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PHOTOELECTRIC ELEMENTS AND REVISED SPECTRAL TYPES OF XX Cas

In this communication, photoelectric elements of the eclipsing binary system XX Cas in U, B and V filters and revised colour indices have been presented. In the absence of good photoelectric observations and complete set of photoelectric elements in the literature, and in order to remove the uncertainties regarding the nature of eclipses, duration of totality, if any, spectral classes of the components, apsidal motion, ellipticity and reflection effects, the UBV photometry of the system XX Cas was carried out by the author during the period December 1972 to February 1975. The observational details and some results were published earlier (Srivastava, 1983). The light outside the eclipses shows continuous variation, hence the rectification of

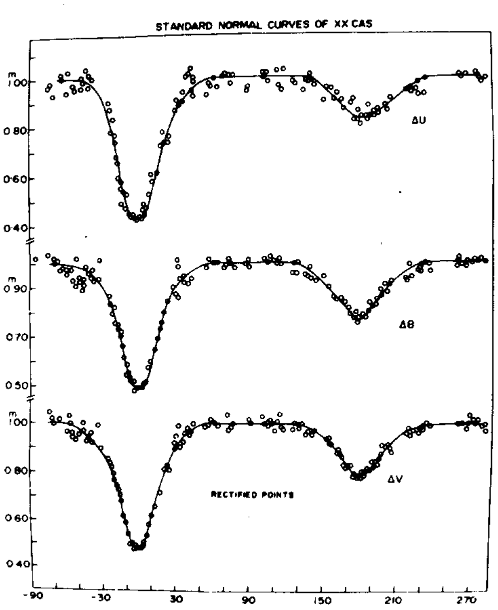

Figure 1 Rectified light curves of XX Cas. The solid lines depict the smoothened light curves through the rectified normals.

the light curves has been done in each filter following the graphical method of Russel and Merrill (1952). The rectified observations and smoothened light curves are shown in Figure 1

The rectification coefficients, given in Table I, rule out the possibility of significant ellipticity and reflection effects.

Table I

Rectification coefficients of XX Cas.

Coefficients	U filter	B filter	V filter
A_0	1.0220	0.9970	0.9740
A_1	-0.0285	-0.0222	-0.0043
A_2	0.0007	0.0009	0.0006
B_1	-0.0018	0.0027	0.0000
B_2	0.0040	-0.0040	0.0000
C_0	0.0372	0.0372	0.0372
C_1	0.0285	0.0222	0.0043
C_2	0.0124	0.0124	0.0124
Z	0.0181	0.0182	0.0192

The elements of the system have been derived using the method of Russell and Merrill (1952) and Merrill's (1950) tables. A nomographic solution was tried with assumed values 0.8, 0.6 and 0.4 for the limb-darkening coefficients (κ), The solution could only be obtained with κ = 0.4, when the primary eclipse was considered to be a total (occultation) in all the three colours. This finding of ours is contrary to the suggestion by Pierce (1938) that the eclipses are partial. However, Pierce has not ruled out the possibility of a total eclipse. The value of k has been arrived at after several trials. The light elements are:

κ = 0.4 (assumed), k = 0.73, p_o = -1.0, α_o^{oc} = 1.0 and α_o^{tr} = 1.0257.

Table II

Geometrical elements of XX Cas

Elements	U filter	B filter	V filter	Mean of U, B and V filters
$1-\lambda_1$	0.570	0.510	0.510	--
$1-\lambda_2$	0.180	0.235	0.220	--
L_1	0.570	0.510	0.510	--
L_2	0.430	0.490	0.490	--
r_1	0.278	0.267	0.269	0.271
r_2	0.380	0.366	0.369	0.372
i	84°.1	84°.2	84°.2	84°.2
θ_e	40°.8	39°.0	39°.3	39°.7
θ_i	3°.4	1°.6	1°.7	2°.2

Elements	U filter	B filter	V filter	Mean of U, B and V filters
J_1/J_2	2.58	1.95	1.95	2.16
pr	0.392	0.346	0.350	--
Sec	0.364	0.335	0.337	—

The geometrical elements are given in Table II, wherein the subscripts 1 and 2 refer to the primary and the secondary components, respectively. The Ψ - method has been used to obtain the computed light curves in U, B and V filters shown as the solid lines in Figure 2.

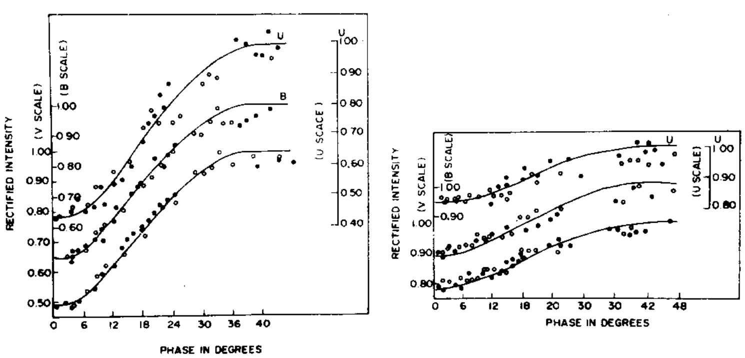

Figure 2

Intensity curves of normal points of XX Cas. The direct points are shown as filled circles and the reflected points as open circles. The solid lines represent the computed light curves.

The interstellar extinction (reddening) has been determined using Q parameter and emploving the relations given by Golay (1974).The intrinsic colour indices and revised spectral types of XX Cas have been obtained, and are listed in Table III alongwith the colour excesses.

Table III

Colours of XX Cas

Star	0	(B-V)	(U-B)	E(B-V)	E(U-B)	Sp.
Primary Comp nent	$-0^{m}.98$	$-0^{m}.32$	$-1^{m}.13$	$0^{m}.68$	$0^{m}.42$	BOV

Secondary Component	-0.72	-0.24	-0.80	0.60	0.35	B2V
Maximum (combined colour of both the components	-0.86	-0.29	-0.98	0.65	0.39	B1V
Comparison star	-0.22	-0.07	-0.17	0.54	0.30	B9V

The average interstellar extinctions come out to be E(B-V) = $0^m.62$ and E(U-B) = $0^m.37$, and the revised spectral types stand as B0V and B2V as against F2V and F2V reported earlier (Srivastava, 1983).

Our results are important in the following respects :

(1) The rectification coefficients show that the reflection and ellipticity effects are insignificant in comparison to the findings of Pierce, and hence the components are non elliptical.

(2) The eclipses are total and not partial as suggested by Pierce.

(3) Present spectral types are closer to those given by Hilditch and Hill (1975), but are slightly different to those of Wyse (1934), Gaposchkin (1935), and Hill et al. (1975).

(4) The interstellar reddening is appreciabely present in the system.

The author is thankful to Dr. C.D.Kandpal for going through the manuscript and for helpful suggestions.

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HR 2554 - A POSSIBLE NEW ζ AUR SYSTEM

HR 2554 (HD 50337, G6 II, $V = 4.40, B - V = 0.92$) is a 195-day single-lined spectroscopic binary that, no doubt due to its southern declination, has drawn little notice beyond its binary nature. Although usually listed in surveys of bright evolved G stars, it has been relatively neglected both spectroscopically and photometrically in recent times and no detailed studies of it have been published in 60 years. Its orbit was last examined by Lucy and Sweeney (1971) from Lick data taken in 1918. *UBV* photometry is available from Johnson *et al* (1966), and the most recent spectral classification (G6 II) is from the Michigan southern all-sky survey (Houk and Cowley 1975). Although its *(U-B)* is too blue for a star of this type, no evidence of the secondary spectrum has been reported.

From observations with the *International Ultraviolet Explorer*, we have found the secondary to be of type A0 V, visually about 3 mag. fainter than the primary star. Using velocities measured from *LWR* high dispersion observations, we have redetermined the orbit and find that the Lucy and Sweeney elements remain unchanged except for a slight reduction of the orbital period by 0.02^d. If the inclination is 90°, photometric eclipses of the secondary star are expected to occur at

$$\text{J.D.} = 2421733.8 + 195.24 \text{ E.}$$

Using these elements and the expected dimensions of the components, we predicted a 6-day eclipse should occur on 21.0 Oct. 1986, with an uncertainty of about 2 days.

IUE observations from 23.9 - 24.5 Oct. 1986 did show the system in a partial phase, apparently at egress, with the ultraviolet flux only 15% of that out-of-eclipse. Using the counts from the *FES*, we find that the depth was 0.06 mag. in *V*. The spectrum of the secondary was overlaid by many sharp, low-level Fe II absorption components from the outer atmosphere of the primary star. HR 2554 thus appears to be a member of the atmospheric eclipsing ζ-Aur systems, joining 22 Vul (Ake, Kondo and Parsons 1985) as the second G-type system in this group.

Further ground-based observations are needed of this star to better define the light curve, particularly to see if the eclipse is total. Two opportunities will present themselves this year: 4.3 May and 15.5 Nov. 1987. Observations around the May eclipse are needed to support further *IUE* observations. We expect the eclipse depths to increase with decreasing wavelength, with $\Delta B \sim 0.14$ and $\Delta U \sim 0.27$ mag.

HR 2554 and our recommended comparison and check stars may be found on *AAVSO* chart 154, identified by *44*, *65*, τ, and *54*, respectively:

Recommended comparison star:	HR 2524	(G6 III, $V = 6.46, B - V = 0.86$)
check stars:	τ Pup	(K1 III, $V = 2.93, B - V = 1.20$)
or:	HR 2523	(K1 II-III +G:p, $V = 5.40, B - V = 1.34$)

(HR 2524 and τ Pup have 10^{th} mag companions at 2" and 26", respectively)

Coordinates for equinox 1987.4, precessed from SAO coordinates, are:

HR 2554	(HD 50337, -53° 1168)	6^h	49^m	34.9^s	−53°	36′	27"
HR 2524	(HD 49705, -54° 1115)	6	46	26.4	−54	40	52
τ Pup	(HD 50310, -50° 2415)	6	49	37.3	−50	35	55
HR 2523	(HD 49689, -51° 2078)	6	46	34.6	−51	15	01

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23 March 1987

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53 PISCIUM - LARGER AMPLITUDE

53 Psc (HR 155, HD 3379, BD+14°76, AG Psc) is a bright star ordinarily classified as B3V or B2.5IV. A light variation of this star was first announced by Williams (1954 a,b). He found the small amplitude of 0.02 magnitude in yellow filter and derived a period of 0,09165 day. The short period of light variation and the spectral type of this star suggested that it might belong to the beta Canis Maioris star class.

On the other hand, Percy (1971) concluded that 53 Psc is not a variable star. Finally, J.-P. Sareyan et al. (1979) based on their photometric and spectroscopic studies classified this star as a member of the beta CMa variable star group. A small amlitude of 0,01 mag in UV filter and 0,002-0,003 mag in blue filter with the period of 0,08 day was obtained. From one night series of 11 spectra the radial-velocity in the range from -11 to -18 km/s was measured and line variations were detected.

In the year 1985 53 Psc was used as a zero point of comparison stars and primary flux standard for International Halley Watch Photometry and Polarimetry Net. A larger magnitude deviation of this star led to the independent photometric measurement. The 65 cm telescope of the Charles University at the Ondřejov Observatory was used. The comparison and check star was 34 Psc (V=5.47. B8V) and 66 Psc (V=5.70, A1V), respectively. The result of measurements in V colour of UBV system from October 3, 1985 is plotted in Fig 1. One can obtain approximately the amplitude of 0,035 magnitude and the period of 0,096 day. This significant change of the amplitude is possible explained as an interference between two different periods.

Further observations are required in order to confirm this amplitude progress and to understand the light variations of this star.

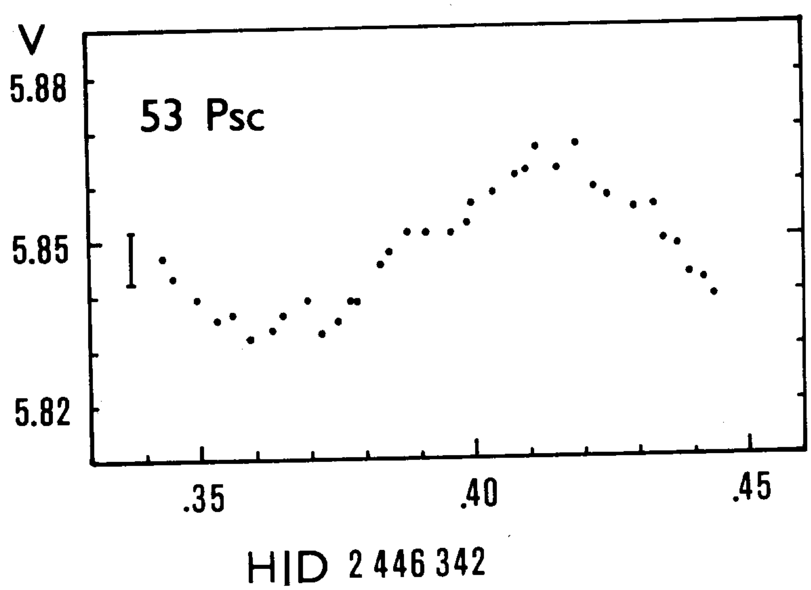

Figure 1. Light variations of 53 Psc in V colour. Standard error is indicated.

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OBSERVATIONS AND A TIME OF MINIMUM OF TV Cet

TV Cet (BD +02° 502), is one of the eccentric-orbit eclipsing binary systems suggested by Giminez and Delgado (1980), and by Giminez (1985), as candidates for possible observation of general-relativistic apsidal motion.

We have observed a secondary eclipse of TV Cet on the night of 1986 September 13-14 (JD 2446687), and have computed a time of minimum. The observations were made with the 46-cm reflector at Appalachian State University's Dark Sky Observatory. The photometer is a Kitt Peak National Observatory single-channel design employing a thermoelectrically cooled EMI 9865QB photomultiplier tube with matching UBVR filters. An Astronomical Time Mechanisms Model 240V amplifier provides a voltage-to-frequency output that is integrated by a microcomputer.

The observations were made through the R filter only, to optimize the signal-to-noise ratio, since the sky was illuminated by a nearly full moon. The observations have not been transformed to Johnson R, since they were only intended for timing analysis. In order to maximize the number of data points, no additional filters were used.

The comparison star used was BD +01° 566, located about 20 arc-minutes to the south of TV Cet. The star BD +02° 500 was used as a check star. The variable and comparison were alternately observed for 10-second integration periods.

The observations (V/C intensity ratio) are tabulated in Table I and plotted in Figure 1. The time of minimum light was

Table I. Observations of TV Cet

Hel. J.D -2446687	V/C	Hel. J.D -2446687	V/C
.75396	1.136	.81427	0.966
.75581	1.128	.81565	0.967
.75747	1.122	.81747	0.970
.76007	1.132	.81865	0.972
.76334	1.114	.81978	0.968
.76511	1.104	.82166	0.993
.76783	1.090	.82291	0.983
.77000	1.089	.82456	0.986
.77281	1.067	.82683	0.990
.77553	1.051	.83271	1.017
.77788	1.037	.83482	1.009
.77977	1.030	.83657	1.021
.78179	1.019	.83814	1.034
.78564	1.010	.84091	1.043
.78762	0.997	.84346	1.050
.79013	0.993	.84574	1.051
.79373	0.992	.84826	1.047
.79738	0.983	.85075	1.073
.79931	0.974	.85292	1.084
.80351	0.961	.85524	1.114
.80611	0.969	.85819	1.111
.80732	0.966	.86211	1.128
.80769	0.972	.86484	1.132
.81126	0.974	.86626	1.147
.81292	0.966	.86776	1.163

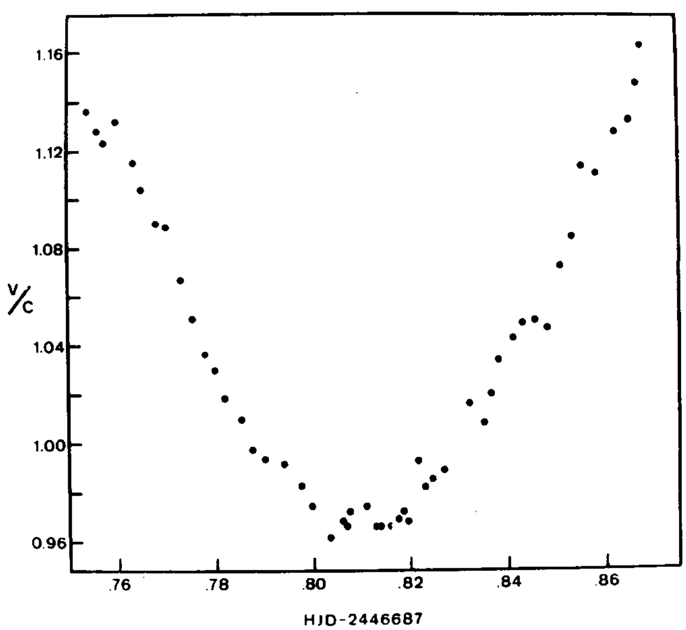

Figure 1. Secondary Eclipse of TV Cet

calculated using a quadratic least-squares fit, using only the data found in the bottom Ø.2 magnitudes of the eclipse. This follows the suggestion of Andersen and Giminez (1985), that asymmetries in the eclipse curve can cause errors if too much of the eclipse width is used. The same data were also analyzed using the method of Kwee and van Woerden (1956), using a program written by Ghedini (1982). The two methods yielded results that agreed within the observational errors. The resulting time of minimum is

Min II = HJD 2446687.8101
$\pm$.0093

where the error is the mean error computed from the errors in the quadratic coefficients.

Using the elements of Jørgensen (1979) places this secondary eclipse at phase 0.498. This may be compared to the light curve solution of Popper and Etzel (1981), which shows secondary minimum at phase 0.494 during 1972-73 (using the same elements).

We gratefully acknowledge the assistance of F. B. Wood and G. Fitzgibbons in providing reference material from the University of Florida Card Catalogue of Eclipsing Binaries.

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ON THE PRIMARY MINIMUM OF ECLIPSING BINARY AY Cam

The eclipsing binary AY Cam (= BV 363 = BD + 77^{o} 0328) was discovered by Strohmeier and Knigge (1961). They assigned it a period of $1^{d}.367485$. The photographic light curve is of Algol type with no indication of secondary minimum, the range of light variation being $9^{m}.9$-$10^{m}.75$. According to McDonald (1964) the spectral type of AY Cam is GO, while Götz and Wenzel (1966) reported its spectral type as A5. Tempesti (1969) gave photoelectric light curve of the system in V light along with the geometrical elements based on Russell- Merrill method. The period given by him is $2^{d}.7349658$.Using Wood's method, Milano and Russo (1979) reanalysed the normal points given by Tempesti (1969) to get a set of photometric and geometric elements for AY Cam. Brancewicz and Dworak (1980) gave the elements of AY Cam based on a period of $1^{d}.367480$. However, the General Catalogue of Variable Stars Vol. I. 1985 (Editor-in-Chief Dr. P.N. Kholopov), reports the period determined by Tempesti (1969).

AY Cam has been observed on five nights in 1978 and 1979 on the 56 cm reflector of Uttar Pradesh State Observatory, Naini Tal through Standard U, B and V filters, using 1P21 photomultiplier and employing d.c. technique. BD + 77^{o}329 has been used as the comparison star. The standard error of observations is $0^{m}.008$ for B, V and $0^{m}.018$ for U filter. The time of minimum (primary) has been determined by Kwee and Van Woerden (1956) method and the mean for U, B and V is as follows : -

$$\text{Prim. Min.} = \text{JD(Hel) } 2443876.3233 \pm .0003$$

The differential magnitudes (Comp. - Var.) in all the three filters U, B and V have been plotted in Fig. 1.

The duration of totality in V filter is about $0^{d}.05$. The depths of the primary minimum in U, B and V filters are $0^{m}.51$, $0^{m}.55$ and $0^{m}.65$ respectively.

Tempesti (1969) published the observed light curve and normal points in V filter. From the observations he concludes that the consecutive minima differ both in depth and in shape. The secondary minimum is $0^{m}.03$ brighter than the primary and shows a constant light lasting $0^{P}.02$, while the primary minimum shows no constant light.

This led him to double the period given by Strohmeier and Knigge (1961).

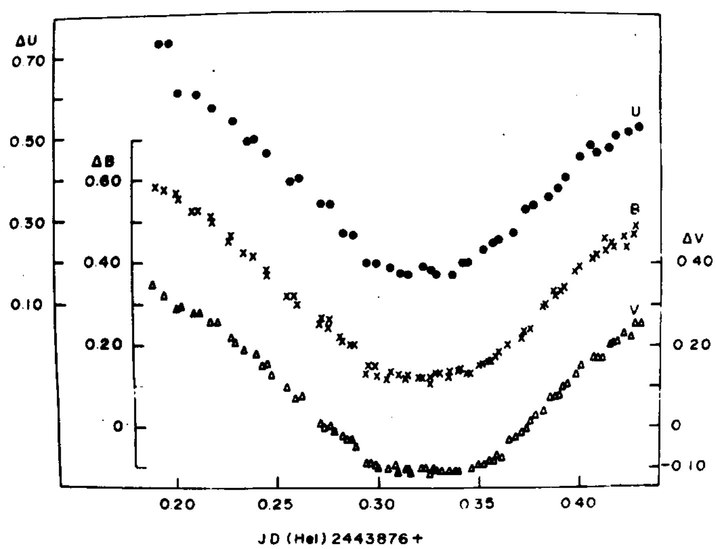

Figure 1: Primary minimum of AY Cam.

The light curve of AY Cam given by Tempesti (1969) shows a scatter of $0^{m}.05$ outside the eclipse. Therefore, it is possible that the magnitude difference of $0^{m}.03$ between consecutive minima may be due to this scatter as the star is not bright ($10^{m}.26$ at minimum) enough for a 15.5 in. refractor, and due to this scatter the constant light during primary minimum is not noticeable for a particular night's observations or else the depth and shape of primary minimum is variable. This remark is based on the fact that our light curve of the principal minimum of AY Cam shows a constant light of $0^{d}.05$ which is almost equal to the duration of constant light in the secondary minimum by Tempesti (1969).

Therefore , we conclude that the period of AY Cam is $1^{d}.367485$

as given by Strohmeier and Knigge (1961).

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AN UNEXPECTEDLY EARLY FADING OF V644 CEN (CPD -60° 3278)

This star was discovered to be variable by O'Connell (1951) who observed the star fade by 0.65 magnitudes on plates taken between 1931 and 1950. O'Connell proposed that V644 Cen was an eclipsing variable having a period of at least 65 years and a minimum lasting 17 to 18 years. Gaposchkin (1951) examined Harvard patrol plates covering the period 1890 to 1949 and concluded that whilst the star underwent minor disturbances of approximately 0.2 magnitudes between 1901 and 1920, there was no evidence for a deep minimum until the one reported by O'Connell. Sahade (1952) noted that the star had a shell spectrum at the time of the 1951 minimum. Hopp and Kiehl (1977) reported analysis of Bamberg sky survey plates which showed that during the period 1964-1975 the star had returned to a new maximum light of approximately 8.86 mpg.

We observed this star in the Johnson UBV bands on 18 occasions between JD 2444742 and JD 2445809 during a shell star monitoring programme (Kilkenny et al. 1985) Our results (Table I and Figure 1) show that during this period

Table I:

MJD	V	B-V	U-B
4742.327	9.911	0.083	-0.632
4979.571	10.025	0.081	-0.585
4979.573	10.021	0.082	-0.587
4980.560	10.018	0.083	-0.591
4980.565	10.031	0.075	-0.592
5075.368	10.148	0.089	-0.433
5101.406	10.100	0.096	-0.526
5102.304	10.106	0.094	-0.528
5106.284	10.096	0.096	-0.524
5140.236	10.123	0.087	-0.496
5419.429	10.235	0.077	-0.339
5419.473	10.257	0.048	-0.342
5420.490	10.228	0.077	-0.358
5424.389	10.235	0.073	-0.355
5427.419	10.262	0.072	-0.343
5710.592	10.294	0.054	-0.405
5715:592	10.327	0.046	-0.372
5809.459	10.213	0.069	-0.365

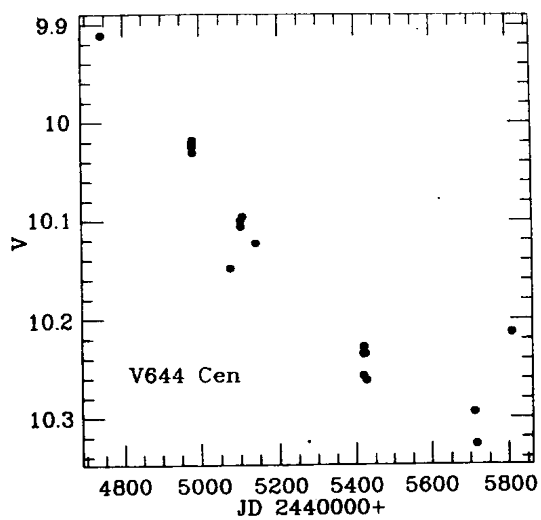

Figure 1

the star was fading steadily and towards the end of our programme had reached a V magnitude of approximately 10.3 (equivalent to mpg of 10.2) which is close to the value reported by O'Connell (1951) and Gaposchkin (1951) for the 1950 minimum. We obtained a single point which may indicate that the star was beginning to brighten again on JD 2445809, but this may be related to small fluctuations superimposed on the minimum such as was seen in the data of O'Connell (1951).

These results clearly show that the lightcurve is more complex than that of a simple eclipsing variable for which, on the evidence of the Harvard plates, no deep minimum would be expected until at least the year 2010.

The current minimum may last until the end of the decade and further observations of the star, both photometric and spectroscopic, would be valuable.

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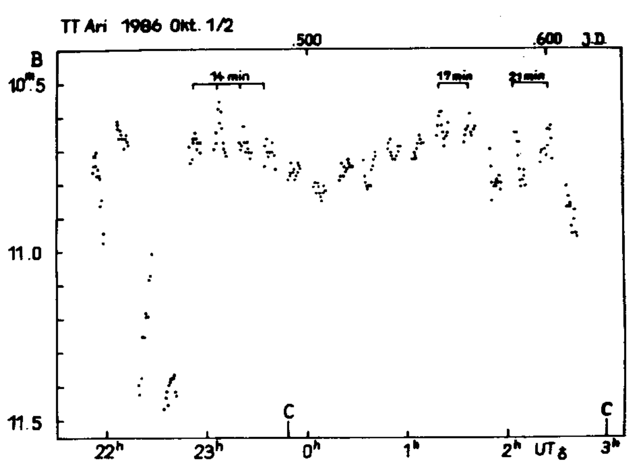
PHOTOELECTRIC OBSERVATIONS OF TT ARIETIS ON 1/2 OCTOBER 1986

Coordinated observations of this accreting white dwarf in a low-mass binary, simultaneously in the X-ray and the optical region, were carried out by numerous authors during summer and autumn 1985 (Wenzel et al. 1986, 1987). One year later, during the night of 1986 Oct. 1/2, we checked the behaviour of the object by photoelectrical observations with the Piszkéstető 50 cm telescope in Hungary. Star c (after Wenzel et al. 1986) served as comparison star. The measurements were made in the blue sensitivity region b. For the transformation into international B magnitudes the empirical formula

$$B = b + \frac{\sec z - 0.7297}{13.3061}$$

was used.

The resulting light curve (Fig. 1) shows the following.



1. During that night the star was in its "active" state (high brightness).

2. The photometric period of about 3.2 hours can clearly be recognized from the space of time between the two observed maxima, but these maxima are not in phase with the maxima "C" computed from the photometric elements given by Wenzel et al. (1986).

3. There are quasi-periodic fluctuations of the kind described in Wenzel et al.(1986, 1987)and Semeniuk et al. (1986). The cycle length seems to be not constant, but varying between 14 and 21 minutes.

4. During the observation time there occured an unusually deep dip in brightness down to $11^{m}_{.}5$.

The numerical data of these observations will be published in "Mitt. Veränderl. Sterne", Sonneberg.

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DELTA CAP : A POSSIBLE RS CVn BINARY

The eclipsing binary δ Cap(= BD - 16° 5943) was known to be a single line spectroscopic binary. Slipher (1906) first detected variable radial velocity in δ Cap. Crump (1921), Luyten (1936), Stewart (1958) and Batten (1961) derived its spectroscopic elements, and changing features were noticed by some authors. Eggen (1956), Wood and Lampert (1963), Dorren et al. (1980) and Ohmori (1981) attempted its photometry, but none of these photometries were satisfactory.

The author for the first time attempted its photometry in all the three (UBV) filters through the 38 cm reflector of the Uttar Pradesh State Observatory using a 1P21 photomultiplier cooled to -20°C, and employing d.c. techniques. Observations of eight nights were secured in the time interval September 1979 to October 1982. The stars γ Cap and ε Cap were used as the comparison and the check stars, respectively.

Photometrically, there are six criteria for deciding whether a certain object is an RS CVn variable or not. These are : (a) light curve variations, (b) colour index outside eclipses, (c) variation of the primary minimum depth, (d) displacement of the secondary minimum, (e) orbital period between 1 day to 2 weeks, and period variations, and (f) the primary and the secondary components belong to the spectral types F-G V-IV and G-K IV-III, respectively.

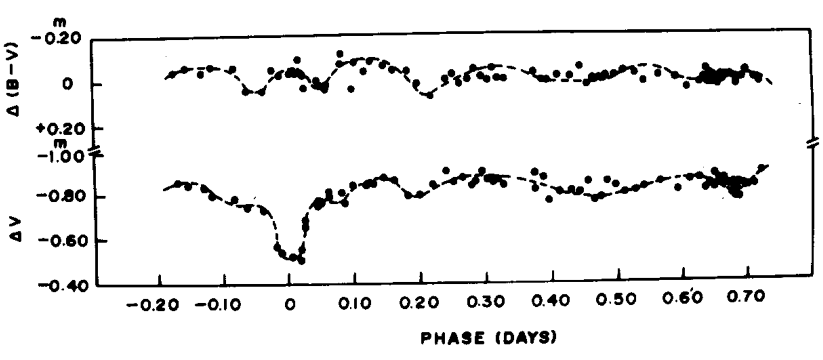

Figure 1

Smoothened V light curve of δ Cap is given in Figure 1, which shows light curve variations outside the eclipses.
The colour index also shows variation outside the eclipses, and throughout the cycle. These variations may also be caused by the intrinsic variability of one of the components of δ Cap or due to the variability of the comparison star. We will undertake the discussion of these possibilities later. The depth of the primary minimum in V filter comes out to be 0.32 magn.
Wood and Lampert (1963), and Ohmori (1981) gave the depths of the primary minimum in V filter as 0.16 magn. and 0.15 magn., respectively, few hundredths magnitude deeper than that given by Eggen (1956).
Thus, it is apparent that the depth of the primary minimum shows some variation. Dorren et al. (1980) gave the depth of the primary minimum in H_α as $0^m.18$.

During the course of our observations, one primary minimum (J.D. 2444163.272) and one secondary minimum (J.D. 2445261.168) were observed, which showed the shifts of $-0^d.001$ and $0^d.046$ respectively, using the ephemeris : J.D. 2421424.847 (Luyten, 1936) + $1^d.0227789$ (corrected) E. The shift of the primary minimum is within the graphical error of determination of minima ($\pm\ 0^d.001$), thus it is apparent that the secondary minimum shows a considerable displacement from its position. On the other hand, Dorren et al. (1980) found that the secondary minimum occurred close to phase 0.5. In this light too, present displacement of the secondary minimum is important.

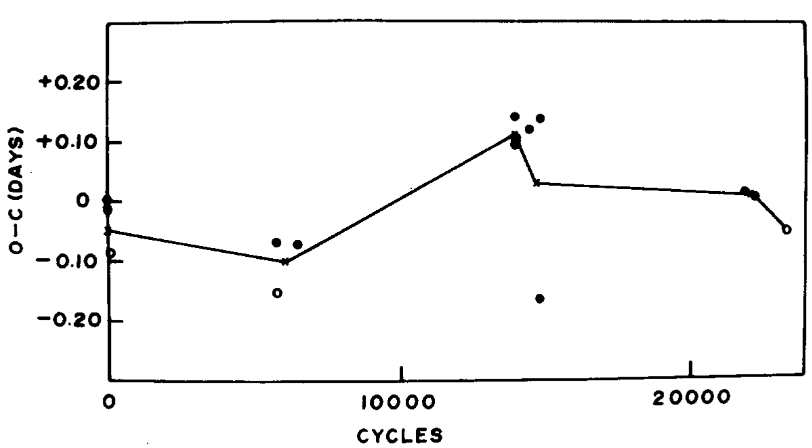

Figure 2

The O-C diagram (Figure 2) using available times of minima, based on the above ephemeris, clearly indicates sudden period changes, which fact is also apparent from the increased corrected period in comparison with earlier ones. Wood and Lampert (1963) did not rule out the possibility of a period change, either.

The spectral types at maximum, at the tip of the primary and at the tip of the secondary minimum appear to be F0IV, F1 IV-III and F1 IV-III respectively. Rough estimates suggest that the secondary eclipse is an occultation. This finding of ours is in agreement with that of Dorren et al. (1980). However, it is difficult to decide whether the eclipses are total or partial. If we assume that the eclipses are total, the brighter component appears to be of F1IV-III spectral type, which is in the line of earlier determinations. We shall now discuss the possibility of intrinsic variability and the variability of the comparison star. The Δ (B-V) colour curve (Figure 1) shows colour variation throughout the cycle, and are supposed to be caused by the intrinsic variability of one of the components. The mean amplitude (max. to min.) of various dips of V light curve is of the order of 0.06 magn., while the mean amplitude of the dips of the colour curve is nearly 0.1 magn., which is not possible. In addition, some of the dips in V light curve and Δ (B-V) colour curve do not correspondingly occur, but are seen shifted. These facts rule out the possibility of intrinsic light variations present in δ Cap. We, checked the variability of the comparison star against the check star, and it was found that the comparison star showed stable behaviour, within error of observations ($\pm$ $0\overset{m}{.}02$). Thus, it is evident that whatever light and colour variations are present in δ Cap, are due to some other phenomenon like star spot activity etc. Now we will assess the spectral type of the secondary component.

Batten (1961) stated that the secondary component must be at least three magnitudes fainter than the primary. He estimated the absolute visual magnitude of the primary component as + 2.2, which corresponds to a normal A6 star (Arp, 1958). Thus, vide his statement, the absolute visual magnitude of the secondary component must be 5.2, which indicates that it is closer to a normal G6 star. Now, on the other hand, if we stick to our assumption that the secondary eclipse is a total occultation, then for the normal (or Main Sequence) primary (F1), the absolute visual magnitude will be 3.0. If we consider Batten's (1961) statement as taken for granted then the absolute visual magnitude for the normal secondary component must be 6.0, which belongs to K1 (Te = 4920°K) type. Now, from another angle, we see that the depth of the secondary minimum (0.07 magn.) is four-and-half times less than the depth of the primary minimum 0.32 magn.), which fact shows that the secondary component is considerably fainter than the primary. In addition Dorren et al. (1980) estimated the temperature of the secondary component as $4700^{o}K$, which is near the temperature of a K2.5V star, while our above estimate shows it to be $4920^{o}K$(K1V). Thus, it is apparent from the above discussion that the primary component belongs to early F type, while the secondary component belongs to late G or early K type. The shallower depth of the secondary minimum may cause some uncertainty in the spectral types of the components, but that will be not more than one sub-spectral class. Since, the maximum belongs to IV luminosity class, and, thus, one component may belong to IV-III luminosity class (Pr:F1IV-III).

Thus, it is apparent from the above discussions that δCap satisfies all the photometric properties of an RS CVn type variable. It is also evident from the above discussions that the light and colour variations are real and sometimes greater than the 3 σ level. Wood and Lampert (1963) stated that the November observations appeared below the September observations, which fact suggests that the light curve is variable in intensity. A similar small difference between the observations on two nights was found by Eggen (1956). Dorren et al. (1980) found light variations on the time scale of several hours. In our observations of two nights falling around phase 0.68 some variation of light is seen. Thus, it seems clear that the light curve of δ Cap shows variation.

Considerable scatter was found in the observations of Dorren et al. (1980). They suspected that this scatter was intrinsic to δCap but could not ascertain it. Our observations also show some scatter around the secondary minimum in V filter, but we have already negated the possibility of these intrinsic light variations. Dorren et al. (1980) also found relatively large scatter in α - index, which is a measure of net strength of H_{α} line, and phase dependent variation of Δα . They suspected the presence of a gas stream or a hot (or cool) spot on the surface of the hotter component. In our observations, although two dips (max. to min.) are visible around phases 0.19 and 0.68, but the dip around $0^{P}.19$ is definitive, hence we feel that cool apots may be present in the system, and may be responsible for the light curve variations.

From the whole discussion, we feel that δ Cap is a possible RS CVn type variable. It is desired to confirm its nature as an RS CVn variable from future observations in different filters.

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On the Constancy of Some Stars in NGC 2287=Messier 41

The Pleiades-age open cluster NGC 2287 contains several luminous red bright-giants and spectroscopically interesting stars. Three of these stars have previously been suspected of low-level variability. In order to confirm this and ascertain the nature of the variations, differential photometry was obtained over two observing seasons.

The stars were observed with the Lowell Observatory 53cm photometric telescope. Two groups of stars were arranged in trios observed in the pattern: star 2-1-3-2..., switching filters at the completion of each cycle. A single nightly observation consisted of one cycle of measurement in each color, the measurements being the mean of six ten-second integrations on "star" compensated by the mean of two integrations on "sky." Diaphragms of 29 or 49 arcsec diameter were used depending on seeing. The data were reduced to instrumental magnitudes, accounting for differential extinction by the use of mean monthly extinction coefficients determined with this specific telescope/filters/detector system in an ongoing program initiated in 1972 (Lockwood and Thompson 1986).

The first group observed in the cluster consisted of three K-type bright-giants, identified by designations assigned by Cox (1954). Pertinent information about the stars is given in Table I.

Table I

Star	HD	V	B-V	MK	Membership probability	Remarks
Group 1						
1=Cox 21	49091	6.908	1.503	K3 IIb	0.81	=ADS 5437
2=Cox 97	49105	7.803	1.147	K0 IIab-IIb	0.89	
3=Cox 75	49068	7.436	1.254	K1.5 II-III	0.90	MK standard
Group 2						
1=Cox 102='a'	49126	7.275	0.592	F8 IV-V + B9.5 V	0.87	
2=Cox 21	49091	6.908	1.503	K3 IIb	0.81	=ADS 5437
3=Cox 107='f'	49212	7.781	1.136	K0 IIab	0.90	

BV photometry and cluster proper-motion membership probabilities are drawn from Ianna *et al* (1987); the MK classifications are by Levato and Malaroda (1979), except Cox 75, which is an MK standard in the 1985 list of Keenan and Yorka (1985). Of this group, Schmidt (1984) suspected variability in Cox 75 and 97 based on DDO photometry on two nights. The group was observed in the present program using Strömgren *y* and *b* filters on thirteen nights from 1985 March 31 to November 7 UT.

The second group included two bright-giants (Cox 21 carried over as a tie-in to group 1) and Cox 102, which has a composite spectrum of hotter stars. In the course of their photometric study of the cluster, Feinstein *et al* (1978) found Cox 102 to be variable with a V range of 0.09 mag from ten observations over a four-month interval. This trio was measured on twelve nights between 1985 November 20 and 1986 March 1 UT using Strömgren *y*, *b*, and *v* filters.

Table II

Pair	Δy σ	Δb σ	Δv σ
Group 1			
1-2	-0.909	-0.672	–
	6	6	
1-3	-0.539	-0.362	–
	5	6	
2-3	0.370	0.310	–
	7	4	
Group 2			
1-2	0.394	-0.094	-1.340
	4	5	9
1-3	-0.495	-0.745	-1.445
	4	4	6
2-3	-0.889	-0.651	-0.105
	6	6	11

Table II summarizes the photometry, showing pairwise differential magnitudes and the standard deviation of these means on the second line of each entry. Because Messier 41 culminates at 1.8 airmasses from Flagstaff, the precision of the data ($\sigma \sim 5$ millimagnitudes in *y* and *b*) is roughly half what we expect for constant stars of similar brightness located north of the celestial

Equator (*cf.* Skiff and Lockwood 1986). Nevertheless the consistency of σ for each filter suggests it is reasonable to conclude that all five stars were constant to better than 1% over the interval covered by the observations. Indeed, for group 1, whose measures were split between two observing seasons, the interseasonal means differ on average by only 2.5 millimagnitudes. Sowell (1986) also reports differential UBV photometry of Cox 21, 97, and 107. A dozen measures were obtained over a four-day baseline in November 1985. These indicate short-term (less than several hours) constancy to within a few millimagnitudes.

These results exclude variations with time scales of hours to months, but longer-term changes are not ruled out.

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AN IMPROVEMENT OF THE ROTATIONAL PERIOD OF CQ UMa

CQ UMa = HR 5153 = HD 119 213 is an SrCrEu Ap star which exhibits light, spectral and magnetic variations with the period of about 2.450 days. All the variations can be explained by the oblique rotator model with extensive "photometric" and "spectroscopic" spots or belts (Mikulášek 1980) and nearly dipole magnetic field (Mikulášek et al. 1984). To build a realistic model of the distribution of these spots on the surface and their relation with magnetic field geometry, we need to know the rotational period with sufficient accuracy.

All the previous determinations of the period of variations of CQ UMa were based on the analysis of photometric data. Light variations of the star in the B and U colours were found by Burke and Howard (1972) on the basis of their UBV observations carried out in the years 1970 and 1971. They obtained a period of 1.706 days. Winzer (1974) derived a period of 1.6980 days from his own UBV measurements. Both periods are incorrect (s. the discussion in Mikulášek et al. 1978). Wolff and Morrison (1975) derived the period of 2.451 days, Mikulášek (1975) 2.45002 days, Mikulášek et al. (1978) 2.449967 days not excluding the double value: 4.899934 days. The double period was then rejected as it is incompatible with the observed projection of the rotational velocity (33 km.s^{-1}) and the expected radius of star (2.0 $R_{\odot}$)(Pavlovski 1979, Mikulášek 1980). Gathering all UBV observations Pavlovski (1979) arrived at the period of 2.449981 days. Musielok et al. (1980) presented the period 2.44988 days based on their 10-colour photometry and ubvy photometry of Wolff and Morrison (1975).

A new set of 25 ubvy measurements of CQ UMa obtained by Pyper and Adelman (1985) substantially enlarges the time interval covered by photoelectric observations of the star to 14 years, that induced us to improve the period of CQ UMa. In our paper we submit the period based on the whole available photometric data which span more than 2000 revolutions of the star. There is impossible to use all the photometric data directly, as they were obtained in various photometric systems (see Table I).

Table I

Authors	Type of photometry	N	Mean epoch	(O - C)
Burke, Howard (1972)	rel.UBV	28(2excl.)	86	0.001 ± 0.036
Winzer (1974)	rel.UBV	18	197	0.000 ± 0.015
Wolff, Morrison (1975)	rel.uvby	25	427	0.000 ± 0.009
Mikulášek et al. (1978)	abs.UBV	9	585	-0.012 ± 0.036
Musielok et al. (1980)	rel.10col.+	29	755	-0.005 ± 0.011
Pavlovski (1979)	abs.UBV	19	1089	0.020 ± 0.019
Pyper,Adelman (1985)	abs.uvby	25	1843	-0.002 ± 0.015

+ see in Schöneich, Staude (1976), N - number of nights

Nevertheless, it follows from the analysis of light curves in the blue region where light variations are most pronounced that light curves here are similar. Light variations may be then expressed in the from:

$$m_i(\varphi) = \overline{m_i} - A_i\, f(\varphi), \qquad (1)$$

where φ is the phase, $m_i(\varphi)$ magnitude in the particular colour, $\overline{m}_i$ - the mean value of the magnitude in $\underline{i}$ - colour, A_i - the amplitude of variations. $f(\varphi)$ is the normalized mean light curve in the blue region with an unit amplitude and zero mean value.

For the determination of light elements and mean light curve $f(\varphi)$ measurements in $\underline{B}$ (UBV photometry), $\underline{b}$ and $\underline{v}$ (ubvy photometry), $\underline{X}$ and $\underline{Y}$ colours (in 10-colour photometry) have been used. Using the least squares method we have obtained the following approximation for $f(\varphi)$:

$$f(\varphi) = 0.486 \cos 2\pi\,(\varphi + 0.067) + 0.102 \cos 4\pi(\varphi - 0.142) \qquad (2)$$

The mean light curve is rather asymmetric with a flat maximum occurring at $\varphi = 0.000 \pm 0.009$ and a deeper minimum at $\varphi = 0.416 \pm 0.004$.
The zero points of the function are situated at the phases 0.207 ± 0.003 and 0.649 ± 0.004. $f_{max}/(-f_{min}) = 0.72 \pm 0.04$.

The phase will be given by the relation:

$$\varphi = \mathrm{FRAC}\ (JD_{hel} - 2\ 440\ 747.746)/2.449909 \qquad (\ 3\ )$$

The ephemeris for the moments of maxima in the blue region has been calculated by the least squares method, too.

$$JD_{Bmax} = 2\ 442\ 487.\underset{\pm 7}{181} + 2.4499\underset{\pm 11}{09}\ (E - 710), \qquad (\ 4\ )$$

where 2 442 487.181 is the moment of the basic maximum, 2.449909 days is present improved rotational period. The beginning of counting of cycles (E = 0) has been put just before the first observation of CQ UMa.

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CORRECT PERIOD OF THE ECLIPSING STAR MN AURIGAE

The period published in Inf. Bull. Variable Stars no. 321 (1968) is wrong. This detached system was investigated anew, and the following elements have been derived from 25 faint observations on Sonneberg plates spanning 3511 epochs:

$$\text{Min.} = 242\ 5647.340 + 5^{d}.58086 \cdot E\ .$$

Further details including the lightcurve will be given in Mitt.Veränderl. Sterne Sonneberg.

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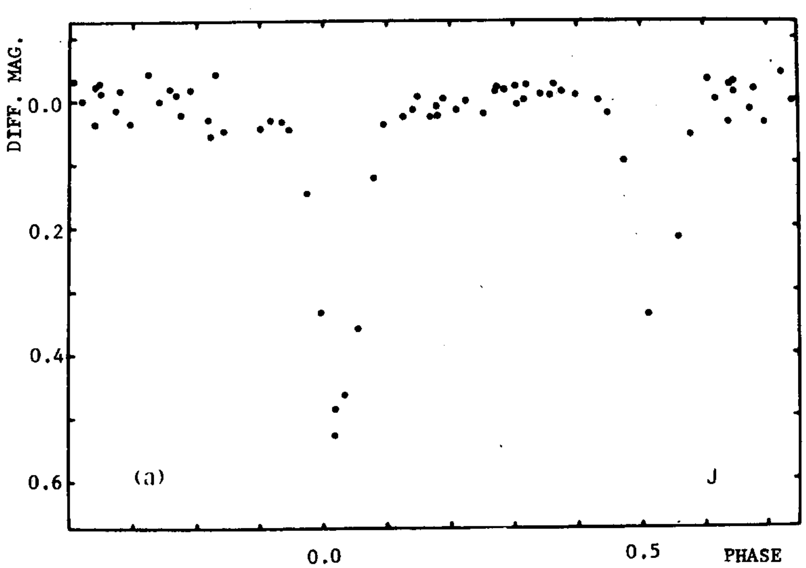
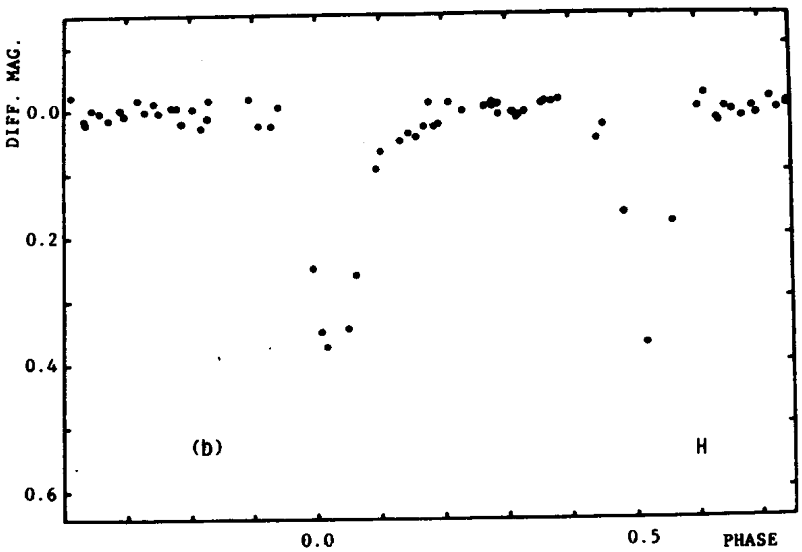
JHK LIGHT CURVES OF CG CYGNI

Infrared photometry of CG Cygni (=BD+34°4217), a short period (P=0.63d) active late-type eclipsing binary, was obtained during four consecutive nights 1986. Aug. 30 - Sept. 3. The comparison star was SAO 70728 (=BD+34°4217); BS 8430 was used as the standard. The observations were made at the Observatorio del Teide, Tenerife, with the 1.5m Sanchez Magro Telescope (Infrared Flux Collector). A single channel infrared photometer was used, with a focal plane chopper and a cooled InSb detector. For each data point, the star was exposed for 10s alternately in the two beams until a signal-to-noise ratio >100 was achieved.





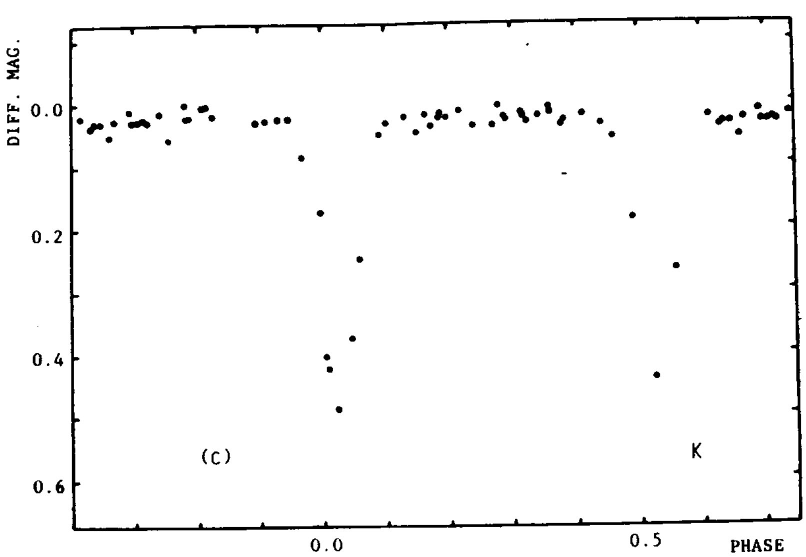


Figure 1: The J, H and K light curves of CG Cygni during 1986 Aug/Sept.

CG Cygni shows most of the characteristics of the RS CVn class of stars (Hall 1975), although it appears that neither component has yet evolved far off the main sequence. Both components are active. The spectral classification seems to have been reliably established to be G9 V + K3 V (or perhaps K3 IV-V) by Naftilan and Milano (1979) who, with co-workers, have extensively studied the system. Infrared excesses in J and K $\sim$ 0.2 mag have been confirmed by Bedford, Fuensalida and Arevalo (1987).

The JHK light curves presented here in Figures 1a, 1b, 1c form part of our continuing programme of observations of CG Cygni. The data have been folded according to the ephemeris of Milone and Ziebarth (1974):

$$HJD = 2439425.1221 + 0^{d}.6311410E,$$

and the differential magnitudes have been normalised to an approximate uneclipsed reference level (Δm=0).

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OPTICAL BEHAVIOUR OF THE X-RAY BINARY V1727 CYGNI
= 4U 2129+47 IN 1986

The star was inspected on 79 blue-senisitive plates (ORWO-ZU21+GG13+BG12) from 47 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 18 March 1986 and 29 November 1986.

The individual estimates, which are listed in Table I are linked to the sequence of comparison stars given by Wenzel (1983).

Table I

J.D.hel. 244....	m_B	Rem.	J.D.hel. 244....	m_B	Rem.
6508.639	18.1		6616.507	>17.5	iv
6533.561	>17.9	iv	6626.505	>17.9	iv
6533.578	>17.9	iv	6626.524	18.2	
6552.503	>17.9	iv	6641.410	>18.4	iv
6552.522	>17.5	iv	6641.428	>17.5	iv
6553.554	18.1		6642.447	>17.5	iv
6553.572	>17.9	iv	6644.485	>17.5	iv
6554.551	>17.5	iv	6645.478	>17.9	iv
6554.569	>17.9	iv	6645.497	18.2	
6563.492	18.3		6646.515	18.1	
6563.510	18.3		6646.537	18.1	
6577.444	>18.4	iv	6648.521	>17.5	iv
6591.508	>17.9	iv	6649.487	>17.9	iv
6591.526	>17.9	iv	6649.512	18.2	
6592.506	>17.9	iv	6650.480	18.2	
6592.528	>17.9	iv	6651.480	>17.5	iv
6596.532	>17.9	iv	6651.500	>17.5	iv
6597.528	>17.5	iv	6678.443	>17.9	iv
6608.423	>17.9	iv	6678.463	18.2	
6609.451	>17.9	iv	6679.429	18.3	
6611.470	18.4		6679.448	>17.9	iv
6611.489	18.4		6683.440	>17.9	iv
6612.489	18.2		6683.461	18.4	
6613.486	18.3		6685.424	>17.5	iv
6613.503	17.9	iv	6685.444	>17.5	iv
6614.500	18.0		6702.357	18.1	
6616.491	>17.9	iv	6702.376	18.3	

J.D.hel.	m_B	Rem.	J.D.hel.	m_B	Rem.
244 ...			244....		
6702.395	>18.4	iv	6714.384	>17.9	iv
6704.354	>17.9	iv	6714.403	18.2	
6704.372	>17.9	iv	6731.315	>17.9	iv
6705.384	18.4		6731.341	>17.9	iv
6705.404	>17.9	iv	6733.441	>17.9	iv
6706.396	18.2		6733.460	>17.9	iv
6706.415	18.3		6737.446	18,4	
6707.364	>17.9	iv	6741.419	>17.9	iv
6707.382	>17.9	iv	6762.420	>17.9	iv
6708.389	>18.4	iv	6763.260	>17.9	iv
6708.408	>17.9	iv	6763.281	>18.4	iv
6713.366	18.3		6764.267	>17.9	iv
6713.406	18.4				

iv = invisible

The object is only visible on 27 plates in the brightness range between $m_B = 18\overset{m}{.}0$ and $m_B = 18\overset{m}{.}4$. On most of the plates the star is below the limiting magnitude and invisible. As in former series (Götz 1985, 1986) the behaviour given here characterizes the low or inactive state of the star, which probably started near 7 September 1983 (Wenzel 1983).
Observations listed in Table I are shown in Figure 1.

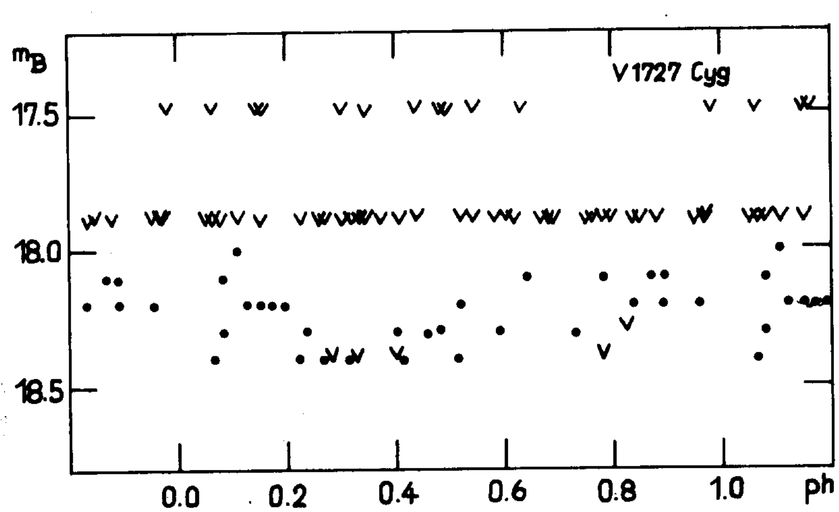

Figure 1

They are reduced to one common epoch by means of the elements

$$\text{Min (hel.)} = 244\ 4403.743 + 0\overset{d}{.}2182579 \cdot E$$

given by McClintock et al. (1982). The arrows indicate "fainter than" observations.

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PHOTOGRAPHIC OBSERVATIONS OF THE PLANETARY NEBULA PK 215 $+3^{o}1$

The planetary nebula PK 215 $+3^{o}1$ (NGC 2346) is a butterfly bipolar nebula. The central star (AGK3 - 00965) was known as a single-line spectroscopic binary. This star had been observed frequently, and no brightness variations were noticed before 1981. In 1982 Kohoutek (1982) found that the brightness of the central star had drastic changes after November 1981, showing a light curve of an eclipsing binary with a period of ≈ $15\overset{d}{.}957$ and an amplitude of $2\text{-}3^m$. Later Mendez et al. (1982) proposed that the eclipses were caused by a dark dust cloud, which circulated around the system. Some other authors have revealed fast and complex variations in the light curves.

We observed the planetary nebula NGC 2346 using the 40/200 cm double astrograph of the Peking Observatory Xing-Luing station from April 1981 to April 1986. The plates used were Kodak Eastman 103aO and IIaO and the selected area SA 98 was used to the magnitude calibration. The plates were measured with a microphotometer. The magnitudes in Table I contain contributions from both the central star and the nebular radiations.

From these observations (see Figure 1) the following conclusions can be made:

1. The observations in 1985 show that the central star of the planetary nebula of NGC 2346 has still obvious "eclipsing" variations with an amplitude of about 3.5 mag., the current elements being:

$$\text{Min. Hel.} = \text{J.D. } 2446153.2 + 15\overset{d}{.}957 \cdot E$$

2. From the observations of 1986 we can see that the minimum of the light curve has increased by about 2-3 mag., so that the amplitude of the variation has been reduced to $\approx 1^{m}.1$; the "eclipsing" variability of the star is not obvious in 1986.

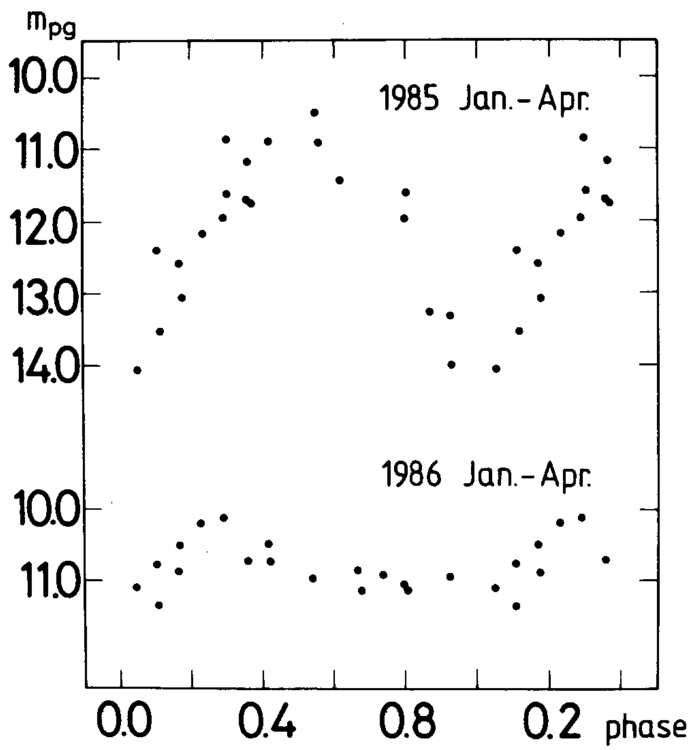

Figure 1: Light curves of AGK3 - 00965. Phases were computed using the elements given above.

The 1985 Sept. observations of Jaśniewicz and Acker (1986) are in between our 1985 and 1986 observations and strenghten the conclusion about the decreasing amplitude of the star.

Table I.

No.	Plate No. DA	J.D. hel. 2440000+	m_{pg}	No.	Plate No. DA	J.D. hel. 2440000+	m_{pg}
1	2829	4724.054	10.91	23	4066	6170.051	14.05
2	3147	4988.024	11.22	24	4067	6171.006	13.52
3	3168	5049.021	10.94	25	4068	6172.078	13.05
4	3206	5078.029	11.33	26	4071	6174.054	11.61
5	3681	5414.054	12.60	27	4079	6178.041	10.90
6	3948	5980.354	13.22	28	4080	6179.045	11.42
7	3969	6026.360	11.36	29	4266	6443.238	10.87:
8	3994	6094.184	10.86	30	4417	6490.003	10.75
9	4005	6095.153	11.17	31	4418	6490.989	10.50
10	4012	6111.172	11.74	32	4419	6491.996	10.20
11	4038	6139.046	12.40	33	4420	6493.007	10.12
12	4041	6139.976	12.58	34	4421	6494.030	10.73
13	4044	6140.976	12.18	35	4422	6495.026	10.48
14	4046	6141.976	11.95	36	4414	6497.000	10.98
15	4049	6142.986	11.70	37	4415	6499.042	10.86:
16	4051	6143.979	10.88	38	4410	6501.044	11.03
17	4053	6146.052	10.48	39	4412	6503.036	10.95
18	4057	6150.030	11.98	40	4413	6521.037	11.09
19	4075	6152.052	13.33	41	4411	6522.008	11.36
20	4061	6166.010	11.60	42	4416	6527.001	10.72
21	4064	6167.040	13.24	43	4430	6531.033	11.14
22	4065	6168.003	14.00:	44	4428	6532.025	10.92
				45	4429	6533.055	11.12

We can say that the variations of the central star of the planetary nebula NGC 2346 will disappear gradually soon, and the brightness of the star will return to the stable phase as it was before 1981.

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HQ AND HV ANDROMEDAE : FURTHER PHOTOMETRIC STUDY OF POLAR CANDIDATES

The variability of these stars was discovered by Meinunger (1975) and they were classified as rapid irregular variables. Later on, Meinunger (1980) pointed out that the spectrograms of the stars show the presence of weak emission lines of Hα and Hβ and therefore he classified them as cataclysmic variables possibly belonging to polars. However, no other spectroscopic or polarimetric observations were made since that time. Here we discuss the results of the photometric investigation of stars on astrograph plates of Sonneberg Observatory. The brightness of Meinunger's (1975) comparison stars was used.

HQ And (=S 10774). After 800^d- rise of brightness at the beginning of our observations, the luminosity changes become larger (in amplitude). However, this effect might be partially explained by the decrease of the exposure time. It seems to be real as some specially obtained plates show rapid variability with the characteristic time of about one-two hours. Unfortunately, these data are insufficient to discuss the possible orbital period.

The brightness difference between "active" and "inactive" states is smaller, as compared to 3 magn. in AM Herculis (Hudec and Meinunger 1976), and one may show only one sure "inactive" state near JD 2440800, and two possible ones near 2441900 and 2446100. The upper limit for the duration of the last mentioned minimum is about 600^d, but between the two first ones is about 1100^d.

HV And (=S 10777) has much more prominent "eclipse-like" "excursions" to "inactive state", which are more similar to that of MV Lyrae before switching off of the accretion in the system (Andronov and Shugarov 1982, Wenzel and Fuhrmann 1983), than to polars. However, the long-period polar QQ Vulpeculae underwent such "excursions", during which the brightness decreases by ~2.5 magn., but in this system their duration is of about two weaks (Andronov et al., 1987), that is much shorter, than in HV Andromedae (upper limit 300^d).

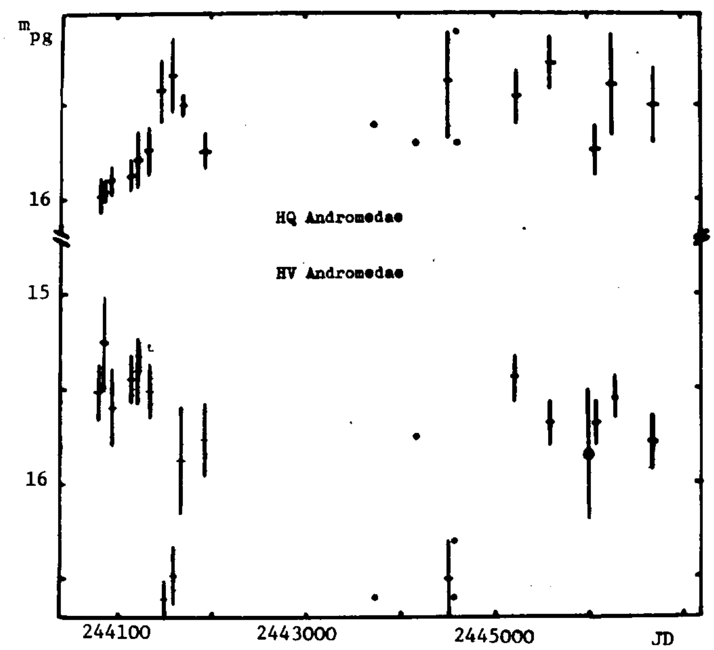

Figure 1

Andronov and Banny (1985) argued for 80.6-min photometric period of the star derived from four nights of observations. However this value might be corected by future observations, our present data are not sufficient to study the orbital variability.

The present data are in agreement with the classification of Meinunger (1980), who supposed these stars were candidates for polars. But naturally, the classification of these stars is not fully confirmed, so the theoretical models for luminosity changes in polars (eg. Andronov 1986 and refs therein) might not yet be applied to these two stars.

The light curves have very large gaps, and it would be important to fill them by using other plate collections, especially at Harvard and Bamberg. Only complex investigations may enable us to understand these interesting objects.

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR EV LAC IN 1983

Photoelectric monitoring of the flare star EV Lac has been carried out at the Stephanion Observatory during the year 1983 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 August 2-21, 1983:

$$V = v_0 + 2.910 + 0.037\,(b-v)_0 \;,$$

$$B-V = 0.444 + 1.093\,(b-v)_0 \;.$$

b) For the period October 3-5, 1983:

$$V = v_0 + 2.645 + 0.171(b-v)_0 \;,$$

$$B-V = 0.487 + 0.972(b-v)_0 \;.$$

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 31.33 hours of monitoring time three flares were 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

Table I

Date 1983	Monitoring Intervals (U.T.)	Total monitoring Time
August		
2-3	20^h38^m - 21^h06^m, 21^h32 - 22^h01^m, 22^h06^m - 22^h40^m, 23 04 - 23 33, 23 37 - 00 09.	2^h 32^m
3-4	21 20 - 21 40, 21 44 - 22 11, 23 14 - 23 44, 23 49 - 00 26.	1 54
4	22 31 - 23 01, 23 05 - 23 34.	0 59
9	22 01 - 22 34, 22 37 - 23 11.	1 07
10	22 38 - 23 11, 23 14 - 23 50.	1 09
11	22 12 - 22 44, 22 48 - 23 19.	1 03
12-13	21 29 - 22 32, 22 52 - 23 24, 23 26 - 23 41, 23 48 - 00 12.	2 14
13	20 33 - 21 08, 21 11 - 21 41, 21 58 - 22 30, 22 33 - 23 20.	2 24
16-17	23 05 - 23 34, 23 38 - 00 19.	1 10
17	21 53 - 22 22, 22 27 - 22 37, 22 40 - 23 01.	1 00
18-19	20 42 - 21 11, 21 15 - 21 47, 22 07 - 22 44, 22 48 - 23 17, 00 10 - 01 10.	3 07
19-20	22 36 - 23 13, 23 17 - 23 53, 00 02 - 00 45, 01 03 - 01 47.	2 40
20-21	22 08 - 22 37, 22 42 - 23 11, 23 15 - 23 44, 00 07 - 00 38, 00 42 - 01 00.	2 16
October		
3	18 39 - 19 09, 19 12 - 19 45, 19 48 - 20 17, 20 33 - 20 59, 21 02 - 21 37.	2 33
4	18 33 - 19 00, 19 02 - 19 31, 19 34 - 20 07, 20 22 - 20 53, 20 55 - 21 28.	2 33
5	18 28 - 19 03, 19 06 - 19 34, 19 36 - 20 05, 20 21 - 20 58, 21 00 - 21 30.	2 39
	Total	31^h 20^m

Table II

Characteristics of the flares observed

Flare No	Date 1983	UT max	t_b min	t_a min	Duration min
	Oct.				
1	3	$21^h15^m.71$	$0^m.36$	1.00	1.36
2	5	18 30. 05	0.52	5.30	5.82
3	5	20 27. 97	0.32	0.44	0.76

$(I_f-I_o)/I_o$ max	P min	Δm mag	σ mag	Air mass
0.20	0.09	0.20	0.02	1.02
0.44	1.00	0.40	0.03	1.08
0.21	0.08	0.21	0.02	1.01

less sky background of the star plus flare, d) the integrated intensity 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 of the flare and g) the air mass at flare maximum.
The light curves of the observed flares in the b colour are shown in Fig. 1-3.

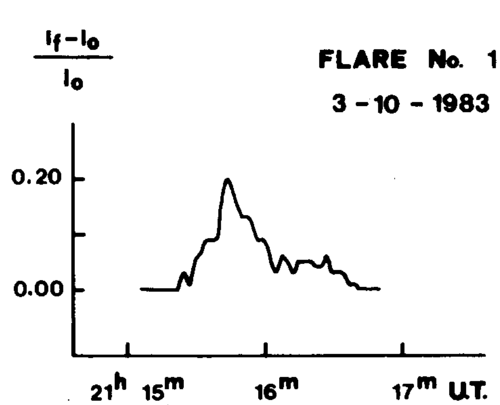

Figure 1

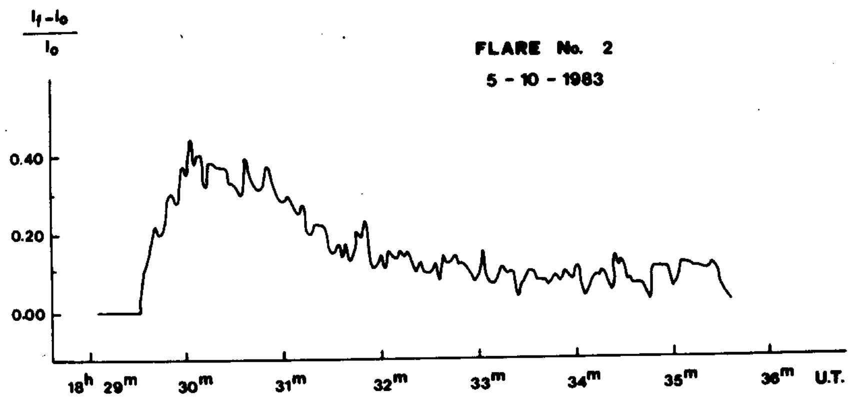

Figure 2

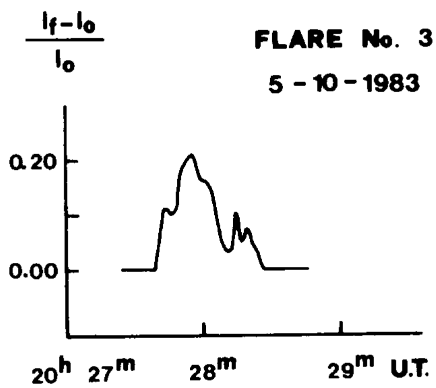

Figure 3

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1983/84 PHOTOMETRY OF THE SPOTTED STAR V 711 TAURI (HR 1099)

Intermediate and narrow band photoelectric observations of the bright (<V> = + 5.8 mag), active RS Canum Venaticorum-type star V711 Tauri (HR 1099, ADS 2644 A; K1 IV + G5 IV; P = 2.84 days) were obtained at Villanova University Observatory on 22 nights, from 1983 September 9 UT through 1984 February 27 UT. A description of the instrumentation, observing procedure, data reduction technique, and discussion of the differential color and H-alpha indices have been given elsewhere (Guinan and Wacker 1985). The comparison and check stars were the same used in previous photometric studies (Dorren et al. 1981; Nha and Oh 1986; Wacker and Guinan 1986). All measures of the variable included the faint visual companion ADS 2644 B (K3 V, V = + 8.83 mag). Nightly mean differential magnitudes were computed, in the sense variable minus comparison, for the intermediate band blue (λ4530), red (λ6600), and narrow band red (λ6568) observations, from which corresponding differential color and H-alpha indices were calculated. The seasonal mean errors for the nightly λλ4530, 6600, 6568, Δ (b-r)' , and Δ α (v-c) data sets are, respectively: 0.008, 0.007, 0.010, 0.011, and 0.013 mag.

The top panel of Figure 1 presents the intermediate band red observations. The orbital phases were computed from the ephemeris of Bopp and Fekel (1976). The amplitude of the red light curve is approximately 0.11 mag. Minimum light occurs at about 0.43P, while maximum light occurs near 0.73P. Maximum, mean, and minimum light have the following differential values, respectively: +1.125, 1.180, and 1.230 mag. The blue light curve (not shown) is similar in shape and amplitude. Continuous photometric coverage of V711 Tauri has been maintained between late 1975 (Bopp et al. 1977) and early 1986 (Wacker and Guinan 1986). Our intermediate band red observations presented in Figure 1, when transformed to V magnitudes, indicates the mean light level of V711 Tauri achieved its brightest value during 1983/84, corresponding to the epoch of minimum total spotted surface area.

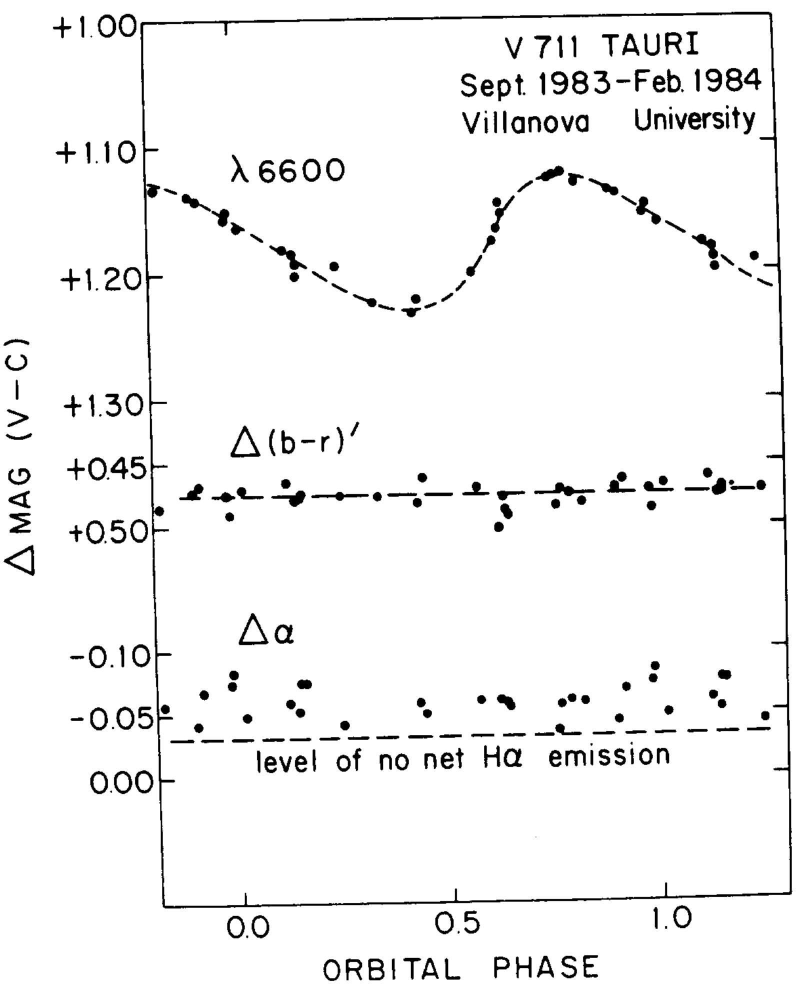

FIGURE 1

The 1983/84 photoelectric observations of V711 Tauri, made differentially with respect to the comparison star 10 Tauri, 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 intermediate band 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 middle panel of Figure 1 displays the differential color index, Δ (b-r)', formed from the intermediate band blue and red differential magnitudes. This index provides a measure of the color changes of the variable relative to the comparison star. No apparent phase dependency exists for the color curve. The seasonal mean value for the Δ(b-r)' data set =+0.479 mag.

The bottom panel of Figure 1 is a plot of the differential H-alpha index, $\Delta\alpha$ (v-c), formed from the intermediate and narrow band red differential magnitudes. As with the color curve, no apparent phase dependency exists. The seasonal mean value for the $\Delta\alpha$ (v-c) data set =-0.054 mag. Based upon the spectral types of the variable and comparison stars, $\Delta\alpha$ (v-c) = -0.035 $\pm$ 0.010 mag corresponds to the level of zero net H-alpha emission.

It is generally accepted that the low amplitude light variations of chromospherically active stars arise from the rotational modulation in brightness of sub-luminous surface regions (i.e. starspots) assumed to be located on the cooler, more active binary component. Photoelectric monitoring of V711 Tauri has been in progress since late 1975. In the context of the starspot hypothesis. Dorren and Guinan (1982) successfully interpreted the seasonal changes in amplitude, maximum, mean, and minimum light of V711 Tauri using two large circular spots cooler than the surrounding photosphere. Utilizing high resolution, high signal-to-noise spectroscopy obtained in September/October 1981, the Doppler imaging study of V711 Tauri by Vogt and Penrod (1983) produced spatially resolved images of the spot distribution on the K1 component. Their results revealed the existence of two cool, large spot regions separated by about 110^{o} in longitude, with the larger spot located near the rotation pole, the other positioned slightly above the equator.

The spectroscopic study by Fekel (1983) presented revised determinations of the fundamental parameters of V711 Tauri, including the inclination of the binary system and the light contribution from the presumed unspotted components (the G5 secondary and the distant companion ADS 2644 B). Incorporating these parameters into the computer code developed at Villanova (cf. Dorren et al. 1981), Wacker and Guinan (1986) carried out light curve modeling of their 1985/86 observations of V711 Tauri and determined a temperature difference between the cooler spots and the surrounding photosphere of 1100 $\pm$ 150 K. The lack of a strong wavelength dependence for our 1983/84 observations is consistent with this temperature determination.

Based on observations obtained between August 25 and October 25, 1983, Gondoin (1986) applied the Doppler imaging technique to photospheric (Fe I) absorption lines and chromospheric (Ca II and H-alpha) emission lines of V711 Tauri.

The results of Gondoin's line profile modeling indicate the presence of two spot regions located on the K1 component. These spots cover about 20% of the stellar disk, are about 1000 K cooler than the surrounding photosphere, and are overlapped by bright solar-like chromospheric plages. The spots were located at latitudes of 62° and 65°, and were separated in longitude by 180°.

Using the spot model program, we generated theoretical light curves based on Gondoin's results assuming the two dark regions have equal areas (see Figure 10 of Gondoin's paper). The resultant light curves have two maxima and two minima, both of equal brightness, separated in phase by 0.50P, and having a small light amplitude of 0.02 to 0.03 mag at visible wavelengths. The characteristics of these theoretical light curves are not consistent with our observed light curves. Although the epochs of our photometry and Gondoin's spectroscopy do not coincide exactly, the stability of our light curves over the six month interval make it unlikely that any significant evolution of the spots, in terms of area or surface distribution, took place. Preliminary modeling of our 1983/84 light curves suggests the two spot regions are about 110° to 140° apart in longitude, are of different areas (2:1), and/or located at different latitudes. The results of both light curve and line profile modeling generally agree in that there exist two extensive spot regions, about 1000 to 1200 K cooler than the photosphere, with at least one spot located at high stellar latitudes. Vogt and Penrod (1983) have commented that line profile modeling is more sensitive to the latitude distribution of the spots, while light curve modeling is more sensitive to the longitude distribution. It would be ideal to develop a procedure involving iterative modeling of both the line profiles and the light curves.

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1985/86 PHOTOMETRY OF THE RS CVn BINARY UX ARIETIS

UX Arietis (HD 21242, BD +28° 0532) is a bright (<V> = +6.55 mag), non-eclipsing RS Canum Venaticorum-type star having a period of 6.438 days. The primary and secondary components of this double-line spectroscopic binary were tentatively classified by Carlos and Popper (1971) as KO IV and G5 V, respectively. It is generally accepted that the light variations of chromospherically active stars (RS CVns, BY Draconis, FK Comae, etc.) are produced by the rotational modulation in brightness of dark starspots. Numerous studies advocating the success of light curve modeling applying the starspot hypothesis have been published (Eaton and Hall 1979; Dorren et al. 1981; Dorren and Guinan 1982; Dorren et al. 1984; Holtzman and Nations 1984; Olåh et.al. 1985; Poe and Eaton 1985). Furthermore, the results of various spectroscopic studies lend increasing support to the existence of cool spotted regions located on rapidly rotating stars (Fekel 1980; Ramsey and Nations 1980; Vogt 1981; Vogt and Penrod 1983; Gondoin 1986).

Multi-color photoelectric observations of UX Ari were obtained at Villanova University Observatory on 20 nights, from 1985 September 14 UT through 1986 January 13 UT. A description of the instrumentation, observing procedure, and data reduction technique, as well as a discussion of the differential color and H-alpha indices, is given elsewhere (Guinan and Wacker 1985). The comparison star was 62 Arietis (HR 1012, BD +27° 0500; G5 III; V = +5.54 mag), which previous photometric studies have demonsrated is constant in light and color (Hall, Montle, and Atkins 1975; Sarma and Prakasa Rao 1984). Nightly mean differential magnitudes were computed, in the sense variable minus comparison, for the intermediate band blue (λ4530), yellow (λ5500), red (λ6600), and narrow band red (λ6568) observations, from which corresponding nightly color and H-alpha indices were calculated. The seasonal mean errors for the nightly λλ 4530, 5500, 6600, 6568, $\Delta(b-r)'$, and $\Delta\alpha(v-c)$ data sets are, respectively: 0.009, 0.005, 0.006, 0.017, 0.011, and 0.018 mag.

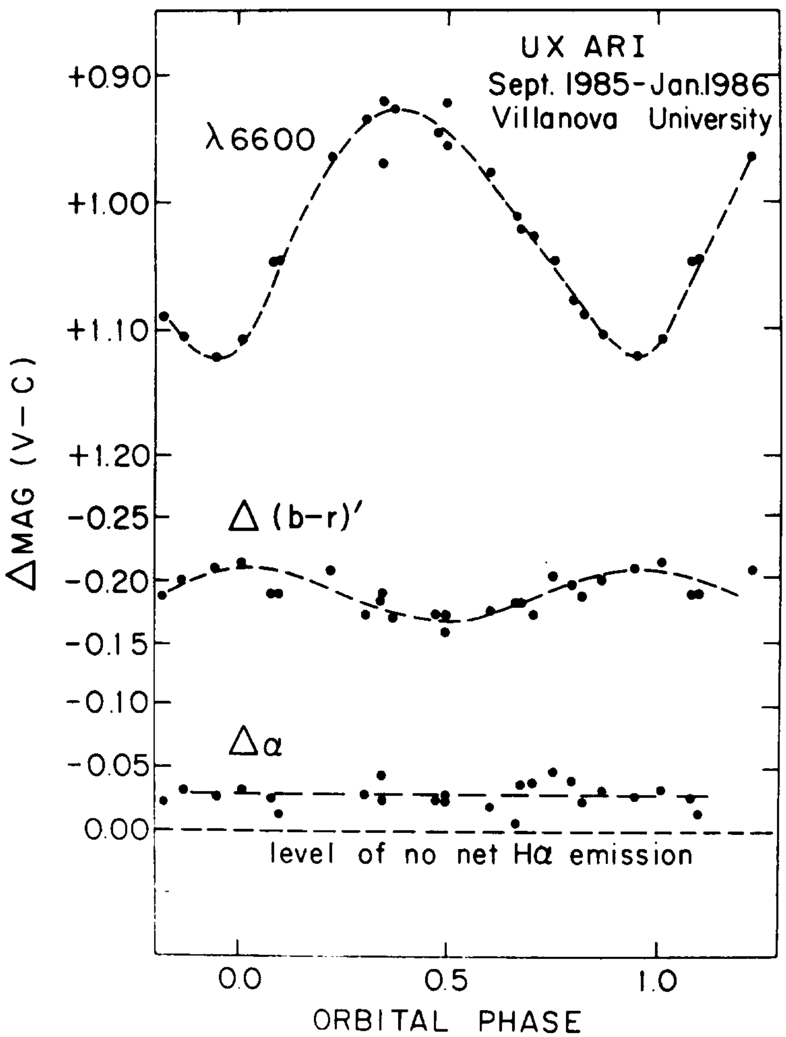

Figure 1

The 1985/86 photoelectric observations of UX Ari, made with respect to the comparison star 62 Ari (G5 III, V = +5.54 mag), are presented. The upper panel is a plot of the nightly mean differential magnitudes formed from the intermediate band red observations. The middle panel is a plot of the differential color index computed from the intermediate band 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 1985/86 light curve of UX Ari formed from the intermediate band red observations. The phases were computed according to the ephemeris quoted by Hall, Montle, and Atkins (1975), which is taken from the spectroscopic study of Carlos and Popper (1971). The amplitude of the red light curve is approximately 0.19 mag, with maximum light occurring at about 0.40P and minimum light occurring at 0.94P. Maximum, mean, and minimum light have the following differential values, respectively: +0.93, 1.02, and 1.12 mag. The shapes of the blue and yellow light curves (not shown) are similar to the red light curve. The light variation is wavelength dependent. The blue light amplitude is approximately 0.16 mag, and the yellow light amplitude is about 0.18 mag.

The middle panel of Figure 1 displays the differential color index, $\Delta(b-r)'$, computed from the intermediate band blue and red differential magnitudes. The color curve is phase dependent, with the index reddest when the light curve is brightest. The seasonal mean value of the $\Delta(b-r)'$ data set is -0.186 mag.

The bottom panel of Figure 1 is a plot of the differential H-alpha index, $\Delta\alpha(v-c)$. No apparent phase dependency exists, and the H-alpha emission is present at all phases. Based on the spectral types of the variable and comparison stars, $\Delta\alpha(v-c) = 0.00 \pm 0.01$ mag denotes the level of zero net H-alpha emission. The seasonal mean value for the $\Delta\alpha(v-c)$ data set is -0.027 mag, signifying the presence of weak-to-moderate H-alpha emission during the 1985/1986 observing season.

Wacker et al. (1986) discussed the results of a photometric study of UX Ari conducted at Villanova during Autumn 1981, using instrumentation similar to that of this study. The wavelength dependence of the light variation of UX Ari reported by Wacker et al. is verified by that given here for our 1985/86 observations in which, at visible wavelengths, the light amplitude increases with increasing wavelength. This aspect of the photometric behavior of UX Ari was first documented by Hall, Montle, and Atkins (1975). The Villanova color curves of UX Ari for epochs Autumn 1981 and 1985/86 are both phase dependent with an amplitude of about 0.05 mag, and are reddest at light maximum. It is interesting to note that the Autumn 1981 UBVR light curves of UX Ari obtained by Zeilik et al. (1982) also show a phase dependency of the color index. However, Zeilik et al. state that UX Ari was reddest during light minimum. Most of the chromospherically active stars having color variations that are reddest when the light curve is faintest are single-line spectroscopic binaries, where the spotted visible star is responsible for the photometric distortion wave.

Comparing the seasonal mean values of the Villanova differential color and H-alpha indices of UX Ari for epochs Autumn 1981 and 1985/86 reveals the system was bluer by 0.03 mag, and exhibited slightly greater (by about 0.02 mag) net H-alpha emission in Autumn 1981, with the mean light level of the intermediate band red light curve fainter by approximately 0.07 mag. The differences between the Autumn 1981 and the 1985/86 values of mean light and net H-alpha emission imply a greater degree of starspot activity during Autumn 1981. The fact that UX Ari was bluer at this time is expected on account of the dominance of the hotter (G5) component at visible wavelengths. Thus, in UX Ari, when the spotted regions on the K0 subgiant are most in view, this component (the cooler, redder star) contributes less light, resulting in the systemic color index to be bluest when the light curve is faintest, and reddest when the light curve is brightest (D. M. Popper, 1986, private communication).

The photometric history of UX Ari between 1972 and early 1981 was summarized by Guinan et al. (1981). Subsequent light curves of UX Ari were obtained in 1981/82 and 1982/83 (Sarma and Prakasa Rao 1984), as well as those obtained at Villanova. We compiled all of the published photometric data of UX Ari and, by constructing a smooth curve through each set of observations, tabulated the seasonal values of maximum, mean, and minimum light, phases of the light extrema, and light amplitude. Comparing the phases of minimum light, it is clear that light minimum has remained "anchored" between 0.93P and 0.95P during four of the last six observing seasons (1980/81 - 1985/86). As of January 1987, no observations of UX Ari were available for the 1983/84 season, while the 1984/85 observations acquired by Busso et. al. (1986) have no coverage of minimum light. It is then possible that the phase of light minimum for UX Ari has remained essentially constant for the last six years. In the framework of the starspot model, the phase of minimum light signals the time of maximum visibility of the spotted regions, which is primarily influenced by the longitudinal distribution of the starspots. If the properties of the photometric distortion wave of UX Ari are, in fact, dominated by the presence of spotted regions located on the K0 subgiant, then the constant value of the phase of minimum light demonstrates that the longitudinal distribution of the spots has not undergone significant changes in the last six years. We are not aware of any other non-eclipsing chromospherically active star in which the phase of light minimum has remained constant for four to six years.

In order to gain a satisfactory understanding of the photospheric and atmospheric structure of UX Ari, seasonal photometric and spectroscopic monitoring, preferably coordinated, needs to be established and maintained. A determination of the relative fluxes from the components at visible wavelengths is needed before detailed modeling of the light curves can be undertaken. Obtaining high dispersion, high signal-to-noise spectra of UX Ari would be ideal for this purpose.

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EARLY UBV PHOTOMETRY OF SUPERNOVA 1987A IN LMC*

The supernova 1987A in the Large Magellanic Cloud could be observed by the author just after its detection on Feb. 24 during the nights of Feb. 24/25 and Feb. 25/26, using the ESO 50cm telescope on La Silla/Chile. Observations were made in UBV Johnson system using the blue-sensitive photomultiplier EMI 6256.
Because of a limit of 5.5 mag for V-brightness it was necessary to mount a mask on the telescope tube which reduced the aperture to 25 cm.
Stars in E-regions (Cousins, 1973 - updated by Vogt et al., 1981) were used as extinction stars; as local comparison stars served HD 42525 (A0V-type) and HD 43107 (B8V-type).

As reported by Wampler (1987) and West (1987) the supernova brightened very rapidely during a few hours by a factor of 200 till about Feb. 23.4 UT and reached around V = 6 mag. One night later V went up to a value between 5 and 4.5 mag.
Now the first few nights after detection of SN 1987A were interesting for the fact that its V-brightness was still somewhat increasing before reaching a maximum for the following days.
The results of my UBV measurements are given in Table I.
The observations started on Feb. 25 at about 1:30 UT with V = 4.65 mag. Five hours later V had increased slowly, but rather continiously to V = 4.60 mag. One night later around V = 4.52 mag was measured during five hours, indicating a more slowly increase of V than before.
The change of the colours during both nights shows that B remained about constant and U dropped slightly.
Further observations with the ESO 50cm telescope were carried out by Magnusson (1987) beginning on Feb. 26/27. The evolution of the lightcurves during the next few days showes a rather constant value of V around 4.4 mag and a significant decrease of B and U, together with an increase of the infrared brightness I.
Altogether the evolution of the B-lightcurve indicates a maximum of B between Feb. 25 and 26; the maximum of U was reached probably before Feb. 24. Further photometric observations will provide us with data about the final maximum of V which is still some unclear at the moment. As far as we know, this supernova is too faint for a type II supernova, probably due to physical conditions of this unusual object itself.

* Observations collected at ESO/La Silla, Chile

Table I: UBV data

Date UT Feb. '87	V (mag)	B–V (mag)	U–B (mag)
25.067	4.65	0.03	–0.68
25.077	4.64	0.03	–0.70
25.087	4.63	0.03	–0.69
25.246	4.60	0.08	–0.66
25.254	4.61	0.07	–0.66
25.264	4.60	0.07	–0.62
26.226	4.52	0.17	–0.47
26.242	4.52	0.16	–0.46
26.259	4.52	0.17	–0.48
26.270	4.52	0.18	–0.47
26.289	4.51	0.19	–0.47
Error (+/–)	0.01	0.01	0.02

Acknowledgements:
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PHOTOELECTRIC PHOTOMETRY OF RHO CASSIOPEIAE

The star Rho Cassiopeiae (Rho Cas, HD 224014, = SAO 035879) was observed with the 0.6 meter Cassegrain telescope and a STARLIGHT-1 photon counting photometer at the University of Northern Iowa (UNI) Hillside Observatory using standard B and V filters. HD 223173 (=SAO 035763,K3II, V=5.51m, B-V=1.65) was used as the comparison star. Rho Cas is a supergiant (F8pIa) star (Percy, and Keith 1985). It has been a known variable for 86 years (Pickering, 1901),much of the time being confined to a brightness between 4.1m to 5.1m (Bailey,1978). Between August 1945 and June 1947 the star decreased in brightness to 6.8m. (Gaposchkin, 1949) after which it recovered to 4.5m to 4.9m (Bailey, 1978). More recent reports, (January to June 1986) show the magnitude of Rho Cas varying less than 0.1m (Taylor, 1986).

Since June 1986 observations at UNI in both blue and visual colors have indicated that Rho Cas has increased in brightness approximately 0.71m in the visual and 0.98m in the blue. The obtained differential magnitudes in the sense of Rho Cas - HD 223173 are given in Table I, which are also plotted in Figure 1 and Figure 2.

Table I

Photoelectric observations of Rho Cassiopeiae

J.D. 2446000+	ΔV	ΔB-V
604.665	-0.5433	-0.1042
610.710	-0.5448	-0.1265
613.672	-0.5497	-0.1479
613.721	-0.5837	------
614.733	-0.5967	-0.0863
614.802	-0.5864	-0.1168
615.724	-0.5801	-0.1364
616.701	-0.5992	-0.0828
623.757	-0.6551	------
624.666	-0.6437	-0.0903
626.651	-0.6376	-0.0913
627.710	-0.6613	-0.0692
628.693	-0.6622	-0.0832

Table I Continued

J.D. 2446000+	ΔV	ΔB-V
629.736	-0.6709	-0.0895
631.708	-0.6896	-0.0751
632.692	-0.6901	-0.0713
633.704	-0.6897	-0.0842
635.682	-0.6911	-0.0890
637.673	-0.7202	-0.0994
638.660	-0.7178	-0.0691
649.655	-0.7780	-0.1123
651.632	-0.8040	-0.0514
655.639	-0.8055	-0.0815
664.676	-0.8032	------
670.616	-0.8156	-0.0858
671.663	-0.8051	------
674.591	-0.8383	-0.0789
675.665	-0.8541	-0.0559
678.642	-0.8597	-0.0876
680.638	-0.8546	-0.1134
681.658	-0.8764	-0.0908
686.573	-0.9095	-0.1109
699.547	-0.9765	-0.0494
701.622	-0.9447	-0.1681
701.720	-0.9533	------
704.544	-0.9639	-0.1550
705.625	-0.9774	------
708.547	-0.9918	-0.1670
708.621	-0.9938	------
709.550	-0.9841	-0.1798
711.540	-0.9893	------
713.545	-0.9644	-0.2419
718.585	-1.0618	-0.2091
720.536	-1.0386	------
722.530	-1.0581	-0.1719
731.516	-1.0020	-0.2299
737.527	-1.0444	-0.2040
740.684	-1.0410	------
743.548	-1.0595	-0.2265
749.538	-1.0676	------
759.542	-1.0944	-0.2541
769.546	-1.1415	-0.2270
775.523	-1.1434	-0.2593
783.542	-1.1750	-0.2979
800.600	-1.2401	-0.3515
804.559	-1.2393	-0.3454
808.544	-1.2372	-0.3357
811.553	-1.2436	-0.3709
814.531	-1.2324	-0.3514
819.520	-1.2461	-0.3414
820.592	-1.2517	------
826.577	-1.2646	-0.3504

Table I Continued

J.D. 2446000+	V	B-V
828.521	-1.2638	-0.3575
833.524	-1.2514	-0.3476
834.545	-1.2608	-0.3537
835.541	-1.2657	-0.3341
837.686	-1.2601	------
838.529	-1.2606	-0.3559
839.641	-1.2870	-0.3496
844.671	-1.2546	-0.3667
850.542	-1.2747	-0.3331
856.730	-1.2590	------
857.683	-1.3330	-0.2086
858.650	-1.2647	-0.3622
859.548	-1.2665	-0.3184
862.566	-1.2739	-0.3199
888.701	-1.1552	-0.2532
889.597	-1.2058	-0.2650
890.513	-1.1635	-0.2810
891.574	-1.1642	-0.3222
892.636	-1.1393	-0.3259
893.615	-1.2319	-0.2244
894.578	-1.1785	-0.2611

Figure 1

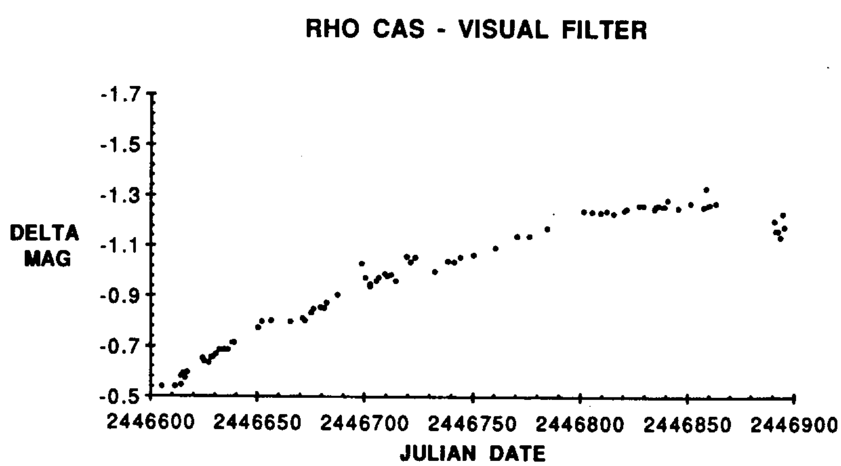
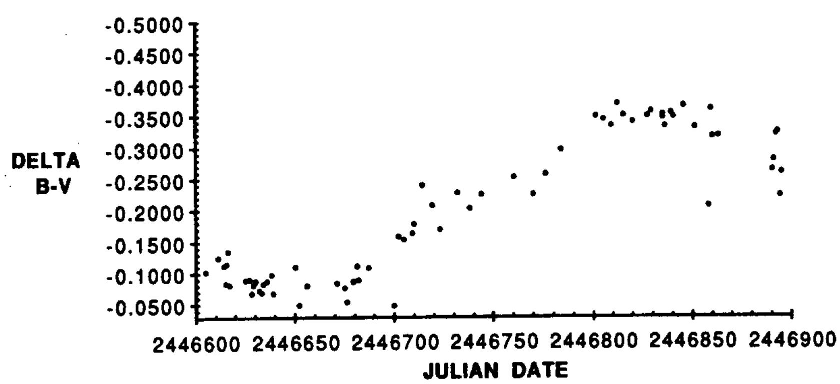


Figure 2

RHO CAS - DELTA B-V



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H-ALPHA OBSERVATIONS OF W UMa (BD+56° 1400).

Photoelectric observations of the short period ($0^d.3336$) eclipsing binary system W UMa were carried out during eight clear nights of March 16,17,21, 23,24,25,27 and 29, 1983. H-alpha narrow (λ_{max}=6569 A°; HWFH=38 A°) and H-alpha wide (A_{max}=6583 A°; HWFH= 238 A°) filters with an unrefrigerated RCA 4509 photomultiplier attached to the 51 cm f/13.5 cassegrain reflector of Biruni Observatory of Shiraz University were used for these observations. The star (BD+55° 1339) served as a comparison star which is frequently used by other investigators of the W UMa system.

The present observations are a continuation of the observations which were carried out through narrow and wide Hβ filters in 1983 (Davan,1985). From H-alpha observations 14 minimum times are obtained using the tracing paper method (Szafraniec,1948), The minima and the (O-C) values are calculated according to the light elements:

$$\text{JD(Hel) Min I} = 2444986.3624 + 0^d.33363808 \cdot E$$

given by Hamzaoglu et al. (1982). The minimum times are as follows:

Date	JD(Hel)	E	(O-C)	Filter
March	2440000. +		d	
16,17	5410.4157	1271	-0.0007	Hα N
21	5415.4178	1286	-0.0032	"
23	5417.4260	1292	+0.0032	"
24	5418.4237	1295	0.0000	"
25	5419.4246	1298	-0.0001	"
27	5421.4242	1304	-0.0023	"
29	5423.2613	1309.5	-0.0002	"
16,17	5410.4151	1271	-0.0013	Hα W
21	5415.4187	1286	-0.0023	"
23	5417.4228	1292	0.0000	"
24	5418.4212	1295	-0.0025	"
25	5419.4232	1298	-0.0014	"
27	5421.4245	1304	-0.0020	"
29	5423.2611	1309.5	-0.0004	"

From the above minima the following two periods are determined:

Period = 0.33363774 $\pm$ 0.00000113 ; H α N

Period = 0.33363700 $\pm$ 0.00000053 ; H α W

The periods are accurately determined to within 0.10sec and 0.05 sec for H α N and H α W observations, respectively.

The variations of the (O-C) values versus number of cycles E are presented in Figure 1. The filled and open dots denote H α N and H α W observations, respectively. The last two dots refer to the secondary minimum observations.

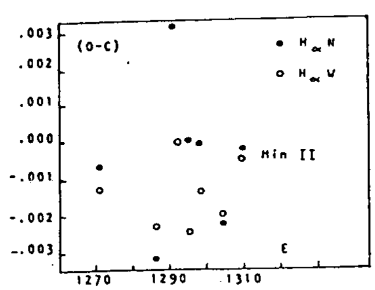

Figure 1

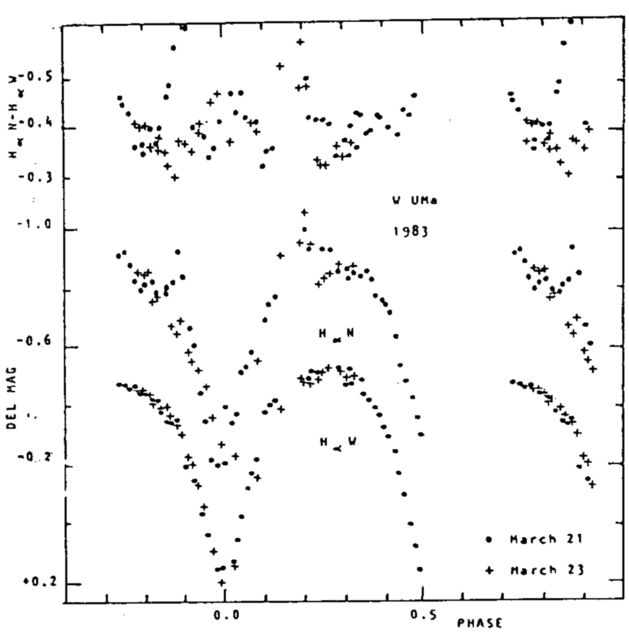

Figure 2

Some investigators found evidences for oscillatory variations in the (O-C) values (Hamzaoglu et al., 1982; Tümer et al., 1980). One can see this oscillatory behaviour among the present (O-C) values. There is a rapid change between the E values of 1285-1300. This is an indication for the intensive activity in the system through March 21 to 25, 1983. This statement will be confirmed if one looks at the light curves of the observations which were obtained on March 21 and 23. There is an increase of light amplitude up to about 0.15 magnitude in H α N but a decrease of about 0.05 magnitude in H α W observations in the phase interval 0.12 - 0.25. While it seemed that any possible light curve wave of W UMa has an amplitude no more than 0.05 mag (Breinhorst, 1971; Rigterink, 1972; Eaton et al., 1980). There are also two other blueing near phases 0.72 and 0.87 in the observation of March 21. The light curves are shown in Figure 2. The filled dots refer to the observation of March 21 and the plus sign indicates the observations of March 23, 1983.

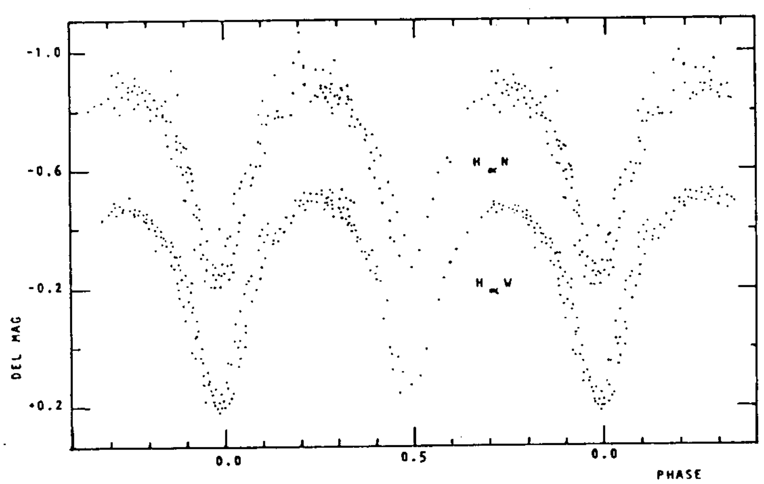

Figure 3

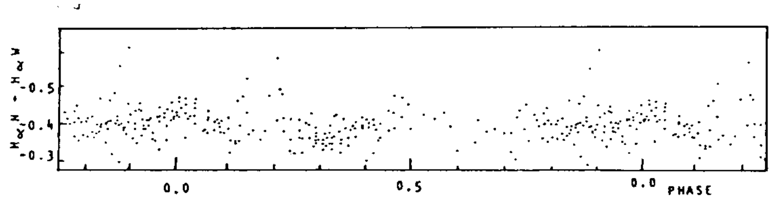

Figure 4

According to the present observations on H - alpha narrow and wide colours one can conclude that the changes both in the (O-C) values and the light amplitudes may be due to mass ejections and/or spot activities in the system. Infrared observations of Shenavrin and Zhukov, (1984) which were carried out in the observational season of 1982 are in good agreement with the present observations. The similarity of the light amplitude changes in both infrared and H-alpha observations also indicates that the sources of activities may have periodic appearances.

A compilation of the light curves, and colour index changes are shown In Figures 3 and 4, respectively.

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I would also like to thank Mr. R. Dümmler and Mr.R. Budell for their help. This work is dedicated to V. Karimipour for his competences and talents.

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INFORMATION BULLETIN ON VARIABLE STARS

Number 3022

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PHOTOMETRIC OBSERVATIONS OF WR78 = HD151932

The southern WN7 star WR78 showed no important photometric variations during an observing run in 1975 by Seggewiss and Moffat (1979) although its spectrum is known to display a complex behaviour. The star was included in an observing run we made with the Walraven photometer and the Dutch 91cm telescope on La Silla in 1986.

Data have been obtained on six nights during the period 23 May - 2 June. Two comparison stars were chosen : HD150608 (C_1) and HD155259 (C_2). The observing sequence was $WC_1C_2WC_1C_2WC_1C_2W$ (where W stands for WR78) and took about half an hour to complete. The reductions were made according to the algorithm published by Manfroid and Heck (1983, 1984). However no color transformation was attempted and the results are given in the natural system. Contrarily to the usual practice with the Walraven system, we used conventional magnitudes and not the decimal log scale. The data were then treated differentially so as to cancel out any trend left in the extraction of the zero point.

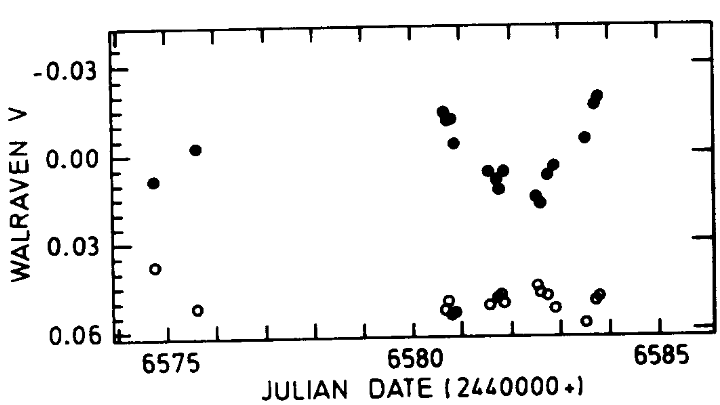

Figure 1. V magnitude.: Plot of the differential data relative to WR78 (filled circles) and to the comparison stars (circles).

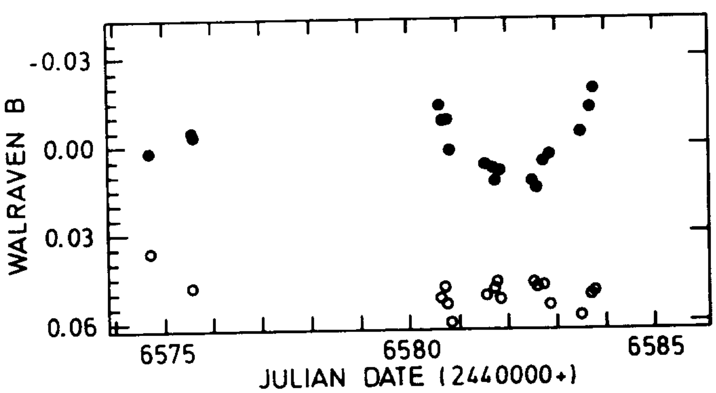

Figure 2. **B magnitude.:** Plot of the differential data relative to WR78 (filled circles) and to the comparison stars (circles).

The most accurate data were obtained in the V and B bands. The scatter of the difference between both comparison stars is $\sigma_V = 0.004$ and $\sigma_B = 0.005$ and provides an estimation of the internal accuracy of the data. Plots of $W - (C_1 + C_2)/2$ and $C_1 - C_2$ are given in figures 1 (V) and 2 (B). They clearly show that WR78 was photometrically variable during our observations with a total amplitude of more than 0.03 i.e. an amplitude which could have been detected by Seggewiss and Moffat (1979) during their 1975 observations. Unfortunately, due to poor weather conditions, our data are too scarse to allow the derivation of any periodicity.

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THE PROPER MOTION OF THE AGK3 VARIABLE STARS. IV. WY Cyg - YY Cyg - R Lac

This is the fourth note on a program conducted to check the proper motion of the AGK3 red variable stars which seems to be affected by systematic errors (Stephenson 1978).

In the previous notes (López 1986; López and Cesco 1986; López and Torres 1987) the redeterminations of the proper motions of CR Gem, SS Vir and RX Peg were reported, the results being quite different from the values quoted in the AGK3 but in good agreement with other determinations, thus confirming Stephenson's (1978) hypothesis.

In this note, we want to draw attention to three stars: AGK3 +44 1985 = WY Cyg, AGK3 +42 2014 = YY Cyg and AGK3 +42 2207 = R Lac for which the AGK3 proper motions seem to be spuriously large when compared with previous determinations (e.g. Palmer 1945; Alden and Osvals 1961). Since first-epoch positions are not available to us, we are not able to attempt the redetermination of new proper motions.

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NEW BRIGHTENING OF SUGANO'S OBJECT IN ORION ASSOCIATION

The fuorlike variation of the brightness of Sugano's object ($\alpha = 5^h33^m06^s.5$ (1900); $\delta = -4^o20'11''$ (1900)) was for the first time observed during 1982 - 1985 (Marsden 1983, Natsvlishvili 1984).

The photographic magnitude of Sugano's object in minimum is about 18^m.

The duration of the flare was about three years. By the observations on the 40" Schmidt telescope of Byurakan Observatory on 19 November 1983 the following colour indices and amplitudes were found (Parsamian, Gasparian 1987):

U - B	B - V	V	Δm_U	Δm_B	Δm_V
-0.7	0.3	14.6	~4.3	$\gtrsim$2.9	> 2.6

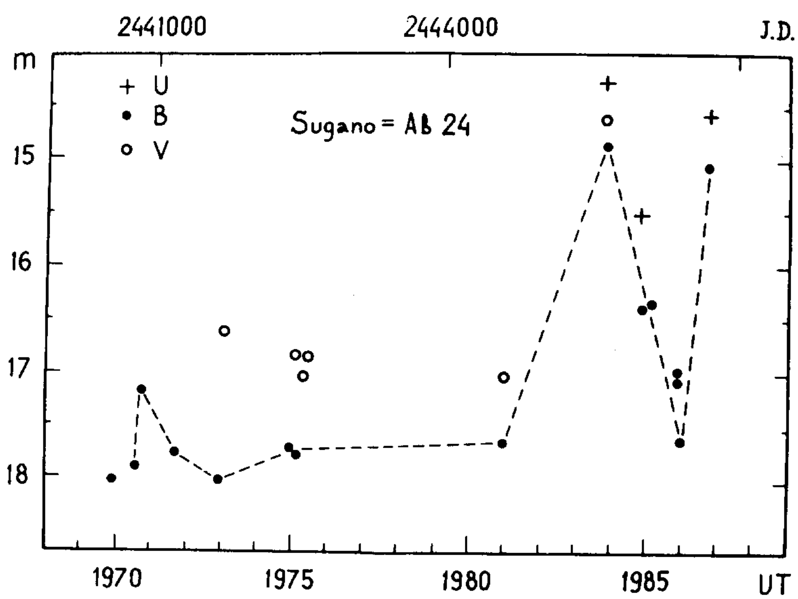

Figure 1

The star demonstrated a rapid flare of amplitude $\Delta m_B \approx 0.6$ on our plates taken on 12 September 1970. On the plates from 4 and 5 November 1986 a new brightening of the star (U = 14.6; B = 15.09; U-B = -0.49) was observed.

The light curve of Sugano's object is given in Fig. 1.

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NO PERIODICITY IN RZ GRUIS

RZ Gruis is a bright and recently discovered cataclysmic variable (Kelly, Kilkenny, and Cooke 1981). Stickland et al. (1984) have presented extensive spectral observations and assign RZ Gru to the UX UMa subclass of cataclysmic variables. The observations reported below agree with this assignment, but do not confirm the one hundred three day photometric period suggested by Siedel (1957).

The variable of RZ Gru was first detected by Hoffmeister (1949), who tentatively included the star in the RW Aur category. Siedel (1957) used two hundred archival plates to find a 103^d periodicity, with brightness variations between $11\overset{m}{.}5$ and $13\overset{m}{.}0$. Since there is no precedent for so long a period (if strictly coherent) among cataclysmic variables, we decided to check the claimed periodicity with the archival plate collection at Harvard. We examined roughly fourteen hundred blue sensitive plates which were exposed between 1890 and 1952. We found no plates which showed RZ Gru significantly brighter than its usual magnitude of $\sim$12.5. We did find seventeen plates on which RZ Gru was roughly one magnitude fainter than usual. The Julian dates of these plates are given in Table I along with other "low-state" times from Siedel (1957) and Stickland et al. (1984). In conjunction with our observed times of normal brightness, we have analyzed the "low-state" times for periodicity. With this much larger data base, we do not confirm the one hundred three day period, or find any statistically significant periodicity.

In October 1982, we performed high speed photometry on RZ Gru with the thirty-six inch telescope on Cerro Tololo through a B filter with integration times between one and ten seconds. Our ten hours of observations (see Table II) included one continuous interval of nearly six hours length. No eclipses were seen, while rapid, large amplitude flickering was always present. If RZ Gru does show eclipses, then we constrain its orbital period to be certainly longer than six hours, and probably much longer. In such a case, the Roche lobe filling secondary star should probably be visible. Hence, it

Table I

"Low-State" Times

J.D.	2,425,154.57	2,431,312.44
	7,606.63	1,375.41
	7,610.50	3,427.63
	7,992.**	3,428.62
	8,373.**	3,430.63
	8,777.41	4,245.**
	8,779.**	4,287.**
	9,756.61	4,347.**
	9,885.49	4,556.**
	31,243.62	45,292.4*
	1,244.62	5,293.3*
	1,282.52	5,293.4*
	1,286.42	5,294.3*
	1,295.57	5,295.3*
	1,303.40	

*Stickland _et al_. (1984)

**Siedel (1957)

Table II

High Speed Photometry

J.D.	2,445,255.530	-	2,445,255.603
	56.526	-	56.760
	57.495	-	57.512
	57.618	-	57.633
	57.683	-	57.731
	59.510	-	59.526
	59.550	-	59.571
	59.647	-	59.656

seems probable that RZ Gru is a low inclination system.

In summary, we concur with Stickland *et al.* that RZ Gru is probably a UX UMa-type cataclysmic variable, but, as usual for these stars, shows no evident periodicity in its excursions to a fainter state.

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Number 3026

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Budapest
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A NEW LONG-PERIOD CEPHEID IN THE LMC *

During a photometric investigation of the metal content of 47 FG supergiants in the LMC, several objects turned out to be variable (van Genderen, van Driel and Greidanus, 1986). One of them was situated in the Cepheid instability strip i.e. HDE 270100. The identification chart is given by Fehrenbach and Duflot (1974, catalogue number is G 458, chart 59B). According to Fehrenbach and Duflot (1982) the coordinates for 1950 are $\alpha = 5^h44^m.97$ and $\delta = -67°30'.6$, the spectral type is G2:Ia, $V_J = 11.84$ (the subscript J refers to the UBV system).

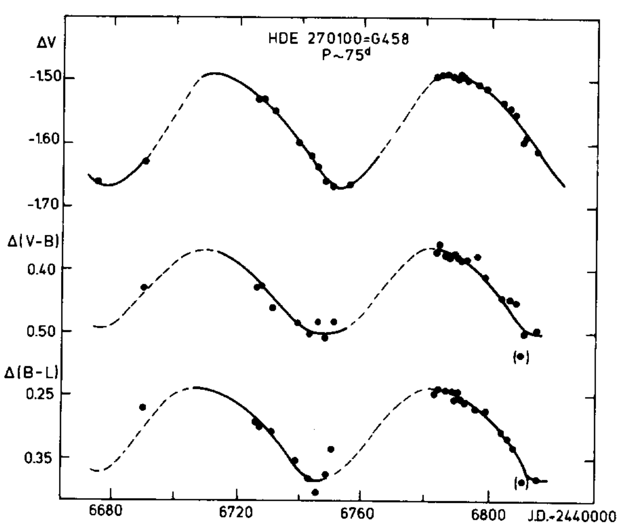

Fig. 1. The light- and colour curves of the recently discovered long-period Cepheid in the LMC HDE 270100 = G 458, relative to the comparison star in log intensity scale.

* Observations collected at the ESO, La Silla, Chile

In order to establish tne precise nature or its variability, a photometric program was started in September 1986. The observations were made with the 90-cm Dutch telescope at the ESO, La Silla, Chile, equipped with the simultaneous VBLUW photometer of Walraven. The star was measured twice per night alternated by the comparison star HD 33486 (B9,$8\overset{m}{.}1$). The diaphragm aperture was 16". Integration times were of the order of 2 minutes per measurement. We present here a short report on the results of the months September 1986 to January 1987. Figure 1 shows the observations relative to the comparison star for V, V-B and B-L in log intensity scale as a function of Julian Date). A more complete discussion with more observations will be given later. The preliminary period P ~ 75^d. The light- and colour curves are characteristic of long period Cepheid of population I in the Magellanic Clouds (van Genderen 1983a and references therein).

The median values for the V and B-V of the UBV system transformed from V and V-B of VBLUW system amount to V_J = 11.8, $(B-V)_J$ = 0.95. The visual light amplitude is $0\overset{m}{.}45$. According to its position in the V-B/B-L diagram the interstellar reddening is small (van Genderen, van Driel and Greidanus 1986).

The new Cepheid has a period close to that of the LMC Cepheid HV 2827 of which P = $78\overset{d}{.}86$, V_J = 12.3 and the visual light amplitude $0\overset{m}{.}6$ (van Genderen 1983a, b).

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PHOTOMETRIC BEHAVIOUR OF THE SUSPECTED PROGENITOR OF SUPERNOVA 1987A ON PLATES OF SONNEBERG OBSERVATORY

The star Sanduleak -69 202 was inspected on 162 blue-sensitive plates obtained by Hoffmeister covering the time between 1934 and 1938, 1952/53 and 1959. The plates were obtained by several cameras of short focal lengths. Therefore the companions of the star, which are given by West et al. (1987) coincide with the image of the progenitor. The sequence of comparison stars used was linked to stars of the regions "a" and "d" given by Westerlund (1961).

The observations are scattering within the photometric range $m_{pg} = 11\overset{m}{.}8$ and $m_{pg} = 12\overset{m}{.}5$. The mean brightness of the star amounts to $m_{pg} = 12\overset{m}{.}08 \pm 0.14$. The high degree of brightness scattering probably is caused by the poor quality of the plates and the place of the object on them.

The individual observations will be published in MVS, Sonneberg.

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PHOTOELECTRIC PHOTOMETRY OF HD 33798

The star HD 33798 (=SAO 40158, = BD +47 1117) is listed as a 7th magnitude, G5 star in *The Henry Draper Catalogue.* HD 33798 was listed as a suspected variable by Fekel and Hall (1985) with chromospheric activity given as a possible mechanism for its variability. This star was observed 39 times with the 0.4 meter telescope at the University of Northern Iowa (UNI) Hillside Observatory during the winter and spring of 1987. We used a STARLIGHT-1 photon counting photometer. A standard V filter was used for all 39 observations. SAO 40213 (= BD +46 993), a G5, 8.1 magnitude star was used as a comparison.

Observations at UNI have revealed a maximum change in brightness in HD 33798 of 0.07m. The behavior appears to be periodic. A visual examination of the data led us to suspect a period of between 9.6 and 9.9 days. Folding the data produced the best agreement when a period of of 9.8 days was chosen. We invite interpretations of our data.

The obtained differential magnitudes in the sense HD 33798 - SAO 40213 are given in Table 1 and Figure 1. A phase diagram, assuming a 9.8 day period, is shown in Figure 2.

Table 1

J.D. 2446000+	ΔV
804.5404	-.7621
811.6102	-.8138
814.6167	-.7604
819.5724	-.7909

Figure 1

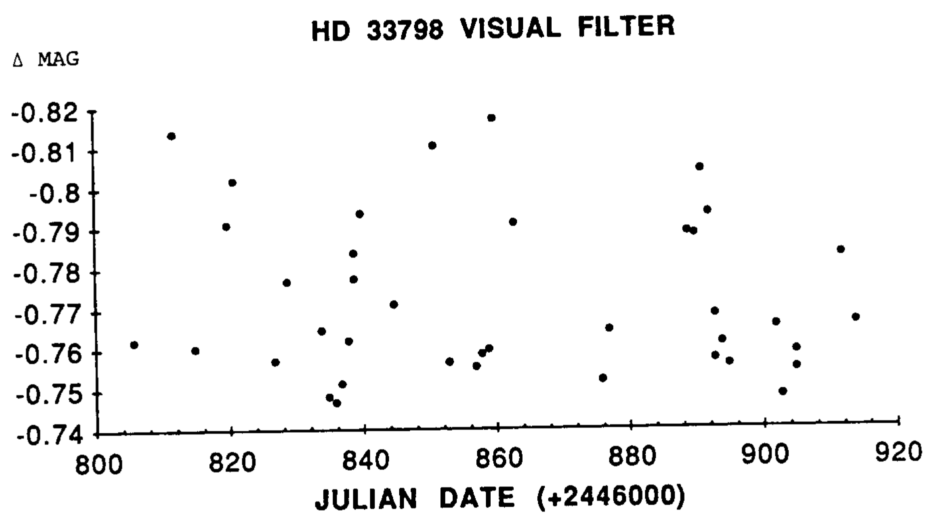

Figure 2

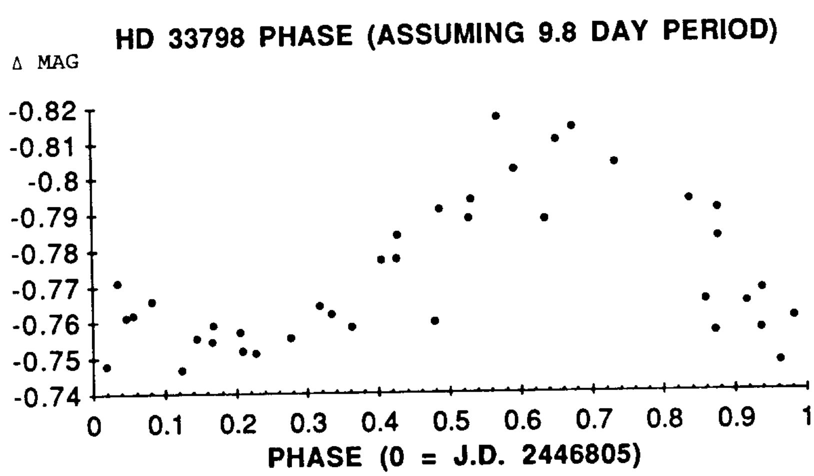

Table I (Continued)

820.6084	-.8020
826.6085	-.7573
828.5692	-.7769
833.5713	-.7646
834.5735	-.7482
835.6154	-.7467
836.6278	-.7514
837.6736	-.7620
838.5812	-.7774
838.5936	-.7838
839.6052	-.7935
844.5406	-.7711
850.5778	-.8103
852.7471	-.7566
856.7133	-.7555
857.5473	-.7585
858.6878	-.7599
859.5745	-.8168
862.5888	-.7908
875.6461	-.7521
876.7089	-.7643
888.5735	-.7885
889.5735	-.7881
890.5956	-.8038
891.5995	-.7932
892.5807	-.7573
892.5948	-.7682
893.6459	-.7613
894.6117	-.7556
901.6125	-.7654
902.6280	-.7481
904.6267	-.7546
904.6417	-.7590
911.5988	-.7829
913.6018	-.7661

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NEW ECLIPSE TIMING OF AS CAMELOPARDALIS FROM THE IUE SATELLITE

As Cam (HD 35311) is an 8th magnitude eclipsing binary consisting of a pair of ~B9V stars moving in an eccentric orbit (e = 0.17) with a period of 3.43 days. Like the eccentric eclipsing binary DI Her (see Guinan and Maloney 1985), AS Cam is an important test case for studying relativistic apsidal motion, because the expected relativistic apsidal motion is comparable to that expected from classical effects. Accurate determinations of the orbital and stellar properties of the system have been made by Hilditch (1972) and Khaliullin and Kozyreva (1983). Furthermore, from a study of eclipse timings Khaliullin and Kozyreva found its observed apsidal motion to be $\dot{\omega}$obs = 16.0 ± 1.3 deg/100 yrs, which is about one-third the expected combined classical and relativistic apsidal motion of $\dot{\omega}$theo = $\dot{\omega}$CL(= 35.7 deg/100 yr.) +$\dot{\omega}$GR(= 7.9 deg/100yr) = 43.6 deg/100 yr. Recently, Maloney et al. (1986) investigated the apsidal motion of AS Cam from eclipse timings dating back to 1899, determined from the Harvard College Observatory plate collection as well as from photoelectrically determined timings up to 1982. Least aquares solutions of these eclipse timings yield and apsidal motion of $\dot{\omega}$obs = 13.6 ± 1.5 deg/100 yrs, which is in good accord with the previous study. Thus, AS Cam joins DI Her in having an observed apsidal motion significantly less than that predicted by theory. At present, the conflict between the observed and the theoretical apsidal motion of AS Cam and DI Her remains unresolved.

On November 23, 1986 and December 06, 1986 AS Cam was observed in the ultraviolet (λλ 1150-3200) with the International Ultraviolet Explorer (IUE) satellite. A comprehensive description of the IUE satellite and its scientific instrumentation is given by Boggess et al. (1978). The chief aim of this study is to uncover evidence in the ultraviolet such as the presence of a third member of the system, circumbinary gas, and/or strong stellar winds that might explain the system's observed small apsidal motion.
In the course of obtaining ultraviolet spectra of the system during primary minimum on 06 December 1986, the Fine Error Sensor (FES) was used as a photo-

meter to measure the changes in the system's brightness at visible wavelengths as the eclipse progressed.

The FES is an unfiltered image dissector tube with an S-20 photocathode which has a broad wavelength response from about 4000A to 7000A with a broad maximum sensitivity centered near 5000A. The incident photons to the FES are reflected from the satellite's 45 cm, f/15 Cassegrain telescopic system. The FES is normally used to provide an image of the star field or in a track mode. In the track mode of operation the FES gives a count rate which is proportional to the brighrness of the object. The brightness of the star is obtained by averaging the count rate from multiple scans of the image dissector with an effective integration time of about 2.5 seconds. The source plus background is actually measured, but for bright stars (mv $\leq$ + 10 mag), the contribution of the background is insignificant. FES measures of a nearby comparison star (HD 34463; V=+8.51; B-V=+0.17) were made near the beginning and end of the 8 hour observing shift to monitor the sensitivity of the detector.
These measurements indicated that the sensitivity of the FES remained nearly constant (to within 1.5 percent) over the ~7 hour observing interval. The camparison and variable stars were observed at the same reference position of the FES detector and measurements consisted of sampling the star's count rate for about 10 seconds. The FES counts of the variable star were reduced differentially with respect to the comparison star and the times were converted to heliocentric Julian Day Number. The differential FES magnitudes were transformed to Δ V (v-c) using the photometric calibration of the FES made recently by Imhoff and Wasatonic (1986). Because the comparison and variable stars are well matched in color and brightness, the conversion to V-magnitudes should be relatively accurate. The differential V-magnitudes obtained with the FES are given in Table I.

Table I
Observations of AS Cam Made with the FES

J.D. Hel. 2446771.0+	Δ V(v-c) (mag)	J.D. Hel., 2446771.0+	Δ V(v-c) (mag)
0.2554	+0.143	0.3827	+0.683
0.2567	0.153	0.3835	0.695
0.2581	0.153	0.3849	0.683
0.2590	0.162	0.3962	0.679
0.3037	0.320	0.3973	0.675
0.3045	0.313	0.3982	0.669
0.3249	0.438	0.4396	0.421
0.3255	0.450	0.4405	0.421
0.3265	0.452	0.4677	0.276
0.3681	0.688	0.4684	0.276
0.3688	0.686	0.4958	0.154
0.3706	0.670	0.4970	0.163
0.3724	0.683	0.4981	+0.163
0.3739	+0.688		

The observations defining the primary eclipse are plotted against heliocentric Julian Date in Figure 1.

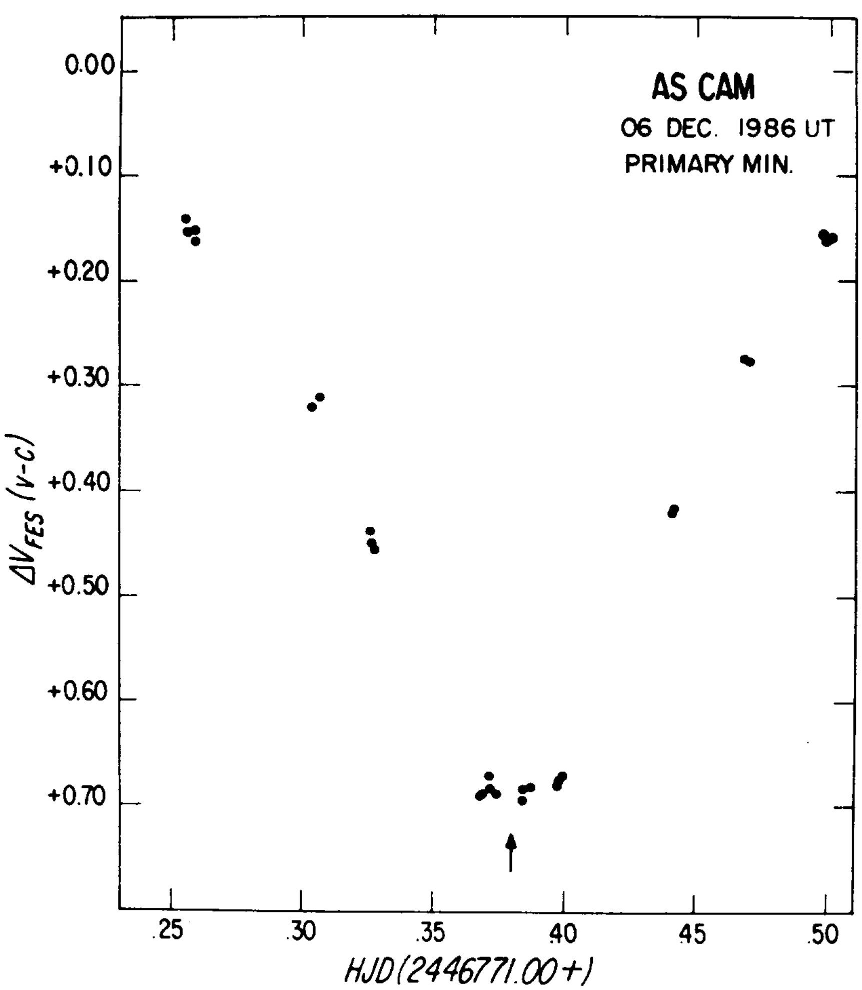

Figure 1

The V-magnitude at the bottom of the minimum is V(FES) = +9.200 which is in excellent agreement with the value of V(MinI) = +9.203 found previously by Khaliullin and Kozyreva (1983). A determination of the time of mid-eclipse was made by reflecting the ingress and egress portions of the light curve until a best fit was obtained. This was accomplished on a video terminal with an IBM-PC. The time of primary eclipse is:

$$T(minI) = HJD\ 2446771.3810 \pm 0.0012d.$$

and the (O-C) = -0.010d was computed using the ephemeris of Khaliullin and Kozyreva. Additional eclipse timings of AS Cam are being attempted from the ground with standard photoelectric photometry. It is important to secure additional timings of primary and secondary minima to determine more precisely the apsidal motion rate of the system.

We wish to thank the IUE staff at Goddard Space Flight Center for help in the acquisition of these data. The IUE telescope operator, Peter E. Summers, did an efficient and careful job in obtaining the observations. This study was supported by NASA under grants GSF 86-110 and 83-283 whose aupport we gratefully acknowledge.

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SIX NEW VARIABLE STARS IN THE CONSTELLATION OF SAGITTARIUS

The central regions of the Milky Way, in the direction of Sagittarius and Scorpii (Right Ascension between 16 h to 19 h and declination from -20 to -40 degrees) constitute a region with large probabilities of finding new variables or nova-like very faint type stars.

Therefore, a systematic search program of such objects was started two years ago. For its development two hundred photographic plates of this region were available. Such plates were obtained starting in 1942 and were obtained in 103a0 emulsions with exposures times of 60 min and utilizing a BM camera provided with a Ross Lunding lens of 7.62 cm diameter and a focal distance of 53.34 cm.

The basic procedure was the comparison of several plates taken in different epochs, utilizing a Zeiss stereocomparator. All the plates were referred to the following plate: BM 111 that was taken on April 10, 1942. The whole sample of the 200 plates of the archive were compared against this plate in the search of new variables.

The results obtained are listed in Table I. They constitute a sample of six new objects, all of which are stellar like and the ID chart of each one is presented in Figure 1.

In order to see if such objects have not been previously reported, the coordinates were estimated from the CD and the SAO star catalogues. Such coordinates were evaluated to the epoch of 1900 and were searched for in the General Catalogue of Variable Stars (Kukarkin et al., 1970). None of them has been previously listed in such catalogues; therefore, it is safe to conclude that the sample of six stars are being reported for the first time.

More information is needed in order to decide on the nature of these stars.

Table I. Coordinates and magnitudes of the reported stars.

I.D.	DM	R.A. (2000)	Dec. (2000)	Estimated magnitude
B		18h 40m 26s	-29d 06m 06s	11
D		18 18 37	-36 23 09	11
E	-33 13239	18 28 04	-33 21 23	8
F		18 20 09	-32 12 49	10
K		18 10 18	-21 04 29	12
L		18 18 43	-28 04 02	11

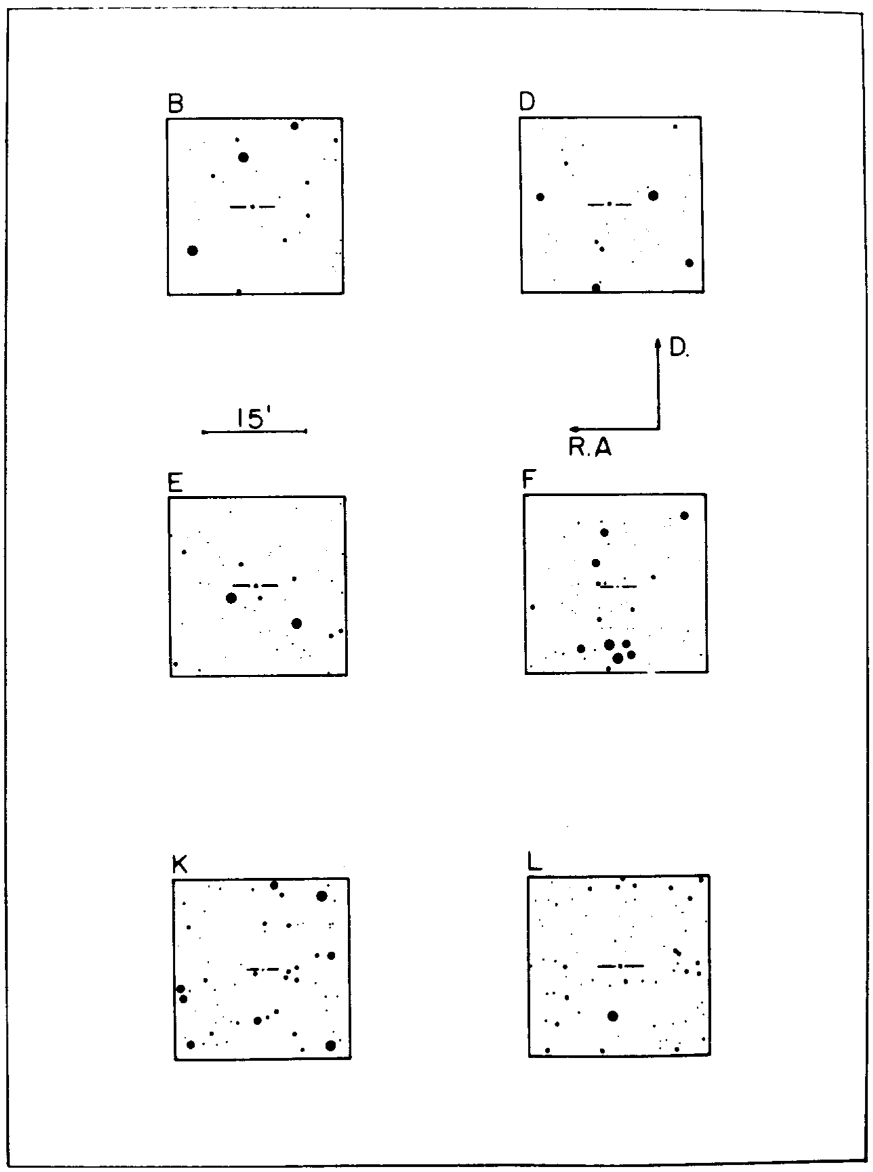

Figure 1

ID charts of the new variables found, scale of the plates is indicated.

Acknowledgements: We would like to thank Dr. O. Cardona for suggesting this project, to J. H. Peña for his advice and to Dr. R. Peniche, to M. A. Hobart, and to T. Gomez for their assistance. All the drawings were made by G. Ceron, and the photographs by I. Cabañas.

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SPOT OBSERVATIONS OF EV Lac

Presented here are the preliminary results of our photometric observations of the spotted flare star, EV Lac. In particular, this paper discusses the results of this last season of observation covering the period from August 1986 to December 1986 and its noted differences from that of previous observations. We also suggest a more suitable second comparison star than the one in standard use. The present observations were taken with the 41 cm telescope at Table Mountain Observatory in four colors (UBVR) using a pulse counting photometer. Carol Ambruster has also provided some data taken with the 36 inch reflector at Kitt Peak. A more detailed report of our results and methods of analysis will be forthcoming in another publication.

In 1983, EV Lac was found to vary with a total amplitude in V of 0.08 mag. and a period of 4.375 days (Pettersen et al. 1983). These data were taken between June 1979 and December 1981. In 1985, we began our observations and found no discernible variation of the star. This period of nonvariability was later confirmed by other observers (Skiff, Brian, private communication) (Melikan, N.D., Melkonian, A.C., private communication).

In August of 1986, we started observing EV Lac again and found a new variation of 0.13 mag. as opposed to Pettersen's (1983) 0.08 mag. Pettersen's period of 4.375 days was assumed, and found to fit our data very well. There was, however, a phase shift noted from Pettersen's (1983) ephemeris, as one would expect if observing a new spot. The phase difference was measured to be -0.236 phase or -1.033 days. We therefore propose a new ephemeris for maximum

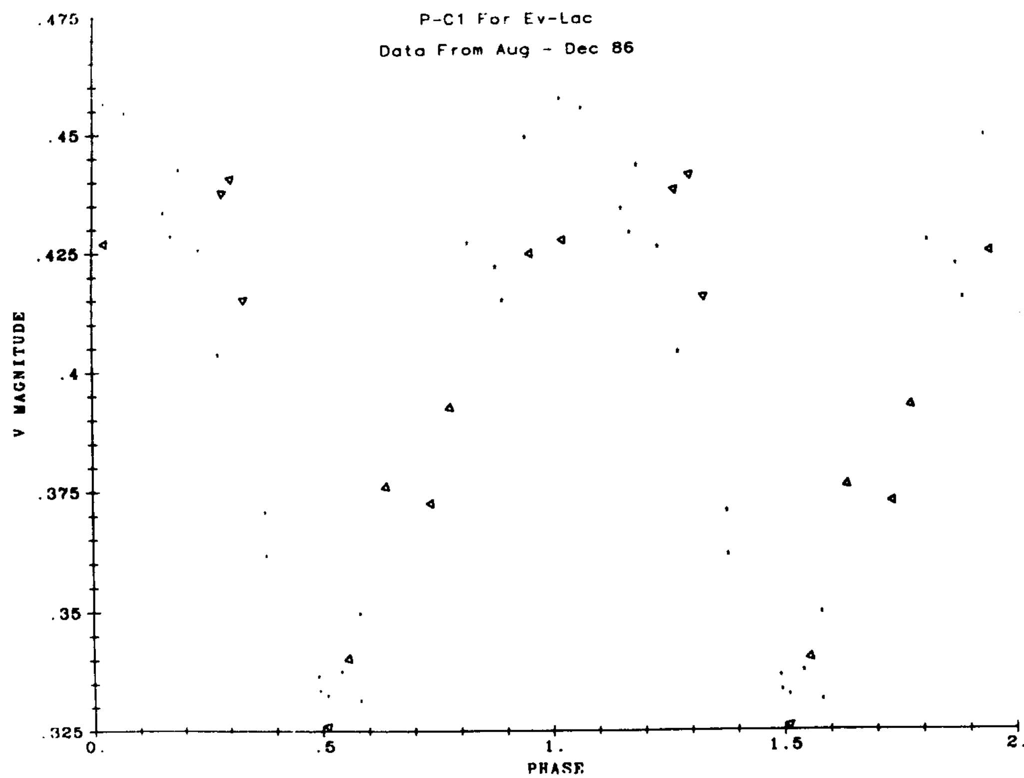

Fig. 1. (P-C1) V magnitude vs. phase for EV Lac. The starred points were taken at Table Mountain and the triangles at Kitt Peak.

spot visibility to be JD 2446499.18 + 4.375*E adjusted from Pettersen's (1983) result for both the phase difference and the approximate appearance data of the new spot. Figure 1 is a plot of the differential V magnitude in P-C1 vs. phase using our new ephemeris. The starred points are the points taken at Table Mountain, and the triangles are those from Carol Ambruster at Kitt Peak.

Pettersen (1983) reported no noticeable variation in the V-R. Our new results, however, do suggest a small but visible variation of 0.03 mag., again suggesting a newer, larger spot than previously observed.

We have long been suspicious of the comparison star, C2, proposed by Pettersen (1980) and which has recently been confirmed to be variable (Tsvetkov et al. 1986). The C2 we have employed is SAO 052337, an 8.9V, K2 star which has worked quite well. It is also close enough to EV Lac and the standard C1 so that differential extinction is not usually a problem.

We would be grateful for correspondence regarding any data you might have that may help in defining this new variation or its connection to past observations.

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AUTUMN 1981 PHOTOMETRY OF THE RS CVn BINARY II PEGASI

II Pegasi (HD 224085; K2 IV) is an active, non-eclipsing RS CVn-type binary. The periodic light variability of this spotted star was discovered by Chugainov (1976), and subsequently confirmed by Rucinski (1977). A number of photometric investigations followed, demonstrating the extensive variety in the light curves of II Peg characterized by seasonal changes in maximum, mean, and minimum light, as well as in the phases of the light extrema. Using the Harvard archival plate collection, Hartmann, Londono, and Phillips (1979) showed that in the 40 years prior to 1945, II Peg was essentially constant in mean light, after which short and long term variability has been present. II Peg has been observed in V to be as bright as +7.19 mag (Chugainov 1976), and as faint as +7.78 mag (Vogt 1981a). The V-band light amplitude has ranged from 0.12 mag (Kaluzny 1984) to 0.45 mag (Byrne 1986). Analyzing the available light curves obtained between 1974 and 1981, Rodono, Pazzani, and Cutispoto (1983) determined that maximum and minimum light migrate towards decreasing orbital phases at different rates (0.23 and 0.03 period/year, respectively), with light minimum and the orbital motion essentially synchronized. Spectroscopically, Bopp and Noah (1980) observed the H-alpha emission of II Peg to be enhanced during maximum visibility of the spotted regions (i.e. photometric minimum). Spectra of the molecular absorption features of VO and the gamma system of TiO obtained by Vogt (1981a) for II Peg unambiguously revealed the spotted regions to be cooler than the surrounding photosphere. Subsequent light curve modeling by Vogt (1981b) determined the spots to be cooler by 1200 $\pm$ 100 K. Also, II Peg is a coronal soft X-ray source (Walter et al. 1980), a transient hard X-ray source (Schwartz et. al. 1981), and a radio emitter at centimeter wavelengths (Owen and Gibson 1978).

Intermediate and narrow band photoelectric observations of II Peg were obtained at Villanova University Observatory on 12 nights, from October 13 through December 01 UT, 1981.

A description of the instrumentation, observing procedure, data reduction technique, and a discussion of the differential color and H-alpha indices is given elsewhere (Dorren, Guinan, and McCook 1984). The comparison star was the same as used by Wacker and Guinan (1986). Nightly mean differential magnitudes were computed, in the sense variable minus comparison, for the intermediate band blue (λ 4530), red (λ 6585), far red (λ 7790), and narrow band H-alpha red (λ 6568) filters, from which nightly mean differential color and H-alpha indices were computed. The seasonal mean errors for the nightly $\lambda\lambda$ 4530, 6585, 7790, and H-alpha narrow band data sets are, respectively: 0.011, 0.008, 0.008, and 0.006 mag.

The top panel of Figure 1 presents the intermediate band red observations. The orbital phases were calculated according to the ephemeris of Vogt (1981a):

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

The phases of minimum and maximum light are, respectively, 0.35P and 0.80P. The amplitude of the photometric wave is about 0.21 mag. Maximum, mean, and minimum light, expressed differentially, have the following respective values: + 0.670, 0.770, 0.875 mag. The $\lambda\lambda$ 4530 and 7790 light curves are similar in shape and phases of the light extrema.

The middle panel of Figure 1 displays the differential color index. Δ(b-r)', computed from the intermediate band blue and red differential magnitudes. This index provides a measure of the color changes of the variable relative to the comparison star. No phase correlation appears to exist, and a considerable amount of observational scatter is present. The seasonal mean value of the Δ(b-r)' data set is -0.678 mag. The seasonal mean error for the Δ(b-r)' data set is $\pm$ 0.013 mag.

The bottom panel of Figure 1 displays the differential H-alpha index, $\Delta\alpha$(v-c). 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 H-alpha emission. The seasonal mean value of the $\Delta\alpha$(v-c) data set is -0.058 mag, indicating the presence of weak-to-moderate H-alpha emission. As with the color curve, no apparent phase correlation exists. Spectroscopic observations of II Peg by Vogt (1981a) determined the H-alpha emission to be global, though preferentially associated with the photometric visibility of the spotted regions. Strong variations in the H-alpha equivalent width correlated with phase were detected by Bopp and Noah (1980) who commented that the H-alpha emission profile of II Peg closely approximates that of the very active RS CVn-type star V711 Tauri (HR 1099). H-alpha spectroscopy of II Peg was obtained during June/July and September-November 1981 by Ramsey and Nations (1984).

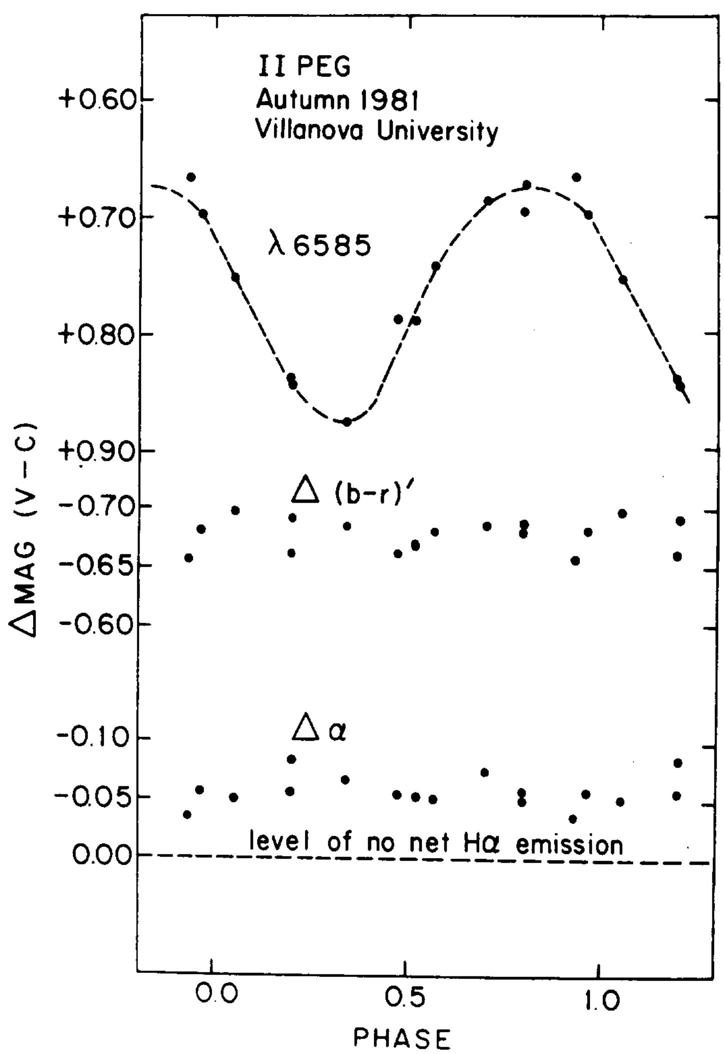

Figure 1: The Autumn 1981 photoelectric observations of II Peg, made differentially with respect to HD 223332, are presented. The top panel is a plot of the nightly mean differential red magnitudes. The middle panel is a plot of the color index. The bottom panel is a plot of the differential H-alpha index, where more negative values represent greater net H-alpha emission.

As stated in their paper, no clear evidence was found for a phase dependence of the H-alpha emission. The ephemeris of Vogt (1981a), which we use to phase our observations, was used to recompute the phases of the Autumn 1981 H-alpha spectra of Ramsey and Nations. The phase of weakest H-alpha emission coincides with the maximum of our light curve. An identical relationship was found by Ramsey and Nations (1984) between the equivalent widths of their H-alpha spectra and the V light curve obtained by Lines et al. (1983).

Light curves of II Peg obtained concurrently with those we present have been published by Zeilik et al. (1982), Lines et al. (1983) and by Byrne (as given in Rodono et al. 1986a). As with the H-alpha data of Ramsey and Nations, the ephemeris which we use to phase our observations was used to recompute the phases of the light curves of Lines et al. and Byrne. Even though different comparison stars were used, all three light curves agree in the phases of the light extrema, as well as amplitude and overall shape. The Lines et al. and Zeilik et al. observations have the best coverage, revealing the maximum to be significantly broader than the minimum. Furthermore, the amplitude of our intermediate band red light curve agrees with that of the broad band red light curve of Zeilik et al. Of perhaps the greatest significance in the results of monitoring the activity of II Peg concerns IUE observations obtained in early October 1981. The emission line fluxes of the chromosphere and transition regions achieved their maximum strength during photometric minimum, providing strong evidence that stellar plages overlie starspot regions (Marstad et al. 1982; Rodono et al. (1986b).

Multi-color photometry of II Peg has been conducted by Vogt (1981a). Nations and Ramsey (1981), Rodono et al. (1986a), Byrne (1986), and Wacker and Guinan (1986). All of these studies have shown the color curve to be reddest when the light curve is faintest, consistent with cool starspot models. The $\Delta(b-r)'$ curve formed from the 1985/86 photometry of Wacker and Guinan (1986), which used the same instrumentation and comparison star as this study, had a seasonal mean value of -0.669 mag. Comparing this value with that presented here for our Autumn 1981 observations indicates II Peg was on the average slightly bluer (by about 0.01 mag) during Autumn 1981 than in 1985/86. However, at both blue and red wavelengths, mean light for 1985/86 is brighter (by at least 0.04 mag) than during Autumn 1981. In the context of the cool starspot model, a spotted single star is expected to become bluer in color as its mean light brightens. Assuming the photospheric temperature of II Peg remains constant, the discrepancy in the seasonal changes between color and mean light of II Peg measured by our Autumn 1981 and 1985/86 observations may reveal a change in starspot temperature (Wacker and Guinan 1986). Light curve modeling by Poe and Eaton (1985) of multi-color photometry of II Peg obtained in 1977, 1979, and 1980 found evidence for seasonal changes in starspot temperature by as much as ∿ 300 K. They suggested the possibility that spots cool down when spot area remains constant and warm up when new spots are being created (Poe and Eaton 1985).

Recently, Byrne (1986) reported on his September 1986 photometry of II Peg, showing it to have the largest observed V light amplitude (0.45 mag) to date, and a well defined $(V-I)_C$ color variation, having an amplitude of 0.10 mag. Additionally, the mean value of the $(V-I)_C$ color index (+1.27 mag) is redder than previously observed.

Multi-color intermediate and narrow band photometry of II Peg for the 1986/87 observing season has been completed at Villanova (Boyd et. al. 1987), confirming the large amplitude and the wavelength dependency of the light variation. It would be of utmost interest to commence in the summer of 1987 both spectroscopic and photometric observations of II Peg in order to ascertain the extent to which the area, temperature, and configuration of the spots have evolved from their 1986/87 values.

We wish to thank Michael Davis and Craig Harris for contributing to the observations while students at Villanova University.

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B, V, R, I LIGHT CURVES OF AD CANCRI

The very short period eclipsing binary system AD Cnc (SVS 1277) was discovered by Kurochkin (1960). He classified it as an RR Lyrae type variable with a period of $0^d.146373$. Efremov et al. (1964) correctly identified AD Cnc as a W Ursae Majoris type system. The system's spectral type is K0 (G. Herbig, 1961). Millis (1972) determined 19 B,V standard magnitudes on the system covering about 60% of one complete cycle. The General Catalog of Variable Stars (1968 and 1985), citing unpublished manuscripts of Kurochkin, list two ephemerides,

$$\text{JD Hel Min. I} = 2441363.8063 + 0^d.2771724E$$

in the third edition and

$$\text{JD Hel Min. I} = 2443192.430 + 0^d.28273824E$$

in the fourth edition. Although the second ephemeris gives better results, both produce large residuals (O-Cs) when applied to the present observations.

The present observations were made on the nights of January 28 - February 1, 1987, inclusive. The 36" #2 reflector at Kitt Peak National Observatory was used with standard B,V,R,I filters in the Cousins system (Bessell 1976) with a dry-ice-cooled RCA 31034a Ga-As photomultiplier tube. The coordinates of the check (BD +10°1866), comparison and variable star are given in Table I. The comparison star has no catalogue identification. Approximately 700 observations were obtained at each effective wavelength.

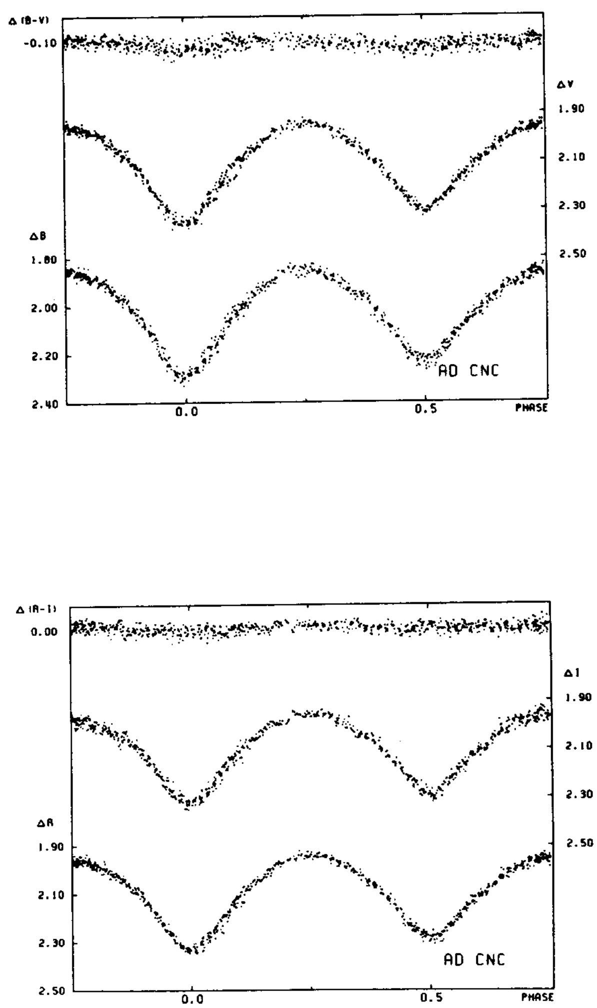

Fig. 1 - Light curves of AD Cnc defined by the individual observations.

Table I

Star	R.A. (1950)	Dec. (1950)
AD Cnc	$8^h43^m38^s$	10°31'02"
Comparison	$8^h43^m15^s$	10°29'44"
Check	$8^h42^m54^s$	10°30'01"

The five epochs of minimum light listed in Table II were determined from the observations made during three primary and two secondary eclipses. An iterative technique based on the Hertzsprung method (1928) was used.

Table II

JD Hel. 2440000+	Minimum	Cycles	(O-C)
46823.7661	I	-11.0	-0.0005
46823.9082	II	-10.5	0.0002
46826.8769	I	0.0	0.0001
46827.7244	I	3.0	-0.0006
46827.8670	II	3.5	0.0007

These times of minimum light along with Kurochkin's recent epoch (GCVS 1985) were introduced into a least squares solution to obtain the following ephemeris:

$$\text{JD Hel Min. I} = 2446826.8767 + 0\overset{d}{.}28273731E$$

This ephemeris was used to calculate the O-Cs in Table II and the phases of the present observations.

The B, V, R and I light curves of AD Cnc 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 1986 LIGHT CURVE OF II Peg

II Peg (=BD+27°4662 = HD 224085 = SAO 91578) is a bright RS CVn-type single-line spectroscopic system. This very interesting spotted binary has been photometrically observed at Catania since 1979 (Rodono' et al., 1980).

We present the UBV differential observations carried out during the period 5 September - 10 November 1986, on 23 nights with a single-channel photon-counting photometer fed by a 0.91m cassegrain telescope. Our principal comparison star was BD+27°4648, while BD+28°4665 and BD+28°4667 were observed several times on each night, as check stars. No significative variations between comparison and check stars were observed.

The observations were corrected for atmospheric extinction. Nightly mean UBV differential magnitudes (variable-comparison star) were computed with reference to several standard stars. The following values for the V magnitude and colors of the comparison star BD+27°4648 were assumed: V=9.403 (Vogt, 1981), B-V=1.04, U-B=0.84 (Rodono' et al. 1986).

Mean $JD_{\odot}$, V magnitudes and colors of II Peg are listed in Tab.I. Orbital phases, also listed in **Table I**, were computed using the spectroscopic ephemeris by Raveendran et al. (1981):

$$JD_{\odot} = 2443030.396 + 6\overset{d}{.}724464\ E$$

The resulting V light curve and B-V and U-B color variations are presented in Fig.1. Typical nightly standar deviations for V, B-V and U-B data are 0.005, 0.01 and 0.02 mag., respectively.

Our observations were obtained simultaneously or immediately following those of Byrne (1986). The light curve presented in Fig.1 is rather well covered and confirm the very large amplitude of II Peg light variations in the fall 1986, and the very bright level of its light maximum. Moreover, our observations indicate a remarkable stability of the spotted area, which remained unchanged at least until the first decade of November, i.e. about half a month later than Byrne's observations.

We also obtained spot models of II Peg V light curve, assuming two spotted circular areas and using our computer code based on the analytical method outlined by **Friedemann & Gurtler** (1975) and already used by us (Rodono' et al. 1986). We adopted the following values for the parameter:

i (inclination of the star rotation axis with respect to the line of sight) = 60 degree;

μ (limb darkening coefficient) = 0.79;

Ls/Lp (luminosity ratio between the secondary and the primary component of the system) = 0.0, i.e., invisible secondary star;

Vo (unspotted V magnitude) = 7.30;

Ts (photosperic temperature) = 4600 K;

Tspot (spot temperature) = 3300 K.

Table I

Photometric observations of II Peg

$JD_{\odot}$ 2446000.0+	PHASE	V	B-V	U-B
678.6186	.5299	7.748	1.04	0.73
680.6360	.8299	7.490	1.00	0.72
682.5482	.1142	7.355	0.99	0.69
683.5527	.2636	7.443	1.01	0.68
685.6036	.5686	7.791	1.04	0.72
686.6010	.7169	7.754	1.04	0.79
688.5695	.0097	7.322	0.98	0.67
689.5734	.1590	7.388	0.99	0.67
708.5279	.9777	7.328	0.99	0.68
709.5107	.1239	7.384	1.01	0.70
710.4757	.2674	7.461	1.00	0.67
712.4323	.5583	7.756	1.05	0.75
714.5658	.8756	7.395	0.99	0.72
716.5659	.1730	7.405	1.01	0.68
730.4752	.2415	7.437	1.00	0.65
731.5346	.3991	7.536	1.02	0.73
735.4854	.9866	7.324	1.00	0.70
736.4825	.1349	7.383	1.01	0.73
737.4332	.2762	7.438	1.01	0.72
742.4673	.0249	7.325	1.00	0.71
743.4572	.1721	7.401	1.01	0.71
744.4498	.3197	7.469	1.01	0.72
745.4810	.4730	7.638	1.03	0.74

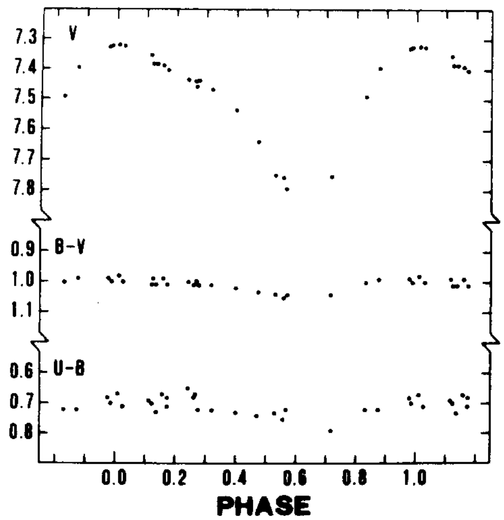

Figure 1

V, B-V and U-B light curves of II Peg obtained at Catania Observatory during the period September - November 1986. Phases were computed from the ephemmeris given by Raveendran et al. (1981): JDo = 2443030.396 + 6.724464E.

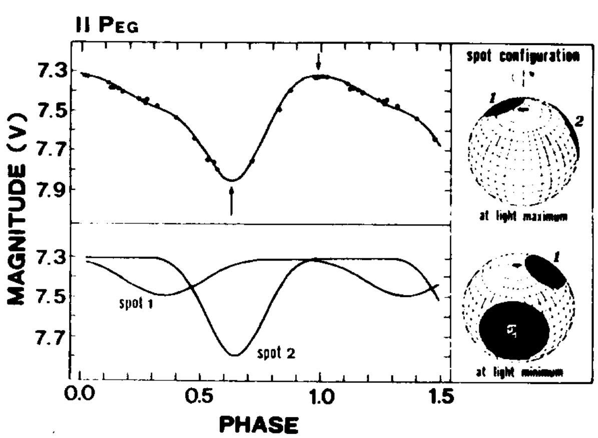

Figure 2

Results of two-spot model fit for the observed light variations (upper panel). The bottom panel shows the contribution of each spot, arrows indicate the phase of light maximum (↓) and light minimum (↑); the corresponding spot configurations are presented on the right hand panel.

The resulting latitudes for the two spots are 58 and 9 degrees. The radii are 23 and 37 degrees respectively. The two spots are 105 degree apart in longitude (Figure 2).

We wish to thank Prof. Marcello Rodono' for suggesting to carry out the present observations and for stimulating discussions.

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INFORMATION BULLETIN ON VARIABLE STARS

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VARIABILITY OF SOME S! STARS

In IBVS No.1490, D. Hoffleit suggested that almost all the S! stars in Stephenson's (1976) "A Catalogue of S Stars" may be variable. I examined the variability of the stars on the photographs taken since then with 8cm and 10cm cameras for brighter stars, and mostly with 18cm Schmidt camera, using Tri-X film and the yellow-green filter to get visual magnitude. The names and positions of the stars are as follows, and all the stars are found to be SR type variable.

Stephenson Cat. No.	Const.	R.A. (1950)	Decl.
S 10	Cas	$0^h43^m54^s$	+63°39'.8
S123	Aur	5 56 4	+35 8.0
S139	Aur	6 11 12	+28 8.9
S223	Mon	7 18 22	- 7 42.5
S687	Cep	21 29 23	+61 20.2
S727	And	23 13 5	+50 2.5

The position of S10 is measured by the writer, identifying the star by personal communication with Dr. Stephenson. The positions of other stars are from Stephenson's (1984) Catalogue, 2nd edition.

1) S10 Cas

The star was measured on about 120 photos in only three observational years, as the star was out of the field in other seasons. The star seems to be SRb variable with the period of probably 210 days. The range is 12.3-14.2v. The light curve is shown in Figure 1.

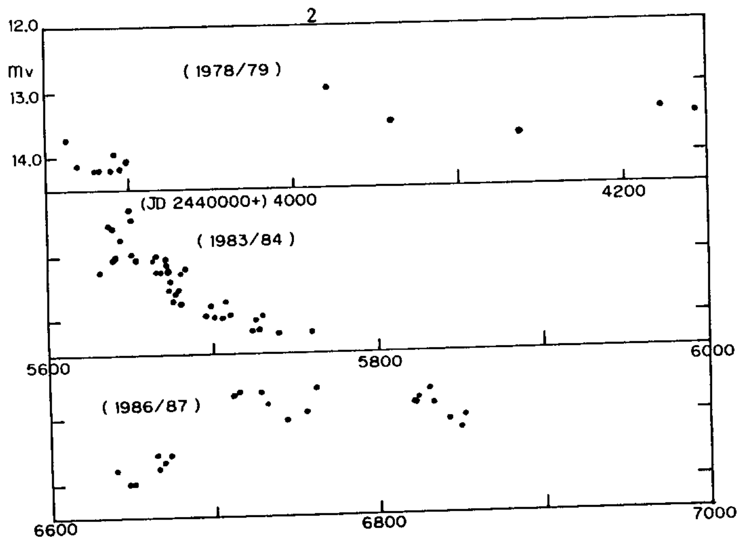

Figure 1

S10 Cas

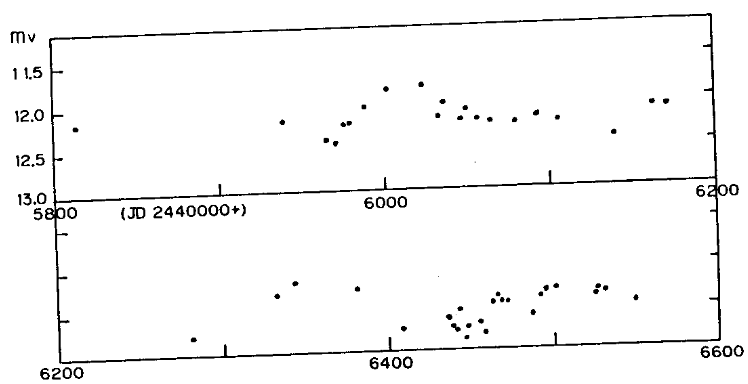

Figure 2

S123 Aur

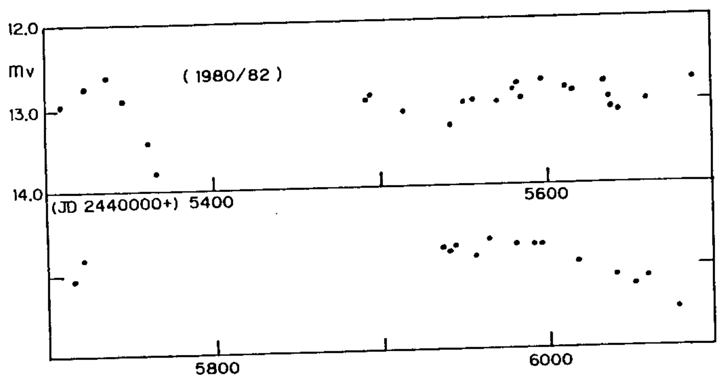

Figure 3

S139 Aur

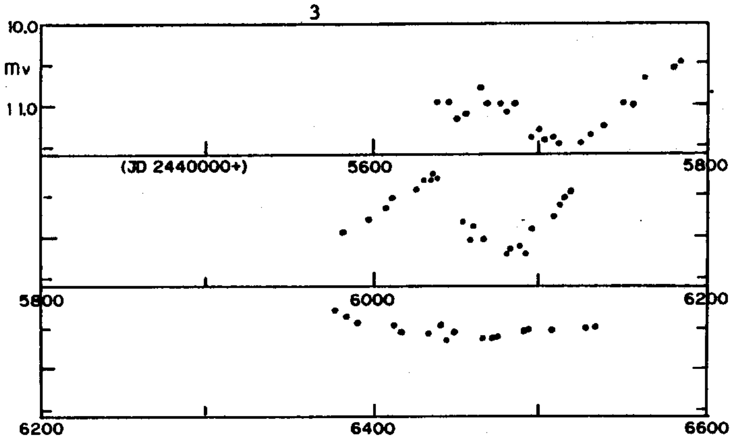

Figure 4

S223 Mon

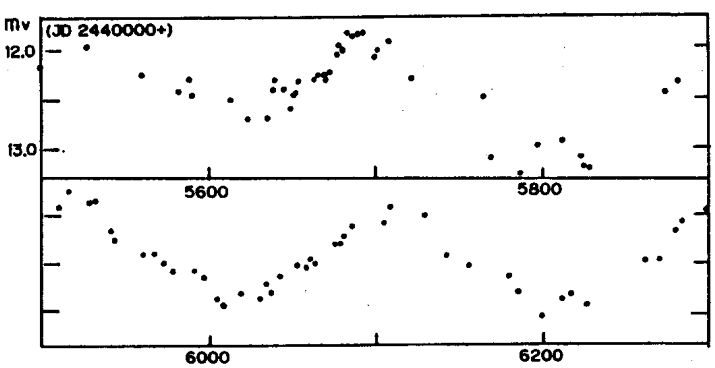

Figure 5

S687 Cep

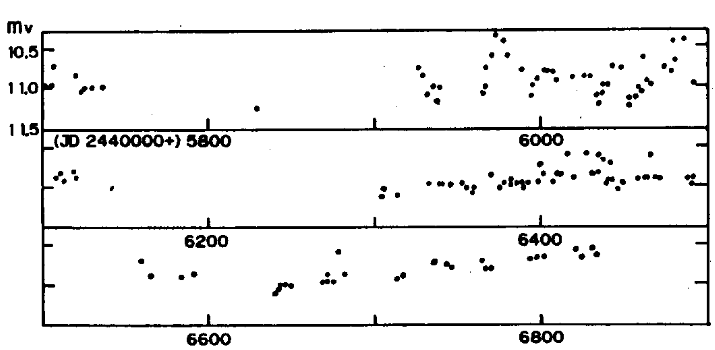

Figure 6

S727 And

2) S123 Aur

This star was measured on more than 170 photos taken in 1978-1987, and found to be possibly SRa type with the range 11.5-13.0v. The following elements are obtained:

$$\text{Max.} = \text{J.D. } 244\ 3870 + 155^{d} \cdot E$$

In Figure 2, the light curve in only recent years is shown.

3) S139 Aur

This star was measured on 250 photos taken in 1979-1987, and it possibly is SRb type with the period of probably 175^{d}. The range was 12.4-13.8v so far.

4) S223 Mon

This star was measured on 130 photos taken in 1979-1987, and it is possibly SRb variable with the range 10.2-11.5v and the period of 194^{d}. The following elements are obtained:

$$\text{Max.} = \text{J.D. } 244\ 4230 + 194^{d} \cdot E$$

The light curve in three observational periods are shown in Figure 4.

5) S687 Cep

This star was measured on 230 photos taken in 1979-1987. The star shows very regular variation with the period of 193^{d} and the range of 11.8-13.4v. It is SRa type and the elements obtained are as follows:

$$\text{Max.} = \text{J.D. } 244\ 3975 + 193^{d}.3 \cdot E$$

In Figure 5 is shown the light curve in recent years.

6) S727 And

This star was measured on more than 370 photos taken in 1979-1987. It is rather irregular than other stars, but it would be SRb type with the period roughly from 88 to 104 days. The range was 10.4-11.3v so far. Figure 6 shows the light variation in recent years.

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INSTABILITIES IN THE LIGHT CURVE OF THE RR LYRAE STAR SS Leo

As part of a long-term project to calculate Baade-Wesselink radii, and hence absolute magnitudes, of RR Lyrae stars (Longmore et al. 1985, Jameson et al. 1987) we obtained UBV photometry of SS Leo (P = 0.62634289 day) on the night of 13/14 March 1987 using the 1m. telescope at the South African Astronomical Observatory. During the ascending branch of the light curve the star showed large fluctuations at all three wavelengths. The comparison star HD 100269, which is less than half a degree distant, was observed at 15 minute intervals and remained constant to within 0.02 mags in each filter. The light curves of SS Leo are shown in the attached figure.

On the night of 9/10 April 1987 one of us reobserved the star. The ascending branch on this occasion was quite normal.

As far as we are aware, the behaviour of SS Leo on the night of 13/14 March 1987 is unique not just for this star but for any RR Lyrae (e.g. Lub 1977). We can find no reason to disbelieve our data; however, until these observations have been independently reproduced there must be an obvious question mark against their reality, and for this reason we feel further analysis or comment is premature.

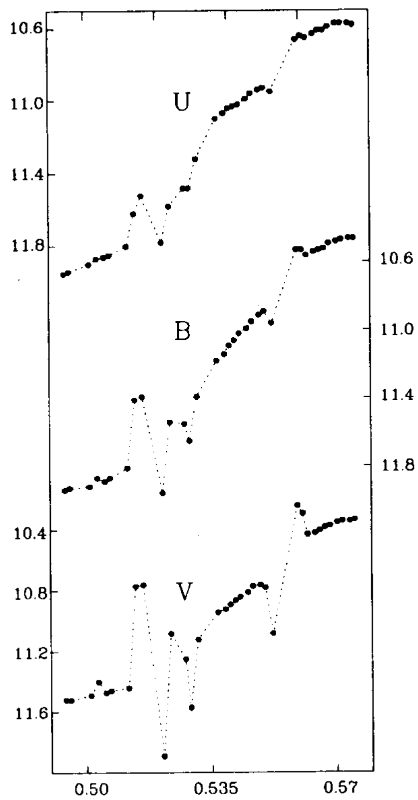

Figure 1

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Lub J. 1977 Astr. Ap. Supp. 29 345

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PHOTOELECTRIC OBSERVATIONS OF EX HYDRAE DURING THE 1986 JULY-AUGUST OUTBURST

EX Hydrae was monitored photoelectrically in July and August 1986 during one of its rare outbursts. As far as the authors are aware this outburst is the first eruption of EX Hydrae to be measured by photoelectric means. Ten second integrations were made predominantly in white light using the photon counting system attached to the 50 cm Zeiss Cassegrain reflector at the Auckland Observatory. Star '96' on AAVSO chart 24728(e) was used as a comparison star with V=9.62, B-V=0.48 and U-B=0.08.

Occasional Johnson U, B and V readings were also taken and the nightly means of these are given in Table I. The existence of two rises in brightness above the normal quiescent level is confirmed by the visual observations of Jones (1986) as can be seen in Figure 1.

Table I: Three colour observations during the 1986 July-August outburst of EX Hydrae

Date 1986	JD-2446000	Number of VBU Observations	Mean Values		
			V	B-V	U-B
July 30	641.91	15	12.46	0.18	-0.91
July 31	642.89	20	13.39	-0.09	-1.10
August 4	646.83	1	12.68	0.09	-0.72
August 5	647.83	16	10.43	0.00	-0.91
August 6	648.86	5	11.13	0.08	-0.73
August 10	652.81	2	13.46	0.04	-1.11

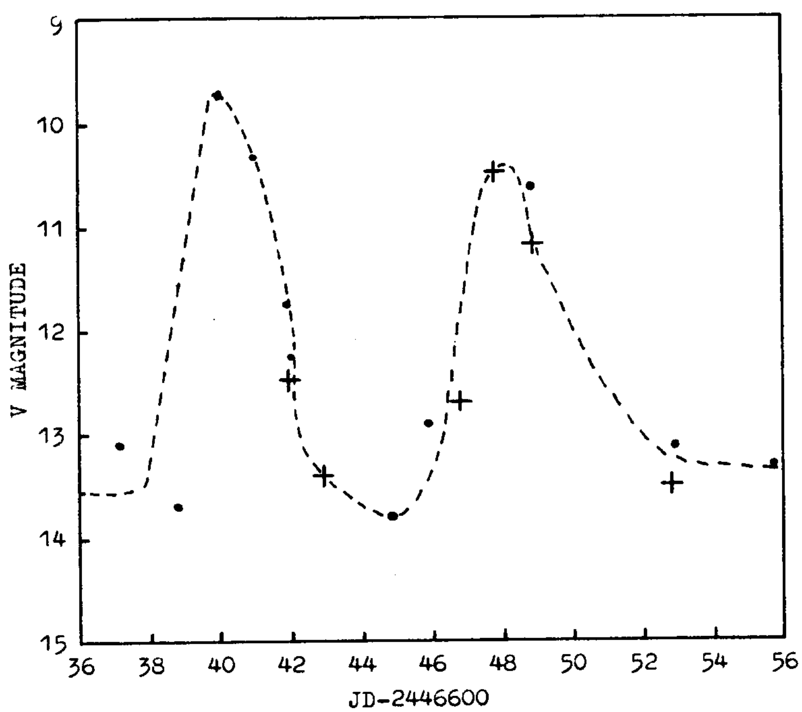

Figure 1. Overall light curve of the 1986 July-August outburst of EX Hydrae. The data shown are the photoelectric V magnitudes (+) and the visual estimates of Jones, 1986.

Continuous monitoring of EX Hydrae on August 6 revealed three hump like features similar to those that characterise the well known 67 minute cycle present in the quiescent state light curve (Vogt et al. 1980, Sterken et al. 1983). However the outburst features are considerably enhanced in intensity compared to the quiescent state features. A graph of the white light magnitude difference from the comparison star clearly shows these features in Figure 2. The heliocentric times of the maxima were found to be HJD 2446648.8037, 2446648.8471 and 2446648.8905.

The light curve shown in Figure 2 indicates that no obvious eclipse-like features occur close to the eclipse times predicted by the ephemeris of Sterken et al. (1983). Dips do appear in the light curve but these may be due to the particularly high level of flickering always present.

Extensive long period monitoring was prevented by inclement weather and the unfavourable position of EX Hydrae at that particular time of year. Further analysis of the data is underway at present and the authors therefore invite others with photoelectric data covering the event to contact them.

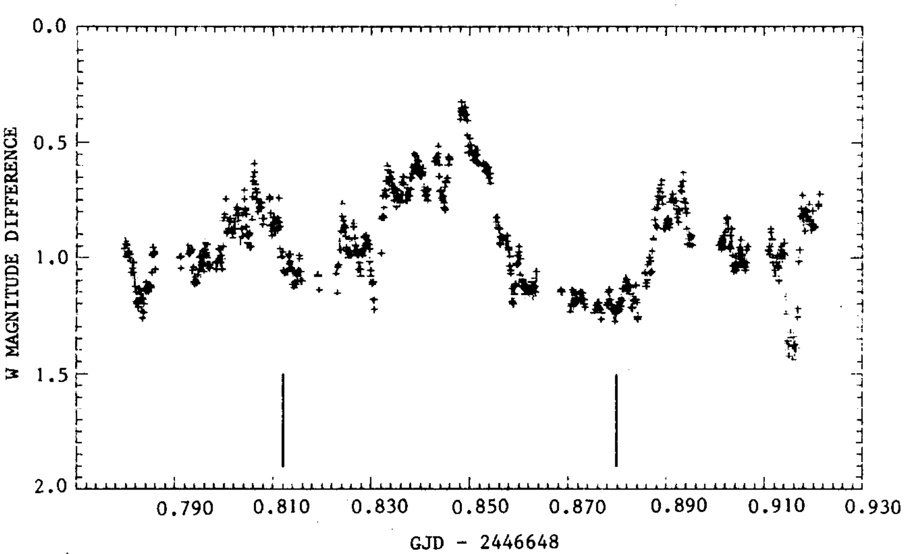

Figure 2. EX Hydrae light curve obtained on August 6. Each point corresponds to one 10 second integration in white light. The timing marks below the data correspond to the eclipse times predicted by the ephemeris of Sterken et al. (1983).

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B.F.MARINO, W.S.G.WALKER - Auckland Observatory

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POSITIONS AND PROPER MOTIONS OF THREE NOVAE

The importance of positions and proper motions of novae for the determination of their mean parallax and mean absolute magnitude has been pointed out by Artyukhina and Kholopov (1962). Moreover, accurate measurements of novae are needed for the detection of radio emission of these stars (Fürst et al. 1986). From old and new plates of the double refractor, astrograph and AG-astrograph at Hoher List Observatory we determined positions and proper motions of the three novae V603 Aql, HR Del and GK Per.

The observational data are given in Table I, while the data of the telescopes, which were used, are given in Table II. For the plates of V603 Aql and HR Del, the field size was large enough that reference stars of the AGK3RN-system could be used (Corbin, 1979). According to de Vegt and Gehlich (1983), the AGK3RN-system is the most reliable representation of the FK4, which can be used in photographic astrometry. For all novae, we took also reference stars from the AGK3 catalog into account. The plates were measured in two (0^o and 180^o) orientations with the ASCORECORD of Hoher List Observatory. A reduction model with terms up to second order of the rectangular coordinates x and y was used. Astrometric tests in the field of the Pleiades have shown that this reduction model is sufficient for the reduction of astrometric measurements of plates of the double refractor (Geffert, 1986a).
For the AG-astrograph, a magnitude equation was found, but this affects only the bright stars $m < 6^m$ (Geffert, 1986b).

Our positions are given in Table III for the AGK3RN and in Table IV for the AGK3. The proper motions are given in Table V and VI. The errors σ stem from internal comparisons of the measurements of different plates at the same epoch, while the errors ε are due to the uncertainty of the transformation from the rectangular coordinates x and y on the plate to the spherical coordinates α and δ at the position of the nova.

Although the errors of the proper motions in the AGK3-system have smaller errors than the proper motions in the AGK3RN-system, it should be noted that, due to the local systematic errors of the AGK3, the proper motions in the AGK3RN-system are more reliable. For future work, it would be therefore very useful to have first epoch plates covering more than $4^{\circ} \times 4^{\circ}$ so that AGK3RN reference stars could be taken into account.

Table I) Observational Data

Plate	Telescope	Date	Emulsion/Filter
V603 Aql:			
B38 I	AG-astr.	12 06 1928	Agfa Scienta
B38 II	AG-astr.	12 06 1928	Agfa Scienta
N49	AG-astr.	25 07 1982	Kodak 103a-O
N51	AG-astr.	10 07 1983	Kodak IIa-O
GK Per:			
R168	refractor	22 11 1902	Matter 3601
R169	refractor	05 12 1902	Matter 3601
R170	refractor	23 12 1902	Matter 3601
R1662	refractor	11 02 1985	Kodak IIa-O
R1666	refractor	12 02 1985	Kodak 103a-O
R1671	refractor	16 02 1985	Kodak 103a-O
HR Del:			
B465	AG-astr.	08 09 1929	Agfa Scienta
3166	astr.	20 08 1978	Kodak IIa-O

Table II) The data of the telescopes

Telescope	Focal Lenght (cm)	Diameter (cm)	Field Size
AG-astrograph	200	11	$6^{o} \times 6^{o}$
astrograph	150	30	6 x 6
refractor	500	30	1.5 x 1.5

Table III) Positions of the novae in the AGK3RN-system

Date	Alpha (1950) (h,m,s)	Delta (1950) (^{o},',")	σ_α (sec)	σ_δ (")	ε_α (sec)	ε_δ (")
V603 Aql:						
1928.4	18 46 21.458	+00 31 36.73	0.015	0.14	0.007	0.16
1983.0	18 46 21.465	+00 31 36.15	0.007	0.20	0.006	0.30
HR Del:						
1929.7	20 40 04.232	+18 58 51.35	--	--	0.008	0.15
1978.7	20 40 04.190	+18 58 51.19	--	--	0.020	0.30

Table IV) Positions of the novae in the AGK3-system

Date	Alpha (1950) (h,m,s)	Delta (1950) (^{o},',")	σ_α (sec)	σ_δ (")	ε_α (sec)	ε_δ (")
V603 Aql:						
1928.4	18 46 21.458	+00 31 36.57	0.009	0.09	0.009	0.12
1983.0	18 46 21.488	+00 31 35.67	0.004	0.02	0.014	0.20
HR Del:						
1929.7	20 40 04.201	+18 58 51.38	--	--	0.007	0.13
1978.7	20 40 04.195	+18 58 51.49	--	--	0.011	0.15
GK Per:						
1902.9	03 27 47.568	+43 44 05.46	0.009	0.08	0.013	0.14
1985.2	03 27 47.499	+43 44 04.08	0.008	0.19	0.013	0.14

Table V) Proper motions in the AGK3RN-system.
The errors σ and ε are mean values from both coordinates.

Name	μ_α ("/100a)	μ_δ ("/100a)	σ_μ ("/100a)	ε_μ ("/100a)
V603 Aql	+0.20	-1.07	0.43	0.63
HR Del	-1.22	-0.33	--	0.65

Table VI) Proper motions in the AGK3-system.
The errors σ and ε are mean values from both coordinates.

Name	μ_α ("/100a)	μ_δ ("/100a)	σ_μ ("/100a)	ε_μ ("/100a)
V603 Aql	+0.71	-1.75	0.22	0.45
HR Del	-0.17	+0.22	--	0.39
GK Per	-0.91	-1.68	0.31	0.21

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INFORMATION BULLETIN ON VARIABLE STARS

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SOME NEW POSSIBLE VARIABLE STARS II.

In the course of a photometric monitoring program of Be stars, it has been found that some of the comparison stars utilized for the differential BV photometry are themselves variable. A previous list of such stars has already been published (Halbedel, 1986). This collection adds to that group 24 more stars whose deviations from mean magnitude make them unsuitable for standards.

A comparison star was considered to be unusable for that purpose if its average residual from mean V magnitude was 0.020 magnitudes or greater. This is a reasonable and conservative criterion since those stars whose magnitudes were considered to be constant showed average residuals from the mean of 0.008 V magnitudes. As 58% of the program stars are being found to be non-variable, it was generally trivial to ascertain which of the two comparison stars used for each program Be star was variable in its own right.However, in several cases when the residuals from the mean of each comparison star both from each other and the program Be star were unacceptably large, it was impossible to determine which comparison was variable since the Be star may also be variable. Therefore, both comparison stars were changed for further observations and added to the following list, denoted by an asterisk.

No information can be obtained concerning possible periodicity due to the non-uniform time intervals between the observations. Spectral types in the following table are from the SAO CATALOG unless otherwise stated.

Table I

STAR	SP. TYPE	STAR	SP. TYPE
HD 12709	B4 IV (1)	HD 32894	A5
13593	A3	42860*	B8
29343*	A	43187*	A0
29376*	B3 V (1)	44768	A0 III (1)

STAR	SP. TYPE		STAR	SP. TYPE
HD 46682	A2		HD 218999	A0
49224*	A2		223043	A0
49294*	A2		224869	A
52124	B9		BD+53 3121	B8
203168	A2		+51 3362	B8
203715	A3		+47 3316	---
204710	B8 Ib	(2)	+7 4201 *	A5
212000	B9		+7 4203 *	A2

(1) --- Kennedy, P.M. & Buscombe, W., MK SPECTRAL CLASSIFICATIONS PUBLISHED SINCE JASCHEK'S LA PLATA CATALOGUE (Evanston, IL), (1974).

(2) --- Buscombe, W., MK SPECTRAL CLASSIFICATIONS: THIRD GENERAL CATALOGUE (Evanston, IL), (1977).

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Reference :

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TIMES OF MINIMUM LIGHT FOR U CEPHEI IN 1986

We present here three times of minimum light for U Cephei observed with the 50-cm reflector of Hyogo University of Teacher Education in 1986. Observations were performed with UBV filters and an uncooled 1P21 photomultiplier tube. We determined the times of minimum using the bisection of chords method.

TABLE I

PHOTOELECTRIC TIMES OF MINIMUM LIGHT IN 1986

JD(Hel) -2440000	E	O - C (days)	d (days)
6496.1757	3291	0.0758	>0.063
6526.0905	3303	0.0741	0.086
6723.0434	3382	0.0767	0.095

The results are listed in Table I. The first column gives the observed times of minimum light. The second and third columns list cycle count and O–C calculated with the ephemeris

$$\text{JD (Hel) min I} = 2438291.5020 + 2^{d}.4930410\text{E},$$

as Olson et al. (1985) did. The fourth column gives an estimate of the apparent duration of totality. All these values are based upon the V data. The third contact of the E = 3291 eclipse could not be observed due to a temporary cloud. Therefore, we cannot judge whether or not the eclipse was an undisturbed one according to the Crawford and Olson's (1979) criterion, d $\geq$ 0.075 day. The other two eclipses were certainly undisturbed ones.

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INFORMATION BULLETIN ON VARIABLE STARS

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Budapest
30 June 1987

HU ISSN 0374-0676

UBV PHOTOMETRY OF EPSILON AURIGAE OUTSIDE ECLIPSE

We made photoelectric photometry of Epsilon Aurigae on ten nights in March and April 1986 with the 50-cm reflector of Hyogo University of Teacher Education. Observations were carried out with UBV filters and an uncooled 1P21 photomultiplier tube. Every night we observed about ten standard stars from Arizona-Tonantzintla Catalogue (Iriarte et al., 1965) to determine the atmospheric extinction coefficients. One night during the observing period twenty standard stars were observed and the transformation coefficients for converting the instrumental system to the Johnson's system were estimated to be $\varepsilon = 0.0026$, $\mu = 0.918$ and $\phi = 1.015$, where the notations are the same as those

TABLE I

MAGNITUDES AND COLORS OF ε AURIGAE

Date (1986)	JD(Hel) -2440000	V	B	U	B-V	U-B
Mar. 4	6494.098	2.94	3.50	3.97	0.56	0.47
Mar. 5	6494.957	2.93	3.49	3.98	0.56	0.49
Mar. 7	6497.019	2.95	3.51	3.97	0.56	0.46
Mar.17	6507.030	2.95	3.53	3.94	0.58	0.41
Mar.24	6514.029	2.94	3.48	3.95	0.54	0.47
Apr. 2	6523.014	2.95	3.51	3.93	0.56	0.42
Apr. 6	6526.996	2.97	3.52	3.97	0.55	0.45
Apr. 7	6527.978	3.00	3.56	3.98	0.56	0.42
Apr.23	6544.000	3.08	3.67	4.07	0.59	0.40
Apr.29	6549.964	3.21	3.69	4.14	0.48	0.45

of Henden and Kaitchuck (1982). We used η Aur and λ Aur as comparison stars. The results are listed in Table I. From March 4 to April 2, 1986, the brightness of ε Aur was approximately constant. After that, the star darkened by $\Delta V = 0.27$ mag in about a month.

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Japan

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Number 3042

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1986 LIGHT CURVE OF V711 Tau*

The intrinsic light variability of the non-eclipsing binary V711 Tau has been observed by several investigators since 1976. The strong and variable emissions from chromosphere, transition region and corona and the short periodic light variability make the system the most suitable for studying the peculiar behaviour of RS CVn binaries. Mekkaden et al. (1982) made a detailed study of the photometric behaviour of V711 Tau during the intervel 1976 and 1982 and found that the brightness at the light minimum remained nearly constant and the wave amplitude increased as the brightness at the light maximum increased. The observations of Bartolini et al.(1983) showed that drastic changes in light curves occured within short time scales and interpreted the phenomenon as due to the latitude and longitude migration of spot groups. Rodono et al.(1986) explained the light curves of 1981-82 on the basis of a two-spot model; a large circular spot near the polar region and the other near the equator.

V711 Tau was observed with the ESO 50 cm telescope at European Southern Observatory, La Silla, through Strömgren uvby filters during 13 nights in October 1986. The observations were made differentially with respect to the comparison star HD 22484 and all measurements of V711 Tau included the fainter visual companion ADS 2444B. The instrumental magnitudes were transformed to the standard system by observing a sufficient

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

number of uvby standards. The photometric phases were calculated using the ephemeris of Bopp and Fekel (1976).

$$JD = 2442766.069 + 2^{d}.83782E$$

Figure 1 is a plot of y magnitudes . The mean error in y is of the order of 0.005 mag. The Strömgren y magnitudes can be converted to Johnson V values using the relation

$$V = y + 0.015(b-y) - 0.003 \quad \text{(Olsen, 1983).}$$

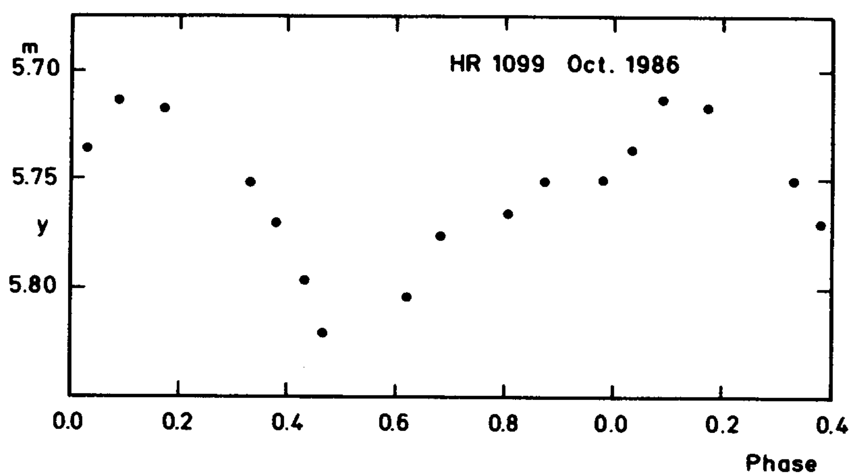

Figure 1

The maximum, minimum and mean brightness are 5.72, 5.82 and 5.77 mag respectively (in Johnson V). The light curve is nearly quasi-sinusoidal and the minimum occurs at 0.5P. the corresponding amplitude is approximately 0.10 mag.

The photometric observations by Wacker and Guinan (1986) during September 1985 and January 1986 showed a flat topped maximum and the minimum light occured at 0.41P. The unpublished observations of 1984/85 exhibited a quasi-sinusoidal light curve with minimum near 0.40P.

Major changes in locations and areas of spot groups took place within an interval of two years. The shape of the light curve changed from quasi-sinusoidal to flat topped maximum and back to a nearly quasi-sinusoidal one, while the maximum light level decreased from 5.63 mag in 1984/85 to 5.72 mag in 1986 and the phase of the minimum advanced by 0.10P. In a very active binary like V711 Tau, exhibiting abrupt changes in light curve and emission line features, areas of activity and therefore spots appear at several locations on the surface and these spots merge or disintegrate within a short time scale. Hence,though the light variations can be reproduced by a two spot model, the model may not represent the real picture of spot groups that are responsible for the sudden changes in activity.

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PHOTOMETRY DURING THE END-PHASE OF A SPOT CYCLE IN II Peg*

II Peg is one of the most active RS CVn binaries with strong chromospheric and transition region emission lines. Its radio and X - ray emissions are comparable to the other active RS CVn members. The optical light curve shows variations in amplitude, shape, phase and mean light level due to the reorientation or appearence of spot groups. Recent observations by Byrne (1986) showed that the light curve had a larger amplitude than any of the previous photometry. He interpreted the behaviour as due to the occurence of a large single spot group and the brightness at the maximum corresponded to the light level of the unspotted surface. In an analysis of the then available photometry of II Peg, Mohin, Raveendran and Mekkaden (1986) found that between the interval JD 2444175 and JD 2444595, the light curves had two minima and they concluded that this phenomenon could be due to the presence of two active regions located at different latitudes. But observations in July-November 1981 showed only one minimum (Rodono et al., 1986). Photometry of II Peg in August-September 1984 by Arevalo, Lazaro and Fuensalida (1985) indicated that the light curve had two minima. Thus the location, area and the number of spot groups change rapidly in this system.

Strömgren uvby photometry of II Peg was carried out at European Southern Observatory, La Silla, during 11 nights in October 1986 using the ESO 50 cm telescope and a single

*Based on observations collected at European Southern Observatory, La Silla, Chile beam photometer with ice cooled EMI 6256 tube. All observations were made differentially with respect to the comparison star HD 223094. Sufficient numbers of standard stars were observed for the conversion of the instrumental magnitudes to the standard system. The standard error for an individual observation in y is 0.015 mag. The Julian days of observation are converted to photometric phases using the ephemerides of Rucinsky (1977).

$$JD = 2443033.10 + 6\overset{d}{.}724183E$$

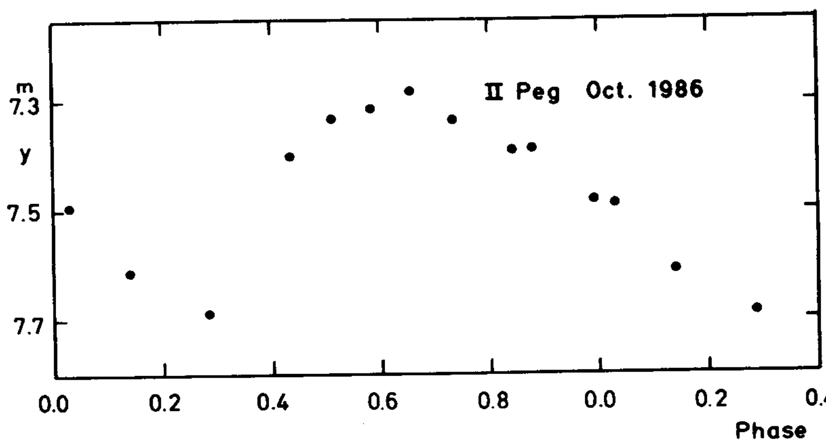

Figure 1

Figure 1 is a plot of the y band light curve of II Peg. It is known that Strömgren y is nearly the same as Johnson V and so a comparitive study of the present work with the photometry available in the literature is possible. The y magnitudes at light maximum and mean light level are converted to Johnson V values using the relation V = y + 0.015(b-y) - 0.003 (Olsen,1983) and found to be 7.29 and 7.49 mag. respectively.

The shape of the light curve and the maximum brightness of II Peg are similar to the observations of Byrne (1986) made one month earlier, but the amplitude is 0.40 mag.; less than in the previous month. Also the minimum of the light curve seems to be advanced by 0.10P. Though the current maximum is the brightest except for the observations of Chugainov (1976) in 1974, it is rather not possible to attribute this value to the unspotted light level since the very active nature of II Peg causes sudden changes in the light curve and continuous observations over a few cycles are necessary to estimate the maximum brightness.

If we assume that the two spot groups observed till early 1985 merged to form the current single spot group, then what we observe in II Peg at present is the end-phase of a spot cycle. A decade of photometry of II Peg shows that the system is one of the most spot active binaries exhibiting single or multiple spot groups at different latitudes and changes occur within a short time scale. Simultaneous photometric and spectroscopic observations over a few consecutive cycles are needed to infer the activity in this system.

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11 NEW VARIABLES IN GLOBULAR CLUSTER M 5

This paper continues the presentation of results of a major investigation for discovering new variables in central regions of globular clusters. Scrutinizing the number of "cluster variables" discovered so far one anticipates the possibility of finding more new ones (Kadla, Gerashchenko, 1984). Study of the clusters M 3, M 13, M 5 and M 92 resulted in discovery of 51 new variables.

The globular cluster M 5 is one of the richest in variables. The Third Catalogue of Globular Clusters (Sawyer, 1973) lists 103 variable stars in this cluster. Five of them did not prove to be variable, the variability of one further star has been dubious, periods have not been determined for V51, V101, V102 and V103.

About 30 photographic plates taken in B colour have been used for searching new variables in M 5. The plates were taken with the two meter telescopes in Ondrejov Observatory (Czechoslovakia), in Rozhen National Observatory (Bulgaria) and in Shemakha Observatory (U.S.S.R.), and with the one meter telescopes of the Astronomical Institute of the Tadjik S.S.R. and of the Konkoly Observatory, respectively. 11 new variables have been found and the variability of V51 and V102 have been confirmed. The dwarf nova V101 fainter than 17m according to the Sawyer Catalogue was not visible on our plates.

The positions of the new variables have been measured on plates taken with the two meter telescope in Ondrejov (7"/mm). In the 2. and 3. columns of Table I, the coordinates of the newly discovered variables are listed. The next column contains the ΔB values, i.e. the estimated magnitude differences. In the last column we give the Küstner numbers (Küstner, 1933).

Table I

N	X	Y	ΔB	K
104	-10.2	42.1	1.1	542
105	- 6.0	15.5	0.8	
106	- 5.1	9.5	0.9	
107	- 0.3	- 4.0	1.0	
108	9.2	- 2.6	0.6	
109	19.2	1.5	1.0	
110	23.8	16.4	0.5	
111	24.2	- 3.4	0.6	
112	28.7	-31.4	1.1	
113	28.8	-33,9	0.8	
114	29.7	- 2.5	1.4	716

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OPTICAL BEHAVIOUR OF THE X-RAY SOURCE EXO 020528+1454.8 IN THE SEASON 1986/87

This object consisting of a pair of dMe stars (dM4.5e+dM4.5e) is identical with Lowell's proper motion star G035-027. First results about the optical behaviour were given by Hudec et al. (1986).

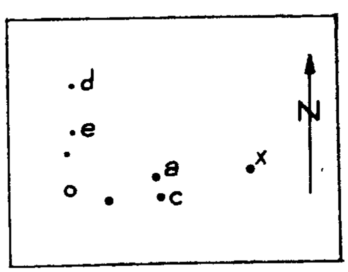

Figure 1

In linking to the sequence of comparison stars given in Figure 1 and Table I the object was measured on 84 blue-sensitive plates (ORWO-ZU21+GG13+BG12) from 26 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between August 2,1986 and February 23,1987. The magnitudes in B of the comparison stars listed in Table I are linked to the sequence of comparison stars of TT Arietis given by Götz (1985). The star "h" there is identical with the star "x" in the present sequence.

The magnitude distribution in B of all individual observations is shown in Figure 2. Most of them are in the range between $m_B = 15^m.65$ and $m_B = 16^m.05$. There is no doubt that the object is variable. But its variability, caused by the two components, is of low amplitude and belongs probably to the low and quiet state of the stars.

In series of 5 and more plates per night the individual observations are scattering within $\Delta m_B \approx 0^m.3$. Only in the night of J.D. 244 6763 the amplitude amounts to $\Delta m_B = 0^m.5$.

Table I

comparison star	m_B
x	$14^m.86$
a	15.64
c	15.89
d	16.30
e	16.84

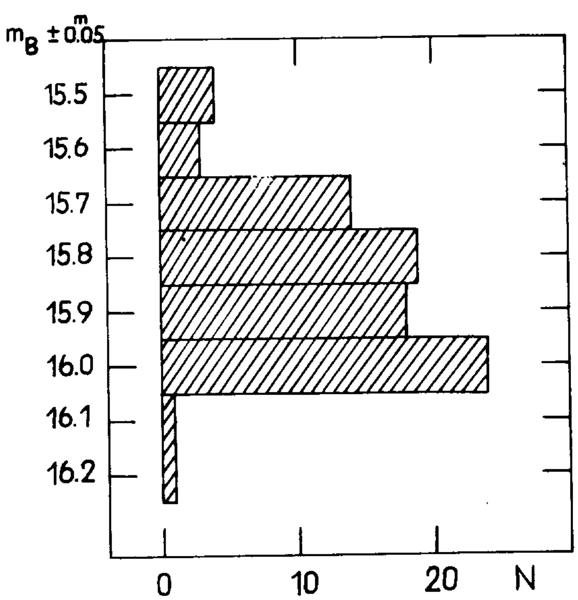

Figure 2

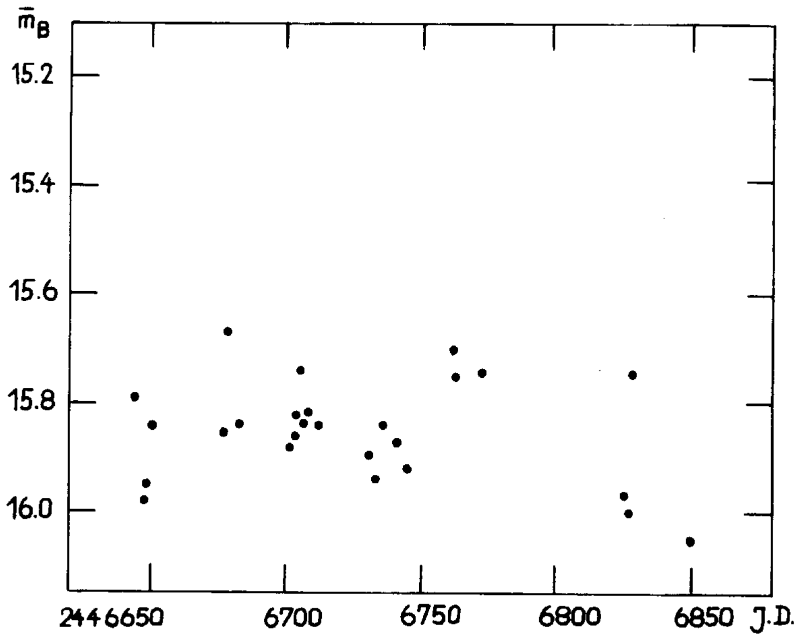

Figure 3

No flare was observed, as can be seen from Figure 3, where the mean values of brightness from each night are given to show the long-scale behaviour of the object.

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UBV PHOTOMETRY OF NOVA ANDROMEDAE 1986

Nova And 1986 (R.A. = $23^h09^m47.72^s$; D. = $+47^o12'00.8''$ (1950); l = 110^o; b = -13^o) was discovered by Mitsury Suzuki on Dec. 5.44 (Kosai, 1986). We report here our systematic UBV photoelectric observations between December 11.73 (1986) and January 21.75 (1987), when the star declined from V = 7.28 to V = 11.32. Between January and February 1987 we followed photographically tha fading of the Nova toward V = 12.4.

All the observations were performed with the 0.4m reflector of the "G. Colombo" Observatory. Photoelectric measurements were carried out at the Cassegrain focus (F/20) equipped with a RCA 931 B photomultiplier tube and UBV filters. The comparison star was 7 And (V = 4.52; B-V = 0.31; U-B = 0.02, from USNO Photoelectric Catalogue). Photovisual magnitudes were estimated on Kodak Tri-X plates exposed through a filter Schott GG 495 (2mm) at the Newton focus (F/5) of the same reflector, adopting the comparison star sequence from AAVSO Chart No. 230746.

The V light curve is presented in Figure 1, where our data are plotted as black dots. As open dots the V estimates published in IAU Circulars 4281, 4282, 4293, 4342, 4360 are also reported. The light curve shows that the Nova attained the maximum at V=6.3 on Dec. 7, 1986. After that the Nova declined rapidly (t_2 = 10^d; t_3 = 21^d) with a rate of 0.20 mag/day. The star entered in the transition phase on December 31 and the final decline started about on January 20.

The (U-B) colour index showed a regular increase from -0.69 (S.D. 0.02) to -0.53 (S.D. 0.04) between Dec. 22 and Jan. 21. By contrast the (B-V) colour index displayed formerly a decline from +0.41 (S.D. 0.02) to +0.18 (S.D. 0.02) about at the end of December, followed by an increase up to +0.52 (S.D. 0.04) in January. These facts can be accounted for by the appearance of strong

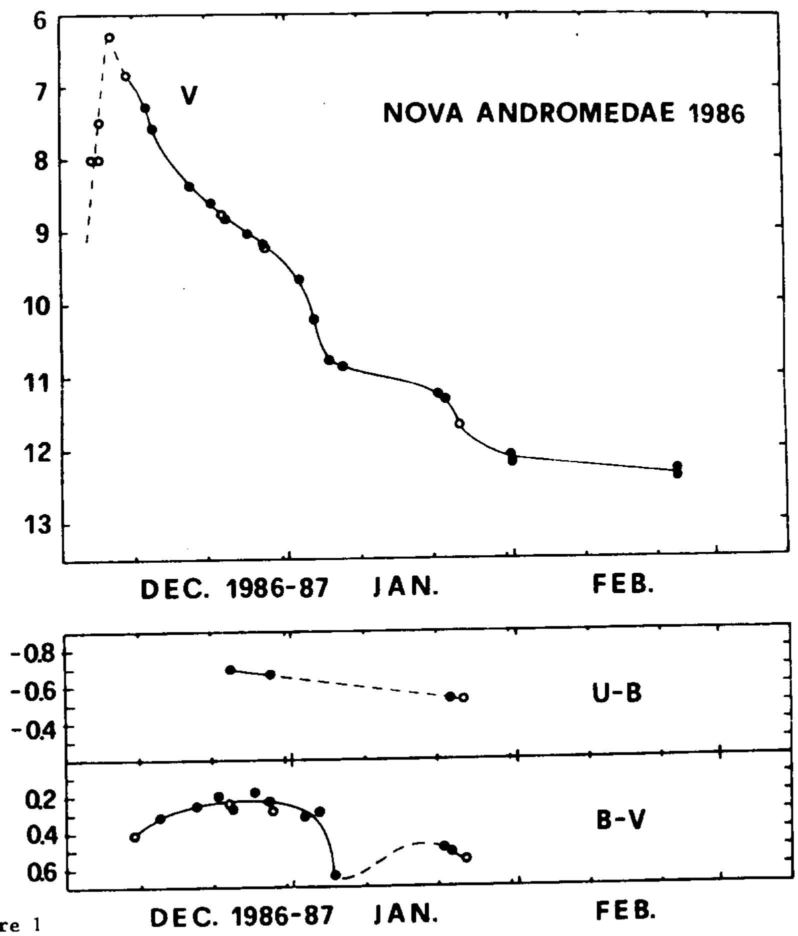

Figure 1

emission bands in the spectrum of the star (L. Rosino, personal communication), following the usual behaviour of Novae in this evolutionary phase.

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Reference:

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EMISSIONS OBSERVED ON OBJECTIVE-PRISM SPECTROGRAMS

In the course of inspection of old objective-prism plates, emission features in several spectra - most probably related to late-type stars - were discovered. Since some of them are rather unusual in appearance, we consider it necessary to report our observations.

The stars in question are listed below. For three of them the BD-numbers are indicated; for the rest indentification charts are given. The stars are located in the direction of OB galactic associations.

Kodak-plates were taken in October 1974 on the 70-cm meniscus telescope of the Abastumani Astrophysical Observatory (USSR) by means of an 8^{o}-objective prism. The reciprocal dispersion at H_{γ} is 166 Å/mm; the spectra were widended to 0.4 mm, their extent being from H_{β} up to 3500 Å. Well-exposed spectrograms were obtained for stars from about 8 to 11 photographic stellar magnitude.

The author would be pleased to offer a more detailed information (including registrograms when possible) to anybody interested in these objects.

List of the observed stars with description of their spectra:

BD 62^{o}0161. Peculiar spectrum with very strong bands of TiO; a number of strong emission lines present, incl. H_{β} , H_{γ} , H_{ς} , Ca I - very strong in absorption. Possibly a symbiotic star.

BD 58^{o}0109. The spectrum is rather weak; nevertheless, several emissions are clearly distinguished. The star is probably late-type.

BD 63^{o}0003. Very peculiar spectrum with very strong bands of TiO and many emission lines, incl. H_{β} , H_{γ} , H_{δ} . Probably a symbiotic star.

No.1 id. shart (star A is BD 33^{o}4186, star B is HD 201668). Late spectral type, probably Me. Emissions in H_{γ},H_{δ}.

No.2 id. chart (star A is BD 56°2679, star B is HD209296).
Strong emission lines, incl. H_β , H_γ , H_δ . Late-type variable.

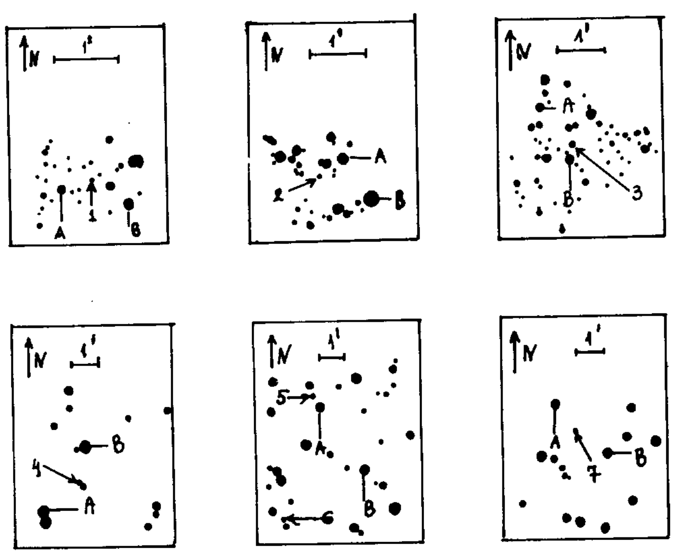
No.3 id. chart (star A is BD 58°2561, star B is HD 218997).
Balmer series in emission; late-type variable, possibly a symbiotic star.

No.4 id. chart (star A is BD 58°0089, star B is BD 59°0092).
Strong bands of TiO. Long-period variable?

No.5 and No.6 id.chart (star A is BD 61°0038, star B is BD 60°0025). M-spectra with strong bands of TiO and a number of emission lines. Probably long-period variables.

No.7 id. chart (star A is BD 59°0138, star B is BD 59°0132).
Similar to No.5 and 6.

IDENTIFICATION CHARTS:



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PX Cep: A NEW LARGE AMPLITUDE ECLIPSING BINARY

PX Cep (=GR 31) was discovered as an eclipsing binary by Romano (1958). Later Romano (1962) published a list of times corresponding to a brightness fainter than normal on photographic plates. The star was named as PX Cep (Kholopov et al., 1978). The fourth edition of the General Catalogue of Variable Stars (Khopolov et al., 1985) refers only to one time of minimum from Romano's list.

Visual observations made by the author from 1983 to 1985 confirmed the eclipsing nature of PX Cep and provided a first preliminary ephemeris for this large amplitude (visually about 2.7 magnitude) EA star.

During 5 nights in 1985 and 4 nights in 1986, PX Cep was measured photoelectrically, jointly with other stars from GEOS and Hipparcos programmes. Results on one of these stars (NSV 12040) were already published by the author (1986). The measures were made with a cooled photometer equipped with filters of the Geneva photometric system, attached to the Jungfraujoch Observatory's 76 cm telescope. 24 BV measurements of PX Cep were obtained (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 Geneva system into Johnson and Morgan's system was made using Meylan and Hauck formulae (1981).

A photoelectric time of minimum in 1985 along with a descending branch recorded in 1986, enables us to confirm the first visual ephemeris. Also using 7 visual times of minimum and Romano's photographic one, I obtained, by means of a leastsquares procedure, more accurate light-elements for PX Cep:

$$\text{Min I} = \text{Hel. J.D. } 2446270.440 + 3^{d}.126993 \cdot E$$
$$\pm 6 \qquad \pm 6$$

V and B-V light curves are constructed using the ephemeris above (see Fig.1). Only the measures between phases 0.8 - 1.2 are plotted.

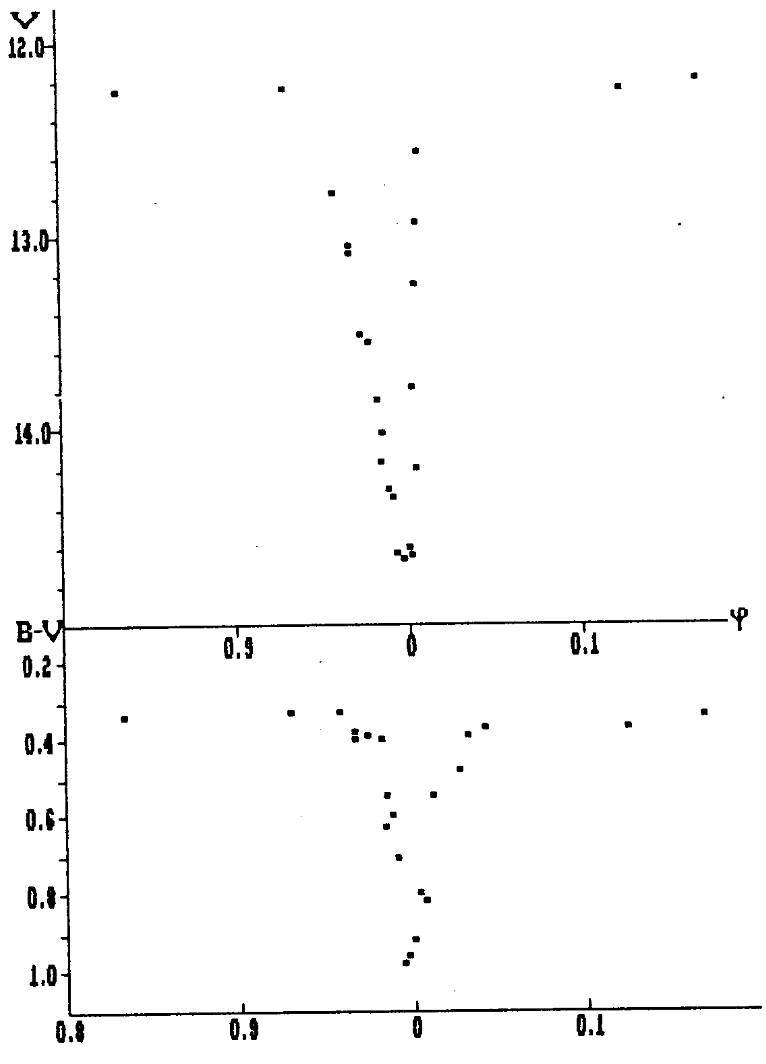

Figure 1: V and B-V light curves of PX Cep, between phases 0.8-1.2 according to the ephemeris of this paper.

Table I : V and B-V measures of PX Cep with phase according to the ephemeris of this paper.

hel.J.D 24 46000+	V	B-V	φ
259.4812	12.31	0.32	0.495
260.5361	12.24	0.33	0.833
264.5751	12.24	0.36	0.124
270.3670	13.52	--	0.976
.3815	13.82	0.38	0.981
.3913	14.02	0.54	0.984
.4010	14.29	0.59	0.987
.4093	14.33	0.70	0.990
.4288	14.64	0.95	0.996
.4378	14.60	0.91	0.999
.4656	14.18	0.81	0.008
.4885	13.77	0.54	0.015
.5142	13.24	0.47	0.024
.5378	12.92	0.38	0.031
.5670	12.56	0.37	0.040
271.5850	12.28	0.34	0.366
642.4179	12.77	0.32	0.957
.4471	13.08	0.37	0.966
.4672	13.50	0.38	0.973
.5005	14.15	0.62	0.983
.5318	14.63	0.97	0.993
.5561	14.63	0.79	0.001
645.5728	13.05	0.39	0.966
648.5841	12.23	0.32	0.929
655.5864	12.19	0.33	0.168

The star varies from 12.25 to 14.65 in V-light. The B-amplitude is 3.0 magnitude. From an inspection of the light curve, I estimate: D ≃ 8 hours and d ≤ 0.5 hours. No secondary minimum could surely be detected, because the photoelectric measures are very scanty outside primary eclipse and visual estimates do not show variation greater than 0.2 magnitude around phase 0.5.

The 2.4 V amplitude of the light variation and the B-V curve suggest a system composed of a main sequence A star with a giant K star. The limb-darkening effect is also visible. These parameters are somewhat inaccurate due to the paucity of measurements all along the period and due to the low signal/noise ratio during primary eclipse.

Further investigations will be published in a future GEOS Circular on Eclipsing Binaries.

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Request for VRI photometry of the RS CVn type binary HD 26337 during 15. through 30. December 1987

Observers in the northern and southern hemisphere at *all geographic longitudes* are begged to obtain VRI photometry of HD 26337, a relatively bright (V_{max} = 6.9 mag) spotted RS CVn type binary with a 1.94 day period. For more specific information on this interesting star see Table 1 and Fekel *et al.* (1987), and Hall *et al* (1987); a V-light curve can be found in the latter reference.

We are going to apply the Doppler Imaging technique (Vogt and Penrod, 1983) to this star during a 10-day run at Kitt Peak National Observatory from 18. - 23. and 26. - 29. December 1987 and we need simultaneous observed lightcurves in order to (i) obtain an independent spot-model solution from the photometric data to prove and compare it with the solution derived from Doppler Imaging, (ii) derive the spot temperature from the V-I color curve and (iii) combine both solutions to a more accurate and *unique* spot map of HD 26337. If successful, this would be the first time that a spot model is applied to both light and color curves *and* high-resolution line profiles observed at the *same* time ! We hope this will also demonstrate more quantitatively to which extend older spot-model solutions derived from photometry *alone* were affected by the non-uniqueness problem.

What do we need ? Several things should be considered by a photometrist who might wish to observe HD 26337. The photometry should be done either in the Johnson VRI or in the Kron-Cousins VRI standard system. Observers with a Solid-State Photometer (e.g. the SSP-3 from Optec Inc.) are also encouraged to participate, their RI-filters are designed to match the standard Johnson system. Please determine your own transformation coefficients, so that magnitudes on your instrumental system can be transformed to one of the above mentioned standard systems; follow the outlinings in Hall (1983), Hall and Genet (1982) or Sanders and Persha (1983). Another important point is that the observations should be carried out through the whole night (or so). HD 26337 has a photometric (and orbital) period of nearly 2.0 days, that makes it very difficult to obtain good

Table 1
Observational properties

Var. star: HD 26337 = BD-8°801
α=04^{h}07^{m}15^s, δ=-08°01'27" (1950.0)
$m_V(max)$=6.9 mag, amplitude in V ~0.20 mag
spectral type G5 IV
photometric period 1.945 days
orbital period 1.94722 days

Comp. star: 37 Eri = HD 26409 = BD-7°758
α=04^{h}07^{m}56^s, δ=-07°03'12" (1950.0)
m_V=5.6 mag, spectral type G5

Check star: BD-9°843
α=04^{h}09^{m}32^s, δ=-08°57'55" (1950.0)
m_V=6.6 mag, spectral type G5

Standard stars: Please chose from *The Astronomical Almanac* for standards on the Johnson system, or from Fernie (1983), and references therein, if you observe in the Kron-Cousins system.

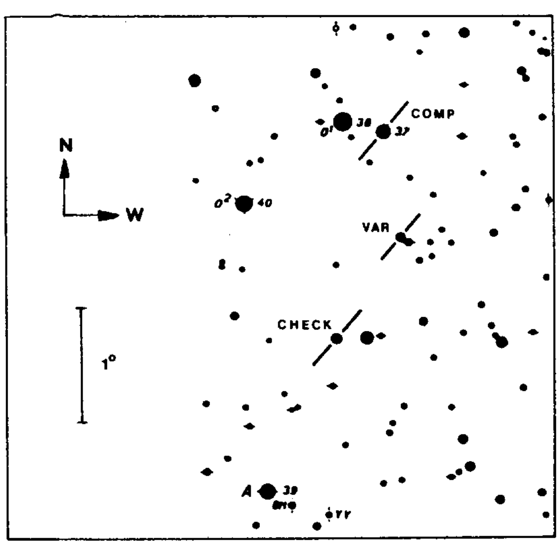

Fig.: 1 Finding chart for the stars in Table 1 phase coverage. Moreover, the spot behavior is changing so fast (see Hall *et al.* 1987) that no more than $\approx$ 5 - 10 rotation cycles should be combined. These requirements can be only fullfilled if several observers at *different* geographic longitudes are observing simultaneousely. Therefore, our request goes especially to observers in Europe, Africa, Asia, Australia and in the Pacific, but also to observers in the United States. Well equipped *amateur-astronomers* are especially welcome and are also invited to participate in this campaign. If you can use only V on your photometer, please go ahead, these observations would be very valuable too. Finally, we plan to publish the photometric results in a separate I.B.V.S. and/or I.A.P.P.P. paper with all contributors as authors. If you decide to help us and want to observe HD 26337, please use the comparison and check star listed in Table 1 and identified in the accompaning finding chart.

Please feel free to write for more information to me or Doug Hall at Dyer Observatory.

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FLARES OF HD 97766

TT Hydrae was observed in UBV colours using a photoelectric photometer attached to the 35-cm Cassegrain telescope at Yunnan Observatory during April 15 to May 24 (UT) in 1987. HD 97766 and HD 97637 were used as the comparison star and the check star, respectively. The UBV bands are close to the Johnson standard system, 20 sec integration time for each colour and 38" diaphragm were employed.

Flares of HD 97766 (=CD $-26^{\circ}8440$; m_V = 8.5; G5) had been found on May 7 and May 9 (UT).

HD 97766 was observed in BV colours on May 7 from 12^h59^m to 15^h58^m UT and in UBV colours on May 9 from 14^h26^m to 15^h53^m UT. The obtained differential magnitudes in the sense of HD 97637 - HD 97766 are listed in Table I and Table II, and plotted in Figure 1 and Figure 2, respectively.

Table I

BV photoelectric observations of HD 97766, 1987 May 7 (UT)

G.M.T.	ΔV mag	G.M.T.	ΔB mag
$12^h59^m.7$	0.601	$13^h00^m.1$	-0.058
13 07.9	0.620	13 08.5	-0.062
13 16.2	0.638	13 16.7	-0.035
13 31.1	0.634	13 31.6	-0.055
13 38.6	0.628	13 39.1	-0.021
13 45.9	0.643	13 46.4	-0.017
13 53.2	0.622	13 53.7	-0.039
14 01.5	0.633	14 02.2	-0.040
14 09.5	0.609	14 10.0	-0.063
14 16.7	0.602	14 17.2	-0.061
14 35.8	0.615	14 36.4	-0.062
14 46.8	0.630	14 47.5	-0.050
14 55.5	0.611	14 56.1	-0.066
15 06.2	0.601	15 06.6	-0.047
15 13.7	0.874	15 14.2	0.238
15 21.7	0.640	15 22.2	-0.052
15 29.9	0.624	15 30.5	-0.045
15 39.2	0.633	15 39.8	-0.041
15 48.2	0.617	15 48.7	-0.056
15 56.8	0.620	15 57.2	-0.061

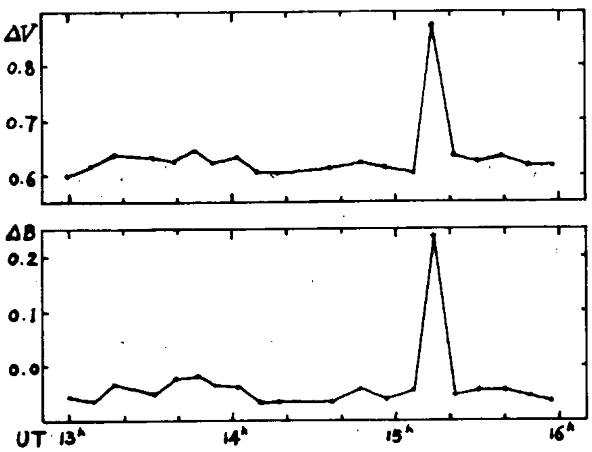

Figure 1

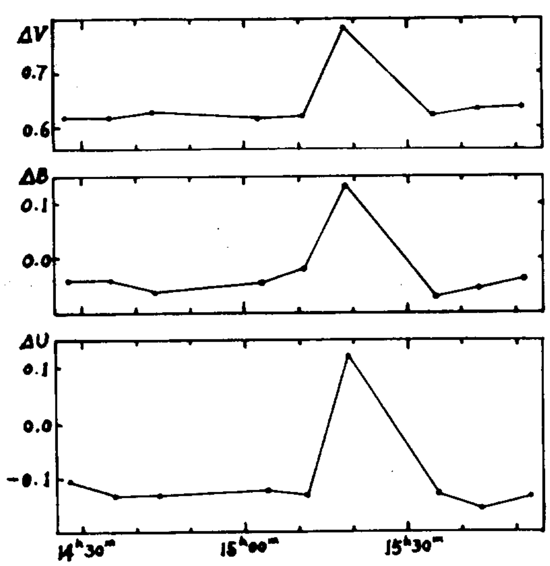

Figure 2

Table II

UBV photoelectric observations of HD 97766, 1987 May 9 (UT)

G.M.T.	ΔV mag	G.M.T.	ΔB mag	G.M.T.	ΔU mag
$14^h26^m.7$	0.617	$14^h27^m.2$	-0.041	$14^h27^m.8$	-0.108
14 35.0	0.618	14 35.6	-0.042	14 36.1	-0.133
14 42.9	0.629	14 43.4	-0.062	14 43.9	-0.131
15 02.6	0.618	15 03.1	-0.046	15 03.9	-0.124
15 10.5	0.622	15 11.0	-0.018	15 11.6	-0.131
15 18.2	0.782	15 18.7	0.136	15 19.2	0.118
15 34.7	0.621	15.35.2	-0.071	15 35.8	-0.130
15 42.5	0.632	15 43.1	-0.055	15 43.8	-0.156
15 51.0	0.637	15 51.5	-0.037	15 52.8	-0.134

The recorded amplitudes of the flares in UBV bands, Δm_V, Δm_B, Δm_U and the errors of observation in a single intergration in UBV bands, σ_V, σ_B, σ_U are given in Table III.

Table III

The recorded amplitudes of the flares and the standard deviations of observation in a single integration

	G.M.T.	Δm_V	σ_V	Δm_B	σ_B	Δm_U	σ_U
May 7,	15^h14^m	0.252	±0.013	0.287	±0.014	---	---
May 9,	15^h19^m	0.157	±0.007	0.183	±0.016	0.249	±0.013

Our observations indicate that the amplitude of the flare in U band is larger than in V band.

More observations would be desirable.

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VRI PHOTOMETRY OF LMC SN 1987A

Photometric observations of SN 1987A were done using 40 cm reflector during the period February 28 to March 10 at Vainu Bappu Observatory, Kavalur. Photometric system consisted of water cooled EMI 9658 R, photomultiplier tube operating at 1500 volts, a strip chart recorder and an amplifier. Observations were done through VRI filter combinations of Fernie (1974). The object was most of the time within 10 degrees of the horizon. HR 1859 and HR 1744 were used as comparisons. The measurements were transformed to the Johnson system through observations of standard stars. We used Raveendran's photometric reduction programs and arrived at a V magnitude of 4.5±0.04 around March 2 and 4.2±0.04 around March 9. We obtained V-R = +0.48±0.03 and R-I = +0.42±0.03. The values quoted are mean values for a period of 4 days each.

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VARIABLE SHELL STRENGTH OF PLEIONE (BU Tau)

The peculiar shell star Pleione (28 Tau, B 8 V) is the most interesting Be star. This star has been the subject of a number of investigations, possessing the very long recorded spectroscopic history. Since 1880, this fascinating object has undergone through different phases (Be ⟶ B ⟶ Shell ⟶ Be ⟶ Shell). This star showed the Be phase from 1888 to 1903 (Pickering, 1889-90; Merrill, 1953). The observations from 1905 to 1936 revealed it to be a normal B star (Frost, 1906; Merrill, 1953). From 1938 to 1954 this star experienced a strong shell phase with maximum shell intensity during 1945-46 (McLaughlin, 1938; Mohler, 1938; Struve and Swing, 1943; Merrill, 1953).

From 1954 a new Be phase started for Pleione which persisted till 1972, with maximum intensity during 1960-1963 (Delplace and Hurbert, 1973; Morgan et al., 1973). The last shell phase of Pleione, which is still persisting, started in 1972 (Gulliver, 1973). Since 1972 the shell strength, as derived from lines, was found continuously increasing (Hirata and Kogure, 1976, 1977, 1978; Katahira and Hirata, 1984).

This shell star possesses unusual large Balmer jump implying strong near-ultraviolet deficiency. Goraya (1985) analysed the behaviour of its Balmer jump from 1975 to 1981. In the present study we have combined our new spectrophotometric measurement of the continuum ($\lambda\lambda$3200-5500 Å) with earlier observations (Goraya, 1984). We have investigated the variation of the shell strength as derived from the flux deficiency at the Balmer continuum in the near-ultraviolet region.

The present observations were made during 2 November, 1982 in the wavelength range $\lambda\lambda$3200-5500 Å. We used a Hilger and Watts scanner at the cassegrain focus (f/13) of 104-cm reflector of Uttar Pradesh State Observatory, Nainital. An exit slit admitting 50 Å of the spectrum was used. The photomultiplier EMI 9658B and standard dc techniques were employed for detecting and recording the signal.

The instrumentation and observational procedures are described by Goraya (1985). Along with Pleione, the comparison star 18 Tau (B 8 V) and the standard star α Leo were also observed. The observations of Pleione and 18 Tau were reduced to standard magnitudes with the help of the standard stars; absolute calibration given by Taylor (1984). The standard deviation of the measurements is ± $0^m.03$.

The differential magnitudes (Δm) of Pleione (Pleione-18 Tau) were computed and are compared with earlier measurements as shown in Figure 1.

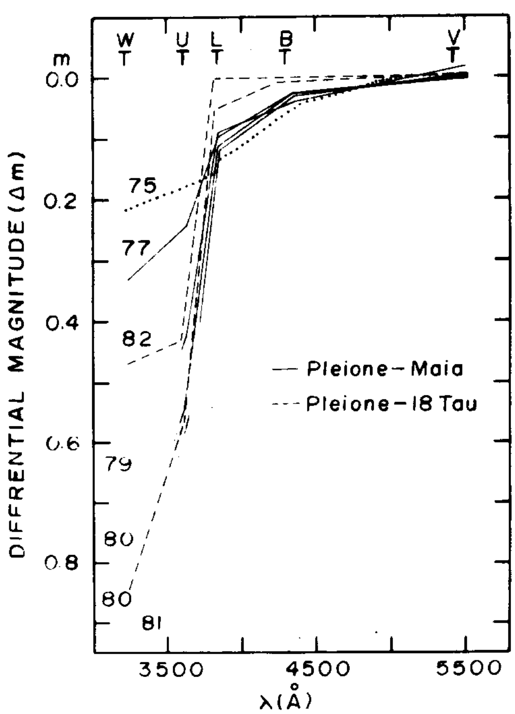

Figure 1: Variation of Balmer jump in Pleione

It is obvious that since 1975 there is a gradual increase in differential magnitudes of Pleione. The highest value reached during 1981, followed by a rapidly decreased value during 1982. This shows that the shell strength of Pleione increased gradually from 1975 to 1981 followed by a sharp decrease onwards. To understand the variation of the shell strength better, we have also plotted the differential magnitudes of Pleione at two wavelengths i.e. Δm_{3300} and Δm_{3600}, as a function of time (cf. Figure 2).

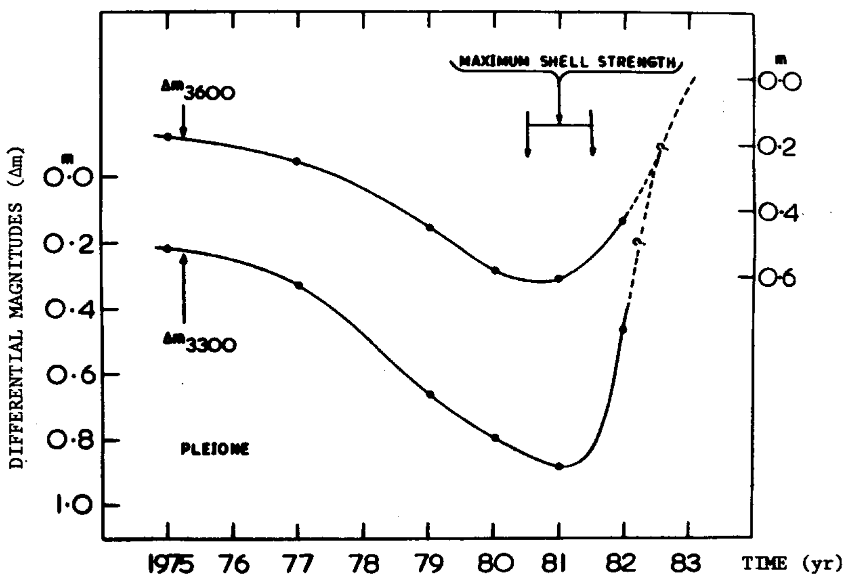

Figure 2: Variation of differential magnitudes of Pleione

It can be infered from this figure also that Pleione gained regular increase in shell strength since 1975 with maximum intensity during 1981, after which the strength started decreasing faster.

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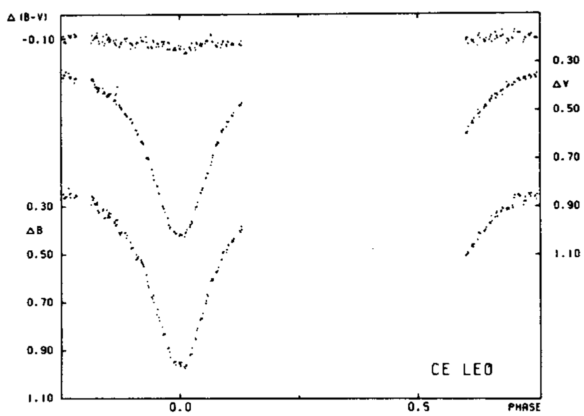
B, V, R, I OBSERVATIONS OF CE LEONIS

The very short period eclipsing binary system CE Leo (S 7763) was discovered by Hoffmeister (1963). Finder charts are included in his paper. Meinunger and Wenzel (1968) give 21 visual times of minimum light as well as visual light curve. Other visual epochs of minimum light appear in BBSAG Bulletins No. 9, 14, 15, 21 and 37. Two photoelectric epochs of minimum light have been determined by Hoffman (1983).

The present observations were made on the nights of January 31 and February 1, 1987. The 0.9m #2 reflector at Kitt Peak National Observatory was used with a photometer which housed standard B,V,R,I filters in the Cousins system (Bessell, 1976) and a dry-ice-cooled RCA 31034a Ga-As photomultiplier tube. The positions of the check, comparison and variable stars are given in Table I. Neither the check nor the comparison star has a known catalogue identification. Approximately 200 observations were made at each effective wavelength in the phase interval 0.6 - 0.1. The B, V, R, I observations of CE Leo defined by the individual observations are shown in Figure 1 as Δm versus phase.

Table I

STAR	R.A. (1950)	Dec. (1950)
CE Leo	$11^h41^m27^s$	23°37'
Comparison	$11^h41^m10^s$	23°34'
Check	$11^h41^m05^s$	23°39'



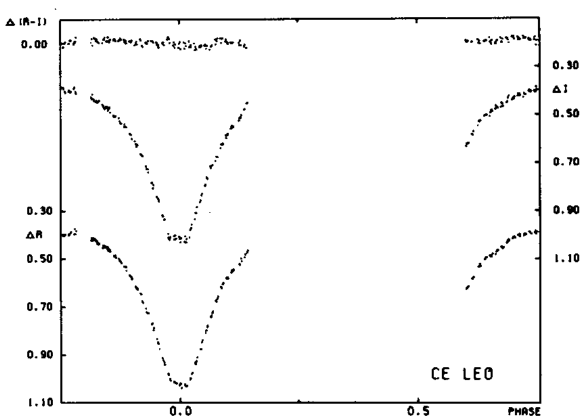


Fig. 1 - Light curves of CE Leo defined by individual observations.

Times of minimum light were determined in all four colors from the observation of one primary eclipse. An iterative technique based on the Hertzsprung method (1928) was utilized. The mean of these four times (p.e. = ±0.0002) is listed in Table II along with Hoffman's (1983) data.

Table II

Photoelectric Epochs of Minimum Light, CE Leo

JD Hel. 2440000+	Cycles	(O-C)	Source
5044.5495	-5877.5	-0.0002	Hoffman
5047.4325	-5868.0	0.0002	Hoffman
6828.0131	0.0	-0.0000	Samec

The ephemeris published by Meinunger and Wenzel (1968, MVS 1966), is JD Hel. Min I = 2437651.650 + $0^{d}.3034286E$. Since this set of light elements does not satisfactorily represent the present data, a new ephemeris was calculated. Using the period from the ephemeris given by Meinunger and Wenzel and the epoch determined from the present observations, the three available photoelectric times of minimum light were introduced into a least squares solution. The resulting ephemeris,

JD Hel Min. I = 2446828.0131 + $0^{d}.30343912E$

was employed in calculating the O-C's in Table II and the phases of the present observations.

Additional photoelectric data are needed to improve this ephemeris.

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A POSSIBLE NEW BINARY STAR IN SAGITTARIUS

In a recent paper, Campos and Sanchez (1987) reported the variability of six new variable stars in the constellation of Sagittarius. These discoveries were carried out in photographic plates dating from 1942 to 1954, but their report did not include the type of variability of each star.

The present paper reports the variability of one of these stars, ("B"), with the following coordinates; RA = $18^h40^m26^s$, DEC = $-29^o6'6''$ (2000), based on the same photographic material utilized by Campos and Sanchez (1987). The variability of the star is striking since it appeared in some plates with equal brightness when compared to the same standard plate (BM 111) used by Campos and Sanchez (1987) and it did not appear in some other plates. Since the limit of detectability on the 60 min exposed plates is of about 14 mag, it was safely concluded that at certain times the star was fainter than this magnitude.

The entire collection of plates with exposures times of 50 and 60 minutes was compared with respect to the BM 111 plate and the results are presented in Table I and shown schematically in Figure 1. From the light curve of the "B" star it can be concluded that it might be an eclipsing binary with an amplitude of variation larger than 2 magnitudes and a period of about seven years.

Recent observations, at the 1.5 m telescope of San Pedro Martir Observatory carried out with the Danish photometer, on the night of June 21-22, 1987 indicate that the V magnitude of this star in that time was of 12.54 mag.

Of course, the material available does not exclude another type of variability, such as a flare star or a nova-like object, particularly because of

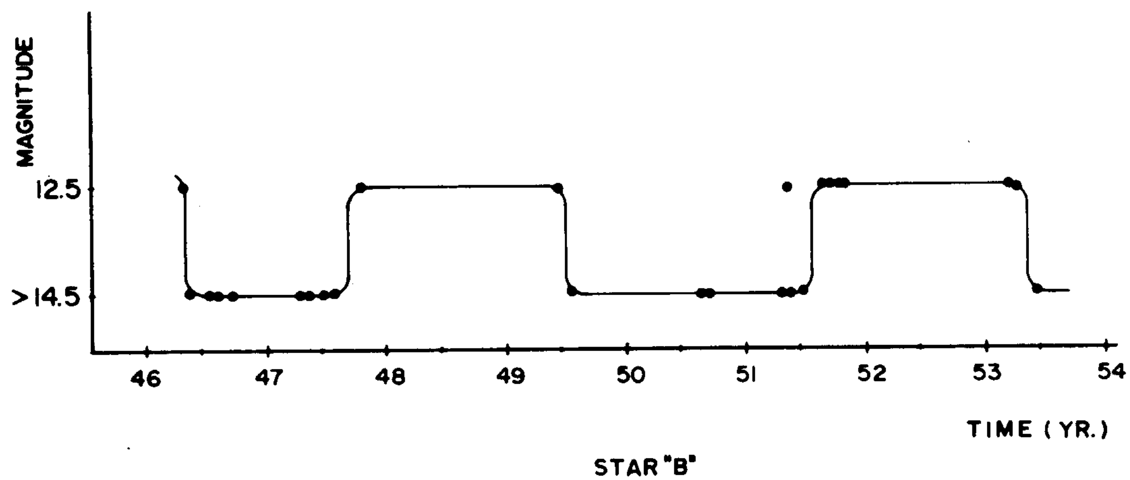

Figure 1

Light curve of the suspected variable star. When the star was visible a visual magnitude of 12.5 was assumed. At other times it was fainter than 14 mag., the detection limit. To convert the x axis into years, add 1900. The continuous line is an eye-ball free-hand fit through the points.

Table I. Log of observations of the suspected new variable star. In the column denoted by E, Y indicates that the star was visible, N that was not detected.

	DATE	PLATE	EXPOSURE TIME (MIN)	E
1942	Apr. 9-10	BM 111	60	Y
1946				
	Apr. 1-2	1127	60	Y
	3-4	1134	60	Y
	5-6	1143	60	Y
	6-7	1146	60	Y
	7-8	1149	60	Y
	May 30-1	1151	60	N
	Jun. 22-23	1157	50	N
	25-26	1158	60	N
	25-26	1159	50	N
	25-26	1160	50	N
	25-26	1161	50	N
	25-26	1162	50	N
	25-26	1163	50	N
	26-27	1165	50	N
	26-27	1166	50	N
	26-27	1167	50	N
	26-27	1168	50	N
	27-28	1169	50	N
	27-28	1170	50	N
	27-28	1171	50	N
	27-28	1172	50	N
	27-28	1175	50	N
	Jul. 26-27	1177	60	N
	27-28	1179	60	N
	Aug. 29-30	1191	60	N
1947				
	Mar. 26-27	1318	60	N
	Apr. 16-17	1319	60	N
	21-22	1321	60	N
	Jun. 14-15	1326	60	N
	Jul. 9-10	1331	60	N
	15-16	1332	60	N
	Sep. 16-17	1344	60	Y
1950				
	Aug. 6-7	1433	50	N
	9-10	1435	60	N
	10-11	1436	50	N
	11-12	1437	60	N

Table I (cont.)

	DATE	PLATE	EXPOSURE TIME (MIN)	E
1951				
	Apr. 10–11	1464	60	N
	12–13	1465	50	N
	17–18	1466	60	Y
	May 3–4	1469	60	N
	6–7	1471	60	N
	7–8	1472	50	N
	Jun. 7–8	1477	50	N
	7–8	1472	50	N
	Aug. 6–7	1489	60	Y
	27–28	1439	60	Y
	Sept. 25–26	1498	60	Y
	27–28	1499	60	Y
1953				
	Mar. 11–12	1664	60	Y
	16–17	1666	60	Y
	17–18	1667	60	Y
	19–20	1668	60	Y
	23–24	1669	60	Y
	25–26	1671	60	Y
	Apr. 23–24	1679	60	Y
	May. 18–19	1683	60	N

the existence of only one isolated visible point in April, 1951, surrounded by five undetectable points all taken in about the same epoch. Therefore, more observations are needed for the accurate determination of the real nature of this star.

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Optica y Electronica

Reference:

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UBV PHOTOMETRIC OBSERVATIONS OF DY PEGASI

DY Pegasi is a well known dwarf cepheid. The variability of this star was discovered by Morgenroth (1934) and it was often observed to study the nature and the period of its light variations. The observations obtained and the investigations published between 1934 and 1980 were summarized by Mahdy and Szeidl (1980). Soloviev (1938, 1940) who determined the first elements of the light variation of this star, indicated that the star had strong light curve variation. This variation was especially considerable in heights of light maxima (0.3 magn.). Although Lange (1944) questioned it, later on Grigorevsky and Mandell (1960) found significant light curve variation and suggested a period of 0.2554 day for this secondary variation. (This modulation period yields a period of 0.0567 day for the first harmonic mode and a period ratio $P_1/Po = 0.778$.) Modern photometric observations (Masani and Broglia, 1954; Hardie and Geilker, 1958; Broglia, 1961; Geyer and Hoffmann, 1975) have shown some non-repetitive character from cycle to cycle of the light curves but the changes in the heights of maxima have never exceeded 0.05 magn. Karetnikov and Medvedev's (1964) photometric observations, however, showed that the form of the light curve of DY Peg changed significantly and very rapidly. According to their investigation the variations in the amplitude exceeded 0.4 magn. Karetnikov and Medvedev proposed a period of 0.255413 day for the secondary variation.

The period changes of DY Peg have been discussed by Quigley and Africano (1979) and by Mahdy and Szeidl (1980) in detail. In the latter study about 100 times of maxima of DY Peg observed by photographic or photoelectric method have been collected and analyzed. The O - C residuals could be almost equally well approximated either by two straight lines or by a quadratic formula. In the first case the period has been constant with a sudden decrease of 7.5×10^{-8} day = -6.5 ms around J.D. 2437500 while in the other case the period has continuously decreased by -7.6×10^{-13} day·cycle^{-1}= 0.33 ms·year^{-1}.

Since both problems, the multiple periodicity and period changes of DY Peg which are essential in investigating the physics of dwarf cepheids are unsolved we decided to observe the star again in order to carry out a new period analysis and to investigate the possible light curve variation.

The 453 photoelectric observations were made at Kottamia Observatory, Egypt on the nights 2/3 , 3/4 , 4/5 and 6/7 August 1986 (J.D. 2446645, 2446646, 2446647 and 2446649). The one beam photoelectric photometer attached to the 74 inch telescope had an EMI 9558B photomultiplier. The amplified output of the tube was fed into a strip chart recorder. The U, B and V filters used were very close to the standard system of Johnson and Morgan. A number of standard stars were also observed to determine the extinction coefficients and the transformation constants. The star BD + 16^{o}4878 served as the comparison and BD + 16^{o}4876 as the check star.

The light curves observed in V and B light are shown in Figures 1 - 4. As can be seen from these figures the light curves are repeated fairly regularly but they also show some non-repetitive character from cycle to cycle. In the last three columns of Table I we have also indicated the brightness of the observed maxima in all the three colours as compared to the comparison star. Although the deviations are certainly larger than the observational errors, the variation at maximum in every colour is less than 0.04 magn. In a forthcoming paper we will carry out a detailed period analysis searching for secondary oscillation in this star.

From our observational material we could derive eight new times of light maximum of DY Peg and we extended the baseline of coverage to 48 years. These

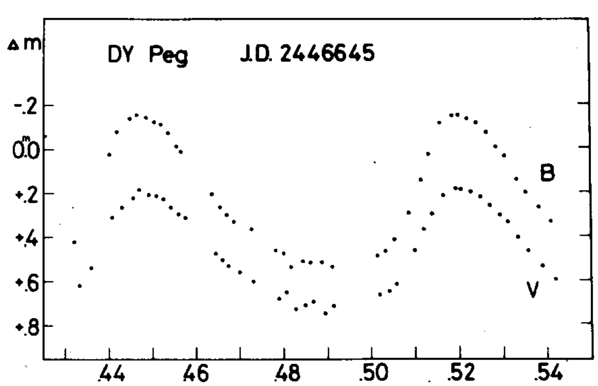

Figure 1

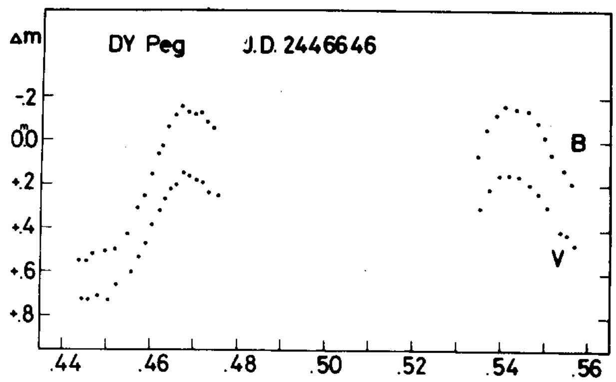

Figure 2

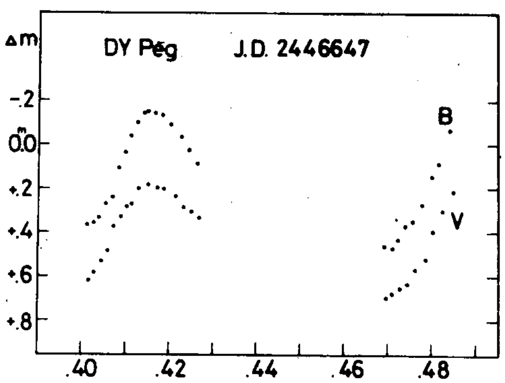

Figure 3

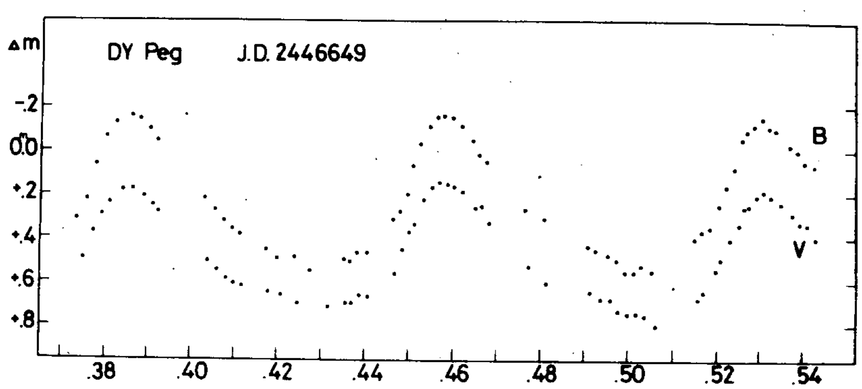

Figure 4

times of maxima are listed in Table I. We have not found any significant shift in time between the yellow, blue and ultraviolet maxima therefore each time of light maximum given in Table I is a mean value obtained from the yellow, blue and ultraviolet light curve.

Table I

Observed times and heights of maxima of DY Peg

Hel. max. J.D. 2446000+	E	$(O-C)_\ell$	$(O-C)_s$	ΔV_{max}	ΔB_{max}	ΔU_{max}
645.4466	190514	-0.0004	+0.0001	+0.186	-0.157	-0.061
645.5195	190515	-0.0004	+0.0001	+0.180	-0.155	-0.060
646.4675	190528	-0.0005	0.0000	+0.147	-0.153	-0.042
646.5408	190529	-0.0001	+0.0004	+0.147	-0.161	-0.034
647.4155	190541	-0.0005	0.0000	+0.181	-0.151	-0.037
649.3849	190568	-0.0001	+0.0004	+0.167	-0.161	-0.042
649.4578	190569	-0.0001	+0.0003	+0.148	-0.153	-0.038
649.5307	190570	-0.0002	+0.0003	+0.185	-0.145	-0.035

The list of light maxima given by Mahdy and Szeidl (1980) has been supplemented by the times of maxima of Table I and both linear and second order least - squares solutions have been carried out.

Mahdy and Szeidl (1980) suggested that a sudden decrease in the period of DY Peg might take place around J.D.2437500 therefere we used only those light maxima to the linear fit which have been observed since that time. The least-squares solution gave the linear ephemeris:

$$C_\ell\text{(Max. hel.)} = \text{J.D. } 2432751.9655 + 0.^{d}072926302\cdot E$$

If the period had really a sudden change around J.D. 2437500, and before and after it the period was constant, the value of the period change was

$$\Delta P = -7.0 \times 10^{-8} \text{ day.}$$

The second order fit using all the maxima observed photographically or photoelectrically yielded the following formula:

$$C_s\text{(Max. hel.)} = \text{J.D. } 2432751.9614 + 0.^{d}072926365E - 2.^{d}31 \times 10^{-13}E^2.$$

In this case

$$\beta = -4.62 \times 10^{-13}\text{day}\cdot\text{cycle}^{-1} = -6.34 \times 10^{-12}\text{days}\cdot\text{day}^{-1} = -20.0 \text{ ms}\cdot\text{century}^{-1}.$$

The corresponding O-C residuals are given in Table I under the headings $(O-C)_\ell$ and $(O-C)_s$. At present we cannot decide which of the two approximations is correct. Further observations can only settle this important question.

The observation and investigation of DY Peg will be continued in the frame of the current observational program of dwarf cepheids at Kottamia Observatory.

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RECENT ONSET OF AN OUTBURST IN μ CENTAURI

μ Cen (HR 5193, HD 120324, MWC 229, B 2 IV-Ve, v sin i= 155 km/s) a member of the Sco-Cen association, is known as a pole-on Be star. The spectrum cyclically displays strong Balmer line emission. First Balmer emission in μ Cen was observed by Fleming (1890). Afterwards strong emissions, mainly in H_α, were observed by different observers in 1904, 1929 - 1931, 1940, 1953, 1962, 1967 and 1973 (Peters, 1979 and references therein). H_α emission was reduced to a central reversal in photospheric feature by June 1976 (Peters, 1979). In 1977 it became almost an absorption line and some flickering in the H_α emission, was observed by Dachs et al. (1981) which in November 1978 even increased to a flare like phenomenon. Again in June 1983 H_α was perfectly symmetric and virtually undisturbed and emission strength of this line had returned to a moderate level from almost zero in 1977/1978. From moderate emission it again came back to pure absorption till 25 March 1985 and on 27 March 1985 a centrally reversed emission (V < R, R < Icont) was observed by Peters (1986). Along with this emission phase a rapid variability (10-20 minutes) in the profile of photospheric He I 6678 A was also observed by her. After this episode μ Cen was in quiescence phase till 01 February 1987 and it started changing from absorption to emission from 02 February 1987. This reached to a maximum emission strength on 07 February 1987 (Baade, 1987). This type of onsets of emission phases alternating between periods of activity and quiescence,will throw important information for studying the ejection mechanisms of matter from the inner part of the star to the circumstellar envelope.

In this paper we present the results of recent outbursts in μ Cen. Spectroscopic observations of μCen in the H_α region (6400 - 6800 A) were obtained on several nights between March 1987 and April 1987 with Bhavanagar spectrograph using a grating of 1800 grooves/mm at the cassegrain focus of the 0.75 m reflector of Vainu Bappu Observatory, Kavalur, India. The reciprocal dispersion at H_α is 16 A/mm on 098 02 emulsion.

The spectrograms were digitized using PDS-1010M microdensitometer with a sampling interval of 5 μm. The laboratory comparison spectrum (Fe + Ar or Fe + Ne hollow cathode source) which were taken on both sides of the stellar spectrum, was used for wavelength conversion. All data reductions were done on a VAX - 11/780 computer using RESPECT software package (Prabhu et al., 1987). Obtained H_α profiles are shown in Fig. 1. In Fig. 1 the wavelength scale has been shown in an opposite way i.e. the wavelength decreases towards the arrow mark.

From Fig. 1. it is clearly seen that on 26 March 1987 the H_α profile has developed a weak central reversal emission. This central reversal has become very strong on 30 March 1987 according to our observation. Due to the clouds we were not able to take observations on 28, 29, 31 March and 01 April 1987. It may be possible that the strength of H_α central reversal emission was stronger on 29 or 31 March 1987. However this emission again came back to absorption on 02 April 1987. These types of outbursts look like non-periodic (from the available literature survey). But the fact may be that most of the mass loss occured outside of our line of sight to the star for which we are not able to get the correct picture. Peters (1986) has suggested that the outbursts maybe interpreted as an evidence for an abrupt large-scale ejection of matter and there may be a possible link between non-radial pulsations and mass loss in Be stars. Again Ando (1986) suggests that the quasi-periodic oscillation of the rotation profile by the wave-rotation interaction may be the most possible mechanism for episodic mass loss in Be stars. The episodic outbursts in μ Cen which is known as a non-radial pulsator (two retrograde sectoral modes of l= 2, 10, Baade, 1984), may be due to the interactions between high and low order sectoral modes (Vogt and Penrod, 1983, Smith and Penrod 1984). To explore the possible reason for episodic outbursts, it is necessary to observe the photospheric and envelope lines simultaneously. Preliminary results of our observations on H_α and He I 6678 A lines, have been presented in Table I.

From our results we find that the velocities of the ejected material are not uniform during the episodic phase. Also we find that the ejected materials are moving both away and towards the observer's line of sight to the star. Maximum velocity of the ejected material towards the observer is 77.6 km/s and that away from the observer is 39.4 km/s . During this outburst we find a a variable weak emission in the profile of He I 6678 A. Present observation suggests that this may be due to the selective mass loss from different latitudes of the star and this selective mass loss may be due to the interactions of different sectoral modes of non-radial pulsations of the star. More details

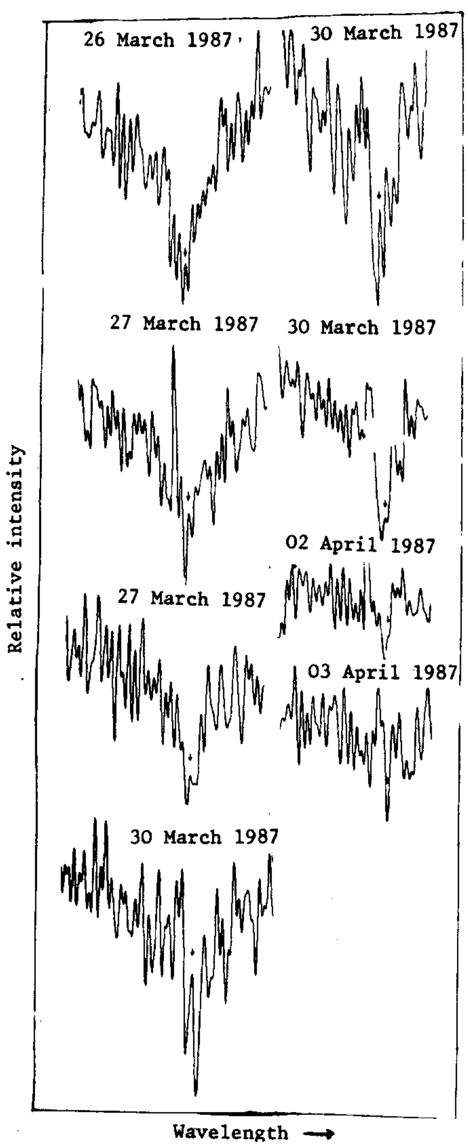

Fig. 1. Spectra of μ Cen in the H_α region. Date of observations have been mentioned along with each spectrum. Wavelength decreases along the right hand side i.e. towards the arrow mark. Vertical arrow marks indicate the peak point of the emission or the absorption minimum. All spectra have been expressed in terms of relative density.

and additional observations will be presented elsewhere. It is noteworthy to mention here that continued observation of μ Cen may provide certain clue to the burning problems of Be stars.

Table I

Date of observation and U T (start and end of exposure)	H_α (6562.817 A)			He I (6678.149 A)	
	Peak/Minimum wavelength (A)	V/R	E/A	Peak/Minimum wavelength (A)	E/A
26 March 1987 20:15 - 20:30	6561.43	< 1	E	6677.74	E
27 March 1987					
20:30 - 20:45	6562.51	< 1	E	6678.79	A
21:00 - 21:45	6563.29	< 1	E	6677.63	E
30 March 1987					
17:22 - 17:40	6562.82	> 1	E	6677.86	E
18:40 - 18:58	6561.35	< 1	E	6679.18	WE
19:07 - 19:22	6561.12	< 1	VWE	6677.40	A
19:30 - 19:45	6562.05	< 1	WE	6678.16	E
02 April 1987					
20:40 - 21:10	6563.68	-	A	6679.79	E
21:25 - 21:55	6562.51	-	A	6677.28	A
03 April 1987	6563.44	-	A	6677.70	E

E - Emission, WE- Weak emission, VWE- Very weak emission, A- Absorption

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DETECTION OF A NEW Be STAR - γ Lup

It is accepted in astronomical community that Be stars may be defined as non-supergiant early type stars showing Balmer emission lines in their spectra (Slettebak, 1979). Origin of the emission lines is from the extended gaseous envelopes surrounding the atmosphere of the central object. In general most of the Be stars are rapid rotators and they show irregular variability both spectroscopically and in magnitude. Line emitting envelope around the Be star may disappear for a long period of time, leaving the central star and the spectrum of the central star apparently looks like a normal absorption-line B-type spectrum. So, with this picture in mind, a Be star may be regarded as B-type star surrounded by gaseous envelope and the envelope has formed due to the material ejection from the central star or by mass transfer from a hypothetical companion in the suspected binary system. Now the question is that whether all B-type stars will become Be stars or not. If not all, what type of B stars are able to form gaseous envelope around it? Another information is essential in finding the elusive cause(s) for the Be phenomenon is that the time scale required for a star to make a transition from a normal B star to a Be star. Thus the study of the spectrum of a star which is in transition from a B-type to a Be star may provide important information for many major unsolved questions of Be phenomenon. Here we present a new spectrum of γ Lup (HR 5776, HD 138690, B2 IV, v sini = 320 km/s) which was a B-type star with rapid rotation. Spectroscopic observations of γ Lup in the H_α region were obtained on 22-25 March 1987 with the Bhavanagar spectrograph using a grating of 1800 grooves/mm at the cassegrain focus of the 0.75 m reflector of Vainu Bappu Observatory, Kavalur, India. The reciprocal dispersion at H_α is 16 A/mm on 09802 emulsion. Obtained spectra of H_α profiles are shown in Fig 1. In Fig. 1 the vertical arrows show the emission peaks within the absorption profile of H_α. In the H_α profile of γ Lup we find two to three emission peaks. Different peaks of central reversal of emission may be due to self-absorption of line radiation in the circumstellar envelope. The width of the H_α profile is very broad which may be due to strong electron scattering in the envelope. The wavelengths of different emission

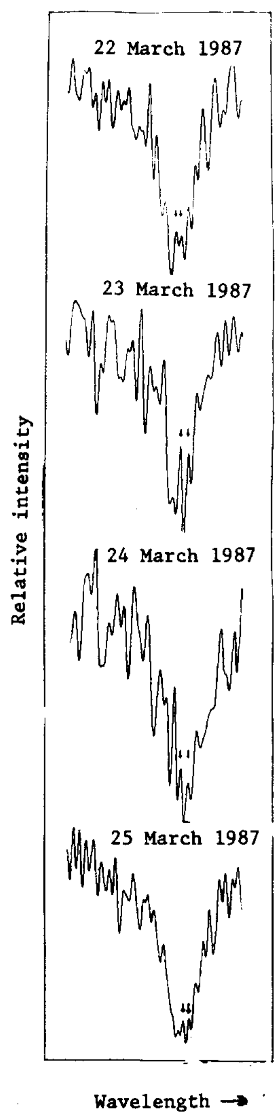

Fig. 1. Spectra of γ Lup in the H_α region. Data of observations have been mentioned along with each spectrum. Wavelength decreases along the right hand side i.e. towards the arrow mark. Vertical arrow marks indicate the peak point of the emission. All spectra have been expressed in terms relative density.

peaks are greater than 6562.817 A which indicates the material flow away from the line of sight of the observer to the star. This material flow may be mainly due to the mass ejection from the central star. At present we believe that high rotational velocity of γ Lup has played the important role for the material ejection from the star. This early type star which has undergone a transition from a B-type to Be may give a lot of important information for understanding the unsolved problems of Be phenomenon. Continued regular observation of this star is suggested.

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THE 68^th^ NAME-LIST OF VARIABLE STARS

The present 68th Name-list of Variable Stars compiled in the manner of 67th Name-list (IBVS №2681,1985) contains all data necessary for identification of 663 new variables finally designated in 1986. The total number of designated variable stars has now reached 29767.

The 68th Name-list consists of two Tables. Table 1 contains the list of new variables arranged in the order of right ascensions. It gives the ordinal number and the designation of a variable, its equatorial co-ordinates for the equinox 1950.0, the range of variability and the system of magnitudes used (sometimes the column "Min" gives in parentheses the amplitude of light variation), the type of variability according to the system of classification described in the forewords to the first three volumes of the 4th GCVS edition, as well as two references to the reference list which follows the Table 2. The first reference indicates the investigation of the star, the second one indicates the paper containing a finding chart or the corresponding Durchmusterung (BD, CoD, or CPD) containing the variable.

Compiling the list we had to introduce a new type of variable stars (R) entering the class of rotating variables.

R – close binary systems characterized by the presence of strong reflection (re-radiation) of the light of the hot star illuminating the surface of the cooler companion. Light curves are sinusoidal with the period equal to P_{orb}, maximum brightness coinciding with the passage of the hot star in front of the companion. The eclipse may be absent. The range of light variations is about $0^m.5 - 1^m.0$ V (KV Vel).

The notation "1.04" in the column giving information on the system of magnitudes used means the 1.04μm band of the system introduced by G.W.Lockwood.

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

We take an opportunity to correct a mistake found in the 67th Name-list (I.B.V.S. №2681, 1985): the star V1810 Cyg does not exist.

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Table I

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
001	IQ	Peg	$00^h 03^m 33^s$	$+29^\circ 02'.2$	15.42	17.15	B	RRAB	001	001
002	NN	And	00 04 21	+31 11.3	15.97	17.51	B	RRAB	001	001
003	NO	And	00 04 23	+31 45.4	16.46	17.17	B	RRC	001	001
004	NP	And	00 08 04	+33 50.3	15.29	16.10	B	EW/KW	001	001
005	NQ	And	00 08 57	+30 34.7	16.16	17.10	B	RRAB	001	001
006	BO	Hyi	00 20 25	−77 56.1	15.5	16.9	P	SR	278	128
007	NR	And	00 45 32	+37 05	14.8	16.0	P	RRAB	002	002
008	NS	And	00 46 20	+34 57.5	11.1	12.2	P	LB	002	002
009	BH	Cet	00 47 33	−17 52.5	13.9	14.9	P	CWB	076	076
010	NT	And	00 47 58	+37 18	15.9	16.6	P	RRC	002	002
011	AT	Psc	00 55 43	+31 24	15.6	16.7	P	EA	002	002
012	AU	Psc	00 57 09	+32 28	15.6	17.1	P	RRAB	002	002
013	NU	And	00 59 32	+33 28	16.3	16.8	P	RRC	002	002
014	NV	And	00 59 37	+37 39	15.3	16.3	P	LB	002	002
015	AP	Scl	01 03 32	−26 59.8	8.60	(0.03)	B	ACVO	227	CoD
016	V655	Cas	01 04 11	+49 08.6	13.4	15.0	V	SR:	015	
017	AV	Psc	01 04 37	+31 58	16.1	17.2	P	RRAB	002	002
018	AW	Psc	01 08 30	+30 22.0	14.7	(17	V	M	015	206
019	AX	Psc	01 09 26	+32 31	15.1	16.0	P	LB:	002	002
020	NW	And	01 10 39	+37 29	15.2	16.5	P	RRAB	002	002
021	NX	And	01 12 57	+39 30	14.3	15.7	P	RRAB	002	002
022	NY	And	01 14 53	+35 16	14.2	15.1	P	LB	002	002
023	BI	Cet	01 20 17	+00 27.2	8.08	8.30	V	RS	279	BD
024	NZ	And	01 20 52	+36 15	14.9	16.3	P	EA/SD	002	002
025	OO	And	01 28 05	+34 51.8	11.1	12.5	P	LB	002	002
026	OP	And	01 33 23	+48 28.1	5.92	(0.09)	V	BY	005	BD
027	AY	Psc	01 34 18	+07 01.1	15.2	16.6	P	NL	280	280
028	OQ	And	01 39 11	+39 09.6	7.64	7.73	V	LB	006	BD
029	BD	Phe	01 48 58	−50 27.2	5.90	5.94	V	DSCTC	079	CoD
030	BK	Cet	01 50 28	−17 10.5	5.73	5.81	V	DSCTC	079	BD
031	BP	Hyi	02 07 15	−73 44.1	15.3	16.2	P	EA	141	281
032	V656	Cas	02 31 43	+64 56.6	8.2	10.8:	I	M	015	282
033	UU	For	02 35 08	−27 11.4	9.8	14.8	V	M	015	
034	VZ	Ari	02 45 51	+24 58.8	5.82	5.89	V	ACV	036	BD
035	V483	Per	02 48 22	+37 37.4	15.1	17.0	P	UV	195	195
036	τ	Per	02 50 42	+52 33.6	3.94	4.07	V	EA/GS	204	BD
037	VZ	Hor	02 50 43	−61 49.4	8.75	8.88	V	BY	135	CPD
038	V484	Per	03 18 49	+48 57.9	11.66	11.75	V	BY	196	
039	V485	Per	03 20 53	+48 37.8	14.07	14.18	V	BY	196	
040	V486	Per	03 22 54	+48 51.7	12.77	12.88	V	BY	196	
041	V487	Per	03 23 51	+48 12.0	12.91	13.07	V	BY	196	
042	V488	Per	03 24 46	+48 29.4	12.80	12.86	V	BY	196	
043	V489	Per	03 26 50	+48 14.5	14.27	14.37	V	BY	196	
044	V837	Tau	03 34 10	+25 49.8	8.2	(0.09)	V	BY:	234	BD
045	V838	Tau	03 35 53	+25 04	16.0	(18.0	U	UV	236	236
046	V839	Tau	03 36 47	+25 18	14.8	16.5	U	UV	237	236
047	V840	Tau	03 37 27	+23 40	14.0	(18.0	U	UV	235	236
048	V841	Tau	03 37 34	+24 13	14.7	16.2	U	UV	236	236
049	V842	Tau	03 38 43	+22 11.4	16.2	17:	P	UV	238	238
050	V843	Tau	03 38 53	+24 55	15.9	16.7	P	UV	237	236

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
051	V844	Tau	$03^h39^m45^s$	+23°20'.7	12.6	14.6	U	UV	236 236
052	V845	Tau	03 40 06	+25 25	14.5	19.7	P	UV	239 236
053	V846	Tau	03 40 32	+22 33	14.8	16.8	U	UV	236 236
054	V847	Tau	03 40 51	+24 05	15.0	20.4	P	UV	239 236
055	δ	Eri	03 40 51	−09 55.9	3.51	3.56	V	RS:	123 BD
056	V848	Tau	03 40 57	+23 13	16.5	(18.0	U	UV	236 236
057	V849	Tau	03 41 22	+24 17	14.0	(18.0	U	UV	236 236
058	V850	Tau	03 41 27	+23 25	14.0	(18.0	U	UV	236 236
059	V851	Tau	03 42 10	+24 15	14.3	20:	U	UV	240 241
060	V852	Tau	03 42 14	+22 29	14.2	17.2	U	UV	236 236
061	V853	Tau	03 42 20	+22 32	14.9	20.2	U	UV	241 241
062	V854	Tau	03 42 27	+23 29	16.7	21:	U	UV	240 241
063	V855	Tau	03 42 41	+24 28.4	10.0	(0.035)	V	BY:	242 242
064	V856	Tau	03 43 04	+24 10	14.0:	(20.0	U	UV	236 236
065	V857	Tau	03 43 11	+24 31	13.1	19.8	U	UV	244 236
066	V858	Tau	03 43 20	+22 33	16.5	19.5	P	UV	237 236
067	V859	Tau	03 43 38	+22 10	13.6	20	U	UV	240 241
068	V860	Tau	03 43 54	+25 05.5	15.4	17.84	B	UV	236 236
069	V861	Tau	03 44 10	+24 09	15.0	(19.0	U	UV	236 236
070	V862	Tau	03 44 20	+22 12	15.9	21.0	U	UV	246 236
071	V863	Tau	03 44 27	+22 04	16.1	16.9	B	UV	236 236
072	V864	Tau	03 44 28	+23 27	14.0	(18.0	U	UV	236 236
073	V865	Tau	03 44 31	+22 13.3	14.2	16.8	U	UV	236 236
074	V866	Tau	03 44 45	+24 16	16.8	19.7	U	UV	239 236
075	V867	Tau	03 44 47	+24 38.1	14.2	20.0	U	UV	249 236
076	V868	Tau	03 45 18	+25 03	16.0	17.0	U	UV	239 236
077	V869	Tau	03 45 20	+22 23.5	14.5	16.1	P	UV	236 236
078	V870	Tau	03 45 25	+22 43.2	15.9	17.64	B	UV	251 251
079	V871	Tau	03 45 27	+24 07	14.7	19.6	U	UV	239 236
080	V872	Tau	03 45 34	+23 52	16.0	(18.0	U	UV	236 236
081	V873	Tau	03 45 41	+24 03.6	15.4	18.8	U	UV	246 236
082	V874	Tau	03 45 42	+24 52	17.5	18.5	P	UV	246 236
083	V875	Tau	03 45 45	+23 05	13.7	19.7	P	UV	247 236
084	V876	Tau	03 46 15	+22 01.5	12.9	16.6	U	UV	236 236
085	V877	Tau	03 46 56	+22 03	15.5	18.8	P	UV	248 241
086	V878	Tau	03 47 32	+22 19	15.4	18.9	U	UV	253 236
087	V879	Tau	03 47 33	+22 52	15.2	16.5	U	UV	254 236
088	V880	Tau	03 48 08	+21 56	12.5	14.5	U	UV	236 236
089	V881	Tau	03 48 11	+24 15	13.7	(18:	U	UV	254 236
090	V882	Tau	03 48 58	+23 50.9	15.3	17.6	U	UV	254 236
091	V883	Tau	03 49 45	+22 17	14.5	17.5	U	UV	236 236
092	V884	Tau	03 50 24	+25 22	15.9	18.7	U	UV	255 236
093	V885	Tau	03 50 55	+25 47	16.0	18.3	U	UV	255 236
094	V886	Tau	03 51 24	+25 20	15.2	16.7	U	UV	236 236
095	V887	Tau	03 51 24	+25 09	16.5	18.0	U	UV	236 236
096	V888	Tau	03 51 34	+23 40	13.5	15.0	U	UV	236 236
097	V889	Tau	03 51 54	+24 25.8	13.5	15.5	U	UV	236 236
098	ε	Per	03 54 30	+39 52.0	2.88	3.00	V	BCEP	283 BD
099	V890	Tau	03 54 36	+25 08	14.5	(18.5	P	UV	236 236
100	V490	Per	04 03 28	+32 15.0	6.98	7.27	V	E:	284 BD

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
101	V491	Per	$04^h04^m14^s$	$+37°56'.7$	7.10	(0.03)	V	BY	053 BD
102	V891	Tau	04 12 46	+06 04.6	6.92	7.00	V	BY	256 BD
103	V892	Tau	04 15 35	+28 12.0	5.55	6.07	K	INA	258 258
104	V893	Tau	04 16 02	+19 47.2	8.63	(0.029)	V	BY	259 BD
105	EK	Eri	04 18 11	−06 21.8	6.24	(0.12)	V	BY	122 BD
106	V894	Tau	04 21 12	+22 48	16.3	20.5	P	UV	260
107	V895	Tau	04 21 22	+14 38.6	7.62	(0.032)	V	BY	259 BD
108	V896	Tau	04 21 24	+26 08	15.2	16.8	P	UV	262
109	V897	Tau	04 21 36	+16 46.3	7.80	(0.042)	V	BY	259 BD
110	V898	Tau	04 21 42	+23 41	14.4	20.0	P	UV	262
111	V899	Tau	04 22 18	+24 10	14.3	20.0	B	UV	262
112	V900	Tau	04 22 18	+23 27	15.5	17.4	U	UV	262
113	V901	Tau	04 22 36	+22 42	15.0	16.6	B	UV	262
114	V902	Tau	04 23 06	+23 58	14.9	16.4	U	UV	262
115	V903	Tau	04 23 18	+22 53	14.9	16.5	B	UV	260
116	V904	Tau	04 23 30	+26 28	16.2	18.6	P	UV	260
117	V905	Tau	04 23 30	+22 26	15.2	17.0	B	UV	262
118	V906	Tau	04 23 32	+16 44.5	7.98	8.06	V	BY	259 BD
119	V907	Tau	04 23 36	+22 14	15.3	17.6	B	UV	260
120	V908	Tau	04 23 42	+25 26	15.0	16.1	U	UV	262
121	V900	Tau	04 23 42	+22 24	14.7	17.0	B	UV	262
122	V910	Tau	04 23 48	+25 13	15.3	17.0	B	UV	260
123	V911	Tau	04 23 48	+16 38.1	8.11	(0.030)	V	BY	259 BD
124	V912	Tau	04 24 12	+25 14	15.6	17.2	B	UV	262
125	V913	Tau	04 24 18	+22 11	14.2	16.2	B	UV	260
126	V914	Tau	04 24 36	+23 28	15.3	16.7	B	UV	260
127	V915	Tau	04 24 42	+23 52	14.6	15.7	U	UV	262
128	V916	Tau	04 24 54	+23 55	15.7	17.1	B	UV	262
129	V917	Tau	04 25 36	+24 38	16.1	18.0	B	UV	260
130	V918	Tau	04 25 41	+19 37.9	8.6	(0.044)	V	BY	259 BD
131	V919	Tau	04 25 42	+24 58	15.6	16.8	B	UV	262
132	V920	Tau	04 25 55	+17 10.6	7.84	(0.050)	V	BY	259 BD
133	V921	Tau	04 26 38	+17 47.1	8.96	8.99	V	BY	259 BD
134	V922	Tau	04 26 48	+23 00	14.6	16.8	B	UV	260
135	V923	Tau	04 27 06	+25 43	15.9	17.3	P	UV	260
136	V924	Tau	04 27 18	+25 03	14.2	16.0	B	UV	260
137	V925	Tau	04 27 48	+22 48	13.1	15.6	U	UV	262
138	V926	Tau	04 27 48	+22 24	16.1	18.9	B	UV	260
139	V927	Tau	04 28 22	+24 04.5	14.0	16.15	B	UV	262 285
140	V492	Per	04 28 37	+36 38.2	6.7	(0.07)	V	RS:	053 BD
141	V928	Tau	04 29 17	+24 16.1	15.7	(2.1)	B	INB:	263 263
142	V929	Tau	04 29 48	+22 13	14.7	16.8	B	UV	262
143	V930	Tau	04 30 00	+26 07	15.5	21.0	P	UV	262
144	V931	Tau	04 30 24	+25 28	14.3	19.7	B	UV	262
145	V932	Tau	04 30 24	+22 29	15.6	16.8	B	UV	260
146	V933	Tau	04 30 54	+25 02	15.3	17.1	B	UV	262
147	V934	Tau	04 31 06	+25 15	15.2	19.1	P	UV	260
148	V935	Tau	04 31 18	+25 25	16.9	19.3	B	UV	260
149	V936	Tau	04 31 24	+21 54	15.6	17.8	P	UV	264
150	V937	Tau	04 31 30	+23 53	15.0	17.3	B	UV	262

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
151	V938	Tau	$04^h31^m44^s$	+15°24'.1	7.94	(0.035)	V	BY	259 BD
152	V939	Tau	04 31 48	+23 44	15.3	16.4	B	UV	262
153	V940	Tau	04 31 48	+22 16	15.6	17.6	B	UV	262
154	V941	Tau	04 32 24	+26 36	15.3	18.5	P	UV	260
155	V942	Tau	04 33 18	+26 36	14.7	16.6	P	UV	260
156	V943	Tau	04 33 24	+24 29	17.1	19.6	B	UV	262
157	V944	Tau	04 33 48	+25 44	16.2	17.8	B	UV	260
158	V945	Tau	04 34 18	+22 55	16.1	19.5	P	UV	262
159	V946	Tau	04 34 48	+24 47	14.1	15.6	B	UV	260
160	V947	Tau	04 35 30	+22 00	15.1	16.2	P	UV	260
161	V948	Tau	04 35 36	+23 37	16.0	18.1	B	UV	262
162	V949	Tau	04 35 48	+22 52	16.1	17.0	B	UV	262
163	V950	Tau	04 36 42	+22 57	14.7	16.2	U	UV	262
164	V951	Tau	04 36 48	+23 49	16.0	17.4	B	UV	260
165	V952	Tau	04 37 48	+22 46	13.6	17.3	B	UV	260
166	V953	Tau	04 38 24	+22 59	13.0	15.9	U	UV	262
167	V954	Tau	04 38 24	+22 29	15.2	17.1	U	UV	262
168	V955	Tau	04 39 04	+25 17.5	14.8	17.2	B	INB	263 286
169	V956	Tau	04 39 24	+24 44	16.0	17.4	B	UV	260
170	V957	Tau	04 39 42	+23 23	15.5	17.1	P	UV	260
171	V958	Tau	04 40 00	+23 35	14.2	15.7	P	UV	262
172	V959	Tau	04 41 12	+25 37	15.8	20.0	P	UV	262
173	AC	Dor	04 44 50	−66 48.2	15.75	16.75	V	RRAB	287 288
174	AD	Dor	04 58 21	−65 45.4	16.1	16.7	P	RRAB	289 117
175	AE	Dor	04 58 35	−65 07.3	15.5	16.85	V	RRAB	287 288
176	BV	Cam	05 01 47	+58 54.3	5.08	(0.07)	V	GCAS	046 BD
177	TU	Pic	05 05 57	−44 53.2	6.93	(0.03)	V	ACV	290 CoD
178	YZ	Men	05 12 42	−77 16.5	7.69	7.75	V	RS	026 CPD
179	BW	Cam	05 15 05	+63 12.9	1.69	3.09	K	M	015
180	TX	Lep	05 17 07	−18 33.6	6.54	(0.04)	V	ACV	148 BD
181	ZZ	Men	05 17 13	−70 48.7	13.9	15.4	P	SRA	291 288
182	V1156	Ori	05 21 14	+02 02.2	7.89	(0.03)	V	SXARI	187 BD
183	V1157	Ori	05 24 47	−05 18.9	15.5	17.8	P	INS:	178 178
184	V1158	Ori	05 25 15	−04 07.7	16.3	18.7	P	UVN	178 178
185	V1159	Ori	05 26 29	−03 36.2	12.5	16.0	P	INS:	178 178
186	V364	Aur	05 26 51	+46 17	11.4	12.2	P	E	292 003
187	V1160	Ori	05 27 10	−06 31.6	16.6	18.0	P	INS:	178 178
188	V1161	Ori	05 29 04	−06 10.8	16.0	17.2	U	INS:	178 178
189	V1162	Ori	05 29 37	−07 17.5	9.78	9.97	V	DSCT	180 180
190	V1163	Ori	05 29 48	−05 37.0	16.5	17.4	P	INS:	178 178
191	V1164	Ori	05 29 48	−06 22.9	15.9	17.1	P	INS:	178 178
192	V1165	Ori	05 29 56	−03 45.2	15.3	16.4	P	INS:	178 178
193	V1166	Ori	05 30 10	−07 36.5	16.3	17.5	B	INS:	178 178
194	V1167	Ori	05 30 18	−03 44.8	15.5	17.3	P	UVN	178 178
195	V1168	Ori	05 30 20	−06 00.1	17.5	18.3	B	INS:	178 178
196	V960	Tau	05 30 36	+18 30.4	5.53	5.69	V	GCAS	293 BD
197	V1169	Ori	05 31 44	−04 52.0	17.4	18.4	B	INS:	178 178
198	V1170	Ori	05 31 45	−05 57.3	16.3	17.6	P	INS:	178 178
199	V1171	Ori	05 31 53	−06 56.3	16.6	18.0	U	INS:	178 178
200	V1172	Ori	05 31 56	−04 25.9	16.8	17.5	P	INS:	178 178

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
201	V1173	Ori	$05^h31^m59^s$	−05°03'.0	13.5	18.0	U	UVN	183 183
202	V1174	Ori	05 32 01	−05 43.6	15.6	16.7	P	INS:	178 178
203	V365	Aur	05 32 16	+48 55	13.8	15.1	P	EA/SD	292 037
204	V1175	Ori	05 32 17	−05 34.1	14.3	18.0	U	UVN	183 185
205	V1176	Ori	05 32 17	−06 00.0	17.3	18.3	P	INS:	178 178
206	V366	Aur	05 32 34	+48 59	13.9	14.9	P	SR	292 037
207	V1177	Ori	05 32 59	−04 13.8	15.9	17.4	P	UVN	178 178
208	V1178	Ori	05 33 33	−06 18.0	14.5	15.4	P	INS:	178 178
209	V1179	Ori	05 33 41	−07 25.6	7.37	(0.10)	V	ACV	187 BD
210	V1180	Ori	05 33 43	−05 44.5	16.7	17.9	B	INS:	178 178
211	V1181	Ori	05 33 43	−06 12.3	15.2	16.3	P	UVN	178 178
212	V1182	Ori	05 33 52	−05 16.4	16.5	18.5	B	INSB:	178 189
213	V1183	Ori	05 34 05	−06 10.2	15.4	16.3	P	INS:	178 178
214	V367	Aur	05 34 38	+43 09	14.5	14.9	P	LB	292 003
215	TY	Lep	05 34 44	−13 07.4	13	(17.5	P	M	149
216	V1184	Ori	05 34 59	−05 35.7	16.4	17.4	P	INS:	178 178
217	V1185	Ori	05 35 11	−05 10.5	12.0	17.4	U	INS:	178 178
218	V1186	Ori	05 35 44	−06 43.3	15.9	20.1	P	UVN	178 178
219	V368	Aur	05 35 56	+41 40	13.7	14.5	P	SR	292 037
220	V1187	Ori	05 37 19	−08 11.4	12.0	13.0	V	LB:	015
221	V1188	Ori	05 37 39	−06 30.9	15.7	16.5	P	INS:	178 178
222	V1189	Ori	05 38 14	−06 32.6	15.1	16.6	P	INS:	178 178
223	V1190	Ori	05 38 24	−05 32.0	14.4	16.4	B	INSB:	178 178
224	V369	Aur	05 38 38	+49 33	13.0	14.0	P	SR	292 003
225	V1191	Ori	05 38 40	−05 41.7	16.5	17.5	P	UVN	178 178
226	V370	Aur	05 40 33	+32 40.8	1.6	2.2	L	M	038
227	BX	Cam	05 41 16	+69 56.9	13.2	16.8	V	M	015
228	V961	Tau	05 41 25	+21 52.2	14.3	15.5	P	LB	192 192
229	TZ	Lep	05 42 33	−20 05.0	16.1	17.6	U	UV	150 150
230	V962	Tau	05 42 42	+22 51.7	13.5	15.4	P	UV	192 192
231	V371	Aur	05 48 46	+43 35	15.5	16.9	P	EA/SD	292 003
232	V372	Aur	05 51 15	+41 50	14.3	15.3	P	IS:	292 003
233	V373	Aur	05 55 58	+38 26.2	5.1	7.0	1.04	M	015
234	AA	Men	05 57 31	−70 05.6	15.4	16.45	V	RRAB	287 288
235	V652	Mon	06 03 46	−10 56.4	15.3	16.5	P	SRB	149
236	V374	Aur	06 06 18	+44 31	15.7	16.6	P	RRAB	292 037
237	V375	Aur	06 07 54	+42 20	14.6	15.6	P	SR	292 003
238	V376	Aur	06 08 10	+46 06	14.2	15.0	P	LB	292 003
239	AF	Dor	06 08 13	−68 39.8	16.0	16.9	P	RRAB	289 288
240	V653	Mon	06 08 35	−06 44.5	6.19	(0.04)	U	ACV	020 BD
241	V377	Aur	06 10 15	+44 17	14.2	15.0	P	RRAB	292 037
242	AO	Lyn	06 12 51	+59 31	15	16	P	RR:	155 155
243	V378	Aur	06 16 55	+46 50	14.1	14.7	P	RRAB	292 003
244	V379	Aur	06 17 51	+41 51	13.6	14.5	P	EA/SD	292 037
245	V380	Aur	06 17 55	+41 15	13.6	14.5	P	SR	292 003
246	V381	Aur	06 18 40	+46 07	13.7	14.8	P	SR:	292 003
247	V654	Mon	06 19 22	−03 50.3	6.10	8.49	1.04	M	015
248	AP	Lyn	06 30 02	+60 58.9	10.9	14.7	V	M	015
249	V655	Mon	06 30 57	+10 04.5	14.9	16.6	P	UV	294 294
250	V656	Mon	06 32 45	+09 30.5	16.3	17.0	P	UV	294 294

№	Name		α1950.0	δ1950.0	Max	Min		Type	References
251	V338	Pup	$06^h33^m28^s$	−45°16'.0	9.07	9.25	V	RRAB	295 CoD
252	V382	Aur	06 33 49	+53 33.6	9.00	9.12	V	SRD	039 BD
253	V657	Mon	06 34 47	+11 17.1	15.0	18.5	P	UV	294 294
254	V658	Mon	06 35 13	+08 16.1	15.3	16.3	P	UV	294 294
255	V659	Mon	06 35 15	+09 37.1	15.8	16.4	P	UV	294 294
256	V660	Mon	06 35 56	+09 14.1	15.3	16.6	P	UV	294 294
257	V661	Mon	06 36 13	+08 24.1	15.8	16.8	P	UV	294 294
258	V662	Mon	06 36 33	+09 23.0	14.7	15.6	P	UV	294 294
259	V663	Mon	06 36 33	+09 20.8	16.0	16.7	P	UV	294 294
260	V664	Mon	06 36 43	+08 25.1	16.0	17.0	P	UV	294 294
261	V665	Mon	06 36 52	+10 23.1	14.8	19.0	P	UV	294 294
262	V666	Mon	06 37 02	+09 13.6	15.8	20.3	P	UV	294 294
263	V667	Mon	06 37 36	+09 31.1	15.8	17.8	P	UV	294 294
264	V668	Mon	06 37 50	+08 54.4	16.6	17.2	P	UV	294 294
265	V669	Mon	06 38 25	+09 24.5	15.5	18.2	P	UV	294 294
266	V670	Mon	06 38 33	+09 39.1	16.5	19.2	P	UV	294 294
267	V671	Mon	06 38 42	+09 54.8	16.6	18.9	P	UV	294 294
268	V672	Mon	06 38 51	+09 52.1	16.3	18.1	P	UV	294 294
269	V673	Mon	06 39 01	+09 36.1	16.4	17.8	P	UV	294 294
270	V674	Mon	06 40 02	+09 15.0	16.0	16.7	P	UV	294 294
271	V675	Mon	06 40 04	+10 25.8	16.4	17.0	P	UV	294 294
272	V676	Mon	06 40 39	+09 38.1	16.3	17.3	P	UV	294 294
273	V677	Mon	06 41 02	+09 16.1	16.2	17.2	P	UV	294 294
274	HP	CMa	06 43 37	−30 53.7	5.48	5.80	V	GCAS	296 CoD
275	V339	Pup	06 44 29	−37 43.2	6.15	6.27	V	GCAS	154 CoD
276	V678	Mon	06 44 56	+09 08.1	15.4	16.1	P	UV	294 294
277	OV	Gem	06 46 57	+16 15.7	5.85	(0.10)	V	SXARI	125 BD
278	V679	Mon	06 48 04	+10 28.1	15.0	16.1	P	UV	294 294
279	V680	Mon	06 56 46	+09 23.3	9.6	10.1	P	RR	297 297
280	V383	Aur	07 13 23	+38 38.9	16.46	18.72	B	EA/SD	001 001
281	V384	Aur	07 14 44	+40 36.7	17.64	18.42	B	EW	001 001
282	HQ	CMa	07 18 53	−26 52.1	6.01	6.27	V	EA	298 CoD
283	V385	Aur	07 22 33	+38 19.0	17.38	18.15	B	RRAB	001 001
284	V386	Aur	07 22 45	+40 58.9	16.73	17.38	B	RRC	001 001
285	V387	Aur	07 23 41	+36 44.8	16.42	17.95	B	RRAB	001 001
286	V388	Aur	07 23 45	+38 54.2	16.62	17.64	B	EB	001 001
287	V389	Aur	07 26 48	+38 28.2	17.17	18.42	B	RRAB	001 001
288	AQ	Lyn	07 28 06	+40 11.6	15.65	16.4	B	EW/KW	001 001
289	V409	Car	07 30 02	−57 53.1	9.1	(0.03)	B	ACVO	299 CPD
290	AR	Lyn	07 31 04	+40 43.5	18.1	18.85	B	EW/KW	001 001
291	AS	Lyn	07 37 06	+41 18.6	17.77	19.23	B	RRAB	001 001
292	AT	Lyn	07 41 53	+40 38.1	17.9	18.6	B	EW/KW	001 001
293	AU	Lyn	07 46 08	+41 50.5	17.51	18.68	B	RRAB	001 001
294	V340	Pup	07 46 48	−23 25.0	11.98	12.20	V	I:	210 210
295	UY	Vol	07 48 25	−67 37.5	16.9	(23	V	XBN+E	301 300
296	V681	Mon	07 49 51	−01 11.6	13	15.5	P	EA/SD	302 163
297	AV	Lyn	07 50 41	+42 57.0	15.99	17.10	B	RRAB	001 001
298	V341	Pup	07 53 20	−28 09.0	7.2	(0.01)	V	ACV	290 CoD
299	AW	Lyn	07 53 56	+43 20.6	15.77	17.10	B	RRAB	001 001
300	V342	Pup	07 54 17	−45 50.8	6.7	(0.040)	V	SXARI:	303 CoD

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
301	AX	Lyn	$07^h 56^m 25^s$	+39° 24'.7	18.06	19.40	B	RRAB	001 001
302	AY	Lyn	07 57 06	+40 47.7	16.77	17.67	B	RRC	001 001
303	V410	Car	07 57 19	−60 38.3	10.67	(0.05)	V	DSCTC	059 304
304	AZ	Lyn	08 00 13	+42 39.2	15.79	17.63	B	RRAB	001 001
305	BB	Lyn	08 01 10	+42 37.6	16.31	17.63	B	RRAB	001 001
306	BC	Lyn	08 06 11	+42 42.4	16.49	17.91	B	RRAB	001 001
307	EH	Cnc	08 23 24	+21 02.7	11.73	12.47:	V	EW/KW	305 048
308	LO	Hya	08 25 58	−02 21.0	6.37	6.61	V	EA/DM	137 BD
309	KR	Vel	08 38 34	−53 05.0	7.22	7.27	V	ACV	187 377
310	KS	Vel	08 39 24	−54 27.1	18:	22	U	UV	271 271
311	KT	Vel	08 40 53	−52 55.2	5.49	5.56	V	ACV	187 377
312	EI	Cnc	08 55 27	+17 57.4	16.32	16.68	U	UV	049 306
313	LP	Hya	09 23 34	−23 48.0	7.9	9.8:	I	M	015
314	LQ	Hya	09 30 01	−10 57.8	7.79	7.86	V	BY	135 BD
315	DR	Leo	09 38 38	+31 30.4	5.84	5.98	V	LB	006 BD
316	KU	Vel	10 06 00	−40 25.4	12.55	(0.07)	V	DSCTC	272 272
317	AG	Ant	10 15 50	−28 44.5	5.30	5.65	V	ACYG:	154 CoD
318	SZ	Sex	10 18 06	+03 36	13.7	(17.6	B	M	232 232
319	V411	Car	10 29 29	−59 43.0	14.5	19	P	N:	307
320	DW	UMa	10 30 38	+59 02.4	15.1	16.6	B	EA	267 308
321	LR	Hya	10 33 33	−11 39.0	8.03	8.05	V	BY	138 BD
322	V412	Car	10 33 50	−57 58.0	9.85	9.88	V	BCEP:	061 310
323	DX	UMa	10 36 36	+56 46.2	14.2	15.3	P	SRA	268 268
324	KV	Vel	10 52 30	−48 31	11.78	12.34	V	R/PN	312 311
325	V413	Car	10 54 04	−60 07.1	8.98	9.12	V	SRB	062 CPD
326	DS	Leo	10 59 57	+22 14.2	9.52	9.57	V	BY	147 BD
327	V414	Car	11 02 52	−59 35.3	6.55	(0.09)	V	ACYG:	313 CPD
328	DY	UMa	11 08 16	+54 51.3	15.1	16.4	P	RRAB	268 268
329	DZ	UMa	11 15 40	+52 58.1	12.0	13.5	P	RVB:	268 268
330	LS	Hya	11 16 59	−30 02.9	7.87	8.00	V	ACV	148 CoD
331	SZ	Crt	11 18 57	−20 10.7	8.1	(0.035)	V	BY	087 BD
332	EE	UMa	11 27 42	+46 56.0	6.35	(0.16)	V	ELL:	053 BD
333	V837	Cen	11 35 44	−45 28.4	7.16	(0.10)	V	DSCT	314 CoD
334	V838	Cen	11 42 11	−49 08.4	8.97	(0.08)	V	BY	315 CoD
335	EF	UMa	11 54 34	+48 45.0	16.4	17.7	P	RR	269 269
336	BY	Cru	12 02 13	−61 43.3	7.62	8.01	V	EB/GS/K	088 CPD
337	GS	Mus	12 03 13	−69 17.7	7.34	7.55	V	ACYG	313 CPD
338	HU	Vir	12 10 46	−08 48.1	8.1	(0.27)	V	RS:	316 BD
339	EG	UMa	12 13 16	+52 47.8	13.0	13.87	B	NL	270 270
340	IL	Com	12 22 32	+25 50.3	8.16	(0.04)	V	RS:	082 BD
341	IM	Com	12 28 36	+14 26.0	17.6	18.5	B	UG:	042 042
342	BZ	Cru	12 39 53	−62 47.1	5.24	5.45	V	GCAS	090 317
343	CC	Cru	12 50 47	−60 03.6	7.97	(0.08)	V	ELL:	092 092
344	IN	Com	12 53 08	+26 09.7	8.7	(0.07)	V	R:/PN	084 083
345	V839	Cen	12 56 04	−36 42.3	9.51	10.13	V	EW/KW	318 CoD
346	BK	CVn	13 16 07	+49 56.7	5.13	(0.04)	V	ACV	036 BD
347	BL	CVn	13 16 33	+33 42.1	8.13	(0.24)	V	ELL	052 BD
348	V840	Cen	13 17 40	−55 34.9	7.5	(12.5	V	NL	069
349	HV	Vir	13 18 28	+02 09.4	11	(13.0	P	N	307 275
350	BM	CVn	13 19 17	+39 08.5	7.21	(0.06)	V	RS	053 BD

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
351	CR	Boo	$13^h 46^m 26^s$	$+08^\circ 12'.4$	13.0	17.5	V	AM:	319
352	DU	Dra	13 50 47	+65 39.7	15.5	(0.03)	V	ZZA	118 320
353	EH	UMa	13 51 27	+52 34.1	6.69	6.87	V	LB	006 BD
354	CS	Boo	14 03 40	+24 49	12:	(1.30)	V	RRAB	321 041
355	CT	Boo	14 06 36	+53 40.8	17.0	18.7:	B	NL:	042 042
356	LT	Hya	14 10 37	−29 40.5	12.1	15.8	V	M	015
357	V841	Cen	14 30 31	−60 11.3	8.49	8.85	V	RS	322 CPD
358	V842	Cen	14 32 13	−57 24.5	4.6	18.6:	V	N	171
359	HR	Lup	15 04 57	−40 23.6	5.76	5.81	V	ACV	154 CoD
360	HI	Lib	15 06 17	−13 48.6	7.48	(0.007)	V	ACVO	151 BD
361	UV	CrB	15 20 16	+25 48.1	7.20	(0.16)	V	ELL	316 BD
362	CU	Boo	15 20 55	+52 39.3	12.9	(0.28)	B	RRC:	043 043
363	CV	Boo	15 24 25	+37 09.7	10.2	11.0	P	EA	323 324
364	MW	Ser	15 26 17	+03 59.8	2.7	4.0	K	M	015
365	V342	Nor	15 32 23	−50 42.6	14.8	15.2	B	E:	166 166
366	V343	Nor	15 34 59	−57 32.6	8.14	(0.12)	V	BY:	325 CPD
367	V344	Nor	15 36 49	−51 03.3	10.5	16	V	M	326
368	V345	Nor	16 02 56	−51 55.0	13	(18	P	ZAND:	327 328
369	V952	Sco	16 07 12	−26 46.7	6.57	(0.04)	V	ACV	222 CoD
370	MX	Ser	16 09 31	−02 59.0	13.2	13.68	B	EW/KW	329 329
371	V953	Sco	16 17 07	−25 44.3	9.2	(0.04)	V	ACV	222 CoD
372	V2205	Oph	16 25 53	−09 13.2	10.40	10.59	V	PVTEL	330 BD
373	V346	Nor	16 28 57	−44 49.1	16.3	17.23	V	FU:	331 331
374	V954	Sco	16 35 20	−44 03.5	7.49	7.75	V	EB/KE	332 224
375	V955	Sco	16 36 26	−27 11.3	8.65	(0.04)	V	ACV	222 CoD
376	V2206	Oph	16 49 26	−12 52.1	10.2	11.5	V	SR:	015
377	V828	Ara	16 57 27	−58 53.1	6.11	6.20	V	GCAS	033 CPD
378	V2207	Oph	16 57 29	−10 32.8	8.4	10.3:	I	M	015
379	V956	Sco	17 03 44	−35 41.6	8.0	8.6	P	GCAS	225 225
380	V817	Her	17 07 14	+42 44.7	16.18	16.32	B	ZZO	129
381	V829	Ara	17 09 59	−56 49.8	6.09	6.20	V	ELL	034 CPD
382	V2208	Oph	17 16 33	−18 27.8	16.7	17.8	P	RRAB	333 174
383	V818	Her	17 17 10	+43 39.6	9.80	11.2	B	SRB	334 BD
384	ι	Ara	17 19 31	−47 25.3	5.18	5.26	V	GCAS	296 335
385	V819	Her	17 20 05	+40 01.4	5.51	(0.12)	V	EA/D+BY	131 BD
386	V830	Ara	17 30 15	−45 35.5	8.11	8.21	V	GCAS:	035 CoD
387	V2209	Oph	17 36 53	−24 01.8	13.9	(16.9	R	M	175 175
388	V2210	Oph	17 46 16	+07 06.9	13.5	14.1	B	RRAB	336 337
389	V2211	Oph	17 48 28	−08 00.7	8.9	10.6:	I	M	015
390	V957	Sco	17 48 53	−34 47.3	5.87	(0.05)	V	SXARI	187 CoD
391	V958	Sco	17 49 56	−34 36.6	6.95	(0.05)	V	ACV	187 CoD
392	V959	Sco	17 50 03	−35 00.4	7.25	(0.14)	V	ACV	187 CoD
393	V4092	Sgr	17 50 31	−29 01.6	9.7	15.3	V	NA	338 339
394	V960	Sco	17 53 19	−31 49.1	10.5	(17	V	N	340 340
395	V4093	Sgr	17 58 39	−29 39.3	16.6	18.2	B	RRAB	213 213
396	V4094	Sgr	17 58 42	−29 42.1	16.5	17.9	B	RRAB	213 213
397	V4095	Sgr	17 58 44	−29 51.0	16.6	17.3	B	RRAB	213 213
398	V4096	Sgr	17 58 48	−29 44.6	16.6	17.8	B	RRAB	213 213
399	V4097	Sgr	17 58 54	−29 45.0	17.4	18.4	B	RRAB	213 213
400	V4098	Sgr	17 58 56	−29 47.6	17.4	17.9	B	RRC	213 213

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
401	V4099 Sgr	$17^h 58^m 59^s$	$-29° 41'.0$	16.9	18.6	B	RRAB	213 213
402	V4100 Sgr	17 59 02	-29 41.7	17.5	18.2	B	EW	213 213
403	V4101 Sgr	17 59 04	-29 42.4	16.9	18.3	B	RRAB	213 213
404	V4102 Sgr	17 59 15	-29 43.9	16.7	18.1	B	RRAB	213 213
405	V4103 Sgr	17 59 16	-29 44.4	17.0	17.5	B	RRC	213 213
406	V4104 Sgr	17 59 20	-29 45.6	17.2	17.8	B	EW:	213 213
407	V4105 Sgr	17 59 26	-29 44.0	18.7	19.1	B	EA	213 213
408	V4106 Sgr	17 59 28	-29 40.5	17.6	18.6	B	RRAB	213 213
409	V4107 Sgr	17 59 30	-29 59.8	17.0	18.0	B	RRAB	213 213
410	V4108 Sgr	17 59 32	-29 48.9	17.1	17.7	B	RRC	213 213
411	V4109 Sgr	17 59 38	-29 44.4	16.9	18.4	B	RRAB	213 213
412	V4110 Sgr	17 59 50	-29 46.2	17.6	19.0	B	CWB	213 213
413	V4111 Sgr	17 59 56	-29 44.2	17.0	17.7	B	RRC	213 213
414	V820 Her	18 00 15	+20 49.9	5.17	5.19	B	*	132 BD
415	V4112 Sgr	18 00 16	-29 53.0	16.8	17.3	B	RRC	213 213
416	V4113 Sgr	18 00 17	-30 02.0	17.1	17.3	B	RRC	213 213
417	V4114 Sgr	18 00 17	-30 07.6	17.1	17.7	B	RRC	213 213
418	V4115 Sgr	18 00 18	-30 10.7	18.2	18.7	B	EW:	213 213
419	V4116 Sgr	18 00 20	-29 51.8	16.9	17.6	B	RRAB	213 213
420	V4117 Sgr	18 00 30	-30 01.7	17.8	18.2	B	DSCT	213 213
421	V4118 Sgr	18 00 42	-29 57.1	18.6	19.3	B	EW:	213 213
422	V4119 Sgr	18 00 47	-30 01.0	17.0	17.9	B	EW:	213 213
423	V4120 Sgr	18 00 59	-20 19.5	0.6	1.0	K	M	015
424	V4121 Sgr	18 04 43	-28 49.9	9.5	(19	P	N	341 341
425	V4122 Sgr	18 09 26	-31 45.8	16.3	17.6	B	RR	215 215
426	V4123 Sgr	18 09 36	-31 37.6	17.4	18.4	B	RR	215 215
427	V4124 Sgr	18 09 41	-31 27.0	16.4	17.6	B	RR	215 215
428	V4125 Sgr	18 10 29	-31 30.5	16.4	17.5	B	RR	215 215
429	V4126 Sgr	18 11 17	-31 50.3	16.5	17.2	B	RR	215 215
430	V4127 Sgr	18 11 29	-32 05.0	17.2	18.4	B	RR	215 215
431	MY Ser	18 15 18	-12 15.8	7.33	7.66	V	EB	342 BD
432	MZ Ser	18 16 07	-13 53.6	8.0	9.5	K	IN:	231 343
433	DV Dra	18 16 18	+50 48	15.3	(21	P	UG:	119 119
434	V4128 Sgr	18 20 53	-24 56.7	16.2	17.6	B	RRAB	344 344
435	V4129 Sgr	18 20 55	-24 51.0	15.9	17.6:	B	RRAB	344 344
436	V4130 Sgr	18 22 00	-24 59.8	16.5	18.0	B	RRAB	344 344
437	V441 Sct	18 25 46	-10 00.2	5.2	8.1	L	M	345
438	V4131 Sgr	18 37 10	-22 42.6	8.68	8.82	V	GCAS:	346 BD
439	V821 Her	18 39 42	+17 38.3	9.2	12.0	R	M	106 106
440	V4132 Sgr	18 40 00	-32 31.8	16.3	16.9	B	EW:	347 347
441	V822 Her	18 49 44	+13 54.2	6.12	6.30	V	EB/KE	134 BD
442	V1377 Aql	19 13 00	+00 26	15.8	17.5	B	EA/D	023
443	V483 Lyr	19 14 06	+30 07.0	16.8	18.3:	B	RRAB	350 156
444	V1378 Aql	19 14 06	+03 37.9	10	(12.7	V	N	024
445	V484 Lyr	19 14 07	+30 10.3	15.6	16.7	B	SXPHE:	350 156
446	V485 Lyr	19 14 31	+30 00.0	16.0	16.9	B	LB	350 157
447	V486 Lyr	19 14 53	+30 14.4	15.7	16.5	B	LB	350 157
448	V487 Lyr	19 15 02	+30 02.1	15.7	16.7	B	LB	350 157
449	DW Dra	19 22 03	+69 50.0	14	15.5	P	EA/SD	352 093
450	V1816 Cyg	19 29 20	+31 15.7	15.5	16.1	P	BY:	352 093

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
451	V1817	Cyg	$19^h 30^m 10^s$	+55°37'.5	6.37	(0.05)	V	RS:	094 BD
452	V1379	Aql	19 36 58	−06 10.7	8.34	8.55	V	RS	316 BD
453	V1380	Aql	19 39 04	+14 47	15.5	16	P	IS:	353 027
454	V1818	Cyg	19 39 20	+29 01.6	8.68	8.96	B	EA:	095 BD
455	V1381	Aql	19 39 36	+07 55	15.5	16	P	IS:	354 027
456	V1382	Aql	19 39 56	+09 52	15	15.5	P	SR	354 027
457	V1383	Aql	19 40 06	+07 45	16	16.5	P	E	354 027
458	V1384	Aql	19 40 39	+06 32	13	13.5	P	LB	354 027
459	V1385	Aql	19 41 03	+12 15	15.5	16	P	SR	354 027
460	V1386	Aql	19 42 00	+13 37	15.5	16.5	P	RRAB	354 027
461	V1387	Aql	19 42 15	+15 20	15.5	16	P	LB	354 027
462	V1388	Aql	19 42 30	+07 52	16	17	P	LB	354 027
463	V1389	Aql	19 43 46	+11 42	14	14.5	P	LB	354 027
464	V1390	Aql	19 44 16	+06 16	16	17	P	SR:	354 027
465	V1391	Aql	19 45 21	+12 27	16	17	P	LB	354 027
466	V1392	Aql	19 47 24	+07 57	15	15.5	P	SR	354 027
467	V1393	Aql	19 47 26	+07 04	14.5	15	P	SR	354 027
468	V1394	Aql	19 47 46	+14 44	16	16.5	P	E:	354 027
469	V1395	Aql	19 48 11	+14 09	15.5	16	P	LB	354 027
470	V1396	Aql	19 48 46	+11 47	15	15.5	P	LB	354 027
471	V1397	Aql	19 49 53	+11 26	13.5	14	P	LB	354 027
472	V1398	Aql	19 49 59	+14 24	15.5	16	P	SR	355 027
473	V1399	Aql	19 50 51	+12 24	14	14.5	P	RRC	355 027
474	V1400	Aql	19 52 05	+14 27	15.5	16.5	P	SRA	355 027
475	V1819	Cyg	19 52 46	+35 34.3	9.5	(14.6	B	N	356 356
476	V4133	Sgr	20 00 15	−38 59.6	6.90	6.92	V	ACV	290 CoD
477	V1401	Aql	20 02 20	−11 44.5	6.18	6.55	V	SRD	029 BD
478	V1820	Cyg	20 03 45	+35 36.8	10.80	(0.04)	V	BCEP	097 357
479	V1821	Cyg	20 04 42	+35 44.2	10.14	(0.06)	V	DSCTC	097 357
480	AR	Cap	20 06 49	−18 29.7	8.08	8.28	V	ACV	148 BD
481	V1822	Cyg	20 09 15	+49 53.7	10.4	(1.1)	R	SRA	098 358
482	V1823	Cyg	20 10 07	+34 29	12.5	13.5	P	RRAB	359 360
483	V1824	Cyg	20 11 45	+48 08.0	10.5	(0.7)	R	SRA	098 358
484	V1825	Cyg	20 14 41	+49 47.0	8.6	(0.6)	R	SRA	098
485	V1826	Cyg	20 21 18	+42 09	15.3	16.8	U	IS	101 101
486	DX	Dra	20 21 31	+62 43.8	12.4	15.2	V	M	015
487	QU	Vul	20 24 41	+27 40.8	5.2	(11.2	V	NA	361 361
488	V1827	Cyg	20 28 48	+41 03	16.1	17.0	U	IS:	101 101
489	LT	Del	20 33 44	+20 00.3	13.05	14.10	V	ZAND	362 363
490	V1828	Cyg	20 35 03	+37 42.1	13.4	(15.0	V	M	102 102
491	V1829	Cyg	20 38 20	+35 48.6	14.3	(15.3	V	M:	103 103
492	V1830	Cyg	20 40 17	+35 40.8	14.6	16.4	V	SRA	103 103
493	V1831	Cyg	20 40 17	+35 23.1	14.3	(16.0	V	M	103 103
494	V1832	Cyg	20 40 18	+46 09.8	13.2	(1.6)	R	SRA	098 104
495	V1833	Cyg	20 40 20	+35 48.3	14.9	(16.0	V	M:	103 103
496	V1834	Cyg	20 41 14	+35 32.0	15.0	(16.0	V	M:	103 103
497	V1835	Cyg	20 42 36	+34 25.2	13.1	15.1	V	LB	103 103
498	V1836	Cyg	20 42 45	+35 47.0	16.0	(18.4	B	M	103 103
499	V1837	Cyg	20 43 31	+37 34.5	13.7	16.0	V	SRA	103 103
500	V1838	Cyg	20 43 45	+36 33.2	12.0	18.0	B	M	103 103

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
501	V1839 Cyg	$20^h 43^m 47^s$	+35°32.7	14.1	15.2	V	E:	103 103
502	V1840 Cyg	20 43 47	+33 37.7	16.0	18.0	B	SR	103 103
503	V1841 Cyg	20 43 51	+35 55.5	15.4	18.5	B	M	103 103
504	FP Aqr	20 44 04	−01 05.3	12.1	13.0	V	LB:	015
505	V1842 Cyg	20 44 11	+36 45.8	16.0	18.0	B	SRA	103 103
506	V1843 Cyg	20 44 26	+33 52.8	15.7	18.5	B	EA/SD	103 103
507	V1844 Cyg	20 44 38	+36 34.2	14.0	(16.0	V	M	103 103
508	V1845 Cyg	20 44 41	+34 19.0	16.2	18.0	B	SRA	103 103
509	V1846 Cyg	20 45 21	+36 12.6	13.0	(16.0	V	M	103 103
510	V1847 Cyg	20 45 21	+36 02.8	15.5	16.6	B	E:	103 103
511	V1848 Cyg	20 45 30	+36 05.7	16.8	(18.5	B	SR:	103 103
512	V1849 Cyg	20 45 50	+36 03.0	13.8	15.4	V	SRA	103 103
513	V1850 Cyg	20 46 00	+35 32.9	14.2	17.3	B	M	103 103
514	V1851 Cyg	20 46 09	+34 50.2	15.6	18.0	B	SRA	103 103
515	V1852 Cyg	20 46 16	+36 03.0	15.6	16.7	B	E:	103 103
516	V1853 Cyg	20 46 17	+34 16.4	10.97	11.10	V	ACYG	105
517	V1854 Cyg	20 46 17	+36 41.5	14.2	15.2	B	SR	103 103
518	V1855 Cyg	20 46 20	+33 43.3	13.2	(16.0	V	M	103 103
519	V1856 Cyg	20 46 21	+35 16.1	14.2	15.7	B	E	103 103
520	V1857 Cyg	20 46 25	+34 02.1	15.9	18.0	B	SRA	103 103
521	V1858 Cyg	20 46 31	+36 02.6	16.0	18.0	B	E:	103 103
522	V1859 Cyg	20 46 57	+35 58.6	16.2	(18.0	B	M	103 103
523	V1860 Cyg	20 47 03	+34 05.2	16.3	(18.5	B	M	103 103
524	V1861 Cyg	20 47 10	+37 16.6	13.1	14.2	V	SR	103 103
525	V1862 Cyg	20 47 14	+33 02.3	13.3	15.9	B	SR	103 103
526	V1863 Cyg	20 47 42	+37 02.6	13.8	14.8	B	LB:	103 103
527	V1864 Cyg	20 48 09	+37 18.9	12.0	15.0	V	M	103 103
528	V1865 Cyg	20 48 19	+34 26.8	15.7	(18.0	B	M	103 103
529	V1866 Cyg	20 48 39	+36 07.3	16.1	17.6	B	E	103 103
530	V1867 Cyg	20 48 42	+35 14.0	14.4	16.5	V	SRA	103 103
531	FQ Aqr	20 48 49	+02 07.5	9.50	9.55	V	PVTEL	016 BD
532	V1868 Cyg	20 49 17	+36 42.5	14.3	(18.5	B	M	103 103
533	V1869 Cyg	20 49 38	+33 15.8	15.9	18.0	B	E	103 103
534	V1870 Cyg	20 49 42	+35 33.1	14.3	17.2	B	E	103 103
535	V1871 Cyg	20 49 42	+35 05.9	13.6	15.6	B	SR	103 103
536	V1872 Cyg	20 49 43	+32 56.5	16.1	17.7	B	SR	103 103
537	V1873 Cyg	20 50 07	+35 56.5	14.8	(18.4	B	M	103 103
538	V1874 Cyg	20 50 08	+35 47.7	13.9	(16.3	B	SR	103 103
539	V1875 Cyg	20 50 10	+35 47.1	15.6	18.5	B	M	103 103
540	V1876 Cyg	20 50 32	+36 43.3	14.6	(16.0	V	M	103 103
541	V1877 Cyg	20 50 42	+34 12.3	13.8	15.2	B	E:	103 103
542	V1878 Cyg	20 51 06	+37 59.8	16.2	17.8	B	LB:	103 103
543	V1879 Cyg	20 51 52	+37 04.2	16.2	(18.5	B	M	103 103
544	V1880 Cyg	20 52 07	+35 43.7	13.0	14.2	V	SR	103 103
545	V1881 Cyg	20 52 44	+34 26.2	15.7	17.7	B	SRA	103 103
546	V1882 Cyg	20 53 23	+37 35.1	15.9	16.8	B	SR	103 103
547	V1883 Cyg	20 53 57	+35 49.6	16.5	17.9	B	SRA	103 103
548	V1884 Cyg	20 54 06	+33 27.6	15.2	17.7	B	EA/SD	103 103
549	FR Aqr	20 54 07	−05 02.2	14.16	14.42	U	UV	364 365
550	V1885 Cyg	20 54 15	+34 30.4	14.3	(16	V	M	103 103

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
551	V1886	Cyg	$20^h54^m16^s$	+36°10'.3	14.1	15.6	B	SR	103	103
552	V1887	Cyg	20 54 39	+32 58.0	14.0	18.5	B	M	103	103
553	V1888	Cyg	20 54 59	+37 13.5	13.8	16.0	V	SRA	103	103
554	V1889	Cyg	20 55 09	+33 56.5	14.3	15.8	B	SR	103	103
555	V1890	Cyg	20 55 47	+35 46.2	13.8	17.0	B	SR	103	103
556	V1891	Cyg	20 56 00	+42 35	12.6	15.0	V	SRA	098	102
557	V1892	Cyg	20 57 19	+34 29.3	16.0	(18.0	B	M	103	103
558	V1893	Cyg	20 57 47	+34 08.2	13.8	16.0	V	SRA	103	103
559	V1894	Cyg	20 58 43	+33 53.3	12.1	13.3	B	SR	103	103
560	V1895	Cyg	20 58 50	+36 19.7	16.0	17.5	B	CEP:	103	103
561	V1896	Cyg	20 59 20	+36 13.9	14.2	(18.5	B	M	103	103
562	V1897	Cyg	21 00 28	+34 58.1	14.0	(16.0	V	M	103	103
563	V1898	Cyg	21 02 09	+46 07.9	7.71	8.15	V	EA/DM	366	BD
564	V1899	Cyg	21 02 43	+53 09.1	15.6	17.5	V	SRA	106	106
565	V1900	Cyg	21 03 03	+35 28.1	14.0	16.4	B	SR	103	103
566	V1901	Cyg	21 09 58	+31 10.6	13.3	14.1	P	EW	359	109
567	V1902	Cyg	21 15 05	+37 31.5	14.3	14.9	B	EW/KW	367	110
568	AY	Mic	21 18 11	−43 44.9	14.6	15.3	B	RR	127	127
569	AZ	Mic	21 18 36	−42 42.4	16.4	17.6	B	RR	127	127
570	BF	Ind	21 18 39	−46 34.8	18.6	19.5	B	RR	127	127
571	V1903	Cyg	21 19 00	+37 59.2	13.6	(16.5	B	M	367	110
572	BB	Mic	21 19 38	−43 28.4	15.9	16.9	B	RR	127	127
573	BC	Mic	21 20 01	−43 47.8	17.5	18.5	B	RR	127	127
574	BD	Mic	21 20 45	−43 23.9	17.8	18.9	B	RR	127	127
575	BE	Mic	21 21 35	−44 13.8	13.7	14.9	B	RR	127	127
576	BF	Mic	21 21 56	−43 27.6	16.7	17.5	B	RR	127	127
577	BG	Mic	21 21 58	−44 52.9	17.2	18.5	B	RR	127	127
578	BH	Mic	21 22 00	−44 59.3	15.8	16.7	B	RR	127	127
579	V1904	Cyg	21 22 48	+33 47.8	13.5	(17.0	B	M	111	111
580	BI	Mic	21 23 06	−30 08.8	8.9	(0.002)	B	ACVO	057	CoD
581	V1905	Cyg	21 23 42	+38 50.2	14.0	16.3	P	IS:	368	110
582	BK	Mic	21 23 55	−44 57.0	19.6	20.4	B	RR	127	127
583	BL	Mic	21 24 11	−43 50.9	16.9	18.4	B	RR	127	127
584	V1906	Cyg	21 25 23	+36 29.0	2.4	3.3	K	M	015	
585	V363	Cep	21 26 59	+71 36.1	13.5	15.6	V	SR:	015	
586	V1907	Cyg	21 29 08	+39 13.8	13.7	(17.5	B	M	369	110
587	V1908	Cyg	21 29 32	+33 36.6	13.4	15.8	B	EA/SD	111	111
588	V364	Cep	21 30 08	+70 46.7	8.4	(0.025)	V	ACV:	070	BD
589	V1909	Cyg	21 30 15	+34 33.2	13.9	15.9	P	EA/SD	111	111
590	BQ	Gru	21 30 16	−45 23.2	19.6	20.4	B	RR	127	127
591	V1910	Cyg	21 30 23	+38 45.0	11.4	15.9	P	ISA:	369	102
592	BR	Gru	21 31 04	−44 51.7	15.5	16.3	B	RR	127	127
593	V1911	Cyg	21 31 05	+35 25	14.2	(18.0	B	M	111	111
594	BS	Gru	21 31 07	−46 54.1	16.1	17.2	B	RR	127	127
595	V1912	Cyg	21 31 11	+35 08.0	12.5	14.0	P	IS:	368	110
596	AS	Cap	21 31 33	−13 42.4	8.0	(0.13)	V	RS:	056	BD
597	IR	Peg	21 31 39	+06 37.6	16.15	16.30	B	ZZO	129	
598	BT	Gru	21 33 54	−46 25.3	17.1	18.4	B	RR	127	127
599	BU	Gru	21 34 00	−44 15.9	17.4	18.8	B	RR	127	127
600	BV	Gru	21 36 21	−43 05.2	16.4	17.6	B	RR	127	127

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References
601	BW	Gru	$21^h36^m44^s$	$-46°32'.7$	15.2	16.2	B	RR	127 127
602	BX	Gru	21 37 21	−42 48.0	15.7	16.5	B	RR	127 127
603	BY	Gru	21 37 26	−47 10.3	14.4	15.4	B	RR	127 127
604	V1913	Cyg	21 41 28	+33 38.4	13.3	15.7	B	SRA	111 111
605	ν	Cep	21 44 01	+60 53.4	4.25	4.35	V	ACYG	370 BD
606	V1914	Cyg	21 48 00	+43 43.9	8.39	8.62	V	ELL	371 BD
607	BZ	Gru	21 54 01	−37 59.1	6.13	6.21	V	DSCTC	079 CoD
608	BG	Ind	21 54 59	−59 15.1	6.11	6.36	V	EA	303 CPD
609	V1915	Cyg	21 55 25	+42 43.9	15.5	16.5	P	RRAB	372 114
610	V1916	Cyg	21 55 28	+44 27.6	15.4	16.8	P	EA/SD	372 114
611	V1917	Cyg	21 55 30	+43 09.2	14.7	16.6	P	E	372 114
612	IS	Peg	21 57 25	+26 11.6	9.8	(0.08)	V	ZZO	190 BD
613	IT	Peg	22 01 28	+35 30	14.3	17.2	B	M	111 111
614	FS	Aqr	22 03 05	−00 38.1	13.2	14.0	P	EW/KW	018 018
615	FT	Aqr	22 04 49	−00 27.0	12.5	13.9	P	SR	018 018
616	IU	Peg	22 04 52	+11 39.3	9.9	15.0	V	M	015
617	FU	Aqr	22 05 39	−02 24.6	13.0	13.4	P	RRC:	018 018
618	FV	Aqr	22 09 22	−09 00.5	13.5	14.6	P	RRAB	018 018
619	FW	Aqr	22 09 22	−09 58.4	13.8	15.0	P	EA	018 018
620	FX	Aqr	22 10 29	−01 58.5	12.4	13.2	P	RRAB	018 018
621	FY	Aqr	22 13 59	−04 03.8	12.5	13.4	P	RRAB	018 018
622	FZ	Aqr	22 14 32	−06 20.7	14.5	14.8	P	EW	018 018
623	GG	Aqr	22 15 18	−00 20.4	14.2	15.1	P	RRAB	018 018
624	V366	Lac	22 16 32	+43 31.8	13.0	16.9	V	M	106 106
625	V367	Lac	22 16 32	+43 29.6	10.5	(15	R	M	146 146
626	GH	Aqr	22 17 17	−05 16.9	13.4	13.8	P	EW/KW	018 018
627	GI	Aqr	22 17 20	+00 04.2	13.8	14.2	P	EB:	018 018
628	GK	Aqr	22 17 23	−00 55.7	12.4	13.6	P	EW/KW	018 018
629	GL	Aqr	22 17 26	−09 02.0	14.1	14.7	P	RR:	018 018
630	GM	Aqr	22 19 22	−02 55.2	13.8	15.0	P	EA	018 018
631	GN	Aqr	22 19 40	−04 27.6	12.1	12.8	P	E:	018 018
632	GO	Aqr	22 20 25	−07 15.1	13.8	14.3	P	RRC	018 018
633	GP	Aqr	22 23 02	−08 11.8	10.7	11.7	P	R:+E:	018 018
634	GQ	Aqr	22 23 42	−00 28.5	13.3	14.2	P	RRAB	018 018
635	GR	Aqr	22 23 57	−09 01.0	14.7	16.5:	P	RRAB	018 018
636	GS	Aqr	22 25 02	−00 32.3	13.2	13.8	P	EW/KW	018 018
637	GT	Aqr	22 25 44	−01 14.8	13.1	14.1	P	CWB:	018 018
638	GU	Aqr	22 26 10	−01 06.3	13.4	15.0	P	RR	018 018
639	GV	Aqr	22 27 25	−08 21.9	13.6	14.0	P	EW/KW	018 018
640	GW	Aqr	22 28 16	−07 57.6	12.5	14.3	P	RRAB	018 018
641	GX	Aqr	22 32 22	−03 58.1	13.1	14.2	P	RRAB	018 018
642	GY	Aqr	22 33 32	−01 53.3	12.9	14.2	P	RRAB	018 018
643	CC	Gru	22 36 04	−52 57.2	6.62	6.68	V	DSCTC	079 CPD
644	GZ	Aqr	22 38 24	−07 48.4	14.6	15.5	P	EW:/KW:	018 018
645	HH	Aqr	22 38 55	−06 44.3	11.1	13.1	P	RRAB	018 018
646	IV	Peg	22 42 25	+17 51.3	12.0	17.8	B	M	191 191
647	HI	Aqr	22 50 51	−11 53.0	5.80	(0.005)	V	ACV	290 BD
648	AZ	Psc	22 56 19	−00 35.1	7.32	7.50	V	RS:	209 BD
649	IW	Peg	22 59 37	+10 20.0	2.4	3.4	K	M	015
650	OR	And	23 02 21	+49 10.8	14.51	(17	B	NL:	349 373

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
651	HK	Aqr	$23^h 05^m 41^s$	$-15°40'.8$	10.83	10.91	V	BY	374	BD
652	IX	Peg	23 08 43	+13 34.6	13.2	14.3	B	RRAB	192	192
653	OS	And	23 09 48	+47 12.0	6.5	18	V	N	170	375
654	OT	And	23 17 38	+41 28.9	7.32	7.72	V	EA/D	007	BD
655	IY	Peg	23 19 38	+17 15.3	12.5	14.3	P	RRAB	192	192
656	IZ	Peg	23 25 46	+10 38.1	1.7	6.4	L	M	194	193
657	KK	Peg	23 42 06	+29 53.5	17.34	18.64	B	RRAB	001	001
658	KL	Peg	23 44 26	+29 34.4	16.21	17.80	B	RRAB	001	001
659	OU	And	23 47 10	+36 08.9	5.90	(0.036)	V	FKCOM:	008	BD
660	V657	Cas	23 49 39	+61 32.1	4.3	6.2	1.04	M	015	
661	KM	Peg	23 53 12	+28 53.2	17.25	18.47	B	RRAB	001	001
662	KN	Peg	23 54 14	+31 23.7	17.21	18.16	B	RRAB	001	001
663	KO	Peg	23 59 41	+29 47.9	15.84	16.81	B	RRAB	001	001

Table II

NN And=002=IV V201 [001].
NO And=003=IV V108 [001].
NP And=004=IV V122 [001].
NQ And=005=IV V301 [001].
NR And=007=S10887 [002].
NS And=008=BD+34°118 (9.5)=S 9497 [003]= =NSV 00306.
NT And=010=S 10888 [002].
NU And=013=S 10891 [002].
NV And=014=S 10892 [002].
NW And=020=S 10895 [002].
NX And=021=S 10897 [002].
NY And=022=S 10898 [002].
NZ And=024=S 10899 [002].
OO And=025=BV 124 [004, *Strohmeier*]= = КЗП 5927 = NSV 00527.
OP And=026=HR 454 [005]=BD+47°460 (6.4).
OQ And=028=BD+38°326 (8.3)=HD 10388 (Ma) [006].
OR And=650=206.1940 [348]=KPD 2302+ +4910 [349]=КЗП5653=NSV 14419.
OS And=653=Nova And 1986 [170, *Suzuki*].
OT And=654=BD+40°5049 (7.4)=HD 219989 (A0) [007, *Crawford*]=NSV 14508.
OU And=659=HR 9024 [008]=BD+35°5110 (5.9).
AG Ant=317=HR 4049 [009, 010]=CoD −28°8070 (5.8)=HD 89353 (B9) [011].
FP Aqr=504=IRC 00490 [012, 014, 015]= =NSV 13284.
FQ Aqr=531=BD+1°4381 (9.0) [016].
FR Aqr=549=Gl 812A [017]=Ross 193.
FS Aqr=614=СПЗ 2631 [018].
FT Aqr=615=СПЗ 2634 [018].
FU Aqr=617=СПЗ 2635 [018].
FV Aqr=618=СПЗ 2638 [018].
FW Aqr=619=СПЗ 2637 [018].
FX Aqr=620=СПЗ 2639 [018].
FY Aqr=621=СПЗ 2641 [018].
FZ Aqr=622=СПЗ 2642 [018].
GG Aqr=623=СПЗ 2643 [018].
GH Aqr=626=СПЗ 2645 [018].
GI Aqr=627=СПЗ 2646 [018].
GK Aqr=628=СПЗ 2647 [018].
GL Aqr=629=СПЗ 2648 [018].
GM Aqr=630=СПЗ 2649 [018].
GN Aqr=631=СПЗ 2650 [018].
GO Aqr=632=СПЗ 2652 [018].
GP Aqr=633=СПЗ 2653 [018].
GQ Aqr=634=СПЗ 2654 [018].
GR Aqr=635=СПЗ 2655 [018].
GS Aqr=636=СПЗ 2656 [018].
GT Aqr=637=СПЗ 2659 [018].
GU Aqr=638=СПЗ 2660 [018].
GV Aqr=639=СПЗ 2662 [018].
GW Aqr=640=BV 980 [019]=СПЗ 2663 [018]= =NSV 14182.
GX Aqr=641=СПЗ 2664 [018].

GY Aqr=642=СПЗ 2666 [018].
GZ Aqr=644=СПЗ 2669 [018].
HH Aqr=645=СПЗ 2670 [018].
HI Aqr=647=HR 8704=BD–12°6371 (5.9)==HD 216494 (B9) [020].
HK Aqr=651=BD–16°6218 (10) [021]=Gliese 890 [022]=NSV 14434.
V1377 Aql=442=СПЗ 2709 [023, *Шугаров*].
V1378 Aql=444=Nova Aql 1984 [024].
V1379 Aql=452=BD–6°5221 (8.0)=HD 185510 (G5) [025, 026].
V1380 Aql=453=S 8147 [027]=NSV 12291.
V1381 Aql=455=S 8150 [027]=NSV 12308.
V1382 Aql=456=S 8152 [027]=NSV 12317.
V1383 Aql=457=S 8154 [027]=NSV 12322.
V1384 Aql=458=S 8158 [027]=NSV 12334.
V1385 Aql=459=S 8160 [027]=NSV 12337.
V1386 Aql=460=S 8167 [027]=NSV 12358.
V1387 Aql=461=S 8170 [027]=NSV 12362.
V1388 Aql=462=S 8169 [027]=NSV 12368.
V1389 Aql=463=S 8172 [027]=NSV 12388.
V1390 Aql=464=S 8173 [027]=NSV 12392.
V1391 Aql=465=S 8177 [027]=NSV 12412.
V1392 Aql=466=S 8182 [027]=NSV 12443.
V1393 Aql=467=S 8181 [027]=NSV 12445.
V1394 Aql=468=S 8186 [027]=NSV 12450.
V1395 Aql=469=S 8188 [027]=NSV 12462.
V1396 Aql=470=S 8189 [027]=NSV 12475.
V1397 Aql=471=S 8197 [027]=NSV 12497.
V1398 Aql=472=S 8199 [027]=NSV 12500.
V1399 Aql=473=S 8205 [027]=NSV 12516.
V1400 Aql=474=S 8211 [027]=NSV 12540.
V1401 Aql=477=HR 7671 [028, 029]==BD–12°5641 (6.2)=HD 190390 (F5) [030]=BV 592 [031]=NSV 12766.
V828 Ara=377=HR 6304 [032, 033]=CoD –58°6607 (6.3)=CPD–58°6964 (6.0)==HD 153261 (B0p) [011].
V829 Ara=381=HR 6384 [034]=CoD–56°6744 (7.0)=CPD–56°8098 (7.8).
V830 Ara=386=CoD–45°11660 (8.2)=HD 158864 (B0)=E7,1 [035]=КЗП 7674==NSV 09139.
ι Ara=384=HR 6451=CoD–47°11484 (5.8)==HD 157042 (B3p) [011]=E7,83 [035]=КЗП 7638=NSV 08566.
VZ Ari=034=HR 830 [036]=BD+24°396 (6.0).
V364 Aur=186=S 9574 [003]=NSV 02020.
V365 Aur=203=S 9750 [037]=NSV 02223.
V366 Aur=206=S 9751 [037]=NSV 02263.
V367 Aur=214=S 9576 [003]=NSV 02453.
V368 Aur=219=S 9753 [037]=NSV 02502.
V369 Aur=224=S 9577 [003]=NSV 02568.
V370 Aur=226=CRL 809 [038].
V371 Aur=231=S 9583 [003]=NSV 02673.
V372 Aur=232=S 9585 [003]=NSV 02707.
V373 Aur=233=IRC+40149 [014, 015]==NSV 02749.
V374 Aur=236=S 9756 [037]=NSV 02844.
V375 Aur=237=S 9591 [003]=NSV 02856.
V376 Aur=238=S 9592 [003]=NSV 02858.
V377 Aur=241=S 9757 [037]=NSV 02870.
V378 Aur=243=S 9598 [003]=NSV 02916.
V379 Aur=244=S 9759 [037]=NSV 02921.
V380 Aur=245=S 9599 [003]=NSV 02923.
V381 Aur=246=S 9600 [003]=NSV 02929.
V382 Aur=252=BD+53°1040 (8.8)=HD 46703 (F5) [039].
V383 Aur=280=II V5 [001].
V384 Aur=281=II V407 [001].
V385 Aur=283=II V601 [001].
V386 Aur=284=II V504 [001].
V387 Aur=285=II V306 [001].
V388 Aur=286=II V4 [001].
V389 Aur=287=II V6 [001].
CR Boo=351=PG1346+082 [040].
CS Boo=354=S 10804 [041].
CT Boo=355=Переменная звезда №1 [042]==СПЗ 2818.
CU Boo=362=$15^h20^m55^s$ +52°39'20" (1950.0) [043].
CV Boo=363=BD+37°2641 (9.3) [044].
BV Cam=176=11 Cam [045]=BS 1622==BD+58°804 (6.0)=HD 32343 (B3p) [046, 047].
BW Cam=179=IRC+60154 [012, 014, 015]==NSV 01910.
BX Cam=227=IRC+70066 [014, 015]==NSV 02601.
EH Cnc=307=SVS 510 [048]=P 3171==КЗП 1297=NSV 04070.
EI Cnc=312=G9–38AB [049].
BK CVn=346=21 CVn [050]=HR 5023==BD+50°1994 (5.0)=Zi 993=КЗП 101374=NSV 06179.
BL CVn=347=BD+34°2411 (8.3)=HD 115781 (G5) [052].
BM CVn=350=BD+39°2635 (6.9)=HD 116204 (K2) [053].
HP CMa=274=BS 2501 [054]=CoD–30°3505 (6.3)=HD 49131 (B3) [055].
HQ CMa=282=HR 2800=CoD–26°4223 (6.7)==HD 57593 (B3) [055].

AR Cap=480=BD–18°5609 (8.0)=HD 191287 (B9) [054].
AS Cap=596=BD–14°6070 (8.0)=HD 205249 (G5) [056].
V409 Car=289=CoD–57°1762 (8.3)=CPD–57° 1246 (8.3)=HD 60435 (A3) [057].
V410 Car=303=Cox 84 (NGC 2516) [058, 059].
V411 Car=319=Nova Car 1953 [060]=NSV 04884.
V412 Car=322=C (NGC 3293) [061].
V413 Car=325=CoD–59°3427 (8.8)=CPD–59° 2857 (9.6) [062]=C4.
V414 Car=327=CoD–59°3533 (7.0)=CPD–59° 3017 (7.2)=HD 96248 (B0) [021,063]= =NSV 05082.
V655 Cas=016=IRC+50028 [012, 015]=NSV 00401.
V656 Cas=032=IRC+60092 [012, 064]=CIT 4 [065]=NSV 00857.
V657 Cas=660=IRC+60427 [012, 014, 015]= =NSV 14731.
V837 Cen=333=CoD–45°7153 (7.3)=CPD–45° 5548 (7.4)=HD 101158 (F0) [066].
V838 Cen=334=CoD–48°6770 (9.2)=HD 102077 (K0) [067].
V839 Cen=345=CoD–36°8231 (8.9)=S 4963 [068]=КЗП 1962=NSV 06044.
V840 Cen=348=Nova–like object in Centaurus [069].
V841 Cen=357=CoD–59°5306 (8.6)=CPD–59° 5631 (9.0)=HD 127535 (K2) [026, 067].
V842 Cen=358=Nova Cen 1986 [171].
V363 Cep=585=IRC+70171 [012, 014, 015]= =NSV 13743.
V364 Cep=588=BD+70°1182 (7.7)=HD 205328 (A0) [070].
ν Cep=605=ν Cep [074, 075]=HR 8334= =BD+60°2288 (4.5)=Zi 2044=КЗП 102128=NSV 13875.
BH Cet=009=A possible BL Herculis variable [076].
BI Cet=023=BD–0°210 (8.0)=HD 8358 (G0) [077, 078].
BK Cet=030=HR547 [079]=BD–17°336 (6.2).
IL Com=340=BD+26°2347 (8.9)=HD 108102 (F8) [082]=Tr 111 (Coma Cluster).
IM Com=341=Переменная звезда №2 [042]= =СПЗ 2819.
IN Com=344=BD+26°2405 (8.7) [083]=LT–5 [084, 085].
UV CrB=361=BD+26°2685 (7.3) [086]= =HD 136901 (K0) [053].
SZ Crt=331=BD–19°3242 (8.7)=HD 98712 (K5)=ADS 8138 A=Gl 425 [087].
BY Cru=336=CoD–61°3326 (8.5)=CPD–61° 2935(8.8)=HD 104901 B [088]= =Dunlop 117 B.
BZ Cru=342=HR 4830=CoD–62°671 (6.5)= =CPD–62°2898 (6.6)=HD 110432 (B1p) [089, 090, 091]=КЗП 101318= =NSV 05874.
CC Cru=343=CPD–59°4551 (8.0)=223 (NGC 4755) [092].
V1816 Cyg=450=G 125–12 [093]=NSV 12113.
V1817 Cyg=451=HR 7428 [094]=BD+55°2215 (6.3).
V1818 Cyg=454=BD+28°3434 (8.8) [095]= =СПЗ 2820.
V1819 Cyg=475=Nova Cyg 1986 [096, *Wakuda*].
V1820 Cyg=478=14 (NGC 6871) [097].
V1821 Cyg=479=10 (NGC 6871) [097].
V1822 Cyg=481=BC 40 [098]=СПЗ 2821.
V1823 Cyg=482=S 3854 [068]=КЗП 5076= =NSV 12892.
V1824 Cyg=483=BC 41 [098]=СПЗ 2822.
V1825 Cyg=484=417 [099]=7279 [100]= =Zi 1897=КЗП 101973=NSV 12973.
V1826 Cyg=485=Variable 1 [101].
V1827 Cyg=488=Variable 2 [101].
V1828 Cyg=490=IRC+40435 [012, 014, 015]= =LD 26 [102]=NSV 13180.
V1829 Cyg=491=V2 [103].
V1830 Cyg=492=V6 [103].
V1831 Cyg=493=V5 [103].
V1832 Cyg=494=BC 240 [104]=СПЗ 2617.
V1833 Cyg=495=V7 [103].
V1834 Cyg=496=V10 [103].
V1835 Cyg=497=V13 [103].
V1836 Cyg=498=V14 [103].
V1837 Cyg=499=V17 [103].
V1838 Cyg=500=V18 [103].
V1839 Cyg=501=V19 [103].
V1840 Cyg=502=V20 [103].
V1841 Cyg=503=V21 [103].
V1842 Cyg=505=V23 [103].
V1843 Cyg=506=V24 [103].
V1844 Cyg=507=V25 [103].
V1845 Cyg=508=V26 [103].
V1846 Cyg=509=V28 [103].
V1847 Cyg=510=V27 [103].
V1848 Cyg=511=V30 [103].
V1849 Cyg=512=V32 [103].

V1850 Cyg =513=V33 [103].
V1851 Cyg =514=V34 [103].
V1852 Cyg =515=V37 [103].
V1853 Cyg =516=LS II +34°26 [105].
V1854 Cyg =517=V38 [103].
V1855 Cyg =518=V39 [103].
V1856 Cyg =519=V40 [103].
V1857 Cyg =520=V41 [103].
V1858 Cyg =521=V43 [103].
V1859 Cyg =522=V46 [103].
V1860 Cyg =523=V47 [103].
V1861 Cyg =524=V48 [103].
V1862 Cyg =525=V49 [103].
V1863 Cyg =526=V51 [103].
V1864 Cyg =527=LD 31 [102]=V53 [103]=
=IRC+40454.
V1865 Cyg =528=V57 [103].
V1866 Cyg =529=V59 [103].
V1867 Cyg =530=V60 [103].
V1868 Cyg =532=V63 [103].
V1869 Cyg =533=V64 [103].
V1870 Cyg =534=V67 [103].
V1871 Cyg =535=V66 [103].
V1872 Cyg =536=V68 [103].
V1873 Cyg =537=V69 [103].
V1874 Cyg =538=V70 [103].
V1875 Cyg =539=V71 [103].
V1876 Cyg =540=V72 [103].
V1877 Cyg =541=V73 [103].
V1878 Cyg =542=V74 [103].
V1879 Cyg =543=V76 [103].
V1880 Cyg =544=V77 [103].
V1881 Cyg =545=V78 [103].
V1882 Cyg =546=V79 [103].
V1883 Cyg =547=V80 [103].
V1884 Cyg =548=V81 [103].
V1885 Cyg =550=V82 [103].
V1886 Cyg =551=V83 [103].
V1887 Cyg =552=V84 [103].
V1888 Cyg =553=V85 [103]=AFGL 2679 [106].
V1889 Cyg =554=V86 [103].
V1890 Cyg =555=V88 [103].
V1891 Cyg =556=LD 34 [102]=2946 [098].
V1892 Cyg =557=V90 [103].
V1893 Cyg =558=V93 [103].
V1894 Cyg =559=V95 [103].
V1895 Cyg =560=V96 [103].
V1896 Cyg =561=V97 [103].
V1897 Cyg =562=V98 [103].
V1898 Cyg =563=BD+45°3384 (8.0)=HD 200776
(B8) [011, 107].
V1899 Cyg =564=AFGL 2699 [108]=СПЗ 2823.
V1900 Cyg =565=V99 [103].
V1901 Cyg =566=SVS 503 [109, *A.Beljawsky*]=
=P 5548=КЗП 5374=NSV 13595.
V1902 Cyg =567=V15 [110]=СПЗ 2373.
V1903 Cyg =571=V14 [110]=СПЗ 2372.
V1904 Cyg =579=СПЗ 2690 [111, *Горанский, Шугаров*].
V1905 Cyg =581=V3 [110]=СПЗ 2365.
V1906 Cyg =584=IRC+40483 [012, 014, 015]=
=NSV 13721.
V1907 Cyg =586=V9 [110]=СПЗ 2369.
V1908 Cyg =587=СПЗ 2691 [111, *Шугаров*].
V1909 Cyg =589=V22 [110]=СПЗ 2379.
V1910 Cyg =591=V10 [110]=LD 57 [102]=
=СПЗ 2370.
V1911 Cyg =593=СПЗ 2692 [111, *Шугаров*].
V1912 Cyg =595=V21 [110]=СПЗ 2378.
V1913 Cyg =604=СПЗ 2693 [111, *Шугаров*].
V1914 Cyg =606=BD+43°4060 (8.3)=HD 207739
(G5) [112, 113].
V1915 Cyg =609=СПЗ 1127 [114]=КЗП 8728=
=NSV 13975.
V1916 Cyg =610=СПЗ 1129 [114]=КЗП 8729=
=NSV 13976.
V1917 Cyg =611=СПЗ 1128 [114]=КЗП 8730=
=NSV 13978.
LT Del =489=He2–467 [115]=PK 63–12°1.
AC Dor =173=HV 12718 [116, *Boyce, McNail*].
AD Dor =174=Var 2 [117]=W2.
AE Dor =175=HV 12741 [116, *Boyce, McNail*].
AF Dor =239=HV 12871 [116, *Boyce, McNail*].
DU Dra =352=G238–53 [118].
DV Dra =433=New cataclysmic variable
[119, *Павлов*]=СПЗ 2704.
DW Dra =449=491.1934 [120]=P 5038=КЗП
4670=NSV 11987.
DX Dra =486=IRC+60288 [012, 015]=NSV
13056.
EK Eri =105=HR 1362 [121, 122]=BD–6°875
(6.8)=HD 27536 (G5) [010]=NSV
01563.
δ Eri =055=δ Eri [123]=HR 1136=BD
–10°728 (3.3)=HD 23249 (K0) [124]=
=NSV 01246.
UU For =033=IRC–30023 [012, 064]=NSV
00878.
OV Gem=277=33 Gem [125]=HR 2519=BD
+16°1298 (6.5)=HD 49606 (B8)=
=СПЗ 2705.

BQ Gru =590=V18 [126]=R17 [127].
BR Gru =592=V9 [126]=R5 [127].
BS Gru =594=R2 [127].
BT Gru =598=R23 [127].
BU Gru =599=V3 [126]=R6 [127].
BV Gru =600=R21 [127].
BW Gru =601=S 7469 [128]=R12 [127]=КЗП 8670=NSV 13820.
BX Gru =602=R20 [127].
BY Gru =603=V15 [126]=R16 [127].
BZ Gru =607=HR 8367 [079]=CoD–38°14801 (6.5).
CC Gru =643=HR 8611 [032, 079]=CoD –53°9191 (7.2)=CPD–53°10326 (6.6)= =HD 214441 (F0).
V817 Her =380=PG 1707+427 [129].
V818 Her =383=BD+43°2716 (8.7)=HD 157010 (Mb)=BV 282 [130]=КЗП 7637=NSV 08523.
V819 Her =385=HR 6469 [131]=BD+40°3136 (5.2)=HD 157482 (F8).
V820 Her =414=96 Her [132]=HR 6738=BD +20°3649 (5.2).
V821 Her =439=IRC+20370 [012, 014]=NSV 11225.
V822 Her =441=HR 7109 [134]=BD+13°3787 (5.9)=HD 174853 (B9)=539 [133]= =Zi 1538=КЗП 101774=NSV 11442.
VZ Hor =037=CoD–62°114 (9.0)=CPD–62° 238 (8.6)=HD 18134 (K0) [135].
LO Hya =308=HR 3337 [032, 054, 136]= =BD–2°2581 (7.0)=ADS 6828 B [137].
LP Hya =313=IRC–20188 [012, 015]=NSV 04485.
LQ Hya =314=BD–10°2857 (7.6)=HD 82558 (K0) [135].
LR Hya =321=BD–11°2916 (7.8)=HD 91816 (K0) [138].
LS Hya =330=CoD–29°9003 (7.7)=HD 98457 (A0) [139, 054].
LT Hya =356=IRC–30217 [012, 064]=NSV 06588.
BO Hyi =006=S 6645 [128]=КЗП 5853=NSV 00146.
BP Hyi =031=HV 11550 [140]=V.McK.1 [141, *McKibben*].
BF Ind =570=V21 [126]=R14 [127].
BG Ind =608=$\varkappa^1$ Ind=BS/HR 8369 [142, 032]=CoD–59°7830 (6.7)=CPD–59° 7744 (7.0)=HD 208496 (F5) [143, 144]=BV 564 [145]=NSV 13971.
V366 Lac =624=AFGL 2881 [146]=СПЗ 2695.
V367 Lac =625=Anonymous red star [146]= =СПЗ 2711.
DR Leo =315=HR 3850=BD+31°2026 (6.2)= =HD 83787 (K5) [006].
DS Leo =326=BD+22°2302 (9.2)=Gliese 410 [147, 309].
TX Lep =180=HR 1754 [148]=BD–18°1056 (7.0)=HD 34797 (B8)=ADS 3910 B.
TY Lep =215=СПЗ 2696 [149, *Горанский*].
TZ Lep =229=New flare star [150].
HI Lib =360=BD–13°4081 (7.5)=HD 134214 (F0) [151].
HR Lup =359=HR 5624 [032, 152, 153]= =CoD–40°9305 (6.2)=HD 133880 (A0p) [011, 154].
AO Lyn =242=S 10886 [155].
AP Lyn =248=IRC+60169 [012, 064]=NSV 03020.
AQ Lyn =288=II V303 [001].
AR Lyn =290=II V2 [001].
AS Lyn =291=II V502 [001].
AT Lyn =292=II V1 [001].
AU Lyn =293=III V203 [001].
AV Lyn =297=III V202 [001].
AW Lyn =299=III V102 [001].
AX Lyn =301=III V103 [001].
AY Lyn =302=III V208 [001].
AZ Lyn =304=III V101 [001].
BB Lyn =305=III V302 [001].
BC Lyn =306=III V206 [001].
V483 Lyr =443=V10 (NGC 6779/M 56) [156].
V484 Lyr =445=V11 (NGC 6779/M 56) [156].
V485 Lyr =446=V8 (NGC 6779/M 56) [157].
V486 Lyr =447=V9 (NGC 6779/M 56) [157].
V487 Lyr =448=V7 (NGC 6779/M 56) [157].
YZ Men =178=CoD–77°188 (8.0)=CPD–77° 196 (8.4)=HD 34802 (G5) [026].
ZZ Men =181=HV 928 [158].
AA Men =234=HV 12691 [116].
AY Mic =568=R22 [127].
AZ Mic =569=R4 [127].
BB Mic =572=V14 [126]=R3 [127].
BC Mic =573=V10 [126]=R11 [127].
BD Mic =574=V11 [126]=R10 [127].
BE Mic =575=R7 [127].
BF Mic =576=R19 [127].
BG Mic =577=R9 [127].
BH Mic =578=R13 [127].
BI Mic =580=CoD–30°18600 (8.0)=HD 203932 (A5) [159, 057].
BK Mic =582=V17 [126]=R15 [127].

BL Mic =583=V4 [126]=R1 [127].
V652 Mon =235=СПЗ 2698 [149, *Горанский*].
V653 Mon =240=HR 2195 [153]=BD–6°1439 (6.3)=HD 42536 (A0) [160].
V654 Mon =247=IRC+00102 [012, 014, 064]= =NSV 02938.
V655 Mon =249=1 [161].
V656 Mon =250=3 [161].
V657 Mon =253=4 [161].
V658 Mon =254=5 [161].
V659 Mon =255=6 [161].
V660 Mon =256=7 [161].
V661 Mon =257=8 [161].
V662 Mon =258=10 [161].
V663 Mon =259=9 [161].
V664 Mon =260=11 [161].
V665 Mon =261=12 [161].
V666 Mon =262=14 [161].
V667 Mon =263=15 [161].
V668 Mon =264=17 [161].
V669 Mon =265=18 [161]≠V418 Mon.
V670 Mon =266=19 [161].
V671 Mon =267=20 [161].
V672 Mon =268=21 [161].
V673 Mon =269=22 [161].
V674 Mon =270=23 [161].
V675 Mon =271=24 [161].
V676 Mon =272=25 [161].
V677 Mon =273=26 [161].
V678 Mon =276=28 [161].
V679 Mon =278=29 [161].
V680 Mon =279=BD+9°1467 (9.4)=HD 267564 (B8)=SVS 1025 [162]=КЗП 929= =NSV 03323.
V681 Mon =296=20.1934 [163]=P 3074=КЗП 1158=NSV 03772.
GS Mus =337=CoD–68°1028 (7.7)=CPD–68° 1612 (7.1)=HD 105056 (B0p) [164, 165, 054]=NSV 05454.
V342 Nor =365=F1 [166].
V343 Nor =366=CoD–57°6042 (7.6)=CPD–57° 7121 (8.3)=HD 139084 (G5) [067].
V344 Nor =367=Nova? Nor [167].
V345 Nor =368=HV 8827 [168]=759.1935= =P 3993=КЗП 2543=NSV 07429.
V346 Nor =373=Starlike object in Herbig–Haro 57 [169].
V2205 Oph =372=BD–9°4395 (9.4) [172, *Landolt;* 173].
V2206 Oph =376=IRC–10348 [012, 015]=NSV 08006.
V2207 Oph =378=IRC–10355 [012, 015]=NSV 08098.
V2208 Oph =382=V13 (NGC 6333/M 9) [174].
V2209 Oph =387=Var 218 [175].
V2210 Oph =388=HV 11048 [176, *Huruhata*]= =КЗП 3479=NSV 09716.
V2211 Oph =389=IRC–10381 [012, 015]=NSV 09764.
V1156 Ori =182=BD+1°996 (8.2)=HD 35298 (B8) [177, 011].
V1157 Ori =183=1 (Table III) [178]=СПЗ 2790.
V1158 Ori =184=135 [178]=СПЗ 2813.
V1159 Ori =185=36.1906 [179]=2 (Table III) [178]=Zi 379=КЗП579=NSV 02011.
V1160 Ori =187=3 (Table III) [178]=СПЗ 2791.
V1161 Ori =188=4 (Table III) [178]=СПЗ 2792.
V1162 Ori =189=BD–7°1108 (9.4) [180].
V1163 Ori =190=5 (Table III) [178]=СПЗ 2793.
V1164 Ori =191=6 (Table III) [178]=СПЗ 2794.
V1165 Ori =192=7 (Table III) [178]=СПЗ 2795.
V1166 Ori =193=35.1903 [181]=8 (Table III) [178]=Zi 390=КЗП 100505=NSV 02109.
V1167 Ori =194=134 [178]=СПЗ 2812.
V1168 Ori =195=9 (Table III) [178]=СПЗ 2796.
V1169 Ori =197=10 (Table III) [178]=СПЗ 2797.
V1170 Ori =198=11 (Table III) [178]=СПЗ 2798.
V1171 Ori =199=12 (Table III) [178]=СПЗ 2799.
V1172 Ori =200=13 (Table III) [178]=СПЗ 2800.
V1173 Ori =201=5 [182]=B5 [183]=СПЗ 2816.
V1174 Ori =202=14 (Table III) [178]=СПЗ 2801.
V1175 Ori =204=Brun 375 [184, 185]=3 [186]= =B21 [183]=П 1588=СПЗ 2503= =КЗП 100552=NSV 02225.
V1176 Ori =205=16 (Table III) [178]=СПЗ 2803.
V1177 Ori =207=132 [178]=СПЗ 2810.
V1178 Ori =208=18 (Table III) [178]=СПЗ 2804.
V1179 Ori =209=BD–7°1131 (7.0)=HD 37151 (B9) [187].
V1180 Ori =210=162 [188]=19 (Table III) [178]= =КЗП 6316=NSV 02407.
V1181 Ori =211=133 [178]=СПЗ 2811.
V1182 Ori =212=E 43 [189]=20 (Table III) [178]= =КЗП 6322=NSV 02421.
V1183 Ori =213=21 (Table III) [178]=СПЗ 2805.
V1184 Ori =216=22 (Table III) [178]=СПЗ 2806.
V1185 Ori =217=2 [186]=B20 [183]=23 (Table III) [178]=П 2572=СПЗ 2807.
V1186 Ori =218=141 [178]=СПЗ 2815.
V1187 Ori =220=IRC–10095 [012, 015]=NSV 02533.

V1188 Ori =221=26 (Table III) [178]=СПЗ 2808.
V1189 Ori =222=27 (Table III) [178]=СПЗ 2809.
V1190 Ori =223=П 2975 [189]=28 (Table III) [178]=КЗП 102486=NSV 02561.
V1191 Ori =225=137 [178]=СПЗ 2814.
IQ Peg =001=IV V401 [001].
IR Peg =597=PG 2131+066 [129].
IS Peg =612=BD+25°4655 (9.0) [190].
IT Peg =613=СПЗ 2694 [111, *Горанский*].
IU Peg =616=DO 7722 (var, M7) [376]= =IRC+10510 [012, 015]=КЗП 102147= =NSV 14037.
IV Peg =646=СПЗ 2688 [191, *Горанский*].
IW Peg =649=IRC+10525 [012, 064].
IX Peg =652=СПЗ 2699 [192, *Горанский*].
IY Peg =655=СПЗ 2700 [192, *Горанский*].
IZ Peg =656=CRL/AFGL 3099 [193, 194].
KK Peg =657=IV V105 [001].
KL Peg =658=IV V106 [001].
KM Peg =661=IV V104 [001].
KN Peg =662=IV V107 [001].
KO Peg =663=IV V103 [001].
V483 Per =035=СПЗ 2559 [195].
V484 Per =038=He 520 [196].
V485 Per =039=AP 15 [196].
V486 Per =040=AP 43 [196].
V487 Per =041=AP 56 [196].
V488 Per =042=AP 70 [196].
V489 Per =043=AP 86 [196].
V490 Per =100=BD+31°703 (6.5) [197, 198, 199]=HD 25799 (B3)=38.1934 [200]= =P 2603=КЗП 377=NSV 01459.
V491 Per =101=BD+37°878 (6.9)=HD 25893 (G5) [053]=ADS 2995.
V492 Per =140=BD+36°903 (6.5)=HD 28591 (G5) [053].
ε Per =098=ε Per [201, 202]=HR 1220= =BD+39°895 (3.2)=HD 24760 (B1)= =ADS 2888 A=Zi 263=КЗП 100363= =NSV 01423.
τ Per =036=τ Per [203, 204]=HR 854= =BD+52°641 (4.2)=ADS 2202 A= =Zi 159=КЗП 100243=NSV 00978.
BD Phe =029=HR 541 [079]=CoD−50°514 (6.1)=HD 11413 (A0).
TU Pic =177=CoD−44°1873 (6.9)=HD 33331 (A0) [205].
AT Psc =011=S 10889 [002].
AU Psc =012=S 10890 [002].
AV Psc =017=S 10893 [002].
AW Psc =018=IRC+30021 [206, 014, 207, 064]=NSV 00426.
AX Psc =019=S 10894 [002].
AY Psc =027=PHL 1065 [208]=PG 0134+070= =NSV 00564.
AZ Psc =648=BD−1°4364 (7.5)=HD 217188 (K0) [209].
V338 Pup =251=CoD−45°2613 (9.3)=HD 47147 (A5) [054].
V339 Pup =275=BS 2510 [010]=CoD−37°3065 (6.5)=HD 49336 (B5).
V340 Pup =294=Anonymous irregular variable [210].
V341 Pup =298=CoD−27°4729 (7.7)=HD 64972 (B8) [144].
V342 Pup =300=CoD−45°3574 (7.3)=HD 65270 (B5) [211].
V4092 Sgr =393=Nova Sgr 1984 [212].
V4093 Sgr =395=1 [213].
V4094 Sgr =396=2 [213].
V4095 Sgr =397=3 [213].
V4096 Sgr =398=4 [213].
V4097 Sgr =399=5 [213].
V4098 Sgr =400=6 [213].
V4099 Sgr =401=8 [213].
V4100 Sgr =402=E1 [213].
V4101 Sgr =403=10 [213].
V4102 Sgr =404=11 [213].
V4103 Sgr =405=12 [213].
V4104 Sgr =406=E2 [213].
V4105 Sgr =407=E4 [213].
V4106 Sgr =408=18 [213].
V4107 Sgr =409=21 [213].
V4108 Sgr =410=23 [213].
V4109 Sgr =411=28 [213].
V4110 Sgr =412=35 [213].
V4111 Sgr =413=40 [213].
V4112 Sgr =415=53 [213].
V4113 Sgr =416=54 [213].
V4114 Sgr =417=56 [213].
V4115 Sgr =418=E9 [213].
V4116 Sgr =419=57 [213].
V4117 Sgr =420=64 [213].
V4118 Sgr =421=E10 [213].
V4119 Sgr =422=E11 [213].
V4120 Sgr =423=IRC−20424 [012, 015]=NSV 10099.
V4121 Sgr =424=Nova Sgr 1983 [214, *Wakuda*].
V4122 Sgr =425=F9 [215].
V4123 Sgr =426=F4 [215].
V4124 Sgr =427=F8 [215].
V4125 Sgr =428=F6 [215].

V4126 Sgr =429=F5 [215].
V4127 Sgr =430=F3 [215].
V4128 Sgr =434=V15 (NGC 6626/M28) [216].
V4129 Sgr =435=V24 (NGC 6626/M28) [217, *Watt*].
V4130 Sgr =436=V16 (NGC 6626/M28) [216].
V4131 Sgr =438=BD-22°4820 (8.7)=HD 172256 (B5) [011, 218].
V4132 Sgr =440=2 [219]=NSV 11237.
V4133 Sgr =476=CoD-39°13583 (7.0)=HD 189832 (F0p) [220].
V952 Sco =369=CoD-26°11240 (6.9)=HD 145102 (B9) [221].
V953 Sco =371=CoD-25°11477 (9.2)=HD 146998 (A2) [222].
V954 Sco =374=CoD-43°10964 (7.6)=HD 149779 (B3) [223]=BV 1474 [224]= =NSV 07868.
V955 Sco =375=CoD-27°11054 (8.1)=HD 150035 (B9) [222].
V956 Sco =379=CoD-35°11320 (8.4)=CPD -35°6860 (8.6)=HD 154450 (B0)= =HV 10856 [225]=КЗП 2944=NSV 08191.
V957 Sco =390=HR 6647=CoD-34°12165 (7.2)= =HD 162374 (B8)=№26 (NGC 6475) [187].
V958 Sco =391=CoD-34°12198 (7.6)=HD 162576 (B9)=№55 (NGC 6475) [187].
V959 Sco =392=CoD-34°12201 (7.7)=HD 162588 (B9)=№59 (NGC 6475) [187].
V960 Sco =394=Nova Sco 1985 [226].
AP Scl =015=CoD-27°355 (8.0)=HD 6532 (A2) [227].
V441 Sct =437=OH 21.5+0.5 [228].
MW Ser =364=IRC+00266 [012, 064]=NSV 07098.
MX Ser =370=HV 10531 [229]=КЗП 2608= =NSV 07530.
MY Ser =431=BD-12°4980 (7.3)=HD 167971 (B0) [011, 054, 230].
MZ Ser =432=W409 (NGC 6611) [231].
SZ Sex =318=New Mira Type Variable [232, *Дамбис*]=СПЗ 2689.
V837 Tau =044=BD+25°580 (8.0)=HD 22403 (G0) [233, 234].
V838 Tau =045=T66b [235]=TCSN 13.
V839 Tau =046=540 [237]=B540=СПЗ 2824= =TCSN 23.
V840 Tau =047=T67b [235]=TCSN 35 [236].
V841 Tau =048=T68b [235]=TCSN 37 [236].
V842 Tau =049=Asiago/A114 [238]=TCSN 53.
V843 Tau =050=525 [237]=B525=СПЗ 2825= =TCSN 54.
V844 Tau =051=TCSN 85 [236]=T73b.
V845 Tau =052=351 [239]=B351=TCSN 96= =NSV 01239.
V846 Tau =053=TCSN 114 [236]=T74b.
V847 Tau =054=344 [239]=B344=TCSN 128.
V848 Tau =056=TCSN 136 [236]=T75b.
V849 Tau =057=TCSN 145 [236]=T76b.
V850 Tau =058=TCSN 155 [236]=T77b.
V851 Tau =059=R20 [240].
V852 Tau =060=TCSN 182 [236]=T78b.
V853 Tau =061=R24 [241].
V854 Tau =062=R21 [240].
V855 Tau =063=Hz 727 [242, 243].
V856 Tau =064=TCSN 206 [236]=T79b.
V857 Tau =065=R6 [244]=TCSN 209.
V858 Tau =066=537 [237]=B537=СПЗ 2826= =TCSN 220.
V859 Tau =067=R22 [240].
V860 Tau =068=267 [245]=B267=TCSN 241= =СПЗ 2706=NSV 01291.
V861 Tau =069=TCSN 253 [236]=T80b.
V862 Tau =070=5b [246]=T5b=TCSN 267.
V863 Tau =071=228 [245]=B228=СПЗ 2707= =NSV 01299.
V864 Tau =072=TCSN 269 [236]=T81b.
V865 Tau =073=473 [247]=B473=R15 [248]= =TCSN 276.
V866 Tau =074=357 [239]=B357=TCSN 292= =СПЗ 2017=NSV 01307.
V867 Tau =075=3 [249]=TCSN 289=Plf 519.
V868 Tau =076=428 [239]=B428=TCSN 316= =NSV 01326.
V869 Tau =077=Asiago/A108 [238]=K15 [250]= =TCSN 318=Plf 384=NSV 01319= =NSV 01330.
V870 Tau =078=Asiago/A91 [251]=Plf 303= =TCSN 323=NSV 01323.
V871 Tau =079=364 [239]=B364=СПЗ 2024= =TCSN 322=NSV 01325.
V872 Tau =080=TCSN 327 [236]=T82b.
V873 Tau =081=7b [246]=TCSN 337=NSV 01331.
V874 Tau =082=8b [246]=TCSN 338=Plf 315= =NSV 01332.
V875 Tau =083=470 [247]=B470=TCSN 343.
V876 Tau =084=T60b [252]=435 [247]=B435= =TCSN 360=NSV 01349.
V877 Tau =085=R18 [248].
V878 Tau =086=4 [253]=Plf 496=TCSN 404.
V879 Tau =087=K33 [254]=TCSN 405=NSV 01293.

V880 Tau=088=TCSN 420 [236]=T83b.
V881 Tau=089=K35 [254]=TCSN 421.
V882 Tau=090=K34 [254]=TCSN 442.
V883 Tau=091=TCSN 463 [236]=T85b.
V884 Tau=092=K37 [255]=TCSN 472.
V885 Tau=093=K40 [255]=TCSN 475.
V886 Tau=094=TCSN 485 [236]=T87b.
V887 Tau=095=TCSN 484 [236]=T86b.
V888 Tau=096=TCSN 489 [236]=T88b.
V889 Tau=097=TCSN 495 [236]=T89b.
V890 Tau=099=TCSN 515 [236]=T90b.
V891 Tau=102=HR 1321 [256]=BD+5°613 (8.5)=HD 26913 (G0) [257]=ADS 3085 B=NSV 01534.
V892 Tau=103=1 [258].
V893 Tau=104=BD+19°694 (8.7)=VB 26 (Hyades) [259].
V894 Tau=106=B23 [260]=СПЗ 2712.
V895 Tau=107=BD+14°693 (7.8)=VA 308 (Hyades) [261]=VB 50.
V896 Tau=108=B49 [262]=СПЗ 2713.
V897 Tau=109=BD+16°592 (8.2)=VA 319 (Hyades) [261]=VB 52.
V898 Tau=110=B46 [262]=СПЗ 2714.
V899 Tau=111=B50 [262]=СПЗ 2718.
V900 Tau=112=B67 [262]=СПЗ 2719.
V901 Tau=113=B48 [262]=СПЗ 2721.
V902 Tau=114=B65 [262]=СПЗ 2722.
V903 Tau=115=B30 [260]=СПЗ 2723.
V904 Tau=116=B26 [260]=СПЗ 2724.
V905 Tau=117=B55 [262]=СПЗ 2725.
V906 Tau=118=BD+16°598 (8.3)=VA 389 (Hyades) [243, 261]=VB 63.
V907 Tau=119=B39 [260]=СПЗ 2726.
V908 Tau=120=B68 [262]=СПЗ 2727.
V909 Tau=121=B53 [262]=СПЗ 2728.
V910 Tau=122=B32 [260]=СПЗ 2729.
V911 Tau=123=BD+16°601 (8.2)=VA 400 (Hyades) [243, 261]=VB 64.
V912 Tau=124=B56 [262]=СПЗ 2730.
V913 Tau=125=B17 [260]=СПЗ 2731.
V914 Tau=126=B34 [260]=СПЗ 2732.
V915 Tau=127=B62 [262]=СПЗ 2733.
V916 Tau=128=B69 [262]=СПЗ 2734.
V917 Tau=129=B37 [260].
V918 Tau=130=BD+19°727 (8.8)=VB 69 (Hyades) [259].
V919 Tau=131=SB 38 [260, 262]=СПЗ 2736.
V920 Tau=132=BD+16°606 (7.8)=VA 495 (Hyades) [243, 261]=VB 73 [259].
V921 Tau=133=BD+17°734 (9.3)=VB 79 (Hyades) [259]=VA 547.
V922 Tau=134=B36 [260]=СПЗ 2739.
V923 Tau=135=B25 [260]=СПЗ 2740.
V924 Tau=136=B41 [260]=СПЗ 2741.
V925 Tau=137=B63 [262]=СПЗ 2744.
V926 Tau=138=B38 [260]=СПЗ 2743.
V927 Tau=139=B73 [262]=LkHα 331=СПЗ 2788=NSV 01630.
V928 Tau=141=A (Трапеция 2) [263]=JH 91==СПЗ 2750.
V929 Tau=142=B54 [262]=СПЗ 2751.
V930 Tau=143=B59 [262]=СПЗ 2752.
V931 Tau=144=B61 [262]=СПЗ 2753.
V932 Tau=145=B22 [260]=СПЗ 2755.
V933 Tau=146=B76 [262]=СПЗ 2757.
V934 Tau=147=B24 [260]=СПЗ 2758.
V935 Tau=148=B40 [260]=СПЗ 2759.
V936 Tau=149=B11 [264]=СПЗ 2708.
V937 Tau=150=B45 [262]=СПЗ 2760.
V938 Tau=151=BD+15°651 (8.5)=VA 748 (Hyades) [261]=VB 97 [259].
V939 Tau=152=SB 42 [260, 262]=СПЗ 2761.
V940 Tau=153=B72 [262]=СПЗ 2762.
V941 Tau=154=B14 [260]=СПЗ 2763.
V942 Tau=155=B16 [260]=СПЗ 2764.
V943 Tau=156=B58 [262]=СПЗ 2765.
V944 Tau=157=B35 [260]=СПЗ 2767.
V945 Tau=158=B74 [262]=СПЗ 2768.
V946 Tau=159=B12 [260]=СПЗ 2770.
V947 Tau=160=B18 [260]=СПЗ 2771.
V948 Tau=161=B51 [262]=СПЗ 2772.
V949 Tau=162=SB 65 [262]= СПЗ 2773.
V950 Tau=163=B66 [262]=СПЗ 2776.
V951 Tau=164=B42 [260]=СПЗ 2777.
V952 Tau=165=B31 [260]=СПЗ 2779.
V953 Tau=166=B64 [262]=СПЗ 2780.
V954 Tau=167=B70 [262]=СПЗ 2781.
V955 Tau=168=B13 [260]=СПЗ 2827=LkHα 332=NSV 01695.
V956 Tau=169=B27 [260]=СПЗ 2783.
V957 Tau=170=B20 [260]=СПЗ 2785.
V958 Tau=171=B44 [262]=СПЗ 2786.
V959 Tau=172=B57 [262]=СПЗ 2787.
V960 Tau=196=120 Tau [265, 054]=HR 1858==BD+18°877 (6.2)=HD 36576 (B3p).
V961 Tau=228=HV 6921 [266]=P 2786=КЗП 674=NSV 02602.
V962 Tau=230=СПЗ 2697 [192, *Горанский*].
DW UMa=320=PG 1030+590 [267].
DX UMa=323=СПЗ 2701 [268].
DY UMa=328=СПЗ 2702 [268].

DZ UMa=329=СПЗ 2703 [268].
EE UMa=332=HR 4430 [053]=BD+47°1880 (6.8).
EF UMa=335=GR 314 [269].
EG UMa=339=Case 1 [270]=СПЗ 2817.
EH UMa=353=BD+53°1667 (6.3)=HD 121297 (Mb) [006].
KR Vel =309=CoD–52°2486 (7.6)=CPD–52° 1581 (7.4)=HD 74169 (A0)=18 (IC 2391) [187]=Hogg 11 (IC 2391).
KS Vel =310=A faint flare star [271].
KT Vel =311=HR 3466=CoD–52°2504 (5.7)= =CPD–52°1605 (6.8)=HD 74535 (B9)=31 (IC 2391) [187]=Hogg 4 (IC 2391).
KU Vel =316=A new pulsating variable [272].
KV Vel =324=LSS 2018 [273].
HU Vir =338=BD–8°3301 (8.0)=HD 106225 (K0) [078].
HV Vir =349=Nova Vir 1929=378.1931 [274, 275].
UY Vol =295=EXO 0748–676 [378, 276].
QU Vul =487=Nova Vul 1984 №2 [277, *Collins*].

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B, V PHOTOMETRY OF ER VULPECULAE

The double-lined spectroscopic and eclipsing binary ER Vul has received more attention in recent years, when Hall (1976) included it into the short period group of RS CVn-type binaries. Many light curves of it were obtained in order to reveal and understand the cause of the variations. Since 1981 the short period RS CVn binaries ER Vul, UV Psc, and SV Cam have been observed at the Ege University Observatory. The light curve variations of the peculiar eclipsing system ER Vul have been discussed recently by Ibanoglu et al. (1987). The photometric results of 1984 and 1985 observations are still in preparation. In this paper we present the 1986 blue and yellow light curves of the system.

The observations were obtained with the 48 cm Cassegrain telescope of the Ege University Observatory. An EMI 9781A photomultiplier and standard B and V filters were used. HD 200270 was chosen as comparison and HD 200425 as check star . The differential magnitudes in two colours were taken as variable minus comparison. These magnitudes were also corrected for atmospheric extinction. The following light elements given by Ibanoglu et al. (1985) were used in computing the phases of the individual observations:

$$\text{Min I} = \text{J.D. Hel. } 2440\ 182.2621 + 0\overset{d}{.}69809409E.$$

Two different light curves were obtained with an interval of a month in each colour. The light curves are shown in Figures 1 and 2. As it is clearly seen from these Figures the system seems to be too active at the end of June, 1986. Short-term,non-periodic light fluctuations seem to be the main characteristics of the system. However, a month later it appears to be fairly quiet. The system is brighter at the first maximum than it is at the second. The descending and ascending branches of both minima are generally asymmetric. The mean brightness of the system reaches its maximum value at about phase 0.35 and it decreases rapidly until phase 0.6, then, it remains almost constant for a long

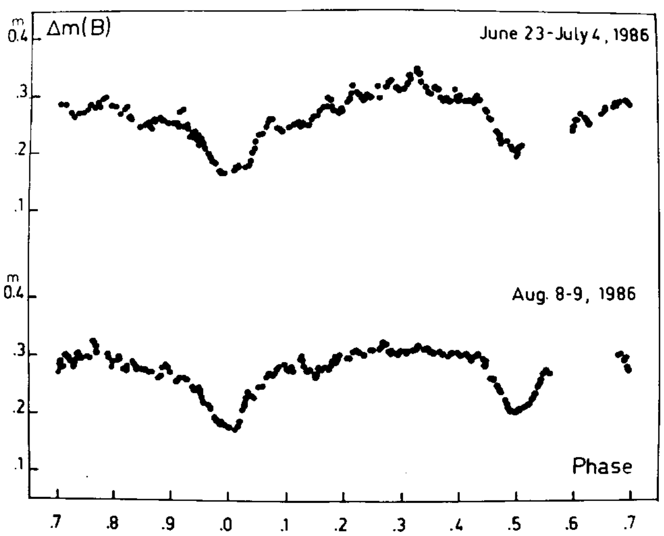

Fig. 1: The blue light curves of ER Vul obtained in 1986.

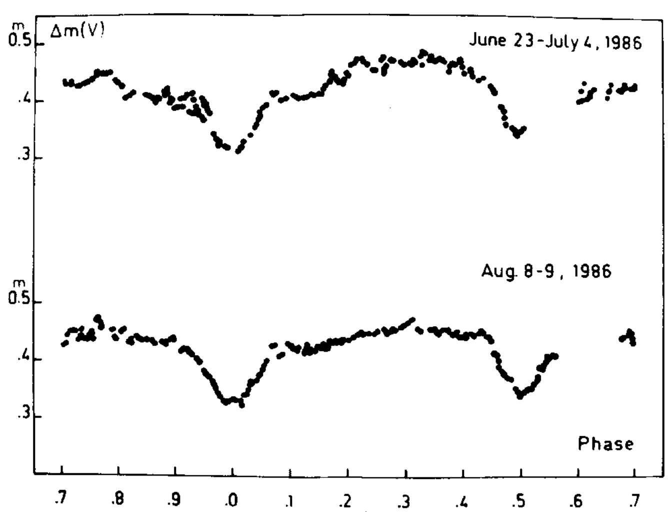

Fig. 2: The yellow light curves of ER Vul obtained in 1986.

phase interval, until about phase 0.1. Therefore, it is too difficult to make any decision about the phase of minima of the wave-like distortion. The phase of the wave-minima obtained so far were plotted versus years. Despite the scattering of the points, the wave-like distortion superimposed on the light curves moves towards the decreasing orbital phase with a period of about eight months. The nonstationary state of the system ER Vul is studied by Botsula (1985) who concluded that gaseous matter exists in the system. The light fluctuations in the light curves may be the result of this event.

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THE 1986 LIGHT CURVES OF UV PISCIUM

Based on photographic observations, the light curve of UV Psc was first published by Huth (1959). Hall (1976), included the system in the short-period group of RS CVn-type binaries. The spectroscopic record of UV Psc is due to Popper (1969) and the system is listed as a double-line binary with emission from both components present in the H and K lines of Ca II. The photoelectric observations of the system were made by several investigators. According to his light curve analysis Sadik (1979) stated that the irregularities in the light curve were caused by a locally hotter (rather than cooler) region.

Two-colour photoelectric observations of UV Psc were carried out from November 10 to November 20, 1986 at the Ege University Observatory with the 48 cm Cassegrain telescope equipped with an EMI 9781A photomultiplier. B and V filters of the standard UBV system were utilized to secure the observations, BD +6° 191 and BD +6° 197 were used as comparison and check stars, respectively. The differential magnitudes in the sense variable minus comparison were corrected for atmospheric extinction and the times of the individual observations were reduced to the Sun's centre. The phases of the individual observations were calculated with the new light elements given by Ibanoglu(1987) as,

$$\text{Min I} = \text{J.D. Hel. } 2444\,932.2985 + 0^{d}\!.86104771E.$$
$$\pm 2 \qquad\qquad \pm 11$$

In Figure 1, B and V light curves of UV Psc obtained in the observing season of 1986 are presented. A continuous light variation due to the wave-like distortion can be easily recognized, except for the phase interval 0.065-0.225 for the blue light. The wave minimum seems to be located just at the secondary minimum of the light curve. As in the light curves of all other RS CVn type binaries, the location of the minimum of the wavelike distortion is shifted towards the decreasing orbital phases in the case of UV Psc, with a period of roughly 1.5-2.0 years.

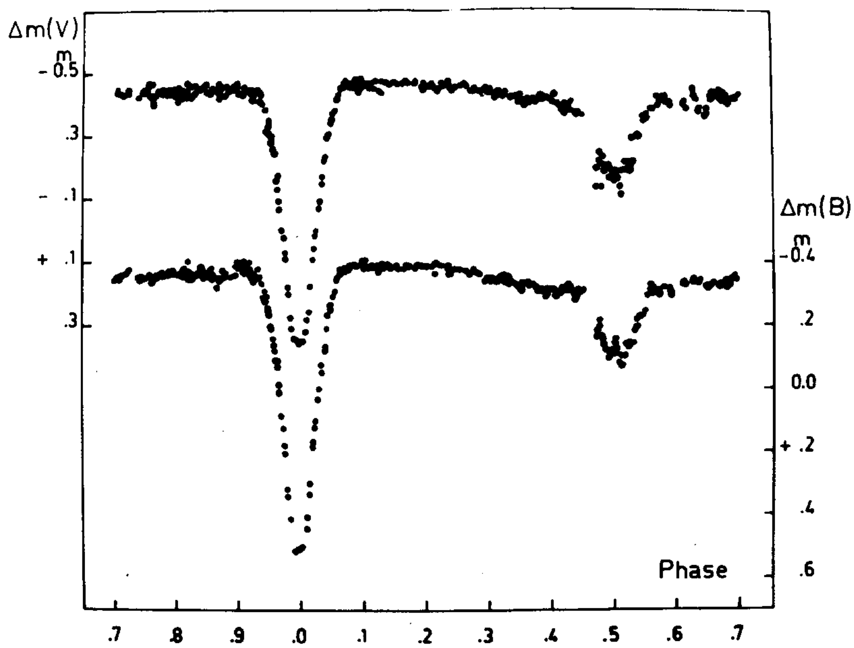

Figure 1: B and V light curves of UV Psc obtained in 1986.

The light curves of the system obtained in 1986 can be considered quiet if the fluctuations between the phase interval 0.475-0.525 are ignored. For the observing season of 1982, however, the light curves of the system in both colours proved to be considerably fluctuating (Ibanoglu, 1987).

The observations of the system will be carried out in the coming observing season.

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HD 185510: A CALCIUM-EMISSION BINARY WITH ECLIPSES OF A SUBDWARF COMPANION

HD 185510 is a K0 III-IV star with strong Ca II H and K emission (Bidelman and MacConnell 1973). It is a light variable with a photometric period of approximately 25 days (Henry, Murray, and Hall 1982). Radial velocities and photometry obtained at SAAO (Balona, Lloyd Evans, and Koen: to be published in SAAO Circulars) yield an orbital period of 20.658 days and an improved photometric period of 25.4 days. The secondary star is a B subdwarf (Fekel and Simon 1985), which is eclipsed at phase 0.40 in the orbital ephemeris using T = 2,440,000.0. The eclipse of the hot star is prominent in U - B (see Fig. 1), but is much smaller in B - V (depth of 0.02 to 0.03 mag). At these longer wavelengths the eclipse variations are dominated by starspot activity on the primary star.

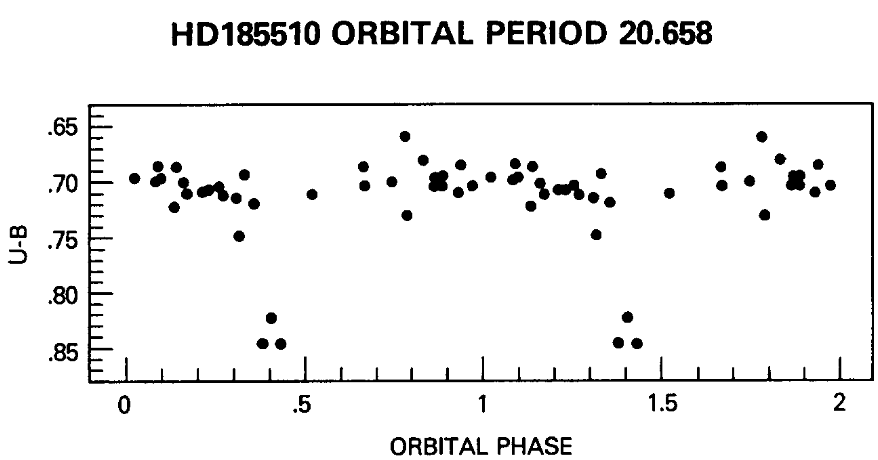

Fig. 1. Photometry of HD 185510 from the SAAO. Zero phase corresponds to JD 2,440,000.0.

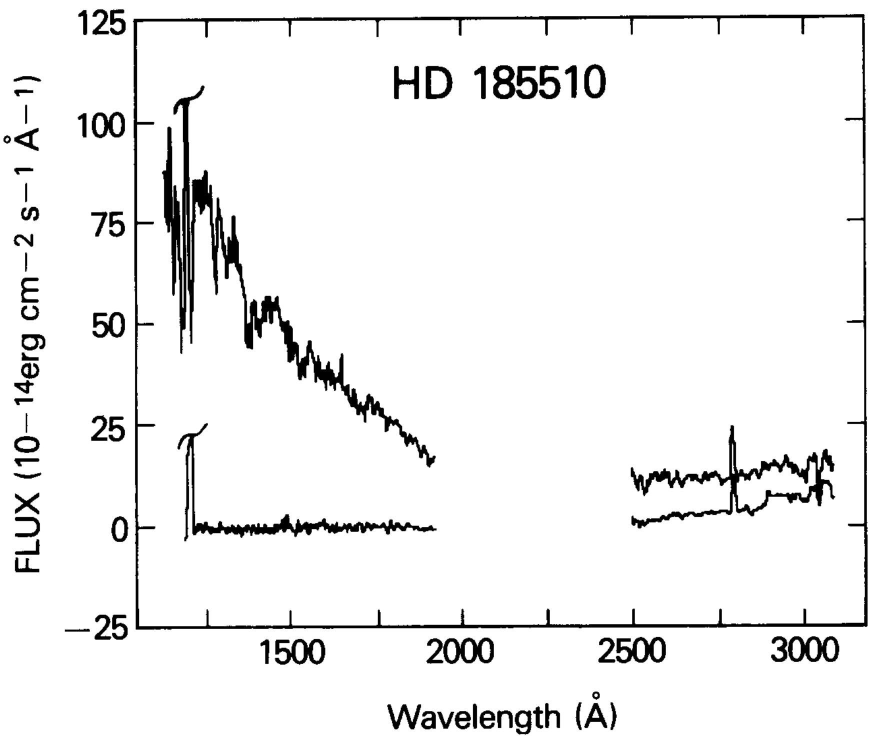

Fig. 2. Low dispersion spectra of HD 185510 obtained with the ultraviolet cameras of IUE. The bright out-of-eclipse spectrum of the hot subdwarf is present in the upper curve, but there is no trace of this star in the lower spectrum, which was taken when the subdwarf was eclipsed by the primary. In both observations the Lyman-alpha line is contaminated by geocoronal emission and has been clipped. We identify the Mg II emission line in the long-wavelength region with the chromosphere of the late-type primary.

At far ultraviolet wavelengths the eclipse of the secondary star appears to be total. Fig. 2 shows a recent out-of-eclipse spectrum of the subdwarf that we obtained with the IUE satellite on JD 2,446,713.42 (corresponding to phase 0.98) and a follow-up observation made with the same exposure time on JD 2,446,742.69 at the time of secondary eclipse. The total eclipse of the subdwarf in the later observation is unmistakable. A third spectrum was kindly taken for us by Dr. Chris Shrader of the IUE Observatory staff on JD 2,446,370.67 during ingress when the subdwarf was not fully occulted. This observation appears to show atmospheric eclipse effects due to the extended chromosphere and transition region of the primary star.

Ground-based observations of HD 185510 in the current observing season were resumed at the SAAO in April 1987. Radial velocity observations show no significant error in the orbital ephemeris, but an uncertainty of several hours cannot be excluded as the semi-amplitude, K, of the velocity curve is only 9.6 km s^{-1}. Photometry near the time of the eclipses of April 1-2 and April 22 showed no fading in U at 0.7627 and 0.3720 days, respectively, before the predicted dates of mid-eclipse. Therefore, the phase of mid-eclipse may be somewhat later than 0.40. The range of the 25-day photometric light wave in V is now 8.26 to 8.45 mag, which is 0.05 mag brighter overall than in 1979-81. This suggests that the spots on the K star have evolved since the earlier observations.

Observations of HD 185510 from the SAAO are continuing. In addition, IUE observations during the ingress and egress phases of the eclipse predicted for 1987 October 25 are planned to study the atmospheric structure of the K star. Additional photometry of HD 185510 from other observatories at a range of longitude would be most valuable, as a complete eclipse curve is needed to interpret the spectroscopic data. Observations should cover the hours before and after the photospheric eclipse when the atmospheric eclipse will take place. Measurements at U and B are most important for this purpose. Observations at longer wavelengths (in V, R, and I) would also be useful for establishing the location and geometry of the starspots on the active primary star. The preferred local standard is HD 185587, V = 9.089, B − V = +0.182 and U − B = −0.019, which lies 7 arcmin ESE. HD 185567, which is 8 arcmin SE of HD 185510 and is a better match in color and magnitude, may be variable (Lloyd Evans, Koen, and Hultzer 1983).

T.L.E. wishes to thank Drummond Laing, Fred Marang, and Hartmut Winkler for making photometric observations in 1987. T.S. and G.S. thank Chris Shrader for assistance with the IUE observations.

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SPECTRUM OF THE RECENT NOVAE :
NOVA ANDROMEDAE 1986 AND NOVA CENTAURI 1986

Spectrum of two recent galactic novae, Nova Andromedae 1986 and Nova Centauri 1986 were recorded during their decline from maximum light with the 102-cm telescope of Vainu Bappu Observatory, Kavalur.

1. Nova Andromedae 1986 was discovered by M. Suzuki (1986) on December 5.44 UT when it was at a magnitude m_{pv} = 8.0. The position of the nova matches with a star of m_{pg} = 17.8 on the Palomar blue sky survey plates (King 1986). Spetroscopic confirmation of the nova was made by Kosai (1986).

A single spectrogram was obtained on December 16.59 UT (8 days after the maximum) at a mean dispersion of 129 Å/mm covering the wavelength range 3500A - 6600A. At the time of the observations, the nova was around V = 7.3, one magnitude below maximum (IAU Circular 4286). The spectrum is characterised by the presence of broad, strong emission lines superposed over moderately strong continuum. Balmer lines of hydrogen are strong and visible up to H11. Other emission lines are those of HeI (RMT 11, 14, 18), TiII (13, 19), CaII (H and K), NaI (D1 and D2), SiII (2,5), FeII (27, 28, 37, 38, 42, 46, 48, 49, 74), NII (3, 5, 8, 28) and OI (9, 10, 15, 16, 18). Weak emissions of forbidden lines at λ5577 and 6300 of [OI] are also present. Forbidden lines of [NII] at λ6548 and 6584 may be blended with H_α . The λ'4640' complex of NIII and NII is fairly developed. The mean of the full width at the base of the Balmer emissions is 2176 ± 219 km/sec.

All the emissions particularly Balmer and FeII lines exhibit P Cygni like profiles. The mean radial velocity of the blue shifted absorption is -1230 ± 17 km/sec. A second blue shifted absorption which is stronger than the first is also exhibited by most of the Balmer lines at a radial velocity -2300 ± 80 km/sec. Interstellar absorption of CaII H and K at radial velocities -21.9 km/sec and -12.7 km/sec, respectively are also present.

The emission at H_α comprises of multiple components. Four distinct components could be seen on our plate. A spectrum recorded on December 16.55 UT in the near infrared shows strong emissions due to OI at λ8446 and 7774. Faint emissions of OI at λ7254, 7246 and HeI 7065 are also present.

Photometric observations (from IAU Circulars 4281, 4286) show that the nova faded by two magnitudes in fifteen days and can be classified as a fast Nova.

2. Nova Centauri 1986 was discovered by McNaught (1986) on November 22.7 UT at m_{pv} = 5.6. He identified the prenova on UK Schmidt B and J plates and found that it varied between 18 and 20 magnitudes during 1974-78. After the outburst it was a naked eye object around December 23 ($m_{pv} \sim 4.8$).

The spectrograms were obtained on December 16.0 and 17.0 UT when the nova was around V = 5.7 (IAU Circular 4284). The spectrum consists of strong emissions at Hα and Hβ. FeII emissions at λ4924, 5018, 5169, 5234, 5317 and OI (9, 10) are strong. Other emissions include FeII (38, 40, 46, 48, 55), SiII (2, 5), NII (3, 6, 8, 9) and NaI (D lines). Forbidden lines of only [OI]λ5578 and 6300 could be identified. The mean of full width at the base of the Balmer and strong FeII emissions is 1472 ± 197 km/sec.

Balmer lines and strong FeII lines show blue shifted absorption components with a mean radial velocity -915 ± 40 km/sec (principal absorption system). A diffuse enhanced absorption at a mean radial velocity -1975 ± 40 km/sec is also present. Hα emission shows multiple components and flat-topped profile. The λ'4640' complex is fairly strong.

The light fluctuation of the nova even around maximum was very rapid (IAU Circulars).

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McNAUGHT'S VARIABLE AT 7^h23^m -03° IS A MIRA STAR

In The Astronomer 23, no. 276 R. McNaught reported on a very red variable discovered by him at the position $7^h23^m12^s.60$ $-3°00'$ $21''.5$ (1950). In order to put an end to the discussion on the nature of this object I checked the photovisual plates of the Sonneberg Sky Patrol of the years 1963 to 1987 mainly taken by H. Huth, and a sample of earlier exposures.

The variable is a Mira star. 22 maxima have been found on that material and led to the following elements:

$$\text{Max.} = 243\ 2918 + 377^d.5 \cdot E .$$

On the patrol plates the object merges with a neighbouring $11^m.5$ uncoloured star, which is easily separated on the Palomar Observatory Sky Survey and on our longer focus exposures. Visual observes should however not confuse both stars (separation 0'.3, the variable is the southern star and also pay attention to the bright cool carbon star BD $-2°2101$ which precedes by 0.5 min. slightly south).The large amplitude, deduced from McNaught's data, is confirmed by our findings:

$$m_{pg} \approx 11.5...>21,\ m_{pv} \approx 8.8...18.$$

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TIME - EVOLUTION OF COLOURS OF TWO EV Lac FLARES

Time - evolution of colours of pure flare radiation has been a subject of many studies with controversial conclusions. Earlier studies by Chugainov (1961, 1965) and Kunkel (1967) revealed reddening of the $(B-V)_f$ and $(U-B)_f$ colours of pure flare radiation during the decay of stellar flares. Kunkel (1967) assumed a two-component model consisting of hot plasma and photospheric bright spot, the cooling of the later being responsible for the observed reddening of flare colours. Kodaira et al. (1976), Cristaldi and Longhitano (1970) and Pettersen (1983) found no time changes of flare colours and suggested that flare colours remain essentially constant during flares. The general consensus on this point at the Catania meeting in 1982 (IAU Coll. No 71) seemed to be that flare colours remain constant with perhaps a little reddening in the last stages of flares (Byrne, 1983). This controversy is probably due to the difficulties in measuring colours of pure flare radiation and the common large observational errors.

In August and September 1985, in the framework of cooperation between Bulgarian Academy of Sciences and the Academy of Finland, joint monitoring observations of the flare star EV Lac were carried out with the Finnish 5 - channel UBVRI photometer-polarimeter attached to the 2 m telescope of the Bulgarian National Astronomical Observatory - Rozhen. The Finnish photometer-polarimeter is of the same type described by Piirola (1975). The photometer design makes it possible to obtain strictly simultaneous observations in all UBVRI colours, which is especially suitable for studies of stellar flares. On Sept. 11, 1985, two flares were observed, No 21 and No 22 of our sample. The amplitudes at maximum (in mag) for Flare 21C (21A and 21B are only small precursors) are: $\Delta U=1.23$, $\Delta B=0.23$, $\Delta V=0.08$, $\Delta R=0.02$ and $\Delta I=0.01$. The amplitudes for Flare 22 are: $\Delta U=2.36$, $\Delta B=0.70$, $\Delta V=0.27$, $\Delta R=0.09$ and $\Delta I=0.02$. Flare 22 is the largest in our sample with a total duration of more than 2.5 hours and time of rise $\sim$ 24 minutes. Pure flare colours $(U-B)_f$ and $(B-V)_f$ were determined for these flares. $(U-B)_f$ versus $(B-V)_f$ are plotted in Fig. 1.

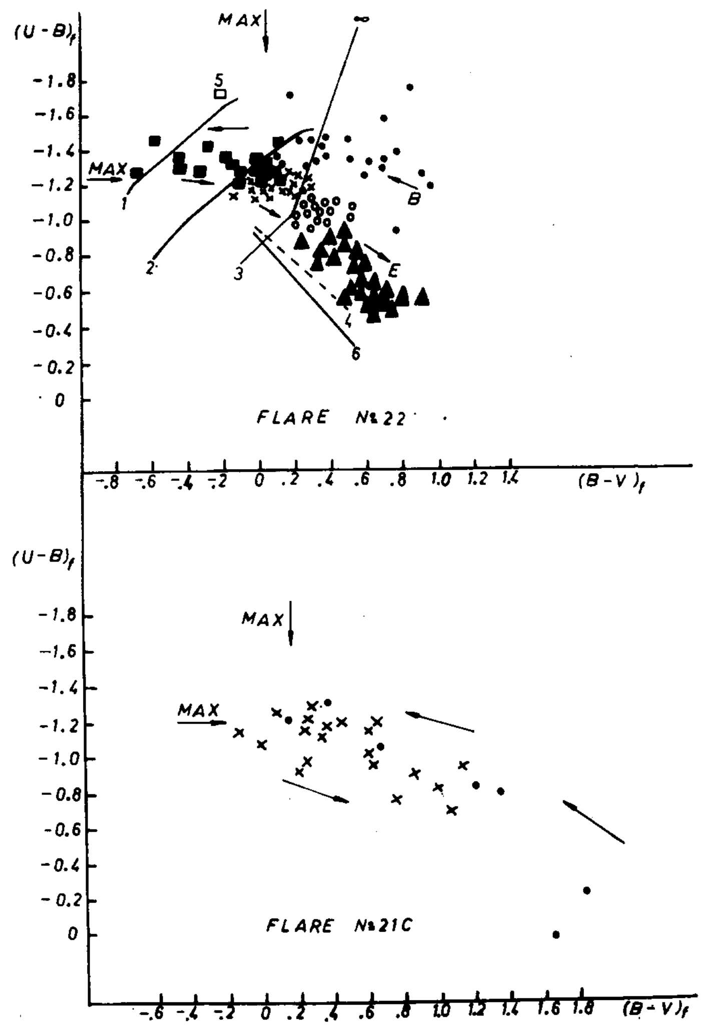

Figure 1

Upper pannel: Two colour diagram of Flare 22. Different symbols stand for different phases of the flare (see text). Arrows show direction of time-evolution. Letters "B" and "E" denote begin and end, respectively. Two arrows show the position of maximum brightness. Lines with numbers represent models: 1 and 2 , nebular models by Kunkel (1970) for T; 14000 K and 25000 K , respectively; 3, model of Gershberg (1967) for T= 80000 K and "border line"; 4, synchrotron ; 5, model of Gursadian (1985) for n = 1 and $\gamma^2 = 10$; 6, black body. Lower pannel: Two colour diagram of Flare 21C. Points represent observations from flare begin to flare maximum. Crosses are observations after flare maximum.

Different symbols stand for the different phases of the flares. Lines represent different models.

Conclusions:

1. There is strong evidence in support of time-evolution of flare colours.
2. On the ground of Flare 22 diagram time-evolution of colours of pure flare includes four stages:

i/ The initial flare colours are: $(U-B)_f \sim -1.2$ and $(B-V)_f \sim 0.6$.
During the first phase there is a transition to the left upper corner of the diagram (point symbols) - to a region with colours $(U-B)_f \sim -1.4$ and $(B-V)_f \sim -0.5$.
ii/ Transition to a region with $(U-B)_f = -1.2$ and $(B-V)_f = 0$ (squares). This is the position of maximum brightness.
iii/ The third phase begins with the maximum brightness. During this phase there are little changes of both $(U-B)_f$ and $(B-V)_f$.
For Flare 22 this phase lasts about 40 minutes and flare colours remain approximately constant. Though there might be a small decrease of both colours near the end of this phase (crosses).
iv/ Final or "reddening" phase. From the region with $(U-B)_f = -1.2$ and $(B-V) = 0$ transition takes place to the right lower corner of the diagram (circles and triangles). By the end of the observations flare position was: $(U-B)_f \sim -0.5$ and $(B-V)_f \sim 0.8$. Observations were stopped before the end of the flare.

The two colour diagram of Flare 21C shows similar transitions,except that the second phase cannot be distinguished. For this flare the initial flare colours are redder: $(U-B)_f \sim -0.8$ and $(B-V)_f \sim 1.3$, or even redder:

Our observations show that time-evolution of flare colours is quite complicated. The existence of four phases in the development of Flare 22 is supported also by the study of its U,B,V amplitudes. None of the existing theories of flares provides an adequate description of time-evolution of flare colours, shown in Fig. 1, and the matter is still far from clear.Nebular theories of Gersberg (1967) and Kunkel (1970) seem to fit observations of colours around maximum (i.e. phases 2 and 3 from the previous discussion). During the final (reddening) phase flare radiation might be dominated by emission of a gradually cooling bright spot. The most difficult part of the present picture seems to be the initial flare phase, for which no theoretical account exists. Observationally, this is the most difficult part of flares too and further observations are needed.

In the theory of Gursadian (1985) evolution of colours of pure flare radiation is only possible, if changing flare-geometry is assumed. For each of the two flares discussed above we would have to admit the same sequence of flare geometrical positions, which is unlikely.

A detailed account of the present work will be submitted to the Astronomy and Astrophysics.

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THE OPTICAL BEHAVIOUR OF KR AURIGAE IN THE SEASON 1986/87

In supplementing and completing the light curve in B given by Götz (1983, 1984, 1985, 1986) the star was measured on 44 blue-sensitive plates (ORWO-ZU21 + GG13 + BG12) from 25 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory, covering the time interval between 5 September 1986 and 30 March 1987, using the comparison star sequence given by Popova (1965). The observations are listed in Table I and shown in Figure 1.

It can be seen from Figure 1 that KR Aurigae was in an extremely high state during the whole time of patroling. Most of the observations are brighter than $m_B = 13^m.0$. Visual observations of the star given by Verdenet, Mizser and Monella (1987) are marked by circles in Figure 1.

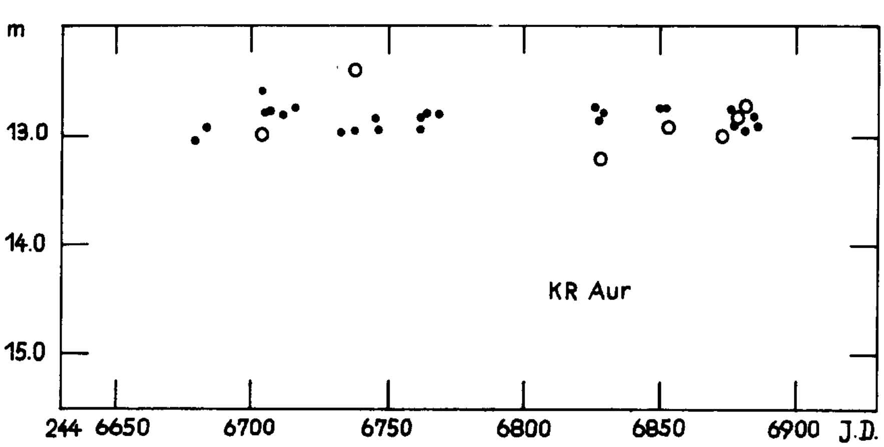

Figure 1

Table I

J.D.	m_B	J.D.	m_B
244....		244....	
6679.592	$13^m.05$	6764.479	$12^m.82$
6683.606	12.92	6764.498	12.82
6704.566	12.72	6769.491	12.79
6704.585	12.45	6769.510	12.86
6705.578	12.84	6826.436	12.71
6705.596	12.75	6826.456	12.82
6707.537	12.79	6827.375	12.83
6707.556	12.77	6827.395	12.86
6713.614	12.72	6828.340	12.83
6713.636	12.89	6828.358	12.75
6716.663	12.76	6850.331	12.87
6733.648	12.95	6850.349	12.64::
6733.663	13.00	6851.311	12.67
6737.551	12.89	6851.335	12.82
6737.571	13.02	6876.344	12.74
6745.633	12.82	6877.299	12.91
6745.655	12.91	6877.317	12.92
6746.622	12.95	6881.303	12.94
6762.530	13.00	6881.322	12.93
6762.550	12.91	6884.308	12.93
6763.493	12.85	6884.328	12.76
6763.512	12.82	6885.328	12.90

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OPTICAL BEHAVIOUR OF AT CANCRI IN THE SEASON 1986/87

In linking to the sequence of comparison stars given in the IBVS No. 2363 this cataclysmic star was measured on 72 blue-sensitive plates (ORWO-ZU21 + GG13 + BG12) from 18 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 27 November 1986 and 27 April 1987. 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
6762.575	$12^{m}.72$	6827.559	$15^{m}.84$	6876.414	$13^{m}.35$
6762.593	12.76	6827.580	15.45	6877.341	13.02
6763.536	12.49	6827.601	15.49	6877.359	12.82
6763.556	12.50	6828.388	15.29	6877.378	12.95
6763.575	12.41	6828.407	15.81	6877.398	12.77
6763.594	12.45	6828.428	16.19	6877.418	12.86
6764.522	12.56	6828.452	15.77	6877.437	12.80
6764.541	12.39	6828.471	16.14	6881.384	13.04
6764.561	12.52	6828.574	15.96	6881.404	13.53
6764.581	12.59	6850.376	15.87	6881.429	12.92
6769.536	12.67	6850.395	15.68	6881.450	13.06
6769.555	12.66	6850.413	15.48	6884.349	15.33
6769.574	12.60	6850.436	15.70	6884.385	15.26
6799.597	12.37	6850.456	15.70	6885.353	15.88
6799.615	12.19	6850.496	16.06	6885.372	16.44::
6799.632	12.27	6850.515	16.12	6885.391	16.31
6826.547	15.88	6851.401	15.43	6885.410	15.82
6826.567	15.87	6851.419	15.67	6885.430	15.91
6826.587	15.93	6851.438	16.28	6909.363	15.92
6826.609	15.77	6851.458	16.22	6909.383	15.50
6827.448	15.74	6851.479	15.54	6909.405	15.71
6827.471	15.81	6851.503	15.54	6910.383	16.02
6827.490	16.01	6876.379	13.48	6910.401	16.08
6827.509	15.82	6876.397	13.37	6913.385	16.35

The long-term light curve of AT Cnc, which results from the mean brightness values of each night and which is given in Figure 1 shows variations between

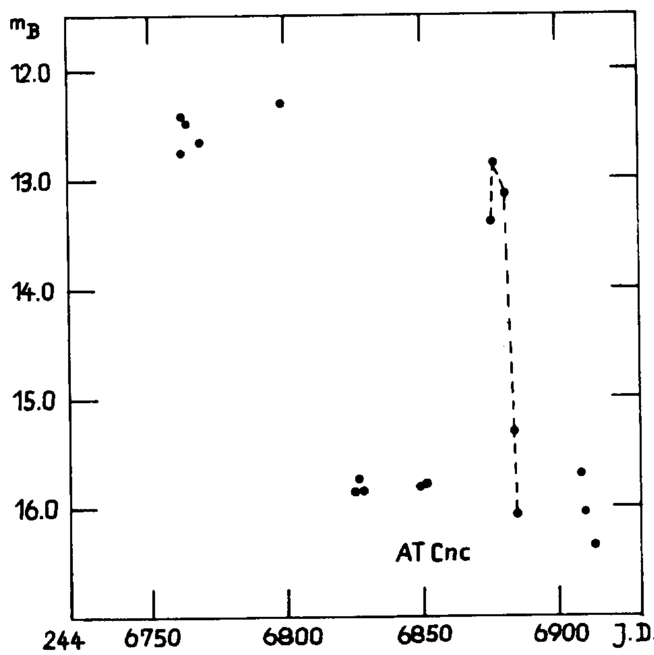

Figure 1

$m_B = 16\overset{m}{.}35$ and $m_B = 12\overset{m}{.}28$. A remarkable decrease of brightness was observed with $\Delta m_B = 2\overset{m}{.}93$ within $3\overset{d}{.}962$ between 26 March and 30 March.

Reducing all observations to one common epoch by means of the improved orbital elements given the IBVS No. 2918 the orbital light changes and the displaced minimum phase in the high state to phase $\sim$ 0.5 can be confirmed.

In opposition to other series of observations from former years, which are reduced in the IBVS No. 2918 concerning the present observations of the low state ($14\overset{m}{.}5 < m_B < 16\overset{m}{.}4$) no positive statements about the behaviour of the orbital light changes can be made. The results mentioned are given in Figures 2 and 3, where the magnitudes m_B from the high and the low state of brightness are plotted against the phases.

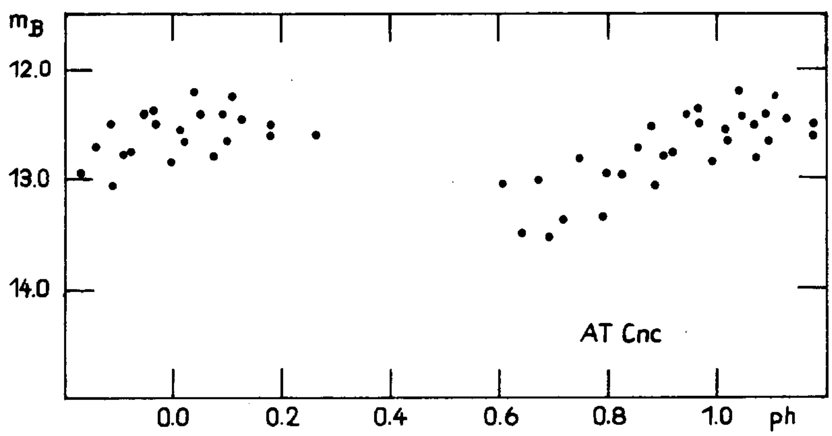

Figure 2

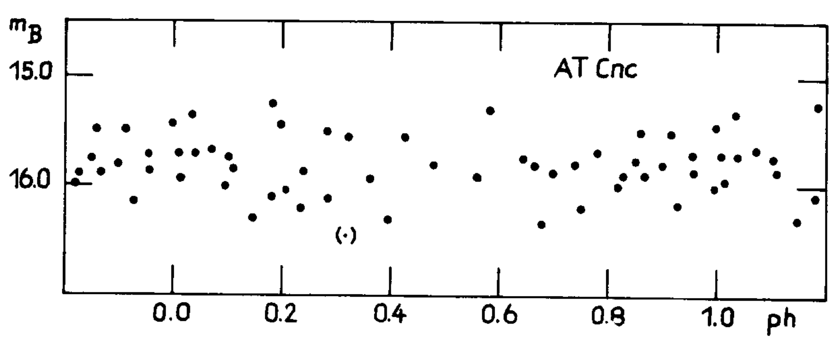

Figure 3

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OPTICAL BEHAVIOUR OF THE POLAR ST LEONIS MINORIS = CW 1103 + 254 IN THE SEASON 1986/87

Using the sequence of comparison stars given in the IBVS No. 2735 the star was measured on 22 blue-sensitive plates (ORWO-ZU21 + GG13 + BG12) from 14 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 27 November 1986 and 23 May 1987. The individual 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
6762.612	$15^m.06$	6877.460	$15^m.76$	6909.431	15.34
6763.613	14.85	6877.481	15.84	6909.450	16.16
6769.617	14.73	6881.474	16.04	6910.425	16.27
6826.636	15.70	6881.493	16.00	6910.443	15.83
6826.656	15.70	6884.437	15.82	6913.409	16.39
6827.622	15.77	6884.460	16.05	6939.391	16.02
6827.643	16.05	6885.449	15.68	6939.411	16.09
6828.615	15.4 :				

The long time-scale light curve in B is shown in Figure 1.

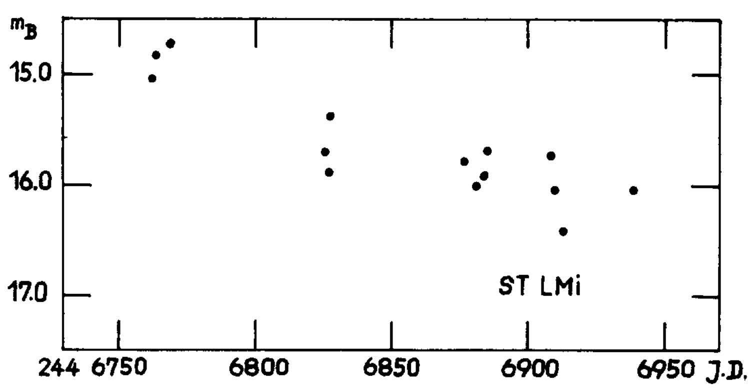

Figure 1.

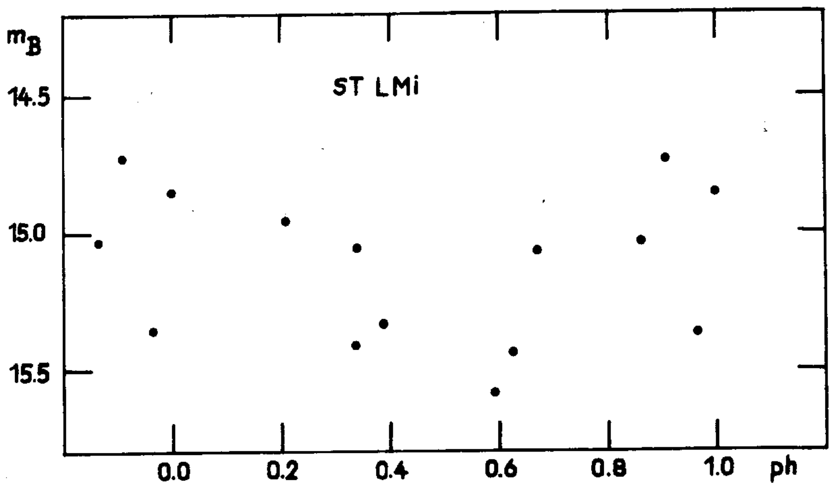

Figure 2

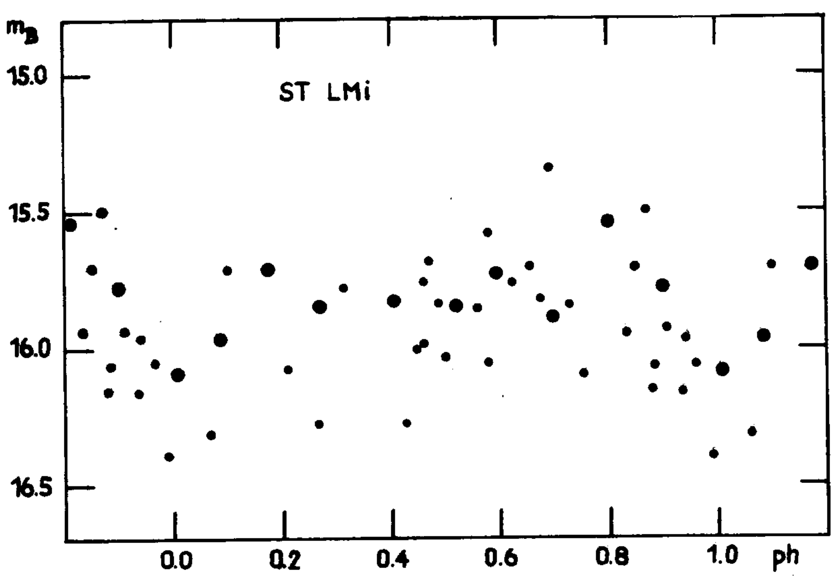

Figure 3

There a slow decrease of brightness from $\bar{m}_B = 14\overset{m}{.}9$ to $\bar{m}_B = 16\overset{m}{.}1$ within the given time interval can be seen. A similar behaviour, which can be explained as a decrease from the X-ray heated high state to the mean brightness state could be shown also from the observations of 1986, which are published in the IBVS No. 2955.

The observations of the high and the mean brightness state were reduced to one common epoch by means of the orbital elements given in the IBVS No. 2735. The results are shown in the Figures 2 and 3, where the individual observations (smalls dots) and the mean magnitudes (large dots) obtained from series of the time interval between 1983 and 1985 (IBVS No. 2735) are plotted against the phase. Both, the individual observations and the mean magnitudes correspond to the given orbital elements.

From Figure 2 it can be presumed that the minimum phase of the high state is displaced to phase ~ 0.5. More observations are needed to make statements about the behaviour of the orbital light changes in the low state ($m_B \sim 16\overset{m}{.}7$).

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PHOTOMETRIC OBSERVATIONS OF THE AM HERCULIS SYSTEM MR SERPENTIS = PG1550+ 191

MR Ser was discovered to be a system of AM Herculis type in 1981 (Stockman et al., 1981). The defining characteristic of all stars of this sub-class of cataclysmic variables is the exhibition of strong linear and circular polarisation that is variable with the same periodicity as the optical and infrared light as well as the radial velocity. A review of the observed properties of these systems is given in la Dous (1989). Photometric, polarimetric, and spectroscopic observations of MR Ser are presented in Liebert et al. (1982), Echevarria et al. (1982) have discussed infrared spectroscopy of this object, and Szkody et al. (1985) have published IUE observations. Usually MR Ser is found to vary photometrically between 14.^{m}8 and 16.^{m}2 in V, the amplitude of the orbital variation is approximately 1^m. The period of variability is 0.078873 ± 10^{-6} days, as derived by Liebert et al.

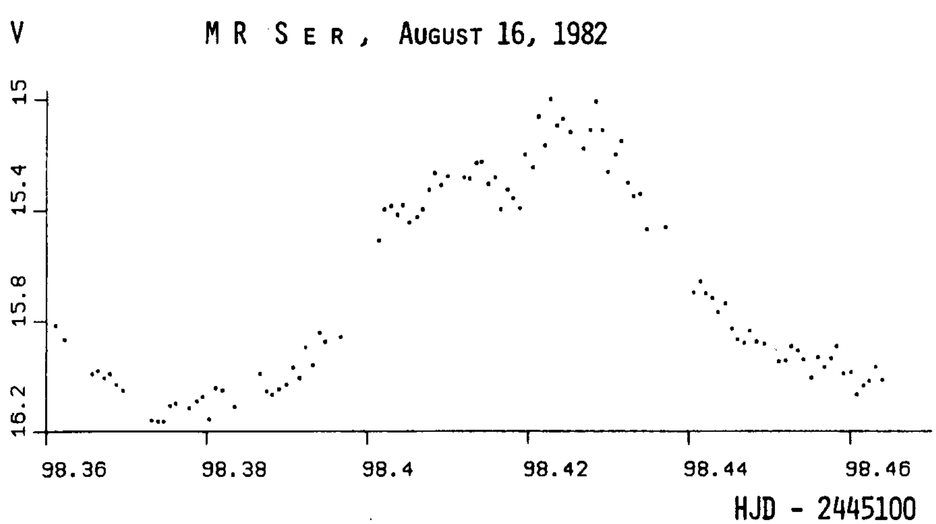

Figure 1

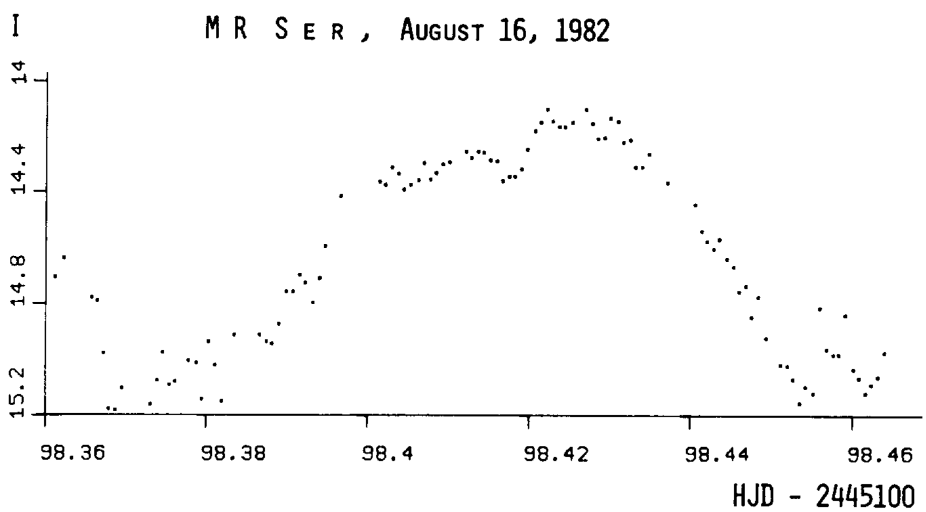

Figure 2

For approximately 2.5 hours (1.3 orbital periods) on August 16, 1982, we observed MR Ser photometrically with the 1.23 m telescope on Calar Alto (Spain). Measurements were carried out sequentially in V and I light using a one-channel photometer with a RCA31034 multiplier. The observations were made in a quasi-high-speed mode (i.e. sky and comparison star were measured only about every 30 minutes) with integration times of 16.8 seconds per filter; including dead times the time resolution in each filter was normally 64.8 seconds. The star at 223 arcseconds north and 153 arcseconds east of the object was chosen as comparison star. Using classical photometric measurements with several standard stars, taken on another night, its colours were determined to be

$$V = 11.^{m}385$$
$$(V-I) = 0.^{m}807$$

All data were reduced with the high-speed reduction software on a Cyber 145 at the Institute of Astronomy of the University of Munich.

The V and I measurements we obtained are shown in Figs 1 and 2. The variation in both energy bands is of roughly the same shape and amplitude, with moderately strong flickering present in both. The hump in I both starts slightly earlier and lasts slightly longer than in V. A dip shortly before hump maximum occurs at the same time in both colours and has about the same shape in both within the accuracy of the measurements. This behaviour clearly is reflected in the (V-I) colour curve (Fig. 3): for most of the orbital cycle the colour is variable about the same average value when changes seem to be due mostly to flickering; during mid-rise and mid-decline of the hump the system becomes redder. Colours are the most stable at the time of halt immediately preceeding the dip, until the minimum of the dip is reached.

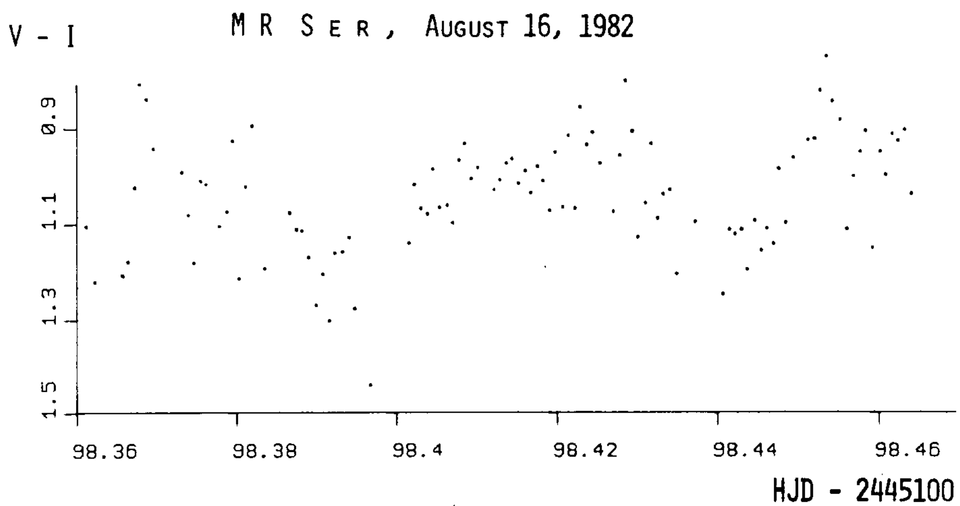

Figure 3

Liebert et al. (1982) have published orbital light curves of MR Ser in V and R2 which, however, were not taken simultaneously but one (R2) immediately after the other (V). The gross appearance of their and our light curves is the same; when compared, our light curves and both of theirs show differences in detail. The V light curve in Liebert et al. shows a very pronounced hold on the ascending branch of the hump and only a minor dip shortly before hump maximum; the hold is not seen in the R2 light which was recorded at the very next orbital cycle. At this point, however, the pre-maximum dip is fairly pronounced, and the shape of this light curve more resembles the shape of ours'. The fact that our (simultaneous) light curves in V and I are quite similar to each other in shape, together with the observation that the V and R curves that Liebert et al. recorded are decidedly different (from each other and from ours) is an indication that on orbital time scales the light of MR Ser is fairly variable, maintaining only approximately the general shape of the light curve.

In the V and R2 observation by Liebert et al. the little dip before hump maximum appears at about the same orbital phase according to the ephemeris and period they derived from the recurrence times of the linear polarisation pulse. The accuracy of the period they give should be sufficient to assign phases to our observations within 0.07 of a period. When doing this, phase zero should occur at HJD 2445198 428 $\pm$ 0.005, which is shortly after hump maximum, whereas it is expected to be at the rising branch before the dip if one assumes a stable relation between the photometric variation and the linear polarization. Thus the error in the period Liebert et al. give seems to be slightly larger than indicated. Furthermore, we are not able to determine whether or not the pre-maximum dip, that seems to be a stable feature in the light curve, always appears at the same orbital phase in V. Since we did not obtain linear polarimetric measurements, we are also not able to improve the period determination of MR Ser.

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FLARES ON AD Leo IN 1973 AND 1983

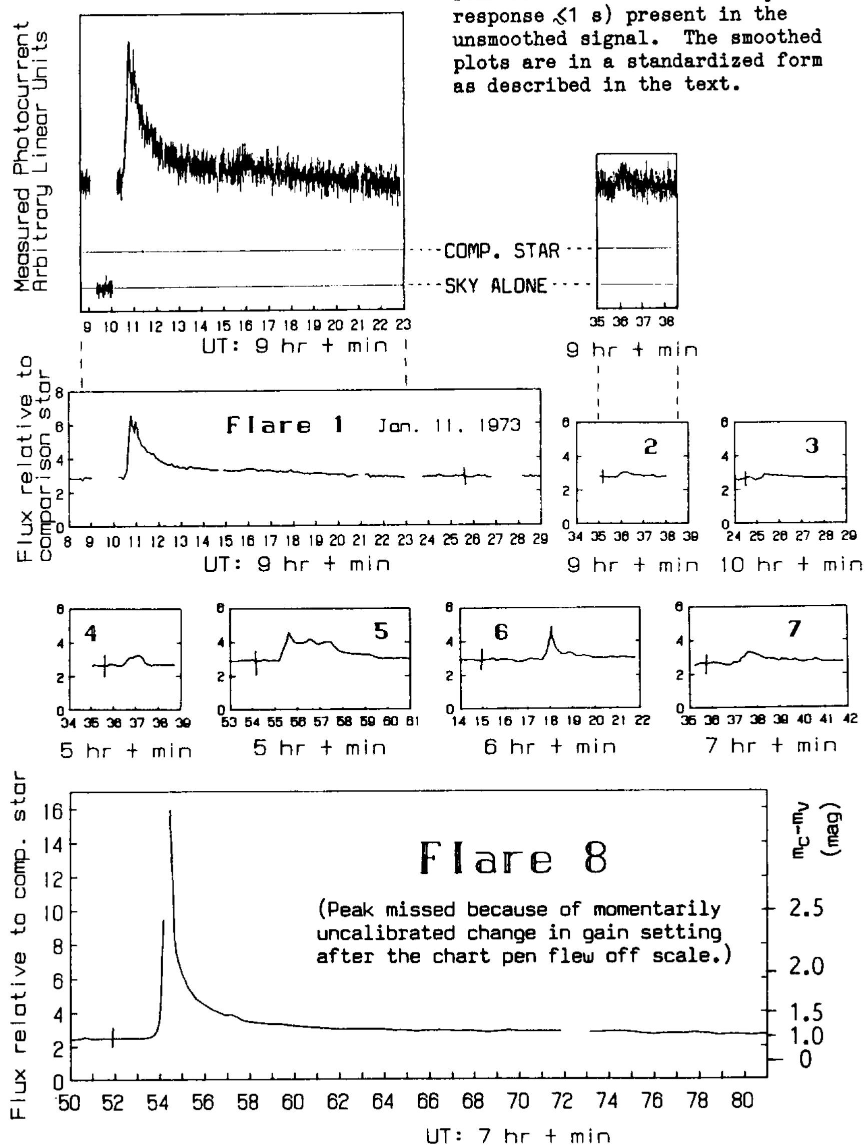
Since 1968, undergraduate students at the University of Delaware have participated in our continuing program of flare-star monitoring with the 24-inch cassegrain at Mt. Cuba Observatory. Except for the possible slow deterioration of equipment, supervising professor, and atmospheric conditions, the instrumental system has remained the same since IBVS 329.

Previously unreported are 21.5 hours of ultraviolet photoelectric monitoring of AD Leonis by a special-project class during January, 1973. To this we have added 5.9 hours of observations in the spring of 1983. To facilitate comparisons, we present both seasons in this combined report. The distribution of times is given in Table II in which gaps greater than one minute are explicitly shown.

Differential measures of the ultraviolet magnitude of AD Leo with respect to the comparison star were made at times of supposed quiescence. From Table III it may be noted that AD Leo averaged 0.07 mag brighter in 1983 than in 1973; however, as might be expected for so active a flare star, this difference is not statistically significant. Standard deviations in 1973 and 1983, respectively, were 0.05 mag (25 points) and 0.08 mag (13 points). In March-April 1982 (IBVS 2426) 17 measures also showed AD Leo brighter than in 1973; the average then being 0.11 mag (0.07 s.d.) brighter.

That the signal-to-noise ratio in 1973 is notably better than in 1983 is due largely to a dark-moon run of excellent weather in January 1973. Less time is now available for such work at the Mt. Cuba telescope; and, consequently, some of the 1983 monitoring was done on lower quality nights. Concern that the system had deteriorated during the decade was relieved by noting that on the two nights when AD Leo was briefly monitored through the same Johnson U filter in 1971 (IBVS 597), the signal-to-noise ratios were as low (5.5 to 8.7) as in 1983.

Fig. 1. Flares in January, 1973. See Table I. The upper plots for flares 1 and 2 are tracings from the original photometer chart to show the interpolated reference levels for the background sky and the comparison star as well as the noise (pen response $\lesssim 1$ s) present in the unsmoothed signal. The smoothed plots are in a standardized form as described in the text.



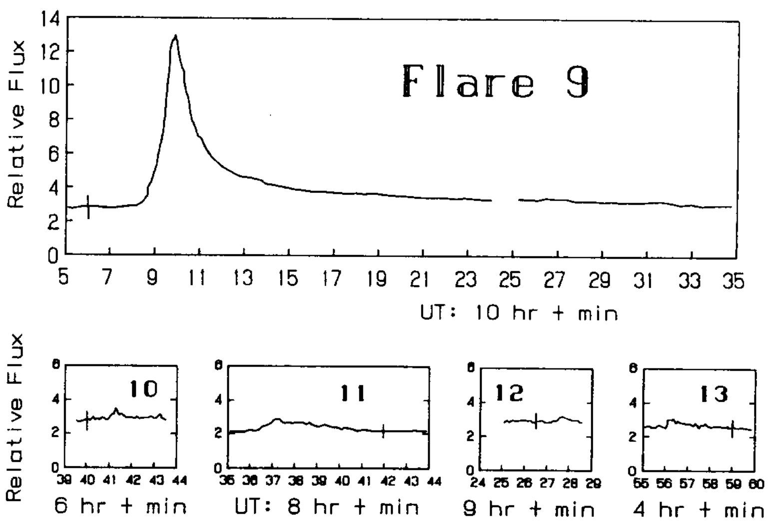


Fig. 1 cont'd. Flares of AD Leo observed in January, 1973.

Table I. Ultraviolet Flares of AD Leonis*

No.	Date yr mo da	UT max h m	t_b min	t_a min	Δ m mag	P min	Air Mass	JD 244 0000+
1	1973 1 11	09:10.6	0.3	17.	0.94	2.26	1.11	1693.88236
2	1973 1 11	09:35.8	0.4	1.2	0.12	0.09	1.14	1693.89986
3	1973 1 11	10:25.3	0.1	1.5	0.15	0.12	1.26	1693.93424
4	1973 1 12	05:36.8	0.2	0.8	0.24	0.17	1.23	1694.73389
5	1973 1 12	05:55.6	0.4	7	0.55	1.16	1.18	1694.74694
6	1973 1 12	06:18.1	0.2	3.5	0.55	0.33	1.14	1694.76257
7	1973 1 12	07:37.7	0.9	2.5	0.24	0.28	1.06	1694.81785
8	1973 1 12	07:54.4	0.7	21	>1.56:	>7.7:	1.06	1694.82944
9	1973 1 12	10:09.9	1.4	33	1.68	10.0	1.22	1694.92354
10	1973 1 13	06:41.4	0.3	4	0.24	0.09	1.10	1695.77875
11	1973 1 13	08:37.3	0.9	9	0.44	0.71	1.08	1695.85931
12	1973 1 13	09:27.7:	0.3:	1:	0.13	0.05	1.14	1695.8942
13	1973 1 30	04:56.3:	0.2:	4	0.22	0.28	1.16	1712.7058
14	1983 3 17	03:50.5	3.5	20+	1.34	15.6+	1.06	5410.66007
15	1983 3 17	05:44.6	1.6	6.4	0.32	2.20	1.18	5410.73931
16	1983 3 17	06:05.3	0.5	23 ?	>2.3	12 ?	1.24	5410.75368
17	1983 5 10	05:27.5	0.2:	–	>3	>20 ?	2.79	5464.72743

* where t_b and t_a are the durations before and after maximum,
Δ m is the change in magnitude of AD Leo (quiescent to maximum),
P is the equivalent duration of the flare.

Flares that we observed are numbered in Table I. Examples of the light curves for both major and uncertain flares are provided in the figures, on which flares are identified by their numbers in Table I. Breaks in the light curves are moments when the background sky and/or comparison star were measured. In a few cases, shown by a fragmented line, the break was caused by a passing cloud (see Flares 15 & 16).

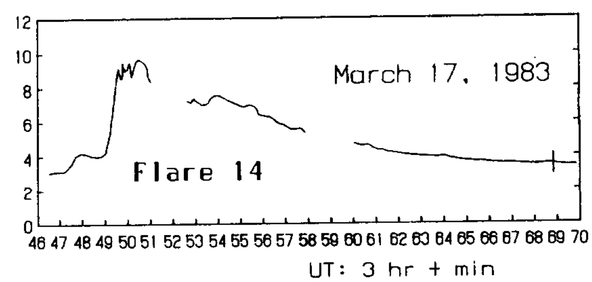
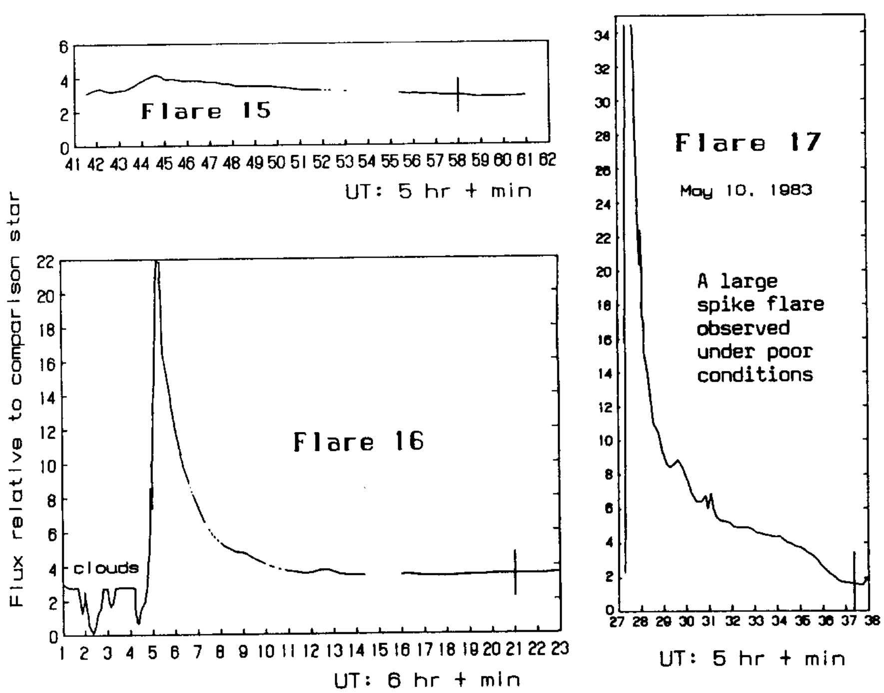


Fig. 2. AD Leonis flares observed in 1983. See Table I and the caption to Fig. 1.



Tracings of all the flares were digitized and plotted in units of the flux of the comparison star. This provides a coordinate reference that is more consistent than the quiescent level of AD Leo, which varies with background activity over the visible hemisphere of the flare star. Also, this plot facilitates estimating when a flare has ended. Note that the ordinate of these graphs may be converted to astronomical magnitudes by taking its logarithm and multiplying by 2.5. For convenient general comparison with Table III, a magnitude scale has been added on the right hand side of the flare-8 figure.

Because this analysis suppresses high frequencies, we have included in Figure 1 faithful reproductions of the original chart recordings for flares 1 and 2. Here may be seen the full photometric noise down to the instrumental time constant of approximately 1 second as well as any potentially real stellar flashes. A peak-to-peak measure of this higher frequency noise has been made near each flare, translated to the relative flux units and included as a vertical "error bar" on the graphs. These represent approximately six standard deviations of the high frequency noise as tabulated in the signal-to-noise ratio in Table III.

The astrophysical importance of the rotation periods of dMe stars has been pointed out by Marcy, Lindsay, and Wilson (1987). Photometric determinations based on the star's nonuniform surface brightness require analyzing a large number of samples because of the inherent variability. Pettersen, Coleman, and Evans (1984) report that Sandmann deduced a rotation period of 2.7 days from starspot modulation of AD Leo. Our UV data is not sufficient to confirm or negate this result, although, on the four consecutive days at the beginning of the 1973 run, such a period is possible if the amplitude at that time was less than 0.03 mag. Quiescent ultraviolet flux, as indicated by the magnitude differences in Table III, averages 2.77 times that of the comparison star. This may be compared directly to the levels portrayed in the figures.

Table II. AD Leo Flare Monitoring: Coverage in 1973 & 1983.

Date	U.T. in hours and minutes		
1973 Jan. 10	9:53.9- 9:58.1,	10:02.1-10:15.1,	10:17.4-10:32.5,
	10:36.4-10:49.0,	10:51.2-10:58.7.	
Jan. 11	8:57.8- 8:58.8,	9:00.7- 9:09.0,	9:10.2- 9:26.9,
	9:28.2- 9:45.0,	9:47.7- 9:59.5,	10:00.6-10:13.8,
	10:15.6-10:29.0,	10:32.5-10:44.0,	10:46.0-10:49.5,
	10:51.9-10:55.0.		
Jan. 12	5:11.6- 5:13.7,	5:16.9- 5:20.8,	5:23.8- 5:30.2,
	5:31.8- 5:38.8,	5:40.2- 5:46.9,	5:48.4- 6:10.5,
	6:13.7- 6:49.8,	6:51.2- 7:07.4,	7:08.8- 7:24.9,
	7:26.2- 8:11.8,	8:13.2- 8:23.9,	8:25.2- 8:26.7,
	8:29.0- 8:30.0,	8:31.8- 8:37.0,	8:38.3- 9:00.7,
	9:02.2- 9:13.7,	9:15.1- 9:28.5,	9:30.2- 9:38.6,
	9:42.5-10:24.1,	10:25.3-10:40.6,	10:42.5-11:00.0.
Jan. 13	3:10.4- 3:19.1,	3:25.2- 3:36.4,	3:38.2- 3:54.4,
	3:55.8- 4:02.2,	4:03.1- 4:10.8,	4:12.6- 4:15.4,
	4:16.5- 4:30.4,	4:33.5- 4:48.9,	4:50.7- 4:59.7,
	5:54.8- 5:56.3,	6:02.1- 6:14.6,	6:15.2- 6:22.0,
	6:23.6- 6:38.0,	6:39.5- 6:43.6,	6:44.8- 6:49.0,
	6:51.2- 6:56.8,	6:58.9- 7:11.1,	7:12.5- 7:34.0,
	7:35.5- 7:51.0,	7:51.9- 7:59.4,	8:11.2- 8:21.7,
	8:22.8- 8:25.9,	8:28.1- 8:44.8,	8:46.7- 9:03.0,
	9:04.2- 9:28.6,	9:30.4-10:02.4,	10:04.2-10:18.6,
	10:19.8-10:34.4,	10:36.3-10:42.0.	
Jan. 26	4:32.5- 4:35.1,	4:37.1- 4:43.8,	4:46.0- 4:57.6,
	4:58.8- 5:21.2,	5:23.6- 5:39.2,	5:40.4- 6:02.1,
	6:03.6- 6:12.0,	6:14.3- 6:31.9,	6:34.0- 6:51.0.
Jan. 30	1:57.4- 1:59.4,	2:03.7- 2:11.0,	2:12.8- 2:17.4,
	2:20.7- 2:33.9,	2:35.4- 2:46.7,	2:49.5- 3:01.8,
	3:07.8- 3:23.8,	3:29.2- 3:44.4,	3:47.6- 3:58.2,
	4:00.6- 4:01.9,	4:05.8- 4:22.6,	4:25.0- 4:42.0,
	4:47.2- 5:01.8,	5:04.1- 5:08.3,	6:05.6- 6:21.0,
	6:23.4- 6:37.4,	6:38.5- 6:53.0,	7:02.6- 7:19.2,
	7:21.2- 7:38.0,	7:40.5- 7:56.6,	7:58.0- 8:16.2,
	8:19.1- 8:26.2,	8:27.0- 8:35.0,	8:36.6- 8:51.7,
	8:54.2- 9:08.8,	9:10.5- 9:27.0,	9:29.6- 9:44.4,
	9:47.0-10:02.9,	10:05.2-10:22.6.	
1983 Feb. 22	4:43.5- 4:49.0,	4:51.8- 4:58.0,	5:00.9- 5:06.1,
	5:12.2- 5:16.0.		
Mar. 3	3:04.0- 3:08.0,	3:12.8- 3:20.6,	3:27.0- 3:34.0,
	3:42.2- 3:50.0,	3:54.0- 3:59.0,	4:02.8- 4:09.6,
	4:15.8- 4:23.0,	4:27.6- 4:35.0,	4:38.1- 4:44.8,
	4:46.0- 4:54.1,	4:56.6- 5:02.5.	
Mar. 17	2:55.1- 3:01.0,	3:05.2- 3:10.6,	3:12.1- 3:17.6,
	3:19.7- 3:27.9,	3:29.4- 3:35.6,	3:38.7- 3:45.0,
	3:46.3- 3:51.1,	3:52.6- 3:57.8,	4:00.0- 4:10.3,
	4:32.0- 4:39.0,	4:41.2- 4:50.0,	4:53.4- 4:59.6,
	5:02.2- 5:10.1,	5:12.6- 5:20.8,	5:22.9- 5:30.0,
	5:31.8- 5:39.6,	5:41.5- 5:52,	5:55.4- 6:14.4,
	6:16.0- 6:23.2,	6:25.0- 6:31.0.	
Mar. 24	5:34.6- 5:43.0,	5:45.5- 5:52.6,	5:55.9- 6:04.3,
	6:06.6- 6:15.8,	6:21.5- 6:32.0,	6:36.1- 6:48.2,
	6:50.5- 7:00.8.		
May 10	5:05.0- 5:12.9,	5:15.5- 5:24.0,	5:27.3- 5:40.0,
	5:42.8-5:51.		

Table III. Ultraviolet magnitude differences between the comparison star and AD Leo during moments of apparent quiescence, and estimates of the unsmoothed signal/noise for AD Leo.

Date	Time hr min	JD 2440000+	$m_c - m_v$	$\frac{I_o}{\sigma}$	Air Mass
1973					
Jan. 10	10 33	1692.9396	1.04	13.0	1.27
Jan. 11	9 00	1693.8750	1.08	-	1.09
"	9 47	1693.9076	1.07	17.1	1.16
"	10 31	1693.9382	1.10	-	1.27
"	10 51	1693.9521	1.08	14.3	1.34
Jan. 12	5 48	1694.7417	1.12	11.5	1.20
"	7 08	1694.7972	1.10	14.1	1.08
"	9 30	1694.8958	1.06	13.4	1.14
"	10 41	1694.9451	1.10	11	1.32
Jan. 13	4 31	1695.6882	1.25	6.9	1.46
"	6 50	1695.7847	1.08	15.9	1.09
"	8 28	1695.8528	1.07	15.6	1.07
"	9 29	1695.8951	1.10	15.9	1.14
Jan. 26	4 36	1708.6917	1.16	-	1.24
"	4 45	1708.6979	1.14	14.2	1.22
"	5 22	1708.7236	1.01	14.8	1.14
"	6 03	1708.7521	1.07	-	1.09
"	6 33	1708.7729	1.03	16.0	1.07
Jan. 30	2 18	1712.5958	1.08	9	1.97
"	3 28	1712.6444	1.00	11.7	1.44
"	4 44	1712.6972	1.02	14.6	1.18
"	6 22	1712.7653	1.03	16.5	1.07
"	7 39	1712.8188	1.06	16.3	1.09
"	8 53	1712.8701	1.05	15.6	1.21
"	10 03	1712.9188	1.15	14.5	1.46
1983					
Feb. 22	4 55	5387.7049	1.09	4.0	1.07
Mar. 3	3 47	5396.6576	1.11	6.4	1.08
"	4 19	5396.6799	1.15	6.1	1.07
"	4 42	5396.6958	1.16	5.8	1.06
Mar. 17	3 43	5410.6549	1.22	9.2	1.06
"	4 57	5410.7062	1.23	7.2	1.10
"	5 07	5410.7132	1.05	7.5	1.12
"	5 18	5410.7208	1.11	8.8	1.13
"	5 37	5410.7340	1.18	7.4	1.17
"	6 21	5410.7646	1.32	7.7	1.28
Mar. 24	6 00	5417.7500	1.16	4.3	1.31
"	6 41	5417.7785	1.16	4.7	1.49
May 10	5 20	5464.7222	1.02	5.6	2.62

Many students participated in obtaining and analyzing this data. Particularly valuable were the contributions by John Cambridge, Tony Nicastro, Mike Simmons, and Jeff Frank. Thanks are also due to the trustees of Mt. Cuba Astronomical Observatory for providing telescope time to the University faculty and students for more than twenty years.

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TIME OF MINIMUM DETERMINATION OF THE ECLIPSING BINARY V1143 CYGNI

V1143 Cygni is a bright (Vmax = +5.86) eclipsing binary consisting of a pair of F5V stars moving in an eccentric orbit (e=0.54) with an orbital period of 7.64 days. The orbital and stellar properties of this system have been accurately determined by Andersen et al. (1987) who find that the stars are close to the ZAMS with an age of about 2 x 10^9 years. In addition, independent, recent determinations of the apsidal motion of V1143 Cyg have been made by Khaliullin (1983) and by Gimenez and Margrave (1985). The results of these studies yield an average value for the observed apsidal motion of $\dot{\omega}$obs=3.45 $\pm$ 0.14 deg/100 yr. This is somewhat smaller than the result of the combined theoretical classical and relativistic contributions to apsidal motion of $\dot{\omega}$cl+gr= 4.25 $\pm$ 0.72 deg/100 yr. determined by Andersen et al. As first noted by Koch (1977), V1143 Cyg could be an important system for studying general relativity because the relativistic contribution to apsidal motion ($\dot{\omega}$gr = 1.86 deg/100 yr) is nearly equal to the Newtonian contribution ($\dot{\omega}$cl = 2.39 deg/100 yr). The classical or Newtonian contribution to apsidal motion arises from the deviations of the figures of the stars from spherical symmetry, caused by tidal and rotational effects which depend on the fractional radii, masses, rotation rates, and the internal mass distribution of the stars.

Photoelectric photometry of V1143 Cyg was conducted with the 51 cm telescope of Biruni Observatory at Shiraz University, Shiraz, Iran. The observations were made on 10 June 1977 UT using blue (b) and yellow (y) filters which are matched closely to the Strömgren uvby system. The data were reduced using the software developed at Villanova University. Details of the instrumentation and data reduction are given by Guinan et al. (1979). Differential magnitudes were computed in the sense variable minus comparison star in which HD 186239 (V= +7.4; A5V) served as the comparison star. Extinction corrections were applied from the atmospheric extinction coefficients determined from the observations of the comparison star, and the local standard times were converted to heliocentric Julian data (HJD).

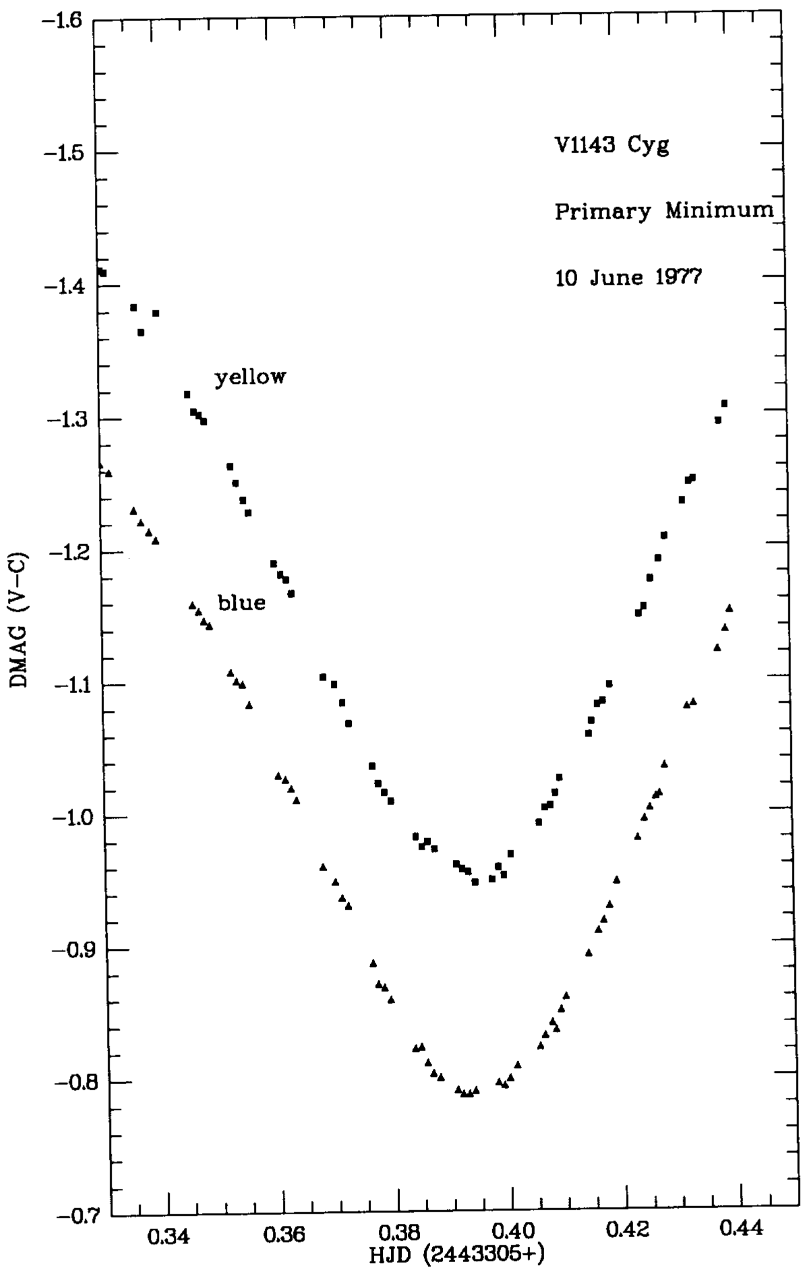

Figure 1 : The differential Strömgren yellow (y) and blue (b) observations of primary eclipse of V1143 Cyg.

The blue and yellow light observations of primary eclipse appear in Figure 1, plotted versus heliocentric Julian Date. A determination of the time of mid-eclipse was made for both light curves using a computer code developed by one of us (SMC). The algorithm involves a computer graphics version of the familiar "tracing-paper" method. The reduced photometric data is first plotted on the screen as observed. This data is then plotted again, reversed in the time coordinate. This second plot can be moved, as a unit, relative to the first curve. When the second plot is positioned such that the curves appear superimposed, the minimum occurs at the same point on the normal and reversed graphs. This best fit method gives extremely precise determinations, as can be seen by the errors given. The time of primary eclipse is:

T(min I)=HJD 2443305.3943 $\pm$ 0.0004.

Using the ephemeris of Andersen et al., the (O-C) of this determination is +0.00003d. More photoelectric timings of primary and secondary eclipses of V1143 Cyg are currently being attempted. A further refinement of the system's apsidal motion should be possible with these new timings.

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24 August 1987
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VARIABILITY OF NSV 01715

In measuring InT stars, DR and DQ Tauri, I noticed fairly big variability of a nearby star which was listed as NSV 01715. More than 350 photographs of this field were taken since 1980 with 18cm and 25cm Schmidt cameras. Tri-X film was used with the yellow-green filter which gives the brightness very close to visual magnitude.

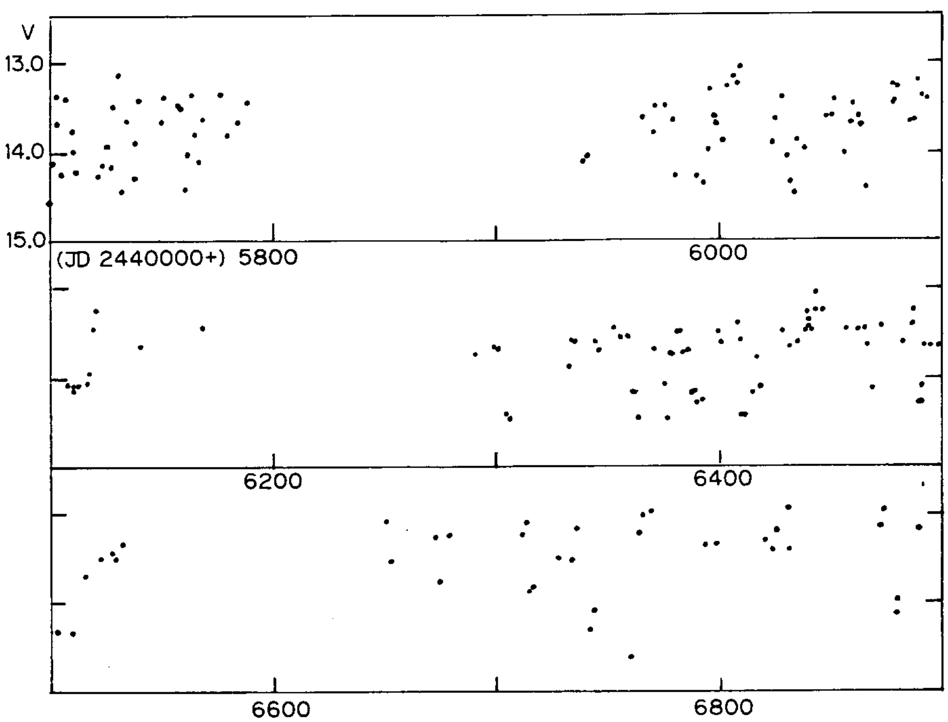

Figure 1. Recent variation of NSV 01715.

The results in recent years are shown in Figure 1. It is noticeable that the star often shows very rapid variation, more than one magnitude in a few days, being more active than DQ Tauri recently. The range was 13.0-14.6v so far.

The star was noticed by G. Haro, B. Iriarte and E. Chavira (1953) to have very strong Hα emission, and was suggested to be an In variable. DR and DQ Tauri were found to be variable by P.N. Kholopov in 1951, but not this star. These facts make me imagine that the star was not so active in around 1951.

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References:

Haro, G., Iriarte, B. and Chavira, E. 1953, TTB, No. 8, 3.
Kholopov, P.N., 1951, Variable Star, 8, No. 2, 83.

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Number 3072

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25 August 1987
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COLORIMETRIC OBSERVATIONS OF Y Ori

During the synchronous photographic observations of stellar flares in the Orion region in the UBV - system, carried out in 1980 by the multiexposure method with three telescopes (40" and 21" Schmidt cameras of the Byurakan observatory and 28" Maksutov camera of the Abastumani observatory), we detected a variation in the brightness of the star Y Ori. Our synchronous observations covered about two months. About the method of these observations, concerning the emulsions used, the precision of synchronization and the method of photographic photometry of our plates, is already published (Mirzoyan et al., 1983). Some observations had been made in Abastumani observatory in UBVRI spectral bands before 6 April 1981. For the study of some characteristics of this star our old observations have also been used. All these observations cover about 14 years.

Y Ori is known as a Mira Ceti type variable with a period of $P = 271\overset{d}{.}3$, and the amplitude of light variation (Kholopov et al., 1985) is

$$m(pg) = 4\overset{m}{.}5$$

The photographic magnitudes were obtained with the Iris microphotometer "Askania" and with the MF 4 of Byurakan and Abastumani observatories respectively. For these measurements standard stars of Orion sequence 1 were used (Andrews, 1970). The mean error of our measurements is about $0\overset{m}{.}2$.

For the reconstruction of light curve of Y Ori the observational data for 155 nights were used. Figure 1 shows the brightness variation of Y Ori in the photographic (pg) lights.

On the base of the obtained results the following interesting facts may be pointed out:

1. The period of light variation of Y Ori is

$$P = 270\overset{d}{.}5 \pm 0\overset{d}{.}2 .$$

2. It was shown that the colour (U-B) of Y Ori was very blue before and after the minimum

$$(U-B) \leq 0,$$

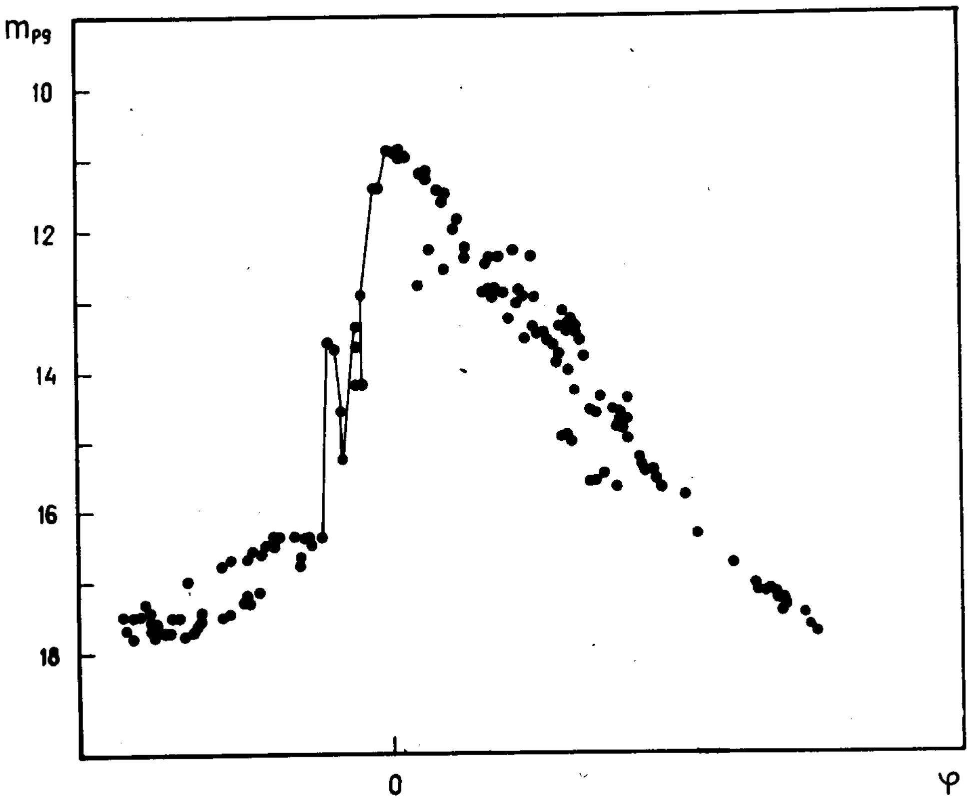

Figure 1. The light curve of Y Ori

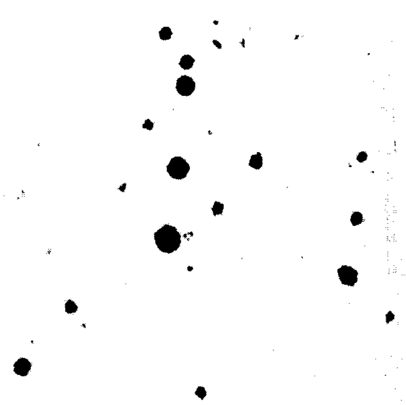

Figure 2a. Y Ori in red light near the minimum on 17 December 1982

Figure 2b. Y Ori in red light near the maximum on 3 February 1983

while near the maximum of brightness it was very red

$$(U-B) = +1\overset{m}{.}4 \ .$$

Almost the same result was pointed out by Mendoza (1967).

3. Our observations give us a possibility to determine the limits of brightness variations of Y Ori in UBVRI bands of spectra. Table I includes these results.

Table I

	U	B(pg)	V	R	I
m(min)	$\geq 18\overset{m}{.}0$	$17\overset{m}{.}5$	$\geq 14\overset{m}{.}7$	$> 11\overset{m}{.}1$	$> 8\overset{m}{.}0$
m(max)	≤ 12.5	10.9	≤ 9.3	≤ 6.8	≤ 6.0
Δm	≥ 5.5	6.6	≥ 5.4	≥ 4.3	$\gtrless 2.0$

4. The existence of nebulosity around Y Ori near the maximum brightness in red lights has to be mentioned. Our observations in red lights cover the interval between 2 and 11 February 1983. For the same nights we have some plates in U and B lights. Ond these plates there is no nebulosity around the star. In red lights we have two plates obtained in December 1982. On these plates the star is in minimum. Figure 2a and b shows Y Ori in red light before and during the maximum brightness.

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INFORMATION BULLETIN ON VARIABLE STARS

Number 3073

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25 August 1987

HU ISSN 0374-0676

NEW Hα - EMISSION STARS IN THE REGIONS NGC 7000, IC 5068 AND IC 5070

During June and September 1979 we observed the NGC 7000, IC5068 and IC5070 regions in order to search for new Hα emission stars. In these regions about 300 emission stars have been found (Merill and Burwell, 1949, 1950; Herbig 1958; Welin 1973; Tsvetkov 1975, Tsvetkov, and Tsvetkova 1978).

When observing these regions, we had two intentions:

1. To find new Hα - emission stars.
2. To find variation of the Hα intensity on already known emission stars.

In the present paper the results of 33 new Hα - emission stars are presented.

The observations have been carried out with the 40" Schmidt telescope of the Byurakan Astrophysical Observatory. The spectral plates have been obtained by the 4° objective prism (1100 Å/mm at Hα) on Kodak 103 aE and II aF emulsions through an RG 610 filter. The average limiting magnitude was about $18\overset{m}{.}5$ (pg).

33 new Hα emission stars were found which have not been included in the references at the end of this note. In Table I the results for these stars are presented. In the columns of Table I the following data are presented respectively: the serial number of the star, coordinates(1950.0), magnitude at minimum and intensity of Hα - emission.

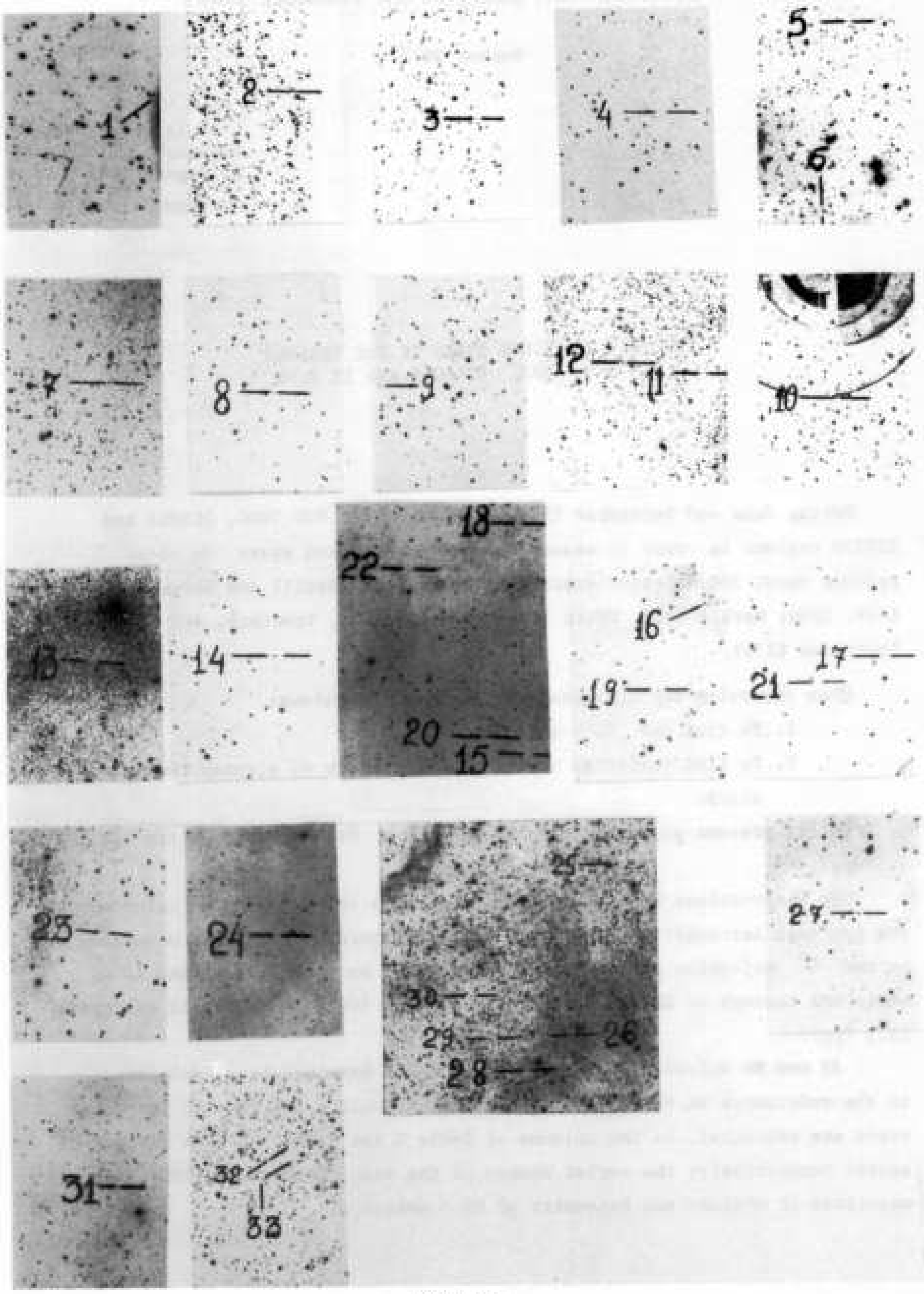
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Figure 1

Table I

New Hα- emission stars in the regions NGC7000, IC5068, IC5070

N	α (1950.0)	δ	m(pg)	IHα	N	α (1950.0)	δ	m(pg)	IHα
1	$20^h32^m01^s$	43 27.3	18.1	m	18	$20^h49^m26^s$	42 37.1	17.5	m
2	32 13	45 31.0	16.6	s	19	49 33	44 01.9	17.9	m
3	32 29	44 36.5	16.9	s	20	49 51	42 01.1	16.0	s
4	36 37	43 25.1	18.5	m	21	49 52	44 30.9	18.5	m
5	36 46	42 18.3	18.0	s	22	51 00	42 27.9	18.5	m
6	36 59	41 57.0	16.5	ss	23	20 52 44	44 28.5	18.5	m
7	41 01	44 50.6	17.2	m	24	53 51	42 02.3	16.5	w
8	41 16	44 16.6	17.6	s	25	55 30	44 53.8	15.8	w
9	43 08	42 59.4	17.0	m	26	55 53	44 38.3	17.7	m
10	46 17	42 49.4	17.8	m	27	56 02	43 53.4	16.0	w
11	47 17	44 55.7	18.7	s	28	56 15	44 35.2	18.5	s
12	48 07	44 56.7	18.0	ss	29	56 32	44 38.3	17.6	s
13	48 32	43 46.6	18.3	m	30	56 40	44 41.3	17.5	m
14	48 44	43 29.6	17.0	m	31	57 55	42 12.0	16.2	m
15	49 10	41 58.3	18.5	m	32	58 42	44 11.6	17.1	m
16	49 11	44 09.7	17.4	s	33	58 43	44 09.6	18.2	w
17	49 18	44 33.4	17.4	s					

The identification charts for the 33 new Hα - emission stars are given in Figure 1.

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Number 3074

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HYDROGEN EMISSIONS ON LOW-DISPERSION SPECTROGRAMS OF B-STARS

The presence of hydrogen emission lines (often accompanied by emission lines of singly ionized metals) in the visible wavelength range of the B-type spectra is a rather frequent phenomenon. Nevertheless, its place in the context of stellar evolution theories is not yet definitely elucidated.

It is well known that in some cases a Be- or a B-shell star loses its emission and becomes a normal B-star, or vice versa. This is the reason why the detection of emission lines in B-spectra and the study of their variations with time is of particular interest.

The objective-prism surveys may appear rather useful in this kind of work. A sufficiently strong emission in the hydrogen lines can easily be detected at a nominal dispersion.

The observations presented here are obtained in the course of inspection of objective-prism Kodak-plates taken in 1974-75 on the 70-cm meniscus telescope of the Abastumani Astrophysical Observatory (USSR), supplied with an 8°-objective prism. The reciprocal dispersion of the spectra is 166 Å/mm at Hγ, their extent being from Hβ up to 3500 Å. We disposed of red plates too, so that we could observe the region of the Hα -line as well. The spectra are widened to 0.4 mm. No attempt has been made for assigning spectral classes to the stars in question. The emission features are observed on two or three plates taken in close periods of time.

The stars are listed below. When no identification numbers are available, we provide identification charts. As far as we know, five of the stars in our list have not yet been observed as emission line stars; three others are presented in the Catalogue of Be-stars (Jaschek and Egret, 1982).

LIST of the observed stars:

BD+61°0154. Sharp emissions in Hα , Hβ .

BD+59°0115. Hβ-emission; Be:

BD+61°0074. Hβ-emission; Be:
(the red spectra of BD+59°0115 and BD+61°0074 are overexposed, so that Hα is not observable)

BD+59°2829. Hβ-emission. (Jaschek and Egret, 1982).

BD+61°0122. Hβ-emission. (Jaschek and Egret, 1982).

BD+62°0001. Hβ-emission. (Jaschek and Egret, 1982).

No. 1 ident.chart (star A is BD+27°3400, star B is BD+26°3561). Sharp emissions in Hα, Hβ , Hγ, Hδ.

No. 2 ident. chart (star A is BD+60°0117, star B is BD+59°0125). Emissions in Hα, Hβ, Hγ.

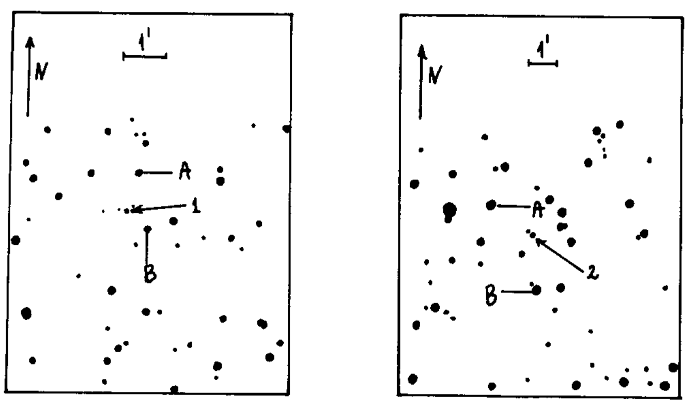

Figure 1. Identification charts

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Reference:

Jaschek, M., Egret, D., 1982 In:"Be Stars", Proc. IAU Symp. No.98, p.261

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PHOTOELECTRIC OBSERVATIONS OF THE SYMBIOTIC BINARY EG ANDROMEDAE

A period of 474 days obtained from spectroscopic observations was announced for this bright symbiotic star (Chochol, 1987 and Chochol et al.1987). Photoelectric measurements taken by the same author confirm this period.

In addition to the measurements of Chochol et al. I give UBV photoelectric observations of this star, obtained by the Sonneberg 60 cm mirror II. Comparison star is BD + 39° 158, the magnitudes are the differences m (EG And) - m (BD +39° 158).

JD	ΔV	ΔB	ΔU	
244 5926.6	+0.19	+1.30	+3.07	(Min)
5935.6	.22	1.37	3.05	(Min)
6002.5	.16	1.26	2.91	
6004.4	.13	1.30	2.87	
6006.5	.13	1.26	2.88	
6036.4	.13	1.25	2.90	
6322.6	.24	-	-	
6327.6	.22	1.28	2.95	
6334.6	.29	1.34	3.00	(Min)
6335.5	.28	1.34	3.03	(Min)
6338.6	.31	1.37	3.04	(Min)
6343.5	.27	1.34	3.03	(Min)
6646.5	.23	1.26	2.70	
6718.5	.14	1.16	2.57	
6762.6	.31	1.33	2.79	
6982.5	.18	1.19	2.74	
6990.5	.14	1.17	2.72	

The observations confirm the minimum at JD 244 6337 (Chochol et al.,1987) but they show the end of a minimum at JD 244 5930. This minimum wouldn't confirm the period of 474 days. Unfortunately the observations are too rare and there are no measurements during the subsequent calculated minimum at JD 244 6811 to give clear evidence.

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PHOTOMETRY OF SUPERNOVA 1987A

Observations were commenced at Boyden Observatory of the Supernova 1987A on the 27th February 1987; news of the outburst had reached us that morning via the South African Astronomical Observatory.

The 41cm reflector was used in this work, with an EMI 6256A photomultiplier tube in an uncooled housing and pulse counting electronics.

The brightness of SN1987A and the reasonably low dark count of this tube ensured a good signal to noise ratio, making cooling unnecessary under the normal night ambient conditions at Boyden.

The results of the B and V measurements are tabulated overleaf.

The values indicate that for at least two months following its outburst the brightness in B has increased steadily following a decrease during the first days; for V the increase has been effectively continuous over this period.

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SUPERNOVA 1987A

Julian Date (add 2446000.0)	B	V	Julian Date (add 2446000.0)	B	V
853.441	4.83	4.45	887.313	5.42	3.79
855.333	5.00	4.40	888.219	5.40	3.76
856.292	5.10	4.48	889.260	5.35	3.75
858.417	5.40	4.40	892.344	5.28	3.65
859.326	5.50	4.50	901.313	5.10	3.40
860.344	5.52	4.49	902.240	5.05	3.38
861.347	5.55	4.40	903.382	4.95	3.35
862.351	5.60	4.39	904.354	4.91	3.32
863.375	5.65	4.35	905.240	4.90	3.31
864.361	5.70	4.30	906.250	4.85	3.36
865.403	5.71	4.28	907.375	4.82	3.32
866.365	5.72	4.25	908.382	4.80	3.30
867.389	5.73	4.24	909.323	4.78	3.20
868.368	5.75	4.22	910.354	4.75	3.18
874.375	5.70	4.20	913.222	4.75	3.15
876.326	5.60	4.15	914.229	4.70	3.15
878.364	5.65	4.10	915.271	4.68	3.12
880.368	5.60	4.00	916.358	4.65	3.11
881.365	5.60	4.00	917.302	4.66	3.10
882.347	5.55	3.90	918.281	4.70	3.11
883.330	5.54	3.85	919.354	4.75	3.16
886.368	5.45	3.80	920.292	4.70	3.10

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IMPORTANT PARAMETERS OF FOUR SMALL-AMPLITUDE CEPHEIDS FROM uvby PHOTOMETRY

The small amplitude cepheids HR8084 (DT Cyg), HR8157, HR7165 (FF Aql) and HR690, were observed in the uvby photometric system with a four-channel spectrograph photometer attached to the 1.5 m telescope at San Pedro Martir Observatory (Mexico), from October 19 to 25, 1986. The data were duely reduced to the standard system by means of standard stars selected from Crawford and Barnes (1970). The results are listed in Table I. The uncertainties are 0.010, 0.004, 0.006 and 0.015 in V, (b-y), ml and cl respectively.

Table I, uvby observations of the program stars

V	b-y	ml	cl	HJD (2440000.+)
		HR8084		
5.875	.369	.222	.736	6724.722
5.909	.373	.228	.759	6729.663
		HR8157		
5.921	.334	.163	.696	6724.728
5.947	.337	.177	.700	6728.724
5.827	.305	.163	.813	6729.674
		HR7165		
5.547	.527	.224	.815	6728.588
		HR690		
6.234	.535	.189	.896	6723.830
6.229	.544	.192	.895	6724.839
6.271	.554	.209	.845	6726.875
6.321	.563	.218	.818	6727.858
6.335	.565	.222	.809	6728.832
----	.560	.209	.826	6729.835

The light and color curves of HR690 are shown in Figure 1.

To calculate atmospheric parameters, we have dereddened the mean values of the observations in Table I. The color excesses E(B-V), were calculated using the method of Dean at el. (1982) (see Arellano Ferro, 1984), and E(b-y)=0.73xE(B-V) was used (Crawford, 1975). The color excesses and the mean intrinsic photometric indices are given in Table II.

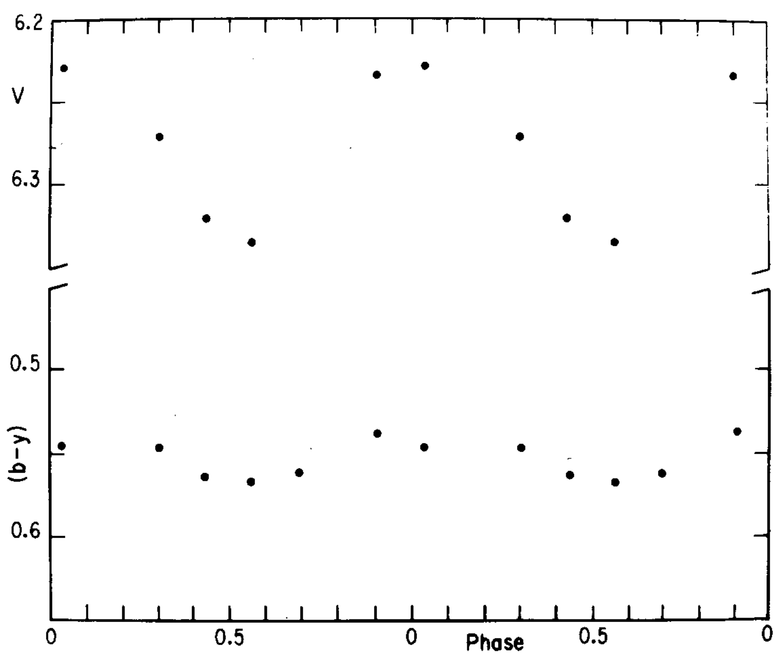

Figure 1.- Light and color variations of HR690 during October 1986. The observations have been phased with the ephemeris HJD_{max}=2444869.94+7.57E (Arellano Ferro 1984).

Table II. Mean intrinsic photometric indices

Star	$(b-y)_o$	$m1_o$	$c1_o$	E(B-V)
HR8084	.349	.232	.744	0.021
HR8157	.285	.181	.728	0.055
HR7165	.396	.266	.789	0.180
HR690	.395	.257	.816	0.216

Figure 2 is a $c1_o$ vs. $(b-y)_o$ diagram and it is sensitive to temperature and gravity. The positions of the program stars relative to the atmospheric models of Kurucz (1979) for [Fe/H]=0, indicate the T_e and log g values listed in Table III.

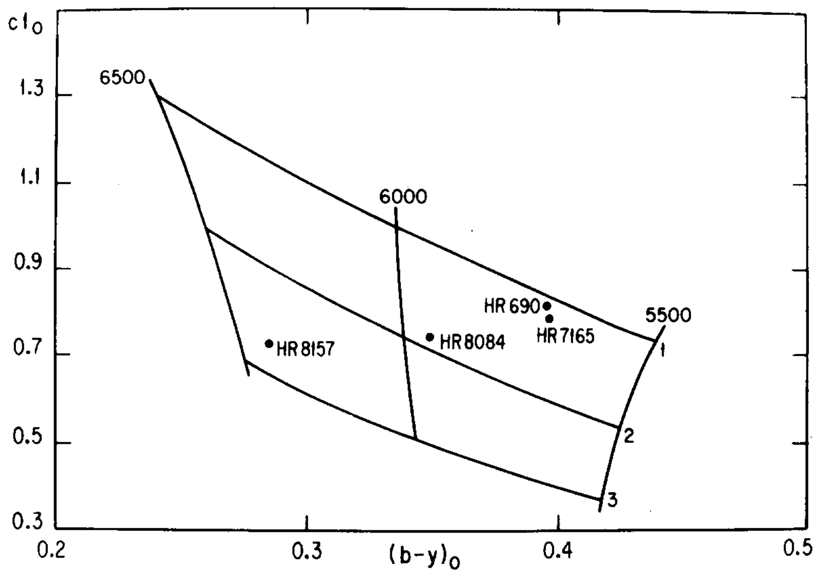

Figure 2.- Atmospheric models by Kurucz (1979) (solid lines) for log g = 1, 2, and 3, and for T_e= 5500, 6000 and 6500 K, all for [Fe/H]=0. The positions of four small-amplitude cepheids are indicated (dots) and allow estimates of log g and T_e for each star.

Table III. Effective temperature and gravity

Star	log g	T_e(uvby)	$T_e(H_\alpha)$
HR8084	2.0	5900	6195
HR8157	2.5	6400	5950
HR7165	1.0	5700	5990
HR690	1.0	5700	5741

The uncertainties in E(B-V) are likely to be smaller than .03 (Dean et al., 1982). Such uncertainties and the fact that $(b-y)_0$ in Table II has to be corrected to mean light, allowed us to estimate the uncertainties in T_e and log g to be smaller than 500 K and .5 respectively. The calculated effective temperatures agree very well with those determined from H_α profile fits (Arellano Ferro, 1984).

The absolute magnitudes M_v of the program stars were estimated using Antonello's (1985) calibration in terms of the bracket quantities [c1] and [m1]. With these values and T_e from Table III we can estimate the stellar radii.

Table IV. Absolute magnitudes and radii

Star	M_V	$M_V(W)$*	$R/R_\odot$	$R/R_\odot(W)$*
HR8084	-2.55	-3.39	28	37$\pm$10
HR8157	-2.79	-3.14	26	34
HR7165	-3.57	-3.57	52	45.5$\pm$6
HR690	-3.71	-4.07	52	58$\pm$22 †

* $M_V(W)$ and R(W) are Wesselink values from Arellano Ferro (1984).

† Radius from Burki and Benz (1982).

M_V and radii values are listed in Table IV and are compared with the Wesselink values derived by Arellano Ferro (1984) and for HR690, with the radius found by Burki and Benz (1982). The agreement is satisfactory.

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PHOTOELECTRIC MINIMA OF ECLIPSING BINARIES

The following table gives photoelectric minima obtained during the years 1985/86 at the Ege University Observatory, Izmir (Turkey) and the Nürnberg Observatory (Germany). Minima of eclipsing binaries observed at both observatories 1960-1984 were published in Astr. Nachr. 288, 69 (1964); 289, 191 (1966); 291, 111 (1968); I.B.V.S. No. 456 (1970), 530 (1971), 647 (1972), 937 (1974), 1053 (1975), 1163 (1976), 1358 (1977), 1449 (1978), 1924 (1981), 2189 (1982), 2385 (1983) and 2793 (1985).

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

Abbreviations of the observer's names:

Be = F. Betten	Sn = S. Evren
Ca = M. C. Akan	Sk = S. Skaberna
Gd = N. Güdür	Sr = C. Sezer
Gl = Ö. Gülmen	Tj = T. Eker
Gr = R. Gröbel	Tm = O. Tümer
Ha = T. Hartlieb	Tn = Z. Tunca
Hs = H. Kara	Va = V. Keskin
Ib = C. Ibanoglu	Wu = E. Wunder
Ls = G. Lichtschlag	Zk = Z. Eker
Sl = S. Congar	

Remarks:

O-C (I):GCVS, Moscow 1985 or 1969/70 or Supplements to the Third Edition of the GCVS. Moscow 1971, 1974 and 1976.

O-C (II): SAC 58, Krakow 1986.

O-C (III): AO Cam: 2445745.6396 + $0^{d}.329921$. E (E. Evans, D. H. Grossoehme,

E. J. Mayer Jr., IBVS 2497, 1984)

V367 Cyg: 2434266.337 +18.59773.E (M. C. Akan, Astrophys. Space Sci., 1987 (in press).

UZ Dra: 2446227.4238+3.2613024.E (Ö. Gülmen, N. Güdür, C. Sezer, IBVS 2953, 1986)

AK Her: 2422977.25905+0.42152207.E+0.0189sin $\left[2\pi \frac{E-32541}{65609}\right]$

(Z. Tunca, V. Keskin, M.C. Akan, S. Evren, C. Ibanoglu, Astrophys. Space Sci., 1987 (in press).

SW Lac: 2442697.4018+0.320719765.E (S. Evren, M.C. Akan, C. Ibanoglu, IBVS 2781, 1985)

AT Peg: 2445615.2541+1.1460766.E (N. Güdür, C. Sezer, Ö. Gülmen, IBVS 2978, 1987)

SAO 077615: 2441 329.510+0.3464551.E (Th. Berthold, Mitteilungen der Bruno H. Bürgel Sternwarte, Hartha, Heft 16, Februar 1981)

V471 Tau: 2440610.06614+0.52118301.E (S. Evren, C. Ibanoglu, Z. Tunca, O. Tümer, Astrophys. Space Sci. 120,97, 1986)

ER Vul: 2440182.2621+0.69809409.E (C. Ibanoglu, M. C. Akan, S. Evren, IBVS 2782, 1985)

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

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

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

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Table

Star	Min. hel.	O-C (I)	O-C (II)	O-C (III)	Filt.	Observer	Instr.	Rem.
	244							
RT And	6298.4807	-0.0014	-0.0037		V	Ls	34	
AB And	6321.4033	+0.0004	-0.0018		V	Be/Ls	34	Min II
BX And	6348.5782	-0.0059 =	-0.0059		B, V	Sr/Sl	48	
	6359.5598	-0.0064 =	-0.0064		B, V	Ca/Va	48	
	6366.577	-0.005 =	-0.005		B, V	Ca	48	Min II
CN And	6289.4649	-0.0200	-0.0043		V	Be/Ls	34	
	6712.45818	-0.0221	-0.0055		B	Sn/Ca	48	
	6712.45936	-0.0209	-0.0043		V	Sn/Ca	48	
	6714.30980	-0.0217	-0.0050		B	Ib/Sn/Ca	48	
	6714.31035	-0.0211	-0.0045		V	Ib/Sn/Ca	48	
	6760.35708	-0.0226	-0.0058		V	Tn/Ca	48	Min II
	6760.35743	-0.0223	-0.0055		B	Tn/Ca	48	Min II
	6762.20995	-0.0209	-0.0041		B	Ib	48	Min II
	6762.21113	-0.0197	-0.0030		V	Ib	48	Min II
	6762.43905	-0.0232	-0.0064		B	Ib	48	
	6762.43926	-0.0230	-0.0062		V	Ib	48	
	6764.2908	-0.0226	-0.0059		V	Ls/Wu	34	
OO Aql	6705.3655	-0.0018	-0.0141		V	Ls	34	Min II
SS Ari	6327.4994	-0.0515	-0.0117		V	Be	34	Min II
TZ Boo	6197.4061	-0.0414 =	-0.0414		V	Gr/Ls	34	
	6212.4130	-0.0412 =	-0.0412		V	Gr/Be	34	Min II
	6610.4528:	-0.0499: =	-0.0499:		V	Be/Ls/Wu	34	
i Boo	6573.4836:	+0.0194:	+0.0162:		V	Ls/Sk	34	Min II
SV Cam	6334.5271	+0.0128	+0.0028		V	Be	34	

Star	Min.hel. 244	O-C (I)		O-C (II)	O-C (III)	Filt.	Observer	Instr.	Rem.
AO Cam	6100.2871	-0.0558			-0.0176	V	Gr/Ha	34	
	6107.3796	-0.0564			-0.0184	B	Gr/Ls	34	Min II
AW Cam	6474.2849	-0.0042		-0.0044		V	Ls	34	
VZ CVn	6576.4665	-0.0009		-0.0055		V	Ha/Ls	34	
VW Cep	6249.4830	-0.0209		-0.0126		B, V	Sr	48	
	6257.4172	-0.0187		-0.0104		B, V	Gl	48	Min II
	6276.4780	-0.0225		-0.0142		B, V	Sr/Ca	48	
EG Cep	6232.4628	+0.0065		+0.0080		V	Gr/Ls	34	
GK Cep	6287.4712	+0.0635		+0.0026		B, V	Gl/Sl	48	Min II
	6311.3413	+0.0616		+0.0004		B, V	Gl/Sl	48	
	6318.3644	+0.0636		+0.0022		B, V	Sr/Tj	48	Min II
	6325.3847	+0.0627		+0.0013		B, V	Sr	48	
	6332.4057	+0.0625		+0.0010		B, V	Sr	48	Min II
	6339.4287	+0.0643		+0.0028		B, V	Sr	48	
	6691.4264	+0.0670		+0.0017		B, V	Sr/Hs	48	
Y Cyg	6287.4210:	-0.0149:		-0.0168:		V	Ls	34	
V367 Cyg	5834.099	-0.125		+0.010	-0.026	B, V	Ca	48	
	5936.572	+0.060		+0.198	+0.159	B, V	Ca	48	Min II
	6224.695	-0.082		+0.065	+0.018	B, V	Ca	48	
	6271.385	+0.114		+0.262	+0.213	B, V	Ca	48	Min II
	6764.000	-0.111		+0.051	-0.012	B, V	Ca	48	
V909 Cyg	6320.324	-0.010	=	-0.010		B, V	Gl	48	Min II
	6327.3377	-0.0100	=	-0.0100		B, V	Gd/Ca	48	
V1073 Cyg	6291.4714:	-0.0200:		0.0000:		V	Be/Ls	34	

Star	Min. hel. 244	O-C (I)		O-C (II)	O-C (III)	Filt.	Observer	Instr.	Rem.
V1425 Cyg	6613.4158	+0.0061	=	+0.0061		B, V	Sr/Zk	48	Min II
	6665.3883	+0.0045	=	+0.0045		B, V	Gd/Zk	48	
	6685.4260	+0.0040	=	+0.0040		B, V	Sr/Zk	48	
	6690.4358	+0.0043	=	+0.0043		B, V	Gd/Zk	48	
UZ Dra	6227.4238	+0.0010		+0.0026	0.0000	B, V	Gd	48	
	6245.3608	+0.0008		+0.0004	-0.0002	B	Gl/Ca	48	Min II
	6245.3601	+0.0001		-0.0003	-0.0009	V	Gl/Ca	48	Min II
AK Her	6224.4309	+0.0008		-0.0081	+0.0033	B, V	Gl/Ca	48	Min II
	6228.4330	-0.0016		-0.0104	+0.0009	B, V	Sr	48	
	6230.332	+0.001		-0.008	+0.0031	B, V	Gl/Ca	48	Min II
	6234.334	-0.002		-0.011	+0.0006	B, V	Sr/Ca	48	
	6243.3987	+0.0001		-0.0088	+0.0026	B, V	Sr	48	Min II
	6244.4510	-0.0014		-0.0103	+0.0011	B, V	Gd/Ca	48	
	6612.4410	-0.0001		-0.0100	+0.0033	B, V	Gd/Zk	48	
	6634.3582	-0.0020		-0.0120	+0.0014	B, V	Ca/Va	48	
	6642.3659	-0.0033		-0.0132	+0.0002	B, V	Ib/ca	48	
	6643.4213	-0.0017		-0.0116	+0.0018	B, V	Ib/Sn/Ca	48	Min II
HS Her	6596.4600	-0.0045		-0.0163		V	Be/Ls/Wu	34	
RT Lac	6253.4651	-0.0140		-0.0300		B	Ib	48	
	6253.4665	-0.0126		-0.0286		V	Ib	48	
	6281.3828	-0.0030		-0.0193		B, V	Sn/Ca/Va	48	Min II
	6286.4422	-0.0176		-0.0339		B	Ib/Ca	48	Min II
	6286.4429	-0.0169		-0.0332		V	Ib/Ca	48	Min II
	6664.4484	-0.0206		-0.0408		V	Sn/Ca	48	
	6664.4505	-0.0185		-0.0387		B	Sn/Ca	48	

Star	Min.hel. 244	O-C (I)	O-C (II)	O-C (III)	Filt.	Observer	Instr.	Rem.
SW Lac	6262.3633	-0.0030	+0.0063	+0.0010	V	Ca	48	Min II
	6262.3636	-0.0027	+0.0066	+0.0013	B	Ca	48	Min II
	6264.4467	-0.0043	+0.0050	-0.0003	V	Ca	48	
	6264.4470	-0.0040	+0.0053	0.0000	B	Ca	48	
	6270.3797	-0.0046	+0.0048	-0.0006	B, V	Sn/Ca	48	Min II
	6270.5404	-0.0043	+0.0051	-0.0003	B	Sn/Ca	48	
	6270.5408	-0.0039	+0.0055	+0.0001	V	Sn/Ca	48	
	6271.5028	-0.0040	+0.0053	-0.0001	B	Ca	48	
	6271.5030	-0.0038	+0.0055	+0.0001	V	Ca	48	
	6272.4655	-0.0035	+0.0059	+0.0005	V	Sn/Ca	48	
	6272.4656	-0.0034	+0.0060	+0.0006	B	Sn/Ca	48	
	6273.4268	-0.0043	+0.0050	-0.0004	V	Ib	48	
	6273.4271	-0.0040	+0.0053	-0.0001	B	Ib	48	
	6274.3887	-0.0046	+0.0048	-0.0006	B	Ca	48	
	6274.3891	-0.0042	+0.0052	-0.0002	V	Ca	48	
	6288.5007	-0.0043	+0.0051	-0.0003	V	Ls	34	
	6329.3932	-0.0037	+0.0060	+0.0004	B	Tn/Ca	48	Min II
	6329.3938	-0.0031	+0.0066	+0.0010	V	Tn/Ca	48	Min II
	6329.5541	-0.0032	+0.0066	+0.0010	B, V	Tn/Ca	48	
	6669.3555	-0.0056	+0.0066	-0.0002	V	Tn/Va	48	Min II
	6669.3565	-0.0046	+0.0076	+0.0008	B	Tn/Va	48	Min II
	6669.5154	-0.0061	+0.0062	-0.0007	B	Tn/Va	48	
	6669.5156	-0.0059	+0.0064	-0.0005	V	Tn/Va	48	
	6689.3995	-0.0066	+0.0057	-0.0012	V	Ib/Ca	48	
	6689.3999	-0.0062	+0.0061	-0.0008	B	Ib/Ca	48	

Star	Min. hel. 244	O-C (I)	O-C (II)	O-C (III)	Filt.	Observer	Instr.	Rem.
SW Lac	6689.5613	-0.0052	+0.0071	+0.0002	B	Ib/Ca	48	Min II
	6689.5616	-0.0049	+0.0074	+0.0005	V	Ib/Ca	48	Min II
	6693.4089	-0.0063	+0.0061	-0.0008	V	Be	34	Min II
XY Leo	6469.408	+0.002 =	+0.002		V	Be/Ls	34	
U Oph	6219.5383	+0.0048	-0.0002		V	Gr/Ha	34	
AT Peg	6000.3358	+0.0169	+0.0166	0.0000	B, V	Gd	48	
	6298.3155	+0.0152	+0.0246	-0.0003	B, V	Gd/Ca	48	
	6315.5062	+0.0147	+0.0246	-0.0007	B, V	Gd/Ca	48	
	6334.419	+0.017	+0.027	+0.002	B, V	Gl	48	Min II
UV Psc	5987.5127	+0.0045	-0.0018		B	Ib	48	Min II
	5987.5134	+0.0052	-0.0011		V	Ib	48	Min II
	6004.3008	+0.0021	-0.0041		B	Ib/Ca	48	
	6004.3015	+0.0028	-0.0034		V	Ib/Ca	48	
	6322.4592	+0.0037	-0.0030		B, V	Tm/Ca	48	Min II
	6326.3344	+0.0042	-0.0025		B, V	Ib/Tj	48	
	6331.5002	+0.0037	-0.0030		V	Ca/Tj	48	
	6331.5005	+0.0040	-0.0027		B	Ca/Tj	48	
	6745.2357	+0.0061	-0.0012		V	Ib/Ca	48	Min II
	6745.2377	+0.0081	+0.0008		B	Ib/Ca	48	Min II
	6753.4130	+0.0034	-0.0039		B, V	Sn/Ca	48	
SAO 077615	6113.4117			+0.0497	V	Gr/Ls	34	
	6115.309			+0.041	V	Ls	34	Min II
V471 Tau	5935.51417	-0.00285		+0.00003	B	Sn/Ca	48	
	5936.55676	-0.00262		+0.00026	B	Tn	48	

Star	Min. hel. 244	O-C (I)	O-C (II)	O-C (III)	Filt.	Observer	Instr.	Rem.
V471 Tau	6019.42479	-0.00275		+0.00019	B	Sn/Ca	48	
	6030.36958	-0.00282		+0.00014	B	Ca	48	
	6351.41848	-0.00289		+0.00030	B	Sn/Ca	48	
	6352.46093	-0.00281		+0.00039	B	Sn/Ca	48	
DR Vul	6319.5047	+0.0513	+0.0514		V	Be/Ls	34	
ERVul	6004.3776	-0.0090	+0.0033	+0.0108	B	Ib/Ca	48	
	6004.3808	-0.0058	+0.0065	+0.0140	V	Ib/Ca	48	
	6235.4368	-0.0196	-0.0070	+0.0008	B	Tn/Ca	48	
	6235.4406	-0.0158	-0.0032	+0.0046	V	Tn/Ca	48	
	6241.3712	-0.0190	-0.0064	+0.0014	V	Sn/Ca	48	Min II
	6241.3738	-0.0164	-0.0038	+0.0040	B	Sn/Ca	48	Min II
	6248.3513	-0.0199	-0.0073	+0.0006	V	Ca	48	Min II
	6248.3577	-0.0135	-0.0009	+0.0070	B	Ca	48	Min II
	6256.3774	-0.0219	-0.0092	-0.0014	B	Sn/Ca	48	
	6256.3806	-0.0187	-0.0060	+0.0018	V	Sn/Ca	48	
	6314.3250	-0.0163	-0.0035	+0.0044	V	Ib	48	
	6314.3256	-0.0157	-0.0029	+0.0050	B	Ib	48	
	6317.4666	-0.0161	-0.0034	+0.0046	B	Ca	48	Min II
	6317.4688	-0.0139	-0.0012	+0.0068	V	Ca	48	Min II
	6605.4301	-0.0172	-0.0040	+0.0043	B, V	Tn/Sn	48	
	6651.5042	-0.0174	-0.0042	+0.0042	B	Ib/Sn	48	
	6651.5047	-0.0169	-0.0037	+0.0047	V	Ib/Sn	48	
	6652.5521	-0.0167	-0.0035	+0.0049	V	Ib/Ca	48	Min II
	6652.5523	-0.0165	-0.0033	+0.0051	B	Ib/Ca	48	Min II

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LET'S FORGET DO Dra

A 16th magnitude cataclysmic variable has recently been identified as the optical counterpart of a HEAO-1 and HEAO-2 X-ray source (Patterson et al.1982). Because the X-ray and optical positions agree to within the 1' accuracy of the X-ray position, and because the X-ray flux and spectrum are about what is expected from cataclysmic variables, there is essentially no doubt that the star is the X-ray source. Hazen (1985) and Wenzel (1983) have searched plate collections and found brightenings to $m\sim12$ which are probably dwarf nova eruptions.

What is perhaps less clear, at first glance, is that this star is extremely likely to be the variable star noted by Tsesevich (1934) and catalogued as "YY Dra" in all editions of the General Catalogue of Variable Stars. In particular, Wenzel (1983) has expressed doubt on this point, prompting the assignment of a new variable star name (DO Dra) to the dwarf nova. This seems quite ill-advised, because, as we shall see, the confusion probably arises from fairly routine errors in position and photometric classification.

The positional data are shown in Figure 1 and Table I. The lower circle and various diagonal lines show the X-ray positions, and (I leave out the detailed arguments, but they can be found in Patterson et al. (1987)) are all consistent with the position of the dwarf nova, star D. The upper circle, drawn with an arbitrary 40" error radius, shows Tsesevich's stated position for YY Dra. The other constraint on the problem comes from Tsesevich's analysis of the brightness variations; he suggested an Algol-type binary varying from m = 12.9 to >14.5 with a period of 4.21123 days. But we have scanned over 500 plates in the Harvard plate collection, and have found no Algol-type light variations for any star in the field (covering typically about 20' by 20'). Wenzel (1983) reports the same result from 700 additional archival plates. We can envision only two solutions: either the reported position of YY Dra is grossly in error, and the star is now lost; or the reported position is in error by 53", and YY Dra is identical to the dwarf nova. We strongly favor the second hypothesis, for these reasons:

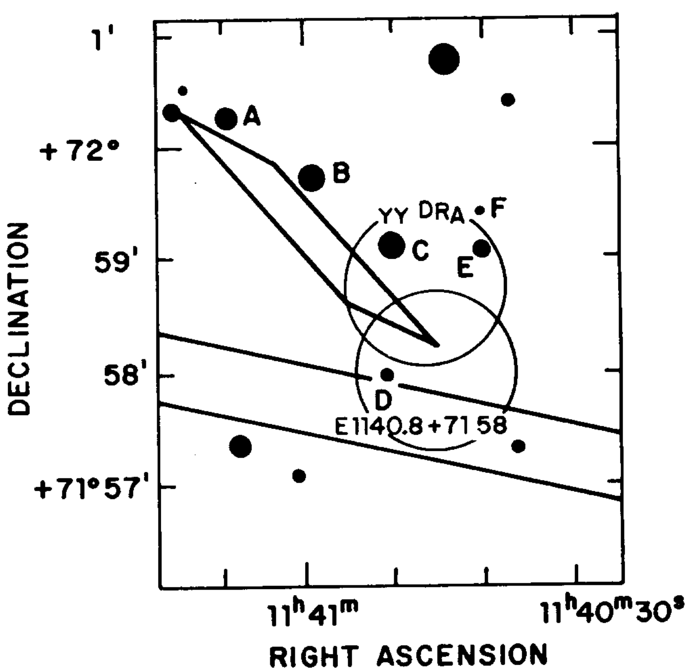

Figure 1

TABLE 1. Measured positions (1950.0)

star D (±1.5")	$11^h40^m48^s.83$	71° 57' 59"
HEAO-2 X-ray (± 1') (E1140.8+7158)	$11^h40^m44^s.7$	71° 58' 3"
GCVS "YY Dra"	$11^h40^m45^s$	71° 58' 48"

(1) At these high galactic latitudes, the incidence of variable stars is about $0.03/deg^2$, so the probability that an erroneous position would accidentally fall within 1' of a true variable star is $\sim 10^{-5}$.

(2) A 13th magnitude Algol binary at high latitude is intrinsically somewhat suspicious. For a typical M_v in the range -1 to +3, one obtains distances of 1-6 kpc -- placing the star well out in the galactic halo, where binaries of any kind seem to be quite rare (Batten 1973). Inspection of the entire Variable Star Catalogue reveals only 3 Algol-type ("EA") stars with m > 12.5 in the 10^4 deg^2 at the galactic poles ($b > 45^o$).

(3) A positional error of 53" is not unusual. The accurate coordinates of 23 cataclysmic variables measured by Lopez (1985) showed an rms offset of 41", compared to the GCVS positions.

(4) It is not difficult to imagine how a sparse set of photographic magnitudes, for a star never observed before or since, could have produced a spurious period and light curve. There are hundreds of precedents.

Thus we have substantial confidence that the star we now recognize as a dwarf nova is YY Dra, the star observed by Tsesevich. The point may seem somewhat academic, but is made here in the interests of accuracy and reasonable nomenclature. Variable stars are commonly re-classified, but that does not warrant re-naming them.

Let's consign the name of DO Dra to a richly deserved oblivion.

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Budapest
31 August 1987

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NEW UBV PHOTOELECTRIC OBSERVATIONS OF GZ And

The variability of eclipsing binary GZ And was detected by Walker(1973) who suggested that GZ And was a W UMa type eclipsing binary.

New UBV photoelectric observations of GZ And were made using P34B photometer attached to the 0.91m reflector between Sep. and Nov. 1984 at McDonald Observatory.

The observed times of light minima , which are the same for each band and (O-C) values are listed in Table I.

Table I. The times of minima

Primary		Secondary	
JD(hel) 2440000+	(O-C)	JD(hel) 2440000+	(O-C)
5950.93175	-0.04313	5984.93999	-0.04350
5951.84676	-0.04314	5985.85502	-0.04351
5985.70251	-0.04350	5986.77004	-0.04352
5986.66105	-0.04352		
6007.66299	-0.04375	6009.64554	-0.04377
6008.57802	-0.04376	6013.61063	-0.04381
6012.54310	-0.04380		
6015.59317	-0.04383		

The (O-C) values were calculated using the formula

$$\mathrm{Min(I)=JD(hel)}\ 2441976.69458 + 0\overset{d}{.}30501\ E$$

given by Walker.

We obtained the new ephemeris of GZ And:

$$\mathrm{Min(I)=JD(hel)}\ \underset{\pm 35}{2445985.70251} + \underset{\pm 4}{0\overset{d}{.}3050067}\ E$$

The UBV light curves of GZ And are plotted in Figure 1.

The average colour indices are $(B-V)=0\overset{m}{.}78\pm0.02$ and $(U-B)=0\overset{m}{.}27\pm0\overset{m}{.}02$ as seen in Figure 2.

The depth of both minima is given in Table II. The depth of the primary minimum and secondary minimum is almost equal.

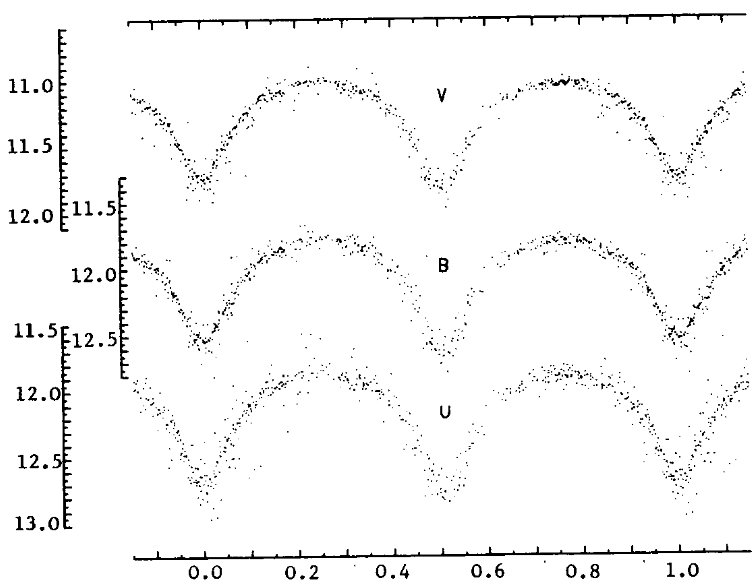

Figure 1. The VBU light curves of GZ And

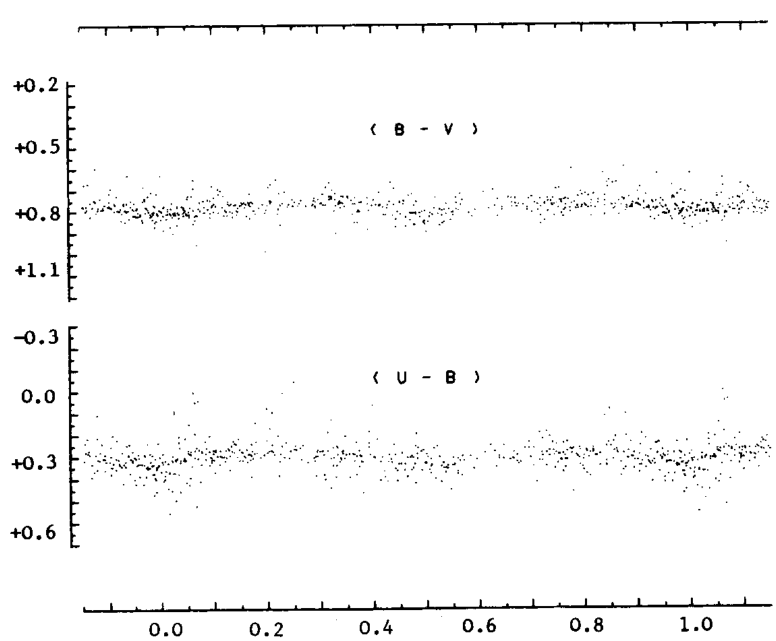

Figure 2. The colour index (B-V) and (U-B) curves of GZ And

Table II. The depth of minima of GZ And

Colour	Depth of minima
V	$0^{m}.88 \pm 0^{m}.02$
B	$0^{m}.92 \pm 0^{m}.02$
U	$1^{m}.01 \pm 0^{m}.03$

The photometric solution of GZ And will be published elsewhere.

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and
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Reference:
Walker,R.L., 1973, Inf.Bull.Var.Stars, No.855.

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PHOTOMETRIC STUDY OF THE BLUE VARIABLES IW, IZ AND IO ANDROMEDAE

The stars discovered by Meinunger (1975) were investigated on 330 plates of Sonneberg collection obtained in JD 2440802-46706.

IW And (=S 10792; all variable star designations are according to Kholopov et al., 1985). A part of the light curve was published by Meinunger (1975). The spectrum is similar to that of OB stars, but with some peculiarities (Meinunger, 1980). Further observations also show the rapid brightness variations, up to 3 magn. in 1^d. However, it seems to be, that the typical state of the star is the inactive state (72% of observations are in interval 15.1^m-15.3^m), which occasionally is being interrupted by maximum brightness (18% in the interval 13.7^m-15.0^m) and minimum brightness (10% in the interval 15.4^m-17.3^m) states lasting some tens of days. These extrema can be regarded as "active states", and practically in all our observations the bright states are accompanied by states of low brightness and vice versa.
Such behaviour differs significantly from that of dwarf novae (eg. Richter, 1986 and references therein) or polars (Hudec and Meinunger, 1976).The light curve is, however, similar to that of KR Aurigae, which is probably a single black hole that accretes matter from interstellar medium (Popova and Vitrichenko, 1978). Another possible explanation of such variability might be connected with a mechanism of radiation-induced outflow from the secondary star in a binary system (Basko and Sunyaev, 1973, King and Lasota, 1984). In order to answer the question which mechanism takes place in this object, multiwavelength photometric and spectral observations are needed. The object might be an X-ray source.

IZ And (=S 10794). Also rediscovered by Stepanian (1982). Only five outburts have been observed, which are listed in Table I.

Table I

JD 24.....	m	n	Reference
41300	15.9	2	Meinunger (1975)
41366	15.4	5	-"-
41975	17.5	1	Stepanian (1982)
42231	15.5	1	-"-
44466	16.3	1	this paper

In Table I n is the number of nights, during which the given outburst was observed. The shortest time interval between the outbursts is $C=66^d$. If we assume the outburst duration (time, during which the star is brighter than 17^m) $L=8^d$ (JD 2441366-74), then, according to Wenzel and Richter (1986), the cycle length is $C_2=LN/n \sim 86^d$. Here N = 107 is the total number of nights, n = 10 - the number of nights, at which the star was bright. It is in good agreement with the value C. However, if we use the value of N instead of T (see Wenzel and Richter 1986 for details), we obtain a sufficiently lower value of $C_1=17^d$ ($g=2$, λ =1.594). It is self-evident, because N is only a lower limit of T, but this value of time of "potentially possible observations" might not be counted with sufficient accuracy.

Using the value of C, we obtain the same values $A=4.1^m$ for "Amplitude-cycle length" relationships both by Kholopov and Efremov (1976) and by Richter (1986). It is in good agreement with the observations (4.9^m according to Meinunger (1975); but the lower limit 20.5^m is very uncertain, more probable is a value of $\sim 1^m$ brighter, as given by Stepanian (1982).

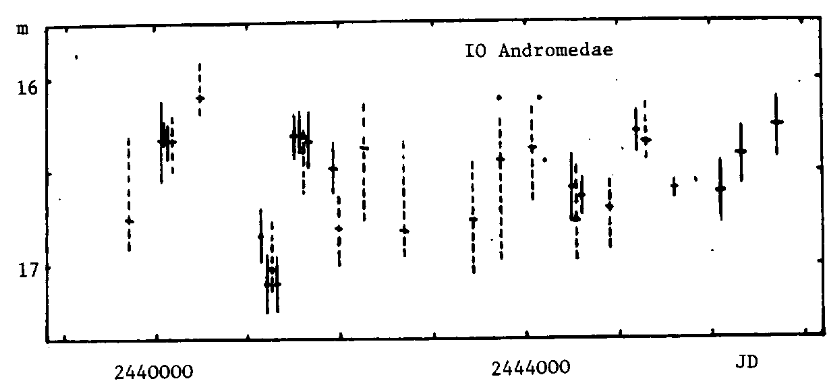

Figure 1 The mean light curve of IO Andromedae from Sonneberg (solid line error bar) and Moscow (broken line) observations. All observations have been reduced to Meinunger's (1975) scale

IO And(=S 10785). The star is supposed to be a polar, However, no emission lines were present in spectra (Meinunger, 1980). The 5-year cyclic variation of the star was suspected from 650 observations from Moscow plate collection (Andronov, 1983). The changes are cyclic but not periodic, as seen from the comparison with 324 Sonneberg observations (Fig. 1). Possibly the object is a quasar (Voykhanskaya, 1987), but not a polar. Its behaviour has some similarities with that observed in other quasars (Kurochkin, 1978). The correct classification is, however, not possible by using only photometric observations.

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ON THE POSSIBLE NOVA OF SOLOVYOV

In 1949, Solovyov (1949a,b) reported on a possible nova in the constellation of Aquila. The evidence for the existence of the nova consists of only one photographic plate taken on 2 May 1949 at 21^h 42.0^m UT. On this plate, the limiting magnitude was 13.5, the nova appeared at between 10.8 and 11.0 magnitude, and the nova's position was 19^h 22^m 58.3^s, $+2^o$ 41' 28" (1949.0 epoch). The nova was not detected on plates taken two days earlier, one day earlier, or 23 days later. From this evidence, it is quite possible that Solovyov's object (CSV101836 = NSV12006) could be a faint galactic nova that brightened on 2 May 1949 and then quickly faded. It is also possible that Solovyov's object could be a flare star of large amplitude, or a gamma ray burster, or a photographic defect.

To help choose between these possibilities, I have examined the plates at the Harvard College Observatory. Specifically, I was looking for plates exposed around 2 May 1949 which showed the position of the possible nova. I did find the plates B74713 (a 45^m exposure started at 3 May 1949 16^h 9^m UT with a limiting magnitude of roughly 14.0) and RB16275 (a 120^m exposure started at 5 May 1949 16^h 42^m UT with a limiting magnitude of roughly 15.5). Both plates showed no sign of anything unusual near the error box.

These observations rule out the possibility of Solovyov's object being a nova, since the object would have to have faded by over 3.0 magnitudes in 19 hours. I would like to request that other astronomers with access to archival plate collections should try to see if they have photographs from the same night. I would also like to request that anyone who may have access to the original plate of Solovyov should examine the image for plate defects. Such an examination should include a comparison of the image under high magnification with those of nearby stars, as well as a blink comparison with a comparable plate.

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NASA/GSFC, Code 661, Greenbelt, MD, 20771,USA

2

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THE ECLIPSE OF THE LONG PERIOD ECLIPSING BINARY 32 CYGNI IN 1987

V 1488 Cyg (32 Cyg) is an eclipsing binary with the period of 1147.4 days. The last eclipse occurred in July 1987. Observations have been made with a 250/3750 cassegrain reflector at Nessa observatory. 30 Cyg (V= 4.83, B-V = +0.09, U-B = +0.15) and 31 Cyg (V= 3.79, B-V = +1.28, U-B = +0.42) were used as comparison stars. From the observations I can estimate the amplitudes in UBV to be U= 0.88, B= 0.13 and V= 0.06.

The observations are given below:

Photoelectric observations of V 1488 Cygni

J.D. 2440000 +	V	B	U
6942.429	4.00	5.50	6.54
6957.438	3.96	5.59	6.54
6972.458	3.78:	5.54	
6974.479	3.97	5.65	6.60
6989.438	3.94	5.65	7.16
6990.413	4.02	5.78	7.40
6991.429	3.94	5.70	7.10
7000.400	3.94	5.61	
7012.436	3.95	5.53	6.46
7014.417	3.94	5.51	6.46
7029.354	3.96	5.58	6.45:

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PHOTOMETRIC BEHAVIOUR OF DR TAURI IN THE SEASON 1986/87

In completing and supplementing the light curve in B the star was measured on 37 blue-sensitive plates (ORWO-ZU21 + GG13 + BG12) from 20 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 4 September 1986 and 23 February 1987. The measurements, which are listed in Table I and which are given in the light curve in Figure 1 were linked to the previous sequence of comparison stars given in the IBVS No. 2172.

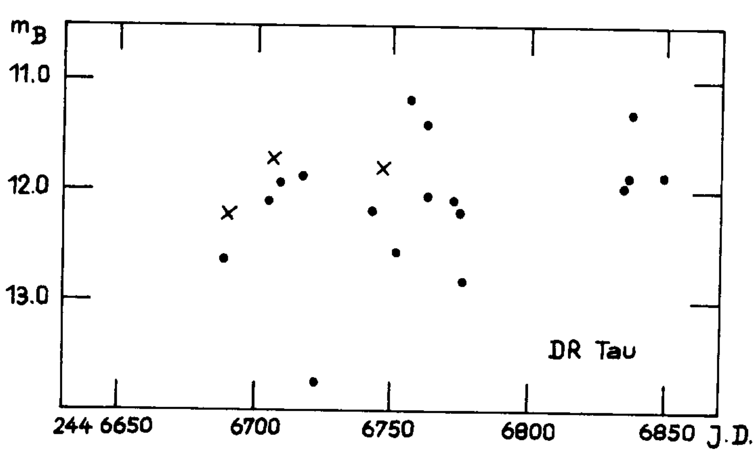

Figure 1

Table I

J.D. 244....	m_B	J.D. 244....	m_B
6678.586	$12^m.63$	6741.567	$11^m.26$
6679.570	12.22	6745.590	11.53
6704.502	11.87	6745.609	11.22
6704.522	12.16	6746.586	12.05
6704.544	12.20	6746.603	12.03
6705.529	11.83	6762.465	12.04
6705.556	11.59	6762.486	12.17
6707.497	11.84	6763.452	12.18
6707.516	12.00	6763.472	12.21
6713.576	11.90	6764.436	12.83
6713.595	11.82	6826.340	11.92
6716.601	13.72	6826.376	11.98
6716.638	13.78	6827.333	11.87
6731.422	12.28	6827.353	11.89
6733.607	11.93	6828.300	11.34
6733.626	11.70	6828.319	11.27
6737.508	12.64	6850.288	11.79
6737.530	12.47	6850.308	11.92
6741.509	11.28		

The light curve shows the star in an active phase. This behaviour is expressed by a total amplitude of $\Delta m_B = 2^m.56$ and by short-time light depressions and brightness increases starting from a normal light at $m_B \approx 12^m.04$.

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UBV PHOTOMETRY OF THE R CORONAE BOREALIS STAR RY Sgr - 1984 TO 1986

Photoelectric observations of the R Coronae Borealis (RCB) star, RY Sgr, have been obtained at Mount John University Observatory (MJUO) between JD 2445923 (1984 August 11) and JD 2446768 (1986 December 4) as part of an ongoing survey of southern RCB stars. The observations prior to JD 2446733 were obtained with the 0.6-m photometric reflector. Observations after this date were obtained with the recently commissioned 1-m reflector. The measurements were made with a photometer equipped with an EMI 6094B photomultiplier tube (S11 photocathode) and UBV filters as described by Bessell (1976).

The magnitude and colours of the comparison star SAO 211100 (V = 7.50, B-V = 0.04, U-B = 0.05) were established after the derivation of the photoelectric constants from observations of E-region standards at MJUO. The magnitude and colours of the check star SAO 211115 (V = 7.52, B-V = 0.16, U-B = 0.15), determined differentially, were found to be consistent to within 0.01 magnitudes in V and 0.02 magnitudes in B-V and U-B. The UBV observations of RY Sgr are listed in Table I.

The light and colour curves for the observations obtained in 1984 and 1986 are reproduced in Figures 1 and 2 respectively. The duration of the semi-regular pulsations varies between 33 and 40 days with an average value of 37 days.

We note that, during 1984, RY Sgr was still recovering from a 6 magnitude obscurational decline in 1982 (Lawson, Cottrell and Bateson 1987). Maxima on

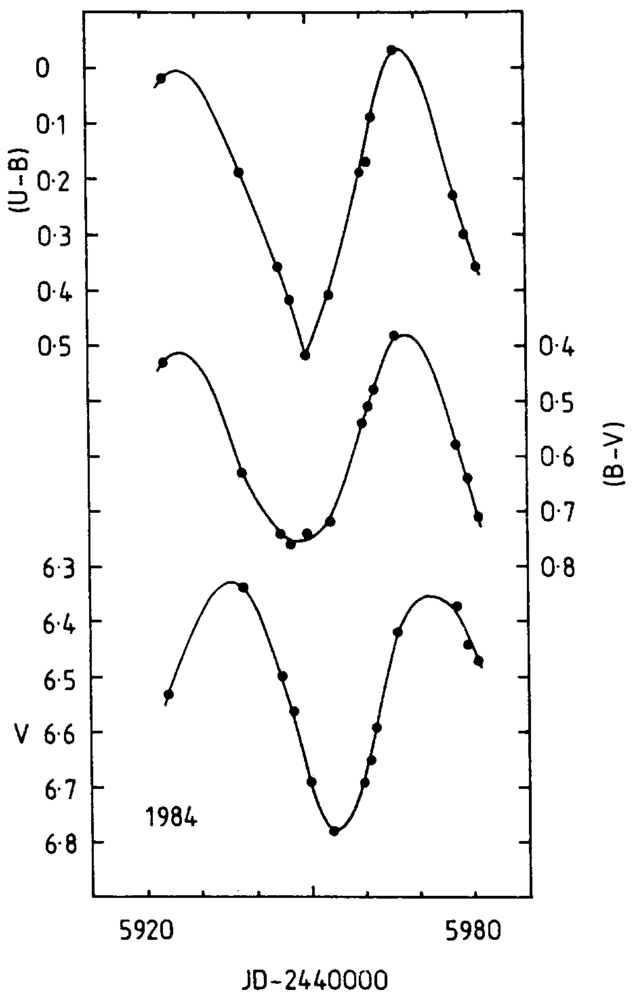

Figure 1 : Light and colour curves of RY Sgr during 1984.

Table I. Photoelectric observations of RY Sgr.

	JD-2440000	V	B-V	U-B	JD-2440000	V	B-V	U-B
1984	5923.90	6.53	0.43	0.02	5960.89	6.65	0.51	0.17
	5937.89	6.34	0.63	0.19	5961.85	6.59	0.48	0.09
	5944.85	6.50	0.74	0.36	5965.95	6.42	0.38	-0.03
	5946.95	6.56	0.76	0.42	5976.85	6.37	0.58	0.23
	5949.83	6.69	0.74	0.52	5978.94	6.44	0.64	0.30
	5953.98	6.78	0.72	0.41	5980.85	6.47	0.71	0.36
	5959.88	6.69	0.54	0.19				
1985	6189.13	6.56	0.48	0.03	6324.86	6.54	0.60	0.36
	6233.04	6.41	0.39	-0.04	6327.86	6.50	0.72	0.40
	6234.07	6.36	0.38	0.05	6328.92	6.54	0.68	0.41
	6275.90	6.22	0.45	0.01	6338.88	6.72	0.66	0.25
	6281.92	6.31	0.59	0.22	6367.88	6.38	0.58	0.23
	6283.96	6.36	0.66	0.27				
1986	6582.95	6.23	0.46	0.03	6667.12	6.37	0.72	0.29
	6584.08	6.18	0.45	0.03	6686.85	6.43	0.49	-0.02
	6586.98	6.15	0.49	0.05	6694.81	6.25	0.53	0.01
	6598.11	6.24	0.65	0.19	6696.08	6.24	0.54	-
	6599.13	6.27	0.64	0.18	6696.90	6.26	0.56	0.06
	6600.08	6.30	0.64	0.18	6698.92	6.26	0.58	0.11
	6615.09	6.41	0.53	0.00	6710.85	6.49	0.71	0.27
	6627.08	6.26	0.69	0.23	6717.94	6.55	0.68	0.25
	6628.04	6.28	0.70	0.24	6719.88	6.50	0.66	0.21
	6628.89	6.30	0.70	0.25	6722.95	6.44	0.53	0.10
	6633.88	6.40	0.72	0.26	6724.88	6.35	0.49	0.05
	6638.01	6.46	0.70	0.24	6730.88	6.25	0.56	0.11
	6638.88	6.47	0.69	0.23	6731.89	6.25	0.57	0.13
	6647.93	6.36	0.44	-0.07	6733.93	6.23	0.64	0.18
	6648.89	6.33	0.42	-0.09	6734.91	6.26	0.62	0.17
	6655.96	6.21	0.50	-0.01	6743.86	6.34	0.71	0.29
	6656.93	6.21	0.53	0.01	6744.94	6.37	0.71	0.28
	6658.10	6.23	0.54	0.08	6766.89	6.16	0.48	-
	6662.84	6.26	0.65	0.19	6768.89	6.13	0.47	-0.01

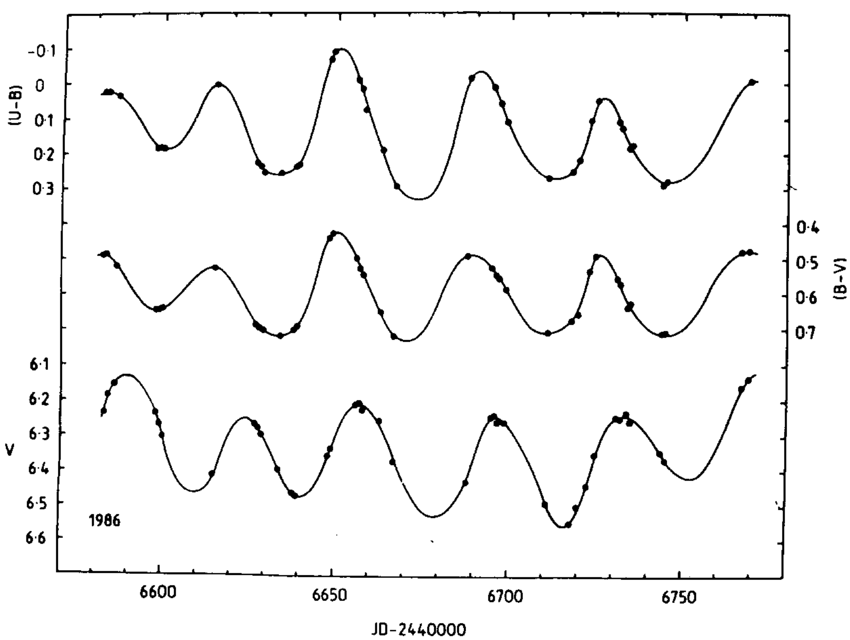

Figure 2 : Light and colour curves of RY Sgr during 1986.

the V light curve during 1984 were 0.1 to 0.2 magnitudes fainter than those during 1986.

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LONG-TERM LIGHT-CURVE OF THE CATACLYSMIC BINARY V 425 CASSIOPEIAE

The variability of V 425 Cas = S 9712 was detected by Hoffmeister (1966, 1967). The discoverer and later on Platejs and Rozenbush (1980) considered the star as a probable R Coronae Borealis variable, because the minima were rare and of rather long duration. No further photometric observations are known to me.

The true nature of the object has been discovered spectroscopically by Shafter and Ulrich (1982): It is a cataclysmic binary with an orbital period of 0.14964 days. Therefore it seemed desirable to study the long-term photometric behaviour in more detail.

An investigation on 297 plates taken with the Sonneberg 400 and 170 mm astrographs yields the following picture of the light-curve. The star was bright ($m_{pg} = 14^m.6$, standard deviation = ± 0.3 mag, n = 248) without exception from 1935 to 1951 and from 1956 to 1964 (no plates available 1952 to 1955). Slow, systematic fluctuations around the quoted mean brightness of this upper stage with an amplitude of perhaps 0.6 mag are indicated but may originate from instrumental effects. However, from 1965 to 1977 and probably also from 1983 to 1985 the star was very restless (no observations 1978 to 1982 and since 1986) - see figure. Several deep minima of a duration of some weeks at least, or even years, and a depth down to $\geq 18^m.5$ occurred, interrupted by intervals of high state.

So the star amazingly resembles the "nova-like" cataclysmic binaries TT Ari, MV Lyr or KR Aur, which are characterized by ceasing mass transfer in low state. We suppose that there are more such objects among the purely photometrically classified so-called R Coronae Borealis stars.

Meaning of symbols in the figure is: filled circles - Sonneberg (small-single observations, large-night averages), crosses - Riga (approximate), arrows - upper limits. Magnitude system of Mt. Wilson Selected Area 42.

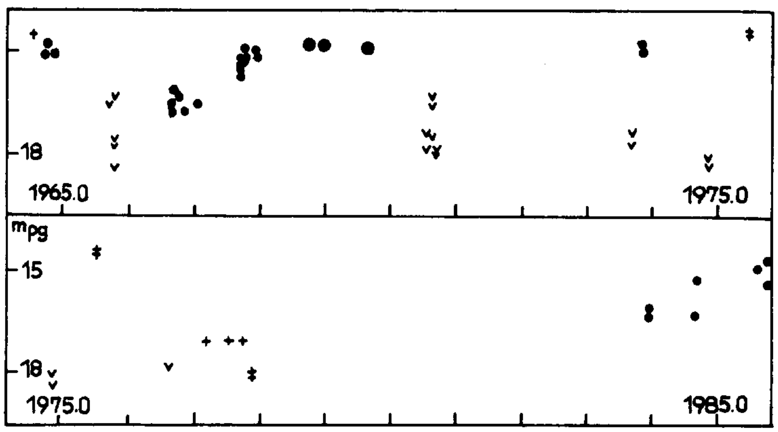

Figure 1

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LIGHT CHANGES IN THE PRIMARY ECLIPSE OF RT Lac

Photoelectric observations of the active RS CVn type binary RT Lac have been continued at the Ege University Observatory. In this note we report about our observations and the light changes within the primary eclipse. The observations were carried out with the 48 cm Cassegrain reflector and one channel B, V photoelectric photometer. A photon counting system, Starlight 1, with an integration time of 10 sec was used. A microcomputer, Amstrad CPC6128, controls the photometer. An uncooled, standard EMI 9924A photomultiplier tube was used at the observations.

A primary eclipse was observed on 27/28 July 1987 in two different wavelengths, in blue and yellow. These are shown in Figure 1. The light variations have been discussed by Ibanoglu et al. 1980) and the periodic light changes within primary eclipse have been reported by Evren et al. (1984). A period for the light variation at mid-primary of about 4.5 years has been suggested. Later on, Ibanoglu et al. (1985) announced that the brightness of the star seen at the primary eclipse had been started to decrease and it would reach its minimum brightness about 1986 observing season. The mean values of brightness at mid-primary have been plotted against the years and are shown in Figure 2. It is clearly seen that the brightness at mid-primary reached its minimum value, which is the same as that in 1981 in blue, but it is a little brighter in yellow light. The last observations of the primary eclipse clearly confirmed that the light variation at mid-primary eclipse is periodic and is repeated with a period of about 5 years.

The light variations outside minima are nearly half of that seen at the primary. Therefore, the events observed in RT Lac cannot be explained with the spot hypothesis alone. These existing light variations in mid-primary eclipse of RT Lac clearly reveal that the component seen during the primary eclipse could be an intrinsic variable.

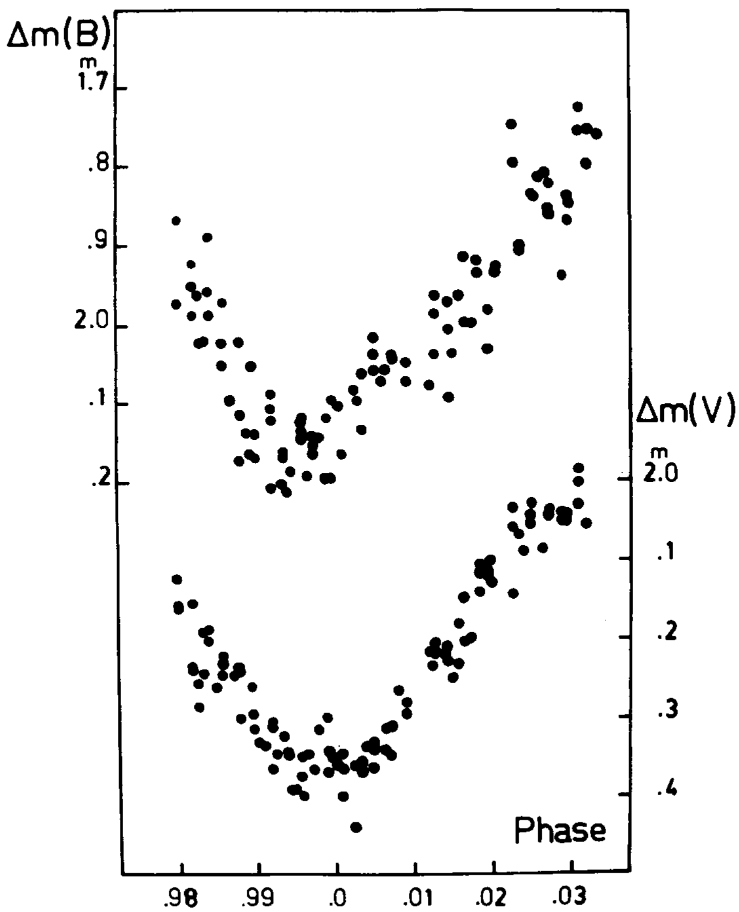

Figure 1

Results of an international observing program at different wavelengths, which will be carried out in this and next observing seasons, of this peculiar system will of course yield valuable information about RT Lac.

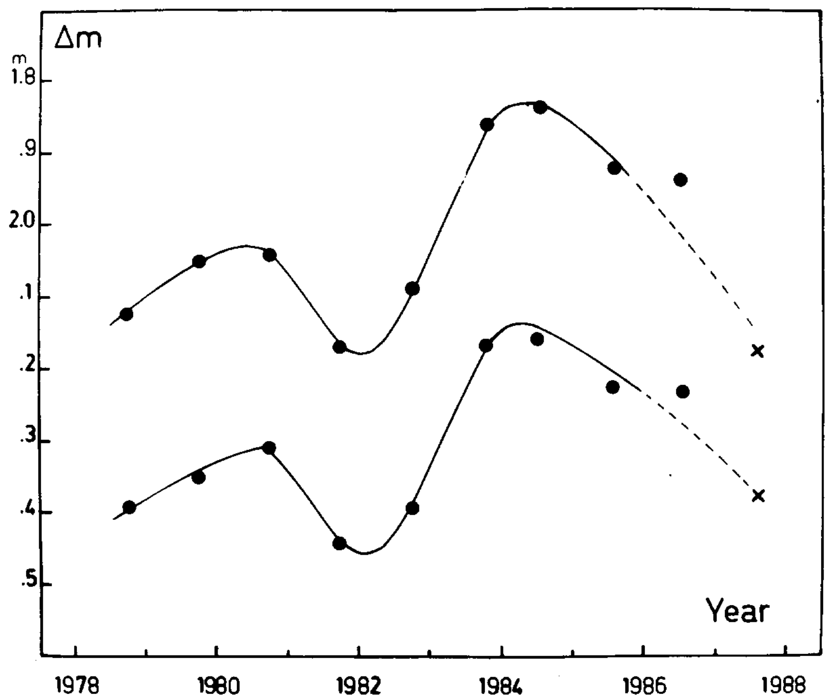

Figure 2

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NEW OBSERVED TIMES OF MINIMA FOR EE Aqr, RV Gru and RW PsA

UBVRI photometric observations of these three short period eclipsing binaries were carried out at La Silla (ESO) during the period 27 August - 2 September 1986 with the ESO 50 cm telescope. Simultaneous spectroscopic observations were also performed for these systems.

For each program star one primary minimum could be observed; the times of minima given below are obtained from averages on the five colours:

	EE Aqr	RV Gru	RW PsA
T(hel.prim.min)	2446674.5897	2446673.8810	2446675.6850

From these and using all the other observed times of minima found in literature the following new ephemerides could be computed:

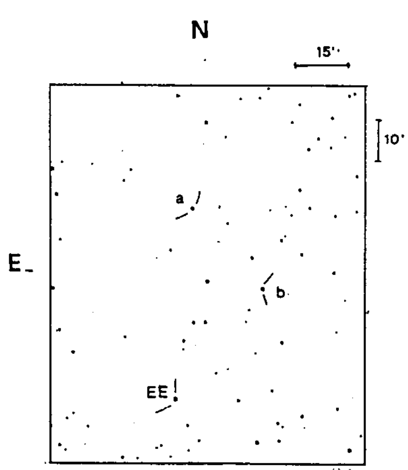

Figure 1

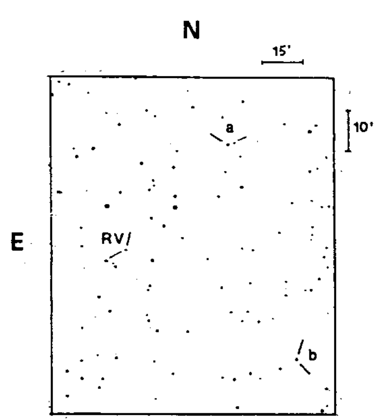

Figure 2

EE Aqr	Hel.J.D.(prim.min.) = 2440828.7809 + E·0.50899513	
	±.0003	±.00000005
RV Gru	2442655.7905 ± E·0.25951625	
	±.0002	±.00000004
RW PsA	2434328.4684 + E·0.36045011	
	±.0008	±.00000004

Table I

Star	(1950)	(1950)	S.T.	m
EE Aqr	22 31 59	-20 07.1	F0	8.0
SAO 165165	22 31 42	-19 18.6	F8	8.5
SAO 165157	22 30 25	-19 38.9	A0	9.1
RV Gru	22 36 25	-47 08.0		11.3
SAO 231212	22 33 38	-46 43.1	K0	9.3
SAO 231204	22 32 12	-47 38.1	G5	9.8
RW PsA	22 06 56	-27 18.9		11.0
SAO 190916	22 06 08	-27 26.5	K2	9.0
SAO 190901	22 04 51	-28 18.2	G0	7.9

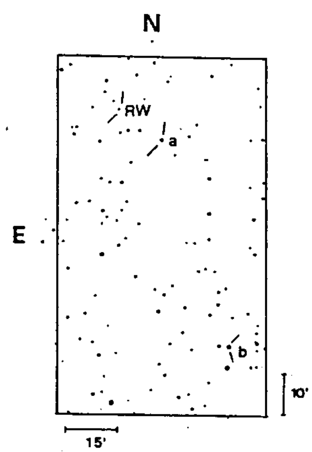

Figure 3

A more complete presentation of the observations will follow in some forthcoming papers. The identifications of comparison and check stars as well as the corresponding finding charts, for each variable star are also given in Table I, and Figures 1 - 3, respectively.

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II PEGASI: EVIDENCE OF EVOLVING STAR SPOT REGIONS

II Pegasi (HD 224085, K2 IV, <V>=+7.5 mag) is a single-line spectroscopic binary with an orbital period of 6.72 days and is a member of the RS CVn class of spotted variable stars. Multi-color photoelectric observations of II Peg were obtained on 14 nights from 6 UT October 1986 to 27 UT February 1987, using the 38 cm Cassegrain telescope at Villanova University Observatory. This reflector is equipped with a microprocessor controlled data aquisition system and pulse counting photometer utilizing an EMI 9658 photomultiplier tube. The observations were made with an H-alpha narrow and Intermediate-band filter pair as well as with intermediate-band blue (λ4530), and yellow (λ5500) filters. HD 223332 (K5; V=+7.05 mag) was used as the comparison star and nightly mean differential magnitudes were determined from the observations. From these values, corresponding nightly mean differential color and H-alpha indices were also determined. The observing procedure, data reduction technique, filter characteristics, and an explanation of color indices have been given by Guinan and Wacker (1985).

The upper panel of Figure 1 is a plot of the nightly mean differential yellow (y) magnitudes versus phase. Orbital phases were computed according to the ephemeris of Rucinski (1977): JD = 2443033.10 + 6.724183 * E. The light curve displays a broad

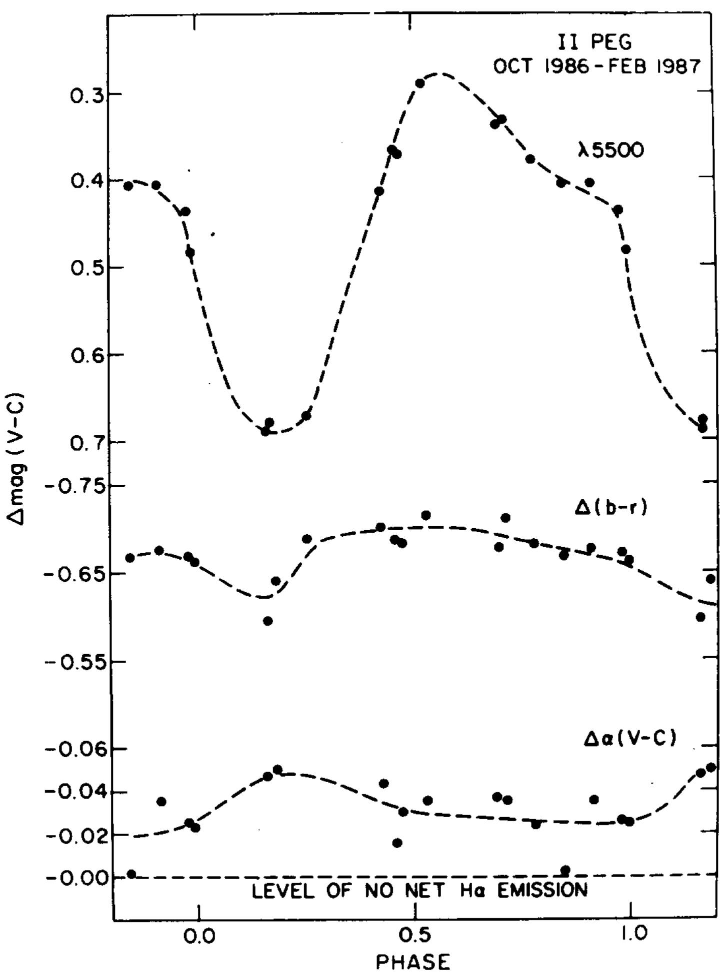

Figure 1

The 1986/87 photoelectric observations of II Peg are plotted against orbital phase. The upper part of the figure is a plot of the nightly mean differential magnitudes. A plot of the differential (b-r) magnitudes is shown in the middle of the figure. The lower portion of the figure shows a plot of the differential H-alpha index, where more negative values indicate greater net H-alpha emission.

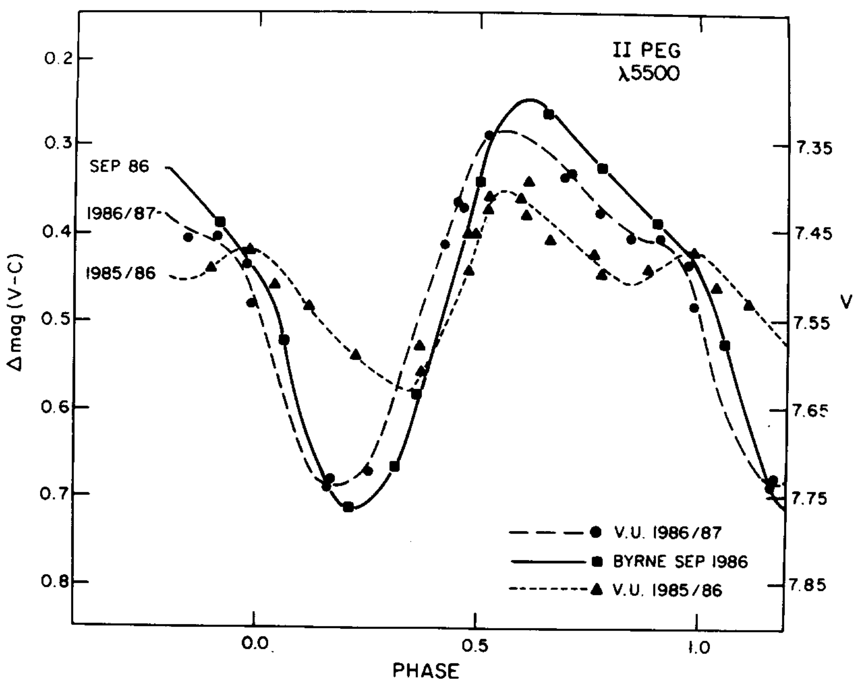

Figure 2

The 1985/86, September 1986, and the 1986/87 yellow light curves of II Peg are plotted against phase. The variations in the shape and amplitude of the light curves over this one year interval are evident.

maximum at about 0.55 phase and a minimum occurs near 0.18 phase. The corresponding light amplitude is approximately 0.40 mag in yellow light. In addition to this large light amplitude, the light curve shows a noticeable inflection at approximately 0.85 phase. The corresponding blue and red light curves (not pictured) have the same shape as the yellow light curve and have light amplitudes of +0.43 mag and +0.31 mag respectively, indicative of a strong wavelength dependence of the light variation.

The middle panel of Figure 1 presents a plot of the nightly mean differential (b-r) color index. The mean value is $\Delta\overline{(b-r)}$ = -0.674 mag. Despite some observational scatter, Δ(b-r) exhibits an obvious phase dependence, in which the color index is most positive (i.e. reddest) when the star is faintest and vice versa. This behavior is consistent with cool starspot models in which the spotted star dominates the light of its companion.

The bottom panel of Figure 1 displays the differential H-alpha index α(v-c), which gives a measure of the net H-alpha emission and is an indicator of chromospheric activity. The seasonal mean value of the $\Delta\alpha$(v-c) data set is -0.031 mag. Based upon the spectral types of the variable and comparison stars, the level of zero net H-alpha emission corresponds to the value $\Delta\alpha$(v-c) $\simeq$ 0.00 $\pm$ 0.01. As shown by this plot, Hα emission is greatest when the star is faintest- an occurrence which supports the theory of large-area starspots and related plages.

Preliminary spot modelling of the light curves was carried out using the computer code developed at Villanova (Dorren et al., 1981). A photospheric temperature of 4700K was adopted for the visible star of the binary from its K2 IV spectral type (Novotny 1973). The light contribution of the unseen star of the binary system was assumed to be negligible since its spectrum is not seen at visible wavelengths. Also, the inclination of the active star's rotation axis to the line of sight was assumed to be $i \sim 65^{\circ}$ (Vogt 1981). The limb darkening coefficients used in computing the theoretical light curves were obtained from the compilations of Al-Naimiy (1978). The amplitudes and shapes of the light curves were fit by assuming two major spot groups of different sizes and located at different stellar latitudes. The spots are separated by $\sim 120^{\circ}$ in stellar longitude and cover about 12 percent of the total surface area of the star. (A minimum of $\sim$24 percent of the star's surface area is spot covered if the spots are symmetrically placed about the star's rotational equator). The assymetric shape and the observed inflection in the light curves could only be reproduced with two spot regions. A spot temperature of T(spot) = 3450K $\pm$ 150K was found from the wavelength dependence of the light curves. This value is in good agreement with spot temperatures determined previously for II Peg by other investigators using different methods (eg. Vogt (1981a;b); Nations and Ramsey 1981; Poe and Eaton 1985; Rodono et al. 1986).

Two recent light curves of II Pegasi, that of Wacker and Guinan (1986) obtained during 1985/86, and that of Byrne (1986) obtained in September 1986, provide interesting comparisons to our 1986/87 light curve, (Figure 2). As can be seen from the figure, the 1985/86 observations indicate a light amplitude of 0.23 mag in yellow which is much smaller than that found less than one year later. However, the level of mean brightness of the star did not significantly change during this interval. Also of interest is the shape of the 1985/86 light curve which shows a shallow secondary minimum and second maximum where the inflection in the light curves occurs during 1986/87. Although not well determined, Byrne's light curve displays the largest amplitude of the three, with a value of $\sim$ 0.45 mag in the V-bandpass. Byrne's observations do not indicate an inflection in the light curve, possibly because there are only a few observations defining this section of the light curve. There appears to be a change in slope occurring between approximately 0.7 phase and 0.9 phase in Byrne's light curve, perhaps due to the inflection.

Since the mean brightness and color of the star did not change significantly between these two years, the total spot area has remained relatively constant. From a comparison of the three available light curves, it appears that the two spot regions of II Peg migrated closer together from 1985/86 to 1986/87. The longitudinal separation of the spots was approximately 160° during 1985/86 and, as discussed previously, about 120° apart during 1986/87. Also, the phase of minimum light has shifted from about 0.30P during 1985/86 to 0.18P in 1986/87 which indicates a drift in the mean longitude of the spot forming region. This phenomena could arise from differential rotation of the star since two spot groups appear to be located at different stellar latitudes. Other RS CVn-type stars appear to show this effect. For example, Lambda Andromedae shows a differential rotation rate between its two large spot groups of $\sim$ 15 degrees per rotation (Dorren and Guinan 1984).

These recent observations of II Pegasi suggest that the system is undergoing a relatively rapid change in the distribution of the starspots. To determine whether this will continue for some time, or will be relatively shortlived, more observations of this star are necessary in the next observing season.

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ON THE PERIOD OF THE W UMa STAR NSV 12040

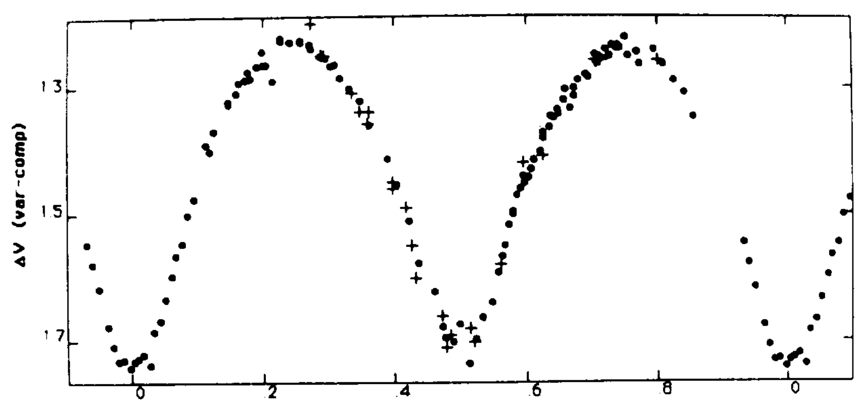
Strohmeier and Knigge (1960) discovered the variability of NSV 12040 (CSV 8172,BD+52^{o}2426), a 10th magnitude W UMa system in Cygnus. Boninsegna (1986) has used 85 visual times of minima to compute an ephemeris having a period of 0.34237 days. However, recent photometric observations are not consistent with this period.

Observations were obtained on five nights in April 1987 with the No. 2 0.9 meter telescope at Kitt Peak National Observatory using the Automatic Filter Photometer and a UBVR filter set. Additional observations were made on one night in August 1987 with the 0.4-meter telescope, pulse counting photometer, and BVR filter set at the Joseph R. Grundy Observatory of Franklin and Marshall College. Comparison and check stars were SAO 31626 and SAO 31624. Data were reduced to differential V magnitudes. Correction for extinction is not significant, and the data have not yet been transformed to the standard system.

Preliminary analysis of these photometric data show that they cannot be phased with the published period. Instead, the data require a slightly longer period differing in frequency by 0.5 c/day from the published period. This longer period allows the combination of the new photometric data with the 23 photometric observations published by Boninsegna (1986).(An arbitrary constant of 9.4 magnitudes has been subtracted from the published magnitudes to bring the data into agreement with the differential magnitudes described here).

The best period was determined by repeatedly phasing the combined dataset to obtain minimum scatter, and the best epoch of minimum was taken as the central time of the minimum observed on heliocentric JD 244 6907.9108. This minimum appears to be the deeper of the two by a small margin (Figure 1). Thus the revised heliocentric ephemeris is

$$\text{J.D. } 24\ 46907.9108 + 0^{d}.4131856\ E$$
$$\pm.0003 \quad \pm.0000085$$



Phase

Figure 1

V magnitude differences (variable minus comparsion) phased with the period 0.4131856 days produce minimum scatter. Crosses mark 23 published photometric observations (Boninsegna 1986) with an arbitrary constant of 9.4 magnitudes subtracted to bring them into agreement with the differential observations.

The quoted error in the epoch is the internal error derived from the bisection of chords method, and the quoted error in period is that error which noticeably increases scatter in the phased light curve.

The phased light curve shown in Figure 1 includes photometric data spanning 754 days, yet the scatter appears rather small. The 23 previously published data points (Boninsegna 1986) are shown as crosses. These data points include two minima which were originally presented as both the primary and secondary minimum, but this analysis shows that these two eclipses are both the shallower eclipse.

The observed B-V color of NSV 12040 as published by Boninsegna (1986) is +0.43, about 0.13 magnitudes bluer than is typical of the bluest contact binaries with periods of 0.34 days (Eggen 1967). That color is, however, marginally consistent with a period of 0.41 days. The revised period places the star at the blue edge of the contact star region of the period-color diagram.

The data reported here will be reduced and published with further analysis elsewhere. This work is supported in part by the National Science Fundation through grant No. PRM-8214360. Some of the data described here were obtained while the author was a visiting observer at Kitt Peak National Observatory, National Optical Astronomy Observatories, operated by the Association of Universities for Research in Astronomy, Inc., under contract with the National Science Foundation. The author would like to thank Sam Barden and Harold Nations for their assistance in obtaining the photometric data.

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Strohmeier, W., Knigge, K., 1960, Bamb. Ver., 5, No.5

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VARIABILITY OF THE DOUBLE STAR HD 41824 AND ITS MULTIPLICITY

Several measurements in the Geneva photometric system with the P7 photoelectric photometer attached to the 70 cm reflecting Swiss telescope at La Silla Observatory in Chile confirm the variability of the double star HD 41824 (HR 2162, CoD -48° 2124, CPD -48° 777, SAO 217708, NSV 2827). Coordinates in the New Catalogue of Suspected Variables (NSV) by Kholopov et al. (1982) for 1950.0 are: R.A.= 6h 03m 29s, Dec. = -48° 27'.2. The star also figures in the Worley-Heintz (1983) catalogue of orbits of visual binary stars. Its period is 463.5 years and the present separation is 2.5". The variability of this star has been announced by Alexander (1970) indicating the amplitude of variation as 0.1 mag. The spectral type given in the Michigan Spectral Catalogue is G6V.

The 43 measurements made in the Geneva photometric system (Table 1) do not allow us to propose a model of the observed fluctuations. We note variations of m = 0.05 in 0.1 day and of at least 0.1 over a longer period (= 400 days). No periodicity has been detected. The values of colour index [B2-V1] are weakly correlated with the magnitudes [V]. The star becomes redder as it becomes fainter (see Fig. 1). The photometric measurements refer to the component stars A and B taken simultaneously. Taking into account the magnitude difference of the components A and B of about 0.3, then the interpretation of magnitudes and colours allows an estimation of the absolute luminosities and the distance (r=23 pc). The resulting photometric parallax confirms the dynamical parallax. Associated with the proper motion, this fact, combined with an estimation of the metallicity suggests that these stars belong to a relatively young population.

Observations of the components of this binary have been done on two occasions with the spectrovelocimeter CORAVEL mounted on the Danish 1.5m telescope at La Silla. They show that the component B has a stable radial velocity of 14.1±0.2 km/s and v.sin(i) estimated at 2.33±1.66 km/s. In contrast, the velocity of the component A is variable and its lines are broader. At the present time we have the following observations:

HJD 2444628.7607 $V_r(A)$ = 12.10 km/s
HJD 2444983.7813 $V_r(A)$ = 32.22 km/s

with a v.sin(i) of 7.99±0.75 km/s

Thus the component A itself is double. Further observations should be carried out to try to distinguish Aa and Ab. As there is no evidence for an eclipse, the variability of the combined system may arise if one of the three components is a "spotted star". Additional photometric measurements and radial velocities are therefore necessary.

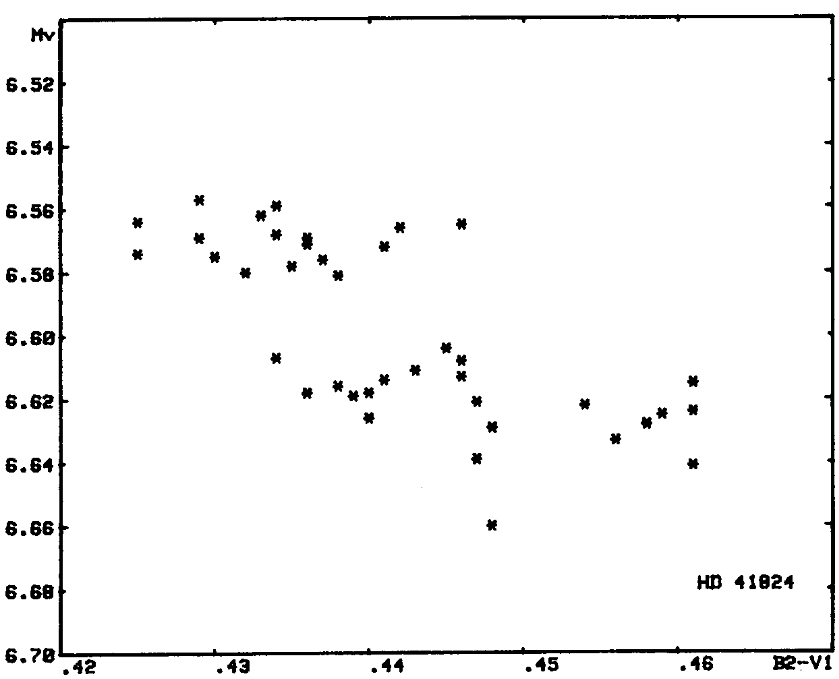

Fig. 1. Individual measurements of HD 41824 showing colour [B2-V1] versus apparent magnitude. Unreliable measurements of weight 0 are not included. It should be noted that both components of the visual double were measured together.

Table I.

No	Time (JD) 24...	P	U-B	V-B	B1-B	B2-B	V1-B	G-B	Q	V
1	43211.534	3	1.469	.092	1.124	1.290	.850	1.117	3	6.626
2	43447.789	3	1.449	.074	1.122	1.268	.832	1.100	3	6.618
3	43568.607	3	1.466	.075	1.115	1.270	.822	1.086	3	6.629
4	45706.741	1	1.468	.071	1.126	1.270	.822	1.087	1	6.660
5	45706.758	1	1.475	.067	1.132	1.266	.819	1.080	1	6.639
6	45706.770	1	1.486	.067	1.131	1.277	.823	1.081	1	6.622
7	45706.784	1	1.479	.067	1.125	1.270	.814	1.075	1	6.633
8	45706.794	1	1.481	.071	1.126	1.283	.822	1.088	1	6.615
9	45706.804	1	1.476	.067	1.129	1.275	.816	1.082	1	6.625
10	45706.814	1	1.487	.062	1.137	1.276	.818	1.082	1	6.628
11	45706.824	1	1.469	.058	1.130	1.275	.814	1.078	1	6.624
12	45706.839	1	1.484	.061	1.130	1.273	.812	1.078	1	6.641
13	45712.806	0	1.462	.067	1.131	1.276	.816	1.084	0	6.657
14	45713.623	2	1.481	.071	1.127	1.280	.822	1.093	2	6.628
15	45719.825	1	1.506	.063	1.127	1.267	.818	1.074	0	6.592
16	45725.560	1	1.477	.064	1.124	1.259	.814	1.072	1	6.604
17	45725.585	2	1.479	.072	1.123	1.271	.825	1.084	2	6.608
18	45725.639	2	1.470	.080	1.124	1.273	.827	1.092	2	6.613
19	45725.705	2	1.468	.080	1.123	1.272	.834	1.090	2	6.616
20	45725.783	2	1.453	.075	1.131	1.271	.830	1.091	2	6.614
21	45726.717	3	1.475	.070	1.132	1.264	.817	1.087	3	6.621
22	45726.780	3	1.468	.081	1.131	1.275	.832	1.089	3	6.611
23	45727.585	2	1.487	.083	1.130	1.275	.841	1.106	2	6.607
24	45729.565	4	1.476	.074	1.129	1.270	.831	1.091	4	6.619
25	45729.718	4	1.463	.076	1.127	1.267	.827	1.087	4	6.618
26	46029.797	3	1.462	.089	1.123	1.278	.840	1.105	3	6.581
27	46047.798	3	1.455	.090	1.117	1.273	.837	1.109	3	6.571
28	46048.539	2	1.450	.071	1.124	1.268	.822	1.084	2	6.565
29	46048.578	2	1.462	.090	1.129	1.275	.833	1.106	2	6.566
30	46048.642	2	1.465	.078	1.123	1.274	.837	1.097	2	6.576
31	46048.718	2	1.470	.087	1.122	1.276	.842	1.110	2	6.559
32	46048.782	2	1.464	.083	1.120	1.265	.835	1.103	2	6.575
33	46048.846	2	1.452	.083	1.117	1.269	.833	1.099	2	6.569
34	46050.655	3	1.461	.089	1.129	1.273	.844	1.105	3	6.557
35	46063.539	3	1.460	.082	1.120	1.264	.830	1.088	3	6.568
36	46063.562	3	1.457	.088	1.119	1.272	.847	1.102	3	6.574
37	46063.635	3	1.463	.084	1.121	1.274	.845	1.107	3	6.569
38	46063.860	3	1.441	.091	1.115	1.282	.841	1.112	3	6.572
39	46067.600	3	1.467	.085	1.119	1.273	.837	1.103	3	6.571
40	46067.719	3	1.460	.091	1.125	1.280	.845	1.104	3	6.578
41	46067.824	3	1.456	.091	1.115	1.271	.839	1.103	3	6.580
42	46075.567	1	1.456	.097	1.126	1.275	.850	1.124	1	6.564
43	46076.601	3	1.451	.088	1.118	1.275	.842	1.109	3	6.562

Details on the P7 photometer can be found in Burnet and Rufener (1979), the Geneva photometric system is described by Golay (1980) and Rufener (1981), the CORAVEL technique is shown in Baranne et al. (1979).

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HD 27503 = LB 3345, A NEW DELTA SCUTI STAR

In the course of a programme of uvby photometry of faint blue stars, the star LB 3345 (= HD 27503) from the list by Luyten & Anderson (1959) was noted as being a probable variable (Kilkenny 1987). A short series of UBV observations on the night of 1986 December 8/9 is shown in Figure 1 and confirms

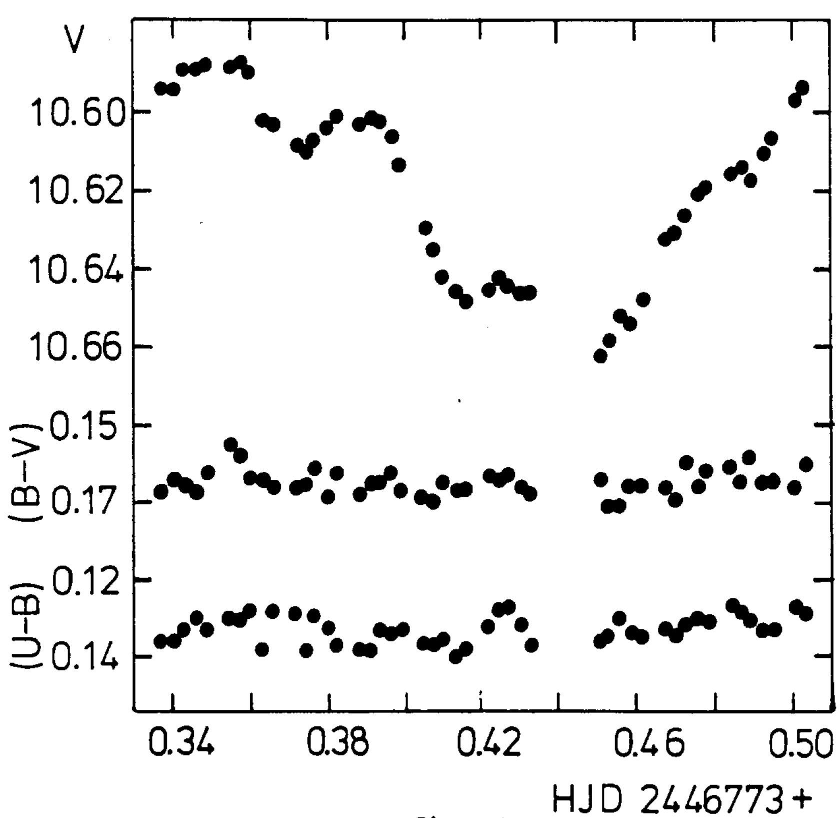

Figure 1

the star to be variable. The timescale and amplitude of the variation suggest a multiperiodic Delta Scuti star (see, for example, Breger 1979). The star has been observed as bright as V = 10.54, so the total range of light variation exceeds 0.1 mag and Luyten & Anderson (1959) give the photographic magnitude as 12.6, which suggests a larger size still. (There does not appear to be any other nearby star bright enough to have caused a misidentification).

All data in Fig. 1 have been corrected to photometry of the nearby star, HD 27444, for which 16 observations give V = 8.824 ± 0.004(sd), (B-V) = +0.536 ± 0.004, (U-B) = -0.036 ± 0.004.

The Strömgren photometry of LB 3345 (Kilkenny 1987) is consistent with a spectral type $\sim$ A2 and puts the star near the blue edge of the Delta Scuti region of the HR diagram, as outlined by Breger (1979). If LB 3345 is near the main sequence, it has an absolute magnitude $\sim$ +1.3 and thus a distance of $\sim$0.7 kpc; at a galactic latitude of $-38\overset{\circ}{.}6$ the star is then $\sim$0.45 kpc from the galactic plane.

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ADDITIONAL PHOTOMETRIC DATA FOR THE X-RAY SOURCE TT ARIETIS DURING 1985-1986

As a part of the programme for the study of anti-dwarf novae (or VY Scl stars) carried out at the Department of Astronomy of the Bulgarian Academy of Sciences, after the organization of regular photometric observations of KR Aur, in 1985 observations of TT Ari, another member of this group, were initiated. During the past two seasons, besides estimates of the brightness of the star in a standard UBV system (Table I), the behaviour of the object in the night of August 22/23, 1985 was followed for 3 hours (Fig. 1) and a patrol was carried out in the "u" region in the night of November 1/2, 1986 (Fig.2). Photoelectric observations were carried out with the 60 cm telescope of the National Astronomical Observatory Rozhen. Star "c" (see Wenzel et al. 1986) served as comparison star. For transformation of the instrumental u,b,v stellar magnitudes to the standard U,B,V magnitudes the relations

$$\Delta V = \Delta v + 0.105\ \Delta (B-V)$$
$$\Delta (B-V) = 1.118\ \Delta (b-v) + 0.034\ \Delta (b-v)\ \bar{x}$$
$$\Delta (U-B) = 0.800\ \Delta (u-b) + 0.056\ \Delta (u-b)\ \bar{x}$$

were used. The integration time was 10s.

Our observations show the following results:

1. During all the nights of the observations the star was in its "active" state. The mean of the resulting points yields the following magnitudes for TT Ari in 1985: U=9.94, B=10.85, V=10.78. For 1986 the mean magnitudes are U=9.76, B=10.67, V=10.78. In 1986 an increase of the average brightness by 0.16 mag in V and 0.18 mag in B and U was found.

2. Our 3 hours of observations were carried out one night after simultaneous X-ray (EXOSAT) and optical observations in the night of August 21/22,1985. Unfortunately the time interval was not sufficiently long. But three-colour

measurements show a well-expressed maximum. The start and the end of the observations are in the neighbourhood of brightness minima. The wave-shaped variations are ∿ 0.25 mag in V and ∿ 0.32 mag in B and U. This is in agreement with the results of coordinated observations (see Hudec et al. 1987).

The position of the maximum "C" calculated from the photometric elements given by Wenzel et al. (1986) is plotted in Fig. 1.

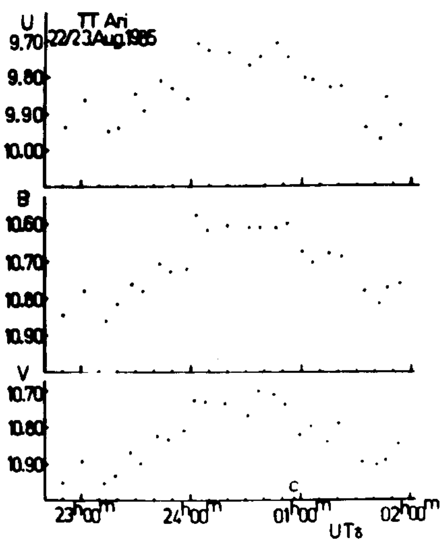

Figure 1

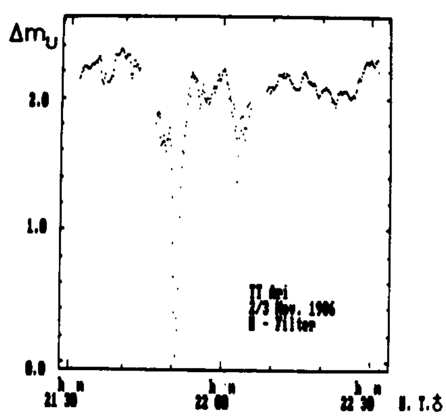

Figure 2

3. Patrol observations during the night of November 2/3, 1986 show quasiperiodic fluctuations with an amplitude up to 0.25 mag and duration up to 3 minutes. The cycle length does not seem to be constant, but varying between 3 and 6 minutes. Observations of Rössiger (1987)carried out a month earlier show quasiperiodic fluctuations of brightness with cycle length between 14 and 21 minutes. Wenzel et al. (1986) found a cycle length of about 10±5 minutes. It seems that the length of the cycle is varying not only during the night but, more essentially, from night to night.

During the patrol observations there occurred an unusually deep dip in the brightness (Δ u ∿ 2.3 mag) with the duration of about 10 minutes. For the first 4-5 minutes the star decreased in brightness by 0.7 mag and in the following 2 minutes it decreased further by 1.6 mag. For the next 3 minutes the star reached the brightness typical of the night. Seven minutes later a new dip of the brightness with an amplitude up to 0.8 mag and duration of about

Table I

Magnitude estimates of TT Arietis

JD 244...	V		B–V		U–B	
6264.5431	10.95	±0.01	–0.06	±0.02	–0.91	±0.02
5496	10.83	±0.01	–0.09	±0.01	–0.95	±0.02
6267.5321	10.94	±0.02	–0.11	±0.02	–0.99	±0.02
.5392	10.98	±0.01	–0.16	±0.02	–0.98	±0.02
.5442	11.01	±0.03	–0.05	±0.04	–0.89	±0.02
6289.5531	10.93	±0.01	–0.09	±0.01	–0.94	±0.03
.5590	10.92	±0.01	–0.06	±0.01	–0.89	±0.03
6671.4993	10.78	±0.01	–0.10	±0.02	–0.89	±0.02
.5110	10.72	±0.01	–0.10	±0.02	–0.90	±0.02
6672.5189	10.78	±0.01	–0.11	±0.01	–0.90	±0.01
.5304	10.85	±0.01	–0.14	±0.02	–0.92	±0.01
.5400	10.87	±0.02	–0.08	±0.03	–0.90	±0.02
.5498	10.87	±0.02	–0.05	±0.03	–0.89	±0.02
6697.4112	10.76	±0.03	–0.18	±0.07	–0.95	±0.07
.4147	10.74	±0.03	–0.06	±0.07	–0.98	±0.07
.4181	10.73	±0.03	–0.09	±0.07	–0.95	±0.07
.4187	10.73	±0.03	–0.13	±0.07	–0.95	±0.07
6736.4882	10.71	±0.01	–0.12	±0.02	–0.89	±0.02
.4961	10.79	±0.01	–0.10	±0.02	–0.84	±0.02

10±3 minutes occurred. It has to be noted that at $21^h\ 07^m$ (UT), 35 minutes before the deep dip, our observations showed a decrease of the brightness too ($\Delta\ u_{max} \sim 0.8$mag, Δ t-about 13 minutes). This part of the observations is not plotted in Fig. 2 because, unfortunately, the recording was performed during a period of stabilisation of the parameters of the instrument. A month before our patrol Rössiger (1987) observed also a deep dip in brightness up to 0.9 mag in the "b" region. In our opinion, further patrol observations would be very useful for elucidating the nature of TT Arietis.

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SOME UNPUBLISHED PHOTOMETRIC OBSERVATIONS OF AC HERCULIS

The present paper reports 20 photographic BV photometric observations of the RV Tauri-type variable AC Her. The limited number of these, previously unpublished, observations is due to the fact that our observing program on AC Her has been interrupted and never continued.

Obviously, the small number of observations does not allow to make a light curve analysis; however these observations can be useful for General Catalogue on Variable Stars' compilers, or for any other investigator who make light curve analysis on data collected by other observers (for example: Erleksova, 1984).

The photometric observations were obtained with the 20/25 cm f/5 Baker-Schmidt camera of the Osservatorio Astrofisico di Pieve S. Paolo using standard BV plate (Kodak)/filter (Schott) combinations during the year 1983.

The data reduction was made with a Ross-type fixed diaphragm digital microphotometer, using the stars BD + 20^{o} 3821 (Blanco et al., 1968), BD + 21^{o} 3465 (DuPuy,1973), HD 170671 (Nakagiri and Yamashita, 1979), BD + 21^{o} 3451 (Dawson and Patterson, 1982) as plate calibrators. The internal accuracy of our magnitudes varies from plate to plate; the 1 σ errors are reported in Tables I and II beside each measured magnitude. The average 1 σ error is about 0.08 magnitudes. Table I lists the B band photometric observations of AC Her, while Table II reports the V band photometric observations. The average (B-V) color index obtained from the observations made, on a descending branch, between the second maximum and the primary minimum of the light is $(B-V)_{av}$= +1.18 ($\pm$ 0.12); it is in good agreement with the results of Nakagiri and Yamashita (1979) and Preston et al.(1963) who give, respectively, values of $(B-V)_{av}$= + 1.15 and $(B-V)_{av}$= + 1.10 for the color index at the primary minimum.

I wish to express my deepest gratitude to prof. L. Rosino (Asiago Astrophysical Observatory) for the helpful discussion on RV Tauri-type variable stars, and particularly on AC Herculis. Many thanks are also due to Mr.M.Ferrari S. Polo a Mosciano Astronomical Observatory - Florence) for the assistance at the microphotometer.

Table I

J.D. 2445000 +	B	J.D. 2445000 +	B
469.384	$8^m.48 \pm 0.09$	528.478	$9^m.33 \pm 0.08$
472.428	7.65 ± 0.09	532.446	9.37 ± 0.12
485.411	7.64 ± 0.08	533.477	9.54 ± 0.10
486.428	7.46 ± 0.07	636.333	7.57 ± 0.07
488.408	7.81 ± 0.08	639.343	8.80 ± 0.13
490.412	7.97 ± 0.07	640.312	8.59 ± 0.09
491.481	7.85 ± 0.07	645.310	8.78 ± 0.02
518.423	8.35 ± 0.06		

Table II

J.D. 2445000 +	V
518.406	$7^m.33 \pm 0.17$
528.466	8.08 ± 0.04
532.453	8.09 ± 0.02
533.466	8.38 ± 0.07
621.382	7.27 ± 0.05

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V471 TAURI ECLIPSE TIMINGS

Further timings of the eclipse of the white-dwarf member of the V471 Tauri system are reported. The observations were obtained with the two-channel photometer at the f/16 Cassegrain focus of the 61 cm. Fick Observatory reflector. Simultaneous measurements in V and R bands provide compensation for varying sky conditions and guiding errors. An integration time of four seconds was employed for both bands.

Table I

V471 Tau Occultation Timing

UT DATE	EPOCH[(a)]	tmid[(b)] MJD	Δt_s [(c)] (sec)	O-C[(d)] (sec)	O-C[(e)] (sec)
1-03-87	11874	46798.09374	358	-308	-11
1-27-87	11920	46822.08823	187	-303	-5
1-28-87	11922	46823.11062	179	-301	-3

(a) As given by ephemeris of Young and Lanning (1975).

(b) Heliocentric mid-eclipse time given in modified Julian date. Estimated errors are ± 5 sec. = 0.00005 days.

(c) Observer's solar correction for time of observation.

(d) C based on ephemeris of Young and Lanning.

(e) O-C of three body model of Beavers et al.(1986).

Table I lists the results of these timings. The next to last column contains the O-C values calculated from the Young and Lanning (1975) ephemeris. The final column contains O-C values of the three-body model of Beavers et al. (1986). With assumed timing errors of ±5 seconds, the results suggest that the Young and Lanning ephemeris O-C curve may be passing through or near its minimum as predicted by the three-body model. Additional eclipse timings over the next several years are needed to confirm this. Such data would be very useful in attempting a refinement of the present three-body orbit.

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IDENTIFICATION OF VARIABLE STARS IN SAGITTARIUS

In a previous number of this Bulletin, the discovery of six bright variable stars in Sagittarius was reported (Campos and Sanchez, 1987). In view of the many exhaustive surveys for variables which have been carried out over many decades for this region, the discovery of several bright, large amplitude variables is somewhat surprising. I have examined the data given (coordinates and finder charts) to see whether any of the objects have been previously reported as variable, especially with objects listed in the General Catalogue of Variable Stars (Kukarkin et al., 1970).

I found the finder charts for B, D, E, F, K and L of Campos and Sanchez's list to be more accurate and reliable than their published coordinates. In three cases (stars D, E and F) their identity was immediately apparent by comparison with previously published finder charts. The coordinates for the remaining three stars are inaccurate. I have redetermined the coordinates of all the Campos and Sanchez variables, using their finder charts and reference stars from the CPD catalogue. The results of my research are given in Table I.

Table I: coordinates and identifications for six variables

ID LETTER*	R.A. (2000)	DEC.	IDENTIFICATION	HDE CHART
B	$18^h 41^m 33^s$	-29° 4'.8	V915 Sgr	....
D	18 18 46	−36 22.5	LM Sgr	185
E	18 27 56	−33 19.8	RV Sgr = HD 169831 = CoD -33°13234	179
F	18 20 12	−32 13.4	BR Sgr = HDE 319724	179
K	18 11 36	−21 2.3	.....	165
L	18 19 2	−28 6.5	V928 Sgr	174

* Designation according to Campos and Sanchez (1987).

Column 1 gives the identification letter for each variable, as designated by Campos and Sanchez.

Columns 2 and 3 give the equatorial coordinates, for 2000.0. They have been checked against the data given by the GCVS.

Column 4 gives the identification, when found. The official variable star name is given, followed by HD and CoD numbers.

Column 5 gives the chart number in Harvard Annals 112,(Cannon and Mayall, 1949), on which the variable star field may be found.

Star K and its immediate vicinity presented an anomaly. Star K is faintly visible at the limit of HDE chart 165, but is not a known or suspected variable. Robert NcNaught, of Siding Spring Observatory, NSW, examined the field on one UK Schmidt plate, and reported that a star 1' south-following star K (according to the chart of Campos and Sanchez) is missing. This star, which I call K^1, is also missing from HDE chart 165, although the published chart suggests it is one or two magnitudes brighter than K. I have measured the coordinates of both objects, relative to SAO stars, to be as follows:

Object K : (1950) : $18^h\ 8^m\ 36\overset{s}{.}6$ $\quad -21^\circ\ 4'\ 0''$ $\quad \pm 4''$

Object K^1: (1950) : 18 8 40.7 $\quad$ -21 4 34 $\quad \pm 4''$

Object K^1 may really be the variable intended, rather than K. It my be a nova or other eruptive variable. This of course assumes that the image corresponds to a real object, and is not a plate defect, error in plotting the chart or other spurious cause. Both objects are shown in Fig. 1.

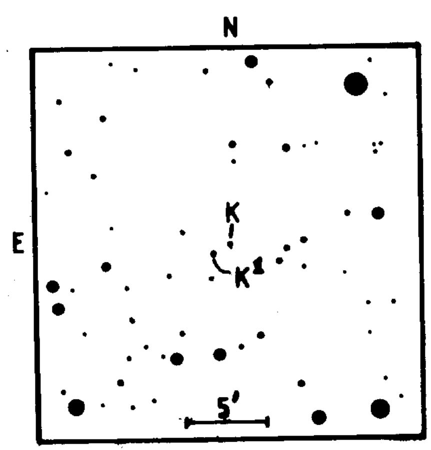

Fig. 1. Identification chart for stars K and K^1.

Of the six variables considered here, five can be definitely identified with previously named stars. The first four are all Mira variables, while the final one ('L') is Nova Sgr 1947 = V928 Sgr. No identification could be made of star 'K'. Better coordinates are presented for all objects.

I thank Robert H. NcNaught, UKESRU, Siding Observatory, Coonabarabran, NSW, for kindly checking the UK Schmidt plate records.

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EPSILON PERSEI AND MU CENTAURI AS SINGLE-PERIODIC RAPID VARIABLES

There has been a continuing discussion on the nature of rapid variability in early-type stars between the proponents of non-radial pulsations /Baade, Bolton, Penrod, Percy, Smith and others/ and the proponents of rotational /or possibly binary orbital/ modulation /Balona, Clarke, Engelbrecht, Harmanec, McGale and others/ - see, e.g., the recent reviews by Percy 1987, Baade 1987 a,b, Harmanec 1987 and references therein.

Baade 1987b pointed out that the formal difference between star "spots" and non-radial pulsations is that the spot patterns must always lead to variations with commensurate periods. He reported a discovery of two or possibly three non-commensurate periods for the B2e star Mu Cen, and also referred to a similar finding by Gies and Kullavanijaya 1987 for the B0.5III-V /non-emission/ star Epsilon Per.

As the issue of multiperiodicity is of primary importance, I decided to re-investigate the independency of the periods reported for both stars. My finding is quite exciting: for Epsilon Per the four different frequencies found are apparently overtones of a single /lower/ frequency, which may correspond to rotational or binary period, and the same is also true for Mu Cen !

Let us discuss both cases in more detail.

Epsilon Persei /45 Per, HR 1220, HD 24760/ is a well-known B0.5III-V rapid light and line-profile variable /Bolton 1983, Percy et al. 1984, Smith 1985/. It is also the brightest component of the visual triple system ADS 2888. Its line-profile variations have an unusually large amplitude and are easily detectable even on normal photographic spectra. Percy and Fullerton 1985 analyzed their October/November 1984 UBV photometry of the star and concluded that the light of the object varied with a period of 3.84 ± 0.02 hours. The amplitude of the light curve changed from night to night.

Recently, Smith et al. 1987 proposed that Epsilon Per is non-radially pulsating with two periods, 3.85 and 2.25 hours, seen both in spectroscopy and photometry. So far the last word was said by Gies and Kullavanijaya 1987, who analyzed long series of high S/N Octicon spectrograms obtained on several nights. Using a sophisticated power spectrum analysis they were able to recover four different periods from their data. These periods - in a decreasing order of significance - are 3.84, 2.26, 4.47 and 3.04 hours.

After several trials I found that all four periods found by Gies and Kullavanijaya are in fact submultiples of a period of 26.9 hours i.e. 1.12 days !

The observed and predicted values /in hours/ are compared in Table 1.

TABLE 1	P	P/6	P/7	P/9	P/12
OBSERVED		4.466±.023	3.837±.005	3.036±.010	2.264±.012
PREDICTED	26.9	4.483	3.843	2.989	2.242

The mutual agreement is remarkably good considering that the observations used for the period determination consist of four nights of observations spanning an interval of five days only. This is certainly a tribute to the careful period analysis carried out by Gies and Kullavanijaya. Note that the most deviating value of 3.036 hours corresponds to the lowest peak in their final power spectrum.

Mu Cen /HR 5193, HD 120324/ is a similarly well-known B2IV-Ve star exhibiting both, rapid and long-term light and spectral variations. Baade 1984 reported the presence of two resonantly coupled periods of 0.505, and 0.101 days seen in Reticon Mg II 4481 and He I 4471 line profiles obtained in

June 1983. Later on, Baade 1987b applied the power spectrum analysis /also used for Epsilon Per/ to his new /April 1987/ spectroscopic observations of Mu Cen and found the following periods: 0.505, 0.391, and 0.440 /or 0.305/ days. He stressed that the ratio of the first two values differs significantly from 5:4 ratio and concluded that Mu Cen is in all probability a truly multiperiodic rapid variable.

I found that it may not be so. Table 2 shows that all the reported periods are in fact submultiples of a single period of 3.535 days .

TABLE 2	P	P/7	P/8	P/9	P/35
OBSERVED		0.505	0.440	0.391	0.101
PREDICTED	3.535	0.505	0.442	0.393	0.101

The most probable interpretation of my finding is that both stars vary with a single period /1.12 days for Epsilon Per and 3.535 days for Mu Cen/ in a highly non-sinusoidal manner. Although unusual, such complicated curves are not unique in the world of stars. I would like to remind in this connection that the X-ray light curves of some X-ray pulsars /which presumably reflect rotation of the objects in question/ also have a highly non-sinusoidal multipeaked shape /c.f., e.g., Joss and Rappaport 1984/.

Identifying the periods of 1.12 and 3.535 days with the rotational periods of the stars in question, and using the observed values of v sin i, 134 and 155 km/s for Epsilon Per and Mu Cen, respectively, one can estimate lower limits to the radii of both stars to be 3.0 and 10.8 solar radii. The radii expected for the observed spectral types would be 6.5 to 13 solar radii for Epsilon Per, and 5.0 to 8.5 solar radii for Mu Cen. Radius of 10.8 or more solar radii seems a bit too large for Mu Cen. It would thus be of interest to test whether this star is not a binary with a 3.535 /or even 7.07/ - day orbital period.

Nevertheless, I find reasonable to stop any further speculations here. Rather, I appeal to all those colleagues, who have access to the /largely unpublished/ observational data on both stars to re-analyze them in the light of the above findings, and publish the light, local line-intensity, and possibly RV curves folded with the best-fit periods near 1.12^d, and 3.535^d for Epsilon Per and Mu Cen, respectively. Searches for the possible presence of measurable magnetic fields and RV variations in both stars would also be of interest. All this could bring us closer to the understanding of these extremely interesting and unusual stars.

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BD +43^{o} 3749 RECOVERED

In his Bonner Durchmusterung Argelander noted a 9.5 magnitude star as +43^{o} 3749. There is, however, no such star at the given position, but the place is instead occupied by the much fainter (m_{pg} = 16.0) emission-line star LkHα 172 (Herbig 1958) = UHα 45 (Welin 1973). Herbig notes that a 1954 spectrum shows the star to be of intermediate to late G type, with rather strong Hβ emission, possibly also Hγ emission, but no emission at H and K. Possibly the strength of Hα emission was weaker during Welin's later survey; emission strengths are given as medium and weak, respectively.

The star was also of m_{pg} about 16 when plates were taken by Wolf in 1901 (Wolf 1925) and 1905 (Palisa and Wolf 1931). It would be extremely interesting to know if Argelander just happened to observe a transient outburst in the star, or whether the star actually did fade by some five magnitudes from the mid-19th century to the beginning of the 20th. Perhaps it might be found on old plates in some observatory archives.

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H-ALPHA VARIABLES IN THE FIELD OF NGC7000, IC5068 AND IC5070

In the course of a program to detect H-alpha emission stars in different Milky Way fields a 36 sq. deg. field was observed in Cygnus containing the NGC7000,IC5068 and IC5070 HII regions. The observations were carried out on several nights in 1979 with the 40" Schmidt telescope of the Byurakan Astrophysical Observatory. (For more details of these observations see Melikyan et al. 1987). It was known that in this region there were about 300 H-alpha emission stars found by Merrill and Burwell (1949, 1950), Herbig (1958), Welin (1973), Tsvetkov (1975), Tsvetkov and Tsvetkova (1978). Melikyan et al. have found 33 new H-alpha emission objects in their survey and 7 of them appeared to show variations in the H-alpha intensity. They have identified altogether 42 H-alpha variables in this region. They classified the intensity of the emission in five categories: 0=no emission, 1= weak, 2= medium, 3= strong and 4= very strong. These results are summarized in Table 1. where the 1st column gives the name of the objects (LkHα, BHα, UHα mean objects found in the Lick survey, in Byurakan and by Welin, respectively; asterisks designate stars discovered by Melikyan et al.). Columns 2-5 (designated with H1 to H4) give the classified intensities published in the cited literature, observed by Melikyan et al. on the nights of 25.07.79, 26.07.79 and 11.09.79, respectively.

Table 1.

Name	H1	H2	H3	H4	Remarks	Name	H1	H2	H3	H4	Remarks
LkHα145	2	4	3	1	IR	BHα16	3	2	1	1	IR
LkHα146	2	0	0	2		3*	0	0	1	3	
LkHα147	2	3	2	1		8*	0	3	3	1	
LkHα150	1	0	2	1		11*	0	1	1	3	IR
LkHα151	2	0	1	1		15*	0	0	3	2	
LkHα154	2	3	1	3		16*	0	1	1	3	
LkHα155	3	2	2	2	IR	19*	0	2	2	3	
LkHα156	2	0	0	2		20*	0	1	0	3	
LkHα159	2	0	0	2		UHα9	2	2	2	3	
LkHα160	2	0	2	2		UHα14	2	0	0	3	IR
LkHα161	2	0	1	2		UHα17	1	3	3	3	
LkHα164	2	1	1	1		UHα26	3	0	2	3	
LkHα166	1	2	2	1		UHα29	1	2	3	3	
LkHα171	3	0	2	3		UHα39	1	2	3	3	
LkHα174	2	2	0	0		UHα44	2	4	4	4	
LkHα176	3	1	1	2		UHα62	2	0	0	3	
LkHα177	2	0	1	3		UHα79	1	0	0	2	
LkHα178	1	2	2	2		UHα101	1	0	0	3	
LkHα179	1	2	2	1		UHα104	2	0	0	3	
LkHα188	2	2	3	1							
LkHα182	2	3	2	3							
LkHα187	1	0	0	1							
LkHα192	2	0	0	3							

(IR designate objects identified with IRAS point sources)

Table 2.

Correlations:	H1	H2	H3	H4
H1	1.0000	-.0289	-.0999	-.0954
H2	-.0289	1.0000	.6462**	-.0919
H3	-.0999	.6462**	1.0000	.0171
H4	-.0954	-.0919	.0171	1.0000

N of cases: 42 1-tailed Signif: ** - .001

Table 3.a–c

Crosstabulation: H1
By H2

H1 \ H2-> Count	0	1	2	3	4	Row Total
0	2	3	1	1		7
1	4		5	1		10
2	11	1	3	3	2	20
3	2	1	2			5
Column	19	5	11	5	2	42
Total	45.2	11.9	26.2	11.9	4.8	100.0

Crosstabulation: H2
By H3

H2 \ H3-> Count	0	1	2	3	4	Row Total
0	10	4	4	1		19
1	1	4				5
2	1	1	6	3		11
3		1	2	2		5
4				1	1	2
Column	12	10	12	7	1	42
Total	28.6	23.8	28.6	16.7	2.4	100.0

Crosstabulation: H3
By H4

H3 \ H4-> Count	0	1	2	3	4	Row Total
0	1	1	4	6		12
1		3	2	5		10
2		4	3	5		12
3		3	1	3		7
4					1	1
Column	1	11	10	19	1	42
Total	2.4	26.2	23.8	45.2	2.4	100.0

In order to study the stochastic behaviour of the H-alpha variability we compared columns 2-5 pairwise by computing the linear correlations between them. These correlations are summarized in Table 2. As one can infer from this table, columns H2 and H3 show a correlation at a high level of significance. To present the dependence between the different columns in more detail we present cross-tabulations of H1 to H2 in Tables 3a-c. Again, one can see that H2 and H3 reveal very strong tie but no dependence can be found between the other columns. We can explain this fact on the following way: H2 and H3 designate data on consecutive nights whereas the time differences between observations corresponding to the other columns are much greater. Therefore, it is natural to suppose that there is an average covariance length of a few days in the stochastic process representing the H-alpha variability of the sources. To set up this hypothesis on a more sound basis we need further observations, possibly on consecutive nights. As a byproduct of this work we might even get the functional form of the dependence of covariances on the time difference between the observations.

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THE PROPER MOTION OF THE AGK3 VARIABLE STARS. V:

Z Del and NSV 12844

This is the fifth note on a program conducted to redetermine the proper motion of those AGK3 variable stars for which the published values seem to be affected by spurious errors. On the previous notes (e.g. Lopez 1986, Lopez and Torres 1987) only red variables were discussed. The results obtained there are in agreement with Stephenson's (1978) hypothesis referred to the systematic errors of the AGK3 reddest stars. Due to the importance of the AGK3 and the variable stars in general in the coming satellite missions, it seems to be convenient to include in this program all kinds of variables or suspected variables without regard to magnitude, spectral characteristics or type of variability.

In this note Z Del = AGK3 +17 2218 and NSV 12844 = AGK3 +5 2903 are presented. The AGK3 proper motion of these stars is: $\mu\alpha$=+0".096, $\mu\delta$=-0".029 for Z Del and $\mu\alpha$=+0".009, $\mu\delta$=-0".163 for NSV 12844.

First-epoch positions were obtained from the re-reduction of the published plate material of the Astrographic Catalogue (AC) (see Table I). Second-epoch positions were derived from new plates taken with the Yale Southern Observatory double astrograph. First and second-epoch plates were reduced using AGK3 stars as reference system. The average mean error for the first-epoch positions is $\pm$0".32

in both RA and DEC while for the second-epoch positions it is $\pm 0''.28$. The resulting proper motions are affected by $\pm$ 0''.005 (me) in both coordinates.

Table II summarizes the values obtained in this note.

Table I. Astrographic Catalogue Plate Material.

Star	AC	Plate No.	Center h m	Zone (°)	Object No.	Epoch
NSV 12844	Toulouse	151	20 04	+05	110	1897.65
Z Del	Bordeaux	522	20 28	+17	68	1900.62

Table II. New Positions and Proper Motions.

Star	RA (1950) h m s	DEC ° ' "	μα ("/yr)	μδ ("/yr)	Epoch
NSV 12844	20 07 16.74	+05 21 37.8	-0.007	-0.003	1986.68
Z Del	20 30 21.71	+17 16 49.0	-0.013	-0.009	1986.43

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