

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

Nos. 3601 - 3700
1991 May - 1992 March

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HU ISSN 0374 - 0676

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3 March 1992

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

Number 3601

Konkoly Observatory
Budapest
8 May 1991

HU ISSN 0374 - 0676

A RECENT BRIGHTENING FOR THE HERBIG Be STAR HD 53367

HD 53367 is one of the brightest of the Herbig Be stars: objects thought to be either zero-age or pre-main sequence stars. Alternately known as MWC 166 and RST 3489 (separation = 0.6 arc sec; $\Delta m = 1.3$ with a B1 Ve star), the star is associated with the nebulosity IC 2177 and is a member of the CMa OB1 association. Spectral types for the star range from B0 IVe (Buscombe 1980) to B1ne (Merrill & Burwell 1933).

Halbedel (1989) has previously published photometry of HD 53367 which shows it to be variable. This paper continues these observations and reports on a recent brightening that the star has undergone. Differential photometry has been carried out by the author for the past six observing seasons with the 0.6-m. telescope of the Corralitos Observatory and its ambient temperature EMI 9924A-based pulse-counting photometer. Standard stars utilized were HD 53240 ($V=6.441$; $B-V=-.083$) and HD 53302 ($V=8.164$; $B-V=+.227$). These stars were stable over the time period of observation to within 0.017 V and 0.020 B-V magnitudes. HD 53367 is sufficiently bright that short integration times could be used. Therefore, there is likely no interference from the surrounding nebulosity which at no time could be seen by the eye.

The previously published four seasons' magnitudes as well as those from the two most recent observing seasons appear in Figure 1, while the newest magnitudes are listed

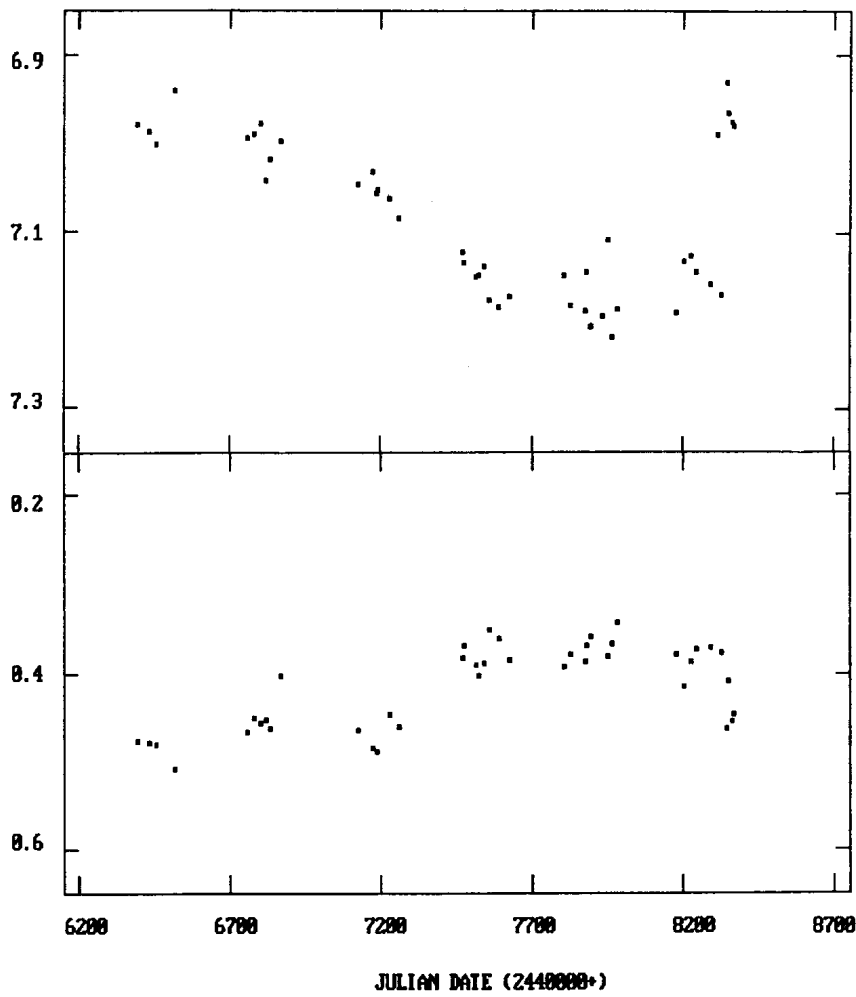


FIGURE 1: MAGNITUDES FOR HD 53367. THE TOP DIAGRAM SHOWS V MAGNITUDE, THE BOTTOM B-V.

in Table 1. It may be seen that the relatively steady decline in V mag has reversed itself dramatically. Observing season 6 reveals a sudden brightening of 0.239 magnitudes in

TABLE 1: MAGNITUDES FOR HD 53367

JD (2440000+)	V	B-V	JD (2440000+)	V	B-V
7806.95833	7.148	+.393	8205.88680	7.132	+.415
7828.00000	7.182	.379	8225.89097	7.125	.386
7878.92013	7.187	.386	8243.80625	7.142	.373
7881.78750	7.142	.368	8292.83194	7.158	.371
7896.80208	7.205	.358	8313.75606	6.989	----
7933.62291	7.194	----	8328.69792	7.170	.378
7952.66805	7.107	.381	8347.66111	6.931	.462
7965.70417	7.217	.367	8348.67500	6.965	.408
7985.63472	7.186	.343	8364.63611	6.976	.454
8176.96250	7.190	.379	8367.62917	6.980	.446

a time period of 19 days. The B-V magnitudes show anti-correlation with the V mag: as the star brightens, its color reddens. This is likely indicative of an increase in optical depth of circumstellar material.

It should be recalled that HD 53367 is visually binary with another Be star whose potential light variations may be influencing the situation since it is only a magnitude and a half fainter than its primary. Perhaps some of the variation proceeds from this source.

HD 53367 will continue to be observed at the Corralitos Observatory in the future in order that its long-term behavior may be understood.

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REFERENCES

- Buscombe, W. 1980, MK SPECTRAL CLASSIFICATIONS, FOURTH GENERAL CATALOGUE (Northwestern Univ., Evanston)
Halbedel, E.M. 1989, PASP, 101, 1004
Merrill, P.W. & Burwell, C.G. 1933, ApJ, 78, 87

COMMISSION 27 OF THE I.A.U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3602

Konkoly Observatory
Budapest
8 May 1991
HU ISSN 0374 - 0676

A CONTINUATION OF QUASI-PERIODIC BEHAVIOR FOR

HD 45677 = FS CMa

HD 45677 = FS CMa is not an "ordinary" member of the class of Be stars. It has been suggested to be an object intermediate between these and the planetary nebulae or else a symbiotic object since it possesses an extended shell of gas and dust of considerable density. Its spectral type has been classified in the range B0p (Rufener 1981) to B3 V (Low et al. 1970), but it possesses strong emission lines both permitted (hydrogen) and forbidden (Fe II, Ni II, Cr II, S II, O I). Partly due to its strong infrared excess, it has been suggested that it is binary with a very late-type giant/supergiant or perhaps an infrared object still in the process of formation (Ciatti et al. 1974). Alternately, Allen (1971) suggested that the excess is caused by H⁻ free-free emission. Recently Sorrell (1989) modelled the far UV to far IR energy distribution as a spherical dust shell (a fossil from the star's formation surrounding a single hot young [$< 10^8$ years] object).

Halbedel (1989) has published four years of photometry for HD 45677 which showed two types of variation: a quasi-periodic 296.5 day V mag variation superimposed on a >3 year change. This paper reports on a further two years of observations for the star. All recent differential photometry was obtained with the 0.6-m. telescope of the Corralitos Observatory and its ambient temperature EMI 9924A-based pulse-counting photometer. Comparison stars used were HD 45495 ($V=8.375$; $B-V=-.027$) and HD 45629 ($V=7.091$; $B-V=-.032$). They

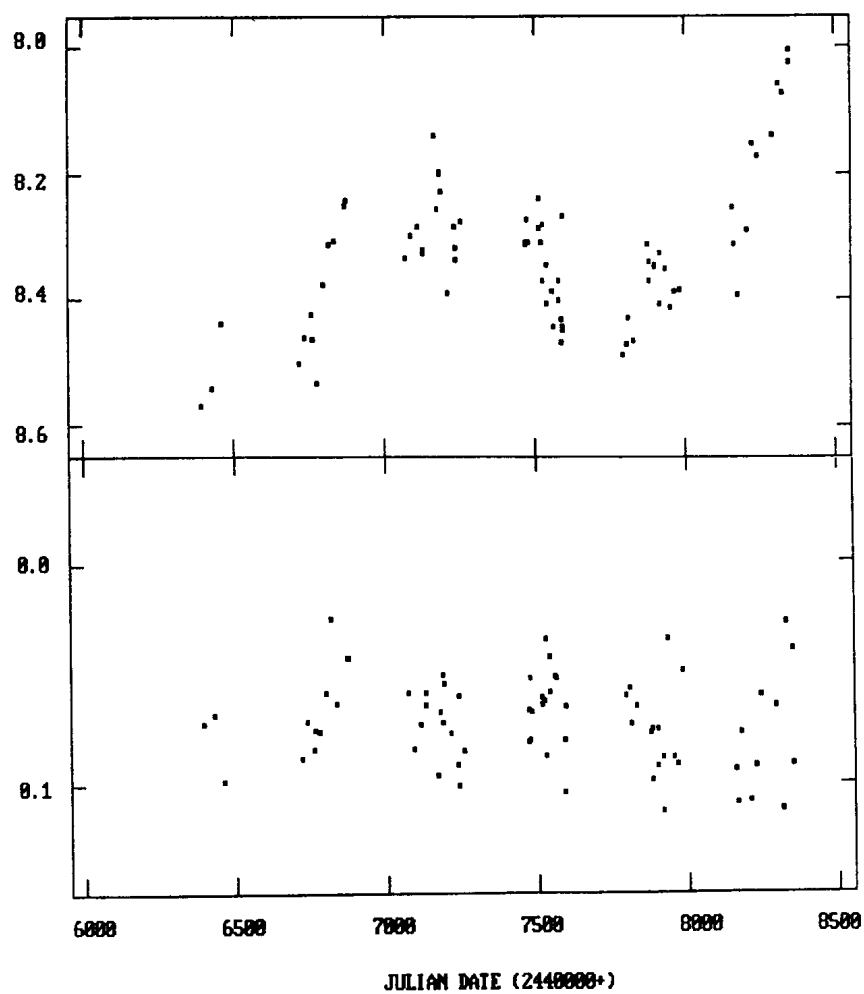


FIGURE 1: MAGNITUDES FOR HD 45677. THE TOP DIAGRAM SHOWS V MAGNITUDE, THE BOTTOM B-V.

TABLE 1: MAGNITUDES FOR HD 45677

JD			JD		
(2440000+)	V	B-V	(2440000+)	V	B-V
7793.96806	8.490	+.060	7965.67361	8.389	+.091
7806.93750	8.471	.057	7983.62222	8.386	.049
7809.93958	8.430	.073	8159.97916	8.255	.094
7827.96111	8.466	.065	8161.95138	8.314	.109
7878.88680	8.313	.077	8176.92986	8.394	.077
7880.85694	8.371	.075	8205.86805	8.291	.108
7881.77222	8.340	.098	8225.86042	8.154	.092
7896.76736	8.349	.075	8243.72569	8.174	.060
7897.76874	8.346	.092	8292.78542	8.138	.065
7915.71805	8.328	.113	8313.68748	8.059	.112
7917.75347	8.408	.088	8328.65694	8.071	.072
7933.61736	8.352	.034	8347.64653	8.023	.091
7952.66250	8.413	.088	8350.62500	8.005	----

were found to be stable to 0.016 in V and 0.017 in B-V over the time period of observation.

The thusfar unpublished magnitudes for HD 45677 are set forth in Table 1, and appear graphically along with the previous data in Figure 1. It may be seen that the star still undergoes both short and long cycle time behavior. At present it is brighter than it has been for some time, but there has been no concomitant color change. A period search utilizing the Minimum Phase Dispersion Technique of Stellingwerf (1978) and all 6 years of data finds that the best quasi-period is still similar, 296.7 days, though the scatter in the phase diagram is greater than when this analysis was previously done for only 4 observing seasons. It seems unlikely that this is anything but a temporary phenomenon since FS CMa has undergone long "stand stills" in the past. Therefore, it is not likely connected with binary motion unless it proceeds from semi-regular light variations of a companion late-type star. Still, it is of interest that quasi-periodicity has persisted for six years thusfar.

HD 45677 will continue to be observed at the Corralitos
Observatory indefinitely.

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REFERENCES

- Allen, D.A. 1971, PASP, 83, 602
Ciatti, F., D'Odorico, S. & Mammano, A. 1974, A&A, 34, 181
Halbedel, E.M. 1989, PASP, 101, 999
Low, F.J., Johnson, H.L., Kleinmann, D.E., Latham, A.S.,
& Geisel, S.L. 1970, ApJ, 160, 531
Rufener, F. 1981, A&AS, 45, 207
Sorrell, W.H. 1989, MNRAS, 241, 89
Stellingwerf, R.F. 1978, ApJ, 224, 953

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

Number 3603

Konkoly Observatory
Budapest
13 May 1991
HU ISSN 0374 - 0676

NEW EPHEMERIS OF THE ECLIPSING SYMBIOTIC STAR AX Per

The light-curve of the symbiotic star AX Per has been studied since 1887 photographically (e.g. Lindsay, 1932, Payne-Gaposhkin, 1946, Mjalkovskij, 1977). The light variations amount to about $\Delta m = 0.2 - 0.3$ mag at a quiescence and of $\Delta m = 2 - 3$ mag at outbursts, but with practically the same minima separation were observed. Lindsay (1932) estimated period of 650 days and Payne-Gaposhkin (1946) 675 days respectively. Recently, Kenyon (1982) analysed mathematically photographic and photovisual light-curves obtained by Mjalkovskij (1977) and found a periodicity of 681.6 days with the ephemeris:

$$JD(\min) = 2436679.4(\pm 8) + 681.6(\pm 7.2) \text{ days} \times E.$$

Since January 1988, when the last outburst started (IAU Circ. No. 4544), AX Per has been monitored intensively both visually and photoelectrically. Two well defined primary minima, observed during this recent star's activity, were used to determine the new ephemeris of the light-minima more accurately.

Photometric observations of AX Per were carried out in the standard UBV system using a one-channel photoelectric photometer installed in the Cassegrain focus of the 0.6/7.5 m reflector of the Skalnaté Pleso (1780 m above sea level) and Tatranská Lomnica (870 m above sea level) Observatories, operating on the principle of the method of pulse counting. HD 10063 (SAO 22481), $V = 7.39$, $B-V = 0.25$, $U-B = -0.33$ was used as the comparison star and SAO 22444, $V = 7.427$, $B-V = 1.016$, $U-B = 0.632$ (Hric et al., 1991) and a star near AX Per ($\alpha(1950) = 01^h33^m5$, $\sigma(1950) = 53^{\circ}59'5$) as the check stars. The measurements were reduced to the international system.

The visual magnitude estimates were obtained from the data published in the IAU Circulars (Nos. 4544, 4549, 4558, 4563, 4566, 4593, 4621, 4685, 4696, 4745, 4820, 4915, 4994, 5113, 5126, 5167)

and those ones supplied by British Astronomical Association (Hric et al., 1991). Comparing the visual with the photoelectric V-magnitude or the photovisual Mjalkovskij's data during the eclipses, the former seem to be shifted by about 0.7 mag. The visual and photoelectric data are shown in Fig. 1. They will be published in the form of a table in Contr. Astron. Obs. Skalnaté Pleso 22.

As one can see in the Fig. 1, the shape of the deep, symmetrical central primary minima evidently reflects an eclipse of the hot component by the M giant. The second degree polynomial least squares fit gives the times of their middles at $JD\ 2447551.7 \pm 1.0$ from visual observations and at $JD\ 2448231.6 \pm 0.6$ from the U, B and V photoelectric measurements. These two last observed minima obviously do not comply with the ephemeris published by Kenyon (1982), see Fig. 1. Provided the orbital period is constant, but different from Kenyon's one, we can write the linear O-C relation as

$$O-C = \Delta JD(\text{Min}) = \Delta JD_0 + \Delta P \times E \quad (1)$$

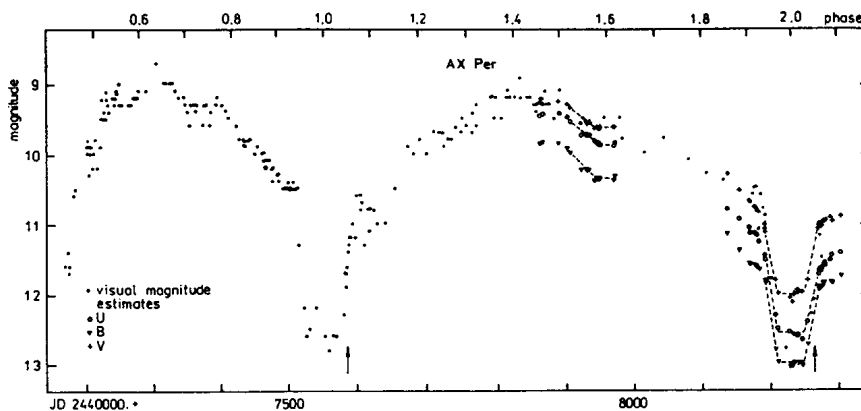


Fig. 1. The light-curve of the recent outburst phase of the symbiotic star AX Per compiled from visual magnitude estimates and photoelectric measurements. Arrows denote the times of the primary eclipses according to the old ephemeris. The orbital phase, on the top of figure, was calculated according to the new ephemeris (2).

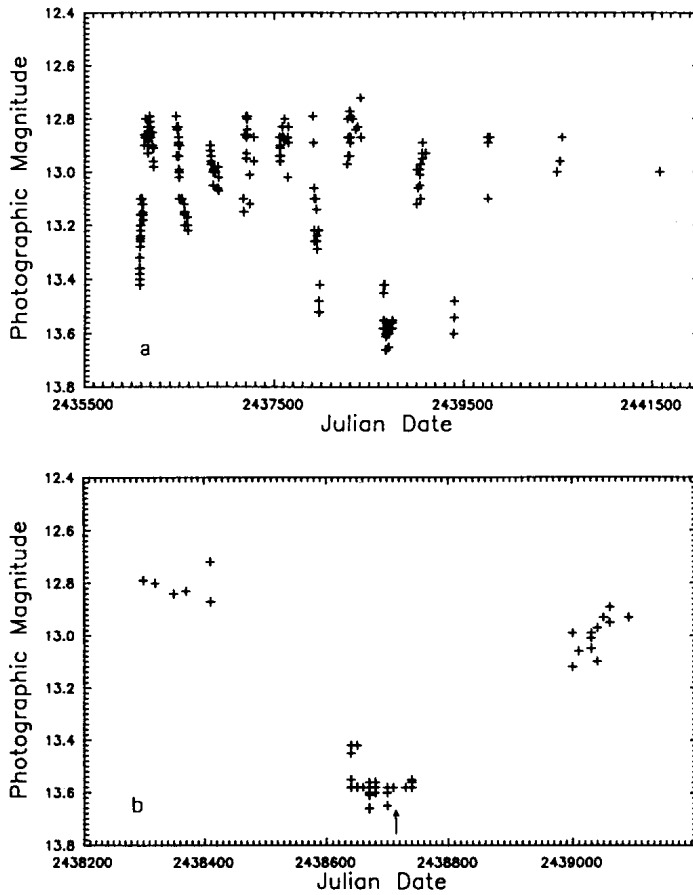


Fig. 2. Photographic data from Mjalkovskij (1977) - a). Only the data at about JD 2438700 seems to cover well the primary eclipse - b). Its determined middle (arrow) agree with the minimum according to the new ephemeris in 0.1 day.

where ΔJDo is a correction to the original epoch (JD 2436679.4) and ΔP is a correction to the old (681.6 day) period. The differences between the observed (JD 2447551.7 and JD 2448231.6) and computed (JD 2447585.0 and JD 2448266.6) times of the minima, -33.3 and -35.0 days respectively, imply the change in period $\Delta P = -1.7$ days. Linear extrapolation of the relation (1) to JD 2436679.4 gives the correction $\Delta JDo = -6.1$ days. So, the new ephemeris of

the primary minima of the symbiotic star AX Per is

$$JD(\text{Min}) = 2436673.3(\pm 0.6) + 679.9(\pm 1.2) \times E \quad (2)$$

Since only these two last minima were defined during the history of the AX Per observations, a confirmation of the new ephemeris (2) is not simple.

Only three minima had been tolerably defined since 1887. They were determined at $JD\ 2412160 \pm 40$ (from the figure in Lindsay, 1932), at $JD\ 2424435 \pm 15$ (from the Fig. 2 in Payne-Gaposhkin, 1946) and at $JD\ 2438712 \pm 1.6$ fitting Mjalkovskij's photographic and photovisual data between $JD\ 2438300$ and 2439090 , as his the best defined minimum, (Fig. 2). These times of primary minima agree with the new ephemeris. The differences are 36.9, 0.1 and 0.1 days respectively. Nevertheless, only further new, better photoelectric, systematic observations can unambiguously confirm or improve our new ephemeris (2).

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References:

- Hric, L., Skopal, A., Urban, Z., Dapergolas, A., Hanžl, O., Isles, J.E., Niarchos, P., Papoušek, J., Pigulski, A., Velič, Z.: 1991, *Contr. Astron. Obs. Skalnaté Pleso* 21, 303 (in press).
Kenyon, S.J.: 1982, *Publ. Astron. Soc. Pacific* 94, 165.
Lindsay, E.M.: 1932, *Bull. Harv. Coll. Obs.* No. 888.
Mjalkovskij, M.I.: 1977, *Perem. Zvezdy Pril.* 3, 71.
Payne-Gaposhkin, C.: 1946, *Astrophys. J.* 101, 362.

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

Number 3604

Konkoly Observatory
Budapest
17 May 1991
HU ISSN 0374 - 0676

Foreground Star on the Dumbbell Nebula: New Red Variable

A light variability of a foreground star on the planetary nebula NGC 6853 (M 27) has been established unusually, by the comparison of cover photos of the *Astronomy* (1990 May issue) and the *Deep Sky* (1990 Autumn issue) magazines. The star in question (marked with an arrow on an accompanying chart) is bright on the former and does not appear at all on the later. A scanning of miscellaneous literature showed that the star is missing on about forty percent of Dumbbell nebula's photos published in last decades. This fact together with an apparently large amplitude and a distinct orange colour of the star could indicate mira type.

An approximate position of the variable star can be determined from a photo given in the *Catalogue of Galactic Planetary Nebulae* (1967): right ascension $19^h 57^m 01^s$, declination $+22^\circ 37.2'$ (1950.0).

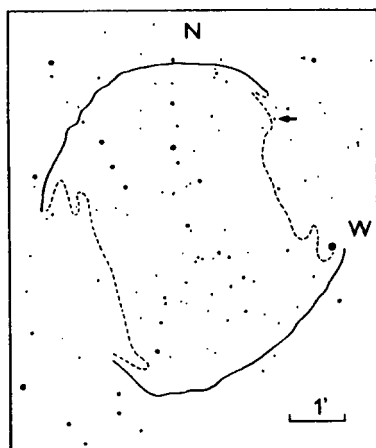


Figure 1

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Reference:

Perek, L., Kohoutek, L.: 1967, *Catalogue of Galactic Planetary Nebulae*,
Academia, Prague, Pl. 99

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

Number 3605

Konkoly Observatory
Budapest
17 May 1991

HU ISSN 0374 - 0676

BVI photometry of the symbiotic star C-1 in the Draco dwarf galaxy

The carbon giant C-1 in the Draco dwarf galaxy was discovered by Aaronson *et al.* (1982) to show emission lines of H I, He I and He II. It has been classified among symbiotic stars by Allen (1984). The symbiotic nature has been confirmed by Munari (1991) who observed marked spectroscopic changes in the emission spectrum and strong variability of H α radial velocity and shape which suggested orbital motion.

A number of plates have been exposed on C-1 with the 67/92 cm Schmidt telescope of the Asiago Astrophysical Observatory in the period 1987-1990. The magnitude of C-1 has been estimated by comparison with a set of reference stars derived from the photometry of Baade & Swope (1961), Stetson (1979) and Carney & Seitzer (1986). A journal of the observations and resulting magnitudes are given in the table.

BVI photographic photometry of C-1

date	J.D.	plate	filter	B	V	I
24 July 1987	2447001.425	103a-O	GG 13	18.6		
26 July 1987	2447003.506	I-N	RG 8			15.4
7 July 1988	2447350.533	103a-O	GG 13	> 17.9		
14 Aug. 1988	2447388.426	103a-O	GG 13	> 18.8		
5 May 1989	2447652.528	I-N	RG 8			15.7
28 May 1989	2447675.555	I-N	RG 8			15.0
9 June 1989	2447687.586	I-N	RG 8			14.5
	2447687.549	103a-O	GG 13	18.6		
3 Aug. 1989	2447742.417	I-N	RG 8			14.7
9 Aug. 1989	2447748.398	103a-O	GG 13	> 19.2		
	2447748.445	I-N	RG 8			::14.7
4 Sept. 1989	2447774.386	I-N	RG 8			15.6
	2447774.423	103a-O	GG 13	> 18.6		
20 July 1990	2448093.480	103a-O	GG 13	18.9		
	2448093.506	103a-D	GG 14		16.8	
28 July 1990	2448101.400	103a-O	GG 13	> 16.5		
18 Aug. 1990	2448122.409	103a-O	GG 13	18.4		
	2448122.439	I-N	RG 8			15.6
14 Oct. 1990	2448179.291	I-N	RG 8			15.5
	2448179.324	103a-O	GG 13	>18.5		

C-1 appears faint on many of the plates. Consequently, appreciable errors are to be expected in the reported photometry, which can be considered accurate on the average to 0.35 mag in I, to 0.25 in B and to 0.15 mag in V. Together with the photoelectric data reported by Aaronson *et al.* (1982) there are in all 12 mag estimates in B, 10 in I and 3 in V. In view of the involved large errors and paucity of data it is hazardous to derive any firm conclusion about the variability of C-1. Anyway some variability seems established in the B band if the observations on JD 2447748.398 and 2448122.409 are compared. The data in the table could support a ~ 1.0 mag variability in the I band which could be described as a bright phase in the summer of 1989.

In any case the data in table show a quiet photometric evolution during 1981-90 with no outburst recorded in the period 1987-90.

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References

- Aaronson, M., Liebert, J., Stocke, J.: 1982 *Ap.J.* 254, 507
 Allen, D.A.: 1984 *Proc.A.S.A.* 5, 367
 Baade, W., Swope, H.: 1961 *Astron.J.* 66, 300
 Carney, B.W., Seitzer, P.: 1986 *Astron.J.* 92, 23
 Munari, U.: 1991 *Astron.Astrophys.*, submitted
 Stetson, P.B.: 1979 *Astron.J.* 84, 1149

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

Number 3606

Konkoly Observatory
Budapest
20 May 1991

HU ISSN 0374 - 0676

A FURTHER PROOF ON THE BINARY MODEL OF HD 94033

HD 94033 was discovered by Przybylski and Bessell (1979) as a dwarf Cepheid with a pulsation period of 86 min.

We have observed 23 times of light maximum with the 60cm reflector at Xinglong station of Beijing Observatory from 1981 to 1991. Additionally, we collected 67 times of light maximum from the literature (Hobart et al., 1985; McNamara, 1985; McNamara et al., 1985). Combined with the 90 data, we have done some analysis of the period and noticed that the O-C values exhibit regular variation with a long period of about 9 years. New data provided here enable the periodicity to be repeated twice, and the analysis indicates that the growth rate of pulsation period is bigger than that in the literature (Yang Xiabing et al., 1985).

Table I gives the heliocentric epochs of maximum of HD 94033. Column 2 is the cycle number of each maximum, column 3 and 4 are the residual values computed with the parabolic equation and the binary model respectively.

After a least squares fit for all the times of maximum by following equation,

$$T_{\max} = T_0 + P_0 E + 0.58 E^2$$

and subtracting this parabola, we get Figure 1 showing how O-Cs vary with cycle number E. It is very clear that the new observation supports the hypothesis of binary model suggested by Jiang Shiyang (1986).

According to the light travel time effect in binary model, we use another (as following) formula to fit the times of maximum again.

$$T_{\max} = T_0 + P_0 E + 0.5\beta E^2 + A \sin \varphi + B \cos \varphi + C$$

where $\varphi = 2\pi f(T - \tau) + e \sin \varphi$

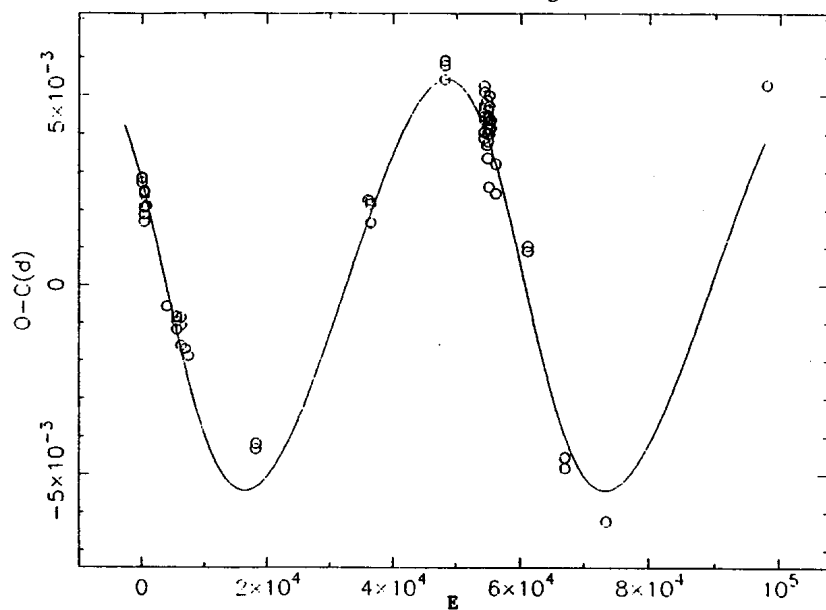
$$A = \frac{a \sin i}{c} \sqrt{1 - e^2} \cos \omega$$

$$B = \frac{a \sin i}{c} \sin \omega$$

Table 1. Times of light maximum for HD94033

T_{max}	E	(O-C) _p	(O-C)	T_{max}	E	(O-C) _p	(O-C)
HJD2440000.+		day	day	HJD2440000.+		day	day
2516.1585	0	0.0027	-0.0001	5751.7243	54369	0.0044	0.0003
2517.9439	30	0.0029	0.0000	5769.7564	54672	0.0046	0.0005
2518.0034	31	0.0028	0.0001	5769.8158	54673	0.0045	0.0006
2518.1223	33	0.0027	0.0001	5769.8750	54674	0.0041	0.0002
2541.9266	433	0.0025	0.0000	5770.6479	54687	0.0034	-0.0005
2541.9859	434	0.0024	-0.0002	5770.7077	54688	0.0037	-0.0005
2542.0448	435	0.0017	-0.0009	5770.7674	54689	0.0039	0.0001
2542.1044	436	0.0019	-0.0006	5776.7185	54789	0.0038	-0.0003
2542.8787	449	0.0025	-0.0000	5777.6699	54805	0.0031	-0.0008
2542.9382	450	0.0025	0.0000	5777.7303	54806	0.0039	0.0002
2542.9973	451	0.0021	-0.0004	5782.6699	54889	0.0041	0.0003
2543.8903	466	0.0024	0.0000	5782.7294	54890	0.0041	0.0003
2544.0094	468	0.0025	-0.0001	5782.7890	54891	0.0042	0.0004
2545.9137	500	0.0025	0.0001	5782.8485	54892	0.0042	0.0004
2545.9729	501	0.0021	-0.0003	5783.6812	54906	0.0037	-0.0002
2562.9930	787	0.0021	-0.0003	5783.7410	54907	0.0040	0.0003
2755.2111	4017	-0.0006	-0.0006	5783.8000	54908	0.0035	-0.0006
2846.9767	5559	-0.0010	0.0003	5784.6935	54923	0.0043	0.0003
2847.0958	5561	-0.0009	0.0005	5784.7527	54924	0.0040	0.0004
2847.1550	5562	-0.0012	0.0000	5784.8125	54925	0.0043	0.0004
2890.0628	6283	-0.0009	0.0008	5792.6660	55057	0.0023	-0.0014
2890.9553	6298	-0.0011	0.0007	5793.2037	55066	0.0044	0.0005
2891.9664	6315	-0.0016	0.0000	5793.2629	55067	0.0041	0.0001
2929.9939	6954	-0.0017	0.0004	5793.6792	55074	0.0038	0.0000
2958.9161	7440	-0.0019	0.0005	5795.0488	55097	0.0047	0.0009
3601.6931	18241	-0.0044	0.0009	5795.1073	55098	0.0037	-0.0000
3604.6688	18291	-0.0043	0.0009	5795.1670	55099	0.0038	0.0000
4664.2720	36096	0.0021	0.0004	5795.6431	55107	0.0038	0.0000
4690.0997	36530	0.0019	-0.0001	5796.0606	55114	0.0047	0.0009
4690.1593	36531	0.0020	-0.0000	5796.1194	55115	0.0040	0.0005
4691.1109	36547	0.0014	-0.0006	5796.1793	55116	0.0044	0.0006
4691.1705	36548	0.0015	-0.0005	5798.6785	55158	0.0041	0.0006
5383.2904	48178	0.0051	-0.0001	5800.6422	55191	0.0040	0.0001
5384.1834	48193	0.0055	0.0003	5808.6168	55325	0.0041	0.0003
5384.2430	48194	0.0056	0.0003	5808.6761	55326	0.0038	0.0004
5748.7479	54319	0.0036	-0.0004	5808.7358	56327	0.0040	0.0004
5748.8081	54320	0.0043	0.0001	5854.4989	56096	0.0029	-0.0002
5748.8671	54321	0.0038	-0.0003	5856.4620	56129	0.0021	-0.0012
5748.9278	54322	0.0049	0.0007	6153.0652	61113	0.0006	0.0006
5748.9861	54323	0.0037	-0.0002	6153.1248	61114	0.0007	0.0012
5749.7608	54336	0.0048	0.0006	6501.2014	66963	-0.0049	-0.0012
5749.8199	54337	0.0044	0.0002	6503.1650	66996	-0.0052	-0.0012
5749.8795	54338	0.0045	0.0002	6503.2248	66997	-0.0049	-0.0011
5749.9387	54339	0.0041	-0.0002	6889.1548	73482	-0.0067	-0.0013
5750.9503	54356	0.0041	-0.0002	8348.1510	97998	0.0047	0.0012

Figure 1 The O - C Diagram



$$C = -\frac{a \sin i}{c} e \sin \omega$$

where $\varphi, f, \tau, e, c, a \sin i, \omega$ are the eccentric anomaly, orbital frequency, time of periastron passage, eccentricity, velocity of light, projected semimajor axis and longitude of the periastron passage in the plane of the orbit respectively.

The least squares fit yields the following pulsational and orbital elements of HD 94033.

$$T_0 = \text{H.J.D.}2442516.15576 \pm 0.0003$$

$$P_0 = 0.059511036 \pm 0.00000017 \text{ day}$$

$$\beta = (2.92 \pm 0.18) \times 10^{-12}$$

$$f = 0.0002956 \pm 0.0000036 \text{ /day;}$$

or: $P_b = 33829.5 \pm 41.2 \text{ day}$

$$a \sin i = (1.43 \pm 0.17) \times 10^8 \text{ km} = 0.95 \pm 0.11 \text{ A.U.}$$

$$e = 0.2$$

$$\tau = \text{H.J.D.}2442708.4$$

$$\omega = 175^\circ$$

The solid line constructed in Figure 1 was determined by the above 8 factors.

Here, we would like to make some explanation. From Figure 1 we can see that e is relatively small, and it is difficult to determine ω , τ exactly with fewer data, we can only regard the above 3 values as reference.

The further proof about binary model on HD 94033 needs more photometry, and a better method is to obtain spectral information.

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References:

- Hobart, M.A. et al.: 1985, *Rev. Mex. Astron. Astrofis.*, 11, 19.
 Jiang Shiyang: 1986, *Ke Xue Tong Bao*, 21, 1642.
 McNamara, D.H.: 1985, *P.A.S.P.*, 97, 715.
 McNamara, D.H. et al.: 1985, *P.A.S.P.*, 97, 322.
 Przybylski, A., Bessell, M.S.: 1979, *M.N.R.A.S.*, 189, 377.
 Yang Xiabing et al.: 1985, *Acta Astrophysica Sinica*, 5, 192.

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3607

Konkoly Observatory
Budapest
20 May 1991
HU ISSN 0374 - 0676

PERIOD CHANGES IN HD79889

HD79889 was first reported as a variable star by Oja(1987), who estimated a period of 0.0958697^d with a V amplitude of 0.4^m, and regarded it as a member of high amplitude δ Scuti star class.

We carried out observations by 60cm reflector of Xinglong station in Beijing observatory in the V-band of standard Johnson UB system from the year 1988 to 1989, and obtained 13 times of maximum. A light-curve was constructed in Fig. 1 for November 13, 1988. We adopted the same comparison stars used by Oja, C1=HD79763, C2=HD80079 whose spectral types are A0 which is close to the A3 reported in the same catalogue for HD79889 (Rodriguez et al., 1990).

For the purpose to study periodic long-term variations, we collected other materials about HD79889 and had altogether 32 points of times of maximum. Table 1 is the data on it, the figures with asterisk were taken from the references. Columns 2-5 represent heliocentric epoch of maximum, cycle number, residuals with linear equation and parabola respectively. Column 6 is the weight for each data.

Using a linear formula, maximum light occurs at the heliocentric epoch

$$T_{max} = 2446506.00785 + 0.09586943E$$

Fig. 2 shows how the O-Cs vary with cycle number E. A further fitting with the least squares method gives:

$$T_{max} = T_0 + P_0E + 0.5\beta E^2$$

$$T_0 = 2446506.00774 \pm 0.00014$$

$$P_0 = 0.095869547 \pm 5.8 \times 10^{-8}$$

$$\beta = -2.1 \times 10^{-11} \pm 5. \times 10^{-12}$$

Table 1. Times of light maximum on HD79889

No.	T ₀ (I)	E(I)	L(O-C)	Q(O-C)	W
1*	46498.3379	-80.0	-.0004	-.0003	.5
2*	46506.0074	0.0	-.0005	-.0003	1.0
3*	46507.3501	14.0	.0001	.0002	.5
4*	46507.4459	15.0	.0000	.0001	.5
5*	46508.4049	25.0	.0003	.0004	.5
6*	46509.4587	36.0	.0005	-.0003	.5
7*	46510.4175	46.0	-.0003	-.0002	.5
8*	46524.4152	192.0	.0004	.0005	.5
9*	46950.4595	4636.0	.0010	.0008	.5
10*	46951.4174	4646.0	.0002	-.0000	.5
11*	47115.6420	6359.0	.0004	.0002	1.0
12*	47118.6131	6390.0	-.0004	-.0006	1.0
13*	47118.7102	6391.0	.0008	.0006	1.0
14*	47121.6813	6422.0	-.0000	-.0002	1.0
15*	47219.5637	7443.0	-.0003	-.0005	1.0
16	47265.1025	7918.0	.0005	.0003	1.0
17	47486.3692	10226.0	.0006	.0006	1.0
18	47488.2852	10246.0	-.0008	-.0008	1.0
19	47488.3811	10247.0	-.0008	-.0008	.8
20	47489.2450	10256.0	.0003	.0003	.8
21	47489.3412	10257.0	.0006	.0006	1.0
22	47493.1755	10297.0	.0001	.0001	1.0
23	47493.2703	10298.0	-.0009	-.0009	1.0
24	47542.2605	10809.0	-.0000	.0000	1.0
25	47544.2730	10830.0	-.0008	-.0007	.5
26	47544.3695	10831.0	-.0002	-.0001	1.0
27*	47551.4645	10905.0	.0005	.0006	1.0
28*	47551.5599	10906.0	.0000	.0001	1.0
29*	47553.5729	10927.0	-.0002	-.0001	1.0
30*	47553.6692	10928.0	.0002	.0003	1.0
31	47627.0088	11693.0	-.0003	-.0001	.8
32	47634.0080	11766.0	.0004	.0006	.5

Fig. 1 Light curve relative to com. star on Nov. 13 1988

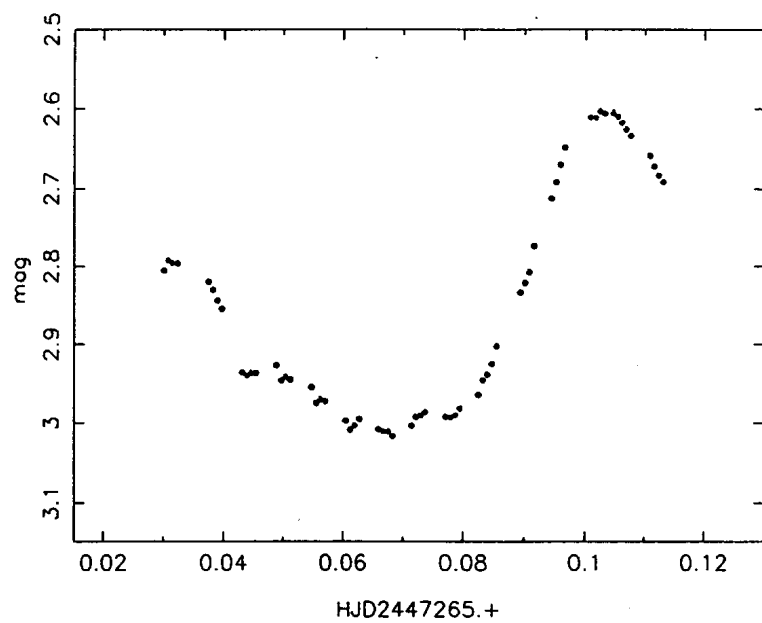
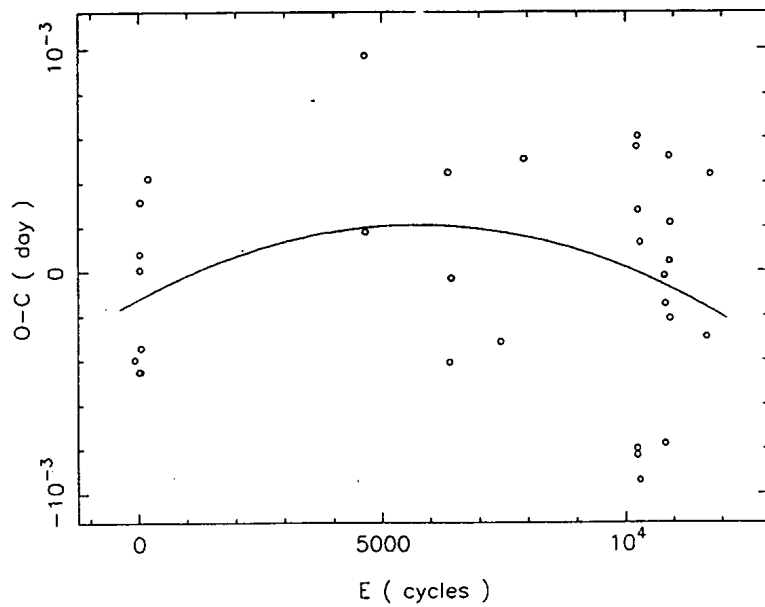


Fig. 2 The O-C Diagram



It indicates that the long period variation accords with the parabola, namely, the rate of period change is negative, and the pulsation period is decreasing.

Considering the short span of time, the fit error is quite big, but the tendency of period change is remarkable. The star deserves further study. Many observations need to be done so that more accurate values will be obtained.

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REFERENCES :

Oja, T. A. Ap., 184 (1987), 215.

Rodriguez, E. et al, Rev. Mexicana Astron. Astrof., 20 (1990), 37.

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

Number 3608

Konkoly Observatory
 Budapest
 21 May 1991
 HU ISSN 0374 - 0676

A PERIOD ANALYSIS OF V505 SAGITTARII

The variable star V505 Sgr (HR 7571, HD 187949) was discovered to be an eclipsing binary by Hoffmeister (1934). Its first photoelectric light curves were obtained by Oosterhoff in 1950 and were analysed by Kwee (1953) and Horak (1967, 1968); meanwhile the system has been observed by Sofronitsky (1953) and Magalashvili and Razmadze (1953). Moreover, V505 Sgr was observed in 1969 by Chambliss (1972). Since it had not been observed for more than 20 years, it was included in our observational programme for 1990. But, unfortunately, only some parts of its light curves were obtained and V505 Sgr will be re-observed this year. Here a study of its period is presented.

Lause (1938) was the first to determine an ephemeris formula for V505 Sgr:

$$\text{Min I (Hel.JD)} = 2425501.376 + 1^d.1828711 \cdot E \quad (1.1)$$

which was based on photographic and visual observations made between 1928 and 1937.

In 1953 Kwee proposed the following ephemeris for V505 Sgr:

$$\text{Min I (Hel.JD)} = 2433515.3295 + 1^d.18287141 \cdot E \quad (1.2)$$

while Chambliss (1972), using all data up to 1972, improved equation (1.1) to the linear:

$$\text{Min I (Hel.JD)} = 2425501.4017 + 1^d.18286730 \cdot E \quad (1.3)$$

and to the quadratic one:

$$\text{Min I (Hel.JD)} = 2425501.3706 + 1^d.18287511 \cdot E - 4.288 \times 10^{-10} \cdot E^2 \quad (1.4)$$

All the minima times of V505 Sgr found in the literature, after Chambliss' work (1972) up to now, are given in Table I. Only three of them (IBVS No.2185, 1982; BBSAG No.59, 1982 and that given in the present work, taken with a k filter) are photoelectric, while the rest of them are visual. The successive columns of Table I give: the Hel.JD; the E_c and $(O-C)_c$ according to the linear ephemeris of Chambliss; the E_M and the corresponding $(O-C)_M$ according to Kholopov's et al. (1985) ephemeris formula and the reference.

When we combine the old minima times of V505 Sgr, given by Chambliss (1972), with the new ones (those of Table I), a least-squares solution yields to the following ephemeris formulae according to the fitting and the

Table I

New Minima Times of V505 Sagittarii

Hel. JD	E_C	$(O-C)_C$ days	E_M	$(O-C)_M$	Reference	
2440000.+						
2274.461	14180	+0.001	-1849	-.001	Rocznik	No 47, 1976
2617.490	14470	-.001	-1559	-.005	"	" 48, 1977
3088.274	14868	+0.001	-1161	-.004	BBSAG	No 31, 1977
3348.499	15088	-.004	- 941	-.010	"	No 34, 1977
3348.515	15088	+0.012	- 941	+0.006	"	" 1977
3348.517	15088	+0.014	- 941	+0.008	"	"
3367.446	15104	+0.017	- 925	+0.011	"	"
3367.410	15104	-.019	- 925	-.025	"	No 35, 1977
3367.434	15104	+0.005	- 925	-.001	"	"
3367.437	15104	+0.008	- 925	+0.002	"	"
3368.627	15105	+0.016	- 924	+0.009	IBVS	No 1502, 1978
3399.360	15131	-.007	- 898	-.007	BBSAG	No 35, 1977
3405.310	15136	+0.029	- 893	+0.023	"	"
3425.406	15153	+0.016	- 876	+0.010	"	"
3691.548	15378	+0.013	- 651	+0.006	BBSAG	No 38, 1978
3704.552	15389	+0.006	- 640	-.002	"	"
3717.551	15400	-.007	- 629	-.014	"	"
3717.567	15400	+0.005	- 629	+0.002	"	"
3717.577	15400	+0.019	- 629	+0.012	"	"
3723.471	15405	-.001	- 624	-.009	"	"
3730.580	15411	-.011	- 618	+0.003	"	"
3730.590	15411	-.021	- 618	+0.013	"	"
3742.387	15421	-.011	- 608	-.018	BBSAG	No 38, 1978
3748.318	15426	+0.006	- 603	-.001	"	"
4046.416	15678	+0.021	- 351	+0.013	"	" 46, 1980
4072.434	15700	+0.016	- 329	+0.008	BBSAG	No 44, 1979
4072.436	15700	+0.018	- 329	-.002	"	"
4079.542	15706	+0.027	- 323	-.021	"	"
4079.516	15706	+0.001	- 323	-.007	BBSAG	No 45, 1979
4091.364	15716	+0.020	- 313	+0.009	BBSAG	No 44, 1979
4117.374	15738	+0.007	- 291	-.001	"	"
4117.378	15738	+0.011	- 291	+0.003	"	"
4143.399	15760	+0.009	- 269	+0.001	BBSAG	No 45, 1979
4181.245	15792	+0.003	- 237	+0.006	"	"
4435.572	16007	+0.014	- 22	+0.004	BBSAG	No 49, 1980
4441.482	16012	+0.009	- 17	-.000	"	"
4461.590	16029	+0.010	0	-.001	IBVS	No 2185, 1982
4499.429	16061	-.004	+ 32	-.014	BBSAG	No 50, 1980
4707.604	16237	-.014	+ 208	-.024	BBSAG	No 54, 1981
4816.450	16345	+0.021	+ 300	-.002	BBSAG	No 56, 1981
4816.462	16329	+0.008	+ 300	+0.010	BBSAG	No 59, 1982
4835.389	16329	+0.020	+ 316	+0.011	BBSAG	No 69, 1983
4912.276	16410	.022	+ 381	+0.011	BBSAG	No 57, 1981
4925.280	16421	.015	+ 392	+0.005	"	"
5172.502	16630	.017	+ 601	+0.005	BBSAG	No 62, 1982
5172.504	16630	.019	+ 601	+0.007	"	"
5178.425	16635	.026	+ 606	+0.014	"	"
5191.434	16646	.023	+ 617	+0.012	"	"
5543.284	16943.5	.030	+ 914.5	-.043	BBSAG	No 69, 1983
5560.483	16958	.018	+ 929	+0.005	"	"
5909.436	17253	.025	+1224	+0.011	BBSAG	No 73, 1984
5909.439	17253	.028	+1224	+0.013	"	No 74, "
6271.402	17559	.034	+1530	+0.018	BBSAG	No 78, 1985
6297.415	17581	.023	+1552	+0.008	"	"
7384.465	18500	.018	+2471	+0.001	BBSAG	No 90, 1989
7740.514	18801	.024	+2772	+0.003	BBSAG	No 92, 1989
7740.519	18801	.029	+2772	+0.008	"	No 93, "
7746.431	18806	.027	+2777	+0.006	"	No 93, "
8058.7025	19070	.021	+3041	-.005	Present Study	
8102.472	19107	.025	+3078	+0.003	BBSAG	No 96, 1990

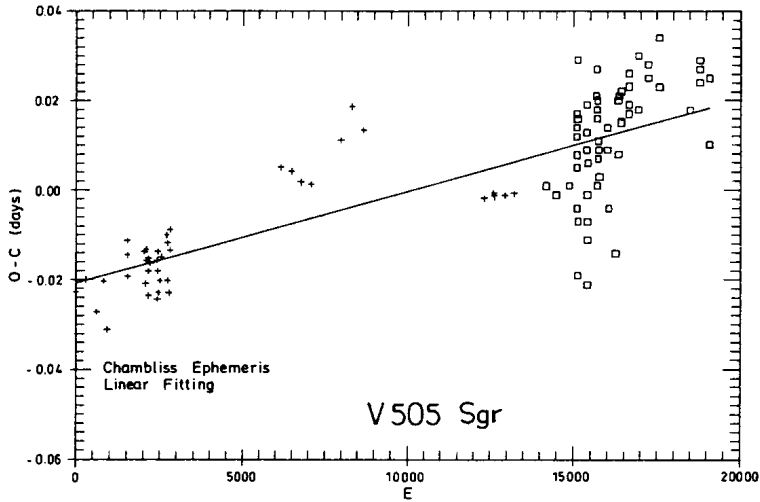


Figure 1: The (O-C) diagram of V505 Sgr according to Chambliss (1972) ephemeris formula. A linear least-squares fitting has been applied to all the data (+: old data; □: new ones).

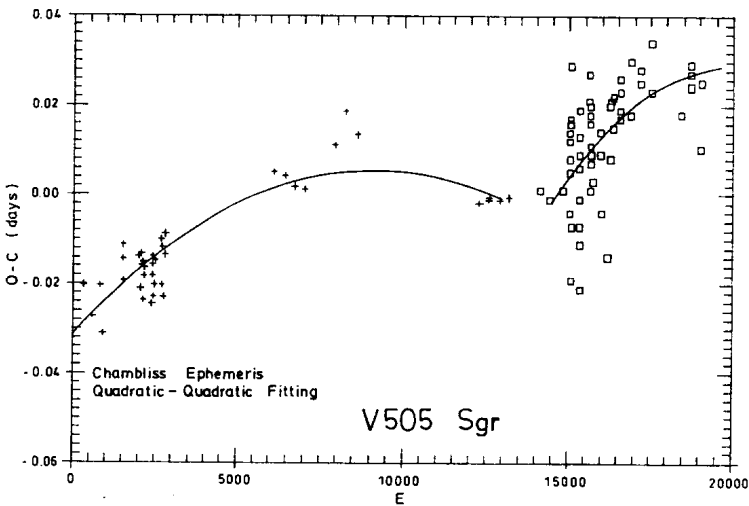


Figure 2: The (O-C) diagram of V505 Sgr according to Chambliss (1972) ephemeris formula. Both the old (+) and the new (□) data have been approached by a quadratic least-squares fitting but each one separately from the other.

ephemeris used. Thus, for the Chambliss (1972) ephemeris and linear fitting, we find:

$$\text{Min I (Hel.JD)} = 2425501.3809 + 1.182869365 \cdot E \quad (1.5)$$

and for quadratic:

$$\text{Min I (Hel.JD)} = 2425501.3501 + 1^d.18287707 E - 4^d.283 \times 10^{-10} \cdot E^2 \quad (1.6)$$

while for Kholopov's et al. (1985) ephemeris and linear fitting, we have:

$$\text{Min I (Hel.JD)} = 2444461.5932 + 1^d.18286942 \cdot E \quad (1.7)$$

and for quadratic:

$$\text{Min I (Hel.JD)} = 2444461.5933 + 1^d.18286963 E + 1^d.49 \times 10^{-11} \cdot E^2 \quad (1.8)$$

The corresponding (O-C) diagram of V505 Sgr for linear fitting and Chambliss (1972) ephemeris is presented in Figure 1, where crosses (+) denote the old data and squares (\square) the new ones. (One can get an almost identical diagram for quadratic fitting, without any visible difference. The same is true for Kholopov's et al. (1985) ephemeris).

But, if we consider the old and the new data of V505 Sgr separately, then we get Figure 2. In this a quadratic - quadratic least-squares fitting has been applied both to the old data (which according to Chambliss (1972) is much better than the linear one) as well as to the new ones.

Unfortunately, there are not minima times of V505 Sgr from 3000E_c to 6000E_c and from 9000E_c to 12000E_c, moreover most of the data are visual exhibiting large scatter. Thus, new minima times of V505 Sgr are needed, and especially photoelectric ones, in order its period behaviour to be examined further.

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References:

- Chambliss, C.R.: 1972, *Astron. J.* 77, 672.
Hoffmeister, C.: 1934, *Astron. Nachr.* 251, 321.
Horak, T.: 1967, *Bull. Astron. Inst. Czech.* 18, 331.
Horak, T.: 1968, *Bull. Astron. Inst. Czech.* 19, 149.
Kholopov, P.N. et al.: 1985, *Fourth Edition of the General Catalogue of Variable Stars*, Moscow.
Kwee, K.K.: 1953, *Bull. Astron. Inst. Neth.* 12, 35.
Lause, F.: 1938, *Astron. Nachr.* 266, 17.
Magalashvili, N.L. and Razmadze, N.A.: 1953, *Peremennye Zvezdy* 10, 313.
Sofronitsky, A.V.: 1953, *Izv. Pulkovo Obs.* 19, 151.

COMMISSION 27 OF THE I.A.U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3609

Konkoly Observatory
Budapest
21 May 1991

HU ISSN 0374 - 0676

1990 BV PHOTOELECTRIC OBSERVATIONS OF CG Cyg

The eclipsing binary CG Cyg was observed from 24 July through 1 Aug with the 1.2m Kryonerion telescope and a single channel photon counting photometer described by Dapergolas and Korakitis (1987). The photometer employs a high gain 9789QB phototube and conventional BV filters. Its output is fed directly to a microcomputer enabling rapid data access.

Photometric observations for this star have been reported previously by Dapergolas et al., (1988), Dapergolas et al., (1989a), Dapergolas et al., (1989b) and other investigators listed by Dapergolas et al. (1989a).

The data reduction method is the standard one and as a comparison star was used the BD +34° 4216. The constancy of the comparison star was verified by Milone et al. (1979). The data presented here were obtained with an accuracy of $\pm 0.015\text{mag}$.

Table I lists the dates of observations and phases covered whereas Figures 1 and 2 summarize the results for B and V colours.

TABLE I

Date	Phase
16-7-1990	.96 .17
18-7-1990	.08 .41
19-7-1990	.60 .97
20-7-1990	.35 .58
23-7-1990	.94 .23
24-7-1990	.48 .85
25-7-1990	.07 .52
26-7-1990	.03 .09
20-8-1990	.33 .60

In Table II the times of minima and the O-C values are listed for the V and B bands respectively. Times of minima

CG CYG (B)

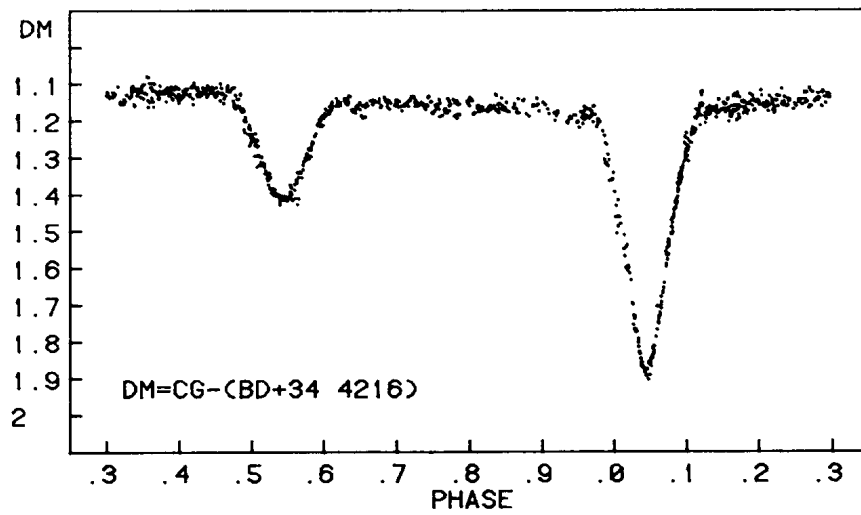


Figure 1

CG CYG (V)

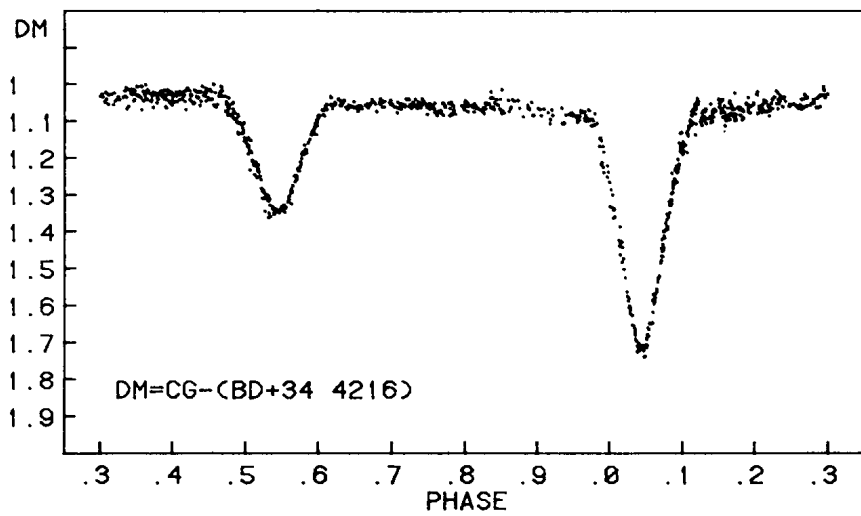


Figure 2

are calculated using the method described by Kwee and van Woerden (1956) whereas the O-C values were determined from the linear ephemeris $T=2439425^d.1221 + 0.^d631141$ given by Milone et al. (1974).

TABLE II

Date	Type of minima	V COLOUR		B COLOUR	
		Heliocentric Jul. Day	(O-C) phase	Heliocentric Jul. Day	(O-C) phase
16/7	Primary	2448089.4531	0.043	2448089.4532	0.044
		± 0.0002		± 0.0002	
20/7	Secondary	2448093.5543	0.541	2448093.5577	0.547
		± 0.0004		± 0.0003	
23/7	Primary	2448096.3960	0.044	2448096.3961	0.044
		± 0.0002		± 0.0002	
24/7	Secondary	2448097.3431	0.544	2448097.3426	0.544
		± 0.0003		± 0.0002	
20/8	Secondary	2448124.4820	0.544	2448124.4821	0.544
		± 0.0002		± 0.0002	

From Fig. 1 and 2 it can be seen that there are irregularities outside the eclipse already reported by Milone et al. (1979); Dapergolas et al. (1989b) and Beckert et al. (1989).

The observed difference between the primary and secondary minima is 0.48mag for the B and 0.37mag for V whereas these values are 0.45mag and 0.39mag for 1989, 0.34mag and 0.30mag for 1988 and 0.41mag and 0.30mag for 1987 (Dapergolas et al., 1988; Dapergolas et al., 1989a; Dapergolas et al., 1989b).

From these values it can be seen that there is a variation in the difference of the two minima depths for both colours for the years 1987-1988, 1988-1989 and 1989-1990 with values -0.07mag, +0.11mag, -0.03mag for B and 0.00mag, +0.09mag and 0.02mag for V, probably due to the photospheric activity of the system.

From the times of minima found here and published by Dapergolas et al. (1989a), Dapergolas et al. (1989b) and Milone

et al. (1979) the residuals (O-C) show large variations which might be due to the continuous period variations of the system.

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REFERENCES

- Beckert, D., Cox, D., Gordon, S., Ledlow, M. and Zeilik, M.: 1989, Inf. Bull. Var. Stars, no 3398.
- Dapergolas, A., Kontizas, E. and Kontizas, M.: 1988, Inf. Bull. Var. Stars, no 3249.
- Dapergolas, A., Kontizas, E. and Kontizas, M.: 1989a, Inf. Bull. Var. Stars, no 3322.
- Dapergolas, A., Kontizas, E. and Kontizas, M.: 1989b, Inf. Bull. Var. Stars, no 3380.
- Dapergolas, A. and Korakitis, R.: 1987, Publ. Nat. Obs. of Athens, Ser II, no28.
- Kwee, K.K. and van Woerden, H.: 1956, Bull. Astr. Inst. Netherlands, 12, 327.
- Milone, E.F. and Ziebarth, K.E.: 1974, Publ. Astron. Soc. Pacific, 86, 684.
- Milone, E.F., Castle, K.G., Swadrom, D., Burke, E.W., Hall, D.S., Michlovic, J.E. and Zissell, R.E.: 1979, Astron. J., 84, 417.

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

Number 3610

Konkoly Observatory
Budapest
23 May 1991

HU ISSN 0374 - 0676

THE UNUSUAL ECLIPSING VARIABLE SS LACERTAE

The star SS Lac is a probable member of the open cluster NGC 7209. On the basis of visual and photographic observations it has been classified as an eclipsing variable. The star is listed in the GCVS with a period of about 14.4 days and an amplitude of 0.4 mag in both primary and eccentric secondary minima.

In a strong contrast Zakirov et al. [7] have published photoelectric observations, showing that the brightness variation was at a standstill during the years 1984 - 89. An attempt has been made to shed light on the situation by examining sky patrol plates of the Sonneberg Observatory and making reduction procedures for all available original observations.

There is a total of about 6000 photometric data. The material dates from the years 1890 - 1989 (see ref. [1] to [7]). The individual sequences of comparison stars of different authors are reduced to the photoelectric sequence of NGC 7209 measured by Hoag et al. [8]. For a detailed analysis of all original data and the reduction procedures see also ref. [3].

The amplitude of the eclipses of each data sample plotted against the time of observation yields a well defined relation which describes the continuous change of the amplitude.

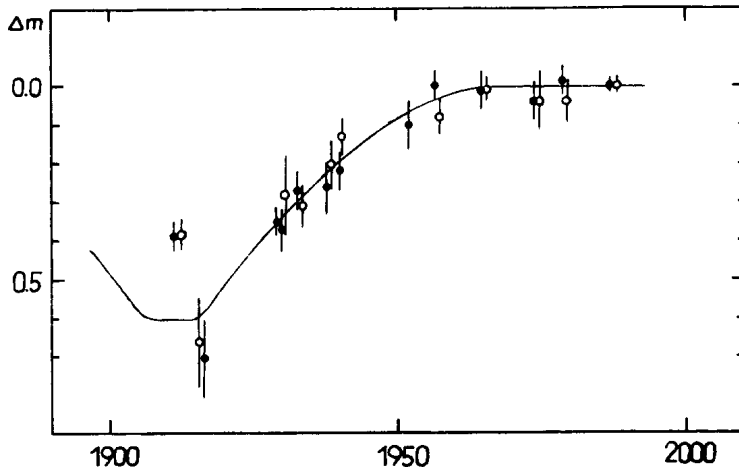


Figure 1: The disappearance of the eclipsing amplitude of SS Lac. Filled (open) circles represent primary (secondary) minima. The solid line is calculated (see text).

On the assumption that the observed variable amplitude is due to a continuous change of the inclination i of the orbital plane of the eclipsing binary, the greatest amplitude corresponds with $i=90^\circ$. In particular a constant di/dt leads to an "eclipsing light-curve" with a much longer time-scale than the real one in the case of central occultation ($t=\tau$), but the shape of these curves is identical. So the best fit in figure 1 (the solid line) gives

$$di/dt = 0.18 \pm 0.02 \text{ } ^\circ/\text{year}$$

$$\tau = 1911 \pm 3 \text{ years.}$$

A possible explanation of the changing inclination is the existence of a distant third body, and the eclipsing binary's orbital plane inclines from the plane of motion around the centre of gravity of the three-body-system (the "big plane") by the angle ϵ . In such cases a precession of the binary's orbital angular momentum axis can take place like in the Sun-Earth-Moon-system.

With θ being the inclination of the "big plane" to the plane of the sky and Ω being the position angle of the line of nodes in the "big plane" we receive:

$$\frac{di}{dt} = \frac{-\sin \theta \sin \epsilon \cos \Omega}{\sin i} \frac{d\Omega}{dt}.$$

Central occultations can happen only if

$$|\tan \theta \tan \epsilon| \leq 1.$$

If we favour a small angle ϵ , the inclination of the "big plane" must be $\theta \approx 90^\circ$ resulting in

$$\frac{di}{dt} = \sin \epsilon \frac{d\Omega}{dt}.$$

So the upper limit of the period of the rotation of the line of nodes equals 2000 ± 200 years.

Furthermore it will be noted that there is a small deviation from the elements derived by Dugan et al. [1], but there is no reliable evidence of apsidal motion. The improved elements using all data are

$$\begin{array}{lll} \text{Min. (I)} = 2415900.694 + 14.416262 E, & \phi \text{ (II)} = 0.575 E \\ & \pm 0.002 & \pm 0.000025 & \pm 0.001. \end{array}$$

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References:

- [1] Dugan et al. (1935), AJ 44, p150.
- [2] Hoffmeister (1921), AN 214, pl.
- [3] Lehmann (1991), MVS 12, 6, in press.
- [4] Szafraniec (1961), Acta Astr. Suppl. 4, p487.
- [5] Tashpulatov (1965), VS 15, p424.
- [6] Wachmann (1936), AN 258, p361.
- [7] Zakirov et al. (1990), IBVS 3487.
- [8] Hoag et al. (1961), US Naval Obs. Publ. Vol.XVII, p349.

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

Number 3611

Konkoly Observatory
Budapest
28 May 1991

HU ISSN 0374 - 0676

THE DISCOVERY OF RAPID OSCILLATIONS IN THE Ap STAR HD 119027

The star HD 119027 was observed for 5.0 hr on the night JD2448377 as part of the *Cape Rapidly Oscillating Ap Star Survey*. Inspection of the real-time data display at the telescope revealed the presence of rapid oscillations with a period $P=8.63$ min and an amplitude $A\approx 1.8$ mmag (Fig. 1). The observations were acquired with the University of Cape Town photometer attached to the 1.0-m Elizabeth telescope of the South African Astronomical Observatory at Sutherland. The data comprise continuous 10-s integrations through a Johnson *B* filter with occasional interruptions for measurements of the sky background.

The data were corrected for coincidence-counting losses, sky background and extinction, in that order. We then removed some gradual ($T>0.5$ hr) sky transparency variations and binned the data to 40-s integrations. The light curves were then Fourier analyzed individually and as a group.

Figure 1

HD119027 JD2448377 BZL40

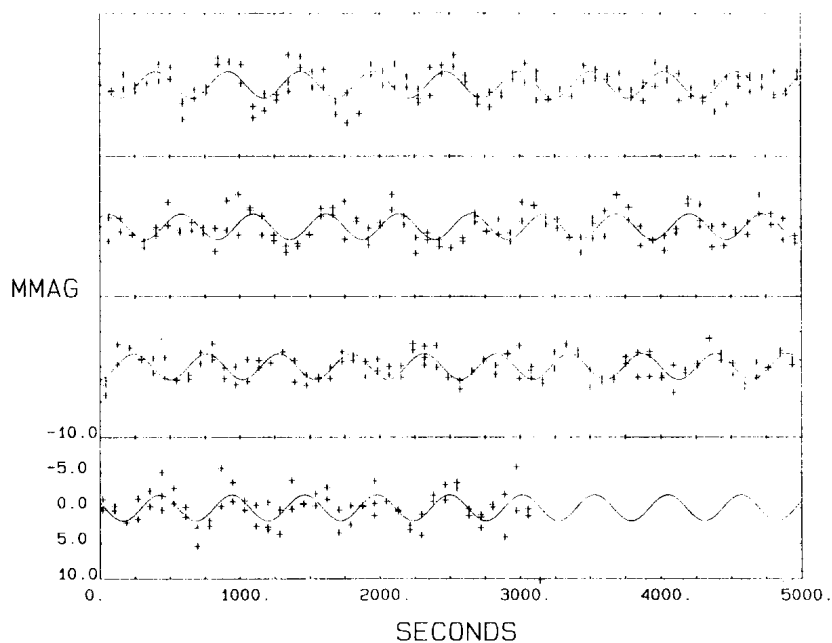
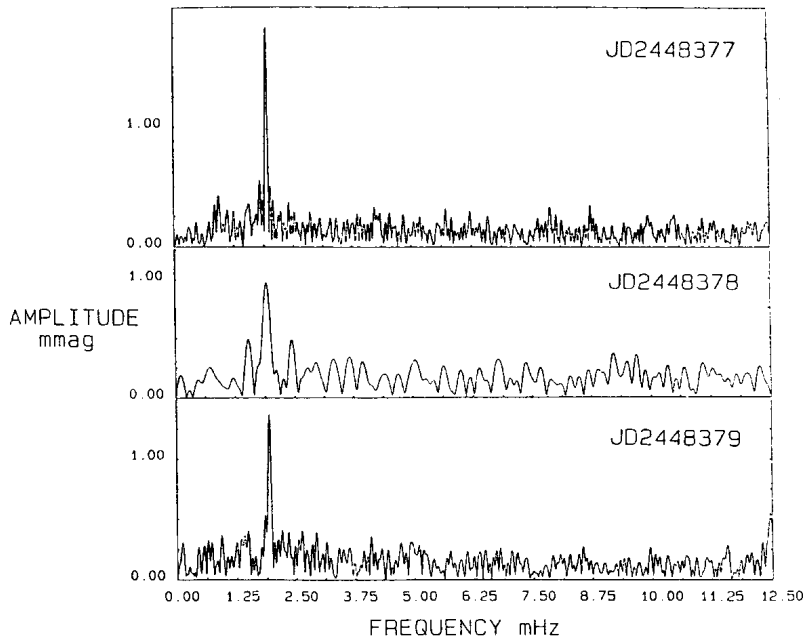


Figure 2



The amplitude spectrum of the data acquired on night JD2448377 is presented in the upper panel of Fig. 2. The prominent peak is at $\nu_1 = 1.93$ mHz. We observed this star again on the following two nights, JD2448378 & 8379, and the amplitude spectra of those two nights are shown in Fig. 2 in the middle and lower panel, respectively. We also Fourier analyzed the three nights together to refine our determination of ν_1 to $\nu_1 = 1.9302$ mHz.

Note that the height of the peak ν_1 differs among the panels by somewhat more than the level of the noise. This suggests that the oscillations in HD 119027 are amplitude modulated on a time-scale of ~ 1 day. We are unable to investigate the nature of this modulation with that data currently at hand. Further observations of this star are scheduled and a detailed frequency analysis will be presented in a future publication.

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

Number 3612

Konkoly Observatory
Budapest
28 May 1991

HU ISSN 0374 - 0676

HD 111828: a new small amplitude variable star[∞]

We adopted HD 111828 as a comparison star for the observations of the variable star ET Mus performed at La Silla Observatory with the ESO 1m telescope on March 1987. The observations were performed with a single channel photometer and an EMI 9789QB photomultiplier in the V and B colours. Since we observed in the same cycle and with the same frequency a third star as a reference (HD 111658), we discovered that one of the two comparison stars showed light variations of a few hundredths of a magnitude. By comparing the differences of magnitudes between each comparison stars and ET Mus it was apparent that the variable object was HD 111828.

From the observations of some standard stars we obtained the transformation from the instrumental to the standard UBV system, deriving for HD 111658 $V = 9.05$, $B - V = 0.09$ and $U - B = 0.06$, and the following mean values for HD 111828: $V = 9.60$, $B - V = 0.29$.

In Table 1 the standard V magnitudes and the $B - V$ colour indices of HD 111828 are reported grouped into normal points. Each normal point is the average of six individual measurements, and has an internal standard error of 2-3 mmag.

In order to confirm this result new observations were planned, taking care of introducing a third comparison star, HD 111687 ($V = 9.19$, $B - V = 0.06$, $U - B = -0.31$, Nicolet, 1978). New measurements were obtained with the same instrumentation mounted at the ESO 50 cm telescope from January 29 to February 5, 1991. HD 111828 has been observed differentially with respect to HD 111658 and HD 111687 and a total of 9 normal points have been gathered, each one consisting of 4 individual cycles of measurements on these three stars. The typical internal standard error of these normal points is of about 2 mmag.

In Table 2 we have reported in the second column the V magnitudes of HD 111828 and in the third one those of HD 111658 for comparison purposes. We see that this last star is constant within the observational error: the data standard deviation is 3.8 mmag.

On the contrary we can see from both the tables that the data of HD 111828 show a light variation with a V amplitude of about 0.04 mag. The datapoints are insufficient to allow a careful analysis of the light variations, but some preliminary considerations can be made. The data from 1 m telescope (Table 1), obtained observing the star consecutively for more than 3 hours in each night, and the data obtained at the 0.5 m in the two nights with two normal points at a distance of about 3.5 hours, show that the light variations during a few hours are at most of the order of a few thousandths

[∞]: Based on observations made at the European Southern Observatory, (ESO), La Silla, Chile

Table 1.

<i>Hel.JD</i>	<i>V</i>	<i>B - V</i>
2447200+		
42.595	9.465	0.287
42.609	9.458	0.287
42.624	9.467	0.282
42.644	9.467	0.285
42.670	9.466	0.286
43.529	9.481	0.279
43.556	9.478	0.280
43.583	9.475	0.281
43.605	9.477	0.281
43.627	9.476	0.283
43.653	9.475	0.283
44.568	9.440	0.291
44.594	9.441	0.292
44.619	9.438	0.294
44.645	9.435	0.298
44.673	9.440	0.290

Table 2.

<i>Hel.JD</i>	<i>V</i>	
2448200+	HD 111828	HD 111658
86.858	9.445	9.057
87.858	9.453	9.052
88.858	9.472	9.048
89.701	9.441	9.045
89.862	9.438	9.050
90.722	9.460	9.047
90.863	9.455	9.045
91.865	9.436	9.052
92.872	9.478	9.053

of a magnitude, and they exclude the possibility of short period variations. On the other hand an examination of all the data in Table 2 could suggest a characteristic time scale of the order of 1.8 d or perhaps of about 4 d if the light curve has a double-wave shape; however the light curve does not seem strictly periodic. From Table 1 we have an indication that the variations of the $B - V$ index are at most of about 0.01 mag. If the reddening is negligible, from the $B - V$ index we can estimate an F0 spectral type, thus HD 111828 could belong to the group of early F-type stars showing small amplitude light variations with characteristic timescales of the order of the day which are being discovered with increasing frequency in the recent years (Abt et al. 1983, Antonello & Mantegazza 1986, Krisciunas & Guinan 1990). The nature of the light variations of these objects is still unclear.

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References:

- Abt, H.A., Bollinger, G., Burke, E.W.: 1983, *Astrophys.J.* **272**, 196.
 Antonello, E., Mantegazza, L.: 1986, *Astron. Astrophys.* **164**, 40.
 Krisciunas, K., Guinan, E.: 1990, *I.B.V.S.* No.3511.
 Nicolet, B.: 1978, *Astron.Astrophys.Suppl.* **34**, 1.

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

Number 3613

Konkoly Observatory
Budapest
4 June 1991

HU ISSN 0374 - 0676

HN CYGNI : THE STAR ERRONEOUSLY CLASSIFIED AS A DWARF NOVA

The variability of HN Cyg (294.1929 Cyg) was discovered by Hoffmeister (1930). Wachmann (1966) published four moments of the maxima, and the star was classified in GCVS as UG:. Bruch *et al.* (1987) reported two additional outbursts. However, Munari *et al.* (1990) derived the spectral type of *M* 6.5 and reclassified the object as the Mira.

The star was observed among the UG-type variables on 232 archive plates of Sternberg State Astronomical Institute (Andronov and Sidorova, in press), using the comparison stars of Wachmann (1966). The histogram (Fig.1) is not characteristic for Dwarf Novae, nor is the light curve. The brightness changed from 14.8^m to 16.5^m (pg), its mean value $\langle m \rangle = 15.75^m$ and the mean-squared deviation $\sigma_m = 0.33^m$.

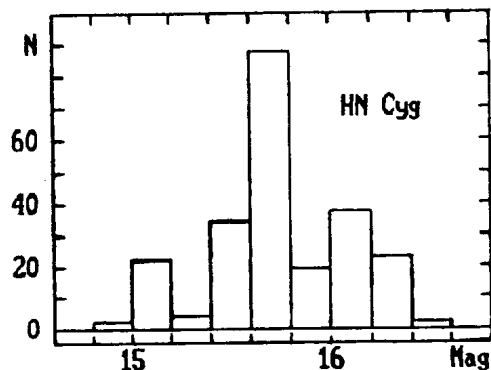


Fig. 1. The histogram of the brightness of HN Cyg. The distribution of the magnitude is nearly symmetrical.

To find the possible period, the brightness was fitted by

$$m(t_1) = a_0 + a_1 \sin(2\pi t_1/P) + a_2 \cos(2\pi t_1/P).$$

As the test function, we used the function

$$S(1/P) = \sigma_0^2(1/P) / \sigma_0^2 = 1 - \sigma_{0-0}^2(1/P) / \sigma_0^2$$

Two prominent peaks were found at the periodogram (Fig. 2a), corresponding to the periods $P_1=72.73^d$ and $P_2=820^d$. From the nonlinear two-frequency least-squares fit we obtained $P_1=72.84 \pm 0.04^d$ and $P_2=828 \pm 6^d$ with the corresponding amplitudes 0.26 ± 0.023^m and 0.23 ± 0.025^m and moments of maxima at $T_1=2440280 \pm 1^d$ and $T_2=2440376 \pm 13^d$.

The periodogram for the residuals (O-C) shows no significant peaks (Fig. 2b). No periodic waves were found from the periodogram analysis of separate seasons for $P > 0.1^d$.

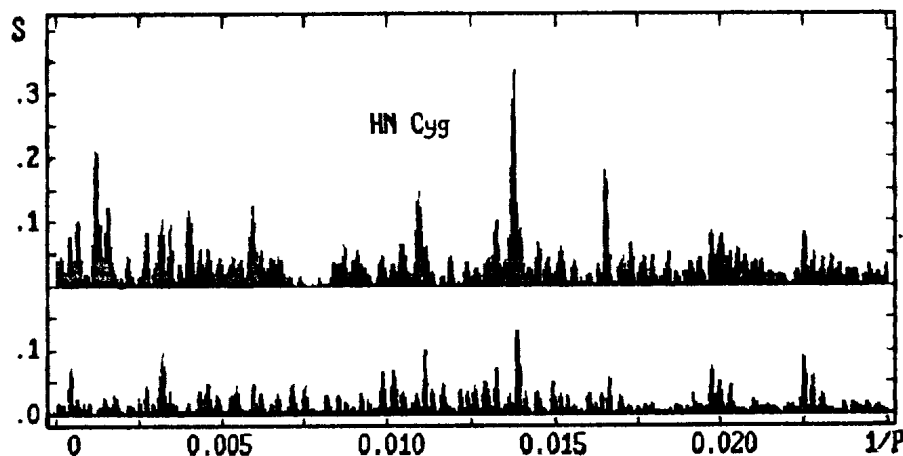


Fig. 2. The periodograms for the observations of HN Cyg (up) and for the residuals from the two-frequency fit (down).

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References

- Bruch, A., Fischer, P.-J., Wilmsen, U.: 1987, -As.Ap.Suppl. 70, 481.
 Hoffmeister, C.: 1930, Sonn. Mitt. No. 17
 Munari, U., Claudi, R., Bianchini, A.: 1990, IBVS No. 3496
 Wachmann, A.A.: 1966, Bergd. Abh. 6, No. 4, 283

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

Number 3614

Konkoly Observatory
Budapest
4 June 1991

HU ISSN 0374 - 0676

THE OUTBURSTS OF THE DWARF NOVA PS AURIGAE

The variability of PS Aur (S 3946) was discovered by Hoffmeister (1949), who pointed out the rapid variations in the range 15.4^m and 16.2^m , outbursts to 14.4^m with the shortest interval between them 35^d . This value of the cycle length was recently confirmed by Geßner (1989). The strong emission lines of H α -H δ and helium were found by Williams (1983). Howell and Szkody (1988) suspected the photometric period $P = 97 \pm 10$ minutes, which is characteristic for SU UMa-type stars.

The star was observed on 180 archive photographic plates of the Sternberg State Astronomical Institute. The comparison stars were linked to the BV sequence of Christian (1980) on 6 plates by using the Iris-photometer of the Sternberg Institute. They are shown in Fig.1. The value of σ_m corresponds to the mean-squared deviation from the mean. Normally $\sigma_m \leq 0.15^m$, but for the stars p, y, q the larger value of σ_m may argue for the possible brightness variations, and they were not used as comparison stars.

The histogram (Fig.2) is characteristic for Dwarf Novae, as well as the light curve, some parts of which are shown in Fig.3. The brightness changed from 14.0^m to 17.2^m (pg), its mean value $\langle m \rangle = 16.02^m$ and the mean-squared deviation $\sigma_m = 0.67^m$. For the observations in 'quiescent' state $m_{pg} > 15.0^m$, $\langle m \rangle = 16.22^m$, $\sigma_m = 0.39^m$. The 'brightenings' were observed on 20 plates corresponding to 12 outbursts. As one may see from the Table 1, the shortest time interval between the subsequent observed outbursts is equal

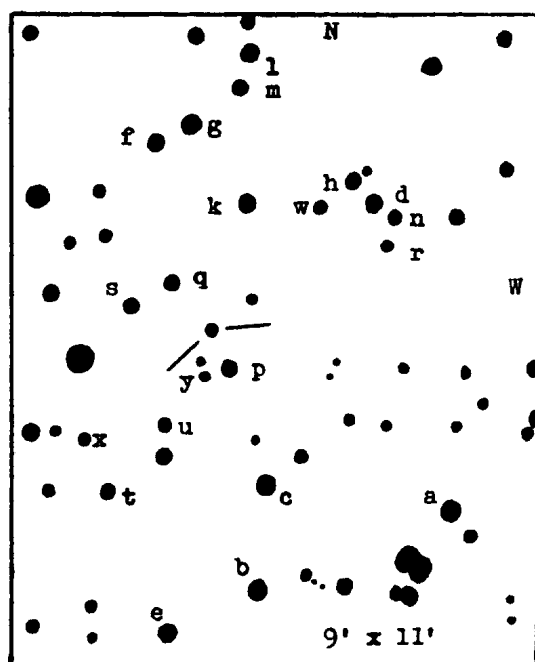


Fig. 1. Comparison stars for FS Aur

*	m_{pg}	σ_m	n
a	13.00	0.08	6
b	13.22	0.09	6
c	13.60	0.06	6
d	13.75	0.05	6
e	13.89	0.09	6
f	14.04	0.10	6
g	14.06	0.07	6
h	14.22	0.09	6
k	14.28	0.07	5
l	14.39	0.08	4
m	14.58	0.17	6
n	14.64	0.10	6
p	14.80	0.22	6
q	14.80	0.15	6
r	15.11	0.14	5
s	15.12	0.15	6
t	15.56	0.19	5
u	15.68	0.09	4
w	15.83	0.09	5
x	16.52	0.27	4
y	17.20	0.16	3

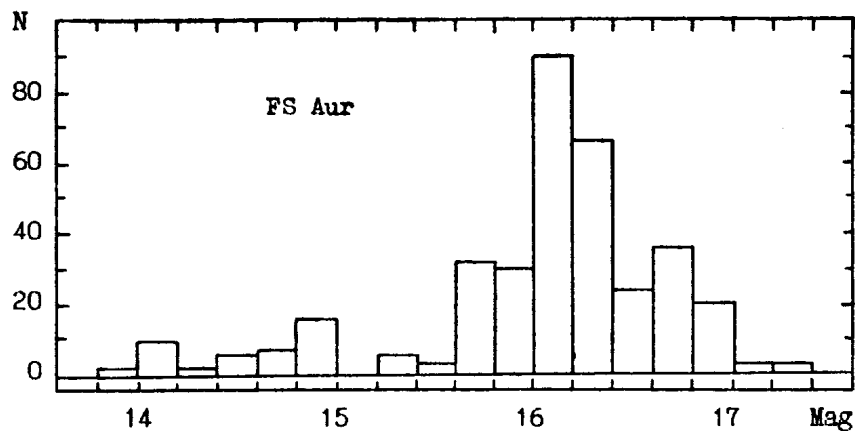


Fig. 2. The histogram for the brightness of FS Aurigae

to 24^d , two are twice longer (50^d and 53^d). Only one interval (33^d) derived from the Moscow plates is near the value 35^d , which was previously suspected by Hoffmeister (1949) and Gefner (1989). From these values one may suppose that the cycle length may be near $C \approx 12^d$. From the revised 'Amplitude-Cycle' relation derived by Richter and Brauer (1989), one may obtain the value $C \approx 13^d$ for the amplitude 2.2^m . Obviously, this statistical relationship corresponds to the relative accuracy ~ 100 per cent, thus such a value must be revised by the future observations.

The ascending branch of the light curve lasts no more than 1^d (Fig.3c), the descending branch lasts from 2^d (Fig.3c) to 3.5^d (Fig.3f). The value of the full outburst width $W=3.0^d$, which may be derived from the statistical 'W-P' relation of Gieger (1987), is in excellent agreement with our data. From the statistical relation between P and the rate of decline $\tau = dt/dm$ (van Paradijs, 1983), one may calculate the value of $\tau = 0.95 \pm 0.21$ days/mag. For different outbursts we obtained the values of τ from 0.6 (Fig.3f) to 1.0 (Fig.3c). Thus the estimated characteristics agree with that observed in other Dwarf Novae with similar orbital periods.

However, no superoutbursts were detected (or recognized), which may be achieved, if $P \leq 2^h$. The amplitude of brightness variations during one night varies with characteristic time from $\sim 0.4^m$ at outburst to $\sim 0.9^m$ at 'quiescence'. However, the time resolution ~ 40 min is insufficient to study the possible orbital or superhump variability.

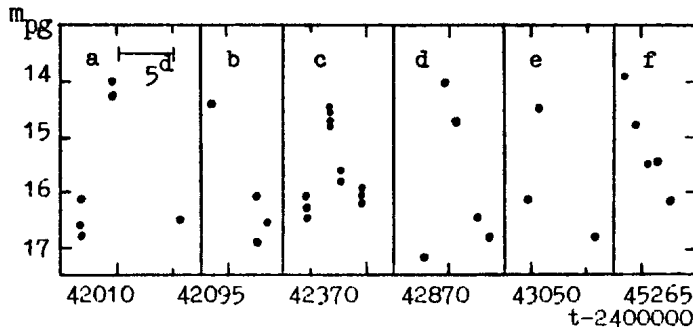


Fig. 3. The fragments of the light curve of FS Aur

Table I

The outbursts of PS Aurigae

26351.2	G+	38472.3	G+	42449.3	G	44900.6	14.1
26687.4	G	40148.5	G++	42812.4	14.9	44987.4	14.1
27046.5	G+	41322.4	G+	42836.3	15.0	45263.6	14.0
27424.3	G+	41390.3	G+	42869.3	14.1	45313.4	14.8
27459.4	G+	42009.5	14.0	43050.5	14.5	46147.4	G
27582.6	G+	42093.4	14.4	43161.5	14.6	46307.5	K13.5
27718.5	G	42336.5	14.6	44254.5	G	46335.6	K14.0
31530.4	G					46420.0	K14.7

Remarks: The (JD-2400000) of the observations near the outburst are given. G corresponds to the photographic observations of Gefner(1989) with 'normal' and 'larger' (G+) brightenings, K - to the visual estimates of Kinnunen (1985). The values without letter correspond to our observations.

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References

- Christian, C.A.: 1980, *Astron.J.* **85**, No. 6, p.700
 Gefner, G.: 1989, *Mitt. veränderl. Sterne* **11**, No 8, p.186
 Gieger, A.: 1987, *Acta Astr.* **37**, 29
 Hoffmeister, C.: 1949, *Veröff. Sternw. Sonneberg* **1**, 3
 Howell, S.B., Szkody P.: 1988, *Publ.Astron.Soc.Pactf.* **100**, 224
 Kinnunen, E.: 1985, *Rep. Scand. Var. Star Obs.* **2**, 90 pp.
 van Paradijs, J.: 1983, *Astron. Astrophys.* **125**, L 18
 Richter, G.A., Brauer, H.-J.: 1989, *Astron. Nachr.* **309**, 413
 Williams, G.: 1983, *Astrophys. J. Suppl.* **53**, No. 3, p.523

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

Number 3615

Konkoly Observatory
 Budapest
 5 June 1991

HU ISSN 0374 - 0676

PHOTOELECTRIC MINIMA OF ECLIPSING BINARIES

The following table gives the photoelectric minima of several eclipsing binaries obtained in the year 1990 at the N. Copernicus Observatory and Planetarium in Brno (Czechoslovakia) by means of the 40-cm telescope, type Nasmyth.

The times of minima in U or B band have been omitted in case the signal-to-noise ratio was insufficient.

The table gives the type of filter, the heliocentric times of minima, the O-C residuals in the various bands, and abbreviations of the observer's name.

These abbreviations are as follows:

DH : Dalibor Hanžl

TH : Tomáš Hudecek

MZ : Miloslav Zejda

Data for calculating the O-C are taken from the following literature:

O-C (I) : SAC 62, Krakow 1990.

O-C (II) : GCVS, Moscow 1985-1987.

O-C (III) : IBVS No.3596 (our light elements).

The moments of the secondary minima are labeled by "s". As far as the data for calculating the times of the secondary minima were not found in the literature, we use the phase 0.5 for predicting the secondary minima

Table I

Star	Filt.	Min.hel. 24...	O-C (I) [d]	O-C (II) [d]	O-C (III) [d]	Observer
KP Aql	V	48084.4392	-0.0079	= -0.0079		DH/TH
	B	48084.4399	-0.0072	= -0.0072		DH/TH
00 Aql	V	48109.4264	+0.0017	= +0.0017		DH/TH
v346 Aql	V	48097.4182	-0.0029	-0.0032		DH
	B	48097.4182	-0.0029	-0.0032		DH
v445 Cas	V	48151.4726	+0.0344	= +0.0344		DH
	B	48151.4720	+0.0338	= +0.0338		DH
	U	48151.4720	+0.0338	= +0.0338		DH
EI Cep	V s	48133.4171	-0.0182	+0.0239		TH/DH
	B s	48133.4171	-0.0182	+0.0239		TH/DH
GS Cep	V	48060.4838	-0.1314	= -0.1314	+0.0054	DH
	B	48060.4845	-0.1307	= -0.1307	+0.0061	DH

Table I (cont.)

Star	Filt.	Min.hel. 24...	O-C (I) [d]	O-C (II) [d]	O-C (III) [d]	Obs.
	V	48085.4936	+0.1743	= +0.1743	-0.0024	DH
	B	48085.4936	+0.1743	= +0.1743	-0.0024	DH
	V	48088.4365	+0.0292	= +0.0292	-0.0027	DH
	B	48088.4358	+0.0285	= +0.0285	-0.0034	DH
	V s	48102.4205	+0.1172	= +0.1172	+0.0008	DH/TH
	B s	48102.4198	+0.1165	= +0.1165	+0.0001	DH/TH
	V s	48205.4300	+0.0644	= +0.0644	-0.0034	DH
	B s	48205.4293	+0.0637	= +0.0637	-0.0041	DH
WZ Cyg	V	48073.4709	+0.0087	+0.0342		DH
	B	48073.4709	+0.0087	+0.0342		DH
V796 Cyg	V s	48134.3799	-0.0237	= -0.0237		DH
	B s	48134.3792	-0.0244	= -0.0244		DH
V1034 Cyg	V	48062.4680	+0.0148	+0.0059		DH
	B	48062.4673	+0.0141	+0.0052		DH
	U	48062.4666	+0.0134	+0.0045		DH
	V	48104.4745	+0.0134	+0.0044		MZ/DH
	V	48106.4245	+0.0095	+0.0005		MZ/DH
	B	48106.4252	+0.0102	+0.0012		MZ/DH
	V	48107.4051	+0.0131	+0.0042		DH/TH
	B	48107.4058	+0.0138	+0.0049		DH/TH
V1356 Cyg	V s	48095.5099	-	+0.0587		DH/TH
AK Her	V	48100.4112	-0.0026	= -0.0026		TH
UV Leo	V	47945.4790	+0.0098	-0.0098		TH
V501 Oph	V	48093.4750	-0.0075	= -0.0075		DH
	B	48093.4743	-0.0082	= -0.0082		DH
V839 Oph	V s	48067.4452	+0.0267	+0.0630		DH
	B s	48067.4452	+0.0267	+0.0630		DH
	U s	48067.4459	+0.0274	+0.0637		DH
	V	48120.4113	+0.0279	+0.0642		DH
	B	48120.4113	+0.0279	+0.0642		DH
	U	48120.4120	+0.0286	+0.0649		DH
GP Peg	V	48115.4362	-0.0038	-0.0224		TH
SV Tau	V	47947.3980	-0.0058	= -0.0058		DH/TH
	B	47947.3987	-0.0051	= -0.0051		DH/TH
CR Tau	V	47945.2937	-0.0170	-0.0063		DH
	B	47945.2943	-0.0164	-0.0056		DH
XY UMa	V	47944.3526	+0.0004	+0.0073		DH
	B	47944.3526	+0.0004	+0.0073		DH
ZZ UMa	V	47967.4137	-0.0031	= -0.0031		DH
	B	47967.4130	-0.0037	= -0.0037		DH

(the secondary minimum is supposed to be symmetric between the primary ones).

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

Number 3616

Konkoly Observatory
Budapest
5 June 1991

HU ISSN 0374 - 0676

SEMI-REGULAR BEHAVIOR FOR THE SUPERGIANT RHO CAS

The F8 yellow supergiant Ia-0 star Rho Cas undergoes mass-loss episodes with accompanying changes in brightness, spectrum and radial velocity. Sheffer & Lambert (1986) have suggested that the star undergoes semi-regular pulsation of the atmosphere with a dominant radial pulsation mode of about 500 days. Boyarchuk et al. (1988) noted that at the beginning of 1986, the spectrum of the star changed dramatically: TiO bands and other characteristics of late stars appeared. This change was accompanied by a light minimum.

Photometrically, Rho Cas is well observed. Recent magnitudes have been published by Leiker & Hoff (1987), Leiker et al. (1988), Leiker et al. (1989a), Leiker & Hoff (1990) and Halbedel (1988). This paper reports on more recent unpublished magnitudes obtained by Halbedel at the Corralitos Observatory, and combines all recent observations into a light curve for the previous 6 years.

All observations were made with the 0.6-m. telescope of the Corralitos Observatory and its single channel uncooled photon-counting photometer equipped with an EMI 9924A tube. The comparison stars utilized were HD 223173 ($V=5.510$; $B-V=+1.650$) and Tau Cas ($V=4.867$; $B-V=+1.116$). These stars were stable to within 0.016 in V and 0.018 in $B-V$.

It has been suggested by Leiker & Hoff (1988) and Leiker et al. (1989b) that Tau Cas is itself a variable star: indeed it appears in the New Catalogue of Suspected Variable Stars. However, as previously observed by the

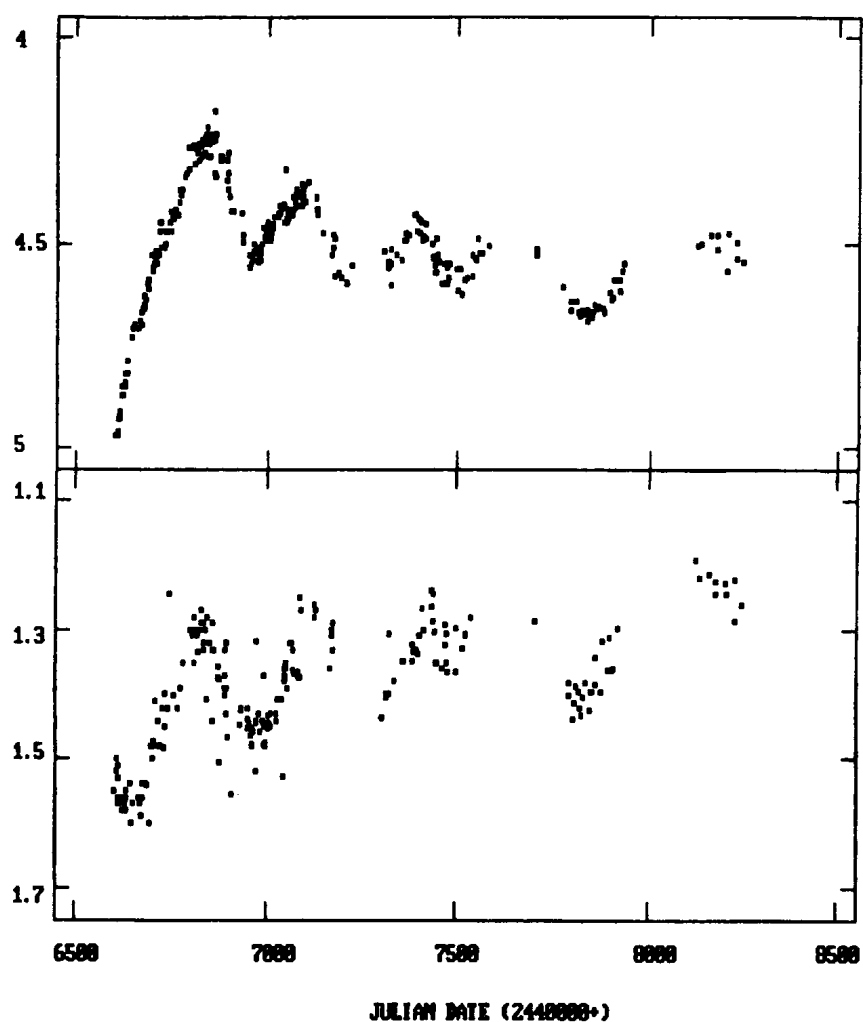


FIGURE 1: MAGNITUDES AND COLORS FOR RHO CAS. THE TOP DIAGRAM SHOWS V MAGNITUDE, THE BOTTOM B-V.

author (Halbedel, 1989), no such variation can be confirmed. On the basis of 59 measures over the JD range 2446994-8244, this conclusion is reaffirmed: the average standard errors about the mean for Tau Cas were 0.012 in V magnitude and 0.015 in B-V. If variability exists, it is below the level

TABLE 1: MAGNITUDES FOR RHO CAS

JD (2440000+)	V	B-V	JD (2440000+)	V	B-V
7411.90069	4.485	+1.266	7810.74583	4.669	+1.387
7412.78888	4.456	1.301	7818.75139	4.678	1.396
7435.87916	4.533	1.263	7827.74971	4.673	1.405
7436.75069	4.539	1.239	7835.70139	4.692	1.382
7437.72083	4.553	1.244	7861.60486	4.662	1.342
7440.76458	4.574	1.286	7878.64374	4.669	1.317
7441.72569	4.540	1.302	7896.61250	4.640	1.313
7470.69930	4.599	1.292	7915.59513	4.617	1.298
7472.69305	4.558	1.324	7917.59236	4.591	1.297
7475.66041	4.588	1.307	8122.81875	4.508	1.191
7501.68611	4.618	1.297	8133.83541	4.500	1.219
7516.61874	4.591	1.329	8159.78611	4.481	1.215
7525.61944	4.586	1.306	8176.69028	4.517	1.225
7526.60763	4.586	1.310	8178.72639	4.479	1.244
7540.59027	4.528	1.282	8201.68263	4.568	1.227
7703.91458	4.515	1.286	8204.61111	4.474	1.245
7790.76528	4.643	1.400	8225.62917	4.498	1.286
7793.82639	4.666	1.381	8228.64097	4.538	1.222
7806.79444	4.642	1.412	8244.63819	4.544	1.262

that can be detected with this system. Therefore, it was continued in usage as a comparison star for Rho Cas.

The newly obtained, thusfar unpublished values for Rho Cas are detailed in Table 1. Figure 1 represents all the magnitudes published in the papers previously cited as well as the new values from Table 1. There is surprisingly little scatter when one considers the multiplicity of sources. The behavior of the star is characterised by an initial brightening, followed by semi-regular cycles with possibly gradually decreasing maxima. The color changes are in phase with the V mag behavior. The star blues as it brightens and reddens as it fades. At any rate, of late Rho Cas appears to be following semi-regular behavior with an approximate cycle time of 400-420 days. Since the star has been known to

undergo outbursts in the past, it will be of interest to follow its behavior in the future. It will continue to be observed at the Corralitos Observatory indefinitely.

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REFERENCES

- Boyarchuk, A.A., Boyarchuk, M.E., & Petrov, P.P. 1988, in Proc. Soviet-Finnish Astro. Meeting, eds. U.Hanni & I. Tuominen (Tartu)
- Halbedel, E.M. 1988, IBVS No. 3171
- Halbedel, E.M. 1989, IBVS No. 3394
- Leiker, P.S. & Hoff, D.B. 1987, IBVS No. 3020
- Leiker, P.S. & Hoff, D.B. 1988, IBVS No. 3176
- Leiker, P.S. & Hoff, D.B. 1990, IBVS No. 3490
- Leiker, P.S., Hoff, D.B., Nesbella, J., Gainer, M., Milton, R., & Pray, D. 1988, IBVS No. 3172
- Leiker, P.S., Hoff, D.B., & Milton, R. 1989a, IBVS No. 3345
- Leiker, P.S., Hoff, D.B., & Tuttle, M.M. 1989b, IBVS No. 3341
- Sheffer, Y. & Lambert, D.L. 1986, PASP, 98, 914

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

Number 3617

Konkoly Observatory
Budapest
6 June 1991

HU ISSN 0374 - 0676

SPECTROSCOPIC DATA ON SEVERAL VARIABLE, OR POSSIBLY VARIABLE, STARS

During the early inspection of the moderate-dispersion objective-prism plates taken for the Michigan Southern Spectral Survey, several objects showing H β and H γ emission were noted but not published (Bidelman and MacConnell 1973) because of uncertain coordinates. New data have become available and it seems worthwhile to publish the old results:

Object	α (1900)	δ	mag.	Date and Remarks
NSV 3632	7 ^h 35 ^m 5	-82° 39'	13.2-14.1 pg	Dec. 1, 1968.
	8 30.3	-9 23	11.7 vis	Jan. 23, 1969; not seen on later plate. Stephenson finds red, br. H α .
Hen 1102	15 41.5	-32 25	13.1 vis	May 29, 1968. Br. H α also seen, sp. perhaps Sc. Henize also classifies it as an uncertain Sc.
V1008 Oph	16 39.0	-14 30	14.2-16.3 pg	June 16, 1969. Stephenson finds type M1, br. H α .

Three other variables appear to have been erroneously classified as of type S: (1) V1959 Cyg was so called by Nassau *et al.* (1954). However, Cohen *et al.* (1989) find it to be an M star, and the late N. Sanduleak has classified it on a 1974 plate as M3. (2) V524 Cas = IRC +70012 was classified S by the writer (1980), but what was thought to be the λ 7909 LaO band is more likely due to VO, and the star is probably of type M8. And (3) GR Cygni = IRC +40466 was also classified as S, again on the basis of the presence of the λ 7909 LaO band. However in this case the attribution to LaO is thought to be correct, but the star also has very strong infrared CN bands, and should no doubt be classified as intermediate between carbon and S. Its infrared spectrum is in fact quite similar to that of the well-known CS star VX Aquilae. The writer would be less than candid if he did not

acknowledge that he quickly re-examined the spectrum of GR Cygni after Volk and Cohen (1989) published their infrared spectral scan showing a strong SiC feature!

Also it may be noted that spectral types for the three RR Lyrae stars BD UMa, BF UMa, and BN CVn have been given by Slettebak and Stock (1959). They are A7, A0, and F0 respectively.

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References:

- Bidelman, W. P. 1980, *Publ. Warner & Swasey Obs.* 2, No. 6.
 Bidelman, W. P., and MacConnell, D. J. 1973, *Astr. J.*, **78**, 687.
 Cohen, M., Wainscoat, R. J., Walker, H. J., Volk, K., and Schwartz, D. E. 1989, *Astr. J.*, **97**, 1759.
 Henize, K. G. 1976, *Astrophys. J. Suppl.*, **30**, 491.
 Nassau, J. J., Blanco, V. M., and Morgan, W. W. 1954, *Astrophys. J.*, **120**, 478.
 Slettebak, A., and Stock, J. 1959, *Astr. Abh. Hamburg* **5**, No. 5.
 Stephenson, C. B. 1986, *Astrophys. J.*, **300**, 779.
 Volk, K., and Cohen, M. 1989, *Astr. J.*, **98**, 931.

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

Number 3618

Konkoly Observatory
Budapest
6 June 1991
HU ISSN 0374 - 0676

HD 181943: AN ACTIVE SINGLE SUBGIANT WITH LITHIUM

From 11 years of V-band photometry, Hooten and Hall (1990) found a photometric period of 385.3 ± 0.6 days for this chromospherically active, single G8 subgiant (Balona 1987). If the photometric period is interpreted as the rotation period due to the modulation by cool starspots, the period of 385 days would be the longest known rotation period for any chromospherically active star. Quite opposite to the general rule, however, that the longer the rotation (photometric) period of late-type stars the less CaII H and K emission, HD 181943 is a *very* active system in several respects: very strong CaII H and K emission, H α and He emission, and continuum light variations. In this paper we demonstrate the strong chromospheric emissions and show that the star has also a strong LiI λ 6707 Å absorption line, which is generally believed to be an indicator of stellar youth. However, there exists the possibility to confuse the evolutionary status of chromospherically active stars because both very active post-main sequence stars and pre-main sequence or very young main-sequence K stars, show a strong to moderate Lithium line (Fekel 1988). Fekel also noted that the primary observational difference is that in post-main sequence stars H α appears as a strong absorption feature.

All observations presented here were obtained at Kitt Peak National Observatory with the coudé feed telescope in April 1991. Grating A and camera 5 were used in second order (centered at $\lambda_c = 6560$ and 6700 Å) and in third order ($\lambda_c = 3950$ Å) at dispersions of 0.105 Å/px and 0.070 Å/px, respectively. The observations utilized a 800-pixel TI CCD and had effective wavelength resolutions of 0.17 Å in the blue and 0.18 Å in the red region. The blue spectra have S/N ratios of around 30:1 and the red spectra approximately 150:1.

Figure 1 shows parts of our spectra centered at, from top to bottom, Ca II H and K, LiI λ 6707 Å, and H α . Very strong H and K emission well above the continuum is present and even He is an emission line almost up to the continuum. The middle panel in Fig. 1 shows the 6700 Å region where the position of the Lithium blend is indicated. In this panel the spectrum of HD 181943 has been shifted to match the spectrum of the G8IV reference star β Aql. No obvious Lithium is present in β Aql and the difference spectrum, HD 181943 minus β Aql, yields an equivalent width for the LiI λ 6707 line of 92 ± 5 mÅ (a Gaussian to the line profile gives 102 mÅ not correcting for the presence of the FeI λ 6707.44 line). From theoretical curves of growth for temperatures around 5100 K and $\log g = 3.75$ given by Duncan and Jones (1983) we obtain $\log n(\text{Li}) = 2.0$ for HD 181943. This places the star well within the range of *Pleiades* Li abundances but above the *Hyades* relation by about a factor of ten. Thus, HD 181943 is most likely a pre-main-sequence object. The bottom panel of Fig. 1 shows the H α line which appears "filled in" up to almost the continuum level and has a core-emission line with a deep central reversal. From the width of the two peaks in the H α

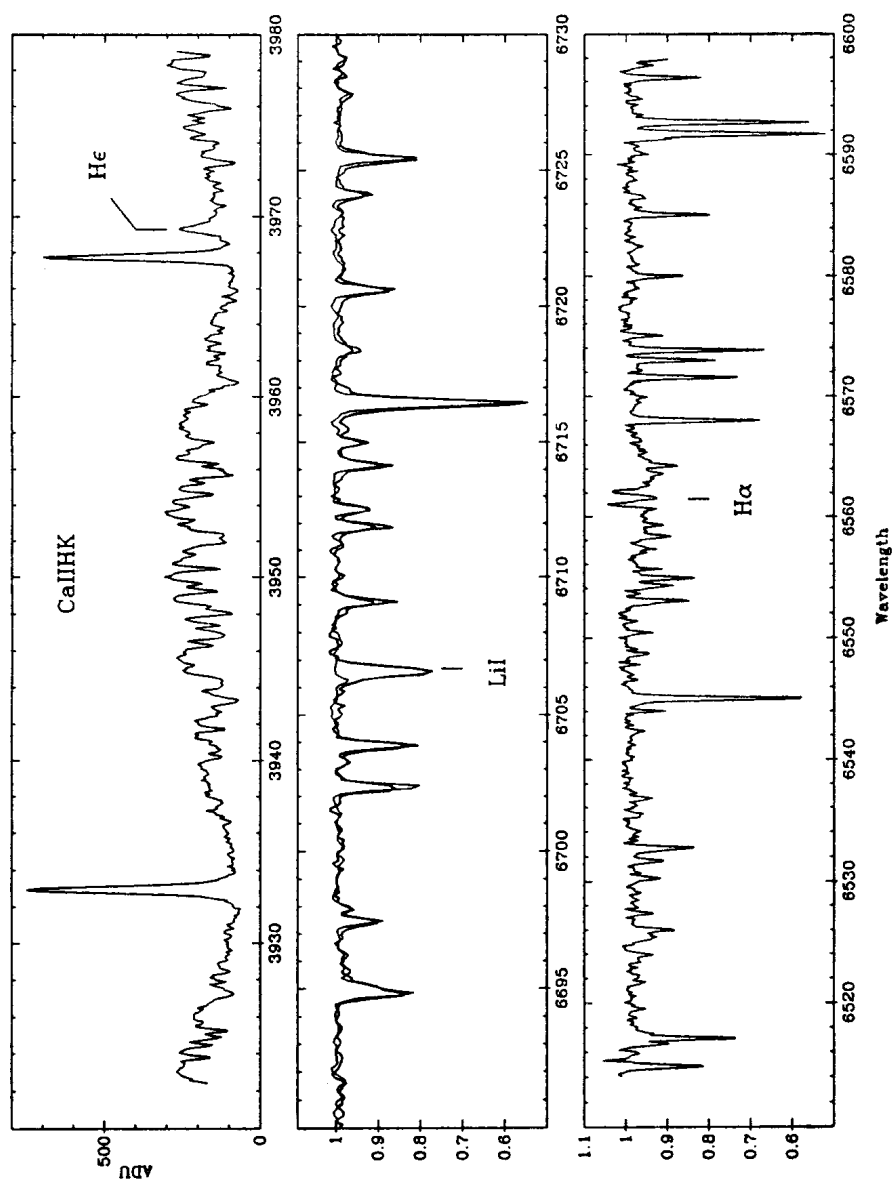


Figure 1

emission profile ($\Delta\lambda=1.071$ Å) and the peak flux relative to the continuum ($F_{\text{mas}}/F_c=1.035$) we find an electron density of $5 \cdot 10^{11} \text{ cm}^{-3}$. This value is on the borderline of a “collision-dominated” and a “mixed-type” H α line formation (i.e., collisions *and* photoionization in the source-sink terms control the shape of the Balmer line) which occurs for $N_e \geq 7 \cdot 10^{11} \text{ cm}^{-3}$ for $T_{\text{phot}} = 5150 \text{ K}$ (G8IV) and an assumed chromospheric temperature of 10,000 K.

From comparison of several unblended photospheric lines with β Aql ($v \sin i = 2.6 \text{ km s}^{-1}$; Gray and Nagar 1985) and an empirical relationship between FWHM and line broadening we derive $v \sin i$ for HD 181943 of $4.2 \pm 1.0 \text{ km s}^{-1}$ and a radial velocity of -33.4 km s^{-1} (JD 2,448,375.9708) in agreement with the radial velocities given by Balona (1987) and his conclusion that HD 181943 is a single star. If we assume that the photometric period measured by Hooten and Hall (1990) is the rotation period, our $v \sin i$ measure translates into a minimum radius of $32 \pm 8 R_\odot$. Clearly, either the subgiant classification must be revised or the photometric period is not the rotation period or is just a spurious value. Since the spectrum of HD 181943 is rather well matched by the G8IV “standard” β Aql and the light curve in Fig. 24 in Hooten and Hall (1990) shows only small scatter (despite its 11 year baseline) we believe that the 385-day period is *not* the rotation period but most likely some spot-cycle period and the star is seen almost pole-on. The lithium abundance and strong chromospheric emissions suggest that HD 181943 is a young star or even a pre-main sequence object and thus should be a rapid rotator. An observationally very similar case might be HR 1362 (Strassmeier *et al.* 1990), another G8 subgiant with a 335-day photometric period, low $v \sin i$, and strong chromospheric emission.

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References

- Balona, L. A. 1987, *S.A.A.O. Circ.* **11**, 1.
Duncan, D. K., Jones, B. F. 1983, *Astrophys. J.* **271**, 663.
Fekel, F. C. 1988, in A DECADE OF UV ASTRONOMY WITH IUE, ESA SP-281, Vol. 1, p. 331.
Gray, D. F., Nagar, P.: 1985, *Astrophys. J.* **298**, 756.
Hooten, J. T., Hall, D. S. 1990, *Astrophys. J. Suppl.* **74**, 225.
Strassmeier, K. G., Hall, D. S., Barksdale, W. S., Jusick, A. T., Henry, G. W. 1990, *Astrophys. J.* **350**, 367.

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

Number 3619

Konkoly Observatory
Budapest
7 June 1991

HU ISSN 0374 - 0676

V 592 HERCULIS - SECOND ERUPTION OBSERVED

This object (V 592 Her = S 10376 = Nova Herculis 1968) was discovered by Richter (1968) who described it as a fast or even very fast nova between $12^m.3$ and $[20^m]$. The 1985 edition of the GCVS gives the type NA. Duerbeck (1987) tentatively tried to identify the postnova on a CCD frame taken with the Calar Alto 2.2 m telescope. Using the insufficient finding chart published in the discovery paper, he found 2 stars near the position of V 592 Her with magnitudes 21^m and 22^m , respectively. But an inspection of the original Sonneberg plates showed that neither identification is correct: V 592 Her is between Duerbeck's stars 1 and 2. Therefore, the amplitude is > 9.5 mag.

210 plates of the 400 mm astrographs, taken since the 1968 outburst, shows that another eruption occurred in 1986. The following observations were obtained on ORWO ZU21 plates without filter:

JD	m
2446500+	
54.12	16.9::
63.54	13.6
91.48	17.5::
92.44	17.6::

Because the outburst lightcurves of a long cyclic eruptive variable are often remarkably similar, we tentatively combined the 1968 and 1986 lightcurves of V 592 Her, as can be seen in Figure 1.

397 sky patrol plates between 1929 and 1966 give no indication of further outbursts (Richter, 1986). Only on two very poor (!) Tachar plates faint traces of about 13^m (plate limit) are indicated (1948 March 29 and 1950 May 16), but probably they are plate faults.

The question arises whether V 592 Her is a recurrent nova (RN) or a dwarf nova (DN). The DN with the largest known amplitude is WZ Sge with 8.5 mag (according to the GCVS). But there are 2 RNe with $A > 9.5$ mag: U Sco (10.6 mag) and V 394 CrA (10.5 mag). This fact speaks in favour of the RN hypothesis of V 592 Her. On the contrary, the lightcurves of all known RNe

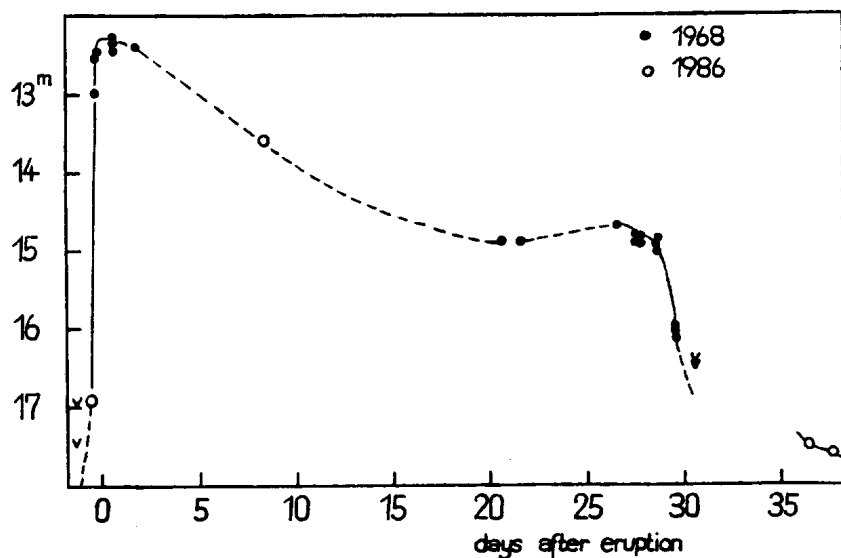


Figure 1

are rather smooth, those of the DN and V 592 Her are not. This, and the blue colour during outburst (Richter, 1968), speak in favour of DN. If so, V 592 Her is the dwarf nova with the largest known amplitude. According to the amplitude cycle-length relationship by Richter (1986), from $A > 9.5$ mag follows $C > 10\,000$ days (27 years), which is not in contradiction to the fact that only 2 outbursts could be found between 1929 and 1990.

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References:

- Duerbeck, H.W.: 1987, A Reference Catalogue and Atlas of Galactic Novae, D. Reidel Publishing Company, Dordrecht/Boston.
Richter, G.A.: 1968, I.B.V.S., No. 293.
Richter, G.A.: 1986, Astron. Nachrichten, 307, 221.

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

Number 3620

Konkoly Observatory
Budapest
7 June 1991

HU ISSN 0374 - 0676

Photoelectric Photometry Of The Carbon Star V614 Mon

Photometric observations of V614 Mon (HD 52532, BD-03°1685, SAO 134049) were made to more accurately determine its periodicity and amplitude range, as only sparse data regarding these parameters are found in existing literature. V614 Mon is a carbon star of subclass J, with a spectral type of R5 (C4, 5J). The major characteristic of J-class carbon stars is the high strength (50%) of the C-12 C-13 isotopic carbon band at 6168 Angstroms relative to the normal band at 6122 Angstroms (Eggen 1972, Gordon 1971, Yamashita 1966). It is also classified as a SRb semi-regular variable with a period of about 60 days, a varying visual amplitude range from 0.10 to 0.35, and a B-V value of +1.74 (Eggen 1972, GCVS 1985, Sky Catalog 2000).

The observations were made on 31 separate nights from JD 2448209 (14 Nov 90) to JD 2448358 (12 Apr 91) as part of the Small Amplitude Red Variable (SARV) Photoelectric Photometry Program for the AAVSO. The detector was a silicon PIN photodiode in a solid-state SSP-3 photoelectric photometer, which was mated to an f/10 8-inch Schmidt-Cassegrain. The observations were made through a SSP-3 Schott visual filter, with the variable star measurements flanked by the comparison star and sky readings. A check star was observed on 90 percent of the nights. The

Table I: V614 Monocerotis Light Curve Data

JD 244+	Visual Magnitude	JD 244+	Visual Magnitude
8209.767	7.34	8297.606	7.30
8211.731	7.38	8302.575	7.32
8234.705	7.44	8311.533	7.38
8235.702	7.43	8314.620	7.48
8245.677	7.39	8316.530	7.50
8251.660	7.37	8321.514	7.49
8261.619	7.39	8323.517	7.52
8270.627	7.38	8325.527	7.52
8274.620	7.38	8327.529	7.52
8279.680	7.35	8337.540	7.52
8280.716	7.36	8341.524	7.54
8282.610	7.36	8346.530	7.50
8285.598	7.33	8348.528	7.48
8288.583	7.35	8354.533	7.41
8290.583	7.31	8358.536	7.35
8296.595	7.30		

comparison and check stars used were SAO 134133 ($V=5.62$, $B-V=1.29$, gK3) and SAO 134031 ($V=6.30$, $B-V=0.57$, F8), respectively. The magnitude difference between these two stars varied randomly by only 0.03-0.04 magnitude. The data were reduced by computer programs written by the author, with all comparison and sky readings being interpolated. Also taken into account in the programs were atmospheric extinction, transformation to the standard UBV system, and corrections to heliocentric time. The standard deviation for all of the observations was less than 0.035 magnitude.

The resulting light curve is constructed from the data in Table I and is plotted below. It represents the most complete continuous light curve on this star published to date. Previous sources indicate a maximum visual magnitude of about 7.2, whereas these most recent observations indicate a maximum magnitude of 7.3. Also, it is noted that the maximum amplitude range is 0.24 magnitude, occurring between JD 8297 and JD 8341. This falls within the limits of previously reported amplitude ranges.

V614 MON

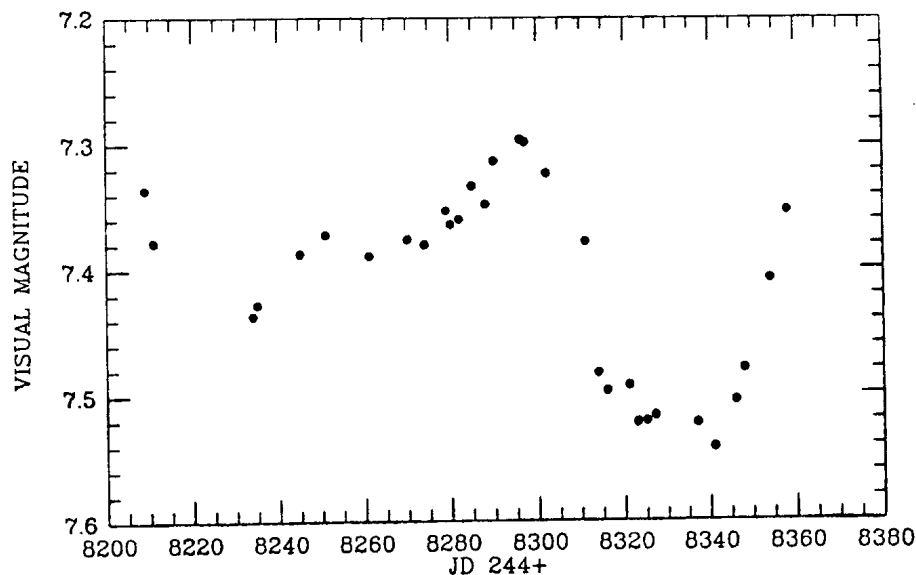


Figure 1

No 60 day period, or any regular period, is easily discernible. If various portions of the light curve are extracted, and some interpolations and extrapolations made, several periods are possible. The possibilities are:

- Peaks occurring just before JD 8205 and around 8297 indicate a period of about 92 days;

- The minima around JD 8222 and 8333 are separated by about 111 days;
- The various extrema around JD 8261, 8297, 8334, and 8370 indicate a half-period of 36-37 days;
- The maxima around HD 8298 and 8370 indicate a period of about 71 days.

Additional observations will be taken to clarify any persistent periodicities. A multiplicity of apparent periods is, of course, a major characteristic of semi-regular SRb variable stars. Thus these observations support the classification of V614 Mon as an SRb variable star with a small amplitude range, but with as yet inaccurately known period(s).

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References:

- Eggen, O.J. 1972, Ap.J., 177,489
Gordon, C.P. 1971, P.A.S.P., 83,667
Keenan, P.C. and Morgan, W.W. 1941, Ap. J., 94,501
Yamashita, Y. 1966, Pub. Dominion Astrophysical Obs., Vol.13, 67
Kholopov, P.N. 1985, GCVS, 4th Edition
Petit, M., 1982, Variable Stars, C. 1987 Wiley and Sons, Ltd.
AAVSO, 1984-89, Private Communications
Hirshfeld A. and Sinnott, R.W. 1985, Sky Catalog 2000, Vol.2, Cambridge University Press and Sky Publishing Co.

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

Number 3621

Konkoly Observatory
Budapest
10 June 1991

HU ISSN 0374 - 0676

DISCOVERY OF RAPID OSCILLATIONS IN THE Ap STAR HD 84041

The rapidly oscillating Ap (roAp) stars are magnetic Ap SrCrEu stars which exhibit low-amplitude ($A \leq 8$ mmag semi-amplitude) rapid broadband light oscillations with periods in the range $P = 4$ -16 min. These light oscillations are interpreted as low degree ($\ell \leq 3$), high overtone ($n > \ell$) p -mode pulsations. The most comprehensive recent review of these variables is that of Kurtz (1990). Shortly after Kurtz's review was written, we commenced a systematic survey of the roAp phenomenon in the Southern sky. The Cape Rapidly Oscillating Ap Star Survey has already led to the discovery of six new roAp stars (Martinez *et al.* 1991, Martinez & Kurtz 1991). We present here the seventh roAp star to be discovered in our survey, HD 84041.

On the night JD2448335 we acquired 1.02 hr of high-speed photometry of HD 84041 which suggested the presence of rapid oscillations with a frequency of 1.1 mHz and an amplitude of about 1.2 mmag. To confirm our detection of rapid oscillations, we observed this star again on the nights JD2448354, 8355, 8358, 8359, 8362 and 8377. The observations were acquired with various 0.5-m, 0.75-m and 1.0-m telescope/photometer combinations at the Sutherland site of the South African Astronomical Observatory. All observations consisted of continuous 10-s integrations through a Johnson B filter. Our usual observing and reduction procedures are described in detail by Martinez *et al.* (1991). The data were all Fourier analyzed in individual nights, in groups of closely spaced nights, and as a whole. There are reasonably convincing indications of amplitude modulation among the nightly data sets, and even on a time-scale shorter than a night, but space does not permit us to present these frequency analyses here. These analyses suggest that the oscillations in HD 84041 are multi-periodic.

In Fig. 1 we present light curve acquired on night JD2448377. The amplitude spectrum of this light curve is shown in Fig. 2, in which the peak of interest is the one labeled ν_1 at 1.14 mHz. The solid line in Fig. 1 is a fit of a sinusoid of frequency $\nu_1 = 1.14$ mHz to the data. The peaks to the left of ν_1 in Fig. 2 are caused by sky transparency variations during the observations. These sky transparency variations have been removed in Fig. 1 to facilitate the reader's perception of the oscillations. There are several non-cosmetic reasons why these peaks must be removed in the frequency analyses, but we

HD84041 JD2448377 BBZL40

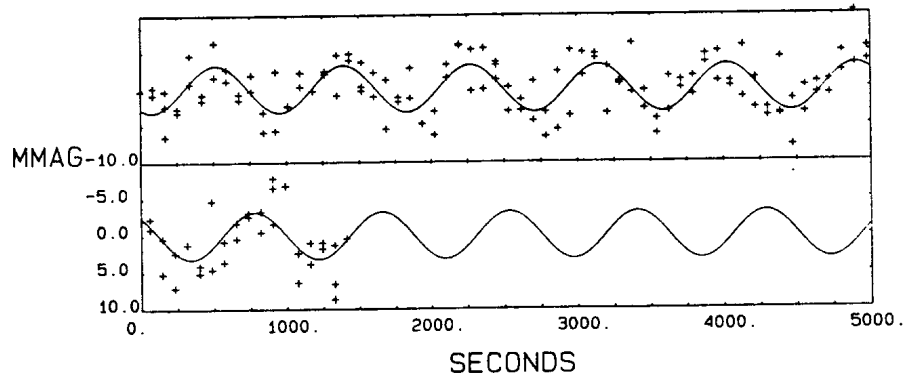


Figure 1

HD84041 JD2448377 BBZ10

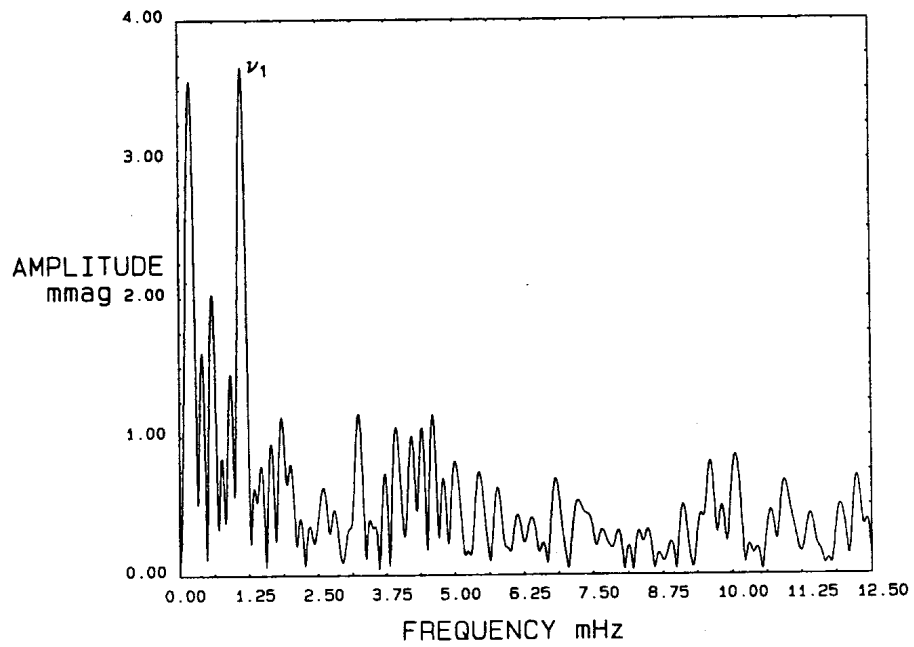


Figure 2

have left them in Fig. 2 so that the reader may judge the data. The noise at frequencies $\nu_1 \geq 0.8$ mHz, the scintillation noise, is quite high in Fig. 1 because these observations were acquired using an 0.5-m telescope. Ironically, these are some of the best signal-to-noise data we have! As Fig. 2 shows, at $\nu_1 = 1.1$ mHz, the oscillations are not clearly in the frequency regime dominated by scintillation noise and this complicates the study of the rapid oscillations in this star. A more detailed analysis of the rapid oscillations of HD 84041 will be presented in a future publication.

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References

- Kurtz, D.W., 1990. *Annual Reviews of Astronomy & Astrophysics*, **28**, 607.
Martinez, P., Kurtz, D.W. & Kauffmann, G., 1991. *Mon. Not. R. astr. Soc.*, in press.
Martinez, P. & Kurtz, D.W., 1991. *Inf. Bull. Var. Stars*, 3553.

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

Number 3622

Konkoly Observatory
Budapest
10 June 1991
HU ISSN 0374 - 0676

G327 - A NEW HORIZONTAL BRANCH VARIABLE STAR BLUEWARD OF THE RR LYRAE
GAP IN M4

G327 (Greenstein 1939) = A64 (Alcaino 1975) = L3315 (Lee 1977) is a horizontal branch star blueward of the RR Lyrae instability strip in the globular cluster M4 (see Fig.1). The proper motion study (Cudworth 1990) shows that G327 is a cluster member ($P_c=0.99$). The magnitudes and colors of this star given by different authors are:

V=13.29, B-V=0.35 (Alcaino 1975)
13.23, 0.43 (Lee 1977)
13.24, 0.47 (Cudworth 1990)

We have pointed out the variability of G327 long ago (1979). Due to the low accuracy of the photographic photometry and the unfavourable observation conditions in China, we failed to find out its period. Thanks to the use of the CCD camera, the preliminary periods have now been obtained. The observations were made with the coated GEC CCD #2 attached to the Cassegrain focus of the 60-cm reflector at the Mount Stromlo and Siding Spring Observatory on 20 and 21 July 1990. The detector contains 383 X 577 useful pixels at a scale of about 0".42/pixel, thus covering a $\sim 2.5 \times 4'$ field. A total of 64 frames (60 visual, 4 blue) were obtained with the exposure time of 5 minutes, and the seeing was between 2".1 and 3".5 (FWHM). Because no guiding device can be used at the 60-cm reflector during exposing, 3 frames must be discarded due to the much elongated images.

Some of the data were reduced at the Anglo-Australian Observatory with the μ Vax 3800 and the others at the Nanjing University in China with the Sun 4 workstation. Only the aperture photometry routine of the DAOPHOT (Stetson 1987) was used to reduce the data because it is not a crowded star field. G298 ($V=12.68$, $B-V=0.59$) was used as the comparison star. Comparing with the star G300 it is shown that the constancy of G298 is better than ± 0.005 mag. Scargle's (1982) modified periodogram was used to analyse the unevenly sampled data because it can detect even faint signals in noisy (low signal to noise ratio) data. The frequency interval to be searched was from 0.8 to 26. After the data were prewhitened with the previous frequency, the same procedure was run again. Three frequencies were thus found and Breger's (1991) program PERIOD was used to improve the values of the frequencies found above simultaneously. The results so obtained are:

$$m(t) = \text{ZEROPOINT} + \sum_{i=1}^3 a_i \sin(2\pi t/p_i + 2\pi\varphi_i)$$

Here $P_1=0.3435$, $a_1=0.01030$, $\varphi_1=0.1586$,
 $P_2=0.1101$, $a_2=0.00606$, $\varphi_2=0.0942$,
 $P_3=0.0550$, $a_3=0.00577$, $\varphi_3=0.3398$,
ZEROPOINT = 0.643

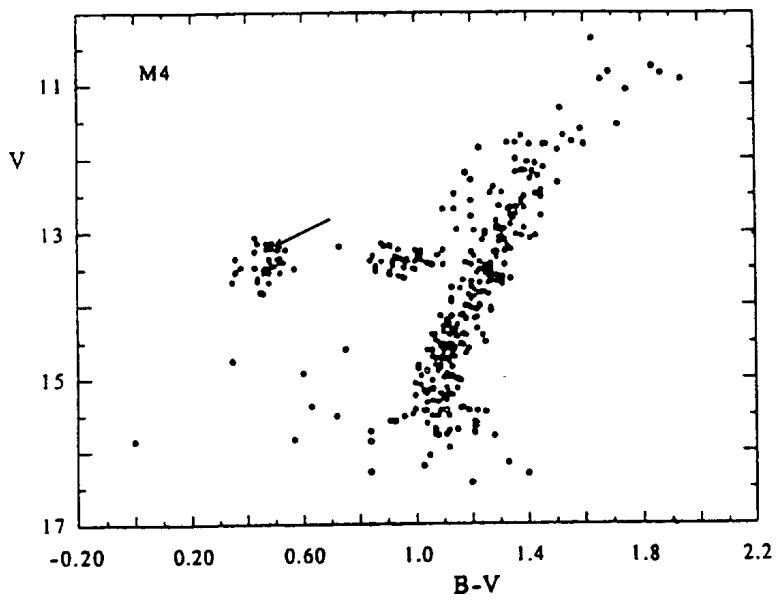


Figure 1

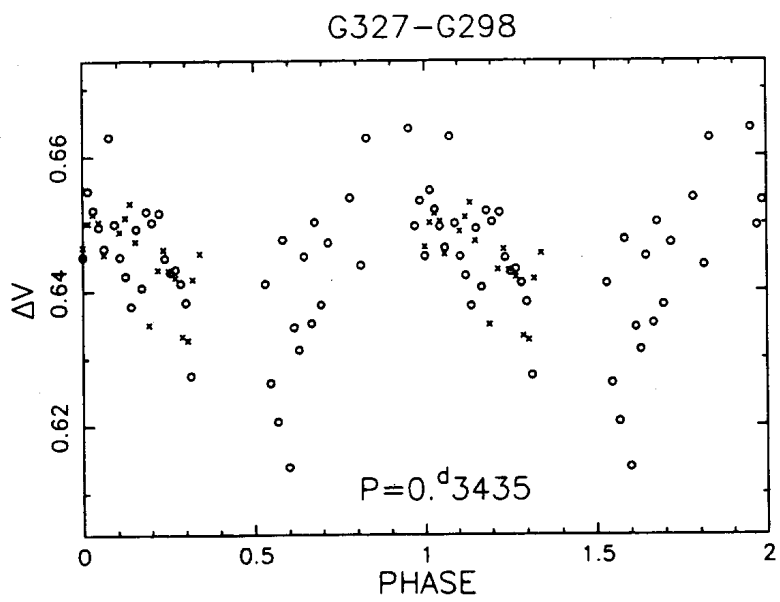


Figure 2

G327-G298

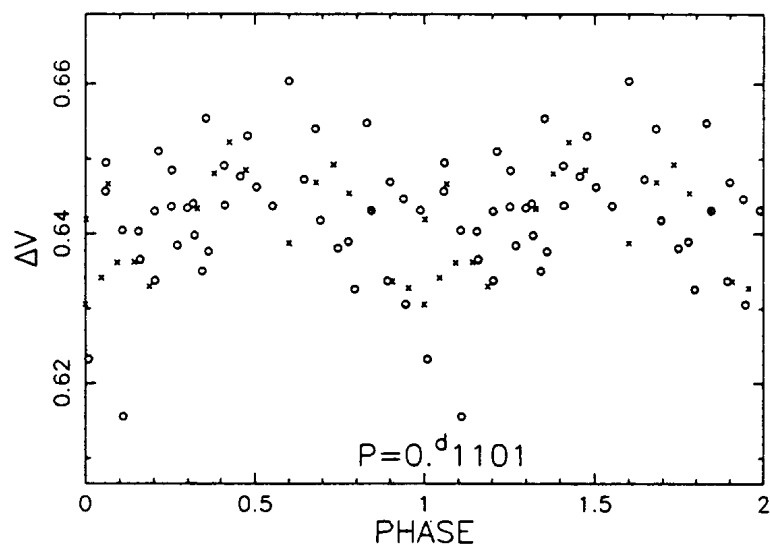


Figure 3

G327-G298

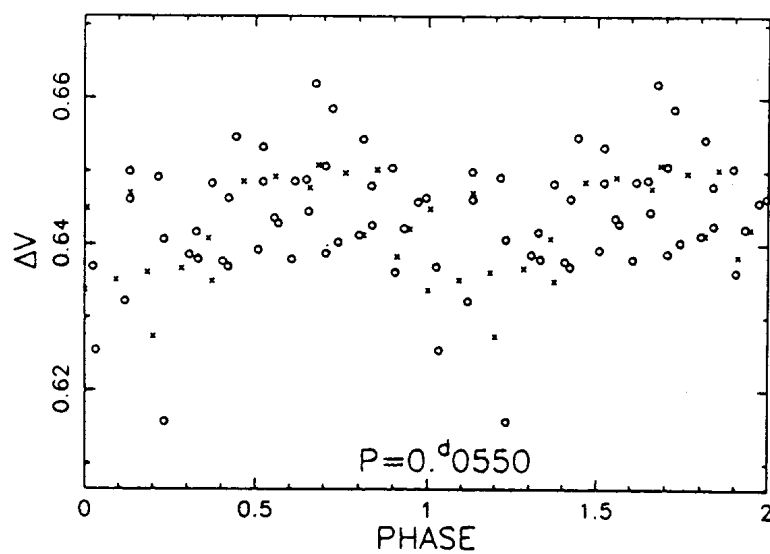


Figure 4

The folded light curves are given in Fig.2,3 and 4. Each light curve is plotted with the data prewhitened with the other two frequencies. G327 is the third horizontal branch variable star in M4 which is located blueward of the RR Lyrae gap and checked with the CCD photometry by us (Yao 1987). Is it possible that G327 pulsates both in the first-overtone and second-overtone?

However, $P_1=0.5158$ seems to fit the observations too because the data are limited. Obviously, further observations are needed to determine the periods accurately.

I wish to thank Prof.A.W.Rodgers, the director of MSSSO, for allocating the telescope time. I thank also the staff members of MSSSO for help with observing. I thank the staffs of AAO for using the computers. This work was supported in part by the grant from the Chinese National Science Foundation.

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References:

- Alcaino,G.,1975, Astro. & Astrophys. Supp.,**21**,1
- Breger,M., 1991, Delta Scuti Star Newsletter,issue 3
- Cudworth,K.M., 1990, A.J., **99**,1491
- Greenstein,J.L., 1939, Ap.J.,**90**,387
- Lee,S.W., 1977, Astro. & Astrophys., Supp., **27**,367
- Scargle,J.D., 1982, Ap.J.,**263**,835
- Stetson,P.B., 1987, P.A.S.P.,**99**,191
- Yao Bao-an, 1979, Publ. of the Beijing Astro. Obs., No.4,1
- Yao Bao-an, 1987, ESO Messenger, No.50,33

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

Number 3623

Konkoly Observatory
Budapest
17 June 1991

HU ISSN 0374 - 0676

V368 Cep - A POST T Tau SPOTTED SINGLE STAR

The star HD 220140 = SAO 10697 has been identified with an X-ray source by Pravdo, White and Giommi (1985). Joy and Wilson (1949) assigned to it the dKO spectral type and noticed strong CaII H and K emission lines in its spectrum. Moore and Paddock (1950) estimated its spectral type as G9V. Poretti, Mante-gazza and Antonello (1985) have found light variations of HD 220140 with the amplitude of 0.04^m and the period of 0.5767^d and classified it as a spotted star. However the photometric period of 2.75^d of this star is reported by Heckert et al. (1990). In the 69-th name list of variable stars Kholopov et al. (1989) have given to this star the designation V368 Cep.

We observed V368 Cep photometrically in October 1990 - March 1991 with the UBVRi photoelectric photometer attached to the 125-cm telescope. Spectroscopic observations were done in November-December 1990 with the coude spectrograph of the 2.6-m telescope which operates with a CCD-device. The following wave-length intervals were covered: 5873-5903 Å, 6546-6576 Å, and 6700-6730 Å. Here we report characteristics of the evolutionary status of the star, namely period and velocity of rotation, space velocity vector and lithium content.

The period 0.5767^d does not fit our photometric observations but the period 2.75^d fits them rather well. However a better representation of them is also obtained with the "satellite" period of $1/(1/2.75 - 1) = -1.571428^d$. The spectra we have obtained yield the projected velocity of rotation $v \sin i = 25$ km/s. Using the relation $R \gg v \sin i P/2\pi$ in which periods of rotation are $P = 2.75^d$ or $P = 1.57^d$ we have derived lower limits of the star radius $R \gg 1.36 R_\odot$ or $R \gg 0.78 R_\odot$. The latter value corresponds to the normal main-sequence K0 star but the former one is about twice larger. According to our computations HD 220140 is at a distance of 21 pc or 42 pc if its luminosity corresponds to the spectral type G9V or the luminosity is 4 times larger (i.e. the radius is 2 times larger). Pravdo, White and Giommi (1985) have concluded that HD 220140 is at a distance of 30 pc if it is a main-sequence dwarf but their X-ray observations indicate that the interstellar absorption in the direction of this star is $10^{20} \text{ H cm}^{-2}$ which gives a distance of ~ 70 pc. Probably there are differences in values of the luminosity and apparent brightness adopted by Pravdo, White and Giommi and us which result in different distances. However both investigations indicate independently that the luminosity of HD 220140 may be larger as compared with the luminosity of a main sequence star.

The most probable value of the radial velocity is -15.6 km/s although several lines (HI, FeI, NaI) give values differing from it by -2 km/s to -4 km/s. The radial velocity of -15.6 km/s differs only slightly from the published radial velocity of -15.1 ± 1.3 km/s according to MtWilson observations (Abt, Biggs 1972) but according to the Lick Observatory the radial velocity is -19 ± 0.9 km/s (Moore, Paddock 1950). We note also the absence of night-to-night radial velocity variations demonstrated by our as well as published observations. Thus it seems highly likely that HD 220140=V368 Cep is a single star. Using values of radial velocity -15 km/s, components of proper motion (published in the SAO Catalogue) $\mu_{\alpha}=0.0731^{\circ}$, $\mu_{\delta}=0.087''$ and distance of 30 pc we obtain the following components of the space velocity vector (km/s) $U=-22$, $V=-28$, $W=-4$. This space motion is quite similar to that of the Pleiades Group for which according to Eggen (1975) $U=-11 \pm 9$, $V=-25$, $W=-8 \pm 8$.

Our spectroscopic observations of HD 220140 show that the LiI 6707 line is stronger than the CaI 6717 line. Using the equivalent width of the LiI 6707 line $W_{\lambda}=0.288 \text{ \AA}$ and curves of growth given by Duncan (1981) we have estimated the Li abundance $\log N(\text{Li})=3.0 \pm 0.1$ which is quite near to the primordial value $\log N(\text{Li})=3.3 \pm 0.1$ (Duncan 1981).

We believe that V368 Cep belongs to the group of single spotted stars with the ages not exceeding $5 \cdot 10^7$ y. Properties of about 20 solar vicinity stars constituting this group have been discussed by Chugainov (1991). Spatial motions of these stars are similar to those of Pleiades group, Tau-Aur and Sco-Cen associations. High lithium abundances were found in several stars of this group. The evolutionary status of these stars is that they probably are in the post-T Tau stage and show the fast axial rotation which is believed to be the spinning-up phase of a short duration. The member of this group LQ Hya and V368 Cep are very similar by their spectral types, photometric periods and high lithium abundances (see Fekel et al. 1986).

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References:

- Abt, A.H., Biggs, E.S.: 1972 *Bibl. of Stellar Radial Velocities*, Latham Process Corp., New York.
- Chugainov, P.F.: 1991 in "Angular Momentum Evolution of Young Stars" Eds. S. Catalano, J.R. Stauffer, Kluwer Acad. Publ., Dordrecht (in press).
- Duncan, D.K.: 1981, *Ap.J.* **248**, 651.
- Eggen, O.J.: 1975, *Publ. Astron. Soc. Pacif.* **87**, 37.
- Fekel, F.C. et al.: 1986, *Astron. J.* **92**, 1150.
- Heckert, P.A. et al.: 1990, *Bull. AAS* **22**, 837.
- Joy, A.H., Wilson, R.E.: 1949, *Ap.J.* **109**, 231.
- Kholopov, P.N. et al.: 1989, *IBVS*, No.3323.
- Moore, J.H., Paddock, G.F.: 1950, *Ap.J.* **112**, 48.
- Porette, E., Mantegazza, L., Antonello, E.: 1985, *IBVS*, No.2807.
- Pravdo, S.H., White, N.E., Gionmi, P.: 1985, *Mon. Not. R.A.S.*, **215**, 11P.

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

Number 3624

Konkoly Observatory
Budapest
17 June 1991
HU ISSN 0374 - 0676

THE UNUSUAL T TAURI TYPE STAR V350 CEPHEI

The variable V350 Cep (SVS 2246) was found in the star formation region NGC 7129 by Gyulbudaghian and Sarkisyan (1978a, b). In 1977-1978 its brightness was near $17^m.5$ B and $16^m.5$ V. The star was not seen on the Palomar Sky Survey print made on 5-6 Aug. 1954 (the limit was $21^m.1$ B). According to Gyulbudaghian (1980) V350 Cep was not seen on 70 plates with the limit $15^m-17^m.5$ pg, obtained during 1936-1966. Preliminary results of photographic observations, given by Pogonyants (1985) are erroneous. All our B and V data are revised in this paper.

We measured V350 Cep on 59 plates from Sternberg Institute collection. Seven estimates in the Baldone Observatory (Latvia) were made by Dr. A. Alksnis. The sequence of comparison stars calibrated through photoelectric standards in cluster NGC 7142 (van den Bergh and Heeringa, 1970) is presented in Table I and in Figure 1. Table II contains our observations. The light curve of V350 Cep, based on our data and all published data is shown in Figure 2.

For the first time the star's brightness has exceeded our plate limit of $\sim 19^m.0$ B and $\sim 18^m.5$ V in 1971. The maximum brightness of the star during the observations was $16^m.4$ B and $15^m.3$ V. The amplitude of V350 Cep is larger than $4^m.7$ B. The amplitude of brightening in near-IR region is about 1^m K during 6 years (1975-1981) (obtained by comparing results of Cohen and Schwartz (1983) and Strom et al. (1976)).

The shape of the light curve of V350 Cep resembles that of FU Ori type star V1515 Cyg (Herbig, 1977). However, as was noted by Gyulbudaghian et al. (1978), the absolute magnitude of V350 Cep corresponds to the value of T Tau type stars. Cohen (1983) presents for V350 Cep (NGC 7129/IRS 1) $L_{bol} = 5.3 L_{\odot}$, i.e. the value of the absolute bolometric magnitude $M_{bol} = +2.9$, while the FU Ori type objects in maximum have $M_{bol} = -2.4 \pm 0.6$ (Herbig, 1977).

Spectral observations in July-Aug. 1978 by Magakyan and Amirkhanyan (1979) showed a classical T Tau type spectrum. Strong spectral variability was later observed by Magakyan (1983). In July 1981 the spectrum was T Tau type with strong emission lines (Cohen and Fuller, 1985). The Ca II H and K

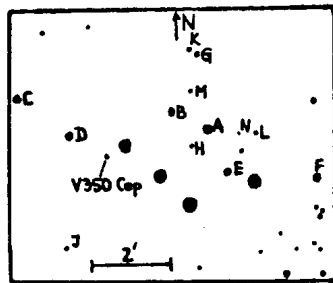


Figure 1. Photographic (V) chart for V 350 Cep

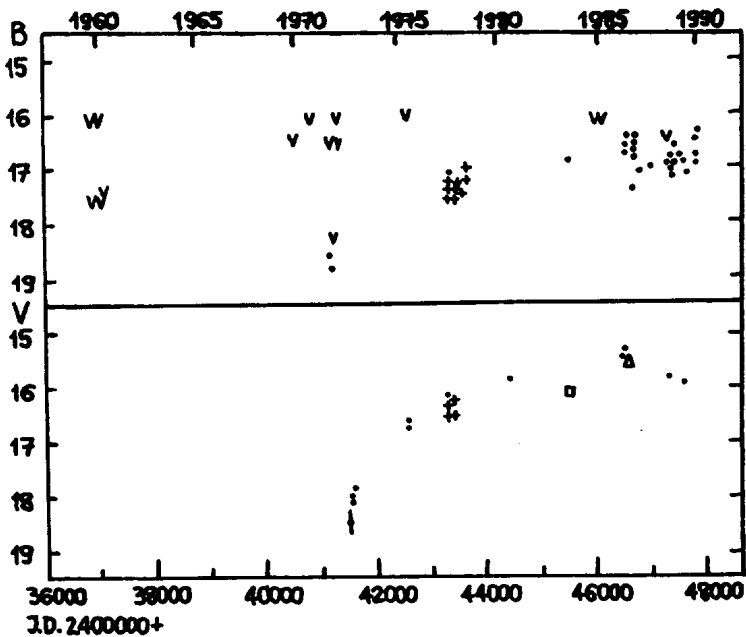


Figure 2. B and V light curves of V350 Cep. Dots are our photographic data, crosses: photographic observations (Gyulbudaghian, Sarkisyan, 1978ab and Akhverdyan, Gyulbudaghian, 1978), triangle: mean photoelectric value by Berdnikov and Ibragimov (Shevchenko, Yakubov, 1989), square: CCD-photometry (Hartigan, Lada, 1985), symbols like letter "v": upper limits of brightness from our data.

Table I

The comparison star's sequence

* B	* V	* B	V
A -----	13.93	J 17.68	16.17
B 15.79	14.40	K 18.24	16.88
C 15.92	14.90	L 18.41	17.19
D 16.08	15.25	M 18.7	16.47
E 16.46	15.22	N 18.6	17.73
F 16.81	14.70		
G 17.19	16.06		
H 17.61	15.96		

Table II

Observations with 50/70/200 cm Maksutov telescope

J.D. 24...	B	J.D. 24...	B	J.D. 24...	V
41241.217	18.6	47416.295	16.94	41577.460	18.1
41246.203	18.8	47418.301	17.07	41578.438	17.9
41247.330	(18.3	47683.444	16.90	46588.519	15.30
46087.207	(16.1	J.D. 24...	V	46590.499	15.48
46588.433	(16.1	41569.453	18.15	47417.280	15.77
46588.433	16.69	41570.373	17.85	47684.502	15.96

Observations with 80/120/240 cm Baldone Schmidt telescope

J.D. 24...	B	J.D. 24...	V
42666.413	(16.1	42666.368	16.55
42666.457	(16.1	42666.383	16.65
43377.471	17.06	43364.438	16.17
		44512.290	15.84

Observations with 40/160 cm astrograph

J.D. 24...	B	J.D. 24...	B	J.D. 24...	B
45558.534	16.90	47032.501	16.96	47766.506	16.98
46646.514	16.47	47385.432	(16.5	47773.451	17.02
46652.482	16.46	47388.466	(16.5	47797.425	(16.5
46657.531	17.40	47395.373	16.84	47807.423	16.96
46685.404	16.45	47418.371	17.05	47836.230	16.69
46706.338	16.57	47422.423	16.93	47852.204	16.47
46712.315	16.70	47448.307	16.66	47861.181	16.36
46762.194	16.86	47471.278	(16.1		
46768.177	17.13	47477.185	16.90		

lines were in emission and broad shallow absorptions (Sp. type M2) were present in Oct. 1982 (op. cit.). Goodrich (1986) reports that the EW of H α emission line was equal to 71 Å in July 1985.

It would be interesting to search for periodic light variations in V350 Cep like those found in many T Tau type stars.

The author is grateful to Dr. V.P. Goranskij for obtaining additional plates and help during the study and to Dr. A. Alksnis for estimating Bal-
done plates.

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References:

- Akhverdyan, L.G., Gyulbudaghian, A.L.: 1978, *Astron. Circ. USSR*, No.1027, 3.
 Bergh, S. van den, Heeringa, R.: 1970, *Astron. Astrophys.*, 9, 209.
 Cohen, M.: 1983, *Revista Mexicana Astron. Astrof.*, 7, num.espec., 241.
 Cohen, M., Schwartz, R.D.: 1983, *Ap.J.*, 265, 877.
 Cohen, M., Fuller, G.A.: 1985, *Ap.J.*, 296, 620.
 Goodrich, R.W.: 1986, *Astron.J.*, 92, 885.
 Gyulbudaghian, A.L., Sarkisyan, R.A.: 1978a, *Astron. Circ. USSR*, No.972, 7.
 Gyulbudaghian, A.L., Sarkisyan, R.A.: 1978b, *Astron. Circ. USSR*, No.982, 4.
 Gyulbudaghian, A.L., Glushkov, Yu.I., Denisyuk, E.K.: 1978, *Ap.J. (Lett.)*, 224, L137.
 Gyulbudaghian, A.L.: 1980, in "Flare stars, FU Ori and Herbig-Haro objects",
 Erevan, Acad.Sci.Arm.SSR, p.199 (in Russian).
 Hartigan, P., Lada, Ch.J.: 1985, *Ap.J. Suppl.*, 59, 383.
 Herbig, G.H.: 1977, *Ap.J.*, 217, 693.
 Magakyan, T.Yu., Amirkhanyan, A.S.: 1979, *Astron. Circ. USSR*, No.1038, 6.
 Magakyan, T.Yu.: 1983, *Pis'ma Astron. Zh.*, 9, 155 (Soviet Astron. Lett.,
10).
 Pogoyants, A.Yu.: 1985, *Astron. Circ. USSR*, No.1359, 3.
 Shevchenko, V.S., Yakubov, S.D.: 1989, *Astron. Zh.*, 66, 718.
 Strom, S.E., Vrba, F.J., Strom, K.M.: 1976, *Astron.J.*, 81, 638.

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

Number 3625

Konkoly Observatory
Budapest
18 June 1991

HU ISSN 0374 - 0676

**Strömgren photometry of suspected
low amplitude δ Sct stars**

Two stars, 21 LMi (HR 3974) and 40 Leo (HR 4054), included in the New Catalogue of Suspected Variable Stars (1982) as probable δ Sct stars, were observed photometrically by using the simultaneous uvby β Strömgren photometer attached to the 75 cm reflector at Sierra Nevada Observatory (Spain). In addition, two other stars β Leo (HR 4534) and FT Vir (HR 4746) were also observed. In total, we carried out eight nights of observation in the years 1988 and 1989. 21 LMi is listed in the New Catalogue of Suspected Variable Stars (1982) with an amplitude of luminosity variation of $\Delta V=0.^m05$, while $\Delta V=0.^m06$ is listed for 40 Leo in the same catalogue. β Leo is included in the list of probable δ Sct stars from Frolov (1970). Bartolini et al. (1981) reported an amplitude of $\Delta V=0.^m025$ with a period of $P=0.^d05$ for this star. FT Vir was found as variable by Eggen (1974) with $\Delta V=0.^m01$ and $P=0.^d05$.

Table 1 lists, for each star, the $b-y$, m_1 , c_1 and β indices from Hauck & Mermilliod (1990). In addition, the magnitudes in the V filter and spectral types, from the Bright Star Catalogue (1982), are presented in columns 3 and 4, respectively. Spectral types of A6V for 21 LMi and A2V for β Leo are found from the calibrations of Gray & Garrison (1987, 1989b). For FT Vir, Breger (1979) gives it as F0n, while Peniche et al. (1981) reported this star as F4III-II. Furthermore, the calibrations from Gray & Garrison (1989a) indicate that FT Vir must be of a spectral type later than F2. Figure 1 shows the sample of δ Sct stars, from López de Coca et al. (1990), in the H-R diagram. The blue and red edges are from Breger (1979). These edges may not be absolute, but are borders to indicate the regions beyond which pulsation is less probable. As can be seen in the figure, the three stars 40 Leo, β Leo and FT Vir lie outside the drawn borders. Only the star 21 LMi is located within the instability strip.

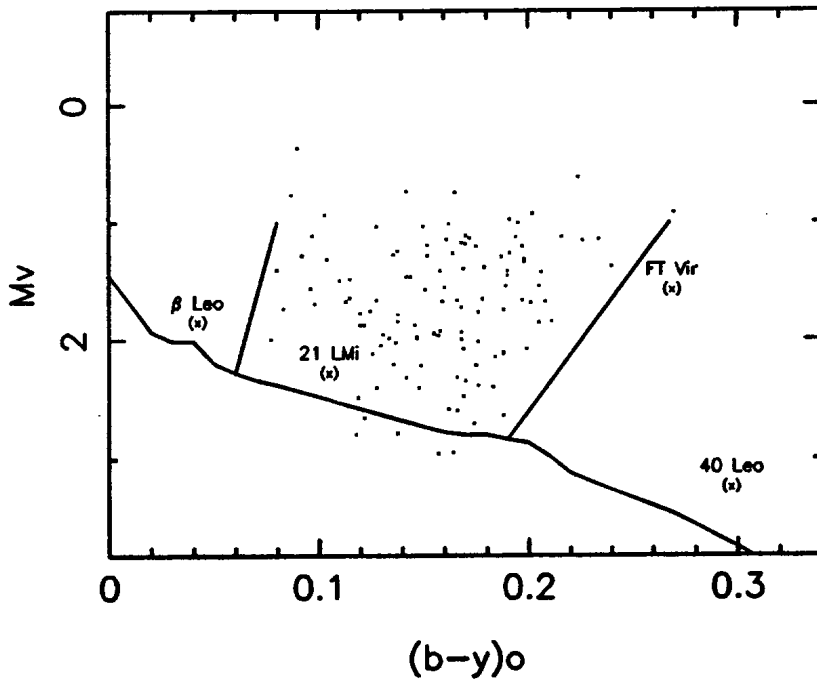


Figure 1

Table 1

Star Name	HR	V (mag)	S.T.	b-y (mag)	m ₁ (mag)	c ₁ (mag)	β (mag)	s (mag)	Number of points	Time observed (hours)
21 LMi	3974	4.48	A7V	0.111	0.196	0.870	2.836	0.0024	53	5.1
C2	4075	5.72						0.0026		
40 Leo	4054	4.79	F6IV	0.297	0.171	0.459	2.654	0.0019	69	5.1
C2	4097	6.15						0.0025		
β Leo	4534	2.14	A3V	0.044	0.210	0.975	2.900	0.0028	55	6.6
C2	4564	5.53						0.0030		
FT Vir	4746	6.22	A8n	0.278	0.173	0.649	2.675	0.0022	22	3.6
C2	4677	6.99						0.0036		

Our results do not change the positions of these stars in the H-R diagram. However, for all four stars, we do not find variability from our observations as can be seen in Table 1. Columns 10 and 11 list the number of observations and spans carried out for each star. Column 9 presents the constancy of the measured light through the V filter, where s denotes the standard error relative to

the magnitude differences C1-star (C1= comparison 1). Similar standard errors were obtained for all the other three uvb filters. For comparison, in Table 1 we also list the standard errors obtained for the check stars (C2) from the same observation periods.

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ACKNOWLEDGMENTS.- This research was supported by the Junta de Andalucía and the Dirección General de Investigación Científica y Técnica (DGICT) under project PB88-0310.

References:

- Bartolini, C., Dapergolas, A. and Piccioni, A. 1981, I.B.V.S. No. 2010
 Breger, M. 1979, P.A.S.P. 91, 5
 Bright Star Catalogue 1982, Yale University Observatory, New Haven
 Eggen, O.J. 1974, I.B.V.S. No. 935
 Frolov, M.S. 1970, I.B.V.S. No. 427
 Gray, R.O. and Garrison, R.F. 1987, Ap.J.S.S. 65, 581
 Gray, R.O. and Garrison, R.F. 1989a, Ap.J.S.S. 69, 301
 Gray, R.O. and Garrison, R.F. 1989b, Ap.J.S.S. 70, 623
 Hauck, B. and Mermilliod, M. 1990, A.Ap.S.S. 86, 107
 López de Coca, P., Rolland, A., Rodríguez, E. and Garrido, R. 1990, A.Ap.S.S. 83, 51
 New Catalogue of Suspected Variable Stars 1982, Nauka, Moscow
 Peniche, R., Peña, J.H. and Hobart, M.A. 1981, P.A.S.P. 93, 735

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

Number 3626

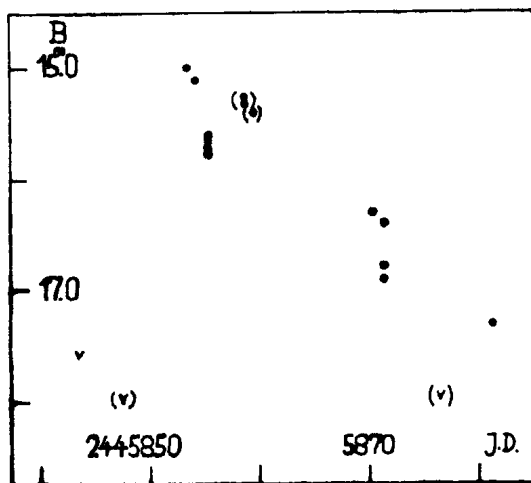
Konkoly Observatory
Budapest
18 June 1991

HU ISSN 0374 - 0676

DV DRACONIS - A LONG-CYCLE DWARF NOVA

DV Dra has been detected as a new cataclysmic variable by Pavlov and Shugarov (1985), who found one outburst on 80 exposures. To the knowledge of the present author no subsequent paper concerning the star has been published since then (see also Bibl. Cat. of Variable Stars, CDS Strasbourg).

As the star is situated in the Sonneberg 50/70/172 cm Schmidt camera field of AM Her, the light-curve of the discovery eruption of June 1984 could be investigated in some detail: The variable had been brighter than about $17^m.3$ for 28 days at least. Its maximum brightness on the plates was $15^m.0$ (1984 June 1.9 UT = J.D. 244 5853.4), its minimum fainter than 21^m (POSS). Secondary fluctuations are indicated. All magnitudes are in the B range of the system of Tapia for AM Her (see Hudec and Meinunger 1977 or Liller 1977).



A search on 144 suitable plates of the 14/70 cm astrograph taken mainly by R. Brandt 1941 to 1969, and by A. Wicklein on 751 additional Schmidt photographs gained in general by W. Götz and K. Heiland in 417 nights of 1982 to 1990 did not reveal any further eruption. On the basis of the shape and the long duration of the outburst, of the scarcity of the eruptions and of the distance to the galactic plane, which would be $z = 0.3 \dots 1.7$ kpc (instead of more than 100 times that value in the case of the object's being a nova), we conclude that DV Dra is a long-cycle dwarf nova perhaps of the WZ Sagittae type.

Figure 1 shows all available observations of the outburst of June 1984. Brackets denote measurements of Pavlov and Shugarov (1985), and arrows indicate "Fainter-than" observations.

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References:

- Hudec, R., Meinunger, L., 1977, Mitt. Veränderl. Sterne 7, 194
 Liller, W., 1977, Sky Telesc. 53, 351
 Pavlov, M.W., Shugarov, S.Yu., 1985, Astron. Tsirk. No. 1373, 8

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

Number 3627

Konkoly Observatory
Budapest
19 June 1991

HU ISSN 0374 - 0676

"QUASIALGOL" BO Cep

The light curve of the rapid irregular variable star BO Cep with Algol-like sharp non-periodic minima was investigated by Hoffmeister (1949), Zajtseva (1971), Wenzel and Bruckner (1978), Kovalchuk and Pugach (1980), Kardopolov and Shutiomova (1980). A satisfactory period could not be found. The spectral type was determined as F2 (Herbig, 1960). A weak emission in H α line ($EW_{\lambda} H_{\alpha} = 4.6 \text{ \AA}$, $v_r H_{\alpha} = -45 \text{ km/s}$) was discovered by Zajtseva and Kolo-tilov (1973).

Our own observations were made in 1987-1990 on mt. Maidanak using the 0.5 m reflector with UBVR-pulse counting photometer and, besides, on October 20, 1988 with the Byurakan 2.6-m reflector with the UAGS spectrograph with 100 \AA/mm dispersion and equipped with an image tube.

The photometric data are given in Table I. They were investigated by a program of Fourier-analysis, dispersion curve analysis and Kurochkin - Jurkevich method. 12 Algol-like weakenings were excluded from the calculations. The light curve folded with the photometric elements $2446364.567 + 10^d.658 \text{ E}$ for 4 years of observations is plotted in Figure 1. Figure 2 shows that both r.m.s. and the average level of the light curve change from year to year. Moreover, minima typical of eclipsing binaries with the amplitude not less than 0.05 V were observed in 1987 and 1990. Algol-like light weakenings with an amplitude of $< 0.5 \text{ V}$ and duration $< 1^d$ occur on an average once per 40 days and are observed near phase 0.0 ± 0.15 . Some Algol-like non-periodic minima are observed very close to phase 0.0. So, minima 2443689.34 and 2443710.31 (Kardopolov, Shutiomova, 1980) indicate $10^d.6558$ period. Algol-like weakenings are comparatively seldom near phase 0.5 ± 0.3 and have lower amplitudes.

The spectrum of BO Cep at 4600-6100 \AA on the scale of intensities is given in Figure 3. The spectrum is an average of 3 spectrograms. In accordance with H β , Fe I, Ca I line intensities the spectral type of BO Cep is F2. The H β line does not show any emission. There is some probability of finding a weak emission in Mg I doublet 5172, 5179 \AA . The Na D line is very wide.

Table I. Photometric data

J.D. 2400000+	n	V _{max}	V _{min}	$\langle V \rangle$	δV	$\langle U-B \rangle$	$\langle B-V \rangle$	$\langle V-R \rangle$
46888 - 47173	67	11.53	11.80	11.588	0.026	-0.04	0.54	0.54
47307 - 47549	137	11.47	11.97	11.582	0.024	-0.03	0.54	0.59
47880 - 47887	109	11.51	11.97	11.615	0.027	-0.03	0.55	0.54
48049 - 48234	110	11.58	11.82	11.618	0.024	-0.05	0.55	0.54

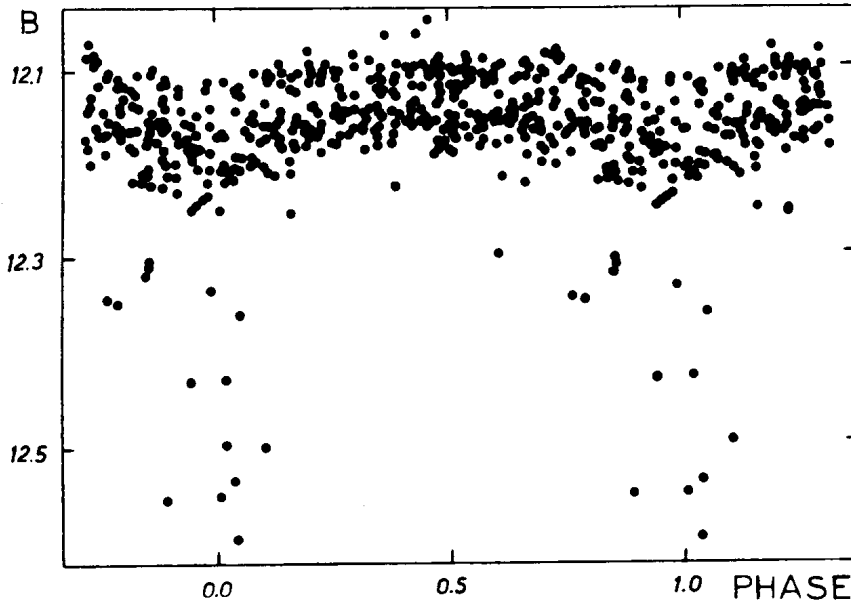


Figure 1. BO Cep summary light curve within 4 years

Wenzel (1977) and Pugach (1981) could ground with sufficient certainty that non-periodic minima occur due to irregular weakenings of the main star by dust fractions. The excess $E_{U-B} = -0.05 \div -0.1$ (Wenzel, Bruckner, 1978) gives some indication that dust is present in BO Cep system.

We suggest that BO Cep is a binary with the orbital plane inclination $i \sim 5^\circ$ and the period of rotation $P = 10.658^d$. The invisible component is surrounded by a nonstable dust shell with radius changing within its Roche lobe. The shell increasing leads to a partial eclipse. The reflection (phase) effect is essential. Sharp non-periodic minima occur when the dust

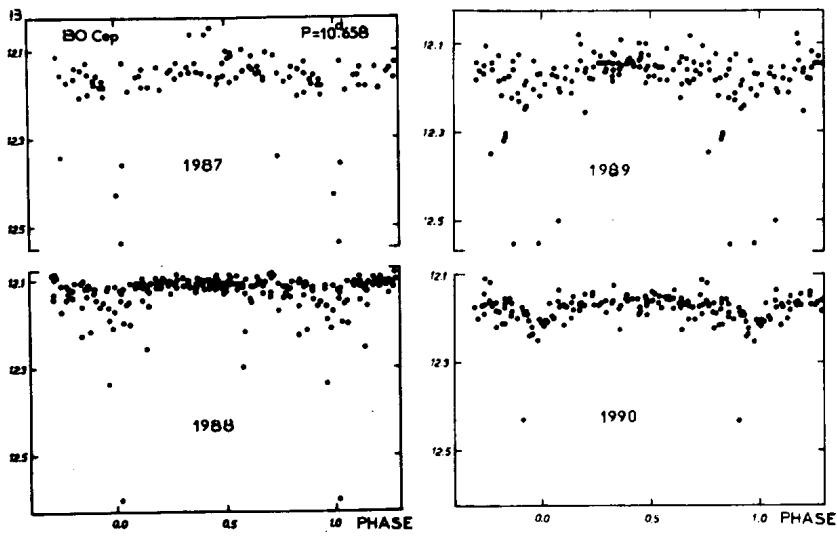


Figure 2. Light curve of BO Cep for each year

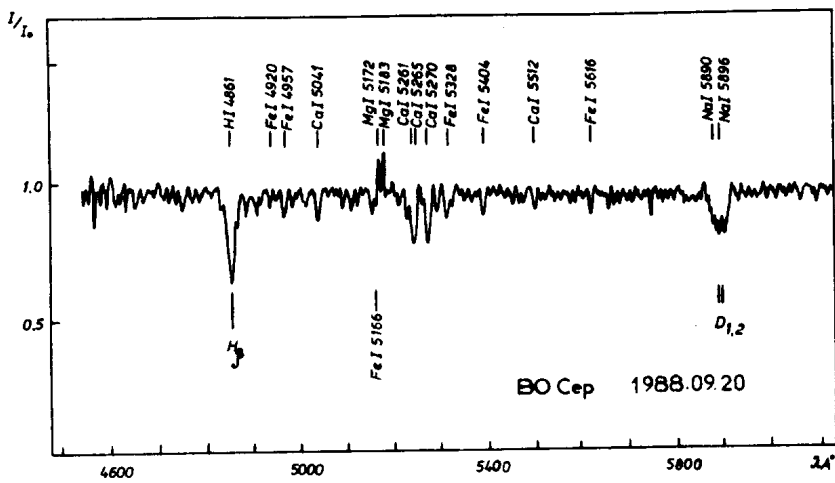


Figure 3. Spectrum of BO Cep at 4600-6100 Å

fragments leave the shell through the inner Lagrangian point, rush to the main star and cause the darkening near its photosphere. A weak variable H_{α} emission can be influenced by the accretion.

RZ Psc shows a similar light curve with $13.^d78$ period. We offer to call such systems "quasialgols".

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References:

- Herbig, G.H.: 1960, Lick Contr. ser II, No.102.
Hoffmeister, C.: 1949, Astron. Nachr., 278, 24.
Kardopolo, V.I., Shutimova, N.A.: 1980, Perem. Zvezdy, 21, 3.
Kovalchuk, G.U., Pugach, A.F.: 1980, Mitt. Veränderl. Sterne, 8.
Pugach, A.F.: 1981, Astrofizika, 17, 87.
Wenzel, W.: 1977, in "Flare Stars", ed. L.V. Mirzoyan, Yerevan, p.105.
Wenzel, W., Bruckner, V.: 1978, Mitt. Veränderl. Sterne, 8, 35.
Zajtseva, G.V.: 1971, Astron. Tsirk., 628, 3.
Zajtseva, G.V., Kolotilov, E.A.: 1973, Astrofizika, 9, 185.

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

Number 3628

Konkoly Observatory
Budapest
19 June 1991

HU ISSN 0374 - 0676

PERIODIC PHENOMENA ON V373 Cep = LkHa 234 LIGHT CURVE

Herbig Ae/Be star V373 Cep = LkHa 234 lies in the compact star forming region MR LkHa 234 associated with NGC 7129, which contains a number of T Tau stars, Herbig Ae/Be variables, Herbig-Haro objects, IR-sources and related objects (Shevchenko, Yakubov, 1989). The spectral type of O8 - A7 was assigned to V373 Cep (Shevchenko, 1989); strong and asymmetrical H α emission is present, $EW_{\lambda} H\alpha = 25 \text{ \AA}$ (Finkenzeller and Mundt, 1984) as well as a few faint emission lines including IR-triplet CaII, OI 8446, Paschen lines (Andrillat and Swings, 1976). V373 Cep is identified with an H $_2$ O-maser, bipolar mass-loss source (Edwards and Snell, 1983). The light curve appears to be close to that of an irregular variable with non-periodic minima (Shevchenko and Yakubov, 1989).

Our own observations of V373 Cep were made in 1983-1990 on mt. Maidanak using 0.5-m reflector with UBVR pulse counting photometer. Three 100 $\text{\AA}/\text{mm}$ spectrograms were obtained using the Byurakan 2.6-m reflector with UAGS-spectrograph equipped with an image tube.

Observational data are listed in Table I. 560 UBVR magnitudes were obtained for 8 years observations. The summary light curve is plotted in Figure 1. Figure 2 shows the annual light curves for 1986-1990. The same data for 1983-1985 can be found in Shevchenko and Yakubov (1989).

The light curves contain waves of different duration. They were studied by means of Fourier-analysis, dispersion curve analysis and Kurochkin - Yurkevich method. Adding the measurements made by Cohen and Kuhl (1979), Racine (1968) and some other authors, the period can be suspected of 7.43 years (2720^d), that is comparable with our own observational epoch. According to Shevchenko (1989) a close period (2200^d) is derived from 120-yrs photographic and photoelectric observations of Herbig Ae/Be star BF Ori.

The light curve of V373 Cep shows 110^d waves, the first epoch being JD 2447043. The cycle of 22 ± 2^d can be also seen in Figure 2, especially in 1987 and 1989. Figure 3 shows the light curve folded with the period of 110^d for 1984-1990.

It appears from the average of three spectra taken on Sep. 20, 1988 in

Table I.

Year :	Epoch	n :	V	:<U-B>:	<B-V>:	<V-R>:	<V-I>
:	JD 2440000+	:	:	:	:	:	:
1983	5505 - 5701	49	12.11 - 12.89	0.14	0.88	0.98	1.65
1984	5868 - 6000	70	11.96 - 12.58	0.15	0.86	0.97	
1985	6263 - 6386	49	12.00 - 12.46	0.18	0.87	1.00	
1986	6617 - 6805	80	11.87 - 12.29	0.15	0.90	1.01	1.64
1987	7020 - 7175	82	11.94 - 12.49	0.16	0.90	1.02	1.68
1988	7307 - 7518	91	12.04 - 12.37	0.15	0.94	1.02	1.65
1989	7688 - 7887	116	12.07 - 12.47	0.22	0.96	1.01	
1990	8049 - 8279	108	12.15 - 13.14	0.16	0.89	1.01	

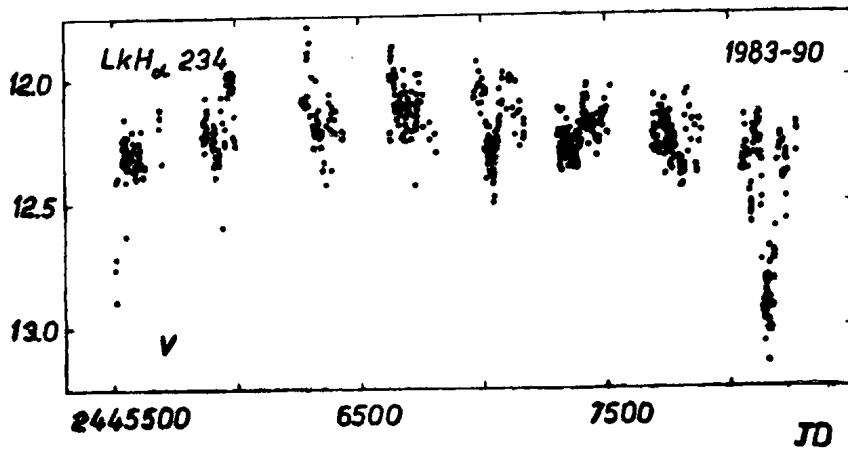


Figure 1

Byravan that IB_0 and EW_{λ} H α for the star is close to those found by Cohen and Kuhl (1979) and Garrison and Andersen (1978). Strong H β , FeII 4556, 4923.9, 5018.4, 5197.6, 5316.7, FeII+MgI 5169, FeII+CrII 5234.6, 5276 emissions are present. The strength of the H γ absorption line corresponds to type B3 that yields good agreement with the two-color diagram. But weak emission in this line can also be suspected. From the emission lines one expects that V373 Cep is between V380 Ori and BF Ori.

We suggest that the periodic phenomena in V373 Cep system are caused by Keplerian rotation in the circumstellar disc accreting on the star. The 110^d

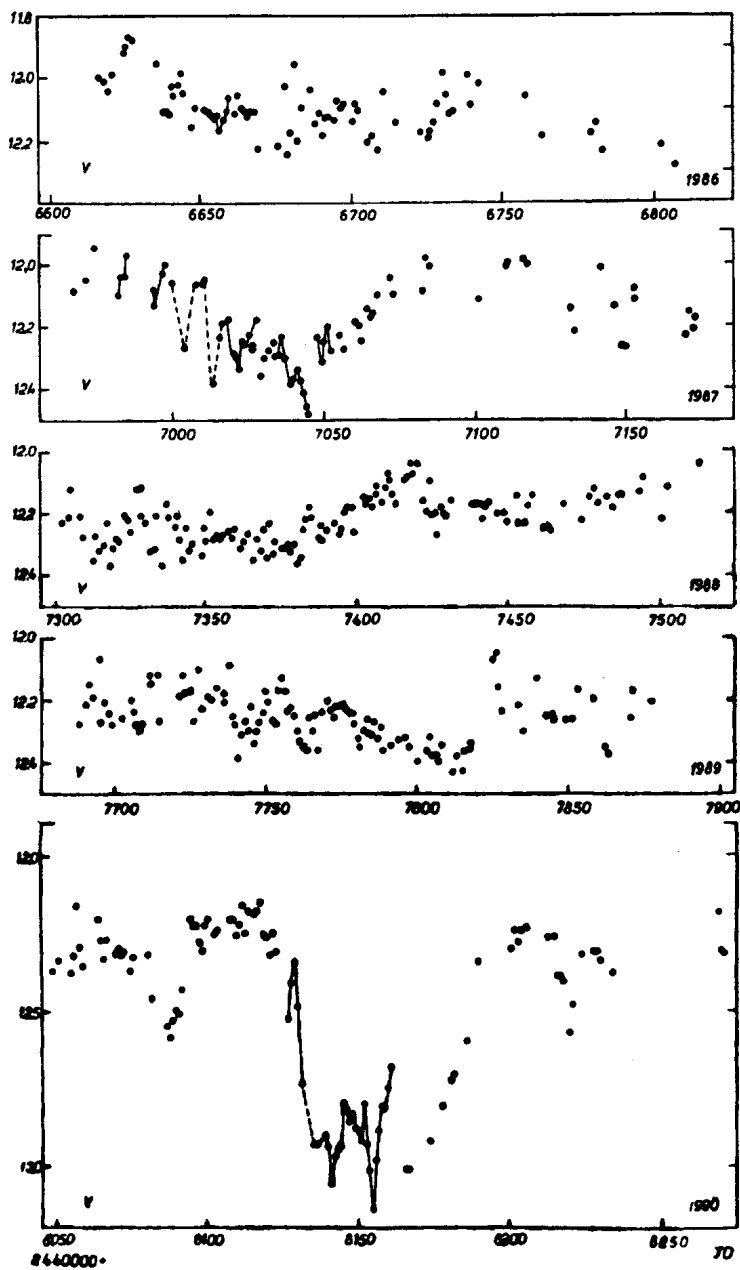


Figure 2

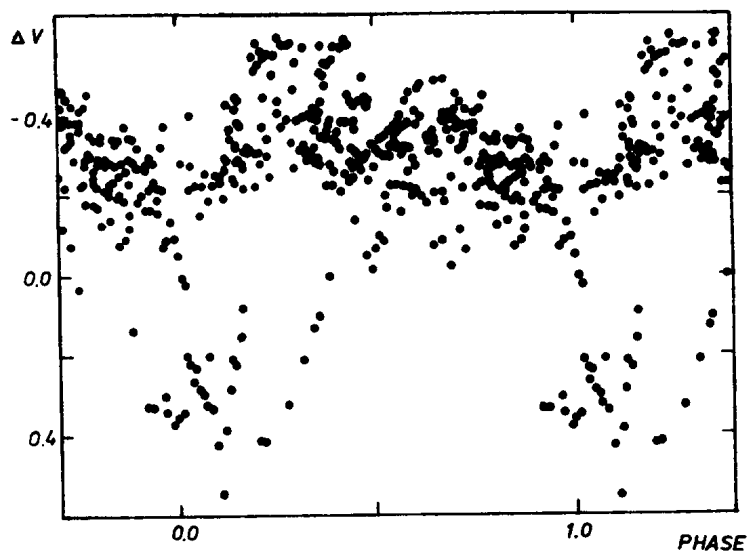


Figure 3

and 2720^d periods seem to appear due to a giant protocomet and related formations moving in the protoplanet disc that leads to opacity changes in the circumstellar envelope.

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References:

- Andrillat, I., Swings, J.P.: 1976, *Astrophys. J.*, 204, L123.
Cohen, M., Kuhl, L.V.: 1979, *Astrophys.J. Suppl. Ser.*, 41, 743.
Edwards, S., Snell, R.L.: 1983, *Astrophys.J.*, 270, 605.
Finkenzeller, U., Mundt, R.: 1984, *Astron. Astrophys. Suppl. Ser.*, 55, 109.
Garrison, L.M., Andersen, C.M., 1978, *Astrophys.J.*, 221, 601.
Racine, R.: 1968, *Astrophys.J.*, 73, 233.
Shevchenko, V.S.: 1989, Herbig Ae/Be stars, Tashkent: "Fan".
Shevchenko, V.S., Yakubov, S.D.: 1989, *Sov. Astr.*, 66, 718.

Number 3629

HU ISSN 0374 - 0676

V1331 Aq1
$$\text{Pri.Min.} = \text{HJD } 2442610.0581 + 1.^d3641953 \cdot E \quad ,$$

+1

Table 1

Normal points of the new UB ν light curve were published by Lorenz et al. (1991).

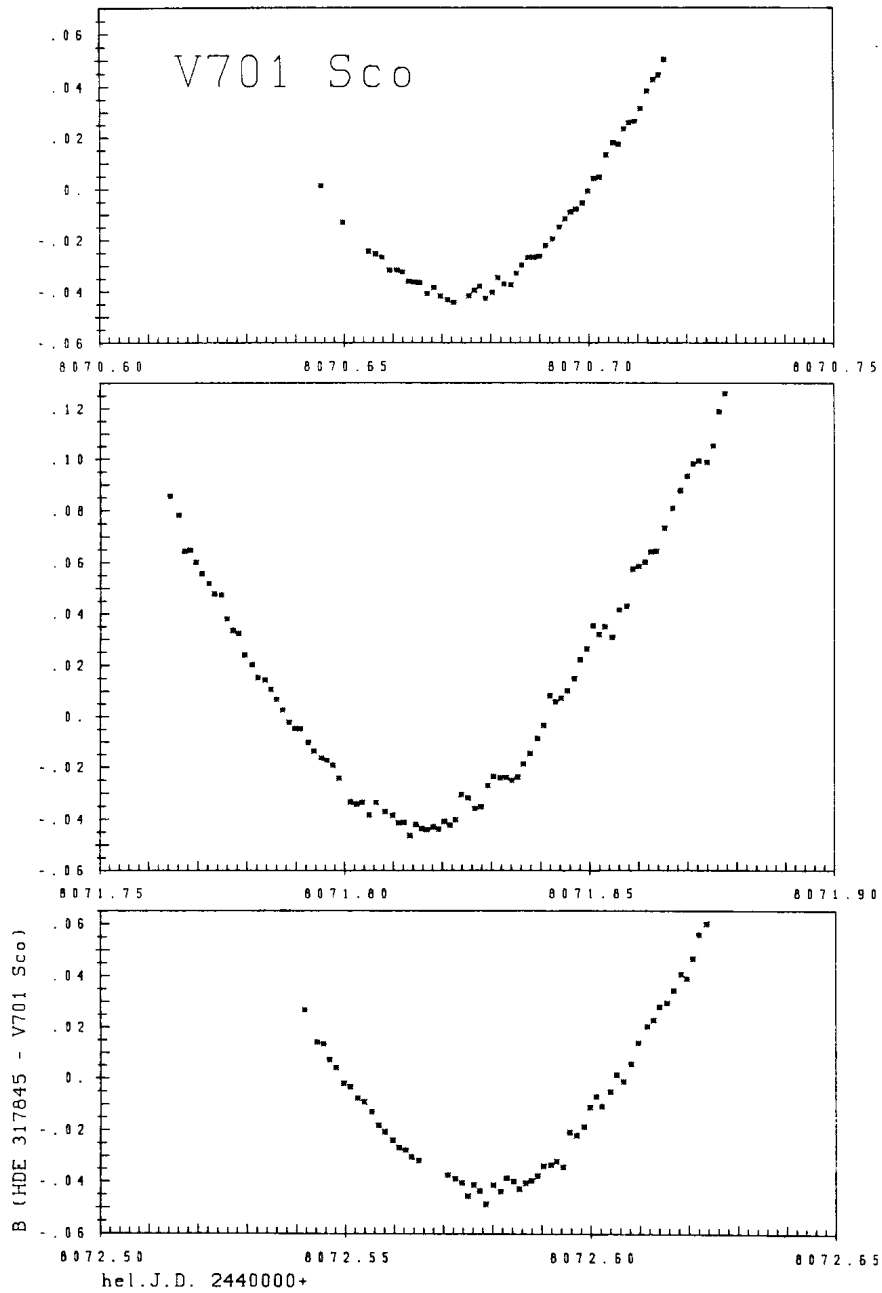


Fig. 1 V701 Sco: measurements of primary (top) and secondary (middle, bottom) minima, obtained in June 1990 at the ESO 50cm telescope

V701 Sco

Recently a photometric and spectrographic study of V701 Sco was published by Bell and Malcolm (1987). This study included also a discussion of the orbital period of the binary, and arrived at the ephemeris

$$\text{Pri.Min.} = \text{HJD } 2446199.5059 + 0.\overset{+3}{\underset{+19}{76187645}}\text{E} ,$$

based on 8 photoelectric times of minima. In Table 2 we give the minimum times obtained in Chile; the measurements are plotted in Figure 1. The comparison star was HDE 317845, the same as used by Bell and Malcolm. The number of epochs and the O-C values correspond to the ephemeris given by these authors. We do not give a new ephemeris, since the O-C values are quite small; they however suggest that the present period has been shorter than 0.761876. The conclusion made by Bell and Malcolm, that the period of V701 Sco has remained nearly constant in the time interval covered by photoelec-

Table 2

HJD 2400000+	Error (day)	Epoch	O - C (day)	Source
48070.6727	0.0002	2456	-0.0016	this paper
48971.8152	0.0002	2457.5	-0.0019	" "
48072.5777	0.0002	2458.5	-0.0013	" "

tric data (which is now about 24 years), is therefore confirmed, in spite of a discordant measurement by Bruton and Chambliss (1985).

MY Ser

No accurate minimum time has yet been published for this star. Among measurements by Davidge and Forbes (1988), there are several nights which cover down- or upward parts of minima, and which can be combined to calculate times of minima. Results for a secondary and a primary minimum are listed in Table 3. There is also given a secondary minimum time calculated from measurements obtained in the UBV system during one night in June 1990. The comparison star was HD 168112.

The formal errors of the minimum times are small, however, asymmetries in the light curves are present and the real errors can be worse. Data in Table 3 suggest that the phase of the secondary minimum is 0.503; according to Davidge and Forbes, MY Ser is a semi-detached system, and in such a case the orbit should be circular. Therefore, we estimate the errors of the min-

imum times as 0.005^d , and the resulting ephemeris is

$$\text{Pri.Min.} = \text{JD } 2446231.612 + 3.32160 \cdot E \quad .$$

+5 +1

Table 3

HJD 24400000+	Error (day)	Epoch	O - C (day)	Source
46230.941	0.002	-0.5	-0.0107	(1)
46232.6125	0.0010	0	0	(1)
48067.7894	0.0008	552.5	-0.0071	this paper

(1) calculated according to data by Davidge and Forbes (1988)

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References:

- Bell, S.A., Malcolm, J.: 1987, Mon. Not. Roy. Astr. Soc., 226, 899.
 Bruton, J.R., Chambliss, C.R.: 1985, IBVS, No.2805.
 Davidge, T.J., Forbes, D.: 1988, Mon. Not. Roy. Astr. Soc., 235, 797.
 Lorenz, R., Drechsel, H., Mayer, P.: 1991, IBVS, No.3599.
 Mayer, P., Wolf, M., Tremko, J., Niarchos, P.G.: 1991, Bull. Astr. Inst.
 Czechosl., 42, No. 4.

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

Number 3630

Konkoly Observatory
Budapest
24 June 1991

HU ISSN 0374 - 0676

1982-1990 UBV OBSERVATIONS OF AM LEONIS

The W UMa system AM Leo is the brighter component of ADS 8024 = Σ 1503. The magnitude difference between the faint and bright components of the visual double was measured at maximum light to be 1.55 mag in the yellow and 1.69 mag in blue light by Eggen (1967). The system was observed photoelectrically without a filter by Worley and Eggen (1956) and Abrami (1959); in B and V filters by Binnendijk (1969); and in 5125 Å, 5170 Å and B filters by Hoffmann and Hopp (1982). Observations by Hoffmann and Hopp form complete light curves in 1977, but incomplete (only 60%) light curves in 1980 and 1981. The spectral type F8 was assigned to the system by Hill et al. (1975), but unfortunately no radial velocity curve was published for this system. Thus the absolute dimension of AM Leo is not known. The light curves of AM Leo are so variable in time that the type of the system sometimes changes from A-type to W-type or vice versa. The system was W-type in 1959 and 1969 observation, but A-type in 1977 observations. It shifted back to W-type in 1980 and 1981 observation.

In order to follow light curve variations we included AM Leo in our observing program in 1982, and have observed it in every observing season since then. The photoelectric observations in U, B and V filters were made with the 30 cm Maksutov telescope at Ankara University Observatory, including the light of the faint visual double star component. Differential observations (4 nights in 1982, and 3 nights each in 1988, 1989 and 1990) were secured by using EMI 6256S photomultiplier in 1982, and EMI 9789QB in the following years. The same comparison star BD+10°2235 as used by Binnendijk (1969) was observed frequently. Differential brightness measurements of the comparison with respect to the check star (BD+10°2233) were found sensibly constant during the observations. The individual magnitude determinations were corrected for differential atmospheric extinction. Thus altogether 51 differential measurements in each filter in 1982, 107 differential measurements in 1988 and 97 differential measurements in 1989 were secured. The

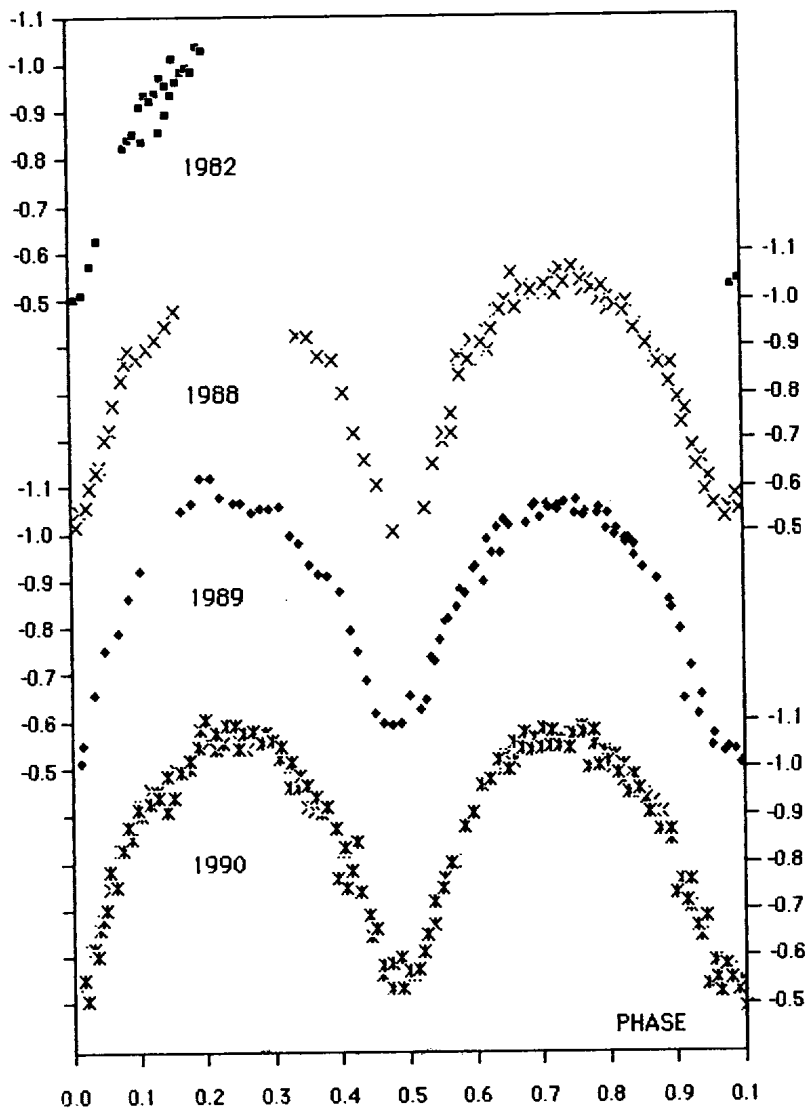


Figure 1. 1982 - 1990 B-light curves of AM Leo

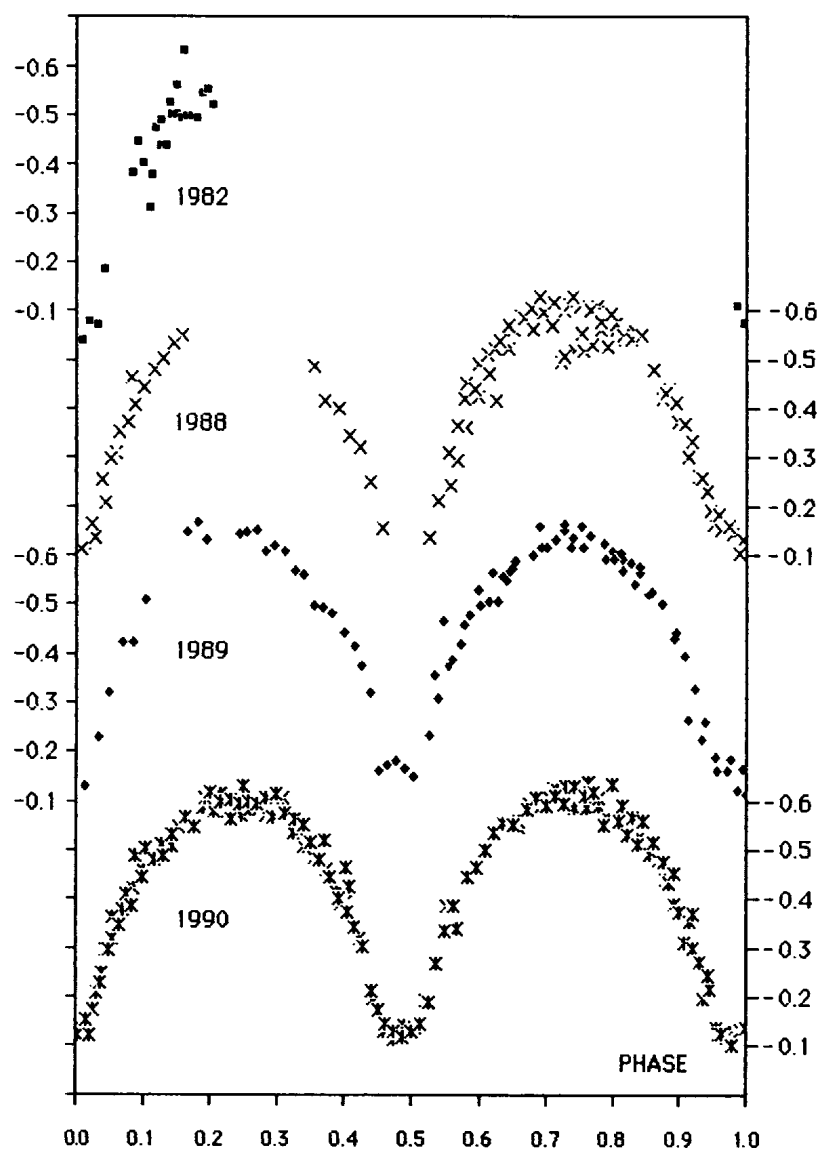


Figure2. 1982 - 1990 V-light curves of AM Leo.

phase of the observations was calculated by using Binnendijk's (1969) light elements

$$\text{MinI} = \text{H.J.D. } 2439936.8337 + 0.36579720 \cdot E$$

and the light curves in V and B passbands are plotted in Figures 1 and 2 for the years 1982, 1988, 1989 and 1990 separately. Although the observing intervals are not long in every observing season, the spread in the observations, particularly in U filter, was found somewhat larger than expected. The 1982 observations cover only 25% of the light curve in the rising branch of the primary maximum. The 20 % of the 1988 light curve is missing in the primary maximum but whole light curves were obtained in the 1989 and 1990 observing seasons. The primary minimum is deeper in 1989 and 1990 while the secondary minimum was deeper (≈ 0.03 mag in B) in 1988 light curves. The primary minimum was found to be total occultation by Binnendijk. Thus the system was W-type in 1969 observations, A-type in 1977 observation, W-type again in 1980 and 1981 observations (cf. Hoffmann and Hopp, 1982). We found that the system was A-type again in 1988. It is still in W-type but we expect it will shift again to A-type probably in 1991 or 1992.

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References:

- Abrami, H.: 1959, Mem. Soc. Ast. Italia, 30, 303.
Binnendijk, L.: 1969, AJ., 74, 1031.
Eggen, O.J.: 1967, Mem. Roy. Ast. Soc., 70, 111.
Hill, G., Hilditch, D.M., Younger, F., Fisher, W.A.: 1975, Mem. Roy. Astr. Soc., 79, 131.
Hoffmann, M., Hopp, U.: 1982, Ap SS, 83, 391.
Worley, C.E., Eggen, O.J.: 1956, PASP, 68, 452.

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

Number 3631

Konkoly Observatory
Budapest
8 July 1991

HU ISSN 0374-0676

U and I band observations of stellar flares

Introduction:

Most photometric observations of stellar flares were obtained with a time resolution of about 10s, allowing for successive measurements in different spectral bands (e.g. UBV). In the case of the observations reported here, we preferentially observed only in one given band in order to obtain well defined light curves and study the flare fine structure. This allowed us to discover two new types of stellar flares of great interest that will be investigated elsewhere (see also Houdebine, 1990).

Observations:

The observations were acquired in March 1990 with the 1m telescope at the European Southern Observatory equipped with its standard photometer. 4 and 2 nights were dedicated to observations respectively in the U and I Johnson's bands. Weather conditions were good to excellent. We give a compendium of the flare observations in Table 1. The second column gives the total duration of the observations for a given star. The sky count level is given in the last column. The flare magnitudes were computed with respect to the stellar quiescent level prior to a given flare. Only one flare was observed in the I band. In the U band the time exposure was 3s and the effective time resolution lies between 4 and 5 seconds due to the data printing time delay. In the I-band, the exposure time was 1s which was almost equal to the effective time resolution.

Other stars were observed on which no flare were detected: CC Eri, Gl 182, Gl 494, Gl 516 AB, Ross 845 and V371 Ori were observed in the U-band respectively for 0.77h (on the 06/03-1991), 0.78h (07/03), 0.7h (04/03) and 1.0h (06/03), 1.25h (05/03) and 1.15h (07/03), 1.5h (06/03), 1.4h (06/03). Similarly, Ross 614, AD Leo, Gl 494, V371 Ori, Wolf 424 AB, YZ CMi were observed in the I-band for respectively 2.3h (08/03), 0.9h (08/03) and 2.9h (09/03), 1.45h (09/03), 1.9h (08/03), 0.9h (08/03) and 2.1h (09/03).

The light curves of the main flares are shown in Figure 1. Note that the ordinate axis only gives the photon count rate. We refer to Table 1 for the sky count level. During the night of the 6 March 1990, Ross 614 exhibited an almost permanent flaring state. The largest flare (in magnitude) was observed on YZ CMi with a 2.87 mag increase. The maximum brightness is reached only 28 seconds after the flare onset. Before this major event, two flare precursors were detected at 09:04:17 and 09:07:36 Sidereal Time.

Wolf 424 AB and Gl 644 AB large flares exhibit secular light curves. The former displays evidence for periodic changes in brightness, and the latter seems a combination of homologous

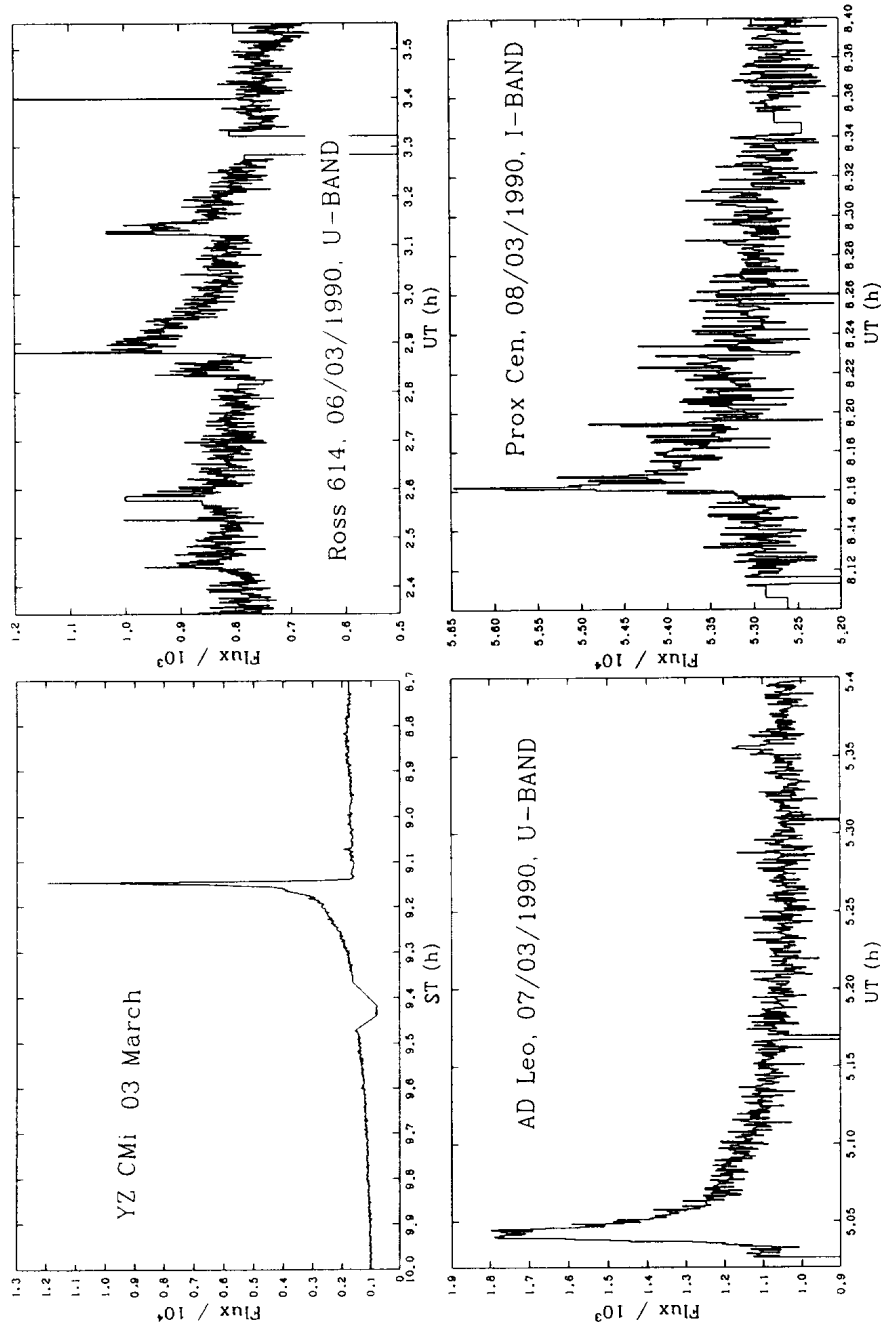


fig. 1: Flare light curves.

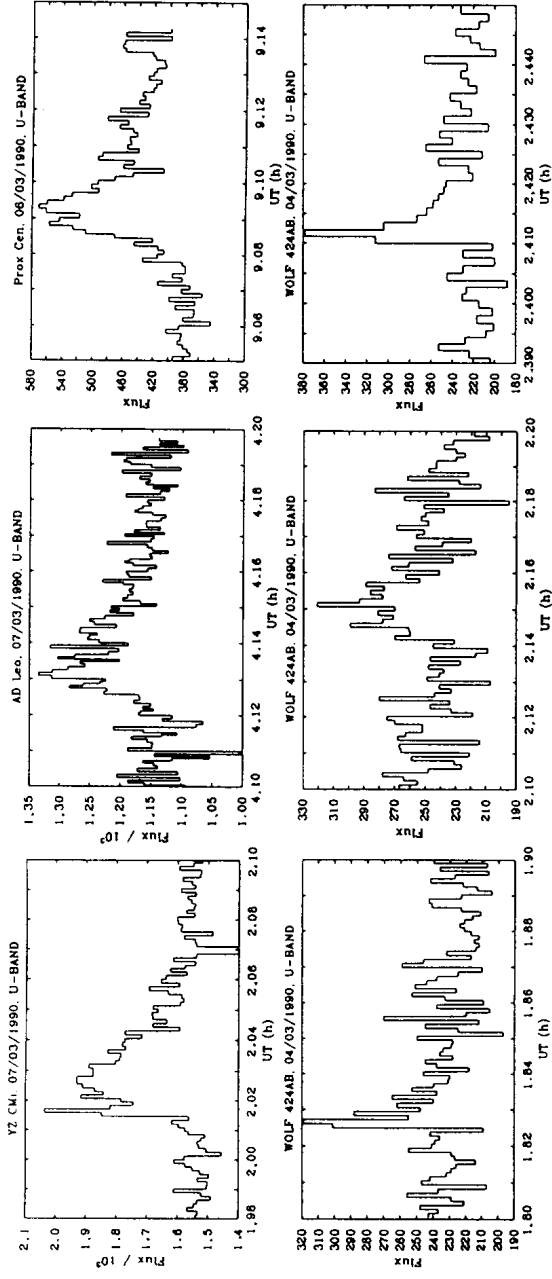


fig. 1 continued:

and sympathetic flares. These flares will be discussed in forthcoming studies (see also Houdebine, 1990).

Table 1: Magnitude, observed duration, and decay time of the flares.

star name	Obs. (h)	Date UT	$t_{1/e}$ (min)	Duration (min)	mag.	UT h : min : s	Band	Sky
AD Leo	3.45	04/03	-	2.3	0.04	23:37:53	U	103
dM4.5e		05/03	2.376	15	1.18	00:36.0*	U	"
		06/03	-	-	-	-	U	268
		07/03	0.95	2.2	0.21	04:07:31	U	252
		"	-	0.9	0.07	04:21:21	U	"
		"	-	1	0.07	04:29:29	U	"
		"	0.552	7	0.66	05:02:06	U	"
		"	-	0.6	0.18	05:21:03	U	"
GL 644AB	2.5	07/03	0.787	60	1.20	07:27:45	U	45
dM3.5e		07/03	0.428	60	1.67	07:39:33	U	"
Prox Cen	1.85	05/03	-	-	-	-	U	130
dM5e	0.8	06/03	0.9	4	0.59	09:04:40	U	122
	2.1	08/03	-	9	0.10	08:07:00	I	340
Ross 614	0.5	05/03	-	-	-	-	U	260
dM4.5e	1.15	06/03	-	2.5	0.27	02:25:59	U	387
		06/03	-	2.2	0.35	02:34:34	U	"
		06/03	-	2.1	0.32	02:49:55	U	"
		06/03	-	9.7	0.60	02:52:40	U	"
		06/03	-	3.7	0.52	03:07:11	U	"
Wolf 424	1.9	04/03	1.43	60	2.50	01:27:47	U	113
dM5.5e		04/03	-	-	1.16	01:49:30	U	"
		04/03	-	-	1.12	02:00:31	U	"
		04/03	-	-	1.03	02:09:05	U	"
		04/03	-	-	1.42	02:24:42	U	"
		04/03	-	-	0.59	02:56:48	U	"
YZ CMi	1.3	04/03	0.94	21.7	2.87	09:08:22**	U	791
dM4.5e		04/03	-	-	0.36	09:04:08**	U	"
	0.9	07/03	2.17	-	0.64	02:00:32	U	1030

* at maximum

** Sidereal Time

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Reference :

HOUEBINE, E.R.: 1990, PhD. Thesis of the Université d'Orsay - Paris XI, France.

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

Number 3632

Konkoly Observatory
Budapest
8 July 1991

HU ISSN 0374 - 0676

HR 2146 A NEW VARIABLE IN AURIGA

Photometric photometry of HR 2146 = SAO 077958 = HD 41429 obtained January 14 to April 13, 1991 in VBRI wavelengths indicates a period of 32.5 days between maxima (Figure 1). 27 Data points in VB taken over 102 days were used in a Data-Compensated-Discrete Fourier Transform program (Belserene, 1986) to determine a period of 32.896 days. Two discernible cycles of maximum light show the period to remain constant while the amplitude fluctuates from 0.112 - 0.064 in V and from 0.088 - 0.069 in B.

The General Catalogue of Variable Stars (Kholopov et al. 1985), the New Catalogue of Suspected Variable Stars (Kholopov et al. 1982) and the 67th, 68th, 69th and 70th Name-List of Variable Stars (Kholopov et al., 1985, 1987, 1989, 1990) do not list HR 2146 as a variable. HR 2146 along with HR 8062 (Snyder, 1990) was selected as a potential variable because the spectrum is similar to those of known variables of mainly small amplitude (Hoffleit, 1979).

HR2146 is listed as 6.08 V, B-V = 1.68, spectral type M3II (Buscombe, 1962) with a dwarf companion F7V, 10.72V at a separation of 10.0" (Hoffleit and Jaschek, 1982). With the luminosity classification of a bright giant HR 2146 is a Small Amplitude Red Variable (SARV) having an amplitude < 0.2 m and $p = 20 - 40$ days (Eggen, 1972a,b, 1973). HR 2146 color variations are $0.12 \pm .01$ in V-R and $0.07 \pm .01$ in V-I which is typical of small amplitude red variables. R-I of 1.6 is redder than the boundary of the classical red variables (R-I ~ 1.0) where light variations tend to be more erratic. Total radiant luminosity, bolometric magnitude = 4.37 and a color temperature of 3200K. Maximum rise is more rapid than minimum decline and amplitudes at longer wavelength are progressively more depressed due to the TiO absorption enhancing the V amplitude more than BR and I (Figure 1).

Observations were made with an Optec SSP-3 photometer using the 0.56m telescope at MacLean Observatory and the 0.25m reflector at Tahoe Observatory. Comparison star = HD 41430, K3III, 7.51 V, B-V = 1.24, and Check star = HD 41398, B2Ib, 7.46 V, B-V = 0.32 (Figure 2). Magnitudes were corrected for extinction and transformed to the standard Johnson BV system.

I acknowledge my gratitude to Gordon MacLean and Sierra Nevada College for the use of the MacLean Observatory and equipment.

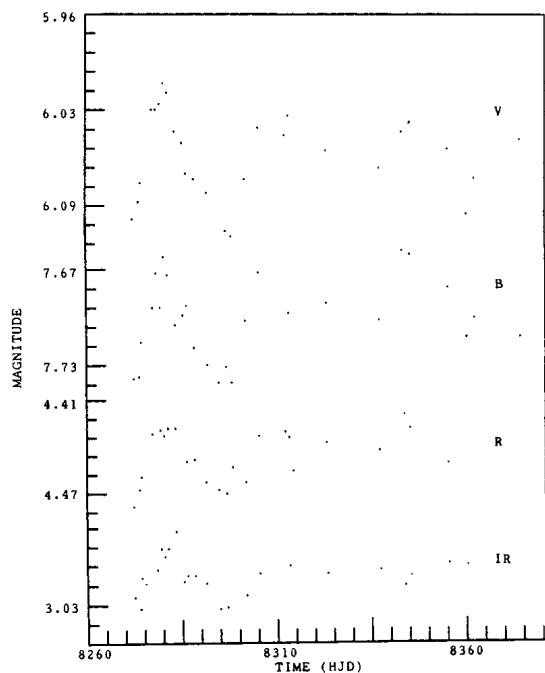


Figure 1. VBRI Color Curves of HR 2146

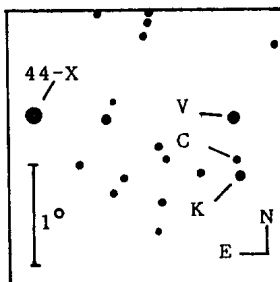


Figure 2.
V- HR 2146
C- Comparison
K- Check

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References:

- Belserene, E.P.: 1986, in the Study of Variable Stars Using Small Telescopes, ed. J.R. Percy (Cambridge University)
- Buscombe: 1962, Mt. Stromlo Mim. No.4.
- Eggen, O.J.: 1972a, *Astrophys.J.*, 174, 45.
- Eggen, O.J.: 1972b, *Astrophys.J.*, 177, 489.
- Eggen, O.J.: 1973, *Astrophys.J.*, 184, 793.
- Hoffleit, D.: 1979, *Journ.Amer.Assoc.Var. Star Obs.*, 8, No.1,17.
- Hoffleit, D., Jaschek, C.: 1982, *The Bright Star Catalogue* 4th edition, Yale Univ. Observatory, New Haven, CT.
- Kholopov, P.N. et al.: 1982, *New Catalogue of Suspected Variable Stars*, Moscow (Publ. Office Nauka).
- Kholopov, P.N. et al.: 1985, *General Catalogue of Variable Stars*, 4th edition, Moscow.
- Kholopov, P.N. et al.: 1985, *IBVS*, No.2681.
- Kholopov, P.N. et al.: 1987, *IBVS*, No.3058.
- Kholopov, P.N. et al.: 1989, *IBVS*, No.3323.
- Kholopov, P.N. et al.: 1990, *IBVS*, No.3530.
- Snyder, L.F.: 1990, *IBVS*, No.3445.

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

Number 3633

Konkoly Observatory
Budapest
8 July 1991

HU ISSN 0374 - 0676

PHOTOMETRY OF THE CHROMOSPHERICALLY ACTIVE BINARY HD 197010

For the past several years we have been conducting a study of the spectroscopic and photometric characteristics of a sample of X-ray emitting stars from the Einstein Observatory Medium Sensitivity Survey identified as probable binary systems by Fleming (1988) and Fleming, et al. (1989). One of these stars, HD 197010 (= 1E2038.3-0046 = SAO 144692 = BD -1° 4025) was discovered to be a short period eclipsing binary by Robb, et al. (1990). The ephemeris he presented was based on observations in 1989 and 1990, but only the 1990 observations included points at eclipse minimum. We report here on first results of almost a year of observations at Gettysburg College Observatory and the National Undergraduate Research Observatory, permitting a new determination of the photometric ephemeris of HD 197010.

We began observing HD 197010 prior to the publication of Robb's discovery notice. Observations revealing its variability were made using the 0.4 meter reflector of the Gettysburg College Observatory (GCO) on September 17, 1990. The GCO telescope is equipped with a computer-controlled UBVRI filter photometer which we have described elsewhere (Marschall, et al, 1990; Marschall and Gauthier, 1991). Though there was clear evidence of variability, the night was not of photometric quality. Further observations were made on the next good night, September 23, 1990, which was, fortuitously, a night of primary minimum. Subsequent follow-up observations were made on 8 nights in October 1990, and 5 nights in May and June, 1991 using the 0.8m telescope on Anderson Mesa, Flagstaff Arizona, operated by the National Undergraduate Research Observatory (NURO) and owned by Lowell Observatory. Observations at GCO were made in B and V, and observations at NURO were made in BVR and I. In all cases, observations of the variable star were bracketed by observations of a comparison star SAO 144729 with frequent observations of a check star, SAO 144655 to insure the constancy of the comparison star and the internal consistency of the measurements. Typical rms fluctuations in the B value of check minus comparison were less than 0.01 magnitudes at NURO and 0.02 magnitudes at GCO.

We observed two primary minima of HD 197010 in fall 1990, and a primary and a secondary minimum in spring, 1991. Times of minima were calculated from the B data only; we noted, as did Robb, no significant differences between the times of minimum in different colors. Two methods were used to compute times of minimum light. The first, which was the preferred method when we had nearly complete observations of the entire eclipse, was to compute the bisectors of the wings of the light curve, along the lines of the technique of Kwee and van Woerden (1956). Some caution was necessary because of the asymmetrical form of the light curve out of eclipse. The second method, used when we had only sparse data near eclipse minimum (this was the case only for the primary eclipse observed at GCO on JD 2448158) was to fit a polynomial to the data, differentiating the results to find the time of minimum. The results for 4 minima are shown in Table 1.

We determined a photometric ephemeris by fitting a least-squares line to the data in Table 1. The data for secondary minimum was included, since it appears to occur precisely at phase 0.5. Excluding it from our analysis produced a slight (.000007 d) decrease in the period, but the resulting phased light curve appeared to match the wings of primary slightly less accurately than when the secondary minimum was included.

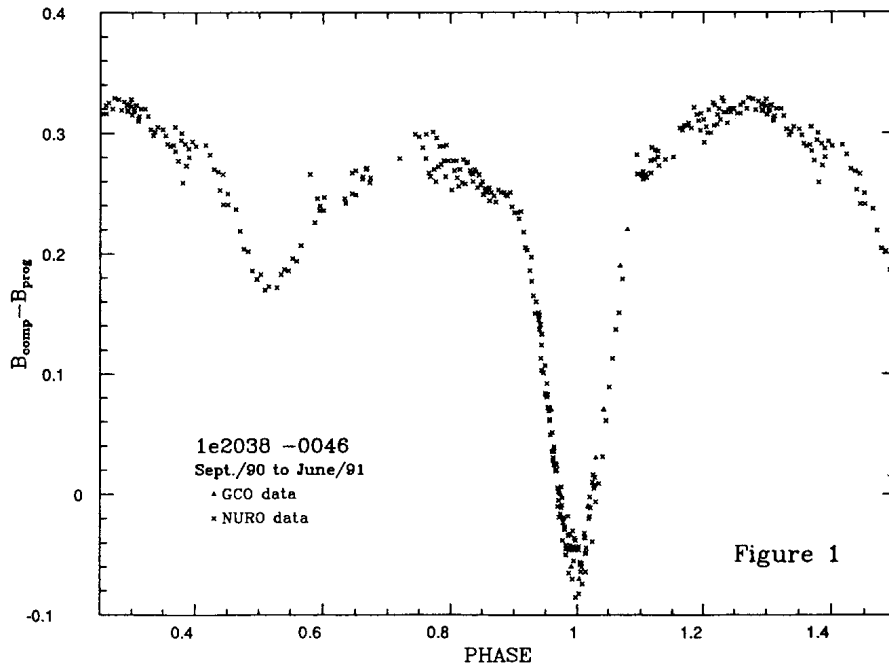


Figure 1

TABLE 1

<u>ID</u>	<u>HJD OF MIN (d.)</u>	<u>ERROR</u>	
Fall GCO	2448158.6048	0.0045	Primary
Fall NURO	2448182.73193	0.00055	Primary
Spring NURO 1	2448402.89996	0.00069	Primary
Spring NURO 2	2448423.86664	0.00189	Secondary

The new ephemeris is:

$$\text{HJD of Primary Minimum} = 2448282.88468 + 0.7101623 \text{ d.} \\ \pm 0.00042 \quad \pm 0.000027$$

This is consistent with the epoch of primary minimum given by Robb (1990), though the period is somewhat shorter. The ephemeris fits our data very well, as shown in the light curve plotted in figure 1. Instrumental magnitude differences between the comparison and program star are shown, since the extinction correction is small. We note a slight difference in the depth of primary minimum between the fall and spring data and some scatter in the out-of-eclipse levels. Some of this may be due to star-spots, which seems plausible given the noticeable asymmetry of the curve. We intend to observe the star intensively during the upcoming observing seasons to refine the photometry and to determine the extent of spot modulation.

We acknowledge the help of Mike Hayden at Gettysburg College Observatory, and Mike Divittorio at NURO, who made some of the observations included here. This work was supported in part by a Small Research Grant from the American Astronomical Society and by a grant from Gettysburg College.

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REFERENCES

- Fleming, T.A. 1988, Unpublished Ph.D Thesis, University of Arizona.
 Fleming, T.A., Gioia, I.M, and Maccacaro, T. 1989, *A.J.*, **98**, 692.
 Kwee, K. K., and Van Woerden, H. 1956, *Bull. Astr. Inst. Neth.*, **12**, 327.
 Marschall, L.A., Karshner, G.B., Gauthier, C.P., and Hayden, M. 1990, *Bull. Am. Astr. Soc.*, **22**, 1238.
 Marschall, L. and Gauthier 1991, *Bull. Am. Astr. Soc.*, **23**, 874.
 Robb, R.M, Dean, F.W., and Scarfe, C.D., 1990, *IBVS*, **3536**.

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

Number 3634

Konkoly Observatory
Budapest
9 July 1991
HU ISSN 0374 - 0676

Coordinated Multi-site Photometry of Southern Rapidly Oscillating Ap Stars

I: The 1992 Campaign on HD 84041 - a call for collaborators.

Asteroseismology is a powerful tool which allows the interior structure and dynamics of stars to be examined in a way analogous to studying the seismology of the Earth. The rapidly oscillating Ap (roAp) stars, being main sequence stars, are excellent subjects for asteroseismological studies. These stars are the only main sequence stars, other than the sun, for which there is indisputable evidence of high-overtone p -mode acoustic oscillations. The peak-to-peak Johnson B oscillation amplitudes are all less than 16 mmag and the oscillation periods range from 4-16 min. Recent reviews are given by Kurtz (1990) and Matthews (1991).

In May of 1990, we started the *Cape Rapidly Oscillating Ap Star Survey*, a systematic study of the roAp phenomenon in the southern hemisphere. The survey has already led to the discovery of 8 new roAp stars (Martinez *et al.* 1990a,b,c,d, 1991a,b,c). This compares favourably with the 14 discovered in the previous 12 years by all roAp star observers. At present, we have only limited frequency analyses of these stars and much further observational work is required. The study of these stars is observationally intense; we need as many collaborators as we can get.

The oscillations in the roAp stars are usually studied using high-speed photometry through a Johnson B filter. The basic goal of such time-series photometry is to extract from the light curve of the star the component frequencies of the oscillations. A coherent oscillation gives rise to a peak in the Fourier transform whose height is proportional to the amplitude of the oscillation. The width (resolution) of such a peak goes roughly as the inverse of the length of the light curve. It is possible to improve the resolution by combining data from successive nights, but then the day-time gaps in the data give rise to ambiguous peaks, or *aliases*, in the amplitude spectrum. Aliasing arises because of cycle count ambiguities when the data are interrupted periodically, as is the case when observations are acquired over several nights from a single site. Since the alias peaks confuse the analysis, the only way to reduce the aliasing problem is to minimize the day-time interruptions in the light curve, hence the need for contemporaneous multi-site observations.

Another reason for acquiring contemporaneous multi-site observations of roAp stars is that the oscillation spectra are not stable in many roAp stars. There is evidence of transient oscillation modes with growth/decay times of the order a day. There is also a possibility of phase-jitter in at least one well-studied roAp star. If we are to follow the temporal behaviour of a changing amplitude spectrum, continuous monitoring of the star is required.

We are planning several multi-site campaigns on the new roAp stars and the purpose of this Bulletin is to call for collaborators to join one or more of these campaigns. In the past, such campaigns have resulted in significant advances in our understanding of these pulsating stars. An example is the 1986 campaign on HR1217 (Kurtz *et al.* 1989).

It is important to appreciate that the detection and study of roAp star pulsations demands the most precise ground-based high-speed photometric measurements possible. Although most roAp stars are so bright that photon statistics are not the major source of noise, the amplitudes of oscillation are very low - less than 1 mmag in many cases. In order to produce useable roAp photometry, it is imperative that observers overcome some common sources of error such as the use of small apertures, careless guiding, sensitivity variations across the aperture, dirty filter or photocathode surfaces, fogged Fabry lenses, damp photomultiplier tube bases, vignetting, spurious periodicities introduced by telescope drive oscillations, erratic excursions of the star in the aperture in a telescope that is too finely balanced, misalignments in the photometer, electronic malfunctions such as drifting or fluctuating HT supply, inadequately shielded photomultiplier tubes, cold boxes that do not regulate the temperature well enough and inaccurate time in the dome.

Readers desiring an example of the kind of photometry required should consult the references listed below. Briefly, we require the noise in the amplitude spectrum above 0.6 mHz to be ≤ 0.4 mmag for a two-hour run at low airmasses on a 1-m telescope. If the noise for frequencies higher than 1.0 mHz is above 0.5 mmag, we regard the night to be marginally photometric and often reject such data from further analysis. Since the scintillation noise scales inversely to the mirror diameter, smaller telescopes will produce data with higher scintillation noise. However, such data will still be highly useful. We routinely obtain data of sufficient quality with our single-channel University of Cape Town photometer attached to the 0.75-m or 1.0-m telescope at the Sutherland site of the South African Astronomical Observatory.

All of the new roAp stars are south of $\delta = -17^\circ$, so prospective collaborators should preferably have access to good photometric sites in the southern hemisphere.

Proposed campaign on HD 84041 in February 1992

Our first campaign will focus on the roAp star HD 84041 which pulsates with a 14.62-min period and an amplitude as high as 3 mmag on some nights (Martinez & Kurtz, 1991b). The pulsation amplitude is modulated on a night-to-night basis and perhaps on even shorter time-scales. One of the aims of the campaign is to study this amplitude modulation in detail.

The campaign will be centered on a core two-week period from 11 Feb to 24 Feb 1992. Collaborators should ideally obtain telescope time during this core period, but several consecutive nights' worth of observations acquired within a 30-day time-span on either side of the core period will still be extremely valuable. We have successfully studied this star with an 0.5-m telescope, but observations using 0.75-m or 1.0-m telescopes are preferable because of the lower scintillation noise.

We envisage making heavy use of electronic mail networks to expedite the transfer and analysis of the data. In this way, we also hope to keep contributors informed of the progress of the campaign even while it is in progress. This should allow us a capacity, albeit limited, to identify and remedy problems arising in the observations. Interested readers are urged to contact us as soon as possible to facilitate the coordination of observing efforts and so that reliable E-mail links can be established. The early establishment of such links will be necessary to develop and test software to cope with the various participants' inevitably different data recording formats.

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References

- Kurtz, D.W., Matthews, J.M., Martinez, P., Seemann, J., Cropper, M., Clemens, J.C., Kreidl, T.J., Sterken, C., Schneider, H., Weiss, W.W., Kawaler, S.D., Kepler, S.O., van der Peet, A., Sullivan, D.J. & Wood, H.J., 1989. *Mon. Not. R. astr. Soc.*, **240**, 881.
- Kurtz, D.W., 1990. *Annual Reviews Astron. Astrophys.* **28**, 607.
- Martinez, P. & Kurtz, D.W., 1990a. Two new southern rapidly oscillating Ap stars - HD 193756 & HD 218495. *Inf. Bull. Var. Stars*, 3509.
- Martinez, P. & Kurtz, D.W., 1990b. HD 190290 - Asteroseismology in one night. *Inf. Bull. Var. Stars*, 3510.
- Martinez, P., Kurtz, D.W., Kauffmann, G. & Jonson, A.C., 1990c. HD 196470 - A new equatorial rapidly oscillating Ap star. *Inf. Bull. Var. Stars*, 3506.
- Martinez, P., Kurtz, D.W. & Kauffmann, G., 1990d. The discovery of rapid oscillations in the Ap star HD 161459. *Inf. Bull. Var. Stars*, 3507.
- Martinez, P. & Kurtz, D.W., 1991a. The discovery of rapid oscillations in HD 19918. *Inf. Bull. Var. Stars*, 3553.
- Martinez, P., 1991b. Discovery of rapid oscillations in the Ap star HD 84041. *Inf. Bull. Var. Stars*, submitted.
- Martinez, P. & Kurtz, D.W., 1991c. The discovery of rapid oscillations in the Ap star HD 119027. *Inf. Bull. Var. Stars*, submitted.
- Matthews, J.M., 1991. *Pubs. Astr. Soc. Pacific*, **103**, 5.

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3635

Konkoly Observatory
Budapest
9 July 1991
HU ISSN 0374 - 0676

**An improved, unambiguous period of the
Ap star 108 Aqr**

The star 108 Aqr = HR 9031 = HD 223640, classified B9pSiSrCr by Cowley et al. 1969, has been observed in the Geneva photometric system between 1986 and 1988 at ESO La Silla with the 70 cm Swiss telescope.

The period (3.73 ± 0.03 days) published by Morrison & Wolff 1971, was not satisfactory because it was based on uvby measurements taken only once a night, so that the alias frequency $1 - \nu$ (i.e. $P = 1.37$ days) was not excluded at all. Our 64 Geneva observations allow to exclude clearly the alias period ($P = 1.37$ days), and our V data combined with the 36 y data of Morrison & Wolff 1971, yield the period

$$P = 3.735236^d \pm 0.000024$$

while the maximum light in the V band occurs on $HJD = 2444655.047$. The resulting lightcurve is shown in Fig. 1, together with the fitted curve (a Fourier series truncated to the first harmonic). The r.m.s. residual scatter of all 100 V and y data together around the fitted curve is only 0.0042 magnitudes.

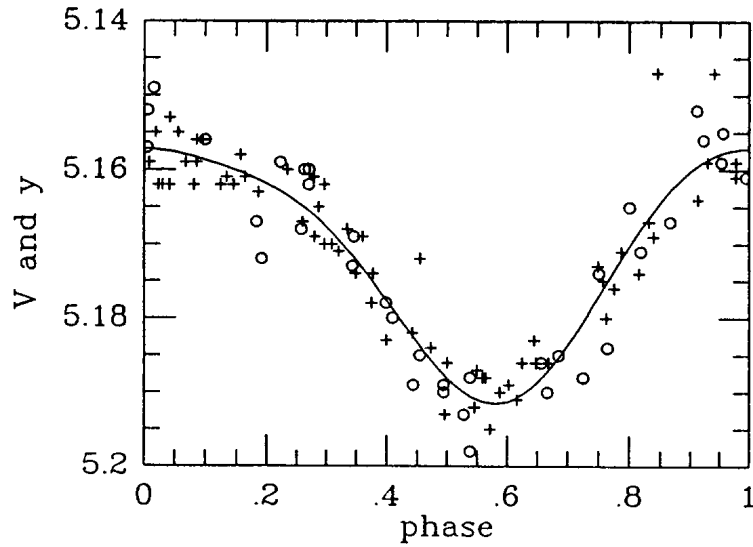


Figure 1: Lightcurve of 108 Aqr in the Geneva V band (crosses) and in Ström-gren's y band (open dots). See the ephemeris in the text.

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References

- Cowley A., Cowley C., Jasehek M., Jasehek C., 1969, *AJ.* **74**, 375
 Morrison N.D., Wolff S.C., 1971, *PASP* **83**, 474

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

Number 3636

Konkoly Observatory
Budapest
12 July 1991

HU ISSN 0374 - 0676

1988 AND 1989 BV PHOTOMETRY OF ER Vul

ER Vul (= #144 in the catalog of Strassmeier *et al.* 1988) is a member of the short-period, eclipsing RS CVn group. To more completely understand the nature of magnetic activity cycles in these stars, we have included ER Vul in our long-term monitoring program. We note that, despite its brightness and rapidly changing light curve, ER Vul has not often been observed. We report here our 1988 and 1989 BV observations.

We observed ER Vul on the nights of 3, 4, 6, 7, 8 August 1988, 29, 30 June 1989, and 1, 2, 4, 8 July 1989 on the San Diego State University 61-cm telescope on Mt. Laguna, California. We used the photometer and techniques previously described by Heckert and Zeilik (1990). Our comparison and check stars were HD 200270 and HD 200425. Our reported data, plotted in Figures 1-4, are differential magnitudes (star-comparison) in the instrumental B and V band systems. These magnitudes are sufficient to model the geometrical starspot parameters; so we did not transform them to the Johnson UBV system.

We used the technique of Budding and Zeilik (1987) to fit the starspot parameters to the distortion wave. The initial binary model fits for unspotted stars for the V band and B band used temperatures of 5900 K and 5750 K from Hill *et al.* (1990).

From these fits we extract a distortion wave and calculate solutions for a circular spot at a temperature of 0 K. For 1988 and 1989 in the B and V bands we get, in degrees,:

	1988	1988	1989	1989
	V band	B band	V band	B band
Longitude	99.5 ± 3.5	94.9 ± 4.6	281.6 ± 4.6	279.6 ± 3.9
Latitude	73.8 ± 1.1	69.2 ± 6.2	68.1 ± 6.1	74.5 ± 4.3
Radius	19.4 ± 0.3	19.9 ± 3.3	13.4 ± 1.9	17.0 ± 2.6

The B and V band results for each year agree to within the errors. Between 1988 and

Figure 1
ER Vul: Laguna 1988
V-Band Instrumental Magnitudes

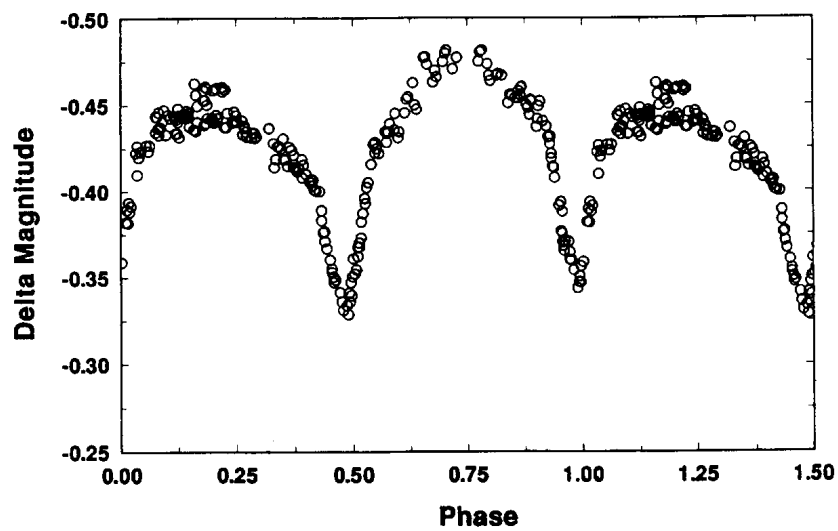


Figure 2
ER Vul: Laguna 1989
V-Band Instrumental Magnitudes

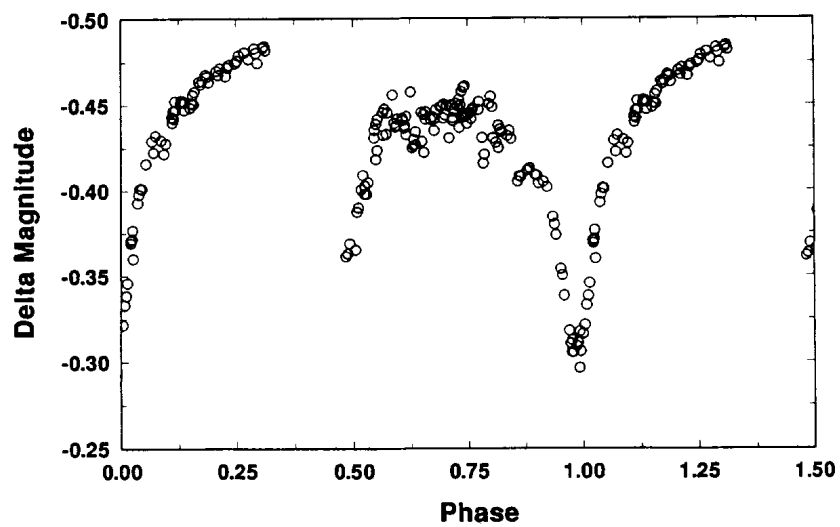


Figure 3
ER Vul: Laguna 1988
B-Band Instrumental Magnitudes

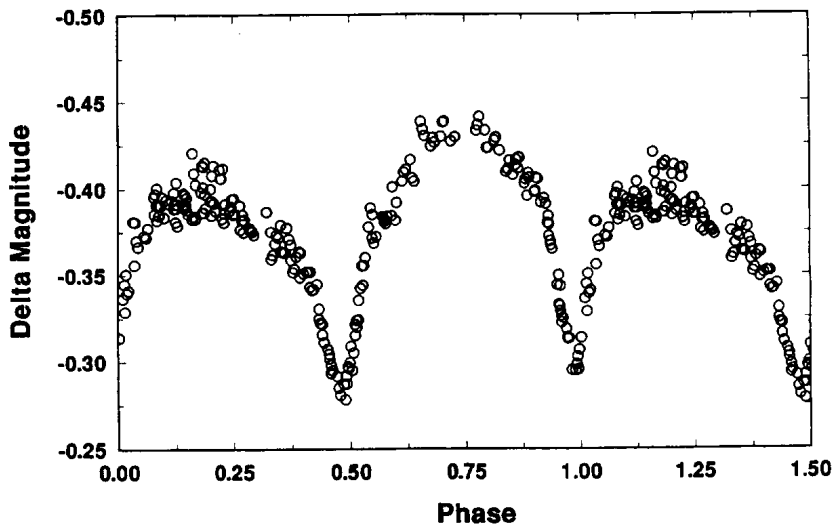
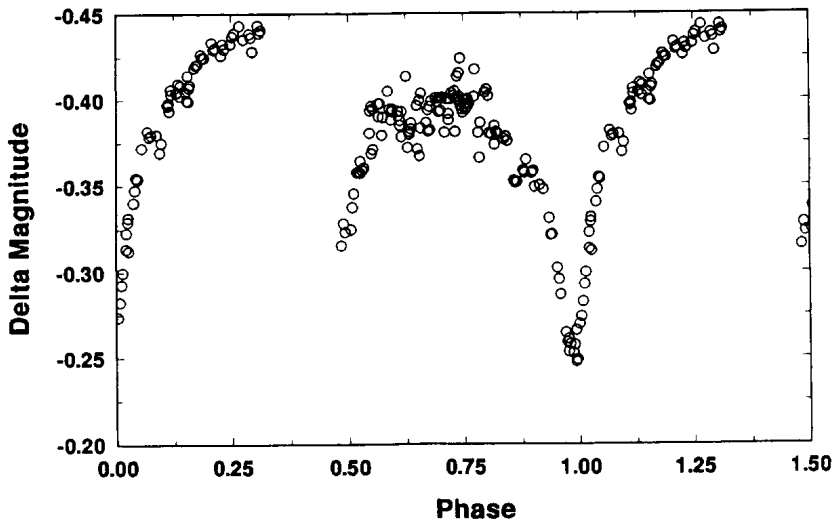


Figure 4
ER Vul: Laguna 1989
B-Band Instrumental Magnitudes



1989 the active region switched some 180° in longitude: for both years the active region was near one of the active longitude belts: $\sim 90^\circ$ in 1988 and $\sim 270^\circ$ in 1989. During the same time the latitude of the active region and the total spotted area remained roughly constant. For a comparison, Budding and Zeilik (1987), modeling 1982 data, found a longitude of roughly 101° , and a spot radius of roughly 9° . The 1988 and 1989 active regions have a slightly larger area and are at a higher latitude than the 1982 active regions.

A 180° longitudinal switch between the active regions during a year is not surprising. We envision that a large spot group has rapidly faded from one active longitude belt while another group developed in the other ALB. We also note that the spotted regions appear at high latitudes, in the range from 60° to 70° . These values are well determined in part because of the high quality of the data and in part because of the system's inclination (72°) is away from 90° .

We thank Ronald Angione for scheduling observing time at Mt. Laguna for this project. PAH received support from Western Carolina University in the form of a Faculty Development Grant and supplemental funds. This work was supported in part by NSF grant AST-8903174 to MZ.

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References:

Budding, E. and Zeilik, M., 1987, Astrophys. J., 319, 827.

Heckert, P.A. and Zeilik, M., 1990, IBVS, No. 3416.

Hill, G., Fisher, W.A., and Holmgren, D., 1990, Astron. Astrophys., 238, 145.

Strassmeier, K., Hall, D.G., Zeilik, M., Nelson, E., Eker, Z., and Fekel, F., 1988, Astron. Astrophys. Suppl. Series, 72, 291.

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

Number 3637

Konkoly Observatory
 Budapest
 16 July 1991
 HU ISSN 0374 - 0676

CCD LIGHT CURVES OF V865 CYGNI

Wachmann (1961) discovered the thirteenth magnitude W UMa variable, V865 Cygni (HBV 235) as a result of his photographic search for variables in the Cygnus star cloud. Thirty-two epochs of minimum of light and a finder chart are included in his paper. Since his observations, V865 Cyg has been neglected.

The present observations of V865 Cyg were made from 16-19 June, 1990, inclusive. The RCA CCD camera system attached to the 1.07 m F/16 Hall reflector telescope was used at Lowell Observatory, Flagstaff, Arizona. The CCD local system approximated the standard Johnson-Cousins VR_cI_c photometric system and observations were transformed to determine R-I standard magnitudes. The chip was cooled with liquid Nitrogen throughout the observing interval to -130°C . Approximate coordinates of the check, comparison and the variable star are given in Table 1. Neither the check nor the comparison star are known to have a catalog identification. About 80 images in V and R and 65 in I were obtained with integration times ranging from one to five minutes. Our observations failed to cover phases 0.6 to 0.85, inclusive, but they suffice to reveal important characteristics of the system.

TABLE 1

Star	R. A. (1990.5)	Dec. (1990.5)
V865 Cygni	$19^{\text{h}} 27^{\text{m}} 02.8^{\text{s}}$	$33^{\circ} 01' 58''$
Comparison	$19^{\text{h}} 27^{\text{m}} 06.2^{\text{s}}$	$33^{\circ} 02' 46''$
Check	$19^{\text{h}} 27^{\text{m}} 06.3^{\text{s}}$	$33^{\circ} 01' 08''$

Four mean epochs of minimum light were determined from the observations made during two primary and two secondary eclipses. The tracing paper method was used to determine the epochs of minimum

light in V, R and I on the first two nights. The bisection of chords technique was utilized to determine the primary epoch in V, R and I and the secondary epoch in V on the last night. An iterative technique based on the Hertzsprung method (1928) was used to determine the remaining epochs. The mean times of minimum light are given in Table 2. These epochs along with those by Wachmann (1961) were introduced into a least squares solution to obtain both a linear and a quadratic ephemeris. Our linear solution included only recent epochs from JD 2436000 on. The quadratic solution included all epochs except for three by Wachmann which were discordant. The improved ephemerides are:

$$\text{JD Hel Min. I} = 2448060.8912(15) + 0.36530170(9)d \cdot E \text{ and,}$$

$$\text{JD Hel Min. I} = 2448060.8912(9) + 0.3653026(2) \cdot E - 5.4(1.2) \times 10^{-11}d \cdot E^2$$

TABLE 2

JD HEL. 2400000+	Minimum	Cycles	(O-C) ₁	(O-C) ₂
48060.8921	I	0.0	0.0009	0.0009
48061.8061	II	2.5	0.0016	0.0016
48062.7158	I	5.0	-0.0020	-0.0020
48062.8998	II	5.5	-0.0006	-0.0006

The linear ephemeris was used to calculate the (O-C)₁ residuals in Table 2 and the phases of the present observations. The quadratic ephemeris was used to calculate the (O-C)₂ residuals.

The V, R light curves of V865 Cyg defined by the individual observations are shown in Figure 1 as normalized intensity versus phase. The light curves in Figure 1 are overlaid by our synthetic light curve solution. Our spotted solution reveals that the system is a contact binary with a mass ratio of about 0.45 and a fillout of 19 percent. The less massive component appears to undergo a brief occultation at the secondary minimum. The early analysis of this system was done by Scott Herr as part of his 1991 senior honors thesis. The final solution and hot spot parameters were determined largely by another undergraduate student, Jim Zetzi. Further details of the solution, along with a complete analysis will be discussed elsewhere.

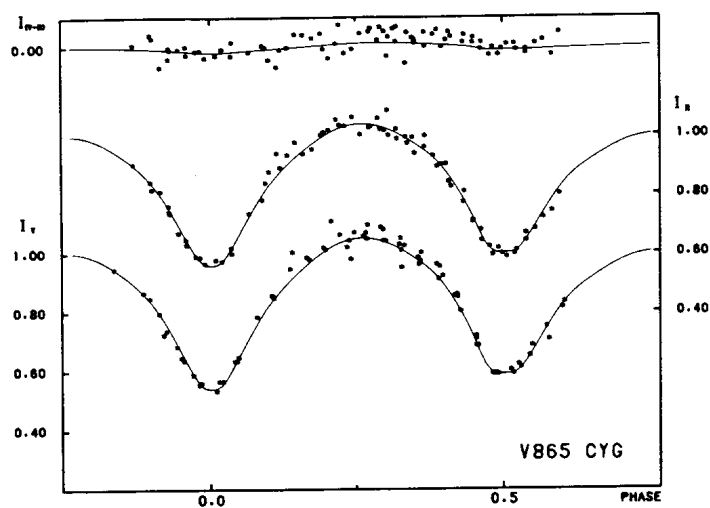


Fig. 1 - CCD Light curves of V865 Cyg as defined by the individual normalized intensities.

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References:

Wachmann, A. A. 1961, Astr.. Hamburg VI(1), 25

Hertzsprung, E. 1928, Bull. Astr. Inst. Netherlands 4, 179

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

Number 3638

Konkoly Observatory
Budapest
16 July 1991
HU ISSN 0374 - 0676

B, V, R, I LIGHT CURVES OF V803 AQUILAE

The very short period eclipsing binary system V803 Aquilae was discovered by Bakos (1950). He correctly classified this system as a W UMa-type. He gave 29 epochs of minimum light and presented a photographic light curve. A finder chart was also included. Later, Harwood (1962) observed V803 Aql and noted that the finder chart by Bakos failed to show a bright star about 0.5' northward of the variable. This object was used as our check star. Also, Locher (1978) found an error in Bakos' elements. He used 26 minimum timings of his own to determine the following ephemeris:

$$\text{JD Hel Min. I} = 2448780.357 + 0.2634254d \cdot E.$$

Moreover, Locher pointed out that V803 Aql was not observed at all between 1937 and 1973. The BBSAG Bulletin has since published well over 100 times of minimum light for this system.

The present observations were made on 1-7 June, 1989 at Kitt Peak National Observatory in Tucson, Arizona using the 0.9m #2 reflector which housed a dry-ice-cooled RCA 31034a Ga-As photometer tube. More than 500 observations were taken at each effective wavelength. The coordinates of the check, comparison and the variable star are given in Table I.

TABLE I

Star	R.A. (1950)	Dec. (1950)
V803 Aql	18 ^h 58 ^m 04 ^s	-7° 33.5'
Comparison	18 ^h 58 ^m 11 ^s	-7° 35.1'
Check	18 ^h 58 ^m 02 ^s	-7° 33.2'

Six epochs of minimum light were determined from observations made during three primary and three secondary eclipses. The first four epochs of minimum light were determined by an iterative technique based on the Hertzprung method (1928), while the last two were determined with the bisection-of-chords method. These epochs are given in Table II. The probable errors are indicated in parentheses.

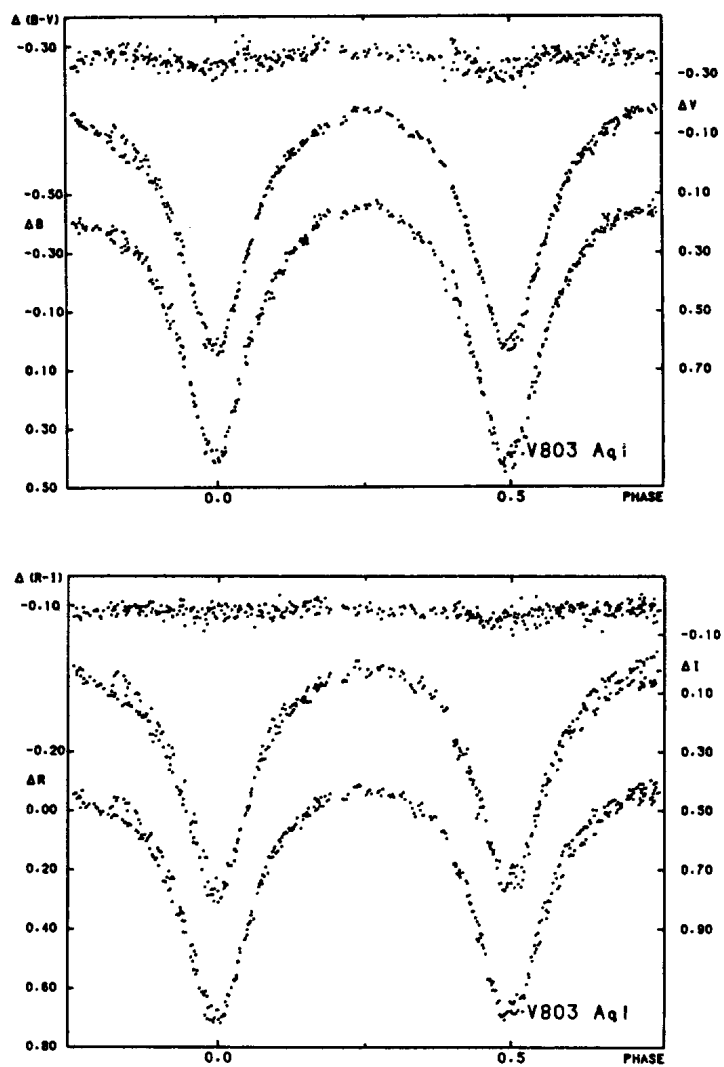


Fig. 1 - Light curves of V803 Aql as defined by the individual observations.

TABLE II

JD HEL. 2440000	Cycles	O-C
7678.8756(1)	- 22.5	- 0.0012
7680.8523(2)	- 15.0	- 0.0002
7681.9052(1)	- 11.0	- 0.0010
7683.8806(1)	- 3.5	- 0.0013
7684.8043(3)	0.0	0.0004
7684.9351(6)	0.5	- 0.0004

These times of minimum light along with BBASG minima following JD 2444500 were introduced into a least squares solution to obtain the following improved linear ephemeris:

$$\text{JD Hel Min. I} = 2447684.8038 + 0.263422299d \cdot E .$$

± 3 11

This ephemeris when used in conjunction with all previous times of minimum light indicates that there have been at least two distinct period changes: an increase followed by a recent decrease.

The light curves of V803 Aquilae defined by the individual observations are shown in Figure 1 as Δm versus phase. The analysis of the observations is underway.

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^b This research was supported partially by 1988-89 Butler Faculty and 1991-92 Student Fellowship Academic Grants.

^c This research was partially supported by a grant from NASA administered by the American Astronomical Society.

References:

- Bakos, G. A. 1950, Leiden Ann 20, 177.
Harwood, M. 1962, Leiden Ann 21, 387.
Hertzprung, E. 1928, Bull. Astron. Inst. Neth. 4, 179.
Locher, K. 1978, BBSAG Bull. #38, 6.

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

Number 3639

Konkoly Observatory
Budapest
17 July 1991
HU ISSN 0374 - 0676

A CONTINUATION OF PHOTOELECTRIC PHOTOMETRY OF RHO CASSIOPEIAE

This paper represents a continuation of previous photoelectric observations of the variable star ρ Cassiopeiae (Leiker et al., 1990, 1989, 1988, 1987). ρ Cassiopeiae (ρ Cas, HR 9045, HD 224014, SAO 035879) is a supergiant (F8pIA) star (Percy & Keith, 1985). It was discovered to be a variable in 1900 by Louise D. Wells (Pickering, 1901). Much of the time this star was confined to a brightness between 4.1m and 5.1m (Bailey, 1978). However, between August 1945 and June 1947 ρ Cas decreased in brightness more than a magnitude (Gaposchkin, 1949). After it recovered from this minimum, ρ Cas continued its irregular variation in brightness between 4.1m and 5.1m.

ρ Cas was observed by Leiker, Hoff, and Caruso at Oak Ridge Observatory, Harvard, MA from September 1990 through February 1991. A 0.4 meter Cassegrain telescope and a STARLIGHT-1 photon counting photometer with standard B and V filters was used. This is the same photometer that was used in our previous work. HR 9010 (HD 223173, SAO 35761, K3 II, V = 5.51 m, B-V = 1.65) was used as the comparison star. These delta magnitudes are not corrected for color or extinction. Standard deviation (σ) was calculated in the usual manner from three delta magnitudes. Table I lists the ΔV and ΔB magnitudes. Figures 1 and 2 are graphical representations of the data presented in Table I.

Table I. ΔV and ΔB magnitudes of ρ Cas obtained by Leiker, Hoff, and Caruso

HJD	ΔVm	σ	HJD	ΔBm	σ
2448107.7	-1.001	0.049	2448107.73	-1.416	0.004
2448116.6	-0.989	0.027	2448116.6	-1.441	0.010
2448130.6	-1.044	0.002	2448130.65	-1.458	0.001
2448138.6	-1.060	0.049	2448138.6	-1.455	0.020
2448145.6	-1.055	0.024	2448145.6	-1.481	0.011
2448153.54	-1.055	0.014	2448153.56	-1.466	0.009
2448155.52	-1.060	0.014	2448155.54	-1.487	0.017
2448159.58	-1.048	0.016	2448159.59	-1.464	0.006
2448166.61	-1.019	0.021	2448166.63	-1.428	0.006
2448169.7	-1.021	0.007	2448169.72	-1.396	0.011
2448180.72	-1.046	0.003	2448180.73	-1.447	0.002
2448189.49	-1.029	0.009	2448189.51	-1.427	0.009
2448192.6	-1.008	0.014	2448192.61	-1.419	0.001
2448196.52	-1.011	0.002	2448196.53	-1.418	0.004
2448200.66	-0.992	0.009	2448200.67	-1.398	0.011
2448204.65	-1.020	0.001	2448204.67	-1.423	0.004
2448211.76	-1.029	0.007			
2448215.66	-0.986	0.024			
2448226.56	-1.021	0.011	2448226.58	-1.397	0.019
2448285.47	-0.961	0.018	2448285.5	-1.341	0.007
2448289.51	-0.979	0.004	2448289.52	-1.309	0.002
2448300.48	-1.000	0.009			

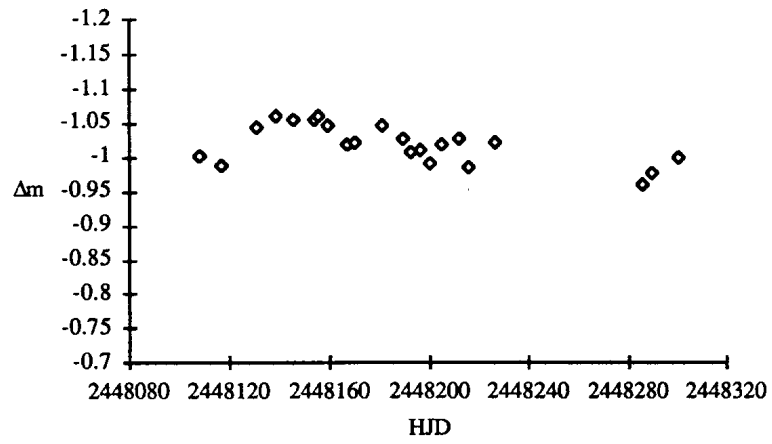


Figure 1. ΔV magnitudes of ρ Cas obtained by Leiker, Hoff, and Caruso

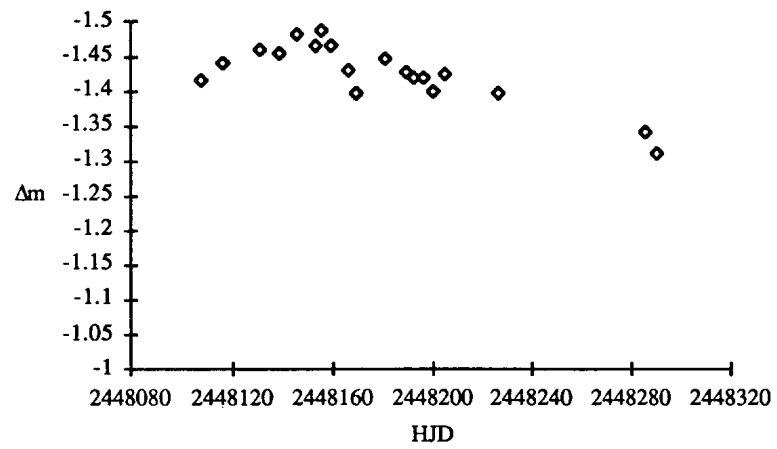


Figure 2. ΔB magnitudes of ρ Cas obtained by Leiker, Hoff, and Caruso

The authors wish to acknowledge the Smithsonian Astrophysical Observatory and Dr. Robert P. Stefanik for the use of the 0.4-M telescope at the Oak Ridge Observatory, Harvard, MA. They would also like to thank Dr. Thomas A. Hockey and the University of Northern Iowa for the use of a photoelectric photometer.

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References:

- Bailey, J. : 1978, *Journal of the British Astron. Association* **88**, (4), 397-401.
- Gaposchkin, S. : 1949, *Harvard College Obs. Bull.* No. 919, 18-19.
- Leiker, P. S., & Hoff, D. B. : 1990, *IBVS* No. 3490.
- Leiker, P. S., Hoff, D. B., & Milton, R. : 1989, *IBVS* No. 3345.
- Leiker, P. S., Hoff, D. B., Nesbella, J., Gainer, M., Milton, R., & Pray, D. : 1988, *IBVS* No. 3490.
- Leiker, P. S., & Hoff, D. B. : 1987, *IBVS* No. 3020.
- Percy, J. R., & Keith, D. W. : 1985, *Cepheids: Theory and Observations.* (ed. B. F. Madore), University of Cambridge Press, pp. 89-90.
- Pickering, E. C. : 1901, *Harvard College Obs. Circular.* No. 54.

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3640

Konkoly Observatory
Budapest
17 July 1991
HU ISSN 0374 - 0676

OBSERVATIONS OF THE SUSPECTED VARIABLE STAR TAU CASSIOPEIAE

This paper represents a continuation of previous photoelectric observations of the suspected variable star τ Cassiopeiae (Leiker et al., 1989, 1988). τ Cassiopeiae (τ Cas, HR 9008, HD 223165, SAO 35763, K1 III, $V = 4.87$ m) was observed by Leiker, Hoff, and Caruso at the Oak Ridge Observatory in Harvard, MA from September 1990 through February 1991. A 0.4 meter Cassegrain telescope and a STARLIGHT-1 photon counting photometer with standard B and V filters was used. This is the same photometer that was used in our previous work.

τ Cas is listed in the *New Catalogue of Suspected Variable Stars* as a possible variable star (Kholopov et al, 1982). Previous observations of τ Cas made at University of Northern Iowa indicate that it may be a variable star (Leiker and Hoff, 1988, 1989). HR 9010 (HD 223173, SAO 35761, K3 II, $V = 5.51$ m, $B-V = 1.65$) was used as the comparison star. The delta magnitudes were obtained in the sense of τ Cas - HR 9010 and are not corrected for color or extinction. Table I lists the mean delta magnitudes obtained for τ Cas. Each mean and standard deviation was calculated from three delta magnitudes. Standard deviation was calculated in the usual manner. See also Figures 1 and 2.

Table I. τ Cas ΔV and ΔB magnitudes obtained by Leiker, Hoff, and Caruso

HJD	ΔV_m	σ	HJD	ΔB_m	σ
2448108.8	-0.659	0.017	2448108.8	-1.149	0.024
2448116.6	-0.663	0.022			
2448130.6	-0.683	0.002	2448130.6	-1.191	0.007
2448131.7	-0.745	0.047	2448131.8	-1.203	0.010
2448153.59	-0.690	0.016	2448153.6	-1.195	0.002
2448155.56	-0.687	0.002	2448155.58	-1.182	0.017
2448162.58	-0.695	0.014			
			2448169.76	-1.184	0.011
2448180.72	-0.674	0.016	2448180.76	-1.201	0.014
2448189.54	-0.679	0.005	2448189.52	-1.204	0.008
2448192.64	-0.676	0.003	2448192.63	-1.180	0.025
2448196.55	-0.682	0.004	2448196.56	-1.186	0.001
2448204.69	-0.683	0.004	2448204.68	-1.189	0.002
2448285.52	-0.681	0.015	2448285.53	-1.182	0.026
2448289.54	-0.703	0.007			

The authors wish to acknowledge the Smithsonian Astrophysical Observatory and Dr. Robert P. Stefanik for the use of the 0.4-M telescope at the Oak Ridge Observatory, Harvard, MA. They would also like to thank Dr. Thomas A. Hockey and the University of Northern Iowa for the use of a photoelectric photometer.

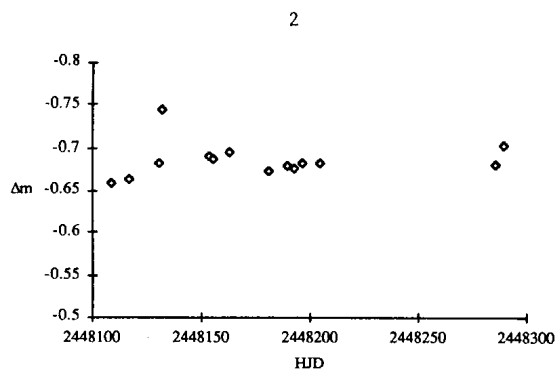


Figure 1. ΔV magnitudes of τ Cas obtained by Leiker, Hoff, and Caruso

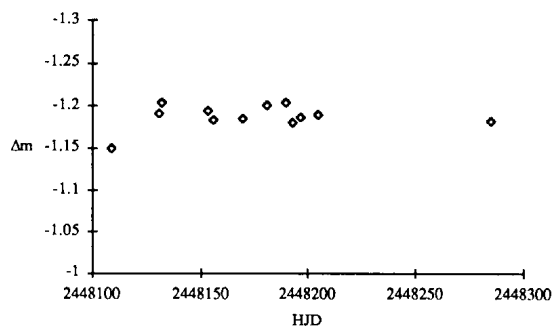


Figure 2. ΔB magnitudes of τ Cas obtained by Leiker, Hoff, and Caruso

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References:

- Kholopov, P. N., et al. : 1982. New catalogue of suspected variable stars. Moscow: Publishing Office (Nauka).
- Leiker, P. S., & Hoff, D. B., & Tuttle, M. M. : 1989, IBVS No. 3341.
- Leiker, P. S., & Hoff, D. B. : 1988, IBVS No. 3176.

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

Number 3641

Konkoly Observatory
Budapest
17 July 1991

HU ISSN 0374 - 0676

THE TOTALITY IN A PRIMARY MINIMUM OF RZ CASSIOPEIAE

RZ Cas (HD17138) is an eclipsing binary system ($P = 1^d.195$) and has shown irregular period changes (e.g., Herczeg & Frieboes-Conde 1974; Nowak & Piotrowski 1982). The system is bright enough ($m_V = 6^m.18$ at light maxima), so many photometric observations, mostly by rather small telescopes, have been made, which mainly concern with the timing of primary minima of the system.

There are also some reports on the type of the primary minimum, i.e., whether it is a total eclipse or partial one. Some observations show totality, but the others do not. For example, those by Huffer and Kopal (1951), Huffer (1955), Chambliss (1976), Surkova (1988), etc. show partial eclipses. On the contrary, those by Szafraniec (1960), Burke and Rolland (1966), Margrave et al. (1975), Arganbright et al. (1988), and Hegedüs (1989), etc. seemed to show total ones. Even among the observations which show totality, the duration of totality reported differs from one another, i.e., from 7 to 22 minutes, and moreover there is a report that the duration of totality depends on the colour (Hegedüs 1989).

The spectral types of the components have been assigned to A2V and G5IV (Chambliss 1976). The colour changes during the primary eclipse are not so large: the colour index at the primary minimum is about $B - V = 0^m.23$, which corresponds to late A to early F, never to G. This is one reason why the primary minimum is considered to be partial, not total (e.g., Chambliss 1976). Accordingly, some observers whose observations show total primary minima are doubtful of the totality (Arganbright et al. 1988).

On December 21 in 1989 we observed the system photoelectrically with the 91-cm telescope equipped with the multi-channel polarimetric photometer at the Dodaira Station of the National Astronomical Observatory of Japan. This photometer of eight channels makes the simultaneous photometry possible. The effective wavelength of each channel is 360 nm (ch.1), 420 nm (ch.2), 460 nm (ch.3), 535 nm (ch.4), 650 nm (ch.5), 695 nm (ch.6), 760 nm (ch.7) and 880 nm (ch.8), respectively (Kikuchi 1989). The other details

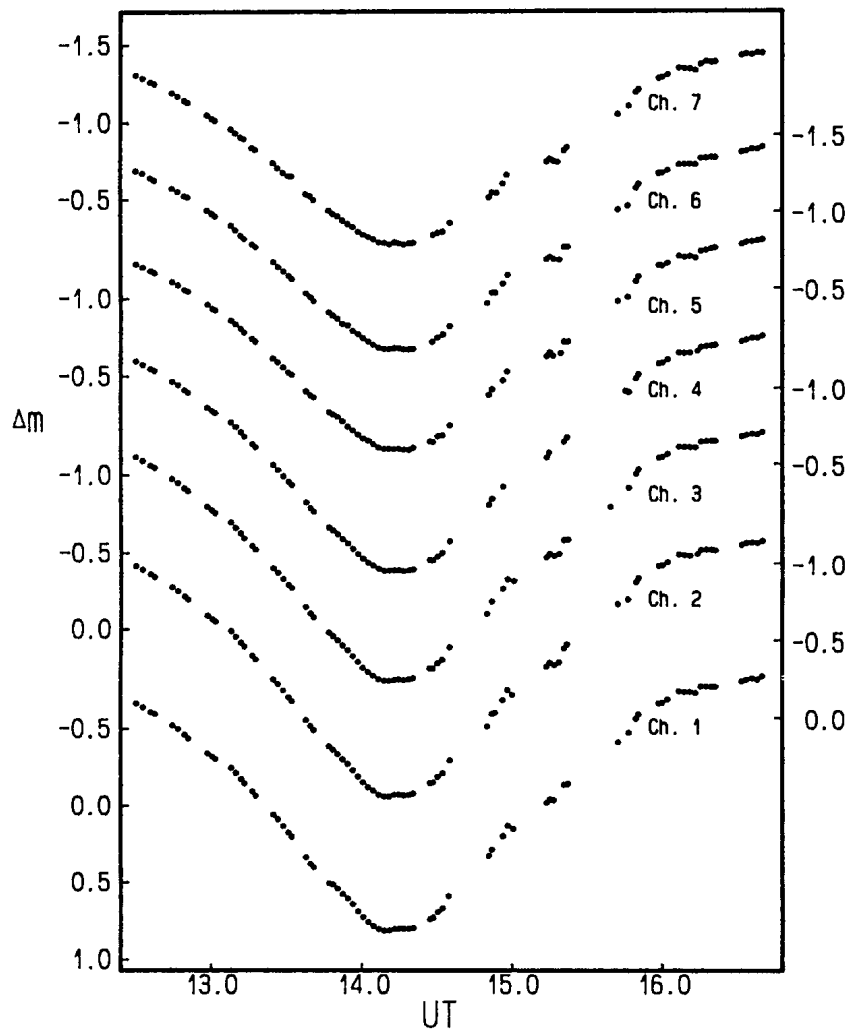


Figure 1. Light curves of a primary eclipse of RZ Cas. The circles represent averaged data usually from three points. The abscissa is Universal Time.

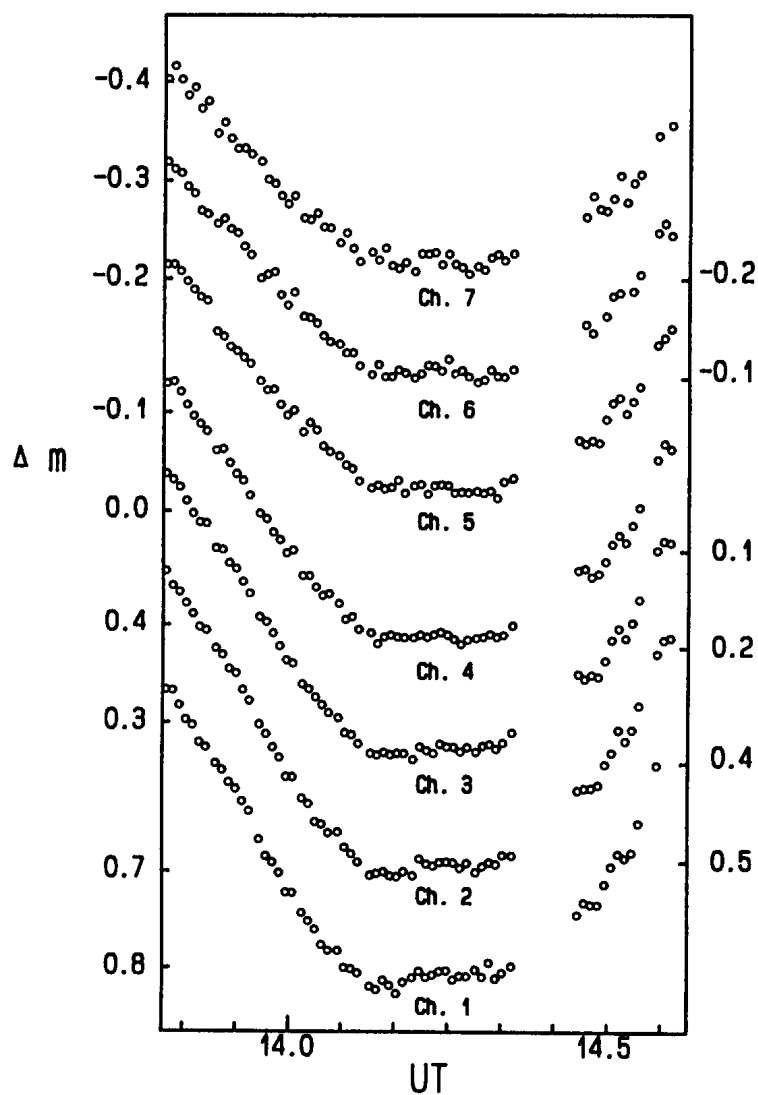


Figure 2. Enlarged light curves near the bottom of the minima of RZ Cas. The circles are individual observations.

of this polarimetric photometer are described in Kikuchi (1988).

On that night we observed a primary minimum with flat bottom showing totality. The comparison star was BD+69°171 (HD16393) and the check star HR791 (HD16769). The differential light curves of the primary minimum at channels 1 through 7 are shown in figure 1 and the enlarged ones around the bottom in figure 2. As can be seen in these figures, the duration of the totality are the same with one another, which is estimated to be 14 minutes irrespective of the colour, corresponding to $0^{\text{P}}0081$. The central time of the minimum has been estimated, after the heliocentric correction, to be HJD 2447882.0971.

Olson (1982) argued that there have been instabilities in the light curves of primary eclipse of RZ Cas, and that the shapes of the primary eclipse vary between partial-type and total-type. We have observed several primary minima of the system also with the 45-cm telescope of Fukushima University in the period covering the above date and found that they were usually total eclipses, the result of which will be published elsewhere.

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REFERENCES

- Arganbright, D.V., Osborn, W., Hall, D.S.: 1988, IBVS, No.3224.
Burke, E.W., Rolland, W.W.: 1966, AJ, 71, 38.
Chambliss, C.R.: 1976, PASP, 88, 22.
Hegedüs, T.: 1989, IBVS, No.3381.
Herczeg, T., Frieboes-Conde, H.: 1974, A&A, 30, 259.
Huffer, C.M.: 1955, ApJ, 121, 677.
Huffer, C.M., Kopal, Z.: 1951, ApJ, 114, 297.
Kikuchi, S.: 1988, Tokyo Astron. Bull., 2nd ser., No.281.
Kikuchi, S.: 1989, Private Communication
Margrave, T.E., Lukes, M.A., Doolittle, J.H., Evenskaas, R.S., MacDonald, J.W. and Murray, N.D.: 1975, IBVS, No.1019.
Nowak, A., Piotrowski, S.L.: 1982, Acta Astr., 32, 401.
Olson, E.C.: 1982, ApJ, 259, 702.
Surkova, L.P.: 1988, Astr. Tsirk., No.1533.
Szafraniec, R.: 1960, Acta Astr., 10, 99.

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3642

Konkoly Observatory
Budapest
18 July 1991
HU ISSN 0374-0676

Clues for periodic energy releases during a stellar flare

Introduction:

Observations of flares on the Sun have shown the very tight evolution of the white light, γ -ray, X-ray and microwave emissions. This highlights the direct link between the locations of white light emission and energy deposition in the atmosphere. By analogy to the solar case, one may expect the stellar white light flare emission to be a meaningful tracer of the energy release and deposition processes. Notably, observations by Beskin et al. (1989) have shown that the continuum emission is essentially thermal in character.

On the other hand, observations of quasi-periodic changes in the light curves may provide an interesting set of information and constraints, so as to model the energy release processes and magnetic field topology (e.g. Tajima et al., 1987). This seems an interesting opportunity in the stellar case since no spatial resolution is yet possible. Clues for quasi-periodicities were discovered by Rodonò (1974), Roizman and Kabichev (1985), Chugainov (1987) and Zalinian and Tovmassian (1987). Here we report on evidence for periodic brightness variations during a white light flare on Wolf 424 AB (dM5.5e).

Observations:

The observations were acquired at the European Southern Observatory with the 1m telescope and its standard photometric equipment. This flare was observed only in the U-band with a time resolution of about 4s. Weather conditions were excellent at the time of the observations.

We show an enlargement of the flare in Figure 1. The flare reached 2.50 mag at maximum. The complete light curve may be found in Houdebine (1990).

The analysis of the strip chart and the recorded light curves allowed us to identify 12 "bursts" occurring during this flare (see Figure 1). The first five bursts display very sharp enhancements and decays. The luminosity increase reached a value of 0.46 magnitude per second for the fourth event, which suggests that we are dealing with rather compact sources.

We listed in Table 1 the Universal Time, approximate duration and fluxes of each event, and the time delay Δt between two successive events. Assuming that two and one undetected events occurred respectively between the bursts No 8 and No 9, and the bursts No 9 and No 10, we inferred the evolution of Δt as given in Figure 2. This figure highlights the periodic character of these bursts, and further shows a rapid decrease in the period - i.e. increase in the bursts frequency - during the *preflare phase* and a rather constant value later.

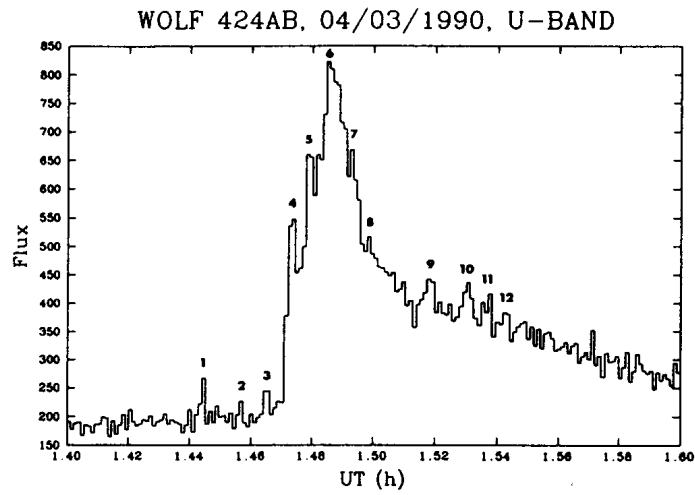


fig. 1: Flare light curve showing the identification of the flare bursts.

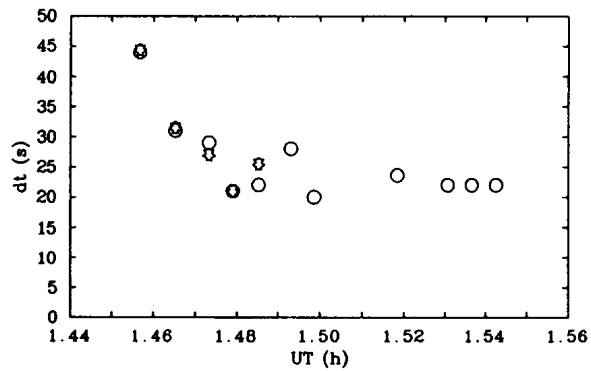


fig. 2: Evolution of the time delays between two successive burts. Circles indicate measurements using the curve in fig. 1, whereas stars relate to measurements from the strip chart recording (see Houdebine, 1990).

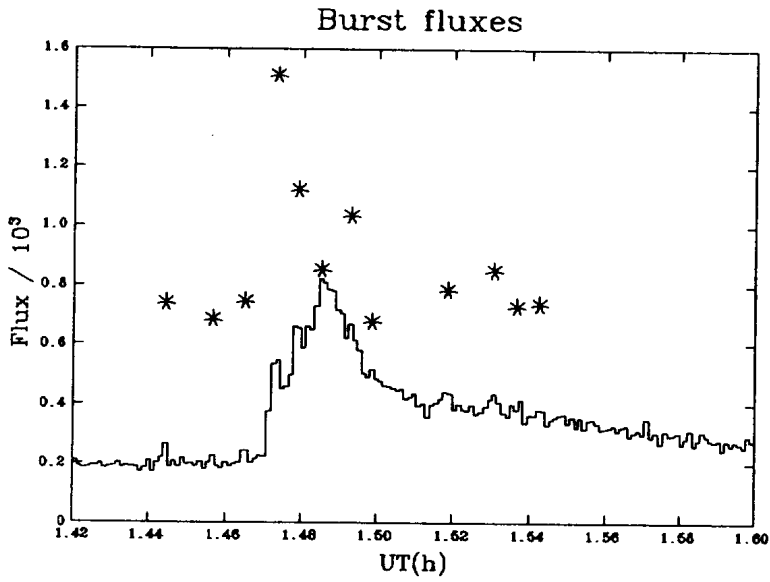


fig. 3: Flare U-band curve and burst flux variations. One notes that the burst's maximum is reached at the very beginning of the slow U-band rise.

Table 1: Parameters of the "bursts".

No.	UT	Duration (s)	Δt^\dagger (s)	Δt^\ddagger (s)	Flux Arbitrary unit
1	01:26:40	6	0	0	8.5
2	01:27:24	5	44	44.4	5.1
3	01:27:55	8	31	31.5	8.8
4	01:28:24	8	29	27	54.7
5	01:28:45	8	21	21	31.3
6	01:29:07	-	22	25.5	15.3
7	01:29:35	4	28	-	26.1
8	01:29:55	4	20	-	4.7
9	01:31:06	9	71	-	11.2
10	01:31:50	9	44	-	15.1
11	01:32:12	12	22	-	7.8
12	01:32:33	12	22	-	8.3

† Time delay from previous burst (data)

‡ Time delay from previous burst (strip chart)

The burst fluxes are superimposed on the global light curve in figure 3. The former increased sharply immediately before the flare onset that we define as the start of the slowly evolving component. We believe that we observed evidence for a periodic energy release phenomenon during a stellar white light flare.

Owing to the very high frequency of white light flares on flare stars, we expect that observations with a time resolution better than 3s in a given band will allow a statistical investigation of these events of great interest.

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References:

- BESKIN, G.M. ET AL.: 1989, IAU Coll. 104 on *Solar and Stellar Flares*, Poster Papers, Catania Obs. Spe. Pub., Eds. B.M. Haisch and M. Rodonò, 95.
- CHUGAINOV, P.F.: 1987, Iz. KRYM. ASTRO. OBS., **76**, 54.
- HOUEBINE, E.R.: 1990, PhD Thesis of the Université d'Orsay - Paris XI, 91400 Orsay, France.
- NAKAJIMA, H., KOSUGI, T., KAI, K., EOME, S.: 1983, *Nature*, **305**, 292.
- RODONÒ, M.: 1974, *Astron. and Astrophys.*, **210**, 303.
- ROŹMAN, G.S., KABICHEV, G.I.: 1985, *Astron. Zh.*, **62**, 1095.
- TAJIMA, T., SAKAI, J., NAKAJIMA, H., KOSUGI, T., BRUNEL, F., KUNDU, M. R.: 1987, *Astrophys. J.* **321**, 1031.
- ZALINIAN, V.P., TOVMASSIAN, H.M.: 1987, IAU Comm. 27, *I.B.V.S.*, No. 2992.

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3643

Konkoly Observatory
Budapest
18 July 1991
HU ISSN 0374-0676

“Homothétiques” white light flares on a dMe star

Introduction:

Few peculiar features have been depicted in flare light curves so far, in spite of the many thousand flares observed. Among these peculiar cases, recursive flares with a periodicity of about 48 min were observed by Doyle et al. (1990), and a similar phenomenon was described by Andrews (1966). Periodic bursts were recorded by Houdebine (1990, 1991) during a flare on Wolf 424 AB and oscillations were observed by Rodonò (1974) during a flare on a star of the Hyades cluster. Haupt and Schlosser (1974) also pointed to the possibility of Homologue or sympathetic flares occurring on UV Ceti. These rare events are of particular interest since they provide valuable constraints for modeling the stellar flare phenomenon.

Most of the flares exhibit rapid and monotonous rise and decay (simple flare) or is made of several successive outbursts occurring randomly at first glance (complex flare) (e.g. Cristaldi and Rodonò, 1973). A lesser proportion display a slow rise and decay and are generally complex in character, but do not however exhibit any secular properties.

Here we report on a peculiar flare that occurred on the active binary GL 644 AB (=V1054 Oph) of spectral type dM4.5e. This large flare is made up of two main series of about 8 events of varying intensity. These series of flares or “flare bursts” do not show any striking periodicity, and the time delay between two successive events seems erratic. What makes this flare particular is the amazing similarity between the relative timing of the several events of the two series.

Observations:

The observations were collected at the European Southern Observatory in March 1990 with the 1m telescope and its standard photometric equipment (see Houdebine, 1990).

The complete flare light curve is given in Figure 1. Enlargements with a chronological numbering of the bursts are shown in Figure 2. Universal times and time delays since the first event in a given series are listed in Table 1. We plotted these delays, Δt_2 vs. Δt_1 , in Figure 3.

Those figures show the most interesting common characteristics of these two series of flares:

- Event No 1 occurs during the rising phase at about 3/4 height of the maximum.
- The increase slows down after the first burst and until the maximum.
- A sharp decrease is observed after the 2nd burst and is followed by the 3rd burst.
- The gradient in the fall in luminosity diminishes after the 3rd event.
- The observed bursts of the two series follow a strictly linear correlation which slope is about 1.45 (see fig. 3).

- No events step back from this correlation by more than 8% !

We therefore conclude that these two series are "homothétiques" in time - i.e. - one series of bursts leads to the other, following a translation and contraction in time.

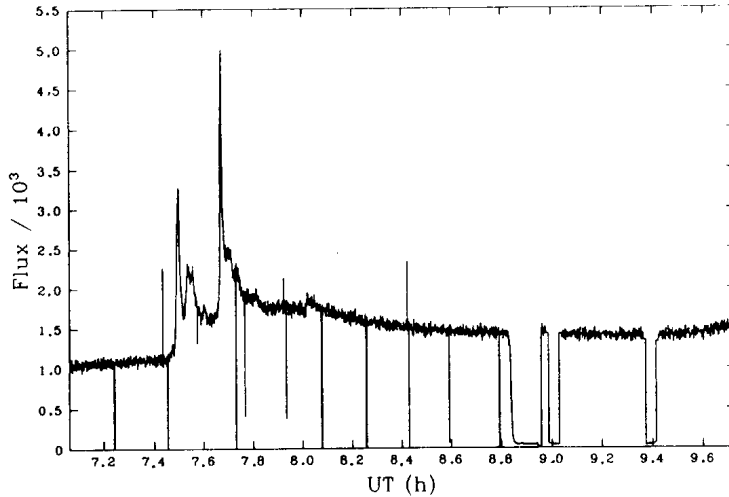


fig 1: Flare light curve in the U-band. The rise after 9.5 UT corresponds to dawn. Sharp cuts in the curve indicate when the star position in the diaphragm was checked.

As usual, it is of interest to compare such stellar events to their solar counterparts. Two similar classes of solar events immediately come to one's mind; the homologous flares and flares triggered by moving disturbances - i.e. - the sympathetic flares. However, the series of flares reported here do not check the requirements for homology as specified by Ellison et al. (1960). Indeed, the two complex flares do not evolve on the same time scale and greatly vary in shape and strength. We may add that no homologous white light flares of equivalent power have ever been observed on the Sun and that homology may sometimes involve disturbances that successively trigger various flare components.

The interpretation as series of sympathetic flares is far more attractive since a simple change by a factor of 1.45 in the speed of a flare born disturbance is required to explain the observations. In such a case, the disturbance speed should be less than 3700 km/s, and the first event must occur at the same location on the star. This subsequently implies that at least the first events are homologous and points to the amazing rapidity (about 10 minutes) of an active region to recover its ability of producing large flares ! Nevertheless, if one compares the strength of events 4 to 7 in the two series, one sees that all active region magnetic patterns did not restore during this 10 min laps of time.

Our early interpretation is that we observed a combination of homologous and sympathetic flares. This further highlights that all complex stellar flares may be in fact a combination of sympathetic flares, and that the Poisson distribution found for the relative timing of stellar flares (e.g., Lacy et al., 1976) originates from the combination of the varying disturbance speeds and active region flare occurrence.

Many other consequences may be inferred from the investigation of this flare, some of which have

already been discussed by Houdebine (1990). A more complete study will appear in a forthcoming publication.

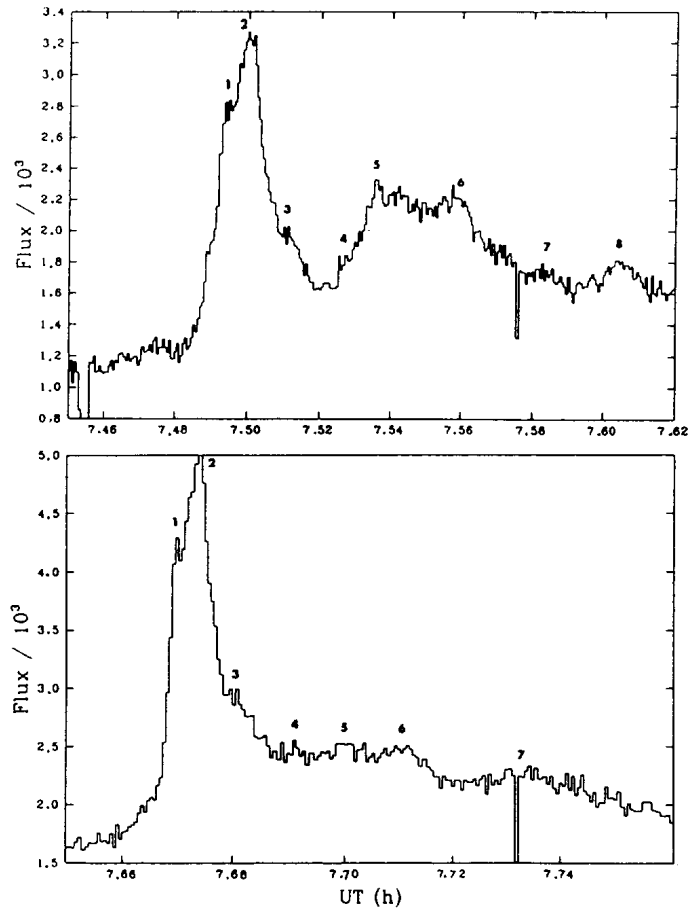


fig 2: Enlargements of the two main series of flares. The ordinate axis gives the photon counting rate.

Table 1: Universal time for the flare events numbered in figure 2, and time delays with respect to the first in a series. The last column shows the ratio of these time delays.

No.	UT h : min : s	Δt_1 (min)	UT h : min : s	Δt_2 (min)	$\Delta t_1/\Delta t_2$
1	07:29:40	0	07:40:12	0	-
2	07:29:59	0.00552	07:40:26	0.00414	1.333
3	07:30:41	0.01698	07:40:51	0.01193	1.423
4	07:31:37	0.03266	07:41:28	0.02116	1.543
5	07:32:41	0.04140	07:42:04	0.03025	1.369
6	07:33:31	0.06417	07:42:38	0.04083	1.572
7	07:35:02	0.08947	07:43:55	0.06222	1.438
8	07:36:15	0.10994	-	-	-

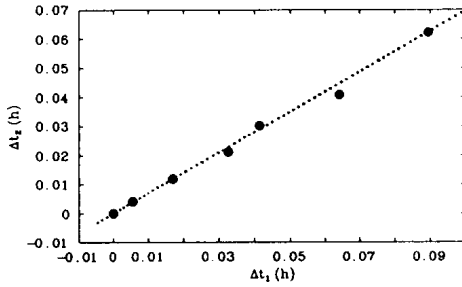


fig 3: Δt_1 vs. Δt_2 .

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References:

- ANDREWS, A.D.: 1966, *Pub. Astron. Soc. Pac.*, **78**, 324.
 CRISTALDI, S., RODONÒ, M.: 1973, *Astron. and Astrophys. Suppl.*, **10**, 47.
 DOYLE, J.G., PANAGI, P.M., BYRNE, P.B.: 1990, *Astron. and Astrophys.*, **228**, 443.
 ELLISON, M.A., MCKENNA, S.M., REID, J.H.: 1960, *Dunsink Obs. Publ.*, **1**, 1.
 HAUPT, W., SCHLOSSER, W.: 1974, *Astron. and Astrophys.*, **37**, 219.
 HOUEBINE, E.R.: 1990, Ph.D. Thesis of the Université d'Orsay - Paris XI, France.
 HOUEBINE, E.R.: 1991, *I.B.V.S.* No. 3631
 LACY, C.H., MOFFET, T.J., EVANS, D.S.: 1976, *Astrophys. J. Suppl. Ser.*, **30**, 85.
 RODONÒ, M.: 1974, *Astron. and Astrophys.*, **210**, 303.

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

Number 3644

Konkoly Observatory
Budapest
18 July 1991

HU ISSN 0374 - 0676

ON THE X-RAY STAR WW Ari = EXO 020528+1454.8

WW Ari, consisting of a pair of dMe stars ($dM4.5e+dM4.5e$), is identical with Lowell's proper motion star G035-027. First results about the behaviour of the total light of the system in the optical range were given by Hudec et al. (1988) and Götz (1987).

To complete and supplement the study of the optical behaviour, the star was measured on 101 blue-sensitive plates (ORWO ZU21+GG13+BG12) from 54 nights obtained with the Schmidt camera 50/70/172 cm of Sonneberg Observatory, covering the time interval between October 2 1987 and February 2 1991. The observations are linked to the sequence of comparison stars given by Götz (1987). The light curve in B is given in Figure 1; it shows the individual observations and, in addition, the series of the season 1986/87. It turns out that the two series differ. While in the season 1986/87 most of the observations are brighter than $m_B = 16^m.0$, in the season 1987-91 a remarkable number of observations are fainter than $m_B = 16^m.0$. The star is scattering nearly over the whole range of amplitude and the light curve is characterized by short-term flares and depressions starting from a mean level. This fact is also confirmed by the histogram given in Figure 2, where the brightness distributions of observations published by Hudec et al. (1988) and Götz (1987) (clear areas) and those of the new series are shown. Remarkable brightness changes of the star are listed in Table I. Considering all observations of the star, the total amplitude of the system in B amounts to 1.2 mag ($15^m.3 - 16^m.5$).

On 3 plates of the new series the two components of the system are isolated and separate. The individual magnitudes of the eastern and western components of WW Ari are given in Table II, where

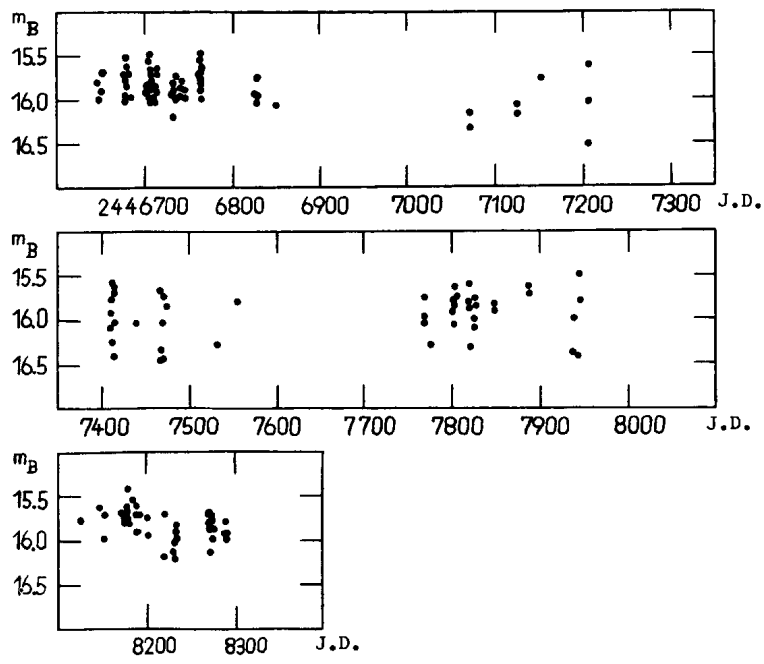


Figure 1

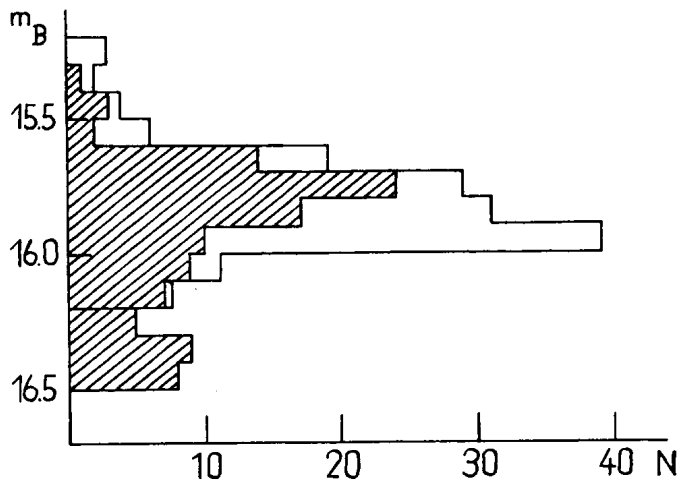


Figure 2

Table I

J.D.hel 244....	m_B	Δt	Δm_B	J.D.hel 244....	m_B	Δt	Δm_B
7205.261 276	15. ^m 62 16.50	0. ^d 015	+0. ^m 88	7823.447 464	15. ^m 86 16.32	0. ^d 017	+0. ^m 46
7413.537 558	15.75 16.26	0.021	+0.51	8220.462 479	16.18 15.69	0.017	-0.49
7414.521 541	16.41 15.58	0.020	-0.83	8274.238 276	15.80 15.38	0.038	-0.43
7471.348 364	16.47 15.76	0.016	-0.71	295	15.82	0.019	+0.45

Table II

J.D.hel 244....	m_B eastern component	western component	distance
7415.548	16. ^m 43	16. ^m 40	3".32
8274.238	15.99:	16.02:	2.93
8274.276	15.76:	15.87:	3.16

the measured angular distances of the two stars have also been listed. In this connection it should be mentioned that the brightness and distance measurements were difficult. As can be seen from Table II, both objects are variable nearly of the same order and in the same manner.

On the best plate, from J.D.hel 244 7415.548, the two dM4.5e stars show nearly the same brightness of $m_B = 16.^m4$. Considering an absolute magnitude of $M_V = 11.8$ and a colour index of $(B-V) = 1.59$ according to data given by Schmidt-Kaler (1982), one finds that the distance to the earth is $D = 40$ pc. This value is at the upper margin of that given by Hudec et al. (1988) with $D = 25$ pc \pm 15 pc, who worked with an average absolute magnitude of $M_V = 13.2$ for dM4-5 stars of the solar neighbourhood. Considering the mean brightness of the stars on the other plates, one obtains distances of $D = 33$ pc and $D = 30.5$ pc.

From the largest and the smallest distances to the earth on the basis of the angular distances the distances between the two stars can be determined. These results are given in Table III, where the values of the individual observations and the mean dis-

tances averaged over all observations are shown. There is no doubt that the system WW Ari is a close pair of stars between which interaction by means of X-rays is possible.

Table III

Angular distance	distances between both components in Astronomical Units	
	D = 25 pc	D = 40 pc
3".32	83.0	132.8
2.93	73.3	117.2
3.16	79.0	126.2
3.14	78.5	125.6

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References:

- Hudec,R.et al., 1988, BAC 39,296-302
 Götz,W., 1987, Inf.Bull.Var.Stars No. 3045
 Schmidt-Kaler,Th., 1982, Landolt-Börnstein, Group VI Vol.2b,
 15-18, Springer-Verlag Berlin, Heidelberg,
 New York

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

Number 3645

Konkoly Observatory
Budapest
23 July 1991
HU ISSN 0374 - 0676

PHOTOGRAPHIC OBSERVATIONS OF THE CATAclySMIC VARIABLE CANDIDATES

PG 1445+584 AND PG 1524+622

The objects PG 1445+584 and PG 1524+622 from the Palomar-Green Survey were suspected to be Cataclysmic Variables (CVs) by Green et al. (1986). However, no information about the detailed classification or at least the possible variability was published. For this purpose, we studied the objects on 57 archival plates obtained at the 40-cm astrograph of the Crimean Laboratory of the Sternberg State Astronomical Institute. All the plates were measured by using the iris-photometer to obtain the brightness of comparison stars and to avoid possible variables among them. The instrumental system is close to B.

The standard stars in SA 15 were used from the list of Brun (1957). The finding charts are shown in Figure 1 and the comparison stars are listed in Table I. The value of σ_m corresponds to the mean-squared deviation from the mean value to estimate the scatter, but not to the standard error of the mean.

The object PG 1524+622 showed distinct variability, as one may see from Table II. The brightening up to 13^m.9 was detected on one plate obtained at HJD 2433762.464. The deviation from the mean value, 14^m.8 is only 0^m.9. The temporal distribution of the observations does not allow us to study the structure of the brightening and thus additional observations are needed. Four plates showed the brightness decrease with an amplitude up to 1^m.5, similar to the eclipsing variables, particularly to BH Lyn = PG 0818+513 (Andronov et al., 1989). For the period search, we used the "method of characteristic times" (Andronov, 1991) and the corresponding FORTRAN routine. Because the number of points is very low (n=4), the periodogram is very noisy. For 57 values of the trial period, the maximum deviation of the phase from zero $|\varphi_{\max}| \leq 0.01$, and thus the period determination is impossible from the present observations.

To search for the possible orbital brightness variations, series of observations were obtained during three subsequent nights. The most prominent (but weak) peaks in the periodogram occurred at periods 1.07 \pm .08, 0.53 \pm .03

and $0.125 \pm .003$ days.

However, the shape of the light curve of PG 1524+622 changes from night to night, thus these periods seem to be unreal, despite the brightness variations at least up to 0.4 occurred with characteristic times $0.10-0.13$. For the precise classification, additional observations are needed.

A weak argument pro long period ($P > 0.3$) may be that the narrow ($d < .05$) deep eclipse may not be observed at short periods due to the exposure time of 30 min. However, the "minima" may be due to the "short-time excursions" to the "low state" like that observed in MV Lyrae (Andronov et al., 1988). It may be noted that IW And showed time intervals with nearly constant brightness, interrupted by rapid "switches" from high to low state (Meinunger and Andronov, 1987). In this case, high states must be observed more frequently, as compared with PG 1524+622.

Table I

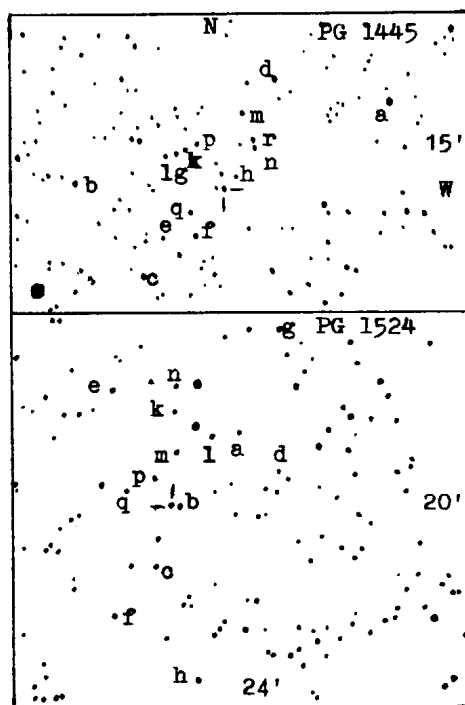


Figure 1

Comparison stars for
PG 1445+584 and 1524+622

*	PG 1445		PG 1524	
	m_{pg}	σ_m	m_{pg}	σ_m
a	12.74	.02	13.86	.07
b	13.16	.04	13.95	.05
c	13.67	.04	14.22	.07
d	14.07	.09	14.45	.08
e	14.64	.08	14.86	.11
f	14.84	.09	15.02	.10
g	15.04	.08	15.13	.11
h	15.57	.10	15.26	.11
k	15.82	.11	15.36	.09
l	15.84	.09	15.67	.10
m	16.08	.11	15.99	.10
n	16.13	.11	16.04	.11
p	16.18	.13	16.48	.13
q	16.63	.07	16.48	.09
r	16.70	.15		
s	17.09	.34		
Var	15.66	.10	14.84	.39

Table II

The photographic observations of PG 1445+584 and PG 1524+622

HJD 24...	PG 1445	PG 1524	HJD 24...	PG 1445	PG 1524
33057.409	15.84	16.32m	47302.398	15.63	14.82
33762.464	-	13.92!	47302.430	15.53	14.85
34480.526	15.70:	14.99	47302.462	15.57	14.73
35598.400	15.64	14.83	47302.496	15.70	14.57
47207.569	15.57	14.82	47304.450	15.70	15.93m
47264.495	15.68	15.13	47305.415	15.57	14.68
47265.553	15.64	15.25	47324.418	15.75	14.63
47266.420	15.68	15.12	47351.408	15.66	14.65
47268.480	15.77	15.12	47355.408	15.68	14.84
47294.512	15.66	14.72	47615.457	15.57	14.41
47295.517	15.66	14.65	47616.539	15.57	14.60
47296.368	15.57	14.77	47619.468	15.66	14.55
47300.341	15.64	14.65	47619.534	15.57	14.88
47300.374	15.84	14.57	47620.485	15.73	14.69
47300.407	15.68	14.69	47622.538	15.84	14.71
47300.440	15.68	14.87	47647.484	15.57	14.85
47300.473	15.80	14.69	47649.498	15.57	14.63
47300.509	15.73	14.49	47650.396	15.70	14.62
47301.303	15.77	14.83	47651.414	15.73	14.68
47301.336	15.57	14.86	47657.495	15.73	14.64
47301.368	15.75	14.76	47658.426	15.70	14.72
47301.399	15.72	14.79	47678.412	15.57	14.92
47301.429	15.51	14.68	47679.316	15.75	14.59
47301.460	15.55	14.75	47734.321	15.72	14.82
47301.491	15.57	14.83	47736.337	15.41	14.70
47301.514	15.69	14.60	47739.306	15.79	15.08
47302.303	15.58	14.83	47973.524	15.55	15.95m
47302.334	15.65	14.92	47984.527	15.84	15.54m
47302.365	15.54	14.81			

Remarks: the symbol ! marks the brightening of PG 1524+622, and the symbol
m - the "minima".

The brightness of PG 1445+584 changed from $15^m.51$ to $15^m.84$ on our plates. Such low amplitude may be due to the scatter of the photographic observations. This behaviour is similar to that exhibited by other PG-objects - 0834+488 and 1639+338, but the "missed" larger variations may not be excluded.

The author is thankful to Yu.S. Shugarov and N.V. Metlova, who mainly obtained the patrol plates centered at SA 15.

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References:

- Andronov, I.L.: 1991, Kinematics and Physics of the Celestial Bodies (Kiev), 7, No.2, p.85.
Andronov, I.L., Fuhrmann, B., Wenzel, W.: 1988, Astron. Nachr. 309, No.1, p.39.
Andronov, I.L., Kimeridze, G.N., Richter, G.A., Smykov, V.P.: 1989, IBVS, No.3388.
Brun, A.: 1957, Atlas des 139 'Selected Areas' du Mt. Wilson.
Green, R.F., Schmidt, M., Liebert, J.: 1986, Astrophys.J.Suppl. 61, 305.
Meinunger, L., Andronov, I.L.: 1987, IBVS, No.3081.

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

Number 3646

Konkoly Observatory
 Budapest
 31 July 1991
 HU ISSN 0374 - 0676

NSV 13679: AS YET ONLY ONE MINIMUM

In the compilation of his first Zone Catalogue Frank Schlesinger¹ found the star BD+49°3511 at 21^h21^m07^s +50° 17' .7 (1950) lacking on one of the two Allegheny plates on which it was to be measured. The original Allegheny plates are at Yale. Besides the two on Schlesinger's program, I found a third where the star was at the plate edge outside the region to be measured. That plate showed the star at maximum. On the plate on which Schlesinger had reported the star missing it is in fact visible, just above the plate limit, probably about 11.5 or 12th photographic magnitude. Thus the star was normal brightness, 9.1 pg, on August 23 and September 18, 1915, but faint on September 16.

In the Yale Archives there is a copy of a letter from Schlesinger to Harlow Shapley dated December 4, 1924, indicating that Schlesinger had asked Shapley to check the Harvard plates of the region. However, I find no evidence as to whether or not such a search was actually made. Hence, on a visit to Harvard College Observatory, I first searched all the plates covering the region that were taken in August and September 1915. On none of the Harvard plates in this interval (Table I, where A = Allegheny, H = Harvard) was the star fainter than its normal brightness.

TABLE I. Observations Near Minimum, 1915

<u>Before minimum</u>	<u>Minimum</u>	<u>After Minimum</u>
Aug. 23 A	Sept. 16 A	Sept. 18 H
Aug. 25 H		Sept. 19 A
Aug. 26 H		Sept. 21 H
Sept. 9 H		Sept. 22 H
Sept. 10 H		
Sept. 11 H		

I then examined the star on about 200 patrol plates taken between 1898 and 1921 but found no further minima. There are approximately a thousand more plates available for a future visit to Harvard. Meanwhile, can anyone at another observatory find plates taken in the critical 1915 period, especially on September 16, to verify the one minimum found? On the Allegheny plate there is no evidence that the image has been affected by any plate blemish. From one minimum among 200 plates examined, if the star is an eclipsing binary the maximum duration of minimum would be approximately seven days (Sept. 11 to 18). The maximum possible period would then be almost four years.

The Figure is a finding chart based on a Lick Atlas photograph. Table II identifies a number of the neighboring stars and gives their photographic magnitudes from the AGK2 catalogue.² (In the AGK3 the same magnitudes are given, but with a few of the stars omitted.)

N



Figure 1

TABLE II. NSV 13679 and Comparison Stars

	BD	pg	Sp
Var.	+49°3511	9.3	A7
A	3513	8.4	F8
B	3516	8.9	K0
C	3514	9.4	K5
Dp	3510p	10.4	A5
Ds	3510s	10.9	-
E	3512	10.5	-

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REFERENCES:

- Schlesinger, F., 1925, Trans. Yale Univ. Obs., Vol. 4.
 Schorr, R. and Kohlschutter, A., 1951, Zweiter Katalog d. Ast.
 Gesellschaft, Vol. 4.

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

Number 3647

Konkoly Observatory
Budapest
12 August 1991
HU ISSN 0374 - 0676

ON THE STABILITY OF THE PERIOD OF BO CEPHEI

For several decennia BO Cep has been regarded as the prototype of irregular variable stars which show Algol-like, but unperiodic, sharp fadings of their brightness. Frequently the star was mentioned in the same breath together with the extremely young stars of T Orionis type, but its evolutionary state has never been firmly demonstrated.

Recently Grankin et al. (1991) showed that in their photoelectric brightness data of the "normal light" of BO Cep a period of about 10 days was hidden, and they constructed good-looking mean lightcurves for the four years 1987 to 1990 of their measurements.

Our own photoelectric material of 1965 to 1976 does not only confirm their period, but, what is more, coherently obeys their elements,

$$C = 244\,6364.567 + 10^d.658 \cdot E$$

Fig. 1 shows the whole of our brightness values folded with these elements. The comparison stars used and their magnitudes are given by Wenzel and Brückner (1978).

Additionally all but one of the deep visual and photographic minima (≥ 0.5 mag) described by Hoffmeister (1944) and Bradl (1978) as well as the - though shallow - three photoelectric fadings of Kardopolov and Shutemova (1980) and of Kovalchuk and Pugach (1980) are characterized by O-C values in the range of $\pm 0^d.14$, provided the above given period is improved by subtracting $0^d.00019$ and amounts to $P_1 = 10^d.65781$. Fig. 2 shows the O-C diagram, where dots represent photoelectrically observed fadings and crosses the deep (and therefore sure) visual and photographic minima; all material has been taken from the quoted papers and observational series.

Thus our observations point to a long-term existence and stability of the period and do not contradict the assumption of Grankin et al. (l.c.) that we deal with an orbital revolution in a binary system.

The reader must be aware of the fact that obviously the minima are of very different depth and that moreover in numerous cases they cannot be realized at all at the predicted dates. The model of Grankin et al. (l.c.) can account for these findings, but a thorough spectroscopic investigation

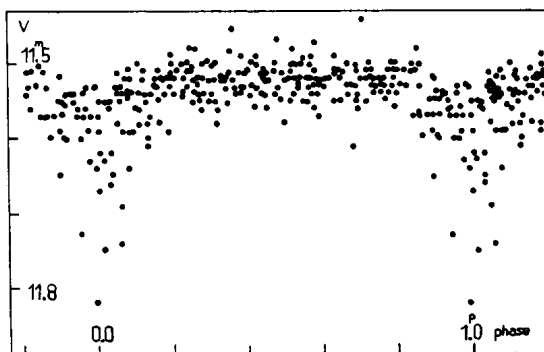


Figure 1

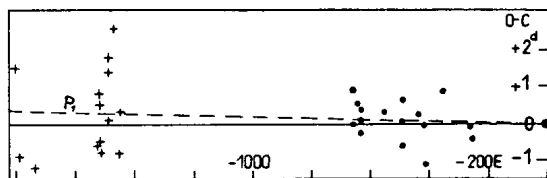


Figure 2

of this important object is clearly overdue. In this connection we remind of two more kinds of "eclipsing" stars with vanishing minima, represented by Kohoutek's central star V 651 Mon of a planetary nebula and by SS Lac with a possibly perturbed orbit, see Lehmann (1991). Maybe these cases are more numerous than hitherto supposed. The large number of eclipsing variables, for which no period could be found, could be explained in this way and must not be necessarily due to the scarcity of the respective data, as has been assumed frequently.

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References:

- Bradl, I.: 1978, unpublished, cited by Wenzel, W., Brückner, V. (1978).
Grankin, K.N. et al.: 1991, I.B.V.S., No.3627.
Hoffmeister, C.: 1944, Astron. Nachr. 274, p.232.
Kardopolo, V.I., Shutemova, N.A.: 1980, Perem. Zvezdy 21, p.305.
Kovalchuk, G.U., Pugach, A.F.: 1980, Mitt. Veränderl. Sterne 8, p.129.
Lehmann, T.: 1991, I.B.V.S., No.3610.
Wenzel, W., Brückner, V.: 1978, Mitt. Veränderl. Sterne 8, p.35.

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

Number 3648

Konkoly Observatory
Budapest
13 August 1991
HU ISSN 0374 - 0676

**Infrared properties of the carbon symbiotic star C-1
in the Draco dwarf galaxy**

The carbon giant C-1 in the Draco dwarf galaxy was discovered by Aaronson *et al.* (1982) to show H I, He I and He II emission lines. Allen (1984) classified C-1 among the symbiotic stars and the interacting binary nature of C-1 has been confirmed by the spectroscopic investigation of Munari (1991a) who also discovered radial velocity variations connected to orbital motion. Munari (1991b) presented the results of a BVI photometric monitoring during the period 1987-1990, which suggested some variability of C-1 especially in the I band. About 90% of galactic carbon stars are known or suspected variables, half of them of the semiregular or Mira type with periods between 60 and 640 days (Claussen *et al.* 1987). The variability reported by Munari (1991b) is characterized by low amplitude and short time scale (~ 55 days) and appears consistent with the low metal content of the Draco dwarf galaxy and the observation that period and amplitude of red variables in galactic globular clusters are proportional to metallicity (Feast 1981).

C-1 has been observed in service mode with the JHKLM infrared photometer at the 1.5 m TIRGO Italian National Infrared Telescope. The resulting magnitudes are given in Table 1 (errors in the *local system* listed):

Table 1 JHK photometry of Draco C-1

band	mag	error
J	11.60	0.04
H	11.35	0.03
K	11.40	0.05

The corresponding C-1 absolute magnitude is $M_K = -8.2$, adopting a distance modulus of $m-M=19.6$ for the Draco dwarf galaxy and an interstellar reddening of $E_{H-V}=0.03$ (Stetson 1979). The absolute magnitude of a sample of 54 carbon stars in the LMC and SMC studied by Cohen *et al.* (1981) and Frogel *et al.* (1980) is $M_K = -8.1 \pm 0.6$. Although there is a remarkable similarity in M_K , the IR colors of C-1 appear very different from those of SMC, LMC and galactic carbon stars.

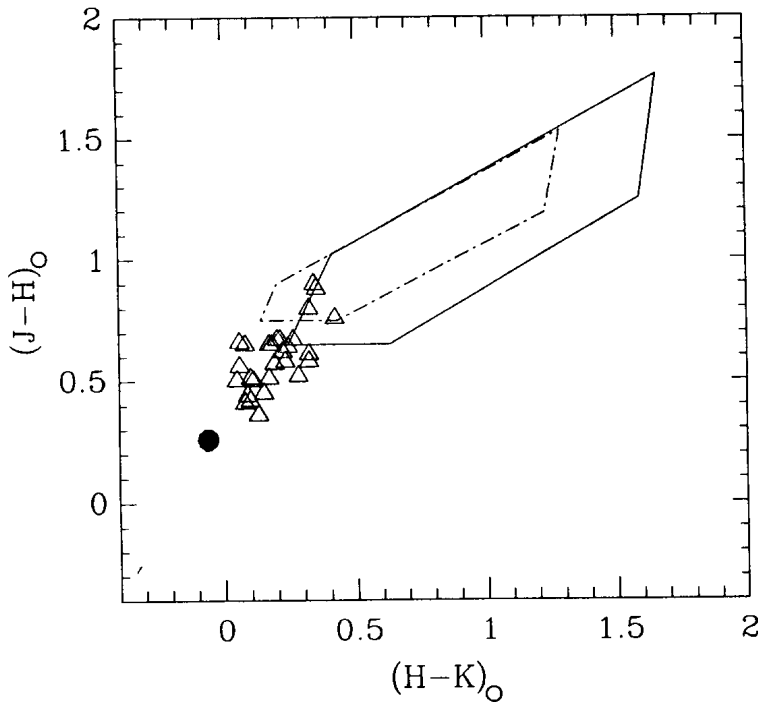


Figure 1

The figure shows where carbon stars lie in a $(J-H)_O$ - $(H-K)_O$ plane, with the interstellar reddening statistically removed. The solid line encloses the region occupied by the 215 galactic carbon stars studied by Claussen *et al.* (1987), which have been detected in the course of the *Two Micron Sky Survey* and that are strongly concentrated towards the galactic plane as the population I stars, to which they belong. The dot-dashed line delimits the diagram region where LMC and SMC carbon stars lie (Cohen *et al.* 1981, Frogel *et al.* 1980 and Frogel & Richer 1983). The triangles are carbon stars belonging to the Galaxy halo, which have observed by Bothun *et al.* (1991) in the direction of north and south galactic poles.

The IR colors of C-1 ($J-H=0.25$, $H-K=-0.05$) are very blue compared with the rest of carbon stars. The IR colors and the negative detection by the IRAS satellite exclude the presence of large quantities of circumstellar dust around C-1. Particularly blue colors for C-1 have already been noted in the optical by Aaronson *et al.* (1982) and Munari (1991b).

The IR blue colors of C-1 are intrinsic to the carbon star and are not due to the binary nature of the system. The contribution by the nebular material, which gives rise to the emission line spectrum, is negligible because

the optical spectra well show unveiled carbon absorption bands down to at least 4400 Å (Aaronson *et al.* 1982, Munari 1991a). The blue colors could be in principle ascribed to the heating effect of the hard radiation field of the white dwarf companion illuminating the atmosphere of the carbon star or to the direct emission of an extended accretion disk around the white dwarf. These sources of blue emission can usually account for $\Delta(B-V)=0.2\div1.0$ mag in the optical photometry of symbiotic stars, but they have no impact in the IR among the ~ 90 object so far investigated (Munari *et al.* 1991, Whitelock & Munari 1991). Moreover, these sources of blue emission should produce an undetected veiling of carbon absorption bands in the optical spectra of C-1.

The blue IR colors of carbon star C-1 could be the effect of a very low metallicity or due to a thermal pulse the star is currently undergoing. Theoretical treatment of thermal pulses in the AGB phase suggests limited excursion in the T_{eff} and large variation in luminosity (Iben & Renzini 1983). The probability to catch a carbon star during a thermal pulse is low and the other carbon star in the Draco dwarf galaxy should be expected to show more red (or *normal*) colors. Instead the only other carbon star in the Draco galaxy that Aaronson *et al.* (1982) have photometered, shows blue optical colors too, also if not extreme as those of C-1. The interpretation of the C-1 blue IR colors in term of particularly low metallicity is suggested by its location in the $(J-H)_0$ - $(H-K)_0$. It lies on the blue side of population II carbon stars which in turn lie on the blue side of population I carbon stars. A particularly low mass loss rate could contribute to the blue IR colors of C-1.

Detailed investigation of the carbon stars in the Draco dwarf galaxy, particularly IR photometry, appears worthwhile.

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References

- Aaronson, M., Liebert, J., Stocke, J.: 1982 *Ap.J.* 254, 507
 Allen, D.A.: 1984 *Proc.A.S.A.* 5, 369
 Bothun, G., Elias, J.H., MacAlpine, G., Matthews, K., Mould, J.R., Neugebauer, G., Reid, I.N.: 1991 *Astron.J.* 101, 2220
 Claussen, M.J., Kleinmann, S.G., Joyce, R.R., Jura, M.: 1987 *Ap.J.Suppl.* 65, 385
 Cohen, J.G., Frogel, J.A., Persson, S.E., Elias, J.E.: 1981 *Ap.J.* 249, 481
 Feast, M.W.: 1981 in *Physical Processes in Red Giants*, ed. I. Iben and A. Renzini (Dordrecht: Reidel), p. 193
 Frogel, J.A., Persson, S.E., Cohen, S.J.: 1980 *Ap.J.* 239, 495
 Frogel, J.A., Richer, H.B.: 1983 *Ap.J.* 275, 84
 Iben, I., Renzini, A.: 1983 *Ann.Rev.Astron.Astrophys.* 21, 271
 Munari, U.: 1991a *Astron.Astrophys.* in press
 Munari, U.: 1991b *Inf.Bull.Var.Stars* 3605

Munari, U., Yudin, B.F., Taranova, O.G., Massone, G., Marang, F., Roberts, G.
Winkler, H., Whitelock, P.A.: 1991 *Astron. Astrophys. Suppl.*, accepted
Stetson, P.B.: 1979 *Astron. J.* 84, 1149
Whitelock, P.A., Munari, U.: 1991 *MNRAS*, submitted.

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

Number 3649

Konkoly Observatory
Budapest
21 August 1991
HU ISSN 0374 - 0676

G326 - ANOTHER DELTA SCUTI STAR IN THE FIELD OF M4

G326 (Greenstein 1939) = A63 (Alcaino 1975) = L3316 (Lee 1977) is a field star in the direction of the globular cluster M4. The projection distance of the star from the center of the cluster is $x = 110''3$, $y = 458''4$. The proper motion study shows that its $P_c = 0$ (Cudworth 1990). The magnitudes and colors given by the different authors are:

V = 13.03,	B-V = 0.71,	(Alcaino 1975)
13.00,	0.76,	(Lee 1977)
13.04,	0.71, U-B = 0.28	(Cacciari 1979)
12.97,	0.81,	(Cudworth 1990)

If the values of $E_{B-V} = 0.44$ and $E_{U-B} = 0.78E_{B-V}$ are accepted, the star's $(B-V)_0$ is about 0.31 and $(U-B)_0 = -0.06$, suggesting a spectral type of F0 (but the $(U-B)_0$ is too blue if it is a Pop. I dwarf star).

G326 was used as a comparison star to check the light variability of

G326-G298

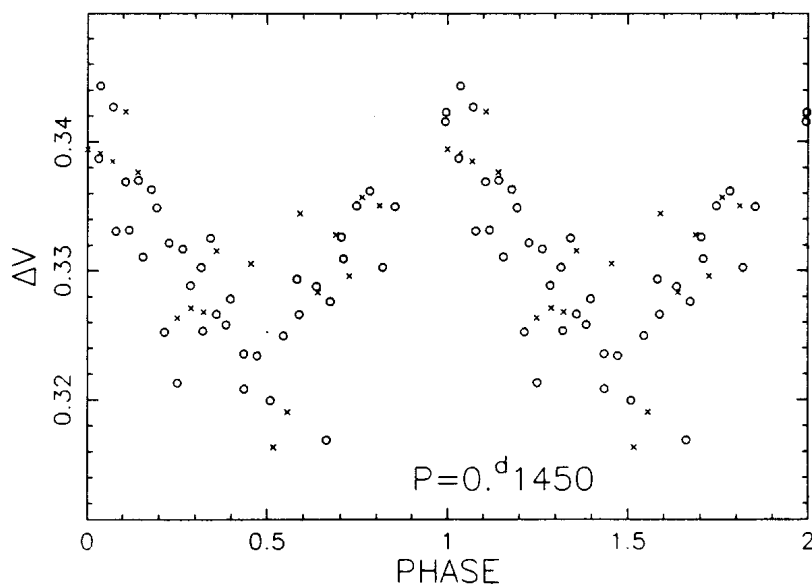


Figure 1

2

G326-G298

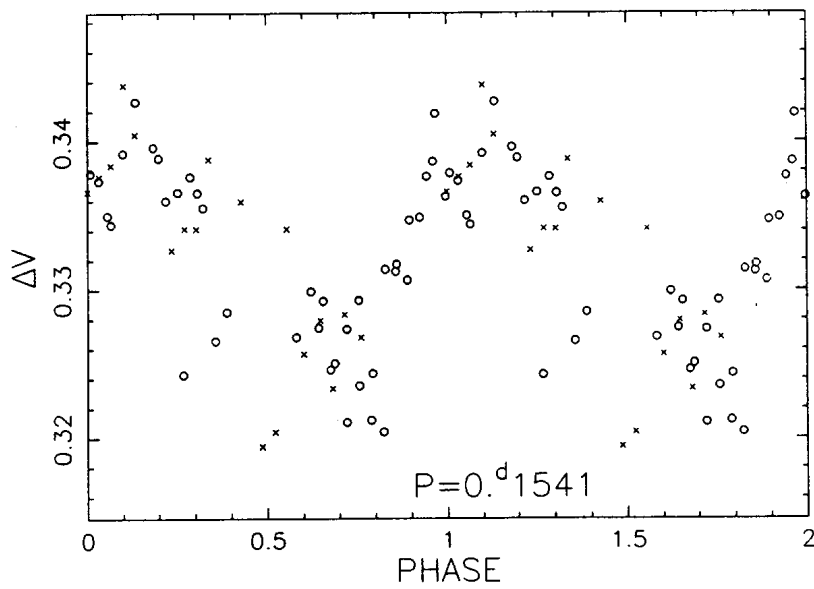


Figure 2

G326-G298

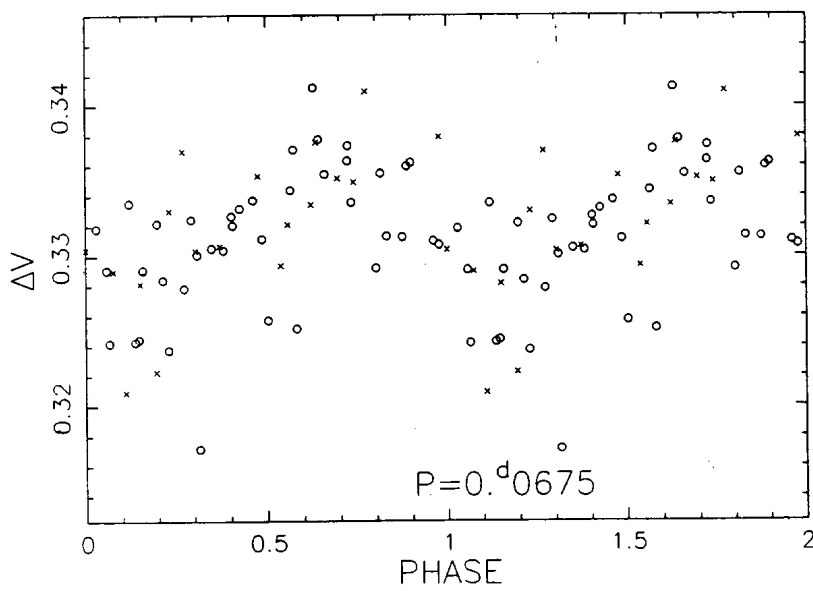


Figure 3

the horizontal branch star G327 in the past. It was shown later that G326 itself was a variable too. The CCD data and the method of reduction used in this paper are the same as before (Yao 1991). Only the zero point shift of about $0^m.01$ between two nights was adjusted.

The preliminary results are:

$$m(t) = 0.329 + \sum_{i=1}^3 A_i \sin(2\pi t/P_i + 2\pi\phi_i)$$

Here

$P_1 = 0.1450$	$A_1 = 0.00801$	$\phi_1 = 0.2518$
$P_2 = 0.1541$	$A_2 = 0.00698$	$\phi_2 = 0.4069$
$P_3 = 0.0675$	$A_3 = 0.00387$	$\phi_3 = 0.7569$

The folded light curves are given in Figs. 1, 2 and 3. Each light curve is plotted with the data prewhitened with the other two frequencies. There is little doubt that G326 is a new Delta Scuti star. However, the periods should be considered as preliminary only due to the limited data.

I wish to thank Prof. A.W. Rodgers, the director of MSSSO, for allocating the telescope time. I thank the staffs of MSSSO for help with observing. I thank the staffs of AAO and Dr. Huang Jia-hao of Nanjing University for using the computers. This work was supported in part by the grant from the Chinese National Science Foundation.

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References:

- Alcaino, G.: 1975, *Astro. Astrophys. Supp.*, 21, 1.
 Cacciari, C.: 1979, *A.J.*, 84, 1543.
 Cudworth, K.M.: 1990, *A.J.*, 99, 1491.
 Greenstein, J.L.: 1939, *Ap.J.*, 90, 387.
 Lee, S.W.: 1977, *Astro. Astrophys., Supp.*, 27, 367.
 Yao Bao-an: 1991, *IBVS.*, No.3622.

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

Number 3650

Konkoly Observatory
Budapest
23 August 1991
HU ISSN 0374 - 0676

COMPLETE B, V, R, I LIGHT CURVES OF CE LEONIS

The compact, nondegenerate field binary, CE Leonis (S 7763) was discovered by Hoffmeister (1963). CE Leo has a high Northern galactic latitude of 74° . Light curves were published in 1987 which covered the secondary eclipse (Samec and Bookmyer 1987). These preliminary observations verified Meinunger and Wenzel's (1968) classification of the light curves as W UMa-type.

The present observations were made on 31 May - 7 June, 1989 at Kitt Peak National Observatory in Tucson, Arizona using the 0.9m #2 reflector with a photometer which housed a dry-ice-cooled RCA 31034a Ga-As photometer tube. Complete Johnson-Cousins' B,V,R_c,I_c light curves were obtained with more than 700 observations taken at each effective wavelength.

Three epochs of minimum light were determined from observations made during one primary and two secondary eclipses. The first two epochs of minimum light were determined by an iterative technique based on the Hertzprung method (1928), while the last was determined with the bisection-of-chords method. These epochs are given in Table I along with the others determined from photoelectric observations by Hoffman (1983) and Samec & Bookmyer (1987). The probable errors of our time determinations are indicated in the accompanying parentheses. Here, we have corrected the time of minimum light given in the report of Samec and Bookmyer (1987). The value was in error by one JD.

TABLE I

JD HEL. 2440000	Cycles	(O-C) ₁	(O-C) ₂	Source
5044.5495	- 8684.5	- 0.0002	0.0002	Hoffman
5047.4325	- 8575.0	0.0002	0.0006	Hoffman
6829.0089	- 2803.5	0.0000	- 0.0006	Samec & Bookmyer
7679.6687(1)	0.0	- 0.0002	- 0.0004	Present Observations
7680.7320(3)	3.5	0.0011	0.0009	Present Observations
7683.7642(6)	13.5	- 0.0009	- 0.0011	Present Observations

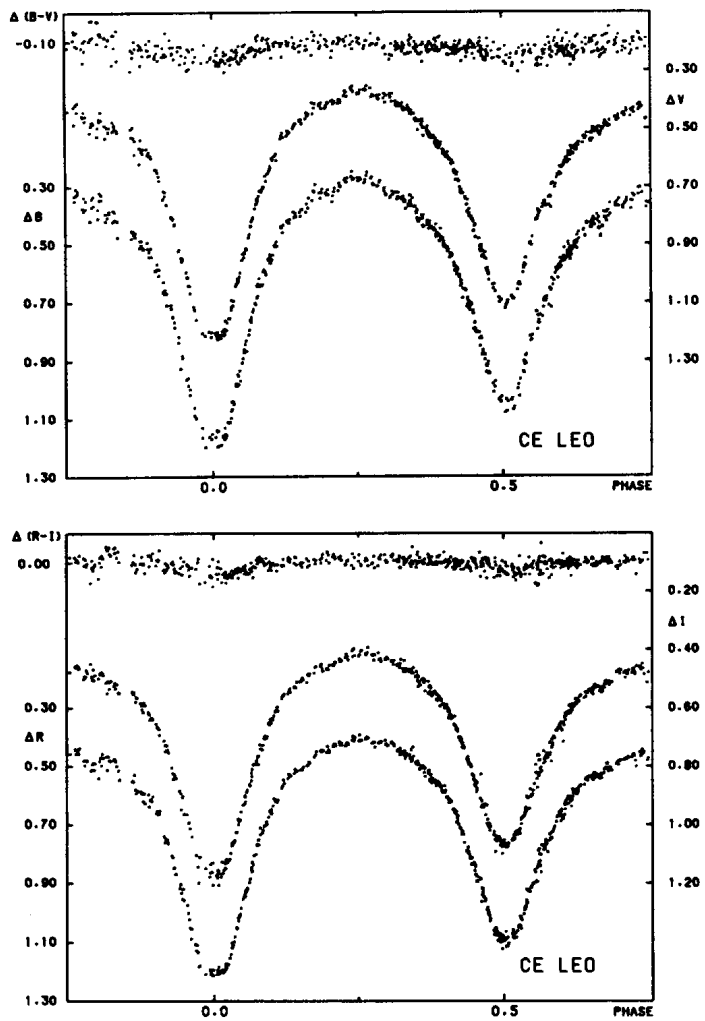


Fig. 1 - Light curves of CE Leo as defined by the individual observations.

These times of minimum light along with a starting ephemeris consisting of our primary epoch and the period of Meinunger and Wenzel (1968) were introduced into a least squares solution to obtain the following improved linear ephemeris:

$$\text{JD Hel Min. I} = 2447679.6689 + 0.30342785d \cdot E.$$

± 3 5

We also determined a quadratic ephemeris based on all available timings of minimum light:

$$\text{JD Hel Min. I} = 2447679.6690 + 0.30342755 \cdot E - 8 \times 10^{-11}d \cdot E^2$$

± 8 20 1

The linear ephemeris was used to calculate the (O-C)₁ residuals in Table I and the phases of the present observations. The quadratic ephemeris was used to calculate the (O-C)₂ residuals.

The complete light curves of CE Leo defined by the individual observations are shown in Figure 1 as Δm versus phase. The analysis of the observations is underway.

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^b This research was supported partially by 1988-89 Butler Faculty and 1991-92 Student Fellowship Academic Grants.

^c This research was partially supported by a grant from NASA administered by the American Astronomical Society.

References:

- Hertzprung, E. 1928, Bull. Astron. Inst. Neth. 4, 179
Hoffman, M., 1983, IBVS #2344
Hoffmeister, C. 1963, AN 287,169.
Meinunger, L. and Wenzel, W. 1968, VSS 7(4), 393
Samec, R.G., & Bookmyer, B.B. 1987, IBVS #3053

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

Number 3651

Konkoly Observatory
Budapest
26 August 1991

HU ISSN 0374 - 0676

**RAPID SPECTROSCOPIC VARIABILITY
IN BE STARS**

The advent of high signal-to-noise solid state detectors has led to the discovery of short timescale variability (\sim tens of minutes) in absorption line profiles of a wide variety of stars (e.g. Smith, 1991 and references therein). The variability consists of weak (less than 1% of continuum) absorption features moving from blue to red accross the line profiles ("moving bumps"). The phenomenon was first detected in a Be star (ζ Oph) by Walker et al. (1979).

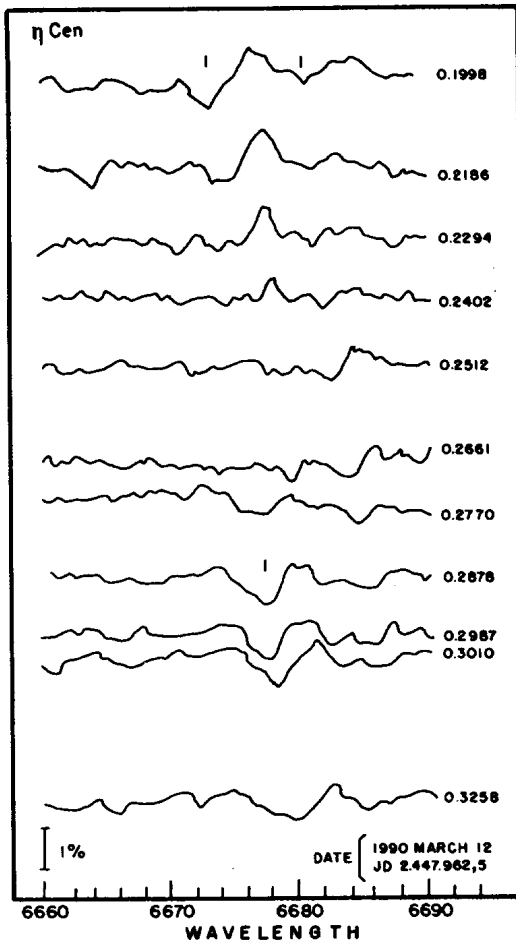
The bumps are often variable in intensity: a bump sometimes disappears or a new one appears were none existed. They are not evenly spaced accross the line profile and different bumps may have different rates of travel ("accelerations"). The visibility of the bumps varies from time to time and in Be stars may be correlated with veiling by circumstellar matter (Smith et al., 1991).

The moving bump phenomenon is generally interpreted as the photospheric manifestation of high-order ($|m| > 4$) sectorial modes of nonradial pulsations (NRP). Recently, Balona (1990) proposed another explanation in terms of rotational modulation (RM) of spots colder than the surrounding photosphere. The two models are virtually observationally undistinguishable: they fit equally well non-simultaneous spectroscopic and photometric data. In any case, it seems quite probable that some kind of surface magnetic activity is involved in Be variations of timescale $<$ day (Smith, 1991). The NRP vs. RM controversy can only be decided with the help of simultaneous (or, at least contemporary) multi-technique observations (e.g. Balona, 1991).

We have started in 1990 a search for moving in the HeI λ 667.8 nm of (mainly) southern, bright Be stars. The objects of our sample have been selected on the basis of confirmed or suspected photometric variability (Cuypers et al., 1989; Balona, 1991). High resolution ($R \geq 30,000$), high signal-to-noise ratio ($S/N \geq 300$) spectroscopic observations have been performed at the Brazilian Laboratorio Nacional de Astrofisica with a CCD camera attached to the coude spectrograph of the 1.6 m telescope. Ten stars have been observed in various epochs (Table 1).

Moving bumps have been detected for the first time in η Cen (Janot-Pacheco et al., 1990). Figure 1 shows the residuals (individual minus average spectra sequence) for

FIGURE 1



this star obtained in March 12, 1990. Some bumps are indicated. Moving subfeatures were also seen in ζ Oph and η Cen, and possibly in γ Arae and ζ Ori. From the average spacing and acceleration of the bumps one can derive the order of the spectral NRP mode supposed to be responsible for the variations (e.g. Yang et al. 1988).

TABLE I

STAR	EPOCH OF OBSERVATIONS	BUMPS
α Eri	June 1990	A
λ Eri	Nov 1990	?
ζ Ori	Apr 1991	D?
κ Ori	Apr 1991	A?
α Col	Apr 1991	?
κ CMa	Mar 1990	?
μ Cen	June 1990	C
η Cen	Mar, Jun 1990 Apr 1991*	D
ζ Oph	June 1990	C
γ Arae	June 1990	D?

A= Absent ; D= Detected ; C=Confirmed ; * International campaign

For η Cen and ζ Oph, our observations are consistent with order $1 = |m| \sim 20$. Janot-Pacheco et al. (1991) have shown that the photometric behaviour of η Cen in 1988 can only be reproduced with the RM model by a judicious sequence of dark and bright spots, which is incidentally reminiscent the sectorial type.

Anyone who has photometric or other data of the stars in Table 1 in 1990 or 1991, or who are interested in the problem exposed here is welcome to join us in a collaboration. A better understanding of the physics behind the rapid variations shown by Be stars will also throw light over the "Be phenomenon" problem.

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References

- Balona, L.A., 1990, M.N.R.A.S. 245, 92
Balona, L.A., 1991, Be Stars Newsletter 24, 5 (ESO)
Cuypers, J., Balona, L.A. and Marang, F., 1989, Astron. Astrophys. 81, 151
Janot-Pacheco, E., Leister, N.V., Torres, C.A.P.C.O., Quast, G.R. and Campos, R.P.
1990, IAU Circular no. 5048
Janot-Pacheco, E., Leister, N.V., Quast, G.R., and Torres, C.A.P.C.O., 1991, in ESO
Workshop "Rapid variability of OB- Stars: Nature and Diagnostic Value", D. Baade
(Ed.) p. 45
Smith, M.A., 1991, Be Stars Newsletter 24, 8 (ESO)
Smith, M.A., Peters, G.J. and Grady, C.A., 1991, Ap. J. 367, 784
Walker, G.A.H., Yang, S. and Fahlman, G.G., 1979, Ap. J. 233, 199
Yang, S., Ninkov, Z. and Walker, G.A.H., 1988, P.A.S.P. 100, 233

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

Number 3652

Konkoly Observatory
Budapest
26 August 1991
HU ISSN 0374 - 0676

A SEARCH FOR ROTATIONAL MODULATION OF T TAURI STARS
IN THE Tau AND Oph DARK CLOUDS

Many efforts were made in 1980 - 1990 by Rydgren and Vrba (1983), Vrba et al. (1984), Bouvier et al. (1986), Herbst et al. (1987), Shevchenko (1986) and others to search for any periodicity in T Tau stars caused by the rotational modulation of spotted photosphere. Some results of these searches were analysed by Bouvier (1989). The observed light and colour periodicity can be used to determine the rotational period, the temperature of the photosphere and spot as well as possible magnetic fields and accretion structures of T Tau stars.

To search for the periodicity and other data, photoelectric UBV_R -photometry of T Tau stars was made on Mt. Maidanak using two 60-cm Zeiss reflectors with pulse counting photometers. 6 stars were observed in 1978-1982. 10-18 ones per year were observed in 1983-1986. Since 1987 the program "Rotor" including about 70 stars has been in progress.

The periodicity of T Tau light curves is analysed by modern methods of digital spectral analysis (Marple, 1987). The methods were adapted to real observational sets by K.N. Grankin. Preliminary results were published by Shevchenko (1986), Berdnikov et al. (1991), Grankin et al. (1991). In this paper we present the most important results of the search for periodicity of 46 T Tauri stars in the Tau and Oph dark clouds. The negative result of the periodicity search for 12 stars seems to be caused for great part by deficiency of observational data.

Values of the periodicity and observational data for 22 stars in TDC and ODC are listed in Table 1. The values in columns 2-4 refer to our own observational sets: amplitude, number of observations and epoch. Columns 5-8 give derived data for the periods discovered: value, statistical possibility, the epoch and amplitude of the periodic process. Column 9 presents the periods referenced by Bouvier (1989).

Table 1. A search for periods in T Tau stars

Star name	Amplitude V _{max} -V _{min}	n	Epoch JD 2440000+	Period days	Pos- sibi lity	Ep.of period 1900+	n <A>	Per. days **

SR 9	11.30-11.77	154	6607-8101	6.54*	0.99	86-90	0.35B	6.4
SR 12	13.17-13.44	106	6964-8100	3.50	0.90	90	0.20B	3.4
HARO 1-1	13.07-13.63	98	6974-8101	3.34*	0.92	87-88	0.25B	
HARO 1-8	13.88-14.24	84	6965-8101	14.58*	0.97	87-90	0.30B	
HARO 1-14	13.75-14.50	88	6964-8101	8.21*	0.98	87-88	0.40B	
V1121 OPH	11.13-11.62	128	6955-8123	8.50	0.90	90	0.22V	
V2058 OPH	12.60-13.09	143	6607-8101	6.90*	0.87	86-88	0.15B	
T TAU	9.80-10.20	276	6665-8259	2.80	0.75	86-90	0.03B	2.8
VY TAU	13.49-13.82	223	6379-8265	5.37*	0.97	85-90	0.10B	
AA TAU	12.55-13.90	212	6690-8265	8.17	0.90	87-90	0.43B	8.2
BP TAU	11.66-12.37	269	6679-8230	7.60	0.70	90	0.20B	7.6
DF TAU	11.30-13.92	515	3741-8271	7.11*	0.97	78-83	1.00B	8.5
DG TAU	11.81-13.04	438	4465-8271	15.24*	0.95	80-83	0.35B	
DI TAU	12.80-13.10	274	6710-8271	7.57	0.80	87-90	0.05B	7.9
DK TAU	11.57-13.85	227	7022-8271	8.20	0.95	87-90	0.90B	
DL TAU	12.60-13.89	222	7017-8270	9.40	0.95	87-90	0.40B	
DN TAU	12.14-12.50	222	6681-8265	6.30	0.85	87-90	0.14B	6.0
GI TAU	12.48-14.91	245	6681-8270	7.02	0.7?	87-90		
V410 TAU	10.69-11.22	333	6660-8271	1.872	0.99	86-90	0.33B	1.88
V819 TAU	12.25-12.44	61	8126-8270	5.60	0.94	90	0.19B	5.6
V827 TAU	12.09-12.30	26	8135-8163	3.75	0.97	90	0.19B	3.75
V830 TAU	13.10-13.30	58	8123-8270	2.75	0.97	90	0.20B	2.75

Notes:

* the detailed information on SR-9, Haro 1-1, 1-14, and V2058 Oph is in Berdnikov et al. (1991), VY Tau in Grankin et al. (1991), DF, DG Tau in Shevchenko (1986).

** periods from published data referenced by Bouvier (1989), SR 12 : in Berdnikov et al. (1991) period is 10.2 with a low possibility.

DF Tau : in 1978-1983 rotational modulation due to a hot spot was present. The spot disappeared after 1984. In 1985-1990 the periodicity is shown in a low possibility $7.1 < P < 8.3$

DG Tau : see DF Tau. A hot spot disappeared after 1982. There is a 455-day cycle too. In 1986-1990 the possible period is $8.3 < P < 16.7$ days.

GI Tau : one can see 7.0-7.5 day period against a very complex irregular variability.

V410 Tau : very stable period 1.872 during 1986-1990.

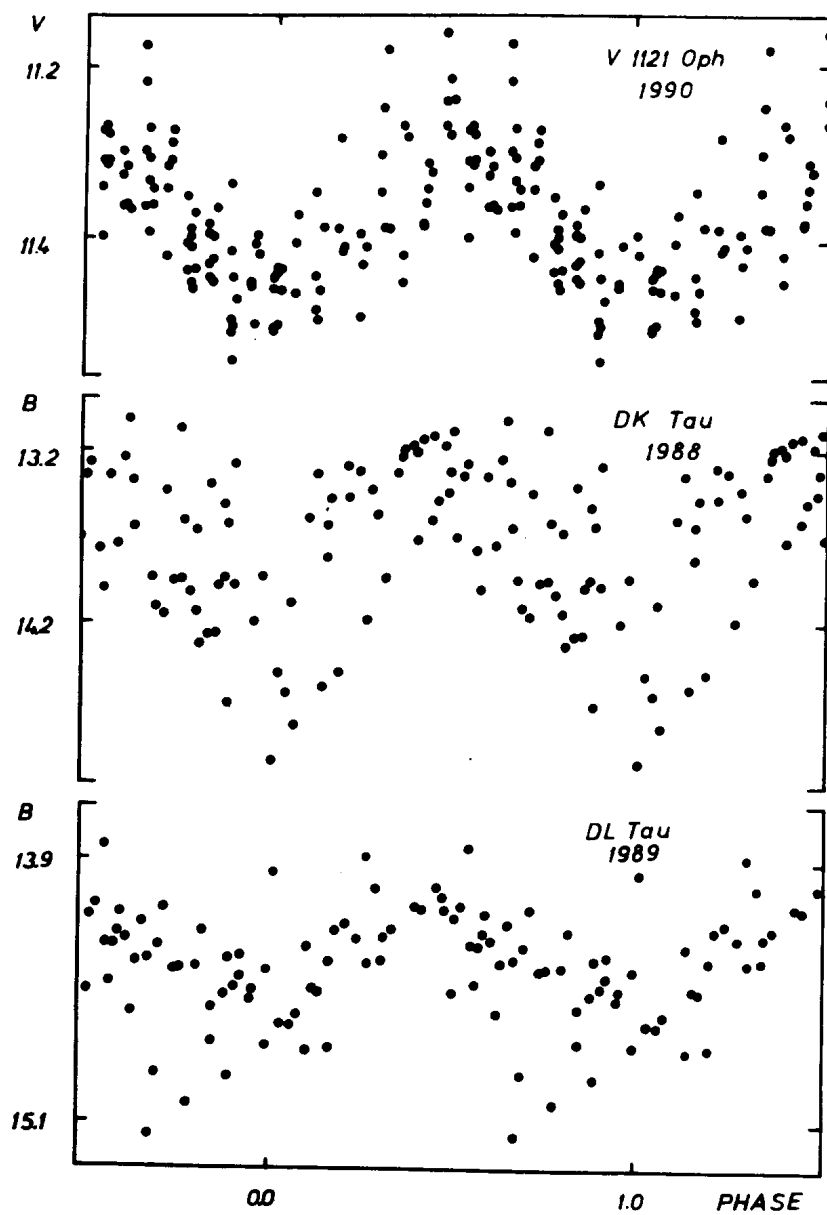


Figure 1. The folded light curve for V1121 Oph ($P=8.5$ days), DK Tau ($P=8.2$ days) and DL Tau ($P=9.4$ days).

We refine and confirm periods recently discovered for 11 T Tau stars. The period of the rotational modulation for DF Tau due to a hot spot was discovered by Shevchenko (1986) and for the second time by Bertout et al. (1988).

Figure 1 shows summary light curves for three T Tau stars of our program. Their periods were found by the authors.

Though the observational data for 9 T Tau stars: RY, CI, CQ, DE, DR, DS, GK, HN, HP Tau are representative enough, we failed in attempting to find any periodicity in their light curves. For four more stars in TDC the periods may be suspected with a low possibility but in this case some difficulties appear with an irregular variability. On the other hand the periodicity may be of a different scale.

As we noticed recently (Berdnikov et al. 1991) the assumption of spotted rotating stars may meet with difficulties.

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References:

- Berdnikov L.N., Grankin K.N., Chernyshev A.V. et al., 1991, Pisma v Astron. Zh., 17, 1, 50.
Bertout C., Basri G., Bouvier J., 1988, Astrophys. J., 330, 350.
Bouvier J., 1989, Pre-publ. Inst. d'Astrophys. de Paris, N 294.
Bouvier J., Bertout C., Benz W., Mayor M., 1986, Astron. Astrophys., 165, 110.
Grankin K.N., Ibragimov M.A., Melnikov S. Ju., et al., 1991, IBVS, No. 3627.
Herbst W., Booth J.F., Koret D.L. et al., 1987, Astron. J., 94, 137.
Marple, Jr. S.L., 1987, Digital spectral analysis, Prentice-Hall New Jersey.
Rydgren A.E., Vrba F.J., 1983, Astrophys. J., 267, 191.
Shevchenko V.S., 1986, in "Flare Stars and Related Objects", ed. Mirzoyan L.V., Yerevan, p.230.
Vrba F.J., Rydgren A.E., Chugainov P.F. et al., 1984, Bull. Am. Astron. Soc., 16, 998.

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

Number 3653

Konkoly Observatory
Budapest
26 August 1991
HU ISSN 0374 - 0676

Evidence for AL Comae Berenices being a Magnetic Cataclysmic Variable

AL Com was originally suspected of being a supernova based on its large outburst amplitude; being near 9 magnitudes. Recently, it has been shown (see refs below) to be a cataclysmic variable (CV), and a likely candidate member of one of the magnetic subclasses.

During April 1987 (Howell and Szkody 1988) the light curve of AL Com showed nearly equal 0.4 mag peak-to-peak modulations with a clearly defined period of 40 ± 1 min. Two years later (Szkody and Howell 1989), the star was observed again at higher time resolution. Period analysis of these data revealed a similar period of 42 ± 1 min, but also showed strong harmonics at 21 and 10.5 minutes. Mukai *et al.* (1990) obtained spectroscopy of AL Com which showed strong Balmer emission lines, thus ruling out the possibility of AL Com being a double degenerate with a short orbital period. It was suggested, based on these results, that AL Com was a likely member of the DQ Her subclass of CVs, with the ~ 40 min period having a likely origin as the spin period of the white dwarf.

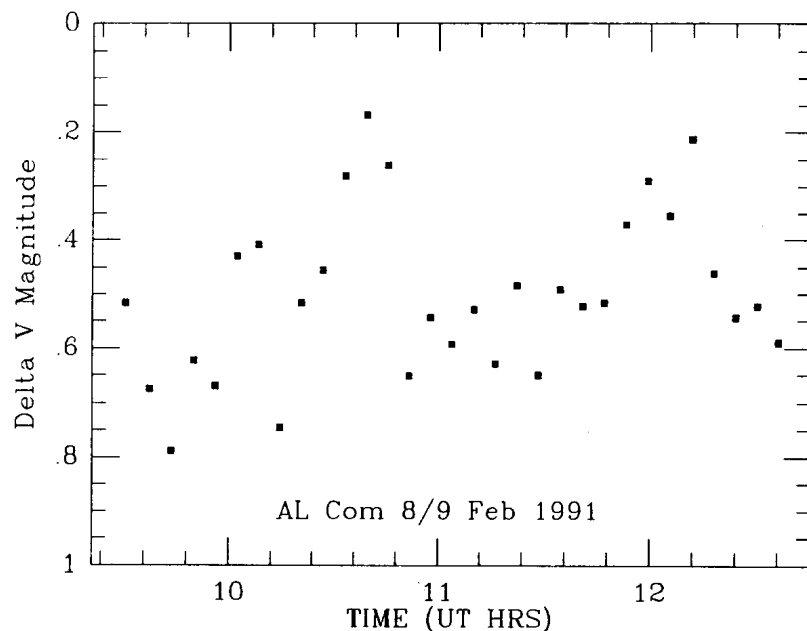


Figure 1

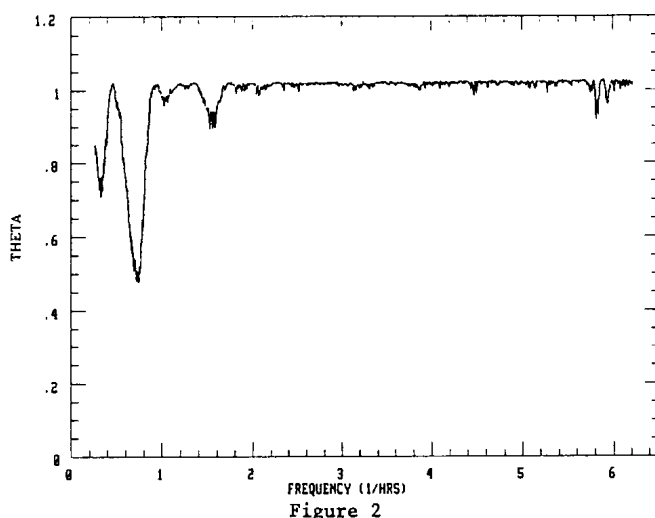


Figure 2

New data obtained by us in Feb. 1991 (when AL Com was 0.6 mags brighter in V than our previous data), showed a different light curve. The 0.4 mag modulation was present but at a period of 84 min, which is exactly twice that previously seen. The power spectrum shows only this single strong period, with only a very weak indication of any period near 40 min and no other harmonics. Since the spin period usually dominates in the optical, we cannot reconcile these observations with a DQ Her type system (i.e., $P_{\text{orb}}^{-1} = P_{\text{spin}}^{-1} - P_{\text{beat}}^{-1}$), unless AL Com sometimes shows a beat period of 42 min that dominates over a spin period of 28 min for the white dwarf.

We believe a better interpretation is that AL Com has switched from two previous active accretion areas to one current active area; behavior often seen in AM Her stars. These types of binaries have strongly magnetic white dwarfs which are in synchronous rotation with the secondary and show episodes during which one or both of the accretion poles are active. X-ray observations are needed to completely confirm our hypothesis.

We feel that the progression of the light curve over the past 5 years and the appearance of a single strong period at 84 minutes, twice that previously seen, provides strong evidence for a magnetic nature for AL Com.

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References:

- Howell S.B. and Szkody P., 1988, *PASP*, **100**, 224
Szkody P. and Howell S.B., 1989, *PASP*, **101**, 899
Mukai K. *et al.*, 1990 *MNRAS*, **245**, 385.

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

Number 3654

Konkoly Observatory
Budapest
29 August 1991
HU ISSN 0374 - 0676

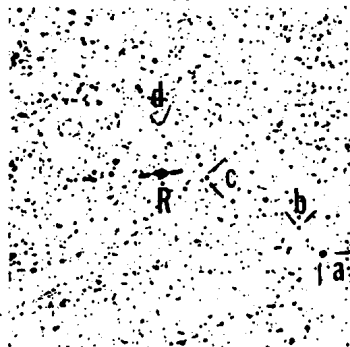
V3821 Sgr AND A NEARBY CARBON STAR

It has been shown that large errors do exist in the published positions of some Variable stars (Carlos Lopez, 1989). W. Bidelman of the Warner and Swasey Observatory pointed out that a carbon star No. 4007 in Stephenson's catalog (1989) had published positions that were very close to the variable V3821 Sgr. A question therefore arose as to whether or not these were one and the same star. The variable is listed in the fourth edition of **The General Catalogue of Variable Stars** as an eclipsing binary of the Algol type. This star was discovered by Dorrit Hoffleit at Harvard around 1935.

Measurements by Christopher Predom and Robert

**Table I. New Positions for Carbon Star No. 4007
and Several Variable Stars.**

Star	(1950)	Remarks
4007	18 23 27.9829 - 22 06 02.535	vis. mag 10.0
	27.7 07	
V3821 Sgr	18 23 22.5560 - 22 06 10.304	13.7-14.6 pg, EA
	24. 06.2	IBVS 660 chart 75c.
V2548 Sgr	18 23 26.5685 - 22 04 03.761	14.5-16.4 pg, SR 159d.
	28 04.1	IBVS 660 chart 82.
NSV 10781	18 23 07.6399 - 22 08 18.519	12.8-13.9 pg
	09 08.3	IBVS 660 chart 75a.
NSV 10782	18 23 10.7336 - 22 07 34.840	14.0-14.5 pg
	11 07.5	IBVS 660 chart 75b.
NSV 10784	18 23 17.2117 - 22 13 55.811	14.4-15.1 pg
	18 14.8	IBVS 660 chart 79.



Finder Chart, Approx. 10' x 10'

North at top

R. Carbon star 4007

a. NSV 10781

b. NSV 10782

c. V3821 Sgr

d. V2548 Sgr

DeMartino on a yellow plate confirmed the position of the carbon star and showed another star in the position of the variable, 76 arc seconds to its west. The identity of the carbon star was established from a marked finder chart supplied by D.J. MacConnell, one of the original investigators of this object. Dr. Hoffleit then checked her original records and visited Harvard Observatory in order to ascertain which star was actually the variable. The carbon star and the variable are in fact two different stars. The plates she had surveyed showed no significant variation of the carbon star. On examination of 230 Harvard plates taken between 1924 and 1951, and another 130 plates at the Maria Mitchell Observatory taken between 1957 and 1962, Dr. Hoffleit had found a total of 16 minima from which she determined the following provisional light element:

$$JD(\min) = 2427239.548 + 0.7503986 n$$

Many more plates are now available at the Maria Mitchell Observatory. Under the direction of Dr. E.P. Belserene, a summer student will determine a more definitive period and light curve.

The new positions we have recorded for the

variable, the carbon star, and a few other nearby variables are shown in Table I. The first line is the new position, the second shows the old coordinates.

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REFERENCES

- Hansen, O.L. and Blanco, V.M. 1975, *Ast. Jour.*, **80**, 1011, star 20482.
- Hoffleit, D. 1972, *Inform. Bull. Var. Stars*, No. 660.
- Hoffleit, D. et. al. 1991, *Journ. Amer. Assoc. Var. Star Obs.* **3**, No. 2.
- Lopez, C.E. 1989, *Journ. Amer. Assoc. Var. Star Obs.* **18**, No. 2.
- Lopez, C.E., Girard, T.M. 1990, *Publications of the Astronomical Society of the Pacific*, **102**, No. 655.
- Stephenson, C.B. 1989, *Pub. Warner and Swasey Obs.* **3**, No. 2.

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

Number 3655

Konkoly Observatory
Budapest
29 August 1991
HU ISSN 0374 - 0676

The photometric variability of the B9p star HD 137509

Cowley & Houk (1975) first pointed out the interesting nature of the B9pSiCrFe star HD 137509 (= CPD -70° 2069 = SAO 257290) which exhibits very strong Cr II, Fe II and Ti II lines in its spectrum. This star was introduced in photometric programs, but it was only recently that its variability was reported on the basis of 10 *UBV* measurements (Lodén & Sundman 1989). Simultaneously Mathys (1991) discovered a strong reversing longitudinal magnetic field, and he noted that the spectrum of HD 137509 undergoes fast and spectacular variations. Most magnetic Bp stars are known to be photometric variables, but the spectropolarimetric observations reported by Mathys (1991) revives our interest for this star. This star should indeed have quite large surface chemical inhomogeneities, and furthermore its two magnetic poles are visible during a whole rotation cycle, which is the most favourable circumstance for surface mapping. Before any further study of the spectrum variations, we need to determine precisely the rotation period. This could be done most efficiently with new photometric observations. At the moment the 9 measurements of the longitudinal magnetic field recorded by Mathys are too few to derive safely a period, but they will be quite useful to avoid spurious periods or to remove ambiguities between different values coming out from the photometry alone.

In March and April 1991, we got 36 new measurements of HD 137509 in the Geneva seven-color photometric system with the photometer P7 attached to the 0.7 m Swiss telescope located at La Silla (Chile). They were reduced in the general reduction frame at Geneva Observatory. The accuracy of the data for several nights appears to be somewhat

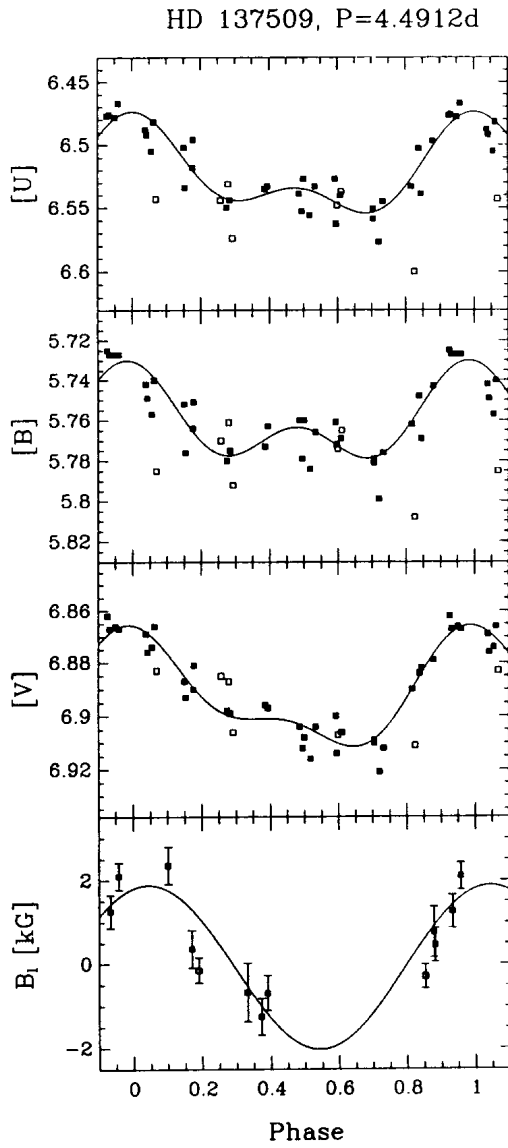


Figure 1: Photometric and longitudinal magnetic field variations of HD 137509. The phase origin is HJD 2448344.575. Open squares are data excluded from the period analysis and from the least-squares fits (low weight photometric data or polarimetric data of Bohlender & Landstreet).

lower due to poor weather and to the very southern declination of the star. Accordingly low weights were assigned to these measurements. We discarded for further analysis only the measurements with a null weight (7 measurements).

HD 137509 undergoes quite large variations for a magnetic Bp star, with $\Delta U \simeq 0.1$ mag and $\Delta V \simeq 0.05$ mag. The phase dispersion method (Stellingwerf 1978) and Renson's (1978) θ_1 test were applied separately to U , B and V magnitudes to determine the period P . Then least-squares fits of the observations were computed with a modified Newton method, assuming that the model function is a sine wave and its first harmonic. The ultimate accuracy on the period P was achieved by slightly varying P and looking for the minimum of the least-squares fit standard deviation for the three magnitudes. The best period coming out from the photometry is $P = 4.5568$ days, but this value is not supported by the magnetic data. Other possible values of the period from the photometry alone are 4.491, 4.505 and 4.594 days. The only one that satisfactorily represents the magnetic variations is:

$$P = 4.4912 \pm 0.0010 \text{ days}$$

which is adopted as the rotation period of HD 137509. A minimum of U occurred at HJD 2448344.575. Two more polarimetric measurements (Bohlender & Landstreet, private communication) support our period, as well as data on the crossover effect derived from the spectropolarimetry (Mathys, in preparation). The figure shows the photometric and the magnetic variations, and the least-squares fits with the adopted period.

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References

- COWLEY, A.P., HOUK, N.: 1975, PASP 87, 527
 LODÉN, L.O., SUNDMAN, A.: 1989, J. Astrophys. Astron. 10, 183
 MATHYS, G.: 1991, A&AS 89, 121
 RENSON, P.: 1978, A&A 63, 125
 STELLINGWERF, R.F.: 1978, ApJ 224, 953

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

Number 3656

Konkoly Observatory
Budapest
4 September 1991
HU ISSN 0374 - 0676

PHOTOMETRIC OBSERVATIONS OF THE CLOSE BINARY

DH CEPHEI

DH Cep (BD+57° 2607, HD 215835) is an early type (O5-6 V), massive, double-lined spectroscopic binary with the orbital period equal to 2.11 days. In 1949 Pearce determined spectrographically the orbital eccentricity of the star as equal to 0.127. He also suggested a fast apsidal motion of the system. These reasons made that the star was included into a programme of photometry of the stars with apsidal motion conducted by the author in early sixties. The lack of other photometric observations required as reference for check of the apsidal motion and also some incompleteness of the obtained light curve discouraged the author from publishing the observations in those old times. As in the meantime some other photometric observations of the star were obtained (Lines et al., 1986) it is perhaps worthwhile to publish also the old ones that could serve for comparison in future investigation of the object.

The photoelectric observations of DH Cep were carried out in the period between June 25 and October 23, 1963 in the Crimean Astrophysical Observatory with a 20-cm (MTM-200) telescope equipped with one channel photoelectric photometer with the V (GG 11) filter. The photometry was differential. The star BD+56° 2865 (HD 215923) was used as the comparison.

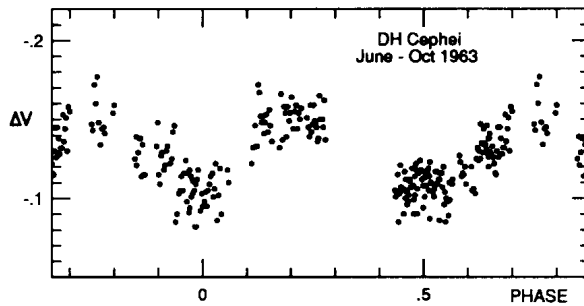


Figure 1. The light curve of DH Cep obtained in 1963.

Fig. 1 presents the light curve of DH Cep. ΔV denotes the difference of the instrumental V magnitudes between the variable and comparison stars. The phase was calculated using the ephemeris:

$$\text{HJD Min} = 2438272.358 + 2.11104 E.$$

The period in the ephemeris is the spectrographic period of Pearce (1949), while the epoch was determined on the basis of the present observations.

The light curve resembles in outline the light curves of DH Cep obtained 22 years later by Lines et al. (1986). Like the observations of those authors also the 1963 light curve does not show any evidence of the periastron motion. The two minima also appear about one half period apart. It indicates (what was already suggested by Lines et al.) that the spectrographic eccentricity of Pearce must be spurious, unless the longitude of periastron is, both in 1963 as in 1985, equal to 90° or 270° . In that case the apsidal motion period might be 22 or 44 years.

Fig. 1 shows also a slight difference in the shape of the two minima. Like in the Lines et al. observations the minimum

at 0.0P appears to be sharper and narrower than the minimum at 0.5P. Assuming that the corresponding minima in the two epochs (1963 and 1985) are due to the same geometric configuration in relation to observer, we can try to determine a photometric period of DH Cep. The values closest to the Pearce value are 2.11093 and 2.11149 days. Additional photometric observations are needed to obtain a real value of period.

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References:

- Lines, H. C., Lines, R. D., Guinan, E. F., and Robinson, C. R.
1986, Inf. Bull. Var. Stars, No. 2932.
Pearce, J. A., 1949, Astron. J., 54, 135.

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

Number 3657

Konkoly Observatory
 Budapest
 9 September 1991

HU ISSN 0374 - 0676

SOME ADDITIONAL DATA ON THE NEW SHORT-PERIOD VARIABLE IN NGC 7142

Recently, Crinklaw & Talbert (1991; =CT) reported on results of a survey for short-period variables in the open cluster NGC 7142. Due to its apparent similarity in both age and morphology to NGC 188, NGC 7142 might have turned out to be a rewarding objective particularly with respect to W UMa stars, since NGC 188 is overabundant in such variables. However, out of 432 stars with $V \leq 18.0$, only one was found to be variable. Unfortunately, there were insufficient observations of this star to classify its variable type, although the data presented appeared to be consistent with those of an eclipse. The above authors suggested further observations of this star.

For some time past, we are engaged in research work in the neighborhood of NGC 7142 and have 5 V and 4 B Tautenburg Schmidt plates at our disposal. From these plates, by iris photometry, we determined the brightness of the star using standards close to it taken from CT. The accuracy of our data is about ± 0.05 in B and V; they are listed in Table 1 together with CT's values. The light curve, again with inclusion of CT's data, is presented in Figure 1.

On the basis of our graphical and tabular material, we can confirm that the star in question obviously is a short-period variable. See Figure 2 for a finding chart and coordinates.

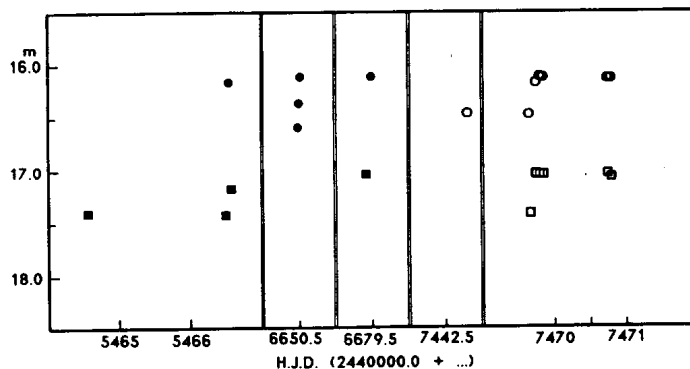


Figure 1. Light curve for the variable star. Circles indicate V-magnitude measurements, squares are B-magnitude values. Filled symbols are our data; open symbols are data taken from Crinklaw and Talbert (1991)

Table 1. Photometry of the variable star.
Above dashed line: Our data. Below:
data from Crinklaw & Talbert (1991)

H.J.D.	V	H.J.D.	B
5466.5487	16.16	5464.5570	17.40
6650.4841	16.59	5466.5043	17.42
6650.5022	16.36	5466.5865	17.17
6650.5216	16.11	6679.4169	17.04
6679.4946	16.11		

7442.8104	16.463	7469.6625	17.408
7469.6410	16.472	7469.7410	17.036
7469.7354	16.172	7469.7910	17.040
7469.7861	16.111	7469.8438	17.039
7469.8382	16.123	7470.7410	17.034
7470.7361	16.130	7470.7938	17.067
7470.7888	16.130		



Figure 2: Finding chart for the variable (1950: $21^h43^m44^s$, $+65^\circ30'08''$; $\pm 10''$), reproduced from a red-sensitive Kiso plate

In particular, we note:

- i) our maximum brightnesses fit well with those of CT in both B and V (17^m04 and 16^m11 , respectively);
- ii) the faintest value is $V = 16^m59$, lower by 0^m12 than CT's minimum;
- iii) there are two sets consisting of three consecutive exposures respectively. With the - somewhat realistic - assumption that $V = 16^m6$ represents the actual (main?) minimum value, the full duration of the minimum would be about 1.5 to 2 hours.

Obviously, some further information on variability is hidden in the paper by VandenBerg and Heeringa (1970): based on 3 V and 4 B plates, they presented the following averaged brightness data for the star (no. 127): $V = 16^m24$, $B = 17^m02$. Therefore, in V a minimum seems to be partly included.

Apart from the reasoning above, on a low-dispersion (2600 Å at H_γ) Tautenburg Schmidt objective prism plate of moderate quality, the star appears to be of intermediate spectral type.

In short, we note that the variable might well be of W UMa type as originally suspected by CT, but a final conclusion can not be drawn unless further monitoring observations are available.

R.S. and R.W. want to express their thanks for allocation of observing time at the Karl Schwarzschild Observatory.

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References:

- Crinklaw, G., & Talbert, F.D. 1991, PASP, 103, 536
VandenBergh, S., & Heeringa, R. 1970, A&A, 9, 209

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

Number 3658

Konkoly Observatory
Budapest
11 September 1991
HU ISSN 0374 - 0676

THE DISCOVERY OF 5.37 DAY PERIODICITY OF VY Tau

Herbig (1977) was the first to pay attention to the large amplitude eruptive variable VY Tau. He suggested that spectral and photometric variations of the star were close to those of EX Lup stars. According to Meinunger (1969, 1971) in 1969-1971 VY Tau showed at least 9 large-scale light increases and declines with amplitudes amounting to 4 mag. Not less than 5 such large-scale eruptions similar to U Gem outbursts were recorded in 1928-1959, the most important one with the amplitude near 5 mag being observed in 1941. Stone (1983) started UBV-photoelectric monitoring of the star in 1971 just immediately after the last light increase, but since 1972 he has failed in attempting to record any large-scale changes.

Our observations of VY Tau have been made at the Mt. Maidanak 60-cm Zeiss telescope with UBVR(I) pulse counting photometer since 1980. The limits of the light variations, average colours and number of observations are listed in Table 1. Variations in the V light level are shown in Figure 1. Stone's photoelectric observations and our ones together provide strong evidence that VY Tau did not show any large light changes and kept a deep minimum ($B = 15.1$ mag) in a time interval as long as 18 years. The previous longest quiet period was observed in 1928-1941.

To search for a periodic component in light variability, our observations made in 1987-1990 were analysed by methods of digital spectral analysis (Berdnikov et al., 1991, Grankin et al., 1991). The analysis yields a period of 5.37 days. Average light curves with the period in BVR are plotted in Figure 2. We emphasize the distinction of the light curves in different filters. The dispersion in the light curves is much larger than observational errors (0.03B, 0.02V, 0.012R). The dispersion is the least in R, where the periodic process is the most distinct. At the same time the amplitudes of the periodic

process are about equal for each filter. The dispersion in the average curves increases sharply near their minima in V and B. In addition, one can often see an excessive flux $+0.1 > B > +0.3$ along the whole light curve.

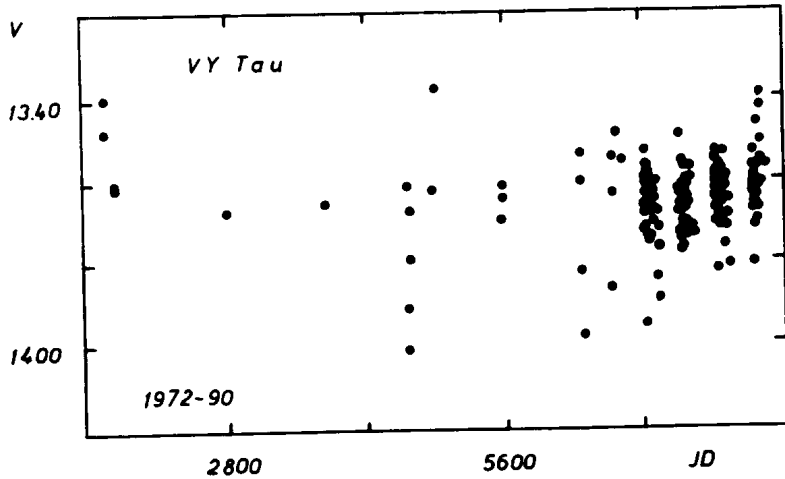


Fig.1. The light curve of VY Tau.

Table 1. Photometric data

J.D. 2400000+	n	V _{max}	V _{min}	<V>	<U-B>	<B-V>	<V-R>
44612 - 44643	6	13.62	14.02	13.841	1.26	1.55	1.50
44845 - 44936	11	13.21	13.82	13.785	0.82	1.43	1.58
45261 - 45302	4	13.34	13.75	13.683	1.22	1.55	1.47
45559 - 45613	4	13.40	13.65	13.526		1.40	1.59
46702 - 46798	5	13.49	13.64	13.557	0.93	1.55	1.43
47020 - 47173	43	13.54	13.77	13.535	0.83	1.47	1.49
47384 - 47537	58	13.56	13.78	13.665	1.08	1.48	1.45
47744 - 47887	60	13.54	13.82	13.649	1.12	1.49	1.47
48130 - 48265	42	13.40	13.72	13.610	0.77	1.47	1.46

Figure 3 shows the B-R colour changes as a function of the brightness in B for VY Tau (dots). This dependence is represented by the line labelled (1). The periodic component of variability may in principle be caused by rotation of the star with hot and cool spots. If the temperature of the star changed when its radius remained constant, its position on

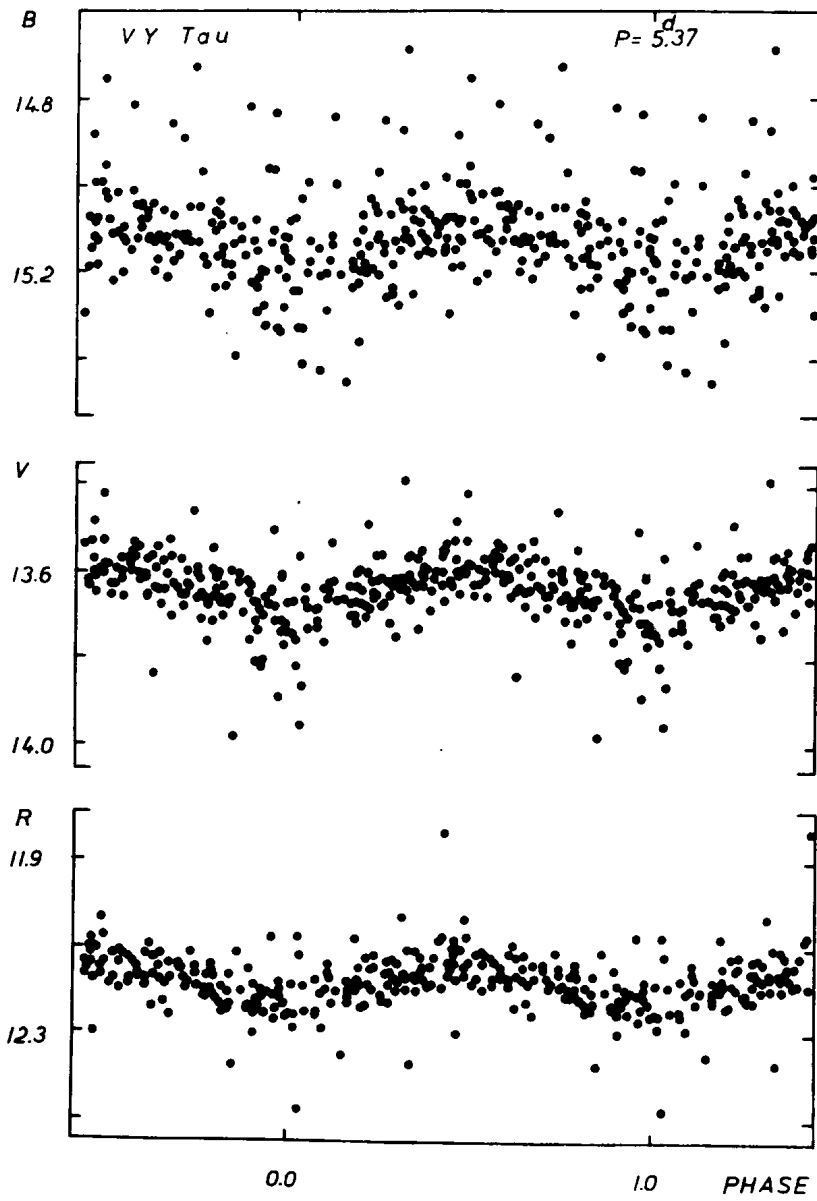


Figure 2. The folded light curves of VY Tau in BVR - bands.

the $B-(B-R)$ diagram would move along (2). But it is curious that the spots did not change appreciably their location and area during 4 yrs observations. For comparison the line of increasing interstellar reddening with a similar slope is also shown (3). The periodic component may also be caused by changing opacity in the star shell by the law of the absorption similar to the normal one (3). Accidental light variations in B may be transients due to flares. The interpretation of the colour changes (1) in Figure 3 presents the greatest difficulties. The increase of the dispersion near the folded light curve minima in Figure 2 may be interpreted with the aid of "quasialgol" BO Cep hypothesis (Grankin et al., 1991). In 1990 the light curve shows a small light rise and perhaps the quiet long period is to be finished.

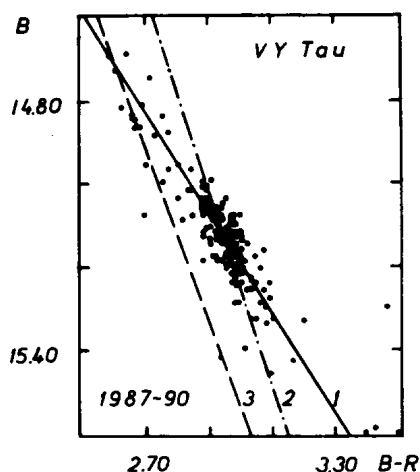


Fig.3. The $B-V$ colour changes of VY Tau

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References:

- Berdnikov L.N., Grankin K.N., Chernyshev A.V. et al., 1991, *Pisma v Astron. Zh.*, **17**, 1, 50.
Grankin K.N., Ibragimov M.A., Melnikov S.Ju., et al., 1991, *IBVS*, No. 3627.
Herbig G.H., 1977, *Astrophys. J.*, **217**, 693.
Meinunger L., 1969, *Mitt. Ver. Sterne*, **5**, 47.
Meinunger L., 1971, *Mitt. Ver. Sterne*, **5**, 173.
Stone R.S., 1983, *IBVS*, No. 2380.

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

Number 3659

Konkoly Observatory
Budapest
12 September 1991
HU ISSN 0374 - 0676

LSS1160 (=CD-44°4834) : A REDDENED β LYRAE SYSTEM

A programme is currently nearing completion at the South African Astronomical Observatory (SAAO) to obtain photoelectric photometry (uvby β /VRI/JHK) for the 'reddened' and 'extremely reddened' stars from the "Luminous Stars in the Southern Milky Way" Catalogue (Stephenson & Sanduleak 1971). Star LSS1160 was found to be variable and was subsequently discovered to be in the New Catalogue of Suspected Variables (NSV4260, Kukarkin et al 1982) and to be a Bamberg variable star (BV1200, Strohmeier & Patterson, 1969) although the type of variability was not known. We have monitored the star in the Johnson UBV system during 1989-91 and it appears to be a β Lyrae type eclipsing system.

LSS1160 was observed with two other stars from the same catalogue to serve as local comparisons; LSS1172 and LSS1184 are near LSS1160 on the sky and are both reddened OB stars, though not as reddened as LSS1160. All data were reduced to the E-region system of Cousins (see Menzies et al 1989) and the mean values for the comparison stars are given in Table 1. LSS1184 shows larger standard deviations in V than the fainter star LSS1172 and the difference between the two seasons 1989-90 and 1990-91 is quite large; it is possibly variable and the V magnitude values were not used to correct the LSS1160 data.

A dispersion minimisation program was used to find a period 4.2905 ± 0.0005 day and the corrected data are shown in Fig. 1, phased with this period. A provisional ephemeris is:

$$\text{HJD (primary min.)} = 2447866.096 + 4.2905 E$$

The continuously variable light curve, relatively long period and the early-type nature of the stars indicate the system is a β Lyrae type eclipsing binary.

Preliminary Strömgren photometry gives:

$(b-y) = 0.855$, $m_1 = -0.195$, $c_1 = 0.065$, $\beta = 2.578$,
however, there may remain transformation uncertainties in these

TABLE 1. UBV photometry of comparisons stars

		V	(B-V)	(U-B)	n
LSS1172	1989-90	9.436 ± 0.006	0.716 ± 0.004	-0.311 $\pm 0.006(\text{sd})$	25
	1990-91	9.437 5	0.719 7	-0.311 8	28
	adopted	9.437	0.717	-0.311	
LSS1184	1989-90	7.603 10	0.743 4	-0.289 6	23
	1990-91	7.581 19	0.742 7	-0.289 6	29
	adopted	var?	0.743	-0.289	

figures (particularly in c_1) because of the high interstellar reddening. Additionally, the $H\beta$ index is probably not a reliable indicator of absolute magnitude because the system is known to show $H\alpha$ emission (Münch 1955). The colours correspond to a spectral type near B0 reddened by $E(b-y)=0.95$ ($A_V = 4.09$) if the stars are main-sequence or giants (Crawford 1978). The $H\beta$ index is consistent with a B0 III star, so given that $H\beta$ could be affected by emission, the stars are unlikely to be more luminous than class III and could easily be less.

Low-dispersion spectroscopy (100 and 210 Å/mm) shows weak Balmer lines of hydrogen. HeI is very weak, though HeI4026 is present; HeII lines are not identified. A feature near H4101 might be SiIV4088 and there is some evidence for CIII/NIII near 4640-50Å. There is no compelling evidence for emission lines in the region 3400-5200Å but $H\alpha$ is very weak in the 210Å/mm spectrogram and is presumably partly filled by emission. Identification of all features (except those of hydrogen) is uncertain because of the low dispersion and rotation effects, but the above

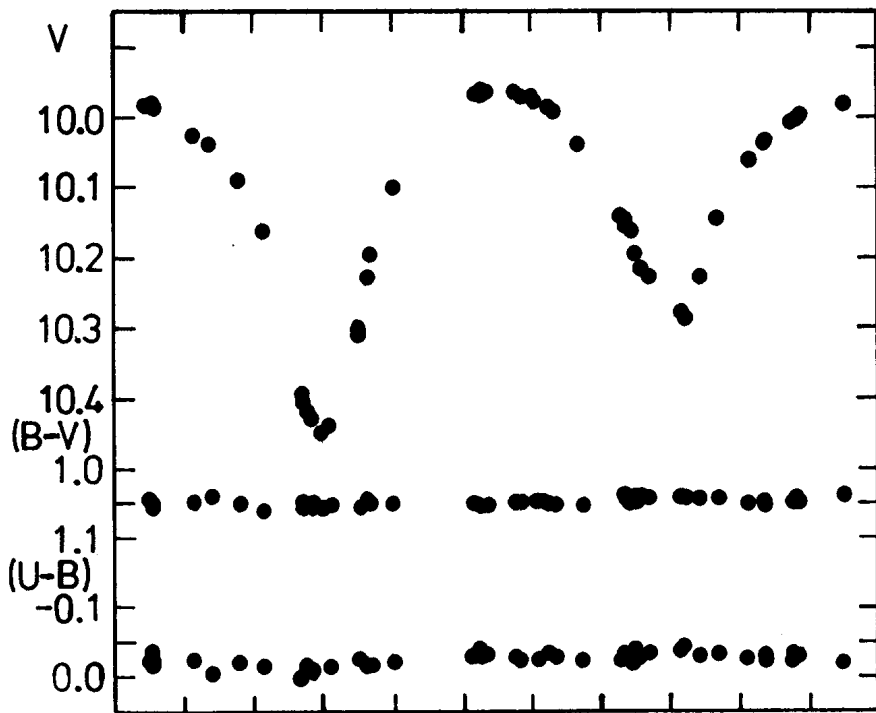


Figure 1. UVB photometry for L551160 phased according to the ephemeris given in the text.

notes are consistent with a type \sim B0 as suggested by the Strömgren colours.

Assuming the primary star to have $V=10.3$ (see Fig. 1) and a type B0, results in a distance of ~ 1 kpc for class V and ~ 1.7 kpc for class III. The observed reddening is then roughly consistent with the average found in Fitzgerald's region 'I' for distances greater than 1 kpc.

A programme of spectroscopy for radial velocity determination and more photometry is planned for early 1992.

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References

- Crawford, D.L., 1978. Astr. J., **83**, 48.
Fitzgerald, M.P., 1968. Astr. J., **73**, 983.
Kukarkin, B.V. et al., 1982. New Catalogue of Suspected Variable Stars. Moscow.
Menzies, J.W., Cousins, A.W.J., Banfield, R.M. & Laing, J.D., 1989. SAAO Circulars **13**, 1.
Münch, L., 1955. Bol. Obs. Tonantzintlay Tacubaya **2**, No.13, 28.
Stephenson, C.B. & Sanduleak, N., 1971. Publ. Warner & Swasey Obs. Vol **1**, No.1.
Strohmeier, W. & Patterson, I., 1969. Inf. Bull. Var. Stars, **330**.

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

Number 3660

Konkoly Observatory
Budapest
18 September 1991
HU ISSN 0374 - 0676

NEW MAXIMA OF THE HYDROGEN-DEFICIENT PULSATING STAR V652 Her
(BD+13°3224) AND A REVISED CUBIC EPHEMERIS

The hydrogen-deficient hot star V652 Her (=BD+13°3224) was discovered by Landolt (1975) to be variable and shown by Hill et al (1981) to be radially pulsating. Kilkenny & Lynas-Gray (1982, 1984) found that the period of the star was decreasing and then that the decrease rate was itself decreasing; the most recently published timings of maxima showed close agreement with the previous findings, namely that a cubic ephemeris is necessary to fit the observations (Kilkenny 1988). It seems likely that the decreasing period could be due to contraction of the star as it evolves from the zero-age horizontal-branch towards the helium main-sequence (Jeffery 1984) however, the change in the decrease rate has not been satisfactorily explained, nor is there a clear theoretical model for the pulsation (Saio 1986).

Because this remarkable, apparently unique star is likely to provide a stringent test of theories of stellar evolution and pulsation, we have continued to make timings of maxima. The results, listed in Table 1 were obtained from series of 30 sec integrations using various filters in conventional photoelectric photometers on the 0.5m and 1.0m telescopes of the South African Astronomical Observatory.

Combining the Table 1 results with those from Landolt (1975), Kilkenny & Lynas-Gray (1982, 1984) and Kilkenny (1988) and solving a cubic equation:

$$HJD_{\max} = T_0 + nP_0 + n^2k_1 + n^3k_2$$

we obtain the coefficients:

$$\begin{aligned}T_0 &= 244\,2216.80406 \pm 0.00035 \\P_0 &= 0.107\,992\,733 \pm 0.000\,000\,049 \\k_1 &= (-44.553 \pm 0.021) \times 10^{-10} \\k_2 &= (+2.958 \pm 0.024) \times 10^{-15}\end{aligned}$$

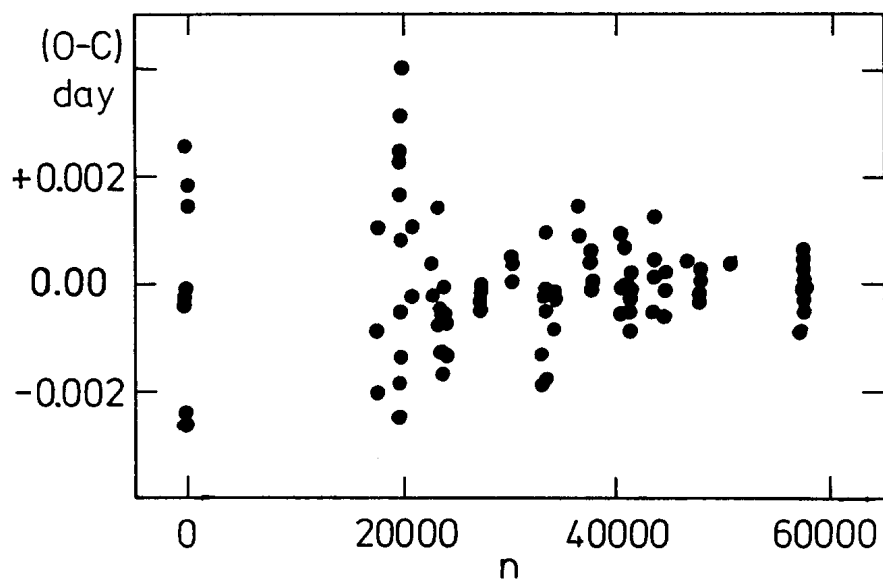


Figure 1. (O-C) diagram for published maxima of V652 Her, including the Table I results and using the ephemeris derived in this paper. The abscissa is cycle number.

Table I. New timings of maxima of V652 Her

HJD	n	tel.	filter	
244 7270.555	46885	1.0m	V	1988
7354.2605	47663	1.0	V	
7354.368	47664	1.0	V	
7384.2775	47942	1.0	V	
7385.246	47951	1.0	V	
7675.4835	50649	1.0	y	1989
8363.623	57048	0.5	B	1991
8365.559	57066	0.5	B	
8368.569	57094	0.5	B	
8371.5795	57122	0.5	B	
8374.5885	57150	0.5	B	
8376.5245	57168	0.5	B	
8403.510	57419	0.5	B	
8406.4125	57446	0.5	B	
8409.4225	57474	0.5	B	
8410.4975	57484	0.5	B	

from 98 observations of maxima. The errors are the formal errors from the least squares cubic fit to the timings of maxima. The (O-C) residuals for the above ephemeris are shown in Fig. 1.

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References:

- Hill, P.W., Kilkenney, D., Schönberner, D. & Walker, H.J., 1981.
Mon. Not. R. astr. Soc., **197**, 81.
Jeffery, C.S., 1984. Mon. Not. R. astr. Soc., **210**, 731.
Kilkenney, D., 1988. Mon. Not. R. astr. Soc., **232**, 377.
Kilkenney, D. & Lynas-Gray, A.E., 1982. Mon. Not. R. astr. Soc.,
198, 873.
Kilkenney, D. & Lynas-Gray, A.E., 1984. Mon. Not. R. astr. Soc.,
208, 673.
Landolt, A.U., 1975. Astrophys. J., **196**, 789.
Saio, H., 1986. IAU Colloq. No. **87**, 425.

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

Number 3661

Konkoly Observatory
 Budapest
 20 September 1991
 HU ISSN 0374 - 0676

1989, 1990 PHOTOELECTRIC LIGHT CURVES OF RT And

The star RT And has been classified by Hall (1976) as an object of the "Short-Period Group" with properties similar to the RS CVn.

Photometric observations for this star have been reported previously by several investigators listed by Dapergolas et al. (1988).

The star was observed photoelectrically for a total of 10 nights with the 1.2m Kryonerion telescope from October 3, 1989 to August 29, 1990 using a single channel photon counting photometer described by Dapergolas and Korakitis (1987). The photometer employs a high gain 9789QB phototube and UVB conventional filters. Its output is fed directly to a microcomputer enabling rapid data access.

The data reduction method is the standard one. Comparison and check stars are the BD +52° 3384 and BD +52° 3377 respectively and the accuracy of the observations presented here is ± 0.015 mag for V, B and ± 0.025 for U.

Table I lists the dates of observations and phases covered.

The derived light curves for U, B, V colours are illustrated in Figures 1, 2, 3. Dots are for the year 1990 and crosses for 1989.

Table I

DATE	PHASE
3 Oct. 1989	.88 - .07
6 Oct. 1989	.43 - .82
7 Oct. 1989	.12 - .44
21 Aug. 1990	.94 - .12
22 Aug. 1990	.30 - .71
25 Aug. 1990	.02 - .48
26 Aug. 1990	.65 - .07
27 Aug. 1990	.61 - .67
28 Aug. 1990	.79 - .19
29 Aug. 1990	.43 - .85

In Table II the times of minima and the O-C values are listed for the V, B and U bands respectively. Times of minima are calculated using the method described by Kwee and van Woerden (1956) whereas the O-C values were determined from the linear ephemeris

$$T = 2441141.88902 + 0.^d628929513.E$$

given by Kholopov, (1982).

Our light curves show asymmetry in the secondary minima that gets larger in short wavelengths, and different for the two observed periods 1989 and 1990.

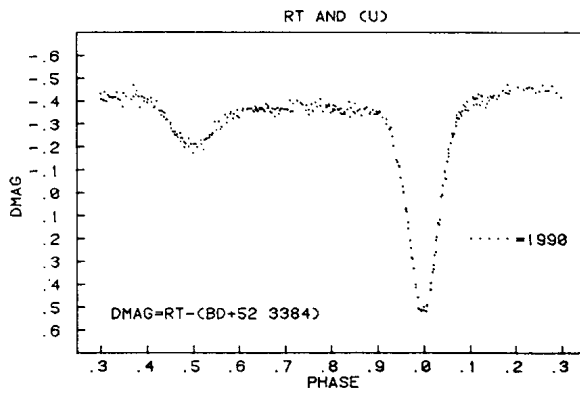


Figure 1

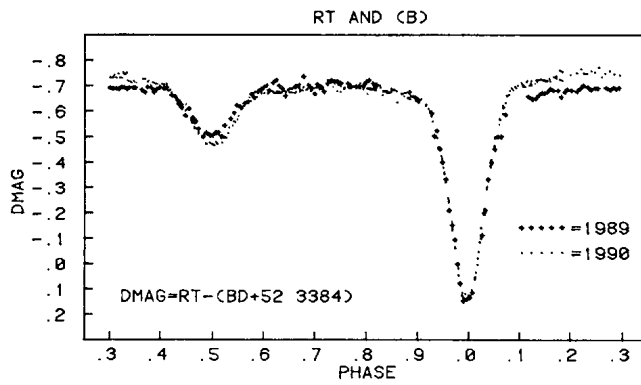


Figure 2

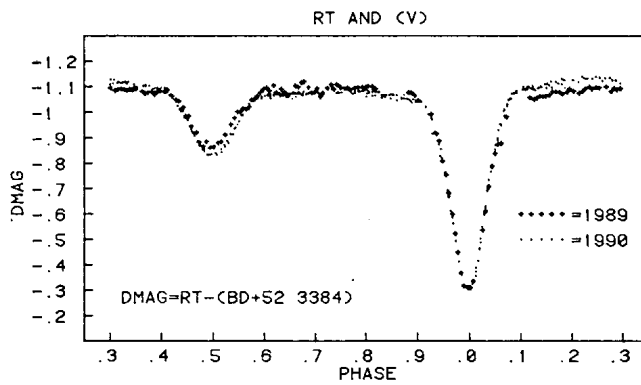


Figure 3

Table II

V COLOUR			B COLOUR			U COLOUR		
Type	Heliocen.	(O-C)	Heliocen.	(O-C)		Heliocen.	(O-C)	
	Jul. Day	phase	Jul. Day	phase		Jul. Day	phase	
	2440000+		2440000.+			2440000.+		
I	7803.5094	0.998	7803.5094	0.998	-----	-----		
	±0.0001		±0.0002					
II	7806.3389	0.497	7806.3404	0.500	-----	-----		
	±0.0005		±0.0003					
I	8125.5203	0.997	8125.5204	0.997	8125.5201	0.997		
	±0.0001		±0.0001		±0.0001			
II	8126.4662	0.501	8126.4665	0.501	8126.4643	0.498		
	±0.0001		±0.0002		±0.0008			
I	8130.5517	0.997	8130.5519	0.997	8130.5519	0.997		
	±0.0001		±0.0001		±0.0001			
I	8132.4386	0.997	8132.4386	0.997	8132.4386	0.997		
	±0.0001		±0.0001		±0.0001			
II	8133.3832	0.499	8133.3856	0.503	8133.3858	0.503		
	±0.0003		±0.0003		±0.0004			

The variability in the levels of maxima noticed previously by Mancuso et al. (1979) and Dapergolas et al. (1988) it is present here as it can be seen in Figures 2 and 3. This is due to a photospheric activity of the system, Gordon et al. (1990), probably attributed to the presence of a spotted region.

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References:

- Dapergolas, A., Korakitis, R.: 1987, Publ. Nat. Obs. of Athens, Ser. II, N28.
Dapergolas, A., Kontizas, E., Kontizas, M.: 1988, I.B.V.S., No.3267.
Gordon, S., Hall, M., Ledlow, M., Mann, E. and Zeilik, M.: 1990, I.B.V.S., No.3469.
Hall, D.S.: 1976, in: "Multiple Periodic Variable Stars", Proc. IAU Coll. No.29, ed. W.S. Fitch, Akademai Kiado, Vol.1.
Kholopov, P.N.: 1982, "General Catalogue of Variable Stars", IVth edition, vol. I, p103.
Kwee, K.K., van Woerden, H.: 1956, Bull. Astr. Inst. Netherlands, 12, 327.
Mancuso, S., Milano, L. and Russo, G.: 1979, Astron. Astrophys. Suppl. Ser., 36, 415.

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

Number 3662

Konkoly Observatory
Budapest
20 September 1991
HU ISSN 0374 - 0676

PHOTOELECTRIC MINIMA OF THE ECLIPSING BINARY XY BOOTIS

The variability of XY Boo (BD+20°2874) was discovered by Hoffmeister (1935). It was found by Tsesevich (1950) that the system belonged to the W UMa type. The system was observed photoelectrically at the Yunnan Observatory in yellow and blue colours using a 60 cm reflector telescope and a photoelectric photometer equipped with an EMI 8256B photomultiplier tube and Johnson's standard B, V filters. The integrations were controlled by a microcomputer.

Integration of each observation is twenty seconds. The comparison and check stars are the same as that used by Binnendijk (1971).

Five minima and the values of E and O-C obtained in both B and V filters for XY Boo are listed as follows:

JD.Hel.	Min.	Filter	E	O-C
2448334.3320	II	V	21439.5	0.1390
.3319		B		0.1389
2448335.2623	I	V	21442	0.1433
.2624		B		0.1434
2448336.3700	I	V	21445	0.1390
.3704		B		0.1394
2448363.2365	II	V	21517.5	0.1404
.2360		B		0.1399
2448364.1655	I	V	21520	0.1435
.1660		B		0.1440

The O-C values were calculated using Binnendijk's ephemeris (1971):

$$\text{JD.Hel.Min.I} = 2440389.7321 + 0.37055251 \text{ E.}$$

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References:

Binnendijk, L.: 1971, Astron.J. 76, 923.
Hoffmeister, C.: 1935, Astron. Nachr. 255, 401.
Tsesevich, V.P.: 1950, Astron. Circ. Kasan (No.100), 18.

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

Number 3663

Konkoly Observatory
Budapest
23 September 1991
HU ISSN 0374 - 0676

1991 BVR PHOTOMETRY OF CG CYGNI

We are continuing our long-term program of photometry of chromospherically-active, short-period binary stars with a new epoch for CG Cygni (= BD +34°4217 = #142 in the catalog of Strassmeier *et al.* [1988]). Our earlier observations in 1989 (Beckert *et al.*, 1989 and Beckert *et al.*, 1991) showed peculiar, short-term, small-amplitude fluctuations imposed upon the eclipsing light curve and maculation wave. Such irregularities outside of eclipse are visible also in the 1990 BV light curves of Dapergolas *et al.* (1991) and those from 1989 (Dapergolas *et al.*, 1989).

We carried out our observations with the 61-cm telescope at Capilla Peak Observatory equipped with a Photometrics CCD camera (Laubscher *et al.*, 1988). We used this system as a multichannel photometer to sample sky, variable, and the comparison star simultaneously. Our filter set (Beckert and Newberry, 1989) is matched to Johnson at B and V and Kron-Cousins at R. Typical exposures were 15-20 seconds at R, 30-40 seconds at V, and 60-70 seconds at B. These provided a typical S/N of about 400. Our comparison star is Yü's (1923) star (a), not BD +34°4216 used by single-channel observers. The observations were made on the nights of June 8, 18, 21, 24, and 27, 1991 (UT).

Figures 1-3 show the delta magnitudes in the instrumental system, which are very close to standard magnitudes. Figure 4 shows a 2-spot information optimization limit (Budding and Zeilik, 1987) fit to the distortion wave at V-band. We have assumed $T_1 = 5300$ K, $T_2 = 4600$ K, and $i = 82.8^\circ$ to make these fits with black ($T = 0$ K) spotted regions. The derived starspot parameters were: longitude = $46^\circ \pm 14^\circ$, radius = $5.6^\circ \pm 1.4^\circ$ for spot #1 and longitude = $238^\circ \pm 11^\circ$, radius = $6.9^\circ \pm 1.3^\circ$ for spot #2. Both spots were fixed at a latitude of 45° .

CG Cygni Instrumental B-Band
June 1991 - Capilla

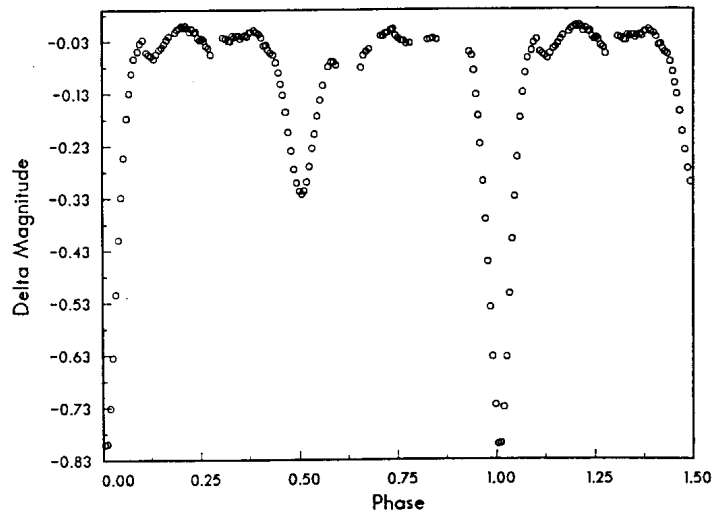


Figure 1

CG Cygni Instrumental V-Band
June 1991 - Capilla

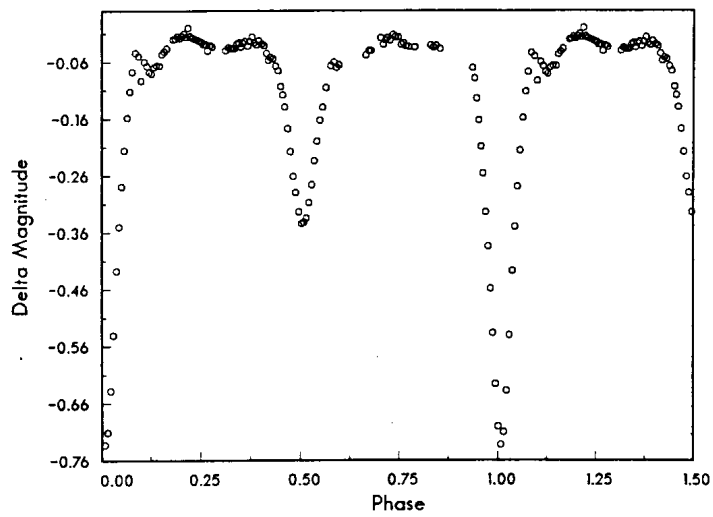


Figure 2

CG Cygni Instrumental R-Band
June 1991 - Capilla

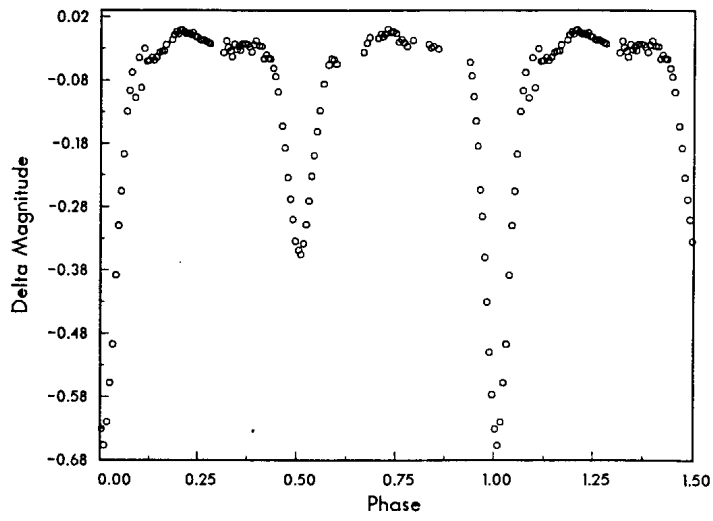


Figure 3

CG Cygni V-Band
2 Spot Fit

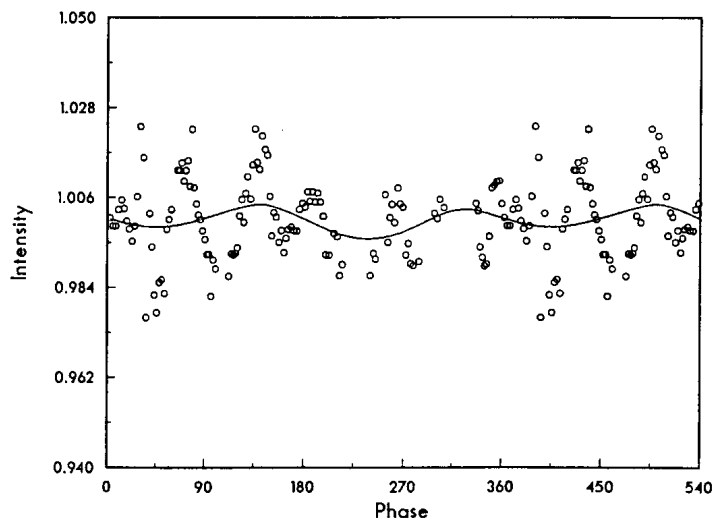


Figure 4

The short-term fluctuations are clearly visible again at all wavelengths. (We carefully monitored a subset of the instrumental magnitudes of the comparison star; they did not show any periodic variations. We were also careful to keep the star images on the same pixels from night to night.) About five peaks are visible in the data at B-band; they are roughly equally-spaced in phase. This gives an approximate period of 3 hours. The features are unlikely caused by very small spots, for their amplitudes are too large and widths too narrow for black, circular spots on either component. We are hard pressed to come up with a physical explanation; gaseous matter between the components would not explain the periodic nature of the effect.

This research was supported in part by National Science Foundation Grant AST-8901374 to MZ.

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References:

- Beckert, D.C. and Newberry, M.V., 1989, *Pub. Astron. Soc. Pac.*, **101**, 849.
Beckert, D., Cox D., Gordon, S., Ledlow, M., and Zeilik, M., 1989, *Inf. Bull. Var. Stars*, No. 3398.
Beckert, D., Gordon, S., Jaderlund, E., Mann, E., and Zeilik, M., 1991, *Inf. Bull. Var. Stars*, No. 3556.
Budding, E., and Zeilik, M., 1987, *Astrophys. J.*, **319**, 827.
Dapergolas, A., Kontizas, E., and Kontizas, M., 1989, *Inf. Bull. Var. Stars*, No. 3322.
Dapergolas, A., Kontizas, E., and Kontizas, M., 1991, *Inf. Bull. Var. Stars*, No. 3609.
Heckert, P.A. and Zeilik, M., 1989, *Inf. Bull. Var. Stars*, No. 3294.
Laubscher, B.E., Gregory, S., Bauer, T.J., Zeilik, M., and Burns, J.O., 1988, *Pub. Astron. Soc. Pac.*, **110**, 131.
Strassmeier, K.G., Hall, D.S., Zeilik, M., Nelson, E., Eker, Z., and Fekel, F.C., 1988, *Astron. Astrophys. Suppl. Ser.*, **72**, 291.
Yü, C.-S., 1923, *Astrophys. J.*, **58**, 75.

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

Number 3664

Konkoly Observatory
Budapest
23 September 1991
HU ISSN 0374 - 0676

Z APODIS IS A PULSATING - NOT A CATAclysmic - VARIABLE STAR

Z Apodis is described in the Fourth Edition of the GCVS as a cataclysmic variable of the Z Cam type (UGZ), and possibly an eclipsing binary. In the earlier third edition it had been described as a long period (L) star. None of these descriptions appear to be correct.

This star was measured photo-electrically on 57 occasions at Auckland Observatory using the 50cm Edith Winstone Blackwell telescope and standard UBV filters, during the period 1975 to 1983. Because it was faint and appeared relatively uninteresting, observations then ceased.

The light curves and period are similar to a cepheid, although more symmetrical than normal. When a complete cycle is plotted on the U-B,B-V diagram this resemblance continues. The large colour changes, compared to the low amplitude, do not indicate a binary system. The 1975 observations are best fitted by a period of 18.89 days, which appears to have persisted up to the beginning of the second data set. The observations of 1977 to 1981 are best fitted by a longer period of 18.975 days and an epoch of JD 2443239.05.

We are puzzled by its reclassification. There is no photometric evidence of a hot star in the system. Even allowing for the possibility of substantial reddening the colours are unusually red for a CV. When more than one observation was made on a night there was no evidence of variations greater than ± 0.03 magnitudes in V. The pulsation period is typical of a giant star, very rare for CVs. We have not observed any of the normal features of a CV on Z Apodis.

The observations are shown in Figures 1 and 2. The U-B light curve is very noisy, but shows no suppression of amplitude indicating a blue companion. We cannot exclude a red companion star, but there is no evidence for such an object. The amplitude of variation appears greater in the 1977 - 81 data. Two observations in 1983 appear as crosses. The amplitude or the period

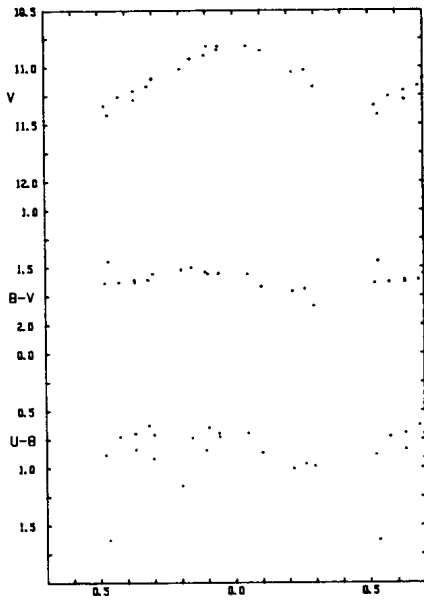


Figure 1 Z AP0015 J D 2442422 - 2442623

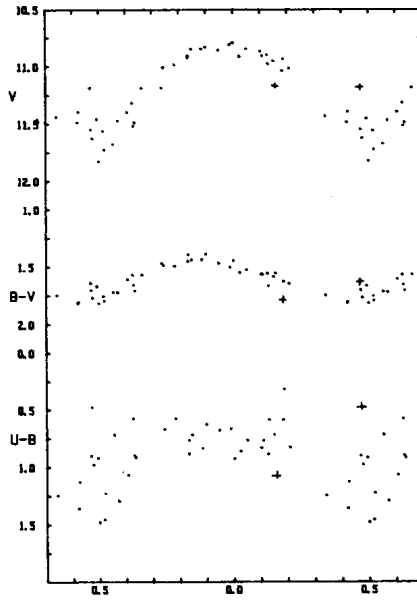


Figure 2 Z AP0015 J D 2443255 - 2445518

has changed again. The period is either erratic, or is changing quickly. Unfortunately, we have not measured the star since 1983.

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

Number 3665

Konkoly Observatory
Budapest
25 September 1991
HU ISSN 0374 - 0676

The optical behaviour of the old nova RR Pictoris in 1985/86

We present spectroscopic and photometric observations of the old nova RR Pic obtained in Febr. 1985 and March 1986 at the ESO Observatory La Silla/Chile. Spectroscopy was performed at the 1.5 m telescope equipped with the Boller & Chivens spectrograph and the IDS whereas the 50 cm telescope with the standard single-channel photometer was used for UBVRI photometry. In total 55 spectra and 923 UBVRI measurements were collected. Tables 1 and 2 give details of the observations.

The spectra cover the wavelength region $\lambda\lambda$ 4500 - 6900 Å (114 Å/mm) and $\lambda\lambda$ 3700 - 7200 Å (172 Å/mm) and have a resolution of about 7 Å and 10 Å respectively. The most pronounced features are the emission lines of HeII λ 4686 Å and H α . Radial velocities of these lines were determined and folded with the photometric period given by Vogt (1975). Fig.1 shows the resulting radial velocity curve for the HeII line which indicates $K \approx 120$ km/s and $\gamma \approx -30$ km/s. Similar values were also derived from the H α measurements. Wyckoff and Wehinger (1977) found the same amplitude and phasing but a different systemic velocity (+40 km/s) from their HeII radial velocity curve. Both lines show a variable asymmetry through the orbital cycle: H α even exhibits a double-peaked structure with a tendency for the blue component to be stronger than the red one around phase 0.1 - 0.2 and vice versa around phase 0.7 (Fig.2). Onset and duration of this behaviour is, however, not strictly the same for each orbital cycle. The equivalent widths of both lines show a pronounced maximum near phase 0.5 - 0.6 and are then stronger by about a factor of 1.5 than around phase zero.

Warner (1986) noticed a disappearance of the strong double-humped shape of the light curve of RR Pic during the years 1972 - 1984 which seemed to be gradually replaced by the second of two minima as the dominant recurrent feature. Haefner and Metz (HM, 1982) recognized these minima as stable features in their light curves obtained in 1980. To elucidate the general behaviour of the present photometric data we examined average light curves covering several orbital cycles. A periodogram analysis revealed no change of Vogt's (1975) period of 0.1450255d. Therefore, the measurements of 1985 and 1986 were superimposed according to his elements respectively. Fig.3 presents a few of the resulting light curves. The characteristic 'W'-shape (HM) is still present though less pronounced in the 1986 data. The first minimum gradually disappears for longer wavelengths due to the growing extent of the principal maximum. The position of this minimum appears now to be shifted from phase ~ 0.43 (1980) to phase ~ 0.52 whereas the second minimum is still at the same position.

Table 1. Spectroscopy of RR Pic

Date	Start (UT)	Duration	Integr. Time (m)	No. of spect.	Disp. (Å/mm)
26 Feb 1985	0 ^h 40 ^m	5 ^h 31 ^m	16	17	114
27 Feb 1985	0 ^h 31 ^m	5 ^h 31 ^m	16	18	114
28 Feb 1985	4 ^h 52 ^m	1 ^h 22 ^m	12	6	172
13 Mar 1986	1 ^h 04 ^m	4 ^h 35 ^m	16	14	114

Table 2. Photometry of RR Pic

Date	Start (UT)	Duration	No. of UBVRI sets
18 Feb 1985	1 ^h 57 ^m	4 ^h 41 ^m	63
19 Feb 1985	1 ^h 16 ^m	5 ^h 21 ^m	77
21 Feb 1985	1 ^h 07 ^m	5 ^h 16 ^m	90
22 Feb 1985	1 ^h 02 ^m	5 ^h 31 ^m	103
24 Feb 1985	1 ^h 05 ^m	5 ^h 13 ^m	98
25 Feb 1985	0 ^h 59 ^m	5 ^h 31 ^m	109
13 Mar 1986	2 ^h 01 ^m	3 ^h 17 ^m	76
15 Mar 1986	0 ^h 27 ^m	4 ^h 49 ^m	115
17 Mar 1986	0 ^h 51 ^m	4 ^h 09 ^m	99
20 Mar 1986	0 ^h 39 ^m	4 ^h 05 ^m	93

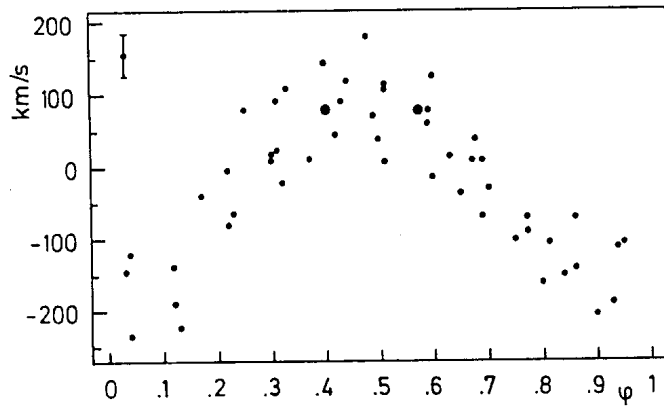


Fig.1 Radial velocity curve of RR Pic based on the HeII $\lambda 4686$ line. Phases are computed using Vogt's (1975) elements. Upper left: Estimated error of a single measurement.

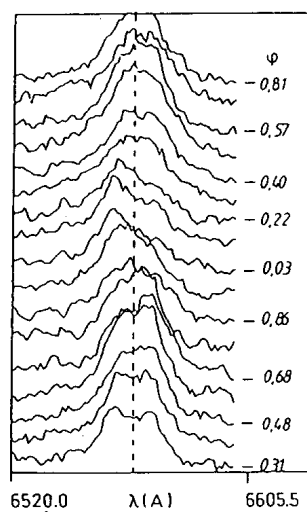


Fig.2 Profile changes of H α for the run of Febr. 26, 1985. Phases are indicated to the right.

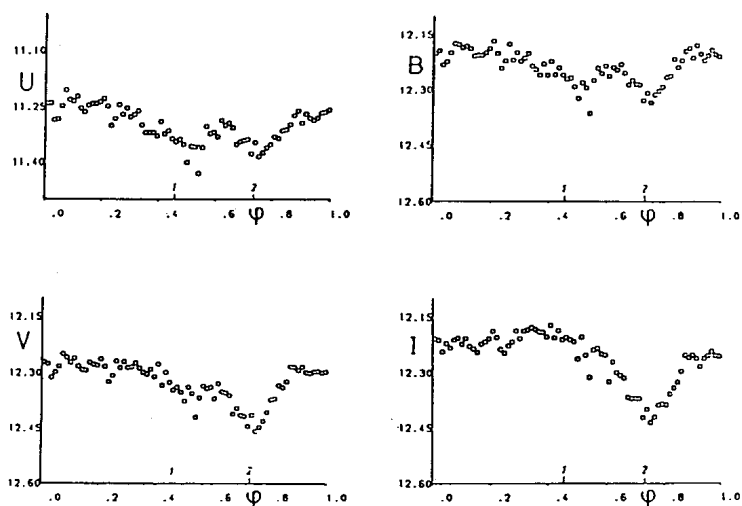


Fig.3 Average light curves (1985) of RR Pic (75 bins per period). The position of the first (1) and second (2) minimum according to HM are indicated. For further explanation see text.

Our new measurements confirm the phase relation between radial velocity curve and light curve given by HM which led to an unusual interpretation with respect to the energy distribution within the accretion disc of RR Pic. Since the system is barely detectable in the infrared (Feast and Glass, 1974) the wavelength dependent changes in the light curve can hardly be ascribed to the influence of the secondary. This behaviour as well as the shift of the first minimum is rather due to the energy distribution in the disc and its gradual variation. At the same time the overall brightness has remained at an almost constant value around $V \approx 12.25$ since ~ 1980 .

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REFERENCES:

- Feast, M.W., Glass, I.S.: 1974, *Mon. Not. R. astr. S.* **167**, 81
 Haefner, R., Metz, K.: 1982, *Astron. Astrophys.* **109**, 171
 Vogt, N.: 1975, *Astron. Astrophys.* **41**, 15
 Warner, B.: 1986, *Mon. Not. R. astr. S.* **219**, 751
 Wyckoff, S., Wehinger, P.A.: 1977, *IAU Coll. No. 42*, p. 81

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

Number 3666

Konkoly Observatory
Budapest
3 October 1991
HU ISSN 0374 - 0676

PHOTOELECTRIC LIGHT CURVES OF HU AURIGAE

The twelfth magnitude variable star HU Aur was first discovered at the Bamberg Observatory as BV 83 (Geyer et al. 1955), and subsequently observed by Filatov (1960) and Strohmeier et al. (1962). However, no photoelectric light curves have been reported so far. In the fourth edition of GCVS (Kholopov et al. 1985), the system is classified as EB/KE. The ephemeris for the primary minimum has been given by Strohmeier et al. (1962) as

$$\text{Min I} = \text{HJD } 2426707.370 + 1^{\text{d}}.408010 \text{ E.} \quad (1)$$

In 1989-1991 we performed photoelectric observations of the system with the 91-cm reflector at the Dodaira Station of the National Astronomical Observatory of Japan. The equipment employed is a multi-channel polarimetric photometer, whose detailed description is given by Kikuchi (1988). The nearby C1 and C2 (BD+34°897) stars in Figure 1 were chosen as the comparison stars.

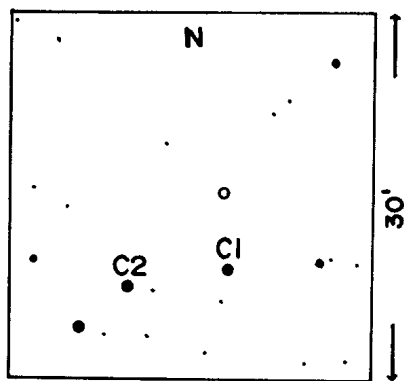


Figure 1. Finding chart of HU Aur. The variable HU Aur is represented by the open circle. The comparison stars are designated as C1 and C2.

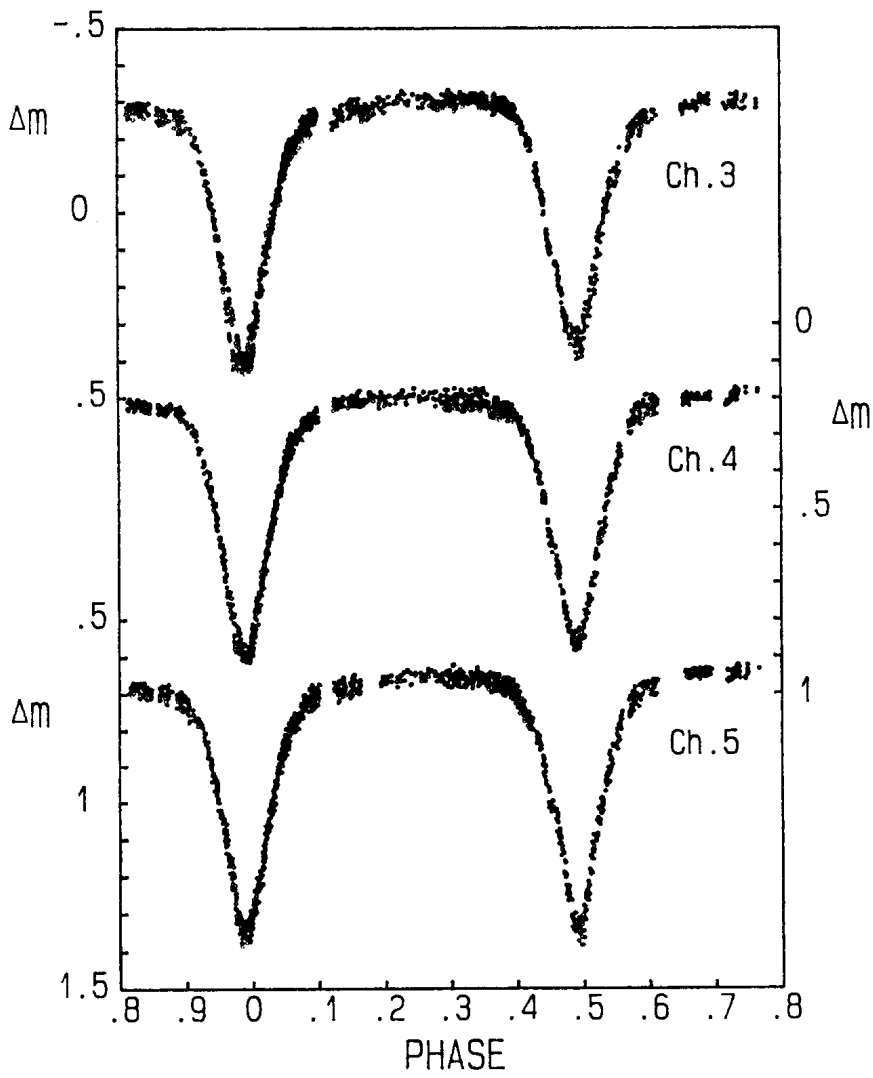


Figure 2. Light curves of HU Aur. The effective wavelengths of the channels 3, 4 and 5 are 460, 535 and 650 nm, respectively.

We have calculated the differential magnitudes of HU Aur with respect to C1, taking into account the differential magnitudes of C2 relative to C1. The light curves are shown in Figure 2 for some channels, where the orbital phases are calculated from the above ephemeris. As is seen in Figure 2, the depths of both minima are almost the same, as predicted by Strohmeier et al. (1962): the shape of the light curves are not EB-type. The colour of the system reveals that HU Aur is not so an early-type system. We have roughly estimated the spectral type of HU Aur to be middle to late F (at light maxima), comparing the colour of HU Aur with the colours of some standard stars taken with the same photometric system.

We caught primary minima twice in our observations, one on October 9 and the other on December 20 in 1989. The times of mid-eclipse have been estimated to be HJD 2447809.1997 (for October 9) and HJD 2447881.0090 (for December 20). According to the ephemeris (1), these yield the O-C values of $-0^d.0162$ ($E = 14987$) and $-0^d.0154$ ($E = 15038$), respectively.

Because the ephemeris (1) has been derived based on photographic observations, we recalculated the ephemeris including our photoelectric primary minima. Assigning weight 1 to photographic observations and 10 to photoelectric ones, we have obtained the following ephemeris,

$$\text{Min I} = \text{HJD } 2447809.199 \pm 6 + 1^d.4080103 \pm 8 \text{ E.} \quad (2)$$

In deriving this, we did not use the data for secondary minima, because it has been reported that these minima occurred slightly out of the mid-phase $0^P.5$ (Strohmeier et al. 1962). The O-C values of the observed primary minima are calculated from the new ephemeris (2) and listed in Table I.

The new orbital period is essentially the same as the old one. This indicates that there has been no period change since the observations by Strohmeier et al. (1962) and the system is probably a detached one, though there seem some indications of proximity effect in the light curves. Therefore, the classification KE in GCVS is surely not an appropriate one.

Table I
The O-C values of primary minima

Observed minima	E	O-C	Source
HJD 242 6707.332	-14987	-0.017	Strohmeier et al.
.353	-14987	+0.004	S
6987.567	-14788	+0.024	S
7397.358	-14497	+0.084	S
7449.379	-14460	+0.009	S
9168.526	-13239	-0.025	S
9175.527	-13234	-0.064	S
243 3157.410	-10406	-0.034	Filatov
3181.460	-10389	+0.080	F
3916.336	-9867	-0.026	F
5503.191	-8740	+0.002	F
5510.189	-8735	-0.040	F
5548.169	-8708	-0.077	F
6756.126	-7978	+0.033	F
6853.476	-7781	+0.005	F
7705.341	-7176	+0.024	Strohmeier et al.
244 7809.1997	0	+0.0006	Present work
7881.0090	51	+0.0014	Present work

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REFERENCES

- Filatov, G.S. 1960, *Astron. Tsirk.*, No.215, 20.
Geyer, E., Kippenhahn, R. & Strohmeier, W. 1955, *Kleine Veröff. Remeis-Sternw. Bamberg*, No.11.
Kikuchi S. 1988, *Tokyo Astron. Bull.*, 2nd ser., No.281.
Kholopov, P.N. et al. 1985, *General Catalogue of Variable Stars*, 4th ed., Vol.I (Nauka, Moscow).
Strohmeier, W., Knigge, R. & Ott, H. 1962, *Veröff. Remeis-Sternw. Bamberg*, 5, No.13.

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

Number 3667

Konkoly Observatory
Budapest
3 October 1991
HU ISSN 0374 - 0676

AN ENIGMATIC CLOSE BINARY V699 CYGNI

The eclipsing binary V699 Cyg (=OV25; $m=12.17-13.24$ pg; spectrum B2) was discovered to be a variable by Whitney (1952). The binary is situated in the region of Cyg OB1.

110 UBVR photoelectric observations were carried out with the 60 cm telescope during 1990/91 on Mt. Maidanak in Uzbekistan. As a comparison the star BD+38°3989 was chosen ($V=8^m.312$, $U-B=-0^m.50$, $B-V=0^m.325$, $V-R=0^m.239$).

According to our estimations the probable error of a single observation of V699 Cyg is $0^m.01$ in V; for $U-B=0^m.012$; for $B-V=0^m.007$ and for $V-R=0^m.012$. The results of our observations are presented in Figure 1 as V light and color curves. The phases have been calculated using the following ephemeris (Whitney, 1952):

$$\text{MinI} = \text{JDH}2432708.664 + 1^d.55152 \cdot E$$

The photographic observations (Whitney, 1952; Romano, 1969) of V699 Cyg are given in the lowest part of the Figure for comparison purposes. It shows a significant decrease of the amplitude of the primary minimum (A). Whitney gives $A=1^m.17\text{pg}$, Romano gives $A=0^m.5\text{pg}$, but we have got only $0^m.1\text{B}$. Whitney's observations were obtained between 1932 and 1950, those of Romano during 1951 - 1967. Comparing both authors' results we have to suppose a discontinuous decrease of the amplitude A.

Nowadays, a number of eclipsing systems is known to show an essential decrease of the variability amplitude. So, the minima of SS Lac disappeared (Zakirov, Azimov, 1990). Soderhjelm (1974, 1984) supposed that the change of the variability amplitude is due to the precession of the binary orbital plane by influence of the gravitational field of a distant component. In our case this hypothesis brings out two questions:

- 1) How to explain sudden the decrease in the amplitude A?
- 2) Why is the photoelectric minimum longer than the photographic one?

The photographic light curve of V699 Cyg was solved by Lavrov's direct method. We obtained the following photometric elements of the binary:

$$r_2/r_1 = 0.75 \quad (\text{fixed})$$

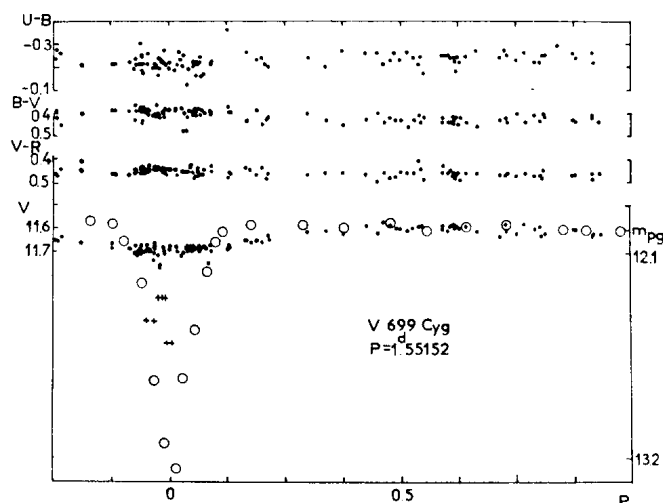


Figure 1. The light curves of V699 Cyg (o-Whitney; +-Romano; .-our).

$$r_1 = 0.333 \pm 0.006$$

$$L_1 = 1.00 \pm 0.01$$

$$i = 89.1^\circ \pm 2.7^\circ$$

If the primary is assumed to be a normal B2V star the nature of the secondary is not quite clear.

We suggest the following interpretation of the amplitude change in V699 Cyg. The massive and hot primary filled its Roche lobe. The secondary is a small cool star surrounded by a thick disk. The disk was formed from the matter of a massive primary. Now the process of the primary expansion is slowing down and the density of the disk decreased due to accretion. The present form of the disk is close to the previous one.

Our observations of V699 Cyg are continued.

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References:

- Romano, G.: 1969, Padova Publ. No.156, 1.
 Soderhjelm, S.: 1974, IBVS, No.885, 1.
 Soderhjelm, S.: 1984, AsAp., 141, No. 1, 232.
 Whitney, B.S.: 1952, AJ., 56, 206.
 Zakirov, M.M., Azimov, A.A.: 1990, IBVS, No.3487, 1.

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

Number 3668

Konkoly Observatory
Budapest
4 October 1991
HU ISSN 0374 - 0676

uvby OBSERVATIONS OF SV CEPHEI

The irregular variable SV Cephei (= BD + 72°1031 = IRAS 22205+7325) belongs to a group of evolutionarily young stars called emission-line stars of the Orion Population. Their properties are described in detail in the corresponding catalogue compiled by Herbig and Bell (1988). A comprehensive collection of observational data for SV Cephei can be found in a paper by Friedemann et al. (1992) together with a model of the circumstellar dust shell which gives a consistent explanation of both the optical and infrared data.

For SV Cephei and two nearby comparison stars we obtained uvby photometry with the 90 cm telescope of the Jena University Observatory. The observations were carried out on 14 nights from January to September 1991. On each night the atmospheric extinction coefficients and the zero points of the transformation equations were determined from a sample of about 15 standard stars. All of them were taken from the original list of uvby standards published by Crawford and Barnes (1970) including revisions by Perry et al. (1987). The two comparisons b and c in the paper by Friedemann et al. (1992) which contains an identification chart too, are identical with the comparison stars a and b in the list of Wenzel (1969). Both stars were measured on each night and finally taken as secondary local standards. Their magnitudes and colour indices together with its r.m.s. errors (in mag) and the number of observations are given in Table I.

Table I. Magnitudes of comparison stars

Star	y = V	r.m.s.	b-y	r.m.s.	m1	r.m.s.	c1	r.m.s.	n
b	10.734	0.006	0.248	0.005	0.151	0.006	0.956	0.006	15
c	11.107	0.008	0.437	0.006	0.124	0.009	0.727	0.008	24

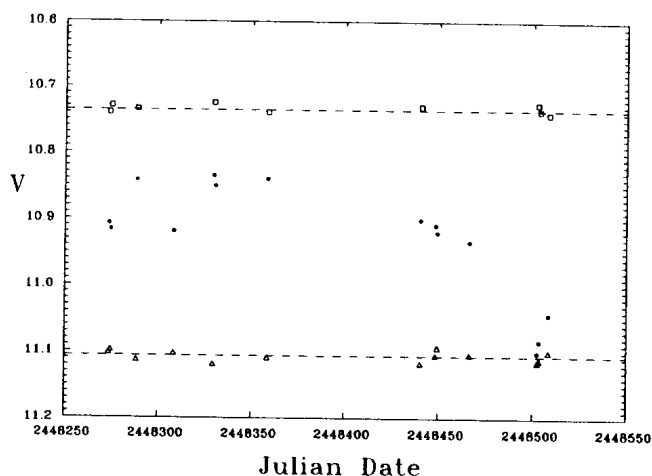
A full description of technical details of the used equipment, the reduction procedure, and the transformation equations is given by Reimann et al. (1989). The final photometric results for SV Cephei are collected in Table II. The r.m.s. errors of the photometric data for SV Cephei have been estimated to be ± 0.012 , ± 0.006 , ± 0.009 , and ± 0.013 mag in V, b-y, m1, and c1, respectively, using the internal agreement of the individual results for the comparison stars obtained in different nights.

Table II. Observations of SV Cephei = BD +72°1031

Julian date	y = V	b-y	m1	c1
2448273.454	10.907	0.257	0.071	1.085
2448274.407	10.916	0.267	0.070	1.084
2448288.375	10.842	0.259	0.054	1.032
2448308.377	10.919	0.265	0.076	1.087
2448329.455	10.835	0.270	0.035	1.031
2448330.425	10.851	0.284	0.038	1.020
2448358.527	10.840	0.279	0.046	1.046
2448440.468	10.901	0.303	0.042	1.031
2448448.430	10.909	0.304	0.034	1.033
2448449.405	10.920	0.291	0.058	1.048
2448466.515	10.934	0.294	0.060	1.055
2448502.504	11.101	0.293	0.109	1.106
2448503.512	11.084	0.312	0.103	1.100
2448508.411	11.044	0.290	0.097	1.076

During the time interval covered by our observations SV Cephei exhibited irregular variability only in the order of 0.3 mag with a shallow minimum around JD 2448502.5. From a closer

inspection of the colour indices we conclude that during the observed time interval intrinsic stellar colour and brightness changes of the order of 0.1 mag were superimposed on circumstellar cloud obscurations of the order of 0.3 mag of nearly neutral character. The light curve and the magnitudes of the comparison stars are shown in Figure 1.



Using the uvby calibrations by Crawford (1975, 1979) and Reimann (1982) for F, A, and B stars, respectively, we deduced for the variable from our observational data a spectral type of B9-9.5, a colour excess $E(b-y) = 0.300$ mag, and a photometric distance of about 715 pc assuming the luminosity class V.

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References:

- Crawford, D.L.: 1975, AJ 80, 955
Crawford, D.L.: 1979, AJ 84, 1858
Crawford, D.L. and Barnes, J.V.: 1970, AJ 75, 978
Friedemann, C., Reimann, H.-G., and Gürtler, J.: 1992, Astron. Astrophys. in press

- Herbig, G.H. and Bell, K.R.: 1988., Lick Obs. Bull. No. 1111
- Perry, C.L., Olsen, E.H. and Crawford, D.L.: 1987, PASP 99, 1184
- Reimann, H.-G.: 1982, PhD Thesis, Jena University
- Reimann, H.-G., Böhm, M., and Pfau W.: 1989, Astron. Nachr.
310, 41
- Wenzel, W.: 1969, Mitt. Veränd. Sterne, Sonneberg, 5, 75

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

Number 3669

Konkoly Observatory
Budapest
7 October 1991
HU ISSN 0374 - 0676

PERIOD CHANGES OF THE BRIGHT RR LYRAE STARS SU Dra AND VY Ser

Alerted by visual observers of the Berliner Arbeitsgemeinschaft für Veränderliche Sterne (BAV) we did some photoelectric photometry on the bright RRab stars SU Draconis and VY Serpentis in search of suspected changes in the primary periods. The telescope used was a 0.34 m Cassegrain, equipped with a 1P21 phototube. All measurements were done in V colour.

SU Dra was discussed in detail by Olah and Szeidl (10), who detected no major period changes, apart from some very small fluctuations, and published the elements:

$$JD \text{ hel. Max.} = 2420605.762 + 0.66041890 \cdot E \quad (\text{I})$$

Table 1 shows a collection of photoelectric maxima of SU Dra obtained since JD 2442000. O-C residuals (I) are given for the elements of Olah and Szeidl (10) and (II) for elements calculated by us on the method of least squares, namely:

$$JD \text{ hel. Max.} = 2448024.4013 + 0.66042153 \cdot E \quad (\text{II})$$

$\pm 17 \qquad \qquad \pm 28$

Table 1: Photoelectric maxima of SU Draconis.

JD hel.	O-C (I)	O-C (II)	Observer	Reference
2442403.5545	+0.0063	+0.0008		Olah and Szeidl (10)
42415.4444	+0.0086	+0.0032		Olah and Szeidl (10)
42454.4077	+0.0072	+0.0016		Olah and Szeidl (10)
42948.3975	+0.0037	-0.0039		Olah and Szeidl (10)
43204.6427	+0.0064	-0.0023		Olah and Szeidl (10)
45054.4846	+0.0149	-0.0011	Ag	Braune and Mundry (1)
46833.6643	+0.0261	+0.0030		Liu and Janes (8)
48024.4036	+0.0301	+0.0023	Gr	this paper
48127.4237	+0.0249	-0.0034	Gz/Wu	this paper

The newly established period clearly differs from Olah and Szeidl (10) and, compared with earlier observations, which are mentioned in a more detailed paper by Wunder (13), a major period increase seems to have occurred at around JD 2441000. The fourth edition of the GCVS (6) already lists a somewhat larger period ($P = 0.66042001$) than Olah and Szeidl (10) found, which nevertheless fails to represent recent observations.

Regarding VY Ser Table 2 lists all available photoelectric maxima of this RRab star.

Table 2: Photoelectric maxima of VY Serpentis.

JD hel.	O-C (I)	O-C (II)	Observer	Reference
2437411.531	-.005	+.007		Tremko (12)
38466.958	-.009	±.000		Fitch et al. (4)
39213.901	-.008	-.002		Fitch et al. (4)
39615.933	-.011	-.006		Stepien (11)
41443.309	-.001	-.002		Lub (9)
44738.869	+.016	+.005		Carney and Latham (2)
44764.566	+.006	-.006		Fernley et al. (3)
47307.4768	+.028	+.008	Ls/Sk/Wu	this paper
47653.798	+.014	-.007		Fernley et al. (3)
48356.4777	+.026	+.002	Wu	this paper

Ephemeris (I) refers to the elements of the fourth edition of the GCVS (7) :

$$\text{JD hel. Max.} = 2431225.341 + 0.71409384 \cdot E \quad (\text{I})$$

while O-C residuals (II) are based on the elements derived by us:

$$\text{JD hel. Max.} = 2448356.4756 + 0.71409615 \cdot E \quad (\text{II})$$

±31 ±33

Jones et al. (5) and Fernley et al. (3) also published new elements for VY Ser. Both differ significantly from our elements because of too few observations.

Including non-photoelectric maxima from JD 2415800 to JD 2437000, which are mentioned in a more detailed analysis by Wunder (13), it seems likely that the period variation is not due to an abrupt change, but is reflected by a continuous and slow increase of the period by 1.2 seconds per century. Also this is somewhat uncertain because of the high scatter of these observations, the process can be described by the formula:

$$\text{JD hel. Max.} = 2438873.2763 + 0.71409494 \cdot E + 1.38 \cdot 10^{-10} E^2$$

±17 ±14 ±10

Abbreviations of the observer's names:

Ag = F. Agerer	Gz = M. Garzarolli	Sk = S. Skaberna
Gr = R. Gröbel	Ls = G. Lichtschlag	Wu = E. Wunder

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References:

- (1) Braune, W., Mundry E., 1982, BAV-Mitteilungen, No.34
- (2) Carney, B.W., Latham, D.W., 1984, Astrophysical Journal 278, 241
- (3) Fernley, J.A. et al., 1990, Monthly Notices of the Royal Astr. Soc. 247, 287
- (4) Fitch, W.S., Wisniewski, W.Z., Johnson, H.L., 1966, Comm. Lunar and Planetary Laboratory 5, Part 2, No. 71
- (5) Jones, R.V., Carney, B.W., Latham, D.W., 1988, Astrophysical Journal 332, 206
- (6) Kholopov, P.N., Samus, N.N., Frolov, M.S., Goranskij, V.P., Gorynya, N.A., Kazarovets, E.V., Kireeva, N.N., Kukarkina, N.P., Kurochkin, N.E., Medvedeva, G.I., Perova, N.B., Rastorguev, A.S., Shugarov, S.Y., 1985, General Catalogue of Variable Stars, 4th Ed., Vol. II, Nauka, Moscow
- (7) Kholopov, P.N., Samus, N.N., Frolov, M.S., Goranskij, V.P., Gorynya, N.A., Karitskaya, E.A., Kazarovets, E.V., Kireeva, N.N., Kukarkina, N.P., Medvedeva, G.I., Pastukhova, E.N., Perova, N.B., Shugarov, S.Y., 1987, General Catalogue of Variable Stars, 4th Ed., Vol. III, Nauka, Moscow
- (8) Liu, T., Janes, K.A., 1989, Astrophys. Journal Suppl.Ser. 69, 594
- (9) Lub, J., 1977, Astron. Astrophys. Suppl. Ser. 29, 353
- (10) Olah, K., Szeidl B., 1978, Mitteilungen der Sternwarte Budapest-Szabadsaghegy, No. 71, 9
- (11) Stepień, K., 1972, Acta Astronomica 22, 175
- (12) Tremko, J., 1973, Contr. of the Astron. Obs. Skalnaté Pleso 5, 175
- (13) Wunder, E., 1991, BAV-Rundbrief 40, No.4, in print

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

Number 3670

Konkoly Observatory
Budapest
9 October 1991
HU ISSN 0374 - 0676

THE PHOTOMETRIC VARIABILITY OF KX ANDROMEDAE

Introduction. KX And (HD 218393) is a bright ($V = 6.9 - 7.1$), active Be star which shows remarkable variations in light, colour and spectrum; see Štefl et al. (1990) for a recent, comprehensive review. There are (i) short-term variations with a possible time scale of 0.35 day (Pavlovski and Ružič 1989) or 0.4716 and/or 4.8635 days (Stagg et al. 1988), due to pulsation or perhaps rotation; (ii) medium-term variations on a well-established time scale of 38.919 days (Štefl et al. 1990), which bear some resemblance to what is observed in strongly-interacting binaries; and (iii) long-term variations on time scales of months to years, due to the changing amount of gas in the circumstellar disc. In an effort to disentangle these variations, we have subjected a large body of existing photometric data to a simple form of period analysis.

Observations. The input data consisted of several hundred UBV observations made between 1974 and 1986, mostly at Hvar Observatory (Štefl et al. 1990), and several dozen BV observations made during the 1980's at the University of Toronto (Percy et al. 1988).

Analysis. The autocorrelation of the observations was studied on time intervals ("lags") of 0 to 2 days and 0 to 40 days. Each interval was divided into approximately 40 bins. All pairs of observations $((m_i, t_i), (m_j, t_j))$ for which $t_j - t_i$ fell in a given bin were averaged: $\langle |m_j - m_i| \rangle$, and the averages plotted against the time difference (Figures 1, 2). If the magnitude was periodic with period P , the curves would show minima of level σ (the observational scatter) at lags of 0, P , $2P$, $3P$ etc., and maxima of level $\sigma +$ about $1.2 \Delta m$ (Δm is the semi-amplitude) at lags of $0.5P$, $1.5P$, $2.5P$ etc.

Results. The results are shown in Figures 1 (V data) and 2 (U data); the results for the B data are very similar to those for the V data, indicating that variations of (B-V) colour are small. The 38.919-day variations are dominant. There is little or no evidence in Figures 1 and 2 (top panels) for maxima or minima corresponding to 0.35 day, 0.4716 day, or any other short period (except possibly ~ 1.2 days); the amplitude of any such short-term variability must be 0.02^m at most. The 38.919-day variations, on the other hand, show up clearly in Figures 1 and 2 (bottom panels). The maxima correspond to full amplitudes of 0.13^m in V, and 0.33^m in U, indicating that variations in (U-B) colour are large, in good agreement with the phase diagrams shown by Štefl et al. (1990). The rather unusual shape of the

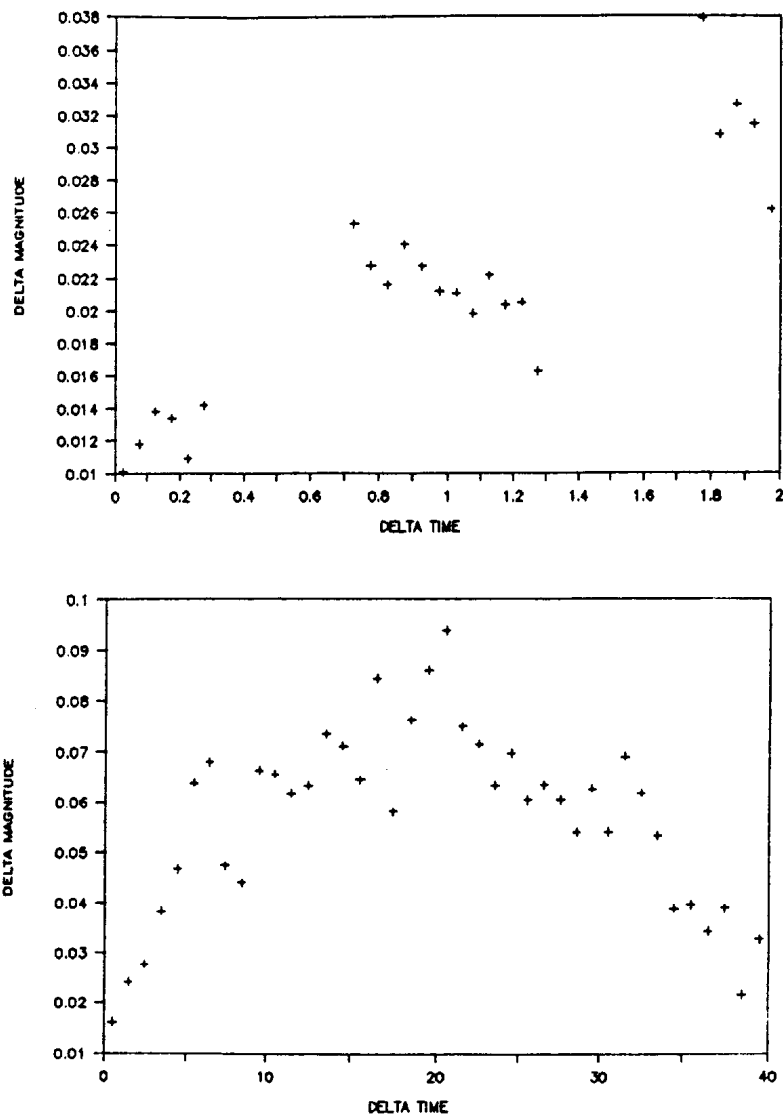


Figure 1. Autocorrelation diagram for V observations of KX And. Top panel: "lags" of 0 to 2 days; note the lack of clear maxima and minima. Bottom panel: "lags" of 0 to 40 days; note the maxima and minima corresponding to the 39-day period.

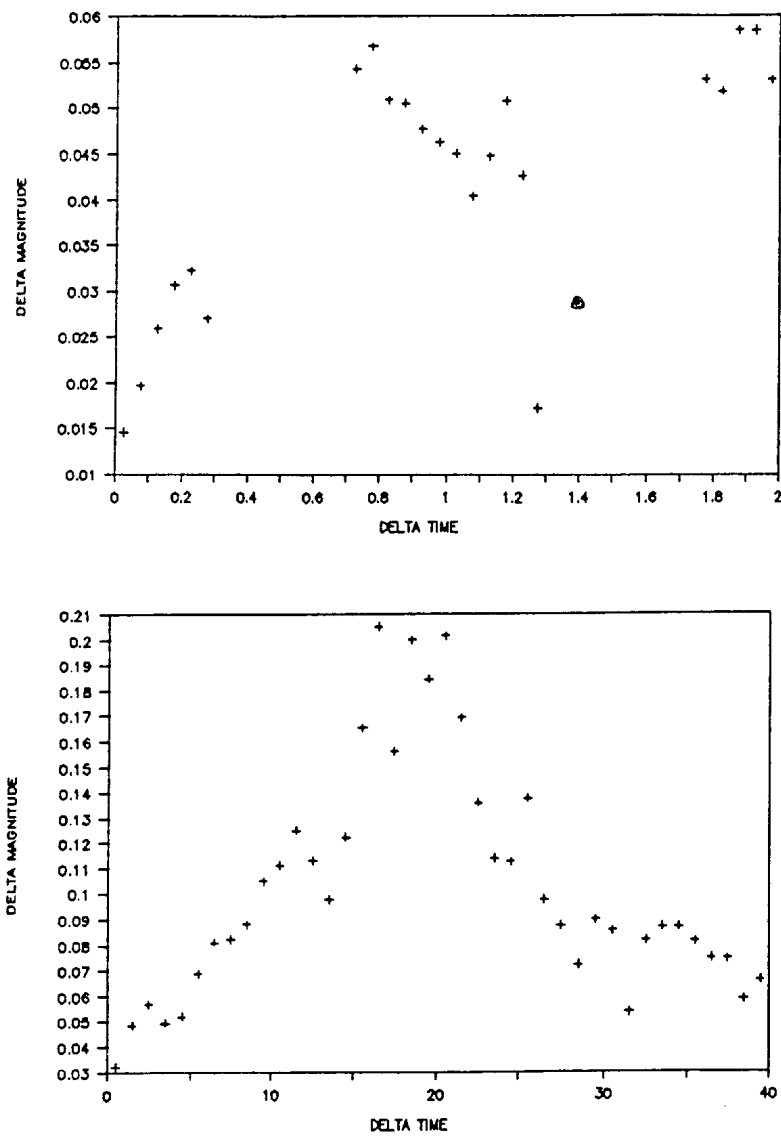


Figure 2. Autocorrelation diagram for U observations of KX And. Top panel: "lags" of 0 to 2 days; bottom panel: "lags" of 0 to 40 days.

autocorrelation diagram for the U data suggests that the variations are non-sinusoidal. Note that Štefl et al. (1990) found strong cycle-to-cycle changes in the light curve, especially in U. In particular, there were two distinct shapes of the U light curve, with different depths of minimum. The fact that Figures 1 and 2 (bottom panels) show clear, low minima at 39 days indicates that the long-term variations are insignificant on time scales of about a month; this is confirmed by light curves for individual years. We attempted to study the long-term variations in V by subtracting the "average" 38.919-day variation, but we found that the amplitude of this variation changed markedly from cycle to cycle, by factors of two or more. The long-term variations seem to have a typical range of 0.1^m , and a time scale of a year or more.

We have since used the simple autocorrelation method to study other stars with complex, irregular variations, and have found it to be very useful for analyzing the time scales, amplitudes and irregular and irregularities in such stars.

Acknowledgements. We are very grateful to Drs. S. Štefl, P. Harmanec and the other authors of Štefl et al. (1990) for making their photometric data available to us in machine-readable form, and to Dr. P. Harmanec for his useful comments. Li Sen (Northern Secondary School) was a participant in the University of Toronto Mentorship Program, which enables outstanding senior high school students to work on research projects with university faculty members.

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References

- Pavlovski, K. and Ružič, Ž. 1989. *Ap.Sp.Sci.* **152**,35
Percy, J.R., Coffin, B.L., Drukier, G.A., Ford, R.P., Plume, R., Richer, M.G. and Spalding, R. 1988. *PASP* **100**,1555.
Stagg, C.R., Božić, H., Fullerton, A.W., Gao, W.S., Guo, Z.H., Harmanec, P., Horn, J., Huang, L., Iliev, L.H., Koubský, P., Kovachev, B.Z., Pavlovski, K., Percy, J.R., Schmidt, F., Štefl, S., Tomov, N.A. and Žižňovský, I. 1988. *MNRAS* **234**, 1021.
Štefl, S., Harmanec, P., Horn, J., Koubský, P., Kříž, S., Hadrava, P., Božić, H. and Pavlovski, K. 1990. *Bull.Astron.Inst. Czechoslovakia* **41**,29

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

Number 3671

Konkoly Observatory
Budapest
10 October 1991
HU ISSN 0374 - 0676

OBSERVATIONS OF SUPERHUMPS IN AQ Eri

Photographic and visual detection of superhumps of this star was done by Kato et al. (1989). They yielded a superhump period of 0.06703 days. However confirmatory observations are necessary because their period was mainly based on photographic data on one night.

The star had again a long outburst starting on February 17, 1991, at $m_v=13.0$ (Koshiro, private communication). This outburst lasted for at least 10 days. However the maximum seems to be significantly fainter than the previous one ($m_v=12.5$).

During this presumable superoutburst, we planned to confirm the superhump period.

The observations were done from February 23 through 26, 1991 with Thomson TH7882 CCD (576×384 pixels, on chip summation of 2×2 pixels) attached to the Cassegrain focus (focal length 4.8m) of 60cm reflector at Ouda Station, Kyoto University.

The Kron I filter ($\lambda_{\text{max}}=780\text{nm}$, FWHM=156nm) was employed to get the best signal to noise ratio. The exposure time was mostly 10 seconds to detect short time-scale variability, such as quasi-periodic oscillations (QPOs) and eclipses, but was 20 or 30 seconds when atmospheric condition was poor.

The frames were processed with the microcomputer-based aperture photometry package developed by the author. The variable (Var) and the comparison (Comp) are marked in Figure 1.

Because of the high sky background due to the nearly full moon located above the variable, the r.m.s. error of a single photometry was 0.05 magnitudes. No systematic variation larger than 0.01 magnitudes between comparison and neighboring stars were detected.

The overall light curve is shown in Figure 2 and those on individual night (February 24, 25, 26) are shown in Figures 3a-c. Each dot represents a differential magnitude between the variable and the comparison.

On February 23, there existed some indication of light variation suggesting superhumps. However the times of maxima cannot be determined because of the cloudy sky. On February 24, superhumps with an amplitude of 0.19 magnitudes were evident. The rise was much steeper than the decline. On February 25, the superhumps became less marked. The amplitude was 0.08 magnitudes and the rise became slower than in the previous night. The light curve on February 26 was similar to that on February 25, but the amplitude increased to 0.14 magnitudes.

Table 1 summarizes the times of superhump maxima on the last three nights.

The intervals between successive superhumps ranged from 0.056 to 0.062 days. By fitting linear equation to the observed time of maxima, the superhump period was determined as either 0.06225 days or 0.05854 days. The latter gives the smaller O-C residuals, but another coexistent periodicity described later is better explained by the longer period.

The 0.06225-day period is 7% shorter than that suggested by Kato et al. (1989). There seems to have been the passing-over of one or two cycle counts per day in their data. Reanalysis of their times of maxima using the present period gives the more probable periods of 0.06284 or 0.05914 days.

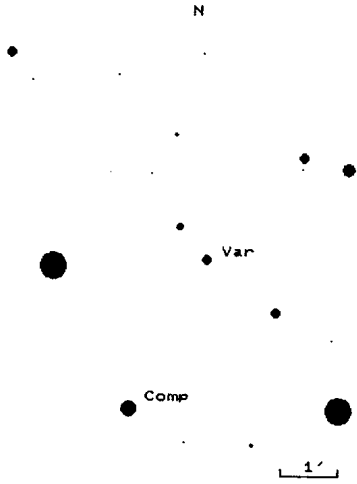


Table 1.

Time of maxima Feb. 1991 (UT)	$O - C_1$ days	$O - C_2$ days
24.442	-0.001	+0.002
24.500	-0.002	-0.002
24.562	+0.002	-0.003
25.439	0.000	+0.003
25.500	+0.003	+0.002
26.434	0.000	+0.002
26.490	-0.002	-0.004
$O - C_1 : \text{Max. UT} = 24.443 + 0.05854E$		
$O - C_2 : \text{Max. UT} = 24.440 + 0.06225E$		

Figure 1.

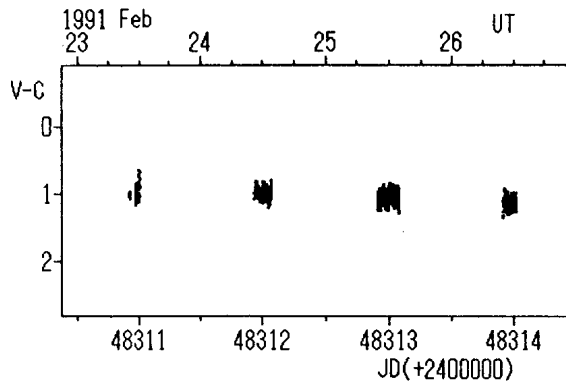


Figure 2.

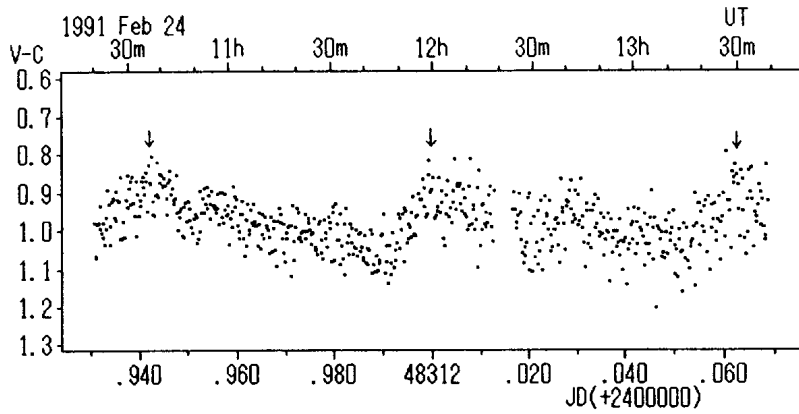


Figure 3a.

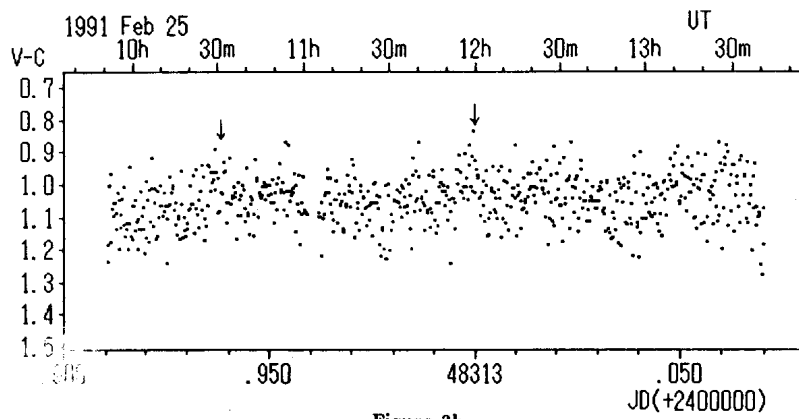


Figure 3b.

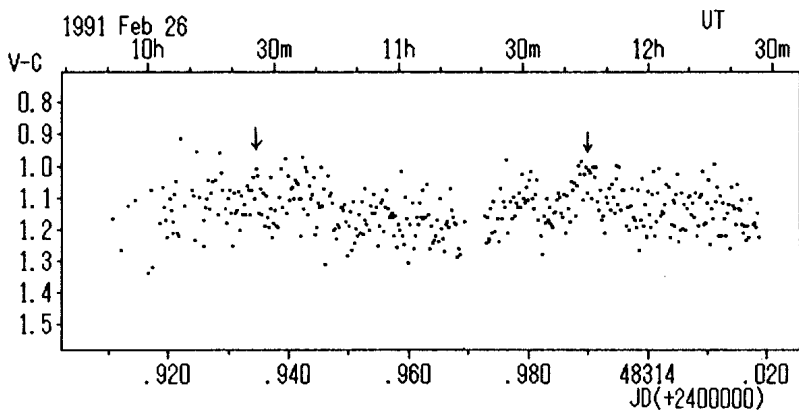


Figure 3c.

If the shorter period is adopted, AQ Eri will be similar to SW UMa (superhump period $P_{sh}=0.05833$ days, orbital period $P_{orb}=0.056815$ days). The similarity of both systems is also supported by statistical analysis of outburst records (Iida, in preparation). In either cases of the period, AQ Eri will have the fourth shortest orbital period confirmed among the SU UMa stars.

The amplitude of the superhumps varied in one day. If this is interpreted as a beat phenomenon between P_{sh} and P_{orb} , as observed in high inclination systems, the beat period will be 2 or 3 days. This value is typical for SU UMa stars except for WZ Sge (Osaki 1985).

The superhump profile has recently been employed as a potential clue to distinguishing mechanisms for superhumps (Mineshige 1988). There was some indication of a secondary bump at superhump phase 0.4 following the second superhump on February 24. This feature, however, was not persistent, while it was stable in SU UMa (Udalski 1990).

At 24.950 UT, a 0.06 magnitude dip lasting 7 minutes was observed. The fade and the rise took less than a minute. This dip may be caused by a transient eclipse as observed in TY PsA at the late stage of the superoutburst (Warner et al. 1989).

Fourier analysis of the original data revealed an additional stable periodicity of 22.9 minutes on February 25 and 26. Similar periodicity during an outburst of WX Hyi was interpreted as a result of 4:1 or 6:1 resonance in the accretion disk with the binary orbit (Kuulkers et al. 1991). In the present case the period is very close to $1/4$ superhump period (if $P_{sh}=0.06225$ is adopted), which is certainly longer than the orbital period. The difference is naturally explained if the 22.9 minute period results from the non-axisymmetric structure of the disk which is precessing at the same angular velocity with the one-armed (eccentric) disk causing superhumps. Further observations during quiescence are required to rule out the possibility of the 22.9 minute period as the rotational period of the white dwarf.

From this discussion mentioned above, we suggest the superhump period of 0.06225 days is more realistic than that of 0.05854 days.

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References

- Kato, T., Fujino, S., Iida, M., 1989, Variable Star Bull. Japan No. 9, 33.
Kuulkers, E., Hollander, A., Oosterbroek, T., and van Paradijs, J., 1991, Astron. Astrophys., **242**, 401.
Mineshige, S., 1988, Astrophys. J., **335**, 881.
Osaki, Y., 1985, Astron., Astrophys., **144**, 369.
Udalski, A., 1990, Astron. J., **100**, 226.
Warner, B., O'Donoghue, D., Wargau, W., 1989, Monthly Notices Roy. Astron. Soc., **238**, 73.

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

Number 3672

Konkoly Observatory
Budapest
11 October 1991
HU ISSN 0374 - 0676

Further Observations of 9 Aurigae

Krisciunas and Guinan (1990) recently found that the F0 V star 9 Aurigae is variable, with an amplitude of $\Delta V \approx 0.06$ mag and a suggested period of 36-39 days. There was some evidence of short term variations (< 1 hr), which would be attributable to pulsations of the star, though it is to be noted that 9 Aur lies to the right of the instability strip (Breger 1979). In this paper we present results that refute the notion that 9 Aur might be a pulsating star.

The photometry discussed in this paper can be found in IAU file 238 of unpublished photometry of variable stars (Breger *et al.* 1990). This amounts to 182 V-band points by Skillman, obtained on 10 nights with his 32-cm automatic photoelectric telescope (APT) (see Skillman 1981), and 143 V-band and 142 B-band points by Guinan, obtained on 4 nights with a 25-cm APT at Mt. Hopkins, Arizona. The comparison star was BS 1561. Data previously made available in IAU file 218 show, using BS 1568 as a check star on 52 nights, that BS 1561 exhibits no suspected variability.

Figs. 1 and 2 demonstrate that 9 Aur can vary linearly by $|\Delta V/dt| \approx 0.01$ mag/hour over the course of a few hours. (The differential brightness of 9 Aur vs. BS 1561 showed no significant temporal trend on 9 of the 14 nights on which the two stars were monitored by Guinan and Skillman.) Frequency analysis was carried out using the Lomb-Scargle algorithm (see Press and Teukolsky 1988) to produce power spectra. Analysis of individual nights' data yields no significant short term (< 1 hr) variations. Combining several nights' data gives peaks approximately equal to 0.73, 2, 3, and 4 cycles per day, which would most likely be artifacts of aliasing (demonstrating only that the data were obtained at about the same time each night).

9 Aurigae vs. BS 1561 (24/25 Dec 1990)

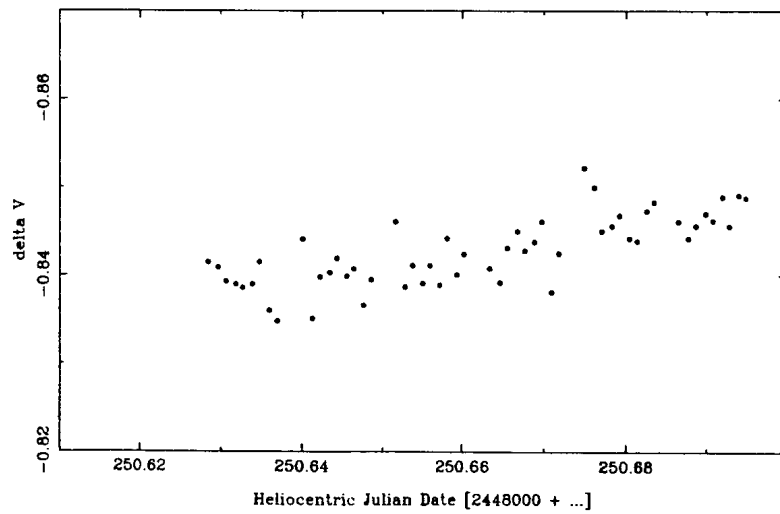


Fig. 1 - V-band differential photometry of 9 Aurigae by Guinan. The data were obtained over 96 minutes.

9 Aurigae vs. BS 1561 (1 Feb 1991 UT)

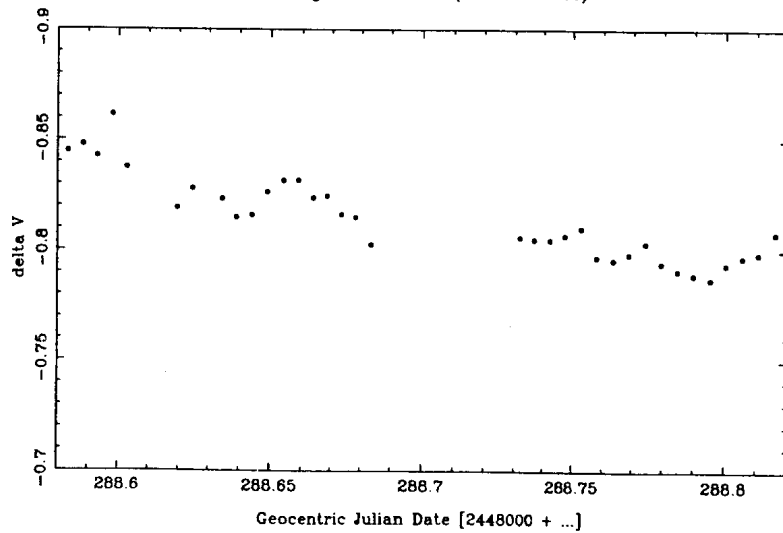


Fig. 2 - V-band differential photometry of 9 Aurigae by Skillman. The data were obtained over 5 hours and 35 minutes.

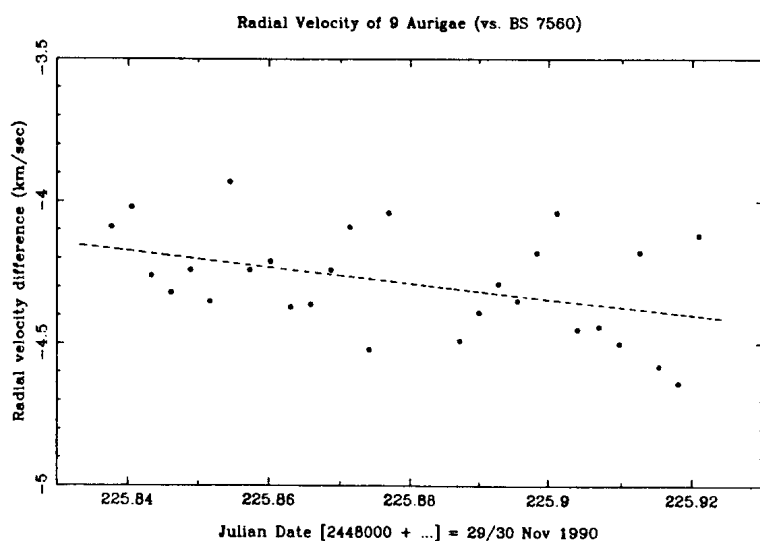


Fig. 3 - Radial velocity measurements of 9 Aurigae, using BS 7560 as the reference star. Data by Abt.

File 238 also contains 28 radial velocities of 9 Aur vs. BS 7560, obtained by Abt on the night of 29/30 Nov 1990 over a two hour time span. Abt's radial velocities were obtained at Kitt Peak with a coude spectrograph giving a dispersion of 15 Å/mm. Fig. 3 shows Abt's radial velocity data. A linear least-squares fit gives a slope that is non-zero only at the 2.3- σ level. The scatter about the mean is only ± 0.18 km/sec, which is no more than one would expect for the equipment and line width. Frequency analysis indicates no periodicity in the data. Thus on the basis of the photometry and radial velocity data, there is no evidence that 9 Aur is a pulsating star with a period comparable (tens of minutes) to those of stars with similar mass and size.

Abt (unpublished) has also obtained a new value of $v \sin i = 20$ km/sec for 9 Aur. (The non-definitive value given in the *Bright Star Catalogue* is 14 km/sec.) Given an assumed size of 1.35 R_{Sun} for an F0 V star, this means that the maximum rotational period of 9 Aur (setting $i = 90^\circ$) is

about 3.4 days. We note that a reanalysis of Guinan's data given in IAU file 218, using the Lomb-Scargle algorithm, gives a power spectrum whose highest peak corresponds to $P = 2.888$ days for the V-band and B-band data. Could this be the true rotational period of 9 Aur? If the variability of the star is other than purely sinusoidal and is somehow related to such a rotational period, a definitive light curve could only be obtained by means of coordinated photometry carried out with a number of telescopes distributed around the Earth. Even then we need to explain how such variability results on a star with no reported spectroscopic anomalies (e.g. evidence of magnetic fields).

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References:

- Breger, M. 1979, *Publ. Astr. Soc. Pacific* **91**, 5.
 Breger, M., Jasehek, C., and Dubois, P. 1990, IBVS 3422.
 Krisciunas, K. and Guinan, E. 1990, IBVS 3511.
 Press, W. H. and Teukolsky, S. A. 1988, *Computers in Physics*
2, No. 6 (Nov/Dec), 77.
 Skillman, D. R. 1981, *Sky and Telescope* **61**, 71.

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

Number 3673

Konkoly Observatory
Budapest
18 October 1991
HU ISSN 0374 - 0676

Photoelectric Photometry Of FP Virginis

FP Virginis (HD 118289, BD +09 2785, SAO 120026) is an old galactic disk gM4 red giant with a (B-V) of 1.65. It is probably a low mass star (less than 3 solar masses), as younger disk population stars of larger masses do not reach the instability regions of small amplitude red variables of the galactic disk and halo populations (Eggen, 1973). Small amplitude red variables are M giants and also possibly asymptotic giant-branch stars, that pulsate with small amplitudes and long periods of up to 200 days (Percy et al, 1989). As part of the AAVSO Small Amplitude Red Variable (SARV) program, observations were recently taken of FP Virginis to more accurately determine its periodicity, if any, and amplitude range. Previous observations of this star have indicated various period ranges from about 40 days to about 68 days, with maximum amplitude ranges from 0.40 to 0.60 magnitude (Eggen 1971, 1973, Ashbrook 1976, AAVSO 1983, 1990). Additionally, previous photometry indicates a red magnitude of 5.3, an infrared magnitude of 3.9, and a bolometric magnitude of -4.15.

The observations were made on 37 separate nights from JD 2448290 (02 Feb 91) to JD 2448453 (15 Jul 91). The detector was a silicon PIN photodiode in a solid-state SSP-3 photoelectric photometer, which was mated to an f/10 8-inch Schmidt-Cassegrain. The observations were made through a SSP-3 Schott visual filter, with the variable star measurements flanked by the comparison star and sky readings. A check star was observed on 35 of the 37 nights. The comparison and check stars used were HD 119288 (V=6.16, B-V=0.42, dF4) and HD 117404 (V=6.17, B-V=1.47, K5), respectively. The mean magnitude difference between these two stars was 0.04 with a standard deviation of 0.016 magnitude. The data were reduced by computer programs written by the author, with all comparison and sky readings being interpolated. Also taken into account in the programs were atmospheric extinction, mean transformation to the standard UBV system computed by observations of UBV standard stars, and corrections to heliocentric time. The maximum internal standard error for all of the observations, calculated for each individual night, was 0.02 magnitude.

The resulting light curve is constructed from the data in Table II and is plotted below. It represents the most complete continuous light curve on this star published to date. The maximum amplitude range is 0.58 magnitude, occurring between JD 2448299 and JD 2448331. This compares fairly well with the earlier measured amplitude ranges. Since the star is classified as a SRb, it has quasi-periodic variations; however, during this most recent observing season the variation in brightness was fairly regular. A peak-to-peak period of 72 days was observed from JD 2448299 to JD 2448371, with the second peak-to-peak period of 63 days from JD 2448371 to JD 2448434. Additionally there is a minimum-to-minimum period of 78 days, observed from JD 2448331 to JD 24484309.

Table I: FP Virginis Period Data

Data Source	Ave. Period (Days)	Amplitude (Magnitude)
Eggen, 1971	40	0.56
Eggen, 1973	44	0.40
Ashbrook, 1976	55	0.60
AAVSO, 1983	64	0.45
AAVSO, 1990	68	0.40
AAVSO, 1991	71	0.58

FP VIRGINIS

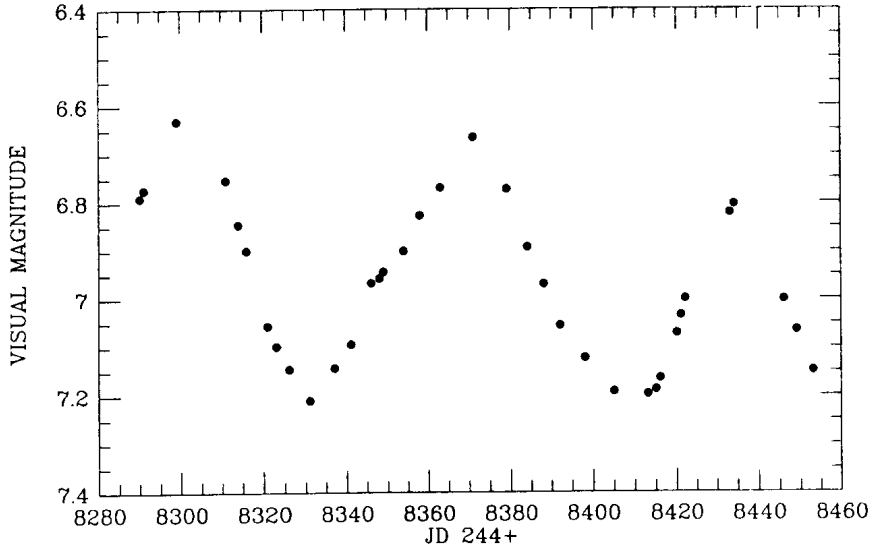


Figure 1

Based on this most recent data, and analyzing earlier data, it appears that the period of FP Virginis is getting longer, although the rate of increase seems to be quite slow. Over the past two decades there has been about a 30 day increase in the period. These results are tabulated in Table I. The 1971 and 1973 data are average periods measured directly from the published Eggen light curves. The 1983 and 1990 periods were extrapolated from AAVSO half-period measurements, and the 1991 period is an average of the three measured periods stated above. The 1976 period was just stated by Ashbrook with no published light curve or data. There does not, however, seem to be any trend toward a steady increasing or decreasing amplitude.

Table II: FP Virginis Light Curve Data

JD 244+	Visual Magnitude
8290.811	6.79
8291.808	6.77
8299.793	6.63
8311.773	6.75
8314.719	6.85
8316.726	6.90
8321.747	7.06
8323.710	7.10
8326.702	7.15
8331.691	7.21
8337.706	7.14
8341.698	7.09
8346.695	6.97
8348.697	6.96
8349.684	6.94
8353.658	6.90
8358.652	6.83
8363.641	6.77
8371.642	6.66
8379.611	6.77
8384.573	6.89
8388.572	6.97
8392.578	7.06
8398.578	7.12
8405.582	7.19
8413.644	7.20
8415.599	7.19
8416.596	7.16
8420.607	7.07
8421.612	7.04
8422.602	7.00
8433.602	6.82
8434.596	6.80
8446.600	7.00
8449.552	7.07
8453.576	7.15

Additional observations will be taken to clarify any persistent periodicities and to see if the trend toward a longer period continues. A multiplicity of apparent periods is, of course, a major characteristic of semi-regular SRb variable stars (Petit, 1982). Thus these observations support the classification of FP Virginis as an SRb variable star with a small amplitude range, and quasi-periodic variations. Acknowledgement is given to Howard Landis of the AAVSO for kindly supplying the SARV archival data for analysis.

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References:

- AAVSO, 1983-1991, Private Communications
Ashbrook, J.: Sky and Telescope, 52, 91, 1976.
Eggen, O.J.: 1971, P.A.S.P., 83, 423.
Eggen, O.J.: 1973, Mem.R.Astr.Soc., 77, 159.
Hirshfeld, A., Sinnott, R.W.: 1985, Sky Catalog 2000, Vol.2, Cambridge University Press and Sky Publishing Co.
Percy, J.R., Landis, H.J., Milton, R.E.: 1989, P.A.S.P., 101, 893.
Petit, M.: 1982, Variable Stars, C. 1987 Wiley and Sons, Ltd.

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

Number 3674

Konkoly Observatory
Budapest
18 October 1991

HU ISSN 0374 - 0676

FURTHER UBV OBSERVATION OF IU AURIGAE

IU Aurigae (B0p + B1p) is most interesting for its remarkable nature of secularly increasing minima depths since the discovery as an eclipsing binary in 1964 (Mayer, 1965). This phenomenon has been explained by an increasing orbital inclination caused by precession of the orbital plane of the eclipsing system. This precession must be due to presence of a third body in the system, which was also suggested from a periodic variation of the light elements (Mayer 1971; Eaton 1978).

According to Eaton (1979), the orbital inclination is continuing to increase by about 0.5 degree/year, and therefore, with 85° for the inclination in 1979, he suggested that the system may be in central eclipse in 1989. The same thing has been also pointed out by Drechsel and Mayer (1987), with an increasing inclination rate of 0.42 degree/year. In order to check whether this is the case, UBV observations have been further carried out, in succession to the author's previous observation in 1987-88 (Ohmori 1989). The present observations have been made with the same 40-cm reflector at the Science Museum of Kawasaki City during seven clear nights in 1989-90.

During the present observations, HD 35619 (BD+34 $^\circ$ 1046) has been used as the principal comparison star. The obtained measurements in mag(var) minus mag(comp) are all plotted in Figure 1. From the present light curve, we can easily deduce amplitudes of 0.^m70 (U), 0.^m66 (B), 0.^m63 (V) for the primary minimum and 0.^m52 (U), 0.^m49 (B) and 0.^m48 (V) for the secondary, as listed in Table I together with all the previous relevant data. As an example, Figure 2 shows a plot of the minima depths in V between 1964 and 1990. It is easily seen in Figure 2 that the minima depths are no longer secularly increasing after 1986. The same tendency can be also seen in variations of the depths in U and B as well. This result is in contradiction with the previous prediction of central eclipse for 1989 by Eaton (1979) and Drechsel and Mayer (1987).

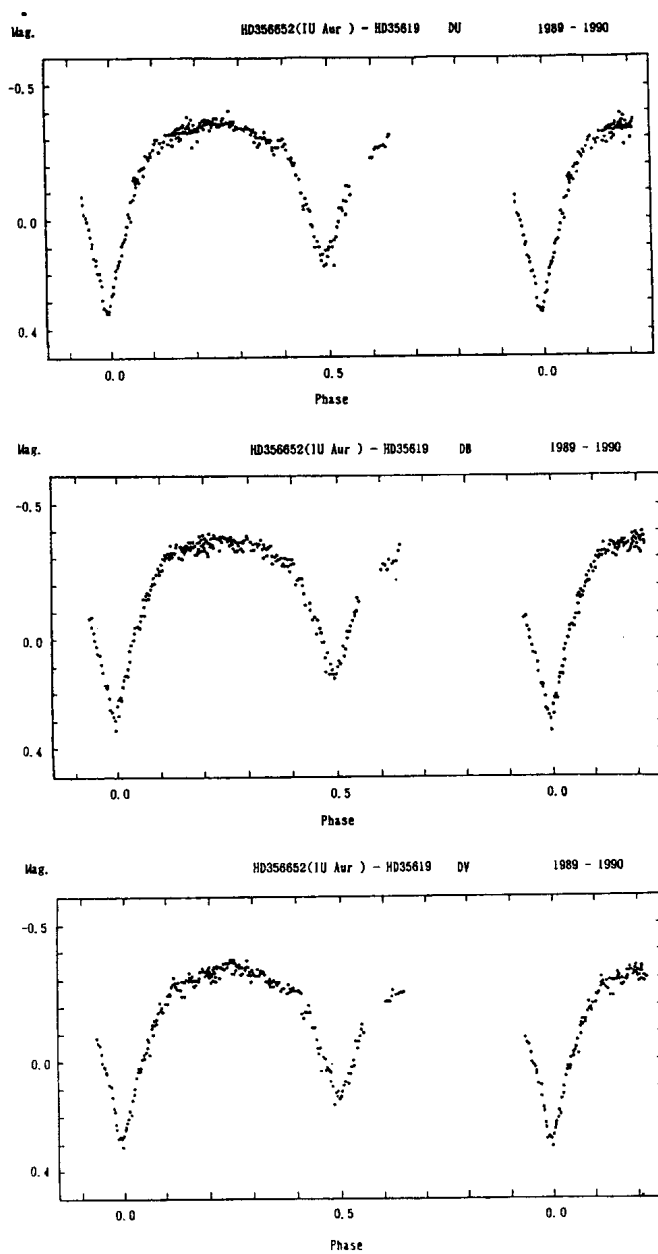


Fig. 1. Light curve of IU Aurigae in 1989-90.

Table 1 Eclipse depths (in mag.) of IU Aurigae

Observation year		1964	1970	1973	1974	1976
Observer		Mayer (1965)	Mayer (1971)	Mayer (1976)	Eaton (1978)	Papousek & Vetesnik (1982)
Prim.	U	0.53	0.60	0.61	0.67	0.71
Min.	B	0.49	0.55	0.58	0.62	0.67
	V	0.48	0.54	0.56	0.60	0.63
Sec.	U		0.46	0.47		
Min.	B		0.43	0.45		0.50
	V	0.38	0.43	0.44		0.48

Observation year		1979	1983	1985	1988	1990
Observer		Eaton (1979)	Mayer & Jozef (1983)	Hui-song (1988)	Ohmori (1989)	This Paper
Prim.	U		0.74	0.80		0.70
Min.	B		0.68	0.74	0.66	0.66
	V	0.68	0.68	0.74	0.64	0.63
Sec.	U		0.57	0.62		0.52
Min.	B		0.55	0.57	0.52	0.49
	V	0.54	0.56	0.56	0.54	0.48

During the present observations, one epoch of the primary minimum has been obtained as JD Hel 2447897.0575 with $O-C = -0.1024$, which can be calculated with Mayer's ephemeris (1987): $JD\text{ Hel } 2438448.4068 + 1.811474 \cdot E$.

I would like to express my thanks to Prof. M. Kitamura of National Astronomical Observatory of Japan for his suggestion of the programme and kind guidance.

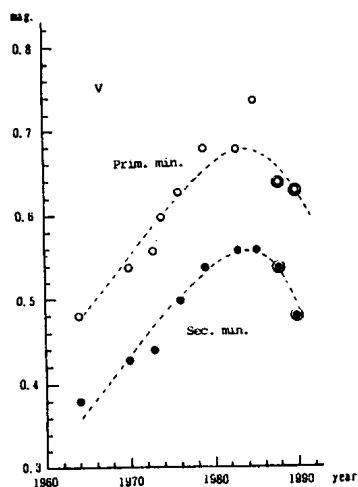


Fig. 2. Variation of eclipse depths of IU Aur in V. Present observations by Ohmori are designated with double circles.

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References:

- Drechsel, H., and Mayer, P.: 1987, *Mitt. Astron. Ges.*, **68**, 246.
 Eaton, J.A.: 1978, *Acta Astron.*, **28**, 63.
 Eaton, J.A.: 1979, *I.B.V.S.*, No.1614.
 Hui-song, T.: 1988, *Chin. Astron. Astrophys.*, **12**, 298.
 Mayer, P.: 1965, *Publ. Astron. Soc. Pacific*, **77**, 436.
 Mayer, P.: 1971, *Bull. Astron. Inst. Czech.*, **22**, 168.
 Mayer, P.: 1976, *Bull. Astron. Inst. Czech.*, **27**, 308.
 Mayer, P., and Jozef, T.: 1983, *I.B.V.S.*, No.2407.
 Mayer, P.: 1987, *Bull. Astron. Inst. Czech.*, **38**, 58.
 Ohmori, S.: 1989, *I.B.V.S.*, No.3333.
 Papousek, J. and Vetesnik, M.: 1982, *Scripta Fac. Sci. Nat. Univ. Brno*, **12**, 435.

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

Number 3675

Konkoly Observatory
Budapest
22 October 1991
HU ISSN 0374 - 0676

DETECTION OF VARIABLE STARS AMONG BLUE STRAGGLERS IN M67

The open cluster M67 has six blue stragglers which are in the delta Scuti instability strip. Hereafter the stars are designated by their Fagerholm (1906) numbers. Danziger and Dickens (1967) observed No.131 for 81 minutes and assigned this star as a suspected variable. Photoelectric photometry of six blue stragglers in the instability strip and one comparison blue straggler outside the instability strip has been made. Observations were obtained on Feb. 11/12 1972, Jan. 11/12 1973, Jan. 11/12 1976 and Feb. 17/18, 18/19, 21/22 and 22/23, 1977. Observed blue stragglers are listed in Table I. Since about 30 per cent of the stars in the instability strip are delta Scuti variables, the probability of all stars to be variable is only 0.1 per cent, thus negligible. Therefore six stars have also been taken as the comparison stars for the first two nights (Figure 1). Two stars (No.185 and No.238) were omitted on the third night, (Figure 2), because we thought that these stars are not variables, according to the first and the second night observations. For the last four nights (Figures 3 and 4), the observations have also been made on one comparison blue straggler (No.136) outside the instability strip, which is nearby to No.131 in the M67 field. The reason to do so is to deny the possibility of the variation of No.131 owing to the position in the cluster field.

The observations have been made using the 91 cm reflector at the Okayama Astrophysical Observatory. The diaphragms used have been 1 mm and 1.5 mm. The 1 mm diaphragm has been used for No.190 only, because a fainter star by 2.7 mag than 190 lies at about 3" from the edge of the 1.5 mm diaphragm. The observed magnitudes have been V. The integration time has been 40 sec. All observations have been made at zenith distances less than 50°. The errors of the observations may be, on the average, 0.007 mag from the Figures. Special attention has been paid to the centering in the diaphragm. Otherwise, errors amount to 0.01 mag or more. Since our concern is the detection of the variability, no magnitude is given. The differential extinction by terrestrial atmosphere is negligible, because the diameter of M67 is 18' (Hogg 1958). The variations of the obtained results due to the dif-

Table 1

Fagerholm number	V	B-V	Spectral Type
55	11.32	0.30	A ₄
90	10.97	0.34	F3
131	11.22	0.415	F0IV:
136	11.31	0.63	
185	11.12	0.24	A4
190	10.96	0.245	A8IV-V:
238	10.96	0.24	A3

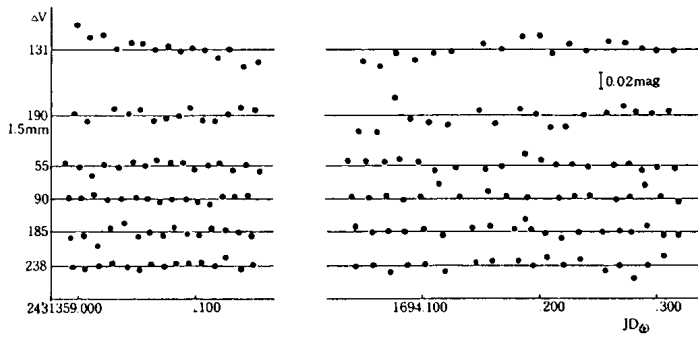


Figure 1

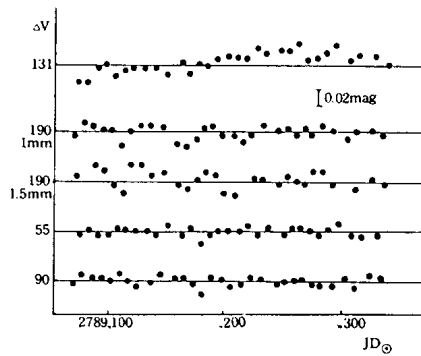


Figure 2

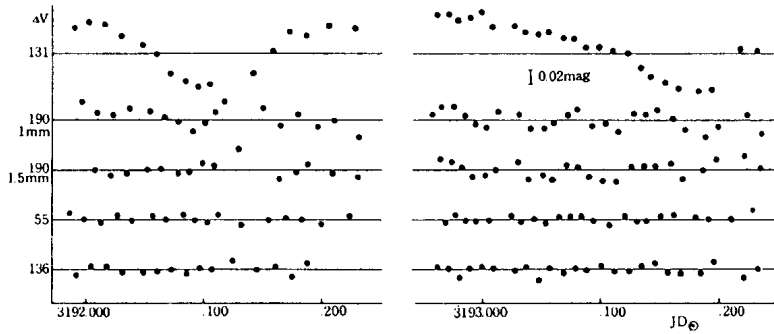


Figure 3

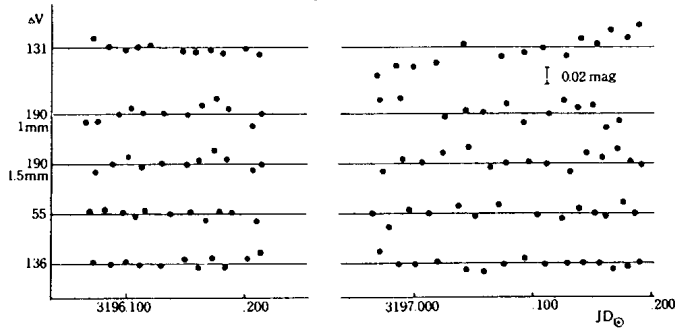


Figure 4

ferences in the color indices are insignificant as are shown in Table I and in the Figures.

The results are given in the Figures 1, 2, 3 and 4. As it is seen in these Figures, No.131 and No.190 are variables, and other four stars are not variables. The frequency of the variables is one-third, in agreement with the percentage of field variables. The period and the amplitude of No.131 are 6 hours or more and 0.00 - 0.05 mag, respectively. The period and the amplitude of No.190 are 1.5 - 2 hours and 0.00 - 0.02 mag, respectively. Thus for both stars, the periods and the amplitudes vary. The period of No.131 is unusually long for a delta Scuti variable. We suggest that pulsation of No.131 is non-radial.

More observations are necessary, in order to continue the monitoring of No.131 and No.190 and to confirm the non-variability of Nos.90, 185 and 238.

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References:

- Danziger, I.J. and Dickens, R.J.: 1967, *Astrophys.J.*, 149, 55.
Fagerholm, E.: 1906, inaugural dissertation, Uppsala.
Hogg, H.S.: 1958, *Handbuch der Physik*, 51, 199.

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

Number 3676

Konkoly Observatory
Budapest
31 October 1991
HU ISSN 0374 - 0676

MULTIPLE PERIODICITY OF δ DELPHINI

Delta Scuti stars are pulsating, short period variables characterized by small amplitude in their light curves. Known stars in this group have A or F type spectra with small color indices.

δ Delphini was noticed as a variable by Eggen (1956) with a period of 0^d.13505 after 3 nights of observations. Eggen defined the star as a member of δ Scuti group and spectral type was given as A7 III by Slettebak (1955). Bidelman (1966) has also defined a new spectral type using δ Del as a prototype.

Table 1. Coordinates of variable and comparison stars.

	α_{1950}	δ_{1950}	Sp	m
δ Del	20 ^h 41 ^m 07 ^s .4	+14° 53' .6	FO IV	4.49 - 4.38 v
ζ Del	20 ^h 32 ^m 58 ^s .2	+14° 30'	A3 V	4.68

In this paper, we present new photometry of δ Del obtained using 0.4 m reflector at the observatory of METU, which was established at the end of 1990. Observations of δ Del (HD 197461) were performed in blue and visual regions and ζ Del (HD 196180) was chosen as comparison star. Differential star-star method was followed and magnitude differences $\Delta m = m(\delta) - m(\zeta)$ corrected for extinction in both filters were then plotted against time (heliocentric julian days). We have also included the previous observations obtained by one of us (Uyaniker, 1989) with a telescope of 20 cm. aperture using SSP-3 photometer. A multiperiod analysis was applied to all available data using the program PERIOD of Breger (1990). Light curves are given in figure 1 and the amplitude spectra for two nights are shown in figure 2. Periods obtained from the frequency analysis are displayed in table 2. Amplitude variations between maxima and minima in the light curves have been detected. It can be seen from figure 1 that δ Del is bluer at maximum than at minimum. The fundamental period obtained from old observations is 0.157 days while new observations resulted in a period of 0.148 days, both in the visual range.

We have also detected, roughly, a second and a third period of 0.057 and 0.042 days, in v filter, respectively (see also table 2). Thus we have tried to represent the light curve as the sum of three Fourier terms. However, the light curves of JD 2447405 and 2448449 are affected with a fourth frequency corresponding to a range of 0.33 to 0.40 days, and are inconsistent with the periods of δ Scuti type stars. These values may be results of the tidal influence of the component star as indicated by Fullerton (1967); who also noticed a 40 day binary period, while Fitch (1975) indicated 40.58 days. Baglin et al. (1973) also put δ Del in the class of binary stars in δ Scuti variables. Observations of JD 2448438 are of poor quality, so this night was excluded from the frequency analysis.

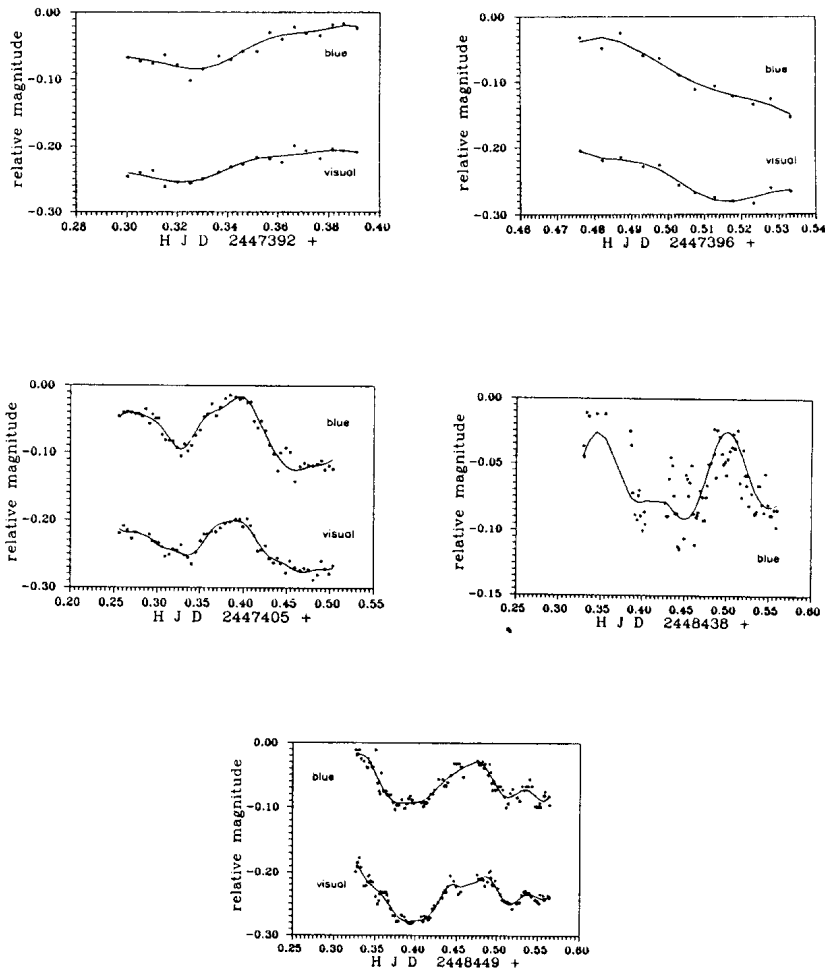


Figure 1. Light curves of HD 197461 in both blue and visual filters.
Note that solid curves indicate the fit.

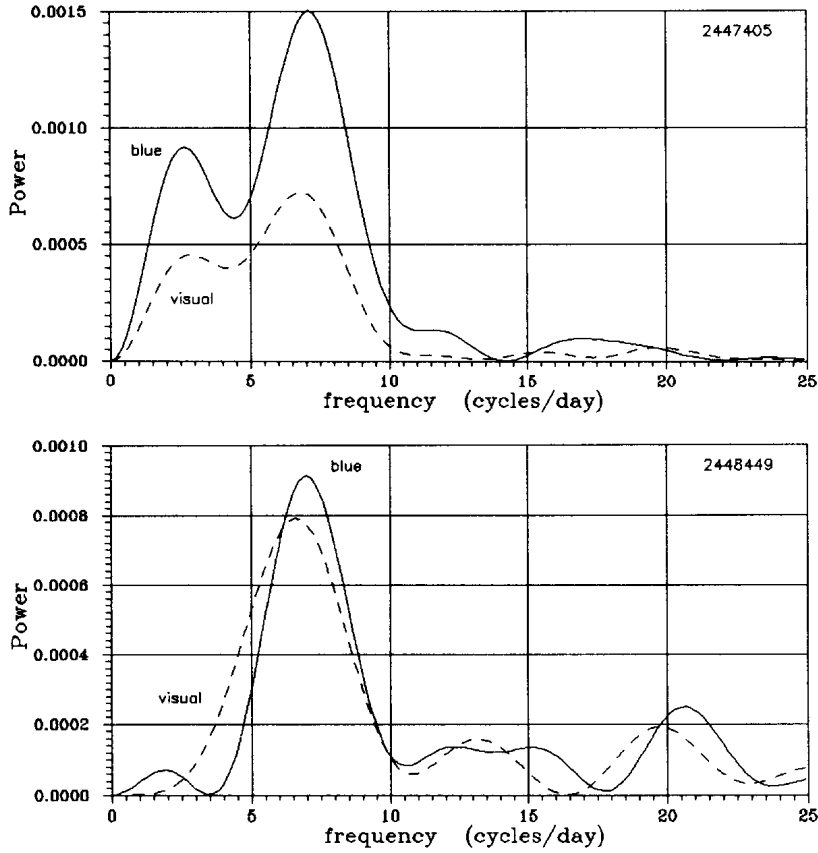


Figure 2. Power spectrum analysis of the data in two filters. Corresponding dates are also labeled.

Fundamental period and its harmonics indicate that P_1/P_0 ratio is about 0.4 to 0.5 for all data available. This result implies that δ Del does not hold the $P_1/P_0 \approx 0.75$ criterion for the radial oscillations (Breger and Bregman, 1975).

Table 2. Frequency fit parameters

HJD	filter	F_1	F_2	F_3	F_4	Residual
2447392	b	8.40	-	24.21	-	0.0078
	v	8.47	-	23.41	-	0.0061
2447396	b	6.73	12.36	-	-	0.0085
	v	5.16	-	27.00	-	0.0048
2447405	b	7.80	17.75	22.99	1.31	0.0094
	v	6.36	11.59	24.34	3.03	0.0069
2448449	b	6.87	17.35	18.60	2.46	0.0094
	v	6.73	17.82	22.74	5.43	0.0074

Thus we conclude that, the preliminary period range obtained above is too small to be the binary period. However this is because of the binary nature of the star. Further work is required and a detailed frequency analysis must be carried out in order to understand the reason of these variations. Continuous observations are also needed to resolve the binary period.

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References :

- Baglin, A., Breger, M., Chevalier, C., Hauck, B., le Contel, J.M.,
 Sareyan, J.P. and Valtier, J.C. : 1973, A.A., 23, 221.
 Bidelman, W.P. : 1966, Vistas in Astronomy, 8, 53.
 Breger, M. : 1990, Comm. in Astroseismology, No.20.
 Breger, M. and Bregman, J. N. : 1975, Ap. J., 200, 343.
 Eggen, O.J. : 1956, Pub. A. S. P., 68, 541.
 Fitch, W.S. : 1975, Multiple Periodic Variable Stars, IAU Colloquium
 No. 29, Budapest, p.167.
 Fullerton, W. : 1967, A. J., 72, 797.
 Slettebak, A. : 1955, Ap. J., 121, 653.
 Uyaniker, B : 1989, Proceedings of 6th National Meeting of
 Astronomy and Space Sciences, İzmir, p.417.

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

Number 3677

Konkoly Observatory
Budapest
4 November 1991

HU ISSN 0374 - 0676

EIGHT NEW OR UNDESIGNATED VARIABLE STARS

A continuing photographic patrol has resulted in the discovery of eight more variable stars that are not included in the General Catalogue of Variable Stars (Kholopov et al. 1985) or the subsequent Name Lists of Variable Stars (Kholopov et al. 1985, 1987, 1989). Four of these stars are found in the New Catalogue of Suspected Variable Stars (Kholopov et al. 1982) and this report represents independent confirmation of their variability. Positions and preliminary magnitude ranges, types, and periods are given in Table I, which continues the list in Kaiser (1990). Figure 1 is a finding chart for DHK 21. The other variables are found in the common catalogues, as noted.

All eight stars have been examined on the Harvard College Observatory patrol plates by D. B. Williams, who has confirmed variability in each case and provided most of the magnitude ranges, types, and periods listed in Table I. In addition, M. E. Baldwin and D. Skillman have confirmed the variability of DHK 17 by visual and photoelectric observations, respectively. Detailed results for individual stars will be reported when analysis of the observations is completed.

Some of the information in this report was obtained from the SIMBAD data retrieval system, database of the Strasbourg, France, Astronomical Data Center, for which I wish to thank Joyce Rey-Watson of the Harvard-Smithsonian Center for Astrophysics and Elizabeth Waagen of the AAVSO staff. The variables were detected using a projection blink comparator (PROBLICOM) as described by Mayer (1977).

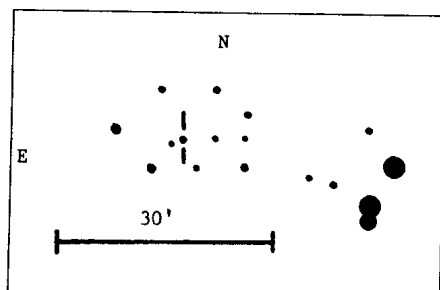


Figure 1. Finding chart for
DHK 21, based on blue images.

Table I.

Var. designation	RA (1950)	Dec (1950)	Range (b)	Type	P(days)
DHK 17 - BD +05 ⁰ 1606 SAO 115161	07h 12m 59s	+05° 08'0	12 -13.5	SR	356
DHK 18 - NSV 4621 BD -05 ⁰ 2898 HD 84617	09 43 56	-05 48.0	10.4-11.9	Lb	-
DHK 19 - BD +40 ⁰ 3449 HD 172740 SAO 47682	18 38 22	+40 17.0	9.2-10.5	SR	60:
DHK 20 - NSV 12930 BD +16 ⁰ 4199 HD 192446	20 12 04	+16 51.7	9.8-11.2	SR:	90:
DHK 21	20 14 16	+46 45	11.4-12.3	SR	400:
DHK 22 - BD +31 ⁰ 4024 HD 332077 SAO 69757	20 15 11	+31 23.9	11.6-12.2	Lb:	
DHK 23 - NSV 13178 BD +31 ⁰ 4152	20 34 43	+32 13	10.7-11.2	SR:	340:
DHK 24 - NSV 1737 BD +15 ⁰ 691 HD 30710	04 47 45	+15 41.9	11.2-12.0	Lb:	-

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References:

- Kaiser, D.H.: 1990, I.B.V.S., No.3480.
 Kholopov, P.N., editor, et al.: 1982, New Catalogue of Suspected Variable Stars, Nauka, Moscow.
 Kholopov, P.N., editor, et al.: 1985, General Catalogue of Variable Stars, Nauka, Moscow.
 Kholopov, P.N., Samus, N.N., Kazarovets, E.V. and Perova, N.B.: 1985, I.B.V.S., No.2681.
 Kholopov, P.N., Samus, N.N., Kazarovets, E.V. and Kireeva, N.N.: 1987, I.B.V.S., No.3058.
 Kholopov, P.N., Samus, N.N., Kazarovets, E.V., Frolov, M.S. and Kireeva, N.N.: 1989, I.B.V.S., No.3323.
 Mayer, B.: 1977, Sky and Tel., 54, 246.

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

Number 3678

Konkoly Observatory
Budapest
6 November 1991
HU ISSN 0374 - 0676

The rotation period of the A0p star HD 133652

The A0pSi star HD 133652 (= HR 5619 = CD -30° 11960) is a very probable member of the Scorpius-Centaurus OB association (Thompson et al. 1987). Although HD 133652 was suspected for a long time to be a magnetic star (Babcock 1957), it was only very recently that Bohlender & Landstreet (1991, to be submitted to ApJS) discovered a strong reversing longitudinal magnetic field from $H\beta$ polarimetric observations. Within the framework of the Oblique Rotator Model, it indicates that the two magnetic poles are visible during a whole rotation cycle. This star therefore deserves special interest, because it is a quite young ApSi star ($1 - 2 \cdot 10^7$ years) with very favourable conditions for surface mapping. Before any further study of the spectrum variations, we need to determine precisely the rotation period, which could be done most efficiently with new photometric observations.

In March 1991, we obtained 25 new measurements of HD 133652 in the Geneva seven-color photometric system with the photometer P7 attached to the 0.7 m Swiss telescope located at La Silla (Chile). They were reduced in the general reduction frame at Geneva Observatory. The accuracy of the data for several nights appears to be somewhat lower due to poor weather. Accordingly low weights were assigned to these measurements. We discarded from further analysis only the measurements with a null weight, for a total set of 34 observations when combined with several previous observations recorded in 1981-82.

HD 133652 exhibits typical variations for a magnetic Ap star, with $\Delta U \simeq 0.07$ mag and $\Delta V \simeq 0.03$ mag. The phase dispersion method (Stellingwerf 1978) and Renson's (1978) θ_1 test were applied separately to U , B and V magnitudes to determine the period P . Then least-squares fits of the observations were computed with a modified Newton method, with the assumption that the model function is a sine wave and its first harmonic. The ultimate accuracy on the period was achieved by varying P slightly and looking for the minimum

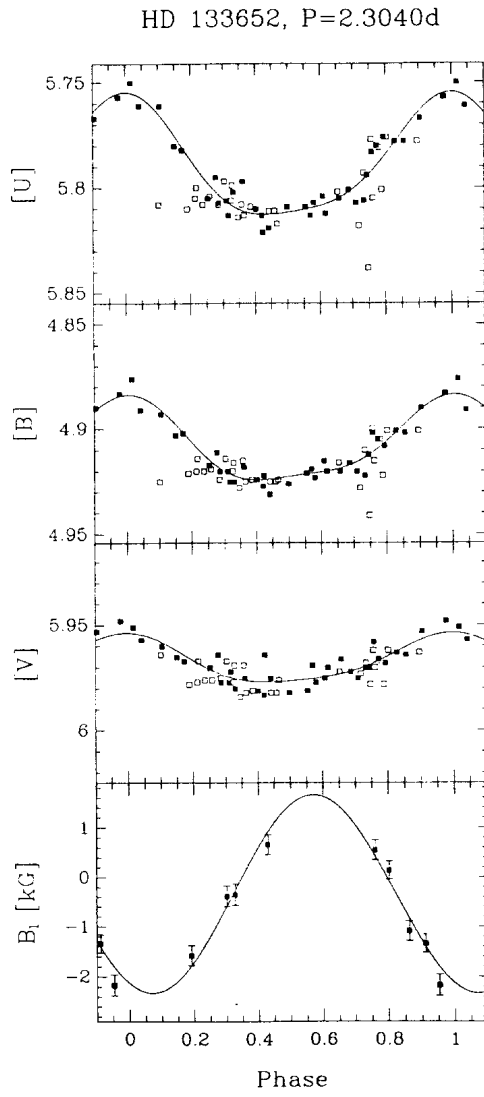


Figure 1: Photometric and longitudinal magnetic field variations of HD 133652. The phase origin is HJD 2448344.652. Open squares are data excluded from the period analysis and from the least-squares fits.

of the least-squares fit standard deviation for the three magnitudes. The resulting best period obtained in this manner from the photometry is $P = 2.3040$ days.

Bohlender & Landstreet obtained 7 polarimetric measurements of the star in 1988 and two more in 1990. These data are best fitted by a sine wave with $P = 2.3042$ days, which fully supports the period derived from the photometry. Therefore we adopt the following rotation period for HD 133652:

$$P = 2.3040 \pm 0.0003 \text{ days}$$

A minimum of U occurred at HJD 2448344.652. The figure shows the photometric and magnetic variations, and the least-squares fits with the adopted period.

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References

- BABCOCK, H.W.: 1957, ApJS 3, 141
RENSON, P.: 1978, A&A 63, 125
STELLINGWERF, R.F.: 1978, ApJ 224, 953
THOMPSON, I.B., BROWN, D.N., LANDSTREET, J.D.: 1987, ApJS 64, 219

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

Number 3679

Konkoly Observatory
Budapest
7 November 1991
HU ISSN 0374 - 0676

THE *IUE* SPECTRUM OF THE SHELL STAR HD 50845

HD 50845 = BD-1°1447 = SAO 133883, visual magnitude 8.2, was found to be a variable velocity shell object with an underlying F5V star (Sahade and Ringuelet 1985; Sahade, Ringuelet and Rotstein 1987).

In order to learn more about this interesting object, two *IUE* images (SWP 30288 and LWP 10103) were secured at the Goddard *IUE* Observatory on day 41, year 1987, in the small dispersion, large aperture mode. The exposure times were of 3600s and 460s, respectively. There is a third LWP image (LWP 10102) available, too weak for analysis.

The *IUE* spectrum of HD 50845 is shown in Fig. 1. The SWP image is too weak to permit any conclusion, while the LWP image is undoubtedly an absorption spectrum.

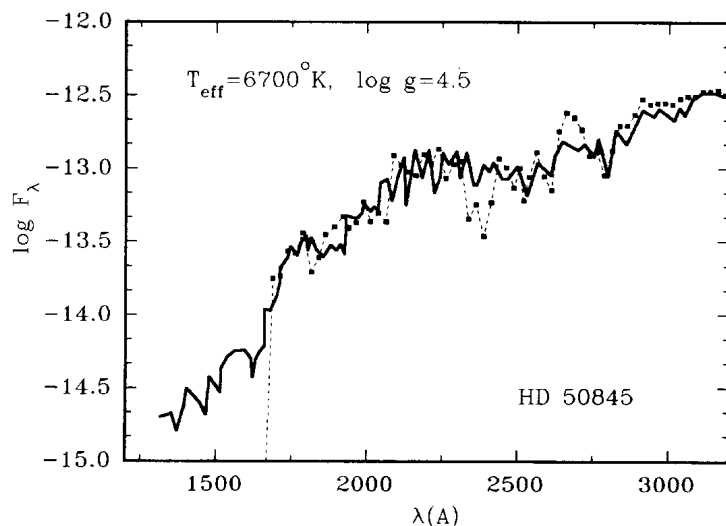


Fig. 1.- The *IUE* spectrum of HD 50845 (full line) and Kurucz's continuum for $T_{\text{eff}} = 6700^{\circ}\text{K}$, $\log g = 4.5$ (broken line).

The comparison of our *IUE* spectrum of HD 50845 with Kurucz's (1979) LTE model-atmosphere calculations shows that the best fitting for the continuous spectrum corresponds to the effective temperature of that of an F5 star and a gravity value around that of a main sequence object (as also shown in Fig. 1). Moreover, our *IUE* spectrum of HD 50845 looks very similar to that of a normal middle F dwarf (cf. Heck *et al.* 1984).

No other conclusions seem to be justified by the *IUE* material at our disposal.

We are indebted to the Goddard *IUE* Observatory staff for so efficiently securing and processing the images of HD 50845 for us.

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REFERENCES

- Heck, A., Egret, D., Jaschek, M. and Jaschek, C. 1984, *IUE Low-Dispersion Spectra Reference Atlas - Part 1. Normal Stars*, (ESA SP-1052).
Kurucz, R.L. 1979, *Ap. J. Suppl.* **40**, 1.
Sahade, J. and Ringuelet, A.E. 1985, *I.B.V.S.*, N° 2710.
Sahade, J., Ringuelet, A.E. and Rotstein, N. 1987, *P.A.S.P.* **99**, 971.

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

Number 3680

Konkoly Observatory
Budapest
11 November 1991
HU ISSN 0374 - 0676

GLIESE 559.1 - A YOUNG SPOTTED SINGLE STAR

An interesting group of spotted single stars belonging to the Local Association has been picked out by Chugainov (1991) and Chugainov et al. (1991). This paper contains the results of photoelectric observations of the single star Gl 559.1 = HD 129333 belonging to the Local Association according to its space velocity vector as given by Gliese (1969). Observations of Soderblom (1981) have shown that this G0V star possesses very intense CaII emission lines. According to the relation found by Noyes et al. (1984) between CaII H and K emission level, spectral type and rotation period, the latter is about 2 days for Gl 559.1.

We have found the light variability of Gl 559.1 from photoelectric observations obtained in the period of March-August 1991 with the 125-cm telescope of the Crimean Astrophysical Observatory and the 60-cm telescope of the Southern Station State Sternberg Astronomical Institute in UBVR and UBVR systems respectively. The results have been analysed for the presence of periodicities by means of Scargle's (1982) method. The highest probability peak corresponds to $1/P_1 = 0.357 \text{ day}^{-1}$ but we cannot exclude the periodicity of $1/P_2 = 0.642 \text{ day}^{-1}$. It seems likely that the latter is an alias due

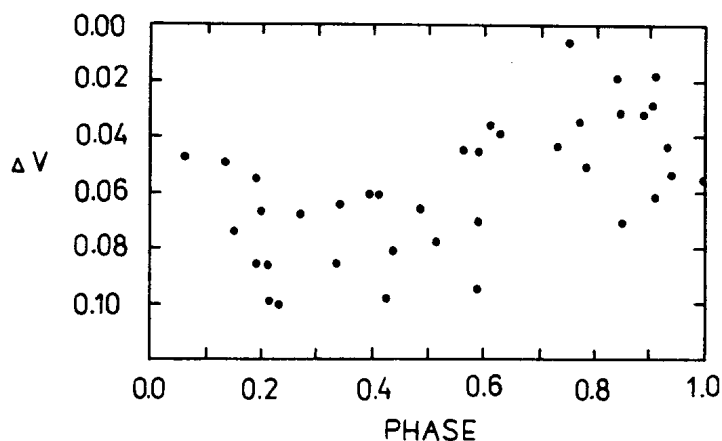


Figure 1

to the one-day repetition of observations, i.e. $1/P_2 = 1 - 1/P_1$. If the rotation period is $P_1 = 2^d.801$ then the equatorial velocity of the star is $v = 2\pi R/P_1 = 18$ km/s supposing that the radius R corresponds to the main sequence. The projected velocity $v \sin i$ of Gl 559.1 is not known. The value of $v \sin i$ has to be also determined from observations in order to verify the adopted values of period and radius.

Figure 1 shows the light curve of Gl 559.1 folded with the period of $2^d.801$. ΔV is the magnitude difference with respect to the comparison star BD+64^o1018. We can derive the amplitudes of brightness and colour variations from our observations only approximately. Their values are equal to $0^m.05$ for the V magnitude and $0^m.01$ for each of colour indices $U-B$, $B-V$, $V-R$ and $R-I$. The variations of colour indices show the star to become redder at light minima. Thus the observed variability may be attributed to the presence of cool spots. The observed brightness and colour amplitudes would correspond to the maximum fraction of the stellar disk covered by spots, $f=0.2$, and the difference between the spot and photospheric temperatures $\Delta T=300$ K. This estimate ignores limb darkening and inclination of the star.

The spectral type of Gl 559.1 is the earliest in the group of 24 spotted single stars belonging to the Local Association. The stars FK Com and V1794 Cyg are the nearest to it by spectral types and rotation periods but they differ from it showing luminosities to be larger. V368 Cep, LQ Hya and V838 Cen have rotation periods similar to that of Gl 559.1 but their spectral types are later. Periods of rapidly rotating early G-stars in young stellar clusters are $0^d.60$ for HeII 520 in α Per cluster (Stauffer et al. 1985) and $1^d.26$ for HII 996 in Pleiades (Panov and Geyer 1991). In general, for G-M main-sequence stars rotation periods range from 0.2-0.6 days to 20-70 days and this range is independent of the spectral type as Soderblom (1991) has concluded. However the scarcity of observational data for early spotted single G stars is worth noting. New observations are needed to improve the relation between rotation periods and CaII emission strengths, to have independent determinations of the rotation periods and projection velocities $v \sin i$, and to study stars with different luminosities and lithium abundances. Spotted main-sequence stars with rotation periods of $0^d.2-0^d.4$ are now known only in the G8-M1 interval of spectral types but not in early G stars. This difference, if confirmed, may be considered as a consequence of a dependence of the spinning-up phenomenon on the stellar mass. One can

suppose that early G stars increase their rotational velocity during the evolution to the main sequence not as strongly as G8-M1 stars do.

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References:

- Chugainov, P.F.: 1991 in Angular Momentum Evolution of Young Stars, S. Catalano, J.R. Stauffer eds., Kluwer Acad. Publ., p.175.
 Chugainov, P.F., Lovkaya, M.N., Petrov, P.P.: 1991, I.B.V.S., No.3623.
 Gliese, W.: 1969, Veröff. Astr. Rechen-Inst. Heidelberg No.22.
 Noyes, R.W., Hartmann, L.W., Baliunas, S.L., Duncan, D.K., Vaughan, A.H.: 1984, Ap.J. 279, 763.
 Panov, K.P., Geyer, E.H.: 1991, Astr. Ap. 242, 112.
 Scargle, J.D.: 1982, Ap.J. 263, 835.
 Soderblom, D.R.: 1981, Ap.J. 248, 651.
 Soderblom, D.R.: 1991 in Angular Momentum Evolution of Young Stars, S. Catalano, J.R. Stauffer eds., Kluwer Acad. Publ., p.151.
 Stauffer, J.R., Hartmann, L.W., Burnham, J.N.: 1985, Ap.J. 289, 247.

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

Number 3681

Konkoly Observatory
Budapest
12 November 1991
HU ISSN 0374 - 0676

Improved Positions of Variable Stars in Northern Pavo

As part of a program conducted to revise and improve the coordinates of variable and suspected variable stars located in the southern hemisphere, accurate positions for confirmed variables in the northern part of Pavo are herein presented. The objects in this constellation located to the south of -67 degrees, have already been discussed by Lopez and Girard (1990).

The methods, procedures as well as a general description of the project can be found in Lopez (1990) and Lopez and Girard (1990).

Table I contains the newly determined positions. For each variable we have listed the name of the variable star, the new RA and Dec (equinox B1950.0 -epoch between 1966.6 and 1973.8- and average standard error of $0.7''$ for both coordinates). The differences between our new positions and those quoted in the GCVS IV range from -0.239 to $+0.165$ minutes of time in RA and from -0.569 to $+0.956$ minutes of arc in Dec.

Considering the 133 objects reported in Table I plus the 950 already published by Lopez and Girard (1990), the total number of variable stars for which we have been able to improve coordinates is now 1083.

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References:

- Lopez, C.E. 1990 J. Am. Assoc. Variable Star Obs. **18**, No. 2, 139.
Lopez, C.E., and Girard, T.M. 1990 Publ. Astron. Soc. Pac. **102**, 1018

TABLE I

Improved Positions in Northern Pavo

Variable	RA	(1950.0)	Dec		Variable	RA	(1950.0)	Dec	
	h	m	s	° ' "		h	m	s	° ' "
R	18	8	4.73	-63 37 43.8	YZ	17	57	28.70	-58 7 12.0
U	20	51	23.11	-62 53 46.2	AA	17	58	39.76	-59 3 16.5
V	17	38	59.78	-57 42 3.6	AB	17	59	36.80	-58 53 47.5
W	17	45	45.37	-62 23 41.0	AD	18	3	4.93	-61 14 19.9
X	20	7	34.18	-60 5 8.6	AF	18	6	23.96	-62 19 5.7
Z	19	30	54.53	-62 52 7.8	AG	18	7	43.29	-62 34 6.4
RS	18	2	57.14	-58 58 5.3	AH	18	9	27.08	-59 2 27.0
RV	18	5	6.99	-59 27 55.3	AI	17	38	13.21	-57 37 9.6
SZ	17	37	5.77	-59 54 16.2	AN	17	53	54.44	-57 1 9.8
TT	17	37	22.92	-57 43 48.6	AO	17	58	21.22	-57 16 4.4
TX	17	43	15.69	-60 4 0.5	AP	17	59	15.75	-62 56 49.3
TY	17	44	0.52	-62 34 59.6	AQ	18	0	23.53	-60 2 16.0
UU	17	45	47.43	-60 0 9.0	AR	18	15	23.84	-66 6 1.1
UV	17	46	47.65	-62 6 1.5	AT	18	13	12.43	-60 17 27.9
UW	17	46	55.29	-61 5 47.4	AU	18	17	53.64	-57 1 39.2
UX	17	47	6.29	-61 52 12.9	AV	18	20	38.21	-58 45 11.8
UY	17	47	6.68	-61 6 54.3	AW	18	23	5.86	-59 16 11.7
VV	17	47	15.89	-61 14 35.6	AX	18	24	34.95	-59 27 4.4
VX	17	48	47.33	-61 53 7.5	AY	18	25	52.56	-58 1 16.3
VY	17	49	23.55	-59 19 24.2	BB	18	30	24.68	-59 16 51.5
VZ	17	50	25.93	-61 35 34.3	BD	18	38	54.77	-57 33 43.1
WW	17	51	6.68	-59 33 59.8	BE	18	40	14.24	-60 8 56.6
WX	17	51	29.06	-59 16 40.2	BF	18	41	13.53	-59 41 35.5
WY	17	51	55.13	-57 9 17.3	BH	18	29	41.85	-65 29 23.4
WZ	17	52	19.47	-59 53 30.0	BM	19	23	42.31	-62 54 57.4
XY	17	53	45.84	-57 36 24.9	BN	19	33	40.88	-60 43 26.4
XZ	17	54	4.83	-59 10 41.8	BW	17	38	49.25	-59 0 54.5
YY	17	56	23.86	-58 26 18.4	BX	17	39	33.58	-59 29 47.5

TABLE I (cont.)

Variable	RA h m s	(1950.0)	Dec ° ' "	Variable	RA h m s	(1950.0)	Dec ° ' "
BZ	17 45 35.77		-60 4 28.9	GM	19 53 17.11		-61 7 25.7
CD	17 50 38.27		-58 51 50.6	GO	19 53 56.02		-57 24 57.3
CE	17 50 57.16		-61 4 6.3	GU	20 3 50.68		-59 0 43.5
CF	17 56 22.29		-57 54 2.1	GV	20 4 17.68		-60 38 1.8
CG	17 56 34.17		-57 47 18.1	GW	20 4 34.58		-57 7 29.9
CI	17 58 7.80		-60 20 20.0	GZ	20 6 9.57		-60 17 30.3
CK	18 4 32.33		-60 13 42.0	HI	20 9 15.00		-59 14 56.5
CL	17 41 3.01		-59 40 39.1	HT	20 13 45.05		-60 46 15.9
CP	18 5 34.90		-57 1 27.2	HV	20 15 6.54		-56 58 58.3
CR	18 8 57.15		-57 6 17.0	HZ	20 17 16.69		-61 9 22.0
CS	18 9 33.96		-59 12 19.6	IM	20 19 42.20		-57 43 15.9
CT	18 11 5.01		-59 39 15.1	IQ	20 22 32.56		-58 21 28.1
CV	18 19 46.61		-58 25 28.5	IT	20 26 41.05		-60 10 22.4
CW	18 25 11.92		-59 22 51.1	IX	20 28 55.52		-61 23 32.0
CX	18 31 16.51		-57 31 38.7	KS	20 42 13.95		-60 24 16.6
CY	18 40 19.05		-57 57 53.5	KU	20 45 21.77		-60 55 54.5
CZ	18 46 57.39		-58 54 18.5	LU	19 45 3.26		-58 44 51.2
DF	18 14 3.08		-65 36 45.6	LV	19 46 35.36		-58 39 56.7
DI	19 33 12.10		-57 4 36.5	LW	19 49 3.56		-58 2 6.6
DL	19 37 56.15		-60 11 20.4	LX	19 51 4.77		-57 10 59.8
DP	18 21 24.12		-64 59 22.2	MM	19 54 36.77		-58 56 55.3
DQ	18 36 23.44		-57 45 51.7	MQ	20 2 16.44		-57 33 25.4
FO	19 47 12.93		-62 51 47.3	MU	20 31 14.01		-61 13 48.0
FU	19 50 9.06		-58 22 14.3	MX	18 19 21.23		-63 58 29.4
FV	19 50 19.55		-59 48 1.2	MY	18 27 40.56		-58 55 34.6
FW	19 50 37.81		-60 36 38.1	MZ	19 7 40.96		-61 21 26.7
FX	19 50 38.96		-60 33 46.6	NN	19 11 34.40		-66 33 46.2
GK	19 52 42.11		-59 37 24.6	NO	19 54 40.04		-62 25 0.9
GL	19 52 53.49		-57 36 44.8	NT	17 55 9.81		-57 35 38.0

TABLE I (cont.)

Variable	RA (1950.0)			Dec		
	h	m	s	°	'	"
NW	18	8	36.11	-65	15	3.7
NX	18	36	31.80	-63	4	57.4
OP	17	38	13.11	-58	15	19.0
OR	17	44	20.59	-61	4	45.5
OS	17	46	15.72	-59	47	56.3
OT	17	47	36.89	-59	49	54.5
OU	17	47	41.45	-60	42	9.4
OW	17	53	11.40	-63	37	40.7
OX	17	52	50.27	-57	48	14.4
OZ	18	1	0.58	-59	47	29.5
PP	18	17	9.02	-59	27	15.9
PR	18	24	43.45	-62	48	23.6
PS	18	31	41.86	-58	28	35.3
PT	18	36	39.31	-62	38	47.0
QR	19	31	13.80	-61	25	55.7
QY	19	49	28.87	-59	27	59.4
V337	20	43	57.90	-62	15	52.0
V340	19	19	42.39	-60	59	28.6
V342	20	36	57.95	-61	46	11.1

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

Number 3682

Konkoly Observatory
Budapest
12 November 1991
HU ISSN 0374 - 0676

On The Position of FG Ser

As part of a program conducted to improve the position of southern variable and suspected variable stars (Lopez and Girard 1990), the case of FG Ser is herein presented.

The GCVS IV gives the position of this variable to the nearest minute of arc in Dec, which implies that the coordinates are only approximate.

We have identified FG Ser in a Kodak blue plate taken on August 17, 1990 with the Yale Southern Observatory double astrograph. A set of 11 AGK3 stars was used as reference system; the least-squares adjustment gave a standard error of 0.38" in both RA and Dec.

The new position we have obtained for FG Ser (equinox B1950.0) is:

$$\alpha = 18^{\text{h}} 12^{\text{m}} 32.90^{\text{s}} \quad \delta = -0^{\circ} 19' 52.9''$$

(the difference between our new position and the one quoted in the GCVS -in the sense new position *minus* GCVS- is 0.048m in RA and -2.882' in Dec).

This new position of FG Ser is in excellent agreement with Allen's (1984) coordinates of the symbiotic star AS 296. This allows to conclude that Schweitzer's (1990) identification of FG Ser with AS 296 is correct, at least from the positional point of view.

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References:

- Allen, D.A. 1984. Proc. Astron. Soc. Aust. **5**, 369.
Lopez, C.E., Girard, T.M. 1990. Publ. Astron. Soc. Pac. **102**, 1018.
Schweitzer, E. 1990. Inf. Bull. Var. Stars 3476.

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

Number 3683

Konkoly Observatory
Budapest
25 November 1991
HU ISSN 0374 - 0676

**The Symbiotic-Like/Cataclysmic Triple System
4 Dra (=CQ Dra): Detection of a
Post-Periastron Passage Brightening**

The unique triple stellar system 4 Dra A + BC = CQ Dra (Reimers, 1985; Reimers et al., 1988) combines in itself the basic structural properties of a symbiotic-like binary (M3 III giant 4 Dra A + hot companion 4 Dra BC) and a cataclysmic one (presumable red dwarf-white dwarf configuration of 4 Dra BC). Such a unique combination makes 4 Dra to be an extraordinarily astrophysically attractive environment of high interest for the study of both above classes of interacting binaries. Although it has been possible to provide a spectroscopic orbital solution for the wide system (4 Dra A + BC; Reimers et al., 1988), the detailed system's setting is far from be known. Earlier observers of 4 Dra have found an irregular optical variability with the amplitude of about 0.1 mag in V (Eggen, 1967) and radio-flux fluctuations on time scales of weeks to months and maybe also on shorter ones of hours to days (Brown, 1987). The data from the UV suggest the presence of significant variations on the scale of days to weeks, too (Reimers et al., 1988; Reimers, 1990, 1991). We have performed long-term UBV monitoring of the system from early 1989 until the end of 1991 October and our interest in the system continues (Skopal et al., 1990; Hric et al., 1991). Our data suggest we have accomplished the first optical photometric detection of the orbital motion within the wide 4 Dra A + BC system (Urban and Hric, 1990). In this contribution we present short description and preliminary discussion of an unexpected feature we have discovered in our UBV light curves - a sudden post-periastron passage brightening of the system in the U colour which is only weakly manifested in the B and V.

All our observations were performed using 60-cm Cassegrain reflectors of the Skalnaté Pleso and Stará Lesná observatories of the Astronomical Institute of the Slovak Academy of Sciences located in the High Tatras Mountains region of northern Slovakia. Both telescopes are equipped with a single-channel pulse-counting photometers. Our data consists of 97 observational runs obtained in 95 nights between 1989 March 12 and 1991 October 29. This data base forms our long-term UBV coverage of the 4 Dra system.

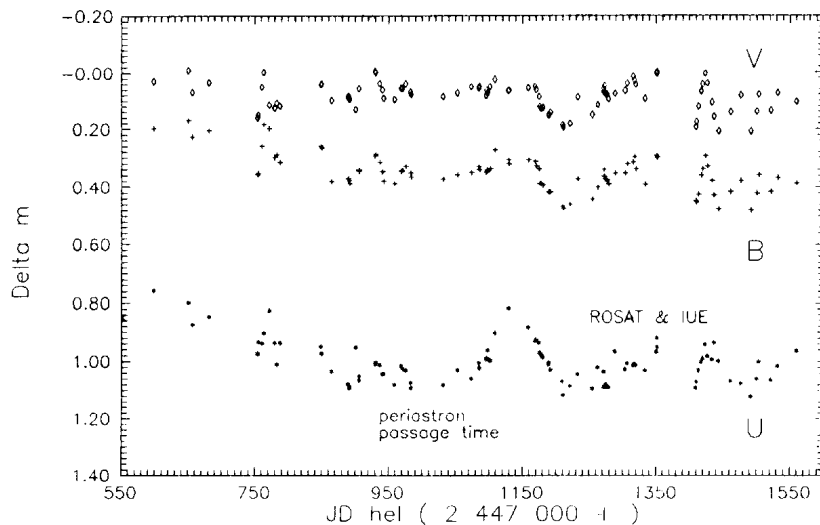


Figure 1: The long-term UBV light curves of the 4 Dra system obtained between 1989 March 12 and 1991 October 29. The data point just below the "and" in the "ROSAT and IUE" inscript corresponds to the night of April 4/5, 1991, when the simultaneous ROSAT and IUE (D. Reimers) and UBV observations (L.H. and Z.U.) were obtained.

As can be easily discerned from Fig. 1, our light curves of the 4 Dra system reflect some long-term modulation with varying degree in the individual colours. The modulation, which we have identified with the 1703-day orbital motion within the 4 Dra A + BC system (Urban and Hric, 1990), is most apparent in the U colour, less prominent in the B and only weakly visible in the V. As the immediate cause of this modulation we have suggested some combination of the reflection effect with a kind of partial eclipse. The unexpected brightening, which maintains almost identical hierarchy of conspicuity in the individual filters, starts shortly after the time of the periastron passage within the 4 Dra A + BC system (according to an ephemeris derived by Reimers et al., 1988). It is hard to specify the exact time of the beginning of the brightness rise, all we can say on the basis of our data is that it has happened some time between 1990 April and early June. The maximum occurred in 1990 August with the overall brightening amplitude of about 0.3 mag in U and about 0.05 mag or less in B and V. By the end of the 1990 October the system has returned to its pre-brightening level. The exact shape of the brightening is, unfortunately, unclear for soon after its maximum the light curves in all three colours exhibit an eclipse-like feature arising most probably due to the approximate alignment of 4 Dra A and 4 Dra BC with the line of sight during that time. The inclination of less than 50 degrees given for the wide system by Reimers et al. (1988) does not favour the classical eclipse interpretation, nevertheless, it is still possible that partial eclipse of some radiating areas within the system has been taking place. A rapid glimpse at the post-brightening part of our light curves shows apparent increase in the general level of photometric activity in the system as compared with the pre-brightening one.

As far as the nature of the brightening itself is concerned, it is possible to consider two basic alternatives: 1. Rayleigh scattering of photons coming from within the environment of 4 Dra BC in the extended atmosphere of 4 Dra A, in an analogy with the mid-eclipse brightening phenomena observed in some eclipsing binaries (cf. Kudzej, 1985, 1986); 2. activity in the close 4 Dra BC pair with the following subalternatives - a/. response to a symbiotic-like sudden accretion following the periastron passage in an eccentric orbit system (Reimers et al., 1988, give $e=0.3$ for the 4 Dra A + BC wide system), b/. totally or partially stimulated intrinsic cataclysmic activity in 4 Dra BC, c/. some combination of a/. and b/. Given the as yet unique character of the observed brightening and the very fact that we have covered to date only about 0.6 of the 1703-day orbital cycle of the wide 4 Dra A + BC system, it is hard to decide now which of the above alternatives seems to be mostly favoured by the still limited data coverage of the system. The environment consisting of a mass-transferring and mass-accreting close pair with a compact component in the neighbourhood of mass-outflowing red giant star (via stellar wind and, presumably, also via mass transfer events due to orbital eccentricity or, perhaps, pulsations) offers a rich variety of scenarios more or less sufficiently explaining the observed phenomena. Nevertheless, we are now making quantitative evaluation of the above and some other more specific, but also more elusive, alternatives and the results will appear elsewhere as a part of our full-scale analysis of all the observations of 4 Dra we have obtained thus far (Urban and Hric, 1991, in preparation).

We are indebted to Professor D. Reimers (Hamburg University Observatory, F.R.G.) for providing us with a preliminary information about the results of his as yet unpublished observations of 4 Dra as well as for the information about the exact time of his recent ROSAT and IUE campaign for this star which has enabled us to obtain simultaneous optical UB_V photometry.

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References

- Brown, A.: 1987, *Astrophys.J.Lett.* **312**, L51.
 Eggen, O.J.: 1967, *Astrophys.J.Suppl.Ser.* **14**, 307.
 Hric, L., Skopal, A., Urban, Z., Dapergolas, A., Hanzl, D., Isles, J.E.,
 Niarchos, P., Papoušek, J., Pigulski, A., Velić, Z.:
 1991, *Contr.Astron.Obs. Skalnaté Pleso* **21**, 303.
 Kudzej, I.: 1985, *Bull.Abastumani Astrophys.Obs.* No. 58, 375.
 Kudzej, I.: 1986, *Astron.Tsirk.* No. 1444, 3.
 Reimers, D.: 1985, *Astron.Astrophys.* **142**, L16.
 Reimers, D.: 1990, private communication.
 Reimers, D.: 1991, private communication.
 Reimers, D., Griffin, R.F., Brown, A.: 1988, *Astron.Astrophys.* **193**, 180.
 Skopal, A., Hric, L., Urban, Z.: 1990, *Contr.Astron.Obs. Skalnaté Pleso*
19, 123.
 Urban, Z., Hric, L.: 1990, *Contr.Astron.Obs. Skalnaté Pleso* **20**, 121.

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

Number 3684

Konkoly Observatory
Budapest
28 November 1991
HU ISSN 0374 - 0676

Spectral changes in the probable SB 60 Cygni ¹

The probable spectroscopic binary 60 Cyg (=HD 200310) has long been known as a variable Be star.* Copeland and Heard (1963) mention a double emission at H β and H γ in 1946. According to Hubert-Delplace and Hubert (1979), the H α emission, which remained weak between 1955 and 1958, increased up to the year 1964. Occasionally, Fe II emissions are seen. Harmanec *et al.* (1986), both from light and radial-velocity curves find a most probable period of 2.48257 days. The energy distribution between 0.33 and 1.06 μ m is given by Gunn and Stryker (1983). At that time (most likely in the early eighties) H α is a moderately bright line and the blue part of the spectrum looks like a rotationally broadened early B-type. The star is classified as B1.5 IV-Vne by Schmidt-Kaler (1967). Beyond H α , observations are very scarce but on our spectrum obtained in 1965 (Andrillat and Houziaux, 1967), the double emission at H α is the only bright line up to 8800 Å; Paschen lines appear as broad and shallow absorption features. Andrillat *et al.* (1988) publish a 1982 spectrum in the same region, which displays "filled in" Paschen lines.

The spectrum still seemed very stable when we secured a CCD spectrum at 1 Å resolution around 1 μ m in August 1991. However, by the end of October, the Hydrogen Paschen 7 photospheric absorption line at 1.0049 μ m had been replaced by an asymmetric double emission (Fig. 1), and the 0.9997 μ m Fe II line appeared with the same type of structure. Further observations in the 0.7 to 0.74 μ m and 0.835 to 0.878 μ m ranges showed the higher members of the Paschen series to exhibit a similar line profile, i.e. a rather ill-defined double peaked emission (with a ~ 6 Å separation), not inconsistent with a ring-shaped emitting region. The P18 line is severely blended with the neighbouring O I line at 0.8446 μ m, the maximum of which peaks at 35 percent above the local continuum. We can also identify neutral nitrogen emission lines at 8629, 8683-86, 8704 and 8714 Å, belonging to multiplets 1 and 8. (see Fig. 2). A thirty minute exposure further to the infrared (1.05 to 1.09 μ m) did not reveal any structure either in absorption or emission at the location of the He I 1.083 μ m line.

While such features make the near-infrared spectrum rather unusual, there is nothing in the blue-violet region (0.39 to 0.525 μ m) that distinguishes the star's spectrum from a bona fide B1.5 type. The He I lines are

¹Based on observations obtained at Observatoire de Haute-Provence (CNRS, France)

* Its variable star name is V1931 Cyg (the Editor).

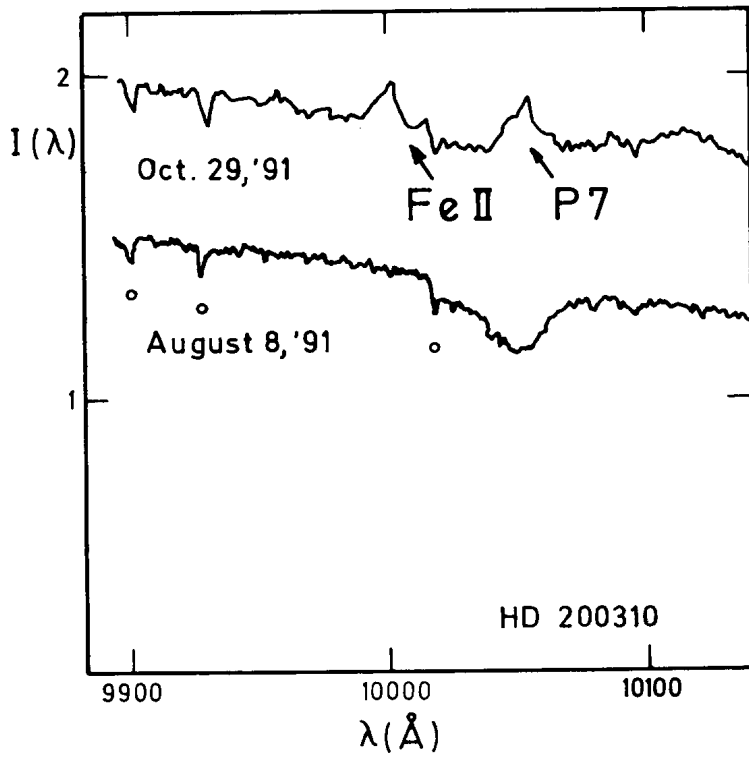


FIG 1. Changes in the $1\mu m$ region between August and October 1991. Note the strength of the Fe II line at 9997\AA . The circles denote atmospheric features.

strong and rotationally broadened at 4009, 4026, 4121, 4144, 4388, 4471, 4713, 4922, 5015 and 7065\AA . Both the triplet and the singlet systems are well represented and it is quite likely that the undetected first line of the $2s - 2p$ series is filled-in with emission. However, the presence of Si III, O II, N II and C II absorption lines in the visible spectrum seems to indicate a higher luminosity class than the one mentioned by Schmidt-Kaler. The equivalent width of $H\gamma$ points to the same direction. Its value of 3.7\AA would better suit to a B 1.5 III-IV star rather than to a main-sequence object. If such is actually the case, the usually admitted $v \sin i$ value of 320 km/s seems indeed somewhat high.

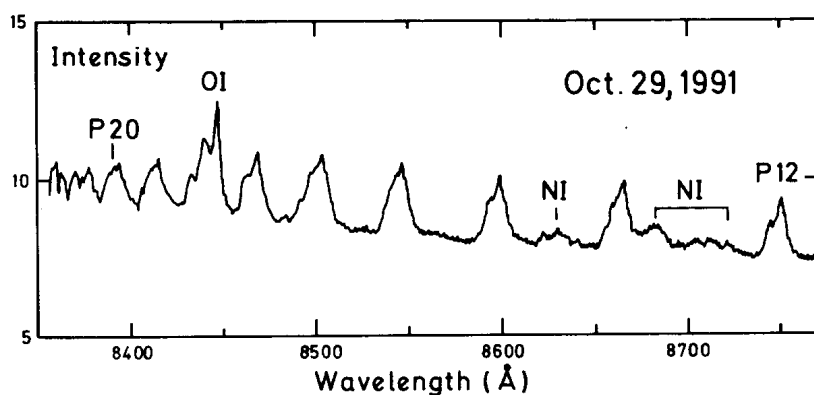


FIG. 2. Spectrum of 60 Cyg in the region of the higher members of the Paschen series. Intensity is on a linear scale. One intensity unit corresponds to $1.42 \cdot 10^{-12} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ Å}^{-1}$

In conclusion, it seems that 60 Cygni has started some time after August a new emission episode which develops at a rate that has not yet been observed. Therefore this object deserves a continuing interest from Be star observers, both photometrically and spectroscopically, especially in the red and in the infrared.

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References

- ANDRILLAT Y., HOUZIAUX L. 1967 J. Observateurs, **50**, 107
 ANDRILLAT Y., JASCHEK M., JASCHEK C. 1988 Astron. Astrophys. Suppl. Ser. **72**, 129
 COPELAND E., HEARD J.F. 1963 Publ. David Dunlap Obs. **2**, 11
 GUNN J.E., STRYKER L.L. 1983 Astrophys. J. Suppl. Ser. **52**, 121
 HARMANEC P., HORN J., KOUBSKY P., BOZIC, H. 1986 I.B.V.S. 2912
 HUBERT-DELPLACE A.-M., HUBERT H. 1979 Un atlas des étoiles Be, Obs. Paris-Meudon
 SCHMIDT-KALER TH. 1967 Publ. Astron. Soc. Pacific, **79**, 181

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

Number 3685

Konkoly Observatory
Budapest
2 December 1991
HU ISSN 0374 - 0676

Detection of a faint variable with $\Delta m > 4^m.5$ in Andromeda

As a by-program in the course of studies on the galactic structure, we have started a search for new variable stars on Palomar Observatory Sky Survey (POSS) prints. The search is done by comparison of overlapping regions of POSS fields (using positive and negative transparent copies) around $\alpha \approx 00^h$, where the largest overlap occurs. Here we present our most obvious candidate.

The star was discovered on POSS O and E839, but is absent on O and E368. Its coordinates are $\alpha = 23^h47^m47^s$, $\delta = +46^\circ42'40''$; ± 0.1 (1950). In Figure 1, finding charts are given.

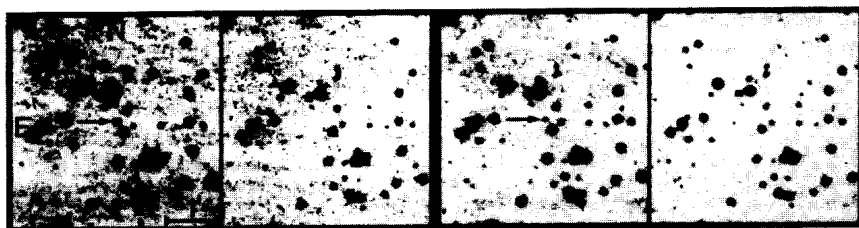


Figure 1: Reproductions from blue-sensitive (O) and red-sensitive (E) POSS prints. From left to right: O839, O368, E839, and E368.

To estimate the brightness of the variable, we measured the size of the star image and used the mean magnitude - diameter relations published by King and Raff (1977) and Humphreys et al. (1991). The weighted means are:

$$m_b = 17.2, m_r = 17.6,$$

with an error of approximately $\pm 0^m.5$, respectively.

On several plates taken with the Schmidt telescopes of the Sonneberg Observatory [$m_b(\text{lim}) \approx 18$] and the Karl Schwarzschild Observatory [$m_b(\text{lim}) \approx 20^m$], in the SE corner of the very recently delivered (1st shipment) POSS II transparency B240 [$m_b(\text{lim}) \approx 22$], as well as on a CCD V frame [$m_V(\text{lim}) \approx 22$] the region in question is contained, but no trace of the star is visible.

The variable thus only appears on the plate pair E and O839. These exposures were taken on Oct. 1/2 1953 (45min E plate, break of 6min, followed by the 12min O plate). A comparison of the star images in O and E shows,

by far more convincing than the rather inaccurate brightness data from above, the blueness of the object. Stars with such an extremely blue colour can at best be found among central stars ($T_{\text{eff}} \approx 10^5\text{K}$) of planetary nebulae. A variable of this amplitude is, however, not known among central stars; besides, there is no nebula visible on the POSS.

As a consequence, it is plausible that the star underwent a brightness change during the exposure of the plate pair, with a rapid increase in brightness during < 1 hour.

By taking the large amplitude ($\Delta m > 4.75$) into account, it is tempting to speculate whether the variable is an eruptive star of some kind. In this connexion it might be of interest that there is no sign of any dark cloud or star forming region in or near the area on the POSS and that there is no IRAS point source at the position of the star. The variable is located just outside the error box of the X-ray source 1H2353+471 (Wood et al. 1984).

It might be rewarding to obtain a very deep exposure (CCDs) in order to gain more information on this object.

A part of this work was supported by the Austrian "Fonds zur Förderung der wissenschaftlichen Forschung" (project P6345). The advice and support by Dr. W. Götz from the Sonneberg Observatory is gratefully acknowledged.

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References:

- Humphreys, R.M., Landau, R., Ghigo, F.D., Zmach, W., and LaBonte, A. 1991, AJ, 102, 395
King, I.R., & Raff, M.I. 1977, PASP, 89, 120
Wood, K.S., Meekins, J.F., Yentis, D.J., Smathers, H.W., McNutt, D.P., Bleach, R.D., Byram, E.T., Chubb, T.A., Friedmann, H., and Meidav, M. 1984, ApJS, 56, 507

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

Number 3686

Konkoly Observatory
Budapest
5 December 1991
HU ISSN 0374 - 0676

UBV OBSERVATIONS OF SN1991T

We report on UBV observations of SN1991T in the galaxy NGC 4527 ($\alpha_{1950.0} = 12^h31^m14^s$, $\delta_{1950.0} = +2^\circ56'28''$) carried out at Serra La Nave stellar Station of Catania Astrophysical Observatory in 1991 from May 7 to May 22, with the 91cm Cassegrain telescope equipped with a photon counting cooled photometer using an EMI 9789QA tube.

As comparison stars we used HD 108202 and HD 107498, the same employed by Cutispoto (1991) in his observations of the supernova at La Silla in May, 16 (IAU Circ. No. 5239). For these stars we have derived the following magnitudes and color indices by observing standard stars in the Coma cluster:

star	V	B - V	U - B
HD 108202	10.265±.006	1.176±.012	1.225±.022
HD 107498	8.415±.014	0.824±.007	0.549±.015

Mean nightly JD_{hel} , V magnitudes, colors and the number of measurements during each run of observations of SN1991T are shown in Table 1.

Table 1. SN1991T: UBV measurements from Serra La Nave

JD_{hel}	V	B-V	U-B	No.
2448384.4496	11.6558±0.0030	0.3722±0.0061	-0.1903±0.0050	24
2448388.4751	11.8314±0.0092	0.5166±0.0066	-0.0400±0.0119	4
2448389.3921	11.9307±0.0030	0.5343±0.0033	-0.0152±0.0066	24
2448392.4247	12.0754±0.0050	0.7065±0.0047	0.1349±0.0082	16
2448394.4904	12.1776±0.0063	0.8429±0.0083	0.1589±0.0157	12
2448398.3889	12.3984±0.0021	1.0474±0.0231	0.2125±0.0215	4
2448398.4636	12.4177±0.0137	1.0487±0.0152	0.1762±0.0209	4
2448399.4152†	12.5938±0.0300	1.1214±0.0289	0.3334±0.0718	8

†bright moon

Our B and V magnitudes are plotted in Figure 1 together with values deduced from photoelectric measurements by other observers, from April 16 to July 18, as communicated in IAU circulars. The time in the abscissa is given in days starting from April 16, i.e. the date of the first UBV photoelectric measurement of the supernova by Cutispoto (IAU Circ. No. 5239). In the V magnitude plot, estimates of visual magnitudes are also shown for the period of exponential decline of the light curve.

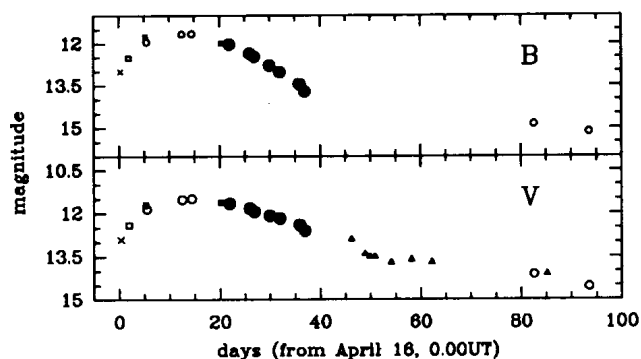


Figure 1: B and V light curves of $SN1991T$ from April 16 to July 15. Filled circles represent our observations.

The decrease of B magnitude (≈ 0.1 mag./day) during the declining phase after the peak brightness, is consistent with a typical $SN Ia$ light curve, as confirmed by the presence of SiII absorption in the spectra taken near the peak (Sivaraman 1991). On the other hand, from the inspection of $B - V$ values, dereddened for a color excess $E(B - V) = .15$ typical of NGC 4527 galaxy (de Vaucouleurs *et al.* 1976), we deduce a trend similar to that of the mean $B - V$ curve for $SN Ia$ phenomena (Wheeler 1991).

We are grateful to Dr. R. Ventura who contributed in the observations and to Prof. N. Panagia for his helpful comments on these data.

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References

- Cutispoto G., 1991, private communication
 de Vaucouleurs G., de Vaucouleurs A., Corwin H.G.Jr, 1976, *Second Reference Catalogue of Bright Galaxies*, Univ. of Texas Press
 Sivaraman K. R., 1991, in IAU Circ. No. 5255
 Wheeler J.C., 1991, in *Supernovae*, J.C. Wheeler, T. Piran and S. Weinberg eds., World Scient. Publish., p. 1

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

Number 3687

Konkoly Observatory
Budapest
6 December 1991
HU ISSN 0374 - 0676

HD 190155=V1359 Aql: not a Cepheid variable*

The variability of HD 190155 was discovered by Henden (1980), who used it as comparison star for V765 Aql. He reported 8 *UBV* measurements spanning 136 days and concluded that "it probably is not a cepheid because the colours are constant with *V* magnitude variation". In spite of this the *General Catalogue of Variable Stars* classified HD 190155 as a suspected *s*-Cepheid variable, also giving a period of 3.7317 d. This period corresponds to one of the higher peaks, but not the highest, in the power spectrum obtained by analyzing Henden's measurements. Owing to the paucity of the data, this result must be taken with a great deal of prudence. As a variable star HD 190155 was named V1359 Aql.

To solve the matter, we photoelectrically observed HD 190155 with the ESO 50 cm in September and October 1991. The *V* observations were performed with a single channel photometer and an EMI 9789QB photomultiplier. HD 189923 (7.3, G5) was used as comparison star and HD 190157 (8.5, G5) as check star; a faint companion is visible a few arcseconds north to HD 189923. The measurement cycle ...-C-V-CK-C-... was repeated at least 4 times and the average of the differential magnitudes relative to HD 189923 were calculated. The normal points so obtained are listed in the table; ΔV 's are in the sense "Star minus HD 189923" and have a typical internal standard deviation of about 0.004 mag.

In our measurements of HD 190155 there is no indication of a light variability as large as that reported by Henden. The star brightness did not vary more than 0.02 mag over the 35 days covered by our survey; however, the rms scatter of the normal points is 0.007 mag, about twice the corresponding value in the HD 190157 measurements. In order to prevent a possible misidentification, HD 190156 was inserted in the observing cycle, being located only 3' south to HD 190155, but its brightness was found to be constant.

Taking into account that the variability of HD 190155 is evident in Henden's mea-

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

Table I

Hel. J. D.	HD 190155	HD 190157	HD 190156
2448503.516	0.717	0.548	
8505.492	0.724	0.552	
.634	0.727	0.554	
.754	0.725	0.547	
8506.490	0.720	0.548	
.662	0.732	0.555	
8507.489	0.728	0.553	
8508.491	0.734	0.562	
8511.491	0.732	0.558	
8512.517	0.731	0.556	
8513.502	0.735	0.556	1.902
8517.496	0.738	0.551	1.903
8518.495	0.732		1.903
8519.495	0.729		
8530.498	0.736	0.552	1.904
8532.506	0.727	0.551	1.905
8533.493	0.731	0.548	1.906
8538.494	0.712	0.551	

surements (the peak-to-peak amplitude is 0.19 mag), we can only conclude that the star is not a periodic variable. Its G5 spectrum suggests that it can be a spotted star; these objects often go through low-level activity phases in which the light variability is hardly detectable. Owing to the very small scatter in our magnitudes the hypothesis of a semiregular variable is much less probable.

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Henden, A.A.: 1980, MNRAS **192**, 621

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

Number 3688

Konkoly Observatory
Budapest
6 December 1991

HU ISSN 0374 - 0676

1991 V PHOTOMETRY OF CG CYG AND A POSSIBLE NEW VARIABLE

As part of our long term program of photometry of chromospherically active binary stars Zeilik *et al.* (1991) observed CG Cyg (=BD 34°4217 =#142 in the catalog of Strassmeier *et al.* (1988)) at BVR during June 1991. They report the short term small amplitude fluctuations imposed on the eclipse and maculation wave that were earlier seen by Beckert *et al.* (1989, 1991) and Dapergolas *et al.* (1989, 1991).

To further investigate these fluctuations, and hopefully study them with very high time resolution we reobserved CG Cyg on August 2, 3, 4, and 5, 1991 UT. We used the 61-cm telescope at Mt. Laguna Observatory operated by San Diego State University. The photoelectric photometer was recently equipped with a red sensitive Hamamatsu GaAs tube operating at -1450V. Our comparison star was BD 34°4216 not Yu's (1923) star (a) as used by Zeilik *et al.* (1991). We did however use star (a) as a check star and observed it frequently to see if it might vary. It appears to do so. To obtain the highest possible time resolution, we observed at V only. We used unbinned 30 second integrations (typically producing a few hundred thousand counts) and observed the sky and comparison roughly every 15 minutes. We plot the unbinned data in Figure 1. Because our observations were only at V, we did not have the B data needed to transform to the Johnson system. Hence, the data are in the instrumental system, which closely matches the Johnson V band. Note that the August data do not for the most part show the short term fluctuations seen in the June 1991 data. There is, however, one small fluctuation at phase ~0.75 that corresponds to a similar fluctuation at the same phase in the June data.

We also modeled the data using the technique of Budding and Zeilik (1987) and the same stellar parameters as Zeilik *et al.* (1991). We find a different star spot solution. We have one spot with the optimized parameters: longitude=87°, latitude=57°, and radius=18° (Figure 2). This result compares with the June 1991 solution for two spots: longitude= 46° & 238°, radius= 5.6° & 6.9° with the latitude fixed at 45°. To ensure that we had no problems with a non-unique solution we attempted to fit the August data with the June solution. The attempt failed. We can therefore reliably conclude that CG Cyg changed its spots significantly during July 1991. The change of spots could have removed the small amplitude rapid fluctuations seen in June 1991; so in light of the spot changes the lack of fluctuations in August is not surprising.

We must also consider the possibility that these fluctuations are caused by variability in Yu's star (a) used by Zeilik *et al.* (1991) and Beckert *et al.* (1989, 1991) as the comparison star. To test this hypothesis we frequently observed star (a) using BD 34°4216 as a comparison. In addition on August 5 we observed it for about 1.5 hours. We find star (a) varies roughly 0.04 mag over time scales of about an hour. We plot our data in Figure 3, and note that the 3 inserts expanding small portions of the horizontal axis are not to the same scale. It is tempting to assume that this variability of star (a) explains the short term fluctuations observed in CG Cyg. However, the June 1991 data show no evidence for such variability in star (a), and the maximum amplitude of the fluctuations is about double the 0.04 mag variations we observed in star (a). In addition Dapergolas *et al.*

CG Cygni August 1991

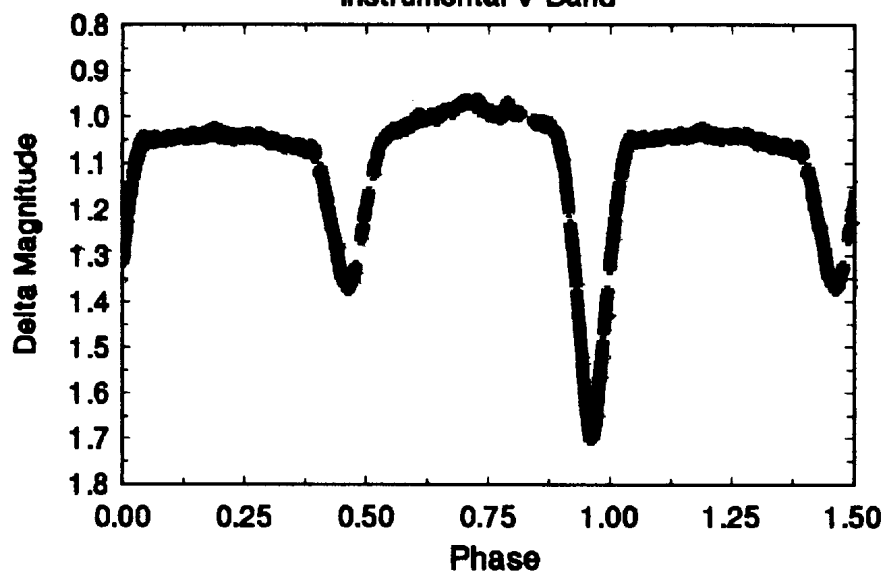
Instrumental V-Band

Figure 1

CG Cygni - 1 Spot Fit

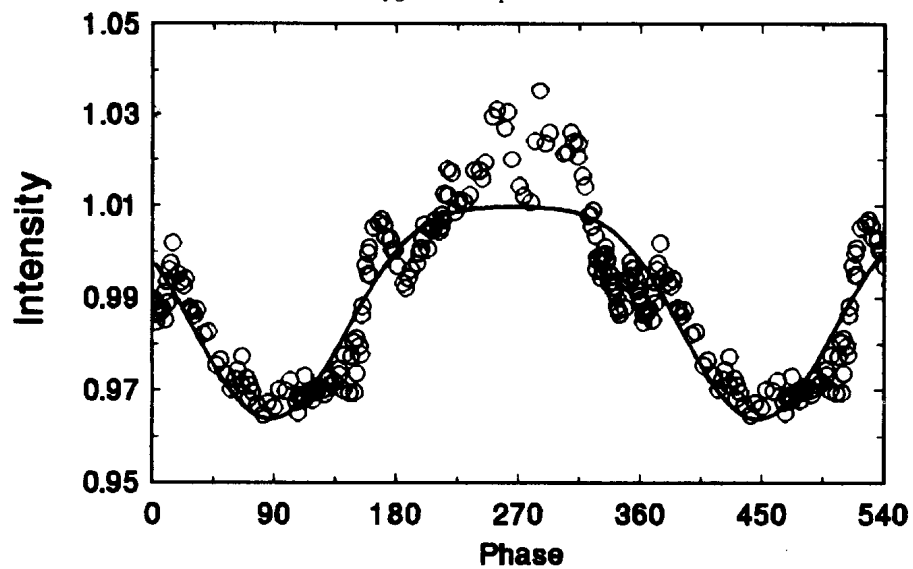


Figure 2

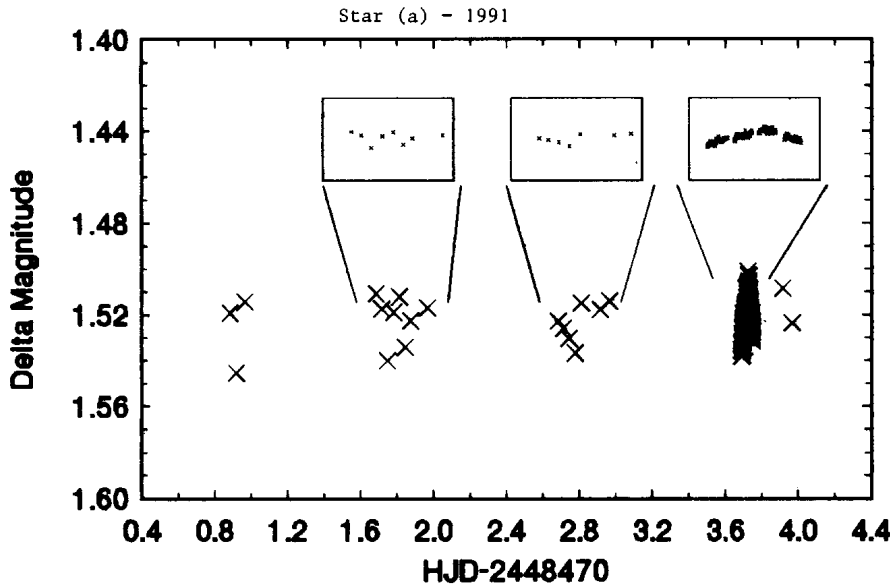


Figure 3

(1989, 1991) observed these fluctuations using BD 3404216 rather than star (a) as a comparison.

The June 1991 CCD frames were reduced again using another star in the field as a check star. The data were considerably noisier because the check star was much fainter than either CG Cyg or star (a); however, to within the noise limits there appeared to be no systematic variations in star (a) (during June) sufficient to cause the observed fluctuations in CG Cyg. Perhaps star (a) has variable amplitude. In addition, these fluctuations do not appear during the eclipses for any of the light curves on which they appear as would be expected if they resulted from variations in star (a). The 1991 and 1989 data show fluctuations at the same phases, and the one fluctuation visible in the August 1991 data is at the same phase (~ 0.75) as one of the June 1991 fluctuations. This effect would be highly unlikely if the fluctuations were an effect of star (a), which would most likely have a different period. This likely period difference would also have smeared out the fluctuations in the June 1991 data, which were taken over a three week interval. Therefore, if the fluctuations were an artifact of star (a)'s variability, they would be unlikely to show up in the June 1991 data. Beckert *et al.* (1989 & 1991) give additional arguments for believing that these fluctuations arise from CG Cyg itself rather than from the comparison star (a). It therefore appears that the fluctuations observed in June 1991 are real rather than an effect of our observed variability in star (a). Additional investigations are needed to confirm the apparent variability in star (a) and to study the short term fluctuations in CG Cyg. With the current data it appears that star (a) is variable but that this variability is insufficient to explain the observed rapid small amplitude fluctuations in CG Cyg.

If these short term fluctuations indeed arise from CG Cyg, we must consider the physical mechanism causing them. We note that they appear in June 1991 just before a

major change in the spots on CG Cyg. Perhaps there is a physical connection. The short term fluctuations might be caused by small spots associated with either the breakup of the spots seen in June or the formation of the August spot. However, this hypothesis is unlikely because it does not easily explain the similarity in structure of the fluctuations for the 1989 and 1991 data or the depth of the fluctuations. Additional data are obviously needed to understand these short term out of eclipse fluctuations.

We would like to thank Ron Angione for scheduling generous amounts of telescope time at Mt Laguna. We acknowledge generous support from a Research Corporation grant to PAH and from a National Science Foundation grant AST-8901374 to MZ.

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References:

- Beckert, D., Cox, D., Gordon, S., Ledlow, M., and Zeilik, M., 1989, *Inf. Bull. Var. Stars*, No. 3398.
 Beckert, D., Gordon, S., Jaderlund, E., Mann, E., and Zeilik, M., 1991, *Inf. Bull. Var. Stars*, No. 3556.
 Budding, E., and Zeilik, M., 1987, *Astrophys. J.*, 319, 827.
 Dapergolas, A., Kontizas, E., and Kontizas, M., 1989, *Inf. Bull. Var. Stars*, No. 3322.
 Dapergolas, A., Kontizas, E., and Kontizas, M., 1991, *Inf. Bull. Var. Stars*, No. 3609.
 Strassmeier, K.G., Hall, D.S., Zeilik, M., Nelson, E., Eker, Z., and Fekel, F.C., 1988, *Astron. Astrophys. Suppl. Ser.*, 72, 291.
 Yu, C.-S., 1923, *Astrophys. J.*, 58, 75.
 Zeilik, M., Heckert, P., Ledlow, M., Rhodes, M., Summers, D.L., Jaderlund, E., and Boudreau, K. 1991, *Inf. Bull. Var. Stars*, No. 3663.

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

Number 3689

Konkoly Observatory
Budapest
10 December 1991
HU ISSN 0374 - 0676

V 1251 CYGNI - UNSUCCESSFUL SEARCH FOR ADDITIONAL ERUPTIONS

Moriyama and Schmeer (1991) announced a new eruption of V 1251 Cyg in October 1991, and Kato (1991) afterwards reported on the development of superhumps.

On 536 suitable Sonneberg Sky Patrol plates taken in the years 1941 to 1990 mainly by H. Huth and B. Fuhrmann, no further eruption could be detected with the exception of the October 1963 outburst of Weber (1966), which was confirmed by two of my observations. Only plates are counted which at least reach magnitude $13^m.3$ (pg) in Weber's system (comparison star c).

We conclude that this is one of the rare SU Ursae Majoris stars with time intervals of several years between successive superoutbursts (= outbursts with superhumps). "Normal" maxima, which usually are of remarkably smaller amplitude, could be easily hidden below the threshold of our plates. However, the object might also behave like WZ Sge, where normal eruptions are obviously missing at all.

On the POSS charts a small triangle of $18^m.5$ stars, the southwestern of them is bluish, lies at the position. If one of these objects is the cataclysmic variable, then the observed amplitude of about 6 mag of the supermaxima as well as the superhump period of $0^d.076$ leads to a cycle length of roughly three years (see the relationships given by Bräuer and Richter (1989)). Therefore, both thoroughly watching the locality by visual or CCD patrol techniques to possibly reveal normal eruptions and the search for the genuine low state object would be promising tasks.

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References:

- Kato, T.: 1991, IAU Circ. No. 5379
Moriyama, M., Schmeer, P.: 1991, IAU Circ. No. 5377
Richter, G.A., Bräuer, H.-J.: 1989, Astron. Nachr. 310, 413
Weber, R.: 1966, I.B.V.S. No. 123

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

Number 3690

Konkoly Observatory
Budapest
10 December 1991
HU ISSN 0374 - 0676

Light variability of HD 224639, HD 224638 and HD 224945 *

The short period light variability of HD 224639 (7.3, F0) was first detected by Manfroid and Renson (1983) who used it as a comparison star in a programme for the search for Ap variables. Since it was probable that the star could be a δ Scuti type variable, we included it in our programme devoted to the study of multimode pulsators.

We observed it in the *B* colour with the 50-cm telescope at Merate Observatory for 3 nights in 1988 and 6 nights in November 1989. During this second run we also observed the star during 9 nights with the ESO 50-cm telescope at La Silla Observatory. These observations showed that HD 224639 is a typical δ Scuti star with a maximum amplitude of about 0.13 mag in the *B* colour, and a preliminary frequency analysis of the data indicated the presence of several pulsation modes. The data were in any case unable to allow an unambiguous frequency identification (Mantegazza and Poretti, 1990).

Using HD 224638 (7.2, F0) and HD 224945 (6.9, A3) as comparison stars, and observing them with the same frequency as HD 224639, we discovered that at least one of them was variable with an amplitude of some hundredths of a magnitude and a characteristic time scale of the order of several hours. For these reasons we planned new intensive observations that we performed at La Silla with the ESO 50-cm telescope from September 5 to October 9, 1991. We were able to get data during 20 nights, observing consecutively for several hours (up to 8) on many of them. In order to detect which of the two comparisons was variable we adopted a third comparison star, HD 225086 (8.0, F2), but after the first observing night it was evident that both HD 224638 and HD 224945 were variable, so that in order to check the constancy of HD 225086 and the accuracy of the measurements a fourth comparison star was introduced in the observing cycle. During the successive 4 nights we used HR 11 (6.43, B8 IIIp), but since the colour of this star is consistently different from that of the others, with the need of introducing large colour terms in the reduction procedure, we preferred to drop it and use in the following nights HD 200 instead. In any case HD 225086, HR 11 and HD 200 were found to be constant within a few thousandths of a magnitude. In the Figure, we show the light curves obtained during a typical night. From top to bottom we have plotted the magnitude differences of HD 225086 with respect to HR 11, HD 224945, HD 224638 and HD 224639 respectively (in the sense "HD 225086 minus program star"). We can see that while HD 224639 shows the typical lightcurve of a δ Scuti star, with an apparent

* Based on observations made at the European Southern Observatory (ESO), La Silla, Chile

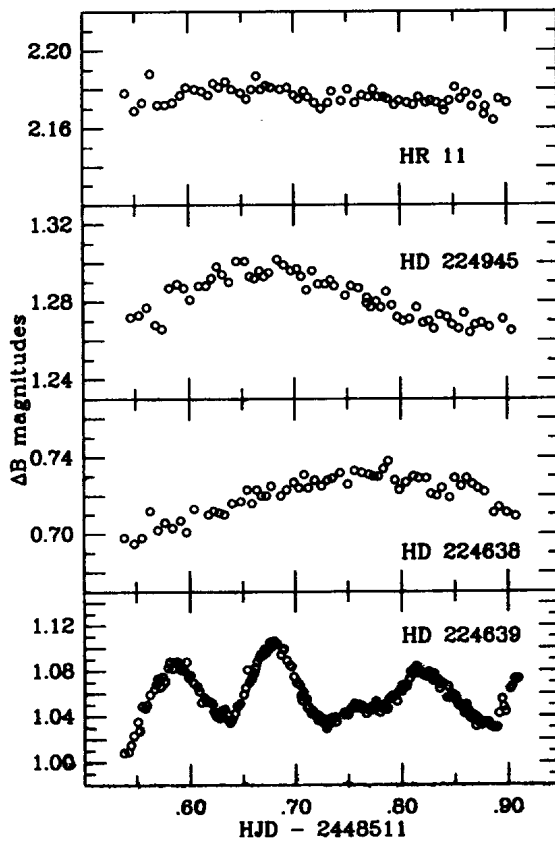


Figure 1

periodicity of the order of 0.1 days, HD 224638 and HD 224945 have a slow variation with timescales longer than the observational baseline. A preliminary examination of the complete set of light curves of these two stars shows the non-regular nature of this variation even if characteristic time scales could probably be defined. F type stars showing the same kind of variability have been discovered with increasing frequency in the last years (Abt et al., 1983; Antonello & Mantegazza, 1986; Krisciunas & Guinan, 1990; Mantegazza et al., 1991) however careful studies are still missing and the nature of the light variability is still elusive. We hope that our conspicuous datasets will enable us to derive the statistical properties of the light variations of HD 224638 and HD 224945. Regarding HD 224639 we have about 2700 differential magnitudes in the *B* colour with respect to HD 225086, corresponding to about 130 observational hours. A preliminary

frequency analysis of these data shows a complex pulsation spectrum with 4 modes, at 6.21, 9.49, 9.54 and 10.57 c/d, having about the same semi-amplitudes of roughly 15 mmag, and with many more of lower amplitudes.

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References:

- Abt, H.A., Bollinger, G., Burke, E.W.: 1983, *Astrophys.J.* **272**, 196
Antonello, E., Mantegazza, L.: 1986, *Astron.Astrophys.* **164**, 40
Krisciunas, K., Guinan, E.: 1990, *Inf.Bull.Var.Stars* No.3511
Manfroid, J., Renson, P.: 1983 *Inf.Bull.Var.Stars* No.2311
Mantegazza, L., Poretti, E.: 1990, in "Confrontation between stellar pulsation and evolution", ASP Conference Series Vol.11, p.324
Mantegazza, L., Poretti, E., Antonello, E.: 1991, *Inf.Bull.Var.Stars* No.3612

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

Number 3691

Konkoly Observatory
Budapest
11 December 1991
HU ISSN 0374 - 0676

PHOTOELECTRIC PHOTOMETRY OF TWO SMALL-AMPLITUDE RED VARIABLES

D. H. Kaiser reported the photographic discovery of two 7th-magnitude red variables, which were designated DHK 12 and DHK 15 in his discovery lists (Kaiser et al. 1990, Kaiser 1990). These stars were thought to be SR type, but the periods were undetermined. To confirm the type and define the periods, I have made differential photoelectric observations of these stars during the past two seasons using a 28-cm Schmidt-Cassegrain telescope, Optec SSP-3 solid-state photometer, and V filter. The observations have been corrected for differential extinction and transformed to V of the UBV system.

DHK 12 - BD +29° 3730, HD 186860, SAO 68801, IRC +30391, NSV 12387

Six photoelectric observations from the 1989 season were reported earlier (Williams 1990). Table I presents 13 additional observations made on 12 nights in 1990. Figure 1 shows the 1990 light curve.

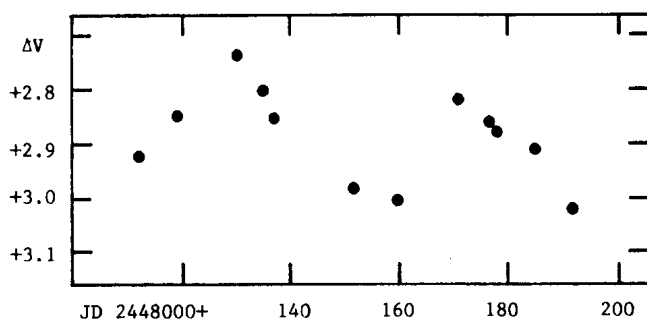


Figure 1. DHK 12

TABLE I. DHK 12

HJD 2440000+ (n)	ΔV	s. d.	HJD	(n)	ΔV	s. d.	
8111.598	(3)	+2.924	± 0.006	8170.599	(3)	+2.817	± 0.018
8118.603	(3)	2.848	0.005	8176.605	(3)	2.850	0.019
8129.614	(3)	2.737	0.008	.633	(3)	2.864	0.009
8134.597	(3)	2.799	0.013	8177.593	(3)	2.868	0.006
8136.642	(3)	2.846	0.005	8184.609	(3)	2.911	0.010
8151.579	(3)	2.982	0.004	8191.627	(3)	3.018	0.013
8159.549	(3)	3.003	0.008				

The comparison star was Phi Cygni. Single measures of the check star HR 7505 on 12 nights show a constant difference, the standard deviation of a single observation from the mean being ± 0.007 . Based on Phi Cyg's magnitude, 4.69 V in The Bright Star Catalogue (Hoffleit and Jaschek 1982), the variable's observed range during the two seasons was 7.43 - 7.83 V. A Discrete Fourier Transform analysis of all the observations indicates a period of 43.0 days.

DHK 15 - BD +10°2067, HD 85720, SAO 98835

Table II presents 17 observations from the 1989-90 and 1990-91 seasons. Figure 2 is the 1990-91 light curve. The comparison star was 31 Leonis. Twenty measures of the check star SAO 118138 on 17 nights have a standard deviation of a single observation from the mean of ± 0.019 . Based on 31 Leo's magnitude, 4.37 V, in the Bright Star Catalogue, the variable's observed range was 7.78 - 8.13 V. DFT analysis yields a primary peak at P = 62.3 days and a secondary peak near 52 days. The second peak may

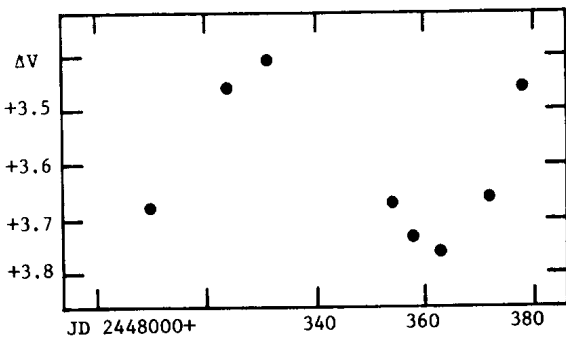


Figure 2. DHK 15

TABLE II. DHK 15

HJD 2440000+ (n)	ΔV	s. d.	HJD	(n)	ΔV	s. d.	
7869.847	(4)	+3.583	± 0.009	8309.684	(6)	+3.682	± 0.017
7953.697	(3)	3.527	0.011	8323.631	(3)	3.459	0.005
7954.675	(4)	3.486	0.005	8330.607	(3)	3.410	0.004
7971.635	(3)	3.552	0.028	8353.593	(5)	3.671	0.007
7977.674	(4)	3.587	0.011	8357.692	(3)	3.735	0.003
8000.643	(3)	3.535	0.021	8362.632	(3)	3.762	0.001
8019.663	(4)	3.473	0.005	8371.625	(3)	3.662	0.010
8041.601	(3)	3.609	0.006	8377.609	(3)	3.460	0.018
8043.612	(3)	3.636	0.012				

represent a difference in the semiregular variable's actual period during the two brief seasons of observation or a 1-cycle per year alias.

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REFERENCES

- Hoffleit, D., and Jaschek, C., 1982, The Bright Star Catalogue, Yale University Observatory, New Haven.
- Kaiser, D. H., 1990, Inform. Bull. Var. Stars No. 3480.
- Kaiser, D. H., Baldwin, M. E., and Williams, D. B., 1990, Inform. Bull. Var. Stars No. 3442.
- Williams, D. B., 1990, Inform. Bull. Var. Stars No. 3443.

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

Number 3692

Konkoly Observatory
Budapest
27 December 1991
HU ISSN 0374 - 0676

THE LIGHT CURVE OF ER VULPECULAE

Observations of ER Vul were carried out in the newly founded Middle East Technical University (METU) Observatory in Ankara. These are the first observations in the METU Observatory situated on the Campus of the Middle East Technical University which went into operation at the end of 1990. It is about 10 kilometers from the city of Ankara. The observatory is attached to the Physics Department at METU in which teaching is in English. In the University, astronomy teaching has been going on since 1962. At present there are 8 astronomers with Ph.D. and 8 graduate students studying astronomy and astrophysics.

The coordinates of the Observatory are:

Geographical latitude: $39^{\circ} 53' 6''.1$
Geographical longitude: $2^{\text{h}} 11^{\text{m}} 10^{\text{s}}.5$
Height above the sea level: 949m.

Although the number of totally clear nights is about 100, the number of clear nights good for observations varies from 150 to 200.

The METU Observatory contains a telescope of Cassegrain type with a 40cm mirror and SSP-3 solid state photometer attached to it. In addition it is expected to install a CCD Camera (Astrolink Cryo, Cam 80, 572x485 pixel) in a year.

Photometric observations of the system ER Vul were done in blue and yellow lights with B and V filters on June 15, 17, 18 and 28, 1991. ER Vul was also observed at the Ege University observatory in 1981 and 1982. The results were presented in a paper by Ibanoglu et al. (1987). They found that the light curves obtained in two colours showed changes in short time intervals. Observations done on the system so far indicate that we need to perform further observations to clarify exactly what the cause of such a variation in the observed light curve may be. Detailed description of the system including full list of references of the previous works on this star can be found in Hill et al.'s (1990) paper.

The components of the system are known to have spectral types GOV and G5V. ER Vul is known as HD 200 391 with $\alpha = 21^{\text{h}} 02^{\text{m}} 25^{\text{s}}.7$, and $\delta = +27^{\circ} 48' 26''$

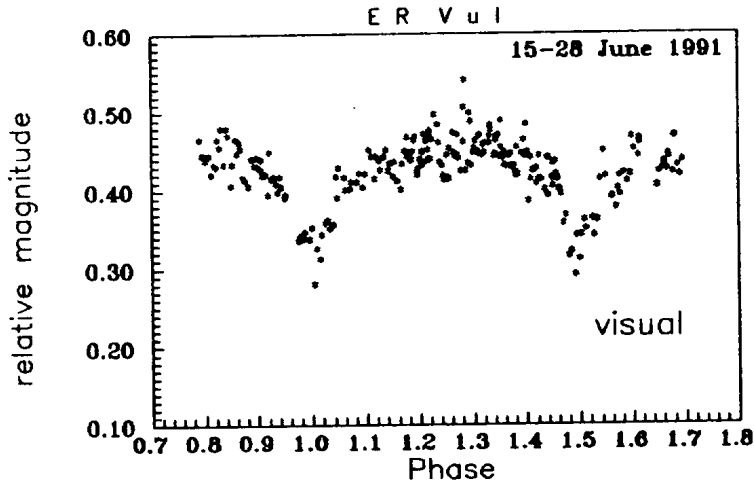


Figure 1. The Light Curve of ER Vul in yellow light.

(2000). The star HD 200270 was chosen as the comparison star. The differential magnitudes in two colours were taken as variable minus comparison. The atmospheric extinction coefficients were computed and then the effect of the atmospheric extinction was removed. The phases of the individual observations were computed using ephemeris

$$\text{Min I} = \text{JD Hel. } 2440\,182.2621 + 0.^{\text{d}}.69809409\,E$$

after heliocentric correction. Finally differential observations versus orbital phases were plotted and the one in yellow colour is presented in Figure 1. The standard deviation for our observing system has been found to be 0.017 ± 0.005 in magnitude.

As it has been noted by previous observers, distortions in the light curve are noticeable at the first glance. There is an irregular variation in the light curve. The variability in the light level outside the eclipses, especially in the phase range from about 1.1 to 1.4 is conspicuous. The amplitude of the variation is larger than 0.10 magnitude. The wave-like variation is clearly seen in the Figure.

Acknowledgement: This work was supported by the Research Fund Project
1989-01.05-02 at METU.

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References:

Hill, G., Fisher, W.A., Holmgren, D.: 1990, *Astron. Astrophys.*, 238, 145.
Ibanoglu, C., Evren, S., Tunca, Z.: 1987, *Astrophys. and Space Sci.*, 136,
225.

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

Number 3693

Konkoly Observatory
Budapest
2 January 1992
HU ISSN 0374 - 0676

TWO-SPOT MODELLING OF HD 106225 = HU Vir IN 1990 AND 1991

HD 106225 was found to be variable by Fekel, Hall, and Henry (1984) and later given the name HU Vir in the 68th Name List of Variable Stars. Their 1982 photometry showed a range of $0^m.25$ in V and a period of $10^d.6 \pm 0^d.1$. As No. 82 in the Catalogue of Chromospherically Active Binaries (Strassmeier et al. 1988), it is a KO III SB1 with an orbital period of $10^d.330$, a negligible eccentricity, and a $V \sin i$ of 25 km/sec.

Differential photoelectric photometry obtained in the B and V band-passes during 1990 and 1991 with the 16-inch automatic telescope described by Henry, Nagarajan, and Busby (1991) confirms the variability. The Julian date ranges covered were 2,447,987.8 to 2,448,042.7 and 2,448,292.9 to 2,448,437.7 and the comparison star was HD 105796, the same one used by Fekel, Hall, and Henry (1984).

We fit the two years of data, separately, with the two-spot modelling procedure developed by Hall, Henry, and Sowell (1990). The resulting parameters are shown in Table 1 (for the V-band data) and Table 2 (for the B-band data). In both years there were two starspots on the KO III star, one larger than the other. In both years and for both spots the light loss was a little greater in B than in V. The two spots in 1990 had rotation periods which were equal within their uncertainties but the two spots in 1991 had significantly different rotation periods. The brightness at maximum, when both spots were turned away from view, increased by about $0^m.03$ in V and $0^m.02$ in B between 1990 and 1991. The rms deviation from the four fits ranged from $\pm 0^m.006$ to $\pm 0^m.013$.

Figure 1 shows the V-band light curves in 1990 and 1991, with the individual observations as points and the parameters from Table 1 as solid curves.

The four different spots show rotation periods which span a range of 2.3 percent. If this is presumed to result from differential rotation, then we can follow the procedure of Hall and Busby (1990, figure 2) to estimate the differential rotation coefficient k . With four spots, we have $n = 4$ and hence $f = 0.45$. The result is then $k = 0.023/0.45 = 0.05$. Note that this value fits almost perfectly on the k vs. $P(\text{rot.})$ relation established by Hall (1991, eqtn. 2) for a larger sample of spotted stars. For the Sun, by comparison, $k = 0.19$.

This work was supported by N.A.S.A. research grant N.A.G. 8-111.

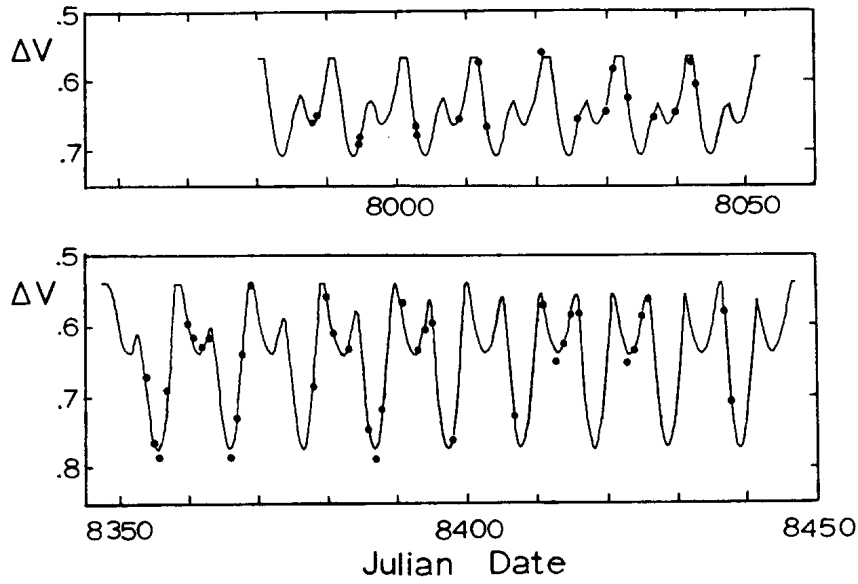


Figure 1. Light curve of HD 106225 = HU Vir in 1990 (top) and 1991 (bottom). Each point is differential magnitude in V with respect to HD 105796. The solid curves represent the two-spot model fits, taken from Table 1.

Table 1. Parameters of the two-spot model fits - V bandpass

epoch	rms	max.	spot	period	JD(min.)	ampl.
1990.34	± 0.006	0.568 $\pm .002$	A	10.22 $\pm .01$	7993.68 $\pm .03$	0.142 $\pm .004$
			B	10.18 $\pm .02$	7997.83 $\pm .15$	0.097 $\pm .004$
1991.30	± 0.012	0.541 $\pm .002$	A	10.44 $\pm .01$	8365.80 $\pm .03$	0.232 $\pm .004$
			B	10.27 $\pm .04$	8371.81 $\pm .08$	0.098 $\pm .004$

Table 2. Parameters of the two-spot model fits - B bandpass

epoch	rms	max.	spot	period	JD(min.)	ampl.
1990.34	± 0.011	0.481 ± 0.003	A	10.20 ± 0.02	7993.72 ± 0.05	0.168 ± 0.007
			B	10.20 ± 0.03	7997.75 ± 0.11	0.113 ± 0.006
			A	10.43 ± 0.01	8365.81 ± 0.03	0.264 ± 0.004
			B	10.27 ± 0.02	8371.83 ± 0.07	0.108 ± 0.005
1991.30	± 0.013	0.458 ± 0.002	A	10.43 ± 0.01	8365.81 ± 0.03	0.264 ± 0.004
			B	10.27 ± 0.02	8371.83 ± 0.07	0.108 ± 0.005
			A	10.43 ± 0.01	8365.81 ± 0.03	0.264 ± 0.004
			B	10.27 ± 0.02	8371.83 ± 0.07	0.108 ± 0.005

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References:

- Fekel, F.C., Hall, D.S., and Henry, G.W. 1984, I.B.V.S. No. 2543.
Hall, D.S. 1991, in The Sun and Cool Stars: Activity, Magnetism, Dynamos,
edited by I. Tuominen, D. Moss, and G. Rüdiger (Berlin: Springer-
Verlag), p. 353.
Hall, D.S. and Busby, M.R. 1990, in Active Close Binaries, edited by
C. Ibanoglu (Dordrecht: Kluwer), p. 377.
Hall, D.S., Henry, G.W., and Sowell, J.R. 1990, A. J. **99**, 396.
Henry, G.W., Nagarajan, R., and Busby, M.R. 1991, I.A.P.P.P. Comm.
No. 45, 11.
Strassmeier, K.G., Hall, D.S., Zeilik, M., Nelson, E., Eker, Z., and
Fekel, F.C. 1988, Astr. Astrophys. Suppl. **72**, 291.

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

Number 3694

Konkoly Observatory
Budapest
28 January 1992
HU ISSN 0374 - 0676

FURTHER OBSERVATIONS OF LIGHT-CHANGES OF THE CENTRAL STAR OF
PLANETARY NEBULA NGC 2346 AT THE BEGINNING OF 1991*)

We followed the central star of NGC 2346 ($215^{\circ}3'1''$; $AR_{1950} = 7^h06^m49^s.7$, $D_{1950} = -0^{\circ}43'29''$) in order to supplement the observations of that star made in January 1991 (Kohoutek, 1991). L. M. and partly L. K. observed at the European Southern Observatory, La Silla, Chile, using the 50 cm telescope and a pulse counting photometer (EMI 9789 QB photomultiplier, dia. 21 arcsec). The measurements are summarized in Table I, where ΔV and ΔB are the differences between the respective brightness (in magnitudes) of the central star and of that of the comparison "b" (see Kohoutek, 1982); every night the central star was measured 3 times and the comparison star twice. The nebular radiation was not subtracted, because the observations were not made in different diaphragms. The ΔV light curve is presented in Fig. 1: it shows the minimum with the depth of at least $\Delta V = 0.12$ mag ($\Delta B \approx 0.16$ mag) and the duration of about 9 - 10 days. Unfortunately it is not possible to determine the time of the minimum. If we adopt JD 2448282.0 (Jan. 25^d.5), the photometric period would then be 14.4 days (the minimum of Jan. 11^d.1 was used). After JD 2448287 the star was nearly constant having $\Delta V = 0^m.17$ and $\Delta B = -0^m.03$.

In Table II are the measurements made by H. Debehogne using the 50 cm telescope at La Silla, Chile (Hamamatsu tube together with the UBV Johnson filters, dia. 21 arcsec); the table contains again ΔV , based on one measurement of the star and one of the comparison every night. The minimum appears on JD 2448309.3 \pm 2 (Feb. 21^d.8). The lower brightness of the central star was also observed on JD 2448303.7 with $\Delta V = +0^m.36$, whereas in the maximum the star was $\Delta V = +0^m.15$. In the following four nights (JD 2448311.6 - 8315.6) the central star was observed by O. H. (Hamamatsu tube, VRI magnitudes) using the same telescope at La Silla - the star shows a nearly constant brightness of $\Delta V = +0^m.05$. The differences ΔV in the maximum light of the star could be explained by the contribution of the nebula, which was not subtracted - the observed brightness of the nebula strongly depends both on the tube and the filter used. The connection of our two minima would lead to the photometric period of only 13.65 days.

*) Based on observations collected at the
European Southern Observatory, Chile

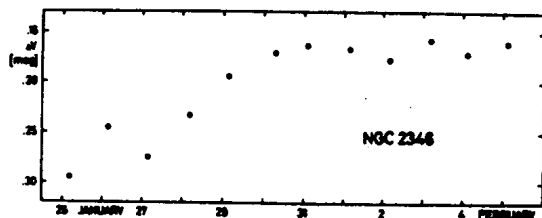
Table I Photoelectric observations of the central star plus nebula of NGC 2346 made by L. Mantegazza

JD 2440000+	ΔV	ΔB
8281.69	+0.295	+0.132
8282.65	0.246	0.072
8283.64	0.275	0.078
8284.67	0.234	0.038
8285.63	0.195	+0.004
8286.80	0.171	-0.028
8287.63	0.164	0.030
8288.64	0.167	0.016
8289.66	0.178	0.023
8290.69	0.158	0.037
8291.61	0.172	0.036
8292.62	+0.161	-0.030

Table II Photoelectric observations of the central star plus nebula of NGC 2346 made by H. Debehogne

JD 2440000+	ΔV
8301.68	+0.16
8302.56	0.13
8303.72	0.36
8304.56	0.16
8305.55	0.15
8306.56	0.14
8308.57	0.49
8309.55	0.60
8310.56	+0.34

Fig.1 $\Delta V = V_{\text{NGC}} - V_{\text{COMP. b}}$ light curve of the central star of NGC 2346 in January-February 1991



The observers from New Zealand report the minimum of NGC 2346 to be $11^m.8$ at JD 2448361.86, and the variability of the brightness of that star in April 1991 as $10^m.3$ - $11^m.2$ (Bateson, 1991). The AAVSO observed some cyclic activity of that star in the range $11^m.0$ - $12^m.0$ also in April 1991 (Bortle, 1991). If we connect the above minimum with that observed by Debehogne, we would get the photometric period only of 13.1 days. Hao (1991) states that the eclipse events reappeared already in 1988 and 1989; nevertheless the scatter of his photographic observations is rather large. Our photoelectric measurements (Kohoutek, unpublished) show nearly constant brightness of that star in both years.

The difference between the photometric and the orbital period (being $P \sim 16$ days) could be attributed to the non central occultation by the dust cloud (Günter, 1991). Nevertheless, the dust region this time seems to be not so regular as in case of the cloud 1981 - 86. Further observations of that star will be necessary.

We are grateful to Dr. H. Debehogne for having observed the central star of NGC 2346.

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References:

- Bateson, F.M., 1991, V.S.S.R.A.S. New Zealand No. M91/4
Bortle, J.E., 1991, AAVSO Circular No. 247 (May 1991)
Günter, T., 1991, PhD. Thesis, Hamburg
Hao, X.-L., 1991, I.B.V.S. Budapest No.3598
Kohoutek, L., 1982, I.B.V.S. Budapest No.2113
Kohoutek, L., 1991, I.B.V.S. Budapest No.3584

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

Number 3695

Konkoly Observatory
Budapest
6 February 1992
HU ISSN 0374 - 0676

PHOTOELECTRIC OBSERVATIONS OF V1285 Aql

The patrol observations of V1285 Aql, carried out in 1990 and in 1991 were a part of the programme for investigation of fast (several seconds) flares and short-time scale variations on late spectral classes stars at the Department of Astronomy of the Bulgarian Academy of Sciences. They were made in U-color of the standard UBV system and in u-color of the uvby system, using two identical single channel photon-counting photoelectric photometers, attached to 60 cm Cassegrain telescopes in the National Astronomical Observatory Rozhen and in the Belogradchik Astronomical Observatory. The photometers have been described by Panov et al.(1982) and Antov et al.(1991).

The altitude above the sea level is 1750 m at Rozhen and 650 m at Belogradchik. The integration time was 1 sec.

BD+8°3899 was used as a comparison star for all the observations. $\Delta u(\text{mag})$ is the difference between the variable star and the comparison star in the instrumental system.

The data processing has been made by Kirov, Antov and Genkov's program system (Kirov et al.,1991).

The data about the monitoring intervals in U.T. are given in Table 1 in the following order:

- monitoring intervals;
- filter;
- observatory, where the observations were carried out;
- the standard deviation of random noise fluctuation

σ_{mag} . It was calculated when the intensity of the star in impulses was lessened with the sky background.

Table 1

Monitoring intervals F O σ_{mag}	Monitoring intervals F O σ_{mag}
16/17 July 1990	22/23 September 1990
22 ^h 48 ^m 14 ^s -23 ^h 06 ^m 29 ^s U R 0.3	21 ^h 27 ^m 11 ^s -21 ^h 52 ^m 52 ^s u B 0.5
23 17 28 -23 35 58 U R 0.3	20 57 36 -22 09 52 u B 0.4
17/18 July 1990	22 10 43 -2 21 24 u B 0.6
21 15 09 -21 24 50 U R 0.09	22 22 29 -22 31 51 u B 0.7
21 25 34 -21 44 54 U R 0.07	22 37 06 -22 49 10 u B 0.4
21 50 06 -22 17 11 U R 0.09	22 50 00 -22 58 36 u B 0.7
22 20 08 -22 51 10 U R 0.09	23/24 September 1990
00 21 23 -00 23 14 U R 0.1	20 10 54 -20 19 47 u B 0.3
00 31 55 -01 09 51 U R 0.1	20 24 05 -20 35 28 u B 0.5
18/19 July 1990	14/15 June 1991
01 39 14 -02 13 16 U R 0.2	23 36 24 -00 00 38 U R 0.08
02 15 58 -02 34 21* U R 0.2	00 07 16 -00 30 39 U R 0.08
23/24 July 1990*	15/16 June 1991
22 08 53 -22 22 10 U R 0.05	23 37 27 -00 00 51 U R 0.1
22 24 50 -22 39 51 U R 0.03	00 03 33 -00 30 04 U R 0.1
22 47 41 -23 26 23 U R 0.05	00 32 14 -00 57 29 U R 0.1
23 36 34 -23 57 15 U R 0.05	14/15 July 1991
24/25 July 1990	23 03 16 -23 28 37 U R 0.1
22 20 16 -22 34 26 U R 0.1	23 36 11 -23 50 34 U R 0.1
22 36 35 -22 48 54 U R 0.1	23 54 38 -00 08 33 U R 0.1
22 54 59 -23 08 19 U R 0.1	9/10 September 1991
26/27 August 1990	19 24 59 -19 41 07 U B 0.2
19 45 50 -20 02 23 u B 0.35	19 45 40 -20 01 42 U B 0.2
20 08 42 -20 27 12 u B 0.4	20 12 22 -20 25 31 U B 0.2
20 37 21 -20 52 14 u B 0.5	20 29 52 -20 41 41 U B 0.2
20 56 24 -21 07 36 u B 0.5	10/11 September 1991
21 13 18 -21 25 02 u B 0.5	19 31 23 -19 41 57 U B 0.1
21 33 47 -21 43 50 u B 0.7	19 48 16 -20 00 17 U B 0.1
27/28 August 1990	20 04 32 -20 17 52 U B 0.2
20 45 01 -21 00 46 u B 0.35	20 20 12 -20 30 56 U B 0.2
21 06 27 -21 18 30 u B 0.4	11/12 September 1991
21 19 57 -21 31 00 u B 0.4	19 23 38 -19 39 35 U B 0.1
21/22 September 1990	19 40 38 -19 51 29 U B 0.1
20 18 42 -20 32 43 u B 0.5	19 55 30 -20 11 03 U B 0.2
20 36 20 -20 39 28 u B 0.7	20 12 25 -20 19 43 U B 0.15

Total monitoring time: 15^h22^m37^s

* - integration time 10 s; R - Rozhen; B - Belogradchik;
F - filter; O - observatory.

One fast flare was detected during 10^h04^m08^s total monitoring time in 1990 and 5^h18^m29^s total monitoring time in 1991. Data for it are given in Table 2 in the following form:

- date;
- U.T. of the beginning;
- U.T. of the maximum;
- the duration of the flare;

- the amplitude of the flare Δm_u , where m_u is the magnitude in u-band of the uvby system. Δm_u was calculated regarding the quiet state phase of the star immediately before flare;

- the standard deviation of random noise fluctuation $\sigma_{mag} = 2.5 \log(I_0 + \sigma) / I_0$, where I_0 is the intensity in impulses of the quiet star, lessened with the sky background, and σ is the standard deviation of random noise fluctuation in impulses. All these values were taken during the quiet state phase immediately preceding the beginning of the flare.

Table 2

Date	U.T. beginning	U.T. max	duration	Δm_u	σ_{mag}
26 Aug 1990	20 ^h 22 ^m 13 ^s	20 ^h 22 ^m 15 ^s	15 ^s	2.2	0.4

The light curve of the observed flare is shown in Fig.1 and 1a.

In the same night when the flare was observed two fast events with durations 1^s ($\Delta m_u = 2.8$) and 2^s ($\Delta m_u = 2.5$) were detected. The question whether they have been caused by the equipment, the atmosphere or the star remains open.

Further, we intend to use a part of this observational material in searches for quasi-periodic modulation in V1285 Aql.

At last, we would like to thank to Dr.Chugainov from Crimean Astrophysical Observatory, USSR for directing our attention to this star.

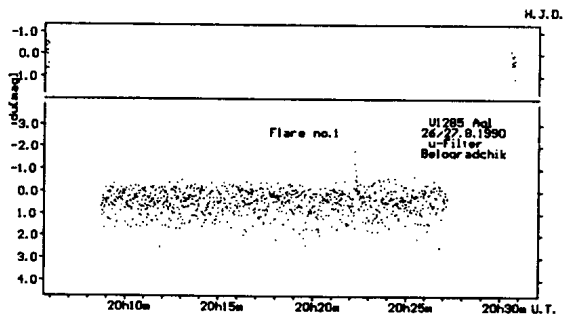


Fig. 1

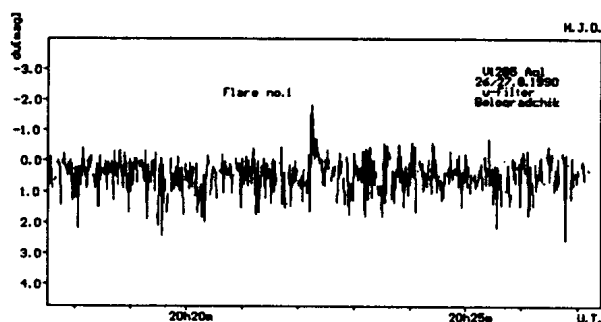


Fig. 1a

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References:

Antov A.P., Genkov V.V., Kirov N.N., Konstantinova-Antova R.K., Staikov Yu., Nikov Ch.N., Sedlankov S.S., Yaramov K., Pamukchiev I.Ch., Notev P.T., Kostev N.G., 1991: in preparation

Kirov N.K., Antov A.P., Genkov V.V., 1991: Compt. Rend. Bulg. Acad. Sci. 44.

Panov K.P., Pamukchiev I.Ch., Christov P.P., Petkov D.I., Notev P.T., Kostev N.G., 1982: Compt. Rend. Bulg. Acad. Sci. 35, no.6, p.717.

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

Number 3696

Konkoly Observatory
Budapest
19 February 1992
HU ISSN 0374 - 0676

MULTICOLOUR OBSERVATIONS OF 4 DRA

The variable star 4 Dra=CQ Dra=BS 4765=HD 108907 ($V \approx 5^m$) is known as a unique triple system containing an M3 giant (4 Dra A) and a cataclysmic binary (4 Dra B), the latter being probably of magnetic type. Orbital period for a wide pair (A+B) is found to be 1703 days, while IUE observations reveal a photometric period $3^h 58^m.5$ for a cataclysmic binary (Reimers et al., 1988). As argued by Reimers (1985), the M giant spectrum dominates the spectrum of 4 Dra at $\lambda \geq 3200 \text{ \AA}$. However, UBV observations by Skopal et al. (1990), Urban & Hric (1990) and Hric et al. (1991) have given the first optical detection of the orbital motion within the wide pair of 4 Dra system. Besides the long-term trends in U and B colours, the above-mentioned observers have discovered irregular variability up to $0^m.15$ on a time-scale of weeks and months with general morphological similarity between all three colours.

In August 1991 we have carried out the photometric observations of 4 Dra in Vilnius photometric system using the 1-m telescope and the single-channel pulse-counting photometer at Mt. Maidanak in Uzbekistan. 6 Dra=BS 4795=HD 109551 ($V=4.89$) was used as a comparison star. The results (Table 1) are presented as differences between the variable and the comparison star in stellar magnitudes in the instrumental system. The observational errors range from $\leq 0^m.01$ to $0^m.04$ varying from night to night and usually increasing towards shorter wavelengths. The measurements have been corrected for differential extinction using the mean extinction coefficients for Mt. Maidanak by Zdanavičius & Macijauskas (1980). It should be mentioned that in some cases the star was lying quite low in the sky ($z \approx 70^\circ$) and the extinction corrections extend up to $0^m.09$ at shortest wavelengths. However, possible errors arising from the use of mean extinction coefficients instead of instantaneous ones cannot alter the general pattern of variability, illustrated in Fig. 1. The most striking feature in Fig. 1 is the well-pronounced variability in the U filter (centered at $\lambda = 3450 \text{ \AA}$) and analogous variations (but with smaller amplitude) up to the wavelength 4050 \AA (filter X). At the same time the variations at longer wavelengths ($\lambda \geq 4660 \text{ \AA}$) are quite moderate and they may even have an opposite sign

compared with that in U filter. However, our observing run is too short for to conclude, whether the behaviour of 4 Dra was really somewhat different from that described by Urban & Hric (1990) and Hric et al. (1991). It can be mentioned that phases of our observations according to the ephemeris for the wide pair by Reimers et al. (1988) are between 0.290 and 0.305.

Table 1. Observations of 4 Dra in Vilnius photometric system

<i>JD</i>	ΔS	ΔV	ΔZ	ΔY	ΔX	ΔP	ΔU
2448471.307	-0.213	0.011	0.086	0.289	0.597	0.939	1.205
472.365	-0.187	0.059	0.111	0.325	0.666	1.104	1.389
473.302	-0.214	0.031	0.085	0.284	0.597	0.968	1.261
476.330	-0.187	0.035	0.115	0.315	0.614	0.980	1.221
478.399	-0.155	0.056	0.130	0.357	0.647	1.042	1.357
479.203	-0.157	0.087	0.134	0.349	0.656	1.016	1.328
482.278	-0.081	0.151	0.216	0.431	0.747	1.096	1.411
487.252	-0.058	0.181	0.216	0.452	0.724	1.055	1.351
489.296	-0.076	0.161	0.212	0.439	0.689	0.979	1.250
490.406	-0.024	0.193	0.236	0.445	0.648	0.923	1.094
492.380	-0.073	0.192	0.212	0.430	0.684	0.966	1.099
493.258	-0.072	0.177	0.210	0.441	0.693	1.008	1.277
494.231	-0.081	0.160	0.212	0.433	0.704	1.033	1.324
496.189	-0.096	0.157	0.200	0.421	0.674	1.032	1.312
496.273	-0.076	0.149	0.200	0.422	0.683	1.023	1.314

The triple system 4 Dra is a very bright star which deserves continuous attention. The multicolour observations described above would be very useful for finding out which role the hot component (cataclysmic binary) can play in forming of the continuous spectrum of the triple system at $\lambda \leq 4000 \text{ \AA}$. Since January 1991 some UBV observations of 4 Dra have been carried out at Tartu observatory as well. Results of them will be published later.

Finally, we are very grateful to Prof. V. Straižys for allotting observing time on the telescope of the Institute of Theoretical Physics and Astronomy of the Lithuanian Academy of Sciences and to Dr. S. Bartašiūtė for her kind help in observations.

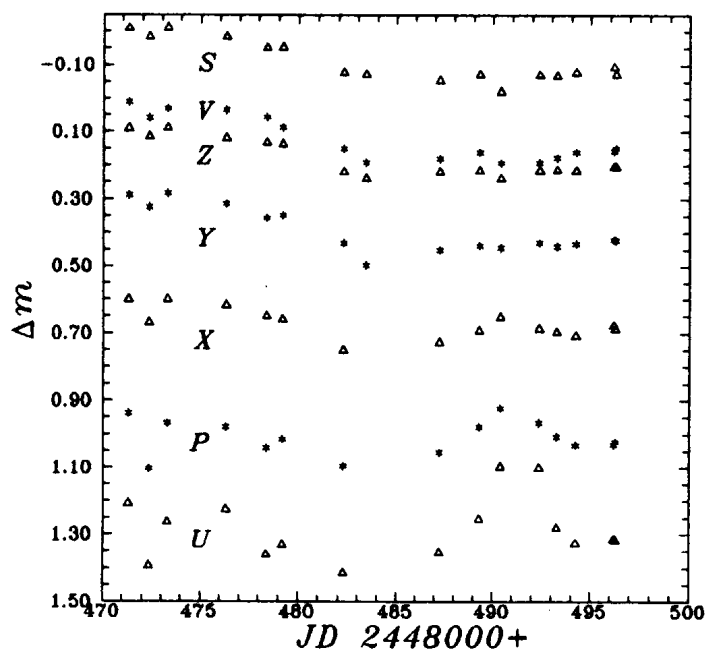


Fig.1. Variability of 4 Dra in seven filters of the Vilnius photometric system.

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References

- Hric, L., Skopal, A., Urban, Z., Dapergolas, A., Hanzl, D., Isles, J. E., Niar-chos, P., Papoušek, J., Pigulski, A., Velič, Z., 1991, *Contr. Astron. Obs. Skal. Pleso*, **21**, 303.
- Reimers, D., 1985, *Astron. Astrophys.*, **142**, L16.
- Reimers, D., Griffin, R. F., Brown, A., 1988, *Astron. Astrophys.*, **193**, 180.
- Skopal, A., Hric, L., Urban, Z., 1990, *Contr. Astron. Obs. Skal. Pleso*, **19**, 123.
- Urban, Z., Hric, L., 1990, *Contr. Astron. Obs. Skal. Pleso*, **20**, 121.
- Zdanavičius, K., Macijauskas, D., 1980, *Bull. Vilnius Astron. Obs.*, **55**, 11.

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

Number 3697

Konkoly Observatory
Budapest
28 February 1992
HU ISSN 0374 - 0676

**The latest ascending branch
in the long-term light curve of MV Lyrae**

In continuation of our programme for study of low-state cataclysmic binaries (Kraicheva (1988), Kraicheva, Antov, Genkov (1987, 1989), Popov, Kraicheva (1991)) some photometric data for MV Lyrae were obtained during 1988-1991. We observed the star on 58 plates of the Rozhen 50/70 Schmidt telescope and one plate of the Rozhen 2m RCC telescope. The B system of comparison star magnitudes of Andronov and Shugarov (1982) was used. Photometric measurement of the plates was carried out on the automatic iris photometer Ascoris (Carl Zeiss, Jena) at NAO "Rozhen". On plates not good enough for measurements, estimates were made by the Nijland-Blazhko method. In Table 1 and in Fig. 1 the results of our observations are presented; colons denote values of less weight. The underlined magnitude is that from plate of 2m telescope. Our observations include the ascending branch of the long-term light curve and complete the curve of Wenzel and Fuhrmann (1989), Fuhrmann and Wenzel (1990).

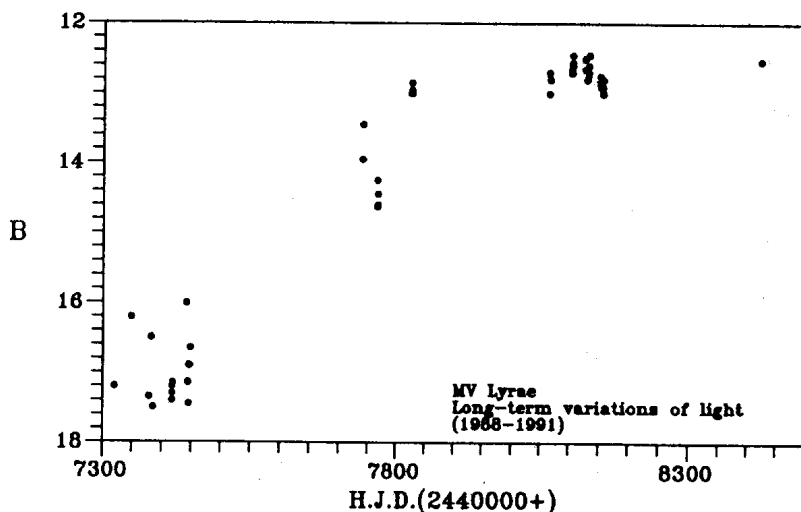


Fig. 1

It should be noted that:

1. The amplitudes of brightness changes may reach $1^m.5 - 2^m.0$ in low and intermediate state which is essentially larger than the values of $0^m.1 - 0^m.5$ obtained for the active state.
2. The decrease in the brightness of MV Lyrae from $12^m.5$ to $18^m.0$ according to Romano and Rosino (1980) occur for about a month. The ascent, however, corresponding to our observations and those of Wenzel and Fuhrmann (1989) lasts considerably longer about 1-1.5 years.

Table 1

Photographic Observations in B of MV Lyrae

HJD 2440000+	B	HJD 2440000+	B	HJD 2440000+	B
7320.431	17.20	7765.465	14.63	8125.426	12.65
7348.440	16.21:	7765.492	14.25:	8128.371	12.65
7379.416	17.35:	7766.454	14.60	8128.390	12.80
7382.447	16.50	7766.480	14.45	8128.408	12.80
7386.348	<u>17.50</u>	7824.406	13.00	8130.387	12.75
7417.360	17.30	7825.292	12.95	8130.435	12.75
7417.386	17.40	7825.311	12.85	8131.396	12.70
7417.486	17.20	7826.266	13.00	8131.414	12.60
7418.397	17.16	8064.524	12.70	8132.412	12.45
7418.427	17.15	8064.546	13.00	8150.406	12.87
7441.459	16.01	8066.432	12.80	8150.429	12.75
7444.296	17.15	8066.523	12.80	8151.469	12.90
7444.326	17.14	8102.440	12.65	8154.353	12.80
7445.316	17.45	8102.459	12.70	8154.377	12.95
7445.342	16.90	8103.483	12.70	8155.401	12.90
7447.309	16.90	8103.507	12.60	8155.425	13.00
7448.294	16.65	8104.471	12.45	8156.321	12.80
7739.422	13.95	8104.488	12.55	8156.345	13.00
7739.447	13.95	8104.520	12.60	8422.330	12.53
7740.464	13.45	8125.384	12.50		

Besides photographic estimates of the brightness, in July 1991, we started photoelectric observations of the star with the 60cm telescope of Belogradchik Astronomical Observatory. The photometer used and the data processing have been described by Antov et al. (1991).

Star "B" (see Walker, 1954) served as comparison star. The integration time was 10 sec. Magnitude estimates in a standard UBV system are presented in Table 2.

Table 2

Photoelectric UBV Observations of MV Lyrae

HJD 2440000+	V	B-V	U-B
8449.478	12.178	-0.114	-1.069
8449.517	12.722	-0.236	-0.933
8450.389	12.611	-0.201	-1.030

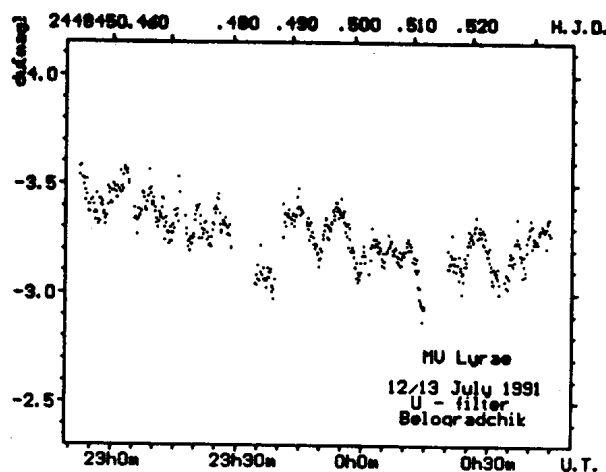


Fig. 2

In addition, a patrol with a duration of 1.5 hours was carried out in the "u" region on the night of July 12/13. Patrol observations (Fig. 2) revealed the existence of rapid variations in light with an amplitude up to $0^m.4$ within 5 minutes.

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References

- Andronov, I. L., Shugarov, S. Yu., 1982, *Astron. Tsirk.*, No 1218, 3
 Antov, A. P., Genkov, V. V., Konstantinova-Antova, R., Kirov, N. K., 1991, *Inf. Bull. Var. Stars*, No 3577
 Fuhrmann, B., Wenzel, W., 1990, *Inf. Bull. Variable Stars*, No 3513
 Kraicheva, Z., 1988, *Inf. Bull. Variable Stars*, No 3210
 Kraicheva, Z., Antov, A., Genkov, V., 1987, *Inf. Bull. Variable Stars*, No 3093
 Kraicheva, Z., Antov, A., Genkov, V., 1989, *Commun. Konkoly Obs. Hung. Acad. Sci.*, 10, No 93, 243
 Popov, V., Kraicheva, Z., 1991, *Contr. Astr. Obs. Skalnate Pleso*, No 20, 63
 Romano, G., Rosino, L., 1980, *Inf. Bull. Variable Stars*, No 1776
 Walker, M., 1954, *PASP*, 66, 71
 Wenzel, W., Fuhrmann, B., 1989, *Inf. Bull. Variable Stars*, No 3391

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

Number 3698

Konkoly Observatory
Budapest
2 March 1992
HU ISSN 0374 - 0676

The Eclipsing Binary TX UMa - a Period Change Again

Abstract. On the basis of the published visual times of minima and our UBV photometric observations of the eclipsing binary TX UMa, another change of its period is presented. The new photometric ephemeris was computed.

1. Introduction

Recently we have been involved in the detailed analysis of the spectroscopic observational material of the eclipsing binary TX UMa obtained at the D.A.O. in 1969-70 and at the Ondřejov Observatory in 1972-80, (Hric *et al.*, 1990; Grygar *et al.*, 1991; Komžík *et al.*, submitted to the Astrophys. Space Sci.). The spectroscopic detection of the interacting processes in this system showed the need for a further photoelectric monitoring.

The photoelectric observations in the UBV system were taken at the Skalnaté Pleso and Stará Lesná Observatories of the Astronomical Institute of the Slovak Academy of Sciences with the identical 60 cm Cassegrain reflecting telescopes equipped with single-channel pulse-counting photometers and photomultipliers. Observed data were recorded and processed using PC IBM-compatible computers.

2. Observations and Conclusions

The first observed minimum (JD 2 448 303) shows the (O-C) value approximately +2 hours (computed using the photometric ephemeris by Oh and Chen, 1984). The last investigation of TX UMa's (O-C) diagram was carried out by the above mentioned authors. The new times of minima (visual, taken from the literature including Cracow database, as well as our photoelectric) can be found in Table I. These new data together with those published by Oh and Chen were used to construct the new (O-C) diagram shown in Fig.1.

The times of our photoelectric minima were determined using parabola fitting method, separately for each colour, and their errors were estimated

TABLE I
Observed times of primary minima of TX UMa

JD_{hel} +2 440 000	Error [days]	Epoch	Type	Observer	Source	Note
6122.372		-807.	VI	Hollis, A.	Isles, J.	
6171.395		-791.	VI	Duncan, H.	Isles, J.	*
6566.535		-662.	VI	Cluyse, L.	Isles, J.	*
6872.887		-562.	VI	Vyatavél, R.	Silhán, J.	
6903.505		-552.	VI	Csipes, J.	Silhán, J.	*
6903.5208		-552.	VI	Renz, W.	BAV Rundbr.37	
7151.6452		-471.	VI	Renz, W.	BAV Rundbr.37	
7531.503		-347.	VI	Renz, W.	Hübacher, J. <i>et al.</i>	
7565.200		-336.	VI	Enskonatus, P.	MVS 12, Nr.2	
7626.477		-316.	VI	Enskonatus, P.	MVS 12, Nr.3	*
7966.496		-205.	VI	Pietz, J.	Hübacher, J. <i>et al.</i>	
8303.46340	0.00005	-95.	PE U	Gliviak, M., Komžík, R.	this paper	
8303.46341	0.00008	-95.	PE B	Gliviak, M., Komžík, R.	this paper	
8303.46352	0.00007	-95.	PE V	Gliviak, M., Komžík, R.	this paper	
8306.5254	0.0002	-94.	PE U	Hric, L., Komžík, R.	this paper	
8306.5258	0.0002	-94.	PE B	Hric, L., Komžík, R.	this paper	
8306.52515	0.00012	-94.	PE V	Hric, L., Komžík, R.	this paper	
8306.5272	0.0004	-94.	PE U	Gliviak, M., Kandra, M.	this paper	
8306.527	0.001	-94.	PE B	Gliviak, M., Kandra, M.	this paper	
8306.5277	0.0003	-94.	PE V	Gliviak, M., Kandra, M.	this paper	
8444.373		-49.	VI	Dědouch, A.	private comm.	
8594.4786	0.0003	0.	PE U	Hric, L., Komžík, R.	this paper	
8594.4792	0.0002	0.	PE B	Hric, L., Komžík, R.	this paper	
8594.4792	0.0003	0.	PE V	Hric, L., Komžík, R.	this paper	

Notes to Table I.

VI-visual, PE-photoelectric, U-filter U, B-filter B
V-filter V, * -omitted

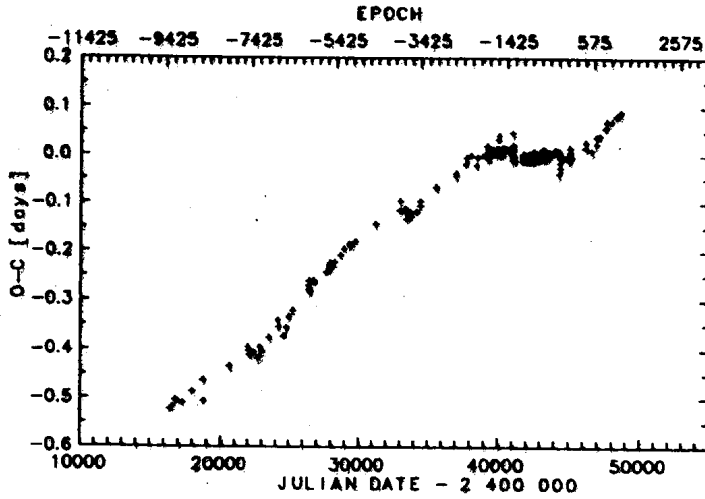


Fig. 1. (O - C) diagram for the times of primary minima of TX UMa, based on the ephemeris by Oh and Chen (1984): $Min_{hel} = 2\,444\,998.1475 + 3.^d.0632382 \times E$

considering Kwee and Van Woerden (1956) method. The shapes of minima do not exhibit significant deviations from the symmetry.

We were lucky enough to gain two simultaneous observations of TX UMa minimum (JD 2 448 306) one at the Skalnaté Pleso Observatory and the other at the Stará Lesná Observatory. These two sets of data lead to a difference in the time of minimum determination which can not be explained by the data inaccuracy. We see the reason of this difference in the deterioration of the observational conditions at the Skalnaté Pleso Observatory, and a subsequent sudden change of the extinction, which caused the drop of the observed brightness (in all colours) at the ascending branch of the eclipse, resulting in the time of minimum delay. This effect can be of more general relevance and we intend to study it in the future in more detail.

The new photometric ephemeris of the system TX UMa was derived by means of the least-squares method using the data from the Table I. Four times of minima were omitted due to their great inherent inaccuracy (marked in the last column of the Table I.) The resulting photometric ephemeris is:

$$\begin{aligned} \text{Min. I} = \text{JD}_{hel} \, 2\,448\,594.47957 &+ 3^d.0633292 \times E \\ &\pm 0.00008 \quad \pm 0.0000008 \end{aligned}$$

Finally we can summarize our results and their interpretation:

1. Between JD 2 445 111 and JD 2 446 122 a new period change of the TX UMa system occurred, the fourth one in this century;
2. The new value of the period is $3.0633292 \pm 8. \times 10^{-7}$ days. This period is longer than that found by Oh and Chen; the difference is $0.^d0000910$;
3. The reason for the period change of TX UMa is the mass transfer from the less massive cooler secondary component F 6 IV to the hot component B 5 V. If the masses of the components $M_1 = 6.1M_{\odot}$ (hot one) and $M_2 = 1.8M_{\odot}$ (cooler one) (Grygar *et al.*, 1991) are assumed the new value of $\frac{\Delta P}{P} = 0.000029706$ yields to the value of the transferred matter $\Delta M = 2.53 \times 10^{-5} M_{\odot}$.

It is interesting to notice an increase of the value $\frac{\Delta P}{P}$ during last ninety years.

Acknowledgements

The authors wish to thank Mr. Milan Gliviak and Mr. Miroslav Kandra for their observational work at the Skalná Pleso Observatory. Our thanks are also due to Mgr. Jindřich Šilhán and to prof. J. M. Kreiner for their help with the search for archival data.

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References

- Dédoch, A.: 1991, *private comm.*
 Grygar, J., Hric, L., Komžík, R., Šíma, Z.: 1991, *Astrophys. Space Sci.* **185**, 189-193.
 Hric, L., Komžík, R., Grygar, J.: 1990, *Astrophys. Space Sci.* **169**, 241-243.
 Hübscher, J., Lichtenknecker, D., Wunder, E.: 1989, *BAV Mitt.* **52**,
 Hübscher, J., Lichtenknecker, D., Wunder, E.: 1990, *BAV Mitt.* **56**.
 Isles, J.: 1989, *BAAVSS Circ.* **68**, 30.
 Komžík, R., Hric, L., Grygar, J.; submitted to *Astrophys. Space Sci.*
 Kwee, K. K., Van Woerden, H.: 1956, *BAN* **12**, No.464, 327.
 MVS: 1989, **12**, Nr. 2, 17.
 MVS: 1990, **12**, Nr. 3, 51.
 Oh, K. D., Chen, K. Y.: 1984, *Astron. J.* **89**, No.1, 126.
 Renz, W.: 1988, *BAV Rundbrief* **37**, No. 1, 12.
 Šilhán, J.: 1991, *private comm.*

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

Number 3699

Konkoly Observatory
Budapest
3 March 1992
HU ISSN 0374 - 0676

PHOTOMETRIC OBSERVATIONS OF R CrB FOLLOWING THE 1983 MINIMUM

R CrB is the prototype of one of the most interesting classes of variables. It is subject to abrupt declines in brightness followed by a slower recovery, often accompanied by fluctuations. Photometric UBVRI-observations during one of these minima were obtained at an altitude of 3100 m Terscol Peak (the Caucasus) with the 0.5 m reflector using an automatic single-channel photometer in 1983-1984. These data of R CrB are listed in Table 2, and are plotted against Julian Date in Fig. 1. Our magnitudes are accurate to $0^m.01$ - $0^m.02$ and the colour indices to $0^m.01$ - $0^m.04$, except at the deep minimum phase, where the observational errors are larger because the variable was observed at low altitude and was close to the limiting magnitude for the 50-cm telescope photometry. The magnitudes and colours of the comparison stars, determined by means of comparison with Johnson's standard stars γ and δ CrB, are given in Table 1.

The observations of R CrB enable us to compare the colour curves of the present decline with other declines of R CrB. As seen from Fig. 1, in the 1983 minimum all colour curves show a redward trend after the star begins to decline in V (this reddening totals $0^m.25$ in U-B, $0^m.4$ in B-V, $0^m.5$ in V-R and by $0^m.35$ in R-I). As the brightness continues to fall toward minimum, however, the colour curves show a blueward trend, as they usually do. On the rising branch, after the variable has recovered by 2^m it has become redder again. On the rising branch, the availability of the reddening is a peculiarity of the R CrB minima. The distinctive feature of the 1983 minimum was an appreciable reddening occurred at visible wavelengths on the descending branch of the light curve when R CrB had faded by $\Delta m_v = 3^m.5$.

As seen from Fig. 1, during brightness oscillations, having amplitudes larger than ordinary ones, occurred at the rising branch, both in the first part (when m_v had recovered to $11^m.5$) and near the end ($m_v = 6^m.5$), the amplitude of the oscillation in the U-B index was significantly larger than it was when the star was fluctuating while in its normal bright state.

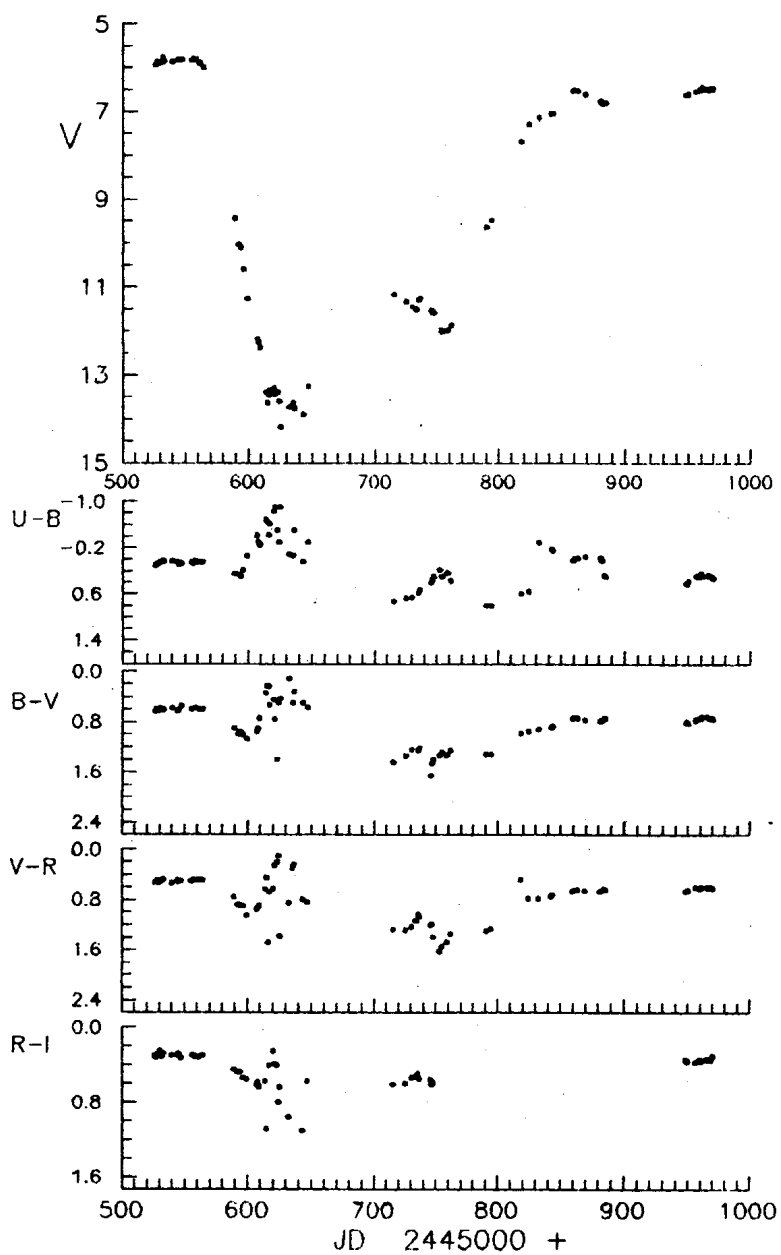


Fig. 1.

Table 1. Comparison stars

Star	V	U-B	B-V	V-R	R-I
BD +28°2475	7 ^m .45	0 ^m .03	0 ^m .47	0 ^m .43	0 ^m .28
BD +28°2469	8.09	0.11	0.62	0.52	0.37
(anonymous) $\alpha=15^h47^m.7$ $\delta=28^\circ16'$	12.25	0.19	0.71	0.58	0.33

Table 2. Observations of R CrB

JD	V	U-B	B-V	V-R	R-I
2445000+					
526.38	5 ^m .94	0 ^m .11	0 ^m .63	0 ^m .53	0 ^m .31
527.36	5.88	0.10	0.60	0.52	0.32
528.36	5.87	0.09	0.62	0.50	0.29
529.34	5.87	0.07	0.60	0.53	0.30
530.40	5.89	0.06	0.59	0.53	0.25
532.43	5.77	0.04	0.61	0.49	0.31
533.45	5.85	0.04	0.60	0.49	0.28
540.33	5.86	0.04	0.58	0.54	0.30
544.38	5.82	0.06	0.63	0.50	0.30
545.37	5.82	0.10	0.62	0.52	0.28
547.34	5.82	0.08	0.55	0.51	0.33
555.29	5.83	0.06	0.60	0.51	-
556.34	5.80	0.08	0.59	0.50	0.30
558.33	5.81	0.04	0.58	0.50	0.31
561.34	5.89	0.06	0.60	0.49	0.32
564.35	6.00	0.06	0.60	0.50	0.30
589.35	9.43	0.25	0.90	0.76	0.45
592.33	10.04	0.26	1.00	0.88	0.48
594.32	10.11	0.30	0.97	0.89	0.48
596.33	10.61	0.18	1.01	0.90	0.54
599.32	11.27	-0.06	1.07	1.05	0.55
607.33	12.18	-0.41	0.96	0.96	0.61

Table 2 (continued)

JD 2445000 +	V	U-B	B-V	V-R	R-I	JD 2445000 +	V	U-B	B-V	V-R
608.32	12. ^m 26	-0. ^m 30	0. ^m 90	0. ^m 93	0. ^m 58	761.54	11. ^m 88	0. ^m 38	1. ^m 26	1. ^m 35
609.25	12.40	-0.24	0.75	0.89	0.64	790.48	9.65	0.80	1.32	1.30
614.21	13.40	-0.68	0.34	0.63	0.57	794.42	9.49	0.81	1.32	1.27
615.20	13.63	-0.65	0.23	0.46	1.08	818.51	7.70	0.60	0.99	0.49
616.38	13.47	-0.42	0.24	1.49	-	824.56	7.30	0.56	0.96	0.79
617.21	13.35	-0.62	0.53	0.68	0.40	832.51	7.15	-0.29	0.92	0.79
620.13	13.30	-0.84	0.45	0.62	0.25	842.42	7.07	-0.17	0.88	0.75
621.20	13.45	-0.91	0.76	0.26	0.39	843.43	7.06	-0.15	0.87	0.73
623.21	13.40	-0.50	1.40	0.20	0.40	859.49	6.54	0.02	0.75	0.67
624.20	13.60	-0.30	0.50	0.10	0.80	860.49	6.52	-0.01	0.74	0.65
625.20	14.19	-0.91	0.43	1.38	0.64	863.48	6.54	-0.02	0.75	0.64
632.21	13.73	-0.09	0.11	0.85	0.96	869.42	6.62	-0.05	0.78	0.66
635.21	13.63	-0.70	0.50	0.30	-	881.38	6.78	-0.03	0.79	0.67
636.21	13.77	-0.50	0.32	0.25	-	882.27	6.82	0.02	0.79	0.66
643.17	13.90	0.05	0.50	0.80	1.10	884.42	6.82	0.28	0.75	0.63
647.17	13.26	-0.30	0.57	0.84	0.57	885.37	6.81	0.30	0.75	0.64
715.60	11.18	0.72	1.45	1.28	0.61	948.29	6.64	0.42	0.81	0.67
725.58	11.35	0.67	1.34	1.29	0.60	949.29	6.63	0.43	0.80	0.66
730.58	11.46	0.66	1.25	1.24	0.54	950.24	6.61	0.38	0.82	0.65
733.58	11.51	-	1.27	1.14	0.53	956.25	6.55	0.29	0.77	0.60
735.60	11.31	0.59	1.26	1.04	0.50	959.27	6.50	0.30	0.74	0.62
736.56	11.27	0.53	1.23	1.07	0.55	960.24	6.52	0.24	0.75	0.61
745.56	11.54	0.40	1.66	1.21	0.56	961.24	6.47	0.28	0.72	0.60
746.60	11.58	0.35	1.47	1.20	0.61	965.23	6.50	0.28	0.72	0.60
747.57	11.60	0.30	1.40	1.40	0.59	966.22	6.52	0.27	0.74	0.61
752.57	11.99	0.18	1.33	1.62	-	968.23	6.49	0.29	0.75	0.60
754.49	12.03	0.30	1.29	1.55	-	969.23	6.50	0.32	0.74	0.61
758.47	12.00	0.23	1.33	1.49	-	970.22	6.49	0.34	0.76	0.62

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

Number 3700

Konkoly Observatory
Budapest
3 March 1992

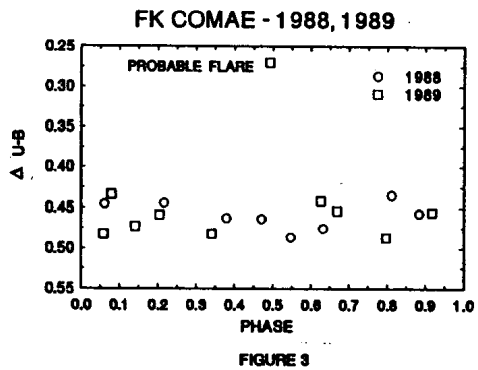
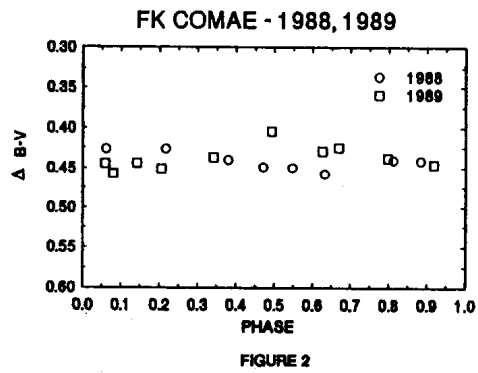
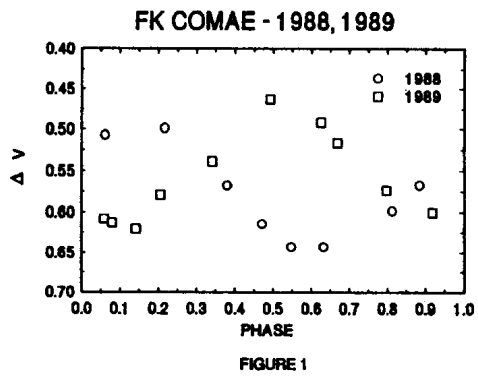
HU ISSN 0374 - 0676

1988 AND 1989 UBV PHOTOMETRY OF FK COMAE

FK Comae Berenices (HD 117555), the prototype star of the FK Comae class of variable stars, was first studied by Chugainov (1966). The photometric properties have recently been studied and reviewed by a number of authors including: Morris and Milone (1983), Holzman and Nations (1984), Bianchi *et al* (1985), Cellino *et al* (1986), and Huovelin *et al* (1987).

We did the photometry on 8 nights between 10 and 21 May 1988, and on 10 nights in 1989 between 8 and 19 May and between 29 June and 3 July. We used the 0.6m telescope at Mount Laguna Observatory operated by San Diego State University. The photometer employed an EMI 6256 phototube operated at -10°C and -1300V. We usually used a 19" aperture but used larger apertures as seeing required. Data were transformed to the standard Johnson UBV system. HD 117567 was the comparison star, and HD 117876 was the check. We find no evidence for variability in the comparison star.

FK Com has two published ephemerides: $\phi = 2442192.345 + 2.400E$ (Chugainov 1976) and $\phi = 2442192.502 + 2.39960$ (Morris and Milone 1983). The 2.400 day period was determined with a single two year study. Morris and Milone used all data available over a roughly fifteen year period. The Morris and Milone period (2.39960^d) is likely a more accurate photometric period; however, the Chugainov period (2.400^d) is more likely to represent the rotational period. If starspots cause the variability and they migrate, the photometric and rotational periods would not be equal. The photometric period would more closely approximate the rotational period, if it were determined over a shorter time interval. We are primarily interested in studying possible spot migrations; so, we used the Chugainov period (2.400^d).



Flares are often observed on FK Com (Morris and Milone 1983). Our practice of averaging nightly observations from a short time period into a single nightly point makes it difficult to distinguish flares. Therefore caution must be used in interpreting data that might be contaminated by flares. None of our 1988 data seem to be significantly contaminated by flares; however, we seem to have a flare in our 1989 data. The point at phase 0.5 in our 1989 data appears bright but not anomalously so at V and B-V (Figures 1 & 2). However at U-B (Figure 3) this point is about 0.15 magnitudes brighter than one might expect. These data were taken on the night of 1 July 1989 UT at about 05:30 UT which we recorded as excellent sky conditions in our observing log. We therefore conclude that we observed a flare on FK Com. Note that the color behavior of this flare is similar to that observed in flares by Morris and Milone (1983). The flare is brightest at U and much less so at V. We have no information about the total energy or duration of the flare. We do however remove this point when considering the nonflare behavior of FK Com below.

We plot our V differential magnitudes in Figure 1. The phase of minimum light shifts from about 0.6 in 1988 to about 0.15 in 1989. The amplitude of variation is about 0.15 mag for both years but a small amount less for 1989 than for 1988. The level of light at maximum is about the same for both 1988 and 1989, if one remembers to ignore the point at phase 0.5. At minimum, the light level is slightly higher in 1989 than 1988. From this information we conclude, in the context of the starspot model, that the major spot or spot group either migrated significantly in longitude or disappeared and reformed at a new longitude between 1988 and 1989. In addition, the area covered by the major spot or spot group decreased slightly in 1989.

We present our B-V and U-B color curves in Figures 2 and 3. They generally show minima and maxima at the same phases as the V light curves. The star is reddest at minimum light as would be expected if cool spots cause the brightness variations.

Ron Angione scheduled generous amounts telescope of time at Mt. Laguna for this work. We also acknowledge support from both Western Carolina University and The Research Corporation.

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References:

- Bianchi, I., Grewing, M., Kappelmann, N.; 1985; *Astron. & Astrophys.*; 149, 41.
Cellino, A., Scaltriti, F., and Busso, M.; 1986; *Astrophys. & Space Sci.*; 121, 265.
Chugainov, P.V.; 1966; *Inf. Bull. Var. Stars*, no. 172.
Chugainov, P.V.; 1976; *Izv. Krimskoj Astrof. Obs.*, 54, 89.
Holzman, J.A., Nations, H.L.; 1984, *Astron. J.*, 89, 391.
Huovelin, J., Pirola, V., Vilhu, O., Efimov, Y.S., Shakhovskoy, N.M.; 1987 *Astron. & Astrophys.*; 176, 83.
Morris, S.L., Milone, E.F.; 1983, *Pub. Astron. Soc. Pac.*; 95, 376.

1991 V PHOTOMETRY OF CG CYG AND A POSSIBLE NEW VARIABLE

ERRATUM

We recently discovered an error in IBVS no. 3688. The latitude and radius of the spot solution for the August 1991 data should read: latitude= 66° and radius= 23° . The latitude and radius of 57° and 18° are in error. We regret any inconvenience this error may have caused.

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