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EDITORS: B. SZEIDL AND L. SZABADOS, KONKOLY OBSERVATORY

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A POSSIBLE CATACLYSMIC VARIABLE IN CANCER

On the photographs taken with the f50 cm camera centered at ι Cancri I detected a variable which showed rapid change of brightness. The emulsion was Tri-X and the yellow-green filter was used to get the brightness very close to visual magnitude. The results of measurements around the outburst are as follows:

U.T.	m_v	U.T.	m_v
1977 Nov. 9.8	[12.0	Nov. 22.8	12.4
12.8	11.9	Dec. 3.8	14.0:
18.8	12.5:	4.7	14.0:
19.7	12.4	6.7	[14.0
20.7	12.3	7.9	14.1
20.8	12.0	8.7	[14.0
21.7	12.3	10.7	[14.0

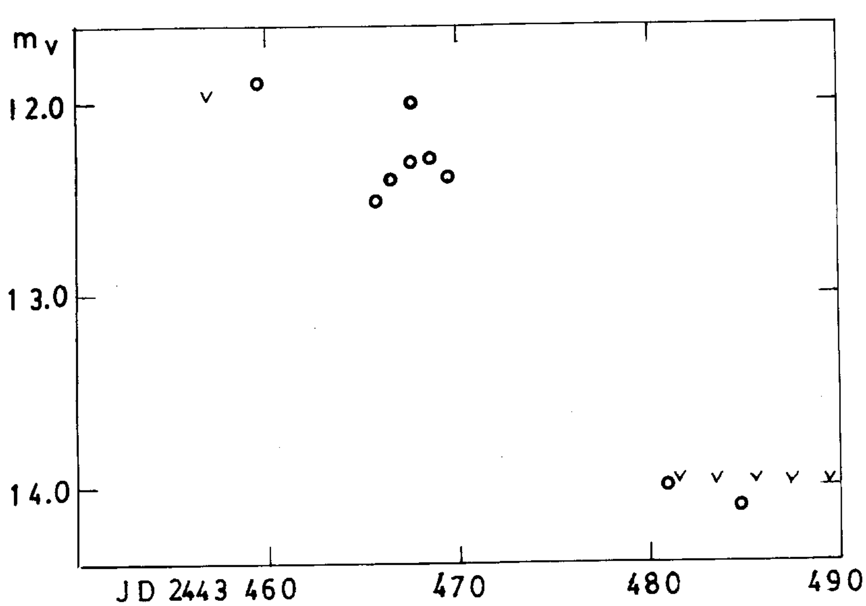

Figure 1. Light variation in 1977

The star was examined on about 280 photographs taken thereafter in six observational seasons through 1977 and 1983, usually from October to May, but no other outburst was found. As I detected the star after the outburst was over, no other materials such as colour and spectrum were available, but judging from the light variation it seems to be a cataclysmic variable like nova or UG type rather than periodic Mira type.

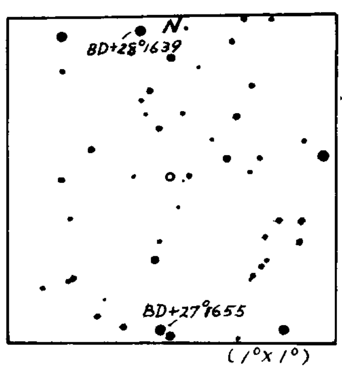

Figure 2. Finding chart

The star was examined on the Palomer Sky Atlas, and a star of brightness $16^{m}.4$(red) and $17^{m}.7$(blue) seems to be the corresponding one.

The position of the star is measured as,

$$\alpha : 8^{h}40^{m}3^{s}, \qquad \delta : +28^{o}2'.4 \qquad (1950.0)$$

MASAAKI HURUHATA

Hodozawa 88
Gotemba-shi, 412
Japan

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A NEW RR - TYPE VARIABLE IN LEO

On about 210 photographs taken from 1978 to 1983, centered at Omicron Leonis, a new RR type variable was found. Two cameras of focal lengths 50 and 85 cm were used with Tri-X emulsion and yellow-green filter which give the brightness very close to visual magnitude. The position of the star is measured as

$$\alpha : 9^h40^m21^s, \qquad \delta : +10^\circ32'.6 \quad (1950.0)$$

The derived elements of the variable are as follows:

$$\text{Max.} = \text{J.D. } 244\ 3877.25\ (\pm 0^d.01) + 0^d.402132\ (\pm 0^d.000002)\cdot E.$$

The mean light curve in 1982/83 season is shown in Figure 1. The type is apparently RRa, and the amplitude is $12^m.6-13^m.7$(v).

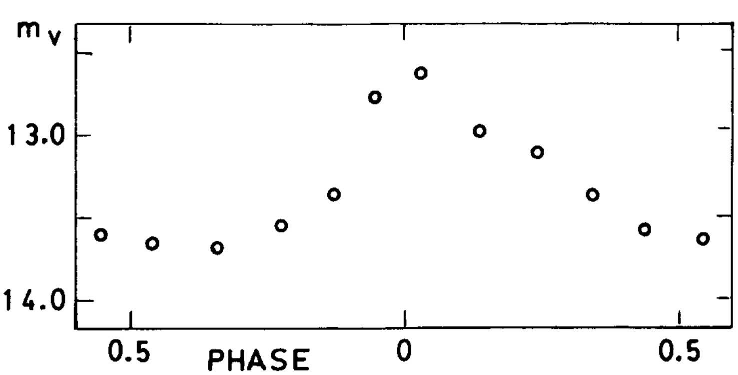

Figure 1. The mean light curve in 1982/83 observational season

The change of period is examined using the mean light curves for each observational season, but no change could be recognized in this relatively short observational period, having no O-C's larger than $0\overset{d}{.}02$.

The finding chart is shown in Figure 2.

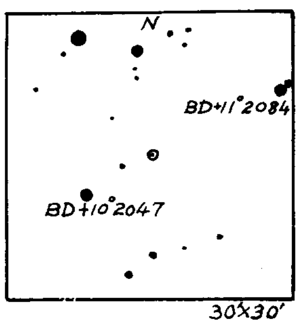

Figure 2. Finding chart

MASAAKI HURUHATA

Hodozawa 88,
Gotemba-shi,
412 Japan

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ON THE δ SCUTI STAR BD +43°1894

Although Agerer, Fernandes, and Frank (1983; IBVS 2370) have reported that BD +43°1894 is a new variable of δ Scuti type from their observations, the variable was already discovered in 1980 by Yamasaki, Okazaki, and Kitamura (1981; Paper I) and was further studied by Yamasaki, González, Peniche, and Peña (1983; Paper II).

Agerer et al. (1983) have derived the pulsational period to be P = $0\overset{d}{.}097949$ from their times of maxima and mentioned that the period seems to be somewhat variable. It is found, however, that their times of maxima can be well represented with our ephemeris (Paper I)

$$\text{Light Max.} = \text{JD(Hel) } 2444291.12521 + 0\overset{d}{.}0982747\ E, \quad (1)$$

as shown in Table I.

Table I

JD2445000+	E	O - C	JD2445000+	E	O - C
347.3827	10748	+0.0010	406.3395	11348	-0.0070
347.4743	10749	-0.0057	406.3437	11348	-0.0028
347.5771	10750	-0.0011	406.4367	11349	-0.0081
379.3174	11073	-0.0036	406.4423	11349	-0.0025
379.4243	11074	+0.0051	406.5367	11350	-0.0064
382.3630	11104	-0.0045	472.3708	12020	-0.0163

Thus, we confirm that a mono-period for BD +43°1894 as given in (1) is correct, and the variability of the period suspected by Agerer et al. (1983) could not be detected from our observations (Paper I, and Paper II).

A.YAMASAKI

Department of Earth Science and Astronomy
University of Tokyo
Meguro-ku, Tokyo 153, Japan

A.OKAZAKI

Tsuda College
Kodaira, Tokyo 187, Japan

M.KITAMURA

Tokyo Astronomical Observatory
University of Tokyo
Mitaka, Tokyo 181, Japan

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IQ Vel: IMPROVED LIGHT-CURVE PARAMETERS

The eclipsing binary IQ Vel was discovered in April 1978 at the European Southern Observatory, La Silla, Chile (Kohoutek, 1979). We have continued to observe this star in 1979 and 1982 at the ESO using again the 50 cm telescope and a pulse counting photometer (EMI 6256 A photomultiplier) and we made 174 UBV measurements. Stars in the E-regions (Cousins, 1973; Vogt, et.al., 1981) served as photometric standards.

Our photometry is consistent with that made in 1978: for the comparison star No.1 we found in 1982: V = 12.404, B - V = +0.547, U - B = +0.053 (n = 23); the brightness of the variable star outside eclipse was: V = 12.812, B - V = +0.294, U - B = +0.174 (n = 8).

Three primary and two secondary minima were recorded having parameters summarized in Table I (a graphical method

Table I Observed minima

Min.hel. JD	Min.	Eclipse depth V	Eclipse depth B	Eclipse depth U	Eclipse duration
2443940.5489 ±5 m.e.	I	$0^m.92$	$0^m.98$	-	- */
4994.7515 ±5 m.e.	II	0.110	0.086	0.078	$0^d.24$
4996.7212 ±2 m.e.	I	0.910	0.977	0.947	0.24
4998.6885 ±5 m.e.	II	0.120	0.099	0.093	0.24
5000.6477 ±2 m.e.	I	0.920	0.981	0.952	0.24

*/ observed by U. Haug

was used for determining the times of the minima). Combining the five primary minima in the period 1978-82 (for the minima observed in 1978 see Kohoutek, 1979) the following elements of the light-curve could be derived:

$$\text{Min.hel.I} = \text{JD } 2444996.72137 + 3^{d}.9262974 \cdot E$$
$$\pm 14 \qquad\qquad \pm 6 \quad \text{m.e.}$$

The secondary minima of 1982 are placed at phase 0.498 and 0.501, respectively, confirming a circular orbit of the binary. The eclipse depth and duration are comparable with those observed in 1978. Also the parameters of the binary system are similar to the preliminary values published earlier. The detailed analysis of the light curve based on all available measurements are planned.

I wish to thank Prof. U. Haug for kindly measuring the minimum in 1979. The observations have been collected at the European Southern Observatory, La Silla, Chile.

L. KOHOUTEK
Hamburger Sternwarte
D-2050 Hamburg 80
West Germany

References:

Cousins, A.W.J., 1973, Mem.Roy.Astron.Soc. 77, 223
Kohoutek, L., 1979, I.B.V.S. No. 1532
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FLARE ACTIVITY OF EPSILON AURIGAE?*

Epsilon Aurigae has been regularly observed at the Yonsei University Observatory with the 40-cm and the 60-cm reflectors in the UBV system. The number of observations in each color, since the observation began in 1982 April, exceeds one hundred. Normally the observation of Eps Aur each night lasted for about an hour or so and the rest of the night was shared with other program stars. Atmospheric extinction for each color was determined by the observation of an extinction star, i. e., a star chosen to observe throughout the night for the determination of the given night's extinction coefficients, and thus the differential extinction was corrected promptly for each night.

Soon after the termination of the ingress of Eps Aur we preempted several photometrically excellent nights to monitor Eps Aur for the entire night, with no other program stars included, using Lamda Aur as a comparison and as the extinction star for the night. Nine such good nights were available in two months, January and February, during which Eps Aur went well into its total eclipse. Eta Aur served as the check star. It is our customary procedure to make a net deflection vs. time diagram for each color of each star in order to correct any misread or misrecorded net deflection(star-sky), which could easily be made by the reader of the chart paper, at the earliest stage of the reduction work preceding computer processing. Through this reduction an unusually large net deflection in B was noticed on the diagram made for the Eps Aur observations of Jan. 21. Among over fifty nights' observations made so far, this Jan. 21 data

*Yonsei University Observatory Contribution No.8.

has been reduced in the instrumental magnitude system and the results are shown in Figure 1. In this figure the open circles represent the blue light curve of

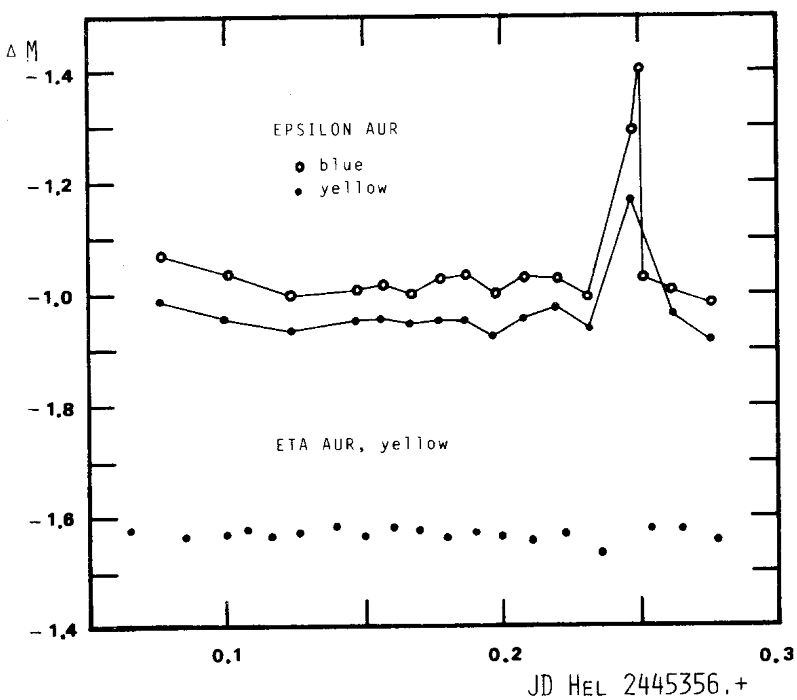

Figure 1.

Blue and yellow light curves of Eps Aur and the yellow light curve of Eta Aur.

Eps Aur and the dots represent the yellow light curves of Eps Aur and Eta Aur. As shown in the figure, Eps Aur exhibits a sudden brightening by about $0^{m}.4$ in B and $0^{m}.2$ in V above their mean magnitudes. This light variation appears to be real because the V light curve of Eta Aur shown in the same figure remains constant throughout the night.

Since the previous eclipse 27 years ago the eclipse light curve of Eps Aur is known to be trapezoidal with a depth of $0^{m}.8$ in the range and neighborhood of visual light wavelengths. There are small, about $0^m_{.}1$, irregular variation, on a time scale of about 100 days in V and B-V in all orbital phases, but the light variation increases to about $0^m_{.}2$-$0^m_{.}3$ during eclipse. There seems, however, no report that Eps Aur has ever been intensively observed to search for light variation shorter than 100 days, say night-to-night or even during a night.

It may be too early to say that there are flare activities in Eps Aur during total eclipse. The light change of $0^m_{.}4$ in B is, however, much larger than the long range variations in V reported by Gyldenkerne(1970). In addition the brightening lasted for only about 20 minutes, which is comparable to the longer flare durations of known flare stars. The light variation in V is insignificant, but we will have to account for the fact that the V measurement was 2 minutes ahead of the peak brightening time estimated on the B light curve. This report requires comformation by other Eps Aur campaign participants.

I.-S. NHA and S. J. LEE

Yonsei University Observatory, Seoul, Korea

Reference:

Gyldenkerne, k. 1970, Vistas in Astronomy 12, 190.

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PHOTOELECTRIC OBSERVATIONS OF 20 CVn*

In spite of many reports (Danziger and Dickens 1967, Breger 1969, Leung 1970, Shaw 1976, and others) on the possible Delta Scuti-type light variations, 20 CVn is listed in the Finding List (Wood et al. 1980) as an interacting binary whose orbital period is very short, P = $0^d.135$ or $0^d.176$. In addition to this the Finding List gives auxiliary informations such as small light variation of $0^m.03$ possibly due to the elliptical nature of the system.

Our attention to 20 CVn was paid to clarify the nature of the light variations of this star, the amount of light variations, and the period of light variation of this star. Using the 60-cm reflector of the Yonsei University Observatory, differential magnitudes in the two colours, B and V, were made with the observations of 19 CVn as the comparison star. Atmospheric extinction coefficients were derived from the comparison star measurements for each night and the differential corrections for the variable star were made.

Out of 10 nights attempted only 4 nights turned out to be useful to cover enough for one full period. The results are given in Table I and the light curves are shown in Figure 1. As are clear in the figure the small light

Table I

Periods and amplitudes of 20 CVn.

JD Hel.	Filter	Period	Amplitude
2445070	v	$0^d.12$	$0^m.03$
2445084	v	0.12	0.03
	b	0.12	0.04
2445378	v	0.13	0.02
	b	0.14	0.03
2445399	v	0.13	0.04
	b	0.13	0.04

*Yonsei University Observatory Contribution No. 13.

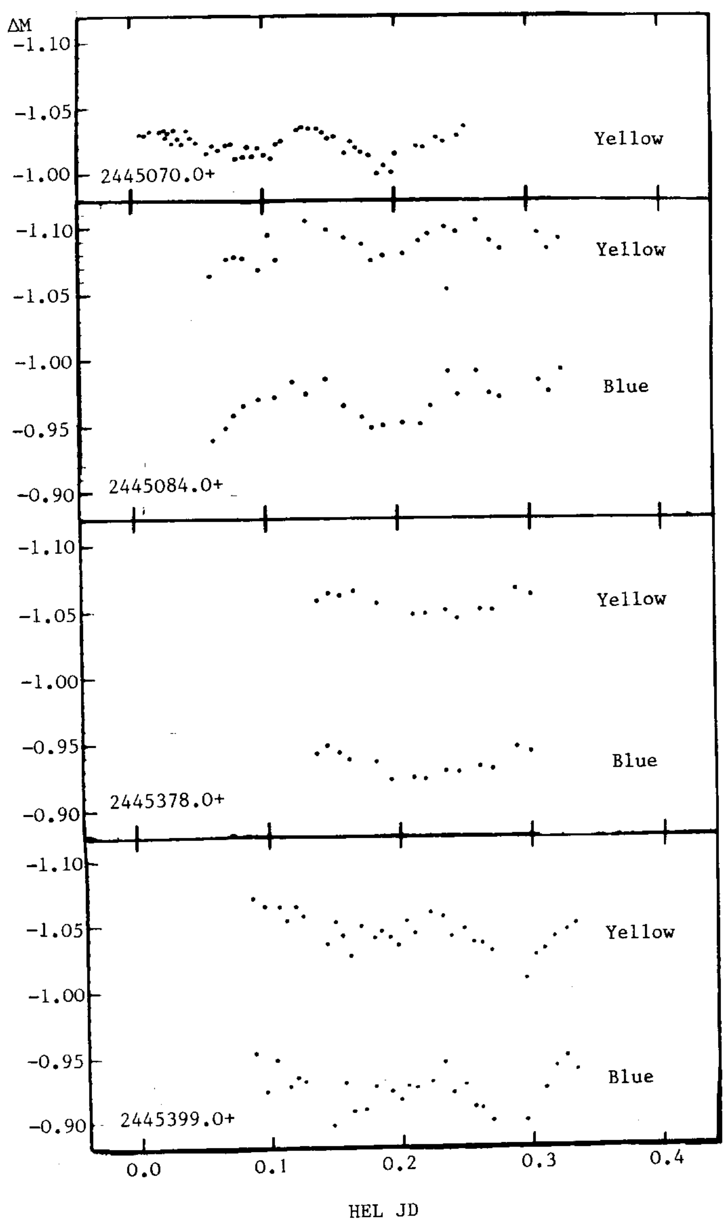

Figure 1

Yellow and blue light curves of 20 CVn

variations with periodicities are indeed present but the shape of light curves are subject to change night to night. Furthermore, the estimates of the periods, $0^{d}.12 - 0^{d}.14$, and the amplitudes, $0^{m}.02 - 0^{m}.04$, of light curves listed in the table suggest that the light variation cannot be originated by the close binary nature.

Y.W. CHUN, Y.S. LEE, and I.-S. NHA
Yonsei University Observatory, Seoul,Korea

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Danziger, I.J. and Dickens, R.J. 1967, Astrophys. J. 149, 55
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MINIMUM TIMES OF THE ECLIPSING VARIABLES AH Cep AND IU Aur

In a paper by one of the present authors (Mayer, 1980) an increasing period was suspected for the early-type eclipsing binary AH Cep, and recently Rafert (1982) suggested an apside-line rotation for this star. In Table I, five new

Table I

Minima of AH Cep

J.D.hel.	Error	Epoch	O - C	Source
2443779.813	$0^d.011$	4953	$+0^d.028$	Hartigan and Binzel (1982)
2444010.532	0.002	5083	+0.028	Skalnatê Pleso Observatory
2445200.499	0.002	5753.5	+0.020	Ondřejov Observatory
2445223.570	0.002	5766.5	+0.019	Ondřejov Observatory
2445562.5380	0.0006	5957.5	+0.0073	Ondřejov Observatory +)
2445579.398	0.003	5967	+0.008	Skalnatê Pleso Observatory

+) Average of measurements in V, B and U colours, individual measurements are 2445562.5383, .5376 and .5381, respectively.

photoelectric times of minima together with a minimum reported by Hartigan and Binzel (1982) are given. Except of the minimum on J.D. 2445562, the minima were only poorly covered by observations, and their estimated mean errors are rather large. The table gives also O-C differences from the ephemeris by Guarnieri et al. (1975):

$$\text{Pri.Min.} = \text{J.D.hel. } 2434989.404 + 1^d.774759 \cdot E.$$

Together with other photoelectric minima listed by Mayer (1980) the minima from Table I are plotted in Figure 1 (except of the minimum by Huffer and Eggen). Apparently, the new minima do not support any of the mentioned suggestions. The period changes of AH Cep are probably irregular.

An increase of the amplitude of AH Cep light curve was observed by Mayer (1980). Now it seems that the amplitude has risen again to about $0^m.25$ (sec. min.) and $0^m.28$ (pri. min.), in V as well as in B colour.

Two new minima were measured for IU Aur (see Table II). As discussed e.g. by Eaton (1979), Schaefer (1981) or Mayer (1983), a monotonous increase of amplitude of both minima of this variable lasts for several decades. The observed depths of both minima are given in Table II, they are again deeper

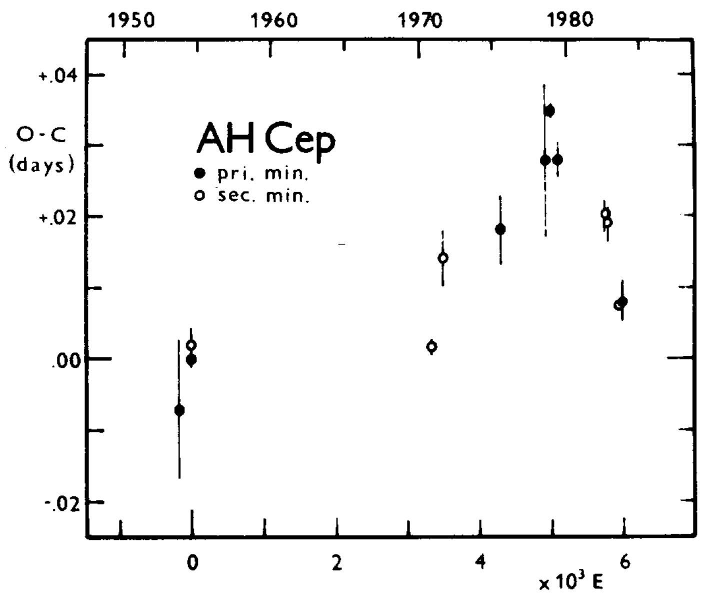

Figure 1

Table II

Minima of IU Aur

J.D.hel.	Error	Epoch	O – C	Minima Depth V	B	U
2445240.5271	$0\overset{d}{.}0010$	3749.5	$-0\overset{d}{.}0018$	$0\overset{m}{.}56$	$0\overset{m}{.}55$	$0\overset{m}{.}57$
2445337.4421	0.0006	3803	+0.0007	0.68	0.68	0.74

now than previously. The O-C differences in the table have been calculated from the ephemeris given by Mayer (1983), :

$$\text{Pri.Min.} = \text{J.D.hel.}2438448.4068+1\overset{d}{.}8114748\cdot E-0\overset{d}{.}0066\cdot \sin(2.208^{\circ}E+25^{\circ}).$$

PAVEL MAYER

Department of Astronomy and Astrophysics, Charles University,
Švédská 8, 150 00 Praha 5, Czechoslovakia

JOZEF TREMKO

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

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR EV Lac IN 1980

Continuous photoelectric monitoring of the flare star EV Lac has been carried out at the Stephanion Observatory during the year 1980 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, the photometer and the observational procedure have been described elsewhere (Mavridis et al., 1982). Here we mention only that the transformation of our instrumental ubv system to the international UBV system is given by the following equations:

$$V = V_o - 0.177(b-v)_o + 2.648,$$

$$B-V = 0.549 + 0.964(b-v)_o,$$

$$U-B = -1.596 + 1.140(u-b)_o.$$

The monitoring intervals in UT as well as the total monitoring time for each night are given in Table I. Any interruption of more than one minute has been noted.

During the 66.56 hours of monitoring time 2 flares were observed the characteristics of which are given in Table II. For each flare following characterictics (Andrews et al., 1969) are given: a) the date and universal time of flare maximum, b) the duration before and after the maximum (t_b and t_a, respectively), as well as the total duration of the flare, c) the value of the ratio $(I_f-I_o)/I_o$ corresponding to flare maximum, where I_o is the intensity deflection less sky background of the quiet star and I_f is the total intensity deflection less sky background of the star plus flare, d) the integrated intensity of the flare over its total duration, including preflares 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

Table I
Monitoring intervals in 1980

Date	Monitoring intervals (U.T.)	Total monitoring time
1980 July		
24	21^h30^m-21^h57^m, 22^h02^m-22^h34^m, 22^h37^m-23^h15^m.	01^h 37^m
26	20 34 -21 11 , 21 13 -21 48 , 21 50 -22 31 , 22 41 -23 33.	02 45
28	21 06 -21 40 , 21 43 -22 16 , 22 19 -22 50 , 23 01 -23 42.	02 19
29	20 02 -20 35 , 20 38 -21 09 , 21 12 -21 48 , 21 59 -22 26,	
	22 29 -23 00 , 23 02 -23 35.	03 11
30	21 03 -21 41 , 21 43 -22 19 , 22 21 -23 06 , 23 15 -23 39.	02 23
31	20 00 -20 37 , 20 39 -21 17 , 21 27 -21 54	
August		01 42
14	00 10 -00 32 , 00 36 -01 04 , 01 08 -01 34.	01 16
14-15	21 44 -22 11 , 22 16 -22 41 , 22 46 -23 13 , 23 17 -23 42 ,	
	23 56 -00 24 , 00 28 -00 36.	02 20
16	00 25 -00 51 , 00 54 -01 39.	01 11
16-17	21 20 -21 48 , 21 52 -22 20 , 22 24 -22 53 , 23 08 -23 37 ,	
	23 40 -00 13 , 00 17 -00 48 , 01 02 -01 48.	03 44
17-18	23 36 -00 14 , 00 17 -00 53 , 00 57 -01 37.	01 54
21-22	23 12 -23 46 , 00 04 -00 51 , 00 57 -01 16.	01 40
25	00 17 -00 52 , 00 57 -01 19.	00 57
26-27	22 49 -23 28 , 23 33 -00 02 , 00 20 -00 29.	01 17
27-28	23 40 -00 13 , 00 17 -00 49 , 00 52 -00 58 , 01 02 -01 26.	01 35
30-31	20 54 -21 24 , 21 29 -22 02 , 22 07 -22 42 , 23 02 -23 34 ,	
	23 38 -23 57 , 00 02 -00 45 , 00 58 -01 36.	03 50
Aug.-Sept.		
31- 1	23 42 -00 10 , 00 14 -00 54 , 00 58 -01 34.	01 44
16-17	23 14 -23 43 , 23 57 -00 26 , 00 29 -01 03 , 01 06 -01 29.	01 55
17	19 16 -19 47 , 19 50 -20 23 , 20 32 -20 51 , 22 28 -22 56 ,	
	23 00 -23 43.	02 34
18	19 06 -19 37 , 19 41 -20 07 , 20 19 -20 49 , 20 53 -21 16 ,	
	21 35 -22 05 , 22 08 -22 39 , 22 51 -23 28.	03 28
19	18 37 -19 02 , 19 04 -19 33 , 19 44 -20 14 , 20 16 -20 45 ,	
	20 56 -21 27 , 21 44 -22 13 , 22 26 -22 51 , 22 54 -23 23.	03 47
21-22	19 57 -20 26 , 20 29 -21 01 , 21 11 -21 41 , 21 45 -22 13 ,	
	22 32 -23 04 , 23 08 -23 44 , 23 56 -00 26 , 00 30 -00 59 ,	
	01 03 -01 18 , 01 21 -01 26.	04 26

Table I (Cont.)

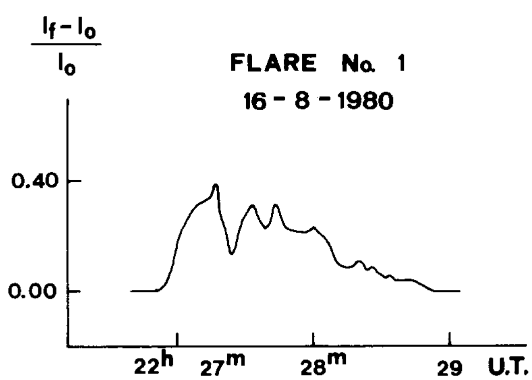
Monitoring intervals in 1980

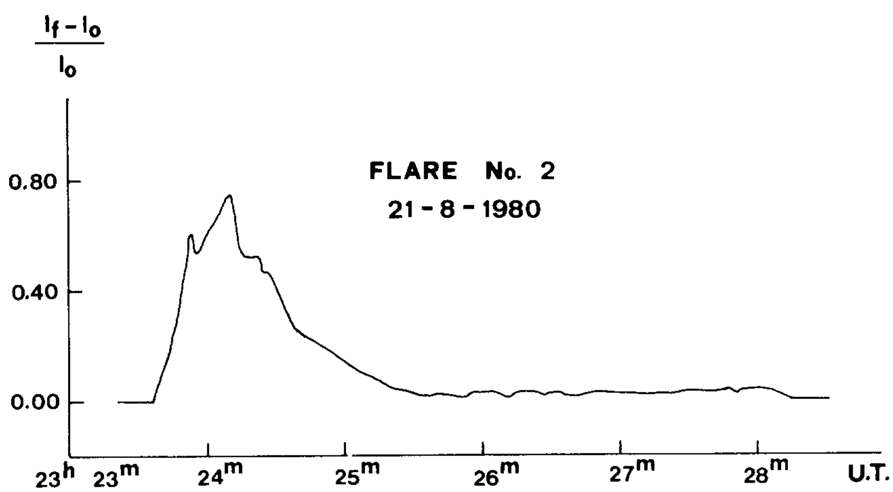
Date	Monitoring intervals (U.T.)	Total monitoring time
1980 Sept.		
23-24	18^h33 -19^h00^m, $19^h04^m-19^h32^m$, $19^h46^m-19^h59^m$, $20^h03^m-20^h35^m$,	
	00 15 -00 45 , 00 50 -01 15 , 01 18 -01 35 .	02^h 54^m
28-29	21 14 -21 43 , 21 46 -22 16 , 22 20 -22 54 , 23 06 -23 24 ,	
	23 28 -23 40 , 23 43 -00 14 , 00 17 -00 47 , 01 01 -01 39 .	03 42
Octob.		
2- 3	18 59 -19 29 , 19 32 -20 00 , 20 04 -20 36 , 20 52 -21 39 ,	
	21 41 -22 20 , 22 23 -22 54 , 23 07 -23 37 , 23 39 -00 04 ,	
	00 07 -00 29.	04 44
3- 4	21 02 -21 31 , 21 33 -22 06 , 22 10 -22 40 , 22 51 -23 19 ,	
	23 22 -23 53 , 23 56 -00 23 , 00 34 -01 14.	03 38
	TOTAL	66^h 33^m

Table II

Characteristics of the Flares Observed

Flare No.	Date	U.T. max.	t_b min	t_a min	Duration min	I_f-I_o/I_o max	P min	Δm mag	σ mag	Air mass
	1980 Aug.									
1	16	22 27.27	0.44	1.64	2.08	0.38	0.34	0.35	0.03	1.008
2	21	23 24.13	0.56	4.11	4.67	0.74	0.64	0.60	0.03	1.014





phase immediately preceding the beginning 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 Figures 1-2.

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G. ASTERIADIS[1] S. AVGOLOUPIS[2]
L.N. MAVRIDIS[1] P. VARVOGLIS[3]

1 Department of Geodesy and Surveying, University of Thessaloniki
2 Department of Astronomy, University of Thessaloniki
3 Department of Mathematics, University of Thrace

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HD 37824 : A NEW VARIABLE STAR

Because Bidelman and MacConnell (1973) reported Ca II H and K emission, we suspected HD 37824 might be an RS CVn binary and therefore might show the photometric wave characteristic of most stars of that type. According to their table VII, $m_v = 7\overset{m}{.}2$ and the spectral type is K1 III + F. In a preprint sent us by Bopp (1983), a spectral scan shows the H and K reversals extending somewhat above the continuum.

During three observing seasons we obtained differential photometry in V of the UBV system using BD +4°1008 as the comparison star. In 1980/81 54 observations were obtained on 18 nights at Dyer, Louth, and Scuppernong Observatories. In 1981/82 36 observations were obtained on 12 nights at Cloudcroft Observatory. In 1982/83 44 observations were obtained at McDonald Observatory. The telescope apertures at those five observatories were 24-inch, 11-inch, 10-inch, 48-inch, 36-inch, and 30-inch, respectively, with the last two both at McDonald.

HD 37824 is definitely variable. The 1982/83 photometry showed the largest variation, $0\overset{m}{.}11$ in V, and the most clearly defined light curve. Inspection of that photometry indicated a period of about 26 days and a nearly sinusoidal shape or about 52 days and a double-humped sinusoidal shape. Two lines of reasoning led us to favor a period around 52 days. (1) Although the 1980/81 and 1981/82 light curves showed smaller amplitudes and were less well defined, the 1980/81 light curve plotted with respect to a 52-day period showed one minimum considerably deeper than the other. (2) Not-yet-published radial velocity measures obtained by Fekel (1983), when analyzed with a period-finding program of Bopp et al. (1970), indicated equally good fits with orbital periods of $53\overset{d}{.}6$ and $25\overset{d}{.}1$. The shorter period, however, implied a very large (and hence unlikely) orbital eccentricity.

If the orbital period indeed is around $53\overset{d}{.}6$ and if the photometric variation is a consequence of nearly synchronous rotation, then the correct photometric period should be around 52 days. To refine that value we de-

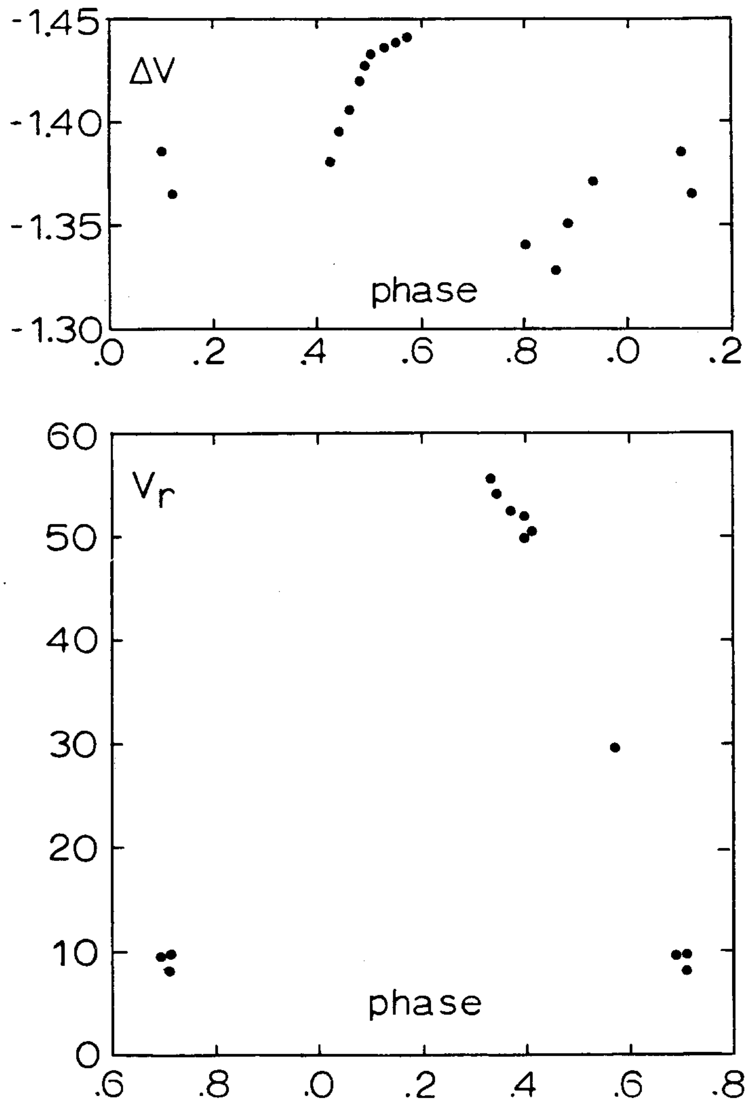

Figure 1

The light curve (top) and the radial velocity curve (bottom).

termined times of minimum light from our three seasons of photometry, although gaps in the coverage made some of those determinations uncertain. The result was $52^{d}_{.}6$. The difference between P(phtm.) = $52^{d}_{.}6$ and P(orb.) = $53^{d}_{.}6$ indicates rotation 2% faster than synchronous.

The upper part of Figure 1 shows the 1982/83 observations from McDonald Observatory plotted versus phase computed with the ephemeris

$$\text{JD } 2{,}445{,}000.0 + 52^{d}_{.}6 \; n \; ,$$

where the initial epoch has been chosen arbitrarily. Each point is a nightly mean. The lower part of Figure 1 shows the radial velocity measures of Fekel plotted versus phase computed with the ephemeris

$$\text{JD } 2{,}444{,}000.0 + 53^{d}_{.}6 \; n \; ,$$

where again the initial epoch has been chosen arbitrarily. The ordinate has units of km/sec.

HD 37824 would profit from additional observation, both photometric and spectroscopic. Better phase coverage would verify that the above periods are not in error by a factor two, and a longer baseline in time would improve our determination of the difference between P(phtm.) and P(orb.). A complete radial velocity curve would yield a solution for the orbital elements. And additional photometry might reveal interesting changes in the shape of the double-humped light curve, which we suspect already occurred between 1980/81 and 1982/83.

We are all very grateful to Dr. Francis C. Fekel, Jr. for letting us examine his radial velocity measures before they are published.

DOUGLAS S. HALL

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

GREGORY W. HENRY

McDonald Observatory
University of Texas
Fort Davis, Texas 79734

HOWARD LOUTH

2199 Hathaway Road
Sedro Woolley, Washington 98284

THOMAS R. RENNER

Scuppernong Observatory
4512 Deerpark Drive
Dousman, Wisconsin 53118

4

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ON THE PERIOD OF BW VULPECULAE

BW Vul was observed at the Wrocław Observatory for the World-wide Observing Campaign on BW Vulpeculae organized in 1982 by M.S. Snowden and C. Sterken. The observations were carried out with a 60-cm Cassegrain reflector and a photoelectric photometer equipped with an EMI 6256S photomultiplier tube and a Strömgren b filter. The weather conditions were relatively poor. Our data are, however, sufficiently accurate and numerous to derive a mean epoch of maximum light.

Taking the period of BW Vul as equal to $P_o = 0\overset{d}{.}20103$, and assuming an initial epoch T_o = 2428000.5, a mean light-curve was derived. It is shown in Figure 1. The points are the individual observations and the solid line, drawn by hand, represents the mean curve.

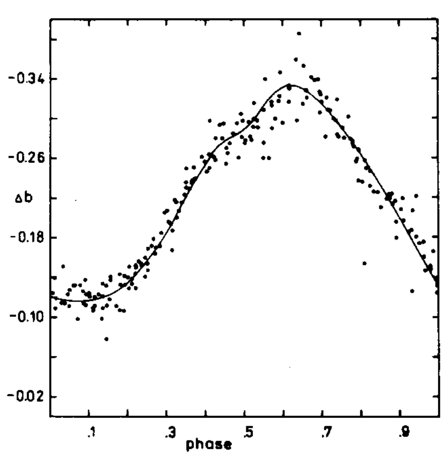

Figure 1

The mean b light-curve of BW Vul. Δb is the magnitude difference "BW Vul minus a mean of HD 198820 and HD 198527"

The following epoch of maximum of BW Vul was derived from the above-mentioned light-curve:

$$\text{Hel. JD (max. light)} = 2445228^{d}.482 \pm 0^{d}.002$$

The (O-C) residuals obtained from this epoch of maximum and from the quadratic ephemerides of Valtier (1976) and Margrave (1979) are $0^{d}.036$ and $0^{d}.014$, respectively. On the other hand, the linear ephemeris of Tunca (1978) yields (O-C)= $0^{d}.005$. This results indicates that Tunca's two linear ephemerides fit the observations better than the quadratic ephemeris of either Valtier or Margrave. Our observations provide, therefore, another argument in favour of a discontinuous increase of the period of BW Vul.

E. SZUSZKIEWICZ AND S. RATAJCZYK

Wroclaw University Observatory
ul. Kopernika 11
51-622 Wroclaw
Poland

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THE UNIQUE DOUBLE-MODE CEPHEID CO Aur

Recently, Mantegazza (1983) has analysed the photoelectric observations of the irregular variable star CO Aur made by Smak (1964) and DuPuy and Randall (1974), and has shown that this star is a double-mode, short period Cepheid pulsating in the first and second radial overtones. At the present, notwithstanding several surveys have been performed, only eleven double-mode Cepheids are known, and all of them are pulsating in the fundamental and first overtone radial modes.

In order to confirm that CO Aur is a double-mode Cepheid, we observed this star in the UBV colours with the photometer attached to the 102 cm telescope of Merate Observatory, from January to March, 1983

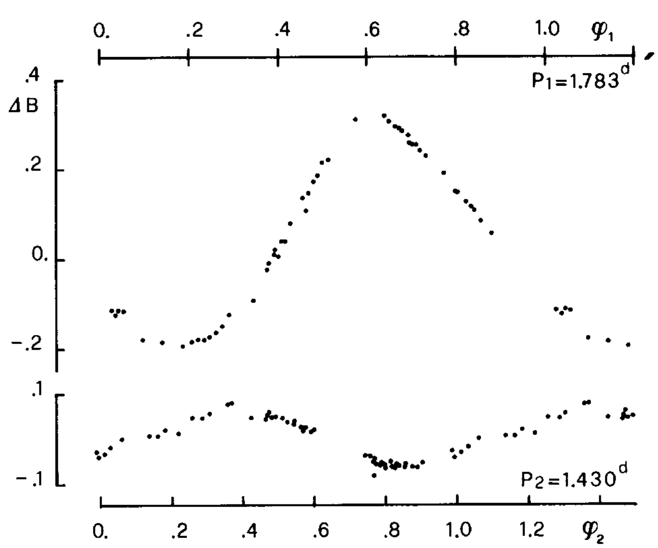

Figure 1

(thirteen nights). The instruments and the observational techniques are the same as those described by Antonello and Mantegazza (1982); in particular, in order to check the accuracy of our measurements, two comparison stars, BD+35°1308 and BD+35°1311, were adopted.

The observations confirm the previous result, that is there are two periodicities, P_1 = 1.783 d and P_2 = 1.430 d. The figure shows the B data prewhitened for the second periodicity and the first order coupling terms and phased with P_1, and the B data prewhitened for the first periodicity and the first order coupling terms and phased with P_2.

Full details on the data and a discussion on the importance of the Fourier analysis of the double-mode Cepheid light curves for the determination of the pulsating modes in Cepheids will be published elsewhere.

E. ANTONELLO and L. MANTEGAZZA
Osservatorio Astronomico di Brera
Via E. Bianchi 46
22055 Merate, Italy

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FLARE STARS IN TAURUS

According to the regular search program of flare stars in stellar aggregates (Ambartsumian and Mirzoyan, 1971; Haro, 1976) we began systematic photographic monitoring observations by the multiexposure method (see, for example, Haro, 1968) in the region of the Taurus dark cloud complex.

The observations were carried out with the 21 in. Schmidt telescope of Byurakan Astrophysical Observatory on ORWO ZU-21 plates with 2-mm Schott filter GG 385 (B-light) and without filter (Pg-light). These observations were made during the period between October 1980 and December 1981. The observations covered a field $4.75^{\circ} \times 4.75^{\circ}$ around the star BD $+23^{\circ}705$ (R.A. = $04^{h}30^{m}$, Decl. = $+24^{\circ}10'$, 1950.0) (stellar association Taurus T 3). The multiexposure plates usually contained a series of six-exposures of 5 or 10 minutes each. The total patroling time is equal to 127.87 hours.

The data on our observations including the number of plates, exposures and effective time of observations are presented in Table I.

Table I

Observational Material

Light	Number of plates	Number of exposures	T_{eff}	Mean limiting magnitude
B	38	226 ($192 \times 10^{m}+28 \times 5^{m}+6 \times 7^{m}$)	$35^{h}02^{m}$	$16^{m}.5-17^{m}.0$
Pg	101	569 ($545 \times 10^{m}+24 \times 5^{m}$)	$92^{h}50^{m}$	$17^{m}.0$
Total	139	795	$127^{h}52^{m}$	

Eleven new flare stars were discovered and some suspected flare events were detected. Data for the observed flare stars and suspected flare stars are given in Table II and Table III, correspondingly. In successive columns of these Tables the following data are presented:

1. Byurakan designation
2-3. Coordinates (1950.0)
4-5. Photographic magnitude at minimum and photographic amplitude

of the observed flare

6. Date of flare event

7. Moments of maximum brightness of stars (UT).

Table II

New Flare Stars

No.	R.A. 1950.0	Decl.	m_{pg}	Δm	Date	UT(max)
B1	$4^h19^m.8$	+25°28'	$17^m.5$(B)*	$2^m.3$	18/19.X.80	$23^h16^m.5$
B2	4 21.5	23 48	17.1(B)*	1.1	28/29.I.81	17 23
B3	4 29.7	22 36	18.5(B)*	1.7	29/30.I.81	18 06.5
B4	4 25.2	24 18	20	5.1	5/6.II.81	18 00
B5	4 40.9	22 17	18.8	4.2	6/7.II.81	15 47
B6	4 31.8	26 28	17.1	1.2	6/7.II.81	20 15
B7	4 23.3	24 35	17.4	1.5	27/28.II.81	18 22
B8	4 22.7	21 51	19.5	5.0	9/10.III.81	17 54
B9	4 29.8	26 28	20.5	5.5	25/26.III.81	18 32
B10	4 28.2	26 25	20	5.3	30.IX/1.X.81	21 05
B11	4 32.4	22 54	17.8	2.2	22/23.X.81	01 56

Table III

Suspected Flare Stars

No.	R.A. 1950.0	Decl.	m_{pg}	Δm	Date	UT(max)
SB1	$4^h23^m.5$	+24°16'	$16^m.9$(B)*	$0^m.7$	27/28.I.81	17^h05^m
SB2	4 21.5	23 45	17.3(B)*	0.4	28/29.I.81	17 23
SB3	4 21.4	24 45	16.9(B)*	0.6	28/29.I.81	18 03
SB4	4 31.3	23 02	17.0(B)*	0.8	29/30.I.81	18 54
SB5	4 34.5	21 51	15.7	0.7	3/4.II.81	16 37
SB6	4 31.4	26 27	18.2	2.4	4/5.III.81	16 45
SB7	4 32.4	21 54	17.5	1.5	9/10.III.81	17 44
SB8	4 27.1	22 53	16.4	1.0	9/10.III.81	18 04
SB9	4 33.2	26 16	16.6	1.6	25/26.III.81	17 27
SB10	4 34.9	22 59	17.2	0.9	2/3.X.81	23 23
SB11	4 33.5	23 29	17.5	1.5	26/27.X.81	01 03

* The observations were made in B light.

A.S. HOJAEV

Byurakan Astrophysical
Observatory, Armenia, USSR

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BVRI PHOTOMETRY OF THE ECLIPSING BINARY QX Cas

During a program to observe Classical Cepheids, we included the eclipsing binary QX Cas since it was located in the same field as the Cepheids CE Cas and CF Cas.

The differential observations were transformed to the Johnson BVRI system through use of standards given by Moffett and Barnes (1979a,b). Nightly extinction determinations from stars given by Barnes and Moffett (1979) were used to define mean seasonal extinction coefficients which were used in the final data reduction. More details on the reduction procedures are given by Moffett and Barnes (1979a).

The variable was measured differentially with respect to the two comparison stars whose adopted values are given in Table I.

Table I

Adopted Comparison Star Values

SAO	V	(B-V)	(V-R)	(R-I)
20968	8.037	1.107	0.839	0.526
20972	9.948	0.658	0.676	0.488

The data for QX Cas are given in Table II where the phases were calculated using the values: P = 6.00471 days, Epoch = 2435755.0 as given in the General Catalogue of Variable Stars.

Table II

BVRI Photometry of QX Cas

Phase	HJD-2440000	V	(B-V)	(V-R)	(R-I)
.001	4215.6400	10.275	0.305	0.319	0.230
.060	4984.5988	10.161	0.309	0.339	0.204
.089	4912.7195	10.228	0.300	0.338	0.200
.121	4822.8416	10.159	0.318	0.326	0.189
.163	4222.6207	10.203	0.307	0.320	0.221
.174	4216.6821	10.173	0.300	0.322	0.167
.247	4913.6639	10.190	0.278	0.323	0.205
.266	4913.7773	10.190	0.276	0.335	0.193
.282	4913.8784	10.176	0.309	0.299	0.212
.328	4223.6130	10.200	0.316	0.317	0.213
.334	4217.6420	10.216	0.296	0.318	0.226
.387	4139.8985	10.218	0.321	0.304	0.248
.389	5010.5964	10.203	0.293	0.329	0.209
.407	4986.6857	10.163	0.326	0.320	0.184
.408	4914.6310	10.216	0.302	0.326	0.212
.417	4914.6880	10.219	0.303	0.341	0.223
.418	4908.6895	10.201	0.294	0.329	0.224
.462	4554.6741	10.181	0.284	0.322	0.228
.509	4218.6927	10.207	0.300	0.317	0.226
.556	5011.5975	10.184	0.309	0.325	0.247
.556	4140.9158	10.130	0.333	0.334	0.169
.577	4105.0090	10.143	0.272	0.335	0.170
.591	4909.7267	10.211	0.300	0.324	0.186
.630	4555.6845	10.221	0.286	0.335	0.199
.889	4142.9140	10.154	0.325	0.332	0.178
.904	4941.6326	10.202	0.317	0.329	0.171
.941	4821.7571	10.185	0.319	0.326	0.210
.945	4911.8499	10.212	0.285	0.338	0.184
.956	4821.8496	10.251	0.296	0.337	0.215
.975	4821.9646	10.316	0.305	0.335	0.218

THOMAS J. MOFFETT

Department of Physics
Purdue University
West Lafayette, IN 47907 U.S.A.

THOMAS G. BARNES, III

McDonald Observatory
Department of Astronomy
The University of Texas
Austin, TX 78712 U.S.A.

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THE ABSOLUTE MAGNITUDE OF AZ CANCRI

AZ Cancri was listed as a flare star by Haro and Chavira (1966); it (T4) had been discovered in 1964 in their search of the Praesepe region. They found it to flare by some 2.5 mag. in the U band, and assigned it a photographic magnitude of 18.9. Later observations have been made by Jankovics (1973) and Jankovics, Tsvetkova, and Tsvetkov (1978), the latter reporting a flare of over six magnitudes in U. During literature searches for variable stars among the objects whose trigonometric parallaxes have been determined subsequent to the appearance of Miss Jenkins' 1963 supplement, the writers independently noted the close similarity in position of this star, which is contained in the first supplement to the 3rd edition of the GCVS, and a faint high-proper-motion star (LP 425-140=LHS 2034: $\mu = 0\farcs908$/yr) discovered in 1963 by Luyten, and for which he later determined (Luyten 1965) a parallax of $0\farcs139 \pm 0\farcs032$ (m.e.) from Palomar plates. Reference to the Luyten-Albers atlas of identification charts for the LHS stars and to a photograph of the field published by Haro, Chavira, and Gonzalez (1976) leaves little doubt as to the identity of the two objects.

Luyten now gives the star a magnitude of 18.6 pg, and with his parallax the star would have $M_{pg} = +19.3$, which would place it among the faintest stars known. It is No. 316.1 in Gliese's 1969 catalogue of the nearby stars. To our knowledge there are no available spectroscopic data.

WILLIAM P. BIDELMAN
Warner & Swasey Observatory
Case Western Reserve University
Cleveland, Ohio 44106

DORRIT HOFFLEIT
Department of Astronomy
Yale University
New Haven, Conn. 06511

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NEW DATA ABOUT THE APSIDAL MOTION IN THE SYSTEM OF RU MONOCEROTIS

Judging from the observations since 1973 there is now a substantial body of evidence which shows that the apsidal motion of the RU Mon system is slowing down. Instead of the previous value $\Delta\omega/\Delta E$ = $0\overset{\circ}{.}01285$ it has now become $0\overset{\circ}{.}0114$. At the beginning of 1982 the value of ω (the longitude of periastron) became 90°, the secondary minimum now precedes the middle of two consecutive primary minima.

At the same time the value of the orbital period P is now lengthening:

E<3400	P = $3\overset{d}{.}584679$
3400<E<6100	639
6100<E<6700	586
6900<E<7900	680

For the next 5-7 years (as well as for the previous ones) the moments of minima may be forecast with the following linear formulae:

Min I Hel. = JD 2441743.1947 + $3\overset{d}{.}584749$ E'
Min II Hel. = JD 2441741.575 + $3\overset{d}{.}584567$ E'

E' = E - 6930

Three recent photoelectric epochs of minima and their representation with these formulae are as follows:

Min I Hel. JD 2444528.544	E'= 777,	O-C = $-0\overset{d}{.}001$
Min I Hel. JD 2445288.5117	989,	+0.0002
Min II hel. JD 2445376.326	1014,	0.000

The paper is due be published elsewhere in detail.

D.Ya. MARTYNOV

Sternberg Astronomical
Institute, Moscow
U.S.S.R.

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V LIGHT CURVE OF CC COMAE

The eclipsing binary CC Com is a system of W UMa type with the shortest known period. The first photoelectric observations in the V band were made by Wenzel (1967). Rucinski (1976) found the elements of this binary from his UBV observations. Two-colour light curves of CC Com were also obtained by Zhukov (1976) and by Breinhorst and Hoffmann (1982).

New light curves in V were obtained with the 60 cm reflector of the Southern Station of Sternberg Astronomical Institute in April 1983. The mean error of one observation did not exceed $\pm 0^{m}.02$. Figure 1 shows the mean light

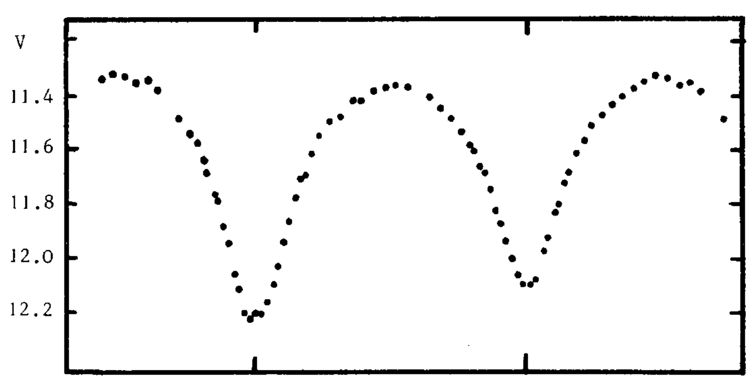

Figure 1

curve of CC Com. The times of minimum light observed in 1980 and 1983 are given in Table I with (O-C)'s calculated by the following ephemeris formula:

$$JD_{hel.} \text{ Min I} = 2442467.8307 + 0^{d}.2206862 \cdot E,$$

where Rucinski's epoch has been taken.

Table I

JD_{hel} 2444000+	Min	(O-C)
584.4316	I	$-0\overset{d}{.}0004$
672.3763	II	+0.0008
1434.5162	I	+0.0009
1435.5087	II	+0.0003
1436.2814	I	+0.0006

Analysis of all photoelectric observations of CC Com leads to the following conclusions:

1. The mean light of the variable star in maxima observed in different seasons varies. This may be due to a physical variability of the third hypothetic component of the system. It may also be due to a long-period variability of Wenzel's comparison star "a", but more thorough studies are needed. However, the differences between the V-values of the comparison star and that of the control star are about the same in 1975 and 1983 and these are $0\overset{m}{.}083$ and $0\overset{m}{.}075$, respectively.
2. O'Connell's effect has been found with five light curves in the V-system. This effect is of cyclic character, moreover it takes place at maximum I (phase 0.25).
3. The secondary minimum in yellow light had an invariable shape and depth during the period of the observations of the CC Com (taking into account the above remark - point 1.)
4. The binary has a variable period but it is difficult to decide on the nature of the change from the appearance of the (O-C) diagram (see Fig.2).

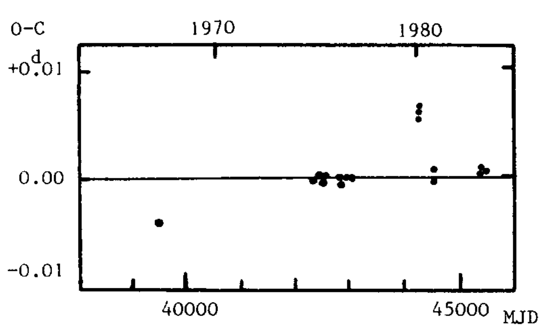

Figure 2

5. During 1975 I discovered short-lived depressions at the light curve together with the colour changing of CC Com. Such depressions are revealed by the observations of Rucinski (1976) as well. The character of these depressions and their position at the light curve (phase 0.36-0.38 and 0.84-0.89) enable us to suppose the existence of nonstationary gaseous streams from the primary or at least to establish definitely the nonstability of the common envelope of the system in the vicinity of point L1.

In conclusion I wish to draw attention to the same peculiarities discovered by us for the light curves of V 523 Cas, which has characteristics similar to those of CC Com.

G.V. ZHUKOV

Department of Astronomy
Kazan University, Kazan 8,
USSR

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SPECTROSCOPIC INVESTIGATION OF SZ Lyn AND SS Psc

The discrepancy between the hydrogen and ionized calcium spectral classes is a characteristic feature of RR Lyrae stars. This discrepancy is determined by the parameter ΔS (Preston, 1959), measured in tenths of a spectral class. ΔS changes with the phase of light variation, reaching the highest values in pre-maximum phases. One can note one more discrepancy for the stars in question, viz. the difference between the ionized calcium and metal spectral classes.

Parallel photoelectric (Garbuzov, 1980a, 1980b) and spectroscopic observations of SZ Lyn and SS Psc were performed to investigate in detail the changes of hydrogen spectral classes: Sp(H), ionized calcium spectral classes: Sp(KCa II) and spectral classes determined from the other metals: Sp(ml) (mainly Fe I, Ca I and Ti II, all 13 criteria) with the phase of light variation. Spectroscopic observations were carried out from October 1979 to January 1980 with the diffraction-grating spectrograph of the 122 cm reflector of the Crimean Astrophysical Observatory of the Academy of Sciences of the USSR. The linear dispersion of the spectrograph is 125 Å/mm. The exposure time was $0\overset{p}{.}14$ for SZ Lyn and $0\overset{p}{.}1$ for SS Psc. Spectra were exposed on Kodak 103aO emulsion. For SS Psc the plates were baked for 52 hours at $t = 63^{\circ}C$ in rarefied air. The criteria for the quantitative spectral classification were taken from Fenina (1975). The systems of equivalent widths of both investigations coincide with each other.

SZ Lyn. The pulsation period of SZ Lyn is $0\overset{d}{.}12$, its light varies in the limits of $9\overset{m}{.}12$ to $9\overset{m}{.}62$ in V. The deviations of O-C residuals with the period of 1146^{d} can be explained by the binary nature of the star. The results of the classification are given in Figure 1. Phases of light variation are calculated with respect to linear elements (Barnes and Moffett, 1975):

$$\text{Max hel JD} = 2438124.3977 + 0\overset{d}{.}12053481 \cdot E.$$

The hydrogen spectral class (Sp H) shows smooth variation with the phase of light variation. The ionized calcium spectral class (Sp KCa II) at the phases of $0\overset{p}{.}0$ - $0\overset{p}{.}6$ nearly coincides with Sp H; at the phases of $0\overset{p}{.}6$ - $0\overset{p}{.}9$ it appears earlier. The intensity of KCaII at these phases abruptly weakens by twice the original value. The maximum of the calcium curve precedes the maximum of the hydrogen curve.

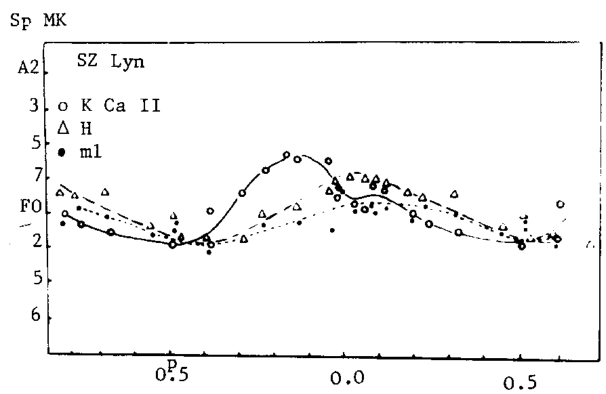

Figure 1

The metal spectral class practically coincides with the spectral class determined from hydrogen absorption lines, only for the phases 0.85 - 0.20 it is a little later. The amplitude of the change of metal line intensity (except K Ca II) is small.

SS Psc. The period of pulsation of this star is $0\overset{d}{.}28$, its light changes from $10\overset{m}{.}76$ to $11\overset{m}{.}18$ in B. Initially SS Psc was classified as an RRc star. The change of spectral classes with the phase of light variation is, on the whole, similar to that in the spectrum of SZ Lyn. This fact and the value of $\Delta(B-V)/\Delta V = 0.39$ put SS Psc together with SZ Lyn and VZ Cnc. These stars are characterized by the normal metal content, and the coincidence of hydrogen and metal spectral classes qualitatively show it.

The greatest discrepancy between the hydrogen and the ionized calcium spectral classes is in the premaximum phases. The shock wave effects may affect the intensity of hydrogen and ionized calcium spectral lines. Thus, in the spectrum of SZ Lyn we observe the faint splitting and the emission in the core of hydrogen line Hα at these phases (Garbuzov, Zaikova, 1983). This phenomenon can be interpreted as a results of moving out of the shock wave through the stellar atmosphere. The emission is poor and it cannot change the intensity of hydrogen spectral lines essentially. The ionization potential of Ca II is rather low, 11.8 eV. Calcium is completely ionized in the atmospheres of hot stars. The K Ca II line is very weak in the spectra of A0 stars (its equivalent width is about 0.3 Å) whereas in F0 stars the equivalent width of this line is about 3 Å. Analysis of the change in the K Ca II equivalent width of SZ Lyn shows the presence of a powerful mechanism in the stellar atmosphere, not connected with the change in B-V and V, that produces the variability of this line. A strong change in the equivalent width of the K Ca II line at nearly constant B-V, observed at some light variation phases of SZ Lyn, is caused by the action of this mechanism. It may also be due to the ionization of the upper atmosphere induced by the moving of the shock wave and by the ultraviolet radiation from behind the front of the shock wave. Another mechanism is possible, which is also connected with the movement of the shock wave. As a result of the shock wave movement the absorption lines are shifted into the short wavelength region, it will be there that the photons of continuum, moving out from deep layers of the stellar atmosphere, will be absorbed (irradiation effect). So there will be the additional surge of the energy to the gas and then its heating. Thus the rise of ΔS at pre-maximum phases may be the shock wave effect.

G.A. GARBUZOV

Odessa Astronomical Observatory
Odessa, U.S.S.R.

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INACTIVE STATE OF MV LYRAE

The cataclysmic variable MV Lyrae is a candidate for a class of polars (Vojkhanskaya et al., 1978, Vojkhanskaya and Mitrofanov, 1980). But unlike other AM Herculis-type objects the polarization of MV Lyrae is very small, its variations are not correlated with brightness changes (Efimov and Shakhovskoy, 1980). The system is identified with an X-ray source H 1901+43 (Mason et al., 1979).

The investigation of archive plates of Sonneberg (Wenzel, 1980) and Moscow and Odessa collections (Andronov and Shugarov, 1982) shows that from the beginning of this century MV Lyrae was mainly in its high state ($B \leq 14^m$). Inactive states lasting from several months to a year have a tendency to gather, the interval between them may be as long as 17 years.

In 1979 the system's brightness fell from $13^m.5$ to 18^m (Romano and Rosino, 1980). The decline lasted for 40-60 days; this may be compared with the value for AM Herculis (Andronov et al., 1983).

Observations were taken with the 50-cm reflector and 40-cm astrograph of the Southern Station of Sternberg State Astronomical Institute and the 45-cm telescope of Odessa Astronomical Observatory. We used the B-magnitudes of comparison stars taken from Andronov and Shugarov (1982). The 1979-1982 light curve is shown in Figure 1.

In the inactive state one can observe flares with an amplitude of 3^m lasting 1-2 months — similar in appearance to the photometric behaviour of cataclysmic variable V 794 Aquilae (Petrochenko and Shugarov, 1982). In addition, the mean brightness may undergo changes of $0^m.3$ when $B \approx 17^m$ and $1^m.2$ when $B \approx 16^m$. We note that the present inactive state is not only the deepest, but the longest as well, compared with other detected minima. Recent observations show that MV Lyrae is now faint. On 2 May 1983 the brightness was about $17^m.5$ (not shown in Figure 1).

If, as Robinson et al. (1981) suggested, we see the binary system entering the 2-3 hour period gap, it is unlikely that MV Lyrae will return to its practically stationary active state for some 10^9 years.

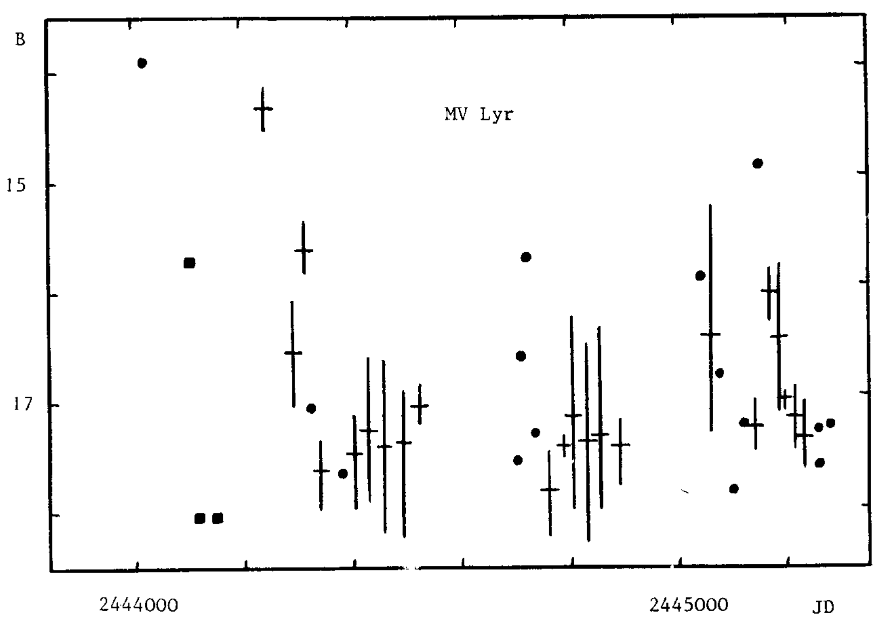

Figure 1

The 1979-1982 light curve of MV Lyrae. Filled squares correspond to the observations of Romano and Rosino (1980)

Individual light curves in the 1981-1982 inactive state are shown in Figure 2. The amplitude of brightness changes may reach $1^m.2$ which is really greater than the values of $0^m.1$ - $0^m.5$ obtained for the active ($B \approx 12^m.5$) state (Walker, 1954).

There is an interesting feature on the light curve when $B = 17^m.3$. Sometimes one may observe "stationary" states lasting 2-3 hours that were detectable from our data and the results of photoelectric study (Robinson et al., 1981).

Photographic observations cannot be fitted on one light curve with a spectroscopic period of $0^d.1336$ (Schneider et al., 1981), but the time-scale of brightness variations is not in disagreement with this value. If the orbital inclination is small ($i \approx 14^o$) (Schneider et al., 1981), possible orbital variations may be saturated by fluctuations connected with the system's instability. The statistical amplitude increase in the inactive state compared with the active state may be attributed to accretion flow in-

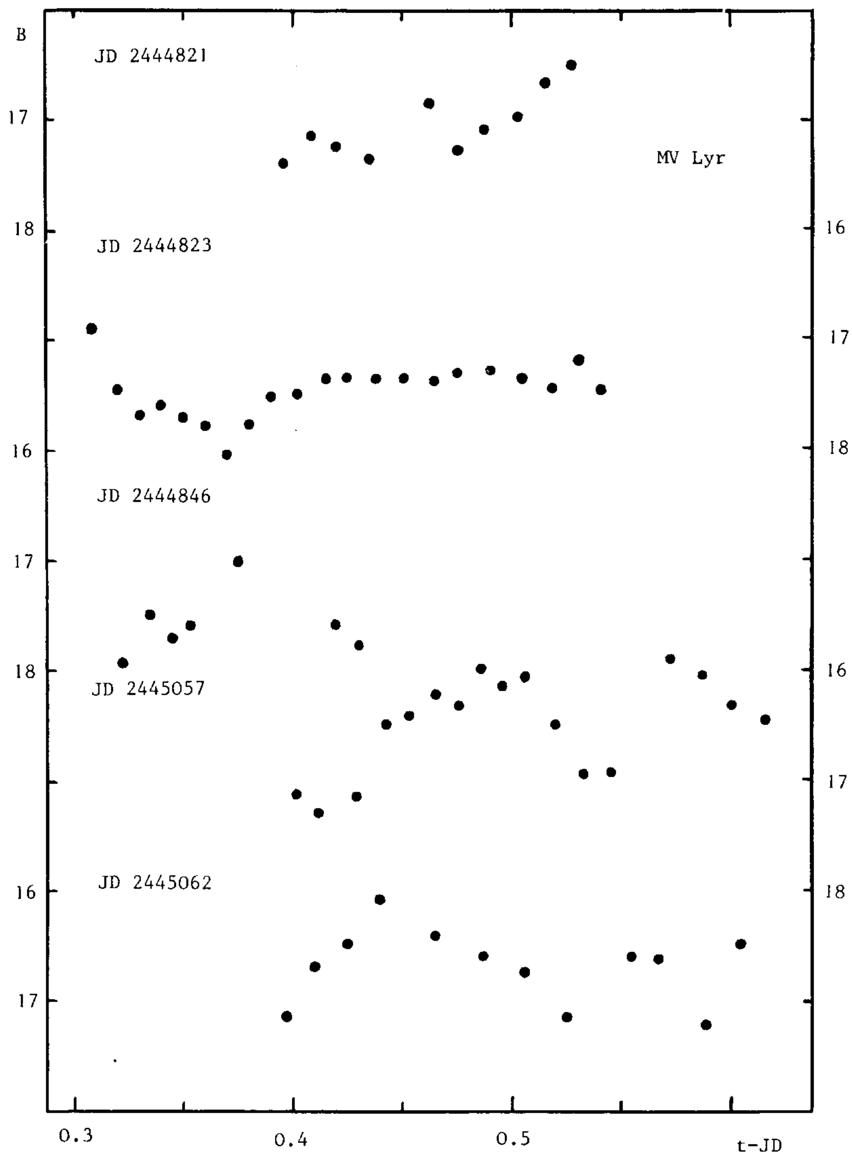

Figure 2
Individual light curves of MV Lyrae

stabilities when the relative contribution of separate inhomogeneities to the luminosity increases. If accretion is completely reduced the luminosity will decrease and variability disappears. Though, as one might expect, separate inhomogeneities may penetrate from the secondary's envelope through the inner Lagrangian point to the primary's Roche lobe. In this case separate flares might be observed on the light curve.

I.L. ANDRONOV

Odessa Astronomical
Observatory, USSR

S.Yu. SHUGAROV

P.K. Sternberg State
Astronomical Institute
Moscow, USSR

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HD 34409 - A DELTA SCUTI VARIABLE

The star HD 34409 (=BD+ 69°315) was reported to be a variable of small amplitude by Hilditch (1971). He also reported the spectral type of HD 34409 as F2 and indicated that the light variations of the star closely resembled δ Scuti type variability in appearance and duration.

This star was chosen as a secondary comparison during the observations of the programme star AS Cam and was observed on the 38-cm reflector of the Uttar Pradesh State Observatory employing 1P21 photomultiplier, conventional UBV filters of Johnson and Morgan (1953) and d.c. techniques.

A total of eight nights of observations obtained between JD 2440544 and JD 2442783, using HD 34463 (=BD+ 69°317) as a comparison star, have been discussed in this communication.

Although the observations during all the eight nights have been secured through U, B and V filters, but the light curves of B filter have only been presented in this paper as the light curves in U and V filters show a large scatter.

Moreover, we were mainly interested in finding out the nature of variability of the star HD 34409 and in obtaining the times of maxima. The scatter present in the observations may be attributed primarily to the faintness ($9^{m}.1$) of the star, the magnitudes of both the variable and the comparison stars being close to the limiting magnitude ($10^{m}.0$) of the reflector.

The details of the variable and the comparison stars are given as follows:

Star	α_{1855}	δ_{1855}	m_V	Sp.Type (BD)
Variable star = HD 34409 = BD+ 69°315	$05^h07^m10^s$	$+69^{\circ}14'.5$	$9^m.1$	A
Comparison star = HD 34463 = BD+ 69°317	$05^h07^m35^s$	$+69^{\circ}25'.3$	$9^m.5$	A

The average standard deviations of the comparison star in U, B and V filters are $\pm0^m.020$, $\pm0^m.010$ and $\pm0^m.012$ respectively. The instrumental magnitudes have been converted into standard magnitudes with the help of several stand-

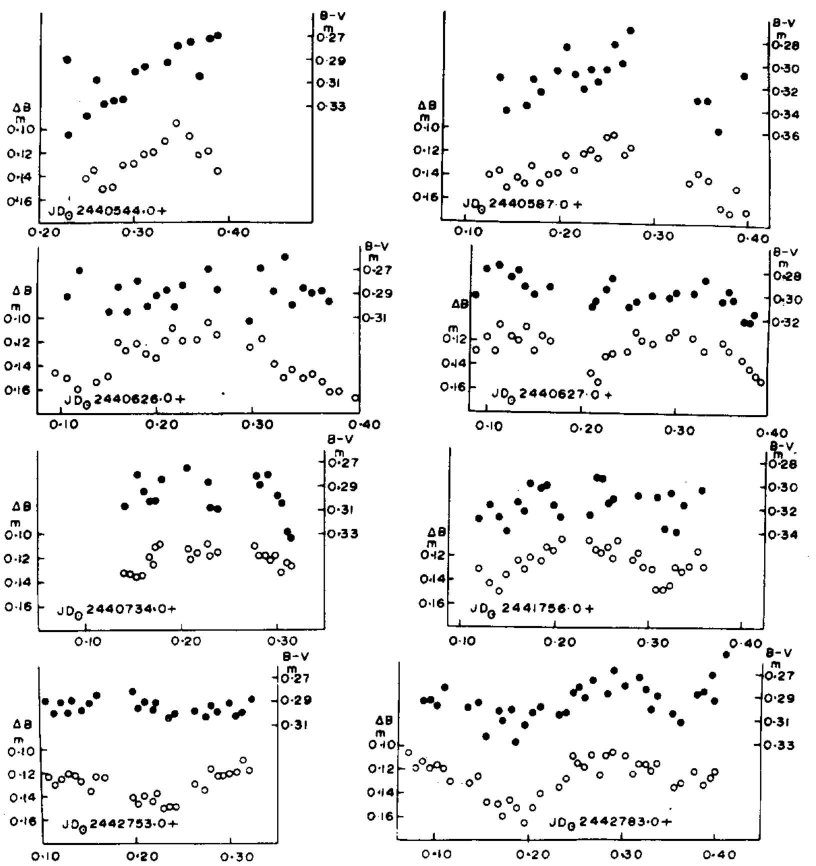

Figure 1 Light and colour curves of HD 34409

ard stars, chosen from the list of Johnson and Morgan (1953). The differential B magnitudes (ΔB), in the sense variable minus comparison, have been plotted against heliocentric Julian day. The light curves, thus obtained are plotted in Fig. 1, wherein the observed points are shown as open circles.

The times of maxima, determined with a graphical accuracy of $\pm 0^{d}.001$, are given below:

JD(Hel)	JD(Hel)
2440544.345	2441734.250
2440587.265	2441756.233
2440626.243	2442753.135
2440627.290	2442783.290

The colour indices (B-V and U-B) of the variable and the comparison star have been determined and are given as under:

Star	B-V	U-B	Sp.Type
HD 34409	$+0^{m}.30$	$+0^{m}.21$	F 2
HD 34463	+0.15	+0.09	A 5

The average colour of the comparison star comes out to be B-V = $+0^{m}.147$ and U-B = $+0^{m}.093$, which places the star into A5V spectral-luminosity class (vide Golay, 1974), while the colour of the variable star comes out to be B-V=$+0^{m}.304$ and U-B = $+0^{m}.205$. These colour indices indicate that the variable is close to spectral-luminosity class F 2 II, showing a moderate ultraviolet excess of $0^{m}.05$, when compared with the colour-colour sequences given by Golay (1974). The luminosity class may be off than this because of the ultraviolet observations being not so reliable due to smallness of the deflections through U filter. The standard deviations of the colour indices for B-V and U-B are $\pm 0^{m}.009$ and $\pm 0^{m}.014$, respectively. This finding, with regard to the spectral class, is in agreement with the results obtained by Hilditch (1971), who also confirmed the spectral type of the variable with the spectroscopic observations. However, there is a disagreement in the value of U-B excess. Accordingly, only difference between our and Hilditch's (1971) findings is that the U-B value of HD 34409 showed an ultraviolet depression (vide Hilditch, 1971), while we find that the U-B value shows a moderate ultraviolet excess. Since Hilditch (1971) did not give any indication about the colour-colour sequence, which he used for assessing the spectral classes, hence it is difficult to point out the cause of this difference. Moreover, he did not mention the luminosity class of the variable star either. The luminosity of the star has been assessed to be $+1^{m}.4$. The colour and luminosity diagram suggests that the star belongs to luminosity class IV, showing an ultraviolet excess of the order of $0^{m}.15$.

The B-V and U-B colour indices of all the observations have been obtained, and the B-V colour of every observation has been plotted on the top of Fig.1 as filled circles.

The light curves presented in Fig. 1 show that the average amplitude of maxima comes out to be $0^{m}.05 \pm 0^{m}.01$. Hilditch also points out that the variable is of small amplitude.

From the above detailed maxima (and employing the method of least squares) we have computed the fundamental (mode) period to be $0^{d}.1803695$. The varying amplitudes present in the light curves show the presence of beat phenomenon.

In addition, HD 34409 falls in the δ Sct region in the colour-colour dia-

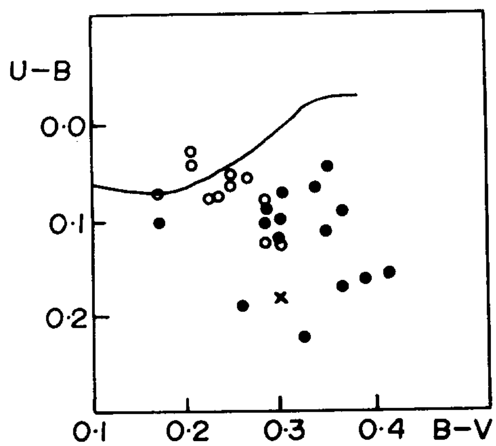

Figure 2. Position of HD 34409 (cross) plotted in the diagram showing δ Sct stars (filled circles) and dwarf cepheids (open circles). The solid line represents the main sequence.

gram (Frolov, 1975) as shown in Fig. 2. The approximate luminosity of the star has been assessed from the data given by Frolov (1975) in Tables 28 and 29. The M_V of HD 34409 has been estimated to be $+1^m.4$. When the values are plotted on the colour (B-V) and luminosity (M_V) diagram given by Frolov (1975), the variable falls in the δ Sct region. Likewise when the luminosity and the period of the star are plotted on the diagram given by Frolov (1975), it follows the P-L relation valid for δ Sct stars. H-R diagram (M_V vs B-V) reveals that the star may belong to luminosity class IV (subgiant) (vide Burbidge and Burbidge, 1958).

All the above facts confirm that the star HD 34409 is a δ Scuti variable of small amplitude ($0^m.05$), spectral type F2 IV, and has a fundamental (mode) period of $0^d.1803695$.

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R.K. SRIVASTAVA and A.K. ARYA

Uttar Pradesh State Observatory
Manora Peak, Naini Tal - 263129
India

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TWO NEW VARIABLE STARS IN THE FIELD OF NGC 6946

Two new variable stars have been discovered on 26 blue plates taken with a 36 cm telescope in a field of one square degree around the galaxy NGC 6946 during the period between July 1964 and September 1966.

Figure 1 shows the finding charts: north is at the top, the side is 15'.

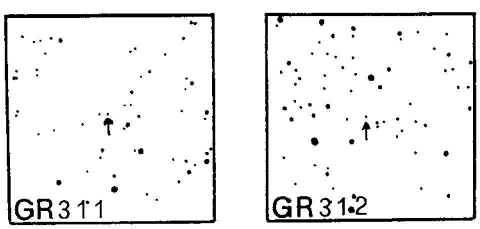

Figure 1

GR 311.- The position 1950 is R.A. = $20^h\ 29^m\ 47^s$, D = + $60^o 10'.5$. This star is very likely a semiregular variable. The observations suggest a period of 145 days. A definite maximum has been observed at JD 2439054 (14.9 mph). The photographic range is from 14.9 and < 15.5.

GR 312.- The position 1950 of this eclipsing variable (EA) is R.A. = $20^h\ 35^m\ 17^s$, D = + $59^o\ 57'.0$. Two minima have been observed respectively at JD 2438941.423 (15.2) and JD 2438967.436 (<15.3). The period is very likely 26.01/n days. The star has an observed range from 14.5 and < 15.3.

In the same field we have observed also the following variables.

DT Cep.- Eclipsing variable. Only a minimum at the date JD 2439051.335 (15.0) has been observed. The O-C = $-0^d.143$ with the elements given by W. Gotz (VVS 2, n.5, 1956).

V778 Cyg.- Slow variations of light between 13.4 and 15.1. Irregular variable.

G. ROMANO AND M. PERISSINOTTO

Istituto di Astronomia
Università di Padova
Italy

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NOTE ON THE SEMI-REGULAR VARIABLE TT Scl

The star TT Scl (R.A. = $00^h11^m53^s$, Dec. = - $30^o47'.2$, 1900) is a semi-regular variable with an average period of $132^d.7$ (Kukarkin et al. 1958). From UBVRI measurements Eggen (1970) found a somewhat shorter average period: 125^d. Furthermore, he has shown that the variation in V is correlated with those in the colour-indices R-I and U-B in the sense that if the star brightens it becomes bluer. As shown by Eggen the same behaviour is also found in other semi-regular variables like X Scl and R Aqr. Eggen further remarks that TT Scl is probably not an M-type variable; it is more closely associated with the Cepheid variables of the halo population.

In November 1982 I have noticed the variable behaviour of TT Scl when I compared my new observations with those of 1981, and have followed it photometrically in VRI (Cousins' system) during my whole observing run at the ESO on La Silla. The observations were made with the ESO 50 cm telescope, several also with the 1 m telescope. G. Alcaino observed the star on one night in November with the 1 m telescope. Later, in December 1982, S. van Amerongen observed the star again with the ESO 50 cm telescope. An IDS spectrum was taken by H.H. Loose and D. Schallwick on November 13, 1982, with the ESO 1.5 m telescope. Since it is not my intention to continue the study of this star, the results of the observations are presented in this note. The photometric data are given in Table I, and the IDS spectrum, which is reduced by M. Pizzaro, is shown in Fig. 1.

Table I. Photometric data of the semiregular variable TT Scl

JD 2445200+	V	V-R	V-I	Date
	12.75	0.88	2.12	10-10-1981
	12.72	0.89	2.10	11-10
70.65	12.17	0.87	1.84	30-10-1982
77.66	11.97	0.88	1.75	03-11
79.60	11.86	0.85	1.66	05-11
80.52	11.83	0.85	1.62	06-11
81.70	11.75	0.82	1.57	07-11
82.57	11.71	0.82	1.56	08-11
83.53	11.69	0.83	1.55	09-11
84.65	11.65	0.83	1.50	10-11
86.53	11.57	0.83	1.46	12-11
87.53	11.53	0.81	1.42	13-11
88.68	11.52	0.79	1.42	14-11
89.52	11.54	0.81	1.45	15-11
90.54	11.48	0.83	1.40	16-11
91.53	11.45	0.82	1.37	17-11
108.66	11.36	0.81	1.37	05-12
109.62	11.39	0.82	1.36	06-12
110.64	11.35	0.83	1.43	07-12
111.61	11.38	0.84	1.44	08-12
113.56	11.40	0.84	1.46	10-12
114.63	11.36	0.83	1.45	11-12
116.62	11.39	0.85	1.48	13-12
121.53	11.54	0.92	1.61	18-12
122.55	11.52	0.90	1.59	19-12

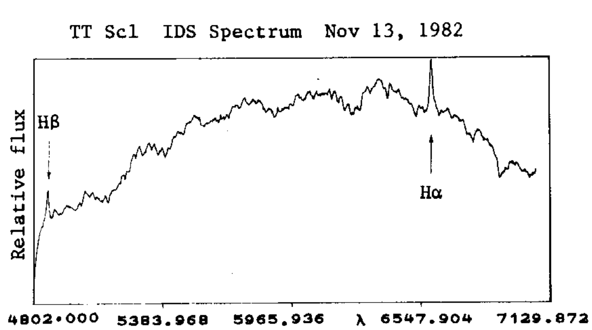

Fig. 1. The IDS-spectrum of TT Scl.

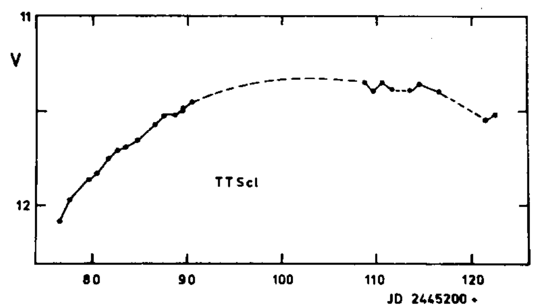

Fig. 2. The visual lightcurve of the semi-regular variable TT Scl.

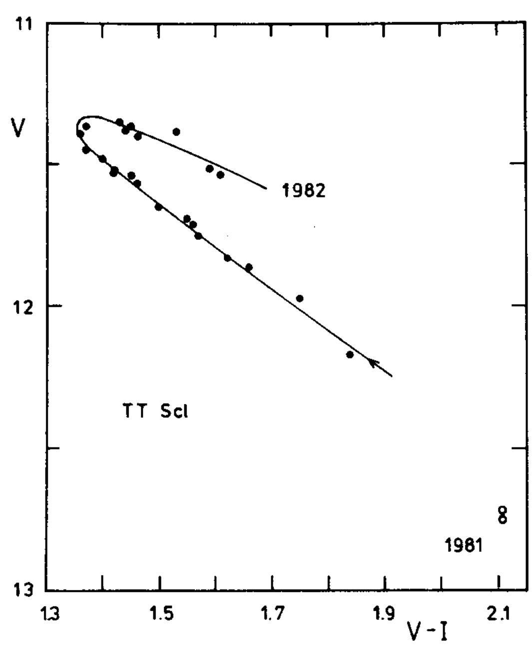

Fig. 3. The V versus V-I relation of TT Scl.

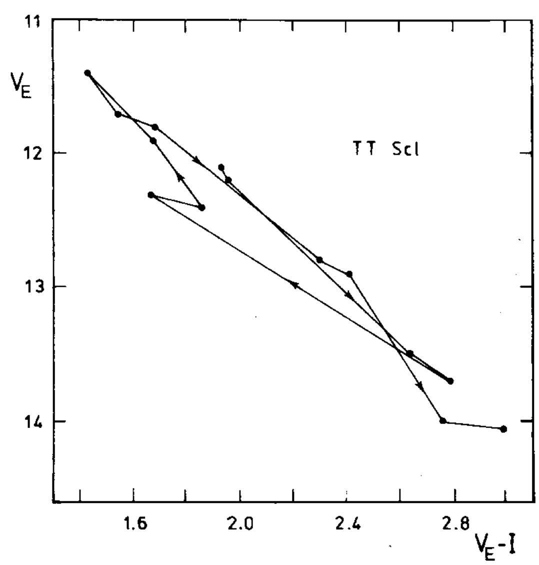

Fig. 4. The plot of V_E against V_E-I of TT Scl from data published by Eggen (1970).

The lightcurve of TT Scl, obtained in November and December 1982, is shown in Fig. 2. It went through a maximum around J.D. 2445340. In Fig. 3 the V versus V-I relation is given. The two datapoints obtained in 1981 are also indicated. It is clear that when the star rises to a maximum in brightness it becomes bluer, and then redder again when it becomes fainter. The scatter around the curve giving this relation is quite small.

It is of interest to compare this relation with that which can be derived from the observations of Eggen (1970). From his V_E lightcurve the V_E values, corresponding to the dates of measurements of R and R-I can be read off. These V_E values are then plotted against V_E-I in Fig. 4. This figure shows a back and forth looping, similar to what is shown in Fig. 3. The direction of the loopings in Fig.'s 3 and 4 are about the same.

There are two conspicuous emission lines in the IDS spectrum of TT Scl due to H_α and H_β. This spectrum shows further that TT Scl is not of spectral type M, in agreement with Eggen's suggestion that TT Scl is not an M-type star.

I would like to thank Dr. H.H. Loose and Dr. D. Schallwick for obtaining the IDS spectrum of TT Scl, and Mr. M. Pizzaro for reducing it. I am also indebted to Mr. S. van Amerongen and Mr. G. Alcaino for obtaining additional photometric observations of this **variable star.** I would also like to thank Dr. N. Vogt for pointing out to me that the variable star is TT Scl.

P.S. THÉ
Astronomical Institute Anton Pannekoek
University of Amsterdam,
Roetersstraat 15,
1018 WB Amsterdam,
NEDERLAND.

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FT LUPI: STUDY OF THE PERIOD AND LIGHT CURVE

FT Lupi (S 5001 = CoD $-42^{\circ}9876$ (9.6) = CPD $-42^{\circ}6864$ (9.3) = HD 132316 (F5) = BV 851 = CSV 2228) is a close eclipsing binary of the southern hemisphere. It was discovered photographically and classified as an Algol system by Hoffmeister (Erg.A.N.,12,1,1949). Subsequently Hoffmeister (Veröff. Sonn. 6,3,132,1965) published a photographic light curve and 27 times of minima, eleven of which are visual determinations; he determined a period P = $0^d.4700903$ days and reclassified FT Lupi as a β Lyr system with amplitudes A1 = 0.8 and A2 = 0.3 mag and suggested that irregularities in the light curve were present. Strohmeier (Mitt. Veränd. Sterne 3,1,1965) published an ephemeris with P = 0.4700895 days and indicated that no irregularities are superposed in the light curves. Further, Strohmeier (IBVS No.184, 1967) obtained an ephemeris (P = $0^d.470089$) from 34 photographic minima. Bauernfeind (Veröff. Bamberg, Band VIII,81,1968) gave 120 times of photographic minima; from these data he obtained a systematic trend of the residuals (O-C) in relation to the light elements given by Strohmeier in 1967. Strohmeier and Knigge (MNASSA 28,75,1969) catalogued S5001 (in Centaurus) as EA and quoted the ephemeris given in IBVS No.184. It was reported in Bull.A.A.S. 3,72,1971 that Gleim gathered 3-colour photoelectric observations at Cerro Tololo. Mauder and Kappelmann (A.G.Mitt. 55,72,1982) discussed FT Lupi among other interesting contact double stars. They showed a V light curve and commented a preliminary photometric solution and absolute elements. They gave a photoelectric period P = $0^d.470073 \pm 0.000002$, as well as a period variation leading to a mass transfer of about 0.3×10^{-6} $M_{\odot}$/year from the primary to the secondary component. Mauder and Kappelmann reproduced the O-C diagram of the minima given by Bauernfeind; they also plotted the minima obtained by Strohmeier (IBVS No.184,1967) and a minimum time found by themselves.

The present study is based on 675 UBV photoelectric observations obtained by one of us (S.L.L.) along four years since 1980 with the 154 cm reflecting telescope at Bosque Alegre Station of Cordoba Observatory; 16 times of minimum light covering about 1700 cycles were derived for each colour, individual

Table I

Min.	J.D. hel. (2400000 +)	Cycles	(O-C)	(O-C)'
II	44769.68020	-621.5	0.0021	0.0025
II	45002.83985	-125.5	0.0008	0.0010
II	45034.80671	-57.5	0.0023	0.0024
II	45060.65903	-2.5	0.0001	0.0002
II	45061.60021	-0.5	0.0011	0.0012
I	45061.83160	0.0	-0.0024	-0.0023
I	45063.71250	4.0	-0.0018	-0.0018
II	45064.88837	6.5	-0.0012	-0.0011
I	45090.50706	61.0	-0.0020	-0.0020
II	45090.74444	61.5	0.0003	0.0003
I	45116.83333	117.0	-0.0003	-0.0004
II	45117.53947	118.5	0.0006	0.0006
I	45117.77240	119.0	-0.0014	-0.0015
I	45531.44618	999.0	0.0001	-0.0008
II	45532.62285	1001.5	0.0017	0.0005
II	45533.56125	1003.5	-0.0001	-0.0009

minima from the three light curves never differed by more than 0.0003 days; their averages are listed in Table I. A least squares linear ephemeris from these data gives:

$$\text{Min. I} = \text{J.D.Hel. } \underset{\pm 0.0003}{2445061.8340} + \underset{\pm 0.0000007}{0\overset{d}{.}4700820} \cdot E \qquad (1)$$

The residuals (O-C) are listed in Table I. From these elements we computed the phases for the V-light and (B-V) colour curves shown in Figure 1. They are given differentially in relation to the comparison star HD 132201 (F0), in the sense variable minus comparison star. The light curve is precisely defined; no large scattering is observed (especially at minima) as found by Mauder and Kappelmann. The depth of primary minimum is 0.9 mag while for secondary is 0.28 mag. The maximum light following primary minimum is about 0.03

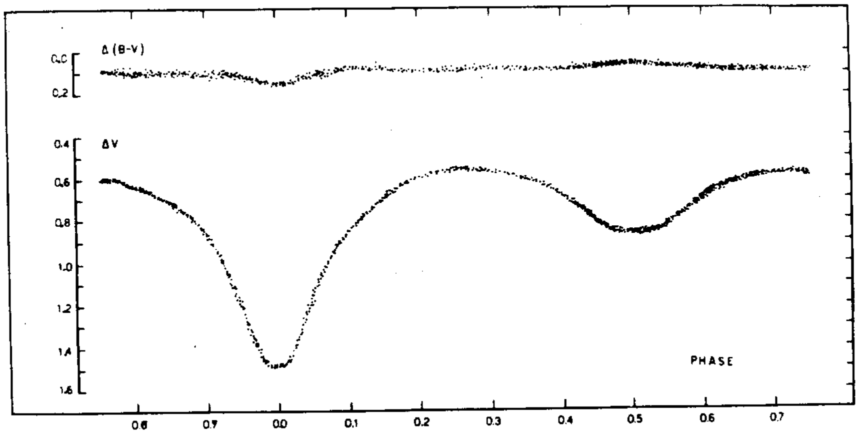

Figure 1

mag higher than that following secondary one. Our observations show the secondary minimum to be flat, thus being an occultation; the duration of this total eclipse is at least 45 min. The (B-V) colour curve is almost constant, except at primary eclipse which is redder by 0.05 mag and bluer at secondary one by about 0.02 mag.

Since there is a considerable number of minima published for FT Lupi during the last 80 years we included all of them in a period study. In the course of the analysis we found some trouble in identifying Bauernfeind's (1968) minima; a study of the data for different epochs and authors allowed a precise identification of all observations starting from the photoelectric data. Determination of the period for different epochs has clearly shown that it is becoming shorter; then all observations were included both in a linear and parabolic least squares ephemerides. The results are:

$$\text{Min. I} = \text{J.D.Hel. } 2445061.880 \pm 0.038 + 0\overset{d}{.}470089 \pm 0.000006 \cdot E \qquad (2)$$

$$\text{Min. I} = \text{J.D.Hel. } 2445061.834 \pm 0.025 + 0\overset{d}{.}470083 \pm 0.000002 \cdot E - 0.114 \cdot 10^{-9} \pm 0.029 \cdot 10^{-9} E^2 \qquad (3)$$

therefore the period is changing at a rate $\dot{P} = 0.0076$ sec/year. The (O-C)' values of the photoelectric observations from the parabolic elements are listed in Table I. The residuals for all observations are given in Figure 2 for the ephemerides (2) and (3). It should be noted that the parabolic elements are well defined, even for photographic and visual observations. A fit to these values exactly predicts, within the errors, the period and slope of the photoelectric elements found for 1981 - 1983.

In conclusion, we presented precise photoelectric V-light and (B-V) colour curves obtained during four years of observations. It was found that FT Lupi shows complete eclipses and that no seasonal changes of light were pre-

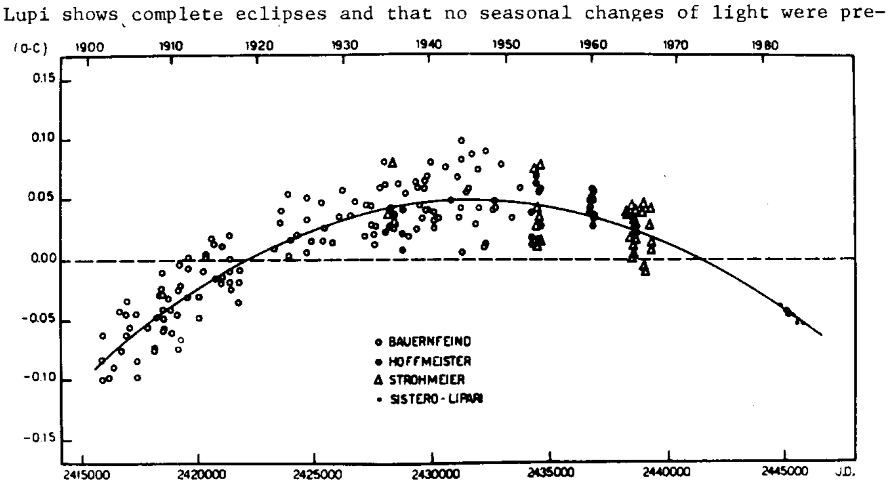

Figure 2

sent. A first detailed study of the period was made and its variation has been well established, though it is smaller by a factor of about 2 than that suggested by Mauder and Kappelmann (1982). The parabolic elements given by formula (3) should be used to predict future circumstances. Finally, we note that a periodic (O-C) light-time effect cannot be ruled out; this would be possible only for an orbital period larger than 160 years.

S.L. LIPARI* and R.F. SISTERO

Observatorio Astronomico and IMAF
Laprida 854 - 5000 Córdoba

Argentina

* member of CONICET, R.A.

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V1057 CYGNI

Photographic UBV magnitudes for this star have been obtained from plates taken with the Uppsala-Kvistaberg Schmidt telescope. The results are, with a probable error of about ±0.1 mag.:

Date	U	B	V
1980-10-09	14.1	13.1	11.2
1982-09-17	-	-	11.5
1983-10-06	14.5:	13.4	11.6

Thus the colours of the star have not changed significantly over the past three years, despite a decrease in visual brightness of about 0.4 mag.

GUNNAR WELIN
Astronomical observatory
Uppsala, Sweden

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PHOTOELECTRIC MINIMA TIMES OF BX ANDROMEDAE

Photoelectric observations of the eclipsing binary BX And were carried out during August and September 1982. The observations were made using a two-beam, nebular-stellar photometer attached to the 48 inch Cassegrain reflector at the Kryonerion Station of the National Observatory of Athens. The B and V filters used are in close accordance to the standard ones.

The minima times have been calculated using Kwee and Van Woerden's method (1956) and are the mean values from B and V observations. The ephemeris formulae used are:

$$\text{Min I (Hel.J.D.)} = 2436528.7777 + 0^{d}.61011534 \cdot E \qquad \text{(I)}$$

(GCVS, 1969 ; SAK, 1982),

$$\text{Min I (Hel.J.D.)} = 2443809.8873 + 0^{d}.61011508 \cdot E \qquad \text{(II)}$$

(Castelaz, 1979).

From our observations four minima times (two primaries and two secondaries) were found and are presented in the following Table, the successive columns of which give: the Hel.J.D., the $(O-C)_I$ and $(O-C)_{II}$ according to the two ephemeris formulae (I) and (II), respectively and the type of minimum.

T a b l e

Hel. JD 2440000.+	$(O-C)_I$ days	$(O-C)_{II}$ days	Min Type
5213.4622	-0.0023	+0.0052	sec
5217.4266	-0.0037	-0.0013	pri
5218.3475	+0.0021	+0.0095	sec
5220.4784	-0.0024	+0.0050	pri

P. ROVITHIS
National Observatory
of Athens
Athens 11851
Greece

H. ROVITHIS-LIVANIOU
Astronomy Department
Athens University
Panepistimiopolis
Athens (631)
Greece

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DETERMINATION OF CEPHEID DISTANCES BY MEANS OF WESENHEIT FUNCTION

It is well known that the determination of Cepheid distances is complicated by the necessity of taking into account the effect of the interstellar absorption. Here we propose a method for determination of true distances when only the ratio R of total A_V to selective absorption E_{B-V} is known:

$$R = A_V/E_{B-V}$$

To solve this problem we use the Wesenheit function W introduced by van den Bergh (1968) and discussed by Madore in a series of papers, e.g. Madore (1982). The important property of this function is its independence on interstellar absorption:

$$W = \langle V\rangle_o - R\langle B-V\rangle_o = \langle V\rangle - R\langle B-V\rangle \quad (1)$$

where $\langle V\rangle = \langle V\rangle_o + A_V$ and $\langle B-V\rangle = \langle B-V\rangle_o + E_{B-V}$.

A similar function for absolute magnitude $M_{\langle V\rangle}$ has been defined by Madore (1976):

$$W_M = M_{\langle V\rangle} - R\langle B-V\rangle_o \quad (2)$$

This expression can be compared with the P-L-C relation for classical Cepheids pulsating in fundamental mode:

$$M_{\langle V\rangle} = a\cdot \log P_F + b\langle B-V\rangle_o + c \quad (3)$$

From Eqs. (2) and (3) we have:

$$W_M = a\cdot \log P_F + (b-R)\langle B-V\rangle_o + c \quad (4)$$

It was stated many times that the numerical value of the coefficient b is very poorly determined by the observational data. Even the method of calculation, least squares or maximum likelihood, may influence significantly the value of this coefficient, as is shown in the paper by Martin, Warren and Feast (1979) where quantities from 2.18 to 3.08 have been obtained. The reason is that b determines the slope of constant P lines on the $M_{\langle V\rangle} - \langle B-V\rangle_o$ plane. These lines are nearly perpendicular to the axis of rather narrow stripe occupied by classical Cepheids and it is difficult to fix the accurate value of the slope b.

Taking into account this fact we propose to assume that b equals R, for which we accept the value 3.20 according to Seaton (1979):

$$b = R = 3.20 \quad .$$

This makes W_M depending only on P_F :

$$W_M = a \cdot \log P_F + c \tag{5}$$

This way we take advantage of the accidental, numerical similarity of two dimensionless quantities: R describing the optical property of the interstellar matter and b appearing in the P-L-C relation, when V and B photometric systems are used.

To illustrate the result of the proposed procedure we have calculated P-L-C and P-W_M relations by means of the data of the author's paper (Opolski, 1982, Table II) where the values $\log P_F$, $M_{<V>}$ and $<B-V>_o$ for 66 Cepheids are listed. The results achieved by the least squares method are as follows:

$$M_{<V>} = -3.8601 \log P_F + 2.731 <B-V>_o - 2.782 \tag{6}$$

s.d.= $\pm$ 0.202

$$W_M = M_{<V>} - 3.20 <B-V>_o = -4.0988 \log P_F - 2.897 \tag{7}$$

s.d.= $\pm$ 0.205 .

Comparing the standard deviations in these formulae we see that the accuracy of the three parameter relation for $M_{<V>}$ with $b = 2.731$ is practically the same as that for W_M with two parameters where we constrain the coefficient b to be equal to 3.20 .

This fact makes it easy to calculate the true distance moduli avoiding the direct taking into account the interstellar absorption. From Eqs. (1) and (2) we have:

$$W - W_M = <V>_o - M_{<V>} = Mod_W = 5 \cdot \log r_W - 5 \tag{8}$$

where Mod_W is the distance modulus and r_W the true distance in parsecs. Now taking advantage of the properties of the functions W and W_M , Eqs. (1) and (5), we get the relations:

$$Mod_W = W - W_M = <V> - 3.20 <B-V> - a \log P_F - c \tag{9}$$

$$\log r_W = 0.2[<V> - 3.20 <B-V> - a \log P_F - c] + 1 \tag{10}$$

where only directly observed quantities P_F , V and <B-V> are used.

The numerical values for a and c in Eqs. (9) and (10) can be taken from the formula (7). But we can also calculate W_M for calibration Cepheids, members of clusters or associations for which Mod are known:

$$W_M = W - Mod = <V> - 3.20 <B-V> - Mod \tag{11}$$

and then we can fix the $P_F - W_M$ relation. From the published moduli of cali-

Table I. Distance moduli Mod and function W_M for calibration Cepheids

	log P	<V>	<B-V>	Mod	W_M
SU Cas	0.290	$5^m.969$	$0^m.725$	7.76	-4.11
EV Sct	0.490	10.128	1.157	11.29	-4.86
CE Cas b	0.651	10.988	1.140	12.79	-5.45
CF Cas	0.687	11.110	1.227	12.79	-5.61
CE Cas a	0.711	10.919	1.213	12.79	-5.75
UY Per	0.730	11.306	1.591	12.16	-5.94
CV Mon	0.731	10.296	1.365	11.37	-5.44
U Sgr	0.828	6.714	1.142	9.24	-6.18
DL Cas	0.903	8.942	1.216	11.54	-6.49
S Nor	0.989	6.414	0.969	10.02	-6.71
VX Per	1.037	9.300	1.242	12.16	-6.83
SZ Cas	1.134	9.826	1.505	12.16	-7.15
VY Car	1.277	7.446	1.193	11.73	-8.10
RU Sct	1.294	9.500	1.779	11.76	-7.95
RZ Vel	1.310	7.114	1.209	11.39	-8.14
SW Vel	1.371	8.126	1.252	12.25	-8.13
RS Pup	1.617	7.006	1.489	11.56	-9.32
SV Vul	1.654	7.221	1.534	11.77	-9.46
S Vul	1.826	9.00	1.92	13.38	-10.52

bration Cepheids we have selected 19 stars listed in Table I. The moduli have been corrected to one system based on the Hyades modulus Mod = 3.31 according to Hanson (1978). The $P_F - W_M$ relation achieved by the least squares method is as follows:

$$W_M = -4.0455 \log P_F - 2.797 \tag{12}$$

s.d. = ±0.158.

This result is very similar to Eq. (7) but has better accuracy and we propose it as final. So for galactic classical Cepheids pulsating in the fundamental mode we have distance moduli Mod_W and distances r_W expressed by the formulae:

$$Mod_W = \langle V\rangle - 3.20\langle B-V\rangle + 4.0455 \log P_F + 2.797 \tag{13}$$

$$\log r_W = 0.2\langle V\rangle - 0.64\langle B-V\rangle + 0.8091 \log P_F + 1.559 \tag{14}$$

With the aid of these relations it is possible to calculate Mod_W and r_W for a large number of Cepheids, e.g. contained in the catalogue by Schaltenbrand and Tammann (1971). Such an investigation is in progress.

An attempt to apply Eq. (14) to galactic Cepheids was made by comparing log r calculated by means of the standard relation:

$$\log r = 0.2[\langle V\rangle - M_{\langle V\rangle} + 5 - 3.20\, E_{B-V}] \tag{15}$$

with $\log r_W$ resulting from Eq. (14). The data needed for these calculations have been taken from papers: <V> and <B-V> — Schaltenbrand and Tammann (1971), $M_{\langle V\rangle}$ — Opolski (1982), E_{B-V} — Dean, Warren and Cousins (1978). As the result we got the mean difference $\Delta \log r = \log r - \log r_W = +0.0286 \pm 0.0044$ and standard deviation of an individual star ±0.038 .

Application of Eq. (13) to the extragalactic Cepheids in the Magellanic Clouds with the photometric data taken from Gascoigne (1969) and Madore (1975) for stars with periods $0.3 < \log P_F < 2.2$ led to the following results:

LMC - 33 stars: $Mod_W = 19.07 \pm 0.21$, $r_W = 65.2 \pm 6.6$ kpc

SMC - 32 stars: $Mod_W = 19.79 \pm 0.18$, $r_W = 90.8 \pm 7.8$ kpc

The details of these investigations will be published in a separate paper.

ANTONI OPOLSKI
Wrocław University Observatory
Wrocław, Poland

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AD Leo FLARE MONITORING

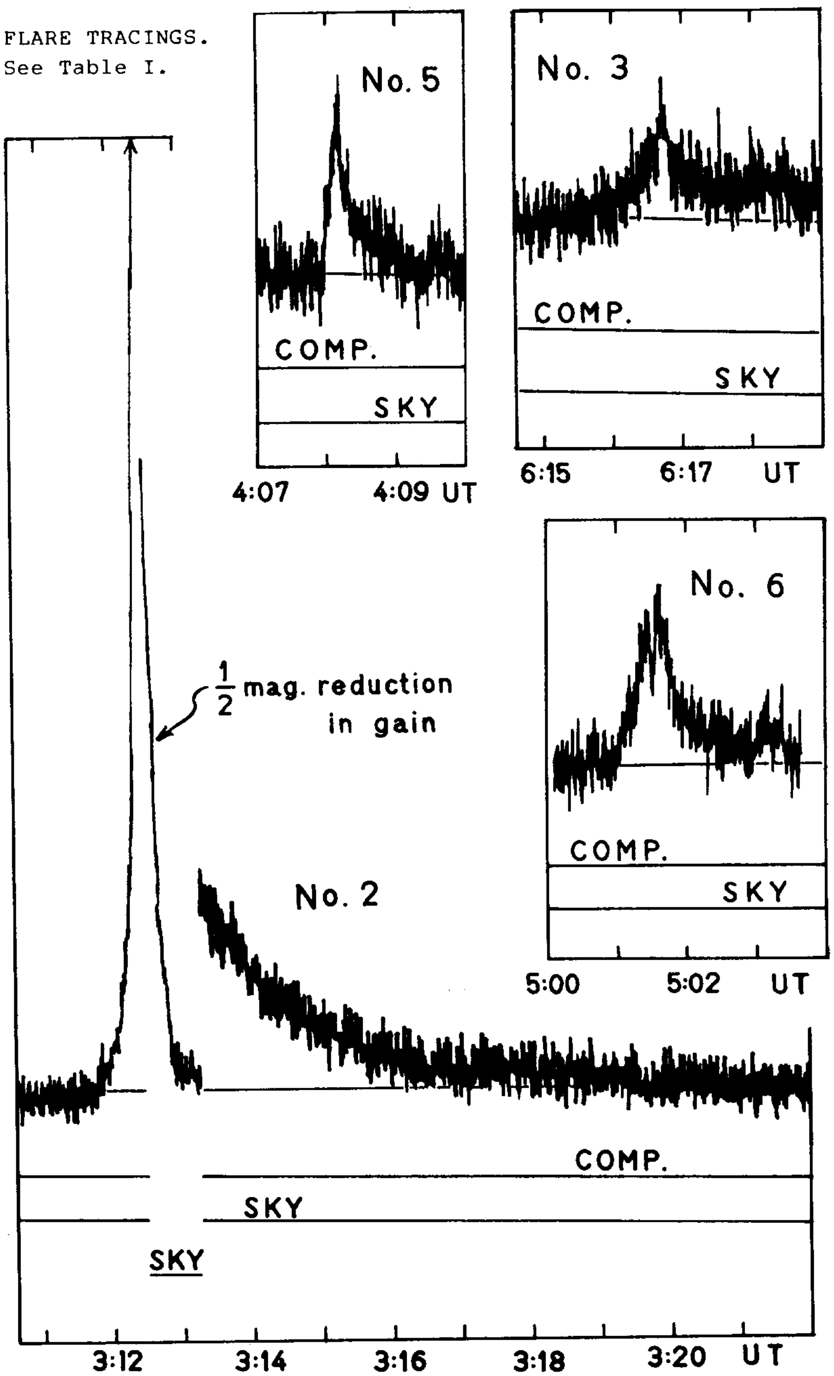
Thirteen hours and eleven minutes of photoelectric ultraviolet monitoring during the spring of 1982 yielded six events on AD Leonis. Light collected by the 61-cm Cassegrain (f/16) at Mt. Cuba Observatory was directed through a Corning 7-54 (standard U) filter and quartz Fabry lens to be measured by an EMI 6256S photomultiplier. The instrumental system is not transformed nightly to the Johnson UBV system but is consistent with previous AD Leo photometry from Mt. Cuba and uses the same comparison star, as recommended in I.B.V.S. No. 326.

Tracings from the strip-chart recorder are reproduced in the figures for the four largest flares. This unreduced data may be compared with the values tabulated in Tables I & II. Table I shows the time of maximum brightness for each event, the difference in magnitude between the star at maximum and at quiescence as interpolated from from adjacent monitoring, the duration before (t_b) and after (t_a) maximum, the integrated intensity from the planimetered area between the flare tracing and the interpolated quiescence deflection in ratio to the mean quiescent deflection, and the air mass through which the star was viewed at the time of maximum.

Table I. Flares of AD Leo

No.	U.T. of Maximum Date 1982	Time hr min	Δm mag	t_b min	t_a min	P min	Air Mass
1	March 25	4 53.6	0.15	3.4	5.6	0.97	1.15
2	March 29	3 12.46	2.5	0.8	8.2	3.85	1.06
3	April 1	6 16.70	0.61	1.3	7.2	1.41	1.53
4	April 15	3 23.5	0.33	1.5	3.0	0.40	1.14
5	April 15	4 08.21	1.17	0.20	0.1	0.46	1.23
6	April 15	5 01.6	0.69	0.8	0.4	1.52	1.43

FLARE TRACINGS.
See Table I.



Noise estimates near the time of the flares may be found in Table II which also gives the difference in magnitude between AD Leo and its comparison star at a distribution of times when no flaring was obvious. Estimates of noise (σ) are made (as in previous reports) by examining four-minute intervals of typical monitoring centered on the tabulated times. Within each interval we note the deflection levels that are exceeded by the chart pen for fractions of the time appropriate to standard deviations of $\pm 2\sigma$ and of $\pm 3\sigma$. Our value of σ (in deflection units) is the average based on these four estimated levels. By dividing σ into I_o, the mean signal deflection, we obtain the tabulated signal/noise ratio. Note that this procedure means that our noise estimates are based primarily on the high frequency components of the statistical noise; i.e., pen excursions often of only one or two seconds duration. Although this is descriptive of the quality of the signal, it is not a number to be simply equated to flare detectability, which also involves the duration and shape of the signal elevation.

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

1982 Date	& Time hr	min	JD 2445000+	$m_c - m_v$	$\frac{I_o}{\sigma}$	Air Mass
March 23	3	43	51.6549	1.15	13.5	1.07
March 25	4	04	53.6694	1.14	9.1	1.08
"	4	30	53.6875	1.31	8.1	1.11
"	5	38	53.7347	1.19	7.2	1.25
March 29	2	43	57.6132	1.17	11.0	1.06
"	4	32	57.6889	1.20	10.6	1.14
"	5	22	57.7236	1.16	7.9	1.25
April 1	6	05	60.7535	1.06	8.6	1.47
"	7	26	60.8097	1.15	7.7	2.17
April 15	2	05	74.5868	1.33	10.8	1.06
"	3	49	74.6590	1.25	10.5	1.18
"	5	37	74.7340	1.21	8.4	1.63
April 20	3	33	79.6479	1.25	9.4	1.19
"	4	34	79.6903	1.16	9.4	1.39
April 22	2	49	81.6174	1.18	9.3	1.12
"	3	33	81.6479	1.19	10.5	1.21
"	4	12	81.6750	1.14	9.1	1.33

Table III. Monitoring Coverage in 1982

Date	U.T. in hours and minutes
March 23	3:35.3-3:46.6
March 25	3:36.0-3:42.0, 3:57.2-4:08.0, 4:13.3-4:22.0, 4:26.5-4:37.0, 4:42.1-4:54.7, 4:56.0-5:09.0, 5:12.6-5:23.1, 5:26.5-5:34.0, 5:35.5-5:42.0, 5:46.0-6:00.0.
March 29	2:03.8-2:14.1, 2:16.5-2:25.3, 2:29.1-2:38.0, 2:40.8-2:52.1, 2:55.5-3:04.0, 3:07.3-3:23.7, 4:13.7-4:21.9, 4:27.0-4:37.0, 4:39.9-4:49.0, 4:51.6-5:02.0, 5:04.7-5:15.0, 5:18.7-5:29.0, 5:31.8-5:41.0, 5:43.6-5:53.0, 5:56.2-6:03.4.
April 1	5:56.8-6:07.0, 6:10.2-6:19.0, 6:21.4-6:30.2, 6:32.8-6:42.0, 6:45.0-6:54.9, 6:57.2-7:00.0, 7:01.0-7:07.0, 7:10.7-7:19.0, 7:21.0-7:31.0, 7:33.2-7:43.0.
April 15	1:03.6-1:13.0, 1:16.8-1:33.0, 1:36.9-1:46.9, 1:48.4-1:58.2, 2:00.6-2:10.9, 2:12.2-2:24.2, 2:44.0-2:55.9, 2:57.6-3:10.7, 3:13.6-3:26.0, 3:28.0-3:40.2, 3:41.9-3:54.0, 3:56.4-4:12.4, 4:16.2-4:27.0, 4:29.5-4:39.0, 4:44.7-4:53.2, 4:55.2-5:03.6, 5:06.0-5:18.0, 5:19.7-5:28.3, 5:30.9-5:40.3, 5:42.8-5:54.0, 5:56.4-6:05.6.
April 20	3:29.9-3:41.0, 3:43.4-3:53.0, 3:54.6-4:04.0, 4:06.0-4:17.0, 4:19.0-4:29.0, 4:31.6-4:41.3, 4:44.0-4:55.0, 4:57.3-5:10.2, 5:12.4-5:23.7, 5:25.2-5:37.0, 5:39.5-5:50.0.
April 22	2:44.2-2:54.1, 2:56.0-3:11.8, 3:15.6-3:25.4, 3:28.0-3:38.7, 3:40.8-3:51.0, 3:53.5-3:59.6, 4:01.0-4:07.0, 4:08.5-4:16.2, 4:18.5-4:28.5, 4:31.4-4:41.4.

RICHARD B. HERR
JEFFREY D. FRANK

Mt. Cuba Observatory and
Department of Physics
University of Delaware
Newark, Delaware 19711
U. S. A.

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PHOTOELECTRIC HαN AND HαW OBSERVATIONS OF R CMa*

The eclipsing binary system R CMa (BD - 16° 1898) was observed in 8 nights from February 18 to March 2, 1983 using a photoelectric photometer mounted on the 51 cm Cassegrain reflector of Biruni Observatory. The photoelectric photometer is equipped with an unrefrigerated RCA 4509 multiplier photocell and a Leeds and Northrup Speedomax was used to record the amplified signal from the photomultiplier. The observations were made using Strömgren HαN and HαW filters possessing characteristics indicated in Table I. The observing sequence was the usual pattern of sky - comparison - variable (3 times) - comparison - sky, with each observation lasting about 50 seconds.

Table I. Filter characteristics

Filter designation	λ(max) (Å)	FWHM(Å)	Max. Transmission
HαW	6583	238	47 %
HαN	6569	38	57 %

BD - 15° 1734 was used as the comparison star and BD - 15° 1732 was observed once a night as the check star. The effects of differential atmospheric extinction were removed using the extinction coefficients derived from the comparison star observations. The differential corrections were, however, small due to the angular proximity of the variable and comparison stars. Light curves are plotted in Figure 1 where the phases were computed according to the following ephemeris (Koch, 1960):

$$\text{Min I} = \text{HJD } 2422030.638 + 1^{d}.1359386\,E$$

but a correction of $0^{d}.0211$ was added to the epoch to bring the recent primary minimum to the 0.0 phase. HαN - HαW index was also computed but no significant phase-dependent variation greater than the observational scatter was observed.

According to Guinan (1977 and 1983) R CMa is an old, high velocity, semi-detached eclipsing binary with mass loss and exchange whose period undergoes changes (an abrupt change in period was observed around 1914) and exhibits

* Contribution No. 10, Biruni Observatory

asymmetry in the light curve. All these suggest that the system should be observed and studied more.

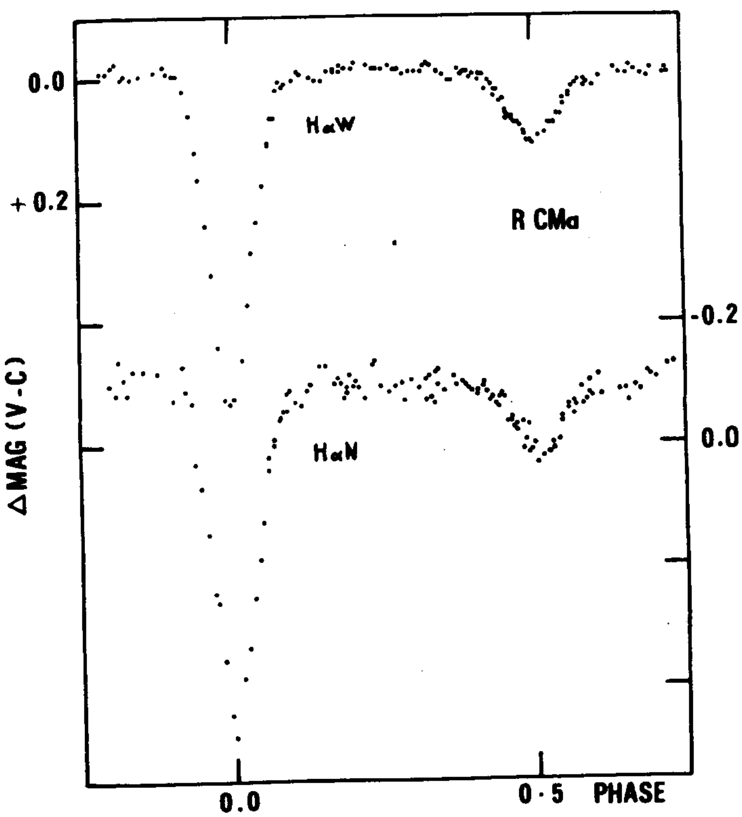

Figure 1. The HαN and HαW light curves of R CMa as a function of orbital phase

We are presently analysing the observed light curves using Kopal's method for partial eclipses (Edalati, 1978). The characteristic parameters of the light curve are given as follows:

Min I (observed) = 2445391.2364 ; O–C = $0^{d}.0211$

Amplitudes:

Min I (HαW) = $0^{m}.545$, Min II (HαW) = $0^{m}.120$

Min I (HαN) = $0^{m}.570$, Min II (HαN) = $0^{m}.115$

Mean values of Δα(V–C) index:

phase interval		$\Delta\alpha$(V–C)
0.97 – 0.03	(Min I)	-0.08 ± 0.01
0.10 – 0.40	(Max I)	-0.08 ± 0.02
0.47 – 0.53	(Min II)	-0.07 ± 0.02
0.60 – 0.90	(Max II)	-0.09 ± 0.03

M.T. EDALATI and B. KHALESSE
Physics Department
School of Sciences
Mashad University
Mashad, Iran

N. RIAZI
Biruni Observatory
Shiraz University
Shiraz, Iran

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NEW OBSERVATIONS OF HZ Her

During the period 27 August - 25 September 1983 photographic observations of the variable star HZ Her were carried out at the Byurakan Astrophysical Observatory with the 40in./52in. Schmidt telescope in U-light (ORWO ZU-21+UG1). The results of the photometry are listed in the Table. During 4^h03^m of the observations 12 plates were obtained, 8 of them by the method of multiple exposure. For these plates the magnitudes listed correspond to the mean values of HZ Her.

Date (1983)		Time of observation (UT)	Time of exposure	m_u
August	27	17^h38^m	$6x5^m$	$12^m.5$
	31	19 15	$8x5^m$	15.3
	31	19 55	15^m	15.2
September	1	19 13	$9x5^m$	12.5
	2	18 05	$6x5^m$	13.7
	13	18 58	10^m	13.2
	14	17 14	$6x3^m$	14.2
	14	18 50	$4x5^m$	14.2
	15	17 10	$6x1^m$	13.4
	15	18 00	$3x3^m$	13.7
	25	16 15	5^m	12.8
	25	16 32	15^m	13.4

The date, the time (UT) of the middle moment of exposure time, and the U magnitudes are listed in the Table. The brightness of HZ Her in U-light during our observations varied from $15^m.3$ to $12^m.5$.

V.V. HAMBARIAN, G.H. BROUTIAN

Byurakan Astrophysical Observatory,
Armenian SSR, 378433
USSR

CORRIGENDUM

The last six Julian days in Table I of I.B.V.S. No. 2331 (9 May 1983) were erroneously given. The correct version of the Table given by Dr. O.J. Eggen is as follows:

TABLE I. Intermediate Band and Hβ Observations of HD 87072

JD 244	Phases	V	b-y	M_1	C_1	β
4693.701	0ᵖ267	8ᵐ35	0ᵐ480	0ᵐ238	0ᵐ784	2ᵐ642
4694.688	0.745	8.34	0.477	0.240	0.774	2.649
5032.701	0.550	8.44	0.501	0.248	0.735	2.637
5050.688	0.266	8.33	0.476	0.232	0.763	2.645
5051.968	0.756	8.37	0.486	0.242	0.776	2.647
5052.715	0.249	8.33	0.465	0.237	0.765	2.654
5057.677	0.653	8.40	0.485	0.250	0.743	2.647
5058.652	0.126	8.26	0.456	0.225	0.808	2.663
5068.604	0.949	8.21	0.443	0.211	0.817	2.674
5069.622	0.442	8.43	0.496	0.244	0.733	2.640
5070.625	0.928	8.22	0.443	0.215	0.832	2.675
5090.604	0.610	8.44	0.499	0.240	0.722	2.646
5119.503	0.615	8.41	0.498	0.236	0.751	2.643
5151.472	0.107	8.26	0.435	0.239	0.839	2.672
5152.476	0.594	8.44	0.501	0.246	0.751	2.643
5153.490	0.085	8.24	0.440	0.242	0.818	2.673
5370.847	0.419	8.40	0.505	0.236	0.744	2.642
5376.785	0.296	8.37	0.500	0.241	0.742	2.643
5377.781	0.779	8.34	0.482	0.229	0.763	2.648
5378.837	0.290	8.38	0.500	0.256	0.748	2.643
5382.833	0.227	8.31	0.474	0.226	0.802	2.654
5383.783	0.688	8.39	0.477	0.237	0.780	2.649
5384.750	0.156	8.30	0.457	0.236	0.820	2.671
5385.733	0.633	8.42	0.476	0.258	0.752	2.646
5386.594	0.050	8.22	0.439	0.224	0.835	...
5386.809	0.154	8.28	0.456	0.225	0.821	2.663

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PHOTOMETRIC STUDY OF IO ANDROMEDAE

The cataclysmic variable IO Andromedae (= S 10785) was discovered in 1975 by Meinunger (1975) and classified as an irregular variable of Ia type. In 1979 Meinunger (1980) suspected that it belonged to AM Her-type objects. Its spectrum is typical of cataclysmic variables, but until now there have been no data about its spectral changes and rapid variability.

IO Andromedae was inspected on nearly 630 photographic plates (mainly ORWO ZU-2) centred on M 31 which were exposed by Prof. A.S. Sharov and his collaborators at the AZT-5 telescope at the Southern Station of Sternberg State Astronomical Institute. The brightness of comparison stars was obtained by fitting them to the B-magnitudes of standard stars published by Baade and Swope (1963) (region No. 4) by using the iris-photometer of Sternberg Astronomical Institute. The finding chart is shown in Figure 1, the adopted brightness of the comparison stars is given in Table I, where B are our results, m_M- Meinunger's (1975). The difference between the magnitude scales is mainly due to the error of zero-point.

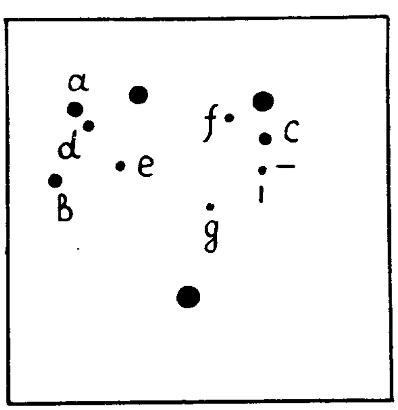

Figure 1

The finding chart for IO Andromedae

Table I

Comparison stars for IO Andromedae

*	B	m_M	*	B	m_M
a	15.34		e	16.58	16.8
b	15.96		f	17.31	
c	16.01	16.3	g	17.60	17.3
d	16.14				

Figure 2 shows the light curve of mean season brightness. Unlike AM Herculis (Hudec and Meinunger, 1976) and MV Lyrae (Wenzel, 1980 and Andronov and Shugarov, 1982), the active and inactive states are much less pronounced. The mean season brightness is variable with an amplitude of about $0\overset{m}{.}6$, never more than $1\overset{m}{.}4$. A five-year cycle of luminosity changes is possible although the system was bright in 1975.

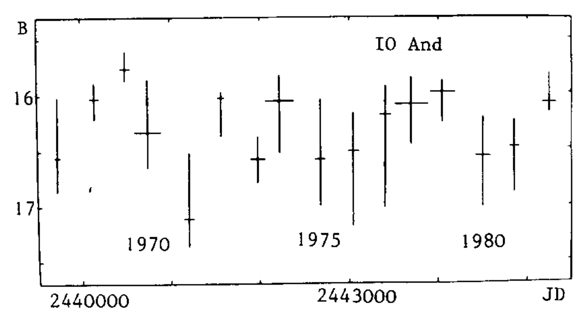

Figure 2

Mean season brightness of IO And. The vertical line corresponds to the interval of brightness changes. The horizontal line marks the mean value.

The seasonal light curves are shown in Figure 3. The interval of brightness changes in our data ($15\overset{m}{.}6$ - $17\overset{m}{.}5$) is somewhat greater than in Meinunger's (1975) data (with his comparison stars): $16\overset{m}{.}2$ - $17\overset{m}{.}1$. The mean brightness from all observations is $16\overset{m}{.}32$ with $\sigma = 0\overset{m}{.}37$. The histogram is asymmetric with bright end decrease being more steep. If $P(B_o)$ is the probability of $B \le B_o$, then for $P(B_o)$ equal to 1/4, 1/2, 3/4 one may obtain the values $15\overset{m}{.}99$, $16\overset{m}{.}23$ and $16\overset{m}{.}49$ for B_o.

Fluctuations with an amplitude of $0\overset{m}{.}4$ and a time-scale of 0.5 hour are present. More rapid variability is possible. Night-to-night changes have similar amplitude, and there is a tendency for it to increase up to $0\overset{m}{.}5$ in intermediate state although in active and inactive states it reduces to $0\overset{m}{.}3$. These changes are not periodic, the observed time intervals between two successive minima are from 4 to 16 days. Fluctuations may mask orbital changes.

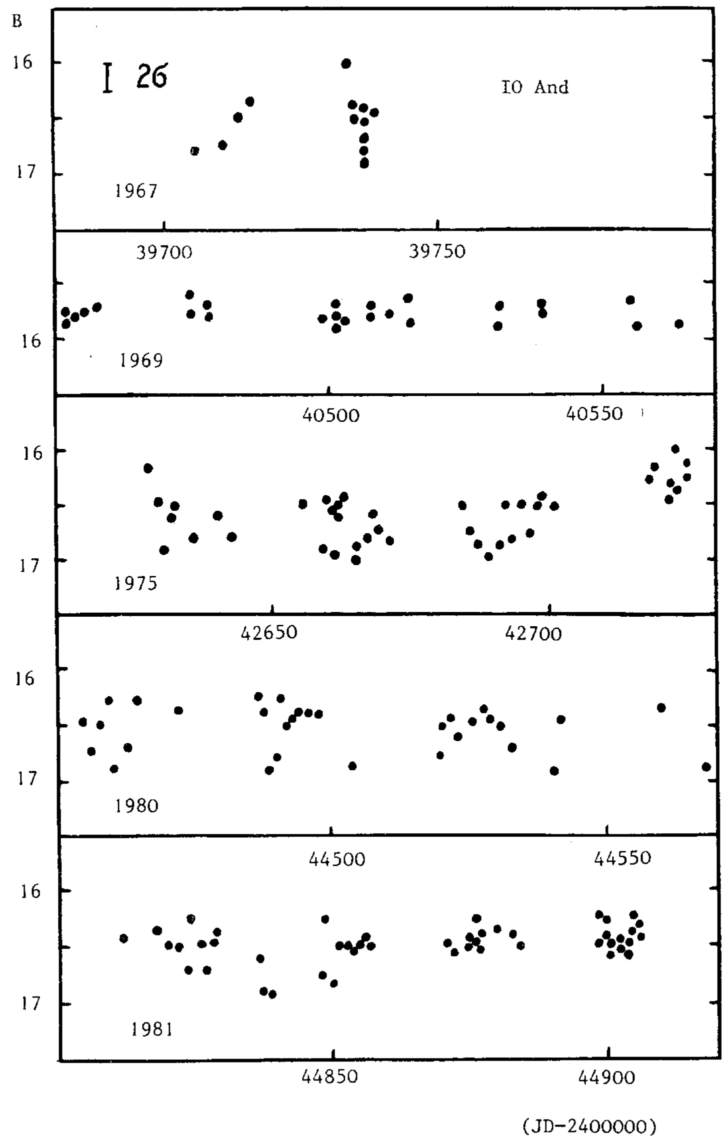

Figure 3
Some seasonal light curves of IO Andromedae

In the years 1968/69, 1972/73, 1978/79 and 1982, the amplitude was minimal, night-to-night changes were masked by rapid fluctuations and observational errors. These "standstills" lasting several months are common for all seasonal light curves and do not depend on their amplitude and system luminosity.

The star was very bright in the U-band. On 14 October 1974 its brightness on one plate was $13^{m}.4 \pm 0^{m}.5$. In the B-band the brightness was slightly variable around $16^{m}.0$. In the V-band the system was faint. On 13 October 1974 it was as bright as comparison star c.

Photometrically, the system looks like V 794 Aquilae which was also classified as a polar by Meinunger (1979). Flares in IO And are slightly narrower than discovered by Petrochenko and Shugarov (1982) in V 794 Aql ($\sim 22^{d}$) and have significantly smaller amplitude (compared with 2^{m} in V 794 Aql). Perhaps these two systems are novalike variables, but not polars.

One may note an analogy with the active state of MV Lyrae. If we have not detected decreases in brightness greater than $1^{m}.5$ before, it does not mean that they might not occur. As we know, MV Lyrae was in active and intermediate states from the beginning of the century and it became fainter (by 6^{m}) in 1979 - being in this state for about 3 years (Andronov and Shugarov, 1982).

Photometric, polarimetric, X-ray and spectral observational sequences are needed to make the classification more plausible.

The author is thankful to Professor A.S. Sharov for his kind permission to use photographic plates from his collection.

I.L. ANDRONOV

Odessa Astronomical
Observatory, USSR

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ON THE CYCLE LENGTH OF THE CATACLYSMIC VARIABLE T LEONIS

T Leonis has one of the shortest orbital periods (1^h25^m) of the cataclysmic binaries with late type secondaries. To my knowledge, only the periods of the long cycle dwarf novae WZ Sge and SW UMa and of the polar EF Eri are shorter (around 1^h22^m). To estimate the cycle length of T Leo therefore seemed important. Up to now only four eruptions were explicitly mentioned in the literature, three of them of the past century plus the one of 1967 June 2, observed by Cragg of the AAVSO (Sky Telesc. 37, 128, Journ.R.Astron.Soc. Canada 62, 142). Five further maxima (1962 Febr. 10, 1971 May 29, 1982 Apr. 12 and June 23, 1983 March 24), detected by members of the AAVSO (Lowder et al.) and AFOEV (Verdenet, Candela, Minois, Bruno and Hanon), remained rather unnoticed.

A total of N = 807 suitable Sonneberg patrol blue plates were checked for maxima of the star. The exposures have been taken since 1929.5 mainly by P. Ahnert and H. Huth of fields centred at 12^h+10^o, 12^h-4^o, 12^h0^o, the declinations of which were chosen one after another and valid for several years each. n = 16 plates of this material show 14 reliable eruptions. Eight of these are represented also on overlapping neighbouring fields, or on simultaneous photovisual exposures on which the star is remarkably fainter in maximum than on the blue sensitive ones. Available records on regular visual series obviously started at 1955 (AAVSO Quarterly Report 22). Since then four maxima have been showing on our investigated exposures. Two of these eruptions are common to AAVSO findings, whereas four further visually detected maxima are not on the checked series because of moonlight or evening twilight.

Taking into account the sun and moonlight gaps in the photographic material of that region and the losses because of meteorological reasons we estimate that 30% of all eruptions are represented on the investigated plates. Therefore we get for the mean cycle length

$$\bar{c} \approx \frac{1983.3 - 1929.5}{14} * 364*0.3 = 420^d.$$

Another approach can be arrived at by considering the ratio N/n in combination with the mean duration $\bar{L}$ of maxima. The observations yield individual values of L lying between $< 6^d$ and $>11^d$. We take $\bar{L} = 5...10$ days and have

$$\bar{C} \approx \bar{L} \cdot \frac{N}{n} = 250...500 \text{ days.}$$

At present it cannot be decided whether the star exhibits two sorts of eruptions (short ones and supermaxima). It should be mentioned that faint $14^m.5$ traces of the variable could occasionally be perceived on the plates. We are inclined to interprete them as due to fluctuations in minimum brightness and therefore we count only observations $< 12^m.6$ as belonging to real outbursts.

A cycle length near 400 days places T Leonis well to the vicinity of SW UMa, V 436 Cen, EK TrA and OY Car, not to speak of WZ Sge, all of them lying in the shortest orbital period domain. The only exception from this tendency recognizable so far is 3A 1148+719, which seems to have a mean cycle length of several years (Wenzel, I.B.V.S. No. 2262, Mitt.Veränd.Sterne Sonneberg 9, 141) at an orbital period of 3^h55^m.

A list of the observed eruptions and some further details will be published in Mitt.Veränd.Sterne Sonneberg 10, No. 2.

W. WENZEL

Sternwarte Sonneberg
Zentralinstitut für Astrophysik
der Akademie der Wissenschaften
der DDR

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SUDDEN BRIGHTENING OF THE RECENTLY DISCOVERED Be STAR HR 7739

As a by-product of the on-going photoelectric observations of bright Be stars at the Hvar Observatory (carried out in the framework of the international IAU campaign by a group of Czechoslovak and Yugoslav astronomers) HR 7739 (HD 192685, BD+25^{o}4165), a bright B3 V star, was discovered to be a variable star (Harmanec et al., 1982, Pavlovski and Božić, 1982). Until then, the star was used as a comparison star for the Be stars 20 Vul and 25 Vul. Following the discovery of the light changes, Barker (1982, 1983) announced that HR 7739 is a Be star, the only previous observation from September 20, 1980 shows the H alpha as a broad absorption line. The emission strengthened rapidly at the beginning of September 1982, reaching some 30 per cent above the continuum level in the period October-December 1982.

Our UBV observations of HR 7739 cover the period July 9, 1981 - December 4, 1982. They were reduced differentially to 17 Vul, which originally served as the check star for the group. Its UBV magnitudes, derived at Hvar and used here, are given, together with some other magnitude determinations, in Table I. Our standard observational and reduction technique (Harmanec et al., 1977) was used.

Table I

UBV data of 17 Vul

V	B-V	U-B	Source
5.07	-0.180	-	Haggkvist and Oja (1966)
5.07	-0.18	-0.70	Eggen (1969)
5.06	-0.18	-0.68	Crawford et al. (1971)
5.066	-0.163	-0.685	this paper

Figure 1 shows the light curve (normals from 2-5 observations each night) in V, B-V and U-B, together with the peak intensity of the H alpha emission measured on Barker's (1983) profiles. A correlated behaviour of the light, colour, and the H I emission is clearly seen. The rapid strengthening of the H alpha emission was accompanied by the brightening of the object, reddening of the B-V, and blueing of the U-B index. It is notable, however, that the subsequent light decrease, observed on December 4, 1982, occured at a time when the emission was still rather strong.

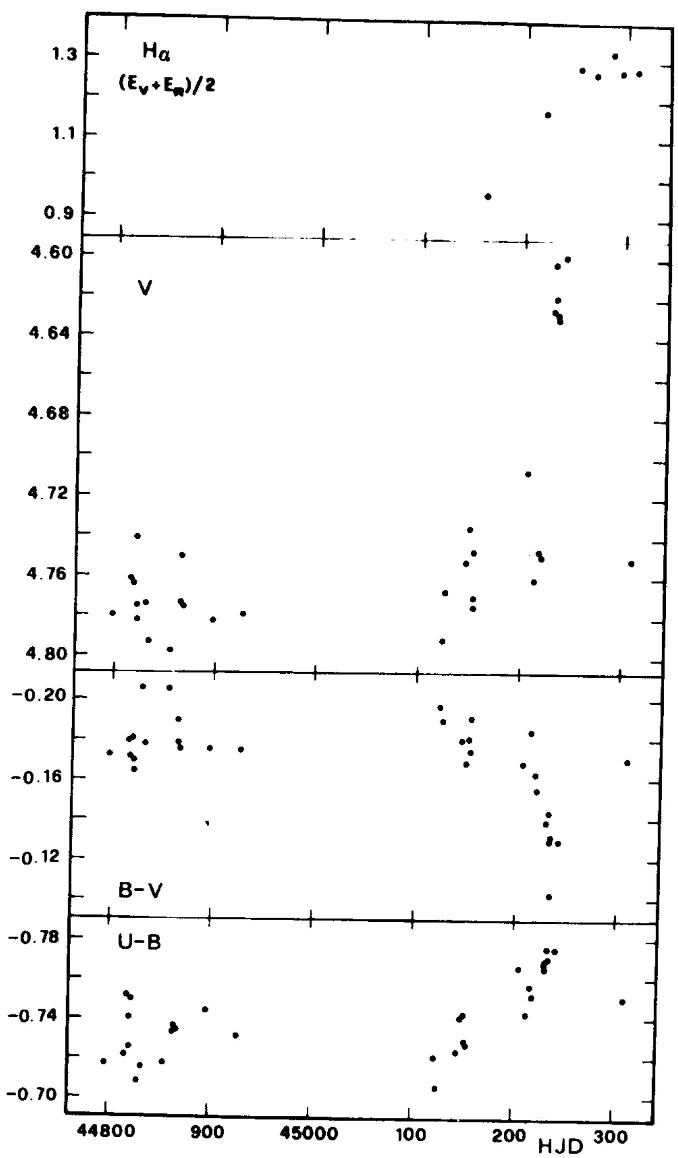
Hα
(E_V+E_R)/2
1.3
1.1
0.9
V
4.60
4.64
4.68
4.72
4.76
4.80
B-V
-0.20
-0.16
-0.12
U-B
-0.78
-0.74
-0.70
44800
900
45000
100
200
300
HJD

Figure 1

In principle, the observed behaviour is an example of the positive correlation between the emission strength and luminosity in V (c.f. Harmanec, 1983 and references therein), which seems to be statistically the most frequent behaviour of Be light variations (Nordh and Olofsson, 1977, Hirata and Hubert-Delplace, 1981).

A comparison of our observations with the previous published UBV measurements of HR 7739 (see Table II) indicates that the brightening we report was observed for the first time - all the previous values agree well with our 1981 values. It probably means that HR 7739 appeared as a normal B absorption star in the sixties and seventies - until July 1982.

Table II

Published UBV data of HR 7739

V	B-V	U-B	Source
4.77	-0.18	-0.73	Johnson et al. (1966)
4.79	-0.191	-	Haggkvist and Oja (1966)
4.80	-0.18	-0.71	Crawford et al. (1971)
4.82	-0.18	-0.72	Johnson and Mitchell (1975) Estimated from their 13-colour photometry
4.77	-0.18	-0.73	Mean of Hvar 1981 observations

HR 7739 was announced to be a spectroscopic binary with an 11.000-day period, by Kodaira (1971). However, Harmanec (1982, unpublished) analyzing all available RV data concluded that an 11-day period is not present in them. It seems that the characteristic time of the RV variations (if they are real at all) is short, probably near one day or so. A similar short-time scale is apparent in our UBV observations, too. We have not attempted any period analysis of the data as we feel that their number is still insufficient for such a purpose.

Further photometric and spectroscopic monitoring of the object from several distant stations, including the determination of new accurate radial velocities would clearly be of great interest.

K. PAVLOVSKI, H. BOŽIĆ

Hvar Observatory, Faculty of Geodesy
41000 Zagreb, Yugoslavia

P. HARMANEC, J. HORN, P. KOUBSKY

Astronomical Institute,
Czechoslovak Academy of Sciences
25165 Ondřejov, Czechoslovakia

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POLARIMETRY OF Be STARS IN THE OPEN CLUSTER NGC 6611

Be stars most probably have symmetrical, disk-shaped envelopes. The lack of spherical symmetry produces a net amount of linear polarization through Thomson scattering in the envelopes. Polarimetric observations are thus a useful tool for testing theoretical Be star models.

In order to compare observations with theoretical predictions the interstellar polarization in the line of sight must be determined. Statistical methods including field stars are currently used (e.g. McLean and Clarke, 1979). These methods give better results for Be stars in open clusters, as spatial association with field stars is easily established. Moreover, once the cluster parameters (m-M, E(B-V)) are known, one readily obtains the absolute magnitude and dereddened colours of the Be star thus allowing more complete tests of the models.

In August, 1981 we started a program of UBVR polarimetric observations of southern open clusters. Measurements were made at the Observatório Astrofísico Brasileiro 1.6 meter telescope with the Instituto Astronômico e Geofísico (Universidade de São Paulo, Brasil) photopolarimeter (Magalhães, 1979).

Some preliminary results for the open cluster NGC 6611 are given in Table I.

Table I

Star number	V	Sp	p^B	θ^B	σ^B	p^V	θ^V	σ^V	Date
150	9.89	B0.5V				2.78	93.89	0.23	7-8/8/82
166	10.36	09V				3.19	97.32	0.18	12-13/8/82
175	10.02	06	4.24	79.37	0.30	3.24	70.63	0.19	12-13/8/82
351	11.26	B1Vne	2.00	68.97	0.40	1.48	82.31	0.36	7-8/8/82
367	9.43	09.5	2.07	92.25	0.13	2.76	94.60	0.11	9-10/8/82
401	8.96	08V	2.37	88.50	0.14	2.79	83.68	0.08	5-6/8/82
469	10.71	B1.5V	1.63	99.06	0.23	2.16	107.95	0.16	9-10/8/82

p and σ in %

Numbers in column 1 are from Kamp (1974), values in column 2 are from Walker (1961), for star number 469 spectral type is from Hiltner (1956). Other spectral types are from Hiltner and Morgan (1969). Columns 4,5 and 6 give the observed polarization values (in%), the polarization angle and the error of measurement for p (%), respectively, in the B filter, columns 7,8 and 9 give the same for the V filter. Last column lists the dates of observations.

Measurements will be pursued on the next observing season. More observations are needed for determining the interstellar polarization throughout the cluster.

L.A.S. REIS
E. JANOT-PACHECO
Instituto Astronômico e Geofísico
Universidade de São Paulo
C. Postal 30.627
01000 São Paulo
Brasil

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A NEW PROBABLE FLARE STAR

A new emission-line star has been detected on a baked Kodak IIIa-J objective-prism plate (unfiltered, 75 minute exposure) taken 10 March 1981 with the Burrell Schmidt telescope at the Warner and Swasey Observatory's Kitt Peak Station. An identification chart is provided for the star which has 1950 coordinates of $\alpha = 14^h\ 54^m.1$, $\delta = +37^o\ 23'$, $\ell = 61^o.8$, $b = +61^o.9$.

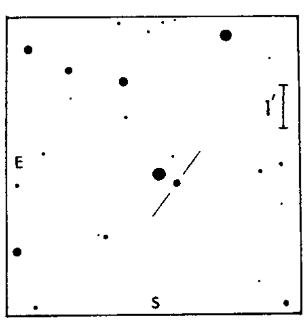

Figure 1

The unwidened spectrum, at a dispersion of 1360 Å mm^{-1} at $H\gamma$, shows the Balmer series strongly in emission down to at least H9. The H and K lines of CaII are the only other emission lines visible and no strong absorption features are seen. Although the continuum longward of λ3900 is very weak, i.e. comparable to B $\sim$ 17 mag., the ultraviolet continuum seen down to λ3400 is remarkably strong. From image diameter measurements made on the Palomar Sky Survey prints one finds B $\sim$ 18 mag. and R $\sim$ 16 mag. Thus this object has the color of a late-type star although the poorly exposed blue continuum shows no evidence of strong TiO bands. No additional plate material covering this star is available in our plate files. It does not appear to be a known proper motion star which suggests $\mu < 0\overset{''}{.}2\ yr^{-1}$.

The most likely explanation of these observations is that this is a M dwarf star seen undergoing a major flare event. The TiO bands would then be veiled and the strong ultraviolet continuum would be consistent with an increase in U of at least three magnitudes. Photometric monitoring and higher dispersion spectroscopy are obviously needed to confirm this interpretation.

N. SANDULEAK

Warner and Swasey Observatory
Case Western Reserve University
Cleveland, Ohio, 44106 U.S.A.

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ANOTHER SEMI-REGULAR VARIABLE IN CYGNUS

A reinspection of photometric data obtained for the investigation of galactic structure in selected regions in Cygnus (Hartl 1975) led us to the detection of an obviously new variable star. Besides 9 U and 8 V values, we derived altogether 63 B values, mainly by using the plate archives of the observatories in Asiago and Heidelberg, supplemented by a few plates recently taken in Innsbruck. The star is located at $\alpha = 21^h14^m06^s$, $\delta = +46^o49'51"$; ±10" (1950.0). A finding chart is shown in Figure 1.

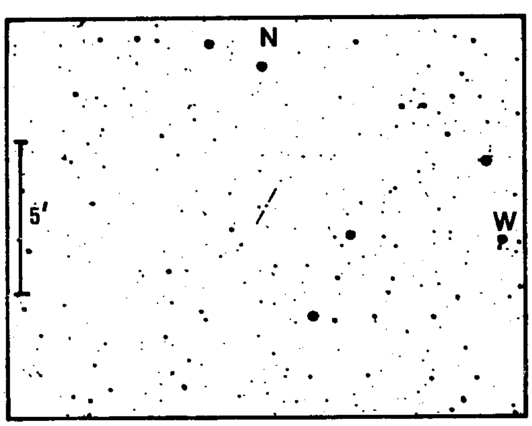
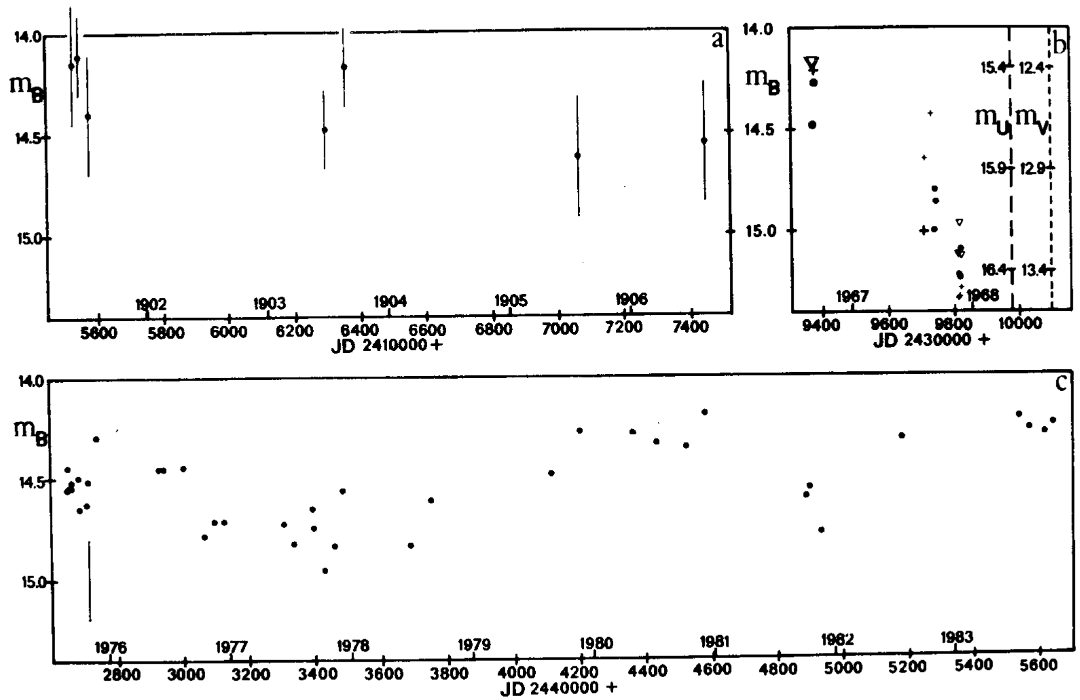


Fig. 1: Finding chart reproduced from a B-plate (103a-O + GG13), obtained with the 90-65-cm Schmidt of the Asiago Observatory.

In Figure 2, all data are given except two B values ($14^m.90 \pm 0^m.2$ in 1952-07-19 and $14^m.62 \pm 0^m.2$ in 1958-09-05). The variability of the star is evident especially in Figure 2b; Figure 2c demonstrates its long-term behaviour.



Figures 2a-c. Light curve of 3 periods. In Figures 2a,c each point represents one observation. The large symbols in Figure 2b are the mean of up to 5 values, with errors of $0\overset{m}{.}02$ to $0\overset{m}{.}1$ (∇: m_V, +: m_U), the residual data in Figure 2b are accurate to $\leq 0\overset{m}{.}2$.

On objective prism plates of the Asiago archives, the star could be classified as M4 - M6. In addition, we found it in a list of cool stars (Nandy and Smriglio 1970), where it is classified as M5.

The luminosity class can be determined indirectly by employing Hartl's (1975) colour excess vs. distance diagram and the extinction in the line-of-sight to the object: For several nights, we have U-B and B-V values at hand derived from plates taken within a few hours; the mean is $U-B = 1^{m}.29$ and $B-V = 1^{m}.95$, respectively. U-B is a rather uncertain quantity for evaluating the extinction for the spectral type we are interested in: e.g., $(U-B)_0 = 1^{m}.58$ for M5III, but $1^{m}.16$ for M6III according to Landolt-Börnstein. The usage of B-V gives $E(B-V) \sim 0^{m}.2$ for an M5 or M6 star, provided it is a giant; this assumption is strongly suggested by Hartl's (1975) absorption model - according to it, a super-giant should suffer from a much higher obscuration. The observed colours also argue against a main-sequence star.

The light curve, spectral type, and luminosity class point to a variable star of semi-regular type (SRa or SRb), though we cannot rule out that it is of irregular type. Since Cygnus is one of the best studied regions of the sky and the star is moderately faint, it might be contained on a number of other plates, particularly because the famous nova Cygni 1975 is only $1^{\circ}.4$ distant.

We are grateful for the permission to use the plate archives of the Osservatorio Astrofisico in Asiago and of the Landessternwarte in Heidelberg. This work was supported by the Austrian Fonds zur Förderung der wissenschaftlichen Forschung under project no. 4128.

G. AUNER, H. HARTL AND R. WEINBERGER

Institut für Astronomie der Universität Innsbruck
Universitätsstr. 4
A-6020 Innsbruck

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25 November 1983

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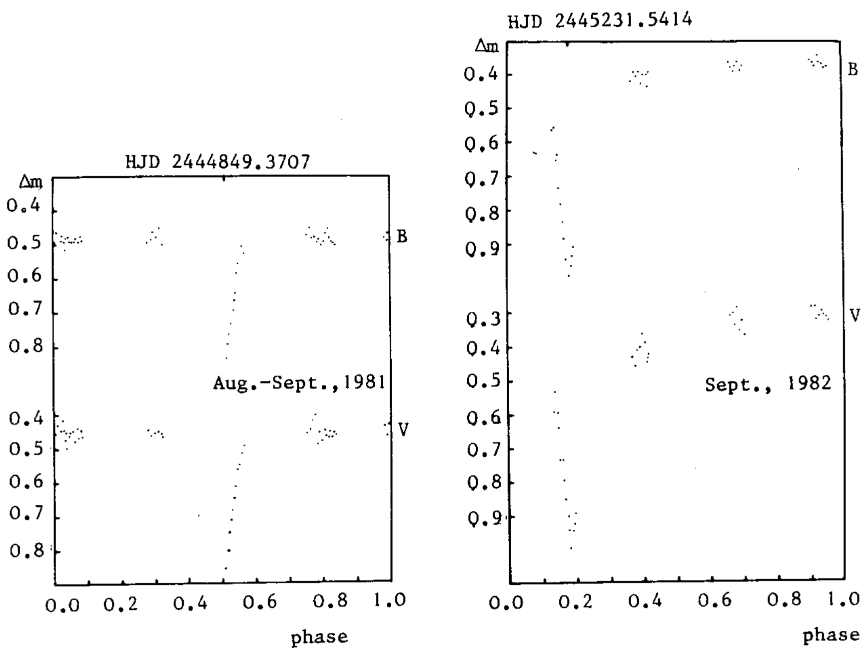
ON THE VARIABILITY OF THE STAR SAO 072799

The star SAO 072799 (BD+37°4713) has been reported in I.B.V.S. No. 1885 to be an eclipsing variable with a period $4^{d}.2150951$. The variability of this star was noticed during photographic observations of the system SW Lac by Frank (1980). A request for a confirmation of the variability of SAO 072799 led us to observe the system photoelectrically.

The photoelectric observations were made on August 29-31 and September 1-3, 1981, as well as on September 16-19, 1982. The observations were made at Kryonerion Astronomical Station, Greece, with a 48-inch Cassegrain reflector and a two beam multi-mode photometer (Goudis and Meaburn, 1973). The two intermediate pass-band filters used were selected to be in close accordance with the standard U,B,V colour system. As comparison star we used SAO 072816 for the period of August-September 1981 and SAO 072787 for the period of September 1982.

The observations made during those periods are given in Figures 1 and 2, respectively. From an inspection of Figure 1 it is obvious that a light minimum occurs around phase 0.5. The ascending branch of that minimum is clearly shown. On the other hand, Figure 2 shows another minimum at phase 0.18. Here the descending branch and a small part of the ascending one can easily be seen. Moreover, there is no indication in both Figures that another minimum exists at any other phase.

From the observations given in Figures 1 and 2 we can conclude that the star SAO 072799 is certainly variable, but it is difficult to define the type and the period of its variability. Therefore, more extensive observations are needed for a better understanding of this new discovered variable star.



Figures 1-2 B and V light curves of SAO 072799

P.G. NIARCHOS
Department of Astronomy
University of Athens
Panepistimiopolis,Athens 621
G r e e c e

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ON THE PERIOD OF BD Cir

The variability of BD Circini (BV510, B_{ph} = 9.8) was discovered by Miss Leavitt (1907) on plates taken of the region centered at 15^h-60^o. She suggested BD Cir to be an Algol type system with an amplitude of 0.8 mag. The first photographic light curve was obtained by Schöffel (1965) who determined a period of P = $0^d.86956$. The photographic light curve showed an amplitude of 0.4 mag which was not in agreement with Miss Leavitt's result.

We have included BD Circini in our UBV photoelectric observing program since 1981. The observations were carried out with the 154 cm reflecting telescope at Bosque Alegre Station of Córdoba Observatory during 32 nights and 5 nights with the 60 cm reflector at Las Campanas Observatory of the University of Toronto. A DC photometer consisting of a RCA 1P21 dry-iced photomultiplier and a set of standard UBV filters were used at Bosque Alegre, while a pulse counting system with an S20 photomultiplier and UBVRI filters were used at Las Campanas.

A total of 672 complete UBV differential observations were obtained for BD Cir in relation to the comparison star CPD-55^o06213. No complete minima were detected in the observations.

Our photoelectric observations were not fitted either by the period given by Schöffel or by their multiples. Therefore, we selected the close pair of minima published by Schöffel and tried several multiples. Then by trial an error we approached a period, giving a reasonable light curve for the UBV observations. This procedure allowed the determination of a preliminary ephemeris from the data obtained in 1981-1982. The resulting period was about of $6^d.7907$ days, i.e. more than twelve times the period suggested by Schöffel. This fact explains why Mallama (1981) had troubles in detecting variability while monitoring BD Circini . Our preliminary ephemeris succesfully predicted a minimum which was detected at partial phases in 1983. A light curve was constructed for all photoelectric observations and a time of minimum light was estimated, we found the last value listed in Table I, together with the photographic minima given by Schöffel.

Table I

Minima of BD Cir

Min	Colour	J.D. Hel.	E	(O-C)	Remarks
I	Pg	2438205.284	-455	0.051	1
I	Pg	2438524.438	-408	0.021	1
I	Pg	2438592.250	-398	-0.079	1
I	Pg	2438877.452	-356	-0.105	1
I	Pg	2438884.457	-355	0.109	1
I	UBV	2444690.786	500	0.003	2

Remarks: 1) Schöffel (1965), 2) Present observations.

Finally, a least squares solution for a linear ephemeris gave:

$$\text{Primary Min} = \text{JD Hel } 2441295.207 + 6\overset{d}{.}79115 \times E,$$
$$\pm 0.030 \quad \pm 0.00007 \text{ m.e.}$$

The resulting ΔV light and Δ(B-V) colour curves are shown in Figure 1.

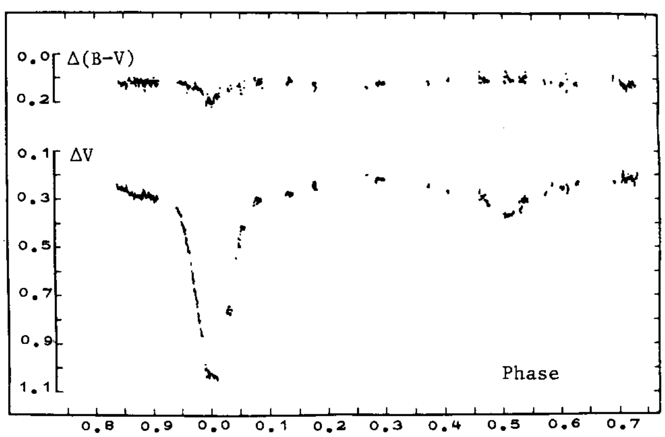

Figure 1

As it can be seen, BD Cir is an Algol type eclipsing binary whose primary minimum is 0.85 mag in depth while the secondary one is 0.2 mag.

SILVANO F. MARTON AND ALBA GRIECO*

Observatorio Astronómico
Laprida 854 - 5000 Córdoba
Argentina

* Fellow of CONICOR

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PHOTOELECTRIC OBSERVATIONS OF UV CETI

Continuous photoelectric monitoring of the flare star UV Ceti was carried out at Stephanion Observatory during 1981 and 1982 in the framework of the Program for Scientific and Technical Co-operation between Department of Geodetic Astronomy, University of Thessaloniki - Greece and Department of Astronomy with National Astronomical Observatory, Bulgarian Academy of Sciences - Bulgaria.

Observations have been made with the 30-inch Cassegrain reflector at Stephanion Observatory with a Johnson dual channel photoelectric photometer in the B colour of the international UBV system. The telescope and the photometer have been described elsewhere (Mavridis et al., 1982). The transformation of our instrumental ubv system to the international UBV system for the years and 1981 and 1982 is given by the following equations:

$$V = v_o - 0.023(b-v)_o + 3.202$$

$$B - V = 0.582 + 1.004(b-v)_o \qquad (1981)$$

$$U - B = -1.869 + 1.021(u-b)_o$$

$$V = v_o - 0.011(b-v)_o + 3.288$$

$$B - V = 0.597 + 1.010(b-v)_o \qquad (1982)$$

$$U - B = -1.899 + 1.031(u-b)_o$$

The monitoring intervals in U.T. 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. The standard deviation of random noise fluctuation - $\sigma(\max) = 2.5 \log(I_o+\sigma)/I_o$, for different times (U.T.) of the corresponding monitoring intervals is given in the fourth column of Table I.

During the 5.2 hours of monitoring time 3 flares were observed the characteristics of which are given in Table II. For each flare following characteristics (Andrews et al., 1969) are given:

a. The date and universal time of maximum.

Table I

Monitoring intervals in 1981 and 1982

Date	Monitoring intervals(U.T.)	Total Monit. Time	σ(U.T.)
1981 Sept.30	02^h12^m–02^h58^m,02^h59^m–03^h03^m,	0^h50^m	0.13(02^h30^m),0.13(03^h00^m)
1982 Oct.14	00 00 -00 21 ,00 25 -00 40,	1^h07^m	0.12(00 03),0.12(00 26)
	00 42 -01 00 ,01 03 -01 16.		0.11(00 44),0.21(00 08)
14/15	23 59 -00 03 ,00 05 -00 23,	0^h43^m	0.10(00 02),0.08(00 19)
	00 24 -00 36 ,00 38 -00 47.		0.08(00 32),0.17(00 39)
15	22 45 -23 41 ,23 43 -23 56,	1^h28^m	0.09(23 10),0.13(23 45)
	23 59 -00 07 ,00 09 -00 20.		0.15(00 04),0.14(00 14)
17	21 52 -22 02 ,22 04 -22 58.	1^h04^m	0.12(21 54),0.16(22 17)

Total = 5^h12^m

Table II

Characteristics of the Observed Flares

Flare No	Date 1982	U.T. max	t_b min	t_a min	Duration min	$\frac{I_f-I_o}{I_o}$ max	P min	Δm mag	σ mag	Air mass
1.	Oct.14	$00^h03^m.1$	0.06	1.66	1.72	0.630	0.361	0.53	0.12	1.955
2.	14	00 29.3	0.06	1.48	1.54	2.063	0.525	1.22	0.12	2.101
3.	15	23 46.4	0.08	2.42	2.50	4.505	0.920	1.85	0.13	1.917

b. The duration before and after maximum (t_b and t_a, respectively) as well as the total duration of the flare.

c. The value of the ratio $(I_f-I_o)/I_o$, corresponding to flare maximum, where I_o is the intensity deflection less sky background of the quiet star and I_f is the total intensity deflection less sky background of the star plus flare.

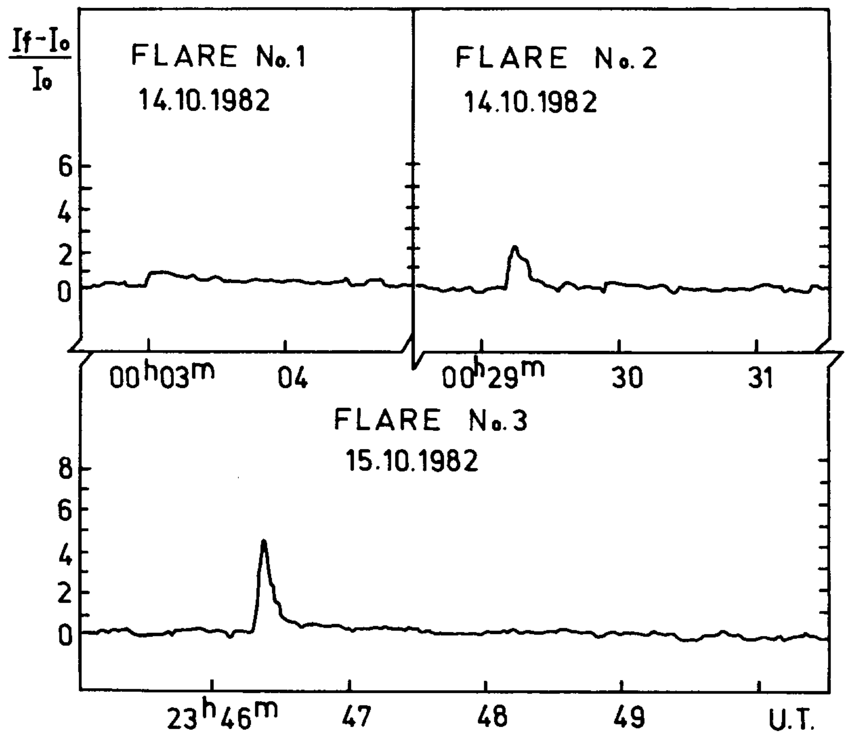
d. The integral intensity of the flare over its total duration, including pre-flares, if present: $P = \int (I_f-I_o)/I_o \, dt$.

e. The increase of the apparent magnitude of the star of flare maximum – $\Delta m(b) = 2.5 \log(I_f/I_o)$, where b is the blue magnitude of the star in the instrumental system.

f. The standard deviation of random noise fluctuation – $\sigma(mag) = 2.5 \log(I_o + \sigma)/I_o$, during the quiet-state phase immediately preceding the beginning of the flare.

g. the air mass at flare maximum.

The light curves of the observed flares in the b colour are shown in Figures 1-3.



Figures 1-3

The authors would like to express their gratitude to the relevant authorities of the respective countries for their support.

M.K. TSVETKOV

Department of Astronomy with
National Astronomical Observatory
Bulgarian Academy of Sciences,
Bulgaria

L.N. MAVRIDIS, G.A. ASTERIADIS

Department of Geodetic Astronomy
University of Thessaloniki
Greece

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Andrews A.D., Chugainov P.F., Gershberg R.E. and Oskanian V.S., 1969, I.B.V.S. No. 326

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PERIODIC LIGHT VARIABILITY OF PG1711+336

PG1711+336, a cataclysmic variable candidate, is identified on the print given in the paper by Green et al. (1982), where it is stated that weak hydrogen emissions have been observed in the spectrum of this object.

250 brightness estimates on the plates of the Sternberg Institute's collection (J.D. 2417823-45470) show slow variation in the range 12.5-13.2 B. The following table gives the limits of brightness variations for some time intervals.

Interval of JD24...	B	n
17823-19626	12.9-13.1	15
40062-40065	12.5-12.7	10
40387-41547	12.6-12.8	210
45357-45470	13.1-13.2	5

During 1983 pulse-counting photoelectric photometers with a 48 cm reflector and with a 60 cm reflector were used and 49 WBVR measurements* and 35 UBV measurements (J.D. 2445442-546) were obtained, respectively. Positions of the variable (dots) and of a number of neighbouring stars (open circles) are shown in the two-colour (W-B, B-V) diagram (Fig.1.). It is obvious that the interstellar reddening is small (E_{B-V} does not exceed $0\overset{m}{.}1$). Hence, the object has a strong ultraviolet excess, its position in the diagram corresponds to the position of very hot cataclysmic stars.

The period analysis of our photoelectric observations shows that all of them satisfy the following elements:

$$JD_{Min\ \odot} = 2445527.283 + 0\overset{d}{.}115883 \cdot E.$$

The mean V light curve plotted with this period (P_1) is shown in Figure 2. The colour indices do not depend obviously on the phase. The dispersion of

* W-magnitudes have a response curve similar to that described by Straižys (1977).

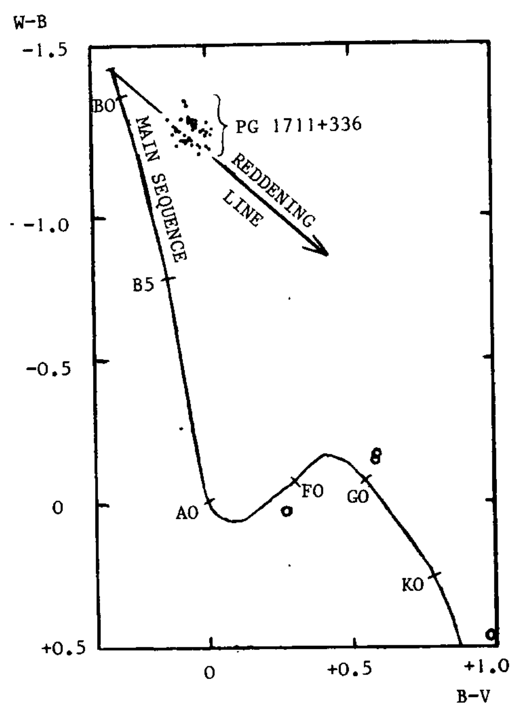

Figure 1

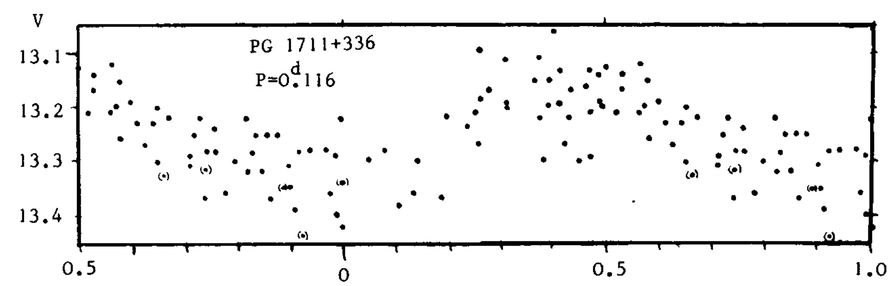

Figure 2

data points about the mean curve exceeds the observational inaccuracies and is due to instabilities of the light curve. One should note that another value of the period, $P_2 = 0\overset{d}{.}131117$ ($1/P_1 - 1/P_2 = 1d^{-1}$), also gives a satisfactory light curve with somewhat greater dispersion of data points about the mean curve.

The light curve we obtained is probably due to the orbital motion in a close binary system which is typical of dwarf novae and other cataclysmic variables. One can see that eclipses are not observed, and the variations are caused by the reflection effect or by a partial eclipse of the gaseous accretion stream falling on the compact component.

Summarizing, our observations confirm that the object belongs to cataclysmic stars. One should, however, note that no bursts characteristic of the majority of cataclysmic stars were observed in PG1711+336.

To clarify the nature of this object and to find definitely which of the period values, P_1 or $2P_1 = 0\overset{d}{.}232766$ is the orbital one, further spectroscopic and photoelectric observations are necessary.

A.V. MIRONOV
V.G. MOSHKALEV
S. Yu. SHUGAROV

Tian-Shan Observatory of the
State Sternberg Astronomical Institute
and
State Sternberg Astronomical Institute
University of Moscow
13, Universitetskij Prospect
Moscow 117234 USSR

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V417 AQUILAE: PHOTOELECTRIC OBSERVATIONS AND IMPROVED PERIOD

The eclipsing binary V417 Aql (BD+5° 4202) was discovered by Hoffmeister (1935), but he only commented that it had a short period. Four times of minimum light were determined by Soloviev (1937), who found a period of $0^d.370114$ and classified it as a W Ursae Majoris system. Further work by Soloviev (1949) yielded an improved period of $0^d.3701207$. Kramer (1947) published four times of minimum light, obtained a period of $0^d.3701250$, and suggested the possibility that the secondary minimum was displaced. With one time of minimum light, Koch (1956) concluded that the secondary was not displaced and redetermined the period to be $0^d.3701251$. The only photoelectric observations of this system appear to be one time of minimum light (Braune and Mundry, 1982).

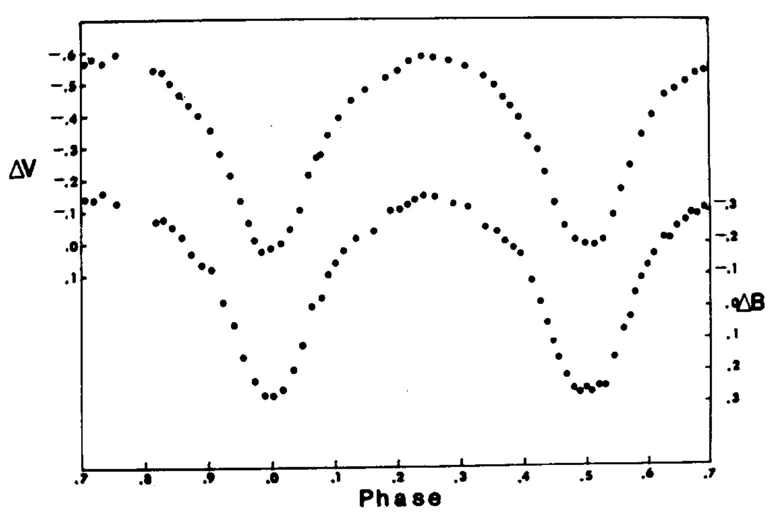

Figure 1

Because this system has not been observed extensively, it was selected for observations on 8 nights between July and October, 1983 with the 41-cm telescope of the Morgan-Monroe Station of the Goethe Link Observatory. A 1P21 photomultiplier tube cooled with dry ice was used in the pulse counting mode with standard B and V filters. Differential measurements were made using BD+5° 4203 as the comparison star and BD+5° 4196 as a check star. Due to the close proximity of the variable and comparison, no corrections for differential extinction were necessary.

Two primary and three secondary eclipses were well defined, from which five times of minimum light were determined with the Hertzsprung method. These are listed in the table below.

JD Hel. 2445000+	Min.	(O-C)
542.6894	II	+0.0004
550.6508	I	+0.0001
554.7234	I	-0.0007
575.6468	II	+0.0002
605.6416	II	0.0000

The following light elements were determined from a least squares solution to these times of minimum light:

$$\text{HJD Min.I} = \underset{\pm 3}{2445554.7241} + \underset{\pm 23}{0^{d}.3703072}E.$$

This ephemeris was used to calculate the (O-C)'s in the table above.

This period is about 16 seconds longer than any previously published period. Since this period change seems rather large, other explanations were explored. Soloviev's first period was based on observations made over an interval of only five nights. With a base line this small, such a large error in the period is understandable. Further refinements in the period relied upon the addition of single times of minimum light or, at most, two epochs determined from observations made on consecutive nights. Unfortunately, an error of 16 seconds in the period would amount to almost precisely one half a period in one year. Because the primary and secondary eclipses have equal depth, it is difficult to distinguish between them. Therefore it appears that past observers may have misidentified some of the eclipses that they observed. Only when observations were conducted over many cycles in a single season, as in the present study, would the error in the period become apparent.

Normal points have been formed from the present observations and are plotted in the accompanying figure. As can be seen, good definition is given to most of the light curve. Analysis of the light curve will be published elsewhere.

DANNY R. FAULKNER
Astronomy Department
Swain Hall West 319
Indiana University
Bloomington, IN 47405
USA

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V3876 Sgr, A MIRA STAR, NOT A NOVA

Khatisashvili (1982) gives an accurate position and finding chart for V3876 Sgr, identifying the object as Nova Sgr 1978. The finding chart and position agree with, and improve upon, those given by Hoffleit (1972) and Hatfield (1972) for the object which received the designation V3876 Sgr in the 60th Name-list (Kukarkin et al 1975) and the third supplement to the third edition of the General Catalogue of Variable Stars (Kukarkin et al. 1976). That variable, however, which had been discovered at the Maria Mitchell Observatory in 1971 by Pamela Bonnell (Hoffleit 1972), is classified (Kukarkin 1976, based on Hoffleit 1972) not as a nova but as a Mira star.

My assistants and I have inspected some 250 plates of the field at the Maria Mitchell Observatory, taken in 1969-1983, to search for nova activity in the vicinity. We find only typical long-period variations of the Mira star, consistent with slightly changed elements.

The last well-observed maximum was at JD 2441484 ± 5^d, E = 13 according to the published elements

$$JD_{max} = 2436830 + 358\ E$$

which were valid for the interval, JD 2436000-41500.

Since then we have caught only an increasingly small part of the descending branch. The little that we see is better represented by

$$JD_{max} = 2441484 + 352\ E$$

for the interval 2441400 to the present. This is a return toward the shorter period, 345^d, which had been found to satisfy the observations in JD 2423900-32000.

The only 1978 Nova in Sagittarius of which I am aware is about 8° south of V3876. It was discovered on an objective prism plate taken in March, 1978 (Stenholm and Lundström 1979). It received the designation V4049 Sgr in the 65th Name-list (Kholopov et al. 1981). A large-scale finding chart and precise position have been given by McCarthy et al. (1981).

I am grateful to EARTHWATCH, of Belmont, Mass., for support of this project, and to volunteers Robin Spry-Campbell and Jane E. Fuller for their assistance.

EMILIA P. BELSERENE
Maria Mitchell Observatory
Nantucket, MA 02554 USA

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PHOTOMETRIC VARIATIONS IN THE Ap STAR HD 215441

Photometric variations of the peculiar class A (Ap) magnetic stars have been theorized to occur due to the rotational modulation of an inhomogeneous distribution of emmittant flux, as opposed to effective temperature variations of the stars as a whole. This process has been shown to occur in the one Ap star α^2 CVn by Cohen (1970) and Molnar (1973). However, calculations of the effective temperature variation of the other highly magnetic (maximum field strength ≈ +32 kilogauss) Ap star HD 215441 (Babcock's star) have left uncertainties as to the applicability of the flux redistribution theory to it. Stępień (1968) calculated a variation of 1300 K in effective temperature, while far-ultraviolet photometry by Leckrone (1974) indicated a variation of no more than 100 K, indicating the existence of a flux redistribution mechanism.

The lack of agreement in these values indicated that, as for α^2 CVn, spectrophotometric observations of the star over its period and consequent effective temperature determinations would be of interest. No basis of data has yet been obtained in support of Leckrone's conclusion that the star undergoes flux redistribution, in terms of observations of the star's continuum over its period.

Observations of HD 215441 over half its period were made in the region from λ7650 to λ8950 using the 256 photodiode array direct mode Reticon spectrometer system developed by the University of California at Los Angeles Department of Astronomy. The instrument was mounted at the cassegrain foci of the 16 inch reflector of the University and the 24 inch reflector of the Table Mountain Observatory facility of the Jet Propulsion Laboratory.

Figure 1 shows a composite of the scans obtained (non-flux calibrated) from phase 0.0 at the top to phase 0.5 at bottom. Phases were calculated using the ephemeris of Preston (1969).

Following the full reduction and sky subtractions for the individual scans, the count per channel values of each scan were divided into those of the scan for phase 0.0 across the entire scan range in an effort to detect any slope variation of the continuum as a function of phase. Figure 2 shows the results

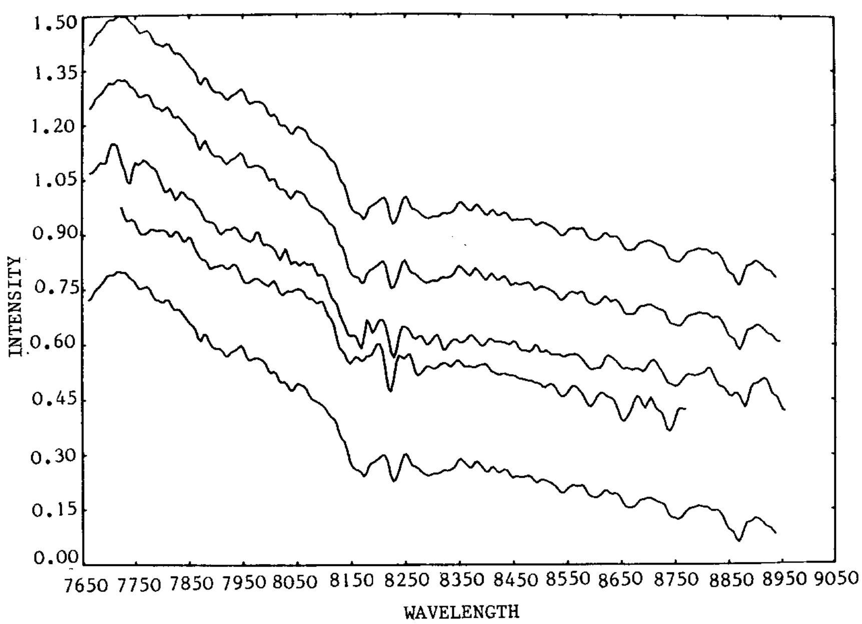

Figure 1

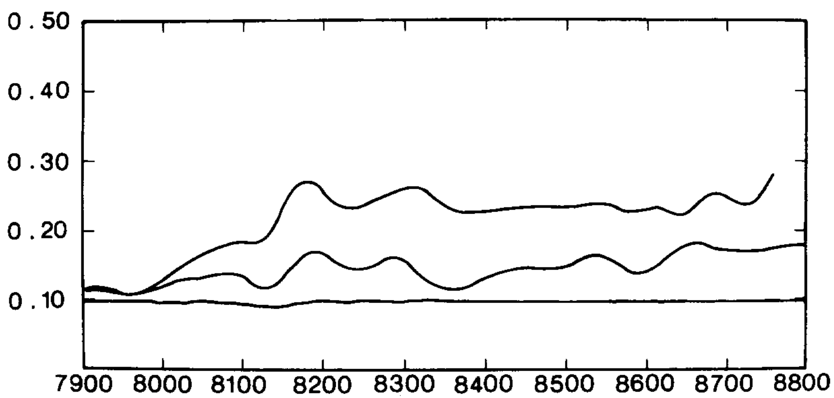

Figure 2

of the divisions where the zero point of the abscissa is arbitrary.

For the wavelength region λ8100 - λ8800 the flat nature of the scan divisions is indicative of negligible slope variations and consequent effective temperature variations over the phases covered in this study. It thus appears that some form of flux redistribution is responsible for the photometric variations of the star, as no form of large temperature variation is indicated by the data obtained here.

The author wishes to thank the University of California at Los Angeles Department of Astronomy and the staff of Table Mountain Observatory for their assistance and provision of facilities. In particular, the assistance of Dr. Roger Ulrich, Mr. Steven Tomczyk, and Mr. Bradley Wood of UCLA is gratefully acknowledged. This work was supported by a grant from U.S. Army Research Office.

M. CORBIN

Undergraduate, Department of Astronomy,
Columbia University
New York, N.Y. 10027
U.S.A.

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PHOTOELECTRIC OBSERVATIONS OF R CrB

The ingress into a recent deep minimum of R CrB was observed photoelectrically with the 165 mm Newtonian reflector at Nessa Observatory using standard BV filters. δ CrB (V = 4.63, B-V = +0.80) and SAO 084005 (V=7.45, B-V= +0.44) were used as comparison stars.

The observations are given below:

Table

Photoelectric observations of R CrB

J.D. 2445000 +	V	B-V	J.D. 2445000 +	V	B-V
454.39	5.65:		539.39	5.86	+0.60
459.38	5.83		546.40	5.84	+0.57
473.42	5.92		547.39	5.86	+0.54
474.40	5.91		555.38	5.92	
481.42	5.80:		558.36	5.81	+0.62
486.35	5.80		561.34	5.89	+0.55
488.36	5.87	+0.53	563.36	6.18:	
492.36	5.88		564.36	6.23:	
494.37	5.78		566.35	6.21	
497.46	5.71		572.32	6.75	+0.58
524.46	5.82:		573.33	6.87	
527.42	5.83	+0.64	576.31	7.57	+0.60
528.38	5.75		577.33	7.91	+0.56
529.40	5.81		578.33	8.28	+0.54
531.40	5.93	+0.58	579.36	8.75	+0.57
537.39	5.82	+0.54	580.33	9.02	
538.40	5.81	+0.60	586.34	9.69:	

D. BÖHME

4851 Nessa No. 11
German Democratic Republic

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REMARKS ON THREE VARIABLE STARS

V 781 Tau

First elements derived by the author (I.B.V.S. No. 1942) were found to be inaccurate. New investigations on Sonneberg Sky-Patrol plates and a revision of the former observations yielded the improved elements for the interval J.D. 2433100 - 2444000:

$$\text{Min. (hel.)} = \text{J.D. } 2443874.954 + 0^{d}.3449100 \cdot E \qquad \text{(EW)}$$
$$(8^{m}.9-9^{m}.3/9^{m}.3 \text{ ph.})$$

Observed minima:

J.D. (hel.)	Epoch	O-C	Observer
2432881.460	-31873.5	$-0^{d}.005$	Berthold, T.
33950.515	-28774	+ .001	
34775.368	-26382.5	+ .002	
35540.371	-24164.5	- .005	
36610.285	-21062.5	- .002	
957.442	-20056	+ .003	
38088.397	-16777	- .002	
440.378	-15756.5	- .002	
39536.327	-12579	- .004	
40981.332	-8389.5	.000	
41329.345	-7380.5	- .001	
330.381	-7377.5	+ .001	
337.279	-7357.5	.000	
42839.363	-3002.5	+ .001	
43853.911 (pe)	-61	- .003	Harris, A.W.
874.954 (pe)	0	.000	(I.B.V.S. No. 1556)

Three photoelectric times of minima obtained by Diethelm, R. (BBSAG Bull. No. 53) might indicate a decrease of the period after J.D. 2444000. Further photoelectric observations are badly needed because of the lack of Sky-Patrol plates after J.D. 2444000.

NSV 00171

NSV 00171 = Wr 63 was announced as a possible Cepheid by Weber, R. (1958, J.O. 41.4).

Estimates on 158 Hartha Sky-Patrol plates (1959-1976) confirmed the variability.

First elements could be derived:

$$\text{Max.} = \text{J.D. } 2439033.579 + 3^{d}.909691 \cdot E \qquad (C)$$
$$(11^{m}.71-12^{m}.14 \text{ ph., } M-m=0^{P}.25)$$

BD +63°0003

This star has been reported to be variable by Guinan, E.F. et al. (I.B.V.S. No. 2227).

The variations of BD +63°0003 were examined on 615 Hartha and Sonneberg Sky-Patrol plates from 1959–1982.

During this time slow waves with a mean period of 310^{d} and variable amplitudes of $0^{m}.3 - 0^{m}.9$ ph. were found. The total amplitude was $10^{m}.1 - 11^{m}.1$ ph.

Because of temporary irregularities, BD +63°0003 seems to be a SRb star.

THOMAS BERTHOLD

Bruno-H.-Bürgel-Sternwarte
DDR-7302 Hartha

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EPSILON AURIGAE

The eclipsing variable ε Aurigae (period 27.06 years) began fading from its normal magnitude (V=2.99) in August 1982, reached its minimum in December 1982 (V ≈ 3.8) and it will reach its former brightness from mid-December 1983 through June 1984.

This supergiant star (A8 Ia), at maximum, has its H_α-line contaminated by two strong emissions. However, the outcome equivalent width is only -0.04 Å (Mendoza and Johnson, 1979). Yet, this faint equivalent width is very easily detected with the H_α-index, measured in the α(16)Λ(9) photometric system (cf. Mendoza et al., 1983).

We have secured data for ε Aur in the α(16)Λ(9) photometric system with the Tonantzintla 1.0-m telescope (1977), and with the San Pedro Mártir 2.1 m telescope (1982 and 1983). The results are given in Table I,

TABLE I

NARROW BAND PHOTOMETRY OF ε AUR (in magnitudes)

α(16)	Λ(9)	Date (U.T.)
0.911	0.542	Jan 3,5,7,29; 1977*
0.964	0.546	Sep 13 (11:47); 1982
0.952	0.546	Sep 14 (12:10); 1982
0.964	0.545	Sep 15 (11:15); 1982
1.058	0.562	Nov 6 (11:54); 1983
1.059	0.560	Nov 14 (09:53); 1983

*σ(α,Λ)=±0.002 mag.

The $\alpha(16)$-index clearly indicates that the H_α-line of ϵ Aur at minimum is less contaminated by emission. In particular, this index yielded an equivalent width, $W(H_\alpha) \gtrsim 0$ in September 1982, and $W(H\alpha) \geqslant 2Å$ in November 1983 (see Table I and loc. cit.). The $\Lambda(9)$-index shows that ϵ Aur remains with its extended atmosphere at maximum and at minimum light (as indicated by the strength of its OI-7774 Å line). Most likely, its luminosity was slightly higher in November 1983 (see Table I).

EUGENIO E. MENDOZA V.
Instituto de Astronomía
Universidad Nacional Autónoma de México
MEXICO

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POLARIMETRIC OBSERVATIONS OF Be STARS

In 1982 we started a program of UBVR polarimetry of bright southern Be stars, extending to the south similar observations already extensively done by other people in the Northern hemisphere (see e.g. Poeckert et al. 1979).

The measurements have been performed with the Instituto Astronômico e Geofísico (Universidade de São Paulo, Brasil) photopolarimeter attached to the Observatório Astrofísico Brasileiro 1.6 meter telescope. The instrument allows simultaneous photometric and linear and circular polarimetric observations (Magalhães 1979).

Some results are given in Table I, for stars with E_{B-V} = 0, that is with no interstellar polarization. Columns give successively, HD numbers, V magnitudes, spectral types, polarization degree (in percent) in U,B,V and R bands, polarization angles in the four bands and dates of the observations.

L.A.S. REIS
E. JANOT-PACHECO

Instituto Astronômico e Geofísico
Universidade de São Paulo
C. Postal 30.627
01000 São Paulo/Brasil

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Table I

HD	V	S_p	p^U	p^B	p^V	p^R	o^U	o^B	o^V	o^R	Date
209014	5.4	B8Ve		0.36±0.05	0.27±0.04	0.17±0.07		31.2±3.9	35.7±4.3	73.7±12.1	09/08/1982
				0.23±0.06	0.32±0.06	0.22±0.05		44.6±7.5	32.9±5.4	46.1±6.4	12/08/1982
			0.17±0.21		0.13±0.15		130.2±51.9		137.4±51.9		21/06/1983
			0.18±0.34	0.42±0.09		0.26±0.24	154.9±51.9	104.8±6.0		128.6±26.3	21/06/1983
209522	5.8	B4IVn	0.34±0.08	0.48±0.07	0.35±0.08	0.48±0.07	18.4±6.8	10.9±4.2	7.9±6.6	16.1±4.2	09/08/1982
			0.28±0.10	0.44±0.08	0.22±0.07	0.19±0.10	35.2±10.2	38.8±5.3	23.5±8.9	49.9±15.2	12/08/1982
			0.32±0.28	0.39±0.12	0.31±0.13		98.5±25.4	109.4±8.6	82.3±12.3		21/06/1983
210129	5.7	B7Ve	0.43±0.10	0.50±0.08	0.32±0.05	0.43±0.10	89.7±6.6	98.0±4.6	108.9±4.5	91.4±6.7	08/08/1982
			0.38±0.06	0.52±0.07	0.50±0.09	0.28±0.11	21.3±4.5	25.0±3.8	49.4±5.2	74.5±11.4	09/08/1982

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THE Hβ EMISSION OF PU Vul

The peculiar nova-like variable PU Vul was observed with the grating spectrograph attached to the 1-m reflector at Yunnan Observatory in September, 1981 and October, 1982. The spectral class of this star was about K without any emissions in September, 1981. But Hα was found in emission in October, 1982 (Liu Zongli, Hao Xiangliang and Mei Bao, I.B.V.S. No. 2291, 1983).

This star was observed using the grating spectrograph attached to the 60/90-cm Schmidt telescope at Peking Observatory on August 29 and September 1, 1983. The two spectra which were obtained on August 29 were essentially similar to those obtained in October, 1982. But the absorption lines of two spectra which were obtained on September 1 were weaker and the emission features were stronger than before and Hβ appeared in emission.

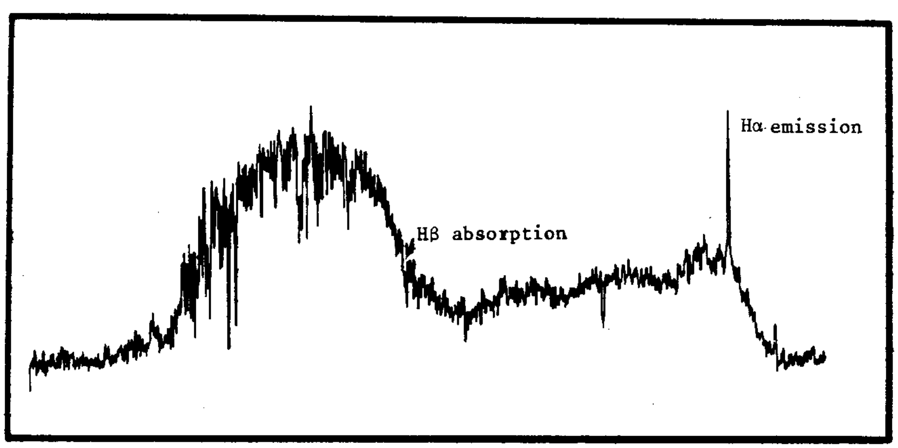

Figure 1a. Tracing of spectrum on 30 October 1982

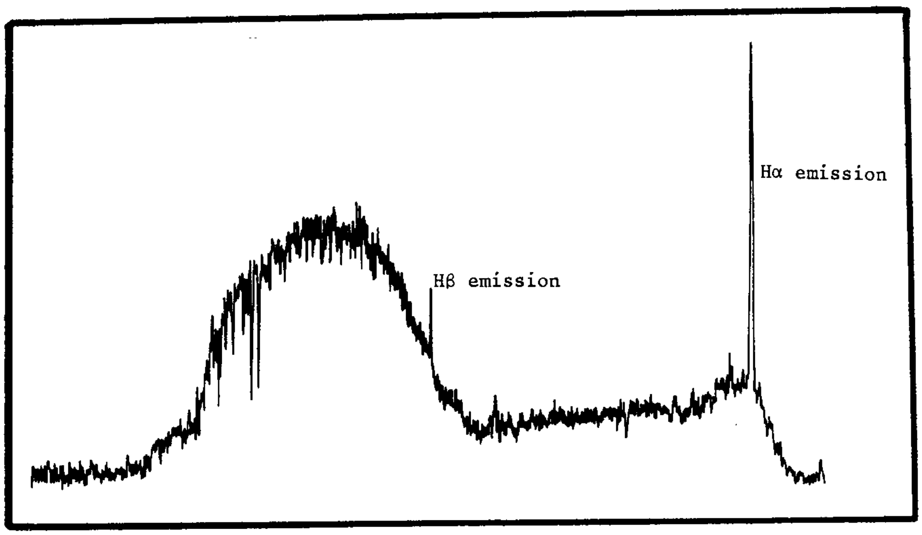

Figure 1b. Tracing of spectrum on 9 October 1983

We observed this star again with the grating spectrograph attached to the 1-m reflector at Yunnan Observatory in October, 1983, obtaining six plates. The emission lines in all these spectra become so strong that one can readily see both the Hα and Hβ in emission.

The tracings of the spectra obtained on October 30, 1982 and October 9, 1983 are presented in Figure 1.

LIU ZONGLI
HAO XIANGLIANG
Peking Astronomical Observatory
Academia Sinica

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THE Be BINARY HR 2142: NO 0.13^m BRIGHTNESS DECREASE IN JANUARY 1983

HR 2142 (HD 41335, BD-6^o1391, MWC 133; B2 IVe) is a well-known bright Be star ($V=5.22^m$, $B-V=-0.07^m$, $U-B=-0.83^m$) and a suspected variable. Peters (1971) discovered that the object exhibits recurrent strong short-lived shell phases each 81 days. Later on, she found that it is in fact an interacting binary (for a complete story see Peters 1976, 1983 and references therein) in which the Be star is the mass-gaining component and that the shell phases are projections of gas streams between the components against the disk of the Be primary. Measuring the wings of the broad stellar lines, she obtained a circular velocity curve of the primary with the semiamplitude K=9.4 km/s. The exact morphology of the shell phases is such that each primary shell phase, lasting 5 days, is - after a one-day gap - - followed by a secondary shell phase (of roughly the same intensity) which lasts only 2 days. This morphology is perfectly confirmed by an extended series of Ondřejov coudé spectrograms of the star. The most recent ephemeris for the time of the maximum intensity of the primary shell phase is (Peters 1976):

$$T_{prim.shell} = JD\ 2440855.5 + 80.860^d \times E\ .$$

The primary shell phase lasts from 0.975 to 0.043^P, the secondary one from 0.056 to 0.080^P, with a maximum strength at 0.068^P.

HR 2142 is one of the objects selected for long-term photoelectric monitoring in a program started by a group of ESO observers. Recently Baade (1983, preprint) and Sterken (1983) reported the first results of its ESO observations. The star was observed in the uvby system and was found to be essentially constant but on two different levels. Sometime between JD 2445323 and JD 2445354 (January 1983) it got about 0.13^m fainter in all four filters. According to the report, it may be either a phase-dependent behaviour or a long-term change. The authors do not publish the photometric data but only a phase diagram in b colour which, by mistake, is computed with a slightly incorrect value of the period, 80.82 days instead of 80.860 days.

Even before the ESO program began, HR 2142 was selected as one of 154 bright Be stars for long-term photoelectric monitoring in the international campaign organized by the Working Group on Be Stars of the IAU Commission 29 (Harmanec et al 1980). In the years 1979-1983 it was observed by three groups of the campaign observers and here we report the first results of these observations. Basic information about our observations is summarized in Table I. The obligatory campaign comparison HR 2205 and check stars HR 2154 and HR 2344 were used in all cases. Their Johnson's et al.(1966) UBV values are given in Table II. Our nightly normal B observations, overlapping partly with the ESO observations, are plotted

Table I

Basic information about present observations of HR 2142

Observatory	Instrumentation	Epoch of obs.(JD)	No. of nights
Skalnaté	0.60-m refl.	2444203 - 296	5
Pleso	UBV	2444625 - 662	6
		2444983 - 994	2
Kitt Peak	0.4-m refl.No.4	2444207 - 211	4
National	b	2444556 - 563	5
Observatory		2444918 - 925	6
Hvar	0.65-m refl.	2444902 -5030	8
	UBV	2445309 - 359	7

in Fig.1, together with the data for both check stars (the KPNO b observations were transformed to the Johnson B magnitude).

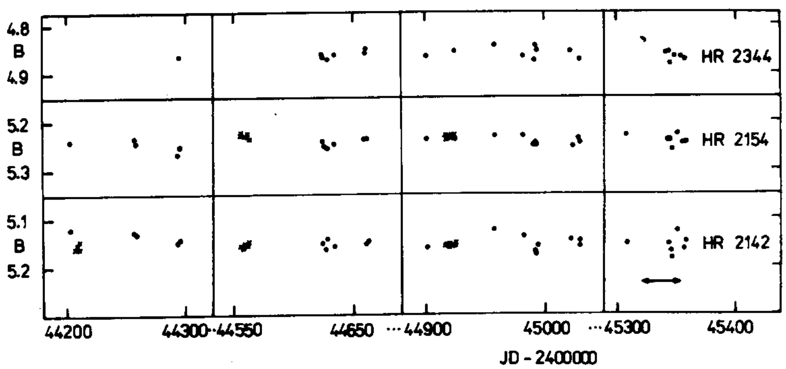

Figure 1

The interval in which the brightness decrease of 0.13^m should occur according to the ESO observations is indicated by an abscissa with arrows. It is clearly seen that <u>no such decrease occured in fact</u>. As the ESO observers used one of our check stars, HR 2344 as their comparison, it is even certain that the variations observed cannot be accounted for by some changes of HR 2344. It is therefore highly probable that the reported ESO observations of HR 2142 represent some observational or reduction error, not a real change in the star. This view is further strengthened by the finding that the light curve of another Be star, 10 CMa, reported in the same ESO observations, shows a similar drop of brightness between JD 2445280 and 2445310. It is easy to verify that the correct magnitude of HR 2142 corresponds to the <u>lower</u> level of the ESO observations.

Table II

Johnson's et al. (1966) standard UBV data for comparison and check stars

Star	V	B	U	B-V	U-B
HR 2205	5.05	4.85	4.07	-0.20	-0.78
HR 2154	5.38	5.25	4.71	-0.13	-0.54
HR 2344	5.05	4.87	4.11	-0.18	-0.76

Concerning possible real light variations of HR 2142, already Percy (1981) suspected slight rapid variations. This view is supported by Fig.1 which shows that the scatter of the points for HR 2142 is greater than that for both check stars, in spite of the fact that the air-mass difference with respect to comparison is usually greater for both check stars than for the variable. We thus suspect that some minor variations on a time scale of days may be present but this conclusion needs further verification because HR 2142 is usually observed at rather large zenith distances at Hvar and Skalnaté Pleso. It is true however that the ESO observations do show also a scatter of about $0.05 - 0.06^m$ on both levels, quite comparable to the scatter of our observations.

The star was monitored for about 0.12^d during one night at Skalnaté Pleso. No variations in excess of $\pm 0.01^m$ were detected on a time scale of hours (c.f. Fig.2).

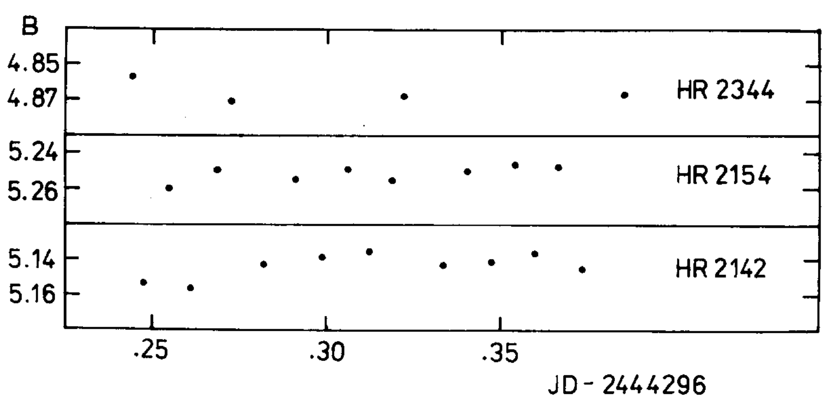

Figure 2

A plot of all our B observations against the phase of the 80.860-day orbital period is shown in Fig.3. It is clearly seen that no phase-dependent variations were detected. It is important to stress however that so far we have not been lucky enough to obtain photometric observations during the primary shell phases. However one Skalnaté Pleso observation obtained on JD 2444661.320 has a phase 0.067^P, i.e. coincides almost perfectly with the maximum strength of the secondary shell phase. Yet, it does not indicate any light change either in magnitudes or in colours. We thus arrive at a rather surprising

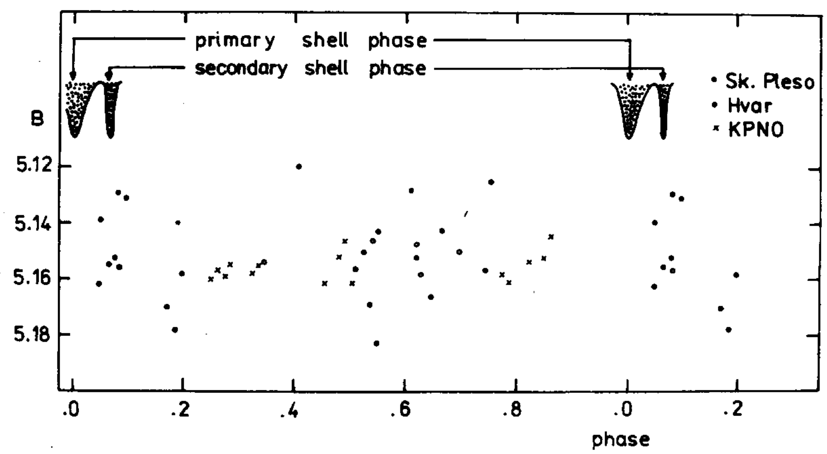

Figure 3

conclusion that the gaseous material responsible for the (at least secondary) shell phase (producing extremely strong and deep H I shell lines) is optically thin in the continuum in all optical wavelengths! This finding should be verified by further observations during the forthcoming shell phases. The next such opportunity is during the week around January 8, 1984.

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P.HARMANEC, J.HORN, P.KOUBSKÝ
Astronomical Institute
Czechoslovak Academy of Sciences
251 65 Ondřejov
Czechoslovakia

J.ŽIŽŇOVSKÝ
Astronomical Institute
Slovak Academy of Sciences
059 60 Tatranská Lomnica
Czechoslovakia

K.PAVLOVSKI, H.BOŽIĆ
Hvar Observatory, Faculty of
Geodesy, University of Zagreb
58450 Hvar
Yugoslavia

J.R.PERCY
Department of Astronomy
University of Toronto
Toronto, Ontario
Canada M5S 1A1

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A NOTE ON X TRIANGULI

Photoelectric observations of some eclipsing variable stars were carried out at the Kryonerion Astronomical Station of the National Observatory of Athens during September 1983. The observations were made using a two-beam, multi-mode, nebular-stellar photometer attached to the 48-inch Cassegrain reflector.

The eclipsing binary X Tri was observed on 16/17 September. Then, at U.T.= 22^h50^m (J.D. = 2445594.4550) a flare like phenomenon was detected.

Figure 1 gives the observed Δm (in V) against Hel. J.D. As one can notice

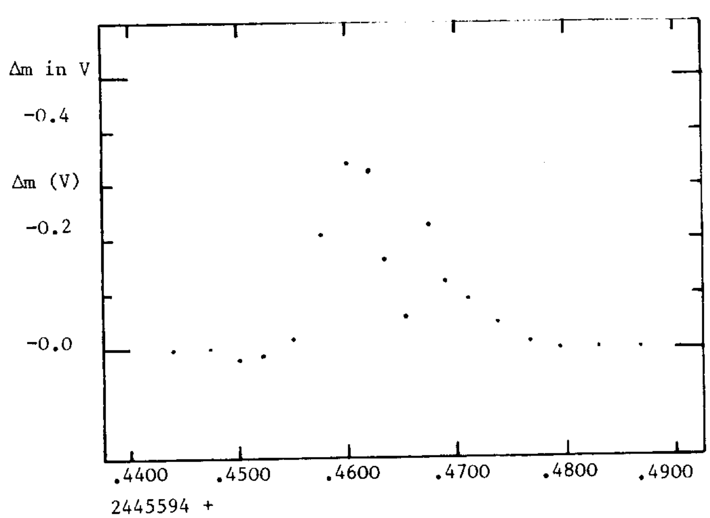

Figure 1

from it, there are two maxima and the whole phenomenon lasted for almost 35 minutes. Using the ephemeris:

$$\text{Min I (Hel. J.D.)} = 2437572.1994 + 0^{d}.9715382\ E$$

(Kukarkin et al. 1969) the observed phenomenon corresponds to phases 0.2725 - 0.2975.

Photoelectric observations of X Tri will be continued firstly to obtain a complete light curve and secondly to find out if the observed phenomenon would be repeated, since an observable mass transfer appears in the system (Mallama, 1975).

P. ROVITHIS

National Observatory
of Athens
Athens (306)
GREECE

H. ROVITHIS-LIVANIOU

Astronomy Department
Panepistimiopolis
Athens (621)
GREECE

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X-RAY VARIABLE STARS IN THE PLEIADES

In the course of an x-ray survey of the Pleiades region (Micela et al., 1983), we have studied two x-ray exposures taken a day apart, respectively on February 7 and 8, 1981, with the Imaging Proportional Counter aboard the Einstein Observatory (Giacconi et al., 1979). Each exposure covers a field of view of ~ 60'x60' with a ~ 50% overlap, 35 cluster members (m_v < 14) fall in the useful field of view of the overlap region according to the optical catalog of Hertzsprung (1947).

The characteristics of both observations are summarized in Table I.

Table I

Characteristics of the observations

	1st Exposure (15457)	2nd Exposure (15458)
Start time	JD 2444642.7571	JD 2444643.9195
Effective exposure	2931.0 sec	4511.5 sec
Limiting sensitivity	$\sim 2.8 \times 10^{29}$ erg sec^{-1}	$\sim 2.3 \times 10^{29}$ erg sec^{-1}

We have detected variability at a level greater than 3σ in the x-ray flux of the star HzII 303, the star HzII 193 shows a marginal variation that if real should be at the 80% level. For the remaining stars in the overlap region counting statistics is too low to allow any positive statement on their variability.

The values of x-ray broad band (0.2 - 3.5 keV) count rates obtained in the two exposures for these two stars, together with the derived fractional variability and the level of significance are shown in Table II.

Table II

Pleiades stars identified as variable x-ray sources

		1st Observ.		2nd Observ.			
Star #	Sp	Rate*	+/-	Rate*	+/-	% Variability	N σ
193	G7	7.9	2.6	14.3	4.0	80	1.4
303	G9	12.0	3.9	37.9	6.2	177	3.0

*Count-rate in units count $s^{-1} \times 10^{-3}$

In the course of an independent optical survey of the Pleiades region the star HII 303 had been observed by van Leeuwen (1983), who reports anomalies in the V and (B-V) values and conjectures that this star might be double and highly reddened.

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S. SCIORTINO, G. MICELA, S. SERIO*, G.S. VAIANA*,

Osservatorio Astronomico
Palazzo dei Normanni, 90134 Palermo, Italy

L. GOLUB, F.R. HARNDEN Jr. AND R. ROSNER

Harvard-Smithsonian Center for Astrophysics
60 Garden St., Cambrigde, Ma 02138, USA

*Also at Harvard-Smithsonian Center for Astrophysics

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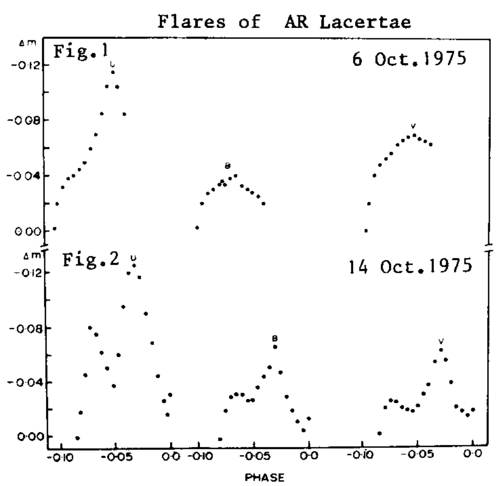
FLARE LIKE ACTIVITY IN AR LACERTAE

The system AR Lac (=BD +45^{o}3813 = HD 210334 = HV 2980 = HR 8448) is an interesting RS CVn binary. The system is known to be a radio source (vide Hjellming and Blankenship, 1973; Gibson and Hjellming, 1974; Spangler et al., 1977; Feldman, 1978; Owen and Gibson, 1978; Walter et al., 1978) showing variable radio emission and also occasionally flaring activity. Ultraviolet observations by Kiziloğlu et al. (1983) through IUE show that it is an active star. H and K emission of CaII and H-alpha emission are found to be present in the system, which indicate that this system has an active chromosphere.

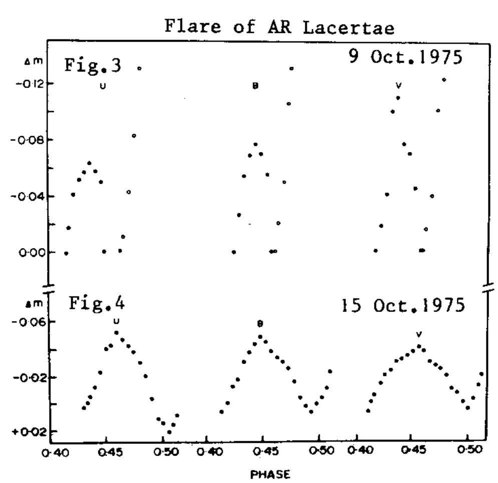
So far UBV flares have been observed in two RS CVn stars, SV Cam (Patkós, 1981) and XY UMa (Zeilik et al., 1982, 1983).

UBV observations of AR Lac were secured during the period October 1975 to January 1976 and some interesting features in the light curves of the system, particularly, an additional light of the order of $0\overset{m}{.}10$, just preceding primary minimum, and of the order of $0\overset{m}{.}05$, just preceding secondary minimum, in all the colours were reported (Srivastava, 1981). These appeared as humps on the shoulders of both the eclipses. The nature of these additional lights has been investigated in this communication.

The additional lights have been observed on four nights (6 October 1975, 9 October 1975, 14 October 1975 and 15 October 1975) in all the three filters. Two nights (6 October 1975 and 14 October 1975) are related to the ingress part of the primary eclipse, while the remaining two nights (9 October 1975 and 15 October 1975) are concerned with the ingress part of the secondary eclipse. The additional lights observed on all the four nights have been obtained by taking the difference of observed and computed lights of the system from the smoothened light curves. These differences are plotted in Figures 1, 2 and Figures 3, 4 for primary and secondary eclipses, respectively. The figures show that flare-like activity is present in the system. The characteristics of flares are given in Table I.



Figures 1-2
Flares of AR Lacertae during primary minimum



Figures 3-4
Flares of AR Lacertae during secondary minimum. Filled and open circles represent the first and the second flares, respectively.

Table I

Characteristics of the flares of AR Lacertae

Min.	Date 1975	Fil- ter	Start time of flare (UT)	End time of flare (UT)	Duration of flare	Time of maxima of flare (UT)	Maximum amplitude of flare (mag.)
Pr.	6 Oct.	U	$16^h\ 33^m.1$	$19^h\ 28^m.9$	$02^h\ 55^m.8$	$18^h\ 57^m.6$	$0^m.12$
		B	16 36.4	19 28.9	02 52.5	18 12.7	0.04
		V	16 40.3	19 28.9	02 48.2	18 42.1	0.07
			First flare				
Sec.	9 Oct.	U	16 45.6	18 06.6	01 21.0	17 30.4	0.06
		B	17 13.2	18 44.9	01 31.7	18 09.1	0.08
		V	16 56.4	18 41.2	01 44.8	17 37.6	0.11
			Second flare				
		U	18 44.9	19 36.5	00 51.6	19 36.5*	0.13*
		B	18 59.1	19 40.4	00 41.3	19 40.4*	0.13*
		V	18 44.9	19 36.5	00 51.6	19 36.5*	0.12*
Pr.	14 Oct.	U	15 50.4	19 32.9	03 42.5	16 32.0	0.15
		B	16 14.2	19 32.9	03 18.7	16 32.0	0.07
		V	15 50.4	19 32.9	03 42.5	16 32.0	0.06
			First flare				
Sec.	15 Oct.	U	16 25.3	19 22.5	02 57.2	17 44.8	0.05
		B	15 51.6	18 52.1	03 00.5	17 15.9	0.05
		V	15 23.8	19 03.1	03 39.3	17 30.2	0.04
			Second flare				
		U	-	-	-	-	-
		B	19 46.1	20 07.8	00 21.7	00 21.7*	0.02*
		V	19 47.9	20 07.8	00 19.9	00 49.9*	0.02*

*These values do not relate to the actual times of maxima, amplitudes of the flares, but are only apparent values as the secondary flares have not been observed fully.

The average standard deviation of individual observations of comparison star is $0^m.02$.

In both the flares of secondary minima (Figures 3 and 4), the flares start from the normal light (quiescent) level, rise to the maximum light (flare) level and then subside and return to the quiescent level. However, the flare curves of 9 October 1975 show a sharp rise and a sharp decline while the flare curves of 15 October 1975 show a slow rise and a slow decline.

The second flare starts on these nights after the main burst. The rise during the second flare is not conspicuous on 15 October 1975 in the U filter due to considerable scatter present in the observations. The secondary flares seem to be more intense showing steeper rise.

The flares of primary minima on 6 October 1975 and 14 October 1975 show declining tendency after the start and then rise to the maximum intensity before the last decline. The flares of 14 October 1975 do not decline to the quiescent levels, but show a tendency to rise before the last decline. The duration of flare on 14 October 1975 is the longest. The pattern of flare of 14 October 1975 indicates that sympathetic flare may have been associated with the preceding flare as is shown in the case of EV Lac (Godoli, 1968). The flares of 6 October 1975 have not been observed fully.

This is the first reporting of the flares in the UBV region for AR Lac.

The author has interpreted these additional light's phenomena on the plausible basis of flare-like activity. However, the alternative interpretations of these additional lights, if any, would need further investigation.

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R.K. SRIVASTAVA

Uttar Pradesh State Observatory,
Manora Peak, Naini Tal-263129,
India

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PHOTOELECTRIC TIMES OF MINIMA OF ECLIPSING VARIABLES

During a program of photoelectric observations of eclipsing variables at Kryonerion Observatory, Greece, the close eclipsing systems V566 Oph (BD+5° 3547) and V388 Cyg (BD+30° 4051) were observed photoelectrically in July 1981 and September 1982, respectively. The observations were made with a 48-inch Cassegrain reflector and a two beam multi-mode photometer (Goudis and Meaburn, 1973). The two intermediate pass-band filters used were selected to be in close accordance with the standard UBV colour system.

The times of minima, given in the following Table I, were determined by the method of bisecting chords which connect the points of equal magnitudes on the opposing branches near the minimum.

Table I

Star	HJD 2440000+	E	O-C	Filter	Rem.
V566 Oph	4795.3461	10684.5	+0.0085	B,V	MinII
V566 Oph	4796.3698	10687	+0.0081	B,V	MinI
V566 Oph	4797.3946	10689.5	+0.0088	B,V	MinII
V566 Oph	4798.4191	10692	+0.0091	B,V	MinI
V566 Oph	4799.4434	10694.5	+0.0093	B,V	MinII
V388 Cyg	5228.4142	13554.5	-0.1413	B,V	MinII
V388 Cyg	5231.4186	13558	-0.1436	B,V	MinI
V388 Cyg	5232.2786	13559	-0.1427	B,V	MinI

The successive columns contain the name of the star, the heliocentric time of minimum, the number of cycles E, the difference O-C, the filter used and remarks. The O-C values for V566 Oph were computed according to the ephemeris given by Dawson and Narayanaswamy (1977):

$$\text{MinI} = \text{JD Hel } 2440418.4931 + 0^{d}.40964431 \times E$$

while the O-C values for V388 Cyg were calculated according to the ephemeris (Cerruti-Sola,M.et al., 1977).

$$\text{MinI} = \text{JD Hel } 2433584.542 + 0^{d}.8590515 \times E$$

P.G. NIARCHOS
Department of Astronomy
University of Athens
Panepistimiopolis,Athens 621
G r e e c e

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ACTIVE AND INACTIVE STATES OF THE X- RAY BINARY 4U 2129+47 = V 1727 CYGNI

From a letter of W. Pietsch, Institut für extraterrestrische Physik of Max-Planck-Institut für Physik und Astrophysik, Garching/München, we learned that V 1727 Cyg was observed in a low state in September and October 1983 in the optical and x-ray regions - see also the announcement of Pietsch et al. in IAU Circ. 3887. Although the object's brightness is rather close to the plate limit even of our best astrographic exposures (two 40 cm four-lens cameras) I tried to look for further inactive phases, with the following results: V 1727 Cyg is strongly variable between $16^{m}.8$ and $18^{m}.1$ (B) on 75 plates taken in 1963, 1967, 1969, 1970, and (scattered) 1972 to 1979, the last definitely bright observation ($16^{m}.7$) being of 1979 Oct. 11. Figure 1 shows the

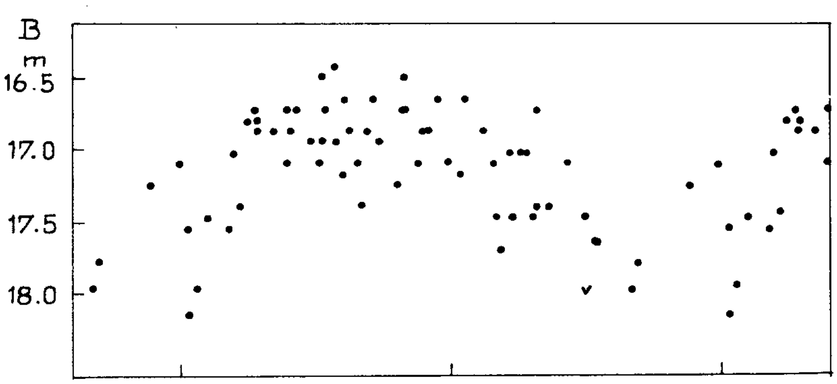

Figure 1

estimates, folded by means of the elements

$$\text{Min. (hel.)} = 244\ 4403.743 + 0^{d}.2182579\ (\pm\ 0^{d}.0000008) \cdot E$$

given by McClintock et al. (Astrophys.J. 258, 245, 1982).

In contrast to that behaviour the star was obviously in inactive faint states on 39 plates of 1938 to 1943 and 1983. After the active time described above the first exposure showing the object faint (>$17^m.8$), when it should have been around $17^m.0$ according to the elements, is of 1983 Sep. 7. Figure 2

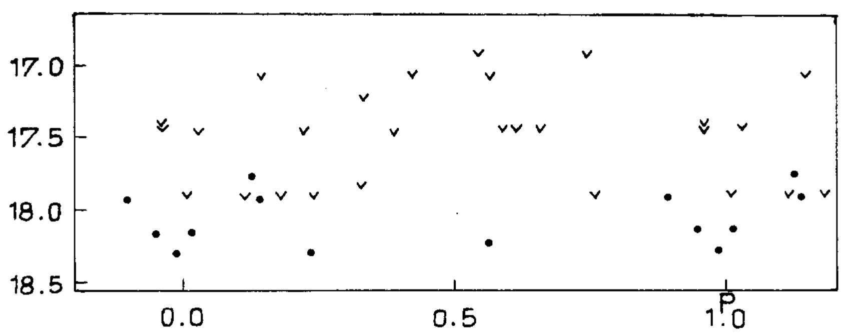

Figure 2

displays the observations of 1938 to 1943. The arrows indicate "fainter than" observations, period as before, zero point arbitrary.

Unfortunately, 7 plates of 1980, 1982 and August 1983 do not definitely contradict either of the two possibilities.

One should note that the light curve of Figure 1 is strongly flattened because of the occasionally rather long exposure times (up to 1/3 P). The asymmetric trend, which has been described by previous authors, is however well seen. The large scatter is also due to the faintness of the star.

The comparison stars used in this investigation can be located on the finding charts of Thorstensen et al. (Astrophys.J. 233, L 57, 1979) as follows; the positions are relative to the variable in millimetres, and the adopted B magnitudes are given in parantheses:

a 3.5 sf ($16^m.5$), b 14.8 n, 4.5 f ($17^m.5$), c 4.3 p ($17^m.9$).

W. WENZEL

Sternwarte Sonneberg
Zentralinstitut für Astrophysik
der Akademie der Wissenschaften
der DDR

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VARIABLE STAR TIMINGS FROM ARIZONA

During 1980-1982, monitoring of several variable stars for polarization was carried out with the MINIPOL polarimeter at Steward Observatory. Standard stars were included in the program so that the data yielded photometric monitoring as well. Eight times of maxima for two Beta Cephei stars (BW Vul and Sigma Sco) were found this way, as were two times of primary minima of the eclipsing contact binary W Corvi. In addition, the Johnson UBVRI photometer at Steward was used to find one maximum of BW Vul, and the UBV photometer at the US Naval Observatory at Flagstaff was used for one minimum of W Corvi. In all cases

Table I

Heliocentric Julian Dates

Star	Hel. JD - 2,440,000	notes
BW Vul (maximum)	4401.8010	MINIPOL B-filter
	4402.8040	"
	4403.8110	"
	4482.8211	"
	4483.8244	"
	4484.8298	"
	4504.7326	U,B,V filters
	4872.8450	MINIPOL B-filter
Sigma Sco (maximum)	4450.5407	"
W Corvi (primary	4704.8490	"
eclipse minimum)	4718.8215	"
	5077.7957	B,V filters - USNO

the data were corrected for extinction, differential magnitudes were plotted, and timings were estimated visually from these plots.

ANDREW P. ODELL
FRANK DORCHAK
KIM ROGALSKI

Dept. of Physics
and Astronomy
Northern Arizona U.
Flagstaff, AZ 86011
USA

SANTIAGO TAPIA
WIESLAW Z. WISNIEWSKI

Lunar and Planetary Lab
Steward Observatory
University of Arizona
Tucson, AZ 85721
USA

DAVID H. SMITH

Sky and Telescope
49 Bay State Road
Cambridge MA 02238
USA

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HD 104901B AN F-TYPE SUPERGIANT ECLIPSING BINARY

HD 104901B has been classified F0Ib-II by Stephenson and Sanduleak (1973), F0Ib/III by Houk and Cowley (1975) and F0IIp by Gahm, Ahlin and Lindroos (1983). The star is 23 arcsec south of the B8Ib/II supergiant HD 104901A. The pair forms Dunlop 117 and the separation has remained fixed for over a century. Observations in 1978 and in 1980 indicated possible variability and the star was monitored for a week in 1981, but significant variation was not noted. However a long run of observations in 1982 and 1983 revealed a variation of 0.35 mag. The intermediate-band and β observations are listed in Table I and a few (R,I) observations are in Table II. The adopted light elements, max = JD 2445065.0 + 106.6 days were used to compute the phases and the results are shown in Figure 1. A value of P = 53.3 days can not be entirely rejected without additional observations, although the distinct difference in width of the two minima makes the shorter period unlikely. The observations cover a span of 4 years so the periodicity is well established. The star is most likely an eclipsing binary. The components are probably near contact and the slight reddening, shown by (b-y), at both eclipses is normal for such systems.

The behaviour of the β index in Figure 1 is of some interest. There is obviously strong Hβ emission at some phases and this is confirmed by the spectra taken by Gahm <u>et al</u>.(1983);

Table I

Intermediate band and Hβ Observations of HD 104901B

JD 244	V	b-y	M_1	C_1	β	Phase
3637.660	$7^{m}.67$	$0^{m}.370$	$0^{m}.050$	$1^{m}.572$	2.593	0.610
3638.650	7.69	0.374	0.057	1.562	2.596	0.620
4305.720	7.76	0.381	0.057	1.522	2.608	0.878
4421.605	7.65	0.364	0.075	1.615	2.625	0.964
4670.700	8.00	0.374	0.060	1.470	2.576	0.300
4694.760	7.66	0.359	0.059	1.605	2.618	0.527
4695.795	7.66	0.363	0.063	1.604	2.614	0.537
4698.774	7.65	0.369	0.059	1.575	2.624	0.565
4702.785	7.66	0.370	0.063	1.545	2.604	0.612
5019.854	7.62	0.364	0.054	1.568	2.624	0.576
5020.847	7.66	0.371	0.050	1.544	2.635	0.586
5025.788	7.76	0.373	0.059	1.540	2.588	0.632
5026.785	7.80	0.386	0.056	1.524	2.586	0.642
5032.750	7.97	0.391	0.074	1.472	2.598	0.697
5049.778	7.77	0.372	0.075	1.579	2.599	0.857
5050.740	7.75	0.373	0.073	1.539	2.601	0.866
5051.757	7.75	0.371	0.064	1.567	2.598	0.876
5057.726	7.64	0.354	0.070	1.593	2.600	0.930
5058.705	7.65	0.366	0.059	1.593	2.598	1.941
5068.667	7.66	0.365	0.059	1.545	2.588	0.035
5069.642	7.69	0.370	0.053	1.603	---	0.044
5070.656	7.70	0.366	0.067	1.577	2.601	0.053
5083.698	7.84	0.385	0.076	1.426	2.592	0.175
5090.719	7.91	0.375	0.076	1.452	2.569	0.240
5091.670	7.93	0.382	0.068	1.499	2.553	0.250
5119.569	7.65	0.364	0.053	1.664	2.626	0.512
5150.521	7.84	0.374	0.092	1.500	---	0.802
5151.510	7.84	0.369	0.073	1.550	2.635	0.812
5152.528	7.81	0.385	0.073	1.543	2.619	0.820
5153.503	7.80	0.370	0.079	1.539	2.607	0.830
5353.854	8.01	0.364	0.115	1.415	2.593	0.710
5366.847	7.83	0.380	0.072	1.498	2.599	0.832
5376.805	7.68	0.375	0.066	1.598	2.599	0.925
5377.812	7.72	0.365	0.057	1.629	2.605	0.934
5378.851	7.66	0.363	0.074	1.608	2.624	0.944
5382.858	7.67	0.347	0.069	1.623	2.587	0.982
5383.840	7.67	0.350	0.071	1.669	2.606	0.991
5384.833	7.67	0.355	0.072	1.636	2.606	0.000
5385.840	7.66	0.352	0.062	1.604	2.611	0.010
5386.809	7.67	0.360	0.065	1.591	2.601	0.019
5403.802	7.87	0.391	0.076	1.408	---	0.178
5412.760	7.90	0.382	0.058	1.467	2.545	0.262
5429.667	7.75	0.380	0.064	1.610	---	0.421
5430.625	7.73	0.382	0.060	1.613	2.582	0.430
5450.569	7.77	0.375	0.058	1.528	2.604	0.617
5451.587	7.76	0.378	0.054	1.523	2.584	0.626
5459.691	7.93	0.384	0.053	1.448	---	0.703
5467.639	7.96	0.393	0.075	1.395	2.593	0.777
5493.542	7.69	0.353	0.080	1.687	2.587	0.020

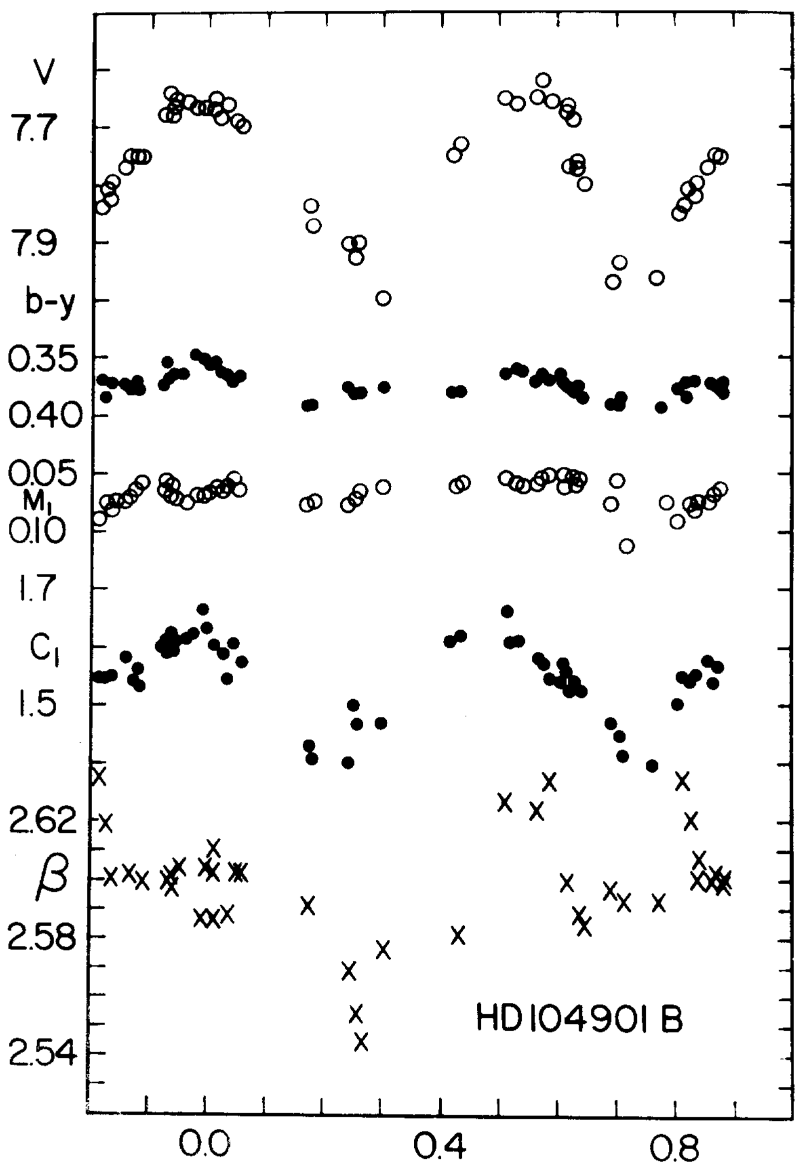

Figure 1

Light and color curves for HD 104901B

Table II

JD 244	R	R-I	Phase
5074.697	7.^{m}54	0.219	0.091
5089.680	7.63	0.237	0.232
5381.872	7.37	0.230	0.972
5411.680	7.61	0.244	0.252

"Hα, Hβ and Hδ lines show distinct P Cygni profiles with a sharp edge between the emission and absorption components. The peak of the emission components is red-shifted by 90 km/sec relative to the stellar radial velocity as determined from the metallic lines." A striking feature of the β index is the relative stability with phase and the behaviour of the Hβ emission must be characterized by some regularity. The run of the β values in the figure also supports the long period with the largest values of β (smallest, or non-existent, emission) bracketing the second minimum and the strongest emission (smallest values of β) occuring near the first minimum.

The photometric parameters of the A component (HD 104901, CPD - 61°3933) are listed in Table III. Applying the reddening

Table III

Photometric Parameters for HD 104901A

V	b-y	M_1	C_1	β	Δ[a]	No.
7.43	0.204	0.021	0.790	2.630	2.5.5.2	7
E(b-y)	[u-b]	M_V	V_0	Mod.	Sp.T.[b]	
0.240	0.913	-2.9	6.4	9.3	B8Ib/II	

a Mean difference in observed values of (b-y), M_1, C_1 and β.

b Houk and Cowley (1975).

and modulus to HD 104901B gives (b-y) = 0.115 mag. and M = -2.7 mag at maximum light. A third component of Dun 117, 26 arcsec north of HD 104901A and apparently a background early type star, gives (V, b-y, M_1, C_1, β) = (10.19, 0.136, 0.026, 0.219, 2.650) mag from 7 observations, yielding E(b-y) = 0.220 mag, M_V = -2.15 mag and a modulus of 11.4 mag. The 10 brightest members of NGC 4103, which is 5° north, give E(b-y) = o.211 ± 0.015 (σ) mag and a modulus of 11.45 ± 0.25 (σ) mag from observations by Stetson (1981). NGC 4755 (κ Cru cluster) is 6° north-east with a reddening of E (b-y) = 0.230 ± 0.20 (σ) mag and modulus of 11.4 mag, derived from observations by Shobbrook (1983). The clusters may be part of the association Cru OBI at a distance of 1.9 kpc and containing Dun 117C.

Although there is no reason to doubt the validity of the distance derived from HD 104901A, 0.72 kpc, or the assumption that the A and B components are at the same distance, it should be noted that a distance of 1.9 kpc for all three components is not contradicted by other available evidence. Values of M_V = -5.0 and -5.2 mag for components A and B, respectively, do not disagree with the wide luminosity class limits imposed by the available spectral classifications, quoted above.

OLIN J. EGGEN

Cerro Tololo Inter-American Observatory*

Casilla 603, La Serena, Chile

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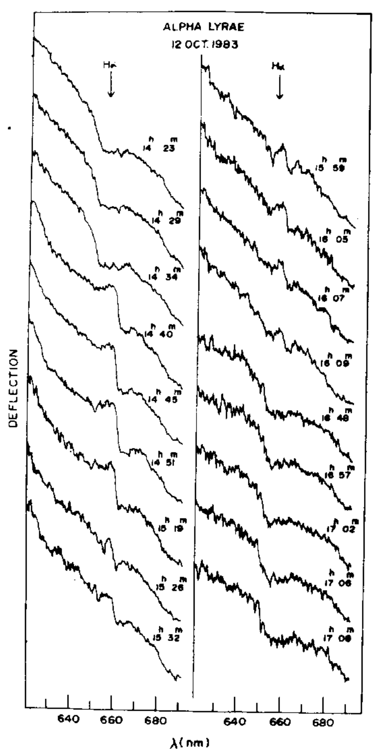
Hα VARIABILITY IN ALPHA LYRAE

Suspected variability is a valuable clue in finding new emission stars. Hα observations of bright stars with no history of line emission can lead to the discovery of hydrogen-emission stars. α Lyrae had been a well known standard star with spectral type AOV. Johnson and Wisniewski (1978) have reported violet shifted emission features associated with the OI λ 7774 Å and λ 8446 Å, as well as the infrared Ca II triplet lines in the infrared spectra of Vega. These features, however, could not be confirmed during later observations by Barker et al. (1978), Griffin (1978) and Bord and Messina (1980). Weak hydrogen-emission superimposed on absorption were noticed by us on 8, 18 and 20 September 1982. In confirmation with that we again observed α Lyrae for several nights. On 12 October 1983 the star α Lyrae again showed hydrogen-emission. We present Hα observations of α Lyrae showing variable Hα profile.

During our spectrophotometric programme of Be stars, the star α Lyrae, used as a standard, was surprisingly found to have Hα in emission. We obtained 18 spectrophotometric scans of α Lyrae on 12 October 1983. Observations were obtained with a Hilger and Watts monochromator on the Cassegrain focus of the 1.0 m telescope at Uttar Pradesh State Observatory on one night. The dispersion at the exit slit of the monochromator was 70 Å/mm. The scans were obtained with an exit slit of 0.7 mm, admitting 50 Å of the spectrum. The enlarged dispersion at the original tracings was 7.8 Å/mm.

Figure 1 shows a series of spectrum scans of α Lyrae. The emission at Hα is obvious. α Lyrae showed variation in the depth and shape of Hα over time scales of about 1.5 hours. First three scans show a normal absorption feature at Hα. The next four scans show peculiar type of Hα profiles with one component in emission and another in absorption. Later on centrally reversed emission was seen at Hα in about six scans. In last few scans the emission disappeared and α Lyrae showed a normal absorption feature at Hα again as it was at the beginning. The activity persisted for about 1.5 hours. We also observed ξ^2Cet(B9III) as the comparison star. The Hα scans of ξ^2Cet are shown in Figure 2. It is evident from Figure 2 that ξ^2Cet showed a normal



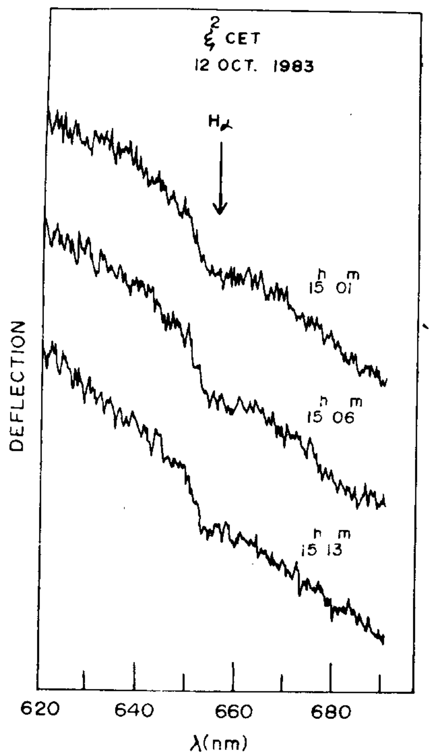


Figure 1

Original spectrophotometric scans of Vega at Hα line region.

Figure 2

Original spectrophotometric scans of ξ^2Cet at Hα line region.

absorption feature at Hα.

Hydrogen-emission in single early-type stars whose luminosities place them on or near the main sequence may be associated with mass ejection produced by rapid rotation. The projected rotational velocity of α Lyrae is very small, i.e., 15km/sec (Hoffleit, 1982). Suspected variability in early-type stars, plus rapid rotation, is a strong indication that the star has been, is, or will be, a hydrogen-emission star. Since the presence of emission depends on the intrinsic and not on the projected rotational velocity, suspected variability in some of the apparently slowly rotating stars is probably also connected with line emission, e.g., α Lyrae. From this type of Hα variability we suggest that α Lyrae would be an excellent candidate for becoming Be star, as was proposed by Irvine (1975) for the star α Leo. We also suggest that α Lyrae may have a thin variable envelope.

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P.S. GORAYA and MAHENDRA SINGH

Uttar Pradesh State Observatory
Manora Peak, Naini Tal-263 129,
India

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CO Aur - DOUBLE MODE CHARACTER CONFIRMED

By inspecting some 880 plates of the Sonneberg Sky Patrol taken from 1928-1983 we were able to find long time stability of the light curve parameters. One of us (B.F.) estimated the brightness by using the conventional Argelander method and improved the first period given by Mantegazza and Antonello (I.B.V.S. No. 2411, 1983). All bright observations were chosen and the improved period of $1^d.783003$ was obtained by conventional (O-C) calculation. After this, normal Fourier analysis of the original observations was executed. For several reasons the data were subdivided into three time sets. The first set contains the early observations (JD 2425500 to 2432000), the second one the in-between (JD 2432000 to 2439000) data and the third one the data from JD 2438000 to 2445000. All three sets were analysed independently. A clear peak was found at 0.56805 cpd (P: $1^d.78301$). The Fourier analysis for the first frequency was executed in the restricted frequency range of 0.55 cpd to 0.57 cpd with frequency steps of 0.00001 cpd.

Table

Set	JD	Number of observ.	First component		Second component	
			f_1(cpd)	A_1(mag)	f_2(cpd)	A_2(mag)
I	2425500-2431840	277	0.560865	0.17	0.70039	0.03
II	2432280-2438000	267	0.56085	0.20	0.70040	0.05
III	2438620-2445400	340	0.56085	0.20	0.70042	0.05

After least square sine-fitting and prewhitening the data were again Fourier-analysed (frequency range 0.4...0.8 cpd, step width 0.00005 cpd): In data sets II and III the highest feature is then at 0.7004 cpd ($P=1\overset{d}{.}4278$). In the first data set the feature at this frequency is indicated just above the noise level. One reason may be the inhomogeneity of the material of the first set. Some preliminary characteristics for the data derived from the Fourier spectra are given in the Table above. Further details will be published later.

B. FUHRMANN, R.H. SCHULT

Sternwarte Sonneberg
Zentralinstitut für Astrophysik
der Akademie der Wissenschaften
der DDR

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HU ISSN 0374-0676

NEW PHOTOELECTRIC MINIMA TIMES OF VW CEPHEI

VW Cep (HD 197433 = BD+75^{o}752) is a W UMa eclipsing binary with a variable light curve and short and long term periodic changes in its period. For these reasons it is frequently observed.

Photoelectric observations of VW Cep, in B and V, were carried out during 1981 and 1983. The observations were made with a two-beam, multi-mode, nebular-stellar photometer attached to the 48-inch Cassegrain reflector at the Kryonerion Astronomical Station of the National Observatory of Athens.

The stars HD 192889 and HD 192635 were used for comparison and checking, respectively. Reduction of the observations has been made using Hardie's method (1962) and the two filters used are in close accordance with the standard ones.

During two observational nights (17/18 Sept. 1981 and 12/13 Sept. 1983) the observations were carried out for several hours and thus two complete light curves were obtained which will be appeared elsewhere. Here we shall give the eight (8) new minima times obtained during our observations.

Table I gives the Hel. JD of the 8 minima, the mean errors σ, the differ-

Table I

Hel.JD 2440000.+	σ days	$(O-C)_I$ days	$(O-C)_{II}$ days	Min Type
4859.3171	±0.0005	-0.1189	+0.0763	I
4862.5187	±0.0004	-0.1180	+0.0973	II
4864.4621	±0.0004	-0.1228	+0.0724	II
4865.4454	±0.0003	-0.1144	+0.0816	I
4865.5811	±0.0004	-0.1171	+0.0781	II
4869.3378	±0.0004	-0.1171	+0.0775	I
5586.4147	±0.0006	-0.1269	-0.0912	II
5590.4471	±0.0006	-0.1301	-0.0944	I

ences $(O-C)_I$ and $(O-C)_{II}$ and the type of minimum. The times of minima and the mean errors have been calculated using Kwee and Van Woerden's method (1956) and are the mean values of B and V observations. The residuals $(O-C)_I$ and $(O-C)_{II}$ have been computed using Kwee's (1966) ephemeris formula:

$$\text{Min I} = (\text{Hel. JD})\ 2433898.44100 + 0\overset{d}{.}27831793E$$

and Kukarkin's et al. (1976):

$$\text{Min I} = (\text{Hel. JD})\ 2433163.959 + 0\overset{d}{.}27831993E,$$

respectively.

The $(O-C)_I$ values given in the foregoing Table are in good agreement with the O-C diagram of VW Cep based on Kwee's (1966) ephemeris formula (Van't Veer, 1973, Karimie, 1983).

P. ROVITHIS

National Observatory
of Athens, Athens
Greece

H. ROVITHIS-LIVANIOU

Astronomy Dept.
Athens University
Panepistimiopolis
Athens - Greece

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HU ISSN 0374-0676

A DATABASE FOR RS CVn BINARY STAR SYSTEMS

We are currently undertaking the task of compiling a Catalog of RS CVn Binary Star Systems. The catalog is broken into four section. The contents of each section is as follows:

Section 1

1. Douglas S.Hall identification number.
2. One of the more commonly used names for the system.
3. Distance to the system in parsecs.
4. 1950 coordinates.
5. Spectral and luminosity classes for the hot and cool stars.
6. Average V maximum outside of eclipse (magnitude).
7. Distortion wave V maximum amplitude (magnitude).
8. A reported x-ray flux in units of 10^{31} ergs/sec.
9. A reported radio flux in units of Janskies.
10. Whether or not H-alpha has been observed in emission.
11. Ca II H and K emission. Star that shows the emission is indicated.
12. Colors in which the system is known to have been observed.
13. Type of eclipsing system (total, partial or none).

Section 2

1. Julian date of conjunction with the presumed cooler star behind.
2. Orbital period in days.
3. Quadratic term in the ephemeris, in days. All values come from the Hall-Kreiner paper in ACTA ASTRONOMICA (30), 387
4. Orbital eccentricity.
5. Indication of variability in the period.
6. Masses (solar units) of the components.
7. Radii (solar units) of the components.
8. Configuration (Detached, Contact, Semi-detached).

Section 3 is a cross-reference for the various names for each system consisting of 1) Bayer (Greek Letter) identification, 2) Flamsteed number,

Table I

Section 1

I.D. Name Distance	R.A. (1950) Dec. (1950)	Hot Cool	Aver.Max. Wave Max.	X-ray (E+31) Radio (JY)	H-alpha H and K	Colors Eclipse
1						
RT And	23 08 56	F8 V	9.01	Soft, <4.0		UBVR
95	+52 45 16	G9-KOV	0.04		Yes	Total
2						
Zeta And	00 44 41	K1 II	4.06	Soft, 0.138		UBVR
31	+23 59 44	-	0.02		Only	Partial
3						
Lambda And	23 35 06	G8 IV-III	3.88	Soft, 0.363	Yes	UBVR
24	+46 11 14	-	0.30	2.0E-2	Only	None
4						
UX Ari	03 23 33	G5 V	6.5	Soft, 2.1	Yes	UBVR (IUE)
50	+28 32 32	KO IV	0.1	.200 Variable	Cool	None
5						
CQ Aur	06 00 39	GO	9.0	Soft, 0.871		UBVR
220	+31 19 51	-			Cool	Total

Section 2

I.D. J.D.(hel)	Period(days)	Quadratic term	e	Period var.	Masses	Radii	
1							
2441141.88902	+0.628929513	-6.33E-11	0.09	-21.1	1.50/0.99	1.36/1.00	D*
2							
2432751.617	+17.7692		0.00		2.70/0.78	14.08/1.44	C?*
3							
2429199.994	+20.5212		0.04		F(M)=0.000611		
4							
2440133.766	+6.43791				0.63/0.71		
5							
2429558.728	+10.621943	+3.78E-7		+5.8	1.6/2.0	1.9/8.7	

*D=detached, C=contact

Section 3

I.D.	Bayer	Flamsteed	HR	HD	BD	Variable	Visual
1.					BD +52 3383A	RT And	
2.	Zeta And	34 And	HR 215	HD 4502	BD +23 106	Zeta And	
3.	Lambda And	16 And	HR 8961	HD 222107	BD +45 4283	Lambda And	
4.				HD 21242	BD +28 532	UX Ari	
5.				HD 250810	BD +31 1179	CQ Aur	

3) Yale Bright Star Catalog number, 4) Henry Draper Catalog number, 5) BD number, 6) Variable star designation and 7) Visual binary designation. Section 4 will contain a bibliography on each source in the catalog (yet to be compiled). A sample listing for each section is given in Table I.

Copies of the catalog are available in tabular printout form or on 5-1/4" floppy diskettes for APPLE micro-computer systems. The first three sections of the catalog are in VISIFILE format, but they can be converted to DIF format on request. The bibliography is currently available in SUPER FILE CABINET format only. Observers are invited to send us preprints and reprints of published data so that we can continually update the catalog.

E. NELSON and M. ZEILIK

Capilla Peak Observatory
The University of New Mexico
Albuquerque, NM 87131
U.S.A.

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THE LONG TIME BEHAVIOUR OF THE POLAR AM Her IN 1983

The star was inspected on 92 blue-sensitive plates (ORWO-ZU 21 + GG 13 + BG 12) from 36 nights taken with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 1983 March 9 and 1983 November 6. The exposure time of these plates varies between 9 and 30 minutes, but most of the plates are exposed 20 minutes. In 21 nights more than one plate per night were obtained.

The used sequence of comparison stars in B is given by Hudec and Meinunger (1977). It is remarkable that concerning its brightness in 1983 AM Her has steped over the limits of this sequence given by the comparison stars q (m_B = $12^m.79$) and e (m_B = $15^m.44$).

The long time light curve in B is shown in Figure 1. There, the estimations on individual plates are plotted by dots. The mean magnitudes from nights with more than on plate are marked by circles.

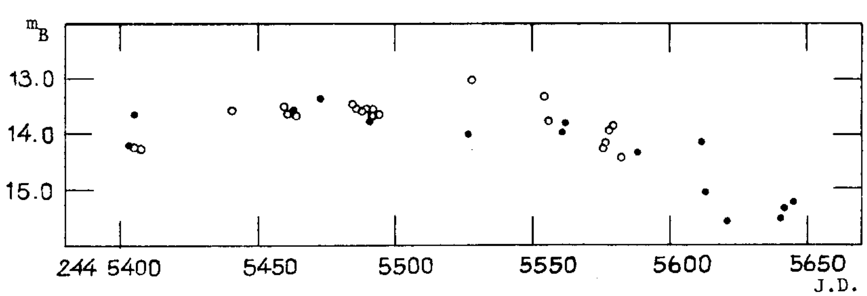

Figure 1

As in the series of the year 1982 (Götz, 1982) two different states of the behaviour of AM Her can be seen in Figure 1. Most of the time in 1983 the star spent in the active state which is characterized by increased brightness caused by X-ray heating. In this phase where the influences of the occultation light changes could be confirmed again a flare was observed on

July 12, 1983. There, the brightness of AM Her increased from $m_B = 13^m.74$ (J.D. hel. 2445528.407) to $m_B = 12^m.33$, $\Delta m_B = -1^m.41$, within $\Delta t = 0^d.024$. On a plate in V (ORWO-RP1 + GG 14), which was exposed 29 minutes later than the maximum plate the brightness of the star is $V = 13^m.10$. From both plates a colour index of $B - V = -0^m.77$ results. The inactive state of the star with a brightness lower than $m_B = 15^m.0$ was observed at the end of the given series. The change from the high to the low state started within 1^d between 1983 October 4 ($m_B = 14^m.16$) and October 5 ($m_B = 15^m.05$).

More details about the behaviour of AM Her, especially concerning the occultation light changes will be published in Mitt.Veränd. Sterne (Sonneberg).

W. GÖTZ

Akademie der Wissenschaften
der DDR, Zentralinstitut für
Astrophysik, Sternwarte
Sonneberg

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INFORMATION BULLETIN ON VARIABLE STARS

Number 2460

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Budapest
16 January 1984
HU ISSN 0374-0676

ON THE δ Sct-LIKE VARIABILITY OF THE Ap STAR HD 10088

The Ap star HD 10088 (BD +21°224, SAO 74848, sp = A0, m_v = 7.9) was found by Weiss (1983) to exhibit light variations characteristic of δ Sct variables. This group of Ap stars with δ Sct characteristics is described by Kurtz (1982 a). Weiss found a period of about 1^d29^m and an amplitude of about $0\overset{m}{.}03$ in Strömgren v on two nights. Efforts were undertaken to obtain additional photometry.

Photometry was carried out on several nights using Lowell Observatory's 1.1 m and 0.8 m telescopes, employing either a single-channel or dual-channel photometer and electronically cooled EMI tubes. Three integrations of either 10 or 15 sec were obtained on the program star, followed by an equivalent number on the comparison star. This produced an equal number of observations for each star. The comparison star used was HD 9985 (BD +20°261, SAO 74837), which is classified in the SAO catalog as sp = A0, m_v = 8.0, and lies only about 1° from HD 10088. The means of the data triplets were first formed. The differential photometry was obtained by subtracting from HD 10088 the interpolated values from a spline fit through the HD 9985 data. The resulting values are plotted in relative differential magnitudes, as shown in the Figure. No corrections were made to heliocentric time.

There appears to be no evidence of variability in any of the data sets. However, it is perhaps not entirely surprising, as the coming and going of variability in δ Sct stars has been well known for some time (Danziger and Dickens, 1967), and may be due to destructive interference of two or more frequencies (Wehlau and Leung, 1964, Fitch and Wehlau 1965). To see a similar phenomenon in an Ap star would strongly support Kurtz' assertion that at least some of the Ap stars showing short-period variability might be δ Sct stars (Kurtz, 1982 a, 1982 b). HD 10088 might be just on the edge of the instability strip, and may, therefore, only occasionally show pulsational instability.

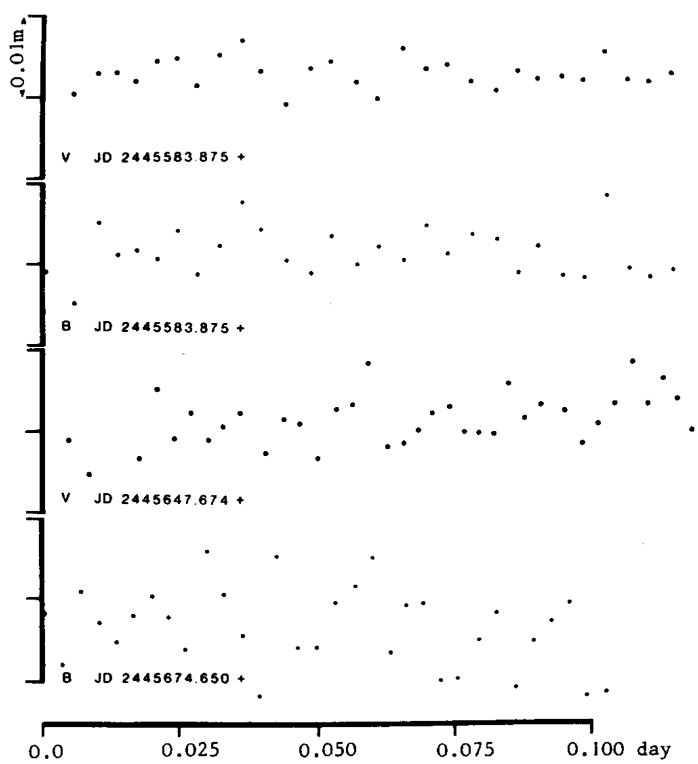

Figure 1

Differential mag. (HD 10088-HD 9985)

Additional monitoring of HD 10088 is desirable to see over what time spans variability is present. If this star pulsates infrequently, a great deal of effort may be necessary to detect it in an active state.

TOBIAS J. KREIDL

Lowell Observatory
P.O. Box 1269
Flagstaff, AZ 86002
U.S.A.

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Number 2461

Konkoly Observatory
Budapest
18 January 1984

HU ISSN 0374-0676

THE LIGHT CURVE OF FG Vul IN 1983

The M5II-star FG Vul, which is one of the oldest members ($\log \tau \approx 9.19$) of the old open cluster NGC 6940 (Götz, 1981) was measured in B (ORWO ZU21+ GG13 + BG12) on 18 plates from 17 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 7 June 1983 and 15 December 1983.

The used sequence of comparison stars in B is listed in Table I.

Table I

Star	m_B	Star	m_B
100	$11^{m}.03$	161	$11^{m}.98$
164	11.31	174	12.02
179	11.64	140	12.02
136	11.76	90	12.12
175	11.78	102	12.28
152	11.91	97	12.73

In Table I the star numbers are those given by Vasilevskis and Rach (1957).

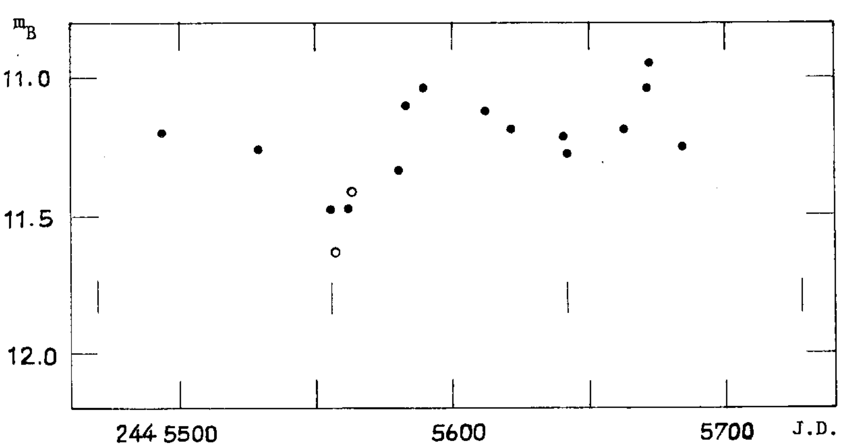

Figure 1

The apparent magnitudes m_B were obtained by linking to the UBV sequence of the cluster given by Walker (1958). In each individual case the magnitude of FG Vul was determined by measuring and considering the full sequence of comparison stars.

The light curve of FG Vul in 1983 is given in Figure 1. There can be seen that the small changes in brightness are characterized by well defined minima of different amplitudes. Taking into account the photoelectric observations of Walker (1958) (n = 13) and Eggen (1973) (n = 5) the following preliminary elements were derived:

$$\text{Min.} = \text{J.D. } 243\ 6095.8 + 86\overset{d}{.}0 \cdot E$$

Min. J.D. 24...	m_B	E	O–C	Author
3 6095.8	$11\overset{m}{.}13$	0	$0\overset{d}{.}0$	Walker
6173.7+	11.24	1	-8.1+	Walker
4 1520	10.90	63	+6.2	Eggen
5558.9	11.48	110	+3.1	Götz
5642.2	11.28	111	+0.4	Götz

The dates of minima which follow from the elements for the present time are marked in Figure 1. Doubtful observations are plotted there by circles.

The individual observations of FG Vul obtained in 1983 are listed in Table II.

Table II

J.D. 244....	m_B	J.D. 244....	m_B	J.D. 244....	m_B
5493.5	$11\overset{m}{.}20$	5580.4	$11\overset{m}{.}34$	5642.2	$11\overset{m}{.}28$
5528.5	11.26	5583.4	11.10	5663.2	11.19
5555.5	11.48	5589.4	11.04	5671.2	11.04
5556.4	11.64::	5612.3	11.13	5672.2	10.95
5561.4	11.48	5621.4	11.19	5684.19	11.27
5562.4	11.42::	5641.3	11.22	5684.20	11.25

FG Vul shows an amplitude of about $\Delta m_B \approx 0\overset{m}{.}5$ in the given series of observations and belongs to the group of semiregular variables.

W. GÖTZ

Akademie der Wissenschaften
der DDR, Zentralinstitut für
Astrophysik, Sternwarte
Sonneberg

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Konkoly Observatory
Budapest
20 January 1984
HU ISSN 0374 - 0676

ON THE SX Phe-TYPE STARS

About ten years ago one of the authors (Frolov, 1974) turned his attention to the physical peculiarities of Delta Scuti stars having short periods (<$0^d_.1$) and large amplitudes (>$0^m_.3$). It was noticed that besides their specific position on the period - amplitude diagram, they are totally lacking in open clusters unlike usual Delta Scuti variables, and they often show metal deficiency. Moreover, it was realized that several Population II objects may also exist among Delta Scuti stars of long-periodic group, e.g. XX Cyg having high space velocity.

After lengthy discussion in the astronomical literature (on Delta Scuti stars being Population I objects excluding only SX Phe itself) it would seem that it is now agreed that there are several low mass low metallicity objects among these stars. The majority of these stars indeed have P < $0^d_.1$ and large pulsational amplitudes. All the doubts have disappeared with the discovery of two such variables NJL 220 (Niss, 1981) and NJL 79 (Jørgensen, 1982) in the globular cluster ω Cen; both have nearly the same physical parameters as SX Phe (P = $0^d_.055$) itself: their amplitudes are about $0^m_.5$ B, periods are $0^d_.046$ and $0^d_.063$, and absolute magnitudes are +2.9 and +3.0. Even if these two stars are not physical members of ω Cen, they have z-coordinates large enough (about 1 kpc) to be the objects of the galactic halo.

In the paper on Delta Scuti stars in open clusters (Frolov and Irkaev, 1982) we have mentioned XX Cyg and RS Gru as being typical for globular clusters with different metal abundances on the basis of their low metal abundances or high space motion. XX Cyg and BDS 1269A = VW Ari with periods $0^d_.135$ and $0^d_.149$, respectively were mentioned by Breger (1979) as probable objects of Population II. In reality, such objects among long-periodic Delta Scuti stars can be more numerous due to faintness of many "Dwarf Cepheids" and to usual lack of such information such as v_r and metal abundance. The only source of information is the star's z-coordinate. In this way we can distinguish 4 more new Population II objects among long-periodic Delta Scuti stars having z-coordinates exceeding 1 kpc: UW CVn ($0^d_.146$), MQ Pav ($0^d_.168$), LZ Her ($0^d_.199$) and V 934 Oph ($0^d_.206$). Taking into account their periods, we adopted absolute magnitudes equal to +2 or to +1; interstellar absorption was calculated ac-

Table I

Star	Period	Amplitude (V)	Criterion of Pop. II
SX Phe	$0^{d}.055$	$0^{m}.5$ var(0.37-0.73)	1, 2
CY Aqr	0.061	0.73	1
DY Peg	0.073	0.61	1, 2
KZ Hya = HD 94033	0.0595	0.80	1, 2
BL Cam = GD 428	0.039	0.30	1, 2
NJL 220	0.046	≥0.5 B	3, ω Cen
NJL 79	0.063	0.48 B	3, ω Cen
SU Crt = HD 100363	0.055	0.03	1, 2
XX Cyg	0.135	0.90	1, 2
VW Ari = BDS 1269A	0.149	0.12	2
BS Tuc = HD 6870	0.065	0.015	2
RS Gru	0.147	0.56	1
UW CVn	0.146	0.5 pg	3
V 934 Oph	0.206	0.4 pg	3
LZ Her	0.199	0.5 pg	3
MQ Pav	0.168	0.5 pg	3

cording to Sharov (1963).

We are already aware of seven Population II objects among long-periodic Delta Scuti stars and nine among short-periodic ones including two stars in ω Cen. Possibly the name "SX Phe-type stars" is not the most appropriate because about half of these variables have much longer periods than the prototype. Possibly the situation with SX Phe stars is the same as for W Vir stars. In both cases the Population II objects have been separated from the majority of Population I stars and in both cases the period distribution is bimodal.

In Table I we include all the Population II SX Phe-type objects known up to date. In addition to the name of the star, its period, and light amplitude, we show in the last column the criterion of Population II: 1 - high space motion; 2 - low metallicity; 3 - z-coordinate exceeds 1 kpc; "ω Cen" indicates that the star (NJL 79 and NJL 220) is in the globular cluster.

M.S. FROLOV

Astronomical Council of the
USSR Academy of Sciences
Moscow, USSR

B.N. IRKAEV

Dushanbe Astrophysical Institute
of Tadjik Academy of Sciences
Dushanbe, USSR

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Number 2463

Konkoly Observatory
Budapest
20 January 1984
HU ISSN 0374 - 0676

NEW DATA ON THE MOST RECENT MINIMUM OF THE X-RAY SOURCE KR Aur

At the end of December 1981 the occurrence of a new minimum of the X-ray source KR Aur was observed (Popov, 1982) in view of which a search was carried out in the observatories' plate collections for new data after those presented by Liller (1980), also to include the object's becoming fainter. A total of 23 plates in the region of KR Aur were found in the plate collection of Harvard College Observatory (H) and that of Sonneberg Observatory (S) for the time interval Jan. 1980 - March 1982.

The magnitudes of the variable were estimated on the basis of Popova's (1965) sequence. Table I contains the magnitudes and brighter limits from all plates as a function of Julian Date.

Table I

J.D. 244...	m_B	Obs.	J.D. 244...	m_B	Obs.
4254.406	13.0	S	4693.327	13.0	S
4254.475	13.1	S	4854.568	13.6	S
4283.646	13.7	H	4908.861	13.5	H
4287.583	13.0	H	4933.793	14.8	H
4288.312	13.0	S	4958.740	(14.4	H
4290.401	13.1	S	5021.361	15.7	S
4308.552	13.5	H	5021.383	15.6	S
4545.495	13.0	S	5044.541	(14.4	H
4577.730	13.5	H	5052.343	15.8	S
4607.649	13.5	H	5052.412	15.6	S
4665.555	13.4	H	5052.582	(14.4	H
4690.535	13.3	H			

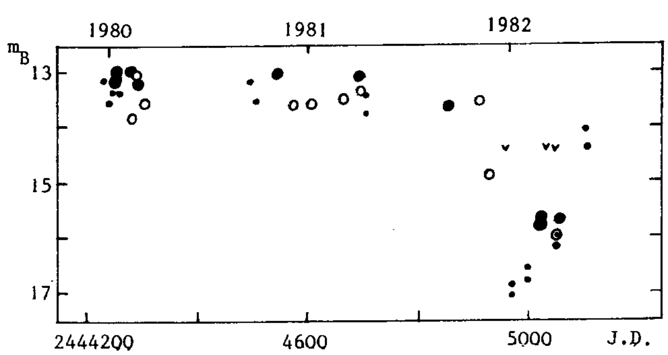

Figure 1

All the data from this study are plotted in Figure 1. The magnitudes estimated by Liller from the Harvard plates are shown as open circles, the data obtained by Popova from the Sonneberg plates as full circles. In addition, as dots, are plotted the observations by the Bulgarian National Astronomical Observatory by Popova, Antov and Popov (1982) for the same time interval. The observations complement each other very well. A steeper decrease of the brightness was more apparent than its increase.

MARTHA H. LILLER

Harvard-Smithsonian Center
for Astrophysics
Cambridge
Massachusetts, 02138 USA

M.D. POPOVA

Department of Astronomy with
National Astronomical Observatory
Bulgarian Academy of Sciences
Bulgaria

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INFORMATION BULLETIN ON VARIABLE STARS

Number 2464

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Budapest
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HU ISSN 0374-0676

REVISED PHOTOMETRIC RESULTS OF SAO 072799

A request for a confirmation of the variability of the star SAO 072799 (Frank, 1980) led us to observe this star photoelectrically in August-September 1981, as well as in September 1982. The observations made during these seasons had been reduced according to the preliminary ephemeris (Frank, 1981)

$$\text{Min I} = \text{JD Hel } 2444632.2326 + 4\overset{d}{.}215095 \times E \qquad (1)$$

and the results have been given in I.B.V.S. No. 2435. From the shape of the light curves given in Figures 1 and 2 of the above mentioned work, it was difficult to define the type and the period of the variability of SAO 072799.

But more recent photometric work (Fernandes and Frank, 1981, Kroll, 1983) led us to reanalyse our observations according to the ephemeris (Fernandes and Frank, 1981)

$$\text{Min I} = \text{JD Hel } 2444257.2826 + 7\overset{d}{.}351785 \times E \qquad (2)$$

Two times of the secondary minimum, given in Table I, have been derived, one by essentially visual inspection and the other by extrapolation of the ascending branch of the respective minimum.

Table I

HJD	$(O-C)_1$	$(O-C)_2$	E	Filter	Min.
2444849.2483	+0.1470	+0.1643	80.5	B,V	II*
2445231.5414	+0.1473	+0.1782	132.5	B,V	II

The $(O-C)_1$ values have been computed by using the ephemeris given by Equation (2), while the $(O-C)_2$ values have been found according to the ephemeris (Kroll, 1983).

$$\text{Min I} = \text{JD Hel } 2444257.2865 + 7\overset{d}{.}351522 \times E$$

The observed light curves are given in Figures 1 and 2. From an inspection of Figure 2 it is obvious that a secondary minimum occurs at the phase 0.52 (see also Fernandes and Frank, 1981). Here the descending and a small part

* By extrapolation

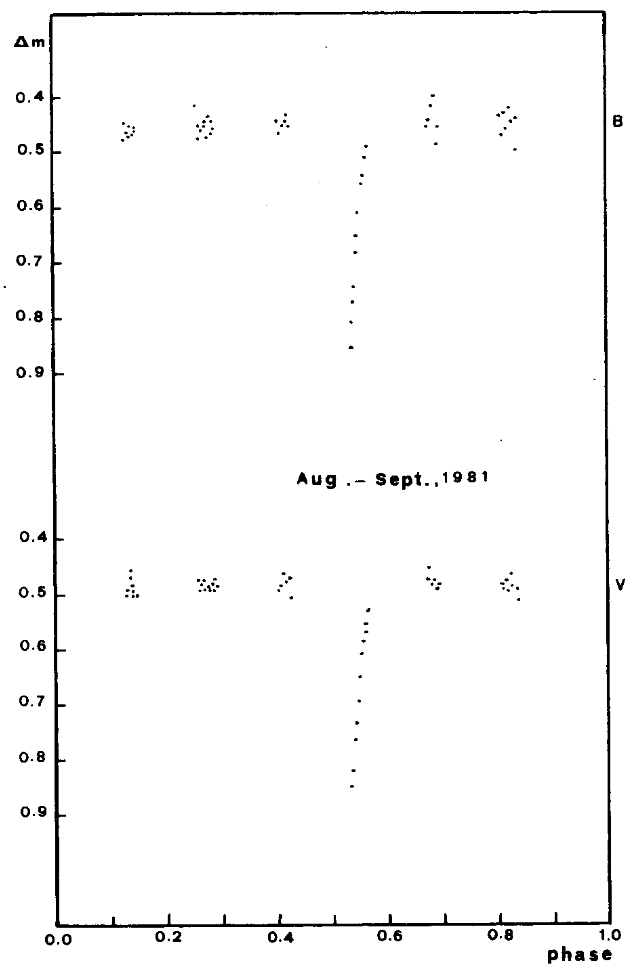

Figure 1

B and V light curves of SAO 072799

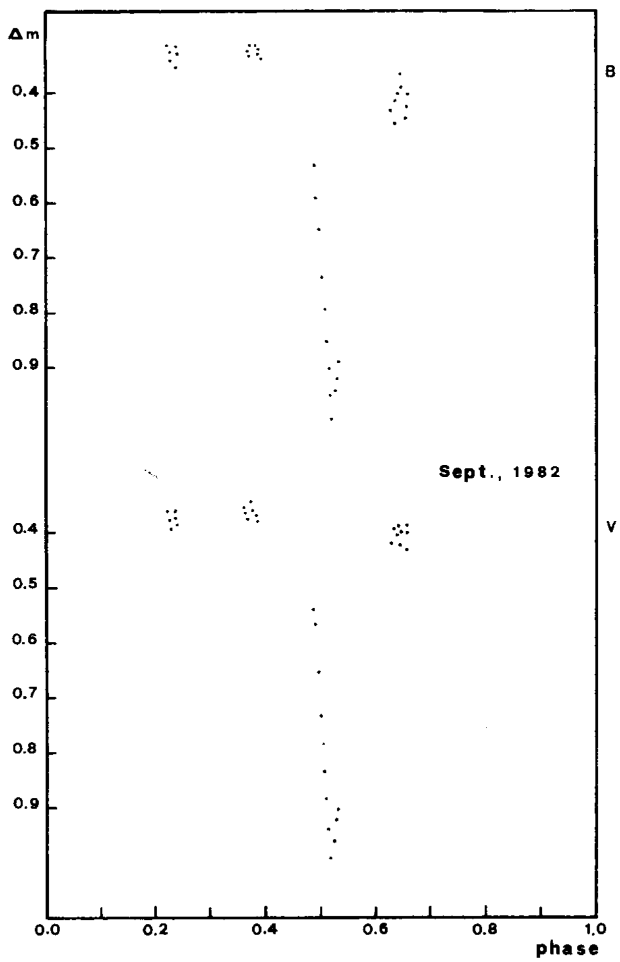

Figure 2

B and V light curves of SAO 072799

of the ascending one can easily be seen. In Figure 1 the ascending branch of the secondary minimum is clearly shown. By extrapolating this part of the light curve we expect the minimum time roughly at the phase 0.52. The maximum light in both Figures seems to be distorted.

From our observations and those made by others (Frank, 1980, Fernandes and Frank, 1981; Kroll, 1983) there is no doubt that the star SAO 072799 is an eclipsing variable with primary and secondary minima of almost equal depth. For a better understanding of this newly discovered eclipsing variable more observations are needed.

P.G. NIARCHOS

Department of Astronomy
University of Athens
Panepistimiopolis, Athens 621
Greece

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Budapest
27 January 1984
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NARROW BAND PHOTOMETRY OF FG Vir

FG Vir = HD 106384 was discovered as a variable star by Eggen (1971) who classified it as a δ Scuti star from the general behaviour of the light curve taken during the night of March 11, 1970.

In order to confirm the δ Scuti character of the light variation of FG Vir, we have carried out multicolor photometry during three nights in March, 1982.

The equipment utilized consisted essentially of a 60 cm telescope with an analogic photometer and a set of narrow band filters designed specifically for δ Scuti variables and described in Le Contel et al. (1974).

We have calculated the magnitude difference between HD 106384 and HD 106976, which was the comparison star. The magnitude difference Var. minus Comp. for filter No. 1 and the colour index (1-2) are plotted in Figure 1.

Since this colour index (1-2) is an indicative of the temperature of the star, we can deduce that FG Vir behaves as a typical δ Scuti variable, i.e. maximum light occurs when maximum temperature. Furthermore, a Fourier analysis of the data showed that there is at least a period of about $0^d.079$, which, via a P-L-C relationship (Breger, 1979), leads to an absolute visual magnitude of $1^m.73$. This value agrees very well with the M_v deduced from a purely photometric calibration of the Strömgren photometry; Philips et al. (1976), for example, give for HD 106384, $M_v = 1^m.60$.

Therefore, we can conclude that FG Vir can be considered as a normal δ Scuti variable, although more observations are needed in order to find the whole periodic content of the star.

P. LOPEZ DE COCA, R. GARRIDO, V. COSTA and A. ROLLAND

Instituto de Astrofísica de Andalucía
Apdo. 2144 Granada, Spain

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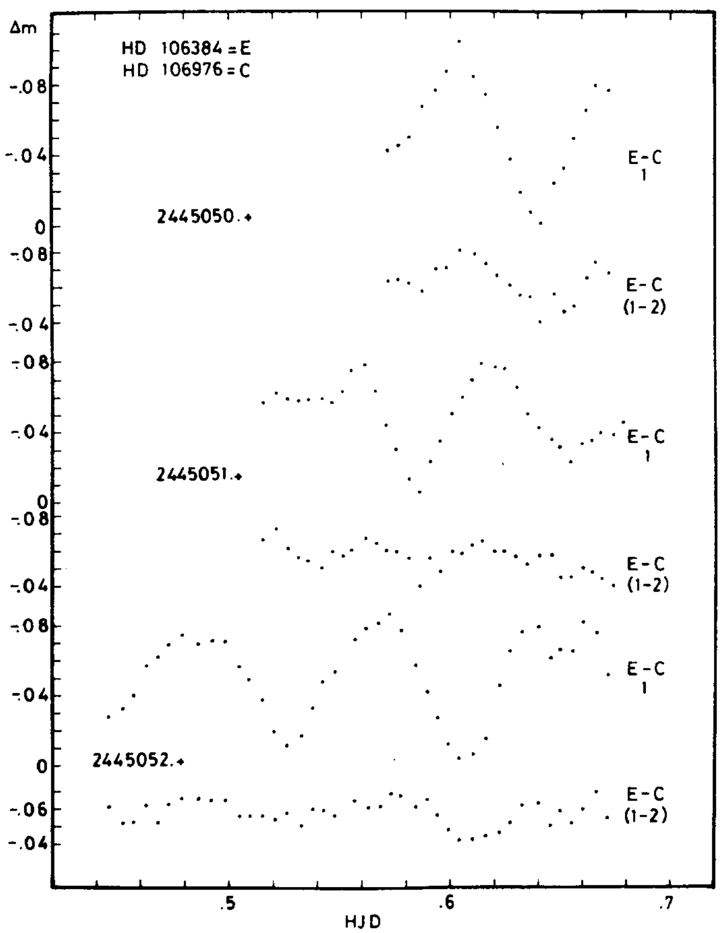
Δm
HD 106384 = E
HD 106976 = C
-.08
-.04
0
-.08
-.04
-.08
-.04
0
-.08
-.04
-.08
-.04
0
-.06
-.04
2445050.+
2445051.+
2445052.+
E-C 1
E-C (1-2)
E-C 1
E-C (1-2)
E-C 1
E-C (1-2)
.5
.6
.7
HJD

Figure 1

COMMISSION 27 OF THE I. A. U.
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30 January 1984
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WEAKENING OF H_β EMISSION OF PU Vul

The peculiar nova-like variable PU Vul was observed on August 29 and September 1, 1983 using the grating spectrograph attached to the 60/90-cm Schmidt telescope of Peking Observatory, and in October of Yunnan Observatory. The H_β appeared in emission on September 1 and was seen to be much enhanced in October, 1983 (Liu Zongli, Hao Xiangliang, I.B.V.S. No. 2446, 1983).

We observed the same star again with the above mentioned instruments in November, 1983 at Yunnan Observatory and in December at Peking Observatory. Four plates were obtained altogether. The H_β emission became very faint. The trace of H_β emission could still be seen on November 3 and 6, 1983. But one could hardly find it on November 4 and December 11, 1983. The H_α emission also seemed to weaken.

The tracings of the spectra obtained on October 10 and November 4, 1983 are presented in Figure 1.

LIU ZONGLI and HAO XIANGLIANG

Peking Astronomical Observatory
Academia Sinica

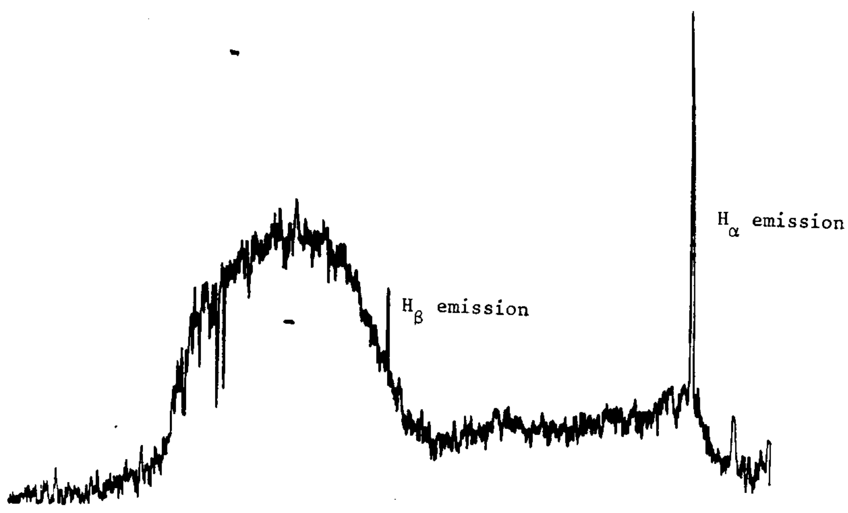

Figure 1a

Tracing of spectrum on 10 October 1983

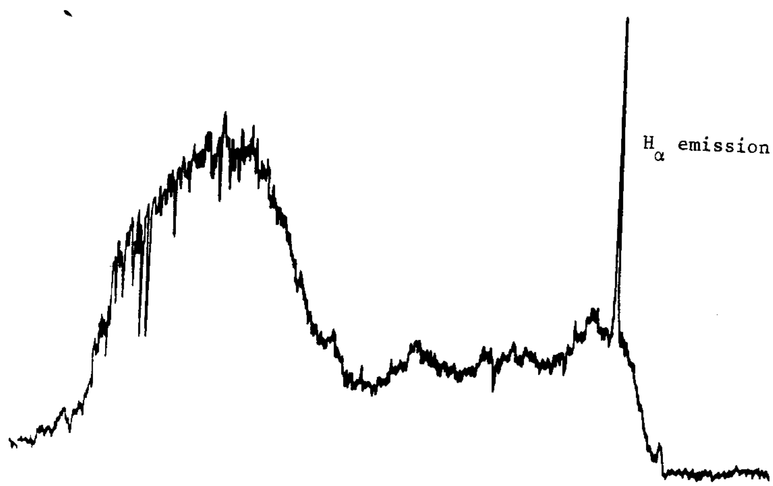

Figure 1b

Tracing of spectrum on 4 November 1983

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Budapest
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FURTHER OBSERVATIONS OF THE CENTRAL STAR IN THE PLANETARY NEBULA NGC 2346

Visual and photographic observation of this unusual object reported previously (Marino and Williams, 1982, 1983) has continued at Auckland during the 1983 observing season, using the same equipment and observing procedures. We present in Table I a summary of the new photographic estimates, and in Table II six sets of three colour UBV photoelectric measurements made at the Auckland Observatory by Walker and Marino.

Table I

Photographic observations of the central star of NGC 2346 during 1983 January to May

J.D. 2445000+	m_v	J.D. 2445000+	m_v
337.9	12.6	387.9	13.8
339.9	13.4	393.8	fainter than 14.2
340.9	fainter than 14.2	398.9	" 14.0
341.9	" 14.2	400.9	12.9
342.9	" 14.2	403.8	13.7
343.9	" 14.2	408.9	fainter than 14.2
344.9	" 14.2	414.8	14.0
345.9	" 14.2	421.9	fainter than 14.0
348.9	" 14.0	422.9	" 14.0
349.9	" 14.2	423.8	" 14.0
350.9	14.2	425.8	" 14.0
351.9	12.8	433.9	13.4
352.9	12.7	434.8	14.0
353.9	12.5	435.9	fainter than 14.0
354.9	12.4	452.8	" 14.0
355.9	12.9	455.8	" 14.0
359.9	fainter than 14.2	463.8	" 14.0
374.9	" 14.0	467.8	" 14.0
382.9	13.5	468.8	" 14.0
383.9	13.1	471.8	" 13.6
384.9	13.0	478.8	" 14.0

For the photoelectric observations the equipment was the Auckland Observatory 50 cm Edith Winstone-Blackwell telescope with the Mark 1 photometer using an EMI 9502 photomultiplier tube, standard UBV filters, and operating in photon detecting mode. The method of observation and reduction was the same as has been described previously (Marino, 1971). HD 55185, V = 4.14, B - V = -0.01, U - B = -0.01 (Cousins and Stoy, 1963) was used as the primary comparison star. The values given in Table II include the background nebulosity of NGC 2346 within the 31 arc second aperture used for the observations. No attempt has yet been made to extract the nebulosity which is a substantial contributor to the brightness in each of the three colours.

Table II

Three colour photoelectric observations of the central star of NGC 2346 including background luminosity in a 31 arc second aperture

J.D. 2445000 +	V	B-V	U-B	Notes
400.931	11.90	+0.64	-0.23	
400.938	11.77	+0.61	-0.12	
400.976	11.84	+0.48	-0.08	
403.857	11.99	+0.76	-0.28	
403.881	12.31	+0.69	-0.57	
414.883	12.43	+0.61	-0.61	no visible stellar image

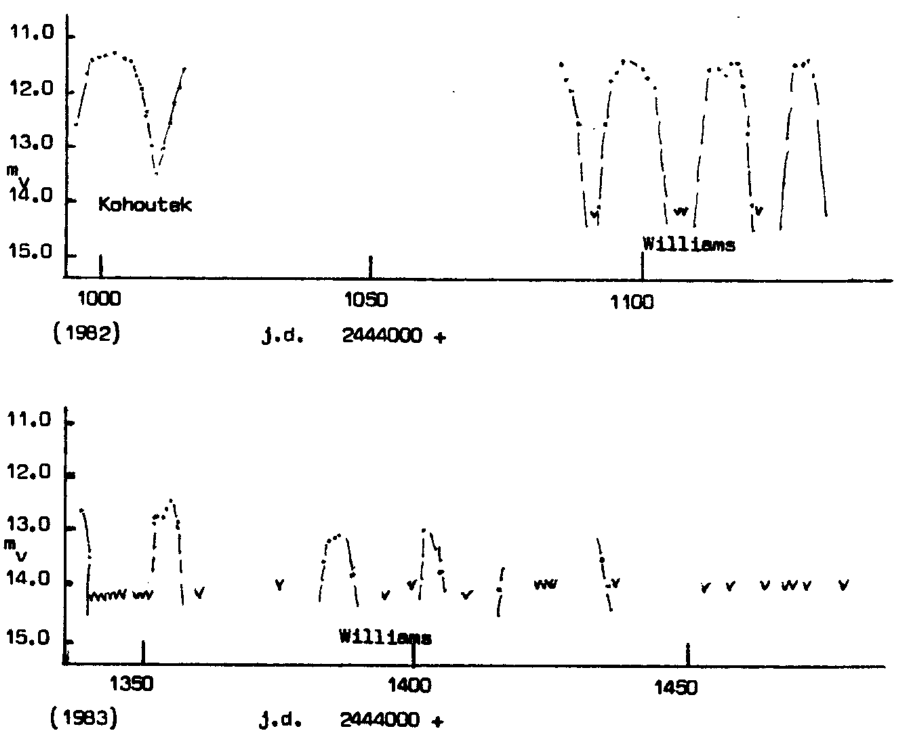

Figure 1

Light curves of the central star in NGC 2346 during the two observing seasons 1982 and 1983

The 16 day periodicity observed during 1982 has continued. However the total light curve has become more and more suppressed with time until only very short faint peaks around 14th magnitude are visible at the end of the current observing season. For the remainder of the cycle the central object is below visiblity threshold or lost within the background nebulosity. The suppression of brightness is illustrated in Figure 1, which shows the earlier 1982 date and the 1983 photographic results.

Mendez et al. (1982) have proposed a model for the eclipsing type behaviour observed in 1982. The data here have been submitted to them for inclusion in a coordinated investigation of the behaviour during the current season. Observing will continue in the 1983-84 season, in the hope that a clearing of the obscuring feature and a return to the pre-1982 magnitude level may be observed.

BRIAN F. MARINO, H.O. WILLIAMS and W.S.G. Walker

Auckland Observatory and Auckland Astronomical Society,
P.O. Box 2858, Auckland 1,
New Zealand

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THE ORBITAL PERIOD AND PHOTOGRAPHIC LIGHT CURVE OF THE ECLIPSING BINARY V 339 Per

V 339 Per was discovered by C. Hoffmeister (1967, Astr. Nachr. 289, 205) to be variable. He observed two minima at JD 2439027.52 and at JD 2439060.53 with a depth of about 2 mag and suspected the object to be an eclipsing binary. Since no orbital period has yet been determined, a total of 87 blue and additional 15 red patrol plates of a field centered at o Per has been inspected for further eclipses.

15 blue plates taken between Sept. 1961 and March 1962 were kindly placed at our disposal by the Landessternwarte Heidelberg. They were obtained with the Bruce double camera (F/5 with F = 206 cm). The other 72 blue plates were taken between Oct. 1969 and March 1976 with the astrograph (F/5 with F = 150 cm) of the Observatory Hoher List of University Bonn, the red plates between March 1976 and August 1982 with the Schmidt telescope (F/4 with F = 138 cm). Thus, this observation material covers the pretty large time interval of 21 years!

Among all the 102 observations a total of 17 new minima could be detected. The observed times of minima are given in the first column of the table.

The search for a periodic representation succeeded and revealed the following ephemeris:

$$\mathrm{Min} = \mathrm{JD_{hel}}\ \underset{\pm .006}{2437550.436} + \underset{\pm .000003}{1\overset{d}{.}099031} \cdot E$$

On the basis of this ephemeris epoch numbers and O-C values have been calculated and are shown in the second and third column of the table, respectively.

Table I

Minima JD 24 00000+	Epoch	O-C
37550.45	0	$0^d.014$
37562.53	11	0.005
37563.62	12	-0.004
37640.55	82	-0.007
39027.52*	1344	-0.014
39060.53*	1374	0.025
40514.54	2697	0.017
40557.35	2736	-0.035
40679.35	2847	-0.027
40858.55	3010	0.031
40915.64	3062	-0.029
41214.60	3334	-0.005
41247.58	3364	0.004
41957.56	4010	0.010
41958.61	4011	-0.039
42842.32	4815	0.050
42843.37	4816	0.001
44662.29	6471	0.024
44663.34	6472	-0.023

*Astron. Nachr. 289, 205

The standard deviation of the O-C values of ±35 minutes proved to be very satisfactory if we compare it with the limited time resolution of the individual observations given by the exposure times of mostly 30 minutes for each plate. Note that due to the relatively large time interval covered by the observations even the rather crude photographic method could fix the orbital period with an accuracy of about $3 \cdot 10^{-6}$ of the period.

In Figure 1 we present the identification of the variable together with the comparison stars used for the estimate of the light curve. The photographic magnitudes of the comparison stars are based on a transfer of a photoelectric sequence in NGC 1778 (Hoag A. A. et al., 1961, Publ. US Nav. Obs. 17, 470) into the Perseus field. Figure 2

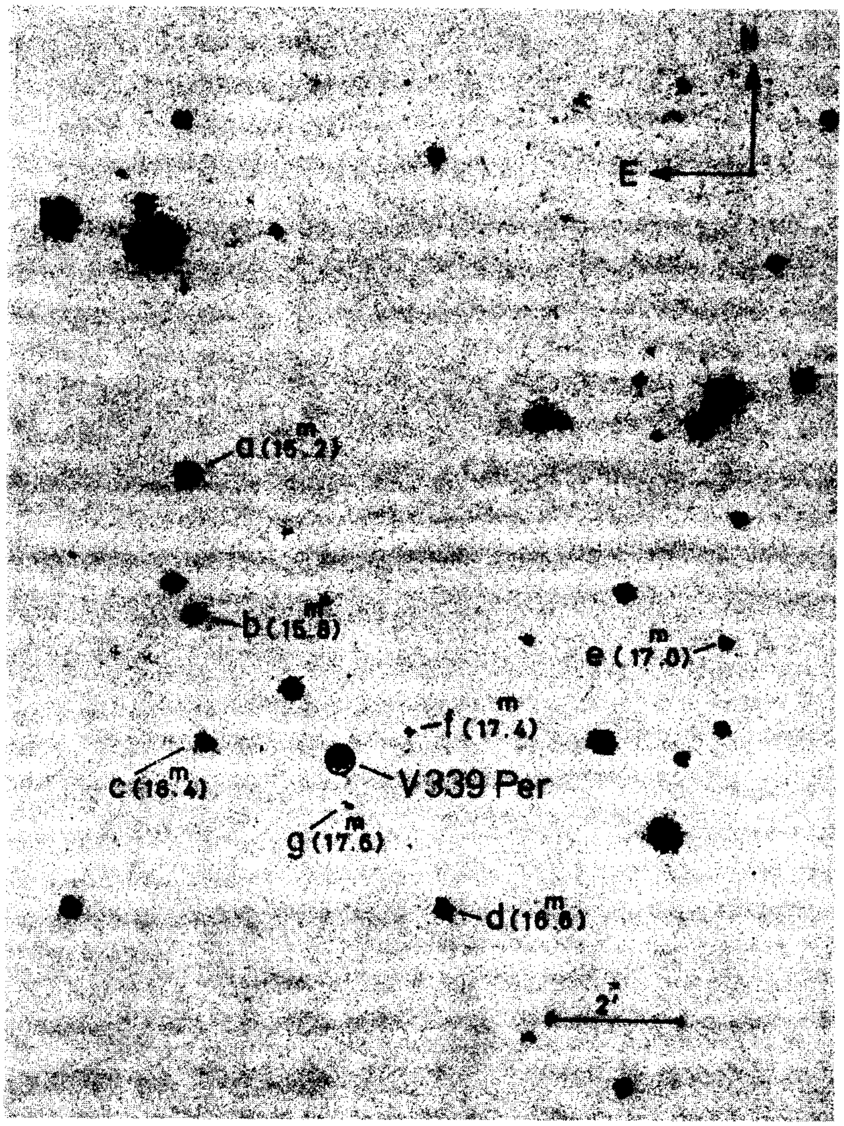

Figure 1

Identification of the variable and comparison stars.
Numbers are photographic magnitudes.

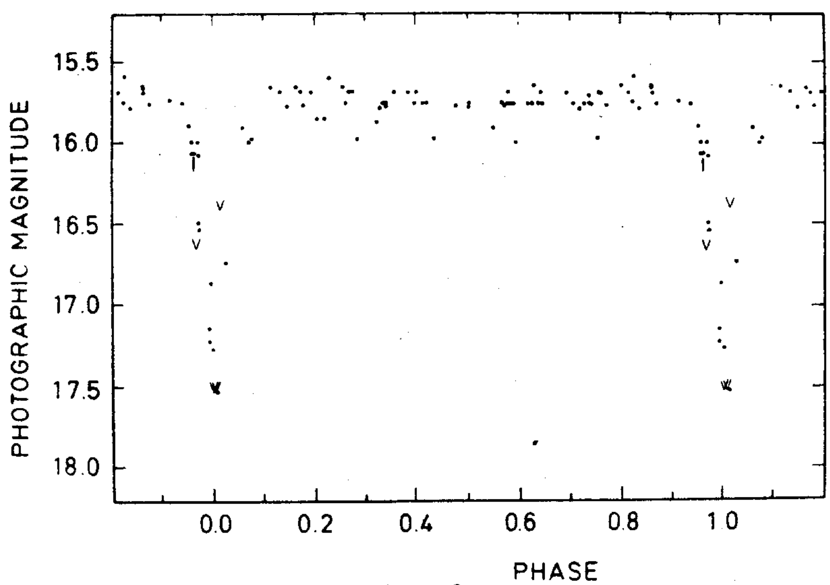

Figure 2

The photographic light curve of V 339 Per. Here a "v" stands for an observation below plate limit.-Besides the 12 clear minima, the marked observation was also seen as a conspicuous minimum and thus used for the determination of the period (E=4o11). The last 4 minima of the table were seen on the red plates.

shows the photographic light curve of V 339 Per estimated on our blue plates by the step method after Argelander with an accuracy of ± 0.11 mag at maximum light. Since in the range of the minimum the variable sometimes appears just above or even below the plate limit, some of these estimates are somewhat uncertain. The light curve is typical for normal Algol systems, no secondary minimum is indicated. The depth of the primary minimum is about 2 magnitudes, its duration about 0.12 of the period or 3 hours.

E. H. GEYER
Observatorium Hoher List
D-5568 Daun

F. GIESEKING
Institut für Astronomie
Universitätsstr. 4
A-6020 Innsbruck

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PERIOD CHANGE OF THE ECLIPSING BINARY IM AURIGAE

Photoelectric observations and improved elements of this binary were reported by Güdür et al. (1982). These elements were as follows:

$$\text{Hel Min JD} = \underset{\pm 11}{2438327.7922} + \underset{\pm 3}{1\overset{d}{.}2472906} \cdot E \qquad (1)$$

We obtained two new photoelectric minima with the 48 cm Cassegrain telescope of the Ege University Observatory. These new minima are given in Table I together with all collected photoelectric ones published up to date. The O-C values in this table were computed with equation (1).

Table I

Times of minima of IM Aurigae

JD Hel	Min	O-C	E	Reference
2438327.7867	I	-0.0055	0	Kondo, 1966
345.873	II	-0.0050	14.5	"
380.803	II	0.0010	42.5	"
385.788	II	-0.0030	46.5	"
700.7403	I	0.0083	299	"
769.3316	I	-0.0014	354	Margoni et al. 1966
40515.5465	I	0.0067	1754	Dworak, 1974
42749.4434	I	0.0062	3545	Dworak, 1976
44517.4706	II	-0.0009	4962.5	Güdür et al. 1982
567.3674	II	0.0043	5002.5	"
569.236	I	0.0020	5004	"
893.5270	I	-0.0027	5264	"
931.5674	II	-0.0046	5294.5	"
45018.2548	I	-0.0042	5364	This paper
261.4702	I	-0.0104	5559	"

The O-C values in Table I are plotted in Figure 1. As it can be seen from the figure, the O-C values of recent minima show a rapid decrease. This is probably due to the abrupt change in the period after 1980. Therefore, we recalculated the light elements of the system by the method of weighted least squares using only four primary minima obtained by us. These new light elements are as follows:

$$\text{Hel Min I JD} = \underset{\pm 2}{2444893.5267} + \underset{\pm 12}{1\overset{d}{.}2472681} \cdot E \qquad (2)$$

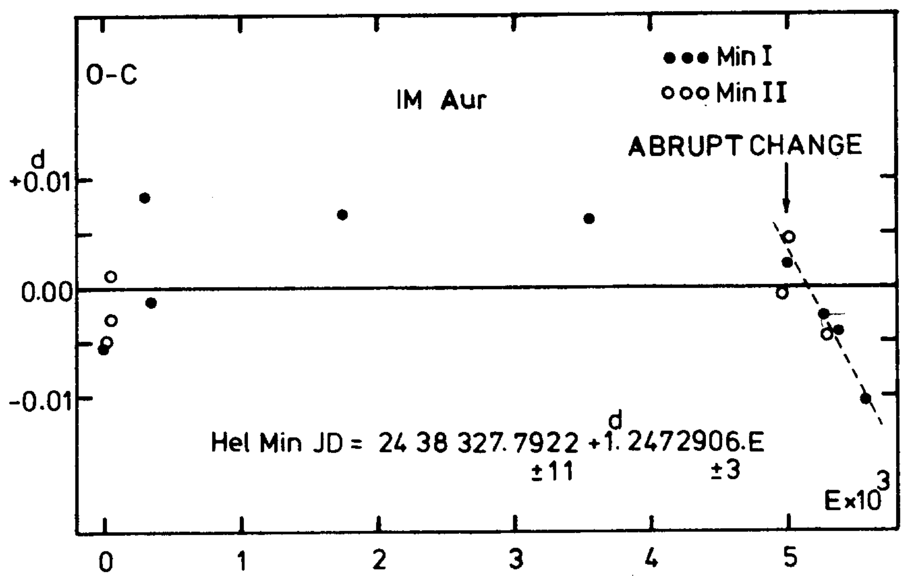

Figure 1

The O-C values computed with the elements given by equation (1)

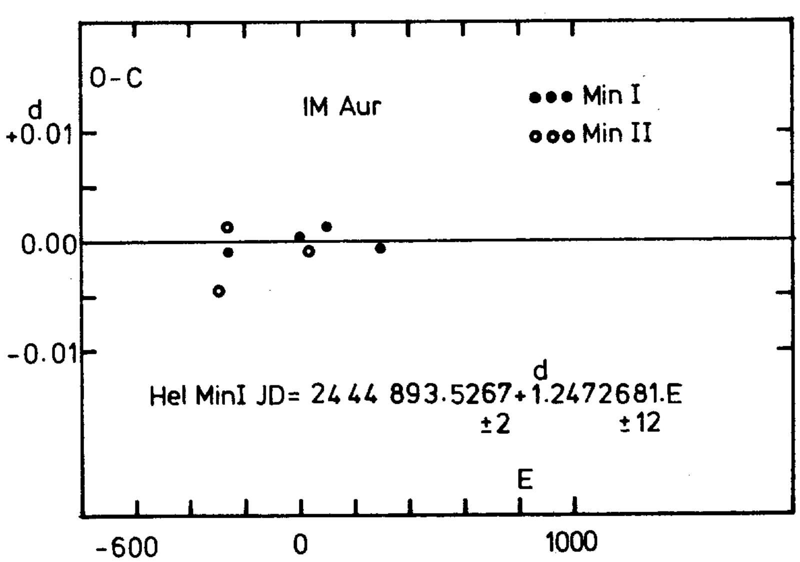

Figure 2

The O-C diagram obtained from equation (2)

The O-C values computed with the equation (2) are shown in Figure 2. These new light elements can be used with sufficient accuracy in prediction of the times of minima for the near future.

Ö. GÜLMEN, C. SEZER and N. GÜDÜR
Ege University Observatory
Bornova-Izmir-Turkey

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OUTBURST OF VY Aqr IN 1983

Photometric observations of the outburst of VY Aqr in Nov.-Dec., 1983 were obtained in Japan favored by good weathers. The outburst was first detected on Nov. 28 by S. Fujino. The observers and the instruments are as follows.

M. Huruhata	(Gotemba)	18cm Schmidt camera
S. Fujino	(Hamamatsu)	31 " "
M. Wakuda	"	f 400mm Camera
T. Saito	"	21cm reflector

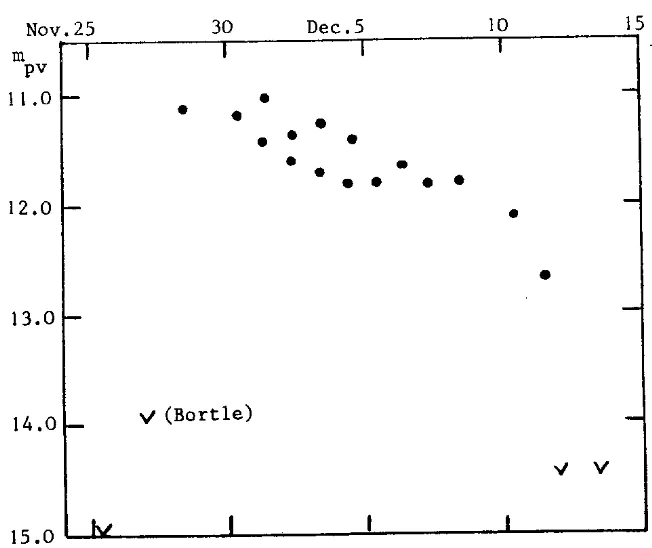

Figure 1

m_{pv} light curve of VY Aqr in 1983

All the observers used Tri X emulsion, and the yellow-green filter was attached to get visual magnitude. The magnitudes of comparison stars were determined photographically by the writer. The results are shown in the following table.

U.T.	m_{pv}	Obs.	U.T.	m_{pv}	Obs.
Nov. 25.37	[15	H	Dec. 4.39	11.3	W
28.43	11.1	F	5.37	11.8	H
30.37	11.2	H	6.39	11.7	S
Dec. 1.36	11.4	H	6.45	11.7	F
1.43	11.0	S	7.41	11.8	H
2.36	11.6	H	8.36	11.8	H
2.40	11.3	F	10.37	12.1	H
3.36	11.7	H	11.36	12.7	H
3.40	11.2	W	12.36	[14.5	H
4.37	11.8	H	13.37	[14.5	H

The results are plotted in Figure 1, in which the pre-outburst observation by J. Bortle on Nov. 27.04 is shown. Thus the outburst is considered to have occurred between Nov. 27.0 and 28.4, and the brightness suddenly decreased on Dec. 11 like SS Cygni type stars.

MASAAKI HURUHATA

Tokyo Astronomical Observatory
Mitaka, Tokyo, 181
Japan

Reference :

Bortle, J., 1983, IAU Circular No. 3896

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POSSIBLE DISCOVERY OF REPEATING OSCILLATIONS IN THE BRIGHTNESS OF BY DRACONIS ON TIMESCALES OF 1-3 HOURS

Considerable attention is now paid in the physics of solar-late type stars to study minutes-to-hours oscillations as probes of the internal structure of stars. Notable in this respect are variations on such timescales of the brightness (Rojzman, 1984) or the flux in emission lines (Baliunas et al. 1981, Linsky et al. 1982) which were observed in several red dwarf stars. Of course, such variations may be connected with flares and may not be a manifestation of oscillations. The task to select variations originating from stellar oscillations is difficult especially because of scarcity of existing observational data of high accuracy. No attempts have been made to discover periodicities of the order of minutes or hours in red dwarf stars, except in Baliunas et al. (1981).

A program to search for and investigate small amplitude brightness variations in the red dwarf flare star BY Dra has been carried out at the Crimean Observatory. Observations were obtained with the 5-channel photoelectric photometer installed on the 125-cm reflector. The photometer was constructed and built at the Helsinki Observatory by V. Piirola. Spectral bands are close to UBVRI. Following relations were obtained

$$\Delta V = \Delta v - 0.131\ \Delta(b-v)$$
$$\Delta B = \Delta b + 0.062\ \Delta(b-v)$$
$$\Delta U = \Delta u + 0.063\ \Delta(u-b)$$
$$\Delta R = \Delta r$$
$$\Delta I = \Delta i - 0.236\ \Delta(r-i)$$

where u,b,v,r,i, are instrumental extra-atmospheric magnitudes. All 5 magnitudes are recorded simultaneously. The time interval between successive records is 24 sec in our observations.

Continuous observations of BY Dra were interrupted every 20-30 minutes in order to observe the comparison star BD +51°2408. The magnitude differences Δm between BY Dra and BD +51°2408 and air masses F(z) were computed for each observation. Corrections for the differential extinction $\alpha\ \Delta\ F(z)$ were computed and added to Δm supposing that the extinction coefficient α does not vary during the night. Values of α were obtained from observations of the comparison star. Further uncertainties connected with variations of α will be estimated.

BY Dra and BD +51°2408 were observed for 5 nights. For one night we observed BD +51°2408 instead of BY Dra and BD +51°2410 as the comparison star. In this last night continuous observations of BD +51°2408 were interrupted every 20-30 minutes to observe BD +51°2410. The journal of observations is given in Table I.

Table I

Date, 1983	Observed star	Comparison star	Time of obs. U.T.	Number of obs.
24-25 Febr.	BY Dra	BD +51°2408	23^h45^m-03^h24^m	476x5
14 March	BY Dra	BD +51°2408	00 25 -02 46	300x5
19-20 Apr.	BY Dra	BD +51°2408	20 45 -01 21	604x5
22-23 Apr.	BY Dra	BD +51°2408	19 45 -01 31	691x5
23-24 Apr.	BY Dra	BD +51°2408	20 00 -01 30	616x5
17-18 Jun.	BD +51°2408	BD +51°2410	19 25 -00 29	556x5

Obtained time series Δm for each night were analyzed by the method of power spectra Fourier transforms. We used explicit formulae for the case of unevenly spaced data (Ferraz Mello, 1977) (a description of such method is also given in Deeming (1975)). It is supposed that the time series

$$f(t_1),\ f(t_2)\ldots f(t_N)$$

$$f(t_j) = \Delta m\,(t_j) - \overline{\Delta m}$$

$$\Sigma\ f(t_j) = 0$$

is such that

$$f(t) = y_1(t) + y_2(t) + \ldots + y_n(t) + x(t)$$

y(t) are periodical functions

$$y_1(t) = C_1 \sin(2\pi\omega_1 t + \varphi_1)$$

$$y_n(t) = C_n \sin(2\pi\omega_n t + \varphi_n)$$

x(t) is a chance variable with a gaussian distribution, and ω is the frequency related with the period P as $\omega = 1/P$.

The first step of computations is the determination of the coefficient of spectral correlation

$$S(\omega) = \frac{I(\omega)}{\Sigma f^2(t_j)}$$

where $I(\omega)$ is the power. $S(\omega)$ is computed for a number of values of ω. Also the semiamplitude C_1, the phase φ_1 and the frequency ω_1 are found of the function $y_1(t)$ which corresponds to the maximum of $S(\omega)$. For a given sample and a given result $S(\omega)$ it is possible to conclude whether the periodicity is significant or not.

After one periodicity is found the filtered time series can be obtained and the next step can be made i.e. computation of $S'(\omega)$ and values of C_2, φ_2, ω_2 of the function $y_2(t)$ corresponding to the maximum of $S'(\omega)$. This process is going on until periodicities found become insignificant.

Examples of power spectra corresponding to the first step are shown on Figures 1,2. They are obtained from the U-band time series of BY Dra (23-24 Apr.) - Figure 1, and BD +51^{o}2408 (17-18 Jun.) - Figure 2. The spectrum for BY Dra displays rather high maxima in the interval $0<\omega<2\cdot10^{-2}\text{min}^{-1}$. Much lower maxima are seen in the spectrum for the comparison star, approximately in the same frequency interval. However, maxima in Figure 2 are higher than the statistical limit determined by non-periodic variations with a gaussian distribution. Probably the maxima of power spectra come from real brightness variations of the star itself in the case of BY Dra and from variations of

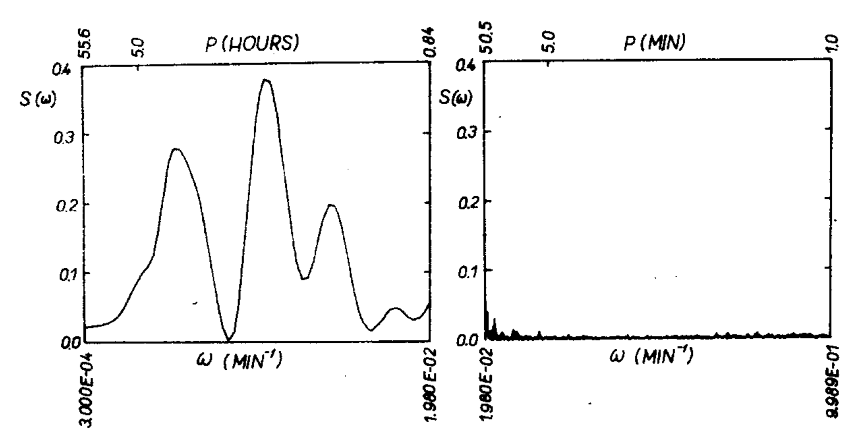


Figure 1

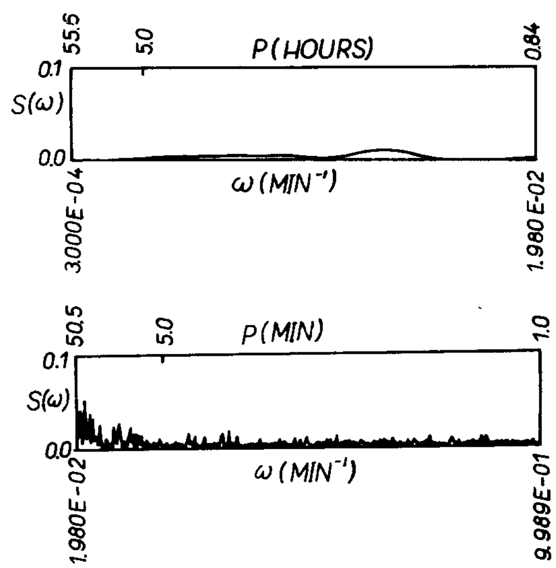
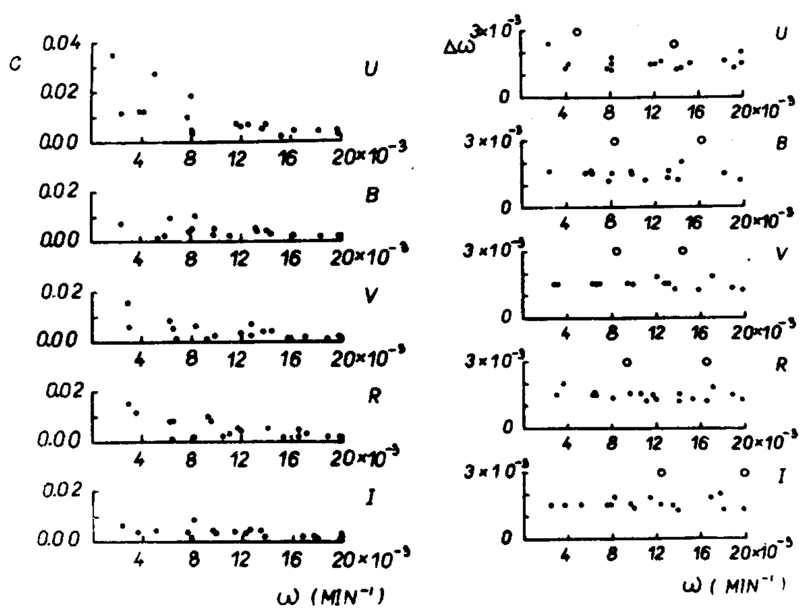


Figure 2

the extinction coefficient α in the case of the comparison star. Corresponding semiamplitudes of variations for the comparison star are from $0^m.001$ for the I-band to $0^m.003$ for the U-band. It should be noted that the differential extinction is approximately the same for pairs BY Dra, BD +51°2408, and BD +51°2408, BD +51°2410. Therefore, values from $0^m.001$ (I) to $0^m.003$ (U) can be taken as estimates of amplitude limits to which the detection of brightness oscillations of BY Dra is restricted by the (not taken into account) influence of extinction variations. It is also possible to estimate the errors of one measurement of Δm. These are $\pm 0^m.014$ for U and $\pm 0^m.006$ for B,V, R,I bands.

We also note that higher maxima in the spectrum of BD +51°2408 are concentrated in the interval of $2.10^{-2} \div 10^{-1} min^{-1}$ which includes the frequency of observing of the comparison star. The spectrum of BY Dra in this interval is approximately the same as the spectrum of BD +51°2408. Thus, the study of light variations of BY Dra with periods of 10-50 min in our case seems to be prevented by extinction variations. No maxima are seen in the spectra in the frequency interval of $0.2 \div 1\ min^{-1}$. So we confine the further study by frequencies not higher than $2.10^{-2}\ min^{-1}$.

For each band and each night of observations of BY Dra parameters of functions $y_1, y_2 \ldots$ were obtained as it was described. The number of filtrations was 3 because further ones were found to be unexpedient. Thus 91 maxima were selected in the spectra. For each of them the parameter $\Delta\omega$ was found which is the difference of frequencies corresponding to $S(\omega)_{max}$ and $0.5\ S(\omega)_{max}$. When these maxima are taken together they overlap so that it is impossible to select any dominating oscillation. Therefore, this part of the analysis is useful only to estimate amplitudes of oscillations and the accuracy of the determination of the frequency of some oscillation. Corresponding values are plotted in Figures 3,4. Semiamplitudes C are expressed in stellar magnitudes. In Figure 4 values of $\Delta\omega$ for the night of 14 March are distinguished by open circles to show that the accuracy of the frequency determination on that night was much lower due to the short duration of observations.



Figures 3-4

This result prompted us to examine averaged spectra to search for frequencies of dominating oscillations. The following procedure was applied. Each spectrum was normalized assuming its maximum value of $S(\omega)$ as a unity. Then spectra of 5 bands were averaged for each night and the mean spectrum for 5 nights was also obtained. These spectra are shown in the left side of Figure 5. One can see here that the only oscillation with the frequency of

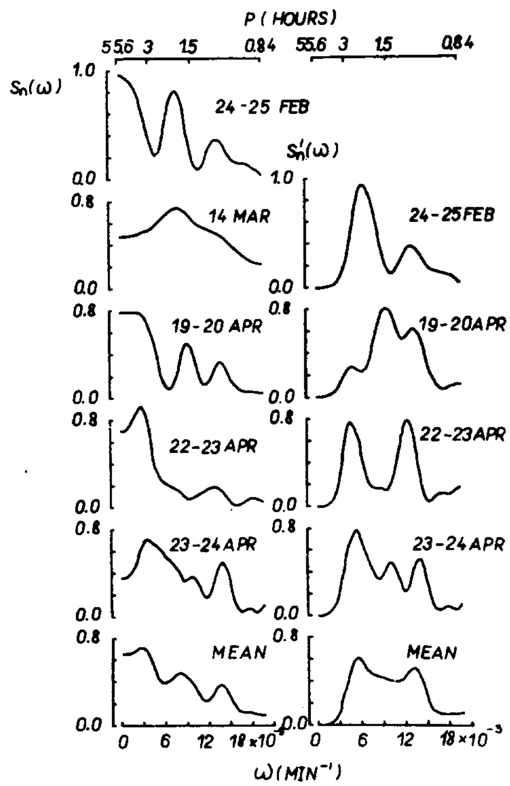


Figure 5

about $1.38 \cdot 10^{-2} min^{-1}$ repeats on all 5 nights. On 3 of the 5 spectra low frequency oscillations are strong.

It is quite possible that low frequency oscillations affect the other ones and, for this reason, spectra differ from one another. In order to exclude this effect we filtered oscillations with the frequency of $3.10^{-4} min^{-1}$ from each of the spectra. Owing to the finite resolution all oscillations with frequencies up to $3.10^{-3} min^{-1}$ were also filtered more or less. Resulting spectra are shown in the right side of Figure 5, for exception of the spectrum of 14 March which is not included because of its low frequency resolution. The oscillation repeating on spectra in the left side of Figure 5 is again repeating in the right hand. The frequency is about $1.32 \cdot 10^{-2} min^{-1}$, i.e. a little less. Also repeating in all spectra in the right side is the oscillation with the frequency of about $5.7 \cdot 10^{-3} min^{-1}$. Moreover, it seems that in the filtered spectra the third repeating oscillation exists with the frequency of about $9.10^{-3}min^{-1}$. It is clearly seen in the spectra of 19-20 Apr., 23-24 Apr. and probably it is present in the spectra of 24-25 Febr., 22-23 Apr. as an unresolved part of the low frequency maximum on the former and as a step on the later.

We conclude that our observations reveal the probable oscillation with the frequency of $1.35.10^{-2}\pm4.10^{-4}min^{-1}$ (P = 74$\pm$2 min) and possible oscillations with frequencies of $5.7\cdot10^{-3}\pm9\cdot10^{-4}min^{-1}$ (P = 175$\pm$28 min) and $9\cdot10^{-3}\pm6\cdot10^{-4}$ min^{-1} (P = 111$\pm$8 min). Errors of frequencies are obtained from differences between their values corresponding to separate nights. The oscillation with the frequency of $5.7\cdot10^{-3}min^{-1}$ is considered only as possible because of the uncertainty introduced by low frequency oscillations. We note that the frequency of the corresponding maximum differs considerably on unfiltered and filtered spectra ($3\cdot10^{-3}min^{-1}$ and $5.7\cdot10^{-3}min^{-1}$, respectively). The accuracy of the frequency determination for this oscillation may be less than that given by us. For the other two frequencies ($9\cdot10^{-3}min^{-1}$ and $1.35\cdot10^{-2}min^{-1}$) the accuracy given seems quite appropriate.

What can be said about the origin of brightness variations? As the observations of BY Dra show there are several oscillations with frequencies repeating from night to night. Semiamplitudes are usually equal to several thousandths of magnitude, possibly increasing with decreasing frequency, seldom reaching $0^m.03$ in the U-band (see Figure 3). These oscillations could be hardly connected with the flare activity as there are no indications of flares during the intervals of our observations. If only the periods are considered it seems likely that the observed oscillations are similar to long period solar oscillations. The range of the later is 30-300 minutes, their amplitudes increase with decreasing frequency (Grec et al., 1980). The mass and the radius of the main component of BY Dra are $0.7\mathfrak{M}_{\odot}$ or $0.5\mathfrak{M}_{\odot}$ and $\geq 0.9R_{\odot}$, respectively (Vogt, Fekel, 1979), the gravity acceleration being $\leq 0.86g_{\odot} = 2.4\cdot10^4$ cm/sec^2. If the oscillations of BY Dra and the Sun are identified with g-modes the assumption can be made that the ranges of periods overlap because of the closeness of gravity accelerations. Just the same is observed. The resemblance of oscillations may be a consequence of the resemblance of internal structures which depend on the mass and the radius. However, it should be noted that the 5-minute oscillations are not found in this study of BY Dra.

These results are encouraging for further investigations of minutes-to-hours light variations of BY Dra and other dwarf stars.

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P.F. CHUGAINOV

Crimean Astrophysical Observatory
P.O., Nauchnyj, Crimea
U.S.S.R. 334413

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LACK OF DETECTION OF A $1^h.77$-PERIODICITY IN THE CP STAR HD 32633

The CP2 star, HD 32633 (HZ Aur, BD +33°954, SAO 57631, m_v = 6.94, sp=B8) was first noted to have a possible photometric variability of 1^h46^m by Rakos (1963), but neither the details nor light curves are given. Evidence for radial velocity variations with this period were presented by Preston and Stepien (1968), but it is not conclusive. Percy (1973) found no systematic variations greater than $0^m.010$ in B, while Stepien and Romaniuk (1973) claim some evidence exists for short-period variability. Weiss (1983) discusses

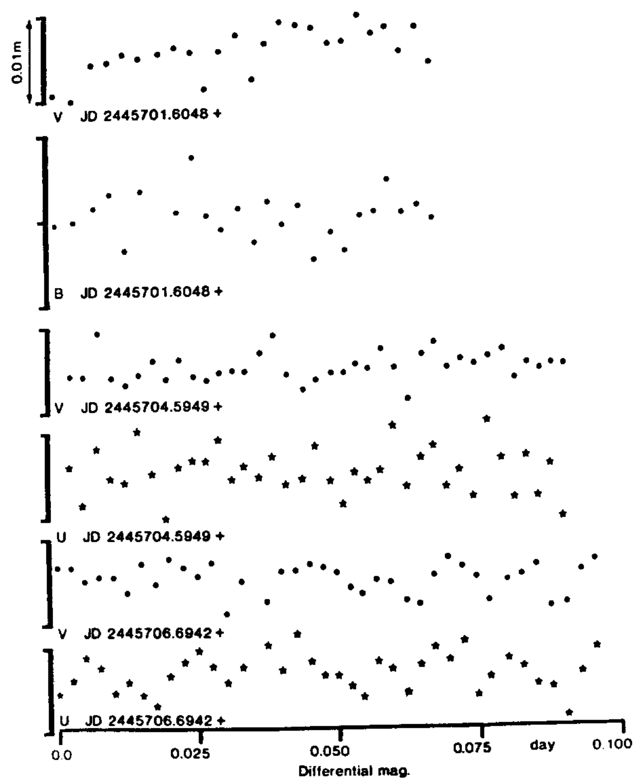

Figure 1

HD 32633 as a possible member of the small group of CP stars showing δ Sct characteristics, but points out the marginal evidence. Consequently, additional photoelectric observations were secured at Lowell Observatory.

Photometry was obtained on three nights using Lowell's 1.1 m telescope with a dual-channel photometer and electronically cooled EMI tubes. As a comparison star, either BD +33°949 (m_V = 8.5) or BD +34°948 (m_V = 7.8) was used. Differential photometry was performed using the average of three 15-second integrations on the program star and the comparison star. Johnson U,B and V filters were utilized. The resulting differential magnitudes are plotted in the Figure, no corrections to heliocentric time have been applied.

No period is evident on the time scale of 1^h46^m in any of these data sets. If the periodicity is to be explained as a δ Sct-like pulsation, the amplitude in B should be about $0\overset{m}{.}03$ (Weiss 1983, op. cit.). The data presented here speak against any such periodicity, but if the situation is similar to the lack of an observed 1^h29^m period in HD 10088 (Kreidl 1984), it certainly cannot be ruled out that such a period may be present on occasion.

Both HD 10088 and HD 32633 seem to cease δ Sct-like pulsational activity over longer periods of time than one would expect. If only these two and not the other known members (HD 3326, HD 4849 and HD 108945) show stages of inactivity, then an explanation is certainly needed to account for such a major difference among the group members.

TOBIAS J. KREIDL

Lowell Observatory
P.O. Box 1269
Flagstaff, AZ 86002
U.S.A.

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EPOCHS OF MINIMUM LIGHT,
DISPLACED SECONDARY ECLIPSE OF SW LACERTAE

SW Lac (BD+37°4717) is a W Ursae Majoris - type system which has long been noted for its period changes and variations in the shape of its light curve. Recent period studies have been conducted by Frasinska and Kreiner (1977) and Faulkner and Bookmyer (1980).

Two Indiana University telescopes were used to observe SW Lac during the autumn of 1983. Three of the present authors (E.E.E., D.H.G., E.J.M.) used the 30-cm refractor of the Kirkwood Observatory, while one author (DRF) used the 41-cm reflector of the Morgan-Monroe Station of the Goethe Link Observatory. The Morgan-Monroe observations were made with standard B and V filters and a 1P21 photomultiplier tube cooled with dry ice. The Kirkwood observations were made with an unfiltered and uncooled Optec SSP-3 photometer, which employs a silicon photodiode. At both observatories differential measurements were made, using BD+37°4715 as the comparison star and BD+37°4711 as the check star.

The Hertzsprung method was used to determine times of minimum light from the observations and are presented in the table below.

Hel. J.D. 2445000+	Min.	(O-C)	Inst.
542.8279	I	0.0002	M-M
554.8542	II	-0.0005	M-M
575.8630	I	0.0012	M-M
579.8695	II	-0.0013	M-M
586.7678	I	0.0015	M-M
610.6588	II	-0.0011	Kirk
634.7124	II	-0.0014	M-M
646.7412	I	0.0004	Kirk
660.5327	I	0.0009	M-M

The final column in the table identifies the instrument used to observe each eclipse, where "M-M" stands for Morgan-Monroe and "Kirk" stands for Kirkwood. The epochs of minimum light from the Morgan-Monroe observations represent the average of individual determinations made in each filter.

The following light elements were obtained from a linear least squares fit to the times of minimum light in the table:

$$\text{JD Hel.Min.I} = \underset{\pm 8}{2445586.7663} + \underset{\pm 22}{.3207195}$$

Residuals were formed using these elements, and are also presented in the table. From these it can be seen that all of the secondary eclipses have negative residuals, indicating that secondary minimum was displaced toward the preceding primary minimum. The magnitude and sense of the displacement is similar to the displacement which Bookmyer (1965) found to occasionally be present. Bookmyer further argued that the displacement was not due to orbital eccentricity, but rather to variations in the shape of the light curve that would affect the determination of times of minimum light. Small variations in the shape of the light curve similar to those noted by Bookmyer were indeed seen in the present observations.

DANNY R. FAULKNER
ERNEST E. EVANS III
DANIEL H. GROSSOEHME
EDWARD J. MOYER Jr.
Astronomy Department
Swain Hall West 319
Indiana University
Bloomington, IN 47405 U.S.A.

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NEW OBSERVATIONS OF CN ANDROMEDAE

The eclipsing binary CN Andromedae, BD +39°0059, was observed on five nights at the Stephen F. Austin State University Observatory. The photometer, which utilizes a dry-ice cooled EMI 6256B photomultiplier, has been described elsewhere (Hibbs, 1980, Michaels, 1981, and Markworth and Michaels, 1982). The 707 observations in the natural B and V system of the telescope/photometer combination are presented in Figure 1. An additional 259 observations in the natural U system were also utilized to determine a total of eight new timings of primary minimum.

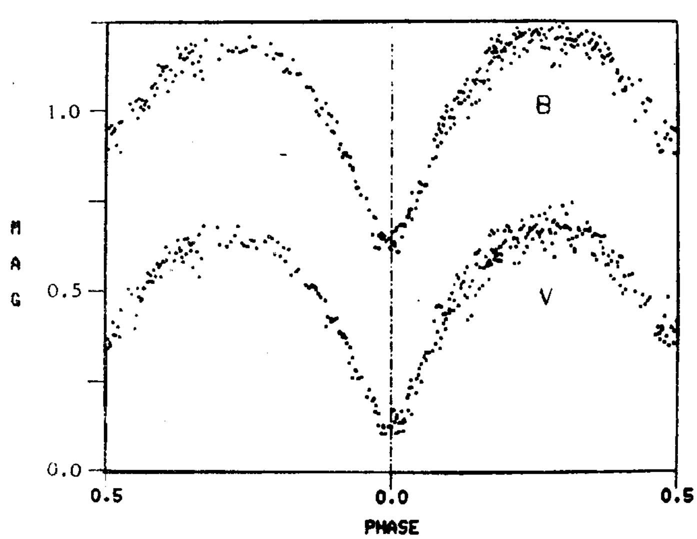

Figure 1
The individual differential magnitudes of CN And in the sense (variable-comparison).

The eclipses during this epoch are rather asymmetric, with the egress branch of either eclipse rising faster than the descent of the ingress branch. Two methods of determination of the times of minimum were, therefore, attempted. Method 1 was the tracing paper method, where a free-hand curve drawn through the ingress branch was reflected upon the egress branch. The ingress branch was selected as the more symmetric, since evidence of excess light can be seen clearly at the maximum following primary minimum and probably affects the primary egress. Method 2 was a least squares fit of the bottom of the eclipse curve (i.e., before the inflexion points) by a parabola. The results are found in Table I. For the least squares fit, the quoted error was determined by standard error propagation techniques, which incorporate the individual errors for the best fit quadratic.

Table I

Filter	JD(2440000+) Tracing Paper	JD(2440000+) Least Squares
V	5608.6999	5608.7001 $\pm$.0047
B	5608.6999	5608.6987 $\pm$.0048
U		5608.6982 $\pm$.0067
V	5620.7300	5620.7299 $\pm$.0041
B	5620.7291	5620.7282 $\pm$.0027
U		5620.7335 $\pm$.0067
V	5654.7426	5654.7441 $\pm$.0018
B	5654.7387	5654.7423 $\pm$.0028

A period study has been conducted using all available times of minimum. Table II lists the Heliocentric Julian Date of minimum, the (O-C) in days from our linear ephemeris, the type of minimum (primary or secondary), the method of observation, the weight given to the timings in the weighted least squares solution, and the reference. The timings of Löchel (1960) were found to be photographic observations (not photoelectric as identified by Seeds and Abernathy (1982)), and their weights reflect this change. The weighted least squares solution for the initial epoch and the period gives the ephemeris

$$\text{Hel JD}_{min} = \underset{\pm 0.00361}{2433570.48113} + \underset{\pm 0.00000016}{0^{d}.46279475} \cdot E$$

Table II

JD_{min}	$O-C_{days}$	Type	Method	Weight	References
2433570.465	-.0161	pri	pg	2	Löchel
4603.437	-.0019	pri	pg	2	"
4653.406	-.0149	pri	pg	2	"
4748.288	-.0057	pri	pg	2	"
4779.283	-.0180	pri	pg	2	"
5400.342	-.0296	pri	pg	2	"
5868.244	-.0131	pri	pg	2	"
6051.526	.0022	pri	pg	2	"
6102.453	.0218	pri	pg	2	"
6108.450	.0025	pri	pg	2	"
6127.386	-.0361	pri	pg	2	"
6399.533	-.0124	pri	pg	2	"
6544.379	-.0212	pri	pg	2	"
6848.466	.0097	pri	pg	2	"
6899.366	.0022	pri	pg	2	"
2441509.4930	-.0006	sec	pe	6	Bozkurt, et al.
1509.4954	.0017	sec	pe	6	"
1512.5044	.0025	pri	pe	6	"
1512.5049	.0031	pri	pe	6	"
1567.5746	.0002	pri	pe	6	"
1567.5761	.0017	pri	pe	6	"
1568.5012	.0012	pri	pe	6	"
1568.5016	.0016	pri	pe	6	"
1577.5278	.0033	sec	pe	6	"
1577.5282	.0037	sec	pe	6	"
1595.344	.0019	pri	v	1	BBSAG 6, 1972
1664.282	-.0164	pri	v	1	BBSAG 7, 1973
1930.401	-.0045	pri	v	1	BBSAG 11, 1973
1981.301	-.0119	pri	v	1	BBSAG 12, 1973
2369.352	-.0143	sec	v	1	BBSAG 18, 1974
2427.267	.0513	sec	v	1	BBSAG 20, 1975
2740.286	-.0103	pri	v	1	BBSAG 24, 1975
2993.450	.0050	pri	v	1	BBSAG 29, 1976
3069.357	.0136	pri	v	1	BBSAG 32, 1977
3431.277	.0281	pri	v	1	BBSAG 35, 1977
3432.462	.0561	sec	v	1	"
3791.358	.0548	pri	v	1	BBSAG 39, 1978
4881.6483	.0007	pri	pe	6	Seeds and Abernathy
4886.7382	-.0001	pri	pe	6	"
4898.7716	.0006	pri	pe	6	"
4908.2602	.0019	sec	pe	6	Yulan and Qingyao
4899.2182	-.0156	pri	pe	6	"
4934.1762	.0014	sec	pe	6	"
4945.5136	.0003	pri	pe	6	Seeds and Abernathy
5608.7001	.0019	pri	pe	6	this paper
5608.6987	.0006	pri	pe	6	"
5608.6982	.0000	pri	pe	6	"
5620.7299	-.0009	pri	pe	6	"
5620.7282	-.0026	pri	pe	6	"
5620.7335	.0027	pri	pe	6	"
5654.7441	-.0021	sec	pe	6	"
5654.7423	-.0039	sec	pe	6	"

where the errors are standard errors. Parabolic, cubic, and differential corrections periodic/parabolic solutions were also attempted for this data using the program of Rafert (1977, 1982). The errors in the higher order terms were found to exceed the numerical values of the parameters in all cases, thus indicating a preference for the linear ephemeris.

The clear evidence of excess light following primary minimum, and the disparity in the heights of the maxima are in stark contrast to the well-behaved light curve of Seeds and Abernathy (1982) which were observed only a year previously. A complete study of CN And will be presented elsewhere.

E.J. MICHAELS
N.L. MARKWORTH
J.B. RAFERT

Stephen F. Austin State University
Department of Physics
Box 13044
Nacogdoches, Tx 75962

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PERIODIC LIGHT CURVE VARIATIONS OF RT LACERTAE

The eclipsing binary RT Lac is one of the most interesting systems among the RS CVn-type binaries. The photometric studies made in visual region so far indicated the existence of distortions on the light curve. Milone (1976) observed the system in the infrared region and suggested that it has an infrared excess and UV deficiency. Besides, RT Lac is an active radio source (cf.Gibson et al., 1978). RT Lac is known as an eclipsing binary which has a sinusoidal distortion on its light curve. The distortion wave migrates towards decreasing orbital phase as in other RS CVn-type binaries. Hall and Haslag (1976) estimated a period of about 9.5 years for the migration wave. They also pointed out that the amplitude of the wave was variable ranging from 0.17 to 0.01 magnitude. The star spot cycle of about 30 years has been estimated from the amplitude variations.

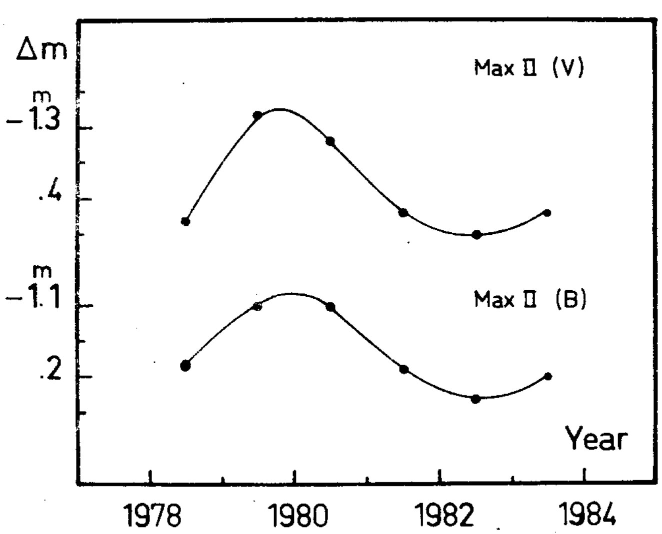

Figure 1

The variations of the brightness of the system at second quarter in yellow and blue light

The system has been observed photoelectrically in successive five years from 1978 to 1983 at the Ege University Observatory. The observations and the almost complete light curves obtained between 1978 and 1981 were published by Ibanoğlu et al. (1980) and by Tunca et al. (1983). The orbital period of the system was found to be decreasing with an amount of 34 s/century and given in the last paper.

The brightness of the system at second quarter and in primary eclipse were plotted against the years in which the observations were carried out and are shown in Figure 1, and 2. The light variations at second quarter show a smooth

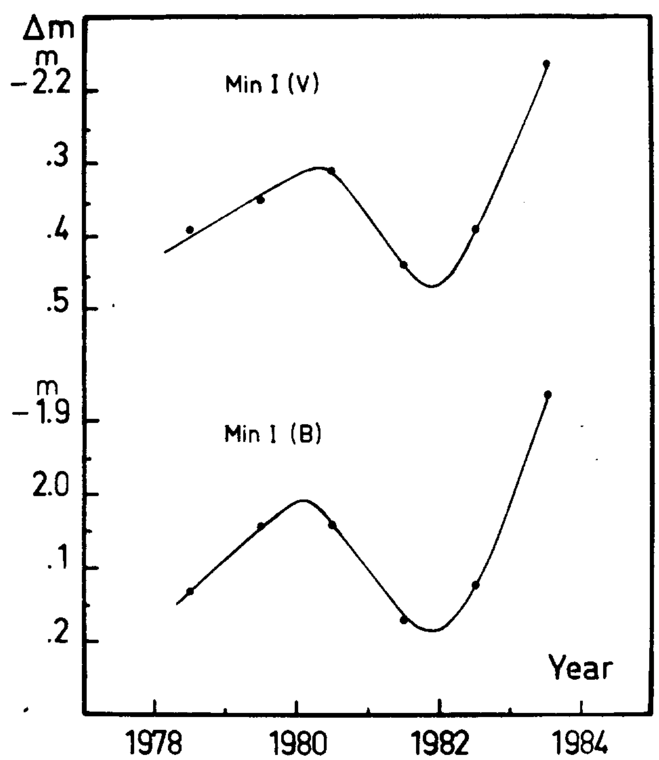

Figure 2

The variations of the brightness of the system at mid-primary in yellow and blue light

curve and produce a period of about five years. Similar variations are also seen in the brightness of the system at primary eclipse, but the period is about four years. Both of the variations at second quarter and at primary eclipse are similar in the colours V and B. The observations of the system RT Lac obtained in successive five years suggest that the light curve variations are periodic with a period of about 4.5 years. This value is nearly the half of that proposed by Hall and Haslag (1976).

S. EVREN, C. IBANOĞLU, Z. TUNCA and O. TÜMER
Ege University Observatory
Bornova-IZMIR/TURKEY

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NEW VARIABLE STARS IN THE γ CYGNI REGION

A systematic search for variable stars has been carried out in the region around γ Cygni using the observational material obtained mainly with the 20 in./28 in. Schmidt telescope of the National Astronomical Observatory at Rozhen between September 1979 and November 1983. The whole observational material (with effective coverage of 298^h) is obtained by the method of multiple exposures. In addition to the 3 variable stars published earlier (I.B.V.S. Nos. 1890, 2130), two new variable stars have been discovered.

Variable 1. The coordinates of the star are:

$$\alpha_{1950.0} = 20^h21^m.3$$

$$\delta_{1950.0} = 42^o09'$$

Figure 1 presents the identification chart of the variable. This is a very interesting irregular variable with sudden increases and decreases in the brightness sometimes within a little more than 1 hour. The observed maximum amplitude in U-light is $1^m.5$ (between $16^m.8$ and $15^m.3$). This star is situated very near V 1515 Cyg, which is a member of the group of FU Orionis stars.

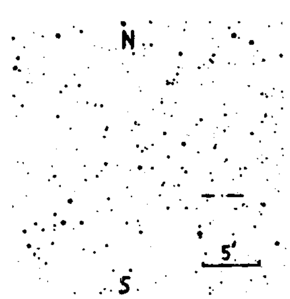

Figure 1

Variable 2. Figure 2 presents the identification chart of this variable with coordinates:

$$\alpha_{1950.0} = 20^h 28^m\!.8$$

$$\delta_{1950.0} = 41^\circ 03'$$

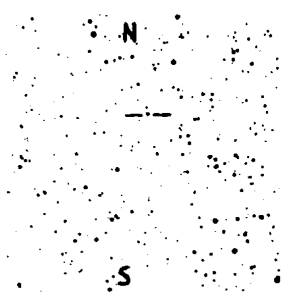

Figure 2

The star varies from $16^m\!.1$ to $17^m\!.0$ in U-light. The observations suggest that the variable may belong to the irregular variables with small and relatively rapid (~1 day) fluctuations with an amplitude of about $0^m\!.9$.

A 15 minute exposure V-plate taken with the 40 in./52 in. Schmidt telescope of Byurakan Astrophysical Observatory was used to obtain the identification charts.

KATYA P. TSVETKOVA

Department of Astronomy with
National Astronomical Observatory,
Bulgarian Academy of Sciences,
Sofia-1184, Lenin Str. 72,
Bulgaria

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ON THE PERIOD OF BH CENTAURI

The early type, massive contact system BH Centauri was put on a program of observations otherwise dedicated to the periods of W UMa binaries on account of recently discovered, conspicuous period variations, apparently quite different from those exhibited by other members of its group. The star has been observed on two nights at Cerro Tololo InterAmerican Observatory, in March 1981, using the No. 2 14-in. telescope and standard photoelectric equipment. 149 B and V observations define two minimum epochs:

JD 2444679.663 (Min. II)
44681.6453 (Min. I)

Table II gives 44 observations lying close to the minimum light. V, B are against the comparison star CPD-62°2179, the check star was CPD-62°2184, corrections for differential extinction remained under 0.001 magn.

Period studies of BH Centauri are severely handicapped by a long gap of photometric observations, 1928-1967. For the history of observations and period determinations the paper Sistero, Candellero and Grieco (1982) should be consulted. In brief, a "mean value" of the period can be found, connecting, although with very large residuals, Oosterhoff's early photographic epochs with the recent photoelectric values:

$$P_1 = 0\overset{d}{.}79158298 \quad \text{(Sistero, formula 3)}$$

The photoelectric observations at Cordoba Observatory indicated that the momentary period is much longer

$$P_1 = 0\overset{d}{.}7915942 \quad \text{(Sistero, formula 1)}$$

Two new minima (Sistero et al.) lead to a somewhat shorter period while the Cerro Tololo observations, combined with the two earlier series of photoelectric minima, suggest the best fitting period value:

$$P_3 = 0\overset{d}{.}79159441$$

virtually identical with the period in Sistero's formula 1.

Table I

BH Centauri, photoelectric min. epochs

Min I=JD2444028.5796+$0^d.79158298$E

JD2439621.7975	I	O-C=-0^d.0397	Leung, Schneider 1977
43987.8119	II	-0.0012	Sistero et al. 1979
43989.7917	I	-0.0003	"
43990.5835	I	-0.0001	"
44028.5796	I	0.0	"
44095.4693	II	+0.0009	"
44280.7071	II	+0.0023	Sistero et al. 1982
44429.5212	II	+0.0043	"
44679.6663	II	+0.0079	This paper
44681.6453	I	+0.0079	"

All available photoelectric O-C determinations are listed in Table I. The minimum epoch obtained by Leung and Schneider yields a very large negative residual of nearly 1 hour, the epoch itself seems, however, beyond doubt correct. Based on the relatively short time span of these observations, a surprisingly large value was derived for the period ($0^d.791616$) which is in conflict with all later data. Recognition that the period has changed considerably follows from a comparison of P_1 and P_2 or P_3.

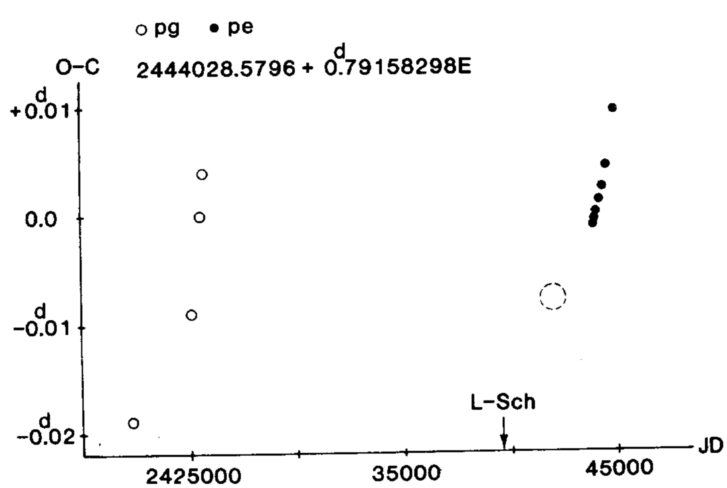

Figure 1
Timing residuals for BH Cen. Photographic data are (in part) normal points. "L-Sch" means the minimum epoch by Leung and Schneider at O-C = -0.040d. The broken circle refers to an apparent shift of the minimum found by Eggen, assuming that these observations were done in Spring 1976 (cf. Sistero' et al. 1982).

The O-C diagram of the minimum epochs (Figure 1) illustrates the background of Sistero's interesting proposal of a possible light-time effect. There is, indeed, a similarity in the system's behaviour, shown in the 1920s and 1970s. Clearly, further and continued observations are needed but the hypothesis of a third body in the system can be subjected to an order of magnitude test of reliability. (See, for example, Irwin's and Landolt's discussion of SV Centauri, 1972, or the introduction to the paper of Frieboes-Conde and Herczeg, 1973.)

Table II

Observations

JD2444679+	ΔV	JD2444679+	ΔB
.6496	−0.195	.6502	−0.195
.6532	−0.261		
.6542	−0.297	.6548	−0.272
.6562	−0.305	.6571	−0.298
.6601	−0.371	.6608	−0.352
.6624	−0.375	.6630	−0.352
.6660	−0.397	.6667	−0.352
.6679	−0.373	.6692	−0.343
.6726	−0.314	.6732	−0.297
.6777	−0.284	.6788	−0.237
.6813	−0.228	.6819	−0.195
.6834	−0.194	.6840	−0.148

JD2444681+	ΔV	JD2444681+	ΔB
.6288	−0.245	.6293	−0.218
.6326	−0.306	.6336	−0.287
.6351	−0.337	.6358	−0.315
.6396	−0.394	.6400	−0.361
.6414	−0.407	.6420	−0.410
.6457	−0.409	.6463	−0.404
.6480	−0.389	.6486	−0.383
.6520	−0.374	.6525	−0.333
.6546	−0.349	.6551	−0.307
.6605	−0.255	.6610	−0.212

The amplitude of the light time variation can only be most crudely estimated , it may be perhaps 1 2/3 hours, that is, for small eccentricity $a_1 \sin i = 6$ AU. Assuming the period P = 50 years and $M_1 + M_2 = 20M_\odot$ for the eclipsing pair, we obtain the following masses for the hypothetical third component in the system:

$$\text{if } i = 90^\circ, \; M_3 = 3.6M_\odot$$

$$i = 60^\circ, \; M_3 = 4.3M_\odot$$

$$i = 30^\circ, \; M_3 = 8.2M_\odot$$

However preliminary and uncertain these estimates might be, the resulting masses are acceptable values and they, at least, do not contradict the light time hypothesis. A distance to the system of 2 kpc would lead to a possible angular separation of the order of 0."01 to 0."02.

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TIBOR J. HERCZEG

Department of Physics and Astronomy
University of Oklahoma, Norman, Oklahoma

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ON THE PERIODS OF RZ COMAE AND V1073 CYGNI

After a long stretch of time characterized by virtually constant periods, these two systems show sign of recently occurring period changes. We would like to note here these variations in order

to determine new (linear) ephemeris formulae for the near future and

to recommend these interesting systems to photoelectric observers for follow-up observations.

A more detailed study of the periods of these binaries together with a discussion of some 30 further W UMa systems is presently being prepared by one of us. The period changes mentioned here have been first noticed during runs of observation at Kitt Peak National Observatory in 1979 and 1980. The systems were later reobserved at Ankara Observatory in order to define the current photometric ephemeris.

We would like to point out that in spite of the apparent similarity of the period changes, the two systems are, within the class of W UMa binaries, rather far apart: V1073 Cygni is a Type A system with one of the longest periods known (0.79 days) while RZ Comae is a Type W system with the somewhat short period of 0.34 days.

RZ Comae. This is a rather neglected system with photoelectric observations covering only the time span of 1950-58; the main study is Broglia's (1960) showing a constant period P = 0.33850604d. Photographic and visual minimum epochs suggest that the same period might have prevailed from about 1934 to 1966. A set of 8 AAVSO timings from 1969 (Baldwin 1973) shows predominantly negative residuals, $O-C=0\overset{d}{.}005 \pm 0\overset{d}{.}0016$, perhaps already indicating a small change in the period.

The Kitt Peak observations from 1979 indicated that Broglia's ephemeris predicted minimum times about 8.6 minutes later than observed. The Ankara measurements, undertaken to derive the new period, confirmed the variation but yielded, rather unexpectedly, practically the same residuals as the Kitt Peak observations two years earlier. Taking these data at face value, that is assuming a timing accuracy of ±0.0001 to ±0.0002 days, would indicate that Broglia's period is still valid but the zero epoch has to be shifted by -0.006d. This seems a rare, almost unique occurrence which makes the observation of the system very desirable.

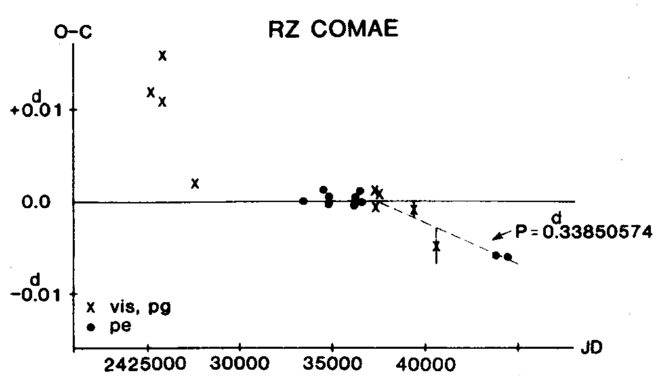

Figure 1

Timing residuals for RZ Comae. (Ephemeris: Broglia 1960.)

Earlier visual and the recent photoelectric observations are, on the other hand, not inconsistent with a small change in the period (see Fig. 1) of about 3×10^{-7} days; this would produce a difference of 0.0006 days between the Kitt Peak and Ankara residuals. The two year baseline separating these observations is probably too short for a definitive statement. We tentatively suggest the new ephemeris formula (Kitt Peak epoch + Broglia's period)

Min.I = JD2443967.9371 + $0^{d}.33850604$E, with the proviso that it may give residuals of the order of -0.0012 days for Spring 1984.

The following Table gives the four new epochs of minimum.

Min. (JD hel)	O-C (Broglia)	Observatory
2443964.8906	$-0\overset{d}{.}0061$	Kitt Peak, no. 3 14-in.
43967.9372	-0.0060	-
44694.3712	-0.0060	Ankara Obs. 12-in. pe
44695.3868	-0.0059	-

V1073 Cygni This system can hardly termed neglected: there are 25 photoelectric epochs of minimum since 1962 but their distribution with time (see Fig. 2) is

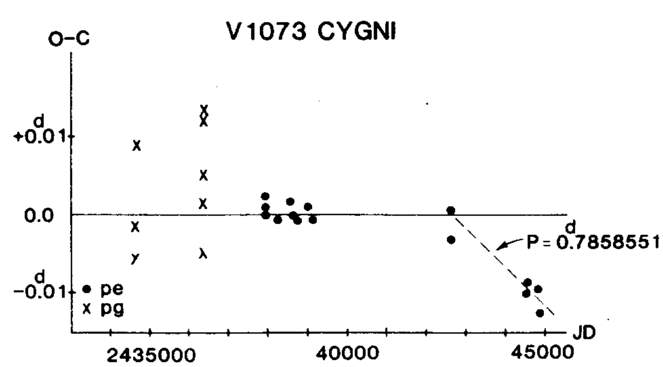

Figure 2
Timing residuals for V1073 Cygni. (Ephemeris: Kondo 1966.)

somewhat uneven. The first comprehensive discussion of the system was given by Kondo (1966); further photoelectric observations were secured at Leiden, Bologna, Catania and Bucharest. Observations between 1953 and 1975 indicate the constancy of the period (Kondo's value: P = 0.7858597d); earlier photographic observations, in spite of their very large scatter, suggest that the same period might be traced as far back as 1930. This means at least 45 years of constant period yet the new data (Kitt Peak 1980, Ankara 1981) indicate that a period change amounting to about -0.4 sec occurred, perhaps around 1976.

We propose the following ephemeris for current use:

Min.I = JD2444502.8652 + $0^d.7858551$ E.

The new epochs are separated by less than one year and show a larger scatter, thus the uncertainty of the new period may be an estimated $\pm 4 \times 10^{-6}$ days. Nevertheless, the new formula will allow much improved predictions of the minimum epochs for the near future.

Min (JD hel)	O-C (Kondo)	(O-C) current	Observatory
2444501.8648	$-0^d.0099$	$-0^d.0004$	Kitt Peak, no. 4 16-in.
44506.7950	-0.0090	+0.0005	-
44783.4139	-0.0127	-0.0016	Ankara, 12-in. pe
44790.4489	-0.0095	+0.0017	-

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ZEKI ASLAN
Astronomical Institute
Ankara University, Ankara, Turkey

TIBOR J. HERCZEG
Department of Physics and Astronomy
University of Oklahoma
Norman, Oklahoma,73019, USA

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ON THE PERIOD OF THE W UMa SYSTEM ε CrA

ε CrA was found to be a binary in 1950 by Cousins and Cox. Cousins (1964) published a photographic light curve and reported a small variation of the period. Knipe (1967) made observations with blue and yellow filters. (See also measurements by Binnendijk, 1965.) The primary component of ε CrA is a star of spectral class F5 and the secondary cooler component is of type GO. This W UMa system is an A type one (transit at primary minimum).

Since 1965, Tapia (1969) and Hernandez (1972) have published UBVRI observations obtained in 1967. Their observations are well represented by the following ephemeris:

$$HJD_{minI} = 2{,}439{,}707\overset{d}{.}6619 + 0\overset{d}{.}5914264\ E$$

Tapia concluded that the period had remained constant for 17 years.

One of us carried out infrared observations of ε CrA at the ESO 1m telescope during the nights of July 2/3 and 3/4, 1982 (Lunel and Bergeat 1983). The period of the system is somewhat over 14 hours. Hence a substantial part of the cycle was covered each night, in a 12 hours interval centred on the meridian transit. The InSb photometer was used with a K-Band filter (2.2μ) and γ CrA was used as a comparison star. 140 individual observations were obtained during the first night (of better photometric quality than the second one). The observed minimum occured later than the epoch computed from Tapia's elements. We found

$$O-C = 0\overset{d}{.}0691$$

Alternatively, the discrepancy could be explained if we accept for 1967-1982 a period larger than Tapia's, i.e. $P = 0\overset{d}{.}5914345$.

The difference is then $0\overset{s}{.}7 = 8\times10^{-6}$ d, well above the accuracy of $\pm\ 10^{-7}$ d quoted by Tapia (1969). Here some doubt arises since his pinpointing of the period on the 1950-1967 time basis relies on the early 1950 photographic observations published by Cousins (1964). Clearly more observations were needed.

In 1983 uvby observations were made with the Danish 50 cm telescope at ESO during the nights of June 22/23 and 23/24. Despite bad weather conditions a primary minimum was determined from the observations in V, which confirm the results of the infrared observations of 1982. The epoch of the minimum is $2{,}445{,}509^{d}.63$, resulting in

$$O-C = 0^{d}.075 \text{ if Tapia's elements are used.}$$

Hence we are able to confirm the elements:

$$HJD_{minI} = 2{,}439{,}707^{d}.6619 + 0^{d}.5914345\ E$$

as published by Lunel and Bergeat (1983).

The authors' contention is that a period variation remains to be established. A regular monitoring of this system would be useful.

J. MANFROID

Institut d'Astrophysique
B-4200 Cointe-Ougrée
Belgium

M. LUNEL and J. BERGEAT

Observatoire de Lyon
F-69230 Saint-Genis-Laval
France

P. BOUCHET

ESO
Karl-Schwarzschild-Strasse 2
D-8046 Garching bei München
FRG

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THE PHASE BEHAVIOUR OF THE GENEVA Z AND Δ(V1-G) PARAMETERS FOR 41 Tau, 56 Tau AND 49 Cnc

In the Geneva seven-colour system there are two parameters distinguishing magnetic from nonmagnetic stars:

Δ(V1-G) defined by Steiger (1974)

$$\Delta(V1-G) = (V1-G) - 0.289(B2-G) - 0^m.302$$

and reddening-free parameter proposed by Cramer and Maeder (1979, 1980)

$$Z = 0.0255U - 0.1740B1 + 0.4696B2 - 1.1205V1 + 0.7994G - 0^m.4572$$

which, however, is not valid for spectral types later than A3. They both, like Ap-sensitive parameters in other photometric systems, measure the depth of a broad absorption structure centred about 5200 Å. Its origin is not yet clear and this is the first reason why the phase behaviour of Z and Δ(V1-G) is important for understanding of the Ap phenomenon. The other one is that Δ(V1-G) and Z are fairly well correlated with the mean surface magnetic field H_s if one considers the hotter Ap stars with H_s not exceeding 5 kGauss.

So far the phase dependence of the strength of 5200 Å structure has been investigated for several stars (cf. e.g. Buchholz and Maitzen 1979, Gertner, Muciek and Mikołajewski 1983, Pyper and Adelman 1983, Maitzen and Vogt 1983).

Here we present the plots of Z and Δ(V1-G) versus phase for other three stars. In each case a sinusoid is fitted by least-squares method. The errors have been calculated for each point separately according to the definitions of Rufener (1981) and vary from $0^m.004$ to $0^m.01$. The clearly erroneous points (marked by crosses) are omitted.

41 Tauri = HD 25823 (Figure 1)

The phases are computed with ephemeris determined by Abt and Snowden (1973):

$$T(\text{periastron passage}) = 2421944.74 + 7^d.227424\ E$$

The best fits are:

$$Z = -0\overset{m}{.}0348 - 0\overset{m}{.}0092\cos(2\pi\varphi + 1.57)$$

and

$$\Delta(V1-G) = 0\overset{m}{.}0262 + 0\overset{m}{.}0078\cos(2\pi\varphi + 1.61)$$

This star was also studied by Adelman (1983) who did not see any variability of the Δa index which is also connected with the strength of the 5200 Å structure.

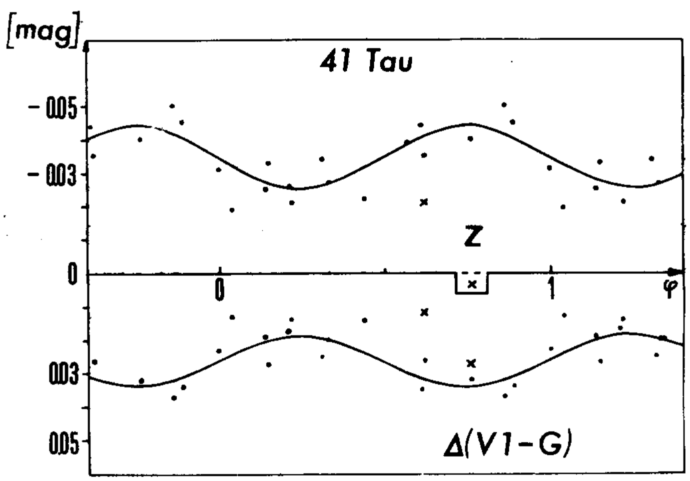

Figure 1

The single-wave fits to Z and Δ(V1-G) for 41 Tau. The observations marked by crosses are excluded

<u>56 Tauri = HD 27309</u> (Figure 2)

The ephemeris used is that of Musielok et al. (1980):

$$JD(U_{max}) = 2442299.51 + 1\overset{d}{.}56896\ E$$

The following curves are obtained:

$$Z = -0\overset{m}{.}0632 - 0\overset{m}{.}0106\cos(2\pi\varphi - 0.44)$$

and

$$\Delta(V1-G) = 0\overset{m}{.}0478 + 0\overset{m}{.}0078\cos(2\pi\varphi - 0.41)$$

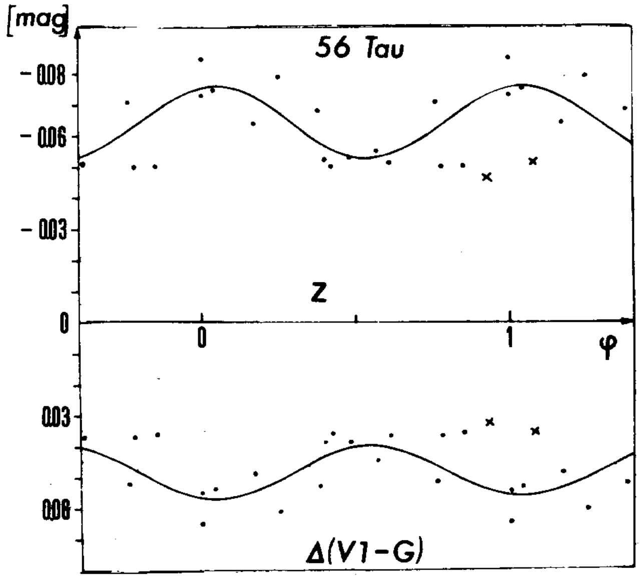

Figure 2
The single-wave fits to Z and Δ(V1-G) for 56 Tau. The observations marked by crosses are excluded

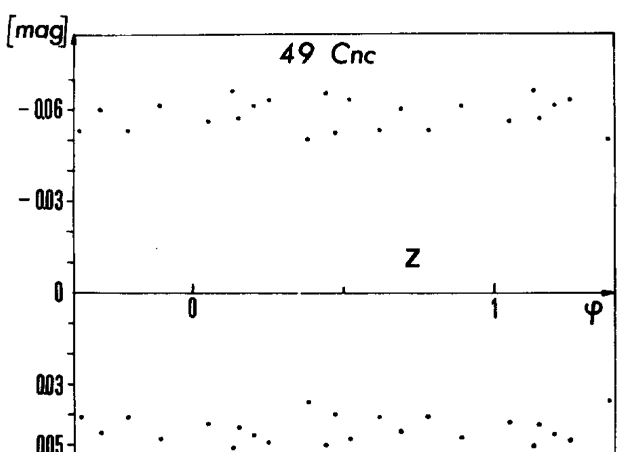

Figure 3
The phase dependence of Z and Δ(V1-G) for 49 Cnc

49 Cancri = HD 74521 (Figure 3)

For phase computations the elements of Winzer (1974) are used:

$$JD(U_{max}) = 2441616.50 + 4\overset{d}{.}2359\ E$$

Both parameters seem to be invariable for this star so we did not make any fitting. However, Adelman and Pyper (1979) suggest a possible variability of the Δa index.

M. MUCIEK and J. GERTNER

Instytut Astronomii
Uniwersytet Mikołaja Kopernika
87-100 Torun
Poland

P. NORTH

Observatoire de Genève et
Institut d'Astronomie
de l'Université de Lausanne
1290 Chavannes-des-Bois
Switzerland

F.G. RUFENER

Observatoire de Genève
1290 Sauverny
Switzerland

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ON THE NATURE OF THE CATACLYSMIC BINARY V 2051 OPHIUCHI

According to the literature V 2051 Oph belongs to the six cataclysmic binaries (with late type secondaries) known to have orbital periods below 90 minutes. Two of them are known as of AM Herculis type, three are dwarf novae with very long cycle lengths, but the long time photometric character of V 2051 Oph has not been fully investigated as yet. Sanduleak and Bateson report of unspecified brightness changes between V $\approx 13^m.0$ and the Palomar O print B value, which is $15^m.4$ in Vogt's system (Publ. Variable Star Sect. RASNZ no. 8) rather than $16^m.5$ estimated by Sanduleak (Inf.Bull. Variable Stars No. 663). A number of high speed photometric series yielded eclipsing light curves with periods near 89.9 minutes and a mean brightness outside eclipses of V $\approx$ B $\approx 15^m.0$.

I checked the region of the variable on about 400 blue sensitive plates of the Sonneberg Sky Patrol taken from 1957 to 1983 by H. Huth of the field centred at 17^h, -20^o. Because of the very low altitude above the horizon the limiting brightness of most of these plates is not better than $11^m.5$ to 13^m.

The object is not visible on any exposure. That means that two alternative explanations are possible: Either V 2051 Oph does represent a dwarf nova with large range outbursts, but has an extremely long cycle length (several years) so that eruptions can easily be missed even on extented plate material, or the relatively small variations mentioned above and occuring below the threshold of our exposures are due to an AM Herculis type for which, apart from eclipses, an amplitude of about 2.5 mag is typical. Both possibilities would not be in contrast with the character of the other five cataclysmic binaries of similar orbita periods.

W. WENZEL

Sternwarte Sonneberg
Zentralinstitut für Astrophysik
der Akademie der Wissenschaften
der DDR

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A FLARE-LIKE EVENT ON THE LIGHT CURVE OF V351 Ori

As a part of our on-going program of UBVR photometry of antiflare stars (Pugach, 1975) we have observed a flare-like episode of V351 Ori (BD $+0^{\circ}1170$, Sp A7 III) in four colours. All observations were obtained at the observing station "Terskol" of Main Astronomical Observatory of the Academy of Sciences of the USSR, using the 0.5m reflecting telescope and a single-channel automatic photon-counting photometer with a PEM-79 uncooled photomultiplier tube.

The comparison star was BD $+0^{\circ}1171$ and the check star was BD$-0^{\circ}1067$. The magnitudes of the variable star in the UBVR-bands in normal brightness are as follows:

$$U = 9^{m}.58, \quad B = 9^{m}.30, \quad V = 8^{m}.98, \quad R = 8^{m}.57$$

The flare-like episode occurred on September 29, 1982 when the star was in a deep minimum - in the BVR-bands the increase of brightness appeared to begin, while in U-filter the brightness of the variable further decreased. From the beginning of the observations on this night and up to the beginning of the flare, the brightness of the variable in the UBVR-bands increased by $0^{m}.095$, $0^{m}.200$, and $0^{m}.320$ respectively. At the same time, the decrease of brightness in the U-band was $0^{m}.175$. Figure 1 shows the flare-like episode in the UBVR-bands relative to the light curve without flare. Symbol "↓" indicates the moments of the comparison star observations, and symbol "↓↓" indicates the moments of the observations of the check+comparison stars. The flare duration at half peak light appears to be 30 minutes.

Conventionally, the flare consists of three parts:

a. a small pre-flare brightness increase with amplitudes increasing through infrared,
b. the main-part of the flare - its amplitude is practically the same in the BVR-bands,
c. a much less intense tail appears after the main-part of the flare (this tail is especially well visible in the BVR-bands).

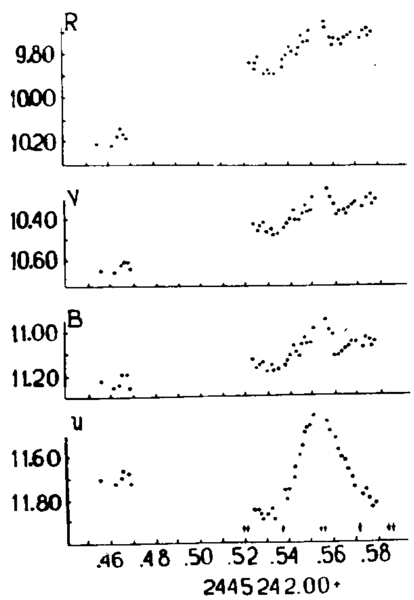

Figure 1

Furthermore, the main-part of the flare in the BVR-bands is a superposition of a few narrow, sequent sharp mini-flares unresolved in time. However, the thin structure of the main-part of the flare in ultraviolet is not observed, and the main-part and the tail are masked by much more significant brightness increase of the variable with an amplitude up to $0\overset{m}{.}5$, in addition the moment of peak flare luminosity precedes the moment of brightness maximum in BVR-bands by 4 min.

No optical flares have been previously found in photometric observations of antiflare stars with the exception of only one case:Pugach's (1975) observations of the variable star RZ Psc (G8-KO) showed a flare with two sharp peaks, a small pre-flare increase of brightness, a sharp forward front and a gradual decrease. The flare was observed, when the variable was in a deep minimum, and the observations were obtained in a mode of continual measuring through B filter. The flare amplitude was $0\overset{m}{.}9$.

As for the flare activity of A and B stars, the information about it is very scanty - the total number of such cases does not exceed ten (Bakos, 1970, Page and Page, 1970, Andrews, 1964, Kunkel, 1975).

The energy characteristics of the flare observed were calculated by assuming the Planck's energy distribution in the spectrum of the variable star with $T_{eff} = 9000^{o}K$ and with a due accounting of the width of the instrumental UBVR system bands. They are as follows:

Filter	The total flare energy $x10^{-35}$ erg	Flare / Base	Peak flare luminosity $x10^{-33}$ erg sec^{-1}
U	8.38	0.250	1.470
B	6.49	0.069	3.132
V	10.39	0.065	5.179
R	8.19	0.072	3.685

where the third column gives the ratio of the flare's luminosity to the luminosity of the quiet star over the same period of time. The ratios of energy magnitudes radiated by the variable star in each band are as follows:

$$E_U : E_B : E_V : E_R = 1.29:1.00:1.60:1.26$$

At the end it should be noted that the observations of the variable obtained within the period from JD 2445242.426 to JD 2445242.516 in a mode of continual measuring through a blue filter showed the presence of a periodic component in the light variation with a period of 320^s and an amplitude up to $0.^m15$.

G.U. KOVALCHUK

Main Astronomical Observatory
Ukrainian Academy of Sciences,
Kiev, USSR

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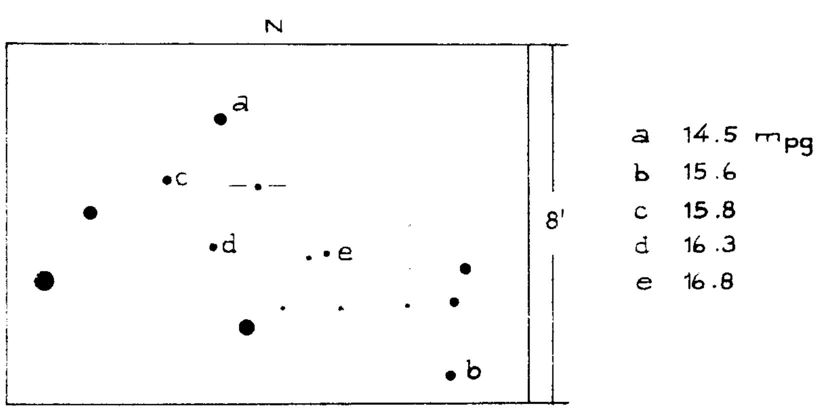
FO And - PROBABLY A NEW MEMBER OF THE SU UMa SUB-GROUP OF DWARF NOVAE

The SU UMa type dwarf novae are characterized by ultra-short orbital periods, two types of outbursts (normal ones and supermaxima) whose widths differ by more than a factor 5, and short cycle lengths of normal eruptions compared with those of supermaxima (Vogt, Astron. Astrophys., 88, 66-76, 1980).

On 257 plates of the field β And taken with the Sonneberg 40 cm astrographs from 1964 to 1984, FO And shows short eruptions of cycle lengths between 15 and 23 days and widths between 1 and 2 days. In the intervals JD 243 9051 ... 9063 and 244 5225 ... 5238 I observed 2 well-defined supermaxima. On Sonneberg sky patrol plates I observed a further supermaximum on JD 243 9801 ... 9803.



The brightness during the supermaxima is about 13.8 m_{pg}, in the minimum the star varies between 17.5 and 18.0 m_{pg} . More details will be given in a forthcoming paper in Mitt. veränderl. Sterne.

Photoelectric observations of FO And are very desirable.

L. MEINUNGER

Sonneberg Observatory of
Central Institute for Astrophysics
of Academy of Sciences of the GDR

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PHOTOELECTRIC OBSERVATION OF THE
FLARE STAR UV Cet IN OCTOBER 1983

The UV Cet monitoring was carried out on 5/6 October 1983 from $23^h\ 16^m$ to $01^h\ 23^m$ UT at Crimean Astrophysical Observatory on the 1.25 m Cassegrain telescope with a one-channel counting photoelectric UBV-photometer. The B-band close to the Johnson standard system, 0.52 s time integration and 10" diaphragm were used.

During the mentioned time interval 5 flares have been recorded, their characteristics are given in Table I:

a. The universal time of flare maximum, UT_{max}
b. The flare duration before and after its maximum, t_b and t_a
c. The equivalent duration of the flare, P
d. The amplitude of the flare, Δm.

The light curves of the flares observed have been processed previously by means of a run-medium on three points and are given in Figs. 1-5. The 0.2 mag on 3σ level is the limiting magnitude for a flare detection.

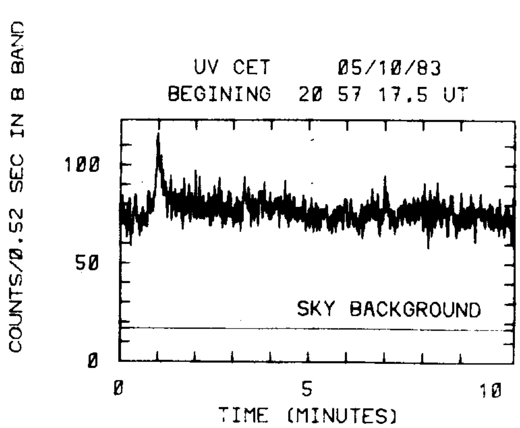

Figure 1

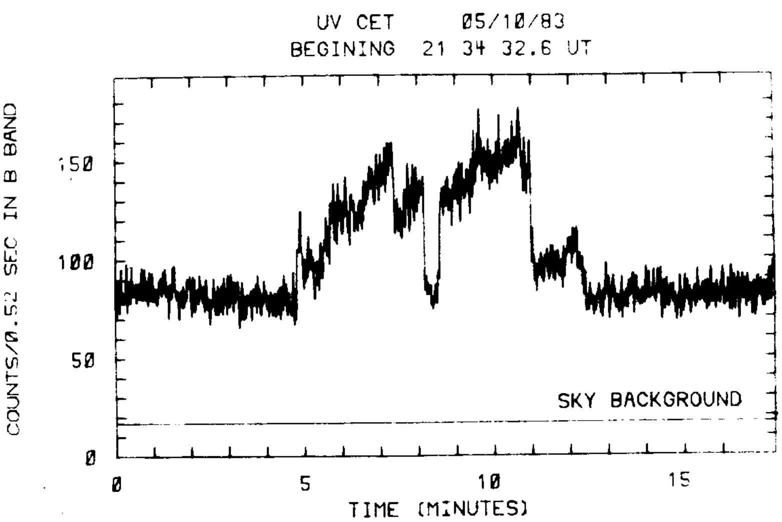

Figure 2

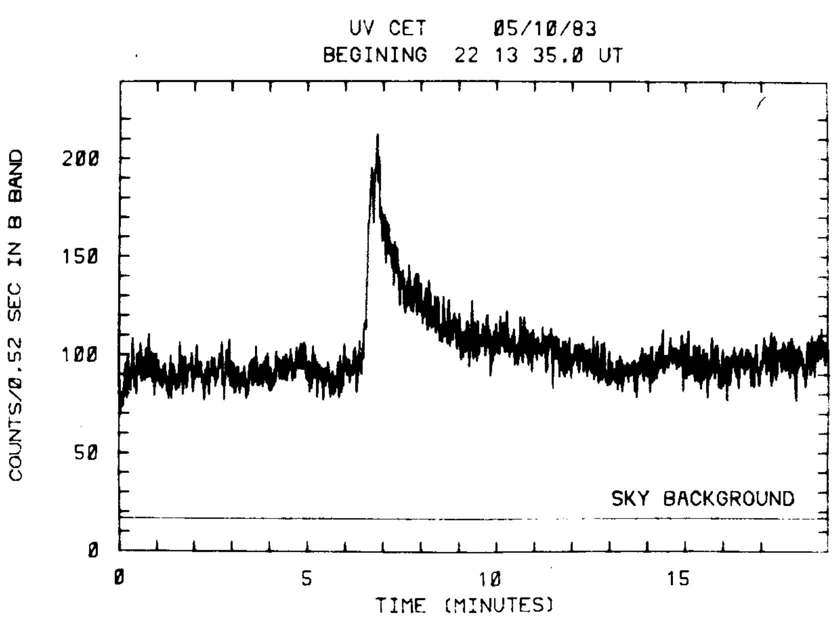

Figure 3

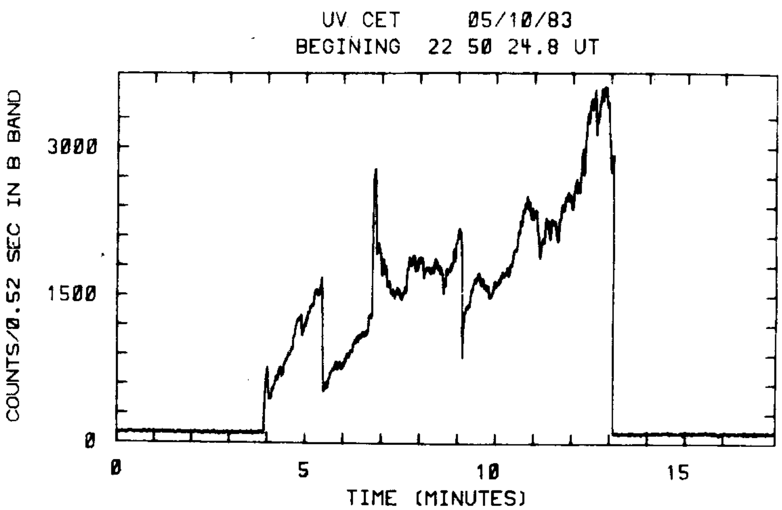

Figure 4

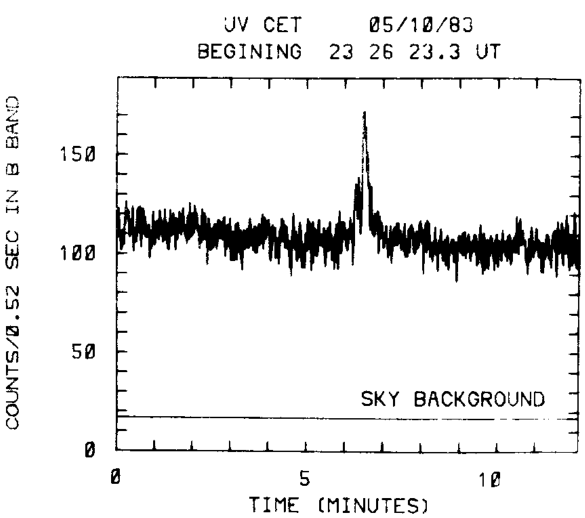

Figure 5

Table I

N	UT_{max}	t_b,min	t_a,min	P,min	Δm
	05.10.83				
1	20 58.3	1	4	0.3	0.6
2	21 45.0	7	2	2.7	0.8
3	22 20.5	0.7	7.2	2.0	1.0
4	23 03.2	8.8	0.2	151	4.0
5	23 32.9	0.7	0.3	0.3	0.5

Figures 1 and 5 show light curves with spikes. Figure 3 shows a flare that may be regarded as a classical one. Figures 2 and 4 show similar curves but their shapes with instant fading suggest a possible malfunction of our equipment.

I.V. ILYIN

Crimean Astrophysical Observatory
Nauchny, Crimea, 334413, U.S.S.R.

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THE ECLIPSE OF THE SYMBIOTIC ECLIPSING BINARY SYSTEM CI CYGNI IN 1982

Regular UBV photometry of CI Cyg ($P = 855^{d}.25$) has been carried out at Crimean Astrophysical Observatory starting from 1973 (Belyakina, 1979 and 1983). The last eclipse of the hot component by the cold one in this binary system occurred in 1982. Ten measurements of CI Cyg in UBVRI system were realized at the 125 cm reflector in addition to the usual UBV photometry carried out at the 64 cm meniscus telescope.

The results of all these observations are plotted in Figures 1 and 2. The brightness of CI Cyg had been rising before the eclipse in the U, B and V bands (Figure 1). The eclipse began on about JD 244 5190. The brightness in U, B, V and R bands decreased by $1^{m}.2$, $0^{m}.9$, $0^{m}.4$ and $0^{m}.1$, respectively till JD 244 5225 . During that period the I-light remained constant. After the phase 0.0 ($\approx$ JD 244 5250) the second light weakening occurred with the amplitudes $\Delta B = 0^{m}.2$, $\Delta V = 0^{m}.4$, $\Delta R = 0^{m}.3$ and $\Delta I = 0^{m}.2$. In this case the U-light remained constant. According to Figure 2 the durations of the 1980 and 1982 eclipses are compatible. But both colour-indices in 1982 minimum are redder than those in 1980.

Apparently, the second light weakening in the minimum is caused by the variations of the red component. From our total photometric data we inclined to conclude that the cold component of the CI Cyg binary system is an irregular variable red giant changing its light within some dozens of days with amplitudes $\Delta V \leq 0^{m}.4$. It is worth noting that, in this respect, it looks like single red giants investigated by Stokes (1971).

The IR photometry also showed the variations of the cold component of CI Cyg (Taranova and Yudin, 1981).

The observations of CI Cyg in the UBVRI system were carried out during 1 - 3 hours with time resolution 25 sec in three nights indicated by the arrows in Figure 1. The obtained light variations did not exceed ± 0.01 .

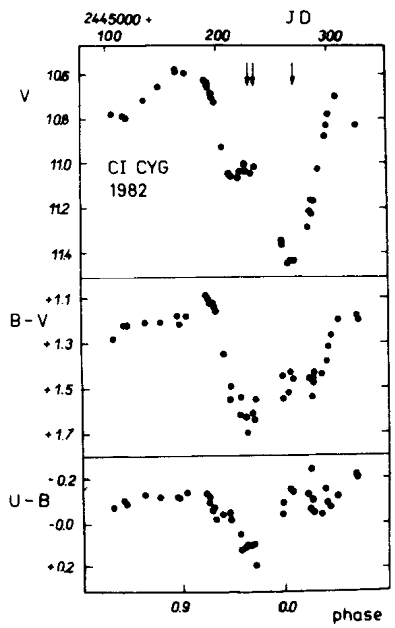

Figure 1

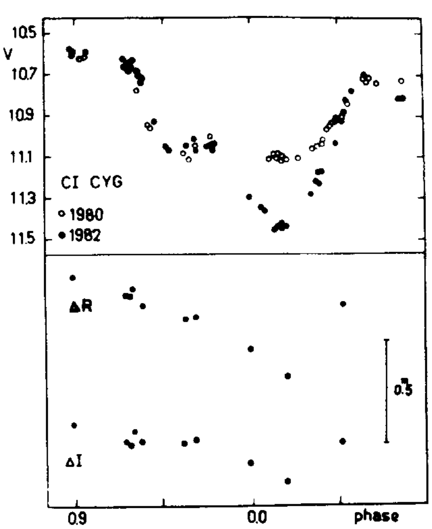

Figure 2

Apparently, in the 1982 eclipse of CI Cyg there were no light fluctuations observed by Burchi et al. (1983) in 1980.

T.S. BELYAKINA

Crimean Astrophysical Observatory
334413 Nauchny, Crimea, U.S.S.R.

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THE DISCOVERY OF A W URSAE MAJORIS VARIABLE IN THE VISUAL BINARY SYSTEM ADS 9019

During observations to obtain UBV data of visual binaries (Walker, 1977) the light of the system ADS 9019 (13411+0537, or ADS 9019 = BD+5^{o}2794 = SAO 120102) was discovered to be varying. Over 1200 photoelectric observations in U, B and V have been obtained and delta magnitude curves are shown in Figure 1. The light curves indicate that the components form a contact binary of the W UMa type. The observations were carried out with the 1-m Ritchey-Chretien reflector at the Flagstaff Station.

Visual observations of ADS 9019, made by the author with the 0.91-m re-

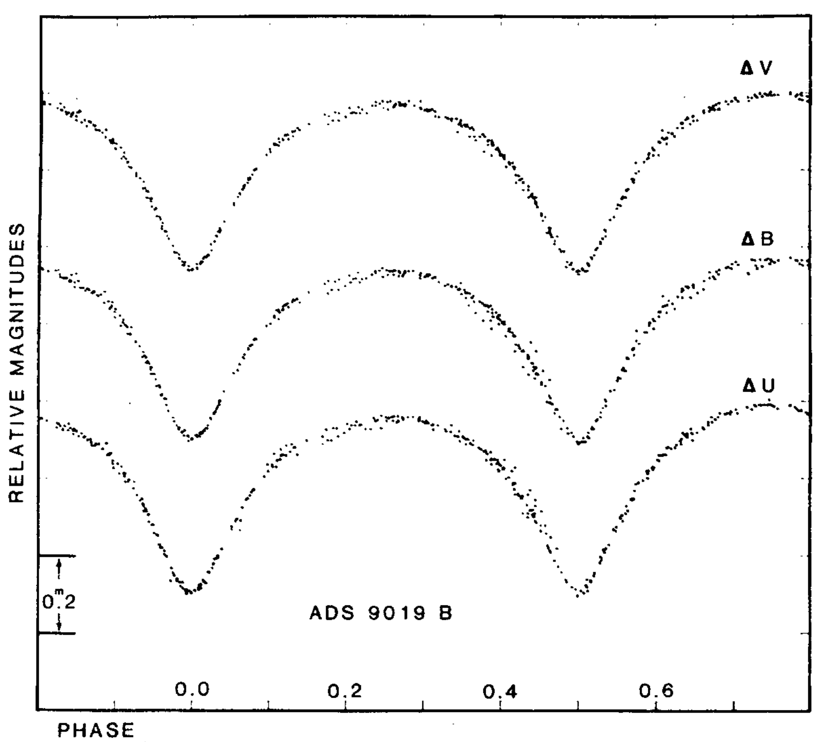

Figure 1

fractor on Mt. Hamilton, indicate that it is the B component that is the variable. In 1979 the position angle of B relative to A was 100°, and the separation was 0."26 . An orbit of the visual binary was computed by W. Heintz (1975) who derived a period of 312 years.

The times of minimum light were determined by the Hertzsprung method (Kwee and van Woerden, 1956). Ten observed minima were combined by least squares to determine the light elements of the system, which are:

$$T = 244\ 4044.5178 + 0^{d}.40767009\,E$$
$$\pm 0.0002 \pm 0.00000008 \text{ p.e.}$$

The magnitudes and colors of the system as a function of phase are given in Table I. These data include the light of the A component. The stars SAO 120108 and SAO 120196 were used as the comparison and check stars, respectively. Their magnitudes and colors are listed in Table II.

Table I. Magnitudes and Colors of ADS 9019

Phase	V	B-V	U-B
0.00	7.48	0.56	0.05
0.25	7.06	0.55	0.04
0.50	7.48	0.56	0.05
0.75	7.06	0.55	0.04

Table II. Magnitudes and Colors of the Comparison and Check Stars

Star	V	B-V	U-B	Sp(HD)
Comp. SAO 120108	6.35	0.62	0.16	G0
Check SAO 120196	7.12	0.93	0.57	G5

The Wood method (Wood, 1972) was used to obtain a light curve solution for ADS 9019 B. This solution, the data, and an analysis will be published elsewhere. In addition a study of the relative orientation of the orbital planes is in progress.

R.L. WALKER

Flagstaff Station
U.S. Naval Observatory
Flagstaff, AZ 86002
U.S.A.

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PHOTOELECTRIC OBSERVATIONS OF THE EW-VARIABLE VZ Psc

VZ Psc is a neglected EW binary system. Discovered by Moorhead (Wolff et al., 1965), this 10-th magnitude variable was observed by Eggen (1967), who gave a mean time of minimum and a period of 0.261 d. More recently VZ Psc was observed visually by European Groups BBSAG (Locher, 1977) and GEOS (Poretti, 1979): 16 visual minima were collected and a period between 0.261178 and 0.261195 d was proposed.

The star was observed photoelectrically during two nights at the 102 cm reflector of Merate Observatory, using a standard V filter, a Lallemand photomultiplier and a Gardiner type integrator (the integration time was set to 20 sec). The variable was observed differentially relative to Eggen's comparison star; the southern star of the couple lying near the comparison star was used as check star (see the chart published by Giclas et al., 1959).

On the night of September 3, 1983 VZ Psc was observed from 2445581.47 to 2445581.56 and no minimum was detected: the shape of the light curve suggests that minima occurred just before and just after the observations.

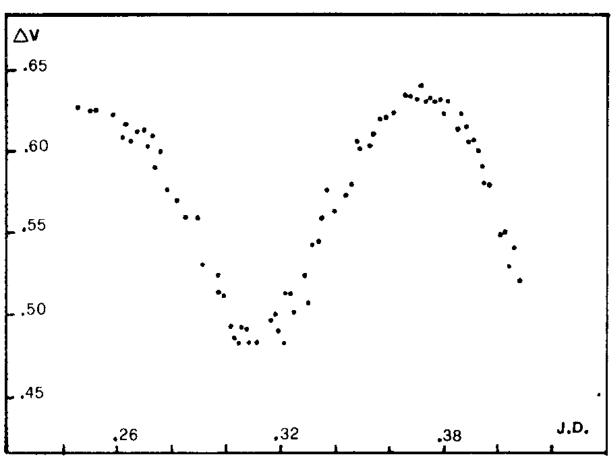

Figure 1. Light curve of VZ Psc on the night of JD 2445639.
ΔV are in the sense "comparison minus variable".

On the night of October 31, 1983 the variable was observed for 0.19 d and a minimum was detected: it was calculated at J.D.hel. 2445639.3113 ($\sigma = 0.0002$) using Kwee and Van Woerden's method (1956). Figure 1 shows the light curve obtained.

It is very difficult to say if it is a primary or a secondary minimum. The maximum following the minimum seems to be brighter than the preceding one; the descending branch observed at the end of the night suggests a minimum fainter than the observed one. Having respect to the small-scale light curve published by Eggen (1967) it seems that the observed minimum is a secondary, but a great uncertainty exists.

Further observations of this short period eclipsing variable are requested.

E. PORETTI

Osservatorio Astronomico
22055 Merate (CO)
Via E. Bianchi 46
Italy

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IMPROVED POSITIONS FOR 15 CATACLYSMIC VARIABLE STARS

Modern astronomical observations generally require accurate celestial coordinates for source acquisitions and candidate confirmations among various observational wavelengths. Nevertheless, many important members of various classes of faint objects are still identified (or misidentified) through the use of relatively poor coordinates that may be perpetuated for decades in the literature. This paper presents new source positions, with accuracies of order 1 arc-sec, for 15 cataclysmic variables.

The star positions were measured with the Computer Assisted Astrometry System of NRAO's Very Large Array. The system allows one to measure the position of objects on the Palomar Observatory Sky Survey (POSS) prints by utilizing the Smithsonian Astrophysical Observatory Star Catalog as a source of reference stars. The source names, types, and their measured 1950.0 coordinates are presented in Table I in order of increasing right ascension, α. The uncertainties in right ascension, $\Delta\alpha$, and declination, $\Delta\delta$, are determined from the variances of the residuals of the fitted reference stars (typically eight stars were fitted). These uncertainties include an empirically determined 0.3 arc-sec measuring precision of the source itself.

It is hoped that these positions will serve to correct published errors of several minutes of arc for some sources and to confirm the more accurately reported positions. The author wishes to thank Dr. Derek Wills who earlier provided the position for SU UMa. This position is included here because its accuracy is comparable or even superior to the other measurements since it was measured with the superb plate measuring engine of the McDonald Observatory using techniques similar to those above with the POSS plates.

TABLE I. POSITIONS OF CATACLYSMIC VARIABLES

SYSTEM	TYPE+	RIGHT ASCENSION α (1950.0)	Δα (time)	Δα (arc-sec)	DECLINATION δ (1950.0)	Δδ (arc-sec)
KT Per	DN	$01^h34^m01^s.67$	$0^s.05$	1.2	+50° 42' 01.7"	1.4
RX And	DN	01 01 46.01	0.05	1.0	41 01 52.2	1.1
RW Tri	NL	02 22 41.57	0.06	1.0	27 52 20.3	0.6
CN Ori	DN	05 49 40.47	0.06	1.0	-05 25 41.0	0.8
SS Aur	DN	06 09 35.57	0.04	0.8	+47 45 13.8	0.4
IR Gem	DN	06 44 25.75	0.04	0.7	+28 09 42.8	0.9
U Gem	DN	07 52 07.78	0.03	0.5	+22 08 02.4	0.6
YZ Cnc	DN	08 07 52.71	0.06	1.0	+28 17 31.0	1.2
SU UMa	DN	08 08 05.45	0.02	0.7	+62 45 22.8	0.4
Z Cam	DN	08 19 39.64	0.01	0.5	+73 16 24.7	1.1
UX UMa	NL	13 34 42.06	0.05	1.2	+52 10 04.4	1.1
V603 Aql	N	18 46 21.42	0.06	0.9	+00 31 34.8	0.8
EM Cyg	DN	19 36 42.13	0.07	1.2	+30 23 33.5	0.6
SS Cyg	DN	21 40 44.42	0.03	0.6	+43 21 21.4	0.6
RU Peg	DN	22 11 35.50	0.06	1.0	+12 27 16.8	0.7

+ DN, dwarf nova; NL, nova-like; N, old nova.

ALAN L. KIPLINGER

Laboratory for Astronomy and Solar Physics
Goddard Space Flight Center and Applied Research Corporation
Landover, Maryland
U.S.A.

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NEW DOUBLE-LINED ECLIPSING BINARIES FOUND WITH RETICON, DIGICON, AND CCD DETECTORS

High resolution coudé spectrometric observations have been made during the past five years as part of a continuing program to determine accurate absolute properties of eclipsing binary stars. A previous progress report (Lacy and Evans 1979) discussed nine of the stars in this program (KP Aql, CW CMa, YZ Cas, V442 Cyg, TX Leo, FL Lyr, EE Peg, V906 Sco, and TX UMa) which were observed with a Reticon detector on the 2.7 m McDonald Observatory reflector. The completed analyses of the observations of CW CMa, YZ Cas, and EE Peg already have been published (Lacy 1982, 1981, and Lacy and Popper 1984). Observations of an additional 27 eclipsing binaries are discussed here. These observations were obtained with the coudé Reticon and Digicon detectors on the 2.7 m reflector at McDonald Observatory and the coudé CCD spectrograph of the 2.1 m reflector at Kitt Peak National Observatory. The binaries have been divided into two groups (double-lined systems and others) and are discussed in detail below:

Double-Lined Eclipsing Binaries

BW Aqr*	IT Cas*	V541 Cyg*	GG Ori*
HS Aur*	MU Cas*	V909 Cyg	IQ Per
BW Boo*	PV Cas	UZ Dra*	YY Sgr*
WW Cam*	V396 Cas*	FS Mon*	V907 Sco*
AY Cam	V459 Cas*	EW Ori*	RW UMa*
SW CMa*	WX Cep	FT Ori	BD +37°4713

Systems with an asterisk (*) either do not have a photoelectric light curve or need to have additional photometric coverage. Photoelectric observers are encouraged to observe these systems in at least two well-calibrated colors in order to make possible the most accurate determinations of absolute stellar properties.

Notes on the individual systems are listed below. The spectral types listed are generally as stated in the General Catalogue of Variable Stars (GCVS). For eccentric orbits the eccentricity is quoted in parentheses if known.

BW Aqr: Spectral type (Sp.) F7, orbital period P= 6.72 days, photographic magnitude (mag.) 10.2. My spectra are consistent with late F. Absorption lines of both components are of about equal strength. The lines are very crowded in the blue. Popper (1971, 1981a) has 5 plates. The existing photometry (Robinson and Kreiner 1970) shows deep, narrow eclipses, a displaced secondary eclipse, and possibly apsidal motion.

HS Aur: Sp. G8V (Popper 1983), P= 9.81 days, mag. 10.5. Lines of both components are of about equal strength. Popper (1983) has many plates. Unpublished photometry by Freuh and Turner shows narrow, deep eclipses. This is a very important system for filling in the gap in absolute data between the Sun and YY Gem.

BW Boo: Sp. A0, P= 3.33 days, mag. 7.0V. This is a large light-ratio system similar to YZ Cas. Lines of the primary are sharp and deep (Am?). Lines of the secondary are very shallow, mainly < 1% deep in the red (6400Å) region. A photoelectric light curve has been obtained by Kurpinska (1975). The single-lined orbit of Gorza and Heard (1971) showed a small eccentricity (0.14).

WW Cam: Sp. A?, P= 2.27 days, mag. 10.6. The stars have nearly equal line strength and moderately narrow lines. There are many nice lines in the blue (4500Å) region. The spectral type appears to be mid-A based on my 120Å wide coudé spectra. Photographic light curves (Huruhata and Gaposchkin 1940) show narrow, deep eclipses.

AY Cam: Sp. A5, P= 2.73 days, mag. 9.69V. The color index (B-V) of Tempesti (1969) corresponds to sp. F1 if there is no reddening. My spectra are consistent with late-A for the primary. The stars have a 2:1 line strength ratio and strong lines. Milano and Russo (1979) and Al-Naimiy (1977) have analyzed Tempesti's photoelectric light curve.

SW CMa: Sp. A8 + A8, P= 10.09 days, mag. 9.3. A poor spectroscopic orbit has been published by Struve (1945) who noted that it "did not represent the observations very satisfactorily." The secondary eclipse is displaced and the orbit is very eccentric (0.50). The lines are narrow, deep, and of nearly equal strength on my spectra.

IT Cas: Sp. F6, P= 3.89 days, mag. 11.0. Narrow lines of nearly equal strength are shown in my spectra, which resemble those of BW Aqr. The secondary eclipse is slightly displaced, indicating eccentricity.

MU Cas: Sp. A0(GCVS), P= 3.86 days, mag. 10.5. The spectra show narrow lines of nearly equal strength. The He I line at 4471Å is much stronger than the 4481Å line of Mg II, and the spectral type therefore must be early B. The uvby indices of Hilditch and Hill (1975) imply a reddened B5 for the average spectral type. Romano (1958) has reported that the secondary eclipse is displaced, but this was not confirmed by Haussler (1973).

PV Cas: Sp. B6, P= 1.75 days, mag. 10.1. The spectra show broad lines of nearly equal strength. He I 4471 is barely visible, and the spectral type appears to be closer to B9 than B6 (GCVS). Popper (1971, 1978) has about two dozen spectrograms.

V396 Cas: Sp. late B, P= 11.13 days, mag. 9.9. The spectra show narrow lines with a line strength ratio of about 3:1. The spectral type appears to be close to A0 on my spectra.

V459 Cas: Sp. B9, P= 8.46 days, mag. 10.3. Moderately narrow lines of nearly equal line strength are shown.

WX Cep: Sp. A2 + A5, P= 3.38 days, mag. 9.3. The lines have approximately equal strength, but the primary's lines are slightly weaker and much narrower than the secondary's lines. According to Popper (1978) "Sahade and Cesco (1945) misinterpreted the appearance of the K-line, which is complex and not usable...Later than A2." Popper has many spectrograms. Ebbighausen et al. (1975) give a photometric orbit.

V541 Cyg: Sp. A0, P= 15.34 days, mag. 10.2. The lines are fairly narrow and of nearly equal strength. The orbit must be very eccentric since the primary and secondary eclipse durations differ by a factor of 2 and the secondary eclipse is displaced (Karpowicz 1961).

V909 Cyg: Sp. A0, P= 2.81 days, mag. 9.3. Lines of both components have nearly equal strength. Gulmen et al. (1982) have a photoelectric light curve in B, V.

UZ Dra: Sp. F8, P= 3.26 days, mag. 9.9. In the red region the lines are both narrow with a line strength ratio of about 2:1. The secondary lines are significantly narrower than those of the primary.

FS Mon: Sp. F2, P= 1.90 days, mag. 10.5. The lines are somewhat broad and rather crowded in the blue. The line strength ratio is about 3:1.

EW Ori: Sp. G0, P= 6.94, mag. 10.4. The lines are sharp and of nearly equal line strength. Popper (1978) has 7 plates. Secondary eclipse is slightly displaced in an unpublished V, R lightcurve by Freuh. This is an important solar-type system.

FT Ori: Sp. A0 + A3, P= 3.15 days, mag. 9.0. The system shows fairly broad lines with the secondary lines somewhat weaker than the primary lines. The orbit is very eccentric (0.40). The lines are unblended only near phase 0.9, although near phase 0.2 they are only slightly blended. J. Tomkin has unpublished Digicon spectra and is collaborating with the author. Cristaldi (1970) has published a photometric orbit.

GG Ori: Sp. A2, P= 6.63 days, mag. 10.8. My spectra are consistent with an early A type. The lines are narrow and of nearly equal strength. The secondary eclipse is displaced (Kordylewski 1951), indicating an eccentric orbit. The eclipses are deep and narrow.

IQ Per: Sp. B7 + A2, P = 1.74 days, mag. 7.7. The lines are broad and the line strength ratio is about 4:1. The secondary component's Mg II 4481Å line is slightly blended with the wings of the very broad 4471Å He I line of the primary when the secondary line is displaced blueward. Young's (1975) estimate of K_2 is about 14% too small. The orbit is slightly eccentric (0.07). Hall et al. (1970) gives a photometric orbit.

YY Sgr: Sp. A0, P= 2.63 days, mag. 9.8. Both He I 4471Å and Mg II 4481Å are double and of comparable strength, implying a spectral type near B8. The He I components are always badly blended. The Mg II components are unblended and of nearly equal strength. The orbit is eccentric (0.16). Keller and Limber (1951) derive a photometric orbit.

V907 Sco: Sp. A0, P= 3.78 days, mag. 9.1. The spectra show nice sharp lines at 4481Å and 4550Å Fe II + Ti II, both components having nearly equal strength. Other lines are rather weak.

RW UMa: Sp. F9 + G9, P= 7.33 days, mag. 10.1. Lines of the secondary are broader than, and of comparable strength to, the primary. This is known to be an "RS CVn" type system. Provisional masses and radii have been given by Popper (1975, 1980).

BD + 37°4713 = SAO 072799: Sp. A0, P= 7.35, mag. 8.0. One component has much broader lines than the other. The secondary eclipse is slightly displaced (Fernandes and Frank 1981), so the orbit is eccentric.

Other Eclipsing Binaries

QX Cas: Sp. B1, P= 6.00, mag. 10.3. No sign of a secondary spectrum can be detected in Digicon scans at phases 0.05, 0.10, 0.19, 0.27, 0.36, or 0.56. Sandage and Tammann (1969) give photometric data.

V380 Cyg: Sp. B1.5III, P= 12.43 days, mag. 5.7. The primary's lines are very broad and deep. Very weak (<1%) features possibly due to the secondary are seen near the 4481 Mg II line of the primary in three Reticon spectra with signal-to-noise ratio greater than 500. The possible secondary features are probably too weak to detect photographically. They are always somewhat blended with the strong primary line, even near quadrature phases. These observations reinforce Popper's (1981b) conclusion that Batten's (1962) orbit for the secondary must be considered unreliable.

VV Ori: Sp. B1, P= 1.49 days, mag. 5.3. The spectra are similar to those of V380 Cyg (above) except the lines of VV Ori are even broader and the secondary is somewhat stronger. The He I lines are always blended. The secondary 4481Å Mg II line is not detectable with certainty in spectra with signal-to-noise ratio of 500. These observations reinforce Popper's (1981) and Andersen's (1976) conclusions that Duerbeck's (1975, 1976) orbit for the secondary must be considered unreliable.

CLAUD H. LACY
Dept. of Physics
University of Arkansas
Fayetteville, AR 72701
U.S.A.

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IMPROVED OUTBURST LIGHTCURVES OF THE NOVAE EY Aql, BC Cas, MT Cen, AND V745 Sco

During a stay at the Harvard College Observatory, photographic plates were examined for outburst records of novae, to determine improved positions and to prepare finding charts for a forthcoming catalogue and atlas of galactic novae (Duerbeck 1983). In a few cases, novae could be identified that had been observed and described elsewhere, and some essential points could be added to the existing light curves.

Table I. Observations

Nova	plate series	J.D. 2400000+	m_{pg}	Nova	plate series	J.D. 2400000+	m_{pg}
EY Aql	MF	24761.	10.9	MT Cen	MF	26485.3	12.2
"	MF	24790.	12.6	"	MF	26529.2	11.7
BC Cas	AC	25811.	ft12.	"	MF	26530.2	11.8
"	AC	25825.	10.7	"	MF	26738.5	14.7
"	AC	25853.	11.5	V745 Sco	B	28645.6	ft14.5
"	AC	25856.	ft12.	"	B	28664.6	11.0
"	AC	25872.	11.7 *	"	B	28668.6	12.45
"	I	25922.	14.0 **	"	B	28670.5	13.0
MT Cen	MF	26454.3	ft16.2	"	B	28672.5	13.25
"	MF	26470.3	14.7:	"	B	28673.6	13.3
"	MF	26474.3	8.35	"	B	28674.6	13.4:
"	MF	26481.3	10.0	"	B	28675.6	13.9:
				"	MF	28688.5	14.6:
				"	MF	28696.5	ft14.5

* poor plate; defect?
**very good image

1. EY Aql (1926)

This nova was discovered by Albitzky (1929) on Simeis plates; it is seen on 5 plates between 1926 September 8 and September 30, it does not appear on a plate taken 1926 August 16 (fainter than $13^{m}.6$). Hoffleit (1932) mentions that the nova was found only on two out of 79 Harvard plates, "during the interval of Albitzky's observations". It is indeed seen on two plates of the MF series, taken 1926 September 2 and October 1. The outburst time and the light curve form can be improved. The magnitude scale by Albitzky (1929) is used. The magnitude at maximum was brighter than $11^{m}.0$, the t_3-time about 40 days. The estimates are given in Table I, and the improved light curve is shown in Fig. 1.

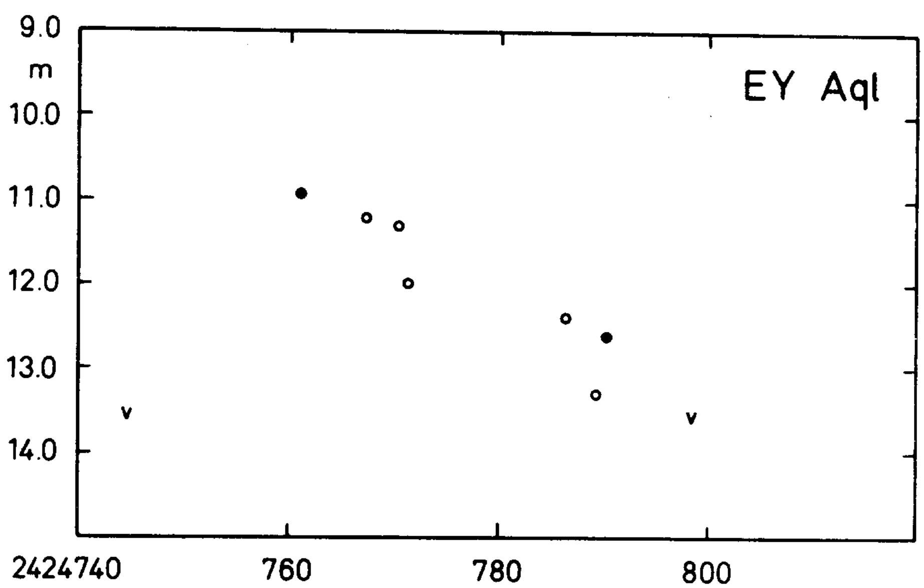

Fig. 1. The light curve of EY Aql (1926). Circles are Albitzky's (1929) magnitudes, dots are magnitudes from Harvard photographs.

2. BC Cas (1929)

This nova was discovered by Beljawsky (1931). Perova and Sharov (1956) list the observations from Moscow (Sternberg) and Simeis plates. Their first plate showing the star was taken 1929 September 4. A Harvard plate shows the object already bright on 1929 July 31, while a plate taken July 18 does not show the star. The Harvard observations are listed in Table I. The improved light curve is shown in Fig. 2.

It cannot be decided whether the first Harvard plate was taken on the rising or on the declining branch of the light curve. The magnitude at maximum was certainly near 10^m, the t_3-time is between 50 and 75 days.

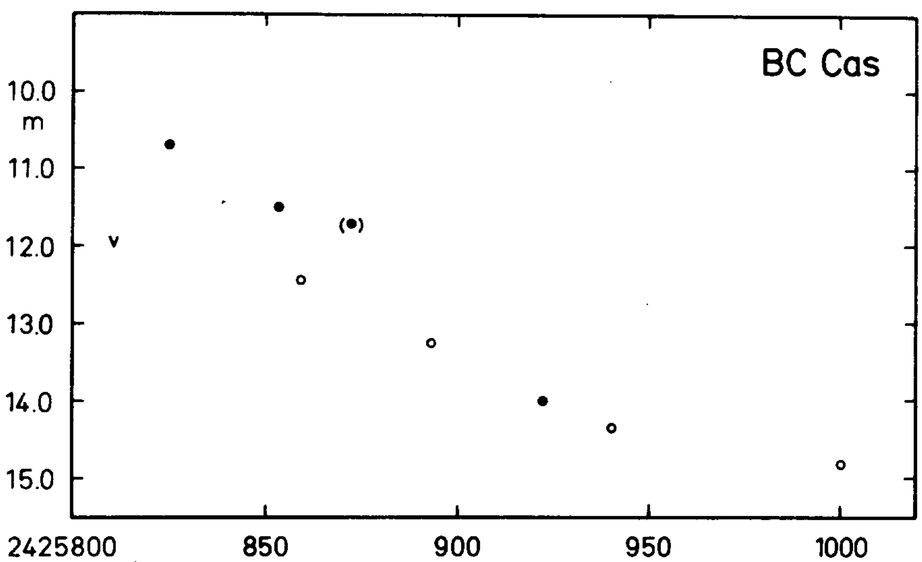

Fig. 2. The light curve of BC Cas (1929). Circles are magnitudes from Perova and Sharov (1956), dots are magnitudes from Harvard photographs.

3. MT Cen (1931)

This nova was discovered by Uitterdijk (1934) on plates taken in May, 1931. The rise to maximum is well covered with observations, however, 9 days after outburst, a gap of 411 days follows, after which the nova had disappeared. Some plates of the MF series show the nova. Uitterdijk's (1934) scale is used for the bright phase of the nova. For fainter phases, a scale was established and calibrated from an ESO/SRC J atlas plate, using King et al.'s (1981) magnitude - image diameter calibration.

The first Harvard plate shows the nova on the rising branch, more than 6^m below maximum. The magnitude at maximum is $8^m.35$, the t_3-time is about 10 days. Unfortunately, too few observations are available to classify the light curve. It may be a fast nova of the FH Ser type (Duerbeck's (1981) class Cb). The observations are listed in Table I, the light curve is shown in Fig. 3.

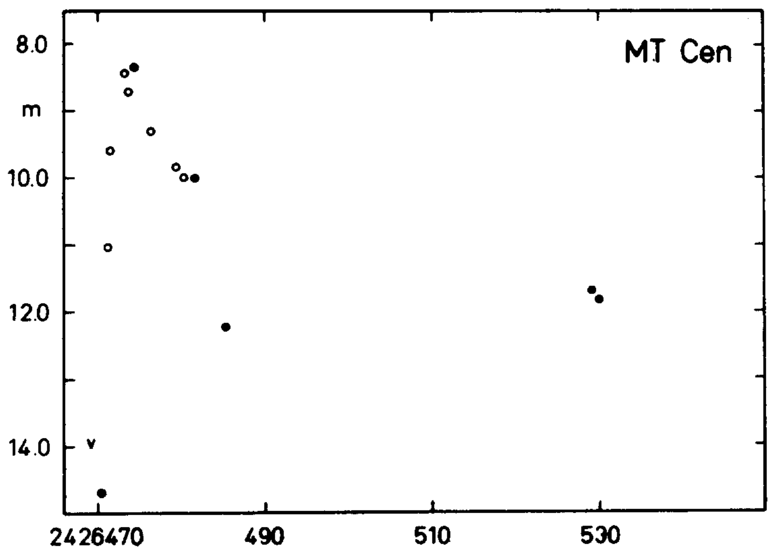

Fig. 3. The light curve of MT Cen (1931). Circles are Uitterdijk's (1934) magnitudes, dots are magnitudes from Harvard photographs.

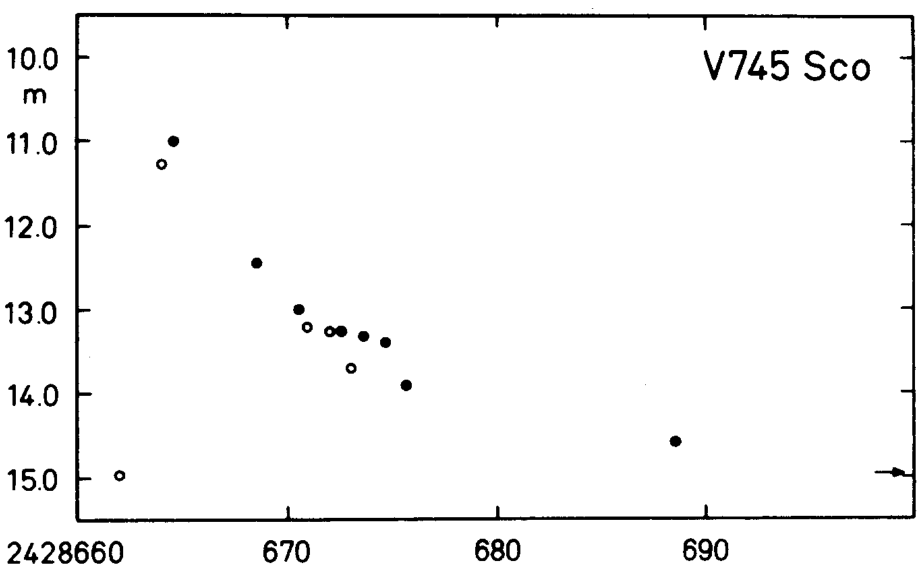

Fig. 4. The light curve of V745 Sco (1937). Circles are Plaut's (1956) magnitudes, dots are magnitudes from Harvard photographs.

4. V745 Sco (1937)

This nova was discovered by Plaut (1958) on plates taken by H. van Gent. It is visible on some B and MF plates. Plaut's (1958) scale is used. The maximum magnitude is $11^{m}.0$, the t_3-time is 12 days. The observations are given in Table I, the light curve is shown in Fig. 4.

Finding charts and accurate positions of the novae will be given in the forthcoming catalogue.

Acknowledgements: I thank Dr. M. Liller for the permission to use the plate collection of the Harvard College Observatory, and for her advice. I also thank the Deutsche Forschungsgemeinschaft for a travel grant (Du 107/4-1) that made the stay at the HCO possible.

H. W. DUERBECK

Observatorium Hoher List
der Universitäts-Sternwarte Bonn

5568 Daun, F. R. Germany

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HIGHLY EXCITED EMISSION LINES IN BX Mon AND ZZ CMi

Continuing the series of spectroscopic observations of symbiotic stars, we have monitored BX Mon (M Hα 61-12, Sp: M4ep) and ZZ CMi (BD +9°1633, Sp: gM6ep) since October 1979. These observations have been carried out with the one prism spectrograph mounted on the 122 cm reflector of the Astrophysical Observatory of University of Padova in Asiago. The spectral range is λλ3800-7800 Å and the dispersion is 60 Å/mm at Hγ. During our observations, some highly excited emission lines which had not been known in these stars were found, or example He II 4686 and [O III] 5007 in BX Mon and [O III] and [Ne III] in ZZ CMi.

BX Mon has been classified as a symbiotic star (Bidelman, 1954), but its detailed properties have not been well known. Allen (1979) rejected BX Mon from his list of symbiotic stars because of its low excitation stage. On the other hand, Michalitsianos et al.(1982) found emission lines of C IV, N III], O III], Si III] and C III] in their ultraviolet spectra and suggested that BX Mon could be classified as a symbiotic star.

In our observations, BX Mon showed TiO absorption bands and emission lines of H I, He I and Fe II in October 1979. The emission line of He II 4686 was found at first on the spectra taken on November 7, 1981. Those were the first spectra for that observational season. The intensity of He II 4686 emission line decreased in February 1982 and increased again in March 1982. In the next observational season, from October 1982, He II 4686 emission line was not seen whereas a weak emission of [O III] 5007 was noticed. The appearance of the other emission lines of H I, He I and Fe II was nearly the same as that observed in October 1979. On the other hand, unusually low excitation conditions were observed in February 1980 and October-November 1983. In these periods, only Hα and Hβ were seen in weak emission while TiO absorption bands were very distinct (Figure 1). The last phenomenon can be explained if we assume that BX Mon is a binary system and the hot component was eclipsed by the cool component at these periods. Photometric observations are waited. Intensity tracings of the spectra taken on

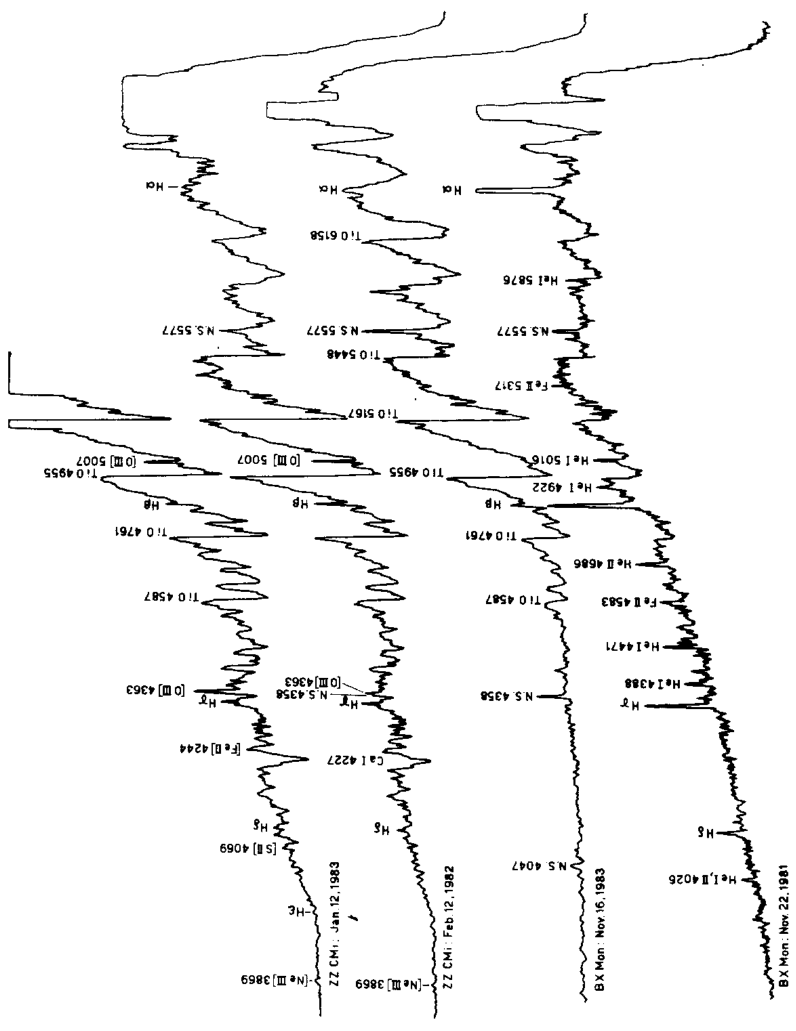

Figure 1

November 22, 1981 and November 16, 1983 are shown in Figure 1. In the figure " N.S. " indicates an emission line of the night sky.

The first detailed spectroscopic observation of ZZ CMi (BD +9°1633) was made by Sanford (1947). The spectra showed Ti O absorption bands, a strong Ca I 4227 absorption line and emission lines of Hα, Hβ, [O I] 6300 and [Fe II]. The absorption features corresponded to a spectral class M 6.

Because of the lack of highly excited emission lines, ZZ CMi has not been classified as a symbiotic star.

In our observations, weak traces of [O III] 5007 and 4363 were noticed at first on the spectra taken on November 22, 1980. Then, they grew gradually and in January 1982 [O III] 5007 became as intense as Hβ. At this time also the emission line of [Ne III] 3869 was noticed. In the next observational season, from October 1982, the emission lines of [O III] were still prominent and [Ne III] existed. The emission line of [O III] 4363 became more intense than [O III] 5007. This suggests that ZZ CMi was surrounded by a rather dense nebulosity. Intensity tracings of the spectra taken on February 2, 1982 and January 12, 1983 are shown in Figure 1.

These results indicate that BX Mon and ZZ CMi can be classified as symbiotic stars according to the criteria of Boyarchuk (1975). Their spectral variations are very interesting. Further spectroscopic and photometric observations are requested.

T. IIJIMA

Astrophysical Observatory of University of Padova in Asiago

I-36012 Asiago (Vicenza) ITALY

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A CLOSE ECLIPSING BINARY SYSTEM IN CYGNUS

The variability of the star PG7 ($\alpha = 19^h29^m.9$, $\delta = +38^o56'$; 1950.0) was discovered by P. Guida (cf. Harns, 1977).

The finding chart of the variable is given in Figure 1, and the magnitudes of the comparison stars derived photographically from the photoelectric standard sequence in NGC 6819 (Anner, 1974) using two plates, are presented in Table 1.

Table I

star	B
a	$12^m.09$
b	12.71
c	12.94
d	13.34

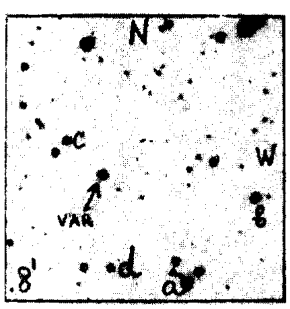

Figure 1

We estimated the object's brightness on 270 photographic plates of the Sternberg Institute plate collection taken during the interval J.D. 2436072–2444436. The reduction of these observations has shown that the star is a W Ursae Majoris type system with the following light elements:

$$J.D.Min._{\odot} = 2439415.247 + 0^d.4050654 \cdot E \quad .$$

The range is 12.5 - 12.9 B, and the minima are of equal depth.

Since the duration of the eclipse is slightly longer than one hour and the typical exposure time was 45^m, the real depth of minima must be greater than that found in our observations.

Figure 2 shows the mean light curve based on the determined period value. No period change was found during this time interval.

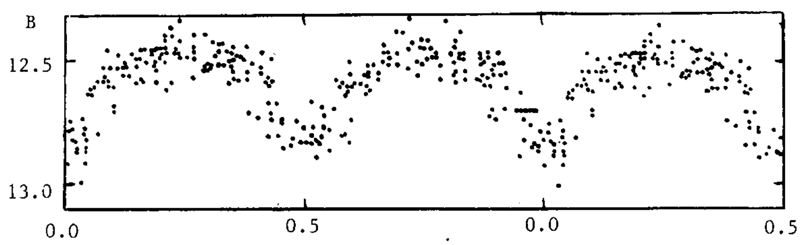

Figure 2

The comparison of the "red" and "blue" Palomar prints shows that the colour of the star does not differ significantly from that of the surrounding stars.

It is desirable to carry out photoelectric and spectroscopic observations of the object in order to determine the physical characteristics of the components of this close binary system.

S.YU. SHUGAROV

Moscow University
Sternberg State Astronomical Institute
13 Universitetskij Prospect
Moscow 119899
U.S.S.R.

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SHELL EPISODE OF PLEIONE (BU Tau)

Pleione is a well known shell star in the Pleiades cluster (HD 23862, $m_V = 5.20$, Sp.Type B8Vn + shell according to Abt and Levato (1978)). Its photometric variability was investigated by Sharov and Lyuty (1976) who collected all available photometric observations on the star. They observed a minimum in 1973 connected with a new shell outburst. In 1974 and 1975 Sharov and Lyuty observed the beginning of a slow increase in B and V. Hopp and Witzigmann (1980) observed BU Tau in B and V during 1977 - 1980. Their observations showed that the shell outburst still goes on as the star has not returned to its normal maximum light.

In continuation with previous observations, Hopp et al. (1982) again observed BU Tau during 1980 - 1982 in BV and UBV and found that BU Tau had an unusual great Balmer jump compared to stars of the same spectral type and luminosity class. They concluded that using 18 Tau as standard, BU Tau had a deficit of about 0.27 mag in U on 7 Sept. 1980. Van Leeuwen et al. (1982) performed measurements of Pleione in the Walraven VBLUW system during 1977 - 1981. Golay and Mauron (1982) presented data for Pleione in the Geneva system, obtained during 1962 and 1979. They found a continuous increase in ultraviolet blocking by hydrogen shell during 1977 - 1981.

In order to investigate the behaviour of BU Tau in Balmer continuum we made spectrophotometric observations of Pleione during December 1980. The observations were obtained in the wavelength range λλ3200-7000 Å with a Hilger and Watts monochromator in the Nasmyth focus of the 52-cm telescope at Uttar Pradesh State Observatory. The scans were obtained with an exit slit of 0.7 mm admitting 50 Å of the spectrum. BU Tau was observed on two nights (27 and 30 December 1980). Along with BU Tau, the comparison star 18 Tau (B8V) and the standard star α Leo were also observed. The observations of BU Tau and 18 Tau were reduced to absolute magnitudes with the help of the standard star. The absolute values of magnitudes correspond to Tug et al.'s (1977) calibration of α Lyrae. The standard deviation of the observations is ±0.03 magnitude. The mean values of absolute magnitudes of BU Tau and 18 Tau normalized to wavelength λ5500 Å are plotted in Figure 1. In Figure 1, the

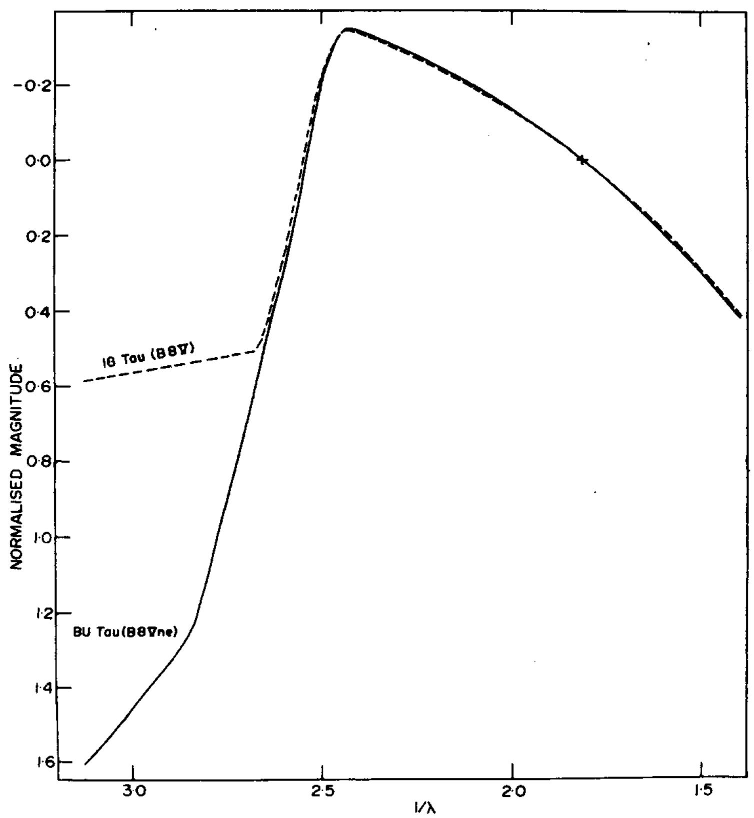

Figure 1

Relative spectrophotometry of BU Tau in comparison to 18 Tau. Spectral types and luminosity classes are indicated. The absolute magnitudes of both stars are normalized to λ5500 Å and the normalisation point is shown by a cross.

star BU Tau has been compared to 18 Tau, the latter star having the same spectral type and luminosity class as that of BU Tau. It is clear from Figure 1 that BU Tau has anomalously large Balmer jump relatively to a normal B star of the same spectral type and luminosity class. The Paschen continuum of BU Tau matches with that of 18 Tau.

In Figure 2, we have compared our present spectrophotometric observations of BU Tau with observations obtained by Van Leeuwen et al. (1982) in the Walraven VBLUW system. The dashed curve represents the differences in magnitudes between Pleione and 18 Tau (B8V) obtained spectrophotometrically by us during December 1980 and the solid curves represent the differences in magnitudes

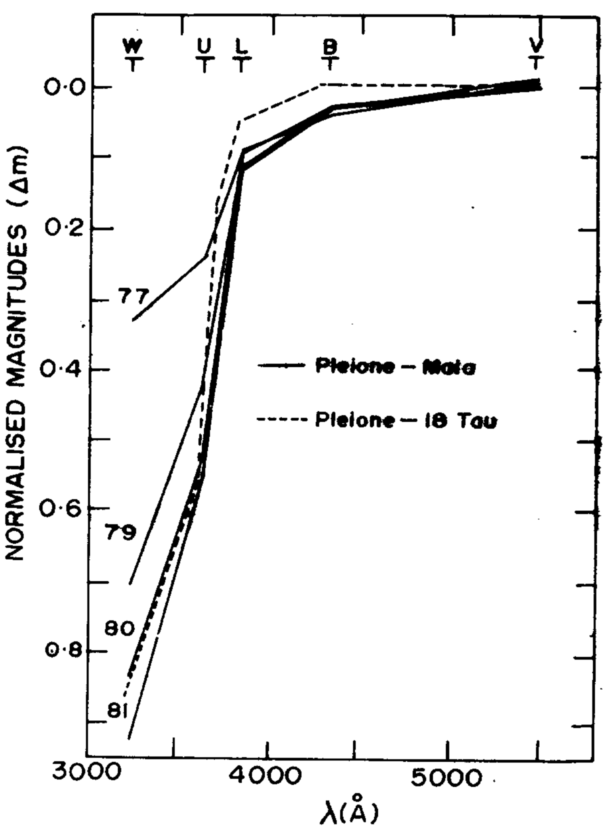

Figure 2
Comparison between the present spectrophotometric observations (dashed curve) and observations in Walraven VBLUW system (solid curves) made by Van Leeuwen et al. (1982). All curves are normalized to λ5500 Å .

between Pleione and Maia (B8IV) obtained with Walraven VBLUW system by Van Leeuwen et al. (1982) during 1977 - 1981.

It is clear from Figure 2 that our spectrophotometric observations of Pleione match with those obtained in the Walraven system in the wavelength range λλ3200-3700 Å during the same observational period in 1980. Our spectrophotometric observations, however, show excess flux in the wavelength range λλ3800-5000 Å. It is obvious from Figure 2 that the ultraviolet blocking by the hydrogen shell clearly increased during 1980-1981 but the increase goes less rapidly than in the years 1977-1979. The blocking is prominent in the Balmer continuum and does not influence the Paschen continuum.

From the above mentioned observations, we conclude that the Pleione shell episode which started in 1973, still goes on.

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P.S. GORAYA

Uttar Pradesh State Observatory
Manora Peak, Naini Tal - 263 129
India

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BD+37°443: A NON-VARIABLE STAR

The variability of BD+37°443, announced by Lolli et al. (1983) was investigated, using the 35 cm telescope of the AAB observatory at Tizzano near Bologna.

Eight Tri-X prof. plates were exposed through a GG 455 filter, for 15^{m} in the period since November 28, 1983 to January 5, 1984. No variations were detected within the experimental errors. After a discussion with C. Bartolini we arrived at the conclusion that the first 4 differences of magnitudes, obtained in 1977, published by Lolli et al. (1983) refer not to BD+37°443 but to a red star located 1$'$.5 to East of BD+37°442 (see the map published by Rebeirot, 1982).

ANDREA CIMATTI
MARCO LOLLI
GIAMPIERO MENGOLI
Associazione Astrofili Bolognesi

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ON THE PERIOD OF AG PEGASI

In the last time two periods of the well known symbiotic star AG Pegasi were published, which are very different. Meinunger (1983) found a period of 827^d from estimations of a large number of plates of the Sonneberg sky patrol and from photoelectric measurements. This period is also well suitable for reducing radial velocity data of the M-component of the star from JD≈243 3000 to 244 2000. Slovak (1982), however, determined the period of $733^d \pm 30^d$ from visual observations of the AAVSO from JD ≈ 244 2000 to 244 4800 (1974 to 1982).

To clarify this difference I examined further observations: visual estimations of the AFOEV from JD ≈ 244 1000 until now and photoelectric measurements made by the author with the Sonneberg 60 cm mirror II.

In addition to the minima of Meinunger two new minima were found:

JD	epoch E_1	$O-C_1$
244 4650	20	-140^d
5400	21	-217

The calculation of $O-C_1$ was carried out with the elements of Meinunger,

$$(1) \quad \text{Min.} = 242\ 8250 + 827^d \cdot E_1 .$$

From E_1 = 17, JD = 244 2360, a systematic negative increase of $O-C_1$ is visible:

JD	E_1	$O-C_1$	E_2	$O-C_2$
244 2360	17	$+51^d$	0	-10^d
3150	18	+ 14	1	+20
3920	19	- 43	2	+30
4650	20	-140	3	0
5400	21	-217	4	-10

An improved representation of these minima is achieved by the following new elements:

$$(2) \quad \text{Min.} = 244\ 2370 + 760^d \cdot E_2.$$

The other minima from $E_1 = 0$ to $E_1 = 16$ are well determined with equ. (1). We suspect a period change near JD $\approx$ 244 3000. Therefore the origin of the light variation cannot be explained simply by orbital motion, but should be caused by a more complex mechanism. Further observations are necessary, especially measurements of radial velocities, which should be examined with the new elements.

R. LUTHARDT

Sternwarte Sonneberg
Zentralinstitut für
Astrophysik der
Akademie der Wissen-
schaften der DDR
64 Sonneberg, DDR

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AN UV ACTIVE PHENOMENON OF EPSILON AURIGAE

We have continuously observed Epsilon Aurigae by three colour (U,B and V) photometry with a 20 cm reflecting telescope at Fukushima University. The results obtained at the ingress phase have already been reported in I.B.V.S. No. 2371 and "Epsilon Aurigae Campaign Newsletter", No. 9.

Continuing these reports we show our results in Figure 1 obtained till the

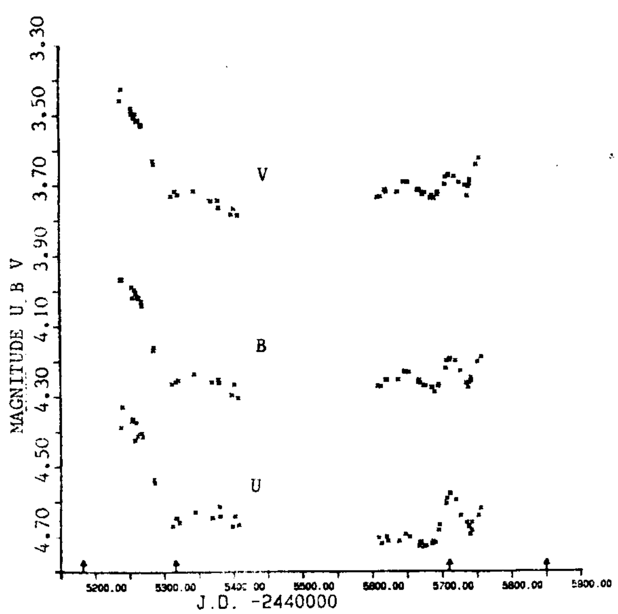

Figure 1

Light curve of ε Aur in U,B and V magnitudes. The small arrows along the abscissa represent the predicted dates of 1st, 2nd, 3rd and 4th contacts, respectively, by Gyldenkerne. Note the anomalous brightening near the 3rd contact.

period of the third contact. It is pointed out readily that the anomalous brightening occured near the end of the totality. It continued for about 40

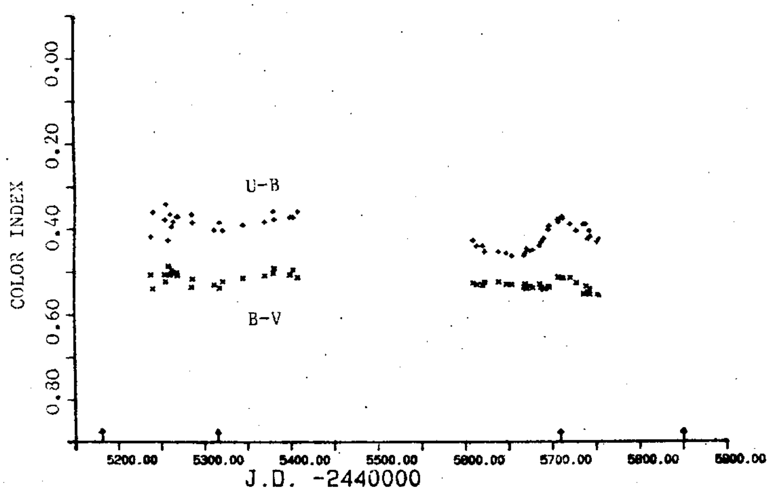

Figure 2

Colour variation at the same period as Figure 1. The colours are almost constant within the measured period except the anomalous brightening phase.

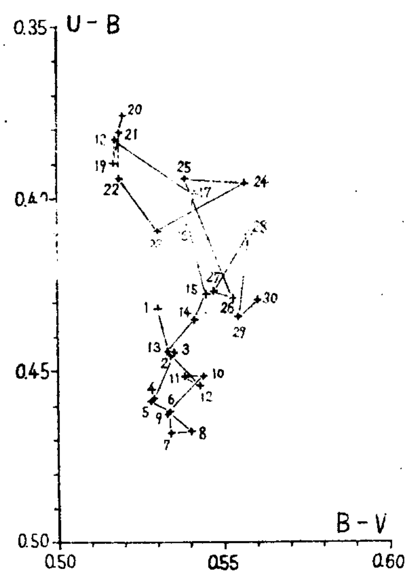

Figure 3

The two-colour diagram of the star after J.D. 2445600. The points are numbered successively and connected by thin lines.

days (J.D. 2445700 - 5740), and its peak coincides with the time of the third contact (J.D. 2445709) predicted by Gyldenkerne (1970). Although the brightening appeared in all colours, it was conspicuous in ultraviolet region. As already known the colour variation of the star is small, but during the period of this brightening it varies appreciably, especially in U-B. The colour change is illustrated in Figure 2. The two-colour diagram around this variation is shown in Figure 3.

The meaning of this phenomenon cannot be clarified from the photometric data only, so the spectroscopic observations around its epoch are highly desirable.

TOSIO OKI, IKUO SEKIYA and KATSUNORI HIRAYAMA

Department of Earth Science
Fukushima University
2, Sugumichi Asakawa, Matsukawa-Machi
Fukushima, Japan 960-12

Reference:

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NEW LIGHT ELEMENTS AND TIMES OF MINIMUM FOR AO CAMELOPARDALIS

AO Camelopardalis (BD+52°0826) is a W-Ursae Majoris type system which was discovered by Hoffmeister (1966). Milone et al., (1982) conducted a brief period study which was the first detailed work done on this system. They obtained four times of minimum and a set of light elements.

This star was observed on four nights during the winter of 1984 using the 42-cm reflector of the Morgan-Monroe Station of the Goethe Link Observatory. The photometer employs a 1P21 photomultiplier tube cooled with dry ice, and Johnson B and V filters. Differential measurements were made using BD+52°0835 as a comparison star and BD+52°0822 as a check against any variability in the comparison star.

The Hertzsprung method was used to determine times of minimum light from the observations in each filter. These results were averaged and are presented in Table I.

TABLE I

HJD	Min.	(O-C)
2445732.6076	II	-0.0002
2445738.5463	II	0.0000
2445745.6402	I	0.0006
2445752.5676	I	-0.0004

The residuals presented here were formed from a new set of light elements which were derived from a linear least squares fit to these observations. The new elements indicate a possible period change from the period determined by Milone, and are:

$$\text{Min.I} = \underset{\pm 2}{2445745.6396} + \underset{\pm 7}{0.^{d}329921}\,E.$$

Complete light curves were obtained in both colors and the curves of normal points are shown in Figure 1.

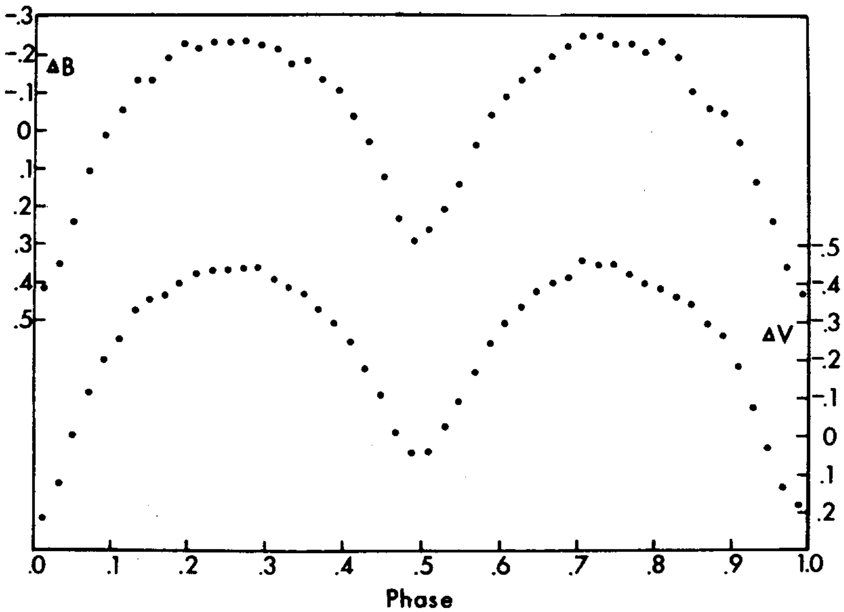

Figure 1

A complete analysis of this system, including a period study and the application of the Wilson-Devinney method of solution to this system will be published elsewhere. The authors would like to express their appreciation to Mr. Danny R. Faulkner and Dr. Stuart L. Mufson for their assistance on this project.

ERNEST E. EVANS III
DANIEL H. GROSSOEHME
EDWARD J. MOYER Jr.
Astronomy Department
Swain Hall West 319
Indiana University
Bloomington, IN 47405 U.S.A.

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SIX NEW VARIABLE STARS

During the period January 1983 to February 1984, photoelectric photometry of selected photographic and visual zenith tube stars was carried out (Guetter and Hewitt 1984). The data were obtained with a single beam photometer attached to the 1-meter reflector at the U.S. Naval Observatory, Flagstaff Station. The photometer employed a cooled EMI 9658R photomultiplier and a combination of filters designed to match the standard UBV system.

The average standard deviation for a single V observation for the program stars was found to be $\pm 0^m.009$. The criterion was adopted that stars with dispersions in visual magnitude greater than or equal to $\pm 0^m.025$ were variables. Seventeen such objects were found, of which eleven are known or suspected variables. The other six stars were not previously known to be varying. Their mean colours indicate that they are K-M giants and it is there-

HD 10388 = BD+38°326 $01^h\ 39^m.2$ +39° 10' (1950)

244 5633.836	7.73	1.65	2.00
244 5653.783	7.64	1.66	1.98
244 5658.699	7.65	1.67	1.99
244 5673.696	7.66	1.67	2.00
244 5674.637	7.67	1.63	1.98
244 5684.669	7.72	1.66	2.01

HD 83787 = BD+31°2026 $09^h\ 38^m.6$ +31° 30' (1950)

244 5402.793	5.98	1.56	1.77
244 5442.682	5.90	1.57	1.76
244 5463.705	5.88	1.57	1.76
244 5464.693	5.89	1.58	1.78
244 5465.680	5.84	1.56	1.77
244 5466.656	5.88	1.57	1.76

HD 84914 = BD+37°2022 $09^h\ 46^m.5$ +36° 59' (1950)

244 5402.808	6.63	1.58	1.95
244 5403.785	6.64	1.58	1.96
244 5465.693	6.56	1.56	1.94
244 5473.664	6.59	1.57	1.92
244 5484.666	6.65	1.58	1.92
244 5485.659	6.61	1.56	1.91

HD 110678 = BD+61°1312 $12^h\ 40^m.9$ +61° 26' (1950)

244 5464.752	6.40	1.27	1.41
244 5465.761	6.37	1.26	1.40
244 5484.708	6.44	1.27	1.40
244 5485.683	6.38	1.28	1.37
244 5506.663	6.39	1.26	1.39
244 5513.667	6.39	1.26	1.39

HD 121297 = BD+53°1667 $13^h\ 51^m.5$ +52° 34' (1950)

244 5402.975	6.78	1.53	1.52
244 5463.807	6.69	1.54	1.58
244 5464.801	6.70	1.55	1.57
244 5484.746	6.87	1.52	1.48
244 5485.706	6.86	1.51	1.48
244 5506.671	6.77	1.53	1.53

HD 184827 = BD+33°3507 $19^h\ 33^m.1$ +33° 41' (1950)

244 5633.611	6.73	1.60	1.84
244 5634.601	6.71	1.59	1.84
244 5653.593	6.69	1.61	1.84
244 5655.568	6.66	1.61	1.85
244 5658.570	6.66	1.60	1.86
244 5674.556	6.66	1.61	1.83

fore concluded that they are irregular variables. In the table the individual measures are presented. Tabulated are the HD and BD numbers, the 1950 coordinates, the heliocentric Julian date of the observation, and the V, (B-V), and (U-B) magnitude and colours, respectively.

H.H. GUETTER and A.V. HEWITT

U.S. Naval Observatory
Flagstaff Station,
P.O. Box 1149,
Flagstaff, AZ 86002,
U.S.A.

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UBV OBSERVATIONS FOR ELEVEN KNOWN VARIABLE STARS

Twelve known variables and six suspected variable stars were included in a photoelectric UBV survey of 317 selected photographic and visual zenith tube stars (Guetter and Hewitt 1984). The observations were obtained with a single beam photometer attached to the 1-meter Ritchey-Chretien reflector at the U.S. Naval Observatory, Flagstaff Station. A cooled EMI 9658R photomultiplier was employed with a filter set selected to transform the measures to the standard UBV system.

HD 7351 = BD+27°196 = NSV 444 — $01^h\ 11^m.3$ +28° 16'

244 5633.801	6.36	1.66	1.95
244 5653.731	6.46	1.70	1.94
244 5655.720	6.40	1.66	1.92
244 5658.665	6.40	1.67	1.91
244 5673.668	6.42	1.66	1.92
244 5674.624	6.40	1.67	1.91

HD 21242 = BD+28°532 = UX Ari — $03^h\ 23^m.5$ +28° 33'

244 5633.882	6.44	0.90	0.44
244 5658.810	6.52	0.89	0.42
244 5674.712	6.41	0.92	0.45
244 5681.765	6.54	0.89	0.37
244 5684.756	6.50	0.90	0.42
244 5687.736	6.44	0.92	0.44

HD 34269 = BD+42°1239 = PU Aur — $05^h\ 14^m.7$ +42° 44'

244 5633.967	5.62	1.57	1.67
244 5647.943	5.60	1.57	1.66
244 5653.931	5.78	1.56	1.61
244 5674.767	5.57	1.60	1.68
244 5684.775	5.56	1.59	1.69
244 5687.790	5.55	1.62	1.69

HD 77443 = BD+39°2193 = UX Lyn $09^h\ 00^m.6$ $+38^\circ\ 57'$

244 5402.741	6.62	1.53	1.43
244 5410.601	6.59	1.53	1.45
244 5424.750	6.82	1.52	1.35
244 5464.671	6.76	1.53	1.38
244 5465.659	6.72	1.52	1.37
244 5466.653	6.74	1.52	1.37

HD 116581 = BD+37°2404 = NSV 6220 $13^h\ 21^m.6$ $+37^\circ\ 18'$

244 5402.945	6.11	1.64	1.94
244 5463.780	6.16	1.63	1.94
244 5464.771	6.18	1.63	1.96
244 5473.756	6.13	1.64	1.94
244 5484.737	6.16	1.65	1.94
244 5485.693	6.13	1.64	1.95

HD 139216 = BD+15°2890 = TAU[4] Ser $15^h\ 34^m.2$ $+15^\circ\ 16'$

244 5403.037	6.35	1.53	1.09
244 5466.880	6.44	1.52	1.08
244 5484.837	6.58	1.56	1.08
244 5485.812	6.58	1.55	1.08
244 5506.744	6.41	1.56	1.12
244 5513.686	6.34	1.55	1.15

HD 147232 = BD+60°1665 = AT Dra $16^h\ 16^m.4$ $+59^\circ\ 53'$

244 5464.898	5.51	1.59	1.73
244 5485.841	5.34	1.60	1.75
244 5506.766	5.49	1.58	1.72
244 5513.711	5.45	1.58	1.71
244 5609.631	5.56	1.57	1.67
244 5610.597	5.57	1.57	1.68

HD 154356 = BD+35°2911 = NSV 8159 $17^h\ 01^m.7$ $+35^\circ\ 29'$

244 5463.929	6.30	1.55	1.68
244 5464.929	6.32	1.55	1.66
244 5506.810	6.20	1.57	1.74
244 5514.721	6.34	1.55	1.70
244 5610.600	6.14	1.55	1.68
244 5622.594	6.27	1.53	1.59

HD 172380 = BD+39°3476 = XY Lyr $18^h\ 36^m.5$ $+39^\circ\ 37'$

244 5466.964	6.03	1.64	1.52
244 5506.864	5.88	1.62	1.51
244 5513.787	5.89	1.62	1.49
244 5610.608	6.13	1.66	1.48
244 5633.604	6.22	1.67	1.49
244 5634.586	6.21	1.66	1.48

HD 201078 = BD+30°4318 = DT Cyg $21^h\ 04\overset{m}{.}4\ +30°\ 59'$

244 5633.640	5.66	0.48	0.30
244 5634.643	5.82	0.56	0.34
244 5647.660	5.93	0.60	0.36
244 5653.607	5.64	0.48	0.30
244 5654.575	5.81	0.58	0.37
244 5655.577	5.84	0.56	0.34

HD 219815 = BD+40°5043 = AN And $23^h\ 16\overset{m}{.}0\ +41°\ 30'$

244 5633.687	6.04	0.22	0.18
244 5647.689	5.98	0.22	0.18
244 5655.643	5.97	0.21	0.18
244 5658.619	5.96	0.20	0.18
244 5673.649	5.98	0.22	0.17
244 5674.615	5.95	0.22	0.17

The average standard deviation of a single V measure for the program stars was $\pm 0\overset{m}{.}009$. However, the average dispersions in visual magnitude for eleven variables out of the eighteen were $\pm 0\overset{m}{.}025$ or greater. The individual observations for these eleven objects are presented in the accompanying table. Included are the HD and BD numbers, the variable proper name and the 1950 coordinates, followed by the heliocentric Julian date of the observation, the V magnitude, and the (B-V) and (U-B) colors, respectively.

H.H. GUETTER and A.V. HEWITT,
U.S. Naval Observatory,
Flagstaff Station,
P.O. Box 1149,
Flagstaff, AZ 86002,
U.S.A.

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PHOTOELECTRIC OBSERVATIONS OF CY AQUARII

The SX Phe-type star CY Aqr ($V_{max} = 10^{m}.4$) has attracted considerable attention in the past because of its very short period. We obtained some 543 observations during October/November, 1983 in the V- and B-band (standard Corning filters) using a single channel photometer attached to the 60 cm RC telescope of the L.Figl-Observatory (University of Vienna). The comparison star was a star denoted "a" by Zissell (1968). This star is about 11' to the north-east of CY Aqr and similar in color; therefore no correction for differential extinction was necessary. Zissell found the intensity of this star to be constant. Because of the short period only either B- or V-filter was used for a single run. No transformation to the UBV system was made. The cycle repetition time of the observations was 2 minutes, combining 15 second integrations for sky, CY Aqr and comparison star; time accuracy of the measurements was kept below 1 second.

We were able to derive 12 times of maximum covering 41 days (671 cycles). Table I shows the time of the light maximum. No dependence of time of maximum on colors could be detected. O - C values are calculated with respect to three different ephemerides; $O-C_1$ refers to the ephemeris derived only from our own observations using a linear least square solution:

$$\text{Max.hel.} = 2445641^{d}.2942 + 0^{d}.06103822 \cdot E$$
$$\pm 0.00009 \pm 0.00000044$$

$O-C_2$ uses the ephemeris given by Mahdy and Szeidl (1980) for observations after 1952; $O-C_3$ are based on new light elements using a quadratic term given by Rolland et al. (1984):

$$\text{Max.hel.} = \text{JH } 2440892^{d}.6370 + 0^{d}.061038318 \cdot E - 4.58 \cdot 10^{-13} \cdot E^{2} .$$

Although sometimes variations in amplitude and shape of the light curve have been reported in the past, we could not find any significant change within the observing period. The mean

Table I

JD hel 2445000 +	O - C_1	O - C_2	E_2	O - C_3	Color
621.3351	+ 0^d.0004	- 0^d.0011	185341	+ 0^d.0013	V
629.3301	- 0.0006	- 0.0021	185472	+ 0.0003	V
631.2843	+ 0.0004	- 0.0002	185504	+ 0.0013	V
631.3453	+ 0.0003	- 0.0011	185505	+ 0.0012	V
635.3122	- 0.0002	- 0.0017	185570	+ 0.0007	B
635.3732	- 0.0003	- 0.0028	185571	+ 0.0006	B
641.2940	- 0.0002	- 0.0017	185668	+ 0.0007	B
641.3550	- 0.0002	- 0.0017	185669	+ 0.0007	B
645.2621	+ 0.0004	- 0.0009	185733	+ 0.0013	B
645.3225	- 0.0002	- 0.0017	185734	+ 0.0007	B
661.2532	- 0.0005	- 0.0020	185995	+ 0.0004	V
662.2920	+ 0.0007	- 0.0009	186012	+ 0.0016	V

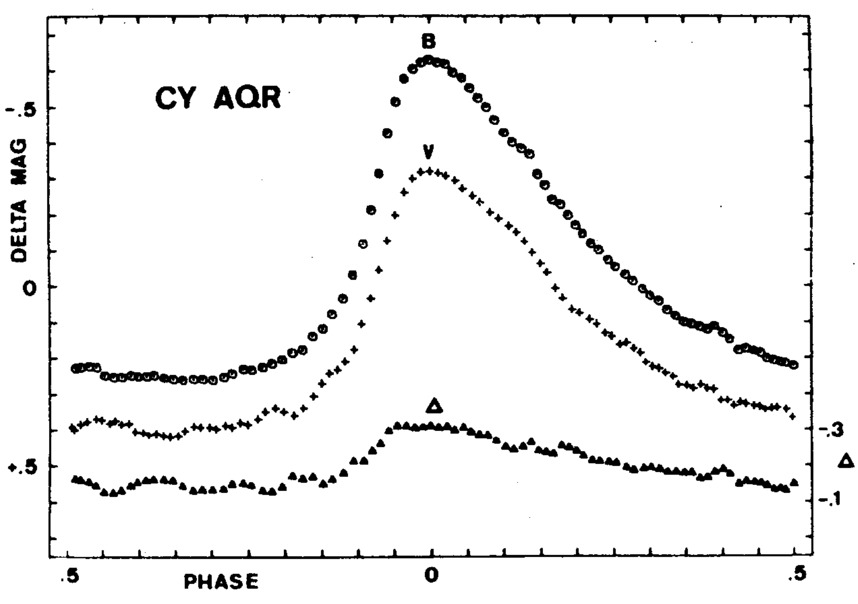

Figure 1

amplitudes in blue and visual light are $0\overset{m}{.}87$ and $0\overset{m}{.}73$ respectively. Figure 1 shows the mean light curves in blue and visual light and also for their differences (Δ).

A. PURGATHOFER †

A. SCHNELL

Institute for Astronomy
University of Vienna
Türkenschanzstraße 17
A-1180 Vienna,Austria

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