COMMISSION 27 OF THE I.A.U.

INFORMATION BULLETIN ON VARIABLE STARS

Nos. 2301 - 2400

1983 March - 1983 September

EDITOR: B. SZEIDL, KONKOLY OBSERVATORY

1525 BUDAPEST, Box 67, HUNGARY

HU ISSN 0374-0676

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20 September 1983

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2301

Konkoly Observatory
Budapest
25 March 1983

HU ISSN 0374-0676

INFRARED MIRA VARIABLES[+]

Infrared sky surveys at 2.2, 4 and 10 μm discovered many optically invisible objects which turned out to be late-type stars surrounded by optically thick circumstellar dust shells. Some of them, as well as some of the optically known Mira variables show intense OH maser emission at 1612 MHz. The emission shows a characteristic profile with two peaks separated by 10 to 60 km/s. Subsequent radio surveys of OH maser emission discovered several hundreds of such double-peaked sources. Many of them were found to be associated with extreme infrared objects (OH/IR stars). Often the infrared and radio emission vary with large amplitudes as in Mira variables. Periods were found between 500 and 1800 days. One example is given in Figure 1.

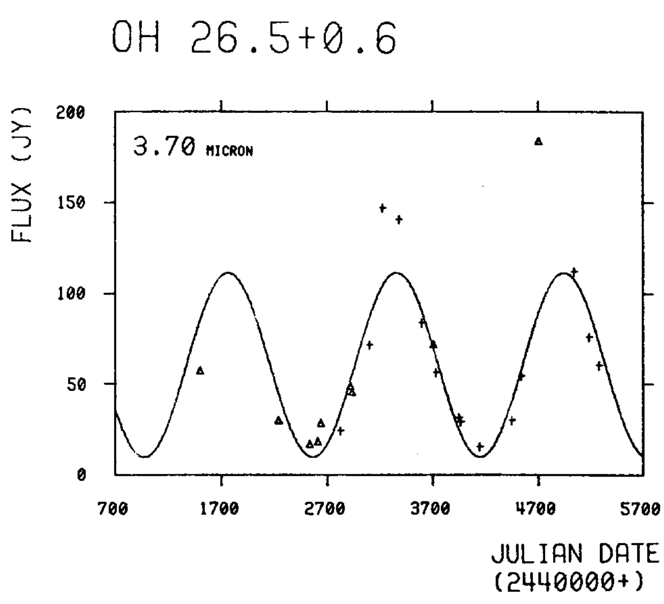

Figure 1

[+]Based on observations made at the European Southern Observatory (ESO)

Table I

Name	Coordinates (1950) α	δ	Period days	Epoch (2440000+)	L	J - L	H - L	K - L	L - M
19.2 - 1.0	$18^h26^m40^s.0$	$-12^\circ39'43''$	610 ± 10	3268	$6^m.00$	-	$>6^m$	$4^m.51$	$1^m.75$
20.3 - 0.1	18 25 27.3	- 11 18 18	680 ± 40	3781	4. 27	>8	5.51	3. 19	1. 21
23.7 + 1.2	18 27 24.1	- 7 39 6	700 ± 30	3438	4. 21	>8	6.09	3. 71	1. 31
26.2 - 0.6	18 38 32.9	- 6 17 55	1330 ± 50	3299	4. 24	-	>8	5. 61	1. 66
26.4 - 1.9	18 43 45.4	- 6 43 46	540 ± 20	3125	3. 55	>9	7.14	3. 93	1. 29
26.5 + 0.6[a)]	18 34 52.7	- 5 26 48	1630 ± 100	3357	1. 88	-	>10	6. 99	1. 91
28.7 - 0.6	18 43 9.4	- 4 4 5	640 ± 10	3445	2. 94	~8	5.35	2. 87	0. 93
30.1 - 0.2	18 44 32.8	- 2 39 3	970 ± 40	3605	3. 31	>8	7.02	3. 65	1. 13
30.1 - 0.7	18 46 3.7	- 2 53 48	1730 ± 200	3936	5. 91	-	-	>7	2. 61
30.7 + 0.4	18 43 17.2	- 1 50 2	1140 ± 30	3947	4. 83	-	>8	6. 60	1. 85
31.7 - 0.8	18 49 26.3	- 1 30 12	510 ± 20	3198	3. 82	5.73	3.43	1. 76	0. 55
32.0 - 0.5	18 48 51.9	- 1 7 27	1490 ± 50	5010	6. 20	-	-	>7	2. 39
32.8 - 0.3	18 49 48.3	- 0 17 52	1750 ± 130	2895	5. 58	-	-	>7	2. 68
39.7 + 1.5[b)]	18 56 4.1	6 38 50	1340 ± 50	4827	0. 86	~10	6.87	3. 61	1. 00
39.9 + 0.0	19 1 42.8	6 8 58	770 ± 20	3617	4. 84	-	>8	5. 36	1. 67
42.3 - 0.1	19 6 44.0	8 11 55	1650 ± 150	3278	7. 35	-	-	>7	2. 76
45.5 + 0.1	19 11 58.7	11 5 21	720 ± 20	3544	4. 23	>8	6.01	3. 63	1. 03

a) AFGL 2205

b) AFGL 2290

Measurements made at ESO (+) and taken from different sources in the literature (Δ) are shown for a prototype object OH 26.5+0.6 together with a sine curve of ~4.5 years period. Such OH/IR stars are thus an extension of the phenomenon of Mira variability to longer periods and also higher luminosities (Engels et al. 1983), e.g. they are infrared Mira variables.

In the two tables a complete list of those OH/IR stars is given which are found to be variable from infrared observations. Since 1976, observations have been made at the ESO-1m-telescope equipped with an InSb-photometer. The photometer has filters with passbands centered at J=1.25 μm, H=1.65 μm, K=2.2 μm, L=3.7 μm and M=4.8 μm (e.g. Engels et al. 1981).

In Table I 17 infrared Mira variables are listed for which periods could be determined. The coordinates have an error of about 10". The mean L magnitude and mean colors are also given. The amplitudes in L are between 0.9 mag (31.7 - 0.8) and 3.3 mag (32.8 - 0.3), the color variations can be as high as 1.5 mag in K-L and 0.6 mag in L-M (Engels, 1982).

In Table II 39 newly discovered OH/IR stars are listed for which variations of more than 0.3 mag have been observed. They are candidate infrared Mira variables. The corresponding OH masers are listed in Caswell and Haynes 1975, Winnberg et al. 1981 and Caswell et al. 1981. Several objects were discovered independently by various groups as noted in the reference column. When possible, published coordinates are given. The L magnitude and the colors are those measured in March, 1982 (J.D. 2445040).

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Table II

Name	Coordinates (1950) α	δ	L	J-L	H-L	K-L	L-M	Ref
285.05 + 0.07	$10^h28^m43^s.3$	- 57°33'27"	3.62	8.3	5.61	2.89	0.77	E, EN
286.50 + 0.06	10 38 0.5	- 58 17 38	2.28	5.71	3.93	2.27	0.76	EN
300.93 - 0.03	12 31 03.7	- 62 33 20	2.67	3.89	2.42	1.27	0.48	EN
305.91 - 1.91	13 15 42.6	- 64 21 51	5.45	-	-	3.43	1.10	EN
315.22 + 0.01	14 29 45.7	- 60 10 23	3.66	7.20	4.69	2.47	0.72	EN
327.1 - 0.3	15 46 54.8	- 54 20 28	7.09	-	-	-	2.90	E
327.4 - 0.6	15 50 17.3	- 54 24 34	0.98	6.57	4.22	2.25	0.69	G, J1
328.4 - 0.2	15 53 32.0	- 53 28 54	3.99	-	5.66	3.24	1.12	G, J1
328.7 - 0.2	15 55 16.2	- 53 16 34	4.35	-	6.22	3.12	0.82	G, J1
331.6 - 0.3	16 09 41.0	- 51 22 23	4.74	-	4.64	2.54	0.72	G, J1
338.5 - 0.2	16 38 19.1	- 46 26 38	4.43	-	-	4.98	1.48	J1
338.5 + 0.1	16 37 27.0	- 46 13 26	5.18	-	-	3.49	0.79	J1
339.93 + 0.37	16 41 32.5	- 44 57 50	5.31	-	6.09	3.23	0.95	EN
339.98 - 0.19	16 44 3.2	- 45 18 2	6.28	-	-	5.15	2.08	E
341.12 - 0.00	16 47 26.4	- 44 18 23	4.64	6.25	4.27	2.10	0.52	EN, J1
342.01 + 0.25	16 49 31.1	- 43 27 44	2.15	6.46	3.71	1.84	0.55	EN
343.4 + 1.3	16 49 52.4	- 41 43 28	2.72	-	6.91	3.83	1.24	E
344.83 - 1.67	17 07 21.3	- 42 25 06	4.57	6.80	4.50	2.61	0.96	EN
346.86 - 0.18	17 07 24.9	- 39 55 3	2.81	6.13	3.63	1.86	0.46	EN
347.57 + 0.11	17 08 27.5	- 39 9 20	4.11	3.94	2.43	1.29	0.31	E
349.18 + 0.20	17 12 51.6	- 37 48 47	4.37	-	-	4.37	1.27	EN, J1
349.39 - 0.01	17 14 28.5	- 37 45 57	3.93	5.83	3.50	1.78	0.51	EN
349.96 - 0.03	17 16 05.2	- 37 18 38	5.68	-	-	3.47	0.96	EN
352.61 - 0.19	17 24 14.3	- 35 13 1	3.70	-	7.25	3.57	0.94	E
353.23 - 0.24	17 26 9.5	- 34 44 42	7.31	-	-	2.63	1.15	EN
353.60 - 0.23	17 27 8.1	- 34 25 31	4.60	-	-	5.38	1.58	EN, J1
354.53 + 0.03	17 28 29.9	- 33 30 21	5.27	-	-	4.20	1.36	J1
354.88 - 0.54	17 31 44.8	- 33 31 38	3.00	-	-	7.46	2.18	J1
357.71 - 0.27	17 37 53.4	- 31 00 11	3.47	5.87	3.38	1.63	0.43	EN
357.77 - 0.15	17 37 32.3	- 30 53 18	6.21	-	4.41	2.00	~0.6	EN

Table II (cont.)

358.16	+ 0.50 [a]	17 36	1.9	- 30 12 54	1.60	7.90	4.70	2.33	0.59	
2.6	- 0.4 [b]	17 50	10.9	- 26 56 00	1.02	5.80	3.38	1.78	0.71	
11.4	- 0.0	18 07	42.7	- 19 6 28	6.15	-	-	-	1.84	E
20.4	- 0.3	18 26	48.5	- 11 17 56	6.44	-	-	~5.4	2.34	J1
21.5	+ 0.5	18 25	45.5	- 10 00 14	~8.1	-	-	-	~3.2	EB
42.6	+ 0.1	19 06	34.5	08 32 54	6.25	-	-	-	1.47	E, J2
43.8	+ 0.5	19 07	8.4	09 47 00	4.49	-	-	4.20	1.34	E
57.5	+ 1.8	19 29	31.1	22 28 50	4.65	-	-	4.18	1.46	E, J2
65.4	+ 1.3	19 49	20.6	29 05 15	3.79	~6.7	4.74	2.62	0.85	E, J2

a) AFGL 1992

b) AFGL 2019

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2302

Konkoly Observatory
Budapest
28 March 1983

HU ISSN 0374-0676

THE LIGHT CURVE OF HD 5303

Photometric data for the RS CVn system HD 5303 have been published by Collier et al. (1981), Rucinski (1983) and Coates et al. (1983). It is of interest to study any changes in the light curve over time, due for example to migration of the distortion wave. We have taken new data in 1982 October, and they are shown in the figure combined with the data of Coates et al. and of Rucinski, which cover the period 1979 October to 1981 October. All the data are plotted using a period of 2.79765 days and the epoch 2444160.52 days, which differ slightly from values published previously.

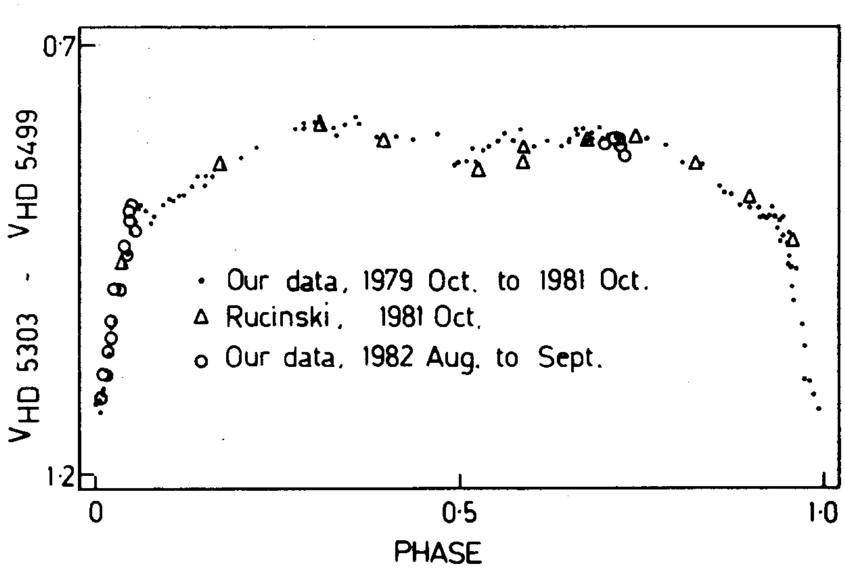

Figure 1

All the data in the figure appear to be reasonably concordant with this period and epoch, so we conclude that from 1979 October to 1982 September there has been no significant change in the light curve of HD 5303.

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Clayton, 3168, Victoria, Australia.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2303

Konkoly Observatory
Budapest
28 March 1983

HU ISSN 0374-0676

A PHOTOELECTRIC SECONDARY MINIMUM OF AR Lac

The first observations from the new Dark Sky Observatory at Appalachian State University have yielded times of minima in two colors for a secondary eclipse of AR Lacertae. The observations were made with the 46 cm telescope and photoelectric photometer equipped with standard UBV filters and an uncooled 1P21 photomultiplier tube. The instrument, in fact, is the same as used by Caton et al. (1977). The amplifier output voltage is converted to a frequency and averaged by a Commodore 4016 microcomputer.

The comparison star used was BD+47°3711, approximately three degrees away and almost identical in color to AR Lac. Effects of differential extinction were not removed, nor were the data converted to standard UBV. The reduced data were analyzed using the method of Kwee and Van Woerden (1956), using a computer program by Mallama (1982). The resulting times of minima for the two colors are:

Color	Hel. J.D.	Mean Error
visual	2444898.6828	± 0.0011
blue	.6869	± .0023

I am grateful to the University of Florida for the loan of their photometer.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2304

Konkoly Observatory
Budapest
30 March 1983
HU ISSN 0374-0676

LIGHT VARIATION OF V 1294 Aql IN THE PAST 50 YEARS

V 1294 Aql (HD 184279, BD + 3°4065, MWC 319, SAO 124788) is a known Be star with long record of spectroscopic and photometric data. Recently, Horn et al. (1982) discussed the correlation between the long-term photometric variations (derived from the photoelectric observations) of the star and the long-term spectral variations. (See also that paper for detailed bibliography of this star.)

In this report we present photometric data derived from visual estimates on 867 blue-sensitive photographic plates taken in the period 1929 to 1980. These plates are from the Sonnenberg plate collection and the brightness of V 1294 Aql was derived by one of us (R.H.).

The data were reduced and in order to limit the scatter, mean values over the intervals of 110 days were formed. They are presented together with available photoelectric measurements and the known history of the shell development in Figure 1.

The mean estimated photographic magnitudes of V 1294 Aql were analysed for possible periods. The overall trend of the brightness was removed and only the residuals were studied further. Reasonable fit was obtained for periods of about 2800 - 3000 days, but no strict long-term periodicity was found. This is also clearly seen from Figure 1.

We can also derive more information on the correlation between photometric and spectral variations. Apparently, the actual shell event (which has been lasting for more than 4000 days now) is accompanied by profound and complex light variations. It seems that the same type of correlation was observed at the end of another long-lasting shell from JD 2425000 to JD 2430000. On the other hand, the relatively short shell period around JD 2432000 passed without any remarkable light variation.

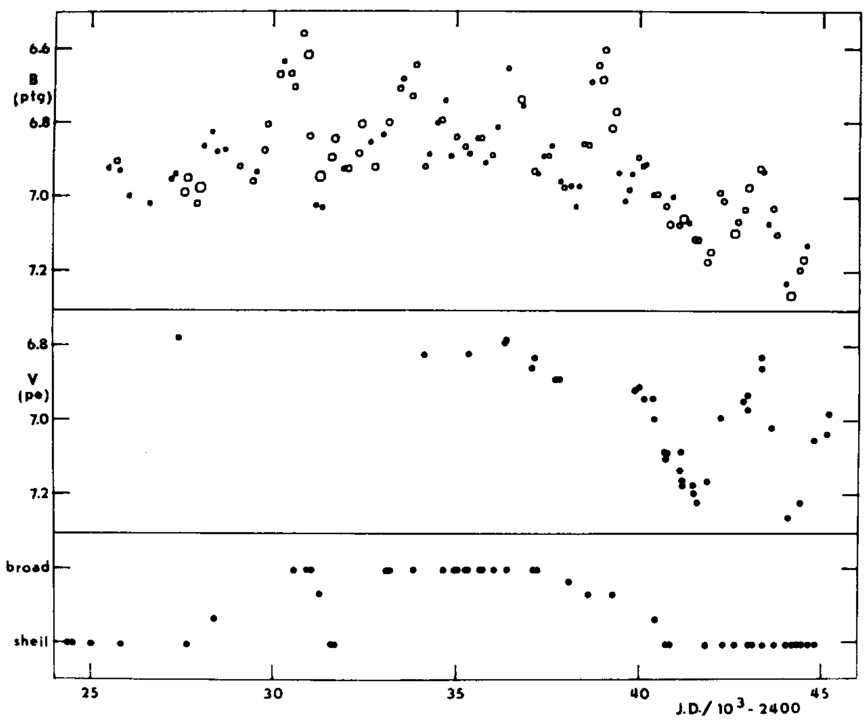

Figure 1

Long-term photometric and spectral variation of V 1294 Aql. Photographic magnitudes are in the upper panel, while the appearance and disappearance of shell lines are on the lowest panel. For comparison, V photoelectric magnitudes are presented in the middle part.

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Reference:

Horn, J., Božić, H., Harmanec, P., Koubský, P., Pavlovski, K., Ždárský F., 1982, Bull. Astron. Inst. Czechosl. 33, 308

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2305

Konkoly Observatory
Budapest
30 March 1983
HU ISSN 0374-0676

EXTREME SURFACE ACTIVITY ON THE COOL COMPONENT OF THE ECLIPSING BINARY FF AQUARII

The binary nature of FF Aqr (=BD-3°5357) was discovered by Dworetsky et al. (1977) when UBV photometry revealed a sharp occultation eclipse lasting about 13 hours in which the time of ingress/egress is only 24 minutes. No secondary eclipse was observed and an orbital period of $9^{d}.21$ was found. An analysis of the photometric and spectrographic observations showed that FF Aqr is an eclipsing binary which consists of a G8 III-IV component with strong Ca II H+K emission, and a less massive, hot subdwarf having a radius of about $0.1R_{\odot}$. In addition, Dworetsky et al. observed a relatively large light variation outside the eclipse (with a V amplitude ≈0.35 mag) which originally was tentatively attributed to the heating of the inner hemisphere of the G8 star by the subdwarf (i.e. the reflection effect). Ultraviolet observations of the system have been made inside and outside the eclipse with the IUE satellite (Dorren, Guinan and Sion 1982) and these observations indicate that the hot component is a sdOB star with $T_e \approx 35,000$K and log $g \approx 6.0$). The UV spectrum of the cool star alone (obtained during the total eclipse of the subdwarf) reveals the presence of strong chromospheric emissions such as Mg II h+k and very strong chromospheric-corona transition region emission lines such as N V, C IV, C II, etc. The level of surface activity observed on the G8 star is generally consistent with its tidally induced rapid rotation of 50-60 km s^{-1}, indicated by the rotationally broadened line profiles measured by Dworetsky et al.

Photoelectric observations of FF Aqr were made on 33 nights from 1977 July through 1978 August at Biruni Observatory, Shiraz, Iran. The data were obtained with the 51-cm reflector, using a photometer equipped with an unrefrigerated RCA 4509 photomultiplier. The v, b, and y filters of the Strömgren intermediate-band uvby system were used. The star was too faint to observe in the ultraviolet bandpass.

Typically about one hour of observations was obtained per night, except during ingress and egress when more observations were obtained. BD-3°5353 and BD-3°5362 were observed as the comparison and check stars, respectively. The effects of differential atmospheric extinction were removed from the data using mean extinction coefficients, but these corrections were insignificant because of the close angular proximity of the comparison and variable stars. The observations were combined to form nightly means, except during ingress/egress when the individual observations were not averaged.

The differential Δb magnitudes are plotted in the figure against orbital phase where the phases were computed using the ephemeris of Dworetsky et al.:

$$\text{Min I} = \text{HJD } 2442752.9577 + 9\overset{d}{.}207755E. \qquad (1)$$

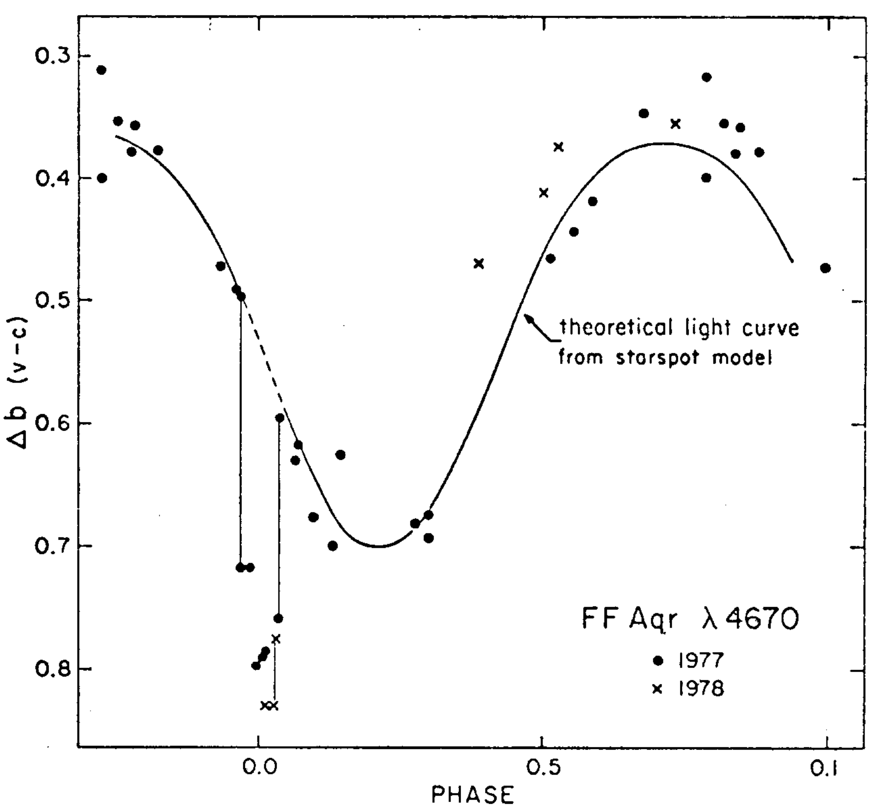

Figure 1

The Δb observations of FF Aqr obtained during 1977 and 1978. Individual observations obtained during ingress/egress are numerous and are represented by straightlines. The solid curve drawn through the data is a theoretical light curve computed with the starspot model.

As shown in the figure, the light curve is characterized by a wavelike light variation with an amplitude of about 0.33 mag, in which the minimum and maximum of the wave occur at about 0.18P and 0.7P, respectively. The primary eclipse is clearly seen at 0.0P about half way down the descending branch of the photometric wave.

The eclipse depth, wave amplitude and orbital phase of the wave maximum for the v, b, and y bandpasses are given in Table I along with the corresponding values determined by Dworetsky et al. from their 1975 UBV data.

Table I

Photometric Parameters of FF Aqr

Bandpass	λ_{eff}(Å)	Eclipse Depth	Wave Amplitude	Phase of Wave Max.
		1975 Dworetsky et al.		
V	5500	$0^m.15$	$0^m.35$	0.66
B	4400	0.4	0.33	0.55
U	3650	1.2	0.22	0.53
		1977		
y	5480	$0^m.11$	$0^m.35$	0.73
b	4670	0.22	0.33	0.72
v	4110	0.49	0.29	0.68

As shown in the table, the eclipse depths and amplitudes of the outside eclipse light variation generally are consistent between two sets of observations. The orbital phase of light maximum, however, appears to occur on the average about 0.13P later in 1977 than in 1975. In addition our 1978 observations suggest that the phase of light maximum occurs near 0.55P. Lastly, light variations as large as 0.10 mag occur from cycle-to-cycle. These cycle-to-cycle variations are particularly noticeable at the bottom of primary minimum. Dworetsky et al. also found that the light curve did not repeat closely. Similar variations are found in the v and y observations, and it appears that these brightness changes arise from the cool component.

The phasing of maximum and minimum light as well as the large amplitude of the photometric wave cannot be explained by the usual binary star interaction effects. This light variation is very similar to the quasi-sinusoidal photometric waves commonly observed for RS CVn variables, which appear to arise from an uneven distribution of subluminous regions (starspots) over the surface of the rotating star (Hall 1976). This possibility was also noted by Etzel et al. (1977).

Spectroscopically the G8 star appears similar to the active RS CVn variables, and it seems reasonable to suppose that the photometric wave observed in FF Aqr also arises from surface inhomogeneities. Following the same analytical procedure used by Dorren et al. (1981) to analyze the light curves of the RS CVn star -- V711 Tau, we find that the present light curves can be fit with the starspot model. The preliminary results of the analysis indicate that about 42% of the cool giant star's surface is covered with large subluminous regions which are about 800K cooler than the photosphere.

Thus, the cool component of FF Aqr rivals or surpasses most of the RS CVn stars in terms of surface activity. In addition, the presence of a cool giant and subdwarf in an eclipsing system provides an unusual opportunity to determine the physical properties of each star, which may play an important role in stellar evolutionary theory.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2306

Konkoly Observatory
Budapest
5 April 1983

HU ISSN 0374 - 0676

ON THE SHORT TIME SCALE PERIOD OF α Cir*

α Cir (HD 128898, Ap(SrCrEu), m_V=3.15) was observed at ESO, La Silla, with the Walraven 5-channel photometer attached to the 90 cm Dutch telescope during the night of July 23 to 24, 1982. Simultaneous measurements through V, B, L, U and W filters were obtained during about 2^h40^m of continuous observations. An integration time of 16 sec was used throughout.

The importance of such multichannel observations lies in the determination of phaseshifts between different colours which allow for the discrimination of different pulsation modes (Balona and Stobie, 1979 and subsequent papers).

Already the first crude reductions following the observations in the same night proved the presence of short time scale variations of α Cir as it was discovered by Kurtz and Cropper (1981). The object seems to have a variable pulsation amplitude which would allow establishment of constraints on i and β as well as an independent determination of the rotational period. These assumptions are based on the validity of the oblique pulsator model for pulsating Ap stars as it is proposed by Kurtz (1982).

Our observations in B, corrected for a mean extinction, are plotted in Fig. 1 and the corresponding power spectrum is presented in Fig. 2. No alias-

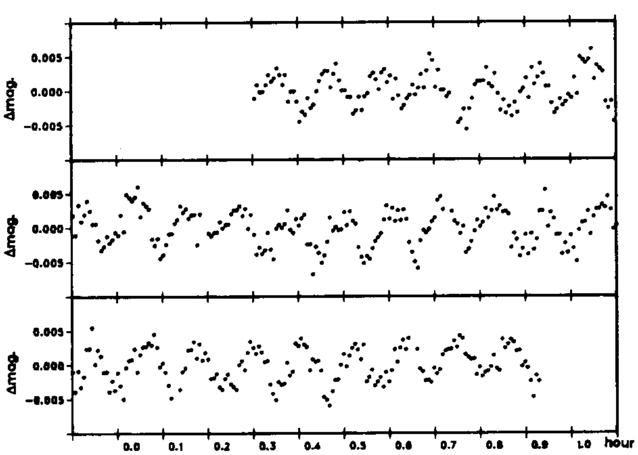

Figure 1

HD128898 23./24.07.82
23:00–26:00 U.T.
90cm Dutch telescope,
E S O La Silla,CHILE
B –filter Walravensystem,magnitudes

* Based on observations obtained at ESO, La Silla

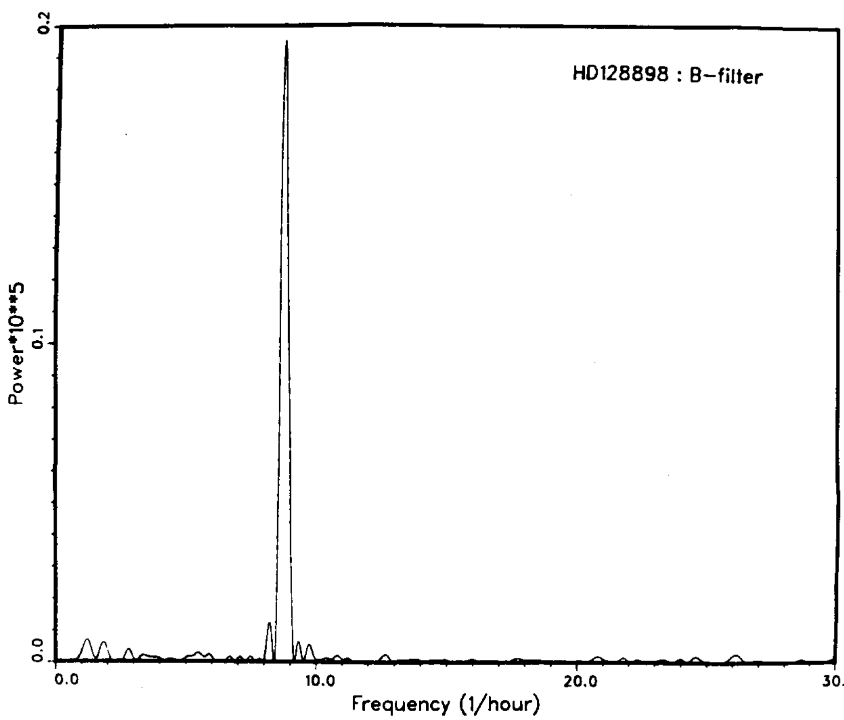

Figure 2

ing problems are evident and a pulsation frequency of

$$f = 8.78\ (hr^{-1}) \qquad [(6.834 \pm 0.01)min]$$

was determined. The amplitude of pulsation was about 0.01 mag in this night and thus considerably larger than in May 2 to 3, 1981 (Kurtz and Cropper, 1981).

A full analysis of the data is in progress and will be published later. With HD 101065 (Weiss and Kreidl, 1980) this is the second pulsating Ap star so far observed at ESO.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2307

Konkoly Observatory
Budapest
8 April 1983
HU ISSN 0374 - 0676

1980 LIGHT CURVE OF II PEGASI

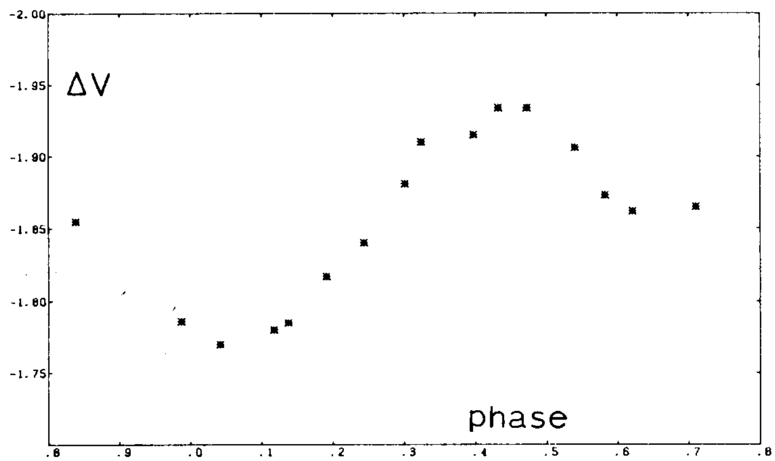
The recent note by Byrne et al. (1983) prompts us to make available our 1980 photometry of this important RS CVn binary.

We observed II Pegasi differentially on 9 nights with the 24-inch at Dyer and on 16 nights with the No. 4 16-inch at Kitt Peak. Our comparison star was BD +28°4648, which is C-2 of Byrne et al. This comparison star and the variable are almost identical in B-V color. The nightly means (of 3 individual differential magnitudes in V of the UBV system) are listed chronologically in Table I, where the first 4 and last 5 are from Dyer.

Table I

Differential V photometry of II Pegasi in 1980

JD(hel.) 2444000+	ΔV	JD(hel.) 2444000+	ΔV
458.892	-1.895	505.739	-1.934
459.865	-1.902	506.749	-1.873
474.846	-1.873	509.837	-1.770
483.763	-1.787	510.838	-1.817
496.896	-1.780	511.735	-1.910
497.746	-1.840	512.735	-1.934
498.780	-1.915	513.733	-1.862
499.739	-1.906	526.755	-1.899
500.884	-1.865	535.900	-1.840
501.747	-1.855	549.966	-1.808
502.745	-1.786	554.702	-1.833
503.756	-1.785	555.860	-1.834
504.856	-1.881		



The 16 nightly means from Kitt Peak are plotted in the Figure, where phase is computed with the ephemeris

$$JD = 2443030.24 + 6\overset{d}{.}724183\ E.$$

Because the light curve of II Peg changes shape so rapidly, the Dyer observations (obtained over a 100-day interval) defined the light curve less well and are not plotted.

We are grateful to NASA for the support provided by research grant NSG-7543.

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Reference:

Byrne, P. B. Butler, C. J., Andrews, A. D., Rodono, M., Catalano, S., Pazzani, V., Linsky, J. L., Bornman, P., and Haisch, B. M. 1983, I.B.V.S. No. 2258.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2308

Konkoly Observatory
Budapest
8 April 1983
HU ISSN 0374 - 0676

1981 LIGHT CURVE OF II PEGASI

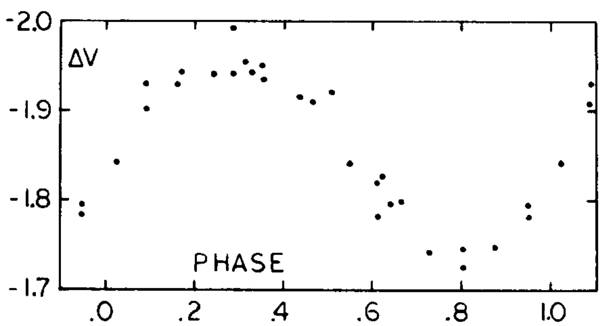
A recent note by Byrne et al. (1983) prompts us to make available our 1981 photometry of the interesting RS CVn binary II Pegasi.

We observed II Peg differentially in 1981, using BD +28^{o}4648 as our comparison star, which is C-2 of Byrne et al. This comparison star and the variable are almost identical in B-V color. Lines observed on 25 nights with his 20-inch, Louth observed on one night with his 11-inch, and Stelzer observed on one night with his 14-inch. The nightly means (of the 2-to-7 individual differential magnitudes in V of the UBV system) are listed in Table I, where the last two are by Louth and Stelzer, respectively.

Table I

Differential V photometry of II Pegasi in 1981

JD(hel.) 2444000+	ΔV	JD(hel.) 2444000+	ΔV
846.86	-1.929	897.71	-1.741
849.88	-1.782	898.71	-1.747
858.84	-1.793	899.70	-1.842
859.83	-1.902	900.69	-1.940
867.85	-1.940	901.69	-1.954
868.86	-1.915	903.68	-1.821
875.77	-1.911	908.66	-1.948
876.76	-1.820	909.67	-1.921
881.75	-1.934	910.71	-1.798
883.71	-1.794	911.67	-1.743
884.78	-1.725	928.65	-1.943
885.74	-1.783	889.75	-1.839
886.73	-1.930	921.65	-1.992
887.72	-1.939		



All 27 nightly means are plotted in the Figure, where phase is computed with the ephemeris

$$\text{JD } 2443030.24 + 6\overset{d}{.}724183 \text{ E.}$$

This light curve differs dramatically from the one just one year before. The 1980 light curve of Hall and Henry (1983) had two distinct minima whereas this 1981 light curve has only one minimum.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2309

Konkoly Observatory
Budapest
8 April 1983
HU ISSN 0374 - 0676

1981-82 LIGHT CURVE OF II PEGASI

A recent note by Byrne et al. (1983) prompts us to make available our 1981 photometry of the interesting RS CVn binary II Pegasi.

II Peg was observed differentially on 19 nights between September 1981 and August 1982 with the 48-inch Newtonian at Cloudcroft Observatory. The comparison star was BD + $28^{o}4648$, which is C-2 of Byrne et al. The nightly means (which include from 1 to 10 individual differential magnitudes in V of the UBV system) are listed in Table I.

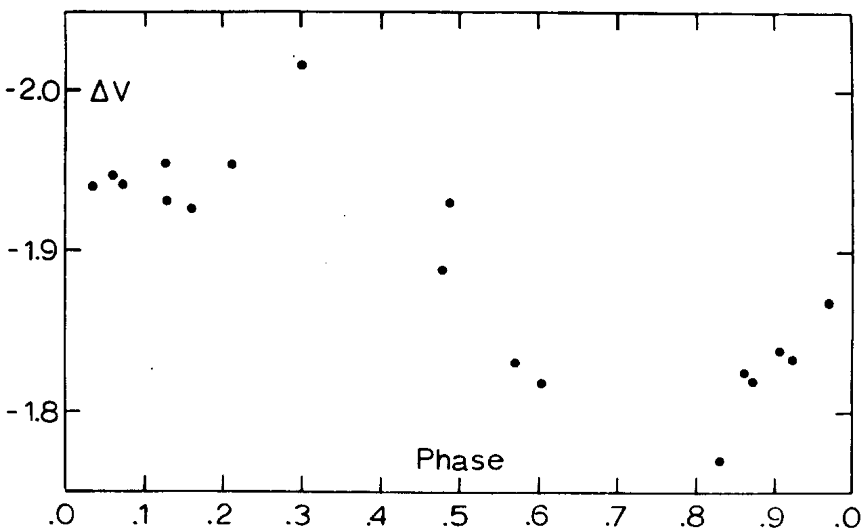
Nightly means are plotted in the Figure, where phase is computed with the ephemeris

$$JD\ 2443030.24 + 6\overset{d}{.}724183\ E.$$

Table I

Differential V photometry of II Pegasi in 1981-82

JD(hel.) 2444000+	ΔV	JD(hel.) 2445000+	ΔV
872.722	-1.803	120.929	-1.834
873.746	-1.927	121.955	-1.941
874.693	-2.016	153.935	-1.770
893.700	-1.955	158.911	-1.831
956.646	-1.931	160.939	-1.820
966.609	-1.869	167.915	-1.840
967.667	-1.932	168.925	-1.947
977.600	-1.818	187.764	-1.825
		188.930	-1.940
		191.925	-1.888
		196.854	-1.953



The first entry in Table I appeared discordant and is not plotted, although the discrepancy might be a result of the light curve's rapid variability rather than measurement error, since these observations span an interval of almost one full year.

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Byrne, P. B., Butler, C. J., Andrews, A. D., Rodono, M., Catalano, S., Pazzani, V., Linsky, J. L., Bornman, P., and Haisch, B. M. 1983, I.B.V.S. No. 2258.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2310

Konkoly Observatory
Budapest
11 April 1983
HU ISSN 0374 - 0676

PHOTOELECTRIC OBSERVATIONS OF TY Del

The eclipsing binary TY Del (BD+12°4539) was discovered by Hoffmeister (1934) who classified it as an Algol system. The best period to date has been that of Ahnert (1973), who gives $P = 1^{d}.1911204$. This variable has been extensively observed photographically and visually, but the only photoelectric observations appear to be one time of minimum light reported by Pohl and Kizilirmak (1972). Koch et al. (1979) called attention to the lack of photoelectric observations to encourage further work on this system.

For this reason TY Del was observed on five nights during the autumn of 1982 with the 40 cm telescope at the Morgan - Monroe Station of Goethe Link Observatory. Differential measurements were made with standard UBV filters along with a 1P21 photomultiplier tube cooled with dry ice. The comparison star used was BD+12°4543 while BD+12°4542 was used as a check star.

Unfortunately, only about half of the light curve was observed, giving good definition of only primary eclipse. The Hertzsprung method was used to determine three times of minimum light which are presented below. For each eclipse a time of minimum light was determined for the observations in each filter which were then averaged.

JD Hel. 2445200+	Min.	(O-C)
16.6413	I	-.0002
41.6545	I	-.0007
53.5673	I	.0008

These were combined with the minimum given by Pohl and Kizilirmak to form a new set of light elements:

$$\text{Hel. Min. I} = 2445216.6415 + 1^{d}.1911287\,E$$
$$\pm 3 \qquad\qquad \pm 2$$

The residuals given above are computed for these light elements. This new period agrees with previously published periods to the fifth decimal. It is hoped that these revised light elements will assist others in planning observations of this star.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2311

Konkoly Observatory
Budapest
12 April 1983
HU ISSN 0374 - 0676

NOUVELLE RECHERCHE DE PÉRIODES D'ÉTOILES Ap OBSERVÉES À L'ESO-VII

Deux missions d'observations photométriques à La Silla avec le télescope danois de 50 cm (système de Strömgren uvby), en septembre 1981 (17 jours) et janvier 1982 (13 jours), nous a permis de trouver les périodes de quelques étoiles Ap. Il y a eu une quinzaine de mesures pour chacune des étoiles observées en septembre 1981 et 18 ou 19 mesures pour chacune de celles qui l'ont été en janvier 1982. La recherche des périodes a été faite comme dans les cas précédents (graphiques de θ_1 et éventuellement θ_2). Les résultats sont les suivants.

Etoile	type spectral	période (j)	grandeur approx. de la variation (mag) y	b	v	u
HD 208217=GC 30695	A0pSrEuCr	8,35±0,10	0,01	0,03	0,09	0,02
HD 10840=GC 2140	B9pSi	2,100±0,007	0,04	0,03	0,02	0,12
HD 45530=GC 8380	B9pSi	1,585±0,010	0,04	0,03	0,02	0,09
HD 58292=GC 9854	A0pSi	2,95±0,03 (ou 1,484±0,010)	0,03	0,02	0,01	0,09
HD 58448=GC 9861	B8pSi	0,831±0,003	0,01	0,02	0,03	0,06
HD 64972=GC 10725	B8pSi	0,727±0,003?	0:	0,01	0,01	0,03
HD 66698=CoD-29°5439	A0pEu	4,12±0,08	0,03	0,03	0,02	0,08

Pour HD 45530=ADS 5097, l'amplitude réelle de la variation est 1,4 fois plus grande que ce que montrent les mesures et qui est indiqué ci-dessus, car la lumière du compagnon à 6" (supposé constant) tombait en même temps dans le diaphragme du photomètre. Ceci étant, les amplitudes de variation de HD 10840 et de HD 45530 en u, à savoir 0,12 et 0,13 mag, sont relativement grandes pour des étoiles Ap; celle de HD 208217 l'est en v (et surtout en c_1 : plus de 0,14 mag).

D'autre part, l'étoile HD 189832=GC 27780, pour laquelle des observations de juillet 1977, avec une base de temps trop courte (14,3j), paraissaient indiquer une période probable d'un peu plus de 15j (I.B.V.S.1391), a été réobservée en septembre 1981. La période est d'à peu près 16j. La petitesse de la variation est confirmée : environ 0,02 mag en v et pratiquement 0 pour les trois autres couleurs.

De plus, d'autres étoiles Ap qui ont été observées en septembre 1981 sont restées constantes, dans les limites d'erreur, pendant la durée de la mission. Ce sont : HD 216494= 74 Aqr (B9pHgMn), HD 224926=29 Psc (B8pMn), HD 3326=HR 151 (A6pSr) et HD 9484=HR 444 (A0pSi). Ces étoiles ont soit une variation trop faible par rapport aux erreurs (ce qui est probablement le cas des deux premières, qui sont au Mn), soit une période trop longue par rapport à la durée de la mission. L'étoile HD 315=HR 11 (B8pSi) varie peut-être légèrement (de 0,02 à 0,03 mag), mais aucune période n'a pu être trouvée à partir des 15 mesures faites. Enfin, HD 5737=α Scl (B6p He faible), aussi observée en septembre 1981, paraît avoir une variation d'environ 0,01 mag (un peu moins en y, un peu plus en u) avec une période probablement de l'ordre de 15j.

Plusieurs étoiles qui avaient été prises comme étoiles de comparaison se sont révélées en réalité être variables. Ce sont : HD 208496=HR 8369 (variation > 0,2 mag, semblable dans les quatre couleurs, P=0,73j ?), HD 215874=70 Aqr (variation d'environ 0,03 mag), HD 224639=BD-3°5741 (variation >0,1 mag, assez semblable dans les quatre couleurs, période courte, 0,215j ou 0,177j ?), HD 45431=GC 8360 (variation de l'ordre de 0,01 à 0,02 mag en y,b,v et de l'ordre de 0,03 mag en u), HD 61429=HR 2944 (variation de 0,06 mag en y,b,v et de 0,08 mag en u, P = 1,30j).

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2312

Konkoly Observatory
Budapest
15 April 1983
HU ISSN 0374 - 0676

PHOTOELECTRIC MINIMA AND PERIOD CHANGES OF CO LACERTAE

CO Lacertae (BD+56°2857) is an eclipsing system known by the short period of the apsidal motion. The variable nature of CO Lac was announced by Zonn (1933). The elements and apsidal motion period were given by Zonn (1936, 1950) and Semeniuk (1967). The spectroscopic orbital elements were determined by Smak (1967). Photoelectric observations and times of minima were published by Kreiner (1968).

During the period July 1981 - August 1982, CO Lac was observed photoelectrically with the 50 cm reflector equipped with an EMI 9789 QB photomultiplier at Cracow Astronomical Observatory. The Schott filter GG-11 (in V region) was used. The star "b" from the Wright's chart of CO Lac (Wright, 1937) was used as a comparison star. No variation was detected in the light of the comparison star.

The times of minima obtained during the period of observations are listed in Table I.

Table I

J.D. Hel. 2400000 +	Epoch	$O-C_1$	$O-C_2$	Remarks
44808.3533 ± 8	11201	$+0^d.0143$	$+0^d.0018$	primary
44821.4349 ± 9	11209.5	-0.0129	-0.0004	secondary
45171.5153 ± 3	11436.5	-0.0136	-0.0019	secondary
45181.5666 ± 5	11443	+0.0134	+0.0017	primary

The epoch, $O-C_1$ and $O-C_2$ values have been calculated from the ephemeris given by Semeniuk (1967):

$$\text{Min. Hel.} = \text{J.D. } 242\ 7534.0728 + 1^d.5422075\,E \qquad (1)$$

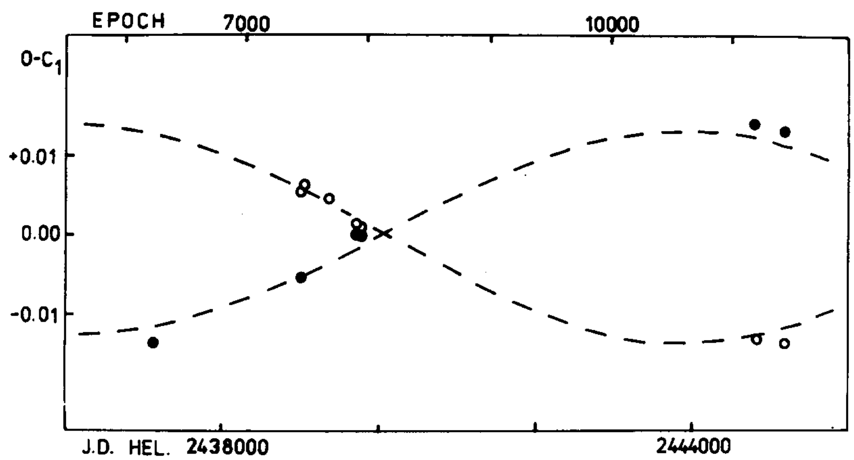

Figure 1

$$\left.\begin{aligned} \text{Min. Hel. (prim.)} &= \text{J.D. } 242\ 7534.0728 + 1^{d}.5422075\,E - \\ &\quad -0^{d}.0133\ \cos(157^{\circ}.7 + 0^{\circ}.0359\,E) \\ \text{Min. Hel. (sec.)} &= \text{J.D. } 242\ 7534.8439 + 1^{d}.5422075\,E + \\ &\quad +0^{d}.0133\ \cos(157^{\circ}.7 + 0^{\circ}.0359\,E) \end{aligned}\right\} \quad (2)$$

Fig. 1 shows the $O-C_1$ curve for all photoelectric times of minimum of CO Lac published by Semeniuk (1967) and Kreiner (1968). The times of minimum light given in that investigation are also included. The full dots denote primary minima, the open ones the secondary minima.

The inspection of Fig. 1 leads to the conclusion that the Semeniuk's elements (2) are in good agreement with recent observations.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2313

Konkoly Observatory
Budapest
18 April 1983
HU ISSN 0374 - 0676

RADIAL VELOCITY VARIATION OF THE Be STAR 6 Cep (HD 203467)

6 Cep (HD 203467, HR 8171, BD+64°1527, SAO 019313, MWC 367) is a bright B emission star. Long-term spectral variation was disclosed by Hubert-Delplace and Hubert (1979) and by Slettebak (1982). Kodaira (1971) analyzed the radial velocity measurements of this star and concluded that 6 Cep is a spectroscopic binary ($P = 1^{d}.12215$, $K = 12$ km/s). These parameters place 6 Cep at the edge of the region where the RV variation can still be interpreted as a consequence of the motion in a binary system containing B-type star.

Recently, several Be stars showing periods close or shorter than 1 day were studied and other interpretation than binarity was proposed: 28 CMa - Baade (1982); λ Eri - Bolton (1982); EM Cep - Rachkovskaya (1975), Hilditch et al. (1982); LQ And - Percy (1983), Harmanec (1983).

Our analysis of the data used by Kodaira (1971) revealed that the period $1^{d}.12215$ is not the only one to fit the RV measurements. Moreover, the least-squares solution led to lower value of K (6.3 km/s), see Fig. 1a. Clearly, the problem of the interpretation of 6 Cep can only be further resolved by collecting new spectroscopic and also photometric (only few available so far) observations.

This communication deals with a more detailed analysis of RV variation of 6 Cep. The results are based on 80 values of RV. 30 values are from the paper by Kodaira (1971). 18 values were measured on spectrograms obtained with the coudé spectrograph of the 2 m PCC telescope (Ondřejov Observatory) and 32 values were derived from the measurements on spectra taken with the coudé spectrograph of the 2 m RCC telescope (National Astronomical Observatory at Rozhen, Bulgaria).

The data are not homogeneous. Different dispersions, emulsions, methods of RV determination and sets of lines were used. Therefore, two files were formed. File A contains all 80 values, while in the file B only the reliable measurements were included. File B is represented by 19 RV measured by Kodaira (1971) on Mt. Wilson plates and by 32 RV measured on Rozhen spectra. The

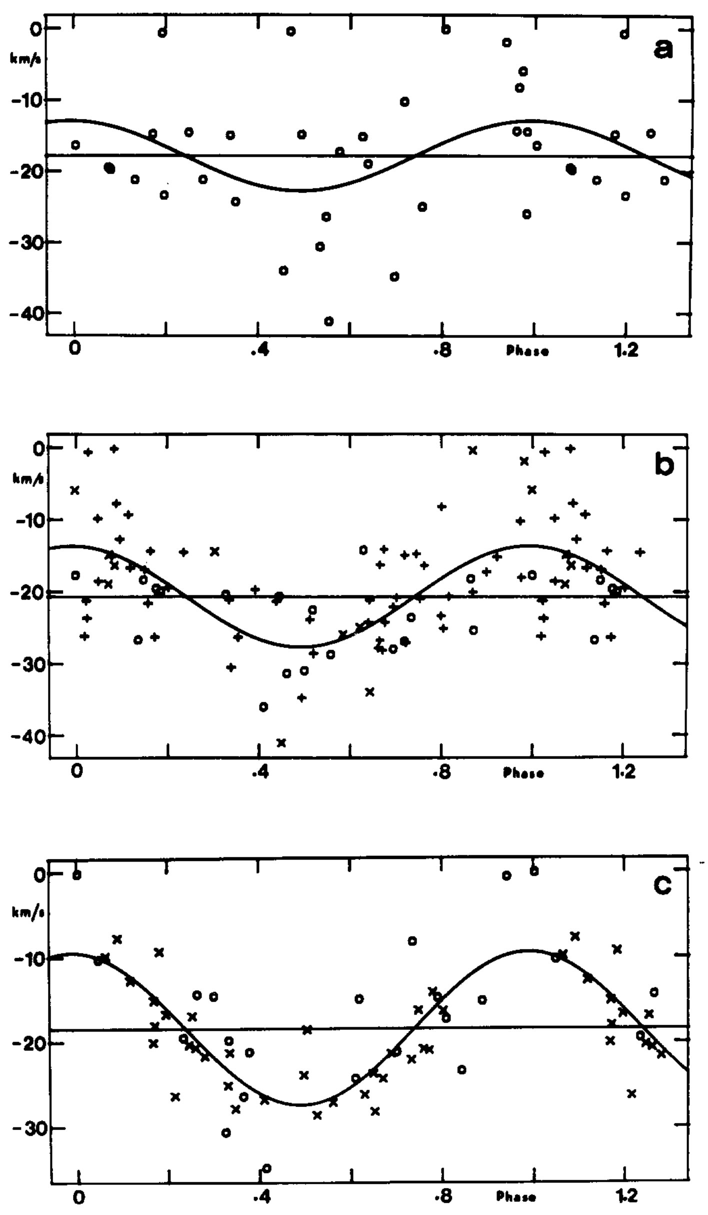

Figure 1. Radial velocity curves for 6 Cep
a) data used by Kodaira (1971), P = $1^{d}12215$, K = 6.3 km/s
b) data of file A, P = $2^{d}438942$, K = 7.0 km/s
c) data of file B, P = $0^{d}708469$, K = 9.0 km/s

second file is reasonably homogeneous. Kodaira (1971) determined the RV with the Grant machine from H lines, while the RV of the Rozhen plates were measured on tracings derived from Ondřejov five-channel microphotometer scans. Usually, the positions of 8 H lines (H8 - H15) served for RV determination.

Both files were analyzed for possible periods. The best-fit period to data of file A is $2^{d}.438942$. The least-square solution is presented in Fig.1b ($K = 7.0$ km/s, $f(m) = 0.875 \cdot 10^{-4}\ m_{\odot}$). The data of file B were better fitted by the period $0^{d}.708469$. The least-square solution is shown in Fig. 1c ($K = 9.0$ km/s, $f(m) = 0.528 \cdot 10^{-4} m_{\odot}$). Both periods are interconnected but the ambiguity cannot be solved with the available data.

The results can be used for testing the binarity of 6 Cep. Adopting the mass of the visible star (B2.5 Ve) $m_1 = 10.4\ m_{\odot}$ and inclination $i = 25^{\circ}$ ($v.\sin i =$ 150 km/s), we derive the mass of the unseen component $m_2 = 0.5\ m_{\odot}$ (file A), $m_2 = 0.4\ m_{\odot}$ (file B). The derived values of m_2 are not in conflict with the binary interpretation of 6 Cep. But one should stress that the $0^{d}.7$ period is close to the rotational period of the star. Obviously, further constraints could be placed on the model of 6 Cep if good photometric data are available.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2314

Konkoly Observatory
Budapest
19 April 1983
HU ISSN 0374 - 0676

VARIABLE F-TYPE SUPERGIANTS FAR ABOVE THE GALACTIC PLANE

Supergiant variability in general is now well established. Still, the wide class of variable B - G-type supergiants is very heterogeneous.

However, several F-type supergiants seem to be strikingly similar as regards their photometric behaviour, galactic distribution and kinematics. Most typical representatives are UU Her, 89 Her, HD 161796, BL Tel (F) and HD 112374. Obviously, similar stars fainter than 7^m are not yet known to be variable due to their small amplitudes. Various aspects were discussed separately in recent papers of van Genderen (1977, 1980) for BL Tel (F); Percy et al. (1979, 1981), Burki et al. (1980) and Fernie (1981) for 89 Her and HD 161796; Arellano Ferro (1981) for HD 112374; and Sasselov (1981) for UU Her. The set of many-sided criteria that brings them together comes from our conception that these supergiants are unique luminous objects situated far above the galactic plane; being, also, outside the Cepheid instability strip and exhibiting (probably non-radial) pulsations. The latter seem to account for the quite specific light and radial velocity variations. These variable stars occupy a compact isolated area on the P - C diagram and do not obey the semi-period - L - C relation for "normal" supergiants (see Maeder, 1980). Probably other common features are their normal Population I abundances and mild infrared excess radiation (however, little information about these features is available up to now). The latter feature is quite interesting as most Population I supergiants do not have it.

Hence, we suspect the possible existence of a group of variable F-type supergiants obeying the following criteria:

a) semi-regular light variations $\leq 0^m.6$ (usually $0^m.2$);

b) periods (two or three alternating) from about 30 to 120 days;

c) spectral type F0 - F7 ($\langle B-V \rangle_0$ from +0.10 to +0.50);

d) luminosity class Ib to Ia;

e) $|z| \geq 1$ kpc;

f) velocity is typical for Population II stars.

The five stars listed above obey strictly these criteria and about twenty other members of this group are suspected, as well. Our criteria reflect the fact that these supergiants differ unambiguously from all established types of variable stars.

The problem of how can such luminous and, probably, young objects be so away from the plane, i.e. the luminosity — high-galactic-latitude controversy, remains equally puzzling even if such non-variable stars exist. We have detected an interesting compact swarm of seven F-type supergiants around SA 28 far above the galactic plane which will be tested for light variability. These suspected new members of the group are: BSD 125 (SAO 42538), BSD 475 (SAO 42524), BSD 820 (SAO 42496), BSD 482, BSD 870 (SAO 42514), BSD 940, and BSD 1050 (SAO 42582), using data from Bartaya (1979). Two similar sets of five and seven stars are to be found nearby (around SA 27 and SA 11, respectively).

As regards 89 Her and HD 161796, Burki et al. (1980) discuss the luminosity — high-galactic-latitude controversy for them. No explanation can be favoured yet. The group of Cepheid-like variables proposed by Percy (1980) is very heterogeneous and most of its members do not obey the above criteria. Such surveys may be, however, quite valuable in discovering very long period Cepheids in our Galaxy.

A careful examination of Bartaya's catalogue (1979) down to 11^m makes us suspect that luminous F-type supergiants at high galactic latitudes are not so rare as they obviously are thought to (see, e.g. Burki et al., 1980). Their further investigation is evidently quite important.

The author is much indebted to N. Nikolov and G. Ivanov for their continuing support and encouragement.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2315

Konkoly Observatory
Budapest
19 April 1983
HU ISSN 0374 - 0676

CD $-30^{\circ}5135$

Photographic UBV magnitudes have been measured for this peculiar, variable emission-line F supergiant on plates taken by Mr. K. Olofsson with the Uppsala Southern Station Schmidt telescope at Siding Spring Observatory, Australia. The results are, with an estimated error of $\pm$ 0.1 magnitude:

Date	V	B	U
9 Nov, 1982	8.95	9.8	10.3
9 Dec, 1982	9.1	10.1	10.4
27 Dec, 1982	9.1	10.1	10.6

The unusually low value of U-B on 9 Dec. may be due to rapid variations, as suggested by Welin (1981). The time lapse from the termination of the U exposure to the beginning of the B one was about 15 minutes.

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Reference:
Welin, G. 1981, Inf. Bull. Var. Stars No. 1940

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2316

Konkoly Observatory
Budapest
20 April 1983
HU ISSN 0374 - 0676

NOVA MUSCAE 1983

Two pre-discovery photos of Nova Muscae 1983 have been received from K.M. Harrison, Director, Astrophotographic Section, Astronomical Society of Victoria (Australia). Both were taken on Ektachrome 400 film, hypersensitised in 8 % hydrogen at 25^{o} for 24 hours. They were taken during a field trip to Rochester, Northern Victoria. Details are:

No. 1. 15 January, 1983, $14^{h}20^{m}$ U.T. Exposure 15 minutes with Olympus lens 50 mm at f2.8 fitted with minus U.V. filter, and mounted on a Celestron 8. Taken by E. Gainsford.

No. 2. 15 January, 1983, $15^{h}05^{m}$ U.T. Exposure 10 minutes with Olympus 50mm lens at f2.8 mounted on a 30 cm reflector. Taken by S. Pattie.

Slides from these photos have been examined by P.M. Kilmartin and A.C. Gilmore, Mount John University Observatory, Lake Tekapo, N.Z. Comparison was made with CPD -65^{o}1708 and CPD -67^{o}1858 for which spectra, colour index and SP_V magnitudes are respectively: K5; 2.06; 7.88 and Ma; 1.77;7.59 (1). The extreme redness of the nova and the absence of stars with similar colour index made estimates of the magnitude of the nova difficult. Kilmartin and Gilmore place the magnitude as between 7.6 and 7.9 on both photos.

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Reference:

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2317

Konkoly Observatory
Budapest
20 April 1983
HU ISSN 0374-0676

PHOTOELECTRIC MINIMA TIMES OF THE ECLIPSING BINARY V 508 OPHIUCHI

Photoelectric observations of the eclipsing variable star V 508 Oph were carried out during 1981. The observations were made using the two-beam, multi-mode, nebular-stellar photometer attached to the 48-inch Cassegrain reflector at Kryonerion Astronomical Station of the National Observatory of Athens.

Reduction of the observations was made in the usual way (Hardie, 1962) and the B and V filters used are in close accordance to the standard ones.

From our observations three primary and three secondary minima times have been derived using Kwee and Van Woerden's method (1956). They are given in the following Table, the successive columns of which give: the Hel. J.D., the residuals O-C and the type of minimum. The O-C values were calculated using Kukarkin's et al. (1976) ephemeris formula:

$$\text{Min. Hel. J.D.} = 2428416.339 + 0^{d}.34479163\,E$$

Table

Hel. J.D. 2444000+	O-C days	Min. Type
783.4265	+0.0012	II
784.4623	+0.0026	II
785.3283	+0.0067	I
785.4958	+0.0018	II
786.3623	+0.0063	I
864.2816	+0.0066	I

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2318

Konkoly Observatory
Budapest
21 April 1983
HU ISSN 0374-0676

SIX VARIABLE STARS DISCOVERED IN BINARY SYSTEMS

A photoelectric program was begun in 1968 at the Flagstaff Station to obtain UBV observations of selected visual binaries. This program has led to the discovery that the A component of ADS 1693 = GZ And was a W Ursae Majoris system (Walker, 1973). Reported here are individual magnitudes and colors that indicate variability for six of those systems.

The average dispersion in V for the 302 program stars is 0.009 magnitudes, whereas the scatter for each of the six stars listed below is much greater, on the order of 0.1 magnitude in V. All these systems were suspected of having light variation prior to these observations.

Listed below are the stars with their ADS and BD numbers, or the discoverer code number, coordinates for 1900.0, the heliocentric Julian Day of the observation, the V magnitude, and the B-V and U-B colors, respectively.

ADS 11632 B = BD + 59° 1915 $18^h\ 41^m\!.8$ +59°27'

244 0104.6968	9.69	1.58	1.05
244 0113.6992	9.67	1.57	1.09
244 0147.6106	9.80	1.55	1.10

ADS 14233 ABp = BD + 11°4368 $20^h 40^m\!.2$ +11°57'

244 0104.7309	6.69	0.16	0.09
244 0113.7305	6.79	0.19	0.09
244 0116.7130	6.69	0.19	0.08
244 0146.7617	6.72	0.18	0.05
244 0147.6803	6.70	0.18	-
244 0170.6680	6.66	0.19	0.07
244 0193.5986	6.69	0.19	0.09
244 0195.6027	6.71	0.17	0.08
244 3057.6965	6.65	0.22	0.07
244 3071.6600	6.69	0.22	-
244 3407.7024	6.70	0.20	0.09
244 3407.7274	6.70	0.20	0.08
244 3794.6495	6.73	0.19	0.09
244 4044.9291	6.71	0.18	0.08
244 4161.6278	6.73	0.18	0.07
244 4174.6100	6.67	0.17	0.07

ADS 14894 AB = BD + 2°4346 $21^h16^m.3$ +02°28'

244 0104.7552	7.40	1.07	0.97
244 0113.7375	7.50	1.07	0.97
244 0116.7297	7.38	1.08	0.96
244 0146.7679	7.42	1.07	0.96
244 0147.7088	7.39	1.07	0.96
244 0170.6810	7.36	1.05	0.98
244 0193.6052	7.44	1.07	0.98
244 0195.6099	7.46	1.07	0.99
244 2715.6237	7.42	1.09	0.92
244 2718.5790	7.41	1.09	0.99
244 2719.6025	7.42	1.05	-
244 3057.7021	7.38	1.07	0.93
244 3071.6760	7.39	1.11	-
244 3419.6662	7.40	1.07	0.94
244 3760.7474	7.40	1.04	0.88
244 3778.7048	7.42	1.08	0.97
244 3794.6669	7.38	1.11	0.99
244 3795.6446	7.41	1.08	0.94
244 4161.6431	7.39	1.11	0.96
244 4174.6253	7.42	1.09	0.95

Kui 110 AB = BD + 61°2233 $21^h57^m.6$ +62°01'

244 2696.6865	6.66	0.03	-0.81
244 2715.6349	6.71	0.07	-0.76
244 2718.6030	6.65	0.08	-0.80
244 2719.6141	6.65	0.06	-0.79
244 3057.7086	6.61	0.09	-0.81
244 3104.6129	6.68	0.04	-0.82
244 3419.7024	6.71	0.03	-0.80
244 3777.7114	6.66	0.04	-0.77
244 4161.6990	6.67	0.04	-0.84
244 4174.6704	6.67	0.05	-0.82
244 4174.6968	6.66	0.04	-0.82

ADS 15679 A = BD + 44°4059 $22^h05^m.2$ +44°21'

244 2696.6923	6.75	-0.03	-0.27
244 2715.6403	6.77	-0.01	-0.29
244 2718.6082	6.74	-0.02	-0.28
244 2719.6227	6.71	-0.04	-0.28
244 3057.7132	6.70	+0.03	-0.27
244 3104.6176	6.81	-0.05	-0.27
244 3419.7070	6.77	-0.03	-0.29
244 3777.7182	6.78	-0.03	-0.24
244 4161.6998	6.79	-0.06	-0.30
244 4174.6751	6.75	-0.03	-0.26
244 4174.7022	6.74	-0.02	-0.26
244 4189.6529	6.76	-0.02	-0.26

ADS 15794 AB = BD + 43°4165 $22^h 11^m.6$ +43°24'

244 2715.6473	7.57	0.02	-0.41
244 2718.6152	7.55	0.03	-0.44
244 2719.6298	7.53	0.02	-0.43
244 3057.7196	7.48	0.06	-0.42
244 3104.6239	7.56	0.00	-0.43
244 3419.7147	7.52	0.00	-0.45
244 3777.7266	7.56	0.01	-0.40
244 4161.7478	7.54	-0.02	-0.47
244 4174.6828	7.55	0.02	-0.43
244 4174.7092	7.54	0.02	-0.42

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Reference:

Walker, R.L. 1973, I.B.V.S., No. 855.

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2319

Konkoly Observatory
Budapest
21 April 1983
HU ISSN 0374 - 0676

OBSERVATIONS OF FOUR VARIABLE STARS IN BINARY SYSTEMS

A photoelectric program was begun in 1968 at the Flagstaff Station to obtain composite UBV observations of selected visual binaries. Four binaries known to contain variables were included in the program. Reported here are individual observations of those systems. Differences between the variables and comparison stars were not obtained, rather, observations were transformed to the UBV system each night.

Listed below are the stars with their ADS and BD numbers, coordinates for 1900.0, and information on the variable. Then follow the heliocentric Julian Day of the observation, the V magnitude, and the B-V, and U-B colors, respectively.

ADS 2046 A = BD $-1^{\circ}0377$ $02^h36^m.1$ $-01^{\circ}07'$
84 Cet Delta Scuti type

244 2726.7852	5.72	0.50	-0.01
244 2786.6267	5.75	0.51	+0.01
244 3104.7800	5.72	0.49	-0.04
244 3134.6838	5.75	0.49	-0.03

ADS 8148 AB = BD $+11^{\circ}2348$ $11^h18^m.7$ $+11^{\circ}05'$
Iota Leo Delta Scuti type

244 3178.9187	3.92	0.41	0.06
244 3225.8124	3.91	0.40	0.05
244 3642.6724	3.97	0.40	0.03
244 3982.7265	3.92	0.41	0.06

ADS 11353 ABp = BD $+0^{\circ}3936$ $18^h22^m.1$ $+00^{\circ}08'$
d Ser Irregular type

244 0113.6854	5.20	0.51	0.25
244 0116.6817	5.24	0.50	0.25
244 0147.5976	5.29	0.49	0.24
244 0309.9932	5.17	0.50	0.23
244 2565.8910	5.18	0.48	0.21

ADS 16483 A = BD +27°4480 $22^h58^m.9$ +27°32'

Beta Peg Irregular type

244 0113.8493	2.50	1.66	1.87
244 0116.8084	2.47	1.68	1.91
244 0146.8024	2.48	1.71	2.01
244 0147.7905	2.44	1.71	1.92
244 0170.7032	2.47	1.69	1.99

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2320

Konkoly Observatory
Budapest
22 April 1983
HU ISSN 0374 - 0676

AAVSO DATA ON MIRA VARIABLES PUBLISHED

The American Association of Variable Star Observers (AAVSO) publishes the observations received from its observers in the form of AAVSO Reports. The AAVSO announces the publication of AAVSO REPORT 38, containing over 150,000 observations from September 9, 1974, to June 5, 1977, Julian Day 2442300 to 2443300, on 557 long period variables stars (Mira type). Data on 450 stars are published in the form of computer-generated light curves (each on a separate 8 1/2 x 11 inch page). Each data point representing one observation is plotted with Julian Date versus magnitude. Figure 1 is a sample light curve of Chi Cyg (reduced for this publication). Dates of observed

Each dot represents one observation.

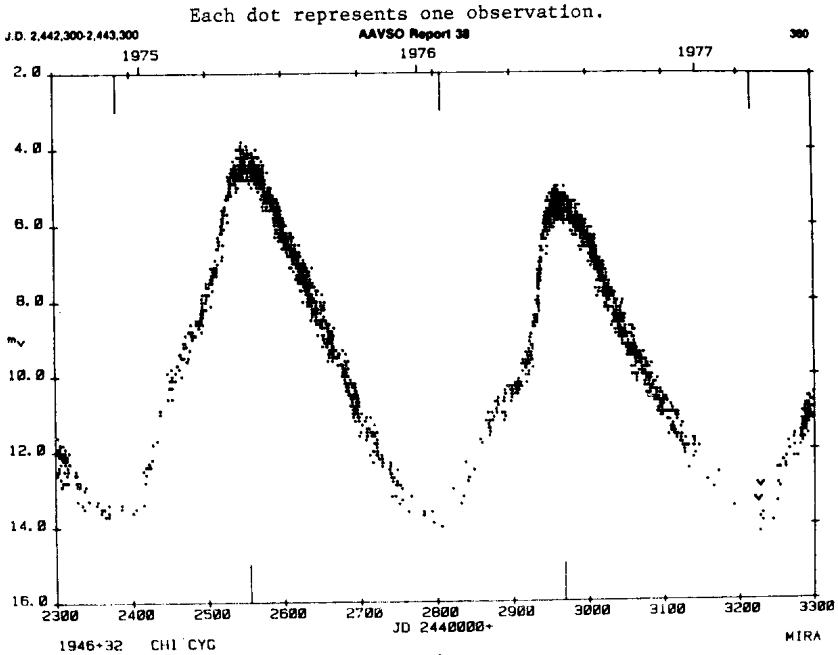

Figure 1

maxima and minima of those stars with AAVSO mean curves are indicated on the plots. These data are also tabulated. For 25 stars, listings of photoèlectric data included in the plots are given. For 107 stars, having too few data points to warrant a plotted curve, individual observations are tabulated. Information on all of the stars mentioned in AAVSO REPORT 38, and the names and observing codes of contributing observers are also tabulated. AAVSO REPORT 38 is now available from: AAVSO, 187 Concord Avenue, Cambridge, MA, USA, 02138, at a cost of $30.00, USA delivery postpaid, or $32.50 (USA funds) for delivery elsewhere postpaid.

AAVSO REPORT 39, covering other types of variable stars for the same time period, will be published in mid-1983.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2321

Konkoly Observatory
Budapest
22 April 1983
HU ISSN 0374 - 0676

EPOCHS OF MINIMUM LIGHT FOR SEVERAL ECLIPSING BINARIES

Presented here are times of minimum light for several eclipsing binaries observed with the 41 cm reflector of the Morgan-Monroe Station of the Goethe Link Observatory. All observations were made with Johnson UBV filters and a 1P21 Photomultiplier tube cooled with dry ice. For each eclipse either the Hertzsprung method or the method of bisection of chords was used, and are indicated by their abreviations in the table. The bisection of chords method was used when the observations were of poor quality and hence these times of minimum light should receive lower weight. The tabulated results

Table

Star	Hel. J.D. 2440000+	Type	Method	(O-C)
BX And	3033.8307	I	Hertz.	0.0032
	3034.7460	II	Bis.	0.0034
	3098.8043	II	Bis.	-0.0004
	3099.7228	I	Hertz.	0.0029
U Cep	5229.6853(V)	I	Hertz.	0.0011
	.6866(B)	I	Hertz.	0.0024
	.6874(U)	I	Hertz.	0.0032
	5259.6035(V)	I	Hertz.	0.0027
	.6034(B)	I	Hertz.	0.0026
	.6035(U)	I	Hertz.	0.0027
	5264.5910(V)	I	Hertz.	0.0041
	.5909(B)	I	Hertz.	0.0040
	.5909(U)	I	Hertz.	0.0040
V366 Cyg	5242.5866	I	Bis.	-0.0419
TZ Eri	5241.8592	I	Hertz.	0.0153
SW Lac	4493.7540	I	Hertz.	0.0000
RW Tau	5221.8143	I	Hertz.	-0.0008
	5257.8086	I	Hertz.	-0.0014

are the average of the three filters. The one exception to this is U Cep where the times of minimum light are known to be a function of wavelength due to circumstellar material (Crawford and Olson, 1979). The residuals were determined using light elements from the following sources: BX And (Chou, 1959), U Cep (Olson, et al., 1981), V366 Cyg (Houten, 1956), TZ Eri (Perova, 1975), SW Lac (Faulkner and Bookmyer, 1978), RW Tau (Olson, 1982).

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2322

Konkoly Observatory
Budapest
25 April 1983
HU ISSN 0374 - 0676

COORDINATED ULTRAVIOLET, OPTICAL AND RADIO OBSERVATIONS OF RS CVn AND FLARE STARS IN OCTOBER 1983 AND MARCH 1984

Time has been allocated on the International Ultraviolet Explorer (IUE) satellite to four groups based at Armagh Observatory (N. Ireland), Catania University (Italy), JILA/NBS University of Colorado (Boulder, USA) and Lockheed Research Lab. (Palo Alto, USA) by ESA and NASA to observe RS CVn and flare stars during the periods October 3-7, 1983 and March 26-30, 1984. The total time allocated is 17 eight-hour shifts, split into 10 shifts in October and 7 in March. We hope to monitor changes in the stars' UV spectra during their spot cycles and, in addition, to derive spatial resolution of atmospheric structures using eclipses. In the case of the flare stars, time-resolved spectroscopy during flares will be attempted as in previous years.

Similar programs were successfully carried out in October 1981 and February 1983. Preliminary results from the October 1981 program will be found in ADVANCES IN ULTRAVIOLET ASTRONOMY (NASA CP-2238), THIRD EUROPEAN IUE CONFERENCE (ESA SP-176) and ACTIVITY IN RED DWARF STARS (IAU Colloquium No. 71, Reidel, in press).

In the coming year we are planning to observe the three RS CVn stars AR Lac, HD 5303 (October 1983) and RS CVn (March 1984). Flare stars will be chosen from among the following list: UV Cet, Gliese 867A, EQ Peg, EV Lac (October 1983) and Proxima Cen, YZ CMi, Gliese 182 and AD Leo (March 1984). Concurrent photoelectric, spectroscopic and radio observations of these stars would add considerably to the scientific results of the IUE data.

Simultaneous ground-based observations are highly desirable for the RS CVn program, in particular during the eclipses. One of the principal aims of these observations is the detection of surface inhomogeneities in the outer atmospheres of these stars using the occulting disk of the companion to scan the surface of the active star. Obviously it is crucial that we know of any temporal variations in either the optical or radio output of the star at these times. Moreover, it is important to obtain complete UBV (or at least V) light curves for the purpose of establishing the shape and phase-shift of the migrating "photometric waves". Therefore, the photometric observations of RS CVn stars need to be carried on over a one-two month interval including the period of IUE observing.

In the case of flare stars, simultaneous ground-based observations are essential for a proper interpretation of the UV and radio data. Such observations should aim at covering the period of the IUE program as completely as possible. Specifically, we are seeking continuous monitoring of the flare stars photometrically, spectroscopically and with radio receivers. Photometric monitoring should be in the Johnson U or B-band, where signal levels permit, and with as short an integration time as possible. In addition we would ask that the program stars should be measured in the Johnson UBVR bands at least twice per night, i.e. before and after the times of continuous monitoring, in order to establish possible or known BY Draconis wave-like variability. Again, observations outside of period of IUE observing could be necessary to obtain as complete as possible light curves.

Transformation to the standard UBV system is important so that observations from different observers can be intercompared.

Spectroscopic observations should aim at obtaining time-resolved spectra in the region near Hα, Hβ, Hγ, Hδ and/or Ca II H and K emission lines to monitor continuum and line profile variability, especially during the course of flare events. The best attainable time and spectral resolution should be sought.

Radio monitoring of program stars should be preferably carried out at several wavelengths simultaneously, including a cm-wavelength, if possible.

As soon as possible, the final scheduling details, as well as suggested comparison stars and, if required, finding charts will be communicated directly to those who indicate their interest by writing or telexing the undersigned.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2323

Konkoly Observatory
Budapest
26 April 1983

HU ISSN 0374 - 0676

OBSERVATIONS OF THE RS CVn STAR HD 26337
WITH THE INTERNATIONAL ULTRAVIOLET EXPLORER SATELLITE

HD 26337 ($m_v = +7.05$; G5 IV) was recently discovered to be a single-line spectroscopic binary and a low amplitude light variable by Fekel et al. (1982). This star had been previously listed by Bidelman and MacConnell (1973) as having noticeable Ca II H+K emission. Fekel et al. confirm this result and report moderately strong Ca II H+K emission and rotationally broadened absorption features indicating a v sin i of about 40-45 km/s. A preliminary analysis of radial velocity observations obtained on 10 nights by Fekel et al. indicates an orbital period of $2\overset{d}{.}04414 \pm 0\overset{d}{.}00047$ with a velocity amplitude of about 50 km/s. Their photoelectric photometry, obtained chiefly in the V-bandpass, on 4 nights during 1979/80 and 24 nights during 1980/81 reveal the star to be a light variable having a quasisinusoidal light curve with an amplitude of about $0\overset{m}{.}16$. In addition, the photometric period, presumably marking stellar evolution, appears to be slightly shorter (by 0.3 %) than the orbital period, where the light elements given by Fekel et al. are:

$$t_{min} = \mathrm{JD}\ 2444635.65 + 2\overset{d}{.}038\,E \qquad (1)$$

The strong Ca II H+K emission, the mid-G spectral type, and the $2\overset{d}{.}04$ quasisinusoidal light variation with a period nearly synchronous with its orbital period reported for HD 26337 all are characteristics of RS CVn variables as defined by Hall (1976).

HD 26337 was observed on 4 days between 1982 December and 1983 March with the International Ultraviolet Explorer (IUE) satellite in order to obtain ultraviolet spectra in the vicinity of the chromospheric Mg II h+k features at λ 2800 . A comprehensive description of the IUE satellite and its scientific instrumentation is given by Boggess et al. (1978). During our observations of the star, the Fine Error Sensor (FES) on board the satellite was used as a photometer to measure the optical brightness of the star. Because the absolute sensitivity of the FES can vary up to $\sim 0\overset{m}{.}10$ over a day, we measured the brightness of HD 26337 with respect to the nearby comparison star 37 Eri (HD 26409). This is the same comparison star used in the ground-based photometry for which Nicolet (1978) gives $V = +5^{m}.44$ and $B-V = +0^{m}.94$. The comparison star was observed before and after the variable star with both stars placed at the same reference position of the detector. The relative brightness of each star was obtained by averaging the count rates from multiple scans of the image dissector of the FES where the precision of the relative magnitudes is about $\pm 0^{m}.01$. The counts were converted to V-magnitudes of the UBV system by using the calibration of Holm and Crabb (1979). In making differential measures, the transformation equation simplifies to:

$$\Delta V_{1-2} = -2.5 \log (C_1/C_2) - 0.24 \Delta(B-V)_{1-2} \qquad (2)$$

where C_1, C_2 are the FES count rates for stars 1 and 2, and $\Delta(B-V)_{1-2}$ is the difference in the (B-V) colors of the two stars. Fekel et al. report a mean color difference between the variable and comparison stars of $\Delta(B-V)_{V-C} = -0^{m}.27$, and we adopted that value in the reductions. The similarity of the B-V indices of the comparison and variable stars diminishes the effect of the color term of the transformation equation and increases the accuracy of the ΔV determination.

The differential V magnitudes, in the sense variable minus comparison, are plotted against the photometric phase in Fig. 1. The 1979/80 and 1980/81 ΔV measures of HD 26337, reported by Fekel et al., also are plotted in the figure. As shown, the mean brightness of the star has decreased from $\Delta V = +1.62$ during 1980/81 to $\Delta V = +1.81$ during 1982/83. Furthermore, there is an indication from the 1979/80 data that the star was brighter during that year with an estimated mean brightness of $\Delta V \sim +1^{m}.57$.

In addition to a decrease in the mean brightness of the star with time, it also appears that the amplitude of the light curve has lessened from about $0^{m}.16$ in 1980/81 to about $0^{m}.10$ in 1982/83. The phase of light minimum is not well determined by the 1982/83 observations, but from the few observations obtained, it appears to be close to that predicted using Eq. (1).

As in the case of other RS CVn variables, if the light variation of HD 26337 arises from the presence of a nonuniform longitudinal distribution of surface inhomogeneities (=starspots) on a rotating star, then the observed changes in the light curves with time imply substantial changes in the relative spot distribution as well as in the total spotted area. To a first approximation, the observed decrease in the mean light of the star implies an overall increase in the total area of starspots that are in view. The decrease in light amplitude coupled with the decrease in mean brightness indicates an increase in the spotted area along with a net movement of the spot centers toward higher latitudes (i.e. toward the rotational pole of the star that is in view). Similar light curve changes were reported by Dorren and Guinan

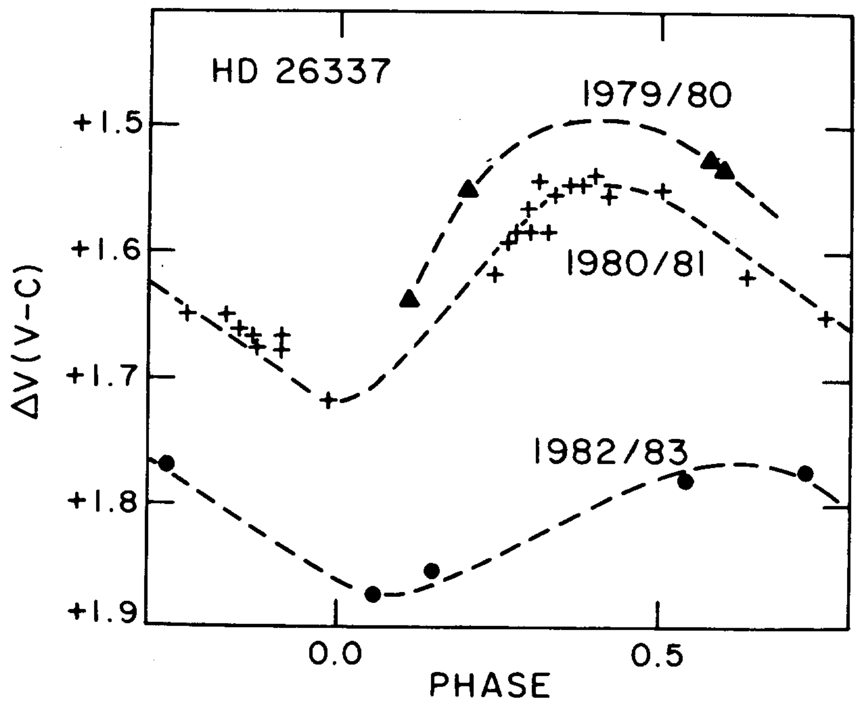

Figure 1. The differential V-magnitudes of HD 26337 (measured relative to 37 Eri) plotted against photometric phase, where the phases were computed from Eq. (1). The 1979/80 and the 1980/81 observations are from Fekel et al. The 1982/83 observations were obtained with the Fine Error Sensor (FES) on board the IUE satellite.

(1982) for the bright RS CVn variable V 711 Tau (=HR 1099) and by Guinan et al. (1982) for UX Ari.

Preliminary reductions of the ultraviolet spectra of HD 26337 reveal moderately strong and variable Mg II h+k λ2800 emission, indicative of a chromospherically active star. We plan to report on the ultraviolet observations in a subsequent paper. More photometry of HD 26337 is certainly desirable to define the nature of the long-term changes in the light curve suggested by the existing data.

We are happy to acknowledge support for this work from NASA research grant NAG5-87.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2324

Konkoly Observatory
Budapest
29 April 1983
HU ISSN 0374 - 0676

DIFFERENTIAL UBV-PHOTOMETRY OF THE CHEMICALLY PECULIAR STAR HD 135297

Babcock (1958) concluded from his 3 Zeeman plates of HD 135297 that this should have a reversing magnetic field. According to the concept of the oblique rotator this is indicative for photometric variability and therefore, I observed this star in UBV relative to the F2-type comparison star HD 135405 at the 60 cm Bochum telescope on La Silla on 12 nights from May 6 to June 16, 1970. The differential magnitudes (based usually on 3 deflections with a typical internal standard deviation of 0.003 mag) are given in the Table.

Table
Log of observations

JD (2440000+)	Δ U	Δ B	Δ V
713.80	-0.885	-0.867	-0.431
714.58	896	870	429
714.75	885	869	434
714.83	889	874	426
715.60	875	865	424
715.72	869	873	424
721.73	886	869	432
725.67	876	878	434
727.70	889	878	437
730.71	873	875	427
745.67	899	886	435
749.65	867	878	426
750.62	896	886	439
752.65	873	880	429
754.62	-0.872	-0.877	-0.426

Thus the ΔU-values scatter around the mean $\overline{\Delta U} = -0.882$ with a standard deviation $\sigma = 0.0105$, the ΔB-values around $\overline{\Delta B} = -0.875$ with $\sigma = 0.0063$ and the ΔV-values around $\overline{\Delta V} = -0.430$ with $\sigma = 0.0048$.

It should be noted that the differential magnitudes are given in the observer's system.

Looking at this data one obtains a weak indication that the ΔU-values show a periodicity of about 3 days or related to it, but a really meaningful period search is precluded at the moment by the uneven coverage of the observing period and by the overall paucity of data in connection with the low amplitude indicated by the standard deviations.

A further check was made using absolute Strömgren-photometry carried out from March 25 to April 2, 1974, the results of which have been published by Maitzen (1976). This photometry contained nearly exclusively Ap-stars, and thus we can only hope to find indications of variability by forming differences between HD 135297 and at least two other Ap-stars which were always observed closely before or after it. This way I found HD 151525 and HD 137949 as so-called "comparison stars".

Only the v-filter measurements were regarded since they should exhibit the largest variation, if any.

Even under these relatively unusual circumstances I obtained:

σ (Δv , HD 151525) = 0.0085 (7 measurements)

and

σ (Δv , HD 137949) = 0.0068 (5 measurements).

This is in surprising agreement with the sigma of the differential UBV-measurements. Therefore, one can draw the conclusion that the variability of HD 135297 is only marginal.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2325

Konkoly Observatory
Budapest
2 May 1983
HU ISSN 0374 - 0676

BD +37° 443 : A NEW RED VARIABLE STAR

BD +37°443 was used as comparison star in the observations of the O-subdwarf BD +37°442 by Bartolini et al. (1982), who accidentally interchanged the identification of the two stars (Rebeirot, 1982).

In 1977 BD +37°443 was much fainter than BD +37°442 and BD +37°446, while according to the BD catalogue and for BD +37 442 also from the AGK2 catalogue it was listed as being brighter.

On January 6, 1983 BD +37°443 was observed photoelectrically with the 152 cm telescope of Bologna Observatory equipped with a five colour photometer described by Lolli (1983) and resulted as bright as in the BD map.

The following differences of magnitude between BD +37°443 and BD +37° 442 (that according to Landolt (1973) and Bartolini et al. (1982) presents variations not larger than $0\overset{m}{.}08$) have been obtained so far:

JD-2440000	ΔV	ΔB	Telescope
3454.42	0.58	1.81	60 cm
3458.48	0.63	1.77	60 cm
3483.41	0.58	1.79	60 cm
3495.37	0.55	1.76	60 cm
5341.40	-0.29	1.10	152 cm

The spectral type K 0 III published by Rebeirot (1970) suggests that BD +37°443 could be a long period or a semiregular variable star.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2326

Konkoly Observatory
Budapest
4 May 1983
HU ISSN 0374 - 0676

H ALPHA OBSERVATIONS OF EPSILON AURIGAE

The binary system ε Aur (= HR 1605) is now passing through the phase of its total eclipse. This system has an orbital period of 27.1 years; the primary star is an FOIa supergiant and the secondary component is an object of unknown nature.

ε Aur has been well studied photoelectrically (Gyldenkerne 1970). The light curve shows only the primary minimum, with a totality phase of roughly constant magnitude that lasts about one year. The secondary component gives no observable contribution, at least in the visible bands, to the luminosity of the system at any time. In spite of this, during the totality phase, the difference in magnitude is restricted within less than one magnitude, so that it is supposed to be caused by a disk-shaped or by a semitransparent object.

At the Trieste Observatory ε Aur has been observed with a photoelectric photometer equipped with two interferometric filters of 30 Å halfwidth. One of them is centered on the Hα 6653 Å line of neutral hydrogen, the other being centered on a nearby continuum region, say 6620 Å. The comparison star, λ Aurigae, is a solar type dwarf (GOV). Table I shows the magnitude of the line minus the magnitude of the red continuum, together with the differences between ε and the comparison. Every value is an average of several particular measurements, made with a time resolution of, typically, 1 minute.

The first fact that these measurements seem to reveal is an evident decrease in the relative flux emitted by the line.

Table I

Date	Δm (H_α - 6620 Å)	Δm_{6620} ($\varepsilon - \lambda$)
Nov. 19, 1982	- 0.05 ± 0.01	- 1.02 ± 0.01
Jan. 11, 1983	- 0.06 ± 0.02	- 0.98 ± 0.01
Jan. 17, 1983	- 0.04 ± 0.01	- 0.98 ± 0.01
Jan. 23, 1983	- 0.05 ± 0.01	- 0.92 ± 0.01
Mar. 17, 1983	+ 0.13 ± 0.02	- -
Mar. 18, 1983	+ 0.09 ± 0.01	- 0.94 ± 0.01

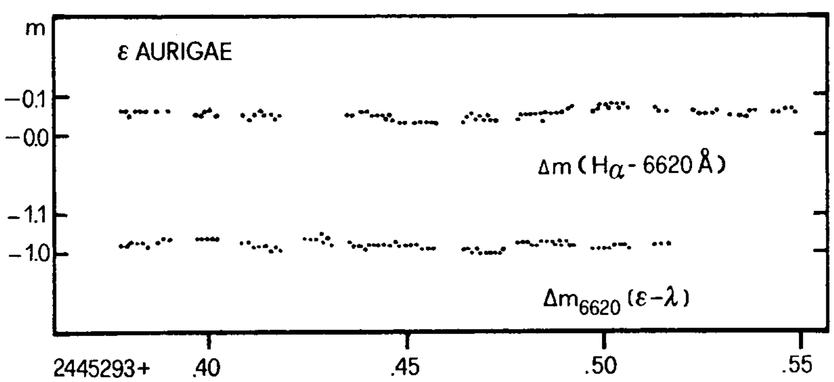

Figure 1. Photoelectric measurements of ε Aurigae during one night, Nov. 19, 1982. The methods used are described in the text.

It may be important to note that this drop happened only well after the beginning of totality, which probably occurred at the end of last year (Stencel 1983). Figure 1 shows one complete run of observations; the behaviour was similar on all the other observing nights, so we can exclude the occurrence of systematic short-time-scale variations in the red flux.

In addition, some high-resolution spectra have been obtained with the 152 cm coudé telescope of the Observatory

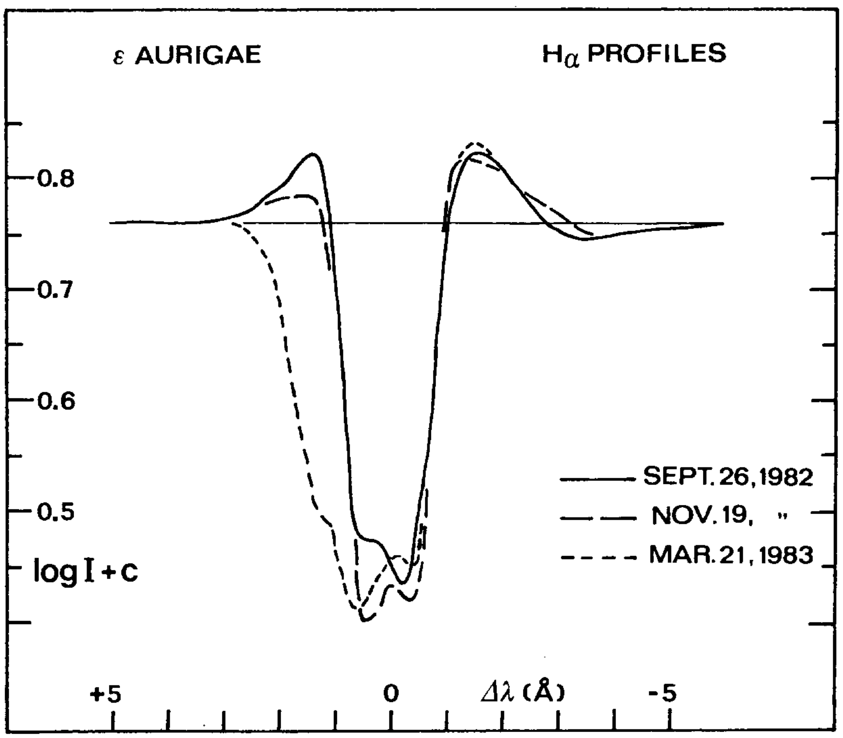

Figure 2. Comparison between H alpha profiles at mid ingress, end ingress and totality phases, plotted in logarithmic scale of intensity.

Haute Provence. One of the most noticeable variations in the spectral features is the change in the profile of the Hα line. In Figure 2 we have plotted the profiles at various epochs. In particular, we can see that the blueward emission wing seemed to remain unperturbed, while the redward one was gradually reduced until it disappeared during last March. In its place, a corresponding broadening of the absorption towards the red can be noted. This observational evidence explains and confirms the analogous decrease observed photoelectrically in the Hα band (30 Å wide).

A similar phenomenon was detected during the corresponding phase of the 1956 eclipse (Wright and Kushwaha 1957), superimposed on strong variations in the blueward emission (occurring, at that time, on the occasion of the first and second contacts). Since significant variations in the Hα profile were seen also out of eclipse (Castelli 1977), one is led to view the observed Hα behaviour in terms of a composite phenomenon. An eclipse effect, generated by combined rotations of the supergiant and of the eclipsing body can produce the Hα inverse P Cygni-like profile, that we observed in March, before mid totality. Irregular variations, probably due to inhomogeneities, both of the primary shell and of the eclipsing object, may then be superimposed.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2327

Konkoly Observatory
Budapest
4 May 1983

HU ISSN 0374 - 0676

ON THE PERIOD OF EG CEPHEI

The first photoelectrical measurements of this β Lyr star were done in 1959/60. They showed some interesting lightcurve instabilities (Geyer, 1961). Therefore, we reobserved this eclipsing binary in the nights of Sept. 1/2, 2/3, 3/4, 1980 with a double beam photometer attached at the Nasmyth focus of the 106 cm Cassegrain telescope of Hoher List Observatory. This photometer which is equipped with usual UBV filters, 1P28B photomultipliers and charge integrators was described by Geyer and Hoffmann (1974, 1975). This instrument allows simultaneous observations of the variable- and the comparison stars with fairly high time resolution. The integration times for the U-measurements were 20 seconds, for the B and V were 10 seconds. A total of 307 U, 614 B and 614 V-observations were obtained on the three nights. We used the same comparison star as Geyer (1961). The reduction of the measurements was done in the usual manner, channel calibrations were done during the second and third night.

From our observations, we derived one time instant for the primary and two time instants for the secondary minima by the Pogson method which are listed in Table I. The O-C values were calculated with the light ephemeris given by Strohmeier (1958) (confirmed by Geyer, 1961).

From the literature, we collected all photoelectric determinations of minimum time instants and the extensive visual and photographic minimum time instant estimations by AAVSO-, BAV-, BBSAG- and Sonneberg-Observers (Mallama, 1980; Ahnert, 1975; Locher, 1975-1980). The visual and photographic deter-

Table I : Determinations of heliocentric Times of Minima for EG Cep

Minimum time	m.e.	C	E	O-C
244 4484.4962	± 0.0025	V	32233.5	+ 0.0252
4484.4951	0.0014	B	32233.5	+ 0.0241
4484.4972	0.0016	U	32233.5	+ 0.0262
4485.5820	0.0016	V	32235.5	+ 0.0217
4485.584	0.004	B	32235.5	+ 0.024
4486.4032	0.0008	V	32237	+ 0.0260
4486.4026	0.0006	B	32237	+ 0.0254
4486.4022	0.0010	U	32237	+ 0.0250

m.e.: mean error; E: Epoch; O-C calculated with the ephemerides of Strohmeier

minations were binned to normal epochs, all photoelectric results were taken into account individually.
These values are listed in Table II.

Using Strohmeier's light ephemeris, we calculated the O-C values given in Table II and shown in Figure 1. We investigated the (O-C)'s for the influence of cumulative and observational

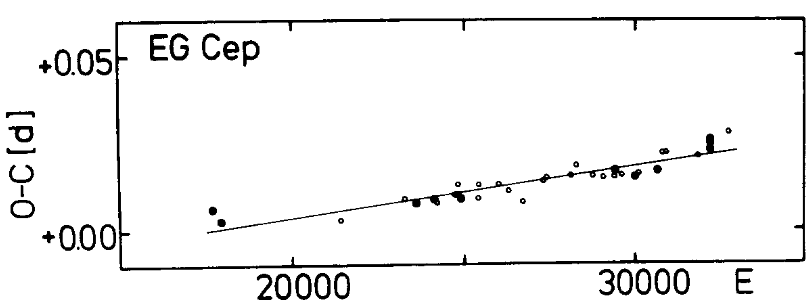

Fig. 1: The O-C diagram according to the light ephemeris of Strohmeier

Table II: Photoelectric minimum time determinations and normal epochs from visual and photographic observations of EG Cephei

Epoch	O-C	W	Reference
17 781	+ 0.^{d}0065	10	Geyer,ZfA 51.79 (1961)
17 941	+ 0.0032	10	
21 373	+ 0.0029	5	Normalepoch (NE)
23 244	+ 0.0091	5	
23 585	+ 0.0083	10	Ahnert,MVS 7.65 (1975)
24 092	+ 0.0087	10	
24 210	+ 0.0080	5	NE
24 739	+ 0.0099	5	
24 795	+ 0.0103	10	Ahnert,MVS 7.65 (1975)
24 794	+ 0.0130	5	NE
24 887	+ 0.0091	10	Ahnert,MVS 7.65 (1975)
25 410	+ 0.0093	5	NE
25 388	+ 0.0127	5	
26 081	+ 0.0132	5	
26 272	+ 0.0108	5	
26 751	+ 0.0079	5	
27 336	+ 0.0133	5	
27 422	+ 0.0153	5	
28 092	+ 0.0154	5	
28 257	+ 0.0186	5	
28 763	+ 0.0156	5	
29 051	+ 0.0147	5	
29 434	+ 0.0152	5	
29 437	+ 0.0169	10	Pohl,IBVS 1358 (1977)
29 612	+ 0.0155	5	NE
30 037.5	+ 0.0149	10	Ebersberger,IBVS 1449 (1978)
30 104	+ 0.0162	5	NE
30 641.5	+ 0.0171	10	Pohl,IBVS 1924 (1981)
30 775	+ 0.0219	5	NE
30 924	+ 0.0222	5	
31 869	+ 0.0213	5	
32 233.5	+ 0.0252	10	this paper
32 235.5	+ 0.0227	10	
32 237	+ 0.0255	10	
32 755	+ 0.0278	5	NE

errors according to the method described by Sterne (1934) with the result that a cumulative period error of $8.8 \cdot 10^{-5}$ day is present. Therefore the slight curvature in the (O-C)-diagram is fully explained by this "random walk" effect. Removing the linear trend in the (O-C)-diagram (figures) one yields the improved light elements:

$$t_{Min.(J.D.)} = 2426\ 929^{d}.4325 + 0^{d}.54462159 \cdot E.$$

Within the errors this new period agrees well with that found by Mallama (1980) based on the 112 visual determinations of AAVSO observers between 1969 and 1978. It represents all mentioned minima instants very well, indicating that the period was constant during 1959-1980 within $9 \cdot 10^{-5}$ day.

Our new UBV lightcurves which resemble those given by Geyer (1961), show some interesting, wavelength dependent instabilities. They will be discussed in detail elsewhere. The found cumulative period errors may be the result of such light curve variabilities.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2328

Konkoly Observatory
Budapest
6 May 1983
HU ISSN 0374 - 0676

ADDITIONAL VARIABLE STARS IN THE SRS CATALOGUE

Following the search conducted to collect the existing astrophysical data for southern fundamental stars (López,1982), a new cross index between known variables and SRS stars is herein presented.

Table I has been prepared by searching the 59th through 66th variable stars naming lists (IAU Inf. Bull. Var. Stars. Nos. 834, 961, 1068, 1248, 1414, 1581, 1921 and 2042).

TABLE I

SRS#	Variable	SRS#	Variable
3248	AA Scl	10516	V772 Cen
3506	AK Cet	12626	FY Lib
3609	AL Cet	13233	V927 Sco
3634	AM Cet	13779	V2111 Oph
4042	AQ Cet	14139	V2113 Oph
4334	AS Cet	14299	V925 Oph
4597	AT Cet	14654	V3792 Sgr
5384	DO Eri	14659	V3903 Sgr
5472	DP Eri	15026	V3879 Sgr
7435	FU CMa	15663	V4063 Sgr
7472	V646 Mon	16618	EW Aqr
8006	BC CMi	19328	V347 Car
8406	VV Pyx	20003	BR Oct
10229	SY Crt	20155	CE Oct
10415	SU Crt		

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Reference:

López, C.: 1982. IAU Inf. Bull. Var. Stars. No. 2241

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2329

Konkoly Observatory
Budapest
6 May 1983

HU ISSN 0374 - 0676

THE PERIOD VARIATIONS OF UX Dra

New times of minimum light of the carbon star UX Dra were derived from the three colour photoelectric observations made at Brno Observatory and from the observations made by Dzervitis et al. (1973). They are collected in the following table:

JD_{min}	(O - C)	E	Observer
244 1705:	-3.7	0	Dzervitis et al.
2040:	9.0	2	Dzervitis et al.
4331	-2.6	16	Vetešnik
4500	-1.3	17	Vetešnik
4665	2.7	18	Vetešnik
4833	-4.8	19	Vetešnik
5005	-1.7	20	Vetešnik
5179	3.0	21	Vetešnik

The minima express the effect of the lengthening of the period and can be well represented with the quadratic formula

$$JD_{min} = 244\ 1708.7 + 160\overset{d}{.}7\ E + 0\overset{d}{.}21\ E^2 \quad .$$

This ephemeris was used for the computation of the (O-C)'s in the table above.

Our attention was also directed to consider the behaviour of the light changes of the star in the time of the old photographic observations made by Payne-Gaposhkin (1952). It was found that the period varied almost linearly in two long term cycles in the duration of about 5000 days. The lengthening of the period from 155 to 185 days was interrupted with an abrupt break at the end of each cycle. The breaks during which the period fell down to the minimum value were: JD 241 7400, 242 2000 and 242 8000. The mean period of about 170 days is keeping till this time.

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References:

Dzervitis, U., Paupers, O., Spulgis, G. 1979, Issl. Solnca i Krasnych Zvezd, Riga, No. 9, 5.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2330

Konkoly Observatory
Budapest
9 May 1983
HU ISSN 0374 - 0676

RADIAL VELOCITY MEASUREMENTS OF α Pyx AND ζ CMa

In 1980 a spectroscopic monitoring of bright southern B stars using the 90cm telescope of Manuel Foster Observatory, Santiago de Chile, was started (Sterken and Vogt, 1982). The programme consists of systematic observations of southern early-type B stars which are too bright to be observed photometrically. During the first months of operation a one-prism spectrograph with a dispersion of 36 Å/mm at Hγ was used.

ζ Canis Majoris (HR 2282, B2.5V, V=3.02, B-V=-.19) is known since long as a long-period spectroscopic binary (Curtis, 1908). Many radial velocities have been published since then, but the star has never been monitored for short-term variability. Its spectral type and luminosity class locates its position in the H-R diagram close to the locus of the β Cep stars. ζ CMa was monitored during 4 nights in December 1980 and January 1981.

From the large scatter in radial velocities obtained on a night-to-night basis, and considering the fact that α Pyxidis (HR 3468, B1.5III, V=3.68, B-V=-.18) has the right spectral type and luminosity class for being a β Cep star, Van Hoof (1973) concluded that it is probably a β Cephei variable. Balona (1977) pointed out that the published radial velocities indicate variation, but he found the star constant in V. We monitored the star during 5 nights in December 1980 and March 1981. Kodak IIa-O emulsion has been used; all plates were measured with the Grant Spectrocomparator at the headquarters of ESO in Garching. The table gives the plate numbers as listed in the logbook of the Manuel Foster Institute, heliocentric date and heliocentric velocity. For

Heliocentric radial velocities α Pyx = HR 3468

Plate nr	JD-2440000	RV	Plate nr	JD-2440000	RV
65	4589.623	5.9	308	4680.745	29.1
66	.648	12.4	309	.758	27.8
68	.686	14.3	310	.773	20.8
74	.807	17.7	311	.784	20.7
75	.818	12.2	312	4682.602	24.4
170	4614.577	12.5	313	.614	23.2
171	.590	14.4	314	.626	20.4
172	.606	16.6	315	.638	23.6
173	.616	21.2	316	.650	23.7
174	.628	15.3	317	.660	20.6
175	.640	19.1	318	.676	10.6
176	.656	21.9	319	.687	19.4
177	.670	19.0	320	.698	19.2
178	.680	22.0	321	.710	18.5
179	.689	14.2	322	.723	23.5
180	.700	30.1	323	.738	25.1
181	.710	20.6	324	.750	21.2
182	.724	20.2	325	.762	16.9
183	.738	52.1	326	.773	24.3
184	.748	19.5	327	.788	25.0
185	.759	6.4	332	4683.561	23.2
290	4677.647	16.8	333	.578	23.1
291	.658	25.2	334	.593	21.2
292	.671	35.1	335	.606	18.6
293	.685	24.0	336	.621	11.5
296	4680.595	26.4	337	.626	18.5
297	.606	13.0	340	.666	31.7
298	.619	7.4	341	.678	23.5
299	.631	8.1	342	.690	21.1
300	.644	13.6	343	.705	17.3
301	.658	19.8	344	.719	19.4
302	.669	16.4	345	.731	10.8
303	.682	9.4	346	.744	21.3
304	.695	24.2	347	.756	27.1
305	.708	16.6	348	.768	7.3
306	.713	37.7	349	.779	24.0
307	.734	23.2	350	.791	45.5

Heliocentric radial velocities ζ CMa = HR 2282

Plate nr	JD-2440000	RV	Plate nr	JD-2440000	RV
46	4590.330	50.3	109	4611.447	78.2
47	.339	39.6	111	.457	26.0
48	.362	25.4	112	.471	16.0
49	.371	33.2	113	.477	21.2
50	.386	31.0	114	.487	19.6
54	.463	42.0	116	.504	23.2
55	.470	33.1	117	.511	27.7
56	.479	31.8	118	.517	35.6
58	.516	20.9	119	.525	59.8
59	.529	25.7	132	4614.319	51.7
61	.545	45.9	133	.327	62.4
78	4595.316	24.9	134	.338	46.5
79	.325	26.8	135	.342	48.4
80	.347	34.8	136	.349	28.6
81	.356	8.2	137	.358	33.7
82	.373	38.0	139	.373	36.7
83	.382	0.7	140	.381	35.6
84	.390	17.7	141	.388	33.7
85	.400	45.7	142	.398	19.0
86	.413	27.7	143	.409	30.9
88	.432	13.0	144	.424	26.3
89	.463	36.1	146	.440	25.7
90	.487	23.5	147	.449	16.2
91	.512	29.5	148	.456	29.2
92	.518	30.5	149	.469	30.6
97	4611.318	22.7	150	.494	16.8
98	.329	41.1	151	.501	41.4
99	.337	32.6	152	.510	35.1
100	.346	53.9	153	.519	10.9
101	.360	47.0	154	.527	35.5
102	.369	45.1	155	.537	28.7
105	.398	38.1	156	.544	38.9
107	.431	34.4			

ζ CMa the radial velocities are the means of the velocities of the He I 4388 and 4471 lines; in the case of α Pyx the He I 4144, 4388 and 4471 lines were used. The mean error on one velocity determination is estimated as 6-8 km s^{-1}. On JD 244-4595, -4611 and -4614 the radial velocity range of ζ CMa is definitely larger than the inaccuracy of the measurements, but the form of the radial velocity curve is too irregular to draw any conclusion regarding the nature of the variations. The measurements of α Pyx yield a relatively well defined sinusoidal velocity curve on JD 2444680, with a probable period of about 5 hours and a range of nearly 20 km s^{-1}. On the other nights the variations were more erratic, but with a smaller amplitude. The presence of this short-term variability makes α Pyx a suitable target for a more elaborate study using a larger telescope equipped with a grating spectrograph.

The authors are indebted to Mrs. E.M. Acuña and Mr. G. Le-Cerf for taking a number of plates, and to the European Southern Observatory for donating the plate material. Financial support was provided by the National Foundation for Collective Fundamental Research (FKFO 2.0028.79) and by the National Science Foundation (NFWO) of Belgium.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2331

Konkoly Observatory
Budapest
9 May 1983
HU ISSN 0374 - 0676

HD 87072: A NEW, BRIGHT, VERY SMALL AMPLITUDE, SHORT PERIOD CEPHEID

HD 87072 is classified F8 Ib/II by Houk and Cowley (1975) and was included in a program of intermediate band and Hβ observations of F type supergiants. Single, one-per-night, observations over a two year span are listed in Table I. The

TABLE I. Intermediate Band and Hβ Observations of HD 87072

JD 244	Phases	V	b-y	M_1	C_1	β
4693.701	0°267	$8\overset{m}{.}35$	$0\overset{m}{.}480$	$0\overset{m}{.}238$	$0\overset{m}{.}784$	$2\overset{m}{.}642$
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	0.496	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
8282.833	0.227	8.31	0.474	0.226	0.802	2.654
8383.783	0.688	8.39	0.477	0.237	0.780	2.649
8384.750	0.156	8.30	0.457	0.236	0.820	2.671
8385.733	0.633	8.42	0.476	0.258	0.752	2.646
8386.594	0.050	8.22	0.439	0.224	0.835	...
8386.809	0.154	8.28	0.456	0.225	0.821	2.663

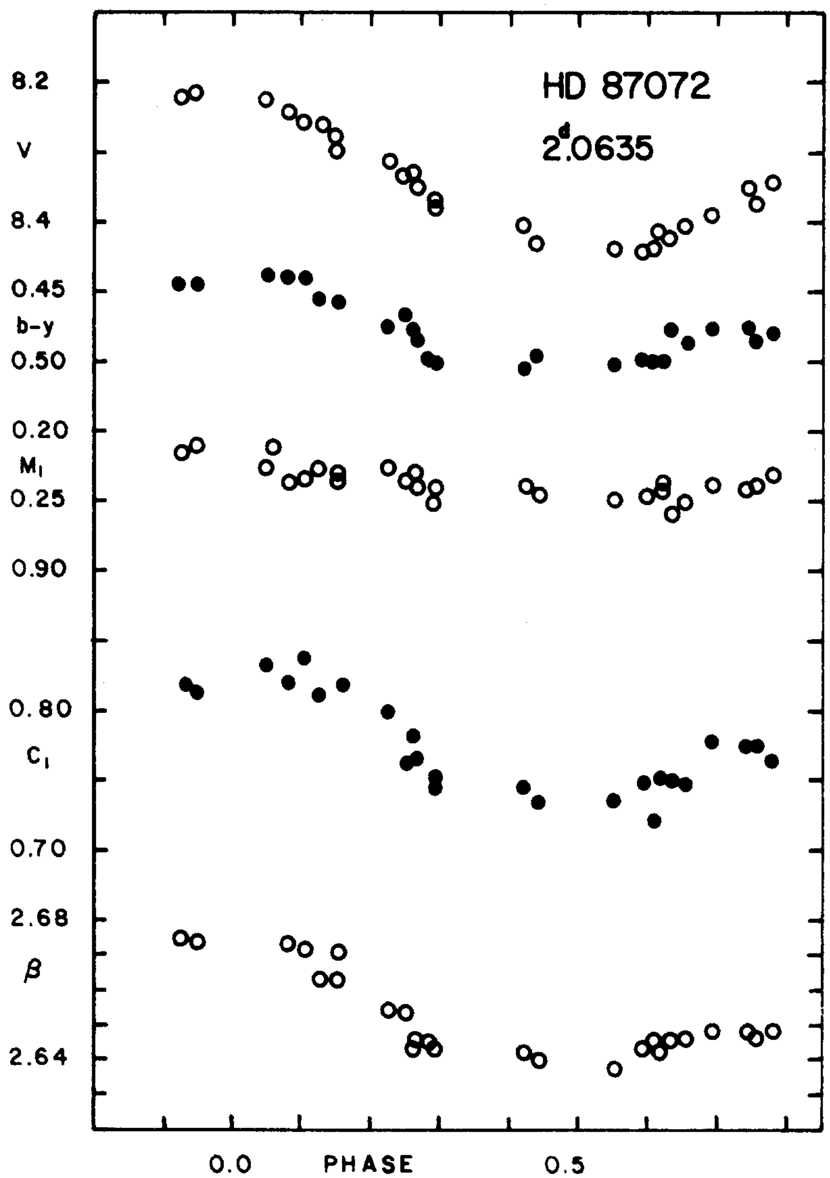
HD 87072
2ᵈ0635
8.2
V
8.4
0.45
b-y
0.50
0.20
M₁
0.25
0.90
0.80
C₁
0.70
2.68
β
2.64
0.0
PHASE
0.5

Figure 1

light elements, Max = JD 2445033.630 $+2\overset{d}{.}063515$ best satisfy these results and the resulting light and color curves are shown in Figure 1. An alternative period of $0\overset{d}{.}6737$ doubles the dispersion of the individual observations.

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Reference:

Houk, N. and Cowley, A. 1975, Michigan Catalogue of HD Stars. Vol. I.

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2332

Konkoly Observatory
Budapest
11 May 1983

HU ISSN 0374-0676

ADDITIONAL HISTORICAL BRIGHTENINGS OF VY AQUARII ?

Very recently the eruptive variable VY Aquarii became known to have undergone 8 outbursts (1907,1929,1934,1941?,1942,1958,1962 and 1973), see Richter (1983), Liller (1983) and references therein.

Examining more than 1000 plates of the Sonneberg sky patrol (mostly taken by H. Huth), I could find some further weak impressions at the extreme plate limit near the position of the variable. Although I cannot rule out that there might be misinterpreted agglomerations of grains or disfigured images of the close comparison star 5 of Vogt (1980) among them, the increased interest in the object induced me not to withhold any piece of evidence, however, problematical it may be. The purpose of this note is to invite further investigation by authors having access to other plate archives.

The comparison stars used are those given by Vogt (1980). The following table lists the observed brightenings, combined into groups of equal outburst cycles.

UT	m_{pg}	remarks
1929 July 5.5	13.0:	
10.5	[12.2	
13.5	13.1:	
14.5	[13.1	
15.5	[13.1	
Aug 6.4	[13.1	
7.5	[13.1	
10.5	[12.2	
10.5	12.2::	
11.4	[13.1	
13.5	[13.1	
27.4	14.1:	
1934 July 16.5	[13.1	
17.5	13.3::	
Aug 5.5	[13.1	
1934 Aug 6.5	14.5::	
1935 Aug 26.5	13.1::?	
1939 Aug 15.5	13.1::	
15.6	13.3::	
16.4	14.2::	
17.4	[14.5	
1940 Aug 30.4	14.5::	
Sep 3.4	12.6::	1
5.4	13.1:	
5.4	[13.1:	
6.4	13.7::	
1941 July 2.5	13.1::	
23.5	[14.5	
1942 Sep 16.5	13.1::?	
30.4	14.5::	

UT		m_{pg}	remarks
1942 Oct	4.4	[13.1	
	12.4	[13.1	
	13.3	[13.1	
1946 Aug	28.5	13.1::?	
	31.4	13.7::	
1950 Aug	10.4	14.5::	
	13.4	[13.1	
	15.5	13.1: ?	
	20.4	[13.1	
	20.4	13.5::	
1954 Nov	15.2	12.7::	
	16.3	13.1	
	23.2	14.5:: ?	
1958 July	11.5	10.5	
	11.5	10.5	
	12.5	10.5	
	12.5	10.8	
	18.5	11.3	
	19.5	11.3	
	25.5	[14.5	
Aug	10.4	[14.6	
	17.4	13.8::?	
	18.4	[14.6	
1962	published elsewhere		
1964 Aug	5.5	[14.5	
	6.5	[13.1	
	8.5	13.6:	
	8.5	[14.5	
	8.5	13.5::	
	9.5	13.6::	
	14.4	[13.1	
1964 Oct	1.4	[14.7	
	2.4	14.5::	
	3.4	[13.1	
	4.3	14.5:	
	4.3	[13.8	1
	4.3	13.1::	
	4.3	14.5::	
	11.4	[14.7	

UT		m_{pg}	remarks
1965 Sep	22.4	13.7:	
	22.4	[13.8	1
	22.4	14.5::	
	22.4	13.6::	
	22.4	14.5::	
	23.5	13.6:: ?	
	24.4	[14.5	
1966 June	21.5	13.1:: ?	
	22.5	13.6:	
	22.5	[13.8	
July	10.4	13.1::	
	23.5	13.9::	
	23.5	14.5::	
	24.5	13.9:	
	24.5	14.5::	
1967 Oct	25.3	[13.1	
	25.3	13.1::	
	28.3	[13.1	
	28.3	13.1:	
	28.3	13.1::	
	28.3	12.6::	
1973 May	28.5	13.1::	
June	5.5	12.2::	
	26.5	[13.1	
July	29.5	9.3	
	29.5	9.4	
	29.5	9.4	
	29.5	9.5	1
	31.5	10.1	
	31.5	9.7	
	31.5	10.5	1
Aug	5.4	10.4	
	5.4	10.4	
	5.4	10.8	
	5.5	11.2	
	23.5	[14.5	
	25.4	13.1::	
	26.4	[14.5	

remarks: 1 = panchromatic

This list shows that during the periods of eruption observed by Liller (1983) our sky patrol plates exhibit only moderately increased magnitudes.

In addition to the 8 outbursts that have hitherto been known, the following observations of increased brightness seem to be reliable: August 1939, August 1940, October 1964, September 1965, July 1966 and October 1967. The other observations are doubtful. Our plates taken since 1973 are without a trace of this star.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2333

Konkoly Observatory
Budapest
13 May 1983

HU ISSN 0374-0676

INFRARED VARIABILITY OF HR 7275

Although Hall's (1976) original classification of the RS CVn stars included infrared excesses as one criterion, little work has been done to observe RSCVn stars in the infrared over complete orbital cycles. We report here infrared photometry of the long-period, non-eclipsing system HR 7275 that clearly shows phase-dependent infrared light curves.

All observations were carried out with the 1.3-meter telescope at Kitt Peak National Observatory during the day. We used the InSb photometer "Otto" with a 20" beam, chopping 60" in declination. Magnitudes were calculated relative to α Lyr, which was taken as 0.0 at JHKL. Because HR 7275 is bright (V≅6), statistical errors in each observation were small, no more than 0.01 mag. Our observations spanned December 1980 to February 1981; most were clustered in January 1981.

Figures 1-4 show the results, plotted as the difference (α Lyr - HR 7275) at each filter. The phases were calculated from the emphemeris given by Fried et al. (1982): HJD = 2431043.57 + 28.59E, which is based on spectroscopy. Note the clear drop from maximum at phase 0.1 to minimum at phase 0.8. The amplitude of this infrared distortion wave is 0.11 at J, 0.09 at H, 0.09 at K, and 0.06 at L.

The VB observations of Fried et al. (1982) from 1978-1980 show that the distortion wave of HR 7275 is quasi-periodic, with V amplitudes as large as 0.5 mag and as small as 0.28 mag. Percy and Welch (1982) reported V-band observations that showed an amplitude of 0.1 mag with minimum at phase 0.45. The photometric period, which varies, is roughly 27.8 days, significantly less than the spectroscopic orbital period of 28.59 days.

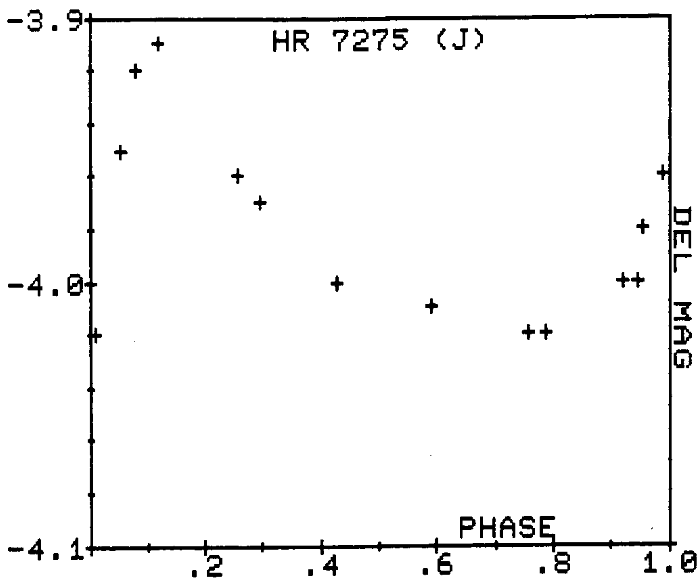

FIGURE 1

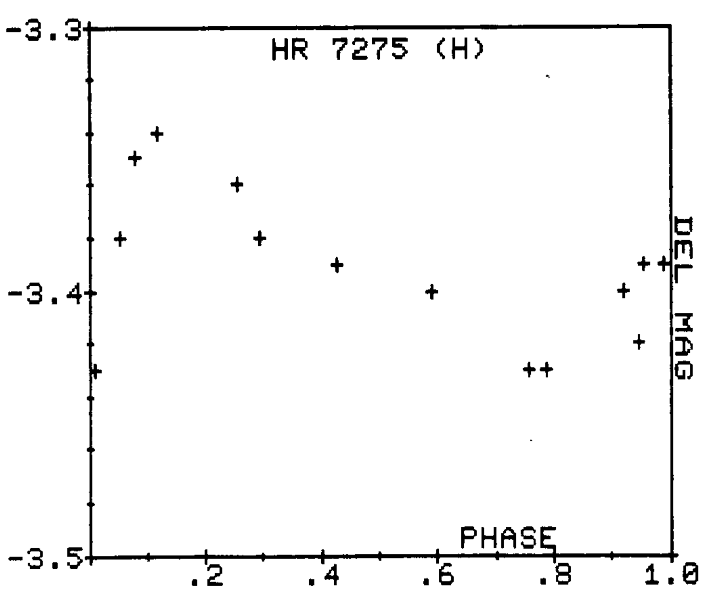

FIGURE 2

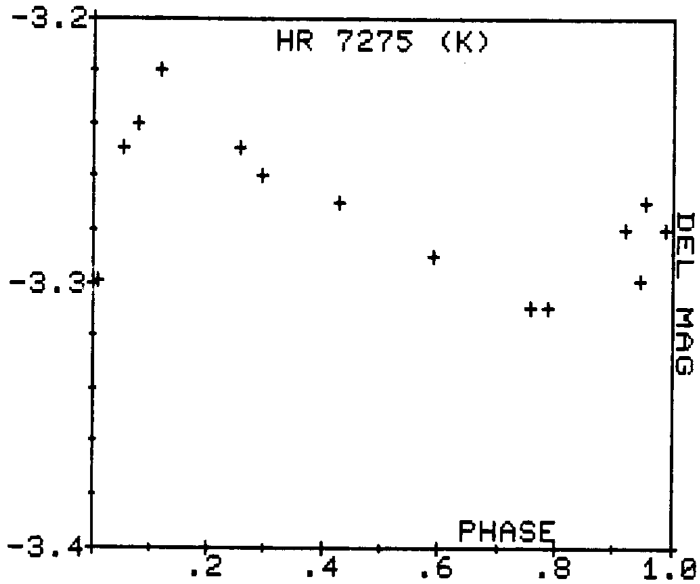

FIGURE 3

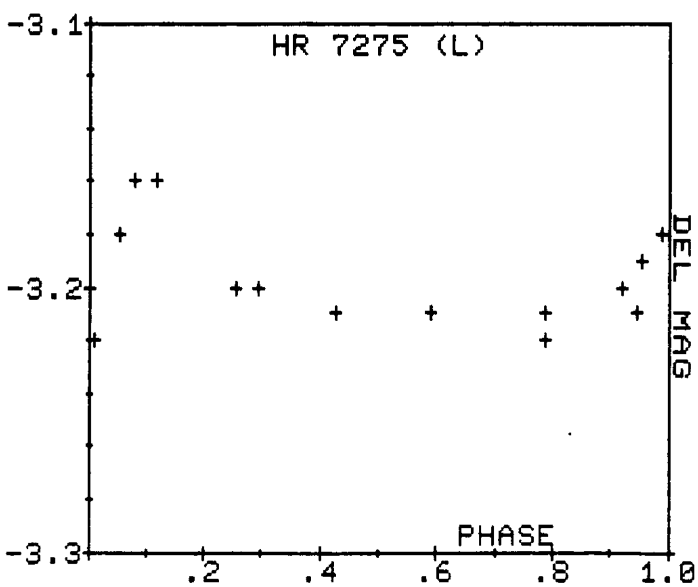

FIGURE 4

Our infrared observations started at about the same time that Fried et al.'s ended. Their results show that the amplitude was increasing, reaching about 0.25 mag at V at JD 2444550. Our results fit in well with their photometric period.

When combined with visual photometry, infrared observations provide the necessary data to fit simple starspot models. With visual photometry (UBVR) obtained at Capilla Peak in Fall 1980, we can model both the temperature and distribution of starspots. We are in the process of doing so for HR 7275, using the data reported here.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2334

Konkoly Observatory
Budapest
13 May 1983

HU ISSN 0374-0676

NEW ECLIPSING SUPERGIANT 22 Vul

An eclipse of 22 Vul (HD 192713, V = 5.15), spectral type G3 Ib-II, was observed on 17 April 1983 during IUE observations from 18^h to 21^h UT. The companion B9 spectrum discovered previously by us with IUE was absent, and the FES magnitude (effective wavelength ∿5200 A) was 0.12 $\pm$ 0.02 mag fainter than on several dates in 1982. The star is a single-lined spectroscopic binary with period 249.1 days (revised by Parsons 1983, Ap. J. Suppl., in press), eccentricity 0.02, and a_1 sin i = 93 x 10^6 km. From the radial velocity curve, times of mid-eclipse of the B secondary by the G primary may be expected at approximately

$$2{,}445{,}442.2 + 249.099\ E.$$

The duration of eclipse is unknown, but totality lasts at least 8 days since observations on 21 April again did not show the B spectrum. From the expected radius ∿40 $R_\odot$ of the primary and estimated mass ratio ∿0.7, totality may be estimated at 10 days for i = 90^o. Eclipse depths will be greater at shorter wavelengths.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2335

Konkoly Observatory
Budapest
16 May 1983

HU ISSN 0374-0676

XY Leo AND THE STAR BD+18°2304

XY Leo (BD+18°2307) is a well-known W Ursae Majoris system, which has undergone a large number of period changes. A recent period study (Gehlich, et al., 1972), using photoelectric observations made in 1971, found a period of $0^d.28411$. De Carlo and Sabatini (1967) discovered that the nearby star BD+18°2304 is an eclipsing binary having a period of $0^d.290$. The close proximity of the two systems (½° apart), their similar periods, and the similarity in the depths of the eclipses in each system suggest the possibility that De Carlo and Sabatini may have observed XY Leo and misidentified it as BD+18°2304.

To test this hypothesis both XY Leo and BD+18°2304 were observed on five nights during the spring of 1983 using the 41cm reflector of the Morgan-Monroe Station of the Goethe Link Observatory. Johnson UBV filters were used with a 1P21 photomultiplier tube cooled with dry ice. The comparison star used was BD+18°2306. Between sky and comparison star readings, observations of both XY Leo and BD+18°2304 were made. For XY Leo 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 the Table I.

Table I

Hel. J.D. 2440000+	Min	(O-C)
5396.6566	I	0.0001
5416.6904	II	0.0051
5444.6685	I	-0.0004
5449.6432	II	0.0026

The residuals were calculated using the light elements published by Kaluzny and Pojmanski (1982), namely:

$$\text{Min. I} = 2445074.4906 + {}^d.2840969E$$

Our primary minima are consistent with these light elements, but our secondary minima show a displacement. Gehlich et al., noted a smaller, time-varying displacement in the secondary.

The complete light curve of XY Leo was observed, thus if BD+18°2304 is a variable having a similar period, variations in its brightness should have been apparent. However, the magnitude of BD+18°2304 as determined with each filter remained constant within $0\overset{m}{.}05$. From this we conclude that BD+18°2304 is not an eclipsing binary and suggest that De Carlo and Sabatini unknowingly observed XY Leo.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2336

Konkoly Observatory
Budapest
23 May 1983

HU ISSN 0374-0676

NEW PHOTOMETRIC DATA FOR THE Ap STAR GY And = HD 9996

GY And is a spectrum, magnetic and light variable Ap star suspected to have a very long period (Preston, 1970). According to Preston and Wolff (1970), spectrum, magnetic field and light appear to vary in the period of 22-24 years. Since that paper no light curve of GY And has been published.

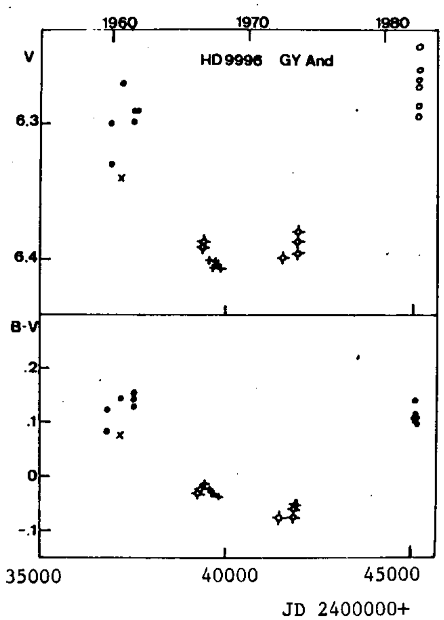

Figure 1

Photoelectric observations of GY And = HD 9996 from 1959 to 1982. Filled circles: Abt and Golson (1962); oblique cross: Osawa and Hata (1962); crossed open circles: Geneva (unpublished); crosses: Stępien (1968); open circles: this paper.

In August 1982, M. Dumont and B. Pernier performed photoelectric measurements in the Geneva color system, using the 76 cm telescope at the Jungfraujoch Observatory (Switzerland). Figure 1 shows V and B-V curves between 1959 and 1982. Additional data come from Abt and Golson (1962), Osawa and Hata (1962), Stępien (1968). Unpublished Geneva data have also been used. The data in the Geneva system have been converted into standard UBV system.

V and B-V variations confirm the possibility of a 22-24 year period. In August 1982, GY And had a mean V magnitude of 6.27 and a mean B-V value of 0.12: in 1982, GY And has reached the 1959 level in V and B-V. GY And was at light minimum in about 1970.

The authors wish to thank Dr. Rufener for permitting to use unpublished data.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2337

Konkoly Observatory
Budapest
24 May 1983

HU ISSN 0374-0676

THE STRANGE CASE OF V 439 CYGNI:

CHEQUERED HISTORY OR MULTIPLE MIS-IDENTIFICATION?

During a search for carbon stars in open clusters, one candidate was found to lie within 1 arc-minute of the centre of the young open cluster Berkeley 87 (OCL - 161; C2019+372). This star, V439 Cygni, was first identified as a carbon star by Perraud and Pelletier (1959) as a result of an objective prism survey, and was included in the General Catalogue of Cool Carbon Stars (Stephenson 1973) as number 2896. The variable star designation is based on an approximately 260-day period reported by van Schewick (1941), who identified it as being a "red" star exhibiting shallow, semi-regular light variations.

Be 87 is a sparsely-populated, heavily reddened open cluster recently studied by Turner and Forbes (1982; TF). They give the colour for V439 Cyg as $(B-V)_0 = +0.01$ (if $E(B-V) = 1.53$), that of a heavily-reddened early-type star.

In an attempt to reconcile the colours measured by TF with the identification as a carbon star, the ten minute reticon spectrum shown here as Figure 1 was taken by one of us (APC) with the 1.27 metre McGraw-Hill telescope on 14 October 1982, using a 600 line blue grating in the first order. The spectrum has been sky-subtracted, fluxed, and smoothed, and has been positively identified as that of star number 15 in TF and as V439 Cygni in the Mitteilungen über Veränderliche Sterne, No. 270 (1957; MVS).

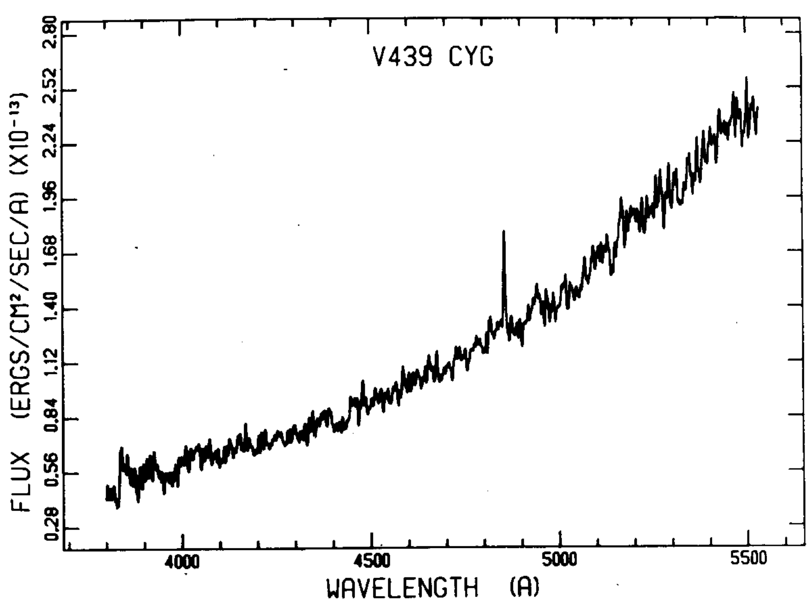

Figure 1

The Reticon spectrum of V439 Cygni as described in text. Spectrum has been sky-subtracted, fluxed, and smoothed

The spectrum is remarkably smooth - the only prominent features being a narrow H_β emission line and an absorption band at λλ 4400 - 4440; the latter is attributed to the λ4430 diffuse interstellar band. There are no Swan bands of C_2 which are characteristic of carbon stars, nor any metallic or molecular lines to suggest a late spectral type. The spectrum shows no prominent helium and carbon lines and in this respect does not resemble the hot hydrogen-deficient carbon stars (Warner 1967). The continuum is reddened, as might be expected from the high value of cluster reddening. It seems very unlikely that V439 Cyg was ever a carbon star; rather, the spectrum appears to be that of a peculiar emission-line star of equivalent spectral type ~B0. It differs from classical Be star spectra in the narrowness of the Hβ emission line and in the lack of underlying photospheric absorption features. The possibility of time variations prevents us from making more definite conclusions regarding the nature of this star.

Two Warner and Swasey objective prism plates, one in the blue spectral region and the other infrared, show no carbon star within many minutes of arc of V439 Cyg, down to 13.5 and 10.0 photographic and infrared magnitudes respectively. V439 Cygni itself is underexposed on the blue plate but the spectrum, in agreement with the observations already cited, is non-banded.

The answer to the confusion concerning the identification of V439 Cygni may lie in the surrounding stars. The only star within 10 arc-minutes of V439 Cyg which is red enough to have been mistaken for a carbon star is the M3.5 Ia star BC Cygni, 7 arc-minutes north. This star has approximately the same magnitude as that given by van Schewick and Perraud and Pelletier, and it is also an irregular variable (TF and references therein), although of larger amplitude than that attributed to V439 Cygni.

Another possibility is that in the spectral region $\lambda\lambda$ 4000 - 4900 where Perraud and Pelletier made their classification, the spectrum of the nearby Wolf-Rayet star ST 3 (Stephenson 1966; type WC pec) may have been confused in the crowded field and at low dispersion with that of a middle C-type star.

The two photographic observations of V439 Cyg by TF are separated by only two months, however no variation in V magnitude was detected to within the photometric errors, but a difference of 0.06 $\pm$ 0.03 in U-B was found. In an attempt to explain the observed non-variability and the variable star designation, TF briefly discuss the possibility of V439 Cyg being a long-period eclipsing binary consisting of a hot and cool companion. This hypothesis is not supported by the spectrum, however, which shows no trace of a cool pre-main-sequence object.

Thus the problem of the non-variable, variable star remains.

V439 Cygni's anomalous position in the colour-magnitude diagram shown in TF can be explained simply if it is assumed to be a B-type star. TF assumed V439 Cyg to be composite and determined E(B-V) = 1.53 from an average reddening of the five nearest stars. De-reddening V439 Cyg as a B star gives E(B-V) = 1.86, resulting in intrinsic values of $V_0 = 6.26$, $(B-V)_0 = -0.32$, and $(U-B)_0 = -1.19$. This places the star slightly to the blue side of the main sequence, not an uncommon location for an emission-line star. Assuming cluster membership gives an absolute magnitude of $M_V = -3.6$, which is quite reasonable for a B0 star.

We conclude that the star identified in the General Catalogue of Variable Stars (Kukarkin et al. 1969) as V439 Cygni is not now either a semi-regular red variable or a carbon star.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2338

Konkoly Observatory
Budapest
25 May 1983

HU ISSN 0374-0676

FLARE STARS IN PLEIADES

Continuous photographic observations of the flare stars in the Pleiades region have been carried out at the Bulgarian National Astronomical Observatory during August-December 1982.

The photographic patrol has been made with the 20in./28in. Schmidt telescope at Rozhen in U-light (ORWO ZU21 plates with UG2 filter).

Three new flare stars and four flare-events of known flare stars have been discovered for 36^h30^m total effective time of observations.

The data of observed flares are given in the Table.

Table I

Rozhen No.	R.A.1900	D.1900	$m_{U\ min}$	Δm_U	Date	Identification
R 19	$3^h37^m.0$	$23^\circ46'$	$18^m.4$	$3^m.6$	29. 9.1982	TC 93
R 20	39.2	24 05	20:	5.7	10.11.1982	
R 21	39.5	23 19	21:	4.3	21.10.1982	
R 22	40.7	22 01	20	6.4	27.10.1982	
R 7	41.5	22 02	17.3	1.3	13.11.1982	TC 275
R 23	43.3	23 21	20:	5.0	29. 9.1982	TC 363
R 9	43.7	24 01	16.9	0.8	9.11.1982	TC 377

The Rozhen designations for the Pleiades flare stars according to M. Tsvetkov et al. (I.B.V.S. No. 2224) have been continued.

The identification of the flare stars was given by Haro et. al. (Bol. Inst. Tonantzintla, vol.3, No. 1, 1982).

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2339

Konkoly Observatory
Budapest
25 May 1983
HU ISSN 0374-0676

FLARE STAR OBSERVATIONS IN NGC 7000 AND IC 5070

Here we present some results on the systematic search of flare stars in the NGC 7000 and IC 5070 region.

Our observations were carried out with the 40in./52in. Schmidt telescope of Byurakan Astrophysical Observatory of the Armenian Academy of Sciences (USSR) and with the 20in./28in. Schmidt telescope of the Bulgarian National Astronomical Observatory at Rozhen during August 1979 to August 1980.

The data of observational material are given Table I.

Table I

Telescope	Light	Time of exposures	Number of plates	Number of exposures	$T_{eff.}$
40"/52"	U	10^{min}	74	416	69^h20^{min}
		5^{min}	3	17	1 25
20"/28"	U	10	4	24	4
	pg	10	12	72	12
				Total:	86^h45^{min}

The data of discovered flare stars are presented in Table II.

Table II

B or R number	R.A.1950	D.1950	m_U or pg	Δm_U or pg	Date
B 53	$20^h43^m.3$	$42^o26'$	18.2 U	2.0 U	14.7.1980
R 1	48.3	43 14	21.0 pg	4.2 pg	19.9.1979
B 54	48.8	40 50	18.3 U	1.7 U	11.7.1980
B 55	53.0	40 17	18.6 U	2.3 U	11.8.1980
B 29*	57.1	42 41	18.5 U	2.5 U	16.8.1980
B 56	59.0	43 58	19.0 U	2.4 U	9.8.1980
B 57	59.6	40 29	16.7 U	1.0 U	6.7.1980
B 58	59.9	42 31	17.9 U	1.4 U	8.7.1980

Column 1. Byurakan (B) or Rozhen (R) designation

Columns 2-3. Coordinates for 1950.0

Column 4. Photographic magnitudes at minimum in ultraviolet (U) or photographic (Pg) light

Column 5. Amplitude of flares in ultraviolet (U) or photographic (Pg) light

Column 6. Date of flare up

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* The increase of the brightness of this repeating flare up is more than 20 minutes.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2340

Konkoly Observatory
Budapest
25 May 1983

HU ISSN 0374-0676

PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR EV Lac IN 1982

Continuous photoelectric monitoring of the flare star EV Lac has been carried out at Stephanion Observatory during the autumn 1982 in the framework of the Program for Scientific and Technical Co-operation between the Department of Geodetic Astronomy, University of Thessaloniki - Greece and the 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 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 year 1982 is given by the following equations:

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

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

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

The monitoring intervals in U.T. as well as total monitoring time for each night are given in Table I. Any interruption of more than one minute has been noted. In the fourth column of Table I the standard deviation of ramdom noise fluctuation $-\sigma(mag) = 2.5 \log (I_o + \sigma)/I_o$, for different times (U.T.) of the corresponding monitoring intervals is given.

During the 11.15 hours of monitoring time 6 flares were observed the characteristics of which are given in Table II. For each flare the following characteristics (Andrews et al., 1969) are given:

a. the date and universal time of maximum,

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 $(I_f-I_o)/I_o$ correspondig 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.

Table I

Monitoring intervals in 1982

Date 1982	Monitoring intervals (U.T.)	Total Monitoring Time	σ_{mag}(U.T.)
Oct.13	19^h06^m-19^h49^m, 19^h52^m-20^h27^m,	4^h02^m	0.02(19^h24^m), 0.02(20^h18^m),
	20 30 -21 09 ,21 28 -21 42 ,		0.03(21 05),0.03(21 33),
	21 43 -22 12 ,22 15 -22 57 ,		0.03(22 06),0.03(22 55),
	22 59 -23 39 .		0.02(23 31).
14	20 21 -20 49 ,20 51 -21 00 ,	2 10	0.03(20 36),0.03(20 55),
	21 03 -21 23 ,21 26 -21 52 ,		0.03(21 10),0.03(21 40),
	21 53 -22 36 ,22 39 -22 43 .		0.03(22 13),0.07(22 40).
15	19 11 -19 31 ,19 35 -19 56 ,	2 00	0.02(19 18),0.03(19 53),
	19 59 -20 26 ,20 29 -20 44 ,		0.03(20 20),0.03(20 34),
	21 52 -22 01 ,22 03 -22 31 .		0.03(21 57),0.03(22 27).
17	18 27 -19 25 ,19 26 -19 52 ,	2 57	0.02(19 00),0.02(19 46),
	19 54 -20 33 ,20 35 -21 29 .		0.02(20 18),0.03(21 20).

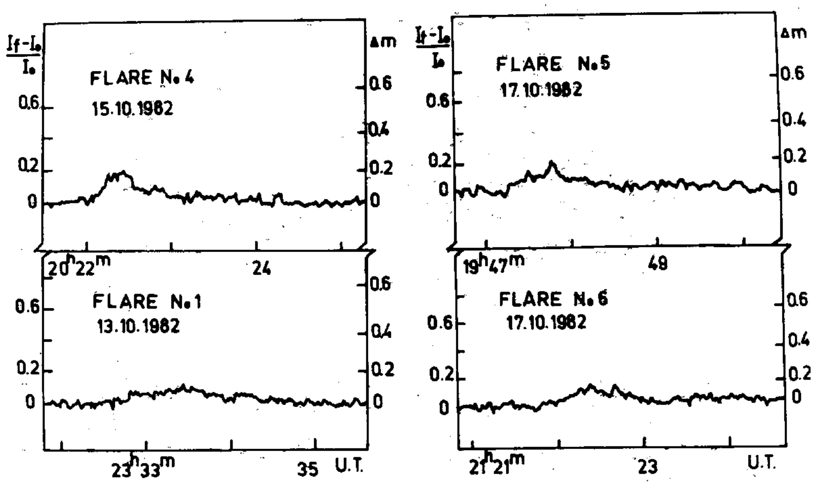
Total = 11^h09^m

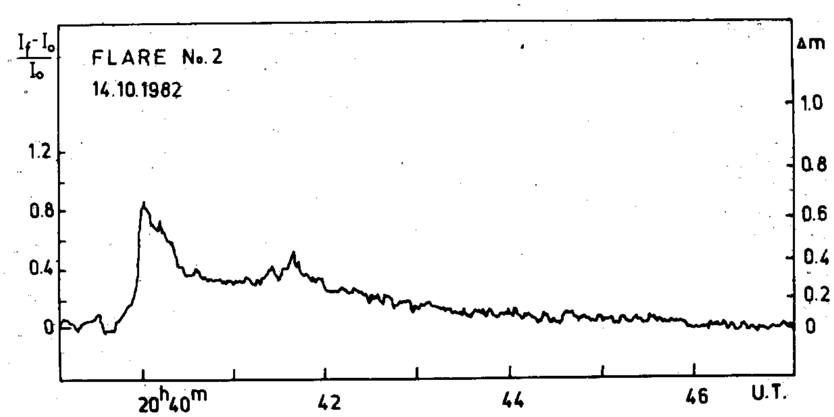
Table II

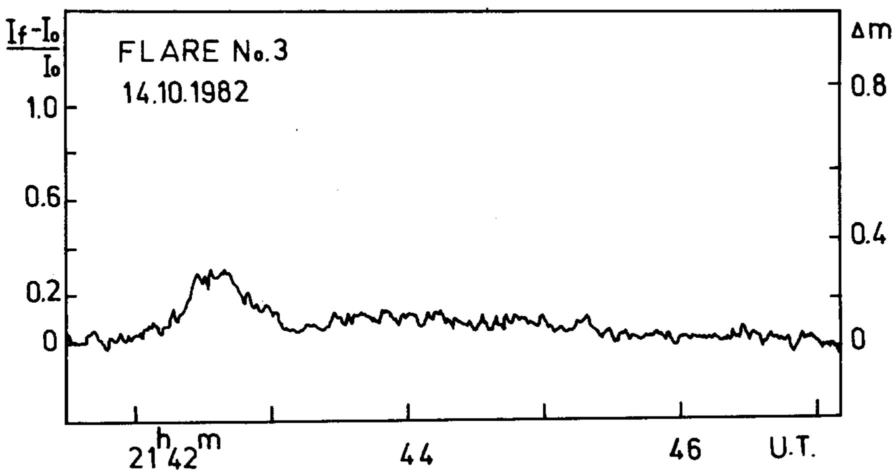
Characteristics of the Flares Observed

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.13	$22^h33^m.4$	1.06	1.34	2.40	0.127	0.092	0.13	0.02	1.320
2.	14	20 40.1	0.30	5.90	6.20	0.857	1.389	0.67	0.03	1.025
3.	14	21 42.6	0.60	4.60	5.20	0.311	0.347	0.29	0.03	1.090
4.	15	20 22.4	0.42	1.90	2.32	0.181	0.107	0.18	0.03	1.019
5.	17	19 47.8	0.52	2.32	2.84	0.190	0.110	0.19	0.02	1.008
6.	17	21 22.4	0.60	0.77	1.37	0.155	0.078	0.16	0.03	1.078

The light curves of the observed flares in the b colour are shown in Figs. 1-6.







Figures 1-6

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

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2341

Konkoly Observatory
Budapest
26 May 1983

HU ISSN 0374-0676

ANONYMOUS IRREGULAR VARIABLE IN PUPPIS

In the course of photoelectric UBV observations of dwarf novae at the European Southern Observatory (1 m and Bochum 61 cm telescope) a comparison star near BV Pup was frequently measured. However, after the reduction of the long series of data it turned out that this reference star is variable also, with an amplitude of about $0^m.15$ in a time scale of hours to days. These variations exceed the error of the measurement ($\leq 0^m.02$) significantly. A periodogram analysis in the range $0^d.01 - 10^d$ revealed no significant periodic variation. Therefore the variable seems to be of irregular type.

The 82 individual observations listed in Table I yield the following mean values and standard deviations:

$$V = 12.044 \pm 0.034$$
$$B-V = 0.403 \pm 0.037$$
$$U-B = -0.015 \pm 0.031$$

The approximate position is

$$\alpha = 7^h 44^m 40^s \quad (1900)$$
$$\delta = -23^\circ 17'.6$$

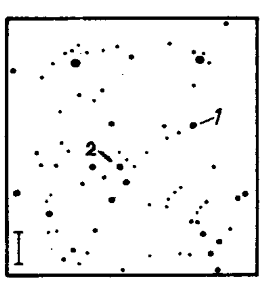

Figure 1

Finding chart. 1: New variable 2: Dwarf nova BV Pup

North is top, east is left. The bar corresponds to the size of one minute of arc.

Table I

The individual observations

HJD- 244 0000	V	B-V	U-B	HJD- 244 0000	V	B-V	U-B
618.6709	12.022	0.356	0.018	1369.6896	12.063	0.375	-0.019
619.5626	12.026	0.389	-0.023	1370.7251	12.070	0.375	-0.010
619.5751	12.027	0.387	-0.017	1381.5844	11.979	0.425	0.024
619.5830	12.024	0.399	-0.030	1381.6434	11.984	0.444	0.025
619.5938	12.015	0.397	-0.019	1382.5804	12.024	0.431	-0.016
619.6017	12.033	0.385	-0.020	1383.5818	12.104	0.398	0.013
619.6121	12.029	0.398	-0.007	1384.6496	12.041	0.414	-0.028
619.6225	12.029	0.405	-0.013	1385.6156	12.032	0.422	-0.003
619.6291	12.043	0.395	-0.039	1386.6307	12.042	0.401	0.003
619.6382	12.009	0.431	-0.022	1387.5710	12.016	0.401	-0.021
619.6457	12.033	0.401	-0.027	1387.6819	11.993	0.446	0.003
619.6611	12.027	0.410	-0.032	1388.6356	12.028	0.398	0.035
619.6694	12.027	0.408	-0.011	1389.6942	12.050	0.366	0.002
619.6806	12.032	0.398	-0.003	1391.6272	12.082	0.460	-0.062
619.6894	12.036	0.400	0.007	1393.5313	12.030	0.386	-0.033
619.7006	12.019	0.417	-0.026	1396.7366	12.038	0.415	-0.016
619.7089	12.024	0.412	-0.008	1396.7470	12.067	0.379	-0.050
619.7164	12.035	0.406	-0.005	1397.6777	12.035	0.381	0.044
619.7284	12.048	0.402	0.021	1398.6899	12.040	0.433	-0.021
619.7358	12.043	0.398	0.023	1399.6825	12.003	0.398	-0.022
619.7463	12.043	0.413	-0.035	1416.6612	12.105	0.348	0.000
619.7538	12.041	0.389	0.000	1417.5740	12.017	0.440	-0.030
619.7629	12.036	0.401	-0.019	1419.6058	11.993	0.418	-0.006
620.5441	12.018	0.390	-0.043	1421.5650	12.041	0.393	-0.014
620.6667	12.037	0.411	-0.025	1423.5427	12.037	0.405	0.017
620.7967	12.075	0.391	-0.041	1439.5685	12.068	0.403	-0.012
621.5463	12.019	0.384	-0.032	1440.5940	12.075	0.381	-0.057
622.5428	12.026	0.369	-0.005	1442.5219	12.061	0.388	-0.020
623.5495	11.998	0.379	-0.030	1661.8397	12.046	0.443	-0.050
625.5627	12.051	0.396	0.032	1664.8452	12.073	0.484	-0.089
626.5567	12.042	0.385	-0.034	1665.6590	12.196	0.447	-0.161
627.7533	12.079	0.347	-0.020	1669.7348	12.086	0.636	-0.079
628.7348	12.106	0.364	0.013	1669.8504	12.092	0.438	-0.056
630.6662	12.022	0.379	-0.033	2047.6961	11.980	0.420	-0.003
631.6987	12.052	0.388	-0.017	2162.5292	12.064	0.412	-0.037
633.7588	12.061	0.397	-0.016	2164.5167	12.080	0.373	-0.033
1364.6897	12.057	0.393	0.025	2165.5222	12.035	0.390	-0.022
1365.5594	12.039	0.379	0.031	2167.5616	12.123	0.365	-0.015
1366.6933	12.012	0.455	0.063	2168.5692	12.107	0.393	-0.012
1367.6931	12.093	0.381	-0.018	3260.5292	12.069	0.399	0.019
1368.7210	12.024	0.422	0.005	3557.6155	12.041	0.371	-0.008

3

A finding chart according to Vogt (1977) is given in Fig. 1. The star is also included in the Sky Survey reproductions prepared for the field of BV Pup by Vogt and Bateson (1982).

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Vogt, N., Bateson, F.M. 1982, Astron. Astrophys. Suppl. Ser. 48, 383

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2342

Konkoly Observatory
Budapest
27 May 1983

HU ISSN 0374-0676

EXAMINATION OF KY AQUILAE

Photographic observations of the stars A and B (see the note in I.B.V.S. No. 1605 by Dr. D. Hoffleit) were carried out in order to clear up the ambiguous identification of KY Aquilae. The camera of 10 cm was used through 1979 and 1981, and the 18 cm Wright-Schmidt camera in 1982, with Tri-X films and yellow-green filters to get visual magnitude. The total number of photographs was about 150.

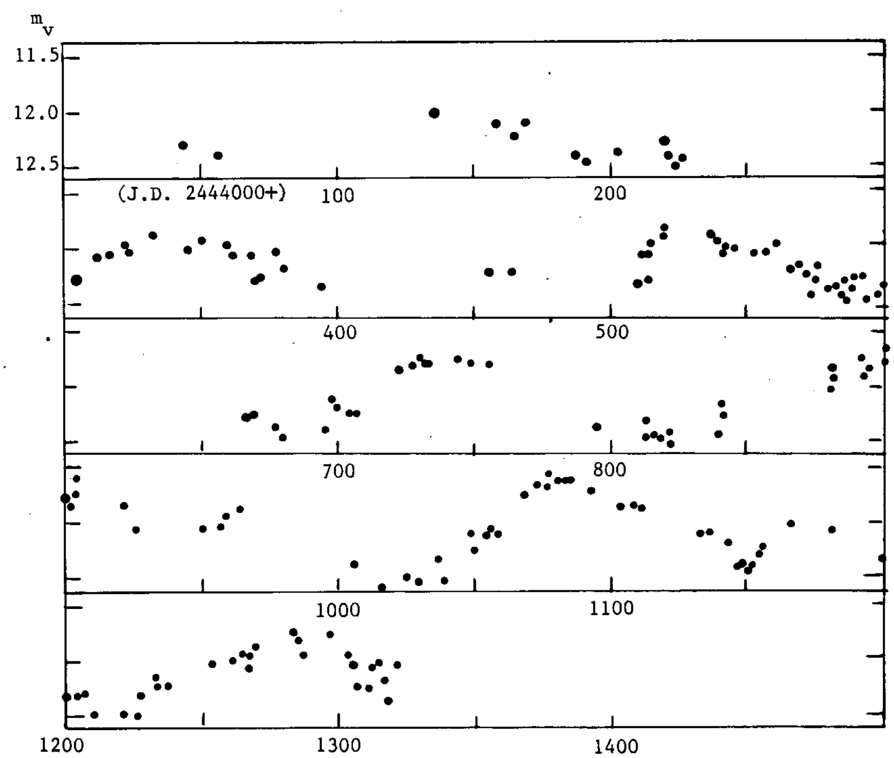

Fig. 1. Light variation of star B (1979-82).

During the above period of observation, the original KY Aql, A, did not show the variation of more than 0.3 magnitudes (13.2-13.5 m_v), and any short periodicity could not be found. The star B showed periodic variation as is shown in Fig. 1. It seems to be a SRa variable, and the range was 11.5-12.6 m_v so far. The variation is fairly well expressed by the following elements:

$$\text{Max.} = \text{J.D. } 244\ 4143 + 191^{d}\cdot E$$

The observed maxima and the O-C values with the above elements are as follows.

Observed max.	O-C
J.D. 244 4140	-3^{d}
340	+ 6
525	0
735	+19
910	+ 3
5080	-18
285	- 4

The position of the star given in the GCVS (1969) is that of the original star A, and the position of star B is measured as

R.A. : $19^{h}29^{m}6^{s}$
(1900.0)
Decl. : $+11^{\circ}33'.2$

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2343

Konkoly Observatory
Budapest
31 May 1983
HU ISSN 0374-0676

THE LIGHT ELEMENTS OF EX Del, V502 Her, AND RT LMi

EX Del, V502 Her, and RT LMi are eclipsing binaries of W UMa type. They were included in a recent series of photoelectric observations of contact binaries with the 1.06m telescope of Hoher List Observatory. During the observations it turned out that their light elements deserve an urgent rediscussion.

1. EX Delphini

This object was discovered by Hoffmeister (1949). A first discussion was given by Huth (Götz et al., 1957), but the W UMa type of variability was found by Karamysh and Mandel (1965), who gave a period of $0^{d}.3968$.

In 1982 larger parts of the light curve were observed in two nights. Because these observations could not be described by the hitherto known light elements, the Sonneberg plate collection was examined. A total of 33 minima between JD 2427338.343 and 2445209.392 could be used to determine the new light elements:

Min. = JD 24338.343 + $0^{d}.3309882 \cdot E$

53 993 epochs are covered by the well distributed minima. There is no indication for a period change.

2. V502 Herculis

Again it was Hoffmeister (1949) who discovered the variability of this eclipsing binary. Gessner (1966) determined its period to $0^{d}.3117$.

Photoelectric photometry during six nights in 1982 and new minimum times from the Sonneberg plates helped to determine the corrected light elements:

Min. = JD 2430938.493 + $0^{d}.3692768 \cdot E$

73 minima between JD 2430938.493 and 2445140.50 covering 38 459 epochs were available. No period change was found during this time interval.

3. RT Leonis Minoris

This variable was found by Hoffmeister (1949) too. Meinunger (1961) gave a preliminary period of $0^d.374$, but, although it is a moderately bright object (11^m), no further discussion on the light elements could be found in the literature.

Photoelectric photometry in three nights in 1982 and a thorough examination of the Sonneberg plate archive revealed 72 minima which span 24 362 epochs between JD 2435868.483 and 2445002.4147. The refined light elements are now:

Min. = JD 2435868.477 + $0^d.3749180 \cdot E$

The period remained constant during this interval within the limits of accuracy.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2344

Konkoly Observatory
Budapest
31 May 1983

HU ISSN 0374-0676

MINIMA OF W UMa STARS

In 1982 photoelectric observations of several W UMa stars were carried out in B and V with the double beam photometer at the 1.06m telescope of Hoher List Observatory. For some of these objects no photoelectric light curves are published so far. A more detailed discussion of the new light curves will be published elsewhere, but some details on the light elements shall be given here. One third of the previously known periods of these objects are severely in error, and subsequent observations for a refinement of the new light elements will be useful. Some additional information on the light elements of EX Del, V502 Her, and RT LMi can be found in another recent issue of the IBVS (Hoffmann and Meinunger, 1983). As the light curve of V417 Aql was covered incompletely, the new period should be regarded as a first approach. When no new period is given, the O-C's do not exceed a few percent of the period, with exception of SS Com, and, to a minor degree, V859 Cyg, V344 Lac, and BK Vul. The minima were determined according to the Pogson and tracing paper methods.

Object	JD Min.	Phase	Rev. Period
EP And	2445221.583	II	
	5224.610	I	
V417 Aql	2445225.35	?	$0^{d}.3377$
TU Boo	5055.449	?	
	5055.612	?	
WZ Cep	4989.326	II	
	4989.534	I	
SS Com	5026.532	I	
	5027.563	II	
V700 Cyg	5163.4793	II	0.290626
	5207.5095	I	
	5209.5435	I	

Object	JD Min.	Phase	Rev. Period
V859 Cyg	5203.544	II	
EX Del	5166.528	II	0.3309882
V502 Her	5081.423	I	0.3692768
DF Hya	5021.3400	II	0.3302005
	5021.5060	I	
V344 Lac	5222.3680	II	
	5222.5635	I	
XZ Leo	5025.358	I	
	5025.595	II	
CE Leo	5044.5495	II	
	5047.4325	I	
RT LMi	4988.3555	II	0.3749180
	5002.4147	I	
NY Lyr	5169.5100	I	
PY Lyr	5119.418	I	
V396 Mon	5022.476	II	
V508 Oph	5078.5785	II	
	5082.5430	I	
AW Vir	5002.645	II	
	5022.6450	I	
BD-6°4068	5095.387	II	0.419757
BK Vul	5211.4060	II	

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References:

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2345

Konkoly Observatory
Budapest
2 June 1983

HU ISSN 0374-0676

THE PHOTOMETRIC BEHAVIOUR OF DR TAURI IN THE SEASON 1982/83

In supplementing and completing the known light curves in B (Götz, 1980, 1982) the star was inspected on 12 blue-sensitive sky patrol plates of Sonneberg Observatory (observer H. Huth) covering the time interval between 1982 August 22 and 1983 March 13. Besides, 26 plates in B (ORWO-ZU 21 + GG 13 + BG 12) from 25 nights between 1982 August 22 and 1983 March 13 were obtained with the 50/70 cm Schmidt camera of Sonneberg Observatory. On these plates the star was measured on the base of the given sequence of comparison stars (Götz, 1982).

All but one of the sky patrol plates are nearly congruent in date with the plates of the Schmidt telescope. Therefore the Schmidt plates were preferred in constructing the light curve which is shown in Figure 1. There the dots represent measurements on Schmidt plates and the open circle the only estimation on sky patrol plates which is not congruent in date. As in the light curve of the season 1981/82 (Götz, 1982) magnitudes estimated on objective prism plates are marked by crosses in Figure 1.

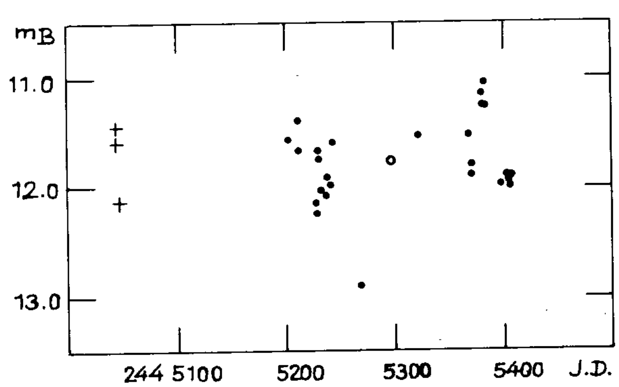

Figure 1

When comparing the given light curve with those obtained in former years we find that DR Tauri obviously has retained its mean brightness. There is only one weak light depression ($m_B = 12\overset{m}{.}90$) which was starting from the bright normal light. But this statement does not contradict the expressed expectation, that the amplitude of the star became smaller in the last seasons.

More details about the behaviour of DR Tauri will be published in MVS.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2346

Konkoly Observatory
Budapest
6 June 1983

HU ISSN 0374-0676

NEW MINIMUM TIMES OF THE W UMa SYSTEM RW Dor

The variability of the W UMa system RW Dor (HV 2435 = HDE 269320) was discovered by Miss Leavitt (1908) on plates taken on the Large Magellanic Cloud. The first classification was made by Miss Cannon (1921), who found a spectral type of K5. However, from our photometric observations we have found (B-V) = 0.84, which is in agreement with Eggen (1960) who measured (B-V)=0.81 indicating that the star is considerably earlier. This fact was recently corroborated by Bidelman and Sanduleak (1982) who estimated the star to be a late type G dwarf on a low dispersion (580 A/mm at Hγ) objective-prism plate.

Photographic minima were published by Hertzsprung in 1928. More recently we published (1981) eight times of minimum obtained from 500 UBV observations. The observations were carried out with the 154-cm reflector at the Bosque Alegre Station of Córdoba Observatory. A conventional photometer with RCA 1P21 photomultiplier refrigerated with dry ice was used. These observations were supplemented by latter ones made with the same instrument and telescope above. A total of 880 observations in each pass-band have been obtained and fifteen new times of minimum were derived.

The colour-averages of the photoelectric times of minimum are listed in Table I (mean errors are in parenthesis) together with the photographic minima published by Hertzsprung (1928). A linear least squares ephemeris using all available photoelectric times of minimum light gives,

$$\text{Min I} = \text{J.D. Hel. } 2444695.10270 + 0.28546371 \cdot E$$
$$\pm 0.00018 \pm 0.00000021$$

while, including the photographic minima, the least squares ephemeris gives,

$$\text{Min I} = \text{J.D. Hel. } 2430938.60167 + 0.2854638109 \cdot E$$
$$\pm 0.00042 \pm 0.0000000086$$

Table I

Min	Colour	J.D. Hel (2400000+)	E	(O-C)	(O-C)'	Remarks
II	Pg	11298.8350	-68799.5	0.0008		1
II	Pg	14168.8830	-58745.5	-0.0044		1
II	Pg	15621.9010	-53655.5	0.0028		1
II	Pg	16013.8360	-52282.5	-0.0040		1
II	Pg	16489.7140	-50615.5	0.0058		1
I	Pg	17075.9030	-48562.0	-0.0051		1
I	Pg	23784.6000	-25061.0	0.0069		1
I	Pg	24172.5370	-23702.0	-0.0014		1
II	BV	44313.5813	46853.5	0.0009	0.0008	2
II	BV	44464.8764	47383.5	0.0002	0.0002	2
I	UBV	44581.7728	47793.0	-0.0008	-0.0008	2
I	UBV	44608.6063	47887.0	-0.0009	-0.0009	2
II	UBV	44608.7488	47887.5	-0.0011	-0.0011	2
II	UBV	44609.6063	47890.5	-0.0001	0.0000	2
I	UBV	44609.7493	47891.0	0.0003	0.0002	2
II	UBV	44610.7487	47894.5	0.0006	0.0005	2
I	UBV	44825.8462(8)	48648.0	0.0011	0.0011	3
II	UBV	44826.8442(4)	48651.5	-0.0001	0.0000	3
I	UBV	44873.8038(6)	48816.0	0.0007	0.0008	3
I	UBV	44874.6594(3)	48819.0	-0.0001	0.0000	3
II	UBV	44874.8010(4)	48819.5	-0.0012	-0.0011	3
I	UBV	44958.5851(4)	49113.0	-0.0007	-0.0006	3
II	UBV	44961.5843(6)	49123.5	0.0011	0.0012	3
I	UBV	44961.7239(6)	49124.0	-0.0020	-0.0019	3
I	UBV	44962.5815(7)	49127.0	-0.0008	-0.0007	3
II	UBV	44962.7267(5)	49127.5	0.0017	0.0018	3
I	UBV	45021.6738(3)	49334.0	0.0005	0.0006	3
II	UBV	45049.5058(6)	49431.5	-0.0002	-0.0001	3
I	UBV	45049.6486(8)	49432.0	-0.0002	0.0000	3
II	UBV	45050.6484(3)	49435.5	0.0005	0.0006	3
I	UBV	45076.4815(4)	49526.0	-0.0009	-0.0007	3

Remarks: 1. Hertzsprung (1928), 2. Marton, Grieco (1981), 3. Present observations.

The cycles E and residuals of these elements are listed in columns (4) and (5) of Table I, while residuals (O-C)' in column (6).

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2347

Konkoly Observatory
Budapest
7 June 1983

HU ISSN 0374-0676

CHANGES IN THE LIGHT CURVE OF W UMa

New photometric observations of W UMa were carried out on three nights of February 16, March 12, March 13, 1983. The observations were made at the Ostrowik Station of the Warsaw University Observatory. A single channel photometer with an EMI 6256 photomultiplier attached to the 60 cm reflector was used. The comparison star was BD +56°1399 and BD +56°1398 served as a check star. The comparison star was the same as used most often in previous investigations of W UMa. The faint visual companion ADS 7494B (V=12^m.3, B-V=1^m.7, Eggen, 1963), about 7" from W UMa was included in all measurements of the variable. The observations were made in V and B and were reduced to the standard UBV system. 560 individual observations in V and 559 in B were obtained. Times of minima obtained from these data with the Kwee and Van Woerden (1959) method are given in Table I.

Table I

J.D. Hel 24 40000+	Colour	E	O-C
5382.55723 6	V	1187.5	-0.0004
5382.55688 5	B	1187.5	-0.0007
5406.41124 11	V	1259	-0.0016
5406.41162 15	B	1259	-0.0012
5407.41197 12	V	1262	-0.0017
5407.41279 9	B	1262	-0.0009
5407.58019 12	V	1262.5	-0.0003
5407.57971	B	1262.5	-0.0008

The O-C values in the Table are calculated with the ephemeris (Hamzaoğlu et al. 1982):

$$\text{Min I} = \text{J.D. Hel.}\,244\ 4986.3624 + 0^d.33363808E$$

One can see that the O–C deviations for the secondary minimum are slightly smaller than those for the primary one.

There are no large differences between the light curves obtained on different nights. Therefore all individual observations were phased with the ephemeris:

$$\text{Min I} = \text{J.D. Hel. } 244\ 5382.5567 + 0.^{d}33363808E$$

and the normal points were calculated. They are presented in Figure 1.

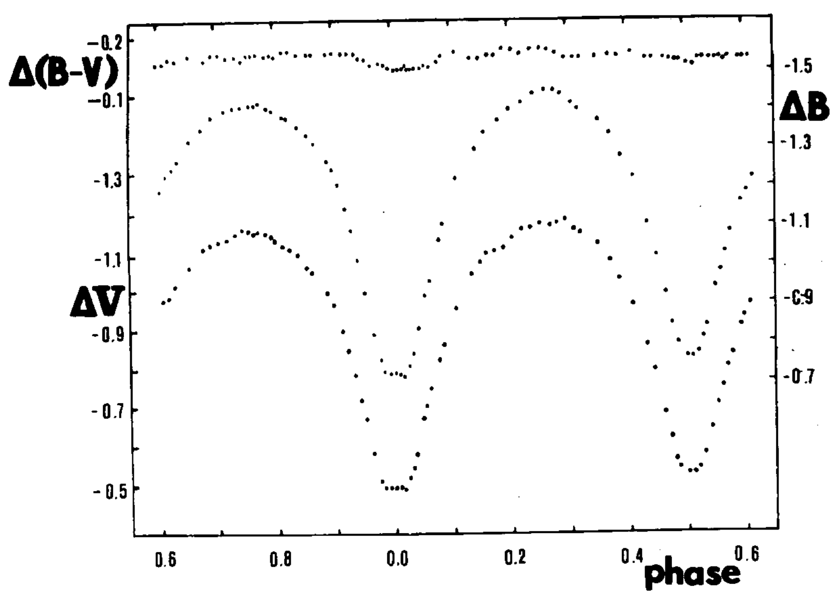

Figure 1

The light and colour curves of W UMa made in 1983

It is well known that the light curve of W UMa is variable in the time scale from weeks to years. This behaviour is not unique among W UMa-type systems. Basing on the available publications I have collected 12 V light curves of W UMa obtained between 1965 and 1983.

Unfortunately direct intercomparison between them was impossible because some observations were left in the instrumental systems. To investigate the seasonal changes in the light curve of W UMa four parameters were chosen (three of them are linearly independent). Denoting the stellar magnitudes at the primary and secondary minima as Min I and Min II, respectively, and the stellar magnitudes at the maxima following the primary and secondary minima

as Max I and Max II, respectively, we can define the parameters:
d1 = MinI - MinII, d2 = MinI - MaxI, d3 = MinII - MaxII, d4 = MaxI - MaxII.
These parameters calculated from 12 light curves are displayed in Figure 2.

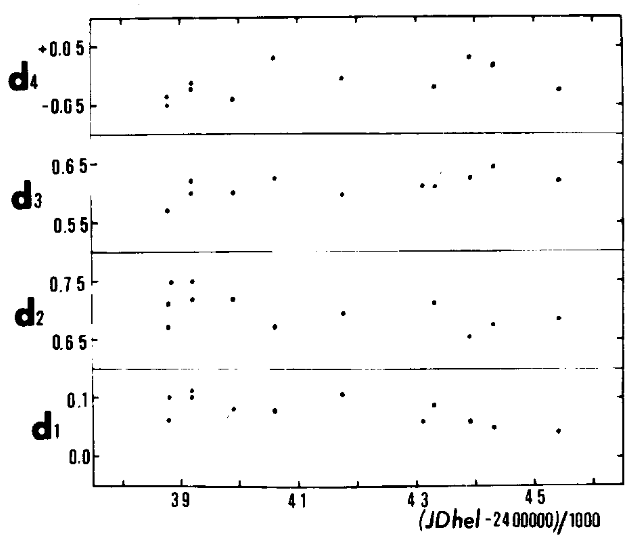

Figure 2

The changes of the parameters describing the light curve of W UMa in the last 17 years.

The observations were taken from the following sources:

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10. Rigterink, P.V., 1972, Astron. J., 77,230
11. present observations

The mean errors of the points in Figure 2 are in the range $0^{m}.003$-$0^{m}.02$. From the inspection of Figure 2 we may conclude:

1. The depth difference d1 between minima can change within at least $0^{m}.08$ and it has some tendency for decreasing during the last 17 years. The primary minimum is always deeper than the secondary one.
2. The amplitude of d2 is about three times greater than the amplitude of d3.
3. The asymmetry of the maxima d4 changes within $0^{m}.07$. Usually the Max I is higher than the Max II.

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References:

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2348

Konkoly Observatory
Budapest
9 June 1983

HU ISSN 0374-0676

VARIABILITY OF THE HOTTER COMPONENT OF THE
ECLIPSING BINARY MM CASSIOPEIAE

The eclipsing binary MM Cas (α_{1980} = $0^h53^m.4$ and δ_{1980} = +54°20'.5) was observed photoelectrically during 13 nights from December 1980 to September 1982 with the 104 cm telescope of the Uttar Pradesh State Observatory to obtain the full UBV light curves. The telescope was equipped with a refrigerated EMI 6094S photomultiplier and standard UBV filters. The light curve obtained in V filter is given in Figure 1, the phases have been computed according to the ephemeris:

$$\text{Min J.D. (Hel)} = 2444581.227 + 1^d.1584704\ E$$

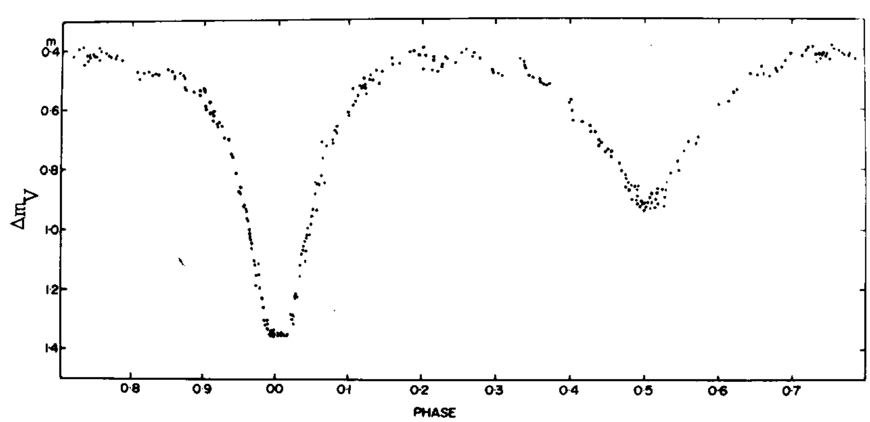

Figure 1

The V light curve of MM Cas

and the magnitude differences are referred to an anonymous star (α_{1980} = $0^h53^m.6$, δ_{1980} = +54°20'.6).

Figure 1 shows the presence of brightness fluctuations of amplitude $0^m.08$

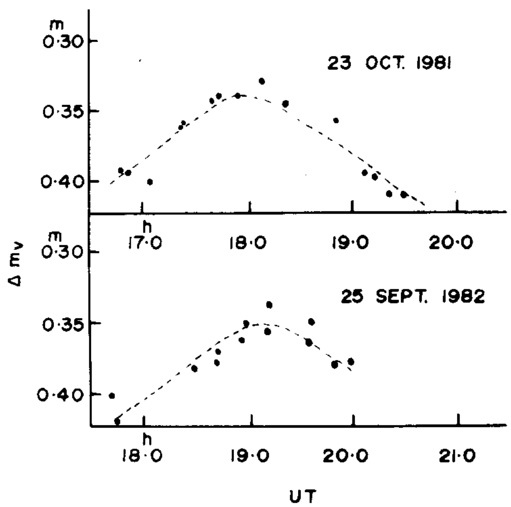

Figure 2

A representation of the light curve of MM Cas between the phases $0^{p}.15$ and $0^{p}.35$ in V filter. Note that the light curve is nearly sinusoidal.

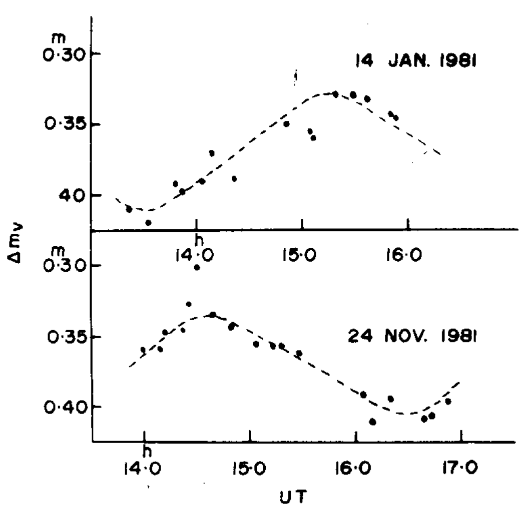

Figure 3

Same as Figure 2, but for between the phases $0^{p}.65$ and $0^{p}.85$.

and period $3^h40^m.0 \pm 1^m$. These brightness fluctuations seem to be enhanced during the secondary minima and disappear during the central phase of primary minima. This behaviour is usually expected in the case of an intrinsic variability of the hotter component which is totally eclipsed during the primary minima. The fragments of the observed light curve between the orbital phases from $0^P.15$ to $0^P.35$ and from $0^P.65$ to $0^P.85$ of the MM Cas in V filter are given, respectively, in Figure 2 and Figure 3. These observed photometric patterns and the spectral type of the primary component given by Wood et al., (1980) in light of the characteristics of Delta Scuti Stars (Breger, 1979 and Frolov, 1975) lead us to conjecture that the hotter component of MM Cas may be a Delta Scuti variable.

We would like to express our thanks to Drs. C.D. Kandpal, J.B. Srivastava, T.D. Padalia and S.K. Gupta for their helpful discussions and valuable remarks.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2349

Konkoly Observatory
Budapest
13 June 1983

HU ISSN 0374-0676

UNUSUAL BEHAVIOUR OF THE RECURRENT NOVA T CrB

Our observations of T CrB were accomplished on the 48 cm telescope of the Byurakan Astrophysical Observatory during nine nights in March-June 1982 and one night in January 1983. The aim of these observations was to detect possible flares, expected (Palmer and Africano, 1982) about the phase 0.2 of the orbital period (Kraft, 1958). The star has been monitored in the u band. Since 02.04.1982 differential photometry in the ubv bands was accomplished as well. BD+26°2761 served as comparison star. The stars BD+26°2756 and BD+26°2763 were used as control stars.

The results of monitoring are given in Table I, where: φ is the orbital

Table I

Date	φ	A	t(min)	σ_T	σ_{BD}	T(min)
04.03.1982	0.06	$0^m.40$	4.9	$0^m.090$	$0^m.010$	64
13.03	0.10	0.65	4.4	0.146	0.023	77
15.03	0.11	0.49	5.9	0.085	0.032	94
30.03	0.17	0.41	4.9	0.069	0.026	81
02.04	0.19	0.63	4.9	0.122	0.025	189
08.06	0.48	-	-	0.048	0.045	117
19.06	0.53	-	-	0.058	0.069	63
29.06	0.57	-	-	0.072	0.076	34
25.01.1983	0.50	-	-	0.066	0.072	20

phase , A - the maximum amplitude of ultra-violet light variation during the night, t - average time interval between light maxima, σ_T - standard deviation of T CrB, σ_{BD} - standard deviation of the comparison star BD+26°2761, T - the duration of each night's observation.

One can see from Table I that since 8 June 1982 the observed (see as well Walker, 1956, Bianchini and Middleditch, 1976) ultra-violet light variation of T CrB has stopped. The standard deviation of T CrB (σ_T) has decreased and become equal to the corresponding value (σ_{BD}) of the comparison star.

The results of differential photometry (Table II) presented in Figure 1, show that the brightness of T CrB decreased in all the observed bands (ubv) at the same time when the ultra-violet light variations stopped.

Table II

Date	Δu	Δb	Δv
04.03.1982	$-0^m.46$	-	-
13.03	-0.96	-	-
15.03	-0.22	-	-
30.03	-0.89	-	-
02.04	-0.70	$0^m.17$	$0^m.06$
08.06	0.11	0.75	-
15.06	0.23	0.73	0.53
19.06	0.05	0.71	0.55
29.06	0.06	0.72	0.49
25.01.1983	-0.59	0.40	0.28

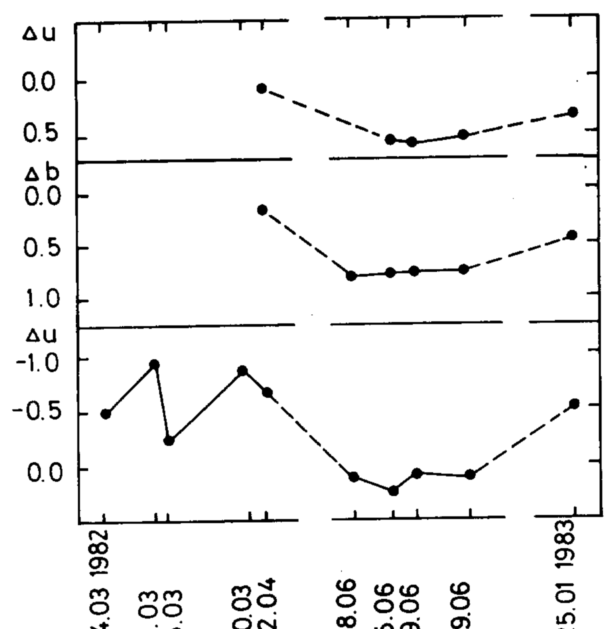

Figure 1

The average brightness decrease in different bands was: $\Delta u = 0^m.70$, $\Delta b = 0^m.56$, $\Delta v = 0^m.47$. That means that the star has reddened. The observation of T CrB in 1983 showed that the brightness had somewhat increased, yet had not reached its original value. The average increase of brightness in ubv bands was: $\Delta u = 0\overset{m}{.}70$, $\Delta b = 0\overset{m}{.}33$, $\Delta v = 0\overset{m}{.}24$. The star had become bluer. The ultra-violet light variation was not observable.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2350

Konkoly Observatory
Budapest
13 June 1983

HU ISSN 0374-0676

LINEAR POLARIZATION OF THE Be STAR 66 Oph

Eighteen wide-band (B) filter linear polarization measurements of the B2 Ve star 66 Oph were carried out over 1981 August - 1982 September. The prime purpose of this Bulletin is to compare ground-based polarimetry with IUE Satellite ultraviolet spectroscopy carried out (intermittently) in years 1981 and 1982.

All the observations being reported here were made at the Cassegrain focus of the 61 cm telescope at Columbia University's Harriman Observatory. The same filter, and

Table I

Polarization Amount and Position Angle of 66 Oph

Date (UT)			P (%)	θ (deg.)
1981	Aug.	27.07	1.28	95.6
1981	Sep.	21.02	1.26	95.6
1981	Sep.	30.04	1.28	95.2
1981	Oct.	21.03	1.30	96.5
1981	Nov.	04.98	1.29	96.1
1982	Mar.	23.36	1.24	93.6
1982	Mar.	24.36	1.25	94.9
1982	Mar.	29.33	1.26	95.2
1982	Apr.	22.24	1.27	93.4
1982	Apr.	23.23	1.22	93.2
1982	Apr.	25.24	1.28	96.4
1982	Apr.	29.23	1.22	94.0
1982	May	15.15	1.27	96.2
1982	Jun.	15.17	1.25	95.7
1982	Aug.	16.11	1.20	95.7
1982	Aug.	20.07	1.17	94.8
1982	Aug.	22.09	1.16	91.8
1982	Sep.	10.07	1.27	96.4

essentially the same polarimeter, ancillary equipment and observing procedures were used as in previous surveys of this type carried out by the author (Hayes 1978, 1980). The interested reader may consult these references for further details regarding instrumentation and observing procedures. The polarization measurements are tabulated in Table I, with P denoting the amount (expressed as a percentage), and θ denoting the direction (expressed in the equatorial coordinate system). Each measurement had a Poisson photon-count standard deviation of 0.02% for P as well as for the two Stokes parameters $Q = P \cos 2\theta$ and $U = P \sin 2\theta$. The standard deviation of θ is given by $28\overset{\circ}{.}7$ (σ_p/P). Observations were only carried out when the moonlight background was negligible.

Comparison was made with previously cited values of this star's blue-wavelength linear polarization. Twelve values were culled from the following publications: Coyne (1976), Hall (1958), Mathewson and Ford (1970), Poeckert (1975), Poeckert, Bastien, and Landstreet (1979), and Serkowski, Mathewson and Ford (1975). The magnitudes of the polarization vectors being reported here were almost invariably larger than those previously chronicled (which run the gamut from 0.97% to 1.19%). Previous reports of polarization vector orientations ranged between 92° and 97° - values consistent with those being reported here. The main results of this intercomparison is that in a historical context the Table I polarization magnitudes are strong and their orientations are consistent with previous observations. This data gives tentative evidence for collinearity when plotted in the Q - U Stokes parameter frame (the scatter of points about the least-squares straight line fit to the data has a standard deviation of 0.027%). If collinearity were upheld by further observations it would indicate an axisymmetric distribution of scatterers (vide Hayes 1980). The wide range of errors quoted by other observers precludes applying the same stringent collinearity test to all the available data.

A series of χ^2-tests [consult Hayes (1980) for details] were carried out to gauge the variability of the consolidated distribution of Q and U data points being reported here. A test of all 18 observations yielded overwhelming evidence for variability (at the >99% confidence level). In addition to previously cited evidence for long-term variations, Serkowski et al. (1975) detected significant polarization changes in a pair of observations made on consecutive nights.

Comparison will now be made with some pertinent ultraviolet data. Peters (1982) reported that some of the resonance lines in five observations of 66 Oph made over the interval 1981 July 9 - November 12 displayed relatively narrow,-250 km s^{-1} velocity absorption features. These narrow features appeared to show variability (admittedly of nonepic proportions) over that interval. During that time the polarization was relatively strong and invariant (variability at only the 50% confidence level). In a brief abstract Sonneborn (1982) reported complex, variable velocity structure in some of this star's resonance lines over the interval 1982 September 8 - October 21. Polarimetry carried at about this time (the last four observations of Table I) evince overwhelming evidence for variability (at the >99% confidence level). The foregoing intercomparisons do not appear to be clear-cut, and may even be somewhat contradictory. The data indicates some evidence for (relatively small-scale) ultraviolet variations, but statistically significant polarization changes occur at about the time when Sonneborn reported variations in the structure of some of this star's resonance lines. The same contradictory state of affairs appears to hold for the Be star ω Ori (manuscript in preparation). The lack of a large intercomparison data base precludes making any definitive statement at this time regarding the relationship (if any) between optical polarization and ultraviolet spectroscopy in 66 Oph. Only further observations will permit a definitive conclusion.

The main results of this work may be summarized as follows. Historically, the polarization of 66 Oph was fairly strong over the course of this observing interval. Intercomparison of polarization and ultraviolet spectral features failed to uncover any consistent relationship (or, for that matter, any consistent antirelationship). The polarization was quite strong but invariant over an interval when there were some indications of changes in ultraviolet line features. But at another epoch both the polarization and ultraviolet spectra evinced changes.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2351

Konkoly Observatory
Budapest
15 June 1983

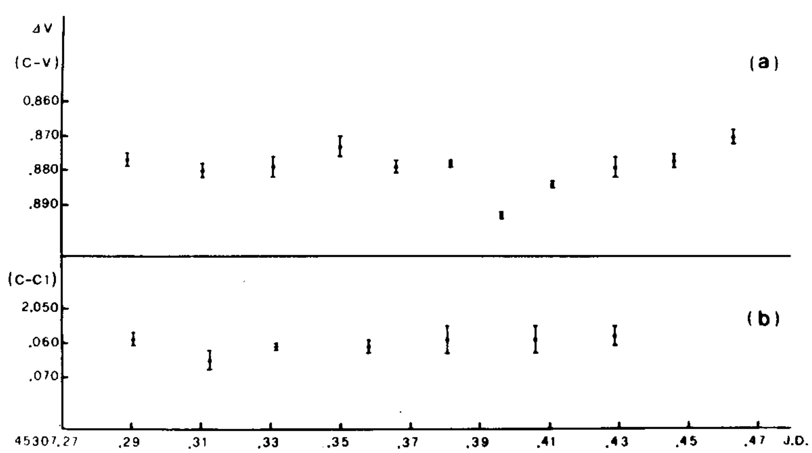
HU ISSN 0374-0676

HD 7119: A PROBABLE NEW PULSATING DELTA DELPHINI STAR

The mutual exclusion between pulsation and metallicity for A and F main sequence stars seems to be well established. For the giant domain (class IV and III) the scenario is more complex: the relation between metallicity and pulsation is depending on the temperature, in the sense that the evolved Am stars, in the blue side, do not show any photometric variability (Garrido, 1980), while in the red side Kurtz (1979) finds a few variable Delta Delphini stars.

With the aim to throw light on this subject, we decided to perform an extensive photometric survey of Delta Del stars. The plan is to observe for at least two nights a sufficient number of objects included in the list of the sure Delta Del stars, kindly furnished by M. Jaschek, and to infer some statistical correlations as metallicity-pulsation, rotation-pulsation and so on.

In the framework of this research we found the probable variability of HD 7119.



We observed HD 7119, classified as Delta Del star by Cowley et al. (1965) and confirmed by M. Jaschek (1982), during JD 45307, in V color. (For instrumental equipment and the reduction procedure, see Bossi et al. 1970). Comparison and check stars were HD 7615 and HD 7745 A.

Figure 1a,b shows the comparison minus variable (c-v) and the comparison minus check (c-c1) light curves, respectively. Each point is the mean of about six individual observations and the bars represent two standard errors.

The understanding of the pulsational characteristics of HD 7119 requests much more study.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2352

Konkoly Observatory
Budapest
15 June 1983

HU ISSN 0374-0676

NEW FLARE STARS IN THE NGC 7000 - REGION

In the period from September to November 1980 we continued the systematic search for flare stars in the NGC 7000 - region.

The observations were made with the 40 in. Schmidt-telescope of Byurakan Astrophysical Observatory on ORWO ZU-21 plates with 2 mm Schott UG-1 filter. In these observations the time of exposition was 10 min. The effective coverage of the observations was about 56 hours and the method of observations was the common one of multiple and equal exposure of 10 minutes.

In Table I the data for four new flares are given.

Table I

No.	α (1950.0)	δ (1950.0)	$M_{u(min)}$	ΔU	Date
B51	$20^h59^m.5$	$41^\circ45'$	$16^m.5$	$1^m.3$	03.09.1980
B52	20 49.9	43 26	19.0	4.7	03.09.1980
T1	21 00.7	42 08	17.8	4.3	04.09.1980
B19	20 41.0	41 11	16.0	1.2	29.10.1980

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2353

Konkoly Observatory
Budapest
17 June 1983

HU ISSN 0374-0676

BIBLIOGRAPHIC CATALOGUE OF VARIABLE STARS

At the Centre de Données Stellaires (Observatoire de Strasbourg, France) (CDS) the Bibliographic Catalogue of Variable Stars (BCVS) is being built up. Its contents is based on the card index of all known variable stars which has been maintained at the Sternwarte Sonnenberg of the Zentralinstitut für Astrophysik, DDR, since the late forties under the supervision of H. Huth. The first part of the BCVS is now complete. For all variable stars with final designation it comprises references of the literature available since the completion of H. Schneller's and R. Prager's "Geschichte und Literatur des Lichtwechsels der Veränderlichen Sterne" (History and bibliography of the light-variations of variable stars) (with proper overlapping). A detailed description of the project is to be found in Bull. d' Inf. du CDS No. 20, p.105. We intend to supplement the BCVS at regular intervals. A similar catalogue is planned for all not-named variables (second part of the BCVS). The BCVS or specially selected samples can be ordered at the CDS on the conditions outlined in Bull. d' Inf. du CDS No. 23,p.131.

For the socialist currency area the

Zentralinstitut für Astrophysik-Rechenzentrum
(Central Institute for Astrophysics-Computing Centre)
DDR - 1502 Potsdam-Babelsberg
Rosa-Luxemburg-Straße 17a

acts as a sub-centre of the CDS and is in the position to provide data from this catalogue and other catalogues of the CDS without hard currency charges. We appeal to all interested workers in the field of variable stars to send preprints and/or reprints of their papers to

Sternwarte (Observatory)
Bibliothek (Library)
DDR-6400 Sonneberg

to guarantee the proper inclusion of the respective title in the BCVS.

W. WENZEL

Sternwarte Sonneberg des Zentralinstituts für
Astrophysik der Akademie der Wissenschaften der
DDR

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2354

Konkoly Observatory
Budapest
20 June 1983

HU ISSN 0374-0676

A NEW ULTRA-SHORT PERIOD DWARF NOVA: SW URSAE MAJORIS

The orbital period of the dwarf nova SW UMa has been determined from radial velocity variations of the Hα emission line. The observations were obtained on 1982 Dec 27, and 1983 Feb 11-13 UT using the Mt. Lemmon 1.5-m reflector equipped with a Robinson-Wampler Image Dissector Scanner (Robinson and Wampler 1972). The radial velocities of the emission lines were measured using the method described in Shafter (1983). The resulting measurements yield the following ephemeris for the time of superior conjunction of the source of the broad Hα emission (i.e. the accretion disk surrounding the white dwarf):

$$T = \mathrm{HJD}\ 2445376.8601 + 0.0567433\ E.$$
$$\qquad\qquad \pm.0008 \qquad \pm.0000025$$

The orbital period of 0.0567433 days is the second shortest of any known dwarf nova. The dwarf nova WZ Sge has an orbital period which is ~ 5 seconds shorter (Robinson, Nather, and Patterson 1978).

In addition to the similarity of their orbital periods, SW UMa and WZ Sge have several other properties in common. For example, the amplitude of the radial velocity variation, K_1, is 47 ± 4 km s^{-1} for SW UMa as compared to the upper limit of 38 km s^{-1} for WZ Sge obtained by Krzeminski and Kraft (1964). The relatively low value of K_1 for both of these systems is certainly not a result of low orbital inclination because, as is well known, WZ Sge is an eclipsing system while, in the case of SW UMa, the emission lines are quite broad (FWHM ≅ 1300 km s^{-1}) and there appears to be an ~ 30% modulation in the light curve with the orbital period indicating that $i > 40°$ (Szkody 1983, private communication). Consequently, it appears that SW UMa like WZ Sge has a relatively large mass ratio, $q(=m_1/m_2)$.

In addition to their mass ratios, the outburst characteristics of the two stars appear to be somewhat similar. WZ Sge errupts every 32 years (Patterson et al. 1981) and, although the mean outburst period of SW UMa is not well known, it is probably also quite long (Glasby 1970). Finally, low dispersion spectra of SW UMa reveal broad Balmer absorptions at Hβ and Hγ.

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

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Budapest
20 June 1983

HU ISSN 0374-0676

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Such absorptions are also seen in other ultra-short period dwarf novae for example T Leo (Shafter and Szkody 1983) and WZ Sge (Krzeminski and Kraft 1964).

T Leo and WZ Sge are probably SU UMa type dwarf novae (Shafter and Szkody 1983; Patterson et al. 1981). In view of the similarity of SW UMa to these two systems, it would not be surprising if SW UMa turned out to be a SU UMa system as well. With this possibility in mind, amateur astronomers are encouraged to monitor SW UMa in order to firmly establish its detailed outburst behavior.

This work has been partially supported by NSF grant AST 80-19745 to Roger K. Ulrich.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2355

Konkoly Observatory
Budapest
20 June 1983

HU ISSN 0374-0676

EMISSION LINE INTENSITY VARIATIONS DURING THE 1982 ECLIPSE OF CI CYGNI

The observations of the last 1982 eclipse of the symbiotic star CI Cyg were carried out with the Canadian Copernicus Spectrograph attached to the 90 cm Schmidt-Cassegrain telescope of Toruń Observatory. The spectrograph has a Richardson image slicer of 3.5 arcsec aperture. 29 spectra of this star with a dispersion of about 160 Åmm^{-1} in the blue spectral range (λ3400 - λ5100 Å) have been obtained during the period August 1981 - April 1983. All the spectra have been taken on Kodak IIa-0 preflashed plates.

Spectra have been converted to the intensity scale by means of the automatic reduction system "Antares" (Turło et al., 1983) with the output on paper tape, using a calibration obtained with a spot sensitometer. The spectral response of the spectrograph and the atmospheric extinction have been corrected by using the mean coefficients obtained from the observations of the standard star α Lyr. The spectra of CI Cyg have been de-reddened with E_{B-V} = 0.45 (Mikołajewska, Mikołajewski 1980, 1983).

The spectra are typical for the quiet phase of a symbiotic star. The most prominent emission lines are the Balmer series of HII, HeII 4686, [NeV] 3426 and [OIII] 5007, [OIII] 4363, [NeIII] 3869. Some other emission lines are also present, for example NIII 4641, HeI 4026, 4471 and 4921, OIII 3450 and 3760, and the permitted and forbidden lines of ionized iron. The strongest TiO absorption bands 4955, 4804 and 4761 have been also identified.

During the 1982 eclipse the strong emission line flux variations have been detected, similar to those observed during the 1980 eclipse (Mikołajewska, Mikołajewski 1982, 1983, Oliversen, Anderson 1982). Figure 1 presents the observed variations in the relative intensities of Balmer H-beta and H-gamma, HeII 4686, HeI 4471 and NIII 4641 lines. The forbidden [OIII] 5007 and 4363, [NeIII] 3869 and [NeV] 3426 lines have not shown eclipse effects and have been constant within the observational errors (11% for [OIII] and 18% for [NeIII] 3869 and [NeV] 3426). Figure 2 presents the intensities of the forbidden [OIII] 4363 line in relation to the sum of depths of TiO bands heads

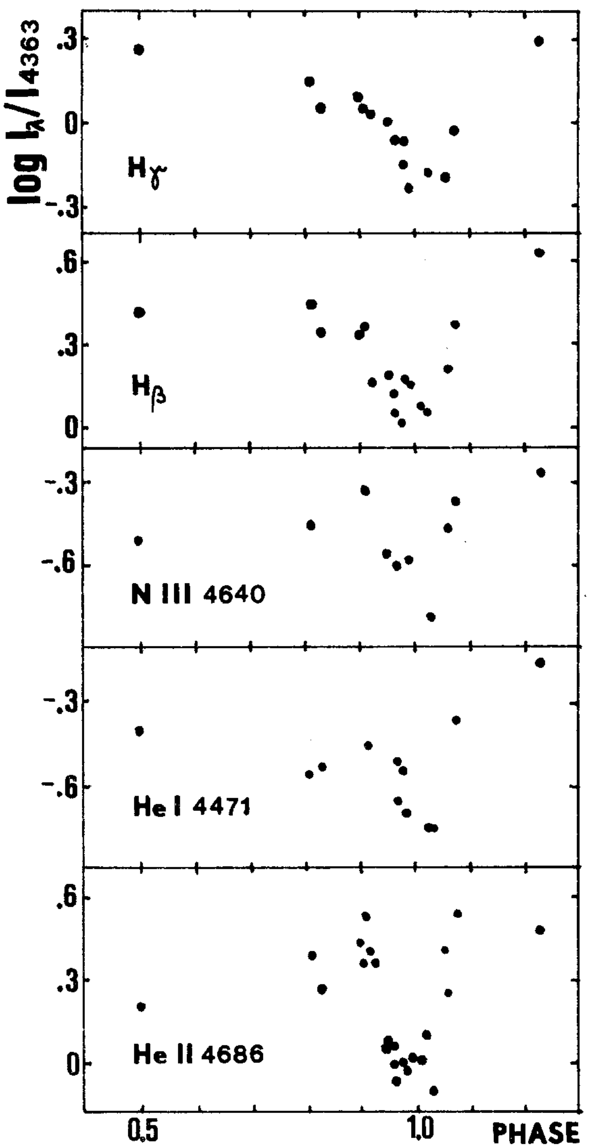

Figure 1

Changes of relative emission line intensities. Phases have been calculated from the ephemeris (Mikołajewska and Mikołajewski 1983):
JD Min = 2 444 396 + 855.25·E

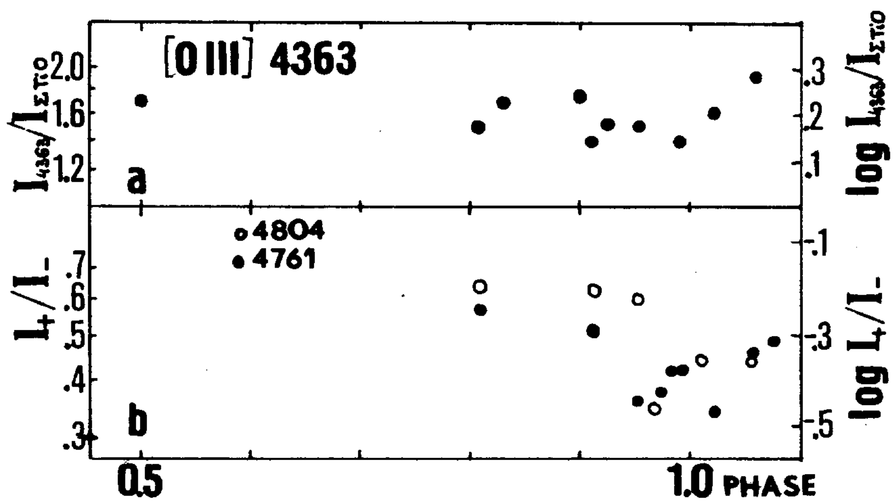

Figure 2

(a) Intensities of [OIII] 4363 emission line in relation to the sum of the depths of TiO bands. (b) Changes of relative depths of TiO 4804 and 4761 bands.

4955, 4804 and 4761. The differences $I_\lambda^- - I_\lambda^+$ have been adopted as the depths of the TiO bands.

The 1982 eclipse in HeII 4686 seems to be slightly shallower and broader than those observed in 1980. Assuming the inclination angle of the orbit near 90^o we have:

$$(R_{cool} + R_E)/\pi a = D/P$$

$$(R_{cool} - R_E)/\pi a = d/P$$

where D is the total duration of the eclipse and d - the duration of the total eclipse. Adopting a period $P = 855\overset{d}{.}25$ the relative sizes of the eclipsing star $R_{cool}/a = 0.366$ and the HeII 4686 emission region $R_E/a = 0.146$ have been calculated. The radius of the cool eclipsing star agrees well with the results obtained from the V photometry during the 1980 eclipse (R_{cool}/a=0.371, Mikołajewska and Mikołajewski, 1983). The HeII 4686 emission region is larger than in 1980 (R_E/a = 0.117). There are no significant changes in the shape of the 1980 and 1982 eclipses in the Balmer H-beta and H-gamma lines.

Figure 3 shows the secular variations in HeII 4686 and H-beta and H-gamma lines. HeII 4686 has been showing a strong increase of intensity since 1977.

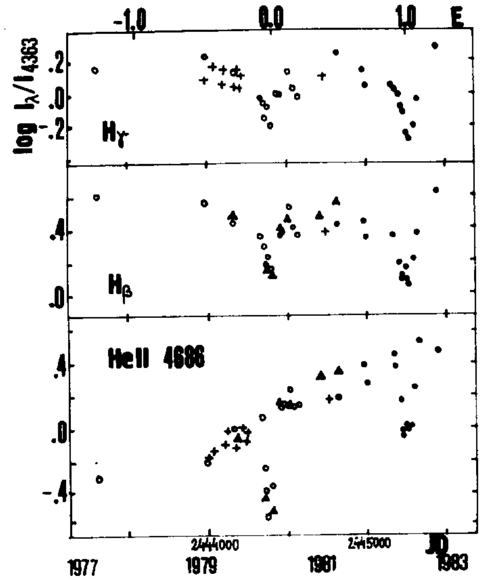

Figure 3

Secular variations of HeII 4686 and Balmer H-beta and H-gamma emission lines. Crosses mark observations of Iijima (1981, 1982), triangles - those of Oliversen and Anderson (1982), open circles - those of Mikołajewska and Mikołajewski (1983) and points - present paper.

The H-beta and H-gamma intensities seem to be constant during the same period.

The more detailed analysis of the obtained results will be published elsewhere.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2356

Konkoly Observatory
Budapest
20 June 1983

HU ISSN 0374-0676

DUST CLOUD IN THE CI CYGNI SYSTEM

CI Cyg is a well known eclipsing symbiotic star with $P = 855^d$ (for references see Kenyon et al. 1982). This paper reports differences in the behaviour of the emission lines HeII λ1640 (Balmer α) and HeII λ4686 (Paschen α) during the 1980 eclipse. The variation of the line ratio of these lines led us to the conclusion that a cloud of dust particles, responsible for the far UV extinction, must be situated in the system.

An interpretation of the spectrophotometric observations of CI Cyg during the 1980 eclipse (Mikołajewska and Mikołajewski, 1983) suggests the presence of a partially eclipsed ionized gas cloud with $T_e \approx 3\cdot10^4$K and $n_e > 10^6$ and a fully eclipsed source radiating like a blackbody with a temperature of about 4000K. The eclipsing body is the M4III-II star filling its critical Roche lobe. The evaluated large inclination of the orbit ($i > 86^o$) denotes that the observed blackbody radiation originates in the edge of a disc with a radius of about 75 $R_\odot$. The results cited above support qualitatively the model of CI Cyg given by Bath and Pringle (1982).

I U E observations have shown eclipses in the intercombination lines, in HeII 1640 and in the hydrogen Balmer continuum λ3000Å. In the optical region eclipses are visible in the hydrogen Balmer lines, HeI 4471 and in HeII 4686. Eclipses in the UV (λ < 2000 Å) are approximately twice as long as those observed in the optical lines and in the Balmer continuum. This phenomenon is illustrated in Figure 1a for HeII 1640 and HeII 4686. Moreover, the eclipse in HeII 4686 is about twice as deep as in HeII 1640. It is easily seen that the I and IV contacts in λ4686 are very close to the II and III contacts in λ1640. The flux ratio of these lines varies with phase (Figure 1b), and is close to the theoretical value ("case B" recombination value of $R = f_\lambda 1640/f_\lambda 4686 \simeq 6.85$) at the mid-eclipse only the nebular component is visible. At other phases HeII 1640 seems to be apparently fainter than predicted. As both these lines should be created in the same region, we cannot explain this phenomenon in terms of optical depths, in the optically thick case the amplitude should be greater for HeII 1640.

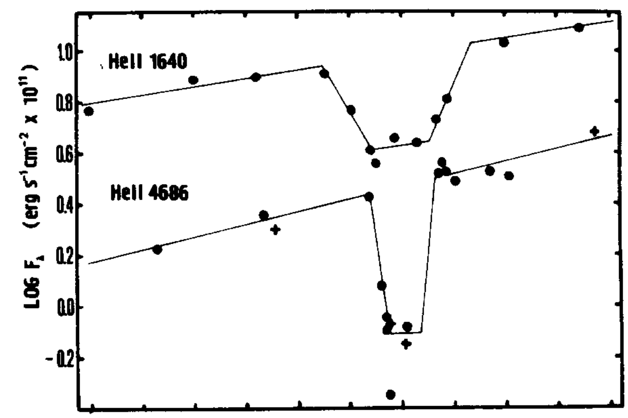

Figure 1a

The eclipses in HeII 1640 (Stencel et al. 1982) and HeII 4686. Fluxes are dereddened with E_{B-V} = 0.45 (Mikołajewska, Mikołajewski 1980). Crosses indicate observations of Oliversen and Anderson (1982).

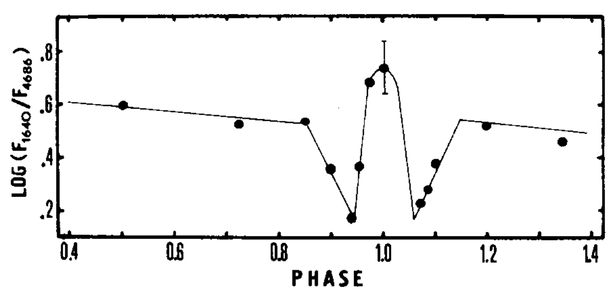

Figure 1b

Variations of the 1640/4686 ratio with phase. The additional eclipsing factor may be a dust cloud (see text and Figure 2).

Infrared observations show a strong excess in the N band 10 μm of CI Cyg (Taranova, Yudin 1979, 1981), this is usually attributed to dust grains. These grains may be responsible for the observed behaviour of the 1640/4686 ratio if they are small enough to be optically active only in the far UV range (λ < 2000 Å). The dust cloud should have such a location in the system as to provide the explanation of the longer "eclipses" in the far UV and the absence of extinction at the mid-eclipse. Most of the late-type luminous stars show the circumstellar 10 μm emission feature traditionally attributed to silicate dust particles (Woolf 1973. Gillet et al., 1968). This feature is also observed in some symbiotic stars: HM Sge (Puetter et al., 1978), CH Cyg (Bopp, 1981), V1016 Cyg (Aitken et al., 1980), R Aqr (Stein et al., 1969). It is interesting to mention that also in early type stars 10 μm silicate emissions are observed together with high circumstellar extinction in the $\lambda < 1800$ Å range (Sitko et al., 1981).

Our proposed model of CI Cyg assumes in addition to the components of the previous model the presence of small dust particles in the central parts of the nebula, near the disc, and between the two components. Low gravity and low temperature around the Lagrangian L_1 point may offer the best conditions for the grain formation, providing the strong anisotropy of grain ejection. On the other hand the estimated temperature of the disc boundary layer should be about 10^5K, so that in the vicinity of the disc, grains should evaporate. In this situation we may expect that the grain growth will be impossible and only small dust particles may exist. Probably condensation and evaporation processes coexist in a kind of equilibrium. The presence of a cloud of small dust particles in CI Cyg (Figure 2) explains qualitatively the observed phenomena.

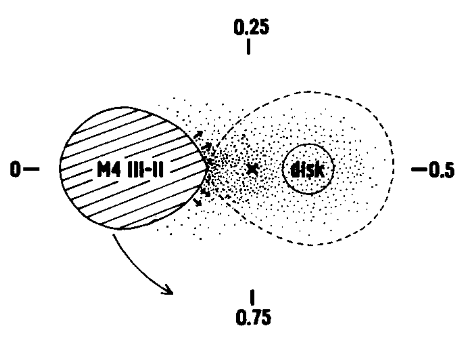

Figure 2

The schematic model of CI Cyg. The shaded region represents the anticipated dust cloud. Arrows indicate the region of dust formation. The stream of matter from L_1 to disc is not indicated. The earlier UV eclipses are caused by the increasing optical depth of the dust on the line of sight. The anomaly of the 1640/4686 ratio disappears when the cloud is eclipsed by the cool component. The mass ratio q = 0.74 (Lijima, 1982).

It is also possible that dust grains are formed in the stream of matter escaping through the Lagrangian L_1 point. In the presence of sufficiently steep pressure gradient the temperature and pressure of the gas may be lowered in a short time. The estimated time in which the matter from L_1 point reaches the disc boundary is ~100 days - apparently long enough to allow dust grains to reach radii of the order of 10^{-7} cm or more. A similar phenomenon e.g. in dwarf novae is not possible as in this case the gas is transferred from L_1 point to the disc in the time of few hours.

The proposed model implies some variability in the N band of CI Cyg: close to the phase "zero" it should reach the minimum. IR spectra between 5 and 25 μm (e.g. using the IRAS satellite), may give us data of great importance.

The authors are very grateful to Professor B.E. Westerlund for careful reading of the manuscript and helpful suggestions.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2357

Konkoly Observatory
Budapest
22 June 1983

HU ISSN 0374-0676

PHOTOELECTRIC PHOTOMETRY OF UX ARIETIS

The non-eclipsing RS CVn binary UX Ari (HD 21242) was observed by us during 1976, 1982 and 1983 using the 38-cm Grubb refractor of the Nizamiah Observatory with an uncooled EMI 9502B photomultiplier, GR 1230A DC amplifier and Honeywell Brown strip-chart recorder. Standard Johnson B, V filters were used. 62 Ari and HR 999 were used as comparison and check stars, respectively.

Figure 1 gives the observed light curves in the instrumental yellow system.

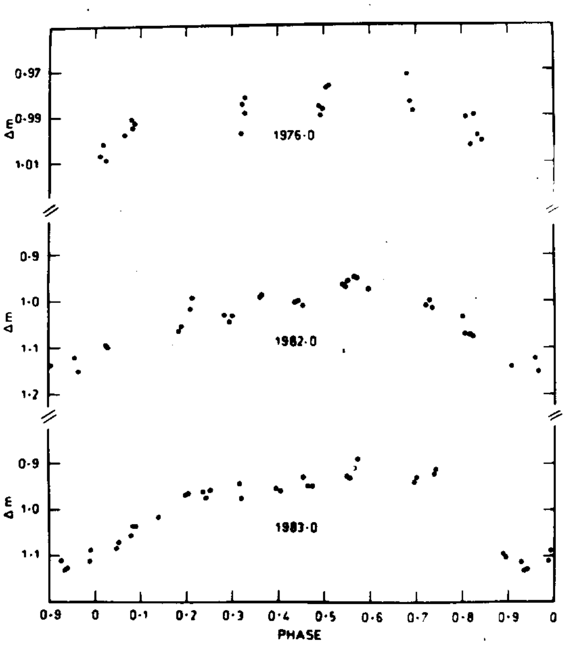

Figure 1

Plot of Δm (normal points) versus phase in instrumental yellow. The phases are calculated using the ephemeris HJD = 2440133.75 = $6^{d}.43791$ E

The phases were computed using the following ephemeris given by Landis et al. (1978):

$$\text{HJD} = 2440133.75 + 6\overset{d}{.}43791\ E$$

The individual observations (about 200) in each year were Fourier analysed with the equation

$$\ell = A_o + A_1 \cos\theta + A_2 \cos 2\theta + B_1 \sin\theta$$

The amplitude and the phase of minimum light (average of yellow and blue) for each year are given below:

Observing Epoch (year)	Phase	Amplitude (mag)
1976.0	0.0064	0.02
	± 0.004	± 0.003
1982.0	0.004	0.15
	± 0.002	± 0.004
1983.0	0.001	0.15
	± 0.002	± 0.004

Zeilik et al. (1982) have reported that their observations of this system during fall-winter of 1981 give a value of 0.97 as the minimum phase and an amplitude of $0\overset{m}{.}21$ in yellow.

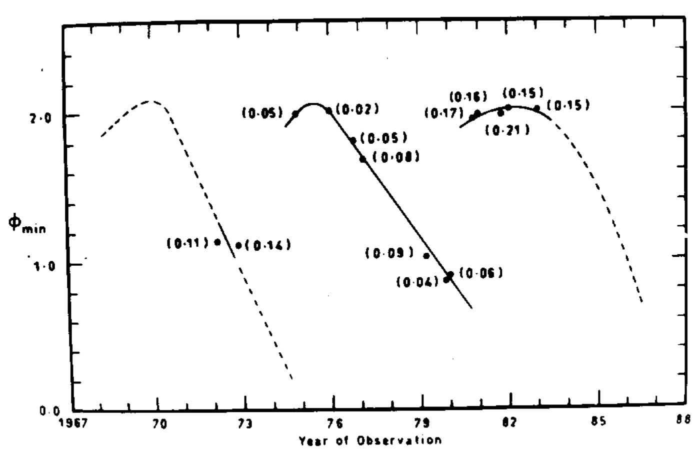

Figure 2

Plot of phase of light minimum versus year of observation. The bracketed number near each point indicates the amplitude of the wave during that year.

The phase and amplitude of the distortion wave in UX Ari has been reported to be undergoing an erratic behaviour during the past 10 years (Zeilik et al., 1982). Using the values of the epoch, phase of light minimum and amplitude published by Guinan et al. (1981), Zeilik et al. (1982) and our own values given above, a plot, the year of observation versus phase of light minimum, is shown in Figure 2. From this figure, it appears that the spot or spots on UX Ari which form first above the co-latitude, have a direct motion for sometime and then move in a retrograde direction after they migrate below the co-latitude and arrive near the star's equator. They disappear after sometime and a new spot cycle starts with the spots forming above the co-latitude again. We suggest a period of 5-6 years for one cycle. If this model is correct, the spots before 1975, between 1975-80 and 1981 onwards form three distinct cycles. There appears to be not much variation in the amplitude of a wave during a cycle suggesting that the nature of the spot or spots does not vary much in a cycle but differs from cycle to cycle.

We suggest that the behaviour of the distortion wave in UX Ari is not erratic but systematic. At present, the spot or spots seem to lie near the co-latitude and will migrate towards the equator thus leading to retrograde motion in the coming years. Further observations will shed more light on the above model.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2358

Konkoly Observatory
Budapest
23 June 1983

HU ISSN 0374-0676

PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR EV Lac IN 1982

Photoelectric observations of flare stars have been continued at the National Astronomical Observatory of the Bulgarian Academy of Sciences and the Stephanion Observatory, Greece. In this paper we report about joint observations of the flare star EV Lac in 1982.

At the National Astronomical Observatory the observations were made with the 60 cm Cassegrain telescope and the UBV one-channel photometer. A photon counting system with an integration time of 1 sec was used. Details of the photometric equipment at NAO are published by Panov et al. (1982).

The transformation of the instrumental ubv system at NAO to the international UBV system for the time under consideration is given by the equations:

$$\Delta V = \Delta v + 0.08\ \Delta(b-v)$$
$$\Delta(B-V) = 1.12\ \Delta(b-v)$$
$$\Delta(U-B) = 0.84\ \Delta(u-b)$$

At the Stephanion Observatory the observations were carried out with the 30-inch Cassegrain reflector of the Department of Geodesy and Surveying, University of Thessaloniki, and a Johnson dual channel photoelectric photometer. The transformation of the Stephanion ubv system to the international UBV system for the period under consideration is given by the equations:

$$V = v_o - 0.011(b-v)_o + 3.288$$
$$B-V = 0.597 + 1.010(b-v)_o$$
$$U-B = -1.899 + 1.031(u-b)_o$$

Table I contains, for each night, the monitoring intervals in UT, the colour in which observations were made, the number of flares observed, the standard deviation of random noise fluctuations in mag for those nights, in which no flare was observed, and the total monitoring time. Designation NAO or Steph.O. stands for the National Astronomical Observatory or Stephanion

Table I

Flare star EV Lac, 1982

Date	Monitoring intervals (UT)	Total monit. time	Number of flares	Colour	NAO/ Steph.O.
1982 Aug.					
19/20	$23^h51^m34^s - 23^h57^m30^s$,				
	23 58 41 -00 48 36 ,				
	00 49 25 -00 58 50 .	$1^h05^m16^s$	2	U	NAO
20/21	22 45 14 -00 20 18 ,				
	00 21 44 -00 38 15 ,				
	00 39 31 -00 51 35 ,				
	00 52 41 -01 05 41 ,				
	01 06 37 -01 33 56 ,				
	01 35 08 -01 49 51 ,				
	01 52 26 -01 58 01 .	3 04 16	3	U	NAO
Sep. 2/3	22 16 39 -22 43 02 ,				
	22 43 58 -23 30 26 ,		0		
	23 31 22 -01 09 24 .	2 50 53	σ=0.16	U	NAO
Oct. 8	20 11 12 -22 36 41 ,				
	22 37 53 -22 56 04 ,		0		
	22 57 16 -23 14 46 .	3 01 10	σ=0.05	U	NAO
23	19 14 00 -19 24 12 ,				
	19 32 22 -20 00 31 ,				
	20 02 24 -21 27 53 ,				
	21 31 00 -23 00 00 ,				
	23 02 36 -23 20 55 .	3 51 09	2	B	Steph.O.
24	19 15 34 -20 40 00 ,				
	20 41 24 -21 06 30 ,		0		
	21 10 30 -22 29 38 .	3 08 40	σ=0.02	B	Steph.O.
25	18 21 00 -18 44 14 ,				
	18 47 22 -20 19 43 ,				
	20 22 00 -21 12 30 .	2 46 05	1	B	Steph.O.
Nov. 8	19 11 09 -20 43 33 ,				
	20 44 40 -21 06 11 .	1 53 55	2	U	NAO
13	17 03 15 -17 11 56 ,				
	17 15 01 -18 57 24 ,				
	19 20 47 -20 03 29 .	2 33 46	2	U	NAO
	Total:	$24^h15^m10^s$			

Observatory, respectively.

During the total of $14^h29^m16^s$ monitoring time in "u" colour (NAO) 9 flares were observed. During the total of $9^h45^m54^s$ monitoring time in "b" colour (Steph.O.) 3 flares were observed. All observations of EV Lac (at NAO and Steph.O.) include also the optical companion.

The characteristics of the observed flares are given in Table II.

Table II

Characteristics of the flares observed

Flare No.	Date 1982	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	p min	Air mass
				N A O						
	August									
1	20^d	$0^h20^m16^s$	0.1	0.6	0.7	1.38	0.35	0.08	0.13	1.021
2	20	0 25 08	0.4	0.9	1.3	1.70	0.57	0.08	0.46	1.025
3	20	23 31 25	0.25	0.58	0.83	1.24	0.23	0.06	0.10	1.003
4	21	01 27 47	0.05	0.22	0.27	1.55	0.48	0.06	0.07	1.104
5	21	01 28 57	0.28	1.0	1.3	1.51	0.45	0.06	0.26	1.105
	November									
6	8	19 40 29	0.23	0.52	0.75	1.20	0.19	0.04	0.06	1.058
7	8	19 47 10	0.17	2.8	3.0	1.22	0.22	0.04	0.33	1.067
8	13	17 59 10	0.58	1.9	2.5	1.19	0.19	0.05	0.17	1.004
9	13	19 58 45	0.17	0.8	1.0	1.51	0.45	0.05	0.17	1.112
				Stephanion Observatory						
	October									
1	23	21 21 26	0.55	1.23	1.8	1.20	0.20	0.02	0.18	1.117
2	23	22 56 48	0.2	0.8	1.0	1.17	0.17	0.03	0.08	1.380
3	25	18 34 50	1.95	0.83	2.8	1.83	0.66	0.07	0.76	1.007

For each flare following characteristics (Andrews et al., 1969) are given:

a. the date and universal time of maximum,

b. the duration before and after maximum (t_b and t_a, respectively),

c. the total duration of the flare,

d. the value of the ratio I_f/I_o, corresponding to flare maximum, where I_f is the total intensity of the star plus flare less sky background, and I_o is the quiet state intensity less sky background,

e. the increase of star's brightness in magnitudes at flare maximum:

$$\Delta m = 2.5 \log(I_f/I_o)$$

f. the standard deviation of random noise fluctuations in mag:

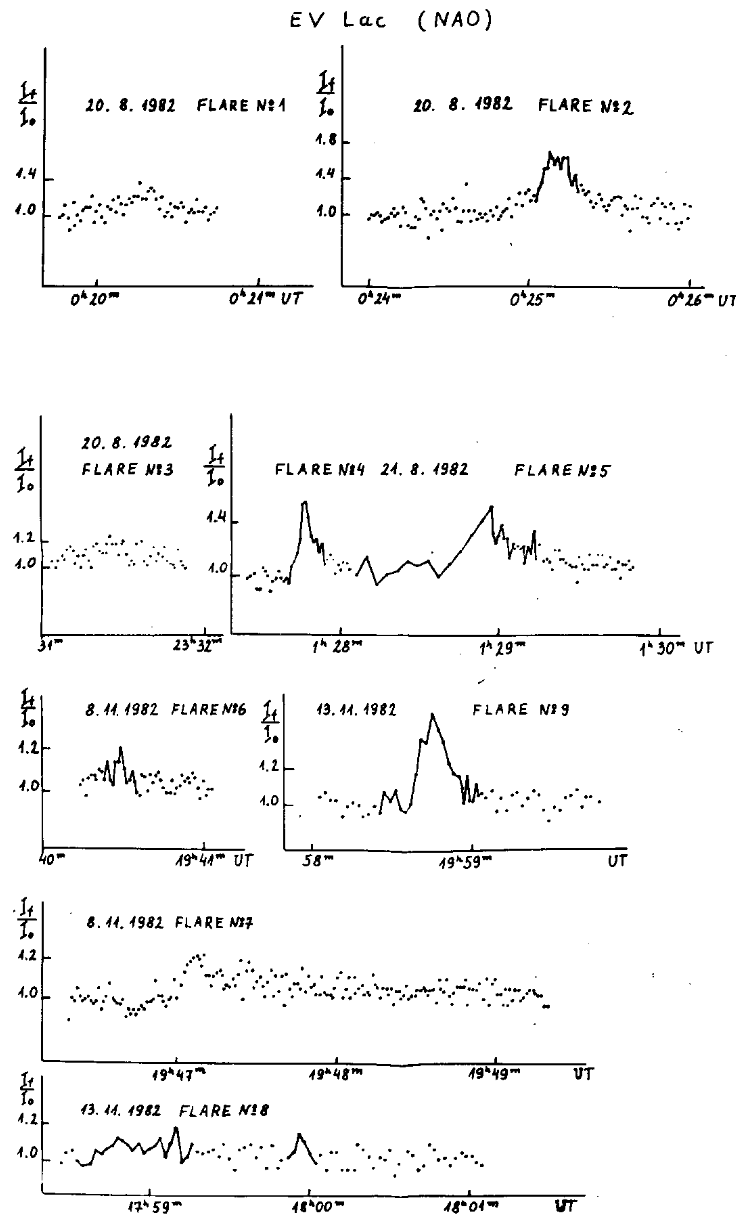
$$\sigma(\mathrm{mag}) = 2.5 \log \frac{I_o + \sigma}{I_o} ,$$

g. the integrated intensity of the flare over its total duration:

$$p = \int (I_f - I_o)/I_o \, dt ,$$

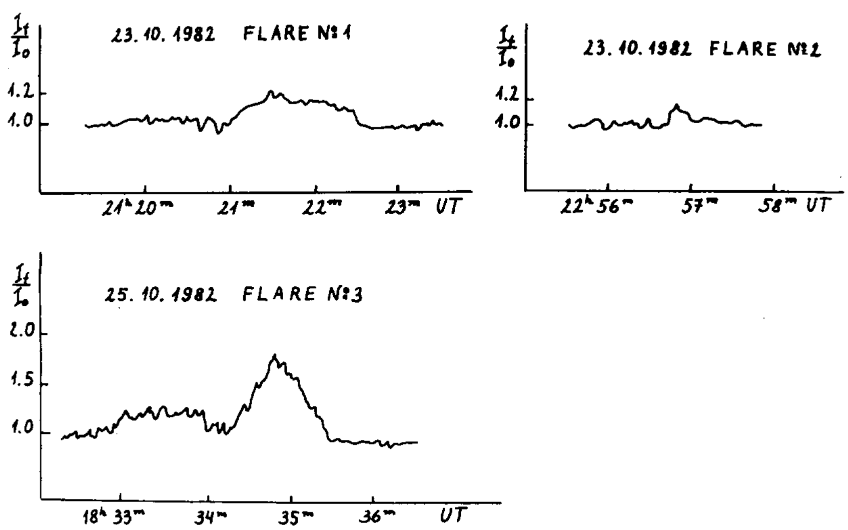
h. the air mass.

The light curves of the observed flares in colours "u" (NAO) and "b" (Steph.O.) are shown in Figures 1-12.



Figures 1 - 9

EV Lac (Steph. O.)



Figures 10 - 12

Acknowledgements

The observations reported in this paper are part of the joint research project under the title "Study of variable stars", carried out by the Department of Astronomy with National Astronomical Observatory, Bulgarian Academy of Sciences, and the Department of Geodesy and Surveying (former Department of Geodetic Astronomy), University of Thessaloniki, Greece. This project is part of the Program for Scientific and Technical Co-operation between Bulgaria and Greece. The authors would like to express their gratitude to the relevant authorities of the respective countries for their support.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2359

Konkoly Observatory
Budapest
23 June 1983

HU ISSN 0374-0676

PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR UV Cet IN 1982

Photoelectric observations of flare stars have been continued at the National Astronomical Observatory of the Bulgarian Academy of Sciences and the Stephanion Observatory, Greece. In this paper we report about our joint observations of the flare star UV Cet during the autumn of 1982.

The equipment used at the National Astronomical Observatory consists of a 60 cm Cassegrain reflector and a one-channel UBV photometer. A photon counting system with an integration time of 1 sec was used. Details of the photometric equipment at NAO are published by Panov et al. (1982). The transformation of the instrumental ubv system at NAO to the international UBV system for the time under consideration is given by the equations:

$$\Delta V = \Delta v + 0.08\ \Delta(b-v)$$
$$\Delta(B-V) = 1.12\ \Delta(b-v)$$
$$\Delta(U-B) = 0.84\ \Delta(u-b)$$

At the Stephanion Observatory the observations were carried out with the 30 inch Cassegrain reflector of the Department of Geodesy and Surveying, University of Thessaloniki, and a Johnson dual channel photoelectric photometer. The transformation of the Stephanion ubv system to the international UBV system for the period under consideration is given by the equations:

$$V = v_o - 0.011(b-v)_o + 3.288$$
$$B-V = 0.597 + 1.010(b-v)_o$$
$$U-B = -1.899 + 1.031(u-b)_o$$

Table I contains, for each night, the monitoring intervals in UT, the colour in which observations were made, the number of flares observed, the standard deviation of random noise fluctuations in mag. for those nights, in which no flare was observed and the total monitoring time. Designation NAO or Steph.O. stands for the National Astronomical Observatory or Stephanion Observatory, respectively.

Table I

Flare star UV Cet, 1982

Date	Monitoring intervals (UT)	Total monit.	Number of flares	Colour	NAO/ Steph.O.
1982 Oct.					
23/24	$23^h27^m34^s$-$00^h39^m38^s$,				
	00 42 55 -00 57 12 ,				
	00 59 05 -01 21 41 ,				
	01 22 43 -01 30 46 .	$1^h57^m00^s$	1	B	Steph.O.
24/25	22 41 07 -22 53 17 ,				
	22 54 24 -23 33 07 ,				
	23 35 30 -00 48 34 ,				
	00 51 17 -01 13 07 ,				
	01 15 26 -01 23 36 .	2 33 57	1	B	Steph.O.
Nov.					
10	21 27 03 -21 32 25 ,		0		
	21 35 13 -22 40 08 .	1 10 17	σ=0.45	U	NAO
11	20 37 08 -20 47 18 ,				
	20 47 46 -20 52 39 ,				
	20 53 38 -21 17 32 ,				
	21 18 07 -21 47 58 ,				
	21 48 50 -21 55 51 ,				
	21 56 36 -22 22 19 ,				
	22 22 56 -22 29 18 ,				
	22 30 29 -22 58 12 ,				
	22 59 03 -23 04 56 .	2 21 30	1	U	NAO
12	20 27 20 -22 38 20 ,				
	22 39 56 -23 03 40 .	2 34 44	3	U	NAO
13	20 20 13 -20 47 55 ,				
	20 48 34 -20 55 46 ,				
	20 57 15 -21 37 48 ,				
	21 38 46 -21 49 49 ,				
	21 52 05 -22 25 00 ,				
	22 26 04 -22 43 17.	2 15 16	4	U	NAO
	Total:	$12^h52^m44^s$			

During the total of $8^h21^m47^s$ monitoring time in "u" colour (NAO) 8 flares were observed. During the total of $4^h30^m57^s$ monitoring time in "b" colour (Steph.O.) 2 flares were observed. The characteristics of the observed flares are given in Table II. For each flare following characteristics (Andrews et al., 1969) are given:

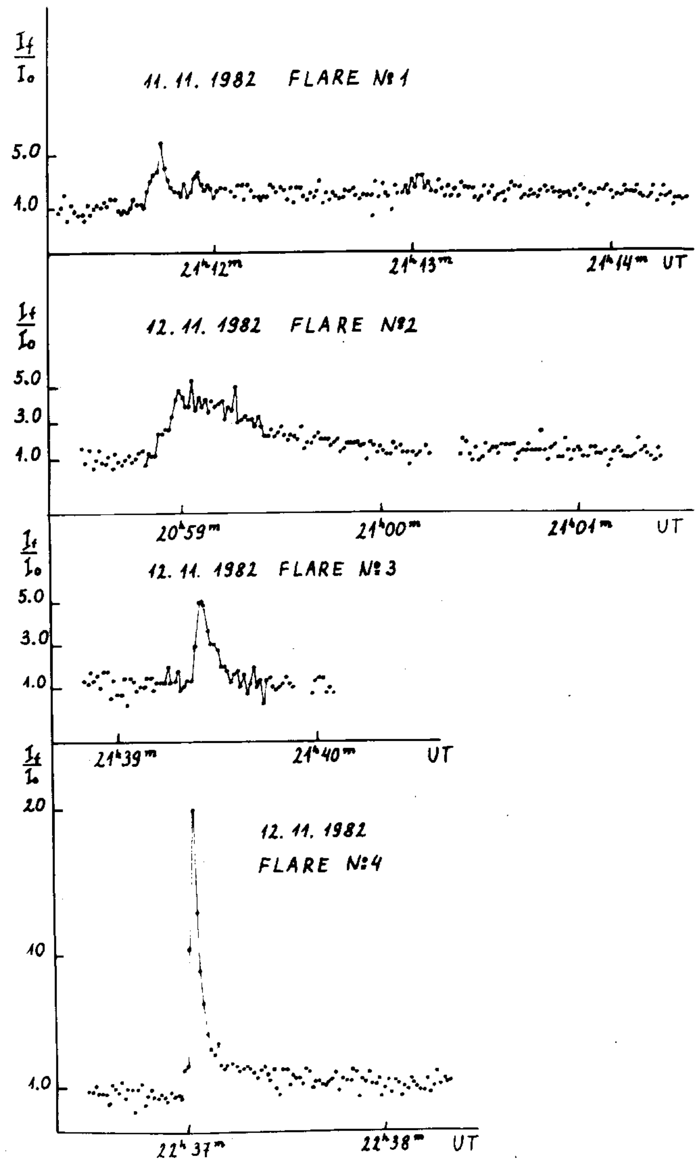
a. the date and universal time of maximum,

b. the duration before and after maximum (t_b and t_a, respectively),

c. the total duration of the flare,

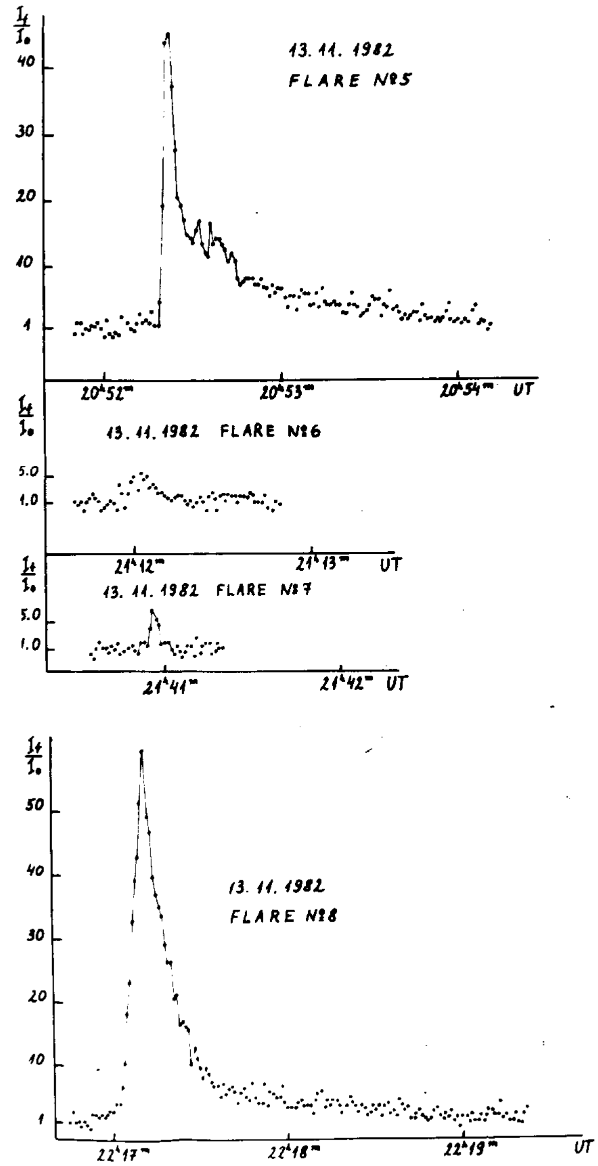
d. the value of the ratio I_f/I_o, corresponding to flare maximum, where I_f is the total intensity of the star plus flare less sky background, and I_o is

UV Cet (NAO)

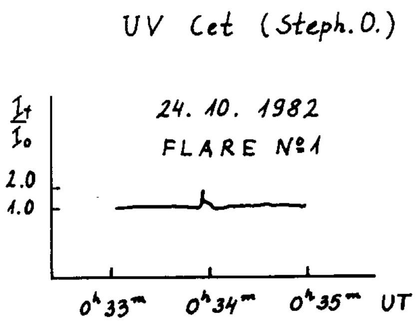


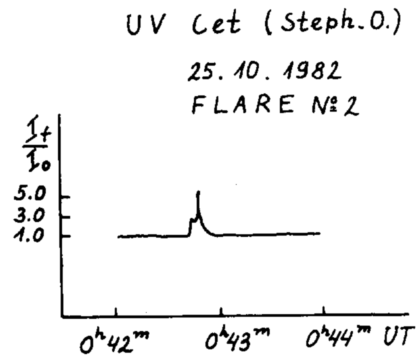
Figures 1 - 4

UV Cet (NAO)



Figures 5 - 8





Figures 9–10

Table II

Characteristics of the flares observed

Flare No.	Date 1982	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	P min	Air mass
	October, Stephanion Observatory									
1	24^d	$0^h33^m55^s$	0.02	0.2	0.2	1.73	0.59	0.2	0.07	2.563
2	25	0 42 50	0.12	0.3	0.4	5.40	1.83	0.36	0.88	2.760
	November,			NAO						
1	11^d	$21^h11^m44^s$	0.07	3.3	3.4	5.98	1.94	0.44	3.6	2.032
2	12	20 59 03	0.22	5.0	5.2	5.35	1.82	0.41	4.5	2.015
3	12	21 39 25	0.05	0.25	0.3	5.0	1.75	0.38	0.7	2.122
4	12	22 37 02	0.07	2.0	2.1	19.87	3.25	0.51	3.0	2.510
5	13	20 52 22	0.07	2.6	2.7	44.83	4.13	0.63	16.9	2.011
6	13	21 12 02	0.12	1.0	1.1	5.48	1.85	0.63	2.3	2.048
7	13	21 40 56	0.03	0.4	0.4	6.78	2.08	0.63	0.5	2.145
8	13	22 17 11	0.3	3.8	4.1	59.77	4.44	0.67	21.1	2.367

the quiet state intensity less sky background,

e. the increase of star's brightness in magnitudes at flare maximum

$$\Delta m = 2.5 \log(I_f/I_o)$$

f. the standard deviation of random noise fluctuations in mag

$$\sigma(\text{mag}) = 2.5 \log\left(\frac{I_o + \sigma}{I_o}\right),$$

g. the integrated intensity of the flare over its total duration

$$p = \int (I_f - I_o)/I_o \, dt \ ,$$

h. the air mass.

The light curves of the observed flares in colours "u" (NAO) and "b" (Steph.O.) are shown in Figures 1-10.

The observations reported in this paper are part of the joint research project under the title "Study of variable stars", carried out by the Department of Astronomy with National Astronomical Observatory, Bulgarian Academy of Sciences, and the Department of Geodesy and Surveying (former Department of Geodetic Astronomy), University of Thessaloniki, Greece. This project is part of the Program for Scientific and Technical Cc-operation between Bulgaria and Greece. The authors would like to express their gratitude to the relevant authorities of the respective countries for their support.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2360

Konkoly Observatory
Budapest
27 June 1983

HU ISSN 0374-0676

ONCE AGAIN: NGC 2346 - NO "ECLIPSES" BEFORE 1982

The central star of the planetary nebula NGC 2346 has been much observed and discussed in the last time because of its drastic light variations occur-

Table I

Date		J.D. minus 2440000	m_{pg}
1981 Jan.	23	4628.304	$11^m.3$
	26	4631.369	11.3
	28	4633.398	11.4
	29	4634.391	11.4
	30	4635.378	11.3
	31	4636.400	11.3
Feb,	1	4637.378	11.0
	1	4637.422	10.9
	2	4638.379	11.0
	26	4662.349	11.1
March	27	4691.345	11.4
	29	4693.327	11.1
Apr.	1	4696.333	11.0
	6	4701.326	11.1
	7	4702.326	11.1
Dec.	28	4967.430	11.1
1982 Jan.	14	4984.349	11.3
	15	4985.368	11.3
Feb.	19	5020.334	11.2
	20	5021.349	11.5
	21	5022.362	12.5
March	15	5044.348	12.4
	16	5045.327	12.6
	19	5048.254	11.7
	23	5052.308	11.8
	24	5053.317	12.3
	27	5056.347	fainter than 13.3 (comp. star e)
Apr.	22	5082.350	11.1
Sep.	25	5238.615	12.7
Oct.	25	5268.547	13.0
1983 Feb.	18	5384.310	fainter than 13.3
	18	5384.346	fainter than 13.3
March	3	5397.344	fainter than 13.3
	9	5403.323	12.9
	12	5406.344	fainter than 13.3
	13	5407.347	fainter than 13.3

ing since 1982. In I.B.V.S. No. 2281 Schaefer reports on the search for early eclipses on old photographic plates of Harvard College Observatory, with negative results.

I repeated this sort of examination on a much larger number of Sonneberg Sky Patrol plates and checked the star on 680 exposures taken between 1928 and 1983. The brightness of the comparison stars were taken from Kohoutek (I.B.V.S. No. 2113). My observations confirm the findings of Schaefer: The star does not show large variability before 1982.

Only rather small, obviously irregular, changes in brightness with an amplitude below 1 mag are observed around a mean magnitude of about $11\overset{m}{.}1$ pg.

The determination of the brightness was, of course, disturbed by the surrounding planetary nebula. Therefore the mean arror is ± 0.3 mag and may be even larger for magnitudes below $12\overset{m}{.}0$.

Table I gives a sample of my observations on our plates.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2361

Konkoly Observatory
Budapest
27 June 1983

HU ISSN 0374-0676

PERIOD CHANGE OF THE RR LYRAE STAR XZ CYGNI

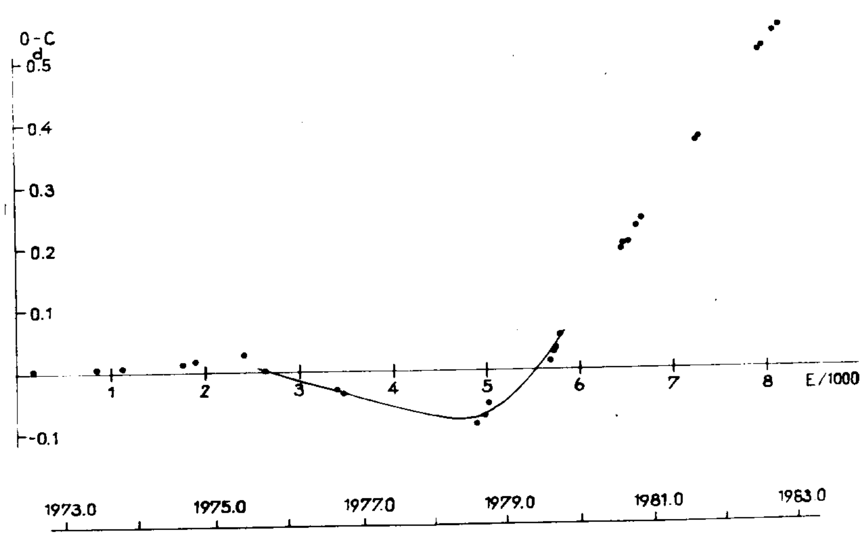
From my series of regular visual and photographic observations of XZ Cyg (see for instance Mitt. Veränd. Sterne Sonneberg 9,p. 82) I derived the O-C diagram given in the figure. It is based on the elements of the main table of Suppl. 3 (1976) to the GCVS:

$$C = 244\ 1453.3856 + 0\overset{d}{.}4664731 \cdot E.$$

A rather strong increase of the period around 1978 was noted already by Taylor (AAVSO Journal 8,p.1; 1979). From my observations the new period of

$$0\overset{d}{.}4666909$$

can be found for the time after 1979.6. This period seems to have been stable for three years at least. In the figure the dots represent data of well ob-



served maxima; the curved line shows the trend of Taylor's observations (l.c.), properly reduced.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2362

Konkoly Observatory
Budapest
30 June 1983
HU ISSN 1374-0676

ON THE VARIABILITY OF THE CENTRAL STAR OF THE PLANETARY NEBULA NGC 1514

The central star of the planetary nebula NGC 1514 (PK 165 - 15.1) is much too luminous relative to the nebula. The spectral type is too late considering the high excitation in the nebula. These facts and the observed UV excess (Kohoutek 1967; Kohoutek and Hekela 1967; Liller and Shao 1968) suggest the presence of a much hotter second component. Also the idea that these two stars form a physical pair is generally accepted, some doubt remains because of partly contradictory radial velocity observations (Kohoutek 1968; Mammano et al. 1968; Greenstein 1972; Acker 1976).

The number of published photometric measurements is small. Some of the observers have suggested variability. Kohoutek (1966) derived a longterm brightness increase of about $-0^{m}.005$/year. Arkhipova (1968) found no variations larger than $\pm 0^{m}.01$ in V and B and $\pm 0^{m}.025$ in U during some observing runs ranging from 10 minutes up to several hours. Lawrence et al. (1967) suspect periodic oscillations of 138 and 855 sec.

During 31 nights covering the period between January 1982 and March 1983 we collected about 350 V measurements of this object with the single-channel photoelectric photometer attached to the 24 inch RC telescope of the L.Figl Observatory. An aperture of 20 arcsec was used, this limited the nebular contribution to less than 1% of the total light and was therefore ignored. Each V magnitude per night consisted of the average of 5 to 6 15 sec integrations. During a few nights the star was monitored continously for a few hours to look for short-term variations.

Table I gives the identification of the observed stars.

Table I

Object	BD	SAO	V	B - V	Sp
Central Star of NGC 1514	$+30^{o}$ 623	057020	9.42+)	0.55+)	K0
Comparison Star	+30 621	057017	8.41	0.87	K0
Check Star	+30 624	057021	8.19	1.46	

+) Data from Liller and Shao

The mean of all measurements is

$$\Delta V \text{ (central star - comparison star)} = 1^{m}.0131 \pm 0.0045 \text{ st.d.}$$
$$\Delta V \text{ (comparison star - check star)} = 0^{m}.2260 \pm 0.0039 \text{ st.d.}$$

These two standard deviations for single measurements are practically identical suggesting constancy of the central star during the observed period.

We checked for short-term variability by analysing the longest run of 5 hours applying Fourier methods. The program used has been described by Breger (1982). Practically the power spectrum is flat. The highest peak of $0^{m}.0017$ amplitude with a frequency of 154 sec is not regarded as significant. The oscillations of 138 and 855 sec as suggested by Lawrence et al. could not be found in our data.

We want to thank M. Breger for valuable help concerning his program.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2363

Konkoly Observatory
Budapest
30 June 1983

HU ISSN 0374-0676

OBSERVATIONS OF AT Cnc IN THE YEARS 1982 AND 1983

The star which is probably of cataclysmic type (Meinunger, 1981) was inspected on 18 blue-sensitive plates (ORWO-ZU 21 + GG13 + BG12) obtained with the Schmidt camera 50/70/172 cm of Sonneberg Observatory covering the time intervals between 1982 April 14 and April 26 and 1983 February 15 and March 13. These observations are listed in Table I. The light curve of the star which shows variations over the whole amplitude between $m_B = 12^m.6$ and $m_B = 15^m.9$ is given in Figure 1.

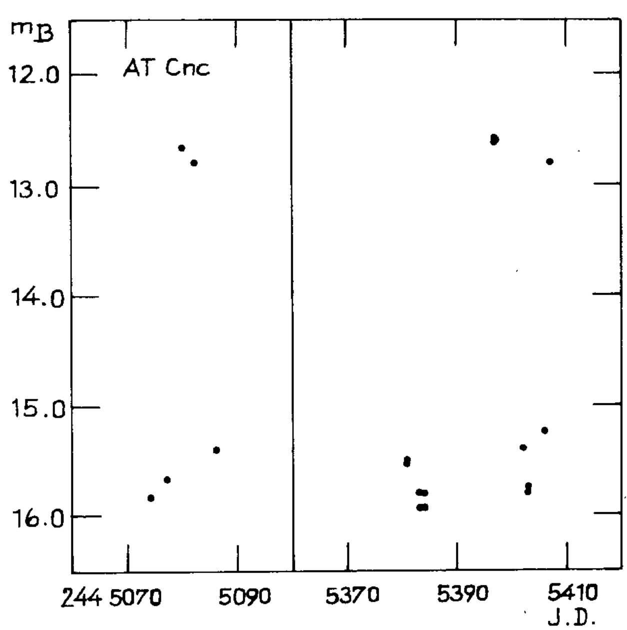

Figure 1

Table I

J.D. 244....	m_B	J.D. 244....	m_B
5074.352	15.83	5384.421	15.80
5077.363	15.67	5384.475	15.93
5080.351	12.66	5397.338	12.59
5082.356	12.79	5397.365	12.59
5086.352	15.39	5402.404	15.39
5381.407	15.53	5403.380	15.80
5381.436	15.53	5403.408	15.74
5383.392	15.93	5406.333	15.25
5383.531	15.80	5407.331	12.79

The used sequence of comparison stars in B is shown in the finding chart of Figure 2.

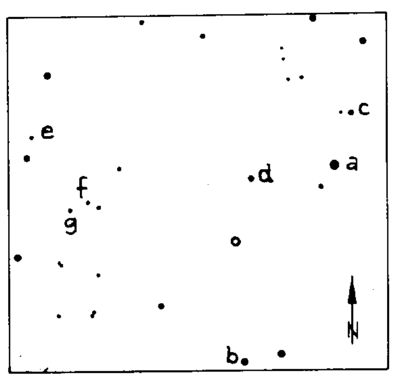

Figure 2

Table II

Comp. star	m_B	Comp. star	m_B
a	12.25	e	14.97
b	12.93	f	15.67
c	13.62	g	16.45
d	14.30		

The magnitudes of these stars which include those given by Romano and Perissinotto (Romano, Perissinotto, 1968) were obtained on 2 plates by linking to the UBV sequence of the Praesepe cluster and are given in Table II.

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Romano, G., Perissinotto, M., 1968, Padova Publ. 151,p.9

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2364

Konkoly Observatory
Budapest
30 June 1983

HU ISSN 0374-0676

THE LIGHT CURVE OF KR AURIGAE IN THE SEASON 1982/83

In linking to the sequence of comparison stars given by M. Popova (Popova, 1965) the star was measured on 19 blue-sensitive plates (ORWO-ZU 21 + GG13 + BG12) obtained with the Schmidt camera 50/70/172 cm of Sonneberg Observatory.

Table I

J.D. 244....	m_B	J.D. 244....	m_B
5228.572	$14^{m}.40$	5370.341	$13^{m}.35$
5229.561	15.12	5381.353	13.47
5230.554	14.26	5384.395	13.33
5237.576	14.28	5397.310	13.22
5238.574	14.69	5403.322	13.26
5240.554	14.98	5405.318	12.93
5241.593	14.74	5406.304	12.95
5268.535	14.29	5407.303	13.02
5322.527	14.07	5438.337	13.39
5369.438	13.17		

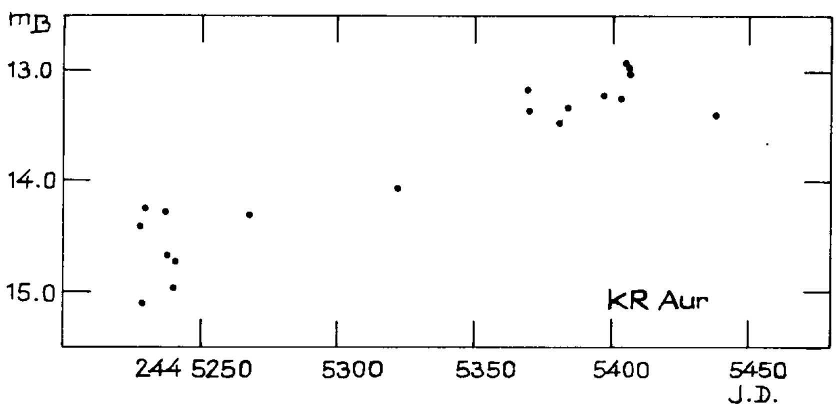

Figure 1

These observations in B which are covering the time interval between 1982 September 15 and 1983 April 13 and which are given in Table I and in Figure 1 show the final phase of an increase in brightness. This increase is superimposed by temporal light fluctuations.

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Reference:

Popova, M., 1965, VS, 15, p.534

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2365

Konkoly Observatory,
Budapest
7 July 1983

HU ISSN 0374-0676

FLARE STARS IN THE REGION AROUND γ CYGNI

For a flare star search in the region around γ Cygni a total of 69 multiple exposure plates (ORWO ZU 21 + UG 2 filter) were obtained with the 40in./52in. Schmidt telescope of the Byurakan Astrophysical Observatory and the 20in./28in. Schmidt telescope of the Bulgarian National Astronomical Observatory at Rojen between September 1981 and October 1982.

Table I gives the data of the observational material.

Table I

Telescope	Time of exposures	Number of plates	Number of exposures	T eff.
40in./52in.	10^{min}	46	275	45^h50^{min}
	5^{min}	1	6	30^{min}
20in./28in.	10^{min}	22	124	20^h40^{min}
				Total: 67^h

Two new flare stars were discovered.

The serial number according to the designations of flare stars started in our previous papers, coordinates for 1950.0, the approximate minimum brightness in pg-light, the observed amplitude of flares in U-light and the date of the flare-up are listed in Table II.

Table II

Number	R.A.(1950.0)	D.(1950.0)	m_{pg}(min)	Δm_U	Date of flares
R 12	$20^h23^m.0$	$42^\circ23'$	21	5.5	17.09.1982
B 4	30.3	39 42	>21	>4.7	19.09.1982

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2366

Konkoly Observatory
Budapest
8 July 1983

HU ISSN 0374-0676

LIGHT AND RADIAL VELOCITY VARIATIONS OF HR 6127

The chemically peculiar star HR 6127 (A2p, m_V=5.74) was observed at the Skalnaté Pleso Observatory with the 60 cm photometric telescope in 18 nights during the period December 1981 - July 1982. The photoelectric observations were made in an intermediate-band filter centered to 526 nm with a 19 nm halfwidth. BD +54^{o}1809 (A3, m_V=7.8) served as a comparison star. The number of observations per night varied from 10 to 140. The standard error of observations was 0.001 mag (0.002 mag in two nights). The amplitude of the light variations is 0.017 mag. An interval of 0.5 - 175 days was searched for the period of variability by a program written according to Morbey (1978). The best fitting yields to the following ephemeris:

JD min = 2 444 985.6031 + 2.144202 x E

The light curve is represented in Figure 1. Dots are nightly means. The 3σ value is marked at the left side of Figure 1.

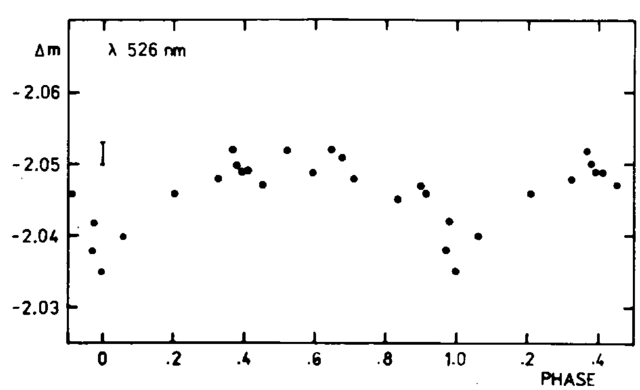

Figure 1

The radial velocities of the Ca II K line in the spectrum of HR 6127 were measured by a TV electronic comparator of the Astronomical Institute of Slovak Academy of Sciences. The radial velocities were measured on 23 spectrograms taken at the Coudé spectrograph of the 2 m telescope of Ondrejov Observatory with the dispersion 0.85 nm/mm. The amplitude of 5.6 km/s was found. In the radial velocities data set the following ephemeris was found

$$\text{JD min} = 2\ 444\ 370.412 + 2.144039 \times E$$

The radial velocities of the CaII K line plotted versus photometric period (Figure 2) formed a curve with the minimum shifted to phase 0.1 of the light curve period.

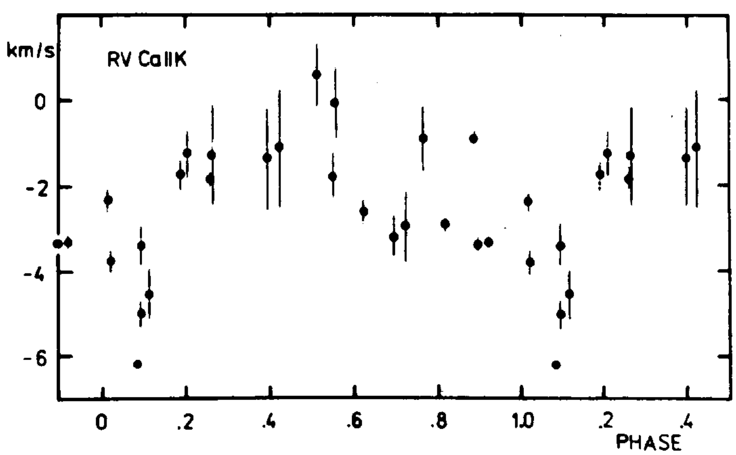

Figure 2

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Reference:

Morbey, C.L.: 1978, Publ. Dominion Astrophys. Obs. Victoria, 15, 105

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2367

Konkoly Observatory
Budapest
11 July 1983

HU ISSN 0374-0676

LIGHT VARIABILITY OF NOVA DELPHINI 1967 IN 1981 AND 1982

Nova Delphini 1967 (=HR Del) has been monitored on three nights in 1981 (9.6 hours) and on three nights in 1982 (10.8 hours) at the Hamburg Observatory in Bergedorf. We used the 1.2 m (f/13) Ritchey-Chrêtien telescope equipped with the pulse counting photometer-polarimeter (RCA C 31034 photomultiplier; Schröder, 1978) and integrated for about 40 sec in an instrumental system close to the Johnson V-band (Schott 2 mm GG 495 + 1 mm VG 6 + 2 mm BG 38). Comparison star No.6 (Barnes, Evans, 1970) was adopted as local standard and served also for determining the extinction.

Similar to our observations made in 1977-1980 (Kohoutek, Pauls, 1980; Kohoutek et al.,1981) the brightness variations were approximated by a one-cycle sinusoid. The times of five maxima were derived (Table I) from the light curves observed on five nights, whereas only a decrease in brightness was observed on 1981 Aug. 28/29.

Table I

Journal of observations and maxima of the light curve.

Date 1981-1982	Period (UT)	Number of obs.	T(MAX) $JD_{\odot}$ 2440000 +
1981 Aug. 28/29	21:39 - 00:48	16	--
Sep. 24/25	20:21 - 23:09	19	4872.342
Sep. 30/Oct.1	18:59 - 22:40	36	4878.371
1982 July 21/22	23:04 - 01:37	30	5172.489
July 27/28	21:38 - 01:38	46	5178.440
July 28/29	21:30 - 01:42	56	5179.502

Combining the maxima of the nights 1982 July 27/28 and July 28/29 the following periods were found in the range of $0\overset{d}{.}14$ - $0\overset{d}{.}27$ corresponding to E = 7,6,5,4 : $0\overset{d}{.}1524$, $0\overset{d}{.}1778$, $0\overset{d}{.}2134$, $0\overset{d}{.}2668$. We eliminated the shortest period by monitoring the nova for about 4 hours during some nights. Then we used the times of the three maxima observed in 1982 (Table I) and searched for elements of the light curve close to the remaining three possible periods given above. We derived the following periods: $0\overset{d}{.}17981 \pm 29$, $0\overset{d}{.}21231 \pm 16$, $0\overset{d}{.}26972 \pm 43$.

Our best fit, $0\overset{d}{.}21231$, is close to the possible periods $0\overset{d}{.}2159$ (found in 1977), $0\overset{d}{.}2167$ (1979) and $0\overset{d}{.}2201$ (1980) and it does not differ very much from the best solution $0\overset{d}{.}21417$ found recently from the RV-data by Bruch (1982).

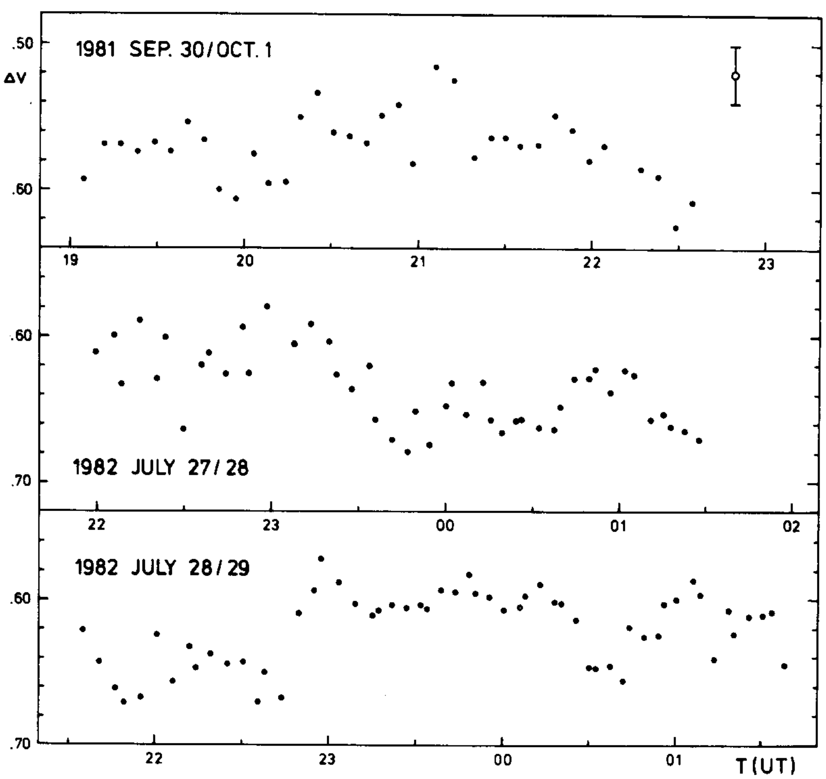

Figure 1
The light curve of N Del 1967 on three nights in 1981 and 1982; Δv = v(Nova) - v(Comp.6).

As to the observations made in 1981 only two maxima are available (the time of the first maximum being uncertain). There exists a possible period $0^{d}_{.}2149$ close to our best 1982 fit.

The decrease of the semi - amplitude of the light curve (see Kohoutek et al., 1981) has continued. In 1981 and 1982 we measured $A_V = 0.029$ mag and 0.025 mag, respectively. With respect to the mean internal accuracy of one measurement of the nova (±0.02 mag), the approximation of the light curve by a sinusoid of such small amplitude is not very reliable (see Fig.1).

The brightness of Nova Del 1967 still seems to drop very slightly: we observed Δv = v(Nova) - v(Comp.6) to be +0.57 mag in 1981, and +0.63 mag in 1982.

We wish to thank Dr. Maria-L. Roth for observing on one night.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2368

Konkoly Observatory
Budapest
12 July 1983

HU ISSN 0374-0676

CONFIRMATION OF THE 6 MINUTE PERIOD FOR 21 Com

In a recent note Musielok and Kozar (1982) claimed that the light variation of 21 Comae Berenices had a period of about 6 minutes.

After this note, Kurtz (1983) reminded us that information cannot be extracted from equally spaced data beyond the Nyquist frequency.

In June 1982 we got some measurements of 21 Com which showed a period of 6 minutes, but with a Nyquist frequency lower than 240 cd^{-1}. Although the significance of the Nyquist frequency for unequally spaced data is not sufficiently clear we decided not to publish these results.

The new data, obtained in April 1983, confirm our early assumption and that of the Musielok and Kozar that 21 Com pulsates at a frequency of about 244 cd^{-1}.

To see this, we have plotted the data in Figure 1 corrected only for atmospheric extinction, from a set taken at Calar Alto Observatory with an ultraviolet filter plus a neutral filter and using the 1.23 m telescope.

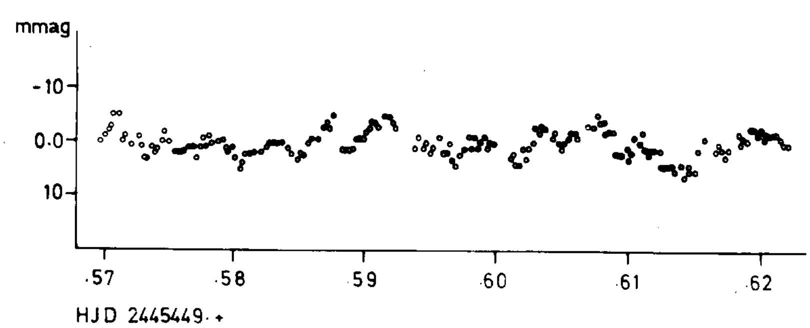

Figure 1

The subsequent power spectrum, in Figure 2, shows a period of about 6 minutes and, also, another one of about 24 minutes which clearly appears in Figure 1, if we look carefully at the plot.

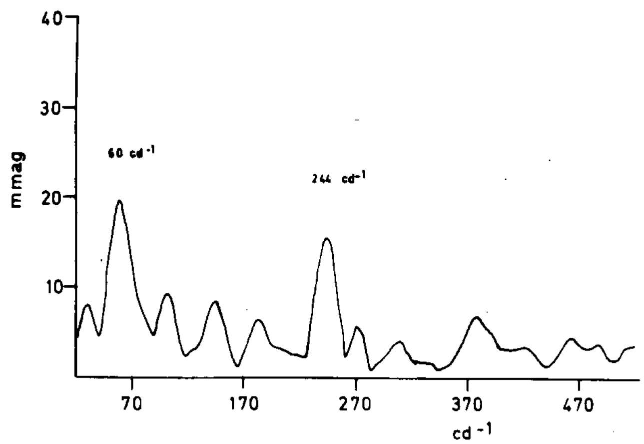

Figure 2

Apparently, the ratio between the two frequencies is four and the amplitude of the higher frequency seems to be modulated by the period of 24 minutes.

More observations are being carried out in order to clarify the light curve of 21 Com, which behaves like the recently named "Rapidly oscillating Ap stars" (Kurtz, 1982).

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2369

Konkoly Observatory
Budapest
13 July 1983

HU ISSN 0374-0676

VARIABLE STAR DISCOVERED NEAR δ SAGITTARII

A previously uncatalogued longperiod variable star has been discovered near δ Sagittarii via the photographic plate collection of the Harvard College Observatory. The star's 1900 coordinates are 18h 14m 23s and -29° 54ꞌ.2. Figure 1 is a finding chart for the variable. The bright

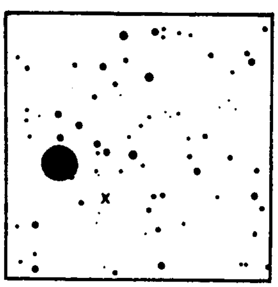

Figure 1

The scale is roughly 20ꞌ to the side. North is at the top, and east is at the left. The position of the variable is represented by an x.

star in the field is δ Sagittarii. The variable's period is 230.5 days ±0.5 day, and the epoch of maximum is JD 2433474. The photographic magnitude at maximum is 13.8, and at minimum is fainter than 16.0. The star was observed on plates taken on JD 2423907 through JD 2436751, with the majority of observations on JD 2423907 through JD 2426556.

This work was funded by National Science Foundation grant number AST-80-05162A, and was done under the direction of Dr. Emilia P. Belserene.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2370

Konkoly Observatory
Budapest
13 July 1983

HU ISSN 0374-0676

BD + 43°1894, A NEW DELTA SCUTI STAR*

During the photographic observation of UU Lyn, one of the authors of this paper, P. Frank detected that one of the comparison stars, BD + 43°1894 was a rapid variable with small amplitude. This could be confirmed photoelectrically by the other co-authors.

P. Frank used a Zeiss Tessar 250/3.5 in combination with Kodak Technical Pan, hypersensitized, and measured the brightness by a microdensitometer. M. Fernandes observed with a 10in. Schmidt-Cassegrain telescope and a digital photometer equipped with an EMI 9781B tube and filters for B and V. F. Agerer observed with a 16in. Schmidt-Cassegrain telescope and a semiautomatic photometer, equipped with a 1P21 and Schott GG 495 filter for V.

A typical light curve is presented in Figure 1. Fortunately, on JD 2445 406 photoelectric and photographic observations were made independently. Both observations are shown in the same Figure. The excellent accuracy of the photographic method is demonstrated. The shape of the light curve is almost sinusoidal, the star varies between $10^m.86$ and $11^m.08$ (photovisual). From 12 maxima

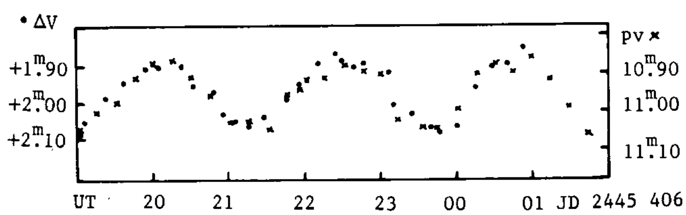

Figure 1

Light curve of BD + 43°1894 in V (comparison BD + 43°1896) and photographic. The photovisual magnitudes are calibrated with the sequence of the Hyades.

*BAV-Mitteilungen Nr. 37

(Table I) the following elements could be derived:

$$\text{Max.} = \text{JD } 2445\ 342.3822 + 0^{d}.097949\ E$$
$$\pm 24 \qquad \pm 4$$

Table I

Maxima of BD + 43° 1894

E	JD 2445...	O-C	method	observer
0	347.3827	+0.0005	pg	Fr
1	347.4743	-0.0058	pg	Fr
2	347.5771	-0.0009	pg	Fr
326	379.3174	+0.0039	V	Fd
327	379.4243	+0.0129	V	Fd
357	382.3630	+0.0131	V	Ag
602	406.3395	-0.0078	V	Fd
602	406.3437	-0.0036	pg	Fr
603	406.4367	-0.0086	V	Fd
603	406.4423	-0.0030	pg	Fr
604	406.5367	-0.0065	pg	Fr
1276	472.3708	+0.0060	V	Fd

The O-C against these elements are given in Table I. The period seems to be somewhat variable.

On two occasions, observations in B and V were performed simultaneously. The amplitude in B ($0^{m}.30$) is larger than in V ($0^{m}.22$). The minima and maxima in B follow those in V by 5 to 14 minutes, the minima and maxima of B-V occur even 5 to 15 minutes later. The colour index varies around $0^{m}.00$. In view of the photometric characteristics, BD + 43°1894 is to be considered as a Delta Scuti star.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2371

Konkoly Observatory
Budapest
19 July 1983

HU ISSN 0374-0676

PHOTOELECTRIC OBSERVATIONS OF ε AURIGAE DURING THE INGRESS

UBV photoelectric observations reported here were made by members of JAPOA (Japan Amateur Photoelectric Observers Association) during the period of October 1982 to March 1983 covering the ingress. Being in co-operation with the international campaign of this remarkable binary star (e.g., Campaign Letters by Hopkins and Stencel 1982), several Japanese amateur astronomers participated in the UBV observations with their own telescopes furnished with photoelectric photometers. The observers and used telescopes are as follows:

Observer	Place	Telescope
T. Abe	Niigata	30-cm reflector
S. Ohmori	Kanagawa	20-cm refractor
T. Ohki and H. Yoshinari	Fukushima	20-cm reflector

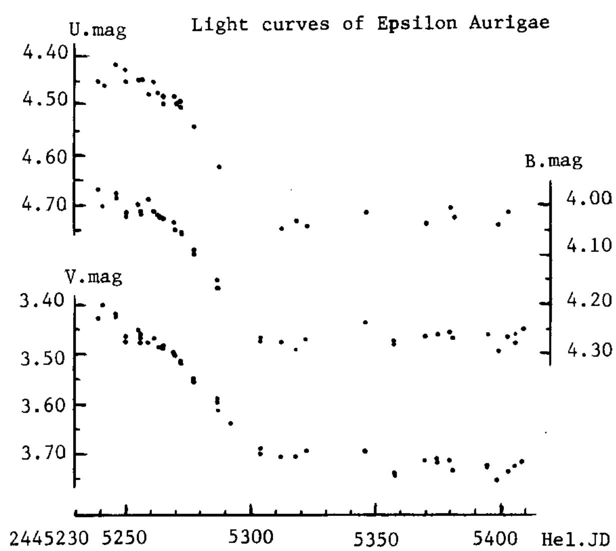

Figure 1

Table I

UBV Photoelectric Observations of Epsilon Aurigae

Date(UT)	Hel.JD 2440000+	U.mag	B.mag	V.mag	Observer
1982					
Sep.24	5239.15	4.452	4.067	3.529	OY
Sep.28	5241.19	4.460	4.102	3.499	OY
Oct. 3	5246.131	4.417	4.084	3.518	Ab
	.141	4.417	4.075	3.524	Ab
Oct. 7	5250.089	4.427	4.116	3.518	Ab
	.101	4.450	4.125	3.563	Ab
Oct.12	5255.15	4.465	4.096	3.552	OY
Oct.13	5256.126	4.451	4.119	3.577	Ab
	.16	4.450	4.113	3.559	OY
	.173	4.458	4.115	3.566	Ab
Oct.16	5259.14	4.477	4.088	3.576	OY
Oct.18	5261.14	4.452	4.114	3.565	OY
Oct.20	5263.118		4.125	3.586	Om
	.121		4.122	3.587	Om
Oct.20	.17	4.473	4.119	3.585	OY
Oct.22	5265.107	4.495	4.127	3.582	Ab
	.116	4.497	4.129	3.580	Ab
	.17	4.497	4.128	3.589	OY
Oct.26	5269.12	4.481	4.132	3.596	OY
Oct.27	5270.18	4.495	4.147	3.601	OY
Oct.29	5272.089	4.490	4.156	3.614	Ab
	.150	4.592	4.158	3.619	Ab
Nov. 3	5277.036	4.540	4.200	3.659	Ab
	.046	4.542	4.188	3.649	Ab
Nov.12	5286.239		4.244	3.691	Om
	.242		4.249	3.691	Om
Nov.13	5287.08	4.623	4.264	3.712	OY
Nov.18	5292.06	4.742		3.738	OY
Nov.30	5304.153		4.367	3.787	Om
	.164		4.374	3.800	Om
Dec. 8	5312.13	4.731	4.373	3.804	OY
Dec.14	5318.17	4.742	4.390	3.803	OY
1983					
Jan.11	5345.08	4.715	4.333	3.793	OY
Feb. 2	5375.002		4.361	3.810	Om
	.006		4.362	3.820	Om
Feb. 4	5370.00	4.737	4.363	3.816	OY
Feb.14	5380.01	4.705	4.354	3.813	OY
Feb.15	5381.10	4.724	4.365	3.835	OY
Feb.28	5394.959		4.380	3.829	Om
	.968		4.381	3.825	Om
Mar. 5	5399.03	4.739	4.392	3.854	OY
Mar. 9	5402.99	4.714	4.363	3.837	OY
Mar.11	5405.953		4.378	3.827	Om
	.958		4.359	3.825	Om
Mar.14	5408.933		4.351	3.817	Om
	.936		4.348	3.814	Om

Abbreviation: T.Abe=Ab, S.Ohmori=Om, T.Ohki and H.Yoshinari=OY

Actual observations were carried out differentially with respect to λ Aur as the primary comparison star and standard stars of Johnson were also observed on each night to make it possible to reduce the individual observations to the standard UBV magnitudes. The observed nights are altogether thirty. The results of the observations are all listed in Table I and they are also plotted in Figure 1.

From the figure, we can estimate the magnitudes in UBV of the bottom level to be U=4.74, B=4.28 and V=3.74, respectively. The epoch of the second contact can be estimated to be about JD 2445306, which is found to be 9 days earlier than predicted by Gyldenkerne (1970).

Photometric reductions to the standard UBV system were carefully made by Ohmori with his computer PC 8801. The participated members of JAPOA would like to express their hearty thanks to Prof. M. Kitamura of Tokyo Astronomical Observatory for his encouragement and generous guidance.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2372

Konkoly Observatory
Budapest
22 July 1983

HU ISSN 0374-0676

PHOTOELECTRIC PHOTOMETRY OF Ap STARS IN IC 2602, NGC 6281 AND IN THE SCORPIO-CENTAURUS GROUP: PRELIMINARY RESULTS

New photometric periods have been obtained for five Ap stars and for one He-weak star which are members of clusters and associations. Observations were carried out at the European Southern Observatory at La Silla (Chile) with the Swiss telescope, using the Geneva photometry, during April, May and June 1983.

The measurements are absolute ones, i.e. no comparison stars were used. However, standard stars were measured sufficiently often and at about the same airmass (i.e. within a few hundredths), so that the V, [U-B] and [B-V] values of the variables could be estimated fairly accurately at the end of each night, with only a rough preliminary reduction procedure.

The data were analyzed with three techniques of period determination: Deeming's (1975) method of discrete Fourier transform, Renson's (1978) θ_1 test and Stellingwerf's (1978) phase dispersion minimization method. The lightcurves were fitted by a function of the type

$$f(t)=A_o + A_1 \cos (\frac{2\pi}{p}(t-t_o) + \phi_1) + A_2 \cos (\frac{4\pi}{p}(t-t_o) + \phi_2)$$

which is generally sufficient.

The stars HD 145102 (DM-26°11240 following the HD practice, Si) and HD 147105 (DM-25°11483, Sr), although measured 34 and 30 times respectively, do not show any really conclusive period because their amplitude is extremely small. HD 147105 might have a greater amplitude than HD 145102, but it is fainter (m_v=8.794), so that the signal-to-noise ratio is poorer. The very strange peculiar star HD 144667 (HR 6000), which seems extremely young (Thé and Tjin A Djie, 1978) and is strongly deficient in silicium (Castelli et al., 1981) was measured six times and seems quite stable. The integration time was three times longer than usual, in order to have better precision. The possibility remains, however, that HR 6000 may vary on a very long timescale, since its projected rotational velocity is lower than 20 km/s (Castelli et al., 1981). The values are given in Table I.

Table I

Preliminary values of the colours and of the magnitude of HD 144667 (HR 6000). A more refined reduction procedure is being made at Geneva Observatory. Brackets mean that the indices are relevant to the Geneva system and not to Johnson's. The V band may be considered as equivalent to Johnson's.

JD-2440000	[U-B]	[V-B]	V	Remark
5442.847	.879	1.054	6.629	
5443.794	.881	1.054	6.630	
5444.740	.880	1.055	6.635	
5445.797	.877	1.054	6.629	
5449.751	.880	1.053	6.639	V magnitude value slightly doubtful
5451.773	.884	1.053	6.632	

The star NGC 6281-15 was detected as peculiar by the Geneva photometry alone, through the Δ(V1-G) and Z parameters (North and Cramer, 1981). A variation is undoubtedly present, although it is not possible at the present time to make a choice between two possible periods. Measurements are going on in order to get a better phase coverage, but it is already worth noticing that for the first time, a lightcurve is established for an Ap star known as such from photometry alone.

The star IC 2602-17 rotates very rapidly, since it has one of the shortest periods known. HD 147890, on the contrary, has a rather long period, strengthening the impression that young Ap stars do not necessarily rotate much faster than older ones (North, 1982)

HD 137193 seems to have a relatively long period too; another, shorter period could be possible, but gives a greater residual dispersion in both the B and V bands.

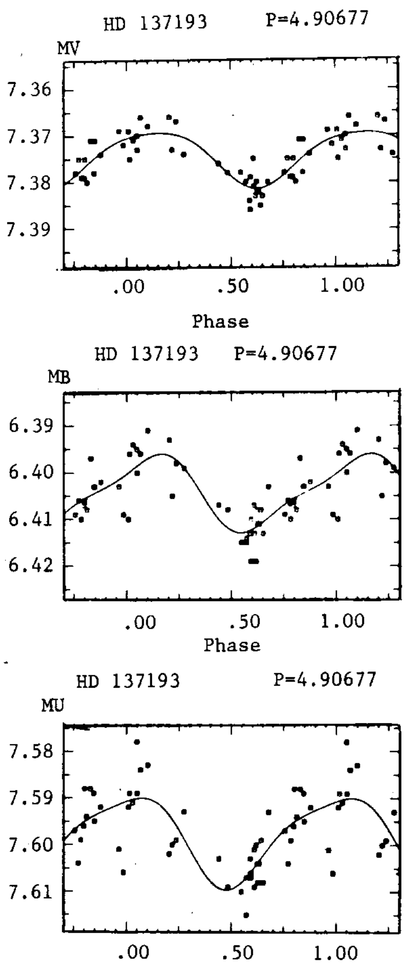

Figure 1

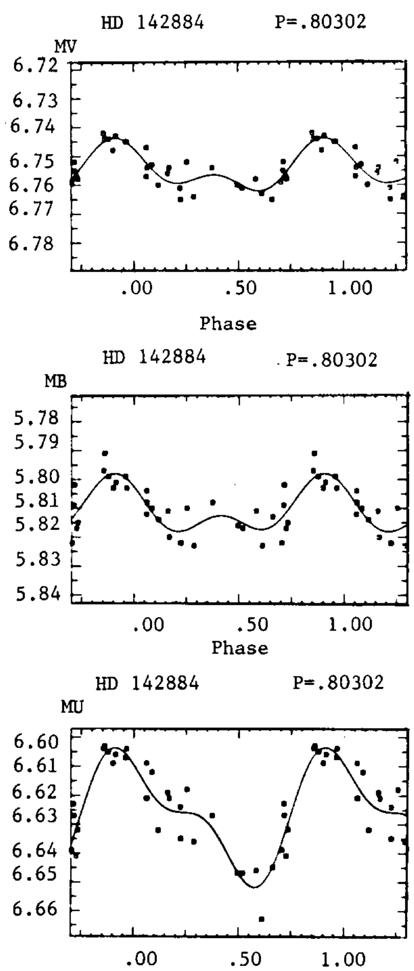

Figure 2

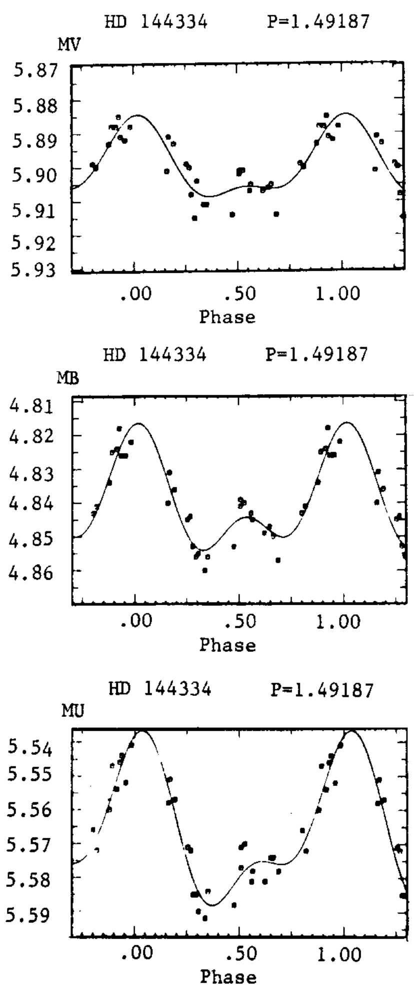

Figure 3

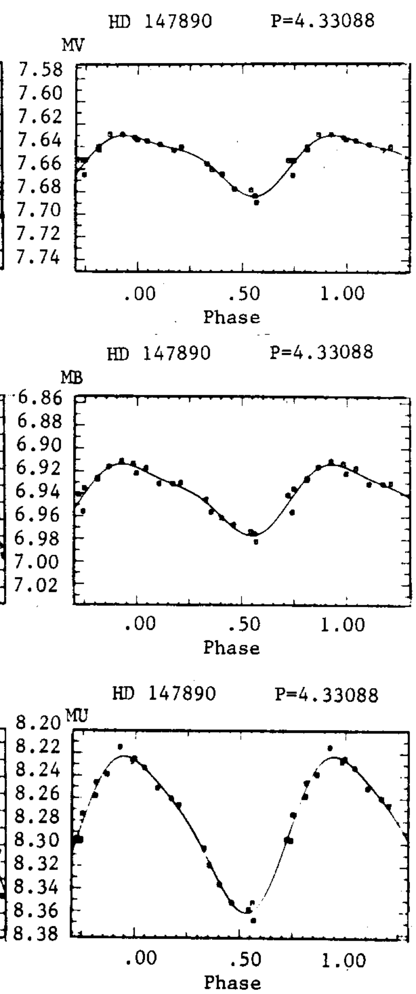

Figure 4

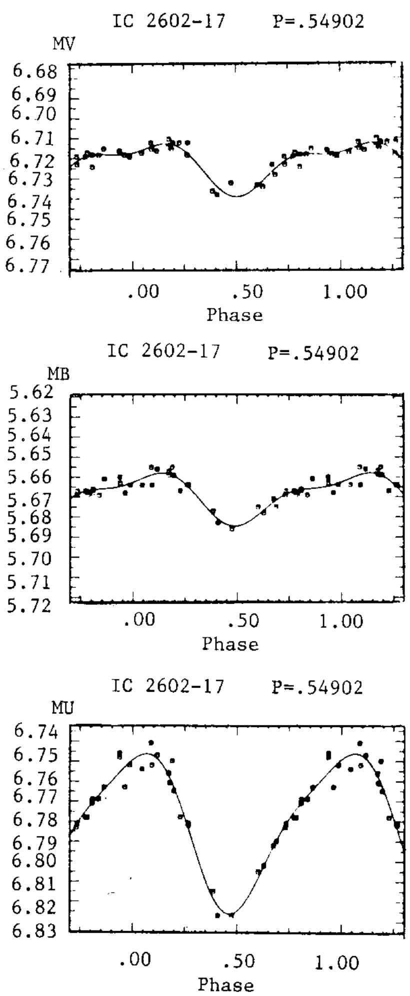

Figure 5

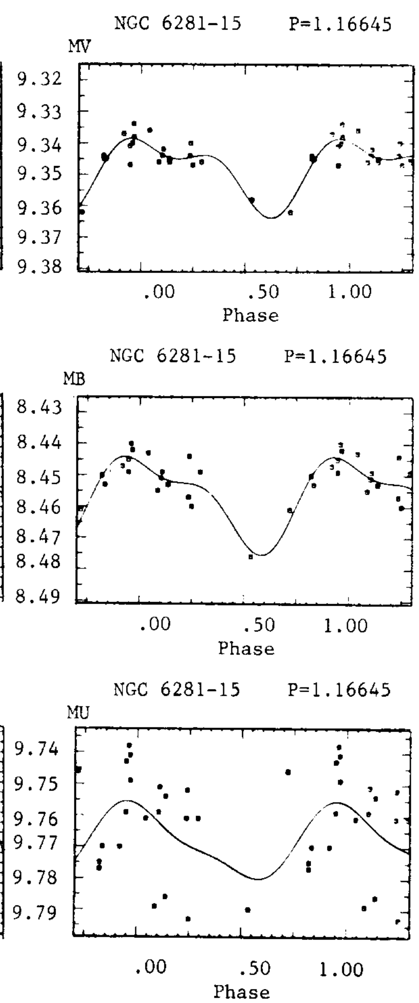

Figure 6

Table II

Cluster or association	HD	DM	Peculiarity	Period	Resid. dispersion [U]	[B]	V	No.of meas.	Remark
Upper Cen	137193	$-39^{\circ}9848$	Si	4.907	.0054	.0041	.0027	40	
				0.8291	.0053	.0047	.0031		Less probable
Upper Sco	142884	$-23^{\circ}12597$	Si	0.8030	.0061	.0049	.0033	29	
Upper Sco	144334	$-23^{\circ}12700$	He wk	1.492	.0048	.0042	.0042	29	
				0.5982	.0047	.0055	.0047		Much less probable
Upper Sco	147890	$-29^{\circ}12529$	Si	4.331	.0055	.0048	.0037	20	
IC 2602-17	92385	$-64^{\circ}1374$	Si	0.5490	.0046	.0028	.0028	30	
NGC 6281-15	153948	$-37^{\circ}11216$	$\Delta(V1-G)$ =.034	1.166 or	.0150	.0039	.0031	21	Ph.metric AP star
				8.119	.0120	.0051	.0035		

The results are summarized in Table II, where the standard mean deviations of the residuals are also given, and in Figures 1 to 6.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2373

Konkoly Observatory
Budapest
22 July 1983
HU ISSN 0374-0676

S 10807 Boo - A NEW RR LYRAE STAR

The variability of the star S 10807 Boo ($14^h51^m.8$ $+15^\circ50'$, 1950.0) has been found by H. Gessner (1978). She assumed that the light variation was probably irregular. After this, the star has been observed by the author photoelectrically in 11 nights during the years 1981 (2 nights) and 1983 (9 nights). Altogether 295 single measurements in the V region could be discussed.

The light curve computed with the elements

$$\text{JD hel Max.} = 2445444.724 + 0^d.281879 \cdot E$$

shows that the object is an RR Lyrae star of subtype c with an amplitude of 0.6 mag in V.

Further information on the star will be published in "Mitt. Veränderl. Sterne, Sonneberg".

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Reference:

Gessner, H., 1978, Mitt. Veränderl. Sterne 8, 65

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2374

Konkoly Observatory
Budapest
25 July 1983

HU ISSN 0374-0676

SEARCH FOR VARIABILITY OF THE SR-CR-EU STAR HD 8783[1)]

In a recent paper by Maitzen and Vogt (1983) the late type Ap-star HD 8783 was shown to exhibit a marked variation in the photometric index a which is a measure of the strength of the λ 5200 broad band flux depression (Maitzen, 1976). From a preliminary analysis Maitzen and Vogt concluded that the period should be either very close to 1 day or 20 days. In order to establish the period of this star we monitored its photometric behaviour in two runs of 10 days each, separated by one year. Comparison stars were HD 8353 and HD 8781. The first run was carried out at the ESO-50cm telescope on La Silla in 1981 from Nov. 3 till Nov. 14. From 10 observations (all taken on different nights) we obtain the following mean differences and standard deviations:

HD 8783 - HD 8353:

u: 0.425 (8.2) v: 0.143 (5.2) b: 0.236 (8.6) y: 0.359 (6.9)

HD 8783 - HD 8781:

u: -0.250 (10.5) v: -0.494 (9.8) b: -0.391 (12.1) y: -0.251 (13.7)

The values in brackets are the standard deviations of a single measurement in units of 0.001 mag.

The second run was performed at the 1m Yale telescope on Cerro Tololo from Oct. 28 till Nov. 7, 1982. On ten different nights 14 differential measurements were taken, but only in the u and v- filters:

HD 8783 - HD 8353:

u: 0.414 (7.9) v: 0.146 (11.3)

HD 8783 - HD 8781:

u: -0.255 (15.8) v: -0.480 (11.4)

On Oct. 29, 1982 we obtained a clear increase of the differential magnitudes in u and v for the comparison star HD 8781 while those obtained with HD 8353 remained essentially constant. Therefore we have to discard HD 8781 as rather short period variable. Its spectral type is F0 II/III according to the

1)Based on observations collected in part at ESO- La Silla and at the Cerro Tololo Interamerican Observatory which is operated by AURA, Inc. under contract with the National Science Foundation.

Michigan catalogue (Houk and Cowley, 1975) and its position in the instability strip is indicated.

One additional measurement has been obtained on Dec. 19, 1982 at the Danish 50 cm telescope on La Silla:

HD 8783 - HD 8353:

u: 0.416 v: 0.140 b: 0.232 y: 0.358

HD 8783 - HD 8781:

u: -0.252 v: -0.494 b: -0.390 y: -0.252

Thus, measurements at 3 different epochs indicate that HD 8783 is virtually constant, the differences in u being caused by slightly different observer systems rather than by intrinsic variations. The periods suggested by Maitzen and Vogt (1983) cannot represent any sensible light variations in HD 8783.

This situation is however puzzling: variability in the index a cannot be denied, it is even very large considering the rather low absolute value of the peculiarity index Δa of HD 8783 (Δa = 0.023), but there is no counterpart of variability in uvby.

Except for one control measurement on 1982, Nov. 7 in the second run mentioned (Δa = 0.031 supporting the value of Maitzen and Vogt) no other Δa-observations were obtained.

In order to resolve the enigmatic case of HD 8783 we propose to further monitor this star both in uvby and the filters of the a-index (Maitzen, 1976). We deem it also of importance to monitor this star spectroscopically and to derive v sin i.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2375

Konkoly Observatory
Budapest
27 July 1983

HU ISSN 0374-0676

NEW PHOTOELECTRIC TIMES OF MINIMA OF VW CEPHEI

VW Cep (BD +75° 752) is a well known eclipsing binary of W UMa-type, which has both variable period and variable light curve. Due to the peculiarities of VW Cep, it has been the subject of many investigators. So, many photoelectric light curves of the system have been obtained and a great deal of theoretical work has been done for a better understanding of this peculiar system.

During a program of photoelectric observations of eclipsing binary stars, the system was observed in two colours (B and V) on September 5-11, 1980.

Table I

HJD	σ	$(O-C)_1$	$(O-C)_2$	Filter	Min.
2440000+					
4488.4702	±0.0001	-0.0002	-0.1072	B,V	II
4489.3063	±0.0002	+0.0009	-0.1060	B,V	II
4489.4439	±0.0001	-0.0006	-0.1076	B,V	I
4490.4189	±0.0001	+0.0003	-0.1067	B,V	II
4490.5577	±0.0001	-0.0001	-0.1071	B,V	I
4491.3926	±0.0001	-0.0001	-0.1071	B,V	I
4492.3681	±0.0002	+0.0013	-0.1057	B,V	II
4492.5060	±0.0001	0.0000	-0.1070	B,V	I
4493.3409	±0.0001	0.0000	-0.1070	B,V	I
4493.4803	±0.0001	+0.0002	-0.1068	B,V	II
4494.3158	±0.0002	+0.0008	-0.1063	B,V	II
4494.4537	±0.0001	-0.0005	-0.1075	B,V	I

The observations were made with a 48-inch Cassegrain reflector (Contopoulos and Banos,1976) 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 BD +74° 889, as check star BD +75° 726.

All the times of minima and the mean errors σ were calculated by the method of Kwee and Van Woerden.

The successive columns of Table I contain the heliocentric time of minimum, the mean error σ , the differences O-C, the filter used and the type of minimum.

The $(O-C)_1$ values were computed using the ephemeris given by Hopp et al.(1979)

$$\text{Min I} = \text{JD Hel } 2443410.4180 + 0\overset{d}{.}27831481 \text{ E}$$

while the $(O-C)_2$ values were calculated according to van't Veer's (1973) ephemeris

$$\text{Min I} = \text{JD Hel } 2433898.4410 + 0\overset{d}{.}27831793 \text{ E}$$

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2376

Konkoly Observatory
Budapest
1 August 1983

HU ISSN 0374-0676

AN INVESTIGATION OF SHORT TIMESCALE VARIABILITY IN 6 EARLY B STARS

Six early B stars suspected of short period variability on timescales of about a day or less were investigated photometrically in September 1982 at the University of Toronto. Observations were made in the B band with the Department of Astronomy 0.4 m telescope relative to nearby comparison stars. The standard deviation in each measurement was typically 0.01 magnitudes or more. A transformation equation of the form $\delta B = \delta B(\text{observed}) + 0.050\ \delta(B-V)$ (Percy,1982) was used. (B-V) values were taken from published data or were estimated from the spectral type. A differential extinction coefficient of the form $\delta B = -k_B\ \delta(\sec z)$ was assumed, with $k_B = 0.40$ magnitudes. (Eight determinations in July and August give $k_B = 0.41 \pm 0.06$ (Percy,1983)).

Of the six stars variability was confirmed in three cases: V358 Per, 2 Vul, and V819 Cyg. In no case could a convincing fit be made to previous periods. In addition, two of the check stars, HD13970 and HR7577, were observed to have relatively large amplitude, short timescale variations.

Notes on Individual Stars

1 Cam

A companion 10.3" away with V magnitude 6.9 gives a combined magnitude V=5.45 and colour (B-V)=0.18. Jerzykiewicz and Sterken (1982) report possible variability on a timescale of hours with range 0.01 magnitude in b. No significant variation of 1 Cam (V) relative to 2 Cam (C1) was detected in this study, but the data are clearly insufficient to rule out variability.

2 Cam

A double star with separation 0.3". Combined photometry and spectral type are given. No significant variation of 2 Cam (C1) relative to HR1314 (C2) was detected.

HR8105

There is a companion star 21.5" away with V magnitude 12.2. All photometry is of HR8105 alone. Jerzykiewicz and Sterken (1982) report variation, possibly on a timescale of hours, with range 0.02 magnitudes in y. No significant variation of HR8105 (V) relative to HD202126 (C1) was detected in this study.

HD202126

A B magnitude of 6.82 was obtained by comparison with HR8120. The spectral type is from the SAO catalogue, and (B-V) is estimated from the spectral type. No significant variation of HD202126 (C1) relative to HR8120 (C2) was detected.

V358 Per

Listed as a Be star in Jaschek and Egret (1981). Hill (1967b) reports an amplitude of 0.09 magnitudes and a period of 1.241 days. Variability has been confirmed, but the observations do not fit Hill's light curve. Errors are large because the stars are faint and in a crowded field.

HD13831

Listed as a Be star in Jaschek and Egret (1981). It has been checked for constancy by Hill (1967a).

HD13970

There appear to be hour-to-hour variations relative to HD13831 (which does not exhibit such rapid changes relative to V358 Per). The observed range of HD13970 (C2) relative to HD13831 (C1) is about 0.07 magnitudes in B.

V568 Cyg

A suspected beta Cephei star (Bolton, 1982). Listed as a Be star in Jaschek and Egret (1981). No significant variation of V568 Cyg (V) relative to HD196120 (C1) was detected.

HD196120

The spectral type is from the SAO Catalogue. No significant variation of HD196120 (C1) relative to HD195102 (C2) was detected.

HD195102

The spectral type is from the SAO Catalogue.

Table I:A list of the stars observed

	Name	HR	HD	V	B-V	Sp
V	1 Cam	1417	28446	5.77	0.18	B0III
C1	2 Cam	1466	29316	5.35	0.07	A8V
C2	HR1314	1314	26764	5.19	0.05	A2Vn
V	HR8105	8105	201819	6.54	-0.14	B1Vp
C1	HD202126	--	202126	6.76:	0.06:	A2
C2	HR8120	8120	202240	6.05	0.21	F0III
V	V358 Per	--	13890	8.51	0.19	B1III
C1	HD13831	--	13831	8.27	0.10	B0IIIp
C2	HD13970	--	13970	8.30	0.14	B5Ib
V	V568 Cyg	7927	197419	6.66	-0.16	B2IV-Ve
C1	HD196120	--	196120	6.67	-0.12	B9
C2	HD195102	--	195102	7.00	-0.06	B9
V	2(ES)Vul	7318	180968	5.43	0.02	B0.5IV
C1	HD181751	--	181751	6.6:	-0.06:	B8
C2	1 Vul	7306	180554	4.77	-0.05	B4IV
V	V819 Cyg	7600	188439	6.29	-0.11	B0.5IIIn
C1	HR7591	7591	188252	5.91	-0.18	B2III
C2	HR7577	7577	188074	6.20	0.36	F2V

For stars with HR numbers the source for photometry and spectral types is Hoffleit (1982). Otherwise, unless noted, Nicolet (1978) was used for photometry and Jaschek (1978) for spectral type.

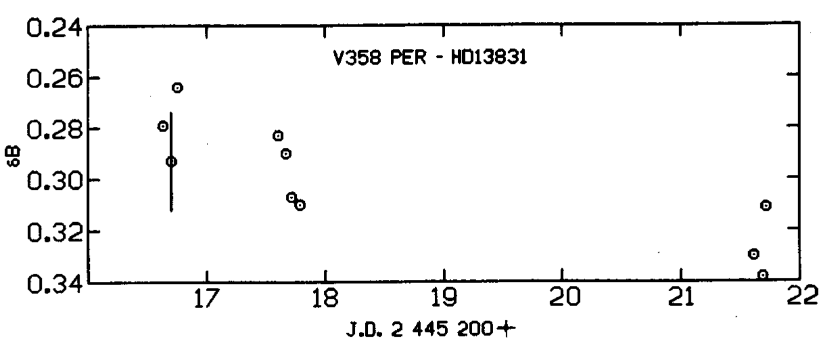

Figure 1. Photoelectric observations of V358 Per (V) relative to HD13831 (C1). The typical error in each measurement is shown.

Table II

Summary of observations

V	C1	C2	Nights	Obs'ns	$\overline{\sigma}$(V-C1)	$\overline{\sigma}$(C1-C2)
1 Cam	2 Cam	HR1314	2	3	0.012	0.009
HR8105	HD202126	HR8120	3	12	0.009	0.010
V358 Per	HD13831	HD13970	3	10	0.019	0.016
V568 Cyg	HD196120	HD195102	4	12	0.008	0.010
2 Vul	HD181751	1 Vul	3	9	0.017	0.017
V819 Cyg	HR7591	HR7577	5	15	0.008	0.011

Each measurement δB_i has standard deviation σ_i. The mean of the σ_i is $\overline{\sigma}$, and the mean of the δB_i is $\overline{\delta B}$ with standard deviation $\sigma_{\overline{\delta B}}$. The variation is significant only if $\sigma_{\overline{\delta B}} > \overline{\sigma}$.

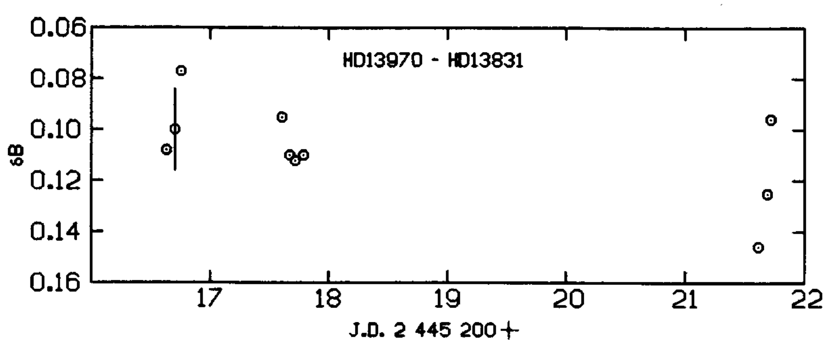

Figure 2. Photoelectric observations of HD13970 (C2) relative to HD13831 (C1). The typical error in each measurement is shown.

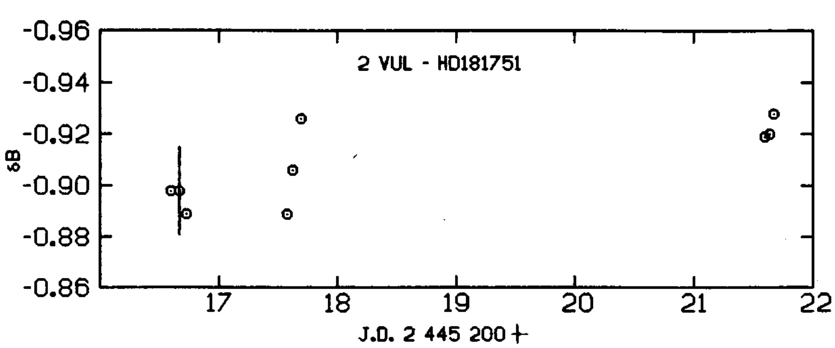

Figure 3. Photoelectric observations of 2 Vul (V) relative to HD181751 (C1). The typical error in each measurement is shown.

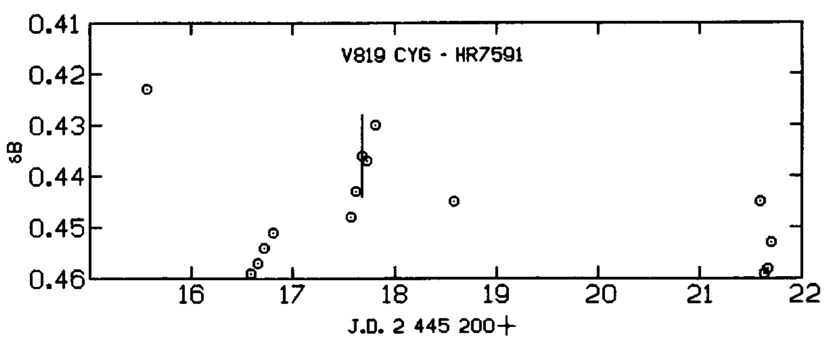

Figure 4. Photoelectric observations of V819 Cyg (V) relative to HR7591 (C1). The typical error in each measurement is shown.

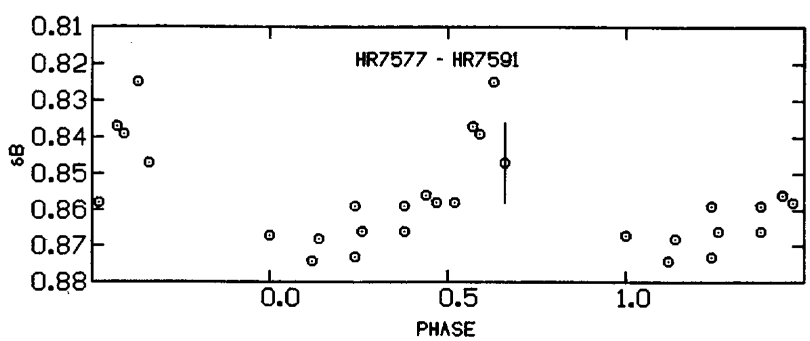

Figure 5. Photoelectric observations of HR7577 (C2) relative to HR7591 (C1), plotted with a period of 0.485 days. The typical error in each measurement is shown.

<u>2 Vul</u>

Short period variability is confirmed, with amplitude about 0.04 magnitudes in B. Data do not fit Lynds' (1959) period of 0.6096 days.

<u>HD 181751</u>

Spectral type and V magnitude are from the SAO Catalogue. (B-V) is estimated from the spectral type.

<u>1 Vul</u>

Listed as a suspected variable in Kukarkin et al (1965). No significant variation of 1 Vul relative to HD181751 (C1) was detected in this study.

<u>V819 Cyg</u>

The light curve of V819 Cygni (V) relative to HR7591 (C1) clearly indicates short period variation with an amplitude of 0.03 magnitudes in B. The data do not fit Lynds' (1959) period of 0.3775 day.

HR7591

Listed as a suspected variable in Kukarkin et al. (1965). Because both V819 Cyg (V) and HR7577 (C2) appear to be varying also, it was not possible to confirm this.

HR7577

HR7577 displays changes in brightness of up to 0.03 magnitudes in only two hours, relative to both V819 Cyg and HR 7591. The variation of HR7577 (C2) - HR 7591 (C1) can be fitted to a 0.485 day period with amplitude 0.05 magnitudes in B.

The observations described in this paper have been deposited in the IAU Archives. The author wishes to thank Dr. John R. Percy for discussions and much helpful advice. Financial support in the form of a Mary H. Beattie Fellowship is also gratefully acknowledged.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2377

Konkoly Observatory
Budapest
1 August 1983

HU ISSN 0374-0676

THE ORBITAL PERIODS FOR SIX CATACLYSMIC BINARIES

The orbital periods for VW Vul, V380 Oph, CM Del, TW Vir, V794 Aql, and SY Cnc have been determined from radial velocity variations of their Hα emission lines. All observations were obtained using the Mount Lemmon 1.5 m reflector equipped with a Robinson-Wampler Image Dissector Scanner[1]. The radial velocities were measured using the method described by Shafter[2]. Table I summarizes the results of the radial velocity studies of the six binaries.

Table I*

Object	Designation	Date(s) of Observation	Duration of Observations (hrs)	Orbital Period (days)	K_1 (km/s)	Ref.
VW Vul	UG?	13-Jul-82	5.1	0.073	100:	3
V380 Oph	NL?	10-May-83	4.5	0.16	100:	5
CM Del	UG?	21-Jul-82	5.4	0.16	150:	3
TW Vir	UG	27-Jan-82	1.7	0.18266(66)	88±5	4
		28-Jan-82	3.0			
		31-Jan-82	3.6			
		28-Apr-82	5.6			
		29-Apr-82	3.8			
V794 Aql	UG?	15-Jul-82	5.0	0.23:	100:	3
SY Cnc	ZC	12-Feb-83	3.3	0.38	90:	4
		13-Feb-83	7.4			
		16-Feb-83	4.0			

*A colon indicates an uncertain value. The references are for finding charts and coordinates.

The only system with a sufficiently accurate period to warrant giving an ephemeris is TW Vir. For this system we find following expression for the time (T) of superior conjunction of the broad Hα emission (i.e. the accretion disk surrounding the white dwarf):

$$T = \text{HJD } 2445088.7121 + 0.182666\,E \cdot$$
$$\pm.0022 \quad \pm.000066$$

A more elaborate discussion of the above systems will appear elsewhere. In particular, additional radial velocity data on V794 Aql. TW Vir, and CM Del obtained by K. Horne, P. Szkody, and the author using the coudé

Spectrograph of the Mount Wilson 100" reflector will be included to improve the accuracy of the orbital elements.

I thank P. Etzel for the use of his Spectroscropic Binary Orbit Program. This work has been partially supported by NSF grant AST 80-19745 to Roger K. Ulrich.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2378

Konkoly Observatory
Budapest
4 August 1983

HU ISSN 0374-0676

PRELIMINARY 1983 PHOTOMETRY OF HD 174429 (PZ Tel)

We present B and V photometry of the proposed RS CVn type star HD 174429, taken over seven nights in the interval 1983 early May to mid June.

HD 174429 (KO Vp, Houk, 1978) was included in a list of southern RS CVn candidate stars by Weiler and Stencel (1979) on the basis of strong Ca II H and K emission. Stencel (1980) suggested it was a member of the RS CVn class on the basis of radial velocity variations obtained by Stacy, Stencel and Weiler (1980). We have obtained photoelectric light curves of this system for 1980 and 1982 (Coates et al., 1980, Coates et al., 1982). On the basis of changes in its light curve from 1980 to 1982, and within the 1982 season itself, we also concluded it was a member of the RS CVn class. (Coates et al., 1982).

This year, we have obtained 28 V and 26 B measurements of HD 174429 on seven nights in May and June. All observations were taken with Monash University's 40cm telescope with an uncooled 1P21 photomultiplier tube. In addition to the comparison stars HD 176557 and HD 176664 used in previous seasons at Monash, we have also included HD 174233 (which is much nearer the programme star in brightness than the other two comparison stars) following communication with Dr. T. Lloyd Evans at SAAO. The magnitude differences between these stars obtained this year are shown in Table I, with the 1980 and 1982 differences included [in brackets] for comparison. We conclude that within observational scatter there has been no change in either the B or V magnitudes of these comparison stars.

Table I

	ΔV	ΔB
HD 176664 - HD 174233	-2.689 ±.004	-1.846 ±.003
HD 174233 - HD 176557	1.421 ±.005	0.337 ±.006
HD 176557 - HD 176664	1.268 ±.006 [1.260 ±.005]	1.509 ±.006 [1.500 ±.004]

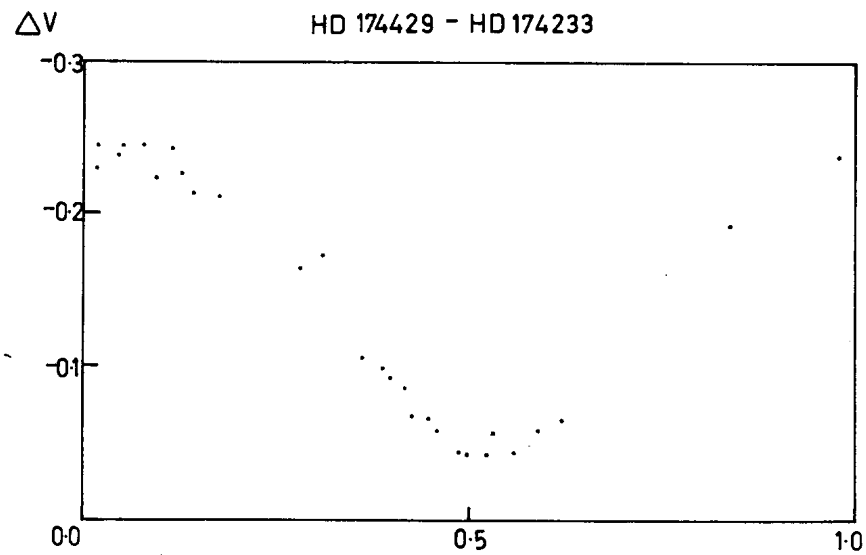

FIGURE 1

The V data obtained on HD 174429 this year are plotted in Figure 1, with the epoch of HJD 2444443.000 and P = 0.943 days, as in Coates et al., (1982). The data are plotted relative to HD 174233 in the sense variable minus comparison, not relative to HD 176557 as given previously. However the present data can be compared directly with the earlier light curves using the data in Table I.

The range in V of about 0.21 magnitudes is similar to the maximum range measured in 1982 (and thus twice the range of the 1980 data), but the maximum brightness is now some 0.05 magnitudes brighter than the maximum of the 1982 curve. As there has clearly been no shift of this size between the comparison stars from 1982 to 1983, we conclude that this must be a real brightening of the star.

Further evidence for a change in the properties of this star can be found by noting that while in 1982 the colour index B-V was found to be constant within the precision of our data at 0.77 $\pm$0.01, the B-V data obtained this year (Figure 2), although scattered, appear to show a dependency on phase, the star being redder when fainter.

The photometric behaviour of this system is similar to that of many related objects (eg: II Peg, as in Vogt (1981), V711 Tau, as in Dorren et al. (1981)

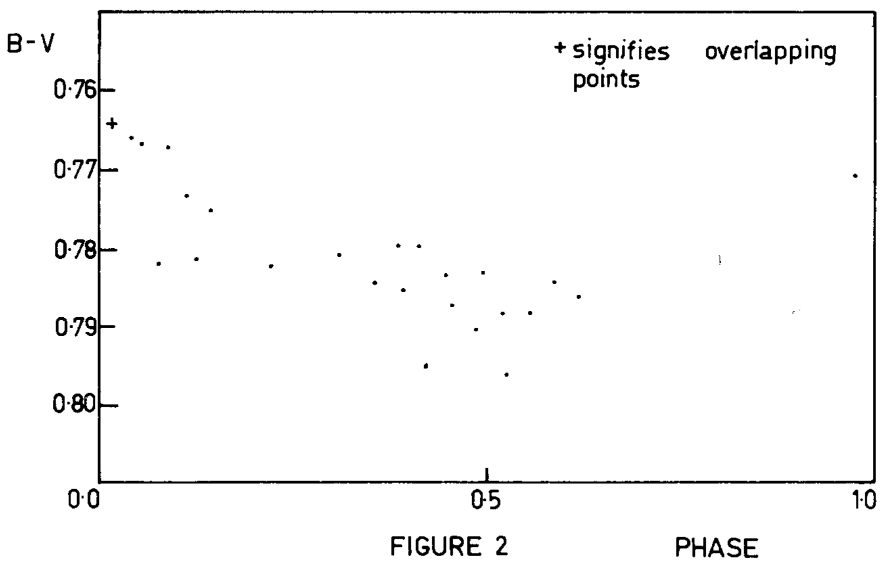

FIGURE 2

in terms of the changes in the shape of the light curve and brightness levels from season to season. It is expected that localized active regions similar in size and temperature to those found for these related systems will also satisfactorily explain the behaviour of this star.

However, before detailed modelling of such regions can be commenced, further information about this system (such as its binarity) must be obtained. Towards this end, we have obtained high dispersion echelle spectrograms of this object with the 1,88 m telescope at Mt. Stromlo observatory on three nights in May and June.

Reduction of these data is proceeding, and further observations, both photometric and spectroscopic, are planned.

We thank Dr. T. Lloyd Evans for sending his observations on HD 174429 to us prior to publication. JLI and TTM are supported by Commonwealth Postgraduate Research Awards.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2379

Konkoly Observatory
Budapest
8 August 1983

HU ISSN 0374-0676

SOME OBSERVATIONS OF THE CENTRAL STAR OF THE BIPOLAR PLANETARY NEBULA NGC 2346

The central star of NGC 2346 has been on our observing program since Spring 1982. The low declination and unfavourable observing conditions did not permit to collect enough data sufficient for a discussion of the whole light curve. In addition, the unexpected drop in brightness made the object too faint for the available 60 cm telescope. However, since the object has recently received increased attention, we feel it justified to publish our few data.

Table I

Date UT	JD 2445000+	V'	B'	U'	Remarks
1982 Apr. 1.81	061.31	$12^{m}.66$			
4.81	064.31	11.63	$11^{m}.94$		
5.81	065.31	11.51	11.82		
10.80	070.30	12.12	12.46		
Oct. 17.13	259.63	11.75	12.08		
21.16	263.66	(14.5)			
31.15	273.65	11.77	11.97	$12^{m}.08$	
Nov. 1.12	274.62	11.74	11.97	12.14	
2.12	275.62	12.13	12.42	12.67	
3.12	276.62	13.12			
17.09	290.59	12.15	12.48	12.63	
19.17	292.67	(15.0)			not vis. in
21.17	294.67				60 cm telescope
22.13	295.63	(15.2)			"
23.17	296.67	(15.0)			"
Dec. 4.0	307.5				"
6.0	309.5	(>15)			"
1983 Jan. 7.0	341.5				"
12.0	346.5	(14.5)			"

The photoelectric data shown in Table I were collected with the single channel photometer attached to the 60 cm RC telescope of the L.Figl-Observatory. All magnitudes are in our instrumental system. Star "a" (outside of the finding chart in Fig. 1, Kohoutek (1982)) served as a comparison star. The contribution of the nebula within the 12" and 21" diameter aperture respectively has been removed by using published data for the brightness of the nebula by Kohoutek (1983). The internal accuracy is of the order of $\pm$ 0$^{m}_{.}$01 to 0$^{m}_{.}$02 for V and B, $\pm$ 0$^{m}_{.}$03 to 0$^{m}_{.}$04 for U. Mainly due to the uncertainty of this correction the final accuracy is certainly worse than the values mentioned above as pointed out by Mendez et al (1982). The V magnitudes in parantheses have been obtained by visual comparison of the central star with the two stars A and B marked in Fig. 1 using the 1.5 m RC telescope of the same observatory. The V magnitudes of these stars have been determined to be V = 14$^{m}_{.}$5 and 15$^{m}_{.}$5 respectively using Kohoutek's (1982) scale and extrapolating with the magnitude diameter relation for the Palomar Sky Survey given by King and Raff (1977).

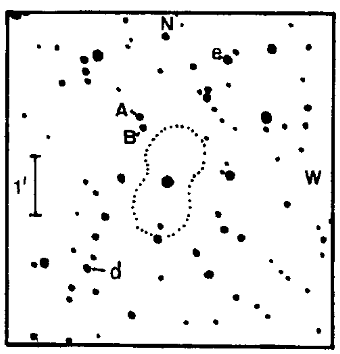

Figure 1

Finding chart for star A and B; star d and e (Kohoutek (1982)) are also marked for reference

We have compared our data with the light curves given by Kohoutek (1983) using his new light elements (Min) = HJD 2445010.60 + 15$^{d}_{.}$957 . E. Except for the observation obtained April 10.80 (σ_V = $\pm$ 0$^{m}_{.}$005, σ_B = $\pm$ 0$^{m}_{.}$020) our April data agree completely with the March-April light curve (upper solid line in Fig. 2). For the rest of our observations we conclude that:

1. Within the covered time the height of the maximum did not differ much from the March-April light curve until about November 1, 1982; at the next cycle it was lower by about 0$^{m}_{.}$4 in V.
2. The deep and wide minimum shown in the January 1983 light curve (lower line in Fig. 2) by Kohoutek (1983) was already present in November 1982, possibly

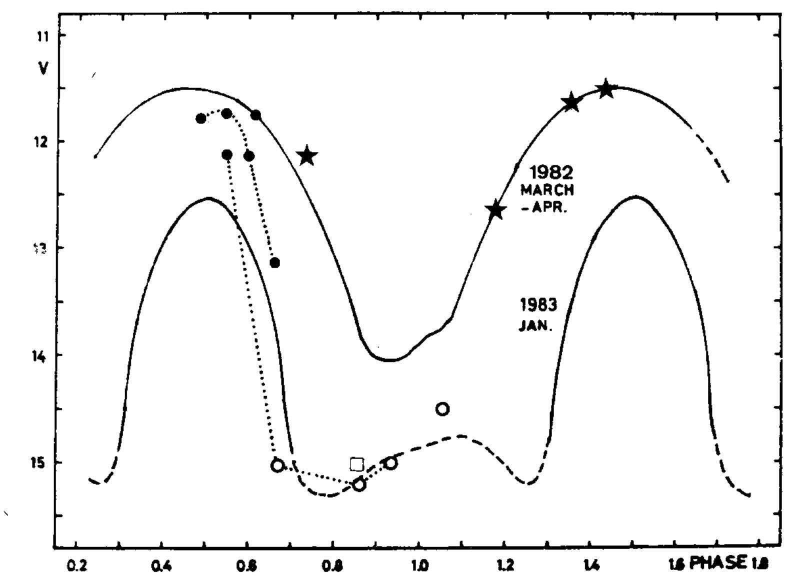

Figure 2

Photoelectric (● ★) and visual (O) magnitudes plotted into Kohoutek's (1983) light curves. □ 1982 October 21 Observation. Data points connected by a dotted line belong to the same cycle. Upper dotted line: 1982 Oct.31 - Nov.2; lower: Nov.17 - 23.

already in October as suggested by the single observation obtained October 21 (Square in Fig. 2).

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2380

Konkoly Observatory
Budapest
8 August 1983

HU ISSN 0374-0676

UBV OBSERVATIONS AND A PHOTOMETRIC SEQUENCE FOR THE
HIGHLY ACTIVE T TAURI STAR VY TAU

VY Tau (1900: $\alpha = 4^h33.3^m$; $\delta = +22^o36'$) is nearly unique among the T Tauri stars for the great range of its brightness variations. The star is of extraordinary interest because Herbig (1977) has raised the possibility that this star may provide an evolutionary link between FU Orionis objects and main sequence stars. Therefore, a photometric sequence in its vicinity is desirable to improve the accuracy of photographic light curves. In addition to data for the sequence stars, a few photoelectric observations of VY Tau are presented.

All observations were made at Lick Observatory, Mt. Hamilton, California. The first four observations of VY Tau were made with the 0.6 meter reflector, a dry-ice cooled 1P21 and a DC amplifier feeding a chart recorder. All other observations were made with pulse counting dual-channel dry-ice cooled FW-129 (S-11) photomultipliers at the 0.9 meter Crossley telescope.

The results are presented in Table I, and the stars are identified in the figure (North at the top, East to the left). The errors given in parentheses in the Table are standard deviations of the mean in hundredths of a mag, as determined from agreement between the independent channels and between nights. An error of 0 means the calculated error was less than 0.005 mag. Estimated errors for the nights when VY Tau was observed with DC equipment are 0.02 mag for V, 0.01 mag for B-V and 0.03 mag in U-B.

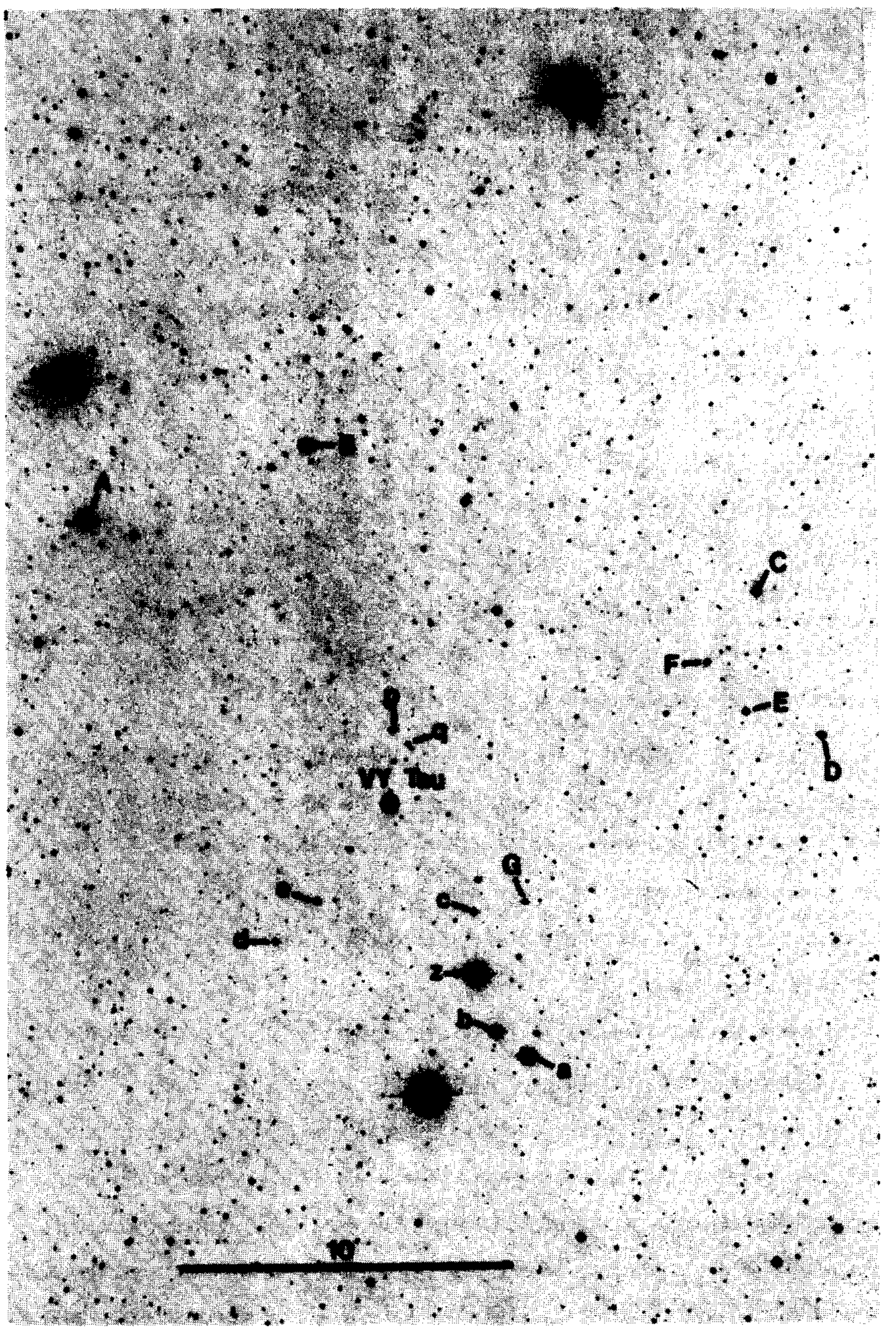

Figure 1   VY Tau and Environs

Table I

VY Tau: Photometry and a Photometric Sequence

Star	JD244+	V	B-V	U-B
VY Tau	1571.988	13.40	1.14	0.10
	1572.941	13.48	1.05	-0.02
	1665.722	13.62	1.30	--
	1665.893	13.61	1.35	--
	2797.---	13.68(1)	1.45(0)	--
	4877.979	13.63(2)	1.53(3)	--
	4909.955	13.38(1)	1.47(0)	--
a	----	10.57(1)	0.37(1)	--
b	----	11.24(1)	0.62(1)	--
c	----	11.53(1)	2.09(3)	--
d	----	13.31(1)	0.99(2)	--
e	----	13.70(1)	0.85(3)	--
p	----	14.04(0)	0.76(4)	--
q	----	14.32(6)	0.92(9)	--
z	----	10.04(0)	0.26(1)	-0.20(1)
A	----	10.29(1)	0.74(1)	0.37(1)
B	----	11.21(1)	0.75(1)	0.15(1)
C	----	11.95(1)	0.68(0)	0.36(1)
D	----	12.35(1)	0.87(1)	0.35(2)
E	----	12.58(1)	0.88(1)	0.41(3)
F	----	13.12(2)	0.86(2)	0.23(3)
G	----	13.36(1)	0.93(2)	0.23(3)

Meinunger (1969, 1971, 1980) has shown that periods of activity are irregularly interrupted by relatively quiescent periods which may last over a decade. It's unfortunate that the present observations fall entirely within such an extended period of inactivity (cf. Meinunger 1980). The observations are few and one should be skeptical of attributing too much significance to it, but there is the suggestion from the B-V colors that the star has reddened by about 0.4 mag over the nine years covered by the observations.

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References:

Herbig, G. H. 1977, *Ap. J.* 217, 693.

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_____, 1971, *Mitt. veränderl. Sterne*, 5, 173.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2381

Konkoly Observatory
Budapest
10 August 1983

HU ISSN 0374-0676

THE SPECTRUM OF VY AQUARII AT MINIMUM

Considerable interest has been recently expressed (see all references following) in the recurrent nova VY Aquarii. Historical brightenings appear to have taken place in 1907, 1929, 1934, 1941?, 1942, 1958, 1962, and 1973. A suggestion of a recurrence period of 11.0 years is partly borne out by the data and McNaught (1982) proposes that another outburst may take place in 1984.

Two spectra of this star were obtained by the author using the image-intensified White spectrograph and 2.1-meter telescope of the Kitt Peak National Observatory on UT 1983 July 17.401 and July 18.394. The scale was approximately 43 Å mm^{-1} on forming gas baked IIIa-J plates and the wavelength range was nearly 3700 - 5000 Å. Visually, VY Aquarii was clearly at minimum, with the magnitude estimated as ≤ 16 from the set-up field. Both spectra were underexposed (despite exposure times of 1.0 and 1.5 hours respectively) but clear indications of some spectral features could be seen. Radial velocities of these features were measured using the single-axis Grant comparator of the Kitt Peak National Observatory.

The spectrum of the star is that of a Be star with all the hydrogen lines visible in emission from H11 to H^{β}. The Ca II K-line and He I lines at $\lambda\lambda$ 4026, 4120, 4143, 4387?, 4471, and 4713? were also seen. All these features took the form of double emission - central absorption profiles. In every case, the central absorption feature did not reach the continuum level and the violet emission feature was always wider, though V = R in intensity. The helium lines were very weak and not measurable for radial velocity. The K-line was quite strong. $H\zeta$ was found to be wider in extent on the violet side which may betoken a contribution from λ 3888 He I in emission. The total widths of the emissions averaged 22.5 Å ($\sim$1600 km s^{-1}) and did not change appreciably over the two nights. The emission widths increased from short to long wavelengths (17.4 Å at H9 to 26.6 Å at $H\beta$ on the second night).

The radial velocities of all features capable of being measured appear in the following table with VEP denoting violet emission peak, CA central absorption, and REP red absorption peak. All velocities are in km s^{-1}.

	1983 Jul 17.401	1983 Jul 18.394
H8 VEP	--------------	-509.8
H8 CA	--------------	-183.0
K-line VEP	-635.4	-603.4
K-line CA	-35.4	-188.9
K-line REP	+504.1	+355.0
$H\epsilon$ VEP	-700.7	-793.1
$H\epsilon$ CA	-65.8	-274.8
$H\epsilon$ REP	+506.0	+233.7
$H\delta$ VEP	-664.9	-578.7
$H\delta$ CA	+10.1	+5.2
$H\delta$ REP	+417.1	+420.8
$H\gamma$ VEP	-531.1	-444.7
$H\gamma$ CA	-161.5	-90.4
$H\gamma$ REP	+370.3	+408.2
$H\beta$ VEP	-501.0	-430.1
$H\beta$ CA	-137.8	+94.5
$H\beta$ REP	------	+389.9
Mean (all CAs)	-78.1	-106.2
Mean (all hydrogen CAs)	-88.8	-89.7

It may be seen that there is considerable scatter in the velocities of the central absorptions, both internally and night to night. There is no consistent Balmer progression, with the exception of a trend for the VEP velocities to move towards more positive values as longer wavelengths are reached. The similarity in the mean hydrogen CA values is interesting but there exists too much internal scatter to accord it much meaning.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2382

Konkoly Observatory
Budapest
12 August 1983

HU ISSN 0374-0676

BV PHOTOMETRY OF THE SUPERNOVA 1982 IN NGC 2268

BV photometry of the supernova in NGC 2268 discovered by Wild (1982) is reported.

Table I

BV photometry of the supernova

Date	UT	B	V
27/2/82	21^h17^m		14.00
27/2/82	22 50		14.05
01/3/82	19 30		14.05
02/3/82	20 05		14.40
06/3/82	21 02	15.4	
06/3/82	20 18		14.45
14/3/82	19 43	16.00	
14/3/82	20 15		14.65
15/3/82	20 15	16.05	
15/3/82	20 41		14.65
24/3/82	20 15	16.45	
24/3/82	21 41		15.30
26/3/82	20 10	16.50	
26/3/82	21 56		15.35
14/4/82	20 58	16.85	
14/4/82	20 15		15.80
18/4/82	21 08	16.95	
14/5/82	21 49		16.1)

The observations were obtained with the 0.4 m Schmidt telescope in Metzerlen on plates 103a-O, 103a-D and filters Schott 2 mm GG 13 in B and Schott 2 mm GG 11 in V.

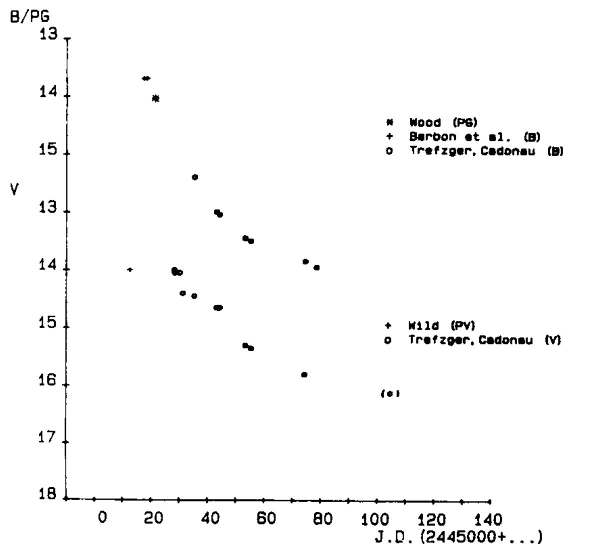

Figure 1: B light curve of SN 1982 Typ I in NGC 2268

Figure 2: SN,NGC 2268 and comparison sequence

Table II

Comparison sequence

No.	B	V	No.	B	V
1	15.4	14.5	34	16.0	14.6
2	15.3	14.0	35	16.1	15.3
3	14.6	14.0	36	16.0	15.1
4	15.9	15.0	37	16.1	15.1
5	16.9	16.1	38	16.0	15.0
6	17.0	16.4	39	16.0	14.8
7	15.7	14.7	40	13.7	12.7
8	15.9	15.2	41	16.8	
9	16.3	15.6	42	17.3	
10	16.9	16.2	43	16.4	
11	17.1	16.1	44	17.0	
12	14.7	13.6	45	16.1	
13	14.9	13.5	46	17.2	
14	16.6	15.5	47	14.8	
15	15.2	14.3	48	16.8	
16	16.2	15.5	49	15.7	
17	16.5	15.1	50	17.2)	
18	16.8	15.8	51	14.7	
19	16.4	15.7	52	14.5	
20	14.6	13.3	53	14.9	
21	16.3	15.5	54	17.4	16.8
22	16.2	15.3	55	16.4	15.6
23	16.5	15.5	56	16.5	15.8
24	17.2	16.3	57	16.1	
25	16.2	15.4	58	17.5)	
26	15.1	14.1	59	17.5	16.9
27	15.2	14.3	60	16.7	16.0
28	15.1	14.1	61	17.2	16.4
29	16.1	15.4	62	16.6	15.8
30	17.3	16.6	63	16.5	15.6
31	17.8)	16.5	64	15.2	
32	16.4	15.6	65	13.4	
33	16.3	15.5			

The comparison sequence was derived from the North Polar Sequence and two fields of stars between the Polar and the comparison sequence.

R. CADONAU

Dr. C. TREFZGER

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2383

Konkoly Observatory
Budapest
15 August 1983

HU ISSN 0374-0676

HR 981 - A NEW USPC

As part of a survey for USPC's south of declination -60°, we observed the F0 giant HR 981 (= HD 20313) on 1981 December 4. ι Hyi (=HR 1025=HD 21024) and ν Men (= HR 1456 = HD 29116) were chosen as comparison and check star, respectively. Figure 1 illustrates the light curve obtained, Fourier analysis of the short span of data indicated a period around 0.066 day and a visual light range ≈ 0.02 magnitude. The solid line in Figure 1 is a reconstructed light curve using this period only; the average difference between comparison and check stars is given by a dashed line. Fourier analysis of the magnitude differences between comparison and check stars indicated that the observed period was only present for HR 981 and could not be attributed to atmospheric conditions or observing procedures.

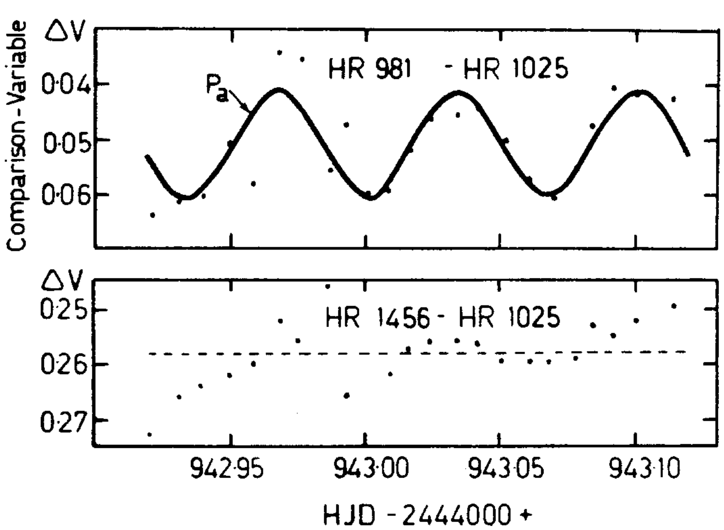

Figure 1

Because of the large scatter in the magnitude differences between check star and comparison star, particularly at the beginning of the observing session, HR 981 was reobserved on 1982 November 21 and again on 1982 December 12 using ι Hyi as a comparison star and HD 20927 (= DM -79° 98) as a check star; light curves and data are given in Figures 2 and 3 where solid lines represent reconstructed light curves and the dashed lines indicate the means magnitude difference between comparison and check stars.

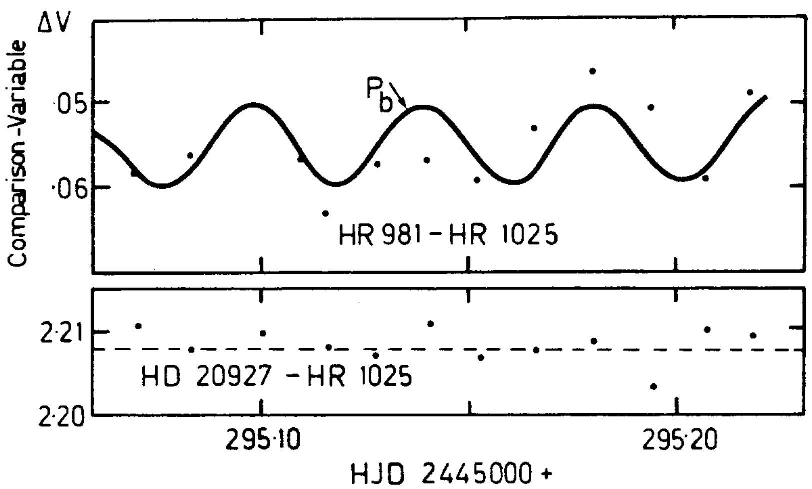

Figure 2

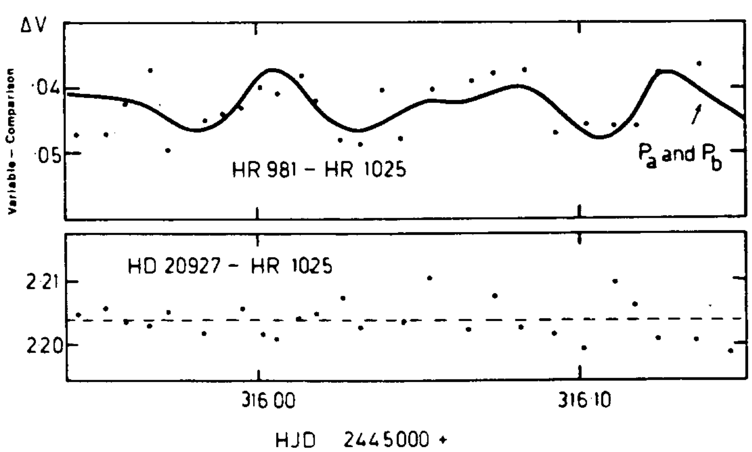

Figure 3

A period of $P_b = 0.041 \pm 0.001$ day was present on all three nights and the period $P_a = 0.065 \pm 0.001$ day was isolated for the two longer observing sessions, the observing session on 1982 November 21 being too short to ascertain this longer period. The amplitudes are not well determined due to insufficient data and small signal to noise ratio, however P_b appears to have an amplitude of 0.003 magnitude and P_a has about twice the value. The calculated period ratio of $P_b/P_a = 0.63 \pm 0.03$ indicates pulsation in the fundamental mode and second overtone. (See Petersen, 1976, where P_2/P_0 is given as 0.61 or Breger, 1979, where $P_2/P_0 = 0.62$). This explanation as to the modes of pulsation observed in HR 981 is reinforced by agreement between $P_0 \simeq 0.07$d calculated using the PLC relation of Breger (1979) with M_v and b-y given in Table I, and $P_a = 0.065$ day observed for this star. HR 981 is a known binary; because of the separation of the components the combined light of HR 981A and B was measured on all nights. Table I gives the average uvby β data for both components of HR 981 as listed by Hauck and Mermilliod (1980) along with their luminosities and effective temperatures calculated from these data.

Table I

	HR 981A	HR 981B
V	5.68	8.06
b-y	0.166	0.284
m_1	0.190	0.159
c_1	0.839	0.463
β	2.765	2.668
M_v	1.79	3.45
T_e	7530 K	6640 K
$(b-y)_o$	0.165	0.289
$[m_1]$	0.219	0.21
$[c_1]$	0.805	0.406

The observed variations can be attributed to HR 981A, as its luminosity and effective temperature place it within the USPC instability region. It is worth noting that HR 981B is too late in spectral type to be a USPC and would have to pulsate with an amplitude ≥ 0.2 magnitude to produce the observed variation of the combined light of HR 981A and B.

We wish to acknowledge the cooperation of Mt. Stromlo and Siding Spring observatories in allocating us time on the 0.4 m telescope. T. Moon is funded by a Commonwealth Government postgraduate research award; travel to and accommodation at Siding Spring observatory were funded through a Monash University special research grant.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2384

Konkoly Observatory
Budapest
15 August 1983

HU ISSN 0374-0676

ON THE PULSATION OF HD 201601

The discovery of the pulsation of HD 201601 (HR 8097, γ Equ) with a period of 12.5 minutes by Don Kurtz (1982, priv. comm.) was an important contribution to the group of oblique pulsators (Kurtz, 1982). HD 201601 is particularly interesting since magnetic field variations with a period of about 72 years (Bonsack and Pilachowski, 1974) would imply an extremely slow rotation, if explained on the grounds of the oblique pulsator model.

A unique feature of the short time scale pulsation of HD 201601 seems to be that the amplitude is variable in time scales considerably shorter than the magnetic field variations. A possible explanation could be that the magnetic field variations are indeed of solar-cycle type, as suggested by Krause and Scholz (1981) and that the rotation period is about 38 days (Kurtz, priv. comm.).

HD 201601 was observed in July 9, 10, and 11 1983 (UT) at the Mauna Kea Observatory, Hawaii, using the 24" telescope of the University of Hawaii.

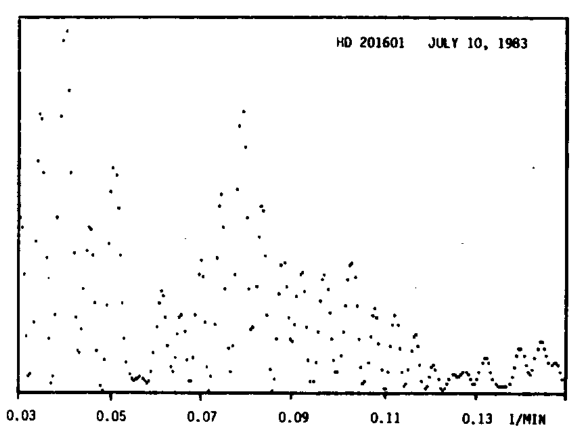

Figure 1:Power spectrum of HD 201601 for July 10, 1983

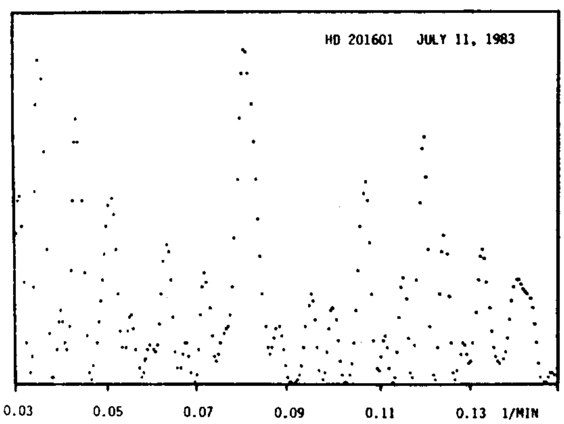

Figure 2:Power spectrum of HD 201601 for July 11, 1983

A classical single channel photon-counting photometer with a Johnson B-filter and a 1.2D neutral density filter was used in combination with a RCA C31034A photomultiplier. The observations are part of a survey for pulsating Ap stars initiated at the European Southern Observatory, Chile, and at the Mauna Kea Observatory. More details concerning the observation technique and reduction can be found in Weiss (1984). In Figures 1 and 2 the best and worst case for the power spectra are presented. In all three cases, however, the power peaks at a frequency of about 0.079 (1/min) are clearly distinguishable from noise. The amplitudes seem to be constant for all three nights and are estimated to be about 0.8 mmag (B). A final analysis of the data will be published elsewhere.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2385

Konkoly Observatory
Budapest
18 August 1983

HU ISSN 0374-0676

PHOTOELECTRIC MINIMA OF ECLIPSING BINARIES

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

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

Abbreviations of the observers' names:

Bu = A. Buchler
Bz = S. Bozkurt
Er = A.Y. Ertan
Es = E. Hamzaoğlu
Gd = N. Güdür
Gl = Gülmen
Gr = R. Gröbel
Ib = C. Ibanoğlu
Ma = D. Matschat
Ml = M. Hamzaoğlu
Sn = S. Evren
Sr = C. Sezer
Tj = T. Eker
Tm = O. Tümer
Tn = Z. Tunca
Va = V. Keskin
Wo = G. Wolfschmidt

Remarks:

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

O-C (II): SAC 54, Krakow 1982

O-C (III): IM Aur 2438 327.7922 + $1^{d}.2472\ 906 \cdot E$ (N. Güdür, Ö. Gülmen, C. Sezer, I.B.V.S. No. 2098, 1982)
NN Cep 2444 507.4033 + $2^{d}.058305 \cdot E$ (N. Güdür, Ö. Gülmen, I.B.V.S. No. 1881, 1980).

Table

Star	Min.hel. 244	O-C (I)	O-C (II)	O-C (III)	Filt.	Obs.	Instr.	Rem.
AB And	5230.4774	+0^{d}.0040	-0^{d}.0054		V	Bu/Gr	34	MinII
CN And	5274.330:	-0.012:			V	Gr	34	MinII
" "	5294.4598:	-0.0139:			V	Gr	34	
OO Aql	5180.445:	+0.003:	-0.006:		V	Bu/Gr	34	MinII
SS Ari	5323.296:	-0.083:	-0.004:		V	Bu/Gr	34	
IM Aur	4569.236	-0.023 =	-0.023	+0.002	B, V	Sn/Sr	48	
" "	4893.5270	-0.0285 =	-0.0285	-0.0027	B, V	Gd/Tj	48	
" "	4931.5674	-0.0306 =	-0.0306	-0.0046	B, V	Gd/Va	48	MinII
" "	5018.2548	-0.0303 =	-0.0303	-0.0042	B, V	Gd/Sr	48	
" "	5261.4702	-0.0376 =	-0.0376	-0.0104	B, V	Gd/Sr	48	
AS Cam	5002.514	-0.213 =	-0.213		V	Wo	34	MinII
RZ Cas	5123.4583	-0.0092	-0.0070		V	Gr/Wo	34	
DO Cas	5186.4744	-0.0073	-0.0016		V	Gr	34	
" "	5306.2903:	-0.0082:	-0.0022:		V	Gr	34	
MN Cas	5280.4612	-0.0027	+0.0072		V	Bu/Gr	34	1)
ZZ Cep	5223.493:	+0.007:	+0.007:		V	Bu/Ma	34	
CQ Cep	5143.4817	-0.0179 =	-0.0179		B	Sn/Tm	48	
" "	5143.4810	-0.0186 =	-0.0186		V	Sn/Tm	48	
EG Cep	5194.4118	+0.0123	+0.0056		V	Bu/Gr	34	
NN Cep	4893.336			+0.001	B, V	Gd/Tj	48	MinII
KR Cyg	5130.4907	+0.0015 =	+0.0015		V	Bu/Gr	34	

Table I (cont.)

Star	Min.hel. 244	O-C (I)	O-C (II)	O-C (III)	Filt.	Obs.	Instr.	Rem.
V478 Cyg	4878.3065	+0.0765		+0.0008		Sr/Tm/Va	48	
V836 Cyg	4874.3997	+0.0084	+0.0072	+0.0002	B	Bz/Sn	48	
" "	4874.4001	+0.0088	+0.0076	+0.0006	V	Bz/Sn	48	
" "	4879.3013	+0.0094	+0.0082	+0.0012	B, V	Bz/Va	48	MinII
" "	4894.3340	+0.0136	+0.0125	+0.0054	B	Bz/Sn	48	MinII
" "	4894.3305	+0.0101	+0.0090	+0.0019	V	Bz/Sn	48	MinII
" "	4895.3097	+0.0092	+0.0080	+0.0010	B	Bz/Tm	48	
" "	4895.3076	+0.0071	+0.0059	-0.0011	V	Bz/Tm	48	
" "	4929.2879	+0.0101	+0.0089	+0.0018	B	Bz/Sn	48	
" "	4929.2875	+0.0097	+0.0085	+0.0014	V	Bz/Sn	48	
V909 Cyg	5178.5261	+0.0239		-0.0009	B, V	Gl	48	MinII
" "	5192.555	+0.026		+0.001	B, V	Sr	48	MinII
" "	5195.3592	+0.0245		-0.0003	B, V	Sr	48	MinII
" "	5202.3736	+0.0253		+0.0005	B, V	Gd/Sr	48	
" "	5216.4002	+0.0248		0.0000	B, V	Gd	48	
" "	5230.4288	+0.0264		+0.0015	B, V	Sr	48	
" "	5261.2870	+0.0250		0.0000	B, V	Gd/Sr	48	
DM Del	5194.4394	+0.0490	-0.0063		B, V	Gl	48	MinII
" "	5219.3558	+0.0476	-0.0078		B, V	Gl/Tj	48	
BS Dra	5121.4700	-0.0003 =	-0.0003		V	Bu/Gr	34	
AK Her	5002.6546	+0.0003 =	+0.0003		V	Wo	34	

Table I (cont.)

Star	Min.hel. 244	O-C (I)		O-C (II)	O-C (III)	Filt.	Obs.	Instr.	Rem.
HS Her	5160.432	-0.011	=	-0.011		V	Bu/Gr	34	
SW Lac	5160.5296	-0.0208		+0.0014		V	Bu/Gr	34	
" "	5192.4399	-0.0221		+0.0002		V	Bu/Gr	34	MinII
" "	5193.4020	-0.0222		+0.0001		V	Bu	34	MinII
RT Lac	5223.4661	-0.0384		-0.0352	-0.0011	B	Ib/Tm	48	
" "	5223.4654	-0.0391		-0.0359	-0.0018	V	Ib/Tm	48	
" "	5228.5404	-0.0382		-0.0349	-0.0007	B	Ib/Tn	48	
RT Lac	5228.5384	-0.0402		-0.0369	-0.0027	V	Ib/Tn	48	
" "	5284.3532	-0.0395		-0.0363	-0.0013	B	Er/Ib	48	
" "	5284.3529	-0.0398		-0.0366	-0.0016	V	Er/Ib	48	
" "	5312.2595	-0.0403		-0.0371	-0.0017	B	Sn/Tm	48	MinII
" "	5312.2610	-0.0388		-0.0356	-0.0002	V	Sn/Tm	48	MinII
AR Lac	5163.4368	-0.0325		-0.0336	-0.0041	B	Er/Tm	48	
" "	5163.4382	-0.0311		-0.0322	-0.0027	V	Er/Tm	48	
" "	5164.4372	-0.0273		-0.0248	+0.0047	B	Tn	48	MinII
" "	5164.4378	-0.0267		-0.0242	+0.0053	V	Tn	48	MinII
" "	5165.4189	-0.0336		-0.0347	-0.0052	B, V	Er/Tm	48	
" "	5166.4098	-0.0379		-0.0354	-0.0059	B, V	Er	48	MinII
" "	5296.3065	-0.0371		-0.0383	-0.0070	B, V	Tm/Tn	48	
V566 Oph	5183.4926	+0.0621		+0.0000		V	Bu/Gr	34	
DI Peg	5196.4870	+0.0034	=	+0.0034		V	Bu	34	

Table I (cont.)

Star	Min.hel. 244	O-C (I)	O-C (II)	O-C (III)	Filt.	Obs.	Instr.	Rem.
UV Psc	5265.5228	+0.0025	-0.0028		B, V	Ib/Tn	48	
" "	5282.3149	+0.0041	-0.0011		B	Sn/Tm	48	MinII
" "	5282.3139	+0.0031	-0.0021		V	Sn/Tm	48	MinII
" "	5284.4666	+0.0032	-0.0020		B, V	Er/Ib	48	
" "	5285.3284	+0.0040	-0.0013		B, V	Ib/Tm	48	
V471 Tau	5284.55656	-0.00239		+0.00160	B	Er/Ib	48	
W UMa	4986.3624	+0.0076	-0.0024		V	Es	48	
" "	4986.5290	+0.0074	-0.0026		V	Es	48	MinII
" "	4987.3639	+0.0082	-0.0018		V	Es	48	
" "	5066.4356	+0.0079	-0.0023		B	Es	48	
" "	5066.2689	+0.0080	-0.0022		B	Es	48	MinII
W UMa	5266.6173	+0.0074	-0.0035		B	Es/Ml	48	
" "	5267.6180	+0.0072	-0.0037		B	Es/Ml	48	
" "	5276.4592	+0.0071	-0.0039		B	Es/Ml	48	MinII
" "	5297.4788	+0.0075	-0.0035		V	Es	48	MinII
" "	5299.4792	+0.0061	-0.0049		V	Es	48	MinII
AH Vir	5022.5734	+0.0635	+0.0015		V	Wo	34	

Remarks: 1) MinII (GCVS), MinI (Krakow)

V478 Cyg 2444 777.4779 + $2^{d}.880795 \cdot E$ (C. Sezer, N. Güdür, Ö. Gülmen, I.B.V.S. No. 2100, 1982)

V836 Cyg 2444 853.4903 + $0^{d}.6534122 \cdot E$ (S. Bozkurt, I.B.V.S. No. 2124, 1982)

V909 Cyg 2445 202.3731 + $2^{d}.8054230 \cdot E$ (Ö. Gülmen, N. Güdür, C. Sezer, I.B.V.S. No. 2245, 1982)

RT Lac 2444 873.3648 + $5^{d}.0739496 \cdot E - 2^{d}.7 \cdot 10^{-8} \cdot E^2$ (Z. Tunca, C. Ibanoğlu, O. Tümer, A.Y. Ertan, S. Evren, Astrophys. Space Science, in press, 1983)

AR Lac 2441 593.7123 + $1^{d}.98319204 \cdot E - 5^{d}.24 \cdot 10^{-9} \cdot E^2$ (S. Evren, C. Ibanoğlu, O. Tümer, Z. Tunca, A.Y. Ertan, Astrophys. Space Science, in press. 1983)

V471 Tau 2440 610.06478 + $0^{d}.52118371 \cdot E - 8.1 \cdot 10^{-11} \cdot E^2$ (Z. Tunca, O. Tümer, M. Kurutaç, C. Ibanoğlu, Astrophys. Space Science 64, 421, 1979)

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

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

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

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2386

Konkoly Observatory
Budapest
18 August 1983
HU ISSN 0374-0676

B AND V PHOTOMETRY OF THE SOUTHERN RS CVn CANDIDATE HD 196818

The star HD 196818 (KO III p: Houk and Cowley, 1975) has been included in several recent lists of stars with Ca II H and K emission, and has been suggested as a candidate RS CVn system (Weiler and Stencel, 1979). Hearnshaw (1979) reports very strong H and K emission in six spectra obtained on this object, and notes that the emission is even more intense than in the very active RS CVn star HR 1099 (V711 Tau). He also reports that radial velocity variations may be present. HD 196818 is a known variable star, with the Bamberg number BV 893. Collier et al (1982) in an optical and radio survey of southern RS CVn systems and related objects observed HD 196818 on five of the eight days of the radio survey but did not detect any radio emission at 5 GHz. They also obtained a high dispersion Hα line profile of this system, which showed a broad shallow absorption.

We have obtained photoelectric B and V measurements of HD 196818 on fourteen nights from 1982 August to 1983 July with the 0.4m telescopes at Monash Observatory and at Siding Spring Observatory. Comparison stars used were HD 193721, HD 194612 and HD 196520. For the data taken at Monash the instrumental system very closely approximates the standard UBV system and no corrections were necessary. For the data taken at Siding Spring, transformation equations were determined from observations of UBV standard stars and the appropriate corrections applied. The B and V magnitude differences between the comparison stars are given in Table I.

Table I

	ΔV	ΔB
HD 193721 - HD 194612	-0.139 ±0.010	-0.701 ±0.008
HD 194612 - HD 196520	-1.701 ±0.011	-1.070 ±0.008
HD 196520 - HD 193721	1.840 ±0.008	1.771 ±0.008

A total of 65 V and 17 B measurements were obtained. Inspection of the data showed that brightness variations over a few hours were small compared with the changes observed over several days, so for a given night's data, two or more individual measurements were combined to form the mean points plotted in the accompanying diagrams.

Figure 1 shows the V light curve of HD 196818 relative to HD 196520. The epoch is arbitrarily chosen to be HJD 2445200.000, and the period is estimated to be 20.31 days. The range in V is about 0.3 magnitudes.

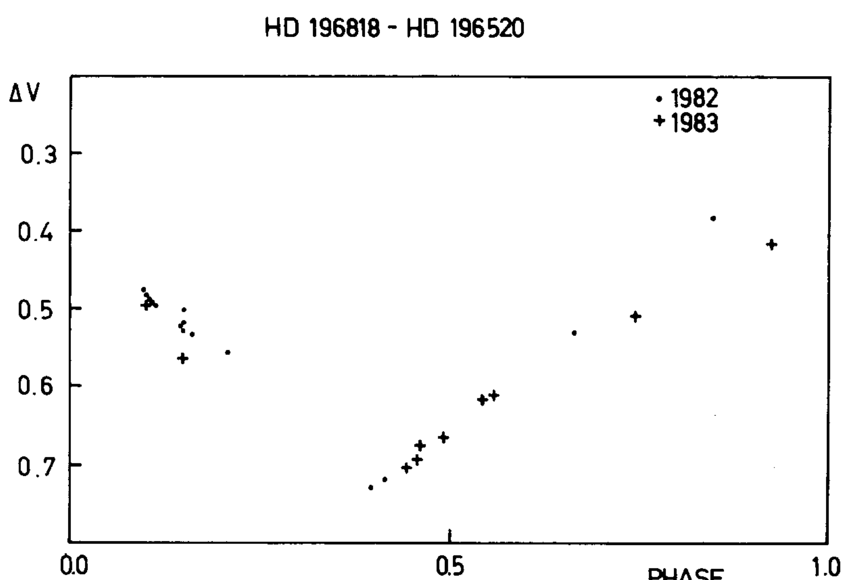

FIGURE 1

Although complete phase coverage has not been obtained, it appears that the light curve is characterized by an almost linear rise and fall, resembling a "sawtooth" wave. A plot of B-V versus V (Figure 2) shows a definite colour change of about 0.05 magnitudes, the star

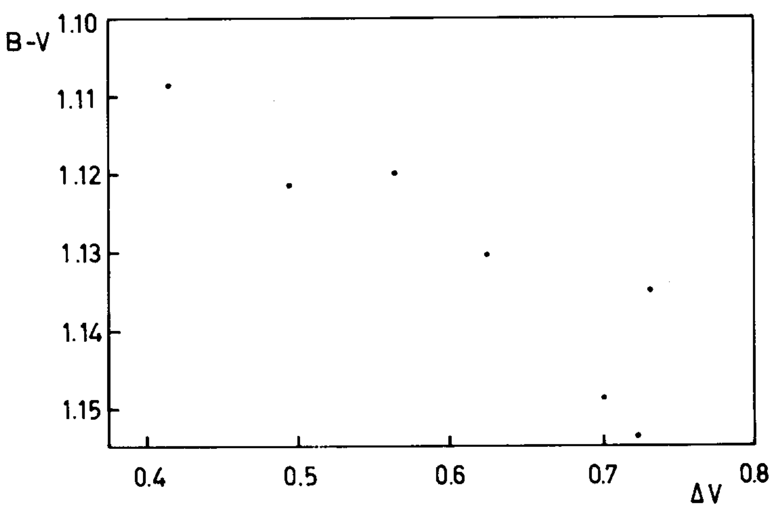

FIGURE 2

being redder when fainter. This would be consistent with the light variations being due to cooler active regions on the surface of the star, as seems to be the case for many related systems. For example, the colour change of this star and the range and shape of its V light curve are similar to those for HD 32918 found by Collier (1982) to be a member of the FK Comae class of single rapidly rotating late type giants.

We note that the light curve obtained here was determined from data taken over almost one year. We have assumed that the light curve has remained stable over this time. If this assumption is invalid then the estimate of the value of the period may also be in error.

We are planning to continue our observations of this star.

We thank the Director and Staff of Mount Stromlo and Siding Spring Observatories for the allocation of telescope time on the 0.4m telescope in 1982. JLI and TTM are supported by Commonwealth Postgraduate Research Awards.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2387

Konkoly Observatory
Budapest
18 August 1983

HU ISSN 0374-0676

ON SOME REMARKABLE PULSATION PROPERTIES OF THE HIGH-LATITUDE F-TYPE SUPERGIANTS

In his recent paper Fernie (1983) states that HD 161796 is unique among known Cepheid-like variables in switching pulsational modes. However, we would like to show in this note that the pulsation properties of HD 161796 are shared by a group of stars which are similar to each other also in many other aspects. This group of variable F-type supergiants far above the galactic plane was proposed in our recent note (Sasselov, 1983) and HD 161796 belongs to it. To avoid clumsiness thereafter, let us name these luminous massive stars of normal Population I composition "UU Her- type" stars (after the member with best studied photometric behaviour).

All "UU Her- type" stars relatively well studied photometrically, possess at least two distinct alternating pulsational modes, switching from one to the other. This phenomenon has been observed in UU Her by Beyer (1948) - periods of 71 and 90 days; and in HD 161796 - by Fernie (1983) - periods of 43 and 62 days. For 89 Her, the observations in 1980 of Percy and Welch (1981) combined with those of Arellano Ferro (1983) show a clearly developed sine variation with a period of 61 days, as opposed to the one of 68 days in 1977/78. Similarly, for BL Tel(F), the value in the V pass band in 1977/78 is likely ~73 days, quite different from the previous distinct periodicity of 65.1 days (van Genderen, 1983). The extensive observations of UU Her show that the actual switching from one pulsational mode to the other occurs after an interval of irregular variability. From the observations of Fernie (1981) one can see that exactly the same happened to 89 Her in 1979 when switching from the 68^d to the 61^d mode; and to BL Tel(F) in 1976 (van Genderen, 1983).

Observations of UU Her in 1978/79 (Sasselov, Perem.Zv., in press) point to a distinct pulsation period of 80 days, i.e. a third one, different from the other two periods. Thus, for longer intervals of time pulsational mode switching in these stars may not be confined to two modes only. Hence, we get various ratios.

A curious phenomenon that has impressed most of the observers mentioned above seems to be common for all "UU Her- type" stars, too: not often, pulsation at full amplitude may cease abruptly - the star remaining constant for a couple of months - and then breaking into oscillations abruptly again. Observed in UU Her in 1935 (for 62 days); in HD 161796 in 1981 (for 64 days); perhaps, in BL Tel(F) in 1969; and, may be, in the end of 1978 in 89 Her.

A unique feature revealed so far only in UU Her is the frequency modulation of its pulsations, unaffected by the mode switching, and probably - not a light-time effect (Sasselov, 1981).

The observations of another "UU Her- type" star - HD 112374 are insufficient to discuss its variability in details. We suggest that it should be observed further from the southern hemisphere. More observations of BL Tel are necessary now, as well.

Discussing the pulsation properties of the "UU Her - type" stars, we have to mention in brief the problems about the interpretation of their light variability. For HD 161796 in particular, Fernie (1983) attributes it to radial pulsations. However, apart from posing much theoretical difficulties, radial pulsations appear to be inconsistent with the behaviour of the other "UU Her- type" stars, as well. The explanation by means of nonradial pulsations seems least contradicting, moreover that the theoretical study by Shibahashi and Osaki (1981) shows that low harmonic f-modes can readily be excited in supergiants on the left-hand side of the Cepheid instability strip - just where the "UU Her- type" stars are located. The harmonic index increases rapidly towards higher temperatures ($\ell \cong 100$ at $T_{eff} = 10000K$) and this may explain the confinement of specific variability to F-type supergiants only. Also mode coupling among radial and nonradial modes perhaps should not be completely ruled out in the close vicinities of the instability strip. However, as a whole, this interpretation also remains conjectural. The recent detection of a probable massive dark companion to 89 Her (Arellano Ferro, 1983), similar to the one in BL Tel, along with the appreciably complex variability of the "UU Her- type" stars, indicates at least that the exact solution may be rather complicated.

The author is much indebted to N.S. Nikolov and G.R. Ivanov for their continuous interest and support.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2388

Konkoly Observatory
Budapest
19 August 1983
HU ISSN 0374-0676

OPTICAL BEHAVIOR OF EZ PEGASI

The unique variable EZ Pegasi at position $\alpha = 23^h14^m26^s$, $\delta = 25^\circ26'.8$ (1950), and of spectrum G5 (General Catalogue of Variable Stars, 3rd Ed.), underwent a flare in November 1943 when its G5 spectrum was observed to have changed to B (Vyssotsky and Balz 1958). Examination of Harvard Observatory photographic plates by G. Mumford showed irregular variation from magnitude 9.5 to 10.5 (Alden 1958).

Spectroscopic observations by Irvine between October 1971 and January 1972 showed normal G5 V spectra in the blue except for Hβ that appeared as a "very broad, weak absorption with possible core emission." Spectra in the visual region revealed short-term fluctuations in the intensity of Hα emission (Irvine 1972). Irvine concluded that the 1943 B spectrum represented a flare, and as the star lacks characteristics of an ordinary flare star, he suggested it to be a probable U Geminorum-type system.

As a result of recent requests to the American Association of Variable Star Observers (AAVSO) from several astronomers concerning the behavior of EZ Peg, the long-term AAVSO observations of this star were compiled. Figure 1 is an AAVSO finder chart and Figure 2 is the AAVSO visual light curve composed of individual observations of EZ Peg. The visual light curve shows an apparent constant brightness at 9.6 ±0.2

magnitudes. Analysis of 30-day means of these observations did not show conclusive evidence of periodic variation. Also, a survey of the long-term observations of individual observers confirmed the constancy of its light behavior.

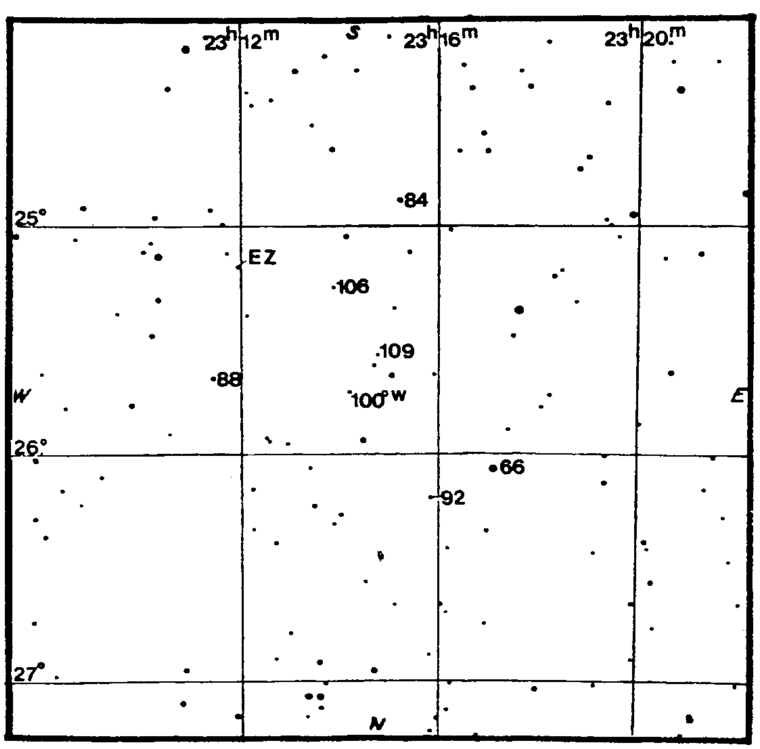

Figure 1

AAVSO finder chart of EZ Peg. The variable W Peg also appears on the chart.

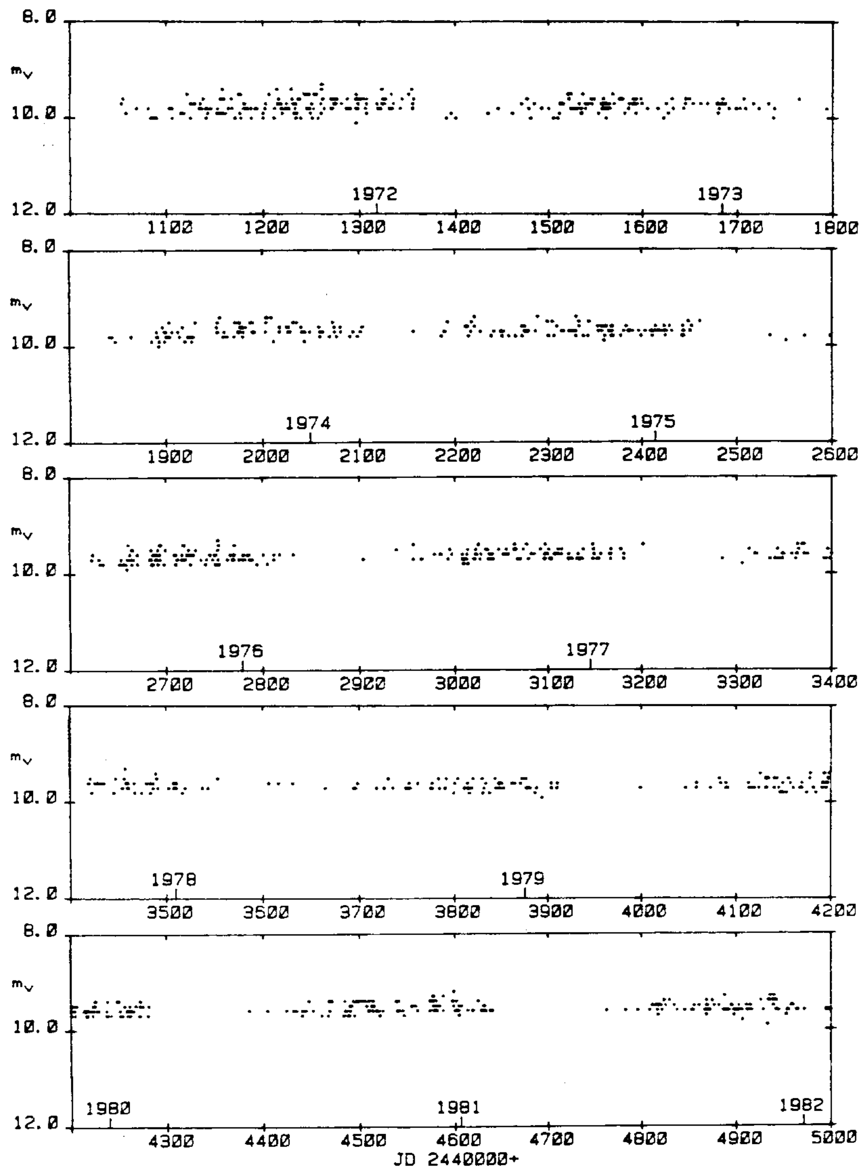

Figure 2

AAVSO visual light curve from 1972 to 1982. Each point represents one observation.

Continued optical monitoring along with spectroscopic observations are needed to further determine the nature of this interesting star. The author wishes to acknowledge the contribution of the observers of the AAVSO.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2389

Konkoly Observatory
Budapest
22 August 1983

HU ISSN 0374-0676

HR 5 = ADS 61: A NEW VARIABLE STAR

We obtained differential photoelectric photometry of the bright (V = $6^{m}.0$) visual binary HR 5 = ADS 61 in late 1981 and in late 1982 at five different observatories, finding it to be variable with a period of $1^{d}.08$. All observers used HD 225257 as the comparison star.

Fried observed with the 16-inch at Braeside Observatory in Flagstaff, Arizona. Brettman observed with the 10-inch at the Braeside-Midwest Observatory in Huntley, Illinois. DuVall observed with the 16-inch at the Modine-Benstead Observatory in Racine, Wisconsin. Poe observed with the 24-inch at Dyer Observatory in Nashville, Tennessee. Shaw observed with the 24-inch at the University of Georgia Observatory in Athens, Georgia. Poe observed in V and B of the UBV system. Shaw observed in the five bandpasses of the Washington photometric system, which includes ultraviolet (c), blue (m), visual (v), red (T1), and infrared (T2). All of the others observed only in the V of the UBV system.

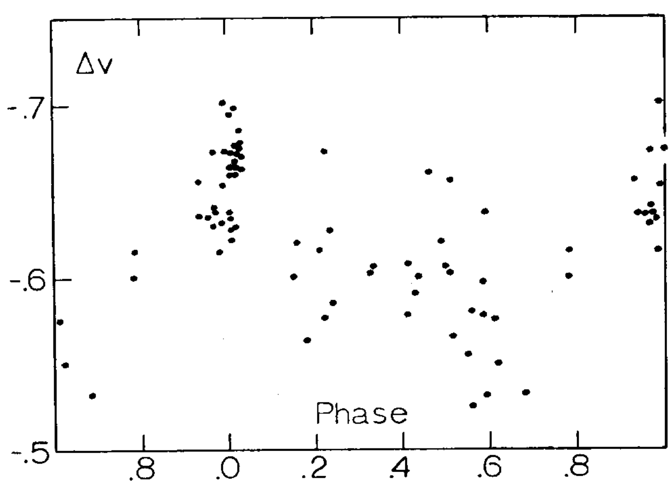

Figure 1

Differential visual magnitudes on 11 nights observed at the Braeside and Braeside-Midwest Observatories. Phase is computed with the period $1^{d}.082$. Zero phase corresponds to JD 2444900.0.

Analysis of the Braeside and Braeside-Midwest data, including observations on 11 nights between JD 2444901.7 and 2444948.7, indicated a period of $1^{d}.082 \pm 0^{d}.002$. Fourier analysis of that light curve, shown in Figure 1, with a sine-curve fit indicated a total amplitude of $\Delta V = 0^{m}.066 \pm 0^{m}.012$. Zero phase in that light curve is placed arbitrarily at JD 2444900.0 but the Fourier analysis indicated a minimum at $0^{p}.592 \pm 0^{p}.036$, which corresponds to $2444915.79 \pm 0^{d}.04$.

Shaw observed only on two consecutive nights, shown in Figure 2, but those two nights defined a minimum very clearly at JD $2445270.66 \pm 0^{d}.01$. Because the two minima thus determined are separated by almost precisely 328 cycles, it seems that cycle count has not been lost. This lets us take advantage of the long baseline between the two years and refine the period to $1^{d}.0819 \pm 0^{d}.0001$. If the separation was 327 or 329 cycles, however, the implied period would be $1^{d}.085$ or $1^{d}.079$, both marginally consistent with the 1981 determination of $1^{d}.082 \pm 0^{d}.002$.

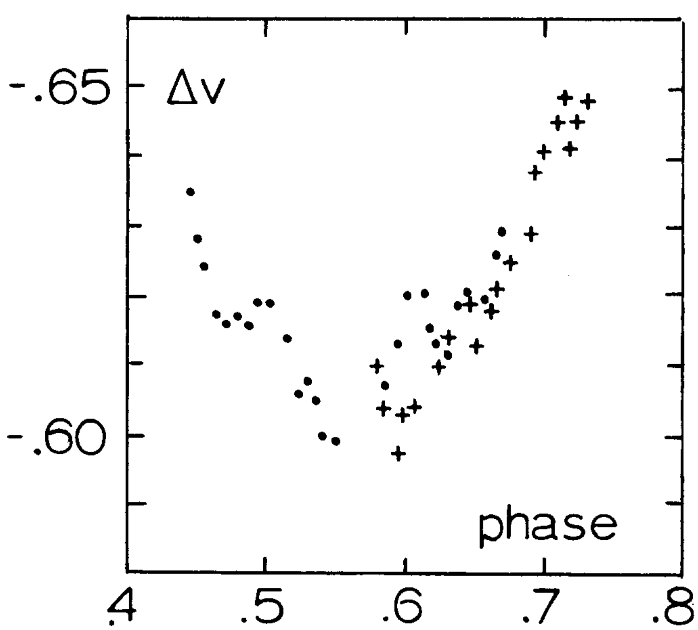

Figure 2

Differential visual magnitudes on two consecutive nights observed at the University of Georgia Observatory. Phase is the same as in Figure 1. Crosses are the first night, circles are the second.

Although Shaw's photometry evidently did not cover the full range of the light variation, we can say how the amplitude depends on wavelength. The ratios in the sense ultraviolet : blue : visual : red : infrared are 1.41 : 0.99 : 1.00 : 0.74 : 0.48, respectively. Thus we see that, compared to the infrared, the variation is about twice as large in the visual and about three times as large in the ultraviolet.

The comparison star HD 225257 is a good choice in that it is only a few arcminutes away from the variable. The color match, however, is not good, with Poe's photometry showing $\Delta(B-V) = +0^{m}.64$. The data plotted in Figures 1 and 2 have not been transformed to V of the UBV system, but that is not important here since they have been used primarily to determine the period.

According to Lippincott (1963) HR 5 = ADS 61 is a visual binary with a semi major axis of 1".43 and an orbital period of 106.83 years. The two components are dG4 and dG8, differing in visual magnitude by $0^{m}.75$. She derived a total mass of $2.8 \pm 0.6\ M_{\odot}$. According to the Fourth Edition of the Yale Bright Star Catalogue, HR 5 is of additional interest in that an invisible companion may be orbitting the dG8 component with a period of 6.9 years. Since both the dG4 and the dG8 components were measured together in our photometry, we have no way of knowing which one is responsible for the 1.08-day variability we have discovered. Spectroscopic observations may help determine the mechanism for the photometric variability. One of the two stars may be a rapidly-rotating unevenly-spotted star, or one of the two may be a spectroscopic binary with an orbital period of $1^{d}.08$.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2390

Konkoly Observatory
Budapest
25 August 1983
HU ISSN 0374-0676

PHOTOMETRY OF FK COMAE

The 8th magnitude star FK Com (BD+24°2592) is the prototype of the small group of single, fast rotating giants of late spectral type. It was first observed photometrically by Chugainov (1976) and later investigated by Ruciński (1981). In this paper we present new observations of FK Com, obtained during 12 nights in May and June 1982.

The observations of FK Com were made using a single channel photometer with the 60 cm Cassegrain telescope at Ostrowik station of Warsaw University Observatory, equipped with an uncooled EMI 6256 A photomultiplier. The variable was monitored through the B and V filters. BD +24°2593 with magnitudes V = 7.621 and B - V = 0.427 (Ruciński, 1981) served as the comparison star and BD +25°2643 with V = 6.091 and B - V = 0.959 (Rucinski, 1981) as the supplementary comparison. The absolute photometry of the comparison star was not done, but the stability of BD +24°2593 relative to BD +25°2643 was better than 0.01 mag during the period of the observations.

Table I lists all our data. The first and second columns give heliocentric julian day and phase, two next columns - differences ΔV and Δ(B-V) in the sense variable minus comparison. The values in third and fourth columns are the mean values of several readings in interval less than 0.05 of the period. The accuracy of each averaged observation is about 0.010 and 0.015 in B-V and V, respectively.

Figure 1 shows the V and B-V light curves constructed using data from Table I and the ephemeris given by Chugainov (1976):

$$JD_{\odot} = 2442192.345 + 2\overset{d}{.}400E$$

The V light curve obtained by us is quite similar to that of Ruciński (1981): maximum light in phase 0.4 - 0.5 and steeper declining branch than the rising one characterize this light

Table I

The observations of FK Com

Hel. J.D. 2440000 +	Phase	ΔV	Δ(B-V)
5116.454	0.379	0.541	0.363
5117.440	0.790	0.616	0.390
5119.423	0.616	0.560	0.377
5119.503	0.649	0.576	0.385
5120.428	0.035	0.626	0.394
5121.446	0.459	0.540	0.365
5122.437	0.872	0.627	0.387
5123.382	0.265	0.573	0.384
5123.478	0.305	0.557	0.371
5124.447	0.709	0.590	0.388
5125.410	0.110	0.609	-
5126.421	0.532	0.525	0.367
5137.433	0.120	0.613	0.378
5139.427	0.951	0.633	0.386

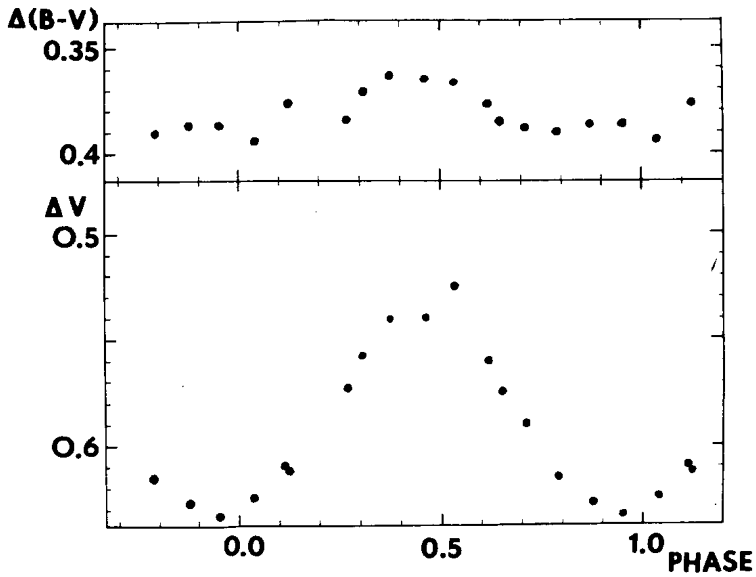

Figure 1

curve. The phase of the maximum light would suggest that the region of the star responsible for optical light variations (dark or bright spot) did not move on the stellar surface during the period 1974 (Chugainov's observations) - 1982. It should be also noted that the B-V colour indicates that the star is redder at minimum light than during maximum.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2391

Konkoly Observatory
Budapest
25 August 1983
HU ISSN 0374 - 0676

ANNOUNCEMENT

CEPHEID COLLOQUIUM

The David Dunlap Observatory, University of Toronto, will host a three- or four-day colloquium on all aspects of cepheid variables (theory and observation, both stellar populations) in mid-1984. Application has been made for this to be an official IAU Colloquium, celebrating the 200th anniversary of the discovery of cepheid variables. It is open to all interested persons. If it receives IAU sponsorship a small amount of travel money may be available to selected participants at the discretion of the Scientific Organizing Committee, but awards will not be decided before March, 1984.

TITLE: Cepheids: Theory and Observation.

DATES: May 29, 30, 31, June 1, 1984.

PLACE: University of Toronto, Toronto, Canada.

The program will include review papers, 10-minute contributed papers, and poster presentations. It is our intention to publish the proceedings. The deadline for the receipt of abstracts is May 1, 1984, but participants wishing to give papers should write to J.D. Fernie (address below) as soon as possible, indicating their approximate topic and any strong preference for oral- or poster-presentation. Choices, however, cannot be guaranteed. There will be a registration fee of $60.

Available accommodation will range from university dormitory rooms to luxury hotels at rates from about $25 per day up. Further details will be available later from J.R. Percy (address below).

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2392

Konkoly Observatory
Budapest
26 August 1983
HU ISSN 0374-0676

ECLIPSE TIMINGS OF 31 CYGNI

Photoelectric UBV observations of the 1982 total eclipse of 31 Cygni were obtained with the Hopkins-Phoenix Observatory 20-cm telescope and Braeside Observatory 41-cm telescope. Differential magnitudes, relative to 30 Cygni, were found by differencing the reduced all-sky photometry of each star. Mean extinction and transformation coefficients, appropriate for each instrument, were used in the calculations.

Following the suggestion of Herzeg (1956), the time t_{50} when 50% of the secondary's light is transmitted (through the outer atmosphere of the primary) provides a more accurate description of immersion or emersion than conventional timings of the four contact points. The duration of eclipse is the time interval between ingress and egress t_{50} times, the time of mid-eclipse, t_{mid}, is the mean of ingress and egress t_{50} times. Although t_{50} is wavelength dependent, t_{mid} is assumed to be wavelength independent (see Stencel et al. (1983) for details). Results of

Table I

	U Filter	B Filter
For 1982 Eclipse:		
Ingress t_{50}	JD 2445222.30±0.13	JD 2445222.89±0.13
t_{mid}	JD 2445254.39±0.13	JD 2445254.39±0.13
Egress t_{50}	JD 2445286.48±0.13	JD 2445285.89±0.13
Duration of Eclipse (days)	64.18±0.18	63.00+0.18
For 1962 Eclipse:		
Ingress t_{50}	JD 2437653.78±0.21	JD 2437654.28±0.21
t_{mid}	JD 2437685.72±0.21	JD 2437685.72±0.21
Egress t_{50}	JD 2437717.66±0.21	JD 2437717.16±0.21
Duration of Eclipse (days)	63.88±0.30	62.88±0.30

these calculations and of similar calculations for the 1962 total eclipse using Copenhagen University Observatory data (Gyldenkerne and Johansen 1970) are given in Table I, where Julian Dates include heliocentric time corrections. Timings for the V filter are not derived because the scatter of data is significant compared to the depth of eclipse.

The mean duration of eclipse is 64.03±0.17 days in U and 62.94±0.17 days in B. The mean period of 31 Cygni, over two cycles, is 3784.34±0.12 days.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2393

Konkoly Observatory
Budapest
30 August 1983

HU ISSN 0374-0676

ON DELTA SCUTI STARS IN OPEN CLUSTERS

Summary

The observational correlations for Delta Scuti stars in clusters reported by Frolov and Irkaev (1982) between average period and cluster age, as well as average absolute magnitude and age, are examined. These correlations are shown to be a natural consequence of the systematically different color-magnitude diagrams for clusters of different ages, and the existence of a period-luminosity-color relation for Delta Scuti stars.

Over 200 Delta Scuti stars have been discovered so far. 29 variables are situated in open clusters. Frolov and Irkaev (1982) have examined these cluster variables and found impressive correlations. They write, "the greater the age, the longer the mean period of cluster variables and the higher their mean luminosity." They did not speculate on the possible reasons for the observed correlations. It would, of course, be exciting to discover that the particular radial or nonradial pulsation modes (and hence the period) chosen by a star would depend on the age of the star. However, a more mundane cause for the observed correlations might be the combination of main-sequence evolution with the known period-luminosity-color (PLC) relation for Delta Scuti stars.

We have reexamined the cluster data given by Frolov and Irkaev. Except for the star K573 in NGC 7789, our calculations give similar results. Cycle-count periods are from an updated collection by Breger and Stockenhuber (1983), and the cluster ages for the younger clusters were taken from Mermilliod (1981). Since the correlations of Delta Scuti star periods with other physical quantities usually involve log P, rather than P, we have averaged the log P values for each cluster.

The variable K573 = V521 Cas in NGC 7789 deserves some reexamination. The almost heroic search by Danziger (1971) for Delta Scuti variability among stars in the crowded field of NGC 7789 detected this one variable. Recent proper motions by McNamara and Solomon (1981) indicate a high probability of cluster membership of 96%.

Danziger conservatively deduced a period of about four hours from his 16 measurements of K573. The value of this cycle-count period must be regarded as quite uncertain. Since a "best" (though uncertain) value is required for statistical work, we have redetermined Danziger's period through a Fourier analysis. A best value of $0^d.147 \pm 0^d.037$ is found. Until more observation of this star become available, we recommend that the value of $0^d.15$ be adopted.

Frolov and Irkaev (1982) seem to have made an error in their absolute magnitude determination for K573, in that the correction for the substantial interstellar extinction seems to have been applied twice. With a reasonable reddening of $E(B-V) = 0^m.27$ and $(m-M) = 12^m.2$ (e.g. see Breger 1982) an absolute magnitude of $(M_V)_0 = 1^m.56$ is found. The effect of our correction is to reduce the steepness of the observed correlation between M_V and age.

The period-age and luminosity-age relations for the cluster variables are shown in Figure 1.

We first turn to the observed M_V-age relation. A good correlation can be seen in the lower part of Figure 1, though not quite as impressive as in Frolov and Irkaev. Is this correlation a specific property of Delta Scuti variables, or simply a reflection of different cluster H-R Diagrams? We note here that only one-third of the stars in the lower instability strip show detectable variability. For each cluster an average M_V value for all the stars inside the instability strip was calculated. Because of main-sequence evolution, these values change with cluster age. In NGC 7789, for example, only the edge of the turn-off point lies inside the instability strip. The results of the calculations are marked with the symbol "E" in Figure 1. The good agreement between the observations and the calculations suggests that the observed relation between average absolute magnitude and cluster age for Delta Scuti stars is simply a reflection of main-sequence evolution.

The existence of an evolutionary luminosity-age relation should result in a similar period-age relation because of the existence of a PLC relation for Delta Scuti stars. While the multiple periods present in many Delta Scuti stars have not yet been determined, average time scales of variation can be determined easily (cycle-count periods). For the stars with known values of the multiple periods, we substitute the value of the period with the largest associated amplitude. These cycle-count periods are correlated with the luminosity and color (Breger 1979, Halprin and Moon 1983). Field and cluster stars show no differences in this regard, and similar PLC relations are also found for individual radial modes.

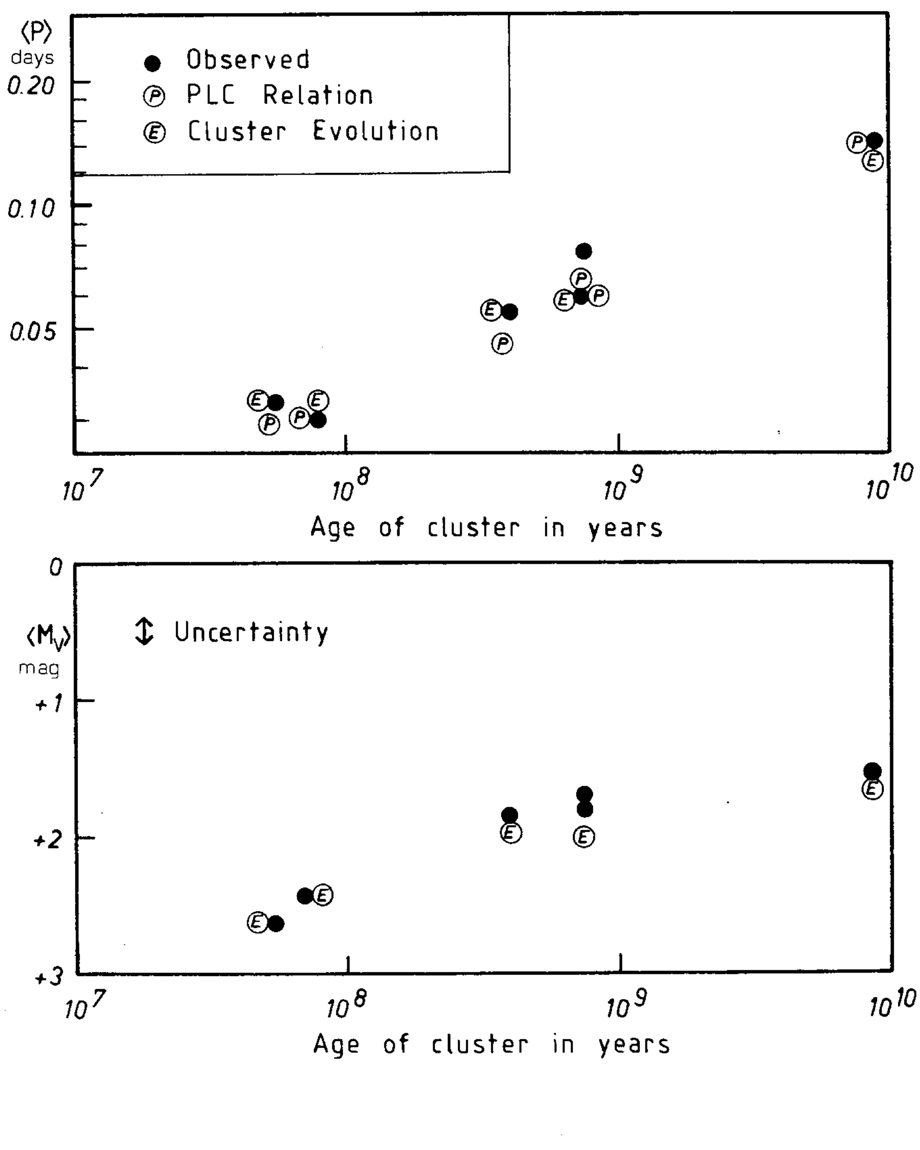

Fig. 1 – Correlations of average pulsation period and M_V with the age of the cluster. The diagrams show that the observed correlations can be explained by the period-luminosity-color relation and main-sequence evolution of the clusters.

To examine whether or not the evolution of cluster main sequences and the PLC can explain the observed period-age correlation, we have computed two average periods for each cluster. The first period (denoted by "P" in Figure 1) represents the calculated periods based on the actual colors and magnitudes of the variable stars. The second period (denoted by "E" in Figure 1) is the expected average period for the all the cluster stars (with or without detected pulsation) inside the instability strip.

The excellent agreement between the calculated and observed average periods indicates that the period-age relation is caused by stellar evolution and the PLC. There is so far no evidence that age and evolution affects Delta Scuti pulsation beyond fixing the initial stellar parameters such as mass, luminosity, and temperature. The only possible modification, which still needs to be explained, lies in the observed large pulsational amplitudes of some metal-poor, undermassive dwarfs such as SX Phe.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2394

Konkoly Observatory
Budapest
1 September 1983

HU ISSN 0374-0676

SEARCH FOR ULTRA SHORT PERIOD VARIATIONS IN EPSILON OCTANTIS

Recently Smith (1983) reported ultra short period oscillations with periods in the order of 100 minutes for the irregular red variables Arcturus and Alderbaran, but cast some doubt whether the observed variations could be considered analogous to the 5 minute solar oscillations. It is suggested that discovery of short period nonradial modes of pulsation in late type stars may provide an insight into convection in stellar envelopes, unfortunately considerable efforts are required to survey likely candidates in an effort to ascertain if such oscillations exist, their amplitudes of variation, and the periods present. Such nonradial oscillations are likely to be of very small amplitudes, generally below the detection limit of photoelectric photometry. However, it is perhaps worthwhile to attempt precise differential photoelectric photometry on some late type stars.

TABLE I

ε Oct				β Oct − ξ Oct		
HJD (2445000+)	V (± 0.02)	B−V (± 0.02)	V−R (± 0.02)	ΔV	Δ(B−V)	Δ(V−R)
466.077	4.61			−1.17		
473.068	4.58	1.41	1.55	−1.18	0.34	0.25
475.070	4.59	1.43	1.59	−1.17	0.34	0.26
503.063	5.06	1.53		−1.21	0.34	
520.081	5.05			−1.18		
534.166	5.18			−1.18		

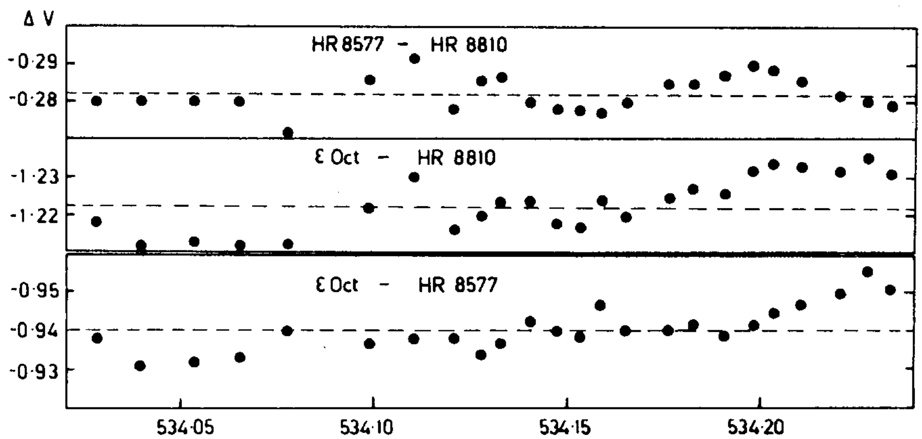
The bright M5 giant ε Oct (= HR 8481 = HD 210967) was discovered to be a semiregular red variable by Eggen (1973), and found to vary by about 0.4 magnitude in approximately 50 days. Using the 0.25 m and 0.4 m telescopes of the Monash observatory, ε Oct was observed on six nights from May to July 1983. As different photomultiplier tubes and filters were used, the necessary standardizations were performed to transform magnitudes and colours to the standard UBVRI system. Average magnitudes and colour indices for ε Oct on each night are given in Table I; also included are the magnitude and colour index differences between nearby comparison stars β Oct (= HR 8630) and ξ Oct (= HR 8663). The quoted errors of ± 0.02 magnitude account for transformation errors as well as observational uncertainty. Measured magnitudes and colours for β Oct and ξ Oct, transformed to the Johnson UBVRI system, are given in Table II.

From Table I it is apparent that ε Oct dimmed in V-light by about 0.5 magnitude from HJD 2445473 to HJD 2445503 with a corresponding B-V change of about 0.1 magnitude. Using the B-V, T_e calibrations for red giants given by Böhm-Vitense (1981), this B-V change indicates that ε Oct cooled from about 3890 K to 3760 K over the 30 day interval.

TABLE II

Star	B-V	V	V-R
β Oct	0.20	4.14	0.18
ξ Oct	-0.14	5.34	-0.08

On 1983 July 18 ε Oct was observed with the 0.4 m telescope for five and a half hours; being of similar B-V to ε Oct, HR 8577 (= HD 213402) and HR 8810 (= HD 218559) were chosen as comparison stars. Results for this session are given in Figure 1; no variations are observed which can be attributed to ultra short period oscillation of ε Oct. The dashed lines give average magnitude differences observed. It is worth noting that the rms scatter of ± 0.005 magnitude forms an upper limit for any ultra short period pulsations of this star.



HJD 2445000 +

Figure 1

T. Moon and J. Innis are supported by Commonwealth Postgraduate Research Awards.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2395

Konkoly Observatory
Budapest
2 September 1983
HU ISSN 0374-0676

MAGNETOMETRIC MEASUREMENTS OF THE CARBON STAR Y CVn

There are three plausible mechanisms at least allowing to explain the causes of the light and radial velocity variations in carbon stars: radial pulsations, circulation of components in close binaries, and rotation of heterogeneous single stars. The last hypothesis could be well supported by measuring and detecting reasonably strong magnetic fields connected with these objects.

The dipole magnetic field of Y CVn was investigated on the Zeeman spectra taken with the grating spectrograph of the 6 meter telescope at Zelenchukskaja (Caucasus) using the dispersion of 1.3 nm/mm in the spectral region of 564 to 626 nm. The Zeeman splitting was measured on 236 absorption lines mostly of molecular origin. No systematic deviations were found among the various producers of the individual absorptions. The splitting was very small and completely drowned in the dispersion of the individual measurements. One can conclude from it that the magnetic field of Y CVn, if any, is very weak, and does not exceed the level of the measuring errors. The mean value of the magnetic induction was derived to be $B = (0.005 \pm 0.010)$ Tesla (in vacuum).

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2396

Konkoly Observatory
Budapest
5 September 1983
HU ISSN 0374-0676

SPECTROSCOPIC OBSERVATIONS OF THE COOL ECLIPSING X-RAY BINARY HD155638

The determination by Bloomer et al. (1983) of the orbital period and eclipse epoch of the cool active X-ray source, HD155638 (Stern et al. 1981), permits evaluation of the phases of my spectrograms obtained at the Lick Observatory on 14 nights. The spectrum is dominated by the lines of the cooler component, for which my estimate of the spectral type is in agreement with the G8IV estimated by Stern et al. The distribution of phases is poor for orbit determination, and on only 6 of the nights are the weaker lines of the hotter component seen in the photographic or D-line region of the spectrum. Even at maximum separation, the lines of the components are not well resolved, and velocities of the hotter component are uncertain. The strong emission lines of CaII give velocities in agreement with those of the cooler component. The lines of the hotter star are too weak and poorly resolved for an evaluation of its spectral type, although from the relative appearance of the D lines and FeI lines, it must be an F star.

No evidence is seen of hydrogen lines in this star.

The values of K, the velocity amplitudes, are 46 km s^{-1} for the cooler star and a roughly estimated 50 for the hotter. These values, together with the period, $27\overset{d}{.}55$, lead to masses 1.3 and 1.2 $m_{\odot}$, typical for double-lined RS CVn systems. The radii, for $i=90^{\circ}$, obtained from the widths of eclipse, are 8.2 and 2.5 $R_{\odot}$. The latter is somewhat larger and the former much larger than for the components in other RS CVn eclipsing binaries (e.g., Popper 1980), and this system appears more evolved than the others. For the shorter periods, the more massive, cooler components cannot become as large as 8 $R_{\odot}$ because of Roche lobe constraints. HD155638 may be considered an RS CVn system intermediate between typical double-lined systems such as RS CVn and WW Dra, with their cooler components subgiants having radii about 4 $R_{\odot}$, and single-lined systems such as λ And, in which the cooler component has evolved into a larger giant (15-20 $R_{\odot}$?) so luminous that lines of the hotter component are not seen in the spectrum.

The photometry of Bloomer *et al*. (1983) leads to some contradictions. From the depths of total eclipse in V, 0.23 mag, the magnitude difference between the components at the time of conjunction is $\Delta M_V=1.6$ mag, the cooler component being more luminous. The magnitude difference at this phase can also be computed from the ratio of the radii and the ratio of luminous surface fluxes. The former, obtained from the phases of inner and outer eclipse contacts, is ≤ 3.3, the upper limit being for $i=90^{\circ}$. The ratio of surfaee fluxes in V may be evaluated as follows. From the reported depths of total eclipse in V, B, and U (0.23, 0.43, and 0.76 mags), the color differences are $\Delta(B-V)=0.79$, $\Delta(U-B)=0.80$. It is difficult to match these color differences with the estimated spectral types. If the types were, for example, G8IV and F5, as estimated, the differences would be only 0.38 and 0.47 mags. The observed color differences would be matched approximately by F0 and K1III or IV, although both these types appear somewhat outside the range admitted by the appearance of the spectrograms. Combining the fluxes corresponding to the latter types (e.g., Popper 1980, Table 1) with the ratio of the radii leads to $\Delta M_V \lesssim 0.0$, far from the value 1.6 obtained from the eclipse depth in V. To match the latter, the ratio of radii would have to be much greater than the upper limit or the difference in spectral type would have to be considerably less than required by the depths in V, B, and U. In order to achieve $\Delta M_V=1.6$ with $R_c/R_h=3.3$, a flux ratio corresponding to types G0V and G8IV, for example, would be required. But types this close together are completely outside the range permitted by the color differences derived from the eclipse depths in the three wavelength bands.

Thus there are two apparent contradictions: The differences between the components in B-V and U-B are greater than would be expected from the appearance of the spectra, and, perhaps more serious, the difference in absolute magnitude between the components is in serious disagreement when evaluated in two different ways, namely from the depth of total eclipse on the one hand and from the ratio of the radii and ratio of surface fluxes, the latter derived from the difference in color index, on the other. Improved photometry leading to better values of the widths and depths of eclipse, and perhaps scanner spectrophotometry as well, would be required to examine these matters further.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 2397

Konkoly Observatory
Budapest
5 September 1983
HU ISSN 0374-0676

V436 CEN REVISITED

The superhump phenomenon seen during supermaxima of the SU UMa stars (Vogt 1974, Warner 1975) continues to attract interest but lacks a convincing explanation. One potentially useful clue to the mechanism underlying the superhumps is the slight but statistically significant decrease in their period during an outburst. Haefner *et al.* (1979) show that the superhumps in the well-studied VW Hyi outburst of December 1974 can be represented by elements containing the terms $0\overset{d}{.}07712E - 2.85 \times 10^{-6}E^2$ (where E is the number of cycles elapsed since the beginning of the outburst). Similarly, in TU Men, Stolz and Schoembs (1981) observed superhumps with elements $0\overset{d}{.}12625 - 6.1 \times 10^{-6}E^2$ and the writer has found elements $0\overset{d}{.}07749 - 6.5 \times 10^{-6}E^2$ for the December 1982 supermaximum of Z Cha.

In contrast, Semeniuk (1980) found a slightly increasing superhump period for the May 1978 supermaximum of V436 Cen. This anomaly suggested a second look at the interpretation of Semeniuk's data with the benefit of the greater amount of information now available for supermaxima of VW Hyi (Haefner *et al.* 1979, Vogt 1983). Semeniuk's observations consist of a short run on 7 May 1978, when V436 Cen was on a pre-maximum plateau, runs during the period 8-13 May when V436 Cen was in full outburst (gradually declining by a magnitude), and runs on 17 and 18 May when V436 Cen was within ∿0.5 mag of its quiescent brightness.

The observations of VW Hyi show (Vogt 1983) that the end of an outburst, when VW Hyi is within 0.5 mag of its quiescent brightness, "late superhumps" develop which have a period similar to that of the superhumps during the bright phases of the outburst, but which are displaced by 0.5P in phase with respect to the latter. This suggests that the 17 and 18 May superhumps observed by Semeniuk may in fact have been late superhumps, and that by including them (with their 180° phase shift) into the solution, the superhump elements have been distorted.

That this is apparently the case is seen in Table I, where the light elements $T_{max} = 2443637.4990 + 0\overset{d}{.}063785E - 9.6 \times 10^{-7}E^{2}$, obtained from a least squares fit, are compared with the observed times of superhump maxima or, for the 17 and 18 May data, the times of superhump maxima less $\frac{1}{2} \times 0\overset{d}{.}0638$:

TABLE 1

JDH 244 3600+				JDH 2443600+			
Observed	*Calculated*	*E*	*O–C*	*Observed*	*Calculated*	*E*	*O–C*
37.5010	37.4990	0	+0.0020	39.6660	39.6664	34	-0.0004
.5597	.5628	1	-0.0030	40.621	40.6219	49	-0.001
.6270	.6266	2	+0.0004	41.513	41.5133	63	0.000
.6847	.6903	3	-0.0056	.576	.5770	64	-0.001
38.5218	38.5192	16	+0.0026	42.6608	42.6589	81	+0.0019
.5850	.5830	17	+0.0020	46.534	46.5365	142	-0.002
.6480	.6467	18	+0.0013	.599	46.6000	143	-0.001
.7132	.7105	19	+0.0027	47.5527	47.5524	158	+0.0004
39.5390	39.5390	32	0.0000	.6170	.6158	159	+0.0012
.6043	.6027	33	+0.0016	.6837	.6793	160	+0.0044

The rms of the deviations in Table 1 is $0\overset{d}{.}0020$, which is less than half the rms of the linear fit given by Semeniuk. In both cases we have omitted the single hump observed on 7 May, which deviates from the ephemeris by $0\overset{d}{.}0127$ and is more likely to be an enhanced orbital hump than a superhump: such enhanced orbital humps are observed in VW Hyi when a normal outburst immediately precedes a supermaximum (Vogt 1933).

In summary, our new interpretation of Semeniuk's observations provide (i) evidence that V436 Cen does not differ from the other SU UMa stars in having an apparently decreasing superhump period during the superoutburst, and (ii) the first evidence for late superhumps occurring in a system other than VW Hyi.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2398

Konkoly Observatory
Budapest
7 September 1983
HU ISSN 0374-0676

THE RECENT SPECTROSCOPIC BEHAVIOUR OF CH CYGNI

CH Cygni was known as a semiregular M6 III star until a blue continuum and permitted and forbidden emission lines of metallic ions appeared for the first time in 1963. Since then, there have been three separate periods of activity in which this star showed a symbiotic spectrum. A program of spectroscopic observations of CH Cygni has been carried on for many years at the Observatory of Trieste, utilizing plates taken on purpose at the Observatoire de Haute Provence. In particular, the entire period of activity begun in 1977 (and not yet ended) is covered by red and blue high dispersion spectra. Here we give some preliminary results drawn from a visual examination of the plates from 1981 to August, 1983. Other publications are concerning the previous years (Faraggiana and Hack, 1971, and Hack et al., 1982).

During these two years the blue continuum was present with almost steady strength, slightly tending to decrease. This can be argued from a slight increase of the absorption band strength, that we explain just in terms of a reduced filling by the additional radiation. The Balmer lines maintained the same appearence, both in the inverse P Cygni profiles and in the visibility of the last terms. Hα, Hβ, Hγ and Hδ have two emission wings, with V>R.

Between July and November, 1981, a lot of chromospheric absorption lines became suddenly visible, and continued to deepen slowly as long as we have observed the star. At the same time the forbidden lines lost much of their intensity, and some of the [Fe II] lines disappeared in 1983, while the other emission lines showed inverse P Cygni profiles. The resonance line of Ca I at λ4227 had a central emission core in 1981; now a sharp absorption is visible in its place. Ionized calcium shows at least three narrow absorptions in the H and K lines; before 1981 there were one or occasionally two wider components, accompanied by a strong red emission.

Coming to the longer wavelengths region, the situation is more stable: all the lines of [O III] are always absent and those of O I (λ6300, λ6364) present an emission of constant intensity.

This behaviour is not much different from that of the previous periods of activity, except for the longer duration of this one and for the evident appearance of inverse P Cygni-like profiles, that is now the principal trait of the spectrum. Measurements of the radial velocities and of the line intensities are in progress.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2399

Konkoly Observatory
Budapest
15 September 1983
HU ISSN 0374-0676

Hα VARIABILITY IN TWO SOUTHERN RS CVn CANDIDATES

We present Hα observations of two southern RS CVn candidates, HD 174429 (PZ Tel) and HD 196818. Recent photometry and brief histories of these objects can be found in Innis et al. (1983a, 1983b).

All observations were obtained with the Cassegrain echelle spectrograph on the 1.0 m telescope at Siding Spring Observatory on four nights in August 1983. The dispersion at Hα was approximately 10Å/mm.

HD 174429 showed variation in the depth of Hα over timescales of a few hours. Figures 1(a) and 1(b) show raw, uncorrected spectra taken almost exactly 24 hours apart. The variation is clearly visible. Our earlier photometry of this object gives a period around 22.6 hours, hence it appears that the Hα variations are not correlated with the photometric wave, as the spectra in Figure 1 are taken at nearly the same photometric phase.

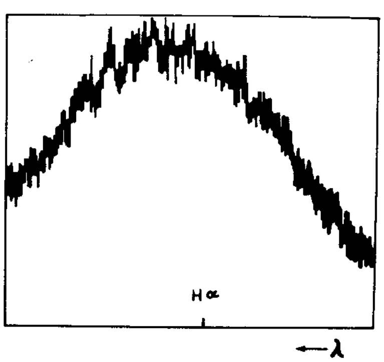

FIGURE 1 (a)

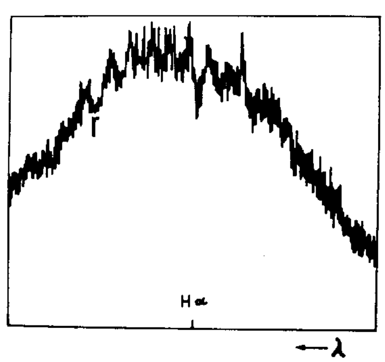

FIGURE 1 (b)

Observations were also taken on HD 196818. Collier et al. (1982) obtained an Hα profile of this object, and reported a broad shallow absorption feature. Our observations show Hα to be clearly in emission (Figure 2), obviously, the Hα profile is variable in this star as well.

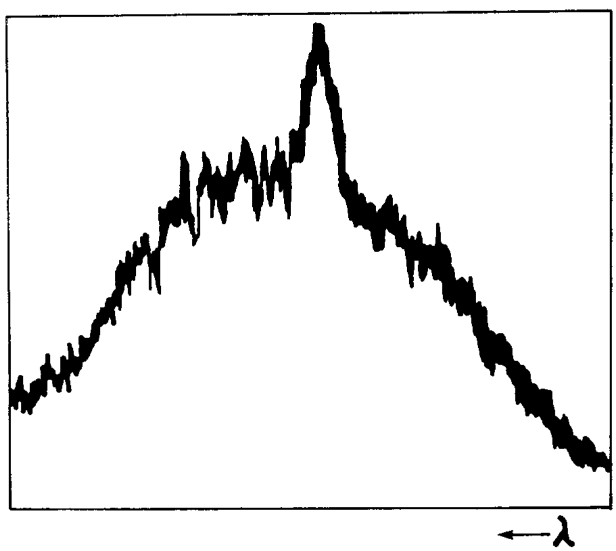

FIGURE 2

We also include an expanded plot of the sodium D lines for HD 196818 (Figure 3) and HD 174429 (Figure 4) which appear noticeably asymmetric.

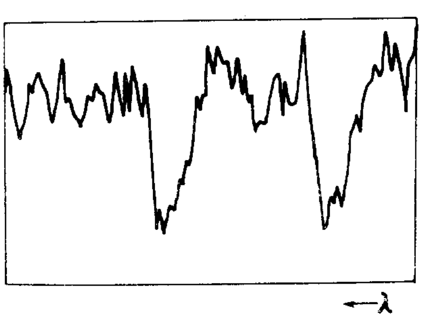

FIGURE 3

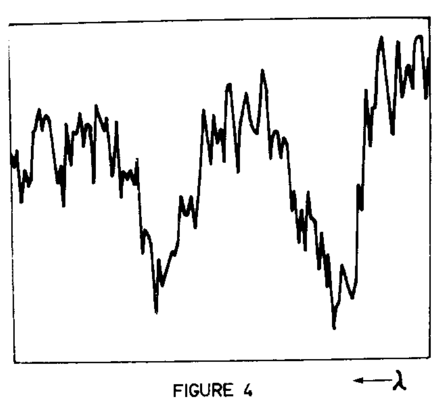

FIGURE 4

We suggest that these asymmetries are attributable to spots on the surface of the star, as has been proposed by Fekel (1983) for the star V711 Tau. (For comparison, Figure 5 shows the D lines of HR 6744, included in our observations as a template star).

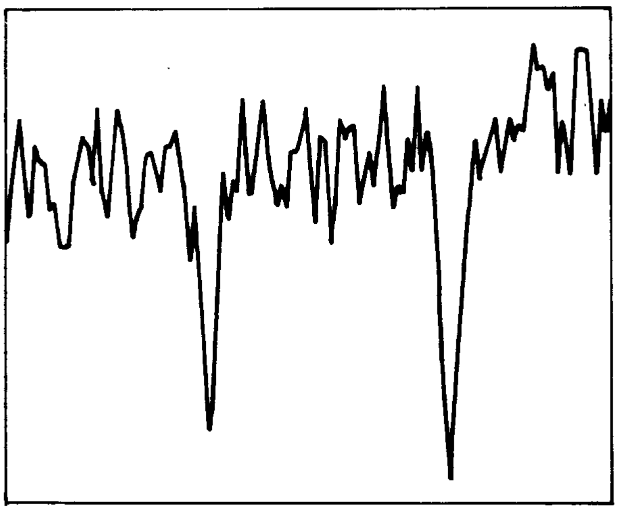

FIGURE 5

We are preparing a more extensive work for publication elsewhere.

We thank the Director and staff of Mount Stromlo and Siding Spring Observatories for the allocation of time on the 1.0 m telescope in August 1983. We also thank Ian Evans of M.S.S.S.O. for assistance with the telescope and spectrograph during the course of these observations. J.L. Innis is supported by a Commonwealth Postgraduate Research Award.

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COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 2400

Konkoly Observatory
Budapest
20 September 1983

HU ISSN 0374-0676

FOUR NEW RED VARIABLES

On the photographs taken with four cameras of focal lengths 20, 30, 50 and 85 cm, the following four red variables were found. The emulsion was Tri-X and the brightness very close to visual magnitude was obtained with green-yellow filter. The positions of the stars are as follows:

Star	R.A. (1950.0)	Decl.
No. 1	$6^h30^m47^s$	$+28^\circ19'.6$
No. 2	19 49 43	+43 30.0
No. 3	19 50 0	+44 6.7
No. 4	20 53 53	+23 44.7 = BD + 23°4183

(Star No.1) On more than 540 photographs taken in 1977 through 1982 with f50 and 85 cm cameras, the star was found to be probably SRa type with a period of 188^d. The range was $11^m.9-13^m.1$(v) so far. The variation is well expressed by the following elements:

$$\text{Max.} = \text{J.D. } 244\ 3490 + 188^d \cdot E.$$

The light variation in the recent years is shown in Figure 1.

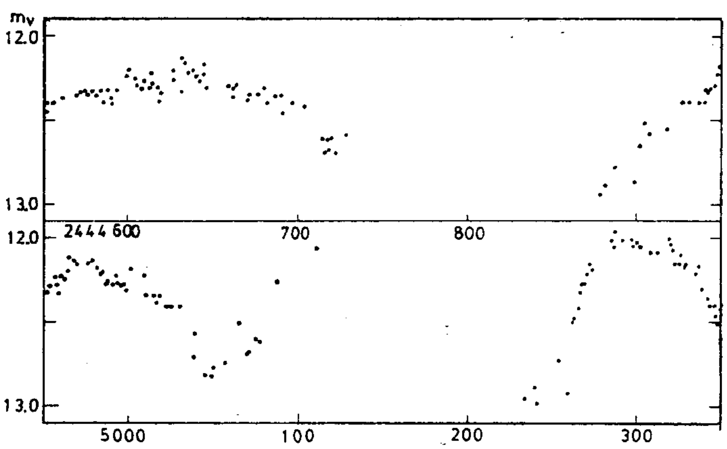

Figure 1. Light variation of star No. 1

(Star No. 2) On about 450 photographs taken in 1976 through 1983 centered at δ Cygni, the star was found to be SRa type having fairly regular variation. The range was $10^{m}.3-11^{m}.5$(v). The maxima were well expressed by the following elements with O-C's less than 10 days:

$$\text{Max.} = \text{J.D. } 244\ 2910 + 119^{d}.3 \cdot E.$$

The light variation only in the recent years is shown in Fig. 2.

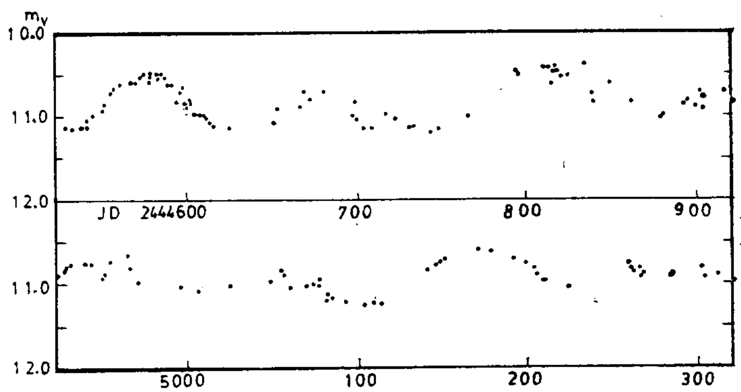

Figure 2. Light variation of star No. 2

(Star No. 3) On the same photographs as of No. 2, the star was found to be probably SRa type with the range of $11^{m}.0-12^{m}.5$(v). The periodicity became sometimes irregular, but the overall variation is generally expressed by the following elements:

$$\text{Max.} = \text{J.D. } 244\ 3640 + 146^{d} \cdot E.$$

The light variation in the recent years is shown in Figure 3.

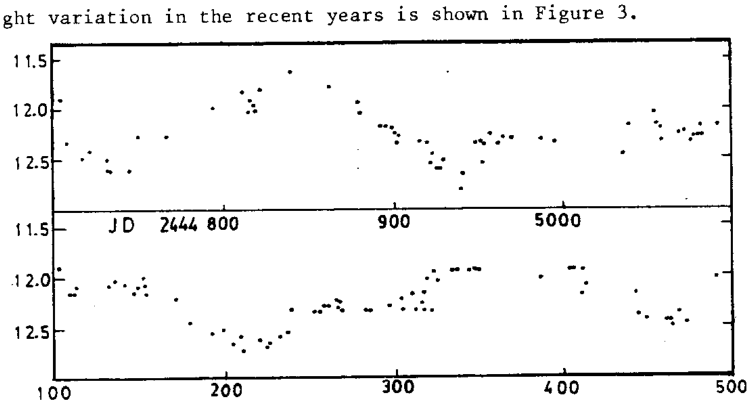

Figure 3. Light variation of star No. 3

(Star No. 4 = B.D. + 23°4183) On more than 300 photographs taken with the f30 cm camera in 1975 through 1982 centered at 31 Vulpeculae, the star was found to be probably SRa or SRb type. The amplitude was $10^{m}.3-11^{m}.4$(v) so far. The variation was fairly regular in some years, but not apparent in some years as in 1977 and 1978. The variation is generally expressed by the following elements:

$$\text{Max.} = \text{J.D. } 244\ 2775 + 116^{d}\cdot E.$$

The light variation is shown in Figure 4.

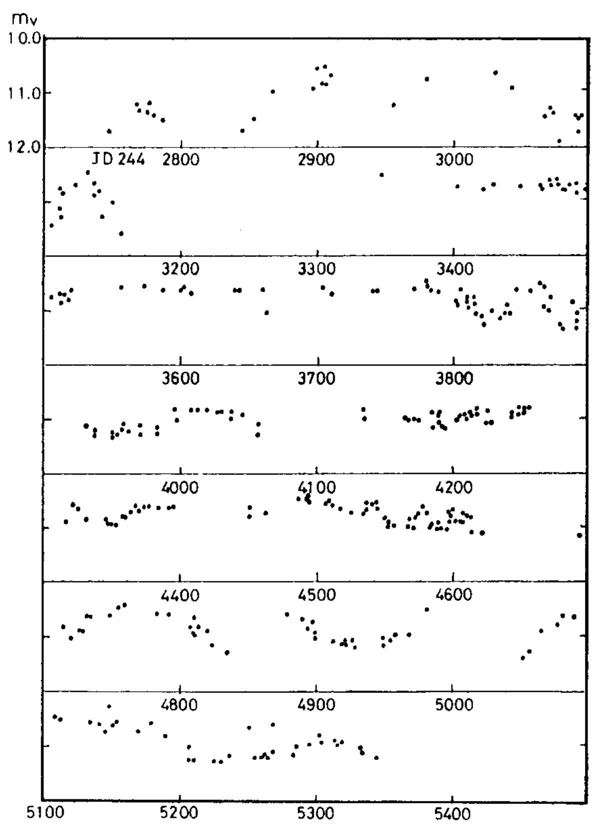

Figure 4. Light variation of star No. 4 (B.D.+23°4183)

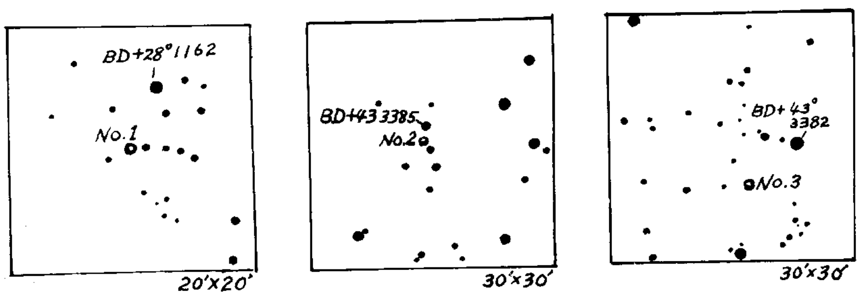

Figure 5. Finding chart of star No. 1, No. 2 and No. 3 .

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