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THE 1981 ECLIPSE OF RZ Oph

RZ Oph = BD +7°3832 is a long period Algol-type binary with P = 261.9277 days. Favorable eclipses occur once every 5 years. The nearest one will occur in the summer of 1981, centered on August 7, 4^h UT. The purpose of this note is to give an advertising summary of the properties of this system with the hope that it might get an adequate attention from the observers.

General information

The spectral types of the components are F3Ib and K5Ib (Hiltner 1946, Baldwin 1979). That of the primary is too late for its mass and probably includes a contribution or a contamination from the disk. The Balmer emission lines from the disk are seen throughout the orbital cycle and undergo spectacular eclipse effects. The relative size of the primary component is very small, compared to the size of the disk and as a result, unlike in many other Algol-type systems, the disk is a fairly stable feature. The object is bright what makes it an inviting target for a detailed study of its disk.

Photometric effects

The eclipse is total. From fragmentary photometric data (Popper, unpublished; Baldwin 1979) it appears that the magnitude ranges are: V = 9.9-10.6 and B = 10.2-11.7. The duration of the eclipse is about 12-13 days, while the duration of totality is about 8-9 days. A good light curve would be crucial for the geometric solution. It is obvious that a cooperative effort is needed involving observers at different geographical longitudes. Three additional photometric effects are to be looked for in the light curve outside of the primary eclipse:

(1) Since the brightness of the secondary component is comparable to that of the primary, there should be an "ellipticity" effect due to the aspherical shape of the secondary.

(2) It is likely that the disk contributes a non-negligible fraction of the combined light in the continuum and if so the effects of its eclipse by the secondary should be visible well before the first and after the fourth contacts.

(3) If the disk is optically thick in the continuum, the effects of the partial occultation of the secondary by the disk should be visible around phase 0.5P. The nearest opportunity will be in August-September 1982.

Spectroscopic effects

Spectacular behavior of the double ($V_d$sin i = 115 km/s) emission lines during the eclipse, first observed by Hiltner (1946), was studied recently by Baldwin (1979; cf. a rediscussion of his data by Smak (1981)). From Baldwin's data it appears that the disk eclipse lasts for about 36-48 days. Good scanner observations with a high spectral resolution can give a wealth of information concerning the structure of the disk. (A good example of an analysis of this type can be found in Young and Schneider (1980)).

Other spectral regions

Nothing is known about RZ Oph in the far UV, X-ray and radio regions. The prospects of studying the eclipse effects in these domains can hardly be overemphasized!

Time-table for 1981

All predictions given below are very uncertain and should be used only as a guide in planning the observations.

Disk eclipse likely to begin . .	July 13	
Disk eclipse certain to begin. .	July 19	
1-st contact	July 31	15^hUT ± 12^h
2-nd contact	Aug. 2	23 UT ± 12
3-rd contact	Aug. 11	9 UT ± 12
4-th contact	Aug. 13	17 UT ± 12
Disk eclipse likely to end . . .	Aug. 24	
Disk eclipse certain to end. . .	Aug. 30	

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References:

Baldwin, B.W., 1979, Ap. J. 226,937
Hiltner, W.A., 1946, Ap. J. 104,396
Smak, J., 1981, Acta Astr. 31, No. 1, in press
Young, P. and Schneider, D.P., 1980, Ap. J. 238,955

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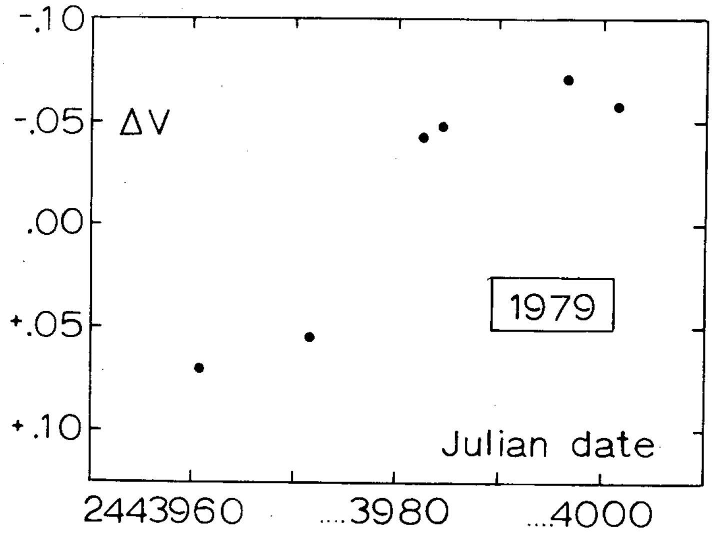
12 CAMELOPARDALIS: A NEW VARIABLE STAR

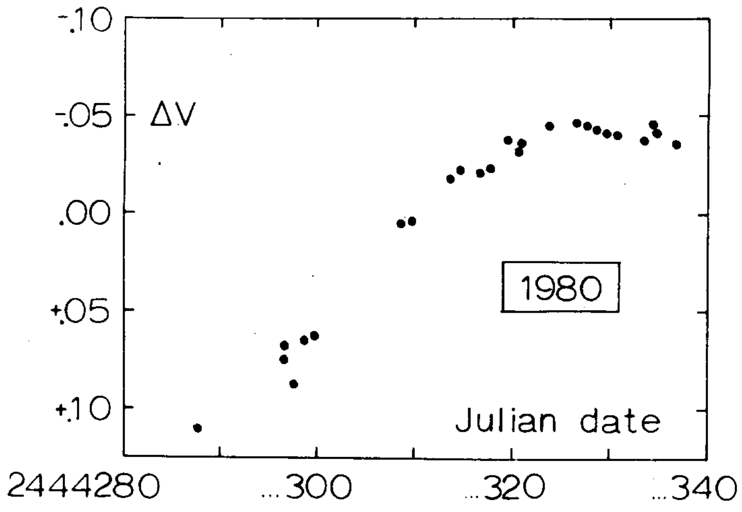
In this note we announce our discovery of the photometric variability of the long-period ($P = 80^{d}.2$) RS CVn binary 12 Cam = HR 1623. The most important reference is that of Abt et al. (1969), who provide the following information. The blue-violet spectrum shows a KO III star but no trace of a secondary star. Radial velocity variations show 12 Cam to be a spectroscopic binary with an orbital period of $80^{d}.174469 \pm 0^{d}.000003$ and a surprisingly large orbital eccentricity of $e = 0.35 \pm 0.02$. There is strong Ca II H & K emission associated with the KO III star.

To search for photometric variability such as is characteristic of so many other RS CVn binaries, Eaton obtained photoelectric observations in 1979 between JD 2443960.60 and 2444001.56 and saw the first indication of variability, with an amplitude well over $0^{m}.1$. Subsequent photoelectric photometry in 1980 between JD 2444287.61 and 2444336.63 by Henry, Landis, McFaul, and Renner confirmed the variability and showed a comparably large amplitude.

Eaton made his observations with a 24-inch telescope and Henry made his with a 16-inch, their equipment having been described by Burke et al. (1980). Landis and Renner made their observations with 8-inch and 10-inch telescopes, respectively, their equipment having been described by Bartolini et al. (1978). McFaul made his observations with an 8-inch telescope and described his equipment in McFaul (1979). All observed with a filter chosen to match V of the UBV system and all used HR 1688 as the comparison star.

The 1979 and 1980 observations are plotted separately in the figures below. Each point is a nightly mean of 2 or 3 or 4 individual differential measures. The ordinate ΔV is differential magnitude (in the sense variable minus comparison) corrected for differential atmospheric extinction and transformed to V of the UBV system with known transformation coefficients.





In applying the transformation correction, we used an assumed constant color difference of $\Delta(B-V) = -0^{m}.059$, determined from Henry's B observations, which is so small that we are confident there is very little residual error related to transformation problems. On 12 of his 13 nights Henry obtained individual differential measures of the check star BD + 59°850 with respect to the same comparison star. Those measures yielded mean values of

$$\Delta V = +2^{m}.0372 \pm 0^{m}.0012$$

and

$$\Delta B = +1^{m}.0365 \pm 0^{m}.0010,$$

with standard deviations of single measures from those means being

$$\pm 0^{m}.0041 \text{ in } V$$

and

$$\pm 0^{m}.0035 \text{ in } B,$$

indicating very little if any variation in either the comparison star or the check star.

Although we did not analyze these data to search explicitly for the photometric period, they appeared to be in phase approximately with the orbital period found by Abt et al. Fourier analysis of the two sets of data, with a period of $80^{d}.174469$ and a sinusoidal shape assumed, yielded amplitudes (max. to min.) of

$$\Delta V = 0^{m}.129 \pm 0^{m}.011 \text{ in } 1979$$

and

$$\Delta V = 0^{m}.140 \pm 0^{m}.004 \text{ in } 1980$$

and epochs of light minimum of

$$2443959.6 \pm 1^{d}.0 \quad \text{in } 1979$$

and

$$2444288.8 \pm 0^{d}.9 \quad \text{in } 1980.$$

These two light minima are separated by 4.13 cycles of the $80^{d}.2$ period, implying that the photometric period is close to but a bit longer than the orbital period, in other words, $P(\text{phtm.}) = 82^{d}.8$. In the jargon of RS CVn binaries this would correspond to a photometric wave migrating towards increasing orbital phase with a migration period of about 7 years.

Also noteworthy is the fact that the mean light level (defined by the

A_o term in the Fourier analysis) changed apparently in one year. The mean level was

$$\Delta V = -0\overset{m}{.}003 \pm 0\overset{m}{.}004 \quad \text{in } 1979$$

and

$$\Delta V = +0\overset{m}{.}017 \pm 0\overset{m}{.}003 \quad \text{in } 1980$$

Because, as we said before, the transformation should be very secure in this particular study, this change in mean level can be believed with some confidence, provided the comparison star did not change brightness between 1979 and 1980.

It came out during discussions at the N.A.T.O. Advanced Study Institute on "Solar Phenomena in Stars and Stellar Systems" that 12 Cam is important as the longest-period RS CVn binary in which approximate synchronization between the stellar rotation (deduced from the photometric wave) and the orbital motion has been established. Moreover, 12 Cam is important also as the RS CVn binary with the largest known orbital eccentricity.

The wave migration towards increasing orbital phase is interesting for two reasons. First, it is opposite in sense from that in most other RS CVn binaries. Second, for true synchronization in a highly eccentric orbit, the components should rotate significantly faster, not slower, than the orbital period. This interesting matter should be studied further by additional photometry in subsequent years. It will also be helpful if this subsequent photometry can define the shape of the descending as well as the ascending branch of the light curve. The matter of the changing mean light level can be investigated further at the same time but only if the photometry is carefully standardized to V of the UBV system.

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Abt, H. A., Dukes, R. J., Weaver, W. B 1969, Ap. J. 157, 717.

Bartolini C., et al. 1978, A. J. 83, 1510.

Burke, E. W. et al. 1980, A. J. 85, 744.

McFaul, T. G. 1979, J.A.A.V.S.O. 8, 64.

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

b) of the A.A.V.S.O.

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GY CYGNI

This star was estimated on Sonneberg Sky patrol plates made during the years 1966-1980. The light curve shows apparent non periodic waves with clear maxima and minima. The middle cycle duration is about $300^d \pm 50^d$. Probable there exists a secondary light variation with a period of 4000^d and an amplitude of o.5 mag.(mpv).

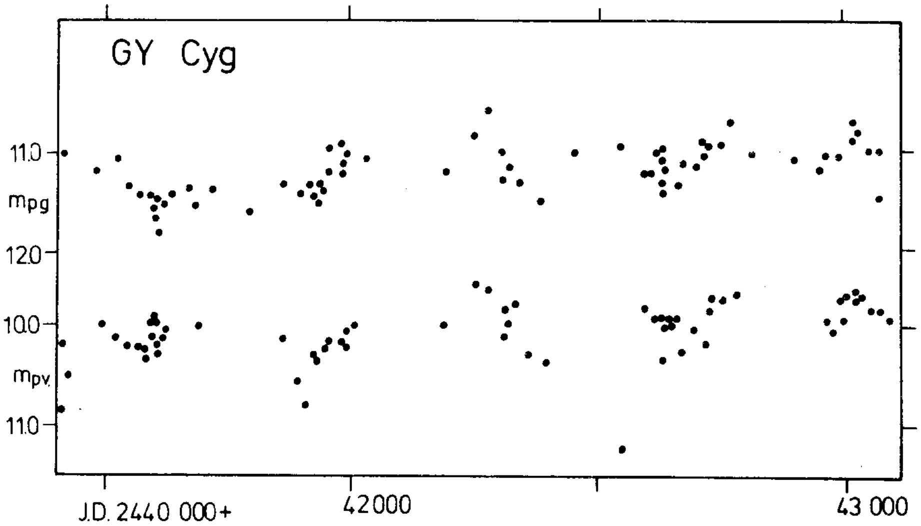

Fig.1. Middle lightcurve from parallel photographic observation series in mpg and mpv.

The observed amplitude of the total light variation is 10.6-11.8 (mpg) and 9.5-10.7 (mpv). The colour index is about (mpg-mpv)=$+1\overset{m}{.}1$.

It is possible that the star is a semiregular type variable of type SR b.

Its spectral type M 7p determined by Jaschek et al.(1) contradicts the observed colour. From the estimated luminosity of the star we can find a distance $r=(1.0\pm0.8)$kpc. The interstellar extinction with $A_V=0^m.2-0^m.7$, which is effective in this distance, increases the discrepancy between the colour index and spectral type.

The peculiarities in the spectrum of this variable pointed out by Wachmann (2,3) call for a detailed spectrographic investigation.

DIETMAR BÖHME
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(1) Jaschek, C., Conde, H. and de Sierra, A.C., La Plata, Ser. Astr. 28.2,, 1964
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SKY PATROL OBSERVATIONS OF PROBABLE NOVA CYGNI 1980 (HONDA)

On Sonneberg Sky Patrol plates, partly from pre-discovery dates, the following brightness data could be derived by comparing the nova with the Harvard sequences in SA 65 and 66 (corrected to the Mt. Wilson system) and (on photovisual plates) with SAO 71612, 71616, 71656. Because of the near-edge position of the object on the plates the magnitudes are difficult to obtain and therefore provisional.

UT	m_{pg}	m_{pv}
1980 Nov. 1.8	$12^{m}.5$:	-
Nov.27.8	11.9	$9^{m}.0$
Dec. 1.8	11.8	9.3
Dec. 3.8	11.9:	-

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THE PRESENT BRIGHTNESS MINIMUM OF TT ARIETIS

In IAU Circular No. 3541 J.E. Bortle and G. Klare et al. reported of an extreme faintness of $m_v = 14\overset{m}{.}5$ of this cataclysmic variable on 1980 November 17. Observations on Sonneberg Sky Patrol plates show that obviously the descent already began in early 1979 and grew steepest in the autumn of 1980. Further minima happened in winter 1956/57 ($12\overset{m}{.}3$), at the end of 1958 ($12\overset{m}{.}2$) and in spring 1967 ($12\overset{m}{.}6$); in brackets the deepest observations are given (m_{pg}). The mean light of the bright phase of the star is surprisingly constant at $m_{pg} = 10\overset{m}{.}8$. My comparison stars were linked to Harvard SA 70 and reduced to the international Mt. Wilson system.

The complete lightcurve subsequently to H. Huth's observations in MVS 1,p.454 will appear in Mitteilungen über Veränderliche Sterne (Sonneberg).

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR AD Leo IN 1976

Continuous photoelectric monitoring of the flare star AD Leo has been carried out at the Stephanion Observatory ($\lambda=-22^\circ 49' 44''$, $\varphi=+37^\circ 45' 15''$) during the year 1976, using the 30-inch Cassegrain reflector of the Department of Geodetic Astronomy, University of Thessaloniki. Observations have been made with a Johnson dual channel photoelectric photometer in the B colour of the international UBV System. The telescope and photometer will be described elsewhere. Here we mention only that the transformation of our instrumental ubv system to the international UBV system is given by the following equations:

$$V = v_o - 0.008(b-v)_o + 2.292,$$
$$(B-V) = 0.737 + 1.043(b-v)_o,$$
$$(U-B) = -1.798 + 1.131(u-b)_o \quad .$$

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

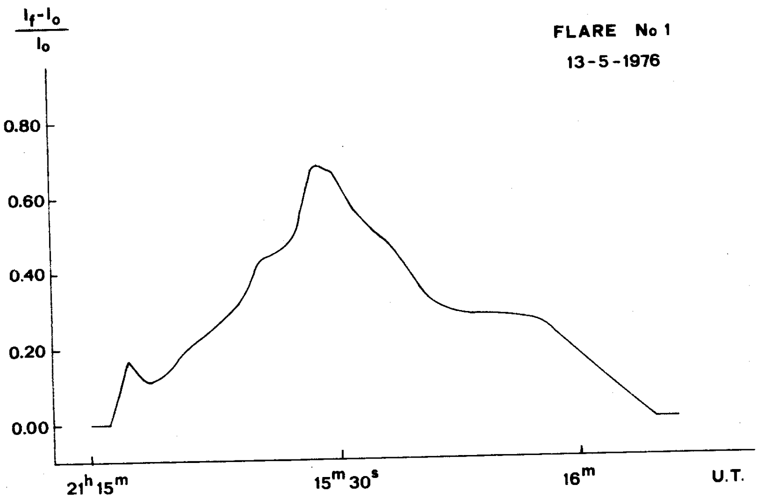
Table I

Monitoring intervals in 1976

Date 1976	Monitoring intervals (U.T.)	Total Monitoring Time	σ(U.T.)
May 13	$19^h56^m-20^h33^m$, $20^h36^m-21^h03^m$, 21 05 -21 24, 21 36 -22 10.	01^h57^m	0.06(19^h58^m),0.09 (20^h39^m),0.09(21 09), 0.11(21 38).
27	20 05 -20 35, 20 37 -21 02.	00 55	0.06(20 17),0.06 (20 39).
June 2	19 38 -20 15, 20 17 -20 44, 20 46 -21 20.	01 38	0.05(19 43),0.07 (20 21),0.07(20 57).

Total $04^h30^m = 4\overset{h}{.}50$

In the fourth column of Table I the standard deviation of random

$\frac{I_f - I_o}{I_o}$
FLARE No 1
13-5-1976
0.80
0.60
0.40
0.20
0.00
21^h 15^m
15^m 30^s
16^m
U.T.

noise fluctuation $\sigma(\text{mag})=2.5 \log(I_o+\sigma)/I_o$ for different times (UT) of the corresponding monitoring intervals is given.

During the 4.5 hours of the monitoring time one flare was observed the characteristics of which are given in Table II.

Table II

Characteristics of the flare observed

Flare No.	Date 1976 May	U.T. max	t_b min	t_a min	Duration min	I_f-I_o/I_o max	P min	Δm mag	σ mag	Air mass
1	13	$21^h15^m.47$	0.44	0.72	1.16	0.68	0.32	0.56	0.09	1.68

For this flare following characteristics (Andrews et al. 1969) are given: a) the date and universal time of flare maximum, b) the duration before and after the maximum (t_b and t_a, respectively), as well as the total duration of the flare, c) the value of the ratio $(I_f-I_o)/I_o$ corresponding of flare maximum, where I_o is the intensity deflection less sky background of the quiet star and I_f is the total intensity deflection less sky background of the star plus flare, d) the integrated intensity of the flare over its total duration, including pre-flares, if present, $P=\int(I_f-I_o)/I_o dt$, e) the increase of the apparent magnitude of the star at flare maximum $\Delta m(b)=2.5 \log(I_f/I_o)$, where b is the blue magnitude of the star in the instrumental system, f) the standard deviation of random noise fluctuation $\sigma(\text{mag}) = 2.5 \log(I_o+\sigma)/I_o$ during the quiet-state phase immediately preceding the beginning of the flare and g) the air mass at flare maximum. The light curve of the observed flare in the b colour is shown in Fig.1.

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Reference:

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

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR BD+16°2708 IN 1976

Continuous photoelectric monitoring of the flare star BD +16°2708 has been carried out at the Stephanion Observatory ($\lambda=-22^{\circ}49'44''$, $\varphi=+37^{\circ}45'15''$) during the year 1976, using the 30 inch Cassegrain reflector of the Department of Geodetic Astronomy, University of Thessaloniki. Observations have been made with a Johnson dual channel photoelectric photometer in the B colour of the international UBV system. The telescope and photometer will be described elsewhere. Here we mention only that the transformation of our instrumental ubv system to the international UBV system is given by the following equations:

$$V = v_o - 0.008(b-v)_o + 2.292,$$

$$(B-V) = 0.737 + 1.043(b-v)_o,$$

$$(U-B) = -1.798 + 1.131(u-b)_o.$$

The monitoring intervals in UT as well as the total monitoring time for each night are given in the Table I.

Table I
Monitoring intervals in 1976

Date 1976	Monitoring intervals (UT)	Total Monitoring time	σ(U.T.)
May 7-8	$20^{h}09^{m}-21^{h}48^{m}$, $21^{h}50^{m}-22^{h}16^{m}$, 22 18 -22 48, 23 00 -23 12, 23 45 -00 08, 00 10 -00 43, 00 45 -01 20, 01 22 -01 51.	$03^{h}36^{m}$	0.10($21^{h}25^{m}$),0.10 (21 54),0.11(22 20), 0.09(23 06),0.07 (23 46),0.06(00 13), 0.06(00 47),0.07 (01 24).
21-22	19 55 -20 20, 20 22 -20 53, 20 55 -21 29, 21 38 -22 08, 22 11 -22 43, 22 45 -23 23, 23 31 -00 16, 00 18 -00 59, 01 01 -01 48.	05 23	0.06(19 58), 0.06 (20 24),0.05(20 57), 0.05(21 41), 0.05 (22 13),0.06(22 48), 0.06(23 34),0.07 (00 28),0.09(01 33).
26-27	20 56 -21 27, 21 29 -21 58, 22 00 -22 31, 22 42 -23 13, 23 16 -23 47, 23 49 -00 29,		0.06(21 01),0.06 (21 33),0.06(22 03), 0.06(22 45),0.07

Table I (cont.)

Date	Monitoring intervals (UT)	Total Monitoring time	σ(U.T.)
1976 May 26-27	00^h40^m-01^h06^m, 01^h08^m-01^h27^m.	03^h58^m	(23^h17^m)0.07(23 52), 0.08(00 44),0.09 (01 12).
28-29	20 17 -20 48, 20 52 -21 21, 21 24 -21 54, 22 04 -22 31, 22 34 -23 02, 23 05 -23 42, 23 52 -00 23.	03 33	0.06(20 21),0.06 (20 56),0.06(21 27), 0.06(22 07),0.06 (22 36),0.06(23 07), 0.06(23 55).
May-June 31-1	20 07 -20 46, 21 20 -21 58, 21 59 -22 30, 22 32 -22 59, 23 10 -23 44, 23 46 -00 11, 00 23 -01 16.	04 07	0.06(20 11), 0.06 (21 24),0.07(22 01), 0.06(22 36),0.06 (23 14),0.06(23 49), 0.08(00 26).
June 2-3	21 39 -22 06, 22 09 -22 41, 22 44 -23 28, 23 37 -00 10, 00 14 -00 51, 01 09 -01 20.	03 07	0.05(21 43),0.07 (22 16),0.06(22 51), 0.07(23 42).0.07 (00 26),0.07(01 12).

Total $23^h44^m = 23^h.73$

Any iterruption of more than one minute has been noted. In the fourth column of Table I the standard deviation of random noise fluctuation $\sigma(mag)=2.5 \log(I_o+\sigma)/I_o$ for different times (UT) of the corresponding monitoring intervals is given.

During the 23.73 hours of the monitoring time no flare was observed.

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TIMES OF MINIMA FOR SEVEN ECLIPSING BINARIES

Sixteen minima for seven eclipsing variables have been determined photoelectrically between September 1979 and September 1980. The telescope used was the 30 cm Maksutov of the University of Ankara, which is equipped with an uncooled EMI 6256 S photomultiplier and dc chart recorder.

The times of minima are given in Table I, where the first entry for each minimum is through the b filter, and the second through the v filter. The filters are closely similar to the standard BV filters. The minimum times were calculated by the method of Kwee and Van Woerden (1). The errors are standard errors.

Table I

Binary	Min.	HJD 2444000	Binary	Min.	HJD 2444000
RX Ari	I	227.3100±0.0017	U Oph	II	432.3183±0.0011
		.3112±0.0020			.3168±0.0021
SW Lac	I	201.2550±0.0004		II	437.3482±0.0006
		.2556±0.0006			.3481±0.0005
	I	202.2174±0.0003	U Peg	I	469.3859±0.0009
		.2177±0.0002			.3855±0.0015
	I	461.3600±0.0005		I	490.3789±0.0004
		.3592±0.0006			.3782±0.0004
	I	480.2822±0.0006	DI Peg	II	143.3560±0.0017
		.2823±0.0003			.3569±0.0015
TZ Lyr	I	426.3931±0.0005		I	144.4227±0.0006
		.3920±0.0004			.4232±0.0003
	I	435.3835±0.0021	ER Vul	I	436.4446±0.0004
		.3858±0.0009			.4448±0.0017
U Oph	I	416.3856±0.0003		II	437.4958±0.0008
		.3853±0.0003			.4969±0.0012

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Technical Research Council of Turkey), and by the National Science Foundation through the grant Ast 78-12307 to Prof. T.J. Herczeg of the University of Oklahoma.

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Reference:
(1) K.K. Kwee and H. van Woerden, Bull. Astron. Neth. 12, 327, 1956

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V 758 Cen, LIGHT CURVE AND STUDY OF THE PERIOD

The eclipsing binary V758 Cen was discovered by W.Strohmeier, H. Ott and E. Schöffel (IBVS, No. 261, 1968); they also published 25 times of photographic minima, and found a period $P=0^{d}.5807835$. K. Chen (IBVS, No. 284, 1968) observed V758 Cen photoelectrically (B) and derived a time of minimum light giving $(O-C)=0^{d}.029$ for the elements determined by Strohmeier et al. Further, H. Bauernfeind (Veröff., Bamberg, Band VIII, 81, 1968) gave 118 minima (and maxima); from these data he found a systematic trend for the residuals in the interval JD 2415000-2430000 when comparing the observations with Strohmeier et al. elements; suggesting a somewhat larger period.

In this note a V-light curve is presented from 500 UBV photoelectric observations carried out at the Bosque Alegre Station of Cordoba Observatory with the 154 cm reflecting telescope (Figure 1). The observations are given differentially in relation to the comparison star HD 120909 (B8). The light variation

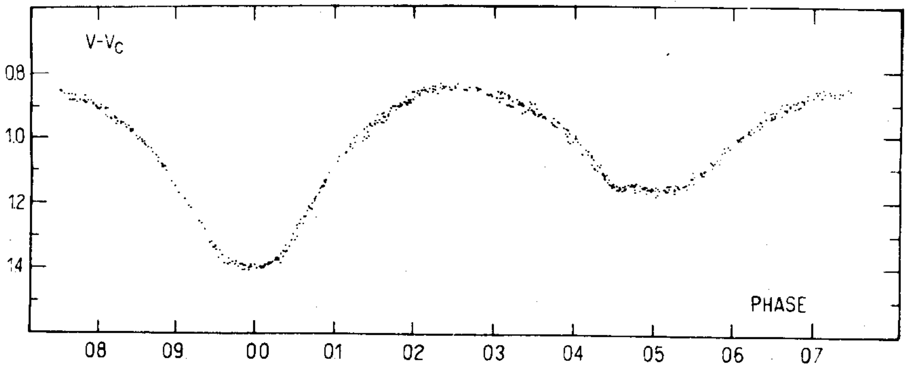

Figure 1

shows a curved primary minimum and a flat secondary one, thus primary being a transit, while secondary is an occultation due to a slightly hotter component, so that the system may be classified as a type-A close (contact) binary.

Three times of minima were derived from each light curve (U,B and V), also two minima were obtained from Chen's photoelectric observations. These minima are listed in Table I.

Table I

Minima of V758 Cen

Min.	Colour	J.D.hel (2400000+)	W	Cycles	(O-C)'	(O-C)
I	B	39977.6959	3	-7620.0	-0.0017	0.0021
II	B	39982.6358	3	-7611.5	0.0016	0.0053
II	V	44389.6313	3	-23.5	0.0015	0.0000
II	B	44389.6314	3	-23.5	0.0016	0.0001
II	U	44389.6321	2	-23.5	0.0023	0.0008
II	V	44392.5335	3	-18.5	-0.0002	-0.0017
II	B	44392.5334	3	-18.5	-0.0003	-0.0018
II	U	44392.5358	2	-18.5	0.0020	0.0006
I	V	44451.4806	3	83.0	-0.0028	-0.0043
I	B	44451.4812	3	83.0	-0.0022	-0.0037
I	U	44451.4815	2	83.0	-0.0019	-0.0034

From the photoelectric data only, the following least squares ephemeris was found:

$$\begin{array}{rl} \text{P.M.} = \text{JD hel. } 2444403.2783 & + 0\overset{d}{.}5807850 \cdot E \\ \pm 0.0004 & \pm 0.0000001 \quad \text{(p.e.)} \end{array}$$

The cycles E, weights and residuals (O-C)' are given in Table I.

The photographic observations of Strohmeier et al. and Bauernfeind quoted above were also analyzed together with the present material; weight W=1 was assigned to photographic values, while W=3, 3 and 2 to the V,B and U minima. The least squares light elements for all data (excluding maxima) are:

$$\begin{array}{rl} \text{P.M.} = \text{JD hel } 2444403.2797 & + 0\overset{d}{.}58078556 \cdot E \\ \pm 0.0012 & \pm 0.00000004 \quad \text{(p.e.)} \end{array}$$

The residuals (O-C) are also in Table I for photoelectric minima; and for all observations including photographic values (135 minima) are displayed in Figure 2.

It is noted that the period obtained from photoelectric observations (7703 cycles) is very close to that found from all

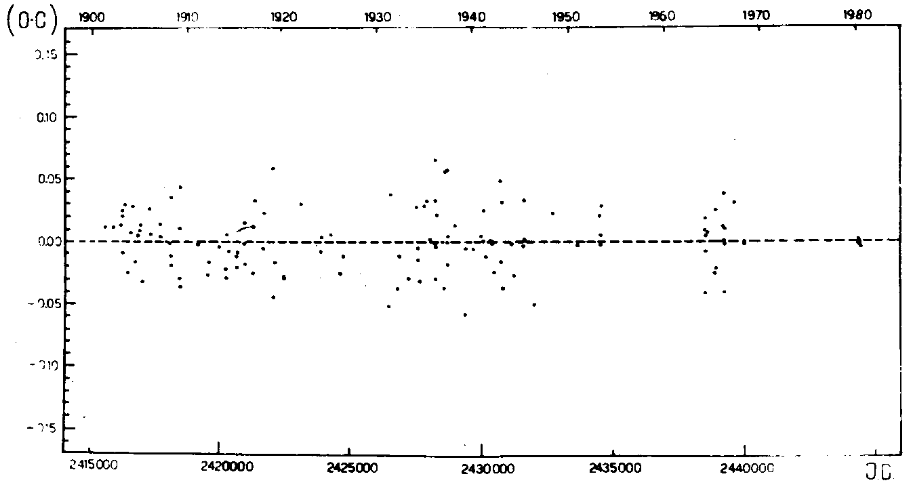

Figure 2

the data (49791 cycles), and somewhat larger than that previously found. The residuals are randomly distributed, so that the period has been constant for the last 80 years.

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MIRA'S LINEAR POLARIZATION NEAR THE 1980 LIGHT MAXIMUM

Four wide-band (B-filter) linear polarization measurements of Mira (ο Ceti) were carried out over a one week interval which commenced about six weeks after the 1980 light maximum. (Janet A. Mattei of the A.A.V.S.O. kindly provided a provisional estimate of the occurrence of Mira's light maximum.) Polarization measurements were carried out at the Cassegrain focus of the 61-cm telescope at Columbia University's Harriman Observatory. A description of the polarimeter and observing procedures, as well as evidence for instrumental accuracy and precision, have been given by Hayes (1980). The observations are listed in Table I, with the amount (P) and direction (θ) of polarization being expressed in percentages and equatorial coordinates, respectively. All observations have a Poisson photon count standard deviation of 0.02% for P, while the standard deviation of θ is given by $28\overset{\circ}{.}7$ (σ_p/P).

Table I

Journal of Mira's Polarization Degree and Position Angle

Date (UT)	P (%)	θ (deg.)
1980 Oct. 31.16	0.87	40.0
1980 Nov. 02.18	0.83	38.6
1980 Nov. 03.12	0.83	40.0
1980 Nov. 06.16	0.82	40.0

Perhaps the most important datum of this report are the position angles. Serkowski (1971) noted that θ appeared to alternate between high and low values for one cycle of Mira's maximum to the next, with variations of 20° - 40° being generally found in the earlier data [vide Shawl (1975)]. Such variations resemble those found in the RV Tauri star U Mon, which Serkowski (1970) has attributed to nonspherical pulsation modes. But the position angles obtained near the 1977 maximum (McLean and Coyne, 1978) differed markedly from the earlier results. Tomaszewski et al. (1980) reported that the position angles around the 1978 maximum were also discrepant, but to a lesser extent. The polarization amounts and positions being reported here bear resemblance to some of the earlier results reported by Shawl (1975). The 1980 polarization observations in concert with results derived by other techniques may permit a resolution of the roles played by nonspherical pulsations and alternative mechanisms such as grain growth in the extended atmosphere, and the waxing and waning of large scale convective cells in the lower atmosphere of this star.

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FAST PHOTOMETRY OF AE Aqr

We observed AE Aqr photoelectrically starting at $JED_{\odot}$ 2444438.659459 with the 1.6m telescope of the Brazilian Astrophysical Observatory. Fast photometry (1s integration time) was carried out in white light during one hour.

The "16.5s" and "33s" oscillations discovered by Patterson (1979) are present in our data. Fig.1 shows the power spectrum for our observing run.

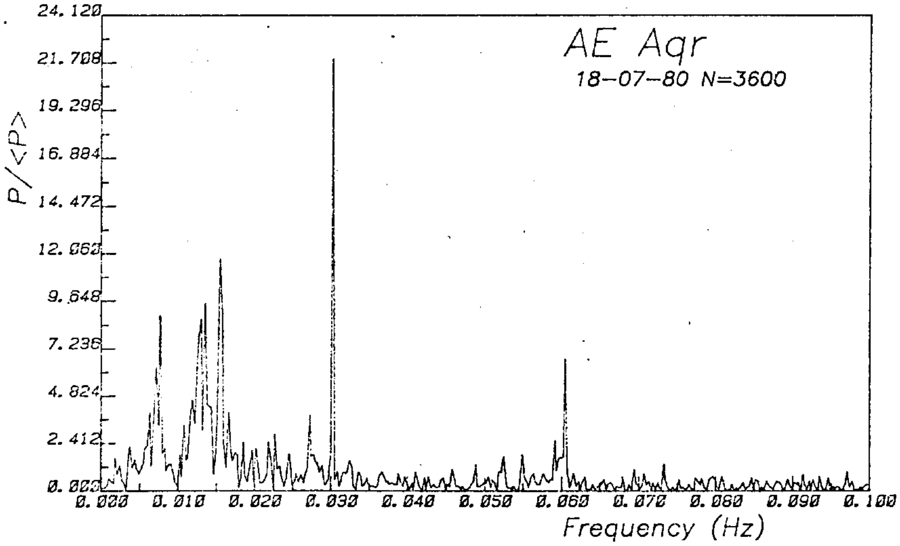

Fig.1. Power spectrum of AE Aqr. Ordinates are power in bin/mean power in the spectrum. The low frequencies were suppressed with a high-pass filter.

We have derived a mean time for the maxima of the "16.5" oscillations, once the effect of the time delay due to the orbital motion of the pulsating source during the observation was subtracted:

Max. light at $JED_{\odot}$ 2444438.659610 (1)
(± 2)

Using the ephemeris given by Patterson (1979)

Max. light at $JED_{\odot}$ $2443668.915387 + 1.91416306 \times 10^{-4}E$
± 3 (± 20)

we found a residue of .569 cycles after 4021309 cycles of the "16.5s" oscillation. This residue would make the cycle counting insecure in normal conditions; but AE Aqr displays an additional feature that we can use: the "main" pulse of the "33s" oscillation has always an even cycle number. As it can be seen in Fig.2, the first pulse in our observing run is the "main" one, and so, should have an even cycle number (4021310).

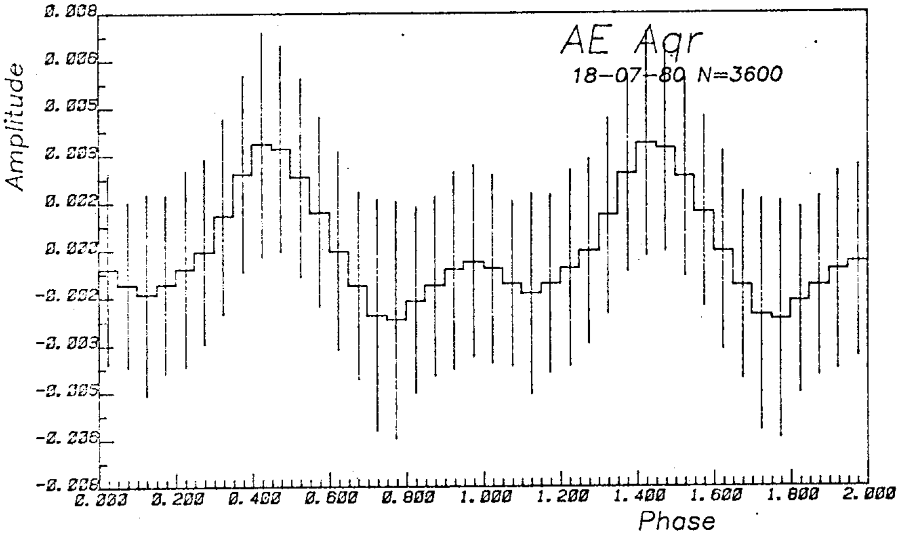

Fig.2. Mean light curve for the "33s" oscillation in AE Aqr. Amplitude is given in magnitudes.

Assuming $\dot{P}$ to be small enough to be detected yet, a correction can be set to the period given in (1)

$$\text{Best } P = 1.91416285 \times 10^{-4} d. \quad (\pm 4)$$

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Reference:
Patterson, J. 1979, Astrophys.J.234, 978

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POSSIBLE HUBBLE-SANDAGE OBJECTS AMONG VARIABLES DISCOVERED IN THE ANDROMEDA GALAXY

With the 2 meter telescope of the Bulgarian Academy of Sciences several plates of the central and south-west region of the Andromeda galaxy have been obtained in 1980. The limiting magnitude is about 21.2 and 22.0 magnitudes for plates of one and three hour exposure time, respectively.

Hubble (1929) observed Nova 36 with a constant magnitude of 18.7 during 11 years. (Hubble's magnitude scale is translated into Baade and Swope's (1964) system.) Nova 36 is also visible on our plates: its magnitude is B=20.0. Therefore, our data show that this star is not a nova.

Hubble also discovered the irregular variable stars H11, H20, H43 and H44. Baade and Swope observed two of these stars and classified H43 as an irregular variable ($20^{m}.70-21^{m}.30$) and H44 - as R CrB variable ($19^{m}.85-21^{m}.45$). H11 and H20, however, have not been investigated since 1928. Here we give the magnitudes of these stars:

J.D.	star	B(mag)
2444529	H11	21.2
2444529	H20	>21.2
2444530	H43	20.3
2444530	H44	20.0

The magnitudes of H11, H43 and H44 presented above are within the limits of their amplitudes as given by Hubble (1929) and Baade and Swope (1964). But H20 is with about 2^{m} weaker in comparison with its brightness in 1928 (now it is 21.2 in comparison with 18.5-19.5 in 1928).

It is quite possible that Nova 36 and H20 are irregular variable stars - Hubble-Sandage objects (S Dor variables). Nova 26 and Nova 39 were also observed by Hubble during several years, but on our plates these stars are not visible (B>22 mag). They are also possible Hubble-Sandage objects.

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LIGHT CURVE AND CHARACTERISTIC PHOTOMETRIC PARAMETERS OF NOVA CYGNI 1978 (V 1668 Cyg)

28 photoelectric V observations performed with the 40-cm refractor of the Teramo Observatory are given in Table I. BD +43°4012 with V=9.27 (checked with BD +43°4017) was utilized as comparison star. All the published photoelectric V and B observations together with some visual and photovisual measures which allow to secure the final rise and the epoch of the maximum are listed in Table II.

Table I

Teramo Observations

J.D.	V		J. D.	V	
2443771.300	7.87	± 0.01	2443806.292	10.37	± 0.01
772.300	7.82	0.01	807.250	10.46	0.03
774.344	8.03	0.01	810.243	10.54	0.01
775.292	8.17	0.01	811.253	10.52	0.01
776.333	8.18	0.00	813.253	10.75	0.01
777.451	8.38	0.00	823.253	11.10	0.01
778.319	8.40	0.00	829.215	11.19	0.03
779.302	8.53	0.01	832.271	11.24	0.02
781.310	8.61	0.00	833.233	11.24	0.02
788.278	9.28	0.01	835.208	11.20	0.01
789.278	9.26	0.01	837.226	11.32	0.00
793.332	9.77	0.01	838.217	11.35	0.00
804.292	10.19	0.01	843.215	11.41	0.02
805.278	10.27	0.01	849.265	11.47	0.02

The light curve drawn with the data of these two tables appears fairly well outlined up to 35 days after the maximum; thereafter the different series of observations diverge highly owing to the blowing up of the strong emissions in the spectrum of the nova. The same behaviour is of course shown by the B-V

Table II
Collected Magnitudes

J. D.	Magn.	B – V	Source
2443759.4	14		Andrews-Lloyd: IAU Circ. 3268
759.84	12		Di Cicco: IAU Circ. 3263
760.5	8.7 pg		Reginaldo: IAU Circ. 3276
761.0	9.0 v		Collins: IAU Circ. 3263
761.5	6.8 v		Morrison: IAU Circ. 3264
761.9	6.9 – 7.0 v		Reginaldo: IAU Circ. 3276
762.0	6.6 v		Hiraga: IAU Circ. 3267
762.57	6.4 v		Bretl: IAU Circ. 3263
762.63	6.3 v		Morgan: IAU Circ. 3263
762.66	6.6 v		Harless: IAU Circ. 3263
762.67	6.4 v		Barstow: IAU Circ. 3263
762.69	6.6 v		Mayer: IAU Circ. 3263
762.78	6.7 v		Collins:IAU Circ. 3263
763.55	6.0 pv		Lloyd: IAU Circ. 3268
763.66	6.17 V		Mattei: IAU Circ. 3303
763.66	6.2 v		Beckman: IAU Circ. 3264
764.29	6.4 v		Baroni-Cavagna: IAU Circ. 3264
764.34	6.35 V	+0.63	Baldinelli: IAU Circ. 3278
764.37	6.38 V	+0.68	Lindgren: IBVS 1543
764.45	6.34 V	+0.58	Duerbeck: Astron. Astrophys. 81,157
764.58	6.2 pv		Stelz: IAU Circ. 3268
764.63	6.33 V		Mattei: IAU Circ. 3303
764.66	6.4 v		Ashbrook: IAU Circ. 3267
764.75	6.32 V	+0.67	de Roux: IBVS 1519
765.41	6.17 V	+0.49	Duerbeck: Astron. Astrophys. 81,157
765.53	6.18 V	+0.50	Mallama: PASP 91,99
765.54	6.00 V		Stelz: IAU Circ. 3268
765.66	6.22 V		Mattei: IAU Circ. 3303
765.88	6.4 v		Morris: IAU Circ. 3267
766.35	6.66 V	+0.50	Baldinelli: IAU Circ. 3278
766.41	6.66 V	+0.50	Duerbeck:Astron. Astrophys. 81,157
767.47	6.92 V	+0.33	" " " " "
767.68	6.90 V	+0.36	Mallama: PASP 91,99
768.40	6.83 V	+0.35	Duerbeck: Astron. Astrophys. 81, 157
768.73	7.02 V	+0.36	de Roux: IBVS 1519
769.49	7.03 V	+0.30	Duerbeck: Astron. Astrophys. 81, 157
769.67	7.23 V		Mattei: IAU Circ. 3303
770.35	7.40 V	+0.29	Baldinelli: IAU Circ. 3278
770.43	7.45 V	+0.29	Duerbeck: Astron. Astrophys. 81, 157
770.64	7.67 V	+	Mattei: IAU Circ. 3303
770.83	7.71 V	+0.18	Margrave: IAU Circ. 3316
771.43	7.86 v	+0.18	Lindgren: IBVS 1543
771.49	7.69 V	+0.26	Duerbeck: Astron. Astrophys. 81, 157

Table II (cont.)

J. D.	Magn.	B – V	Source
2443771.72	7.74 V		Mattei: IAU Circ. 3303
771.80	7.79 V	+0.18	Margrave: IAU Circ. 3316
772.29	7.66 V	+0.29	Duerbeck: Astron. Astrophys. 81, 157
772.51	7.72 V	+0.24	Mallama: PASP 91,99
774.53	8.02 V	+0.34	deRoux: IBVS 1519
775.33	7.97 V	+0.29	Duerbeck: Astron. Astrophys. 81, 157
775.77	8.34 V	+0.18	Margrave: IAU Circ. 3316
776.29	7.98 V	+0.28	Duerbeck: Astron. Astrophys. 81, 157
776.81	8.17 V		Mattei: IAU Circ. 3303
777.29	8.12 V	+0.29	Duerbeck: Astron. Astrophys. 81; 157
777.52	8.29 V	+0.28	Mallama: PASP 91, 99
777.55	8.33 V	+0.25	deRoux: IBVS 1519
778.31	8.15 V	+0.30	Duerbeck: Astron. Astrophys. 81, 157
778.60	8.24 V	+0.27	Mallama: PASP 91, 99
778.70	8.30 V	+0.21	Margrave: IAU Circ. 3316
779.40	8.34 V	+0.30	Duerbeck: Astron. Astrophys. 81, 157
780.58	8.62 V	+0.31	Mallama: PASP 91, 99
780.69	8.68 V	+0.27	deRoux: IBVS 1519
781.80	8.68 V	+0.22	Margrave: IAU Circ. 3316
783.41	8.53 V	+0.28	Duerbeck: Astron. Astrophys. 81, 157
783.63	8.80 V		Mattei: IAU Circ. 3303
784.62	8.79 V		" " " "
785.64	8.87 V		" " " "
786.52	9.00 V	+0.21	deRoux: IBVS 1519
786.57	8.94 V	+0.22	Mallama: PASP 91,99
786.72	9.00 V		Mattei: IAU Circ. 3303
786.85	9.11 V	+0.22	Margrave: IAU Circ. 3296
787.76	9.32 V	+0.24	" " " "
788.76	9.37 V	+0.21	" " " "
789.32	9.06 V	+0.29	Hopp: IBVS 1633
790.26	9.08 V	+0.34	" " "
790.83	9.18 V	+0.23	Margrave: IAU Circ. 3296
791.53	9.30 V	+0.25	Mallama: PASP 91, 99
791.76	9.47 V	+0.19	Margrave: IAU Circ. 3296
792.44	9.32 V	+0.28	Duerbeck: Astron. Astrophys. 81, 157
792.70	9.71 V	+0.11	deRoux: IBVS 1519
793.27	9.15 V	+0.16	Hopp: IBVS 1633
793.36	9.47 V	+0.29	Duerbeck: Astron. Astrophys. 81, 157
794.26	9.62 V	+0.33	" " " " "
794.31	9.67 V	+0.40	Hopp: IBVS 1633
795.31	9.64 V	+0.20	" " "
795.72	9.81 V	+0.19	Margrave: IAU Circ. 3299
796.27	9.42 V	+0.33	Duerbeck: Astron. Astrophys. 81, 157
796.78	9.92 V	+0.19	Margrave: IAU Circ. 3299

Table II (cont.)

J. D.	Magn.	B – V	Source
2443797.25	9.70 V	+0.09	Bruch: IBVS 1567
798.20	9.81 V	+0.09	" " "
799.20	9.70 V	+0.04	" " "
799.76	9.90 V	+0.17	Margrave: IAU Circ. 3299
800.19	9.81 V	+0.04	Bruch: IBVS 1567
800.38	9.68 V	+0.22	Hopp: IBVS 1633
801.14	9.71 V	+0.05	Bruch: IBVS 1567
801.25	9.66 V	+0.21	Duerbeck: Astron. Astrophys. 81, 157
801.78	9.89 V	+0.14	Margrave: IAU Circ. 3299
802.53	9.95 V	+0.27	Mallama: PASP 91, 99
803.22	9.91 V	+0.06	Bruch: IBVS 1567
803.35	9.83 V	+0.22	Duerbeck: Astron. Astrophys. 81, 157
803.85	10.17 V	+0.12	Margrave: IAU Circ. 3299
804.44	9.80 V	-0.02	Bruch: IBVS 1567
805.30	9.95 V	+0.18	Duerbeck: Astron. Astrophys. 81, 157
807.31	9.90 V	+0.47	Hopp: IBVS 1633
808.34	10.10 V	+0.24	" " "
809.56	10.16 V	+0.20	Mallama: PASP 91, 99
814.21	10.44 V	+0.52	Hopp; IBVS 1633
814.37	10.35 V	+0.32	Duerbeck: Astron. Astrophys. 81, 157
815.23	10.36 V	+0.41	Hopp: IBVS 1633
818.26	10.41 V	+0.35	Duerbeck: Astron. Astrophys. 81, 157
825.21	10.54 V	+0.31	" " " " "
828.25	10.51 V	+0.29	Hopp: IBVS 1633
829.27	10.51 V	+0.41	" " "
832.26	10.61 V	+0.25	" " "
833.25	10.63 V	+0.24	" " "
847.25	10.90 V	+0.16	" " "
848.25	10.83 V	+0.31	" " "
849.37	10.97 V	+0.43	Duerbeck: Astron. Astrophys. 81, 157
850.19	10.99 V	+0.23	Hopp: IBVS 1633
862.24	10.93 V	+0.33	" " "

values after J.D. 43800 appear tremendously scattered, in accordance with the fact that the standard colours are meaningless for an emission object. A characteristic feature of this nova, already pointed out by other observers, is the complicated structure of the maximum: it appears to have been two maxima, at J.D. 2443763.7 and at J.D. 2443765.5; the first maximum time relies largely on the photoelectric observation made by Mattei on J.D. 2443763.66: the reliability of this datum has been checked considering the good agreement of the remaining observations of Mattei with those of other observers, This structure of the maximum, which looks like a miniature version of the complicated structure of some slow novae such HR Del, is rather surprising in a fast nova such Nova Cyg 1978.

From the V light curve and the B-V colour displayed in Fig.1 the photometric values and the characteristic times of the dec-

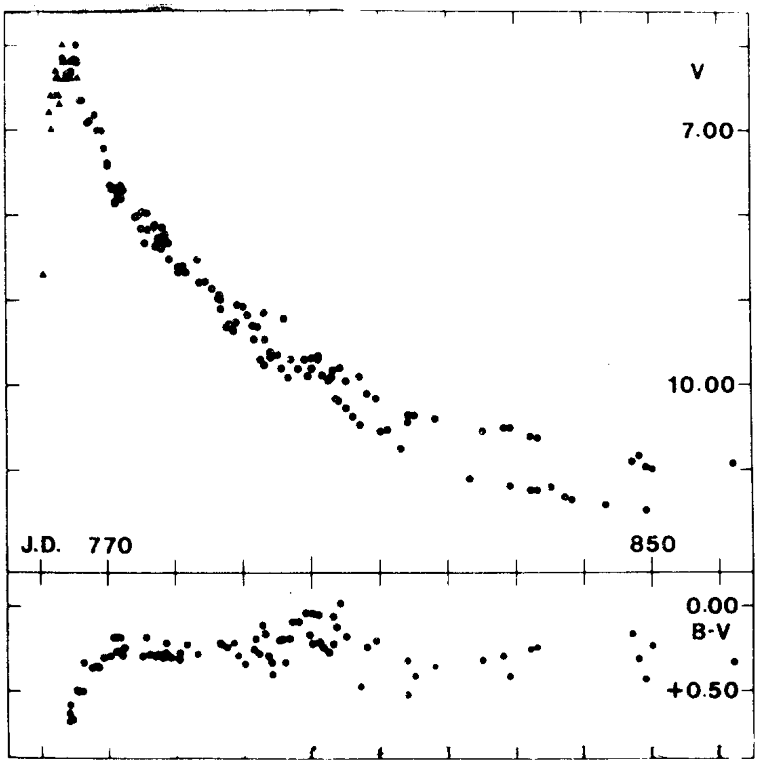

Fig. 1:

At the top: the V light curve ▲ : visual or photovisual observations,

● : photoelectric observations.

The lower branch after J.D. 3805 is formed by Teramo observations only; the upper branch is formed by the observations of Duerbeck and of Hopp.

At the bottom: the B-V curve (only photoelectric measures).

line are derived:

$t_2 = 12^d$ $t_3 = 23^d$ (V light)

$t_2 = 15^d$ $t_3 = 30^d$ (B light)

$M_{Vmax} = 6.1$ $(B-V)_{max} = +0.68$

According to the standard criterion, V 1668 Cyg may be classified as a fast nova. It has not been possible to check the reliability of the highest observed photoelectric brightness (V=6.00; Stelz, 1978); therefore we have assumed for the magnitude at maximum the conservative value V=6.1.

By means of the well known relation of Schmidt as revised by Pfau (1976), $M_B = -10.67 \pm 0.30 + 1.80(\pm 0.20)\log t_3$, the absolute magnitude at maximum $M_B = -8.0 \pm 0.6$ is derived. Assuming the Schmidt value +0.35 for the intrinsic B-V colour at maximum, the absolute V magnitude results

$M_{Vmax} = -8.4 \pm 0.6$ (from the rate of decline).

With this assumption, the observed B-V give the value +0.33 for the reddening of the nova. This result is in good agreement with the value $M_{Vmax} = -8.3$ found by Mallama and Skillman (1979) using the same criterion.

The method of the rate of decline $2/t_2$ as calibrated by Rosino (1964) confirms this result giving $V_o = -8.0$. The method of the light curve crossing point t=15 days (Buscombe and Vaucouleurs, 1955; Pfau, 1976) gives $V = -8.2 \pm 0.6$.

The absolute magnitude found by various observers with criteria independent from the rate of decline results much fainter: -7.5 ± 0.5 from the interstellar K I line (Slovak and Vogt, 1979); -6.8 ± 0.7 from the colour excess and the assumed reddening law (Duerbeck at al., 1980).

The disagreement between the results obtained using the rate-of-decline criterion and those obtained using other criteria appears confirmed and the doubt that the t_3-time is not so good luminosity indicator for all novae as hitherto assumed (Duebeck and Pollok, 1980) would appear therefore strengthened. We think, however, that the methods based on the interstellar absorption are of very little weight in this region of the sky where the absorption is so erratic.

A two hours monitoring on October 11, 1978, shows a maximum

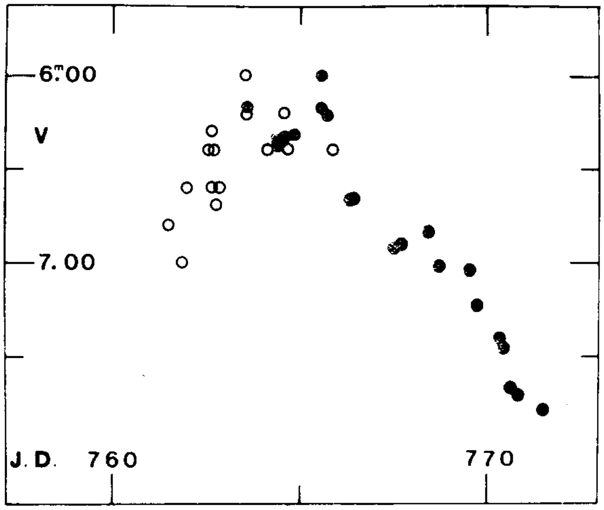

Fig. 2 :

The structure of the maximum : ○ visual or photovisual observations,

● photoelectric observations.

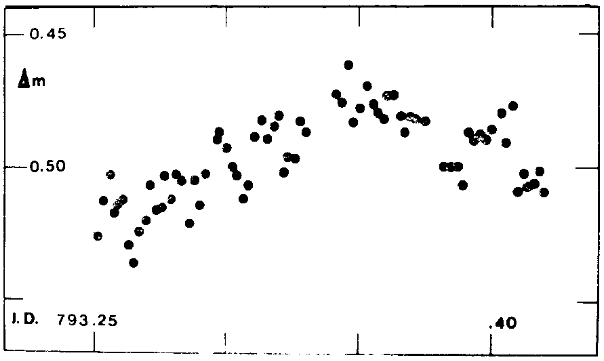

Fig. 3 : The short period light variation on October 11, 1978.

of the short period regular oscillation found in the nova light curve shortly after the maximum by Campolongo et al., (1980). The amplitude and the shape of the observed stretch agree with the amplitude and the period (respectively $0\overset{m}{.}15$ and $10\overset{h}{.}54$) found by the quoted authors. The statement of Mallama and Skillmann that a two-hour monitoring on September, 27, 1978, showed no short-time variation is not surprising: owing to the length of the cycle the monitoring may have fallen on an almost constant phase.

The presence of short-period regular oscillation in the very proximity of the maximum light was discovered for the first time in Nova Cyg 1975 (=V 1500 Cyg); the occurrence that the first monitoring of a nova thereafter expressly carried out has given a positive result seems to indicate that such a phenomenon is a rather general feature. Photoelectric monitoring for several hours during the first decline of the novae is therefore highly recommended.

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THE PERIOD OF THE Bp STAR HD 213918

HD 213918 (BD +38°4801), m_V=8.715, is a very hot, Si λ4200 star (Bertaud, Floquet 1974). Its projected rotational velocity is 80 km/s according to Wolff (1980). It has a rather deep λ5200 depression, since its peculiarity index Z is -0.048, leading to a photometric estimate of the mean surface field H_S (Z, X) = 4.0 kG (Cramer and Maeder 1980a, b). It is a visual double star (ADS 16064) with 1.8" separation and visual magnitudes 8.7 and 13.2. So the companion has a negligible influence on the colours and amplitude of variations.

Furthermore, HD 213918 is a member of the association Lacerta OB1 and is relatively young (1.26 10^7 yrs after Abt (1979)). This fact, together with the high estimated field (4.0 kG is actually a lower boundary, because the relation between Z and H_S is not bijective) makes such an object interesting.

It was observed between 26 September and 4 October 1980 from the Gornergrat Observatory with the 1m telescope, in the Geneva photometric system. Eleven differential measures have been obtained, with HD 213801 and HD 214243 as comparison stars; these proved to be constant over the observing time span, while HD 213918 shows variations of about $0\overset{m}{.}07$ through the V filter (the measures of the other magnitudes have not yet been reduced). A period P=1.43 ± 0.03 days was derived using the Θ_1 test proposed by Renson (1978), see Fig. 1.

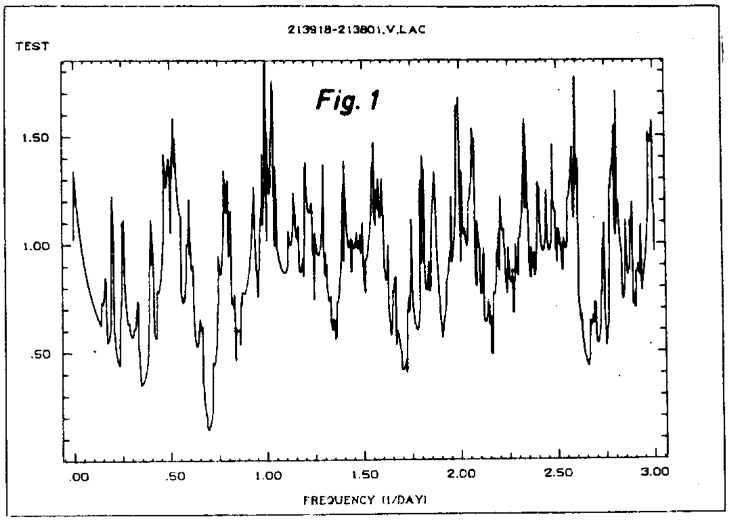
Fig. 1
213918-213801,V,LAC
TEST
1.50
1.00
.50
.00
.50
1.00
1.50
2.00
2.50
3.00
FREQUENCY (1/DAY)

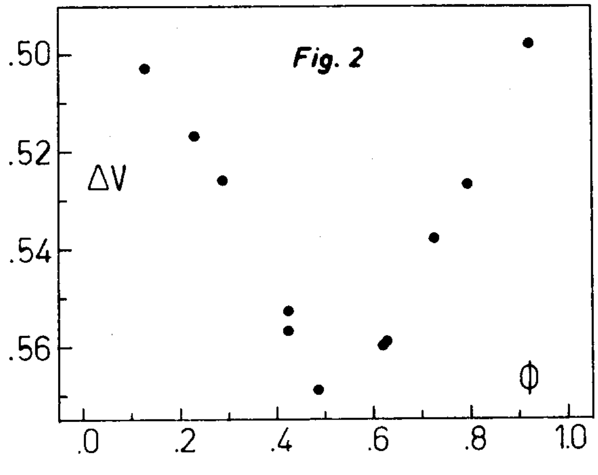
Fig. 2
.50
.52
.54
.56
ΔV
Φ
.0
.2
.4
.6
.8
1.0

The V magnitudes relative to the first comparison star (HD 213801) are shown in Fig. 2 as a function of the phase, according to the ephemeris

$$\text{J.D. (max. light)} = 2444509.32 + 1\overset{d}{.}43E$$

Differential extinction was taken into account.
If a radius $R = 3\ R_\odot$ is assumed, then the real rotational velocity may be estimated from the relation $V = 50.6\ R/P = 106$ km/s. This is about half the value admitted for field late-B stars (Slettebak 1954). From Vsini = 80 km/s the inclination is 49°.

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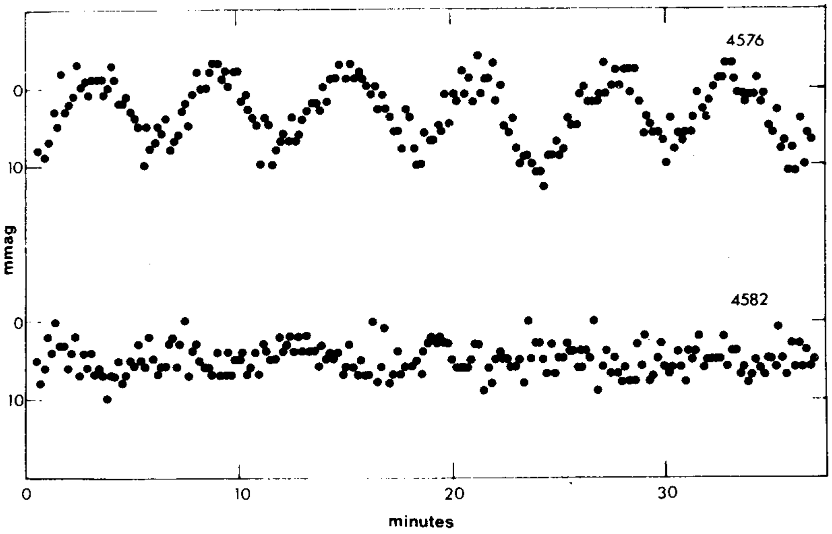
DISCOVERY OF 6.15 MINUTE OSCILLATIONS IN THE COOL MAGNETIC Ap STAR HD 24712

In 1978 the discovery of light variability in HD 101065, Przybylski's star, with the remarkably short period of 12.14 minutes was announced in these Bulletins (Kurtz 1978). An extensive analysis of the light variations and new infrared spectra led Kurtz and Wegner (1979) to suggest that HD 101065 is simply an extreme example of the cool magnetic Ap stars rather than a unique object as has often been suggested. One immediate inference of this suggestion is that other cool magnetic Ap stars may also pulsate with hitherto unsuspected short periods.

On the night of 27/28 October 1980 observing from the Wise Observatory at Mitzpe Ramon, Israel, oscillations with a period of 6.15 minutes were discovered in the cool magnetic Ap star HD 24712. Extensive observations of this star are now being made from the South African Astronomical Observatory at Sutherland. Figure 1 shows small sections of the B light curves of HD 24712 obtained in December 1980 on two nights separated by six days. On the first night shown the peak to peak variation is nearly 0.01 mag and unequivocal. On the second night shown the variation is slightly less than 0.002 peak to peak, but can still be seen and stands out clearly in an amplitude spectrum. The ob-



Figure

Sections of the Johnson B light curves of HD 24712 obtained on J.D. 2444576 and 2444582. The light curves extend for hours on either side of the sections shown with similar appearance. Each point represents a 10-s integration. Light curves have also been obtained on all the nights in between those shown with a decreasing amplitude from night to night.

servations extend for hours on either side of the small pieces shown in Figure 1. Observations have also been obtained on all of the nights between the two illustrated with steadily decreasing amplitude from night to night.

The 6.15 minute variability of HD 24712 is thus established with certainty. It has been observed on a dozen nights from two different sites and with two different telescope-photometer combinations. It is also apparent that the variability is multiperiodic and seems likely that the major beat period is near to, or the same as, the rotation period of this star of 12.448 days.

HD 24712 is perhaps the second coolest Ap star known next to HD 101065. It is a spectrum variable and has a magnetic field which varies from 300g to 1300g during the 12.448 day rotation period (Preston 1972). We suggest here that there exists a class of cool magnetic Ap stars with short period light variability and that the discovery and study of these stars will make an important contribution to our understanding of stellar pulsation, magnetism, abundance anomalies and the relationships among them.

Photometric searches for these objects must be done using high speed photometry with stable equipment from a good site. Weiss (1978), using conventional photometry with two comparison stars, suspected variability in U in HD 24712 with a period around 3 hours. It is quite possible that 3 hours was the beat period between his sampling frequency and the actual frequency of variation in this star. Because of the possibility of beat periods on the order of days, observations on one night are not sufficient to rule out variability. Several 1 hour runs on different nights would be desirable.

We are in the process of carrying out such a program. An extensive discussion of HD 24712 as well as other newly discovered variables of this type will be published in the near future.

We acknowledge the Wise Observatory of Tel Aviv University and the Smithsonian Research Foundation Grant SFC-0-3005 for the use of their facilities at Mitzpe Ramon, Israel.

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PHOTOELECTRIC OBSERVATIONS AND NEW ELEMENTS FOR KO AQUILAE

The binary system KO Aquilae has been observed at the Bucharest Observatory in 1978-1979 with a 50-cm telescope. The photometer has an unrefrigerated EMI-6256B photomultiplier. In all 769 determinations in filter B and 748 in filter V have been obtained. The mean light curve in V is represented in Fig.1 (crosses). The phases were computed using the photometric elements

$$\text{Phase} = (\text{JD (hel)} - 2441148.560) / 2^{d}.86401 \qquad (1)$$

from (1) . In order to have the zero-phase in the middle of the primary minimum, the mean curve was shifted by subtracting 0.0075 from the phase.

An approximate solution has been obtained using a model of Horåk type, the rectification of the curve outside the minima has been computed with the Fourier development having the constants

$A_o = 0.93417$

$A_1 = 0.00454$ $\qquad B_1 = -0.00549$

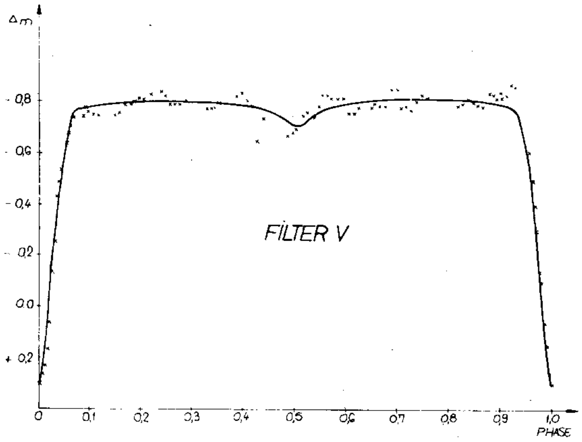
$A_2 = 0.00900$ $\qquad B_2 = -0.00947$

The limb darkening coefficients were adopted as $u_h = 0.45$ and $u_c = 0.60$. The elements are given in Table I. the solution indicates an occultation at the primary minimum, the greater but cooler star passing in front of the smaller and hotter star, both eclipses being partial.

Table I

$r_h = 0.1840$	$i^o = 86.76$
$r_c = 0.2435$	$L_h = 0.8488$
$k = 0.7556$	$L_c = 0.1512$

The elements from Table I were improved using Wood's model. The results are given in Table II and the theoretical light-curve is represented in Fig.1.



From this figure one can see a good concordance between the theoretical and observed light-curves.

Table II

Variable parameters

$i^{o} = 82.33$
$r_h = 0.2133$
$r_c = 0.2397$
$k = 1.1235$
$T_c(eq)^{o} = 5641$
$W_c = 0.041$
$q = 0.453$

Fixed parameters

$T_h(eq)^{o} = 9900$
$W_h = 0$
$\beta_h = \beta_c = 0.25$
$u_h = 0.45$
$u_c = 0.65$
$n = 3.5$

Auxiliary parameters

$a_h = 0.2148$
$b_h = 0.2134$
$c_h = 0.2118$
$a_c = 0.2490$
$b_c = 0.3277$
$c_c = 0.2323$
T_h (pol)^{o} = 9969
T_c (pol)^{o} = 5762
L_h (norm) = 0.8724
L_c (norm) = 0.1276
L_h (ap) = 0.1218
L_c (ap) = 0.0178

The complete solution, including observations with filter B, will be published elsewhere.

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PHOTOELECTRIC OBSERVATIONS OF R CrB

The irregular variable, R CrB, prototype of its class, was observed photoelectrically on nine nights in the Spring of 1980. A total of 35 differential magnitudes were obtained, with four each night except the last night when only three were obtained. All observations were made on the 20cm f-15 Cassegrain telescope at the Fairborn Observatory. Each measurement of the variable was bracketed by measurements of the comparison star HD 141352. A TRS-80 microcomputer was used to log the data and provide preliminary on-line reduction.

The raw differential magnitudes were corrected for differential extinction and transformed to the V of the standard UBV system, and heliocentric corrections were made to the Julian dates. These reductions were made on a TRS-80 computer using a program adopted from one written by D. S. Hall. The transformation to standard V was based on 36 observations of the close pair 27 and 28 LMi in V and B which provided an epsilon of 0.027. An average nightly extinction of 0.25 was assumed. The comparison star V was taken as $7^{m}.45$, and its B-V as $0^{m}.44$ as provided by Fernie (1980). The B-V value of the variable was taken as 0.80 based on data from Fernie, Sherwood, and DuPuy (1972). The reduced observations are given in Table I.

Table I

JD$_\odot$ 244+	V	JD$_\odot$ 244+	V	JD$_\odot$ 244+	V
4348.730	5.87	4364.683	5.84	4368.633	5.79
4348.734	5.88	4364.687	5.83	4368.636	5.76
4348.738	5.88	4364.692	5.81	4368.639	5.74
4348.742	5.91	4364.693	5.83	4368.643	5.75
4351.708	5.88	4365.657	5.91	4369.670	5.79
4351.713	5.89	4365.661	5.86	4369.673	5.82
4351.717	5.88	4365.666	5.89	4369.675	5.79
4351.721	5.87	4365.669	5.87	4369.679	5.78
4363.648	5.82	4367.655	5.73	4394.607	5.81
4363.653	5.83	4367.658	5.71	4394.610	5.82
4363.657	5.77	4367.661	5.71	4394.613	5.86
4363.662	5.79	4367.664	5.74		

The mean magnitudes and standard deviations for each nights observations were calculated as shown in Table II.

Table II

Nightly means and standard deviations

$JD_{\odot}$ 244+	Mean V	SD	$JD_{\odot}$ 244+	Mean V	SD
4348	5.89	.019	4367	5.72	.020
4351	5.88	.019	4368	5.76	.019
4363	5.80	.026	4369	5.80	.025
4364	5.83	.023	4394	5.83	.029
4365	5.88	.025			

These are plotted versus JD in Figure 1..

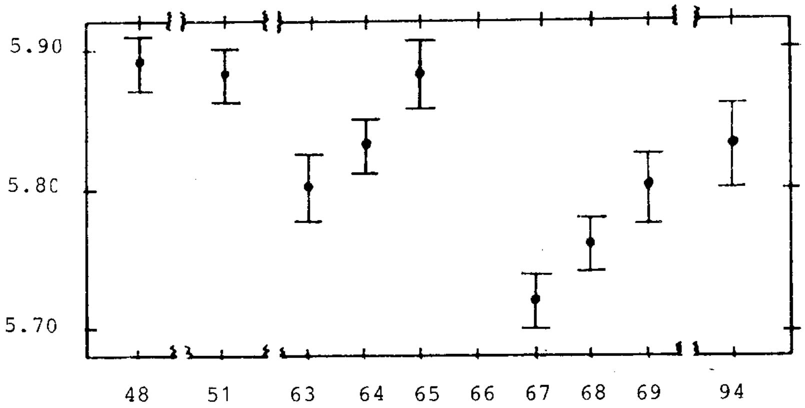

Figure 1:R CrB V Magnitude Vs. JD. (24443+)

The variations shown were in all likelihood due primarily to variations in R CrB itself, although uncorrected variations in the equipment and atmospheric conditions cannot be ruled out entirely as causitive factors. The apparent "saw tooth" pattern from JD (244+) 4363 to 4369 may only be coincidental, but it could represent a characteristic of the fine structure of the luminosity variations of this type of star.

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HONDA'S VARIABLE IN CYGNUS: A NEW LONG PERIOD VARIABLE

Following Honda's discovery of a probable nova in Cygnus on 198o November 29 (Honda, 198o), a spectroscopic program was initiated at the Kavalur Observatory. The spectra reveal that this star is not a nova but a long period variable of type M4e.

The spectrograms were obtained between 198o December 8 and 1981 January 5. An image tube spectrograph was used at the Cassegrain focus of the 102cm reflector at the Kavalur Observatory. Most of the spectra were recorded at a low dispersion of 400Amm^{-1} since a spectroscopic programme on the recent supernovae in NGC 6946 and 1316 was in progress (Prabhu, 1981). However, one spectrogram was obtained at a higher dispersion of 65A mm^{-1} on 1981 January 4.61 UT to facilitate detailed analysis. This spectrogram covers the wavelength region of 4200A-6200A while the lower dispersion spectrograms cover 4200A-8400A.

Even as the first spectrum was recorded, the prominent molecular bands and the sharp emission lines of hydrogen showed this star to be a red variable and not a nova. Subsequent observations at higher dispersion allow us to classify the spectrum. A density plot of this spectrogram in the region of 4800A-6200A appears in the figure. The plot is digitally averaged over ten sampling intervals of 8 μm each. The narrow emission line of H_β and the absorption bands of TiO have been labelled in the figure. The identifications have been made following Merrill (1940), Merrill, Deutsch and Keenan (1962) and Keenan and McNeil (1976).

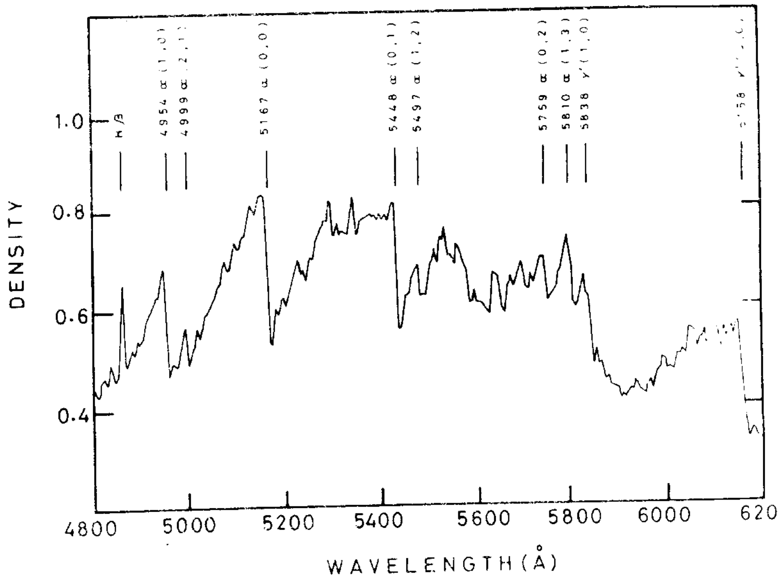
The prominence of TiO bands and the absence of ZrO bands show that this variable has a spectral type of M. The 5736A band of VO, a characteristic of stars later than M6, is not visible in the spectrum. The TiO α System at 5759A (0,2) and 5810A (1,3) are clearly visible and hence the spectrum cannot be of type earlier than M3. The strengths of the above bands and also the bands at 5448A (0,1) and 5497A (1,2) belonging to the same system indicate a spectral type of M4.

Though the region between H_β to H_γ has a lower exposure on our spectrogram, a few more features could definitely be identified by us as also the Balmer emission lines seen in our spectrograms appear in Tables I and II.

Table I

Emission Lines

6563A	H_α
4861A	H_β
4303A	H_γ
4101A	H_δ



Spectrum of the variable in the region 4800A-6200A on Jan. 4.61 UT

Table II
Absorption Bands of TiO

5167 $\alpha(0,0)$	5448 $\alpha(0,1)$	5759 $\alpha(0,2)$	5810 $\alpha(1,3)$
4955 $\alpha(1,0)$	4999 $\alpha(2,1)$	5497 $\alpha(1,2)$	
4761 $\alpha(2,0)$	4804 $\alpha(3,1)$		
4584 $\alpha(3,0)$			
6158 $\gamma'(0,0)$	5838 $\gamma'(1,0)$		
7054 $\gamma(0,0)$	7589 $\gamma(0,2)$	8206 $\gamma(0,3)$	
6651 $\gamma(1,0)$	7125 $\gamma(1,2)$		

The identifications between 6200A and 8400A have been made on the low dispersion spectrograms. The sharpness of the emission lines of H_β and H_γ indicates that the variable was already in its post-maximum phase.

Waagen (1980) finds from the Harvard photographic plates that this object has varied in brightness from a mag >14 to mag ~ 10 between 1938 and 1951. Continuous photoelectric observations of this variable are necessary in order to ascertain its period and the range of light variations.

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A NOTE ON BZ ERIDANI

In this communication, first photoelectric photometry of the system BZ Eridani in three colours and some tentative results have been presented.

Observations were carried out through the 38-cm reflector, employing 1P21 photomultiplier thermoelectrically cooled to -20°C, the UBV filters of Johnson and Morgan system and d.c. techniques.

A total of ten nights of observations have been secured during the period December 1975 to March 1976, using BD-6° 840 and BD-6°846 as comparison and check stars, respectively. Instrumental magnitudes have been standardized with the observations of four standard stars (ωEri, μ Eri, ν Eri and ϵ Eri). Accuracy of individual observation in U, B and V filters are respectively, $\pm0\overset{m}{.}035$, $\pm0\overset{m}{.}032$, and $\pm0\overset{m}{.}024$.

During the course of our observations two primary and one secondary minima have been obtained with a graphical accuracy of $\pm0\overset{d}{.}001$ in time.

Using the epoch, JD 2425558.445 (Meinunger, 1966), a new period of $0\overset{d}{.}6641701$ has been determined which is not significantly different from that of Meinunger (1966), $0\overset{d}{.}6641704$. Kippenhahn (1955) has given a slightly different epoch, JD 2425558.456, from that of Meinunger (1966).

From the light-curves (Figure 1), we find that:

(1) The depth of primary minimum is nearly half of that given by Hoffmeister (1934) and Meinunger (1966).
(2) The duration of eclipse is nearly half of the value given by Meinunger (1966).
(3) The depth of secondary minimum is nearly half that of the primary.

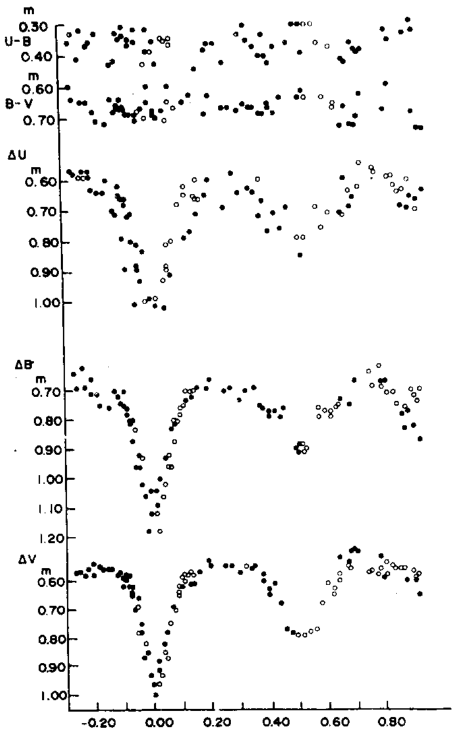

Fig.1. Light and colour curves of BZ Eridani (Filled and open circles represent direct and reflected points, respectively)

The secondary eclipse seems to be a total (occultation) with a duration of totality about $1^{h}.2$.

The colours of both the components of the system have been obtained. These, on comparing with Arp's (1958) colour-sequences, indicate that the primary and the secondary components belong to GOIII and G2III spectral types, respectively. The systemic colour is of G1III type, which is considerably different from that given by Götz and Wenzel (1961), F2.

In order to decide on the type of light curve, present light curve characteristics have been compared with those listed by Strohmeier (1972). It is found that our light curve shows some similarity with that of W UMa type light curve, but on the whole it is closer to Algol type as suggested by Hoffmeister (1934).

Summary of results

Amplitude of primary minimum : $0\overset{m}{.}42$(U), $0\overset{m}{.}48$(B), $0\overset{m}{.}44$(V)
Amplitude of secondary minimum: $0\overset{m}{.}20$(U), $0\overset{m}{.}21$(B), $0\overset{m}{.}23$(V)
Times of primary minima : JD 2442836.164(±0.001)
JD 2442840.155(±0.001)
Time of secondary minimum : JD 2442835.172(±0.001)
Duration of eclipse (D) : $7\overset{h}{.}2$(U), $5\overset{h}{.}6$(B), $5\overset{h}{.}6$(V)
Duration of totality (d) : $1\overset{h}{.}6$(U), $0\overset{h}{.}8$(B), $1\overset{h}{.}1$(V)
Spectral type of primary component : GOIII(B-V=+$0\overset{m}{.}644$, U-B=+$0\overset{m}{.}326$)
Spectral type of secondary component : G2III(B-V=+$0\overset{m}{.}682$, U-B=+$0\overset{m}{.}513$)
Combined spectral type of both the components : G1III(B-V=+$0\overset{m}{.}664$, U-B=+$0\overset{m}{.}336$)
Spectral type of comparison star (= $-6^{\circ}840$) : F6I(B-V=+$0\overset{m}{.}524$, U-B=+$0\overset{m}{.}436$)

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PHOTOELECTRIC PHOTOMETRY OF SOME Be STARS

P. Harmanec et al.(1980) have recently suggested an observational photometric campaign on Be stars. As a short contribution, we present here the observations we obtained at the Loiano (Bologna) 60cm telescope, using a three channel photoelectric photometer with a S 11 EMI 9502B photomultiplier tube. The filters are the Schott standard ones for the UBV system.

Because all the observations were made near the meridian, mean seasonal absorption coefficients accounting also for the second order terms were considered in order to correct the differential measurements.

In the following table are reported the nightly means along with the number of individual observations. Each individual observation is the mean of four measurements of ten seconds of integration. Sometimes two nightly points were obtained. The internal scatter of the data is generally small, rarely producing a standard error on the mean amounting to more than some thousands of magnitude, thus the nigthly points are accurately defined in the instrumental system. The transformation to the standard UBV system is not as satisfactory. Typical reduction errors are of $0\overset{m}{.}03$, $0\overset{m}{.}04$, $0\overset{m}{.}05$ in V,B and U color. The comparison and check stars we used are reported in the short notes following the table. Their UBV magnitudes were taken from the references indicated.

This research was partially supported by the National Group of Astronomy of the National Research Council (CNR).

	V	B	U	n
KX And				
2443395.48	6.945	7.273	6.871	3
467.38	6.915	7.263	6.679	5
471.36	6.973	7.246	6.740	7
o And				
2443110.39	3.604	3.514	2.991	9
395.56	3.589	3.499	2.969	3
467.34	3.607	3.514	3.008	3
472.31	3.588	3.478	3.005	5
κ Dra				
2443583.46	4.01	3.84	-4.15 †	3
639.36	3.951	3.803	-4.173 †	3
.51	3.960	3.831	-4.152 †	6
4 Her				
2443631.57	5.753	5.667		3
639.44	5.756	5.682		8
.56	5.757	5.706		6
φ Per				
2443109.44	4.022		3.001	10
467.45	3.958	3.938	2.803	3
471.43	3.963	3.937	2.810	8
472.35	3.963	3.938	2.808	2
BU Tau				
2443472.45	5.215		4.969	2
483.45	5.222	5.185	4.979	4
HR 894				
2443395.39	6.114	6.047	5.716	4
.55	6.116	6.056	5.726	2
399.55	6.116	6.043	5.713	2
471.41	6.117	6.046	5.716	4

KX And

= HD218393 - Comparison star: 5 And = HD218470 (Harmanec et al. 1977); check: HD218674 (Harris, 1955) and HD 218393. The object which is probably a spectroscopic binary with strong mass transfer (Harmanec et al.1980), shows small variations in v and B colors and greater in U along with larger variations of U-B index.

o And

Comparison stars: HD217227 (Harris, 1955) and 2 And = HD 217782.

κ Dra

Comparison star: HD109551 (Häggkvist and Oja,1966); because his U magnitude is not available, we have reported in the table the ΔU differences (†) between the variable and the comparison star in the standard system. A little light variation seems to be present during the night 2443639.

4 Her

Comparison star: HD142373 (Iriarte et al. 1965). Light fluctuations are absent in the night 2443639 during $3^h.6$ of observations.

ϕ Per

Comparison star: 2 Per (V magnitude from Bright Star Catalogue, color indices from Crawford, 1963); Check: HD11151. The star is clearly brighter in late 1977 than in late 1976. The brightening is more notable in U color.

BU Tau

28 Tau(Pleione) - Comparison star: 18 Tau = HD23324 (Iriarte et al. 1965); check: 16 Tau = HD23288. The star is constant during the short period of observation.

HR 894

Comparison star: HD18950; check: 22π Per = HD18411 (Iriarte et al. 1965) and 28ω Per = HD19656. We deduce the following magnitudes for the comparison star: V = 6.86 ± 0.03, B = 6.86 ± 0.03, U = 6.53 ± 0.05. During our observations the object remains perfectly constant.

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65th NAME – LIST OF VARIABLE STARS

The present 65th Name–list of variable stars has been compiled in accordance with the rules established in the 56th list. It contains all necessary identifications for 778 new variables designated in 1980.

The whole number of the designated variable stars is now 28254.

In the square brackets the reference number is given for the work where (not always firstly) the information in discovery of the variable had been published. This reference number accompanies designation or number of the star given for it in the cited work. Name of the discoverer is mentioned only in the cases when it does not coincide with the name of the author of the cited work.

Reference numbers 0001–5216 correspond to the numbers from literature list published in the first volume of the 3rd edition of General Catalogue of Variable Stars (pages A42–A121). The numbers 5217–5824 correspond to the supplementary list published in the First supplement to the Catalogue (pages 279–289). The numbers 5825–6828 correspond to the supplementary list published in the Second supplement to the Catalogue (pages 361–380). The numbers 6829–7733 correspond to the supplementary list published in the Third supplement to the Catalogue (pages 342–357).

The numbers 7734–7894 had been published in the 62nd Name–list (IBVS № 1248, 1976), the numbers 7895–7979 – in the 63rd Name – list (IBVS № 1414, 1978), the numbers 8029, 8054, 8070, 8116, 8144, and 8197–8284 – in the 64th Name – list (IBVS № 1581, 1979). At last the numbers 7996 and 8305–8587 are given in the present edition.

The serial numbers of flare variables in the Pleiades cluster are preceded here by the symbol Plf.

It is necessary to correct the misprint entered in the previous 64th Name – list (IBVS № 1581, 1979): υ Cyg must be read instead of ν Cyg.

We are grateful to *T.D.Nishtcheva* for preparation of the Name – list for the print.

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N.B. PEROVA

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Sternberg State Astronomical
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Moscow, December, 1980

LL And = $00^{h}39^{m}.2$ + 26°21ʹ [8306].

LM And = СПЗ 2382 = № 1 [8307].

LN And = HR 8768 [8308] = BD+43°4378 (6.1) = HD 217811 (B3) = SAO 052626 = ADS 16472.

LO And = Wr 136 [4364] = КЗП 8853 = NSV 14569.

LP And = IRC + 40540 [6005, 6977] = NSV 14623.

LQ And = HR 9070 [2765, 8309, 8408] = BD + 45°4381 (6.5) = HD 224559 (B5) = SAO 053540 = КЗП 8901 = NSV 14788.

MY Aps = L 19–2 [8310, 8311].

FI Aqr = CoD–24°17160(7.5) = CPD –24°7351(7.3) = HD 212432(B9) [8312] = SAO 191117.

FK Aqr = BD–21°6267(9.0) = CPD–21°8162 (9.2) = HD 214479 (Ma) = SAO 191294 = Gliese 867 A [8313, 8314].

FL Aqr = BD–21°6267 B [0311, *Dyer*] = Gliese 867 B [8314] = КЗП 8780 = NSV 14256.

FM Aqr = 70 Aqr = HR8676 [8315] = BD –11°5923(6.3) = HD 215874 (F0) = SAO 165308.

V1340 Aql = СПЗ 1162 [0494, *Васильева*] = КЗП 7928 = NSV 11270.

V1341 Aql = СПЗ 1219 [6887] = КЗП 8040 = NSV 11546.

V1342 Aql = СПЗ 1231 [2274] = КЗП 8107 = NSV 11748.

V1343 Aql = SS 433 [8316] = A 1909 + 04 = 4C 04.66.

V1344 Aql = BD + 4°4009(7.8) [8317] = HD 179315 (K2) = SAO 124374.

V1345 Aql = СПЗ 2342 [8318].

V1346 Aql = Var 121 [8319].

V1347 Aql = Var 41 [8319].

V1348 Aql = $19^{h}13^{m}33^{s}$ –09°32ʹ35ʺ [8320].

V1349 Aql = Var 49 [8319].

V1350 Aql = Var 51 [8319].

V1351 Aql = Var 53 [8319].

V1352 Aql = AS 353 [8433] = СПЗ 2418 = NSV 11921.

V1353 Aql = BD+15°3801 (9.5) = HD 231320 = TTV–8 [8321, *Leis*] = СПЗ 2339.

V1354 Aql = IRC+10429 = S 10833 [8322].

V1355 Aql = TTV–9 [8321, *L.Kalv*] = СПЗ 2340.

V1356 Aql = 121.1935 [0470] = P 5093 = КЗП 4810 = NSV 12394.

V1357 Aql = BD + 14°4219 (7.3) = HD 191980 (B5) [8323] = SAO 105821.

V801 Ara = 4U 1636–53 = MXB 1636–53 [8324].

V802 Ara = F [8329].

V803 Ara = S 5956 [4001] = КЗП 7516 = NSV 8025.

V804 Ara = S 5965 [4001] = КЗП 7527 = NSV 8049.

V805 Ara = S 5968 [4001] = КЗП 7529 = NSV 8050.

V806 Ara = S 5969 [4001] = КЗП 7530 = NSV 8053.

V807 Ara = S 6010 [4001] = КЗП 7548 = NSV 8083.

V808 Ara = S 6015 [4001] = КЗП 7551 = NSV 8089.

V809 Ara = S 6022 [4001] = КЗП 7552 = NSV 8105.

V810 Ara = S 6027 [4001] = КЗП 7554 = NSV 8109.

V811 Ara = S 6033 [4001] = КЗП 7560 = NSV 8120.

V812 Ara = S 6035 [4001] = КЗП 7564 = NSV 8118,

V813 Ara = S 6040 [4001] = КЗП 7565 = NSV 8126.

V814 Ara = S 6051 [4001] = КЗП 7571 = NSV 8139.

V815 Ara = S 6065 [4001] = КЗП 7576 = NSV 8175.

V816 Ara = S 6081 [4001] = КЗП 7586 = NSV 8212.

V817 Ara = S 6087 [4001] = КЗП 7589 = NSV 8221.

V818 Ara = S 6134 [4001] = КЗП 7618 = NSV 8427.

V819 Ara = CoD–48°11659 (9.5) = CPD –48°9163 (9.6) = E [8333] near NGC 6352 cluster.

V820 Ara = BPM 25114 [8335].

VV Ari = BD +19°296 (7.5) = HD 11285 (F0) [8336] = SAO 074983.

VW Ari = BD+9°321 (7.0) = HD 15165 (A3) [8337, 8443, 8444] = SAO 092952.

VX Ari = Gliese 109 [8341].

VY Ari = BD+30°448 (7.2) = HD 17433 (K0) = SAO 055899 = СПЗ 2316 = = Gliese 113.1 [8343].

V346 Aur = BD + 38°955 (8.8) [8344, 8345] = = HD 280188 (S) = SAO 057472 = = IRC +40101 = КЗП 6136 = NSV 1745.

V347 Aur = 24.1939 [0922] = КЗП 458 = = NSV 1774.

V348 Aur = BD + 35°1046 (8.9) [8345] = = HD 34467 (Nb) = IRC +40120 = = Wr 66 [2576] = КЗП 6165 = = NSV 1917.

V349 Aur = CCS 332 [8144] = СПЗ 2390.

V350 Aur = CCS 333 [8144] = СПЗ 2391.

V351 Aur = CCS 362 [8144] = СПЗ 2392.

V352 Aur = HR 2557 [8349] = BD + 44°1551 (6.5) = HD 50420 (F0) = SAO 041429.

CL Boo = GR 299 [8350].

CM Boo = S 10805 [8351].

CN Boo = HR 5343 [8352] = BD +19°2779 (6.7) = HD 124953 (A5) [6870] = = SAO 100949 = NSV 6607.

CO Boo = S 10806 [8351].

CP Boo = HR 5441 [8353] = BD + 37°2545 (6.8) = HD 127986 (F5) = SAO 064212.

CZ Cnc = $8^h25^m30^s$ + 20°21′34″ [8354].

DD Cnc = Ton. 14 in Praesepe cluster [8356].

DE Cnc = S 10803 [8357].

DF Cnc = Ton. 15 in Praesepe cluster [8356].

DG Cnc = Ton. 16 in Praesepe cluster [8356].

DH Cnc = Ton. 17 in Praesepe cluster [8356].

DI Cnc = K 6 in Praesepe cluster [8358].

DK Cnc = 1.1954 [0499] = КЗП 6645 = = NSV 4159.

DL Cnc = Ton. 18 in Praesepe cluster [8356].

DM Cnc = S 10834 [8359].

DN Cnc = K 7 in Praesepe cluster [8358].

DO Cnc = Ton. 19 in Praesepe cluster [8356].

DP Cnc = Ton. 20 in Praesepe cluster [8356].

DQ Cnc = Ton. 21 in Praesepe cluster [8356].

DR Cnc = Ton. 22 in Praesepe cluster [8356].

DS Cnc = Ton. 23 in Praesepe cluster [8356].

DT Cnc = Ton. 24 in Praesepe cluster [8356].

DU Cnc = K 8 in Praesepe cluster [8358].

DV Cnc = IRC + 10200 = $8^h57^m56^s$ + 8°35′.9 [8361].

AY CVn = GR 276 [8362].

AZ CVn = GR 277 [8362].

BB CVn = GR 278 [8362].

BC CVn = GR 279 [8362].

BD CVn = GR 280 [8362].

BE CVn = GR 281 [8362].

BF CVn = BD + 36°2322 (9.5) [8363] = = Gliese 490 A [8455].

BG CVn = GD 154 [8364].

BH CVn = HR 5110 [8365, *Vaucher*] = = BD + 37°2426 (5.1) = HD 118216 (F0) = SAO 063623.

HK CMa = 12 CMa = HR 2509 [8054] = = BD–20°1576 (6.0) = CPD –20°1651 (6.0) = HD 49333 (B8) = = SAO 172318.

ι CMa = 20 CMa [8395] = HR 2596 [5909] = BD–16°1661 (6.0) = = HD 51309 (B5) = SAO 152126 = = КЗП 6531 = NSV 3292.

BF CMi = $7^h25^m02^s$ +04°43′.8 [8373].

AO Cap = 20 Cap [8375] = HR 8033 = = BD–19°5982 (6.2) = CPD –19°7959 (6.2) = HD 199728 (AOp) = SAO 164043.

AP Cap = BD–17°6373 (7.5) = HD 207188 (B9) [8312] = SAO 164653.

V372 Car = HR 3088 [8380] = CoD –54°1966 (6.5) = CPD –54°1420 (5.9) = HD 64722 (B3) = SAO 235579.

V373 Car = CoD–60°1953 (9.7) = CPD –60°968 (8.2) = C 41 [8383, 8384], in NGC 2516 cluster.

V374 Car = HR 3147 [6311] = CoD−60°1992 (6.2) = CPD−60°1006 (5.7) = HD 66194 (B3) [8386] = SAO 250055 = = NSV 3856. In NGC 2516 cluster.

V375 Car = HR 3186 = CoD−60°330 (6.8) = = CPD−62°953 (6.8) = HD 67536 (B3) [8387] = SAO 250101.

V376 Car = HR 3582 [8388] = CoD−58°2347 (5.1) = CPD−58°1301 (4.8) = HD 77002 (B3) = SAO 236436 = = NSV 4328.

V377 Car = CoD−56°2757 (8.3) = CPD −56°2154 (7.6) = HD 81769 (B8) [8389] = SAO 236955.

V378 Car = CPD−57°3517 (9.0) = № 24 in NGC 3293 cluster [8215].

V379 Car = CoD−57°3350 (9.3) = CPD −57°3526 (8.2) = № 26 in NGC 3293 cluster [8215].

V380 Car = CoD−57°3351 (9.5) = CPD −57°3527 (8.8) = HD 92007 (B) = = № 27 in NGC 3293 [8215].

V381 Car = CoD−57°3354 (8.9) = CPD −57°3533 (8.8) = HD 92024 (B) = = SAO 238235 = № 5 in NGC 3293 cluster [8215].

V382 Car = x Car = HR 4337 [4456, 6352] = = CoD−58°3855 (5.0) = CPD −58°3189 (6.2) = HD 96918 (F8p) [6870] = SAO 238813 = КЗП 6820 = = NSV 5103.

χ Car = HR 3117 [8395] = CoD−52°2203 (3.6) = CPD−52°1343 (4.3) = HD 65575 (B3) = SAO 235635.

V591 Cas = 3 [8325].

V592 Cas = LS 55°−8 [8326].

V593 Cas = 4 [8325].

V594 Cas = BD +61°154 (9.5) [8327, 8328].

V595 Cas = BD + 55°388 (8.9) [7315, 8330] = = HD 236835 (M0) = SAO 022538 = = IRC + 60061 = NSV 599.

V596 Cas = Ross 15 [7144, 8331] = КЗП 102364 = = NSV 684.

V597 Cas = 1 [8332].

V598 Cas = BD + 61°366 (7.3) [7315] = HD 12208 (Ma) = SAO 012090 = = IRC + 60072 = 107 (Champ J) [8338] = КЗП 102367 = NSV 697.

V599 Cas = 2 [8332].

V600 Cas = 3 [8332].

V601 Cas = 4 [8332].

V602 Cas = 1 [8339].

V603 Cas = 2 [8339].

V604 Cas = 3 [8339].

V605 Cas = BD +58°445 (8.8) [8330] = HD 14242 (K5) = SAO 023203 = = IRC + 60081 [6005] = NSV 787.

V606 Cas = 4 [8339].

V607 Cas = 5 [8339].

V608 Cas = S 10797 [8340].

V609 Cas = 6 [8339].

V610 Cas = 7 [8339].

V611 Cas = 8 [8339].

V612 Cas = 9 [8339].

V613 Cas = 1 [8342].

V614 Cas = 2 [8342].

V615 Cas = LSI + 61°303 [8346].

V616 Cas = 4 [8342].

V617 Cas = 3 [8342].

V618 Cas = 5 [8342].

V619 Cas = 1 [8348].

V620 Cas = 3 [8348].

V621 Cas = 2 [8348].

V622 Cas = 4 [8348].

V623 Cas = BD + 57°702 (7.9) [8345] = = HD 19557 (R5) = SAO 023858 = = IRC + 60113 = Wr 36 [2576] = = КЗП 6011 = NSV 1063.

V624 Cas = 6 [8348].

V625 Cas = 5 [8348].

V626 Cas = 7 [8348].

V627 Cas = HRC 316 = AS 501 [8433] = = СПЗ 2419 = NSV 14378.

V628 Cas = HRC 317 [7822] = NSV 14482.

V629 Cas = BD +51°3661 (9.0) = HD 221936 (A0) [7955] = SAO 035587.

V630 Cas = OV 29 [8355].

V631 Cas = 1 [8325].

V632 Cas = 2 [8325].

ϰ Cas [8480] = 15 Cas = BS 130 = BD +62°102 (4.5) = HD 2905 (B0) [8213] = SAO 011256 = Zi 27 = = КЗП 100038 = NSV 195.

V815 Cen = HR 4327 = CoD−41°6343 (5.5) = = CPD−41°5118 (5.6) = HD 96616 (A2p) [8360, 8481] = SAO 222581.

V816 Cen = CoD−46°7232 (8.7) = CPD −46°5445 (8.3) = HD 101065 (B 5) [7968, 8366, 8367] = SAO 222918.
V817 Cen = HR 4625 [4456] = CoD−40°7128 (5.9) = CPD−40°5542 (5.6) = HD 105521 (B 3) [6311] = SAO 223242= = КЗП 6893 = NSV 5474.
V818 Cen = BV 1725 [8368].
V819 Cen = CoD−57°4947 (8.7) = CPD −57°5986 (8.6) = HD 115599 (A 2) [8222] = SAO 240739.
V820 Cen = CoD−37°9248 (8.6) = CPD −37°6004 (9.0) [8369] = SAO 205326.
V821 Cen = CoD−45°9033 (9.6) = CPD −45°6748 (9.0) = HD 124448 (B 2) [6899, 7799, 8370] = SAO 224792 = NSV 6598.
V822 Cen = Cen X−4 [8371, 8372].
χ Cen = HR 5285 [8308] = CoD−40°8405 (4.8) = CPD−40°6441 (4.7) = HD 122980 (B 3) = SAO 224673.
V339 Cep = JV 4 [8376, *Uhlig*].
V340 Cep = JV 5 [8376, *Uhlig*].
V341 Cep = JV 6 [8376, *Uhlig*].
V342 Cep = JV 7 [8376, *Uhlig*].
V343 Cep = 3017 [8377] = СПЗ 2410.
V344 Cep = A [8379].
V345 Cep = B [8379].
V346 Cep = JV 8 [8376, *Uhlig*].
V347 Cep = 11 [7881] = JV 9 [8376, *Uhlig*]= = NSV 13750. In IC 1396 region.
V348 Cep = JV 10 [8376, *Uhlig*].
V349 Cep = JV 11 [8376, *Uhlig*].
V350 Cep = СПЗ 2246 [8381].
V351 Cep = BD+56°2806 (9.2) = HD 239994 (F 8) [8382] = SAO 034575.
V352 Cep = BD+60°2469 (9.0) = HD 217692 (Mb) = SAO 020368 = IRC+6038= = 3 [7920]. In NGC 7635 region.
BB Cet = BD−21°84 (6.2) = CPD−20°59 (6.4) = HD 3580 (B 8) [8312]= = SAO 166438.
BC Cet = BD−11°177 (8.1) = HD 5601 (A0) [8385] = SAO 147533.
CR Cha = HRC 244 [6415] = HM 4 [8378]= = NSV 5049.
CS Cha = L. 4 [4159] = КЗП 6813 = = NSV 5073.
CT Cha = L. 5 [4159] = КЗП 6816 = = NSV 5081.
CU Cha = CoD−76°488 (8.4) = CPD −76°654 (8.5) = HD 97048 (A0) [7792, 8378] = SAO 256802 = = NSV 5106.
CV Cha = HRC 247 [6415] = HM 30 [8378]= = NSV 5138.
CW Cha = 31 in Cha T 1 [8390] = NSV 5139.
BO Cir = CPD−64°3004 (9.2) = HD 129494 (F0) [8391].
BP Cir = CoD−60°5320 (7.9) = CPD −60°5511 (8.0) [8374] = HD 129708 (F2) [8391] = SAO 252879= = BS 479 [4362] = КЗП 102753 = = NSV 6786.
BQ Cir = $15^h11^m.7$ −58°57′ [8392].
BR Cir = Cir X−1 [8492] = 3U 1516−56.
TV Col = 2A 0526−328 [8394].
λ Col = HR 2056 [4456, 8215] = CoD −33°2599 (5.2) = CPD−33°938 (5.0) = HD 39764 (B5) [8380] = = SAO 196276 = КЗП 6409 = = NSV 2709.
HI Com = СПЗ 2301 [8396].
HK Com = B2 [8397] = СПЗ 2348.
HL Com = C in ON 325 field [8398].
HM Com = СПЗ 2302 [8396].
HN Com = B 3 [8397] = СПЗ 2349.
HO Com = B 1 [8397] = СПЗ 2347.
HP Com = B 7 [8397] = СПЗ 2353.
HQ Com = B 4 [8397] = СПЗ 2350.
HR Com = СПЗ 2304 [8396].
HS Com = B 6 [8397] = СПЗ 2352.
HT Com = СПЗ 2305 [8396].
HU Com = СПЗ 2306 [8396].
HV Com = B 5 [8397] = СПЗ 2351.
HW Com = СПЗ 2308 [8396].
V691 CrA = 2A 1822−371 = 2S 1822−371 [8399].
TY CrB = R 808 [8400].
TZ CrB = 17 CrB A = σ CrB A = HR 6063 [8402] = BD+34°2750 A (5.7) = HD 146361 (G0) = SAO 065165 = ADS 9979 A.
TT Crv = BD−11°3291 (6.8) = HD 107814 (Ma) [8225] = SAO 157253 = IRC −10268.

TU Crv = HR 4797 [8403] = BD−19°3521 (6.7) = CPD−19°5207 (7.1) = HD 109585 (A5) = SAO 180937.
SY Crt = BD−11°3063 (6.5) = HD 97918 (Ma) [8225] = SAO 156568 = IRC−10252.
BP Cru = 3U 1223−62 [8404].
BQ Cru = FMH 1 [8405].
BR Cru = CoD−55°4778 (8.6) [8406] = CPD−55°5216 (8.6) = SAO 240236.
BS Cru = CoD−59°4454 ($10\frac{3}{4}$) = CPD −59°4528 (9.3) = G [8407]. In NGC 4755.
BT Cru = CPD−59°4542 (9.4) = IV−18 [8407]. In NGC 4755.
BU Cru = CoD−59°4458 (8.3) = CPD −59°4543 (7.8) = HD 111934 (B2) [6899] = SAO 252070 = I−06 [8407] in NGC 4755 = NSV 6012.
BV Cru = I −05 [8407]. In NGC 4755.
BW Cru = CPD−59°4564 (8.8) = SAO 252078 = F [8407]. In NGC 4755.
δ Cru = HR 4656 [4583, 6352] = CoD −58°4466 (3.1) = CPD−58°4189 (3.7) = HD 106490 (B3) = SAO 239791 = КЗП 6902 = NSV 5510.
θ^2 Cru [0094] = HR 4603 [6352] = CoD −62°610 (5.5) = CPD−62°2561 (5.3) = HD 104841 (B3) = SAO 251717 = КЗП 102690 = NSV 5446.
λ Cru = HR4897 [8417] = CoD−58°4794 (4.8) = CPD−58°4584 (5.1) = HD 112078 (B 3) = SAO 240368.
μ^2 Cru = HR 4899 [8420] = CoD−56°4689 (5.0) = CPD−56°5487 (4.1) = HD 112091 (B 3p) [8419] = SAO 240367.
V1670 Cyg = SVS 711 [0534, *Beljawskaja*] = P 5051 = КЗП 4713 = NSV 12121.
V1671 Cyg = BD + 30°3645 (7.6) = HD 184927 (B 2) [8426] = SAO 068542.
V1672 Cyg = SVS 719 [0534, *Beljawskaja*] = P 5092 = КЗП 4802 = NSV 12370.
V1673 Cyg = SVS 723 [0534, *Beljawskaja*] = P 5127 = КЗП 4831 = NSV 12434.
V1674 Cyg = BD + 34°3816 [8429].
V1675 Cyg = BD + 42°3563 (7.8) [8432] = HD 190065 (Ma) = SAO 049092 = IRC + 40373.
V1676 Cyg = BD + 35°3953 (7.0) = HD 190918 (Op) [8213] = SAO 069402 = ADS 13374 A = КЗП 102981 = NSV 12795. In NGC 6871 cluster.
V1677 Cyg = M 242 [8252].
V1678 Cyg = M 276 [8252].
V1679 Cyg = BD +36°3956 (8.0) [4696, 4765] = HD 192641 (Oa) = SAO 069677 = КЗП 102991 = NSV 12944.
V1680 Cyg = M 225 [8252].
V1681 Cyg = M 221 [8252].
V1682 Cyg = M 224 [8252].
V1683 Cyg = M 277 [8252].
V1684 Cyg = M 220 [8252].
V1685 Cyg = BD + 40°4124 (9.5) [8439] = NSV 13028.
V1686 Cyg = LkHα 224 [8495, 8439].
V1687 Cyg = BD + 43°3571 (7.5) = HD 193793 (Oa) [8501, 8502] = SAO 049491 = NSV 13030.
V1688 Cyg = M 213 [8252].
V1689 Cyg = M 223 [8252].
V1690 Cyg = M 219 [8252].
V1691 Cyg = M 230 [8252].
V1692 Cyg = M 212 [8252].
V1693 Cyg = M 215 [8252].
V1694 Cyg = M 218 [8252].
V1695 Cyg = Byurakan 1 [8504] = СПЗ 2388.
V1696 Cyg = BD +52°2777 (9.5) = HD 197406 (Ma) [8505] = NSV 13240.
V1697 Cyg = СПЗ 2272 [8507].
V1698 Cyg = Konkoly 1 [8508] in NGC 7000 region.
V1699 Cyg = СПЗ 2356 = B 41 [8510] in NGC 7000 region.
V1700 Cyg = СПЗ 2359 = 1 [8511] in NGC 7000 region.
V1701 Cyg = 43 [7115] in Cyg T−1 region.
V1702 Cyg = LkHα 152 [4771, 7115] = КЗП 8591 = NSV 13361.

V1703 Cyg = Lk Hα 153 [6859, 7115] = = NSV 13363.
V1704 Cyg = LkHα 155 [4771, 7115] = = КЗП 8592 = NSV 13364.
V1705 Cyg = СПЗ 2275 [8507].
V1706 Cyg = 44 [7115] in Cyg T–1 region.
V1707 Cyg = 28 b [7115] in Cyg T–1 region.
V1708 Cyg = СПЗ 2276 [8507].
V1709 Cyg = Konkoly 4 [8508] in NGC 7000 region.
V1710 Cyg = СПЗ 2357 = B 43 [8510] in NGC 7000 region.
V1711 Cyg = СПЗ 2277 [8507].
V1712 Cyg = СПЗ 2360 = 3 [8511] in NGC 7000 region.
V1713 Cyg = СПЗ 2361 = 4 [8511] in NGC 7000 region.
V1714 Cyg = СПЗ 2358 = B 44 [8510] in NGC 7000 region.
V1715 Cyg = 474 [8529] = 2947 [8377] = = СПЗ 2406.
V1716 Cyg = СПЗ 2278 [8507].
V1717 Cyg = СПЗ 2362 = 5 [8511] in NGC 7000 region.
V1718 Cyg = СПЗ 2280 [8507].
V1719 Cyg = BD + 50°3259 (8.1) [8516] = = HD 200925 (F5) = SAO 033108.
V1720 Cyg = BD + 48°3289 (8.5) [8517] = = HD 201416 (K0) = SAO 050479.
V1721 Cyg = СПЗ 2336 [8401, *Шугаров*].
V1722 Cyg = СПЗ 2337 [8401, *Шугаров*].
V1723 Cyg = СПЗ 2191 [8414, *Шугаров*].
V1724 Cyg = СПЗ 2192 [8414, *Шугаров*].
V1725 Cyg = СПЗ 2338 [8416, *Шугаров*].
V1726 Cyg = BD + 48°3398 (8.9) = SAO 050939 = СПЗ 2299 [8421].
V1727 Cyg = 4U 2129 + 47 [8423].
V1728 Cyg = JV 12 [8376, *Uhlig*].
V1729 Cyg = СПЗ 2262 [8427, *Шугаров*].
V1730 Cyg = JV 13 [8376, *Uhlig*].
V1731 Cyg = CCS 3053 [7751] = СПЗ 2181 = = NSV 13823.
V1732 Cyg = СПЗ 2414 [8377].
V1733 Cyg = JV 14 [8376, *Uhlig*].
V1734 Cyg = JV 15 [8376, *Uhlig*].
V1735 Cyg = 12 in IC 5146 [8431].
V1736 Cyg = СПЗ 2381 [8434, *Шугаров*].
V1737 Cyg = 57.1919 [8435] = JV 16 [8376, *Uhlig*] = Zi 2054 = КЗП 5487 = = NSV 13962.
V1738 Cyg = JV 22 [8376, *Uhlig*].
V1739 Cyg = JV 23 [8376, *Uhlig*].
LR Del = BD + 16°4401 (7.5) = HD 199180 (A0) [8323] = SAO 106651.
LS Del = BD + 19°4574 (8.0) = HD 199497 (G5) [8438] = SAO 106694.
α Dor = HR 1465 = CoD–55°916 (3.5) = CPD–55°663 (4.1) = HD 29305 (A0p) [8437] = SAO 233564 = BD 995 [5562] = NSV 1657.
DH Dra = $10^h13^m.5 + 73°40'$ [8440, *Kowal*] = NSV 4799.
DI Dra = BD + 79°329 (8.0) = HD 89069 (A0p) [8323] = SAO 007115.
DK Dra = HR 4665 [8441] = BD+73°549 (6.5) = HD 106677 (K0) = = SAO 007533.
DL Dra = HR 5492 [8209] = BD +61°1451 (6.0) = HD 129798 (F2) = SAO 016466 = ADS 9357 = Σ 1878 [8442] = КЗП 102755 = = NSV 6777.
EE Eri = BD–2°563 (7.7) = HD 19712 (B9) [8385] = SAO 130319.
EF Eri = 2A 0311–227 [8449, 8451].
EG Eri = 20 Eri = HR 1100 = BD –17°699 (5.0) = HD 22470 (A0p) [8437] = SAO 149063.
EH Eri = 46 Eri = HR 1449 = BD –7°838 (5.8) = HD 29009 (B9) [8437] = SAO 131309 = = ADS 3305 A.
τ^9 Eri = 36 Eri = HR 1240 = CoD –24°2022 (4.4) = CPD–24°493 (4.5) = HD 25267 (A0p) [8385] = = SAO 169017.
TY For = HR 733 [8462] = CoD–25°979 (6.5) = CPD–25°284 (6.8) = = HD 15634 (F0) = SAO 167837.
TZ For = CoD–36°1218 (6.7) = CPD –36°331 (6.9) = HD 20301 (G0) [8463] = SAO 194176.
ν For = HR612 = CoD–29°706 (4.9) = = CPD–29°225 (4.1) = HD

12767 (A0p) [8437] = SAO 167532=
= Zi 110 = КЗП 100162 = NSV 717.
OS Gem = BD + 28°1494 (9.0) [8466] = SAO
079766.
BI Gru = S 6484 [4001] = КЗП 8756 =
= NSV 14123.
BK Gru = CoD–39°14697 (7.2) = CPD
–39°9117 (6.8) = HD 212385 (A2p)
[8375] = SAO 213795.
BL Gru = S 6509 [4001] = КЗП 8797 =
= NSV 14336.
BM Gru = S 6518 [4001] = КЗП 8816 =
= NSV 14406.
BN Gru = S 6519 [4001] = КЗП 8818 =
= NSV 14415.
BO Gru = S 6523 [4001] = КЗП 8822 =
= NSV 14425.
V746 Her = BD + 11°2987 (7.2) = HD 148296
(Ma) [8225] = SAO 102172 =
= IRC + 10305.
V747 Her = СПЗ 2066 [8206].
V748 Her = СПЗ 2067 [8206].
V749 Her = G 169–34 = EG 197 [7996].
V750 Her = СПЗ 2068 [8206].
V751 Her = S 10823 [8474].
V752 Her = S 10810 [8474].
V753 Her = S 10824 [8474].
V754 Her = S 10811 [8474].
V755 Her = S 10813 [8474].
V756 Her = S 10812 [8474].
V757 Her = СПЗ 2082 [8206].
V758 Her = S 10814 [8474].
V759 Her = СПЗ 2083 [8206].
V760 Her = S 10815 [8474].
V761 Her = S 10825 [8474].
V762 Her = S 10816 [8474].
V763 Her = S 10817 [8474].
V764 Her = S 10818 [8474].
V765 Her = S 10819 [8474].
V766 Her = S 10820 [8474].
V767 Her = S 10821 [8474].
V768 Her = S 10822 [8474].
V769 Her = СПЗ 2096 [8206].
V770 Her = СПЗ 2097 [8206].
V771 Her = HR 6718 = BD + 45°2635 (6.4) =
= HD 164429 (B9) [6456] = SAO
047106 (6.2) = NSV 9958.
V772 Her = BD + 21°3302 (7.5) = HD 165590
(G0) [8482] = SAO 085723 =
= ADS 11060.
KX Hya = 14 Hya = HR 3500 [7968] =
= BD–2°2699 (5.7) = HD 75333
(B9) = SAO 136308.
KY Hya = BD–17°2838 (9.8) = 208.1932
[0190] = P 615 = КЗП 1442 =
= NSV 4469.
KZ Hya = CoD–24°9357 (9.4) = CPD
–24°4572 (9.4) = HD 94033 (A0)
[8483, *Przybylski*] = SAO 179271.
η Hya [8395, 8480] = 7 Hya = HR 3454
[7967] = BD + 3°2039 (5.0) = HD
74280 (B3) = SAO 117050 =
= Zi 717 = КЗП 100996 =
= NSV 4212.
BC Ind = CoD–68°2248 (7.3) = CPD
–68°3444 (7.5) = HD 206653 (B9)
[8312] = SAO 255067.
DH Leo = BD + 25°2191 (7.5) = HD 86590
(G5) [8305] = SAO 081134 =
= NSV 4696.
DI Leo = $10^h04^m43^s$ + 14°11′39″ [8484].
RY LMi = EG 65 [7996] = G 117–B 15 A
[8400].
HL Lup = 2U 1543–47 [8486].
HM Lup = He 3–1101 = Sz 72 [8546].
HN Lup = He 3–1104 = Sz 74 [8546].
HO Lup = He 3–1140 = Sz 88 [8546].
UZ Lyn = 2 Lyn [1295, 8547] = HR2238 =
= BD + 59°959 (5.0) = HD 43378
(A0) = SAO 025665 = КЗП 102500 =
= NSV 2902.
VV Lyn = BD + 36°1638 (9.5) = Gliese
277 A [8313] = SAO 060150 =
= DO 13078 (M1).
V470 Lyr = G 207–9 [8487].
V471 Lyr = 19 Lyr [8488, *Winzer*] = HR
7283 = BD + 31°3497 (6.0) = HD
179527 (A0) [8489] = SAO
067946 = NSV 11806.
V472 Lyr = СПЗ 2196 [8490].
V473 Lyr = HR 7308 [5830, 8548] = BD
+27°3314 (6.2) = HD 180583
(F8p) = SAO 087008 = NSV 11865.
V474 Lyr = СПЗ 2293 [8491].
V475 Lyr = СПЗ 2292 [8491].
V476 Lyr = BD + 40°3673 (9.4) [8493] =
= IRC + 40344.
α Lyr [8279, 4597, 4590] = 3 Lyr =
= HR 7001 = BD + 38°3238 (1.0) =
= HD 172167 (A0) = SAO 067174 =

= IRC + 40322 = ADS 11510 A = = Zi 1458 = КЗП 101745 = = NSV 11128.
XY Men = CPD–72°371 (9.6) = HD 271227 (A3) [8496, *Feast*].
V638 Mon = HR 2202 [8418] = BD–4°1393 (6.5) = HD 42657 (B9) = SAO 132941 = ADS 4799.
V639 Mon = S 10826 [8497].
V640 Mon = HR 2422 [5150] = BD+6°1309 (6.5) [8586] = HD 47129 (B0p) [8585] = SAO 114146 = Zi 542 = = КЗП 100751 = NSV 3048 = = GG 172 [8584].
V641 Mon = BD +9°1331 (8.5) = HD 47732 (B8) [8500] = SAO 114241.
V642 Mon = Walker 92 [8499].
V643 Mon = S 10827 [8497].
V644 Mon = BD–10°1774 (7.2) = HD 51480 (B5p) [8503, 8587] = SAO 152149= = P 418 = КЗП 924 = NSV 3298.
V645 Mon = 28 Mon = HR 3141 = BD–0°1882 (5.3) = HD 65953 (K0) [8506] = = SAO 135380 = IRC 00166.
FF Mus = 1 [8509].
FG Mus = 2 [8509].
FH Mus = HR 4814 [8215] = CoD–65°1311 (6.8) = CPD–65°1941 (6.8) = HD 110020 (B9) = SAO 251987.
FI Mus = 3 [8509].
FK Mus = 4 [8509].
FL Mus = 5 [8509].
FM Mus = 6 [8509].
FN Mus = 7 [8509].
FO Mus = 8 [8509].
FP Mus = 9 [8509].
FQ Mus = 10 [8509].
FR Mus = 11 [8509].
FS Mus = 12 [8509].
FT Mus = 13 [8509].
FU Mus = 14 [8509].
FV Mus = 15 [8509].
FW Mus = 16 [8509].
FX Mus = 17 [8509].
FY Mus = 18 [8509].
FZ Mus = 19 [8509].
GG Mus = 20 [8509].
GH Mus = 21 [8509].
GI Mus = 22 [8509].
α Mus = [8395] = HR 4798 [4583, 3712, 6352] = CoD–68°1104 (2.9) = = CPD–68°1702 (3.7) = HD 109668 (B3) = SAO 251974 = = КЗП 6935 = NSV 5776.
η Mus = HR 4993 [8513] = CoD –67°1385 (5.3) = CPD–67°2224 (5.6) = = HD 114911 (B8) = SAO 252224.
QV Nor = 3U 1538–52 [8514].
QW Nor = 245. 1934 [4618] = HV 8812 = = P 3979 = КЗП 2515 = NSV 7374.
QX Nor = 4U 1608–52 [8521].
CC Oct = CoD–79°790 (7.7) = CPD –79°1049 (7.5) = HD 188136/7 (F8, A3) [8522] = SAO 257761.
CD Oct = LFT 1679 [8524].
σ Oct = HR 7228 [8403] = CoD–89°13 (5.5) = CPD–89°47 (5.7) = HD 177482 (F0) = SAO 258857.
V2111 Oph = BD–2°4242 (6.9) = HD 151061 (Mb) [8225] = SAO 141344 = = IRC 00291.
V2112 Oph = HR 6434 = BD +6°3386 (7.0)= = HD 156697 (F0) [6838] = = SAO 122270 = NSV 8505.
V2113 Oph = BD + 2°3296 (7.0) = HD 156860 (Mb) [8225] = SAO 122279 = IRC 00301.
V2114 Oph = BD +8°3418 (7.3) = HD 158228 (Ma) [8225] = SAO 122405 = IRC + 10328.
V2115 Oph = СПЗ 2300 [8409, *Горанский*].
V2116 Oph = 3U 1728–24 [8411].
V2117 Oph = СПЗ 2309 [8412, *Горанский*].
V2118 Oph = BD +11°3315 (7.5) = HD 164615 (F2) [8413] = SAO 103308.
ω Oph [4170] = 90 ph = HR 6153= = BD–21°4381 (5.5) = CPD –21°6183 (4.5) = HD 148898 (F0) = SAO 184450 = КЗП 7382 = = NSV 7795.
V1032 Ori = 11 Ori [4446, 8418] = HR 1638 = BD +15°732 (5.3) = HD 32549 (B9) = SAO 094290 = = КЗП 102464 = NSV 1818.

V1033 Ori = СПЗ 2334 = 3 [8422].
V1034 Ori = СПЗ 2335 = 4 [8422].
V1035 Ori = СПЗ 2384 = 56 [8425].
V1036 Ori = СПЗ 2393 = 40 [8428].
V1037 Ori = СПЗ 2399 = 52 [8425].
V1038 Ori = СПЗ 2345 = 8 [8430].
V1039 Ori = СПЗ 2385 = 57 [8425].
V1040 Ori = СПЗ 2395 = 43 [8428].
V1041 Ori = СПЗ 2396 = 44 [8428].
V1042 Ori = СПЗ 2397 = 46 [8428].
V1043 Ori = СПЗ 2394 = 42 [8428].
V1044 Ori = Brun 220 [2850] = П 1404 = = КЗП 100533 = NSV 2188.
V1045 Ori = BD−4°1173 (7.0) = HD 36916 (B9) [8437] = SAO 132292 = = П 1628.
V1046 Ori = HR 1890 [8054, 8215] = BD −4°1183 (7.0) = HD 37017 (B0) = = SAO 132317 = П 1933.
V1047 Ori = СПЗ 2398 = 47 [8428].
V1048 Ori = СПЗ 2386 = 61 [8425].
V1049 Ori = 60 [8425].
V1050 Ori = СПЗ 2387 = 62 [8425].
V1051 Ori = HR 1957 = BD−10°1258 (7.0) = = HD 37808 (B8) [8437] = SAO 150680.
V1052 Ori = СПЗ 2400 = 54 [8425].
V1053 Ori = СПЗ 2346 = 7 [8430].
V1054 Ori = BD−0°1089 (8.0) = HD 38823 (A5) [8385] = SAO 132550.
V1055 Ori = 3U 0614 + 09 = D [8329].
V1056 Ori = BD + 5°1198 [7315, 8330] = = HD 44213 (Ma) = SAO 113741 = = IRC + 10116 = NSV 2924.
V342 Pav = CoD−62°1335 (8.5) = CPD −62°6175 (8.5) = HD 196517 (A2) [8445] = SAO 254850.
ρ Pav = HR 7859 = CoD−61°6435 (5.0) = = CPD−61°6495 (6.3) = HD 195961 (F5) [8447] = SAO 254835 = Zi 1920 = КЗП 101998 = = NSV 13166.
IK Peg = HR 8210 [8448] = BD + 18°4794 (6.7) = HD 204188 (A3) = SAO 107138.
IL Peg = СПЗ 2256 [8450, *Шугаров*].
IM Peg = HR 8703 [7468] = BD+16°4831 (5.5) = HD 216489 (K0) = SAO 108231 = NSV 14343.
V436 Per = 1 Per [8452] = HR 533 = BD +54°396 (5.7) = HD 11241 (B3) = = SAO 022690.
V437 Per = СПЗ 2343 = BC 89 [8453].
V438 Per = BD +55°564 (8.5) = HD 13970 (B3) [8454] = SAO 023138.
V439 Per = BD +56°595 (8.5) [8330] = = SAO 023269 = NSV 809 = = 2444 [6870].
V440 Per = BS 690 [7964] = BD+54°535 (6.4) = HD 14662 (G0p) = SAO 023283 = ADS 1820.
V441 Per = BD +56°609 (8.4) [7315, 8330] = = HD 14826 (Ma) = SAO 023309 = = IRC +60090 = NSV 822.
V442 Per = S 9153 [3910] = NSV 906.
V443 Per = S 9155 [3910] = NSV 914.
V444 Per = S 9157 [3910] = NSV 920.
V445 Per = S 9158 [3910] = NSV 922.
V446 Per = S 9159 [3910] = NSV 941.
V447 Per = S 9161 [3910] = NSV 957.
V448 Per = S 9730 [3903] = NSV 966.
V449 Per = S 9535 [3905] = NSV 989.
V450 Per = S 9163 [3910] = NSV 999.
V451 Per = S 9164 [3910] = NSV 1015.
V452 Per = S 9536 [3905] = NSV 1026.
V453 Per = S 10516 [5506] = NSV 1034.
V454 Per = S 9169 [3910] = NSV 1036.
V455 Per = S 10517 [5506] = NSV 1044.
V456 Per = S 9172 [3910] = NSV 1059.
V457 Per = S 9173 [3910] = NSV 1065.
V458 Per = S 9175 [3910] = NSV 1073.
V459 Per = BD +48°894 (8.9) [8456] = = SAO 038754.
V460 Per = S 9732 [3903] = NSV 1111.
V461 Per = BD +48°905 (8.8) [8456] = = HD 20919 (F5) = SAO 038788.
V462 Per = S 10518 [5506] = NSV 1138.
V463 Per = S 9538 [3905] = NSV 1149.
V464 Per = S 10519 [5506] = NSV 1153.
V465 Per = BD +47°842 (8.7) [8457, *Slovak*] = HD 21553 (A3) = SAO 038891.
V466 Per = BD +51°762 (8.9) [8458, 8344, 8460] = IRC +50100 = Zi 200 = = КЗП 100294 = NSV 1223.
V467 Per = 42 Per [8464] = HR 1177 = = BD +32°667 (5.8) = HD 23848 (A2) = SAO 056727 = СПЗ 2383.

V468 Per = G38–29 [8467].
V469 Per = d Per = 53 Per [4995, 8468] =
= HR 1350 = BD +46°872 (5.1) =
= HD 27396 (B3) = SAO 039483 =
= Zi 283 = КЗП 100379 = NSV 1560.
V470 Per = BC 185 [8469] = СПЗ 2344.
AZ Phe = HR 239 [8336] = CoD–44°216
(6.7) = CPD–44°101 (6.8) = HD
4849 (F0) = SAO 215254.
ξ Phe = HR 183 = CoD–57°137 (6.0) =
= CPD–57°143 (6.1) = HD 3980
(F0p) [8470, 8471] = SAO 232152 =
= КЗП 102327 = NSV 261.
SY Pic = CoD–49°1449 (8.6) = CPD
–49°581 (8.6) = HD 30849 (A5)
[8472, 8385] = SAO 217008.
AG Psc = 53 Psc [1051] = HR 155 = BD
+14°76 (6.1) = HD 3379 (B3) =
= SAO 091995 = КЗП 5865 =
= NSV 226.
AH Psc = BD +8°215 (9.5) [8473] = Zi 67 =
= КЗП 100104 = NSV 482.
AI Psc = GR 282 [8475].
AK Psc = GR 283 [8475].
AL Psc = GR 284 [8475].
AM Psc = GR 285 [8475].
AN Psc = BD +14°226 (8.0) = HD 9202
(Mb) [8225] = SAO 092471 =
= IRC +10018.
TX PsA = Gliese 871.1 B [6873].
PR Pup = HR 2761 [7968] = CoD–46°3000
(6.2) = CPD–46°1311 (6.3) =
= HD 56455 (A0p) = SAO 218570.
PS Pup = HR 2889 = CoD–35°3652 (6.7) =
= CPD–35°1292 (7.2) = HD 60168
(A0) [8476] = SAO 198093.
PT Pup = HR 2928 = BD–19°1967 (5.8) =
= CPD–19°2396 (5.8) = HD 61068
(B3) [8477] = SAO 153149.
PU Pup = m Pup = HR 2944 = CoD
–25°4828 (5.4) = CPD–25°2623
(5.4) = HD 61429 (B8) [8478] =
= SAO 174175 = ADS 6246.
PV Pup = 2 Pup B [8479] = HR 3009 =
= BD–14°2193 (7.0) = HD 62863
(A0) = SAO 153362 = ADS 6348 B.
PW Pup = CoD–30°5135 (9.2) = CPD
–30°2041 (9.0) = BV 670 [4665] =
= NSV 3753.
PX Pup = HR 3099 = CoD–29°5189 (6.8) =
= CPD–29°2182 (8.3) = HD
65183 (Mb) [6324] = SAO 198609 =
= IRC–30107 = NSV 3825.
PY Pup = HR 3151 = CoD–48°3388 (6.7) =
= CPD–48°1400 (6.6) = HD
66255 (A0p) [8481] = SAO 219292.
PZ Pup = CoD–34°4233 (8.5) = CPD
–34°1912 (8.1) = HD 66403 (B5)
[8389] = SAO 198721.
QQ Pup = CoD–44°3980 (7.0) = CPD
–44°2138 (7.3) = HD 66605 (A0p)
[8481] = SAO 219333.
QR Pup = CoD–41°3922 (8.2) = CPD
–41°2302 (7.8) = HD 69342 (B8)
[8389] = SAO 219666.
VV Pyx = HR3335 = BD–20°2538 (6.8) =
= CPD–20°3719 (7.1) = HD
71581 (A0) = SAO 175870 =
= BV 634 [5843] = NSV 4089.
HV Sge = 1 [8319].
HW Sge = 2 [8319].
HX Sge = 3 [8319].
HY Sge = 4 [8319].
HZ Sge = 5 [8319].
II Sge = 6 [8319].
IK Sge = 7 [8319].
IL Sge = 120 [8319].
IM Sge = 8 [8319].
IN Sge = 9 [8319].
IO Sge = 10 [8319].
IP Sge = 11 [8319].
IQ Sge = 13 [8319].
IR Sge = 12 [8319].
IS Sge = 14 [8319].
IT Sge = 15 [8319].
IU Sge = 16 [8319].
IV Sge = 17 [8319].
IW Sge = 18 [8319].
IX Sge = 19 [8319].
IY Sge = 20 [8319].
IZ Sge = 21 [8319].
KK Sge = 22 [8319].
KL Sge = 24 [8319].
KM Sge = 23 [8319].
KN Sge = 25 [8319].
KO Sge = 26 [8319].
KP Sge = 27 [8319].
KQ Sge = 28 [8319].

KR Sge = 29 [8319].
KS Sge = 30 [8319].
KT Sge = 31 [8319].
KU Sge = 32 [8319].
KV Sge = 33 [8319].
KW Sge = 34 [8319].
KX Sge = 35 [8319].
KY Sge = 36 [8319].
KZ Sge = 37 [8319].
LL Sge = 38 [8319].
LM Sge = 39 [8319].
LN Sge = 40 [8319].
LO Sge = 42 [8319].
LP Sge = 43 [8319].
LQ Sge = 44 [8319].
LR Sge = 45 [8319].
LS Sge = 46 [8319].
LT Sge = 47 [8319].
LU Sge = 48 [8319].
LV Sge = 50 [8319].
LW Sge = 52 [8319].
LX Sge = 54 [8319].
LY Sge = 56 [8319].
LZ Sge = 55 [8319].
MM Sge = 57 [8319].
MN Sge = 58 [8319].
MO Sge = 59 [8319].
MP Sge = 60 [8319].
MQ Sge = 61 [8319].
MR Sge = 62 [8319].
MS Sge = 63 [8319].
MT Sge = 64 [8319].
MU Sge = 65 [8319].
MV Sge = 66 [8319].
MW Sge = 68 [8319].
MX Sge = 67 [8319].
MY Sge = 69 [8319].
MZ Sge = 70 [8319].
NN Sge = 72 [8319].
NO Sge = 71 [8319].
NP Sge = 73 [8319].
NQ Sge = 74 [8319].
NR Sge = 122 [8319].
NS Sge = 75 [8319].
NT Sge = 76 [8319].
NU Sge = 78 [8319].
NV Sge = 77 [8319].
NW Sge = 80 [8319].
NX Sge = 79 [8319].
NY Sge = 81 [8319].
NZ Sge = 82 [8319].
OO Sge = 83 [8319].
OP Sge = 84 [8319].
OQ Sge = 85 [8319].
OR Sge = 94 [8319].
OS Sge = 95 [8319].
OT Sge = 97 [8319].
OU Sge = 99 [8319].
OV Sge = 101 [8319].
OW Sge = 102 [8319].
OX Sge = 104 [8319].
OY Sge = 105 [8319].
OZ Sge = 106 [8319].
PP Sge = 107 [8319].
PQ Sge = 109 [8319].
PR Sge = 110 [8319].
PS Sge = 111 [8319].
PT Sge = 112 [8319].
PU Sge = 116 [8319].
PV Sge = 115 [8319].
PW Sge = 117 [8319].
PX Sge = 118 [8319].
PY Sge = 119 [8319].
PZ Sge = 123 [8319].
QQ Sge = TTV–10 [8321] = СПЗ 2341.
V4035 Sgr = 207 [8424]. In NGC 6522 region.
V4036 Sgr = 434 [8424]. In NGC 6522 region.
V4037 Sgr = D9 [8424]. In NGC 6522 region.
V4038 Sgr = 403 [8424]. In NGC 6522 region.
V4039 Sgr = 644 [8424]. In NGC 6522 region.
V4040 Sgr = 590 [8424]. In NGC 6522 region.
V4041 Sgr = D5 [8424]. In NGC 6522 region.
V4042 Sgr = D11 [8424]. In NGC 6522 region.
V4043 Sgr = D6 [8424]. In NGC 6522 region.
V4044 Sgr = A29 [8424]. IN NGC 6522 region.
V4045 Sgr = HR 6802 = CoD–28°14268 (7.1) = CPD–28°6374 (6.6) =

=HD 166469 (A0p) [8375] = SAO 186444.
V4046 Sgr = CoD−32°13906 (9.7) = CPD −32°5229 (10.2) = HD 319139 (K5e) [8518].
V1047 Sgr = СПЗ 2284 [8519].
V1048 Sgr = СПЗ 2285 [8519].
V4049 Sgr = Nova Sgr 1978 [8520].
V4050 Sgr = HR 6870 = CoD −36°12524 (6.0) = = CPD−36°8190 (6.2) = HD 168733 (B8) [8375] = SAO 210061.
V4051 Sgr = 3 [8523].
V4052 Sgr = 12 [8523].
V4053 Sgr = 13 [8523].
V4054 Sgr = 57 [8523].
V4055 Sgr = 15 [8523].
V4056 Sgr = 63 [8523].
V4057 Sgr = 566 [8525].
V4058 Sgr = СПЗ 2286 [8519].
V4059 Sgr = HV 9509 = 931.1936 [4579] = = BV 1705 [7897] = 2 [8526] = = P 4843 = КЗП 4314 = NSV 11250.
V4060 Sgr = $18^h40^m57^s$−21°43′.4 [8527].
V4061 Sgr = СПЗ 2287 [8519].
V4062 Sgr = CoD−28°16029 (6.4) = CPD −28°6981 (6.8) = HD 185183 (B9) [8312] = SAO 188386.
V4063 Sgr = CoD−24°15532 (7.8) = CPD −24°6796 (8.0) = HD 185969 (F0) [8403] = SAO 188473.
V4064 Sgr = CoD−27°14317 (7.5) = CPD −27°6855 (7.3) = HD 187473 (B9) [8312] = SAO 188626.
V918 Sco = HR 6164 = CoD−42°11399 (6.0) = = CPD−42°7441 (7.0) = HD 149404 (B1) [6311, 8530] = SAO 226953 = = NSV 7842.
V919 Sco = HR 6249 = CoD−41°10972 (7.3) = = CPD−41°7673 (6.8) = HD 151932 (Oc) [8531, 8532] = SAO 227328 = NSV 7998.
V920 Sco = HD 326333 (B5) [8417]. In NGC 6231 cluster.
V921 Sco = CoD−42°11721 (10) [8535].
V922 Sco = CoD−38°11462 (7.5) = CPD −38°6638 (7.6) = HD 153747 (B9) [8536, *McKay*] = SAO 208337.
V923 Sco = HR 6327 = CoD−37°11201 (6.5) = CPD−37°6874 (6.9) = = HD 153890 (F0) [8537] = = SAO 208355.
V924 Sco = CoD−33°12119 (9.7) [8512].
V925 Sco = CoD−33°12237 (8.3) = CPD −33°4466 (9.8) = HD 159378 (K5) [8541] = SAO 209008.
V926 Sco = 3U 1735−44 = MXB 1735−44 [8542].
AM Scl = 86 [8545].
AN Scl = CoD−29°376 (8.3) [8549] = = CPD−29°126 (8.6) = HD 7280 (G5) = SAO 166877.
AO Scl = G 269−140 [8549].
V431 Sct = HRC 283 [7822] = MWC 300 [8433] = NSV 10890.
V432 Sct = HR 6932 = BD−14°5077 (6.8) = = HD 170397 (A0p) [8375] = = SAO 161528.
LX Ser = $15^h35^m44^s$+19°01′30″ [8550] = = СПЗ 2354.
LY Ser = BD +24°2901 (7.4) = HD 139608 (Mb) [8225] = SAO 083921 = IRC +20283.
LZ Ser = SVS 578 [0552] = P 4384 = = КЗП 3326 = NSV 9375.
MM Ser = Ser X−1 = 4U 1837 +04 = = MXB 1837 + 05 [8553].
MN Ser = СПЗ 1163 [0494] = КЗП 7947 = = NSV 11346.
V732 Tau = Plf 485 [8554] = СПЗ 2333.
V733 Tau = Plf 466 [8554] = СПЗ 2317.
V734 Tau = Plf 481 [8554] = СПЗ 2330.
V735 Tau = 1 [8555]. In Pleiades region.
V736 Tau = 2 [8555]. In Pleiades region.
V737 Tau = K44 [8558]. In Pleiades region.
V738 Tau = $03^h40^m24^s$+25°56′42″ [8559] = СПЗ 2203 = NSV 1240. In Pleiades region.
V739 Tau = Plf 477 [8554] = СПЗ 2326.
V740 Tau = K 36 [8558]. In Pleiades region.
V741 Tau = 1 [8560]. In Pleiades region.

V742 Tau = 1 [8561]. In Pleiades region.
V743 Tau = K 48 [8558]. In Pleiades region.
V744 Tau = K 39 [8558]. In Pleiades region.
V745 Tau = 3 [8562]. In Pleiades region.
V746 Tau = 2 [8560]. In Pleiades region.
V747 Tau = A 151 [8558]. In Pleiades region.
V748 Tau = Pll 468 [8554] = СПЗ 2319.
V749 Tau = Pll 472 [8554] = СПЗ 2322.
V750 Tau = Pll 480 [8554] = СПЗ 2329.
V751 Tau = Pll 483 [8554] = СПЗ 2332.
V752 Tau = 2 [8561]. In Pleiades region.
V753 Tau = Pll 479 [8554] = СПЗ 2328.
V754 Tau = Pll 467 [8554] = СПЗ 2318.
V755 Tau = 4 [8555]. In Pleiades region.
V756 Tau = A 155 [8558]. In Pleiades region.
V757 Tau = Pll 482 [8554] = СПЗ 2331.
V758 Tau = K 42 [8558]. In Pleiades region.
V759 Tau = Pll 476 [8554] = СПЗ 2325.
V760 Tau = Pll 478 [8554] = СПЗ 2327.
V761 Tau = K 47 [8558]. In Pleiades region.
V762 Tau = K 50 [8558]. In Pleiades region.
V763 Tau = Rojen 4 [8564]. In Pleiades region.
V764 Tau = Pll 475 [8554] = СПЗ 2324.
V765 Tau = K 46 [8558]. In Pleiades region.
V766 Tau = HR 1194 = BD + 12°516 (7.0) = = HD 24155 (B9) [8418] = SAO 093637.
V767 Tau = K 45 [8558]. In Pleiades region.
V768 Tau = Pll 474 [8554] = СПЗ 2323.
V769 Tau = Pll 469 [8554] = СПЗ 2320.
V770 Tau = K 38 [8558]. In Pleiades region.
V771 Tau = 3 [8561]. In Pleiades region.
V772 Tau = Pll 471 [8554] = СПЗ 2321.
V773 Tau = HD 283447 (K2) [8567].
V774 Tau = HR 1322 = BD +5°614 (7.5) = = HD 26923 (G0) [7834] = SAO 111698 = ADS 3085A = NSV 1536.
V775 Tau = 60 Tau [8569] = HR 1368 = = BD +13°668 (5.7) = HD 27628 (A3) = SAO 093892. In Hyades cluster.
V776 Tau = 68 Tau [8571] = HR 1389 = = BD + 17°719 (4.7) = HD 27962 (A2) = ADS 3206 = SAO 093923.
V777 Tau = 71 Tau [8569] = HR 1394 = = BD + 15°625 (5.0) = HD 28052 (A5) = SAO 093932. In Hyades cluster.
V778 Tau = СПЗ 2159 [8573, *Медведева*].
V779 Tau = СПЗ 2158 [8573, *Холопов*].
V780 Tau = 307 [8574].
V781 Tau = BD +26°971 (8.9) = HD 248087 (G0) = SAO 077615 [8576].
θ^2 Tau [8578] = 78 Tau = HR 1412 = = BD +15°632 (4.0) = HD 28319 (F0) = SAO 093957. In Hyades cluster.
ρ Tau = 86 Tau [8569] = HR 1444 = BD +14°720 (5.4) = HD 28910 (A5) = = SAO 094007. In Hyades cluster.
υ Tau = 69 Tau [8569] = HR 1392 = = BD +22°696 (4.5) = HD 28024 (A5) = SAO 076608. In Hyades cluster.
PS Tel = V39 in NGC 6584 [8528].
PT Tel = V29 in NGC 6584 [8528].
PU Tel = HV 9849 [0629, *Boyd*] = V24 in NGC 6584 [8528] = КЗП 3956 = = NSV 10516.
PV Tel = CoD−56°7300 (8.9) = CPD −56°8755 (8.4) = HD 168476 (B) [8370, 7825] = SAO 245434 = = NSV 10687.
PW Tel = HR 7416 = CoD−45°13296 (6.0) = = CPD−45°9740 (6.4) = HD 183806 (A0p) [8375] = SAO 229741.
TT Tri = GR 286 [8475].
TU Tri = GR 287 [8475].
TV Tri = GR 288 [8475]. In M33 region.
TW Tri = СПЗ 2288 [8533] = GR 292 [8475]. In M33 region.
TX Tri = СПЗ 2289 [8533] = S 10830 [8534]. In M33 region.

TY Tri = Wr 138 [4364] = КЗП 5959 = NSV 710.
TZ Tri = 6ι Tri [8538] = HR 642 [7964] = BD+29°371 (5.0) = HD 13480 (G0) = ADS 1697 = SAO 055347.
UU Tri = S 10504 [5506] = NSV 887.
KY TrA = Nova TrA 1974 = TrA X−1 = A 1524−61 [8544].
KZ TrA = 3U 1626−67 [8551] = 4U 1626−67 [8552].
CF Tuc = CoD−75°26 (7.8) = CPD−75°68 (7.6) = HD 5303 (G0) = SAO 255716 = BV 625 [5843] = NSV 337.
CG Tuc = HR 8919 = CoD−63°1607 (5.8) = CPD−63°4891 (4.5) = HD 221006 (A0p) [8375] = SAO 255497.
DH UMa = BD+50°1603 (9.2) [8460] = HD 77234 (R5) = SAO 027100 = NSV 4354.
DI UMa = S 5305 [2763] = КЗП 6692 = NSV 4407.
DK UMa = 24 UMa = BS 3771 [7964] = BD+70°565 (5.2) = HD 82210 (G0) = SAO 006897.
DL UMa = BD+70°567 (7.5) [7964] = HD 82620 (F0) = SAO 014934.
DM UMa = BD+61°1211 (8.7) [8556] = SAO 015338 = 2A 1052+606.
DN UMa = 65 UMa [8557] = HR 4560 = BD+47°1913 (7.3) = HD 103483 (A0) = SAO 043945 = ADS 8347 = Zi 905 = КЗП 101230 = NSV 5384.
DO UMa = GR 274 [8362].
DP UMa = 67 UMa = HR 4594 [8448] = BD+43°2179 (5.1) = HD 104513 (A3) = SAO 044002.
DQ UMa = GR 295 [8350].
DR UMa = GR 296 [8350]. In M 101 region.
RZ UMi = СПЗ 2310 [8563].
HW Vel = HR 3440 [8565] = CoD−52°2480 (5.6) = CPD−53°1796 (5.7) = HD 74071 (B5) = SAO 236151.
HX Vel = HR 3462 [8566] = CoD−47°4251 (5.5) = CPD−47°2578 (6.2) = HD 74455 (B3) [8387] = SAO 220313.
HY Vel = HR 3467 [8308] = CoD−52°2506 (5.1) = CPD−52°1607 (5.2) = HD 74560 (B5) = SAO 236205.
HZ Vel = HR 3517 [8215] = CoD−38°4925 (7.0) = CPD−38°2738 (7.2) = HD 75654 (A2) = SAO 199682.
II Vel = CoD−48°4184 (9.6) = CPD−48°2002 (8.8) [8389].
IK Vel = CoD−52°2772 (8.4) = CPD−52°1916 (8.4) = HD 78291 (B5) [8389] = SAO 236583.
IL Vel = CoD−52°2955 (9.1) = CPD−52°2185 (8.5) = HD 80383 (A) [8568] = SAO 236814.
IM Vel = HR 3831 = CoD−48°4831 (7.0) = CPD−48°2558 (7.4) = HD 83368 (F0p) [8481] = SAO 221339.
IN Vel = CoD−41°5219 (8.6) = CPD−41°3888 (9.3) = HD 83442 (K2) [8570] = SAO 221347.
IO Vel = CoD−53°3077 (7.4) = CPD−53°2664 (7.0) = HD 83625 (A0p) [8360] = SAO 237163.
IP Vel = HR 3872 A [8572] = CoD−50°4420 (6.8) = CPD−50°2636 (6.9) = HD 84400 (B8) = SAO 237260.
IQ Vel = $10^h02^m07^s$ −40°31′53″ [8575] in the field of planetary nebula NGC 3132.
IR Vel = 256.1935 [2935] = HV 8250 = P 3387 = КЗП 1556 = NSV 4741.
GL Vir = G 12−30 [8577] = NSV 5547.
GM Vir = S 10621 [5884, *Hoffmeister*] = NSV 5706.
GN Vir = S 9786 [3903] = NSV 5907.
GO Vir = СПЗ 2266 [8579].
GP Vir = BD−5°3730 (8.0) = HD 118246 (B8) [8580, *D. G. Turner*] = SAO 139430.
GQ Vir = Gliese 540.2 [6873].
GR Vir = BD−6°4068 (7.8) = HD 129903 (G0) = SAO 140120 [8581] = BV 747 [4655] = NSV 6785.
GS Vir = СПЗ 2311 [8582, *Куликовский*].
GT Vir = СПЗ 2312 [8582].
GU Vir = СПЗ 2313 [8582].
GV Vir = СПЗ 2314 [8582].
NY Vul = СПЗ 2195 [8490].
NZ Vul = Var 86 [8319].

OO Vul = Var 87 [8319].
OP Vul = Var 88 [8319].
OQ Vul = Var 89 [8319].
OR Vul = Var 90 [8319].
OS Vul = Var 91 [8319].
OT Vul = Var 92 [8319].
OU Vul = Var 93 [8319].
OV Vul = Var 96 [8319].
OW Vul = Var 98 [8319].
OX Vul = Var 100 [8319].
OY Vul = Var 103 [8319].
OZ Vul = Var 108 [8319].
PP Vul = Var 113 [8319].
PQ Vul = Var 114 [8319].
PR Vul = СПЗ 2291 [8491].
PS Vul = BS 7508 [7964] = BD +26°3654 (6.8) = HD 186518/9 (A0+K0) = = SAO 087640 = IRC + 30386 = = ADS 12850 = КЗП 102958 = = NSV 12354.
PT Vul = GD 385 [8494].
PU Vul = $20^{h}19^{m}.0 + 21^{\circ}26'$ [8583]. Novalike object.

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Supplement to the List of Abbreviations

AAO Newsletter – Anglo-Australian Observatory, Epping. Newsletter.
Sitzb Akad Wien – Sitzungsberichte der Österreichischen Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Klasse. Wien.
Tartu Teated – W.Struve nimeline Tartu Astrofüüsika Observatoorium. Teated.
Uppsala Rep – Uppsala Astronomical Observatory. Report.

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A COMPLETE OPTICAL LIGHT CURVE OF THE HYADES ECLIPSING BINARY V471 TAURI WITH THE IUE SATELLITE

V 471 Tauri (BD $+16^{\circ}516$) is a $\sim 12\overset{h}{.}5$ eclipsing binary member of the Hyades cluster, consisting of a K0(2) V star and a hot white dwarf component (Nelson and Young 1970; Young and Nelson 1972). The system has been extensively studied and a review of its physical properties is given by Nelson and Young (1976). Although initially much attention was given to determining the properties of the white dwarf component and the system's evolutionary history from its Hyades membership, it has become apparent that the cool component is also important because it displays many properties in common with the chromospherically active components of RS Canum Venaticorum binaries (Hall 1976). Like RS CVn stars, the cool component has strong variable Ca II H and K emission lines (Oswalt 1979), as well as strong Mg II $\lambda 2800$ h and k emission(Guinan and Sion 1979). In addition, the light curve of V471 Tauri is abnormal and displays a variable wave-like disturbance similar to the photometric waves found in RS CVn-type variables. Ibanoǧlu (1978) reports, furthermore, that the photometric wave in V471 Tau migrates toward decreasing orbital phase with a period of about 191 days. In RS CVn systems the photometric wave has been attributed to the rotational modulation of optically darker starspots through the observers's field of view.

On 14 August 1980 UT, V471 Tau was observed continuously for about 14 hours with the International Ultraviolet Explorer (IUE) Satellite in order to obtain ultraviolet spectra ($\lambda\lambda 1150$-3200) over the entire orbit. A comprehensive description of the IUE satellite and its scientific instrumentation is given by Boggess et al.(1978). In the course of observing the star, the Fine Error Sensor (FES) on board the satellite was used as a photometer to obtain the first complete light curve of V471 Tau. The $12^{h}.5$ orbital period of the system hitherto has not permitted a complete light curve to be obtained in one continuous observing session from ground-based stations.

The FES is an unfiltered image dissector tube with an S-20 photocatode which has a broad wavelength response from about 4000Å to 7000Å with a broad maximum sensitivity centered near 5000Å. The incident photons to the FES reflected from the satellite's 45 cm, f/15 Cassegrain telescopic system. The FES is normally used to provide an image of the star field at which the telescope is pointed or in a track mode. In the track mode of operation the FES gives a count rate which is related to the brightness of the object. The brightness of the star is obtained by averaging the count rate from multiple scans of the image dissector with an effective integration time of about 2.5 seconds. The source plus background is actually measured, but for bright stars ($m \leq +11$ mag) the contribution of the background is insignificant. Holm and Crabb (1979) and Stickland (1980) have independently calibrated the FES in terms of V of the UBV system. We have used the calibration of Holm and Crabb given below in reducing our data since it appears to yield better results with our standard stars:

$$V(\mathrm{FES}) = +16^{m}.58 - 2.50 \log C_f - 0.24\,(B-V) \qquad (1)$$

where C_f is the FES count rate from the fast track. The above calibration was derived from 120 observations of 60 stars in the overlap fast track mode and has an accuracy of about $\pm 0^{m}.06$.

In order to increase the precision of the FES measures, the star was observed for 15 seconds except during the first 90 minutes where the observing interval was 5 seconds. The observations were made as frequently as possible between the exposures of the UV cameras and a total of 71 FES measures were obtained. Judging from the repeatability of successive measures, the relative magnitude measures have an uncertainty of less than $\pm 0^{m}.01$. The FES measures were transformed to V magnitudes using the value of $B-V=+0.92$ for inside primary eclipse and $B-V=+0.86$ elsewhere. These B-V values were obtained from the photometric studies of Young and Nelson (1972) and from Ibanoǵlu (1978).

The times at which the observations were made were converted from Universal Time to heliocentric Julian Date and the orbital phases were computed with the ephemeris of Oliver and Rućinski (1978):

$$\text{MIN I} = \text{HJD } 2440610.06642 + 0\overset{d}{.}52118294\cdot E \qquad (2)$$

where zero phase corresponds to mid-eclipse of the white dwarf by the K-component (i.e. primary eclipse). As shown by Oliver and Rućinski, the period of V471 Tau is variable and equation (2) corresponds to the range in epoch of 3000-4800 and was taken from Table II of their paper. The data are plotted against orbital phase and Universal Time in Figure 1. The eclipse limits (first contact to fourth contact) are shown in the figure and correspond to 0.967 to 0.033 phase for primary minimum and 0.467 to 0.533 phase for secondary eclipse. These limits were obtained from the study of Beavers, Oesper and Pierce (1979) where the average time interval between first contact and fourth contact is 49^m24^s and

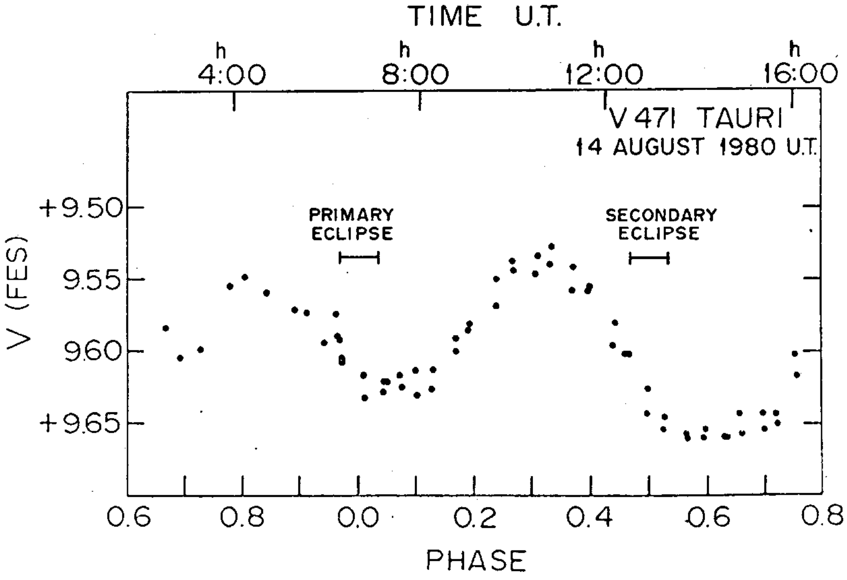

Figure 1: The FES light curve of V471 Tauri

where the duration of totality is about $47^{m}12^{s}$. As can be seen from the figure the light curve is well defined by the data and has a light amplitude of about $0^{m}.12$ with two maxima and two minima of different brightnesses occurring within an orbit. Although in the ultraviolet the depth of primary eclipse is large (about $0^{m}.32$ in the U-bandpass and $1^{m}.56$ at $\lambda 2700$), at the wavelength of the V bandpass, the contribution of the white dwarf to the total light of the system is very small where the depth of primary eclipse is less than $0^{m}.02$. No detectable decrease in brightness is expected at secondary eclipse because of small fractional size of the white dwarf relative to the cool star. No loss of light attributable to an eclipse is seen in the data at the time of secondary eclipse. Thus the light variation in the optical region arises almost entirely from the K-star. The mean value of two measures taken close to 0.0 phase of V(FES) = $+9^{m}.63$ is $0^{m}.08$ brighter than the value of V = $+9^{m}.71$ given by Young and Nelson for near 0.0 phase. (Using Stickland's calibration of the FES yields a value of V(FES) = $+9^{m}.512$ for the same data.) Since the primary eclipse is a total occultation, these measures correspond to the brightness of the facing hemisphere of the K component. With an uncertainty of $\pm 0^{m}.06$ in the calibration of FES to V magnitudes, it is difficult to determine whether the star is brighter or if the observed difference in brightness arises from the variations in the sensitivity of the FES.

Neglecting the minor loss of light during primary ecplipse, the light minima appear to occur at 0.07 phase and near 0.60 phase with V(FES) = $+9^{m}.63$ and V(FES) = $+9^{m}.66$, respectively. The brighter maximum occurs near 0.32 phase with V(FES) = $+9^{m}.54$ and the fainter maximum is near 0.80 phase with V(FES) = $+9^{m}.55$. The occurrence of the higher maximum near 0.32 phase is in good accord with the phase expected from the 191 day migration period suggested by Ibanoǧlu (1978). The form of the light curve is unusual and does not correspond to the light variation theoretically expected from the tidal distortion of the K-star and from the irradiation of the inner hemisphere of the cooler star by the hotter white dwarf (the so-called reflection effect). The light curve is, however, similar to others obtained previously at optical wavelengths for V471 Tauri (see Ibanoǧlu 1978 and Tunca et al. 1979). It also appears that the light curve does not repeat even over one orbital cycle. This can be seen in Figure 1 when the data covering the same phases are compared near the beginning and end of the observing interval. Some of these differences could, however, be caused by small drifts in the sensitivity of the FES over the observing interval.

A more thorough discussion and analysis of the optical light curve will be published elsewhere, together with the UV data. We have demostrated in this study, as in a few others (cf. Boggess et al. 1980; Guinan and Sion 1980; Rućinski et al. 1980) the importance and usefulness of the FES as a photometer. It is suggested, however, that the absolute sensitivity of the FES be monitored by observing standard stars during each observing run.

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PHOTOELECTRIC MINIMA OF THE ECLIPSING BINARY PV CASSIOPEIAE

The eclipsing binary PV Cas (BV 72; BD+58°2554) has been investigated by different authors (Geyer, 1961; Pohl, 1969; Ibanoglu, 1971, 1974) during the past twenty years. It was also observed photoelectrically at the Konkoly Observatory and four primary and seven secondary minima were obtained. BD+58°2562 was used as comparison star.

The observations were made in B and V colours with the
(*) 24" Newton telescope (in Budapest) equipped with an unrefrigerated EMI 9502 B photomultiplier and with the
(**) 20" Cassegrain telescope (in the mountain station) equipped with an unrefrigerated EMI 9058 QB photomultiplier.

The O-C values were calculated with the following elements given by Ibanoglu (1974):

$$\text{Min I} = \text{J.D.Hel. } \underset{\pm\ 3}{2440227.4044} + \underset{\pm 16}{1\overset{d}{.}75046986}\ E$$

Table I Times of minima

Min. (Hel.)	O-C	Type	Remark
2442233.4400	-0.0016	I	**
2716.5735	+0.0005	I	**
2766.4270	+0.0006	II	*
2786.5905	-0.0005	I	**
2850.4495	+0.0006	II	*
3046.5050	+0.0022	II	*
3076.2635	+0.0025	II	*
3125.2795	+0.0041	II	*
3348.4910	-0.0007	I	*
3482.3715	+0.0019	II	*
3524.3860	+0.0038	II	*

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Geyer, E.H.: Zeitschrift für Astrophysik 51, 79 (1961)
Pohl, E.: Inf. Bull. var. Stars No. 386 (1969)
Ibanoglu, C.: Inf. Bull. var. Stars No. 555 (1971)
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PHOTOELECTRIC MINIMA OF ECLIPSING BINARIES

The following Table gives photoelectric minima obtained during the years 1978/79 at the Ege University Observatory, Izmir (Turkey) and the Nürnberg Observatory (Germany). Minima of eclipsing binaries observed at both observatories 1960 - 1977 were published in Astr. Nachr. 288, 69 (1964); 289, 191 (1966); 291,111 (1968); IBVS 456 (1970), 530 (1971), 647 (1972), 937 (1974), 1053 (1975), 1163 (1976), 1358 (1977) and 1449 (1978).

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

Abbreviations of the observers' names:

Bo = G. Bode
Ch = B. Chwastek
Eb = J. Ebersberger
Er = A.Y. Ertan
Gr = R. Gröbel
Ib = C. Ibanoglu
Kt = M. Kurutac
Li = B. Liebscher
Me = T. Mertelmeier
Mi = F. Mittl
Pl = E. Pohl
Rd = E. Roderer
Sb = R. Sendelbeck
Sn = S. Evren
Tg = I. Thiering
Tm = O. Tümer
Tn = Z. Tunca

Remarks:

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

O-C (II) : SAC 51, Krakow 1979

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

m : only the elements I or the elements II give secondary minimum.

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

Table

Star	Min.hel. 244	O-C(I)	O-C(II)	Filt.	Obs.	Instr.	Rem.
RT And	3880.2460	-0.0078	-0.0043	-	Pl	34	
AB And	3749.4090	+0.0043	+0.0043	V	Eb/Tg	34	
TZ Boo	4013.455	+0.019	-	V	Gr	34	Min II
44 i Boo	3608.473	-0.003 =	-0.003	V	Eb	34	Min II
	3717.480	+0.002 =	+0.002	V	Eb/Tg	34	Min II
	4007.385	-0.003 =	-0.003	V	Gr	34	
SV Cam	3892.254	-0.010	-0.004	-	Gr/Pl	34	
RZ Cas	3861.2794	-0.0042=	-0.0042	V	Pl/Rd	34	
TW Cas	3832.3536	-0.0045	-0.0063	-	Pl	34	
PV Cas	3777.3538	-0.0037(m)	-0.0123	-	Me/Sb	34	
VW Cep	3524.3900	-0.0084	-0.0031	V	Ch/Eb	34	Min II
	4001.4203	-0.0119	-0.0052	V	Li	34	Min II
EG Cep	3617.4529	+0.0032	-0.0018	V	Bo/Eb	34	Min II
AI Dra	3796.3259	-0.0049=	-0.0049	V	Gr/Tg	34	
TX Her	3974.5363	+0.0033	+0.0131	V	Gr/Li	34	Min II
AK Her	3656.5194	-0.0009=	-0.0009	V	Eb/Mi	34	
DI Her	4024.4399	+0.0059=	+0.0059	V	Gr	34	Min II
RT Lac	3772.3161	-0.0210	-0.0264	V	Er/Ib/Sn/Tm	48	
	3772.3168	-0.0203	-0.0257	B	Er/Ib/Sn/Tm	48	
	3782.4647	-0.0204	-0.0259	V	Er/Ib/Sn/Tm	48	
	3782.4654	-0.0197	-0.0252	B	Er/Ib/Sn/Tm	48	
SW Lac	3756.4151	-0.0245	0.0000	V	Me/Tg	34	
	4069.4412	-0.0208	+0.0018	V	Gr	34	
UV Leo	3608.354	-0.007	+0.006	-	Ch/Eb	34	Min II
XY Leo	3606.396	-0.024 =	-0.024	V	Gr/Me	34	Min II
V 566 Oph	3662.477	+0.043	+0.011	V	Eb/Me	34	
U Peg	3789.353	-0.007	-0.018	V	Gr/Tg	34	Min II
HU Tau	3833.3662	+0.0055=	+0.0055	B,V	Kt/Tm	48	
	3834.3967	+0.0079=	+0.0079	B,V	Kt/Tm	48	Min II
	3835.4228	+0.0058=	+0.0058	B,V	Kt/Tm	48	
	3837.4797	+0.0064=	+0.0064	B,V	Kt/Tm	48	

Table (cont.)

Star	Min.hel. 244	O-C(I)	O-C(II)	Filt.	Obs.	Instr.	Rem.
V 471 Tau	3816.3840	-0.0013	-	B	Ib/Kt/Tm/Tn	48	
	3817.4262	-0.0015	-	B	Ib/Kt/Tm/Tn	48	
	3819.51106	-0.00135	-	B	Ib/Kt/Tm/Tn	48	
	3832.5405	-0.0015	-	B	Ib/Kt/Tm/Tn	48	
	3861.2058	-0.0013	-	B	Ib/Kt/Tm/Tn	48	
	3864.33283	-0.00135	-	B	Ib/Kt/Tm/Tn	48	
W UMa	3563.3995	+0.0063	+0.0011	B,V	Sn/Tm/Tn	48	
	3564.4005	+0.0064	+0.0012	B,V	Sn/Tm/Tn	48	
	3594.4289	+0.0075	+0.0022	V	Bo/Rd	34	
	3928.3998	+0.0078	+0.0014	B,V	Sn/Tm/Tn	48	
	3928.5658	+0.0070	+0.0006	B,V	Sn/Tm/Tn	48	Min II
	3929.4009	+0.0080	+0.0016	B,V	Sn/Tm/Tn	48	
	3929.5668	+0.0071	+0.0006	B,V	Sn/Tm/Tn	48	Min II
	3930.4019	+0.0081	+0.0016	B,V	Sn/Tm/Tn	48	
	4262.3693	+0.0067	+0.0008	B,V	Sn/Tm/Tn	48	
	4275.3814	+0.0070	-0.0006	B	Sn/Tm/Tn	48	
	4275.3816	+0.0072	-0.0004	V	Sn/Tm/Tn	48	
	4279.3855	+0.0074	-0.0002	B,V	Sn/Tm/Tn	48	
	4280.3866	+0.0076	0.0000	B	Sn/Tm/Tn	48	
	4280.3866	+0.0076	0.0000	V	Sn/Tm/Tn	48	
	4298.4035	+0.0081	+0.0004	B,V	Sn/Tm/Tn	48	
	4312.4166	+0.0085	+0.0007	B,V	Sn/Tm/Tn	48	

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PHOTOMETRY OF WZ Sge

WZ Sge was observed shortly after its 1978 outburst using the 36" Yapp reflector at RGO equipped with a "People's Photometer". Simultaneous B, V measurements were made in the sequence sky-comp-sky-WZ-sky-comp-sky under rather poor conditions, with an integration time of 20^s; star 'c' of Krzeminski and Kraft (1964) was used as the comparison.

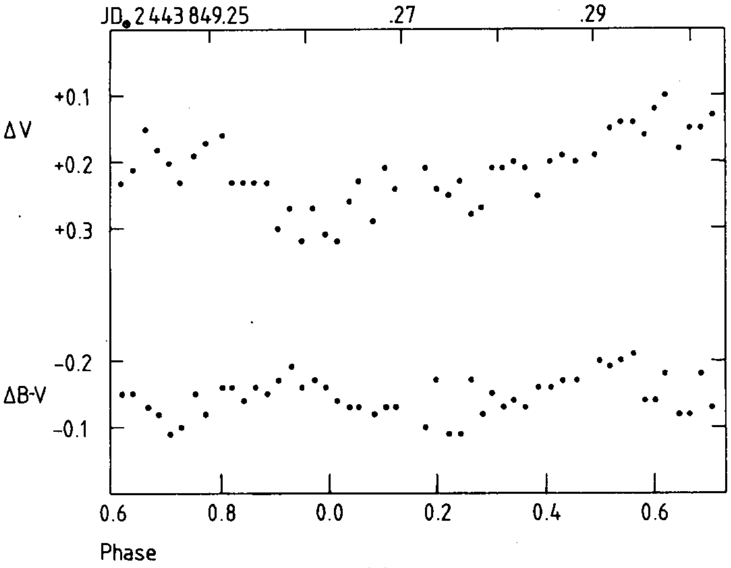

Figure 1

The results are shown in Figure 1. The V amplitude approaches $0^m.2$ and a broad primary minimum is present, approximately in phase with the pre-outburst ephemeris (Robinson et al., 1978) shown in the figure. There is some evidence for the flickering reported by McGraw and Patterson (1978) but nothing quantitative can be said because of the poor sky conditions.

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FLARE STARS IN ORION

Twenty-two new flare stars (Table I) and 8 repeated flares of known flare stars (Table II) had been revealed, while continuing the photographic observations in the Orion nebula region with the Abastumani Observatory 70-cm Meniscus-type telescope, using the multiple exposure method.

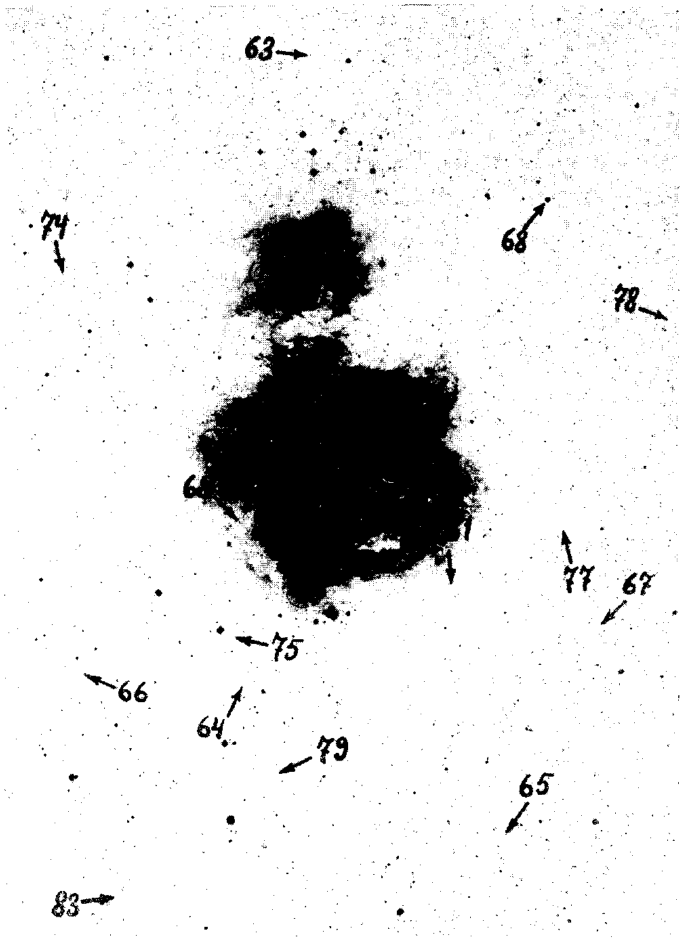
Table I and II give the data of these flares. We are continuing the numeration of flare stars.

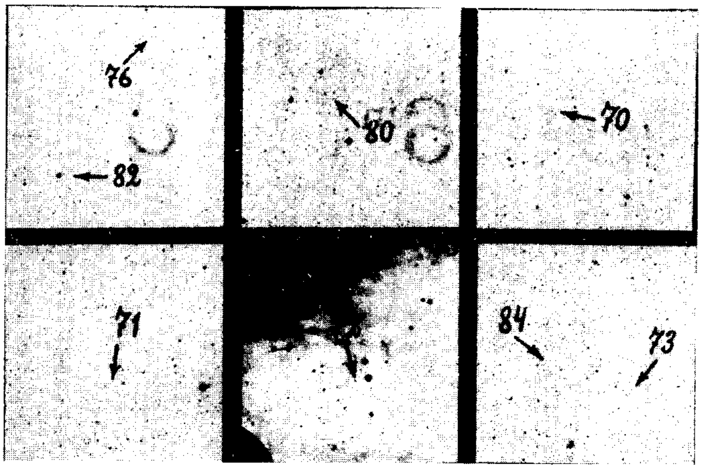
Table I

No	α_{1900}			δ_{1900}		m_{pg}	Δm_{pg}	Date
63	5^h	30^m	28^s	-4°	$09'.4$	$16^m.7$	$1^m.0$	27.10.1979
64		31	23	-6	18.6	18.8	2.6	28.10
65		27	45	-6	49.6	16.9	1.1	28.10
66		33	37	-6	16.3	20.4	4.4	28.10
67		26	25	-6	06.5	17.2	1.0	28.10
68		27	08	-4	39.0	21.0	5.4	29.10
69		31	26	-5	45.4	15.2	1.3	16.11
70		23	00	-4	05.6	17.5	1.4	17.11
71		35	02	-6	36.0	16.9	0.7	17.11
72		29	44	-5	47.0	17.6	3.3	17.11
73		23	42	-7	08.5	18.7	1.8	17.11
74		33	53	-4	54.5	17.0	0.6	18.11
75		31	32	-6	08.9	19.4	3.2	25.11
76		28	28	-3	16.5	19.0	3.6	26.11
77		26	57	-5	46.5	17.1	1.2	26.11
78		25	28	-5	03.7	17.7	0.9	27.11
79		30	55	-6	37.2	18.2	3.0	15.12
80		34	46	-3	28.4	15.6	1.6	15.12
81		28	30	-5	58.6	19.1	3.5	15.01.1980
82		29	31	-3	44.8	19.2	3.8	15.01
83		33	08	-7	02.3	19.o	4.3	16.01
84		24	57	-7	03.0	18.5	1.7	16.01

Table II

No	α_{1900}	δ_{1900}	m_{pg}	Δm_{pg}	Date	Ident.
1	$5^h\ 30^m\ 31^s$	$-5^\circ\ 00'.0$	$17^m.0$	$1^m.1$	29.10.1979	Ab 49
2	37 52	-5 52.6	16.3	1.1	17.11	T 254
3	30 44	-7 20.8	15.2	2.5	17.11	T 228
4	30 10	-6 34.1	16.0	1.3	19.11	T 154
5	28 28	-5 36.7	15.5	0.8	25.11	T 194
6	27 32	-4 03.7	17.9	1.8	26.11	T 8
7	27 32	-4 03.7	17.9	1.8	27.11	T 8
8	32 10	-4 50.9	19.1	3.1	16.01.1980	A 47





Out of all registered flares Nos 79, 80, 83 are slow ones, the brightness of which had increased during more than 40 minutes.

In Table II the flare stars identified with Tonantzintla (1), Asiago (2) and Abastumani (3) lists are denoted by T, A and Ab, respectively.

Outbursts numbered 6 and 7 of the star T8 took place within the time interval $3^h 35^m$. These outbursts are presumably the result of the same flash-activity cycle.

Finding charts are given.

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HD 175742: A NEW RS CVn VARIABLE

The $8^{\rm m}.4$ SB1 binary HD 175742 is known to display strong Ca II H & K emission lines (Joy and Wilson 1949, Fekel 1980) and to have a variable radial velocity (Wilson and Joy 1950). A spectroscopic orbital solution recently has been published by Imbert (1979), who gives the period as $2^{\rm d}.879395$, the primary spectral type as K0 V, and the secondary spectral type between K5 V and M2 V. He also predicts the possibility of a partial eclipse.

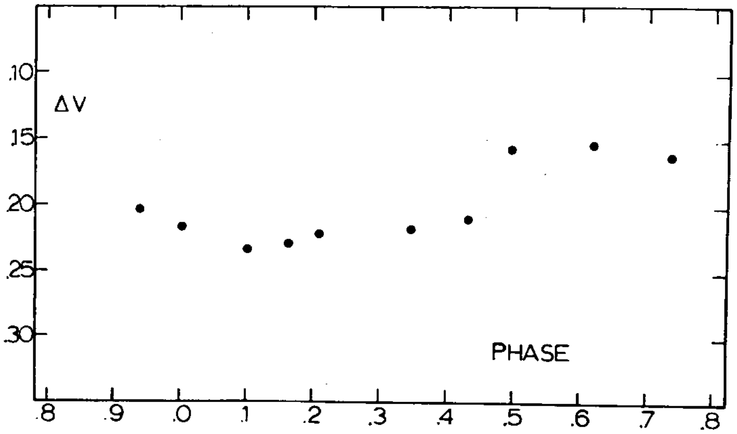
The author observed HD 175742 photoelectrically on ten nights with the 0.6 meter reflector at Dyer Observatory to look for optical variability.

Hel. J.D. (2,444,500+)	Phase	ΔV	ΔB
35.5800	$0^{\rm p}.1651$	$0^{\rm m}.229$	$-0^{\rm m}.556$
36.5346	.4966	.156	
38.5914	.2109	.222	
45.5311	.6210	.153	−0.653
49.5138	.0042	.217	−0.566
50.5014	.3472	.218	
54.5072	.7384	.162	
55.5569	.1029	.233	
56.5096	.4338	.210	
69.4874	0.9410	0.204	

BD $+23^{\circ}3497$ was observed as a comparison star. The table gives nightly means of the three differential magnitudes obtained each night. Correction has been made for differential extinction and transformation to the UBV system, and Δ is in the sense variable minus comparison. The standard deviation of the nightly measures was usually $\pm 0^{\rm m}.005$ or less. Phases were computed with the ephemeris

$$\mathrm{JD(hel.)} = 2,443,677.045 + 2^{\rm d}.879395\ E,$$

where the epoch is Imbert's time of conjunction with the cooler star in front.



The nightly means in V are plotted versus orbital phase in the figure and fit with the truncated Fourier series

$$\ell = A_o + A_1\cos\theta + A_2\cos2\theta + B_1\sin\theta.$$

The resulting sine curve has an amplitude (maximum to minimum) of $\Delta V = 0^m\!.079 \pm 0^m\!.012$ and a minimum at phase $0^p\!.165 \pm 0^p\!.023$.

This roughly sinusoidal light variation is clearly evident with its $0^m\!.08$ amplitude and is typical of the wave seen in most RS CVn binaries. There is, however, no evidence of an eclipse near Imbert's time of conjunction.

Further photometry is being planned to determine the photometric period more precisely (to check for any migration of the wave through the light curve) and to look for variations in the wave amplitude.

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References:

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HD 178450: A NEW RS CVn VARIABLE

The G6 V spectrum of $8^{m}.1$ HD 178450 displays strong Ca II H & K emission lines (Joy and Wilson 1949) and variable radial velocity (Wilson and Joy 1950). Fekel (1980), who is observing HD 178450 to determine its spectroscopic orbital elements, suggests it as a good candidate for RS CVn-type optical variability.

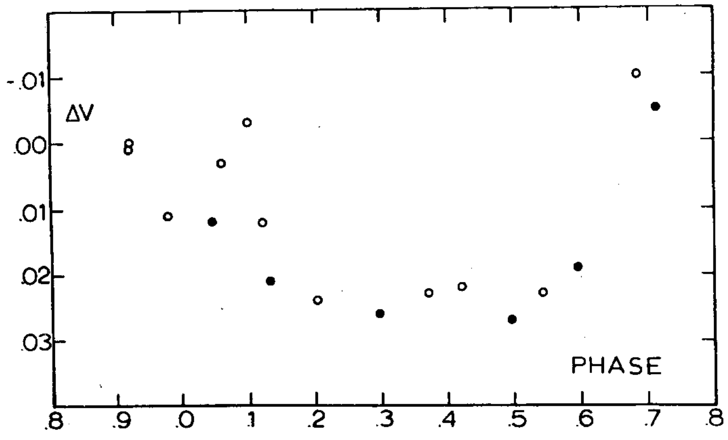
HD 178450 was observed photometrically between JD 2444506 and 2444513 with the No. 4 0.4-meter telescope at Kitt Peak National Observatory and between JD 2444526 and 2444569 with the 0.6-meter telescope at Dyer Observatory. BD $+31^{\circ}3457$ was used as the comparison star. Means of the three individual differential magnitudes obtained each night are shown in the table, where Δ is in the sense variable minus comparison. The observations have been corrected for differential atmospheric extinction and transformed to the standard UBV system. The

Hel. J.D. (2,444,500+)	Phase	ΔV	ΔB
06.6490	$0^{p}.2970$	$0^{m}.026$	$-0^{m}.207$
09.7431	.7131	-0.005	
10.6632	.1342	0.021	-0.217
11.6727	.5962	0.019	
12.6400	.0389	0.012	-0.218
13.6448	.4988	0.027	
26.5868	.4219	0.022	
35.5967	.5454	0.023	
36.5459	.9798	0.011	
38.6025	.9211	0.001	
45.5476	.0996	-0.003	
49.5298	.9221	0.000	
50.5104	.3709	0.023	
54.5178	.2049	0.024	
55.5667	.6850	-0.010	
56.5194	.1210	0.012	
69.4993	0.0615	0.003	

standard deviation of the individual nightly magnitudes was usually $\pm 0^{m}.005$. Phases were computed with the ephemeris

$$JD(hel.) = 2{,}444{,}506.0 + 2^{d}.185\ E,$$

where the epoch is arbitrary and the period is the photometric period as determined below.



The nightly means in V are plotted in the figure with filled circles for Kitt Peak and open circles for Dyer. The photometric period was determined by fitting the data with the truncated Fourier series

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

varying the period (and thus recomputing the phases) until the smallest errors in the coefficients resulted. The period which best fit the data was $2^{d}.185$ with an estimated uncertainty of $\pm 0^{d}.005$. The sine curve resulting from the use of this period had an amplitude (maximum to minimum) of $\Delta V = 0^{m}.033 \pm 0^{m}.005$ and a minimum at $0^{P}.348 \pm 0^{P}.024$, which would correspond to JD 2,444,506.76 $\pm 0^{d}.05$.

The light curve is only approximately sinusoidal and suggests some cycle-to-cycle changes in shape. These changes in the light curve, along with the small amplitude of the variation, may imply an uncertainty in the period larger than estimated above from the Fourier coefficients. In fact, the variation may not even be strictly periodic. More nearly continuous photometry over fewer cycles would be needed to define the shape of the light curve more accurately.

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References:

Fekel, F.C. 1980, private communication.
Joy, A.H. and Wilson, R.E. 1949, Ap. J. 109, 221.
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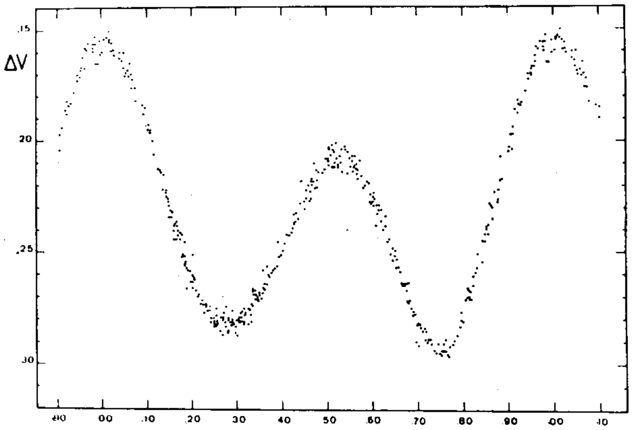
THE VARIABILITY OF HR 1081 = TU Hor

The variability of HR 1081 (HD 21981, A2V) was discussed by Stobie (1971) during a search for δ Scuti stars. His data did not allow him to decide whether it was a δ Scuti variable or an eclipsing system. As the radial velocity of this star is noted "variable" in the Yale Catalogue of Bright Stars, he adopted the second possibility. The star was named TU Hor in the second supplement of the General Catalogue of Variable Stars (Kukarkin et al, 1974).

The variability of TU Hor was rediscovered with the photometer of the Geneva Observatory at La Silla, Chile, at Julian Day 2443434, when it showed a range of about 0.08 magnitude in V. The photometric variability of this star has been studied in more detail during November and December, 1980, with the same equipment at La Silla. HR 1075 (HD 21882) proved to be an excellent comparison star, as it is fairly near to HR 1081, has about the same spectral type (A5V) and remains remarkably constant. The total variation range in V is about 0.14 magnitude, and a period of 0.936 days could be estimated. The magnitude difference HR 1081-HR 1075 is displayed in Figure 1 as a function of the phase computed with this period. An epoch of maximum light is Julian Day 2444542.132.



The V magnitude difference HR 1081-HR 1075 as a function of the phase computed with the 0.936 day period.

The striking feature of this light curve is that not only the minima are of unequal depth (they differ by about 0.015 magnitude), but that also two consecutive maxima are very distinct, as they differ by as much as 0.05 magnitude. The light curve is also asymmetric, in the sense that, when phase 0 corresponds to the main maximum, the second maximum is at phase 0.52, and the minima are at phases 0.28 and 0.76 respectively.

The extreme regularity with which the light curve repeats itself with each cycle suggests a geometrical origin of the variability. However, in normal eclipsing binaries, both maxima are equal. There are some known cases (Frolov et al., 1980) of eclipsing binaries where one component is also a pulsating star, but it seems almost impossible that some "synchronization" mechanism between the pulsation of the component and the orbital movement could impose the pulsation period of 0.936 days necessary to match the observations of this A2V star. Moreover, this spectral type places TU Hor at the very hottest end of the instability strip for δ Scuti stars, where the pulsation amplitudes can be expected to be small.

It is unlikely that the variability of TU Hor could be attributed to the Ap phenomenon. None of the published MK types indicates any peculiarity. Also the Z-index, the peculiarity index for early-type stars in the Geneva photometric system (Cramer and Maeder, 1979), for this star (Z = -0.010) does not indicate a pronounced Ap character. Finally, a rotation period of 0.936 days for an A2V star corresponds to an equatorial rotational velocity of about 120 km/s, while the Ap stars are known to be slow rotators.

Additional information is obviously needed to clarify the problem of the variability of HR 1081. Spectra have been taken at different phases and also the variation of the photometric colours will be useful in this context. These results will be presented elsewhere.

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PHOTOELECTRIC TIMES OF MINIMA OF ECLIPSING BINARIES

The following times of minima have been determined from photoelectric V-filter observations made using the 40-cm f/18 Cassegrain reflector of the University of Montana. The observing procedure was the same as that described in IBVS No. 1478 (Margrave et al., 1978).

Table I. Heliocentric Times of Primary Minima

Star	Hel.JD-2,440,000	E	O-C	N
KO Aql	4516.6774	918	$+0\overset{d}{.}0025$	51
RZ Cas	4152.9197	11945	+0.0005	31
	4451.7293	12195	-0.0017	26
	4476.8307	12216	-0.0005	33
	4507.9058	12242	-0.0018	64
TV Cas	4453.8209	1577	+0.0013	69
TW Cas	4500.8105	1745	-0.0022	27
DO Cas	4451.8248	15373	-0.0045	34
	4477.8494	15411	+0.0028	30
	4516.8723	15468	-0.0002	52
AT Peg	4442.8188	3494	-0.0551	50
	4520.7515	3562	-0.0575	49

A least-squares parabolic fit was utilized to find each time of primary minimum in Table I, in which are listed the heliocentric Julian Date (minus 2,440,000) for each minimum, its epoch number E, the O-C value, and N, the number of observations used in the determination. The ephemerides used to calculate the O-C values are given in Table II.

Table II. Ephemerides for Program Stars

Star	Epoch	Period	Source
KO Aql	2,441,887.4724	$2^{\mathrm{d}}.864055$	IBVS 1869
RZ Cas	2,429,875.6902	1.1952473	Herczeg and Friboes-Conde
TV Cas	2,441,595.3582	1.8125944	IBVS 1869
TW Cas	2,442,008.3873	1.4283240	IBVS 1869
DO Cas	2,433,926.4573	0.6846661	SAC 51
AT Peg	2,440,438.383	1.146105	SAC 51

Incorporating the two minima for AT Peg given in Table I into the data set which was used in IBVS No. 1869, the following updated parabolic ephemeris is obtained for AT Peg:

$$\text{Hel. JD (Min)} = 2,440,407.4370 + 1^{\mathrm{d}}.14610886 \cdot E - 5.5772 \times 10^{-9} \cdot E^2.$$

This quadratic ephemeris fits all known photoelectric minima back to 1969 with a mean residual of $0^{\mathrm{d}}.0017$ and implies a continuous period decrease since 1969 of 15.4 seconds per century. The epoch number for the last minimum of AT Peg in Table I is E = 3589 for the quadratic ephemeris and the residual is $+0^{\mathrm{d}}.0016$.

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References:

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CALL FOR SYSTEMATIC PHOTOELECTRIC OBSERVATIONS OF CX Dra

CX Dra (HD 174237, HR 7084, SAO 031165) is a bright Be star whose photometric variability was disclosed by Merlin (1975). Koubský (1976) found that the star is a single-line spectroscopic binary with a period of 6.69 days. In a detailed study, based on photoelectric UBV measurements of the star obtained in the period from 1964 to 1978, Koubský et al. (1980) showed that at least three different types of photometric variability are superimposed:

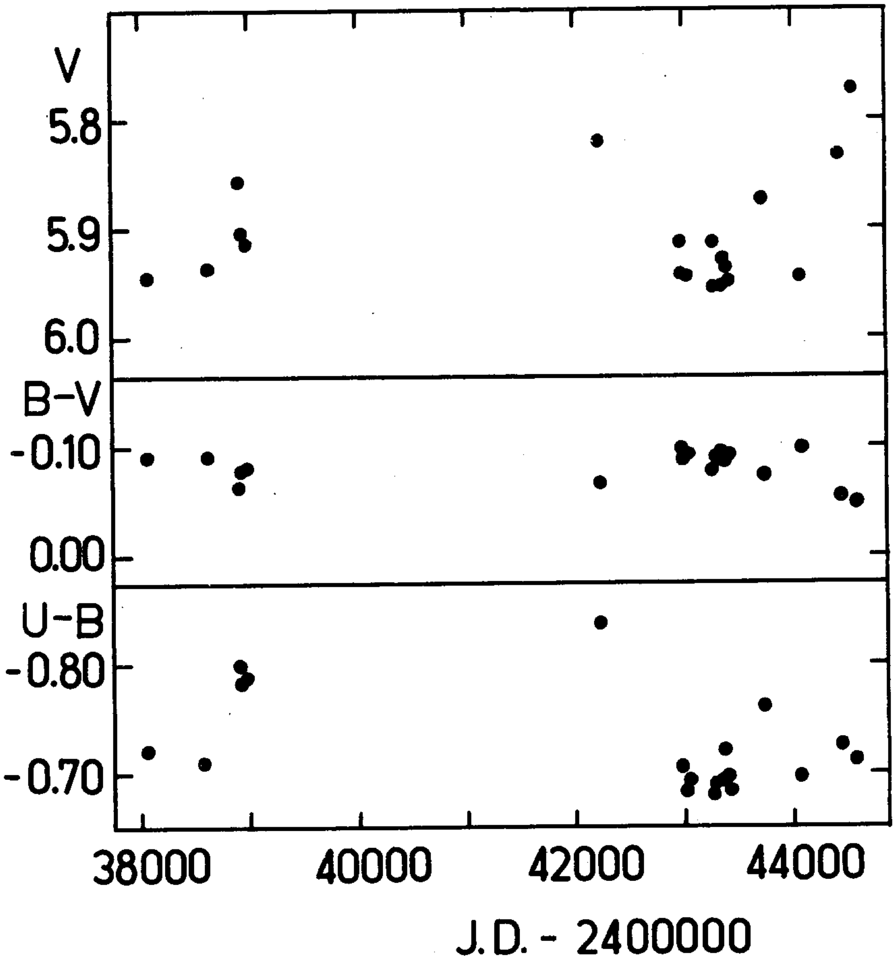
1. Long-term variability with a range of 0.2^m in V and B, and more than 0.3^m in U,
2. Periodic variations, with the orbital period of 6.696 days, and amplitudes around 0.03^m in all three colours, and
3. Occasional night-to-night variations (up to 0.1^m in V).

In summer and autumn 1980 we observed CX Dra at Hvar (Yugoslavia), Kryoneri (Greece) and Skalnaté Pleso (Czechoslovakia) observatories. We have detected very remarkable photometric behaviour of the star. Already in July (JD 2444433-40) the star was unusually bright (the V colour varying roughly between 5.8^m and 5.9^m). Such values were in the past detected only by Merlin (1975) during twelve days in July 1974 (JD 2442228-40). On August 24, 1980 (JD 2444476) the brightness of CX Dra increased to the following extreme values

$V = 5.68^m$, $B-V = -0.02^m$ and $U-B = -0.73^m$.

In the fall of 1980 we detected values around 5.77^m in V. The long-term behaviour of the star is illustrated in the Figure, where normal points (averaged over 10 to 50 days) are plotted.

A remarkable peculiarity of the brightening observed in 1980 is that the U-B values remained almost constant and did not follow the changes in the V colour as in all previously recorded cases.



We thus appeal to all colleagues interested in the Be-star photometry to secure as much photoelectric observations of CX Dra as possible. Clearly, even simultaneous observations of different kinds would be of a great value. The star will soon be well observable on the morning sky. We recommend to use HR 7060 (V = 6.187^m, B-V = + 0.080^m, U-B = + 0.132^m) as the comparison and HR 7028 (V = 5.994^m, B-V = -0.069^m, U-B = -0.232^m) as the check star, and to observe the check as frequently as variable.

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References:

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RV CVn, A REMARKABLE SHORT PERIOD ECLIPSING BINARY

RV CVn, a W UMa system placed in the sky not far from the globular cluster M3, has been discovered by Larink (1921) and discussed by means of photographic observations by Szeidl (1973).

This object has been observed with the double beam photometer at the 1.06m telescope of Hoher List Observatory on May 14 and 15, 1980 in B and V with integration times of 180 seconds for each measurement. Comparison star has been BD+29°2444. The following minima times have been obtained:

Min. II JD 2444374.5045 O-C=+$0^{d}.0101$
Min. I JD 2444375.4430 O-C=+$0^{d}.0051$

The O-C's have been computed according to the period given by Szeidl:

Min. I = 2424642.587 + $0^{d}.2695671$E

Considering the precision of the photographic minima determinations and a possible variability of the light curve shape which can be expected for a short period W UMa system, the period has remained constant to 10^{-7} within the last 60 years.

With the light elements given above the B and V measurements relative to BD+29°2444 have been plotted in Figs. 1 and 2.

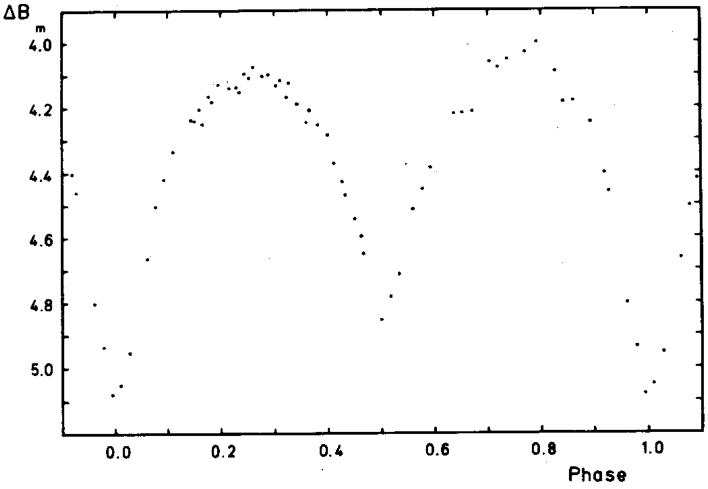

Fig. 1 B light curve of RV CVn

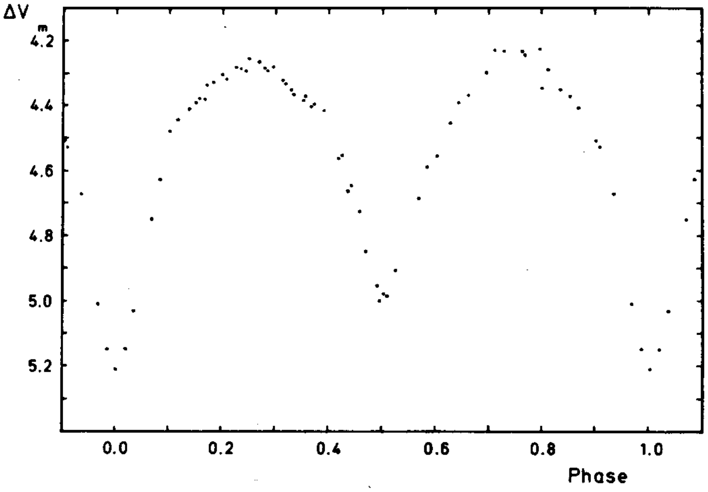

Fig. 2 V light curve of RV CVn

The light changes of RV CVn exceed $1^{m}.0$, which is quite rare among W UMa systems. The difference of the minima depths ($\sim 0^{m}.25$) is large for ordinary contact systems. At phase 0.35 in both nights a considerable "shoulder" has been found in the light curve indicating some activity in the system. The minima of RV CVn are apparently incomplete, but because of the not very densely covered light curves a detailed analysis has been omitted. With some reservation (e.g. is the contact model applicable?) the light curve atlas by Anderson and Shu (1979) indicates a mass ratio of 0.9 and an inclination of more than 80°.

These characteristics make RV CVn a favourable target for further more detailed investigations.

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B AND MG BAND OBSERVATIONS OF AH Vir IN 1977

AH Vir (BD+12°2437) is a frequently observed eclipsing binary of W Ursae Majoris type (e.g. Binnendijk, 1960; Bakos, 1977). It is known as an active system with well established period jumps and light curve changes. Its primary minimum is an occultation; so it belongs to Binnendijk's (1970) subclass "W", whose members are famous for their instabilities.

AH Vir has been observed on March 24 and 25, 1977 with the 61cm Bochum telescope at the European Southern Observatory (La Silla/Chile). The telescope was equipped with its standard photometer, but the observations have been made in B and two narrow band regions (512.5nm/4.5nm Hw., 517.0nm/4.0nm Hw.). The narrow band filters cover the Mg "b" triplet and a neighbouring line-poor region. Main comparison star has been BD+12°2436.

Minima times have been determined as follows (epochs and O-C's according to JD 2442155.6164+0^{d}.40753162E, the most recent period given by Bakos):

JD hel.	2443227.6270	Ep.	2630.5	O-C	+0^{d}.0005
	2443227.8310		2631.0		+0^{d}.0007
	2443228.6445		2633.0		-0^{d}.0008
	2443228.8510		2633.5		+0^{d}.0019

Apparently the last period was still valid in 1977.

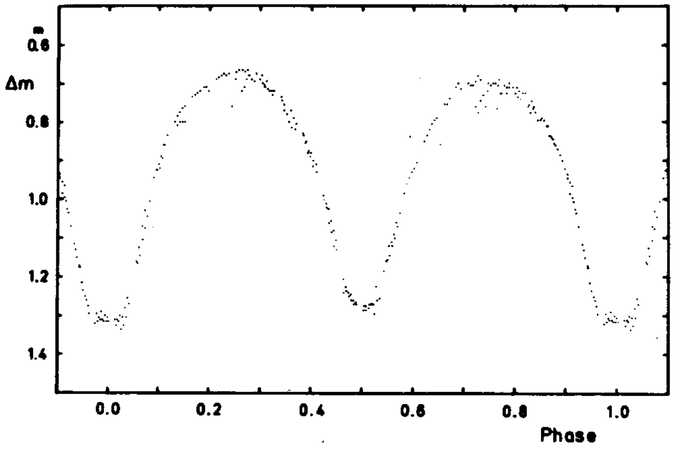

Fig. 1 Measurements of AH Vir in B

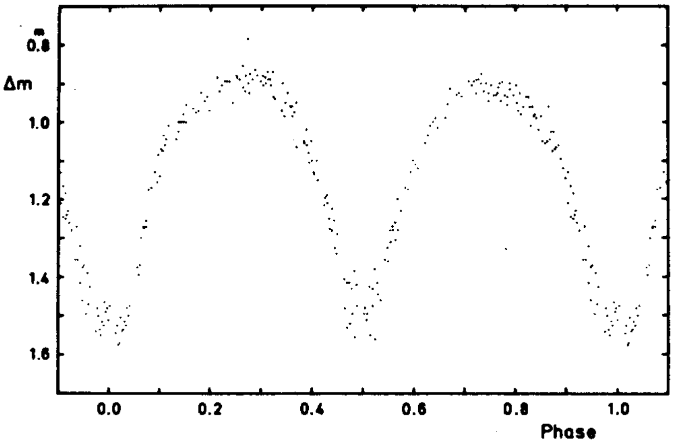

Fig. 2 Measurements of AH Vir at λ512.5nm

Figs. 1, 2, and 3 show the measurements in the individual colours. The light curves exhibit only minor distortions. The minima have slightly declining slopes and there are marginal "shoulders" at phases 0.15 and 0.35 (external tangencies) - invisible in the "continuum" band, indicated in B, and better visible in the Mg "b" band. At these two latter phases the only deviations ($0\overset{m}{.}02$) from a straight line in a plot of the Mg "b" minus continuum index, which is not shown here, could be found. From geometrical considerations the conclusion can be drawn that close to the inner Lagrangian point L_1 a region with lower temperature is facing the observer around $0\overset{p}{.}25$. On the other hand the second maximum is in general fainter than the first one. This has only a very small influence on the colour indices. From the present data alone an interpretation seems to be difficult.

The light outside the eclipses (phases 0.16...0.34, 0.66...0.84) can be described by

$$\begin{aligned}\ell_B = 0.9086 &- 0.0141 \cos\theta - 0.0750 \cos 2\theta \\ &+ 0.0078 \sin\theta - 0.0065 \sin 2\theta\end{aligned}$$

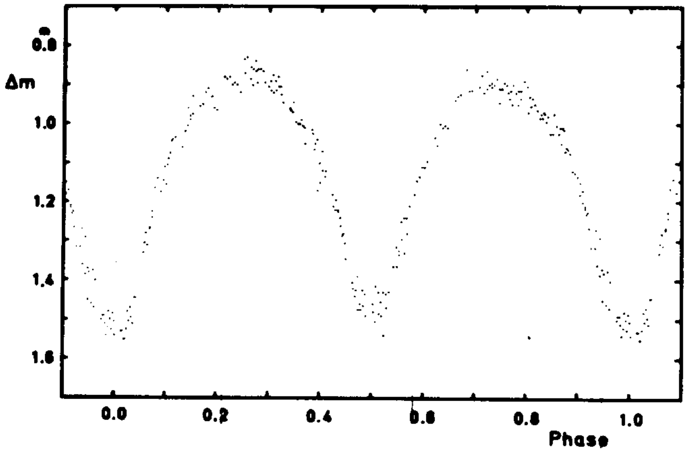

Fig. 3 Measurements of AH Vir at λ517.0nm

No correction for the light of the secondary has been made. The negative sin 2θ coefficient shows that the above mentioned asymmetry of the minima can be traced up to the maxima.

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PHOTOMETRIC OBSERVATIONS OF THE SHORT PERIOD W UMa SYSTEM BM UMa

BM UMa has been discovered as a variable star by Hoffmeister (1963) and classified as "short period". Meinunger and Wenzel (1968) classified it as RRc star with a period of $0^{d}.136$. Shugarov (1975), however, found that BM UMa is an eclipsing binary of W UMa type.

The star has been observed photoelectrically in B and V with the double beam photometer at the 1.06m telescope of Hoher List Observatory on February 22, 1980. Comparison star has been an 11th magnitude (V) star with the approximate coordinates (1950) $11^{h}09^{m}.2$, $+46^{\circ}43'$. Minima times have been obtained:

Min. I	JD hel.	2444292.3496
Min. II	JD hel.	2444292.4853

The period given by Shugarov was not precise enough to link the new minima with his minimum epoch. By adding $0^{d}.068$ also the maxima determined by Meinunger and Wenzel have been used to derive the new elements:

$$\text{Min. I} = \text{JD hel. } 2437348.558 + 0^{d}.2712207E$$

They satisfy all cited extrema.

Figs. 1 and 2 show the light curves in both colours.

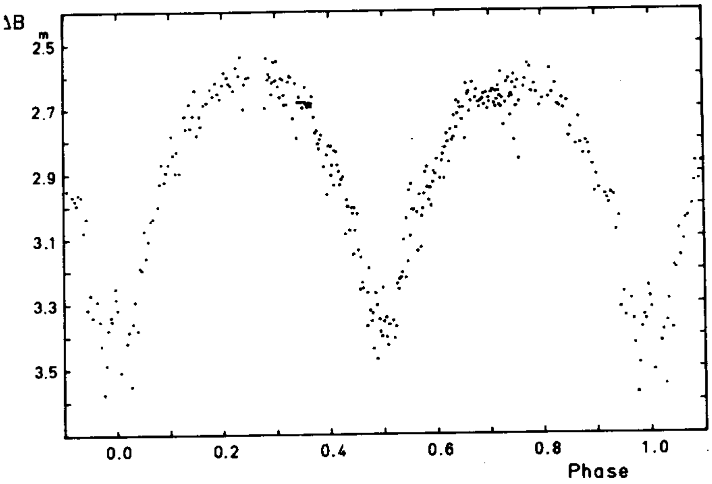

Fig. 1 B light curve of BM UMa

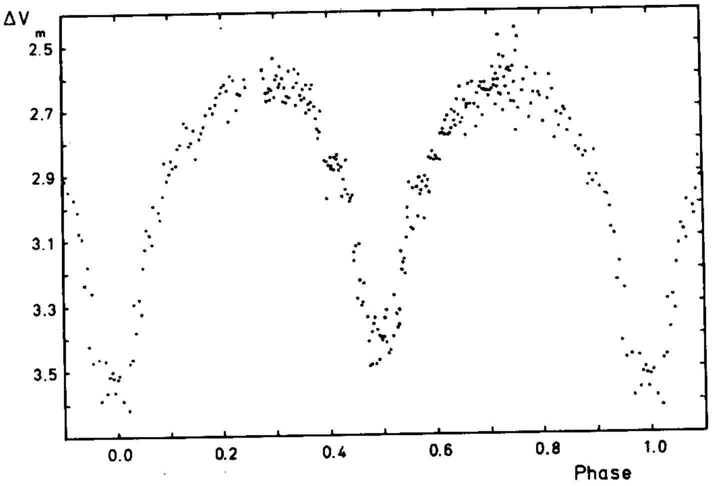

Fig. 2 V light curve of BM UMa

The formation of normal points and a preliminary rectification lead to the conclusion that the eclipses are complete. Although the maxima differ somewhat in brightness, major asymmetries of the light curve seem to be lacking. By the large photometric errors of this 14th (V) magnitude object it could only be estimated (on the basis of the Russell - Merrill method and the Anderson and Shu (1979) theoretical light curve atlas) that the ratio of the radii is of the order of 0.8 to 0.9 and the orbital inclination is about 85°. The broad maxima resemble light curves with a fill-out $f \sim 0.5$.

It should be checked if the well observed photographic light curve by Meinunger and Wenzel, which led to the classification "RR Lyrae star", is an indication for a variable asymmetry in the light curve of BM UMa.

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PHOTOELECTRIC PHOTOMETRY OF BF PAVONIS †

BF Pavonis has been discovered by Shapley et al. (1939). They classified it as W UMa type eclipsing binary and gave a preliminary period of $0\overset{d}{.}170$. Such a short period has not been confirmed for a W UMa star so far. Therefore it has been checked photoelectrically with the two channel photometer at the 1m ESO telescope (La Silla/Chile) in B and V in July 1980. Comparison star has been CD-59°6951.

It turned out that the period has to be changed to $0\overset{d}{.}3056$. With this period and by using the minimum time

JD hel. 2444438.7611

the light curves in Figs. 1 and 2 have been plotted. They do not show larger irregularities. It is not quite clear if the minimum at phase 0.0 is in fact the deeper one, for the other minimum is not completely covered by observations and there may be minor systematic errors at its branches because of inferior weather conditions.

A determination of preliminary orbital elements has been attempted. The atlas of theoretical light curves by Anderson and Shu (1979) yields a mass ratio $q \sim 0.8$ and an

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† Based on observations made at the European Southern Observatory (La Silla/Chile).

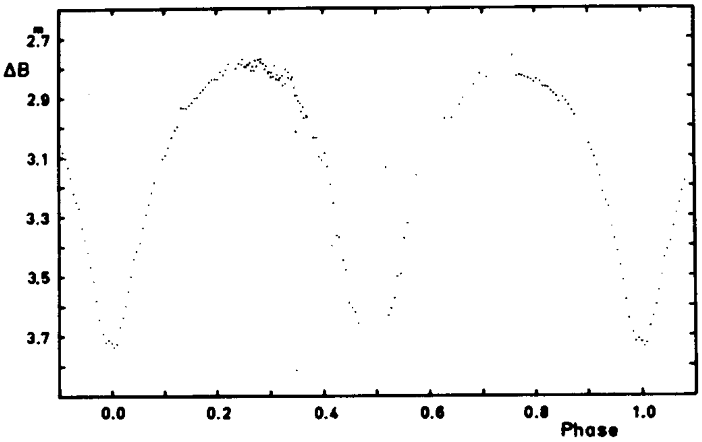

Fig. 1 B observations of BF Pav

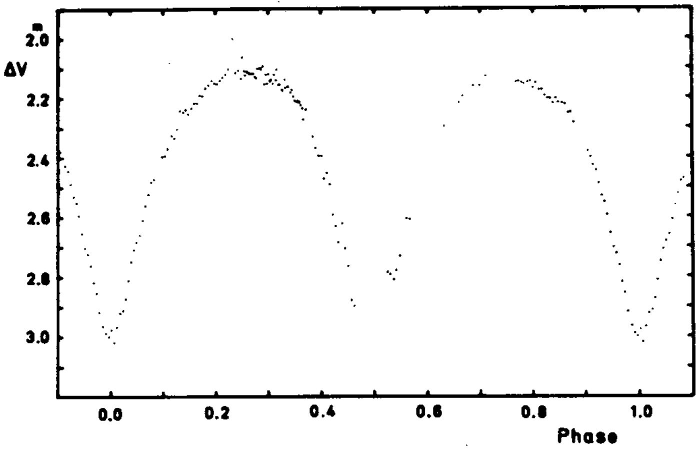

Fig. 2 V observations of BF Pav

inclination $i > 80^\circ$. This would indicate a ratio of the radii $k \sim 0.9$. The Russell-Merrill method has been applied to the well observed minimum at phase 0.0. It has been checked if that minimum is a transit or an occultation. The former possibility is in better accordance with the shape relations but it yields a ratio of the radii k of only 0.70 ($i=88^\circ$); the latter has its best fit at k=0.82. Unless the observations are repeated, it can only be concluded that the ratios of the masses and the radii are not far from unity which is demonstrated by the unusually large amplitude of $0\overset{m}{.}9$.

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A PHOTOMETRY OF AZ Vir

The variability of AZ Vir has been discovered by Jensch (1937). Although several authors observed about a dozen minima times, as late as 1974 Busch found the correct period of $0^d.35$ for this W UMa type eclipsing binary. A photoelectric light curve has been published by Meinunger (1977).

Photoelectric measurements of AZ Vir have been obtained in April 1976, May 1978, and April 1979. They have been carried out with the double beam photometer at the 1.06m reflector of Hoher List Observatory. The mainly used comparison star "b" is the same as that of Meinunger. Check stars "a" and "c" are 14^s west/ 8' south and 58^s east/ 4' south of **AZ Vir**, respectively, all stars being of the same order of magnitude.

Minima times have been determined:

JD hel.	Ep.	O-C
2442885.413	42781.0	$+0^d.003$
2442885.591	42781.5	$+0^d.006$
2442886.448	42784.0	$-0^d.011$
2443656.424	44986.0	$+0^d.003$
2443976.536	45901.5	$-0^d.003$

Epochs and O-C's are according to the ephemeris

Min. I = JD 2427926.4052 + $0^d.3496646871$E

No larger period changes seem to be present during the last

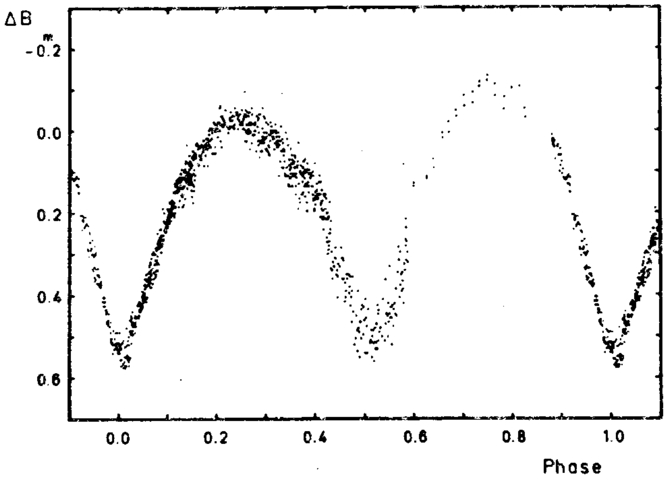

Fig. 1 B observations of AZ Vir

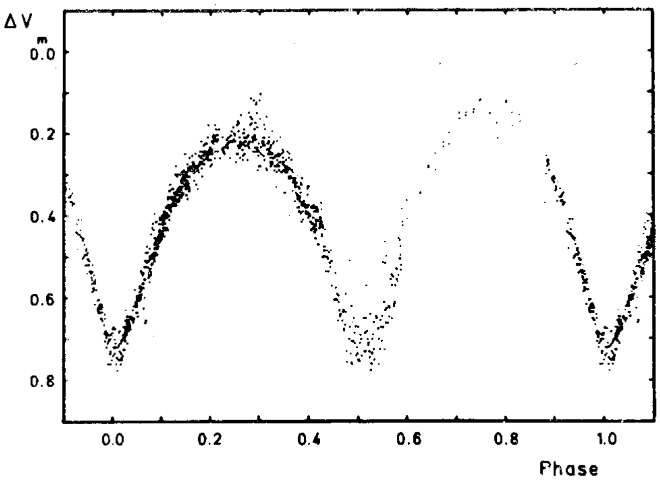

Fig. 2 V observations of AZ Vir

three decades.

Figs. 1 and 2 show the B and V measurements relative to star "b". Generally the light curves confirm the observations published by Meinunger (those phases should be shifted by $0^{p}.5$ to place the deeper minimum at phase 0.0). Between 1976 and 1978 no changes in the light curve were detected. The 1979 measurements fill the gap between phases 0.65 and 0.85. Although the minima show some asymmetry and there are other indications of minor complications, an analysis of the orbital elements has been tried by means of the Russell-Merrill method and using the atlas of theoretical light curves for contact binaries by Anderson and Shu (1979). The former showed that the primary minimum is probably a transit (partial eclipses), but the rectified eclipses are moderately shallow, and no solution could be obtained. The latter method yields a best representation of the light curve with

$$q = 0.65 \pm 0.10 \qquad f = 0.8$$
$$i = 70^{\circ} \pm 5^{\circ} \qquad \beta > 0$$

and full limb darkening.

With $k = q^{0.55}$, a good empirical relation for W UMa systems with periods shorter than $0^{d}.5$, a ratio of the radii $k=0.8$ is obtained.

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THE MAXIMUM TIMES AND NEW LIGHT ELEMENTS OF κ BOOTIS

During the intermediate and narrow band photometry of some Delta Scuti type variables, κ Boo was also observed at Ege University Observatory with the 48 cm Cassegrain telescope on six nights in June 1980 and twelve times of maxima were obtained. These times of maxima are given in the following table. Since the period of $0^{d}.069$ given by Millis (1966) does not agree with the new observations, the new period of $0^{d}.0762927$ has been derived using the times of maxima and the cycle numbers, and utilized.

Table
The maximum times of κ Boo

JD Hel.	O-C(I)	O-C(II)	E	Filter
2444 401.3670	$0^{d}.0000$	$0^{d}.0061$	1	b
.3580	- .0090	- .0029	1	y
.4435	.0002	.0063	2	b
.4385	.0048	.0013	2	y
404.3285	- .0139	- .0059	40	u
.3290	- .0134	- .0054	40	v
.3285	- .0139	- .0059	40	b
.3315	- .0109	- .0029	40	y
408.3770	- .0089	.0018	93	v
.3785	- .0074	.0033	93	b
.3800	- .0054	.0048	93	y
416.3035	- .0169	- .0009	197	y

The O-C(I) residuals are the deviations from the light elements,

$$\mathrm{Max.} = \mathrm{JD\ Hel.}\,2444\ 401.2907 + 0^{d}.0762927\ E.$$

The least squares solution has been applied to these residuals and cycle numbers(E), and the new light elements were derived as follows,

$$\mathrm{Max.} = \mathrm{JD\ Hel.}\,2444\ 401.\underset{\pm 18}{2847} + 0^{d}.\underset{\pm 24}{076242}\ E.$$

The O-C(II) residuals indicate the deviations from these new light elements. The period we obtained is ten per cent longer than that of Millis.

The light curves and physical parameters of the star will soon be published elsewhere.

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Reference:

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TIMES OF MINIMA OF TEN ALGOL-LIKE BINARIES

We give times of minima for 27 primary eclipses of 10 Algol-like binaries. Most observations were made with the 1.0 M Prairie Observatory reflector, with single-channel pulse-counting photometer, RCA C31034A-02 photomultiplier, and Strömgren-Crawford uvby and Kron I filters. Two minima were also obtained using the 0.4 M Mt. Laguna reflector with single-channel DC integrator photometer, RCA 1P21 photomultiplier, and uvby filters. Times of minima for each color were determined in most cases by the method of Kwee and Van Woerden (1956) and programmed by R.C. Crawford.

TABLE I

TIMES OF PRIMARY MINIMA SHOWING NO WAVELENGTH DEPENDENCE

Binary	HJD - 2440000	Binary	HJD - 2440000
XZ And	3779.8763 ± 0.0001	ST Per	3821.6554 ± 0.0002
	3809.7364 ± 0.0001		3882.5664 ± 0.0001
	3847.7403 ± 0.0001		4120.9133 ± 0.0002
	4257.6387 ± 0.0001		4520.8075 ± 0.0007[c]
	4542.6659 ± 0.0000		
		U Sge	4374.8182[a]
KO Aql	3737.655 ± 0.001[a]		
	4049.836 ± 0.001[a]	RW Tau	3820.7835 ± 0.0001
	4387.7954 ± 0.0001[b]		4180.7319 ± 0.0001
W Del	4438.7465 ± 0.0001	X Tri	3760.8573 ± 0.0000
	4462.7765 ± 0.0002		3831.7795 ± 0.0002
			4171.8186 ± 0.0001
			4546.8309 ± 0.0001

[a] Graphical determination.

[b] Correction to I.B.V.S. No. 1840.

[c] y, b, v only; I, u eclipses were asymmetrical or noisy.

TABLE II

TIMES OF PRIMARY MINIMA SHOWING WAVELENGTH DEPENDENCE

Binary	HJD - 2440000				
	I	y	b	v	u
SW Cyg	4428.7625	.7631	.7634	.7640	.7647
	± .0003	± .0001	± .0001	± .0001	± .0003
	-----	4460.7738	.7745	.7754	.7762
		± .0007	± .0008	± .0004	± .0004
RW Mon[a]	3883.7712	.7708	.7708	.7709	.7714
	± .0001	± .0001	± .0001	± .0001	± .0001
RV Oph	4427.7251	.7251	.7251	.7254	.7255
	± .0002	± .0001	± .0001	± .0002	± .0002
RW Tau	4191.8080	.8076	.8074	.8072	.8085
	± .0001	± .0001	± .0001	± .0001	± .0001
	4587.7519	.7515	.7513	.7511	.7523
	± .0001	± .0002	± .0000	± .0000	± .0001

[a] Replaces the single time given in I.B.V.S. No. 1840.

Table I lists times and mean errors for binaries in which times were wavelength-independent. Table II tabulates those times showing wavelength dependence. Apparent time of mid-eclipse is always latest in the ultraviolet. McNamara and Feltz (1976) noted in U Sge that ultraviolet times were delayed from yellow, blue, and violet times by ~ 43 seconds, and Crawford (1979) remarked on ultraviolet delays in U Cep as large as 11 minutes. Among the systems of Table II, earliest times range from infrared in SW Cyg to violet in RW Tau. The maximum time spread is from 35±19 sec (RV Oph) to 190±37 sec (SW Cyg). All of these systems apparently are affected by circumstellar effects of mass transfer, as discussed by Crawford (1979) and Olson (1980).

The author thanks the National Science Foundation for support of this work, and Dr. Burt Nelson for observing time and assistance at the Mt. Laguna Observatory. Mr. Dean Espitallier and Mr. Tom Bryant assisted with observations of SW Cyg and W Del at Mt. Laguna Observatory.

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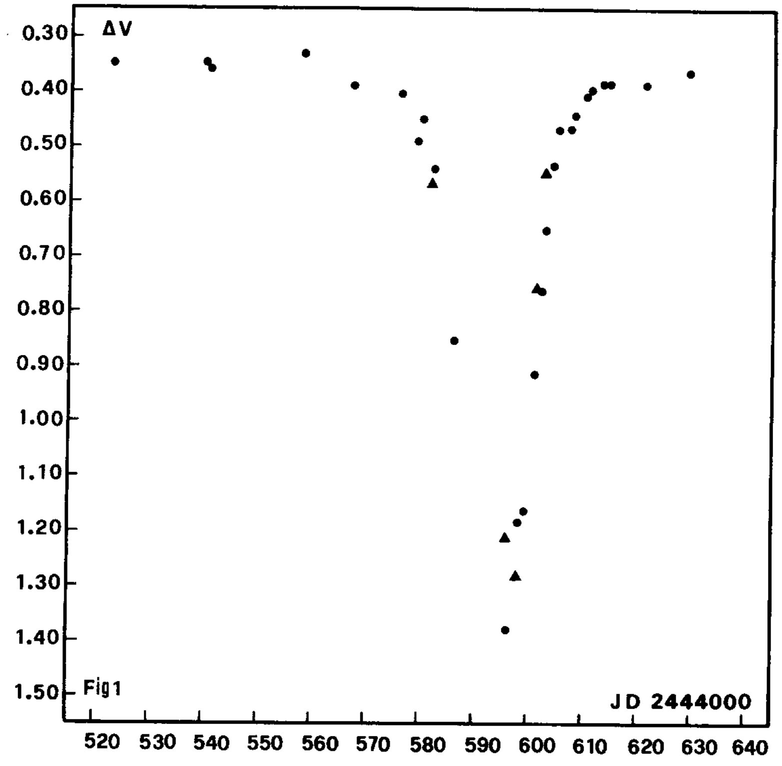
1980 ECLIPSE OF EE CEPHEI: LIGHT CURVES AND TIME OF MINIMUM

The star was observed as follows:

Tizzano observatory: 350 mm reflector f:5.2; photographic observations in U (IIaO + UG1, 1mm), B (IIaO + GG385, 2mm), V (IIaD + GG455, 2mm).

Tignano observatory: 400 mm reflector f:5; photoelectric observations with a single channel photometer (unrefrigerated 1P21) in UBV (Johnson system) and reduction to the International System; photographic observations in I (1N + RG695, 2mm).

BD +55°2690 was used as comparison star for photoelectric observations. Differential magnitudes in the sense variable star less comparison star in V are given in Figure 1.



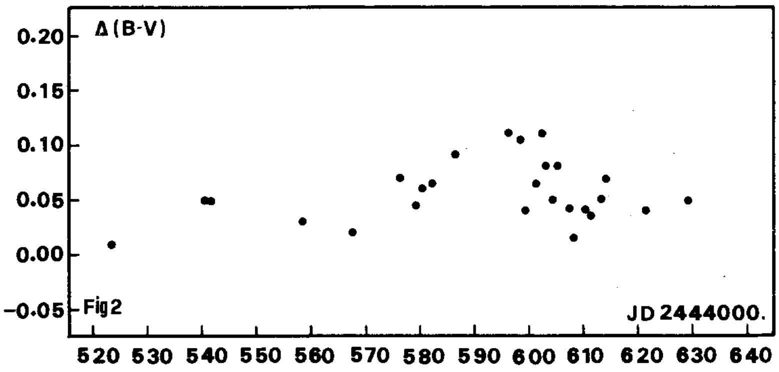


Fig2

Observations made during 26 nights, covered better the ascending branch of the light curve, for we had bad weather conditions during the first part of the eclipse.

Considering the magnitudes at maximum of EE Cep as

$V_{max} = 10.72$; $B-V_{max} = .37$; $U-B_{max} = -.18$ (Barbier et al. 1973)

the star reached during the 1980 minimum at least the $V_{mag} = 11.75$, and with $\Delta(B-V)_{min} - \Delta(B-V)_{max} = \sim .05$ (fig.2) is $B_{min} = \sim 12.17$.

The computed time of minimum in V is:

$$\text{J.D.} 2444594.1 \pm 0^d.4$$

and the O-C computed on the basis of the elements

Min = J.D. 2434346.0 + 2049.53 E (Meinunger 1976)

is

$$O-C_{1980} = 0^d.4 \pm 0^d.4$$

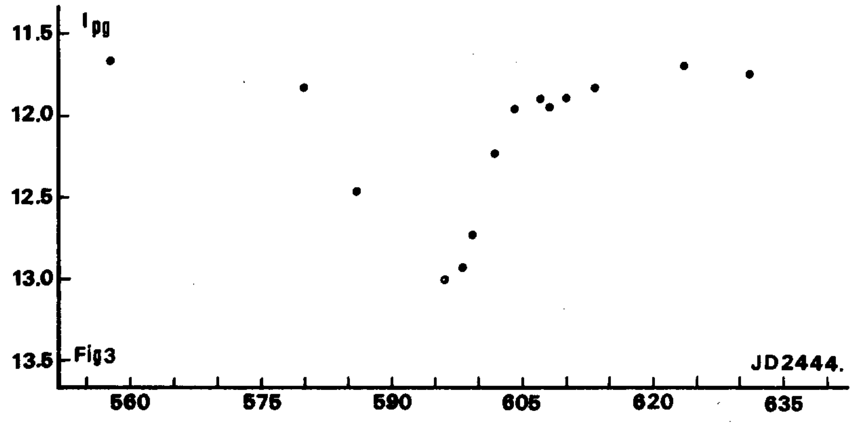
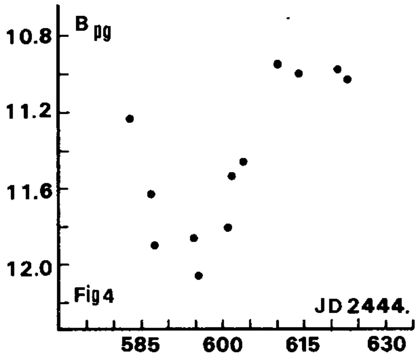


Fig3

All the photographic magnitudes must be considered provisional and subject to further revision. Some difficulties in checking the magnitudes came from the fact that we found the *b* and *c* stars (see identification chart from Meinunger 1975) as variables with amplitude of ∿ 0.15 mag in V. Figure 3 report the infrared magnitudes and lightcurve, that are in the Johnson's system (sequence in NGC 2632=M44). Photographic magnitudes in V are in the same colour system as for the photoelectric observations, that must be revised in view of the variability of the *b* and *c* stars. For this provisional reductions we used the average value of the *b* star. V photographic light curve is superimposed to the photoelectric one in



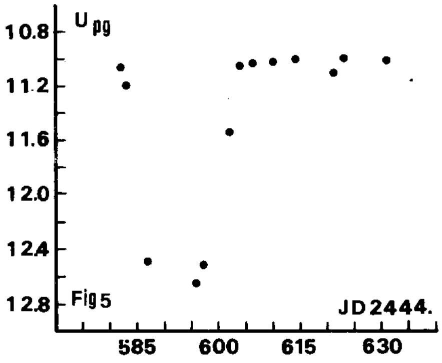


Fig. 1: points =photoelectric, triangles =photographic.

Ten spectra were taken by T.Iijima at the 122 cm telescope of the Asiago Observatory, with the VI camera and RCA image intensifier. The dispersion was 60 Å/mm at Hα wavelength. All the spectrograms show the Balmer series from Hα to H8, with broad absorption lines. Strong and broad Hα and narrow Hβ emission lines are superimposed. Absorption HeI line can be suspected. No appreciable spectral variations can be revealed during the eclipse. The spectrum is of a Be star of the B5 III-IV (more possible III) spectral type.

More detailed and revised results of both spectroscopic and photometric observations will be published thereafter.

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CD -30°5135

Photographic UBV magnitudes have been measured for this peculiar emission-line F supergiant on plates taken by Mr. B. Pettersson with the Uppsala Southern Station Schmidt telescope at Mount Stromlo Observatory, Australia. The results are, with an estimated error of ± 0.1 mag.:

	V	B	U
13 Oct, 1980	9.0	9.75	10.4
29 Nov, 1980	9.15	10.0	10.7
9 Dec, 1980	9.6	10.4	11.15

When compared to earlier photometry (Turner 1977, Welin 1977 and 1978), these values indicate that the conclusion drawn by me in 1978, viz. that the star is redder when it is bright, is no longer tenable. Rather, the colours of the star change erratically.

In part this may be caused by rapid variations, that make at least photographic determinations to relate to slightly different brightness levels. Thus from 29 Nov two U plates, and from 9 Dec two B plates, are available, showing small but possibly significant magnitude differences, of the order of slightly more than 0.1 mag., on 9 Dec in less than ten minutes. (The values given above are weighted means.)

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ON THE PERIOD OF LIGHT VARIATION IN THE RS CVn SYSTEM HD 86590

The suspected variability of the spectroscopic binary HD 86590 has recently been confirmed by Hall, Vaucher, and Louth (1), whose photoelectric observations made early in 1979 show a nearly sinusoidal wave when plotted with respect to the spectroscopic period of $1^{d}.070354$ by Bolton (2). The photoelectric observations in 1976 by Bolton and his colleagues confirm the presence of the wave but the phasing is different (2).

The system has been on our observing program at the University Observatory at Ankara since 1975; the aim was to look for possible eclipses and variability. Although no observations, however, could be obtained since 1977, it will be useful to give an account of these observations in the light of the recent results mentioned above.

We have 321 observations in v and 226 observations in b on a total of 16 nights in two seasons between January 1975 and May 1977 obtatined with the 30-cm maksutov telescope with an EMI 6256S photomultiplier.

The observations in v are plotted in Fig.1a with respect to the spectrocopic period quoted above. The phasses are calculated using the spectroscopically adjusted epoch (2), JD 2442849.896, so that the primary eclipse should fall at phase 0.0. The instrumental magnitudes are relative to the comparison star HD 86132. They are corrected for differential extinction when necessary. Each point in the figure corresponds to the mean of up to 10 individual observations.

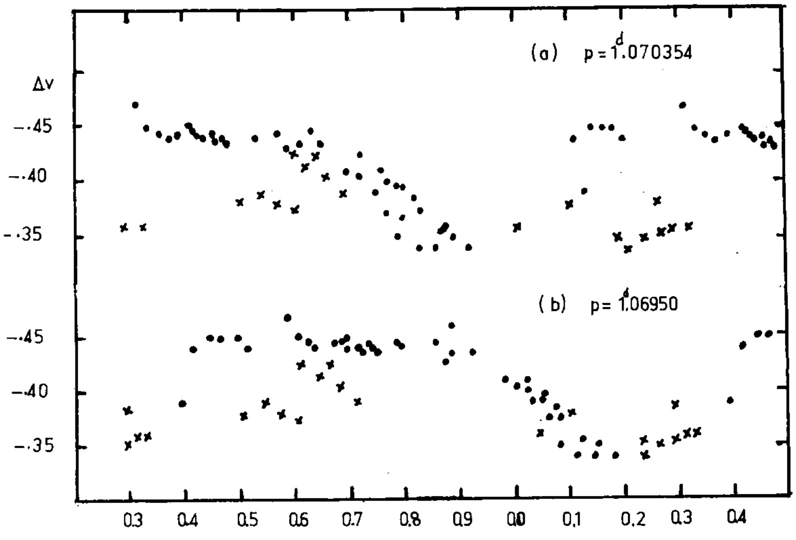

Fig.1

The mean standard error of a single differential measure, obtained using the two check stars HD 86418 and HD 85428 and the comparison star, is about ± $0^m.012$ in both colours.

The light curve has a full amplitude of $0^m.14$ in v and $0^m.16$ in b, which, apart from any scale differences, agree well with other observations (1,2,3,). But it is seen from Fig.1a that our observations, which are spread over a longer interval of time than those by Hall et al. (1), do not fit the spectroscopic period: 1976 observations, shown as crosses, depart the most while observations on different nights in 1977 fall systematically above or below each other on the descending branch of the light curve. We have looked for systematic errors between the seasons and between nights but found none. The nightly mean differences between the two check stars, and between a check star and the comparison star, have a standard deviation of only ± $0^m.005$ in v and ± $0^m.006$ in b (up to 15 observations of a check star are available on a given night). Therefore, unless there are intrinsic variations of the order of weeks, or even days, over and above long term changes and wave migration encountered in similar objects, it is possible that the photometric period is different from the spectroscopic period.

We have two approximate times of minima JD 2443194.475 and 2443225.45. These, plus that given by Hall et al. (1), namely 2443969.85, imply a period of $1^{d}.06950$. The observations plotted against this period and the same epoch as before are shown in Fig.1b. The mean wave is better defined but there are observations on two nights in 1976 that fall below the curve around the phase 0.6. It is interesting to note that the phase of a possible eclipse considered by Hall et al. falls here, but the phasing of the points suggests againsts an eclipse and it is possible that the period is still wrong.

A better fit is achieved with a period twice as long, viz., $2^{d}.13899$. This is shown in Fig.2 in both colours. The minimum observed by Hall et al. fits nicely at phase 0.59. This period also satisfies the BV observations by Bolton and co-workers with a phase shift of about 0.09. Clearly this long period variation, if real, can not be due to eclipse and such a double wave is not expected. The observations around the phases 0.05 and 0.35 which vary in the wrong direction might point to the period as being still wrong. More observations

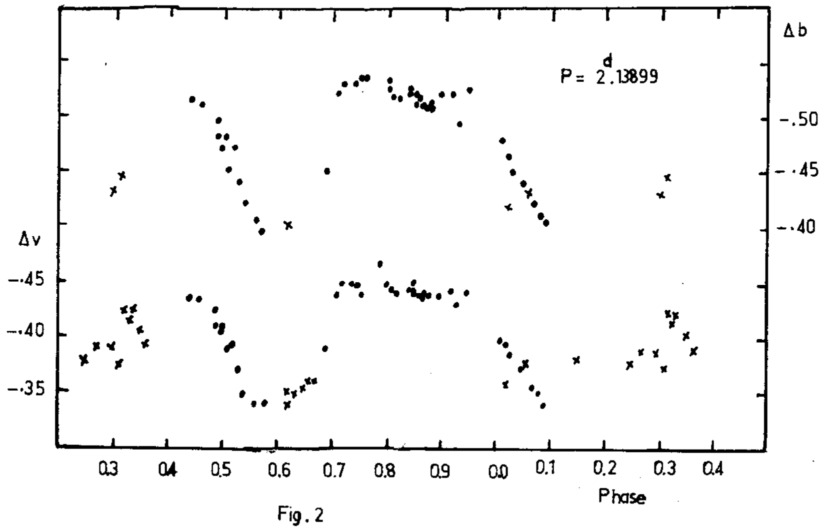

Fig. 2

are needed to eliminate spurious periods and to study the light curve changes. Observations of this system will be continued.

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REMARKS ON 6 VARIABLE STARS

EP And

Elements for this star have been announced by Locher, K. (BBSAG Bull. 25) and the authors of the GCVS-Supplement 1976. Sky-Patrol plates of the Hartha and Sonneberg Observatories have been used to check the period in the years 1928-1976.
Improved elements

a) for the interval from J.D. 2425500-2437600:

$$\text{Min.(hel.)} = \text{J.D. } 2427483.258 + 0\overset{d}{.}4041081 \cdot E \qquad \text{(EW)}$$

b) for the interval from J.D. 2437600-2443000:

$$\text{Min.(hel.)} = \text{J.D. } 2440152.449 + 0\overset{d}{.}4041070 \cdot E \qquad \text{(EW)}$$

V 466 Cyg

In SAC 50 (1979) corrected elements for this Algol-type binary were given to satisfy two minima of Diethelm, R. (Orion 120 and 126)
Twenty newly observed Min. I and II from 1954-1979 confirm the elements of the GCVS. A period change since 1935 is not probable.

EG Sgr

Although this star has been often observed we have no clearness about its true period, moreover, following the GCVS the period should be variable.
Photographic investigations of Sonneberg Sky-Patrol plates from 1929-1979 and an analysis of the former published minima having

lead to the acceptance of the long value ($4^{d}.97$). There are no symptoms for a period change in the last 50 years. A new revision of 64 minima found from 1903-1980 yields the following somewhat improved elements:

$$\text{Min.(hel.)} = \text{J.D. } 2441830.517 + 4^{d}.9723590 \cdot E \qquad \text{(EA)}$$

A final decision whether the period is $4^{d}.97$ or $2^{d}.49$ is still outstanding.

CSV 5844

Lukatskaya, F.J. discovered this star (=BD + 63°17) and announced it as a possible eclipsing binary (Astron. Circ. 216.13, 1960). Investigations of this star on 344 plates were carried out. The photometric behaviour is characterised by a normallight of $10^{m}.7$ ph. irregular appearing minima (depth about $0^{m}.5$ mag.,duration 6-8 days). Therefore CSV 5844 seems to be a member of the BO-Cep group (Isb).

SAO 077615

In I.B.V.S. No. 1556 Harris, A.W. has given two possible values of the period of this bright W UMa type star. A revision of 232 Hartha Sky-Patrol plates (1958-1977) yields 13 new minima I and II, representable by a period near Harris' second variant. Moreover, an abrupt period increase of 1.5 sec. in 1971 was detected. Elements available from J.D. 2436540-2441300:

$$\text{Min.(hel.)} = \text{J.D. } 2436637.340 + 0^{d}.3464380 \cdot E \qquad \text{(EW)}$$

and from J.D. 2441300-2443200:

$$\text{Min.(hel.)} = \text{J.D. } 2441329.510 + 0^{d}.3464551 \cdot E \qquad \text{(EW)}$$
$$(8^{m}.9-9^{m}.3/9^{m}.3 \text{ ph.})$$

Huruhata's object in CMi

Huruhata announced a new bright Algol-type variable in I.B.V.S. No. 1574.

From investigations of 200 plates he derived first elements which could be confirmed on principle by further minima found on 394 Sonneberg Sky-Patrol plates from 1942-1979.
The improved elements are:

$$\text{Min.(hel.)} = \text{J.D. } 2444169.571 + 1\overset{d}{.}1806866 \cdot E \quad \text{(EA)}$$

$$(10\overset{m}{.}85 - 11\overset{m}{.}60 \text{ ph., no secondary minimum } D = 0\overset{P}{.}18)$$

THOMAS BERTHOLD
Bruno-H.-Bürgel-Sternwarte
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PHOTOELECTRIC OBSERVATIONS OF EV Lac

Between 1972 and 1976 a series of photoelectric observations was made on the flare star EV Lac at the Stephanion Observatory by the staff of the Department of Geodetic Astronomy, University of Thessaloniki, with a 30 inch reflector equipped with a cooled Johnson dual channel photometer (RCA 1P21 multiplier) and Johnson standard UBV filters. The measurements were secured by a Hewlett-Packard 7100 B chart recorder.

The data of the comparison stars are given in Table I, the observations of the variable (nightly means) in Table II. The tie-in observations were also made at Stephanion Observatory.

Table I

Comparison	V	B
a = BD +43°4299	9.16	10.33
b = BD +43°4296	9.97	10.83

The characteristics of the flares observed during the period 1971-1975 and 1978 have been already published (Contadakis, Mavridis 1972; Asteriadis, Mavridis, Stavridis 1973; Arabelos, Kareklidis, Mavridis, Stavridis 1978; Contadakis, Kareklidis, Tsioumis 1979; Contadakis, Mahmoud, Mavridis, Stavridis 1980; Avgouloupis, Kareklidis, Mavridis, Phylactopoulos, Varvoglis 1980).

Mahmoud (1978) determined the quiet state magnitudes of the flare star EV Lac corresponding to the period 1972-1976 for a discussion of the photoelectric behaviour of the star during quiescent state. His material has been used in this present paper for the purpose of periodicities detection in the variation of the quiet state luminosity of the star.

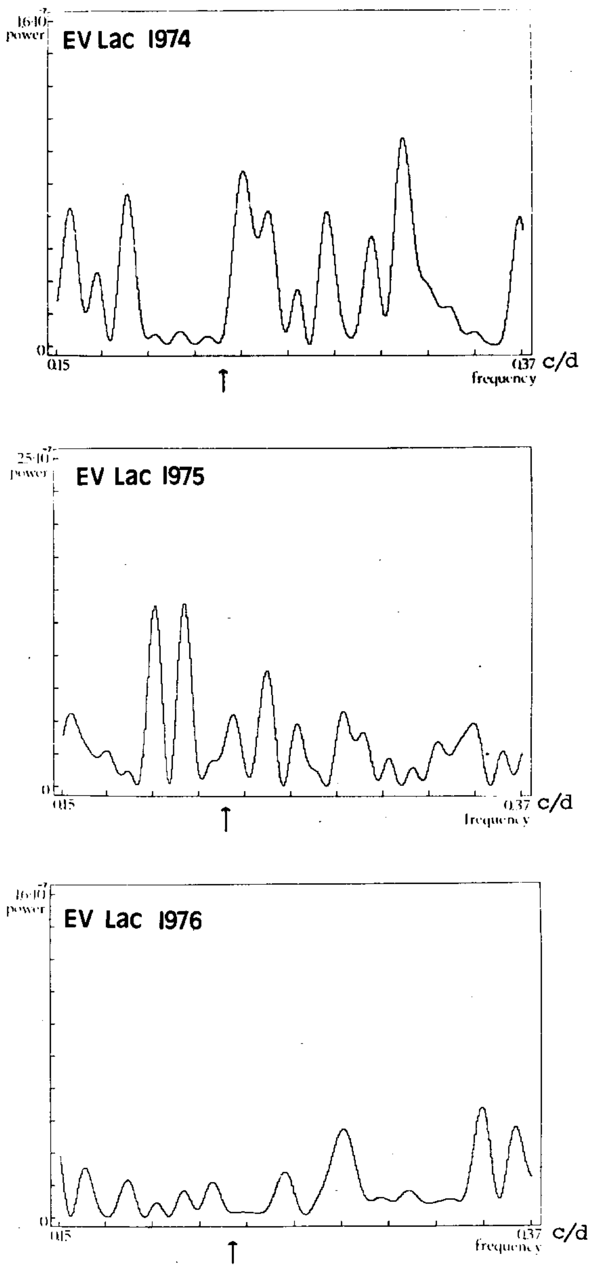
In order to find any periodic variation in the star's brightness during quiescent light, Fourier analyses of the observed data

Table II

Photoelectric yellow and blue observations of EV Lac

J.D.	V	J.D.	V	J.D.	V	J.D.	V
2440000+		2440000+		244000+		2440000+	
1545.414	10.08	1950.386	9.97	2306.419	10.07	3026.445	10.05
1547.476	10.01	1952.392	10.01	2308.411	10.09	3033.419	9.97
1569.524	9.91	2269.515	10.08	2310.407	10.05	3034.423	9.97
1570.437	10.02	2271.494	10.05	2637.502	10.23	3035.422	9.98
1572.412	10.11	2273.502	10.08	2642.490	10.19	3036.420	9.95
1929.435	10.04	2282.474	10.08	2644.490	10.20	3037.413	9.97
1931.463	10.00	2283.485	10.09	2652.463	10.22	3038.408	9.95
1933.428	10.02	2284.485	10.07	2653.470	10.24	3039.406	9.99
1934.443	10.03	2285.488	10.03	2656.475	10.24	3040.406	9.96
1935.440	10.05	2291.517	10.20	2996.537	9.95	3041.396	10.00
1941.419	9.90	2293.481	10.07	2999.523	9.87	3047.394	9.95
1942.406	9.98	2295.475	10.05	3009.487	9.98	3048.378	9.98
1943.391	10.04	2296.459	10.06	3021.478	9.95	3050.369	9.99
1944.427	9.87	2297.459	10.06	3024.443	9.96	3051.370	9.95
1946.400	10.01	2300.428	10.10	3025.438	9.97	3052.370	10.01
1948.395	9.99	2305.417	10.15				

J.D.	B	J.D.	B	J.D.	B	J.D.	B
1545.414	11.55	2274.363	11.47	2654.348	11.58	3018.486	11.42
1547.476	11.42	2282.446	11.44	2655.332	11.60	3019.448	11.46
1569.524	11.47	2283.449	11.46	2656.419	11.61	3020.451	11.42
1570.437	11.46	2284.413	11.45	2658.488	11.59	3021.469	11.41
1572.412	11.53	2285.457	11.41	2688.429	11.66	3022.502	11.43
1929.435	11.42	2291.464	11.54	2689.397	11.57	3023.451	11.42
1931.463	11.38	2293.426	11.42	2690.337	11.59	3024.473	11.42
1933.428	11.43	2294.468	11.35	2693.415	11.63	3025.459	11.41
1934.443	11.39	2295.474	11.47	2694.392	11.57	3026.443	11.46
1935.440	11.46	2296.426	11.37	2696.276	11.63	3027.429	11.46
1941.419	11.32	2297.461	11.40	2697.349	11.66	3033.459	11.42
1942.406	11.38	2300.444	11.47	2707.289	11.66	3034.452	11.46
1943.391	11.39	2305.420	11.50	2981.521	11.37	3035.444	11.44
1944.427	11.29	2306.419	11.46	2982.488	11.39	3036.430	11.42
1946.400	11.41	2308.398	11.46	2983.531	11.36	3037.435	11.40
1948.398	11.39	2310.365	11.36	2996.531	11.40	3038.454	11.41
1950.386	11.36	2324.478	11.60	2998.421	11.39	3039.385	11.43
1952.392	11.41	2327.436	11.46	2999.529	11.39	3040.454	11.38
2239.514	11.41	2329.454	11.45	3003.458	11.39	3041.417	11.44
2240.514	11.48	2613.458	11.64	3005.456	11.41	3047.438	11.38
2241.543	11.44	2615.430	11.73	3007.457	11.41	3048.400	11.43
2245.513	11.46	2635.479	11.61	3008.475	11.41	3050.405	11.42
2247.477	11.43	2636.487	11.65	3009.491	11.41	3051.411	11.41
2247.560	11.49	2637.455	11.56	3010.403	11.42	3052.400	11.46
2248.435	11.51	2640.465	11.66	3011.444	11.46	3054.436	11.44
2267.496	11.46	2642.535	11.62	3012.503	11.44	3055.407	11.42
2269.479	11.47	2644.466	11.61	3013.500	11.44	3062.320	11.31
2270.506	11.51	2652.402	11.61	3016.447	11.43	3063.438	11.46
2271.462	11.43	2653.440	11.63	3017.464	11.44	3064.453	11.16
2273.465	11.45						



Figures 1, 2 and 3

were made. Since the dMe stars show slow, small amplitude light variations with periods of the order of some days, the period search was made between 0.1 and 1 cycle/day (1 and 10 days) for each year's observations, separately. The calculations were carried out with the TPAi computer of Konkoly Observatory.

A light variation of $4\overset{d}{.}378$ period and about $0\overset{m}{.}07$ amplitude was detected by Pettersen (1980) concerning his 1979 observations.

Figures 1, 2 and 3 display the periodograms of EV Lac. Although there are some peaks in the graphs, all of them are under the significance level. The arrows indicate the value where Pettersen's period was found.

It is mentioned that the average brightness of EV Lac in 1975 seems to be about 0.2 magnitude fainter (both in V and B), and also the flare activity of the star was weaker than in the other years (see Mahmoud, 1980).

In this star during the observed time intervals no periodic light variations have been found. This result means that either the star had constant brightness during the time of observations, or the amplitude of the possible light variations are less than the observational error.

The authors wish to express their thanks to G. Kovács for kindly placing his period analysis program at their disposal.

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THE SHOCK RADIATION EFFECT ON THE PULSATING VARIABLE STARS' LIGHT AND COLOUR CURVES

As is known several lines of spectroscopic evidence point to the existence of shock fronts in the atmospheres of pulsating variable stars. The correlation between the maximum width of the loop L_{U-B} in the U-B, B-V plane and strength of the hydrogen emission lines, which we revealed (Batyushkova and Erleksova, 1980), may be one more argument for the explanation of these peculiarities using the shock model. The calculation of shock radiation is essential for the radius determination by Wesselink's method. The task of removing of the excess radiation from the light and colour curves must be solved before the Wesselink's method may be used (Klimishin, 1972).

We have calculated the excess radiation from the shock in U,B,V-bands and the changes in colour indices Δ(U-B) and Δ(B-V) because of this shock. The propagation of the shock has been regarded in the atmosphere of W Vir type star with a velocity D=80km/sec, which is in accordance with the observable velocities on the level where $\tau = 0.1$ and $\rho = 2.5 \times 10^{-9}$g/cm^3. We have supposed that the atmosphere consists of pure hydrogen and the radiation is due to the free-bound and free-free transitions. The necessary values of electron concentration and temperature have been obtained from shock structure calculations by Whitney and Skalafuris' (1963) method. The numerical results indicate that the shock wave has no effect on the colour index B-V within $0\overset{m}{.}01$ and the relation between the amount of the V-band radiation and Δ(U-B) colour excess may be represented as

$$\Delta V = 0.66\Delta(U-B) \qquad (1)$$

that is different from Abt's result for RR Lyr (Abt, 1959).

Our results were applied to BL Her ($P=1^{d}.31$). The normal light curve was obtained by combination of Abt and Hardie's (1960) and also Gavrilova and Kiselyov's (1979) observations. Then ΔV was calculated and the light curve was corrected on the radiation from the shock (Fig.1) by using of the U-B, B-V diagram (Fig.2) and supposing that the relation (1) is performed on all phases of ascending branch of the light curve.

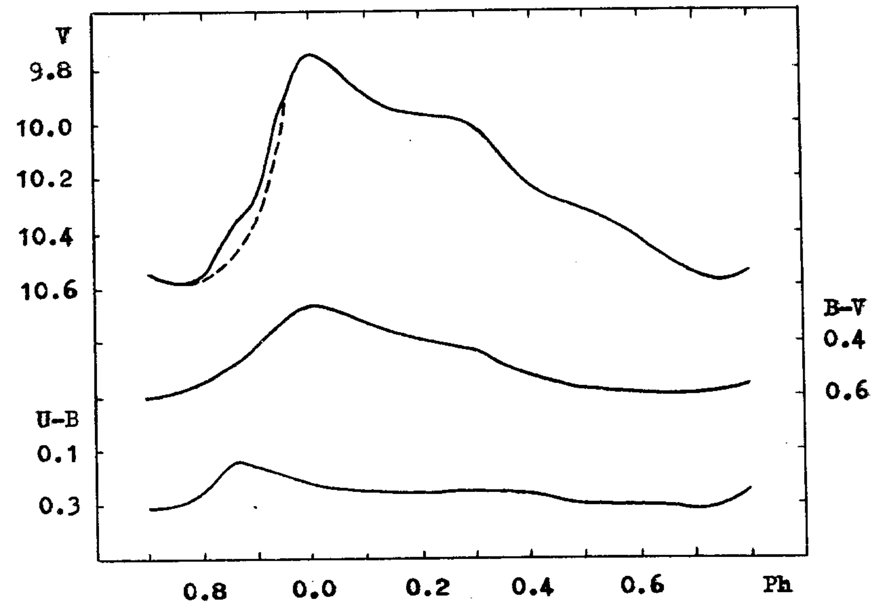

Figure 1. The normal V,B-V, U-B light and colour curves of BL Her. The minimum value of the colour index U-B exactly corresponds to the phase of the hump on the ascending branch of the light curve. The dashed line represents the light curve corrected on the shock radiation effect.

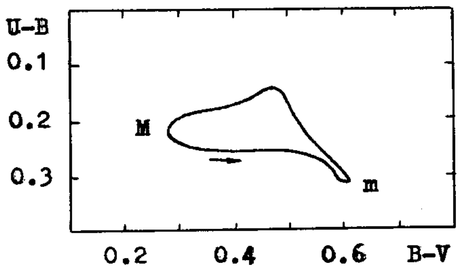

Figure 2. The observed colours of BL Her as a function of phase. The letters M and m indicate the phases of maximum and minimum light, respectively. The maximum width of the loop corresponds to the phase of a hump on the ascending branch. The arrow points the trend in which the loop is described.

Further on the radius was calculated by Wesselink's method. The radial velocity curve, which was presented by Abt and Hardie (1960), was used. Taking into account the phase lag between the light and radial velocity curves by Frolov's (1966) method, we have received $R=(4.99\pm0.18)\times10^6$km for 14 phase pairs instead of $R=(6.7\pm1.3)\times10^6$km with uncorrected light curve.

As is seen the removing of the shock radiation effect from the light and colour curves led us not only to a smaller mean radius, but it decreased significantly the mean relative error of its determination. We obtained the absolute magnitude of BL Her $M_V=-0^m.21$ according to our value of radius, and this is in full accord with the existing period-luminosity relations.

It is proposed to publish the results of the work in the Tajik Bulletin in more details.

The author would like to thank Professor I.A. Klimishin for continued encouragement and helpful discussion of the results obtained.

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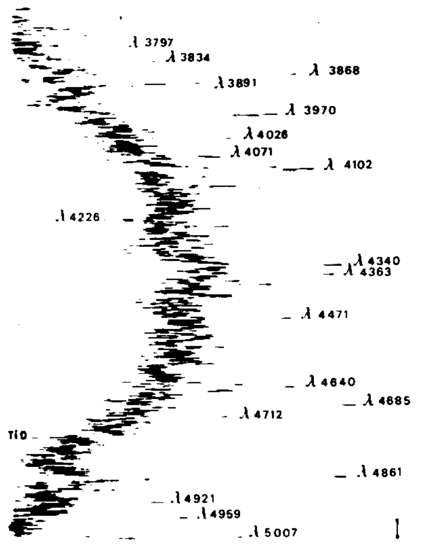
SPECTROSCOPIC OBSERVATION OF CI CYGNI IN 1980

The visible spectrum of the symbiotic star CI Cygni was recorded on September 19, 1980 with the 193 cm telescope at the Observatoire de Haute-Provence. The spectral range is from λ 3700 Å to 5000 Å and the reciprocal dispersion is 38.2 Å mm^{-1} at Hγ.

Photometric data by several observers (1), (2) indicate that the star was at the time in the post-eclipse phase (V = 10.55, B-V = 0.93, U-B = 0.99).



The microphotometer tracing represented in Figure 1 shows the main features of the spectrum which exhibits some strong emission lines. So, the following lines are readily observed:

- [Fe V] : λλ 3891 Å, 4071 Å (IP : 75 eV) which were absent in 1978-79 (3),
- [Ne III] : λ 3868 (IP : 63.4 eV) fairly strong,
- [O III] : λλ5007 Å, 4959 Å, 4363 Å, (IP : 54.9 eV), (note that λ 5007 line is stronger than λ 4363 as in the 1979's observations (4)).
- He II : λ 4686 Å (IP : 54.4 eV).

The 2-0 absorption band of the TiO α-system is present. All the identified emission lines are listed in Table I.

Table I

λ_{obs}	Elements	λ_{obs}	Elements
3770	H 11	4341	Hγ
3797	H 10	4363	[O III] (2 F)
3835	Hη	4388	He I (51)
3868	[Ne III] (1 F)	4413	Fe II (32)
3889	He I (2) + Hζ	4417	[Fe II] (6 F)
3891	[Fe V] (3 F)	4471	He I (14)
3967	[Ne III] 1 F	4485	Fe II (9)
3969	Fe II (3)	4492	Fe II (37)
3970	Hε + H I	4514	N III (3)
4009	He I (55)	4520	Fe II (37)
4026	He I (18)	4541	He II (2)
4068	[S II] (1 F)	4556	Fe II (37)
4071	[Fe V] (1 F)	4582	Fe II (38)
4097	N III (1)	4629	Fe II (37)
4102	Hδ	4634	N III (2)
4121	He I (16)	4640	N III (2)
4144	He I (53)	4650	C III (1)
4178	Fe II (28)	4656	[Fe III] (3 F)
4199	He II (3) + N III (6)	4685	He II
4226	Ca I abs	4712	He I (12)
4233	Fe II (27)	4861*	Hβ*
4245	[Fe II] 21 F	4922	He I (48)
4267	C II (6)	4959	[O III] (1 F)
4286	Fe II	5007	[O III] (1 F)

*A doubling of the H_{β} line is observed (λλ 4860.5-1.8)

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PHOTOMETRIC VARIABILITY OF KAPPA CASSIOPEIAE

Kappa Cassiopeiae (HR 130, HD 2905, B1 Ia, V = 4.15) has a long history of suspected velocity and light variability. Most recently, Elst (1979) has reported light variability with a period of $0^d.09028$ (about 2^h) and an amplitude (as judged from his Figure 1) at least $0^m.06$ in blue light. Such variability, if interpreted as pulsation, implies a very small Q-value and a very high overtone.

In view of this theoretical implication, κ Cas was observed on seven nights in November 1980, using the #4 0.4 m telescope at Kitt Peak National Observatory, near Tucson, Arizona. The telescope was equipped with a single-channel photometer, with a dry-ice-cooled 1P21 photomultiplier and pulse-counting electronics. A high-quality 3^m neutral density filter was used to reduce the number of counts, in order to eliminate coincidence corrections. Observations were made through a Strömgren b filter, relative to HR 146 and HR 244. These observations, corrected for differential extinction and reduced to the sun, are shown in Figure 1.

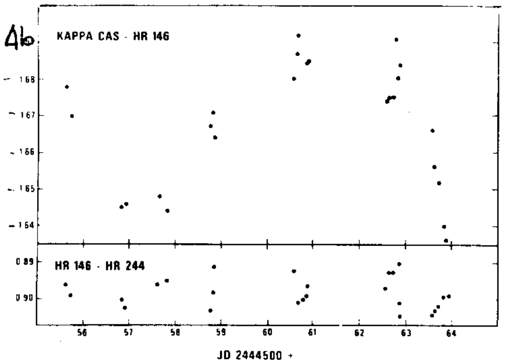

Figure 1: Light variability of κ Cas, relative to HR 146, in blue light. The lower panel demonstrates the constancy of the comparison stars HR 146 and HR 244.

On the first six nights, the hour-to-hour light variability in κ Cas is no greater than that in the comparison stars. Note that on the sixth night, the scatter is greater ($\pm0^{m}.005$) in *both* κ Cas and the comparison stars, than it is on the other five nights ($\pm0^{m}.003$). On the seventh night, κ Cas faded smoothly by $0^{m}.030$ in $0^{d}.26$. The comparison stars remained constant. Thus there is no evidence for light variability in κ Cas with a period of $0^{d}.1$, and with an amplitude $>0^{m}.01$. An amplitude of $0^{m}.06$ is certainly ruled out, at least in November 1980.

On the other hand, there is conspicuous light variability with a period of about 7^{d} and an amplitude of $0^{m}.05$. This period is close to that which would be expected due to the pulsation of a B1 Ia star (Burki 1978, but see also Maeder 1980 for a more detailed discussion of supergiant variability).

Several other B supergiants were also observed along with κ Cas: 5 Per, 9 Per, HR 1040, 55 Cyg, 9 Cep, 13 Cep and 26 Cep. In each case, there was *no* hour-to-hour variability $>0^{m}.01$, but in each case, there *was* day-to-day variability of a few hundredths of a magnitude. Such variability is often observed in B supergiants (Burki 1978).

On the other hand, hour-to-hour variability is *not* common in B supergiants; in κ Cas, it is either sporadic or non-existent.

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LIEGE SYMPOSIUM No.23

As it was announced in "a peculiar newsletter" No.5, the 23rd Liège International Astrophysical Symposium will be devoted to α^2 CVn-type variables (Ap stars) and related stars (He variables, Am stars, etc.).

It is meeting with a big success. The attendance which was initially planned to be limited to a hundred participants, will largely exceed this number in fact. The contributed papers being also very numerous the Colloquium previously fixed from 23 to 25 June 1981 will be extended by one additional day, through Friday 26.

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RADIAL AND NON-RADIAL OSCILLATIONS IN HD 116994 (V743 Cen)

HD 116994 (V743 Cen) is a large amplitude ($\Delta V \approx 0.25$ mag) δ Scuti variable which McAlary and Wehlau (1979-MW) have pointed out may be oscillating in non-radial modes. In a frequency analysis of four consecutive nights of Johnson B observations MW derived a principal frequency of 9.79 d^{-1} for HD 116994 with two subsidiary frequencies at 9.66 d^{-1} and 9.85 d^{-1}. In analogy with Shobbrook and Stobie's (1974) work on 1 Mon, they suggested that the three closely spaced frequencies in HD 116994 may be due to pulsation in rotationally perturbed non-radial *m*-modes.

Since McAlary and Wehlau's work, however, Balona and Stobie (1980a) have reanalysed 1 Mon and by applying their theory of phase shifts between the V light curve and B-V colour curve (Balona and Stobie 1980b) have shown that the frequency of highest amplitude in 1 Mon is due to radial pulsation. Similarly, the frequencies of highest amplitude in δ Scuti itself (Balona, Stobie, and Dean 1980), HD 188136 (Kurtz 1980a), and HR 1170 (Kurtz 1980b) have all been shown to be due to radial pulsation using this same technique. The suspicion therefore arises that the frequency of highest amplitude in HD 116994 may also be due to radial oscillation.

We decided to test this hypothesis by applying Balona and Stobie's theory to the B and V phases of the frequency of highest amplitude in HD 116994. Observations in both B and V colours are available in the literature for this star in the original discovery paper by Chen (1968) as well as in a subsequent analysis by Chambliss (1968). However, before actually fitting the principal frequency of HD 116994 to Chen's and Chambliss' data to find the V and B-V phases, we felt a new frequency analysis of all of the available data on HD 116994 was warranted.

Frequency Analysis

A considerable number of observations of HD 116994 are scattered throughout the literature. Table I. summarizes them.

Table I

Data for HD 116994

JD 244 0000+	Source	Colours	Comments
39243,4,8	Chen (1968)	UBV	observations given
39594,39603	Jones (1969)	unspecified	maxima only
39634,5,6,7,8	Chambliss (1968)	UBV	observations available - IAU(27). RAS-5
41445	Kilambi (1976)	*uvby*	observations given, magnitude scale inverted
42886,7,8	Geyer and Vogt (1976)	UBV	maxima only
42887,88,89,90	McAlary and Wehlau (1979)	B	observations given
43291	Balona and Stobie (private communication)	BV	observations given

Using the technique of Fourier analysis of unequally spaced data (Deeming 1975) we have reanalysed some of the above B data with the results given in Table II. The column labelled σ is the rms scatter of the residuals after prewhitening by each frequency.

Table II.

Frequencies derived for Various Subsets of the B data

Data Set	f d^{-1}	A m mag	σ m mag
Chen	(±0.19)		82.9
	9.78	109.4	29.0
	19.56	28.9	20.9
	9.90	15.7	17.5
	(±0.20)		111.4
Chambliss	9.78	153.1	31.1
	19.57	31.4	20.1
	(±0.30)		86.5
McAlary and Wehlau	9.79	119.1	20.9
	19.60	22.3	13.9
	10.57	12.8	
	or 9.60	12.4	

The frequency of highest amplitude derived from all three of these data sets is the same. This is also true of the frequency of second highest amplitude which is clearly just the first harmonic of the frequency of highest amplitude. The third derived frequency presents some problems, however.

For Chen's data we found a peak in the amplitude spectrum at $f = 9.90\ d^{-1}$, for Chambliss' data we could find no outstanding third peak, and for MW's data we found the peak at $f = 10.57\ d^{-1}$ to be slightly higher than its 1 d^{-1} alias at $f = 9.60\ d^{-1}$ which they selected.

The discrepancy between our analysis of MW's data and their analysis may have to do with our slightly different analysis techniques, but, in any case, resolution problems inhibit a thorough analysis of any of the data sets in Table II. Loumos and Deeming (1978) have shown by analysing artificial data that two frequencies of equal amplitude can only be completely resolved using Fourier techniques if they are separated in frequency space by at least $1.5/\Delta T$ where ΔT is the time span of the data set. For each of the data sets in TableII.$1.5/\Delta T$ is given in parentheses as the error in frequency. It can immediately be seen that the two frequencies at $f = 9.66\ d^{-1}$ and at $f = 9.85\ d^{-1}$ derived by MW are too close to the principal frequency at $f = 9.79\ d^{-1}$ to be completely resolved.

In order to circumvent this problem we attempted to derive the frequency of highest amplitude from all of the B data in the literature which have a time span of 4048 d (11 yr). Because each of the individual data sets span only a few days, cycle count across the yearly gaps is difficult to keep. Fortunately, the timing of Jones' observations some 40 d prior to Chambliss' observations in the same year suppress most of the yearly aliases in the amplitude spectrum. We artificially recreated Jones' data by shifting MW's light curve for JD 2442888 to match Jones' times of maximum and then produced an amplitude spectrum of all the B data listed in Table I. The frequency derived is not absolutely secure because of large 1 yr^{-1} and $\sim 1/10$ yr^{-1} aliases, but a highest peak does occur at $f_1 = 9.77708$ d^{-1}. For purposes of further analysis we adopt this frequency.

Using a multivariate least squares program we fit the principal frequency $f_1 = 9.77708$ d^{-1} and its first $(2f_1)$ and and second $3(f_1)$ harmonics to all of Chen's, Chambliss', MW's, and Balona and Stobie's B data. The amplitude of the second harmonic is a negligible 4 m mag. Our final fit of f_1 and $2f_1$ to the B data is given in Table III.

Table III.
Fit of f_1 and $2f_1$ to all of Chen's, Chambliss', MW's, and Balona and Stobie's B data

	f d^{-1}	A m mag	ϕ	σ m mag
f_1	9.77708	111±2	1.952±0.016	
$2f_1$	19.55416	26±2	1.679±0.067	39

These parameters fit the relation $\Delta B = \sum_i A_i \cos[2\pi f_i(t-t_o)+\phi_i]$ where t_o = JD 2439000.

We have determined a value of f_1 of sufficient accuracy to resolve it from secondary frequencies more than ± 0.00025 d^{-1} away. Thus the resolution problem discussed for the results in Table II. can be greatly reduced by prewhitening all of the B data by the parameters given for f_1 and $2f_1$ in Table III. and then analysing the residuals. That gives the results as found in Table IV.

For all three of these data subsets we find a frequency near $f_2 = 9.9\ d^{-1}$ and hence consider the identification of that frequency to be secure. The close spacing of f_2 to f_1 indicates that at least one of those two frequencies must be due to pulsation in a non-radial mode. From both Chambliss' and MW's data we find another frequency which, within the resolution limits of those subsets, is coincident with $2f_1$. It is impossible to say with only these data whether this coincidence is due to problems with the fit of f_1 and $2f_1$ to the data or whether a real pulsation with a frequency very near $2f_1$ is being resonantly driven.

Table IV.

Frequencies derived from the residuals of the various data sets after prewhitening by f_1 and $2f_1$ given in Table 3

Data Set		f d^{-1}	A m mag	σ m mag
Chen	f_2	9.94	21.0	17.9
		11.33	9.3	16.6
Chambliss	f_2	9.80	38.8	19.5
		19.61	12.9	17.1
MW	f_2	9.90	17.6	13.4
		10.53	8.7	11.9
		19.54	8.3	10.5

Finally we fit f_1 and $2f_1$ by least squares to Chen's and Chambliss' B and V data.

Table V.

Fit of f_1 and $2f_1$ to Chen's and Chambliss' B and V data

f d^{-1}	A_B m mag ± 1.6	ϕ_B	A_V m mag ± 1.6	ϕ_V	A_{B-V} m mag	ϕ_{B-V}	$\Delta\phi(V,B-V)$
9.77708	126.4	2.011 ± 0.013	95.1	1.975 ± 0.016	31.5	2.120 ± 0.052	$-8 \pm 3^{\circ}$
19.55416	32.0	1.788 ± 0.050	24.0	1.966 ± 0.064	9.4	1.319 ± 0.170	
	$\sigma_B = 25.2$		$\sigma_V = 22.4$				

The amplitudes and phases for B-V have been analytically derived from their B and V components and the error in phase for B-V has been estimated by scaling the phase error in B proportionally to amplitude. The last column in Table V. gives the phase shift between the V light curve and the B-V colour curve, $\Delta\phi(V,B-V) = \phi(V) - \phi(B-V)$, for f_1.

Assuming linearity, a direct relationship between B-V and surface brightness, and a phase lag between the flux and radius variations of roughly 90°, Balona and Stobie (1980b) have shown that $\Delta\phi(V,B-V)$ in an oscillating star is dependent on the pulsation mode. We expect that $\Delta\phi(V,B-V)$ should be about -11° for radial pulsation, 0° for odd-ℓ non-radial pulsation, $+16^{\circ}$ for $\ell = 2$ non-radial pulsation, and greater than $+120^{\circ}$ for $\ell \geqslant 4$ and even non-radial pulsation. From the phase shift given for f_1 in Table V. of $\Delta\phi(V,B-V) = -8 \pm 3^{\circ}$ we can conclude with good confidence that f_1 is due to radial pulsation although odd-ℓ non-radial pulsation is not absolutely ruled out. The phase shift for $2f_1$ depends on the shapes of the light curves and not on the pulsation mode of f_1.

Our conclusion then is that the principal frequency in HD 116994 is very probably due to pulsation in a radial mode and that a secondary frequency is present at about f = 9.9 d^{-1} which is due to pulsation in a non-radial mode. This is a pattern similar to that seen in 1 Mon, δ Scuti, HD 188136, and HR 1170.

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NEW LIGHT ELEMENTS OF TY URSAE MAJORIS

The variability of the short period eclipsing system TY UMa was discovered by Beljawsky (1933). The following light elements, obtained on the basis of photographic measurements, are reported in the literature:

Min I = helioc. J.D.	$2427283.443 + 0^{d}.3010392\ n$	Zverev	(1933)
	$27360.375 + 0.3011424$	"	(1937)
	$38112.392 + 0.3011432$	GCVS	(1968)
	$39651.447 + 0.3011424$	Götz	(1969)

Several hundred photoelectric B and V observations were made at the Merate Observatory during the year 1967. By least squares fitting of a parabola to observations the following times of minimum were derived:

helioc. J.D.	2439532.4971	2439614.3955
	532.6727	643.4673
	561.5685	648.4306
	562.4545	673.4247
	563.5179	676.4407
	566.5328	681.4023

From these values the new light elements follow:

$$\text{(1)}\quad \text{Min I} = \text{helioc. J.D. } \underset{\pm\quad 4}{2439532.67350} + \underset{19\ \text{m.e.}}{0^{d}.35453989\ n}$$

The period $P_s = 0^{d}.30114$ is not really the true one P, but a related period rising from the likely unfavourable time distribution of the measurements. The 1 day interval of observations and the period P give rise to spurious periods (Renson, 1980):

$$P_s^{-1} = P^{-1} \pm 1\ j^{-1} \quad (j = \text{integer})$$

With the above values the equation is fulfilled with j=2.

The twelve photoelectric instants were then combined, in a weighted least squares solution, with twenty visual or photographic times given in the literature to derive the ephemeris given below:

$$(2) \quad \text{Min I} = \text{helioc. J.D. } \underset{\pm\ \ \ \ 6}{2439532.6741} + \underset{33}{0\overset{d}{.}35453694}\ n \quad \text{m.e.}$$

The difference between the periods (1) and (2) is larger than the corresponding mean errors. However considering the short interval encompassed by photoelectric observations (about 150 days) we can only question a variation of the period. New B and V observations now in progress at the Merate Observatory will help to settle this point and to see if TY UMa undergoes seasonal light curve variations.

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VARIABILITY OF THE EXTREME SILICON STAR ALPHA Dor=HD 29305 +)

In a forthcoming paper Renson and Manfroid (1981) show this star to be variable with an extremely large amplitude in Strömgren-u of 0.1 mag. Due to the fact that Alpha Dor is a binary, Renson and Manfroid conclude from a Δm of 0.3 - 0.4 that the intrinsic variability of the Ap-component should be increased by a factor of 1.7.

The period, unfortunately, turned out to be close to 3 days that their light curves (obtained in the uvby system) exhibit 3 pronounced gaps, while the relatively large number of observations (n=39) gather at 3 equidistant phases, one around the maximum and the others at nearly the same minimum level. In the light curves of Renson and Manfroid one rather easily recognizes that the differential indices $\Delta(b-y)$, Δm_1 and Δc_1 show a markedly smaller scatter than the colour differences Δu, Δv, Δb and Δy. One plausible explanation would be a slightly variable comparison star with negligible variability in the colour differences. Manfroid (1981) offered another explanation, which is related to the type of photometer used by Renson and Manfroid:

This photometer (attached to the 50-cm Danish telescope on La Silla) records the registrations in uvby simultaneously, hence any variations of the sky transmission appear in all filters with the same amount. In the case of HD 29305 very short integration times were selected (owing to the brightness of the star) so that there was not sufficient time for the sky fluctuations to average out in the individual filter measurements. Such fluctuations, however, cancel out when forming colour differences of simultaneous filter measurements.

Hence, it is more useful in this case to look at the differential curves of b-y, m_1 and c_1 to draw some conclusions about the possible shape of the variation curve within the phase gaps.

It is especially the c_1-curve which suggests that between the minima phases there might be a secondary maximum of this variation.

As silicon stars exhibit (or seem to exhibit) less frequently double wave variations than the Ap stars of later type, it would be an interesting undertaking to obtain information also on the phase regions not covered by Renson and Manfroid.

In order to contribute to this project I have carried out measurements of this star on two photometric runs on La Silla. The first one was performed already in fall 1971 at the Bochum 60 cm telescope, the second one in Nov/Dec 1979 at the ESO 50 cm telescope. In both cases the uvbyg_1g_2 system, as described by Maitzen (1976) was used.

It is not very easy to find a good comparison star for Alpha Dor. In the first run I took HD 31203/4 (iota Pic) a visual binary as comparison star, which showed to be rather unhandy due to its separation of 12". Thus, for the second time I used HD 27647 and HD 30478 (Kappa Dor).

From the 1971 observations it was clear that the period of Alpha Dor should be related to 3 days. The same conclusion can be drawn from the observations in 1979, although by chance only 1 minimum phase could be observed. Thus, there is the problem of a period so close to a small integer number of days that it takes a long observing time during one season to cover the whole variation cycle. Another approach which should possibly be preferred is to combine observations performed from two or more observatories with sufficient separation in longitude. As there are only bright stars involved the required telescope size is rather small, hence the availability should be rather easily ensured.

The present measurements, given in Table I do not yet define an unambiguous final period, when added to the Renson and Manfroid set, since the gap between all three observing periods is too large.

Finally, from a comparison of the differences Alpha Dor minus HD 30478 and HD 30478 minus HD 27647, especially on 1979-11-24 it is clear that HD 30478 must vary within the time scale of hours. The amplitude of the variations should be within 3 or 4 percent. All this points to a Delta Sct variable.

Table I

Differential measurements.

a) Alpha Dor minus Iota Pic (=HD 31203/4)

JD - 2440000	u	v	b	g_1	g_2	y	Night Y M D
1278.80	-2.782	-2.519	-2.215	-2.116	-2.018	-1.949	711122
1279.77	846	512	223	107	038	960	23
1281.77	776	493	201	102	013	932	25
1282.75	855	519	232	123	047	964	26
1283.71	775	495	204	097	016	935	27
1285.71	-2.856	-2.512	-2.234	-	-	-1.964	711129

b) Alpha Dor minus HD 27647

4202.61	-4.628	-4.087	-3.945	-3.949	-3.918	-3.882	791124
4202.81	617	081					24
4203.60	538	058	913	916	885	841	25
4203.61	541	056	916	924	892	842	25
4203.81	543	058	917	924	894	852	25
4205.77	623	085	947	957	923	882	27
4208.62	627	085	947	955	924	887	30
4214.65	-4.613	-4.077	-3.942	-3.949	-3.920	-3.881	791206

c) HD 27647 minus HD 30478 (Comparison stars)

4202.61	1.708	1.788	1.843	1.868	1.882	1.907	791124
4202.81	1.678	1.742					24
4203.60	1.676	1.757	1.825	1.852	1.866	1.890	25
4203.81	1.685	1.755	1.824	1.850	1.869	1.890	25
4205.77	1.664	1.733	1.802	1.830	1.846	1.876	27
4208.62	1.676	1.750	1.817	1.844	1.861	1.888	30
4214.65	1.692	1.770	1.836	1.866	1.879	1.906	791206

In Table II I present the results of the absolute photometry for the 3 stars observed during the 1979 mission. The comparison star HD 27647 has had no published Strömgren parameters so far.

Table II

Absolute photometry in 1979 ($n = 6$)

HD	V	b-y	m_1	c_1	δV	$\delta b-y$	δm_1	δc_1
27647	7.172	0.039	0.191	0.988	6	2	5	5
29305	3.297	-0.030	0.120	0.610	20	3	4	34
30478	5.283	0.113	0.181	0.989	10	3	5	7

The sigmas are given in units of 0.001 mag.

It is interesting to note that the variable comparison star Kappa Dor (HD 30478) shows a relatively large mean error in the catalogue of Grønbech and Olsen (1976) in agreement with our finding.

According to the Δa-values found for Alpha Dor it should be a very mild Ap star. However, we have to take into account that the strength of the 5200 A depression is diluted by the presence of the second star which contributes a depressionless 5200-region to the measurements.

Acknowledgements are due to Prof. Schmidt-Kaler who enabled the 1971 mission and to the European working group on Ap-stars for supporting the 1979 ESO-application for observing time at the 50 cm ESO telescope.

+) Observations based on data collected at the European Southern Observatory, La Silla, Chile.

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FURTHER SPECTROSCOPIC OBSERVATIONS OF BD + 16° 516 (V 471 TAURI)

Spectroscopic observations of the white-dwarf eclipsing binary V 471 Tauri are reported. The star was observed in February 1980 and 22 spectra were obtained where, particularly H and K lines of CaII were investigated (Hamzaoğlu, 1980). Further simultaneous spectroscopic and photoelectric observations were carried out, starting from November 1980 until the second part of February 1981. The spectroscopic observations were carried out at the Astrophysical observatory of Asiago-Italy and the photoelectric observations were achieved at Ege University Observatory-Izmir. In the course of spectroscopic observations over 70 spectra with the 122 cm telescope (cassegrain), prism spectrograph (with dispersions 42 Å/mm and 40 Å/mm at λ3968 and λ3933 Å, respectively) and RCA image-tube were obtained. Some of these spectra were taken in a "single-trail" mode as suggested by Walker and Chincarini (1968). In this mode of observations the H and K double reversals (absorptions+emissions) of CaII are seen more clearly and any kind of variation, if exist can be discerned very easily. Also in the same spectra, apart from the central emission component (K_3) of λ3968 line, the two weaker emissions (K_{2r}, red displaced and K_{2v}, violet shifted) within the same absorption line are clearly visible. The radial velocities of these K_{2v}, K_{2r} emissions were determined and presented in Fig.1. The orbital elements of the star were determined using 36 spectra appropriately spaced in orbital phases. The spectral lines of KOV spectral type star were used in the determination of the mean radial velocity. From the radial velocity curves it was deduced that,

a. All spectral lines utilized in the radial velocity measurements are in absorption (as seen in KOV spectral type stars) except λ3933, λ3968 (H,K) of CaII and very likely H_α is in emission (H_α was separately observed with the 182 cm telescope and Echelle spectrograph).

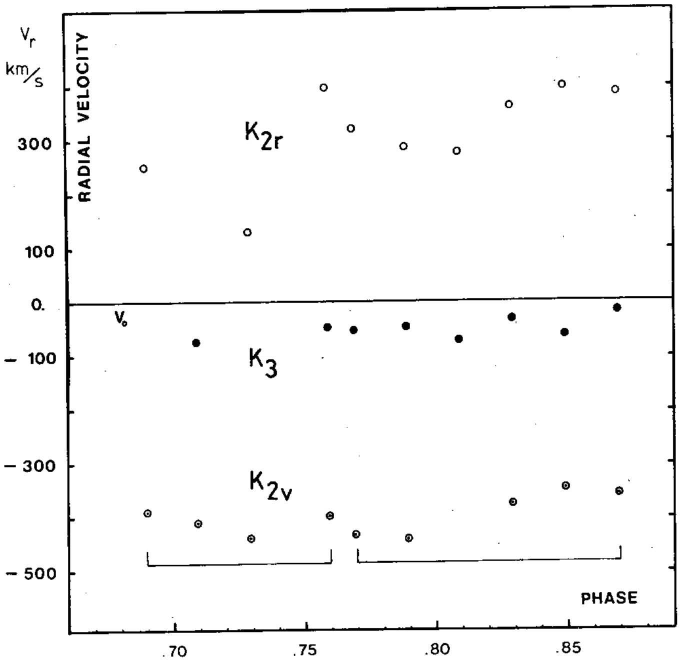

Fig.1. Displaced emission lines of the KOV component of the star. They were measured in the single-trail spectra among 0.69-0.87 orbital phases. Dots, open circles and dotted circles indicate:
a. Central emission (K_3)
b. Red-shifted emission (K_{2r}) and violet displaced emission (K_{2v}) of λ3968 Å line, relative to the baricentric γ velocity (+39 km/s) of the star. The first four spectra (0.69-0.76 phases) were obtained (January 2,1981) on the same night consecutively on the same plate. Whereas the last six spectra (0.77-0.87 phases) were obtained (December 31, 1980) in the same way (single-trail) as the first four spectra.

b. Although λ3933 and λ3968 Å emission lines of CaII are chromospheric in origin their radial velocities conform with the mean radial velocity curve.(Fig.2.)

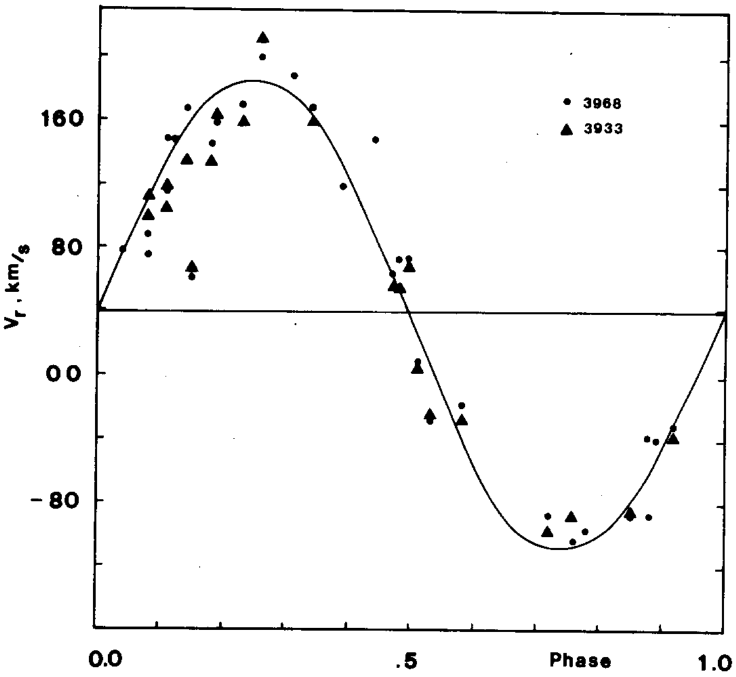

Fig.2. Observed data obtained from λ3968 and λ3933 Å emission lines of CaII. The solid curve represents the orbital elements with e=0.0, K=147 km, γ=39 km/s (Vo) and P=0.52118286 (assumed).

c. Although 4340 Å (H_γ) line (in absorbtion) appears clear and sharp in the spectra, does not conform with the radial velocity curve, obtained using the other lines within the spectra. H_γ exhibits different baricentric γ velocity values (Fig.3).

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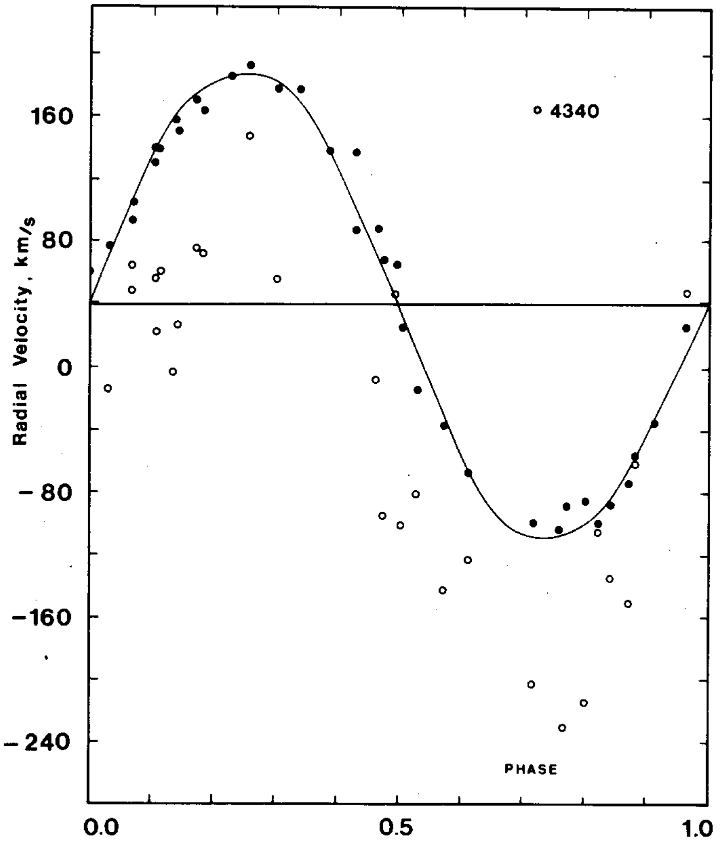

Fig.3. H_γ (λ4340 Å) data measured in the same spectra, do not conform with the radial velocity curve obtained for the elements cited in Fig.2.

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ANOMALOUS V/R VARIATION IN EW Lac

Hadrava et al.(1978), Harmanec et al.(1979), and Hirata and Kogure (1979) reported that EW Lac (HD 217050, B2 IIIpe, shell) has shown a strong change in its spectrum and colors in 1978, after a long stable shell-star phase. Poeckert (1980) has made a detailed study on the radial velocity and line strength changes in 1978 - 1979.

We have examined the spectral variation of EW Lac for the period of 1973 - 1980, on about 60 spectrograms which were obtained at the Okayama Astrophysical Observatory. Our examination has been made mainly on the V/R relation of violet (V) and red (R) emission components and the asymmetric feature of spectral line profiles. As the result we have found an anomalous V/R variation which has begun in 1975 and is still lasting in 1980.

The results of our inspection are summarized in Table I, where V/R relation is shown by an equality or an inequality between V and R components. When no emission is seen, the letter N is used instead of the respective V and R. The letters C and Z in the column of Sp denote the high- and low-dispersion spectrograms, respectively, obtained with the following spectrograph:
C = coudé spectrograph attached to the 188-cm reflector, the dispersion being approximately 10 A/mm for Hβ are bluer spectral region, and 20 A/mm for Hα.
Z = prism spectrograph attached to the 91-cm reflector, the dispersion is 72 A/mm at Hγ.

The asymmetric feature of the shell absorption profiles in higher members of the Balmer series (H10 ∿ H20) is given in Table I with the designation of: sym = symmetric, asym = asymmetric, R-fade = the wing in the red side is fading-out, and V-fade = the wing in the violet side is fading-out. In the last column is given the principal quantum number n_ℓ of the upper level of the last visible Balmer lines. The value of n_ℓ may be thought as an indicator of the development of the shell-line forming envelope (Kogure et al, 1978).

Table I. V/R variation of EW Lac

Epoch		Sp	V/R relation					Profiles of higher members	n_1
			Hα	Hβ	Hγ	Hδ	H8		
1973	V	C	–	–	–	V∼R	N=N	sym.	33
	XI	C	V=R	V=R	V=R	V∼R	N=N	sym.	36
1974	VIII	C	V=R	V=R	V=R	V∼R	N=N	sym.	36
	X	C	V=R	V∼R	V∼R	V∼R	N=N	sym.	40
1975	XI	C	V=R	V=R	V∼R	V≳R	V≳N	slightly asym. (R-fade)	34
	XII	Z	–	V∼R	V≳R	V≳R	–	(sym.)	–
1976	VIII	Z	–	V∼R	V≳R	V≳R	–	sym.	–
	XI	C	–	V≲R	V∼R	–	–	–	–
1977	VIII	C	–	–	–	V>N	V>N	asym. (R-fade)	36
	X	C	V≲R	–	–	V>N	V>N	asym. (R-fade)	36
1978	XI	C	V∼R	V>R	V>R	V>N	V>N	asym. (R-fade)	37
1979	V	C	–	–	–	V>N	N<R	nearly sym.	31
	VIII	C	V>R	–	V>R	V∼R	N<R	asym. (V-fade)	32
	XI	C	V>R	V>R	V∼R	V<R	N<R	asym. (V-fade)	35
1980	VII	C	–	–	V<R	V<R	N<R	asym. (V-fade)	–
	IX	Z	–	V≳R	V<R	N<R	N<R	asym. (V-fade)	–
	XI	C, Z	V>R	V<R	V<R	N<R	N<R	asym. (V-fade)	36
	XII	Z	–	V<R	V<R	N<R	N<R	asym. (V-fade)	–

From Table I we readily see that the asymmetric profiles can be traced back as early as 1975 in Hδ and H8, and, since then EW Lac seems to have entered a new phase of anomalous V/R variation, which is characterized by a kind of propagation of V/R relation from higher to lower members of the Balmer series.

The characteristic feature of this V/R variation may be stated as follows.

(1) Successive appearance of two opposite types of V > R and V < R propagation. The first V > R propagation has started in 1975 from H8 and reached Hα about 4 years later. The duration of the same V > R relation for each Blamer line is 2 ∿ 4 years. The second V < R propagation has started in 1979 from H8 and reached Hβ in 1980. The time scale may be the same as before.

(2) Association with the asymmetric profiles of higher members of the Balmer series. The first V > R propagation is related with the F-fade asymmetry, whereas the second V < R propagation is with the V-fade asymmetry.

(3) Relationship with the value of n_ℓ. The value of n_ℓ takes its minimum at the onset of V/R propagation (n_ℓ = 34 in 1975 and 31 in 1979) and increases gradually up to its maximum at the end of the same phase of V/R propagation (n_ℓ = 37 in 1978).

Complicated behavior of this anomalous V/R variation offers an interesting theoretical problem. If we adopt the eccentric rotating ring model suggested by Huang (1973, 1975), the successive V > R and V < R propagation may be explained qualitatively by adopting multiple eccentric rings whose major axes are oriented to progressively rotated directions. Quantitatively, however, this simple model involves many difficulties. Particularly, an important point to be explained is why EW Lac has entered a new phase of anomalous V/R variation after a long stable period. Further investigations observational as well as theoretical are much desired.

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LIGHT CURVE VARIATION AND PERIOD BEHAVIOUR OF SW LACERTAE

SW Lac, the eclipsing binary of the W UMa type is known from the variable light curve and its period behaviour.

SW Lac was observed photoelectrically by us in the autumn 1975 and in the autumn 1980. In 1975 the observations were made with the 60 cm Cassegrain telescope of the Warsaw University Observatory in Ostrowik. In September 1980 SW Lac was observed using the 50 cm reflector of the Konkoly Observatory (Piszkés-tetö Mountain Station). Moreover since October to December 1980 we observed this star with the 20 cm Zeiss refractor of the Torun Observatory in Piwnice. All the measurements were made with the Johnson BV (UBV - Konkoly Observatory) filters and reduced to the standard system. In both seasons the same comparison star was used (BD + $37^{\circ}4715$). The Kwee and van Woerden method (1956) was utilized to determine 13 moments of minima (7 primary, 6 secondary). All the observations and minima will be published in Acta Astronomica (Mikolajewska, Mikolajewski 1981).

The minima obtained by us and also all the UBV minima determined by other authors in the interval 1975-1980 were plotted in the O-C diagram (Fig.1) using the ephemeris given by Faulkner and Bookmyer (1978):

$$\text{JD HEL MIN I} = 2443459.74760 + 0\overset{d}{.}3207216 \cdot E \quad (1)$$

The obtained results lead to the following conclusions:

1. The period of SW Lac changed suddenly probably in 1977. Two linear elements of light were determined by least squares solutions:

$$\text{JD HEL MIN I} = \underset{\pm 31}{2443459.74772} + \underset{\pm 2}{0\overset{d}{.}3207168}\ E \qquad (2)$$

for the interval 1975-1977 (8 primary minima).

$$\text{JD HEL MIN I} = \underset{\pm 20}{2444499.52671} + \underset{\pm 1}{0\overset{d}{.}3207215}\ E \qquad (3)$$

for the interval 1977-1980 (16 primary minima).
So the period increased by $\Delta P = \underset{\pm 2}{0\overset{d}{.}0000047}$.

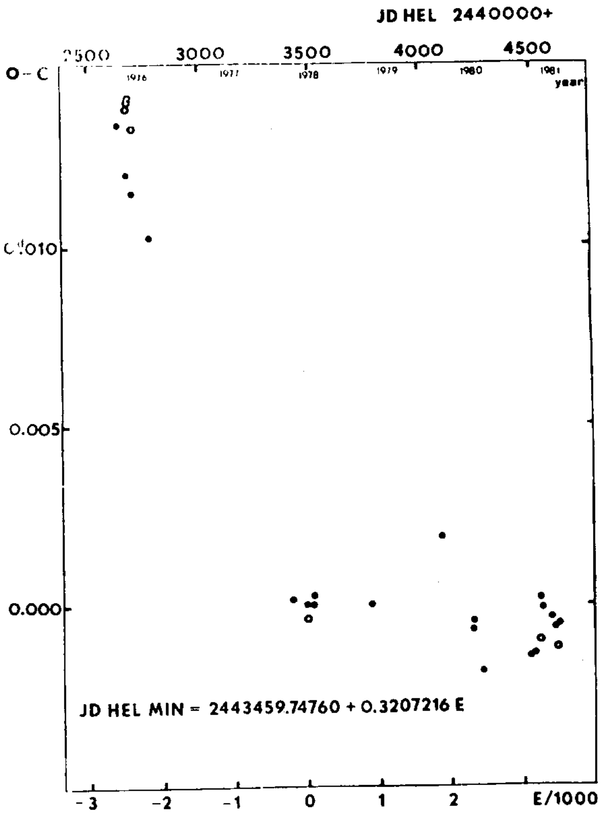

Fig.1. Recent period variation of SW Lac from UBV observations. Times of minima are taken from: Mikolajewska, Mikolajewski 1981,

Faulkner, Bookmyer 1978, Ebersberger et al. 1978, Pohl, Gulmen 1981, Pohl, Kizilirmak 1976, Aslan et al. 1981: Dots represent the primary minima, open circles the secondary. The average error of the individual point is $0^{d}.0001$-$0^{d}.0003$.

2. The elements determined by Faulkner and Bookmyer (1978) using only 4 minima are in good agreement with the average calculated from all minima observed during 1977-1980.
3. Although there are not many minima observed during 1977-1980 it seems that the period was undergoing fluctuations around the average value given in (3).
4. Using the times of 5 primary minima obtained by us in the autumn 1980 we have determined new elements with good accuracy:

$$\text{JD HEL MIN I} = \underset{\pm 3}{2444499.52716} + \underset{\pm 2}{0^{d}.3207186} \cdot E \quad (4)$$

It results from the above that the period decreased again by $\Delta P = \underset{\pm 2}{0^{d}.0000029}$. If it is not a temporary fluctuation of the period, then these elements will predict epochs of minimum light in the near future.

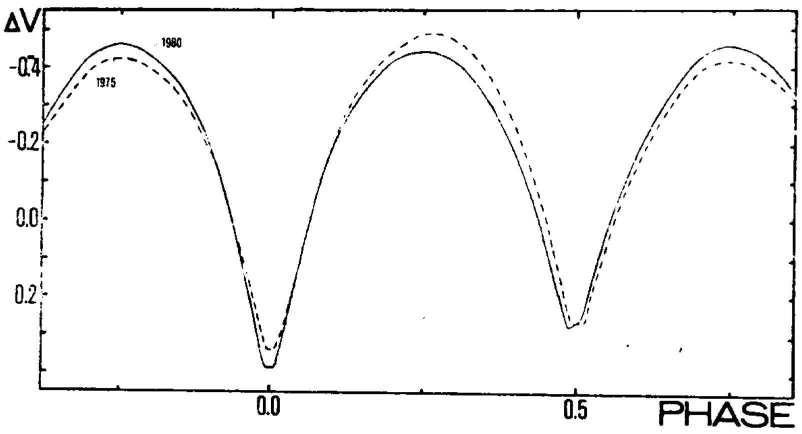

Fig.2.Schematic average V light curves of SW Lac obtained in 1975 (broken line) and 1980 (continuous line).

Fig.2 presents schematic average V light curves obtained by us in 1975 and 1980. The preliminary analysis of our observations leads to some conclusions:

1. Both curves are very asymmetric.
2. The depths of both minima were changing from night to night up to about $0^{m}.05$ in both seasons.
3. The mean V-brightness in 1975 and 1980 decreased by about $0^{m}.1$ in comparison to that in the period 1965-1969 (Ruciński 1968, Semeniuk 1971, Stępień 1980). It seems that similar changes occurred in 1953-1962 (Bookmyer 1965).
4. In 1975 the maximum following the primary minimum was higher than that following the secondary. All the prevailing observations of the V light curves and that in 1980 show the maximum following the primary minimum lower than that following the secondary, although some fluctuations of the difference in the height of maxima seem to occur (Ruciński 1968). Taking into consideration our observations and the earlier ones, one can find the periodicity of these changes amounting 10÷13 years. This can be adequate to the spot activity cycle or may be caused by the drift of the spotted region on the more massive component surface.
5. The additional peculiarity of the light curve from 1975 is that the secondary minimum appears on the average later than 0.5 phase while the prevailing observations and those of 1980 show the shift of the secondary towards the preceding primary (Bookmyer 1965, Ruciński 1968). This is also visible on the 0-C diagram. We have confirmed that the secondary minimum is always shifted towards the lower maximum. Bookmyer (1965) mentioned the correlation between the difference in heights of maxima and displacement of secondary minimum from phase 0.5. It is possible to explain this by the existence of dark spots on the more massive component (Binnendijk 1970).
6. The average colour indices in the extrema of the light curves are very close to those obtained by other authors and favour the hypothesis about the strong dark spot activity on the W UMa systems (Stępień 1980).

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ELEMENTS FOR V1714 Sgr

V1714 Sgr, a long period variable at $17^h 46^m 33^s$, $-29° 30'.6$ (1900), was discovered by L. Plaut (1958), who was, however, unable to derive a period. Fourteen images brighter than magnitude 15.0 (photographic) or 14.0 (red) have been found in a search of the plate collections at the Harvard College and Maria Mitchell Observatories. The earliest is from 1889, the most recent from 1972. These occur within ± 53 days of the following mean elements:

$$JD_{max} = 2433527 + 532\ E.$$

The photographic range is 13.6 to fainter than 17. A seventeenth magnitude image seen on deep plates when the variable is near minimum apparently belongs to another star.

The search was carried out by Margaret Lyons, Marion Wolfson, and Karen McTigue. Financial support came from the National Science Foundation and Earthwatch/Center for Field Research.

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TU Men, A NEW MEMBER OF THE SU UMa SUBGROUP OF DWARF NOVAE *

TU Men = S 6732 was first discovered by Hoffmeister (1961 and 1963), who also classified it as an U-Geminorum star with a brightness range of 11 - 17 p. During 1963 and 1978 TU Men has been observed in 2193 nights by several members of the VSSRASNZ (Bateson 1979). On these observations Bateson based his assumption that one could distinguish two groups of outbursts: Faint eruptions ($m_V \simeq 13^m\!.5$), which last approximately 1 day and recur every 37 d, and bright eruptions ($m_V \geqslant 12^m\!.5$), which last 4 - 20 days recuring every 194 days.

TU Men therefore seemed to possess two characteristics of SU UMa stars, recently defined by Vogt (1980).

A third, and probably the most important property of SU UMa stars - periodic superhumps during a superoutburst -, has been detected during an observation run at the European Southern Observatory at La Silla, where photometry and spectroscopy of TU Men was performed. (For more details see Table I.)

The light curve, recorded during a time interval of 16 days, is shown in Fig. 1. It should be mentioned that Bateson (1980) reports a visual brightness of $11^m\!.6$ for TU Men at JD 2444557, so that the duration of the supermaximum exceeds 22 days, as can be seen from Fig. 1.

Figure 1 also demonstrates the periodic superhump phenomenon. The amplitude of the variations decreases from $\Delta m = 0^m\!.36$ during the first two nights to $\Delta m = 0^m\!.13$ at the end of the observations.

---

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

Table I

Date	HJD Start 2444500 +	End	Telescope	Filter	Integr. time
1980-11-20/21	64.543	64.854	62cm Bochum	white	1 sec
1980-11-20/21	64.73	64.85	50cm Danish	u,b,v,y	10 sec
1980-11-21/22	65.520	65.770	62cm Bochum	white	1 sec
1980-11-22/23	66.520	66.631	62cm Bochum	white	~5 min
1980-11-23/24	67.527	67.653	62cm Bochum	white	1 sec
1980-11-27/28	71.536	71.780	62cm Bochum	white	1 sec
1980-11-30/01	74.670	74.837	1.5m Danish	white	1 sec*
1980-12-01/02	75.635	75.840	1.5m Danish	white	1 sec*
1980-12-02/03	76.561	76.687	1.5m Danish	white	1 sec*
1980-12-03/04	77.587	77.684	1.5m Danish	white	1 sec*
1980-12-04/05	78.564	78.704	1.5m Danish	B	1 sec
1980-12-04/05	78.535	78.710	1m ESO	I	1 sec
1980-12-05/06	79.545	79.667	1m ESO	B/R	5 sec

Table I: Journal of observations: Photometry
During the nights 1980-11-24/25/26/27 and 1980-11-28/29 the brightness of TU Men was determined at a time between the superhumps during the nearly constant phase in order to record the progress of decline from supermaximum.

* high speed photometry and simultaneously spectroscopic observations at the 1.5m ESO telescope

The superhump-timings cannot be described by a constant period: With a period P determined from the first two nights, one gets a phase shift of maximal 1.4 P for the last recorded superhump. So, as in the case of VW Hyi (Häfner et al., 1979) and YZ Cnc (Patterson, 1979), a linear decreasing period has been adopted for the superhumps. A least square fit to the observed timings of maximal brightness yields the following ephemerides:

$$\mathrm{HJD} = 2444564.58\underset{\pm 3}{4} + .126\underset{\pm 15}{25}E - \underset{\pm 1}{6.1} \times 10^{-6}E^2$$

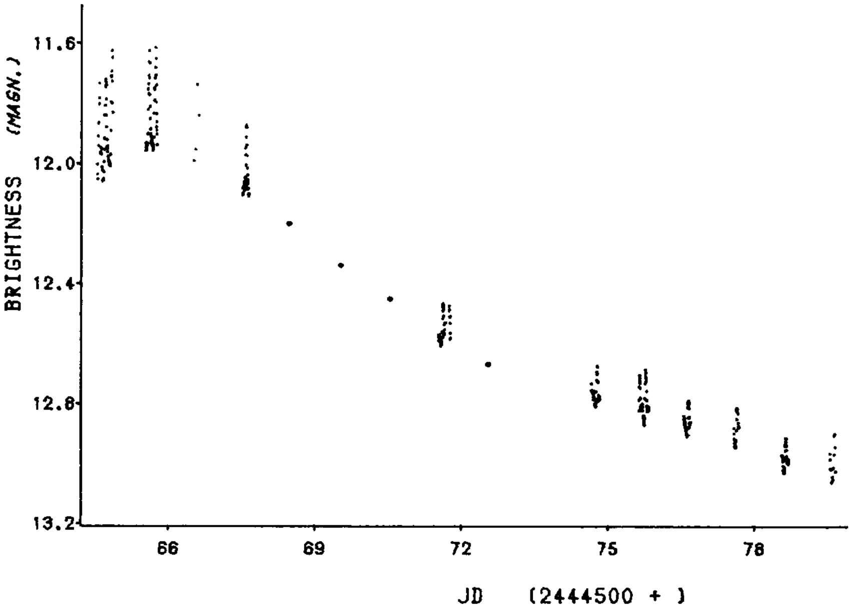

Fig. 1. Light curve of TU Men over the whole observing run (1980, Nov. 20 - Dec. 6). For the reduction of measurements, star "E" from Bateson et al. (1977) was used as comparison star for TU Men.

Note: For the last two nights the B-measurements are displayed.

The most striking fact is the long superhump period P_S, which is the longest known until now. If one accepts that the orbital period P_O of TU Men is slightly different (± 3 - 4 %) from P_S, as for other SU UMa stars (Vogt, 1980), then the value of P_O lies in the range of 3^h. As in the case of YZ Cnc (Patterson, 1979) this indicates that the SU UMa stars are not restricted to the ultrashort dwarf novae with $P_O \leqslant 2^h$.

A more detailed analysis of the photometry of TU Men together with an analysis of the spectroscopic observations will be published elsewhere.

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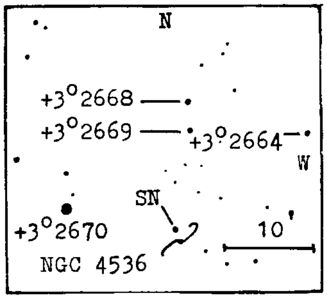
COORDONNÉES DE SUPERNOVA 1981 DANS NGC 4536

2 Mars 1981 Tsvetkov (URSS) a découvert une supernova dans NGC 4536. 9 Mars 1981 nous avons la photographié avec le télescope de Maksutov 35/50/120 de notre observatoire an utilisant l'émulsion ORWO ZU 21 9 x 9 cm.

Le cliché a été mesuré à l'aide d'Ascorecord. Les coordonnées de supernova ont calculées par la méthode de Turner.

En même temps on a déterminé la position de galaxie NGC 4536. Les coordonnées de supernova et celles de NGC 4536 ont données dans la table.

Objet	$\alpha 1950.0$	$\delta 1950.0$
Supernova	$12^{h}31^{m}56^{s}.25$	$+2^{\circ}28'31''.1$
NGC 4536	$12^{h}31^{m}53^{s}.68$	$+2^{\circ}27'47''.7$



En qualité de répere nous avons pris les étoiles de FK3: +3°2669, +3°2670, +3°2664, +3°2665, +2°2554 et +2°2556.

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VARIABLE STARS IN THE PLEIADES CLUSTER

From October 22 till November 27, 1980, we performed photometry on 8 late G and early K type stars in the Pleiades cluster. From previous measurements on these type of stars in this cluster it looked as if many of them are variable. The 8 stars, which were measured with the Walraven photometer on the Dutch 91 cm telescope (Lub, 1979) on La Silla, ESO, form a random choice of G and K type stars in the cluster. All of these stars are members according to their proper motions and distance moduli. The selected stars are given in Table I The numbers are from Hertzsprung (1947).
All of these 8 stars turned out to be variable according to our measurements and for 5 of them a lightcurve was obtained. Also two of the comparison stars are variable, but for only one of them a light curve could be obtained. The light curves and the periods are given in Figures 1a and 1b as differences, in 10log(I) for the V-channel, between the given star and substandard for the cluster, star 804. The zero points for the phase calculations were JD=2444534.5 for star 34 and JD=2444542.5 for all others.

Table I

Invest. stars		Comp. stars		local standard	
Hz	m_V	Hz	m_V	Hz	m_V
746	11.28	745	9.45	804	7.84
129	11.45	164	9.53		
1220	11.83	1132	9.43		
34	12.04	25	9.47		
1124	12.30	1122	9.29		
1883	12.57	1797	10.10		
879	12.81	727	9.27		
686	13.35	745	9.45		

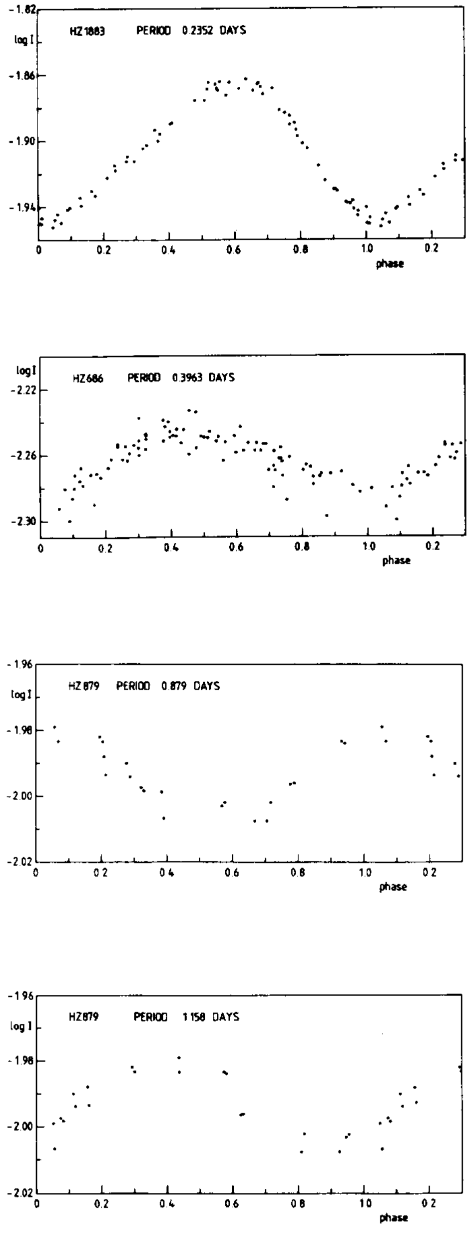
HZ 1883 PERIOD 0.2352 DAYS
log I
-1.82
-1.86
-1.90
-1.94
0
0.2
0.4
0.6
0.8
1.0
0.2
phase
HZ 686 PERIOD 0.3963 DAYS
log I
-2.22
-2.26
-2.30
0
0.2
0.4
0.6
0.8
1.0
0.2
phase
HZ 879 PERIOD 0.879 DAYS
log I
-1.96
-1.98
-2.00
-2.02
0
0.2
0.4
0.6
0.8
1.0
0.2
phase
HZ 879 PERIOD 1.158 DAYS
log I
-1.96
-1.98
-2.00
-2.02
0
0.2
0.4
0.6
0.8
1.0
0.2
phase

Fig.1.a

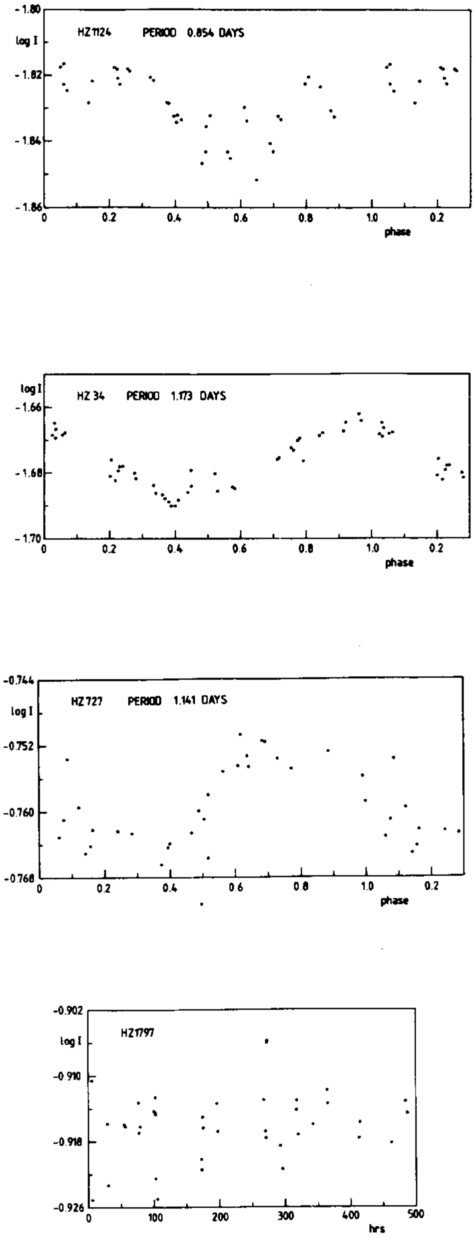
HZ 1124 PERIOD 0.854 DAYS
log I
-1.80
-1.82
-1.84
-1.86
0
0.2
0.4
0.6
0.8
1.0
0.2
phase
HZ 34 PERIOD 1.173 DAYS
log I
-1.66
-1.68
-1.70
0
0.2
0.4
0.6
0.8
1.0
0.2
phase
HZ 727 PERIOD 1.141 DAYS
log I
-0.744
-0.752
-0.760
-0.768
0
0.2
0.4
0.6
0.8
1.0
0.2
phase
HZ 1797
log I
-0.902
-0.910
-0.918
-0.926
0
100
200
300
400
500
hrs

Fig.1.b

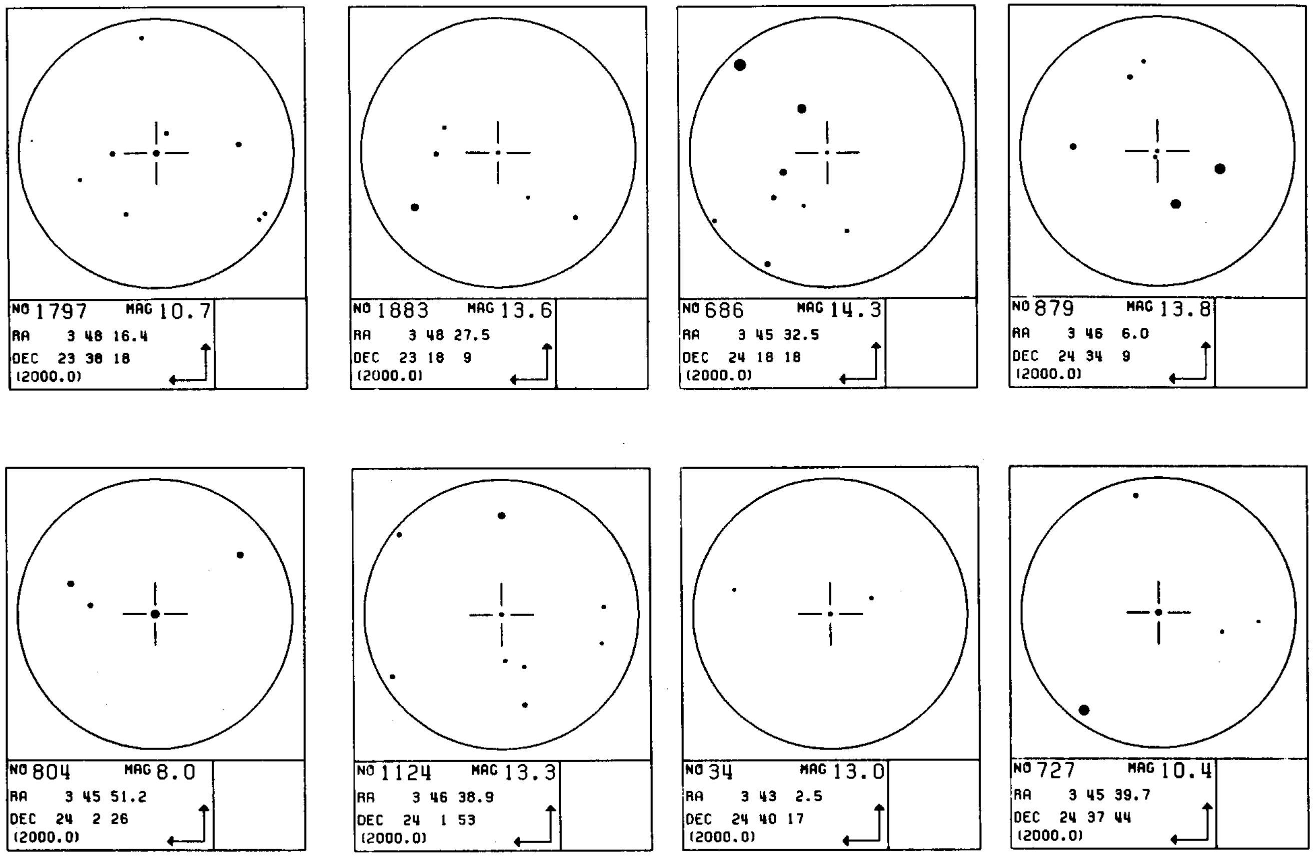
NO 1797 MAG 10.7
RA 3 48 16.4
DEC 23 38 18
(2000.0)
NO 1883 MAG 13.6
RA 3 48 27.5
DEC 23 18 9
(2000.0)
NO 686 MAG 14.3
RA 3 45 32.5
DEC 24 18 18
(2000.0)
NO 879 MAG 13.8
RA 3 46 6.0
DEC 24 34 9
(2000.0)
NO 804 MAG 8.0
RA 3 45 51.2
DEC 24 2 26
(2000.0)
NO 1124 MAG 13.3
RA 3 46 38.9
DEC 24 1 53
(2000.0)
NO 34 MAG 13.0
RA 3 43 2.5
DEC 24 40 17
(2000.0)
NO 727 MAG 10.4
RA 3 45 39.7
DEC 24 37 44
(2000.0)

Fig. 2.

Star 1883 shows clearly a BY Draconis lightcurve but has a rather short period for this type of star. Like most of the BY Draconis stars this star is a flare star (Haro et al, 1973). The light curve is stable within 0.003 magnitudes in the V band, which, together with the short period, rules out the possibility of rotational variation. Variations like described by Hartmann and Rosner (1979) in the form of modifications of the convective energy transport seem much more likely.
Star 686 is also known as a flare star (Haro et al, 1966, 1972). The period of star 686 is not certain; a period of 1.98 days seems also possible, for which the amplitude would probably be larger. For star 879 two periods are given, of which the shorter one seems more likely. Star 1124 showed a minimum which was getting deeper during our observing period. The period for star 34 was difficult to obtain because of the rather bad coverage of the light curve. The stars 686, 879, 1124 and 34 are possibly also BY Draconis stars. Star 727 seems a regular variable star, but the light curve and thus the type are still uncertain. No light curve could be obtained for star 1797.
For all of these stars and for star 804 search maps are given in Figure 2. The diameter of each field is 12', the magnitudes indicated are photographic magnitudes and the limiting magnitude is around m_v=13.5

A paper on star 1883 together with Dr. M. Walker of Lick Observatory, who did radial velocity measurements on this star, is in preparation.

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VARIABLE STARS IN THE LSS CATALOGUE

Among the 5132 objects contained in Stephenson and Sanduleak's (1971) catalogue of "Luminous Stars in the Southern Milky Way" are a considerable number of variable stars. Most of those known at the time were noted as such in the catalogue but, of course, many additional variables have been found since its publication. Table I lists those stars of the catalogue that are now, to the writer's knowledge, either named variables or contained in the two catalogues of stars suspected of variability. The literature search included the 3rd edition of the GCVS, its three supplements, and the 62nd through 65th variable-star naming lists (I.A.U. Var. Star Bull. Nos. 1248, 1414, 1581,and 1921). A few additional as-yet unnamed variables are also known but are not included.

The objective-prism spectral classifications of the LSS catalogue are generally expressed in terms of the OB natural group nomenclature, as is also true for the similar Case-Hamburg northern-hemisphere luminous star survey. Their significance can be judged by reference to Fig. 1, prepared by N. Sanduleak, of the writer's (1972) paper. In many cases actual MK types are also available in the literature, but this is not generally true for the fainter stars. The U Geminorum star CZ Orionis (LSS 30, OB$^-$) and the large-range 8.8-day eclipsing binary AI Sagittarii (LSS 4851, OB),among others, are especially notable in this regard. It is also worthy of mention that the LSS catalogue gives accurate coordinates and useful charts for all of its entries.

TABLE I

VARIABLE STARS IN THE LSS CATALOGUE

LSS No.	Spectrum	Name or Susp. Var. No.	LSS No.	Spectrum	Name or Susp. Var. No.
30	OB^{-}	CZ Ori	1571	OB	V348 Car
38	OBce	FR CMa	1578	F3 I	102640
71	F2 II	102512	1644	OB	V369 Car
94	OB^{-}	EY CMa	1679	OB^{-}	V380 Car
98	WC	EZ CMa	1685	OB^{-}	V381 Car
104	OB^{-}	6531	1761	WNh	101151
110	OB^{+}le!h	V644 Mon	1768	WC	102653
156	OB	V569 Mon	1799	OB	DW Car
167	OB	FN CMa	1839	OB(ce)	QZ Car
177	OB^{-}ce, (h)	FV CMa	1868	OBle!p	η Car
245	OBce, h	HI CMa	1883	OB	101159
255	OB^{-}	GY CMa	1885	F5 II	SX Car
306	OB	UW CMa	1968	OB^{-}	AA Vel
312	OB^{-}	NV Pup	2008	OB	HH Car
414	F5 II(r)	VZ CMa	2033	OBce,le,h	GG Car
418	OB^{-}ce	FY CMa	2035	OBce,le,h,r	AG Car
509	F6 I-II	VX Pup	2076	WC5	102656
548	OB^{-}h	OW Pup	2091	OB^{-}	HI Car
804	G0 Ih	PW Pup	2117	OB or B7 II	102657
824	OB^{-}	KY Pup	2151	OB^{+}(le)	QU Car
980	WR	γ Vel(A)	2154	WNh	102659
1006	OB^{+}ce,le,h	MX Pup	2217	OB	6824
1094	OB^{+}le!h	FY Vel	2232	OB	EM Car
1162	OBh	102598	2237	A7 Ib	6825
1180	OB^{+}le,h	GW Vel	2258	F4 II	GI Car
1214	OB^{+}	102608	2268	OB	GL Car
1227	OB^{+}	GP Vel	2361	OB	V808 Cen
1255	OB^{+}	GX Vel	2369	A: I:	V809 Cen
1265	A5 Ib	6701	2370	OB	TU Mus
1317	OB	6725	2374	F0 Ib	o^{2} Cen
1334	OB^{-}	102624	2417	OB(ce)	LW Cen
1365	OB	6754	2427	OB	102670
1376	F8 II	GX Car	2432	OB	BH Cen
1440	WCh	102634	2458	OB^{-}	MO Cen
1444	OB:le,r	1575	2464	OB^{-}	V346 Cen
1446	OBh	QY Car	2468	OB^{-}	V644 Cen
1489	OB^{-}	6778	2471	OB	MP Cen
1490	OB^{-}	CO Car	2501	OB^{-}	SV Cen
1495	OB^{-}	HP Car	2502	OB^{+}ce,h	V801 Cen
1523	OB^{+}le,h,r	HR Car	2511	OB	V350 Cen

TABLE I (cont.)

VARIABLE STARS IN THE LSS CATALOGUE

LSS No.	Spectrum	Name or Susp. Var. No.	LSS No.	Spectrum	Name or Susp. Var. No.
2515	OB	LZ Cen	3899	OB_ + WR:	V884 Sco
2639	OBce	AB Cru	3917	OB$^-$	V616 Ara
2662	OB$^+$le,h,r	BI Cru	3928	OB$^+$le,h	2944
2788	A5 Iab	102717	3939	OB	V457 Sco
2800	OB$^+$	BS Cru	4012	OB	101636
2806	OBh	BT Cru	4070	OB_	V474 Sco
2807	OB	BU Cru	4181	OB$^-$	V499 Sco
2808	OB_	BV Cru	4193	OB$^-$	V700 Sco
2816	OB$^-$	BW Cru	4225	OB	101659
2879	OBh	6978	4237	OB$^+$	101660
2900	OB	1980	4332	F8 I	V905 Sco
2933	WCh	θ Mus	4338	OB$^+$	V2076 Oph
3024	F8_Ib-II	V378 Cen	4340	Nova	V2024 Oph
3043	OB$^-$	V606 Cen	4356	OB$^+$le,h	V3892 Sgr
3044	OB	7023	4368	WR	V3899 Sgr
3185	OB$^-$	QS Cen	4469	OB$^+$ce,le,h	V771 Sgr
3271	OB$^-$(ce),n	7144	4571	OB	7750
3311	OB$^-$h	7170	4700	OB	V3903 Sgr
3331	OB$^-$	7175	4791	B6 Ib	μ Sgr
3625	OB$^+$	QU Nor	4851	OB	AI Sgr
3646	OB$^+$	102803	4954	OB$^+$r	V4029 Sgr
3654	OB$^-$	μ Nor	4956	OB$^+$r	V4030 Sgr
3672	OB$^+$	V918 Sco	5021	OB$^+$r	V430 Sct
3785	W(N)h	V919 Sco	5024	OB$^+$h,r	RY Sct
3807	OB$^+$	V900 Sco	5061	OB$^-$	V2349 Sgr
3822	OB$^-$	V920 Sco	5077	F2 II	V Sgr
3834	OBle,h	CL Sco	5079	F5 I:	X Sct
3850	OB_	V861 Sco	5123	OB$^+$	MV Sgr
3854	OB$^-$	102812			
3890	OB	102814			

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SPECTRAL CHANGES IN GK PER (1901)

The old nova GK Persei (1901) has been spectroscopically observed during the February-April 1981 outburst with the 122 cm and 182 cm reflectors of the Observatory of Asiago.

An Echelle spectrogram in the Hα region (disp. 16 Å/mm) taken on March 27.83 UT, when the star was near its light maximum (cf. IAUC 3574, 3587), shows an inverse P Cyg profile.

A prism spectrogram (disp. 60 Å/mm at Hγ) obtained on April 2.85 UT, during the early decline ($m_V \approx 11.6$, from plates obtained at Asiago with the 90/65 cm and the 50/40 cm Schmidt telescopes), shows that the HeIIλ 4686 emission is considerably stronger than in all our previous spectra until January 1981. The intensity ratio Hβ/HeIIλ 4686 has changed from $\geqslant 2.3$ (light minimum) to 1.2 (early decline).

On April 14.82 UT and 15.81 UT, during the late decline, two grating spectrograms (disp. 120 Å/mm) show a marked weakening of all the emissions: faint Hα, barely visible Hβ and HeII and no trace of Hγ.

Such a behaviour, also observed during the outburst of some U Gem stars (see Warner,B.:1976, IAU Symp.No.73,p.85), indicates that the H emission decrement is larger than the absorption decrement.

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RW Dor, LIGHT CURVE AND STUDY OF THE PERIOD

The variability of RW Dor (HV 2435, Bph ≃ 10.8) was announced in Harv. Ann. 60, 100, 1908. Hertzsprung (B.A.N., II, 77, 1925) determined the first photographic elements and found a light curve of W UMa type; he quotes the spectral type K5 as given in Harv. Bull. 754, 1921, suggesting the star to have dwarf characteristics and a sensible proper motion. Schilt (B.A.N., III, 88, 1925) published an improved photographic light curve, he obtained a difference in depth of minima of 0.11 mag and estimated preliminary geometrical elements. Further, Hertzsprung (B.A.N., IV, 146, 1928) published photographic minima and a period P= $0^{d}.14273194 \pm 0^{d}.00000006$. These elements are given in the GCVS (Kukarkin et al. 1969) and in the Finding List I.B.S. (Wood et al. Philadelphia, 1980). Jones (M.N.R.A.S., 85, 1924-5) measured the proper motion of RW Dor and Dworak (I.B.V.S., 846, 1973) computed the photometric parallax including the system among the the eclipsing binaries within 100 ps from the sun. These data confirmed Hertzsprung's 1925 suggestion.

We included RW Dor in our programme of UBV photoelectric observations at the Bosque Alegre Station of Cordoba Observatory. From about 500 observations obtained in 1979-1980 we derived eight times of minimum light for each pass-band of the UBV system. The colour-average of these minima are listed in Table I (mean errors are in parenthesis) together with the photographic minima published by Hertzsprung (1928).

A linear least squares ephemeris for Hertzsprung values gives,

$$(1)\qquad \mathrm{PM} = \mathrm{JD\ Hel}\ 2418240.3154 + 0^{d}.28546389 \times E',$$
$$\pm 0.0015 \pm 0^{d}.00000010\ \mathrm{m.e.}$$

while for our photoelectric data we obtain

$$(2)\qquad \mathrm{PM} = \mathrm{JD\ Hel}\ 2444514.97510 + 0^{d}.28546261 \times E'',$$
$$\pm 0.00020 \pm 0^{d}.00000053\ \mathrm{m.e.}$$

The above light elements show that the period has not changed within the errors since 1920's. Therefore all minima (Table I) have been included in the analysis for a linear ephemeris, giving

$$(3)\qquad \mathrm{PM} = \mathrm{JD\ Hel}\ 2430938.60171 + 0^{d}.285463812 \times E,$$
$$\pm 0.00078 \pm 0^{d}.000000016\ \mathrm{m.e.}$$

Table I

Minima of RW Dor

Min	Colour	J.D. Hel (2400000+)	E	(O-C)	(O-C)'	(O-C)"	Remarks
II	Pg	11298.835	-68799.5	0.0008	0.002		1
II	Pg	14168.883	-58745.5	-0.0044	-0.004		1
II	Pg	15621.901	-53655.5	0.0028	0.003		1
II	Pg	16013.836	-52282.5	-0.0040	-0.004		1
II	Pg	16489.714	-50615.5	0.0058	0.006		1
I	Pg	17075.903	-48562	-0.0051	-0.005		1
I	Pg	23784.600	-25061	0.0069	0.005		1
I	Pg	24172.537	-23702	-0.0014	-0.004		1
II	BV	44313.5813(10)	46853.5	0.0008		0.00007	2
II	BV	44464.8764(10)	47383.5	0.0002		-0.00002	2
I	UBV	44581.7728(8)	47793	-0.0009		-0.00055	2
I	UBV	44608.6063(5)	47887	-0.0010		-0.00059	2
II	UBV	44608.7488(6)	47887.5	-0.0012		-0.00073	2
II	UBV	44609.6063(8)	47890.5	-0.0001		0.00029	2
I	UBV	44609.7493(5)	47891	0.0002		0.00062	2
II	UBV	44610.7487(9)	47894.5	0.0005		0.00092	2

Remarks: 1/ Hertzsprung (1928), 2/ Present observations.

The cycles E and residuals (O-C) of these elements are listed in columns 4 and 5 of Table I, while (O-C)' and (O-C)" from (1) and (2) are in columns 6 and 7. Note that the cycles E' and E" are not given in Table I and that their zeros are different.

The differential light curves corresponding to the nights of January, 3, 4, 5 and 6, 1981, are displayed in Figure 1. They are relative to an uncatalogued star ($\Delta\alpha = 28^{s}.8$ E, $\Delta\delta = 6' \, 30''$ N)

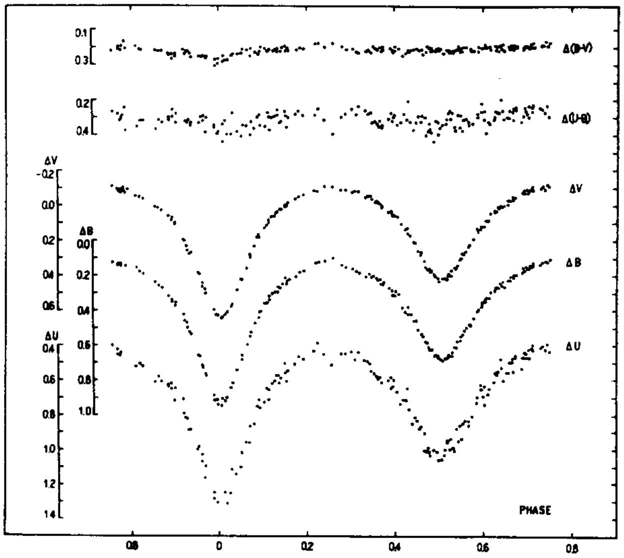

Figure 1.

of about the same colours. It is seen that the light curve of RW Dor is similar to a W UMa star as previously classified, however, primary minima are deeper than secondary minima by $\delta\Delta V \simeq 0.22$, $\delta\Delta B \simeq 0.23$, $\delta\Delta U \simeq 0.22$, indicating a considerable difference of temperatures of the components, also the colours at primary minimum are redder than the combined light at maxima by about 0.1 mag.

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THE 1978 ECLIPSE OF R AQUARII

The light curve of the symbiotic Mira variable R Aqr is characterized by highly variable minima, with the deviations from a normal Mira light curve usually ascribed to activity on the part of a hot sub-main sequence companion. (For a discussion of the light curve of R Aqr see Mattei and Allen 1979). During the enhanced activity of 1928-35 the maximum of the Mira component was suppressed at the same time that the minimum was raised, giving rise to speculation that in fact only a single star might be involved (Wallerstein and Greenstein 1980).

Although the behavior of minimum light from 1974 to 1980 has been very different from that of 1928-35 (Fig. 2) the maximum brightness has again been reduced by over two magnitudes. If the irregular variations in minimum light are due to activity centered around the hot companion, then the depression of

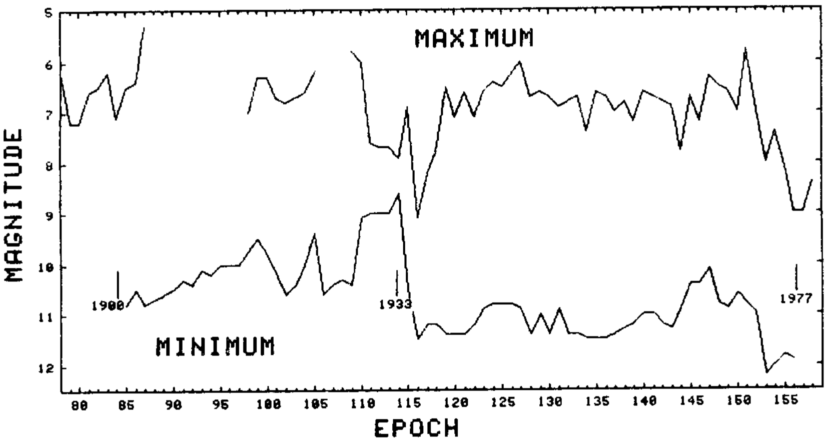

Figure 2. Magnitude at maximum and minimum light of the Mira component. The pronounced dips in the brightness at maximum in 1934 and 1978 are indicated, and the anticipated dates of previous eclipses are in 1890 and 1846.

the maximum can be interpreted as the result of an eclipse of the Mira component by an extended accretion disk or cloud around the secondary. This interpretation is supported and suggested by a comparison of the photometry of Barnes (1973) and of Lockwood (1972) done in the late 1960s with the more recent infrared photometry of Catchpole et al. (1980) (Fig. 1). A normal Mira energy distribution is consistent with the late 1968 photometry and with 3-14 micron measurements of R Aqr in 1968 by Stein et al. (1969). However, the 1975-77 spectrum is both fainter and redder in the 1-3 micron region than would be expected from the normal Mira distribution and the previous measures. These JHKL band results are consistent with the visual magnitude range during 1975-78 if the normal energy distribution is assumed to have been subjected to an intervening absorption $A_V \gtrsim 2$ magnitudes in 1975-78,

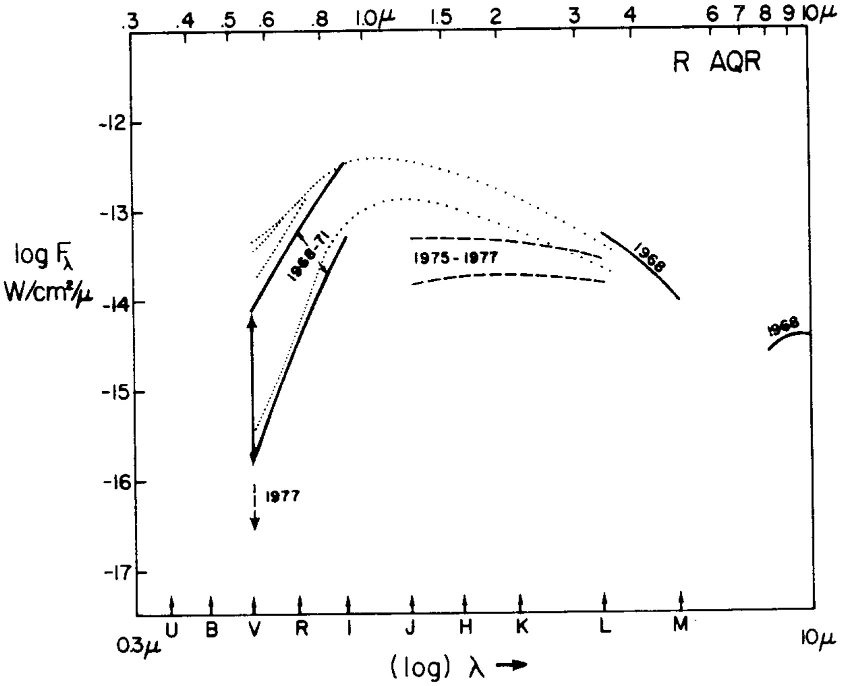

Figure 1. The energy distribution of R Aquarii in 1968 - 1971 (solid lines) and 1975 - 1977 (dashed lines) compared with a normal Mira distribution (dotted lines). VRI photometry is from Barnes (1973); the 3-14 micron measurement in 1968 was by Stein et al.(1969); the 1975 - 1977 JHKL photometry is taken from Catchpole et al. (1980). The normal Mira distribution was obtained by analysis of Mendoza's (1967) photometry for o Cet and χ Cyg.

but not in 1968-71. From observations made in 1977, Wallerstein & Greenstein (1980) found internal $A_V \sim 2$ from the Balmer line ratios. It is therefore likely that the suppressed maxima in 1934 and 1978 are the result of the Mira component in the system being eclipsed by an extended gas cloud around the secondary star in the system.

From the spacing between the dips in the plot of magnitude at maximum light, the orbital period must be 44 years (41.5 times the period of the Mira, ensuring that alternate eclipses are difficult to observe due to the position of R Aqr near the sun at maximum light). The duration of the eclipse is $\lesssim$ 8 cycles = 8.5 years. In order to have an eclipse duration $\sim$20% of the orbital period one must have a) nearly equal masses and the occulting material filling the Roche Lobe of the secondary and/or b) a highly eccentric orbit with periastron occurring at an orbital phase opposite the current, eclipse, phase. Since the mass of the Mira is probably $1-2M_\odot$ and the secondary, presumably a white dwarf, $.5-1M_\odot$, the period of 44 years implies a separation 14-18 A. U.: the Mira component, with $R \simeq 1-2$ A. U., is nowhere near filling its Roche lobe. The material which is currently occulting the Mira must therefore have been accreted from a spontaneous wind from the Mira rather than from Roche Lobe overflow. The orbital velocities predicted from this are ~10 km/s, with maximum displacement expected in 1967 and 1945.

The interpretation of the anomalies in the light curve of R Aqr in terms of an eclipse is supported by the appearance of the O-C diagram for R Aqr (Figure 3). The current and 1934 "events" do not produce obvious effects on

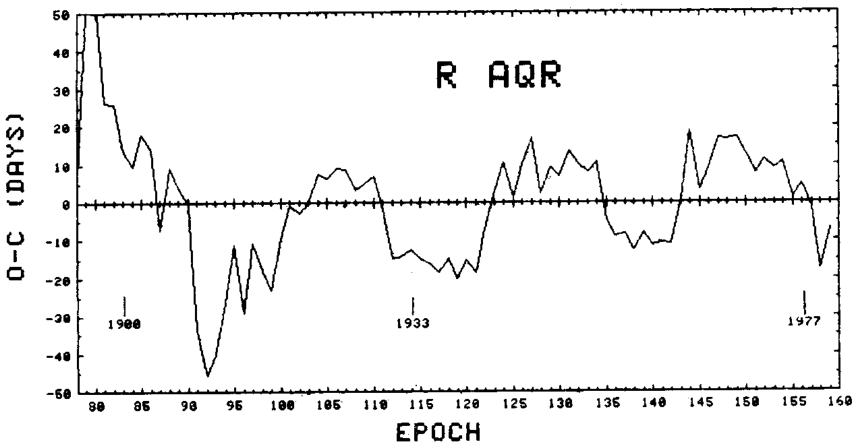

Figure 3. Observed - Calculated (O-C) times of maximum light for the Mira component. Calculated maxima use C = JD 2382892.4 + 386.30 E. The eclipse epochs are indicated on the figure.

the timing, as they would almost certainly do if they were caused by changes in the condition of the Mira component. However, if the anomalies in the light curve are caused by a combination of activity on the companion and the orbital geometry, no effect is expected on the timing of maximum light. There is a hint in the O-C of a possible resonance between the O-C period and the orbital period. (Mira O-C plots are very complicated in general, however, so this one must be interpreted with great caution. See Heiser (1975) for normal Mira O-Cs for comparison).

Previous eclipses of the Mira must have occured in 1890 -- when, as presently, R Aqr would have been difficult to observe at maximum and the data are correspondingly sparse -- and in 1846, where although there are not many observations available the maximum does appear to have been no brighter than 8th magnitude. Townley *et al*. (1928) noted that a spectrum of R Aqr taken in 1893 showed a faint nebular band and emission lines of hydrogen with no trace of an M type spectrum, confirming the likelihood of an 1886-94 eclipse.

A corollary of this hypothesis is that the true light curve of the Mira component alone is probably that seen in 1950-1965, with $\langle v_{max} \rangle = 6^{m}.9$ and $\langle v_{min} \rangle = 11^{m}.2$, rather than $\langle v_{max} \rangle = 6^{m}.5$ and $\langle v_{min} \rangle = 10^{m}.3$ as usually quoted (*General Catalogue of Variable Stars*).

The current eclipse should be nearly over, although observations made in late 1981 or early 1982 may still show effects of some intervening material from the outer parts of the circumstellar cloud or disk of the secondary. By mid 1982, however, the visual lightcurve and the energy distribution should be back to their normal values. The next eclipse is then expected in 2018-2026 AD.

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PHOTOELECTRIC MINIMA OF THE ECLIPSING VARIABLE VW CEPHEI

The W UMa-type eclipsing variable VW Cephei was observed on July 7-10,1980,at Kryonerion Observatory,Greece.Seven times of minima obtained during this season are listed in the following Table I.The observations were made with a 48-inch Cassegrain reflector (Contopoulos and Banos,1976) and a two beam multimode photometer (Goudis and Meaburn,1973).The two intermediate pass-band filters used were selected to be in close accordance with the standard UBV colour system.

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

The successive columns contain the heliocentric time of minimum,the mean error σ ,the difference O-C,the filter used and remarks.The following ephemeris,given by Hopp et al.(1979), was used for calculation of the O-C values.

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

Table I

HJD 2440000+	σ	O-C	Filter	Rem.
4428.4934	±0.0002	-0.0001	B,V	Min I
4429.3281	±0.0001	-0.0004	B,V	Min I
4429.4673	±0.0001	-0.0003	B,V	Min II
4430.4412	±0.0001	-0.0005	B,V	Min I
4430.5805	±0.0001	-0.0004	B,V	Min II
4431.4160	±0.0001	+0.0002	B,V	Min II
4431.5553	±0.0001	+0.0003	B,V	Min I

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IS AE Aur A VARIABLE STAR?

Among the 19 stars, listed by Blaauw (1961) as "runaway" stars, AE Aur is the only one for which photometric variability had been reported. Schneller concluded that the star has an amplitude of about $0^{m}.2$. Therefore, only photoelectrical measurements should be used to discuss the light changes.

Photoelectrical observations had been reported by Schneller (1936), Groeneveld (1944) and Kharitonov (1957). Eleven new observations by the authors during four evenings in the winter 1980/1981 have been made with the 75 cm telescope of the Wilhelm Foerster Observatory Berlin, an 1P21 photomultiplier behind GG13+BG12 filters for the B band and GG11 for the V band of the UBV system. As comparison stars served 16 Aur, 19 Aur, SAO 057884 (for these stars the magnitudes and colours have been adopted from Blanco et al. 1968), and SAO 057893 ($V=6^{m}.63$, $B-V=+0^{m}.22$). Schneller's 35 measurements were made in comparison to λ Aur in

Table

Author	Year	Result	
Schneller	1936	$\overline{\Delta m} = 0^{m}.857 \pm 0^{m}.006$	
Groeneveld	1944	$\overline{\Delta m_1} = 0.026 \pm 0.015$	$\lambda_{eff} = 495$ nm
		$\overline{\Delta m_2} = -0.052 \pm 0.019$	$\lambda_{eff} = 412$ nm
Kharitonov	1957	$\overline{\Delta V} = 0.921 \pm 0.005$	
		$\overline{\Delta (P-V)} = -0.101 \pm 0.006$	
this paper	1980	$\bar{V} = 6.055 \pm 0.008$	
	1981	$\overline{(B-V)} = +0.248 \pm 0.006$	

an instrumental system. Groeneveld's 4 observations were made in comparison to BD+31°955 in a two colour instrumental system. Kharitonov used 19 Aur as comparison for his 14 PV observations. If we disregard only one of Schneller's observations, we find the mean values and mean square errors of the table. As the mean square errors of all reported observational runs are in the order or even less then the observational accuracy, we conclude that AE Aur is not a variable star.

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NEW VBLUW OBSERVATIONS OF THE YELLOW VARIABLE SUPERGIANT Tr 27 - 102 = HD 159378

1. Introduction

The G0 Ia supergiant Tr 27-102 = HD 159378, a member of the open cluster Tr 27, showed to be variable during an observing run in 1977. The light amplitude was about 0.12 mag and the characteristic period about 80 d (van Genderen and Thé, 1977, hereafter called Paper I). In view of its abnormal colour indices compared with other G type supergiants, the presence of a blue companion seemed to be a natural explanation (van Genderen, 1980, hereafter called Paper II). This short note deals with new VBLUW observations made in 1980.

2. Observations

The observations were made with the Walraven VBLUW simultaneous photometer attached to the 90-cm lightcollector at the ESO (La Silla, Chile) during 14 nights in June and July 1980. References concerning the photometric system are given in Paper I. The observations discussed in that Paper were made with the same equipment when the telescope was still in South Africa. Since slight changes in the photometric system originated after some improvements in the equipment were performed after the move to Chili, we only give here the tentative results. However the differences between the photometric systems of 1977 and 1980 are of minor importance for the present note. The exact transformation will be available in the near future. They will be not larger than 0.01 in log intensity scale. The comparison star HD 158528 is the same as in 1977. A diaphragm of 15" aperture has been used. The standard deviations (in log intensity scale) for the observations are in ΔV and $\Delta(V-B)$, ± 0.002, in $\Delta(B-L)$, ± 0.005 and in $\Delta(B-U)$, ± 0.007.

3. Discussion

Figure 1 depicts the light- and colour curves relative to the comparison star in log intensity scale. It shows a rising branch with a timc scale of the same order as the light curves of Fig. 1 in Paper I viz. ∿ 40 d. The scatter is much smaller than in Paper I, since the sky conditions in Chili are better and the equipment has been improved. Because the intensity in W is low, we omit the curve for the index (U-W), but give an average value in Table 1.

Similar to the observations of 1977 all colours become bluer when the star rises in brightness. A comparison of the average values of brightness and colours of 1980 with those of 1977 shows a remarkable change, which is evident from the last row of Table 1 (the photometric data of the comparison star were checked in 1980 and showed to be constant within the limits of the expected differences between the VBLUW systems of 1977 and 1980). The variable became brighter by 0.13 mag in V, while the colour indices became redder, with the exception of the B-U index, which became bluer. In magnitude scale the changes in V, B, L, U and W are as follows: 0.13, 0.08, -0.18, 0.25 and -0.18 mag respectively (negative signs mean a decrease in flux). Thus the changes are remarkably high in the ultra violet bands: L (3840 A, containing the Balmerlimit), U and W (3630 and 3250 A respectively, at the short wavelength side of the Balmerjump).

With the aid of Fig. 2 of Paper II, which depicts the three two-colour diagrams, one can see the shift of the star's position (after a reddening correction has been applied). It is evident that the determination of physical parameters of the hypothetical blue companion has little sense, as long as colours vary so strongly. Because of this effect, the parameters as derived in Paper II may be spurious. It is thus possible that the blue companion lies in reality closer to the main sequence, that its T_{eff} is higher and its absolute magnitude is fainter than derived in Paper II. The blue companion is certainly no white dwarf. Its absolute brightness is then too low to have any influence on the combined colours. High resolution ultra violet spectroscopy is now the only method to find the characteristics of both components.

The large colour change is presumably related to the little understood phenomenon of supergiant variability. If the blue companion is relatively bright and evolved, it could well be also the cause of the long time scale variation.

Table 1. Average photometric parameters of Tr 27-102 = HD 159378 in 1980 in the VBLUW system (in log int.) and in the UBV system (in mag and with subscript J). For the reddening correction we used $A_V = 3.3\ E_{V-B}$.

	V	V-B	B-L	B-U	U-W	V_J	$(B-V)_J$
			(log intensity)			(mag)	
relative to HD 158528 :	-0.068	0.766	0.350	0.528	0.58		
on the natural system :	-0.667	0.884	0.546	0.903	0.74	8.40	1.94
on the natural system corrected for reddening :	1.64	0.18	0.24	0.46	0.42	4.20	0.5
difference 1980-1977 :	0.05	0.02	0.10	-0.07	0.17	-0.13	0.05

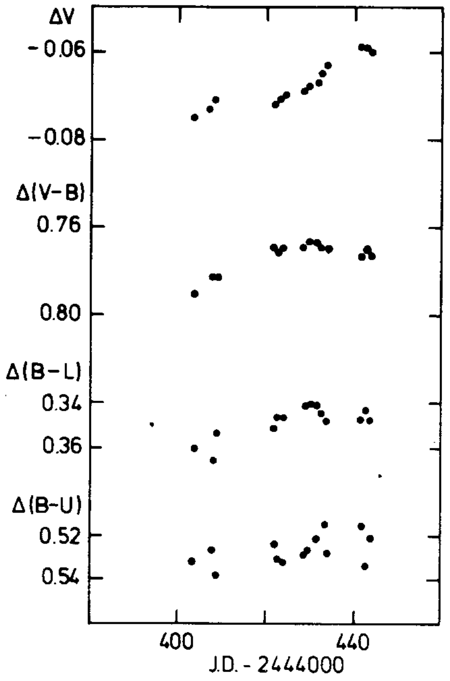

Figure 1

The light- and colour curves of Tr 27-102 = HD 159378 relative to the comparison star (in log intensity scale).

Our thanks are due to Prof. P.S. Thé for his comments on this note.

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ANS OBSERVATIONS OF DH Cep, CV Vel, AND RS Vul

The three close binary systems DH Cep, CV Vel, and RS Vul were observed with the spectrophotometer system aboard the ANS satellite (van Dunien et al. 1975) in 1974 and 1975. Aside from twenty observations of CV Vel, all data were obtained for phases outside eclipse. Table 1 lists the observed average magnitudes out of eclipse for the three systems. These numbers are $m_{\lambda} = -2.5\log f_{\lambda\bullet} + C$ where the constant C has been chosen to make the magnitude zero at $f = 3.64 \times 10^{-9}$ ergs/cm^2/s/Å. The V magnitudes have been taken from the literature. For DH Cep we used the photometry of Hill, Hilditch, and Pfannenschmidt (1976), for CV Vel, the V magnitude of Cousins and Stoy (1963), and for RS Vul, an average between the determination of Popper (1957) and Hilditch and Hill (1975).

TABLE 1

Out-Of-Eclipse Magnitudes

Band	DH Cep	CV Vel	RS Vul
V	8.59	6.69	6.80
3300Å	8.012	5.570	6.339
2500	8.270	4.875	6.273
2200	9.289	4.533	6.495
1800	7.828	4.146	5.680
1550	7.908	3.908	5.466

Photometric data have been deposited in the IAU Commission No. 27 photometric data center (Breger 1979) as File 81.

DH Cep (HD 215835) is a double-lined spectroscopic binary consisting of a pair of ~O5 stars in a very close orbit (Pearce 1949). Its relatively large minimum masses (23 and 19$M_{\odot}$) suggest that the inclination should be large enough for modest eclipses to occur. Although Pearce predicted eclipses ~0.1 mag deep from his radial velocity study, the ground based photometry of Hill, Hilditch, and Pfannenschmidt (1976) and the unpublished photometry of A. M. Heiser (private comm.) indicate that the system is only an ellipsoidal variable of 0.05 mag amplitude. The ANS data (Figure 1) reaffirms this result: No eclipses and low-amplitude ellipsoidal variation.

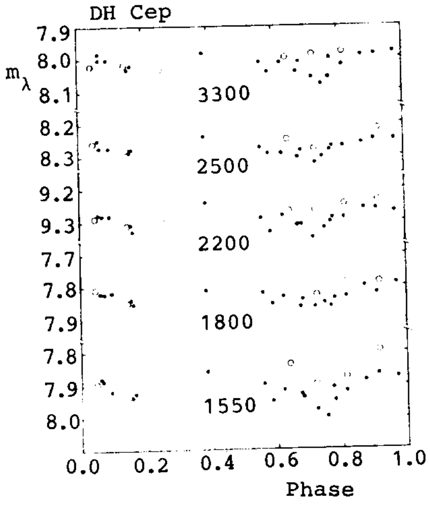

Figure 1. ANS observations of DH Cep. Circles are data for 1975.0; dots, those for 1975.5. Phases were calculated with the elements JD(Hel.) = 2432759.807 + 2.11104·Phase.

This star is especially interesting in that it is a member of the heavily reddened open cluster NGC7380 (Pearce 1949). We are fortunate that photometry defining the upper main sequence exists for this cluster (Hoag et al. 1961, Hoag and Applequist 1965), although Underhill (1969) has determined that the cluster field is severely contaminated with foreground and background stars. DH Cep appears to have the bluest colors in the cluster, and the spectral type corresponding to its UBV colors as derived from the Q-method (Johnson and Morgan 1953) is at least as early as B0.5. The ANS ultraviolet colors are not completely consistent with those of a O5-type star reddened by the Galactic mean reddening law. Wesselius et al. (1980) have published a mean extinction curve for the ANS passbands which can be used to relate the relative strength of the 2200-Å absorption bump to the mean color excess in (B-V): ΔBump = 2.15*E(B-V). For our photometry of DH Cep, ΔBump = 1.208 implies E(B-V) = 0.56. However, the (λ-V) color excesses derived by assuuming DH Cep has the colors of an O5-6 star correspond to E(B-V) = 0.70.

Although the photometric studies of Hoag et al. find a mean color excess for the cluster of E(B-V) = 0.58, the probable members isolated by Underhill exhibit greater reddening. The color excess of DH Cep is thus consistent with the cluster reddening and its O5.5 + O6.5 spectral type (Conti and Alschuler 1971), although the strength of the 2200-Å bump is relatively weak for the total reddening.

The short spectroscopic period (2.111 days) and large minimum masses derived by Pearce suggest that the system should be a massive contact binary. The radii expected for main-sequence components having the masses derived by Pearce are comparable to the mean radii of the Roche lobes regardless of the inclination. Ruciński's (1973) family of light curves for contact binaries indicates that it is not possible to obtain the low amplitudes of the observed light curves with a contact binary having a reasonable inclination. Thus, we infer that the components are considerably smaller than expected for their apparent masses and spectral types. We suspect that there are systematic errors in the spectroscopic analysis in the sense that the radial velocity amplitudes are too large. The large eccentricity quoted by Pearce (e = 0.13) suggests this is likely. We were disappointed not to find a larger light amplitude of variation for this star.

CV Vel (HD 77464) is a pair of main-sequence stars in a 6.89-day eclipsing binary (Andersen 1975; Clausen and Gronbech 1977). Both components are early B-type stars, B2.5V according to Clausen and Gronbech. We observed two occurrences of the primary eclipse exactly one year apart for which we derive a mean time of minimum: $\text{JD}_{\odot}$ 2 442 572.281 + 0.001. The star is little reddened. No 2200-Å extinction bump is apparent in the ultraviolet photometry. Andersen (1975) adopted a (B-V) color excess of only 0.03 mag. The ultraviolet colors of the binary out eclipse are those of an unredened B4V star on the calibration of Wu et al. (1980). A color excess of only a few hundredths of a magnitude in (B-V), which our ultraviolet data cannot exclude, would make these colors consistent with the B2.5V spectral type of Clausen and Gronbech.

RS Vul is an Algol binary with a B5-type hotter component (Hutchings and Hill 1971). Although we observed neither eclipse, we have obtained colors of this star for a wide range of wavelength by combining our photometry with the ground-based data of Hilditch and Hill (1975), V = 6.80, (b-y) = 0.14 out of eclipse. The colors out of eclipse are those of a moderately reddened B5 star. The 2200-Å extinction feature is readily apparent in the photometry.

Its strength, ΔBump = 0.48, corresponds to E(B-V) = 0.22. This is the same color excess derived from the observed (λ-V) colors by assuming the Galactic mean extinction curve and the mean colors of a B5V star (Wu et al. 1980).

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A SEARCH FOR MAIA VARIABLES

The Maia variables are a mysterious group of possibly intrinsically variable stars. In the Hertzsprung-Russell Diagram they are situated between the Beta Cephei variables (B3) and the Delta Scuti stars (A2). Struve (1955) reported the possible light variability of the star Maia (B7III), but concluded later that Maia was not variable. The reported periods and sometimes even the reality of the reported variability of most other Maia variables cannot be regarded as established either. However, the variability of <u>some</u> stars in the B4 - A1 spectral range is quite certain. Some (or all) of this variability can be identified with known types of variable stars in this spectral range. Examples are the 53 Per variables (53 Per: B5, nonradial pulsation, see Buta and Smith 1979),and some peculiar A stars, which can show light variability due to rotation of a spotted surface or short-period pulsation. The <u>observed</u> hot border of the Delta Scuti instability strip at A2V cannot be regarded as absolute, and occasional short-period pulsation might occur in the A0 - A1 region. The incidence and amplitudes of pulsation, however, should decrease with increasing distances from the hot "border".

Some searches for variability in the Maia temperature domain have been negative (e.g. Percy 1978, Breger 1969). This is in contrast to various reports of variability in the literature for other individual stars. It therefore appears prudent to observe more stars and to document the observed variability as well as constancy.

Photoelectric millimag photometry of five promising candidates was obtained with the 0.76 meter telescope at McDonald Observatory. To decrease

TABLE I

OBSERVED CONSTANCY OF PROGRAM STARS

STAR	SPECTRAL TYPE	(b-y)	CONSTANCY (mag)	TIME OBS. (hours)	DATE (U.T.)
6555	A2	0.176	0.002	3.8	78 Jun 10
			0.004	8.0	78 Jun 11
			0.005	5.3	78 Jun 12
6618	A0	0.016	0.002	3.8	78 Jun 10
			0.004	8.0	78 Jun 11
			0.005	5.3	78 Jun 12
6917	A2V	0.045	0.003	4.5	78 Jun 12
			0.003	6.0	78 Jul 3
7060	A2	0.040	0.003	6.0	78 Jul 2
7091	A0	0.038	0.003	2.5	78 Jul 1
COMPARISON STARS					
6554	Am	0.173	0.002	3.8	78 Jun 10
			0.004	8.0	78 Jun 11
			0.005	5.3	78 Jun 12
6831	G0	0.374	0.003	6.0	78 Jul 3
6876	Am	0.143	0.003	4.5	78 Jun 12
			0.003	6.0	78 Jul 3
7044	dF2	0.242	0.003	4.5	78 Jun 12
7061	F6V	0.314	0.003	2.5	78 Jul 1
7071	G5	-	0.003	6.0	78 Jul 2
7154	dF4	0.286	0.003	6.0	78 Jul 2

the possibility of systematic observational errors, the conventional three-star millimag technique was applied: the program star was measured together with two comparison stars with the V filter. Every star was observed for one minute, and the telescope was then moved to the two comparison stars. The consecutive cycling allowed a close examination of the residuals.

No systematic variability could be detected, e.g. the residuals appeared random for all stars. This applied to the nights of highest photometric quality ($\sigma \sim 0^{\mathrm{m}}.002$) as well as the less perfect nights ($\sigma \sim 0^{\mathrm{m}}.004$). Table I lists the properties and observational results for the stars examined.

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UBVRI TIMES OF MINIMA OF VW CEPHEI

The Automated Filter Photometer at Kitt Peak was used on the number two 0.9 meter telescope during the interval 19-26 August, 1980, for UBVRI observations of VW Cephei. Useful data were obtained on all or parts of four nights. The single comparison star was BD + 74°889, comparison star "a" in the list by Kwee (1966). One second integration times for each filter permitted accumulation of a large body of observational data. The small range in air mass for the comparison star, a result of its large declination, produced a low weight determination of extinction coefficients. Since differential extinction between the variable and comparison star is very small, it was sufficiently accurate to use mean first and second order coefficients in all colors for a first pass extinction correction for both the variable and comparison star. Calculated magnitude residuals, for the comparison star, from predicted constant extra-atmosphere magnitudes and colors then were examined for time-dependent variation. Where appropriate, time-dependent corrections were applied to both variable and comparison star. This procedure will be described in a separate publication.

The times of observation received an initial heliocentric correction, followed by a light time correction for orbital motion relative to the close visual companion. The visual binary orbital elements of Hershey (1975) were used for this correction. (See also Linnell (1980)). The correction, added to heliocentric times, was -0.01453 days.

The final J.D. times of primary minima are in Table I and secondary minima in Table II, listed by spectral band. The calculated times are among the output of a computer program which will be described in a separate publication. Approximately 150 observations entered the equations of condition for each spectral band in each minimum.

Table I

Primary Minima, VW Cephei

Date	Filter	Time of Min.		Date	Filter	Time of Min.	
Aug.19	I	2444470.77895	±.00017	Aug.25	I	2444476.90234	±.00024
	R	470.77835	±.00015		R	476.90228	±.00021
	V	470.77840	±.00015		V	476.90198	±.00016
	B	470.77850	±.00015		B	476.90179	±.00015
	U	470.77820	±.00015		U	476.90189	±.00015
Aug.21	I	2444472.72680	±.00011	Aug.26	I	2444477.73699	±.00010
	R	472.72667	±.00011		R	477.73673	±.00010
	V	472.72699	±.00013		V	477.73661	±.00010
	B	472.72658	±.00010		B	477.73644	±.00009
	U	472.72666	±.00010		U	477.73613	±.00009

Table II

Secondary Minima, VW Cephei

Date	Filter	Time of Min.		Date	Filter	Time of Min.	
Aug.19		No Data			V	476.76488	±.00018
Aug.21	I	2444472.86721	±.00016		B	476.76516	±.00014
	R	472.86818	±.00022		U	476.76541	±.00015
	V	472.86813	±.00018	Aug.26	I	2444477.87697	±.00018
	B	472.86807	±.00016		R	477.87735	±.00022
	U	472.86834	±.00018		V	477.87757	±.00019
Aug.25	I	2444476.76450	±.00020		B	477.87815	±.00017
	R	476.76495	±.00018		U	477.87844	±.00017

An effect is apparent in the solutions which does not appear to have been discussed previously. To within the errors of observation for all nights, the time of primary minimum comes first in U followed successively by B, V, R and I. The total range of times of primary minimum is the same, within the error of determination, on all nights. It is approximately 60 seconds, from U to I. The sequence is reversed for secondary minimum, with earliest minimum occurring in I, followed successively by R, V, B, and U. The time range of secondary minimum approximates 150 seconds. Light asymmetry is such that the higher maximum follows primary minimum. Color data indicate a higher source temperature at the elongation following primary minimum.

It is worth noting that the difference in depths of minima precisely equals the difference in heights of the maxima. This rule holds in all color bands even though the differences gradually and monotonically increase from the I band to the U band.

A more detailed discussion of these effects will appear in a separate publication.

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SEVEN-COLOUR-PHOTOMETRY OF THE SILICON VARIABLE HD 37808 +)

Very recently Renson and Manfroid (1981) published uvby lightcurves of HD 37808 based on a period of 1.099 days determined from a sample of 33 measurements which were obtained in Nov. 1977. I have also obtained 10 measurements on 10 consecutive nights in Feb. 1973 at the ESO 1m-telescope using standard uvby and in addition H-beta-wide and the filters g_1 and g_2 introduced by Maitzen (1976) for measuring the strength of the absorption feature around 5200 A. The first impression of this series of measurements was a variation with a period of about 10 days. As such a period would be extraordinarily long for a Silicon star the associated period close to one day seemed more plausible.
Unfortunately the time gap to the observations of Renson and Manfroid is too large and hence the refining of the period 1.099 days is not yet possible until other measurements become available. Fig.1 shows in the upper part the lightcurves reduced with the period 1.099 days and JD 2441728.18 as zero-point for the phases. Differential magnitudes were obtained using HD 37635 as comparison star which was also one of Renson and Manfroid's comparison stars. In the lower part of Fig. 1 the run with wavelength of the maxima and minima of the lightcurves is displayed. One easily recognizes the depressions at g_2(5240A) and at v (4100A) which are typical for Ap stars.
The curve of the minima shows smaller depressions than that of the maxima. This is well explained by lower absorption both in the ultraviolet and in the visual depression regions. The former results in a smaller backwarming effect. Both effects modulate the depth of the depression features.
In general, we learn from the lower part of Fig.1 that the slope of the Paschen continuum of HD 37808 is very similar (albeit a

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+) Based on observations collected at the European Southern Observatory (ESO), La Silla (Chile).

bit steeper) to the Paschen slope of the comparison star HD 37635.

TABLE I Journal of observations: HD 37808 minus HD 37635.

J.D. ⊙ 2440000+	u	v	b	Hßw	g_1	g_2	y
1728.564	-0.054	-0.035	-0.039	-0.031	-0.029	-0.005	-0.024
1729.557	71	41	51	44	40	15	36
1730.541	92	48	58	50	37	12	37
1731.538	99	56	65	62	50	22	42
1732.584	105	64	69	62	53	22	45
1733.545	90	56	58	52	48	19	35
1734.530	81	44	57	48	38	09	32
1735.557	74	44	49	44	38	11	31
1736.566	64	34	40	35	31	11	23
1737.557	-0.066	-0.029	-0.036	-0.037	-0.031	-0.002	-0.021

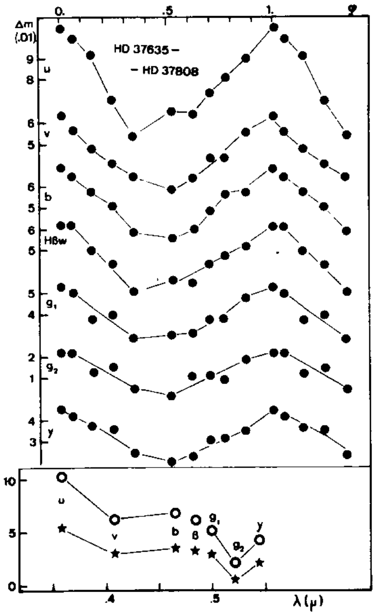

FIG. 1:

Upper part: Lightcurves in the sense HD 37635 minus HD 37808 in uvbßg_1g_2y. Phases were obtained using the elements:

Max(u) = JD 2441728.18 + 1.099 E.

Lower part: Maxima (open circles) and minima (stars) of the lightcurves in the upper part versus wavelength.

This is in accordance with similarity in the uvby (see Hauck, Mermilliod, 1980) and UBV (see Blanco et al., 1970) values of both stars.

As for other Ap-stars there is a discrepancy in spectral types: Cowley (1972) classifies HD 37808 as B9.5 IIIp Si 4200. while Lesh (1968) gives B7V for HD 37635 for which the HD type is B5. From the uvby calibration of B type stars (Crawford, 1978) one gets B5-6V for the Ap star and B6V for the comparison star. Thus the Ap line criteria yield a significantly cooler spectral type than the continuum flux distribution of the Ap star. In addition, the relatively weak hydrogen lines were explained by higher luminosity compensating the later type of the spectral classification.

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ECLIPSE TIMINGS OF STEPANIAN'S STAR

Stepanian's Star has been observed at the Cloudcroft Observatory using its high-speed photometric system. We report eight eclipse timings and give an ephemeris resulting from these and the eclipse timing reported by Horne et al. (1980 IAU #3462).

$$\text{Pri Min}_o = \underset{\pm\ 3}{2444293.0236} + \underset{\pm\ 1}{{}^{d}.158432}$$

Min$_{\odot}$ 2444000.+	(O-C) Days
312.9858	-.0003
316.9462	-.0007
320.9069	-.0008
343.7227	.0008
344.8306	-.0004
346.8913	.0007
372.7152	.0001
396.7965	-.0003

A more detailed discussion of these observations will be given in a later paper.

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HD 114842, A NEW SHORT PERIOD VARIABLE STAR

During a search for the periodic content of the Delta Scuti star HR 5005 we had to choose an extra comparison star from those previously considered by Jerzykiewicz (1975). He took HR 5014 and HR 5059 as standard stars but concluded that HR 5014 was most likely a variable itself. With this conclusion in mind, a third standard star had to be considered. Following the criteria for choosing the comparison stars, as stated in Baglin et al. (1973) or in Warman et al., (1974), this would have to be close to our problem star, (≤2°), of about the same magnitude as the variable (6.5 for HR 5005) and approximately of the same spectral type. Since one third of the stars that lie within the instability strip are variable (Breger, 1979) we chose an F8 (HD 114842) that should be outside these limits.

On analyzing the light curves of all our observed stars, one can conclude that the original consideration of Jerzykiewicz can be attributed to a different air mass extinction since these two standard stars are more than 9 minutes apart. Our analysis showed that the light curve of these two stars behave similarly on all nights although, on revising the literature it was found that HR 5014 is reported as a double star in the Bright Star Catalogue and by Jeffers et al. (1963) in the Index Catalogue of Visual Double Stars, where it is reported that this star was observed in 1959 by Finsen who established it as a double system and determined a separation of 0".1, an angle of inclination of 27", and also that both components are of the same brightness, 7.1 mag. No further information of this system has been available to us, so we cannot conclude if the slight difference observed is due to the binarity. But due to the fact that it has been reported as double, it cannot be taken as a standard in the present study and was just taken as a check star for the atmospheric conditions.

The equipment utilized was the 60-inch telescope at the San Pedro Mártir Observatory, México. An 1P21 cooled detector and Johnson's V filter were employed. For each reported point of the differential photometry, six ten-second integrations were obtained; to the average of this flux a ten-second integration of the sky was subtracted and the magnitude was obtained by means of the familiar relation $m=-2.5 \log F$. Our data point are accurate to 0.004 mag; the average time span between successive reported points is of about eleven minutes and the accuracy in time is of 2 minutes.

The results are presented in Figure 1. The amplitude is of about 0.035 mag, but the period, determined from peak to peak, is rather irregular, suggesting the presence of several simultaneous modes of pulsation; the shortest is of about 0.056 d, whereas the largest indicates a figure closer to 0.191 d. The average period is of 0.095 d. Its spectral type is rather late, an F8; nevertheless, due to the characteristics shown, (short period of the order of hours, low amplitude variation and an F spectral type) one might conclude that, more likely, this is a Delta Scuti Pulsator.

Breger, (1979) in his recent review article does not list another star as late as this one. Of course, the possibility that it lies outside the instability border exists, but another more likely possibility is that its spectral type is inaccurately determined. Peña et al. (1981) have shown that, in general, the spectral types of the Delta Scuti stars are not very accurately determined. We encourage the obtention of spectra of this star to fix its position univocally in both the PLCR and the HR diagrams and establish its pulsational nature.

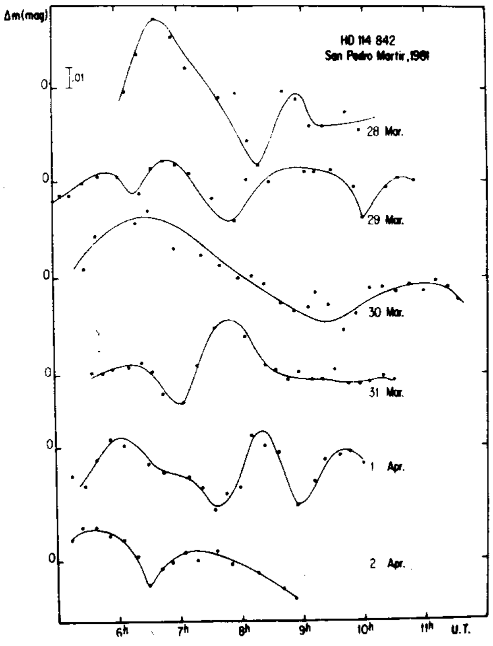

Figure 1

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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR EV Lac IN 1980

A program of photoelectric observations of flare stars has been started at the National Astronomical Observatory of the Bulgarian Academy of Sciences using a 60 cm Cassegrain reflector with a photoelectric equipment. In this paper we report the observations of the flare star EV Lac during the summer of 1980.

The photoelectric equipment consists of a one channel photometer (described by A. Tomov, Dissertation, 1977, Sofia) and a photoncounting system. The photomultiplier used is the EMI 9789 QB. The transformation of our instrumental ubv system to the international UBV system is given by the equations:

$$\Delta V = \Delta v - 0.12.\Delta(b-v)$$
$$\Delta(B-V) = 1.14.\Delta(b-v)$$
$$\Delta(U-B) = 1.08.\Delta(u-b)$$

The monitoring intervals in U.T. as well as the total monitoring time for each night are given in Table I. The observations have been carried out in "u" colour with an integration time of 1 sec. Generally, one registration has been made every 3 sec, but when a flare was noticed, an-every-1sec-registration has been switched over. In this way for every flare a time-resolution of 1 sec was achieved.

During the total of 21^h32^m monitoring time 11 flares were observed, the characteristics of which are given in Table II. For each flare following characteristics are given:

a. The date and universal time of flare-maximum.
b. The duration before and after maximum (t_b and t_a respectively).
c. The total duration of the flare.

d. The intensity ratio I_f/I_o, where I_f is the flare maximum intensity less sky background and I_o is the quiet state intensity less sky background.

e. The increase of the star magnitude at flare maximum:

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

where "u" is the ultraviolet magnitude of the star in our instrumental system.

f. The standard deviation of random noise fluctuations in mag.

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

The light curves of the observed flares in colour "u" are shown in Figs. 1-11. We want to make brief comments about some interesting features of individual flares.

Flare N° 3 shows a distinct pre-flare intensity minimum with a duration of about 40 sec and with a superposed pre-flare. The "anti-flare" lies some 0.07 mag below the mean intensity level.

About 2 min after the maximum of flare N° 3, an increased value (up to 20%) of "σ" for random-noise is observed. This could probably mean that some of the small "noise-peaks" contain flare activity. This is probably the case for flare N° 5, too, again 2-3 min after the flare maximum.

Flares N° 4 and N° 5 form a "double-flare" with two peaks of similar shape and amplitude at 3.5 min apart from each other. The reason for considering them different flares is that before flare N° 5 intensity reached almost quiet state level.

Flare N_o 7 shows that the maximum light with Δm_f=0.75 mag is reached within 7 sec.

For flare N° 11,6-point averages have been plotted, because of the long duration of the flare. With the total duration of 20 min this is the most powerful flare in this report.

We want to thank Ing.A.Ustabashiev for his valuable technical assistance.

Table I

Date 1980	Monitoring intervals(U.T.)	Total Effective Monitoring Time
July		
14/15	$23^h39^m25^s$-$23^h46^m20^s$,234635-235018,235039-235616,235630-000120,000136-000713,000730-001520,001533-002447,002507-003323,003340-004227,004243-004908,004926-005745,005800-010708,010726-011643,011658-012426,011241-013244,013300-013650.	$1^h53^m21^s$
15/16	232753-233254,233308-234716,234734-000407,000421-002825,002843-004449,004505-010150,010206-011851,011909-013125.	2 01 28
16/17	225149-230107,230252-231212,231246-231740,231816-232744,232751-235328,235357-001544,001658-003843,003857-005959,010015-011347,011358-013009.	2 32 57
17/18	225405-230043,230107-230842,230857-231347,231405-232300,232317-233145,233158-234237,234254-235309,235321-000850,000905-002121,002135-002351.	1 27 21
August		
2	222312-223448,223548-223651.	0 12 39
4/5	224711-225930,225945-231643,231652-233102,233122-235140,235200-235240,235252-002630,002641-004241,004322-010918,010933-012017,012131-015048,015104-020015.	3 09 11
5/6	230111-232857,232913-002200,002317-005439,005502-012549,012610-020036.	2 57 28
6/7	222826-224611,224631-224711,224725-230338,230355-232440,232509-233746,233759-234418,234439-234518,234533-000637,000652-002556,002612-005414,005523-011750,011807-013410,013434-014012.	3 07 16
7	223421-224305,224320-231321.	0 48 45
8/9	222616-223104,223121-223541,223551-224347,224401-225303,225314-230402,230416-231027,231038-231834,231849-232721,	

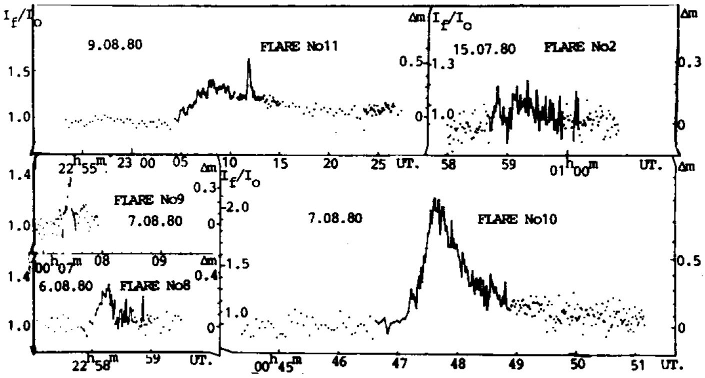
Table I (continued)

8/9	232832-233636,233648-234401, 234411-000356,000407-001522, 001535-002428,002441-003420, 003439-004033,004042-010131, 010145-010855,010907-011623, 011639-014853,014912-015308.	3 21 42
	Total	$21^h32^m08^s$

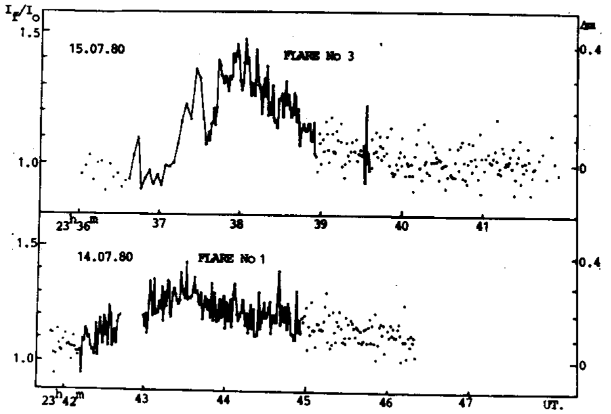
Table II

Charasteristics of the Flares Observed

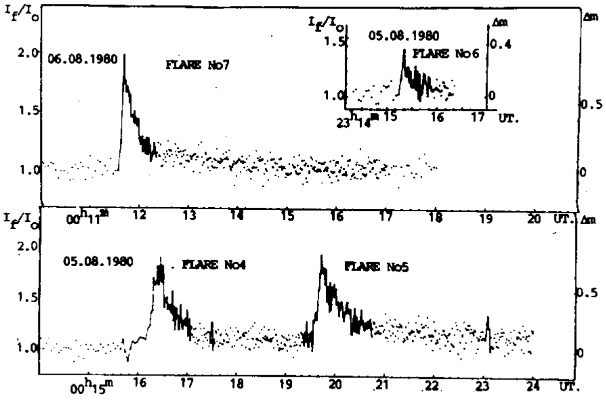
Flare No.	Date 1980	U.T. max	t_b min	t_a min	Duration min	I_f/I_o	Δm mag	σ mag
1	14.07	$23^h43^m31^s$	1.3	2.8	4.1	1.42	0.38	0.06
2	15.07	00 59 20	1.3	1.5	2.8	1.22	0.22	0.05
3	15.07	23 38 03	1.7	3.5	5.2	1.48	0.42	0.06
4	5.08	00 16 27	0.6	1.9	3.5	1.90	0.69	0.07
5	5.08	00 19 43	0.4	4.4	4.8	1.93	0.71	0.075
6	5.08	23 15 20	0.2	1.2	1.4	1.38	0.35	0.06
7	6.08	00 11 42	0.1	4.1	4.2	1.99	0.75	0.06
8	6.08	22 58 16	0.4	1.5	1.9	1.36	0.34	0.07
9	7.08	00 07 27	0.1	0.7	0.8	1.40	0.37	0.07
10	7.09	00 47 38	0.8	5.3	6.1	2.10	0.81	0.07
11	9.08	23 11 50	4	16	20	1.62	0.53	0.09



Figures 2, 8, 9, 10, 11



Figures 1, 3



Figures 4, 5, 6, 7

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EXTRAGALACTIC NOVA OR UNUSUAL U Gem-TYPE VARIABLE?

A new variable star: R.A.=$10^h31^m19^s$, Dec.=+$31^\circ24'$(1950), l=$197\overset{\circ}{.}0$, b=+$59\overset{\circ}{.}8$, has been found by one of us (L.Z.) during inspection on the Carl Zeiss, Jena blinkcomparator a pair of B-plates of a field near SA 54. The star occurs to be visible on several other photographs taken on April 1980 the same week as on the discovery plate with the Schmidt telescope of the Radioastrophysical Observatory at Baldone. B- and V- magnitudes of the variable object are given in Table I. They are measured in the system of magnitudes of the comparison stars, partly presented in Table II. On other 138 B- and 134 V-photographs (limiting magnitude B$\simeq$18.5, V$\simeq$17.5) obtained between March 1970 and May 1979, and after 1980 May 5 the star is not visible. According to A.S.Sharov there are no traces of the star either on the Palomar Observatory Sky Survey charts or on seven plates of the region from Sternberg Astronomical Institute plate collection taken in 1952-53 and 1974.

Thus the amplitude of the observed outburst was at least 5 mag and it lasted not less than 7 days. If the object is nova, it belongs, probably, to the fast novae (light decline 0.2 mag/day) and was observed not very long after its maximum light. Then it is placed beyond the boundaries of our Galaxy.

If the object is a cataclysmic variable of U Gem-type, then either its outburst was exceptionally large or its mean period between outbursts was extraordinarily long.

To decide between the two alternatives the search for the star on plates of the respective region of the sky taken at other observatories would, probably, help.

The variable is indicated on the finding chart (12x12 arcmin) together with the comparison stars according to Table II.

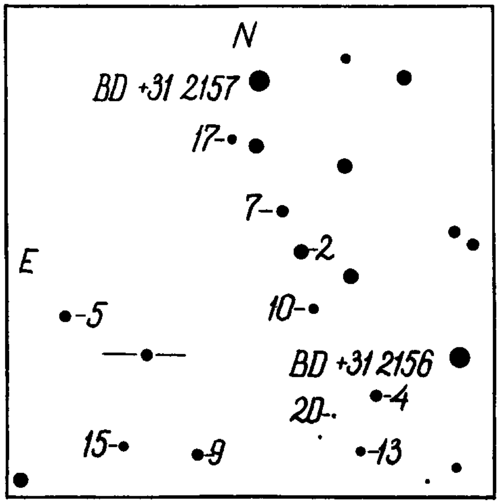

Figure 1

Table I

Date (UT)	B (mag)	Date (UT)	V (mag)
1980 Apr. 11.85	15.87	1980 Apr. 12.85	15.97
Apr. 11.88	15.73	Apr. 16.82	17.43
Apr. 12.97	16.09	Apr. 19.90	17.13
Apr. 14.89	16.36		
Apr. 15.93	16.96		
Apr. 16.85	17.05		
Apr. 17.91	17.20		
Apr. 18.96	17.40		

Table II

Star	B	V	Star	B	V
2	14.91	14.22	10	17.05	15.95
4	15.35	14.66	13	17.35	16.01
5	15.75	15.25	15	17.48	15.98
7	15.89	14.79	17	17.63	16.72
9	16.18	15.33	20	18.67	17.28

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CT Eri: PHOTOELECTRIC TIMES OF MINIMUM AND IMPROVED PERIOD

The variability of the tenth-magnitude star CT Eri (CD-33°1755, CPD-33°506, FO) was first announced by Strohmeier (1968), who found a period of $0\overset{d}{.}634196$ from 24 photographic times of minimum obtained between 1903 and 1946. Bauernfeind (1968) reported 63 and 14 photographic times of minimum and maximum light, respectively. Strohmeier and Knigge (1969) classified the system as a W UMa-type eclipsing binary. However, the reality of the W UMa-type tentatively assigned by Strohmeier and Knigge was somewhat uncertain since the depth of the secondary minimum was unknown.

New photoelectric observations of CT Eri were carried out with the 150-cm reflector at the Bosque Alegre Station of the National University of Córdoba (Argentina) during six nights from November 1980 to January 1981. The f/21 Cassegrain reflector was equipped with a conventional design photometer. A 1P21 photomultiplier refrigerated with dry ice, standard UBV filters, and a circular diaphragm of about 1.8 mm in diameter (12 arcsec) were used. The measurements were made differentially with respect to the comparison star HD 28913, whose spectral type is B9. All the UBV observations have been corrected for first and second-order differential extinction. The comparison star is located $\sim 0\overset{\circ}{.}7$ south-east from CT Eri, and consequently the corrections applied for differential extinction were small. The mean errors of a single differential observation in V, (B-V), and (U-B) are about 0.015, 0.015, and 0.03, respectively. A total of 855 individual observations (285 in each band) has been obtained. The bisection-of-chords procedure was utilized to determine nine times of primary minimum and six of the secondary one.

Separate linear least squares solutions were obtained for the photographic data of 1900-23 (group I), 1924-35 (group II), 1936-43 (group III), and 1945-67 (group IV). A number of photographic minima considered not very reliable have not been used in the above calculation. Finally, a linear least squares solution using the mean photographic minima of each group and the new photoelectric ones yields the following improved ephemeris:

$$\text{Hel.Min I} = \underset{\pm 10}{2444555.6736} + \underset{\pm 79}{0\overset{d}{.}634195498}\ E \qquad (1)$$

Table I

Individual times of minimum light of CT Eri

Minimum	J.D.Hel. 2400000 +	E	(O-C)	References
I	15267.879	-46181.0	-0.012	Bauernfeind
I	15337.694	-46071.0	0.041	"
I	16006.817	-45016.0	0.088*	Harvard Min.
I	16072.672	-44912.0	-0.013	Bauernfeind
II	16310.898	-44536.5	0.072*	"
I	16316.877	-44527.0	0.026	Harvard Min.
I	16377.788	-44431.0	0.055*	Bauernfeind
I	16558.538	-44146.0	0.059	"
I	16856.594	-43676.0	0.042	"
I	17166.670	-43187.0	-0.003	"
I	17497.763	-42665.0	0.040	"
I	17828.855	-42143.0	0.082*	"
II	18264.762	-41455.5	-0.020	"
I	18605.702	-40918.0	0.040	"
II	18651.669	-40845.5	0.028	"
I	18946.873	-40380.0	0.014	"
I	19326.741	-39781.0	-0.001	"
II	20177.537	-38439.5	0.021	"
I	20474.621	-37971.0	-0.015	"
I	20594.485	-37782.0	-0.014	"
I	20803.791	-37452.0	0.007	"
I	21160.834	-36889.0	-0.002	Harvard Min.
II	21330.499	-36621.5	0.016	Bauernfeind
I	23404.642	-33351.0	0.022	"
I	23820.601	-32695.0	-0.051	"
I	24120.643	-32222.0	0.017	"
I	24478.266	-31658.0	-0.047*	Strohmeier
I	24498.632	-31626.0	0.025	Harvard Min.
I	24503.668	-31618.0	0.025	"
II	24512.852	-31603.5	-0.024	Bauernfeind
I	24766.877	-31203.0	0.006	"
I	24804.877	-31143.0	-0.046	"
II	24821.733	-31116.5	0.004	"
I	25286.295	-30384.0	0.017	"
I	25500.611	-30046.0	-0.025	Harvard Min.

Minimum	J.D.Hel. 2400000 +	E	(O-C)	References
I	25561.489	-29950.0	-0.029	Harvard Min.
I	25617.362	-29862.0	0.034	"
I	25657.300	-29799.0	0.018	"
I	25995.346	-29266.0	0.038	"
I	26277.517	-28821.0	-0.008	"
II	26341.305	-28720.5	0.043	Bauernfeind
II	26576.559	-28349.5	0.011	"
II	26696.442	-28160.5	0.031	"
I	26763.270	-28055.0	-0.049	"
II	27722.509	-26542.5	-0.031	"
I	27754.552	-26492.0	-0.014	"
II	28072.624	-25990.5	0.008	"
II	28201.351	-25787.5	-0.006	"
I	28397.607	-25478.0	-0.033	"
I	28458.489	-25382.0	-0.029	"
I	28510.497	-25300.0	-0.031	"
I	28708.439	-24988.0	0.042*	Strohmeier
I	28760.331	-24906.0	-0.069*	"
I	28782.595	-24871.0	-0.002	"
I	28789.566	-24860.0	-0.007	"
I	28817.464	-24816.0	-0.014	"
II	28844.421	-24773.5	-0.010	"
I	28918.293	-24657.0	-0.022	"
II	29154.592	-24284.5	0.039	Bauernfeind
II	29203.420	-24207.5	0.034	"
II	29586.466	-23603.5	0.026	"
I	29651.409	-23501.0	-0.036	"
I	29679.311	-23457.0	-0.038	"
I	29848.639	-23190.0	-0.041	"
I	29911.403	-23091.0	-0.062*	"
I	30240.624	-22572.0	0.011	Harvard Min.
I	30254.595	-22550.0	0.029	Bauernfeind
I	30367.451	-22372.0	-0.001	Harvard Min.
I	30618.561	-21976.0	-0.032	Bauernfeind
I	30665.576	-21902.0	0.052*	"
I	31003.496	-21369.0	0.054*	"
II	31671.639	-20315.5	-0.036	"
I	32118.461	-19611.0	-0.005	"
I	32466.589	-19062.0	-0.050	"
I	33151.578	-17982.0	0.008	"
I	33494.644	-17441.0	-0.026	"
I	33703.275	-17112.0	-0.045	"
II	33718.263	-17088.5	0.039	"
II	34272.534	-16214.5	0.023	Strohmeier
I	34447.265	-15939.0	0.033	Bauernfeind
II	34692.407	-15552.5	0.059*	"
I	38314.549	-9841.0	-0.007	Strohmeier
I	38349.433	-9786.0	-0.003	"
I	38377.335	-9742.0	-0.006	"
I	38384.321	-9731.0	0.004	"
I	38398.280	-9709.0	0.010	"
I	39436.444	-8072.0	-0.004	"
II	44554.7251	-1.5	0.0028	This paper
II	44554.7257	-1.5	0.0034	"
II	44554.7270	-1.5	0.0047	"

Minimum	J.D.Hel. 2400000 +	E	(O-C)	References
I	44555.6716	0.0	-0.0019	This paper
I	44555.6719	0.0	-0.0017	"
I	44555.6736	0.0	0.0000	"
II	44556.6270	1.5	0.0021	"
II	44556.6291	1.5	0.0042	"
II	44556.6287	1.5	0.0038	"
I	44558.8440	5.0	-0.0005	"
I	44558.8423	5.0	-0.0022	"
I	44558.8444	5.0	-0.0002	"
I	44612.7488	90.0	-0.0023	"
I	44612.7499	90.0	-0.0013	"
I	44612.7495	90.0	-0.0017	"

*Minimum not used in computing ephemeris (1).

The second column of Table I lists the times of minimum light for CT Eri previously published together with the photoelectric minima reported in this note. The remaining columns give in succession the epoch numbers and residuals (O-C) calculated from the linear ephemeris given in equation (1), and sources of reference. In Figure 1 the (O-C) residuals are shown plotted against epoch number. They are randomly distributed showing that the orbital period has remained nearly constant from the first times of minimum in 1900 till the present time.

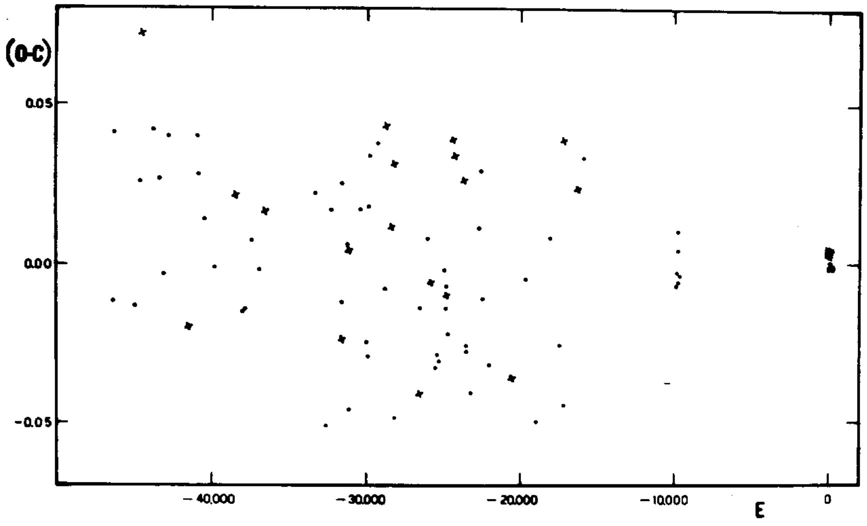

Figure 1

Orbital phases have been computed from the revised ephemeris (1) and preliminary light and colour curves have been obtained. The differential light curves in the V-magnitude and (B-V) colour are shown in Figure 2, the differences ΔV and Δ(B-V) are in the sense:variable minus comparison. Although the coverage of the light curves is not complete, the following interesting features should be noticed : (1) the light curves of CT Eri reveal a total eclipse at the secondary minimum where light is almost constant for about 90 minutes, (2) the depth of the secondary minimum is about one-half of the primary one. This feature argues, perhaps, in favour of a β Lyrae-type system rather than a W UMa-type. (3) there is no change in the colour index curve (B-V) throughout the orbital period.

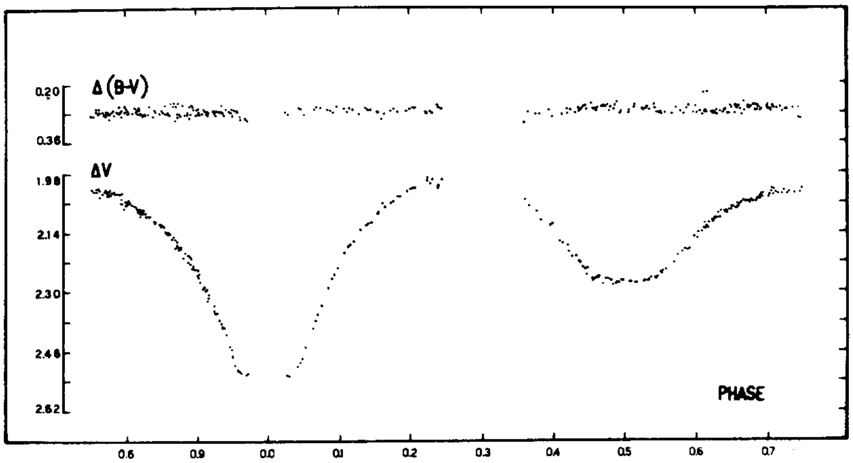

Figure 2

The system will be observed again in the next observing seasons in order to complete the light curves and analyze them using different methods of solution.

For assistance during observations we thank Mrs. J. E. Laborde, H. Moyano, and J. R. Puerta. This work was partially supported by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) of Argentina.

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ECLIPSE IN CI Cyg BINARY-SYSTEM IN 1980

Photometric observations of the symbiotic eclipsing-binary star CI Cyg have been continued in 1980 from March,31 to December 1. (Belyakina, 1976,1979a,b,1980)

These observations were very important because of the next expected eclipse in CI Cyg binary-system for summer 1980.

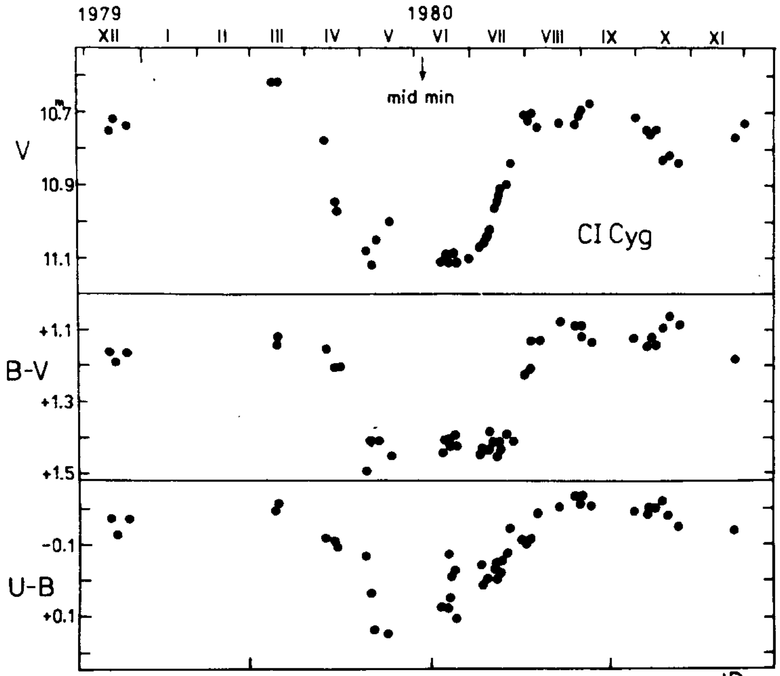

Figure 1

The results of UBV observations in 1980 and those of the end of 1979 are plotted in Fig.1. Unfortunately, due to bad weather conditions the number of the observations for the eclipse ingress was not sufficient. It is seen in Fig.1 that all three curves showed the eclipse effect. The amplitudes of the light variations in V,B,U-bands are $0.^{m}45$, $0\overset{m}{.}8$, $1\overset{m}{.}0$, respectively. Considerable U-light fluctuations are seen in minimum. V magnitude before the eclipse was $0\overset{m}{.}1$ less than after it. The minimum center was near 1980 June 6.

Our observations of 1975 (Belyakina, 1976, 1979a) and those of 1980 are compared in Fig.2. From Fig.2 it is seen that as the durations of both minima as minimum V magnitudes are close to each other.

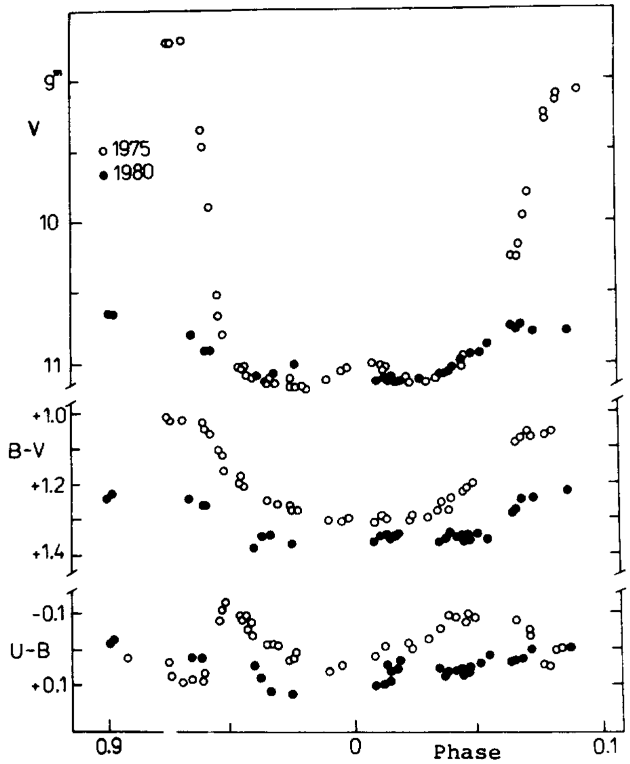

Figure 2

But (B-V) and (U-B) colour indices in 1980 were redder than in 1975. Moreover the from of the (U-B) curve variations in 1980 changed as compared with 1975. These facts evidence that U-band radiations in the eclipse minimum decreased considerably from 1975 to 1980. One of the possible causes of this effect might be the decrease of U-light radiating region.

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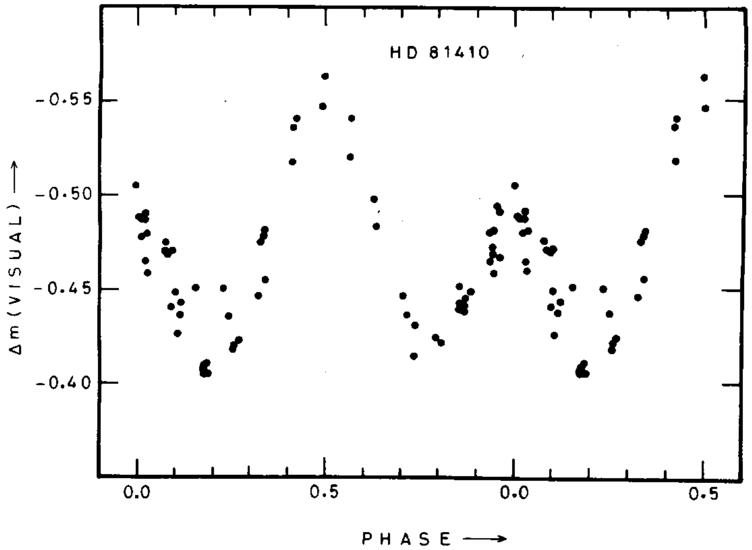
ON THE PHOTOMETRIC PERIOD OF HD 81410

HD 81410 is a single lined spectroscopic binary with K1 III spectrum displaying strong CaII H and K emission and 'filled Balmer lines' (Bidelman and MacConnell 1973, Eggen 1978). Photometric observations by Eggen (1973) in 1971 and 1972 confirmed the suspected light variability of HD 81410. He quotes a photometric period of 25.4 day which satisfies the observations of each season separately.

HD 81410 was included in our photometric programme on late type emission binaries mainly because very little is known about this system. Observations were made with the 34-cm reflector of the Kavalur Observatory on 34 nights, during 1981 January 3-March 14, through standard B and V filters. All measurements were made with respect to the comparison HD 81904. As a check on the constancy of the comparison, HD 80991 was also observed. An unrefrigerated 1P21 together with the conventional d.c. setup was used throughout.

It was immediately understood that the present set of observations does not follow the period derived by Eggen. Our observations indicated a period around 12.7 day. We tried a number of trial periods and find that P = 12.86833 day fits the present as well as Eggen's observations well. In the figure the visual magnitude difference, HD 81410-HD 81904, is plotted against the photometric phase computed using the above period. The time of the first observation is taken as the initial epoch. We find that the light curve has changed drastically since Eggen obtained the first light curve during 1971-72. The amplitude of light variation has decreased to ~ 0.15 from ~ 0.45 mag and the mean light level of the system has gone up by ~ 0.10 mag.



It appears that HD 81410 is a member of the RS CVn group of binaries proposed by Hall (1976), where the photometric variation is attributed to the presence of 'starspots' which rotationally modulate the observed flux. A detailed analysis of all the available information, both spectroscopic and photometric, is in progress and will be published elsewhere.

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PHOTOMETRIC OBSERVATIONS OF V523 Cas

V523 Cas is an eclipsing binary of W UMa type with one of the shortest known periods ($0^{d}.2337$). Discovered by Weber (1957), photoelectric observations and analyses have been given by Lavrov and Zhukov (1975, 1976) and Bradstreet (1981)

In November 1979, V523 Cas has been observed during four nights with the 1.06m telescope of Hoher List Observatory and its double beam photometer. The light curves in B and V are shown in Figs. 1 and 2. An independent analysis of these data has been carried out, but as the results generally agree well with those obtained by Bradstreet, only a few remarks seem to be necessary.

Minima times have been determined:

JD hel.	2444191.3291	Min. II
	2444194.4828	Min. I
	2444195.5363	Min. II
	2444200.3262	Min. I

A combination of the minima times determined by Lavrov and Zhukov (1976), Busch (1974), Bradstreet (1981) and those listed above indicate an increase of the period to $0^{d}.2336908$ since JD 2441300.

At the maxima and at primary minimum small night to night brightness changes have have been noticed, but they had no detectable effect on the light curve analysis. It is interesting to note that an analysis of the data by means of the Russell-Merrill method reproduced essentially the elements found by Lavrov and Zhukov. So the light curve is apparently quite stable. Because of the well known shortcomings of this method, applied to W UMa binaries, their findings have to be translated to the contact model, however. Somewhat critical seems to be the question if V523 Cas has com-

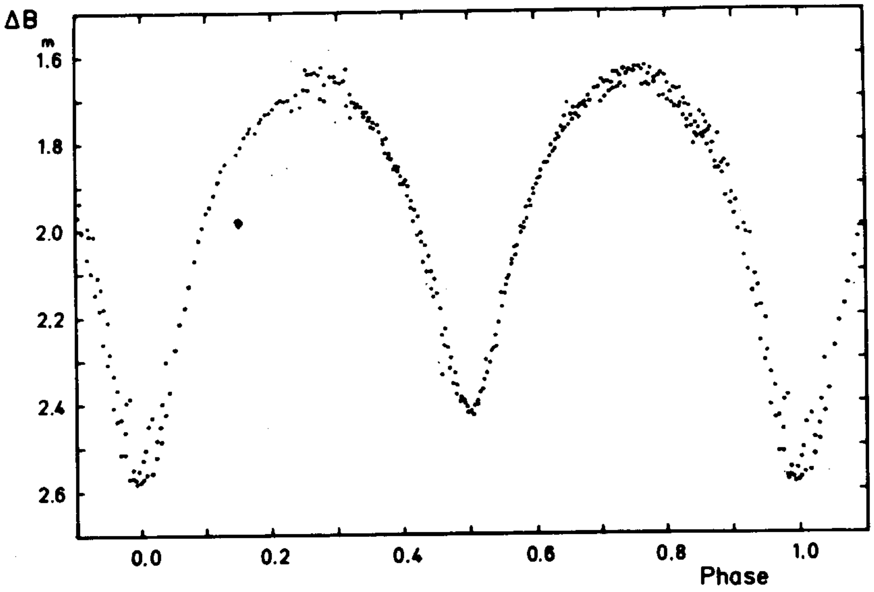

Fig. 1 B light curve of V523 Cas relative to BD+49°151

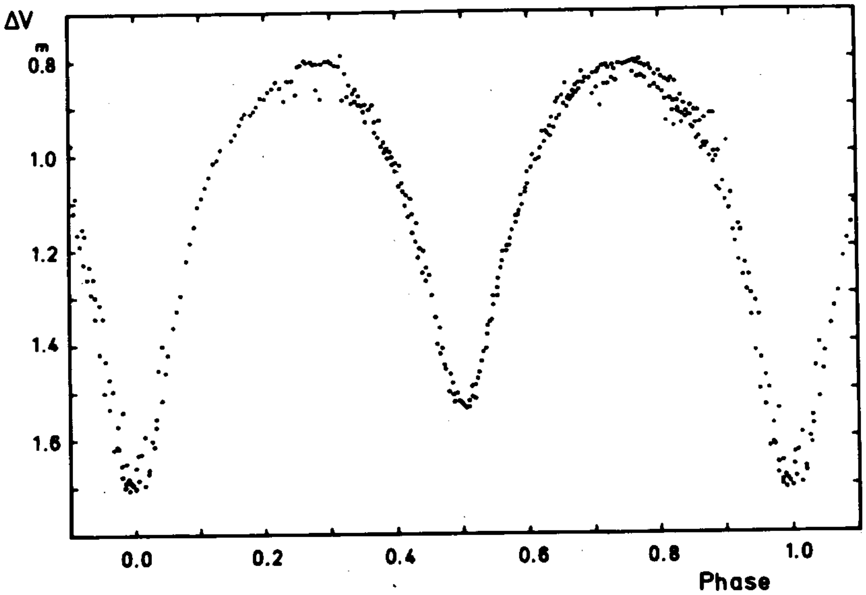

Fig. 2 V light curve of V523 Cas

plete or partial eclipses. There is a rivalty of the results by the Russell-Merrill type analysis which yields only a definite complete eclipse solution (and - even more important - of the data in fig. 4 in the paper by Lavrov and Zhukov (1976) which shows a flat bottom of the primary minimum) versus the theoretical light curve solution by Bradstreet, who obtained incomplete eclipses. The observations reported here do not show a constant part in the occultation minimum, but the eclipses are probably almost tangential.

V523 Cas exhibits two minor complications which are very similar to respective ones in CC Comae (Rucinski, 1976). 1) The second maximum is slightly brighter than the first maximum: the B_1 rectification coefficient in the classical second order Fourier expansion of maximum light is -0.0072. For longer period W type systems usually a slight brightness excess of the maximum following the occultation can be found. 2) The colour at min. II becomes redder than expected. It is suggested that the present assumptions on the brightness and temperature distributions on the components are not quite sufficient yet to explain these phenomena in the coolest contact binaries.

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OBSERVATIONS OF SOUTHERN dMe STARS IN 1975 †

In November 1975 (JD 2442721 to JD 2442736) 13 southern red dwarfs have been measured several times each night with the 50cm ESO telescope (La Silla/Chile) and its standard UBV photometer. The aim was to detect small scale BY Dra type variability. Besides the well known dMe star AU Mic two other dMe stars showed a significant variability. For "detectability limit" the following definition has been adopted: For a given night the comparison stars yield an empirical relation photometric error (standard deviation) / magnitude. Variability is then assumed, if the measurements of a programme star vary by more than twice the photometric errors for each single night of comparison stars with comparable brightness.

The dMe stars satisfying this condition are:

1) AU Mic

With the light elements

$$JD\ 2442720.75 + 4\overset{d}{.}865\ E$$

the B and V light curves in Figs. 1 and 2 have been plotted. The period is by Torres and Ferraz Mello (1973). Since their observations of 1971 the V amplitude has dropped from $0\overset{m}{.}30$ to $0\overset{m}{.}12$. The (B-V) amplitude is now $0\overset{m}{.}02$. The shape of the light curve has also changed considerably. The complete rise to the maximum takes only $0\overset{p}{.}20$. Since the magnitude at maximum has slightly decreased and the brightness of the minimum has increased, it can be concluded that the variability causing spots on AU Mic are now spread more uniformly over all longitudes.

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† Based on observations made at the European Southern Observatory (La Silla/Chile)

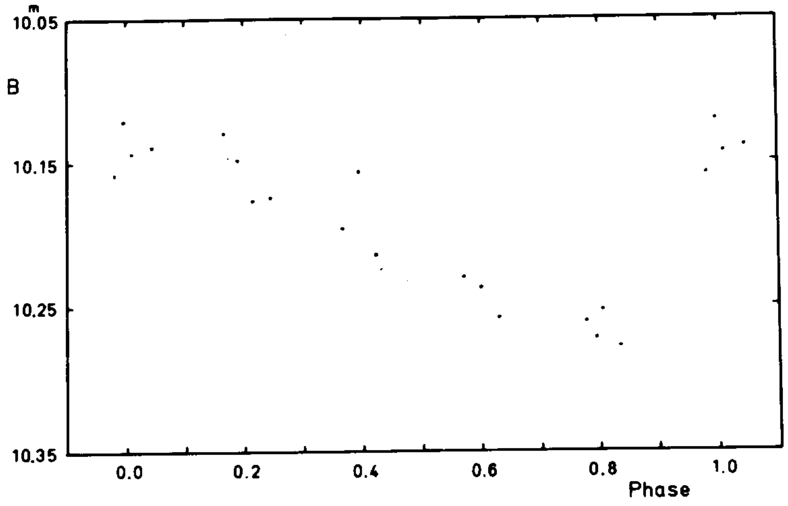

Figure 1 B light curve of AU Mic

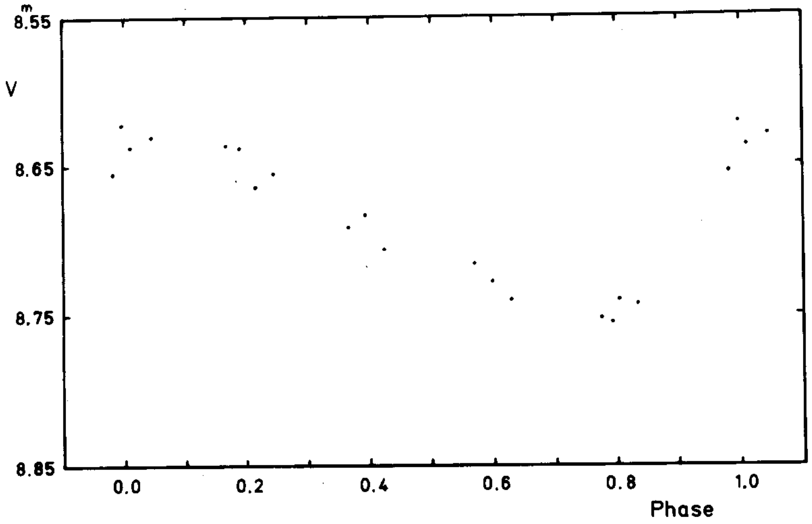

Figure 2 V light curve of AU Mic

2) Gliese 54.1

Although no significant BY Dra syndrome could be detected, this star showed the strongest variability among the programme stars: during one night it exhibited a flare with a B amplitude of at least $0\overset{m}{.}73$. Measurements of that night:

JD hel.	2442733.6222	V	$11\overset{m}{.}911$
	.6653		11.725
	.6687		11.761
	.7131		11.824
	.7494		11.895
JD hel.	2442733.6204	B	$13\overset{m}{.}873$
	.6636		13.147
	.6653		13.239
	.7099		13.641
	.7131		13.673
	.7470		13.747

3) CD-23°693

Unlike the other programme stars this one shows a sinusoidal brightness modulation of $0\overset{m}{.}015$ amplitude. Although this amplitude is small, it satisfies formally the above mentioned condition, which would set a significance limit at $0\overset{m}{.}010$. The V light curve is shown in Fig. 3.

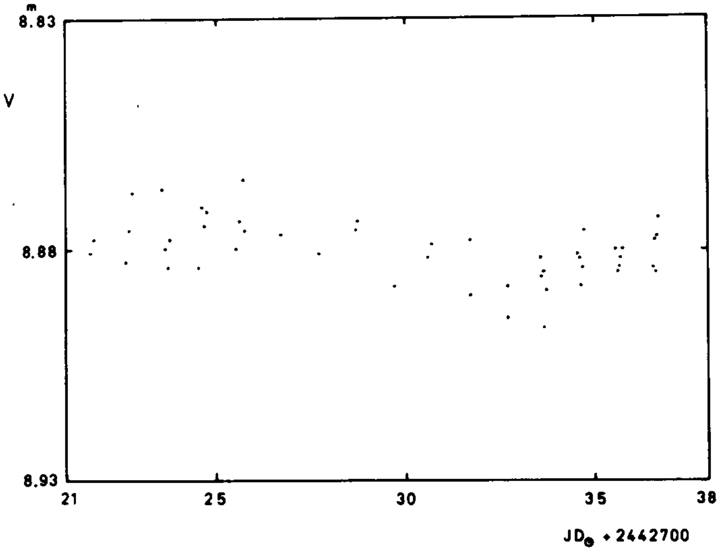

Figure 3 V observations of CD-23°693

A doubtful case is CD-37°15492. The 65 observations of this dMe star (the brightest of the programme stars and excellently placed in the sky for observations) form an irregularly variable sequence on a time scale of a few days with an amplitude of $0\overset{m}{.}015$. Perhaps a longer observing run on this object can reveal a periodicity for this modulation.

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Reference:

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LIGHT CURVES OF DD Com AND TY UMa

DD Com is an eclipsing binary of W UMa type. It has been discovered by Hoffmeister (1964). A photographic light curve has been published by Meinunger and Wenzel (1968). The object has been observed on April 12, April 13, May 13, 1980 and February 11 and February 13, 1981 with the double beam photometer at the 1.06m telescope of Hoher List Observatory. Comparison star has been a 13th magnitude star 11mm left and 13mm above DD Com in the finding chart by Hoffmeister.

The star showed minima at

JD hel.	Ep.	O-C
2444342.3845	24379.0	$-0\overset{d}{.}001$
2444373.48	24494.5	0.00
2444647.6750	25513.0	+0.010
2444649.6925	25520.5	+0.008

The previously known light elements by Meinunger and Wenzel can be slightly modified:

JD hel. min. I = 2437779.410 + $0\overset{d}{.}2692061$E

Light curves from the B and V measurements are shown in Figs. 1 and 2. Not only the minima differ well in brightness, but also the first maximum is considerably brighter than the second maximum. These asymmetries have decreased between 1980 and 1981, however. It is concluded that DD Com is a more active contact binary, similar to VW Cep.

TY UMa has been discovered by Beljawsky (1933) and was observed by several authors since then. But only very shortly ago (Broglia and Conconi, 1981) the correct period ($0\overset{d}{.}35$) of this W UMa type eclipsing binary has been announced.

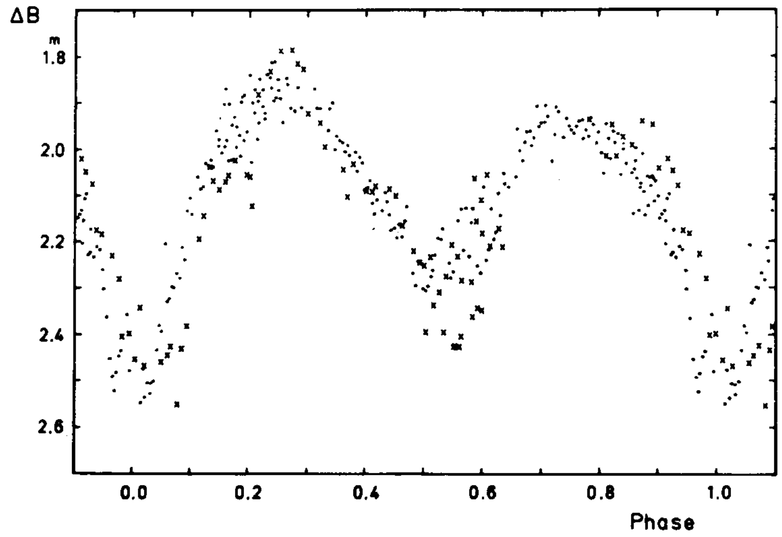

Fig. 1 B light curve of DD Com. Dots: 1980 data, crosses: 1981 data

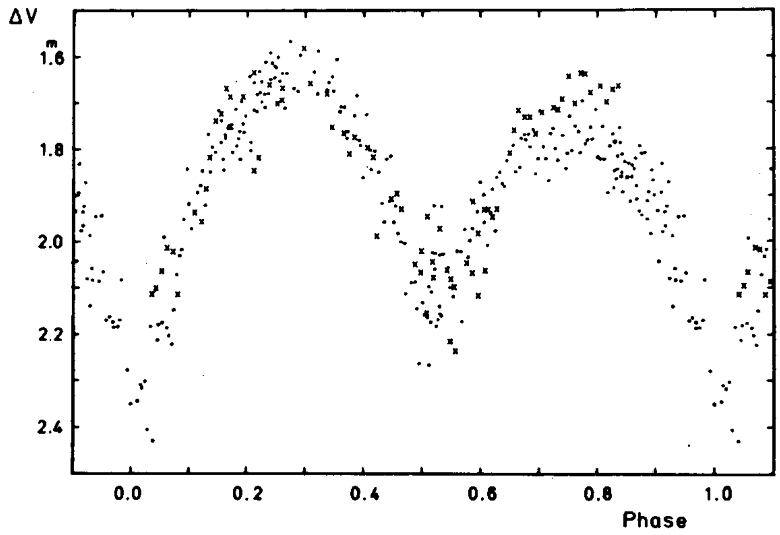

Fig. 2 V light curve of DD Com

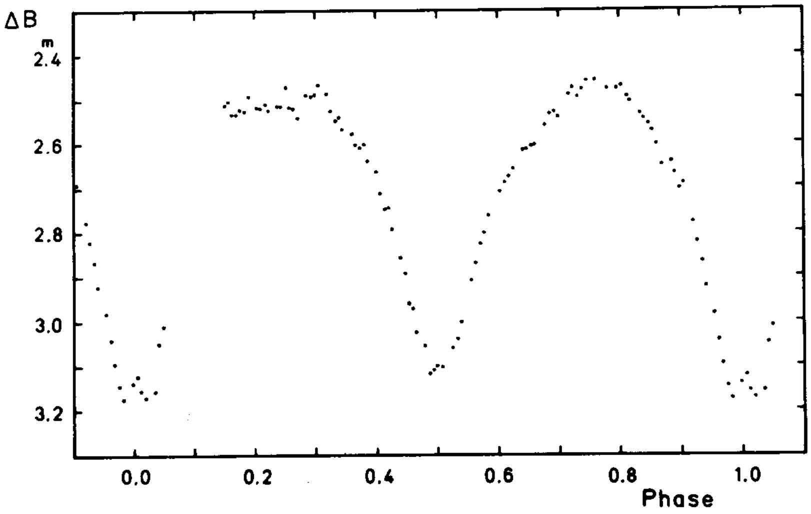

Fig. 3 B light curve of TY UMa

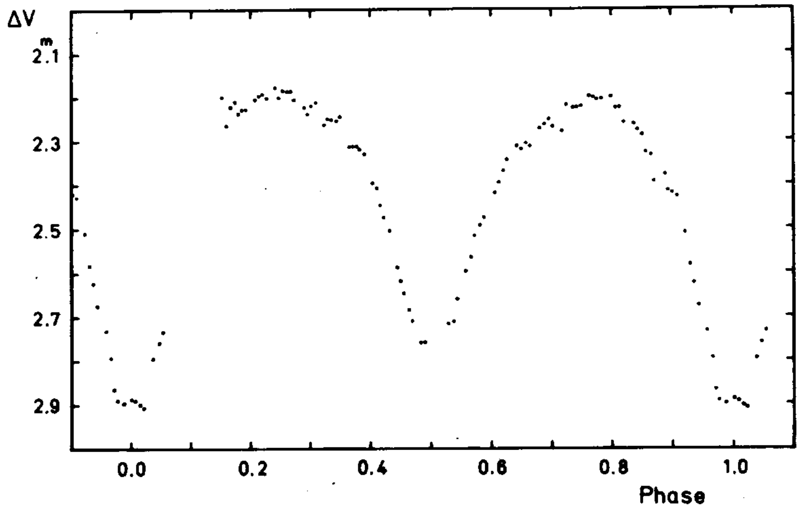

Fig. 4 V light curve of TY UMa

Observations of TY UMa could be obtained on February 13, 1981. BD+56°1572 served as comparison star. The observing instrument was again the 1.06m telescope of Hoher List Observatory with its double beam photometer. The following minima times have been determined:

JD hel.	2444649.389	min.II
	2444649.564	min. I

Although both minima are 7 minutes early with respect to the new light elements by Broglia and Conconi, a period change since 1967 cannot be derived from this result yet. Figures 3 and 4 show the light curve of TY UMa in B and V. Especially the V curve shows minima with constant intervals. So this is another W UMa system with complete eclipses.

Fourier coefficients for the light outside the eclipses (phases 0.16...0.34, 0.66...0.84) have been calculated:

$$\ell_B = 0.9031 + 0.0157 \cos \theta - 0.0920 \cos 2\theta - 0.0017 \sin \theta - 0.0158 \sin 2\theta$$

$$\ell_V = 0.8729 + 0.0283 \cos \theta - 0.1059 \cos 2\theta + 0.0115 \sin \theta - 0.0094 \sin 2\theta$$

There are a positive cos θ term and a larger sin 2θ term. They are in contradiction to a light curve free of complications. A detailed analysis should be postponed until reliably undistorted light curves of TY UMa are available.

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OBSERVATIONS OF VARIABLE STARS ACCIDENTALLY FOUND ON MINOR PLANET PATROL PLATES

While blinking plates for minor planets we have found a few stars obviously changing their brightness. They have mostly been identified as objects listed in the first catalogue of suspected variable stars (Kukarkin et al., 1951). Unless otherwise stated, the observations have been made with the 30cm f:5 astrograph of Hoher List Observatory.

1) UW Gem

Classified as an eclipsing binary there has been some confusion about its identification (Hoffmeister, 1944). Because no finding chart is available, Fig. 1 shows the variable and its surrounding stars. The brightest objects shown are BD+13°1377 (lower right) and BD+13°1378 (upper middle). The actual observations are

JD hel. 2444290.4200 m_{pg} $17\overset{m}{.}5$
2444291.4758 $15\overset{m}{.}5$

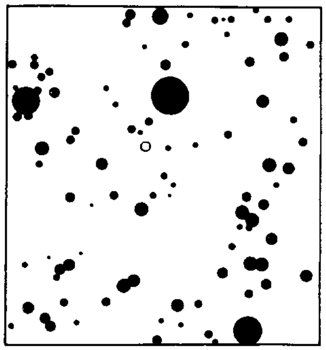

Fig. 1 Finding chart for UW Gem

2) CSV 2361 (Lib)

The star has been observed as follows:

JD hel.	2444369.4857	m_{pg}	$14^{m}.5$
	2444369.5121		$14^{m}.5$
	2444370.5141		$15^{m}.5$
	2444371.4884		$15^{m}.5$

3) CSV 3422 (Oph)

The first four plates have been taken with the 30cm f:17 refractor of Hoher List Observatory by M. Geffert.

JD hel.	2443340.4211	m_{pg}	$15^{m}.8$
	2443361.3988		$15^{m}.0$
	2443364.4065		$15^{m}.2$
	2443365.409		$16^{m}.0$
	2444370.5847		$15^{m}.6$

4) CSV 4566 (Aql)

The star is bright on both prints of the Palomar Observatory Sky Survey.

JD hel.	2444369.5445	m_{pg}	$14^{m}.8$
	2444370.5646		$14^{m}.8$
	2444371.5626		$15^{m}.5$

5) Anon. (Lib) 1950.0 $15^{h}07^{m}.9$ $-9^{\circ}18'$

A finding chart is given in Fig. 2. The star marked by dashes is BD-8°3915. The variable seems to be faint on the

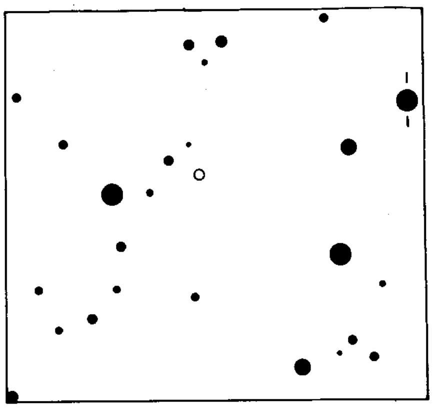

Fig. 2 Finding chart for the suspected variable in Libra

Atlas Stellarum by Vehrenberg and on the red print of the Palomar Observatory Sky Survey, but bright on its blue print.

JD hel.	2444370.4621	m_{pg}	$13^{m}.4$
	2444370.4871		$13^{m}.6$
	2444371.4607		$13^{m}.0$

Although none of the suspected variability types can be confirmed by these few observations, it can be concluded that all of the previously suspected variable stars are in fact variable on time scales of a few hours.

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OBSERVATIONS OF TZ Boo, BL Leo, AND V524 Mon

In February 1981 photoelectric observations of several eclipsing binaries have been made with the 1.06m telescope of Hoher List Observatory and its double beam photometer. Among them are:

1) TZ Boo. A complete new light curve could be obtained. The magnitudes at the four main phases were

Phase	0.00	B	$11^{m}.49$	V	$10^{m}.79$
	0.25		11.11		10.41
	0.50		11.47		10.77
	0.75		11.14		10.46

A minimum time has been determined

JD hel. 2444650.5625 Ep. 16885.5 O-C $-0^{d}.015$

according to the light elements (Hoffmann, 1980a)

$$\text{JD hel. min. I} = 2439632.8418 + 0^{d}.29716200E$$

The tendency of the O-C's noticed in 1980 (Hoffmann, 1980b) has continued and increased to $-0^{p}.05$. So it is suggested that the period of TZ Boo has in fact become shorter.

The light curve shows an almost round shaped, slightly declining minimum at phase 0.5 when there should be the flat and sharply limited occultation minimum. Also a brighter maximum at phase 0.25 is not usual for TZ Boo, although it has been observed previously, for instance in 1975.

2) BL Leo. A minimum time has been observed, but there are only few measurements defining the rising branch after the minimum. The minimum was at

JD hel. 2444648.615 Ep. 24821.5 O-C $-0^{d}.009$

So the light elements

$$\text{JD hel. min. I} = 2437650.654 + 0^{d}.2819318E$$

given by Meinunger and Wenzel (1968) seem to be generally confirmed.

3) V524 Mon. A complete light curve has been measured in B. Comparison star has been a 10th magnitude star 24mm above the variable in the chart by Wachmann (1966). The following minima times have been determined:

JD hel.	2444648.295	Ep.	35970.5	O-C	$+0\overset{d}{.}003$
	2444648.434		35971.0		0.000

These data are obviously still well consistent with the light elements by Wachmann

$$\text{JD hel. min. I} = 2434446.442 + 0\overset{d}{.}28361714E$$

The accuracy of the individual measurements has been lowered by a strongly moonlit sky. Therefore only normal points are given in Fig. 1 where the light curve is shown. There are no detectable brightness differences between the maxima as well as between the minima within the limits of accuracy. The

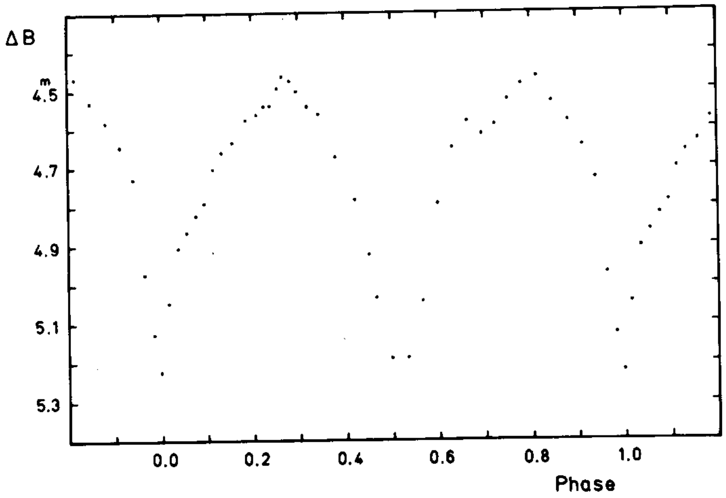

Fig. 1 B light curve of V524 Mon (normal points).

minimum at phase 0.5 seems to be slightly wider. So that minimum may be of occultation type.

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PHOTOMETRY AND DISTANCE OF NOVA CORONA AUSTRINA 1981

Photometry of Nova CrA (I.A.U. Circular 3590) ($\alpha = 18^h40^m.6$, $\delta = -37^\circ33'$ [1981], $\ell = 358^\circ$, $b = -14.4^\circ$) was carried out on the S.A.A.O. 0.5m and 1.0m telescopes during a three-week period shortly after discovery. UBV and $V(RI)_{KC}$ were obtained on two photometers equipped with an EMI6256 and an EMI9659 photomultiplier tube, respectively. The results appear in Table I.

Table I

2444000	V	B-V	U-B	V-R	V-I
703.63	8.87	-0.33	-0.91	1.05	1.07
704.56	8.98	-0.38	-0.92	1.02	0.97
706.68	9.25	-0.38	-0.96	1.03	0.82
712.58	9.88	-0.50	-0.98	0.87	0.46
713.62	9.93	-0.52	-0.94	--	--
715.64	10.06	-0.59	-0.95	0.78	0.39
720.55	10.60	-0.70	-1.05	--	--

Formal errors are $\lesssim$.01 except for the 5th and 7th U-B points where they are $\sim$.015. However, the transformation to the standard system is no doubt very rough because of the probable extreme differences between the nova spectrum and those of normal calibrating stars. This is demonstrated by the consistent shift of V(blue tube) - V(red tube) = 0.176, dispersion 0.012. The tabulated V magnitude corresponds to an average of the two tubes, or to V(blue tube) minus one-half the average shift on two nights when only blue tube data were available. Mr. J. D. Laing contributed the last epoch observation with the 1.0m; the rest are 0.5m by the author.

A straight-line fit of magnitude versus time is fair except for V-I. We obtain

$$V = 8.539 + (JD - 2444700.) \times 0.1009$$
$$B = 8.284 + (JD - 2444700.) \times 0.0801$$

Kozai and Kosai (I.A.U. Circular 3950) reported the time of discovery as JD2444697.25. Gilmore (I.A.U. Circular 3951) provided evidence that eruption had not yet occurred as of 2.20 days earlier. With these limits on the time of maximum, together with the van den Bergh (1965) nova parallax

$$M_{pg}(max) = -11.9 + (3.2 \pm 0.3) \log t_2$$

the Bahcall-Soneira (1980) space reddening model (based on Sandage's (1972) modified cosec *b* law and an obscuring layer in the Galactic plane of z scale height 100 pc)

$$A_B(r) = 0.83(1 - \exp(-2.5r)),$$

and a distance scale of R_o= 9 kpc, we obtain the distance to the nova and its Galactocentric (R,z) position given in Table II.

Table II

$t_{discovery} - t_{maximum}$ (d)	r(kpc)	R(kpc)	z(kpc)
0.0	8.5	2.2	2.1
1.1	8.2	2.3	2.0
2.2	7.9	2.4	2.0

The parallax-based uncertainty on the distance is typically ±1.6 kpc, that on z, ±0.4kpc. The nova apparently is located in the proximity of the central Galactic bulge.

One caution on this analysis is in order, however. The announcing circular provisionally gave two V magnitudes of 7.0 (2444697.25) and 7.4 (2444701.27), which fit the slope but are 1.25 magnitudes brighter than the S.A.A.O. extrapolated line. If these two data points were confirmed, then the above analysis would yield r = 4.8-4.4 kpc, R = 4.5-4.8 kpc, and z = 1.2-1.1 kpc in place of Table II.

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PHOTOELECTRIC OBSERVATIONS OF THE LOW-AMPLITUDE CEPHEID V1726 Cyg

V1726 Cyg (=BD + 48°3398=SAO 050939=SVS 2299) was discovered and classified as a cepheid variable with low amplitude and sinusoidal light curve in the course of a detailed investigation of the open cluster M39 by one of the authors (I.P., 1979). Our previous photographic photometry revealed the basic properties of the variable V1726 Cyg, i.e. the form of the light curve, period, amplitude and colour indices. It, however, became clear that more precise photometry was desirable in view of the possible membership of the cepheid V1726 Cyg to an anonymous open cluster (I.P., 1979).

The cepheid V1726 Cyg was observed photoelectrically using the 0.6 m Zeiss reflector equipped with an uncooled photomultiplier EMI 6256s and filter combination reasonable close to the standard UBV system at the Crimean station of the Sternberg Astronomical Institute. Several observations were made with an analogous reflector but with another photometer at Maydanak, the high-mountain expedition of the Tashkent Astronomical Institute. All the observations were converted to the UBV system. The comparison star was the standard star N$^{\underline{o}}$9=BD + 47°3439 (Johnson, 1953) and it was monitored both before and after every observation of the cepheid. The results of our BV photoelectric photometry of the cepheid V1726 Cyg are listed in Table I. Observations made at zenith distances greater than 51°are marked by colon. In Figure 1 the composite V and (B-V) curves versus phase are plotted according to the revised elements,

$$\mathrm{Max}_V \text{ JD hel} = 2444105.39 + 4\overset{d}{.}2359\cdot E$$

Table I.

B,V observations of the cepheid V1726 Cyg

JD hel (2444000+)	V	B-V	JD hel (2444000+)	V	B-V
021.507	8.960	0.904	032.519	8.928	0.885
022.382	9.049	0.952:	033.340	8.885	0.846:
022.525	9.050	0.936	033.473	8.877	0.872
023.387	9.022	0.931:	034.368	8.975	0.941:
023.517	9.016	0.909	034.515	8.997	0.925
024.357	8.892	0.893:	035.430	9.063	0.952
024.511	8.895	0.849	035.516	9.059	0.942
025.359	8.909	0.889:	037.441	8.888	0.857
027.484	9.023	0.934	037.523	8.873	0.865
027.492	9.022	0.920	039.441	9.060	0.944
028.364	8.923	0.879:	039.526	9.061	0.957
028.515	8.924	0.876	457.397	8.894	0.887
030.368	8.987	0.927:	461.173	8.859	0.865
030.521	9.032	0.930	464.155	8.992	0.912
031.355	9.060	0.938:	464.161	8.989	0.929
031.518	9.054	0.956	465.157	8.869	0.865
032.469	8.947	0.892	466.160	8.900	0.902

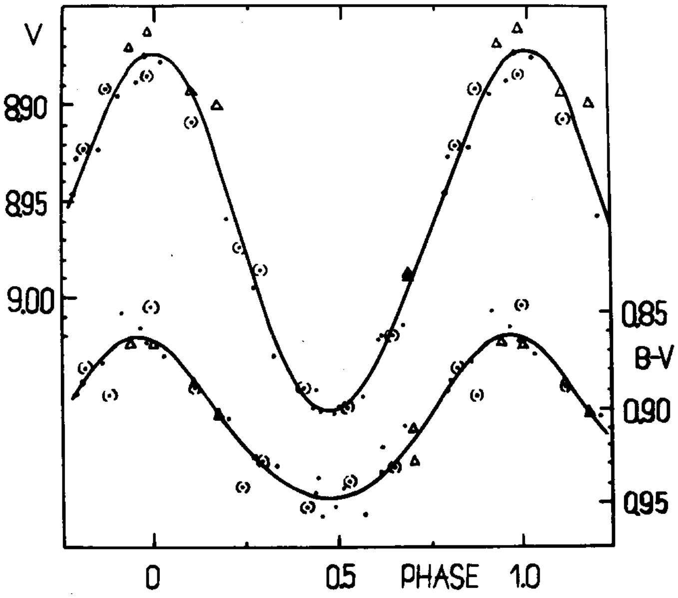

Figure 1:Composite V and (B-V) curves of V1726 Cyg. Dots-Crimean observations, dots in bracket-Crimean observations at $z>51^{\circ}$, triangles-Maydanak observations.

In addition we performed a Fourier analysis for the composite light and colour curves (the solid curves in Figure 1), using the algorithm of Schaltenbrand and Tammann (1971). The extreme and intensity averaged values of the cepheid V1726 Cyg magnitudes in V,B and (B-V) are shown in Table II. The (U-B) variations are marginal (probably less than $0^m.04$) and as we failed to match the two different sets of observations in U-light it is not reasonable to present these observations.

Table II.

The light curve parameters of V1726 Cyg

Period = $4^d.2359$
Log P = 0.6269

V_{max} = 8.872	V_{min} = 9.061	ΔV = 0.189
B_{max} = 9.736	B_{min} =10.007	ΔB = 0.271
<V> = 8.967	<B> = 9.872	<B-V> = 0.908

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NATURE DE LA VARIABLE UY Mon

Dans le General Catalogue of Variable Stars (Kukarkin et al., 1969), UY Mon est classée binaire à éclipses de période 1,261246 jour sur la base des observations photographiques de Gaposchkin (1953).

Précédemment différentes périodes lui avaient été attribuées 4,8640 jours (Guthnick et Prager, 1928), 5,340 (Prager, 1929), 5,33903 (Parenago, 1948) et plus récemment 1,261253 (Busch, 1973); toutes ces études considérant également l'étoile comme binaire à éclipses.

Aucune vitesse radiale n'existant pour cette étoile relativement faible (m_{pg} 9,6) nous l'avons observée au spectromètre à vitesses radiales *coravel* (Baranne et al., 1979) entre février 1980 et mars 1981.

Dès les premières mesures il nous apparut qu'aucune des périodes ci-dessus ne convenait pour représenter nos observations.

Avec les 18 vitesses très précises obtenues (tableau), nous avons recherché la période avec le programme Harpe (Imbert, 1979) dans l'intervalle de un à six jours avec un pas de 0,002 jour; le calcul nous a donné un seul minimum très net du σ des résidus (0,6 km s^{-1}) correspondant à la période 2,398 jours.

Afin de confirmer cette valeur la même méthode a été utilisée indépendamment avec les 60 mesures photographiques de Parenago (1948); nous avons obtenu le minimum du σ pour une période P = 2,39813 jours, en excellent accord avec celle calculée à partir des vitesses radiales et probablement plus précise car déduite de mesures beaucoup plus étalées dans le temps. Cette valeur de 2,39813 jours permet de représenter également les mesures anciennes de Prager (1929) d'une manière satisfaisante.

Table I

JJ	VR	O-C	JJ	VR	O-C
44297,4208	26,7	-1,2	44335,4063	40,9	-0,5
44298,4528	35,2	-0,5	44337,3021	42,4	0,3
44299,4049	42,1	0	44337,3819	42,7	-0,5
44300,2944	27,1	0,1	44572,5882	45,3	0,5
44300,4111	28,5	-0,2	44573,5826	26,3	0,6
44331,3250	24,9	-0,5	44681,3368	25,0	-0,1
44332,3458	39,5	-0,2	44682,3701	38,5	0,3
44333,3833	29,6	1,4	44683,2785	37,7	0,5
44334,3681	35,2	0,4	44683,3875	32,6	-0,4

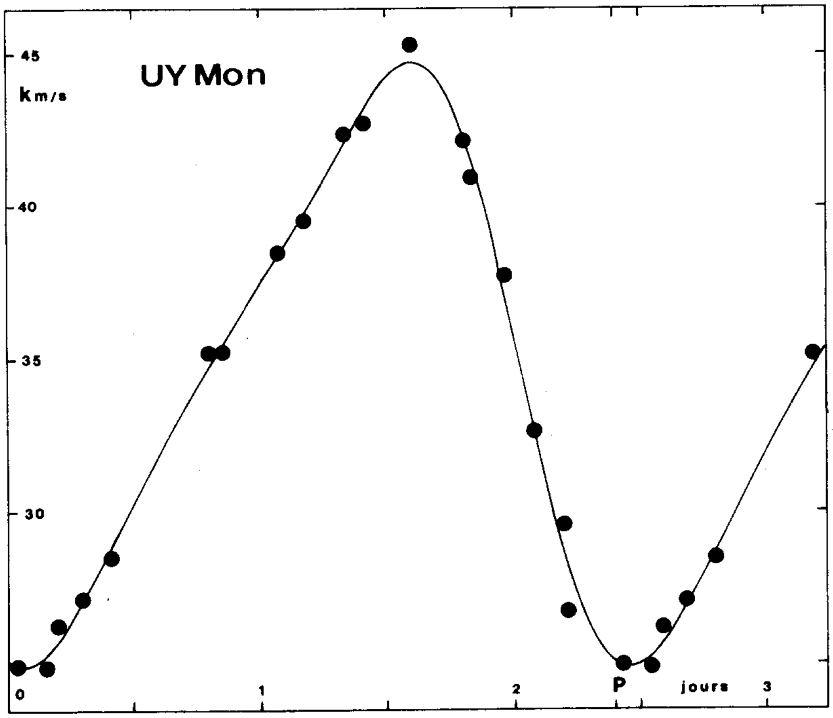

Fig. 1. Mesures de vitesses radiales ramenées à un même cycle avec la période 2,39813 et lissage à trois harmoniques

Avec cette période nous avons calculé une orbite spectroscopique; nous avons ainsi obtenu pour a sin i et f(m) respectivement 305 000 km et 0,0002 $M_{\odot}$; ces valeurs sont tout à fait inacceptables pour un système à éclipses. L'hypothèse d'une variable intrinsèque étant ainsi retenue, la forme des courbes de vitesses radiales (montée lente, descente rapide) (Fig. 1) et de lumière (montée rapide, descente lente) (Fig. 2), associée au type spectral de l'étoile (F8II), suggère une variable du type cepheïde classique.

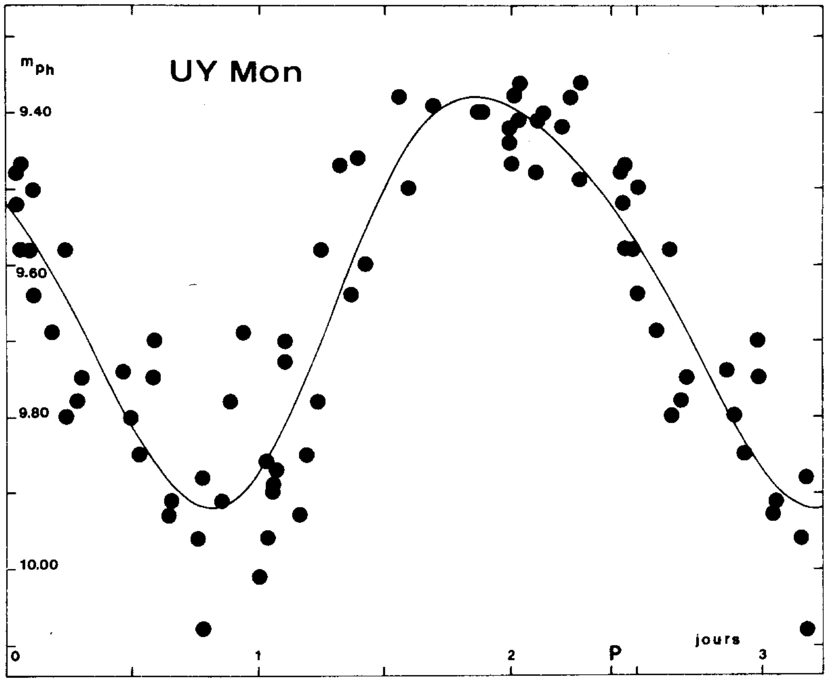

Fig. 2. Mesures photographiques de Parenago ramenées à un même cycle avec la période 2,39813 et lissage à deux harmoniques

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B-FILTER LINEAR POLARIZATION MEASUREMENTS OF μ Cep IN THE AUTUMN OF 1980

Arsenijevic et al. (1980) have recently reported on four V spectral region linear polarization measurements of the semi-regular variable star μ Cep (M2 Ia, SRc) which were carried out in 1980 August and September. This bulletin will report on seven wide-band (B) filter linear polarization measurements of μ Cep which were made in a contiguous epoch. All the observations being reported here were carried out at the Cassegrain focus of the 61 cm telescope at Columbia University's Harriman Observatory. The same filter, and essentially the same polarimeter, ancillary equipment and observing procedures were used as in previous surveys of this type carried out by the author (Hayes 1980a, 1980b). The interested reader may consult these references for further details regarding instrumentation and observing procedures.

The polarization observations are reported in Table I, with P denoting the amount (expresssed as a percentage), and θ denoting the direction (expresssed in the equatorial coordinate system). Each observation had a Poisson photon-count standard deviation of 0.025% for P as well as for the two Stokes parameters $Q = P \cos 2\theta$ and $U = P \sin 2\theta$. The standard deviation of θ is given by $28^\circ\!.7\ (\sigma_p/P)$. Observations were only carried out when the moonlight background was negligible.

Perusal of the data suggests that the polarization was relatively quiescent over most of the observing

Table I

Polarization Degree and Position Angle of μ Cep

Date (UT)	P (%)	θ (deg.)
1980 Oct. 01	4.16	41.6
1980 Oct. 07	4.18	41.2
1980 Oct. 10	4.21	41.3
1980 Nov. 03	4.19	41.7
1980 Nov. 05	4.17	41.4
1980 Nov. 13	4.12	42.1
1980 Dec. 04	4.05	39.7

interval. But the very last observation (1980 Dec. 04) suggests that the polarization had commenced to decrease. (Unfortunately, the paucity of observations in 1980 December precludes making any more definitive statement.) A series of formal statistical tests [consult Hayes (1980a) for details] were carried out to gauge the variability of the consolidated distribution of Q and U data points. A test of the first five observations showed variability at only the 57% confidence level, which is considered to be statistically insignificant. A test of all seven observations showed variability at the 99% confidence level, a statistically significant result. The quiescence of the first five observations (1980 Oct. 01 - Nov. 05) agrees with the invariant polarization over about a month's interval reported by Arsenijevic et al. (ibid). The variability detected over the complete observing interval is in agreement with Coyne and Kruszewski's (1968) observation that large changes in polarization occur over the course of a few months in this star. Arsenijevic et al. (ibid) reported a mean $\bar{P}$ of 3.8% and a mean $\bar{\theta}$ of 35°, and noted that the polarization was larger than any previously reported in the English-language literature. The B-filter polarizations being reported here ($\bar{P}$ = 4.15%, with a $\bar{\theta}$ of 41.3°) are also quite large. Differences in the amount and direction of polarization in the B- and V-region are not unexpected in late-type stars, and have previously been been reported in μ Cep by Coyne and Kruszewski (ibid).

The results of this survey may be summarized as follows. The wide-band (B) filter linear polarization measurements being reported here both concur with, and complement and extend the V spectral measurements of Arsenijevic et al. (ibid). Both series of measurements showed that in a historical context the polarization was remarkably strong. The significance and implications of such large polarization values have already been pointed out by Arsenijevic et al. (ibid). The data being presented here has been shown to be variable over the course of the complete observing interval (some 2 months). The later stages of this survey suggest that the polarization has started to decrease. This star will continue to be monitored as part of an ongoing effort to determine the precise morphology of polarization variations in selected late-type stars.

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A PHOTOELECTRIC TIME OF MINIMUM OF TV Cas IN FOUR COLOURS

During the winter of 1980-1981 TV Cas was observed at the wavelengths 4720, 6720, 7820 and 8710 Å of the Utrecht Photometric System (Provoost, 1980) using the 40 cm f/12.5 reflector of the Astronomical Institute at Utrecht. This telescope is located at the Dutch Observatory in Ausserbinn, Switzerland ($\lambda = -8^{\circ}8'44''$, $\phi = 46^{\circ}23'05''$, alt. = 1350 m) and is equipped with a single-channel photometer containing a refrigerated RCA 31034 A tube. The data were reduced with the comparison star BD+58°0024. The primary minimum of J.D. 2444602 (28/29 Dec. 1980) is recorded approximately from phase 0.92 to 0.06. In each colour 34 observations are available.

Several methods (e.g. Gauss-curve fit, parabolic fit) were used to find the time of minimum light in each wavelength. Although these methods all yield practically the same value, the error is hard to determine. This is due to model-dependence and the small number of points. The best way to arrive at a good estimation of the error in a time of primary minimum is to compare independent measurements of that minimum, for instance by taking those obtained in several colours. The results presented in Table I were determined by a "folding-method", which is in principle a midpoint-method. This table also shows the standard deviation and the number of observations involved. Of course this can only be done on the assumption of wavelength-independence of the time of minimum.

The ephemeris of Margrave (1980) 2441595.3582 + 1.8125944·E was used to calculate the O-C values for the most recent photoelectric timings of primary minimum in Table II. These results seem to indicate a slight increase in period of TV Cas.

Table I

An Observed Heliocentric Time of Minimum of TV Cas

filter λ_o	Hel. JD. - 2,444,000.0	Number of observations used
4720	602.4530 (±.0008)	29
6720	602.4538 (±.0009)	29
7820	602.4539 (±.0012)	29
8710	602.4528 (±.0013)	31
mean	602.4534 ±.0004	118

Table II

O-C Values of the Most Recent Timings of Primary Minimum of TV Cas

Hel. JD. - 2,440,000.0	E	O-C	Source
3786.7841	1209	-.0007	IBVS 1869
3795.9491	1214	+.0003	"
4094.9264	1379	+.0005	"
4114.8657	1390	+.0013	"
4453.8209	1577	+.0013	IBVS 1930
4602.4534	1659	+.0011	this paper

A more thorough investigation of this problem will be published separately (De Landtsheer, 1981). In the meantime it is clear continuous observation of TV Cas is needed.

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RAPID OSCILLATIONS IN RR PICTORIS *

Novae are very rare among the cataclysmic variables which show ultra short light variations with periods around 30s and $Q = 1/|dP/dt| \sim 10^4 - 10^5$. The oscillations in dwarf novae seem to be strongly correlated to eruptions. Two nova like objects UX UMa and V3885 Sgr presumably in continuous outburst stage, are also known to show rapid oscillations, and there was RR Pic already mentioned by Warner (1976, 1981) who found periods between 20 and 40s.

Simultaneous photometric and spectroscopic observations have been performed during two nights in Dec., 1980. Table I gives a summary of the photometric observations and results.

Table I.

Start HJD-2444500	Stop	Oscillation Period P(s) at Start	$dP/dt \cdot 10^5$
76.70976	76.84133	31.54	1.2
77.69081	77.77000	31.31	0
77.77000	77.84014	31.42	0

Telescope: 1.5m   Time resolution: 1s   Filter: B

While in the first night a single slowly increasing period of initially 31.5s prevailed, two different quasiconstant periods of 31.3s and 41.4s existed separately with a sudden changeover about in the middle of run 2. Figures 1a, b, c and 2a, b, c show light curve, relative amplitude and phase variation of the

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*Based on observations collected at the European Southern Observatory, Veröffentlichungen der Sternwarte München, Bd. 7 Nr. 33

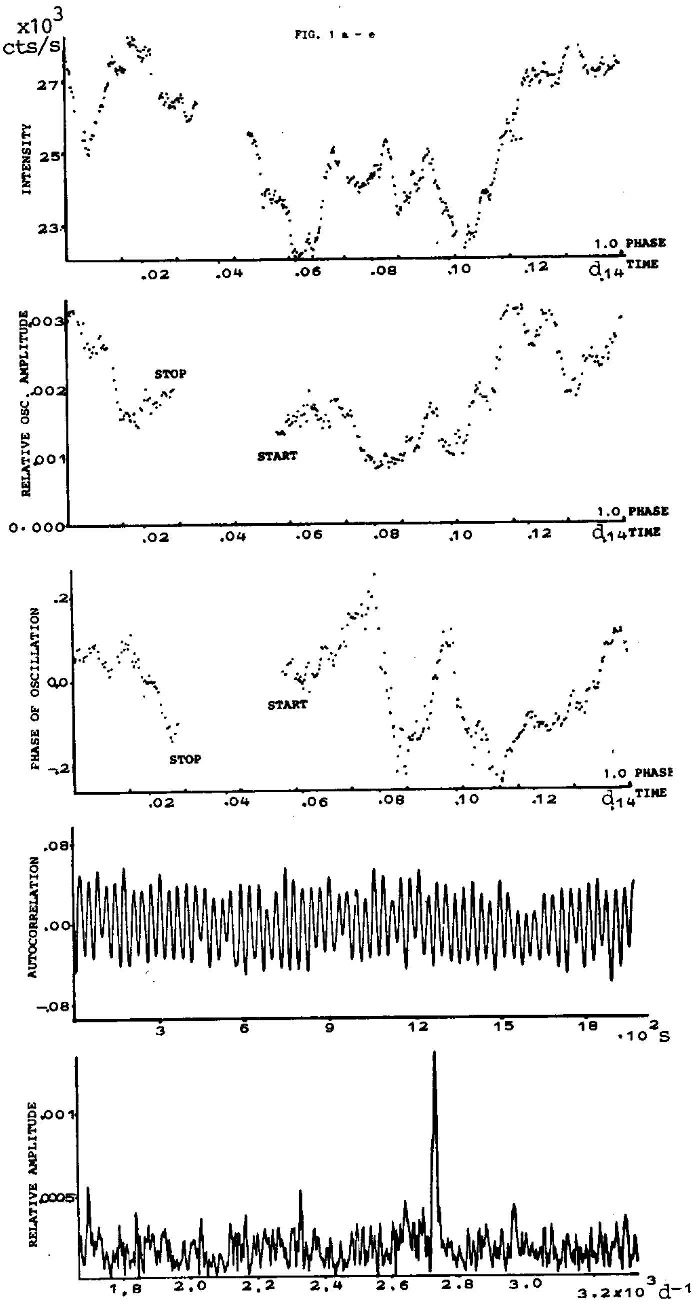
FIG. 1 a - e

Fig. 1a,b,c Run 1. Light curve of RR Pic, relative amplitude of oscillation and phase variation of oscillation versus orbital phase.

Fig. 1d Run 1. Autocorrelation function (slow intensity variations subtracted, value of zero delay omitted)

Fig. 1e Run 1. Periodogram. Relative amplitude versus periods per day.

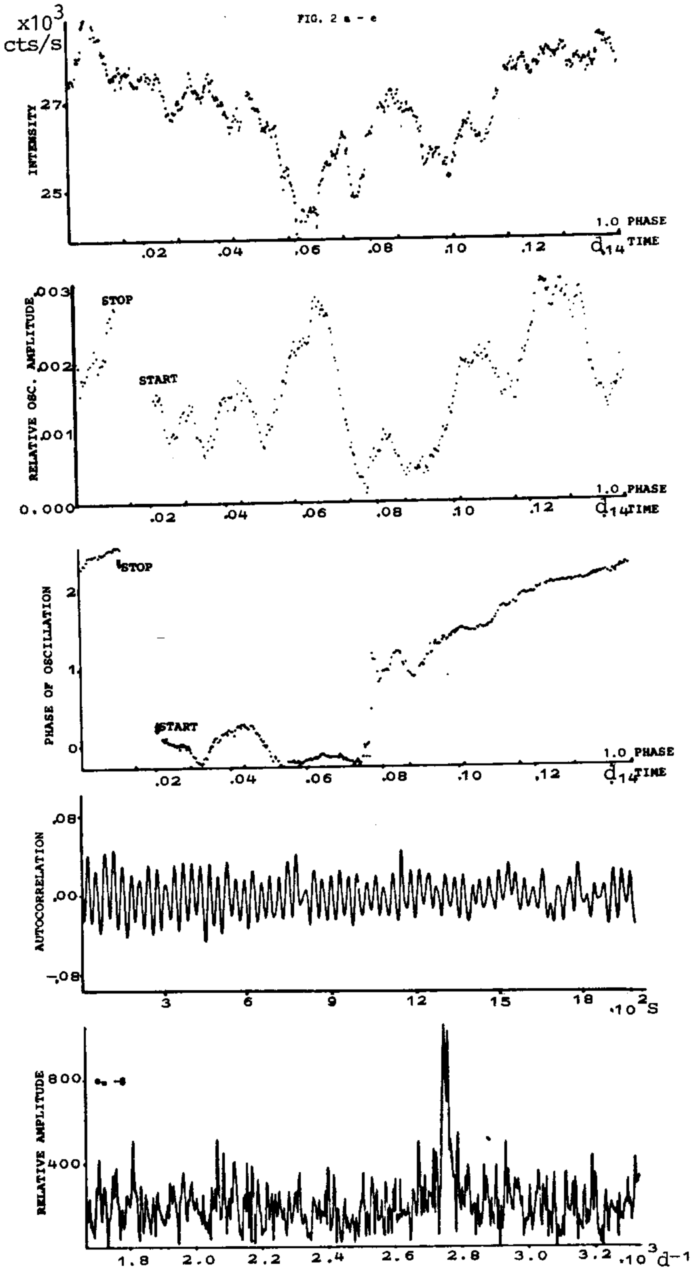

Fig. 2a-e   Run 2. Same as Fig. 1a-e

oscillation versus orbital phase for the two nights respectively. The orbital phase is according to Vogt (1975) who defined $\varphi = 0$ for the main brightness maximum: HJD (MAX) = 2438815.379 + .1450255·E. Primary eclipse occurs at $\varphi = .75$ (Haefner et al, 1981). The oscillation amplitude in both nights is small around orbital phase .6 before primary eclipse. However no strong phase shift of the oscillation during eclipse occurs, as was found by Nather (1974) for UX UMa and Patterson (1979) for HT Cas. The oscillations maintained phase stability as long as they were detectable, with a phase-jitter of approx. $\pm 50^{\circ}$ for a fitted sine track of 40 periods. From the autocorrelation functions (Fig. 1d, 2d) Q was determined to $Q \gtrsim 10^5$ (run 1) and $Q \sim 10^4$ (run 2). These values coincide quite well with those known for dwarf novae. In run 2 during phase .2 ± .1 a broad minimum of the oscillation amplitude is seen and both runs show a steep increase to maximum ($\varphi \sim .85$) just after eclipse. Fig. 1e and 2e show a periodogram in the range of 25-50s demonstrating the signal to noise ratio. The double peak of Fig. 2e is produced by the two oscillation periods. The fact that no phase shift during eclipse is observed (Fig. 1c, 2c) may be interpreted by a partial eclipse which does not affect the oscillating source. The orbital inclination of RR Pic according to Haefner et al. (1981) is 65° and they claim that only the outer rim of the disc is eclipsed by the secondary. This confirms the central location of the oscillation source. The low oscillation amplitude around orbital phase .2 (run 2) and .6 (run 1, 2) could be due to veiling of the centre by the disc itself which may have an increased z-dimension at such areas which are between primary and observer during the relevant phases. In the model of Haefner et al. these areas coincide with the normal hot spot and a hot area on the outer disc.

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THE DISCOVERY OF 6.8 MINUTE OSCILLATIONS IN α Cir

Rapid oscillations have been discovered in the cool magnetic Ap stars HD 101065 (Kurtz and Wegner 1979), HD 24712 (Kurtz 1981), HR 3831, and 33 Lib (Kurtz - unpublished). HR 3831 oscillates primarily with a period of 11.67 minutes and 33 Lib (HD 137949) oscillates with a period of 8.27 minutes. While searching for more of these rapidly oscillating Ap stars, we have discovered light variations with a period of 6.8 minutes in the F0p star α Cir (HR 5463, HD 128898).

Figure 1 shows a 6.5 hour long light curve of this star obtained by M.S.C. on 1981 May 02/03 with the University of Cape Town photometer attached to the 0.75-m telescope of the South African Astronomical Observatory (S.A.A.O.). The light curve is divided up in to 1 hour sections which can be read continuously from left to right, top to bottom. Each panel is 0.04 mag high with the central solid line representing the mean magnitude of the star for the night. The conditions on the night this light curve was obtained were not good with some very light cirrus. Sky transparency changes account for the slow erratic changes in this light curve. Superimposed on the sky transparency changes are the 6.8 minute variations which are easy to see. Figure 2 shows an amplitude spectrum of the light curve shown in Figure 1 where the 8.8 hour^{-1} frequency stands out. The low frequency peaks in Figure

HR5463 JD2444727 B

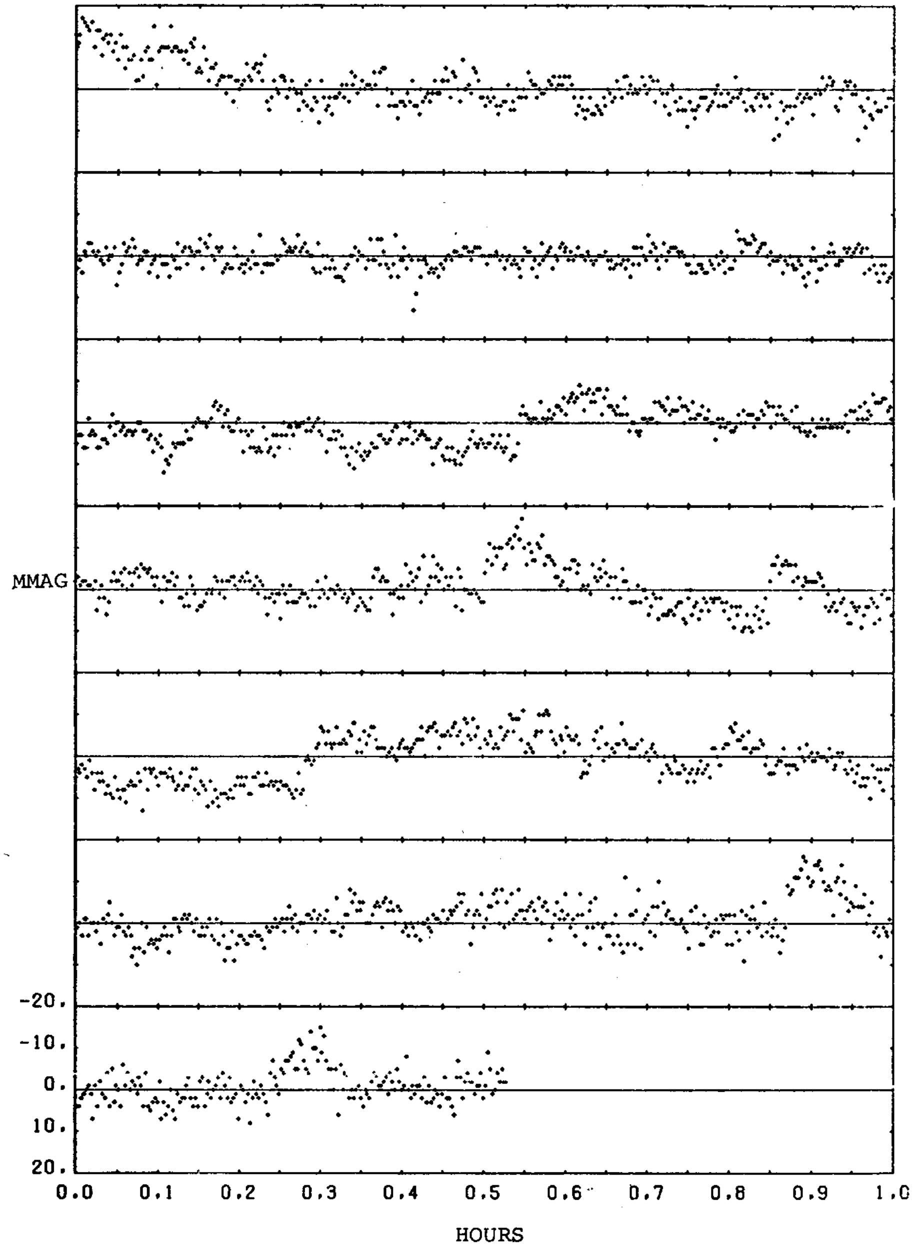

Figure 1

2 are due to the sky transparency changes. We have confirmed these oscillations on several additional nights with one hour observing runs using the S.A.A.O. 0.5-m telescope.

This brings to five the number of rapidly oscillating Ap stars known. The first author will publish a complete analysis of these stars in the near future.

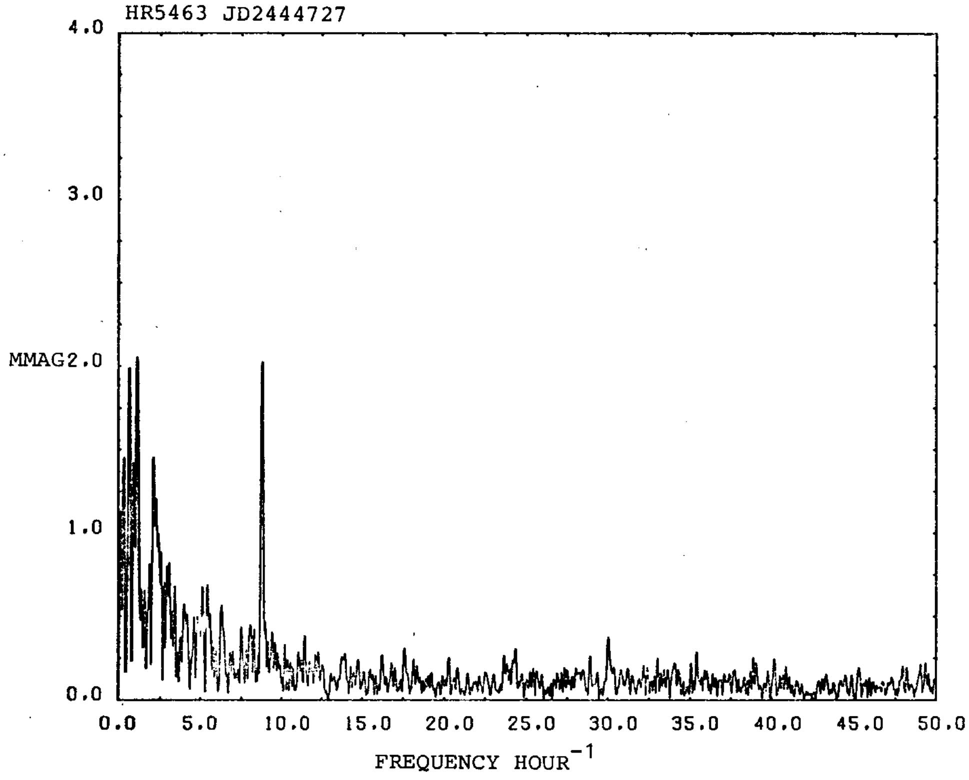

Figure 2

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THE ORBITAL PERIOD OF THE OLD-NOVA GK Per (1901)

Forty image-tube spectra of GK Per have been obtained with the Echelle spectrograph attached at the Cassegrain focus of the 182 cm reflector of the Observatory of Asiago. The spectra cover the range λλ6100-7100 A with a mean dispersion of 16.1 A/mm. The main observed feature is the Hα emission, which shows a broad and variable line profile. Radial velocity measurements of Hα have been derived from a mean of settings on the outer edges of the emission.

The standard error for each determination is of the order of 20 km/s.

Using the minimum X^2 method, our data fit an orbit having the following elements:

$P = 1\overset{d}{.}9020\ (\pm 0.000043)$ $\omega = 91\ (\pm 6)^{\circ}$
$a \sin i = 2.22\ (\pm 0.03) \times 10^{7}\,\mathrm{km}$ $\gamma = +97\ (\pm 8)\ \mathrm{km/s}$
$e = 0.44\ (\pm 0.25)$ $\tau = 2444249.78\ (\pm 0.002)\ \mathrm{JD}$

where errors are given at the 1σ level.

The orbital period that we have derived for GK Per is in agreement with those given by Kraft (1964) and Bianchini, Hamzaoglu and Sabbadin (1981) and rejects the solution suggested by Paczynski (1965) and assumed by most authors.

Attention must be paid to the interpretation of the observed eccentricity and velocity amplitude. As pointed out by Smak (1970), the hot-spot can cause a distortion of the emission profile which produces spurious amplitudes and eccentricities.

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OBSERVATIONS OF SU UMa BEFORE AND DURING A SUPEROUTBURST +

SU UMa stars have recently been defined by Vogt (1980) as dwarf novae that show two distinct properties: short and long lasting eruptions (superoutbursts) and periodic light variations (superhumps) during a superoutburst. The prototype SU UMa itself, though beeing fairly bright, apparently was never observed in detail during a superoutburst. Therefore its membership to this subgroup of dwarf novae still needs to be confirmed.

SU UMa was observed with a 2-channel highspeed photometer attached to the 1.23 m telescope of the Calar Alto Observatory in Spain (Table I gives the observational data). During two nights the object was measured in minimum light, during the third night SU UMa was in outburst (Barwig et al., 1980). Using data from the AAVSO (1981) it could be confirmed that the star started a superoutburst just before our last run. A lightcurve of this eruption, derived from the AAVSO data, is shown in Fig. 1.

To demonstrate the short time variations in the lightcurve, two examples of our measurements in minimum and maximum light are shown in Fig.2 and 3 respectively. The amplitude of the flickering in minimum light is comparable to that of WX Hyi and V436 Cen and increases in intensity by a factor of two during outburst. No pronounced periodic features were found which could be attributed to orbital motion, but an analysis of periodic

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+Based on observations collected at the MPIA Heidelberg Observatory, Calar Alto, Spain.

variations in our measurements before the outburst yielded a period of 120 min ± 10% with a relative amplitude of a few percent and a significance of 3 - 4σ. Interpreted as an orbital phenomenon SU UMa would belong to the long period members of this special group. The chance, however, that this result is accidentally is large.

Periodogram and autocorrelation function revealed a period of 13 min, which is most clearly seen in channel R of run 2 (Fig.4) and less pronounced in run 3. Similar periodic variations have already been reported by Mumford (1964).

Table I

Date	Run No.	Start HJD 2444300+	End	
1980-03-10/11	1	09.570	09.694	Wavelength region:
1980-03-12/13	2	11.529	11.694	Channel B : λ_{eff} = 400 nm
1980-03-15/16	3	14.331	14.626	Channel R : λ_{eff} = 590 nm
				Integration time: 3 s

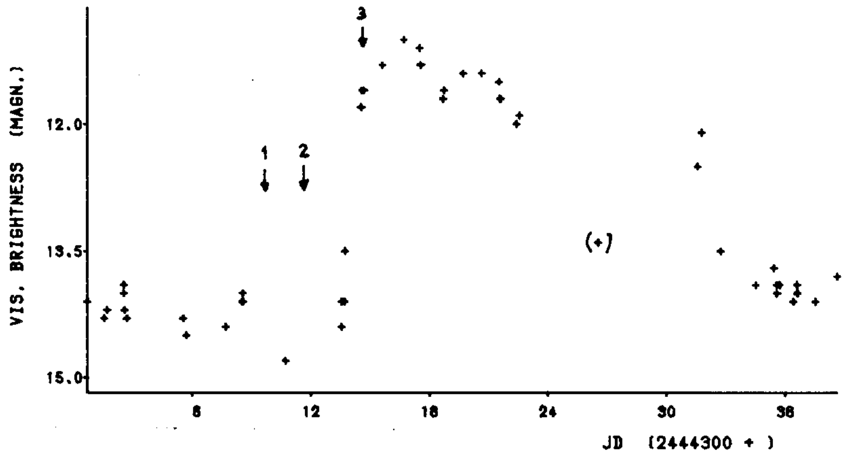

Fig.1 Lightcurve of SU UMa from AAVSO (1980, Mar.2 - Apr.6). The times of our runs are indicated by arrows 1 - 3. The point in brackets means: "fainter than".

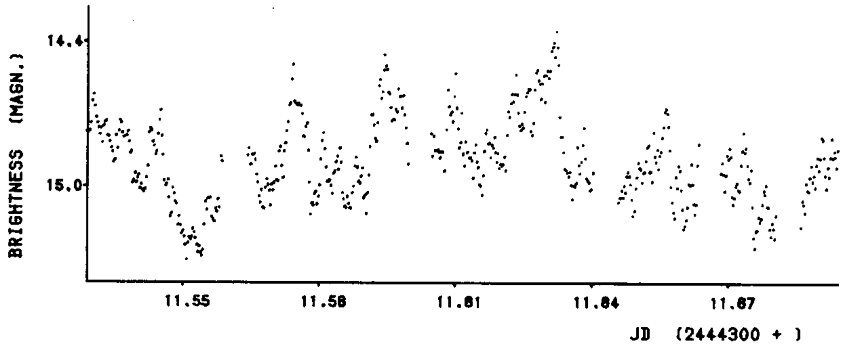

Fig.2 Photometry of SU UMa in minimum light (run 2, channel B)

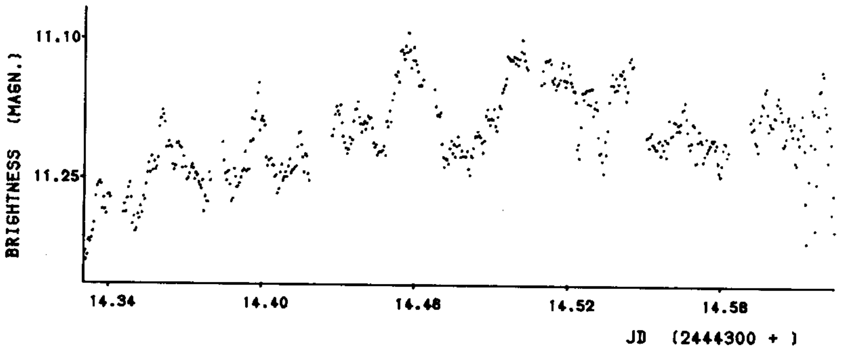

Fig.3 Photometry of SU UMa during superoutburst (run3,chan.B)

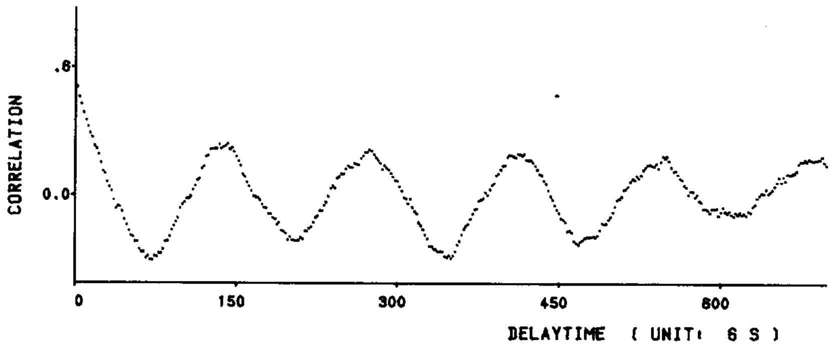

Fig.4 Autocorrelation function of SU UMa (run 2, channel R)

It is important to know whether SU UMa exhibits superhumps or not.
According to the AAVSO data our last run covers the time interval between 15 and 22 hours after start of eruption (T_O). As can be seen in Fig. 3, during that time the brightness of the star increased by less than 0.1^m if one disregards light changes due to flickering. A similar result can be derived from AAVSO data received near the time of our measurements: 4 out of 6 values indicate constant luminosity (11.6^m). That means, the brightness of SU UMa reached a standstill at the time of our observations.

A thorough investigation of our data by means of normal periodogram technique did not reveal any periodic features with significant amplitudes for any superhumps. The AAVSO data from the time interval between 2 and 6 days after T_O clearly show a further increase in brightness. With regard to the small sample and large scatter in these data, periodic light variations cannot be excluded but cannot be proved either.

In other SU UMa stars superhumps evolved one or two days after beginning of outburst. Marino et al. (1979) and Vogt (1981) already proposed that each superoutburst starts with a normal eruption, and after a short standstill the characteristic supermaximum emerges.

Under this respect it may still be possible that SU UMa is the prototype of its group.

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PHOTOELECTRIC OBSERVATIONS OF VZ Cas

VZ Cas is a Mira-type variable star with a period of $169^d.28$. The spectral type of the star is M0e-M3e. The magnitude is $9^m.3$ - $13^m.3$ (Kukarkin et al., 1976).

The star VZ Cas was observed as comparison for the eclipsing binary GG Cas along with BD + 55°280. Later on it was found that this is already listed as a Mira-type variable. Observations were mainly taken with the 35-cm reflector of the Uttar Pradesh State Observatory using an unrefrigerated 1P21 photomultiplier and d.c. techniques. The mean differential magnitudes of VZ Cas are being reported with BD + 55°280 taken as comparison star. The differential magnitudes are listed in Table I.

Table I.

Differential standard magnitudes of VZ Cas

Julian Date	(VZ Cas-BD+55°280)		Julian Date	(VZ Cas-BD+55°280)	
	B	V		B	V
2438 722	$1^m.46$	$1^m.20$	2439 068	$1^m.08$	$1^m.15$
724	1.05	0.88	076	2.00	0.54
726	1.39	1.11	080	0.77	0.86
736	1.14	1.01	081	1.57	0.20
755	1.13	-0.07	083	0.90	1.07
757	1.21	0.02	086	1.78	0.16
758	0.81	-0.26	106	1.44	1.25
760	1.41	-0.17	110	0.97	1.10
766	1.73	0.17	434	1.66	0.59
767	1.55	0.10	448	1.69	-0.09
769	1.21	0.37	777	1.14	-0.16
2439 060	1.15	1.00	792	1.36	-0.18
066	1.40	1.12	2444 526	2.35	1.28

On the night of October 13, 1980 VZ Cas and BD + 55°280 were observed along with standard stars in order to get their magnitudes and colours which are as follows:

Star	V	B-V
VZ Cas	$12^{m}.27$	$+1^{m}.15$
BD + 55°280	11.00	+0.08

During the observing season 1964-1965, VZ Cas was found to vary by about $1^{m}.4$ and $0^{m}.9$ in yellow and blue colours, respectively. The nightly observations, however, do not show a variation in the light.

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Reference:

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LIGHT VARIABILITY OF NOVA DELPHINI 1967 IN 1980

We observed Nova Delphini 1967 (= HR Del) during 7 nights in 1980 at the Hamburg Observatory in Bergedorf. The 1.2 m (f/13) Ritchey - Crétien telescope and a pulse counting photometer - polarimeter with two RCA C 31034 photomultipliers (Schröder, 1978) was used; we measured in an instrumental system close to the Johnson V-band (Schott 2 mm GG 495 + 1 mm VG 6 + 2 mm BG 38) and integrated for about 40 seconds. Comparison stars Nos. 5 and 6 of the list of Barnes, Evans (1970) were adopted as local standards and served also for determining the extinction.

The nova has been monitored for 22.2 hours, but for the detailed analysis of the light curve we used only observations made in the best atmospheric conditions (15 hours in 5 nights - Table I). The observed brightness varied slightly (Fig. 1) and could be approximated by a one-cycle sinusoid. Six extrema could be derived from the light curve of three nights (Table I) whereas only an increase in brightness was observed on Sep. 3/4 and a brightness decrease appeared on Sep. 7/8.

TABLE I Journal of observations and extrema of the light curve.

Date 1980	Period (UT)	Number of obs.	MIN JD$_\odot$ 2444400 +	MAX
Aug. 14/15	21:23 - 00:50	40	66.424	66.512
Sep. 1/2	19:43 - 00:03	50	84.441	84.349
Sep. 3/4	21:25 - 23:12	18	--	--
Sep. 7/8	19:38 - 21:09	18	--	--
Sep. 15/16	19:12 - 23:07	37	98.327	98.436

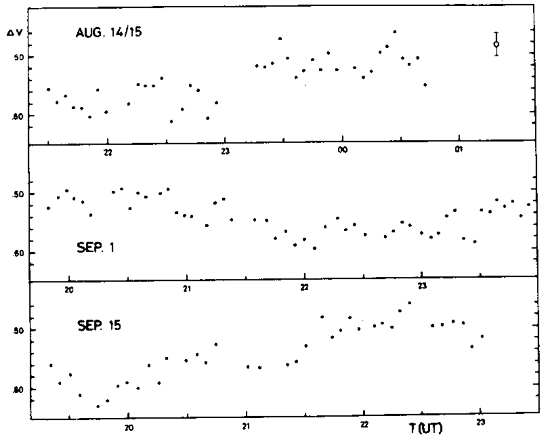

Fig. 1 The light curve of N Del 1967 in three nights in 1980; v = v(Nova) - v(Comp.6) .

Assuming a periodic variation we looked for solutions in the range of $0\overset{d}{.}14 - 0\overset{d}{.}27$. Unfortunately, due to rather scarce observations, there exist numerous periods with a reasonable fit to our extrema. We eliminated most of the periods because they were not compatible with the estimated phase of the light curve on Sep. 3/4 and 7/8, respectively. The possible periods are as follows: $0\overset{d}{.}152706$, $0\overset{d}{.}165363$, $0\overset{d}{.}180308$, $0\overset{d}{.}198222$, $0\overset{d}{.}220089$.
± 41 ± 37 ± 33 ± 35 ± 53

Similar to the method we had used for reducing our 1977 and 1979 data (Kohoutek, Pauls, 1980) we computed a least-squares fit of our Δv = v(Nova) - v(Comp.6) measurements to a sinusoid. We selected only periods close to the possible periods given above and found the results summarized in Table II: t_o is the time of the phase 0.0, A_v is the half-amplitude.

It is not possible to find out the true period from our photometric observations in 1980. The reduced chi-square value χ^2_ν (0.025 mag was adopted as an estimated error of a single Δv measurement) excludes the period near $0\overset{d}{.}1527$ and is not in favour of $0\overset{d}{.}165339$, but the difference in χ^2_ν is small between the remaining three periods given in Table II. In Fig.2 we present the mean Δv light curve of N Del 1967 corresponding to the period $0\overset{d}{.}180289$.

TABLE II Mean light curve of N Del 1967 in August - September 1980. Sinusoidal fit using 163 Δv measurements.

Period	[d]		0.165339	0.180289	0.198207	0.220071
	m.e.	±	34	38	44	54
χ^2_ν			1.216	1.097	1.030	1.016
t_o	[d]		66.3713	66.3619	66.3514	66.3402
($JD_\odot$ - 2444400)		±	44	44	47	53
A_v	[mag]		0.037	0.039	0.039	0.039
	m.e.	±	3	3	3	3

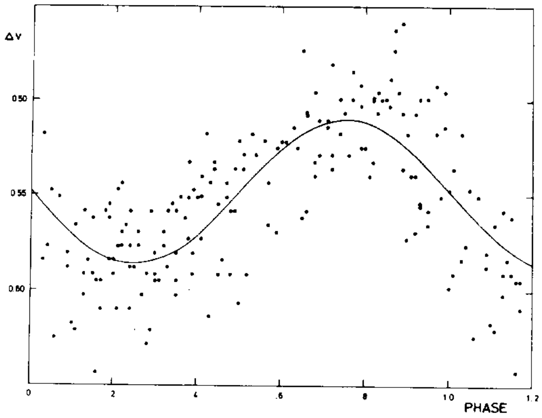

Fig. 2 Mean light curve of N Del 1967 in 1980; $P = 0^{d}.180289$, n = 163 .

The best periods resulting from the 1979 observations were $0^{d}.1776$ and $0^{d}.2167$ (slightly poorer fit). In 1980 we obtain periods somewhat larger, $0^{d}.18029$ and $0^{d}.22007$ (slightly better fit), and an additional period $0^{d}.19821$. The period might increase by about $0^{d}.003$ within a year, but this vague proposition has to be proved. It should be added, that there also exists a solution $P = 0^{d}.17834$ ($\chi^2_\nu = 1.142$) much closer to one of the periods found in 1979, but the predicted phase of the photometric light curve for Sep. 7/8 is inconsistent with the observed brightness decrease of the nova. The decrease of the semi-amplitude of the light curve from 0.084 mag (1977) and 0.051 mag (1979) to 0.039 mag (1980) seems to be guaranteed. Further photometry of this nova is planned.

We wish to thank Dipl. Phys. Th. Kleine for providing us with some computer programmes.

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PHOTOMETRIC VARIABILITY OF 10 LACERTAE

The star 10 Lac has been reported several times as a spectroscopic variable. Smith (1977), who included the star in the group of the so-called 53 Persei variables (see Sareyan et al, 1980, for the observational definition), tried to calculate a period for the variation of the line Si IV λ4654.1 on the basis of non-radial pulsations. He obtained two possible values, 14.2 and 8 hours, the second being the most probable one. Otherwise, the star has never been detected as photometric variable.

We observed 10 Lac during the nights of September 24th and 25th, 1980. 2 And was used as comparison star. In view of the considerable difference in spectral type between 10 Lac and 2 And - O9 and A3, respectively - the atmospheric extinction is espected to be larger for the bluer star; by considering the part of the spectrum in which we observe - U and B filters of Johnson - this difference is not negligible. We estimate the corrections upon the light curve by assuming the extinction coefficient to depend on the wavelength in the form $E=\exp(-A\lambda^{-4})$ E being the ratio of the fluxes inside and outside the atmosphere and A a constant (Rayleigh scattering).

In Figures 1 and 2 are represented the light curves for the two days of observation. Crosses correspond to 2 And and circles to the magnitude difference 10 Lac - 2 And. Vertical bars represent the above mentioned corrections relative to the value, corresponding to which the star crosses the meridian. As we can see, the correction goes in the sense of increasing the amplitude of the variation. In other words, the variability found is real.

As we dispose of very few data, it is difficult to perform a period analysis with a certain confidence. We tried such an analysis and got a most probable period of 6.4 hours for

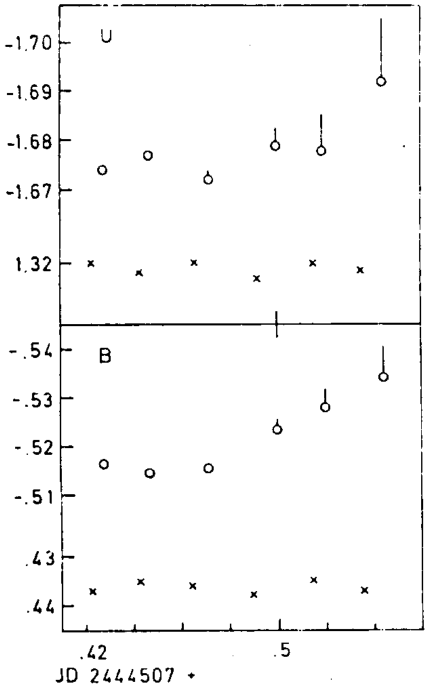

Figure 1.

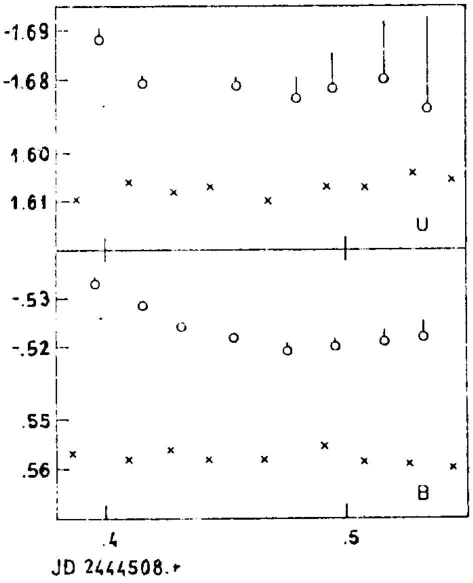

Figure 2.

both U and B filters, using the original and the corrected data. The amplitude should lie between $0^m.02$ and $0^m.03$. However, only an intensive photometric monitoring of the star will allow a more reliable determination of its characteristics.

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UBV OBSERVATIONS OF 88 Her (V744 Her)

This star has been photoelectrically observed from June 1978 to September 1980, in order to follow the long term variation of its light and colour. The photometer is equipped with an unrefrigerated 1P21 photomultiplier. A single channel V/F converter

Table

UBV OBSERVATIONS OF 88 Her

J.D. 2440000+	V	B-V	U-B	N
3664.387	6.942 ±0.007	-0.156 ±0.019	-0.469 ±0.023	3
3688.405	6.878 ±0.011	-0.124 ±0.037	-0.459 ±0.028	3
3689.378	6.886 ±0.019	-0.143 ±0.011	-0.446 ±0.008	3
3695.377	6.871 ±0.003	-0.138 ±0.008	-0.420 ±0.090	3
3698.369	6.839 ±0.052	-0.135 ±0.065	-0.411 ±0.017	2
3707.388	6.887 ±0.036	-0.159 ±0.034	-0.452 ±0.043	3
3710.386	6.875 ±0.010	-0.138 ±0.023	-0.445 ±0.024	3
3759.345	6.874 ±0.014	-0.156 ±0.010	-0.420 ±0.070	3
3775.322	6.884 ±0.022	-0.118 ±0.042	-0.409 ±0.035	3
3788.303	6.869 ±0.007	-0.155 ±0.036	-0.394 ±0.026	3
3798.255	6.826 ±0.007	-0.122 ±0.007	-0.413 ±0.010	3
3805.275	6.859 ±0.012	-0.123 ±0.017	-0.426 ±0.025	4
3810.259	6.847 ±0.008	-0.137 ±0.006	-0.402 ±0.013	4
4131.358	6.797 ±0.016	-0.128 ±0.015	-0.399 ±0.012	3
4395.442	6.789 ±0.011	-0.138 ±0.016	-0.390 ±0.021	3
4406.388	6.768 ±0.007	-0.138 ±0.002	-0.374 ±0.013	3
4410.404	6.774 ±0.003	-0.144 ±0.005	-0.380 ±0.004	4
4426.403	6.768 ±0.013	-0.129 ±0.018	-0.393 ±0.014	5
4442.359	6.785 ±0.018	-0.145 ±0.010	-0.389 ±0.005	3
4456.410	6.771 ±0.010	-0.141 ±0.017	-0.387 ±0.008	3
4461.355	6.769 ±0.004	-0.138 ±0.013	-0.393 ±0.013	3
4465.394	6.764 ±0.007	-0.135 ±0.015	-0.389 ±0.016	3
4485.408	6.762 ±0.010	-0.128 ±0.022	-0.411 ±0.025	3
4523.292	6.777 ±0.005	-0.134 ±0.014	-0.401 ±0.011	3

provides a direct print of deflections and times. The telescope is a 400 mm Ø, f=200 mm newtonian reflector. The observed magnitudes and colour indices reduced to the standard UBV system are listed in the table as nightly normals with their probable error.

HD 162132 was used as comparison star with the following UBV values:

V=6.493, B-V= +0.070, U-B= +0.080 (Harmanec et al. 1978)

The magnitude of 88 Her turned to increase from JD 2443770 as confirmed by Nakagiri and Hirata (1979) and Magalashvili and Kumsishvili (1980). It is confirmed that the photometric variation is similar to the light variation of Pleione and not of eclipsing pattern. The similar spectral behaviour of 88 Her and Pleione have been pointed out by Hirata (1978). The observations do not show any appreciable evidence of the spectroscopic period of about 87^{Y} although it may be suspected from some phase-magnitude plots. Further observations of the system will be very interesting.

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PHOTOELECTRIC OBSERVATIONS OF BV DRACONIS

The short period eclipsing binary BV Dra (SAO 166036) has been observed during August and September 1980 as well as during May 1981. The observations have been made using the two-beam, multi-mode, nebular-stellar photometer of the National Observatory of Athens attached to the 48-inch Cassegrain reflector at Kryonerion Astronomical Station. The B and V filters used are in close accordance to the standard ones. From our observations four primary and six secondary minima times have been derived and are represented

Table

Hel. J. D. 2444000+	O-C days	σ days	Type of Min.
473.4512	0.0127	±0.0003	II
474.3267	0.0130	±0.0002	I
475.3781	0.0142	±0.0003	I
476.4283	0.0142	±0.0003	I
478.3529	0.0135	±0.0003	II
480.2772	0.0124	±0.0003	I
480.4531	0.0133	±0.0004	II
500.4051	0.0125	±0.0002	II
506.3578	0.0125	±0.0002	II
752.4579	0.0168	±0.0006	II

in the following Table. The successive columns give the heliocentric J.D., the residuals O-C, the mean errors σ, and the type of minimum.

The times of minima and the mean errors have been calculated by Kwee and Van Woerden's method (1956) and are the mean values from B and V observations except that at Hel. J.D. 2444480.2772 for which there are observations only in V. The ephemeris used is that of Kukarkin et al. (1969).

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INFRARED PHOTOMETRY OF BETA LYRAE

As part of our on-going program of infrared observations of close-contact and peculiar binary systems, we have been making photometric observations of Beta Lyrae since 1977. We are using the 1.3-meter with the "Otto" InSb detector at Kitt Peak National Observatory; most of the observations were made during the day. The beam size was 32"; chopping of 60" was done in declination. The standard star for all observations was Alpha Lyrae, whose magnitudes on the Kitt Peak scale are: J (1.2 microns) = +0.013, H (1.6 mcrons) = 0.005, K (2.2 microns) = 0.015, L (3.5 microns) = -0.019, and M (4.6 microns) = -0.045. Extinction corrections were usually small (<0.01 mag) at all wavelengths. One observation cycle (standard-source-standard) took about 5 minutes to achieve a signal-to-noise ratio $\geq$100

Figures 1-5 summarize the results to date. Statistical errors for each datum are smaller than the sizes of the symbols, which indicate the year of observation. Phases were calculated from JD = 2439935.86 + 12.9327 E (Rocznik Astronomiczny, 1976). Beta Lyrae is known to go though large changes of period (Kreiner, 1978; Bahýl´, 1979); we have not corrected for these changes in our figures. Despite this, the infrared light curves are remarkably consistant from year to year.

Previous infrared observations of Beta Lyrae have been reported by Jameson and Longmore (1976) and Viotti et al. (1978). Jameson and Longmore's data are from 1973-1974 and include observations at 8.6 microns. Our observations have many more data points to more clearly define the shape of the infrared light curves. Viotti et al. (1978) do not present any light curves but do report J = 3.28, K = 2.99, L= 2.82, and M = 2.78 at phase 0.14; our values at the same phase are: J = 3.26, K = 3.06, L = 2.84, and M = 2.68.

Note that the depth of the primary eclipse decreases relaive to the secondary eclipse at longer wavelengths. Our data give primary eclipse magnitudes

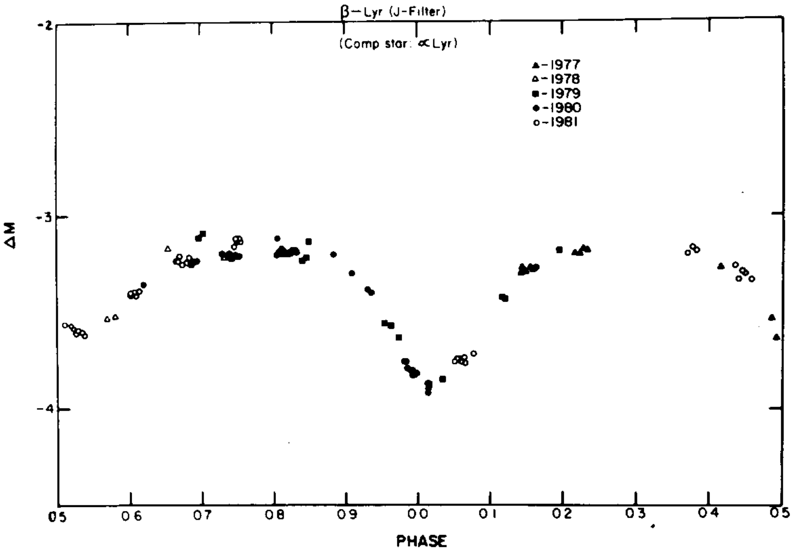

Figure 1

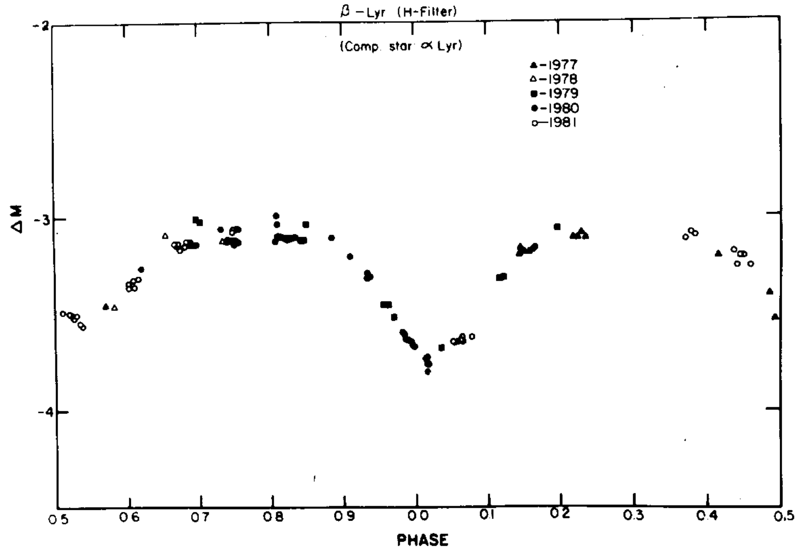

Figure 2

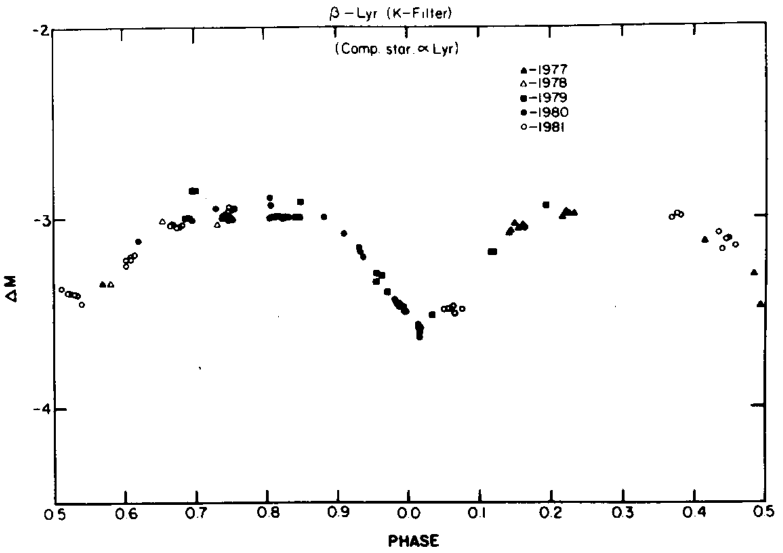

Figure 3

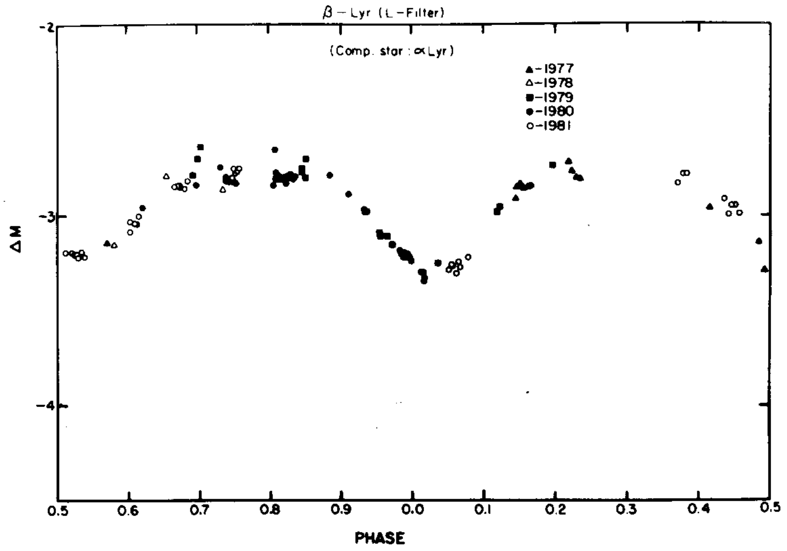

Figure 4

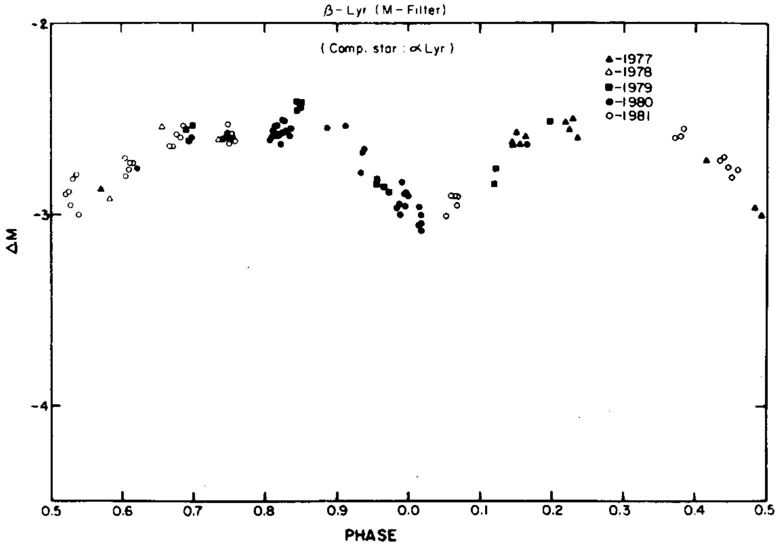

Figure 5

as: J = 3.84 ± 0.06, H = 3.69 ± 0.07, K = 3.54 ± 0.07, L = 3.23 ± 0.6, and M = 2.90 ± 0.08; and secondary eclipse magnitudes as: J = 3.57 ± 0.09, H = 3.49 ± 0.09, K = 3.36 ± 0.10, L = 3.16 ± 0.08, and M = 2.83 ± 0.09.

We plan to continue this program in 1981-82 to fill in gaps in the light curve.

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HD 224113 - A NEW ECLIPSING, DOUBLE-LINED BINARY *

The optical variability of the B5 IV-star HD 224113 was discovered accidentally by the author in July 1978 at the ESO-site in La Silla/Chile. Up to that time this system was known as a single-lined spectroscopic binary (Archer and Feast, 1958). Subsequent uvby-photometry (ESO 50cm telescope) and spectroscopy in the blue, red and infrared region (1.5m telescope, mostly 12 A/mm) during August 1979 and 1980 revealed an Algol type light curve and led to the detection of the secondary spectrum on IIIa-J(B) plates. This offers now the opportunity

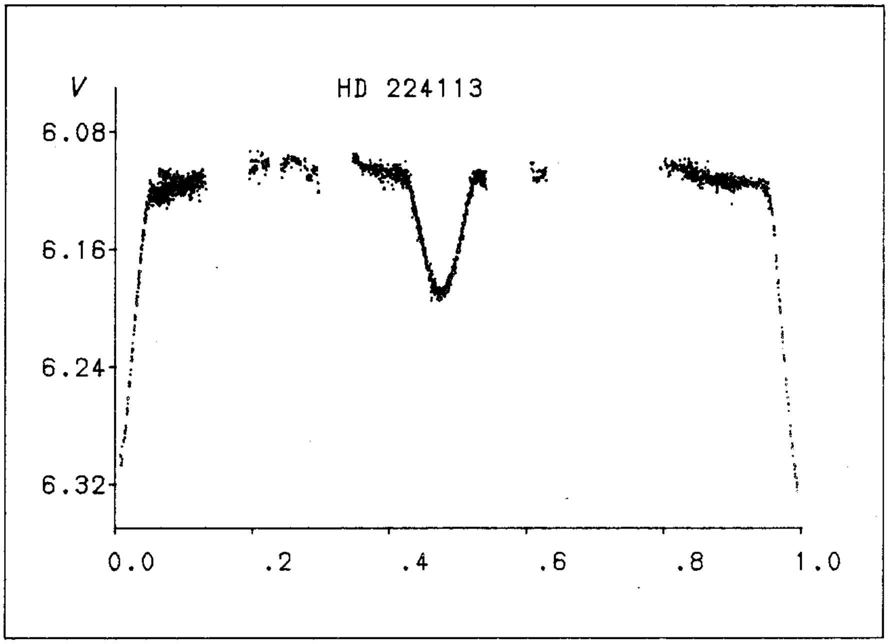

Fig. 1 The V-light curve

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* based on observations collected at the European Southern Observatory.

to derive the dimensions of this system in absolute units which is especially important in the case of early type non-main sequence stars.

Fig. 1 shows the hitherto incomplete light curve (1970 measurements) transformed into the Johnson V-system. Both, the complete secondary minimum and the ascending part of the primary minimum, are measured in two observation runs with a time difference of about one year. Therefore a precise period could be derived which is slightly shorter than that previously known. The epoch of the primary minimum is given by the formula:

$$\text{HJD } 244\ 3698.5118 + 2\overset{d}{.}445088E$$

The light curve clearly demonstrates some complications of the system: Reflection and ellipticity effects, and the influence of gas streams or circumstellar material are small but definitly present. Moreover the displacement of the secondary minimum to phase 0.476 indicates a non-zero eccentricity of the orbit in contradiction to Lucy and Sweeney (1971), who obtained a circular orbit recalculating the available spectroscopic data.

No rectification has been attempted because of the lack of sufficient data outside the minima. However, a fairly good representation of both minima could be obtained with the tentative parameters (Merrill-Russell method): $k = 0.44$, $r_2 = 0.103$, $i = 82^{\circ}$, $x = 0.6$. The well observed secondary minimum probably is an occultation very near to totality. (The minimum light of the primary minimum (transit) has been estimated to be around $6\overset{m}{.}325$ according to some V-measurements kindly provided by H.J. Schober).

Fig. 2 shows the radial velocity curves derived from the CaII-K-line only. This line is the only line of the secondary suitable for radial velocity measurements. Sometimes MgII 4481 seems also to be present. Besides that the secondary spectrum causes an asymmetry of the H-lines. From the spectral behaviour and the derived photometric elements one can estimate the spectral type of the secondary to be around A0. Some difficulties arise measuring the K-lines: The primary line is blended by an interstellar component (radial velocity 0.7 km/s) and the secondary line will be distorted for positive velocities by HeI 3936 of

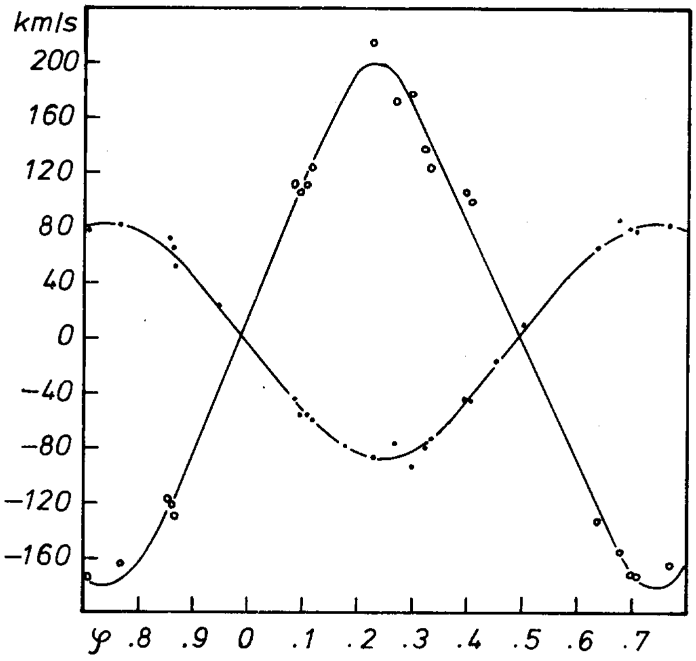

Fig. 2 The radial velocity curves, · primary, ∘ secondary

the primary (see Fig. 3). The elements found from these radial velocity curves are: K_1 = 86 km/s, K_2 = 190 km/s, γ = 2 km/s. There is a small difference (± 3 km/s) for the γ-values of the individual curves which can be related to gas streams in the system. Whereas K_1 is in quite good agreement with the result by Archer and Feast, γ differs appreciable from thêir value (13 km/s). This may mainly be due to differences in the velocity systems but may also be a hint for a third body in the system. However, the value obtained for ω (mean from the two radial velocity curves and the light curve) amounts to 169° (refering to the primary) and agrees well with 167° found by Archer and Feast. Therefore the latter possibility must be ruled out. The orbital eccentricity has been determined to be e = 0.044. V-magnitude, semi-major axis, radius and mass for both components are given in Table I.

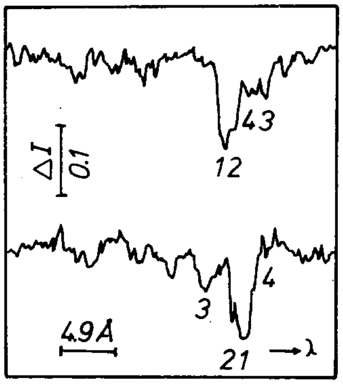

Fig. 3 Intensity tracings of the K-line region at two phases: ϕ = 0.30 (top) and ϕ = 0.68 (bottom). 1: K-line primary, 2: K-line interstellar, 3: K-line secondary, 4: HeI 3936.

Table I.

	Primary	Secondary
V	$6^{m}.20$	$8^{m}.96$
a	4.19 $R_\odot$	9.26 $R_\odot$
R	3.15 $R_\odot$	1.39 $R_\odot$
M	3.76 $M_\odot$	1.70 $M_\odot$

The preliminary results reported here will be used as initial parameters for the final evaluation by means of computer simulation after completing especially the photometric data.

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AR AURIGAE - TRIPLE SYSTEM?

The binary AR Aur is well known as a detached system. Since the discovery of its variability by Pedersen and Steensgard in 1931 it has been observed by several observers photoelectrically. Between 1935 and 1939 the period was $4^{d}.13467$ according to Huffer and Eggen (1947). There are two other estimations referred to this period, $4^{d}.134581$ by Nassau (1937) and $4^{d}.1346607$ by Woodward (1943). O'Connell (1979) analysed all the visual, photographic and photoelectric observations made up to 1978 and claimed that the period of this binary had undoubtedly changed. He derived the value $4^{d}.134686$ for the period between 1963 and 1970. Besides, he concluded that the period became decreasing in about 1974.

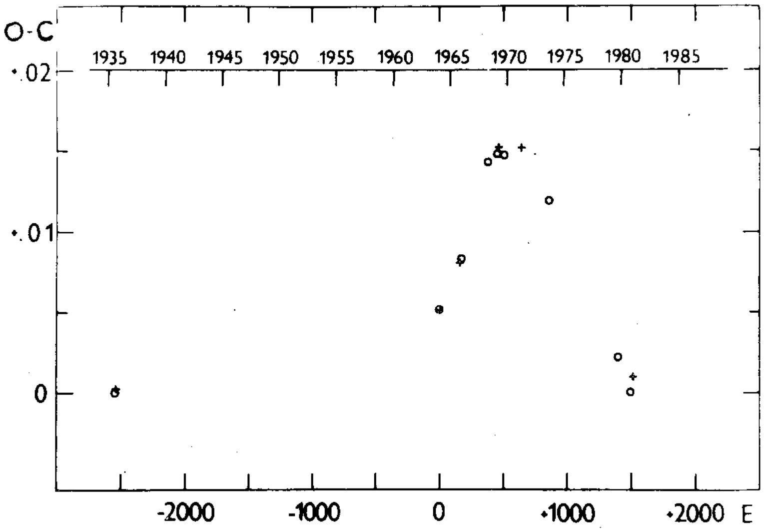

Figure 1

AR Aur is one of the objects we have studied from the point of view of their Ap characteristics. Between 1979 and 1981 we managed to observe two primary and one secondary minima photoelectrically. The observations were made by the photoelectric photometer attached to the cassegrain focus of the 0.6 m telescope at the Skalnaté Pleso Observatory. Our results together with all the photoelectric minima given by O'Connell (1979) are listed in Table I. Because of their large scatter we have omitted the visual and the photographic minima. Figure 1 shows the O-C diagram constructed according to the ephemeris

$$JD/MinI/ = 2\,427\,887.7217 + 4.1346662 \times /E + 2543/ \qquad /1/$$

The period in this formula is the average one that we obtained taking into account only the first and the last primary minima from Table I. It is obvious in Figure 1 that a continual change of the period has taken place in the system. The part since 1964 up to now can be fitted well by a parabola that results in the following ephemeris

$$JD/MinI/ = 2\,438\,402.1832 + 4.134695 \times E - 2.2 \times 10^{-8} \times E^{2} \qquad /2/$$

$$\pm .0007 \qquad \pm .000002 \qquad \pm .2$$

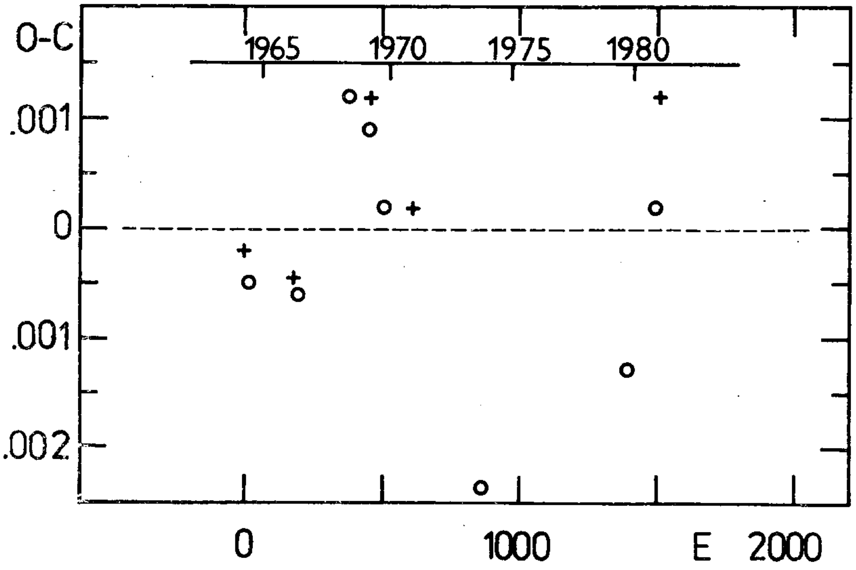

Figure 2

The O-C residua after this parabola fitting are shown in Figure 2. The mean period derived for our three minima is $4^{d}.134652$ ±.000006.

All the observations obtained so far have displayed at first an increase of the period until about 1964 followed by a decrease till 1981. As this system is detached, such cyclic changes of the period can be induced by a third body in the system. Unfortunately, a lack of observations between 1935 and 1964 does not allow us to decide whether the residua in Figure 1 should be best fitted by a double or a single wave. At any rate, a duration of one cycle is shorter then about fifty years, therefore the third body can not be the star HR 1732, that was said to be in a physical connection with AR Aur (Hoffleit, 1964).

Table I

JD 2 400 000.+	E	Date	O - C /1/	O - C /2/	Observer
27 887.7217	-2543	1935.23	.0000		Huffer and Eggen
27 889.7892	-2542.5	1935.24	+.0002		"
38 404.2504	0.5	1964.03	+.0052	-.0002	O'Connell
38 435.2603	8	1964.11	+.0051	-.0005	"
39 098.8783	168.5	1965.93	+.0092	-.0004	Johansen
39 154.6964	182	1966.08	+.0093	-.0006	"
39 940.2880	372	1968.23	+.0143	+.0012	O'Connell
40 246.2538	446	1969.07	+.0148	+.0009	"
40 248.3215	446.5	1969.08	+.0152	+.0012	"
40 498.4683	507	1969.76	+.0147	+.0002	Gülmen
40 930.5414	611.5	1970.94	+.0151	+.0002	Battistini et al.
41 941.464	856	1973.71	+.0119	-.0023	Schellerman et al.
44 153.5008	1391	1979.77	+.0022	-.0013	This paper
44 612.4465	1502	1981.02	.0000	+.0002	"
44 614.5150	1502.5	1981.03	+.0012	+.0014	"

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SEARCH FOR THE PERIOD OF THE BINARY SHELL STAR V 505 MONOCEROTIS

The variability of the radial velocity of the star HD 48 914 (V 505 Mon) was discovered by Pearce and Petrie (1950). Hoag and Smith (1959) classified it as B5 Ib, Turner (1976) as B5 II. Petrie and Pearce (1962) pointed out that the hydrogen lines are shell-like. They classified the star as B4.

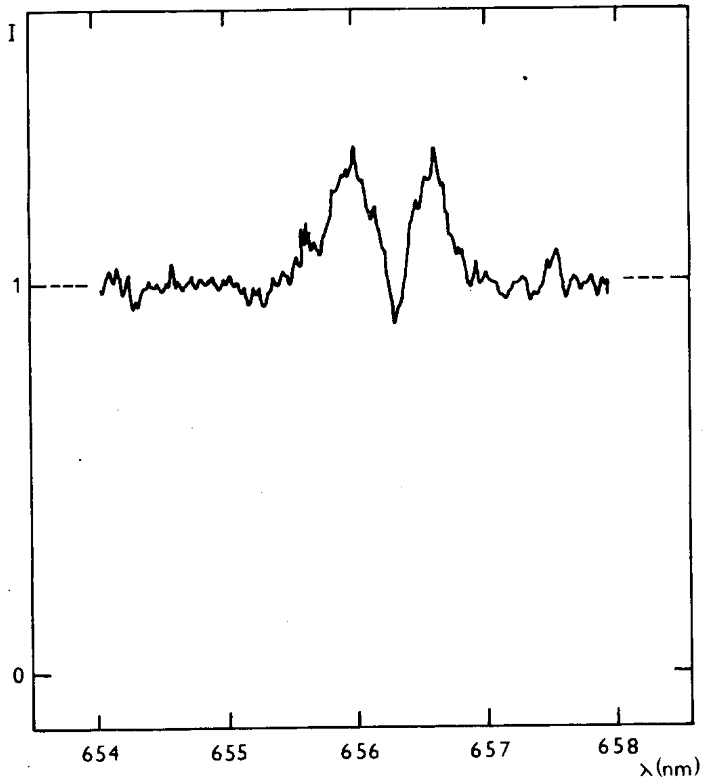

Figure 1

The light variability of the star was discovered by Wachmann (1966). According to him, the amplitude is 0.5 mag. and period shorter than one day. Eggen (1978) made (u,v,b,y,β) photometric observations of the star in the years 1975-76. He found only small light variations of 0.15 mag.

At the spectrogram with dispersion 1.7 nm/mm taken by the 2m telescope at Ondrejov Observatory on January 31,1981 emission feature of H_α line (Fig.1) was discovered which indicate that V 505 Mon is a shell star. The spectral classification made from this spectrogram is B3 II-III.

The star was observed at Skalnaté Pleso Observatory by a photoelectric photometer installed in the Cassegrain focus of the 0.6 m telescope in V colour from 1977 to 1981. The star HD 48 956 was used as comparison star. We found the changes of the light of V 505 Mon with an amplitude of 0.5 mag. The programs for period search Hec 18 and Hec 21 (Harmanec, 1981) were used to find the period. The best period connected with the eclipses of the components is 26.94745 days (Figure 2). But the period 53.7805 days is possible too (Figure 3). The ephemeris for former period is

$$\mathrm{JD\ (Min)} = 2444635.318 + 26.94745 \times E \,. \qquad (1)$$

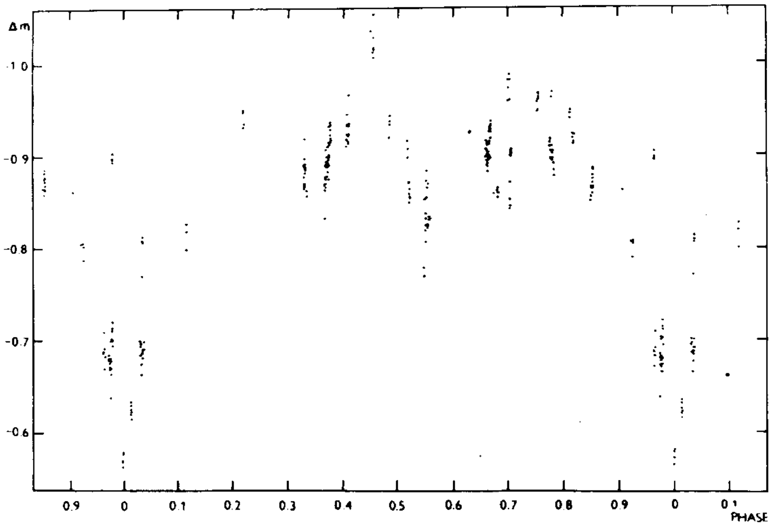

Figure 2

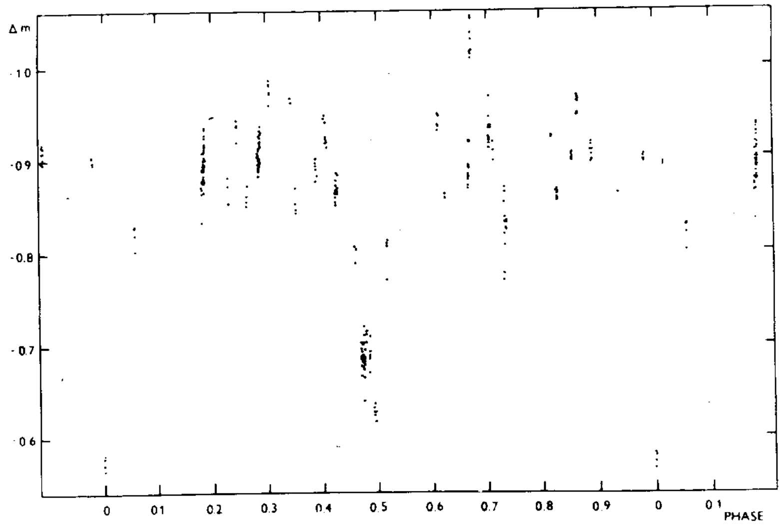

Figure 3

It is possible to see on Figure 2 and Figure 3 that short term variations with the amplitude 0.15 mag. are present on the light curve. We found the period of the variations as 0.9912467 day. It was believed that the period of eclipses is shorter than one day. These variations are responsible for it.

Pearce and Petrie (1950, 1962) measured radial velocities on 9 spectra covering a period from the year 1929 to 1959. They obtained the range of radial velocities from + 90 km/s to - 40 km/s. We tried to find the radial velocity curve with the periods mentioned above, but we failed. The determination of radial velocities in shell stars is a serious problem. There are long term variations of the radial velocities there, so it is necessary to obtain many spectra in a short time interval.

The further photometric and spectroscopic observations of the star V 505 Mon are highly desirable.

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NEW VARIABLE STARS IN THE FIELD AROUND MV LYRAE

A further survey of the 6^{O}X6^{O} field centered on MV Lyrae, previously examined by G. Romano (IBVS N^{O}645) on the material obtained with the 67/90/210 cm Schmidt telescope of Asiago, has led to the discovery of four new variable stars (GR 306, 307, 308, 309). The position 1950.0 of these stars and their characteristics are listed in Table I. The magnitudes are B.

Table I

Star	R.A.	D	max	min	Type
GR 306	$18^{h}59^{m}02^{s}$	$+44^{O}11'$	17.7	18.5	RR :
GR 307	19 03 11	+44 37	16.3	17.9	RR :
GR 308	19 14 03	+43 18	16.2	17.3	SR
GR 309	19 18 11	+43 43	13.6	18.5	M

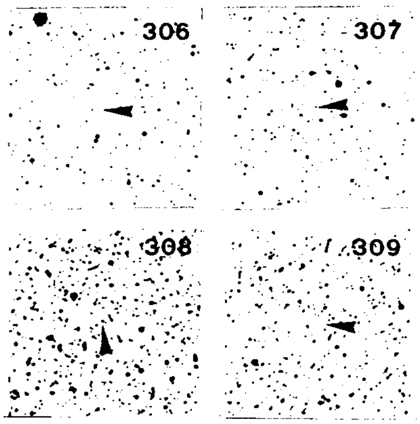

Figure 1

An intercomparison blue-infrared shows that the variables GR 306 and GR 307 are bluish, while GR 308 and 309 are very red. The finding chart is represented in Figure 1 (15′ of side, north in the top).

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A DRAMATIC CHANGE IN THE LIGHT CURVE OF V711 Tau (HR 1099)

V711 Tau (= HR 1099) is known to be one of the most active stars of the RS CVn binaries group. Its light curve shows striking amplitude variations from season to season but it maintains a nearly sinusoidal shape (Bartolini et al., 1978, Dorren et al., 1981, Dorren and Guinan, 1981). UBV photometry has been obtained since 1977-78 in a cooperative effort at Catania and Torino Observatories in order to follow the light-curve evolution and the shifts of the light minimum in orbital phase.

The purpose of this Bulletin is that of showing the rather unusual and changing light-curves during 1980-81.

In the figure the V light curves obtained in 1979-80 and 1980-81 at Catania and Torino are plotted versus the orbital phase computed with the ephemeris:

$$\text{J.D. (hel.)} = 2442766.069 + 2^{d}.83782\ E.$$

The differential magnitudes Δm (variable-comparison), were determined using 10 Tau as comparison star. The upper part of the figure shows the 1979-80 light curve, while the lower part shows the 1980-81 observations. The 1980-81 available data are grouped in three contiguous and homogeneous intervals of time in order to obtain reasonably defined light curves with small

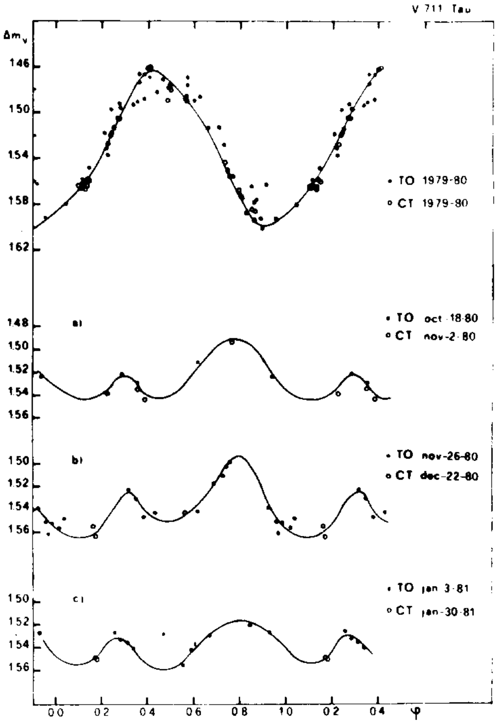

Figure 1

V light curves of V711 Tau obtained in 1979-80 and in 1980-81

dispersion. In fact no light curve was possible to obtain but a high-dispersion 0.08-magnitude band, much larger than the observation accuracy would allow, when all of the 1980-81 observations were considered for one single light curve. The reason for this apparent puzzle is readly shown in the figure: the light curve of V711 Tau is undergoing dramatic changes, not only with respect to the quasi-sinusoidal ones in the last few years, but from one interval of time to another in the same observation season. Each of the 1980-81 light curves are double-peaked and i) the amplitude, ii) the phase of the deeper light minimum and iii) its level are variable. The observed amplitude has been decreasing from $0^m.14$ to $0^m.06$,while the light minimum migrates backwards and has brightened by about $0^m.05$.

Dorren et al. (1981) have proposed a model with two large circular spots spaced by 0.23 of the stellar circumference to explain the light curves of 1977-78 and 1979. They find the mean latitude of the spots to have moved from 48° to 15°. If we assume their model, the 1980-81 light curves would imply that the two spots have moved in longitude or a new large spot, separated by about one half of the stellar circumference with respect to the photocentre of the previous center of activity, has developed. Due to the complex double-peaked 1980-81 light curves it is very difficult to define what is the migration rate of the spots. The deepest minimum occurs about at phase $0^p.1$. If we assume that it represents the same minimum of the previous year we have a new very fast advancing migration of the wave, while it was slowing down in 1979 and 1980. On the other hand the phase of the shallow minimum is about $0^p.5$ which is difficult to explain in terms of spot migration because the migration rate would be so large that an appreciable shift would have been detected during the four months of -observations.

Most probably we are witnessing the transition from one spot cycle to another with both old and new centers of activity affecting the observed light curve. If the star rotates differentially, the two minima-or maxima-will migrate on the light curve at different rates, unless the two spot centers are located at the same stellar latitude, and strong variations of the light curve should be expected until the active center of the old cycle is completely decayed. Actually three observations on February and late March 1981 show appreciable differences with respect to the other observations and probably indicate further changes of the light curve.

It is very important to trace as continuous as possible the behaviour of V711 Tau light curve in particular the migration rate of both light minima, their amplitudes and light levels in order to make available precise observation constraints on RS CVn stars spot modelling. Therefore we urge observers of V711 Tau to intensify the efforts in order to obtain well time-resolved light-curves as early as possible in the next observation season.

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