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PERIODIC VARIATIONS IN THE POLARIZATION OF V 603 Aql+

In August and September 1981 the linear and circular polarization of the old nova V 603 Aql has been observed (partly simultaneously with photometric observations) using the ESO two channel polarimeter at the 1m and 61cm telescopes. By technical reasons the observations have been performed during two sections separated by a gap of 11 nights. From the radial velocity measurements published by Kraft (1964) a low inclination angle of the nova system must be deduced. Therefore an extremely weak intrinsic polarization has to be expected and only a large number of measurements allows to draw conclusions about the system. This conflicts with the long integration time necessary for a single polarization measurement of a V~11.9 star (Haefner, 1981). As a compromise all measurements have been carried out with an integration time of 160 sec in the white light. Altogether 470 linear and 310 circular observations have been collected. The instrumental polarization was determined each night by measuring near distant stars. Since there is a clear difference between the spectroscopic period ($3^h19^m.5$) reported by Kraft (1964) and the photometric period ($3^h28^m.6$) found by Haefner (1981) it was a main point to check the polarimetric results for periodicities by correlation and periodogram techniques.

+ Based on observations collected at the European Southern Observatory.

In the linear polarization no high significant period could be detected in the range from 3 min. to 6 hours. Only one period with $3^h33^m.8$ was more pronounced (see Fig. 1). Since this period does not coincide either with the spectroscopic or the photometric one an interpretation is difficult at the moment. However, it should be emphasized that this periodic variation was completely absent during the first section of observation and may be correlated with a special hump phenomenon in the light curve: During the second observation section an increase in the intensity with a duration of ~ 3 min. and an amplitude of ~ $0^m.2$ could be observed sporadically. This peak was superimposed to the broad hump observed by Haefner (1981) and had a mean period of about 3^h39^m. Shortly before and after this peak a remarkable increase in the scatter of the polarization values could be noticed.

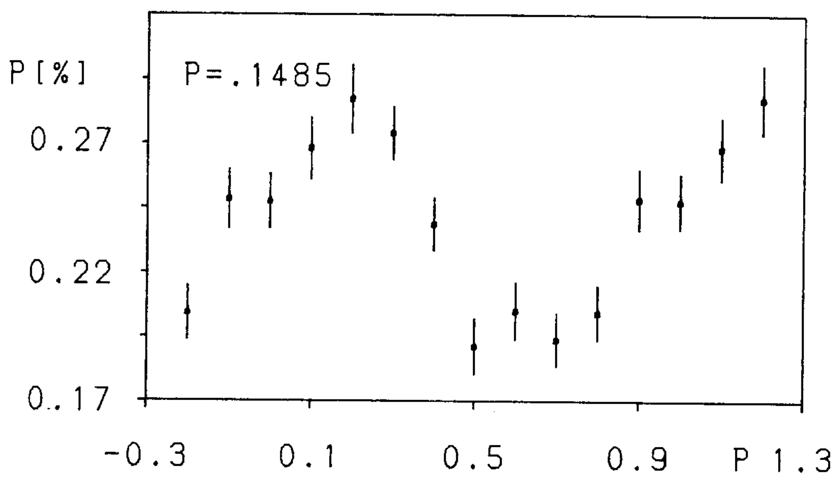

Fig. 1: Phase diagram of the degree of the linear polarization during section 2 (315 values). The vertical bars give the mean error within phase bins of 0.2.

In the circular polarization a highly significant period of $3^h18^m.2$ is present (Fig. 2). In terms of the usual model of

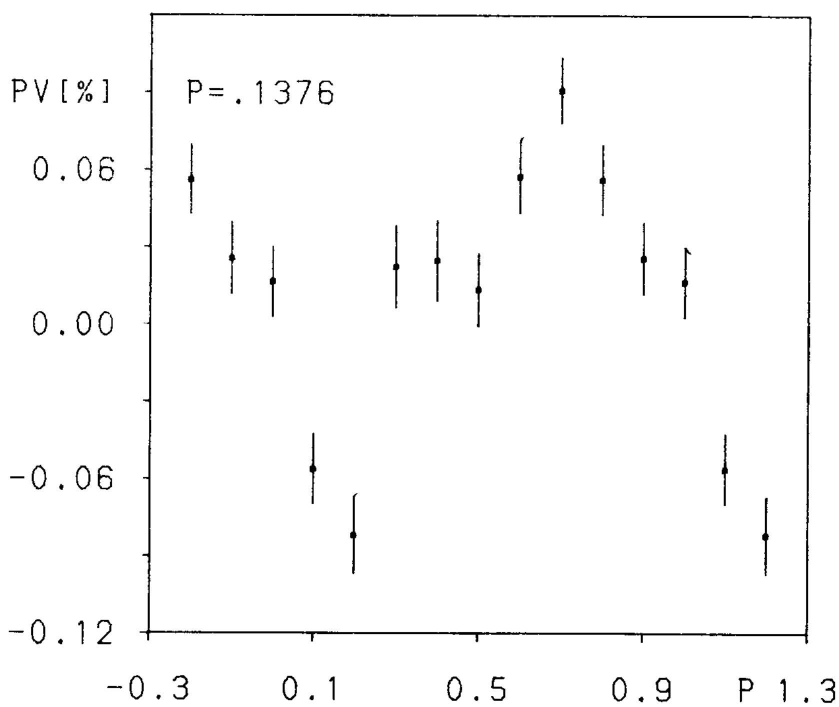

Fig. 2: Phase diagram of the normalized Stokes parameter V (310 values). The vertical bars give the mean error within phase bins of 0.2.

cataclysmic variables this polarization has to be ascribed to the white dwarf. Shape and change in sign of the Stokes parameter V suggests a magnetic rotator. However this would imply that the white dwarf would rotate almost synchroneously like the AM Herculis type stars.

More detailed results which also take into account spectroscopic and photometric measurements will be published elsewhere.

K. METZ
Universitäts-Sternwarte
Scheinerstr. 1
D-8000 München 80
Germany

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PHOTOELECTRIC MINIMA OF ECLIPSING VARIABLES

The following Table gives photoelectric minima of the variables obtained at Yunnan Observatory and Beijing Observatory (China) in 1980, 1981 and 1982. AX Vir was observed at Beijing Observatory by using the 60-cm telescope and its photometer with an EMI 6256B photomultiplier tube. These times of light minima with

Table I

Star	Filter	J.D.hel 244....	m.e.	(O-C)I	(O-C)II	rem.
CN And	V	4908.2602	$\pm 0^d.0011$	-0.0103		II
	V	4899.2182	.0014	-0.0278		I
	V	4934.1762	.0002	-0.0109		II
ZZ Aur	B,V	4962.2221	.0006	-0.0235		I
	B,V	4963.1249	.0008	-0.0225		II
	B,V	4965.2282	.0004	-0.0235		I
	B,V	4966.1330	.0009	-0.0205		II
WX Cnc	B,V	4990.3068	.0008	+0.0208		II
	B,V	4992.1403	.0004	+0.0174		I
	B,V	4993.3681	.0004	+0.0207		I
	B,V	4995.2058	.0004	+0.0215		II
R CMa	V	4639.2392	.0004	+0.0078		I
FG Hya	B,V	4640.2739	.0005		+0.0800	II
	B,V	4641.0989	.0003		+0.0854	I
	B,V	4933.3719	.0005		+0.0941	II
	B,V	4934.3528	.0007		+0.0915	II
	B,V	4968.2776	.0004		+0.0854	I
	B,V	4997.2901	.0004		+0.0846	II
	B,V	4998.1080	.0003		+0.0829	I
UZ Leo	V	4638.4321	.0002		-0.0686	I
ER Ori	V	4577.2932	.0005	+0.0022		I
	B,V	4610.1053	.0002	+0.0009		II
	B,V	4611.1622	.0005	-0.0007		I
	B,V	4612.2221	.0003	+0.0007		II
Y Sex	B,V	5001.3624	.0002	+0.0915		II
AX Vir	V	5053.1590	.0007	-0.0157		II
	V	5056.3188	.0004	-0.0173		I
	V	5062.2937	.0005	-0.0138		II

their mean errors were computed by using the Kwee and Van Woerden method. The rest of these binaries were observed by using the 100-cm Cassegrain-telescope and its photometer with a 1P21 photomultiplier tube at Yunnan Observatory. The times of minima with mean errors were obtained with the quadratic curve fitting method.

All the observations for these binaries were corrected for differential extinctions. Column "(O-C)I" was calculated with the elements given in "Rocznik Astronomiczny Observatorium Krakowskiego for the Year 1982". "(O-C)II" was determined from the elements published in "General Catalogue of Variable Stars, Moscow 1969/70".

The times and light curves and their analyses for ZZ Aur, WX Cnc and AX Vir will be published in "Acta Astronomica Sinica, China" and "Acta Astrophysica Sinica, China", respectively.

YANG YULAN AND LIU QINGYAO

Yunnan Observatory, Academia Sinica
Kunming, China

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HD 36705 - A POST T TAURI STAR*

By identifying a flaring X-ray source with the star HD 36705 (which had been known to be chromospherically active: Hearnshaw (1979)) and by determining its short rotational period of only 0.514 days seen in the brightness modulation due to spots, Pakull (1981) pointed out an object which is going to be one of the most important for studying the rotation-activity connection in late-type stars. However, its membership to any of the recognized classes of active stars is not obvious at all. The existing spectral classifications K1IIIp and K2IVp suggest an RS CVn-type system whereas the short period argues that the star cannot be too large and might be more alike BY Dra-type stars. The short period and fast spot migrations observed by Pakull could also indicate similarity to the white dwarf - red dwarf pair V471 Tauri (the necessary IUE observations have not been obtained yet).

Confusion with the variability type of HD 36705 increased when Collier (1982) pointed out that the star does not show any systematic radial velocity changes. This finding coupled with the giant spectral classification and the appearance of Hα in weak emission suggested to him that the star belongs to the group of extremely active fast-rotating giants for which FK Com is now considered as a prototype (Bopp and Stencel 1981).

Here, we would like to point out that HD 36705 might be one of the brightest post T Tauri stars (Herbig 1973, 1978, 1981). Observations made in January 1982 with the Reticon detector on the 1.5m ESO telescope in La Silla with the resolution of about 3 Å reveal the existence of the strong lithium line at 6707 Å (cf. figure). Four obtained spectra show this line very clearly; unfortunately, due to the low resolution, the line is partly

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

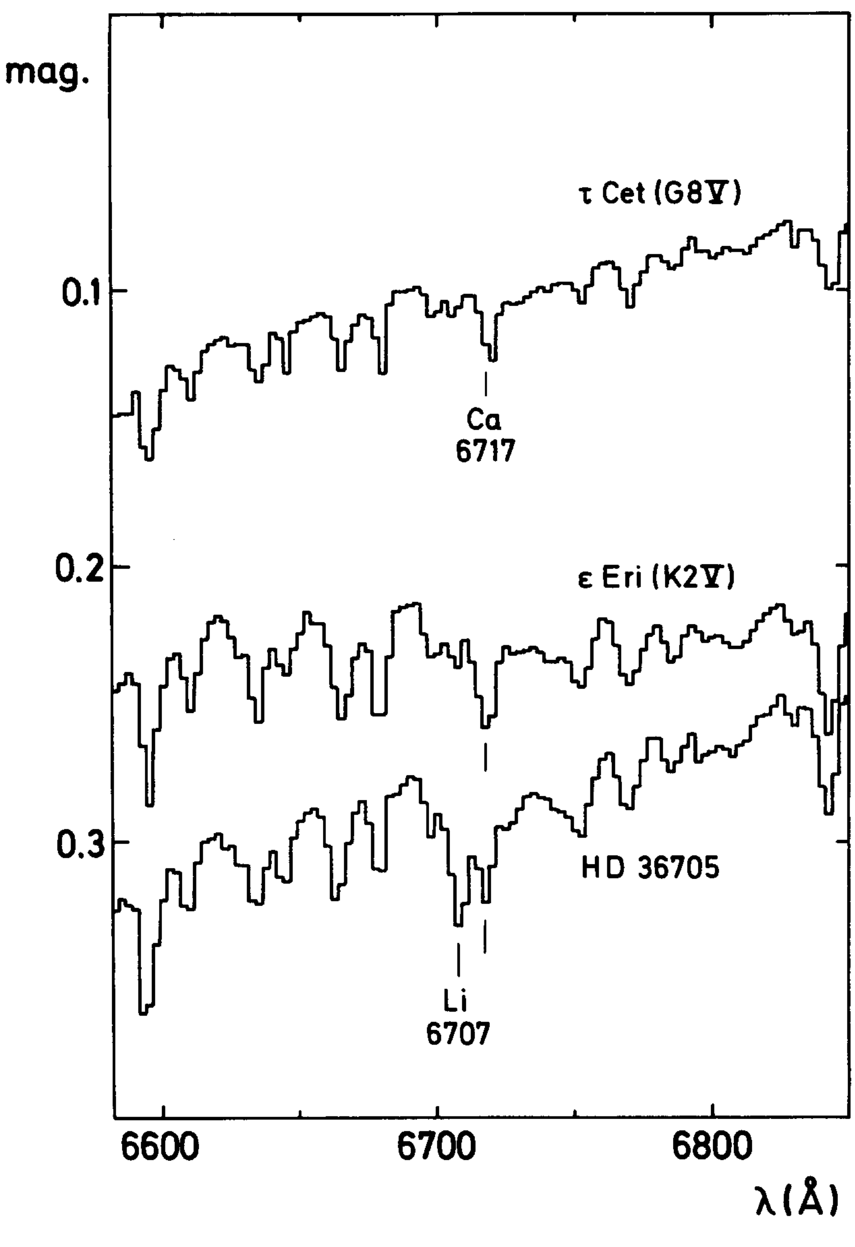
mag.
τ Cet (G8V)
0.1
Ca
6717
0.2
ε Eri (K2V)
0.3
HD 36705
Li
6707
6600
6700
6800
λ(Å)

Figure 1

blended with the Ca line at 6717 Å so that one can only roughly estimate the equivalent widths: EW(6707) = 0.32 ± 0.03 Å and EW(6707)/EW(6717) = 1.7 ± 0.1. Applying the method which uses the line ratio (Danziger and Conti 1966) we obtain logN(Li) = 2.7 (assuming the same Ca abundance as on the Sun); working directly with the equivalent width (Zappala 1972) one obtains logN(Li) = 2.5 + saturation corr.; the abundances are in the scale logN(H) = 12. So high lithium abundances in late spectral types are observed only among very young stars. Therefore, we suggest that the star belongs to the still small group of young, fast rotating stars which for some reason escape detection but should be relatively numerous according to Herbig's estimates. However, as already mentioned in the literature a number of times, the groups of post-T Tau and BY Dra stars might partly overlap since many indications exist that members of the latter group, including its prototype, are relatively young objects.

It should be mentioned that in addition to the partly filled-in Hα, the lines of the infrared Ca II triplet (8498, 8542, 8662 Å) were found to be definitely shallower than in stars of similar spectral types (KO-K2) as estimated from absorption lines. No other emissions were seen in the region between Hα and 9500 Å.

HD 36705 was also photometrically observed from La Silla in October 1981 and January 1982. The light curves (to be published elsewhere) reveal a very high level of variability in time scales of a few days so that closures in phase diagrams were not always possible during 5-7 days intervals necessitated by the proximity of the period to one half of a day. In addition, the light curves separated by 3 months have distinctly different shapes and direction of a systematic spot migration (if any) is still undecided. The ranges of variability were: V = 6.80 - 6.85 in October 1981 and V = 6.83 - 6.88 in January 1982 whereas the mean values of indices in the Strömgren and Cousins photometries were: b-y = 0.509, m_1 = 0.285, c_1 = 0.253, and U-B = 0.361, B-V = 0.825, V-R = 0.485, V-I = 0.945.

S.M. RUCINSKI
Max-Planck-Institut für Astrophysik
Karl-Schwarzschild-Str. 1
D-8046 Garching bei München
(on leave from Warsaw University Observatory)

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PHOTOGRAPHIC OBSERVATIONS OF THE SUPERNOVA IN NGC 4490

Photographic observations of the supernova in NGC 4490 (Wild, 1982) were carried out with the 188-cm reflector at Okayama Astrophysical Observatory and with the 105-cm Schmidt telescope at Kiso Observatory in May 1982. The observations were made in B-colour band on Kodak IIaO emulsion. The used B-band filters were Hoya L35 at Okayama and Schott GG 385 at Kiso. Referring to the comparison stars of Blanco et al. (1966), the magnitude was determined with the method of stellar image diameter. The estimated B-magnitudes of the supernova are as follows:

Date	UT	Observatory	B
19 May	$7^h\ 48^m$	Okayama	15.0
24 May	11 40	Kiso	15.5

T. YAMAGATA

Department of Astronomy, University of Tokyo,
Bunkyo-ku, Tokyo 113, Japan

M. IYE

Tokyo Astronomical Observatory, University of
Tokyo, Osawa 2-21-1, Mitaka, Tokyo 181, Japan

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SPECTROSCOPIC INVESTIGATION OF VZ Cnc

VZ Cnc is an RR_s star according to the GCVS (Kukarkin et al. 1969). One of its main features is the clearly marked Blazhko effect. Fitch (1955) obtained the period of the Blazhko effect ($P_B = 0^d.716$, $P_o = 0^d.178$). The light variation period P_o has remained constant for 70000 epochs (Firmanyuk, 1980). Photoelectric observations of VZ Cnc were carried out for two nights in March 1980 with the aid of the Crimean Astrophysical Observatory's 64 cm reflector. Comparison of the author's observations with those of Todoran (1976) and Mochan (1980) shows that P_o continues to be constant and the observations satisfy the linear elements:

Max hel JD = 2433631.8655 + $0^d.17836367$.E (Todoran, 1976)

The Ψ phases of the Blazhko effect are also calculated in accordance with linear elements:

Max hel JD = 2433631.8605 + $0^d.716292$.E' (Todoran, 1976).

The spectroscopic material was obtained in February and March 1980 with the aid of a diffraction-grating spectrograph in Nasmith focus of the 122 cm reflector of the Crimean Astrophysical Observatory. 39 spectrograms with linear dispersion of 37 Å/mm were obtained. These spectrograms were processed by the generally accepted methods and divided into two groups in accordance with the ψ phases of the Blazhko effect (maximum and minimum).

The estimates of T_{eff} and log g_{eff} for various phases of light variation and Blazhko effect were made as a result of the comparison of observational $H\gamma$ profiles, and theoretically calculated by the Kurucz method (1979). The observed profiles are in better agreement with Kurucz's (1979) ones than the calculations of Searle and Oke (1962). To eliminate the effects of the splitting of the lines we gave more weight to the longer wavelength wing, although the profile of the line was always symmetrical within the errors of measurements.

The results are presented in Figure 1. The changes of effective

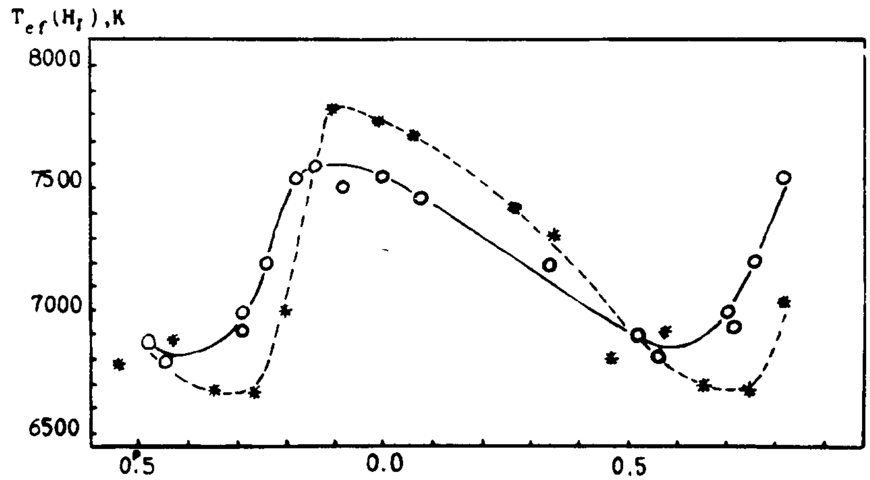

Figure 1

temperature with the light variation phase differ for the different Blazhko effect phases studied. The amplitude of T_{eff} variation for Ψ = 0.453 - 0.730 is greater than for Ψ = 0.730 - 0.920. Also the moments of maxima for these curves are displaced. The T_{eff} variation curve for the maximum of the Blazhko effect (Ψ = 0.453 - 0.730) is more asymmetric and in the phases φ = 0.750 - 0.920 we observe a sharp increase in T_{eff}, whereas the curve for Ψ = 0.730 - 0.920 shows smooth variation with light variation phase.

The accuracy of the determination of log g_{eff} does not permit us to discover the differences connected with the Blazhko effect, nor to trace the g_{eff} variation with phase with any degree of confidence. Our average value of $< \log g_{eff} >$ = 2.7 is greater than that obtained by Danziger and Oke (1967), but it does not fall into the region of g_{eff}, accepted for the RR_s and δ Sct stars (Jones, 1973).

We defined the electron concentration in the atmosphere of VZ Cnc by the methods of Inglis-Teller and Unsöld. The calculations were made utilizing the methods and corrections expounded by Kopylov (1961, 1966). The average electron concentrations are $\log n_e(n_m)$ = 13.22 and $\log n_e$ (Hγ, Hδ) = 15.17. These quantities correspond to the electron concentrations in the atmospheres of the normal stars A8 III - F2 III. The electron concentrations $n_e(n_m)$ calculated for each phase showed no clear dependence on period. Consequently, it would seem that the conditions in the atmospheric layers, responsible for the formation of n_m are relatively stable. According to $\log n_e(n_m)$ - Sp plots (Kopylov, 1961) VZ Cnc is a star of luminosity class III.

The variation in the strength of hydrogen lines with phase of light variation is common for stars of this type. The amplitude of variation is 25 - 40% and decreases with increase in line number.

G.A. GARBUSOV
Odessa Astronomical Observatory
Odessa, U.S.S.R.

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MULTI-COLOR PHOTOMETRY OF V711 TAURI (HR 1099)

The photometric distortion wave of the RS CVn variable V711 Tau has changed progressively in recent years. Landis et al. (1978) and Bartolini et al. (1978) gave visual observations made in late 1976 through late 1977. Feldman et al. (1978) observed a series of intense radio bursts in early 1978, and Chambliss et al. (1978) reported visual photometry during these outbursts. Chambliss and Detterline (1979) found that by early 1979 the visual wave amplitude had increased from an earlier value of $\sim 0^{m}_{.}08$ to $\sim 0^{m}_{.}2$. During the summer of 1979, Feldman et al. (1979) observed additional intense radio bursts. By fall 1979, Guinan et al. (1979) observed an increase in peak brightness with an intermediate-band filter centered on Hα. In this three-year interval, the phase of minimum light, calculated with the spectroscopic ephemeris JD(hel.) = 2,442,766.069 + $2^{d}_{.}83782$E, migrated steadily from ~ 0.55 to ~ 0.95. Blanco et al. (1980) observed dramatic changes in the 1980-81 visual light curve, in which the earlier wave was resolved into lower amplitude waves with indeterminate migration rates.

In this bulletin we give uvby (Strömgren-Crawford) and I (Kron) observations made in 1977 and early 1978. To these we add uvby observations made on five consecutive nights in October, 1981. Earlier observations were made with the 1-m Prairie Observatory reflector. Differential magnitudes, relative to 10 Tau, were corrected for differential extinction and transformed to the standard systems. They are listed in Table 1 to two decimals only, because of small uncertainties in transformation coefficients. The 1981 observations were made with the 0.4-m reflector of Mount Laguna Observatory, San Diego State University, using a digital integrating system with a dry ice-refrigerated 1P21 photomultiplier. The same filter set was used for all observations (Olson 1981). Yellow observations were transformed to Johnson V, and all observations include the close visual companion ADS 2644B.

Table I Observations of HR 1099, 1977-1978

JD(hel) 2,440,000 +	ΔI	ΔV	Δb	Δv	Δu
3373.872	1.02	1.52	1.72	2.06	2.29
3397.891	1.12	1.62	1.81	2.12	2.34
3398.809	1.04	1.55	1.75	2.09	2.32
3409.904	1.06	1.57	1.77	2.11	2.34
3413.829	1.02	1.52	1.73	2.06	2.31
3419.870	1.06	1.56	1.76	2.11	2.34
3419.902	1.08	1.58	1.78	2.12	2.35
3420.859	1.08	1.60	1.80	2.14	2.36
3423.716	1.06	1.58	1.78	2.13	2.35
3429.884	1.07	1.57	1.77	2.11	2.33
3430.836	1.03	1.53	1.73	2.07	2.30
3433.918	1.05	1.56	1.76	2.10	2.34
3434.824	1.08	1.61	1.82	2.15	2.38
3577.553	1.11	1.58	1.77	2.11	2.34

Table II Observations of V 711 Tauri, 1981

JD(hel) 2,440,000 +	ΔV[1]	Δb[1]	Δv[1]	Δu[1]
4896.863	1.499	1.714	2.058	2.303
4897.908	1.565	1.782	2.133	2.386
4898.948	1.530	1.752	2.132	2.347
4899.975	1.526	1.741	2.101	2.347
4900.824	1.561	1.786	2.131	2.381

[1]Typical mean errors: V and b, ± $0\overset{m}{.}003$; v and u, ± $0\overset{m}{.}004$.

Figure 1 shows ultraviolet, violet and blue light curves, with open circles representing 1977 observations. The 1981 observations, shown as filled circles, were shifted graphically to fit roughly into the 1977 curves. At these wavelengths, the 1981 observations fall fairly well onto the earlier light curves.

Figure 2 shows visual and near-infrared light curves. Here the distortion waves are slightly less well-defined than in Figure 1. The 1981 visual curve has brightened, particularly around minimum light.

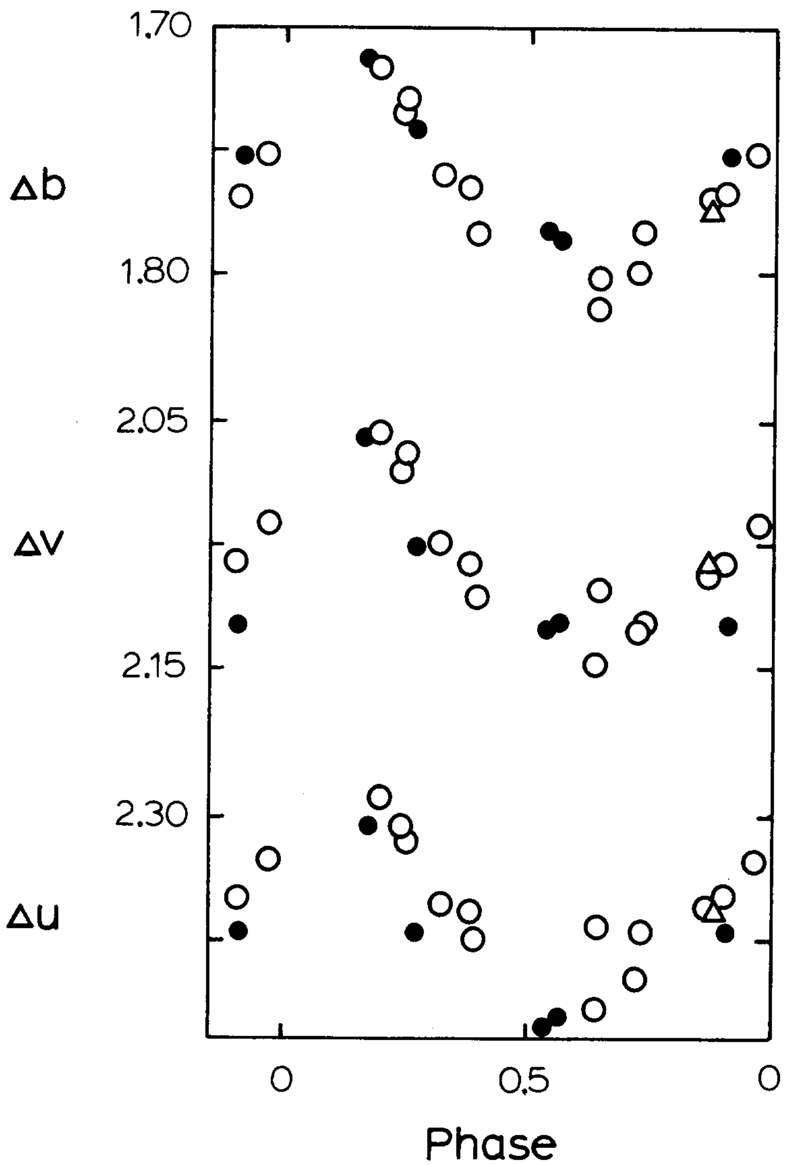

Figure 1 - Intermediate-band blue, violet, and ultraviolet light curves of V711 Tau. Open circles, late 1977; triangles, March 1978; filled circles, October, 1981.

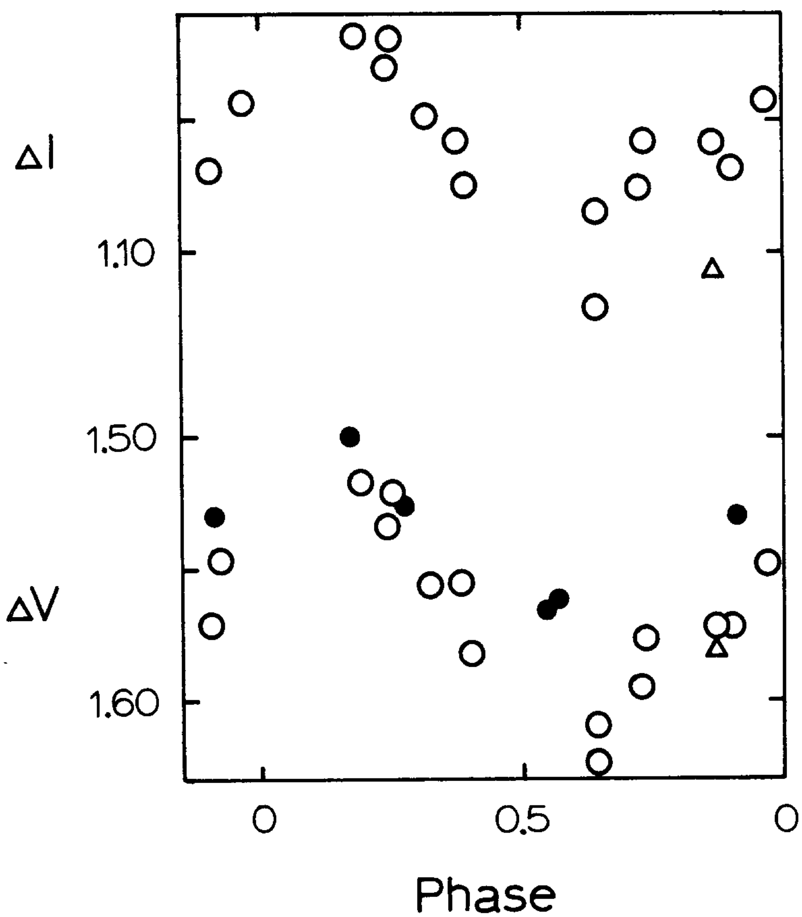

Figure 2 - Near-infrared and visual (transformed from Strömgren-Crawford y) light curves of V711 Tau. Same symbols as in Figure 1.

The last observations in Table 1 were made in March, 1978 just after the intense radio bursts but well before the light curve changes of 1979-1981. They are shown as triangles in Figures 1 and 2. Only in the infrared, and perhaps in the visual, do these points lie below the mean 1977 light curve. Chambliss et al. (1978) found a small phase shift between 1977 and 1978 visual curves, but such a shift would not remove the infrared discrepancy. Perhaps some kind of transient effect depressed the long-wavelength light. If such disturbances were fairly common, then phase changes might be easier to determine from short-wavelength photometry.

Five times of minimum light from 1976.8 to 1979.9, extracted from publications cited above, gave the least-squares ephemeris for minimum light: JD (hel.) = (2,440,000.58 ± 0.08) + (2.840612 ± 0.000060)E. A crude time of minimum for the 1981 observations, 2,444,898.1 ± 0.3, yielded an (O–C) of + $0\overset{d}{.}3$ ± $0\overset{d}{.}3$ from this ephemeris. It is therefore possible that the distortion wave in late 1981 remained coherent with the pre-1980 wave. These data yield a wave migration period just under 8 years.

The author thanks the National Science Foundation and the University of Illinois Research Board for partial support of this work. Jay Gallagher, William Hartkopf, Richard Radick, Kenneth Yoss, David Lien, and Michael Peck assisted with observations at Prairie Observatory. The author also thanks Dr. Burt Nelson for observing time and the staff of Mount Laguna Observatory for assistance.

EDWARD C. OLSON
Department of Astronomy
University of Illinois
1011 W. Springfield
Urbana, IL 61801-3000
USA

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PHOTOELECTRIC OBSERVATIONS OF MT Her

The variability of this star was discovered by Hoffmeister (1935). Kukarkin et al. (1974) list the star as having an Algol type light curve with light elements: 2441117.417 + 0.4877 1779E, an out-of-eclipse brightness ($\sim$ pg) of 11.8 mag., and F5 spectral type. The ephemeris comes from Pokorný (1973), who listed a number of older times of observed minima in which a number of Warsaw based observers participated, and this was used to calculate phases for the presently reported observations. Among Pokorný's sources is Zonn (1956), whose finding chart and comparison stars were also used in the present work.

Photoelectric observations of MT Her through filters which could directly be related to standard B and V magnitudes were made using the 74 inch reflector at Kottamia (Egypt) over a period of 5 nights between 3 and 10 July, 1981. Zonn's (op.cit.) star c provided the main comparison, while occasional checks were made on his star a. A full description of the observing equipment was given in Murad's (1982) thesis, and it was also referred to in another recent Bulletin (Kadouri, 1981). A new feature of this equipment is that of digital data processing.

The differential B and V light curves (variable-comparison) are shown in the accompanying diagram - the first such photo-

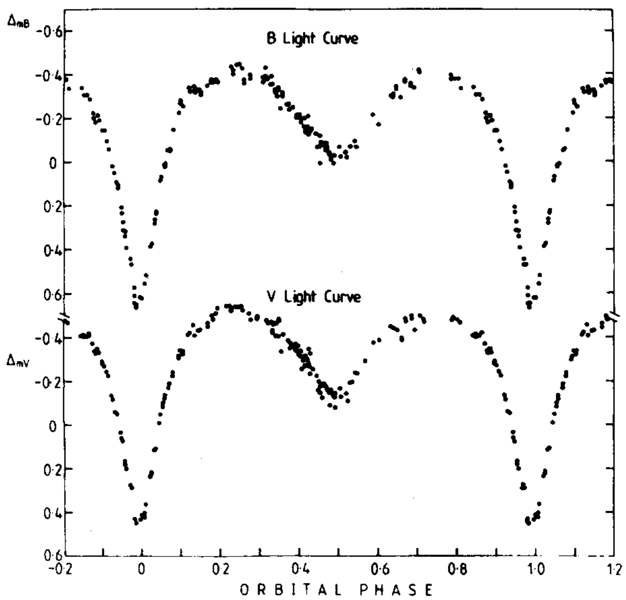

Figure 1

electrically obtained curves, as far as we are aware. They suggest a β-Lyrae type character of the light variation (c.f. Kukarkin et al.'s (op. cit.) designation!), together with some asymmetry about the secondary minimum, which like the primary, appears to occur slightly before prediction. The accompanying diagram comes from data measured from the ratemeter driven chart recorders; the simultaneously acquired but more copious quantity of digital information only repeats the same overall features.

These light curves should be analysed in more detail subsequently.

E. BUDDING

Carter Observatory
P.O. Box 2909
Wellington 1
NEW ZEALAND

I. M. MURAD

Department of Astronomy
The University
MANCHESTER
M13 9PL

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PHOTOELECTRIC PHOTOMETRY OF Ap STARS IN THE ORION AND UPPER SCORPIUS ASSOCIATIONS: PRELIMINARY RESULTS

As part of a general programme for searching periods of magnetic stars in clusters, all magnetic stars of the Orion association listed in Joncas and Borra (1981) were examined for their variability. At least three measurements have been made for each star, each one consisting in the sequence C1-V-C2-V-C2-V-C1 or C1-C2-V-V-V-C2-C1, V being the supposed variable and C1 and C2 always being the stars HD 33647 and 35640. If no variation greater than $0^m.010$ was found either in V, [U-B] or [B-V] (brackets mean that Geneva UBV filters are involved) among these measures, the star was no longer monitored, while in the opposite case the star was measured twenty times or more. Among the 22 stars listed by Joncas and Borra in their tables 1 to 3, two had been measured in 1980-81: HD 37151, which was found more or less constant, and HD 36916, perhaps a non-member (Warren and Hesser 1977), whose period has already been published by Renson and Manfroid (1981). HD 35008 has 16 absolute measures in the Geneva system and does not seem to vary. Among the remaining ones, nine were found to vary in the sense specified above.

One of the comparison stars, HD 33647, is a MnHg star (Schneider 1981). The author was not aware of this at the time of the observations: the star had been chosen because it had been measured many times and had a small standard deviation. A period search carried out on 318 differential magnitudes C1-C2, with the aid of the discrete Fourier transform method of Deeming (1975), yielded an unambiguous period of 0.565 days in spite of the very small amplitude. This variation introduces a noise in the differential measurements of the other stars, whose peak-to-peak amplitude is only $0^m.0012$ and $0^m.0027$ in V and U respectively, which may be considered negligible.

Table I

Association	Peculiarity (as given in Joncas & Borra 1981 or Hartoog 1977)	HD	Period	Amplitudes [U-B]	[B-V]	V	No. of measurements	Remark
Ori OB1	MnHg	33647	0.565	~.002		~.003	318	Differential measures C1-C2
	He w.	35298	1.85	.03	.02	.03	26	
	Si	36313	.59	.03	.016	.026	34	
	SiSr, He w.	36526	1.54	.03	.012	.028	23	
	He w.	36540	2.18	.035	.02	.055	24	
	Si, He w.	36668	2.11	.037	.012	.023	20	
	SiSr, He w.	37140	2.70	.028	.022	.034	27	
	Si	37210	11.2(?)	.045	.024	.027	20	P=.92 not completely excluded, but less probable
	B9.5p	37633	1.56	.07	.055	.06	20	
	Si	37642	1.08	.06	.018	.035	25	
Upper Sco	SiCr	147010	3.92 or 1.34	<.01	.035	.045	63	Absolute, single measures

Some CP2 stars have been monitored in the Upper Scorpius complex too, but HD 147010 alone has been sufficiently measured to give a period: this was obtained from absolute measures. It was not possible from photometry alone to choose between two periods, but the low value of vsini (20 km/s, Wolff 1981) might exclude the 1.34 days period since it implies an inclination $i = 12^{o}$ only if $R = 2.5\ R_{\odot}$. Such a low inclination seems inconsistent with the large amplitude observed, but further measures are necessary.

The periods and peak-to-peak amplitudes are listed in Table I. The periods were obtained with the methods of Deeming (1975) and Stellingwerf (1978) from V, [U-B] and [V-B]data. For HD 37210, Renson's θ_1 test (Renson 1978) was used as well. HD 33647 was analysed with Deeming's and Renson's methods only.

Among these stars, all but HD 33647 (since HgMn stars are considered non-magnetic) and HD 37633 have had their magnetic field measured by Borra (1981), or by Brown and Landstreet (1981). The periods suggested by Borra (1981) for HD 35298 and 36526 are confirmed, while HD 36668 has a period nearer to 2.1 than to 2.7 or 3.0. HD 37642 has a period nearer to 1.08 than to 0.8 days, while HD 36313 has one of the shortest periods known among magnetic stars. HD 147010 is a spectrum variable according to Kameswara Rao and Rajamohan (1982): however, the 5.7 days period they suggest is not confirmed by the present work.

It is remarkable that the distribution of the periods found here for magnetic stars is not very much different, if any, from the distribution obtained for field Si stars, especially if the period of HD 37210 is really 11.2 days. Since field Si stars are about ten times older on the average (5×10^{7} years, Wolff 1981), this may imply that magnetic braking during the main sequence lifetime is not sufficient to explain the small angular momentum of hot CP2 stars. Such a conclusion is strengthened by the fact that that the bias against long periods exists in the present work as well as in most published works on field Ap stars.

I thank C. Waelkens and P. Bartholdi for having observed the star HD 147010. I am also indebted to P. Bartholdi, who implemented a FORTH programme of period search on the HP 2100 computer of the Swiss telescope at La Silla. I thank H. Schneider (Göttingen) for having drawn my attention to the peculiarity of

HD 33647.

This work is based on observations collected at the European Southern Observatory (ESO) at La Silla, Chile.

P. NORTH

Institut d'Astronomie de
l'Universitê de Lausanne et
Observatoire de Genève
CH-1290 Chavannes-des-Bois
Switzerland

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR BY Dra IN 1977

Continuous photoelectric monitoring of the flare star BY Dra has been carried out at the Stephanion Observatory ($l=-22^o49'44''$, $\varphi=+37^o45'15''$) during the year 1977, using the 30-inch Cassegrain reflector of the Department of Geodetic Astronomy, University of Thessaloniki. Observations have been made with a Johnson dual channel photoelectric photometer in the B colour of the international UBV system. The telescope, the photometer and the observational procedure have been described elsewhere (Mavridis et al., 1981). Here we mention only that the transformation of our instrumental ubv system to the international UBV system is given by the following equations:

$$V = v_o \; -0.016(b-v)_o + 1.227,$$

$$B-V = 0.684 + 1.057(b-v)_o \quad ,$$

$$U-B =-1.521 + 0.979(u-b)_o \quad .$$

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

Table I

Monitoring Intervals in 1977

Date 1977 July	Monitoring Intervals (U.T.)	Total Monitoring Time
7	20^h15^m - 20^h45^m, 20^h47^m - 21^h25^m, 21^h27^m - 22^h27^m.	02^h 08^m
8	19 29 - 20 04 , 20 07 - 20 36 , 20 38 - 21 07, 21 57 - 22 23 .	01 59
10	20 40 - 21 18 , 21 20 - 21 53 , 21 55 - 22 22.	01 38
	Total 1977	05^h 45^m $=05^h.75$

During the 5.75 hours of the monitoring time no flare was observed.

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L.N. MAVRIDIS and P. VARVOGLIS
Department of Geodetic Astronomy
University of Thessaloniki

Reference:

Mavridis, L.N., Asteriadis, G., and Mahmoud, F.M.: 1982, in E. Mariolopoulos, P.S. Theocaris, and L.N. Mavridis (Editors) Compendium in Astronomy, D. Reidel, Dordrecht-Holland, p. 253.

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR BY Dra IN 1980

Continuous photoelectric monitoring of the flare star BY Dra has been carried out at the Stephanion Observatory ($l=-22^{o}49'44''$, $\varphi= +37^{o}45'15''$) during the year 1980, using the 30-inch Cassegrain reflector of the Department of Geodetic Astronomy, University of Thessaloniki. Observations have been made with a Johnson dual channel photoelectric photometer in the B colour of the international UBV system. The telescope, the photometer and the observational procedure have been described elsewhere(Mavridis et al., 1981). Here we mention only that the transformation of our instrumental ubv system to the international UBV system is given by the following equations:

$$V = v_o + 0.011(b-v)_o + 3.191 \quad ,$$

$$B-V = 0.569 + 1.022(b-v)_o \quad ,$$

$$U-B = -1.858 + 0.962(u-b)_o \quad .$$

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

During the 30.93 hours of the monitoring time no flare was observed.

Table I

Monitoring Intervals in 1980

Date 1980	Monitoring Intervals (U.T.)	Total Monitoring Time
July		
4	21^h04^m - 21^h34^m, 21^h37^m - 22^h03^m.	00^h 56^m
5	20 35 - 21 24.	00 49
6	20 27 - 20 49 , 20 58 - 21 36 ,21 40 -22 13 .	01 33
7	20 42 - 21 09 , 21 13 - 21 45 .	00 59
9	19 52 - 20 23 , 20 26 - 21 06 ,21 07 -21 56 .	02 00
10	20 40 - 21 09 , 21 11 - 21 42 ,21 45 -22 32 .	01 47
24	21 35 - 22 05 , 22 08 - 22 35 ,22 38 -23 12 .	01 31
26	20 24 - 20 52 , 20 55 - 21 33 ,21 35 -21 38 ,	
	21 39 - 22 19 .	01 49
27-28	20 07 - 20 46 , 20 49 - 21 22 ,21 25 -21 56 ,	
	22 11 - 22 42 , 22 45 - 23 18 ,23 24 -23 56 ,	
	00 06 - 00 32 , 00 47 - 01 20.	04 18
28	20 21 - 21 16 , 21 19 - 21 58, 22 00 -22 36 .	02 10
29	20 06 - 20 29 , 20 37 - 20 59, 21 02 -21 34 .	01 17
August		
16	19 18 - 19 45 , 19 48 - 20 16, 20 22 -20 31 ,	
	20 37 - 20 47 .	01 14
19	19 53 - 20 08 .	00 15
21	20 05 - 20 38 , 20 42 - 21 13.	01 04
22	19 23 - 19 57 , 20 00 - 20 34, 20 51 -21 31 ,	
	21 34 - 22 07 .	02 21
24-25	21 00 - 21 34 , 21 38 - 22 13, 22 40 -23 17 ,	
	23 20 - 23 53 , 00 21 -00 57, 01 01 -01 24 .	03 18
26	19 40 - 20 13 , 20 17 -20 51, 21 05 -21 38 ,	
	21 41 - 22 24 .	02 23
27	19 27 - 19 51 , 19 57 -20 28, 20 44 -21 14 ,	
	21 18 - 21 49 , 22 05 -22 33, 22 35 -23 07 .	03 08
31	20 47 - 21 14 .	00 27
	Total 1980	30^h 56^m = $30^h.93$

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

(1) Department of Geodetic Astronomy, University of Thessaloniki
(2) Department of Astronomy, University of Thessaloniki
(3) Department of Mathematics, University of Thrace

Reference:

Mavridis, L.N.., Asteriadis, G., and Mahmoud, F.M.: 1982, in E. Mariolopoulos, P.S. Theocaris, and L.N. Mavridis (Editors) Compendium in Astronomy, D. Reidel, Dordrecht-Holland, p. 253.

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HR 3562 AND HR 3600, TWO NEW MULTI-PERIODIC B-TYPE STARS

HR 3562 (HD 76566, BD $-44^{\circ}4951$) is a 6th magnitude star classified B3IV by Houk (1978). The photometric classification by means of the stellar photometric boxes (Nicolet, 1982) confirms this spectral type since the following stars are found in the box of HR 3562: HD 32630 (B3V), HD 45321 (B2.5V), HD 46189 (B4IV), HD 57573 (B3V). In addition, the calibration of Cramer and Maeder (1979) for the B-type stars measured in the Geneva photometric system gives $M_V = -1.48$ and $\log T_e = 4.235$ for HR 3562, values which are in agreement with the B3IV type. On the other hand, note that the projected rotational velocity is low (vsini = 5 km/sec) and that the star is a visual binary with a separation of 35" and a difference of magnitude of $6^m.5$ (see Hoffleit, 1982).

HR 3600 (HD 77475, BD $-41^{\circ}4720$) is a 5th magnitude star. Its spectral classification by Houk, B5III, is not in agreement with the photometric classification by Nicolet, since the following stars are found in the box of HR 3600: HD 36267 (B5V), HD 39764 (B5V), HD 74071 (B5V), HD 186837 (B5V). For HR 3600, the calibration of Cramer and Maeder gives $M_V = -0.68$ and $\log T_e = 4.183$. These values confirm that the spectral type B5V is the correct one. Finally, note that this star is probably also slowly rotating since vsini = 0.

These two stars have been measured in the Geneva photometric system from the Swiss Station at La Silla Observatory, Chile, from November 1981 to February 1982. Both stars have shown small amplitude variations: in the case of the 69 measurements of

HR 3562, the peak-to-peak amplitude $2A_V$ in the V-filter is about $0^m.04$ and the standard deviation σ_V is $0^m.0097$; in the case of the 55 measurements of HR 3600, it is $2A_V \cong 0^m.03$ and $\sigma_V = 0^m.0069$.

Fourier analysis of the measurements reveals three significant periods in both stars:

HR 3562:	$P_1 = 1.97$d.	$A_1 = 0^m.0089$
	$P_2 = 1.73$d.	$A_2 = 0^m.0066$
	$P_3 = 1.66$d.	$A_3 = 0^m.0037$
HR 3600:	$P_1 = 9.64$d.	$A_1 = 0^m.0083$
	$P_2 = 14.4$d.	$A_2 = 0^m.0073$
	$P_3 = 10.7$d.	$A_3 = 0^m.0030$

The residual dispersion around the light curves (with the three periods) fitted on the observation is $\sigma_{res} = 0^m.0038$ for HR 3562 and $0^m.0034$ for HR 3600. These fitted light curves and the photometric measurements are shown in Figures 1a and 2a. In Figures 1b and 2b are shown the residues (observation minus fitted curve). The dotted lines mark the levels $\pm\ \sigma_{res}$.

In the case of HR 3562, the determination of the periods is unambiguous because: 1) a photometric survey was organized during a second season and Fourier analysis reveals the same periods (however, the amplitudes are not conserved). 2) a continuous monitoring during several nights has shown that no variation of periods shorter than 6 h. can be detected. Thus, the peaks at $P \cong 2$d in the Fourier spectrum are real and cannot be produced by the interference between periods shorter than 1d and the peculiar data sampling (1 measurement per night).

On the contrary, a doubt subsists in the determination of the periods of HR 3600. Indeed, the star was not measured continuously during several nights. Thus, it is not excluded that the correct periods are shorter than 1d and that the 3 periods given above

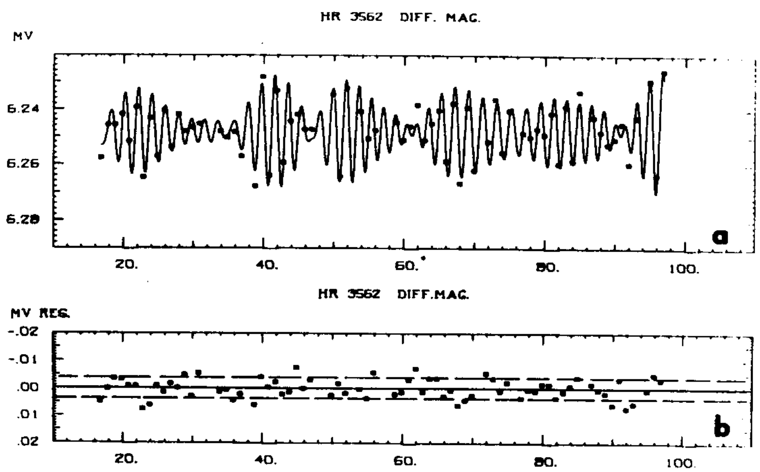

Figure 1

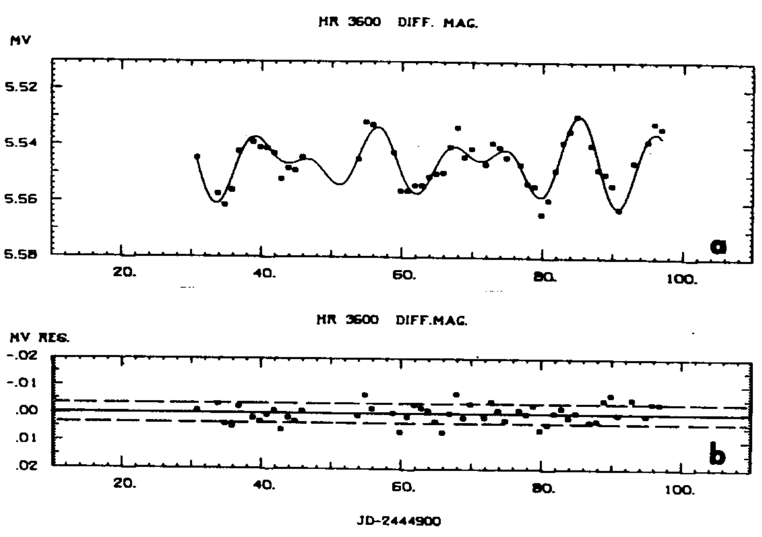

Figure 2

are spurious periods produced by the data sampling. A new monitoring is planned for the next season in order to resolve this problem of period determination.

Recall of the main characteristics of HR 3562 and HR 3600. They are main sequence stars of type B3 and B5. They are multi-periodic small amplitude photometric variables. The periods are larger than 1d (this must yet be confirmed in the case of HR 3600). They have small projected rotational velocities. Consequently, these two stars can be classified as slow variable stars (see Le Contel et al. for definition of this group of stars).

G. BURKI *, M. BURNET *, A.S. MAGALHÃES +,

P. NORTH x, F. RUFENER *, C. WAELKENS *o

* Observatoire de Genève
CH-1290 Sauverny
Switzerland

x Institut d'Astronomie de
l'Université de Lausanne
CH-1290 Chavannes-des-Bois
Switzerland

\+ Observatório Astronomico
Universidade do Porto
4400 Vila Nova de Gaia
Portugal

o Astronomisch Instituut
Naamsestraat 61
B-3000 Leuven
Belgium

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PHOTOELECTRIC EPOCHS OF MINIMUM LIGHT, UZ PUPPIS

B,V Light curves of the southern eclipsing binary system UZ Puppis (BD-13°2170) were observed photoelectrically in January 1981 with the 50cm telescope at Cerro Tololo InterAmerican Observatory. Two nearby stars were monitored as comparison and check stars. The observations define one primary and one secondary eclipse curve. An iterative procedure based on the Hertzsprung (1928) method was used to determine the epochs of minimum light,

JD Hel. Min. I = 2444613.6983

JD Hel. Min. II = 2444615.6871 .

These and the photoelectric epochs of minimum light observed by Bloomer (1973) were entered into a least squares solution which yielded the ephemeris

$$\text{Hel. JD Min. I} = \underset{\pm 6}{2444613.6991} + \underset{\pm 15}{0^{d}.79485112}\,E\ .$$

The residuals or O-C's are negative for the primary minima and positive for the secondary minima. However, the data are meager.

A least squares solution utilizing only the times of the primary minima yielded

$$\text{Hel. JD Min. I} = \underset{\pm 4}{2444613.69829} + \underset{\pm 1}{0^{d}.79485120}\,E.$$

An orbital analysis of the system is in progress.

BEVERLY B. BOOKMYER
Department of Physics and Astronomy
Clemson University
Clemson, South Carolina 29631 U.S.A.

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HD 1833: A NEW VARIABLE STAR

Because Bidelman and MacConnell (1973) reported Ca II H and K emission, we suspected HD 1833 might be an RS CVn binary and therefore might show the photometric wave characteristic of most stars of that type. According to their table VII, $m_v = 8^m.2$ and the spectral type is K1 III + F.

Henry, observing with the No. 4 16-inch Cassegrain at Kitt Peak, obtained data on 6 nights between JD 2444506.8 and 2444513.8. Observing with the 24-inch Cassegrain at Dyer he obtained data on 7 nights between JD 2444526.8 and 2444605.5. Lines, observing with his 20-inch Cassegrain, obtained data on 25 nights between JD 2444845.9 and 2444928.7. Henry and Sherlin, observing with the 48-inch Newtonian at Cloudcroft, obtained data on 11 nights between JD 2444872.7 and 2445160.9. All observations were made in V with HD 1680 as the comparison star. The individual differential magnitudes, corrected for differential extinction and transformed differentially to V of the UBV system, have been sent to the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1979), where they are available as file no. 106.

Examination of our data showed immediately that HD 1833 is variable, with an amplitude of $\Delta V = 0^m.10$. A period-finding program, based on an approach similar to that of Lafler and Kinman (1965), yielded $34^d.36$ as the best period, with $34^d.46$ as another possibility almost as good. The figure below is a plot of the nightly means, where ΔV is in the sense variable minus comparison. Phase is computed with the ephemeris

$$JD = 2444949.5 + 34^d.46\ n,$$

where the initial epoch is an approximate time of minimum light. The first two groups of data (from late 1980) are in the upper half, with triangles for Kitt Peak and circles for Dyer. The last two groups (from late 1981 and early 1982) are in the bottom half, with crosses for Lines and plusses for Cloudcroft. Comparing the two plots we see the light curve has undergone some change. Neither light curve is a good sinusoid, but the shapes are difficult to describe in a simple way.

We have been in communication with Luis Balona and T. Lloyd Evans of

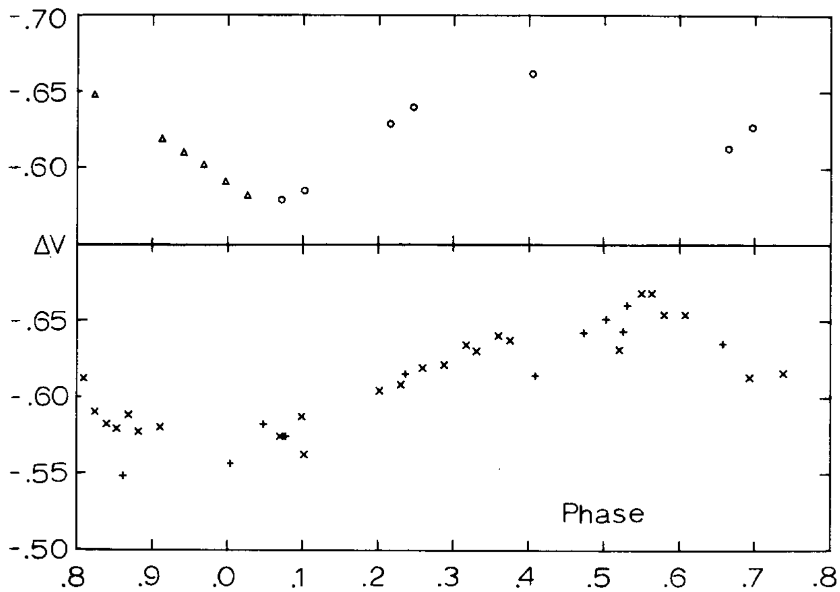

Figure 1

the South African Astronomical Observatory, who tell us they have been obtaining spectroscopic and photometric observations of this star (and all of the stars in table VII of Bidelman and MacConnell). If radial velocity measures indicate HD 1833 is a binary system with an orbital period around 36 days, then it would be a long-period RS CVn binary by the definition of Hall (1976).

RICHARD D. LINES

6030 North 17th Place
Phoenix, Arizona 85016

GREGORY W. HENRY
JERRY SHERLIN
Cloudcroft Observatory
Cloudcroft, New Mexico 88317

DOUGLAS S. HALL

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

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HD 37847: A NEW VARIABLE STAR

Because Bidelman and MacConnell (1973) reported Ca II H and K emission, we suspected HD 37847 might be an RS CVn binary and therefore might show the photometric wave characteristic of most stars of that type. According to their table VII, $m_v = 7^m.0$ and the spectral type is G8 III + F.

Henry, observing with the 24-inch Cassegrain at Dyer, obtained data on 8 nights between JD 2444605.7 and 2444688.5. Henry and Sherlin, observing with the 48-inch Newtonian at Cloudcroft, obtained data on 7 nights between JD 2444959.9 and 2445022.6. All observations were made in V with BD $-20^{\circ}1150$ as the comparison star. The individual differential magnitudes, corrected for differential extinction and transformed differentially to V of the UBV system, have been sent to the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1979), where they are available as file no. 106.

Examination of our data showed immediately that HD 37847 is variable, with an amplitude of $\Delta V = 0^m.32$. A period-finding program based on an approach similar to that of Lafler and Kinman (1965) yielded a period of $28^d.22$, with an uncertainty of only about $\pm\ 0^d.01$. The figure below is a plot of the nightly means, where ΔV is in the sense variable minus comparison. The plusses are for Dyer, the circles for Cloudcroft. Phase is computed with the ephemeris

$$JD = 2444652.0 + 28^d.22\ n,$$

where the initial epoch is a time of minimum light. Because of the gap between $0^P.4$ and $0^P.8$ in phase, we cannot be certain if the point near $0^P.4$ represents the full maximum brightness.

Additional photometry should be obtained to define the entire light curve, although the period seems well determined. We have been in communication with Luis Balona and T. Lloyd Evans of the South African Astronomical Observatory, who tell us they have been obtaining spectroscopic and photometric observations of this star (and all of the stars in table VII

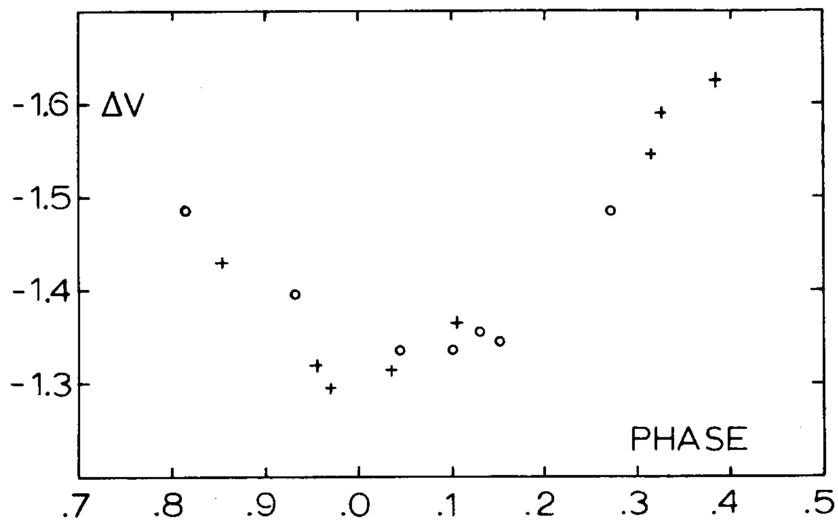

Figure 1

of Bidelman and MacConnell). If radial velocity measures indicate that HD 37847 is a binary system with an orbital Period around 28 days, then it would be a long-period RS CVn binary by the definition of Hall (1976).

GREGORY W. HENRY
JERRY SHERLIN

Cloudcroft Observatory
Cloudcroft, New Mexico 88317

DOUGLAS S. HALL

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

References:

Bidelman, W. P. and MacConnell, D. J. 1973, A.J. 78, 687.

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HD 185510: A NEW VARIABLE STAR

Because Bidelman and MacConnell (1973) reported Ca II H and K emission, we suspected HD 185510 might be an RS CVn binary and therefore might show the photometric wave characteristic of most stars of that type. According to their table VII, $m_v = 8^m.1$ and the spectral type is KO III/IV.

Henry, observing with the No. 4 16-inch Cassegrain at Kitt Peak, obtained data on 3 nights between JD 2444716.9 and 2444719.9. Henry and Sherlin, observing with the 48-inch Newtonian at Cloudcroft, obtained data on 6 nights between JD 2444872.6 and 2444893.6 and on 11 nights between 2445115.9 and 2445153.9. All observations were made in V with BD - 6^o5222 as the comparison star. The individual differential magnitudes, corrected for differential extinction and transformed differentially to V of the UBV system, have been sent to the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1979), where they are available as file no. 106.

Examination of our data showed immediately that HD 185510 is variable, with an amplitude of $\Delta V = 0^m.20$. We had difficulty finding one period which would combine all of the data into a light curve which had a smooth shape and no discrepant points. As the figure below shows, the period does seem to be around 25 days. This is a plot of the nightly means of the second group of Cloudcroft data, where ΔV is in the sense variable minus comparison.

Additional photometry should be obtained in order to determine the photometric period accurately and see if all of our data can be phased together properly. We have been in communication with Luis Balona and T. Lloyd Evans of the South Africa Astronomical Observatory, who tell us they are obtaining spectroscopic and photometric observations of this star (and all of the stars in table VII of Bidelman and MacConnell). If radial velocity measures indicate HD 185510 is a binary system with an orbital period

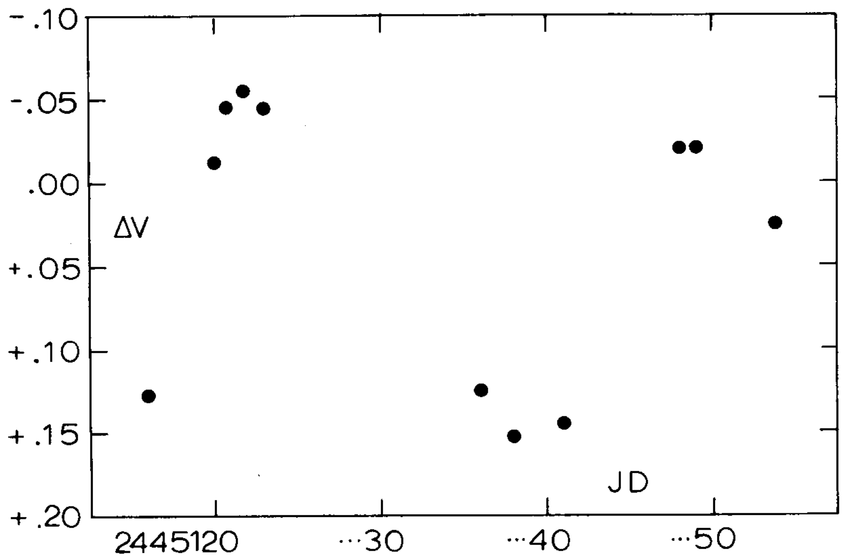

Figure 1

around 25 days, then it would be a long-period RS CVn binary by the definition of Hall (1976).

GREGORY W. HENRY
STEPHEN MURRAY

Cloudcroft Observatory
Cloudcroft, New Mexico 88317

DOUGLAS S. HALL

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

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Bidelman, W. P. and MacConnell, D. J. 1973, A. J. 78, 687.

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Hall, D. S. 1976, I.A.U. Colloq. No. 29, 287.

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HD 190540: A NEW VARIABLE STAR

Because Bidelman and MacConnell (1973) reported Ca II H and K emission, we suspected HD 190540 might be an RS CVn binary and therefore might show the photometric wave characteristic of most stars of that type. According to their table VII, $m_v = 8^m\!.4$ and the spectral type is KO IV + F.

Henry, observing with the No. 4 16-inch Cassegrain at Kitt Peak, obtained data on 3 nights between JD 2444716.9 and 2444719.9. Henry and Sherlin, observing with the 48-inch Newtonian at Cloudcroft, obtained data on 17 nights between JD 2444872.7 and 2445153.9. All observations were made in V, with BD - 18°5593 as the comparison star. The individual differential magnitudes, corrected for differential extinction and transformed differentially to V of the UBV system, have been sent to the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1979), where they are available as file no. 106.

The figure below is a plot of nightly means of the Cloudcroft data,

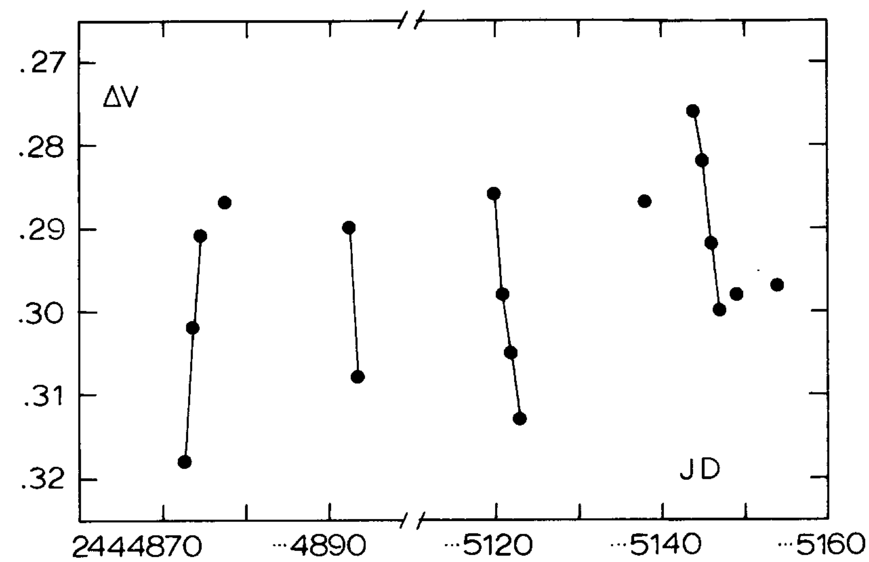

Figure 1

where ΔV is in the sense variable minus comparison. Points taken on consecutive nights are joined with straight line segments. It was immediately obvious that HD 190540 was variable, with an amplitude of $\Delta V = 0^{m}.04$. Further inspection of the data suggested that the period was around 8 days or a bit longer. With a period-finding program based on an approach similar to that of Lafler and Kinman (1965), three periods were found ($8^{d}.10$, $8^{d}.35$, and $8^{d}.60$) which produced light curves of comparable quality. All three were somewhat unsatisfactory, however, in at least one respect. Either the light curve is variable with time or else we somehow have failed to find the correct period.

Additional photometry should be obtained to determine more accurately what the photometric period really is. We have been in communication with Luis Balona and T. Lloyd Evans of the South African Astronomical Observatory, who tell us they have been obtaining spectroscopic and photometric observations of this star (and all of the stars in table VII of Bidelman and MacConnell). If radial velocity measures indicate HD 190540 is a binary system with an orbital period around 8 days, then it would be a regular RS CVn binary by the definition of Hall (1976).

GREGORY W. HENRY
JERRY SHERLIN

Cloudcroft Observatory
Cloudcroft, New Mexico 88317

DOUGLAS S. HALL

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

References:

Bidelman, W. P. and MacConnell, D. J. 1973, A. J. 78, 687.

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HD 205249: A NEW VARIABLE STAR

Because Bidelman and MacConnell (1973) reported Ca II H and K emission, we suspected HD 205249 might be an RS CVn binary and therefore might show the photometric wave characteristic of most stars of that type. According to their table VII, $m_v = 8^m.0$ and the spectral type is K1 III.

Henry and Sherlin, observing in V with the 48-inch Newtonian at Cloudcroft, obtained data on 4 nights between JD 2444872.7 and 2444877.7 and on 8 nights between 2445119.9 and 2445153.9. The comparison star was BD $-14^\circ 6063$. The individual differential magnitudes, corrected for differential extinction and transformed differentially to V of the UBV system, have been sent to the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1979), where they are available as file no. 106.

Inspection of our data showed immediately that HD 205249 was variable, with an amplitude of $\Delta V = 0^m.13$. The two groups of data do not cover the entire light variation between maximum and minimum, but the portions covered do indicate a period greater than about 50 days. Further analysis of the data suggests that a period of 58 days would combine the two groups into a smooth light curve. The figure below is a plot of the nightly means, where

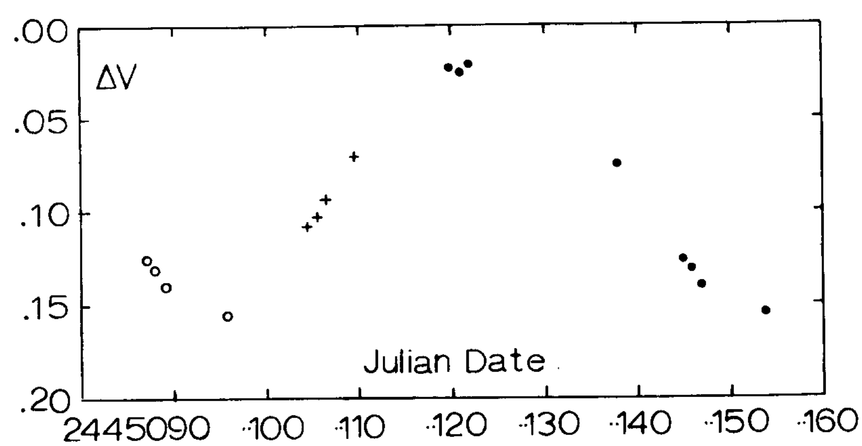

Figure 1

ΔV is in the sense variable minus comparison. The dots are from the second group; the circles are the last four points moved back one cycle (58 days); and the plusses are from the first group, moved forward four cycles (232 days).

If this interpretation is correct, then a time of maximum would be JD 2445121 and a time of minimum would be 2445154. The slight asymmetry (faster rise, slower decline) is consistent with the steeper slope defined by the four points of the first group.

The photometric period of 58 days, which we tentatively suggest, is not firmly established, however, and should be confirmed with additional photometry. We have been in communication with Luis Balona and T. Lloyd Evans of the South African Astronomical Observatory, who tell us they have been obtaining spectrocopic and photometric observations of this star (and all of the stars in table VII of Bidelman and MacConnell). If radial velocity measures indicate HD 205249 is a binary system with an orbital period around 58 days, then it would be a long-period RS CVn binary by the definition of Hall (1976).

GREGORY W. HENRY
JERRY SHERLIN

Cloudcroft Observatory
Cloudcroft, New Mexico 88317

DOUGLAS S. HALL

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

References:

Bidelman, W. P. and MacConnell, D. J. 1973, A. J. 78, 687.

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PHOTOMETRIC VARIABILITY OF HR 3119

HR 3119 is a double-lined spectroscopic binary with components of similar spectral types. Young and Koniges (1977) have given an F8V spectral classification based on a spectrum obtained at an epoch when the lines of the components were not resolved. The orbital period of the binary is 11.08 days and mass ratio of the components is very close to unity (Harper 1939).

We included HR 3119 in a photometric programme of late type emission binaries on the basis of its classification as a radio binary by Spangler et al. (1977). The star was observed with the 34-cm Cassegrain reflector of the Kavalur Observatory through standard B and V filters. Observations were made on 15 nights between December and January 1979-80. HD 65301 and HD 67224 were observed along with HR 3119 as comparison stars. The figure is a plot of differential magnitudes against phase computed with the following ephemeris (Eaton et al. 1981):

$$JD = 2444530.0 + 10\overset{d}{.}17\ E.$$

Each point is an average of three or four independent measurements of a single night and the total uncertainty of a point is ~ 0.008 mag. The light curve is nearly sinusoidal with an amplitude of ~ 0.04 mag. The B-V colour does not show any significant variation. Eaton et al. (1981) observed the star on five nights during the interval covered by our observations and these fall on the mean light curve shown in the figure.

From the spectral class, Ca II H and K emission photometric light variation and radio emission, Eaton et al. classify HR 3119 as a member of RS CVn binaries. Young and Koniges (1977),

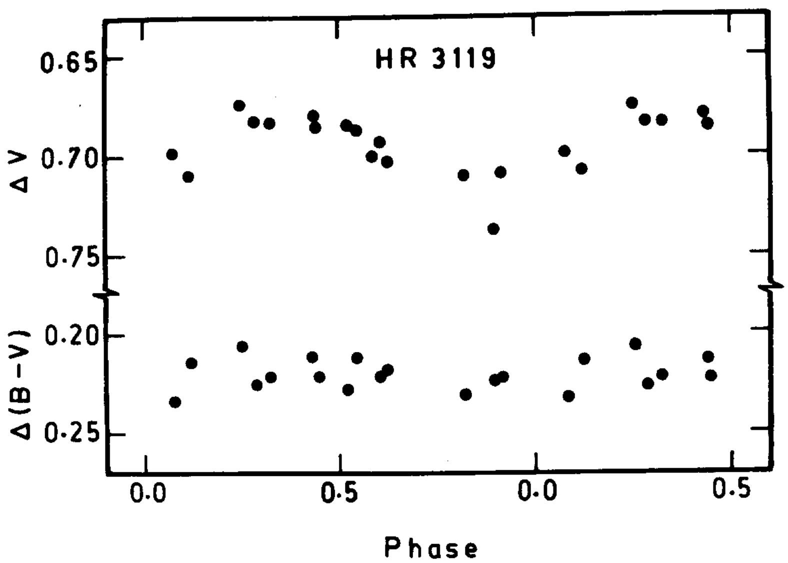

Figure 1

from a spectrum obtained in the single-lined phase, find that the radial velocity derived from the Ca II H and K emission lines are more negativ by 22 kms^{-1} than that derived from the absorption lines and so the emission might not be of chromospheric origin. HR 3119 stands out in several aspects from the classical RS CVn systems. All of the classical RS CVn binaries have near-circular orbits and their photometric and orbital periods differ very little due to orbital synchronisation. The higher eccentricity (e = 0.11) of the orbit observed in the case of HR 3119 may be the reason for the significant difference in its orbital and photometric periods. In a typical RS CVn system the spectral type of the secondary component is ~KO, whereas both the components of HR 3119 are of earlier spectral types (~F8). In this respect this star resembles σ^2CrB, where the components are F6 and G1. Spangler et al., in their radio survey of close binaries, find that these two stars are the least luminous among the known radio binaries. More systematic observations, both photometric and spectroscopic, are necessary to understand the peculiarities of this binary.

M.V. MEKKADEN

A.V. RAVEENDRAN

S. MOHIN

Indian Institute of Astrophysics
Bangalore 560034
India

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HISTORICAL LIGHT CURVES OF FOUR T TAURI STARS

I have examined the archival plate collection at the Harvard College Observatory to obtain the historical light curves of SY Cha, TW Cha, VZ Cha, and DR Tau. This study was designed to look for periodic photometric variation (and hence rotation periods) as first suggested by Mathieu and Fich (1982). The reason for choosing the

Table I

J.D.minus 2,400,000	TW Cha	SY Cha	VZ Cha	J.D.minus 2,400,000	TW Cha	SY Cha	VZ Cha
25986.572	13.9	14.3	13.7	27649.226	13.9	>14.1	14.1
26057.312	14.1	14.3	13.8	27811.468	----	----	13.4
26067.434	----	----	13.5	27874.505	----	14.2	14.4
26071.395	----	----	13.9	27930.272	13.7	14.1	13.5
26086.308	14.4	14.2	14.2	27960.257	14.4	14.3	14.2
26092.479	13.9	14.3	14.3	27960.347	14.5	14.2	14.3
26096.348	13.9	14.3	>14.3	27978.196	14.0	14.1	13.5
26118.219	14.0	14.3	14.5	27982.347	14.0	----	>14.1
26144.220	13.8	14.3	14.1	28257.517	14.0	13.3	13.7
26144.286	13.9	14.3	14.4	28260.599	13.9	>14.1	>14.2
26366.423	----	13.7	13.7	28307.240	13.9	13.9	14.3
26399.461	14.2	14.0	13.9	28307.318	13.5	14.0	14.1
26456.286	13.8	14.0	>14.5	28327.226	14.3	14.3	12.9
26472.352	14.4	14.4	14.8	28336.228	13.6	14.1	>14.5
26481.344	13.6	14.5:	13.8	28339.312	13.4	14.1	14.3
26486.220	14.1	14.4	13.3	28342.229	13.7	14.0	14.1
26486.288	14.2	14.0	13.5	28357.234	14.0	14.1	13.2
26486.349	----	----	13.4	28387.232	14.5	14.1	13.8
26504.338	----	----	13.8	28486.535	13.9	14.3	13.8
26505.328	14.1	14.2	13.9	28598.446	13.9	14.4	14.6
26539.222	14.0	14.2	13.5	28639.411	14.4	14.3	14.1
26769.461	13.0	13.5	14.0	28639.496	14.3	14.2	13.9
26805.445	14.2	13.9	14.6	28670.318	14.4	14.8	14.8
26811.426	----	----	13.2	28694.228	13.9	14.3	14.1
26839.373	14.0	14.3	>14.3	28694.312	14.1	14.4	14.1
26918.223	14.2	>14.3	>14.2	28721.234	14.0	14.2	14.2
27186.380	14.4	14.2	13.7	28770.239	14.1	>14.1	14.1
27523.299	14.1	14.5	14.1	28878.552	14.6	14.4	13.4
27524.348	14.1	13.5	>14.0	28912.558	14.2	14.2	14.4
27546.295	14.3	13.7	14.3	28968.505	14.0	14.3	13.7
27570.236	14.0	14.1	13.8	28993.491	14.1	14.1	>14.1
27631.227	>14.4	14.1	13.8	29001.480	13.5	----	13.9:

Table I (cont.)

J.D.minus 2,400,000	TW Cha	SY Cha	VZ Cha	J.D.minus 2,400,000	TW Cha	SY Cha	VZ Cha
29014.327	14.3	14.2	14.4	29349.346	----	12.7	14.1
29014.411	14.1	14.1	14.3	29374.410	14.2	14.2	14.2
29018.318	14.2	14.3	13.8	29374.494	14.1	----	13.9
29018.424	14.1	14.1	13.9	29382.275	14.4	14.5	13.4
29022.462	14.4	14.0	13.8	29399.228	14.1	14.0	13.6
29042.402	14.3	14.0	14.2	29399.316	14.2	14.4	14.1
29046.336	13.9	14.0	14.2	29403.380	14.2	14.3	13.7
29049.248	14.1	14.0	14.3	29407.264	13.5	14.3	13.5
29049.334	14.2	14.2	14.3	29410.329	14.1	14.4	12.8
29049.376	14.3	14.2	14.2	29410.351	14.5	14.2	13.2
29073.357	14.0	14.3	13.6	29419.217	13.0	14.2	13.7
29077.255	13.9	>14.0	14.2	29428.331	14.4	14.2	14.2
29079.252	14.2:	>14.3	14.5	29435.227	14.2	14.4	14.2
29079.295	----	----	14.2	29435.312	14.0	14.4	----
29101.281	14.5	14.1	13.8	29463.230	14.6	14.3	13.6
29125.236	14.1	>14.2	14.2	29471.245	14.5	14.3	14.1
29222.539	14.1	14.1	14.1	29480.326	----	----	13.8
29266.543	14.6	14.3	14.1	29620.538	14.3	14.3	14.0
29341.420	14.5	14.3	13.5	29666.466	14.3	14.0	14.2

Table II

J.D.minus 2,400,000	SY Cha	J.D.minus 2,400,000	SY Cha	J.D.minus 2,400,000	SY Cha
15498.598	14.2	30852.363	14.1	43613.687	14.1
18043.605	13.9	30915.237	14.3	43615.525	14.3
18456.572	14.5	31109.555	14.1	43616.689	14.3
22105.512	14.4	31286.235	14.4	43694.498	14.0
22112.503	>14.2	31478.490	14.1	43899.772	>13.7
25594.496	14.0	31593.233	14.3	43901.748	>14.1
25626.478	14.3	31647.236	14.2	43901.821	>13.8
25650.543	14.0	31970.230	14.0	43902.753	14.1
25689.458	14.2	32005.236	14.4	44018.625	14.1
25710.369	14.0	32021.236	14.2	44020.545	13.0
25731.293	14.5	32276.536	14.5	44021.539	14.1
25759.214	14.5	32317.313	14.2	44021.667	14.5
25776.213	>14.1	32384.237	14.0	44023.703	14.1
29696.359	14.4	32593.412	13.9	44638.989	>13.7
29716.462	13.6	32626.517	14.2	44643.986	13.9
29731.393	14.0	32670.214	14.5	44647.040	14.0
29764.197	14.3	32702.229	14.3	44663.969	14.1
29811.210	14.2	33000.359	14.4	44673.052	14.1
29819.233	14.3	33041.233	14.4	44674.059	14.2
29823.213	14.4	33070.271	13.9	44694.957	14.3
30004.491	14.0	33091.232	14.4	44699.891	>13.7
30057.515	14.5	33099.320	14.2	44700.007	13.8
30061.473	14.2	33125.235	14.0	44727.892	>14.2
30085.456	14.3	33308.539	14.1	44727.984	14.2
30106.393	14.5	33409.383	14.5	44749.828	14.3
30117.400	14.4	33477.237	14.5	44994.029	14.0
30134.409	14.2	33664.558	14.2	45054.957	14.5
30178.213	14.3	33834.300	14.5	45073.889	14.0
30198.235	14.5	34099.466	14.4	45085.986	14.1
30436.355	14.5	43613.640	14.2		

Table III

J.D.minus 2,400,000	DR Tau	J.D.minus 2,400,000	DR Tau	J.D.minus 2,400,000	DR Tau
42427.635	11.7	43214.526	13.9	44192.724	11.5
42452.552	11.5	43397.842	>14.0	44222.607	12.5
42716.838	12.1	43399.579	12.2	44247.612	12.1
42745.690	12.5	43427.864	13.4	44273.530	12.2
42748.671	12.6	43438.813	14.4	44274.542	12.2
42754.710	11.8	43459.788	12.5	44283.610	13.6
42754.767	11.9	43462.688	12.2	44549.772	11.2
42770.590	12.0	43480.698	13.2	44549.835	11.2
42779.643	12.4	43482.717	12.8	44577.669	11.2
42783.552	12.1	43540.522	11.4	44577.700	11.8
42798.599	12.2	43542.538	12.0	44607.589	11.2
42806.535	12.2	43550.583	12.7	44607.619	11.7
42811.555	12.2	43567.508	12.6	44630.545	12.1
42829.528	12.2	43568.505	12.3	44630.573	12.2
43043.851	12.5	43754.846	11.5	44663.510	11.8
43044.806	11.8	43791.848	12.2	44665.505	12.2
43044.861	11.4	43792.849	12.1	44672.894	12.0
43046.569	12.9	43814.745	12.2	44673.924	11.2
43074.768	13.2	43814.772	12.3	44872.884	11.2
43078.787	14.0	43840.716	12.4	44908.796	11.8
43097.675	12.2	43840.742	12.5	44911.762	11.4
43099.781	12.2	43870.613	11.1	44933.641	12.0
43126.664	12.1	43870.637	11.4	44939.627	11.9
43155.560	12.1	43921.538	12.4	44955.623	11.4
43166.593	12.1	43922.548	13.1	44955.649	11.5
43166.651	12.0	43922.580	12.6	44985.585	12.1
43182.569	12.8	43933.542	11.2	44985.638	12.1
43192.531	13.2	44136.761	12.2	44994.598	11.9
43193.512	12.7	44172.797	12.8	44994.621	11.9
43193.567	12.9	44192.696	11.5	45044.511	11.8

first three stars for examination was the reports of periodicities by Mauder and Sosna (1975) and Kappelmann and Mauder (1981). B, V, and R observations of SY Cha during 1970-2 will be reported by Schaefer (1982). During this period, SY Cha brightened and showed strictly periodic oscillations with a $1\overset{m}{.}6$ amplitude. DR Tau showed a similar brightening in the 1970's (Chavarria-K. 1979), so it is of interest to look for oscillations during its "outburst". Additional observations of DR Tau after 1975 are given in Kuan(1976), Bertout et al.(1977), Bastian and Mundt(1979), Cohen and Kuhi(1979), Chavarria-K.(1979), and Gotz(1982).

All plates that I examined were from the A, MF, RB, or Damon series and are in the B magnitude system. The magnitudes (see Tables I-III) were estimated visually, so the one sigma error is roughly $0\overset{m}{.}20$.

The sequence of comparison stars for DR Tau was taken from Gotz(1982). The Chamaeleon sequence was derived from measurements of the stars in Selected Area SA203. I have performed a Fourier Transform on the data for the various stars and find no significant periodicities between $0^{d}.7$ and $100^{d}.0$.

BRADLEY E. SCHAEFER
Massachusetts Institute of Technology
Cambridge, Mass. 02139 USA

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR AD Leo IN 1982

Photoelectric observations of flare stars have been continued at the National Astronomical Observatory of the Bulgarian Academy of Sciences. In this paper we report about our observations of the flare star AD Leo in 1982.

The observations were carried out with the 60 cm Cassegrain reflector and the one channel U,B,V photoelectric photometer. A photon counting system with an integration time of 1 sec was used. Details of this equipment are published by Panov et al. (1982). Here we give the transformation of the instrumental u,b,v system to the international U,B,V system for the period under consideration:

$$\Delta V = \Delta v + 0.10\Delta(b-v)$$
$$\Delta(B-V) = 1.13\ \Delta(b-v)$$
$$\Delta(U-B) = 0.84\ \Delta(u-b)$$

Monitoring observations were carried out on 6 nights in February and March 1982 in colour "u". Table I contains, for each night, the monitoring intervals in UT, the number of flares observed, as well as the total monitoring time.

During the total of 17^h57^m monitoring time 23 flares were observed, the characteristics of which are given in Tables II-VII. 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.

c. the total duration of the flare.

Table I

Flare star AD Leo, 1982

Date	Monitoring intervals (U.T.)	Total monit. time	Number of flares
1982			
Febr. 16/17	$21^h12^m01^s$–$23^h11^m24^s$,		
	23 15 17 –00 18 58 .	$3^h03^m04^s$	5
18	20 32 13 –21 55 24 ,		
	21 56 19 –22 19 56 ,		
	22 21 18 –23 38 09 .	3 03 39	5
March 18	20 50 14 –23 00 18 .	2 10 04	1
25	19 10 54 –19 27 55 ,		
	19 29 58 –22 58 22 .	3 45 25	7
26	18 49 50 –19 22 19 ,		
	19 24 07 –20 56 19 ,		
	20 57 55 –21 19 55 ,		
	21 29 31 –22 31 46 .	3 28 56	3
27	19 00 52 –20 13 25 ,		
	20 28 14 –20 55 36 ,		
	21 57 46 –22 43 25 .	2 25 34	2
	Total:	$17^h56^m42^s$	23

Table II

Characteristics of the flares observed

on February 16, 1982

Flare No	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	P min	Air mass
1	$21^h46^m27^s$	0.18	1.1	1.3	1.18	0.18	0.03	0.07	1.108
2	21 59 26	0.13	2.0	2.1	1.48	0.42	0.03	0.22	1.095
3	22 58 31	0.38	1.5	1.9	1.25	0.24	0.03	0.16	1.074
4	23 37 55	0.67	0.7	1.4	1.20	0.20	0.03	0.10	1.090
5	23 57 00	0.30	4.0	4.3	1.66	0.55	0.03	1.09	1.107

Table III

Characteristics of the flares observed

on February 18, 1982

Flare No	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	P min	Air mass
1	$21^h15^m20^s$	0.33	4.7	5.0	2.81	1.12	0.03	1.33	1.139
2	22 07 15	0.42	0.8	1.2	1.19	0.19	0.03	0.09	1.085
3	22 09 24	1.0	1.0	2.0	1.22	0.21	0.03	0.13	1.084
4	22 21 44	0.27	2.3	2.6	1.38	0.35	0.03	0.17	1.078
5	22 51 52	0.57	1.1	1.7	1.17	0.17	0.03	0.11	1.074

Table IV

Characteristics of the flare observed on March 18, 1982

Flare No	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	P min	Air mass
1	$20^h53^m00^s$	0.28	1.5	1.8	1.29	0.28	0.03	0.19	1.074

Table V

Characteristics of the flares observed on March 25, 1982

Flare No	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	P min	Air mass
1	$19^h34^m55^s$	0.82	10.0	11.0	2.79	1.12	0.03	3.81	1.095
2	20 14 50	1.00	6.0	7.0	1.74	0.60	0.03	2.04	1.075
3	21 31 00	0.67	1.5	2.2	1.46	0.41	0.03	0.33	1.106
4	21 41 56	0.10	2.0	2.1	1.41	0.37	0.03	0.23	1.118
5	21 54 58	2.63	14.0	16.6	2.18	0.85	0.03	8.75	1.136
6	22 26 58	0.55	2.0	2.6	1.44	0.40	0.03	0.39	1.194
7	22 51 52	Duration = 2 sec			1.47	0.42	0.03	0.01	1.256

Table VI

Characteristics of the flares observed on March 26, 1982

Flare No	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	P min	Air mass
1	$19^h11^m30^s$	1.5	23.0	24.5	2.93	1.17	0.03	21.05	1.115
2	20 47 13	0.80	9.0	9.8	5.33	1.82	0.03	7.61	1.078
3	22 27 34	0.12	0.4	0.5	1.36	0.33	0.03	0.06	1.203

Table VII

Characteristics of the flares observed on March 27, 1982

Flare No	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	P min	Air mass
1	$19^h38^m35^s$	0.42	1.5	1.9	1.71	0.58	0.03	0.19	1.092
2	22 30 08	0.13	0.7	0.8	1.61	0.52	0.03	0.05	1.198

d. The value of 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 of the star less sky background.

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

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

where "u" is the instrumental ultraviolet magnitude.

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

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

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 in colour "u" are shown in Figures 1-23. Every point on the figures represents 1 sec integration of intensity.

The distribution of amplitudes of the observed flares is shown in Table VIII.

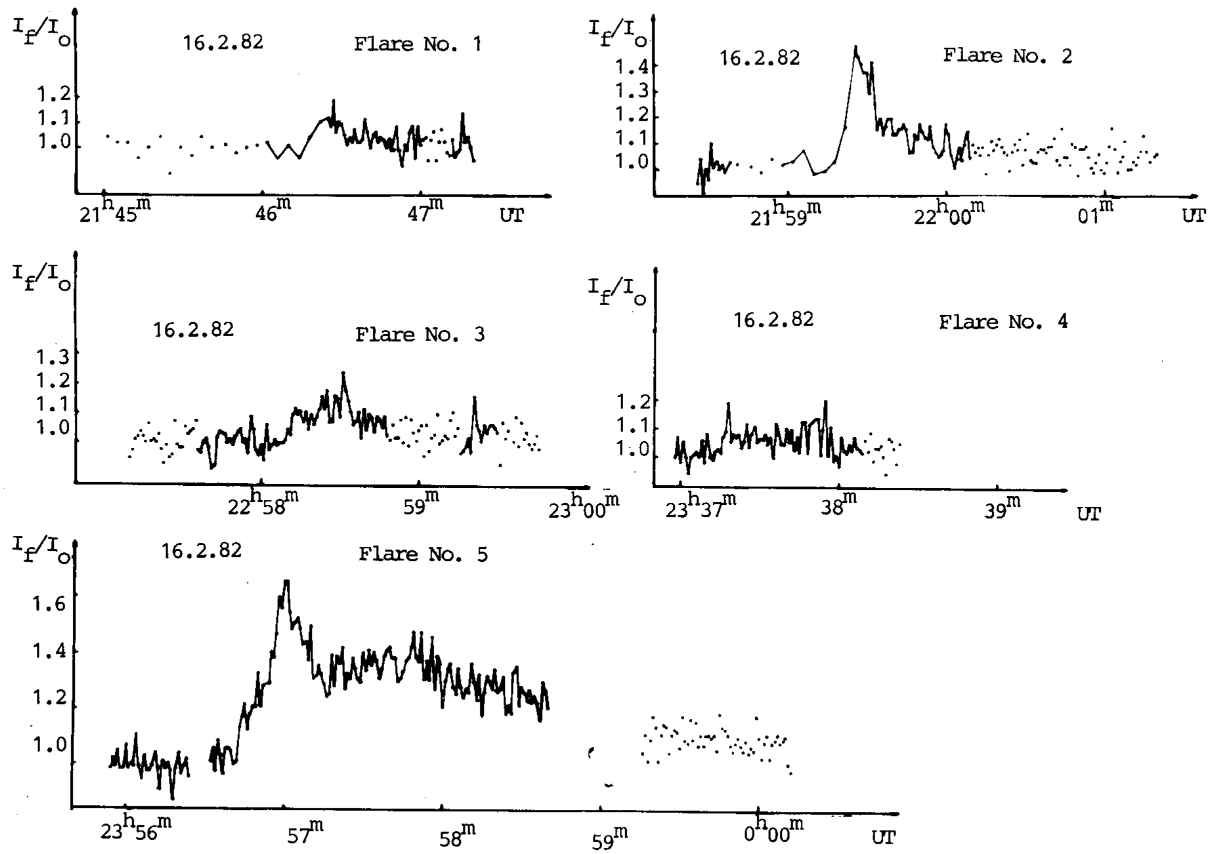
Table VIII
Distribution of the amplitudes of the flares observed

	Amplitudes Δm			
	$0^m.15-0^m.5$	$0^m.5-1^m.0$	$1^m.0-1^m.5$	$1^m.5<$
Number of flares	14	5	3	1

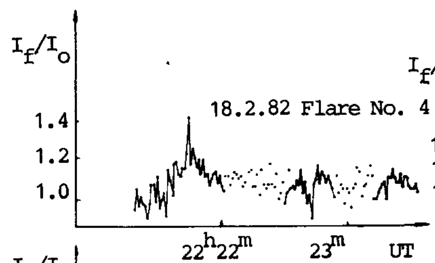
Previous observations of AD Leo by other observers (Moffett, 1974) revealed a frequency of flare occuring of about 1 flare per 3 hours monitoring time (in colour "u"). In the period under consideration we observed about 3 times higher frequency of flare occuring, which means that in that period AD Leo was in a state of enhanced flare activity. Comparison with observations of the star by other observers during the same time would be most desirable.

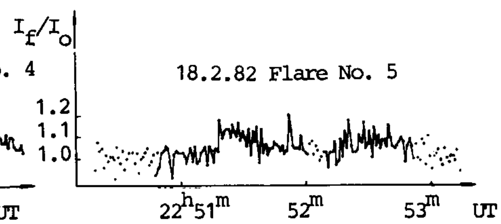
We observed pre-flare decrease of brightness only in two cases. Flare No.1 of 18.3.1982 has a pre-flare decrease of 0.07 mag and duration of 5 sec, and flare No.4 of 25.3.1982 has a pre-flare decrease of 0.10 mag and duration of 20 sec. It should be stressed, however, that pre-flare decreases of brightness can only be secured by synchronous observations by two or more telescopes.

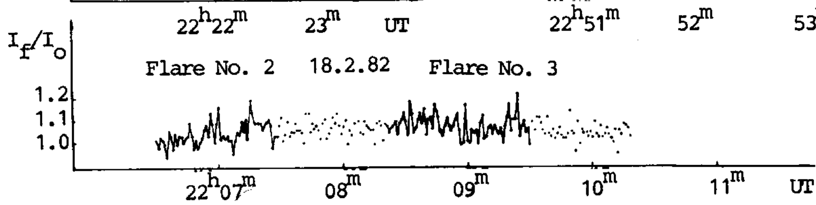
The comparison star BD+20°2464 was observed on each night listed in Table I, several times in U,B,V, in order to search for long-term brightness variability of AD Leo. For the period

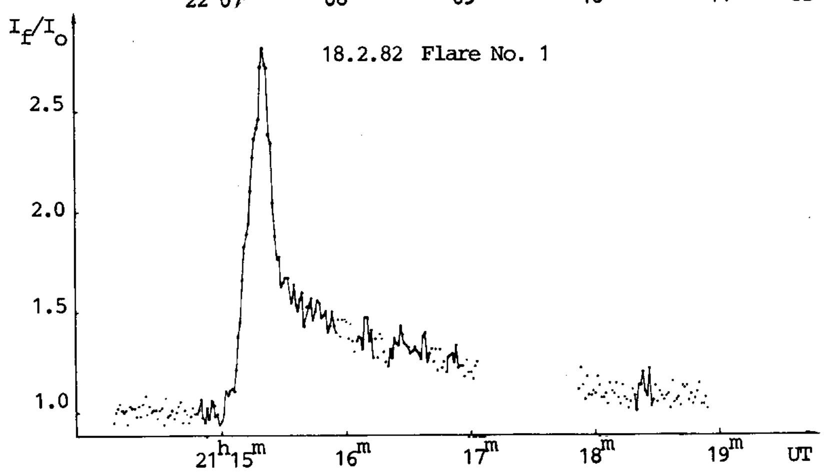


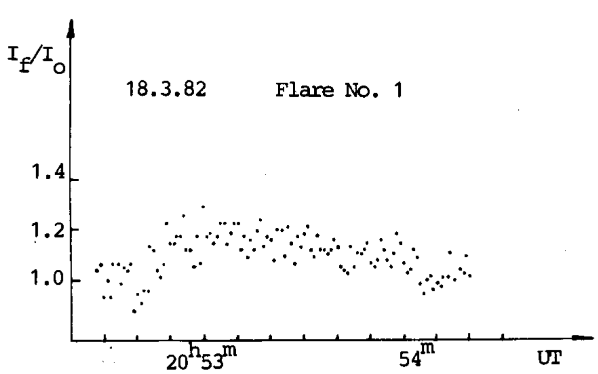
I_f/I_o
16.2.82
Flare No. 1
1.2
1.1
1.0
21^h45^m
46^m
47^m
UT
I_f/I_o
16.2.82
Flare No. 2
1.4
1.3
1.2
1.1
1.0
21^h59^m
22^h00^m
01^m
UT
I_f/I_o
16.2.82
Flare No. 3
1.3
1.2
1.1
1.0
22^h58^m
59^m
23^h00^m
I_f/I_o
16.2.82
Flare No. 4
1.2
1.1
1.0
23^h37^m
38^m
39^m
UT
I_f/I_o
16.2.82
Flare No. 5
1.6
1.4
1.2
1.0
23^h56^m
57^m
58^m
59^m
0^h00^m
UT

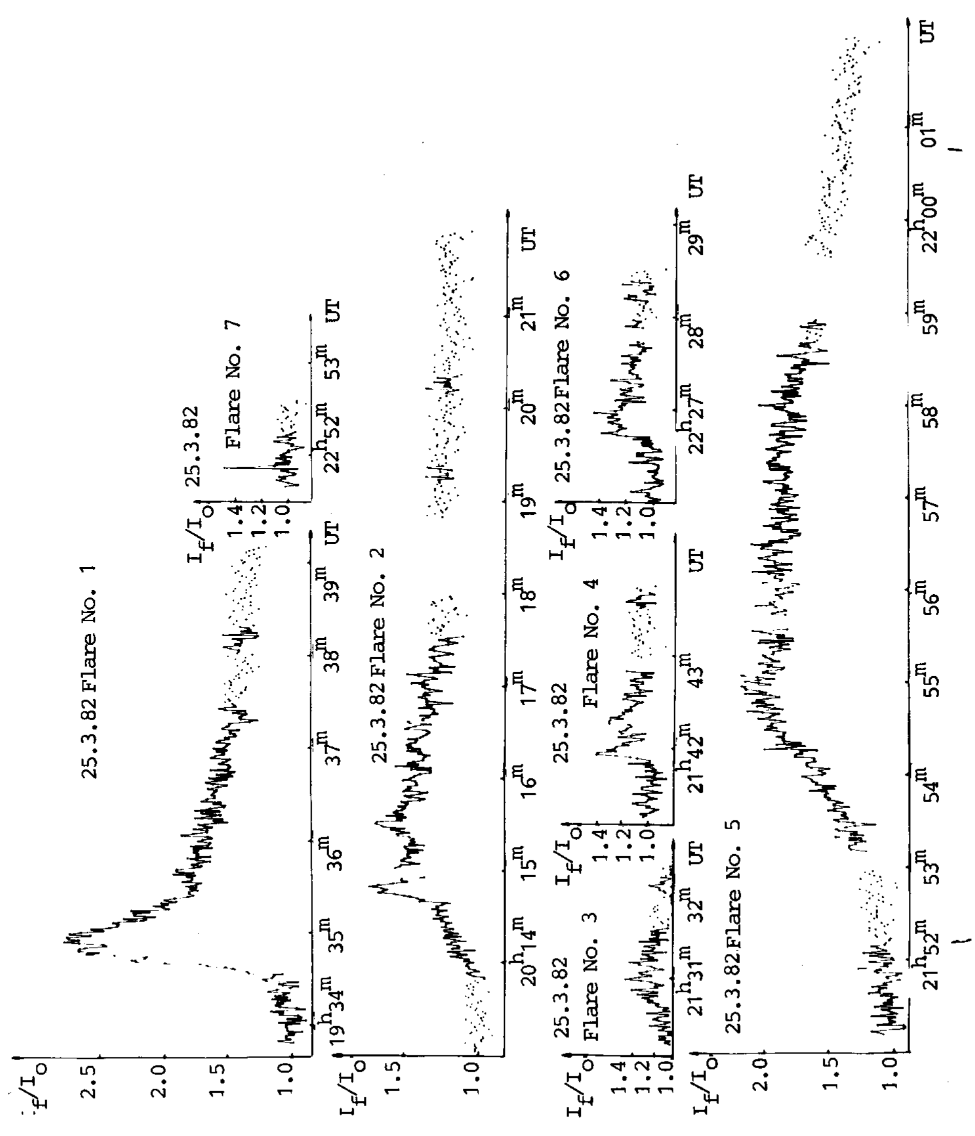

I_f/I_o
18.2.82 Flare No. 4
1.4
1.2
1.0
22h22m
23m
UT


I_f/I_o
18.2.82 Flare No. 5
1.2
1.1
1.0
22h51m
52m
53m
UT

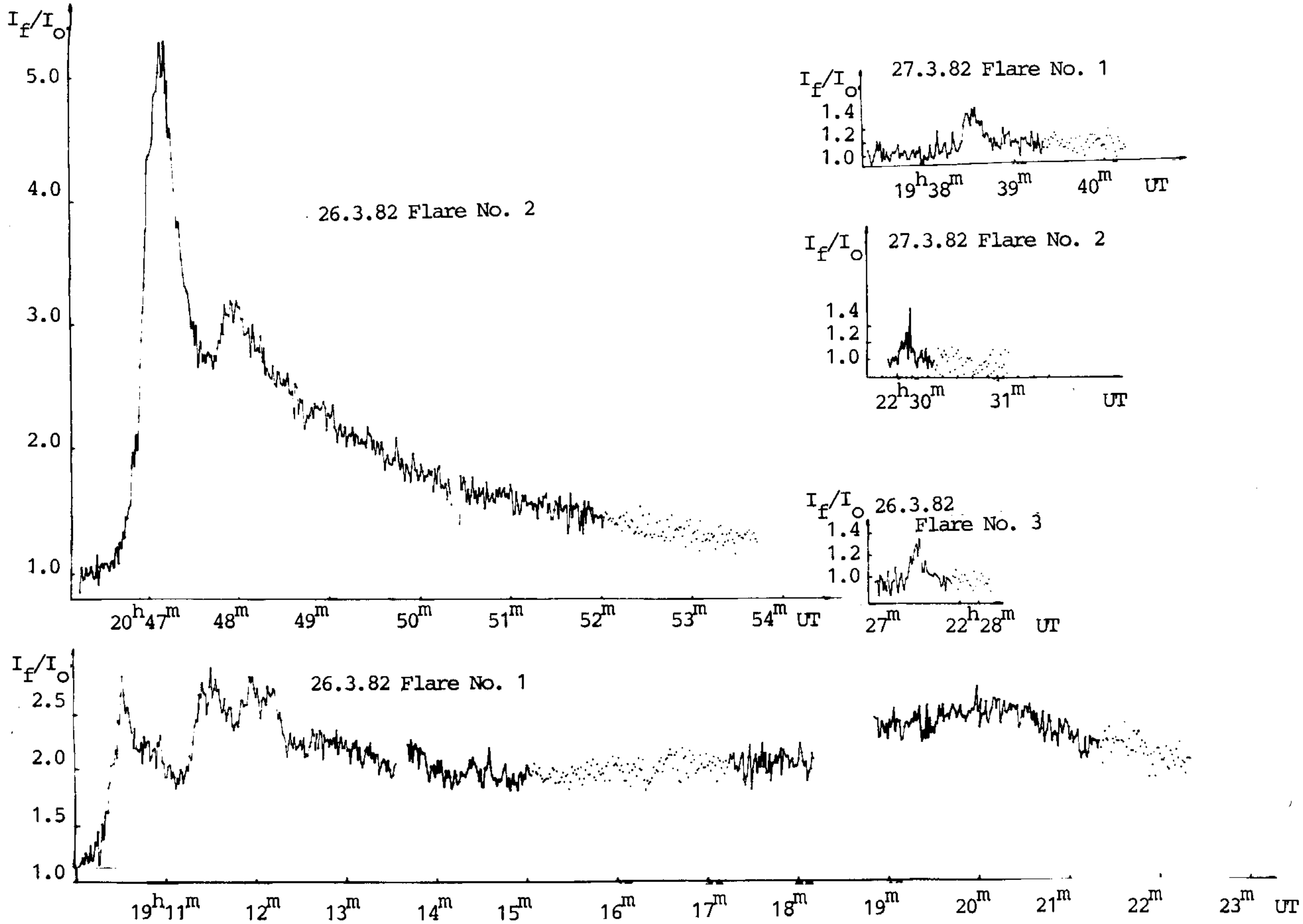

I_f/I_o
Flare No. 2
18.2.82
Flare No. 3
1.2
1.1
1.0
22h07m
08m
09m
10m
11m
UT


I_f/I_o
18.2.82 Flare No. 1
2.5
2.0
1.5
1.0
21h15m
16m
17m
18m
19m
UT


I_f/I_o
18.3.82
Flare No. 1
1.4
1.2
1.0
20h53m
54m
UT



25.3.82 Flare No. 1
25.3.82 Flare No. 2
25.3.82 Flare No. 3
25.3.82 Flare No. 4
25.3.82 Flare No. 5
25.3.82 Flare No. 6
25.3.82 Flare No. 7
I_f/I_o
UT



I_f/I_o
5.0
4.0
3.0
2.0
1.0
26.3.82 Flare No. 2
20^h47^m 48^m 49^m 50^m 51^m 52^m 53^m 54^m UT
27.3.82 Flare No. 1
1.4
1.2
1.0
19^h38^m 39^m 40^m UT
27.3.82 Flare No. 2
22^h30^m 31^m UT
26.3.82 Flare No. 3
27^m 22^h28^m UT
26.3.82 Flare No. 1
2.5
2.0
1.5
1.0
19^h11^m 12^m 13^m 14^m 15^m 16^m 17^m 18^m 19^m 20^m 21^m 22^m 23^m UT

under consideration, no significant changes in the quiet state U,B,V, brightness of AD Leo were found. Thus, the remarkable flare activity of AD Leo in 1982 was not connected with quiet state brightness variability.

K.P. PANOV

M. GRIGOROVA

A. TSINTSAROVA

Department of Astronomy with
National Astronomical Observatory
Bulgarian Academy of Sciences
Sofia, 7 November str. No.1
Bulgaria

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1982 PHOTOMETRY OF ER VUL

We have completed a light curve for ER Vul (BD+27°3952, HD 200391, SAO 089396) within a one week period in October 1982 to minimize the effects of short-term, intrinsic variations. We carried out the observations at the Capilla Peak Observatory of the University of New Mexico. Our 61-cm Boller and Chivens telescope has a single-channel, photon-counting photometer with a cooled EMR 641A phototube and a Kitt Peak UBVR filter set. A microcomputer controls the photometer (Elston and Zeilik, 1982); its on-line data reduction assures that observations obtain a statistical error of no more than ±0.01 mag.

As for our 1981 observations (Zeilik et. al., 1982), we used BD+27°3946 as our comparison star. Observations of this star over a wide range of air masses resulted in a good determination of the UBVR extinction coefficients. Phases were calculated from HJD=2440182.3212 + 0.62892990E (Al-Naimiy, 1978). Dates (UT) and phases covered were: 3 Oct., 0.17 to 0.50; 6 Oct., 0.47 to 0.73; 7 Oct., 0.82 to 0.19; and 9 Oct., 0.69 to 0.89. Figures 1 through 4 summarize the results in instrumental magnitudes; actual observational points are shown <u>not</u> normal points. Note that our data is <u>comparison</u> <u>minus</u> <u>source</u>, the opposite of the usual convention, so the y-axis lacks a minus sign.

We can compare these observations to those in 1981 by ourselves and Kadouri (1981), who used the same comparison star. First, the overall system brightness

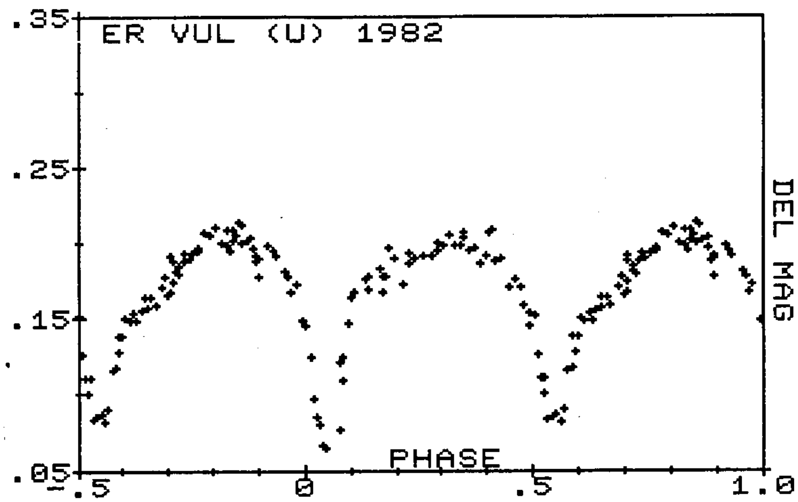

FIGURE 1

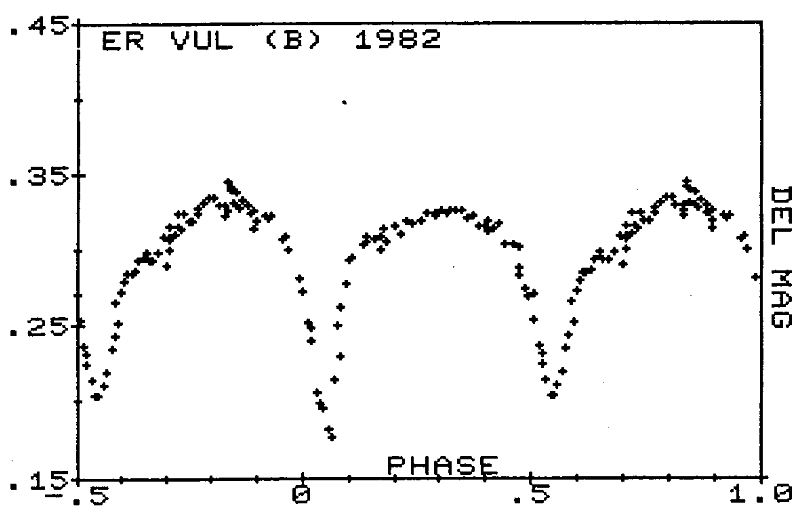

FIGURE 2

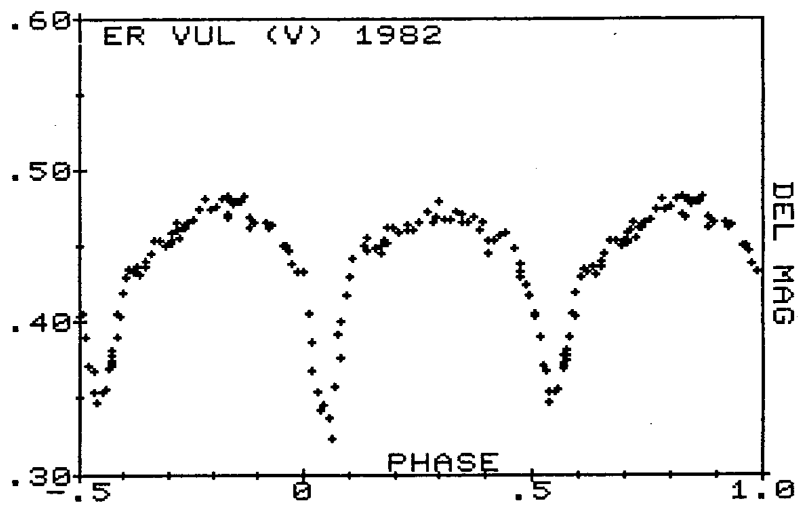

FIGURE 3

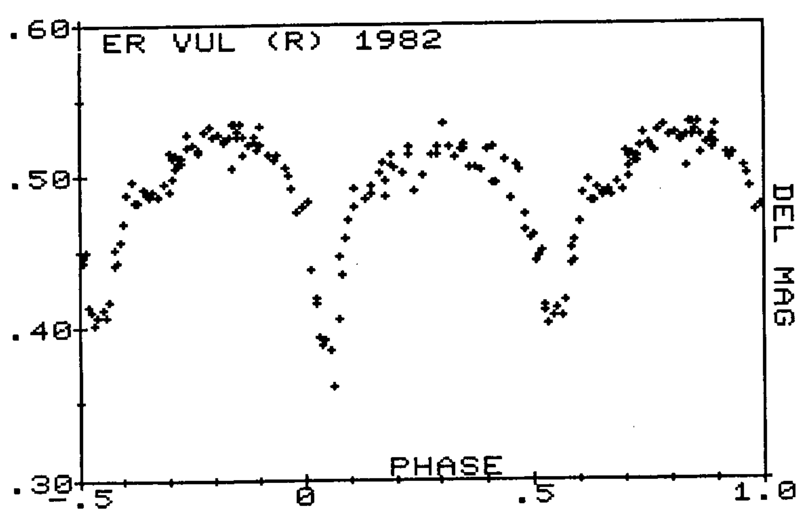

FIGURE 4

has decreased by 0.05 mag. at U, 0.04 mag. at B, 0.05 mag. at V, and 0.03 mag. at R. Second, the shoulder at phase 0.25 is still depressed and more symmetrical than that at 0.75. Third, the primary eclipse is still deeper than the secondary, but the difference has decreased a little -- by about 0.01 mag. at UBV. Fourth, both limbs appear flatter than before.

As noted by Kadouri (1982), the ephemeris from Al-Naimiy (1978) no longer gives consistant results; both the primary and secondary eclipses have shifted ~+0.05 phase with respect to that predicted from the earlier ephemeris.

We are planning to continue observations of this system at least once a year to track its variations.

M. ZEILIK, B. BACA, D. BATUSKI, S. BURKE, R. ELSTON, and P. SMITH

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

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ANNOUNCEMENT

Appended, in toto, is a letter relating to the planned reconstitution of a WG on Supernovae

Commission 28 is planning to reinstitute a Working Group on Supernovae. The previous one formed in 1961, moved under the auspices of Commission 27 (Variable Stars) in the early 70's and largely ceased to function with the death of its founder, Fritz Zwicky, in 1974. Vera Rubin, as president of Commission 28, has asked me to act as Interim Chairman of the revived working group until formal arrangements can be made at the 19th General Assembly in New Delhi.

It seems to me that the working group could serve two major functions, roughly parallel to those of other IAU WG's:

1. To act as an advocate of supernova searches and supernova researches both within the astronomical community and with respect to the external powers that control observing time, computing time, and funding. The automated searches operating or soon to be operating in Cambridge (UK), New Mexico, Berkeley, and probably other places I do not know about will naturally much increase the demand for observing time to obtain follow-up data and for computing power to analyze and interpret it.

2. To provide a coordinating service among those programs currently and soon to be engaged in supernova searches and those individuals and institutions equipped to provide light curves, spectra, and other data at radio, infrared, X-ray, and ultraviolet - not to mention optical - wavelengths.

Both your advice and your assistance would be very much appreciated. If you are involved, in any way, in supernova research, or if you can think of specific ways that a working group could facilitate your activities, or if you are willing to be an active member of the group, please let me know. I will try to reach members of other relevant commissions (High Energy Astrophysics, etc.) with messages similar to this one. But do, please, share this with anyone you think might be interested and let me know if there are people or institutions involved in supernova work that I may not know about.

VIRGINIA TRIMBLE

Astronomy Program
University of Maryland
College Park MD 20742
301-454-5822
July to December each year

Department of Physics
University of California
Irvine CA 92717
714-833-6948
January to June each year

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TWO NEW VARIABLE STARS IN M 13

We have investigated five stars for variability in the globular cluster M 13 = NGC6205 with Nos. 66, 526, 598, 761 and 1067 in Ludendorff's (1905) catalogue on 60 plates taken with the 60-cm reflector of Belogradchik Astronomical Station (Bulgaria) during eight years, from 1974 to 1982 (J.D.2442299-2445090). The photometric system is near the B one (Russev and Russeva, 1979). All these stars are physical members of the cluster according to their proper motions, position in the colour-magnitude diagram (Cudworth and Monet, 1979) and radial velocity measurements (for L598, Strom et al., 1970).

The analysis of the available observational material has shown that L66 and L598 are undoubtedly variable stars, but we have not found any evidence of variability of the other three stars - L526 ($\bar{B} = 14^m.34$, $\bar{B}-\bar{V} = +0^m.52$, the magnitudes V are by Cudworth and Monet, 1979), L761 ($\bar{B} = 14^m.91$, $\bar{B}-\bar{V} = +0^m.11$) and L1067 ($\bar{B} = 14^m.76$, $\bar{B}-\bar{V} = +0^m.14$). It should be mentioned that the stars L66 and L598 were suggested to be variable in brightness by Cudworth and Monet (1979). The average B magnitudes of the two stars are given in Table I with the numbers of observations per night (n).

The star L66 (No.306 in Kadla's catalogue, 1966, or No.11-72 in Arp's list, 1955) was measured on 48 plates taken on 29 nights. The observations were explained with the following elements:

$$\text{Max} = \text{J.D. } 2442305.389 + 21^d.165 \cdot E$$

The light curve of L66 is shown in Figure 1a.

From the average light curve we obtained for the amplitude

Table I

JD 24...	L66	n	L598	n	JD 24...	L66	n	L598	n
42 299.31	^{m}	-	$13^m.64$:	1	43 366.35	$14^m.75$	1	$13^m.66$	3
303.31	14.82	1	13.86	1	368.33	14.80	3	13.82	3
306.32	14.84	1	13.73	2	667.39	14.81	3	13.63	3
311.28	14.87	1	-	-	669.39	14.82	1	13.60	2
324.27	14.81	1	14.00	1	993.53	-	-	13.55	3
332.25	14.90	1	13.89	1	994.50	14.81	5	13.72	5
338.25	14.92	1	13.93	1	995.48	14.75	5	13.76	5
340.23	15.12:	1	13.93	1	996.49	14.76	1	13.82	1
985.43	14.74	2	13.78	2	44 137.37	14.86	1	13.83	1
988.50	14.75	1	13.72	1	754.53	14.80	1	13.84	1
43 304.52	14.85	1	13.83	1	755.45	14.79	3	13.79	3
305.48	14.81	1	13.82	1	759.39	14.64	1	13.69	1
308.51	14.91	1	13.58	2	760.54	14.65	1	13.71	1
310.40	14.93	2	13.60	2	787.43	14.69	1	13.86	1
338.36	14.82	3	13.79	3	788.37	14.74	1	14.12:	1
365.34	14.71	2	13.64	4					

$A_B = 0^m.24$ and $\bar{B} = 14^m.80$. Since $\bar{V} = 14^m.10$ (Cudworth and Monet, 1979) the colour index of the star is $\bar{B}-\bar{V} = +0^m.70$. So that L66 lies between the red boundary of the instability strip and the asymptotic giant branch (AGB) on the colour-magnitude diagram. The period of L66 is typical for the W Virginis stars, but the amplitude is unusually small for this kind of variables. It is possible that the star is in a phase of evolution on the AGB, when with the definite combination of parameters and a number of the relaxation cycle in the helium shell, for a short time, it may behave as a quasi periodical variable, without coming into the instability strip (Mengel, 1973).

Additional comprehensive photometry of L66 might yield new information on the nature of this star.

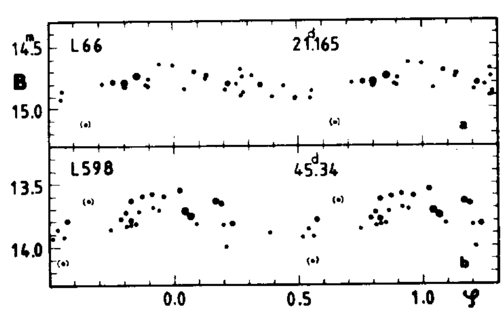

Figure 1: Light curves of L66 (a) and L598 (b). The size of the dots is proportional to the numbers of observations per night.

The star L598 is one of the brightest ($\bar{B} = 13^{m}_{.}72$) and reddest ($\bar{B}-\bar{V} = +1^{m}_{.}58$) stars in M 13. Our 58 observations on 30 nights permitted the construction of the light curve, which is shown in Figure 1.b. The light curve elements are:

$$\mathrm{Max} = \mathrm{J.D.}\ 2442269.50 + 45^{d}_{.}34 \cdot E$$

The comparison with the other red variable stars in M 13 (Russeva and Russev, 1980) has shown that the star L598, according to its period, amplitude ($A_B = 0^{m}_{.}32$) and infrared magnitude ($\bar{I} = 10^{m}_{.}10$, from three image tube observations), belongs to the smaller amplitude group with periods of 35-45 days. On the period-amplitude and period-magnitude diagrams (see Fig. 3 in the same paper) the star falls on the sequences for the AGB stars.

Details of our studies on L598 and other red variables in M 13 will be published in Per. Zvezdy.

TATIANA RUSSEVA

Department of Astronomy
Academy of Sciences, Sofia
Bulgaria

LUBOMIR ILIEV and RUSCHO RUSSEV

Department of Aştronomy
University of Sofia
Bulgaria

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FLARE STARS IN THE PLEIADES

Photographic monitoring observations in the Pleiades region have been continued at the Bulgarian National Astronomical Observatory.

The observations were made with the 20"/28" Schmidt telescope at Rojen during 1979 - 1981.

Table I gives the characteristic data of the observational material. The total effective time of observations amounts to 53^h20^m.

Table I

Telescope	Light	Time of exposures	Number of plates	Number of exposures	T_{eff}
20"/28"	U	10^{min}	30	163	27^h10^m
"	Pg	10^{min}	26	156	26 10
					Total = 53^h20^m

The data of observed flares are summarized in Table II.

Table II

Rojen N	HII	$R.A._{1900.0}$	$D_{1900.0}$	$m_{u/pg}$ min	$m_{u/pg}$	Date	Identification
R 12^x	134	$3^h37^m.7$	23°55′	17.0_u	$0^m.5_u$	14.10.80	T 68
R 12	"	"	"	"	$1^m.7_u$	29.11.81	"
R 13	-	$3^h37^m.9$	25°09′	18.6_u	$2^m.6_u$	23.11.81	T 69
R 14^x	335	$3^h38^m.4$	23°45′	16.0_u	$0^m.6_u$	17.10.81	T 73
R 15	-	$3^h41^m.6$	22°04′	16.8_u	$2^m.6_u$	30.10.81	B 473
R 16	-	$3^h43^m.0$	24°02′	17.7_{pg}	$1^m.7_{pg}$	22.09.79	B 476
R 17	-	$3^h43^m.6$	23°37′	19.2_{pg}	$4^m.5_{pg}$	24.09.79	T 54
R 18	-	$3^h44^m.0$	21°54′	18.8_{pg}	$3^m.3_{pg}$	17.09.79	-

^{x}Flares were discovered after the reexamination of the observational material published in our previous papers (IBVS No. 1749, IBVS No. 1888).

The successive columns give the following data:

1. Rojen designation. The numeration according M. Tsvetkov et al. (I.B.V.S. No. 1888) has been continued.
2. Hertzsprung number.

3-4. Coordinates for 1900.0.

5-6. Photographic magnitude at minimum and amplitude of the observed flare either in U- or pg- light.

7. Date of the flare event (U.T.).
8. Identification of the flare stars by the Tonantzintla (T) and the Byurakan (B) lists.

M.K. TSVETKOV
KATYA P. TSVETKOVA
ASSYA G. TSVETKOVA
S.A. TSVETKOV

Department of Astronomy with
National Astronomical Observatory,
Bulgarian Academy of Sciences,
Sofia-1000, 7th November str. 1
Bulgaria

H.S. CHAVUSHIAN

Byurakan Astrophysical
Observatory
Byurakan, Armenia
U.S.S.R.

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IS UX Dra A CARBON BINARY STAR?

The carbon star UX Dra, usually classified as a semiregular variable, was observed photoelectrically at Brno Observatory during the time period between August 1979 and October 1982. Simultaneous high dispersion spectra of this star were taken with the 2m telescope at the Ondřejov Observatory.

The light curve obtained in three colour expresses a strong regularity in alternating one deep and one shallow minima which suggests the light changes of a photometric binary. The radial velocity curve based on the measurements of details of the Swan molecular bands $C_2(1,0)$ and $C_2(0,1)$ is in conformity with the hypothesis of the binary nature of UX Dra. The half-amplitude of the radial velocity changes found is 2.2 km/s, the period is about 340 days, i.e. twice as long as the mean period declared for the semiregular light changes of UX Dra. If UX Dra is really a photometric binary then the confrontation of both light and radial velocity curves leads to the conclusion that the smaller and warmer component of the system is occulted by a substantially more massive carbon star during the primary minimum.

Could anybody verify the alternation of the deep and shallow minima in this star on the basis of some observations made closely before 1979?

M. VETEŠNIK

Department of Astronomy, Brno University
61137 Brno, Czechoslovakia

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SOME REMARKS ON THE CLOSE BINARY X-RAY SOURCE AM Her

In studying the long time behaviour the star was inspected on 56 blue-sensitive plates (ORWO-ZU 21 + GG13 + BG 12) taken with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 1982 April 15 and 1982 September 24. The exposure time of these plates varies between 5 and 30 minutes. In 11 nights more than one exposure per night were obtained. The used sequence of comparison stars in B is given by Hudec and Meinunger (1977).

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

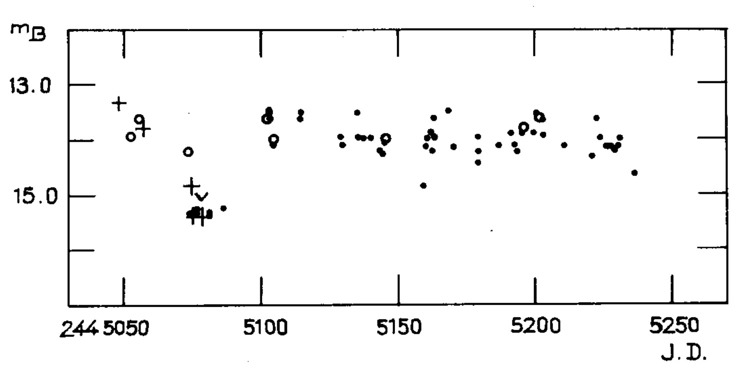

Figure 1

There, the plotted estimations from Schmidt plates (·) are supplemented and completed by observations on blue-sensitive sky patrol plates (o) of Sonneberg Observatory and by visual observations (+) published by Verdenet (1982), Mattei (1982) and Magalhaes (1982) and reduced to B according to the statements of Patterson and Price (1980) and Szkody (1978).

In the long time light curve of Figure 1 two different states of the behaviour of AM Her can be seen. The low state could be observed from 1982 April 15 to 1982 April 27; according to the light curve it could not have lasted longer than 4 weeks and was thus extremely short. This state is identical with the inactive state of the system which is characterized by minimum brightness of AM Her at about B = $15\overset{m}{.}3$. In this state the amplitude of the occultation light curve is very small.

The high and active state of AM Her is closely combined with the increase of brightness caused by X-ray heating. In such phases the star can keep a maximum brightness of approximately $B \approx 13\overset{m}{.}0$ with variations of about 0.5 mag on the average (Hudec, Meinunger). In the given long time light curve the high state is characterized by a broad band of observations between $B \approx 13\overset{m}{.}5$ and $B \approx 14\overset{m}{.}4$ beginning at 1982 May 13 after the low state. Also remarkable is the well pronounced decline from the high to the low state.

In order to study the influences of occultation light changes to the overall light curve, in particular at the high state, all observations, were reduced by means of the orbital elements

$$\text{min.}_{\text{hel.}} = 244\ 5180.440 + 0\overset{d}{.}12892774 \ .\ E$$

to one common epoch.

The result is given in Figure 2 where the magnitudes m_B are plotted against the phases. The activity of the orbital period, given by Szkody, Raymond and Capps (1982), can be confirmed evidently at the high state. The mean occultation light curve in B (marked by circles) is in conformity with that given by Szkody (1978). In the low state, however, no periodical variation can be seen in our observations because of their small amplitude and of the long exposure times of the plates used.

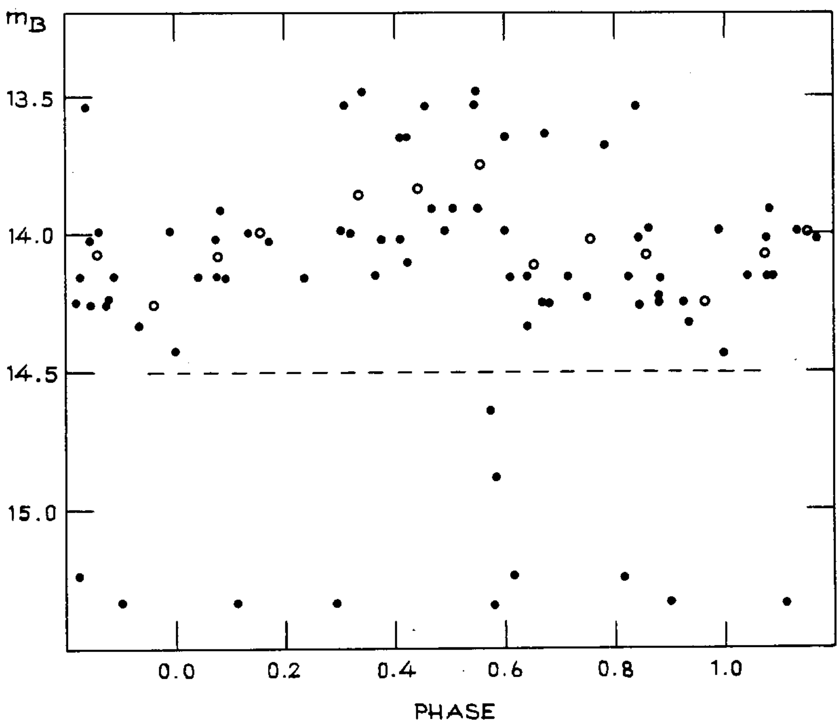

Figure 2

More details about the behaviour of AM Her in the past year will be published in MVS. We thank Mr. Boller, guest student at our observatory, for taking a series of plates at the Schmidt camera.

W. GÖTZ

Akademie der Wissenschaften
der DDR Zentralinstitut für
Astrophysik, Sternwarte
Sonneberg

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THE SERENDIPITOUS DISCOVERY OF TWO NEW BRIGHT VARIABLE STARS IN THE FIELD OF HD 108

In the course of searching for light variations of the O8fe star HD 108, light variations of two nearby stars BD+63°0003 and BD+62°2356 (= HR 9097) were uncovered. Hitherto, neither BD+63°0003 nor BD+62°2356 have been reported as variable stars. On the other hand the original object of the study, HD 108, was found to be constant in brightness within about ~ 0.02 mag over the interval investigated.

The observations were made with the 38-cm reflector at Villanova University Observatory, using a photometer equipped with a refrigerated RCA C31034 Ga-As photomultiplier. A pair of intermediate- and narrow-band interference filters centered near the rest wavelength of the Balmer Hα line was used. The characteristics of the filters have been given by Guinan et al. (1982). The Hα intermediate bandpass filter is centered at λ6585 and has a bandwidth broad enough (FWHM ≈ 280Å) that the included line feature does not significantly contribute to the measure. Thus, the intermediate bandpass measure is essentially that of the continuum centered near λ6585. On two nights additional observations were made with an intermediate band λ4530 interference filter, to determine the colors of the stars.

The observations were obtained on 39 nights from 1979 October through 1982 August, with most of the observations being made during 1979 and 1980. Typically about one hour of observations were made on each night. Although originally BD+63°0003 and BD+62° 2356 were observed as comparison and check stars, respectively and HD 108 was designated as the variable, it became apparent that at least one of the comparison and check stars was variable. In order to check on the variability of these stars, an additional star, BD+62°0005 was added to the observing program.

After several weeks it became apparent that both BD+63°0003 and BD+62°2356 were variable, and that HD 108 was not significantly variable. Thus, to our surprise the originally designated variable star HD 108 was constant in light while the primary comparison and check stars were both variable! The visual magnitudes and spectral types of the above stars are listed in Table I along with their corresponding BD and HD designations.

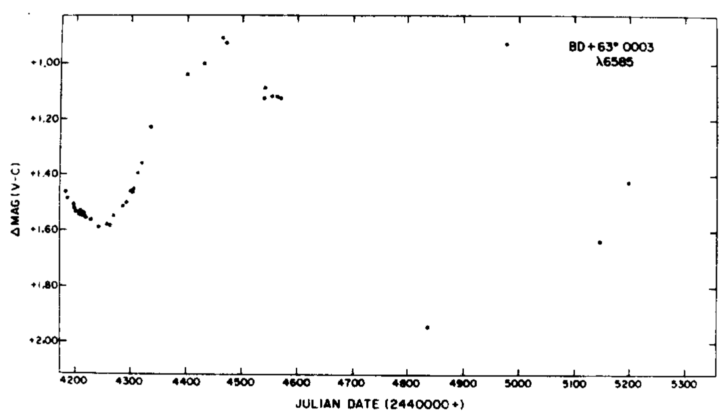

Figure 1

The λ6585 light curve of BD+63°0003. The comparison star is BD+63°0005.

Table I

BD	HD	m_V	Sp. Type
+62°2363	108	+7.4	O8fe
+63°0003	-	+8.3(v)	(M2-M5)
+62°2356	225094	+6.24	B3 Ia
+63°0005	371	+6.42	G1-3 II

The light variability of BD+63°0003 and BD+62°2356 are shown in Figures 1 and 2, respectively, where the differential magnitudes in the λ6585 bandpass were computed with respect to BD+62°0005.

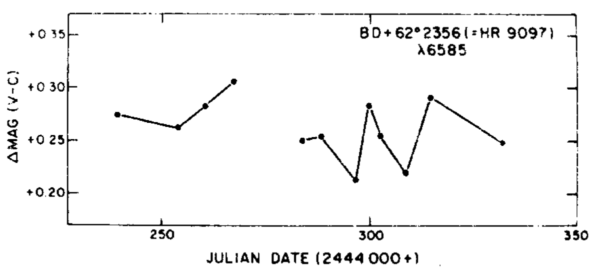

Figure 2
The λ6585 observations of BD+62°2356 plotted against Julian Date. BD+63°0005 served as the comparison star.

The points plotted are nightly normals and typically contain about 8 to 12 individual 20-second integrations. Except for HD 108, the α-indices of these stars did not show any significant abnormalities or variations and are not plotted here. As shown in Figure 1, the light curve of BD+63°0003 is well defined up to JD2444600, with a minimum and maximum occurring near JD2444250 and JD2444460, respectively. Only a few observations were obtained after JD2444600, but the observation made on JD2444835 is over 0.3 mag fainter than the previous minimum. It also appears that light variation is more rapid after JD2444800 than before. From the figure it appears that the light variation of BD+63°0003 is cyclic rather than periodic with a full light amplitude of about ~ 1.0 mag. Although no direct spectral classification of BD+63°0003 appears available, the color index derived from the HD catalogue of CI = $m_{pg} - m_v$ = +1.5 mag indicates that it is a cool star. To verify this, BD+63°0003 was observed on two occasions with an intermediate bandpass λ4530 filter in addition to the Hα filter set, and a (b-r) color index was formed from the intermediate band λ6585 and λ4530 bandpasses. This color index indicates that BD+63°0003 is an M-type star. Since it does not appear to have a large proper motion, BD+63°0003 is most likely a luminous star and not a dM star. From its inferred late spectral type and the cyclic form of its light variation BD+63°0003 appears to be a semi-regular red variable with a tentative classification of SRa (Glasby 1969).

As shown in Figure 2, BD+62°2356 appears to vary irregularly on a timescale of several days with a full amplitude of about 0.1 mag. The light curve is not well defined and does not exclude periodic variations of the order of 2 days or less. BD+62°2356 has been assigned a B3 Ia spectral classification in the Bright Star Catalogue (Hoffleit 1964) and similar light variations have been found for other supergiant B-stars with β Ori (Rigel) being the most well known (Chentsov and Snezhko 1971).

According to de Jager (1980) many if not all luminous supergiants show irregular brightness variations. Systematic studies of the brightness variations of B- and A-type supergiants have been carried out by Sterken (1976) and by Rufener et al. (1978) in which irregular or cyclic light variations were found with time scales of 15 to 20 days and with amplitudes of ~0.02 mag to ~ 0.10 mag. It appears that the light variations found here for BD+62°2356 are similar to those found for other B- and A-type supergiants. More photometric observations and a better spectral classification are needed for this star.

As for HD 108, originally the object that first prompted the study, no light variation greater than ~ 0.02 mag was apparent over the interval studied. Short-term light variations were not investigated here, and are still possible. HD 108 did show substantial Hα emission, however, which appears variable on a time-scale of days. The Hα emission variation will be discussed in a subsequent paper.

EDWARD F. GUINAN

Harvard-Smithsonian
Center for Astrophysics
60 Garden Street
Cambridge, Mass. 02138

GEORGE P. MC COOK and
ANDREW G. WEISENBERGER

Astronomy Dept.
Villanova University
Villanova,
Pennsylvania 19085

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PHOTOELECTRIC OBSERVATIONS OF THE PECULIAR SYSTEM VW Cep

VW Cep (= BD +75°752 (7.2) = HD 197433 (G5) = GC 28804) is a W UMa-type system. Since its discovery (Schilt, 1926) it has been frequently observed because of its peculiar light variations. The orbital light-time effect proves the existence of a third star in the system (Hershey, 1975).

Mauder (1972), Rucinski (1973, 1974) and Giannone and Giannuzzi (1974) made several studies explaining the physical properties of the VW Cep system.

Schmidt and Schrick (1955) gave the following ephemeris:

$$\text{Min I} = \text{J.D. } 2424658.759 + 0\overset{d}{.}27831993 \cdot E.$$

Brown and Pinnington (1969) studied VW Cep as a typical system of the W UMa-type variables. Szczepanowska (1959) made photoelectric observations of this star. She found that the variations of the O-C values were identical for the primary and secondary minima, and the course of the O-C diagram suggested a periodicity in the period variation.

Szafraniec (1960) constructed a number of light curves for 3 eclipsing binaries, among them was the VW Cep system. Todoran and Pop (1972) investigated several minima of this star and found the following periodic elements:

$$\text{Min I} = \text{HJD } 2433483.4257 + 0\overset{d}{.}27831758 \cdot E + 0\overset{d}{.}050 \cos[0\overset{\circ}{.}0048(E-4700)]$$

Rovithis and Rovithis-Livaniou(1980) show that the period decrease which started in 1960 is still present. Hershey (1975) discussed the period changes, determined the absolute parallax and the astrometric orbit of VW Cep and proved the presence of a third body in the system.

Kreiner and Winiarski (1981) presented photoelectric observations of this star in three successive nights and reported short time-scale variations in the light curve. Mahdy and Soliman (1982) observed new light curves of VW Cep using the ephemeris of Cristescu (1978):

$$\text{Min I} = \text{J.D. } 2443448.2663 + 0\overset{d}{.}2783176 \cdot E.$$

These elements are also used in the present work. Mahdy and Soliman concluded that outside the eclipse, the VW Cep system is somewhat brighter, when the larger and hotter component is advancing while the smaller and cooler component is receding, than in the case of converse position.

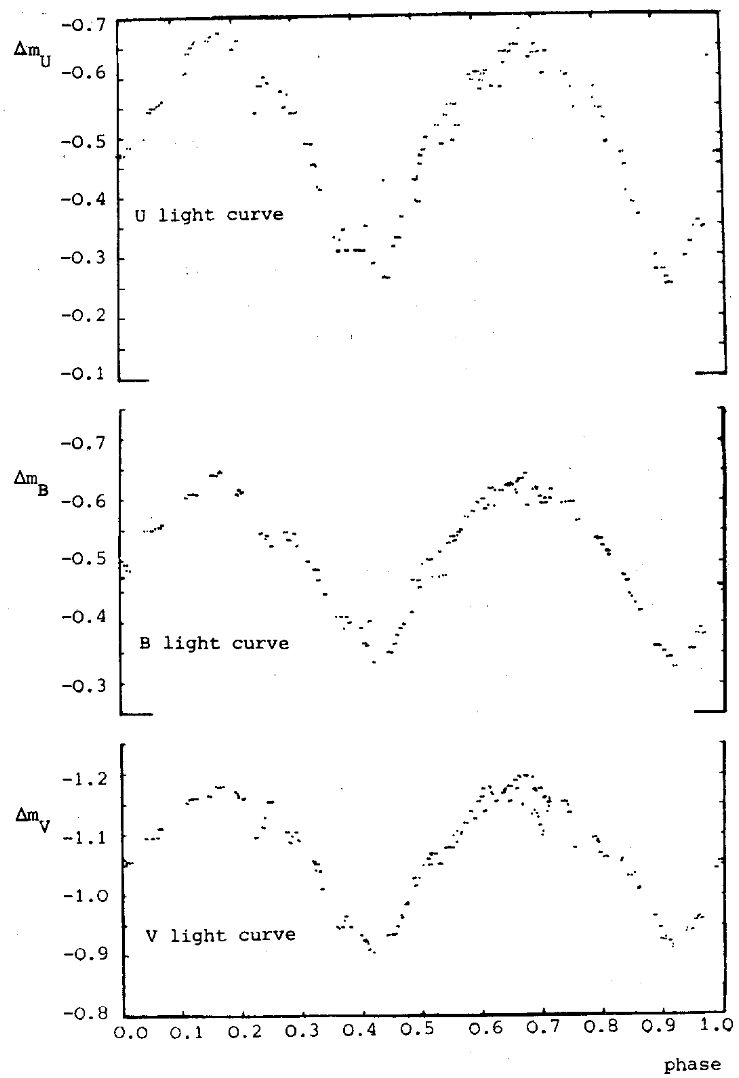

Figure 1

The observations of the present work were carried out at Kottamia Observatory using the 74" reflector on two successive clear nights, 7/8 and 8/9 of July, 1982. The instruments were described in Mahdy and Soliman's (1982) paper. BD +75°877 was used as comparison star.

The light curves in three colours are seen in Figure 1. Four primary and four secondary eclipses were observed. The observations will be published in Helwan Observatory Bulletin.

The observed light curves are somewhat scattered and this is similar to that observed by Mahdy and Soliman (1982). In order to describe the variability of the VW Cep system more observations are needed. Further photometric observations of this system are planned.

A.S. ASAAD, S.M. NAWAR,
M.A. SOLIMAN and N.S. AWADALLA
Helwan Observatory
Egypt

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MULTIPLE COMPONENTS IN THE Hα PROFILE OF THE LUMINOUS SUPERGIANT HD 217476

The G-type supergiant HD 217476 (HR 8752) is one of the most luminous stars in our Galaxy, and curious behaviour has been reported at ultraviolet, optical and radio wavelengths (Sargent, 1965; Smolinski, 1971; Smolinski, Feldman and Higgs, 1977; Stickland and Harmer, 1978; Smolinski, Climenhaga, Funakawa and Fletcher, 1979; Lambert, Hinkle and Hall, 1981). Although this star has been extensively observed for more than a decade, the complex and variable nature of the spectrum is not well understood.

During 1982 this high luminosity supergiant showed multiple components in Hα and in the metallic lines. Some of these components were not observed in any of our previous spectra of this star obtained at the Dominion Astrophysical Observatory over a 13-year period since 1969. Only a brief description of these interesting features as observed during 1982 will be given in this paper, but a full discussion of their behaviour based on our 13 years of observations will be given in a separate paper which is presently in preparation.

In Figure 1 are shown the profiles in the spectral region containing Hα and the TiII line at λ6559.6 for two spectra taken on May 4, 1982 and on September 27, 1982. The radial velocity information for the various components of these lines is given in Table I.

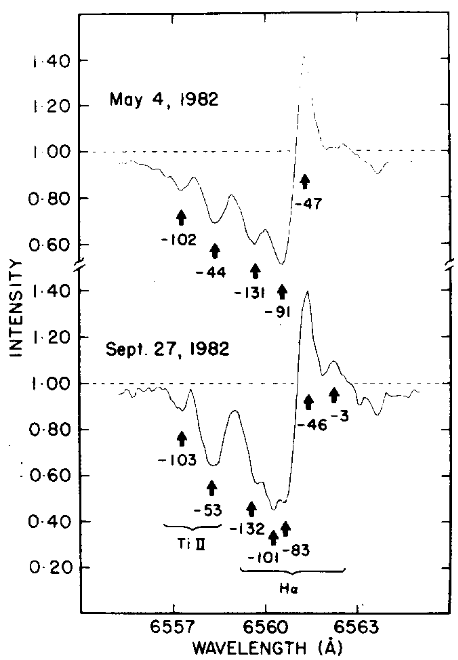

Figure 1 : The Hα region for HD217476 with dispersion 10 A/mm. The horizontal broken lines show the continuum levels of the spectra. The numbers give the radial velocities of the components. Note that the emission component with velocity -3 km/s appears in Hα on September 27.

Table I

Radial Velocities for HD217476 in the Hα Region

Date	Plate No.	Radial Velocity (km/s)							
		TiII		Hα					
		A_2	A_s	A_1	A_2	A_3	A_2+A_3	E_1	E_2
May 4, 1982	14167	-102	-44	-131	--	--	-91	-47	--
Sept. 27, 1982	14402	-103	-53	-132	-101	-83	-96*	-46	-3

Note *Best fit for the A_2 and A_3 components together.

The components of particular interest are as follows.

(1) There is a red emission component (E_2) in Hα with velocity ≃ -3 km/s in addition to the red emission (E_1) which is always present with velocity ≃ -46 km/s. This -46 km/s emission component may be formed in the HII region surrounding the high luminosity star. The -3 km/s component varies in intensity and its origin is uncertain, but it may be associated with a binary nature and/or a pulsation of the star.

(2) An absorption component (A_1) appears in Hα with velocity ≃ -131 km/s where blue emission occurred in previous spectra in 1979.

(3) Three absorption components (A_1, A_2, A_3) appear in the Hα profile on September 27th with velocities ≃ -132 km/s (the component referred to in (2)), -101 km/s and -83 km/s, while only two components (A_1 and a blend of A_2 and A_3) are seen in the May 4th profile with velocities -131 km/s and -91 km/s. The shape of the absorption part of the Hα profile is similar to that observed by Luck and Lambert (1981) in the long period Cepheids χ Cyg and SV Vul.

(4) The TiII line at λ6559.6 shows two components on May 4th, one (A_2) with velocity -102 km/s is presumably formed in the expanding envelope, and the other (A_s), with velocity ≃ -44 km/s is the stellar component. On September 27th, the pattern is similar, but the stellar component now has a velocity ≃ -53 km/s. There is a possibility that the -102 km/s component is blended with a telluric H_2O line. However, most of the absorption lines, and in particular the neutral Fe I lines, show this same pattern.

More details and interpretation of the behaviour of this circumstellar envelope will be given in the paper which is presently in preparation.

J. SMOLINSKI*, J.L. CLIMENHAGA and H. FUNAKAWA
Department of Physics, University of Victoria,
Victoria, B.C.,
Canada

J.M. FLETCHER
Dominion Astrophysical Observatory,
Victoria, B.C.,
Canada

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* On leave from N. Copernicus Astronomical Center, Toruń, Poland

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PHOTOELECTRIC OBSERVATIONS OF W UMa (BD+56°1400)

In I.B.V.S. No. 2102, we presented two MinI and one MinII values obtained in January 1982 and adopted the first J.D. Hel MinI as T_o. We also recalculated the (O-C) values for the last 79 years from the available visual photographic, photoelectric MinI and II observations. We demonstrated that for the last few years (4-5) the (O-C) values have been steadily decreasing. In the present observing season we resume to monitor the star (BD+56°1400) relative to the comparison (BD+56°1399) with the 48 cm Cassegrain telescope and unrefrigerated EMI 9781 A detector. Here we present the first observations of this observing season and confirm that the (O-C) is still decreasing:

J.D. Hel MinI	: 2445266 . 6163	O-C = $-0^{d}.002$
J.D. Hel MinI	: 2445267 . 6176	O-C = -0.002
J.D. Hel MinII	: 2445276 . 4584	O-C = -0.002

These minima were obtained only in B colour because of the higher accuracy wanted to be obtained in the determination of the minimum times. We also noticed within the MinII obtained on November 2, 1982 (J.D. 2445276.4584) that there were clear fluctuations in the observed brightness as already suggested by many authors. Meanwhile we attempt to bring out these brightness fluctuations within the MinII by continuous monitoring of the variable star.

MELEK HAMZAOĞLU
ESAT HAMZAOĞLU
Ege University Observatory
P.K.21 Izmir-Turkey

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FLARE STARS IN ORION

On purpose to study flare stars statistically we have continued the photographic observations in the Orion Nebula region with the 70/100/210-cm Meniscus-type telescope of the Abastumani Observatory. 31 new flare stars (Table I) and 18 repeated flares of the known flare stars (Table II) were found around the Trapeze system.

Table I

No	RA(1900)			D(1900)		m_{pg}	Δm_{pg}	Date
101	5^h	31^m	55^s	-6°	$00'.5$	$16^m.2$	$1^m.1$	11.10.1981
102	5	31	32	-7	19.8	19.3	3.4	11.10.1981
103	5	23	44	-6	08.1	16.7	1.2	11.10.1981
104	5	28	47	-6	52.8	15.4	1.5	11.10.1981
105	5	33	14	-6	56.7	15.3	1.0	22.10.1981
106	5	29	41	-4	06.1	16.6	1.0	26.10.1981
107	5	29	52	-7	40.2	16.4	1.2	27.10.1981
108	5	29	08	-5	40.4	16.0	2.3	28.10.1981
109	5	32	40	-6	59.7	18.9	3.0	28.10.1981
110	5	31	43	-5	47.8	17.3	1.7	28.10.1981
111	5	28	39	-6	28.4	18.6	2.2	29.10.1981
112	5	25	44	-5	30.3	15.5	1.5	30.10.1981
113	5	25	40	-4	42.2	20.4	5.0	30.10.1981
114	5	31	09	-4	54.8	17.5	2.3	31.10.1981
115	5	28	37	-6	08.3	16.7	1.6	06.11.1981
116	5	30	54	-6	49.1	19.6	4.0	07.11.1981
117	5	27	06	-3	44.8	17.4	1.8	25.11.1981
118	5	32	18	-3	35.1	15.6	1.6	26.11.1981
119	5	32	02	-6	23.4	18.6	4.5	27.01.1982
120	5	31	44	-6	18.1	19.0	3.8	27.01.1982
121	5	28	27	-7	06.1	16.5	1.7	27.01.1982
122	5	32	30	-6	07.0	15.8	1.5	27.01.1982
123	5	25	46	-4	58.4	19.8	3.6	27.01.1982
124	5	27	16	-4	47.5	>21.0	>4.8	29.01.1982
125	5	30	07	-6	46.2	17.7	1.1	29.01.1982
126	5	30	24	-6	09.1	16.9	1.8	18.02.1982
127	5	28	18	-5	59.2	19.2	2.9	24.02.1982
128	5	38	42	-6	17.3	15.9	1.5	24.02.1982
129	5	28	58	-5	23.8	16.5	1.0	24.02.1982
130	5	28	52	-4	43.5	17.3	1.4	25.02.1982
131	5	30	52	-5	17.1	16.6	1.5	25.02.1982

Table II

No	RA(1900)	D(1900)	m_{pg}	Δm_{pg}	Date	Ident.
1	5^h 28^m 47^s	-4^o $59\overset{'}{.}9$	$18\overset{m}{.}3$	$3\overset{m}{.}8$	26.09.1981	Ab 46
2	5 30 14	-5 10.7	16.1	2.2	26.09.1981	T 223
3	5 30 10	-6 34.1	16.0	1.2	04.10.1981	T 154
4	5 28 47	-6 52.8	15.4	1.3	24.10.1981	Ab 104
5	5 31 34	-6 30.2	16.9	1.4	26.10.1981	Ab 17
6	5 32 50	-5 33.1	18.7	2.5	28.10.1981	Ab 62
7	5 28 30	-5 58.6	19.1	3.3	28.10.1981	Ab 81
8	5 29 52	-7 40.2	16.4	1.1	29.10.1981	Ab 107
9	5 30 10	-6 34.1	16.0	2.6	30.10.1981	T 154
10	5 31 55	-6 00.5	16.2	1.2	30.10.1981	Ab 101
11	5 31 13	-6 29.2	16.0	1.0	27.01.1982	T 83
12	5 29 39	-6 26.8	18.2	1.9	29.01.1982	T 37
13	5 29 50	-5 06.1	16.7	1.8	12.02.1982	T 40
14	5 30 10	-6 09.3	16.9	3.8	22.02.1982	T 153
15	5 29 33	-5 36.5	16.3	1.4	23.02.1982	B 7*
16	5 30 10	-6 34.1	16.0	1.4	24.02.1982	T 154
17	5 31 54	-5 07.8	17.9	1.7	24.02.1982	T 100
18	5 30 56	-5 20.3	16.5	1.6	24.02.1982	T 72

*see Melikian (1981)

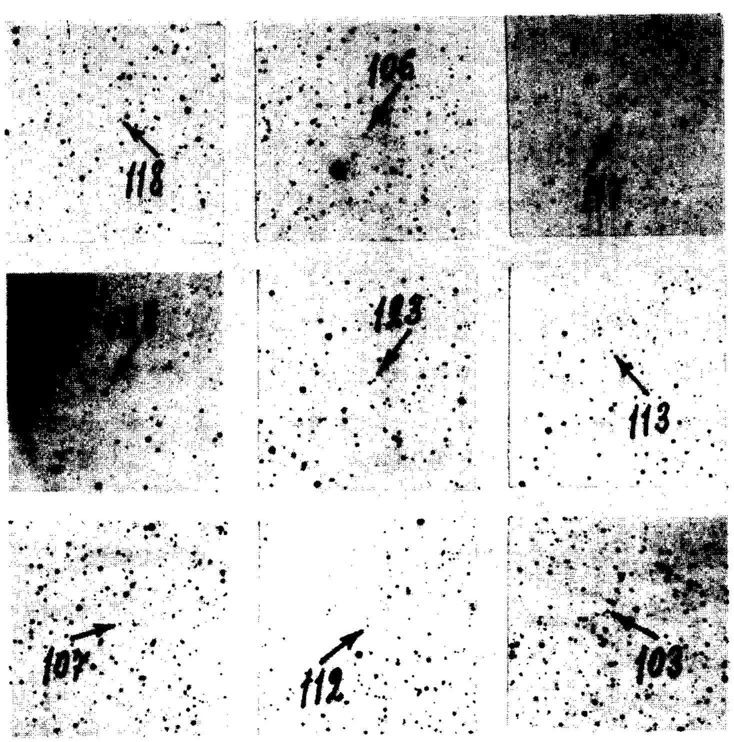

Figure 1

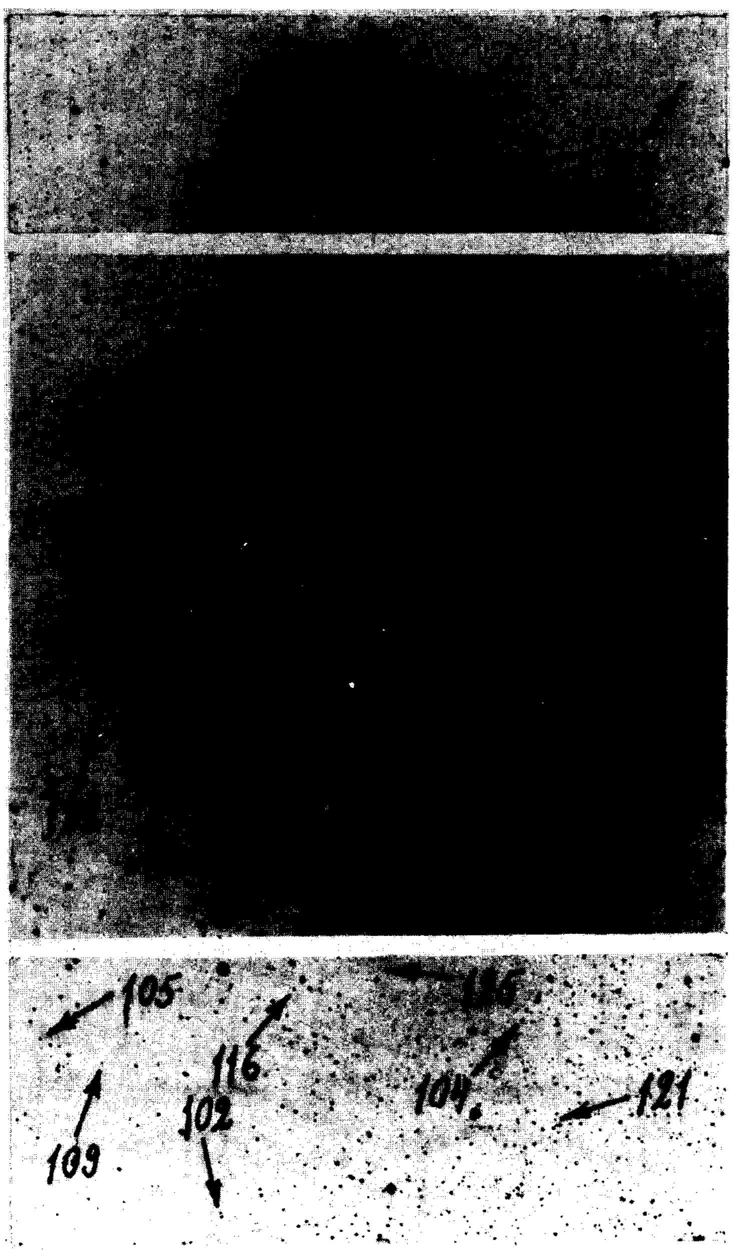

Figure 2

We have continued "Ab" numeration of the Orion's flare stars as we did it before (Natsvlishvili, 1982).

Outbursts of the stars Ab 119 and T 153 are slow ones and their light curves have double-maximum shape.

Finding charts are given.

R.SH. NATSVLISHVILI
Abastumani Observatory,
Georgia, USSR

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VY AQUARII

This recurrent nova (1907, 1962) appears to be in outburst on chart 225 of the Papadopoulos True Visual Magnitude Star Atlas. The image is elongated with the same shape and direction as stellar images and its position as measured from the paper chart is coincident (three arcseconds distant, approximately the error of measurement) with the precise position

RA (1950) $21^h\ 09^m\ 28^s.33$

DEC (1950) $-09^\circ\ 01'\ 56''.3$

ACCURACY $\pm\ 0''.3$

measured by A.S.-Czerny (RGO) from a glass copy of the PSS.

The plate (chart 225) was exposed on 1973 July 31 at 21^h34^m UT and the image is of mag +9.7 in comparison with a published photometry of nearby stars, Vogt (1980). This is about three magnitudes above the chart limit. The original plate has not yet been checked.

Previous outbursts have occurred in August 1907 and August 1962, an interval of 55.0 years. Should the 1973 outburst be confirmed (11.0 years after the 1962 outburst) a recurrence period of 11 years is suggested with the next outburst possibly in 1984.

A check of plates taken in 1973 would be valuable, and if confirmed, a check of other plates may produce further outbursts.

The following references contain identification charts for VY Aqr.

The "outburst" was found whilst preparing charts for the TA/BAA Nova Search Programme and the writer wishes to thank A.S.-Czerny and the RGO for the use of facilities.

ROBERT H. McNAUGHT

Earth Satellite Research Unit
Royal Greenwich Observatory
Herstmonceux Castle
Herstmonceux
Nr. Hailsham
East Sussex
United Kingdom.

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BP OCTANTIS - A VARIABLE Am STAR

Bessell and Eggen (1972) reported short period variations of the Am star BP Oct (= HR 5491 = HD 129723 = DM -87°235); they indicated a period of about 0.08 day and a visual light range of 0.02 to 0.04 mag. Breger et al.(1972) observed BP Oct on one night and found no evidence of short period variability; from the spectrum they concluded that it was a classical Am star situated near the main sequence. There was no indication of spectral variation. Eggen (1973) also found that BP Oct did not vary, and suggested that he may have observed it during a low amplitude phase of the star.

We observed BP Oct in the Johnson V band on 13 nights during 1982 using the 0.41 m telescope at the Monash Observatory and the 0.41 m telescope at Siding Spring Observatory. Data taken on single nights confirm that no short period variations exist. Figure 1 illustrates V band measurements

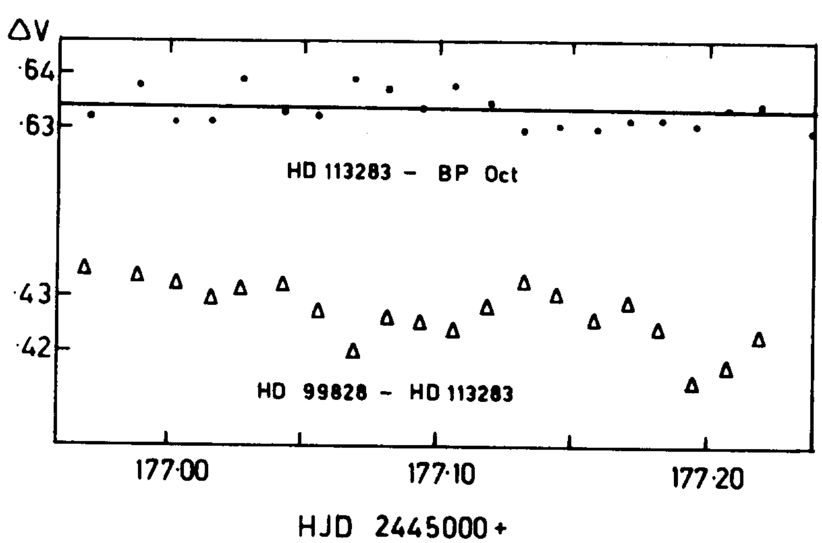

Figure 1

taken on HJD 2445177 where the r.m.s. variations were small. Fourier analysis of 95 measurements taken between HJD 2445068 and 2445177 also indicates that no short period variations (< 0.3 day) occur for BP Oct. However there is strong evidence for longer period variations (∿ 3 day). Table I gives the average magnitude difference for each night. HD 113282 (= DM -86°283) was chosen as the primary standard, differences between HD 113283 and HD 106461 (= DM -87°196) and HD 99828 (= DM -88°109) are also given for some nights. Because all stars were observed through similar air masses that remained essentially constant, differential extinction

Table I

No.	HJD (+244500)	HD 113282 - BP Oct	HD 113283 -HD 106461	HD 113283 -HD 99828	No. meas.	σ	σ_{mean}	Place
1	68.113	.612	.467		15	.009	.002	M
2	112.052	.635	.463		5	.010	.004	S
3	112.929	.624	.467		11	.011	.004	S
4	113.939	.622	.464		7	.008	.003	S
5	114.118	.628	.461		10	.012	.004	S
6	114.994	.637	.466		7	.010	.004	S
7	152.080	.620	.491		20	.006	.001	M
8	177.096	.634		-0.428	20	.005	.001	M
9	203.912	.618	.472	-0.428	5	.010	.004	M
10	225.169	.624			5	.003	.003	M
11	233.144	.626			5	.002	.001	M
12	234.135	.632			5	.006	.003	M
13	235.208	.624	.495		3	.010	.006	M
14	236.129	.621	.480		3	.004	.003	M

Notes to Table I Column 1 gives the number of the data point as it appears in figure 2. Column 2 lists the Heliocentric Julian Date while the next 3 columns give average magnitude differences. Column 6 lists the number of measurements from which the average was derived. Note that each measurement at the telescope is the average of about 100 seconds on the star. Columns 7 and 8 give the r.m.s. error in a single measurement and the r.m.s. error of the mean. 'S' in column 9 denotes measurements made at Siding Spring, 'M' denotes measurements at Monash.

corrections were small and colour corrections to the extinction were negligible.

Magnitude differences between HD 113283 and HD 106461 appeared to vary for measurements taken at the Monash Observatory. We later confirmed both photometrically and visually that a 10½ mag. star was sometimes being included in the aperture during measurement of HD 106461. This did not occur for the Siding Spring measurements as a smaller aperture was used. Colour corrections between measurements taken at Siding Spring Observatory and Monash Observatory were found to be negligible.

Figure 2 is a phase plot for data given in Table I. This best fit for

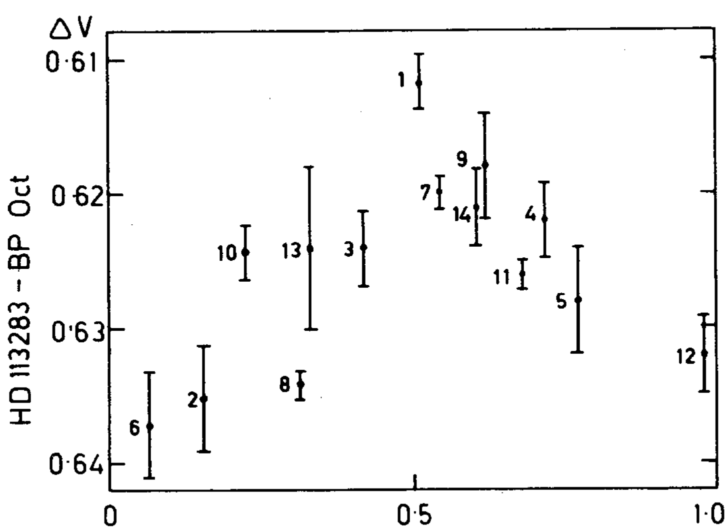

Figure 2

P = 3.225 day was obtained via a trial and error method programmed into a mini-computer. Intermediate and narrow band indices from several sources (Bessell and Eggen, 1972; Lindemann and Hauck, 1973; Grønbech and Olsen, 1976 and Eggen, 1979) are consistent with one another and indicate $M_V = 2.9 \pm 0.3$, $\log g = 4.20 \pm 0.08$ and $T_e = 7480\,K \pm 100\,K$. Using our measured B-V of 0.29 for BP Oct and the (B-V),T_e calibration of Böhm-Vitense (1981) we calculate $T_e = 7480 \pm 200$ K in agreement with T_e determined from the c_1,(b-y) calibrations of Breger (1974).

Considering the position of BP Oct in the HR diagram, our reported 3 day variations are not consistent with radial pulsation. Binarity is not indicated and rotational phenomena can be discounted on the basis of slow rotation of Am stars. We tentatively suggest that, for some Am stars, the diffusion mechanism described by Baglin (1975) may lengthen rather than stop pulsation. Non-radial g-modes of pulsation responsible for longer period variations in ZZ Ceti stars are discussed by Unno et al. (1979), however, they do not give 1.5 $M_\odot$ models with which to compare our observations.

D.W. COATES, S. DIETERS, J.L. INNIS, T.T. MOON and K. THOMPSON
Department of Physics, Monash University,
Clayton, Victoria 3168, Australia.

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FOUR COLOUR PHOTOMETRY OF THE BRIGHT PRE-MAIN SEQUENCE SHELL STAR
V856 Sco (HR 5999)

The semi-regular variable V856 Sco (=HR 5999 = HD 144668) has recently aroused much interest as a bright probable pre-main sequence star (see, e.g. Thé and Tjin A Djie, 1978; Tjin A Djie et al., 1982). Its brightness undergoes irregular variations of a few tenths of a magnitude, interrupted on time scales of months by deep minima (~1.5 mag deep) lasting a few days or weeks. V856 Sco forms a visual binary system with HR 6000, a late B star with remarkable spectral peculiarities (Castelli et al., 1981). HR 6000 seems to be constant in light (Thé and Tjin A Djie, 1978) and radial velocity (Andersen and Nordström, unpublished).

V856 Sco was monitored in the Strömgren uvby system from February 2 through 25, 1981, using the Danish 50 cm reflecting telescope on La Silla, Chile, and the 4-channel photometer and pulse-counting equipment described by Grønbech et al. (1976). HR 6000 was used as the comparison star and appears constant

Table I: Magnitude differences V856 Sco - HR6000

H J D	y	b-y	m1	c1	b	v	u
2444638.86657	0.112	0.211	0.049	0.494	0.322	0.583	1.336
2444639.87099	0.122	0.216	0.049	0.527	0.338	0.603	1.395
2444639.87343	0.118	0.216	0.051	0.523	0.334	0.602	1.392
2444640.84274	0.239	0.229	0.048	0.484	0.469	0.746	1.507
2444640.84704	0.242	0.231	0.045	0.486	0.473	0.750	1.513
2444640.87215	0.247	0.230	0.047	0.484	0.476	0.753	1.514
2444641.87063	0.254	0.234	0.044	0.505	0.488	0.767	1.551
2444642.89446	0.419	0.242	0.058	0.503	0.660	0.960	1.764
2444643.87416	0.296	0.238	0.046	0.483	0.534	0.819	1.586
2444644.86374	0.198	0.222	0.054	0.489	0.420	0.696	1.461
2444645.88509	0.157	0.218	0.047	0.496	0.376	0.641	1.402
2444648.85685	0.129	0.220	0.046	0.507	0.349	0.616	1.389
2444649.89295	0.130	0.209	0.059	0.485	0.340	0.608	1.361
2444650.89684	0.132	0.211	0.058	0.487	0.342	0.611	1.366
2444651.88671	0.119	0.211	0.056	0.501	0.330	0.597	1.364
2444653.84944	0.114	0.211	0.043	0.495	0.325	0.578	1.327
2444654.84873	0.134	0.212	0.054	0.512	0.346	0.612	1.390
2444655.88873	0.122	0.214	0.051	0.506	0.337	0.602	1.374
2444656.90070	0.142	0.210	0.053	0.540	0.352	0.615	1.419
2444658.88793	0.240	0.214	0.055	0.517	0.454	0.723	1.509
2444659.89806	0.291	0.232	0.053	0.530	0.524	0.809	1.624

also during our observations, extinction coefficients being available from other programme stars observed the same nights. During the same period, coudé spectra were obtained with the ESO 1.5 m telescope to monitor the suspected radial velocity variations of V856 Sco. The spectroscopic results will be published later.

Table I lists the observed magnitude differences in the sense V856 Sco - HR 6000 in the instrumental system. For transformation to the standard uvby system, use the coefficients given by Clausen et al. (1976) and the standard uvby indices for HR 6000 by Grønbech and Olsen (1976) - (note that HR 5999 and HR 6000 have been interchanged in this catalogue).

During the period of our observations, the brightness of V856 Sco varied through a range of 0.3 mag, but no deep minimum occurred. We plan no further photometry of this star at present.

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J. ANDERSEN, J.V. CLAUSEN
B. NORDSTRÖM

Copenhagen University Observatory
Brorfelde, DK-4340 Tølløse
Denmark

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HD 154973, A NEW SHORT PERIOD VARIABLE STAR

It is estimated that about a third of the stars in the instability strip of the HR diagram are pulsators (Breger, 1979). Keeping this in mind, whenever a known variable star is going to be observed, systematically an additional comparison star is chosen with the spectral characteristics of a Delta Scuti star.

In the present case, when HR 6391 was observed, three comparison stars were chosen according to the criteria stated by Warman et al. (1974) or Baglin et al. (1973), namely that they must be of approximately the same magnitude and spectral type of the problem star and that they should be closer than two degrees to it. It is expected that at least two of them should behave alike and probably the third could be variable. The characteristics of the observed stars are shown in Table I.

Table I

STAR	M_V	Sp. T.	α (1982)	δ (1982)	Type
V HR 6391 (=V620 Her)	6.8	A8V	$17^h\ 10^m\ 18^s$	+24° 16'	Variable
C_1 HD 155543	7.0	F2	$17^h\ 03^m\ 35^s$	+24° 17'	Standard
C_2 HD 155104	6.8	AO	$17^h\ 07^m\ 53^s$	+24° 31'	Standard
C_3 HD 154973 (=BD+24°3124)	8.2	A2	$17^h\ 07^m\ 05^s$	+24° 37'	New variable

The observations were made with the 60-inch reflector telescope at the Observatorio Nacional, San Pedro Mártir, México, during the nights of May 20, 21, 22 and 23, 1982. A dry-ice cooled 1P21 photocell was used with the Johnson's V filter.

Each observation is the result of at least four ten-second integrations of every star and two ten-second integrations of the sky. The sequence C_1 sky V sky C_2 sky C_3 sky was followed uninterruptedly. The photometric points reported in Figure 1 are the magnitude differences between HD 154973 and the average of the standard stars C_1 and C_2 interpolated to the time of the observation. The average of the points was then subtracted to establish the zero baseline. Our data points are accurate to 0.005 mag; the average time span between successive points is 0.008 day and the accuracy in time is of 0.001 day.

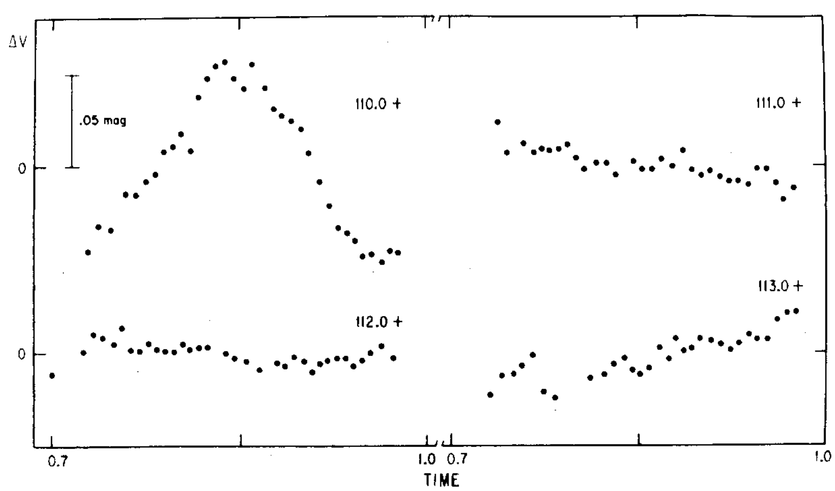

Figure 1.: Photoelectric photometry of HD 154973. Ordinate is in magnitudes; to convert time shown to HJD add 2445000.0.

From Figure 1 it can be seen that the amplitude of variation changes from night to night from 0.10 mag on May 20, 1972 to basically a constant star on May 22. On one night (May 20) the calculated standard deviation of the difference in magnitudes of the comparison stars is about a third that of the magnitude of the variable star while, on May 22 is about a half.

This same behavior has been observed in HR 5005. This star was first reported by Danziger and Dickens (1967) but later, Valtier (1971) failed to detect any light variability on an observing run of almost five hours but the variability of the star was later confirmed by Jerzykiewicz (1975), and Peña et al. (1982). This is a behavior one could expect if more than one pulsation mode is present since at times destructive interference may occur.

By now, nothing can be said about the period of this star, but it is of the order of hours. Due to the fact that it has a spectral type A2, low amplitude and short period of variation, it could be said that it is a probable δ Scuti star. More detailed observations are encouraged since they are necessary to determine its periodic content.

The observations reported in this paper have been submitted to the IAU Archives of Unpublished Observations of Variable Stars (Breger, at the University of Texas-Austin).

We would like to thank the staff of the Observatorio Astronómico Nacional for the assistance provided. One of us, M.A.H., would also like to acknowledge the University of Mexico for the observational time provided.

MARCO A. HOBART
Facultad de Física
Universidad Veracruzana
Apartado Postal 270
Jalapa, Ver., México

JOSE H. PEÑA and
ROSARIO PENICHE
Universidad Nacional Autónoma de México
Apdo. Postal 70-264
04510 México, D. F.

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PHOTOGRAPHIC PHOTOMETRY OF V 1515 CYGNI

In the course of the programme to discover and investigate flare stars and other nonstable objects in the γ Cygni region, a great number of monitoring photographic plates have been obtained in u-, b- and v-bands in the period 1976-1982. The observations were made with the 20 in./28 in. Schmidt-telescope of National Astronomical Observatory of the Bulgarian Academy of Sciences at Rozhen and with the 40 in./52 in. Schmidt-telescope of Byurakan Astrophysical Observatory, of the Armenian Academy of Sciences, U.S.S.R.

On 120 plates the magnitudes of V 1515 Cygni - a member of the very interesting group of FU Orionis stars, the fuors - could be also measured.

The following telescopes and plate-filter combinations were used:

40"/52" Schmidt-telescope	for u- ORWO ZU2+UG1 or ZU21+UG1
	for b- Kodak IIAO+GG385 or ZU21+GG385
	for v- Kodak ID+GG495
20"/28" Schmidt-telescope	for u- ORWO ZU21+UG2
	for b- ORWO ZU21+GG13
	for v- RPI+GG11

The measurements were carried out with an Ascorecord type Ascoris (Carl Zeiss, Jena) photometer. To our photographic photometry we used 11 stars from UBV-photoelectric standard stars in Cyg OB2 association from the catalogue of Kazanassmas et al. (1981) and 3 photographic standard stars from the work of Reddish et al. (1966). The iris readings for V 1515 Cygni were corrected for inhomogeneous background according to the method of Argue (1960). The mean error of an individual measurement is $0^m.12$.

Table I gives our estimates of magnitudes of V 1515 Cygni. We have to note that the star sometimes changes its brightness with an amplitude of 0.5 mag during one hour.

J.D. 244....	v	b	u	J.D. 244....	v	b	u
3019.408		13.58		4570.205			16.20
3020.442		13.83		4570.251			16.14
3021.364		13.70		4703.584		14.31	
3399.183			15.52	4704.541		14.15	
3399.331			15.54	4708.559			15.52
3399.351			15.26	4726.534			15.70
3400.353		13.49		4728.522			16.19
3400.361		13.68		4735.503			15.32
3400.369	12.10			4756.551			15.44
3400.385	12.10			4759.444			15.40
4143.416		13.71		4761.551			15.53
4187.209			14.64	4764.542	12.34		
4187.250			14.56	4765.472			15.98
4187.337			14.75	4785.386			15.98
4188.196			14.46	4785.428			15.80
4217.190			14.50	4787.463			15.90
4407.526			15.14	4788.520			15.59
4408.476			15.31	4789.436			15.78
4409.452			15.35	4789.539		14.30	
4409.578			15.21	4817.420			15.83
4430.565			15.02	4818.395			15.18
4434.409			15.20	4818.549		14.23	
4434.509			15.46	4819.372			15.12
4435.396			15.58	4820.358			15.28
4435.445			15.08	4822.521			15.77
4435.500			15.40	4825.435			15.50
4435.560			15.59	4826.457			15.92
4436.455			15.18	4827.440			15.33
4437.365			15.01	4838.404			15.78
4438.539			15.12	4844.287			15.30
4459.411			15.80	4846.324			15.55
4463.365			16.01	4846.455			15.76
4464.397			15.09	4868.376			15.15
4464.444			15.40	4869.260			15.60
4466.380			15.82	4869.325			15.52
4466.432			15.60	4869.372			15.56
4466.530			15.87	4870.291			15.30
4468.476			15.61	4870.338			15.40
4483.365			15.69	4870.385			15.48
4488.361			15.76	4870.478			15.71
4489.302			15.98	4872.272			15.01
4492.236			15.90	4872.381			15.52
4492.264			15.93	4874.349			15.17
4492.292		14.47		4877.292			15.73
4492.304		14.63		4898.353			15.03
4493.309			15.92	4901.240			15.62
4493.335		14.50		4907.217			15.63
4493.348	12.79			4933.192			15.84
4494.264	12.64			5210.510			15.19
4494.278	12.76			5218.258			15.03
4494.294	12.77			5219.274			15.09
4495.270			16.07	5220.259			15.08
4496.342			16.11	5220.298		13.93	
4517.433			16.26	5228.298			14.96
4520.273			16.03	5228.320		14.02	
4521.360			16.26	5229.303			15.50
4524.292			15.78	5230.368			15.45
4542.276			15.99	5231.278			15.14
4543.291			16.34	5231.391		14.37	
4549.250			15.88	5232.408		14.40	

Figure 1 presents the light curve in u-, b- and v-bands in the period 1976-1982 according to our photographic photometry (denoted with dots) supplemented with photoelectric observations of Stone (Herbig, 1977), Landolt (1977), Kolotilov (1979), Kolotilov and Petrov (1981) (denoted with "x").

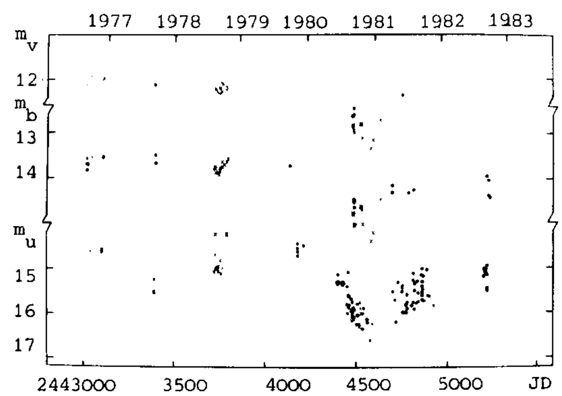

Figure 1

Kolotilov and Petrov (1981) noticed a brightness decrease in V 1515 Cygni. Recent observations of Kolotilov (private communication) and our ones showed that the star decreased its brightness with an amplitude of 1.8 mag in u-band from the beginning of 1980 to the beginning of 1981. Since that time its brightness has been increasing, although till the autumn 1982 V 1515 Cygni did not reach the magnitude it had at the end of 1979.

KATYA P. TSVETKOVA

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

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SHORT TIME SCALE LIGHT VARIATIONS OF 21 COMAE

Differential photometric measurements of 21 Com were made in the B band with the 60 cm Cassegrain telescope of the Astronomical Institute of Wrocław University in Białków. On six nights more than 450 individual measurements were obtained. The observations cover about 30 hours, which is comparable to the whole observational time of the so far published photometric measurements of 21 Com with time resolution of minutes. As comparison stars 17 Com B and 18 Com were used.

The period of 32 minutes reported by Bahner and Mavridis (1957), Percy (1973), (1975) and by Weiss et al. (1980) has not been confirmed. This is in accord with a recent result of Jarzębowski (1982).

We performed frequency analysis of our data in the range from 6 to 420 c/d. Two highest peaks in the Fourier transform occurred at ν_1=244.24 c/d-$P_1 \cong 5.9$ min and ν_2=267.11 c/d-$P_2 \cong 5.4$ min. After prewhitening the data with one of the above mentioned frequencies the amplitude of the other did not change. Both these frequencies are similar to those found recently by Kurtz (1982) in five other cool Ap stars. The amplitudes of light variations corresponding to the frequencies we found are practically the same and equal to 0.00147 ± 0.00034 mag. Because of the low signal to noise ratio the reality of these frequencies requires independent confirmation.

B. MUSIELOK

Astronomical Institute
of the Wrocław University
51-622 Wrocław, ul. Kopernika 11
Poland

T. KOZAR

51-657 Wrocław, ul. Kazimierska 17/32
Poland

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REFINEMENT OF THE FREQUENCIES OF PULSATION OF DELTA SCUTI

New photoelectric observations of δ Scuti taken on 1982 July 14 and 17 using the 0.41 m telescope of the Monash observatory are presented in Figures 1 and 2, ε Scuti (= HR 7032)was used as a comparison star, the differential magnitudes being corrected for atmospheric extinction.

Fitch (1976) compared a solution to the light curve of δ Scuti derived from Fourier analysis of Fath's data (1935, 1937, 1940) with one obtained from Fourier analysis of his own data obtained in 1972-73. Differences between the two solutions for the larger amplitude frequencies (f_o and f_{n1}) were small, using these differences Fitch calculated a fractional change in the fundamental frequency of -1.6×10^{-5} in 36 yr but cautioned that such small differences could be attributed to observational errors.

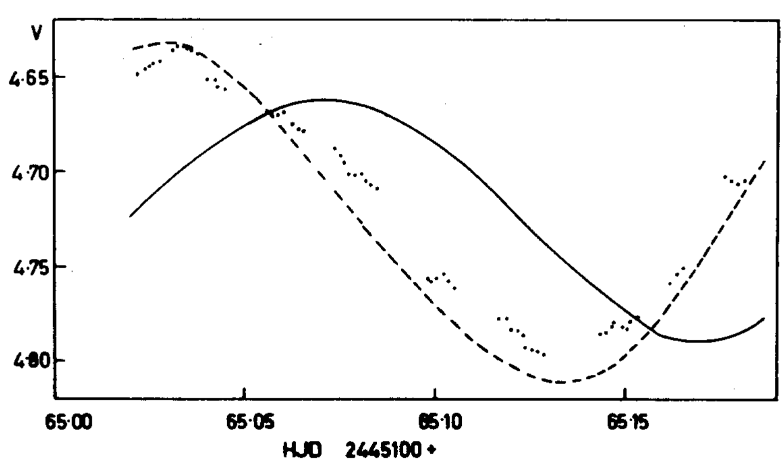

Figure 1

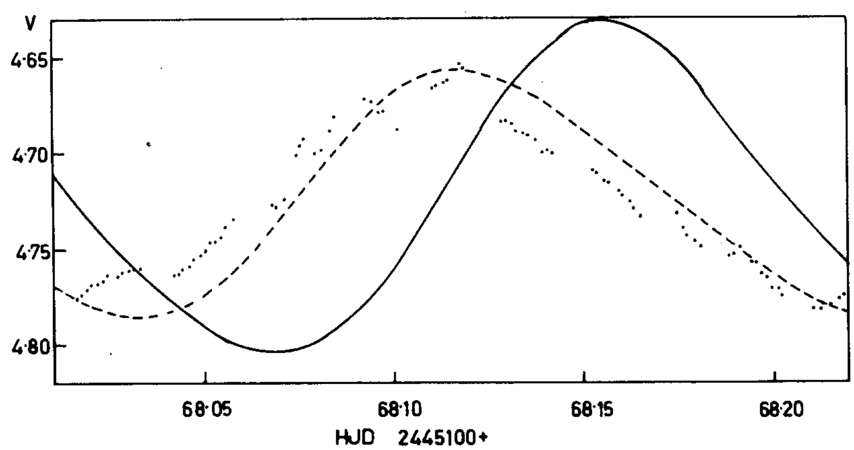

Figure 2

Moon and Keay (1982) used observations of a single maximum to refine the fundamental frequency of δ Scuti, data in Figures 1 and 2 are consistent with their refined value for the frequency of the fundamental mode of pulsation.

Using a similar argument to Moon and Keay it is unlikely that our observed light curves of δ Scuti are shifted by one or more complete cycles from the light curve predicted by Fitch's solution. These predicted light curves are given as solid lines in Figures 1 and 2.

Because Fitch defined an epoch some 40 years prior to his 1972-73 observations we found it necessary to choose a new epoch (=HJD 2441800) close to his observations, and to recalculate the phases accordingly. Data given by Fitch (1976) are adequately represented by this solution. Only the fundamental and first nonradial modes (f_o, f_{n1}) are known to sufficient precision to refine their values further. However these two frequencies, along with their second harmonics ($2f_o$, $2f_{n1}$) and sum (f_o+f_{n1}) describe most of the behaviour of δ Scuti.

Adjustment of Fitch's values for the fundamental and first nonradial frequencies gave the dashed curves in Figures 1 and 2, where f_o=5.160760 cycles day^{-1} and f_{n1} = 5.3540 cycles day^{-1}, the estimated errors being $\pm$ 0.000004 cycles day^{-1} and $\pm$ 0.00004 cycles day^{-1} respectively. This was the closest representation to the data achieved using only f_o, f_{n1}, and their harmonics and combination frequency. Small residuals between our solution for the light curve and the observations can be accounted for by other frequencies present and some observational uncertainty.

Comparing our result for the fundamental frequency with that given by Fath (1937), f_o = 5.160758, and that given by Fitch for Fath's data (1976), f_o = 5.160780, it appears that any change in f_o over 45 yr is small and probably due to observational uncertainty. Considering the precision of photoelectric photometry and the complicated nature of the light variations of δ Scuti, the fundamental mode of pulsation appears stable, any fractional secular changes are probably less than .000004 in 45 yr.

D.W. COATES, T.T. MOON, K. THOMPSON and M.L. WINSALL

Department of Physics, Monash University,
Clayton, Victoria 3168, Australia

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PHOTOMETRIC OBSERVATIONS OF THE SECONDARY MINIMUM OF 1 Per

The variability of 1 Per = HD 11241 = V 436 Per was detected by Kurtz (1977), its eclipsing nature was demonstrated by visual estimates published by European Group GEOS that indicated exactly the period and the eccentricity of the orbit (Figer et al., 1979) as confirmed by further photoeletric observations carried out by North and Rufener (North et al., 1981). However photometric parameters are not yet known with good precision because few UBV measures have been obtained during the minima. Radial velocity fit is very uncertain, as North et al., (1981) emphasize. Possible orbital models were proposed by North et al. (1981) and Gaspani (1982).

Photoelectric observations with B,V standard filters have been carried out at Merate Observatory in the nights of 1981, November 10 and 12, 1981, December 9, 1982 January 29 and 30. HR 540 (6.442 V,A5m) and HD 12303 = 4 Per (5.007 V,B8V) were used as comparison and check star, respectively. The quoted magnitudes are given by Rufener (1976) in the Geneva Observatory seven colour system. No variation has been found for HR 540, in accordance with Kurtz's conclusions (1977). The measures in the nights of JD 2444948 and 2445000 have been obtained during ascending branch of secondary minimum, in accordance with the ephemeris:

Min I (or short) = JD 2443562.853 + 25.9359 x E (1)

that provides the min II (or long) at 0.4141 phase (North et al., 1981). Table I reports V observations: each ΔV is the mean of several measures. Phases are calculated from (1). In the night of JD 2444919 1 Per seems to be brighter than in the other nights: this feature has been already pointed out by Kurtz (1977). Runs performed each night by Rufener (1976) and Percy (1982) are not so long to confirm it, even if the r.m.s. of Geneva observations is quoted as 'reasonable' by North et al. (1981).

Table I

Hel. J.D. 2440000 +	Phase	ΔV	σ	n
4919.279	0.2992	0.947	0.007	4
.286	0.2994	0.953	0.007	5
.312	0.3005	0.947	0.014	4
.321	0.3008	0.953	0.005	4
.327	0.3010	0.947	0.008	4
4921.253	0.3753	0.933	0.010	4
.260	0.3756	0.922	0.005	4
.271	0.3760	0.942	0.014	4
.293	0.3768	0.919	0.006	4
.307	0.3774	0.937	0.006	3
.335	0.3784	0.935	0.016	4
.339	0.3786	0.939	0.010	4
4948.228	0.4153	0.748	0.006	4
.233	0.4155	0.753	0.003	5
.250	0.4162	0.748	0.003	4
.255	0.4164	0.763	0.006	4
.276	0.4172	0.769	0.003	4
.284	0.4175	0.773	0.004	5
.307	0.4184	0.784	0.001	2
4999.288	0.3840	0.938	0.005	4
.291	0.3842	0.936	0.004	4
5000.238	0.4207	0.823	0.007	4
.248	0.4210	0.822	0.005	4
.293	0.4228	0.858	0.011	4
.302	0.4231	0.873	0.005	4
.351	0.4250	0.900	0.006	4
.368	0.4257	0.906	0.003	4
.408	0.4272	0.938	0.012	4

V observations of 1 Per. ΔV are in the sense HR 540 minus 1 Per ; σ is the standard error.

So, it is necessary to observe 1 Per along the whole light curve.

Further details about my photoelectric observations (in the B colour) will be published elsewhere.

E. PORETTI

Osservatorio Astronomico di Brera
Via Bianchi, 46
22055 Merate
Italy

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SHORT-PERIOD VARIABILITY OF THE BINARY STAR HD 206631

During observations of the eclipsing binary EK Cephei on a very photometric night at the Blue Mountain Observatory of the University of Montana on October 6-7, 1980 one of the comparison stars exhibited abnormal fluctuations in its brightness. Its behavior resembles that of a Delta Scuti-type variable not previously reported, with an amplitude of about 0.03 mag and a period of about 25 minutes as shown in Figure 1.

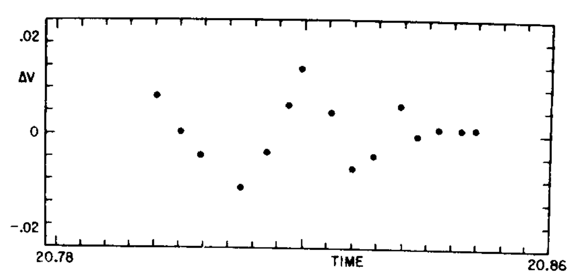

Figure 1. Photoelectric photometry of HD 206631 in 1980. The ordinate is in magnitudes. To convert the time shown to Hel. JD, add 2,444,500.0.

The characteristics of this star [HD 206631=BD+67°1343=SAO 19573=ADS 15225, $\alpha=21^h39^m21^s$, $\delta=+68°09^m$ (1950)] as given in the Star Atlas of Reference Stars and Nonstellar Objects (SAO, 1969) are as follows: spectral type, A0, and photographic and visual magnitudes of 8.9 and 8.3, respectively.

A 40 cm f/18 Cassegrain telescope with an EMI 6256B photomultiplier and a Corning 3384 filter that reproduces Johnson's V filter were utilized.

The comparison stars used were +68°1239 (8.8 mag, G0) and +67°1362 (7.9 mag, K2). During these observations the dispersion in the magnitude difference C_1-C_2 was 0.0027 mag., whereas the amplitude of the variable was about 0.03 mag. A single observational sequence of the two comparison stars and the variable at the Blue Mountain Observatory takes about 1.5 min., but in order to make the data homogeneous with that obtained at the Observatorio Astronómico Nacional, México, averaging of all data points lying within a five-minute time span was performed.

Dr. T. E. Margrave encouraged the Mexican group studying variable stars at the Instituto de Astronomía, University of Mexico, to verify his discovery. However, the mounting of the two telescopes available at that time did not permit observation of stars north of declination 62°, so this request was not fullfilled until the two-meter telescope at the San Pedro Mártir Observatory was utilized. These observations were carried out on the nights of August 9 and 11, 1982. The Johnson V filter and a 1P21 cooled photomultiplier were used. The standard stars used during the two nights of observations were BD+67°1362 and BD+67°1332, one of which was utilized previously at Montana. However, a different comparison star than +68°1239 was necessary, since its declination made its observation with the two-meter telescope impossible. Therefore BD+67°1332 was utilized instead. Its spectral type is A0, and its visual magnitude is 8.6. These two stars satisfy very well the requirements for comparison stars as reported by Warman et al. (1974).

The light curves obtained on these last two nights are presented in Figure 2. Each point represents the average of six ten-second integrations of the star (V) and one ten-second integration of the sky (S), which was subtracted from the average. The magnitude was then

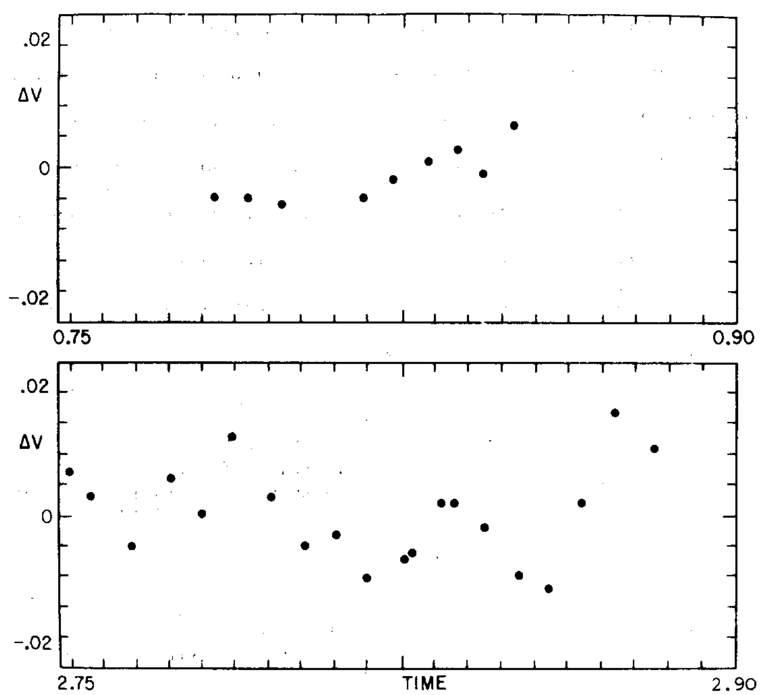

Figure 2. Photoelectric photometry of HD 206631 in 1982. The ordinate is in magnitudes. To convert the times shown to Hel. JD, add 2,445,190.0.

obtained by means of the well-known relation $m = -2.5 \log (\overline{V}-S)$. The differences between the magnitude of the variable and the averages of the two comparison stars were calculated for each time at which the variable was observed. The precision of each point is 0.004 mag. in brightness and 0.0035 day in time. The standard deviation of the difference between the two comparison stars is 0.005 mag., far less than the 0.03 mag. of the variable's amplitude.

Due to the fact that this star has spectral type A0, a period on the order of an hour, and an amplitude of variation of 0.03 mag. one can conclude that it is almost certainly a Delta Scuti variable. Thus

HD 206631 would be one of the fastest Delta Scuti pulsators, having a period comparable to that of the cluster star variables (Breger, 1979).

It should be emphasized that HD 206631 is also a binary star. According to Jeffers et al. (ADS, 1963), it was first reported by W. T. Hussey in 1904 as having a separation of 1.2 arc sec and magnitudes for the components of 8.8 and 10.3 mag. The photometric data will be submitted to the IAU Archives (M. Breger, University of Texas-Austin). Further cooperative research on this star is planned.

T. E. MARGRAVE
University of Montana
Department of Physics & Astronomy
Missoula, Montana 59812
U.S.A.

Rosario PENICHE and
J. H. PEÑA
Instituto de Astronomía - UNAM
Apdo. Postal 70-264
04510 México, D. F.
México

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SOME VARIABLE STARS IN THE SRS CATALOGUE

It is very well known that the SRS (Southern Reference System) meets the need of accurate determination of positions and proper motions on a fundamental system for the southern hemisphere (Scott, 1968).

Some results of several years of meridian observations have already been published (e.g. Høg and Von der Heide, 1976); however, the astrophysical information for SRS stars is rather poor. Recently Nicolet's 'Catalogue of Homogeneous Data in the UBV Photometric System' (Nicolet, 1978) has been searched and extense lists of photometric SRS candidates have been prepared (López, 1982); in addition, the 'Special Supplement to the Third Edition of the General Catalogue of Variable Stars' (Kukarkin et al., 1972) was checked for possible coincidences between known variable or suspected variable stars and SRS stars; agreements within 6 arcsec in each coordinate has been taken as correct identification and are listed in Table I.

CARLOS LÓPEZ
Obs. Félix Aguilar
Benavides 8175 (o)
Marquesado 5407
San Juan-Argentina

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TABLE I

SRS#	Variable or Susp.Var.N°	SRS#	Variable or Susp.Var.N°
154	5915	9534	RT Sex
170	SY Phe	9670	CK Car
481	6074	9958	IX Car
717	RT Pic	9996	BZ Car
780	102514	11237	6963
1030	102595	11458	101361
1121	6719	11745	7060
1223	WZ Vel	11878	W Hya
1443	6891	11912	DL Vir
1898	101539	12967	7195
2079	7643	13425	V718 Sco
2401	8424	13874	SS Sco
2658	8754	14169	101647
2686	8769	14765	101719
2913	100001	14787	101720
3038	5846	14794	102865
3449	100075	14860	101728
3471	5880	15032	SS Sct
3792	100110	15091	YZ Sgr
4515	100199	15105	S Sct
4658	Z Eri	15331	8116
4700	RR Eri	15431	101821
5543	387	15488	101831
5916	RZ Eri	17466	102178
6436	CK Ori	17564	102194
6470	100538	17867	S Scl
6703	6408	18978	716
7611	RY CMa	19458	6867
8502	1334	20348	5521
9485	CM Vel		

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HR 3084 - AN EARLY TYPE CLOSE BINARY*

Radial velocity variations of HR 3084 have been detected by Wilson (1914) from three spectra obtained in Jan. 1914. He found a velocity range of about 94 km/s and classified this star as a spectroscopic binary (Wilson, 1953). This tentative assignment appears again in the 4^{th} edition of the Bright Star Catalogue although in the meantime only one additional measurement by Buscombe and Kennedy (1964) had been published.

During a four colour survey of standard stars Olsen (1974) found the scatter for this star to be about twice than normal and concluded that it might be a variable with an amplitude of about $0^m.07$ in V. The spectral type of B2.5 V (Hiltner et al., 1969) or B3 IV (Cousins and Stoy, 1963) led Jerzykiewicz and Sterken (1977) to put HR 3084 on their list of program stars in searching for β Cep variability. They observed this star together with two comparisons and found light variations in the range between $0^m.02$ and $0^m.03$. However, they could not attribute this variability to one star exclusively. But they concluded, that if the variations were periodic, the period would be longer than half a day.

During five consecutive nights in March 1977 the author obtained 30 blue spectra (12 A/mm; IIa-O) with the coudé spectrograph of the 1.5m telescope on La Silla (ESO). The radial velocities have been determined using the Grant machine and the reduction facilities of the ESO headquarter in Garching. In most cases 11 Balmer lines and 6 He lines could be measured with a r.m.s. error of about 8.5 km/s for a single plate. This relatively large scatter is mainly due to the rotational distortion of the lines (v sin i = 221 km/s according to Uesugi

*based on observations collected at the European Southern Observatory.

and Fukuda (1970)). Olsen (1977) kindly provided the 57 unpublished photometric observations (V), which he had obtained within 94 nights from Nov. 1971 to Febr. 1972. A periodogram analysis of these photometric and the spectroscopic measurements in the range $0\overset{d}{.}02$ to $2\overset{d}{.}5$ revealed a most probable period of $1\overset{d}{.}112 \pm 0\overset{d}{.}001$.

Fig. 1 presents the light curve according to this period. Two minima of unequal depths ($\sim 0\overset{m}{.}050$ and $\sim 0\overset{m}{.}025$) are shown, which are separated by half a cycle. The phase is computed with the ephemeris

$$\text{HJD } 244\ 1267.358 \pm 1.112\ E,$$

where the initial epoch is the approximate time of the deeper minimum.

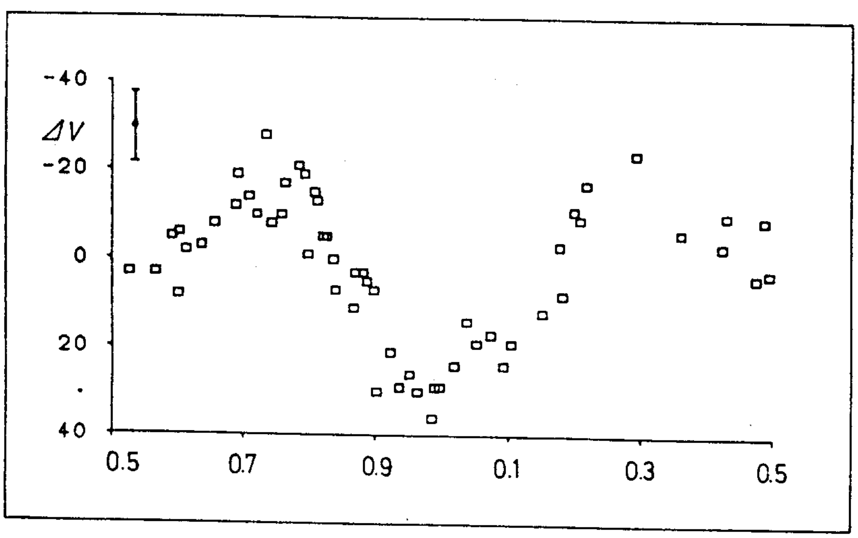

Fig. 1 The light curve of HR 3084. Shown are V magnitude differences (in units of 10^{-3}) with respect to the mean value, which was derived by Olsen (1974) to be $4\overset{m}{.}500$. The r.m.s. error of $0\overset{m}{.}008$ is indicated in the upper left.

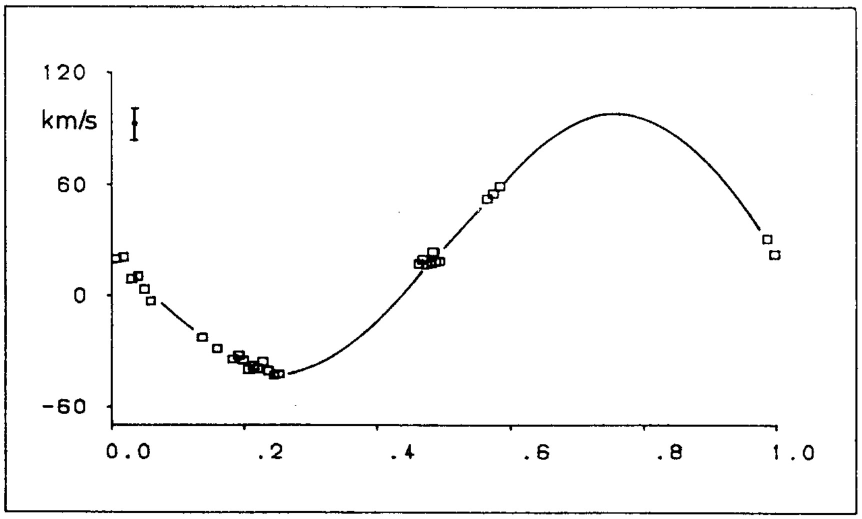

Fig. 2 The radial velocity curve of HR 3084. The r.m.s. error of 8.5 km/s is shown in the upper left.

Fig. 2 shows the radial velocity curve. A sine fit revealed an amplitude of K = 71 km/s and a systemic γ velocity of 29.5 km/s. This yields $a_1 \sin i = 1.09 \cdot 10^{11}$cm and for the mass function $f(M)_{\odot} = 0.041$. No spectroscopic evidence for the secondary star and no emission features have been found so far. Phase zero corresponds to HJD 244 3229.017. This phasing is consistent with variations obtained performing a narrow band (H_β) photometry some nights prior to the spectroscopic observations. The time elapsed between Olsen's photometry and the spectroscopy is too long for the determination of a more precise value of the period.

This preliminary results show, that a β Cep variability certainly can be excluded. The light variations and the phase relation between light curve and radial velocity curve are consistent with a binary nature of HR 3084. Probably it does not eclipse but is rather an ellipsoidal variable. In order to find out whether the system is in a semidetached or a contact configuration a light curve synthesis program will be applied and the results will be published elsewhere.

R. HAEFNER
Universitäts-Sternwarte
Scheinerstr. 1
D-8000 München 80
Germany

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HR 7578: A POSSIBLE LATE-TYPE ECLIPSING BINARY AND/OR A BY DRACONIS VARIABLE

High dispersion spectroscopic observations obtained at the Erwin W. Fick Observatory, Iowa State University and McDonald Observatory, University of Texas have shown that HR 7578 = HD 188088 is a bright, V=6.16, double-lined K2-3 V binary with a period of 46.8 days and an eccentricity of 0.69. The minimum masses of the components are 0.85 $\pm$ 0.03 $M_{\odot}$ each, suggesting that the inclination of the system may be high enough for eclipses to occur despite the relatively long period and presumed small radii of the stars.

Because there are very few eclipsing binaries of solar type or later, a search for such eclipses is important. Since the declination of this object is -24°, it is best observed from the southern hemisphere. The ephemerides for possible eclipses are

$$2444147.591 + 46.817E$$

for a possible eclipse near apastron and

$$2444158.880 + 46.817E$$

for a possible eclipse near periastron.

Because of the large eccentricity, an eclipse near periastron is more likely to occur and could last up to 10 hours. A total eclipse near apastron would last about 54 hours. Spectroscopic observations obtained near times of possible eclipse minima show little, if any, change in line strengths, implying that the possible eclipses are at best partial. During 1983, the best opportunity to observe a possible eclipse near periastron occurs in mid-May.

Spectroscopic observations indicate that the components have _v_ sin _i_'s of 5 - 8 km s^{-1} each. Such rotational velocities (Bopp, Noah, and Klimke 1980) suggest that the system may be a BY Draconis variable. Thus, low amplitude, quasi-sinusoidal light variations with a period of 5 - 8 days may be detected. A full discussion of this system will appear in a forthcoming volume of the Astrophysical Journal.

FRANCIS C. FEKEL, JR.

Goddard Space Flight Center
Laboratory for Astronomy and
Solar Physics
Code 685
Greenbelt, Maryland 20771

W. I. BEAVERS

Erwin W. Fick Observatory
Iowa State University
Ames, Iowa 50010

Reference:

Bopp, B. W., Noah, P. V., and Klimke, A. 1980, A.J. 85, 1386.

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A NEW RED VARIABLE IN AQUILA

While working on the optical counterpart of the x-ray source 4U1915-05, a new variable was discovered on a IV-N plate exposed by one of us (JEG) at CTIO on August 26, 1977. It is a faint, red object located at R.A. = $19^h16^m 02^s.28$, Dec. = $-5^o19'44''.3$ (1950), approximately 4.5 arc minutes west of the x-ray position (Fig. 1).

Referring to an approximate blue magnitude sequence estimated from the Palomar Observatory Sky Survey (POSS) blue print using the King and Raff calibration (1977), we examined more than 100 Harvard plates taken with various astrographs (25-, 40- and 60-cm apertures) between 1899 and 1949. Although the star was mostly below the plate limits, it did brighten to nearly $B \sim 16$ on several occasions and to B = 15 in 1924-1925 (Fig. 2). Since its image is not visible on the Palomar blue print, i.e., $B > 21$ in 1951, the range of its variation is at least six magnitudes.

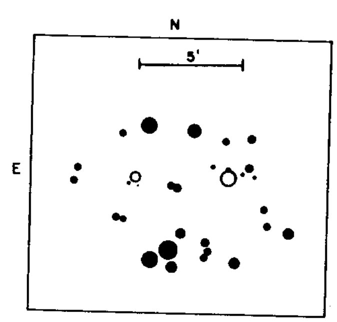

Figure 1. Finding chart for the new variable, which is indicated by the larger circle. The smaller circle is the optical candidate of the x-ray source 4U1915-05.

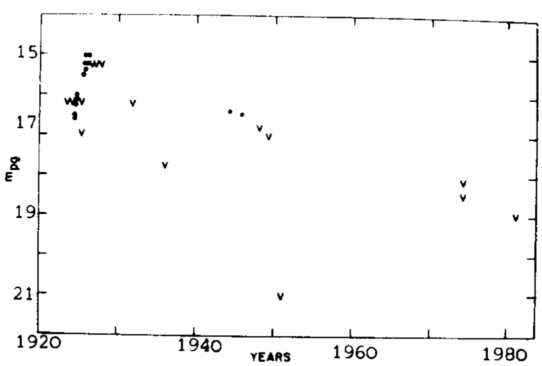

Figure 2. Light curve of the new variable. "V" signs indicate limiting magnitude estimates. The deep minimum in 1951 is from the POSS blue print.

The red magnitude of the star is about 18 on the Palomar red print. By an approximate color relation given for the Palomar P and R magnitudes (Minkowski and Abell, 1963), we found P-V$\sim$1.9 for the star.

The limiting magnitude of the POSS and those of several plates taken with the 1.5-meter reflector at Harvard's Agassiz Station in 1974 and 1981 are also shown on the light curve. If the light variation is periodic, our magnitude materials seem to indicate a period of 200-300 days.

The above data suggest that the object is probably a long-period variable.

J. E. GRINDLAY and C. Y. SHAO
Harvard-Smithsonian Center for Astrophysics
Cambridge, Massachusetts, 02138

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THE FIRST PHOTOELECTRIC LIGHT CURVES AND THE PERIOD OF V 909 CYGNI

The variability of V 909 Cygni (HBV 318=BD $+27^{\circ}3441$) was discovered photographically by Wachmann (1963) who obtained 14 minima from his 416 photographic measurements. He classified the system as an Algol type eclipsing binary and gave the light elements as follows:

$$\text{J.D. Hel Min.} = 24\ 35\ 317.465 + 1^{d}.4027080.E \quad ....(1)$$
$$\pm 5 \qquad\qquad \pm 83$$

He also presented the light curve of the system with 25 normal photographic points. There is no secondary minimum in his light curve and the depth of the primary minimum is about $0^{m}.42$.

In order to check the light variation and the period of V 909 Cygni, we decided to observe it photoelectrically during the summer of 1982. Using the single channel UBV photometer of Ege University Observatory, attached to the 48 cm Cassegrain telescope, the star was observed on 14 nights. An unrefrigerated EMI 9781 A photomultiplier tube and B,V filters very close to the Johnson's standard system were used during the observations. BD $+27^{\circ}3442$ was used as comparison throughout the observing period. The extinction coefficients in separate colours for each night were calculated from the observations of the comparison star using the conventional method; then, all differential observations (variable minus comparison) were corrected for the differential extinction. The corrections were small, because the comparison star is very close to V 909 Cygni. Firstly we observed three minima; their E numbers were even according to Wachmann's light elements. The depths of these minima were equal. Then we observed another minimum. We saw that its E number was odd and it was considerably deeper than the previous ones. Therefore we decided that the period of the system should be twice that of given by Wachmann (1963). During the observations four primary and three secondary minima have been obtained and are given in the following table.

The observed times of minimum

Hel.Min.J.D.	Min.	Filter	O-C
24 45 178.5261	II	B,V	-0.0009
192.555	II	"	+0.001
195.3592	II	"	-0.0003
202.3736	I	"	+0.0005
216.4002	I	"	0.0000
230.4288	I	"	+0.0015
261.2870	I	"	0.0000

Using the above new photoelectric minimum times and the photographic ones given by Wachmann (1963), the new light elements are calculated by the method of weighted least squares as follows:

$$\text{Min.I} = \text{J.D. Hel } 24\ 45\ 202.3731 + 2^{d}.8054230 \cdot E \quad \ldots\ldots (2)$$
$$\pm 19 \qquad\qquad \pm 10$$

The light and colour curves of the system are presented in Figure 1. The phases in the Figure and the O-C values in the table were calculated with the equation (2).

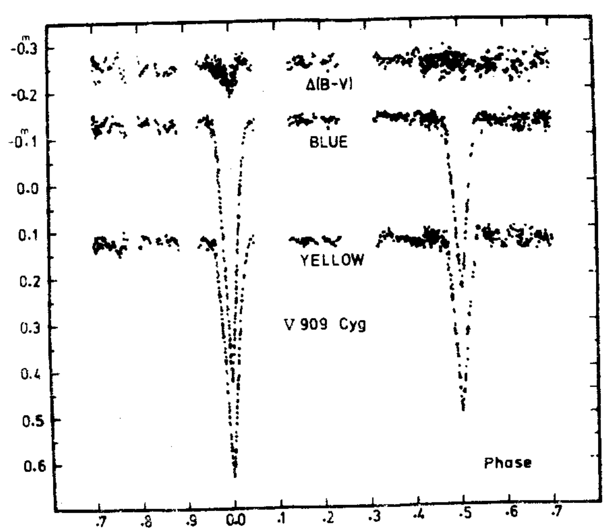

Figure 1

The light curves show that V 909 Cygni is a typical well-detached Algol type eclipsing binary. The colour of the system is slightly reddening at the primary minimum and varies about $0^m.540$ and $0^m.500$ at the primary, $0^m.360$ and $0^m.360$ at the secondary minimum in blue and yellow light, respectively. The solutions are in progress.

This project is partly supported by the Turkish Scientific and Technical Research Council.

Ö. GÜLMEN, N. GÜDÜR, C. SEZER

Ege University Observatory
Bornova-Izmir-Turkey

Reference:

Wachmann, A.A.: 1963, Astronomische Abhandlungen der Hamburger Sternwarte, Bergedorf, Band VI, Nr.7, 138

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IAU ARCHIVES OF UNPUBLISHED OBSERVATIONS OF VARIABLE STARS

Contents

I. Summary

The Archives of Unpublished Photoelectric Observations of Variable Stars was created to provide permanent archives in different parts of the world. The Archives can replace lengthy and expensive tables in scientific publications by a single reference to the archival file number. Furthermore, many observations are never used for scientific publications, and the Archives could make such observations available to other astronomers for a time when they might become very important.

The number of assigned file numbers has grown to 112. This represents a welcome acceleration of growth. A temporary delay in the retrieval of previous files from the Royal Astronomical Society in Great Britain has been rectified.

The Strasbourg Data Center (Centre de Données Stellaires) has joined the Variable Star Archives as a third depository. The center will provide computerization and free retrieval starting with File 84. Discussions are presently taking place concerning the handling of extremely lengthy files, and optional submission of data files by computer tape.

The Publications of the Astronomical Society of the Pacific published the summaries of recent files on a regular basis. Two detailed reports can be found in the Pub.Astr.Soc.Pac. 91, 408 (1979), and Pub.Astr.Soc.Pac. 93, 528 (1981).

Astronomers who wish to obtain unpublished photoelectric measurements on variable stars may do so by requested whole files from

Mrs. E. LAKE, Librarian

Royal Astronomical Society
Burlington House
London, W1V ONL, Great Britain

or

Dr. E. MAKARENKO

Odessa Astronomical Observatory
Shevchenko Park
Odessa 270014 U.S.S.R.

or

(starting with File 84)

Dr. C. JASCHEK

Centre de Données Stellaires
Observatoire de Strasbourg
11, Rue de l'Université
67000 Strasbourg
France

There is no charge for short files.

II. Address change for submitting new files

Astronomers who wish to submit unpublished photoelectric observations of variable stars to the Archives, should submit three copies as well as a brief descriptive cover sheet to the Coordinator (address listed below). Alternatively, one of the three copies could be sent directly to Dr. Makarenko (U.S.S.R.). The Coordinator will assign file numbers and forward the observations to London and Strasbourg (and Odessa, if necessary). New files must be printed or handwritten in blank ink. Please note that computer output sometimes lacks sufficient contrast and character sharpness for duplication. The printed part should be no larger than 20 by 27 cm. If a new number is required for scientific publications (in place of extensive tables of measurements), the file number can be assigned by the Coordinator before receipt of the actual measurements. The new address is:

Prof. M. BREGER

Universitäts-Sternwarte
Türkenschanzstr. 17
A-1180 Wien
Austria

III. The first hundred files

The first 100 files cover a time period of more than 15 years, during which the Archives were coordinated by Dr. G.H. Herbig, Dr. W.S. Fitch and the present coordinator. The titles of the first 100 files are:

1. 3433 UBV measures of V Sge by Herbig, Preston, Smak and Paczynski.
2. About 2390 U measures of AE Aqr by Walker.

3. About 990 uby measures of BD + $14^{\circ}431$ by Smak.
4. 2726 U measures of Nova WZ Sge by Krzeminski.
5. 508 UBV measures of HD 116994 by Chambliss.
6. About 6500 UBV measures of Nova Z Cam by Krzeminski and Mumford.
7. About 3370 yellow and white measures of EX Hya by Krzeminski.
8. 1191 BV measures of AU Pup by Chambliss.
9. About 1200 uby measures of HR 7484 by Koch.
10. 1167 blue measures of 16 Lac by Walker.
11. Measures of EM Cyg by Mumford and Krzeminski.
12. UBV measures of SX Ari, CU Vir, HD 173650 and χ Psc by Blanco, Catalano and Godoli.
13. 964 BV measures of TT Lyr, AD Her and RV Oph by Walter.
14. 630 UBV measures of HD 199757 by Chambliss.
15. About 660 ubv, Hγ measures of δ Cet, ν Eri, β CMa, ξ' CMa, 15 CMa, β Cru, ζ' Lup, σ Sco and θ Oph by Watson.
16. About 517 UBV and 197 intermediate band measures of SX Cas by various observers, edited by Koch.
17. UBV measures of RZ Cnc by Broglia and Conconi.
18. 471 UBV measures of V505 Sgr by Chambliss.
19. About 2400 ubv measures of QS Aql, EC Cyg, FZ Del, AK Her, LS Her and EW Lyr by van der Wal.
20. About 2535 bv measures of CW Cep and RU UMi by Nha.
21. About 4800 UBV measures of SU Cep, UV Lyn and RU UMi by Bossen.
22. About 240 UBV measures of HDE 302013 by Cannon and others.
23. 145 UBV measures of RZ Cep by Epps and Sinclair.
24. 1530 differential B measures of HL Tau-76 by Fitch.
25. 7932 differential UBV measures of SX Aur, MN Cas, RW CrB and V891 Cyg by Klawitter.
26. 1111 differential UBV measures of 21 Com, 41 Tau, HD 140160 and HD 224801 by Blanco and Catalano.
27. 2954 B and R measures of AR Lac by Kron, Gordon, Adams and Smith.
28. 363 λ 8100 Å measures of YY Gem by Kron and Gordon.
29. UBV measures of CC Ser by Sarma and Parthasarathy.
30. UBV measures of HD 140728, HD 215038 and HD 215441 by Blanco, Catalano and Vaccari.
31. 1338 V measures of 1 Mon by Shobbrook and Stobie.
32. 4663 V measures of AC And by Szeidl.
33. 274 BV measures of SV Vol, GS Hya, VX Scl and DH Vir by Penfold.
34. 950 uvby measures of HD 217061 by Lanning and James.
35. 4492 uvby measures of HDE 226868 = Cyg X - 1 by Lanning.

36. 1812 UBV measures of RZ Cas by Chambliss.
37. 754 UBV measures of U Peg by A.R. Hogg.
38. 4800 V measures of α Vir, λ Sco, κ Sco, β CMa, ξ'CMa and 15 CMa by Shobbrook and Lomb.
39. 1280 U measures of TT Ari by Smak.
40. 2008 UBV measures of AR Lac by Chambliss.
41. 350 measures each of U Oph in 50 Å bands at 4750, 4476, 4230 and 4026 Å , by Koch and Koegler.
42. 4855 b measures of δ Sct by Fitch.
43. 5574 V measures of CC And by Fitch.
44. uvby measurements of WW Aur by P.B. Etzel.
45. UBV measurements of RU UMi by A.R. Hogg.
46. BV measurements of V1500 Cyg (Nova Cyg 1975) by C.W. Armbruster, W. Blitzstein, A.B. Hull and R.H. Koch.
47. UBV measurements of HX Ara by H.W. Duerbeck and K. Walter.
48. U Cep-E. Olson.
49. TU Hor-H. W. Duerbeck.
50. EE Peg and S Equ-S. Catalano and M. Rodono.
51. KO Aql-C. Blanco and S. Cristaldi.
52. HR 3413-A. Heck, J. Manfroid and P. Renson.
53. TT Ari-H. W. Duerbeck (File number assigned, but data not received yet.)
54. AH Tau-H. W. Duerbeck (File number assigned, but data not received yet.)
55. HR 3413-P. Renson and C. Sterken.
56. ω Oph-P. Renson and H.M. Maitzen.
57. HD 125248, HD 134793, HD 184905-C. Blanco et al.
58. 14 Aur-W. S. Fitch and W.Z. Wisniewski.
59. HD 59256, HD 66255, HD 66605, HD 83368, HD 83625, HD 94660 and HD 96616-J. Manfroid.
60. Nova Cygni 1978-W. Blitzstein et al.
61. Multicolor Observations of AW UMa-E.J. Woodward, R.H. Koch and P.R. Eisenhardt.
62. UBV Photometry of U Cephei by N.R. Markworth.
63. Observations of Three Southern δ Scuti Stars: AI Scl, WZ Scl, and XX Scl by D.L. Dupuy.
64. UBV Photometry of the eclipsing binaries Z Her, RS Vul, AR Lac and AW Peg by Th. Wesselink.
65. Unfiltered Photometry of V523 Cas by D.H. Bradstreet.
66. BV Photometry of RW Com by H. Hoffman.
67. Intermediate-band Photoelectric Observations of U Cephei by E.C. Olson.

68. Intermediate-band Photoelectric Measurements of S Cancri by E.C. Olson.
69. UBV Magnitudes of AL Vel by F.B. Wood.
70. V757 Centauri by M.A. Cerruti.
71. HR 7308 by A. Greenberg.
72. Differential B and V Photometry of HD 132209 by D.W. Kurtz.
73. Differential B and V Photometry of HD 101065 by D.W. Kurtz.
74. Differential Photometry of 28 Cygni and HR 7807 by G.G. Spear, J. Mills and S.A. Snedden.
75. uvby Observations of Peculiar A Stars by P. Renson and J. Manfroid.
76. B and V Observations of the Delta-Scuti Variable BD $+28^{\circ}1494$ by P. Broglia.
77. Red Spectrophotometry of VW Cep in 1976 by J.A. Eaton.
78. VRI Observations of YY Eri, W UMa, SW Lac, AW UMa, RZ Tau for 1976 by J.A. Eaton.
79. AW UMa: Photoelectric Observations by B.J. Hrivnak.
80. XY Leo: Photoelectric Observations by B.J. Hrivnak.
81. Ultraviolet Spectrophotometry of Close Binary Systems CV Velorum, RS Vulpeculae and DH Cephei by C. Wu and J.A. Eaton.
82. Individual Observations of AG Phe by M.A. Cerruti.
83. Differential V,B Photometry of 54 Cam by D.S. Hall.
84. UBV Photometry of UV Lyncis by N.L. Markworth.
85. BV Photometry of DM UMa by R. Kimble.
86. UBV Photometry of RY Gem by D.S. Hall, Tilman Stuhlinger and John W. Wilson.
87. Photoelectric Photometry of HR 7275 by D.S. Hall.
88. Photometry of θ Ori A by D.S. Hall and J.R. Sowell.
89. Photoelectric Observations of 44 i Boo, by Russell M. Genet. (File number assigned, but data not received yet.)
90. B Magnitudes of BW Vul, by A.P. Odell. (File number assigned, but data not received yet.)
91. B Magnitudes of HR 151, HR 239 and HR 7461, by Donald W. Kurtz.
92. 16 Algol Systems: XZ And, KO Aql, RZ Cas, U Cep, U CrB, SW Cyg, W Del, AI Dra, TT Lyr, RW Mon, RV Oph, ST Per, U Sge, RW Tau, X Tri, and TX UMa by E.C. Olson.
93. HD 8357-D. S. Hall.
94. 29 Dra-D. S. Hall.
95. HD 26337-D. S. Hall.
96. HD 136905-D. S. Hall.
97. RS Indi-D. S. Hall.

98. Algol-G. A. Bower.

99. 10 Ap Stars: HR 4082, HR 4109, HR 4327, HR 4552, HR 4817, GC 17563, HR 4965, HR 5158, HR 5269 and GC 19369 by P. Renson and J. Manfroid.

100. SV Tau-C. R. Chambliss. (File number assigned, but data not received yet.)

MICHEL BREGER

Universitäts-Sternwarte
Türkenschanzstr. 17
A-1180 Wien
Austria

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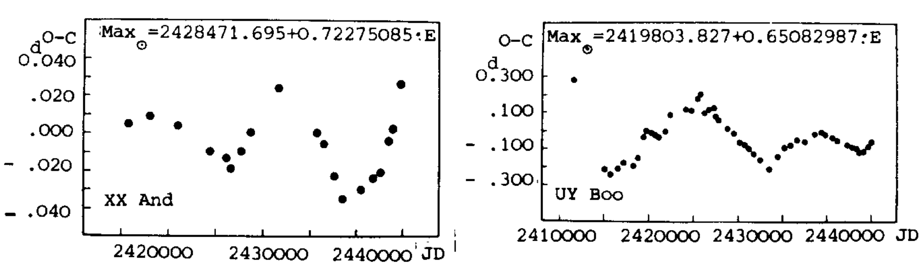
CYCLIC VARIATIONS OF THE PERIODS OF RR LYRAE TYPE STARS

An investigation of the instability of the light variation period of RR Lyrae type stars has been carried out at Odessa Astronomical Observatory. From the investigated stars a group of objects could be distinguished for which the presence of cyclicity in the variations of periods is inherent. It was shown that the cyclicity observed is not due to the binary nature of the objects studied.

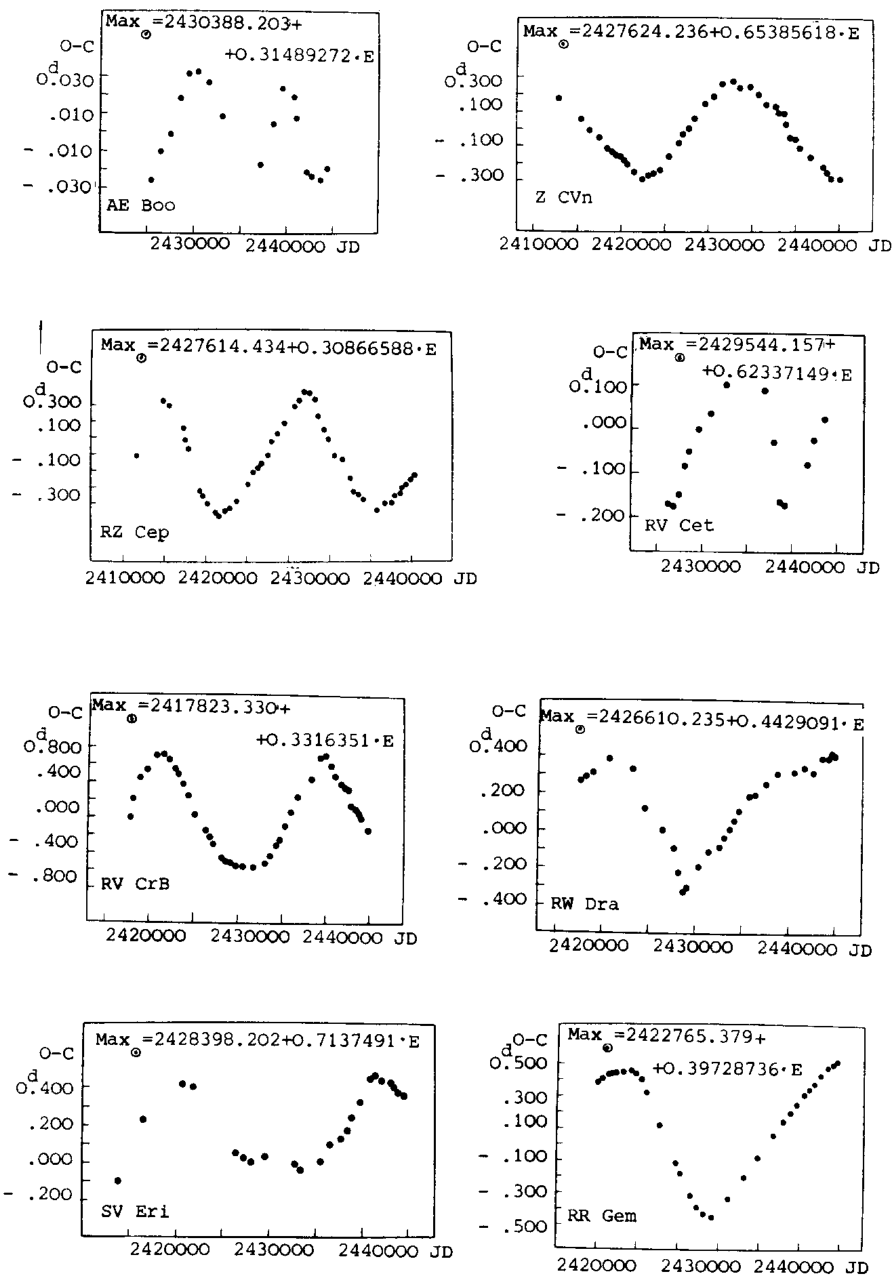
It has been supposed that the cyclicity in the variations of the periods of RR Lyrae stars is caused by two different limited states of stars. The nature of the internal mechanism which maintains the cyclic variations of the periods is probable associated with variations in stellar structure. (Firmanyuk, 1980; Astron. Circ. No. 1118)

Cepheids, Mira-, RV Tauri- and eclipsing stars show cyclic variations in their periods as well.

At present the model of the mechanism maintaining cyclicity in the periods of light variations of RR Lyrae stars has not yet been constructed. The nature of cyclicity in the variations of the periods of variable stars of other types is not clear either. Now it looks worth presenting the O-C diagrams of some RR Lyrae type stars showing cyclic period changes.



Figures 1-2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+0.31489272·E
O-C
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.010
- .010
- .030
AE Boo
2430000 2440000 JD
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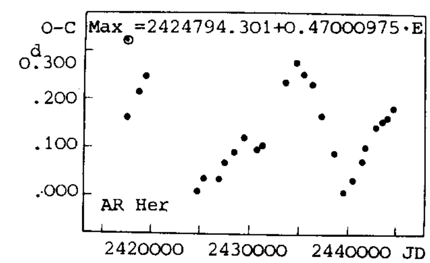
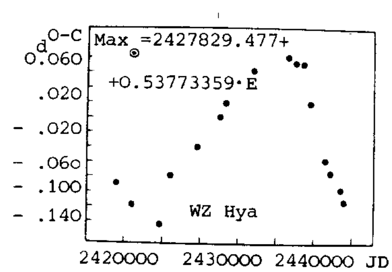
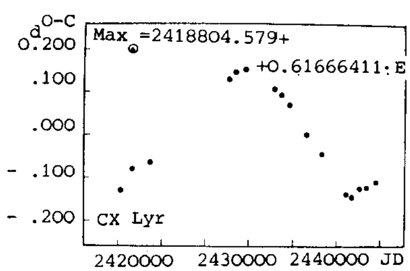
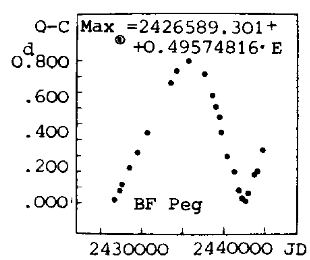
O-C
0.d300
.100
- .100
- .300
Z CVn
2410000 2420000 2430000 2440000 JD
Max⊙=2427614.434+0.30866588·E
O-C
0.d300
.100
- .100
- .300
RZ Cep
2410000 2420000 2430000 2440000 JD
Max⊙=2429544.157+
+0.62337149·E
O-C
0.d100
.000
- .100
- .200
RV Cet
2430000 2440000 JD
Max⊙=2417823.330+
+0.3316351·E
O-C
0.d800
.400
.000
- .400
- .800
RV CrB
2420000 2430000 2440000 JD
Max⊙=2426610.235+0.4429091·E
O-C
0.d400
.200
.000
- .200
- .400
RW Dra
2420000 2430000 2440000 JD
Max⊙=2428398.202+0.7137491·E
O-C
0.d400
.200
.000
- .200
SV Eri
2420000 2430000 2440000 JD
Max⊙=2422765.379+
+0.39728736·E
O-C
0.d500
.300
.100
- .100
- .300
- .500
RR Gem
2420000 2430000 2440000 JD

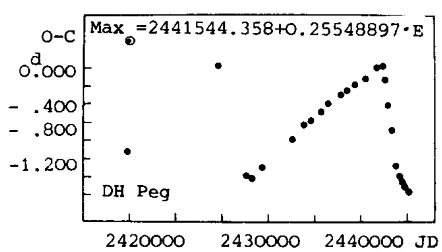
Figures 3-10

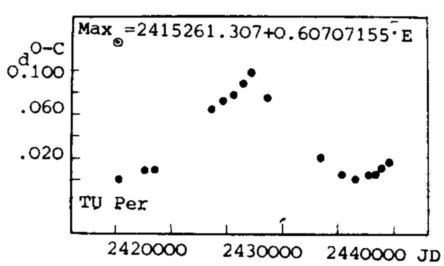


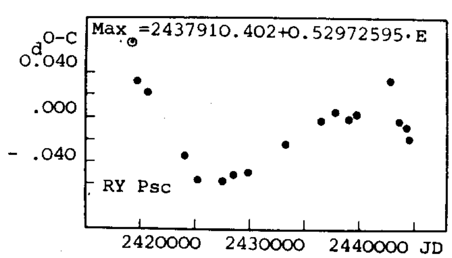


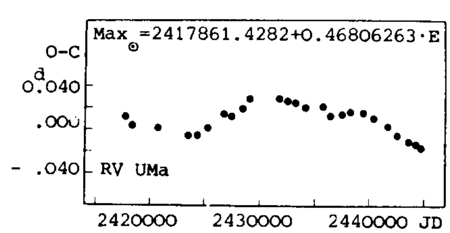












Figures 11-18

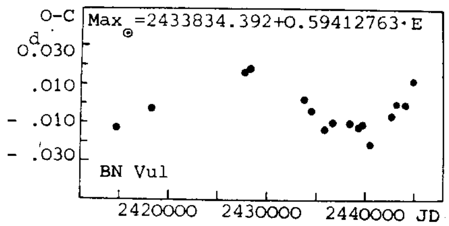


Figure 19

The elements of these RR Lyrae stars are given below:

Table

Star	Elements	Number of cycles
XX And	Max JD = 2428471.695 + 0.72275085 E	13000
UY Boo	Max JD = 2419803.827 + 0.65082987 E	14000
AE Boo	Max JD = 2430388.203 + 0.31489272 E	10000
Z CVn	Max JD = 2427624.236 + 0.65385618 E	22000
RZ Cep	Max JD = 2427614.434 + 0.30866588 E	18000
RV Cet	Max JD = 2429544.157 + 0.62337149 E	12500
RV CrB	Max JD = 2417823.330 + 0.3316351 E	18500
RW Dra	Max JD = 2426610.235 + 0.4429091 E	23000
SV Eri	Max JD = 2428398.202 + 0.7137491 E	22000
RR Gem	Max JD = 2422765.379 + 0.39728736 E	27500
AR Her	Max JD = 2424794.301 + 0.47000975 E	14500
WZ Hya	Max JD = 2427829.477 + 0.53773359 E	28000
CX Lyr	Max JD = 2418804.579 + 0.61666411 E	28000
BF Peg	Max JD = 2426589.301 + 0.49574816 E	16000
DH Peg	Max JD = 2441544.358 + 0.25548897 E	16500
TU Per	Max JD = 2415261.307 + 0.60707155 E	22000
RY Psc	Max JD = 2437910.402 + 0.52972595 E	23000
RV UMa	Max JD = 2433834.392 + 0.59412763 E	24000
BN Vul	Max JD = 2417861.4282 + 0.46806263 E	25000

FIRMANYUK B.N.

Odessa Astronomical Observatory
U.S.S.R.

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IDENTIFICATION OF HD 174429 AS AN RS CVn SYSTEM

We present 1982 photoelectric observations of the RS CVn candidate HD 174429.

HD 174429 (= SAO 245781 = CP -50 10862) is included in a list of southern RS CVn candidates by Weiler and Stencel (1979). Radial velocity measurements and H & K line profiles are given by Stacy et al. (1980). Optical variability was reported by Coates et al. (1980).

HD 174429 was observed in the Johnson B & V passbands on sixteen nights in the interval 1982 May to October at Monash Observatory, and at Siding Spring Observatory. The standard stars used were HD 176557 (= SAO 245894 = CD -50 12292) and HD 176664 (= SAO 245899 = CD -51 11893). The measurements showed that the magnitude differences between the standards were constant at 1.260 ± 0.005 in V, and 1.499 ± 0.004 in B.

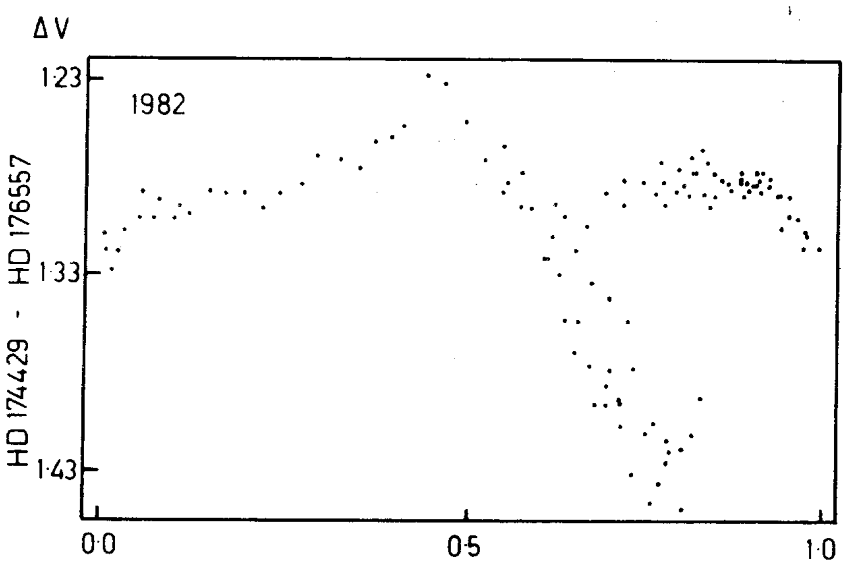

Figure 1

The V light curve obtained is shown in Figure 1. The primary epoch is HJD 2444443.0000, the period is estimated to be 0.943 days and ΔV is relative to HD 176557.

Minimum light is now about 0.09 magnitude fainter than that reported by Coates et al. (1980), while maximum light is about 0.01 magnitude brighter. Also the shape of the light curve has altered radically from 1980 (see Figure 2).

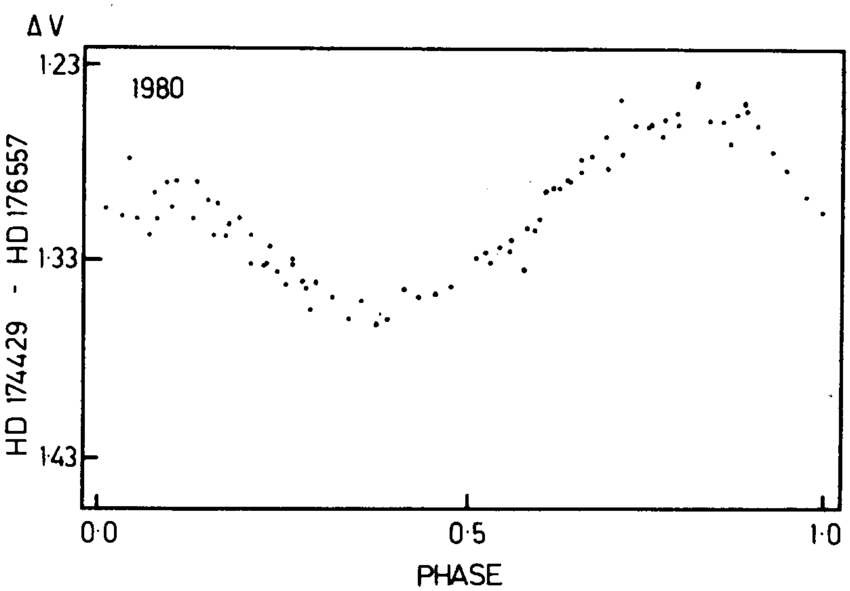

Figure 2

Plotting the 1982 V data in the intervals 1982 May to July, and August to October (Figures 3(a) and 3(b)) shows how the light curve has changed in form within the 1982 observing season. The minimum at phase approximately 0.8 observed early in the season was no longer present when observations were made at this phase in August. Such variation is typical of the RS CVn class of stars.

A plot of the colour index B-V versus V is shown in Figure 4. A least squares straight line fitted to these data (solid line in Figure 4) was found to be of negligible gradient, indicating that B-V for this system was constant within the accuracy of our measurements at +0.77 ± 0.01.

Houk (1978) gives HD 174429 as spectral type K0 Vp. The B-V value obtained from our observations is significantly bluer than would be expected if the system was a single K0 V star. Using these colour data and assuming

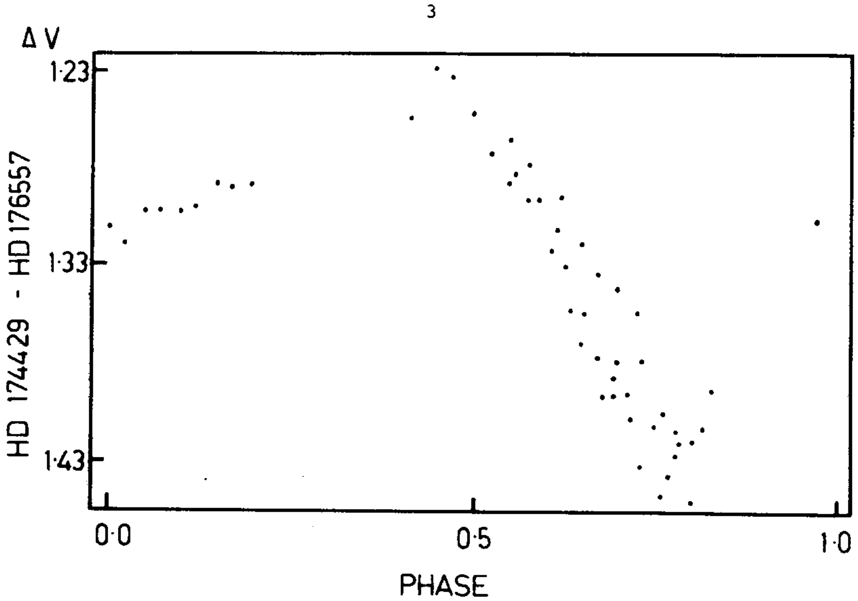

Figure 3 (a)

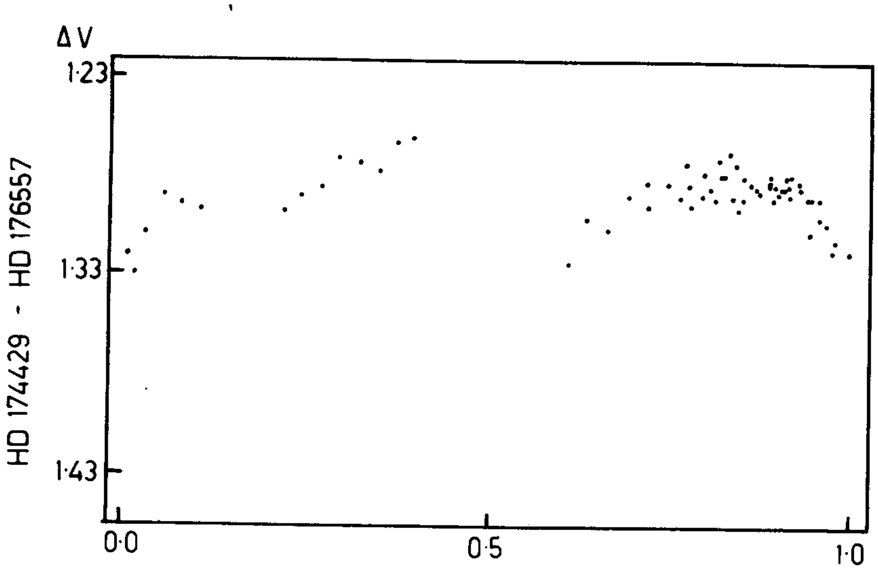

Figure 3 (b)

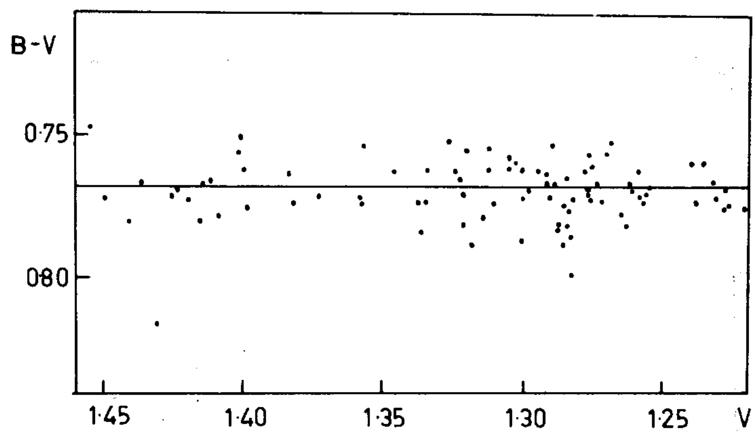

Figure 4

that the system is a binary, with both components on the main sequence, calculations indicate that the primary is near G5.

Preliminary analysis suggests that if the variability of the system is solely due to the presence of cooler active regions on the surface of the secondary, then these regions need to be around 3000 K cooler than the K0 V photosphere, and cover approximately 50% of the effective area of its surface, in order to reproduce the observed V range without a detectable colour change. This suggests an extremely high amount of activity on the surface of the K0 star. However, we stress the tentative nature of our conclusions about the sizes and temperatures of these regions.

On the basis of these observations we identify HD 174429 as a member of the RS CVn class. More observations are required to investigate this system further.

D.W. COATES, J.L. INNIS, T.T. MOON and K. THOMPSON
Department of Physics, Monash University,
Clayton, Victoria 3168, Australia.

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ON DELTA SCUTI STARS IN OPEN CLUSTERS

29 Delta Scuti stars are already known as members of different open clusters. Data for these variables are given in Table I.

Table I

<u>Praesepe</u> $m_o - M = 6.20$ $A_V = 0.0$ log t = 8.54 $\bar{P} = 0^d.055$ (BT,BV Cnc excluded)

$\bar{M}_V = +2.0$ (BT Cnc excluded)

1. BT Cnc = KW 204	$P = 0^d.102$	FOIII	V = 6.68	M_V = +0.5
2. BR Cnc = KW 45	0.038	FOVn	8.26	+2.1
3. BS Cnc = KW 154	0.051	A9Vn	8.51	+2.3
4. BU Cnc = KW 207	0.053	A7Vn	7.68	+1.5
5. BN Cnc = KW 323	0.039	A8V	7.80	+1.6
6. BQ Cnc = KW 292	0.074	F2Vn	8.18	+2.0
7. BV Cnc = KW 318	5^h::	FOV	8.66	+2.5
8. BW Cnc = KW 340	0.072	FOVn	8.48	+2.3
9. BX Cnc = KW 445	0.053	A7V	7.97	+1.8
10. BY Cnc = KW 449	0.058	A7Vn	7.92	+1.7

<u>Pleiades</u> $m_o - M = 5.64$ $A_V = 0.06$ log t = 7.2 $\bar{P} = 0^d.032$ $\bar{M}_V = +2.5$

1. V 534 Tau = HII 1266	$P = 0^d.032$	A9V	V = 8.27	M_V = +2.6
2. V 624 Tau = HII 158	0.020	A7V	8.50	+2.8
3. V 647 Tau = HII 1362	0.047	A7V	8.10	+2.4
4. V 650 Tau = HII 1425	0.031	A3V	7.78	+2.1

<u>Coma</u> $m_o - M = 4.55$ $A_V = 0.0$ log t ≈ 8.6 $P = 0^d.055$ $M_V = +1.9$

1. FM Com = HR 4684	$P = 0^d.05515028$	A7V	V = 6.44	M_V = +1.9

<u>Hyades</u> $m_o - M = 3.29$ $A_V = 0.0$ log t = 8.83 $\bar{P} = 0^d.080$ $\bar{M}_V = +1.7$

1. ν_2 Tau = VB 60	$P = 0^d.133$	A8Vn	V = 4.29	M_V = +1.0
2. θ^2 Tau = VB 72	0.080	A5V	4.85	+1.6
3. ρ Tau = VB 95	0.067	A8Vn	4.66	+1.4
4. V 480 Tau = VB 123	0.042	A7IV	5.10	+1.8
5. V 483 Tau = VB 30	0.054	FOV	5.58	+2.3
6. V 696 Tau = VB 33	0.036	A9V	5.23	+1.9
7. V 775 Tau = VB 38	0.062	FOm	5.72	+2.4
8. V 777 Tau = VB 141	0.162	A8Vn	4.48	+1.2

<u>α Per</u> $m_o - M = 5.94$ $A_V = 0.30$ log t = 7.1 $\bar{P} = 0^d.034$ $\bar{M}_V = +2.7$

1. V 459 Per = H 501	$P = 0^d.037$	FOIV	V = 9.14	M_V = +2.9
2. V 461 Per = H 606	0.035	A8 V	8.98	+2.7
3. V 465 Per = H 906	0.030	A6Vn	8.78	+2.5

Table I (cont.)

NGC 2264 $m_o - M = 9.10$ $A_V = 0.21$ log $t \approx 6$	$\bar{P} = 0^d.117$:			$\bar{M}_V = +0.7$	
1. V 588 Mon = W 2	$P = 0^d.11$:	A7III-IV	$V = 9.68$	$M_V = +0.4$	
2. V 589 Mon = W 20	0.124	F2III	10.27	+1.0	
NGC 7789 $m - M = 12.20$ $A_V = 0.84$ log $t \approx 9.7$	$P = 0^d.17$:			$M_V = +0.7$	
1. V 521 Cas	$P = 0^d.17$:	$M_V = +0.7$	$V = 13.76$		

Distance moduli (m_o-M) for Pleiades, Praesepe, Hyades, α Per and NGC 2264 are from Kholopov (1980); those for Coma cluster and NGC 7789 are from Becker and Fenkart (1971); ages of the clusters are directly from Lindoff, (1968) or in the same system of ages; spectral types, V-magnitudes, periods for individual variables are from different modern sources; absolute magnitudes M_V are based on adopted values of distance moduli, V and interstellar absorption A_V. In the case of θ^2 Tau V, Sp and M_V are given for companion (Peterson et al., 1981) though it is unknown which star is unstable. It is interesting to note that two stars in the Hyades cluster, V 775 Tau and V 777 Tau are X-ray sources, according to recent published data.

There is a difference between the known open cluster variables and field stars: Delta Scuti stars having large light amplitudes (more than about $0^m.1$) are absent in the clusters, excluding only one possible outlying (about 10^o from the cluster) member of the Hyades cluster VZ Cnc (Eggen, 1979). Besides 29 small amplitude variables which are all Delta Scuti type stars, one can find five more suspected open cluster variables of this type in Rufener (1981). These stars are probably also small amplitude variables. Therefore, about one sixth of all known Delta Scuti stars are small amplitude members of different open clusters.

Two correlations for open cluster Delta Scuti stars are shown in Figure 1 and Figure 2: mean period and mean M_V of the cluster variables versus the age of the cluster; NGC2264 was omitted by the reason of its extremely young age and peculiar evolutionary status of its two known Delta Scuti stars. The two Figures show that, the greater the age, the longer the mean period of cluster variables and the higher their mean luminosity.

The present statistics unfortunately holds almost fully on dwarf Delta Scuti stars, which themselves cannot have large pulsational amplitudes. More statistics on giant stars is needed to confirm (or disprove) the result on small amplitudes of open cluster members. It is interesting to note here that several large amplitude Delta Scuti stars along with short-periodic SX Phe type variable (Jørgensen, 1982) can be typical for globular clusters with different metal abundances (RS Gru, XX Cyg).

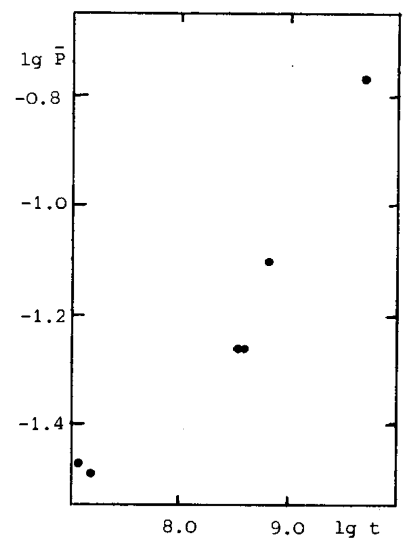

Figure 1

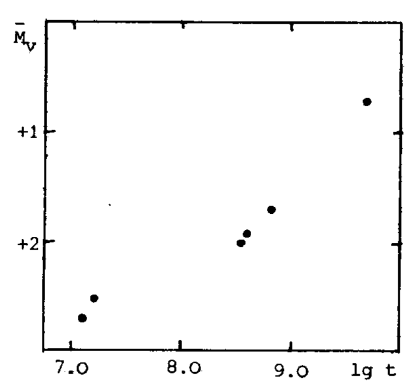

Figure 2

More serious attention must be paid to the search for these variables in open clusters, old open clusters and globular clusters for better understanding of population type range, age range, mass range etc. for the whole Delta Scuti complex.

We are obliged to Dr. P.N. Kholopov, to Dr. Yu.N. Efremov and to Dr. M. Breger for useful comments and discussion.

M.S. FROLOV

Astronomical Council of the
USSR Academy of Sciences
USSR

B.N. IRKAEV

Dushanbe Astrophysical Institute of
Tadjik Academy of Sciences
USSR

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PHOTOMETRIC AND SPECTROSCOPIC INVESTIGATION OF Y CVn

The famous carbon star Y CVn became the object of our photometric and spectroscopic investigation in the past few years. The three colour BVR photometry of this star was provided at Brno Observatory and its high dispersion spectra were taken with the 2m telescope of the Ondřejov Observatory. The observational activity was directed to investigate the relationship between the light and radial velocity changes of carbon stars.

Our observations have led to the statement that the variations of the radial velocity of Y CVn based on the measurements of details of the Swan molecular bands $C_2(1,0)$ and $C_2(0,1)$ do not exceed the scale of ± 2 km/s. They may be connected with the light changes of the star but the observing material due to incompleteness does not allow to give more detailed information. As the spectroscopic observations are spread through the whole observing time period, the photometric ones express a serious gap just near critical epoch of the first of the three observed times of minimum light. Could perhaps anybody complete our information on the light activity of Y CVn in the time interval J.D. 244 4200 - 4400 ?

The most striking feature of our photometric observations is the continuous decrease of the B-V index of the star. Since the beginning of 1980 to the present the star has become more blue by about 0.6 magnitude. The red colour index V-R expresses no systematical change during the same time period.

M. VETEŠNIK

Department of Astronomy, Brno University
61137 Brno, Czechoslovakia

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NONCIRCULAR ORBIT OF TU Cam

TU Camelopardalis (HR 2027) is a Beta Lyrae type eclipsing binary of visual magnitude m_V = 5.1. One secondary and two primary minima were observed in the period December 1977 - January 1980. The observations were performed by the 0.6 m photometric reflector at the Skalnatê Pleso Observatory. The star was observed in B and V filters of the standard UBV system and in two intermediate band filters centered at 472 and 527 nm. Times of the observed minima are listed in Table I, which contains also two photoelectric minima published earlier by Wood (1951) and West (1968).

Table I

JD (hel.)	(O-C)	Cycle	Source
2 432 633.655	0.0000	0	Wood (1951)
2 438 051.3755	0.0000	1 847	West (1968)
2 443 495.4960	- 0.0007	3 703	This paper
2 444 174.5778	+ 0.0349	3 934.5	"
2 444 243.4751	0.0000	3 958	"

From the minima listed in the first and in the last lines of Table I, we derived the following ephemeris:

$$\text{JD (Min I)} = 2\ 444\ 243.4751 + 2\overset{d}{.}933\ 2542 \times E.$$

The value of the period is equal to that found by West (1968). The (O-C) values corresponding to our ephemeris are given in column 2 of Table I. There is a notable high value of (O-C) for the secondary minimum observed at JD 2 444 174, that corresponds to the phase 0.512. West (1968) did not find any displacement of the secondary minimum, and hence he assumed a circular orbit for the TU Cam system. His observations, however, do not cover satisfactorily the vicinity of the secondary minimum.

Spectroscopic orbits for TU Cam were computed by Harper (1924), Luyten (1936) and Mannino (1954) with the eccentricities 0.030, 0.040 and 0.037, respectively. As West pointed out, the mean value of the eccentricity, e = 0.035 from these spectroscopic orbits leads to the shift of the secondary minimum to the phase 0.522.

J. ŽIŽŇOVSKÝ

Astronomical Institute
Slovak Academy of Sciences
059 60 T. Lomnica
Czechoslovakia

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FURTHER OBSERVATIONS OF EV Lac IN 1974

High-speed photometric techniques developed for observations of optical pulses and ultra-rapid variability on time scales of 1 millisecond to 10 seconds were utilized for the patrol of the dMe flare star, EV Lac, in 1974. The 36-inch Yapp reflector at the Royal Greenwich Observatory was employed with the 2-star photometer, designed by Dr Bingham, to simultaneously monitor EV Lac and a comparison star, BD +43°4310 (Sp K0, $22^h46^m26^s$, +44°25'.6, 1950), separated 28'.2 from EV Lac. A multi-channel analyzer (Fabri-Tek Model 1072) was fed with the amplified dual pulses from the ultraviolet photoelectrons detected at two uncooled EMI 6256A photomultipliers. Additional observations on three other nights were made using the Brookdeal 501 Photon-counting System and the data logger previously employed at the RGO (See Andrews 1973).

On 19 August 1974 four runs each lasting 4096 seconds were made with the Fabri-Tek System. The progress of the dual counting for the two stars in the standard U-band filter was displayed on an oscilloscope and recorded on punch tape. A dwell time of 8 seconds for each channel was used. During the third run, a stellar flare of amplitude $0^m.3$ in the ultraviolet with duration 14 minutes was observed against the combined light of EV Lac and its faint companion (See Andrews and Chugainov 1969). The time of maximum was $23^h05^m45^s$ UT. However, due to a malfunction in the tape punch the individual data were irretrievable. The only record retained was on a tracing onto transparent paper from the oscilloscope display, and a detailed diary of events.

On 20-22 August 1974 observations were continued using the Brookdeal System. Continuous monitoring in the ultraviolet in the auto-repeat mode was performed with a 10-second integration. The counter was maintained at a fairly constant temperature in an enclosure within the dome.

The 13 hours total coverage of EV Lac is given in Table I with Universal Time noted to the nearest minute. Parentheses indicate poor sky

Table I

Coverage (UT) of EV Lac in the Ultraviolet

1974	
19 Aug	(2052-2102,2103-20),2121-50,2154-2203,2211-41,2242-2319,2324-29 2336-2400.
20 Aug	0000-05,0006-33,0053-58,0216-30,(0230-0311),(2050-2103,2119-24), (2127-29),2140-54,2158-59,2206-55,2326-2400.
21 Aug	0000-23,0033-38,0050-0101,0113-23,0125-29,0148-53,0155-0203, (0205-08,0210-19),0255-0300,(2024-43),2054-2109,2115-28,(2128-33), 2146-57,2219-21,2127-29,2241-45,2302-51.
22 Aug	(0008-19,0020-39),0041-0105,0114-16,0118-19,0134-41,(0241-49), (0259-0302),(2047-2100),2109-28,2146-53,2256-2321,2325-2400,
23 Aug	0000-06,0008-22,0052-0111,0121-55,0209-22,0243-0308.

TOTAL COVERAGE 13^h08^m over 4 consecutive nights.

conditions or observations made during semi-twilight (Astronomical Twilight : End 21^h25^m, Begin 02^h40^m UT). A total of 3210 dual counts were successfully recorded on the data logger under good sky conditions. See Fig.1, which

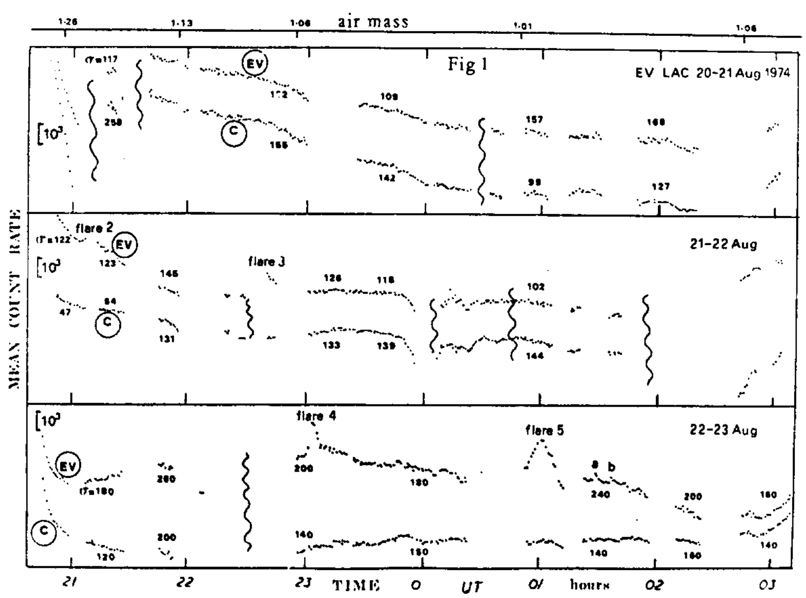

Figure 1

shows the mean count-rates over 1 minute intervals. Two partially-recorded flares were noted during 21 August (Nos.2 & 3), but fluctuations at 00^h12^m UT on the same night are thought to be noise. Flare No.5 on 22-23 August showed structure on its decline (a,b in Fig.1). Details of all flares are summarized in Table II. The r.m.s. scatter in the count rate is indicated

Table II

Observed Flares of EV Lac

No.	1974	UT(Max)	ΔU	Duration (mins)	I_{o+f}/ I_o	P (mins)
1	19 Aug	$23^h05^m45^s$	$\sim 0^m.3$	∼14	-	-
2	21 Aug	(21 12)*	-	-	-	-
3	21 Aug	(22 40)*	>0.4	>4	-	-
4	22 Aug	23 03 00	0.66	31	1.84	4.71
5	23 Aug	01 00 26	0.41	16	1.46	4.72

* Incomplete light curves. Rise or maximum missed.

at intervals throughout the night in Fig.1, and the vertical curly lines indicate shifts in the zero point for the two stars. Observations were all made at small air mass. See top scale in Fig.1.

The well-observed flare on 22-23 August (No.4) was a typical, double-peaked event with a maximum amplitude of $0^m.66$, and is shown in detail in Fig.2. Since the author had limited means to follow the quiescent light

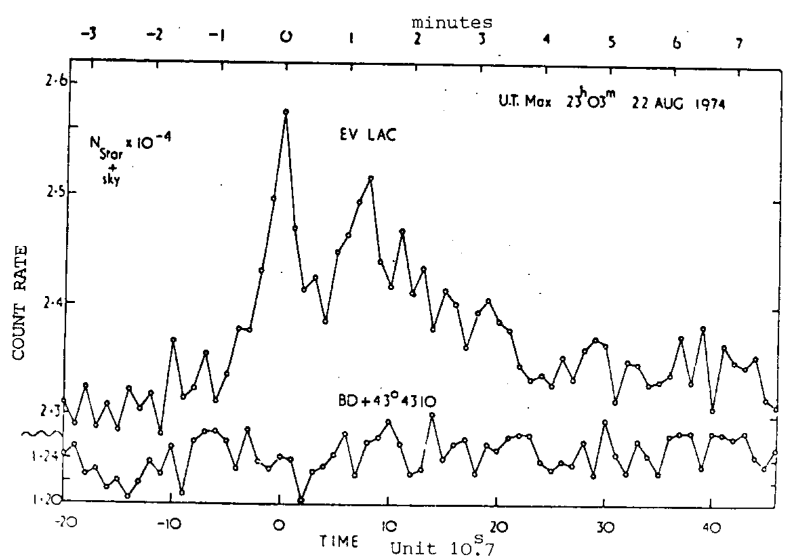

Figure 2

during the run using the data logger, the slow change apparent in Fig.1, amounting to a total rise of about $0^{m}.3$ only became evident during reductions. Flare No.4 occurred superimposed on this gradual rise in the ultraviolet. The second flare on that night two hours later was very slow with a rise time of about 8 minutes and an amplitude above "quiescence" of $0^{m}.41$. The energy considerations for this night, however, are open to doubt due to the very small signal-to-noise ratio in the ultraviolet. The total data has not been searched for flare events on very short time scales.

A. D. ANDREWS
Armagh Observatory
Armagh BT61 9DG
Northern Ireland

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Andrews, A.D., 1973. IBVS 851.

Andrews, A.D. & Chugainov, P.F., 1969. IBVS 370.

(For details on the comparison star, BD $+43^{o}4310$, see I.B.V.S. No. 2253)

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FLARES OF EV Lac AND UBV PHOTOMETRY DURING THE QUIESCENT PHASE IN 1975

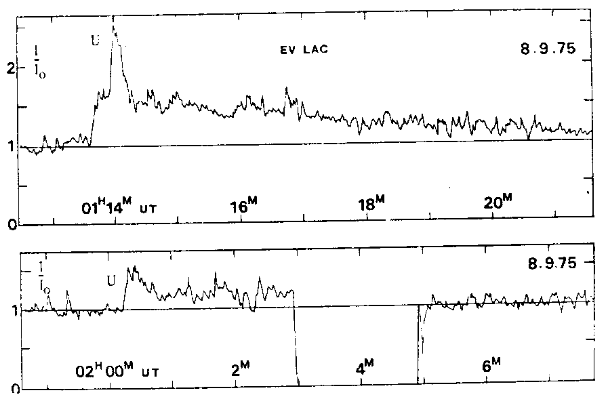
Concluding a series of observations of the dMe flare star, EV Lac ($22^h44^m40^s$, +44°04'.6, 1950, Chart G216-16, Lowell Obs.Bull.140,1967), made at the Royal Greenwich Observatory, Herstmonceux, using the 2-star photometer on the 36-inch reflector, we present unpublished results for 1975. Both pulse-counting and additional, simultaneous strip-chart recording were made, the former with a 10-second sampling time. For a description of the equipment and a discussion of results, see Andrews 1973 and 1982. The comparison star used in channel 2 was BD +43°4310 (Sp KO, $22^h46^m25^s$, +44°25'.4, 1950). EV Lac was monitored for 11^h42^m over six nights between 29 August and 9 September 1975 in one of the standard UBV bands. Universal Times (UT) of monitoring are given in Table I to the nearest minute, those in parentheses indicating poor sky conditions.

Table I

Monitoring Times of EV Lac

1975	Filter	UT
30 Aug	V	0044-0120,0136-42.
1 Sept	U	2120-42,2145-2248,2250-2300,(2301-20).
2 Sept	U	(2108-18,2124-35,2136-2207,2210-15),
	B	(2216-19,2222-49,2252-2304),
	U	(2305-07),
	B	(2311-17,2319-34,2337-47,2351-2400),
3 Sept	B	(0000-03,0005-15),0018-36,0040-45,0046-56,0057-0114,
	B	0120-24,0125-45,
	U	0146-52.
7 Sept	U	(2120-45,2148-56),
	B	(2227-37),
	U	(2241-44),
	B	(2252-54,2256-2300,2314-19,2323-29,2331-38),
	U	2340-2400,
8 Sept	U	0000-21,0023-31,0033-58,0104-26,0129-0202,0205-45.
	U	2038-55,(2059-2126),2138-2202,2207-11,(2212-29),
	U	2230-35,2310-22,2346-49,2354-2400,
9 Sept	U	0000-02.
10 Sept	U	(0102-10,0112-17,0118-19,0122-24).
TOTAL COVERAGE		11h42m over 6 nights.

One moderate ultraviolet flare (No.3) of amplitude $1^{m}.04$ with a duration of 10 minutes and a slow decline was well recorded on 8 September (See Fig.1 and Table II). A second smaller flare (No.4) of amplitude $0^{m}.48$ followed



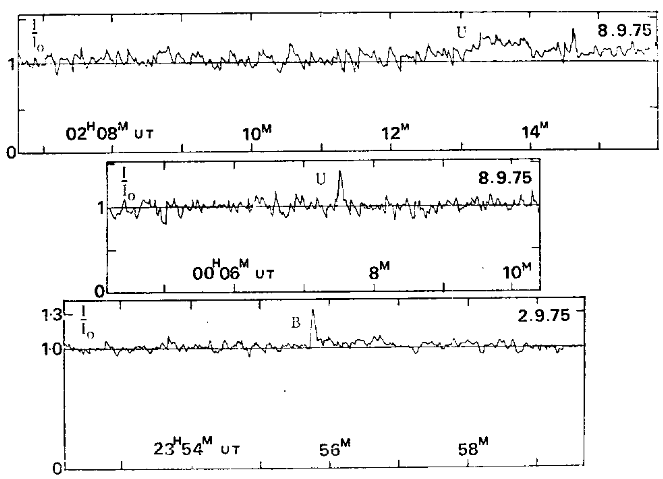
Figures 1-2

Table II

Flare Characteristics (Observed on 36-inch at RGO)

No.	1975	UT	Filter	Δm	P(mins)	m_f	Fig.
1	2 Sept	$23^h55^m45^s$	B	$0^m.31$	0.06	12.65	5
2	8 Sept	00 07 30	U	0.40	0.03	13.12	4
3	8 Sept	01 14 00	U	1.04	2.94	11.41	1
4	8 Sept	02 00 20	U	0.48	0.68	12.57	2
5	8 Sept	02 13 20	U	0.28	0.46	13.26	3

46 minutes later. However, as judged from the falling count-rate in the comparison channel during what appeared to be a normal slow decline in EV Lac, it was suspected that both stars were drifting out of their diaphragms. After checking and finding no adjustment necessary, it was found that the flare star had already returned to its quiescent level 2.5 minutes later. The shape of the later part of the light curve of No.4 is therefore doubtful. Three other flares are also listed in Table II and shown in Figs.3,4 and 5. Table II contains the observed amplitude, Δm, the apparent magnitude of flare light at maximum (m_f), corrected for the faint companion (See Andrews and Chugainov 1969), and the integrated intensity (P) or equivalent duration in minutes (See Andrews, Chugainov, Gershberg and Oskanian 1969), uncorrected for the faint companion. Corrected P' may be found from $P'(U) = 1.76\ P(U)$ or $P'(B) = 1.43\ P(B)$, which includes allowance for the slow change in the quiescent level which pertains to the 1975 observations, as described below.



Figures 3-5

The author continued collaborative observations of EV Lac from the Catanian Astrophysical Observatory using the 61-cm reflector for simultaneous 3-colour photometry from 29 September until 10 October 1975. These joint results will be published separately, together with the full Catania data, in a forthcoming Bulletin. Photometric measurements on five nights of EV Lac and a comparison star of similar colour, BD +43°4303 ($22^h44^m19^s$, +44°01'.7, 1950) listed by Andrews and Chugainov (1969) were made, together

Table III

Standard Photometry (Observed on 61-cm telescope at Catania)

1975	UT	V	U-B	B-V	n
29 Sept	23^h02^m	$10^m.113$	$0^m.570$	$1^m.362$	2
1 Oct*	23 00	10.082	0.586	1.353	3
4 Oct	19 59	10.042	0.587	1.352	4
8 Oct	20 47	10.091	0.526	1.373	3
8 Oct	21 55	10.123	0.631	1.344	3
9 Oct	21 16	10.068	0.692	1.346	4
Means (EV Lac incl.opt.comp.)		10.086 ±.027	0.599 ±.052	1.355 ±.010	
c.f. Andrews and Chugainov 1969		10.05 ±.015	0.75 ±.03	1.37 ±.015	
* Also BD +43°4310		9.597	0.745	1.216	

with measurements on a single night of BD +43°4310, the comparison star used at the RGO earlier. Data in Table III for the star, EV Lac, includes the light of the faint companion. Slow variations in UBV are suspected from the present work, and the U-B colour differs by $0^m.15$ from results from previous photometry. It is important to note, however, that these observations do not confirm the persistent $0^m.2$ drop in B and V in the quiescent level of EV Lac in 1975 as reported by Mahmoud and Oláh (1981). There is, moreover, a disagreement of $0^m.05$ in V in the photometric standard, BD +43°4299, used by the two groups of observers. Further work on the slow secular variation of EV Lac, in relation to the dark spot hypothesis, is important.

A. D. ANDREWS
Armagh Observatory
Armagh BT61 9DG
Northern Ireland

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Mahmoud, F.M. and Oláh, K., 1981, IBVS 1943.

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DETECTION OF 5-6 DAY OUTBURSTS IN FLARE ACTIVITY IN EV LACERTAE, INTERPRETED AS A ROTATIONAL EFFECT, AND A TENTATIVE REPORT OF TEMPORAL RELATIONSHIPS BETWEEN FLARE EVENTS

Early international collaborative monitoring of dMe flare stars arranged by the IAU Commission 27 Working Group concentrated on fortnightly runs on a few selected stars, namely, UV Cet, AD Leo, YZ CMi and EV Lac. In the Seventies, long series of observations were appearing, and usually were spread over very much wider time intervals, and important new and largely independent results using high time-resolution and/or simultaneous spectroscopic coverage were reported. In 1970, coverage of EV Lac was about 128 hours on 18 consecutive nights, and results show that the star was apparently 'flare-free' on 7 nights, with grouped outbursts of activity on other nights. The present paper deals with the unusually good series of observations of EV Lac between July and October 1975 at about 1-second resolution.

In 1975, a total of 208 hours coverage of EV Lac in the B or U band, spanning 79 days, was obtained after allowance for overlap, and a total of 50 separate flares, with a few being observed at more than one station, were successfully recorded at six observatories (Catania, Crimea, Herstmonceux, Oslo, Stephanian and Tokyo), yielding an average of 1 flare/4.16 hours. Examination of the time distribution of flares and coverage again shows, however, that flares occur in groups. As many as 42 out of the 50 flares are found in groups, each group lasting 5 or 6 consecutive nights, suggesting several distinct outbursts of stellar activity, not a long-term periodic phenomenon. Within each group the rate of flaring is double the above-quoted average, reflected in the fact that during only 108.4 hours of the total 208 hours was EV Lac flaring at all. The best example of these groups of flares is shown by the following diary of events. On 30 and 31 Aug and 1 Sept 1975, there were no flares in 9.5 hours total coverage, while 10 flares occurred over the following 6 nights, 2 - 7 Sept, during 28.4 hours coverage. Furthermore, the termination of this group is

Table I

Flares in 1975 and their Observed Characteristics (See Text)

No	1975	UT	HJD	ΔU	ΔB	P_U	P_B	Obs	Ref *	Group
1++	20 Jul	00^h02^m1	2613^d50293	-	0^m24	-	0.36	Ste	e	-
2	27 Jul	01 44.8	2620.57468	2^m07	0.83	12.15	2.32	Cat	a	-
3-6	3 Aug	-	-	<0.3	-	-	-	Tok	f**	5?
7	3 Aug	16 07.0	2628.17383	1.9	0.43	-	0.85	Tok	f	5?
8	3 Aug	16 33.8	2628.19242	5.9	3.35	-	34.0	Tok	f	5?
9	7 Aug	23 32	2632.44139	-	0.08	-	0.06	Cri	b	5?
10	10 Aug	21 39	2635.40473	-	0.18	-	0.64	Cri	b	1
11	10 Aug	21 55	2635.41584	-	0.44	-	0.46	Cri	b	1
12	11 Aug	21 49	2636.41173	-	0.10	-	0.14	Cri	b	1
13	11 Aug	23 14	2636.47076	-	0.07	-	0.38	Cri	b	1
14	12 Aug	23 20.2	2637.47506	-	0.07	-	0.02	Ste	e	1
15	14 Aug	22 29	2639.43961	-	0.50	-	3.91	Cri	b	1
16	14 Aug	22 59	2639.46044	-	1.63	-	5.50	Cri	b	1
17	15 Aug	00 00	2639.50280	-	0.73	-	0.64	Cri	b	1
18	15 Aug	01 14.4	2639.55447	2.47	1.26	17.30	4.60	Cat	a	1
19	15 Aug	21 51.0	2640.41322	-	0.19	-	0.73	Ste	e	1
20	29 Aug	21 58.1	2654.41876	-	0.15	-	0.06	Ste	e	-
21	2 Sep	23 55.7	2658.50060	-	0.31	-	0.06	Her	c	2
22	3 Sep	00 11.1	2658.51126	-	0.08	-	0.01	Ste	e	2
23	4 Sep	01 12.6	2659.55401	0.52	0.10	1.20	0.09	Cat	a	2
24	6 Sep	00 55.2	2661.54203	0.40	0.06	2.33	0.20	Cat	a	2
25	7 Sep	19 47.5	2663.32837	0.37	0.14	0.70	0.11	Cat	a	2
26	7 Sep	20 07.6	2663.34233	0.58	-	0.17	(0.02)+	Cat	a	2
27	8 Sep	00 07.5	2663.50893	0.40	-	0.03	(0.00)	Her	c	2
28	8 Sep	01 14.0	2663.55511	1.04	-	2.94	(0.42)	Her	c	2
29	8 Sep	02 00.3	2663.58723	0.48	-	0.68	(0.10)	Her	c	2
30	8 Sep	02 13.3	2663.59631	0.28	-	0.46	(0.09)	Her	c	2
31	12 Sep	22 10.2	2668.42755	0.50	-	0.19	(0.03)	Cat	a	-
32	12 Sep	23 46.6	2668.49450	2.15	0.93	14.15	2.45	Cat	a	-
33	13 Sep	00 14.3	2668.51373	0.67	-	4.03	(0.58)	Cat	a	-
34	13 Sep	00 44.5	2668.53470	1.43	1.03	30.55	3.78	Cat	a	-
35	14 Sep	01 14.3	2669.55540	0.99	0.34	2.76	0.45	Cat	a	-
36	28 Sep	23 26.3	2684.48050	0.76	0.28	1.47	0.50	Cat	a	3
37	28 Sep	23 53.2	2684.49918	0.42	-	1.40?	(0.20)	Cat	a	3
38	29 Sep	23 02.0	2685.46362	1.39	0.54	7.48	3.60	Cat	a	3
39	1 Oct	22 15.0	2687.43098	1.99	1.38	24.41	6.98	Cat	a/e	3
40	3 Oct	20 38.2	2689.36376	-	0.21	-	3.2	Ste	e	3
41	7 Oct	19 25.1	2693.31296	-	>0.64	-	1.25	Osl	d	4
42	7 Oct	22 46.2	2693.45260	-	0.11	-	0.15	Ste	e	4
43	7 Oct	23 12.6	2693.47093	-	0.09	-	0.03	Ste	e	4
44	8 Oct	19 22.8	2694.31133	-	0.10	-	0.28	Ste	e	4
45	8 Oct	19 59.9	2694.33713	-	0.10	-	0.06	Ste	e	4
46	8 Oct	21 35.4	2694.40341	0.85	0.25	2.45	0.16	Cat	a	4
47	9 Oct	02 39.1	2694.61432	0.43	-	0.70?	(0.10)	Cat	a	4
48	10 Oct	20 37	2696.36286	-	0.1	-	-	Osl	d	4
49	11 Oct	21 37.3	2697.40470	-	0.20	-	0.45	Ste	e	4
50	11 Oct	22 07.8	2697.42591	-	0.14	-	0.63	Ste	d/e	4

* Refs: a) Rodonò & Andrews (unpublished) private communication b) Bruevich et al.1980 c) Andrews 1982 d) Andersen 1976 e) Contadakis et al.1980 f) Kodaira et al.1976.

** Four small flares recorded between 14-16hrs UT. Details not available.

\+ Parentheses indicate empirical relationship, $P_U = (1/7)P_B$, invoked.

++ Double peak.

clearly defined by an absence of flaring during 11.5 hours coverage over the 4 succeeding nights, 8 - 11 Sept. At least three other such groups are tentatively identified in the 1975 data. No such strong grouping appears in the 1970 data, although there is a 'switching off' on 3 consecutive nights (5 - 7 Sept 1970) during 12.5 hours coverage, EV Lac having flared over 5 consecutive nights (29 Aug - 2 Sept 1970) with no flares on either 28 Aug during 7.5 hours or 3 Sept during 6 hours.

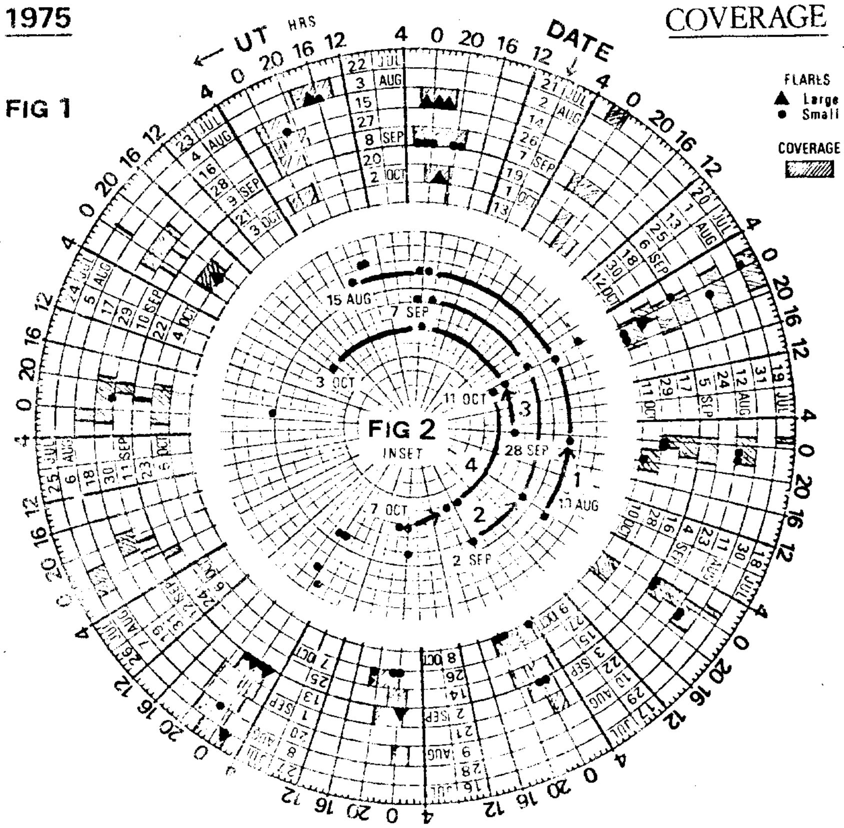
A list of all flares in 1975 is given in Table I, together with some of their observed characteristics. The Heliocentric Julian Date less 2440000^{d} ($\pm 0^{d}.00005$) of the time of flare maximum (HJD), the amplitude in U or B, the integrated intensity or equivalent duration in minutes (P), and

EV LAC

1975

FLARES AND COVERAGE

FIG 1



the flare group to which it has been assigned are tabulated. A summary of the coverage and flares is shown in Fig.1, arranged in a tentative 12-day cycle for reasons set out below. The inset (Fig.2) is a diminished version of Fig.1 with solid lines joining the hypothetical groups (Nos.1-4), with dates of commencement and termination. Symbols differentiate between large flares ($P_B > 2$ mins) and small events. When P_B is not available, it is estimated using an approximate empirical result that $P_B = (1/7)P_U$. In Table II, a summary of some relevant data for each of five groups is given,

Table II

Summary of 'Group' Data

Group	Dates 1975	Coverage hrs	Flare Nos (See Table 1)	Rate flares/hr	ΣP_B mins	Rel.Energy (*)
1	10-15 Aug	21.8	10 to 19	2.18	17.02	0.0130
2	2- 7 Sep	28.4	21 to 30	2.84	1.12	0.0007
3	28 Sep-3 Oct	18.5	36 to 40	3.08	15.75	0.0142
4	7-11 Oct	24.7	41 to 50	2.74	3.11	0.0021
(5)?	(3- 7 Aug)	(15.0)	(3 to 8)	(2.14)	(37.59)	(0.0418)

* Relative Energy/unit coverage = ΣP_B /(Coverage x 60)

the last group, No.5, consisting of flares only from the very active phase observed by Kodaira, Ichimura & Nishimura (1976) during a long observing run on a single night, and a single flare on 7 Aug. The mean rate of flaring (Table II, Col.5) is remarkably constant, but the total integrated intensities within each group vary considerably. A measure of the relative total energy per unit coverage (last Col.) also shows distinctive variations of an order of magnitude. Partly for this reason, it is suggested that the flares in 1975 occurred in several active areas, possibly at different longitudes. See Fig.3.

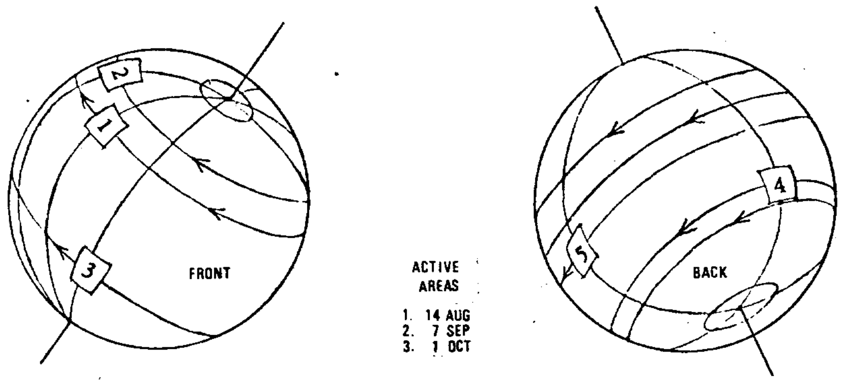


Figure 3

Interpreting 'groups' as 'active areas', a schematic representation of the visible hemisphere (front) on, say 7 Sept. 1975, would show an active area (Group 2) near the limb. After that date, it had passed around the receding limb due to stellar rotation, and could have apparently 'switched-on' initially when it first appeared 5 or 6 days previously around the other, approaching limb. This suggests a period of rotation of approximately 12 days. The separation in latitude in Fig.3 is purely arbitrary. An earlier active area (No.1) and later active areas (Nos.3-5) may be placed on the front or back hemisphere according to this hypothetical 12-day rotation period. Flares are assumed to be frequent within an active area, the life-time of which lasts typically less than one rotation, and new active areas are assumed to be relatively rare globally. Unfortunately, due to the observing window of a few hours each night (about 3-6 hrs), aliasing with 24 hours in previous frequency analyses was unavoidable. We also note that the possible binary nature of EV Lac could modify the true period with interference from a non-synchronous orbital period. Outbursts of activity, however, seem prevalent in the 1975 data. Nevertheless, the associated, small rotational velocity (v sini = 1 km/sec) for a red dwarf with a photometric radius of $0.22R_{\odot}$ (Gershberg 1970) and a rotational period of 12 days, is doubtful. A submultiple or related period is possible with additional effects due to differential rotation.

An interesting statistical anomaly is noted for three large flares in 1975, which occurred at $01^{h}14^{m}.4$ UT on 15 Aug (Catania, No.18), at $01^{h}14^{m}.0$ on 8 Sept (Herstmonceux, No.28) and at $01^{h}14^{m}.3$ on 14 Sept (Catania, No.35). After heliocentric correction, these events show a mean 'drift' of only 3 secs/day. The author has carefully searched the original Catania data, amongst others, and one interpretation is that this anomaly is a rare chance coincidence of the time of the Herstmonceux flare and the termination time of the Catania observations which depended to some extent on whether a flare was in progress at or near 'close-down', shortly after 01^{h} UT. However, further examination of the time distribution of all 50 flares of 1975 has revealed other events which are related in time, suggesting, albeit tentatively, an internal stellar 'clock', governing the appearance of flares. Approximate but significant 'periods' between flares have been reported by a number of authors for several flare stars, with searches performed using frequency analysis but these are never confirmed. A 'mean interval' between large flares has also been frequently used to define a 'photometric rotation period', as well as defining an indicator of activity. It is perhaps pertinent to this question that the estimated rotational velocity of a dMe star from an extrapolation of the spectral-type/rotation relation is about 10 km/sec which is about equivalent to a 1-day period. Spectroscopic work suggests $v \sin i$ <25km/sec (Wilson 1961). In Table III, the mean value of the quantity, $\Delta T = 1 - (T_{B-A}/N)$, which expresses the departure from the nearest whole number of days (N), of the interval (T_{B-A}), between flares B and A, per day. This 'drift rate' is recognizable in six individual sets, one of which is the above 'anomaly' (See Table III, Col.2).

Table III

Mean ΔT(Flare B - Flare A) in mins/day for six different Drift Rates

Advance(+), Retard(-)

(and rms deviation in ΔT in secs/day)

ΔT =	+2.5271	+0.0540	-2.4118	-3.9361	-6.1142	-9.8685	mins/day
B-A =	24-17	28-18	22- 2	20-16	26-15	44-23	
	35-24	35-28	[32-22] *	44-20	31-18	45-33	
	30-18		[42-32]	21-18	44-31		
	37-12	$\pm 0^{s}.9$	42- 2	46-21	33-24	$\pm 5^{s}.3$	
			36-18	39-22	39-33		
rms	$\pm 4^{s}.8$		43-33	49-39	46-39		
					34-28		
			$\pm 1^{s}.7$	$\pm 5^{s}.7$	38-34		
					37-29		
					41-31		
					44-18		
					$\pm 17^{s}.0$		

(A,B are Flare Nos from Table 1)

* Multiples of same 'interval' ($4^{d}.99162$)!

N.B. Times of flares are usually only given to nearest 0.1 min, and infrequently to nearest second, due to ambiguity in multi-peaks or very slow rise times.

Another is the sidereal drift (Col.4), commented on earlier by the present author (Andrews 1968) and by Herr (1970 & 1971). Out of the total 50 flares, 31 are thus accounted for in Table III. The rms deviation within each set is remarkably small, being of the order of the accuracy of the timing of flare events. Flare No.18 appears most frequently, which may indicate some significant patterning of the events around this event. A sidereal drift due to spurious flares occurring at the same hour angle of the telescope seems here to be ruled out, as several stations are involved. It is of particular interest that a relationship between the drift rates (ΔT) is evident for the 'retardation' sets, in that their ratios are almost constant ($\sim$1.6). See Table IV. The author has no suggestions as to the

Table IV

Ratio between Mean Drift Rates

ΔT	Ratio
+2.5271	
+0.0540	
-2.4118	>1.63
-3.9361	>1.55
-6.1142	>1.61
-9.8685	

reasons for these latter results unless they are connected with differential rotation between active areas at differing stellar latitudes. These results are sufficiently puzzling to stimulate further work on the time distribution of flares.

A. D. ANDREWS
Armagh Observatory
ARMAGH BT61 9DG
Northern Ireland.

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INFORMATION BULLETIN ON VARIABLE STARS

Number 2255

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Budapest
1982 December 22

HU ISSN 0374-0676

COMPARISON STARS WHICH TURN OUT TO BE VARIABLES

The Working Group on Standard Stars (IAU Commissions 29, 30, 45) will publish lists of comparison stars which turn out to be variables or suspected variables, in the Standard Star Newsletter. This circular will be edited twice a year.

The observers are kindly requested to point out these objects for publication in the Newsletter, writing to the following address:

Prof. Laura E. Pasinetti
Osservatorio Astronomico di Brera
Via E. Bianchi 46
22055 Merate, Italia

The deadline for the next issue is April 1st, 1983.

All contributors are anknowledged for this invaluable collaboration.

LAURA E. PASINETTI

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BZ URSAE MAJORIS - MISSING LINK BETWEEN THE DWARF NOVAE OF U GEMINORUM AND WZ SAGITTAE TYPE

BZ UMa was discovered by Markaryan (Astrofizika 4, 144) on one of his objective prism plates. The star was bright ($10^m.5$ pg) on one exposure and faint (16^m) at other dates. One further maximum ($11^m.0$ vis.) has been observed since, by members of the AAVSO (Mayall, Journ. R. Astr. Soc. Canada 66, 181).

New interest in the star has been excited by the paper of Green et al. (Publ. Astron. Soc. Pac. 94, 560) who confirmed the dwarf nova nature of the object by spectroscopic classification. I checked the region of BZ UMa on Sonneberg patrol plates taken mainly by H. Huth. At our disposal were:

I. 640 plates centred at 8^h+60^o of 1957 to 1982.4,
II. 620 " " " 10^h+60^o " " " " ",
III. 190 " with various centres of 1928 to 1956.

The quality (limiting magnitude $13^m.5$ to $14^m.5$) of the homogeneous series I and II is remarkably better than that of series III.

Table I shows the 4 maxima found on 6 plates of the series I and II, the only one of series III and the observations of Markaryan (M); the AAVSO maximum of 1971 Apr. 21 is confirmed.

Table I

Maxima of BZ UMa

Date	m_{pg}	Source	Δt
1950 Oct. 14.0 UT	13^m	III	6.3 a
1957 Jan. 24.0	12.0	I	2.0
1959 Jan. 16.1	11.0	II	6.9
1965 Dec. 21	10.5	M	5.4
1971 Apr. 23	12.3	II (2 plates), AAVSO	2.8
1974 March 20.9	11.2	I, II (2 plates)	≥8.1

Three dwarf novae of U Gem type with very long mean outburst intervals C are: SW UMa (C = 459^d, mean duration of maxima L = 15^d), DX And (430^d and 20^d), and UV Per (360^d and 7^d). WZ Sge has C = 32.6 years and L = 25^d. The mean cycle length of BZ UMa can be estimated by

$$C \approx L \cdot \frac{N}{n} ,$$

where N is the number of plates and n the number of maximum observations. In our case N/n for the series I + II will be 210 or 160 depending on the choice of N and n (whether each night is counted repeatedly in the case of several plates per night or only once). L should be in the range of 10^d ... 20^d. It follows:

$$C \approx 4.4 \ldots 11.5 \text{ years.}$$

The figures quoted for N/n obviously also match the findings of series III.

Supposed that no maxima have been missed we get from the time intervals Δt of Table I the mean value

$$L \geq 5.2 \text{ years.}$$

It should be remarked that neither the observations of the AAVSO and the SUAA/VSS nor our plates yield any eruption later than 1974.

We conclude that BZ UMa might be an intermediate object in connecting the U Gem and WZ Sge classes. The presence of emission lines of doubly and triply ionized C and N at λ = 4640 ... 4650 Å detected by Green et al. (l.c.) is in nice agreement with that suggestion.

W. WENZEL

Sternwarte Sonneberg
Zentralinstitut für Astrophysik
der Akademie der Wissenschaften
der D.D.R

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1982 UBVR PHOTOMETRY OF HD 108102

We have completed a light curve for HD 108102 (SAO 82295, BD +26° 2347) that shows it photometric variability. The data was obtained between March 17, 1982 and June 10, 1982 at the University of New Mexico's Capilla Peak Observatory. Our photon-counting system employs a cooled EMR 641A phototube and a Kitt Peak UBVR filter set. The photon counts are fed to a microcomputer, which integrates the data online to insure statistical errors for each point of about ±0.01 magnitude or less (Elston and Zeilik, 1982).

We used SAO 82325 (G5) as our comparison star. We compared the magnitude of this star at V band with that of SAO 82631 (our comparison star for UX Com) at very similar air masses for five different nights and found the total variation to be less than ±0.01 magnitude, consistent with our statistical error, so SAO 82325 appears to have constant light output.

Our results are summarized in Figures 1-4 in the instrumental UBVR magnitude system (comparison minus source). Phases were calculated using the spectroscopic period for this noneclipsing binary system, 0.9616 day (Barry, 1979), and an arbitrary epoch of 2440000.0. The nights of observation and phases covered are listed in Table I.

Variations of the light curve of about 0.04 magnitude (except for the R-filter data where more scatter is present) follow the same general pattern in all four figures. The star definitely exhibits optical variability, but the

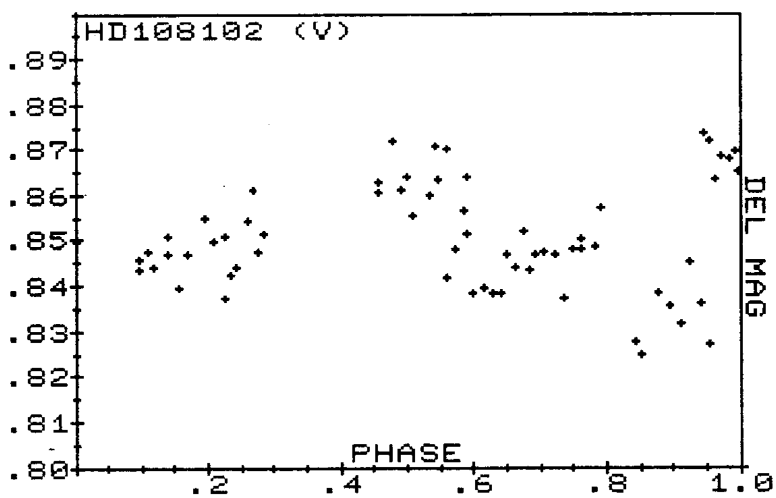

FIGURE 1

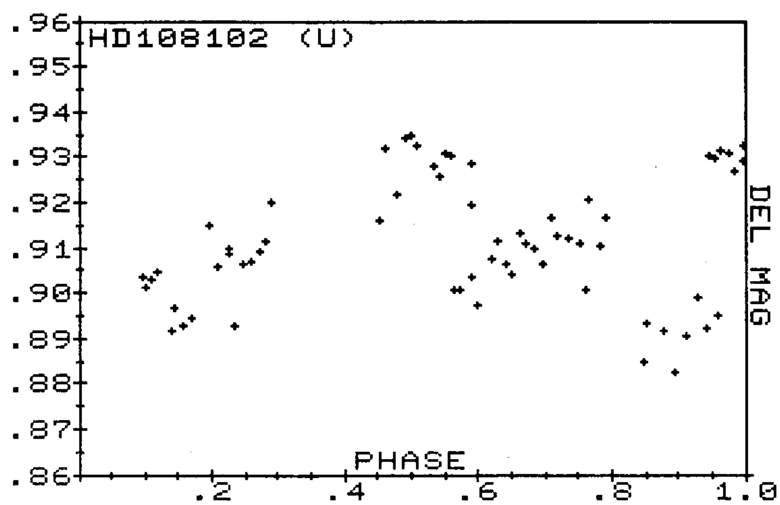

FIGURE 2

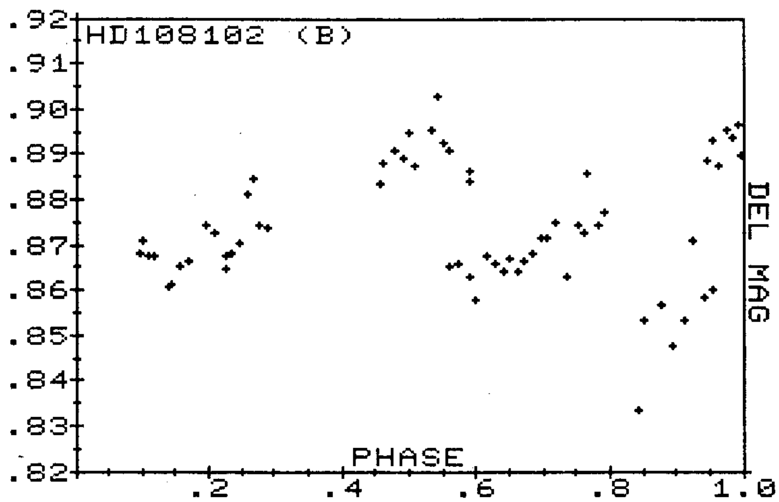

FIGURE 3

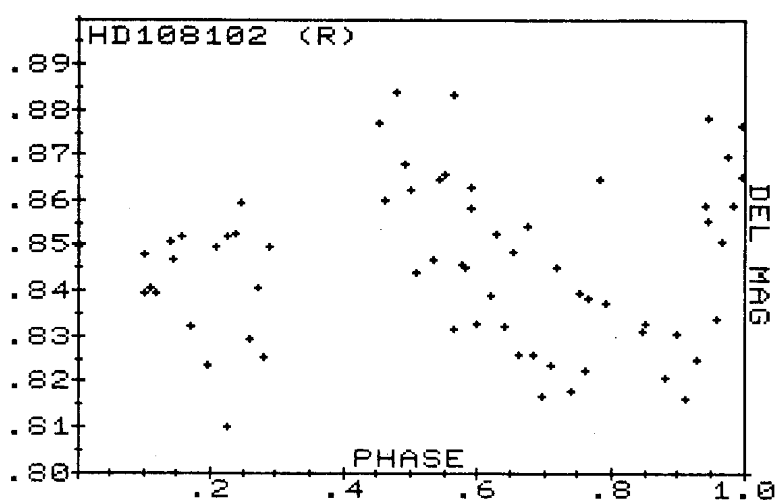

FIGURE 4

TABLE I - 1982 Phase Log HD 108102

Date (UT)	Phase	Date (UT)	Phase
3/17	0.56-0.78	5/21	0.09-0.16
4/3	0.19-0.28	5/31	0.46-0.59
4/19	0.94-0.99	6/10	0.84-0.95

regions of phase overlap (0.56-0.59 and 0.94-0.95) have such large discontinuities in magnitude that we are sure that the photometric period and the spectroscopic period are not the same. Analysis of the data using a minimum-line-length routine while varying the period indicates that other periods near one day (notably 0.82 and 1.3 day) may fit the data much better, but further analysis and new observations with smaller gaps will be required to determine the actual photometric period.

M. ZEILIK, D. BATUSKI, S. BURKE, R. ELSTON and P. SMITH

Capilla Peak Observatory
Department of Physics and Astronomy
The University of New Mexico
Albuquerque, N.M. 87131
U.S.A.

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COORDINATED ULTRAVIOLET, OPTICAL AND RADIO OBSERVATIONS OF RS CVn AND FLARE STARS

Time has been allocated on the International Ultraviolet Explorer (IUE) satellite to three groups based at Armagh Observatory (Northern Ireland), Catania Observatory (Italy) and JILA (Boulder, USA) by the British SERC, ESA and NASA Agencies, respectively, to observe RS CVn and BY Dra flare stars during the period 1-7 February 1983. The total time allocated (12 eight-hour shifts) is comparable to the period of RS CVn and BY Dra-type optical variability and many times the mean inter-arrival time between flares. As a result it is hoped to be able to monitor changes taking place in the star's UV spectrum along a complete cycle of spot-like slow variation and during any fast transient phenomenon, with particular reference to those lines indicative of physical conditions in the chromosphere, transition region and lower corona.

A similar coordinated program was carried out successfully in October 1981, and preliminary important results have been presented at several recent meetings: ADVANCES IN ULTRAVIOLET ASTRONOMY, Boulder, Colorado, NASA-CP 2238 (January 1982), THIRD EUROPEAN IUE CONFERENCE, Madrid, ESA-SP 176 (May 1982), ACTIVITY IN RED-DWARF STARS, IAU Colloquium 71, Catania (August 1982). A complete account of the 1981 collaborative program is in preparation.

We are planning to observe three RS CVn systems (RS CVn, V 711 Tau = HR 1099, II Peg = HD 224085) along a complete cycle of variability and one flare star (AD Leo or YZ CMi). Concurrent photoelectric, spectroscopic and radio observations of these stars would add considerably to the scientific program in the UV band.

Simultaneous observations are not essential for the RS CVn program, as we are mainly interested in detecting spot/plage modulation of the stellar emission vs rotation phase, which is normally a stable phenomenon over a few cycles. Nevertheless simultaneous coverage is highly desirable, whenever possible, as useful information can be obtained on any transient phenomenon that occur during the IUE exposure.

Of course, simultaneous observations of the selected flare star (YZ CMi and AD Leo) will be essential, as the study of UV-associated flare events is the principal aim of the flare star program.

Therefore we are appealing all photometric, spectroscopic and radio observers to cooperate in providing the necessary coverage. Photometric observations should consist of U, B, V preferably photoelectric measurements of RS CVn stars with respect to the indicated comparison stars (Table I).

Table I

IUE Program Stars and suggested comparison stars

Gliese	Name	HD/DM	SAO	(1950)	(1950)	V(max)	Sp	Period
501.1	RS CVn	114519	063382	$13^h08^m18^s$	+36°12'01"	7.9	F4V+K0IV	4.7979 d
	C 1	+35°2420	063401					
	C 2	+36°2347	063397					
-	V711Tau	22468	111291	03 34 13	+00 25 33	6.0	G5IV+K1IV	2.84
	C 1	22484	111292					
	C 2	22796	111334					
-	II Peg	224085	091578	23 52 29	+28 21 18	7.3	K2IVe+ ?	6.72
	C 1	+28°4667	091577					
	C 2	+28°4648	091593					
	C 3	224016	091568					
388	AD Leo	+20°2465	081292	10 16 54	+20 07 19	9.4	M4.5Ve	-
	C 1	+21°2175	081296					
	C 2	+20°2460	081274					
285	YZ CMi	-	-	07 42 04	+03 40 48	11.2	dM4.5e	2.78
	(a)	+03°1778	115869					
	(b)	-	-	(cf. finding chart by A.D.Andrews, IBVS 342,1969)				
	(e)	+04°1806	-					

Transformation to the standard UBV system is desirable. We urge photometric observes to start their observations before the actual period of IUE observations and, if necessary, to prosecute them in order to secure a good phase coverage of the light curves. Continuous photoelectric monitoring of the flare stars in the standard U or similar wave band, with integration times of between 1 to 10 seconds, during the IUE exposures is recommended. Comparison star measurements (cf. Table I) should be carried out before and after the IUE exposure /photoelectric monitoring of flare stars.

As soon as available, the final details of the observation schedule will be communicated directly to those who have shown their interest by contacting one of the undersigned at the address, or better at the telex indicated below.

P.B. BYRNE, C.J. BUTLER, A.D. ANDREWS

Armagh Observatory, Armagh BT61 9 DG
Northern Ireland
(TELEX: 747937 ARMOBS G)

M. RODONÒ, S. CATALANO, V. PAZZANI

Osservatorio Astrofisico and University
Università di Catania, 95125 Catania
Italy
(TELEX: 970359 ASTRCT I)

J.L. LINSKY, P. BORNMAN

JILA/NBS, University of Colorado
Boulder, CO 80309
U.S.A.
(TELEX: 45897 SOLTERWARN BDR)

B.M. HAISCH

Loockheed Research Laboratory
Dept. 52-12, Bldg. 255
3251 Hanover Street, Palo Alto, CA 94304
U.S.A.
(TELEX: 8953046 LKHD G)

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DELTA ERIDANI: A VERY BRIGHT NEW VARIABLE STAR

This is a very bright star ($V = 3^{m}.5$) in which Wilson (1963) reported Ca II H and K emission of intensity 1 on his 1-to-5 scale and which Keenan and Pitts (1980) recently classified K0+ IV. Examining the catalogue of Abt and Biggs (1972) and a few others we noted that published radial velocity measures seem to indicate a variation somewhat larger than can be accounted for by the expected uncertainties. These three facts made us suspect delta Eridani might be an RS CVn-type binary and therefore might be photometrically variable, as are most members of that class. The Fourth Edition of the Yale Bright Star Catalogue notes delta Eridani as "VAR?" but with no accompanying bibliographic reference.

Henry observed delta Eridani photoelectrically on 13 nights with the No. 4 16-inch at Kitt Peak National Observatory and on 4 nights with the 24-inch at Dyer Observatory; Renner observed on 9 nights with the 10-inch at Scuppernong Observatory; Fisher observed on 7 nights with his 12.5-inch in San Antonio, Texas; and Landis observed on 6 nights with his 8-inch in Locust Grove, Georgia. All observers used epsilon Eridani as the comparison star, obtained 2 or 3 differential measures on each night, corrected for extinction, and transformed to V of the UBV system.

Examination of our photometry showed that delta Eridani is variable with an amplitude of about $0^{m}.02$ and a period of about 10 days. The figure below is a plot of nightly means of the ΔV values from Kitt Peak, where Δ is in the sense variable minus comparison. A bit more than one complete cycle seems to be defined. The other observations, spread out over longer intervals of time and/or somewhat lower in accuracy, do not define this small-amplitude variation as well but are consistent with a total range of about $0^{m}.02$.

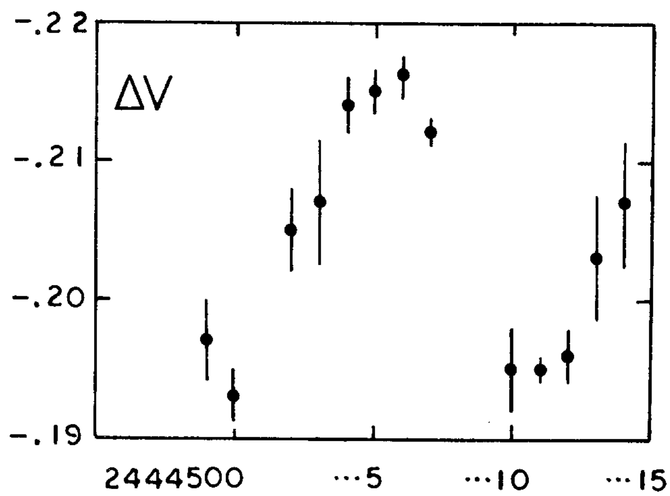

Figure 1

In the RS CVn binaries the period of any slow light variation (not attributable to eclipse, ellipticity, or reflection) is taken to be a measure of the rotation period of one star presumed to be darkened unevenly with starspots. Moreover, in all known RS CVn binaries except one (lambda Andromedae) the rotation is synchronous with the orbital motion to within a few percent (Hall 1981). Therefore we argue that, if delta Eridani indeed is a binary system, the orbital period should be around 10 days also. Spectroscopic observers will enjoy obtaining spectrograms of this bright star to check our prediction. The total radial velocity variation might, however, be quite small because of the small orbital inclination. A K0 subgiant with a radius of 5 $R_{\odot}$ and a rotation period of 10 days would have an equatorial velocity of 25 km/sec. The value of V sin i = 2.2 km/sec measured by Smith (1979) therefore would imply an orbital inclination of only $i = 5^{\circ}$. An inclination this small could, we point out, help explain why the light variation in delta Eridani is so small in amplitude.

If delta Eridani proves to be a binary, it will be the second brightest RS CVn binary known, with only alpha Aurigae being brighter.

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GORDON F. FISHER

2319 Gramercy Place
San Antonio, Texas 78201

DOUGLAS S. HALL[a]
GREGORY W. HENRY[ab]

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

HOWARD J. LANDIS

50 Price Road West
Locust Grove, Georgia 30248

THOMAS R. RENNER

Scuppernong Observatory
4512 Deerpark Drive
Dousman, Wisconsin 53118

STEVEN N. SHORE

Warner and Swasey Observatory
Case Western Reserve University
East Cleveland, Ohio 44106

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a) Guest Investigator, Kitt Peak National Observatory, operated by the Association of Universities for Research in Astronomy, under contract with the National Science Foundation.

b) now at the McDonald Observatory, Fort Davis, Texas.

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POSITIONS OF FOUR NOVAE*

The importance of the determination of coordinates and proper motions of novae has been pointed out by Artyukhina and Kholopov (1962). Positions of the novae RR Pic, CP Pup and T Pyx, which are included in Artyukhina and Kholopov's list, were determined. In addition, the position of Nova Aquilae 1982 was measured.

The observations were carried out with the GPO astrograph of the European Southern Observatory, La Silla, Chile. The focal length of the telescope is 4 m, corresponding to a scale of 51.5 "/mm. The observational data are given in Table I. AGK3 stars for Nova Aql and SAO stars for the other novae were

Table I

Observational Data

Plate	Object	Date	Emulsion/ Filter
3353	RR Pic	1979 Jan 12	098 / Red
3354	RR Pic	1979 Jan 12	098 / Red
4419	CP Pup	1981 Jan 7	2aO / -
4420	T Pyx	1981 Jan 7	2aO / -
5673	N Aql 1982	1982 Jun 15	2aO / -
5674	N Aql 1982	1982 Jun 15	2aO / -

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

used as reference stars. The plates were measured with the KOMESS of the Bonn Observatory. Our reduction model contains terms up to the third order in the coordinates X and Y. For the plates of Nova Aql only quadratic terms were used because the third order terms were not significant: The errors of the plate constants were larger than the plate constants themselves. No colour equation was found; a magnitude equation could not be detected because the reference stars are in a narrow magnitude range. Table II gives the results of our

Table II

Nova Positions

Object	Epoch of obs.	α 1950	δ 1950	Cat.	N	σ_α(0".01)	σ_δ(0".01)
RR Pic	1979.0	$06^h35^m09^s.799$	$-62^\circ35'49''.28$	SAO	20	32	21
CP Pup	1981.0	08 09 52.037	-35 12 04.35	SAO	13	53	27
T Pyx	1981.0	09 02 37.151	-32 10 47.41	SAO	22	47	43
N Aql 1982	1982.5	19 20 50.142	+02 23 35.32	AGK 3	16	24	33

N = number of reference stars

measurements. The errors in columns 7 and 8 are the mean errors of the nova positions provided from the least square solution for an individual plate. These are mainly caused by the local errors of the reference stars in the field. The internal error resulting from the comparison of the results from different plates (Nova Aql and RR Pic) is about 0".1.

In the fields of T Pyx and RR Pic, 6 stars from the Perth 70 catalogue were included in our measurements. The mean differences between the catalogue positions and our positions are given in Table III.

Table III

Mean differences between Perth 70 positions and our positions in the sense Perth 70 - our positions

Field	Δ_α(0".01)	Δ_δ(0".01)	Number of stars
T Pyx	-05 ± 20	-72 ± 24	6
RR Pic	-37 ± 10	-39 ± 14	6

It should be noted that the "astrometric position" of RR Pic as given by Wyckoff and Wehinger (1978) does not refer to the nova, but to the nearby SAO star 249586.

While finding charts of RR Pic, CP Pup and T Pyx are given by Wyckoff and Wehinger (1978), Pettit (1954), and Humason (1938), respectively, a finding chart of Nova Aql 1982 is given in Figure 1. This reproduction from

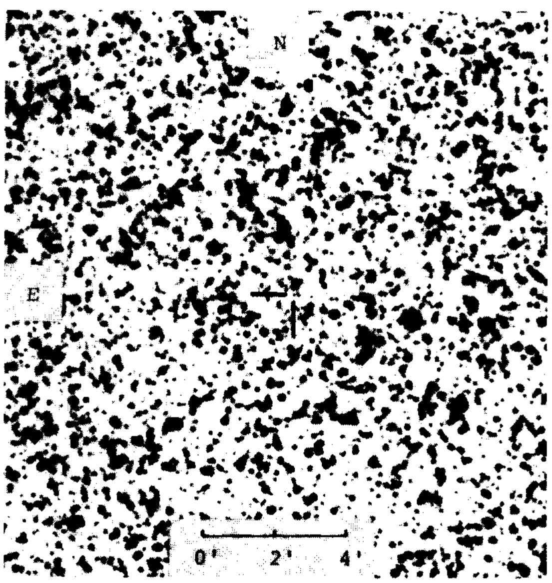

Figure 1

Finding chart for Nova Aql 1982. This reproduction from the Palomar Observatory Sky Survey red plate 323 shows a star of $R \approx 18^m$ close to the position of the nova.

the Palomar Observatory Sky Survey shows a faint star ($B \approx 20^m$, $R \approx 18^m$, the eastern component of a pair with a separation of $\approx 10''$) close to the position of the nova. The derived amplitude of $\approx 13^m$ is near the mean amplitude of novae; the red colour can at least partly be explained by interstellar extinction.

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H.W. DUERBECK and M. GEFFERT

Observatorium Hoher List
der Universitäts-Sternwarte Bonn
D-5568 Daun
Federal Republic of Germany

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VY AQUARII - CONFIRMATION OF THE 1973 OUTBURST

A star-like image at the position of the cataclysmic variable VY Aqr on chart 225 of the Papadopoulos atlas has been discovered by Mc Naught who announced this finding as a possible outburst overlooked as yet (IBVS No. 2232).

This was really an outburst; it can be confirmed on three Sonneberg sky patrol plates of the field 21^h00^o taken by H. Huth. I did the following estimates:

UT	m_{pg}	
1973 June 27.0	$>12^m.2$	invisible
July 30.0	9.5	
Aug. 1.0	9.9	
" 6.0	10.6	
" 24.0	>13.0	invisible
" 25.9	>12.0	"
" 26.9	>12.0	"
" 27.9	>13.0	"

The stars 1 to 4 of Vogt (RASNZ/VSS Publ. 8, p.8) and HD photographic magnitudes of 4 additional stars served for comparison.

W. WENZEL

Sternwarte Sonneberg
Zentralinstitut für Astrophysik
der Akademie der Wissenschaften
der DDR

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THE X-RAY SOURCE 3A1148+719 IS ANOTHER DWARF NOVA WITH VERY LONG CYCLE LENGTH

The X-ray source 3A1148+719 (= 2A1150+720) has been identified by Green et al. (Publ. Astron. Soc. Pac. 94,560) and by Patterson et al. (Bull. Amer. Astron. Soc. 14, 618) with a 15th to 16th magnitude star showing U Geminorum-like spectra. An identification of the object with the 12th magnitude Algol variable YY Draconis discovered by Tsesevich (Perem. Zvezdy 4, 291) has also been suggested because of the apparently near coincidence of the published positions.

After having inspected a sample of 950 Sonneberg sky patrol plates centred at 12^h $+80^\circ$ which were taken by H. Huth during 700 nights of the years 1963 to April 1982 I came to the following conclusions:

1. A 12th magnitude star near the given position of YY Dra (which is 3.1 minutes of arc south of BD $+72^\circ544$) is constant; no Algol variable with the properties published by Tsesevich)(l.c.: P = $4^d.21123$, range $12^m.9$...>14.5 pg) can be found. Probably the catalogued position is erroneous. In this way the fact that since Tsesevich's note in 1934 to my knowledge further observations of the genuine YY Dra have not been reported can also be explained.

2. At a place approximately 4.0 minutes of arc to the south of BD $+72^\circ544$ (and slightly following) I have found an interesting eruptive object, which could be localized easily on the Palomar prints. The plate series mentioned above shows it bright ($10^m.6$ pg) in two nights only (UT 1968 Nov. 10.8 and 1975 Nov. 23.8) and otherwise invisible fainter than the plate limit, which is about $14^m.5$ on numerous exposures and in most cases not poorer than $13^m.5$. These two eruptions are confirmed without doubts on plates of the adjacent (overlapping) field and on photovisual plates taken simultaneously. With certainty this object is the cataclysmic star classified spectroscopically and by the presence of X-ray radiation. Concerning the mean cycle length,

which should be for statistical reasons of the order of 5...20 years, the object obviously is very much alike BZ UMa (see IBVS No. 2256).

3. YY Dra is not identical with 3A1148+719; anyhow, the brightness published for the "normal" levels of the two stars contradict each other.

W. WENZEL
Sternwarte Sonneberg
Zentralinstitut für Astrophysik
der Akademie der Wissenschaften
der DDR

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A PRELIMINARY EPHEMERIS FOR THE NEWLY-DISCOVERED ECLIPSING BINARY HD 174403 (A POSSIBLE COMPANION TO THE CEPHEID BB Sgr?)

Gieren (1981) recently reported the detection of an eclipse for the 7th magnitude spectroscopic binary HD 174403 (Wilson and Joy 1950, Lloyd Evans and Stobie 1971), which is located at $\alpha(1950) = 18^h\ 48^m\ 09^s$, $\delta(1950) = -20°\ 21'\ 36''$. This star is the closest object of comparable brightness to the $6^d.6$ classical Cepheid BB Sgr (1½ arcmin distant), and has frequently been used as a comparison star for this variable, despite being of earlier spectral type (B6). In fact, it has been suggested that HD 174403 might be a physical companion to BB Sgr, despite some evidence to the contrary (Stephenson 1960, Lloyd Evans and Stobie 1971). Consequently, a full orbital and eclipse solution for this system would be very useful both for establishing its distance and for investigating its relationship to the Cepheid in more detail. We recently obtained new photometry for HD 174403 as part of a program involving the study of BB Sgr as a coronal member of the open cluster Cr 394, and independently detected an eclipse for this system. Our purpose here is to present a preliminary ephemeris for HD 174403 derived from the available data, and to draw the attention of other observers to the pressing need for more extensive photometric and spectroscopic observations of this eclipsing/spectroscopic binary system.

The photometric data used in this analysis consist of the various observations of the system (all but one at maximum light) that are alluded to by Pel (1976) and Gieren (1981), who used this object as a comparison star for BB Sgr, a single observation at maximum published by Fernie (1969), and new observations presented in Table I. Only V magnitudes are listed here. The average values for the colours of the star outside of eclipse are as follows:

V = 7.51, B-V = 0.16, U-B = -0.26, V-R = 0.11, V-I = 0.23.

These values differ slightly from those given by Gieren (1981).

Other observations of this star are reported in the literature, but lack any record of the date of observation. The useable data sample the star brightness on 70 different nights, on only two of which was the object observed to be in eclipse. Our eclipse observation of HJD 2444738.7824 found the star $0^m.36$ fainter than maximum, while the star was $0^m.23$ fainter than maximum for

Table I

Photoelectric Observations of HD 174403

HJD 2440000+	V	n	Observer	Telescope
4489.549	7.54:	3	Fernie	David Dunlap 0.5-m
4686.872	7.52	1	Pedreros	Las Campanas 0.6-m
4687.856	7.50	1	Pedreros	Las Campanas 0.6-m
4688.832	7.53	1	Pedreros	Las Campanas 0.6-m
4689.842	7.49	2	Pedreros	Las Campanas 0.6-m
4690.817	7.51	1	Pedreros	Las Campanas 0.6-m
4723.867	7.50	2	Turner	Las Campanas 0.6-m
4724.823	7.50	1	Turner	Las Campanas 0.6-m
4728.842	7.51	1	Turner	Las Campanas 0.6-m
4729.834	7.51	1	Turner	Las Campanas 0.6-m
4730.854	7.51	1	Turner	Las Campanas 0.6-m
4738.7824	7.87*	1	Turner	Las Campanas 0.6-m
4739.873	7.51	1	Turner	Las Campanas 0.6-m
4850.682	7.53:	1	Turner	Kitt Peak #4 0.4-m
4852.688	7.50	1	Turner	Kitt Peak #2 0.9-m
4854.649	7.51	1	Turner	Kitt Peak #2 0.9-m
4855.642	7.52	1	Turner	Kitt Peak #2 0.9-m
4857.645	7.52	2	Turner	Kitt Peak #2 0.9-m
5105.839	7.51	2	Pedreros	Las Campanas 0.6-m
5107.856	7.49	2	Pedreros	Las Campanas 0.6-m
5108.829	7.51	2	Pedreros	Las Campanas 0.6-m
5110.861	7.50	2	Pedreros	Las Campanas 0.6-m
5112.900	7.51	2	Pedreros	Las Campanas 0.6-m
5114.842	7.50	1	Pedreros	Las Campanas 0.6-m

* - Star in eclipse.

Gieren's eclipse observation. Our observation must correspond more closely to the brightness at mid-eclipse than that of Gieren, although by how much is still uncertain. The period of variability is presumably some fraction of $299^{d}.2846$, which is the difference in dates between the two eclipse observations.

A unique solution for the period of HD 174403 would not be possible were it not for the availability of radial velocity observations for this star. Lloyd Evans and Stobie (1971) have published 4 values for the radial velocity of HD 174403 derived from plates obtained on 4 nights in 1969-70, and we can quote an additional measure of -2.8 (± 2.2) km s^{-1} (based on 8 lines) from a 12 Å mm^{-1} plate of HD 174403 obtained in May 1980 (HJD 2444375.855) with the Cassegrain spectrograph on the David Dunlap Observatory 1.9-m telescope. The velocity measures suggest a period of about 60 days for the system, but we tested for the true period using all reasonable integral fractions of $299^{d}.2846$. Only for P = $59^{d}.86$ are the radial velocity observations consistent with the phase of primary eclipse occurring when the primary is on the far side of its orbit. A detailed orbital solution is not possible with so few observations, but a reasonable guess at the radial velocity curve for HD 174403 based upon the 5 measures is presented in Figure 1. Estimates for the orbital elements of the system, as derived from this curve, are as follows:

$V_o = -8.3$ km s^{-1}	$e = 0.31$	$a \sin i = 0.08$ A.U.
$K = 15.3$ km s^{-1}	$\omega = -23°.98$	$f(M_1,M_2) = 0.019$

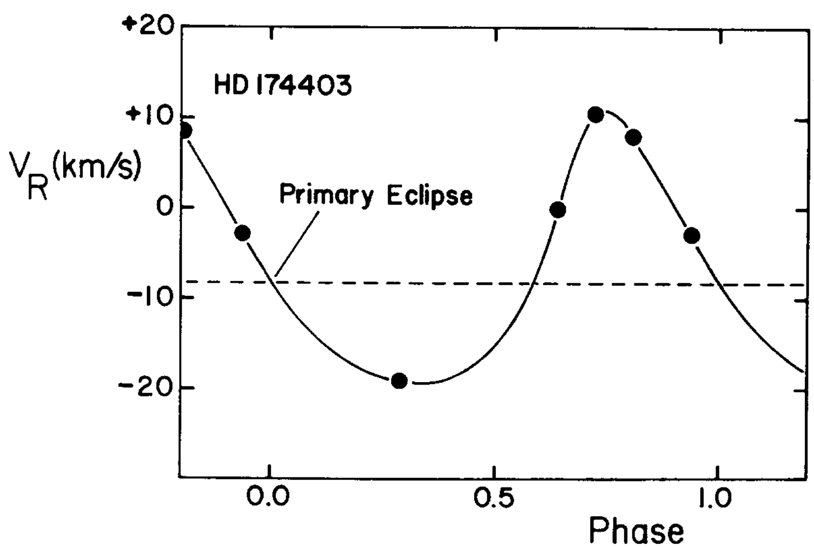

Figure 1

A preliminary ephemeris for the times of primary eclipse in HD 174403 is:

$$\text{HJD } (V_{min}) = 2444738.7824 + 59.8569 \text{ E} .$$

A search through the available photometry confirms that none of the other observations, other than the two already mentioned, were made at the times of primary eclipse. A secondary eclipse is expected near phase 0.585 according to the radial velocity data, and an observation by Pel (1976) on HJD 2440823.317 coincides with this exactly. However, Pel did not note any significant change in brightness for HD 174403 on this date, so the depth of secondary minimum is presumably not more than 0.01 or 0.02 in V.

It is possible to make some predictions about the components of HD 174403 by using the radial velocity data, the photometric data, information on the spectral type (B6 IV) of the primary, and the knowledge that $i \simeq 90°$. On this basis, we estimate the masses of the two components of HD 174403 to be about

6 $M_\odot$ and 1 $M_\odot$, respectively. The luminosity of the primary inferred from its spectral type (and from an unpublished Hβ observation by J.D. Fernie) is $M_V \simeq -1.5$, and the probable value of ΔV between the two stars in the system is perhaps 6^m. The lack of detectable secondary eclipses in the system would seem to confirm this last estimate.

From the photometric data we find a reddening for HD 174403 of $E_{B-V} = 0.30$, and a distance of 415 pc ($V_o-M_V = 8.09$). In contrast, the cluster Cr 394, of which BB Sgr is probably a member, has a reddening of $E_{B-V} = 0.33 \pm 0.01$ m.e. for member stars near HD 174403 (and BB Sgr), and a distance of 646 pc ($V_o-M_V = 9.05$). The radial velocity of BB Sgr (Gieren 1982) is about 11 km s^{-1} more positive than that of HD 174403, so one might conclude from the evidence that the two are not physically related. Nevertheless, there are enough uncertainties in some of these quantities that the question cannot be considered as fully resolved. Gieren (1982), for example, has suggested that BB Sgr may itself be a spectroscopic binary, in which case a comparison of radial velocities for it and HD 174403 (particularly in the absence of velocity measures for Cr 394 members) may not be entirely meaningful. The luminosity of HD 174403 is also not well-determined from the spectroscopic data, and the star does fit extremely well onto the top end of the main-sequence in the cluster H-R diagram, as do cluster stars which photometrically appear to be of spectral type B6 IV. Thus, until an eclipse solution for HD 174403 becomes available, it seems best to postpone further discussion of its possible relationship to the Cepheid BB Sgr.

DAVID G. TURNER
Department of Physics and Astronomy
Laurentian University
Sudbury, Ontario, P3E 2C6, Canada

MARIO PEDREROS
Department of Astronomy
University of Toronto
Toronto, Ontario, M5S 1A7, Canada

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PHOTOELECTRIC UBV OBSERVATIONS OF PU Vul IN 1982

The following observations are a continuation of similar measurements performed on the same object in 1981 (IBVS No. 2071).

All data presented were obtained with the 24 inch Ritchey-Chrêtien telescope of the L.Figl Observatory. Except for the addition of a digital counter (R70) and a printer the same equipment was used for the observations as described in our first paper. BD +21°4165 = SAO 88548 (star A) was used as primary comparison star which in turn was checked in most nights against BD +20°4533= SAO 88572 (not SAO 88573 as erroneously written in IBVS No. 2071). A slight systematic light variation of about $\Delta V = \pm 0^m.01$ between these two stars seems to be present. No final conclusion could be drawn on the nature of this variation. With regard to this we plan to follow both objects more closely during the next observing season.

As in 1981 all measurements were reduced to star A with its adopted magnitudes V = 9.300, B - V = + 0.520 and U - B = + 0.030. This is somewhat arbitrary since we have not yet performed an accurate tie-in of this star to the UBV system. Since star A is very close to the variable no correction for extinction was applied.

Table I shows the numerical results. All errors quoted are the mean errors of the mean. n gives the number of comparisons in each colour. In several nights with very poor sky conditions only V magnitudes could be obtained.

During the whole observing period lasting from early April to December PU Vul was always at maximum light. This means that the actual maximum has been lasting already 130 days longer than the previous one. Compared to the last year the object showed much more structure in the light curve, which is plotted for V, B and U in Figure 1. In general the variations behave more similar for V and B compared to U.

This is even more evident from the two colour diagram (Figure 2) producing a pronounced scatter in the vertical direction. The most remarkable activity started around September 7 with a steep decrease of the B and V brightnesses followed a few days later by the U brightness. The respective gradient for

Table I

UT 1982	JD 2445...	V	n	B - V	n	U - B	n
04 06,10	065,60	8,567±0,004	10	0,669±0,004	10	0,450±0,004	10
17,13	076,63	8,599 2	14	0,669 4	12	0,448 4	7
05 15,03	104,53	8,581 2	10	0,698 2	11	0,481 4	10
16,02	105,52	8,556 3	10	0,711 3	10	0,477 5	10
17,03	106,53	8,578 3	10	0,708 4	10	0,490 3	12
18,02	107,52	8,590 7	6	0,730 7	6	0,471 8	3
19,02	108,52	8,589 2	10	0,706 4	10	0,500 5	10
27,03	116,53	8,562 3	10	0,709 4	10	0,502 6	10
28,02	117,52	8,561 5	10	0,720 6	10	0,485 8	10
31,02	120,52	8,558 3	9	0,710 3	10	0,493 4	10
06 01,05	121,55	8,545 1	5	0,717 3	5	0,493 6	5
06,00	126,50	8,563 3	10	0,705 3	6	0,496 3	6
08,98	128,48	8,548 9	10	0,717 9	10	0,459 13	4
07 02,89	153,39	8,664 6	6				
02,95	153,45	8,658 3	12	0,738 4	10	0,487 2	10
03,00	153,50	8,672 3	7				
05,92	156,42	8,657 3	12	0,710 4	10	0,476 4	10
08,97	159,47	8,612 4	10	0,700 5	8	0,482 7	9
10,93	161,43	8,611 2	13	0,699 3	10	0,479 6	9
14,89	165,39	8,581 2	10	0,694 3	11	0,473 4	10
21,90	172,40	8,604 2	7	0,683 3	3	0,534 11	5
29,99	180,49	8,692 4	10	0,682 10	9		
30,96	181,46	8,713 2	4				
08 01,95	183,45	8,743 3	18	0,685 4	13	0,408 5	12
04,01	185,51	8,796 5	17				
05,93	187,43	8,738 3	10	0,682 5	10	0,413 9	10
10,95	192,45	8,645 10	4				
11,87	193,37	8,625 3	12	0,725 4	11	0,497 6	8
15,87	197,37	8,607 3	10	0,706 4	11	0,509 7	9
18,82	200,32	8,631 2	5	0,729 6	6	0,539 8	5
22,81	204,31	8,654 4	12	0,699 7	5	0,519 10	6
25,80	207,30	8,622 3	9	0,688 5	6		
09 03,91	216,41	8,599 3	10	0,684 4	8	0,523 7	8
04,85	217,35	8,567 2	6	0,691 4	7	0,569 10	6
13,86	226,36	8,625 6	9	0,710 8	10	0,484 5	9
14,83	227,33	8,665 5	10	0,700 7	10	0,477 11	10

Table I cont.

UT 1982	JD 2445...	V		n	B - V		n	U - B		n
09 17,82	230,32	8,927±0,003		10	0,699±0,004		10	0,381±0,007		10
18,82	231,32	8,949	3	10	0,674	4	10	0,357	7	10
18,85	231,35	8,939	7	3	0,685	7	3	0,340	4	3
18,88	231,38	8,931	9	3	0,676	10	3	0,349	31	3
18,90	231,40	8,930	13	3	0,688	14	3	0,356	9	3
18,91	231,41	8,941	5	3	0,662	7	3			
18,94	231,44	8,928	2	3	0,675	5	3			
18,95	231,45	8,947	5	3	0,654	7	3			
18,98	231,48	8,924	2	3	0,670	5	3			
19,00	231,50	8,921	5	3	0,679	7	3			
19,81	232,31	8,870	4	10	0,680	5	10	0,389	16	12
19,84	232,34	8,875	6	3	0,681	9	3			
19,86	232,36	8,882	5	3	0,656	9	3			
19,89	232,39	8,864	3	3	0,689	5	3			
19,91	232,41	8,886	8	3	0,675	9	3			
19,93	232,43	8,883	2	3	0,679	3	3			
19,95	232,45	8,889	3	3	0,672	4	3			
19,97	232,47	8,886	8	3	0,667	11	3			
20,00	232,50	8,876	7	3	0,677	7	3			
20,82	233,32	8,845	4	9	0,699	4	8	0,401	8	9
20,95	233,45	8,826	5	8						
20,98	233,48	8,824	8	5						
21,01	233,51	8,824	4	6						
28,87	241,37	8,612	18	12	0,684	19	17	0,483	13	10
29,78	242,28	8,600	3	12	0,682	3	11	0,464	4	12
10 03,81	246,31	8,646	3	10	0,674	5	10	0,473	8	10
07,82	250,32	8,623	3	11	0,626	4	10	0,455	7	10
11,79	254,29	8,635	6	10	0,56:					
16,77	259,27	8,528	3	11	0,584	4	11	0,353	5	10
18,81	261,31	8,587	4	11	0,566	5	10	0,380	9	8
20,76	263,26	8,596	2	9	0,556	3	8	0,355	8	9
22,77	265,27	8,599	5	9	0,538	7	9	0,336	10	9
27,78	270,28	8,520	4	9	0,542	4	9	0,294	8	9
30,74	273,24	8,504	4	9	0,546	8	9	0,254	10	9
31,74	274,24	8,472	6	9	0,547	6	9	0,252	6	9
11 01,74	275,24	8,472	2	6	0,540	3	6	0,255	4	9

Table I cont.

UT 1982	JD 2445..	V		n	B - V		n	U - B		n
11 02,76	276,24	8,464±0,002		6	0,535±0,003		6	0,244±0,006		7
03,81	277,31	8,480	1	5	0,526	2	5	0,227	8	4
04,75	278,25	8,464	3	6	0,516	5	6	0,225	7	7
06,72	280,22	8,467	3	9	0,522	5	7	0,229	7	9
11,72	285,22	8,469	5	9	0,500	5	9	0,226	9	9
12,73	286,23	8,476	2	9	0,506	4	9	0,245	9	9
19,73	293,23	8,497	3	8	0,521	4	9	0,285	11	3
20,68	294,18	8,508	3	10	0,517	5	6	0,270	7	6
21,72	295,22	8,507	4	9	0,506	4	9	0,267	5	9
22,71	296,21	8,487	2	3	0,511	4	3	0,289	12	3
23,73	297,23	8,495	3	7	0,517	4	9	0,271	9	13
25,73	299,23	8,489	2	7	0,517	4	4	0,266	7	9
12 03,70	307,20	8,522	4	9	0,528	4	4	0,286	3	9
05,69	309,19	8,516	4	5	0,530	4	4	0,282	5	9
10,69	316,19	8,522	29	4						

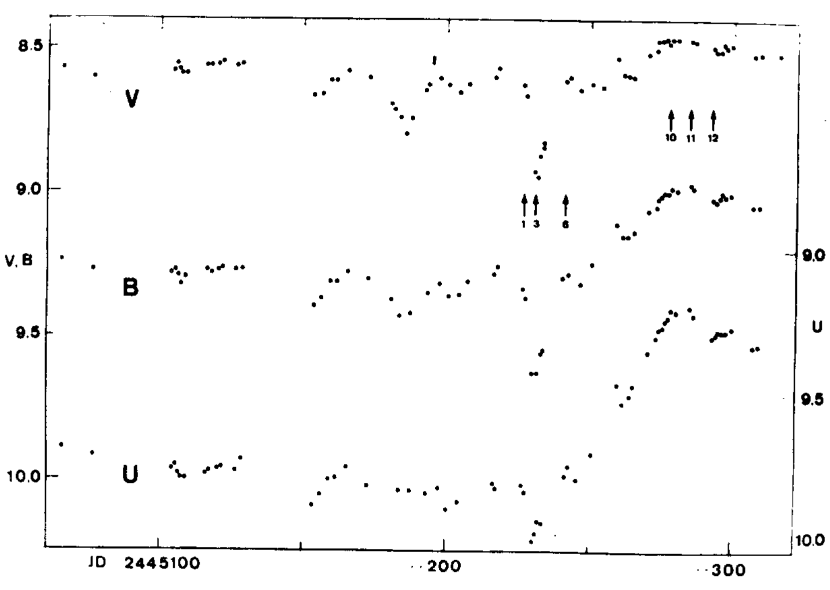

Figure 1

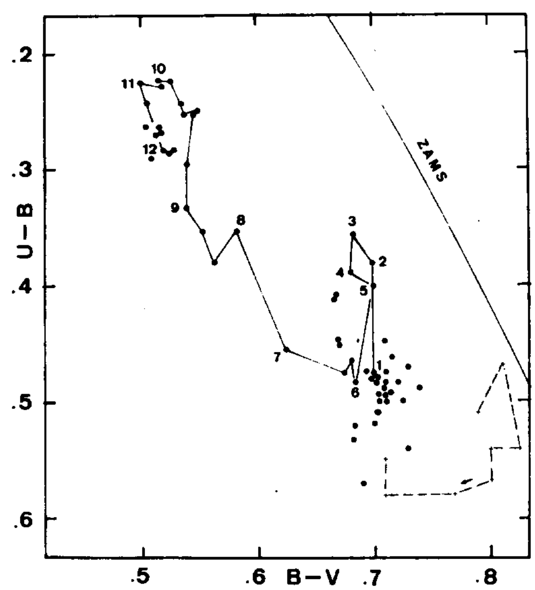

Figure 2

all three colours was almost $0^m.1$ day^{-1}. In the U band this "minimum" ($\Delta U \approx 0^m.2$) was only half as deep as in B and V. Two weeks later PU Vul in all three colours reached the original level again. The following increase was strongest in U ($\Delta U \approx 0^m.6$; gradient about $0^m.016$ day^{-1}) while in V the brightening amounted only to $0^m.15$. A new "maximum" in all three bands occured around November 6. Since then the object faded slowly with some oscillation, somewhat faster in B and V and still faster in U. Figure 2 shows the path of the variable at this long active phase in the two colour diagram. For comparison we also indicated the path of the rise of PU Vul last year according to our own observations by a dashed line. The position of PU Vul in the two colour diagram at maximum light during last year is well within the bulk for 1982. The numbers in Figure 2 refer to phases indicated in Figure 1 by arrows. The last three weeks of the slow fading are characterized by a relatively stable position in the two colour diagram.

Chochol et al. (1981) suggested the presence of a 78 respectively 75 days period with an amplitude of some $0^{m}.2$ in V. Considering the observed activities we did not attempt to check this hypothesis.

A. PURGATHOFER

A. SCHNELL
Institute for Astronomy
University of Vienna
Türkenschanzstraße 17
A-1180 Vienna, Austria

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PHOTOGRAPHIC OBSERVATIONS OF THE MAGNETIC BINARY SYSTEM PG 1550 +191

The AM Herculis-type magnetic binary star PG 1550 +191 has been discovered by S. Liebert et al. (1982, Ap.J. 256, 594) on the Palomar Green Survey (PG) of blue stellar objects at high galactic latitude.

The star shows polarization and light variations with a period of $0^d.078873$ (Liebert et al. 1982). Its mean infrared color index is similar to that of AM Herculis high state.

The star was observed on seventeen plates obtained at Asiago with the 40/50/100 cm Schmidt during the period August 1972 - May 1981. The time of exposure was five minutes on the average.

We have determined the brightness of the variable during the period covered by the present observations. The derived magnitudes are reported in Table I.

Table I

JD 244...	m_{pg}	JD 244...	m_{pg}
1534.3921	15.7	3284.5483	14.7
1572.3143	15.1	3306.5527	15.5
2272.3643	14.9	3664.5882	15.1
2519.5961	15.0	3986.5555	15.4
2549.5649	14.8	4017.5135	15.6
2606.4839	15.0	4372.5392	15.2
2904.6017	15.0	4402.4581	15.6
3227.6416	15.0	4402.4651	15.1
		4753.4981	15.0

Although the observations were not sufficient to improve the period given by Liebert et al., they showed that the star was always in its high state.

The variation of brightness from 14.7 to 15.7 was due to eclipses.

G. ROMANO

Istituto di Astronomia
Università di Padova

Erratum: In IBVS No. 2161 (1982 June 15), the new variable star is not GR 306 but GR 310.

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PHOTOGRAPHIC OBSERVATIONS OF THE CENTRAL STAR IN THE PLANETARY NEBULA NGC 2346

In IBVS No. 2113 Kohoutek (1982) has reported drastic changes in the light curve of the central star of the bipolar planetary nebula NGC 2346. These were interpreted as a partial or near total eclipse of the main component of a close-binary system. An orbital period of 17.2 ± 0.4 days was estimated from the light curve.

Earlier radial velocity measurements by Mendez and Niemela (1978) and Mendez (1980) indicated a shorter period of 16 days for the system.

One of us (Marino) observed this system visually in 1982 April using the sequence magnitudes published by Kohoutek. In the five cycles which had elapsed since Kohoutek's data the O-C residual of the minimum using his ephemeris was -6.0 ± 2.0 days. These observations, together with estimates made visually from four photographs taken by Williams, have been presented at the 1982 Annual Conference of the RASNZ (Marino and Williams, 1982). A period of 16.0 ± 0.1 days, consistent with the radial velocity results, was found to be a better fit.

In this circular we present refined estimates of the four photographic observations, plus estimates made from a further 20 photographs exposed by Williams during 1982 May-June. These include exposures during two further minima.

The instrument used for the photography was a 53 cm Cassegrain telescope, owned by Williams, with an f/3 primary mirror stopped down to f/4 to reduce coma at the edges of the photograph. Exposures were for 5 minutes made at the prime focus on Kodak Tri-X film with a yellow filter to approximate visual magnitudes. Prints were made at a scale of 10 arc seconds per 1 mm. Magnitudes were estimated by Marino by visual comparison of the photographic image of the variable with those of the adjacent sequence stars. The reduced magnitudes are listed in Table I.

Table I

Photographic observations of the central star of NGC 2346 in 1982 May-June.

JD 2445000+	m_v	JD 2445000+	m_v
090.8	fainter than 14.2	113.8	11.5
091.8	14.0	114.8	11.6
092.8	12.5	115.8	11.4
093.8	11.8	116.8	11.4
094.8	11.6	117.8	11.9
095.8	11.4	118.8	12.7
099.8	11.5	119.8	14.0
100.8	11.7	120.8	fainter than 14.2
101.8	11.9	127.8	11.4
105.8	fainter than 14.2	128.8	11.4
106.8	fainter than 14.2	129.8	11.3
111.8	11.5	130.8	11.6

Determination of the magnitude at minimum was made difficult by the surrounding nebulosity. In the cases marked 'fainter than 14.2' no positive stellar image could be separated from the nebulosity.

The period of approximately 16 days is confirmed by the additional two minima.

The magnitudes derived by this method are unlikely to be completely consistent with the earlier published photoelectric observations. They should however be sufficiently close to allow some valid comparison to be made. The light curves when plotted suggest the depth and width of minimum may now be greater than previously, and the duration of maximum light shorter by some one to two days.

Photography a few days each side of predicted minima will be continued and supplemented by visual observations by local variable star observers during the coming observing season.

BRIAN F. MARINO and H.O. WILLIAMS

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

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VY AQUARII

According to Mc Naught (1982) this erupting star (1907, 1962) appeared to have been in outburst in 1973. The outburst could be confirmed by Wenzel (1983).

By investigating 1066 sky patrol plates (from 1928 to 1982) of the fields $21^h 0^\circ$, $21^h - 4^\circ$, and $21^h - 18^\circ$ taken by H. Huth and predecessors I found the brightness decline of an outburst in 1958.

The plates used to obtain the lightcurves during the two additional outbursts given below include some with the object far out of the centre. Dots are from blue plates, circles from red plates. The extrapolated maxima of the

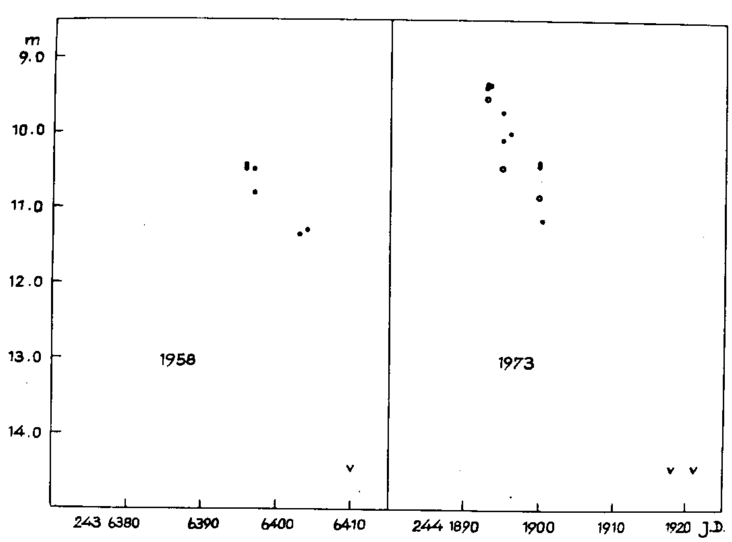

Figure 1

outbursts appear to have occured around 1958 June 25...June 30 and 1973 July 20. The blue colour near maximum light seems to indicate that there is no strong H alpha emission typical for nova spectra. Instead, the blue colour resembles U Geminorum stars.

Altogether there have been observed 4 outbursts in a period of 55 years. The probability that a further outburst was overlooked due to bad weather or moonlight is below 50%. As our sky patrol could watch this part of the sky only in the season from June to November, for this object the total number of outbursts in this 55-year period may be about 8 to 10 corresponding to a mean cycle length of about 5 to 7 years. This comparatively short cycle length and the presumable absence of strong H alpha emission near maximum light seem to indicate that VY Aquarii is a dwarf nova which resembles WZ Sagittae rather than a recurrent nova.

This object should be watched for the next brightness maximum in order to allow spectroscopic investigations during the time of the maximum and the whole course of the decline.

G.A. RICHTER

Akademie der Wissenschaften der DDR
Zentralinstitut für Astrophysik
Sternwarte Sonneberg

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ON THE VARIABILITY OF THE 5200 Å STRUCTURE FOR α^2CVn

The magnetic star α^2CVn has been investigated at Toruń Observatory in order to look for the variability of the broad absorption structure at about 5200 Å. The observations were made in May-July 1982 by means of the Canadian Copernicus Spectrograph on the 90 cm Schmidt-Cassegrain telescope. The spectrograph has an image-slicer of 3 arcsec aperture, giving the reciprocal dispersion of about 160 Å/mm. The spectra were taken on Kodak IIa-F preflashed plates.

The standard stars αLyr, αAql and γUMa were observed along with α^2CVn to remove the influence of emulsion sensitivity, instrument transmission characteristics and atmospheric extinction.

For resulting spectra of α^2CVn the continua have been drawn as straight lines between 4900 and 6200 Å, according to Mihalas' (1966) model of A star. The equivalent widths of the range 4900-5400 Å have been computed. Their phase dependence is shown in Figure 1. The phases are computed according to the ephemeris found by Farnsworth (1932).

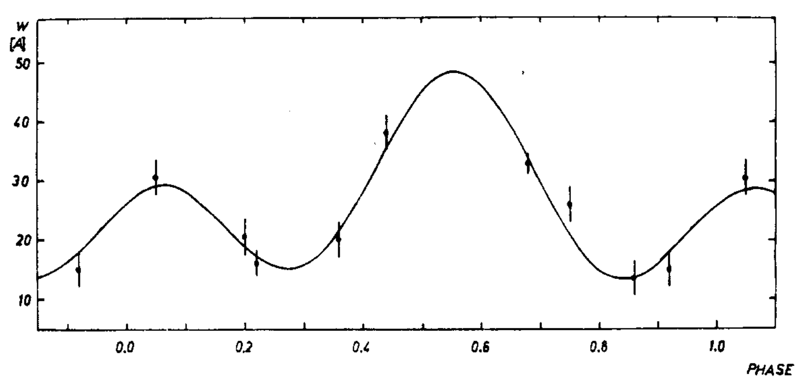

Figure 1: Phase variation of equivalent width of the 4900-5400 Å region in the spectrum of α^2CVn. Standard deviations are indicated. The solid line is a best fitted double-wave obtained by least squares method.

The Pearson's approximation quality parameter χ^2 is 2.74 in this case. Because of the small number of observational points we checked the reliability of our results trying to approximate the sets of casual points located at the same phases and with the same errors like in the case of observations, by the double-wave. This procedure has been applied to 100 various sets. The mean χ^2 for them is of an order of magnitude greater than for the observations.

As can be seen the variability of the 5200 Å structure is clear. The maxima of the double-wave are in good agreement with those obtained by Burbidge and Burbidge (1955) and Cohen et al. (1969) for equivalent widths of individual elements. The maximum at $\varphi = 0.05$ corresponds to group A elements (rare earths, Ti, Mn) and that at $\varphi = 0.55$ to group B (Fe, Cr).

Further observations are still running and a detailed discussion will be published elsewhere.

J. GERTNER, M. MUCIEK, M. MIKOLAJEWSKI

Institute of Astronomy
Nicolaus Copernicus University
ul. Chopina 12/18 87-100 Torun,
Poland

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uvby OBSERVATIONS OF V471 Tau IN OCTOBER 1981*

The red dwarf - white dwarf binary V471 Tau is for many reasons one of the most interesting close binaries. One of the aspects is the spot activity of the K2V component due to the fast, orbitally synchronized rotation (P=0.521 d). The time scale of spot re-arrangements on this star is very short, of the order of days, as documented in a number of studies, e.g. in the 1976 uvby photometry on 9 consecutive nights by Rucinski (1981).

Here, new uvby observations obtained also on 9 consecutive nights of the last decade of October 1981 are presented. They have been collected with the simultaneous four-colour photometer on the 50 cm Danish telescope in ESO, La Silla, Chile (Grønbech et al. 1976). Up to 40 standard stars were observed each night and the following data for the comparison star HD 24040 have been obtained from 9 independent tie-ins to the standard system: $V = 7.508 \pm 0.002$, $(b-y) = 0.412 \pm 0.001$, $m_1 = 0.221 \pm 0.001$, $c_1 = 0.380 \pm 0.002$. These values differ slightly from those given in Rucinski (1981) and are probably of a higher quality than the previous data.

The differential observations of V471 Tau are listed in Table I and are plotted in Fig. 1 together with the 1976 light curve. The observations were obtained normally only once per night, at culminations through air-masses about 1.47. The time in Table I is expressed in heliocentric modified Julian Days (MJD = JD - 2 400 000.5); the phases have been computed from the ephemeris of Oliver and Rucinski (1978) for the segment C of their (O-C) diagram: MJD 40609.56642 + 0.52118294 E.

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

Table I

Differential observations of V471 Tau

(relative HD 24040)

MJD (hel)	Phase	ΔV	Δ(b-y)	Δm_1	Δc_1
44898.235	0.721	1.924	0.116	0.099	-0.271
.300	.844	1.941	0.108	0.121	-0.292
44899.278	.721	1.929	0.097	0.125	-0.240
44900.248	.582	1.965	0.117	0.093	-0.289
44901.250	.506	1.966	0.118	0.101	-0.315
44905.203	.088	1.961	0.102	0.113	-0.254
.282	.241	1.941	0.113	0.105	-0.294
44906.231	.063	1.953	0.108	0.117	-0.271
44907.254	.024	1.973	0.118	0.120	-0.164
44908.255	.946	1.946	0.112	0.097	-0.248
44909.253	0.861	1.944	0.112	0.108	-0.257

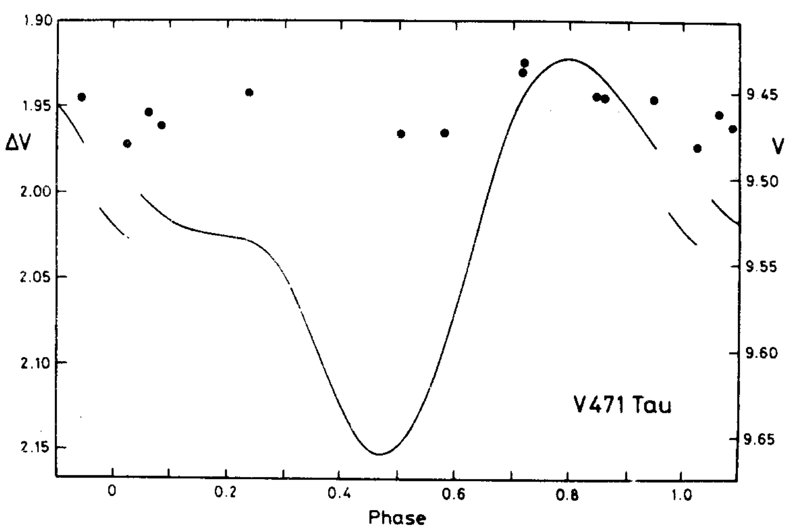

Fig.1 The October 1981 observations of V471 Tau plotted on the phase diagram together with the 1976 light curve.

The new observations indicate that the variability of V471 Tau almost disappeared in October 1981 with the brightness level ($\Delta V = 1.95$) stabilized close to the maximum brightness observed in 1976 at phase 0.81 ($\Delta V = 1.92$). The mean differential indices (all observations outside eclipse): $\Delta(b-y) = 0.110 \pm 0.002$, $\Delta m_1 = 0.108 \pm 0.003$, $\Delta c_1 = -0.273 \pm 0.008$ were also close to those observed at the light maximum in 1976: $\Delta(b-y) = 0.108$, $\Delta m_1 = 0.110$, $\Delta c_1 = -0.288$ but differed from those at the light minimum in 1976 at phase 0.5: $\Delta(b-y) = 0.135$, $\Delta m_1 = 0.095$, $\Delta c_1 = -0.360$. This sheds new light on the unexplained peculiarity of colours at light minimum noticed previously and suggests that this peculiarity was not caused by the reflection effect of the white dwarf light.

These observations have been collected at ESO, La Silla during my association with the Max-Planck-Institut für Astrophysik, Munich; I am grateful to the Directors of the Institute for extending its excellent facilities to me.

S. M. RUCINSKI
Institute of Astronomy
Madingley Road
Cambridge CB3 OHA, England
(on leave from the Warsaw University
Observatory)

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uvby OBSERVATIONS OF HD 5303 IN OCTOBER 1981*

The observations of the RS CVn-type southern binary HD 5303 (Collier et al. 1981) have been obtained on 12 consecutive nights of the last decade of October 1981. The simulatneous four-colour photometer on the 50 cm Danish telescope in ESO, La Silla, Chile (Grønbech et al. 1976) was used. Up to 40 standard stars were observed each night to tie the observations of the variable and three auxiliary stars to the standard uvby system. Star HD 5499 was used as the primary comparison. The four colour indices of the auxiliary stars are listed in Table I. The mean errors of all photometric data in that table are typically 0.002 to 0.004.

Table I

Auxiliary stars for HD 5303

Star	HD	CPD	Sp	No. of nights	V	b-y	m_1	c_1
Comparison	5499	$-74^{\circ}74$	K1IV	11	6.685	0.595	0.435	0.380
Check 1	5210	$-75^{\circ}66$	G1/2V	11	8.691	0.375	0.193	0.299
Check 2	4815	$-75^{\circ}64$	K4III	5	5.081	0.847	0.740	0.402

Table II

Differential observations of HD 5303 (relative HD 5499)

MJD (hel)	Phase	ΔV	Δ(b-y)	Δm_1	Δc_1
44898.106	0.814	0.842	-0.128	-0.241	-0.084
44899.079	.162	0.840	-0.131	-0.256	-0.080
44900.076	.519	0.845	-0.117	-0.269	-0.057
.253	.582	0.818:	-0.123:	-0.244:	-0.099:
44901.112	.889	0.878	-0.124	-0.244	-0.068
44903.048	.581	0.834	-0.123	-0.281	-0.081
44904.080	.950	0.928	-0.123	-0.252	-0.073
44905.061	.300	0.795	-0.115	-0.252	-0.066
44906.086	.667	0.810	-0.113	-0.247	-0.072
44907.098	.028	0.951	-0.120	-0.238	-0.092
44908.101	.387	0.813	-0.130	-0.238	-0.071
44909.066	0.732	0.808	-0.120	-0.238	-0.069

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

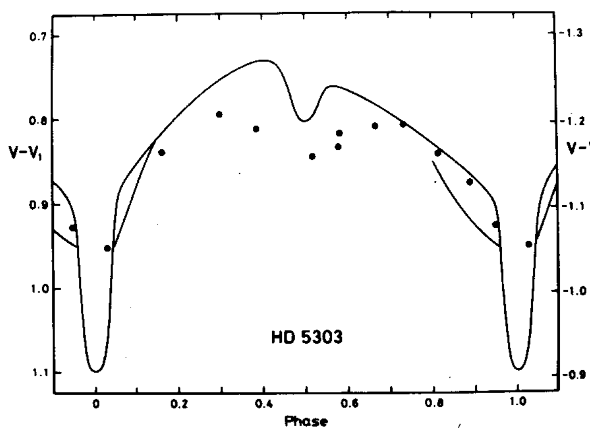

Figure 1: The new observations of HD 5303 plotted together with the light curves of Collier et al. (1981) which were obtained in 1979 and 1980.

The differential observations of HD 5303 are listed in Table II and plotted in Fig. 1. They were obtained normally only once per night, through air-masses between 1.44 and 1.54. The time in Table II is expressed in heliocentric modified Julian Days (MJD = JD - 2 400 000.5). The phases have been computed from the ephemeris given in the note added in proof in Collier et al. (1981).

The differential data in Fig. 1 are plotted together with the light curve copied from graphs given in Collier et al. who already noticed rather large changes in the light curve in time-scales of a few months (this is marked in the schematic light curves in Fig.1). Here we would like to note a rather substantial change in shape around the secondary minimum and a moderately good agreement with one of the previous light curves at the primary minimum.

S. M. RUCINSKI
Institute of Astronomy
Madingley Road
Cambridge CB3 OHA, England
(on leave from the Warsaw University
Observatory)

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TIMES OF MINIMUM LIGHT AND THE LIGHT ELEMENTS FOR Y CVn

Three times of minimum light of the semiregular variable carbon star Y CVn were derived from photoelectric measurements made at Brno Observatory in the years 1980-82. Six other times are based on visual observations of Biskupski (1963) and on photoelectric measurements of Dzervitis et al. (1979). All the minima observed are collected in the following table:

JD_{Min}	O-C	Observer	JD_{Min}	O-C	Observer
243 6100	2.5	Biskupski	244 2140	-0.7	Dzervitis
6350	0.7	Biskupski	4410	-3.1	Vetešnik
6600	-1.1	Biskupski	4660	1.3	Vetešnik
244 1630	-7.1	Dzervitis	5165	2.7	Vetešnik
1890	1.1	Dzervitis			

The minima JD 244 1630, 4660 and 5165 were computed from the three colour observations. The minima JD 244 1890, 2140 and 4410 are based only on a few observations and were derived by means of the mean light curve of the star.

The minima are in good agreement with the light elements:

$$JD_{Min} = 243\ 6097.5 + 251.8\ E$$

The new period P = 251.8 days corresponds very well to that noticed in the paper by Biskupski (1963) but it quite disagrees with the mean period given for Y CVn in the General Catalogue of Variable Stars (P = 158 days).

M. VETEŠNIK

Department of Astronomy, Brno University
61137 Brno, Czechoslovakia

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ERRATA

The minimum times for six binaries published in IBVS No. 2159 contain erroneous light-time corrections plus a misprint in the case of ST Aqr. The correct times are as follows.

Binary	H JD 2400000+
ST Aqr	44841.3903$\pm$0.0004
RW CrB	44780.4066$\pm$0.0002
	44783.3126$\pm$0.0010
V836 Cyg	44840.4224$\pm$0.0003
	44842.3826$\pm$0.0002
TZ Lyr	44784.4100$\pm$0.0005
BB Peg	44812.5030$\pm$0.0003
DI Peg	44843.4270$\pm$0.0002
	44848.4100$\pm$0.0002

E. DERMAN, N. YILMAZ, S. ENGIN
Z. ASLAN, C. AYDIN, Z. TÜFEKÇIOĞLU
University Observatory
A.Ü. Fen Fakültesi
Ankara, Turkey

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THE PHOTOMETRIC PERIOD OF SZ PICTORIS

In this short note we derive the photometric period of SZ Pictoris = HD 39917, which Andersen et al. (1980) had discovered to be variable and suggested was an RS CVn binary with 'a period of the order of a couple of days'.

First we used a period-finding program similar to that of Lafler and Kinman (1965) to analyze the 16 V magnitudes in Table I of Andersen et al. between JD 2443931.5 and 2443941.6. The result was $2^{d}.45$ with an uncertainty of a few hundredths of a day.

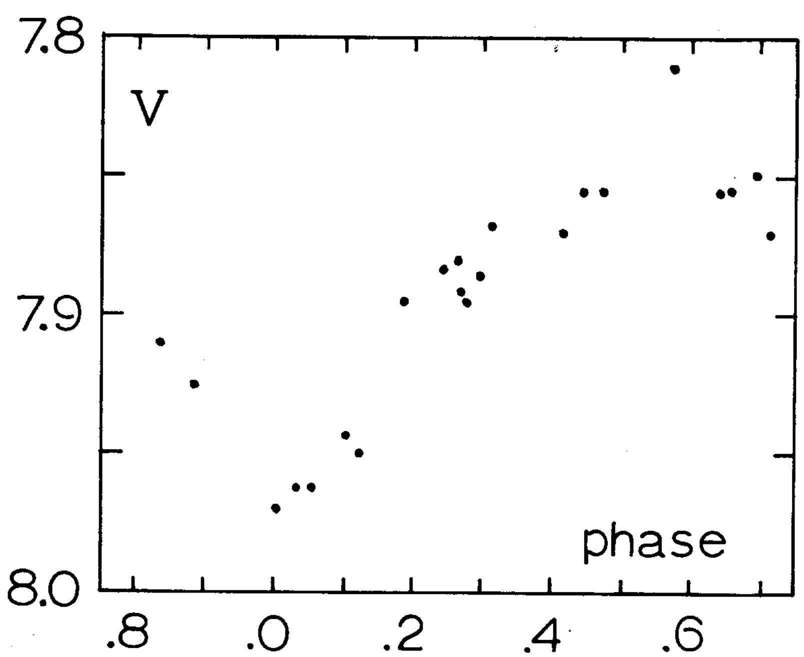

Figure 1

Then we considered the first two values of V in their table, which were about 700 days earlier, and the last four values, which were about 200 days later. Analysis showed that all 22 V magnitudes would produce a coherent light curve with a period of $2\overset{d}{.}441$, although we admit that there might have been some ambiguities in phasing together the three groups of data.

The light curve is shown in the figure below. Phases are computed with the ephemeris

$$\text{JD } 2443931.54 + 2\overset{d}{.}441\, n \, , \qquad (1)$$

where the initial epoch is a time of minimum light. The amplitude of the light curve from maximum to minimum is about $0\overset{m}{.}15$.

BRIAN M. BELL
DOUGLAS S. HALL
ROBERT L. MARCIALIS

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235
U.S.A.

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UBV AND SPECTROSCOPIC OBSERVATIONS OF PU VULPECULAE

We present observations which were obtained during the very remarkable brightening phase (especially in U) of PU Vul in October and November 1982 described by Purgathofer and Schnell (1983, hereinafter 'PS'). Table I lists the UBV-results which were obtained by one of us (H.M.M.) as Visiting Astronomer at the 1m Yale University telescope of the Observatorio Interamericano de Cerro Tololo (CTIO)+). A single channel photometer with a dry ice cooled S4 type photomultiplier was available in pulse counting mode with data output on a thermal printer.

Table I

UBV-observations of PU Vul minus BD 21°4165.

JD(2 ·0000+)	Δ V'	e	Δ B'	e	Δ U'	e	n
5271.52	-0.759	1	-0.748	5	-0.400	4	2
5272.51	772	2	760	4	428	1	2
5273.51	795	5	780	3	456	7	2
5276.50	825	2	814	8	500	4	5
5277.51	828	2	827	3	540	6	4
5278.51	837	6	842	2	558	4	3
5279.51	828	3	842	5	538	5	3
5280.51	830	1	849	3	574	2	3
5281.51	-0.834	4	-0.860	6	-0.590	6	3

Notes: The columns headed by 'e' contain the values of the mean errors (in units of 0.001 mag) of the preceding values. 'n' is the number of integrations of 15 sec.

+) operated by the Association of Universities for Research in Astronomy (AURA), Inc. under contract with the National Science Foundation.

Due to the early right ascension the measurements were taken in dawn. Therefore, the sky readings were used to obtain a smooth curve from which the respective sky values during the star measurements were taken. The air masses of the photometric observations were always in the vicinity of 2.

The differences in Table I are given in the observer's system. Comparing our results with those of PS we notice good agreement in the zero-points of B and V. As our measurements exhibit a rather small scatter around a smooth curve, we conclude that the comparison star BD 21^{o}4165 (which we have in common with PS) is constant (at least over the time interval spanned by our observations). Hence, the slight systematic variability of BD 21^{o}4165 mentioned by PS must refer to longer time scales.

Significant difference appears in U:Our U-curve is somewhat steeper than that of PS, and our U of PU Vul is 0.1 mag fainter. This is consistent with a smaller effective wavelength of our U-filter.

Like PS we also lack an accurate transformation to the UBV-system. However, we may use spectral classification in order to estimate how close we match the UBV-system. Therefore, one of us (JH) has obtained spectrograms of PU Vul parallel to the photometric run (and one in June 1982), at the 1.5 m telescope of the Leopold Figl- Observatory of the Vienna University using a dispersion of 125Å/mm at the Boller & Chivens spectrograph and unbaked IIa-O plates. The results are listed in Table II.

Table II

Spectroscopic observations of PU Vul.

JD(2440000+)	height	n	spectral type
5157.55	500	1	F8-9 I
5273.34	350	1	F5 Ia
5274.25	500	2	F6 I
5275.26	500	3	F6 Ia

Notes: The spectrum height is given in microns, 'n' is the number of spectrograms.

During the brightening phase the H-beta line appears in weak, but definite emission with a P Cyg type blue-shifted absorption. This was not found on the first date of Table II.

Taking into account the usual calibrations of supergiants in the UBV system and the UBV results of PS we arrive at the following conclusions:

The reddening should be 0.10<E(B-V)<0.15. Therefore the U-B values of PS during the time of the spectroscopic observations would point to luminosity class III. However, this is not compatible with our spectral types.

A consistent result would be reached by U-B values which are about 0.15 mag redder than those of PS. Our U-measurements which are 0.1 mag fainter than those of PS comply with this condition considering the errors and uncertainties involved.

Nevertheless, the atmospheric conditions of PU Vul are likely to be peculiar (which is indicated by the fact that the H and K lines of Ca yield a somewhat later spectral type than the other lines - in agreement with Yamashita et al. (1982)) and therefore our conclusions drawn from the comparison of spectroscopic and photometric observations are somehow straightforward and preliminary.

J. HRON

H.M. MAITZEN

Institut für Astronomie
der Universität Wien
Türkenschanzstraße 17
A-1180 Wien/Austria

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Yamashita Y., Maehara H., Norimoto Y.: 1982, Publ. Astron. Soc. Japan 34, 269

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Number 2274

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PHOTOELECTRIC OBSERVATIONS OF AT Cam AND AZ Cam

B,V light curves of the eclipsing binary systems AT Cam and AZ Cam (BD +82°0263) were observed photoelectrically in December 1981 and January 1982 with the 60 cm telescope at Peking Astronomical Observatory.

The comparison star and check star are given in Table I.

Table I

Comparison star and check star

	BD No.	R.A. (1981)	Dec. (1981)
Comp. star of AT Cam		$5^h36^m21^s$	67°01'37"
Check star of AT Cam		5 38 41.5	66 59 02
Comp. star of AZ Cam	82°0264		
Check star of AZ Cam	82°0261		

All the observations for these binaries were corrected for differential extinction. The Kwee and Van Woerden's method was used to determine the times of minimum light. Table II lists the times of minimum light of AT Cam and AZ Cam.

Table II

The times of minimum light of AT Cam and AZ Cam

Star	JD Hel. 2400000 +	m.e.	Filter	rem.
AT Cam	44959.2884	0.0005	V	I
	44959.2875	0.0006	B	I
	44983.0155	0.0004	V	I
	44983.0220	0.0004	B	I
AZ Cam	44985.1908	0.0005	V	I
	44985.1908	0.0005	B	I
	44987.1744	0.0005	V	II
	44987.1688	0.0005	B	II

The B light curves are shown in the accompanying diagrams (Fig.1 and Fig.2). These light curves of AT Cam and AZ Cam are similar, the primary and secondary minima have practically the same depth.

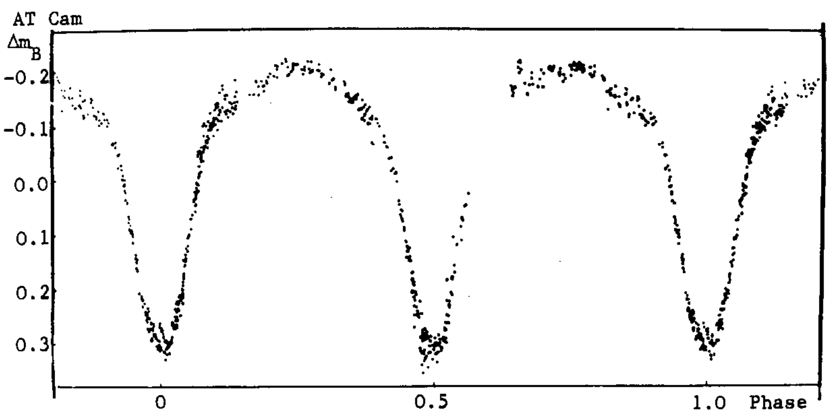

Figure 1:B light curve of AT Cam

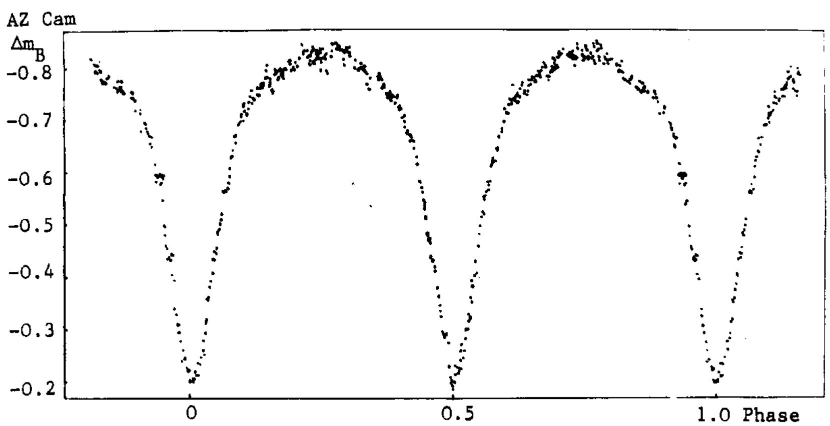

Figure 2:B light curve of AZ Cam

On the basis of earlier and our observations we have computed the new elements of AZ Cam, obtaining:

$$\text{JD Hel. Min I} = 2444985.908 + 1^{\mathrm{d}}.3192299 \cdot E$$

The probable errors obtained from a least squares solution for these quantities were $\pm$ 0.0005 for the initial epoch and $\pm$ 0.0000004 for the period.

These light curves should be analysed in more detail subsequently.

ZHAI DI SHENG, ZHANG RONG XIAN and ZHANG JI TONG
Peking Astronomical Observatory
CHINA

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THE NEW PERIOD OF AD Boo

The eclipsing system AD Boo (BD +25°2800) was observed photoelectrically with the 60 cm telescope at Peking Astronomical Observatory from April to June in 1981.

A total of 1518 photoelectric B,V observations were made on 14 nights. The star used as a comparison was BD +25°2803 and BD +25°2801 was used as a check star.

Four times of primary minimum were determined. The secondary minimum was also observed four times.

The times of minima have been calculated by Kwee and van Woerden's method. Table I lists the times of minimum light.

Table I

Minima of the light curve of AD Boo in yellow band

JD Hel. 2444000+	m.e.	rem.
701.0941	0.0003	II
704.1985	0.0005	I
730.0570	0.0005	II
731.0935	0.0005	I
736.2642	0.0004	II
766.2627	0.0003	I

All the observations for AD Boo were corrected for differential extinctions. Figure 1 gives the V light curve of the binary.

The observations show that

(1) the system is Algol type,

(2) its period given by earlier observers is wrong, the period is about 2.0688112 days, twice of that given by them,

(3) the primary and secondary minima are 0.64 mag and 0.40 mag in yellow,

0.68 mag and 0.37 mag in blue, respectively, in these light curves.

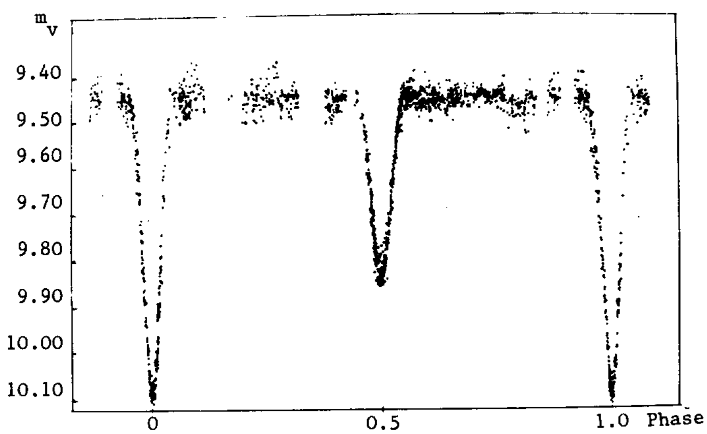

Figure 1

V light curve of AD Boo

From Van Buren's (1974) and our epochs the new ephemeris was found:

$$\text{JD Hel. Min I} = \underset{\pm 0.0004}{2444704.1985} + \underset{\pm 0.0000002}{2^{d}.0688112} \cdot E$$

An analysis of these light curves is in progress.

ZHAI DI SHENG, ZHANG RONG XIAN and ZHANG JI TONG
Peking Astronomical Observatory
CHINA

Reference:
Van Buren, D., 1974, J. Amer. Assoc. Var. Star Observ., 3, No. 1,6-10

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Number 2276

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OBSERVATION OF RAPID CHANGES IN THE LIGHT CURVES OF FK COMAE

FK Com (HD 117555) is the prototype of a small group of apparently single, rapidly rotating (v sin i > 50 km/s) G-K giants with strong Ca II H + K emission. The evolutionary status of the FK Com stars is peculiar and at present poorly understood, but the model proposed by Bopp and Stencel (1981), in which these stars result from the coalescence of W UMa binaries, successfully explains many of their properties, including the rapid rotation. Photoelectric photometry of FK Com reveals low amplitude light variations with a 2.40 day period (Chugainov 1966, 1976; Rucinski 1981). The light curves have a quasisinusoidal form with amplitudes in V between 0.08 mag and 0.14 mag; the light curves resemble those of the RS CVn variables. A survey of the properties of the stars in the group has been given by Bopp (1982). In the coalesced binary model for FK Comae the light variations are presumed to arise from inhomogeneities in surface brightness (starspots). In the other current model, proposed by Walter and Basri (1982), the giant component of FK Com is accompanied by a Roche-lobe filling companion of low mass, and the light variations are associated with a hot spot on the primary at the terminus of an accretion stream.

We carried out photometry of FK Comae ($\langle V \rangle \sim 8.0$) on 34 nights from 03 March 1982 to 25 August 1982 with the 38-cm reflector at Villanova University Observatory. The comparison star was HD 117567 and HD 117876 served as a check. A pair of narrow- and intermediate-band Hα filters was used, with additional observations at λλ 4530 and 7790. A description of the instrumentation and the filters is given by Dorren and Guinan (1982) and references therein. Use of the Hα filter pair permits a measure of the strength of the Hα emission to be determined in the form of an α-index:

$$\alpha = -2.5 \log (F_N/F_I) + \text{constant}$$

where F_N and F_I are the fluxes through the narrow and intermediate-band filters, respectively. Typically 40 to 60 minutes observations were obtained each night with each measure lasting about 40 s. Nightly means were formed from the observations. Corrections for the effects of differential atmospheric extinction were made. However, these corrections were very small because of the close angular proximity (7 arc min.) of the comparison star.

The observations at λ6585 obtained with the intermediate-band Hα filter are shown in Fig. 1. The phases were calculated according to the ephemeris of Chugainov (1976):

$$JD_{min} = 2442192.345 + 2.400E,$$

where zero phase corresponds to minimum light. The observations have been

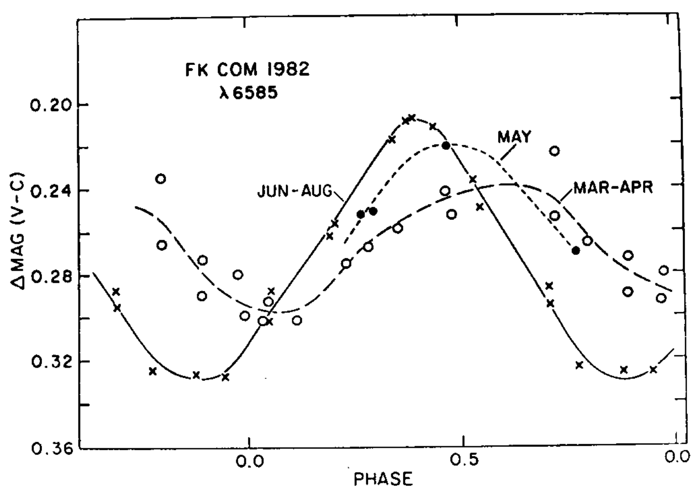

Figure 1

The λ6585 light curve of FK Com. The points are nightly means.

divided into groups according to date of observation. The hand drawn lines assist in following the chronological development of the light curve. It is clear that rapid, probably continuous changes took place in the amplitude and shape of the light curve and in the phase of the light minimum and maximum which shift about 0.15 phase in the direction of decreasing phase over the observing interval of five months. The amplitude increases from 0.06 mag in March-April to 0.12 mag in August for the λ6585 data, and, as shown in Figure 1, the brightness of the star at light maximum increased while the brightness at minimum light decreased over the interval studied. These changes in the light curve are consistent with the starspot model in which an increase in the extent of the subluminous regions or changes in their surface distribution can produce the observed changes. Furthermore, our λ4530 data show that the wavelength dependence of the light curve amplitude is indicative of cool, rather than hot spots. Preliminary spot modeling using the method described in Dorren et al. (1981) suggests spots about 900°K cooler than the photosphere, and about 6% of the total stellar surface area spotted.

The differential α-index is plotted against Julian Date in Fig. 2 where

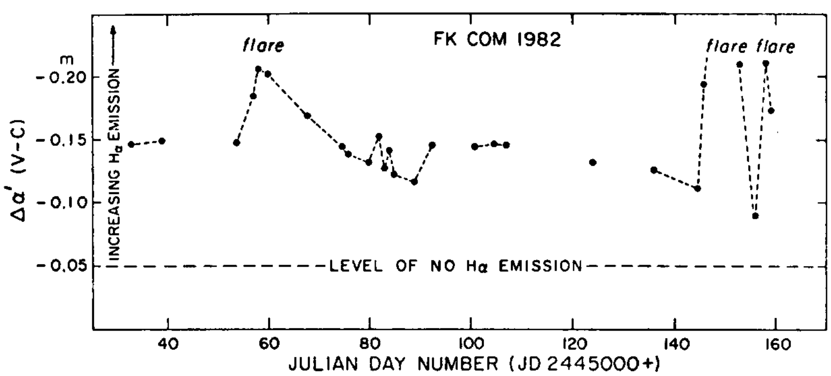

Figure 2

The nightly mean instrumental α-index with the approximate level of zero emission

the net Hα emission increases upwards in the plot. The broken line in the figure at Δα'(V-C) = 0.05 mag indicates the expected value of the index if the variable star had no Hα emission, and, as shown, Hα emission is always present. At least three significant Hα flare events were detected during the 1982 season, with the first flare episode near JD 2445058 being of longest duration. No appreciable enhancement in continuum radiation was observed during the flare events. Flares seem to be relatively common and long lasting and do not appear correlated with the photometric phase.

A fuller account of these observations will be published elsewhere.

J.D. DORREN

Dept. of Astronomy and Astrophysics
University of Pennsylvania
Philadelphia, PA 19014

E.F. GUINAN

Harvard-Smithsonian
Center for Astrophysics
60 Garden Street
Cambridge, MA 02138

G.P. McCOOK

Dept. of Astronomy
Villanova University
Villanova, PA 19085

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OBSERVATIONS OF V711 TAURI IN OCTOBER 1981/JANUARY 1982*

The observations of V711 Tau were obtained in ESO, La Silla, Chile during two photometric programmes: 1. the uvby photometry with the 50 cm Danish telescope in October 1981, 2. the UBVRI (Cousins) photometry with the 50 cm ESO telescope in January 1982. The same comparison star 10 Tau was used on both occasions. The uvby photometric data for the comparison star based on 9 nights are: V = 4.287, (b-y) = 0.366, m_1 = 0.173, c_1 = 0.374 (m.e. ± 0.002 in all cases); they agree very well with the previous results of Olsen (1977). The UBVRI mean data based on 6 nights are: V = 4.36 ± 0.01, (B-V) = 0.550 ± 0.003, (U-B) = 0.031 ± 0.005, $(V-R)_c$ = 0.349 ± 0.005, $(V-I)_c$ = 0.689 ± 0.009. When compared with the previous UBV data they reveal a reasonably good agreement of the (B-V) and (U-B) colours and an unexplained drop in V which is probably caused by some transformation problem.

The differential observations of V711 Tau are listed in Tables I and II and are plotted in Fig. 1. The ephemeris used to compute phases was based on the spectroscopic one by Bopp and Fekel (1976; cf. also Dorren et al. 1981): MJD 42765.569 + 2.83782 E; it predicts moments of conjuction with the more active component in front.

We would like to point out the following:

1. The light curve has a long lasting depression and a short maximum at phases around 0.7 to 0.8.
2. The location of this maximum is strengthened by addition of a few uvby observations by Olson (1982) made exactly on the same nights in October 1981 as the present uvby observations but plotted by Olson with a considerable and perhaps misleading phase shift.

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

3. The UBVRI observations made in January 1982 agree well with those obtained by Mohin et al. (1982). They indicate an increase in the minimum light level by about 0.06 mag. in 2 months.

Table I

Differential uvby observations of V711 Tau
October 1981

MJD (hel) (=JD-2400000.5)	Phase	ΔV	Δ(b-y)	Δm_1	Δc_1
44898.246	0.519	1.561	0.221	0.150	−0.111
44899.273	.881	1.495	0.221	0.166	−0.105
44900.239	.222	1.573	0.225	0.149	−0.112
44901.209	.564	1.540	0.220	0.150	−0.122
44905.196	.969	1.533	0.224	0.145	−0.124
44906.225	.331	1.563	0.226	0.141	−0.118
44907.248	.692	1.483	0.219	0.148	−0.112
44908.248	.044	1.558	0.224	0.146	−0.111
44909.247	0.396	1.564	0.227	0.137	−0.109

Table II

Differential UBVRI observations of V711 Tau
January 1982

MJD (hel) (JD-2400000.5)	Phase	Δ V	Δ(B-V)	Δ(U-B)	Δ(V-R)	Δ(V-I)
44987.035	0.807	1.424	0.377	0.486	0.207	0.380
44988.092	.180	1.505	0.372	0.448	0.205	0.392
44989.041	.514	1.503	0.376	0.443	0.203	0.391
44990.037	.865	1.438	0.384	0.461	0.210	0.378
44992.037	.570	1.504	0.362	0.439	0.215	0.419
44993.041	0.924	1.504	0.369	0.449	0.221	0.412

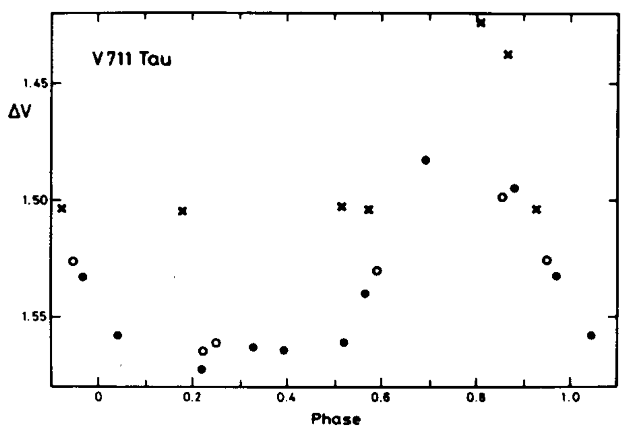

Figure 1

The light curve of V711 Tau obtained in October 1981 (filled circles) and January 1982 (crosses). Observations obtained simultaneously by Olson (1982) in October 1981 are also plotted (open circles).

It is the pleasant duty to acknowledge that the present observations have been obtained during author's association with the Max-Planck-Institut für Astrophysik in Garching, West Germany.

S. M. RUCINSKI
Institute of Astronomy
Madingley Road, Cambridge CB3 OHA
(on leave from the Warsaw University
Observatory)

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

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1983 February 17

HU ISSN 0374-0676

EPSILON CEPHEI: A COMPLEX DELTA SCUTI STAR

Epsilon Cephei (HR 8494) was found to be variable by Breger (1966). He observed the star on two nights and derived a period of about 0.042 days by inspecting the times of maximum. He was, however, unable to combine the two nights to improve the period. His light curve shows a variable amplitude (from 0.02 to 0.026 magnitudes). Fesen (1973) observed the star for seven hours on one night using a y filter and found dramatic evidence of variable amplitudes (from 0.007 to 0.025 magnitudes). By inspecting times of maximum, Fesen derived a period of 0.043 days, though he suggests that the period was variable and nearly doubled after three cycles.

Epsilon Cephei has been observed on seven nights ranging from September 1974 to August 1982. The data taken during 1977 were obtained with the 152 cm telescope at Black Moshannon Observatory (Pennsylvania State University) using V and U filters in a dual channel DC photometer. The other observations were taken at the Joseph R. Grundy Observatory of Franklin and Marshall College with a V filter and DC electronics. The light curves are shown in Figure 1, where each point is the difference in magnitude between the variable and the average of the preceding and following comparison star observations. The comparison star was HR 8472, the same as that used by Fesen.

Out of seven nights, only three or four are useful. The combination of low amplitude and short period makes the effect of noise difficult to remove. From an inspection of the times of maximum in these light curves, we estimate the period to be 0.04 ±0.003 days. This is consistent with the periods estimated by Breger and Fesen.

To compensate for the high noise level and to try to improve the period, we calculated 3-bin variance spectra as described by Jurkevich (1971). Three bins are expected to be best for limited data sets (DuPuy, 1982). Spectra were calculated using the original, unsmoothed data. Of the seven, only the four longest and least noisy produced usable spectra (Figure 2). They yield periods of 0.039, 0.041, 0.037 and 0.035 days. The average of these is 0.038 days. An identical spectrum computed from Fesen's data (Figure 3) yields a period of 0.037 days.

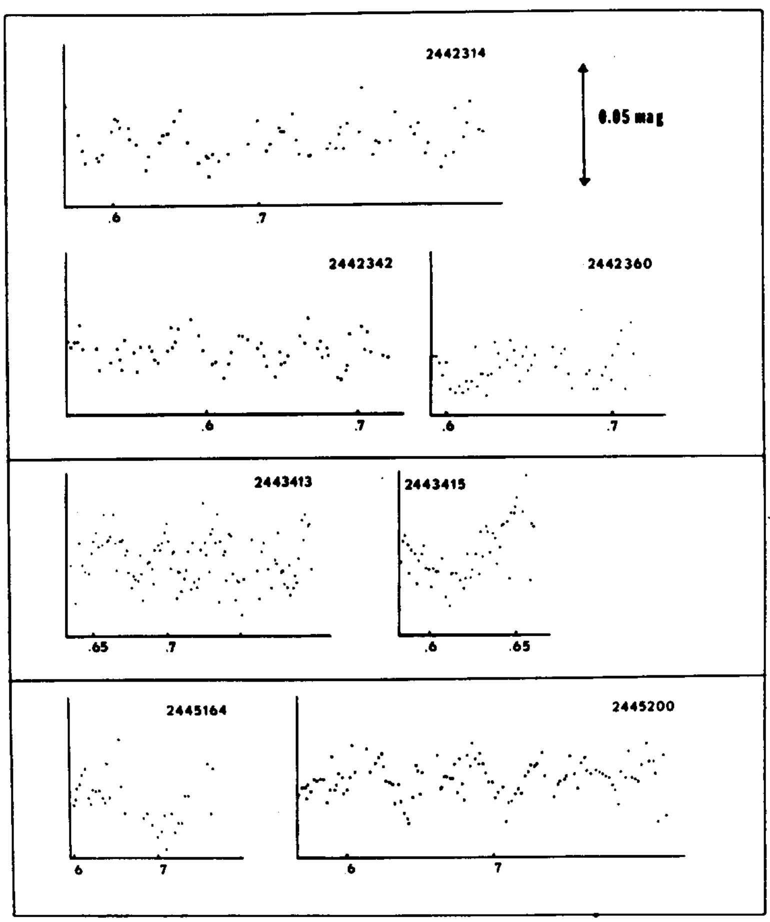

Figure 1

Light curves of Epsilon Cephei in V magnitude from 1974, 1977 and 1982

We suggest, on the basis of these spectra, that the true period is about 0.038 days and not the 0.042 days commonly quoted in the literature. Due to the uncertainty in the period and the spacing of the data sets, we cannot combine data from different nights to improve the resolution in the spectrum.

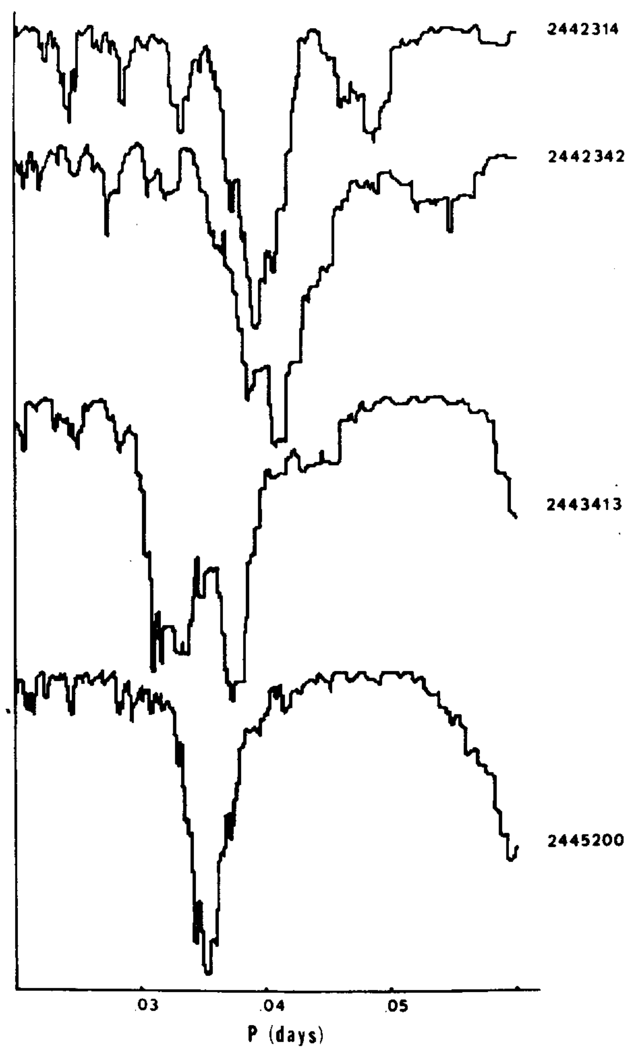

Figure 2

Three bin variance spectra of the four best nights shown in Figure 1

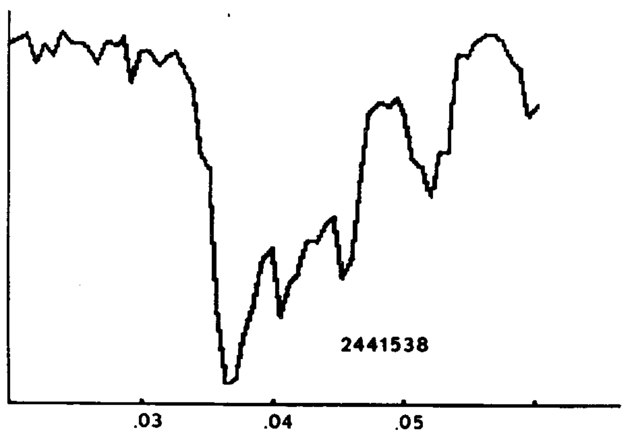

Figure 3

A three bin variance spectrum of the observations published by Fesen (1973)

The data published here suggest that the amplitude varies about an average of roughly 0.02 magnitudes. We suspect that these variations in amplitude are caused by the beating of multiple periods, but our data does not justify searching for a second period. Although the variance spectra might suggest that the period was different on different nights, we prefer to believe that the stars's complex behaviour is due to the beating of at least two periods and not due to abrupt period changes as suggested by Fesen.

Epsilon Cephei is a complex Delta Scuti star of very short period. Careful analysis will probably reveal beating though such a study will require high quality observations made on successive nights.

We would like to thank the Astronomy Department of Pennsylvania State University for providing observing time for one of us (MAS) in 1977.

MICHAEL A. SEEDS

Franklin and Marshall College
P.O. Box 3003
Lancaster, PA 17604
USA

C.W. PRICE

Department of Physics
Millersville State College
Millersville, PA 17551

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REVISED POSITION OF A FLARE STAR IN PISCES

The Right Ascension and Declination of this flare star, annouced by Bond (1976), have been determined using a plate taken with the 20 inch double astrograph of the Yale Southern Station.

Five reference stars from the SAO Catalogue were used; the adopted relation between the measured coordinates and the standard coordinates of the reference stars, include the usual six linear plate constants which have been determined with the aid of the least squares method. The mean of the absolute differences between the catalogue and observed positions was found equal to $0\overset{''}{.}38$ in each coordinate.

Table I lists the epoch of observation, the coordinates (1950.0) determined in this note and, in the last two columns, the position quoted by Bond (1976).

Table I

EPOCH	RA (1950.0)	DEC	RA (1950)	DEC
1982.79	$23^h 29^m 10\overset{s}{.}586$	$-03^\circ 01' 11\overset{''}{.}72$	$23^h 29^m 09^s$	$-03^\circ 01\overset{'}{.}7$

CARLOS LÔPEZ
Obs. Félix Aguilar
Benavides 8175 (o)
Marquesado 5407
San Juan-Argentina

Reference:
Bond, H.E.: 1976, IAU. Inf. Bull. Var. Stars, N°1160

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NOTE ON XZ Eri AND RU Hor

XZ Eri and RU Hor are two dwarf novae variables, both of UG sub-type (Vogt and Bateson, 1982). The minimum photographic magnitudes quoted in the 'General Catalogue of Variable Stars' (Kukarkin et al., 1969) are 16.5 and 16.3 respectively (both magnitudes are preceded by the symbol '(' indicating the posibility of fainter minimun).

Recently a set of finding charts of southern and equatorial dwarf novae has been published by Vogt and Bateson (1982).

A program conducted to improve the positions of this kind of variables was started by the author. During the development of such program, neither XZ Eri nor RU Hor were seen on blue plates (Kodak 103a-O, unfiltered) taken on November 16, 1982 with the 20 inch double astrograph of the Yale Southern Station.

The conclusion from this fact is that, at that time, the magnitude of each star was, at least, 17.5 or fainter.

CARLOS LÔPEZ
Obs. Fêlix Aguilar
Benavides 8175 (o)
Marquesado 5407
San Juan-Argentina

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

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NGC 2346 DOES NOT SHOW ECLIPSES BEFORE 1981

Kohoutek (1982) and Mendez, Gathier, and Niemela (1982) discuss the recently discovered eclipsing behavior of the central star of the planetary nebula NGC 2346. They conclude that no eclipses were visible in the recent past (i.e. the 1970's). This conclusion is primarily based on the exposure of 52 spectrograms recorded between December 1976 and February 1981. If large amplitude eclipses had occurred during this span of time, then the spectrograms taken during the phase of the eclipse would be substantially under exposed. This rapid onset of eclipses is a unique phenomenon and should be confirmed by more direct methods.

The collection of archival photographic plates at Harvard College Observatory can be used to search for old eclipses. Briefly, I find that NGC 2346 did not exhibit large amplitude eclipses before 1981. In the table, I have tabulated 21 magnitudes, based on plates taken since January

Table I
Magnitudes for NGC 2346

DATE	JD minus 2440000	COLOR	PHASE	m
Apr 15 '82	5074.544	B	0.85	13.2
Mar 20 '82	5048.876	R	0.25	bright
Mar 18 '82	5046.560	B	0.10	11.5
Feb 15 '82	5015.586	V	0.17	11.3
Jan 22 '82	4991.590	B	0.66	12.4
Dec 26 '81	4965.092	R	0.01	bright
Dec 26 '81	4965.056	B	0.01	11.5
Dec 20 '81	4958.793	B	0.61	12.3
Nov 3 '81	4911.887	B	0.68	11.3
Apr 2 '81	4696.874	B	0.23	11.1
Mar 28 '81	4691.540	B	0.90	11.2
Mar 9 '81	4672.943	B	0.74	11.1
Feb 28 '81	4663.581	B	0.15	11.4
Jan 31 '81	4635.657	B	0.41	11.3
Jan 6 '81	4610.679	B	0.84	11.2
Dec 15 '80	4588.759	R	0.47	bright
Nov 6 '80	4549.899	B	0.04	11.1
Mar 11 '80	4309.523	B	0.01	11.2
Feb 6 '80	4275.617	B	0.89	11.4
Jan 10 '80	4248.710	B	0.21	11.2
Jan 10 '80	4248.690	R	0.21	bright

1980. The magnitudes have a one sigma error of $0^m.2$ and the phase is based on a period of $15^d.991$ and an epoch of 2443126.0. Note that the December 1981 observation shows an eclipse, however the November 1981 observation (at a similar phase) shows the star at its normal brightness. This could indicate that either the period is incorrect or that the deep eclipses started with a time scale similar to an orbital period. Spectroscopic and photometric observations published elsewhere provide ample evidence that the period is well known.

I have also examined 37 plates taken between 1968 and 1979 and 155 plates taken between 1899 and 1953. On no plate exposed before December 1981 was the central star fainter than its normal magnitude. If eclipses had occurred during any substantial fraction of the epoch when observations are availible, then it would be highly unlikely for them to have been missed.

My conclusion is that NGC 2346 probably experienced a sudden turn on of deep eclipses in November 1981. Neither the nebular eclipse hypothesis (Mendez, Gathier, and Niemela 1982) nor the nodal motion hypothesis (cf. Schaefer 1981) can allow for such a short eclipse turn on time scale.

BRADLEY E. SCHAEFER
MIT, Room 37-576
77 Massachusetts Ave
Cambridge, MA 02139
USA

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PHOTOELECTRIC OBSERVATIONS OF W UMa (BD $+56^{\circ}1400$)

This well known eclipsing variable has been on the observing list of the Ege University Observatory for the last two years. Observations in two colours, B and V are in progress. The variable was observed in October, 1982 during two (23 and 24) and in November, 1982 during three nights (2, 23, 25). The data for 23 and 24 October had been already reduced and Hel. Min. times were presented (Hamzaoğlu, M., Hamzaoğlu, E., 1982). Here we present the latest two minima obtained on 23 and 25 November, 1982 both in V colours, where

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

were used.

So far in the published reports of this star, we presented only the minimum times together with the (O-C) values according to the above given ephemeris. No errors were presented. Any classical method can be used and observations can be fitted to parabola, but asymmetry and seasonal changes within the light curve of the star prevented us in doing so. Instead, we adopted the chord bisection method and applied the least square fit to the mid-points of the minima. We present the journal of data in Table I obtained from the above given ephemeris.

Table I

Date	J.D. Hel.	Type of Min	Colour	E	(O-C) days
23 Oct. 1982	2445266.61735	Min I	B	840	-0.00104 ± 0.00007
24 Oct. 1982	2445267.61805	Min I	B	843	-0.00125 ± 0.00006
02 Nov. 1982	2445276.45917	Min II	B	869.5	-0.00154 ± 0.00010
23 Nov. 1982	2445297.47882	Min II	V	932.5	-0.00109 ± 0.00010
25 Nov. 1982	2445299.47919	Min II	V	938.5	-0.00255 ± 0.00008

MELEK HAMZAOĞLU, FEHMI EKMEKÇI and ESAT HAMZAOĞLU

Ege University Observatory
P.K. 21
Izmir - Turkey

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SPECTROPHOTOMETRIC OBSERVATIONS OF NOVA SAGITTARII 1982 NEAR MAXIMUM LIGHT

Spectrophotometric observations of Nova Sgr 1982, when it was near maximum light, have been obtained with the McGraw-Hill Observatory 1.3 meter telescope. These data were taken on both 1982 October 13 (1^h48^m and 2^h02^m UT) and 1982 October 14 (1^h35^m UT) using the intensified reticon scanner. The night sky was subtracted and the fluxes were calibrated using observations of the white dwarf EG 139 taken on the same night. Spectral features have been measured and identified using the single observation from the second night. This spectral scan is shown in Figure 1.

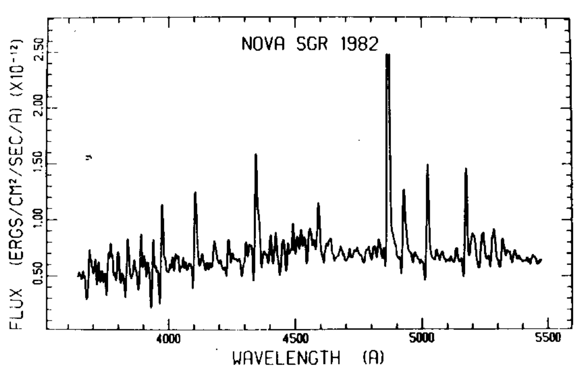

Figure 1

The spectrum of Nova Sgr 1982 taken on October 14, 1982. The peak of the Hβ line is at approximately 3.6 x 10^{-12} ergs cm^{-2} s^{-1} $Å^{-1}$, but has been truncated on this plot. The original resolution was ~3 Å, and the plot has been smoothed to ~5 Å. Prominent features can be identified from Table I.

A plot of the magnitudes given in the IAU Circulars by Kosai and Honda (1982), Mack and Cousins (1982), Churms and Hers (1982), and Elias and Verdenet (1982) shows Nova Sgr 1982 exhibited a double maximum similar to those seen in DM Gem (Campbell 1915) and NQ Vul (Cottrell and Smith 1978). We estimate from looking at the light curve that our observations were made within ±1 day of the first and brighter maximum when the star was near eighth magnitude. Judging from the strength of the emission lines it seems likely that our observations are taken just after maximum light, which probably occurred on ~12 October 1982. Thus the first observations at approximately ninth magnitude by Kosai and Honda may have caught the nova during a pre-maximum halt.

The spectrum was observed from ~3700 Å to ~5400 Å, although the wavelengths are only properly calibrated between ~3900 Å and ~5100 Å. The Balmer series of H are seen in emission with weak, violet displaced absorption. Other prominent emissions include Fe II, Ti II, and Ca II. No satisfactory identification was found for several lines and blends. Table I lists the measured lines together with their velocities, corrected to the sun.

The mean H emission velocity is found to be +69 ± 25 km s^{-1} (Hβ - Hε). The mean from the emissions of the ionized metals is +26 ± 29 km s^{-1}, but blending of these lines causes some uncertainty in this value. The mean absorption velocity from seven lines is -619 ± 27 km s^{-1}, thus indicating a net outward flow of ~700 km s^{-1}. All of the absorption lines are weak, shallow, and single. The weakness of the absorptions and the presence of only low excitation emission lines reinforces the suggestion that the nova was observed at a very early post-maximum phase (McLaughlin 1960).

Small differences in the spectra between the two nights are present. The Balmer lines show a small central absorption in the peak of the emission on the first night which is not present on the second night, and in general

Table I

Measured Features in Nova Sgr 1982

Ion (multiplet)	λ_o (Å)	Radial Velocities ($km\ s^{-1}$) Emission	Absorption	Comments
H 10	3797.90	*	*	
H 9	3835.39	*	*	
Fe II (127) ?	~3864	*		
H 8	3889.05	*	*	
Ti II (34)	3900.55	-29		
Ti II (34)	3913.46	+50		
Ca II-K	3933.66	+216	-491	
Hε	3970.07	+124	-609	Blend with Ca II-H
Fe II (127) ?	~4024			
Fe II (126) ?	~4032			
Unidentified	~4035			
Ti II (87)	4053.81	-40		
Hδ	4101.74	+72	+730	
Fe II (22)	4124.79	+86		
Fe II (27)	4128.74	(-66)		Blend with Si II 4128(3)
Fe II (27)	4173.45	+163		
Fe II (28)	4178.86	-37		
Fe II (27)	4233.17	+3		
Ti II (41)	4300.05	(+46)		Blend with Ti II 4301(41)?
Unidentified	~4318			
Hγ	4340.47	+3	-617	
Fe II (27)	4351.76	-120		
Ti II (51)	4399.77	-148		
Fe II (27)	4416.82	+163		Blend with Fe II 4414(32)?
Unidentified	~4448			
Ti II (31)	4468.49	-80		
Fe II (37)	~4490			Blend
Fe II (37), (38)	~4520			Blend
Ti II (50), Fe II (37)	~4534			Blend
Fe II (37), Cr II (44)	~4556			Blend
Fe II (37), (38)	~4588			Blend
Hβ	4861.33	+79	-653	
Fe II (42)	4923.92	+85	-589	
Fe II (42)	5018.43	+57	-645	
Fe II (42)	5169.03	*	*	
Fe II (49)	5197.57	*		
Si II ?	~5202	*		
Fe II (49)	5234.62	*		
Fe II (49)	5275.99	*		
Fe II (49), (48)	5316.61	*		Blend

* Outside the region of well-established wavelengths

( ) Velocity uncertain due to line blending the emission lines appear to be about 30% stronger on the second night, further supporting the suggestion that the first observation was obtained very near maximum light.

We thank Dr. Matt Johns for his help with the instrument during our observing run.

J. R. SOWELL and A. P. COWLEY
Astronomy Department
University of Michigan
Ann Arbor, Michigan 48109
U.S.A.

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SPECTROSCOPIC EVIDENCE FOR SHORT PERIOD AND HIGH ECCENTRICITY OF THE BINARY ORBIT OF o ANDROMEDAE

o And is an eclipsing spectroscopic single lined binary. Guthnick (1941) suggested a light variation period of 1.5765 days. Schmidt (1959) gave a period of 1.5998398 days from his much more accurate photoelectric measurements. But Bossi et al. (1977), Pastori et al. (1982) and Baade et al. (1982) disagreed with this period. Pastori et al. (1982) gave a period of 23.5 years from spectroscopic analysis. Baade et al. (1982) have concluded that short term quasiperiodic radial velocity variations are not present during the initial stage of the new shell phase. Further, there is no spectroscopic evidence for o And to be a short period spectroscopic binary.

o And underwent a shell phase in 1981 and is still in shell phase (Bossi et al. /1982/, Hayes /1982/). We have been continuously observing this shell spectrum since 15 October 1981, in Hα at a dispersion of 17.2 Å/mm on 09802 Kodak Plates. We report here our observations from 15 October 1981 to 5 October 1982 taken at the 100 cm reflecting telescope of Kavalur Observatory at its Cassegrain focus. In Table I we present, in order, date of observation, JD. phase (calculated from JD 2444948.147), measured radial velocity, calculated radial velocity and residual O-C from the elements adopted.

Table I

Date	JD	Phase	Radial Velocity observed km/s	Radial Velocity calculated km/sec	O-C
15 Oct. 1981	4893.166	0.167	-41.13	-	-
16 Oct. 1981	4894.094	0.278	-39.07	-39.06	- .01
8 Dec. 1981	4947.092	0.369	- 0.66	- 5.95	5.29
9 Dec. 1981	4948.109	0.977	22.00	21.98	.02
9 Dec. 1981	4948.132	0.991	29.26	-	-
9 Dec. 1981	4948.147	0.000	38.26	-	-
9 Dec. 1981	4948.157	0.006	22.00	23.71	-1.71
11 Dec. 1981	4950.063	0.144	1.12	6.97	-5.85
9 Jan. 1982	4979.102	0.485	21.59	22.34	-0.75
23 Jan. 1982	5144.430	0.213	-11.85	-14.74	2.89
5 Oct. 1982	5248.188	0.174	-27.06	-	-
5 Oct. 1982	5248.261	0.217	-19.11	-15.97	-3.14

The orbital elements obtained are as follows:

$K = 34.165$ km	T_o = JD 2444894.0905
$V_o = 13.50$ km/sec	$P = 1.67458$ d
$e = 0.539$	$a \sin i = 662437.8$ km
$\omega = 177.046^o$	$f(m) = 0.004$

The radial velocity curve is shown in Figure 1. We omitted four observa-

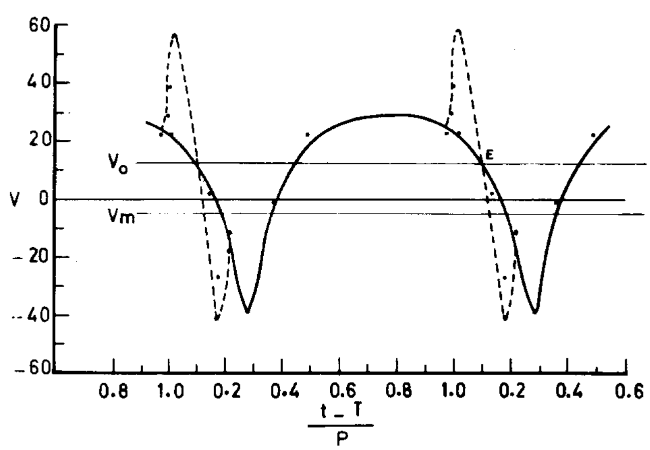

Figure 1

Radial Velocity Diagram

tions, in deriving the orbital elements. These observations do not lie on the RV curve adopted and differ in computed values from the elements adopted. The eclipse of the bright star occurs at E on the decreasing branch of the RV curve where it intersects the V_o axis. Just before E, two observed RV are + ve differing the RV curve and just after E, two observed RV are - ve differing the RV curve. This is explained by the rotation effect and the gas stream present around the binaries. The binaries in which this effect has been found are all very close so that one can expect interactions like tidal waves or more violent phenomena. The gas streaming distorts the RV curve, in the sense that we have a positive amount of distortion just before eclipse and a negative amount just after eclipse. Without applying the proper correction we may thus find incorrect orbital elements. This explains the omission of the four observed RV for calculating the orbit.

MAHIPAL SINGH
Indian Institute of Astrophysics
Bangalore - 560 034
India

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THE HIGH FREQUENCY LIMIT TO FOURIER ANALYSIS. A REMINDER OF THE NYQUIST FREQUENCY

This note is a reminder to astronomers using Fourier Analysis (to determine the frequencies present in variable star data) that one cannot extract from a continuously sampled data set any frequency greater than $1/2\Delta$ where Δ is the sampling interval. The reason for this is that aliases arise due to beating between the sampling frequency, $1/\Delta$, and any real frequency, f, present in the data. Thus, in the power spectrum of data varying with the frequency f, peaks will occur at f, $1/\Delta + f$, $1/\Delta - f$, $2/\Delta + f$, $2\Delta - f$, etc. The high frequency limit to any meaningful frequency search exists where the real frequency f and the lowest frequency alias $1/\Delta - f$ overlap, that is, when $f = 1/\Delta - f$ which yields the Nyquist frequency of $f = 1/2\Delta$.

I have illustrated this problem in Figures 1 and 2 which are amplitude spectra of artificial data. These data have sampling interval of $\Delta = 0.05$ hour (or a sampling frequency of 20 hour^{-1}) and a time span of 5 hours. In Figure 1 there is a real frequency of 1 hour^{-1} present in the data with an amplitude of 10 m mag. In Figure 2 there is a real frequency at 7 hour^{-1}. Note that the amplitude spectra shown in Figures 1 and 2 would look identical if the real frequency in the original data were at the frequency of any of the aliases. Also note that the aliases under discussion here occur for continuously sampled data sets and are not the same as the aliases which arise in the Fourier analysis of astronomical data with time gaps. Aliases caused by time gaps in the data are simply cycle count ambiguities across the gaps.

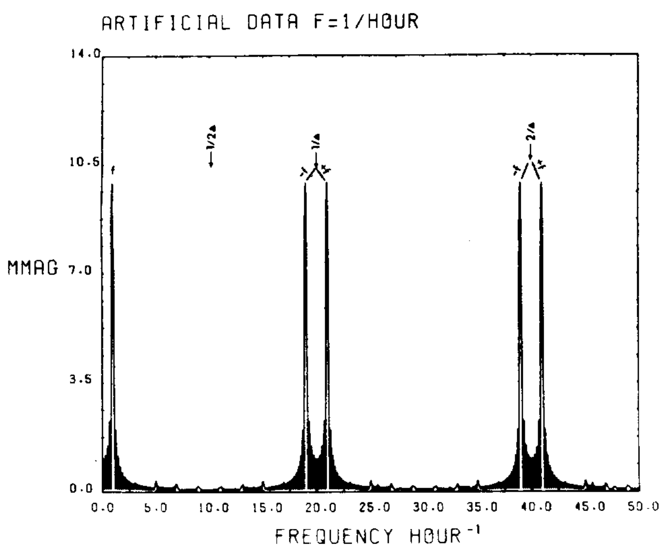

Figure 1

An amplitude spectrum of 5 hours of artificial data sampled at a frequency of $1/\Delta$ = 20 $hour^{-1}$ which gives a Nyquist frequency of $1/2\Delta$ = 10 $hour^{-1}$. The data were generated with a frequency of 1 $hour^{-1}$ with an amplitude of 10 m mag. The noise is due to three decimal truncation of the generated magnitudes.

The impetus for the note comes from two recent issues of *IBVS* in which astronomers have performed Fourier analyses beyond the Nyquist frequency and obtained results which are very probably wrong. Burki *et al.* (1982) Fourier analysed data sampled at "1 measurement per night" for HR3562 and derived "three significant periods" all less than 2 days which is the Nyquist

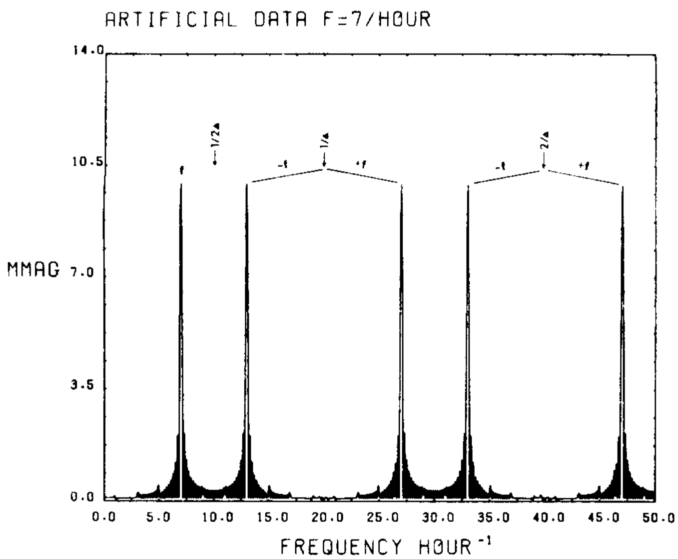

Figure 2

An amplitude spectrum of the same data set as in figure 1 except with a generating frequency of 7 hour^{-1}. One can easily see from these two figures that the highest frequency which can be unambiguously extracted from such a diagram is the Nyquist frequency where the real frequency and the lowest frequency alias overlap.

limit to their analysis. Musielok and Kozar (1982) suggest periods of 5.4 and 5.9 minutes for data they have on 21 Com. Yet, if their 450 measurements obtained during 30 hours of observation are uniformly spaced, then their data spacing is about 4 minutes/measurement which limits their search to periods greater than 8 minutes.

D. W. KURTZ
Department of Astronomy,
University of Cape Town,
Rondebosch. 7700.
Cape. SOUTH AFRICA.

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IS BF ARAE DWARF NOVA OF SU UMa TYPE? *

Little is known about the dwarf nova BF Ara. Since the variability of this star was discovered by Shapley and Swope (1934) no further observations have been published. Its photometric maximum brightness is quoted as $13^{m}_{\cdot}6$ by Kukarkin et al. (1969). On ESO Schmidt-plates it appears as a star of roughly $17^{m}_{\cdot}5$. A chart based upon the observations to be described in this note is given by Vogt and Bateson (1982).

Photometric observations of BF Ara in the UBV colour system have been carried out on 15 September 1979 at the 1-m-telescope of the European Southern Observatory with the one-channel photometer (for details of the observations and reductions, see Bruch, 1982). A light curve of BF Ara has been measured for about 120^{m} with a time resolution of about 80^{s}. It is re-

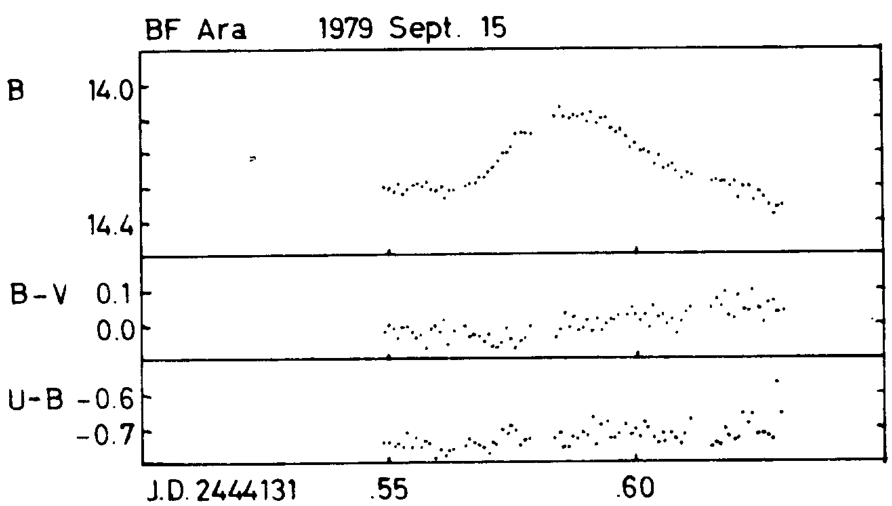

Fig. 1: Light- and colour curves of BF Ara

* Based on observations collected at the European Southern Observatory

produced in Figure 1. The mean values of brightness and colours are:

$$V = 14.24 \pm 0.09$$
$$B-V = 0.01 \pm 0.05$$
$$U-B = -0.72 \pm 0.04$$

BF Ara was obviously observed in outburst. Most dwarf novae do not show strong variations in this phase. However, the light curve of BF Ara exhibits an outstanding hump with an amplitude of about $0^{m}.25$. Such a feature is well known from the light curves of SU UMa - stars in superoutburst (Vogt, 1980). The amplitudes of these so-called superhumps range between $0^{m}.15$ and $0^{m}.35$. They appear with a period a few percent longer than the orbital period of the systems.

The striking similarity between the hump in the light curve of BF Ara and the superhumps of the SU UMa - stars suggest a classification of BF Ara as SU UMa - star. This is supported by the good agreement of the colours of BF Ara with the mean colours of SU UMa - stars during superoutburst, after reasonable corrections for the interstellar reddening have been applied (see Tables 31 and 47 of Bruch, 1982).

If BF Ara is really a member of the SU UMa - subgroup of dwarf novae a lower limit of about 2^{h} for the orbital period can be estimated from the light curve. This is long for the period of a SU UMa - star, but it is not an extreme value. YZ Cnc (Vogt, 1980) and TU Men (Stolz and Schoembs, 1981) have even longer periods. Thus, also from this point of view BF Ara fits well among the SU UMa - stars.

A spectrum of BF Ara was taken on 16 September 1979, the night after the photometric observations, at the 1.5-m-telescope of ESO, equipped with a Boller and Chivens Cassegrain spectrograph and an EMI image tube. Like almost all outburst spectra of dwarf novae, it shows a strong blue continuum with superimposed broad and shallow absorption lines of hydrogen.

The classification of BF Ara as SU UMa - star might be premature in view of the scarce observations. Nevertheless it appears worthwile to keep an eye on this star.

A. BRUCH

Astronomisches Institut
Domagkstraße 75
D-4400 Münster
Fed. Rep. Germany

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* copies are available from the author on request

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PHOTOMETRIC OBSERVATIONS OF CATACLYSMIC VARIABLES *

Photometric observations of 24 cataclysmic variables in the UBV colour system were carried out during 11 nights in 1978 and 1979 at the 1-m-telescope of the European Southern Observatory at La Silla. All measurements were taken with the ESO one-channel photometer. For details concerning the measurements and the data reduction, see Bruch (1982a).

The results of the observations are given in Table I. In general, each star was observed once or twice in each colour. The errors of the brightness and colour indices were estimated from informations about photon statistics furnished by the photometer software (including statistical fluctuations of the night sky brightness, which is important for the faintest stars observed) and from the deviations of the individual measurements from the mean. Since the integration times per colour ranged between 60^s and 100^s and were thus not short compared to the flickering time scale, rapid brightness variations of the stars tend to enhance the errors.

Light curves of some of the brighter stars were observed with a time resolution between 300^s and 8^s for a period between 38^m and 297^m. In these cases, Table I gives the mean values of brightness and colours for each observing run. Here, the errors were computed solely from the deviations of the individual measurements from the mean. For all light curves, the brightness difference ΔV between the brightest and the faintest data point is also given in Table I in order to allow an estimate of the flickering amplitude. It is interesting to note that the flickering of the SU UMa - star WX Hyi (which belongs to those cataclysmic variables with particularly large flickering amplitudes; see Bruch, 1982a) is strongest on the decline from an outburst just before reaching the minimum stage. A comparatively low flickering amplitude is observed from the old nova HR Del; a fact which is interpreted elsewhere (Bruch, 1982b).

Most of the cataclysmic variables observed exhibit colours which are within the range normally found for these objects. There are, however, three exceptions.

* Based on observations collected at the European Southern Observatory

Table I: UBV colours of cataclysmic variables

Name	Date J.D. 2440000+	Type[1]	Phase[2]	V	B−V	U−B	N[3]	V
VY Aqr	4130	RN	m	17.08 ± 0.22	−0.18 ± 0.25	−0.80 ± 0.17	2	
VZ Aqr	4129	U	m	16.51 ± 0.16	0.78 ± 0.20	−0.32 ± 0.26	1	
AE Aqr	4129	NL		11.39 ± 0.03	0.85 ± 0.04	−0.09 ± 0.16	2	
UU Aql	4129	U	m	16.66 ± 0.18	0.71 ± 0.20	−1.28 ± 0.15	1	
FO Aql	4128	U	m	16.57 ± 0.14	0.66 ± 0.17	−0.58 ± 0.16	1	
V 725 Aql	4130	U	m	15.79 ± 0.11	1.52 ± 0.14	0.60 ± 0.47	2	
AT Ara	4131	U	m	14.25 ± 0.12	0.82 ± 0.09	−0.69 ± 0.12	2	
WW Cet	4126	Z	St?	14.04 ± 0.24	0.11 ± 0.24	−0.98 ± 0.15	13	0.88
	4131	Z	St?	14.16 ± 0.04	0.04 ± 0.05	−1.04 ± 0.02	2	
BP CrA	4129	Z	M	14.23 ± 0.07	0.10 ± 0.02	−0.79 ± 0.02	2	
HR Del	3724	N	m	12.16 ± 0.09	−0.05 ± 0.02	−0.84 ± 0.02	45	0.17
	3727	N	m	12.19 ± 0.05	−0.10 ± 0.01	−0.84 ± 0.02	23	0.16
	3728	N	m	12.14 ± 0.03	−0.09 ± 0.01	−0.82 ± 0.02	90	0.14
	3729	N	m	12.15 ± 0.04	−0.09 ± 0.01	−0.80 ± 0.02	99	0.12
	3730	N	m	12.10 ± 0.03*			500	0.14*
IS Del	4129	Z	St?	15.90 ± 0.07	0.09 ± 0.08	−0.65 ± 0.06	2	
WX Hyi	3724	SU	m	14.68 ± 0.37	0.08 ± 0.17	−1.14 ± 0.09	11	0.93
	3727	SU	m	14.85 ± 0.12	0.07 ± 0.11	−1.07 ± 0.11	35	0.53
	3728	SU	m	14.84 ± 0.11	0.01 ± 0.06	−1.10 ± 0.09	68	0.53
	3729	SU	m	14.75 ± 0.12			325	0.77
	3729	SU	m	14.72 ± 0.14*			350	0.68*
	3730	SU	m	14.76 ± 0.19	0.02 ± 0.07	−1.18 ± 0.09	125	0.94
	4127	SU	Dec	13.07 ± 0.09	0.20 ± 0.04	−0.02 ± 0.10	166	0.85
	4129	SU	Dec	14.21 ± 0.27	0.21 ± 0.11	−0.97 ± 0.15	170	1.43
	4130	SU	m	14.70 ± 0.16	0.08 ± 0.08	−1.16 ± 0.11	195	0.77
	4131	SU	m	14.66 ± 0.15	0.07 ± 0.07	−1.18 ± 0.10	141	0.65

Table I (continued)

Name	Date J.D. 2440000+	Type[1]	Phase[2]	V	B–V	U–B	N[3]	V
TU Ind	4129	U	m	15.32 ± 0.04	0.22 ± 0.06	–0.89 ± 0.03	2	
V 841 Oph	3724	N	m	13.39 ± 0.03	0.40 ± 0.02	–0.55 ± 0.04	9	0.09
	3727	N	m	13.22 ± 0.04	0.43 ± 0.03	–0.60 ± 0.04	16	0.18
	3728	N	m	13.28 ± 0.04	0.40 ± 0.03	–0.58 ± 0.04	15	0.14
	3729	N	m	13.10 ± 0.10	0.40 ± 0.03	–0.58 ± 0.04	101	0.26
	3730	N	m	13.03 ± 0.05	0.40 ± 0.02	–0.61 ± 0.04	83	0.20
	3730	N	m	13.44 ± 0.06*			451	0.32*
V 2051 Oph	4128	U	m	15.32 ± 0.06	0.00 ± 0.07	–0.90 ± 0.05	1	
BI Ori	4131	U	Dec?	14.56 ± 0.03	0.04 ± 0.04	–0.78 ± 0.03	2	
CN Ori	4131	Z	St?	12.81 ± 0.01	0.02 ± 0.01	–0.74 ± 0.01	2	
RU Peg	4129	U	m	12.64 ± 0.01	0.63 ± 0.02	–0.78 ± 0.05	2	
RZ Sge	4129	U	m	16.86 ± 0.23	0.56 ± 0.27	–0.78 ± 0.25	1	
MM Sco	4131	U	m	17.00 ± 0.16	1.53 ± 0.27	–0.70 ± 0.38	2	
FQ Sco	4130	U	m	16.83 ± 0.16	1.62 ± 0.28	–0.70 ± 0.44	2	
V 478 Sco	4131	U	m	16.27 ± 0.12	0.42 ± 0.14	–0.67 ± 0.11	2	
UZ Ser	4128	U	m	15.69 ± 0.08	0.14 ± 0.06	–0.71 ± 0.04	2	
FY Vul	4128	Z	m	14.80 ± 0.04	0.53 ± 0.04	–0.65 ± 0.04	2	

[1]: Type
N = nova
U = U Gem star
Z = Z Cam star
SU = SU UMa star
RN = recurrent nova
NL = novalike variable

[2]: Phase
m = minimum
M = maximum
St = standstill
Dec = decline

[3]: N = number of individual measurements

* = B-magnitudes

MM Sco has an extremely red B-V - colour index, but is blue in U-B. This might indicate an extreme intensity distribution between the hot primary and the cool secondary. Vogt (1981) measured red colours both in B-V ($0^m_.8 \ldots 1^m_.3$) and U-B ($0^m_.2 \ldots 0^m_.8$). It is doubtful that this discrepancy can be explained by normal colour variation due to flickering.

FQ Sco shows colours similar to MM Sco. However, it has a faint optical companion which might have been in the diaphragm and influenced the observations.

The colours of V 725 Aql resemble those of the recurrent nova T CrB (Bruch, 1980; Walker, 1957).

Since all three systems have been observed quite inadequately so far, the results for these stars await confirmation by independent observations.

A. BRUCH

Astronomisches Institut
Domagkstraße 75
D-4400 Münster
Fed. Rep. Germany

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HR8768 - AN ULTRA SHORT PERIOD VARIABLE?

An earlier investigation (by Balona 1982) of three of Jakate's (1979) proposed early-type ultra-short-period variables cast doubt on the existence of this group of variables. Balona saw no variation over a few thousandths of a magnitude for HR3467, HR3582 and HR5294. This led us to reinvestigate the remaining northerly member of the group HR8768 (=HD217811=SAO 52626=BD +43°4378). Percy (1980) has reobserved this star, but in light of Balona's findings we decided to look one more time.

The variable was measured using SAO 52551 as a comparison and SAO 52599 as a check. Delta magnitude, in the sense HR8768-minus comparison, is plotted versus heliocentric Julian Date in Figure 1. There seems to

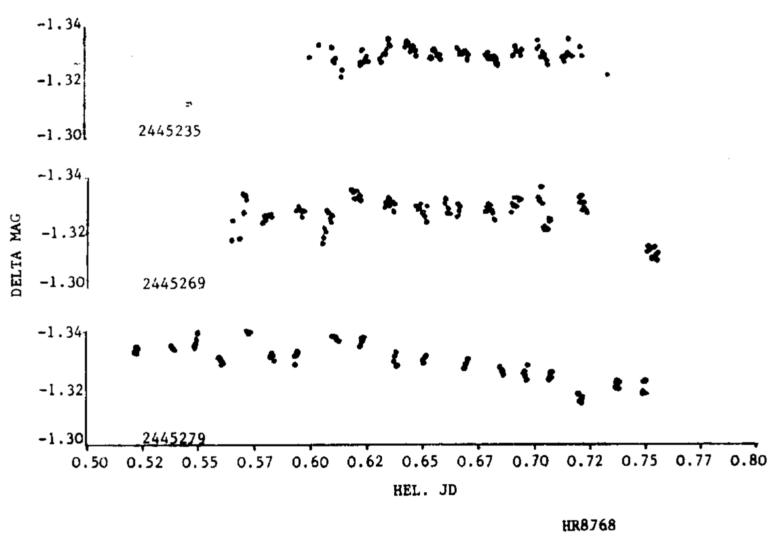

Figure 1

be no significant variation in HR8768 on JD 2445235 and JD 2445269. However, a gradual decline of approximately .02 magnitudes is present from JD2445279.62-.75. Since the check star also drops in this time period it is uncertain whether this can definitely be attributed to HR8768. In any case, no ultra-short period variation such as that found by Jakate ($P=0^d.02$, $\Delta m \simeq 0^m.025$) was found. To confirm this, we conducted a periodogram analysis on our data for frequencies up to 100 cycles/day. None were found with amplitude greater than $0^m.003$, which is below the estimated measurement error.

The delta magnitude in B of SAO 52599 minus SAO 52551 is plotted in Figure 2. SAO 52599 seems to have more variation than HR8768,

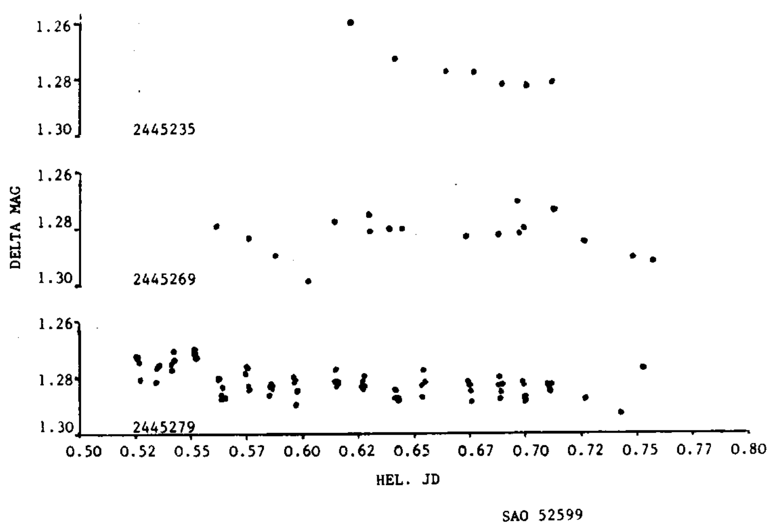

Figure 2

dropping $0^m.02$ on both JD 2445235 and JD 2445279. There may even be some variation on JD 2445269 but this night was not as good as the other two. Careful scrutiny of the data indicates the variation can be attributed to SAO 52599 and not the comparison star SAO 52551. SAO 52599's spectral type, A3, the magnitude of the variation ($0^m.02$), and the time-scale (2-5 hours) suggest that it might be a delta-Scuti variable but additional data is needed to confirm its type of variability.

In conclusion, it is always difficult to prove the photometric constancy of a star, particularly a low amplitude variable, with only a few nights data. However, on the basis of our observations of HR8768 we must support Balona's conclusion that Jakate's four stars are not members of a new group of early-type ultra-short-period variables. It will require further observations to determine if HR8768 has a low amplitude variation that is either aperiodic or of long period.

J. S. SHAW, D. A. FRAQUELLI,
D. H. MARTINS and S. B. ANDREW
University of Georgia Observatory
University of Georgia
Athens, Georgia 30602

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NEW DELTA-SCUTI-TYPE VARIABLE IN TRIANGULUM

While observing the eclipsing binary V Trianguli: $1^h28^m57^s$, +30°6'27" (1950) a nearby star at $1^h29^m15^s$, +30°7'10" (1950) was found to be variable. It was observed in the Washington Photometric System colors C, M, and V on eight different nights from October, 1982 to January, 1983. The amplitude of variation was $0^m.12$ in C, $0^m.083$ in M, and $0^m.0$ 7 in V and was roughly sinuosoidal. Data for the two nights with the best coverage, JD2445341 and JD2445351, are shown in Figure 1. SAO 54783 was used as a comparison star. Delta magnitude in V (new variable - SAO 54783) is plotted versus heliocentric Julian Date.

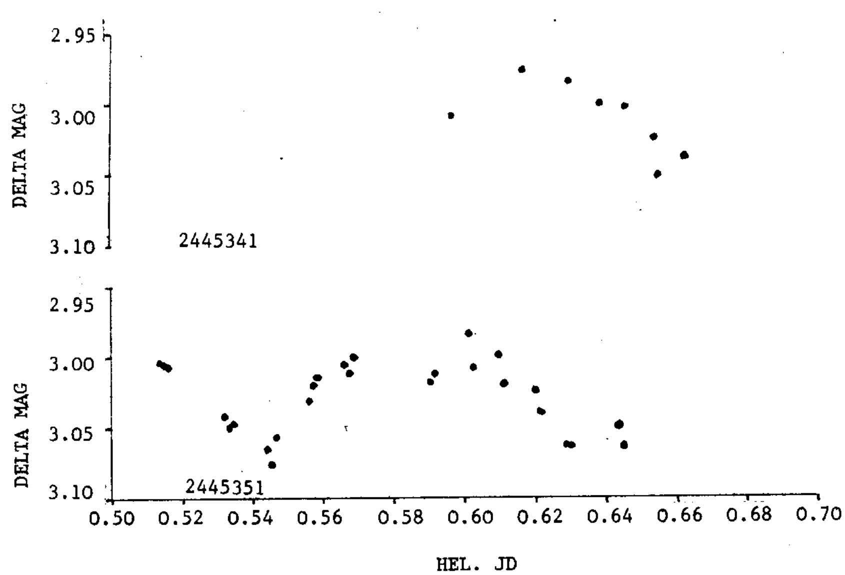

Figure 1

Compared to V Tri at maximum light the new variable is $0^{m}.3$ fainter in V, or $11^{m}.2$. Further, it has identical (M-V) and (C-M) indices which implies the same spectral type, A3, as V Tri. A periodogram analysis of the data from all nights indicates a period near 0.10 days, with the possibility of multiple periods. The light amplitude variation, period and spectral type indicate the new variable is a delta-Scuti-type variable.

J. S. SHAW, D. A. FRAQUELLI, D. H.
MARTINS, and D. E. STOOKSBURY
University of Georgia Observatory
University of Georgia
Athens, Georgia 30602

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ARCHER 5 IDENTIFIED AS RZ Com

The announcement of the discovery of 24 variable stars in the region of the Coma star cluster was made by Archer (1959). Apparently none of these variables have been confirmed, hence they have not received variable star designations. However, some of the eclipsing binaries on Archer's list were included in The Fifth Edition of the Finding List for Observers of Interacting Binary Stars (Wood, et al., 1980).

While preparing finder charts to pursue observations of these variables, the present author noted several similarities between Archer's star number 5 and the known eclipsing binary RZ Com (BD $+24^{\circ}2475$). The argument that the two are one in the same is based upon the following considerations:

1. Archer noted that Prager (1929) had previously discovered Archer 5,but Prager's discovery eventually was designated RZ Com.
2. The 1950 coordinates of RZ Com agree precisely with those given by Archer for Archer 5.
3. The period of Archer 5 ($\overset{d}{.}339$) agrees well with that of RZ Com ($\overset{d}{.}33850604$).
4. Similar amplitudes are given for both stars.

Perhaps the confusion is partly due to the magnitude given for Archer 5 (9.6). Some of the 24 stars studied by Archer can be identified as BD and SAO stars. Comparison of Archer's magnitudes to catalog magnitudes show that Archer's estimates are about one magnitude too bright. This correction would cause Archer 5 and RZ Com to have about the same magnitude. It is hoped that the editors of future editions of the Finders' List will take these arguments into consideration and delete Archer 5 (number 1490 in the list).

DANNY R. FAULKNER

Astronomy Department
Swain Hall West 319
Indiana University
Bloomington, IN 47405
U.S.A.

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OBSERVATIONS OF PU Vul

We observed PU Vul with the 60/90-cm Schmidt telescope at Peking Observatory and obtained some spectrograms of this star using the spectrograph attached to the 1-m telescope at Yunnan Observatory in 1981 and 1982.

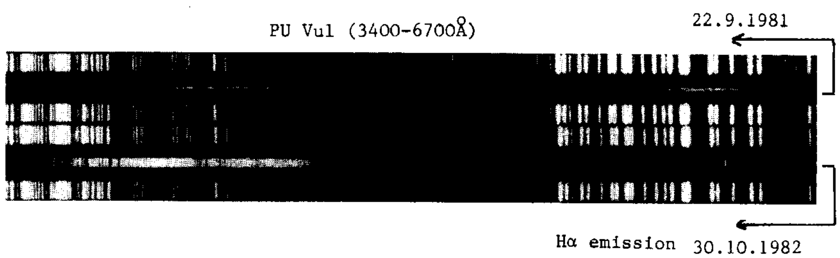

Figure 1

Perhaps there was a small outburst again during October and November, 1982. Our photographic observations are as follows:

UT 1982	m_{pg}
8.22	9.28
8.25	9.23
10. 7	9.17
10. 8	8.99
11.15	8.69
11.16	8.81
11.17	8.82
12.13	9.16:
12.20	9.18:
12.30	9.24:

The spectral class of this star was about K in September, 1981. But one more Hα emission was found on its spectra in October, 1982.

LIU ZONGLI, HAO XIANGLIANG and MEI BAO

Peking Astronomical Observatory
Academia Sinica
Peking, China

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PHOTOELECTRIC TIMES OF MINIMA OF ECLIPSING BINARIES

Photoelectric V-filter observations of selected eclipsing binaries were continued with the 40-cm f/18 Cassegrain reflector at the Blue Mountain Observatory during the 1982 observing season. The observing procedure was identical to that described in Margrave et al. (1978).

Following past practice, least-squares parabolic fits were made to the observations. Table I contains the resultant Heliocentric Julian Date

Table I. Heliocentric Times of Minima

Star	Hel. JD - 2,440,000	E	O-C	Remark
KO Aql	5209.7844 ± 0.0003	1160	+0^d.0082	P
RZ Cas	5204.7352 ± 0.0008	12825	-0.0016	P
	5217.8828 ± 0.0008	12836	-0.0017	P
TV Cas	5256.8056 ± 0.0002	2020	+0.0067	P
TW Cas	5207.8303 ± 0.0001	2240	-0.0028	P
PV Cas	5164.5753	1962	-0.0022	S
	5165.4760	1963	+0.0022	P
	5253.8509 ± 0.0004	2013	-0.0008	S
XX Cep	5206.7625 ± 0.0008	1569	+0.0088	P
	5220.7876 ± 0.0004	1575	+0.0099	P
SW Lac	5201.7407 ± 0.0005	5431	-0.0063	S
	5203.8264 ± 0.0009	5438	-0.0053	P
	5204.7892 ± 0.0006	5441	-0.0046	P
AT Peg	5219.8562 ± 0.0005	4199	+0.0064	P

(minus 2,440,000) for each eclipse along with its probable error, cycle number E, and O-C value. The data for the first two eclipses of PV Cassiopeiae were kindly supplied by Dr. Alvaro Giménez (1982). The letters P and S in the Remark column denote a primary or secondary eclipse, respectively. The references for the ephemerides used to calculate the O-C values are given in Table II.

Table II. Ephemerides References

Star	Reference
KO Aql	Margrave (1980)
RZ Cas	Herczeg and Friboes-Conde (1974)
TV Cas	Margrave (1980)
TW Cas	Margrave (1980)
PV Cas	Gimenéz and Margrave (1982)
XX Cep	SAC 53
SW Lac	Faulkner and Bookmyer (1978)
AT Peg	Margrave (1981)

The residuals for RZ Cassiopeiae appear to have reversed the trend towards more negative values that was exhibited during the preceding two seasons. The residuals for XX Cephei continue to become more positive, which indicates that the period given in SAC 53 needs to be increased.

The quadratic elements for AT Pegasi cited in Table II provide much smaller residuals for the eclipse time given here and those given in the previous notes from this observatory than do the quadratic elements given in SAC 54. In the case of the AT Pegasi eclipse reported here the SAC 54 quadratic elements yield O-C = $-0\overset{d}{.}0821$. Those who plan to observe this system should make allowance for this discrepancy if they use the SAC 54 quadratic elements.

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THOMAS E. MARGRAVE

Blue Mountain Observatory
University of Montana
Missoula, Montana 59812
USA

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ADDITIONAL HISTORICAL OUTBURSTS OF VY AQUARII

The eruptive variable VY Aquarii (see references in McNaught, 1983, The Astronomer 19, 156) was known to have undergone outbursts in 1907, 1962 and 1973. The 1973 outburst was confirmed by Wenzel (1983, IBVS no. 2261). Wood (1925, Bull. H. C. O. No. 826) searched the Harvard College Observatory plate collection from 1890 to 1925 without finding additional outbursts.

Examination of more than 500 sky patrol plates from the periods 1925-1952 and 1962-1981, and a few other plates in the Harvard collection, has revealed three additional definite outbursts and one possible outburst (observed on one plate only).

Dates and magnitudes (from the same comparison stars used by Wenzel) are:

UT			m_{pg}	
1929	June	3.3	>12.2	invisible
	"	5.2	>11.5	"
	"	11.1	13.1	
	"	14.0	8.0:	
	July	9.0	14.6	
	"	13.0	12.0	
	"	31.9	>>14.7	invisible
1934	June	11.0	>14.7	invisible
	"	22.3	9.0:	
	"	27.2	10.8	
	July	9.0	>14.5	invisible
	"	9.3	>13.1	"
	"	11.0	>13.1	"
	"	14.0	12.2	
	"	17.2	>13.1	invisible
	"	18.2	14.7:	
	"	20.2	>14.7	invisible
	Aug.	6.2	>>14.7	"

1941	Apr.	16.1	11.1	one plate
	May	7.1	>14.7	invisible
1942	Oct.	1.0	>11.5	invisible
	"	4.0	>13.1	"
	"	7.9	11.0	
	"	8.0	11.0	
	"	14.0	>14.5	invisible

MARTHA H. LILLER

Harvard-Smithsonian Center for Astrophysics
60 Garden Street
Cambridge, MA 02138
U.S.A.

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STATISTICAL ANALYSIS OF FLARE STAR OBSERVATIONS

A large scale photoelectric monitoring program on five flare stars was carried out at the Stephanion Observatory, Greece during the period 1972-1976. The observations enable us to make some comments on these stars.

I. One of the main problems of flare star observations is how to separate the flare events from the noises caused by the equipménts used and by the instabilities of the Earth's atmosphere. In order to minimize the thermoionic effects we used dry carbondioxide ice for cooling. The observations were made in the B band.

The fluctuation of the observations of the five flare stars has been measured at every certain interval of time ΔT to avoid random values. The name of the stars and the number of points measured are given in Table I for the years 1973 and 1974, separately. The total monitoring time was 124 hours.

Table I

No.	Name of the flare star	No. of measured points in 1973	No. of measured points in 1974
1	BY Dra	265	89
2	EV Lac	144	87
3	BD $+13^{\circ}2618$	46	---
4	BD $+55^{\circ}1823$	---	213
5	AD Leo	---	52

$\sigma(m)$ and η were calculated from the following formulae:

$$\sigma(m)=2.5\,\log\frac{I_o+\sigma(I)}{I_o}\ , \quad \text{where} \quad \sigma(I)=\sqrt{\frac{(I_i-\bar{I})^2}{N-1}}\ ,$$

I_i= measured intensity deflection (i=1,2,...,N)

$I = \frac{1}{N}\sum_{i=1}^{N} I_i$, I_o= intensity deflection of the flare star at quiescence less background, and

$\eta = \frac{\Delta m}{\sigma(m)}$, where $\Delta m = 2.5 \log \frac{I_f}{I_o}$, $I_f = I_o$ + noise deflection.

The distribution of η for each observed flare star for the years 1973 and 1974, respectively are shown in Figs. 1 and 2.

A careful and refined analysis of these figures gives the η values which correspond to more than 99% confidence that the flucuation is a flare event. The results are summarized in Table II.

Table II

No.	Name of the flare star	η with confidence more than 99%, in 1973	η with confidence more than 99%, in 1974
1	BY Dra	5.0 ± 0.05	5.0 ± 0.09
2	EV Lac	4.0 ± 0.06	4.0 ± 0.07
3	BD $+13^{o}2618$	6.0 ± 0.16	---
4	BD $+55^{o}1823$	---	4.0 ± 0.04
5	AD Leo	---	4.0 ± 0.10

The mean value of η= 4.57 ± 0.30 i.e. $\eta \approx 5$, which is a suitable criterion for our photoelectric observations of flare event detection in the B - colour with a confidence more than 99%, i.e. if $\Delta m \geq 5\sigma(m)$, we can say with more than 99% confidence that the event is a flare.

II. Kunkel (1973) defined a flare duration parameter T_q where the subscript q denotes the fraction of peak light at which the measurement was taken (e.g. $T_{0.5}$ is the duration of a flare at half peak light, $T_{0.2}$ is the duration at 20% of peak light, etc.). He found an empirical formula between the luminosity of the flare star of dMe type and the flare duration observed in the U - band:

$$\langle \log T_{0.5} \rangle = -0.15\, M_V + 1.61 \pm 0.17$$

From our data for the flare star EV Lac which was observed from 1972 through 1976 and 75 flare events were detected in the B band, we were able to determine Kunkel's parameter T_q for q= 0.5, 0.2 and 0.1 (Table III). Omitting the very uncertain values of the events Nos 21,40,46,51 and 65 we obtain:

$$\langle \log T_{0.5} \rangle = -0.092 \pm 0.036$$
$$\langle \log T_{0.2} \rangle = +0.186 \pm 0.046$$
$$\langle \log T_{0.1} \rangle = +0.375 \pm 0.052$$

Table III

No. of flare events	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$	No. of flare events	$T_{0.5}$	$T_{0.2}$	$T_{0.1}$
1	$1^m.46$	$3^m.50$	$4^m.15$	39	$2^m.32$	$9^m.85$	$12^m.60$
2	0.64	0.95	–	40	–	–	–
3	0.56	0.75	2.40	41	1.46	4.60	–
4	0.34	–	–	42	1.30	4.85	5.85
5	1.44	2.00	7.05	43	0.74	1.75	3.20
6	0.36	0.60	2.95	44	1.62	1.90	2.10
7	0.94	1.20	2.09	45	0.60	–	–
8	0.92	1.23	2.53	46	–	–	–
9	0.54	1.33	1.84	47	0.32	0.52	0.55
10	0.34	0.40	0.45	48	0.96	7.50	10.40
11	1.62	2.10	–	49	0.24	0.42	0.46
12	0.74	2.50	4.63	50	0.18	0.19	0.24
13	0.94	1.56	3.00	51	–	–	–
14	1.04	2.10	2.90	52	0.72	1.12	4.52
15	0.38	0.55	0.85	53	0.44	1.04	1.08
16	2.00	3.35	3.75	54	1.32	3.50	9.10
17	1.16	1.70	2.00	55	0.80	0.92	1.28
18	2.64	4.90	9.20	56	0.60	–	–
19	0.28	0.55	–	57	1.04	4.00	5.40
20	0.58	–	–	58	0.40	0.43	0.67
21	–	–	–	59	1.24	1.82	–
22	0.58	2.05	2.10	60	1.80	1.84	2.84
23	0.48	1.25	1.35	61	1.54	1.92	2.06
24	0.28	2.75	4.65	62	0.76	1.96	3.88
25	2.10	3.90	–	63	1.04	1.82	5.82
26	0.94	2.30	3.60	64	0.52	1.30	2.28
27	2.98	5.35	–	65	–	–	–
28	0.32	0.35	0.85	66	0.36	0.50	0.68
29	0.34	1.24	2.20	67	1.30	2.20	3.36
30	1.58	5.50	16.35	68	2.14	2.50	3.34
31	0.94	2.50	2.55	69	2.44	–	–
32	0.64	0.80	2.20	70	0.30	0.38	0.45
33	1.30	3.40	4.75	71	2.78	–	–
34	1.14	2.65	2.75	72	0.68	0.84	0.94
35	0.78	0.85	0.90	73	0.68	1.52	2.28
36	2.64	4.10	4.15	74	0.40	0.45	1.66
37	1.74	2.50	2.68	75	0.49	0.68	2.02
38	0.24	0.90	–				

Applying these values in Kunkel's formula we calculate the differences:

$$\Delta M_V\ (T_{0.5}) = 0^m.31$$

$$\Delta M_V\ (T_{0.2}) = 2.16$$

$$\Delta M_V\ (T_{0.1}) = 3.42$$

Our results for $\langle \log T_{0.5} \rangle$ confirm Kunkel's empirical formula.

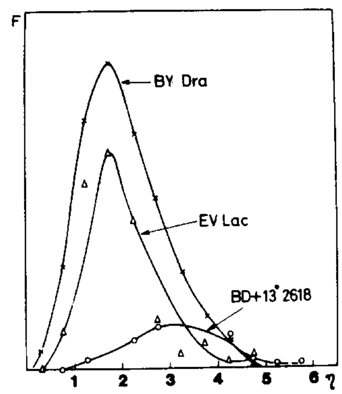

Figure 1

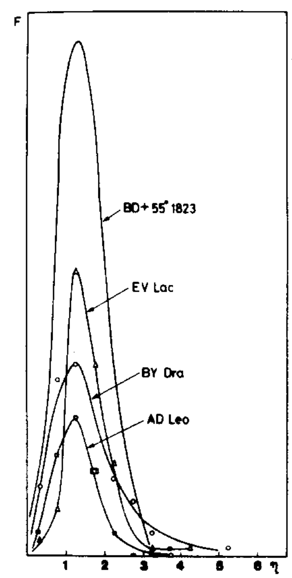

Figure 2

Thanks are due to Prof. Dr. L.N. Mavridis, Head of the Department of Geodetic Astronomy, University of Thessaloniki, Greece, for supervising this research.

F.M. MAHMOUD
Helwan Institute of
Astronomy and Astrophysics
Cairo - Egypt

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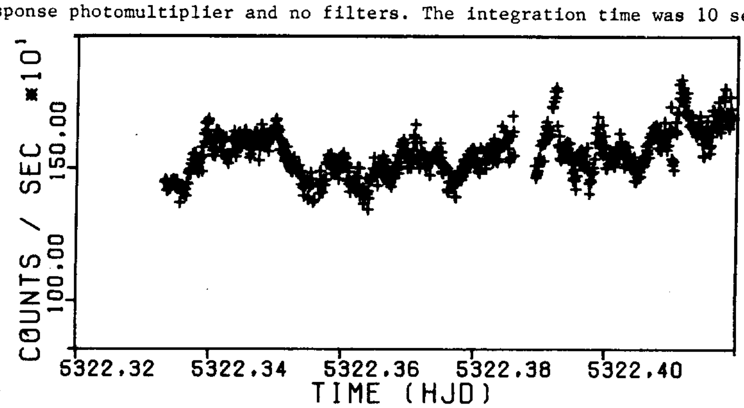
HIGH SPEED PHOTOMETRY OF PG0244+104

PG0244+104 is among the cataclysmic variable candidates found in the Palomar Green Survey (Green et al. 1982). It is described as having high excitation emission lines, and an Hβ line 5000 km sec^{-1} broad (FWZI). Green et al. list its B magnitude as 15.8.

In order to check the nature of this star I observed it on 18 December 1982 with the 40 inch reflector at the Sutherland site of the South African Astronomical Observatory. A high speed photometer was used with an S-20 response photomultiplier and no filters. The integration time was 10 secs.



The Figure shows the light curve obtained during two hours of observation. The mean light level corresponds to a B magnitude ~14.7, considerably brighter than previously listed.

The evident activity in the light curve shows PG0244+104 to be a rapid variable of the cataclysmic class.

BRIAN WARNER

Department of Astronomy
University of Cape Town
Republic of South Africa

Reference :

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THE NATURE OF THE COOL COMPONENT OF THE BX MONOCEROTIS SYMBIOTIC SYSTEM

BX Mon (Mep) shows a combination spectrum (low temperature absorption features plus high temperature emission lines) with particularly strong HI emission lines (Merrill and Burwell 1950, Bidelman 1954). It is often classified among the symbiotic stars (e.g. Michalitsianos et al. 1982) and is distinguished in having a period of 1374 days (Mayall 1940). If its variability is due to Mira pulsations, as generally supposed, then it has the longest known period for this type of variable (although the OH/IR sources which are thought to be related to Miras do have periods of this order). This note describes some infrared observations which indicate that BX Mon is not a Mira variable.

JHKL (1.25; 1.65; 2.2; 3.5μm) photometry obtained with the SAAO MKII photometer on the 0.75m reflector in Sutherland on 1982, November 20 yield the following magnitudes:

$J = 6.96$; $H = 5.96$; $K = 5.63$ and $L = 5.40$ ($\pm$ 0.05 JHK, $\pm$ 0.09 L).

These colours do not fall in the regions of the infrared two-colour diagrams occupied by Mira variables (Feast et al. 1982). Furthermore they do not indicate the presence of the dust excess typical of symbiotic systems containing Mira variables (Feast et al. 1983). When allowance is made for a very small amount of reddening ($E_{B-V} = 0.1 - 0.2$, Michalitsianos et al. 1982), these colours are appropriate to a normal M5III star (Lee 1970). This spectral type is in reasonable agreement with the M4 classification of the absorption spectrum by Bidelman (1954).

A low resolution infrared (1.2 - 2.5μm) spectrum of BX Mon was obtained with a filter wheel spectrometer on the 1.9m reflector at SAAO on 1983, January 28. Except for the presence of Paschen-β emission the spectrum is typical for a non-Mira M giant (M4-M6) in having moderately strong CO absorption at 2.3μm. There is no sign of the H_2O absorption features which are particularly strong in Mira variables. (see e.g., the symbiotic Mira R Aqr, Whitelock et al. 1983).

The strength of the Balmer emission lines is definitely abnormal for a Mira (Bidelman 1982, private communication). It would seem likely that these lines originate in the nebulosity surrounding the symbiotic system and are excited by the hot component. This would explain the Me classification of a star which is not a Mira.

The infrared observations described above are atypical for a long-period Mira. It is unlikely that the variation is due to a semi-regular variable given its large-amplitude (mpg ∿ 3 mag.), long-period and its regularity. It is therefore possible that the variation is actually associated with the orbital motion in the symbiotic binary. If this is the case then BX Mon is clearly a system which merits further study.

We are grateful to Prof. W. P. Bidelman for some useful correspondence and to Dr M. W. Feast for helpful discussion.

P. A. WHITELOCK and R. M. CATCHPOLE

South African Astronomical Observatory
P O Box 9
Observatory, Cape Province
7935
South Africa

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ON THE CONSTANCY OF THE PERIOD OF THE MAGNETIC Ap STAR HD 215441

Rakosch (1968) suggested variable periods for some Ap stars. From the point of view of the interpretation of the light variability of magnetic Ap stars as an effect of rotation it is an important question whether the period is constant or not. Therefore many authors investigated this problem. In the course of time it becomes more and more clear that all observations can be explained with constant periods.

Only HD 215441 remains, for which Rakosch (1968) and later Stift (1973) discussed a variable period. Renson (1972) could not find any change in the period of this star, but Panov and Schöneich (1975) showed that, at some epochs, small changes could not be excluded. All these investigations, carried out with O-C-diagrams, use a small number of observations around the extreme values of the light curves only. The accuracy of the obtained phases will be higher if all points of the light curve are used.

Hempelmann and Schöneich (in preparation) developed a method for the determination of the brightness distribution over the star's surface from the light curve. This method permits also derivation of the phase angle Θ, at which the centre of the peculiar region passes by the line of sight. It has to be underlined that, among all parameters, Θ can be obtained with the highest degree of accuracy and is especially for a star like HD 215441 with a single peculiar region, independent from the accuracy of other parameters.

We investigated the wavelength dependence of Θ. The values of Θ were computed for the light curves of the ten colour photometry by Schöneich et al. (1976) and the UV photometry by Leckrone (1974), provided that the observations are carried out at nearly the same time. Figure 1, presenting Θ as a function of the wavelength, shows a constancy of Θ in the range greater than 200 nm. For this reason one can compare the light curves from all other authors in different colours.

For all available observations by Jarzebowski (1960), Cameron (1966), Stepien (1968), Schöneich et al. (1976), Leckrone (1974), Hildebrandt et al. (in preparation) and Panov (private communication) the angle Θ was computed

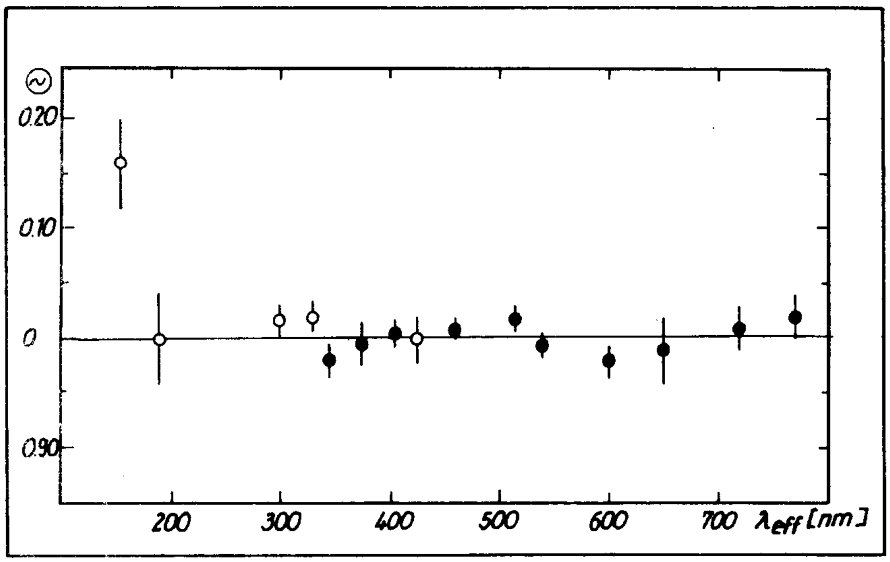

Figure 1

The wavelength dependence of the phase angle Θ. Open circles denote Θ from measurements by Leckrone (1974), filled circles are for the ten-colour-photometry

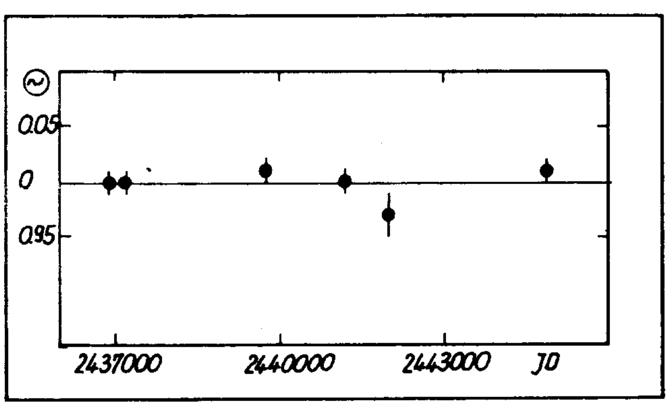

Figure 2

The time dependence of Θ.

with the elements by Panov (private communication).

$$JD_o = 2441902.49 + 9.4875\ E$$

Figure 2 presents the computed Θ as a function of time. There is no significant difference of a single Θ from the averaged ones and therefore we conclude that in the last 22 years there has been no observational evidence for any change in the period of HD 215441.

A. HEMPELMANN, W. SCHÖNEICH

Zentralinstitut für Astrophysik
Astrophysikalisches Observatorium Potsdam
DDR-1500 Potsdam
Telegrafenberg

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HD 85037 NOUVELLE VARIABLE A ECLIPSES PROBABLE

Pour une étude de variations photométriques d'étoiles Ap en décembre 1975, la seconde étoile de comparaison adoptée pour l'une d'elles (HD 83368) était HD 85037 (=GC 13508= CoD-49°4692, m_v=6,7:, type AOp). Des écarts probables dans les mesures ont fait craindre qu'elle soit variable. Des observations ultérieures, en février 1977, (Renson et Manfroid 1978) ont donc été faites avec une autre seconde étoile de comparaison C_2, tandis que la première, C_1=HD 82578, restait la même. Les résultats, analysés sur la base des différences Ap - $(C_1+C_2)/2$, ont alors été beaucoup meilleurs et cela au delà de ce que pouvait faire prévoir la moins bonne précision générale des observations de 1975 (mesures isolées de chaque étoile au lieu des séquences symétriques C_1-Ap-C_2-Ap-C_2-Ap-C_1). Ceci confirme que c'est bien C_2 de 1975, c'est-à-dire HD 85037, qui varie.

L'examen des différences C_2-C_1, pour les quatre couleurs du système *uvby* utilisé, à l'aide de la méthode habituelle de recherche des périodes (Renson 1978,1980), indique qu'il y a effectivement une période probable de

1,346j ± 0,005j .

Toutefois, les observations de 1975 n'étant pas assez diversement réparties en fonction de l'heure pour éliminer les périodes associées, il n'est pas exclu, quoique moins probable, que la vraie période soit environ 0,812j ou 0,576j ou peut-être même 4,1j. Il n'est pas exclu non plus que la véritable période soit le double de la valeur trouvée.

La Figure 1 montre, pour *y*, les différences C_2-C_1 entre HD 85037 et la première étoile de comparaison, HD 82578 (=GC 13156=CoD-47°5002), en fonction de la phase calculée avec P=1,346j. Pour les trois autres couleurs *b,v* et *u*, les figures, non reproduites ici, sont très semblables à celle-ci.

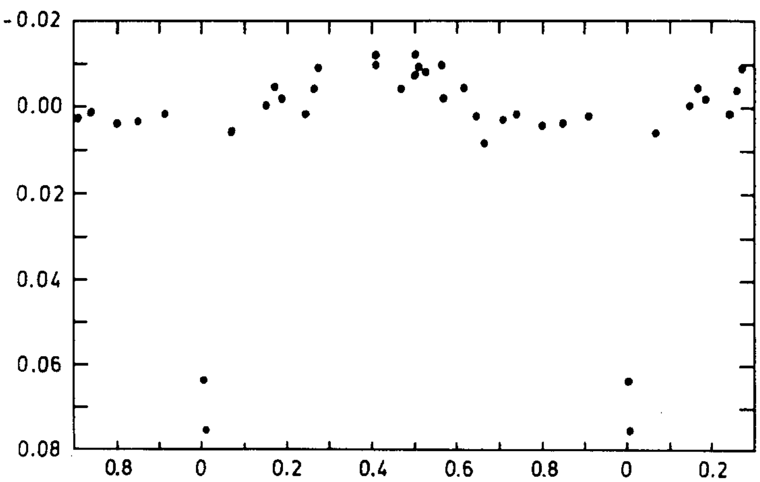

Figure 1

L'origine adoptée pour les phases est l'époque J.J. 2442763,00. La phase 0 correspond alors à un minimum aigu indiqué par deux des mesures et qui donne à penser que la cause de cette variation est un phénomène d'éclipse.

Il est toujours possible qu'une valeur divergente soit éventuellement causée par une erreur accidentelle dans les mesures, sans qu'aucune vérification ne soit possible puisque les mesures de 1975 étaient des mesures isolées. Néanmoins, non pas une, mais deux mesures divergent par rapport à l'ensemble des autres et cela pour les quatre couleurs; ceci rend le phénomène d'éclipse assez probable. De plus, même l'ensemble des autres mesures montre une faible variation générale. Celle-ci peut être due notamment à un effet d'ellipticité.

L'éclipse est probablement très partielle. La variation totale observée est faible : moins de 0,09 mag pour chacune des quatre couleurs (peut-être un peu moins en v et u qu'en y et b). Nous ne connaissons toutefois pas la profondeur réelle du minimum, la densité d'observations étant insuffisante.

Il y a peut-être un minimum secondaire juste avant la phase 0,7; mais ici aussi le manque d'observations ne permet pas d'apprécier sa profondeur ni même d'être sûr de sa réalité. Si c'est le cas, l'orbite doit être assez excentrique et l'angle entre la direction d'observation et la ligne des apsides assez grand. Notons cependant que d'après les observations, l'étoile serait alors plus lumineuse dans l'intervalle le plus long entre les minima.

Etant donné que le minimum principal n'est indiqué que par deux mesures et que le reste de la variation ne dépasse pas beaucoup les erreurs de mesures, les conclusions ne peuvent être que provisoires. Pour interpréter plus complètement et valablement les variations, il faudrait faire un beaucoup plus grand nombre d'observations. Des mesures de vitesse radiale seraient évidemment utiles aussi pour confirmer la nature binaire de cette étoile HD 85037.

L'auteur remercie l'E.S.O. pour le temps d'observation qui lui a été accordé et au cours duquel les mesures ont été obtenues. Il remercie aussi A. Heck qui a fait toutes les observations de décembre 1975.

P. RENSON

Institut d'Astrophysique
de l'Université de Liège
B-4200 Cointe-Ougrée (Belgique)

(Observations faites par A. HECK
à l'Observatoire Européen
Austral, ESO, La Silla, Chili)

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IMPROVED LIGHT ELEMENTS OF W GRUIS

The purpose of this note is to present five new times of minimum light of the southern eclipsing binary W Gru, to give an improved (4 years base-lined) photoelectric linear ephemeris and to recalculate the parabolic ephemeris given by Cerruti and De Laurenti (1981). History of this object is also given in the latter reference.

The observations were made during 1981 and 1982 at CTIO* in the U, B, V bands. Individual minima together with that determined by Cerruti and De Laurenti (1981) are listed in Table I. The standard errors are given in brackets, they were determined from the light curves on each pass-band. A least squares linear ephemeris gives:

$$\text{Min I} = \text{HJD } 2444517\overset{d}{.}6963 + 2\overset{d}{.}9685249\ E, \quad \pm.0006 \quad \pm.0000034 \text{ m.e.} \qquad (1)$$

In Table I we also list the cycles E with their weights and the residuals (O-C) from the above ephemeris.

The minimum defined by (1) together with those determined by Pickering (1913), Payne-Gaposchkin (1947) and Imbert (1974) gives the following least squares parabolic ephemeris:

$$\text{Min I} = \text{HJD } 2430132\overset{d}{.}153 + 2\overset{d}{.}9685021\ E + 7\overset{d}{.}52\ 10^{-9}\ E^2, \quad \pm.017 \quad \pm.0000026 \quad \pm0.69\ 10^{-9} \text{ m.e.} \qquad (2)$$

Residuals from the parabolic ephemeris are presented in Table II, labelled as Table I. The (O-C) residuals and the resulting increase of the period at a constant rate of 0.080 sec/y confirm our previous results (Cerruti and De Laurenti, 1981). Figure 1 depicts the (O-C) residuals from (2).

*CTIO is operated by AURA under contract with the NSF (USA).

Table I

Times of minima and residuals for linear ephemeris

Min.	Band	HJD(sigma) 2400000+	E(w)	(O-C)
I	V	43778.5326(2)	-249.0(7.1)	-0.0010
I	B	43778.5309(3)	-249.0(5.8)	-0.0027
I	U	43778.5263(11)	-249.0(3.0)	-0.0073
I	V	43781.4987(3)	-248.0(5.8)	-0.0034
I	B	43781.4992(2)	-248.0(7.1)	-0.0029
I	U	43781.4970(5)	-248.0(4.5)	-0.0051
II	V	43818.6125(5)	-235.5(4.5)	0.0038
II	B	43818.6144(2)	-235.5(7.1)	0.0057
II	U	43818.6153(10)	-235.5(3.2)	0.0066
II	V	44177.8042(2)	-114.5(7.1)	0.0040
II	B	44177.8046(4)	-114.5(5.0)	0.0044
II	U	44177.8030(3)	-114.5(5.8)	0.0028
I	V	44517.6947(4)	0.0(5.0)	-0.0016
I	B	44517.6947(7)	0.0(3.8)	-0.0016
I	U	44517.6935(15)	0.0(2.6)	-0.0028
II	V	44830.8771(7)	105.5(3.8)	0.0014
II	B	44830.8764(6)	105.5(4.1)	0.0007
II	U	44830.8758(8)	105.5(3.5)	0.0001
II	V	44833.8435(4)	106.5(5.0)	-0.0007
II	B	44833.8438(6)	106.5(4.1)	-0.0004
II	U	44833.8436(6)	106.5(4.1)	-0.0006
II	V	44839.7774(8)	108.5(3.5)	-0.0038
II	B	44839.7790(9)	108.5(3.3)	-0.0022
II	U	44839.7770(4)	108.5(5.0)	-0.0042
II	V	44842.7510(6)	109.5(4.1)	0.0012
II	B	44842.7514(4)	109.5(5.0)	0.0016
II	U	44842.7493(4)	109.5(5.0)	-0.0005
II	V	45228.6577(7)	239.5(3.8)	-0.0003
II	B	45228.6599(3)	239.5(5.8)	0.0019
II	U	45228.6585(6)	239.5(4.1)	0.0005

Table II

Times of minima and residuals for parabolic ephemeris

Min.	Meth.	HJD(sigma) 2400000+	E(w)	(O-C)
II	vis.	10001.6	-6781.5(1.0)	-0.0015
I	ph.	30132.156	0.0(3.0)	0.0033
I	sp.	41569.88(55)	3853.0(1.3)	-0.0231
I	UBV	44517.6963(06)	4846.0(4.1)	0.0056

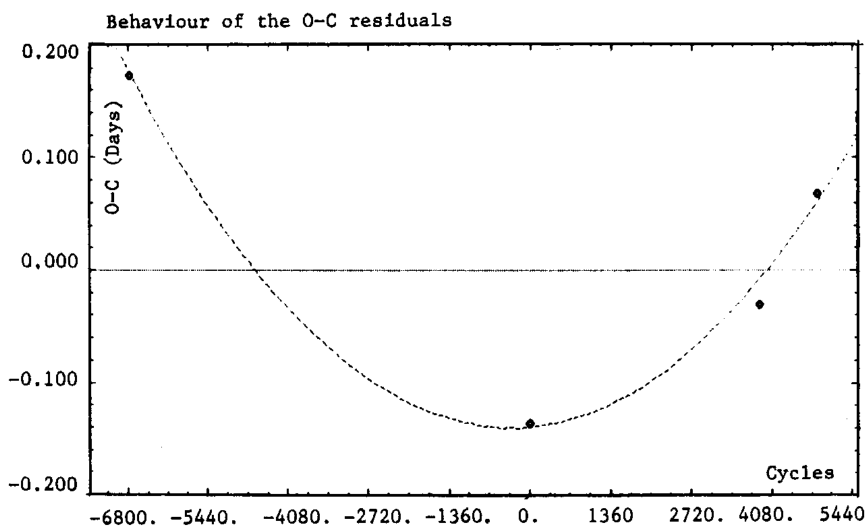

Figure 1

The light curve constructed with 2500 individual observations and a classical orbital analysis will be published elsewhere.

MIGUEL ANGEL CERRUTI

Instituto de Astronomia
y Fisica del Espacio
CC 67 Suc 28
1428 Buenos Aires
Argentina

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UBV OBSERVATIONS OF YY Eri

The 8th magnitude W UMa-type eclipsing binary system YY Eri appears to be a fairly representative example of the W subgroup of these stars (Binnendijk, 1965, 1970; Ruciński, 1973; Yamasaki, 1975) - possibly the first to be recognized as such (Struve, 1947). In keeping with this character is the tendency of period increase (Yamasaki, op.cit.) noted by Cillié (1951), Huruhata et al. (1953) and Kwee (1958), and taken to have constant retardation by the Purgathofers (1960), though Bhattacharyya (1967) indicates that this need not be the case.

The star was observed during five nights, over the period Jan. 22-Feb. 7 1983, at the Black Birch Outstation of Carter Observatory, using the 41cm Ruth Crisp telescope and optical filters which have characteristics close to standard UBV. The observations cover the primary minimum three times and part of the secondary on one night (see diagrams). Data in the phase range ∿ 0.45-0.7 were obtained on the night of Feb. 6 with less than perfect weather present (thin cirrus), which deteriorated somewhat during the observations. This is reflected in the increased scatter of the given points, and the "normalizing" (averaging) of later data from that night. The remaining data are individual points straightforwardly obtained by a standard DC amplifier/chart recorder system, with a minimum of reductional procedures applied through the University of Wellington's VAX computer. (The diagrams shown have been produced as part of the output from this computer).

The principle comparison and check stars were the same as those used by Bhattacharyya (op.cit.). The discrepancy between comparison and check (s.d. $0^{m}.022$ in B and U) is rather greater than one would like; it may be associated with some microvariability of the K-type check star.

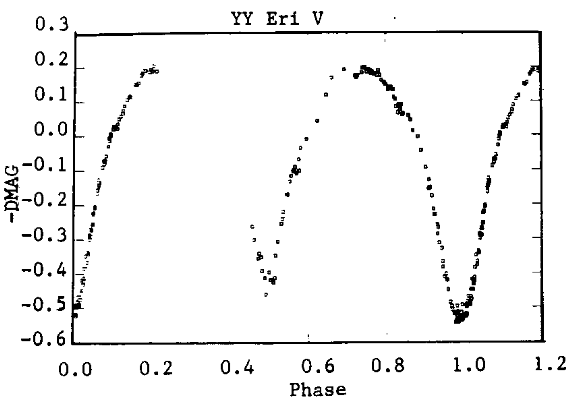

Figure 1

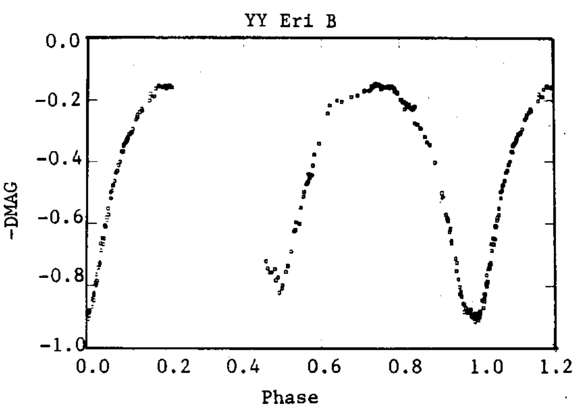

Figure 2

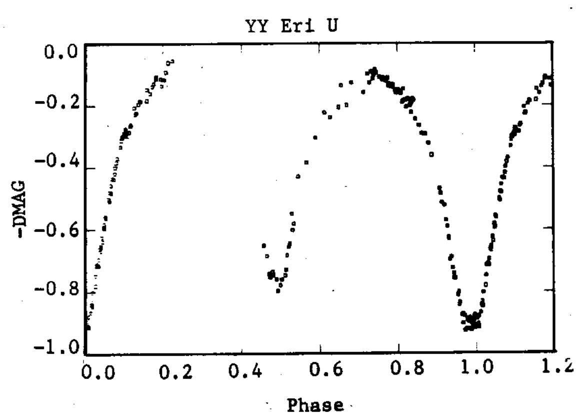

Figure 3

A preliminary epoch of minimum is given as HJD 2445356.9456. This will give an O-C of -0.0086 days when reckoned by the light elements of the Purgathofers, though this is reduced to -0.0045 days when calculated from Strauss' (1976) more recent light elements. While the residual is still rather large, it is less than that given by Strauss when comparing his own observed time of minimum with that calculated by the ephemeris of the Purgathofers. Strauss (op.cit.) concluded that the period was nonmonotonically varying, or that the Purgathofers did not estimate it accurately (though the error limit specified by the latter is much less than could explain the discrepancy).

Perhaps this period variation is related to the "exceptionally interesting phenomenon" of apparent spectroscopic luminosity variation emphasized by Struve (op.cit.), which in turn may be connected with the polarization effects considered by Oshchepkov (1974), (though the latter's interpretation of the sense of the supposed "stream" is surely at variance with other effects). In any case, the system merits close attention as a potentially informative member of this enigmatic class of object.

EDWIN BUDDING

Carter Observatory
P.O. Box 2909,
Wellington, 1,
NEW ZEALAND.

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