acknowledgements. Thanks are due to Dr. M.I. Lavrov for the aid in the practical use of his program, and to M.A. Svechnikov for useful suggestions and constructive comments.

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THE LUMINOSITY OF THE ECLIPSING BINARY HV12714 AND ITS MEMBERSHIP IN THE LMC

The 13th magnitude eclipsing system HV12714 has been previously studied by Gaposhkin (1972). In Table 10 of his study the system was assigned an absolute photographic magnitude of -5.0 which puts it at the same distance as the LMC, and suggests membership in that system. It is important to confirm these results since they imply that HV12714 is one of the most luminous eclipsing systems known, and further detailed investigation would be warranted. In what follows the intrinsic brightness of HV12714 is investigated using spectral classification.

If HV12714 is indeed a member of the LMC, and hence intrinsically luminous, then both the 1.4 day period and the lack of interaction effects in the light curve preclude a system with significantly evolved components. The absolute V magnitude calibration of Humphreys and McElroy (1984) for luminosity class V then indicates that the primary would be an O star. On the other hand, if HV12714 were a Galactic foreground system it would be substantially closer than the LMC so its intrinsic luminosity would be correspondingly lower. Therefore, unless the primary was a subdwarf, its spectral type would be later than O or early B despite the fact that the evolutionary status of the components could not be accurately deduced from the light curve in this case.

A classification spectrum of HV12714 was obtained on Dec. 19, 1985 with the '2-D Frutti' detector on the 1.0 metre telescope at CTIO. The spectrum shows strong Balmer lines and prominent Ca K absorption. A large Balmer discontinuity is also seen. Comparison with standards observed on the night of observation along with those of Jacoby et. al. (1984) indicate that the spectrum of HV12714 is that of an early A dwarf. The absolute B magnitude of such a star would be approximately +1.0 (Allen 1973). Therefore the luminosity given by Gaposhkin (1972) appears to be in error and the system seems not to be a member of the LMC.

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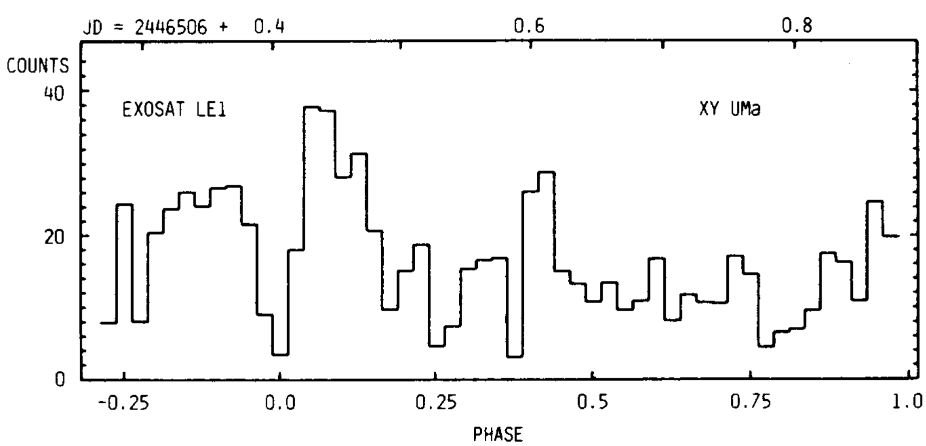
THE X-RAY LIGHT CURVE OF XY URSAE MAJORIS

XY UMa is a short period (P = 0.48d) active late-type (G2-G5 + K5) detached eclipsing binary system, in which the hotter star appears to be the active component (Geyer 1980). We expected such a system to be a source of coronal X-ray emission, and this expectation was supported by the strength of the chromospheric ultraviolet emission lines (Budding, Kadouri and Gimenez 1982). Observations with the EXOSAT X-ray observatory were made continuously through 1.25 orbital cycles during 1986 March 16/17. We present here the soft X-ray light curve, obtained with the LE CMA instrument through the thick Lexan filter, which has a



response over the energy band 0.04-2 keV (6-300 Å). The phase is calculated from the ephemeris of Geyer (1977)

$$HJD = 2435216.5011 + 0.4789944E$$

and the signal is in units of photon counts per time bin of 1035s (40 bins = 1 orbital period).

It is seen that XY UMa shows considerable and complex variability in its X-ray emission over the orbital cycle, with evidence of a primary eclipse but absence of a secondary eclipse, as well as flaring activity. A full analysis of the X-ray light curve is in progress and will be published elsewhere.

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NEW DATA ON V503 SAGITTARII

The Lowell Observatory investigators commented concerning the newly-discovered proper-motion star G154-12 (μ = 0".32/yr, m_p = 15.2, color class +4) that "the motion is somewhat uncertain, since the object assumed to be the first-epoch image is 1.5 magnitudes fainter than the second-epoch images." One of us (W.P.B.) has recently noted that the position of this object is nearly identical with that of the apparently unstudied variable V503 Sgr discovered by Shajn in 1933. She found it to be visible on only 6 out of 23 plates, with a magnitude ranging from 13.3 to below 14.6 pg.

During the course of discussion on this object, H.L.G. offered to try to improve the proper-motion determination by obtaining a third-epoch plate with an added 23 year epoch. Comparing a plate of G154-12 taken on September 5, 1986 with the first-epoch plate of June 1931, the brightness of the variable was very similar on the two plates; but the proper motion, under these more comparable conditions, was found to be only about one-third as large. The published admonition that the motion originally found was "somewhat uncertain" is correct; and it was probably due to the fact that the star was 1.5 magnitudes brighter on the second-epoch plates, and being so excessively red, a large portion of the motion found was due to a radial color-magnitude displacement.

On a Burrell Schmidt infrared objective-prism plate the spectral type appears to be M3 or M4.

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POSSIBLE OPTICAL COUNTERPART TO THE GRBS 1979 MARCH 25B (1810+31)

A preliminary evaluation of the data obtained by checking 1733 plates from the Sonneberg Observatory collection (Central Institute for Astrophysics of the Academy of Sciences of the GDR) has revealed a possible optical counterpart to the gamma ray burst source (GRBS) 1979 March 25b. The data represents about 1807 hours (nearly 0.2 year) of cumulative exposure.

The object was detected on 3 different plates at the same position. The preliminary coordinates are RA = 18 h 09 m 27 $\pm$ 3 s, d = + 31^o 23.0$'\pm$ 0.5$'$ (1950.0). The plates were taken on 1946 March 27, 1946 August 31 and 1954 April 27. In all three cases, the images of the object exhibit structure somewhat different from those of stars, indicating short flash as a possible explanation of these images. The position of the object is closely outside (about 6.5 arcmin away from the centre) the error box given by Laros et al. (1985).

Preliminary estimated blue magnitudes for 1 sec optical flash lie in the range 4 - 7, resulting in possible gamma ray to optical fluency ratios E_{γ}/E_0 of order 10^2 to 10^3.

The position of the object proved to be empty on the POSS prints indicating enormous amplitude of brightening and, consequently, eliminating the possibility that the object is a classical variable star.

As the object appears on 3 independent plates at the same position, its reality seems to be considerably more certain than the reality of images found previously by other authors on only one plate. Nevertheless, great variety of properties of photographic emulsion being taken into account, we cannot yet be absolutely sure that the images detected indeed represent the true optical counterparts to GRBS.

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DETECTION OF A SATELLITE LINE SYSTEM IN HIGH-DISPERSION SPECTRA OF THE BETA LYRAE TYPE BINARY HD72754

During a spectroscopic research on peculiar binaries carried out in February 1986 with the ESO 1.5m-telescope equipped with the Coudé-spectrograph the ß Lyrae type object HD72754 = FY Vel (B2I:pe; $08^h29^m24^s$, $-49^o16'$; 1900) was observed twice with a dispersion of 12A/mm in the spectral range 3650A $\leq \lambda \leq$ 5050A (baked IIaO-emulsion). The two spectra were obtained at JD2,446,467.68 and JD2,446,468.60 corresponding to orbital phases ϕ = 0.56 (spectrum Nº 1) and ϕ = 0.59 (spectrum Nº 2), respectively. The reductions were carried out at Astronet pole in Trieste, Italy, using a PDS microdensitometer and ELSPEC software package (Pasian, Rusconi and Sedmak, 1982). The RMS errors resulting from calibration are 2% in exposure and 0.01A in wavelength values. The wavelengths were reduced to a heliocentric scale.

Both spectra clearly show the Balmer series in absorption from H8 up to H28, while Hδ, Hγ, and Hß display broad emissions superposed by a central absorption. In addition, the lines H8 up to H28 as well as the HeI-singlet lines $\lambda\lambda$ 3926, 3965, 4009, 4143, 4388, 4438, 4922, 5016 exhibit red- as well as blue-shifted satellite lines which are much more pronounced at orbital phase ϕ = 0.56 than at ϕ = 0.59; the same is true at least for CaIIK, while CaIIH is not completely separated from Hε. In Fig. 1 the profiles of the lines H15, H9 and HeI(51)λ4388 taken from spectrum Nº 1) are plotted as an example.

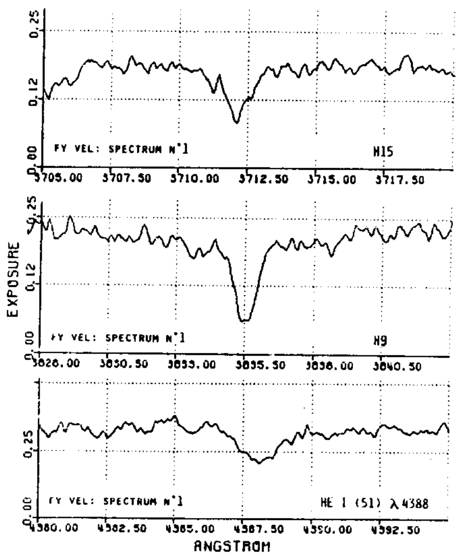

Figure 1

Especially at orbital phase $\phi = 0.56$, i.e., close to secondary minimum, part of the HeI-lines mentioned above seem to display even more satellite lines (complex multifolded structure of the profiles); as an example, Fig. 2 shows the region around HeI(50) λ 4438 for both spectra; note that this feature has considerably changed from $\phi = 0.56$ to $\phi = 0.59$, a fact which was also observed for some other lines.

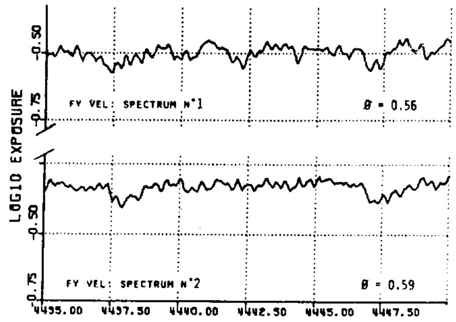

Figure 2

This satellite line phenomenon seems worth while being compared to β Lyrae, which is similar to HD72754 in several respects (Thackeray, 1971), red-shifted satellite lines being observed shortly before and blue-shifted satellites shortly after primary eclipse.

The mean velocity-displacements of the line systems are given in Table 1 (no account has been made for the γ-velocity of the system).

Table 1: Mean Velocity-Displacements of the Line Systems

Spectrum Nº 1:

Blue-shifted satellite line : $\bar{v} = (-\ 67 \pm 17)$km/sec

Central component : $\bar{v} = (+\ 7 \pm 5)$km/sec

Red-shifted satellite line : $\bar{v} = (+\ 80 \pm 27)$km/sec

Spectrum Nº 2:

Blue-shifted satellite line : $\bar{v} = (-\ 58 \pm 11)$km/sec

Central component : $\bar{v} = (+\ 22 \pm 6)$km/sec

Red-shifted component : $\bar{v} = (+121 \pm 20)$km/sec

The mean velocity of the central component increasing from orbital phase $\phi = 0.56$ to $\phi = 0.59$ is well in agreement with attributing this component (also being the strongest) to the primary.

The satellite lines then might be due to gaseous streams moving from one component to the following side of the other one.

It should be mentioned that at least part of the central absorption components mentioned above appear to be doubled or even multiple features.

Other features clearly identified are the HeI-doublet lines $\lambda\lambda$4026, 4421, 4471, 4713 as well as the MgIIλ4481-doublet, and also some NII- and SiII-lines are seen, they all exhibiting complex multiple-structure profiles.

Also two red spectra of HD72754 with a dispersion of 20A/mm have been obtained; analysis is still in progress, and results will be published later. High-resolution spectroscopy covering a whole cycle in well spaced intervals will be necessary to derive a detailed model of this interesting system.

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VARIABILITY OF Be STARS

Around 30 Be stars were monitored through red and near infra-red photometry during the observing season 1982-83 and we had noticed that the stars, HR 1508, HR 1789, HR 2538, HR 2996, HR 5193 and HD 45677 showed significant brightness fluctuations when compared with the earlier published data.

All programme stars including standard stars were observed with the standard RI passbands of the Johnson's system with a 20-seconds of arc diaphragm for 4 nights. A photoelectric photometer attached to the 1.2 meter reflecting telescope of the Japal-Rangapur Observatory, Hyderabad, India was used for the observations. A dry-ice cooled EMI 9558B photomultiplier tube was used as the detector and the photocurrent was recorded by means of a GR 1230A - DC amplifier and a Honey-Well Brown chart recorder.

The extinction coefficients for R and (R-I) were determined from the observation of standard stars, taken from the list given by Johnson (1966), and also from the observations of an early and a late spectral type star on each night and all the observations were corrected for atmospheric extinction. The instrumental magnitudes of a programme star were transformed to the standard system through normal procedure. Table I lists the observations of the above mentioned six stars and the columns are self-explanatory. The mean internal probable error of a single measurement in R and (R-I) is $\pm 0\overset{m}{.}02$ and $\pm 0\overset{m}{.}03$ respectively.

A few of the programme stars were observed earlier by Johnson (1965, 1966), Mendoza (1958) and Feinstein and Marraco (1979) on the standard RI system. The variable nature of HR 1508, HR 1789, HR 2538, HR 2996, HR 5193 and HD 45677 is shown in the figure. A detailed version of this paper will be published elsewhere.

Figure 1 - 4 Variability of Be Stars. Red magnitudes (Filled Circles), Infra-Red Magnitudes (Filled Triangles).

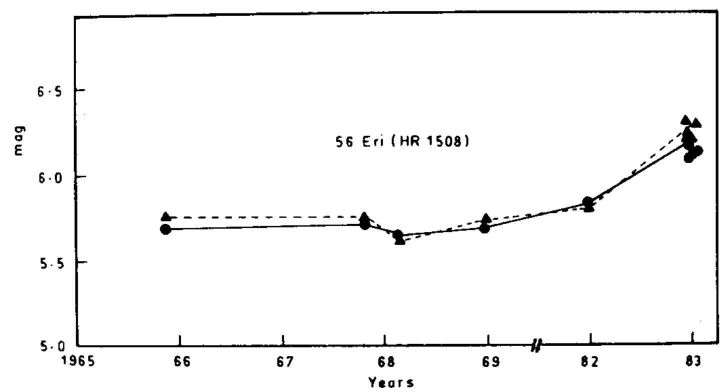

Figure 1

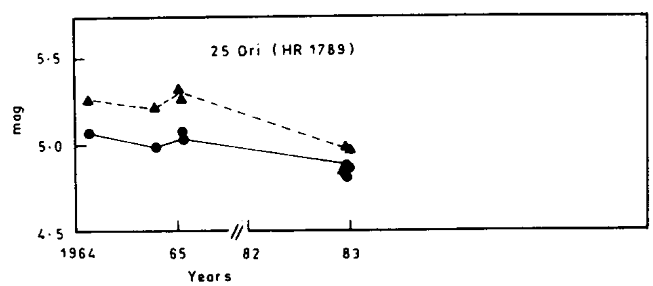

Figure 2

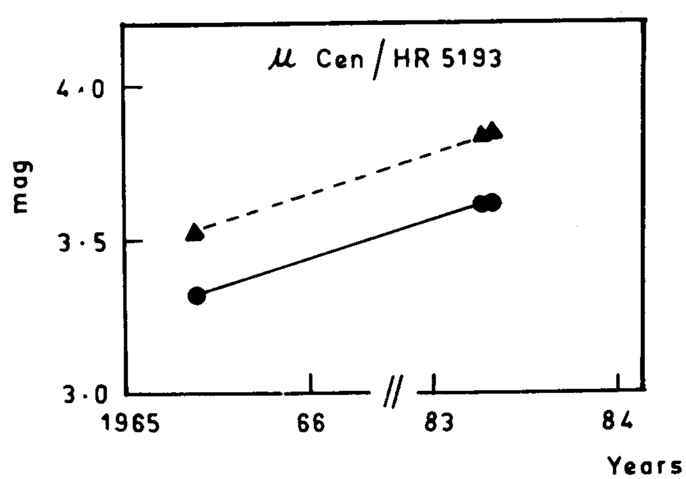

Figure 3

HR 1508 : This star suddenly became fainter by about $0\overset{m}{.}5$ in both R, I passbands even though it had maintained constant level of brightness since 1965 to early 1982.

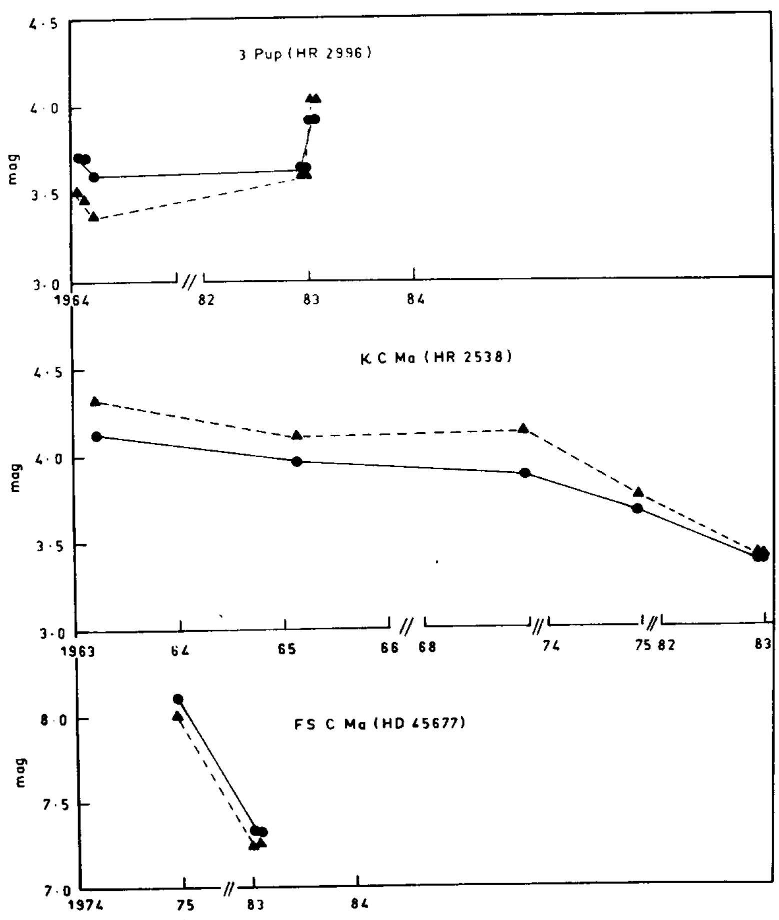

Figure 4

HR 1789 : Present observations show that this star is brighter in both R, I passbands but the brightness increase is much more predominent in I passband.

HR 2538 : The present data indicates that the star is brighter by almost $0\overset{m}{.}7$ in both R, I compared to that of 1963 observations. Dachs et al. (1986) showed that the star brightened by almost $0\overset{m}{.}5$ in V passband and its color index (B-V) increased from -0.23 to -0.09 during the period 1965-83.

HR 2996 : This star became fainter in both R,I passbands in the early part of 1983 eventhough it had maintained constant level of brightness from 1964 until late 1982.

Table I

Star	Sp.type	Heliocentric Date of observation (J.D. 2440000 +)	R	(R-I)
56 Eri HR 1508	B2Ve	5315.1876	6.19	-0.13
		5315.1883	6.17	-0.11
		5324.3049	6.10	-0.13
		5324.3056	6.11	-0.13
		5356.2545	6.13	-0.16
		5356.2552	6.13	-0.16
25 Ori HR 1789 HD 35439	B1VPe	5315.2984	4.81	-0.03
		5315.2991	4.81	-0.03
		5324.3155	4.88	-0.09
		5324.3160	4.88	-0.08
Kappa CMa HR 2538 HD 50013	B1.5 IVne	5324.4195	3.44	+0.02
		5324.4202	3.44	+0.02
3 Pup HR 2996 HD 62623	A3q	5324.4262	3.68	+0.08
		5324.4269	3.68	+0.09
		5356.3815	3.92	-0.11
		5356.3820	3.92	-0.11
μ Cen HR 5193 HD 120324	B2 IV-Ve	5437.3450	3.63	-0.22
		5437.3455	3.63	-0.22
FS CMa HD 45677	B3q	5356.3264	7.33	+0.08
		5356.3270	7.34	+0.07

HR 5193 : Both R,I magnitudes are fainter than that of early 1965 observations by about $0^m.3$.

HD 45677 : The present observations show an increase in brightness by about $0^m.8$ in both R,I passbands when compared with 1975 observations.

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LARGE AMPLITUDE SPOT VARIATIONS ON II Peg

II Peg (= HD224085 = SAO091578) is a member of the RS CVn class of binaries (spotted late-type giants and subgiants). Its optical light curve exhibits a wave of variable amplitude and phase with an underlying period of about 6.72 days. It is a single-line spectroscopic binary, the companion to which has not been hitherto detected. This latter fact makes it a relatively simple system to analyse since one does not have the complication of two spotted stars as in many other systems.

One of the many difficulies in trying to model the spot distributions in RS CVn's is the question of what are their unspotted magnitudes. The maximum of II Peg's light curve (the time when the visible hemisphere is least spotted) has been observed to vary over the last decade between V = 7.34 in 1976 (Rucinski 1977) and V = 7.49 in 1980 (Poe and Eaton 1980). Earlier observations by Chugainov (1976) indicated a light curve maximum of V = 7.18 in 1974. This value for the unspotted magnitude is in conflict with the results of an archival plate survey carried out by Hartmann, Londono and Phillips (1978) which indicated that II Peg was constant (and therefore presumably unspotted) between 1900 and 1940 at a magnitude no brighter than V = 7.3. Chugainov does not identify his local comparison stars and so it is impossible to determine from his published results whether a zero-point error occurred. It seems probable therefore, on the basis of the evidence to hand, that II Peg has never been observed to have a light curve maximum much brighter than V = 7.3. The largest amplitude variations of II Peg yet observed are those reported by Chugainov (1976) and Vogt (1981) *viz.* V = 0.33.

The purpose of this Bulletin is to draw attention to the fact that, during September 1986, II Peg had a larger amplitude than any reported previously and a brighter maximum

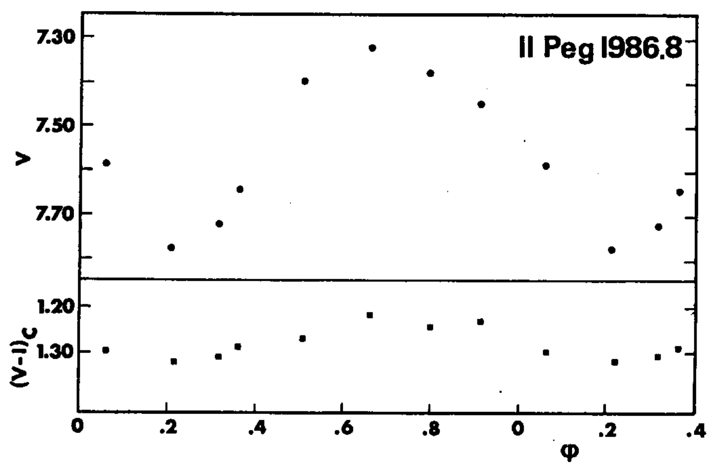

Figure 1

than any previously reported with the exception of the Chugainov data. II Peg was observed with the St. Andrews Photometer on the 1m telescope at the South African Astronomical Observatory's station at Sutherland over a 2-week interval from 9th to 22nd September 1986. Magnitudes were determined on the $UBV(RI)_C$ system by reference to Cousin's E-region standard stars (Menzies, Banfield and Lang 1980) and differentially with respect to a local comparison star C1 = DM+28^{o}4667 (Byrne <u>et al</u> 1983). The mean magnitude and colours derived for C1 were V = 8.245+0.005, (B-V) = +1.281+0.002, (U-B) = +1.356+0.020, $(V-R)_C$ = +0.659+0.006, $(V-I)_C$ = +1.249+0.006. Figure 1 gives a plot of the V and $(V-I)_C$ light curves for II Peg differenced with respect to C1 and phased according to the ephemeris of Rucinsky (1977) i.e. JD = 2443033.10 + 6.724183 E.

The following points should be noted from the light curve. First, as remarked above, the amplitudes in both V magnitude and $(V-I)_C$ colour are probably the largest yet observed *viz.* V = 0.45 and $(V-I)_C = 0.10$. Second, the mean magnitude (V = 7.55) is not very different from that observed in the interval 1977-84 (Poe and Eaton 1985, Rodono' et al 1986 and Arevalo, Lazaro and Fuensalida 1985). Third, the mean $(V-I)_C$ is redder than observed previously *viz.* +1.27. Lastly, V_{max} and V_{min} are respectively brighter and fainter than previously observed, except for the observations of Chugainov (1976).

From the first and fourth points above it can be concluded that the degree of asymmetry in the spot distribution and, as a result, the temperature contrast between the two hemispheres of II Peg, is greater than ever observed previously. Yet from the second point the overall degree of spottedness is not markedly greater than it has been in recent years. It seems quite possible therefore that the two major spot activity groups discussed by other authors have moved close to the same stellar longitude, perhaps as a result of differential rotation. This interpretation means that the current light maximum of II Peg may correspond to a surface as free of spots as it has been possible to observe during the last decade. Furthermore the large amplitude of the variation in both magnitude and colour yields a hitherto unique opportunity to determine the size and temperature of the spots photometrically. Similarly spectroscopic observations taken at opposite phases of the variation should enable spectra to be obtained which are representative of the (relatively) spot-free and almost-fully-spotted surfaces of the star respectively.

In view of this unusual configuration and its probable temporary nature I would therefore appeal to optical and IR photometrists and spectroscopists to observe the star on as many nights as possible during the rest of the current season in order to determine its main characteristics. It will also be of the very greatest interest to track the evolution of this unusual state. For instance, will the proposed two major spot groups be seen to separate on the optical light curve and, if so at what rate?

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THE ROTATIONAL VELOCITY AND MASS RATIO OF 5 CETI

Five Ceti (HR 14=HD 352) is a single-lined spectroscopic binary containing a K giant (Christie 1933). In spite of its 96-day period, Lines and Hall (1981) have found it to be an ellipsoidal variable, possibly with shallow eclipses. Superficially, the light curve resembles that of the W UMa-type contact binary AW Ursae Majoris (Paczyński 1964). The similarity must be only apparent, however, for if the mass ratio of 5 Cet were small enough for it to be a completely eclipsing contact system, its long period and large radial velocity variations (K = 24.3 km/s; Beavers and Salzer 1985) would give it a prohibitively large total mass. Nevertheless, the light curve indicates that the K giant must be filling or nearly filling its Roche lobe. Ultraviolet spectra show a somewhat warmer component (~ spectral type F) with rather broad lines. For a better understanding of the nature of this hot component, we will need to know the stars' masses, hence the mass ratio of the system.

Since the optical light curves appear to be produced by a contact binary of low mass ratio, most of their amplitude must be due to <u>ellipsoidal</u> variation, and it is possible that the system does not even eclipse. Thus the light curves provide only poorly defined limits on the mass ratio ($q = M_2/M_{gK}$) and orbital inclination, although they seem to require the K star nearly to fill its Roche lobe. However it is possible to restrict the value of q by comparing the <u>rotational</u> velocity of the K giant with its <u>orbital</u> velocity, provided this star <u>is</u> nearly in contact with its Roche lobe.

Table 1

HIGH-DISPERSION SPECTRA OF 5 CETI

DATE	EPOCH $JD_{\odot}$-2440000	PHASE*	RADIAL VELOCITY (km/s)
20 Sep 1984	5963.8780	18.54	9.4 ± 0.3
8 Oct 1984	5981.9042	18.73	24.0 ± 0.8
19 Nov 1984	6023.7171	19.16	-21.0 ± 0.3

* Phases are on the ephemeris of Lines and Hall (1981).

As part of a comprehensive study using ultraviolet observations to analyze the hot companion, we have obtained three spectra of 5 Cet at high dispersion with the coudé feed telescope at Kitt Peak National Observatory (operated by AURA, Inc., under contract with the NSF). Epochs of the observations and results are given in Table 1. The first two observations were obtained by Barden during programs to study line profiles of active late-type stars. The third spectrum was obtained for us by Darryl Willmarth on a Kitt Peak request night at roughly twice the resolution of the other two observations. In addition, a wavelength calibration source was observed with this same instrumental setup, as were spectra of the K giant stars HD 8949 (K1 III), ε Tau (K0 III), and α Tau (K5 III), chosen as rotational velocity standards. These stars should be excellent standards for slow rotation, since all single K giants are expected to have Vsini less than a few km/s (Gray 1982). In fact, we have found accurate rotational velocities for two of these stars in the literature ε Tau (Vsini = 3.0 km/s; Baliunas, Hartmann, and Dupree 1983) and α Tau (Vsini = 2.7 km/s; Smith and Dominy 1979). The spectrum of 5 Cet has lines decidedly broader than those of the slowly rotating comparison stars. In addition, the strength of metallic lines in the Hα region is consistent with a spectral type in the range K2-K4. Absorption lines in 5 Cet are decidedly stronger than in HD 6734 (K0 III) but are weaker than in α Tau (K5 III).

The three spectra of 5 Cet were analyzed by Barden with standard computer programs developed to fit the spectra of binary stars with combinations of spectra of single stars (e.g., Barden 1984). The resulting rotational velocity is 22 ± 3 km/s; the derived radial velocities agree well with the velocity curve of Beavers and Salzer (1985).

For a star in contact with its Roche lobe, the radius in terms of orbital separation varies as $1/(1+q^{0.5})$ while the radius of its orbit about the center of mass goes as $q/(1+q)$. This gives a relation between Vsini and K of the form

$$V\sin i/K = Cq^{-1}\{(1+q)/(1+q^{0.5})\} \quad (1)$$

where C is at worst a slowly varying function of q and orbital phase. We note that J. S. Gallagher (1984; private communication) has previously used this reasoning to measure mass ratios of cataclysmic variables. The term C is a complicating factor, since the stars are severely distorted tidally, and we have evaluated it in the following manner.

We can define an effective radius for the star r_{eff} and and a constant C_1 such that

$$C_1 = \sum(x/R)\delta L/\sum\delta L = r_{eff}/R_1. \quad (2)$$

Here, x is the orthogonal distance on the plane of the sky from the star's rotation axis to a point on its surface, and R is its maximum projected radius. But for a synchronously rotating component of a binary system we likewise have

$$C_2 = \sum(x/a)\delta L/\sum\delta L = r_{eff}/(a_1+a_2). \quad (3)$$

where the a's are the semi-major axes. Thus

$$C_2/C_1 = R_1/(a_1+a_2) = qR_1/\{a_1(1+q)\} \quad (4)$$

Since $R_1 \sim V\sin i$ while $a_1 \sim K_1$,

$$\frac{V\sin i}{K} = \frac{1+q}{q}\,\frac{C_2}{C_1}. \quad (5)$$

C_1 can be evaluated analytically for spherical stars and numerically for rapidly rotating stars. For an undarkened circular disk $C_1 = 0.42$, while if the limb-darkening coefficient is x=0.6, $C_1 = 0.37$. For synchronously rotating members of contact binary systems seen at conjunction, we find $C_1 \approx 0.40$. Thus we will adopt $C_1 = 0.40 \pm 0.02$. C_2 has been calculated for a contact component of a binary seen at phase 0.16. The resulting values of C_2 and Vsini/K are listed in Table 2. They correspond to C = 0.78 in Eq. (1).

Table 2
Vsini/K vs. q FOR A CONTACT COMPONENT

q	C_2	Vsini/K
1.2	0.150	0.69
1.0	0.156	0.78
0.833	0.163	0.90
0.71	0.168	1.01
0.625	0.173	1.13
0.50	0.183	1.37

The best values of Vsini and K available thus give Vsini/K = 0.91 ± 0.13. This corresponds to the mass ratio $q = M_2/M_{gK} \leq 0.82 \pm 0.14$. The inequality derives from the possibility that Star 1 might not actually fill its Roche lobe, in which case our procedure would overestimate q.

These values of K and q lead to plausible masses for the two components only if the inclination is relatively low. The mean radial velocity of 5 Cet is small, suggesting that the system is not a high velocity star of low metallicity and extreme age. Thus the mass of the more evolved component, conceivably the K giant, should be about 1.0 $M_\odot$ or greater. We achieve this with $i < 70°$. Such a small inclination is also consistent with the amount of ellipsoidal distortion of the light curve, provided the K giant is in contact with its Roche lobe.

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PHOTOELECTRIC PHOTOMETRY OF UZ Dra

The period of the eclipsing binary UZ Dra= BD+68° 1065 was investigated by Dugan and Wright(1939), Koch and Koch(1962), and Dueball(1964). UZ Dra is being observed spectroscopically by Lacy(1984) who suggested us to observe it photoelectrically. The system has been observed at the Ege University Observatory on 35 nights during the summer seasons of 1984 and 1985. This is going to be the first photoelectric light curve since it is neglected photometrically. The observations were made with the 48 cm Cassegrain reflector equipped with an unrefrigerated EMI 9781A photomultiplier tube and Johnson's standard B,V filters. A total of 522 and 515 individual points were obtained in B and V colours, respectively. The comparison star, BD +68° 1061 showed no significant variations against the check star, BD +68° 1066. The atmospheric extinction coefficients in each colour for every night were calculated from the observations of the comparison star using conventional methods. Then, all the differential observations (variable minus comparison) were corrected for differential extinction.

Primary and secondary times of minima have been obtained three times of each. They are given in Table I. The other times of minima which can be found in literature are also included. The O-C residuals in the Table were calculated with the following light elements:

$$JD\ Hel\ Min\ I = 2446227.4238 + 3.^{d}2613024.E.$$

Table I. Times of minima of UZ Dra.

JD Hel.	Min	Method	E	(O-C)	Ref.
2433570.300	I	vis	-3881	-0.009	1
751.325	II	vis	-3825.5	0.014	1
759.468	I	vis	-3823	0.003	1
34121.466	I	vis	-3712	-0.003	2
134.512	I	vis	-3708	-0.003	2
152.456	II	vis	-3702.5	0.004	2
439.443	II	vis	-3614.5	-0.003	2
488.358	II	vis	-3599.5	-0.008	2
530.751	II	pg	-3586.5	-0.012	3
35380.337	I	vis	-3326	0.005	4
551.552	II	vis	-3273.5	0.002	4
36231.531	I	vis	-3065	-0.001	5
859.334	II	vis	-2872.5	0.001	5
40363.607	I	vis	-1798	0.005	6
376.650	I	vis	-1794	0.003	6
513.632	I	vis	-1752	0.010	6
557.650	II	vis	-1738.5	0.000	6
41570.2834	I	pe(B)	-1428	-0.0006	7
570.2829	I	pe(V)	-1428	-0.0011	7
44461.428	II	vis	-541.5	-0.001	8
510.353	II	vis	-526.5	0.005	9
854.406	I	vis	-421	-0.009	10
929.428	I	pe	-398	0.003	11
45172.399	II	vis	-323.5	0.006	12
534.398	II	vis	-212.5	0.001	13
718.660	I	vis	-156	-0.001	14
821.379	II	vis	-124.5	-0.013	15
878.4650	I	pe(B)	-107	0.0006	16
878.4643	I	pe(V)	-107	-0.0001	16
914.3391	I	pe(B,V)	-96	0.0003	16
958.3660	II	pe(B,V)	-82.5	-0.0004	16
971.4105	II	pe(B,V)	-78.5	-0.0011	16
46191.550	I	vis	-11	0.001	17
227.4238	I	pe(B,V)	0	0.0000	16
245.3608	II	pe(B)	5.5	-0.0002	16
245.3601	II	pe(V)	5.5	-0.0009	16
271.437	II	vis	13.5	-0.014	17

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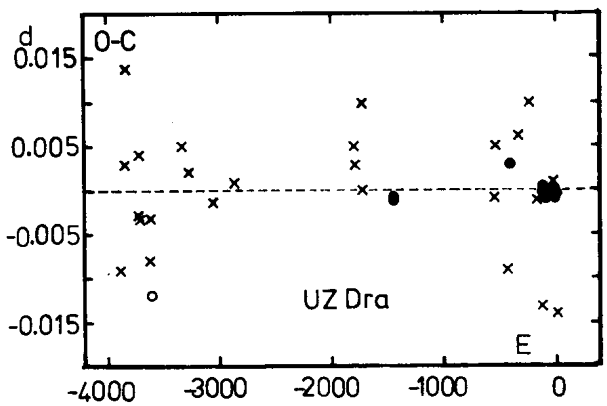

Figure 1 : O-C diagram of UZ Dra. The dots, circles and crosses denote photoelectric, photographic and visual observations, respectively.

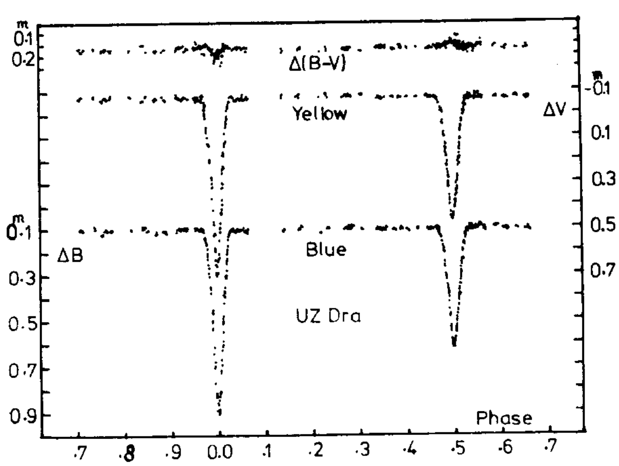

Figure 2 : The light and colour curves of UZ Dra.

The period is taken from GCVS(1969,1985) which seems to fit observations fairly good. Therefore, we didn't attempt to improve it. Also the existing photoelectric times of minima are inadequate for such an attempt. Moreover, the better fit is obtained with the above new epoch which we beleive more accurate one in our times of minima. The O-C diagram is shown in Figure 1.

The light and colour curves of UZ Dra are shown in Figure 2 where the phases have been calculated with the above light elements. The shape of the light curve is typical of Algol type. The observed duration of eclipses are about $D = 4^h40^m$ *which is interestingly short for this period. The amplitudes are about* $0^m.795$ *and* $0^m.765$ *at the primary,* $0^m.515$ *and* $0^m.530$ *at the secondary minimum in blue and yellow light, respectively. The system is slightly redder at the primary and bluer at the secondary minimum which implies the spectral type of the secondary component is later than that of primary.*

The photometric analysis of the light curves is in progress and will be published elsewhere. *This work has been partly supported by the Research Foundation of Ege University with the project number 1985/036.*

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FLARE OBSERVATIONS OF EV Lac

This communication presents the results of the observations of the flare star EV Lac carried out at the National Astronomical Observatory of the Bulgarian Academy of Sciences. The observations cover the period from 11 to 14 August, 1986, when, together with the reported photoelectric observations on the 60 cm telescope and the FF-1 single-channel photoelectric photometer, more than 40 spectrograms in the blue and red spectral regions of EV Lac were obtained for a period of two nights. More detailed data with reference to the character of the spectrum during the photoelectric monitoring in the U light will be published later.

The total effective observational time is about 13 hours. The light curves of the observed flares, as well as some data on the behaviour of the star's brightness in the light minimum are shown. Table I lists the respective data on the observed flares: number of flare, date of flare in U.T., maximum moment in U.T., the duration of the increase (t_1), that of the decrease (t_2), amplitude in U light (Δm_U) and errors in observations (δ_U).

It is worth noting that the EV Lac monitoring was carried out excluding the optical companion of the star.

Figure 1 shows the light curves of the observed flares. Universal time (U.T.) is indicated along the abscissa, while the value $(I_f - I_o)/I_o$ are plotted along the ordinate where I_o is the stellar intensity in normal state and I_f is the stellar intensity with additional emission during the flare.

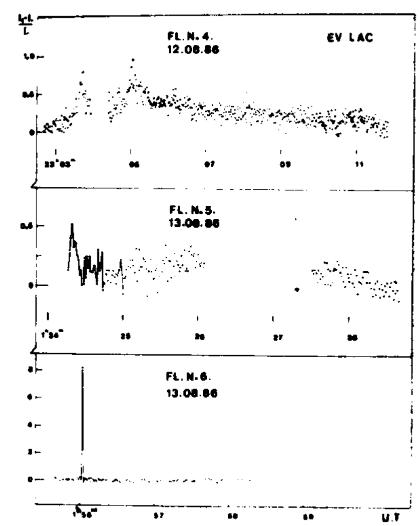

Figure 1:Light curves of observed flares of EV Lac

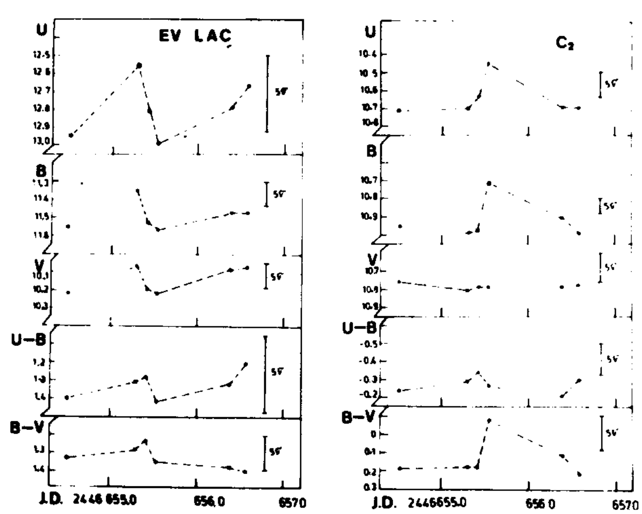

Figure 2 Light curves of EV Lac in undisturbed state and of the standard star C_2 during the observational period 12 August - 14 August, 1986.

Table I

Data for observed flares of EV Lac

N	Date of flare (UT)	Time of maximum(UT)	Time of increase	Time of decrease	m_U	U
1a	11.08.86	$23^h38^m33^s$	43^s	$-^s$	$0^m.52$	$0^m.07$
1b	11.08.86	22 39 38	8	40	0.54	0.07
2	12.08.86	01 11 10	15	145	0.52	0.13
3	12.08.86	21 07 10	70	180	0.85	0.06
4a	12.08.86	23 03 40	20	-	0.55	0.06
4b	12.08.86	23 05 00	30	200	0.66	0.06
5	13.08.86	01 24 23	8	240	0.46	0.07
6	13.08.86	01 56 02	1 total duration		2.44	0.08

Table II

Results of UBV measurements of EV Lac and the standard star C2

Date U. T.	EV Lac V	B-V	U-B	C_2 V	B-V	U-B
12.08.1986						
00^h15^m	$10^m.22$	$1^m.33$	$1^m.40$	$10^m.76$	$0^m.19$	$-0^m.24$
20^h25^m	10.07	1.28	1.31	10.81	0.18	-0.29
22^h32^m	10.20	1.23	1.28	10.79	0.19	-0.34
13.08.1986						
00^h56^m	10.22	1.35	1.42	10.79	-0.08	-0.26
22^h43^m	10.09	1.38	1.32	10.79	0.12	-0.21
14.08.1986						
02^h00^m	10.07	1.40	1.20	10.78	0.22	-0.30

We should like to attract particular attention to the case of flare No.6 where a spike-shaped increase of the light of EV Lac was again recorded as during the 1984 observations (Tsvetkov et al., 1985).The nature of this sort of flares is still controversial and it is therefore necessary simultaneous observations in the ultraviolet spectral region to be carried out in order to prove and understand the physical conditions of its appearance.

We can further say that flare No. 6 is also comparable in character and amplitude to the phenomenon observed by Gershberg and Petrov (1985) during simultaneous observations with ASTRON.

The UBV photometry of EV Lac in the light minimum was carried out by employing the photometric standards C_1 and C_2 (Pettersen and Jin-Chung Hsu, 1981, Pettersen, 1980). It should be noted here that the star C_2 is of spectral class A3V. During the processing of the observational data it was found out that this star exhibits light variations in the U and B colour with an amplitude of about $0^m.3$, while in the V light it was constant (Fig. 2). This result brings to question the use of C_2 as a standard star in investigations of the light variations of EV Lac. On the other hand, using the standard star C_1, relatively short-time light and colour variations of EV Lac were recorded by Pettersen (1980). Table II is a summary of the results of the measurements for EV Lac and the standard star C_2.

Thanks are due to L. Iliev for his assistance in part of the observations.

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OPTICAL BEHAVIOUR OF THE POLAR ST LEONIS MINORIS = CW 1103 + 254 IN 1986

Using the sequence of comparison stars given in the IBVS No. 2735 the star was measured on 20 blue-sensitive plates (ORWO ZU21 + GG13 + BG12) from 14 nights taken with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 7 February 1986 and 26 May 1986. On 6 nights more than one plate per night were obtained. The exposure time of the plates amounts to 20 minutes. The individual observations are listed in Table I.

Table I

J.D.hel.	m_B	J.D.hel.	m_B
244....		244....	
6469.586	$15^m.41$	6507.568	$15^m.58$
6469.606	15.59	6533.451	15.94
6473.590	15.36	6533.469	16.31
6473.609	14.96	6550.380	16.15
6474.512	15.44	6552.362	15.96
6474.531	15.03	6553.365	15.76
6476.550	15.33	6555.363	16.06
6476.572	15.07	6559.442	15.98
6506.546	15.70	6563.394	16.27
6506.566	15.93	6577.403	15.85

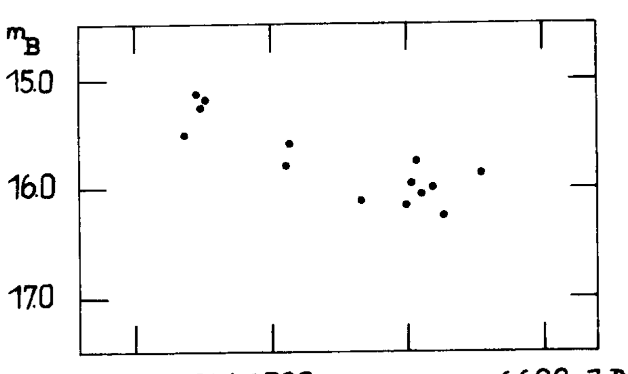

Figure 1

The long time-scale light curve in B is shown in Figure 1. There a slow decrease of brightness from $m_B \approx 15^m.2$ to $m_B \approx 16^m.0$ within the given time interval can be seen. This behaviour can be explained as a decrease from the X-ray heated high state of ST LMi to the mean brightness state, which in former series of observations was accepted as the high state. From the

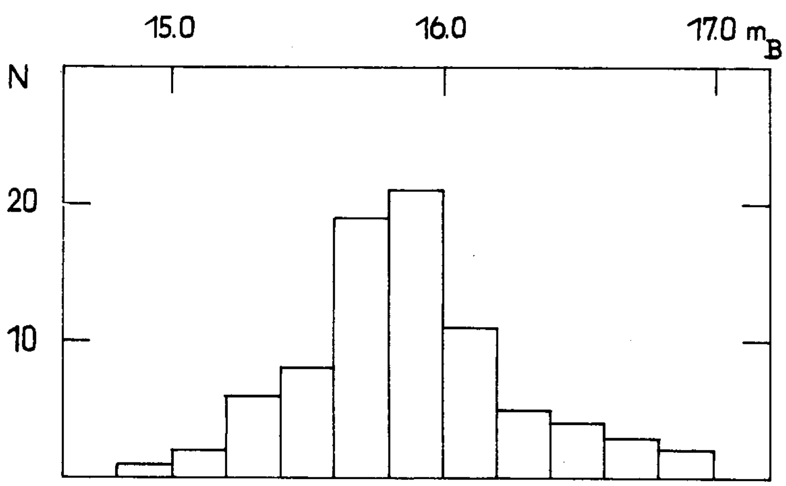

Figure 2

brightness distribution of the star obtained from all individual observations between 1982 and 1986 and shown in Figure 2 the conclusion can be drawn that the star prefers the mean brightness state. In connection with this behaviour it is worth mentioning that in the season 1983/84 an increase of brightness from the low to just the mean state was observed (Gotz, 1985).

Because of the small number of observations in 1986 no positive statements about the behaviour of the occultation light changes can be made.

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Reference:
Götz, W. 1985, I.B.V.S. No. 2735

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NEW PHOTOELECTRIC OBSERVATION OF W UMa SYSTEM 44i BOOTIS

The eclipsing variable 44i Boo is the fainter component of the visual binary ADS 9494. It is the brightest known W UMa-type eclipsing binary star (Bopp and Witzigmann, 1982).

It has been observed many times since its discovery (Schilt, 1926), (Eggen, 1948; Binnendijk, 1955; Schmidt and Schrick, 1957; Wehlau and Leung, 1961; Semeniuk, 1963; Catalano and Saitta, 1964; Brown and Pinnington, 1969; Kurpinska and Van't Veer, 1970; Gieseking, 1977; Hopp et al., 1977; Breinhorst, 1978; Duerbeck et al., 1978; Mikolajewska and Mikolajewski, 1980; Rovithis and Livaniou, 1981; Hopp and Witzigmann, 1982).

The system 44i Boo is known to have abrupt period changes as well as strong light activities. According to Bergeat et al. (1972) the star has an "active" period of 3 years followed by a 7 years "quiet" period. The former active periods were 1945-1947, 1955-1957, 1966-1968, 1976-1978. Thus new active period is expected to be in 1986-1988.

As a part of a program to study this eclipsing binary, photoelectric observation has been done with the 40 cm Cassegrain telescope of ALBATTANI Observatory (IRAQ-TARMIYA, latitude = $33^{\circ}37'32''$ N, longitude = $44^{\circ}28''.6$ E) during the nights 26, 27, 28 of July 1986.

An unrefrigerated photometer equipped with a 1P21 photomultiplier tube and UBV filters in close accordance with standard Johnson's filter was attached to the telescope (Kadourie et al. 1986).

The observations were made in B and V filters only.

The comparison star was 38 Boo. A total of 50 normal points have been

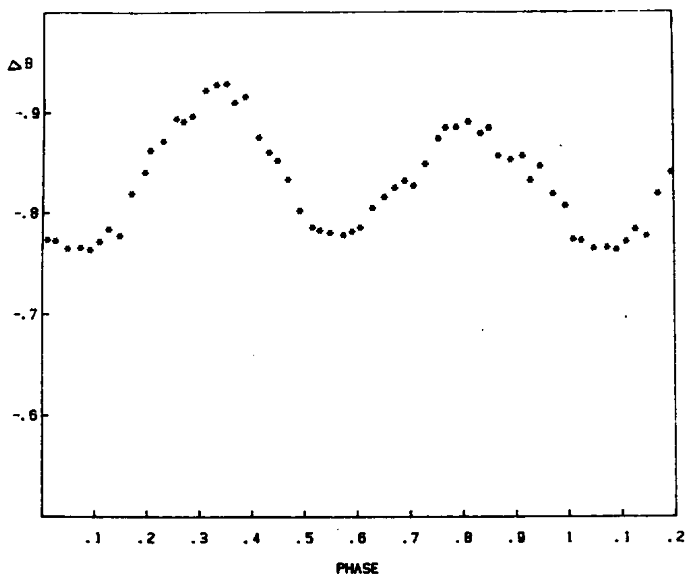

Figure 1 Light curve of 44i Boo in blue filter

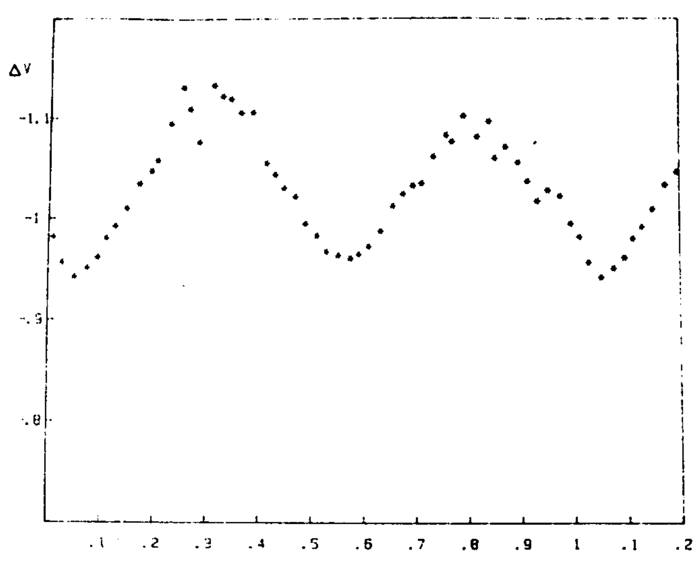

Figure 2 Light curve of 44i Boo in yellow filter

obtained from 213 observation points in eash filter and the light curves are shown in Figures 1 and 2 respectively. The probable error for a single observation was ±0.025 in V and ±0.03 in B filter.

The phases are computed according to Duerbeck's (1978) ephemeris:

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

The following table shows the times of minima and O-C values.

Filter	Min.	J.D. (Hel.)	O-C
B	I	2446640.30262	0.0174
B	II	2446638.29375	0.0171
V	I	2446640.30052	0.0153
V	II	2446638.29390	0.0151

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NEW EPHEMERIS AND LIGHT CURVE OF CF Pup

Eclipsing variable star CF Pup (CoD -49° 2046, S3270, CPD -49° 856, discovery number 10.1942 Pup) was discovered by Hoffmeister (1943). So far the existence of the secondary minimum had not been known. Because the duration of the flat part of the primary minimum (totality) is comparable with the duration of the night, the ephemeris based on Hoffmeister's photographic survey plates gave the wrong period.

The new ephemeris (error estimates under resp. digits)

$$T\ (\text{min HJD}) = 2445742.566\underset{2}{3} + 7\overset{d}{.}64959\underset{5}{0}.E$$

is based on the observations in the Geneva photometric system of Golay (1974, 1980) and Rufener (1964, 1981) performed during the interval 1978 - 1985 with the 70 cm Swiss telescope at La Silla Observatory, Chile. The photometer P7, described by Burnet (1976) and by Burnet and Rufener (1979) was used for all observations.

As the two branches of the primary minimum were never observed during the same night the ephemeris and its errors were estimated from the geometrical fitting of individual observations into one light curve. Accurate determination of the times of minima would thus be a very suitable project for a multisite photometric observing programme (Chile, South Africa, Australia and/or New Zealand).

For the filter V the following preliminary parameters have been derived:

Magnitude V = 10.15
Duration of totality d = 0.03 P or 5.5 hours
Duration of eclipse D = 0.12 P or 22 hours
Depth of primary minimum 1.9 mag.
Depth of secondary min. 0.08 mag.
Ratio of stellar radii k = 0.6   (eclipse duration)

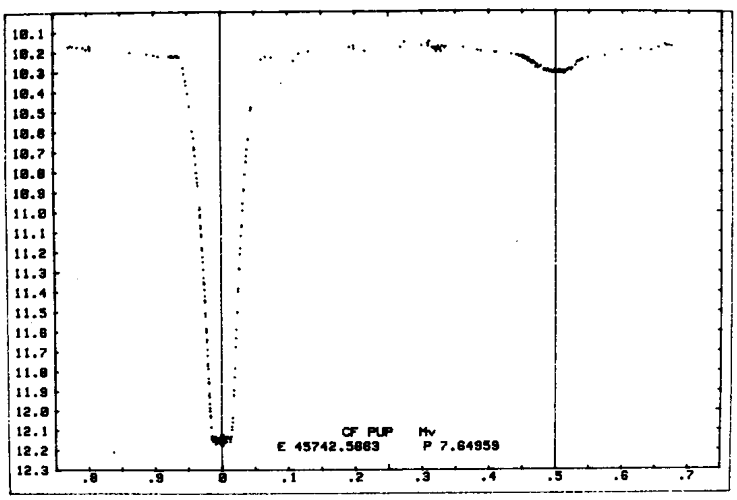

Fig 1. Light curve of CF Puppis. Points represent individual observations in filter V in the GENEVA photometric system. Ordinates: V magnitudes. Abscissae: Phase.

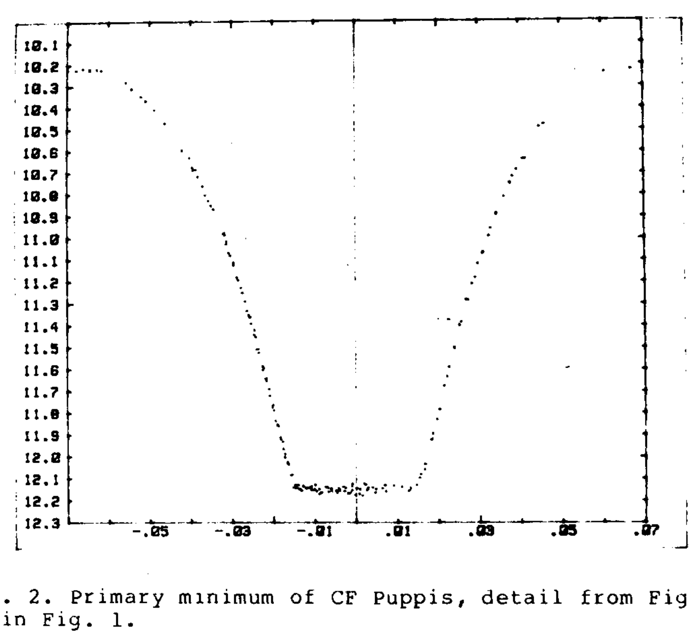

Fig. 2. Primary minimum of CF Puppis, detail from Fig. 1. Axes as in Fig. 1.

The light-curve represented by individual measurements in the colour V of the Geneva photometric system (which is the same as V in the UBV system) is shown in Figs. 1. and 2. First rough estimates of spectral types based on the colours of Geneva photometry indicate F4 III and K2 III for primary and secondary component respectively.

These are only preliminary results. We publish them now to make this information available to other observers, mainly spectroscopists. After filling a few gaps in the light curve, full details and the solution will be published elsewhere.

One of the authors (Z.K.) wishes to express his gratitude to the director of Geneva Observatory Prof. M. Golay for the support during the stay at ESO, La Silla, and at the Geneva Observatory. We acknowledge the excellent assistance of the constructor of the photometer Dr. M. Burnet for keeping the P7 photometer in good condition and for some additional observations of this star.

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β Cas: A PROBABLE SMALL AMPLITUDE MONOPERIODIC δ Sct STAR

Recently, the bright star β Cas (V=2.26, B-V=+0.35) and some other δ Sct stars have been observed with IUE. During the same period, photometric observations of β Cas were carried out at the Merate Observatory in order to get some indications on the modal content of the pulsation of this star. 710 measurements were performed during 8 nights from September 2 to October 4, 1986 with the 50 cm reflector using a standard V filter together with a neutral filter. The comparison stars were ν^2Cas (V=4.63, B-V=+0.96) and ν^1 Cas (V=4.83, B-V=+1.21). For the frequency analysis we adopted the least squares power spectrum technique (see Antonello et al.,1986), and we obtained the period P=0.10101 d, which is slightly different from that given by Millis (1966). The difference can be explained by the wrong cycle number assumed by Millis between the first and the second maximum observed by himself. Our period fits well these times of maximum.

Considering P as known constituent we searched for a second period; however we have not detected any significant peak in the power spectrum. This means that there should not be a second period with a semi-amplitude greater than 0.001 mag. The P=0.10101 d explains 61% of the data variance and leaves a r.m.s. residual of ±0.008 mag, i.e. the same obtained for the two comparison stars. The full amplitude of the V-light curve of β Cas is 0.03 mag.

Our results do not confirm the amplitude variations obtained with radial velocity measurements (Yang et al.,1982). However, those observations were made during one night and covered only two cycles.

A detailed report on our observations and data analysis will be published elsewhere.

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Antonello,E., Mantegazza,L., Poretti,E.: 1986, Astron. Astrophys. 159, 269
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STRÖMGREN uvby-H_β PHOTOMETRY OF THE SOLAR TYPE STARS HD 152391 and HD 154417

An observational program is currently being developed to obtain accurate four color uvby-H_β photometry of some selected Ca II emission solar type stars (Wilson,1978). The existence of photometric variations in a selected sample of the Wilson's group have been reported by Dorren and Guinan (1982) and Radick et al. (1982,1983) in the shorter time scale (stellar rotation).

In this note we present the photometric results of the Ca II variables HD 152391 (SAO 121921) and HD 154417 (SAO 122056). HD 152391 has been monitored with particular interest due to the existing contradiction between the Ca II period P_{CaII} = 11 days (Vaughan et al., 1981, Baliunas et al., 1983) and the photometric period P_{ph} = 37 days suggested by Dorren and Guinan (1982).

The observations were carried out from July 16 to 29, 1984 for both stars and July 21 to 31, 1985 for HD 152391, using the 1.5 m telescope at the Calar Alto Observatory (Almeria, Spain), located at 2165 m over the sea level. A general purpose UBVRI single channel, pulse-counting, computer-controled photometer was used. A general description of the photometer and data acquisition equipment can be found in Lahulla (1982).

Observations were made in each of the four Strömgren passbands and Crawford n and w bands centered in the Balmer H_β line, with 16 sec integration time. The observing sequence was the familiar pattern of sky-comparison-variable-variable-comparison-sky.

The effects of differential atmospheric extintion were removed and the data reduced to differential magnitudes with respect to the comparison stars.

For HD 152391 two comparison stars were selected. Comparison = HD 152449 (spectral type F8, V=7.4) and chek = BD -01^o 3268 (spectral type F0V, V=6.2). These stars were previously used by Radick et al. (1983) and Dorren and Guinan (1982).

For HD 154417 the comparisons are: comparison = BD $+00^o$ 3649 = SAO 122146 (spectral type G5IV, V = 6.1) and check = BD $+00^o$ 3654 (spectral type F5, V = 6.5).

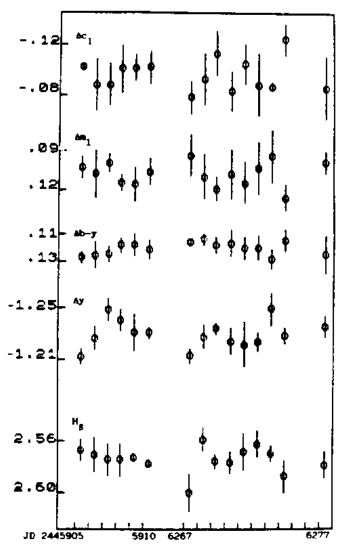

Figure 1 Photometric variations of HD 152391 versus Julian Date.

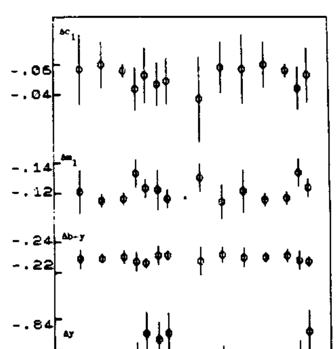

Figure 2 Photometric variations of HD 154417 versus phase.

Both pairs of comparison-check stars were plotted as a function of time and the residuals were used to test the possible sensitivity changes, variable extinction and intrinsic variability in the comparisons.

An hour of observations was tipically obtained each night and normal points were formed by averaging the individual measurements. The σ night-to-night RMS dispersion for the normal points of pairs comparison-check for the y band and b-y, m_1, c_1 indices are given in Table I.

Table I

	σ(y)	σ(b-y)	σ(m_1)	σ(c_1)
(c-ck) HD 152391 1984	.010	.004	.008	.014
(c-ck) HD 152391 1985	.011	.004	.006	.012
(c-ck) HD 154417 1984	.006	.003	.006	.006

The reduced magnitude differences HD 152391 - C and HD 154417 - C in the y band and b-y, m_1, c_1 indices versus Julian Date and phase, respectively, are plotted in Figures 1 and 2.

From Fig. 1 we can see a remarkable constancy in the 1985 y data over an observational period equal to the previously computed Ca II period. The absence of well defined photometric variations can be interpreted as a consequence of the long term variations (cycles). Wilson (1978) gives a P_{cyc} = 12 years for the HD 152391 with a minimum in the year 1975 which predicts a new minimum in 1987. If the spot activity is correlated with the Ca II emission, like in the Sun, the absence of photometric variations (or below the observational uncertainties) in the 1985 data is consistent with the predicted stellar cycle. More observations are needed in the next years to confirm it.

The scatter is higher in the 1984 data, showing an amplitude variation of .03 - .04 in the y band which is in the same range that the amplitudes calculated by Radick et al. (1983). Unfortunately the period coverage is not long enough to compute a defined photometric period and associated amplitude.

Fig. 2 shows the light curve for the HD 154417 in 1984 season. An amplitude of .03 - .04 in y band with a period around 8 days can be deduced. If this amplitude is compared with the RMS errors given in Table I, we can see that it is over 5σ level. No significant color variations can be deduced from the data. On the other hand the photometric period is consistent with the Ca II data from Vaughan et al. (1981).

A more detailed discussion of the complete uvby and H_β photometry will be published elsewhere. This work was supported by grant nº 3455/83 from CAICYT.

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UBV OBSERVATIONS OF T CORONAE BOREALIS

The cataclysmic variables exhibit light variations on different time scales. At Rojen observatory a program has been initiated for searching for relatively long-time variations of the brightest old novae and reccurent novae. In this paper the photoelectric observations of T CrB , carried out with the 60-cm telescope in 1985 are presented. The star A of SA 60 has been used as a standard (Priser, 1974).

A continuous 2.5 hour observation of T CrB in B band on 14/15 May 1985 showed the presence of short-time variations of amplitude $\leq 0\overset{m}{.}07$ on a time scale of 6 - 10 min. In Fig. 1 the differences $\Delta m = m_{var} - m_{std}$ are given for 10 second integration time of the photon counting. The values of V, B-V and U-B during the whole night are presented in Figure 2.

In the observations for long-time variability when they last 10 minutes or more, the small range short-time variations are averaged. Shorter observations are less representative. In Table I the values of V, B-V and U-B are given for 1985. The accuracy of the data has been estimated from the observations of the standard star on good photometric nights. The mean error σ is

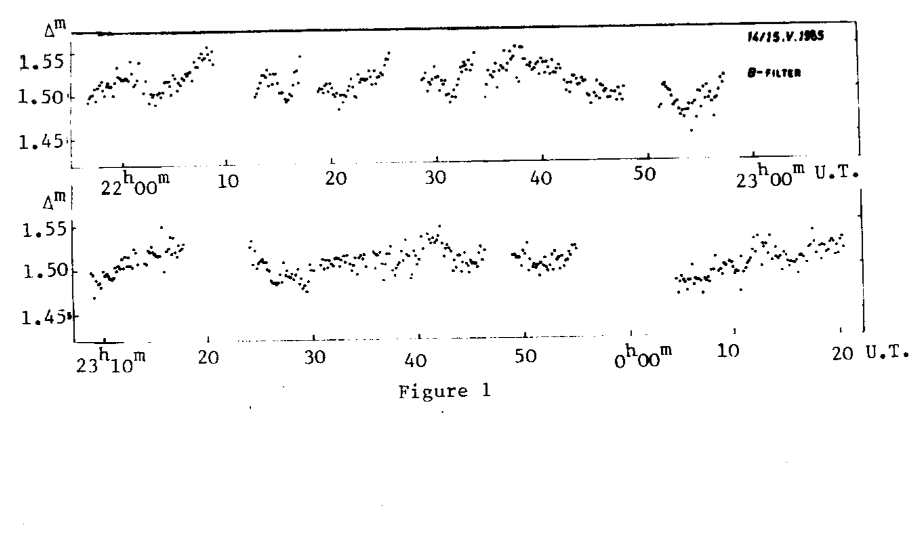

Figure 1

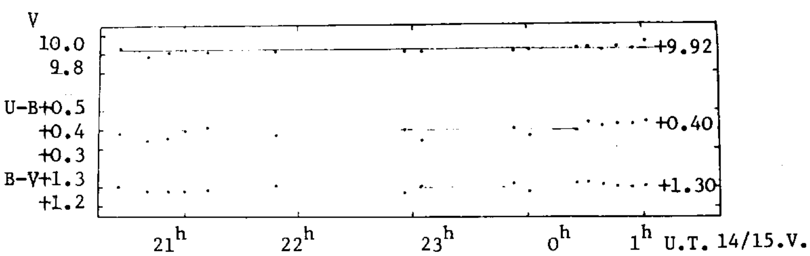

Figure 2

less than ± 0.02 for V and B-V values and ±0.05 for U-B. We point out two cases of rapid variations: (i) on 16 July (J.D. 2446263..) U-B exhibits two jumps in 35 minutes by 0.32 mag. and 0.11 mag. respectively, V and B-V being constant within the error: (ii) on 20 July (J.D. 2446267..) B-V and U-B change by $0^m.1$, V being constant. On both nights the atmospheric conditions are referred as good ones.

Table I

J.D.	V	B-V	U-B	Duration of observation
2446200.370	9.92	+1.29	+0.37	100^m
200.524	9.93	+1.32	+0.43	60
203.833	9.91	+1.33	+0.52	15
209.510	9.89	+1.37	+0.66	55
210.493	9.88	+1.34	+0.52	15
227.452	9.92	+1.28	+0.47	35
230.451	10.01	+1.50	+0.56	10
263.403	10.16	+1.20	-0.16	10
263.408	10.19	+1.18	+0.16	10
263.416	10.17	+1.16	+0.05	15
267.381	10.11	+1.06	-0.13	15
267.388	10.09	+1.15	-0.03	15
290.454	9.91	+1.34	-0.32	10
302.338	10.12	+1.20	+0.09	45
324.341	9.93	+1.34	+0.62	45
329.292	9.94	+1.33	+0.57	30

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Reference:

Priser, J. B., 1974, Publ. US Naval Obs., Sec. ser., XX

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NEW AND NEGLECTED VARIABLES IN THE CEPHEUS OB 2 ASSOCIATION

An objective prism search for Hα emission stars in the region of IC 1396 was begun at Konkoly Observatory in 1980 in order to find the possible low mass members of the association Cep OB 2. The first results of this survey are already published (Kun, 1986). Further emission stars were detected on four plates taken in 1985-86. Among them there are four stars which were found to be variable by Gieseking (1976). A photographic UBV photometry of the Hα emission stars led to the discovery of five new variable stars. Their coordinates for 1950, V magnitudes at three different epochs, B-V and in some cases U-B colour indices are given in Table I. Identification charts are presented in Fig. 1.

The photometric plates were obtained with the 60/90/180 cm Schmidt telescope of Konkoly Observatory. The variability of the stars was established from six plates taken on three nights (27/28 June 1968, 20/21 Oct 1985 and 13/14 Sept 1986). The photographic magnitude scale was calibrated using Lichtbuer's (1982) photoelectric sequence. The mean internal error of the magnitudes derived as averages from six plates is about 0.1 mag. A star is regarded here variable if the rms scatter of its magnitude averaged from six plates exceeds $0^m.4$. The Julian dates given in Table I are the means of the beginning of the first exposure and the end of the second exposure of the given night. The magnitudes listed at a given JD are averages of two plates. B-V, and where the brightness of the star made it possible, U-B colour indices were also derived from two plates in each colour taken on the same night (20/21 Oct 1985).

We extended the photometry for some already known variable and extremely red stars situated within our field which is of five degrees in diameter and is centred on HD 206267, the exciting star of IC 1396, because there is very scarce information in the literature for these stars. These stars are as follows:

a) DZ, GL and GM Cep, probable Orion-variables. Their light variations have been investigated photographically by Suyarkova (1975) and Albo (1979a,b). DZ and GM Cep show Hα emission on our objective prism plates.

Table I

N	R.A.(1950)	D(1950)	JD 2400000+ 39035.5 V	46359.4 V	46359.4 B-V	46359.4 U-B	46691.5 V
1	$21^h27^m10^s.0$	$+58^\circ06'00''$	15.33	15.94	2.76		16.19
2	21 31 47.4	+57 34 52	16.28	15.10	2.23	0.14	14.95
3	21 37 9.2	+57 16 53	16.47	14.22	2.44	1.16	15.55
4	21 48 5.8	+56 32 34	13.18	14.38	0.96	1.03	14.22
5	21 49 9.0	+55 57 6	13.80	14.22	1.15	0.04	13.20

Notes to Table I:
1. Star No.20 from Dorschner et al. (1973)
3. Star No.80 from Kun (1986)
4,5. Stars 21-040 and 21-041 from Dolidze (1975), respectively

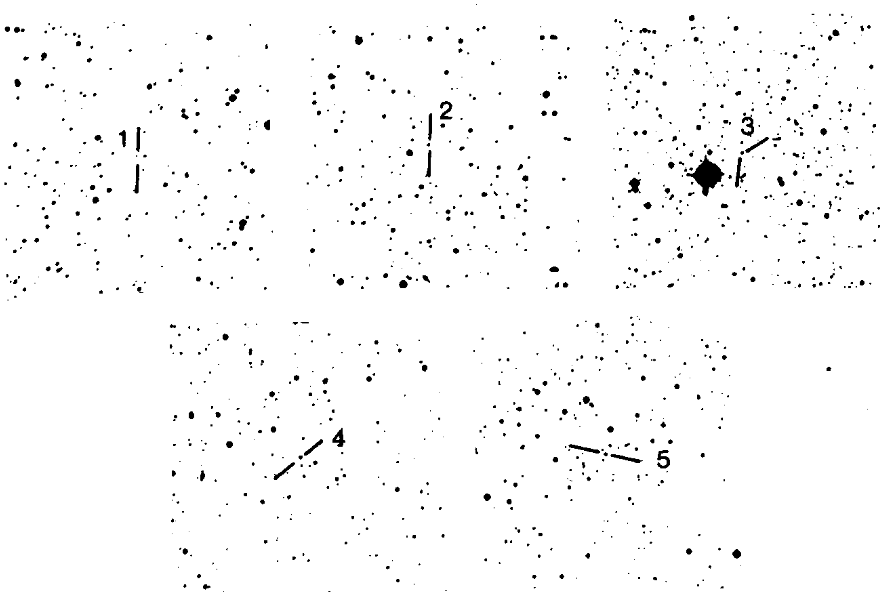

Figure 1. North is at the top and east is to the left. 10'=4cm.

b) Red variables, which, because of their colour and large amplitude are regarded as possible Miras. They are as follows:

-V 345 Cep which was listed as an extremely red star by Dorschner et al. (1973). Its light variation was discovered by Friedemann et al. (1977).

-V 346, V 347, V 348 and V 349 Cep, red variables found by Pfau and Friedemann (1980).

-Stars C, D and E from a list of red variables by Friedemann et al. (1977), later designated as IV 19, 20 and 21 by Pfau and Friedemann (1980).

Table II

Name	JD 2400000+ 39035.5 V	46359.4 V	B–V	U–B	46691.5 V	Remark
GL Cep	11.34	11.38	2.37		11.57	
GM Cep	12.87	14.30	3.01		15.02	Hα emission
DZ Cep	13.63	14.30	1.21	0.67	13.93	Hα emission
V 345 Cep	12.22	13.73	4.34		14.86	
V 346 Cep	14.07	13.91	2.76		14.56	
V 347 Cep	15.80	12.58	3.17	0.88	15.62	Gieseking 11
V 348 Cep	14.55	14.52	1.67		14.42	
JV 19	16.43	15.93	4.06		16.71	
JV 20	—	17:	2.8:		14.13	
JV 21	—	16.9	1.9		16.8	
Gieseking 6	15.25	15.03	1.87		14.86	
Gieseking 15	13.20	13.56	1.21		13.38	
Gieseking 17	15.18	15.39	0.66	0.56	15.42	Hα emission
Gieseking 18	15.18	15.57	1.09	0.45	16.17	Hα emission
Gieseking 19	14.75	16.70	2.15	-0.09	15.68	CSV 8684
Gieseking 20	15.39	15.07	1.02		15.68	Hα emission
Gieseking 23	—	16.0	1.04		15.68	
Gieseking 24	15.10	15.45	0.52	0.50	15.13	Hα emission
Dorschner 21	14.68	14.32	4.87		14.57	
Dorschner 22	15.35	14.75	4.42		15.16	
Dorschner 23	15.75	15.70	1.33		15.68	
Dorschner 24	12.51	12.39	3.36		12.17	
Dorschner 25	16.10	16.00	2.30		16.28	

Table III

IRAS source R.A.(1950)	D(1950)	Associated object R.A.(1950)	D(1950)	
$21^h24^m58\overset{s}{.}7$	+57°54'01"	$21^h24^m59\overset{s}{.}0$	+57°54'	V 346 Cep
21 28 2.2	+57 46 12	21 28 6.0	+57 46 12"	V 347 Cep
21 28 54.5	+55 14 18.9	21 28 55	+55 14	JV 19
21 30 45.5	+56 13 16.0	21 30 46	+56 14	JV 20
21 31 47.6	+57 34 52.0	21 31 47.4	+57 34 51.7	No.2
21 32 56.2	+56 47 36	21 32 59	+56 48	Dorschner 24
21 33 47.2	+57 23 8.0	21 33 47.7	+57 23 15	Gieseking 15
21 36 15.3	+57 30 42.0	21 36 12.0	+57 31 0	GL Cep*
21 36 44.7	+57 17 45.0	21 36 44.0	+57 19 12	GM Cep*
21 37 9.0	+57 16 42.9	21 37 9.2	+57 16 53	No. 3
21 41 16.5	+58 43 32.9	21 41 16.4	+58 43 34	Gieseking 19

* The identification is given in the IRAS Point Source Catalogue.

c) Unnamed faint variables found by Geyer and Gieseking (1975) and Gieseking (1976) during a photographic search for variable stars around Mu Cephei. Stars Nos. 6, 11, 15, 17, 18, 19 (=CSV 8684), 20, 23 and 24 are situated within our field. No. 11 happens to be identical with V 347 Cep but Gieseking finds it equally bright in the red and blue. Among these stars, Nos. 17, 18, 20 and 24 show Hα emission on our objective prism plates. Regarding their relatively blue colour they are possibly Orion-variables.

d) Stars Nos. 20, 21, 22, 23, 24 and 25 from a list of extremely red stars by Dorschner et al. (1973) were also measured because their very red colour suggests that they might be variables. No. 20 is found to be variable and in addition it shows Hα emission on two objective prism plates taken in 1986. We remark here that our photometry shows these stars systematically brighter and bluer than the original photometry which was based on measuring the diameters of the stars on the Palomar Observatory Sky Survey prints.

Table II summarizes the photographic magnitudes and colour indices for the above listed stars.

Finally we mention that some of these stars seem to have counterparts in the IRAS Point Source Catalogue. GL and GM Cep are identified with infrared sources in the Catalogue. In Table III we give a comparison of the coordinates of further IRAS sources with those of our stars. In some cases there are other optical objects within the uncertainty ellipse. In these cases, beside the very good agreement of the coordinates the fact that these stars were selected on the basis of their red colour and/or Hα emission supports the identity of the stars and infrared objects.

The poor information available for these stars is not enough to establish their types. The large amplitudes of their light variation, the Hα emission, red colour and the possible infrared excess together with their apparent location in a region of star formation suggest that at least some of them are pre-main sequence variables; these properties do not exclude, however, that some of them are of Mira type. They are worthy of further study.

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PHOTOELECTRIC OBSERVATIONS OF R CrB

The star R CrB was observed photoelectrically with the 250/3250 Cassegrain telescope and an EMI 9781 B PMT at Nessa Observatory using standard UBV filters. δ CrB (V = $4^m.63$, B-V = $0^m.80$, U - B = $0^m.37$) and SAO 084005 (V= $7^m.45$, B - V = $0^m.44$, U - B = $0^m.02$) were used as comparison stars. These observations are the continuation of those published in IBVS No. 2835. The observations are listed in the following table.

Table

Photoelectric observations of R CrB

J.D. 2446000 +	V	B - V	U - B
534.333	6.18	+0.73	
535.335	6.18	+0.64	
550.417	6.12	+0.63	
552.404	6.07	+0.60	+0.26
553.440	6.03	+0.56	+0.17
554.418	6.02	+0.62	+0.13
563.396	5.97	+0.63	+0.13
576.425	5.90	+0.52	
577.408	5.85	+0.63	+0.01
591.404	5.78	+0.58	
592.413	5.79	+0.58	
597.379	5.79	+0.62	
604.413	5.87	+0.58	+0.14
605.379	5.88	+0.64	
608.425	5.86	+0.55	+0.17
611.400	5.88	+0.58	+0.13
614.392	5.88	+0.68	
639.363	5.92	+0.48	
642.342	5.90	+0.63	

Table I. (Cont.)

J.D. 2446000 +	V	B - V	U - B
646.371	5.83	+0.60	
648.367	5.81	+0.64	
649.363	5.80	+0.61	
660.383	5.89	+0.62	
663.367	5.87		
668.354	5.98	+0.58	
677.313	5.95		
679.313	5.92	+0.58	
692.283	5.83	+0.53	
693.292	5.81		
698.275	5.86		
699.296	5.84	+0.51	
705.271	5.82	+0.53	
708.273	5.73	+0.52	
709.271	5.81	+0.50	
714.263	5.80		
716.279	5.85	+0.58	
718.250	5.79	+0.57	
721.238	5.75	+0.60	

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ON THE PERIOD VARIATION OF YZ Boo

YZ Boo is one of the few high amplitude δ Scuti stars. The investigation of their period changes may give some information about their evolutionary state. Therefore we carried out new photometry of YZ Boo with the aim of investigating its period variation.

The period changes of YZ Boo was first studied by Szeidl and Mahdy (1981). They suspected that a slight continuous increase of the period had taken place:

$$\text{Max.hel.} = \text{J.D. } 2442146.3543 + 0\overset{d}{.}104091580\cdot E + 5\overset{d}{.}3\text{x}10^{-13}\cdot E^2$$

Jiang (1986) reexamined all the observations published up till 1984 and made a thorough investigation of the period changes of YZ Boo and found the new ephemeris with a quadratic term:

$$\text{Max.hel.} = \text{J.D. } 2442146.35481 + 0\overset{d}{.}1040915791\cdot E + 4\overset{d}{.}3\text{x}10^{-13}\cdot E^2$$

Peniche et al. (1985) carried out new accurate photometry of YZ Boo and made a detailed study of the period variation of the star independently of Jiang. Peniche et al. (1985) took the old poorly determined visual observations of Tsessevich (1958) into account, as well, and came to the conclusion that the period was basically constant:

$$\text{Max.hel.} = \text{J.D. } 2442146.35481 + 0\overset{d}{.}1040915680\cdot E + 1\overset{d}{.}12\text{x}10^{-13}\cdot E^2$$

where the uncertainty in the quadratic coefficient is of the order of the derived value.

In order to study of the period changes of YZ Boo and to determine a more accurate ephemeris we observed the star from 24 June until 12 July 1986 on 13 nights. The observations were carried out by the 74 inch telescope at Kottamia Observatory, Egypt. Standard U, B and V filters with EMI 9558B tube were used.

The observed times of light maxima are given in Table I. In columns 2 and 3 the cycle numbers and the $O-C_{lin}$ values are given calculated according to the linear elements of Jiang (1986):

$$C_{lin} = \text{J.D. } 2442146.35531 + 0\overset{d}{.}1040915678 \cdot E$$

Table I

Observed light maxima of YZ Boo

J.D.hel.	E	$O-C_{lin}$	$O-C_{quad}$
2446606.3697	42847	$+0\overset{d}{.}0030$	$+0\overset{d}{.}0023$
612.3000	42904	+0.0001	-0.0006
612.4040	42905	0.0000	-0.0007
613.3399	42914	-0.0010	-0.0016
614.2773	42923	-0.0004	-0.0010
614.3825	42924	+0.0007	+0.0001
615.3193	42933	+0.0007	+0.0001
617.2972	42952	+0.0009	+0.0002
618.3361	42962	-0.0011	-0.0018
619.2745	42971	+0.0004	-0.0002
620.3170	42981	+0.0020	+0.0014
621.3569	42991	+0.0010	+0.0003
622.2936	43000	+0.0009	+0.0002
623.3338	43010	+0.0002	-0.0005
624.2713	43019	+0.0008	+0.0002
624.3770	43020	+0.0024	+0.0018

The list of light maxima of YZ Boo given in the paper of Peniche et al. (1985) were supplemented with Jiang's (1986) and our observed maxima and then a least-squares solution was carried out. The photoelectric maxima obtained in the last 30 years were only taken into account. As the weights assigned to the times of light maxima may sometimes be a matter of subjective judgement, equal weights were given to each time of light maxima in our calculations. The following new quadratic equation has been obtained:

$$C_{quad} = \text{Max.hel.} = \text{J.D. } \underset{\pm 26}{2442146.35479} + \underset{\pm 41}{0\overset{d}{.}1040915805} \cdot E + \underset{\pm 1.47}{3\overset{d}{.}43} \times 10^{-13} \cdot E^2$$

This formula has been valid since 1955, when the first photoelectric observations were carried out by Eggen (1955).

Our observations show definite light curve variations. Both the shape and the amplitude of the light curve are subjected to changes from cycle to cycle. An overtone pulsation is probably excited beside the fundamental mode. In a forthcoming paper we will carry out a detailed period analysis of this star.

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A NEW PERIOD CHANGE OF SW LACERTAE

SW Lac (BD+37°4717) is a well-known W UMa-type binary with occasional period changes (see e.g. Mikolajewska and Mikolajewski, 1981).

UBV photometry of SW Lac was carried out during ten nights between 29 June and 14 July,1986. The observations were made with the 74-inch reflector at the Kottamia Observatory, Egypt. Two primary and three secondary minima were observed during that time. Table I contains the times of minima, the number of cycles and the O-C values as calculated from the ephemeris given by Bookmyer (1965):

$$H.J.D.=2437572.57231+0^d.32072811 \cdot E$$

Table I

H.J.D.	E	O-C
2446613.5361	28189.5	$-0^d.2013$
614.4973	28192.5	-0.2023
619.4704	28208	-0.2004
620.4321	28211	-0.2009
624.4404	28222.5	-0.2017

The Figure shows the O-C diagram of SW Lac covering 25 years (from E=0). The points in the Figure were taken from Lafta and Grainger (1985; and references therein), Niarchos (1985), Evren et al. (1985), and Table I. The points represent averages when there have been more than one O-C values during 100 cycles.

Lafta and Grainger (1985) used all the then available photoelectric minima in constructing their diagram, and they used Bookmyer's ephemeris. In order to make the comparison of the two O-C diagrams easier, the same ephemeris was used in this paper, too.

The right hand side of the Figure shows that SW has had another period change since 1985 (E≈27100). The exact time of the change is uncertain because of the large gap between the O-C values of Evren et al. (1985) and those in the present paper. A new period can, however, be determined from the Figure using the last two sets of data: $P = 0^d.320706586$.

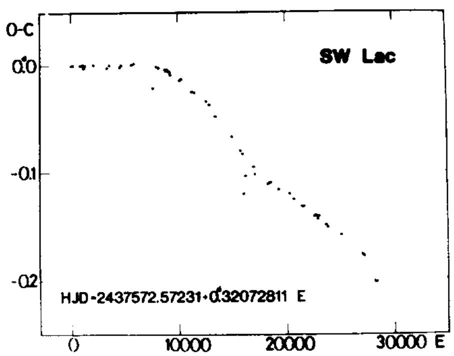

Figure 1

Fransiska and Kreiner (1977) listed the periods of SW Lac since 1893. Table II shows an updated version of their Table I.

Table II

Years	Period	ΔP	Ref.
1893-1914	$0^d.3207124$		Frasinska and Kreiner (1977)
1914-1928	0.3207151	$+0^s.23$	- " -
1928-1951	0.3207166	+0.13	- " -
1951-1960	0.3207213	+0.41	- " -
1960-1968	0.3207282	+0.60	- " -
1973-1977	0.3207144	-1.19	- " -
1977-1979	0.3207229	+0.73	Evren et al. (1985)
1980-1985	0.3207198	-0.24	- " -
	0.3207204		Niarchos (1985)
1986-	0.3207066	-1.17	present paper

Frasinska and Kreiner (1977) mentioned two possible causes for this period change: (i) the presence of a third body in the system, (ii) intrinsic variations due to mass exchange processes in the system. As there is little evidence for periodicity in the period change, the second explanation seems more probable.

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PHOTOELECTRIC OBSERVATIONS OF θ CrB IN 1984-86

The Be-star θ CrB was included on our observational programme in mid 1984 after Harmanec's(1983) predicted time of possible eclipse. The three colour UBV photoelectric observations of θ CrB presented in this paper were performed at the University Observatory in Brno in the course of the years 1984-86.

The photomultiplier and filter combinations on a one-channel photoelectric photometer attached to the 24-inch telescope were the same as in Papoušek (1974). The instrumental photometric system was close to the standard UBV system and the transformations from the instrumental system to the UBV one and the differential extinction corrections were applied to all the observations in the usual way.

HR 5760 (= HD 138341) served as a primary comparison star, the stars 50 Boo and BD +32°2607 (= SAO 64824) were used as check stars. Their brightness and colour indices - as observed by us - are given in Table I.

Table I

Photometric data for comparison and check stars

Star	V	B-V	U-B
HR 5760 = comparison	6.440	+0.188	+0.126
	±2	±3	±4
50 Boo = check 1	5.368	-0.065	-0.210
	±1	±3	±2
BD +32°2607 = check 2	7.205	+0.228	+0.095
	±4	±3	±5

The photometric values of 50 Boo were derived from the observations of 16 standard stars in the neighbourhood of θ CrB during three nights. The values of HR 5760 were derived from differential observations to the 50 Boo in 38 nights in 1985-86 and scattering of individual measurements did not exceed ±0.015 in V, ±0.020 in B, and ±0.025 in U colour, respectively. Data for check star 2 were computed from differential observations to the comparison star and to 50 Boo in 41 nights and scattering of its values is similar as for HR 5760.

The variable star θ CrB was observed in 57 nights, between 22.5.1984 and 4.10.1986 and about 1300 individual measurements were obtained. These observations in different nights are presented in Table II, where phases are computed according to the ephemeris given in Harmanec (1983), : denotes less accurate measurements and n in the last column denotes the number of individual observations.

Table II

Photometric observations of θ CrB

JD-2440000	Phase	V	B	U	n
5843.347	0.974	4.155	4.021	3.502	12
		±5	±35	±40	
.385		4.121	–	–	6
		9			
5851.365	0.990	4.132	4.016	3.456	36
		11	7	16	
.472		4.068:	3.909:	3.424:	11
		11	25	80	
5853.354	0.994	4.151	–	3.501	13
		16		11	
.444		4.158	4.016	3.450	12
		14	8	1	
5858.403	0.003	4.097	4.025	3.478	19
		5	7	6	
5879.382	0.044	–	4.016	3.465	14
			4	10	
5940.317	0.164	4.209	–	–	6
		20			
5941.326	0.166	4.132	4.017	3.467	20
		6	7	3	
6176.443	0.626	4.136	4.022	3.466	21
		4	2	2	
6177.429	0.628	4.120	4.016	3.460	24
		3	2	4	
6178.431	0.630	4.137	4.013	3.455	23
		3	2	3	
6182.388	0.638	4.174:	4.004	3.478:	15
		3	8	21	
6194.498	0.661	4.144	4.004	3.461	15
		3	4	4	
6197.390	0.667	4.141	4.012	3.453	25
		4	5	9	
6210.444	0.693	4.127	4.009	3.464	20
		2	2	4	
6212.424	0.696	4.122	4.012	3.455	24
		4	7	4	
6221.417	0.714	4.136	4.021	3.458	42
		1	2	6	

JD-2440000	Phase	V	B	U	n
6224.384	0.720	4.135	4.017	3.466	17
		1	2	2	
6244.363	0.759	4.132	4.013	-	10
		4	9		
6247.374	0.765	4.134	4.011	3.458	34
		5	2	7	
6249.378	0.769	4.141	4.023	3.453	36
		2	3	4	
6251.377	0.773	4.127	4.025	3.458	38
		2	2	8	
6253.382	0.777	4.140	4.015	3.483	20
		1	2	9	
6280.344	0.829	4.131	4.018	3.458	33
		2	4	7	
6290.333	0.849	4.134	4.029	3.469	38
		1	3	6	
6292.339	0.853	4.132	4.030	3.499:	23
		1	7	14	
6293.326	0.855	4.140	4.042	3.482	34
		3	4	7	
6297.331	0.863	4.137	4.004	3.448	30
		9	5	8	
6299.311	0.866	4.155	4.042	3.484:	18
		4	4		
6300.313	0.868	4.111	4.037	3.503	38
		6	8	3	
6308.322	0.884	4.146	4.023	3.455	25
		5	12	7	
6309.299	0.886	4.134	4.026	3.469	27
		7	8	6	
6311.299	0.890	4.129	4.029	3.463	36
		3	4	3	
6318.293	0.904	4.140	4.009	3.460	17
		4	13	7	
6327.326	0.921	4.160	4.038	3.481	27
		7	3	6	
6328.271	0.923	4.147	4.015	3.454	22
		6	2	15	
6334.257	0.935	4.137	4.028	3.479	29
		5	4	4	
6338.258	0.943	4.128	4.021	3.481	24
		2	2	4	
6340.264	0.947	4.127	4.028	3.482	21
		3	5	5	
6343.250	0.952	4.149	4.027	3.483	23
		14	3	4	
6363.214	0.992	4.156	4.057	-	9
		14	8		
6592.417	0.440	4.130	4.018	3.461	20
		1	6	4	
6605.388	0.466	4.130	4.004	3.467	23
		7	2	2	
6607.396	0.469	4.129	4.008	3.444	21
		10	4	4	

JD 2440000	Phase	V	B	U	n
6609.384	0.473	4.096	4.006	3.462	22
		10	15	7	
6612.363	0.479	4.138	4.023	3.452	12
		3	6	4	
6614.382	0.483	4.105	4.000	3.465	22
		6	2	2	
6626.370	0.507	4.148	4.019	3.467	19
		5	8	6	
6646.361	0.546	4.140	4.017	3.441	17
		5	5	4	
6660.313	0.575	4.181	4.019	3.472	29
		7	6	8	
6672.299	0.599	4.142	-	-	3
		13			
6679.297	0.610	4.129:	4.029	3.481	12
		27	15	10	
6685.303	0.622	4.116	4.009	3.469	19
		3	5	7	
6690.282	0.632	4.130	4.016	3.464	23
		6	9	5	
6693.309	0.638	4.158	4.043:	3.494	9
		7	44	10	
6700.267	0.651	4.138	4.029	3.453	19
		15	9	23	
6705.250	0.661	4.138	4.036	3.510:	12
		20	15	25	
6708.250	0.667	4.139	4.037	3.444	12
		15	5	12	

The averaged photometric values of θ CrB in different years are collected in Table III.

Table III
Averaged photometric values of θ CrB in 1984-86

Year	V	B-V	U-B	nights
1984	4.135 ±.008	-0.120 ±.006	-0.550 ±.007	8
1985	4.136 ±.002	-0.115 ±.002	-0.555 ±.002	33
1986	4.130 ±.004	-0.110 ±.003	-0.555 ±.004	17

From the measurements listed in the Table II it is clear that no decline of brightness of θ CrB exceeded 0.06 mag in each colour was observed in 1984-86. Some different declines occurring in V and U colours in different heights are very similar to that observed by Fernandes et al. (1985) on July 22, 1984. Small changes in brightness of θ CrB from night to night are - in our opinion - real and we agree with the result of Fernandes et al. that the eclipse of this hypothetical binary system in the interval of our observations did not occur.

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FIRST EPHEMERIS FOR THE W UMa-TYPE STAR NSV 12040

NSV 12040 (CSV 8172, BV 313, BD+52° 2426) discovered by Strohmeier and Knigge, (1960) is listed as a rapid variable star, with spectral type F, in the New Catalogue of Suspected Variable Stars (Kukarkin et al., 1982). Its coordinates are: $\alpha = 19^h\ 24^m\ 55^s$, $\delta = +52^{\circ}\ 20\overset{'}{.}8$ (1950.0).

Visual observations led to the possibility that the star was a close binary system (Boninsegna, 1984: Wils, 1984). A first ephemeris has been computed using 85 visual times of minimum obtained by a dozen of GEOS observers from 1983 to 1985. Both minima are of almost equal value in brightness.

$$\text{Min I or II} = \text{Hel. J.D. } 24\ 45825.389 + 0\overset{d}{.}342437 \cdot E \qquad (1)$$
$$\pm 4 \qquad \pm 7$$

To confirm the visual observations, NSV 12040 was monitored photoelectrically jointly with other stars of the GEOS and Hipparcos programme. The Jungfraujoch Observatory's 76 cm telescope was used. The measurements were made using the cooled photometer with BV filters of the Geneva Observatory. 23 BV measurements of NSV 12040 were obtained during 5 nights in 1985 and 1986 (see Table I) by the GEOS members H. Boithias, M.Dumont, E. Joffrin, P.Louis, P.Rousselot and the author. Reductions of the observations were made using the method described by Dumont (1983). Transformation of the B-V values from the Geneva system into Johnson and Morgan's one was made using Meylan's and Hauck's formulae (1981).

A V and B-V light-curve is constructed using ephemeris (1) (see Fig.1). No variation of the B-V index greater than 0.03 mag. appears. The V magnitude at maximum is 10.65 and 11.10 at minimum. The mean B-V value, not corrected for reddening, is +0.43. The period obtained using visual observations is confirmed.

Approximate times of minimum were computed from the composite light-curve. These are listed in Table I along with the number of cycles and O-C's according to ephemeris (1). It was not possible to discriminate the primary minimum from the secondary one.

Table I: photoelectric measurements of NSV 12040

H.J.D 24 46000+	V	B–V
268.4371	10.71	0.42
268.4628	10.85	0.42
644.4163	10.65	0.43
644.4413	10.74	0.43
644.4701	10.89	0.44
644.4917	11.06	0.45
644.5101	11.08	0.44
644.5437	10.82	0.47
644.5913	10.66	0.43
646.4754	10.60	0.40
646.5122	10.76	0.43
646.5281	10.86	0.43
646.5427	11.00	0.42
646.5608	11.11	0.44
649.4052	10.74	0.43
649.4306	10.95	0.41
649.4545	11.09	0.43
649.4702	11.10	0.43
649.4872	10.98	0.44
649.5129	10.81	0.43
649.5469	10.66	0.42
649.5858	10.66	0.41
655.5733	10.65	0.42

Table II: Times of minimum of NSV 12040 using the composite V light-curve of fig. 1.

Hel J.D.	E	O–C (d)
2446644.503	2392	+0.005
2446649.462	2406.5	–0.002

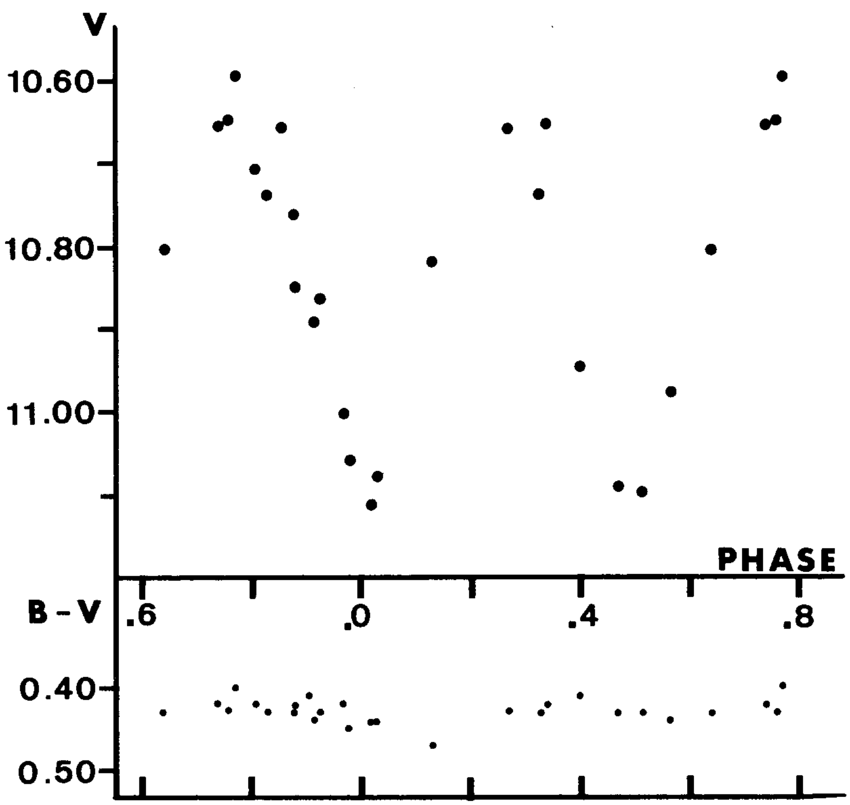

Figure 1: V and B-V light curve of NSV 12040.
Phase according to ephemeris of this paper.

The quasi-constancy of the B-V index, along with the 0.34 day period and the spectral type, allow us to catalogue NSV 12040 as a probable new W UMa type variable. It is, however, noteworthy that NSV 12040 lies near the upper boundary of the period-color diagram for contact binaries, described by Eggen (1967), see also Giuricin et al. (1983). More observations are needed for this particularly interesting object. A more accurate ephemeris will be published (Boninsegna, 1987).

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OPTICAL BEHAVIOUR OF THE POLAR AM Her IN 1985

In linking to the sequence of comparison stars given by Hudec and Meinunger (1977) the star was measured and inspected on 131 blue-sensitive (ORWO-ZU 21 + GG13 + BG 12), 10 uv-sensitive (ORWO-ZU 21 + UG 2) and 12 photo-visual (ORWO-RP 1 + GG14) plates from 55 nights taken with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 11 February and 27 October 1986. The individual observations will be published in MVS, Sonneberg. On 44 nights more than one plate per night was obtained.

Table I

J.D.hel. 244 ...	U - B	B-V	B
6645.392	-0.37::		$13^m.91$::
6645.427	-1.57		15.11
6645.440		0.51	15.11
6646.396		0.73	14.17
6646.439	-0.83		14.42
6648.396		-0.01	14.50
6648.410	-1.10		14.50
6648.439	-0.86		14.26
6649.388		0.93	14.48
6649.410	-0.86		14.48
6649.432	-1.00		14.34
6650.392		0.35	14.14
6650.411	-1.22		14.14
6650.430	-1.70		14.62
6651.399		-0.05	14.02
6651.420	-0.76		14.02
6651.443	-0.66		13.92
6679.330	-1.36		14.96
6679.351	-0.98		14.58
6679.371		0.59	14.58
6679.393		0.14	14.13
6683.337	-0.92		14.30
6683.358	-0.65		14.03
6683.379		0.05	14.03
6705.303	-0.96		13.76
6705.347		0.76	14.02
6709.298	-1.16		13.71
6709.308		0.69	13.71
6713.308		0.09	13.89

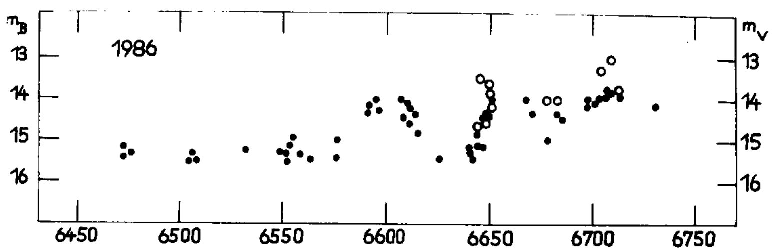

Figure 1

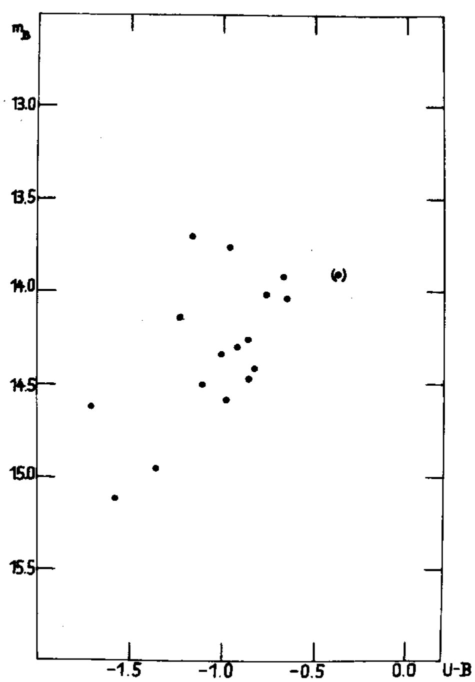

Figure 2

The long-time light curve in B and V (open circles) is given in Figure 1, As in the series of other years (see Götz,1986)two different states of brightness behaviour of AM Her can be seen there.

The low state is characterized by a long-lasting minimum of 104^d at the beginning of the series. Considering the light curve obtained in 1985 (Götz, 1986) the given minimum is probably the continuation of the 120^d low state at the end of the mentioned series. Assuming this case the total duration of the low state crossing the season 1985/86 amounts to about 290^d. The light curve in Figure 1 shows also a minimum of about 20^d and a short decrease to $\bar{B} \simeq 15\overset{m}{.}0$ within 10^d.

The observations of the high state which is caused by X-ray heating are in the mean brightness $\bar{B} \simeq 14\overset{m}{.}0$.

The colour indices B-V and U-B of the star obtained on 11 nights are listed in Table I. The B-V colour indices complete the colour-magnitude diagram (m_B- (B-V)) given by Götz (1984) and are in agreement with the behaviour shown there. The colour-magnitude diagram m_B- (U-B) is given in Figure 2. There, with increasing brightness the colour indices become larger.

The occultation light changes from the high and low state observations superimposed on the long-time behaviour of the star are in agreement with the improved elements and the occultation light curves given by Götz (1984).

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TWO-COLOUR PHOTOMETRIC STUDY OF NOVA CYGNI 1986

Nova Cygni 1986 was discovered by Wakuda (1986). Penhallow and Tatum (1986) presented the precise coordinates of this object ($\alpha = 19^h52^m45^s.89$, $\delta = +35^o34'18''.7$, 1950.0). Wenzel and Fuhrmann (1986) gave photographic magnitudes of the star near maximum, and since that time about thirty visual estimates have been published (IAU Circ. 4249, 4257, 4259, 4260).

In this paper we present photographic and photovisual observations of Nova Cyg 1986 derived from 21 pairs of Sonneberg Sky Patrol plates. The finding chart is shown in Fig. 1. By cat's eye photometry we derived the magnitudes of comparison stars (Table I) on 17 photographic and 12 photovisual plates using the magnitudes of stars near CI Cyg (Howard and Bailey, 1980): the magnitudes of our comparison stars a, b, c, f were linked to SAO catalogue data. For photographic magnitudes we used B values and for photovisual magnitudes the relation (Rendtel, 1976) m_{pv} = V - 0.22 (B-V).

The values of σ show the mean quadratic deviation of individual determinations from the mean value. The stars l and m are possibly variable, and they were not used at Sonneberg Observatory.

Because of the two disturbing neighbouring stars the brightness of the nova was determined on the plates by visual estimates. The results (rounded to the nearest half tenth) are listed in Table II and are shown in Figs. 2 and 3 (filled circles). The internal accuracy of the magnitudes in the instrumental system is believed to be in the range 0.05 to 0.1 mag.

The small systematic difference between the magnitudes presented in this paper and by Wenzel and Fuhrmann (1986) is due to the accuracy of the zero-point determination. The rise time from $13^m.2$ to 9.3 (pg) is of about four days, and then a minimum was observed before the main maximum. The amplitude of this minimum was larger in pg ($\approx$ 1.0) than in pv ($\approx$ 0.3 mag), and its duration of 5^d is larger than the duration of the pre-maximum standstill of some hours frequently observed in novae (see e.g. Pskovskij, 1974). This and other features of the light curve resemble those observed in Nova Pictoris 1925 (RR Pic). During this secondary minimum the star appears to be redder (CI = $m_{pg} - m_{pv} \approx 1^m.0$ in our instrumental system) compared with the nearby maxima (CI $\approx 0^m.3$).

Table I

Comparison stars of Nova Cygni 1986

Star	m_{pg}	σ_{mpg}	mpv	σ_{mpv}	BD
a	$8^{m}.1$:	–	$8^{m}.28$	$0^{m}.05$	+35° 3851
b	8.7:	–	8.57	.07	3867
c	9.6:	–	8.53	.08	3857
d	9.62	$0^{m}.10$	9.53	.11	3854
e	9.63	.11	9.40	.14	3858
f	9.80	.12	8.45	.09	3852
g	10.55	.08	10.43	.15	
h	10.84	.11	10.30	.10	
i	10.96	.14	10.02	.10	
j	11.23	.16	10.70	.16	
k	11.36	.12	10.74	.12	
l	11.76	.15	11.15	.21	
m	11.97	.17	10.80	.17	
n	12.94	.31	–	–	

Table II

Pg and pv observations

HJD 244 6000+	m_{pg}	m_{pv}	HJD 244 6000+	m_{pg}	m_{pv}
613.462	$>15^{m}.0$	–	685.410	$10^{m}.75$	$10^{m}.15$
641.429	13.2	$>11^{m}.15$	704.318	11.25	10.2
642.427	11.65	10.8	705.315	10.95	10.2
644.416	10.35	9.6	.346	11.2	10.2
645.426	9.6	8.8	706.300	10.55	9.6
646.433	9.3	9.0	707.310	10.55	9.9
648.425	10.2	9.05	708.315	10.4	9.9
649.426	10.25	9.05	709.306	10.55	9.9
650.430	9.45	8.75	711.293	10.4	9.7:
651.433	8.7	8.5	713.325	10.9	10.15
679.361	10.35	10.0			

Unfortunately, there is a gap in our observations in August and September and the visual observations published in IAU Circ. are rather sparse (x in Fig.3). However, ≈ 40^{d} after maximum a second local minimum was observed, which was also more pronounced in the blue spectral region than in the visual one. At that time the colour index increased as well. After this " transition stage", which is characteristic for novae (Pskovskij, 1974), see also the observations of Nova Vul 1984 I (PW Vul) by Kudashkina and Andronov (1985), a short local maximum with an overall duration of ≈ 10^{d} was observed.

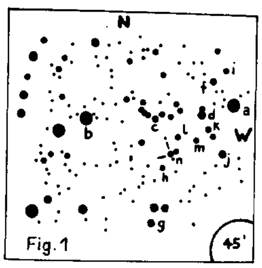

Figure 1

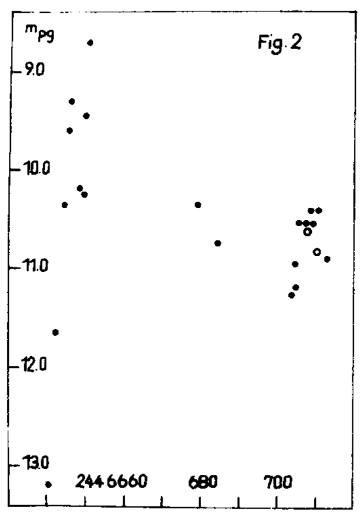

Figure 3

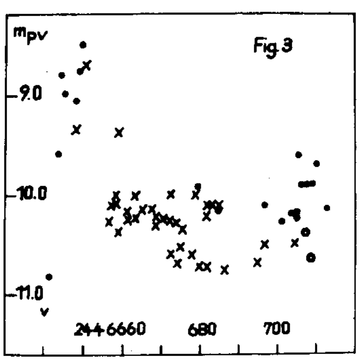

Figure 2

As one may see from Fig. 2 our m_{pg} estimates agree sufficiently well with the photoelectric observations of Monella (1986) (o in Fig. 2 and 3), and so we assume that the systematic deviation of our instrumental m_{pg} system from the standard B system is not larger than 0.1 to 0.15 mag. There is, however, a systematic deviation of our m_{pv} data from other visual magnitudes of the nova. Obviously in this colour range the nova photometry is much more sensitive against differences in the instrumental systems.

The comparison of the details of the light curve of Nova Cyg 1986 with the curves of other novae shows that it is probably a slow nova similar to Nova Pictoris 1925.

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ON THE CORONAL ACTIVITY OF RS CVn SYSTEMS

Re-examination of the x-ray emission from RS CVn systems altered the picture of coronal activity for these systems almost completely. It was found, contrary to the general belief, that the stellar radius but not the rotation of the stellar surface is the dominant parameter in the level of coronal activity of the components of RS CVn systems.

X-ray data used in the analysis are from HEAO1 A2 and Einstein surveys (Walter and Bowyer, 1981). X-ray luminosity L_x was taken to be the coronal activity indicator. Non-existence of the rotation period-coronal activity relation for these systems has been confirmed after Rengarajan and Verma(1983). Majer et al.(1984) also found no significant rotation-activity correlation for the RS CVn stars they studied. They also used L_x as coronal activity indicator. It was shown that same result persists (contrary to the findings by Walter and Bowyer, 1981; and Basri, et. al., 1985) even when surface x-ray fluxes, but not flux ratios, are used. The bolometric luminosity used in obtaining flux ratios has long been known to be an orbital period dependent quantity for the subgiant stars in binaries (e.g. Gratton, 1950, see also Young and Koniges,1977) and produces an artificial rotation-activity relation for the subgiants in RS CVn systems (Rengarajan and Verma, 1983).

The coronal activity was found to be correlated with the square of radius and the relation is much better defined when the both components in the systems are assumed to be active (see Fig. 1.). In some systems e.g. RZ Cnc RT Lac, VV Mon, AR Mon, RW UMa less massive components are more evolved and it seems they are more active components of the respective algol-like systems. In addition to nineteen RS CVn systems two other binaries (Algol and V471 Tau) from two different classes have been included in the analysis for comparison. It looks in general that mass transfering systems do not obey the same radius-activity relation. Here, the duplicity effects such as Roche-lobe overflow or stellar wind to the companion and interacting coronae or non-synchronism in long period binaries should be operative. All these effects to the activity

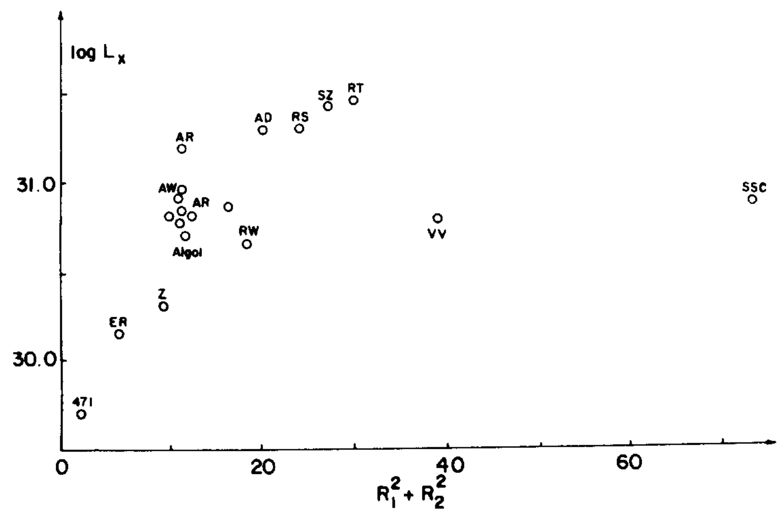

Figure 1

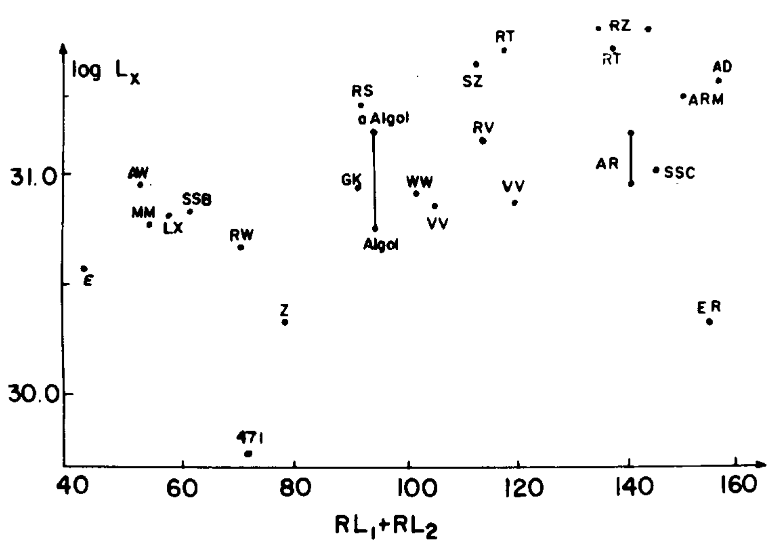

Figure 2

seem to be represented by a single parameter called Roche-lobe filling percentage RL. A clear correlation is found between RL and coronal activity (see Fig. 2). Not only the cooler, more evolved components but both components contribute to the x-ray emission as proportional to their RL. Effective temperature, bolometric luminosity and mass seem not to correlate with coronal activity for the components of RS CVn systems.

I believe that R and RL represent the most important dynamo parameter namely thickness of the convective layer for the late type evolved stars in binaries, and surface rotation rates of these stars are quite different from convective velocity where the dynamo works. This is why rotation activity correlation is not seen in RS CVn systems. Such a result can be understood with the assumption that the dynamo works on the base of a differentially rotating thick convective layer of the late type stars.

Details of this work will be published elsewhere.

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THE 1985/86 LIGHT CURVE OF II PEGASI: TWO MAXIMA OF UNEQUAL BRIGHTNESS

The single-line spectroscopic binary II Pegasi (HD 224085, BD +27°4642; K2 IV; <V> = +7.5 mag) was observed photoelectrically on 19 nights from 1985 September 14 UT through 1986 January 22 UT at Villanova University Observatory. A description of the instrumentation, observing procedure, data reduction technique, and explanation of the differential color indices has been given elsewhere (Guinan and Wacker, 1985). The comparison star was HD 223332 (BD +27°4625, SAO 091503; K5; V = +7.05 mag). Monitoring of this star with respect to SAO 091593 (V = +9.40 mag) by Vogt (1981) has established its constancy in light and color. Nightly mean differential magnitudes were computed, in the sense variable minus comparison, for the intermediate band blue, yellow and red observations, from which nightly mean differential color indices were formed. The mean errors for the nightly λλ 4530, 5500, 6600, Δ(b-y)' and Δ(b-r)' data sets are, respectively: 0.012, 0.008, 0.010, 0.015 and 0.016 mag.

The upper half of Figure 1 presents the light curve of the nightly mean differential yellow magnitudes. The orbital phases were calculated according to the ephemeris of Vogt (1981):

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

where zero phase corresponds to the moment of superior conjunction (primary component farthest from the earth). The light curve possesses two maxima, as well as two minima, all of unequal brightness. The deeper of the two minima has a value of 0.57 mag, occurring near 0.28P. The brighter of the two maxima equals 0.36 mag and occurs about 0.21P later, producing a very steep ascending branch and a corresponding light amplitude of 0.21 mag. The blue and red light curves (not shown) are identical in shape to the yellow light curve. The red light amplitude is approximately 0.19 mag, while the blue light amplitude is

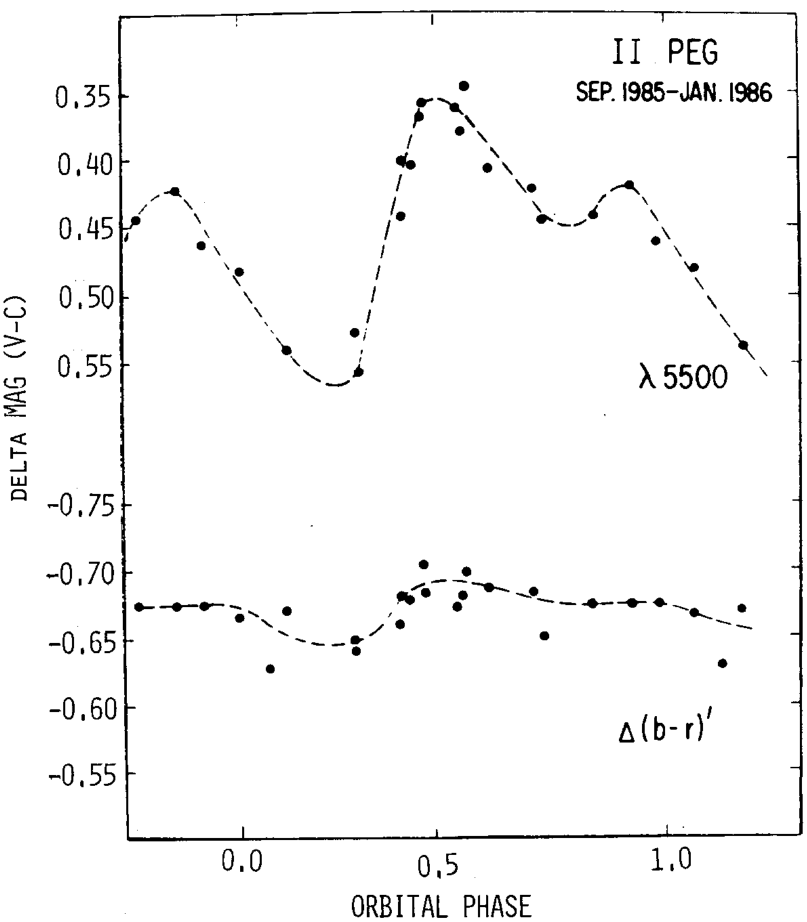

Figure 1 : The 1985/86 photoelectric observations of II Peg, made with respect to the comparison star HD 223332, are presented. The top panel is a plot of the nightly mean differential yellow magnitudes. The bottom panel is a plot of the differential color index formed from the intermediate-band blue and red observations.

about 0.23 mag.

The lower half of Figure 1 presents the differential color index Δ(b-r)' The mean value of the Δ(b-r)' data set = -0.669 mag. Despite a considerable degree of observational scatter, the color curve exhibits a noticeable discontinuity between 0.05P and 0.50P, coinciding with the minimum of the photometric wave. Similar behavior is also displayed by the Δ(b-y)' color curve (not presented).

Our light curve of II Pegasi presented in Figure 1 is very similar to that obtained for DM Ursae Majoris during early 1981 by Mohin et al. (1985), as well as the October/November 1979 light curve of II Pegasi obtained by Nations and Ramsey (1981). For chromospherically active stars such as II Pegasi and DM Ursae Majoris, the photometric variations are attributed to the rotational modulation of subluminous photospheric regions (i.e. starspots). Implementing the computer code developed at Villanova (cf. Dorren et al. 1981), we have carried out exploratory starspot modeling of our 1985/86 observations. Assuming two major spots or spot groups of different areas located at different latitudes, the amplitude and shape of the light curve can be reproduced providing the spot groups have a longitude separation between 120^{o} and 170^{o}. More extensive light curve modeling is planned.

Utilizing identical filters and instrumentation, intermediate band blue and red photometry of II Pegasi has been obtained at Villanova during three observing seasons: Autumn 1981 (unpublished), 1985/86 (this study), and Autumn 1986 (in progress). For each season, the blue observations were plotted versus the red observations, from which a correlation coefficient was computed. the values of the correlation coefficient for the 1985/86 and Autumn 1986 observations are essentially equivalent, while the value for the Autumn 1981 observations differs by approximately 17%. This difference corresponds to a change in the wavelength dependence of the light variation. This is suggestive of a change in the starspot temperature by a few hundred degrees, assuming the temperature of the unspotted photosphere remains constant. Albregtsen, Joras and Maltby (1984) find evidence for a correlation between the sunspot umbra/photosphere intensity ratio and the phase of the solar cycle. However, they were unable to find any significant correlation between the umbral intensity and the other sunspot parameters such as size, age, maximum magnetic field strength, or type of sunspot. Many of the previous studies of chromospherically active stars involving light curve modeling employing the starspot hypothesis have assumed the starspot temperature to remain constant from season-to-season. The validity of this assumption in its application to II Pegasi can only be established by obtaining further observations at both blue and red wavelengths in order to ascertain if the seasonal color changes reported here are real.

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V 358 Lyr - A WZ SAGITTAE STAR ?

Andronov (1986) kindly informed us that according to Galkina and Shugarov (1985) this object discovered by Hoffmeister is invisible on all plates of the Moscow collection (period: JD 243 4112 ... 244 5264). We therefore examined this star on all available Sonneberg plates (about 310 plates of the period JD 243 8551 ... 244 6476) and found that the star is only visible on 3 plates. The dates are given in the following table:

Plate	1965	JD	m_{pg}
Te_4 4601	Jun 25	243 8937	[14.5
Te_4 4609	Jun 29	8941	13.27
GC 1387	Aug 4	8977	16.42
GC 1388	Aug 19	8992	17.31
GC 1389	Aug 23	8996	[18.5

On the prints of the Palomar Sky Survey the object is invisible [21^m.

The magnitudes of the comparison stars were determined by fitting to the sequence of MV Lyr (Andronov and Shugarov, 1982), see Fig. 1 and the following table.

star	m_{pg}	star	m_{pg}
a	13.22	e	16.38
b	13.81	f	16.53
c	14.39	g	18.1:
d	15.21		

The light curve, tentatively interpolated between the few measured points, is given in Fig. 2. It reminds one of a fast nova. According to Duerbeck (1981) the absolute magnitude of a fast nova at maximum is about $-9\overset{M}{.}4$. The galactic co-ordinates of the object are:

$$l = 72\overset{\circ}{.}6, \qquad b = +16\overset{\circ}{.}5,$$

Taking the apparent magnitude of V 358 Lyr to be $13\overset{m}{.}0$ at the top of the maximum and assuming the interstellar extinction to be 0.4 mag (Sharov 1963), we get a distance of r = 250 kpc from the Sun and z ≈ 71 kpc from the galactic plane.

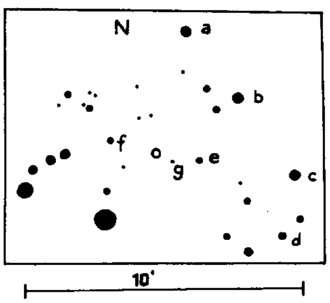

Figure 1

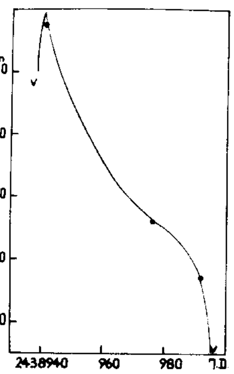

Figure 2

It is true that novae are sometimes situated far away from their parent galaxy (Wenzel and Meinunger, 1978 and Richter, 1981), but these values of r and z are rather large. They could, however, be reduced to some extent if the interstellar extinction should turn out to be larger than estimated.

But there is still a chance for V 358 Lyr to be a WZ Sagittae star whose maximum brightness is expected to be about $+2^{M}$. That this is by no means implausible can be shown by the fact that the few observed points in Fig.2 can be almost exactly fitted into the light curve of WZ Sge itself (Ortolani et al. 1980).

Thus the question whether V 358 Lyr is a classical nova or a WZ Sagittae type object remains open. There are, however, some points in favour of the WZ Sagittae interpretation.

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PHOTOELECTRIC OBSERVATIONS OF FLARE STAR EV Lac IN 1984

Within the framework of the program of investigation of flare stars in the solar neighbourhood and stellar aggregates patrol observations of the flare star EV Lac have been carried out in the Rozhen National Astronomical Observatory in the autumn of 1984 (Tsvetkov et al., 1986). These observations were made with the 60-cm Cassegrain telescope, using an EF_1 one-channel electrophotometer (Panov et al., 1981). The accuracy in the U-band was $\sigma \leq 0.09$, integration time 1s. For the patrol observations of EV Lac together with its optical companion (an A-type star of constant brighness; V=12.00, B=12.74 and U=12.95 according to Andrews and Chugainov, 1969) a diaphragm of diameter 1.5 mm(41.25 arcsec) was used. This has to be taken into consideration when using the data listed in the table for recorded flares where no corrections have been made for stellar companions.

For $15^h42^m43^s$ effective observation time 17 flare events were detected some of which forming separate groups of flares.

Table I lists the total effective observation time in each individual night, and the respective number of detected flare events during the patrol observations of EV Lac.

Table II lists data on these flare events, viz. date and the moment of maximum brightness in universal time, duration before and after this maximum (t_b and t_a, respectively) and total duration of the flare ; value of the relation $(I_f+I_o)/I_o$ for the maximum of the flare, where I_o is the intensity deflection less sky background of the quiet star and I_F is the total intensity deflection less sky background of the star plus flare, the integrated intensity of the flare over its total duration, including pre-flares, if present, $P=\int(I_f-I_o)/I_o\,dt$, the increase of the apparent magnitude of the star at flare maximum $\Delta m_u=2.5\log(I_f/I_o)$, where u is the uv magnitude of the star in the instrumental system, the standard deviation of random noise fluctuation $\sigma(mag)= 2.5\log(I_o+\sigma)/I_o$ during the quiet-state phase immediately preceding the beginning of the flare, and the air mass at flare maximum.

Fig.1 shows the light curves of spike flares observed in the u band.

During the patrol observations a number of estimations of the brightness of EV Lac were made using standards C_1 and C_2 according to Pettersen (1980) and its brightness was found to be comparatively constant.

Table I

Total monitoring time

Date	T_{eff}	Observed flares
18/19 Oct. 1984	$3^h\ 23^m\ 12^s$	8
19/20 Oct. 1984	5 35 07	4
20/21 Oct. 1984	1 40 01	2
21/22 Oct. 1984	1 45 26	1
23/24 Oct. 1984	1 04 58	1
10/11 Nov. 1984	2 13 59	1
Total: on six nights	$15^h\ 42^m\ 43^s$	17

Table II

Characteristics of the flares observed

	Date 1984	U T_{max}	t_b min	t_a min	D min	$\frac{I_f - I_o}{I_o}$	P	Δm_u mag	σm_u mag	X
1	18 Oct.	$20^h33^m43^s$	0.120	3.280	3.400	0.729	0.310	0.59	0.05	1.04
2	-"-	21 02 57	0.533	22.383	22.916	3.503	6.236	1.63	0.05	1.06
3	-"-	22 17 49	6.183	11.517	17.700	0.860	1.573	0.67	0.04	1.19
	A	22 11 46	0.133	>2.867	>3.000	0.223	>0.163	0.22	0.04	1.18
	B	22 14 51	0.217	>0.800	>1.017	0.532	0.240	0.46	0.04	1.18
	C	22 15 40	0.017	>0.650	>0.667	0.361	0.108	0.33	0.04	1.18
	D	22 16 23	0.067	>0.933	>1.000	0.288	0.134	0.27	0.04	1.18
	E	22 17 49	0.500	11.517	12.017	0.860	0.928	0.67	0.05	1.19
4	-"-	22 31 19	0.008	0.008	0.017	1.465	0.024	0.71	0.05	1.22
5	-"-	22 31 26	0.008	0.008	0.017	1.013	0.017	0.41	0.05	1.22
6	-"-	22 31 33	0.008	0.008	0.017	4.654	0.078	1.77	0.05	1.22
7	-"-	22 31 36	0.008	0.008	0.017	1.006	0.017	0.41	0.05	1.22
8	19 Oct.	00 44 36	-	9.067	>9.067	>0.458	>0.170	0.41	0.07	1.85
9	-"-	19 13 43	0.380	1.720	2.100	0.192	0.105	0.19	0.05	1.00
10	-"-	20 15 58	0.008	0.025	0.033	1.951	0.065	1.17	0.06	1.02
11	-"-	21 01 23	0.100	3.950	4.050	0.283	0.178	0.27	0.05	1.06
12	-"-	21 37 28	2.75	1.20	3.95	0.230	0.288	0.23	0.05	1.12
13	20 Oct.	20 19 54	0.833	2.117	2.95	0.241	0.197	0.23	0.04	1.03
14	-"-	21 00 32	0.917	1.55	2.467	0.368	0.449	0.34	0.05	1.07
15	21 Oct.	18 59 10	0.633	2.333	2.966	0.250	0.188	0.24	0.05	1.00
16	23 Oct.	20 56 32	0.366	1.716	2.083	0.420	0.380	0.38	0.05	1.08
17	10 Nov.	18 34 37	0.150	1.817	1.967	1.022	2.589	0.77	0.09	1.01

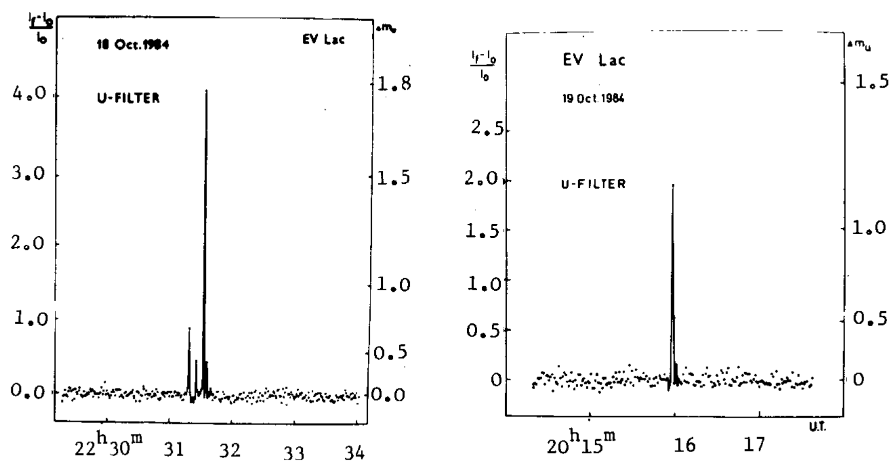

Figure 1

The following mean values of the brightness of EV Lac in the instrumental ubv system were established:

$\bar{v}=10.04\pm0.04$; $\bar{b}=11.42\pm0.05$; $\bar{u}=12.24\pm0.05$

Using the following equations our instrumental system was converted into the international UBV system as follows:

$\Delta V = (0.105\Delta(B-V)$; $\Delta(B-V) = 1.118\Delta(b-v)$; $\Delta(U-B) = 0.800\Delta(u-b)$

Figure 1 shows the light curves of spike flares observed in the u band.

Before discussing the physical conditions causing flare events of such a short duration and relatively high amplitude up to $\Delta m_u = 2^m.49$*(No. 6) it is necessary to make sure that there are neither instrumental errors nor other influences.

Current printed records of spike flares of EV Lac and other flare stars are of very great importance for the elucidation of their nature. Over the last decade a number of astronomers engaged in patrol observations of flare stars, were faced with similar phenomena still insufficiently corroborated. There are several factors accounting for the difficulties; duration of the flares is close to the integration time of the device used for the patrol observations ; the phenomenon occurs mainly in the U-band, and with simultaneous observations the amplitudes in the B-band are generally by approximately 1 stellar magnitude smaller ; possible interference that may cause spikes in the device.

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*If EV Lac's companion is taken into consideration in estimating the amplitude of flare No. 6, its influence would increase the value by $\Delta m_u = 0^m.723$.

A most reliable evidence of the existence of such flares would be provided by simultaneous observations of high time resolution, varying from 0.1s to 1s, in the ultraviolet band simultaneously on two telescopes.

In this sense the publication of the present results may be regarded as launching a call to put forward such a program. Another reason is that as early as in 1972, Moffett gave valid grounds for the project of making high time resolution patrol observations. Parallelly an increasing number of authors obtain results suggestive of similar spike flares - in the optical spectral region of flare stars UV Cet, EV Lac and AD Leo (Cristaldi and Rodono, 1970,1973 ; Gershberg and Petrov, 1985 ; Zalinian and Tovmassian, 1986 ; Ichimura and Shimizu, 1986).

Beskin et al. (1985) could not detect such flare events on the 6m telescope of the Special Astrophysical Observatory, when a MANIA device was used to detect small-scale time changes in flare events in some UV Ceti type stars. On the other hand, Lang et al. (1983) detected similar spike flares of 0.1s duration in the radiorange during a flare event in AD Leo.

In view of the contentions made regarding the physical conditions in the atmosphere of flare stars at the time of their activity (Ambartsumian, 1954; Ambartsumian, Mirzoyan, 1982) it is of primary importance to prove the existence of rapid flare activity of UV Ceti stars, of small-scale time structure of the flare, and the existence of spike flares, as well.

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NEW PHOTOMETRY OF THE WOLF-RAYET STAR HD191765

A small photometric and spectral variability of the star HD191765 (WN6) with the period $7^d.44$ was discovered by Antokhin et al. (1982). The amplitude of the photometric variability was equal to $0^m.04$. It was suggested that this is a binary system consisting of a WR star and a neutron star (so-called "WR+ compact companion" system, see Moffat, 1983). Antokhin and Cherepashchuk (1984) improved the value of the period of the light variability (P= $7^d.483$) and reported about discovering the narrow, "eclipse-like", secondary minimum on a light curve. This argues for a binary nature of this star.

Recently the paper of Vreux and Manfroid (1985) has been published which is devoted to photometric observations of HD191765 during 14 days in August 1985. These observations have been made with the purpose of searching the fast variability of HD191765. Vreux and Manfroid report that no light changes greater than $0^m.02$ have been found in filters λ4060Å ($\Delta\lambda$=70Å) and λ4260Å ($\Delta\lambda$=65Å) from night to night.

Our observations of HD191765 were carried out at the 48-cm telescope of the Alma-Ata Station of the Shternberg State Astronomical Institute in October December 1984, September-October 1985, April-May and June-July 1986. The UBV-photometer in the regime of photon counting was used. Two comparison stars were observed : HD 191917 (V=$7^m.8$, B1)=C1 and the star K (Cherepashchuk, 1972)=C2.

Figures 1-4 show the results of these observations in B,V filters. Each point is the average value of 3-19 individual light observations.

The value $m_{c2}-m_{c1}$ is also shown. One can see that the value $m_{c2}-m_{c1}$ is stable within the accuracy $\pm0^m.006$.

Our observations in a time interval 1984-1986 show that the character of the light variability of HD 191765 after 1983 changed significantly :

1. The average light of the star is variable on a long timescale. In a time interval of ~3 months in 1984 it changed by $0^m.02$ (Fig.1, the straight line is drawn using the least-square method). The average light in 1986 is also variable (Fig.3,4).

2. The shape of the light curve is also variable. The variability became less regular in 1984 (Fig.1) and irregular - in 1985 and probably 1986 (Figs.2 - 4).
3. The amplitude of the variability decreased to 0.02 in B,V filters in 1985 and increased again in 1986. It must be pointed out that the results of our observations in 1985 (Fig.2) being practically simultaneous with the observations of Vreux and Manfroid (1985) are consistent fully with their results.

Thus, light curves of HD191765 are variable in shape, amplitude and average light level on a long timescale. Similar variations in the light curve were observed in the case of another suspected "WR + compact companion" system, HD50896 (Lamontagne et al., 1986). Such variations can be explained by precession effects arising from a nonsymmetric SN-explosion in a binary system.

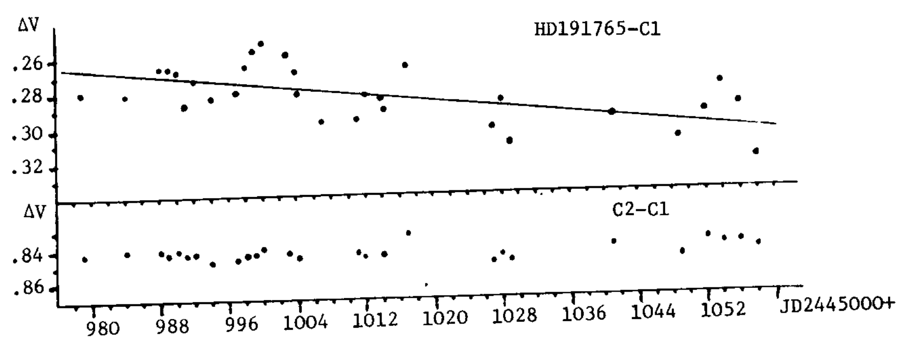

Fig. 1 V-observations of HD191765 in 1984.

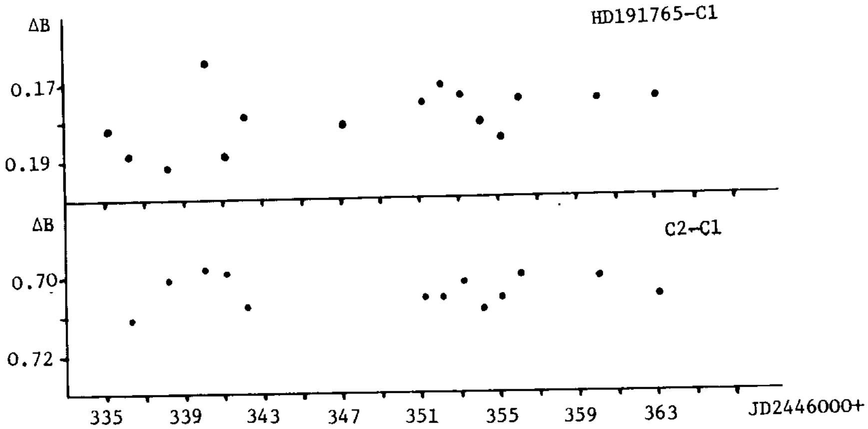

Fig. 2 B-observations of HD191765 in 1985

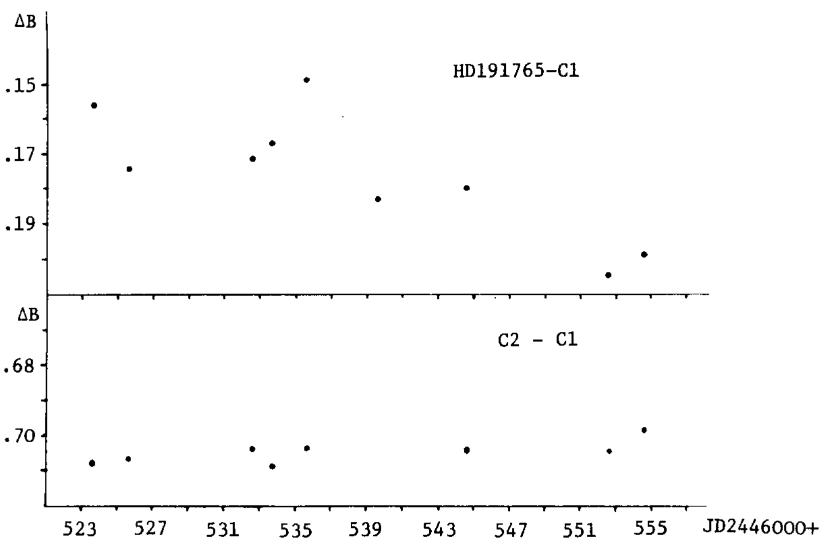

Fig. 3 B-observations of HD191765 in April-May 1986.

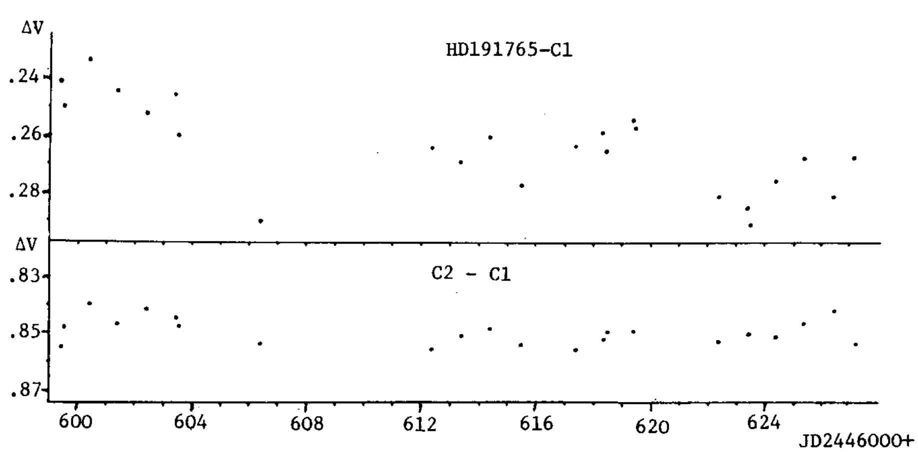

Fig. 4 V-observations of HD191765 in June-July 1986.

As a result of such explosion the rotational axis or the formed neutron star can align oblique to the orbital plane. Further observations of this interesting star are nesessary.

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CHROMOSPHERIC VARIABILITY IN THE M7 GIANT θ APODIS

It is well known that the mean fraction of a cool giant star's luminosity emitted in chromospheric lines decreases with advancing spectral type (e.g., Linsky and Ayres 1978; Steiman-Cameron, Johnson, and Honeycutt 1985; Judge 1986). The temporal variability is less well understood or even studied, however. Chromospheric emission can change in cool stars for a variety of reasons. For instance, the chromosphere may simply grow through the addition of active regions, spicules, or whatever. The heating may change for several causes, such as the passage of discrete shock waves through the atmosphere of a pulsating star or modification of magnetic field structures. Alternatively, the emission can be absorbed in circumstellar shells so that we cannot receive the photons, though they were emitted.

K giants, such as α Boo, are normally assumed to have roughly constant chromospheric emission on short timescales. Limited observations for α Boo obtained by McClintock et al. (1978) show no evidence for variation in either flux or profile. Similarly, the K giant in the interacting binary system 5 Ceti (gK2-4 + Fp) appears to have constant Mg II flux to within ~ 15% in 8 observations covering 2 years. On the other hand, Baliunas et al. (1981) report rapid variability of Ca II in α Tau (K5 III) and λ And (G8 III-IV), albeit at only the 10% level. A recent analysis of IUE photometry for cool giants by Brozius et al. (1986) finds some evidence for rotational modulation of chromospheric flux, especially in the hybrid-chromosphere stars which are thought to have solar type active regions in addition to the extended chromospheres of cool giants. Again, this is at only the 10% level.

The chromospheric emission of cooler giants can be variable too, in some cases by considerable amounts. Dupree et al. (1984) have found the supergiant irregular variable α Ori to be chromospherically variable by up to ±50%. Carpenter (1986) has recently reported changes in the profiles of chromospheric Fe II lines in the M3 giant γ Cru. Moreover, extensive series of spectra of the warm carbon stars TW Hor (Querci and Querci 1985) and TX Psc (Johnson et al. 1986) show variations in chromospheric Mg II emission of up to an order of magnitude. The Mira variables, in which shock heating of the photospheres is well documented, have even greater variability associated with the passage of individual shocks through the ambient chromosphere.

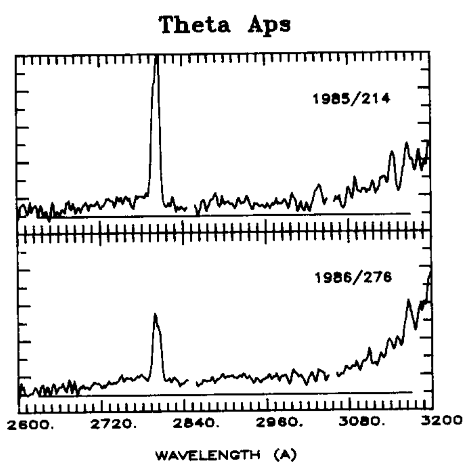

Figure 1. Ultraviolet observations of θ Aps at two epochs. In the upper panel we have an observation at 1985/Aug 2 (JD 2,446,279.9); in the lower panel, 1986/Oct 2 (JD 2,446,706.6). Flux in the ultraviolet continuum is essentially the same at both times, being 0.3 mag brighter at the second epoch. Optical flux determined with the fine error sensor was brighter by roughly the same amount. Chromospheric emission as determined by Mg II flux was much lower at the second epoch. Furthermore, the profile of this partially resolved pair of lines indicates that the flux ratio k/h changed as well, the 2796 Å k line becoming stronger as the flux decreased. This was in the sense that would be expected from a decrease in electron density or a decrease in circumstellar shell absorption.

We report here observations of a semi-regular variable at two epochs that show a large difference in the level of chromospheric emission. θ Aps (HD 122250) is a cool M giant in the circumpolar region of the southern sky. Payne-Gaposchkin (1952) found it to be variable (type SRb) in data consisting of 578 patrol plates obtained in Chile. The star showed a range of 6.35-8.35 photographic magnitudes with a ~ 119 day period. Being unfavourably placed for observation from the northern hemisphere, it has not attracted the attention that such a bright variable might deserve. However, Eggen (1975) obtained limited optical photometry which shows variability on a ~ 10 day timescale. Also, in a group of 593 southern red giants studied by Eggen and Stokes (1970), θ Aps was the reddest in a (105,62) color. We have observed the star twice with the *IUE* satellite, once on 1985/Aug 2 and again on 1986/Oct 2. Visual magnitudes have been obtained from the fine error sensor signal on the two days with the formulas given by Imhoff and Wasatonic (1986), but the results likely contain large systematic errors. The FES was used in different modes at the two epochs, the first measurement being taken in the overlap mode with a ~ 35% coincidence correction. In addition, the derived magnitudes are much brighter than expected from ground based photometry. The magnitude difference, however, indicates that the star was 0.3 ± 0.15 mag brighter at the time of the second *IUE* observation. The ultraviolet continuum was also brighter by roughly this amount. In contrast, the Mg II λ2800 emission was *lower* by nearly 0.9 mag. Other chromospheric features in this wavelength region are generally quite weak in comparison to Mg II, and none can be measured reliably in our spectra. C II] λ2325 is lost in the noise, Al II] λ2669 is possibly present but weak, Fe I UV44 is detected at high dispersion - λ2823 but not λ2844 (Eaton and Johnson 1986) but is a very weak feature in the low dispersion spectra.

The *profile* of Mg II appears to have changed with the decrease in flux. As the emission became weaker, the 2796 Å k line became stronger relative to the 2803 Å h line. This difference in k/h ratio suggests two causes: 1) the circumstellar shell could have become less dense, intercepting less of the k line for which the circumstellar extinction is expected to be greater (Eriksson *et al.* 1986), or 2) the electron density could have decreased in the chromosphere giving rise to less emission but less collisional deexcitation and mixing of the upper levels, hence less suppression of the k line. The former explanation would predict a *brighter* Mg II feature, in contradiction to what was observed, and it therefore is clear that changes in the cool circumstellar envelope alone are not an appealing explanation of the reduced Mg II emission.

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12 January 1987
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LETTER FROM THE EDITORIAL OFFICE OF THE JOURNAL OF THE AAVSO

Dear Fellow-Member of the I. A. U. :

I am sure you are familiar with the work of the AAVSO in collecting and publishing observations of variable stars, primarily by amateurs. I have been pleased to act as editor of its Journal for the past nine years.

This year, the organization celebrated its 75th anniversary by holding a three-day symposium on variable star astronomy. The proceedings of this stimulating meeting will include historical and scientific review papers and contributed papers by professionals and amateurs, and it will be published this winter as an extra-large issue of the Journal of the AAVSO. (See partial program on Page 2). It will be sent to all members and regular subscribers as a part of their subscription.

In order to publish this extraordinary volume, we must raise an additional $10,000. I know you value this sort of publication and I feel sure you will want to subscribe. For a contribution of $30, you will receive a postage-paid copy of the anniversary issue and have the opportunity to receive an informative package describing the AAVSO, for $50 or more, you will also receive the subsequent year's two issues.

As a professional, I feel that we all benefit from the work of the AAVSO, and I hope you will take this opportunity to encourage this dedicated and remarkable organization.

December 1, 1986

Sincerely,

CHARLES A. WHITNEY
Professor of Astronomy

Office of the Editor
25 Birch Street
Cambridge, MA 02138

Journal of the AAVSO
75th Anniversary Issue

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ON THE PERIOD OF QQ VULPECULAE : NEW MINIMA FROM OLD PLATES

QQ Vul is an AM Her-type system with the longest known period. However, the value of this period was not known so precisely, as it is needed to accurate phase determination.

In this paper we present the previous results of the re-examination of the observations from Moscow (Andronov and Yavorskij 1983) and Sonneberg (Fuhrmann, 1984) plate collections. The modified version of the program published by Andronov (1985) was adopted for the period search and light curve approximation using the cubic spline functions.

The values of $P=0.1545207^d \pm 3 \cdot 10^{-7}$ (M) and $P=0.1545204^d \pm 3 \cdot 10^{-7}$ (S) were derived for all Moscow (M) and Sonneberg (S) observations. No peaks were seen at the periodograms near the positions of the previously published periods. The derived moments of "normal" minima are the moments of time, nearest to the mean time of the observations in a fixed season, which have the corresponding phase. The accuracy of the moments of minima was usually $0.001-0.002^d$, but never larger than 0.005^d. All the available moments of minima are presented in Table I, together with 19 minima published by Andronov e.a. (1986 a, b) and 3 minima derived from the photoelectric light curves published by Nousek e.a. (1984) and Mukai e.a. (1986). The following linear elements were obtained using the least-square method :

$$\text{Min. HJD} = \underset{\pm 8}{2440000.0628} + \underset{\pm 22}{0^d.154520356} \cdot E \qquad \text{(A)}$$

The residuals from this ephemeris are shown in Fig.1. Assuming the cyclic variation of them, one may obtain the best fit formula :

$$\text{Min.HJD} = \underset{\pm 7}{2440000.0633} + \underset{\pm 18}{0^d.154520351} \cdot E + \underset{\pm 96}{0^d.00618} \cdot \cos(2\pi(E-E_o)/P_E) \qquad \text{(C)}$$

where $E_o=4125 \pm 692$, $P_E=27712 \pm 945$. The phase of the periodic variations may also be written as $2\pi(t-t_o)/P_t$, where $t_o=2440637 \pm 107$, and $P_t=4282 \pm 146$.

As in other polars, the cyclic changes of (O-A) might be interpreted by the "swinging dipole" model (Andronov, 1982,1986; Campbell, 1984). The amplitude of the changes of the orientation of the magnetic axis of the white

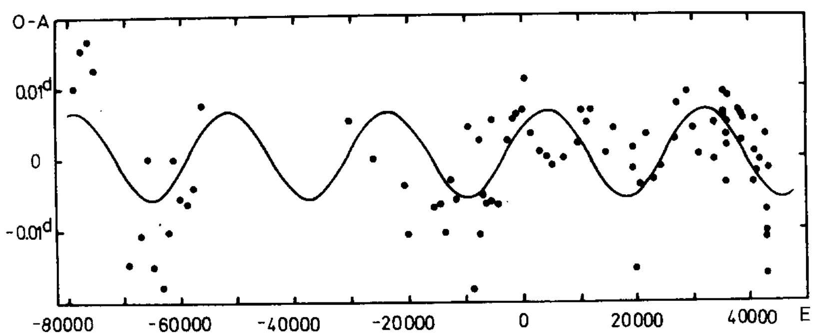

Figure 1

dwarf, is 14±2°, that is nearly the same as the value of 17° observed in AM Herculis (Andronov, 1982). But the cycle duration is four times longer as compared with 1100^d in AM Herculis. These "swingings" may cause the changes of the photometric and spectral characteristics of QQ Vul observed by Mukai et al. (1986).

It must be pointed out that we observe the cyclic but not periodic changes in (O-A) and in other characteristics. Not only the cycle, but the amplitude is variable as well. So the equation (C) corresponds only to the mean value of the cycle length. One of the possible explanations might be connected with the long term changes of the characteristics of the secondary's atmosphere (Wenzel and Fuhrmann 1983). The large dispersion of O-C of $0.006^d = 0.04^P$, as one may see from photographic and photoelectric observations, is also characteristic for polars, because of the heterogeneities of the accretion flow which lead to the rapid changes in the accretion column's structure. However, this phenomenon has to be investigated using statistical methods in future works.

It might be noted that in the third "long-period" polar H 0538+ 608 recently discovered by Remillard e.a.(1986), the shapes of the polarization and photometric curves underwent changes, which are much more pronounced compared with other polars. The possible explanation might be that the white dwarf in this object is still synchronizing, but not synchronized (eg.Andronov, 1986), so the "waltz" stage is not become yet to a "swing" stage.

Table I

T	D - R	D - C	E	Rem.	T	D - R	D - C	E	Rem.
27779.677	0.0101	0.0039	-79086	S^{*}_{*}	41578.495	0.0063	0,0052	10215	M_{*}
27979.477	0.0153	0.0093	-77793	S_{*}	41752.947	0.0048	0,0053	11344	M
28190,244	0.0165	0.0114	-76429	S_{*}	41879,810	0.0066	0,0082	12165	M
28345.842	0.0125	0,0083	-75422	S	42241.536	0.0005	0.0049	14506	M_{*}
29294,724	-0,0149	-0.0113	-69281	S_{*}	42453.696	0,0041	0.0093	15879	M_{*}
29647.189	-0.0108	-0,0052	-67000	S	42978.905	-0,0016	0,0043	19278	M
29823,508	0.0004	0.0065	-65859	S_{*}	42984,007	0,0012	0.0071	19311	M
29990.529	-0.0151	-0,0089	-64778	S	43034.673	-0,0155	-0.0097	19639	M_{*}
30221.689	-0,0175	-0.0119	-63282	S_{*}	43217,173	-0.0040	0,0010	20820	M
30389.042	-0.0101	-0.0052	-62199	S	43372.473	0.0031	0.0070	21825	M_{*}
30523,021	-0.0002	0,0038	-61332	S_{*}	43572.107	-0.0032	-0.0008	23117	M
30730,382	-0,0055	-0,0031	-59990	S	43746.717	-0.0012	-0.0003	24247	M
30937.593	-0.0063	-0,0057	-58649	S_{*}	44101,345	0.0026	0.0003	26542	M_{*}
31103.241	-0.0041	-0.0050	-57577	S	44222.803	0.0076	0.0044	27328	M
31310.310	0,0076	0,0049	-56237	S	44457,830	0.0091	0.0043	28849	M_{*}
35342,516	0,0051	0.0046	-30142	S_{*}	44656.538	0,0040	-0.0018	30135	M
35990.261	0.0008	-0.0045	-25950	S	44798.384	0,0003	-0,0058	31053	M
36814.777	-0.0038	-0.0085	-20614	S_{*}	45231,818	0,0047	-0.0009	33858	N
36907.946	-0.0106	-0,0143	-20011	S	45232,740	-0,0004	-0.0060	33864	N
37583,358	-0.0070	-0.0056	-15640	S	45460.509	0,0056	0.0012	35338	S
37791.343	-0,0064	-0.0033	-14294	S	45485.542	0,0063	0.0021	35500	S
37904,757	-0,0104	-0.0064	-13560	S_{*}	45501.615	0.0092	0,0051	35604	S
38061.448	-0,0030	0.0020	-12546	M	45530.502	0.0009	-0,0030	35791	Ab
38177,490	-0,0058	-0.0003	-11795	S	45530,652	-0.0037	-0.0075	35792	Ab
38264.640	-0.0052	0.0006	-11231	S_{*}	45562,490	0.0031	-0,0005	35998	Ab
38533,824	0.0043	0.0105	- 9489	M	45562.650	0,0086	0,0050	35999	Ab
38629,295	-0.0183	-0.0122	- 8871	S_{*}	45563,570	0.0015	-0,0021	36005	Ab
38825.389	-0.0106	-0.0051	- 7602	S_{*}	45908.619	0,0066	0.0058	38238	Mu
38836.682	0.0024	0.0078	- 7529	M	45961,305	0,0011	0.0009	38579	Ab
38946,693	-0.0051	-0.0002	- 6817	M	45963,315	0.0024	0.0021	38592	Ab
38982,386	-0.0063	-0.0016	- 6586	S_{*}	45969.345	0.0061	0.0059	38631	Ab
39159.312	-0,0061	-0,0026	- 5441	M_{*}	46006.275	0.0057	0.0058	38870	Ab
39168,131	0,0053	0,0087	- 5384	S	46296,455	-0.0035	-0.0008	40748	Ab
39341.491	-0.0066	-0,0046	- 4262	M_{*}	46324.270	-0,0022	0,0007	40928	Ab
39584,715	0,0024	0.0022	- 2688	M	46328.295	0.0053	0,0082	40954	Ab
39726.413	0,0052	0,0038	- 1771	M_{*}	46328,445	0,0008	0.0037	40955	Ab
39853,275	0.0060	0.0035	-950	M	46489.454	-0.0004	0.0037	41997	Ab
40081,352	0,0110	0.0068	526	M_{*}	46621.418	0.0032	0.0031	42851	Aa
40239.882	0,0031	-0.0020	1552	M	46626,352	-0,0075	-0.0025	42883	Aa
40466,252	0.0008	-0,0052	3017	M_{*}	46638,241	-0.0165	-0,0115	42960	Aa
40660.947	0.0002	-0.0060	4277	M	46639.328	-0,0112	-0,0061	42967	Aa
40797,387	-0.0013	-0,0073	5160	M_{*}	46653.399	-0,0015	0.0036	43058	Aa
41119,563	-0.0002	-0.0049	7245	M	46655.399	-0.0103	-0.0052	43071	Aa
41492,732	0.0021	0,0002	9660	M					

Remarks:

S,M - Mean minima from Sonneberg and Moscow Plates;
* - observations from two or three subsequent seasons were used

N - minima from Nousek e.a.(1984)
Mu - Mukai e.a.(1986)
Aab - Andronov (1986ab)

Because of its longest known period, QQ Vulpeculae is in some sense the intermediate object between "classical" and "intermediate" polars. So further simultaneous multicolour observations might clarify the details of the structure and evolution of magnetic close binaries.

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A NEWLY DETECTED RR LYRAE STAR

The star BD+40°0060 = NSV 134(Strohmeier, 1958; Nikulina, 1959) is supposed to be a rapid irregular variable in the New Catalogue of Suspected Variable Stars. A more detailed inspection of the object revealed that it consists of two stars of almost equal brightness, the angular distance between them being about 6 seconds of arc. Photoelectric UBV observations were carried out by the author during 24 nights from 1985 September 11 to 1986 December 5 with the Sonneberg 60 cm telescope II and the Piszkéstető 50 cm telescope (Hungary). Because of the small angular distance of the pair it was not possible to measure the stars separately. The magnitude difference in V to the comparison star BD+40°0056 varies between 0.5 to 1.0 mag. One of the stars, probably the preceding one, has clearly turned out to be an RR Lyrae star of type "ab". The companion would then have to be a late G type star according to the classification by Götz and Wenzel (1962). The observations in V are best reproduced by the following elements:

$$JD_{hel}(Max.) = 244\ 6764.241 + 0^{d}.470568 \cdot E.$$
$$\pm 1 \qquad\qquad \pm 2$$

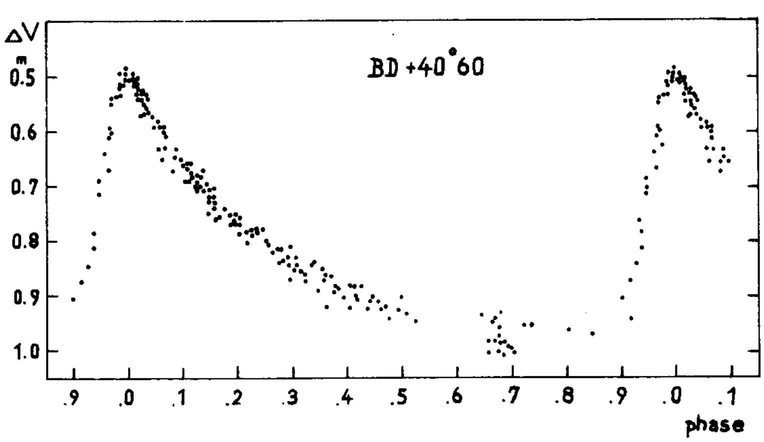

Figure 1

Whether or not the object is a physical pair is still unresolved.

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AT PEGASI: PHOTOELECTRIC OBSERVATIONS AND LIGHT ELEMENTS

The only existing photoelectric light curve of the eclipsing binary AT Peg(HD 210892 = BD+07°4824) was given by Cristaldi and Walter(1963). It is reanalyzed by Giuricin et al.(1981). Several authors observed the system visually and photographically. The published times of minima are listed in Table I. The spectroscopic orbital elements are studied by Hill and Barnes(1972). Margrave(1981) investigated the period changes of the system by combining his photoelectric times of minima with the other photoelectric ones since 1969. He concluded that the period is decreasing. Moreover, this decreasing has been accelerated since 1975 which fits quadratic light elements.

The system was observed photoelectrically at Ege University Observatory on 13 nights during the observational seasons of 1983, 1984, 1985 and 1986. The observations were made in blue and yellow colours using the 48 cm Cassegrain telescope and photoelectric photometer equipped with an unrefrigerated photomultiplier tube EMI 9781A and Johnson's standard B,V filters. A total of 529 and 396 points were obtained in B and V colours, respectively. BD+07°4818 was used as the comparison, and BD+08°4800 as the check star. The comparison star showed no significant variations against the check star. The extinction coefficients were determined for each night from observations of the comparison star. The differential observations(variable minus comparison) were corected for the atmospheric extinction. Four primary and two secondary times of minima were obtained and included in Table I.

Table I. Times of minima of AT Pegasi.

JD Hel.	Min	Method	W	E	(O-C)	Ref.
2433504.526	I	vis	1	-6050	-0.060	1
504.523	I	vis	1	-6050	-0.063	1
558.387	I	vis	1	-6003	-0.066	1
888.463	I	vis	1	-5715	-0.061	1
34272.406	I	vis	1	-5380	-0.056	2
303.350	I	vis	1	-5353	-0.056	2
35019.666	I	pg	2	-4728	-0.041	3
034.572	I	pg	2	-4715	-0.034	3
097.598	I	pg	2	-4660	-0.043	3
332.541	I	vis	1	-4455	-0.047	4
332.549	I	vis	1	-4455	-0.039	4
370.363	I	vis	1	-4422	-0.045	4
370.365	I	vis	1	-4422	-0.043	4
388.710	I	pg	2	-4406	-0.036	3
726.810	I	pg	2	-4111	-0.030	3
36085.527	I	vis	1	-3798	-0.037	4
085.528	I	vis	1	-3798	-0.036	4
100.434	I	vis	1	-3785	-0.029	4
108.447	I	vis	1	-3778	-0.038	4
108.455	I	vis	1	-3778	-0.030	4
108.460	I	vis	1	-3778	-0.025	4
37175.478	I	vis	1	-2847	-0.010	5
175.471	I	vis	1	-2847	-0.017	6
497.5211	I	pe	3	-2566	-0.0155	7
544.507	I	vis	1	-2525	-0.019	5
544.515	I	vis	1	-2525	-0.011	5
872.315	I	vis	1	-2239	0.010	8
872.317	I	vis	1	-2239	0.012	8
872.321	I	vis	1	-2239	0.016	8
872.318	I	vis	1	-2239	0.013	8
873.480	I	vis	1	-2238	0.029	9
904.402	I	vis	1	-2211	0.006	8
37911.287	I	vis	1	-2205	0.015	8
38226.464	I	vis	1	-1930	0.019	10
234.468	I	vis	1	-1923	0.001	10
288.348	I	vis	1	-1876	0.015	8
288.347	I	vis	1	-1876	0.014	8
319.289	I	pg	2	-1849	0.012	10
642.458	I	pg	2	-1567	-0.015	11
940.447	I	vis	1	-1307	-0.007	12
940.454	I	vis	1	-1307	0.000	12

Table I(continued)

JD Hel.	Min	Method	W	E	(O–C)	Ref.
2439057.353	I	vis	1	-1205	-0.001	12
356.480	I	vis	1	-944	-0.002	6
356.485	I	vis	1	-944	0.003	6
356.486	I	vis	1	-944	0.004	6
387.406	I	vis	1	-917	-0.020	13
685.443	I	vis	1	-657	0.036	14
40407.438	I	pe(V)	3	-27	-0.001	15
438.383	I	pe(V)	3	0	0.000	15
477.326	I	vis	1	34	-0.024	16
493.394	I	pe(V)	3	48	-0.001	17
877.3368	I	pe(V)	3	383	0.0044	18
877.3372	I	pe(V)	3	383	0.0048	18
41576.446	I	vis	1	993	0.004	16
599.378	I	vis	1	1013	0.014	16
661.2728	I	pe(B,V)	3	1067	0.0203	19
42661.8136	I	pe(V)	3	1940	0.0315	20
712.2435	I	pe(V)	3	1984	0.0338	21
43728.8093	I	pe(V)	3	2871	0.0249	20
44089.8270	I	pe(V)	3	3186	0.0267	20
128.7925	I	pe(V)	3	3220	0.0255	20
136.8149	I	pe(V)	3	3227	0.0253	20
442.8188	I	pe(V)	3	3494	0.0253	22
520.7515	I	pe(V)	3	3562	0.0244	22
826.7553	I	pe(V)	3	3829	0.0243	23
45219.8562	I	pe(V)	3	4172	0.0191	24
615.2538	I	pe(B)	3	4517	0.0184	25
957.360	II	pe(B)	-	4815.5	0.019	25
46000.3358	I	pe(B,V)	3	4853	0.0169	26
298.3155	I	pe(B,V)	3	5113	0.0152	26
315.5062	I	pe(B,V)	3	5128	0.0147	26
334.419	II	pe(B,V)	-	5144.5	0.017	26

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The (O-C) residuals in the Table I were computed with the following light elements given in the Second Supplement to the Third Edition of GCVS(1974):

$$\text{Hel MinI JD} = 2440438.383 + 1^{d}.146082 \cdot E. \qquad (1)$$

The (O-C) values are plotted in Figure 1.

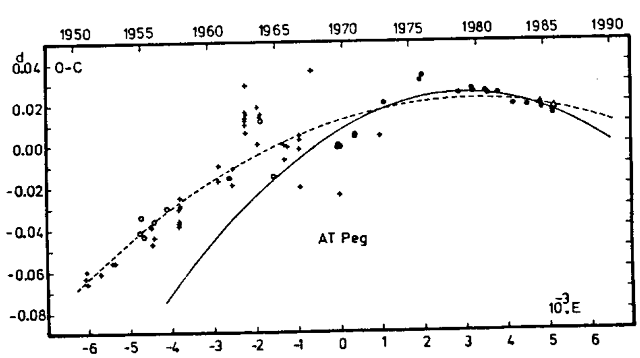

Figure 1. O-C diagram of AT Pegasi. The plusses, circles, dots and triangles denote visual, photographic, photoelectric primary and photoelectric secondary minima, respectively. The dashed and solid lines represent the computed parabola using the equation (2) and (3), respectively.

Using all times of primary minima listed in Table I, quadratic light elements have been calculated by the weighted least squares method as follows:

$$\text{Hel MinI JD} = \underset{\pm 14}{2440438.3946} + \underset{\pm 3}{1^{d}.1460884}.E - \underset{\pm 10}{1^{d}.00\times 10^{-9}}.E^{2}. \qquad (2)$$

This means that the period of AT Peg is decreasing with the rate of (5.5± 0.5) second per century. On the other hand, using only all of the photoelectric times of minima, following quadratic light elements have been obtained with the same method:

$$\text{Hel MinI JD} = \underset{\pm 14}{2440438.3898} + \underset{\pm 10}{1^{d}.1460938}.E - \underset{\pm 21}{1^{d}.92\times 10^{-9}}.E^{2}. \qquad (3)$$

The decrease in the period is (10.6 ±1.1) second per century for this set. The light elements given by the equation (3) are in good agreement with the photoelectric times of minima but, the photographic and visual observations show large deviations. However, the light elements given by the equation (2) seem to fit all observations. At present, it is difficult to decide which elements are appropriate because of the lower accuracy of the photographic and visual observations. For this reason, the photoelectric minimum times are needed.

The light and colour curves of AT Peg are shown in Figure 2 where the phases have been calculated with the following linear light elements:

$$\text{Hel MinI JD} = \underset{\pm 4}{2445615.2541} + \underset{\pm 3}{1^{d}.1460766}.E. \qquad (4)$$

These light elements have been obtained with the photoelectric primary minima between the years of 1975 and 1985 using the least squares method. The light curves of AT Peg show a deep primary and a shallow secondary minimum. Their amplitudes are about $0^{m}.845$ and $0^{m}.785$ at the primary, $0^{m}.080$ and $0^{m}.100$ at the secondary minimum in B and V light, respectively. The system is redder at the primary and slightly bluer at the secondary mini-

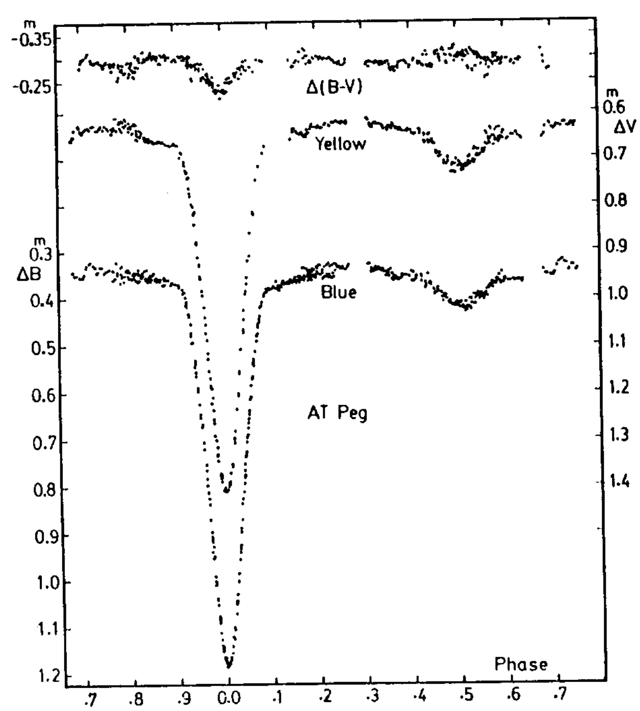

Figure 2. The light and colour curves of AT Peg.

mum which implies that the spectral type of the secondary is later than the primary. The photometric analysis of the light curves is in progress and will be published elsewhere. This work has been partly supported by the Research Foundation of Ege University with the project number 1985/036.

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POSSIBLE ORBITAL PERIOD OF NOVA VULPECULAE 1984 I (PW VULPECULAE)

In the course of a thorough investigation of the light-curve of PW Vul on 299 plates of Sonneberg Observatory and the Crimean Station of the Sternberg Institute of Moscow a dense series of 61 Sonneberg astrographic plates, taken between 1986 Sep. 30 and Oct. 10, were analysed with respect to periodic variations. After subtraction of the monotonous trend of the normal brightness decline the data were subjected to a period search programme, and the following elements were found:

$$\text{min.(hel.)} = 244\ 6704.263 + 0^{d}.21372.E$$
$$\pm \qquad 3 \qquad\qquad 91$$

The light-curve resulting from folding the data by these elements is given in the figure.

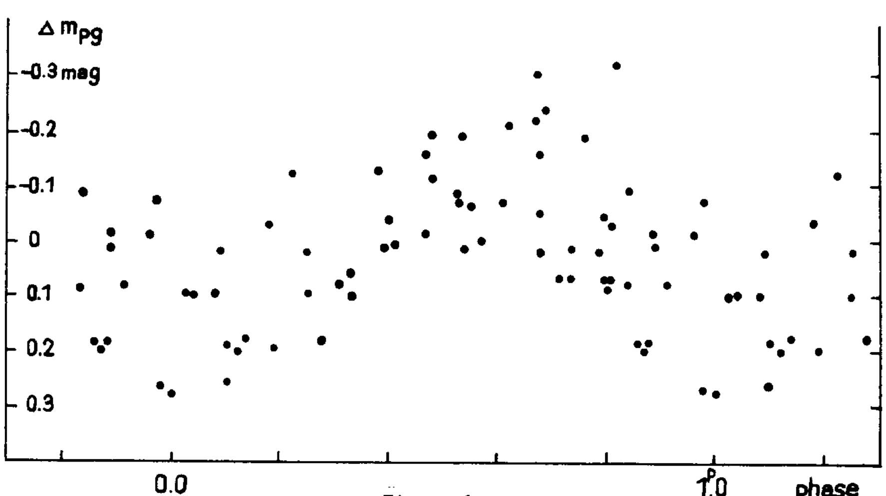

Figure 1

The scatter is not larger than can be normally expected for this sort of photographic observations. Therefore we conclude that the period is probably real, especially since it is in the typical range of orbital periods of novae.

Particulars concerning the system of comparison stars and the overall light-curve will be published in Mitt. Veränderl. Sterne.

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THE PROPER MOTION OF THE AGK3 VARIABLE STARS. III:

RX Peg

This is the third note on a program conducted to check the proper motion of the AGK3 red variable stars which seem to be affected by systematic errors (Stephenson 1978). On the previous notes, CR Gem = AGK3 +16 639 (Lopez 1986) and SS Vir = AGK3 +1 1462 (Lopez and Cesco 1986) were discussed. The case of RX Peg = AGK3 +22 2375 = BD +22°4508 = HD 208526 is herein presented.

The first-epoch position is based on the published material of the Paris Astrographic Catalogue (AC) where RX Peg was identified with object 148 on plate 314 (zone +22 degrees and epoch 1892.75). The second-epoch position has been obtained from a new plate (epoch 1986.50) taken with the Double Astrograph of El Leoncito Station. Both plates were treated in the same way and reduced using the surrounding AGK3 stars as a reference system. The mean error for the AC plate is $\pm$ 0".38 in α and $\pm$ 0".33 in δ, whereas for the new position it is $\pm$ 0".26 in both α and δ.

The resulting annual proper motion is:

$\mu\alpha*\cos(\delta)$ = -0".007 $\pm$ 0".005 (me); $\mu\delta$ = -0".002 $\pm$ 0".004 (me)

The values quoted in the AGK3 are:

$\mu\alpha$ = -0".033 and $\mu\delta$ = -0".270

Our result is in agreement with Palmer's (1945) determination, thus confirming that the values quoted in the AGK3 are in error.

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SEARCH FOR FLARE STARS IN NGC 7000 REGION

Within the framework of the observational programme for investigating the flare stars in the NGC 7000 emission nebula region 95 patrol photographic plates were obtained with the 67/92 cm Schmidt telescope of the Asiago Observatory. The total effective time of observations from August 1972 to September 1974 is 49^h59^m. The multiexposure method of observations was used - on most of the plates 5 star images were obtained of 5 minute duration each. Kodak 103 AO plates with UG 1 filter or without filter were used.

During an earlier examination of the region and a later revision 5 flare-events were found. The following data are summarized in Table I :

1. The serial number of the flare star;
2. The Byurakan designation according to Tsvetkov et. al., IBVS 938,1974; IBVS 1002,1975, only for repeated flare-events;
3. - 4. Coordinates for 1950.0;
5. Photographic magnitude in the undisturbed state in the U- or pg-light;
6. Observed amplitude in the U- or pg-light;
7. Date of the flare-event (U.T.);

Table I

No	Other designation	$R.A._{1950.0}$	$D_{1950.0}$	$m_{U/pg}$	$m_{U/pg}$	Date
A1	B14	$20^h49^m.3$	$44^\circ00$	15.5_U	2.6_U	5.10.1972
A2		52.0	44 09	16.5_{pg}	0.6_{pg}	19.10.1973
A3	B18	53.7	43 23	20.4_{pg}	4.4_{pg}	4.09.1972
A4		55.3	41 50	19.5_{pg}	3.5_{pg}	9.09.1972
A5		55.8	43 46	16.5_{pg}	2.0_{pg}	4.09.1972

The identification charts of the discovered flare stars and precise photographic photometry will be given later.

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NEW B,V LIGHT CURVES OF LS DELPHINI

LS Del (BD+19° 4574,HD199497) was discovered as a W UMa type eclipsing variable by Bond(1976) from photometric and spectroscopic observations. Bond gave a light curve, based on only 24 points, in the uvby photometric system and derived a period of 0.3638 days. According to the list published in the 4th edition of GCVS, the visual magnitude of the system varies from 8.61 to 8.76. The variable received its current name in 1981 (Kholopov et al., 1981).

New photoelectric observations of LS Del in B,V colors were made by us, with the 60-cm Cassegrain telescope at the Xinglong station of the Beijing Astronomical Observatory, on 4 nights of August 1986. In the observations, BD+19°4576 and +19°4590 were used as comparison and check stars, respectively. Data concerning them are summarized in Table I. One primary and two secondary minima were obtained. Those minima are listed in Table II, together with the time of minimum of LS Del obtained by Bond. The new light elements obtained as follows:

$$\text{Hel MinI} = 2,446,670.1658 + 0\overset{d}{.}3639207\ E$$
$$\pm 22 \qquad\qquad \pm 3$$

Table I

Data for variable, comparison and check stars

BD	Name		Sp.	V	B-V
+19 4574	LS Del	MinI	G5IV	8.89	0.89
		MinII		8.87	0.90
		Max		8.73	0.89
+19 4576	Comparison		K0	8.50	1.00
+19 4590	Check		F5V	7.40	0.50

Table II
Times of minima of LS Del

JD hel 2440000.+	E	O-C
2687.418 *	-10944	+0.0003
6668.1609	-5.5	-0.0033
6670.1686	0	+0.0028
6671.0744	+2.5	-0.0012

* Bond (1976).

The period found by us is slightly longer than the old one. The light curves are shown in Figure 1 where the differential magnitudes ΔB,ΔV for the system relative to the comparison star have been plotted against the phases which were calculated with the elements given in this article.

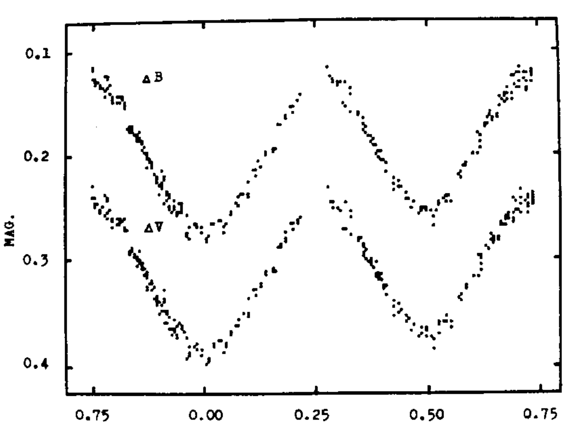

Figure 1

From the new observations, the depth of primary minimum is 0.16 mag. in V band, a little deeper than 0.15 mag.given by Bond. The difference between the depth of the primary and secondary minima is of 0.02 mag. The detailed discussion will be given elsewhere.

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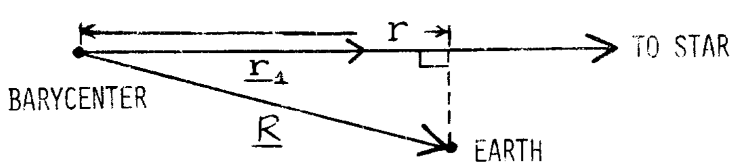
ADOPTION OF THE BARYCENTER OF THE SOLAR SYSTEM AS THE REFERENCE POINT FOR THE TIMING OF VARIABLE STAR OBSERVATIONS.

A number of considerations lead to a strong recommendation that observers of variable stars express times in Barycentric Times:

1. The advent of radio time signals giving Coordinated Universal Time, and the use of microcomputers for timekeeping, makes it possible to determine current Terrestrial Dynamic Time (TDT) with considerable precision.
2. Heliocentric times referred to the center of the Sun are subject to a periodic component caused by the motion of the Sun around the Barycenter. The principal term has a period of about 12 years (Jupiter) and causes a variation of about +/-0.00004 day.

The recent changes in the format of the Astronomical Almanac and the development of the Floppy Almanac permit convenient calculation of the Barycentric Equatorial Rectangular Coordinates of the Earth, J2000, for any TDT.

An algorithm for determining the light time correction to the TDT of an observation follows:



$\underline{r}_1$ = unit vector in the direction of a star.

$\underline{R}$ = radius vector from the Barycenter to the center of the Earth.

$r = \underline{R} \bullet \underline{r}_1 = R \cos(\underline{R}, \underline{r}_1)$.
$= X \cos\delta \cos\alpha + Y \cos\delta \sin\alpha + Z \sin\delta$.

Light Time Correction = r x 499.004782 seconds.

X,Y,Z = Barycentric equatorial rectangular coordinates of the Earth, J2000, for time TDB (differs from TDT by no more than 2 milliseconds).
α, δ = Mean Right Ascension and Declination of the star, Epoch J2000.
499.004782 = I.A.U. primary constant; light time for a unit distance in the Solar System.

The light time correction is added algebraically to TDT to get Barycentric Time. The maximum monthly variation of this correction, caused by the motion of the center of the Earth around the center of mass of the Earth-Moon system, is about +/- 15 milliseconds. The maximum possible daily variation, caused by the rotation of the Earth, is about 21 milliseconds.

If adopted, this convention should remove the principal timing error caused by the observer's motion and eventually increase the accuracy of period variation studies with a long time base.

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Editors' note: Dr. P. Ahnert (Sonneberg Observatory , G.D.R.) published a Table in "Mitteilungen über Veränderlichen Sterne , Suppl. 1. (1961)" for the barycentric light time corrections for the years 1850 - 2051 taking into account the effect of the five outer planets.

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HU ISSN 0374 - 0676

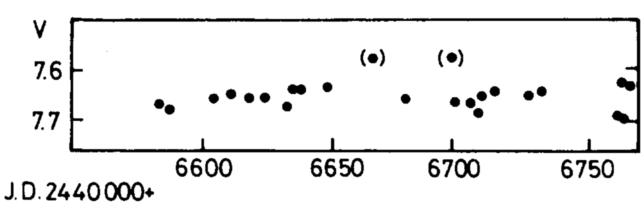
IS V 1675 CYGNI A VARIABLE STAR?

Berthold (1978) published the first and only observations of this bright star. He estimated the brightness of the star on plates of the Hartha Sky Survey and found a light variation in the range of 8.4 - 9.1 m_{pg}. Berthold suspected that the star was of the type Inbs.

I observed the star in 1986 with a photoelectric photometer attached to the 250/3250 Cassegrain telescope at Nessa Observatory. No clear light variation has been found. The average brightness and colour of the star are as follows:

$$V = 7.65 \pm 0.03 \qquad B-V = +1.71$$

The colour index is normal for an M-type star with a small interstellar extinction. The observations will be continued in the year 1987.



DIETMAR BÖHME
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PSF 93

Reference:

Berthold, T., 1978, Hartha Mitt. Vol. 12.14

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PHOTOELECTRIC OBSERVATION OF THE FLARE
STAR UV Cet IN DECEMBER 1985

The flare star UV Cet was monitored in cooperation with EXOSAT program on December 22, 1985 from 16^h19^m to 18^h49^m UT and on December 23 from 16^h46^m to 20^h01^m UT using the 1.25 m Cassegrain telescope with a five-channel photon-couting UBVRI -photometer. The UBVRI bands are close to the Johnson standard system, 2 sec integration time and 20" diaphragm were used.

During the first night no flare activity was observed, see Fig. 1 where records of star+background and background only are shown.

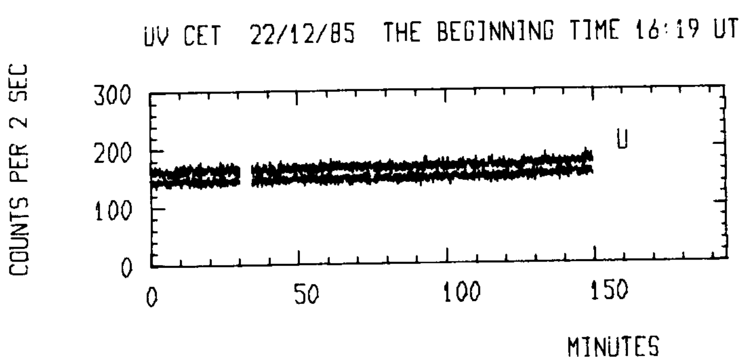

Figure 1

Note that a flare limit detection in a single integration is 0.3 mag at the 1σ level. During the second night rather high flare activity was observed: five flares are recorded and they are shown in Fig. 2.

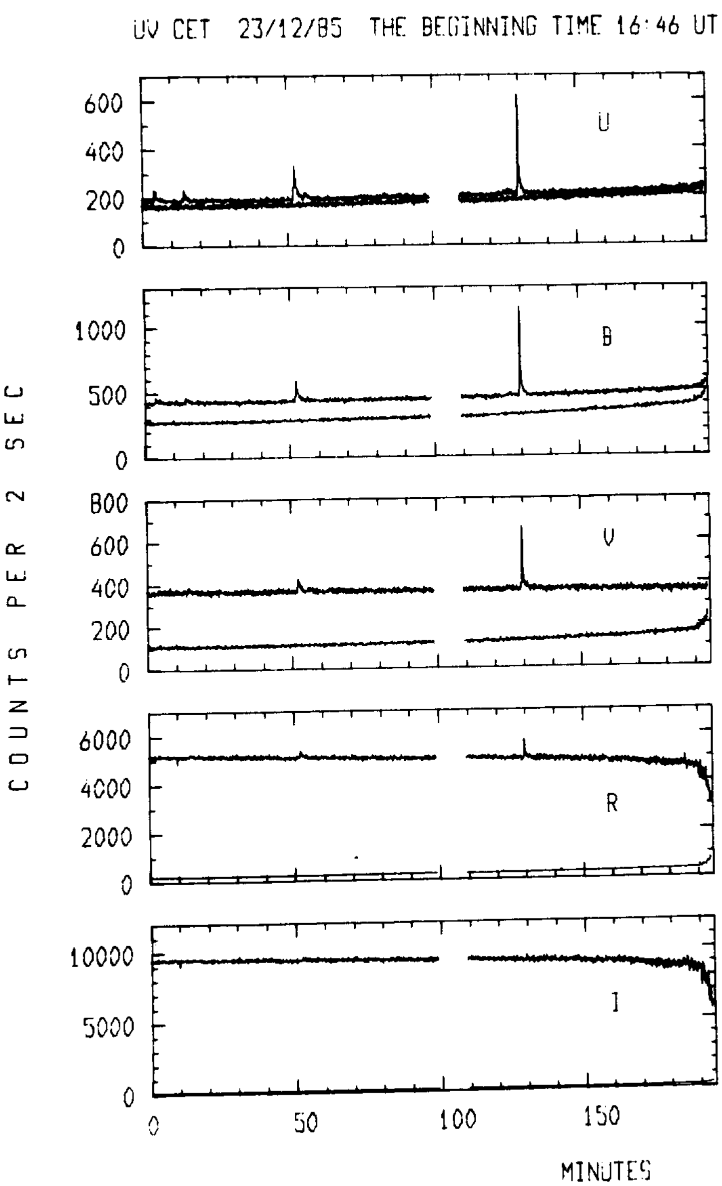
UV CET 23/12/85 THE BEGINNING TIME 16:46 UT
COUNTS PER 2 SEC
U
600
400
200
0
B
1000
500
0
V
800
600
400
200
0
R
6000
4000
2000
0
I
10000
5000
0
0
50
100
150
MINUTES

Figure 2

A clear preflare is observed before the last, the most powerful flare. Few characteristics of the recorded flares are given in Table I :

Table I

N	UT_{max} 23/12/85	t_a	t_b	P	Δm_u
1	$16^h50^m.5$	0.5	4.2	6.2	1.2
2	$17^h00^m.9$	1.5	2.5	4.5	1.3
3	$17^h38^m.7$	0.3	3.2	9.4	2.1
4	$17^h42^m.3$	0.5	3.8	6.1	0.9
5	$18^h56^m.1$	0.2	2.5	7.8	3.2

a. The universal time of the flare maximum, UT_{max}.
b. The flare duration before and after its maximum, t_a and t_b (min).
c. The equivalent duration of the flare, P (min).
d. The amplitude of the flare in U-band, Δm_u.

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HU ISSN 0374-0676

PHOTOELECTRIC LIGHT CURVES OF V523 CASSIOPEIAE

The very short period eclipsing binary system V523 Cas was discovered by Weber (1957). V523 Cas and CC Com have the shortest orbital periods, $0\overset{d}{.}234$ and $0\overset{d}{.}221$, respectively, of any of the known eclipsing systems. Subsequent photoelectric light curves have been published by Lavrov and Zhukov (1976), Bradstreet (1981) and Hoffman (1981). Zhukov (1985) studied all available light curves and reported both long term and short term cyclic variations.

The present observations of V523 Cas were made on three nights during October, 1986. The 24 inch F/13.5 reflector at Lowell Observatory was used with standard Johnson B,V filters and a thermoelectrically cooled EMI 6256 photomultiplier tube. The comparison and check stars were BD 49°0160 and BD 49°0151, respectively. Approximately 460 observations were obtained at each effective wavelength.

Six epochs of minimum light were determined, using the Hertzsprung technique (1928), from observations made during three primary and three secondary eclipses. These are given in Table I.

Table I

JD Hel. 2446700+	Minimum	Cycles	(O-C)
6.66816	I	-9.0	0.0002
7.71907	II	-4.5	-0.0005
7.83668	I	-4.0	0.0003
7.95309	II	-3.5	-0.0002
8.65443	II	-0.5	0.0001
8.77141	I	0.0	0.0002

The ephemeris given by Lavrov and Zhukov was based on both photoelectric and photographic observations. Since Bradstreet retains their initial epoch in his improved ephemeris, a new ephemeris based on photoelectric observations only is needed.

However, a least squares fit to all available photoelectric minima (which cover a span of about 23,500 cycles) leads to large O-C's. This result is apparently due to a change in the period of the system since Lavrov's and Zhukov's observations. This matter will be discussed at length in a forthcoming paper. Due to these considerations, an improved ephemeris has been calculated based on the photoelectric minima determined subsequent to Lavrov's and Zhukov's observations. The minima listed in Table I along with the eighteen other photoelectric minima of Bradstreet (1981) and Hoffman (1981) were introduced with equal weights into a least squares solution to obtain the following improved ephemeris:

$$\text{JD Hel Min. I} = \underset{\pm 2}{2446708.7712} + \underset{\pm 2}{0.^{d}23369145} \quad \text{(p.e.)}$$

This ephemeris was used in calculating the O-C's in Table I, and in determining the phases in Figure 1.

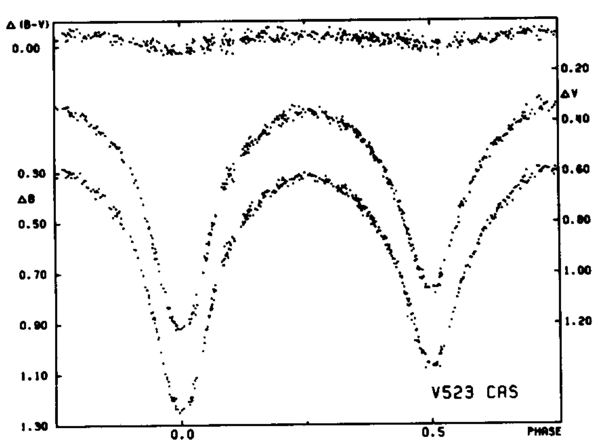

Fig. 1 - Light curve of V523 Cas defined by the individual observations,

The B and V light curves of V523 Cas 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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VW HYA - ULTRAVIOLET ECLIPSE OF THE SECONDARY AND NEW EPHEMERIS

The eclipsing binary VW Hya (not in HD, BD, CPD, discovery number 72.1929) was discovered by Hoffmeister (1929) as an eclipsing binary with a very deep minimum, with a brightness outside minimum of 10.5 magnitude. The star has been observed with the 70cm reflecting Swiss telescope at La Silla Observatory in Chile with the P7 photoelectric photometer (see Burnet 1976 and Burnet, Rufener 1979) in the Geneva photometric system. The observations continue and we publish the preliminary results because of the rather unusual behaviour of the system during secondary eclipse.

Generally the shape of the light curve is typical of a double star with red and blue components, however the secondary eclipse in the U colour is unexpectedly too deep. Obviously a source of ultraviolet radiation is eclipsed during the secondary eclipse. Fig. 1 shows the light curve in the V filter. Fig. 2 shows the detailed secondary minimum in the U filter. Measurements in the B1 filter, which is closest to U, do not show the secondary minimum - Fig. 3. For readers not familiar with the Geneva photometric system, Fig. 4 shows the response curves for filters U and B1 (see Rufener 1963,1981 or Golay 1974,1980).

The observation is based on only one observation of the secondary minimum. The effect may be transient and observers are advised to monitor the secondary eclipse in colour U. Obviously spectroscopic observations may finally reveal more details concerning UV emission on the secondary star. The new ephemeris is as follows:

$$T(\mathrm{minI}) = 2446083.7665 + 2.6964378 \cdot E \quad \text{(in HJD)}$$

These are provisional results. More details will be published later after reduction of all observations for a complete light curve.

Coordinates 1950.0: RA = 8:31:31, Dec. = -14:29.8.

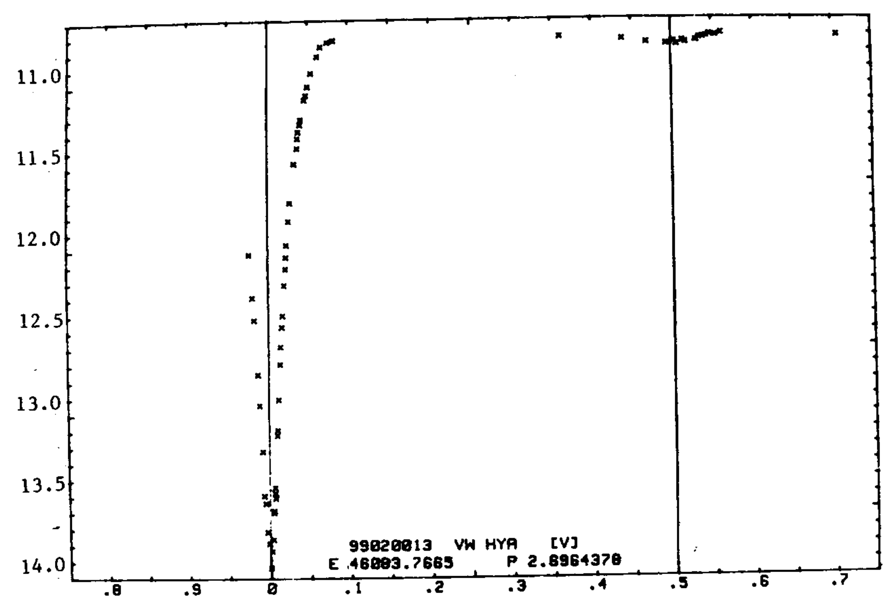

Fig. 1. Light curve of VW Hya. Magnitude [V] against phase. Filter [V] of the Geneva photometric system corresponds to V of the UBV system.

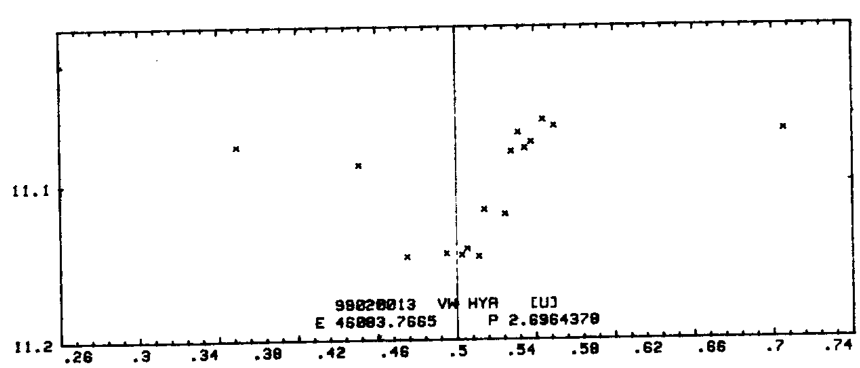

Fig. 2. Secondary minimum of VW Hya in filter [U]. Ordinates: Magnitude [U]. Abscissae: Phase.

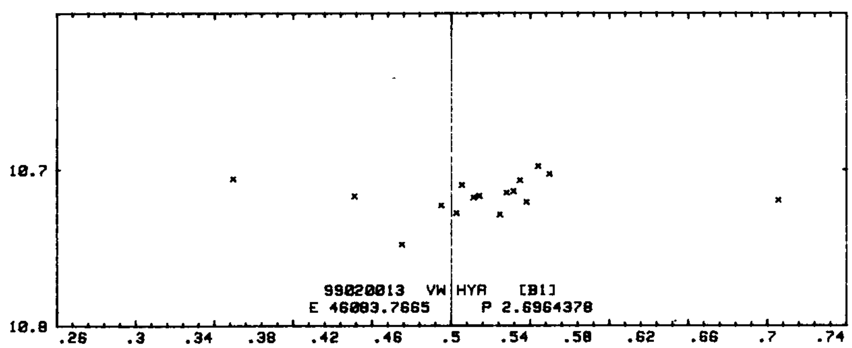

Fig. 3. Secondary minimum of VW Hya in filter [B1]. Ordinates: Magnitude [B1]. Abscissae: Phase.

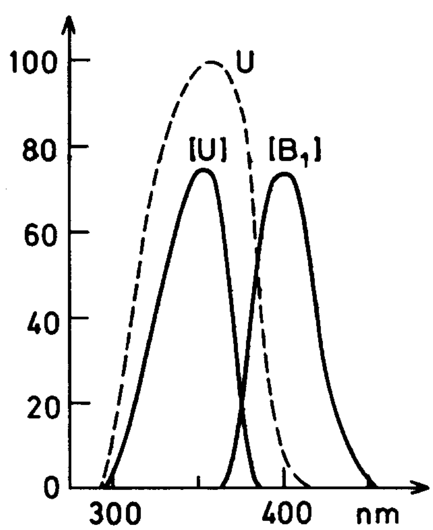

Fig. 4. Response curves for filter [U] and [B1]. For comparison response curve of filter U from UBV system as dashed line.

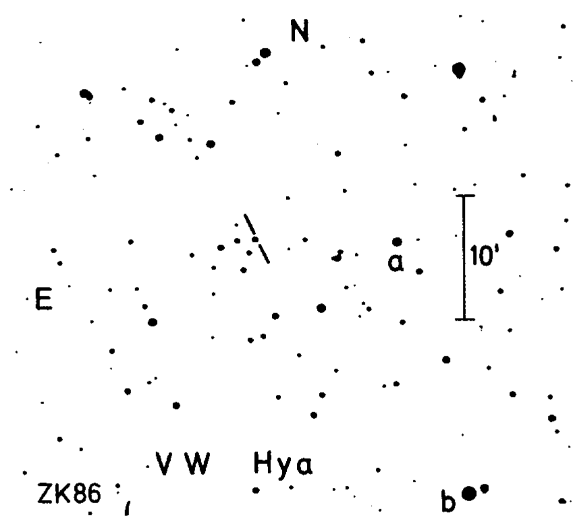

Fig. 5. Finding chart for VW Hya. Two brighter nearby stars marked a and b are marked on the chart too. Star a is HD72530, V = 9.14 mag. and b is HD72462 V = 6.38 mag. The chart is based on the atlas by Papadopoulos (1979).

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UBV OBSERVATION OF NOVA ANDROMEDAE 1986

M.Suzuki (Ena City, Gifu, Japan) discovered a nova of $m_{pv} = 8^m_.0$ at $\alpha = 23^h09^m_.5$, $\delta = +47^\circ10'$ (equinox 1950.0) on Dec. 5.44 (UT), 1986. After the maximum light, we observed the nova in UBV colours with the 40-cm reflector of the Science Museum of Kawasaki on Dec.11 (UT). 7 And was used as the comparison star.

The obtained differential magnitudes in the sense of Nova - 7 And are given in Table I , which are also plotted in Figure 1.

Table I

UBV Photoelectric Observations of
Nova Andromedae 1986

1986 Dec. 11 (UT)

G. M. T	Hel. JD 2446775	DU mag	DB mag	DV mag
8 45.6	0.8650	2.1827	2.8020	2.9739
9 15.7	0.8859	2.1805	2.7903	2.9653
10 5.5	0.9205	2.1693	2.7813	2.9520
10 25.2	0.9342	2.1749	2.7837	2.9582
10 42.3	0.9461	2.1825	2.7831	·2.9612
11 6.5	0.9629	2.1818	2.7861	2.9757
11 25.6	0.9761	2.1996	2.7686	2.9728
11 48.3	0.9919	2.1752	2.7484	2.9546
12 16.5	1.0115	2.1437	2.7272	2.9307
12 40.0	1.0278	2.1349	2.6687	2.8860
12 57.7	1.0401	2.1484	2.6703	2.8925

Our observation indicates the existence of some increasing light. It is also found that the B-V colour is becoming redder with time while the U-B bluer.

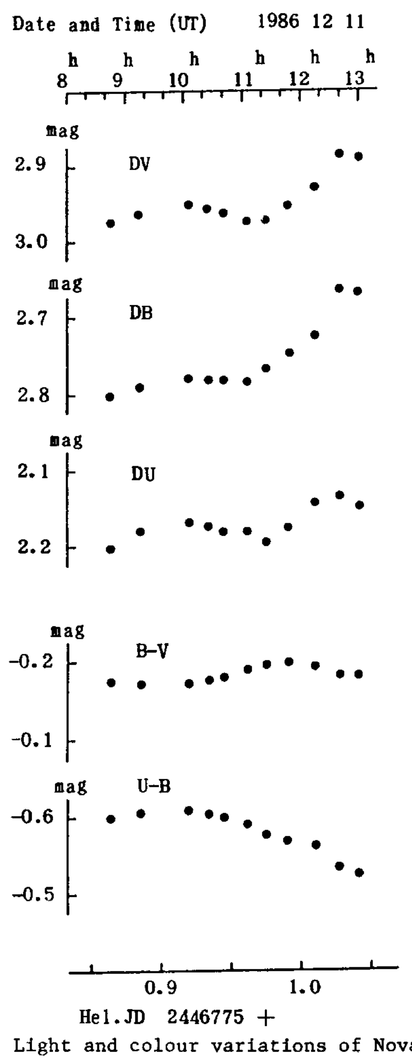

Figure 1. Light and colour variations of Nova Andromeda 1986 on Dec.11.

We would like to express our hearty thanks to Prof. M.Kitamura of Tokyo Astronomical Observatory for his encouragement.

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SPECTROSCOPIC DISCOVERY OF AN ERUPTIVE AND TWO PROBABLE LATE-TYPE EMISSION-LINE VARIABLES

The following stars, of presumed interest to variable star observers, were discovered on 75 minute exposure (baked Kodak IIIa-J emulsion) objective-prism plates (1360 Å mm^{-1} at $H\gamma$) taken for the Case Low-Dispersion Northern Sky Survey (see Pesch and Sanduleak, 1983).

1. $\alpha = 10^h52^m18^s.9$, $\alpha = +37° 15'.8$ (1950). On a plate taken on 5 May 1981, the spectrum is that of a 14th magnitude, moderately blue early-type star with very weak hydrogen absorption lines. However, inspection of the Palomar Sky Survey (POSS) prints shows only a 19th magnitude stellar image at this position. Thus, this would appear to be some type of eruptive variable which underwent at least a 5 mag. outburst.

2. $\alpha = 10^h45^m16^s.9$, $\delta = +52° 34'.4$ (1950). On 14 Jan. 1983, the spectrum is that of a late K or early M-type star with strong Balmer series emission seen down to at least $H\epsilon$ and a very strong ultraviolet continuum. The star seems to have a comparable apparent magnitude of B $\sim$16.5 on both the objective-prism plate and the POSS O print. The

image diameters on the POSS O and E prints yield an estimate of B-V $\sim$ +1.0. Such stars are only rarely noted in our survey; the only other case (involving a flare star) was reported by Sanduleak (1983). Not a known proper motion star.

3. $\alpha = 16^h30^m33^s.0$, $\delta = +53° 33'.6$ (1950). Involved here is a physical double ($\sim$3 arc seconds separation) of two comparable brightness (B $\sim$16 mag.) late K or early M-type stars. The easternmost and slightly fainter component (to which the above coordinates apply) alone displays, on a plate taken 23 May 1984, the H and K Lines of Ca II in emission with extraordinary strength, i.e. the strongest yet seen at this dispersion by these observers. Neither star shows evidence of the Balmer series in emission nor any indication of an abnormally strong uv continuum. This pair does not appear to have been detected in proper motion surveys.

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PHOTOELECTRIC LIGHT CURVES OF VZ PISCIUM

The very short period eclipsing binary system VZ Psc was confirmed, photoelectrically, as a W Ursae Majoris-type system by Moorehead (Wolff et al. 1965). Subsequent photoelectric observations, made by Eggen (1967), Poretti (1984, 1985), Davidge and Milone (1984) and Fry and Milone (1985), have resulted in three published photoelectric minima and an initial period determination of 0.261 days. Bradstreet (1985) has obtained two well covered one-color photoelectric light curves. However, these have high probable errors of a single observation of $\pm0^{m}_{.}018$ and $\pm0^{m}_{.}022$. He applied the Wilson-Devinney code to his most recent light curve but no unique solution was determined. Hrivnak and Milone (1985) have conducted a recent spectroscopic study and stated that VZ Psc has a mass ratio near unity. The shallow depths of minima (about $0^{m}_{.}3$) and the apparent variability of the amplitude and shape of the light curve have hampered work on the system.

The present observations were made on October 10 and 11, 1986. The 24 inch F/13.5 reflector at Lowell Observatory was used with standard Johnson B, V filters and a thermoelectrically cooled EMI 6256 photomultiplier tube. The comparison star was BD +04°5010. The check star is the $11^{m}_{.}5$ star eastward and adjacent to the comparison star shown on the chart by Giclas et al. (1959). Approximately 320 were obtained at each effective wavelength.

Four epochs of minimum light were determined from observations made during two primary and two secondary eclipses. The bisection of chords technique was used. These are given in Table I.

JD Hel 2446700+	Minimum	Cycles	(O-C)
9.6894	II	-4.5	-0.0008
9.8228	I	-4.0	0.0018
10.7344	II	-0.5	-0.0009
10.8658	I	0.0	-0.0001

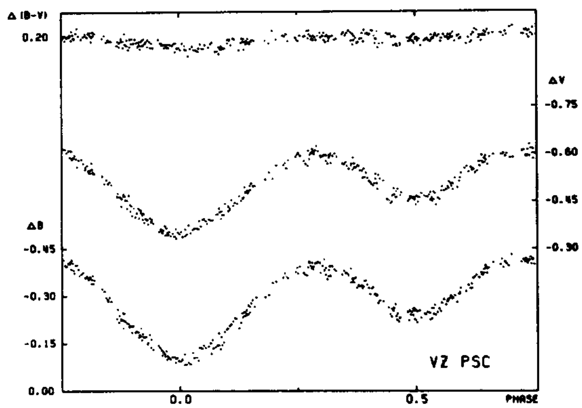

Fig. 1 - Light curve of VZ Psc defined by the individual observations.

These four minima along with thirteen other photoelectric minima by Eggen (1967), Bradstreet (1985), and Poretti (1984, 1985) were introduced with equal weights into a least squares solution to obtain the following improved ephemeris:

$$\text{JD Hel Min. I} = \underset{\pm 4}{2446710.8659} + \underset{\pm 4}{0^{d}.26125897} \text{ (p.e.)}$$

This ephemeris was used in calculating the O-C's in Table I and the phases of the present observations.

The B and V light curves of VZ Psc 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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THE LIST OF THE NEAREST AND BRIGHT ECLIPSING BINARIES FROM THE HIPPARCOS PROGRAM

In the previous paper (Dworak and Oblak, 1984) we gave a review of arrangements of astrometric HIPPARCOS program. The HIPPARCOS satellite will be launched on a geostationary orbit in the beginning of 1988.Technical data were also briefly described in that paper. Our program (No 00177) of observations of the nearest eclipsing binaries (and also bright systems which are included into the standard program), extensively presented in the previous paper, has been accepted by the Organizing Committee of the HIPPARCOS Project.

The planned observations will serve for determination of heliocentric parallaxes of these stars as well as for determination of their geometric and physical parameters and to verification of the modified mass-luminosity relation (Brancewicz and Dworak, 1980).

To obtain homogenous results for such parameters the new or additional observations of eclipsing binaries from the HIPPARCOS program are very needed. Table I contains a revised list of the nearest and also bright eclipsing binaries for which photometric or spectrometric (or both) observations will be necessary in further elaborations. Especially the determination of spectral type and luminosity class for secondary components of eclipsing systems is needed to estimate their effective temperatures. The solution of light curve from photoelectric observations is also needed for the determination of geometric parameters of each eclipsing system.

The consecutive columns of Table I contain: name and type of the star (EA - an Algol-type, EB - β-Lyr-type, EW - W UMa-type, E - an eclipsing binary without determined type), co-ordinates for the epoch 2000.0, observations needed (photometric, spectrometric or both), and the year of the last observation. The data for this list are taken from General Catalogue of Variable

Table I

The nearest and bright eclipsing binaries for which new or additional observations are needed (spec., phot., or both)

Name	Type	α (2000.0)	δ (2000.0)	Obs. needed	Year of last obs.
RT AND	EA	$23^h10^m51^s$	$+53^\circ01'.5$	spec.	1986
AN AND	EB	23 18 23	+41 46.3	both	1980
BX AND	EA	2 09 01	+40 47.9	both	1983
BW AQR	EA	22 23 17	−15 20.1	both	1985
DV AQR	EB	20 58 42	−14 29.3	spec.	1984
DX AQR	EA	22 02 27	−16 58.1	spec.	1981
EE AQR	EB	22 34 42	−19 51.6	both	1985
QS AQL	EA	19 41 06	+13 48.7	spec.	1980
R ARA	EA	16 39 42	−57 00.2	both	–
V535 ARA	EW	17 38 05	−56 49.8	spec.	1984
RR ARI	EA	1 55 50	+23 34.8	both	–
HS AUR	EA	6 51 19	+47 41.0	phot.	1983
IM AUR	EA	5 15 29	+46 24.9	spec.	1983
TZ BOO	EW	15 08 10	+39 57.9	spec.	1983
VW BOO	EW	14 17 26	+12 33.2	both	1983
44i BOO	EW	15 03 49	+47 39.0	phot.	1985
SV CAM	EA	6 41 27	+82 17.8	phot.	1986
VZ CVN	EA	13 32 04	+28 34.8	spec.	1986
R CMA	EA	7 19 27	−16 23.3	spec.	1986
EX CAR	EA	10 25 00	−63 38.2	both	1924
AR CAS	EA	23 30 00	+58 32.9	spec.	1947
CW CAS	EW	0 45 56	+65 05.3	spec.	1981
RR CEN	EW	14 16 54	−57 51.5	spec.	1984
V716 CEN	EB	14 13 56	−54 37.8	spec.	1984
V752 CEN	EW	11 42 46	−35 49.0	both	1986
XZ CEP	EB	22 32 25	+67 08.9	both	1982
EM CEP	EW	21 53 48	+62 36.8	spec.	1982
AA CET	EW	1 59 01	−22 55.1	both	1986
RZ CHA	EA	10 42 35	−82 02.4	phot.	1980
ε CRA	EW	18 58 44	−37 06.8	spec.	1983
SX CRV	EW	12 40 14	−18 48.0	spec.	–
V346 CYG	EA	20 19 25	+36 20.1	both	1971

Name	Type	α (2000.0)	δ	Obs. needed	Year of last obs.
V1061 CYG	EA	$21^h07^m20^s$	+52 02.8'	both	1986
V1362 CYG	E	20 03 41	+36 25.5	both	-
RW DOR	EW	5 18 30	-68^o13.6	both	1982
TW DRA	EA	15 33 50	+63 54.3	phot.	1986
AI DRA	EA	16 56 18	+52 41.7	spec.	1986
BV DRA	EW	15 11 53	+61 50.4	spec.	1984
BW DRA	EW	15 11 53	+61 50.7	spec.	1984
CM DRA	EA	16 34 24	+57 09.0	spec.	1985
YY ERI	EW	4 12 09	-10 27.7	phot.	1985
CO ERI	EA	2 35 39	-45 04.0	both	1963
TZ FOR	EA	3 14 40	-35 33.5	phot.	-
GX GEM	EB	6 46 08	+34 25.0	both	-
RV GRU	EW	22 39 26	-46 52.5	both	-
Z HER	EA	17 58 07	+15 08.2	spec.	1979
V624 HER	EA	17 44 17	+14 24.4	spec.	1984
GK HYA	EA	8 30 50	+ 2 16.5	spec.	1961
SU IND	EW	20 54 41	-45 43.9	both	-
TX LEO	EA	10 35 03	+ 8 39.1	spec.	1967
AM LEO	EW	11 02 11	+ 9 53.8	spec.	1986
AP LEO	EW	11 05 04	+ 5 09.2	spec.	-
ES LIB	EB	15 16 47	-13 02.6	spec.	1980
δ LIB	EA	15 00 58	- 8 31.2	spec.	1982
TZ LYR	EB	18 15 50	+41 06.6	spec.	1986
FL LYR	EA	19 12 05	+46 19.4	spec.	1983
TY MEN	EW	5 26 50	-81 35.3	spec.	1980
UX MEN	EA	5 30 01	-76 15.0	phot.	1973
V566 OPH	EW	17 56 52	+ 4 59.1	spec.	1986
V839 OPH	EW	18 09 21	+ 9 08.0	both	1985
V1010 OPH	EB	16 49 28	-15 45.4	both	1984
ER ORI	EW	5 11 15	- 8 33.3	spec.	1983
KZ PAV	EA	20 58 48	-70 25.9	both	1980
EE PEG	EA	21 40 02	+ 9 10.9	phot.	1979
LX PER	EA	3 13 18	+48 06.7	phot.	1983
AE PHE	EW	1 32 33	-49 31.5	both	1970
δ PIC	EB	6 10 18	-54 58.0	spec.	1973
UV PSC	EB	1 16 54	+ 6 48.8	both	1985
XZ PUP	EB	8 13 31	-23 57.0	spec.	-

Name	Type	α (2000.0)	δ	Obs. needed	Year of last obs.
TY PYX	E	$8^h59^m44^s$	$-27^\circ48'.7$	spec.	1978
RS SGR	EA	18 17 36	-34 06.9	phot.	1980
V505 SGR	EA	19 53 07	-14 36.5		1985
V525 SGR	EB	19 07 14	-30 10.1	spec.	1973
V1647 SGR	EB	17 59 14	-36 56.8	spec.	1982
V2509 SGR	EB	18 15 51	-35 39.3	spec.	1967
μ SGR	EA	18 13 46	-21 4.0	spec.	1938
V393 SCO	EA	17 48 48	-35 03.9	spec.	-
V760 SCO	EA	16 24 49	-34 54.3	spec.	1965
TY TAU	EA	4 34 42	+15 16.3	spec.	1985
EN TAU	EA	5 56 42	+25 14.9	spec.	1975
HU TAU	EA	4 38 16	+20 41.5	spec.	1984
HO TEL	EA	19 52 00	-46 52.1	spec.	1980
XY UMA	EB	9 09 59	+54 30.1	both	1985
XZ UMA	EA	9 31 27	+49 28.4	both	1985
W VOL	EW	7 37 43	-69 32.8	spec.	-

Stars (Kukarkin et al., 1985), from a catalogue of parameters of eclipsing binaries (Brancewicz and Dworak, 1980) and also from the Cracow Card Index of Minima for Eclipsing Binaries.

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OBSERVATIONS OF SPIKY FLARES OF BY Dra AND EV Lac

During the last years an investigation of flare stars with high time resolution has been carried out at Byurakan Observatory. With the use of the automatic electrophotometer in which the output signal is recorded only in the case when it exceeds the mean level by a given amount (say 3σ or 6σ), several short flares of the star EV Lac have been detected (Zalinian, Tovmassian, 1986). A group of spiky flares (Fig.1) similar to one detected by Jarrett and van Rooyen (1979) was recorded.

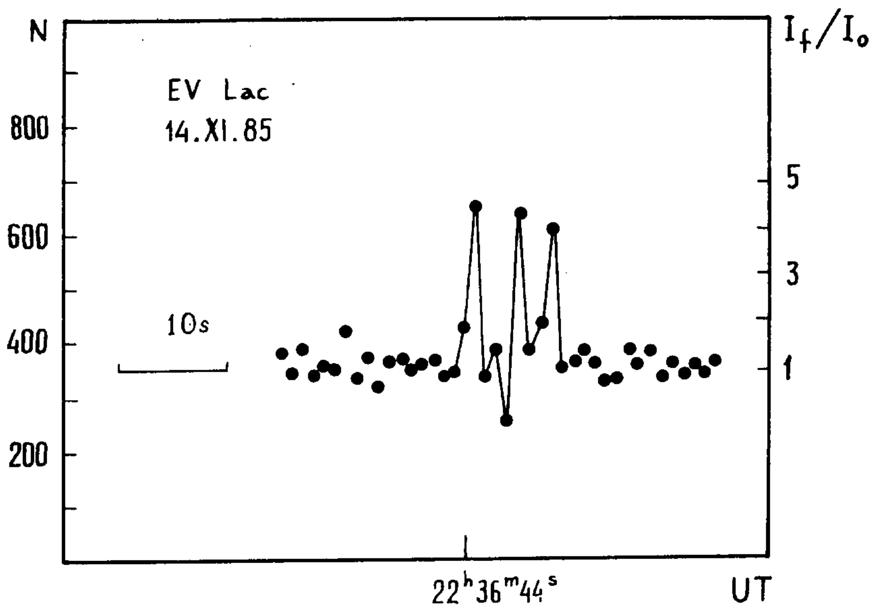

Figure 1

Spikes of EV Lac observed with a one-channel (U) electrophotometer

In our case three spikes with a duration of about 2-3 sec each have taken place in 10 sec. The brightness of the star in each spike increased by about 1.5 magn.

But the records of spiky type short flares of 1-2 sec duration may always cause suspicion - do they represent a real increase of star brightness or they may be a result of some impulsive processes in the used photomultiplier or in the amplifier circuits of the electrophotometer. In order to solve this problem a two-channel fast electrophotometer was constructed (Zalinian, 1987). The first observations were made mainly in U now we have a possibility of simultaneous monitoring of the observed stars in two colours - U and B.

In 9 hours of observations with the 40 cm telescope using this two-channel electrophotometer with 0.1 sec time constant one typical flare of BY Dra of about 4 sec duration was detected (Fig.2).

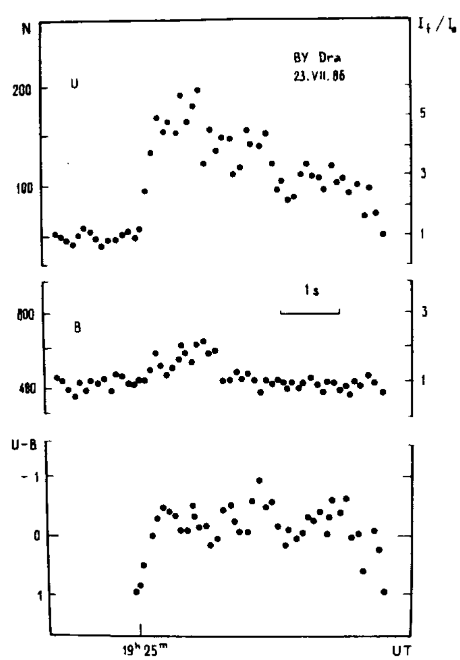

Figure 2: Light curves of BY Dra flare in U and B and the U-B colour curve of the flare

The brightness of the star increased by about 2 magn. in U. In B filter the increase of the brightness was ∿ 1 magn. The increase of the brightness in U occured in 1 sec, faster in the first (0.2 sec) and then a bit slower. The U-B colour of the star was about -0.25 and varied little during the flare event.

At the same period of observations a group of 7 spikes in U exceeding the level of the fluctuations of the BY Dra radiation of minimum by more than 6σ have been recorded (Fig. 3). The duration of each spike is less than 0.2 sec. Spikes occurred in about 1.5-4 minutes one after another. The brightness of the star in each spike increased by about two times. In case of non-simultaneous observations in B, such flares of brightness could hardly be considered as real, though similar groups of flares of a little bit longer durations have been detected earlier by observations only in U (Jarrett and van Rooyen, 1979). In our observations two or may-be three spikes in U were accompanied with simultaneous spikes in B, which by more than 3σ , exceeded the mean level of the signal determined as usually in our electrophotometer by the preceeding 100 counts. The simultaneous registration of these flares in two independent channels convinces in their reality.

Three flares of EV Lac have been detected during 13 hours of observations. The duration of the first flare (Fig.4) with an amplitude of 2.8 magn. in U was only 0.4 sec. The increase of the brightness occurred in less than 0.1 sec. The flare is confidently recorded in B , as well. The U-B colour of this flare did not change during the flare, as in the case of the described flare of BY Dra, and it was -0.4. The second flare (Fig.5), observed in the following night after the first one, belongs to the type of very rear powerful flares with an amplitude of about 5 magn. in U . The duration of the brightness increase in this case was about 0.2 sec and that of the whole flare was about 0.7 sec. The colour of this flare, as usually in the case of powerful flares, was very blue, U-B $\approx -2\overset{m}{.}5$.

The third flare (Fig.6) had an ordinary amplitude ∿ 1.8 magn. in U. Its duration was 0.3 sec. The increase of brightness lasted 0.1-0.2 sec. The amplitude of the flare in B was ∿ 1 magn. The U-B colour of the flare was about $-1\overset{m}{.}0$.

Thus, the two-channel electrophotometer with a high time resolution permits us to detect short flares of flare stars with an appreciably high confidence.

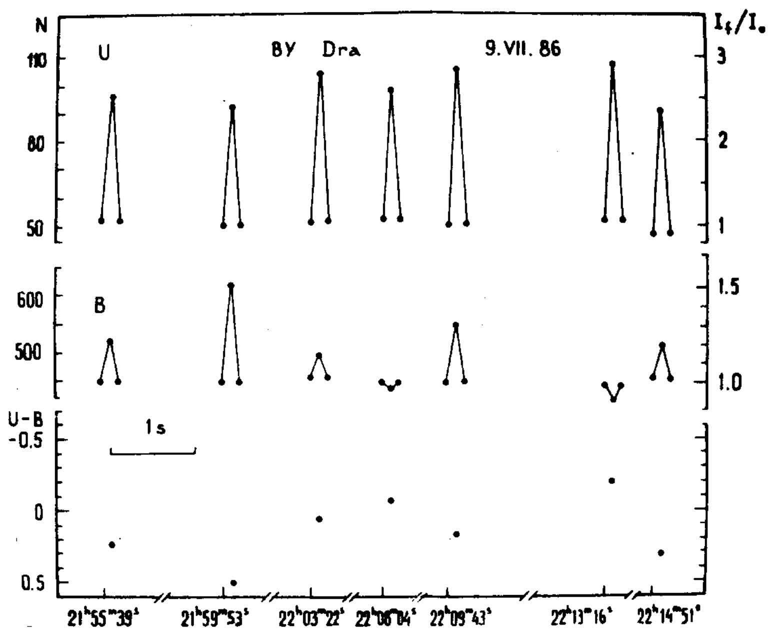

Figure 3: Sequence of spikes of BY Dra and corresponding U-B colours

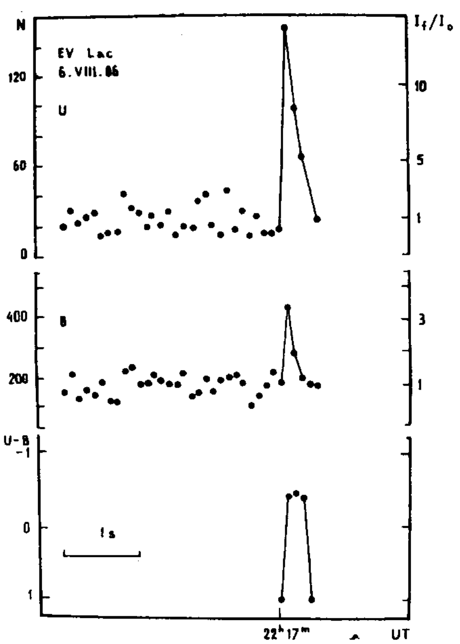

Figure 4: The flare of EV Lac observed on 6 August 1986

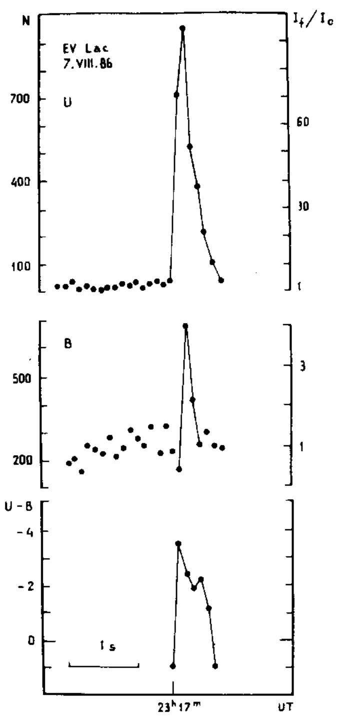

Figure 5
The flare of EV Lac observed on 7 Aug. 1986

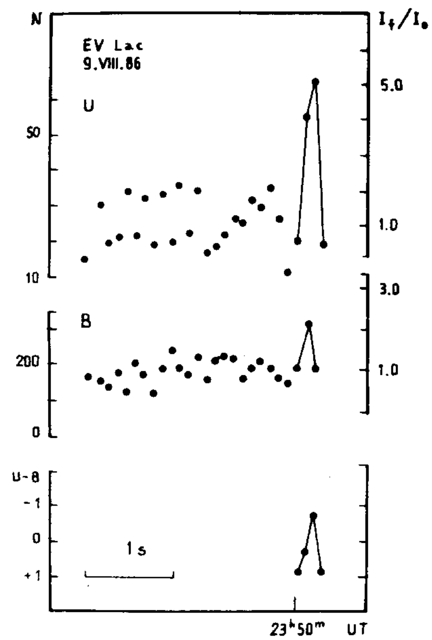

Figure 6
The flare of EV Lac observed on 9 Aug.1986

The duration of some of the flares detected by us is so short that they would definitely be lost in observations with ordinary time constants of 10 - 20 sec. The detection of short flares evidences that the frequency of flares of flare stars is higher than it has usually been accepted.

The detection and study of spikes and fast rising parts of the light curves of flare stars is undoubtedly very important for understanding of the nature of these stars.

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SPECTRAL TYPES OF 60 RED VARIABLE STARS

The spectral types given in Table I were estimated from infrared-sensitive objective-prism plates taken with the Warner & Swasey Observatory Burrell Schmidt. All stars are contained in the Infrared Astronomical Satellite Point Source Catalogue, and the types were determined in the

Table I

Name	Type	Name	Type
DT And	M8	V1291 Cyg	M8
XX Aqr	M4	V1295 Cyg	M7
BZ Aqr	M3	V1296 Cyg	late M
DE Aqr	M5	V1447 Cyg	M5
DF Aqr	M5	V1672 Cyg	M6
DG Aqr	M6:	IQ Gem	M5:
BW Aur	M6	GZ Mon	M7:
CE Aur	M7	IK Mon	M8
CT Aur	M4	V575 Mon	M8:
DU Aur	M4	DR Per	M5
GO Aur	M7	EI Per	M8
KP Aur	M8	LR Per	C
PQ Aur	M3	NSV 30	M2:
PR Aur	M6	NSV 765	M3
PT Aur	M3	NSV 1237	M4
EM CMa	M6	NSV 1756	M4
SS CMi	M5	NSV 2134	M5
XX Cap	M5	NSV 2181	M4
AN Cas	M8	NSV 2520	M5
V489 Cas	M5	NSV 2923	M
V490 Cas	M7	NSV 2941	M7:
LN Cep	M2:	NSV 3042	M4
HS Cyg	M7	NSV 3187	M4
V935 Cyg	M7:	NSV 3212	C
V946 Cyg	M7	NSV 3434	M4
V971 Cyg	M7	NSV 3594	M5
V1252 Cyg	M5	NSV 3730	M5
V1266 Cyg	M7	NSV 4114	M8:
V1274 Cyg	M8	NSV 4397	M4
V1284 Cyg	M7	NSV 4412	M4

course of a systematic identification of IRAS sources in a number of areas, mainly at the higher galactic latitudes. Generally, the stars appeared on only a single plate.

It is a pleasure to acknowledge that this research was supported (in part) under NASA's IRAS Data Analysis Program and funded through the Jet Propulsion Laboratory.

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uvbyβ PHOTOMETRY OF V1719 Cyg

uvby photoelectric photometry of the pulsating variable V1719 Cyg was carried out at Abastumani Astrophysical Observatory during three nights , 10-11, 11 - 12, 12 - 13 September, 1986 with the 125 cm automatic reflector. Measurements were made relative to the star HD 200739. Crawford's primary standards were found to be too bright for our apparatus; besides, they are considerably far from the comparison star. So HD 200739 was reduced to HD 201319. Photometric characteristics for the latter were taken from the catalogue of Perry and Johnson (1982). The results for the comparison star are as follows:

$$y = 8.282 \pm 0.007, \quad b-y = 0.096 \pm 0.005,$$
$$m_1 = 0.227 \pm 0.010, \quad c_1 = 1.009 \pm 0.014, \quad \beta = 2.854 \pm 0.016$$

(the r.m.s. errors are obtained for a series of 20 observations). Such a high value of the m_1 index for HD 200739 was not a surprise as it is a metallic line star (Bertaud, 1960).

The technique of observing the RR Lyrae stars with our telescope was previously discussed in detail (Alania and Abuladze,1986). Altogether 220 light estimations are obtained for V1719 in each colour of the uvbyβ system. They are very well distributed in phase.

By averaging the observed values close in phase the normal curves v, b-y, m_1, c_1 and β were drawn, Then, according to Crawford's method (1975, 1979) they were corrected for the effect of the interstellar light absorption. On the average E(b-y) = 0.042 was obtained. Phases were calculated according to Poretti's (1984) elements

$$\text{Max.Hel.} = 2444212.145 + 0^d.267298.E$$

According to our observations O-C=$-0^p.07$. b-y and c_1 corrected for the interstellar absorption, were plotted on Relyea and Kurucz's (1978) theoretical diagrams for b-y and c_1 to determine the effective temperatures and gravity on the stellar surface for the solar content. Calculations were carried out for each phase of the normal curves. Figure 1 shows the variations of all

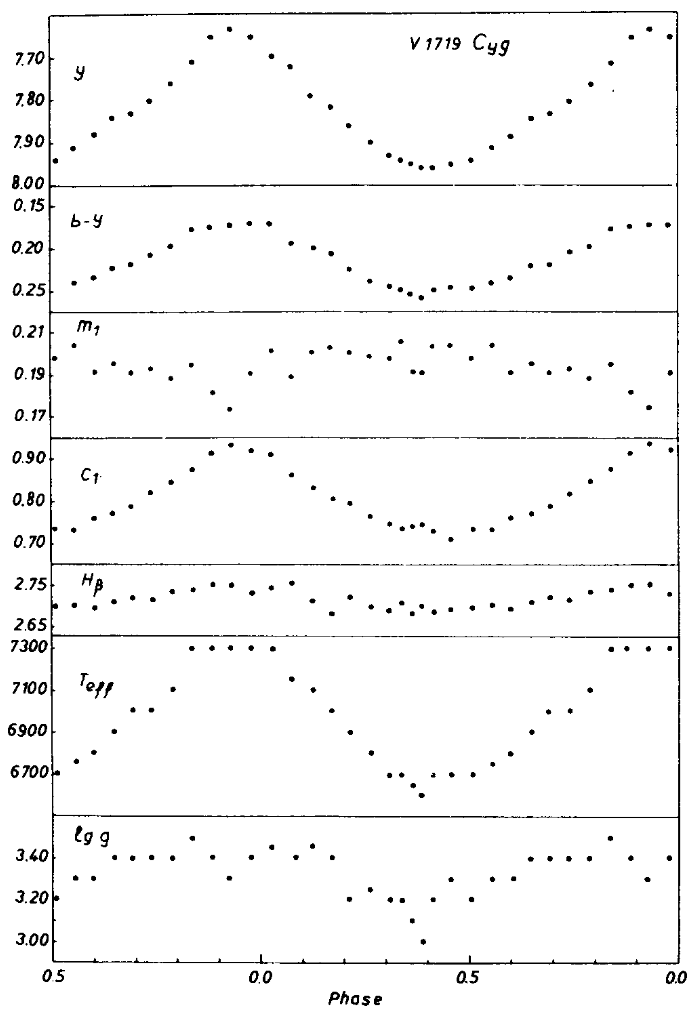
V 1719 Cyg
y
7.70
7.80
7.90
8.00
b-y
0.15
0.20
0.25
m1
0.21
0.19
0.17
c1
0.90
0.80
0.70
Hβ
2.75
2.65
Teff
7300
7100
6900
6700
lg g
3.40
3.20
3.00
0.5
0.0
0.5
0.0
Phase

Figure 1

the photometric characteristics for V1719 Cyg during a cycle.
It is known that RRc stars are characterised by a certain structure at their maxima on the light curves. This feature was not observed for the star in question. A mean value of m_1 over the cycle is 0.197, which according to the relation (Butler,1975)

$$[\,Fe/H\,] = 15.87(m_1)_o - 2.86$$

gives +0.3 for [Fe/H].
In addition, m_1 somewhat decreases near the maximum light of V1719 Cyg.

Table I contains the extreme values of V=y, b-y, c_1, β , T_{eff} and lg g.

Table I

Parameters	Max.	Min.	Amplitude
y	7.63	7.96	0.33
b-y	0.172	0.253	0.081
c_1	0.935	0.724	0.211
β	2.755	2.685	0.070
T_{eff}	7300	6700	600
lg g	3.40	3.20	0.20

The observational material and discussion will be published elsewhere.

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U.S.S.R.

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SEMIREGULAR VARIATIONS OF NOVA V841 OPH (1848) AT MINIMUM

V841 Oph (RA $=16^h59^m30^s$; D.= $-12^o53'53''$; Equin.2000) is an old nova which erupted in 1848 reaching at maximum an apparent visual magnitude $m_v \sim 4$. The star had a moderately fast decline ($t_2 \sim 60^d$; $t_3 \sim 110^d$) returning after some years at its normal magnitude $m_v \sim 12.5$. Its amplitude $A_v \sim 8.5$ is less than normal for a nova, so that the star has been considered as a potential recurrent- one.

In the course of a general study of the light curves and spectra of galactic novae, which is being carried out at Asiago, we have collected all the estimates of visual magnitude of V841 Oph published by different Authors (Barnard,Peek , Steavenson) from 1919 to 1947. These magnitudes, although not evenly distributed on the light curve, clearly show the presence of relatively slow brightness fluctuations, between magns. 12 and 13 ,with a periodicity of the order of 51 days (Fig.1). Their amplitude, however, is not constant but varies erratically from 0.5 to 1.0 magns. Moreover, at times the fluctuations cease and the star remains more or less constant at $m_v \sim 12.5$ for weeks or months , perhaps with some flickering of 0.1-0.2 magns. (Fig.2).

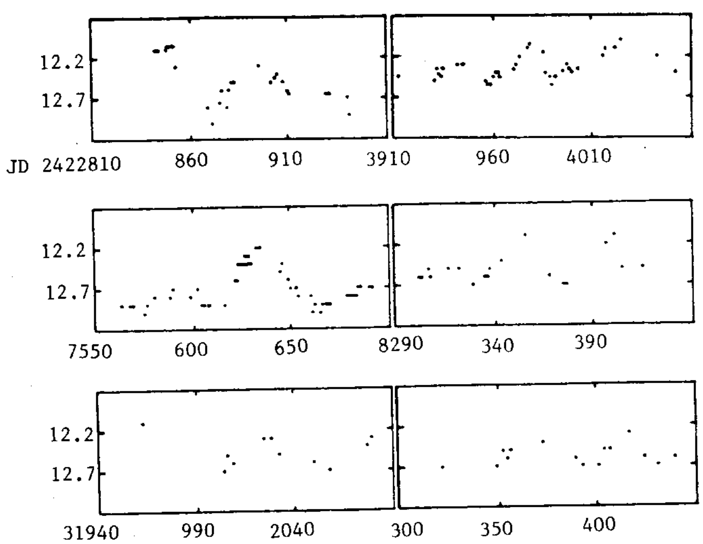

Fig. 1. Semiregular maxima in the light curve of V841 Oph

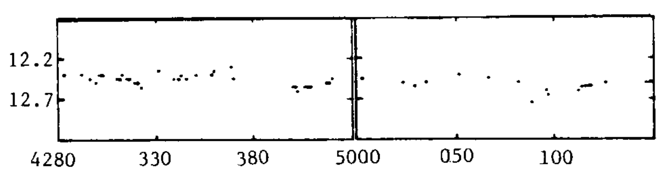

Fig. 2. Light curve of V341 Oph in the quiet periods

The semiregular periodicity of V841 Oph was noticed by Barnard (1921) , Turner (1921) and Steavenson (1923) who proposed different periods, from 27 to 50 days, without coming however to a definite conclusion on the length of the period. Since we dispose now of a much more abundant material (420 visual magnitudes at minimum over an interval of 28 years)we have thought it was worthy to examine better the question of the semiregularity of this old nova. We have therefore selected in the general light curve 17 maxima, fairly well defined, all brighter than m_v 12.3, distributed within the interval 1919-1947, finding , after some tentatives, that the epochs t_M of the maxima were fairly well satisfied by the following elements: t_M = JD 242 7633 + $51^d.50$ E.

The observed J.D. of the selected maxima, the corresponding date, the visual magnitude , the number E of cycles passed from the epoch T_o and the phase $(T_o - T_M)/P$ of each maximum are given in Table I.

Table I - Observed maxima and residuals.

JD 2400000	Date	m_v (max)	E	Phase
22119	1919 Jun 9	12.00	-107	+0.07
22176	Aug 5	12.10	-106	-0.04
22481	1920 Jun 5	12.10	-100	+0.04
22849	1921 Jun 8	12.05	- 93	-0.11
22893	Jul 22	12.30	- 92	+0.04
23199	1922 May 24	12.05	- 86	+0.10
23253	Jul 17	12.10	- 85	+0.05
23978	1924 Jul 11	12.05	- 71	-0.03
24025	Aug 27	12.00	- 70	+0.06
24701	1926 Jul 4	12.10	- 57	-0.07
24750	Aug 22	12.00	- 56	-0.02
24795	Oct 6	12.05	- 55	+0.11
27635	1934 Jul 16	12.20	-	+0.04
28355	1936 Jul 5	12.10	+ 14	+0.02
28401	Aug 20	12.10	+ 15	-0.09
31962	1946 May 21	12.10	+ 84	+0.06
32417	1947 Aug 19	12.30	+ 93	-0.11

The mean light curve of the nova at minimum,during the periods of semiregular activity is shown in Fig.3, the phases having been computed with the precedent elements. Of course the magnitudes of the star observed in its periods of quiescence, as shown in Fig.2, have not been taken into consideration.

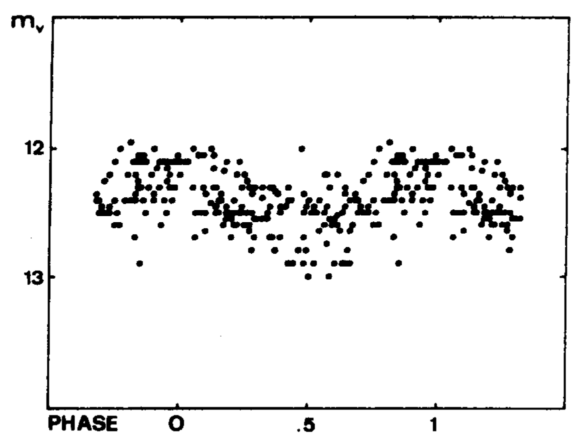

FIG.3 . MEAN LIGHT CURVE OF V841 OPH

The mean light curve reproduced in Fig.3 is typical of semiregular variables. The mean amplitude is 0.42 ,between m_v 12.15 and m_v 12.57 , the curve has a sinusoidal-like shape. The relatively high dispersion of the points is mostly due to the variable amplitude of the oscillations and also to the fact that the period, although its average value $51^d.5$ is maintained for 28 years, changes irregularly between 45 and 57 days from cycle to cycle.

This very interesting old nova has now been included in a regular programme of spectroscopic and photometric observations at Asiago.

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INFRARED PHOTOMETRY OF BRUN 276

We have secured JHKLM photometry, on the San Pedro Martir photometric system (cf. Tapia et al.), of the T Tauri star Brun 276, embedded in the Orion Nebula, with the 2.1 m telescope of Observatorio Astronomico Nacional, UNAM at San Pedro Martir, B.C.N, Mexico, on January 29, 1987 (U.T.). These data have been combined with Walker's (1969) UVB photometry, and "R,I"-magnitudes estimated from a red paper copy of the PSS, and from a glass infrared plate taken also with the Palomar Schmidt by Haro in 1959, respectively. These R,I- magnitudes were derived following the procedure outlined by Liller and Liller (1975). The results are summarized in Table 1 (the probable errors are listed in the last row of this Table).

Table I: MULTICOLOR PHOTOMETRY OF BRUN 276

U	B	V	R	I	J	H	K	L	M
17.78	18.77	18.04	16	15	14.15	13.50	12.75	10.7	8.8
			0.6	0.6	0.1	0.1	0.1	0.4	0.4

The previous data (cf. Mendoza et al.) placed Brun 276 below the main sequence ($M_{bol} \simeq 10$). Now, the infrared observations can be used to derive a photometric luminosity (cf. Mendoza 1966, 1968, and Imhoff, and Mendoza 1974). However, this luminosity will be a lower limit of the total luminosity, because of (1), Brun 276 can be brighter (see below); and (2), the observed fluxes have been used uncorrected by the effects of intestellar extinction (spectral type unknown), if any. On the other hand, since Brun 276 is not an IRAS source, it is possible to have a good approximation of this photometric luminosity assuming that fluxes beyond 30 microns are negligible. This way, the results yield a photometric luminosity around 3 solar luminosities. Therefore, the warm circumstellar envelope, indicated by the infrared photometry listed in Table I, raises Brun 276 slightly above the main sequence on the HR diagram, as do other T Tauri stars (loc. cit.) .

One of us (EEM) also obtained uvbyH-beta photometry of Brun 276 on November 8, 1986 (U.T.) which confirms the variability of this object, and the emission in the hydrogen line H-beta. This photometry yields V = 15.5, roughly the brigthness of the star at the time that Brun made his catalogue (cf. Brun 1935).

We would like to thank to Prof. Haro for facilitating us his IR-plate, and Mssrs. Chaidez, and Sanchez for their help at the 2.1m telescope.

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR EV Lac IN 1985

Photoelectric monitoring of the flare star EV Lac has been carried out at the Stephanion Observatory during the year 1985 using the 30-inch Cassegrain reflector of the Department of Geodetic Astronomy, University of Thessaloniki. Observations have been made with a Johnson dual channel photoelectric photometer in the B colour of the international UBV system. The telescope and photometer used have been described elsewhere (Mavridis et al., 1982).

The transformation of our instrumental ubv system to the international UBV system is given by the following equations:

a) For the period June 20-July 10, 1985

$$V = v_o + 0.086\ (b-v)_o + 2.160,$$
$$B-V = 0\overset{m}{.}376 + 1.035\ (b-v)_o.$$

b) For the period August 7-14, 1985

$$V = v_o + 0.037\ (b-v)_o + 2.020,$$
$$B-V = 0\overset{m}{.}393 + 1.050\ (b-v)_o.$$

c) For the period September 2-8, 1985

$$V = v_o - 0.020\ (b-v)_o + 1.953,$$
$$B-V = 0\overset{m}{.}451 + 1.007\ (b-v)_o.$$

The monitoring intervals in UT as well as the total monitoring time for each night are given in Table I. Any interruption of more than one minute has been noted.

During the 31.82 hours of monitoring time one flare was observed, the characteristics of which are given in Table II. In this table following characteristics (Andrews et al. 1969) are given: a) the date and universal time of flare maximum, b) the duration before and after the maximum (t_b and t_a, respectively), as well as the total duration of the flare, c) the value of the ratio $(I_f-I_o)/I_o$ corresponding to flare maximum, where I_o is the intensity deflection less sky background of the quiet star and I_f is the total intensity deflection less sky background of the star plus flare, d) the integrated inten-

Table I

Monitoring Intervals

Date	Monitoring intervals (U.T.)	Total Monitoring Time
1985		
June		
21-22	23^h42^m-00^h13^m, 00^h17^m-01^h00^m,	1^h14^m
23-24	23 33 -00 04 , 00 07 -00 37 ,	
	00 39 -01 06 .	1 28
24-25	23 30 -00 02 , 00 05 -00 32 ,	
	00 45 -01 10 .	1 24
26-27	23 51 -00 24 , 00 27 -01 00 .	1 06
27-28	23 22 -23 37 , 23 39 -23 50 ,	
	23 53 -00 26 , 00 38 -01 00 .	1 21
29	00 01 -00 31 , 00 33 -01 01 .	58
July		
7-8	22 51 -23 20 , 23 23 -23 59 ,	
	00 14 -00 45 , 00 48 -01 12 .	2 00
8-9	22 51 -23 25 , 23 28 -00 02 ,	
	00 15 -00 46 , 00 49 -01 12 .	2 02
9-10	23 04 -23 36 , 23 38 -00 13 ,	
	00 33 -01 06 .	1 40
August		
7	22 37 -23 01 , 23 03 -23 30 ,	
	23 35 -23 44 .	1 00
8	23 04 -23 20 .	16
9-10	22 01 -22 29 , 22 32 -22 46 ,	
	22 48 -23 02 , 23 05 -23 19 ,	
	23 21 -23 41 , 23 43 -23 57 ,	
	00 57 -01 08 .	1 55
10-11	22 01 -22 20 , 22 22 -22 41 ,	
	22 43 -23 05 , 23 07 -23 23 ,	
	23 25 -23 41 , 23 43 -00 02	1 51
11-12	22 23 -22 47 , 22 49 -23 06 ,	
	23 11 -23 41 , 23 44 -00 14 ,	
	00 17 -00 50 , 00 52 -01 19 .	2 41
14	22 14 -22 28 , 22 30 -22 57 .	41

Table I (continued)

Date 1985	Monitoring intervals (U.T.)	Total Monitoring Time
September		
2	21^h36^m-22^h10^m, 22^h15^m-22^h54^m, 22 58 -23 47 .	$2^h\ 2^m$
3-4	22 20 -22 45 , 22 50 -23 41 , 00 06 -01 03 .	2 13
4-5	22 45 -22 59 , 23 45 -00 22 , 00 29 -01 11 .	1 33
6-7	22 24 -22 58 , 23 04 -23 46 , 00 14 -01 00 .	2 2
7-8	22 02 -22 37 , 22 43 -23 36 , 00 05 -00 35 , 00 38 -01 02 .	2 22
	TOTAL	31^h49^m

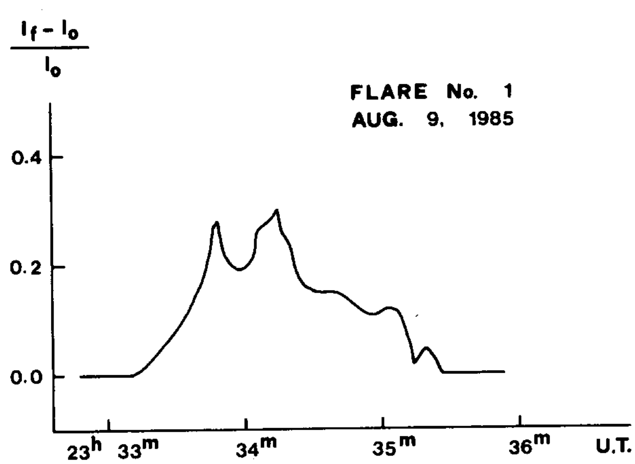
Table II
Characteristics of the Flare Observed

Flare No.	Date	U.T. (max)	t_b (min)	t_a (min)	Duration (min)
	1985 August				
1	9	$23^h\ 34^m.24$	1.10	1.16	2.26

$(I_f-I_0)/I_0$ (max)	P (min)	Δm (mag)	σ (mag)	Air mass
0.30	0.30	0.29	0.03	1.019

sity of the flare over its total duration, including pre-flares, if present, $p = \int (I_f - I_o)/I_o dt$, e) the increase of the apparent magnitude of the star at flare maximum $\Delta m(b) = 2.5 \log (I_f/I_o)$, where b is the blue magnitude of the star in the instrumental system, f) the standard deviation of random noise fluctuation $\sigma(mag) = 2.5 \log (I_o+\sigma)/I_o$ during the quiet - state phase immediately preceding the beginning of the flare and g) the air mass at flare maximum.

The light curve of the observed flare in the b colour is shown in Fig. 1.



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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR BY Dra IN 1985

Photoelectric monitoring of the flare star BY Dra has been carried out at the Stephanion Observatory during the year 1985 using the 30 - inch Cassegrain reflector of the Department of Geodetic Astronomy, University of Thessaloniki. Observations have been made with a Johnson dual channel photoelectric photometer in the U colour of the international UBV system. The telescope and photometer used have been described elsewhere (Mavridis et. al, 1982). The transformation of our instrumental ubv system to the international UBV system is given by the following equations:

a) For the period June 20- July 10, 1985

$$V = v_0 + 0.086\ (b-v)_0 + 2.160,$$
$$B-V = 0.376 + 1.035\ (b-v)_0\ ,$$
$$U-B = -2.010 + 1.116\ (u-b)_0\ .$$

b) For the period August 7 -14, 1985

$$V = v_0 + 0.037\ (b-v)_0 + 2.020,$$
$$B-V = 0.393 + 1.050\ (b-v)_0\ ,$$
$$U-B = -1.710 + 0.963\ (u-b)_0\ .$$

c) For the period September 2-8, 1985

$$V = v_0 - 0.020\ (b-v)_0 + 1.953,$$
$$B-V = 0.451 + 1.007\ (b-v)_0\ ,$$
$$U-B = -1.520 + 0.931\ (u-b)_0\ .$$

The monitoring intervals in UT as well as the total monitoring time for each night are given in Table I:

Table I

Monitoring Intervals

Date	Monitoring intervals (U.T.)	Total Monitoring Time
1985		
June		
20	20^h00^m-20^h29^m, 20^h33^m-21^h03^m, 21^h21^m-21^h54^m,	
	21 56 -22 21 .	1^h57^m
21	19 58 -20 24 , 20 26 -20 58 , 21 12 -21 44 ,	
	21 46 -22 15 , 22 53 -23 20 .	2 26
22-23	19 47 -20 19 , 20 27 -20 55 , 21 08 -21 43 ,	
	21 45 -22 16 , 22 53 -23 25 , 23 27 -24 00 ,	
	00 12 -00 35 , 00 37 -01 02 .	3 59
23	19 48 -20 17 , 20 19 -20 49 , 21 02 -21 32 ,	
	21 42 -22 05 .	1 52
24	20 09 -20 38 , 20 40 -21 15 , 21 28 -22 00 ,	
	22 02 -22 32 .	2 06
26	19 51 -20 21 , 20 25 -20 55 , 21 08 -21 42 ,	
	21 44 -22 14 .	2 04
27	19 45 -20 17 , 20 19 -20 57 , 21 11 -21 49 ,	
	21 51 -22 22 , 22 41 -23 03 .	2 41
28	19 45 -20 15 , 20 17 -20 54 , 21 08 -21 40 ,	
	23 13 -23 42 .	2 08
July		
5	20 32 -20 58 , 21 01 -21 35 , 21 50 -22 24 ,	
	22 27 -22 34 .	1 41
8	19 47 -20 16 , 20 19 -20 46 , 20 59 -21 37 ,	
	21 40 -22 22 .	2 16
9	20 56 -21 22 , 21 25 -21 50 .	51
August		
7	20 30 -21 02 , 21 04 -21 28	56
8	20 31 -20 43 , 20 45 -21 00 , 21 02 -21 31	56
9	19 50 -20 22 , 20 27 -20 57 .	1 02
10	20 02 -20 20 , 20 23 -20 38 , 20 41 -21 00	52
September		
3	20 12 -20 52 , 20 56 -21 36	1 20
	TOTAL	$29^h\ 7^m$

Any interruption of more than one minute has been noted. During the 29.12 hours of monitoring time no flare was observed.

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INFORMATION BULLETIN ON VARIABLE STARS

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PHOTOELECTRIC LIGHT CURVES OF BX PEGASI

The very short period eclipsing binary system BX Peg was discovered by Hughes (Shapley and Hughes, 1934). Photoelectric light curves have been published by Zhai and Zhang (1979) and Hoffman (1982). Three photoelectric times of minimum light have been recently published by BAV (1984). Leung, Zhai, and Zhang (1985) used the Wilson-Devinney code to determine a solution from Zhai's and Zhang's data which were obtained with an uncooled photomultiplier. Another solution using light curve synthesis techniques was determined by Kaluzny (1984) who used Hoffman's incomplete light curve. Both sets of data indicate that BX Peg undergoes total eclipse during primary minimum, but the depth of this minimum is somewhat different in the two curves. It is interesting to note that Chou's (1966) light elements give a primary minimum which now appears as a secondary minimum when compared to Zhai's and Hoffman's primary epochs.

The present observations of BX Peg were made on the nights of September 27-30, inclusive. The 24 inch F/13.5 reflector at Lowell Observatory was used with standard V, I filters in the Kron-Cousins-Bessell system (Bessell, 1976) with a dry-ice-cooled RCA 31034B photomultiplier tube. The comparison and check stars were BD +25°4584 and BD +25°4582, respectively. Observations were halted during the last night due to instrument failure, so the light curve is incomplete. Approximately 200 observations were obtained at each effective wavelength.

Four epochs of minimum light were determined from observations made during two primary and two secondary eclipses. All minima were determined by the Hertzsprung technique (1928) except for the earliest minimum which was found by the bisection-of-chords method. These are the last four epochs given in Table I.

Table I

JD Hel. 2440000+	Minimum	Cycles	(O-C)	Source
44195.3771	I	-5192.0	-0.0002	Hoffman, 1982
44195.2373	II	-5192.5	0.0002	Hoffman, 1982
45640.2445	II	-39.5	-0.0006	BAV #38, 1984
45646.2746	I	-18.0	0.0005	BAV #38, 1984
45651.3219	I	0.0	0.0002	BAV #38, 1984
46701.7787	I	3746.0	0.0010	Present Observations
46703.7409	I	3753.0	0.0002	Present Observations
46703.8797	II	3753.5	-0.0011	Present Observations
46704.7227	II	3756.5	0.0006	Present Observations

The times of minimum light shown in Table I were introduced with variable weights into a least squares solution to obtain the following improved ephemeris:

$$\text{JD Hel Min. I} = 2445651.3217 + 0^{d}.28042071\ E$$
$$\pm \quad 2 \quad \pm \quad 4\ \text{(p.e.)}$$

and this was used in calculating the O-C's in Table I and in determining the phases of the observations. The period is significantly different than that given by Chou (1966).

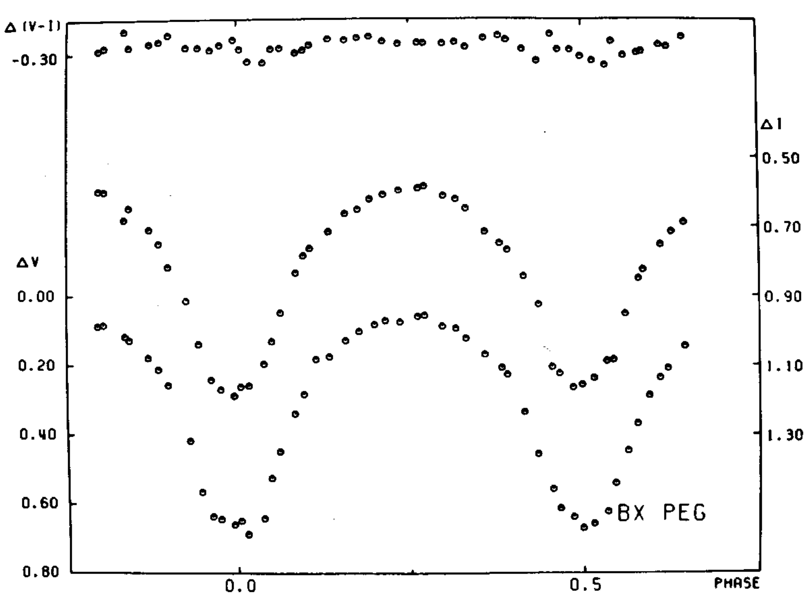

Fig. 1 - Light curves of BX Peg defined by normal points.

The V and I light curves of BX Peg defined by normal points are shown in Figure 1 as Δm versus phase. The large scatter in the observations is due, at least in part, to the variable weather conditions which were present during the observing run.

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VARIABLE NATURE OF Be STARS

In an earlier communication, we (Kilambi et al., 1986) had reported the photoelectric variable nature of six B-emission line stars, HR 1508, HR 1789, HR 2538, HR 2996, HR 5193 and HD 45677 observed through Red and near Infrared passbands of the Johnson's system. In continuation of it, we are reporting the variable/non-variable nature of the remaining B- emission line objects observed during 1982-83 observing season.

The observational procedure, the extinction correction and the standardization procedure followed are already published in the previous communication by Kilambi et al.(1986). Table I gives the observations of these stars and the columns are self explanatory. The mean internal probable error of a single measurement in 'R' and (R-I) is $\pm 0^{m}.02$ and $\pm 0^{m}.03$, respectively.

A few of the programme stars were observed earlier by Johnson (1965, 1966), Mendoza (1958) and Feinstein and Marraco (1979) on the standard RI system. These observations are also incorporated in the determination of variable/ non-variable nature of the stars.

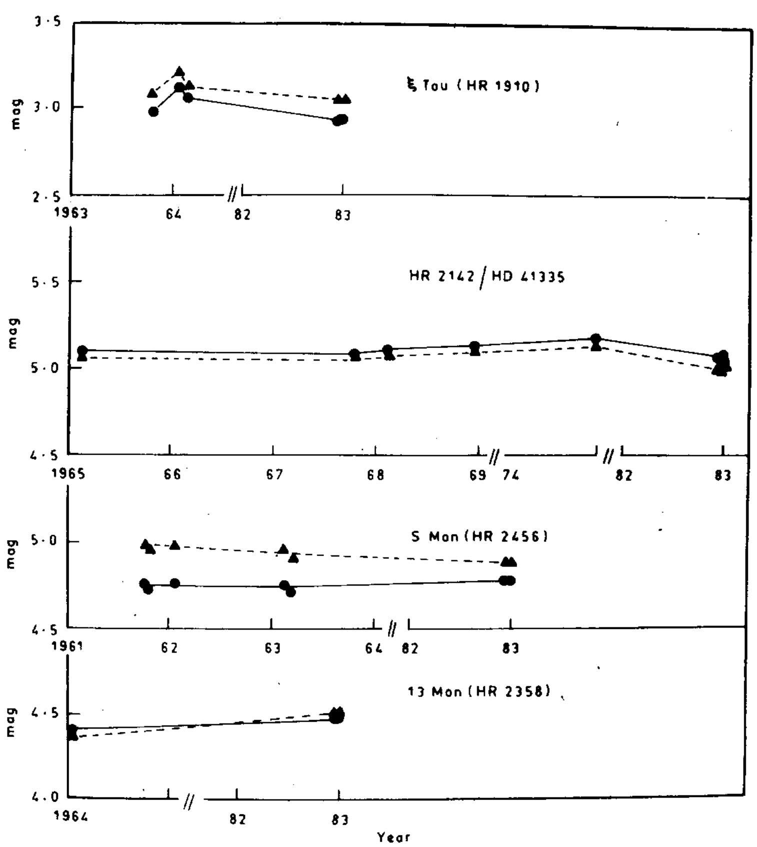
TABLE I

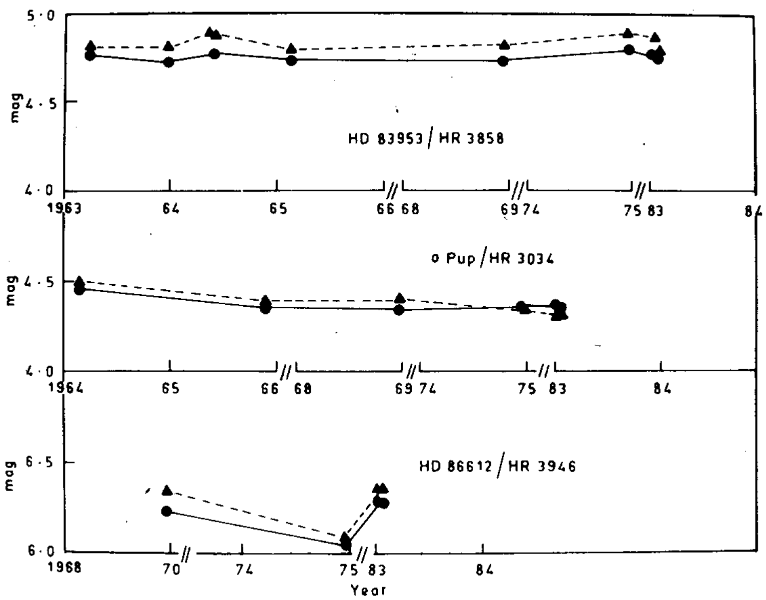
Star	Spectral type	Heliocentric Date of observation (J.D. 2440000 +)	R	(R-I)
Phi And	B7 Ve	5315.1150	+ 4.26	-0.00
HR 335		5315.1160	4.25	0.00
HD 6811				
γ Cas	BO 1Ve	5315.1027	2.30	-0.11
HR 264		5315.1036	2.30	-0.08
HD 5394				
Phi Per	B2 Ve	5315.1232	3.92	0.01
HR 496		5315.1238	3.91	0.03
HD 10516				
HR 985	B2.5 Ven	5315.1684	5.11	-0.05
HD 20336		5315.1689	5.10	-0.03

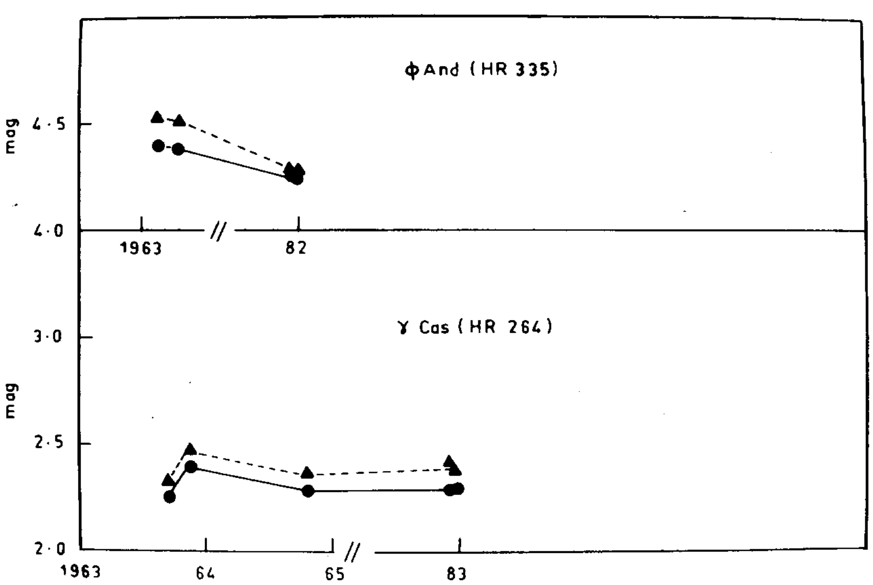
Star	Spectral type	Heliocentric Date of observation (J.D. 2440000 +)	R	(R-I)
Psi Per	B5 Ve	5315.1756	4.18	-0.01
HR 1087		5315.1764	4.18	-0.01
HD 22192				
AB Aur	B9q	5356.2660	6.95	+0.03
HD 31293		5356.2667	6.95	+0.03
HD 31648	A2q	5356.2778	7.56	+0.06
		5356.2789	7.55	+0.07
Zeta Tau	B2IIIe	5315.3055	2.94	-0.11
HR 1910		5315.3062	2.94	-0.11
HD 37202				
HD 37806	A0e	5356.3151	7.82	-0.01
		5356.3158	7.84	-0.04
HR 2142	B2Ve	5315.3359	5.06	+0.05
		5315.3366	5.05	+0.06
		5324.3636	5.08	+0.04
		5324.3643	5.08	+0.04
17 Lep	A0 + M1	5315.3422	4.34	+0.54
		5315.3428	4.34	+0.54
		5324.3925	4.36	+0.50
		5324.3931	4.35	+0.50
13 Mon	A0	5324.4027	4.50	-0.02
HR 2385		5324.4033	4.50	-0.02
HD 46 300				
S Mon	O7f	5324.4104	4.78	-0.11
HR 2456		5324.4114	4.78	-0.11
HD 47839				
HD 50138	B6 IIIe	5356.3702	6.72	+0.06
		5356.3707	6.72	+0.05
Omicron Pup	BOV pe:	5356.3882	4.37	+0.06
HR 3034		5356.3887	4.37	+0.07
HD 63462				
HR 3858	B5e	5356.3980	4.78	-0.09
HD 83953		5356.3986	4.74	-0.04
HR 3946	B5e	5356.4048	6.30	-0.07
HD 86612		5356.4053	6.29	-0.08
HR 4123	B9Ven:	5356.4111	5.62	-0.06
HD 91120		5356.4124	5.63	-0.02
Zeta Crv	B8e	5437.3371	5.26	-0.14
HR 4696		5437.3378	5.25	-0.12
HD 107348				
Theta CrB	B6Vnne	5437.3543	4.12	-0.16
HR 5778		5437.3549	4.12	-0.16
HD 138749				
4Her	B7e	5437.3959	5.77	-0.17
HR 5938		5437.3970	5.78	-0.18
HD 142926				

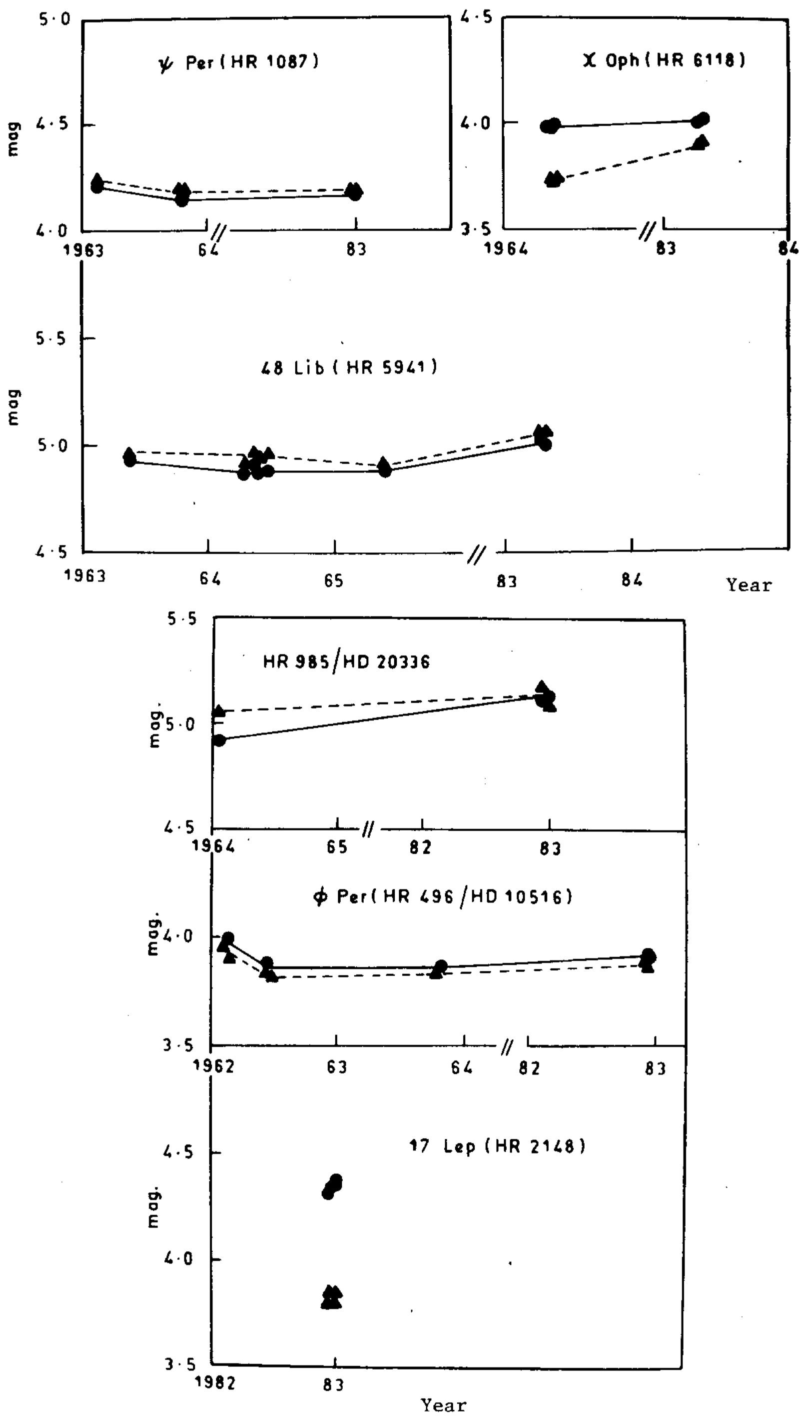
Star	Spectral	Heliocentric Date of observation (J.D. 2440000 +)	R	(R-I)
48 Lib	B5 IIIpe	5437.4063	4.93	-0.13
HR 5941		5437.4068	4.93	-0.13
HD 142983				
Chi Oph	B2 IVpe	5437.4135	4.00	+0.11
HR 6118		5437.4142	4.00	+0.09
HD 148184				
HD 259431	B5e	5356.3363	8.22	+0.21
		5356.3370	8.22	+0.21

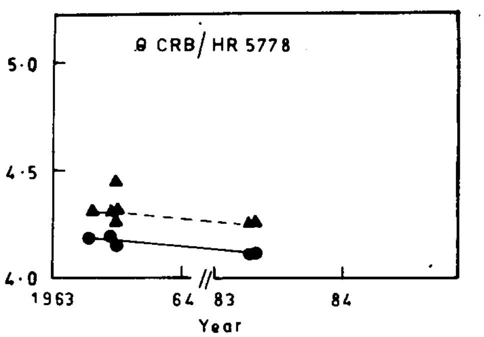
Figure 1-16: Variable/non-variable nature of Be stars. Red magnitudes (filled circles), infrared magnitudes (filled triangles).




5·0
4·5
4·0
mag
HD 83953 / HR 3858
1963
64
65
66 68
69 74
75 83
84
o Pup / HR 3034
1964
65
66 68
69 74
75 83
84
6·5
6·0
HD 86612 / HR 3946
1968
70
74
75 83
84
Year


φ And (HR 335)
4·5
4·0
mag
1963
82
γ Cas (HR 264)
3·0
2·5
2·0
1963
64
65
83
Year


ψ Per (HR 1087)
χ Oph (HR 6118)
48 Lib (HR 5941)
HR 985/HD 20336
φ Per (HR 496/HD 10516)
17 Lep (HR 2148)
mag
Year



REMARKS :

HR 335 : Slightly brighter than 1963 observations.

HR 264 : No change in brightness, but yet reported as a variable with V = 1.6 - 3.0 in the literature.

HR 496 : No change in brightness since early 1962. Double-lined spectroscopic binary with P= 126.7 days.

HR 985 : More or less constant in brightness.

HR 1087 : No change in brightness in both R, I passbands.

HR 1910 : The present observations are comparable with that of late 1963 measurements, eventhough, some fainter values were recorded in the early part of 1964. Single-lined spectroscopic binary with P= 132.91 days and reported as variable with V= 2.9 - 3.0 .

HR 2142 : No change in brightness.

HR 2358 : No change in brightness.

HR 2456 : No change in brightness.

HR 3034 : Eventhough, it was fainter in the early part of 1964, but brightened in late 1966 and since then, maintained more or less constant brightness.

HR 3858 : No change in brightness except for minor fluctuations.

HR 3946 : The present R, I magnitudes agree with that of early 1970 observations, eventhough, it was brighter by almost $0^m.2$ in 1975.

HR 5778 : No change in brightness.

HR 5941 : No change in brightness, but reported as variable with V= 4.8 - 5.0 in the literature.

HR 6118 : No change in brightness in R passband but, slightly fainter in I passband.

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