

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

Nos. 3101 — 3200  
1987 October — 1988 June

EDITORS: L. SZABADOS and B. SZEIDL  
KONKOLY OBSERVATORY  
H-1525 BUDAPEST  
P.O. Box 67, HUNGARY

HU ISSN 0374 — 0676

## CONTENTS

- 3101 PRE-OUTBURST LIGHT CURVE OF NOVA CYGNI 1975 (V1500 Cyg)  
Richard A. Wade  
19 October 1987
- 3102 BV LIGHT CURVES OF BY Dra IN 1986  
G. Cutispoto, G. Leto, I. Pagano, G. Santagati, R. Ventura  
21 October 1987
- 3103 FLARE STAR OBSERVATIONS IN THE PLEIADES-REGION  
Janos Kelemen  
21 October 1987
- 3104 NEAR SIMULTANEOUS POLARIMETRY AND PHASE-RESOLVED SPECTROSCOPY OF THE  
AM Her SYSTEM H 0538+608  
Paul A. Mason, J.W. Liebert, G.D. Schmidt  
26 October 1987
- 3105 AY LYRAE SUPEROUTBURST PHOTOMETRY  
Michal Szymanski, A. Udalski  
26 October 1987
- 3106 A NEW RED VARIABLE STAR  
M. Kun  
29 October 1987
- 3107 1987 AMPLITUDE CHANGES OF II Peg LIGHT CURVE  
J.A. Cano, R. Casas, C. Gallart, J.M. Gomez, E. Jariod, M. Peracaula  
3 November 1987
- 3108 PULSATION PERIODS IN Delta SERPENTIS  
P. Lopez de Coca, A. Rolland  
3 November 1987
- 3109 THE 1986 OBSERVATIONS AND THE PERIOD STUDY OF CN ANDROMEDAE  
S. Evren, C. Ibanoglu, Z. Tunca, M.C. Akan, V. Keskin  
6 November 1987
- 3110 POSITIONS AND FINDING CHARTS OF NOVA HERCULIS 1987 AND NOVA SAGITTARII  
1987  
Hilmar W. Duerbeck  
6 November 1987
- 3111 THE NATURE OF THE VARIABILITY OF 42 Per  
A.H. Batten  
11 November 1987
- 3112 32 Cyg: UBV PHOTOMETRY OF ECLIPSE IN 1987  
A. Dolzan  
18 November 1987
- 3113 A REMARK ON TV CYGNI  
W. Wenzel  
27 November 1987

- 3114 ADDITIONAL REMARK ON SOLOVYOV'S SO-CALLED NOVA AQUILAE 1949  
W. Wenzel  
2 December 1987
- 3115 PHOTOELECTRIC OBSERVATIONS OF R CrB  
D. Bohme  
3 December 1987
- 3116 RAPID VARIATION IN H $\alpha$  EMISSION OF Gamma CASSIOPEIAE  
S.C. Joshi, R.K. Srivastava, J.B. Srivastava  
3 December 1987
- 3117 1986 BV LIGHT CURVES OF BH VIRGINIS  
M.J. Arevalo, B. Robayna, J.J. Fuensalida, D.K. Bedford  
8 December 1987
- 3118 NEW MINIMA TIMES AND LIGHT ELEMENTS FOR Sigma AQUILAE  
David B. Williams  
9 December 1987
- 3119 PHOTOMETRIC OBSERVATIONS ON SZ Psc  
K. Thompson  
9 December 1987
- 3120 HD 30861, A NEW ELLIPSOIDAL VARIABLE  
W. Verschuren, H. Hensberge, H. Schneider, K. Pavlovski  
11 December 1987
- 3121 MORE ABOUT FY Aql AND GRBS 790331  
R. Hudec  
17 December 1987
- 3122 A NEW VARIABLE STAR IN CASSIOPEIA  
J.L. Sedano, E. Rodriguez, P. Lopez de Coca  
22 December 1987
- 3123 Gamma LUPI DOES NOT APPEAR TO BE A Be STAR  
Dietrich Baade  
23 December 1987
- 3124 ON THE CONTINUED IMMACULATENESS OF THE Be STAR Mu CENTAURI  
Dietrich Baade  
23 December 1987
- 3125 PHOTOELECTRIC TIMES OF MINIMA OF FOUR ECLIPSING BINARIES  
T. Hegedus  
28 December 1987
- 3126 OPTICAL BEHAVIOUR OF THE POLAR AM Her IN 1987  
W. Gotz  
29 December 1987
- 3127 TIMES OF MINIMA OF SOUTHERN ECLIPSING BINARIES  
Miguel Angel de Laurenti, M. Angel Cerruti  
4 January 1988
- 3128 COORDINATED MULTIWAVELENGTH OBSERVATIONS OF YY Gem  
C.J. Butler  
8 January 1988

- 3129 PHOTOELECTRIC OBSERVATIONS OF SN 1987A  
Clive Rowe, B. Allen  
11 January 1988
- 3130 UPDATE ON THE RR LYRAE STAR NSV 134  
Charles F. Prosser  
19 January 1988
- 3131 53 Psc REVISITED  
J.M. le Contel, E. Chapellier, J.C. Valtier, E. Rodriguez, P. Sedano,  
P.J. Morel, D. le Contel  
19 January 1988
- 3132 A RECENT LIGHT CURVE FOR THE BRIGHT W UMa TYPE ECLIPSING BINARY GR Vir  
E.M. Halbedel  
19 January 1988
- 3133 PHOTOELECTRIC PHOTOMETRY OF RR Her  
J. Papousek  
20 January 1988
- 3134 VARIABILITY OF THE CARBON STAR BD +51d1329  
J. Kizla  
21 January 1988
- 3135 UBV OBSERVATION OF NOVA VULPECULAE 1987  
Osamu Ohshima  
21 January 1988
- 3136 POSSIBLE DETECTION OF SOLAR-TYPE CYCLES IN CATAclysmic VARIABLES  
A. Bianchini  
25 January 1988
- 3137 THE LIGHT VARIATIONS OF THE HYPERGIANT HR 8752 (V509 Cas)  
L. Mantegazza, E. Poretti, E. Antonello  
27 January 1988
- 3138 NEW B, V LIGHT CURVES OF AA URSAE MAJORIS  
Lu Wenxian, Wang Ruyou, Fan Qingyuan  
27 January 1988
- 3139 UBVRI OBSERVATIONS OF THE CHROMOSPHERICALLY ACTIVE STAR HD 155555  
(V824 Ara) IN 1986 AND 1987  
S.M. Rucinski  
28 January 1988
- 3140 HIGH SPEED PHOTOMETRY OF HAMUY'S VARIABLE  
Brian Warner, R.E. Nather  
28 January 1988
- 3141 ON THE PERIOD CHANGE OF THE RR LYRAE-TYPE VARIABLE XZ CYGNI  
V.P. Bezdenezhnyi  
1 February 1988
- 3142 SIMULTANEOUS TWO-COLOUR OBSERVATION OF THE FLARE STAR EV Lac IN  
SEPTEMBER 1987  
V.P. Zalinian  
2 February 1988

- 3143 A POSSIBLE VARIABLE STAR INSIDE THE ERROR BOX OF GRBS 790331  
R. Hudec  
5 February 1988
- 3144 STROMGREN PHOTOMETRY OF UU Her: 1987 RESULTS  
G. Umana, S. Catalano, E. Marilli, C. Trigilio  
8 February 1988
- 3145 PHOTOMETRIC OBSERVATIONS OF THE INTERMEDIATE POLAR AO PISCUM  
Janusz Kaluzny, I. Semeniuk  
8 February 1988
- 3146 TW Hya: A T TAURI STAR FAR FROM ANY DARK CLOUD  
UBVRI OBSERVATIONS IN 1986 AND 1987  
S.M. Rucinski  
9 February 1988
- 3147 ON THE PHOTOMETRIC FEATURES OF R CrB DUST ENVELOPE  
A.F. Pugach, G.U. Kovalchuck  
10 February 1988
- 3148 LIGHT CURVE OF V482 CYGNI, AN R CrB STAR  
Emilia P. Belserene, D.L. Summers, E.A. Scheer  
19 February 1988
- 3149 A NEW EPHEMERIS FOR RW ARIETIS  
I. Todoran  
19 February 1988
- 3150 SV Cen - UBV LIGHT CURVE 1974-79  
Z. Kviz  
22 February 1988
- 3151 THE ELLIPSOIDAL VARIABILITY OF 75 PEGASI  
Douglas P. Hube, B.E. Martin, A.F. Gulliver  
26 February 1988
- 3152 A POSSIBLE VARIABLE STAR NEAR IC 402  
Dominique Proust  
29 February 1988
- 3153 PHOTOELECTRIC MINIMA TIMES OF THE BINARY STAR V508 Oph  
P. Rovithis, H. Rovithis-Livaniou  
4 March 1988
- 3154 SHOULD WE REALLY FORGET DO Dra?  
P.N. Kholopov, N.N. Samus  
10 March 1988
- 3155 THE PERIOD OF TWO Bp Si Mg STARS: HD 60431 AND CoD -51d3378  
P. North, J. Babel, T. Lanz  
15 March 1988
- 3156 NEW PHOTOELECTRIC TIMES OF MINIMA OF V839 OPHIUCHI  
P.G. Niarchos  
15 March 1988
- 3157 THE VARIABILITY OF 53 Psc  
L.A. Balona, F. Marang  
17 March 1988

- 3158 W Cru - MINIMUM IN THE GENEVA PHOTOMETRIC SYSTEM  
Z. Kviz, F. Rufener  
17 March 1988
- 3159 LIGHT CURVE VARIATIONS OF SV CAMELOPARDALIS  
M.C. Akan, Z. Tunca, C. Ibanoglu, S. Evren, V. Keskin  
18 March 1988
- 3160 THE DISCOVERY OF A BETA LYRAE VARIABLE IN THE VISUAL BINARY SYSTEM  
ADS 14977  
R.L. Walker  
18 March 1988
- 3161 PHOTOELECTRIC EPHEMERIS OF THE EARLY-TYPE ECLIPSING BINARY  
V593 CENTAURI  
E. Lapasset, J.J. Claria, M. Gomez  
22 March 1988
- 3162 PHOTOELECTRIC OBSERVATIONS OF THE ECLIPSING BINARY V676 CENTAURI  
M. Gomez, E. Lapasset  
22 March 1988
- 3163 HY PAVONIS: PHOTOELECTRIC TIMES OF MINIMUM AND IMPROVED PERIOD  
E. Lapasset, M. Gomez  
22 March 1988
- 3164 PHOTOELECTRIC TIMES OF MINIMUM OF THE ECLIPSING BINARY RT HYDRI  
M. Gomez, J.J. Claria, D. Minniti, E. Lapasset  
22 March 1988
- 3165 A LIST OF BINARY CEPHEID CANDIDATES DESERVING RADIAL VELOCITY  
OBSERVATIONS  
L. Szabados  
23 March 1988
- 3166 OPTICAL BEHAVIOUR OF THE X-RAY BINARY V1727 CYGNI = 4U 2129+47 IN THE  
SEASON 1987/88  
W. Gotz  
25 March 1988
- 3167 NEW TIMES OF MAXIMUM BRIGHTNESS FOR SX Phe  
Ennio Poretti  
25 March 1988
- 3168 IS Nu Her REALLY A VARIABLE STAR?  
E. Poretti, L. Mantegazza, E. Antonello  
25 March 1988
- 3169 NEW OBSERVED TIMES OF MINIMA FOR MR Cyg, V477 Cyg  
C.A. Wood  
29 March 1988
- 3170 THE LAST MAXIMA OF HR 8752 = V509 Cas  
E.M. Halbedel  
30 March 1988
- 3171 RECENT BEHAVIOUR OF THE YELLOW SUPERGIANT Rho Cas  
E.M. Halbedel  
30 March 1988

- 3172 PHOTOELECTRIC PHOTOMETRY OF Rho CASSIOPEIAE  
P. Steven Leiker, D.B. Hoff, J. Nesbella, M. Gainer, R. Milton, D. Pray  
31 March 1988
- 3173 1987 BVRI PHOTOMETRY OF RT And  
M. Zeilik, D. Beckert, C. De Blasi, M. Ledlow, M. Rhodes, T. Williams  
5 April 1988
- 3174 A NEW VARIABLE STAR IN VIRGO  
E. Rodriguez, J.L. Sedano, P. Lopez de Coca, A. Rolland  
12 April 1988
- 3175 V PHOTOMETRY OF SUPERNOVA 1987A  
A.H. Jarrett  
13 April 1988
- 3176 IS Tau CASSIOPEIAE A VARIABLE STAR?  
P. Steven Leiker, D.B. Hoff  
13 April 1988
- 3177 PHOTOELECTRIC B AND V OBSERVATIONS OF W UMa  
A. Dolzan  
18 April 1988
- 3178 UBV PHOTOMETRY OF THE R CORONAE BOREALIS STAR GU Sgr - 1986/87  
W.A. Lawson, P.M. Kilmartin, A.C. Gilmore  
25 April 1988
- 3179 VARIABILITY IN THE Be STAR SB 357 (= CD -37d316)  
David Kilkenny  
25 April 1988
- 3180 PHOTOMETRIC OBSERVATIONS OF Zeta AURIGAE DURING THE 1987-1988 ECLIPSE  
A. Asonuma, S. Nishida, S. Okumura, M. Shimada, Y. Ueda, T. Watanabe,  
M. Saito  
3 May 1988
- 3181 UBVR - PHOTOMETRY OF BH Cep  
A.F. Pugach  
4 May 1988
- 3182 ON THE LIGHT VARIABILITY OF V530 Cyg  
A.F. Pugach  
4 May 1988
- 3183 OTHER MAXIMUM FOR THE PULSATING STAR V1719 Cyg (HD 200925)  
S.F. Gonzalez-Bedolla, D. Flores  
5 May 1988
- 3184 BIBLIOGRAPHICAL CATALOGUE OF RR LYRAE STARS  
A. Heck  
5 May 1988
- 3185 PHOTOELECTRIC MINIMA OBSERVATIONS OF THE SHORT PERIOD ECLIPSING BINARY  
BP VELORUM  
E. Lapasset, M. Gomez  
5 May 1988
- 3186 HR 7923 IS A VARIABLE STAR  
D. Bohme  
16 May 1988

- 3187 VARIABILITY OF THE HERBIG Be STAR BHJ 71  
N.D. Melikian, V.S. Shevchenko, M.A. Ibragimov, S.D. Jakubov,  
A.V. Chernyshev  
16 May 1988
- 3188 BD +0d3566, A NEW SHORT PERIOD VARIABLE STAR  
T. Gomez, J.H. Pena, M.A. Hobart  
18 May 1988
- 3189 PHOTOGRAPHIC UBV PHOTOMETRY OF FLARE STARS IN THE Gamma CYGNI REGION  
Katya P. Tsvetkova, M.K. Tsvetkov  
20 May 1988
- 3190 FLARE STAR OBSERVATIONS IN ORION BY THE METHOD OF PHOTOGRAPHIC STELLAR  
TRACKS  
Renada K. Konstantinova-Antova, M.K. Tsvetkov  
20 May 1988
- 3191 PHOTOGRAPHIC UBV PHOTOMETRY OF H $\alpha$  EMISSION IN THE Gamma CYGNI  
REGION  
Katya P. Tsvetkova, M.K. Tsvetkov  
20 May 1988
- 3192 PERIOD CHANGES IN AC HERCULIS  
E. Zsoldos  
24 May 1988
- 3193 VARIABLE C IN M33  
M. Lovas, E. Zsoldos  
24 May 1988
- 3194 PHOTOMETRIC BEHAVIOUR OF KR AURIGAE IN THE SEASON 1987/88  
W. Gotz  
26 May 1988
- 3195 PHOTOMETRIC BEHAVIOUR OF DR TAURI IN THE SEASON 1987/88  
W. Gotz  
26 May 1988
- 3196 NSV 03005: A PROBABLE LONG-PERIOD ECLIPSING BINARY  
Daniel H. Kaiser, M.E. Baldwin, D.B. Williams  
27 May 1988
- 3197 AUTO-CORRELATION TECHNIQUES IN SEARCHES FOR RAPID QUASI-PERIODIC  
MODULATION IN dMe FLARE STARS  
A.D. Andrews  
30 May 1988
- 3198 FURTHER AUTO-CORRELATION ANALYSIS OF dMe PROXIMA CENTAURI (V645 Cen)  
A.D. Andrews  
30 May 1988
- 3199 THE PERIOD OF THE A0p Si PROBABLE BLUE STRAGGLER NGC 6281-9  
P. North, G. Jasiewicz, Ch. Waelkens  
6 June 1988
- 3200 1988 BVRI PHOTOMETRY OF XY UMa  
Michael Zeilik, D. Cox, C. De Blasi, M. Ledlow, M. Rhodes, T. Williams  
7 June 1988

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

Number 3101

Konkoly Observatory  
Budapest  
19 October 1987  
*HU ISSN 0374 - 0676*

PRE-OUTBURST LIGHT CURVE OF NOVA CYGNI 1975 (V1500 Cyg)

Renewed interest in the very faint magnetic nova Cygni 1975 (Chlebowski & Kaluzny 1987; Schmidt, Smith & Elston 1987) prompts me to report findings from my recent inspection of two plates taken with the Palomar 1.2m Schmidt telescope in 1969 and 1970. These are the only Palomar Schmidt plates taken of the region of Nova Cygni between 1953 and August 1975.

Plate PS14992 by J. Kristian is a two-color 103a0 plate, exposed 1969 August 17 for 5 min behind a GG13 filter and 50 min behind UG1, as part of a (B,UV) survey. The nova image is not seen. I have estimated  $B > 18.0$  using the comparison sequence of Kaluzny and Semeniuk (1987). A scratch directly across the position of the nova B image precludes obtaining a reliable fainter limit, although comparison star C3 ( $B \approx 19.9$ ) is clearly seen. Probably the nova was fainter than 19.

Plate PS15900 by M. V. Penston is a IIIaJ plate exposed 1970 July 31 for 60 min behind a Wratten 4 filter (the "g" passband). There is a slight clumping of plate grain at the nova position; other similar clumpings visible under high magnification correspond to faint images on the finding chart of Kaluzny and Semeniuk. These images are at least 1 mag fainter than star C3. The nova was therefore at least as faint as 20.5 mag.

Kukarkin and Kholopov (1975) have reported some pre-discovery images of Nova V1500 Cyg during the weeks just before the eruption in 1975 August. They also report upper limits of 19 mag in 1972 and 17.9 in 1974 December. The limits reported here are slightly more remote in time from the outburst than those of Kukarkin and Kholopov, but the limit for PS15900 is substantially fainter. These limits are closer in time to the outburst than the 1967 Oct-

ober limit of 19.5 from Asiago plates (Rosino & Tempesti 1977). Thus they provide additional useful constraints for evaluating whether Nova Cygni 1975 followed the "hibernation" scenario that has been put forward by Shara et al. (1986). More generally, they bear on the question whether novae have the same brightness before and after eruption (cf. Robinson 1975). The present brightness of V1500 Cyg varies about  $V = 17$ . (Kaluzny & Semeniuk 1987).

Thanks are due to Dr. R. J. Weymann, Director of the Mt. Wilson & Las Campanas Observatories, for permission to use the plate material. Drs. A. Sandage and A. Saha, and Mr. B. Katem were instrumental in helping me locate and inspect the plates.

RICHARD A. WADE  
Steward Observatory  
University of Arizona  
Tucson, AZ 85721  
U.S.A.

#### References:

- Chlebowski, T. & Kaluzny, J. 1987. I.A.U. Circ. 4413.  
Kaluzny, J. & Semeniuk, I. 1987. Acta Astronomica, in press.  
Kukarkin, B.V. & Kholopov, P.N. 1975. Astr. Tsirk. No. 889.  
Robinson, E.L. 1975. Astron. J. 80, 515.  
Rosino, L. & Tempesti, P. 1977. Sov. Astron. 21, 517.  
Schmidt, G.D., Smith, P. & Elston, R. 1987. I.A.U. Circ. 4415.  
Shara, M.M., Livio, M., Moffat, A.F.J. & Orio, M. 1986. Astrophys. J. 311, 163.

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

Number 3102

Konkoly Observatory  
Budapest  
21 October 1987  
HU ISSN 0374-0676

BV LIGHT CURVES OF BY Dra IN 1986

BY Dra (= BD +51 2402 = HD 234677 = SAO 31048) is the prototype binary system (M0Ve + M0Ve) of the flare stars which also shows low-amplitude quasi-periodic light variability outside of flares. This variability is generally attributed to rotational modulation of starspots (Rodono' 1986). Previous photometry of this very interesting star was presented by Rodono' et al. (1983).

We present BV differential photometry carried out during the period 8 July - 8 November 1986, on 22 nights with a single-channel photon-counting photometer fed by a 0.91m Cassegrain telescope. Our principal comparison star was HD 172268 (= BD +51 2408 = SAO 31070), while HD 172468 (=BD +51 2410 = SAO 31077) was observed several times each night, as check star.

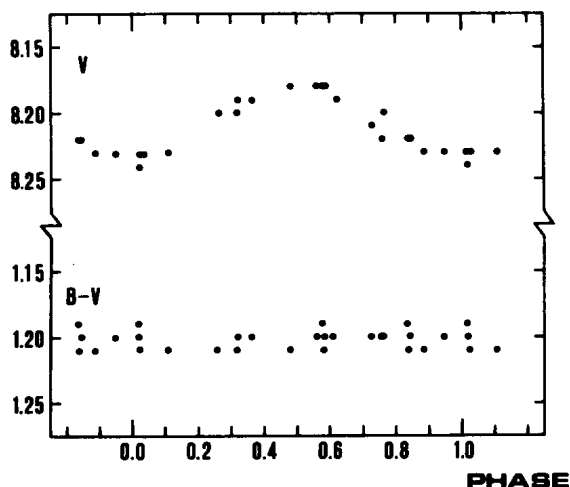


Figure 1

V, B-V light curves of BY Dra obtained at Catania Observatory during the period July - November 1986. Phases were computed from the ephemeris given by Chugainov (1966):  $JDo = 2438983.612 + 3.836x$ .

Table I  
Photometric observations of BY Dra

JDe	PHASE	V	B-V
2446000.0+			
619.4549	.5743	8.18	1.19
620.4535	.8346	8.22	1.19
621.4944	.1060	8.23	1.21
622.4653	.3590	8.19	1.20
623.4556	.6172	8.19	1.20
624.4722	.8822	8.23	1.21
678.4204	.9459	8.23	1.20
682.5171	.0138	8.23	1.20
683.4565	.2586	8.20	1.21
685.3637	.7559	8.22	1.20
686.4045	.0272	8.23	1.21
687.5217	.3186	8.19	1.20
688.5217	.5793	8.18	1.21
708.4042	.7623	8.20	1.20
709.3779	.0161	8.24	1.19
711.4557	.5578	8.18	1.20
714.3657	.3164	8.20	1.21
716.3697	.8388	8.22	1.21
730.3324	.4787	8.18	1.21
731.2870	.7236	8.21	1.20
742.2400	.5829	8.18	1.20
743.2319	.8415	8.22	1.10

The observations were corrected for atmospheric extinction. Nightly mean BV differential magnitudes (variable - comparison star) were computed with reference to several standard stars. The following values of the V magnitude and B-V color for the comparison star BD +51 2408 were assumed:  $V=7.893$   $B-V=1.259$  (Vogt, 1975).

Mean JDe, V magnitudes and B-V color of BY Dra are listed in Table I. Photometric phases, also listed in Table I, were computed using the photometric ephemeris derived from Chugainov (1966):

$$JDe = 2438983.612 + 3.836xE$$

The resulting V light curve and B-V color are presented in Fig.1. No significant B-V color variation is observed. Nightly standard deviations for V and B-V data are 0.01 and 0.015 mag, respectively.

We also obtained spot models for the BY Dra V light curve, assuming two spotted circular areas and using our computer code based on the analytical method outlined by Friedemann and Gurtler (1975) and already presented by Rodono' et al. (1986). We adopted the following values for the parameter involved in the model:

$i$  (inclination of the star rotation axis with respect to the line of sight) = 30 degree;

$\mu$  (limb darkening coefficient) = 0.85;

$L_s/L_p$  (luminosity ratio between the secondary and the primary component of the system) = 0.52;

$V_0$  (unspotted V magnitude) = 8.00;

$T_s$  (photospheric temperature) = 4100 K;

$T_{spot}$  (spot temperature) = 3500 K;

The resulting latitudes for the two spots are 81 and 25 degrees. The radii are 38 and 13 degrees respectively. The two spots are 245 degrees apart in longitude (Figure 2).

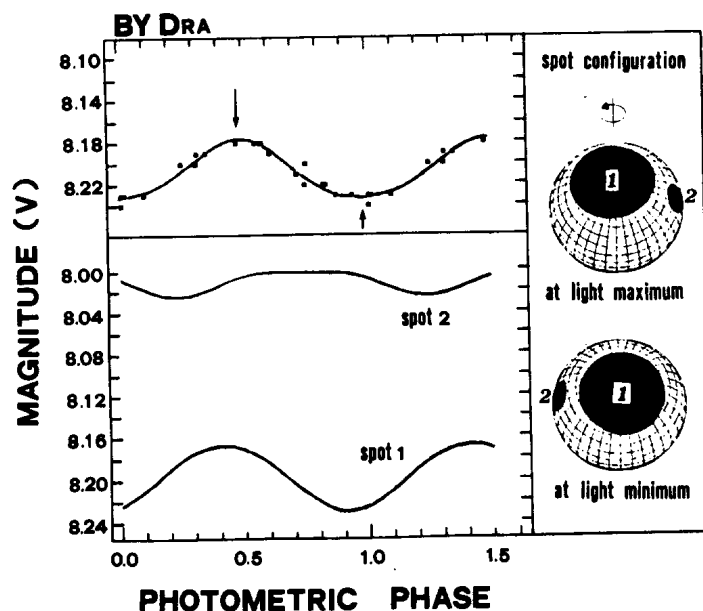


Figure 2

Results of two-spot model fit for the observed light variations (upper panel). The bottom panel shows the contribution of each spot, arrows indicate the phase of light maximum ( $\downarrow$ ) and light minimum ( $\uparrow$ ); the corresponding spot configurations are presented on the right hand panel.

In previous papers (Vogt 1981, Melkonian et al. 1981, Olah and Soliman 1984), the question concerning the variability of the comparison stars HD 172468 and HD 172268 has been raised. From our observations of BY Dra in the years 1984, 1985 and 1986 the following seasonal average  $\Delta mag$ , in the sense HD 172268 minus HD 172468, result :

1984	$\Delta V = .378 \pm .005$	$\Delta B = .370 \pm .006$
1985	$\Delta V = .375 \pm .006$	$\Delta B = .372 \pm .006$
1986	$\Delta V = .372 \pm .007$	$\Delta B = .369 \pm .007$

Although no systematic variation can be inferred from these observations, we sometimes obtained nightly mean values that seem to indicate some variability. At present time we are not able to ascertain if one, or both, of the comparison are variable. Nevertheless, as obtained by Olah and Soliman (1984), the light curves generally show higher scatter using HD 172268 as comparison than using HD 172468. For this reason we prefer HD 172268 as comparison, but further dedicated observations of these two stars are necessary.

We wish to thank Prof. Marcello Rodono' for suggesting to carry out the present observations and for stimulating discussion.

G.CUTISPOTO, G.LETO, I.PAGANO, G.SANTAGATI, R.VENTURA

Catania Astrophysical Observatory  
Astronomical Institute of Catania University  
CNR-Gruppo Nazionale di Astronomia, Unita' di Ricerca  
di Catania

V.le A.Doria, 6  
95125, Catania ITALY

#### References:

- Chugainov, P.F.: 1966, *Inf.Bull.Var. Stars*, No.122.  
Friedemann, C., and Gurtler, J.: 1975, *Astron.Nachr.* 296, p.125.  
Melkonian, A.S., Olah, K., Oskanian, A.V., Oskanian, V.S.: 1981, *Astrophys.* 17, p.112.  
Olah, K. and Soliman, M.A.: 1984, *Inf.Bull.Var.Stars*, No.2648.  
Rodono', M., Pazzani, V. and Cutispoto, G.: 1983, in "Activity in Red-Dwarf stars", IAU Coll. No.71, p.179, P.B.Byrne and M.Rodono' eds., D.Reidel, Dordrecht, Holland.  
Rodono', M.: 1986, in "Highlights of Astronomy", p.429, J.P.Swings ed., D.Reidel, Dordrecht, Holland.  
Rodono', M. et al.: 1986, *Astron.Astrophys.* 165, p.135.  
Vogt, S.S.: 1975, *Astrophys.J.* 199, p.418.  
Vogt, S.S.: 1981, *Astrophys.J.* 250, p.327.

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3103

Konkoly Observatory  
Budapest  
21 October 1987  
HU ISSN 0374 - 0676

FLARE STAR OBSERVATIONS IN THE PLEIADES-REGION

Between 1975 and 1985 more than 300 multiexposure survey plates were obtained in the mountain station of the Konkoly Observatory. The exposures were taken on Kodak 103a0 type plates through UG2 filter using our 60/90 cm Schmidt telescope. The observations were made by the chain exposure method. Each plate contains 6 successive images for every star with a 10 minute exposition time. The plates were checked by a Zeiss Blinkcomparator and the image series of the flare events were measured by a Cuffey Iris Astrophotometer (Kelemen, 1986). The accuracy of the photometric measurements are rather poor due to the well known difficulties of the ground based ultraviolet photographic observations. Because of the relative high error level my list contains only those flare events where the measured U amplitude exceeds one magnitude.

The celestial coordinates of the flare stars which are brighter than 18 magnitude in their quiet state, were also measured. The coordinate measurements were carried out with an Ascorecord measuring device. The accuracy of the measured coordinates is:

in right ascension  $\pm 0.53$  s

in declination  $\pm 1.4$  "

Table I. contains the measured data.

Table I

No.	(1) R.A. (1900)	(2) D.	(3) U <sub>min</sub>	(4) U <sub>ampl.</sub>	(5) J.D. 244...	(6) Remark
1	—	—	17.5	2.5	2776	(A)
2	3 44 45	24 59 02	>18	>3.1	2776	(465)
3	3 39 54	23 33 41	18	3.4	3428	(225)
4	3 39 21	24 47 40	>18	>2.6	3428	(193)
5	3 43 49	24 48 26	18	2.8	3429	(429)
6	3 45 30	24 04 06	16.5	2	3429	—
7	3 39 37	22 14 39	>18	>3.2	3452	(208)
8	3 33 33	23 10 23	17.6	3.7	3452	(13)
9	3 45 46	23 53 07	>18	>2.1	3454	(502)
10	—	—	>18	>1.8	3454	(B)
11	3 46 59	22 09 58	17.7	2.3	3455	(532)
12	—	—	17.8	2.6	3455	(C)
13	3 40 17	25 40 23	17.8	3.1	3455	(240)
14	—	—	>18	>2.1	3455	(D)
15	—	—	>18	>2.1	3455	(D)
16	3 47 41	23 44 23	17	2.1	3455	—
17	3 41 06	23 51	>18	>4	3455	—
18	3 38 18	23 33 44	>18	>1.2	3455	—
19	3 32 35	23 14 52	>18	>2.4	3455	—
20	3 32 35	23 14 52	>18	>1.6	3455	—
21	3 40 28	23 43 40	>18	>1.6	3455	—
22	3 43 42	24 01	18	2.8	3455	—
23	3 43 42	24 01	18	1.9	3455	—
24	3 45 22	22 00 58	>18	>2.2	3455	—
25	3 41 60	22 20 46	>18	>1.4	3455	(332)
26	—	—	17.5	1.9	3455	(E)
27	—	—	>18	>3.9	3484	(F)
28	3 36 53	24 22 33	>18	>5	3484	—
29	3 43 42	24 01	17	2.4	3484	—
30	3 43 42	24 01	17	2.4	3484	—
31	3 43 42	24 01	15.7	5	3484	—
32	—	—	>18	>2.6	3488	(G)
33	3 40 59	25 09 45	>18	>2.2	3488	—
34	3 43 42	24 01	>18	>2.9	3488	—
35	3 47 25	22 22 26	>18	>3	3488	(540)
36	3 41 43	23 59 35	>18	>3.2	3488	(312)
37	3 41 43	23 59 35	>18	>2.1	3488	(312)
38	3 45 13	23 38 09	17.6	2.9	3488	—
39	3 37 13	24 22 31	16.7	2.8	3488	—
40	3 37 13	24 22 31	16.7	2.1	3488	—
41	3 38 00	24 07	17.6	3.4	3488	—
42	3 47 32	22 39 16	>18	>1.7	3489	—
43	3 47 32	22 39 16	>18	>1.5	3489	—
44	3 37 03	23 15 23	17.5	4.4	3489	(87)
45	3 41 46	25 12 54	17	2	3836	—
46	—	—	>18	>2.6	4113	(H)
47	3 32 34	23 31 29	17.7	2.4	4118	—
48	3 45 02	21 53 53	17.8	3.4	4118	(484)
49	3 45 02	21 53 53	17.8	3.1	4118	(484)
50	3 42 45	24 14 58	>18	>1.7	4118	(384)

Table I (cont.)

No.	(1) R.A. (1900)	(2) D.	(3) U <sub>min</sub>	(4) U <sub>ampl.</sub>	(5) J.D. 244...	(6) Remark
51	3 40 37	21 54 44	18	2.3	4118	(253)
52	3 43 42	24 01	17.7	3.1	4143	-
53	3 39 11	23 22 09	16.6	2.4	4143	(176)
54	3 38 29	23 29 24	17.1	1.6	4172	-
55	3 34 56	24 22 24	17.8	2	4172	-
56	3 39 15	23 06 17	18	2	4172	(181)
57	3 34 40	23 26 06	>18	>1.4	4172	-
58	3 39 29	24 26 24	>18	>2	4172	(198)
59	3 40 33	23 41 16	18	2.5	4172	-
60	3 42 44	24 18 50	>18	>2.7	4172	(382)
61	3 42.8	24 19	>18	>1.9	4172	(346)
62	—	—	>18	>3.2	4172	(I)
63	3 35 17	23 46 43	>18	>3.3	4172	(37)
64	3 41 47	24 10 31	>18	>2.2	4172	(319)
65	3 41 29	24 32 04	16.7	3.4	4172	(292)
66	3 41 29	24 32 04	16.7	1.7	4172	(292)
67	—	—	>18	2.2	4172	(J)
68	—	—	>18	>1.4	4172	(K)
69	—	—	>18	>2.4	4172	(K)
70	—	—	>18	>3	4172	(L)
71	3 38 00	24 07	16.4	3.5	4172	-
72	3 38 00	24 07	16.4	1.9	4172	-
73	3 49 33	22 43 40	18	1.5	4172	-
74	3 49 33	22 43 40	18	5.4	4172	-
75	3 37 43	22 48 58	17.1	2.4	4172	-
76	3 37 43	22 48 58	17.1	1.1	4172	-
77	—	—	>18	>2.7	4172	(M)
78	—	—	>18	>2.7	4172	(N)
79	3 37 13	25 18 40	16.6	3.6	4173	-
80	3 38 00	24 07	17	1.9	4173	-
81	3 37	23 12	>18	>1.7	4173	-
82	—	—	16.2	2.9	4173	(O)
83	—	—	>18	>2.9	4173	(P)
84	3 43 42	24 01	17.4	2.2	4173	-
85	3 45 13	23 38 09	17.6	3	4173	-
86	3 43 42	24 01	>18	>3.8	4173	-
87	3 45 50	23 10 40	>18	>2.9	4173	-
88	3 45 48	23 59 05	>18	>3.4	4173	-
89	3 45 13	23 38 09	17.6	2.2	4173	-
90	3 43 38	23 42 19	>18	>4	4173	-
91	3 43 38	23 42 19	>18	>2.5	4173	-
92	3 37 55	22 57 21	>18	>3.2	4173	-
93	3 37 55	22 57 21	>18	>1.8	4173	-
94	3 45 52	23 53 48	>18	>2.5	4173	(504)
95	3 41 06	23 51	16.4	1.7	4173	-
96	3 45 13	23 38 09	17.6	2.8	4173	-
97	3 38 49	24 07 05	18	3.5	5354	-
98	—	—	>18	>3	5354	(Q)
99	3 44 43	21 40 58	>18	>3.7	5354	-
100	3 37 03	25 12 27	>18	>3.3	5354	-
101	3 37 03	25 12 27	>18	>2	5354	-

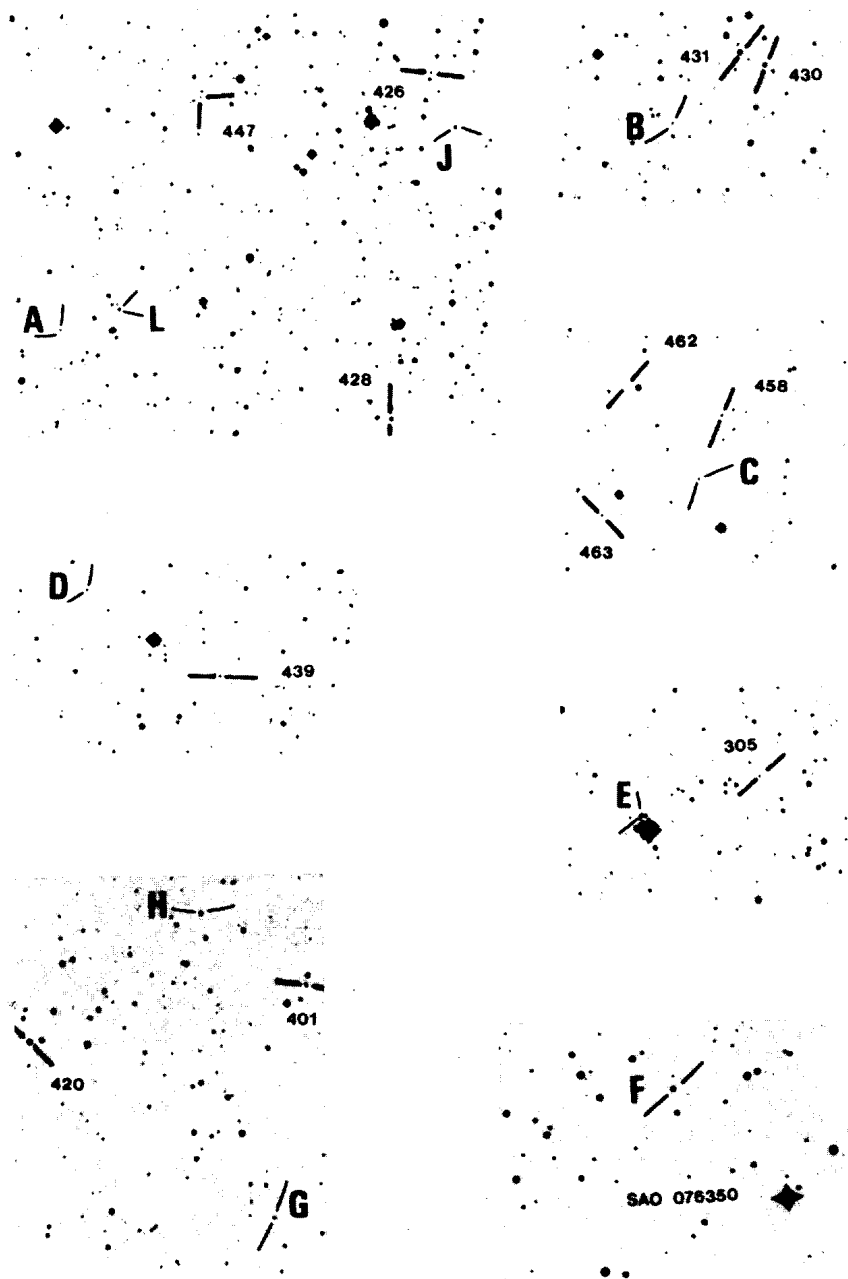


Figure 1

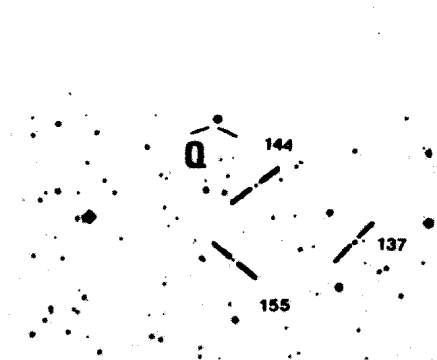
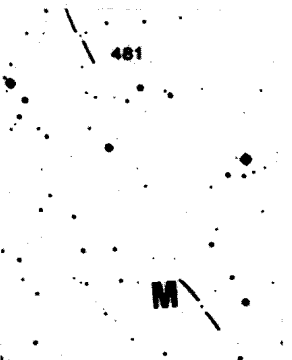
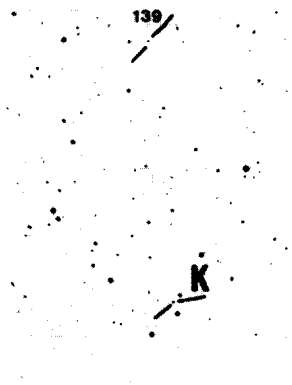
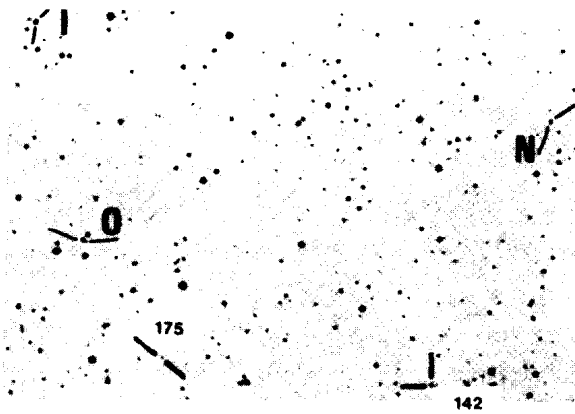


Figure 1 (cont.)

Columns (1) and (2) contain the measured celestial coordinates for the epoch 1900.

Columns (3) and (4) contain the quiet brightness in U band and the measured photographic amplitude.

Column (5) gives the J.D. of the observations.

In the (6) remark column I give the latest Haro numbers (Haro et. al., 1982) if it is possible.

In the cases where the coordinates are missing I give identifications charts. The charts are reproductions of the Haro charts (Haro et. al., 1982) in which the numbered stars represent the known flare stars. The letters standing in the Remark column correspond to those stars in the identifications charts, which are marked with letters.

JÁNOS KELEMEN

Konkoly Observatory

Budapest, Hungary

#### References:

- Haro, G., Chavira, E. and Gonzales, G. 1982: Bul. Inst. Tonantzintla, Vol. 3, No. 1.
- Kelemen, J. 1986: "Eruptive phenomena in stars", Comm. Konkoly Obs. Hung. Acad. Sci., Budapest, N. 86, ed. L. Szabados

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3104

Konkoly Observatory  
Budapest  
26 October 1987  
HU ISSN 0374 - 0676

NEAR SIMULTANEOUS POLARIMETRY AND PHASE-RESOLVED SPECTROSCOPY  
OF THE AM Her SYSTEM H0538 + 608

We have obtained nearly simultaneous polarimetry and time-resolved spectroscopy of the recently discovered AM Her system H0538+608, also catalogued as 4U 0541+60 (Forman et al. 1978) and 1H 0533+607 (Wood et al. 1984). Time-resolved spectroscopy was obtained using the Multiple Mirror Telescope on 1986 December 22 UT just 7 orbits before circular polarization data was obtained with the Steward Observatory 90 in. telescope. This object exhibits rapid flickering in the optical light curve and circular polarization phase modulations. Circular polarization behavior is shown to change on time scales as short as 7 binary periods. We derive a more precise orbital period of  $3.262 \pm 0.036$  hours. However, the variations in the binary phase modulations of the circular polarization, and the relative paucity of such data, preclude presentation of a precise long-term ephemeris.

H0538+608 is one of eight AM Her type systems discovered from its X-ray emission. It has exhibited a wide range of optical luminosity variation. Harvard plates indicate that the B magnitude of this object has dropped below 17 (Remillard et al. 1986), while at times it has been as bright as 14. In addition H0538+608 exhibits other features typical of AM Her objects. These include strongly modulated photometric variations, strong circular polarization, intense optical emission features of H I and He II, and optical flickering on time scales of seconds (Liebert and Stockman 1985). These features, noted by Remillard et al. (1986), left no doubt about the classification of H0538+608 as an AM Her type magnetic binary, but the binary period and other system parameters remained very uncertain.

Circular polarization measurements of H0538+608 were made at various times from 1985 August 19 to 1987 September 12. These observations were made at the Steward Observatory 90 in. telescope with the OCTOPOL polarimeter. Circular polarization variations between about 0 and 10 % were observed to modulate with the binary period. No linear polarization observations were obtained. We confirm the existence of an irregular circular polarization cycle as noted by Remillard et al. (1986). In addition the sign of the circular polarization changed from negative to positive within a period of about 20 orbital cycles.

The usual hydrogen and helium emission lines and an inverted Balmer decrement are present. A total of four emission-line components are observed. These include broad and narrow components as well as a transient and an asymmetric component. Each of the components, with the exception of the transient feature, are shown to modulate with the orbital period. The broad and narrow components are separated by 0.4 phase. The broad component has a velocity amplitude  $K \approx 504 \text{ km/s} \pm 60 \text{ km/s}$  and a systemic velocity  $\gamma \approx +42 \text{ km/s} \pm 40 \text{ km/s}$ . The narrow component has  $K$  and  $\gamma$  velocities of  $\approx 215 \text{ km/s} \pm 20 \text{ km/s}$  and  $+29 \text{ km/s} \pm 15 \text{ km/s}$ , respectively. In addition, the accretion stream apparently

remains unthreaded by the white dwarf's magnetic field well after passing near the inner Lagrangian point. We determine that this object is definitely one of only three AM Her type systems with periods greater than the 2 to 3 hour period gap which means that it is an important system in need of extensive study.

PAUL A. MASON  
JAMES W. LIEBERT  
GARY D. SCHMIDT

Steward Observatory  
University of Arizona  
Tucson, Arizona 85721  
U.S.A.

#### References :

- Forman, W., Jones, C., Cominsky, L., Julien, P., Murray, S., Peters, G.,  
Tananbaum, H., and Giacconi, R., 1978, Ap.J.Suppl., 38, 357.  
Liebert, J., and Stockman, H.S., 1985, In: "Cataclysmic Variables and Low-  
mass X-ray Binaries", eds. D.Q. Lamb and J. Patterson, Dordrecht, Reidel,  
pp. 151-171.  
Remillard, R.A., Bradt, H.V., McClintock, J.E., Patterson, J., Roberts, W.,  
Schwartz, D.A., and Tapia, S., 1986, Ap.J., 302, L11.  
Wood, K. et al., 1984, Ap.J.Suppl., 56, 507.

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

Number 3105

Konkoly Observatory  
Budapest  
26 October 1987  
HU ISSN 0374-0676

AY LYRAE SUPEROUTBURST PHOTOMETRY

AY Lyr is a member of SU UMa subclass of dwarf novae. Main characteristic of this class is the occurrence of brighter and longer lasting "superoutbursts" in addition to normal dwarf nova outbursts. During these superoutbursts SU UMa stars show periodic light variations called "superhumps".

Although AY Lyr has been continuously monitored by AAVSO observers for many years and its visual light curves during eruptions are well defined (Danskin and Mattei, 1978), only one precise photometry of a superoutburst has been published by now (Patterson, 1979).

In this paper we present observations of AY Lyr made in September 1987. We started on the night of Sept. 21/22 and found that the star was already in superoutburst. Observations were continued on the following 8 nights (Table I).

Table I

No.	Date	Run Start (UT)	Duration (hours)
1	1987-09-21	19.3	4.2
2	1987-09-22	19.2	4.0
3	1987-09-23	18.3	1.8
4	1987-09-24	18.3	2.9
5	1987-09-25	18.3	5.3
6	1987-09-27	18.0	4.5
7	1987-09-28	18.1	2.8
8	1987-09-29	20.2	2.3

The observations were obtained with the 60 cm reflector of the Ostrowik Station of the Warsaw University Observatory using the Double-Beam Photometer System (Szymański and Udalski, 1987). The comparison star, BD+38°3272 was monitored simultaneously in the second channel in order to remove effects of atmospheric transparency variations. Its constancy was checked for by occasional comparison with BD+38°3276 star on each night. We made observations in white light with integrations lasting 10 - 30 seconds depending on weather conditions and star brightness.

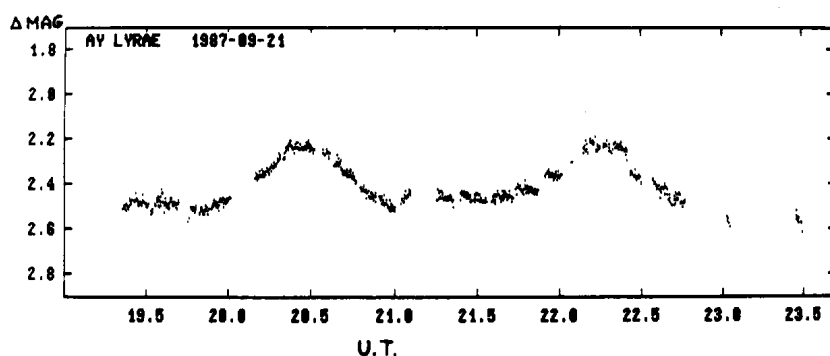


Figure 1

In Fig.1. the Sept. 21/22 light curve is presented. The superhumps with an amplitude of 0.3 mag were clearly visible and so they were on the following 4 nights. On the subsequent two runs they were partly masked by the flickering and finally they disappeared completely on Sept. 29/30.

Preliminary inspection of the data yields the superhump period of 109.4 min. This is somewhat larger than one derived by Patterson (1979) who obtained 108.8 min.

Full details of our analysis will be published elsewhere.

This paper was partly supported by the project RR.I.11.

MICHAŁ SZYMANSKI and ANDRZEJ UDALSKI  
Warsaw University Observatory,  
al. Ujazdowskie 4,  
00-478 Warszawa,  
Poland.

#### References:

- Danskin, K. and Mattei, J. (1978), J. Am. Assoc. Var. Stars Obs. 7, 1.  
Patterson, J. (1979), Astron. J. 84, 804  
Szymanski, M. and Udalski, A. (1987), In preparation.

COMMISSION 27 OF THE I. A. U.  
 INFORMATION BULLETIN ON VARIABLE STARS  
 Number 3106

Konkoly Observatory  
 Budapest  
 29 October 1987  
 HU ISSN 0374 - 0676

A NEW RED VARIABLE STAR

During the photographic photometry of the H $\alpha$  emission stars in the region of the open cluster Tr 37 (Kun, 1986) a new variable star was found on the plates taken with the 60/90/180 cm Schmidt telescope of Konkoly Observatory. The coordinates of the star (see the identification chart) are:

$$\alpha(1950)=21^{\text{h}}40^{\text{m}}56^{\text{s}}.3, \delta(1950)=+57^{\circ}06'28''.5.$$

Variability of the star was established from the following observations:

Date of observation	JD	Measured magnitude		
		R	V	B
28 June 1968	2440035.49	-	17.0	-
31 Oct. 1972	2441622.43	13 <sup>m</sup> .2	-	-
20 Oct. 1985	2446359.39	14 <sup>m</sup> .7	18 <sup>m</sup> .0	invisible
16 June 1986	2446597.49	-	15 <sup>m</sup> .5	18 <sup>m</sup> .6
14 Sep. 1986	2446687.49	-	15 <sup>m</sup> .0	-

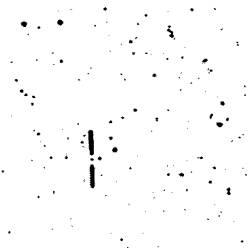


Figure 1. The identification chart. North is at the top and east is to the left. The size of the chart is 15'X15'.

The photographic R, V and B magnitudes were determined using Lichtbuer's (1982) photoelectric sequence. The magnitudes listed here were averaged from two plates taken on the same night. A red-filtered objective prism plate obtained on 13th August 1986 shows this star brighter than the star

which is situated immediately to the west of it whereas the Palomar Observatory Sky Survey red print shows the reverse situation. Our objective prism plate shows a TiO band characteristic for an M type star as well.

An IRAS point source is to be found at the coordinates  $\alpha(1950)=21^{\text{h}}40^{\text{m}}59^{\text{s}}.1$  and  $\delta(1950)=+57^{\circ}06'20''$ , and it is thought that this infrared emission might well come from the red star. We cannot, however, exclude the possibility that the far infrared source is the neighbouring star which, according to Marschall and van Altena (1987), is a member of Tr 37 and may thus be a pre-main-sequence star having infrared excess.

Obviously this limited amount of information is insufficient for characterizing the nature of the star. The red colour and the large amplitude suggest that the new variable is probably a Mira type star, similarly to the red variables found in this region by Friedemann et al. (1977) and by Pfau and Friedemann (1980). The most important questions to be answered include the determination of the period of the light variation if it exists, and to decide whether the star is a member of Tr 37 or not. Examination of the archival plate material of other observatories would probably shed more light on the nature of this star.

M. KUN  
Konkoly Observatory  
H-1525 Budapest,  
P.O. Box 67, Hungary

#### References:

- Friedemann, C., Gürtler, J. and Pfau, W.: 1977, *Astron. Nachr.* 298, 327.  
Kun, M.: 1986, *Astrophys. Sp. Sci.* 125, 13.  
Lichtbuer, P. C.: 1982, *Vatican Obs. Publ.* 2, 1.  
Marschall, L. A. and van Altena, W. F.: 1987, *Astron. J.* 94, 71.  
Pfau, W. and Friedemann, C.: 1980, *Astron. Nachr.* 301, 69.

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

Number 3107

Konkoly Observatory  
Budapest  
3 November 1987  
HU ISSN 0374-0676

1987 AMPLITUDE CHANGES OF II Peg LIGHT CURVE

The RS CVn type star II Peg (HD 224085, BD +27°4642) has been photometrically observed since 1986 using a 0.4m telescope with a solid-state photometer at Mollet Observatory, Barcelona (Spain).

From 3 to 11 December 1986 we made differential photometric measurements with the B and V filters using HR 8997 and BD +28°4667 as comparison star and check star, respectively. We continued these observations in 1987 with BVRI filters (Johnson system) using HD 223332 as comparison star by checking it with HR 8997 on several nights.

The resulting BVRI light curves obtained during the period 12 September - 18 October 1987, are plotted in Figure 1. The orbital phases were calculated according to the ephemeris of Vogt (1981):

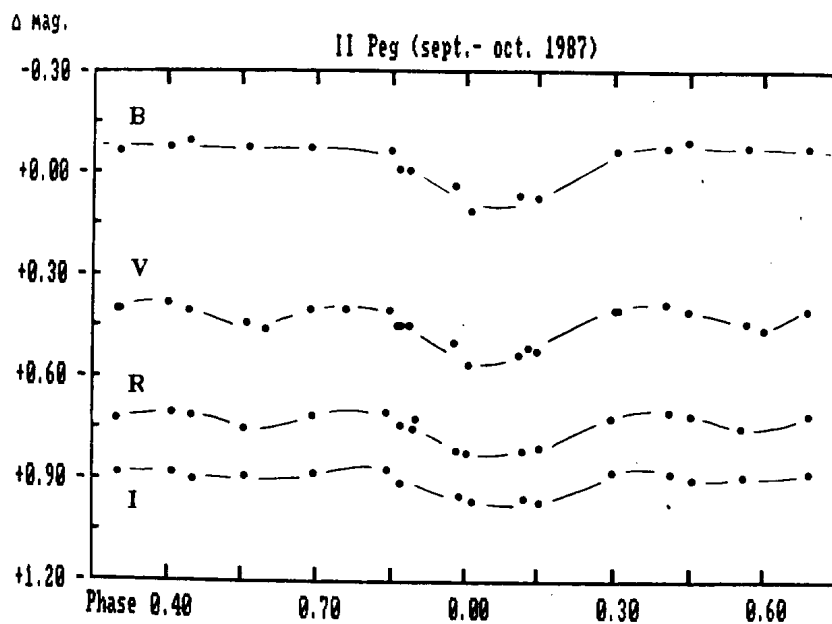


Figure 1

$$\text{HJD} = 2443033.47 + 6^{\text{d}}.72422 \text{ E}$$

Regarding Byrne (1986), Cutispoto et al. (1987), Mekkaden (1987), and our own observations (December 1986, unpublished information) which match the observations of Cutispoto et al., the current V light curve shows an important amplitude decrease due to a lower maximum and an upper minimum. That is, a variation of the amplitude in V from 0.5 to 0.15 magnitudes has occurred within only a few months.

Such a fast change, as the present one, has not been noticed in the past with the exception, perhaps, in 1978 (Poe and Eaton, 1985), although a complete light curve of II Peg was not available in that year.

J.A.CANO, R.CASAS, C.GALLART, J.M.GOMEZ,  
E.JARIOD, M.PERACULA  
Grup d'Estudis Astronòmics  
Apartat 9481  
08080 Barcelona  
Spain

#### References:

- Byrne, B.P.: 1986, Inf. Bull. Var. Stars, No. 2951  
Cutispoto, G., Leto, G., Pagano, I., Santagati, G., Ventura, R.: 1987, Inf. Bull. Var. Stars, No. 3034  
Mekkaden, M.V.: 1987, Inf. Bull. Var. Stars, No. 3043  
Poe, C.M., Eaton, J.A.: 1985, Astrophys. J. 289, 649.  
Vogt, S.S.: 1981, Astrophys.J. 247, 975

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

Number 3108

Konkoly Observatory  
Budapest  
3 November 1987  
HU ISSN 0374-0676

PULSATION PERIODS IN DELTA SERPENTIS

The Delta Scuti star  $\delta$  Ser (HR 5789 = HD 138918) was discovered as a variable star by Millis (1967), based on four nights of observation. He obtained a period of 0.13 days and an amplitude of 0.05 magnitudes in V filter. Valtier (1972) reanalysed the former data obtaining a period of 0.134 days.

We measured the flux of  $\delta$  Ser during eleven nights in 1975 and two nights in 1979, with the 30 cm Cassegrain-reflector at the "Mojón del Trigo" Observatory using a standard UBV system.

The Fourier analysis carried out for our data (Lopez de Coca et al., 1984) showed two frequencies: 6.4227 c/d as the predominant one and, once the data were prewhitened for this frequency, the maximum peak appeared at 7.8869 c/d and the power spectrum after subtracting this second frequency is practically white noise. The ratio of the two periods is 0.814, which is in good agreement with the expected theoretical value for the ratio between the first and the second overtones (Petersen, 1976; Stellingwerf, 1979). A detailed report on our observations and data analysis will be published elsewhere.

P. LÓPEZ DE COCA and A. ROLLAND  
Instituto de Astrofísica de Andalucía  
Apdo. 2144, Granada, (Spain).

References:

- López de Coca, P., Garrido, R. and Rolland, A. 1984, Astron. Astrophys. Suppl. Series, 58, 441.  
Millis, R.L. 1967, Dissertation, University of Wisconsin.  
Petersen, J.O. 1976, in "Multiple Periodic Variable Stars", IAU Colloquium, No. 29, Budapest, Vol. 2. p. 195.  
Stellingwerf, R.F. 1979, Astrophys. J. 227, 935.  
Valtier, J.C. 1972, Astron. Astrophys. 16, 38.

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

Number 3109

Konkoly Observatory  
Budapest  
6 November 1987  
HU ISSN 0374-0676

## THE 1986 OBSERVATIONS AND THE PERIOD STUDY OF CN ANDROMEDAE

The light variability of the short-period eclipsing binary CN And was firstly discovered by Hoffmeister(1949). On the basis of photographic data, Tsesevich(1956) classified the system as an Algol-type and derived an orbital period of 2.599 days. Later, Löchel(1960) classified it as a W UMa-type system and determined the orbital period to be 0.462798 day. In 1972, Bozkurt et al.(1976) obtained asymmetric B,V light curves of the system. Although it was on the same point on the Period-Colour diagram with W UMa systems, Kaluzny(1983) observed the system in B and V colour in 1982 and suggested that the light curves of the system were similar to the  $\beta$  Lyrae-type curves because of the difference in the depths of the minima. Yu-lan and Qing-yao(1985), in 1981 observations, observed two flare events.

The photoelectric observations were made with the 48 cm. Cassegrain telescope of Ege University Observatory equipped with an EMI 9781A photomultiplier, on the nights 8/9, 10/11 October, 25/26, 27/28 November, 1986. B and V filters, which are close to the standard UBV system, were used. BD +39°0065 and BD +39°0064 were used as comparison and check stars, respectively. The magnitude differences between the variable and the comparison stars in two colours were corrected for atmospheric extinction and the times of the individual observations were reduced to the Sun's centre.

Tsesevich(1956), who firstly made the photographic observations of CN And, found the light elements as,

$$\text{JD Hel. Min I} = 24\ 33913.386 + 2.2599 \cdot E. \quad (1)$$

Löchel(1960) recalculated the light elements as,

$$\text{JD Hel. Min I} = 24\ 33570.465 + 0.462798 \cdot E. \quad (2)$$

With the weight 0.1 assigned to the photographic minima and the weight 1.0 to the photoelectric minima, Kaluzny(1983) derived the linear fit to the O-C values as,

$$\text{JD Hel. Min I} = 24\ 45231.5215 \pm 21 + 0.46279477 \pm 10 \cdot E \quad (3)$$

and, a quadratic fit as,

$$\text{JD Hel. Min I} = 24\ 45231.5216 \pm 50 + 0.46279661 \pm 51 \cdot E - 4.7 \times 10^{-11} \pm 1.3 \cdot E^2. \quad (4)$$

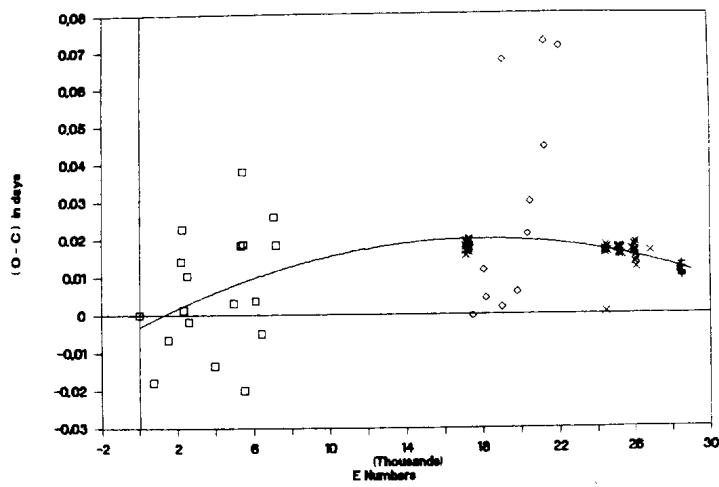


Figure 1. The O-C variation of CN And.  $\square$ ,  $\diamond$ ,  $\times$ , and  $+$  refer to visual, photographic, photoelectric, and the present photoelectric observations, respectively.

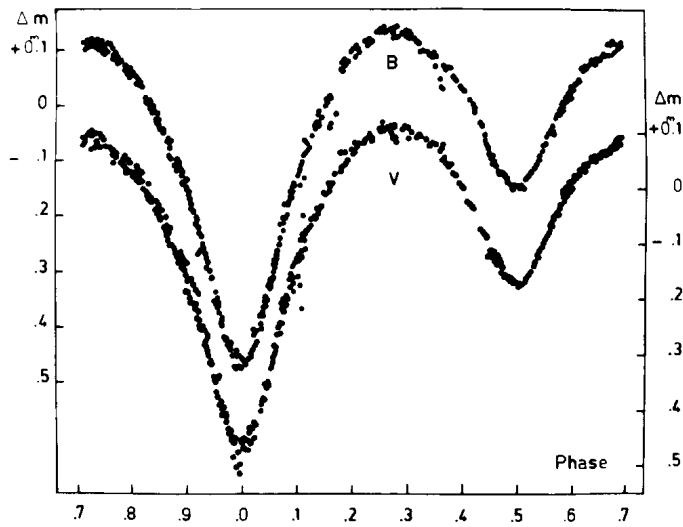


Figure 2. B and V light curves of CN And obtained in 1986.

According to this quadratic form, the period is decreasing.

In this study, we collected 71 minimum times and added to these our 6 MinI and 4 MinII times given in Table I. We used the epoch 24 33570.465 given by Löchel(1960), the period 0.46279475 day given by Michaels et al.(1984) and obtained the new light elements in a quadratic form as,

$$\text{JD Hel. Min I} = 24\,33570.4618 \pm 25 + 0.46279731 \pm 35 \cdot E - 7.1 \pm 1.1 \cdot E^{-11} \quad (5)$$

Table I. Observed minima of CN And.

Minimum time	E	O-C(I)	O-C(II)
24 46712.4594	28397	0.0118	-0.0004
46712.4582	28397	0.0107	-0.0016
46714.3098	28401	0.0111	-0.0011
46714.3104	28401	0.0117	-0.0006
46760.3574	28500.5	0.0107	-0.0014
46760.3571	28500.5	0.0103	-0.0018
46762.2100	28504.5	0.0120	-0.0001
46762.2111	28504.5	0.0132	+0.0011
46762.4391	28505	0.0097	-0.0024
46762.4393	28505	0.0099	-0.0022

The theoretical curve for the period change which was calculated from the above equation, is given in Figure 1 with a solid curve. The weights of 1,2, and 3 are assigned to the visual, photographic and photoelectric minima, respectively.

Because of the decrease in the period of the system, an epoch was selected for the beginning of the observing season, and a period calculated from equation (5), and used for the phase calculation. Linear elements for this step are as follows:

$$\text{JD Hel. Min I} = 24\,46711.5342 + 0.46279321 \cdot E \quad (6)$$

The light curves are shown in Figure 2 where the magnitude differences between the variable star and the comparison star have been plotted against the phases calculated from the above equation.

Because of the depth of MinII is almost equal to half of the depth of MinI, and the similarity of the light curves to the  $\beta$  Lyrae-type, the system can be classified as a  $\beta$  Lyrae-type system. It can be seen that both maxima are shifted towards the phase 0.5.

The analysis of the light curves of the system is being in progress and the results will be published elsewhere.

S. EVREN, C. IBANOGLU,  
Z. TUNCA, M. C. AKAN,  
and V. KESKIN

Ege University Observatory  
Bornova, Izmir - TURKEY

**References:**

- Bozkurt, S., İbanoglu, C., Gülmen, Ö., and Güdür, N.:1976, Inf. Bull. Var. Stars, No.1087.
- Hoffmeister, C.:1949, A.N., 12,1.
- Kaluzny, J.:1983, Acta Astr., 33, 345.
- Löchel, K.:1960, M.V.S., No.457-458.
- Michaels, E. J., Markworth, N. L., and Rafert, J. B.:1984, Inf. Bull. Var. Stars, No.2474.
- Tsesevich, W.:1956, A.C.Kasan, 170, 14.
- Yu-Lan, Y., ve Qing-Yao, L.:1985, Inf. Bull. Var. Stars, No.2705.

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3110

Konkoly Observatory  
Budapest  
6 November 1987  
HU ISSN 0374-0676

POSITIONS AND FINDING CHARTS OF  
NOVA HERCULIS 1987 AND NOVA SAGITTARII 1987\*

The Reference Catalogue and Atlas of Galactic Novae (Duerbeck 1987) contains positions, finding charts and additional information for 277 novae and related objects complete to December 31, 1986. Positions and finding charts of more recent novae will be published irregularly in the IBVS. This first supplement contains positions and finding charts of N Her 1987 and N Sgr 1987.

Direct plates of the fields of the two objects were taken with the GPO astrograph of ESO La Silla on 098 emulsion + RG 630 filter. The plates were measured on the ESO Optronics 3000, using SAO stars as astrometric standards. Details of the observations and the nova positions are given in Table 1. Furthermore, the prenova candidates were measured on POSS and ESO/SRC sky atlas plates. The results are given in Table 2. The magnitudes were estimated using the image diameter calibrations by King and Raff (1977) and King et al. (1981). Figs. 1 and 2 are finding charts, prepared from the POSS blue (103a-0 emulsion) and SRC (IIIa-J emulsion + GG395 filter) sky atlas plates. They cover regions of  $4'3 \times 4'3$ .

The image of the prenova Sgr 1987 appears double on the magnified photograph. However, only the position of a single image could be measured. The slight difference between the right ascensions of the nova and the prenova indicates that the following and brighter component of the suspected close double star should be identified as the outburst object.

---

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

2

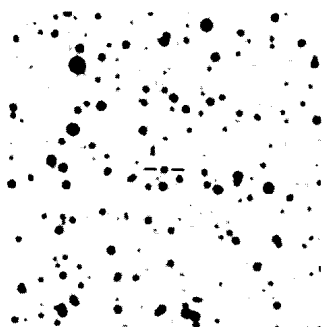


Figure 1

Finding chart for Nova Her 1987 (© 1960 National Geographic Society - Palomar Sky Survey. Reproduced by permission of the California Institute of Technology)

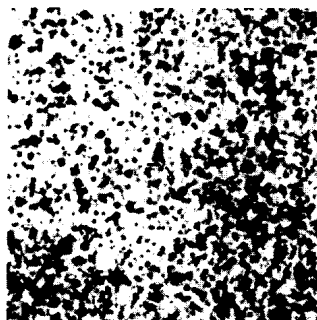


Figure 2

Finding chart for Nova Sgr 1987 (© Royal Observatory Edinburgh). On both charts, north is on the top, west to the right

Table 1. Nova positions on GPO plates

Object	GPO plate No.	Date	RA (1950)	Decl. (1950)
N Her 1987	11081	87 July 5.20	18 <sup>h</sup> 41 <sup>m</sup> 26 <sup>s</sup> .71	+15°16'13".3
N Sgr 1987	11087	87 July 8.11	17 56 29.08	-32 16 12.9

Table 2. Prenova positions on sky atlas plates

Object	Sky atlas plate	magn.	RA (1950)	Decl. (1950)
N Her 1987	POSS 287 O	18.0p	18°41' 26.73	+15°16'13.3
N Sgr 1987	SERC 456 J	≈21.5j	17 56 29.21	-32 16 12.6

Acknowledgement. I thank the California Institute of Technology and the Royal Observatory Edinburgh for permission to reproduce sky atlas plates.

HILMAR W. DUERBECK  
 Astronomisches Institut  
 der Universität Münster  
 Wilhelm-Klemm-Str. 10  
 D-4400 Münster, F.R.G.

## References:

- Duerbeck, H.W. 1987, A Reference Catalogue and Atlas of Galactic Novae,  
 Dordrecht: Reidel (also published in Space Sci. Rev. 45, 1).  
 King, I.R., Raff, M.I. 1977, Publ. astr. Soc. Pacific 89, 120.  
 King, D.R., Birch, C.I., Johnson, C., Taylor, K.N.R. 1981, Publ. astr. Soc.  
 Pacific 93, 385.

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

Number 3111

Konkoly Observatory  
Budapest  
11 November 1987  
HU ISSN 0374-0676

THE NATURE OF THE VARIABILITY OF 42 Per

The star 42 Persei (HD 23848, V467 Per) is listed in the latest edition of the General Catalogue of Variable Stars (Kholopov et al. 1987) as an eclipsing variable with a period of  $22^d.58$  - a period derived by Kolykhalova et al. (1978) from photoelectric observations. The total range in V is less than  $0^m.1$ . W.S. Adams (1912) first identified the star as a spectroscopic binary, on the basis of four radial velocity observations.

Observations were made at several other observatories, especially Allegheny (Beardsley 1969) but the only orbital elements to have been determined were computed by Morbey and Brosterhus (1974). These elements depend strongly on the Allegheny observations. While it might be possible to improve the elements if modern observations were to be made from a single observatory, it seems unlikely to the present writer that the period of  $1.765346^d$  is seriously in error.

Although the light-curve published by Kolykhalova et al. does resemble that of a system displaying very shallow eclipses, the period is not reconcilable with that found spectroscopically. The photometric period is not a simple multiple of the spectroscopic one, nor is it one of the spurious periods associated with the  $1.8^d$  period (although it is about ten times as long as one of the spurious periods). The distribution of the photometric observations is not favourable for the detection of a period as short as  $1.8^d$ . In Figure 1, those observations are plotted on the  $1.8^d$  period (the zero of phase is the time of periastron passage as given by Morbey and Brosterhus). Except for those labelled 1, 2 and 3, the observations define a double wave within the orbital period. The minima of the wave occur close to the predicted phases of spectroscopic conjunctions ( $0^P.02$  and  $0^P.53$ ) which are probably well determined despite the uncertainties in  $e$  and  $\omega$ . Of the three deviant points, No. 1 is marked as uncertain by Kolykhalova et al. and No. 2 is some  $0^m.02$  brighter than any other measurement. In the light-curve published by Kolykhalova et al. point No. 2 is still deviant, occurring near the phase of secondary minimum; in the present plot, at least it is found close to the phase of maximum brightness. Thus, only the point No. 3 is deviant without any a priori reason to reject it. If it should be in error

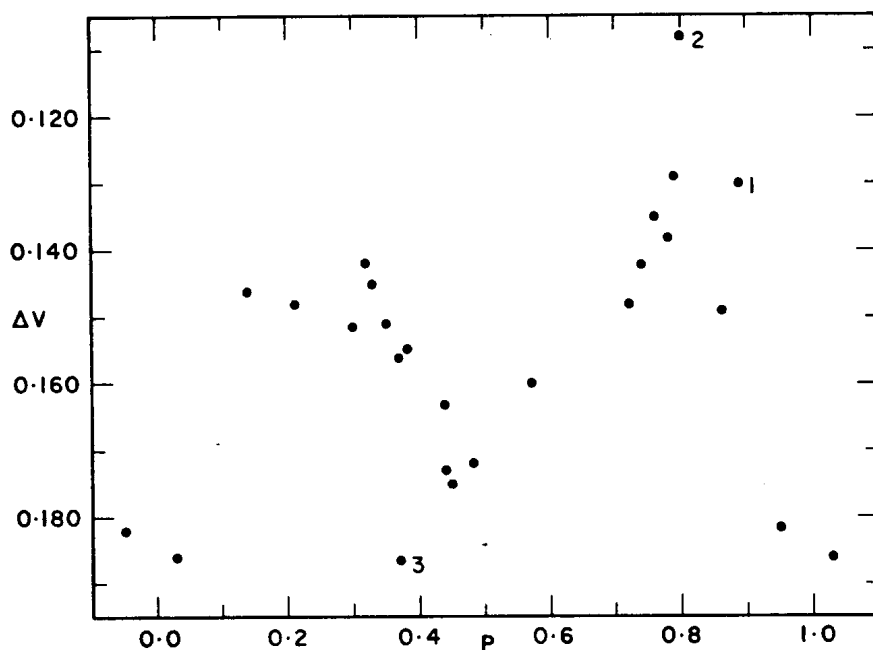


Figure 1: Photometric observations of 42 Per plotted on the spectroscopic period. See text for details.

by as much as the other two (but in the opposite sense) it would fit the curve quite well. On the other hand the Allegheny observations of radial velocity make no sense on the period of  $22^d.58$ .

The minima of the light-curve are poorly defined by the available observations and very shallow eclipses still cannot be ruled out from the shape of the light-curve alone. The very small mass-function ( $0.0074m_{\odot}$ ) makes eclipses seem unlikely, however. If the visible A3 V star is plausibly assumed to have a mass of about  $2m_{\odot}$ , no credible value for the mass of the invisible component can be deduced for any value of the orbital inclination that produces eclipses. For an inclination of around  $25^{\circ}$ , it would be possible to satisfy the mass-function with individual masses of about  $2m_{\odot}$  and  $1m_{\odot}$ , and the system would then consist of stars on or near the main sequence. These figures have been deliberately kept approximate but they serve to indicate that 42 Per should probably be classified as an ellipsoidal variable. The star may repay further observation.

A.H. BATTEN

Dominion Astrophysical Observatory  
Herzberg Institute of Astrophysics  
5071 W. Saanich Road  
Victoria, B.C. V8X 4M6  
CANADA

## References:

Adams, W.S.: 1912, Pub. Astr. Soc. Pacific 24, 129.

Beardsley, W.R.: 1969, Pub. Allegheny Obs. 8, No. 7.

Kholopov, P.N. et al.: 1987, General Catalogue of Variable Stars, 4<sup>th</sup> Ed.

Vol. 3. Nauka, Moscow.

Kolykhalova, O.M., Mironov, A.V. and Moshkalev, V.G.: 1978, Per. Zvezd 21, 105.

Morbey, C.L. and Brosterhus, E.B.: 1974, Pub. Astr. Soc. Pacific 86, 455.

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

Number 3112

Konkoly Observatory  
Budapest  
18 November 1987  
HU ISSN 0374-0676

## 32 Cyg : UBV PHOTOMETRY OF ECLIPSE IN 1987

The long period eclipsing binary 32 Cyg (V 1488 Cyg) was observed from 6 July to 28 July 1987 during a primary minimum. UBV photometry of this event was obtained using a 0.3 m f/16 Cassegrain telescope and one channel photometer with photomultiplier EMI 9781B. Extinction and transformation coefficients were used to correct the differential magnitudes to the standard system (Hall and Genet, 1982). The comparison star was HD 192985 as suggested by Schroeder (1987).

Observations of 32 Cyg are given differentially, with respect to HD 192985. Each value is an average of three individual integrations. Internal errors were  $\pm 0.01$  magnitude. Estimation of amplitude was made from observations in each band : U = 0.68, B = 0.17 , V = 0.05.

Table I

Photometric observations of V1488 Cyg:

J.D.(Hel) 2440000+	$\Delta U$	$\Delta B$	$\Delta V$
6983.482	0. <sup>m</sup> 55	-0. <sup>m</sup> 56	-1. <sup>m</sup> 89
6984.403	0.55	-0.55	-1.90
6986.491	0.59	-0.55	-1.92
6987.439	0.72	-0.55	
6988.448	0.79	-0.50	-1.89
6989.554	1.08	-0.48	-1.91
6993.476	1.23	-0.38	-1.85
6996.500	1.02	-0.42	-1.89
6997.451	0.84	-0.49	-1.89
7005.388	0.50	-0.59	-1.88

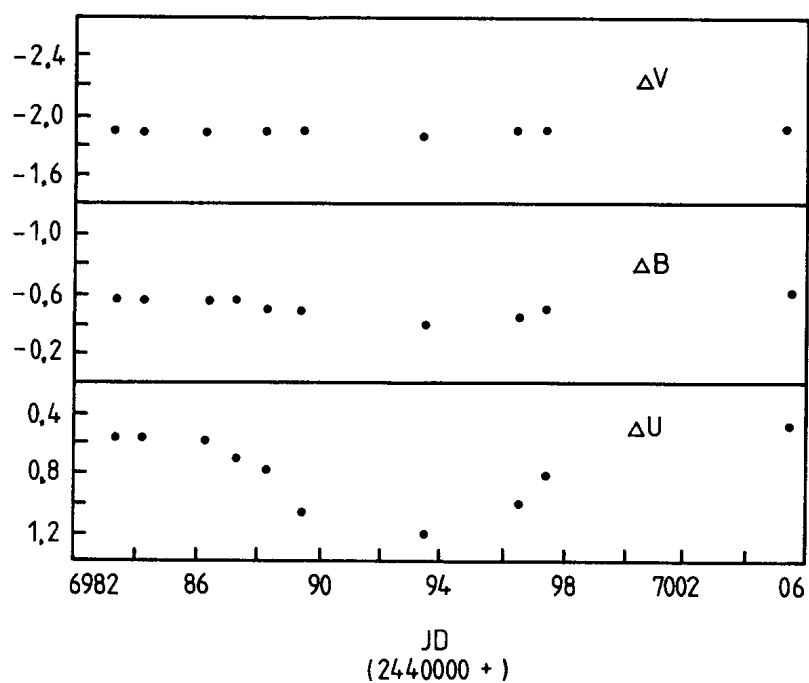
Time of minimum was determined using tracing paper method (U band). The (O-C) value was calculated using the formula

$$\text{Min}(I) = \text{J.D. (Hel)} 2444125.96 + 1147.4^d * E$$

given by SAC 58 (Cracow).

Observed J.D.(Hel) Min(I)	(O-C)	Filter
2446992.92	-1.04	U

Figure 1 shows the light curve in UBV filters from JD 2446983 to 2447005.



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

Number 3113

Konkoly Observatory  
Budapest  
27 November 1987  
HU ISSN 0374-0676

A REMARK ON TV CYGNI

My attention was drawn to this star by the two discordant spectral class data given in the General Catalogues of Variable Stars 1963 and 1985: M0 in the main table (source not specified) and G0 in the remarks (according to Metik, 1960). A study of literature yielded the following results:

1. The announcement of variability of BD+46°2970 = TV Cyg (Köhl, 1900) is based on a misunderstanding. Köhl compared his visual impression with the chart of Williams (1900), which had been drawn according to the photographic (blue-sensitive) aspect and which naturally shows this reddish star much fainter than it looks visually.
2. A similar error is due to Metik (1960). In his table the wrong identification of star +46°2 of figure 16 (chart 9) with BD+46°2970 is excusable, because on his photographic material the true BD +46°2970 - just visible 1.5 minutes of arc southwest of +46°2 near the edge of the reproduced area - is distinctly fainter than the latter.
3. Conclusion: As supposed also by several photometric observers BD+46°2970 = TV Cyg is not variable with high probability. Vyssotsky and Balz (1958) gave the spectral type K2, while Gaposchkin (1939) assigned a spectral type of M to this star.

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

References:

- Gaposchkin, S., 1939, Harvard Ann. 108, 6  
Köhl, T., 1900, Astron. Nachr. 154, 13  
Metik, L.P., 1960, Izv. Krymskoj Astrofiz. Obs. 23, 60  
Vyssotsky, A.N., and Balz, A.G.A., 1958, Publ. Leander McCormick Obs. Virginia 13, II, 118  
Williams, A.S., 1900, Astron. Nachr. 152, 77

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

Number 3114

Konkoly Observatory  
Budapest  
2 December 1987  
HU ISSN 0374-0676

ADDITIONAL REMARK ON SOLOVYOV'S SO-CALLED  
NOVA AQUILAE 1949

Schaefer (1987) recently reminded the owners of plate collections on Solovyov's (1949) forgotten announcement of a possible nova in Aquila.

Solovyov's plate was of 2 May 1949 21<sup>h</sup>42<sup>m</sup>0 UT. In the Sonneberg collection there is a patrol plate, taken on the same night by H. Huth on 3 May 1949 0<sup>h</sup>50<sup>m</sup> - 1<sup>h</sup>30<sup>m</sup> UT, which shows no trace of a star at the given position. Because the time of exposure is about 3.5<sup>h</sup> later than that of the discovery plate and since our limiting magnitude is not better than 11.5<sup>m</sup>, our negative observation can only intensify the statement that no confirmation of Solovyov's finding exists.

W. WENZEL

Sternwarte Sonneberg  
Zentralinstitut für Astrophysik  
der Akademie der Wissenschaften  
der DDR

References:

- Schaefer, B.E., 1987, Inf. Bull. Variable Stars, No. 3082.  
Solovyov, A.V., 1949, Astron. Tsirk., Nos 87 and 88.

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

Number 3115

Konkoly Observatory  
 Budapest  
 3 December 1987  
 HU ISSN 0374-0676

PHOTOELECTRIC OBSERVATIONS OF R CrB

The star R CrB was observed photoelectrically with the 250/3250 Casse-  
 grain telescope and an EMI 9781 B PMT at Nessa observatory using standard  
 UBV filters. SAO 084005 ( $V = 7.45$ ,  $B-V = 0.44$ ) was used as the comparison star.  
 These observations are the continuation of those published in IBVS No. 2962.  
 The observations are listed in the following table.

Table I  
 Photoelectric observations of R CrB

J.D. 2440000+	V	B-V	J.D. 2440000+	V	B-V
6923.400	5.94	+0.64	7047.375	5.83 :	+0.36 :
6932.446	5.80	+0.69	7049.354	5.79	+0.65
6940.417	5.79	+0.53	7067.325	5.82	+0.55
6956.419	5.86		7068.321	5.83	
6972.479	5.91	+0.57	7069.325	5.80	
6988.463	5.95	+0.51	7070.313	5.90	+0.63
6989.446	5.73	+0.66	7078.356	5.91	
7011.438	5.92	+0.56	7082.392	5.90	
7013.440	5.79	+0.63	7094.238	5.77	+0.53
7028.425	5.91	+0.42	7095.242	5.72	+0.47
7033.429	5.91	+0.64	7106.221	5.80	

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

Number 3116

Konkoly Observatory  
Budapest  
3 December 1987  
HU ISSN 0374-0676

RAPID VARIATION IN  $H_{\alpha}$  EMISSION OF  $\gamma$  CASSIOPEIAE

The well known Be star  $\gamma$  Cassiopeiae has been an object of intense study through over a century. Apart from the major phases namely, Be, Be shell, and normal B star with time scales of decades, the star also shows rapid changes in the visible spectrum. The time scales of these variations may be of the order of months, days and even a few minutes. Slettebak and Snow (1978) found simultaneous emission events in the  $H_{\alpha}$  line and ultraviolet Si IV and Mg II lines lasting for a duration of about 100 minutes. Rapid profile variations on a time scale of a few minutes have been detected for  $H_{\beta}$  by Hutchings (1976) and Doazan (1976). These changes are believed to be erratic. Reynolds and Slettebak (1980) have found definite evidence of the change in emission intensity on the time scale of months for four Be stars, though night to night changes, and changes on an individual night are less certain.

In this communication, we report the scanner observations taken at the Uttar Pradesh State Observatory, on four nights in October–November 1986. Appreciable changes in  $H_{\alpha}$  line are seen.

The observations were secured at the Cassegrain focus of the 104-cm reflector through a spectrum scanner and standard d.c. recording technique. The dispersion at the focal plane of the spectrophotometer is 70 Å/mm. An entrance aperture of 2 mm (equivalent to 30 arc sec) and an exit slit of 0.4 mm have been used.

The tracings were read out near the  $H_{\alpha}$  line at 2 mm intervals on the chart paper, which corresponds to nearly 13 Å in wavelength scale. A free hand continuum was drawn on both sides of the  $H_{\alpha}$  line, and the emission intensity in terms of continuum  $I_{\lambda}/I_c$  was read out at points covering the entire line.

Figure 1 shows the  $I_{\lambda}/I_c$  versus  $\lambda$  plot. In this plot the position of the peak on the red side of the line is designated as origin of wavelength scale. Figure 1 clearly shows the sequence of changes in the shape of the  $H_{\alpha}$  line during the period of these observations.

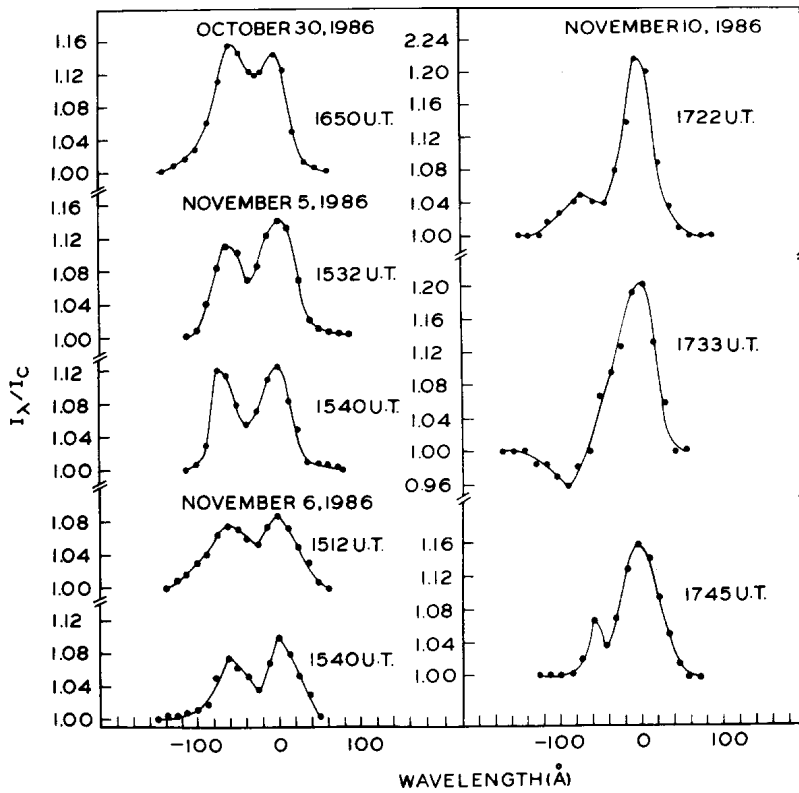


Figure 1. Spectral scans of  $H_{\alpha}$  line on four nights

On October 30, the violet component of the line is the stronger one. On November 5 and 6, the red component has become slightly stronger compared to the violet. On November 10, however, the violet component has become very faint with respect to the red one. In fact in one scan on November 10, at 17:33 UT, the violet component is entirely absent. There seems to be an extended underlying absorption instead. The reality of this absorption feature may, however, be uncertain.

In order to estimate the changes in the total emission intensity of the  $H_{\alpha}$  line, we have planimetered the area under the emission curves of each scan. Table I shows these values along with the equivalent widths of each scan. It is apparent from Table I that the  $H_{\alpha}$  emission intensity was maximum at 14.2 Å on 30 October 1986. The same seems to have increased to an average of about 11.4 Å on 10 November 1986.

Table I. Measured intensities of the  $H_{\alpha}$  line

Date	UT	Area under the curve ( $\text{cm}^2$ )	Equivalent width ( $\text{\AA}$ )
1986 October 30	0.742	35.6	14.2
November 5	0.647	30.1	12.0
November 5	0.653	26.8	10.7
November 6	0.633	23.2	9.3
November 6	0.653	20.0	8.0
November 10	0.724	31.5	12.6
November 10	0.731	28.6	11.4
November 10	0.740	25.2	10.1

The hydrogen emission mechanism in Be stars is the ionization of hydrogen atom both from the ground, and excited states, followed by recombination to the excited states and then cascading to lower excited states. The amount of recombination radiation in a particular line depends on the hydrogen particle density ( $N_i, N_e$ ) and the emitting volume. Fresh ejection of material is required to increase the emitting volume having the appropriate particle density for the rapid changes observed in the shape of the  $H_{\alpha}$  line and its total strength. This ejection of stellar matter could occur from random points along the equatorial regions of the rotating stellar disc, causing changes in the particle density as well as the emitting volume density.

Due to this matter taking part in the rotation also, the region of the increased particle density would present differently to the line of sight, causing the changes in the shape of the line. The particle density in the emitting regions of the Be stars are believed to be  $10^{10}$ - $10^{12} \text{ cm}^{-3}$  (Hirata and Kogure, 1984). An increase in the density to twice the mean value would mean addition of some  $10^{11} \text{ cm}^{-3}$  particles, or an addition of some  $10^{-13}$  gram of hydrogen.

Changes of this magnitude have not been reported earlier for  $\gamma$  Cas. This situation may therefore represent a particular phase of activity of the star.

We acknowledge with thanks the useful discussions held with Dr. B.S.Rautela.

S.C. JOSHI, R.K. SRIVASTAVA and J.B. SRIVASTAVA  
Uttar Pradesh State Observatory,  
Manora Peak, Naini Tal, 263 129  
INDIA.

## References:

- Doazan, V., 1976, in Proc. IAU Symp. 70, Be and Shell Stars  
ed. A. Slettebak. D. Reidel Publ. Co., Dordrecht, Holland, p. 37.
- Hirata, R. and Kogure, T., 1984, Bull. Astron. Soc.  
India 12, No. 2, 109.
- Hutchings, J.B., 1976, in Proc. IAU Symp. 70, Be and Shell Stars ed. A.  
Slettebak, D. Reidel Publ. Co., Dordrecht, Holland, p. 13.
- Reynolds, R.C. and Slettebak, A., 1980, Publ. Astron. Soc. Pacific 92, 472.
- Slettebak, A. and Snow, T.P. 1985, Astrophys. J. Lett. 224, L127.

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

Number 3117

Konkoly Observatory  
Budapest  
8 December 1987  
HU ISSN 0374-0676

1986 BV LIGHT CURVES OF BH VIRGINIS

The first photometric observations of BH Virginis (HD12909) were made by Kitamura et al. (1957) and Koch (1967). Further observations were carried out by Sadik (1978), Hoffmann (1982), and Scaltriti et al. (1985). Hoffmann (1982) concluded that the observational characteristics of the system made it close to short period RS CVn binaries (Hall 1976).

BH Virginis is included in our program to monitor the RS CVn short period systems. The observations were performed during the week 11-17 June 1986 at the observatorio del Roque de los Muchachos with the 1 m. Jacobus Kapteyn telescope. We used the People's photometer and standard U,B,V,R,I filters (Jones 1984).

Simultaneous measurements sky-star were made with both channels and the signal to noise ratio was higher than 100 in all cases.

HD121935 was chosen as the main comparison star, and the standard stars were selected from Landolt (1983). After transformation to the standard system its magnitudes are in good agreement with the findings of Koch (1976) and Scaltriti et al. (1985).

The B and V light curves are shown in figures 1 and 2, where the differential magnitudes are plotted against orbital phase calculated with the ephemerides of Koch (1967).

$$\text{HJD} = 2438107.19047 + 0.81687099 E$$

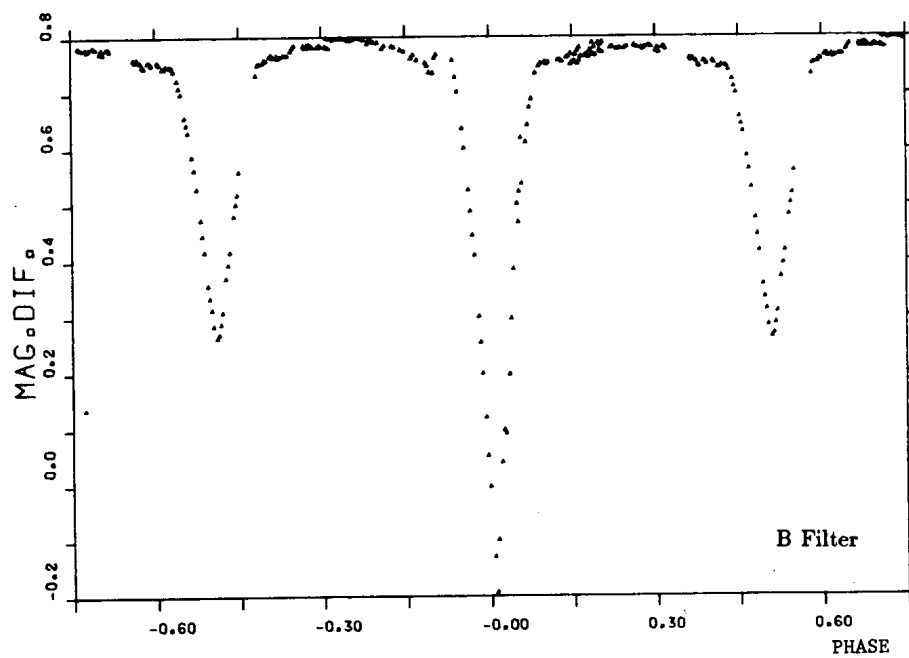


Figure 1

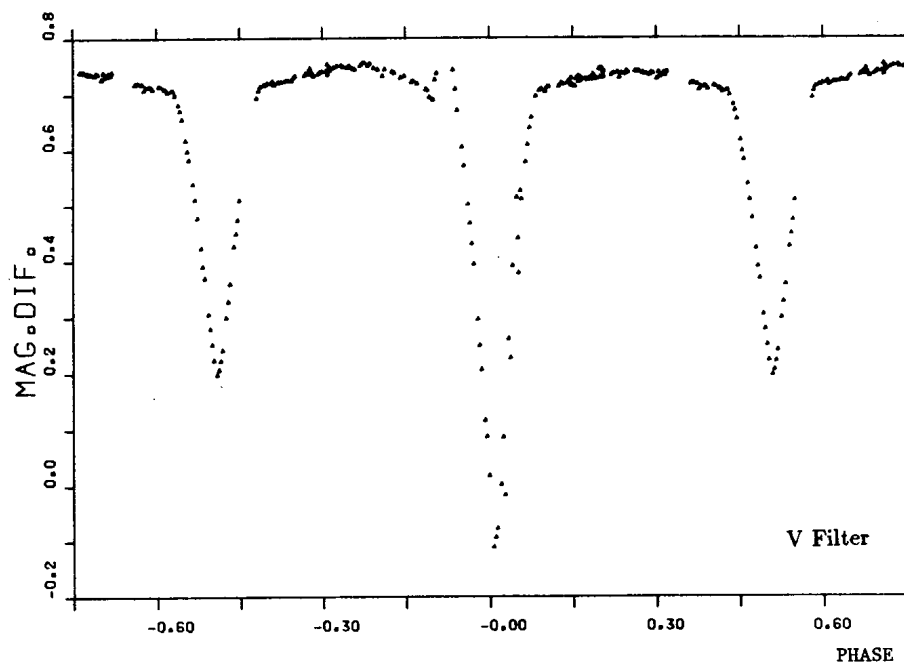


Figure 2

The system shows no significant changes in both mean levels and depth of eclipses compared to 1984 light curves ( Scaltriti et al. 1985 ).

In a further paper, we will present the results of the analysis of these light curves and a discussion of their peculiarities.

M.J. AREVALO, B. ROBAYNA, J.J. FUENSALIDA  
Instituto de Astrofísica de Canarias  
38200 La Laguna, Tenerife  
Canary Islands, Spain

D.K. BEDFORD  
University of Birmingham  
Dept. of Space Research  
Birmingham B15 2TT, U.K.

#### References:

- Hall, D.S. : 1976, in Multiple Period Variable Stars, I.A.U. Colloq. No. 29, Pt. 1, ed. W.S. Fitch (Reidel, Dordrecht), p.287.  
Hoffmann, M. :1982, Astron. Astrophys. Suppl. Ser. 47,561.  
Jones, D. :1984, R.G.O. La Palma, Technical Note, No 10.  
Kitamura, M., Nakamura, T., and Takahashi, C. : 1957, Publ.Astron.Soc.Japan 9, 191.  
Koch, R.H. : 1967, Astron. Journal 72,411.  
Landolt, A.U. : 1983, Astron. Journal 88,439.  
Sadik, A.R. :1978, PhD Thesis, University of Manchester.  
Scaltriti, F., Cellino, A. and Busso, M. : 1985, Astron. Astrophys. 149, 11.

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

Number 3118

Konkoly Observatory  
Budapest  
9 December 1987  
HU ISSN 0374-0676

## NEW MINIMA TIMES AND LIGHT ELEMENTS FOR SIGMA AQUILAE

In 1986, I chose the small-amplitude eclipsing binary Sigma Aquilae (HR 7474) to test the capabilities of a new photometer. It was soon apparent that minima were occurring almost 2.5 hours later than predicted by the light elements in the General Catalogue of Variable Stars (Kholopov et al., 1985, citing Wylie, 1922). Observations were therefore continued to determine accurate times of primary and secondary eclipses.

During the 1986 and 1987 seasons, 162 mean differential magnitudes in V of the Johnson system were obtained with an Optec SSP-3 solid-state photometer and 20-cm reflector, using Upsilon Aquilae (HR 7519) as the comparison star. The following normal times of minima were determined by the tracing paper method from each season's light curve:

TABLE I

HJD 244+	Min. I/II	O-C (a)	O-C (b)
6728.6292 +10	I	+0 <sup>d</sup> .100	-0 <sup>d</sup> .0009
6729.6086 +15	II	+0.105	+0.0034
7027.0196 +12	I	+0.101	-0.0015
7027.9978 +16	II	+0.104	+0.0016

(a) GCVS elements, Min. I = HJD 242 2486.797 + 1<sup>d</sup>.95026 E

(b) New light elements, below.

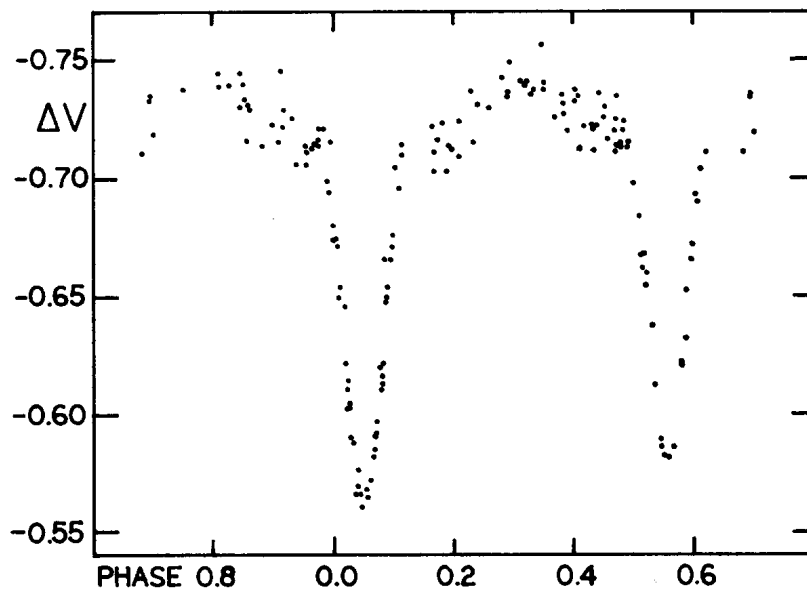


FIGURE 1. The light curve of Sigma Aquilae. The phases are calculated according to the light elements of Wylie (1922). Each point represents the mean of three or four differential measures.

A literature search failed to find any photoelectric times of minima published since Wylie (1922). However, one unpublished timing of primary eclipse by D. Engelkemeir (17 pe measures in 1961) is recorded on card 4 of the Sigma Aquilae file, Eclipsing Binary Card Catalogue, University of Florida (Wood, 1987): Min. I = HJD 243 7589.669.

Engelkemeir's timing differs by only  $0^d.004$  from a constant period between Wylie's epoch and the new times of minima reported here. Assuming, on this evidence, that the period has indeed been constant, the six available times of eclipse were used to derive improved light elements by least-squares linear regression:

$$\text{Min. I} = \text{HJD } 242\,2486.7955 + 1^d.95026827 \text{ E}$$

The standard deviation of a single timing from these elements is  $\pm 0^d.0027$ . Monet (1980) reports a spectroscopic period of  $1^d.950271$ , much closer to the improved photometric value than Wylie's period.

The observations are plotted in the accompanying figure. Based on Upsilon Aquilae's magnitude, 5.91 V, in The Bright Star Catalogue (Hoffleit and Jaschek, 1982), Sigma's magnitude at maximum is 5.17 V. The V amplitude is 0.18 (Min. I) and 0.16 (Min. II).

Surprisingly, no modern photoelectric light curve of Sigma Aquilae has been published. Hill et al. (1976) report 57 three-color measures, but almost no observations were made in the deep phases of eclipse. I am therefore continuing observation of Sigma Aquilae to provide light curves with complete phase coverage in B and V.

DAVID B. WILLIAMS  
9270-A Racquetball Way  
Indianapolis, Indiana 46260  
USA

#### References:

- Hill, G., Hilditch, R. W., and Pfannenschmidt, E. L., 1976, Publications of the Dominion Astrophysical Observatory, Victoria, 15, 1.
- Hoffleit, D., and Jaschek, C., 1982, The Bright Star Catalogue, Yale University Observatory, New Haven.
- Kholopov, P. N., Samus, N. N., Frolov, M. S., Goranskij, V. P., Gorynya, N. A., Kireeva, N. N., Kukarkina, N. P., Kurochkin, N. E., Medvedeva, G. I., Perova, N. B., Shugarov, S. Yu., 1985, General Catalogue of Variable Stars, 4th edition, Nauka Publishing House, Moscow.
- Monet, D. G., 1980, Astrophys. J. 237, 513.
- Wood, F. B., 1987, private communication.
- Wylie, C. C., 1922, Astrophys. J. 56, 232.

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

Number 3119

Konkoly Observatory  
Budapest  
9 December 1987  
HU ISSN 0374-0676

PHOTOMETRIC OBSERVATIONS ON SZ Psc

Photometric observations of SZ Psc relative to the comparison star HD 219018 were obtained on 19th 20 August 1986 and 20th through 23rd September 1986. The data are shown in Fig. 1 as standardized  $\Delta V$  plotted against photometric phase computed according to the ephemeris by Percy (1985).

Primary minimum =  $\text{HJD } 2442308.843 + 3.965404 E - 1.13 \times 10^{-7} E^2$ .

Although the entire minimum was not observed it is clear that minimum light occurred later than predicted by approximately 9.5 hours or 0.10 phase. Some colour data were obtained in August and the exit from eclipse is plotted in Fig. 2 as a function of UT on the night of August 20th 1986.

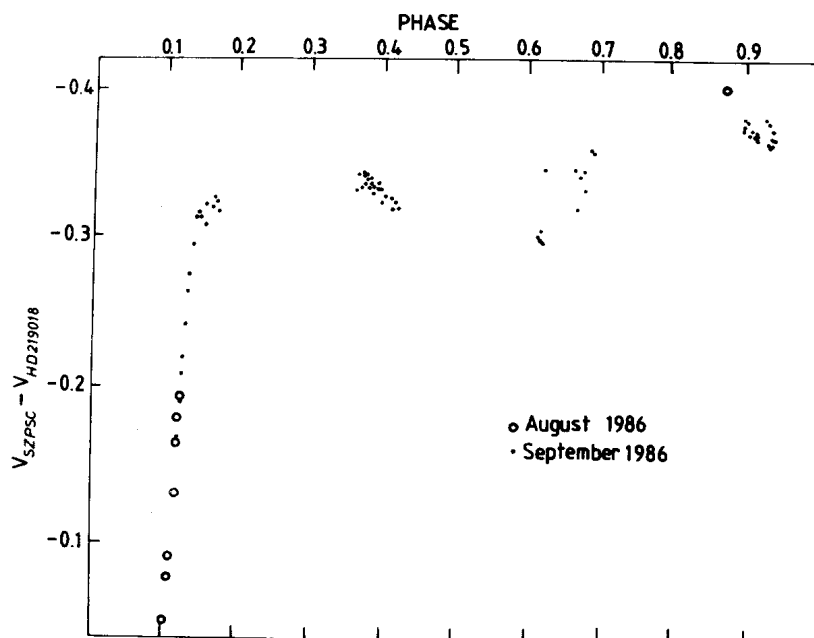


Figure 1

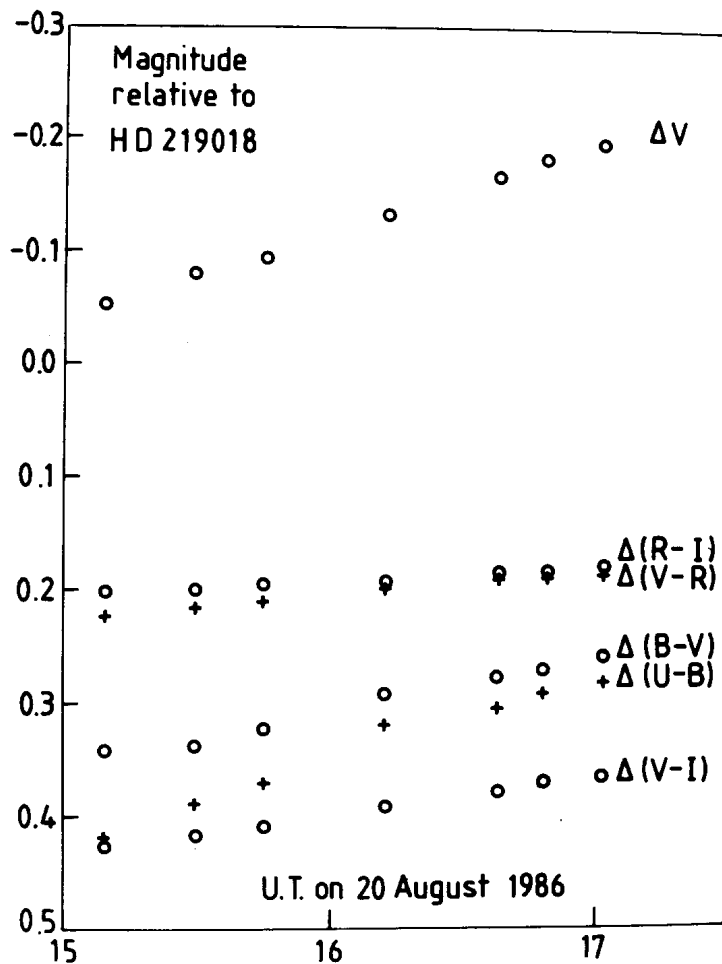


Figure 2

The check star HD 219114 was observed 13 times and its magnitude relative to HD 219018 was found constant at  $\Delta V = 0.185 \pm 0.007$ . The August data were obtained with the 1 m SSO telescope using the Twin channel chopper, the September data were obtained using the 0.4 m SSO telescope with a single channel photometer. I thank the Australian National University for the use of these telescopes.

K. THOMPSON

Monash University  
Clayton, Victoria 3168  
Australia

Reference:

Percy, J.R., 1985, J. Roy. astr. Soc. Canada 79, 113.

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

Number 3120

Konkoly Observatory  
Budapest  
11 December 1987  
*HU ISSN 0374-0676*

HD30861, A NEW ELLIPSOIDAL VARIABLE \*

The first announcement for variability of HD30861 (spectral type according to the Michigan catalogue: A2V, Houk, 1978) was given by Hensberge et. al. (1981). They used this star as a comparison for the CP2 star HD30849, but rejected it later due to evident variability.

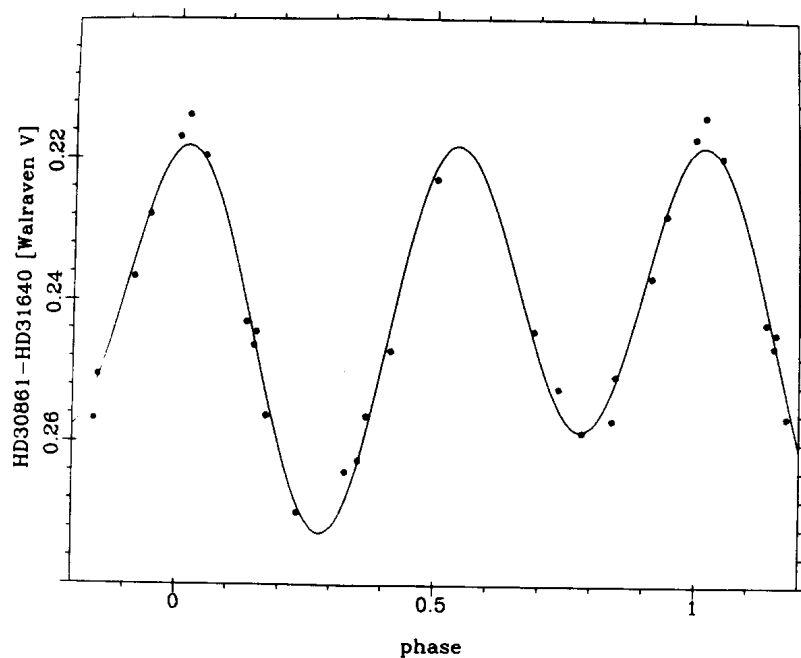


Figure 1

\* Based on observations obtained at ESO, La Silla/Chile.

In order to check independently the variability and to determine the period we observed HD30861 in 1981 and 1986 at La Silla/Chile. The ESO 50cm (Strömgren photometry) and the Dutch 90cm (simultaneous Walraven photometry) telescope, respectively, were used. The comparison star was HD31640 (spectral type according to the Michigan catalogue: A3/5m, A5-7, derived from CaII K, Hydrogen and metal lines, respectively), for which the constancy was already well established (Hensberge et al.).

Our investigations were successful. We found a double wave variation and estimated a preliminary period of 0.852 days. The phase relation, referring to the first observation, is given by

$$JD = 2446775.5520 + E \cdot 0.852.$$

Figure 1 presents the light curve in Walraven *V*. Notice that Walraven *V* is given as  $\log_{10}$  intensity (multiply with  $-2.5$  to be on a magnitude scale). The fit was obtained by a function of the type

$$a_0 + a_1 \cdot \cos(\phi - \phi_0) + a_2 \cdot \cos 2(\phi - \phi_0)$$

with  $\phi$  = phase and  $\phi_0 = 0.28$ . In the case of Walraven *V* we obtained  $a_0 = 0.2420$ ,  $a_1 = .0072$  and  $a_2 = .0236$ . It seems that  $a_2$  is independent of wavelength ( $0.0234 \pm 0.0002$  in all Walraven passbands), while  $a_1$  reaches a maximum near the Balmer jump ( $a_1 = 0.0090$  in Walraven *L*). The standard deviation for individual *V* measurements, as computed from the scatter of the absolute Walraven *V* for the comparison star (relative to their average), is  $\sigma_V = .0019$ .

The final analysis of the complete photometry is under way and will be published elsewhere.

W. VERSCHUREN	University of Antwerp (RUCA)
	Theoretical Mechanics and Astrophysics
H. HENSBERGE	Groenenborgerlaan 171
	B-2020 ANTWERP
H. SCHNEIDER	Universitäts-Sternwarte
	Geismarlandstr. 11
	D-3400 GÖTTINGEN
K. PAVLOVSKI	Faculty of Geodesy
	Hvar Observatory
	Kačičeva 26
	YU-41000 ZAGREB

#### References :

- Houk, N. 1978: "Michigan catalogue of two-dimensional spectral types for the HD stars"  
Vol. 2, Dept. Astron., Univ. Michigan  
Hensberge, H., Maitzen, H.M., Deridder, G., Gerbaldi, M., Delmas, F., Renson, P., Doom, C.  
Weiss, W.W., Morguleff, N. 1981: Astron. Astrophys. Suppl. **46**, 151

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

Number 3121

Konkoly Observatory  
Budapest  
17 December 1987  
*HU ISSN 0374-0676*

MORE ABOUT FY Aql AND GRBS 790331

There are usually no variable optical candidates in the error boxes of gamma-ray burst sources (GRBS). One exception is the variable star FY Aql lying inside the box of GRBS 790331 and having been previously catalogued as a Mira variable with a period of 208 days (Ahnert-Rohlfs and Götz, 1954).

On the other hand, Laros et al. (1985) have discussed the possibility that FY Aql may in fact be a dwarf nova. More recently, spectrophotometric data published by Hartmann and Pogge (1987) suggest the variable is of M4e III spectral type and thus support the previous classification of FY Aql as a Mira variable star.

In order to get also more detailed photometric data, the object was measured on more than 400 astrographic plates taken at the Sonneberg Observatory of the Central Institute for Astrophysics of the Academy of Sciences of GDR and covering the time interval 1928-1985. Because FY Aql represents one component of an apparent double, the integral brightness of both components was estimated and then the brightness of FY Aql was calculated using the measured magnitude of the other component according to Hartmann and Pogge (1987).

Our photometric data confirm the classification of FY Aql as a Mira type variable. Preliminary results of our investigation are:

1. The mean period over the time interval investigated is 209.7 d with elements  
 $\text{Maximum} = 244\ 5155 + 209^{\text{d}}.7 \times E$
2. The mean amplitude of light changes is nearly  $1^{\text{m}}.7$  in B (both components) or  $\geq 3^{\text{m}}$  in B (FY Aql only).
3. The shape of maximum is symmetric and narrower or equal than that of minimum indicating the variable is of a subtype  $\beta_1$  or  $\beta_2$  according to the classification by Ludendorff (1928).
4. The typical duration of maximum (brightening) of the integral (both components) light curve is  $\sim 100$  days.

We conclude that FY Aql is indeed a Mira type variable, the estimated period being fully consistent with the period-spectrum relation of Mira stars according to Keenan (1966). More details will be published elsewhere (Hudec, 1988).

R. HUDEC  
Astronomical Institute  
251 65 Ondřejov  
Czechoslovakia

#### References:

- Ahnert-Rohlfs, E. and Götz, W.: 1954, Veröff. Stern. Sonneberg, 2, 52.  
Hartmann D., and Pogge R.W.: 1987, Ap.J. 318, 363.  
Hudec, R.: 1988, Bull. Astron. Inst. Czechosl., in preparation.  
Keenan, P.C.: 1966, Ap.J. Suppl. Ser. 13, 333.  
Laros, J.G. et.al.: 1985, Ap.J. 290, 728.  
Ludendorff, H.: 1928, Handbuch der Astrophysik 6, 99 (Springer-Verlag Heidelberg).

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

Number 3122

Konkoly Observatory  
Budapest  
22 December 1987  
HU ISSN 0374-0676

A NEW VARIABLE STAR IN CASSIOPETA

In an observational program on the eclipsing binary AB Cas, BD + 70<sup>0</sup>188 was used as the comparison star (also used by Ando, 1980) and SAO 4710 (BD+70<sup>0</sup>199=HD 16439) as the check star. The observations showed that while BD + 70<sup>0</sup>188 kept a nearly constant brightness, SAO 4710 presented an undoubted photometric variability. This last star is not present in any of the variable star catalogues, hence it has to be considered as a new variable star. SAO 4710 was observed three nights in November 1987 with the 75 cm reflector at the "Sierra Nevada" Observatory (Spain) in the Strömgren four colours. Figure 1 shows the light curve in the v filter for November 17 th. In a preliminary Fourier

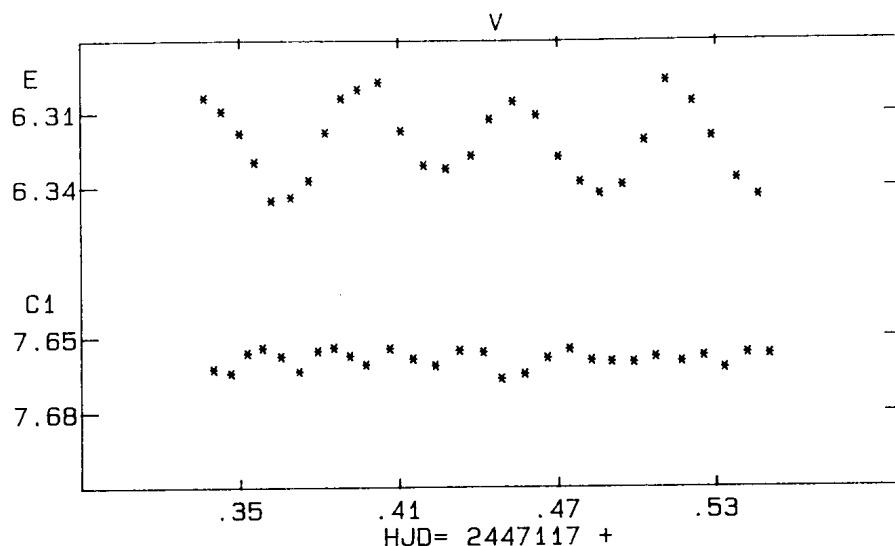


Figure 1. - Light curve in the v filter at November 17th, with E = SAO 4710 and C1 = BD +70<sup>0</sup>188. The magnitudes are in the instrumental system.

analysis of these light curves we could verify that SAO 4710 is a monop periodic pulsator with an amplitude of  $0.041^m$  in the v filter. After prewhitening of the main frequency (17.1438 c/d) the power spectrum does not show any further peak with a global amplitude greater than  $0.007^m$ .

A tentative ephemeris is given as:

$$\text{HJD max.} = 2447117.39742 + 0.05833^d \cdot E$$

$\pm 8$ 
 $\pm 5$

The general aspect of the light curves suggests that we are dealing with a Delta Scuti type variable.

A more detailed study of this star will be published later.

J.L. SEDANO

E. RODRIGUEZ

P. LÓPEZ DE COCA

Instituto de Astrofísica de Andalucía

Apdo. 2144, Granada, Spain

Reference:

Ando, H. 1980, Astrophys. Space Sci. 71, 249.

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

Number 3123

Konkoly Observatory  
Budapest  
23 December 1987  
HU ISSN 0374-0676

GAMMA LUPU DOES NOT APPEAR TO BE A Be STAR\*

Ghosh *et al.* (1987) recently reported the discovery of the bright B2 IV star  $\gamma$  Lupi (= HR 5776 = HD 138690) as a new Be star. This bright ( $V = 2.8$  mag) star has not previously been seen to display emission lines, and the detection of a non-emission line B star that suddenly becomes a Be star would be very important indeed as Ghosh *et al.* (1987) point out.

Even more important is, however, that such inferences are based on reliable observational facts (*cf.*, *e.g.*, the similar case of HD 91948 as discussed by Bolton and Lyons 1984). My inspection of nearly 70 references kindly supplied by the Centre de Données Stellaires, Strasbourg, for  $\gamma$  Lup and the period 1950 to 1987 did not uncover any indication of circumstellar material in excess of what can be expected for non-emission line B stars. Jaschek *et al.* (1964) did not find the  $H\alpha$  emission looked for, nor did any other spectral classification work (*e.g.*, de Vaucouleurs 1957, Slettebak 1968, Hiltner *et al.* 1969) discover bright spectral lines. Oegerle and Polidan (1982) searched *Copernicus* scans for circumstellar OI  $\lambda$  1304 Å without detecting it at the 5 mÅ level. Likewise, Snow *et al.* (1979) only detected the two very strongest of the numerous FeIII lines often seen in Be stars. Therefore, there was probably no significant amount of circumstellar matter along the line of sight. The intrinsic linear polarization as measured by Serkowski (1970) is consistent with there also being no circumstellar matter in a nonspherical configuration. Barker *et al.* (1985) measured a longitudinal magnetic field strength of  $45 \pm 74$  Gauss, *i.e.* the star may as well have no magnetic field.

Ghosh *et al.* mention 320 km/s as the  $v \sin i$  of  $\gamma$  Lupi. This appears to be the value given by Huang (1953). On the revised scale, Slettebak *et al.* (1975) derive only 210 km/s. Also, Slettebak's (1968) spectral classification is B2 IV, not B2 IVn, so that  $\gamma$  Lupi at least is not an extreme Bn star. The star is known to be a close visual binary consisting of two components of nearly equal brightness with an angular separation of

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

less than 1 arcsec and an orbital period of about 150 years (Heintz 1956). Van Albada and Sher (1968) measured radial velocity variations with a full range of about 80 km/s and suggest that one of the two visual components is a spectroscopic binary with a possible period of  $2.8 \pm 0.1$  day. My re-analysis of their data and the more recent radial velocities by Levato *et al.* (1987) does not contradict this conclusion. However, van Albada and Sher's measurement of April 25.019, 1966 is rather discrepant. This problem is somewhat alleviated, but not completely removed, with a period near 0.739 day which is a 1 c/d alias and also roughly one-quarter of the period found by van Albada and Sher so that the radial velocity variations may also be non-orbital in origin. With this period, the radial velocity curve is very non-sinusoidal. A new series of multiple observations per night seems necessary for the conclusive resolution of this ambiguity. Independent of the result, it is almost certain already that  $\gamma$  Lupi does contain an intrinsically variable star as is suggested by the two He I  $\lambda$  6678 Å line profiles of Fig. 1 which were observed on two consecutive nights and display the typical signature of intermediate-order ( $m \approx 8-10$ ) nonradial pulsation. On the other hand, in a search for new  $\beta$  Cephei stars,  $\gamma$  Lupi was tested by Jakate (1979) for rapid variability, but no variations were detected at the 0.01 mag level.

Snow (1981) found a slight asymmetry in the UV resonance lines from which he deduced a mass loss rate of  $9.65 \cdot 10^{-11} M_{\odot}/\text{yr}$ . He states that of the 22 stars in his sample only three are non-emission line stars (this statement was also carried over to Snow 1982), but  $\gamma$  Lupi is not among the three exceptions mentioned. Since no other evidence of the star being a Be star is given and Snow *et al.* (1979) explicitly say that emission lines are not known from this star,  $\gamma$  Lupi probably was just accidentally not included among the pure B stars in Snow (1981). All available evidence therefore suggests that  $\gamma$  Lupi in fact did not so far harbour a Be star.

The evidence that Ghosh *et al.* offer for  $\gamma$  Lupi recently having turned into a Be star is based on four photographic spectra with a reciprocal dispersion of 16 Å/mm (unfortunately the widening of the spectra is not given). The H $\alpha$  tracings each show two or three faint (Ghosh *et al.* do not provide a flux scale but it can indirectly be deduced with the help of Fig. 2 discussed below) spikes which however vary in position and strength. None of these features exceeds the amplitude of the noise in the adjacent continuum as is to be expected if they, too, are just typical spikes in the noise. At this level the discrimination between Be and B stars clearly becomes doubtful, and ultimately the latter category may even vanish. The reality of these features is also for another reason doubtful since general experience (*e.g.*, Dachs *et al.* 1986) shows that the separation of the H $\alpha$  emission peaks in Be stars is the larger the weaker the emission is (see Dachs *et al.* 1986 for the explanation in the framework of the standard equatorial disk model). By comparison, the features of Ghosh *et al.* appear too closely spaced.

Purely by coincidence I have obtained a single H $\alpha$  spectrum of  $\gamma$  Lupi with the Coudé Echelle Spectrometer (CES) plus Reticon detector of the European Southern Observatory at La Silla on April 12, 1987, i.e. just 18-21 days after Ghosh *et al.* (1987). The characteristics of this spectrum and the reduction procedure applied to it are the same as described in Baade *et al.* (1988) except for possible low-amplitude large-scale distortions which have not been attempted to correct. The profile is reproduced in Fig.

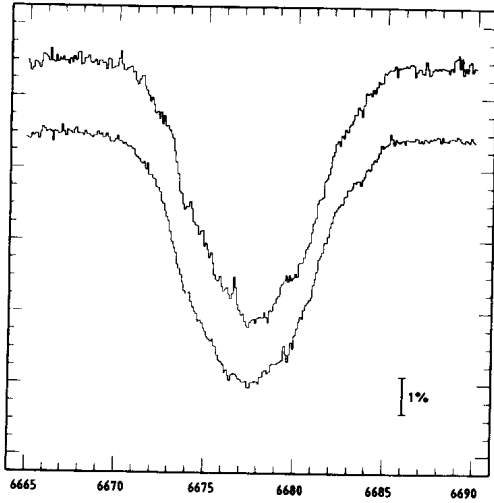


Figure 1: Two  $\text{HeI } \lambda 6678 \text{ \AA}$  profiles of  $\gamma$  Lupi obtained on January 22 (top) and 23 (bottom), 1985. Note the wiggles which are probably indicative of intermediate order ( $m \approx 8-10$ ) nonradial oscillations. The flux scale is provided by the vertical bar; the offset between the two spectra corresponds to 2% of the adjacent continuum flux.

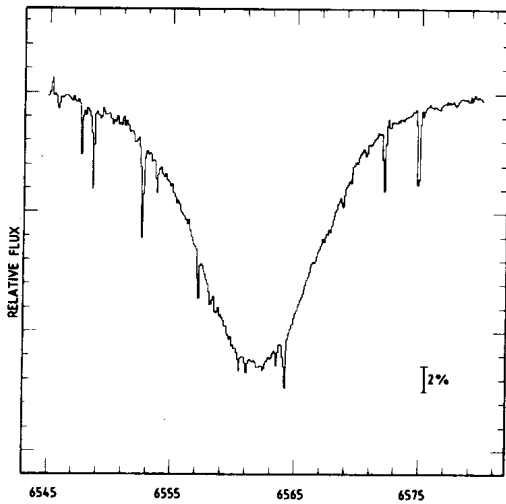


Figure 2:  $\text{H}\alpha$  profile of  $\gamma$  Lupi observed on April 14, 1987. The vertical bar gives the flux scale (in units of the adjacent continuum); it also indicates the order of magnitude of the fainter of the features reported by Ghosh *et al.* (1987). The numerous sharp absorption features are of telluric origin. The profile is not perfectly symmetric because low spatial frequency distortions due to flatfielding, *etc.* have not specifically been corrected for (*cf.* also Smith *et al.* 1987 and Baade *et al.* 1988). There is no indication whatever of an emission component.

2; at a S/N of better than 600 there is no trace of an emission component.

Observations by Baade *et al.* (1988) have shown that Be stars may undergo small outbursts which produce faint H $\alpha$  line emission that fades on a timescale comparable to the time elapsed between the observations by Ghosh *et al.* and the one in Fig. 2. In so far the new data do not prove that  $\gamma$  Lupi has *never* been a Be star, especially not because the occurrence of emission may also depend on the phase of the short-term variability. But the assumption that  $\gamma$  Lupi is not a Be star still seems well justified.

DIETRICH BAADE  
Space Telescope-European Coordinating Facility  
European Southern Observatory  
Karl-Schwarzschild-Str. 2  
D-8046 Garching bei München  
West Germany

#### References :

- Baade, D., Dachs, J., van de Weygaert, R., Steeman, F.: 1988, *Astron. Astrophys.*, in press (= *ESO Scient. Prepr.* No. 550)
- Barker, P.K., Landstreet, J.D., Marlborough, J.M., Thompson, I.B.: 1985, *Astrophys. J.* **288**, 741
- Bolton, C.T., Lyons, R.W.: 1984, *Inf. Bull. Var. Stars*, No. 2580
- Dachs, J., Hanuschik, R., Kaiser, D., Rohe, D.: 1986, *Astron. Astrophys.* **159**, 276
- de Vaucouleurs, A.: 1957, *Mon. Not. R. astron. Soc.* **117**, 449
- Ghosh, K.K., Kuppaswamy, K., Jaykumar, K., Rosario, M.J., Velu, C.: 1987, *Inf. Bull. Var. Stars*, No. 3057
- Heintz, W.D.: 1956, *Astron. Nachr.* **283**, 145
- Hiltner, W.A., Garrison, R.F., Schild, R.E.: 1969, *Astrophys. J.* **157**, 313
- Huang, S.-S.: 1953, *Astrophys. J.* **118**, 285
- Jakate, S.M.: 1979, *Astronom. J.*, **84**, 552
- Jaschek, C., Jaschek, M., Kuciewicz, B.: 1964, *Zeitschr. Astrophys.* **59**, 108
- Levato, H., Malaroda, S., Morrell, N., Solivella, G.: 1987, *Astrophys. J. Suppl. Ser.* **64**, 487
- Oegerle, W.R., Polidan, R.S.: 1982, *Publ. Astron. Soc. Pacific*, **94**, 997
- Serkowski, K.: 1970, *Astrophys. J.* **160**, 1083
- Slettebak, A.: 1968, *Astrophys. J.* **151**, 1043
- Slettebak, A., Collins, G.W., Boyce, P.B., White, N.M., Parkinson, T.D.: 1975, *Astrophys. J. Suppl. Ser.* **29**, 137
- Smith, M.A., Graves, J.E., Jaksha, D.B., Plymate, C.L., Ramsey, L.W.: 1987, *Publ. Astr. Soc. Pacific* **99**, 654
- Snow, T.P.: 1981, *Astrophys. J.* **251**, 139
- Snow, T.P.: 1982, *Astrophys. J. (Letters)* **253**, L39
- Snow, T.P., Peters, G.J., Mathieu, R.D.: 1979, *Astrophys. J. Suppl. Ser.* **38**, 227
- van Albada, T.S., Sher, D.: 1968, *Bull. Astron. Inst. Netherlands* **20**, 204

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

Number 3124

Konkoly Observatory  
Budapest  
23 December 1987  
HU ISSN 0374-0676

ON THE CONTINUED IMMACULATENESS OF THE Be STAR MU CENTAURI\*

The line profile variability (LPV) of Be stars is still a relatively young subject (Baade 1979), it *may* (*cf.* Baade 1987a) contain the key to the unsolved question why the mass loss from Be stars is so dramatically different from the behaviour of B stars, and it has so far been detected only by comparatively few observers, not at last because the requirements on the S/N are very high. This makes it tempting for everybody to take up the challenge and find the explanation; but evidently the given combination of circumstances also poses some risks. In particular, it is sometimes overlooked that the LPV of early-type stars is one of the most complex variability patterns known from stars other than the sun. To keep *all* its facets in mind when trying to explain the observations is very difficult, and it would be dishonest to claim that this has already been achieved by any model. However, as has been cautioned earlier (Baade 1987b), attempts to overcome the sometimes confusing multidimensionality of the observed parameter space by concentrating on just one detail are inadequate. Paradoxical though it may appear, this applies especially to the basic categorization of the phenomenon.

In a recent note, Harmanec (1987b) has renewed a proposal by himself (Harmanec 1984, 1987a) and others (for references see, *e.g.*, Harmanec 1987a and Baade 1987b) that line profile-variable early-type stars are either spotted stars or binaries or some combination thereof. He derives seemingly new arguments from the preliminary analyses of  $\epsilon$  Per (B0.5 III-V) by Gies and Kullavanijaya (1987) and  $\mu$  Cen (B2 IVe) by Baade (1987c) in which it had been shown that the observed LPV is due to multi-mode nonradial pulsation (NRP). I understand that Gies (1987, private communication) does not concur with Harmanec's conclusions. The following discussion is therefore formally limited mainly to the case of  $\mu$  Cen, but it should have much broader applications (of Harmanec's [1987b] characterization of  $\mu$  Cen and  $\epsilon$  Per as being 'extremely interesting and unusual' only the first part is right).

This is by far not the first round of the discussion rotational and/or orbital modulation due to corotating stationary features (hereafter simply called 'starspots' although

---

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

in a binary the features may be circumstellar) *vs.* NRP's, the explanation that has been adopted by virtually all spectroscopists who have presented observations of LPV's in early type stars. But it is instructive to begin this round by repeating (*cf.*, *e.g.*, Baade 1987a,b,c) the main arguments in support of NRP's since some seem already forgotten:

- Starspots do not account for absorption line wings which during certain phases extend beyond the normal footpoint of the profile (see, *e.g.*, Fig. 1).
- Starspots do not explain phase velocities that differ from the rotational velocity.
- The advocates of the spotted star class of models have not so far forwarded a model for the generation and maintenance – including considerable amplitude variations without change of the overall geometrical structure – of starspots or complicated circumstellar structures over extended periods. If magnetic fields are thought to be involved, it is interesting to note that at the current detection threshold of about 100 Gauss magnetic fields are not known from 'normal' OBA stars. On the other hand, chemically peculiar stars which have or are suspected to have magnetic fields and which at least in some cases do show inhomogeneous chemical surface abundance distributions do not display LPV of the type discussed here.
- Starspots cannot explain non-commensurate multiple periods.

The point that Harmanec tried to make is that the non-commensurability claimed for the periods of  $\mu$  Cen (Baade 1987c) is debatable.

In astronomy, the search for period commensurabilities has a long history and even dates back to the times when it was considered important to find out if the constellations of the planets repeat periodically. Today we know that they do not (if exact repetition is demanded). One step to this realization must have been the distinction between rational and irrational numbers. All numbers resulting from physical measurements are inaccurate at some level, *i.e.* the number of their decimal places that is reliably known is finite. This is the same as saying that all measured numbers are rational numbers. Then, the conclusion is trivial that *any* finite set of measured numbers are commensurate. However, for a random sample of numbers, their smallest common multiple will usually be a much larger number and accordingly rather meaningless. A remarkable point about Harmanec's (1987b) work is, therefore, that he finds a fairly small common multiple each of four periods in both  $\epsilon$  Per and  $\mu$  Cen. A more detailed analysis of many more observations of  $\mu$  Cen from different observing seasons pending, I do not comment the fact that the preliminary study in Baade (1987c) with reasonable certainty finds only two of the four periods chosen by Harmanec (but the presence of at least one more period of order 0.1 day is evident from the data). The more important question is if Harmanec's scheme has physically sound implications.

In his interpretation of  $\mu$  Cen, Harmanec excludes spots on a single star because already the minimum radius of 10.8 solar radii that he infers is too large for a B2 star while the correction for  $\mu$  Cen's low inclination probably contributes another factor  $\sim 1.5$  (Baade 1987a). It is even easier to agree with Harmanec's conclusion on account of his superperiod being 35 times the  $\sim 0.1$  day period: As has been stated many times in connection with NRP's, the number of features visible at any one time in the profile is slightly less than one-half of the number of features distributed along the star's circumference. In  $\mu$  Cen's line profiles the number of features associated with the presumable

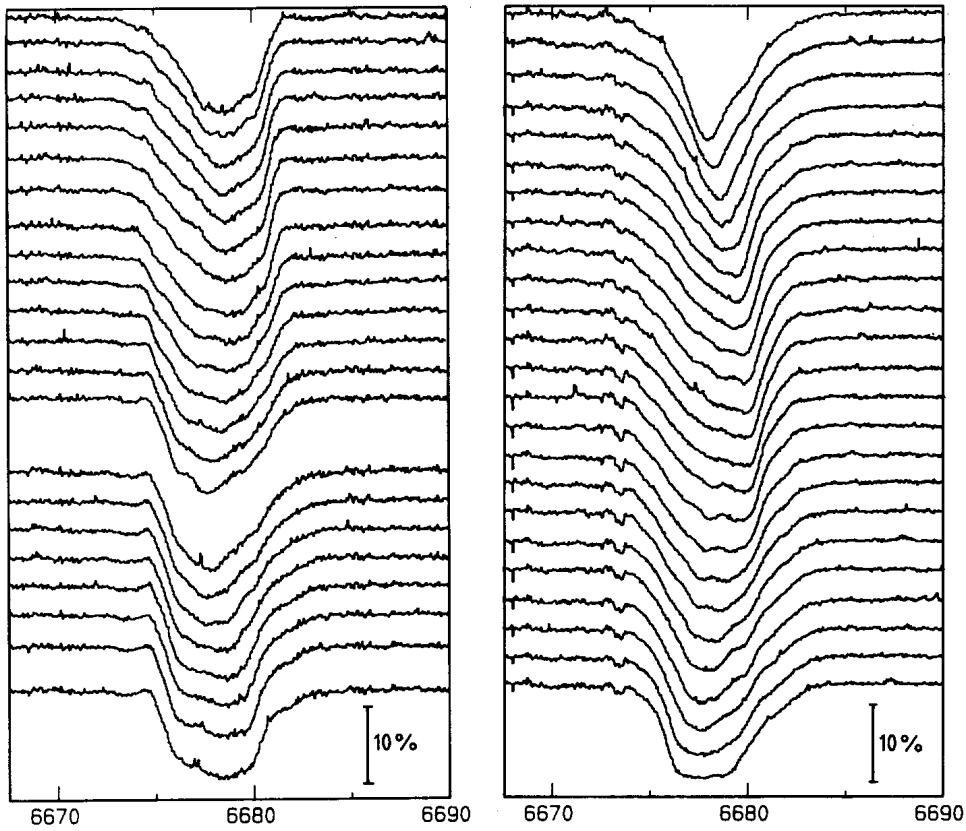


Figure 1: Profile variations of He I  $\lambda$  6678 Å in  $\mu$  Centauri on 1987 April 10 (left panel) and 1987 April 17 (right panel). The spectra are normalized to the adjacent continuum flux, the scale is provided by the vertical bar in the lower right corner. In either series of spectra time increases from top to bottom. The vertical offsets between the spectra are such that one hour corresponds to 10% of the continuum flux. The first observation on April 10 was at 01:23 hrs UT, the first one on April 17 at 00:42 hrs UT. The various features to the left of the profiles of April 17 are due to imperfect flatfielding. Other spikes and artefacts were also left uncorrected.

0.1 day period (Baade 1984) never exceeds 5 (at most 6) while Harmanec's scheme predicts nearly 17! For the other periods the disagreement is similarly large, and in  $\epsilon$  Per Harmanec's (1987b) numbers miss the available fits and/or estimates for the respective number of sectors (Smith, Fullerton and Percy 1987, Gies and Kullavanijaya 1987) by a factor of about 2. It was for that reason that commensurabilities involving factors larger than 4 and 5 were not considered in Baade (1987c). Harmanec simply ignores that, for surface phenomena, spectroscopy – in contrast to photometry – provides not only temporal but also spatial periods (wavelengths).

In his treatment of two preprints (Gies and Kullavanijaya 1987, Baade 1987c), Harmanec (1987b) pays regrettably little attention to one published paper which is based on a comparable set of observations of  $\epsilon$  Per. On a first glance, that work by Smith, Fullerton, and Percy (1987) may have the 'disadvantage' that it does not supply a small set of simple numbers but that it gives a very complicated description of the phenomenon in terms of variable periods, variable pulsations amplitudes, oscillatory phase shifts, event like departures from a periodic behaviour, *etc.* which are all ascribed to the nonlinear superposition of basically two large-amplitude pulsation modes. Not only is such a scenario unnecessary for stationary starspots, it is also very doubtful whether one could deliberately contrive it. It is therefore essential to bear in mind that with the above terminology turned into modeling tools, Smith, Fullerton, and Percy succeeded in reproducing the observed line profiles including their simultaneous photometry. Re-analysis of the same data in the light of Gies and Kullavanijaya's results is under way but apparently has not so far (Smith and Gies 1987, private communication) identified any major inadequacies in the analysis given by Smith, Fullerton, and Percy (1987).

Harmanec's preferred solution for  $\mu$  Cen is a binary with a period of either 3.535 or 7.07 days. (For  $\epsilon$  Per resorting to a binary model is not justified because there is no evidence for circumstellar matter other than a wind. It needs to be asked, therefore, if a model that has to be split into two radically different versions when applied to the qualitatively fairly similar LPV of just two stars has much explanatory power.) The aforementioned difficulty for single stars is avoided in binaries because then a periodic structure in circumstellar matter can be postulated of which only some fraction will be projected on the Be star. But in order for the various structures required by multiple periods to be arranged at the same radius it is necessary that their wavelengths (spatial periods) share the *same* commensurability pattern as the periods. Future work on  $\mu$  Cen (Baade *et al.*, in preparation) will show whether or not this is so.

In any case, it is important to realize that the data require *periodic* circumstellar structures and not just 'highly non-sinusoidal' ones as Harmanec (1987b) suggests. His comparison with the very structured light curves of X-ray pulsars is inappropriate so long as indications of high harmonics of their orbital periods such as the ones which Harmanec constructs for  $\mu$  Cen seem to be lacking. It is difficult to imagine how a multiply periodic structure involving as many as  $7+8+9+35$  (if not  $14+16+18+70$ ) sectors of four different widths (plus others not yet detected) can be sustained in a circumstellar envelope against the effects of distortions by the companion and radially differential rotation. But there are other arguments (in addition to those listed above) than lack of imagination (and it deserves to be mentioned that most of them do not require access to the original data):

- Not every OB star (and not every Be star, either) is a member of a close binary system. It appears not advisable to contrive a model that has no chance to account for the ubiquity of LPV's in early-type stars (Baade 1987b). In  $\mu$  Cen in particular, there is no evidence for a companion.
- Like in other Be stars, the V/R ratio of the two emission components occasionally seen in HeI  $\lambda$  6678 Å seems to vary with the period of the slowest variation which in the case of  $\mu$  Cen is 0.5 day. If the star is single, there are ways to understand this (*cf.* Baade 1987a). In a binary, the period of variation of emission features – whose occurrence does not depend on their being projected on a background source – should be the orbital one; symmetry variations with one-seventh (if not one-fourteenth) of the orbital period appear very odd by any means.
- The probable low inclination of  $\mu$  Cen (Baade 1987a; the apparent lack of eclipses may for some configurations slightly further strengthen this point in a binary model) requires that the multi-cellular structure of the circumstellar matter invoked by Harmanec is located at high stellar latitudes. If the orbital plane is not too different from the equatorial plane of the Be star, it is not clear how the companion should have such a profound effect high above the orbital plane and why duplicity is at all postulated.
- There are both prograde and retrograde features in the line profiles of  $\mu$  Cen (Baade 1984, 1987a). If circumstellar matter is responsible for them, the rotation axis of the pattern must be viewed under a small angle,  $i_{shell}$ , because otherwise only the near hemisphere of an assumed circumstellar shell will be seen projected on to the Be star thereby producing only prograde features. This is inconsistent with there being only between one-half and one-third (or one-quarter and one-sixth) of all sectors visible at a given time (*cf.* the single-star case).
- The absorption features move across the whole breadth of the profile so that their  $v_{shell} \sin i_{shell}$  must be similar to the stellar  $v \sin i = 155 \text{ km s}^{-1}$  (Slettebak 1982). From the previous point it follows that  $i_{shell}$  must be the smaller, the larger the shell's dimension is. But both the number of sectors not seen projected on the Be star as well as the suggested periods of 3.535 or even 7.07 day show that the shell would *not* be small. Accordingly,  $v_{shell} = 155 / \sin i_{shell} \text{ km s}^{-1}$  may easily exceed the limits imposed by any reasonable binary model. If such limits shall not apply because of magnetic fields or theirlike, the whole binary model becomes obsolete.
- The relative uniformity of the propagation of the line profile distortions leaves little room for an oblique magnetic rotator. Then, the same reasoning as in the previous point brings also a single-star model into trouble because with  $i = i_{shell}$  being very small  $v$  will get too large. (*E.g.*, if  $r_{shell} = 2 r_{star}$ ,  $i_{shell} = 20^\circ$  is too large to produce retrograde features of the observed strength. But for  $i_{shell} = 15^\circ$ ,  $v_{star}$  will already be  $600 \text{ km s}^{-1}$ .)
- I had not previously (Baade 1987c) succeeded in finding a single pair out of 20 nights of observations in which the LPV of  $\mu$  Cen was just nearly the same. (As the example of the sun's planets shows, this has no implication as to whether or not the variations are periodic.) Harmanec now predicts that the LPV repeats every 7.07 days; but from none of six pairs of nights that are spaced by 7 days I find this confirmed. An example is shown in Fig. 1. Either Harmanec's commensurability is spoilt by additional periods that do not fit into his scheme or it vanishes with

the true values of the periods. In any case, the data do not sustain the idea that the variability of  $\mu$  Cen can be represented by a single period.

In summary, the belief that the LPV of Be stars is due to starspots or circumstellar matter appears in no way supported by Harmanec's numerics.

Even though there is no *exact* commensurability, the discovery of just one more star whose periods come equally close to commensurability requiring only relatively small factors would probably call for an explanation, especially since without rotational and/or orbital modulation there is no longer an *a priori* need for perfect commensurability. Commensurabilities involving the azimuthal mode order,  $m$ , had previously been suggested for various nonradially pulsating stars (for references see Baade 1986). Both  $\epsilon$  Per and  $\mu$  Cen provide an example since in either star the mode with the shortest of the periods considered by Harmanec (1987b) is roughly  $m$ -commensurate with the longest period mode. Owing to the large contribution of the rotation to the observed phase velocities, these commensurabilities may only be apparent (*cf.* Baade 1987a); but that explanation does not apply to the respective three longest periods of either star which are clearly not  $m$ -commensurate. That is, their associated wavelengths do not share the commensurability, and the latter therefore exists only in the inertial, not in the corotating frame. If those near-commensurabilities are significant, they constitute a more general phenomenon with  $m$ -commensurability only being a special case.

I thank Dr. Myron Smith for constructive comments on the manuscript and him and Dr. Doug Gies for keeping me informed about the progress of their respective work.

DIETRICH BAADE

Space Telescope-European Coordinating Facility  
European Southern Observatory  
Karl-Schwarzschild-Str. 2  
D-8046 Garching bei München  
West Germany

#### References:

- Baade, D.: 1979, *The Messenger* (ESO), No. **19**, 4  
 Baade, D.: 1984, *Astron. Astrophys.* **135**, 101  
 Baade, D.: 1986, in *Highlights of Astronomy*, ed. J.-P. Swings, D. Reidel, p. 255  
 Baade, D.: 1987a, in IAU Coll. No. 98 *Physics of Be Stars*, eds. A. Slettebak and T.P. Snow, Cambridge Univ. Press, p. 361  
 Baade, D.: 1987b, in IAU Symp. No. 132 *The Impact of very high S/N Spectroscopy on Stellar Physics*, eds. G. Cayrel and M. Spite, D. Reidel, in press (= *ESO Scient. Prepr.* No. 529 A)  
 Baade, D.: 1987c, in IAU Symp. No. 132 *The Impact of very high S/N Spectroscopy on Stellar Physics*, eds. G. Cayrel and M. Spite, D. Reidel, in press (= *ESO Scient. Prepr.* No. 529 B)  
 Gies, D.R., Kullavanijaya, A.: 1987, *Astrophys. J.*, in press  
 Harmanec, P.: 1984, *Bull. Astr. Inst. Czechoslovakia* **35**, 193  
 Harmanec, P.: 1987a, in IAU Coll. No. 98 *Physics of Be Stars*, eds. A. Slettebak and T.P. Snow, Cambridge Univ. Press, p. 339  
 Harmanec, P.: 1987b, *Inf. Bull. Var. Stars* No. 3097  
 Slettebak, A.: 1982, *Astrophys. J. Suppl. Ser.* **50**, 55  
 Smith, M.A., Fullerton, A.W., Percy, J.R.: 1987, *Astrophys. J.* **320**, 768

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

Number 3125

Konkoly Observatory  
Budapest  
28 December 1987  
HU ISSN 0374-0676

## PHOTOELECTRIC TIMES OF MINIMA OF FOUR ECLIPSING BINARIES

We made differential photoelectric measurements during November and December of 1987 with the new 40 cm f/14 Cassegrain reflector at the Baja Observatory. The telescope was made in the Astronomical Observatory of the Odessa University (USSR) and is connected with a Starlight-1 stellar photometer made in USA, by the firm Thorn EMI. The latter is employed in the standard UBV system. The transformation coefficients of our telescope-photometer system are as follows:

$$\epsilon = -0.014 \pm 0.063, \quad \mu = 1.263 \pm 0.041, \quad \psi = 0.953 \pm 0.068$$

The comparison stars were as follows:

for OO Aql : BD+8<sup>0</sup>4220,  
RZ Cas : BD+69<sup>0</sup>171,  
VW Cep : BD+75<sup>0</sup>765,  
AG Per : BD+32<sup>0</sup>714

The times of minima were obtained by least-squares parabolic fitting to the measured points near the centre of minima. Table I contains the Heliocentric Julian Date, and the O-C residuals obtained by different ephemerides.

Table I

Star	N	Filter	J.D.Hel. -2 400 000	E	O-C <sub>I</sub>	O-C <sub>II</sub>
OO Aql	45	V	47058.3422	16664	-0.0032	+0.0313
OO Aql	65	V	47060.3709	16668	-0.0017	+0.0328
RZ Cas	45	B,V	47118.3364	24901	-0.0545	+0.0086
RZ Cas	39	B,V	47142.2418	24921	-0.0541	+0.0091
VW Cep	36	V	47142.4445	10725.5	-0.0318	
VW Cep	36	B	47142.4452	10725.5	-0.0311	
AG Per	49	V	47118.4458	2684	+0.0160	-0.0117

The value of  $N$  means the number of measured points used in the parabolic fit. Column  $E$  gives the number of cycles have elapsed since the epoch taken into account in the calculations of  $O-C$ . The  $O-C$  residuals  $O-C_I$  and  $O-C_{II}$  are computed using the following references:

Star	References	
	for $O-C_I$	for $O-C_{II}$
OO Aql	GCVS 1987	Demircan and Gdr, 1981.
RZ Cas	Parenago, 1952	Hecceg and Friboes - Conde, 1974
VW Cep	SAC 58	
AG Per	SAC 58	Gdr, 1984

The first residual of OO Aql may be considered of less weight as compared with the second one. In the case of AG Per the  $O-C_{II}$  value was calculated taking into account also a sinusoidal term (Gdr, 1984), but for the others it was done by only the linear term. AG Per has shown a slight fluctuation of the brightness near the light minimum, and so does, but more strongly, OO Aql and VW Cep. So, the uncertainties of their minima times are increased somewhat owing to this fact. RZ Cas seems to show a distinct period increase.

T. HEGEDS  
Baja Observatory  
Baja, P.O.Box 766.  
HUNGARY

#### References:

- Demircan, O. and Gdr, N., Photometric and Spectroscopic Binary Systems, 413-439, D.Reidel Publ. Co., 1981.
- Gdr, N., 1984, I.B.V.S. 2644.
- Hecceg, T., and Friboes-Conde, 1974, Astr. and Ap. 30, 259,
- Parenago, P.P., 1952, Variable Stars 9, 125,
- Rudnicki, K., 1987, Suplemento ad Annuario Cracoviense, No.58, Krakow.

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

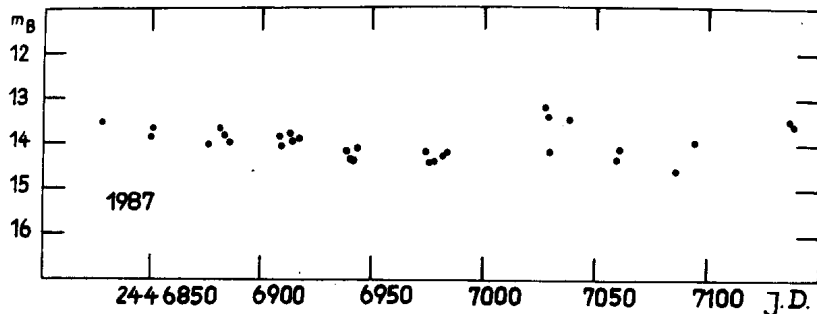
Number 3126

Konkoly Observatory  
Budapest  
29 December 1987  
HU ISSN 0374-0676

OPTICAL BEHAVIOUR OF THE POLAR AM Her IN 1987

In linking to the sequence of comparison stars given by Hudec and Meiningner (1977) the star was measured and inspected on 89 blue-sensitive plates (ORWO-ZU 21+GG 13+BG 12) from 30 nights taken with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 1 February and 9 December 1987. The individual observations will be published in MVS, Sonneberg.

The annual light curve in B is given in Figure 1.  
There, all of the observations are in the high state which is caused by X-ray heating. The mean brightness amounts to  $B = 13.94$ .



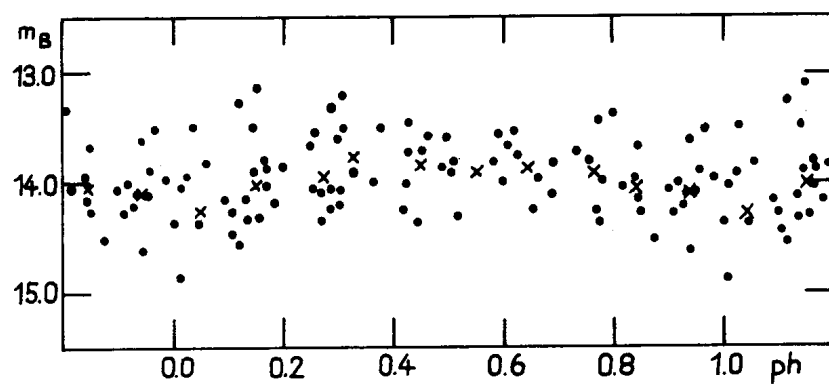


Figure 2

Figure 2 shows the occultation light changes superimposed on the long-time behaviour of the star in agreement with the improved elements and the occultation light curve in B given by Götze (1984).

W. GÖTZ

Zentralinstitut für Astrophysik  
der Akademie der Wissenschaften  
der DDR  
Sternwarte Sonneberg

#### References:

- Hudec, R., Meinunger, L., 1977, MVS 7, 194.  
Götz, W., 1984, IBVS, No. 2649.

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

Number 3127

Konkoly Observatory  
 Budapest  
 4 January 1988  
 HU ISSN 0374-0676

TIMES OF MINIMA OF SOUTHERN ECLIPSING BINARIES

As part of an extensive program devoted to search for periods, times of minimum light and period variations of bright southern close binaries, we present here photoelectric minima for RS Sgr, RR Cen, and IT Nor.

Observations were made between 1985 and 1987 at the Yale Southern Station of Félix Aguilar Observatory (San Juan, Argentina) with the 76 cm reflecting telescope, refrigerated RCA 31034 photomultiplier and photon counting techniques. The usual symmetrical pattern was followed during the measurements through the filters, in alternative sequences variable-comparison star and sky reading. The following times of minimum were determined:

Star	Filter	Min	HJD	m.e.
			2440000+	
RS Sgr	V	I	6296.5126	0.0048
RS Sgr	B	I	6296.5120	0.0060
RS Sgr	U	I	6296.5106	0.0065
RS Sgr	V	I	6622.6362	0.0006
RS Sgr	B	I	6622.6356	0.0049
RS Sgr	U	I	6622.6359	0.0040
RR Cen	V	I	6621.6678	0.0034
RR Cen	B	I	6621.6677	0.0041
RR Cen	U	I	6621.6677	0.0046
IT Nor	V	I	6623.7370	0.0048
IT Nor	B	I	6623.7369	0.0074
IT Nor	U	I	6623.7372	0.0106
IT Nor	V	II	6624.7151	0.0049
IT Nor	B	II	6624.7151	0.0047
IT Nor	U	II	6624.7151	0.0032

A study of the period of RS Sgr and a light curve analysis of IT Nor will be published elsewhere.

MIGUEL ANGEL DE LAURENTI  
 Observatorio Astronómico Mercedes  
 Calle 29 No. 575  
 6600 Mercedes (Buenos Aires)  
 Argentina

MIGUEL ANGEL CERRUTI  
 IAFE  
 CC 67 Suc 28  
 1428 Buenos Aires  
 Argentina

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

Number 3128

Konkoly Observatory  
Budapest  
8 January 1988  
*HU ISSN 0374-0676*

COORDINATED MULTIWAVELENGTH OBSERVATIONS OF YY Gem

From 4-6 March 1988 a coordinated programme of observations of the eclipsing binary flare star, YY Geminorum, is planned involving IUE, GINGA (X-rays) and various ground-based facilities. The principal objectives of this programme are (1) to provide data on the surface structure of the two components of YY Gem by the techniques of rotational modulation and eclipse imaging, and (2), to observe flares over as many different wavelength regions as possible. This project presently involves the following institutes: Armagh Observatory, the Institute of Astronomy at the University of Catania, the Joint Institute for Laboratory Astrophysics of the University of Colorado, the Rutherford-Appleton Laboratory, Oxfordshire, the Laboratoire de Physique Stellaire et Planetaire du CNRS and the Institute for Astronomy of the University of Hawaii.

The purpose of this circular is to solicit observations from ground-based telescopes around the world during the period 19:00 UT 4 March to 19:00 UT 6 March 1988, with particular emphasis on the eclipses at the following times:

primary	secondary
	4 March UT=15:06
5 March UT=00:52	5 March UT=10:38
5 March UT=20:24	6 March UT=06:10
6 March UT=15:56	

Optical eclipses last approximately 2.15 hours.

YY Gem is a ninth magnitude companion of the bright star Castor from which it is separated by approximately one minute of arc. In order of preference, suggested comparison stars are the following: SAO 60181, SAO 60182 and SAO 61217.

We welcome the participation of any observer who can contribute either photometric or spectroscopic observations. Interested observers are requested to contact the undersigned and to notify us of their telephone and telex numbers and/or BITNET

C.J. BUTLER  
 Armagh Observatory,  
 College Hill,  
 ARMAGH,  
 BT61 9DG,  
 N. Ireland.

Tel. (44) 861 522928 Telex 747937 ARMOBS G  
 BITNET address CJB@UK.AC.RL.STAR

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

Number 3129

Konkoly Observatory  
Budapest  
11 January 1988  
HU ISSN 0374-0676

PHOTOELECTRIC OBSERVATIONS OF SN 1987A

SN LMC 1987A was monitored photoelectrically at two independent, New Zealand observatories from February 1987 to September 1987.

West Melton Observatory, Christchurch, uses a 36 cm. cassegrain reflector, an uncooled 9502 S/A end-window photomultiplier, a current-to-frequency converter and 3x10 second integrations, using a 45 arcsecond sky aperture.

Johnson U,B and V filters are used and the system is standardised against Cousins E-Region standards from which transformation coefficients are derived to correct the system spectral response.

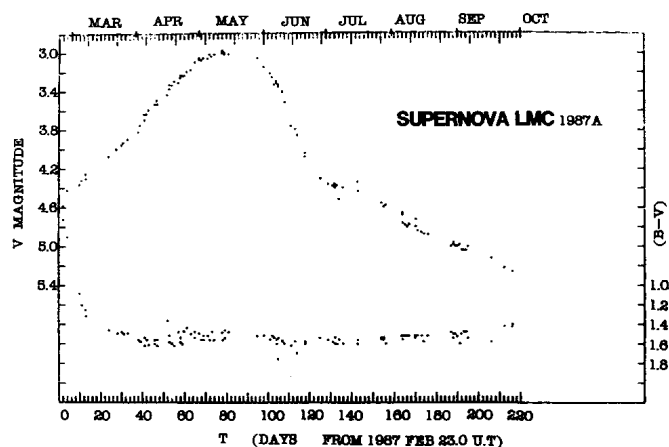


Figure 1

Adams Lane Observatory, Blenheim, uses a 30 cm. cassegrain reflector, an uncooled EMI 9789 QB, end-window photomultiplier, a current-to-frequency converter and 3x10 second integrations with standardised U,B, and V filters and 60 arcsecond sky aperture.

Both observatories used Theta Doradus ( $V=4.82$ ,  $B-V=1.28$ ,  $U-B=1.38$ ) as primary comparison star for differential photometry measurements.

The results have been combined in Figure 1. Agreement is good in V with systematic but consistent differences (0.08 magnitude) apparent in B-V.

CLIVE ROWE

Joyce Memorial Observatory,  
West Melton, Christchurch,  
New Zealand

BILL ALLEN

Adams Lane Observatory,  
Blenheim,  
New Zealand

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

Number 3130

Konkoly Observatory  
Budapest  
19 January 1988  
*HU ISSN 0374-0676*

UPDATE ON THE RR LYRAE STAR NSV 134

In a previous bulletin (Rössiger 1987) the announcement was made that the star BD+40°0060 = NSV 134 was probably an RR Lyrae variable of type "ab". Mention was made of a companion star to NSV 134 that is as almost equally bright as the variable and located about 6 arc-seconds away. Since it is not known whether or not the variable and its bright companion are indeed a physical pair, we decided to obtain spectra of them in order to help resolve this issue. On August 3, 1987 (UT) we obtained echelle spectra of both the variable and its companion using the coude Hamilton Spectrograph at the Shane 3-meter telescope at Lick Observatory. Since it was unknown how stable the period of the variable's light curve was, CCD images of the variable's field were taken at approximately 5 minute intervals on August 25, 1987 (UT) using the Nickel 1-meter telescope at Lick Observatory. The CCD images were reduced to derive the relative magnitudes of the variable and surrounding stars and to construct the variable's light curve.

The CCD was a Texas Instruments  $500 \times 500$  pixel device used at an imaging scale of 0.18 arc-seconds per pixel. A red filter was employed which generally restricted the light transmission to the range 6100Å to 7300Å. From the CCD images it was discovered that in fact there are two other fainter stars located near the variable and the bright companion. Figure 1 shows the field of the variable (north at top, east at left) with the designations A: NSV 134, the variable, B: the previously recognized bright companion, C: a fainter companion located almost midway between A and B, D: a very faint star just to the west of B, and E: a field star. All of these stars appear blended together on the red and blue copies of the Palomar Observatory Sky Survey. The apparent separation between the variable and its brightest companion is about 7.5 arc-seconds. The fainter companion is located about 4.5 arc-seconds from the variable and 3.5 arc-seconds from B.

Field of NSV 134

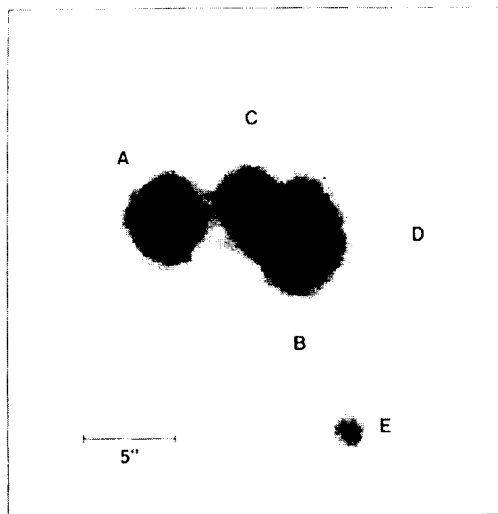


Figure 1.

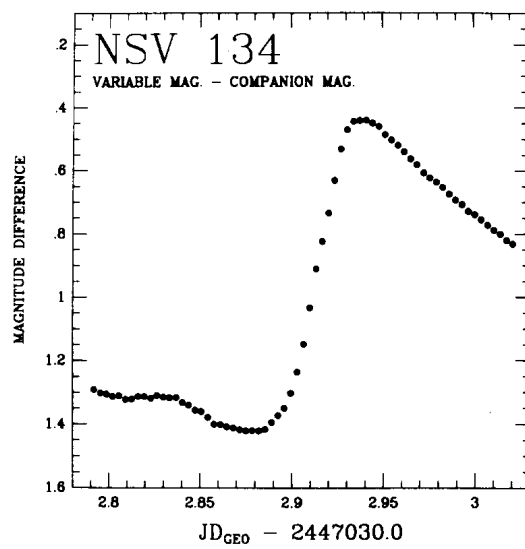


Figure 2.

The variable's light curve from the images is given in Figure 2, plotted in terms of the magnitude difference from the brighter companion (B) in the sense 'variable magnitude minus companion magnitude'. The observations indicate that the variable did go through an amplitude of  $0.^m980$  ( $\sigma = 0.^m004$ ) in its light variation on August 25 (UT). This amplitude is essentially twice that stated by Rössiger and could mean that the comparison star he used, BD+40°0056, may have some variation in brightness as well. No variability was detected in the companion B or any of the other stars, except the star E whose relative magnitude was not calculated due to its faint signal on the short exposure CCD images. The observed time of maximum for NSV 134 coincides nicely with that calculated from the elements given by Rössiger to within the time interval between exposures. The elements given by Rössiger were therefore used to compute the variable's phase at the time its spectrum was taken on August 3 (UT).

The midpoint of the 20 minute exposure for the variable occurred at 11.<sup>h</sup>71444 Aug. 3, 1987 universal time ( $JD_{geo} = 2447009.988$ ). From Rössiger's elements this corresponds to the variable having a phase of approximately .24. The high dispersion spectra indicate that the variable had a radial velocity at that time of  $-194$  km/sec while the companion's (B) radial velocity was  $-62$  km/sec. This radial velocity for the variable can be regarded as near its mean radial velocity due to its phase at the time of observation. The large difference in radial velocities indicates that NSV 134 and its brightest companion B, do not form a physical pair. The spectra show that the variable did indeed have an early-type spectrum while that of B was late-type — very probably late-G which would agree with the classification given in the New Catalogue of Suspected Variable Stars (1982). Further study of the fainter companion, C, is needed in order to determine what its relation is to either of the two brighter stars.

I am grateful to S. Rössiger for kindly supplying finding charts for NSV 134, to R. Kraft of Lick Observatory who assisted in obtaining the echelle spectra, and to R. Pogge for the image processing of Figure 1. This work was supported in part by the University of California Davidson Fund.

CHARLES F. PROSSER  
Board of Studies in Astronomy  
and Astrophysics  
Natural Sciences II  
Univ. of California Santa Cruz  
Santa Cruz, California 95064 USA

References :

- New Catalogue of Suspected Variable Stars, Kholopov, P.N. editor, Kukarkin, B.V. *et al.*, "Nauka", 1982.
- Rössiger, S. 1987, Information Bulletin on Variable Stars, Konkoly Observatory, Number 2977.

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

Number 3131

Konkoly Observatory  
Budapest  
19 January 1988  
*HU ISSN 0374-0676*

53 Psc REVISITED

53 Psc (B2.5 IV, HR 155, HD 3379) is a variable star located on the red side of the  $\beta$  Cma star instability strip. Williams (1954), Mathews (1956) and Sareyan et al. (1979) observed short period variations in light and radial velocity. Large profile variations were also claimed by Mathews (1956) and Sareyan et al. (1979). The quoted periods range from 0.08 to 0.091 day and the amplitudes are small: 0.01 mag in the UV domain, 0.002 to 0.01 in the blue region, a few km/s to 25 km/s in radial velocity over a night. Percy (1971) and Jerzykiewicz (1973, in Sareyan et al. 1979) found it to be constant in the B and the y filter respectively.

Recently, Wolf (1987) published a V light curve with an amplitude of 0.035 mag and a period of 0.096 d.

We report here on series of observations that we performed on 53 Psc in 1982 and 1987 with the 62 cm telescope of the Nice observatory at Pico del Veleta (Spain).

Two comparison stars, viz. 34 Psc (HR 26) and 66 Psc (HR 254), were used. The observations were made through our UV filter "4" and blue filter "5" (Sareyan et al., 1976) in 1982. In 1987 we used Strömgren u and b filters. Two nights of observation were obtained in October 1982, while in 1987, 2 and 4 nights were obtained in September and November respectively. The observational runs lasted more than 4 hours. The air masses were less than 2 during each observing sequence. Although the quality of the different nights were not of first class, a variation with a total amplitude over 0.01 mag would have been detected. This was not the case on any given night.

In view of these results the behaviour of 53 Psc appears rather peculiar: observed at different scattered moments this star exhibits variations with amplitudes varying from 0.002 to 0.035 mag in visible light and from few to 25 km/s in radial velocity.

Because a considerable amplitude in light variations is only observed on a single night from among more than fifteen, it is statistically not probable

that the observed amplitude changes are related to a beat period between interfering modes.

Although its period is very short, the pulsational constant of 53 Psc derived from Shobbrook's (1985) new photometric calibration is equal to 0.017 which is a value similar to the pulsational constants of the  $\beta$  Cma variables in NGC 6231 (Shobbrook, 1985).

The observed amplitude variations could be related to the location of 53 Psc at the low temperature border of the  $\beta$  Cma instability strip where the mechanism responsible for the instability is perhaps not enough efficient to maintain a stable pulsation. It would be interesting to look for such a phenomenon in  $\iota$  Her, another star of this region of the HR diagram in which short period variations have also been detected (Chapellier et al., 1987).

Another possibility is that 53 Psc presents long term changes in amplitudes similar to those pointed out in different  $\beta$  Cma stars (Chapellier, 1986).

More simultaneous photometric and spectrographic observations are needed in order to obtain a better understanding of the behaviour of 53 Psc which could lead to new ideas on the mechanism responsible for this type of variability.

J.M. LE CONTEL<sup>1</sup>, E. CHAPELLIER<sup>1</sup>, J.C. VALTIER<sup>1</sup>,  
E. RODRIGUEZ<sup>2</sup>, P. SEDANO<sup>2</sup>,  
P.J. MOREL<sup>1</sup>, D. LE CONTEL<sup>1</sup>

(1) L. A. 128, Observatoire de Nice  
B.P. 139 - 06003 NICE CEDEX, France

(2) I.A.A.  
Apartado 2144, GRANADA, Spain

#### References:

- Chapellier, E.: 1986, *Astron. Astrophys. Suppl. Ser.*, 64, 275.
- Chapellier, E., Le Contel, J.M., Valtier, J.C., Gonzalez-Bedolla, S.F., Ducatel, D., Morel, P.J., Sareyan, J.P., Geiger, I., Antonelli, P.: 1987, *Astron. Astrophys.*, 176, 255.
- Mathews, R.T.: 1956, *Publ. Astron. Soc. Pacific*, 68, 455.
- Percy, J.R.: 1971, *Astron. J.*, 76, 1105.
- Sareyan J.P., Le Contel J.M., Valtier J.C.: 1976, *Astron. Astrophys. Suppl. Ser.* 24, 129.
- Sareyan, J.P., Le Contel, J.M., Ducatel, D., Valtier, J.C.: 1979, *Astron. Astrophys.*, 72, 313.
- Shobbrook, R.R.: 1985, *Monthly Not. Roy. Astron. Soc.*, 214, 33.
- Williams, A. D.: 1954, *Publ. Astron. Soc. Pacific*, 66, 88.
- Wolf, M.: 1987, *IBVS*, No. 3003.

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

Number 3132

Konkoly Observatory  
Budapest  
19 January 1988  
HU ISSN 0374-0676

A RECENT LIGHT CURVE FOR THE BRIGHT W UMa TYPE ECLIPSING  
BINARY GR Vir

GR Vir = HD 129903 has been found to be an eclipsing binary of the W UMa type. First indications of its variability were given by Strohmeier et al. (1965), who stated that the photographic amplitude was 0.4 magnitudes. A partial light curve was published by Harris (1979) who gave a provisional period of 0.3472 days on the basis of 3 nights of observation. Hoffmann (1983) published a radically different period (0.419757 days) which was adopted for the most recent edition of the General Catalog of Variable Stars. No recent spectral classifications beyond that of GO given in the SAO Catalog could be located.

GR Vir has been observed in BV colors at intervals between JD 2446121 - 6952 with the 0.6-m. telescope of the Corralitos Observatory and its single channel photon-counting photometer and uncooled EMI 9924A photomultiplier tube, and on JD 2446866 - 7 with the Kitt Peak Observatory #2 0.9-m. telescope with its automated filter photometer and cooled IP21 tube. Observations of standard stars revealed no systematic color differences to  $> 0.002$  magnitudes between the Corralitos and Kitt Peak systems. The primary comparison star chosen was HD 129870 ( $V = 8.99$ ;  $B-V = +.62$ ; GO) with HD 129976 ( $V = 9.43$ ;  $B-V = +.90$ ; G) used as a check of its non-variability. The standard errors of the mean magnitude of (HD 129976 - HD 129870) were 0.012 in V magnitude and 0.016 in B-V.

A period of 0.346975 days was found for GR Vir on the basis of 916 observations over a total of nearly 2400 cycles. This period is in good agreement with that originally suggested by Harris. Plotting the same data with the Hoffmann period showed that his period is in error and does not represent the observations very well. The V magnitude of the symmetrical maxima is approximately 7.81 and the eclipse depths of primary and secondary minima, 0.36 and 0.31 V magnitudes respectively. There is a slight reddening during primary eclipse of about 0.03 magnitudes in B-V, leading to the conclusion that the secondary star is slightly later in spectral type and less luminous.

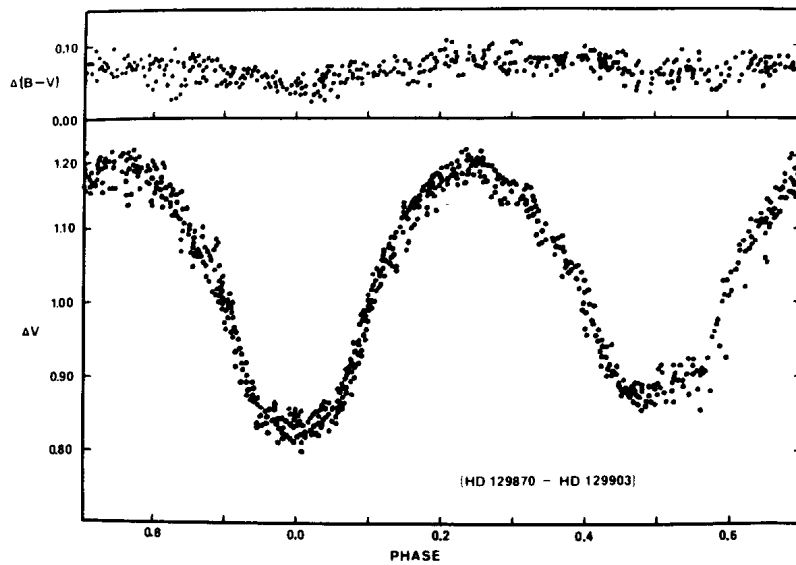


Figure 1 : V magnitude light curve and B-V color changes for GR Vir. These are shown as differences between the comparison star HD 129870 and the variable GR Vir.

The eclipses may be total. Graphic depiction of the light curve and color changes appear in Figure 1, with phase calculated by the following ephemeris:

$$\text{Prim. Min.} = \text{Hel. JD } 2446560.85006 + 0.346975 \cdot E$$

An analysis of the light curve will be published later. Kind thanks are tendered to L. Szabados for pointing out the variable designation and a helpful reference.

E.M. HALBEDEL  
Corralitos Observatory  
P.O. Box 16314  
Las Cruces, NM 88004  
U. S. A.

#### References:

- Harris, A.W. 1979, Inf. Bull. on Var. Stars, No. 1691.  
Hoffmann, M. 1983, Inf. Bull. on Var. Stars, No. 2344.  
Strohmeier, W., Knigge, R., and Ott, H. 1965, Inf. Bull on Var. Stars, No.115.

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

Number 3133

Konkoly Observatory  
Budapest  
20 January 1988  
HU ISSN 0374-0676

## PHOTOELECTRIC PHOTOMETRY OF RR Her

The variable star RR Her was included in my observational programme of some late type variable stars in 1983. The two colour photoelectric observations ( in B and V bands ) of RR Her were performed from time to time at the University Observatory in Brno and finished in 1987.

The photomultiplier and filter combinations on a one-channel photoelectric photometer attached to the 60 cm telescope were very close to the standard UBV system. During 17 nights over 150 individual measurements of the variable star were obtained. The data of the comparison stars are listed in Table I; these values were derived in the usual way from UBV standard stars near RR Her. From my observations it follows that these comparison stars are constant in brightness.

Table I

Photometric data for comparison stars

Object	BD	SAO	V	B-V	U-B
Comparison A	+50 <sup>0</sup> 2250	29779	9. <sup>m</sup> 25	+0. <sup>m</sup> 97	+0. <sup>m</sup> 83
Comparison B	+51 <sup>0</sup> 2053	29771	9.95	+1.10	+1.04

The observations of the RR Her are presented in Table II, where : denotes less accurate measurements and n in the last column denotes the number of individual observations in each colour.

Table II

Photometric observations of RR Her

JD-2440000	V	B-V	n	JD-2440000	V	B-V	n
5472.50	8.313	+2.54	7	5857.42	9.66	+3.02	6
	+10	+1			+1	+2	
5606.37	9.545	+2.96	2	6176.51	8.835	+2.77	5
	+6	+1			+3	+1	
5621.26	9.750	+2.91	3	6177.48	8.808	+2.855	6
	+14	+2			+3	+15	
5809.53	8.84:	+2.80:	4	6251.43	8.105	+2.505	3
	+3	+4			+6	+10	
5838.45	9.45	+2.83:	8	6253.43	8.148	+2.49	7
	+2				+3	+1	
5852.46	9.60	+2.96	5	6292.35	8.864	+2.77	3
	+2	+2			+4	+2	

2							
Table II				(Cont.)			
JD-2440000	V	B-V	n	JD-2440000	V	B-V	n
6300.34	9.04	+2.73	2	6605.40	9.925	+2.97	3
	+2	+2			+20	+3	
6311.32	9.304	+2.82	5	6915.54	8.522	+2.78	5
	+5	+3			+3	+1	
6592.43	9.658	+2.84	3				
	+1	+1					

These photoelectric observations - although somewhat fragmentary - confirm that the period of variability of this star is near the value  $P = 239.7$  days published in Kholopov et al. (1985).

J. PAPOUŠEK

Department of Astronomy  
Brno University  
Kotlářská 2, 611 37 BRNO  
Czechoslovakia

Reference :

Kholopov, P.N. et al.; 1985, General Catalogue of Variable Stars, Vol.II,  
Nauka, Moscow

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

Number 3134

Konkoly Observatory  
Budapest  
21 January 1988  
HU ISSN 0374-0676

## VARIABILITY OF THE CARBON STAR BD+51°1329

In our observational program of IRC objects some poorly investigated C and S type stars are also included which are close to local IRC standards.

BD+51°1329 ( $\alpha=7^h31^m.5$ ,  $\delta=51^\circ37'$ ) is a carbon star of spectral type C4,5, for which Bidelman has noted strong SiC<sub>2</sub> bands (Stephenson, 1973). In Dearborn survey of faint red stars BD+51°1329 is designated as DO 31774 with a spectral type of R and magnitude 10.<sup>m</sup>0 (Lee et al., 1947).

Observations were obtained at the Radioastrophysical observatory in Baldone using the 55-cm cassegrain telescope and a double-channel photon-counting photometer in Johnson system. The comparison stars are BD+51°1327 and 51°1328 with magnitudes, color indices and spectrum as follows:

BD	HD	V	V-R	R-I	Sp
+51°1327	59721	6.47	0.99	0.67	K0
+51°1328	59875	8.32	0.63	0.55	G5

Results of VRI observations are given in Table I. Some sporadic observations in filter B give an amplitude  $\Delta B \approx 0.<sup>m</sup>4$ .

Alksne et al. (1983) noted that strong SiC<sub>2</sub> bands appeared mainly in irregular or semiregular variables. A diagram R-I versus V-R cannot give exactly the type of variability but the position of BD+51°1329 indicates a possible type of Lb or SR.

Table I

JD2440000+	V	V-R	R-I
3951	10. <sup>m</sup> 16	-	1. <sup>m</sup> 34
4314	9.88	-	-
4316	9.86	-	1.32
5044	10.35	-	1.31
5061	10.24	-	-
5125	10.30	-	-
5382	10.40	-	-
5404	10.18	1.96	-
5745	10.36	-	-
5747	10.37	-	-

Table I (Cont.)

JD 2440000+	V	V-R	R-I
5780	10. <sup>m</sup> 18	1. <sup>m</sup> 97	1. <sup>m</sup> 33
5781	10.20	1.95	-
5825	10.27	1.99	-
5830	10.33	2.00	-
5976	10.25	1.97	-
6020	10.14	1.91	-
6022	10.13	1.96	-
6166	10.13	1.97	-
6468	10.28	2.06	-
6477	10.20	2.00	-
6503	10.25	2.02	-
6534	10.35	2.04	-

J. KIZĻA

Academy of Sciences of the Latvian SSR

Radioastrophysical Observatory

Riga, USSR 226524

## References:

- Alksne Z., Alksnis A., Dzervitis U., 1983, Properties of carbon stars of the Galaxy, Riga "Zinatne".
- Lee O.J., Gore G.D., Bartlett, Th.J., 1947, Ann. Dearborn Obs., vol.5, part IC.
- Stephenson, C.B., 1973, Publ. Warner and Swasey Obs. vol.I, No. 4.

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

Number 3135

Konkoly Observatory  
Budapest  
21 January 1988  
HU ISSN 0374-0676

UBV OBSERVATION OF NOVA VULPECULAE 1987

Beckmann and Collins (1987) discovered a nova at R.A. =  $19^{\text{h}}02^{\text{m}}.1$  Dec. =  $+21^{\circ}40'$  (equinox 1950.0) on Nov. 15.042 and Nov. 15.128 UT. UBV observations reported here were made from three days after the discovery to mid-December 1987 with a 20-cm reflector at Tamashima, Japan.

The photometer used consists of a microcomputer controlled photon counter and an uncooled Hamamatsu R 647-04 photomultiplier (bi-alkali cathode) and UBV filters ( Schott GG495 (2-mm) for V, GG385 (2-mm) + BG12 (1-mm) for B, and UG1 (2-mm) for U ). Actual observations were made differentially with respect to HR7267 (V = 6.23, B-V = +0.40, U-B = +0.01, F3V ) as a comparison star and the comparison star was also checked with HR7306 (V = 4.77, B-V = -0.05, U-B = -0.54, B4IV according to Hoffleit (1982) ).

In the data reduction, the dead time corrections of the photon counter and the atmospheric extinction corrections were carried out. Not only the first order extinction for differential air mass but also the second order extinction for colors were taken into account because the observations were made at relatively large zenith distances. The transformation coefficients to the UBV system were determined from observation of standard stars.

The obtained V magnitudes and colors are given in Table I and also plotted in Figure 1. Visual observations of early time of discovery are also shown for comparison in the figure. For the check of the quality of observations on the respective nights, the differential magnitudes and colors between the comparison and the check stars are given in Table II.

It was found that the magnitude of the nova was decreasing slowly, and both B-V and U-B colors became bluer with time. It is presumed that the light maximum must have been about the day discovered (Nov. 15 UT) according to V magnitudes and colors presented here. This is supported by the study of van den Bergh and Younger ( 1987 ) ; novae with smooth light curves exhibit a sharp reddening pulse in both B-V and U-B which is centered within one day of maximum light and the half-width of these reddening pulses run up to 7 days for slow novae.

Table I

UBV photometry of Nova Vulpeculae 1987

No.	Hel. J.D. 2447000+	n	V		B-V		U-B	
			mean	s.d.	mean	s.d.	mean	s.d.
1	117.9087	8	7.39	0.01	0.86	0.01	0.42	0.03
2	119.9002	7	7.17	0.01	0.73	0.01	0.03	0.02
3	123.8988	8	7.28	0.01	0.67	0.02	-0.02	0.01
4	128.8902	9	7.28	0.01	0.64	0.01	-0.25	0.02
5	130.8991	6	7.30	0.01	0.65	0.02	-0.34	0.02
6	131.8940	9	7.07	0.01	0.66	0.01	-0.22	0.03
7	132.8849	4	7.22	0.02	0.61	0.01	-0.49	0.04
8	133.8790	10	7.62	0.01	0.67	0.02	-0.19	0.02
9	136.8869	8	7.99	0.01	0.59	0.01	-0.49	0.01
10	142.8685	1	8.13	-	0.57	-	-0.56	-
11	143.8815	7	7.87	0.01	0.67	0.02	-0.50	0.06
12	145.8806	4	8.06	0.01	0.54	0.00	-0.67	0.02
13	148.8853	5	7.93	0.01	0.58	0.02	-0.78	0.03

"n" in the third column denotes the number of single observations with 20-seconds integration time for each band.

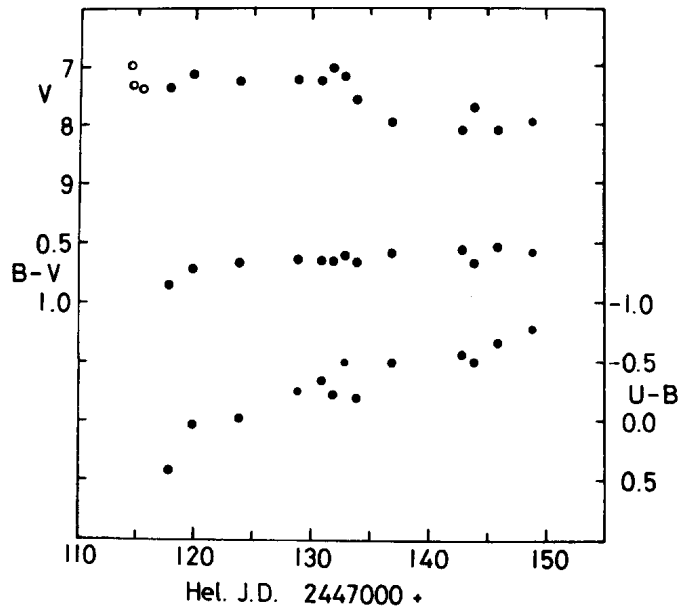


Figure 1 Light and color curves of Nova Vulpeculae 1987. Filled circles refer to photoelectric observations; open circles to visual observations by Beckmann and Collins (1987).

Table II

Observed differential magnitudes and colors between the comparison and the check stars

No.	J.D. 2447000+	n	$\Delta V$	$\Delta(B-V)$	$\Delta(U-B)$
1	117.9	4	1.45	0.46	0.54
2	119.9	1	1.44	0.48	0.51
3	123.9	1	1.45	0.45	0.54
4	128.9	1	1.44	0.47	0.56
5	130.9	2	1.45	0.47	0.53
6	131.9	2	1.44	0.45	0.57
7	132.9	1	1.46	0.45	0.56
8	133.9	2	1.47	0.46	0.53
9	136.9	2	1.47	0.44	0.55
10	142.9	1	1.44	0.50	0.52
11	143.9	1	1.47	0.42	0.57
12	145.9	2	1.46	0.45	0.53
13	148.9	2	1.48	0.42	0.57
mean			1.46	0.46	0.54
B.S.Catalogue			1.46	0.45	0.55

I would like to express my hearty thanks to Prof. M.Kitamura of Tokyo Astronomical Observatory and Dr. A. Yamasaki of Tokyo University for their encouragements and advice.

OSAMU OHSHIMA

Member of Japan Amateur Photoelectric  
Observers Association ( JAPOA )  
Tamashima 3-10-15, Kurashiki, Okayama  
713, Japan

#### References:

- Beckmann, K. and Collins, P. 1987, I.A.U. Circular No.4488.  
Hoffleit, D. 1982, The Bright Star Catalogue, 4th edition, Yale University Observatory.  
van den Bergh, S. and Younger, P.F. 1987, Astron. and Astrophys. Suppl. Ser., 70, 125.

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

Number 3136

Konkoly Observatory  
Budapest  
25 January 1988  
HU ISSN 0374-0676

## POSSIBLE DETECTION OF SOLAR-TYPE CYCLES IN CATAclysmic VARIABLES

Cataclysmic variables ( CVs ) are evolved close binary systems in which a low-mass, usually main sequence or near main sequence secondary is filling its Roche lobe and transfers matter onto a white dwarf primary. For reasonable mass transfer rates, most of the luminosity is produced by the release of gravitational energy of the transferred material inside the viscous accretion disc which is formed around the collapsed object. We suggest that the presence of solar type cycles in the secondaries of CVs can modulate the mass transfer rate on time scales of months and years and explain some of the peculiarities observed in the long term light curves of these binary systems. This idea is supported by the modern picture of solar cycles, in which a convective-pulsating phenomenon is responsible for the observed variations of the photospheric radius, the differential rotation and the magnetic cycle ( Gilman 1986).

The presence of non-radial g-mode pulsations in the secondaries of some CVs and Low Mass X-Ray Binaries, capable of modulating the mass flow rate within these systems, has been proposed by Vogt (1980), Bianchini et al. (1986) and Friedhorsky (1986). In particular, Bianchini et al. (1986) have suggested that the 7 year modulation seen in the light curve of the old nova GK Per might be ascribed to the presence in the secondary of a genuine solar type cycle. According to Applegate and Patterson (1987) the presence of magnetic cycles in the cool components of binary systems could explain the period changes observed in V471 Tau, CVs, RS CVn and W UMa stars.

If we avoid the cases of disc instability phenomena or steady nuclear burning on the surface of the white dwarf, the continuous, apparently irregular, light variations observed in the long-term light curves of old-novae and nova-like systems can be attributed to mass transfer rate variations. Variations of mass transfer rate in dwarf nova systems, instead, are more clearly represented by changes in the time interval between the outbursts (Warner 1987). We then suggest that the presence of solar type cycles in the late-type secondaries of CVs can produce a more or less periodic variation of both : (i) the observed "quiescent" luminosities of old-novae and nova-like systems; and (ii) the time intervals between consecutive outbursts of dwarf-nova systems.

To detect periodicities in the long-term light curves of CVs we adopt the procedure suggested by Deeming (1975). The discrete Fourier transform of a data file (magnitudes or  $\Delta T$  versus time) is then taken as the convolution of the true Fourier transform with the spectral

2

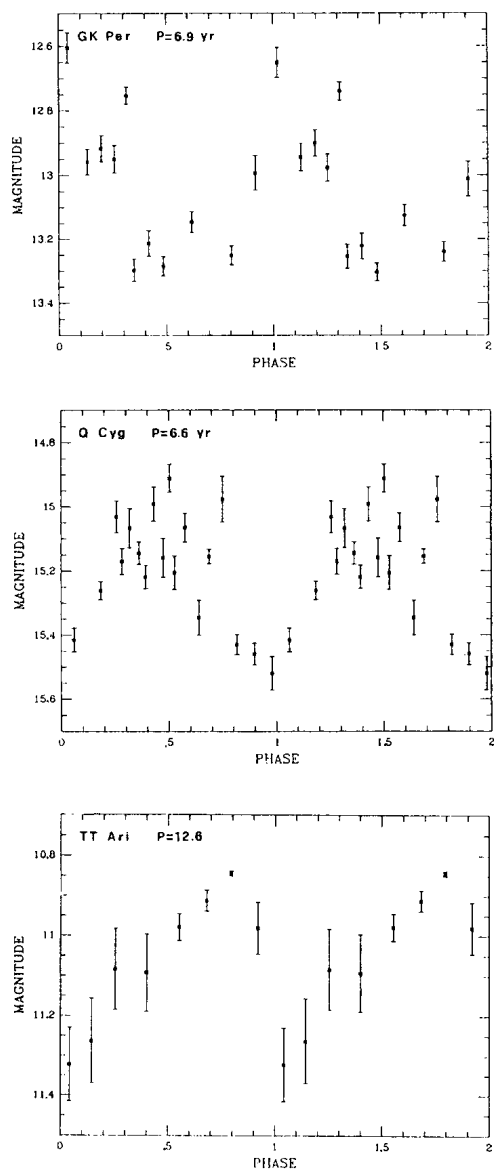


Figure 1. The folded light curves of GK Per, Q Cyg, and TT Ari and the folded  $\Delta T$ -T (times) diagrams of SS Cyg and U Gem are shown. Filled squares represent averages over 90, 30, 11, 38 and 15 original datapoints respectively. Standard deviations are also given.

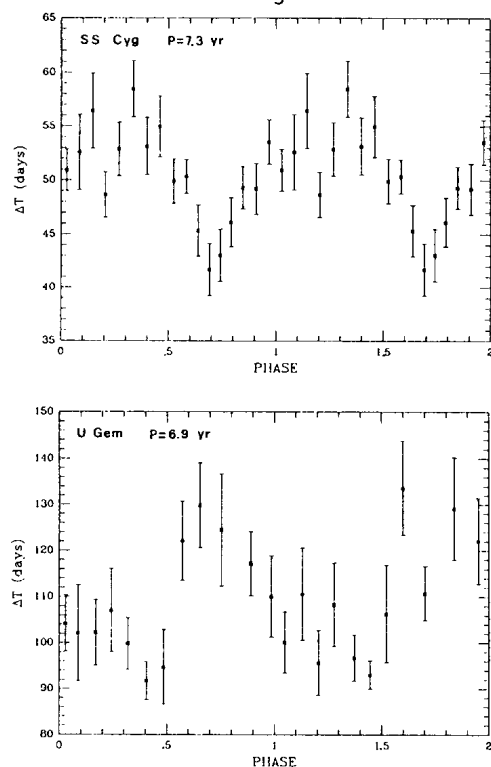


Figure 1 (cont.)

window (sampling) of the data. The methodology to discriminate between true and spurious periodicities is described by Barbieri et al. (1977). An additional test to avoid aliases has been done, in which each power spectrum of the original data has been compared with that obtained by correcting the data for the presence of one or more sinusoids. The main periodicities found have been finally shown by plotting in phase the original data and then averaging over bins as specified in the caption to Figure 1. This considerably reduces the irregular or random component in amplitude of single cycles.

We have analysed the light curves of the classical old-novae GK Per (1901), in the interval 1922-1948 (references in Sabbadin and Bianchini 1983); V841 Oph (1848) (same interval and references as for GK Per); Q Cyg (1876), in the interval 1950-1982 (Shugarov 1983); and of the nova-like variable TT Ari, in the period 1928-1982 (Hudec et al. 1984). We have also analysed the temporal variations of the time intervals between successive outbursts of the two well known dwarf-nova prototypes U Gem and SS Cyg (light curves by Mattei et al. 1985, 1987). The periods of the main cycles shown by these objects are of, respectively, 6.9, 3.3, 6.6, 12.6, 7.3 and 6.9 years. These results are shown in Figure 1. A more detailed analysis and discussion of

solar-type cycles in CVs will be given in a forthcoming paper. We wish that this study can cast new light on the poorly understood long-term photometric behaviour of CVs and also contribute to the so-called "solar-stellar connection studies" (Rodono` 1986).

A. BIANCHINI

Osservatorio Astronomico  
I-35100 Padova, Italy

#### References:

- Applegate, J. H., and Patterson, J.: 1987, *Astrophys. J. Letters*, 322, 102
- Barbieri, C., Romano, G., di Serego, S., and Zambon, M.: 1977, *Astron. Astrophys.*, 59, 419
- Bianchini, A., Sabbadin, F., Favero, G. C., and Dalmeri, I.: 1986, *Astron. Astrophys.*, 160, 367
- Deeming, T. J.: 1975, *Astrophys. Space Sci.*, 36, 137
- Gilman, P. A.: 1986 in 'Physics of the Sun' ed. P. A. Sturrock, Vol 1, 95
- Hudec, R., Huth, H., and Fuhrmann, B.: 1984, *The Observatory*, Vol 104, N. 1058, 1
- Mattei, J. A., Saladyga, M., Waagen, E. O., Jones, C. M.: 1985, *AAVSO Monograph* 1
- Mattei, J. A., Saladyga, M., Waagen, E. O., Jones, C. M.: 1987, *AAVSO Monograph* 2
- Priedhorsky, W.: 1986, *Astrophys. and Space Sci.*, 126, 89
- Rodono, M.: 1986, in "Highlights of Astronomy", ed. J.P. Swings, Vol. 7, 429
- Sabbadin, F., and Bianchini, A.: 1983, *Astron. Astrophys. Suppl. Ser.*, 54, 393
- Shugarov, S. Yu.: 1983, *Variable Stars* 21, N. 6, 807
- Vogt, N.: 1980, *Astron. Astrophys.*, 88, 66
- Warner, B.: 1987, *Mon. Not. R. astr. Soc.*, 227, 23

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

Number 3137

Konkoly Observatory  
Budapest  
27 January 1988  
HU ISSN 0374-0676

THE LIGHT VARIATIONS OF THE HYPERGIANT HR8752 (V509 Cas)

HR8752 is a very luminous G-type supergiant. Its variability both in light and radial velocity has been discussed by Arellano Ferro (1985). According to him these variations are probably due to non-radial pulsations.

More recent photometric data have been published by Halbedel (1986) and by Zsoldos (1986).

We observed this star in 15 nights from July to December 1985 with the 50 cm reflector of the Merate Observatory. During each night 7-10 UB<sub>V</sub> differential measurements were taken and grouped into a normal point. The internal standard error of these normal points averages 0.002, 0.003 and 0.004 mag in V, B and U colours respectively.

HR 8761 ( $V=6.20$ ,  $B-V=1.50$  and  $U-B=1.53$ ) and HR 8778 ( $V=6.43$ ,  $B-V=0.90$ ) were used as comparison stars. The standard deviations of the night to night magnitude differences between the two comparison stars are 0.006, 0.008 and 0.009 mag in V, B-V and U-B respectively.

Transformation into UB<sub>V</sub> standard system was secured by the observation of some standard stars. The two comparison stars' UB<sub>V</sub> colours so obtained are coincident within 0.01 mag with those published in "The Bright Star Catalogue" (Hoffleit and Jaschek, 1982). The U-B colour of HR 8778 is not reported in that catalogue, the value determined by us is +0.55.

The UB<sub>V</sub> magnitudes of HR 8752 so determined are listed in Table I and plotted in Figure 1.

Examining all the published photometry of HR 8752 we can see that the phasing between light and colour curves is changing: in 1980 V and B-V curves were in anti-phase; in 1984 the B-V curve was delayed of about a quarter of a cycle with respect to the V one; in 1985 the two curves were in phase. This fact along with the changing amplitude of the light curve seems to suggest that different processes could be responsible of the variability of HR8752. Very recently Zsoldos (1987) has proposed a preliminary model which try to explain the observed V variations by means of a coupling between pulsation and mass loss.

From our data we see that in 1985 maximum brightness took place at J.D.  $2446322 \pm 2$ . The only published U-B data are due to Zsoldos and Olah (1985) and Zsoldos (1986), however they are too scattered with respect to the amplitude of the variations in this colour and therefore they cannot show any clear trend. Our data show that the ascending branch of (U-B) curve was steeper than the descending one in the same way as V and (B-V) curves.

We observe that there is a systematic difference of about 0.03-0.05 mag between Zsoldos' and our (U-B) data. At the moment we are unable to explain it, but it could be connected to the transformations to the standard system, because our standard stars spanned only a limited range in (U-B) colour. For our data the selected standard stars allowed to obtain quite reliable

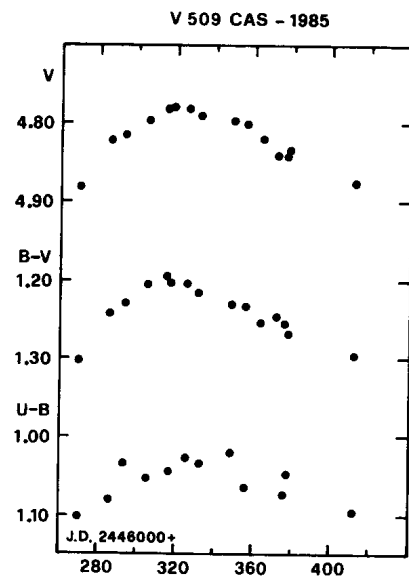


Figure 1

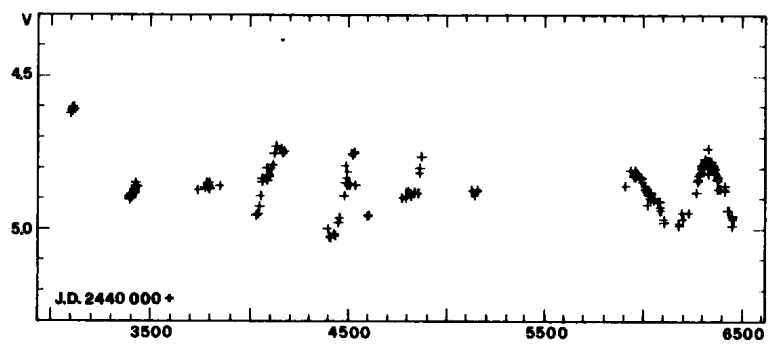


Figure 2

Table I

<i>J.D.</i>	<i>V</i>	<i>B - V</i>	<i>U - B</i>
2446270.45	4.882	+1.304	+1.101
286.48	4.820	+1.242	+1.081
293.53	4.815	+1.228	+1.034
305.52	4.795	+1.204	+1.053
315.42	4.781	+1.197	-
317.44	4.779	+1.201	+1.045
326.51	4.780	+1.207	+1.027
332.39	4.790	+1.214	+1.035
349.31	4.793	+1.227	+1.020
356.33	4.799	+1.231	+1.064
364.44	4.818	+1.253	-
372.30	4.838	+1.246	-
376.47	4.840	+1.254	+1.072
378.28	4.834	+1.268	+1.046
412.31	4.875	+1.296	+1.095

standard V and B-V colours, but, due to the limited range spanned by the U-B colours of the standard stars, that was not the case for this index.

Finally we tried to analyse by means of the least squares power spectrum technique (Antonello et al. 1986) all the existing photometry of HR8752 obtained since 1977 (fig.2). However these data cover too few light cycles and with too many gaps so that is not possible to obtain very significant results. For the present it is only possible to confirm the result yet obtained by Arellano Ferro (1985) and Zsoldos (1986), i.e. the cycles have a characteristic timescale of about 1 year. On the other hand is possible to infer this fact by a mere visual inspection of the light curve. As emphasized by Poretti (1987), a better knowledge of the light curve behaviour could be secured by the collaboration to the monitoring project of some amateur astronomers equipped with photoelectric photometer.

L.MANTEGAZZA<sup>1,2</sup>

E.PORETTI<sup>1</sup>

E.ANTONELLO<sup>1</sup>

<sup>1</sup>Osservatorio Astronomico di Brera

Via Bianchi, 46

22055 Merate

Italy

<sup>2</sup>Dipartimento di Fisica Nucleare e Teorica

Universita' di Pavia

Italy

## References:

- Antonello, E., Mantegazza, L., Poretti, E.: 1986, *Astron. Astrophys.*, **159**, 269.
- Arellano Ferro, A.: 1985, *Monthly Not. Roy. Astron. Soc.*, **216**, 571.
- Halbedel, E. M.: 1986, *Inf. Bull. Var. Stars*, n. 2876.
- Hoffleit, D., Jaschek, C.: 1982, 'The Bright Star Catalogue', Yale University Obs.
- Poretti, E.: 1987, 98<sup>th</sup> IAU Coll., Paris 1987, in press.
- Zsoldos, E.: 1986, *Inf. Bull. Var. Stars*, n. 2913.
- Zsoldos, E.: 1987, *Proc. IAU Symp. No. 122*, I. Appenzeller and C. Jordan (eds.), 465.
- Zsoldos, E., Olah, K.: 1985, *Inf. Bull. Var. Stars*, n. 2715.

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

Number 3138

Konkoly Observatory  
Budapest  
27 January 1988  
HU ISSN 0374-0676

## NEW B,V LIGHT CURVES OF AA URSAE MAJORIS

AA UMa (S4758) was discovered as an eclipsing variable by Hoffmeister (1948). A number of periods have been determined. Tsessewitch (1956) gave a period of 3.0703 days and classified it as an Algol system; Meinunger (1961) 0.<sup>d</sup>466352 as a W UMa binary; Strohmeier and Ott (1963) 0.<sup>d</sup>763839 as a Beta Lyrae variable; Meinunger (1976) 0.<sup>d</sup>468106 and giving UBV light curves but the scatter being fairly large ; and Borovicka (1985) 0.<sup>d</sup>46812555. The spectral type of the system was given to be G2 by Götz and Wenzel (1961); F8 by Mc Donald (1964) ; G0 listed in GCVS ; and G0 by Lu (1988). The system was observed with the 60-cm reflector at Xinglong station of Beijing Astronomical Observatory on 7 nights in 1987. Its light curves were both in B and V well covered in phase. Six minima secured are as follows :

(JD hel 2,440,000+)	
6,857.2571(II)	6,885.1121 (I)
6,859.1304(II)	6,886.0493 (I)
6,860.0650(II)	7,118.2393 (I)

The stars BD +46°1544 and +46°1545 were employed as the comparison and check stars, respectively. In order to determine the magnitudes and colours of the variable, comparison and check, the star HD 84035(BD+43°1953) was used. The standard deviation in a single check-comparison magnitude was 0.007 in B and V, which indicated that the comparison was satisfactorily constant. The new observations showed that the depths of the primary and the secondary eclipses were almost identical in B, but in V the depth at phase zero was definitely deeper than that at phase 0.5.

Combining 39 moments of minima found in the literature, the new light elements of the system derived is :

Hel. Min. I= 2,446,885.1119+0. <sup>d</sup> 46812583 E
+ 21                   +21

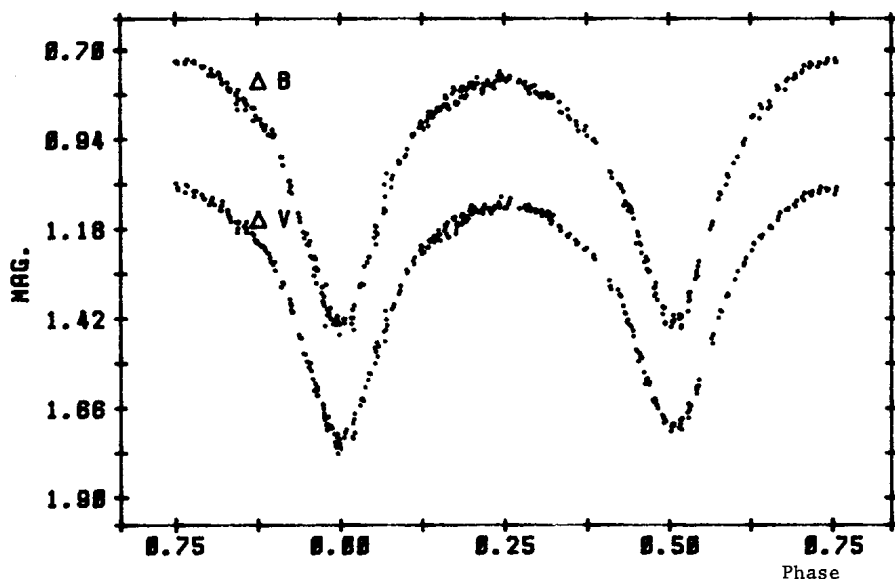


Figure 1 : Light curves of AA UMa

By comparing our minima with those determined by Meinunger, a correction of half a cycle was made to Meinunger's. This would imply that the light curves of AA UMa were variable like in the case of TZ Boo. A plot of differential magnitudes of the system with the new elements is shown in Figure 1. It is noted that the B-V index determined here is  $0^m.60$  at maxima instead of  $0^m.64$  given by Meinunger. The former is in very good agreement with GO from the spectroscopic classification by Lu. It is also noted that O'Connell effect in AA UMa is obvious. A united photometric and spectroscopic analysis of the system is under way and will be given elsewhere.

LU WENXIAN

WANG RUYOU

FAN QINGYUAN

Shanghai Observatory  
Academia Sinica  
Shanghai, China

#### References:

- Borovicka, J., 1985, Brno. Obs. and Plan. Contr., No. 26, 48.  
Götz, W. and Wenzel, W., 1961, MVS, 1, 570.  
Hoffmeister, C., 1948, Erg. A.N. 12, 1.  
Lu, W.X., 1988, Acta Astrophysica Sinica, 8.  
McDonald, D., 1964, Virginia Publ. XII, 54.  
Meinunger, L., 1961, MVS, 1, 557.  
Meinunger, L., 1976, MVS, 7, 139.  
Strohmeier, W. and Ott, H., 1963, IBVS, No. 38.  
Tsessewitch, V.P., 1956, AC Kasan, No. 170.

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

Number 3139

Konkoly Observatory  
Budapest  
28 January 1988  
HU ISSN 0374-0676

UBVRI OBSERVATIONS OF  
THE CHROMOSPHERICALLY ACTIVE STAR HD 155555 (V824 Ara)  
IN 1986 AND 1987

The RS CVn-type binary with the memorable name HD 155555 (now called V824 Ara) has a relatively short orbital period  $P = 1.6817$  days and consists of components of similar mass (Bennett *et al.*, 1962, Stacy *et al.*, 1980, Fernández-Figueroa *et al.*, 1986). Its optical variability was described by Udalski and Geyer (1984) who found a typical spotted-star migration-wave with the amplitude of about 0.08 in  $V$ . The rotation period implied by the spot re-appearance was found to be 1.66 days. Udalski and Geyer gave references to the literature before 1984. The subsequent photometric publications were by Bopp *et al.*, (1986) ( $UBV$  data obtained in 1985), Lloyd Evans and Koen (1987) ( $UBVR_{CI}$  data from 1979 and 1981), and Collier Cameron (1987) ( $UBVR_{CI}$  data from 1979 and 1980).

The present paper contributes to the monitoring of the optical variability of HD 155555. The observations were obtained in June 1986 and in March 1987 at the Las Campanas observatory using the 61 cm telescope of the University of Toronto and the single-channel photometer. The E regions were observed to place the observations in the Cousins  $UBVR_{CI}$  system. Continuously poor photometric conditions prevailed during both runs and it is rewarding that the data for comparison stars do not drastically differ from those obtained by previous observers. There may exist some systematic differences for the  $B - V$  and  $U - B$  colours of the comparison stars, most probably due to the redness of both stars because mean colours for the program star do not show any systematic deviations. The  $VR_{CI}$  data seem to be in good accord with the previous observations. The mean data for the comparison stars are given in Table I.

Each observation of HD 155555 was referenced to both comparison stars and a mean value was taken. These mean values are listed in Table II. The phases in that table have been computed using the ephemeris for the light minimum given by Udalski and Geyer (1984):

$$\text{Min. (JD hel.)} = 2445803.07 + 1.66 E$$

The observations for both years are shown in the graphical form in the accompanying figure. As we can see there, the time of minimum light was observed to agree with the ephemeris in 1986 but was shifted by about a half of the period in 1987. This shift can be due either to a spot migration or to an accumulated uncertainty in the rotational period. The approximate moments of the light minima in 1986 and 1987, which – in future – may help to define better the variability characteristics of HD 155555 are:

$$\begin{aligned} \text{June 1986: Min. (JD hel.)} &= 2446583.30 \\ \text{March 1987: Min. (JD hel.)} &= 2446867.95 \end{aligned}$$

Table I

## THE COMPARISON STARS FOR HD 155555

$U - B$	$B - V$	$V$	$V - R_C$	$V - I_C$	Reference
HD 156427					
1.656	1.494	7.395	0.805	1.543	Udalski and Geyer (1984)
1.660	1.492	7.410			Bopp <i>et al.</i> , (1986)
	1.50	7.42	0.80	1.53	Collier Cameron (1987)
1.695	1.453	7.417	0.797	1.555	Las Campanas 1986
1.712	1.469	7.419	0.790	1.558	Las Campanas 1987
HD 154775					
1.962	1.587	7.589	0.865	1.744	Udalski and Geyer (1984)
2.006	1.532	7.616	0.874	1.742	Las Campanas 1986
2.056	1.555	7.615	0.865	1.734	Las Campanas 1987

Table II

 $UBVR_CI_C$  OBSERVATIONS OF HD 155555

JD(hel)	Phase	$U - B$	$B - V$	$V$	$V - R_C$	$V - I_C$
2446000 +						
582.590	0.590	0.303	0.776	6.728	0.451	0.910
582.709	0.662	0.302	0.783	6.749	0.452	0.909
583.608	0.204	0.265	0.805	6.773	0.451	0.897
583.705	0.262	0.281	0.795	6.757	0.451	0.897
584.625	0.816	0.286	0.786	6.774	0.450	0.898
584.738	0.884	0.265	0.782	6.761	0.452	0.903
585.607	0.408	0.298	0.786	6.717	0.448	0.885
587.659	0.644	0.287	0.789	6.725	0.443	0.886
588.620	0.223	0.329	0.790	6.798	0.457	0.906
589.626	0.829	0.279	0.788	6.744	0.444	0.885
860.878	0.234	0.317	0.805	6.801	0.457	0.916
861.852	0.820	0.338	0.799	6.729	0.446	0.904
865.865	0.238	0.274:	0.779	6.774	0.446	0.904
867.860	0.440	0.304:	0.812	6.786	0.443	0.908
868.847	0.034	0.362:	0.785	6.708	0.446	0.892
869.828	0.625	0.329	0.806	6.786	0.460	0.917
870.823	0.225	0.270:	0.799	6.755	0.445	0.899

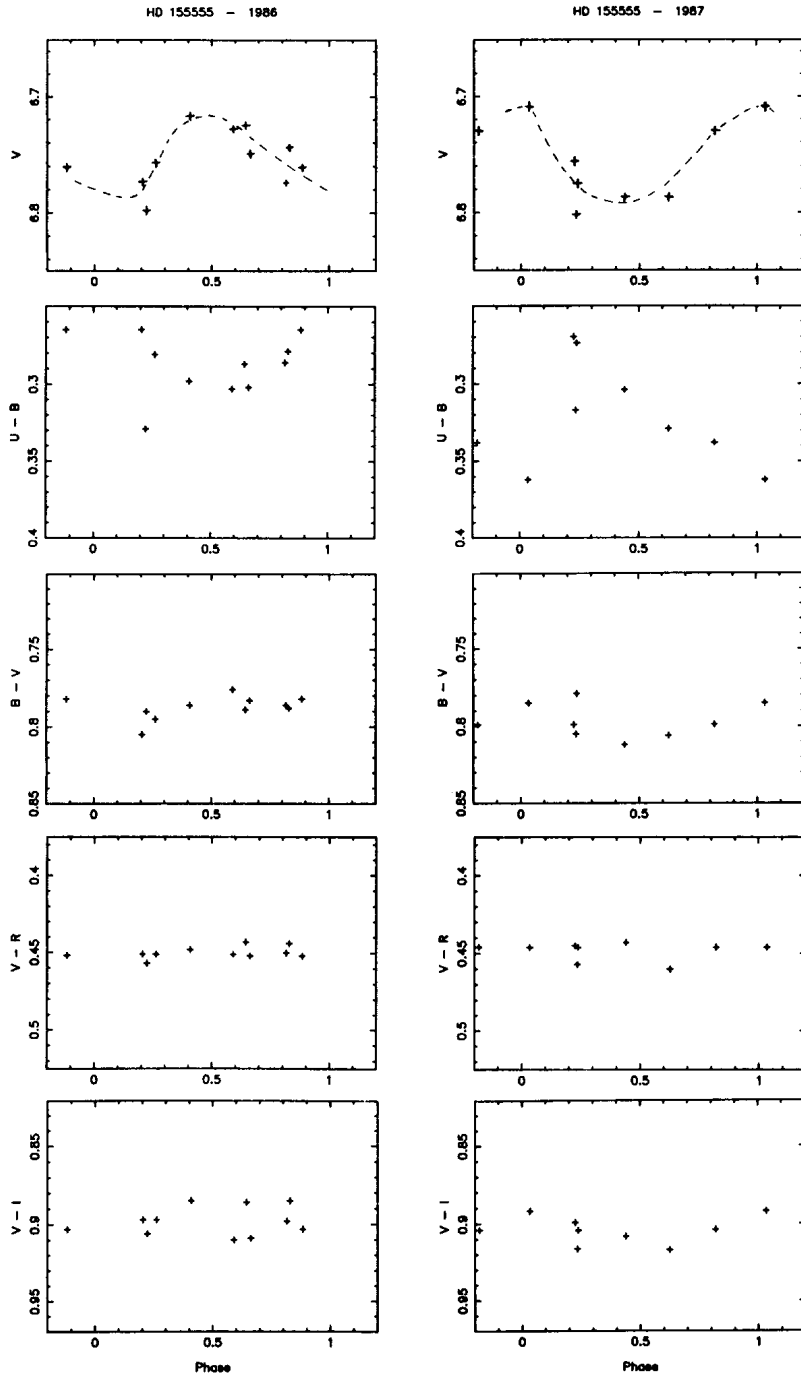


Figure 1

The mean brightness of HD 155555 during both seasons was about  $V = 6.76$ , i.e. by about 0.09 fainter than observed by Udalski and Geyer (1984) and by about 0.03 fainter than observed by Bopp *et al.*, (1986), but in a good agreement with the somewhat lower levels observed by Lloyd Evans and Koen (1987) and Collier Cameron (1987). The amplitude  $\Delta V \simeq 0.08$  was similar to that observed by all previous observers. The mean colour data also agree very well with the previous results (notice, however, that  $V - I_C$  of Udalski and Geyer deviates by about 0.05 from all other results).

The very small colour variations of HD 155555 seem to reveal a relationship which seems to be standard for spotted stars in that most of the colours (except  $U - B$ ) become redder for the decreased brightness. This tendency is better visible in  $B - V$  and  $V - I_C$ . The  $V - R_C$  colour does not seem to change by much whereas the  $U - B$  colour becomes more ultraviolet for the decreased brightness of the star. This phenomenon is also characteristic for spotted stars where dark regions are apparently surrounded by areas of increased chromospheric activity.

This work has been supported by an operating grant of the Natural Sciences and Engineering Research Council of Canada.

S. M. RUCINSKI  
David Dunlap Observatory  
University of Toronto  
P. O. Box 360  
Richmond Hill, Ontario L4C 4Y6  
Canada

#### References:

- Bennett, N. W., Evans, D. S., and Laing, F. D.: 1962, Roy. Obs. Bull. No. 61.  
Bopp, B. W., Africano, J., and Quigley, R.: 1986, Astron.J., **92**, 1409.  
Collier Cameron A.: 1987, S. Afr. Astr. Obs. Circ. No. 11, 57.  
Fernández-Figueroa, M. J., Sedano, J. L., and de Castro, E.: 1986, Astron. Astrophys., **169**, 237.  
Lloyd Evans, T., and Koen, M. C. J.: 1987, S. Afr. Astr. Obs. Circ. No. 11, 21.  
Stacy, J. G., Stencel, R. E., and Weiler, E. J.: 1980, Astron.J., **85**, 858.  
Udalski, A., and Geyer, E. H.: 1984, Inf. Bull. Var. Stars, No. 2593.

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3140

Konkoly Observatory  
Budapest  
28 January 1988  
HU ISSN 0374-0676

HIGH SPEED PHOTOMETRY OF HAMUY'S VARIABLE

During work on a photoelectric sequence for the Seyfert galaxy Arakelian 120, Mario Hamuy discovered a blue variable star with short term brightness variations similar to those of cataclysmic variables (Hamuy and Maza, 1986a,b). High speed photometry of Hamuy's star by Bond et al. (1987) confirmed the presence of rapid flickering, with a total range of  $\sim 0.15$  mag. A low quality spectrum of the star showed the presence of a broad H $\beta$  absorption line with a central, possibly double, emission peak. The presence of the absorption component suggests that Hamuy's star belongs to the UX UMa class of cataclysmic variables.

On 30 December 1986 we obtained a 3.6 hr photometric run on Hamuy's star, using the University of Texas High Speed Photometer (Nather 1973) on the 82-in Struve reflector at McDonald Observatory. 3 sec integrations in 'white light' (i.e. no photometric filter in front of the RCA 8850 photomultiplier) were obtained, starting at 06 hr 07 min 58 sec U.T. The light curve, with sky subtracted and extinction removed, is shown in Figure 1. The ordinate is the fractional intensity variation about the mean.

The star shows rapid flickering activity with a total range of 0.25 mag. Although the flickering is rather more rapid and of greater amplitude than is characteristic of UX UMa itself (Warner and Nather 1972) or of other UX UMa stars such as RW Sex (Hesser, Lasker and Osmer 1972) and V3885 Sgr (Cowley, Crampton and Hesser 1977), the brightest of the UX UMa stars, IX Vel, does show rapid flickering, albeit of lower amplitude (Williams and Hiltner 1984). The UX UMa stars have orbital periods 3-5 hours; our run is of sufficient length to exclude the possibility of any large brightness modulation in this period range.

However, there is also a resemblance between the light curve of Hamuy's star and that of EX Hya (Warner 1973 and unpublished), which indicates that an orbital period less than 2 hours should also be considered.

The eclipses in EX Hya are narrow and often of irregular profile (Warner 1972 and unpublished). Such features, if they exist in Hamuy's star, would be difficult to detect amidst the flickering activity. However, we note that

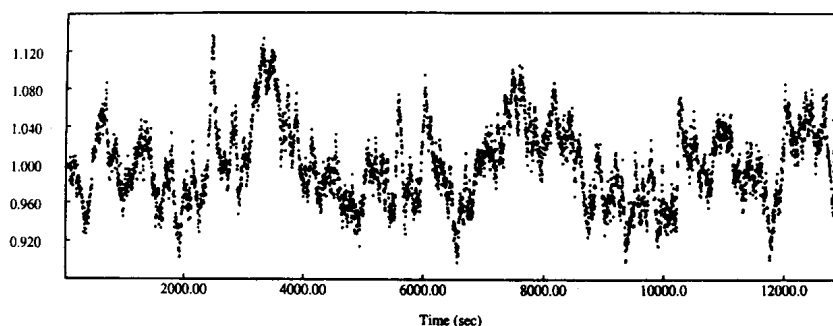


Figure 1 ; Light curve of Hamuy's star at 3 sec time resolution. The vertical scale is relative intensity.

the separation of the two low dips in the light curve of Bond et al. (1987) is 0.0592 days and the separation between the two narrow eclipse-like features that occur in our light curve near times 6500 secs and 11800 secs is 0.0601. The earlier feature, near time 2000 secs, is however separated by 0.054 day from the next dip. The near coincidence of some of these separations, and the similarity of the light curve with that of EX Hya, indicates that a more extensive campaign of spectroscopy and photometry of Hamuy's star is justified.

BRIAN WARNER<sup>1,2</sup>  
R. EDWARD NATHER<sup>1</sup>

- 1 Department of Astronomy, University of Texas, Austin, Texas, U.S.A.
- 2 Department of Astronomy, University of Cape Town, 7700 Rondebosch, South Africa.

#### References:

- Bond, H.E., Grauer, A.D., Burstein, D. and Marzke, R.O., 1987, *Publ. astr. Soc. Pacific*, **99**, 1097.  
 Cowley, A.P., Crampton, D. and Hesser, J.E., 1977, *Astrophys. J.*, **214**, 471.  
 Hamuy, M., and Maza, J., 1986a, *Int. Astr. Un. Circ. No.* 4172.  
 Hamuy, M., and Maza, J., 1986b, *Inf. Bull. Var. Stars*, No. 2867.  
 Hesser, J.E., Lasker, B.M. and Osmer, P.S., 1972, *Astrophys. J.*, **176**, L31.  
 Nather, R.E., 1973, *Vistas in Astr.* **15**, 91.  
 Warner, B., 1972, *Mon. Not. R. astr. Soc.*, **158**, 425.  
 Warner, B., 1973, *Mon. Not. astr. Soc. S. Af.*, **32**, 120.  
 Warner, B. and Nather, R.E., 1972, *Mon. Not. R. astr. Soc.* **159**, 429.  
 Williams, G.A., and Hiltner, W.A. 1984, *Mon. Not. R. astr. Soc.*, **211**, 629.

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

Number 3141

Konkoly Observatory  
Budapest  
1 February 1988  
HU ISSN 0374-0676

## ON THE PERIOD CHANGE OF THE RR LYRAE-TYPE VARIABLE XZ CYGNI

Based upon 2500 photographic, photovisual and visual observations obtained by the author between 1957 - 1985, as well as upon published data by other authors, an analysis was made of the behaviour of the mean fundamental pulsation period of XZ Cygni (Bezdeneshnyi 1977, 1986).

Table I shows the moments of 46 mean maxima derived, the corresponding (O-C)-residuals and the numbers of the main cycle E calculated by means of Klepikova's (1970) linear elements:

$$\text{Max. hel.} = \text{J.D.}2436933.981 + 0.466579 \cdot E.$$

Table I

Max.hel J.D. 2400000+	O-C	E	notes	Max.hel. J.D. 2400000+	O-C	E	notes
36084.336	-0.006	- 1821	pg	45906.225	-0.537	+19231	pg
36435.217	+0.017	- 1069	pg	46281.385	-0.507	+20035	pg
37074.422	+0.004	+ 301	pg	44412.441	-0.802	+18030	pg
37512.536	+0.005	+ 1240	pg	45209.502	-0.657	+17738	pg
37896.533	-0.006	+ 2063	pg	45608.474	-0.611	+18593	pg
38354.243	-0.001	+ 3044	pg	45916.483	-0.544	+19253	pg
38983.187	-0.010	+ 4392	pg	46303.290	-0.531	+20082	pg
39377.418	-0.040	+ 5237	pg	36448.269	-0.008	- 1041	pv
39721.299	-0.032	+ 5974	pg	36809.416	+0.012	- 267	pv
40230.267	-0.099	+ 7065	pg	37174.269	-0.002	+ 515	pv
40986.458	-0.233	+ 8686	pg	37521.410	+0.003	+ 1259	pv
41642.349	-0.351	+10092	pg	37904.475	+0.008	+ 2080	pv
41545.280	-0.368	+ 9884	pg	38253.480	+0.014	+ 2828	pv
42292.140	-0.501	+11485	pg	38645.411	+0.010	+ 3668	pv
42626.588	-0.590	+12202	pg	38990.168	-0.026	+ 4407	pv
42981.525	-0.720	+12963	pg	39373.244	-0.011	+ 5228	pv
43357.487	-0.821	+13769	pg	39785.202	-0.045	+ 6111	pv
43732.535	-0.902	+14573	pg	40465.384	-0.133	+ 7569	pv
44081.555	-0.883	+15321	pg	40814.336	-0.183	+ 8317	pv
44467.495	-0.804	+16148	pg	41176.325	-0.262	+ 9093	pv
44814.253	-0.714	+16891	pg	41649.323	-0.372	+10107	pv
45187.586	-0.644	+17691	pg	41565.368	-0.347	+ 9927	v
45561.369	-0.591	+18492	pg	41906.355	-0.419	+10658	v

Using the observations spanning from 1905 to 1954 published by Klepikova (1959), our mean maxima, and the material obtained by other authors (see Bezdeneshnyi, 1986), the system of nine linear elements was determined by a least squares solution. All the elements of XZ Cygni are discussed and compared with those published elsewhere.

Table II

No.	Interval J.D.	Mo	P	References
1	2417000-24800	2417201.243 +9	0.4665861 +2	Martin and Plummer (1914) Bezdeneshnyi (1986)
2	24800-34600	25031.492 +2	0.4665818 +1	Payne-Gaposchkin (1947) Bezdeneshnyi (1986)
3	34600-38700	36933.981	0.466579	Klepikova (1970)
4	38700-39800	38983.184 +16	0.466560 +4	Bezdeneshnyi (1986)
5	39800-40750	40465.383 +11	0.466516 +2	Bezdeneshnyi (1986)
6	40750-42300	40445.805 +3	0.4664831*	Bezdeneshnyi (1977)
7	42300-43900	43628.486 +45	0.466442 +3	Taylor (1978-79) and Bezdeneshnyi (1986)
8	43900-45200	45209.507	0.466679	Bezdeneshnyi (1986)
9	45200-46300	45209.511	0.466637 +7	Bezdeneshnyi (1986)

\* the period  $P = 0.466480$  is of good fit as well (Bezdeneshnyi, 1986)  
+4

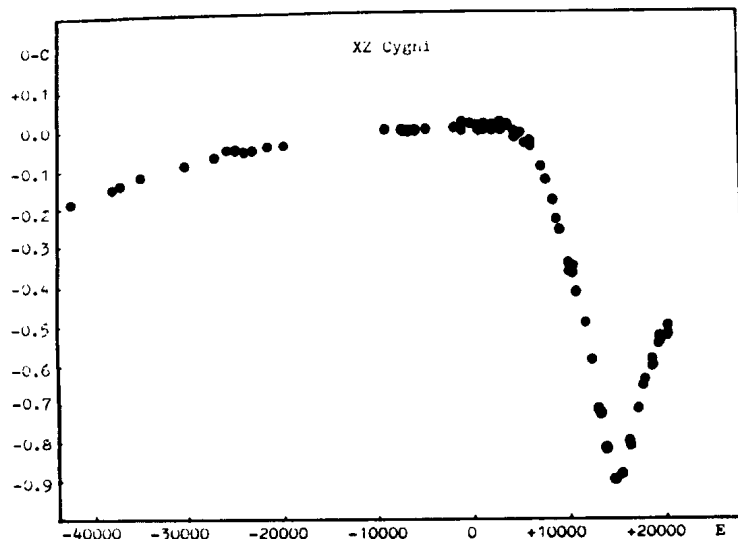


Figure 1 O-C diagram for XZ Cyg

In Figure 1 (O-C)-values are shown versus E for 80 years.

V.P. BEZDENEZHNYI  
Odessa Observatory, USSR.

References:

- Bezdeneshnyi, V.P. 1977, The Variable Stars, Suppl. 3, 14, 125.  
Bezdeneshnyi, V.P. 1986, in: "The Problems of Astronomy" , V.2  
Ukrain. Res. Inst. Sci. Techn. Inform.  
(UkrNIINTI) No 430, p.127-148.  
Klepikova, L.A. 1959, The Variable Stars, 12, 164.  
Klepikova, L.A. 1970, S.A.C. 42.  
Martin, C. and Plummer, H.C. 1914, M.N. 74, 225.  
Payne-Gaposchkin, C. 1947, H.A. 118, No 19.  
Taylor, P.O. 1978-79, J.A.A.V.S.O. 7, No 2, 82.

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

Number 3142

Konkoly Observatory  
Budapest  
2 February 1988  
HU ISSN 0374-0676

SIMULTANEOUS TWO-COLOUR OBSERVATION OF THE  
FLARE STAR EV Lac IN SEPTEMBER 1987

Photoelectric monitoring of the flare star EV Lac has been carried out with the help of two-channel photoelectric photometer attached to the 40 cm Cassegrain reflector of the Byurakan Astrophysical Observatory. The photometer gives us the possibility to record flares in both U and B colours simultaneously with time resolution equal to 0.01 sec (Zalinian and Tovmasian, 1987).

On 15 September 1987 a flare of 40 min duration was recorded with time resolution of 0.1 sec. The light curve and colours of the flare are given in Figures 1 and 2. In Fig.2 the light curve of the flare is averaged over 5 points.

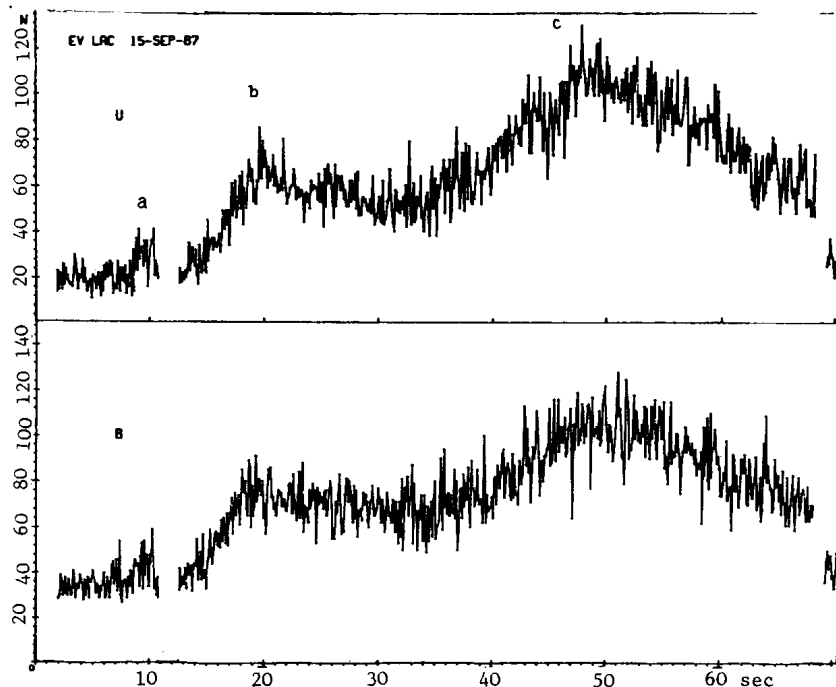


Figure 1

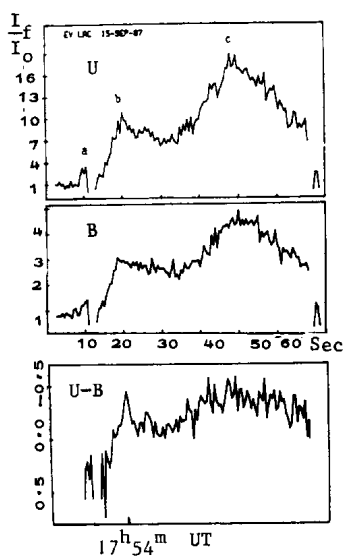


Figure 2

The light curve shows, that the flare obviously consists of two maxima "b" and "c", and that the flare is preceded by a faint precursor of 2 s duration. A similar preflare of 1.5 s duration and  $\Delta m_u = 1.1^m$  was recorded on 8 August 1985 at 5 s before the beginning of the main flare with an amplitude of  $\Delta m_u = 2.2^m$  (Zalinian and Tovmassian, 1986).

The durations of preflares in both cases are small (in both cases < 3 s). If such preflares really occur before each large flare they could not be recorded in observations with larger integration time.

Table I

max	T (sec)	$\Delta m_u$	$\Delta m_s$	U - B	Duration (min)
a		1.2	0.4	0.3	
b	63	2.6	1.1	-0.4	
c	27	3.1	1.6	-0.5	40

The main characteristic features of the observed flare are given in Table I in which T is the time interval between maxima "a" and "b", and "b" and "c";  $\Delta m_u$ ,  $\Delta m_b$ ; amplitudes of flares in U and B colours; U - B: colour of the star during the flare.

V.P. ZALINIAN  
Byurakan Astrophysical Observatory  
Byurakan, Armenia, USSR

## References:

- Zalinian V.P., Tovmassian H.M., 1986, Soobshch. Byurakan Obs., 58 .  
Zalinian V.P., Tovmassian H.M., 1987, IBVS, No. 2992.

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

Number 3143

Konkoly Observatory  
Budapest  
5 February 1988  
HU ISSN 0374-0676

A POSSIBLE VARIABLE STAR INSIDE THE ERROR BOX  
OF GRBS 790331

A possible unknown variable star has been found inside the error box of the gamma-ray burst source 790331 (Laros et al., 1985).

The faint star at  $RA = 19^h 25^m 25.4(+1.3)$ ,  $\delta = +03^{\circ}35'40''(+20'')$  (1950.0) having normally  $m_{pg} \sim 15.7$  shows increased brightness at  $m_{pg} \sim 14.6$  on the plate taken by the 40 cm astrograph at the Sonneberg Observatory of the Central Astrophysical Institute of the Academy of Sciences of the GDR on July 26, 1962 (JD 243 7872.468). The plates taken by the same instrument  $\sim 1$  h before and  $\sim 2$  d aftershow the star at the normal, fainter light.

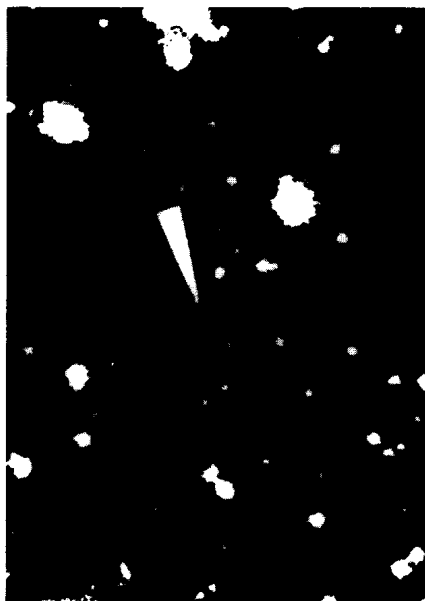


Figure 1 : Finding chart for the suspected variable star. Size of the frame represents  $9 \times 6$  arcmin<sup>2</sup>.

The investigation of this star using more than 400 astrograph plates from the Sonneberg collection has revealed no other brightening in the time interval 1928 - 1987, although low-amplitude ( $\sim 0.3 - 0.4$  mag.) magnitude variations cannot be ruled out. The examination of the POSS prints has revealed no remarkable color of the star.

More optical data are needed to confirm the variability found, to make a classification of this suspected variable star and to clarify the possible relation to the GRBS 790331.

R. HUDEC  
Astronomical Institute  
251 65 Ondřejov  
Czechoslovakia

Reference:

Laros J.G. et al.: 1985, *Ap. J.* 290, 728.

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

Number 3144

Konkoly Observatory  
Budapest  
8 February 1988  
HU ISSN 0374-0676

STRÖMGREN PHOTOMETRY OF UU Her : 1987 RESULTS

UU Her is an F supergiant that seems to be the prototype of a class of evolved stars. All of them share peculiar photometric variability, spectral type and position very high above the galactic plane. Basic photometric features are the long periods, small amplitudes, and remarkable mode switching of two or more periods. In particular UU Her is known to switch between periods of  $\sim 45$  and 72 days (Ferne 1986), in addition, Sassellov (1983) found the star to have a period of 80 days in 1978-1979.

Within a program aimed to study the photometric and spectroscopic behaviour of these stars, we performed u,v,b,y photometry of UU Her, from June to November 1987 at the 91 cm Cassegrain telescope of the Catania Astrophysical Observatory with a photon-counting photoelectric photometer.

The same set of standard Strömgren filters but different photomultipliers (EMI 6256/s and EMI 9658/Ra) were used throughout the observing period. Even if the EMI 9658/Ra has a sensitivity extended to the red, no difference due to the red leak has been found in the instrumental photometric system.

Two main comparison stars BD +38° 2798 ( $V = 8.866$ ,  $B-V = 0.417$ ; Sassellov et al. 1987) and HR 6123 ( $V = 5.535$ ,  $b-y = 0.112$ ; Ferne 1986) have been used to carry out differential photometry. In addition ten u,v,b,y standard stars have been nightly observed to deduce b-y, m<sub>1</sub>, c<sub>1</sub> indices. BD +38° 2798 is named TZ Her as variable, but in the last General Catalogue of Variable Stars (Kholopov, 1985) is reported as non variable. No evidence of variability is seen from our observations displayed in Figure 1, where BD +38° 2798 is plotted against HR 6123, in agreement with the photometry of Ferne (1986). The external error of our differential photometry estimated from the nightly averages of the differential observations between the two comparison stars, weighted by the dispersion around the mean of each night, turns out to be about 0.004 mag. Magnitude differences of UU Her with respect to HR 6123 in the y filter are shown in Figure 2 and a summary of the photometric results is given in Table I.

The y filter light curve plotted in Figure 2 is characterized by two minima of different depth, so that UU Her in 1987 appears to show an RV Tau-like behaviour. The interval between the two minima is about  $45 \pm 2$  days

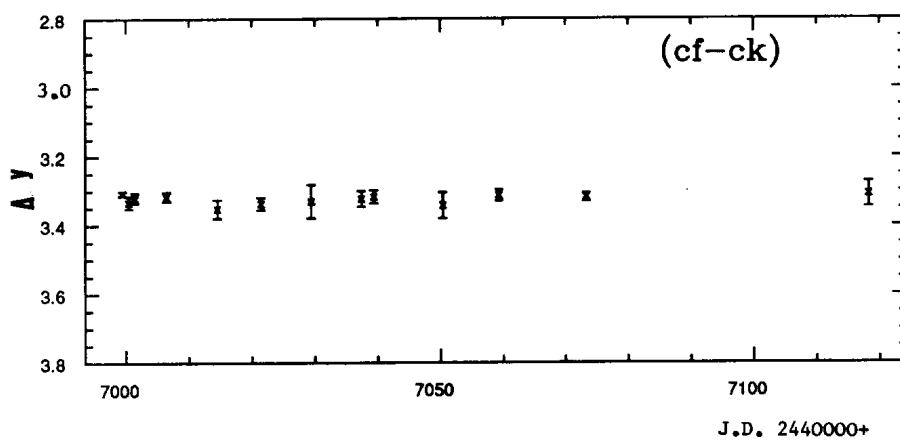


Figure 1

Differential magnitudes of our comparison stars.  
 (BD +38°2798 - HR 6123)  
 Error bar is the standard deviation of each night

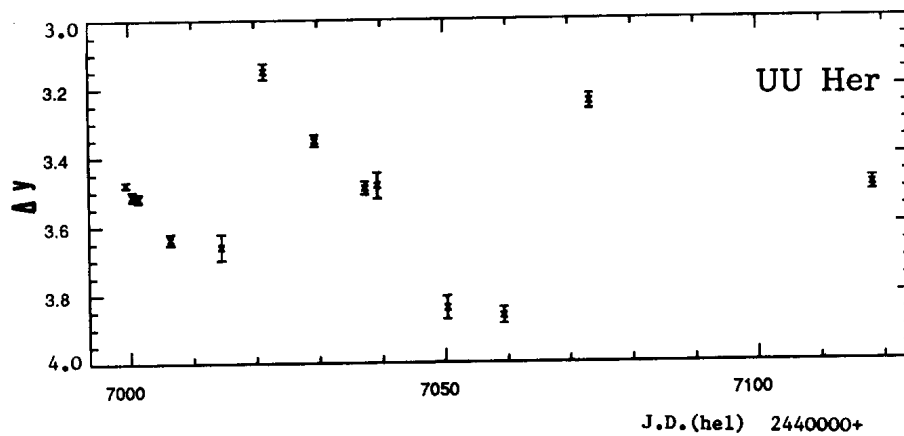


Figure 2

Light curve of UU Her against HR 6123

Table I  
UU Her Strömgren Photometry in 1987

Julian Day	$\Delta y$	b-y	c1	m1
2440000.0+				
6999.425	3.478	0.429	0.788	0.129
7000.427	3.512	0.449	0.919	0.142
7001.412	3.517	0.417	0.919	0.141
7006.428	3.637	0.419	0.862	0.153
7014.481	3.660	0.310	0.863	0.247
7021.411	3.149	0.215	1.123	0.173
7029.396	3.353	0.414	1.003	0.078
7037.372	3.491	0.471	0.965	0.147
7039.363	3.484	0.446	0.982	0.190
7050.354	3.840	0.500	0.886	0.198
7059.320	3.863	0.459	0.824	0.124
7073.301	3.243	0.361	1.074	0.114
7118.275	3.489	0.346	0.899	0.241

and the difference in the depth in the y filter is about 0.2 mag. This light curve is in very good agreement with the one observed in 1961 (Ferne 1986). In 1984 and 1985 UU Her showed a fairly constant sinusoidal light curve with 71.3 day period (Sasselov et al., 1987), so that we have seen a new switch in the pulsation mode of this enigmatic star.

G. UMANA<sup>1</sup>, S. CATALANO<sup>1</sup>, E. MARILLI<sup>2</sup>, C. TRIGILIO<sup>1</sup>

<sup>1</sup> Institute of Astronomy, University of Catania

<sup>2</sup> Catania Astrophysical Observatory  
Citta' Universitaria  
Viale A. Doria 6  
95125 Catania, Italy

#### References:

- Ferne J.D. 1986, Ap.J. 306,642.  
Kholopov P.N., 1985 General Catalogue of Variable Stars, Moscow, Nauka.  
Sasselov D. 1983, IBVS, No. 2387,  
Sasselov D., Zsoldos E., Ferne J.D. and Arellano Ferro A., 1987, PASP 99,967.

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

Number 3145

Konkoly Observatory  
Budapest  
8 February 1988  
HU ISSN 0374-0676

## PHOTOMETRIC OBSERVATIONS OF THE INTERMEDIATE POLAR AO PISCUM

In this note we present the results of photometric observations of the intermediate polar AO Psc (H2252-035) obtained by one of us (JK\*) on the night of September 14, 1986 at the Cerro Tololo Inter-American Observatory (CTIO).

The observations were carried out with the 1.0 m telescope of the CTIO equipped with a one channel photometer used in pulse counting mode. The observations were made in the B filter with a 27 arcsec diaphragm. The integration time usually was 10 seconds. The sky and the comparison star were measured every 14 min on the average. The comparison star was the star located approximately 5'2 South and 6' West (see the chart of Griffiths et al. 1980).

During the observations we made one UBV measurement of the comparison star and two UBV measurements of the variable. They are given in Table I. The transformation to the standard UBV system was performed using the procedure and the formulae described in the paper by Semeniuk and Kaluzny (1988).

Table I  
UBV measurements

Star	JDHel.	V	B - V	U - B
	2446688.+			
Comp.	0.5386	9.72	0.58	0.07
AO Psc	0.5404	13.34	0.02	-0.94
AO Psc	0.6872	13.26	0.00	-1.05

Figure 1 presents the light curve of AO Psc.  $\Delta B$  denotes the difference between the variable and comparison star in the instrumental B magnitude.

Using our observations we calculated the moments of maximum light for three periodicities present in the object. The orbital maximum was determined by fitting a sinusoid of the fixed orbital period to the observations. To derive the mean times of maximum light of the 859 s and 805 s pulsations we have applied the same analysis as for the 20.9 min and 22.9 min periodicities of FO Aqr (Semeniuk and Kaluzny 1988).

\* Guest observer at the Cerro Tololo Inter-American Observatory,

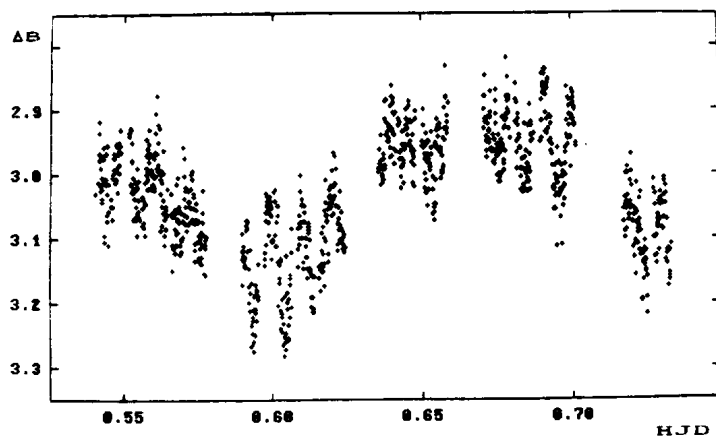


Figure 1

Table II

Times of maximum light

Periodicity	JD Hel	$\sigma$	E
	2446688.+		
Orbital	0.6710		12194
859 s	0.6098	$\pm 0.0004$	152381
805 s	0.6094	$\pm 0.0007$	193648

Table III

Ephemerides for times of maximum light.

$$\text{HJD Max} = M_0 + P_0 E + BE^2.$$

Periodicity	$M_0$	$P_0$	$B \cdot 10^{13}$
	2440000.+		
Orbital	4864.1428	0.1496252	-
	$\pm 0.0028$	$\pm 0.0000005$	
859 s	5174.18142	0.009938493	-3.87
	$\pm 0.00016$	$\pm 0.000000002$	$\pm 0.25$
805 s	4883.92074	0.009319484	-2.87
	$\pm 0.00037$	$\pm 0.000000004$	$\pm 0.30$

Our times of maximum light are listed in Table II where  $\sigma$  denotes the r.m.s. error. We added these times to the samples collected by van Amerongen et al. (1985) and we obtained the ephemerides given in Table III. The epochs E of maximum light in Table II are calculated with these ephemerides.

The ephemerides of Table III are, within the error limits, the same as obtained by van Amerongen et al. (1985) and confirm the conclusion of these authors : there is no evidence for a change in the orbital period, while the periods of the 859 s and 805 s pulsations are decreasing.

J.K. thanks Dr. R.W. Williams for the opportunity to observe at Cerro Tololo, and to Mike Shara for his generous support of the trip to Chile.

JANUSZ KALUZNY and IRENA SEMENIUK  
Warsaw University Observatory  
Warszawa, Poland

#### References:

- Griffiths, R.E., Lamb, D.Q., Ward, M.J., Wilson, A.S., Charles, P.A.,  
Thorstensen, J., McHardy, I.M., Lawrance, A., 1980, M.N.R.A.S.,  
193, 25P.  
Semeniuk, I., and Kaluzny, J., 1988, Acta Astr., 38, in press.  
Van Amerongen, S., Kraakman, H., Damen, E., Tjemkes, S., and van Paradijs, J.,  
1985, M.N.R.A.S., 215, 45 p.

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

Number 3146

Konkoly Observatory  
Budapest  
9 February 1988  
HU ISSN 0374-0676

**TW HYA: A T TAURI STAR FAR FROM ANY DARK CLOUD  
UBVRI OBSERVATIONS IN 1986 AND 1987**

TW Hya is one of the most interesting objects among young late-type stars. Herbig (1978) pointed it out as a possible candidate for being one of – then very rare – post-T Tauri stars. However, a multi-angled investigation of Rucinski and Krautter (1983; hereinafter RK) definitely showed it to be an absolutely normal T Tauri star. The main point here is that TW Hya is quite far ( $\approx 13^\circ$ ) from any dark cloud, star formation complex, or other concentration of young proto-stellar material. Yet, it is definitely not “naked” – as defined by Walter (1987) for stars which exhausted supplies of the circumstellar accretable matter – and shows clear signatures of a classical T Tauri stage. TW Hya may have formed in an isolated small cloud, as de la Reza *et al.*, (1986) suggest, but it must have retained enough circumstellar matter to insure the continuing accretion.

The variability of TW Hya was observed in 1982 to be quite erratic (RK). Short time-scale trends of a few hours in duration were seen to be superimposed on, or combined with longer night-to-night variations. The total range was  $10.9 < V < 11.3$ . The colours were redder for lower brightness, but parallel trends in colour–magnitude plots on individual nights suggested a few sources simultaneously contributing to the variability. Dr. F. Vrba (private communication) noticed a possible periodicity of about 2 days in the RK data which could have been the spot modulation, as observed in other T Tauri and naked T Tauri stars (Bouvier *et al.*, 1986a, 1986b; Herbst 1986; Rydgren and Vrba 1983; Rydgren *et al.*, 1984). An independent analysis of the RK data has shown that such a periodicity is definitely present. Unfortunately, its reality may be questioned because it is practically identical with the quasi-Nyquist frequency for the data sampled in close groups at one-day intervals.

The present observations were obtained in June 1986 and in March 1987 at the Las Campanas observatory using the 61 cm telescope of the University of Toronto and the single-channel photometer. The E regions were observed to place the observations in the Cousins *UBVR<sub>C</sub>IC* system. The weather conditions were quite poor during both runs. The observations were made differentially relative to the same comparison stars as used in 1982. The new determinations of the *UBVRI* data for the comparison stars were made on 7 nights in 1986 and 5 nights in 1987 (Table I). When compared with the 1982 data which were obtained during perfect weather conditions at ESO, the new data reveal a generally good agreement of colours but some shifts in the *V* magnitudes. Since the magnitude difference between the comparison stars also changed, we may suspect some small long-term variability (by about 0.04 – 0.08 in *V*) in one or both stars. This would not entirely be unexpected in view of both comparison stars most probably being late-type giants.

The new data for TW Hya are listed in Table II and are shown in graphical form in the figure. The picture is exactly the same as in 1982. The range of variability

Table I

## THE COMPARISON STARS FOR TW HYA

$U - B$	$B - V$	$V$	$V - R_C$	$V - I_C$	Reference
C1 (SAO 202005)					
1.095	1.172	9.116	0.599	1.139	Rucinski and Krautter (1983)
1.071	1.152	9.072	0.586	1.163	Las Campanas 1986
1.080	1.156	9.090	0.570	1.158	Las Campanas 1987
C2 (HD 95470, SAO 202001, K 2/3 III)					
1.412	1.307	8.744	0.678	1.273	Rucinski and Krautter (1983)
1.406	1.275	8.652	0.662	1.300	Las Campanas 1986
1.418	1.278	8.664	0.647	1.288	Las Campanas 1987

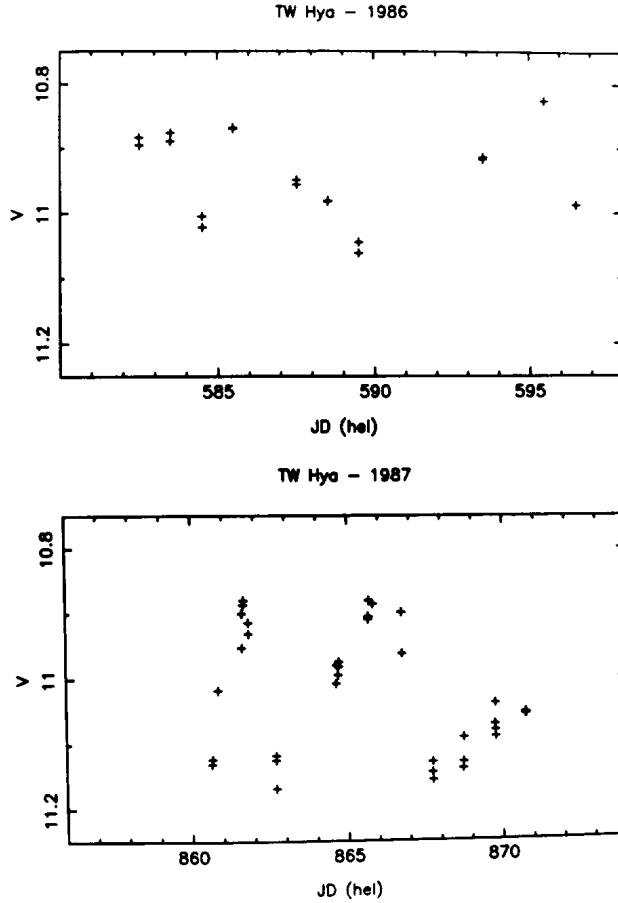


Figure 1

Table II

*UBVR<sub>C</sub>I<sub>C</sub>* OBSERVATIONS OF TW HYA

JD(hel)	<i>U</i> − <i>B</i>	<i>B</i> − <i>V</i>	<i>V</i>	<i>V</i> − <i>R<sub>C</sub></i>	<i>V</i> − <i>I<sub>C</sub></i>
2446000 +					
582.523	−0.44:	0.930	10.884	0.850	1.586
582.527	−0.36:	0.891	10.896	0.850	1.575
583.506	−0.27	0.983	10.890	0.845	1.575
583.514	−0.29	0.987	10.877	0.845	1.572
584.507	−0.28	1.085	11.005	0.905	1.678
584.518	−0.26	1.091	11.022	0.907	1.679
585.494	−0.27	0.867	10.871	0.837	1.544
585.498	−0.33	0.885	10.869	0.819	1.522
587.512	−0.30	1.020	10.950	0.878	1.630
587.516	−0.30	1.056	10.957	0.886	1.637
588.507	−0.20	1.022	10.983	0.885	1.635
588.518	−0.14	1.016	10.982	0.877	1.617
589.493	−0.20:	1.122	11.062	0.933	1.696
589.498	−0.31:	1.087	11.045	0.926	1.674
593.501	−0.31:	1.003	10.917	0.875	1.590
593.510	−0.40:	0.982	10.913	0.866	1.621
595.493	−0.58	0.921	10.826	0.893	1.556
596.512	−0.22:	0.993	10.987	0.895	1.642
860.637	0.06	1.186	11.130	0.945	1.712
860.657	−0.09	1.150	11.122	0.935	1.705
860.853	−0.05	0.999	11.017	0.885	1.628
861.616	−0.31	0.932	10.952	0.867	1.564
861.624	−0.24	0.974	10.900	0.845	1.577
861.668	−0.31	0.916	10.887	0.827	1.545
861.676	−0.26	0.937	10.880	0.816	1.545
861.823	−0.21	0.941	10.914	0.851	1.555
861.831	−0.28	0.957	10.931	0.865	1.565
862.682	0.12	1.197	11.124	0.932	1.707
862.689	0.06	1.164	11.117	0.947	1.735
862.698	0.18	1.131	11.168	0.937	1.710
864.631	−0.24	1.074	11.007	0.900	1.623
864.642	−0.30	1.093	10.979	0.893	1.626
864.696	−0.38	1.037	10.994	0.889	1.618
864.704	−0.21	0.988	10.981	0.895	1.619
864.716	−0.26	1.010	10.974	0.892	1.611
865.667	−0.35	1.053	10.909	0.845	1.576
865.675	−0.40	0.937	10.905	0.841	1.561
865.688	−0.30	0.935	10.880	0.825	1.532
865.813	−0.28	0.954	10.885	0.825	1.545
866.736	−0.34	0.971	10.898	0.908	1.568
866.748	−0.47	0.991	10.961	0.941	1.612
867.708	0.09	1.175	11.144	0.900	1.717
867.716	0.21	1.148	11.128	0.914	1.693
867.731	0.39	1.281	11.156	0.928	1.706
868.689	−0.04	1.166	11.138	0.921	1.705
868.706	0.40	1.211	11.128	0.904	1.659
868.714	0.27	1.221	11.090	0.900	1.685
869.722	0.15	1.015	11.070	0.874	1.654
869.730	0.23	1.241	11.038	0.879	1.632
869.738	−0.19	1.120	11.079	0.910	1.658
869.746	0.17	1.226	11.089	0.907	1.695
870.707		1.131	11.055	0.917	1.658
870.714		1.039	11.052	0.909	1.663
870.722		1.046	11.054	0.916	1.646

is similar, as is a general relationship between brightness and colours. The data were analysed for periodicity but, contrary to the 1982 observations, they do not reveal any clear signal of a few days in duration. This does not prove that the 2-day periodicity observed before was entirely spurious because this time scale is actually the hardest to prove or disprove anyway. A visual inspection of nightly data again seems to suggest existence of trends with a characteristic scale of about 0.2 day.

This work has been supported by an operating grant of the Natural Sciences and Engineering Research Council of Canada.

S. M. RUCINSKI  
David Dunlap Observatory  
University of Toronto  
P. O. Box 360  
Richmond Hill, Ontario L4C 4Y6  
Canada

#### References:

- Bouvier, J., Bertout, C., and Bouchet, P. 1986a, *Astron. Astrophys.* **158**, 149.  
 Bouvier, J., Bertout, C., Benz, W., and Mayor, M. 1986b, *Astron. Astrophys.* **165**, 110.  
 de la Reza, R., Quast, G., Torres, C. A. O., Mayor, M., Meylan, G., Llorente de Andrés, F. 1986, in *New Insights in Astrophysics*, ESA SP-263, p.107.  
 Herbig, G. H. 1978, in *Problems of Physics and Evolution of the Universe*, ed. L.V.Mirzoyan, Publ.Armenian Acad.Sci., Yerevan, p.171.  
 Herbst, W. 1986, *Publ. Astron. Soc. Pacific*, **98**, 1088.  
 Rucinski, S. M., and Krautter, J. 1983, *Astron. Astrophys.* **121**, 217.  
 Rydgren, A. E., and Vrba, F. J. 1983, *Astrophys.J.* **267**, 191.  
 Rydgren, A. E., Zak, D. S., Vrba, F. J., Chugainov, P. F., Zajitseva, G. W. 1984, *Astron. J.* **89**, 1015.  
 Walter, F. M. 1987, *Publ. Astron. Soc. Pacific*, **99**, 31.

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

Number 3147

Konkoly Observatory  
Budapest  
10 February 1988  
HU ISSN 0374-0676

ON THE PHOTOMETRIC FEATURES OF R CrB DUST ENVELOPE

The variable stars of RCB type constitute a small subclass of old evolved objects which show random Algol-like fadings of large amplitude (Zhilyaev et al., 1975). Besides the drastic photometric variability they show several peculiar features, as follows:

1. helium-rich, hydrogen-deficient composition (Searle, 1961; Danziger, 1965),
2. quasi-periodic light variations of intermediate amplitude (Feast, 1975; Alexander et al., 1972),
3. bright emission lines at minimum brightness (Payne-Gaposchkin, 1963),
4. variability of light polarization (Efimov, 1980),
5. infrared excess (Feast and Glass, 1973; Shenavrin et al., 1979; Stein et al., 1969).

Some of these RCB properties can be reasonably interpreted assuming that dust cloud condensations are the reason of the occasional brightness fadings. While the stellar brightness gets dimmer, the colour indices, IR-excess, degree of the light polarization and the intensity of emission lines are enhanced.

Let us consider the optical properties of the dust cloud without touching the question of the dust genesis. In spite of numerous multicolour photoelectric observations of the star, the optical properties of RCB circumstellar dust are not completely understood. For a long time two observational facts, viz.

- a.) the profound difference of the reddening factors  $R$

$$R = A_V / E_{b-v} = \Delta V / \Delta(B-V)$$

for descending ( $R_d$ ) and ascending ( $R_a$ ) branches of a light curve, since according to observations  $R_d \gg R_a$ ;

- b.) noticeable variability of factor  $R_d$  during the recovery phase as the star brightness grows from minimum to the normal level; led some investigators to the spurious conclusion that RCB dust significantly differs from interstellar dust with  $R_{is} = 3.2$  (Wing et al., 1972).

Our study implies that it is not the case. Fernie et al., (1972) were the first who turned attention to the case that  $R_{\downarrow} \gg R_{is}$  could not be only due to the intrinsic properties of the dust particles but might also point to the existence of dense obscuring clouds which partially cover the stellar disk. An assumption of the heterogeneity of obscuring matter over the disk of the star allows to explain the variability in the  $R_{\downarrow}$  and  $R_{\uparrow}$  (Pugach, 1984). To avoid or at least to reduce the influence of the heterogeneity upon  $R_{\uparrow}$  one should make photometric observations near the normal brightness ( $\Delta V \approx 0.05$ ) when obscuring matter is more or less uniform in a projection over the stellar disk.

We took our UBVR-observations of R CrB during its recovery phases when the brightness of the star was approaching to the normal level and V-magnitudes ranged within  $5.8 - 6.6$ . Observations were made at Terskol Peak, the Caucasus (3100 m) with the 0.5 m reflector equipped with an automatic single-channel photometer. We used HD 141352 = BD +28°2475 (F2) as a comparison star and HD 140913 = BD +28°2469 (G0 V) as a check one. Their magnitudes were obtained by means of differential measurements with standard star BS 5889 = HD 141714 = BD +26°2737 (G5 III).

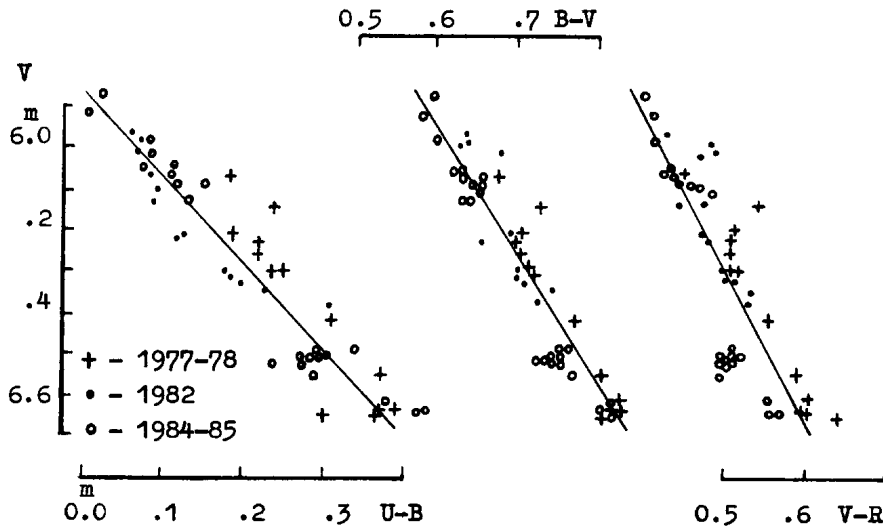


Figure 1

We observed two R CrB minima in 1977-78 and 1982 and the 1983-84 minimum was observed by Goncharova (1985). In Fig. 1 V-R, B-V and U-B colour indices are plotted against V-magnitudes (1977-78 -- crosses, 1982 -- dots and 1983-84 -- circles). The solid lines represent the law:

$$\Delta V = 3.81 \Delta(V-R); \quad \Delta V = 3.20 \Delta(B-V); \quad \Delta V = 2.12 \Delta(U-B).$$

Two remarks are to be added to these figures.

1. Data of the three minima of R CrB are within the limit of one relation. It points to the constant character of the optical properties of the dust within some years.
2. The V versus (B-V) and V versus (V-R) dependences for R CrB exactly coincide with that of interstellar extinction law (Schultz, Wiemer, 1975) implying that RCB dust causes the same extinction effect within 0.4 - 0.7 microns as the interstellar matter.

Thus, as follows from our observations, the optical properties of the RCB dust bear a strong resemblance with that of interstellar matter in the R, V, B passbands and slightly differ from interstellar law for the ultraviolet region.

A.F. PUGACH, G.U. KOVALCHUCK  
Main Astronomical Observatory,  
Kiev 252127, USSR,

#### References:

- Alexander, J.B., Andrews, P.J., Catchpole, R.M. et al., 1972, Mon. Not. Roy. Astron. Soc., 158, p. 305-360.
- Danziger, I.J., 1965, Mon. Not. Roy. Astron. Soc., 130, p. 199-221.
- Efimov, Yu.S., 1980, Izv. Crim. Astr.Obs., 61, p. 110-119.
- Feast, M.W., 1975, Variable Stars and Stellar Evolution, IAU Symp. No.67, Moscow, Reidel Publ., p. 129-141.
- Feast, M.W., Glass, I.S., 1973, Mon. Not. Roy. Astron. Soc., 161, p. 293-303.
- Fernie, J.D., Sherwood, V., Du Puy, D.L., 1972, Astrophys. J., 172, p. 383-390.
- Goncharova, R.I., 1985, Sov. Astron. J. Lett., 11, p. 855-860.
- Payne-Gaposchkin, C., 1963, Astrophys. J., 138, p. 320-341.
- Pugach, A.F., 1984, Sov. Astron. J., 61, p. 491-499.
- Schultz, G.V., Wiemer, W., 1975, Astr. Astrophys., 43, p. 133-139.
- Searle, L., 1961, Astrophys. J., 133, p. 531-550.
- Shenavrin, V.I., Taranova, O.G., Moroz, V.I. et al., 1979, Sov. Astron. J., 56, p. 1007-1011.
- Stein, W.A., Gaustad, J.E., Gillet, F.C. et al., 1969, Astrophys. J., 155, L3-L7.
- Wing, R.F., Baumert, J.H., Strom, S.E. et al., 1972, Publ. Astron. Soc. Pacific, 84, p. 646-647.
- Zhilyaev, B.E., Orlov, M.Ya., Pugach, A.F. et al., 1975, Stars of RCB type, Kiev, Naukova Dumka Publ. (in Russian).

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

Number 3148

Konkoly Observatory  
Budapest  
19 February 1988  
*HU ISSN 0374-0676*

LIGHT CURVE OF V482 CYGNI, AN R CrB STAR

There are some 700 plates at the Maria Mitchell Observatory with useful images of V482 Cyg. This R Coronae Borealis variable has recently been studied in the infrared by Gaustad et al. (1988), who discuss its association with three close companions and determine its absolute magnitude on the reasonable assumption that the association is a physical one. The Maria Mitchell data through 1970 had been reported by Esther Hu (1971). At the suggestion of John Gaustad, we have extended her work.

Figure 1 is the photographic light curve through January 1988. The magnitudes are estimates relative to B. S. Whitney's (1949) photographic sequence augmented by a star of magnitude 15.4 pg, from Wachmann (1966). We made one other change in Whitney's sequence. On our plates the star marked b on his chart looks about 0.6 mag too faint, relative to its neighbors, for its published magnitude, 12.05 pg. A reasonable although not a unique explanation for the discrepancy is that the wrong star is marked on Whitney's chart. There is a somewhat brighter star 11 arcmin north preceding and we have calibrated our magnitude estimates on the assumption that Whitney's magnitude 12.05 refers to this star. A curve through his photographic mean points is superimposed on the Maria Mitchell data in Fig. 1. The agreement is entirely satisfactory.

V482 Cyg is typically 12.2 in maximum and can drop below 15.4. The start of the current minimum was suspected by JD 2447030 (August 1987). The magnitude reached 13.0 by 2447115 (November), and thereafter the drop has been rapid, as reported in IAU Circulars 4511 and 4515. The current faintness of the variable provides a good opportunity for observers with

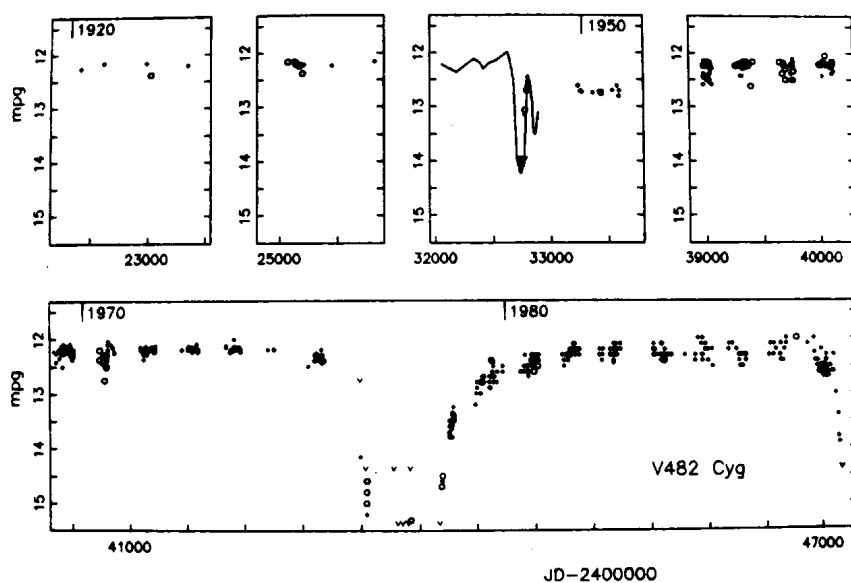


Figure 1. Photographic light curve of V482 Cygni. The circles indicate low weight. The symbol V means that the variable was fainter than the indicated magnitude.

appropriate equipment not only to study conditions in minimum but also to get data about the fainter companions. Gaustad et al. estimate that their V magnitudes are in the range 13.6-16.8. They are all within 7 arcsec of the variable.

We gratefully acknowledge grants AST-8320491 and AST-8619885 from the National Science Foundation in support of variable star research at the Maria Mitchell Observatory.

EMILIA P. BELSERENE, DAVID L. SUMMERS, ELLEN A. SCHEER

Maria Mitchell Observatory  
Nantucket MA 02554 USA

#### References:

- Gaustad, J.E., Stein, W.A., Forrest, W.J., and Piper, J.L.  
1988. Pub. Astr. Soc. Pacific, March 1988, in press.  
Hu, E. 1971. AAVSO Abstracts, Oct. 1971, p. 16.  
Wachmann, A.R. 1966. Astr. Abh. Hamburg. Stw. Vol. VI, 379.  
Whitney, B.S. 1949, Astrophys. J., 109, 538.

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

Number 3149

Konkoly Observatory  
Budapest  
19 February 1988  
HU ISSN 0374-0676

## A NEW EPHEMERIS FOR RW ARIETIS

The main purpose of this note is to establish new light elements for the variable star RW Arietis and put in agreement the photoelectric observations performed by Bookmyer et al. (1977) and Penston (1972). Such a problem is accessible if we do not take into consideration the photoelectric observations from JD 2439384, 2439505, 2439507, 2440335 and 2440337. These last observations could be influenced by an unknown cause.

Figure 1 shows the common light curve of RW Arietis plotted with the newly derived ephemeris

$$JD_{\max} = 2439475.6618 + 0.^d_{.3543145} E.$$

Here dots and open circles represent Bookmyer's et al. (1977) and Penston's (1972) observations, respectively.

The ephemeris determined above agrees with Detre's (1937) observations, as we can see in the following table.

Max. hel. 2428000+	E	O-C
074.550	-32178	+0. <sup>d</sup> 020
154.273	-31953	+ .022
181.203	-31877	+ .025
183.299	-31871	- .005
407.603	-31238	+ .018
408.622	-31235	- .026
431.649	-31170	- .030
455.419	-31103	+0.001

The available observational data taken here into consideration seem to agree with the old proposal that RW Arietis is an RR Lyrae variable of type c in Bailey's classification.

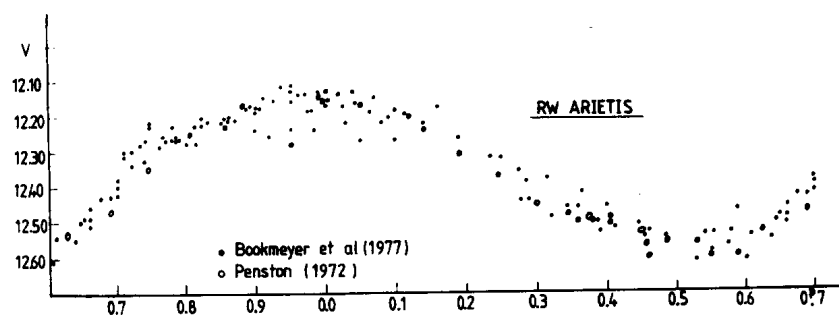


Figure 1

I. TODORAN

Centre for Astronomy and Space Sciences  
 Astronomical Observatory  
 Cluj-Napoca, Romania

## References:

- Bookmyer , B.B., Fitch, W.S., Lee, T.A., Wisniewski, W.Z., Johnson, H.L., 1977,  
 Rev. Mexicana Astron. Astrofisica 2, 235.  
 Detre, L., 1937, Astron. Nachr. 262, 81.  
 Penston, M.J., 1972, Mon. Not. Roy. Astron. Soc. 156, 103.

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

Number 3150

Konkoly Observatory  
Budapest  
22 February 1988  
HU ISSN 0374-0676

SV Cen - UBV LIGHT CURVE 1974-79

The light curve of the eclipsing variable SV Cen (HD 102552) is presented here with details of minima and maxima. Comparison star HD 102503 was used for all observations and differential magnitudes in the sense Variable - Comparison are presented here graphically and numerically in the file No. 177 of the IAU Archives of Unpublished Photoelectric Observations of Variable Stars. The observations were done with standard UBV photometers at Perth Observatory and Siding Spring Observatory.

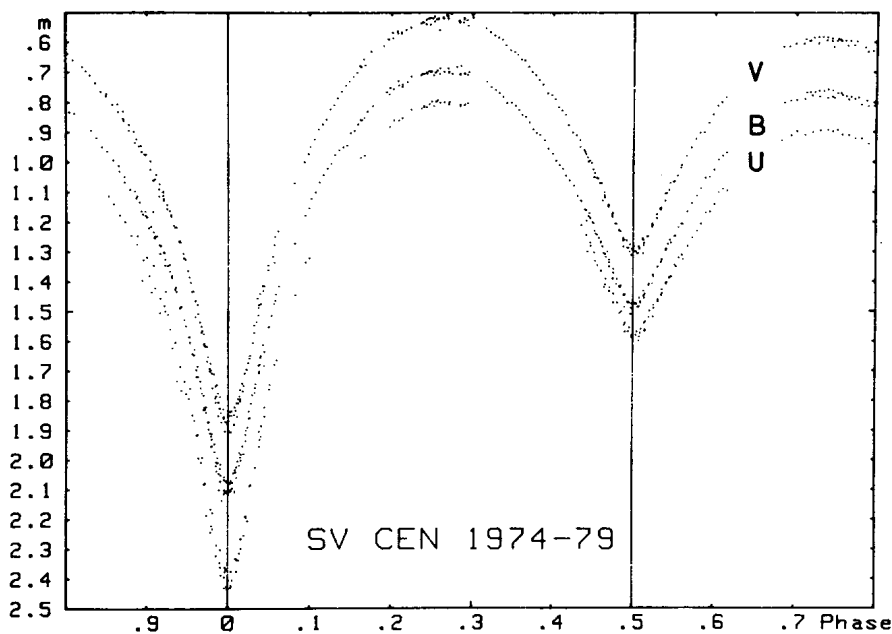


Fig. 1. Light curve of SV Cen in the UBV photometric system during the period 1974-79 (Perth and Siding Spring). Ordinates: Differential magnitude Var-Com in B, for V shift +.2 and for U shift -.2. Abscissae: Phase.

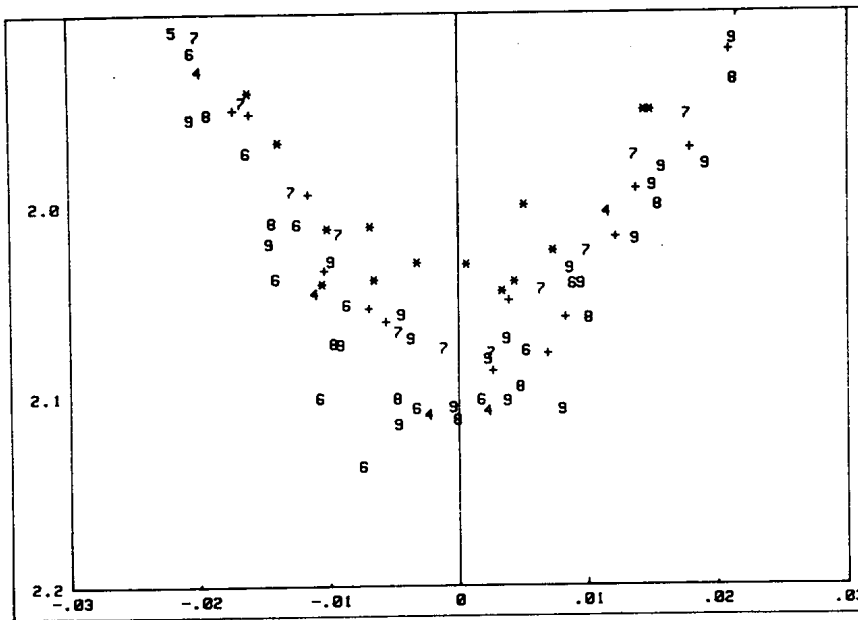


Fig. 2. Differential magnitudes in B for phases close to primary minimum in detail. The digits represent the last digit of the year of observation between 1974-79, their center coordinates B(mag) and phase. For comparison, the 1970 observations of Irwin, Landolt (1972), and 1972 of Landolt (1973) are added.

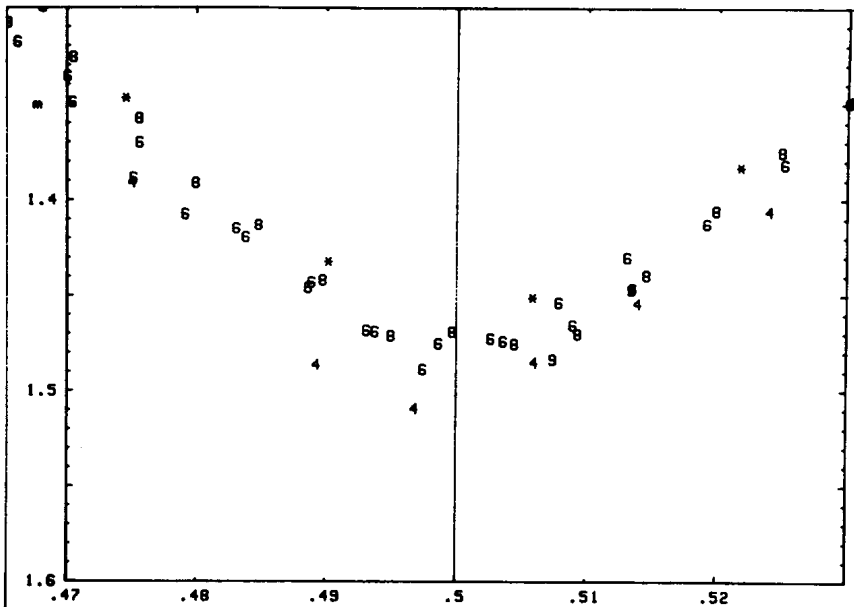


Fig. 3. The same as in Fig. 2 but for secondary minimum.

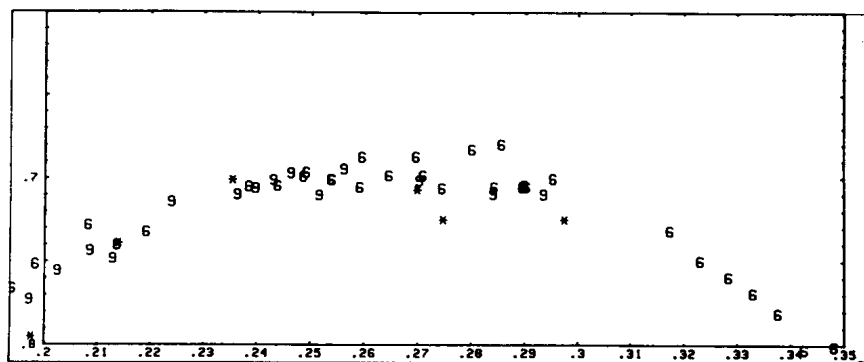


Fig. 4. As for Fig. 2 for the higher maximum with expanded magnitude scale.

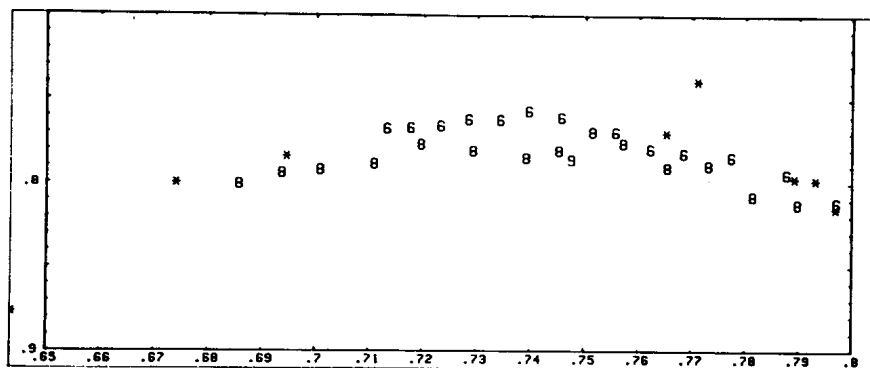


Fig. 5. As for Fig. 2. for the lower maximum with expanded magnitude scale.

Some observations have already been published by the author (Kviz 1976a) but the majority of observations is available in the files mentioned above. As the period of SV Cen varies very fast and in a rather complex way (Kviz 1976b, 1979, 1980; Herczeg, Drechsel 1985; Irwin, Landolt 1979) the calculation of the phase was based on interpolated values of epochs and periods. The main aim of these observations was the study of the variability of the period and of changes in the depth of minima. Some results concerning this topic have already been published (Kviz 1976b, 1982, 1983).

Figure 1 shows the light curve in V,B, and U differential magnitudes. Figures 2 and 3 show details of the primary and secondary minima respectively, distinguishing the observed points for individual years of observation. Primary minimum shows larger fluctuations from year to year than the secondary. To be sure that the variation in the depth of minima (discussed in previous papers: Kviz 1976b, 1982, 1983) is not caused by the variation of the zero point of the whole light curve, the observation at both maxima was carefully carried on and the details are presented in the Figures 4 and 5. As can be seen there are no variations of the brightness at maxima (note the changed vertical scale for maxima in comparison with minima, Figs. 2 and 3).

The fluctuation in the depth of minima is thus real and observers are reminded to pay sufficient attention not only to the time of the minimum but also to the depth by measuring carefully the magnitude of the minima. Observations on Siding Spring finished in 1979 because of discontinued support by the Australian Research Grant Commission. More observation of this star have been done by the author in the Geneva photometric system: they are being reduced and the results will be published in due time.

Z. KVIZ

School of Physics  
University of New South Wales  
P.O. Box 1  
KENSINGTON, N.S.W. 2033  
AUSTRALIA

#### References:

- Herczeg, T.J., Drechsel, H. 1985, *Astrophys. Space Sci.* 114, 1.  
 Irwin, J.B., Landolt, A.U. 1972, *PASP* 84, 686.  
 Irwin, J.B., Landolt, A.U. 1979, *Coll. No.* 46, Hamilton, N.Z. p. 465.  
 Kviz, Z. 1976a, *IBVS*, No. 1162.  
 Kviz, Z. 1976b, *Proc. Astron. Soc. Australia*, 3, 45.  
 Kviz, Z. 1979, *New Zealand Journ. Sci.*, 22, 469.  
 Kviz, Z. 1980, *IBVS*, No. 1864.  
 Kviz, Z. 1982, *Proc. Astron. Soc. Australia*, 4, 405.  
 Kviz, Z. 1983, *Trans. IAU XVIII B*, p. 290.  
 Landolt, A.U. 1973, *PASP*, 85, 117.

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

Number 3151

Konkoly Observatory  
Budapest  
26 February 1988  
HU ISSN 0374-0676

THE ELLIPSOIDAL VARIABILITY OF 75 PEGASI

75 Pegasi = HD222133 = HR8963 is a single-lined spectroscopic binary with the very short period of 0.5021035 day, and an extreme value of mass ratio (Hube and Gulliver, 1985). Analysis of the spectroscopic data led to the conclusion that the primary component fills, or is close to filling, its critical Roche lobe. Furthermore, it was predicted that a shallow primary eclipse ( $\sim 0^m.02$ ) would occur. After the fact, it is clear that we ought to have made explicitly a prediction of ellipsoidal photometric variations.

75 Pegasi has been observed since September 1987 with the 2-star photometer on the 0.5m telescope of the Devon Astronomical Observatory. Standard B and V filters have been employed. On all but the first night, the comparison star in channel-2 has been SAO108725 and the check star was BD+17°4953. The latter two stars have been constant relative to one another to better than about  $0^m.03$ . Corrections for atmospheric extinction are negligible with our observing procedures. Corrections for gain variations between the two channels have been made. We have not made transformations from the local to the standard UBV system.

On September 23/24, 1987, a complete sinusoidal light variation was detected during 7 hours of continuous observing, and with phasing relative to the spectroscopic orbit consistent with ellipsoidal variability. Observations on subsequent nights have confirmed the photometric variability and the initial interpretation of it. In this note we present a sample of the available photometric data and results of a very preliminary analysis.

In Figure 1 we have plotted the magnitude differences  $B(\text{VAR}) - B(\text{COMP})$  obtained on five nights and averaged in phase intervals of 0.025P. Phases are from  $T_0 = \text{HJD}2442644.131$  as found in the spectroscopic orbital solution. The photometric data are consistent with the spectroscopic period of 0.5021035 day.

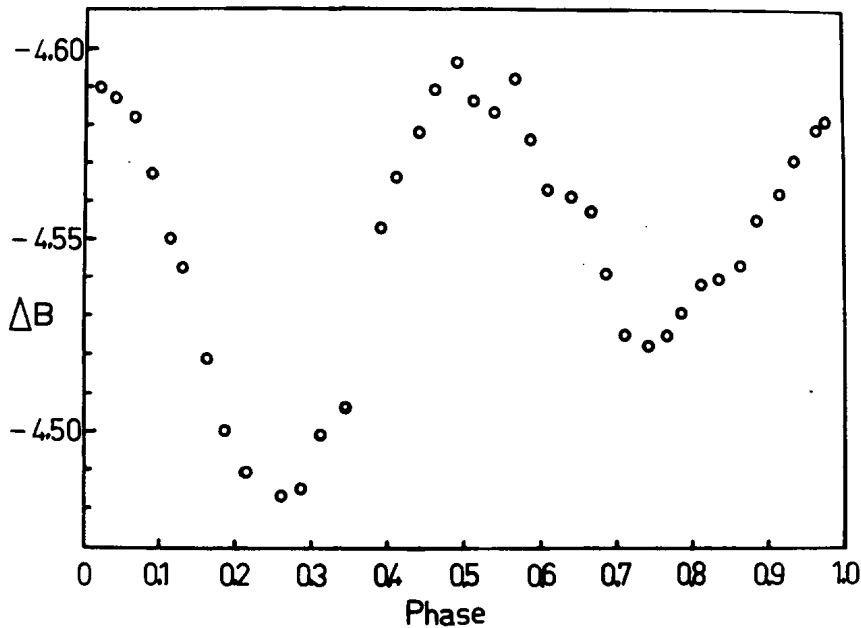


Figure 1

There is some evidence - not revealed in Figure 1 because we have averaged together data from several nights - for cycle-to-cycle variations in the shape of the light curve. These might be due to irregular mass flow from the Roche-lobe-filling primary, or to some intrinsic instability in one of the components. At this time, we cannot exclude observational or reduction errors.

Within the observational uncertainties, the two maxima are equal. The deeper minimum at primary conjunction may include contribution from the predicted shallow eclipse, but that will not be known with certainty until a detailed analysis has been completed. We have used a least-squares routine to fit the following Fourier series to the data in Figure 1

$$\Delta B = -4.549 + 0.0029\cos\theta - 0.0431\cos 2\theta + 0.0162\sin\theta - 0.0043\sin 2\theta$$

$$(\pm 0.001) \quad (\pm 0.0018) \quad (\pm 0.0019) \quad (\pm 0.0019) \quad (\pm 0.0018)$$

where the uncertainties are standard deviations. The predominance of the  $\cos 2\theta$  term is consistent with a gravitationally distorted primary component and ellipsoidal light variation.

A complete discussion of this binary system will be presented elsewhere after the photometric data have been transformed to the standard UBV system and analysed in conjunction with the spectroscopic data.

DOUGLAS P. HUBE and BRIAN E. MARTIN

Department of Physics  
University of Alberta  
Edmonton, Alberta  
Canada T6G 2J1

and

AUSTIN F. GULLIVER

Department of Physics and Astronomy  
Brandon University  
Brandon, Manitoba  
Canada R7A 6A9

Reference:

Hube, D.P. and Gulliver, A.F., 1985, Publ. Astron. Soc. Pacific 97, 280.

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

Number 3152

Konkoly Observatory  
Budapest  
29 February 1988  
HU ISSN 0374-0676

## A POSSIBLE VARIABLE STAR NEAR IC 402<sup>(\*)</sup>

A star of 12 th magnitude (visual) situated 0.8 south from the IC402 (Sc) galaxy ( $\alpha = 05^h03^m9$ ,  $\delta = -9^\circ10'0$ ; 1950) is visible on the Palomar Sky Survey blue and red plates number 0898. The photographic magnitude of the galaxy derived from the P.O.S.S is 13.9 (Nilson, 1973) or 13 (Voroncov-Velyaminov et al., 1962, 1963, 1964, 1968).

During an observing run with the 1m telescope at ESO, La Silla (Chile) the star was not visible by eye through the UBVR photometer guiding system equipped with an RCA intensifier: the star was fainter than  $m_v \approx 16.5$  on 23 January, 1988, at  $01^h24^m$ (UT).

In the same conditions, the star was then visible on the following night, as confirmed on a CCD frame kindly obtained by J. Van Paradijs at the ESO 1.54 m telescope. Table I lists UBVR observations made during the two nights: January 24, at  $01^h45^m$ (UT) and January 25, at  $02^h23^m$ (UT).

Table I

	Jan.24, 1988	Jan.25, 1988
V	15.57	15.14
B-V	0.585	0.937
U-B	-0.242	-0.335
V-R	0.479	0.332
V-I	0.764	0.762

DOMINIQUE PROUST  
Observatoire de Meudon  
92195 Meudon Principal CEDEX  
France

### References:

- Nilson, P.; 1973, Catalogue of Selected non UGC galaxies, Uppsala report No.5.  
Voroncov-Velyaminov, B.A., et. al, 1962, 1963, 1964, 1968, Morphological catalogue of Galaxies, Moscow State University, Moscow.

(\*)based on observations made at ESO, La Silla (Chile)

COMMISSION 27 OF THE I. A. U.  
 INFORMATION BULLETIN ON VARIABLE STARS  
 Number 3153

Konkoly Observatory  
 Budapest  
 4 March 1988  
 HU ISSN 0374-0676

PHOTOELECTRIC MINIMA TIMES OF THE BINARY STAR V508 Oph

The eclipsing binary BD+ 13° 3496 ( V 508 Oph ) is a peculiar short period variable star. Its variability was firstly detected by Hoffmeister in 1935 and it was classified as W UMa type by Jacchia (1936). Karetnikov obtained photographic and photovisual light curves of V508 Oph in 1963 and 1977, respectively; while Rovithis and Rovithis-Livaniou (1983) obtained the first BV photoelectric observations of it. Recently, UBV light curves for the system were published by Lapasset (1985) and a spectroscopic analysis was made by Lu (1986).

Because of its peculiarity (unequal amplitudes of its light curves in the different colours) this star was re-observed during 1986. Our photoelectric observations were made using the two-beam, multi-mode, nebular-stellar photometer attached to the 48-inch Cassegrain reflector at Kryonerion Astronomical Station of the National Observatory of Athens. The B and V filters used are in close accordance to the standard ones and reduction of the observations was made in the usual way (Hardie, 1962).

From our observations two primary and four secondary minima times were derived using Kwee and Van Woerden's method (1956). These moments are presented in Table I the successive columns of which give: the Hel. JD, the (O-C) values and the type of minima,

Table I

Hel.J.D.	(O-C) <sub>Kuk</sub>	(O-C) <sub>Kar</sub>	(O-C) <sub>Lap</sub>	(O-C) <sub>Kho</sub>	Min.
2440000,+					
6668,4185	+0 <sup>d</sup> 0174	+0 <sup>d</sup> 0067	-0 <sup>d</sup> 0014	+0.0041	II
6671,3510	+0.0191	+0.0085	+0.0003	+0.0049	I
6674,4526	+0.0176	+0.0070	-0.0012	+0.0043	I
6675,3150	+0.0180	+0.0074	-0.0008	+0.0048	II
6677,3836	+0.0179	+0.0072	-0.0010	+0.0046	II
6678,4182	+0.0181	+0.0075	-0.0008	+0.0048	II

In the residuals the C values have been calculated using Kukarkin's et al. (1976), Karetnikoy's (1977), Lapasset's (1985), and Kholopoy's et al. (1985) ephemeris formulae, respectively.

P. ROVITHIS

Astronomical Institute  
National Observatory  
of Athens, Athens  
Greece

H. ROVITHIS-LIVANIOU

Section of Astrophysics -  
Astronomy and Mechanics  
Athens University  
Athens 157 83 Zografos  
Greece

#### References;

- Hardie, R.H.: 1962, in W.A. Hiltner (ed.), Stars and Stellar Systems Vol. II, "Astronomical Techniques", University of Chicago Press, Chicago.  
Hoffmeister, C.: 1935, Astron. Nachr. 255, 405.  
Jacchia, L.: 1936, Astron. Nachr. 261, 212.  
Karetnikoy, V.G.: 1963, Perem. Zvezdy 14, 348.  
Karetnikoy, V.G.: 1977, Perem. Zvezdy Suppl. 3, 247.  
Kholopoy, P.N. et al.: 1985, Fourth Edition to the General Catalogue of Variable Stars.  
Kukarkin, B.V. et al.: 1976, Third Edition to the General Catalogue of Variable Stars.  
Kwee, K.K. and Van Woerden, H.: 1956, Bull. Astron. Inst. Neth. 12, 327.  
Lapasset, E.: 1985, I.B.V.S. No 2828.  
Lu, W.: 1986, Publ. Astron. Soc. Pacific, 98, 577.  
Rovithis, P., and Rovithis-Livaniou, H.: 1983, Astrophys. Space Sci. 96, 283.

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

Number 3154

Konkoly Observatory  
Budapest  
10 March 1988  
*HU ISSN 0374-0676*

SHOULD WE REALLY FORGET DO Dra?

In a recent paper (Patterson and Eisenman, 1987) it is argued that the HEAO-2 X-ray source E1140.8+7158, recently identified with a 16th magnitude cataclysmic variable, is in fact identical with the variable star YY Dra (discovered by Tsesevich, 1934, and classified by him as an Algol-type star with a period of 4.21123). So Patterson and Eisenman consider the decision taken by us (Kholopov et al., 1985) to assign a new variable star name (DO Dra) to the dwarf nova to be erroneous.

The problem of YY Dra is really a complicated one; our attempts to get additional information from Prof. Tsesevich have been described elsewhere (Samus, 1988 ab). Evidence for the identity of E1140.8+7158 and YY Dra presented by Patterson and Eisenman is surely of considerable interest and will be taken into account in our work. However, this evidence is not absolutely convincing (this is discussed in some more detail below), and we feel that some misunderstanding exists about principles of assigning (or not assigning) new names to variable stars. In fact, in dubious cases we always tend to not to assign a new name to a star not sufficiently studied and not easily identified on the sky if a possibility exists of its being identical with a better studied and readily identified named variable star. On the contrary, we tend to assign a new name to a well-studied and easily identified star if there is a grounded possibility of its being not identical with a poorer studied and not readily identified star.

Now, the main reasons for Patterson and Eisenman's belief that the X-ray source and YY Dra cannot be different stars are of statistical nature. It is well known that such arguments are valid only a priori, and if it turns out that the improbable case of YY and DO Dra being not identical does take place in reality, any such argument will be of no use. Moreover, some of Patterson and Eisenman's points of argument could be criticised. The incidence of variable stars at high galactic latitudes is in fact the incidence of known variable stars, and the completeness at these latitudes may not be good. We also would recommend, when discussing the number of bright Algols in the GCVS, to consider also "E", not only "EA" stars.

Finally, we agree that Tsesevich could probably give a wrong position; quite obviously his magnitudes could be too bright (many similar cases are known in the publications of the 30s). However, an active researcher of variable stars would never take a dwarf nova (almost always in minimum light!) for an Algol star (almost always in maximum light!) and never find a period with many decimals unless it is at least an alias period.

To conclude, we do not recommend to forget DO Dra, and we do not recommend to forget YY Dra, either. If one really wants to forget something, it would be better to forget YY Dra until it is proven that DO Dra and YY Dra are the same, or until the real YY Dra is found. As a group responsible for the names of variable stars we are very much interested in avoiding confusion and strongly recommend to use the name DO Dra for E1140.8+7158.

P.N. KHOLOPOV  
Sternberg Astronomical  
Institute  
13, University Avenue,  
Moscow 119899, USSR

N.N. SAMUS  
The Astronomical Council  
of the USSR Academy of Sci.  
48, Pyatnitskaya Str.,  
Moscow 109017, USSR

#### References:

- Kholopov, P.N., Samus, N.N., Karazovets, E.V., Perova, N.B. 1985, I.B.V.S. No.2681 .  
Patterson, J., Eisenman, N. 1987, I.B.V.S., No.3079.  
Samus, N.N. 1988a, in "Istoriko-Astronomicheskiye Issledovaniya" ("Studies in the History of Astronomy", in Russian), Moscow, "Nauka" Publishers (in press).  
Samus, N.N. 1988b, l'Astronomia (in Italian; in press).  
Tsesevich, W. 1934, Variable Stars, 4, 291.

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3155

Konkoly Observatory  
Budapest  
15 March 1988  
HU ISSN 0374-0676

THE PERIOD OF TWO Bp Si Mg STARS:  
HD 60431 AND CoD -51°3378

The Si Mg peculiarity type is extremely rare among the hot Ap stars with enhanced silicon lines. To our knowledge, there are only three of them: HD 3473, HD 60431 and CoD -51°3378. The latter two are in the southern celestial hemisphere and were monitored with the Swiss telescope at the European Southern Observatory, La Silla (Chile), using the Geneva photometry. HD 60431 was observed at the beginning of 1987, while CoD -51°3378 (classified Si Mg by Bidelman, 1985) was measured in January 1988.

Both stars show a fairly large amplitude in the [U] band, reaching almost 0.<sup>m</sup>1 peak-to-peak, while the amplitude in the V band hardly reaches 0.<sup>m</sup>04. All colours vary in phase.

The period of HD 60431 is very short and certainly holds the record among the classical magnetic Ap stars (Preston's CP2 category): we have obtained

$$P = 0.475518 \pm 0.000059 \text{ d.}$$

This is shorter than the shortest periods known to date, such as 0.5207 (HD 124224, Si) or 0.51747 (HD 164429, Si Cr Sr). The only star which could have a similar, or even shorter, period is HD 177517 (Hg Si), but the published periods are ambiguous and uncertain ( $P=0.4877$  or  $0.33772$  d., Manfroid and Mathys, 1985).

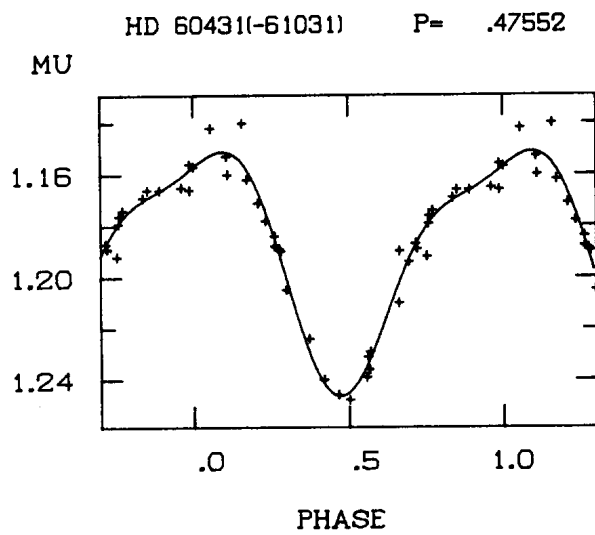
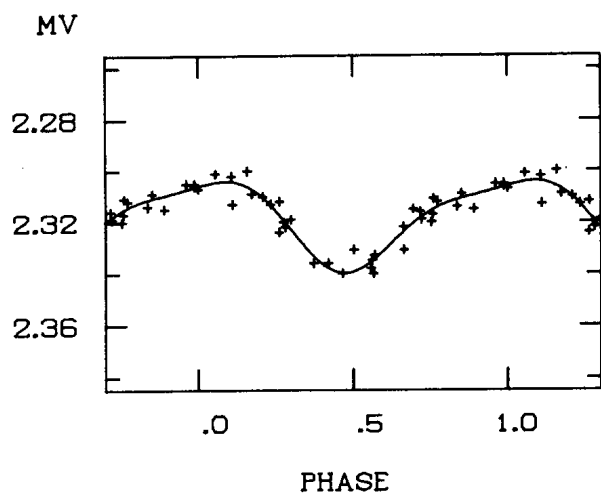


Figure 1

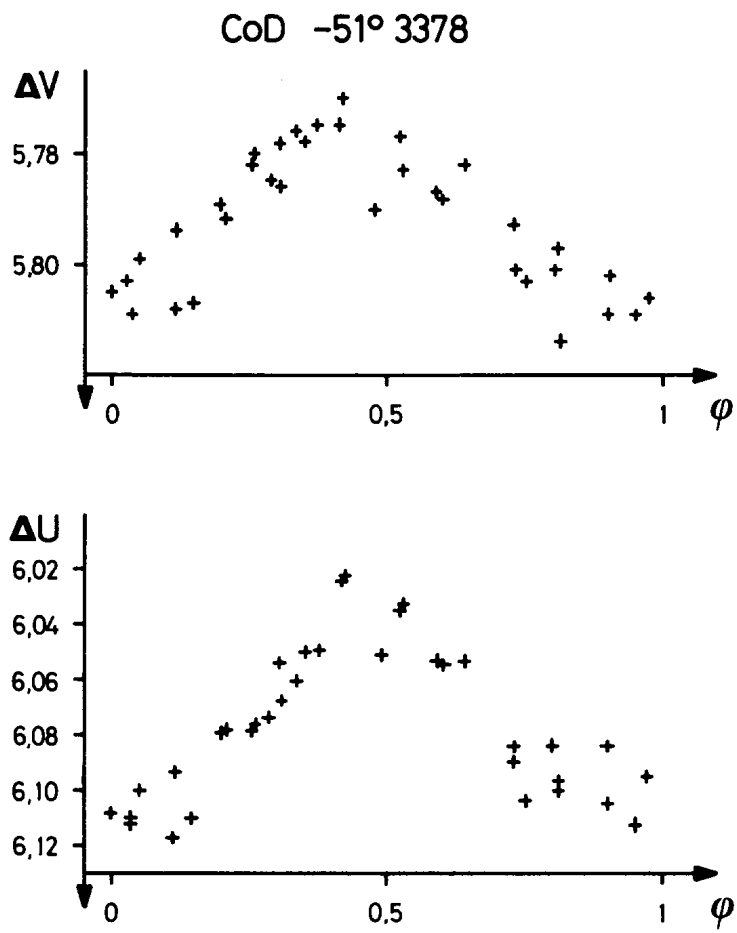


Figure 2

Applying the oblique rotator model, i.e. the well-known formula  $v_{\text{eq.}} = 50.6 \frac{R}{P}$ , such a short period implies an equatorial velocity  $v_{\text{eq.}} = 245 \text{ km s}^{-1}$  if we assume  $R \approx 2.30 R_{\odot}$ . The latter radius holds for a  $4.5 M_{\odot}$  star lying on the ZAMS (the mass is deduced from the calibrated X and Y parameters of the Geneva photometry), so it must be considered rather as a lower boundary. Therefore, the  $245 \text{ km s}^{-1}$  value of the equatorial velocity is probably a lower limit too. Such a rapid rotational velocity is more typical of the normal stars than of the Ap stars, and may be a challenge to the theory of radiative diffusion, the most promising one for explaining the Ap stars' abundance patterns. Indeed, rapid rotation induces meridional circulation, which will tend to counteract the diffusion processes. It would be most interesting to determine the magnetic field, which is an essential ingredient in the diffusion processes, among the Si stars (Mégessier, 1984).

CoD -51°3378, on the contrary, has a period

$$P = 1.282 \pm 0.006$$

which is quite common, since it is close to the maximum of the period distribution of the young Si stars (North, 1987).

Fig. 1 shows the lightcurves of HD 60431 for the [U] and V bands. The magnitudes are differential ones, relative to HD 61031.

Similarly, Fig. 2 shows the lightcurves of CoD -51°3378. Here the differential magnitudes are relative to HD 76805.

P. NORTH, J. BABEL and T. LANZ  
Institut d'astronomie de  
l'Université de Lausanne et  
Observatoire de Genève  
CH-1290 CHAVANNES-DES-BOIS  
Switzerland

#### References:

- Bidelman, W.P.: 1985, *Astron. J.* 90, 341  
Manfroid, J. and Mathys, G.: 1985, *Astron. Astrophys. Suppl. Ser.* 59, 429  
Mégessier, C.: 1984, *Astron. Astrophys.* 138, 267  
North, P.: 1987, *Astron. Astrophys. Suppl. Ser.* 69, 371 59

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

Number 3156

Konkoly Observatory  
Budapest  
15 March 1988  
HU ISSN 0374 - 0676

NEW PHOTOELECTRIC TIMES OF MINIMA OF V839 OPHIUCHI

V839 Oph is a W UMa-type variable which shows noticeable changes in its light curves. These changes could arise from activity on the surface of the common envelope or from some material surrounding the system (Lafta and Grainger, 1985).

During a program of photoelectric observations of eclipsing binary stars, the system was observed in two colours (B and V) on June 9-16, 1985. The observations were made with a 48-inch Cassegrain reflector and a two beam multi-mode photometer (Goudis and Meaburn, 1973). The two intermediate pass-band filters used were selected to be in close accordance with the standard UBV colour system. BD+9°3589 and BD+9°3573 were used as comparison and check stars respectively.

Five times of minima observed during this season were calculated by the method of bisecting chords which connect the points of equal magnitudes on the opposing branches near the minimum.

Table I

HJD	E	O-C	Filter	Rem.
2440000+				
6228.5744	14132.5	0.0354	B,V	MinII
6229.3928	14134.5	0.0358	B,V	MinII
6230.4152	14137	0.0357	B,V	MinI
6231.4379	14139.5	0.0380	B,V	MinII
6233.4817	14144.5	0.0348	B,V	MinII

The successive columns of Table I contain the heliocentric time of minimum, the number of cycles E, the difference O-C, the filter used and remarks. The O-C values were computed according to the ephemeris

$$\text{MinI} = \text{JD Hel } 2440448.4129 + 0.40899532 \times E$$

which has been taken from the "General Catalogue of Variable Stars", Vol. II, edited by Kholopov et al. (1985).

A detailed analysis of the observations of V839 Oph will be given elsewhere.

P.G. NIARCHOS  
Section of Astrophysics,  
Astronomy and Mechanics  
Department of Physics  
University of Athens  
GR-157 83 Zografos  
Athens-GREECE

#### References:

- Goudis, C. and Meaburn, J.: 1973, *Astrophys. Space Sci.* 20, 149.  
Kholopov, P.N. et al.: *General Catalogue of Variable Stars*, Vol. II, "Nauka", 1985.  
Lafta, S.J. and Grainger, J.F.: 1985, *Astrophys. Space Sci.* 114, 23.

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

Number 3157

Konkoly Observatory  
Budapest  
17 March 1988  
HU ISSN 0374 - 0676

THE VARIABILITY OF 53 Psc

The B2.5IV star 53 Psc was suspected by Williams (1954) to be variable with a period of about 0.09 days. Sareyan *et al.* (1979) found the star to be slightly variable on two nights with about the same period found by Williams. From radial velocity measurements on one night they obtain a significantly shorter period of about 0.055 days. They concluded that the star is probably a  $\beta$  Cep variable. Recently, Wolf (1987) obtained photometry of this star during one night and found a large amplitude variation (0.035 magnitudes) with a period of about 0.096 days. More recently, Le Contel *et al.* (1988) could find no variation larger than 0.01 mag. from two nights in 1982 and 6 nights in 1987. This behaviour is most puzzling and the star deserves closer attention.

We report here results of intensive photometric monitoring of 53 Psc during a continuous run from 3 Sep to 30 Sep 1986. As comparison stars we used HR 26 and HR 254 which are the same two stars used by the previous observers. We obtained a total of 147 observations of 53 Psc over 17 nights through the Strömgren b filter using the 0.5-m reflector of the South African Astronomical Observatory.

Our results showed that 53 Psc and the two comparison stars were constant to better than 4 millimags during this time. We performed a periodogram analysis on 53 Psc and concluded that no significant periodic variations existed with an amplitude larger than 2 millimags. We can thus be certain that 53 Psc was constant to within this limit.

Whereas the observations of Williams (1954) could be dismissed owing to the reported poor observing conditions and those of Sareyan *et al.* (1979) could be regarded as marginal, we cannot overlook the well-defined large amplitude light curve found by Wolf (1987). Further observations of 53 Psc could prove important to our understanding of variability among early-type stars if such observations took place while the star was active. It is possible that this star is subject to episodes of transient variability as suspected for 22 Ori (Balona & Engelbrecht 1985).

L.A. BALONA and F. MARANG  
 South African Astronomical Observatory,  
 P.O. Box 9, Observatory 7935,  
 Cape,  
 South Africa.

#### References:

- Balona, L.A. & Engelbrecht, C.A., 1985. *Mon. Not. R. astr. Soc.*, **214**, 559.  
 Le Contel, J.M., Chapellier, E., Valtier, J.C., Rodriguez, E., Sedano, P., Morel, P.J. & Le Contel, D., 1988. IBVS No. 3131.  
 Sareyan, J.P., Le Contel, J.M., Ducatel, D., & Valtier, J.C., 1979. *Astron. Astrophys.*, **72**, 313.  
 Williams, A.D., 1954. *Publ. Astron. Soc. Pacific*, **66**, 88.  
 Wolf, M., 1987. IBVS No. 3003.

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

Number 3158

Konkoly Observatory  
Budapest  
17 March 1988  
HU ISSN 0374 - 0676

W CRU - MINIMUM IN THE GENEVA PHOTOMETRIC SYSTEM

W Cru = HD 105998 is an enigmatic eclipsing variable. Plavec (1984) launched the campaign for observation of this star and the reader can find further information in his paper. Here we publish some of our preliminary observational results to provide a guidance to spectroscopists about the most important phases. So far we have no data about the secondary minimum, but observations continue.

The observations are performed with the reflecting 70-cm Swiss telescope at ESO La Silla and the P7 photometer (Burnet 1976, Burnet, Rufener 1979) for the GENEVA photometric system (Golay 1974, 1980, Rufener 1964, 1981). Figs. 1 to 3 represent part of the light curve close to primary minimum in colours [V], [U] and [G] respectively. For phase calculation the following ephemeris was used:

$$\text{Min I (HJD)} = 2440731.6 + (198.53).E$$

The asymmetry of the light curve with respect to the minimum is obvious. It would be important to know whether this asymmetry repeats for all eclipses or if it varies from one eclipse to another. Also the difference in the photometric behaviour for different colours is quite apparent. The humps on both sides of the minimum are puzzling. Fig. 4. shows the variation of the Geneva index [U-B2]. There is lot of symmetry and also asymmetry in this behaviour. Using this graph theoreticians and spectroscopists may select the appropriate phase for more detailed study to find out what is really happening at certain phases. The star is quite bright (8 mag.) and the period long (198.5 day) and high resolution spectra can be obtained even with telescopes of moderate size.

Fig. 5 shows the relationship between magnitude [V] and the index [U-B2]. Each measured point is represented by two digits showing the phase multiplied by 100. Thus the number 08 marks (at its center) the point with phase 0.08. The asymmetry between the descending and ascending branches is remarkable. Note the differences close to the phases .13 and .83, and also the loop between phases .17 and .28. If this loop also repeats at other cycles (epochs) at the same phase, this part of the light curve might be the most interesting one for spectroscopic observations. However, comparing our light curve with the recent photoelectric observations of other observers (Marino et al. 1984, Menzies, Jones 1984) we see that the light curve might be variable and the steps and humps may not always occur at the same phase. Nevertheless, from our data it also seems that other indices are changing continuously and smoothly between the phases .15 and .30, and would deserve further attention of both photometrists and spectroscopists.

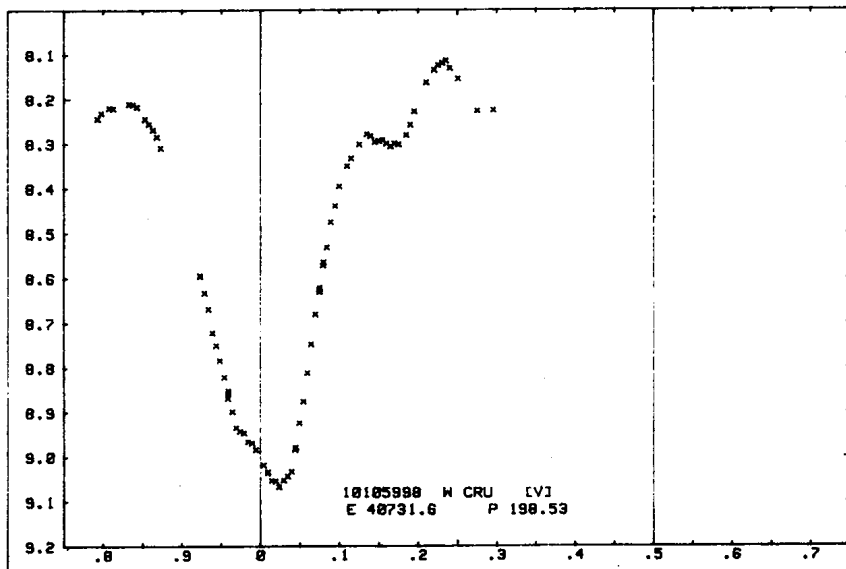


Fig. 1. Magnitude [V] against phase for W Cru

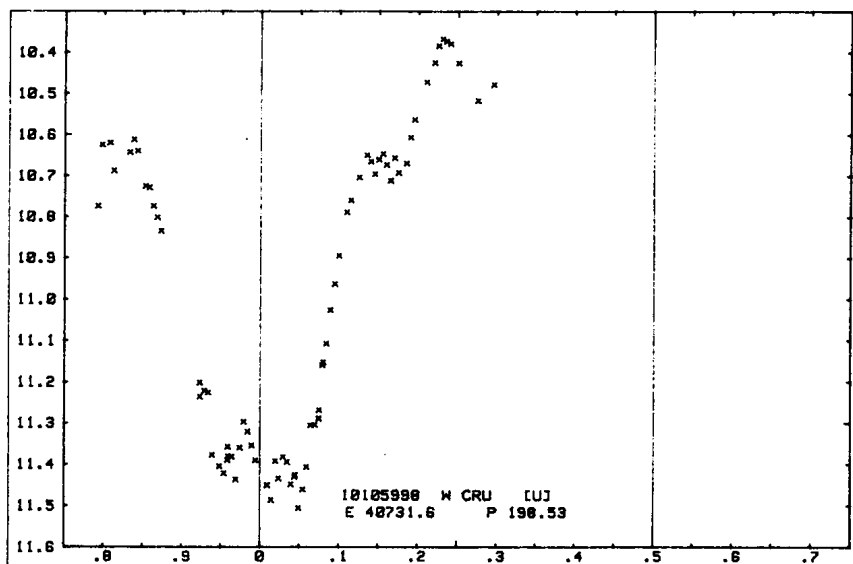


Fig. 2. Magnitude [U] against phase for W Cru

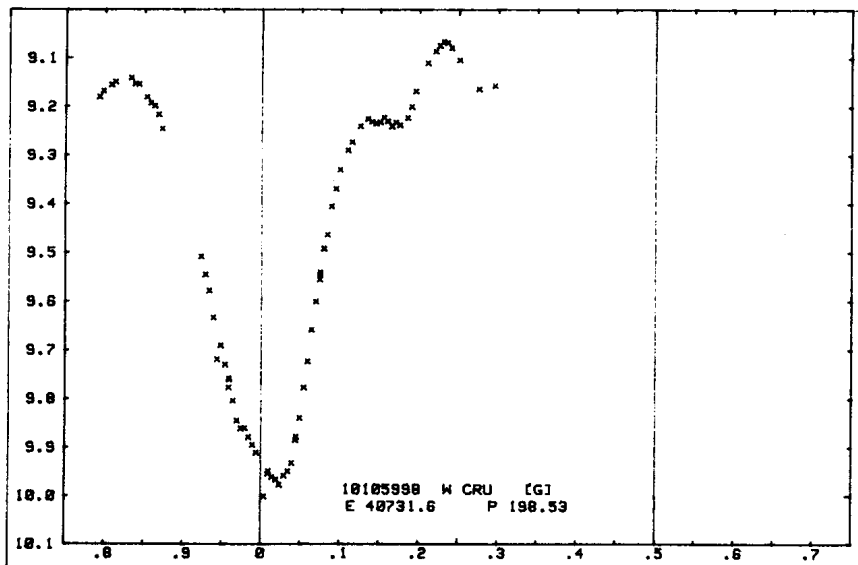


Fig. 3. Magnitude [G] against phase for W Cru

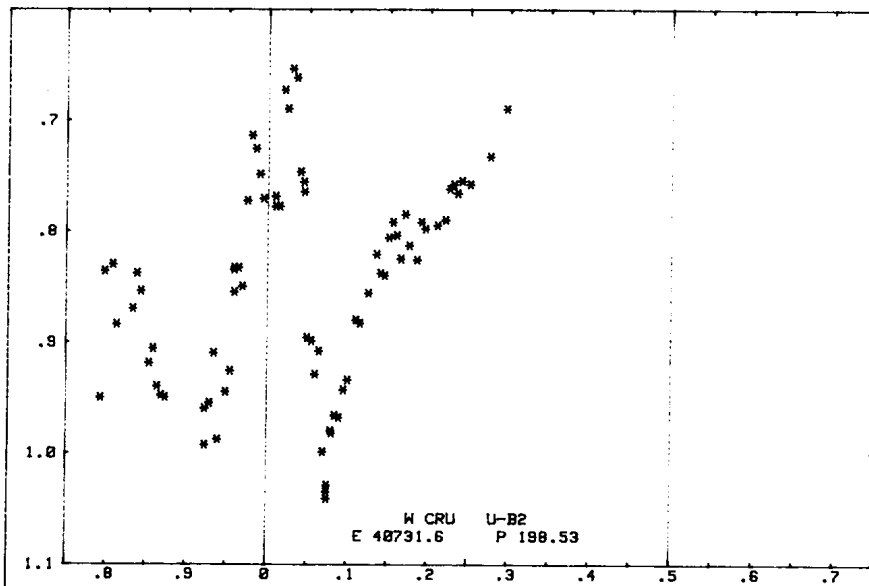


Fig. 4. Geneva index [U-B2] against phase for W Cru

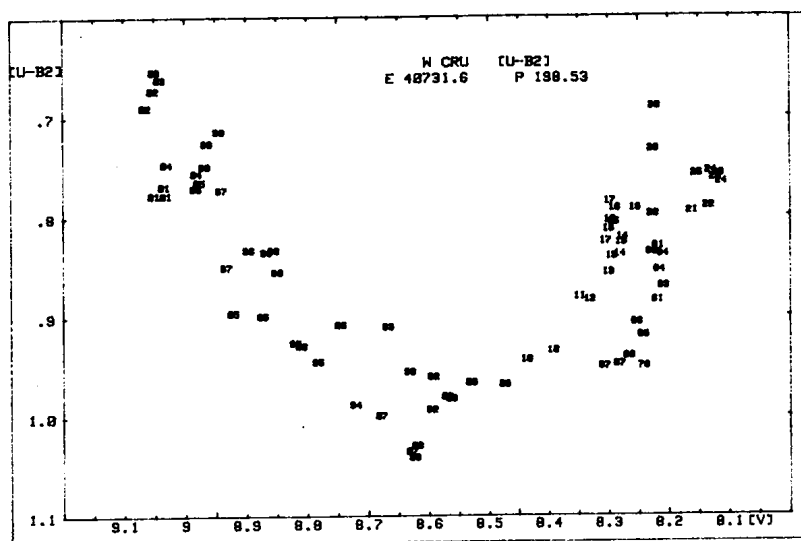


Fig. 5. Colour index [U-B2] against magnitude [V], two-digit numbers represent the phase multiplied by 100

Most of the observations were done in 1984/85 by one of the authors (Z.K.). Since then some observations have been carried out by the constructor of the photometer, M. Burnet, and occasionally by other observers of the Geneva Observatory. Further observations are being reduced and they will be published elsewhere.

Z. KVIZ\*, F. RUFENER  
Observatoire de Geneve  
CH-1290 Sauverny  
Switzerland

#### REFERENCES:

- Burnet M. 1976, Thesis No. 235, Ecole Polytechnique Federal de Lausanne.  
Burnet M., Rufener F. 1979, *Astron. Astrophys.* 74, 54.  
Golay M., 1974, *Introduction to Astronomical Photometry*, Reidel, Holland.  
1980, *Vistas in Astronomy*, 24, 141.  
Marino et al. 1984, IBVS No. 2582.  
Menzies J.W. & Jones J.S. 1984, IBVS No. 2623.  
Plavec M. 1984, IBVS No. 2524.  
Rufener F. 1964, *Publ. Obs. Geneve, Ser. A.*, 66.  
1981, *Astron. Astrophys. Supp. Ser.* 45, 207.

\* On leave from:  
School of Physics, University of New South Wales, P.O. Box 1,  
Kensington, NSW, Australia.

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

Number 3159

Konkoly Observatory  
Budapest  
18 March 1988  
HU ISSN 0374-0676

LIGHT CURVE VARIATIONS OF SV CAMELOPARDALIS

The light variability of SV Cam was firstly discovered by Guthnick (1929). Wood (1946) reported an asymmetry in the system's light curve; according to his analysis, the primary component is close to its Roche limit. Hence, the observed period and light curve variations were considered reasonable due to the instability of the primary near its limiting surface. The long-term variation in the O-C curve of SV Cam has been subjected to studies by Sommer (1956), Frieboes-Conde and Herczeg (1973), Hilditch et al. (1979), and Cellino et al. (1985) who reported different light-time periods ranging from 57.5 to 74.7 years. Hall (1976) included the system into his list of short-period RS CVn-type binaries. Meanwhile, Hilditch et al. (1979) attributed the out-of-eclipse changes to a BY Dra-type variability of the secondary component. An extensive observational material was presented by Patkós (1982). Patkós (1981) also gave a discussion on the locations of some flare-like events he observed.

We observed the system in B and V filters with the 48 cm Cassegrain reflector of Ege University Observatory on three nights in October 1985. An uncooled EMI 9781 A was the photomultiplier employed. BD +82°168 has been monitored as comparison star. The differential magnitudes in the sense variable minus comparison were corrected for atmospheric extinction and the times of the individual observations were reduced to the Sun's centre. The corrected magnitudes were plotted against the phases which were computed by using the light elements given by Cellino et al. (1985) as

$$\text{Min. I} = \text{J.D. (Hel.) } 2426949.3939 + 0.59307133E \quad .$$

$\pm 8 \qquad \pm 3$

In Figures 1 and 2, the present photoelectric light curves of the system are presented along with the unpublished photoelectric ones obtained by Celikezer (1976) in our observatory during the observing season of 1975, to demonstrate in what manner the system's light changes. What immediately can be deduced from Figures 1 and 2 when they are compared with Figure 1 of Hilditch et al. (1979) is the existence of a completely different behaviour of the individual light curves obtained in different epochs.

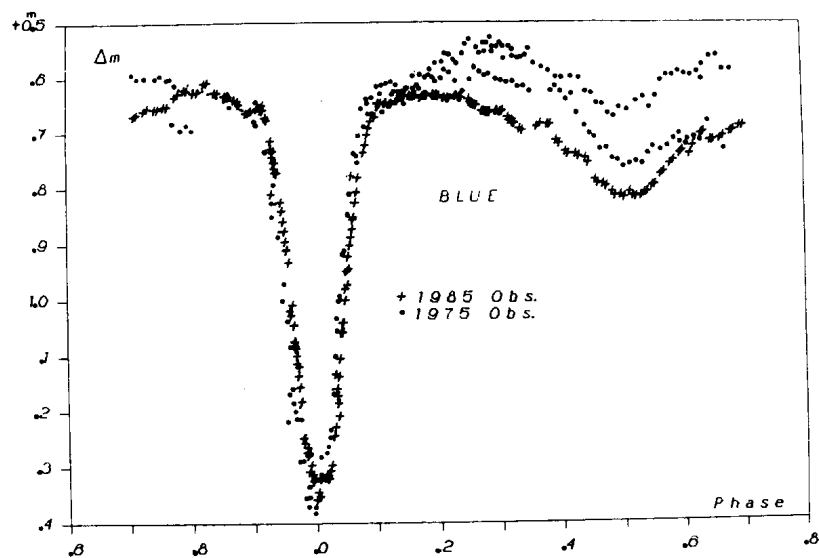


Figure 1. B light curves of SV Cam. Dots are Celikezer's observations obtained in 1975. Plus signs refer to the present observations.

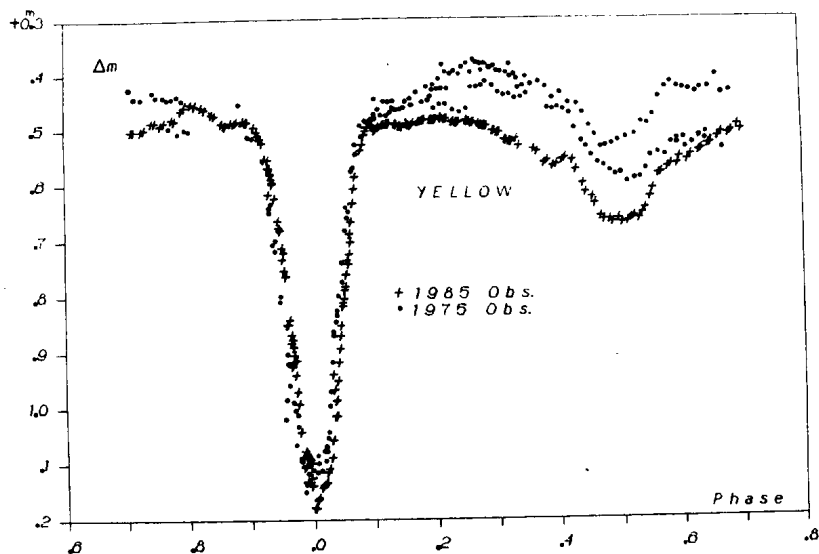


Figure 2. V light curves of SV Cam. Signs are the same as in Figure 1.

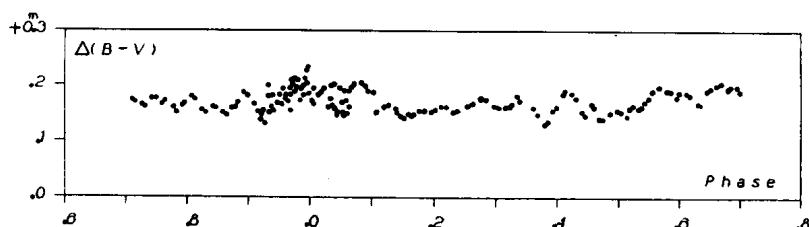


Figure 3. B-V colour variation of SV Cam in 1985 with respect to the comparison star.

According to the observations of Hilditch et al. (1979), all light curves coincide to within  $\pm 0.01$  mag at mid-secondary eclipse, which normally urged them to conclude that the light curve variations are due to intrinsic variability of the cooler component which is invisible around phase 0.5. Contrary to this situation, the light curves obtained in our observatory both by us and Celikezer (1976) do not have indications of any coincidence at mid-secondary eclipse. As it is seen from Figures 1 and 2, the light levels of Celikezer's and the present light curves differ from each other not only at the secondary minimum, but also for the most parts. It is worth noting that Celikezer's observations obtained on ten nights between March-December 1975 are well separated from night to night.

As reported by Hilditch et al. (1979), only 7 percent of the secondary component is visible at phase 0.5, that is, the secondary eclipse is practically total. When this fact is considered together with the varying light levels seen in secondary minimum (see Figures 1 and 2) it seems very unlikely for the secondary component "alone" to take the whole responsibility of the system's light-curve variations.

Getting rid of making any comment for the time being here on the potential contribution(s) of the secondary component on the light-curve changes, the photoelectric observations presented in this paper evidently suggest that the primary component should have a significant role on this event. This is also consistent with the conclusions of Cellino et al. (1985) and Patkós (1981).

Figure 3 shows the colour variations of SV Cam with respect to the comparison star.

An extensive work is being carried out on the present observations of SV Cam and the results will be published in the near future.

M.C. AKAN, Z. TUNCA, C. IBANOGLU, S. EVREN, and V. KESKIN

Ege University Observatory  
Bornova, Izmir, Turkey

## References:

- Celikezer, N.: 1976, Master's thesis, Ege University, Bornova, Izmir.  
 Cellino, A., Scaltriti, F., Busso, M.: 1985, *Astron. Astrophys.*, 144, 315.  
 Frieboes-Conde, H., Herczeg, T.: 1973, *Astron. Astrophys. Suppl.*, 12, 1.  
 Guthnick, P.: 1929, *Astron. Nachr.*, 235, 83.  
 Hall, D.S.: 1976, in "Multiple Periodic Variable Stars," *Proc. IAU Coll. No. 29*,  
 ed. W.S. Fitch, Reidel, Dordrecht, Vol. 1, p. 287.  
 Hilditch, R.W., Harland, D.M., McLean, B.J.: 1979, *Monthly Notices Roy. Astron. Soc.*, 187, 797.  
 Patkós, L.: 1981, *Astrophysical Letters*, 22, 1.  
 Patkós, L.: 1982, *Commun. Konkoly Obs. Hung. Acad. Sci. Budapest*, No. 80.  
 Sommer, R.: 1956, *Astron. Nachr.*, 283, 155.  
 Wood, F.B.: 1946, *Contr. Princeton Obs.*, No. 21, p. 40.

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

Number 3160

Konkoly Observatory  
Budapest  
18 March 1988  
HU ISSN 0374-0676

## THE DISCOVERY OF A BETA LYRAE VARIABLE IN THE VISUAL BINARY SYSTEM ADS 14977

In 1948, Hopmann (1948) listed ADS 14977 (SAO 107139=BD+13°4708) as a suspected variable. Its variability was confirmed this fall at the Flagstaff Station with 650 UBV observations obtained with the 1-m Ritchey-Chretien reflector. The appearance of the light curve, the amplitude and frequency of the light variation, the spectral type (A2) indicate that the A component of ADS 14977 is an eclipsing binary of the Beta Lyrae type.

Two primary minima were observed at:

$$T(1) = 244\,6731.6339$$

$$T(2) = 244\,7064.6953,$$

which produced the following light elements:

$$T = 244\,6730.18247 + 0.^d7272018 \cdot E$$

The V observations are plotted in Figure 1. The magnitudes and colours of the system, as a function of phase, are given in Table I. These data include the light of the B component (sep.=3.5 arc seconds). Table II lists the magnitudes and colors of the comparison and check stars.

Table I

Magnitudes and Colors of ADS 14977 Aa x B

Phase	V	B-V	U-B
0.00	7.24	0.16	0.04
0.50	7.12	0.12	0.03
0.75	7.05	0.12	0.04

Table II

Magnitudes and Colors of the Comparison and Check Stars

Star	V	B-V	U-B
Comp. SAO 107132=BD+13°4705	8.65	0.53	-0.04
Check SAO 107134=BD+13°4706	9.68	1.13	0.96

The UBV data and light curve analysis (SIMPLEX) are being prepared for publication. Photoelectric CCD observations have been obtained and are being used to remove the light of the B component in the analysis.

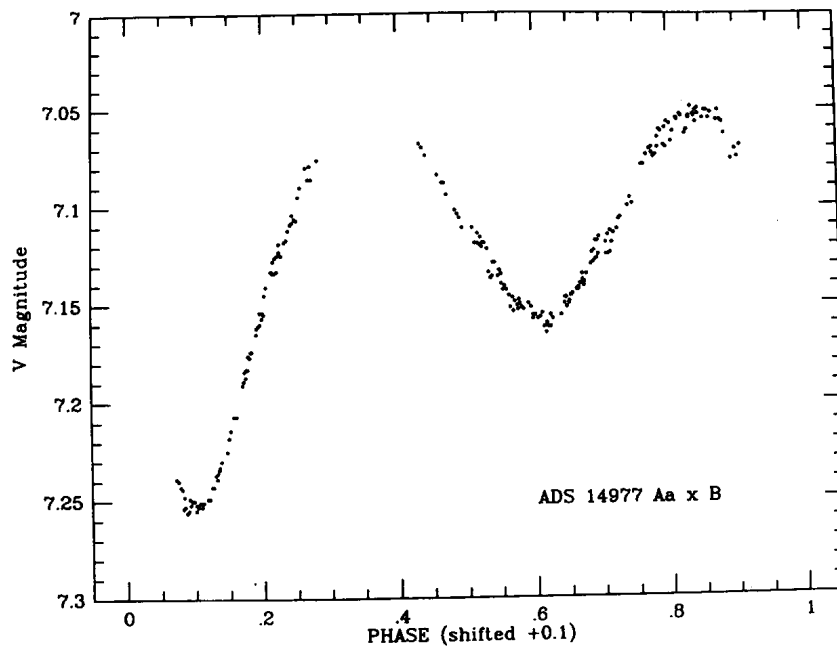


Figure 1

R.L. WALKER  
Flagstaff Station  
U.S. Naval Observatory  
Flagstaff, AZ 86002 U.S.A.

## Reference:

Hopmann, J.: 1948, Z. Astrophysics, 24, 263.

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

Number 3161

Konkoly Observatory  
Budapest  
22 March 1988  
HU ISSN 0374-0676

## PHOTOELECTRIC EPHEMERIS OF THE EARLY-TYPE ECLIPSING BINARY V593 CENTAURI

The variability of the eleventh magnitude eclipsing binary V593 Cen (CoD -61° 3721, CPD -61° 3558) was first announced by Shapley and Swope (1940). Van Gent (1948) classified this star as a W UMa-type eclipsing binary and obtained the following ephemeris on the basis of his 19 photographic times of minima.

$$\text{Min I} = \text{J.D. hel } 2427621.2693 + 0.7553542 \text{ E} \quad (1)$$

$$\pm 0.0024 \pm 0.0000028 \text{ E}$$

New photoelectric observations of V 593 Cen were carried out with the 154 cm. reflector at the Bosque Alegre Astrophysical Station of the National University of Córdoba (Argentina) during observational seasons from 1984 until 1987. The f/21 Cassegrain reflector was equipped with a conventional design photometer; a 1P21 photomultiplier refrigerated with dry ice and a standard UBV set of filters were used. The measurements were made differentially with respect to the comparison star HD115071, whose spectral type is B1. All the UBV observations have been corrected for first and second order differential extinction. A total of 1165 individual observations in each band which completely cover the light curve were obtained and a preliminary photoelectric analysis of the system was realized (Lapasset et al., 1987). The location of the variable at maximum light in the color-color diagram is consistent with an unreddened main sequence star of spectral type B5. So V593 Cen is a new member of the early-type contact binary group.

In this note we present 18 times of minimum determined by means of the bisection-of-chords procedure. A linear least squares solution using our photoelectric data yields the following updated ephemeris:

$$\text{Min I} = \text{J.D. hel } 2445815.56344 + 0.75535990 \text{ E} \quad (2)$$

$$\pm 0.00017 \pm 0.00000018$$

The photoelectric minima, the epoch numbers and O-C residuals calculated from the ephemeris given in equation (2) are listed in Table I. As Van Gent (1948) noticed the choice of the primary minimum is somewhat arbitrary because the minima differ only by a few hundredths of a magnitude.

Table I

Photoelectric times of minimum light of V593 Centauri

Min	JDhel. 2440000.+	E	O-C
I	5815.5634	0.0	-0.00004
I	5815.5639	0.0	0.00046
I	5815.5648	0.0	0.00136
I	6170.5820	470.0	-0.00059
I	6170.5815	470.0	-0.00109
I	6170.5814	470.0	-0.00119
II	6582.6319	1015.5	0.00048
II	6582.6313	1015.5	-0.00012
II	6582.6312	1015.5	-0.00022
II	6613.6019	1056.5	0.00072
II	6613.6017	1056.5	0.00052
II	6613.6002	1056.5	-0.00098
I	6615.4894	1059.0	-0.00018
I	6615.4896	1059.0	-0.00002
I	6615.4899	1059.0	-0.00032
II	6887.7981	1419.5	-0.00127
II	6887.7968	1419.5	-0.00002
II	6887.7961	1419.5	-0.00076

Spectroscopic observations of this system will be carried out in the coming observing season. These observations together with the photoelectric ones will allow us to obtain a simultaneous solution of radial velocity and UBV light curves (Wilson, 1979, Van Hamme and Wilson, 1985).

We wish to express our thanks to J. Laborde, J.R.Puerta and J.Ahumada for their assistance during the observations.

This work was partially supported by the Consejo Nacional de Investigaciones Cientificas y Técnicas (CONICET) of Argentina,

E. LAPASSET, J.J. CLARIÁ, M. GÓMEZ

Observatorio Astronómico  
Universidad Nacional de Córdoba  
Laprida 854, 5000 Córdoba  
Argentina

#### References:

- Lapasset, E., Gómez, M., and Clariá, J.J., 1987, Boletín de la Asociación Argentina de Astronomía, No. 33, in press.  
Shapley, H., and Swope, H.H., 1940, Annals of the Harvard College, Vol. 90, No. 5, p. 177.  
Van Gent H., 1948, Bulletin of the Astronomical Institutes of Netherlands, Vol 10, p. 382.  
Van Hamme, W., and Wilson, E.R., 1985, Astron. and Astrophys., 152, 25.  
Wilson, E.R., 1979, Astrophys. J., 234, 1054.

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

Number 3162

Konkoly Observatory  
Budapest  
22 March 1988  
HU ISSN 0374-0676

PHOTOELECTRIC OBSERVATIONS OF THE ECLIPSING BINARY  
V676 CENTAURI

Based on photographic observations, the first light curve of V676 Cen ( $\alpha = 14^h 34^m 42^s$ ,  $\delta = -38^\circ 37' 7''$ , 1950.0) was given by Hoffmeister (1956). He determined a difference between minima of the order of 0.1 magnitudes and classified this variable as a W UMa-type system. Besides, Hoffmeister obtained 83 times of minimum which gave the following ephemeris:

$$\text{Min I} = \text{J.D. hel } 2434425.555 + 0.292397 E \quad (1)$$

So far, no other observations of this star have been published. During 1987 this twelfth magnitude short period eclipsing binary was observed photoelectrically in the UB system using the 76 cm. and the 154 cm. telescopes of El Leoncito (San Juan, Argentina) and Bosque Alegre (Córdoba, Argentina) stations, respectively. At El Leoncito an RCA 34031 (A) photomultiplier refrigerated by Peltier effect and photon-counting electronics were used. The observations at Bosque Alegre were performed by means of an RCA 1p21 photomultiplier refrigerated with dry ice. Standard UB filters were employed

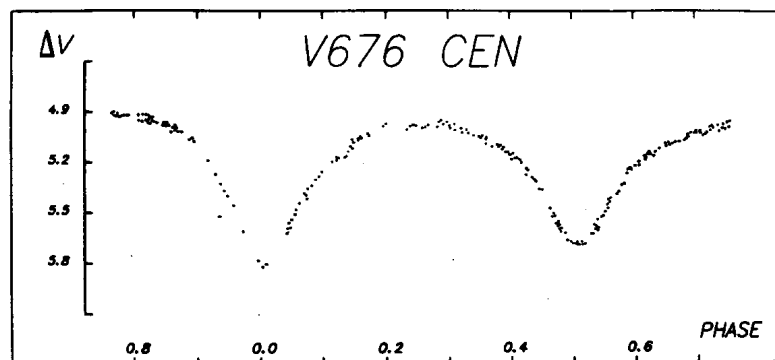


Figure 1, V light curve of the eclipsing binary V676 Centauri

Table I. Photoelectric times of minimum light of  
V676 Centauri

Min	JD hel. 2440000.+	E	O-C
II	6965.6195	-20.5	-0.00171
II	6965.6199	-20.5	-0.00131
II	6965.6167	-20.5	-0.00151
I	6971.6167	0.0	0.00149
I	6971.6167	0.0	0.00149
I	6971.6155	0.0	0.00029
II	6973.5174	6.5	0.00165
II	6973.5163	6.5	0.00055
II	6973.5184	6.5	0.00265
II	6975.5618	13.5	-0.00068
II	6975.5607	13.5	-0.00178
II	6975.5617	13.5	-0.00078
II	6978.4869	23.5	0.00052
II	6978.4867	23.5	0.00032
II	6978.4858	23.5	-0.00058
I	7007.5860	123.0	0.00111
I	7007.5814	123.0	0.00221
II	7008.6001	126.5	-0.00246
II	7008.6011	126.5	-0.00146

in both cases. The measurements were made differentially with respect to the comparison star HD128488. All the observations were corrected by first and second order differential extinction using mean coefficients for both observatories.

A total of 1326 UBV observations were derived and from them 19 new times of minima were calculated. These times of minima were used to deduce the following linear least squares ephemeris:

$$\text{Min I} = \text{Hel. J.D. } 2446971.61521 + 0.2923901 E \quad (2) \\ \pm 0.00034 \quad \pm 0.000057$$

The photoelectric minima together with the epoch number and O-C residuals calculated from the ephemeris given in equation (2), are listed in Table I. As shown in the table, the difference between the observed minima and those calculated from ephemeris (2) yield very small randomly distributed O-C residuals, all being smaller than 0.003 day.

Although the coverage of the photoelectric light curve (Figure 1) is not complete, there is no doubt that we are dealing with a close (contact) system. The continuous light variation due to proximity and reflection effects of the components outside eclipses is easily recognized. Besides, the difference in brightness during the primary and the secondary minima is only about 0.<sup>m</sup>15.

The observations of this variable will be continued during the next observing seasons to complete the light curves and to analyze them by means of modern

synthetic computational methods.

For assistance during observations we thank Messrs. J. Laborde, J.R. Puerta and J. Ahumada. Also we express our gratefulness to the Director of Felix Aguilar Observatory for the observing time.

This work was partially supported by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) of Argentina.

M. GÓMEZ, E. LAPASSET  
Observatorio Astronómico,  
Universidad Nacional de Córdoba  
Laprida 854, 5000 Córdoba,  
Argentina

Reference:

Hoffmeister C., 1956, Veröffentlichungen der Sternwarte zu Sonneberg, Band 3,  
Heft 1, p. 43.

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3163

Konkoly Observatory  
Budapest  
22 March 1988  
HU ISSN 0374-0676

HY PAVONIS: PHOTOELECTRIC TIMES OF MINIMUM  
AND IMPROVED PERIOD

The variability of the short period eclipsing system HY Pavonis ( $\alpha = 20^{\text{h}} 18^{\text{m}} 06^{\text{s}}$ ,  $\delta = -73^{\circ} 51' 8''$ , 1950.0) was detected by Hoffmeister (1963) who suggested that it was an Algol-type eclipsing binary. Gessner and Meinunger (1974) obtained a photographic light curve with an amplitude of the order of 0.9 magnitudes. They found that the depths of both minima were almost equal so that they classified this star as a W UMa-type eclipsing binary. From their photographic observations 12 times of minimum were determined which yielded the following ephemeris:

$$\text{Min I} = \text{Hel. J.D. } 2436730.4586 + 0.^{\text{d}}351653 \text{ E} \quad (1) \\ \pm 0.0044 \quad \pm 0.000027$$

As no photoelectric data of this eleventh magnitude star have been published so far, we decided to include it in our short-period-eclipsing-binary observational program.

In this note we present 16 new photoelectric times of minimum obtained at El Leoncito (San Juan, Argentina) and at Bosque Alegre (Córdoba, Argentina) stations during the 1987 observing seasons. The observations carried out at El Leoncito were performed by means of a 76 cm. reflector telescope, an RCA 34031(A) photomultiplier refrigerated by Peltier effect and photon-counting electronics. At Bosque Alegre the observations were realized with a conventional design photometer and an RCA 1P21 photomultiplier refrigerated with dry ice attached to the 154 cm. reflector. In both observatories standard BV filters were employed.

The measurements were made differentially with respect to the comparison star designated as number 1 in our finding chart (Figure 1). All observations have been corrected for first and second order differential extinction. The comparison star is located approximately 5 minutes of arc south-west from HY Pav and consequently the corrections for differential extinction were small.

Table I. Photoelectric times of minimum light of HY Pavonis

Min	JD hel, 2440000.+	E	Q-C
I	6972.8229	0.0	0.00139
I	6972.8224	0.0	0.00094
I	6973.8762	3.0	-0.00024
I	6973.8762	3.0	-0.00030
I	7002.7128	85.0	0.00060
I	7002.7107	85.0	-0.00149
II	7002.8863	85.5	-0.00178
II	7002.8866	85.5	-0.00141
I	7008.6904	102.0	0.00006
I	7008.6897	102.0	-0.00064
I	7009.7454	105.0	0.00006
I	7009.7452	105.0	-0.00011
I	7022.7576	142.0	0.00107
I	7022.7590	142.0	0.00246
II	7023.6354	144.5	-0.00029
II	7023.6354	144.5	-0.00030

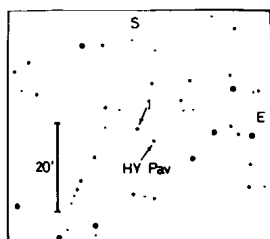


Figure 1. Finding chart of HY Pavonis

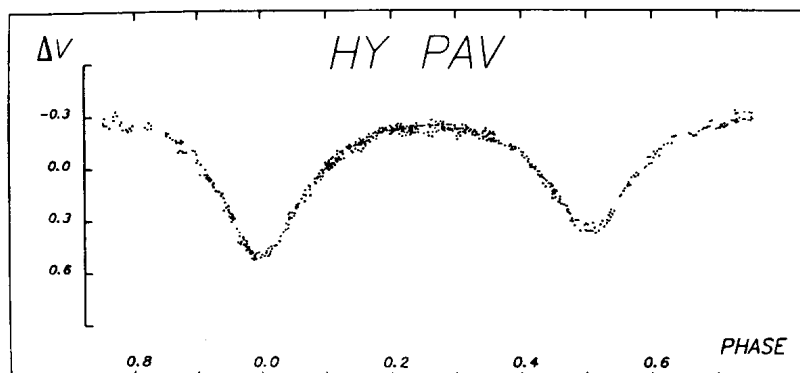


Figure 2. V light curve of the eclipsing binary HY Pavonis

From 735 observations for each (BV) passband we derived 16 times of minimum light. The bisection-of-chords method was used to determine 12 times of primary minimum and 4 of the secondary one. A linear least square solution using our photometric data yields the following updated ephemeris:

$$\text{Min I} = \text{Hel. J.D. } 2446972.82149 + 0.^d3516555 \text{ E} \quad (2) \\ \pm 0.00027 \quad \pm 0.0000027$$

Table I lists the 16 times of minimum light reported in this note. The last two columns give the epoch number and the (O-C) residuals calculated from equation (2). Within the precision of the ephemeris determinations no variability of the period of the system can be asserted.

Although the light curve of the system (Figure 2) has not been completed yet, it shows the typical configuration of the W UMa-type systems. The difference between minima is about 0.15 magnitudes. The maxima clearly show the variation due to the deformation and reflection effects of the components.

This system will be observed again during the next observing season in order to complete the light curves and analyze them by means of a synthetic method of solutions.

We are very grateful to the Director of the Félix Aguilar Observatory (San Juan) for granting the running time at El Leoncito Observatory. The assistance of J. Laborde, J.R. Puerta and J. Ahumada during the observations carried out at Bosque Alegre (Córdoba) is also gratefully acknowledged.

This work was partially supported by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) of Argentina.

E.LAPASSET, M. GÓMEZ  
Observatorio Astronómico  
Universidad Nacional de Córdoba  
Laprida 854, 5000 Córdoba  
Argentina

#### References:

- Hoffmeister, C., 1963, Veröffentlichungen der Sternwarte zu Sonneberg, Band 6, Heft 1, p. 50  
Gessner, H., Meinunger, I., 1974, Veröffentlichungen der Sternwarte zu Sonneberg, Band 6, Heft 5, p. 318

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

Number 3164

Konkoly Observatory  
Budapest  
22 March 1988  
HU ISSN 0374-0676

PHOTOELECTRIC TIMES OF MINIMUM OF THE ECLIPSING  
BINARY RT HYDRI

The eclipsing binary character of the thirteenth magnitude star RT Hydri ( $\alpha = 1^h 10^m 18^s$ ,  $\delta = -79^\circ 26' 8''$ , 1950.0) was discovered by Shapley and Hughes (1934). They classified this short-period variable as a W UMa-type eclipsing binary and obtained, on the basis of photographic measurements, the following ephemeris:

$$\text{Min I} = \text{J.D. hel } 2425480.50 + 0.^d 284038 \text{ E} \quad (1)$$

Although RT Hydri has been known to be a variable star for about 50 years, little attention has been paid to it, and neither photographic nor photoelectric light curves of this system have been yet published.

During an observational run at the Complejo Astronómico El Leoncito -CASLEO- (San Juan, Argentina) in September 1987, RT Hydri was observed photoelectrically in the UBV system using the 2.15 m reflecting telescope. Observations were carried out with the Vatican Observatory Polarimeter, VATPOL (Magalhães et al. 1984) used as a photometer. Two dry-ice cooled RCA 31034 Ga-As photomultipliers were used as detectors. A standard UBV set of filters and small diaphragms of 3 and 5 seconds of arc were also employed.

The measurements were made differentially with respect to the comparison star designated as number 1 in our finding chart (Figure 1).

All the observations were corrected for first and second order differential extinction. The comparison star is located  $\sim 3'$  north-west from RT Hydri, and consequently the corrections were small. A total of 540 individual observations (180 in each band) have been obtained. The bisection-of-chords procedure was utilized to determine six times of primary minimum and six of the secondary one. A linear least squares solution using our photoelectric data yields the following updated ephemeris

$$\text{Min I} = \text{J.D. hel } 2447054.78679 + 0.^d 2839975 \text{ E} \quad (2) \\ \pm 0.00026 \pm 0.0000092$$

Table I lists the 12 times of minimum light reported in this note. The last two columns give the epoch numbers and the O-C residuals calculated from equation (2). Because of the shortness of the period and the large amount of time elapsed without observations, it is difficult to join unambiguously our

Table I. Photoelectric times of minimum light of RT Hyi

Min	JD hel 2440000.+	E	O-C
I	7054.7863	0.0	-0.00048
I	7054.7864	0.0	-0.00042
I	7054.7866	0.0	-0.00016
I	7056.7748	7.0	-0.00001
I	7056.7764	7.0	0.00167
I	7056.7762	7.0	0.00146
II	7061.7436	24.5	-0.00111
II	7061.7439	24.5	-0.00086
II	7061.7435	24.5	-0.00120
II	7068.8448	49.5	0.00014
II	7068.8449	49.5	0.00025
II	7068.8454	49.5	0.00074

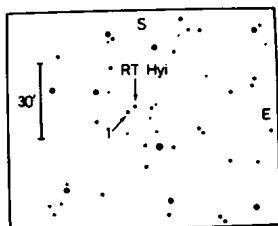


Figure 1. Finding chart of RT Hydri

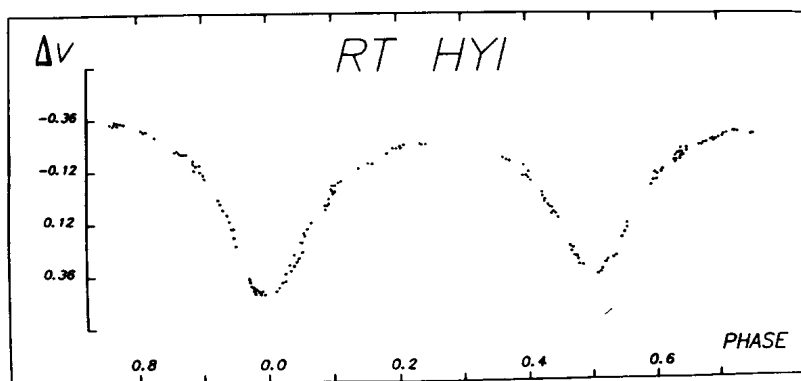


Figure 2. V light curve of the eclipsing binary RT Hydri

minima with the older photographic ones. Consequently, no variability of the period can be asserted.

Although the coverage of the light curve (Figure 2) is not complete, the light curve itself presents the typical characteristics of the W UMa-type systems. The maxima clearly show the variation due to the reflection and proximity effects of the components and the differences between the successive minima are only about 0.05 magnitudes.

The observations of the system will be continued in the next observational seasons in order to complete the light curves and analyze them using the Wilson and Devinney (1971) computer procedure.

We are very grateful to Dr. H. Levato for observing time and facilities at CASLEO. The assistance of J.C. Berneri and A. De Franceschi is also gratefully acknowledged.

This work was partially supported by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) of Argentina.

M.GÓMEZ, J.J. CLARIÁ, D. MINNITI, E. LAPASSET  
Observatorio Astronómico,  
Universidad Nacional de Córdoba  
Laprida 854, 5000 Córdoba  
Argentina

#### References:

- Magalhães, A.M., Benedetti, E., and Roland, E.H., 1984, Publ. Astron. Soc. Pacific., 96, 383  
Shapley, H., and Hughes, E.M., 1934, Annals of Harvard College Observatory, 90, No. 4, 172  
Wilson, R.E., and Devinney, E.J., 1971, Astrophys. J., 166, 605

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3165

Konkoly Observatory  
Budapest  
23 March 1988  
HU ISSN 0374 - 0676

A LIST OF BINARY CEPHEID CANDIDATES DESERVING RADIAL  
VELOCITY OBSERVATIONS

The Cepheid variables are continuing to play an important role in astronomy, and this statement is especially valid for the Cepheids belonging to binary systems. These stars may lead us to a more accurate determination of Cepheid masses as well as to the exact calibration of the zero-point of the period - luminosity relationship. The frequency of binaries among the classical Cepheids is considerable: every third or fourth Cepheid has a companion (Burki, 1984).

The discovery of a companion to a Cepheid is usually time consuming. Nevertheless, there are 27 cases where the presence of the companion has been established beyond doubt:

U Aql,	FF Aql,	V 496 Aql,	$\eta$ Aql,	RW Cam,	Y Car,	YZ Car,
SU Cas,	CE Cas,	DL Cas,	AZ Cen,	KN Cen,	AX Cir,	AG Cru,
SU Cyg,	V 1334 Cyg,	Z Lac,	T Mon,	S Mus,	Y Oph,	SV Per,
AW Per,	S Sge,	W Sgr,	V 636 Sco,	Y Sct,	$\alpha$ UMi.	

Generally speaking the final proof comes from radial velocity observations, where variations in the  $\gamma$ -velocity are explained in terms of orbital motion. This is demonstrated by the recent discovery of two Cepheid binaries (Z Lac and Y Sct) following a very extensive radial velocity survey of Cepheids (Moffett and Barnes, 1987; Barnes et al., 1987, 1988).

Moffett and Barnes (1987) compared the  $\gamma$ -velocities derived from their own data with those published by Caldwell and Coulson (1987), and intriguing deviations were found in a number of cases. Moffett and Barnes recommended that Cepheids with large differences in their  $\gamma$ -velocities as measured at different epochs should be examined for possible orbital motion. The aim of this note is to emphasize that most of the Cepheids with seemingly variable  $\gamma$ -velocity in Table I of Moffett and Barnes have already been suspected as binaries based on photometric and other evidence. A third-epoch radial velocity curve will probably reveal the binary nature of most of them. Table I gives some basic information on these binary Cepheid candidates. The

Table I. Cepheids with large radial velocity shifts according to  
Moffett and Barnes (1987)

Cepheid	$v_r$ km/s	P	$\langle V \rangle$	Evidence for duplicity
TT Aql	2.9	13. <sup>d</sup> 75	7. <sup>m</sup> 13	MF 80
FM Aql	3.0	6.11	8.27	M 77
RY CMa	4.6	4.68	8.11	
TW CMa	3.2	6.99	9.56	P 78
RW Cas	6.8	14.79	9.24	Sz 89
MW Cyg	2.8	5.95	9.49	MF 80
V 386 Cyg	4.9	5.26	9.63	K 66, M 77, MF 80
RZ Gem	7.4	5.53	10.01	M 77, MF 80
V Lac	5.4	4.98	8.94	
X Lac	3.9	5.44	8.41	MF 80
Y Lac	4.0	4.32	9.15	M 77, Sz 89
RR Lac	4.6	6.42	8.85	Sz 89
U Sgr	4.7	6.75	6.69	LE 68
W Sgr	2.8	7.60	4.67	J 74, B-VP 85
RV Sco	5.8	6.06	6.97	K 66
V 482 Sco	6.8	4.53	7.96	G 82
V 500 Sco	7.2	9.32	8.73	K 66, M 77, MF 80
SZ Tau	4.1	3.15	6.53	M 77, Sz 77
X Vul	3.1	6.32	8.85	J-P 76

Table II. Suspected Cepheid binaries for which radial velocity  
data are insufficient to prove duplicity

Cepheid	P	$\langle V \rangle$	Evidence for duplicity
FN Aql	9. <sup>d</sup> 48	8. <sup>m</sup> 38	D 77, P 78, Sz 88
RX Aur	11.62	7.67	M 63, J-P 76, Sz 88
YZ Aur	18.19	10.38	M 77, MF 80, Sz 81
RS Cas	6.30	9.94	MF 80
SY Cas	4.07	9.87	MF 80
VV Cas	6.21	10.74	M 77
BP Cas	6.27	10.93	LE 68
BY Cas	3.22	10.28	K 66, MF 80
AK Cep	7.23	11.18	M 77, MF 80
VX Cyg	20.13	10.07	K 66, M 77
BZ Cyg	10.14	10.22	K 66, MF 80
DX Gem	3.14	10.74	B 85
V 465 Mon	2.71	10.38	B 85

Table III. Suspected Cepheid binaries lacking radial velocity data

Cepheid	P	$\langle V \rangle$	Evidence for duplicity
CF Cas	4. <sup>d</sup> 88	11. <sup>m</sup> 14	M 77
V 532 Cyg	3.28	9.09	M 77, Sz 77
CS Mon	6.73	10.99	P 78
CV Mon	5.38	10.30	M 77, P 78, Sz 80

successive columns contain the following data: name of the Cepheid; the difference in the  $\gamma$ -velocity measured at the two epochs (the absolute value of the data given by Moffett and Barnes, 1987); the pulsation period; the mean value of the V magnitude averaged over one pulsational cycle; and references to the existence of the companion (initial of the author's first name and the last two digits of the year are given). Note that there are only two Cepheids from among the 19 stars in Table I that have never been reported as being suspected binaries. In addition, for five Cepheids there is more than one independent piece of evidence concerning their duplicity.

Unfortunately, a considerable number of Cepheids have not been subjected to a very thorough spectroscopic study. Table II contains a list of those suspected binary Cepheids that have at least a single epoch radial velocity curve, and a new series of radial velocity measurements would certainly support the binary nature of some of them.

Finally, Table III contains information on four Cepheids (also suspected binaries) that have never been observed spectroscopically as far as the radial velocity is concerned. The photometric evidence, however, suggests that these stars — as well as the binary Cepheid candidates listed in Tables I and II — are worthy of thorough spectroscopic study.

L. SZABADOS

Konkoly Observatory of the  
Hungarian Academy of Sciences  
H-1525 Budapest, XII. P.O. Box 67  
Hungary

#### References:

- Barnes, T.G., Moffett, T.J., and Slovak, M.H. 1987, *Ap.J.Suppl.*, 65, 307.  
Barnes, T.G., Moffett, T.J., and Slovak, M.H. 1988, *Ap.J.Suppl.*, January.  
Böhm-Vitense, E., and Proffitt, C. 1985, *Ap.J.*, 296, 175.  
Burki, G. 1984, *Astron. Astrophys.*, 133, 185.  
Burki, G. 1985, In "Cepheids: Theory and Observations", *Proc. IAU Coll. No.82*, ed. B.F. Madore (Cambridge Univ. Press), p.34.  
Caldwell, J.A.R., and Coulson, I.M. 1987, *Astron. J.*, 93, 1090.  
Dean, J.F. 1977, *MNASSA*, 36, No.1, 3.  
Gieren, W. 1982, *Ap.J.Suppl.*, 49, 1.  
Jacobsen, T.S. 1974, *Ap.J.*, 191, 691.  
Janot-Pacheco, E. 1976, *Astron. Astrophys. Suppl.*, 25, 159.  
Kurochkin, N.E. 1966, *Perem. Zvezdy*, 16, 10.  
Lloyd Evans, T. 1968, *Mon. Not. R. astr. Soc.*, 141, 103.  
Madore, B.F. 1977, *Mon. Not. R. astr. Soc.*, 178, 505.  
Madore, B.F., and Fernie, J.D. 1980, *Pub. Astr. Soc. Pacific*, 92, 315.  
Mianes, P. 1963, *Ann. Astrophys.*, 26, 1.  
Moffett, T.J., and Barnes, T.G. 1987, *Pub. Astr. Soc. Pacific*, 99, 1206.  
Pel, J.W. 1978, *Astron. Astrophys.*, 62, 75.  
Szabados, L. 1977, *Mitt. Sternw. ung. Akad. Wiss., Budapest*, No. 70.

- Szabados, L. 1980, Commun. Konkoly Obs. Hung. Acad. Sci., Budapest, No.76.  
Szabados, L. 1981, Commun. Konkoly Obs. Hung. Acad. Sci., Budapest, No. 77.  
Szabados, L. 1988, Pub. Astr. Soc. Pacific, in press.  
Szabados, L. 1989, to be published.

COMMISSION 27 OF THE I. A. U.  
 INFORMATION BULLETIN ON VARIABLE STARS  
 Number 3166

Konkoly Observatory  
 Budapest  
 25 March 1988  
 HU ISSN 0374-0676

OPTICAL BEHAVIOUR OF THE X-RAY BINARY V1727 CYGNI  
 = 4U 2129 + 47 IN THE SEASON 1987/88

The star was inspected on 49 blue-sensitive plates (ORWO-ZU 21 + GG 13. + BG 12) from 24 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 26 March 1987 and 13 January 1988.

The individual estimates, listed in Table I are linked to the sequence of comparison stars given by Wenzel (1983).

Table I

J.D. hel. 244...	m <sub>B</sub>	Rem.	J.D. hel. 244...	m <sub>B</sub>	Rem.
6881.601	>17.5	inv	7029.454	>17.5	inv
6884.588	>17.9	inv	7029.501	>17.9	inv
6884.605	>17.5	inv	7030.444	>17.9	inv
6885.587	>17.9	inv	7030.476	>17.9	inv
6885.606	>17.5	inv	7030.504	>17.5	inv
6909.566	>17.9	inv	7039.463	>17.5	inv
6910.554	18.3		7039.482	>17.5	inv
6910.573	18.4		7039.502	>17.5	inv
6914.553	>17.9	inv	7039.527	>17.9	inv
6914.570	>18.3	inv	7060.390	>17.9	inv
6917.554	>17.9	inv	7060.412	18.3	
6917.570	>17.9	inv	7060.439	18.4	
6939.532	>18.3	inv	7061.397	>17.9	inv
6941.512	>18.3	inv	7087.290	18.3	
6941.532	17.9		7087.311	>17.9	inv
6976.449	17.9::		7094.344	>17.9	inv
6976.467	18.1		7094.364	>17.5	inv
6976.485	>18.3	inv	7141.276	>17.9	inv
6977.483	>17.9	inv	7141.335	>17.9	inv
6977.499	>17.9	inv	7143.209	>17.5	inv
6983.495	>18.1	inv	7152.290	>17.5	inv
7028.422	18.0:		7152.309	>17.9	inv
7028.456	>17.9	inv	7174.222	>18.3	inv
7028.475	>17.9	inv	7174.248	>17.5	inv
7029.454	>17.5	inv			

On most of the plates the stars is below the plate limit. The object is visible only on 8 plates. The brightness varies there between  $m_B = 17.^m9$  and  $m_B = 18.^m4$  and characterizes, as in former series (Götz, 1985, 1986, 1987), the low or inactive state of the star, which probably started near 7 September 1983 (Wenzel 1983).

W. GÖTZ  
Akademie der Wissenschaften  
der DDR,  
Zentralinstitut für Astrophysik  
Sternwarte Sonneberg, DDR

References :

- Götz, W., 1985, I.B.V.S. No. 2732  
Götz, W., 1986, I.B.V.S. No. 2895  
Götz, W., 1987, I.B.V.S. No. 3013  
Wenzel, W., 1983, I.B.V.S. No. 2452

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

Number 3167

Konkoly Observatory  
Budapest  
25 March 1988  
HU ISSN 0374-0676

## NEW TIMES OF MAXIMUM BRIGHTNESS FOR SX Phe (\*)

SX Phe is the prototype of a well known class of variable stars belonging to the spherical component of the old galactic disk population with periods less than 0.10 and amplitude of a few tenths of a magnitude. Coates et al. (1979) reviewed all the available timings of maximum light and established accurate values for the two periods simultaneously excited, i.e.  $P_0 = 0.054964438^d$  and  $P_1 = 0.042772692^d$  identified as the fundamental mode and the first overtone respectively. The analysis led to the ephemeris

$$\text{Max} = \text{Hel. J.D. } 2438636.6170 + 0.054964438 \times E \\ - 0.00325 \sin 2\pi(0.28503575 \times E - 0.107) \quad (1)$$

This ephemeris is reported in the Fourth Edition of the General Catalogue of Variable Stars (Kholopov et al., 1985) and curiously enough the only maxima observed photoelectrically after 1978 seem to be the 17 timings by Coates et al. (1980), made a few months after the publication of their ephemeris.

In order to fill the gap and upon request of some Guest Investigators at the IUE satellite interested by a correlation between spectral features and the phase of the light variation, photometry of SX Phe was included in an observing run carried out during November 1987 with the 50 cm telescope of the European Southern Observatory (La Silla, Chile) and devoted to much less studied  $\delta$  Sct stars. Observations were carried out with a Strömgren b filter on the nights of November 9-10 and 13-14, logging a total of 4.0 hours. The comparison star chosen by Stock and Tapia (1971), i.e. HD 223011, was used. Two maxima with a difference in brightness of about 0.10 mag were observed. The Figure reproduces the light curve for November 13-14: a third maximum occurred just at the beginning of the observations, but cannot be determined reliably. The observed times of maxima are

$$\text{Hel. J.D. } 2447109.5509 \quad O-C = + 0.0011^d \\ 113.5628 \quad - 0.0026^d$$

O-C's refer to ephemeris (1) with  $E = 154153$  and  $154226$  respectively. Taking observational errors and uncertainties of  $P_0$  and  $P_1$  into account the small O-C's suggest no large change in the periods from 1960 to now. However,

(\*) Based on observations collected at European Southern Observatory,  
La Silla, Chile

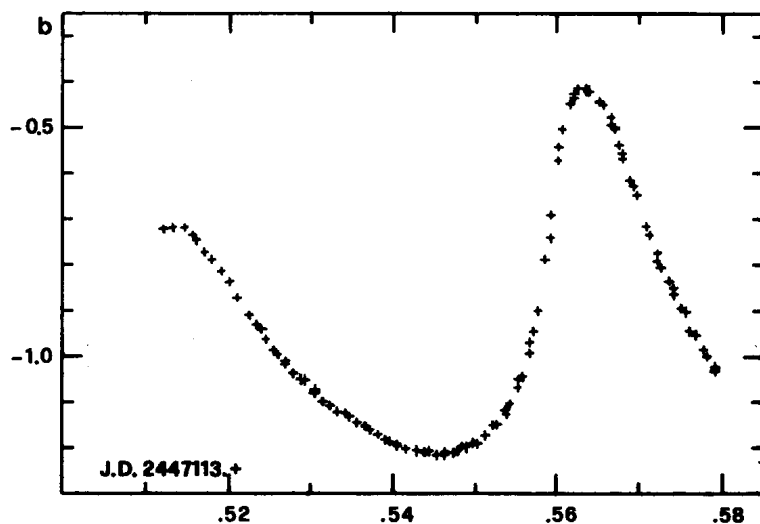


Figure 1

it is interesting to note that the linear term of the (1) fits better the observed times of maxima: O-C's are  $+0.0009^d$  and  $+0.0004^d$  respectively. Of course, further checks of ephemeris (1) are recommended. The project looks particularly attractive for southern amateur astronomers with small telescopes equipped with photoelectric photometers.

The observational data can be requested from the author.

ENNIO PORETTI

Osservatorio Astronomico di Brera  
Via E. Bianchi, 46  
22055 Merate (CO)  
Italy

#### References:

- Coates, D.W., Dale, M., Halprin, L., Robinson, J., Thompson, K.: 1979, Monthly Not. Royal Astron. Soc., 187, 83  
Coates, D.W., Halprin, L., Heintze, G.N., Thompson, K.: 1980, Inf. Bull. Var. Stars, No. 1756  
Kholopov, P.N., et al.: 1985, General Catalogue of Variable Stars, Fourth Edition, Moscow  
Stock, J., Tapia, S.: 1971, Astron. Astrophys. Suppl. 3, 253

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

Number 3168

Konkoly Observatory  
Budapest  
25 March 1988  
*HU ISSN 0374-0676*

IS  $\nu$  Her REALLY A VARIABLE STAR ?

The bright star  $\nu$  Her = HR 6707 was suspected to be a variable star by two observers independently. Searching for microvariability in bright stars, Jackisch, (1963) found an amplitude of 0.06 mag in V and a period of 29 d. It must be noted, however, that Jackisch used  $\alpha$  Lyr as comparison star, which choice does not seem very adequate. Henriksson (1976) included  $\nu$  Her in a list of variable that he discovered during a survey of stars located in the Cepheid instability strip. On the basis of 39 V measures he reported an amplitude of 0.05 mag but was not able to give a period.

These two works led Hoffleit and Jaschek (1982) to mention the star as a probable  $\delta$  Sct variable and Kholopov et al. (1985) to classify it as a possible SRd variable.

In order to confirm the variability, we undertook observations of  $\nu$  Her in 1986, adding it to other F-G-K giant variables under spectroscopic and/or photometric investigation.  $\nu$  Her was observed on 12 nights from May 31 to August 24, 1986 with the 50 cm reflector of Merate Observatory. HR 6775 (V=5.04, B-V=+0.52, U-B=-0.09, F7V) and HR 6814 (V=5.88, B-V=+0.01, U-B=+0.11, A3V) were used as comparison stars. On each night, 7-9 differential measurements were taken and grouped into normal points. The internal standard error of these normal points averages 0.003 mag in all colours, while the night-to-night standard deviation of magnitude differences between the comparison stars are 0.005, 0.006, 0.008 mag in V, B, U respectively. HR 6814=ADS 11149 is a close double star: its B component was suspected to vary more than 2 mag (Baize, 1962). However, if the mean difference in magnitude between the two components is really 2.5 mag (Baize, 1962), then our measures exclude variations of the B component during our survey greater than 0.1 mag.

The Table shows the  $\Delta m$  between HR 6775 and  $\nu$  Her.  $\Delta m$ 's are in the sense comparison minus variable star. Taking observational errors into account, it is hard to find a variation larger than 0.01 mag in the data. If one assumes that  $\nu$  Her is an SRd variable, then, we must admit that we have observed the star during a quiescent phase of its light variability. If we consider the star

Table I

J.D.	$\Delta U$	$\Delta B$	$\Delta V$
2446582.43	+ 0.592	+ 0.801	+ 0.654
587.41	—	+ 0.791	+ 0.651
603.46	+ 0.568	+ 0.790	+ 0.646
604.45	+ 0.566	+ 0.786	+ 0.643
610.39	—	+ 0.796	+ 0.651
616.46	—	+ 0.782	+ 0.647
636.43	—	+ 0.797	+ 0.652
648.43	—	—	+ 0.646
655.44	+ 0.581	+ 0.807	+ 0.664
662.43	+ 0.586	+ 0.795	+ 0.651
663.46	—	—	+ 0.657
667.39	+ 0.573	+ 0.809	+ 0.658

to be a  $\delta$  Sct variable, our results (i.e. light constancy during normal points and small peak-to-peak amplitude) are conflicting with those of Jackisch's and Henriksson's surveys. Percy, et al. (1979) found no variation larger than 0.02 mag in B and V light: this result strengthens our conclusion. Considering its spectral type and luminosity class (F2III) and the current calibrations of uvby $\beta$  photometry, we may estimate that  $\nu$  Her is located near the blue edge or more probably outside the instability strip. From these considerations it is probable, in our opinion, that  $\nu$  Her is not a variable star at all.

E. PORETTI  
L. MANTEGAZZA (\*)  
E. ANTONELLO  
Osservatorio Astronomico di Brera  
Via E. Bianchi, 46  
22055 MERATE (CO)  
Italy

(\*)and Dipartimento di  
Fisica Nucleare e Teorica  
Università di Pavia  
Pavia, Italy

#### References:

- Baize, P.: 1962, *Journal des Observateurs*, **45**, 117  
 Henriksson, G.: 1976, *Astron. Astrophys.* **54**, 309  
 Hoffleit, D., Jaschek, C.: 1982, *The Bright Star Catalogue*, Fourth Edition, New Haven  
 Jackisch, G.: 1963, *VSS* **5**, H.5  
 Kholopov, P.N. et al.: 1985, *General Catalogue of Variable Stars*, Fourth Edition, Moscow  
 Percy, J.R., Baskerville, I., Trevorrow, D.W.: 1979, *Publ. Astron. Soc. Pacific*, **91**, 368

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

Number 3169

Konkoly Observatory  
Budapest  
29 March 1988  
HU ISSN 0374-0676

## NEW OBSERVED TIMES OF MINIMA FOR MR Cyg, V477 Cyg

Photoelectric observations of these two Algol class eclipsing binaries were carried out at the 0.4 meter telescope at the Morgan-Monroe Station of the Goethe Link Observatory of Indiana University. V477 Cyg and MR Cyg were observed on September 14 and October 4, 1987 (UT), respectively.

The photometric equipment consisted of a 1P21 photomultiplier tube in a dry ice cooled housing, pulse counting electronics, with microcomputer control of data acquisition and data recording. BD +47°3622 and BD +31°3926 were used as comparison stars for MR Cyg and V477 Cyg, respectively. The times of minima given below were obtained from light curves in U and V for the two stars.

	<u>MR Cyg</u>	<u>V477 Cyg</u>
Hel. Primary Minimum	2447072.6211	2447052.5946
	+6	+11

For V477 Cyg, the period  $2^d.346993$  of the linear approximation of O'Connell (1970) and the epoch JD 2445139.7944 of Lacy et al. (1987) combine with the above result to produce an O-C value of  $+0^d.0009 \pm 0^d.0011$ , verifying the usefulness of O'Connell's approximation as updated by Lacy et al.

For MR Cyg, the above result yields an O-C value of  $+0^d.0050 \pm 0^d.0006$  using the mean ephemeris calculated by Battistini et al. (1972), and an (O-C) value of  $+0^d.0012 \pm 0^d.0006$  using the mean ephemeris calculated by Söderhjelm (1978). However, the period ( $1^d.6770345$ ) and epoch (JD 2427013.612) of Lavrov (1965) produce an O-C value of  $-0^d.0005 \pm 0^d.0006$ , indicating possible reversal of the abrupt period decrease occurring circa 1966, discussed by Söderhjelm (1978).

C.A. WOOD

Department of Astronomy  
Indiana University  
Bloomington, Indiana 47405  
U.S.A.

## References:

- Battistini, P., Bonifazi, A., and Guarnieri, A., 1972, *Astrophys. Space Sci.*, **19**, 395  
Lacy, C.H., Frueh, M.L., and Turner, A.E., 1987, *Astron. J.*, **94**(4), 1035  
Lavrov, M.I., 1965, *Bull. Engelhardt Obs.*, **38**, 3  
O'Connell, D.J.K., 1970, *Vistas in Astronomy*, **12**, 271  
Söderhjelm, S., 1978, *Astron. Astrophys.*, **66**, 161

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

Number 3170

Konkoly Observatory  
Budapest  
30 March 1988  
*HU ISSN 0374-0676*

THE LAST MAXIMA OF HR 8752 = V509 Cas

Much interest in the light and spectrum variability of the hypergiant HR 8752 = V509 Cas has recently been shown, particularly since there is speculation that the cause of the changes is non-radial pulsation. Sheffer and Lambert (1987) have determined that this pulsation may be bimodal with a dominant mode of approximately 421 days and a secondary of 315, both of which may be overtones of a primary fundamental mode of 1070 days. Concerted efforts by photometrists (e.g., Mantegazza et al., 1988; Zsoldos, 1986; Halbedel, 1985, 1986) have provided relatively complete coverage of the recent light variations of this star. It has been interesting to note that while the average magnitude of HR 8752 has remained essentially constant over the past decade, the B-V colors have consistently become more blue with time, implying that there has been an effective temperature increase of about  $800^{\circ}\text{K}$  over that time period.

This paper reports on the most recent behaviour of this interesting hypergiant. Observations at the Corralitos Observatory have now followed HR 8752 through four maxima. The observations in BV colors have been carried out with the single channel photon-counting photometer and uncooled EMI 9924A photomultiplier tube. The comparison star HR 8761 ( $V=6.20$ ;  $B-V=+1.50$ ) and its check HR 8778 ( $V=6.43$ ;  $B-V=+0.90$ ) have remained constant throughout this time period to within 0.01 in V magnitudes and 0.02 in B-V.

The thusfar unpublished Corralitos magnitudes are shown in Table I, and graphically depicted for the entire four year span in Figure 1. It is interesting to note that the last maximum of HR 8752 was somewhat depressed in V magnitude and that the trend towards bluer colors has most definitely continued.

Two spectra centered on  $H\alpha$  were also obtained by the author with the Kitt Peak Observatory coudé feed telescope and CCD camera on JD 2447119.6715 and 7120.6819. These showed the same profile at  $H\alpha$  as has been previously observed by others for this star: a double peaked emission line with deep central absorption superimposed on a wider absorption. Mean radial velocity measures of these features and a superposition of the line profiles revealed no detectable change from night to night. The radial velocities appear in Table II and the line profile in Figure 2.

Table I

JD-2440000	V	B-V	JD-2440000	V	B-V
6710.6868	4.92	+1.24	7028.7777	5.01	+1.27
6713.7958	4.88	1.25	7045.8340	5.03	1.29
6714.7826	4.88	1.23	7046.7993	5.01	1.29
6717.7277	4.88	1.23	7047.8201	5.03	1.26
6730.7805	4.91	1.21	7049.7507	4.97	1.27
6732.7395	4.88	1.25	7050.8438	4.98	1.25
6735.6847	4.87	1.22	7051.7021	4.99	1.25
6754.6062	4.90	1.29	7062.7750	4.96	1.24
6755.6548	4.91	1.25	7066.7826	4.98	1.23
6756.7381	4.95	1.25	7067.6875	4.97	1.22
6759.6111	4.84	1.24	7087.7194	4.95	1.21
6773.6326	4.91	1.21	7088.7528	4.96	1.20
6774.6145	4.94	1.19	7089.6271	4.94	1.21
6776.6125	4.95	1.23	7102.7451	4.92	1.21
6777.5784	4.93	1.23	7106.6965	4.90	1.21
6794.6263	5.01	1.19	7124.6819	4.91	1.17
6795.5951	5.02	1.26	7125.6806	4.90	1.17
6797.5770	4.99	1.24	7126.6271	4.90	1.17
6800.5909	4.99	1.25	7127.6340	4.91	1.17
6814.5784	5.00	1.30	7128.6229	4.90	1.18
6817.5826	5.00	1.30	7169.5771	4.88	1.16
6945.9424	4.99	1.13	7170.5868	4.86	1.17
6948.9479	4.97	1.20	7173.5785	4.91	1.12
6949.9417	4.98	1.20	7174.5785	4.91	1.10
6951.9076	4.99	1.20	7175.5861	4.96	1.15
6994.8465	4.97	1.22			

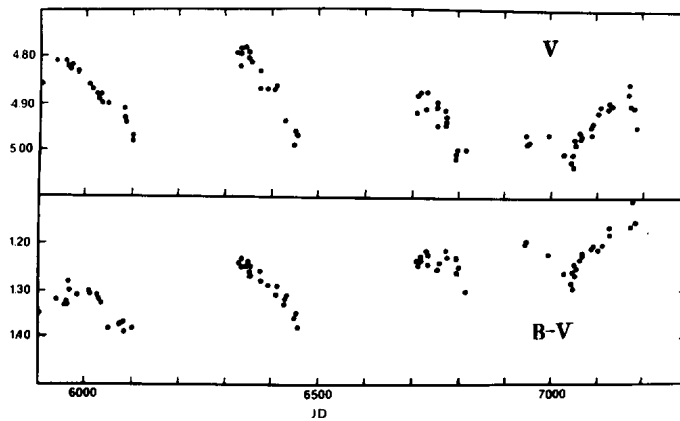


Figure 1. V and B-V observations for HR 8752 for the past four observing seasons.

Table II

H  $\alpha$  feature mean radial velocities:

Violet Emission Peak	-134.7 km s <sup>-1</sup>
Line Profile center	- 98.2
Deepest Absorption	- 94.0
Red Emission Peak	- 49.0

Mean stellar radial velocity:

$-43.7 \pm 5.9$  km s<sup>-1</sup> (from 7 lines)

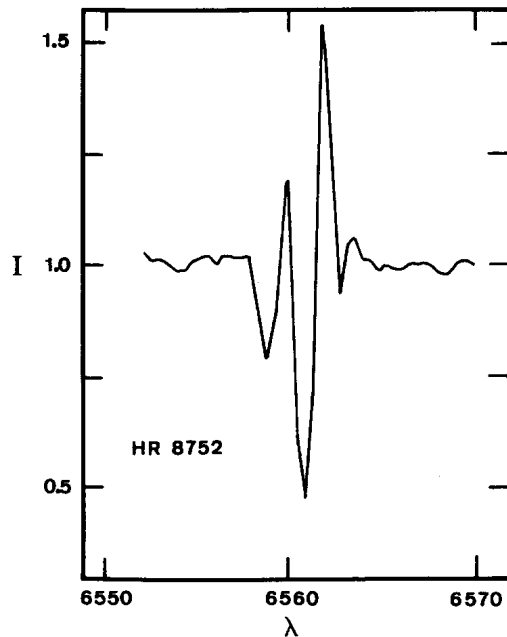


Figure 2. Mean H  $\alpha$  line profile for HR 8752.

E.M. HALBEDEL  
 Corralitos Observatory  
 P.O. Box 16314  
 Las Cruces, NM 88004  
 U.S.A.

References:

- Halbedel, E.M., 1985, Inf. Bull. Var. Stars, No. 2718  
 Halbedel, E.M., 1986, Inf. Bull. Var. Stars, No. 2876  
 Mantegazza, L., Poretti, E., and Antonello, E., 1988, Inf. Bull. Var. Stars, No. 3137  
 Sheffer, Y., and Lambert, D., 1987, Publ. Astr. Soc. Pacific, 99, 1277  
 Zsoldos, E., 1986, Inf. Bull. Var. Stars, No. 2913

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

Number 3171

Konkoly Observatory  
Budapest  
30 March 1988  
HU ISSN 0374-0676

RECENT BEHAVIOUR OF THE YELLOW SUPERGIANT RHO Cas

Rho Cas has previously revealed complex photometric and spectroscopic changes. Quasi-periodicities of various lengths have been suggested, with the most convincing being that of Sheffer and Lambert (1986) who derived a dominant radial pulsation mode of about 520 days from a comprehensive examination of line profile changes. The light variations have had excellent coverage by the visual observers of the AAVSO and appear to show most recently a semi-regular to irregular phasing of approximate amplitude less than 0.4 magnitudes. Photometrically, Leiker, and Hoff (1987) have published the most current comprehensive light curve for JD 2446604 - 6994.

Rho Cas has been added to the long-term monitoring program of the Corralitos Observatory. Observations in BV colors were carried out with the 0.6 m. telescope and single channel photon-counting photometer equipped with an EMI 9924A photo-

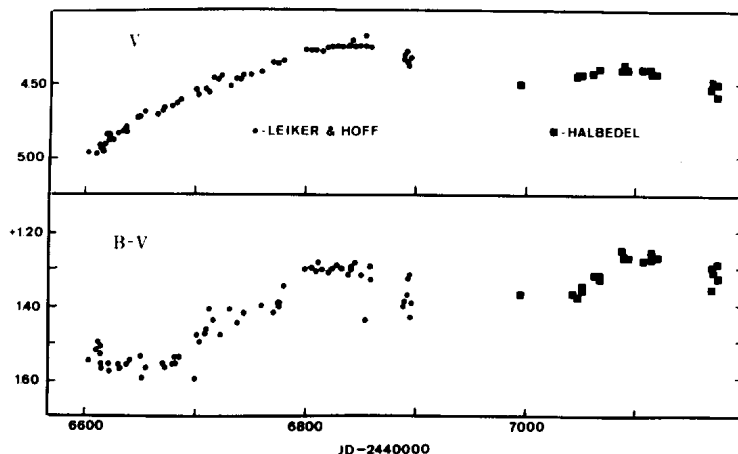


Figure 1. V and B-V observations for Rho Cas.

multiplier tube. The comparison stars used were HD 223173 ( $V=5.51$ ;  $B-V=1.65$ ) and Tau Cas ( $V=4.867$ ;  $B-V=+1.116$ ). No variations greater than 0.01 in either  $V$  or  $B-V$  were noted for the comparison stars.

The data are shown in Figure 1 graphically and given in Table I. Generally, a gentle decline in  $V$  magnitude from Leiker and Hoff's last values and interesting mirrored behaviour in  $B-V$  (though of greater range) are noted.

Table I

JD-2440000	V	B-V	JD-2440000	V	B-V
6994.9389	4.49	+1.37	7089.6299	4.40	+1.27
7045.8541	4.45	1.37	7106.7076	4.39	1.28
7046.8291	4.45	1.36	7125.6986	4.39	1.28
7047.8236	4.44	1.38	7126.6313	4.42	1.26
7049.7556	4.42	1.36	7127.6472	4.43	1.27
7050.8486	4.44	1.35	7128.6264	4.42	1.27
7051.7069	4.43	1.36	7169.6035	4.53	1.36
7062.8014	4.43	1.32	7170.6160	4.48	1.30
7066.7938	4.39	1.32	7173.6062	4.51	1.31
7067.6924	4.40	1.33	7174.5840	4.58	1.29
7087.8312	4.41	1.25	7175.5917	4.49	1.33
7088.7785	4.37	1.27			

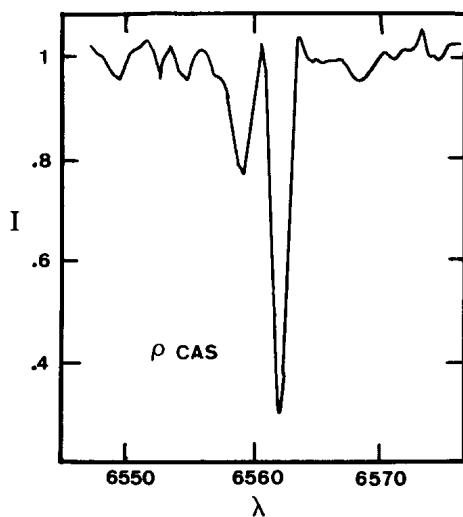


Figure 2. Mean  $H\alpha$  line profile for Rho Cas.

Table II

H $\alpha$ feature mean radial velocities:	
emission peak	-71.3 km s <sup>-1</sup>
line profile center	-63.6
deepest absorption	-48.4
mean stellar radial velocity:	
-44.5 $\pm$ 5.1 km s <sup>-1</sup> (from 12 lines)	

Two spectra of Rho Cas were obtained by the author with the Kitt Peak Observatory coudé feed telescope and CCD camera. The spectra were centered at H  $\alpha$  and showed the presence of a single emission peak distorting the profile of the line to the blue. The spectra were taken on JD 2447119.7208 and 7122.6313.

There was shown no sensible change in line profile or radial velocity between the two nights. Table II lists the mean radial velocities, and Figure 2 the line profile.

E.M. HALBEDEL  
 Corralitos Observatory  
 P.O. Box 16314  
 Las Cruces, NM 88004  
 U.S.A.

#### References:

- Leiker, P.S., and Höff, D.B., 1987, Inf. Bull. Var. Stars, No. 3Q20  
 Sheffer, Y., and Lambert, D., 1986, Publ. Astr. Soc. Pacific, 98, 914

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

Number 3172

Konkoly Observatory  
Budapest  
31 March 1988  
HU ISSN 0374-0676

PHOTOELECTRIC PHOTOMETRY OF  $\rho$  CASSIOPEIAE

The peculiar variable star  $\rho$  Cassiopeiae ( $\rho$  Cas, HD 224014, = SAO 035879) was observed by four observatories using photoelectric photometers. Observations covered the period of time from September 18, 1986 to November 26, 1987. This represents a follow-up of data presented in an earlier bulletin (Leiker and Hoff, 1987). In that bulletin we reported on a substantial brightening of this star. That brightening epoch has now been confirmed by other observers, whose data is presented here. This note also contains data which suggests that the star has now begun to dim slightly.

$\rho$  Cas is a supergiant (F8pIa) star (Percy & Keith, 1985).  $\rho$  Cas was discovered to be a variable in 1900 by Louise D. Wells (Pickering, 1901). Much of the time this star was confined to a brightness between 4.1m and 5.1m (Bailey, 1978). Between August 1945 and June 1947  $\rho$  Cas decreased in brightness more than a magnitude (Gaposchkin, 1949). After it recovered from this minimum,  $\rho$  Cas continued its irregular variation in brightness of 4.1m and 5.1m (Leiker, 1987).

$\rho$  Cas was observed extensively from June 1986 to April 1987 by Leiker and Hoff (1987). A 0.4 meter Cassegrain telescope and a STARLIGHT-1 photon counting photometer at the University of Northern Iowa (UNI) Hillside Observatory using standard B and V filters was used to make the observations.  $\rho$  Cas was again observed by Leiker and Hoff from April 17, 1987 through August 19, 1987 using the same equipment. All of the  $\Delta m$  are made in the sense of  $\rho$  Cas - HD 223173. Table 1 lists the  $\Delta V$  magnitudes obtained from April 17, 1987 to August 19, 1987. Table 2 list the  $\Delta B-V$  magnitudes. Figures 1 and 2 are graphical representations of the data presented in Tables 1 and 2 respectively. Three observations were made to produce each of the delta magnitudes. Standard deviation and mean error were calculated according to Hall and Genet (1982).

Nesbella and Gainer observed  $\rho$  Cas from September 18, 1986 to October 19, 1987 using a 0.2 meter Schmidt-Cassegrain telescope and a solid state detector.  $\rho$  Cas was observed in both blue and visual light. Also listed are the number of observations made to produce each delta magnitude. Standard deviation and mean error was calculated according to Hall and Genet (1982). Table 3 lists the  $\Delta V$  magnitudes and Table 4 lists the  $\Delta B-V$  magnitudes (Leiker, 1987). Figures 3 and 4 are graphical representations of the data presented in table 3 and 4 respectively. All of the  $\Delta m$  are made in the the sense of  $\rho$  Cas - HD 223173.

Milton observed  $\rho$  Cas from December 8, 1986 to November 26, 1987. Milton used a 0.2 meter Schmidt-Cassegrain telescope, and a 1P21 photomultiplier tube with pulse counting electronics. The obtained  $\Delta m$  are in the sense of  $\rho$  Cas - HD 223173 (Leiker, 1987). Standard deviation and mean error were calculated by Milton. Table 5 list the  $\Delta$  magnitudes obtained. See figure 5.

Pray observed  $\rho$  Cas from September 10, 1986 to October 30, 1987. Mean error was calculated by Pray. Table 6 lists these data. The listed  $\Delta m$  are in the sense of  $\rho$  Cas - HD 223173 (Leiker, 1987). Figure 6 is a graphical representation of this data.

Table I.  $\Delta V$  magnitudes of  $\rho$  Cas obtained by Leiker and Hoff

HJD	$\Delta V$	$\sigma$	error
2446902.727	-1.085	0.044	0.025
2446930.853	-1.083	0.031	0.018
2446931.823	-1.029	0.015	0.009
2446932.821	-1.014	0.010	0.006
2446950.707	-0.983	0.020	0.012
2446951.691	-0.981	0.019	0.011
2446952.672	-0.952	0.022	0.013
2446953.697	-0.960	0.007	0.004
2446958.597	-0.970	0.018	0.011
2446958.741	-0.967	0.009	0.005
2446960.696	-1.007	0.023	0.013
2446961.709	-0.991	0.018	0.011
2446962.728	-1.006	0.003	0.001
2446972.734	-0.984	0.010	0.006
2446973.663	-0.970	0.007	0.004
2446978.680	-0.987	0.004	0.002
2446979.704	-0.990	0.045	0.026
2446979.713	-1.000	0.013	0.008
2446984.671	-1.009	0.018	0.010
2446990.654	-1.027	0.025	0.015
2446992.709	-1.038	0.006	0.003
2446993.676	-1.031	0.017	0.010
2446997.668	-1.060	0.042	0.024
2446998.708	-1.016	0.016	0.009
2447000.737	-1.046	0.041	0.024
2447002.656	-1.025	0.012	0.007
2447003.647	-1.015	0.007	0.004
2447005.697	-1.028	0.011	0.006
2447008.671	-1.036	0.004	0.002
2447010.661	-1.057	0.008	0.005
2447012.676	-1.047	0.005	0.003
2447024.597	-1.072	0.010	0.006
2447026.612	-1.083	0.013	0.007

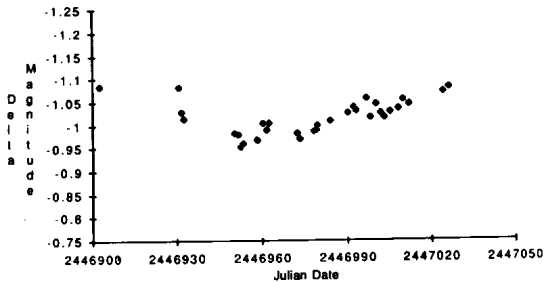
Figure 1.  $\Delta V$  magnitudes of  $\rho$  Cas obtained by Leiker and Hoff

Table II.  $\Delta(B-V)$  magnitudes obtained by Leiker and Hoff

HJD	$\Delta B-V$	$\sigma$	error
2446930.853	-0.205	0.044	0.031
2446931.823	-0.226	0.026	0.019
2446932.821	-0.228	0.022	0.016
2446950.707	-0.212	0.024	0.017
2446951.691	-0.197	0.022	0.015
2446952.672	-0.228	0.050	0.036
2446953.697	-0.206	0.026	0.018
2446958.597	-0.187	0.021	0.015
2446960.696	-0.170	0.032	0.022
2446961.709	-0.197	0.031	0.022
2446962.728	-0.172	0.003	0.002
2446972.734	-0.206	0.013	0.009
2446973.663	-0.210	0.029	0.020
2446979.713	-0.222	0.016	0.012
2446984.671	-0.192	0.024	0.017
2446990.654	-0.209	0.038	0.027
2446992.709	-0.173	0.006	0.004
2446993.676	-0.200	0.032	0.023
2446997.668	-0.170	0.047	0.033
2446998.708	-0.175	0.027	0.019
2447002.656	-0.199	0.016	0.011
2447003.647	-0.218	0.007	0.005
2447005.697	-0.206	0.014	0.010
2447008.671	-0.203	0.012	0.009
2447010.661	-0.202	0.009	0.007
2447012.676	-0.220	0.013	0.009
2447024.597	-0.220	0.015	0.011
2447026.612	-0.210	0.020	0.014

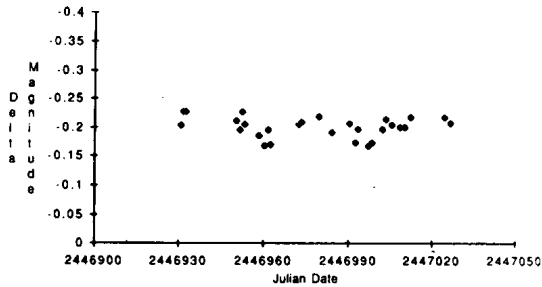
Figure 2.  $\Delta(B-V)$  magnitudes of  $\rho$  Cas obtained Leiker and Hoff

Table III.  $\Delta V$  magnitudes of  $\rho$  Cas by Nesbella and Gainer

JD	$\Delta m$	$\sigma$	error	#
2446691.516	0.921	0.011	0.008	2
2446732.686	1.037	0.005	0.002	8
2446735.541	1.037	0.008	0.002	16
2446748.695	1.086	0.009	0.003	12
2446812.688	1.239	0.027	0.012	5
2446822.573	1.247	0.009	0.002	14
2446829.542	1.253	0.015	0.004	12
2446837.535	1.256	0.009	0.003	10
2446845.512	1.254	0.009	0.003	9
2446871.521	1.219	0.017	0.007	7
2446872.517	1.212	0.011	0.006	4
2446874.523	1.210	0.023	0.010	5
2446877.524	1.217	0.011	0.006	3
2446895.869	1.121	0.010	0.004	8
2446906.799	1.086	0.033	0.007	22
2446964.757	0.986	0.012	0.007	3
2446970.757	0.999	0.008	0.003	5
2446971.696	0.963	0.025	0.015	3
2447029.773	1.083	0.009	0.004	6
2447039.628	1.103	0.024	0.017	2
2447042.641	1.186	0.284	0.107	7
2447053.688	1.078	0.008	0.003	6
2447067.613	1.112	0.006	0.003	5
2447073.623	1.130	0.008	0.004	5
2447082.609	1.120	0.005	0.002	5
2447083.597	1.129	0.008	0.004	5
2447087.562	1.128	0.006	0.003	5

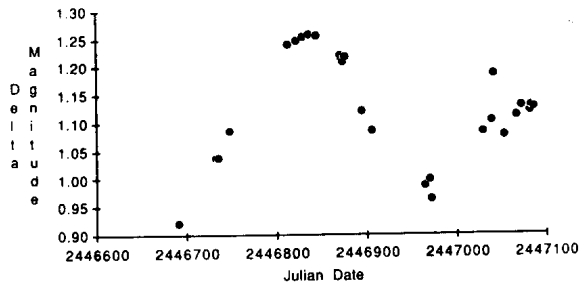
Figure 3.  $\Delta V$  magnitudes of  $\rho$  Cas by Nesbella and Gainer

Table IV.  $\Delta(B-V)$  magnitudes of  $\rho$  Cas by Nesbella and Gainer

JD	B-V	$\sigma$	error
2446691.516	0.108	0.023	0.017
2446732.686	0.168	0.034	0.024
2446735.541	0.251	0.033	0.024
2446748.695	0.406	0.071	0.050
2446812.688	0.300	0.049	0.035
2446822.573	0.316	0.034	0.024
2446829.542	0.381	0.043	0.030
2446837.535	0.319	0.033	0.023
2446845.512	0.242	0.018	0.013
2446871.521	0.293	0.038	0.027
2446872.517	0.276	0.018	0.013
2446874.523	0.273	0.038	0.027
2446877.524	0.145	0.036	0.025
2446895.869	0.185	0.039	0.027
2446906.799	0.094	0.037	0.026
2446964.757	0.192	0.031	0.022
2446970.757	0.132	0.024	0.017
2446971.696	0.332	0.035	0.024
2447029.773	0.242	0.043	0.030
2447039.628	0.196	0.029	0.021
2447042.641	0.123	0.284	0.201
2447053.688	0.261	0.021	0.015
2447067.613	0.287	0.015	0.010
2447073.623	0.282	0.012	0.008
2447082.609	0.284	0.014	0.010
2447083.597	0.276	0.015	0.011
2447087.562	0.278	0.018	0.012

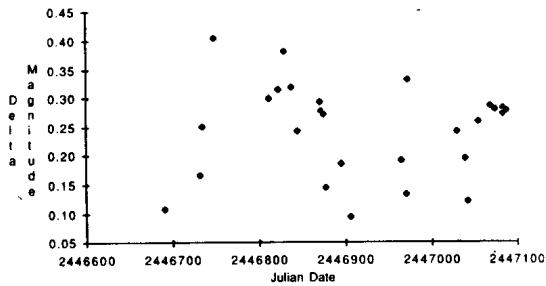
Figure 4.  $\Delta(B-V)$  magnitudes of  $\rho$  Cas by Nesbella and Gainer

Table V.  $\Delta V$  magnitudes of  $\rho$  Cas by Milton

HJD	$\Delta V$	$\sigma$	error	#
2446772.692	-1.126	0.005	0.003	3
2446792.792	-1.243	0.028	0.016	3
2446803.680	-1.247	0.004	0.002	3
2446811.637	-1.238	0.009	0.005	3
2446832.669	-1.263	0.013	0.008	3
2446845.681	-1.256	0.012	0.007	3
2446851.664	-1.253	0.010	0.006	3
2446987.880	-1.046	0.008	0.004	3
2447001.810	-1.044	0.007	0.004	3
2447015.735	-1.074	0.007	0.004	3
2447030.879	-1.102	0.004	0.002	3
2447037.782	-1.097	0.011	0.006	3
2447071.695	-1.138	0.007	0.004	3
2447085.689	-1.152	0.022	0.013	3
2447094.649	-1.148	0.004	0.002	3
2447102.690	-1.157	0.003	0.002	3
2447125.627	-1.118	0.002	0.001	3

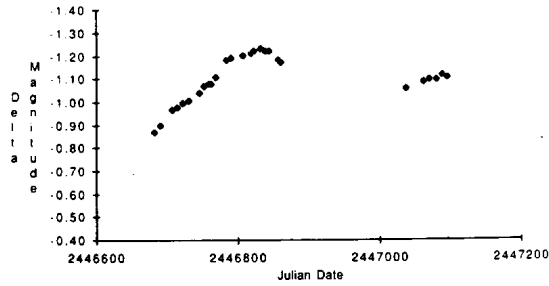
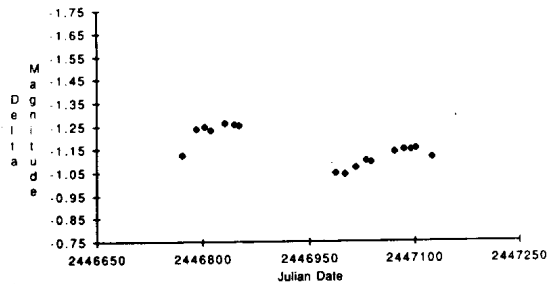
Figure 5.  $\Delta V$  magnitudes of  $\rho$  Cas by MiltonFigure 6.  $\Delta V$  magnitudes of  $\rho$  Cas by Pray

Table VI.  $\Delta V$  magnitudes of  $\rho$  Cas by Pray

JD	$\Delta V$	error	JD	$\Delta V$	error
2446683.5	-0.87	0.006	2446820.5	-1.21	0.006
2446691.5	-0.90	0.006	2446824.5	-1.22	0.006
2446709.5	-0.97	0.006	2446834.61	-1.23	0.006
2446715.5	-0.98	0.006	2446841.53	-1.22	0.006
2446723.5	-1.00	0.006	2446846.51	-1.22	0.006
2446732.5	-1.01	0.006	2446859.52	-1.18	0.006
2446747.5	-1.04	0.006	2446862.53	-1.17	0.006
2446754.5	-1.07	0.006	2447040.558	-1.06	0.002
2446760.5	-1.08	0.006	2447065.535	-1.09	0.002
2446764.5	-1.08	0.006	2447074.493	-1.10	0.002
2446770.5	-1.11	0.006	2447083.493	-1.10	0.002
2446786.5	-1.18	0.006	2447091.536	-1.12	0.002
2446792.5	-1.19	0.006	2447098.53	-1.11	0.002
2446809.5	-1.20	0.006			

P. STEVEN LEIKER  
 DARREL B. HOFF  
 Hillside Observatory  
 Department of Earth Science  
 University of Northern Iowa  
 Cedar Falls, Iowa 50614-0506  
 USA

JOHN NESBELLA  
 MICHAEL GAINER  
 Department of Physics  
 Saint Vincent College  
 Latrobe, Pennsylvania 15650  
 USA

RUSSELL MILTON  
 Klamath Observatory  
 Somes Bar, California 95568  
 USA

DON PRAY  
 Furnace Hill Observatory  
 40 Hillcrest Drive  
 Cranston, Rhode Island 02920  
 USA

## References :

- Bailey, J. (1978).  $\rho$  Cassiopeiae, 1964-1975. Journal of the British Astronomical Association. 88, (4), 397-401.
- Gaposchkin, S. (1949).  $\rho$  Cassiopeiae. Harvard College Observatory Bulletin. Number 919, 18-19.

- Hall, D. S., & Genet, R. M. (1982). Photoelectric Photometry of Variable Stars. International Amateur-Professional Photoelectric Photometry. Fairborn, OH: Fairborn Observatory.
- Leiker, P. S., & Hoff, D. B. (1987). Photoelectric photometry of Rho Cassiopeiae. Information Bulletin on Variable Stars. Number 3020.
- Leiker, P. S. (1987). A Review of Photometric Research on  $\rho$  Cassiopeiae, Including Photoelectric Observations Obtained at the University of Northern Iowa. Unpublished Master's Thesis. University of Northern Iowa. Cedar Falls, Iowa, USA.
- Percy, J. R., & Keith, D. W. (1985). The quasi-cepheid nature of Rho Cassiopeiae. Madore, B. F. Cepheids: Theory and Observations. University of Cambridge Press.
- Pickering, E. C. (1901). Sixty-four new variable stars. Harvard College Observatory Circular. Number 54.

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

Number 3173

Konkoly Observatory  
Budapest  
5 April 1988  
HU ISSN 0374-0676

1987 BVRI PHOTOMETRY OF RT And

In a return to our long-term program of BVRI photometry of RS CVn stars, we report here on our first CCD observations of RT And (=BD+52°3383A). The catalog of Strassmeier et al. (1988) lists RT And (catalog #163) as a short-period RS CVn system (P=0.6289 d) containing F8V and G5V stars, which show strong CaII H and K emission and a V-band distortion wave amplitude of about 0.06 mag. Milano et al. (1981) present light curves and solutions from 1949 to 1978 and Mancuso et al. (1979, 1981) discuss in depth the issue of a transit versus occultation solution for the light curves. They conclude that a transit solution is the better one for a pair of main-sequence stars, a result also found by Budding and Zeilik (1987).

We have previously reported on single-channel UBVRI photometry of RT And (Zeilik et al., 1982). We have since installed a CCD camera with an RCA SID501EX chip on our 61-cm telescope (Laubscher et al., 1988). The results here are the first using the CCD camera as a multichannel photometer, in which we observe the variable, sky, and comparison star (BD+52°3384) on the same frame. The data were reduced with an effective aperture of 13"; observations were made on 11 and 12 Nov 1987 and 12 Dec 1987UT. The night of 11 Nov was partially cloudy but the results were still consistent (to within 1%) with the other night's data. The overall error in the data is 0.008 mag.

Figures 1-4 show the results in the instrumental system, in which the effective wavelengths of the filters are: B, 463.6 nm ; V, 337.5 nm ; R, 667.0 nm ; and I, 806.4 nm ;. The phases were calculated from the ephemeris  $HJD = 2441141.888 + 0.628929843E$ , (Strassmeier et al., 1988, Table 4).

We analyzed the V-band light curve following the procedure of Budding and Zeilik (1987). The distortion curve amounted to only ~2% amplitude ; we fit this maculation effect with a single spot group at a latitude of 45°. The computed parameters of the fit were a longitude of  $261 \pm 7^\circ$  and a spot radius of  $9.0 \pm 0.7^\circ$  for a black, circular active region. This contrasts with our 1981 results in which we found a longitude of  $128 \pm 8^\circ$  and a radius of  $8.3 \pm 0.1^\circ$  for a single spot group (Budding and Zeilik, 1987 ; Table 4). The starspot

## RT And B Band

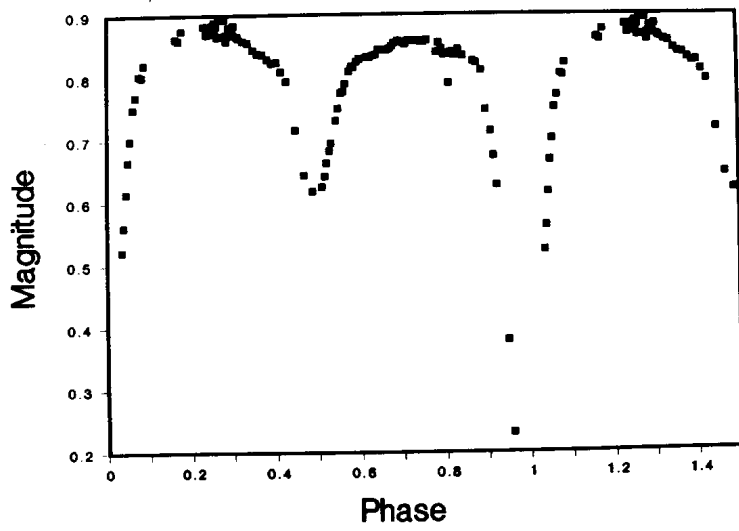


Figure 1.

## RT And V Band

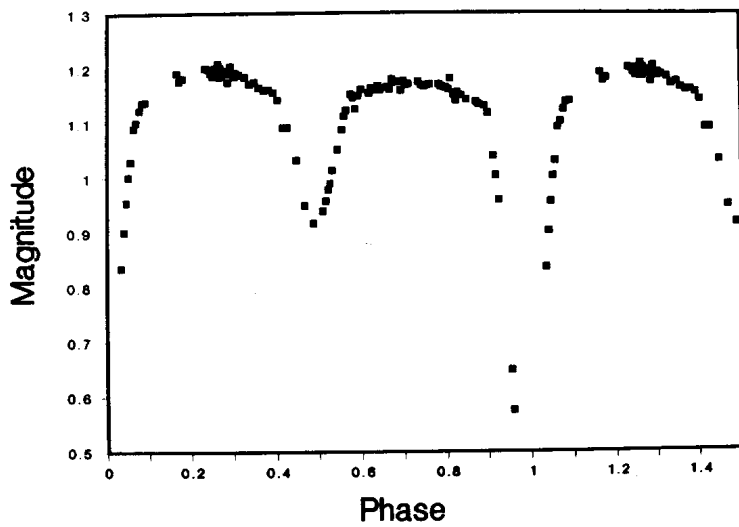


Figure 2.

3

RT And R Band

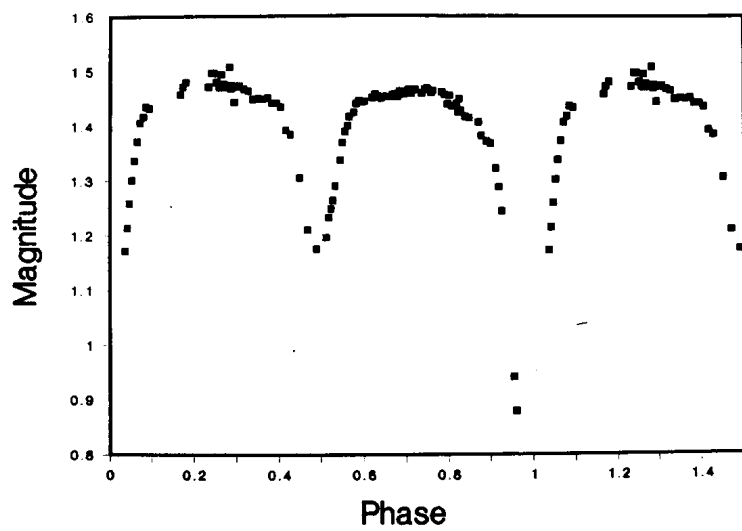


Figure 3.

RT And I Band

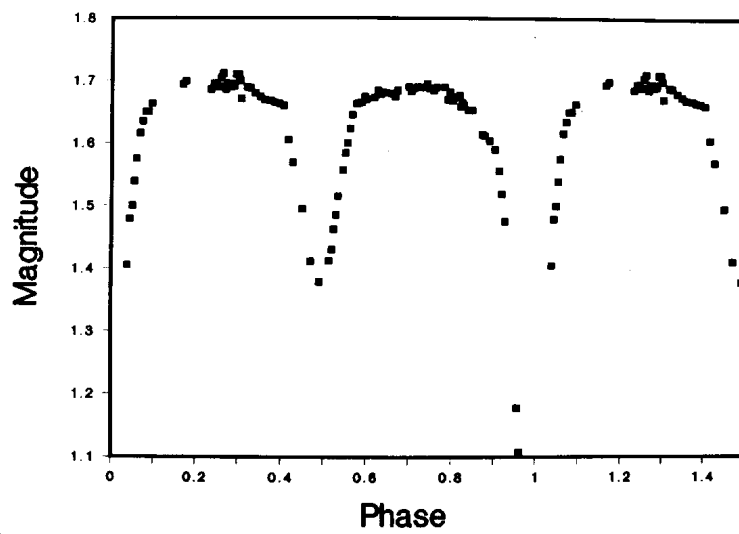


Figure 4.

group has migrated in longitude but, as is typical for the short-period RS CVn systems, shows up near the quadrature points.

M. ZEILIK, D. BECKERT, C. De BLASI, M. LEDLOW,  
M. RHODES, T. WILLIAMS  
Capilla Peak Observatory  
Institute for Astrophysics  
The University of New Mexico  
Albuquerque, NM 87131 U.S.A.

#### References:

- Budding, E., and Zeilik, M., 1987, *Ap. J.*, 319, 827-835  
 Laubscher, B., Gregory, S., Bauer, T., Zeilik, M., and Burns, J., 1988, *Pub. Astron. Soc. Pacific*, 100, 131-136  
 Mancuso, S., Milano, L., Russo, G., Sollazzo, C., 1979, *Astrophys. and Space Sci.* 66, 475-486  
 Mancuso, S., Milano, L., Vittore, A., Budding, E., Jassur, B.M.Z., 1981, in *Photometric and Spectroscopic Binary Systems*, edited by E.B. Carling and Z. Kopal, pp. 313-329  
 Milano, L., Russo, G., Mancuso, S., 1981, *Astron. Astrophys.* 103, 57-62  
 Strassmeier, K.G., Hall, D.S., Zeilik, M., Nelson, E., Eker, Z., and Fekel, F.C., 1988, submitted to *Astron. Astrophys. Suppl. Series*  
 Zeilik, M., Elston, R., Henson, G., Schmolke, B., and Smith, P., 1982, *IBVS No. 2090*

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3174

Konkoly Observatory  
Budapest  
12 April 1988  
HU ISSN 0374-0676

A NEW VARIABLE STAR IN VIRGO

In an observational program of the  $\delta$  Scuti star HD 114842, SAO 139186 was used as comparison star and SAO 139174 (BD - 1<sup>o</sup>2777 = HD 114125) as check star. The observations showed that while SAO 139186 kept a nearly constant brightness, SAO 139174 presented an undoubted photometric variability on 18 March. This last star is not present in any of the variable star catalogues, hence it has to be considered as a new variable star. SAO 139174 was observed on two nights in March 1988 by using the simultaneous uvby $\beta$  Strömgren photometer attached to the 75 cm reflector at the Sierra Nevada Observatory in Spain.

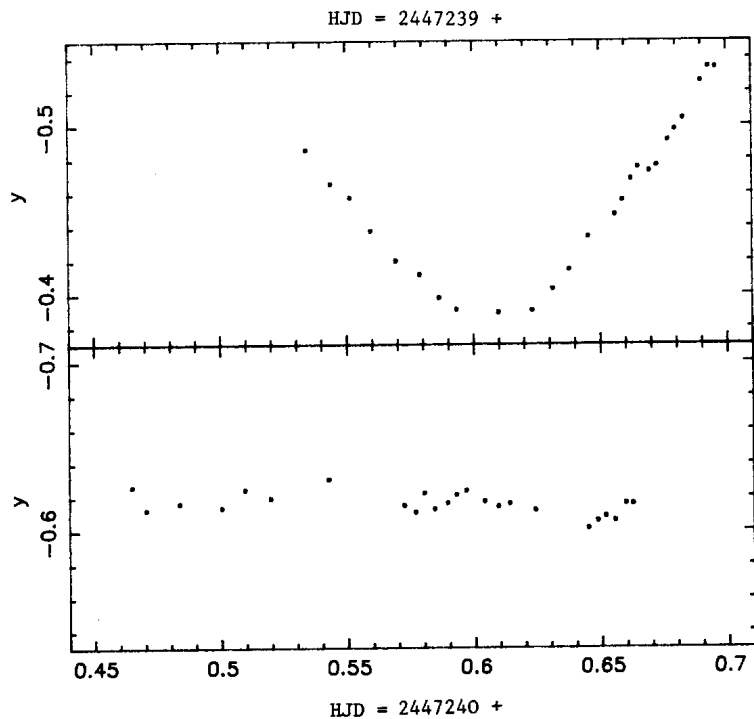


Figure 1

The Figure shows the light curves of 18 and 19 March in the y filter. The magnitudes are differences SAO 139174 - SAO 139186 in the instrumental system. Although the light curve is very incomplete, it suggests that we are dealing with an eclipsing binary system. The magnitude difference between out of eclipse level and the minimum brightness is  $0^m.23$  in the y filter and the time of minimum is  $JD = 2447239.6051 \pm 0.0010$ .

More photometric observations are clearly needed on this new variable star.

E. RODRIGUEZ

J.L. SEDANO

P. LOPEZ DE COCA

A. ROLLAND

Instituto de Astrofisica de  
Andalucia  
Apdo. 2144, Granada, Spain

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

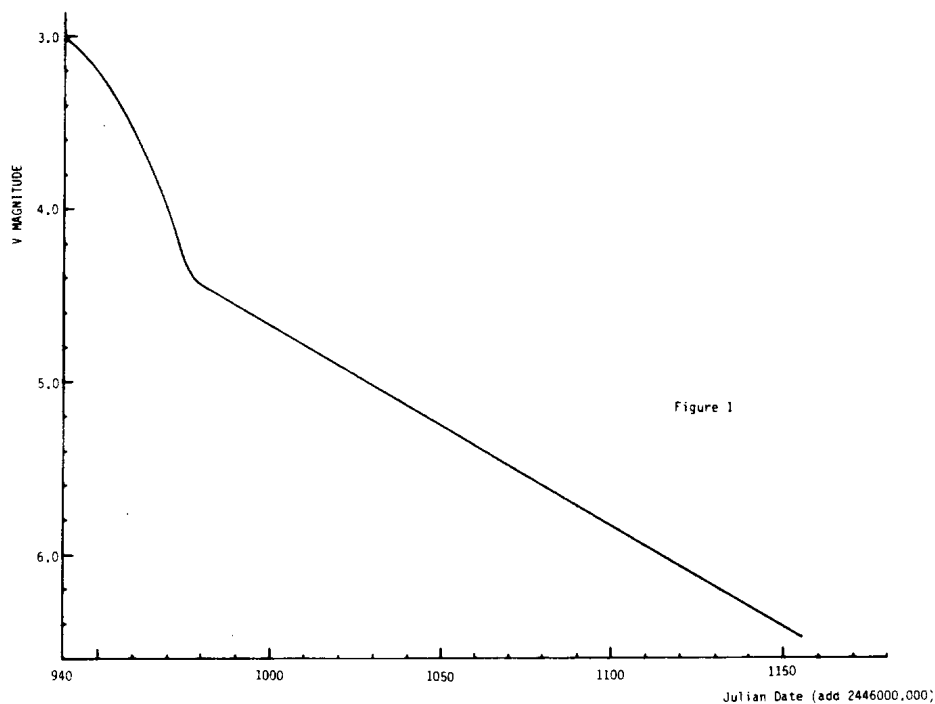
Number 3175

Konkoly Observatory  
 Budapest  
 13 April 1988  
*HU ISSN 0374-0676*

V PHOTOMETRY OF SUPERNOVA 1987A

Further to the observations of Supernova 1987A previously reported by Jarrett (1987) photometry has continued at Boyden as occasion permitted. The measurements are tabulated below and represented in Figure 1.

Julian Date (add 2446000.000)	V	Julian Date (add 2447000.000)	V
941.403	3.00	029.479	5.10
943.323	3.05	030.479	5.00
944.396	3.10	031.469	5.20
945.392	3.10	032.458	5.20
946.299	3.10	034.458	5.10
948.361	3.15	035.500	5.00
949.330	3.20	039.465	5.20
952.368	3.25	052.500	5.30
953.264	3.30	053.427	5.35
954.372	3.35	054.462	5.10
955.330	3.38	055.493	5.20
956.292	3.40	056.438	5.20
957.302	3.45	057.382	5.30
962.285	3.65	059.479	5.30
965.313	3.80	062.448	5.60
966.299	3.80	063.465	5.40
969.323	3.90	069.479	5.50
970.309	4.00	073.472	5.60
971.323	4.10	080.438	5.60
974.323	4.15	083.451	5.60
976.365	4.30	091.448	5.70
978.316	4.40	092.458	5.70
981.285	4.45	114.490	6.00
983.372	4.45	124.486	6.10
984.313	4.50	125.448	6.00
985.326	4.50	126.500	6.00
		138.486	6.00
		139.438	6.20
		140.448	6.20
		142.465	6.20
		153.448	6.30



After the virtually continuous rise in V monitored over the interval JD2446853 to JD2446920 (Jarrett, 1987) it is interesting to note the sharp decline from  $3.^m0$  to  $4.^m4$  over the period JD2446941 to JD2446978. Thereafter there has been a steady decline of  $0.^m01$  per day throughout the remainder of the monitoring period.

A.H. JARRETT  
 Boyden Observatory  
 University of The Orange Free State  
 Bloemfontein  
 Republic of South Africa

Reference:

Jarrett, A.H., 1987, IBVS, No. 3076.

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

Number 3176

Konkoly Observatory  
Budapest  
13 April 1988  
HU ISSN 0374-0676

IS  $\tau$  CASSIOPEIAE A VARIABLE STAR?

The star  $\tau$  Cassiopeiae ( $\tau$  Cas, HD 223165, HR 9008, SAO 35763, K1 III, V=4.87m) was observed at the University of Northern Iowa (UNI) Hillside Observatory during 1986 and 1987. We used a 0.4 meter Cassegrain telescope and a STARLIGHT-1 photon counting photometer with standard B and V filters.

$\tau$  Cas has been used extensively as a comparison star for  $\rho$  Cassiopeiae variability studies. The American Association of Variable Star Observers has used  $\tau$  Cassiopeiae as a primary comparison star for  $\rho$  Cassiopeiae for a number of years.  $\tau$  Cas is listed in the *New Catalogue of Suspected Variable Stars* (Kholopov, 1982). Due to this suspected variability  $\tau$  Cas was gradually dropped from the  $\rho$  Cassiopeiae observing program by the British Astronomical Association (Percy, 1985). Although Percy's work leads him to believe that  $\tau$  Cas may not be a variable star. As a portion of a study done at UNI on  $\rho$  Cassiopeiae, we believe that  $\tau$  Cas *does* have a small degree of variability. HD 223173 (HR 9010, SAO 35761, K3 II, V = 5.51m, B-V = 1.65) was used as the comparison star. Table 1 lists the mean delta magnitudes obtained for  $\tau$  Cas. Figures 1 and 2 are graphical representations of these data.

Figure 1  
 $\tau$  Cas Visual Delta Magnitudes

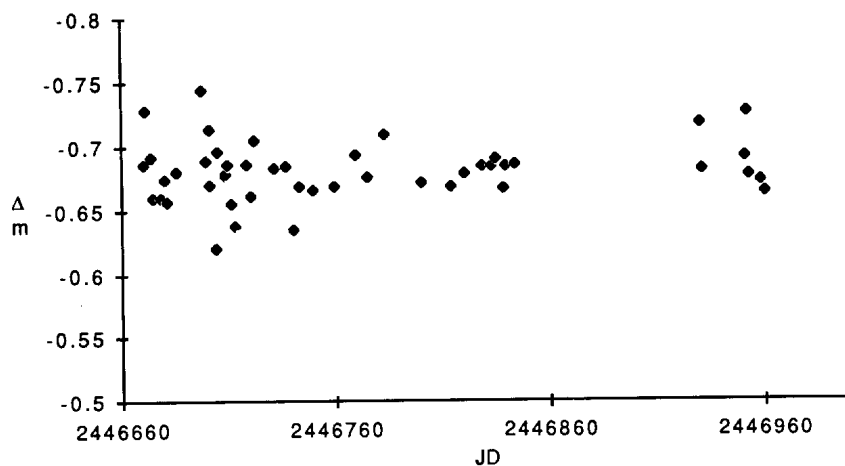
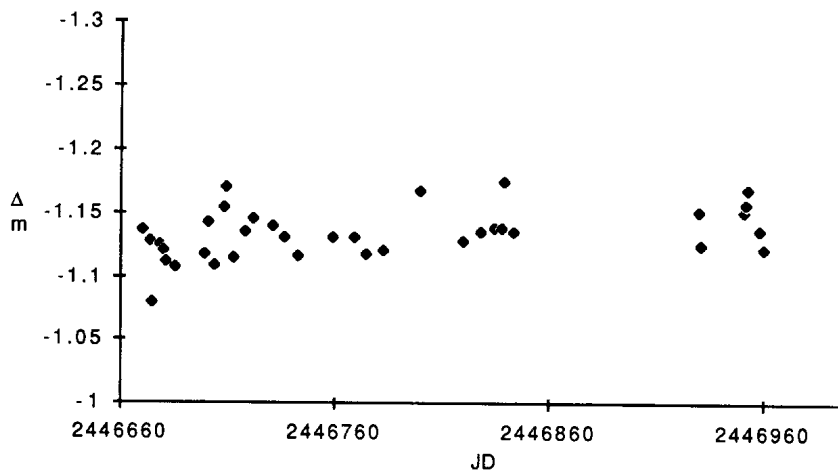


Table 1  
 $\tau$  Cas Visual and Blue Delta Magnitudes

JD	V	error	#	JD	B	error	#
2446670.616	-0.687	0.005	2	2446670.631	-1.136	0.004	2
2446671.663	-0.728	0.028	2	2446674.709	-1.127	0.009	2
2446674.591	-0.692	0.023	2	2446675.685	-1.081	0.017	2
2446675.665	-0.660	0.026	2	2446678.663	-1.126	0.006	2
2446678.642	-0.660	0.011	2	2446680.655	-1.121	0.009	2
2446680.638	-0.675	0.007	2	2446681.674	-1.113	0.006	2
2446681.658	-0.656	0.026	2	2446686.593	-1.107	0.021	2
2446686.573	-0.680	0.015	2	2446699.565	-1.118	0.005	2
2446697.658	-0.744		1	2446701.652	-1.143	0.021	2
2446699.547	-0.688	0.035	2	2446704.584	-1.110	0.047	2
2446701.622	-0.714	0.006	2	2446708.563	-1.154	0.008	2
2446701.720	-0.670	0.018	2	2446709.569	-1.170	0.034	2
2446704.544	-0.620	0.025	2	2446713.564	-1.116	0.019	2
2446705.625	-0.697	0.086	2	2446718.601	-1.135	0.005	2
2446708.546	-0.677	0.004	2	2446722.553	-1.146	0.018	2
2446708.621	-0.680	0.008	2	2446731.535	-1.140	0.000	2
2446709.550	-0.687	0.039	2	2446737.544	-1.131	0.019	2
2446711.540	-0.656		1	2446743.571	-1.116	0.026	2
2446713.545	-0.638	0.031	2	2446759.562	-1.130	0.008	2
2446718.585	-0.687	0.028	2	2446769.527	-1.130	0.008	2
2446720.536	-0.661	0.046	2	2446775.505	-1.119	0.004	2
2446722.530	-0.705	0.001	2	2446783.524	-1.121	0.044	2
2446731.516	-0.685	0.010	2	2446800.571	-1.166	0.066	2
2446737.527	-0.686	0.022	2	2446820.581	-1.128	0.003	3
2446740.684	-0.636	0.048	2	2446828.627	-1.135	0.010	3
2446743.548	-0.668	0.010	2	2446835.572	-1.138	0.007	3
2446749.538	-0.666	0.021	2	2446838.645	-1.138	0.010	3
2446759.542	-0.669	0.037	2	2446839.670	-1.175	0.010	3
2446769.546	-0.693	0.011	2	2446844.708	-1.135	0.018	3
2446775.523	-0.677	0.025	2	2446930.895	-1.152	0.008	3
2446783.542	-0.709	0.015	2	2446931.861	-1.126	0.004	3
2446800.600	-0.671	0.057	2	2446951.713	-1.152	0.001	3
2446814.566	-0.669	0.002	3	2446952.663	-1.157	0.008	3
2446820.568	-0.680	0.006	3	2446953.686	-1.169	0.009	3
2446828.615	-0.685	0.014	3	2446958.764	-1.137	0.003	3
2446833.587	-0.685	0.009	3	2446960.742	-1.123	0.012	3
2446835.564	-0.691	0.003	3				
2446838.644	-0.667	0.023	3				
2446839.662	-0.686	0.005	3				
2446844.699	-0.687	0.012	3				
2446930.884	-0.720	0.007	3				
2446931.851	-0.682	0.004	3				
2446951.723	-0.692	0.014	3				
2446952.654	-0.727	0.009	3				
2446953.674	-0.677	0.011	3				
2446958.754	-0.674	0.008	3				
2446960.729	-0.664	0.004	3				

Figure 2  
 $\tau$  Cas Blue Delta Magnitudes



P. STEVEN LEIKER  
 Hillside Observatory  
 Department of Earth Science  
 University of Northern Iowa  
 Cedar Falls, IA 50614-0506  
 USA

DARREL B. HOFF  
 Harvard-Smithsonian  
 Center for Astrophysics  
 60 Garden St.  
 Cambridge, MA 02138  
 USA

#### References:

- Kholopov, P. N. (1982). New catalogue of suspected variable stars. Moscow: Publishing Office (Nauka).
- Percy, J. R. (1985). Tau Cas: not a variable star. Journal of the American Association of Variable Star Observers, 14, (2), 52-54.

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

Number 3177

Konkoly Observatory  
Budapest  
18 April 1988  
HU ISSN 0374-0676

PHOTOELECTRIC B AND V OBSERVATIONS OF W UMa

Photoelectric observations of the short period eclipsing binary system W UMa, discovered by G. Muller and P. Kempf at Potsdam in 1903, were carried out during four nights between January 30 and March 4, 1987. A photometer equipped with an unrefrigerated EMI 9781B photomultiplier tube and standard B, V filters has been used, attached to the 32 cm f/16 Cassegrain telescope, located in Ljubljana, Yugoslavia. The star SAO 27340 (HD 83564) was used as a comparison star.

In the Figure 1, the light curves obtained in B and V colours, respectively, are presented. The phases were calculated according to the light elements:

$$\text{Min. I} = \text{J.D. Hel. } 2444986.3624 + 0.^{\text{d}}.33363808E$$

given by Hamzaoğlu et. al. (1982).

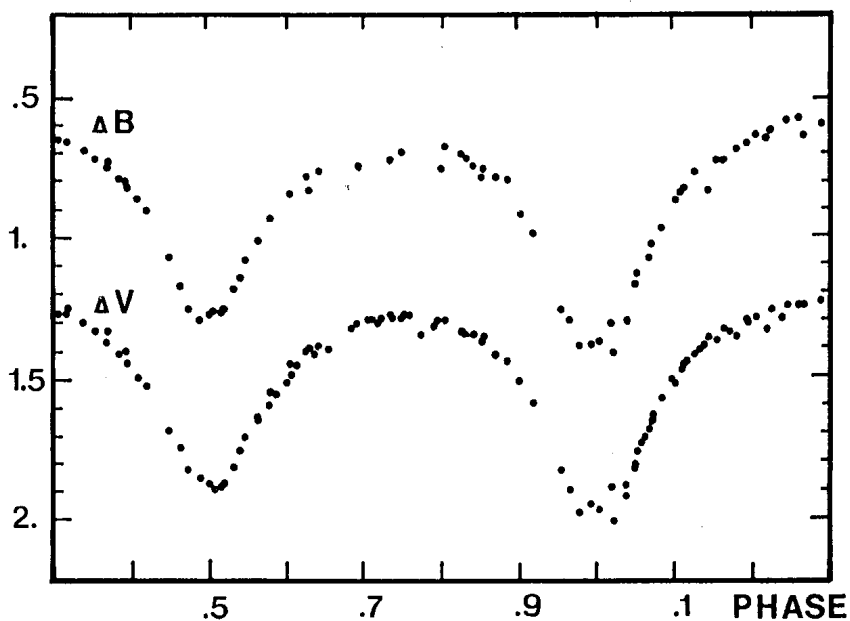


Figure 1

From this data times of minima have been calculated using the tracing paper method.

The minimum times are:

Min. I = JD (Hel) 2446826.3658

Min. II = JD (Hel) 2446826.5349

A. DOLŽAN  
Zasavska 88  
61231 Ljubljana  
Yugoslavia

Reference :

Hamzaoglu, M., Hamzaoglu, E., and Eker, T., 1982, I.B.V.S. No. 2151.

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

Number 3178

Konkoly Observatory  
Budapest  
25 April 1988  
*HU ISSN 0374-0676*

**UBV PHOTOMETRY OF THE R CORONAE BOREALIS STAR GU Sgr – 1986/87**

Photoelectric observations of the R Coronae Borealis (RCB) star, GU Sgr, were obtained at Mount John University Observatory (MJUO) during 1986 and 1987 as part of an ongoing survey of southern RCB stars. The 1986 observations were obtained with the 0.6-m photometric reflector; the 1987 observations with the 1-m reflector. The measurements were made with the MJUO No.1 photometer equipped with an EMI 6094B photomultiplier tube (S11 photocathode) and UBV filters as described by Bessell (1976).

The magnitude and colours of the comparison star HD 169441 ( $V = 9.87$ ,  $B-V = 0.24$ ,  $U-B = -0.01$ ) were standardised after the derivation of the photoelectric constants from observations of E-region standards at MJUO. The magnitude and colours of the check star HD 168990 ( $V = 9.30$ ,  $B-V = 0.49$ ,  $U-B = 0.36$ ), determined differentially, remained constant to within 0.01 magnitudes in  $V$  and  $B-V$  and 0.02 magnitudes in  $U-B$ . The UBV observations of GU Sgr are listed in Table I. The light and colour curves for the observations obtained in 1986 and 1987 are reproduced in Figures 1(a) and 1(b) respectively.

A linear solution to the times of maxima on the light curve gives a value for the average period of  $37.0 \pm 0.3$  day. This value is very similar to the period of 37–38 day determined from visual estimates of GU Sgr obtained between 1956 and 1969 by Bateson and Jones (1972). We note that although the average period of GU Sgr is similar to the average pulsation period of RY Sgr (Lawson and Cottrell 1988), the amplitude of the light and colour curves of GU Sgr are lower and less regular than those of RY Sgr (see e.g. Lawson et al 1987).

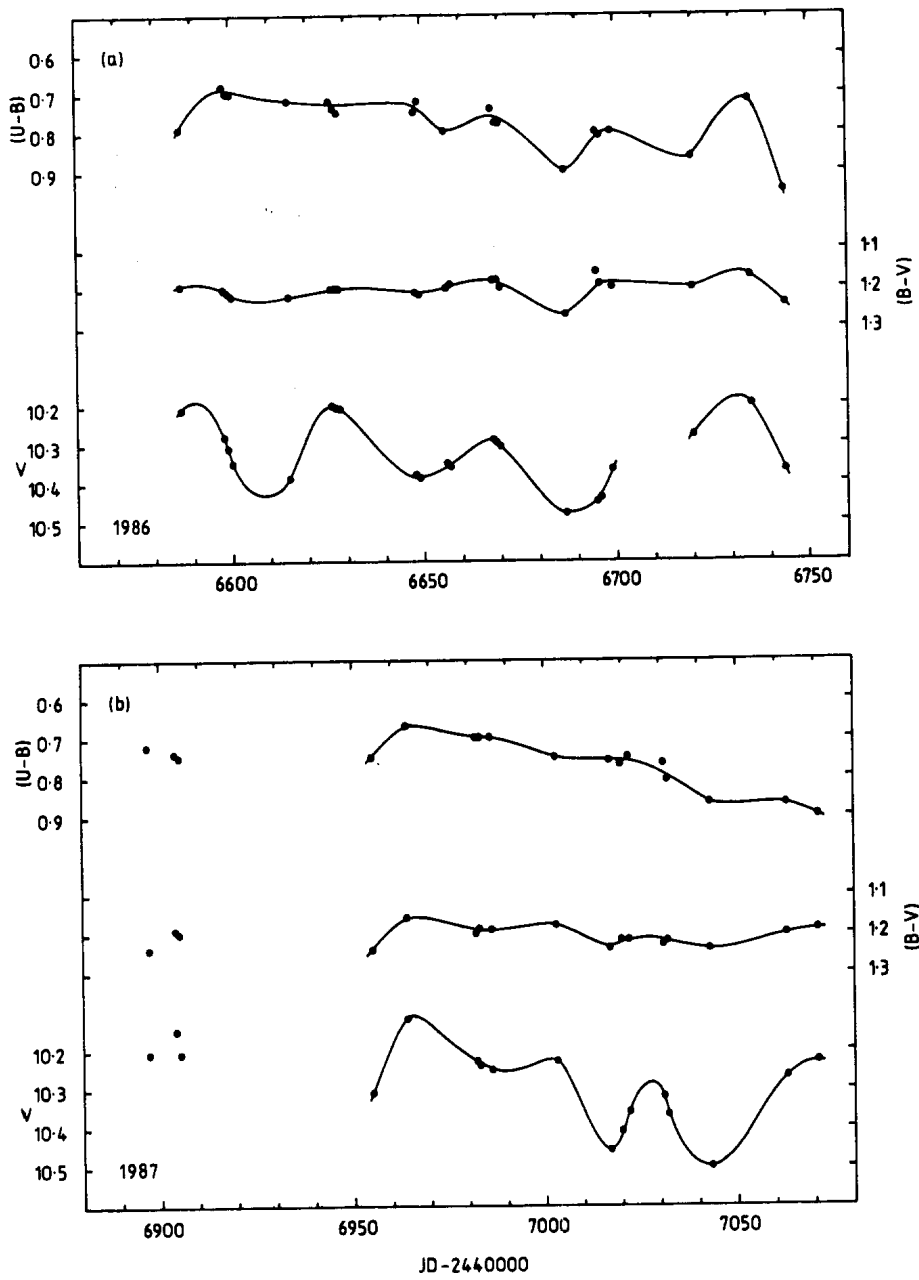


Figure 1. Light and colour curves of GU Sgr during (a) 1986 and (b) 1987.

Table I. Photoelectric observations of GU Sgr

	JD-2440000	V	B-V	U-B	JD-2440000	V	B-V	U-B
1986	6586.88	10.21	1.19	0.79	6656.97	10.36	1.19	—
	6597.99	10.28	1.20	0.68	6667.96	10.29	1.18	0.74
	6599.06	10.31	1.21	0.70	6669.07	10.30	1.18	0.78
	6600.01	10.35	1.22	0.70	6669.97	10.31	1.20	0.78
	6615.02	10.39	1.22	0.72	6686.94	10.48	1.27	0.90
	6626.05	10.20	1.20	0.72	6694.93	10.45	1.16	0.80
	6627.00	10.21	1.20	0.74	6696.01	10.44	1.19	0.81
	6628.06	10.21	1.20	0.75	6698.95	10.37	1.20	0.80
	6648.06	10.38	1.21	0.75	6719.94	10.28	1.20	0.87
	6649.02	10.39	1.22	0.72	6734.87	10.20	1.17	0.72
	6656.09	10.35	1.20	0.80	6743.89	10.37	1.24	0.95
1987	6897.20	10.21	1.24	0.72	7071.06	10.46	1.24	0.76
	6904.13	10.15	1.19	0.74	7020.04	10.41	1.22	0.77
	6905.13	10.21	1.20	0.75	7021.99	10.36	1.22	0.75
	6955.00	10.31	1.24	0.75	7030.97	10.32	1.23	0.77
	6964.02	10.12	1.16	0.67	7031.92	10.37	1.22	0.81
	6981.90	10.23	1.20	0.70	7042.93	10.50	1.24	0.87
	6982.99	10.24	1.19	0.70	7062.95	10.27	1.20	0.87
	6986.00	10.25	1.19	0.70	7070.98	10.23	1.19	0.90
	7003.10	10.23	1.18	0.75				

W.A. LAWSON, P.M. KILMARTIN and A.C. GILMORE

Mount John University Observatory  
Department of Physics  
University of Canterbury  
Christchurch  
New Zealand

#### References:

- Bateson, F.M. and Jones, A.F., 1972, Circ. var. Star Section, R.A.S.N.Z., 193.  
Bessell, M.S., 1976, P.A.S.P., 88, 557.  
Lawson, W.A. and Cottrell, P.L., 1988, M.N.R.A.S., in press.  
Lawson, W.A., Kilmartin, P.M., Gilmore, A.C. and Clark, M., 1987, I.B.V.S., 3085.

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3179

Konkoly Observatory  
Budapest  
25 April 1988  
HU ISSN 0374-0676

VARIABILITY IN THE Be STAR SB 357 (=CD -37°316)

Star number 357 in the survey of Slettebak & Brundage (1971) was classified 'B' type by them and B2 pec by Graham and Slettebak (1973) who also made observations in the Strömgren (uvby) system. Graham & Slettebak (1973) note that H $\beta$  is not visible in their low dispersion spectrograms and that the star may have emission. This was confirmed by Heber & Langhans (1986) who found central reversal in all the Balmer hydrogen lines, HeI 4922, and possibly other helium lines. From uvby photometry and fitting the wings of H $\gamma$ , they find  $T_{\text{eff}} = 17900$ ,  $\log g = 4.0$ ,  $V \sin i = 130$  km/sec, and a distance from the galactic plane of nearly 6 kpc, which is quite remarkable.

SB 357 (=CD -37°316) has been observed with the SAAO 1m telescope in the 'faint blue' star programme (see e.g. Kilkenny 1987) and is clearly variable. Strömgren photometry from this programme is given in Table 1; the colours are typical of a B2-B3 star reddened by  $E(b-y) \sim 0.05$ , though there may also be variability in colour. Heber & Langhans (1986) give  $E(B-V) = 0.055$  derived from Strömgren photometry.

Some short sequences of almost continuous monitoring of SB 357 were made using Johnson B and V filters, also with the SAAO 1m telescope; these are listed in Table 2 and shown in Fig. 1. There is no evidence for any short period variability as big as 0.01 mag, on a timescale of less than 2-3 hours. The mean values given in Table 2 have standard deviations in the range 0.003 - 0.006 mag; I am grateful to Mr F. Marang who made the last two single observations with the SAAO 0.5m telescope. The

observations on HJD 2447073 were tied to regular observations of the E-region standard El/46 (Menzies, Banfield & Laing 1980) whilst those on HJD 2447119 and 7120 were corrected to the much nearer HD 5061 (= SB 352) which was classified ADVn by Slettebak & Brundage (1971) and appears constant from SAAO observations tied to E-region standards ( $V = 8.640 \pm 0.004$ ,  $B-V = +0.011 \pm 0.002$ ; 17 observations on 3 nights).

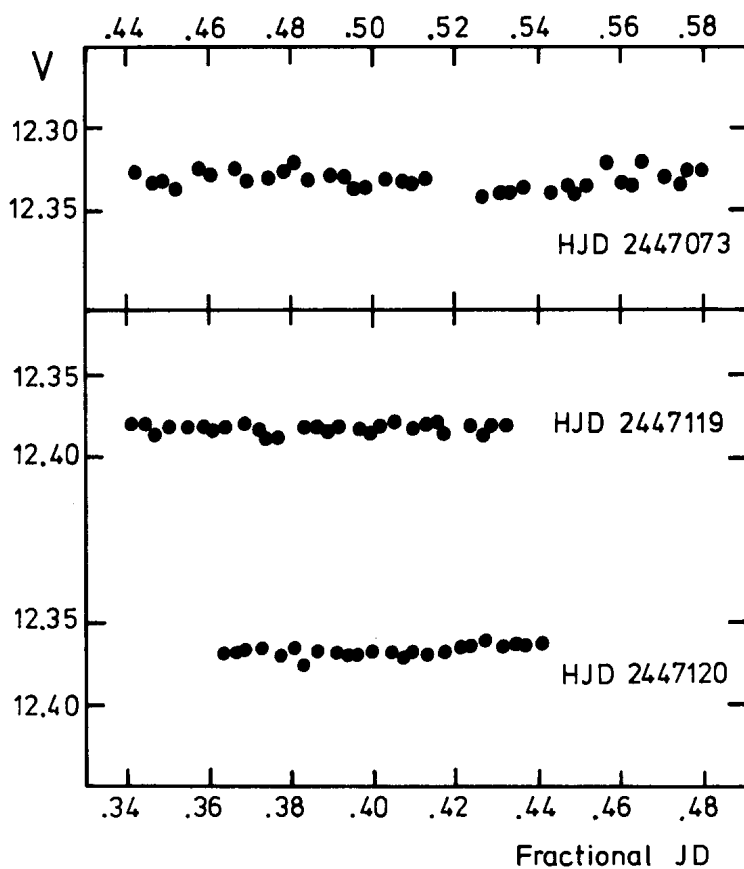


Figure 1. V magnitudes from three short BV sequences of observations of SB 357 (= CPD-37316). The Julian date of each run is noted and all observations are corrected to El/46 or HD5061 (see text).

Table 1 Strömgren photometry of SB 357

HJD	V	(b-y)	m <sub>1</sub>	c <sub>1</sub>	Date
2446682.592	12.536	-0.063	+0.093	+0.251	8 Sep 86
6768.398	12.494	-0.043	+0.079	+0.193	3 Dec 86
6769.400	12.479	-0.030	+0.059	+0.202	4 Dec 86
6772.386	12.531	-0.071	+0.116	+0.208	7 Dec 86
7071.495	12.325	-0.017	+0.063	+0.210	2 Oct 87
7072.385	12.325	-0.017	+0.075	+0.186	3 Oct 87
.443	12.320	-0.017	+0.069	+0.197	
.554	12.328	-0.027	+0.072	+0.187	
7121.368	12.341	-0.020	+0.071	+0.177	21 Nov 87
.463	12.365	-0.042	+0.090	+0.192	
7122.365	12.362	-0.029	+0.066	+0.222	22 Nov 87

Table 2 BV photometry of SB 357

HJD	V	(B-V)	n	Date
2447073.44 to .58	12.331	-0.091	36	4 Oct 87
7119.34 to .43	12.382	-0.125	28	19 Nov 87
7120.36 to .44	12.367	-0.127	24	20 Nov 87
7123.39 to .40	12.351	-0.107	4	23 Nov 87
7127.344	12.382	-0.096	1	27 Nov 87
7128.337	12.377	-0.075	1	28 Nov 87

Considering all the data, there is weak evidence from the 1987 results around HJD 2447120-30 for variability on a time scale of  $\gtrsim 10$  days and with amplitude  $\gtrsim 0.04$  mag, but comparing 1986 and 1987 photometry indicates that variations of up to 0.2 mag are possible over a year or less. Given the unusual location of this apparently normal Be star, some 6 kpc from the Galactic plane, sustained monitoring would be worthwhile.

DAVID KILKENNY

S A Astronomical Observatory  
P O Box 9  
Observatory 7935  
South Africa

## References:

- Graham, J.A. & Slettebak, A., 1973. Astr. J., 78, 295.
- Heber, U. & Langhans, G., 1986. 8 years of uv astronomy with  
the I.U.E. Satellite, ESA SP-263 p279, London.
- Kilkenny, D., 1987. Mon. Not. R. astr. Soc., 228, 713.
- Menzies, J.W., Banfield, R.M. & Laing, J.D., 1980. SAAO  
Circular 5, 149.
- Slettebak, A. & Brundage, R.K., 1971. Astr. J., 76, 338.

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

Number 3180

Konkoly Observatory  
Budapest  
3 May 1988  
HU ISSN 0374- 0676

PHOTOMETRIC OBSERVATIONS OF ZETA AURIGAE  
DURING THE 1987-1988 ECLIPSE

Photoelectric UBV observations of the long period eclipsing binary Zeta Aurigae were carried out from November 1987 to January 1988 with a 40 cm reflector at the Department of Astronomy, Kyoto University. The comparison star is Lambda Aurigae (GOV) whose magnitude and color indices are,  $V=4.71$ ,  $B-V=0.67$ , and  $U-B=0.10$ , respectively. Twenty-two standard stars were used for reduction of the data and the reduction was done in usual manners.

The resulting differential magnitudes in the Johnson system are listed in Table I in the sense of Zeta Aurigae minus Lambda Aurigae.

Table I. Magnitudes of Zeta Aurigae minus Lambda Aurigae

Date	JD*	$\Delta V$	$\Delta B$	$\Delta U$	n*
Nov. 11	2447111.075	-0.895	-0.303	-0.142	3
Nov. 19	2447119.279	-0.670	0.354	2.106	3
Nov. 20	2447120.094	-0.700	0.365	1.953	3
Nov. 25	2447125.099	-0.802	0.158	1.661	2
Dec. 1	2447131.075	-0.751	0.346	2.035	2
Dec. 7	2447136.999	-0.768	0.336	2.019	2
Dec. 14	2447143.984	-0.743	0.275	2.085	2
Dec. 23	2447153.002	-0.765	0.314	2.058	3
Dec. 24	2447154.119	-0.750	0.342	2.069	5
Dec. 25	2447155.123	-0.862	0.005	1.485	7
Dec. 26	2447156.134	-0.913	-0.229	0.178	7
Dec. 27	2447157.069	-0.898	-0.287	0.073	6
Dec. 28	2447158.132	-0.932	-0.251	0.043	8
Jan. 20	2447180.977	-0.926	-0.246	-0.001	3

\* JD is Julian Day at mid-time of observations, and n is number of observations.

A. ASONUMA, S. NISHIDA, S. OKUMURA,  
M. SHIMADA, Y. UEDA, T. WATANABE, and  
M. SAITO  
Department of Astronomy  
University of Kyoto  
Kyoto 606  
Japan

COMMISSION 27 OF THE I. A. U.  
 INFORMATION BULLETIN ON VARIABLE STARS  
 Number 3181

Konkoly Observatory  
 Budapest  
 4 May 1988  
 HU ISSN 0374-0676

UBVR - PHOTOMETRY OF BH Cep

BH Cep (F5 IV) is a rapid irregular variable star with unpredicted Algol-like light fadings (Wenzel and Brückner, 1978, Zhelezniakova and Kardopolov, 1980). Zaytseva and Kolotilov (1972) have observed two-components in the H $\alpha$  emission line with changing profile and intensity.

We carried out photoelectric UBVR observations of the star using the one-channel pulse-counting photometer and 0.5 m reflector at Peak Terskol (Caucasus, 3100 m). Details of reduction procedure and the reference stars have been described elsewhere (Pugach and Kovalchuk, 1983).

During 29 observational nights in 1972-1984 the star showed reasonable light variations near normal brightness 11<sup>m</sup>. The amplitude of variations in V does not exceed 0.5<sup>m</sup>. We have failed to detect deep light fadings previously reported by Hoffmeister (1949).

The recovery rise to the normal brightness was observed on J.D. 2441653. During 260 minutes of three-colour observations the brightness of the star increased

$$\Delta V = -0.22^m \quad \Delta B = -0.34^m \quad \Delta U = -0.39^m$$

as it is shown in Figure 1. The unusually wide scatter of the U, B, V magnitudes exceeding the standard deviation should be emphasized.

In Figure 2 U-B, B-V and V-R colour indices are plotted vs. V-magnitudes. Crosses in the figure represent eight sequential phases of the brightness rise on J.D. 2441653. While the star gets brighter the colour indices decrease. The solid lines in Figure 2 represent the "colour - magnitude relation" law:

$$\frac{\Delta V}{\Delta(U-B)} = 2.12 \quad \frac{\Delta V}{\Delta(B-V)} = 3.20 \quad \frac{\Delta V}{\Delta(V-R)} = 3.81$$

It strictly coincides with that of interstellar reddening law in the B, V, R passbands. Then colour - magnitude relations for BH Cep imply that its light variability should be caused by variable opacity of circumstellar matter which is like the interstellar one.

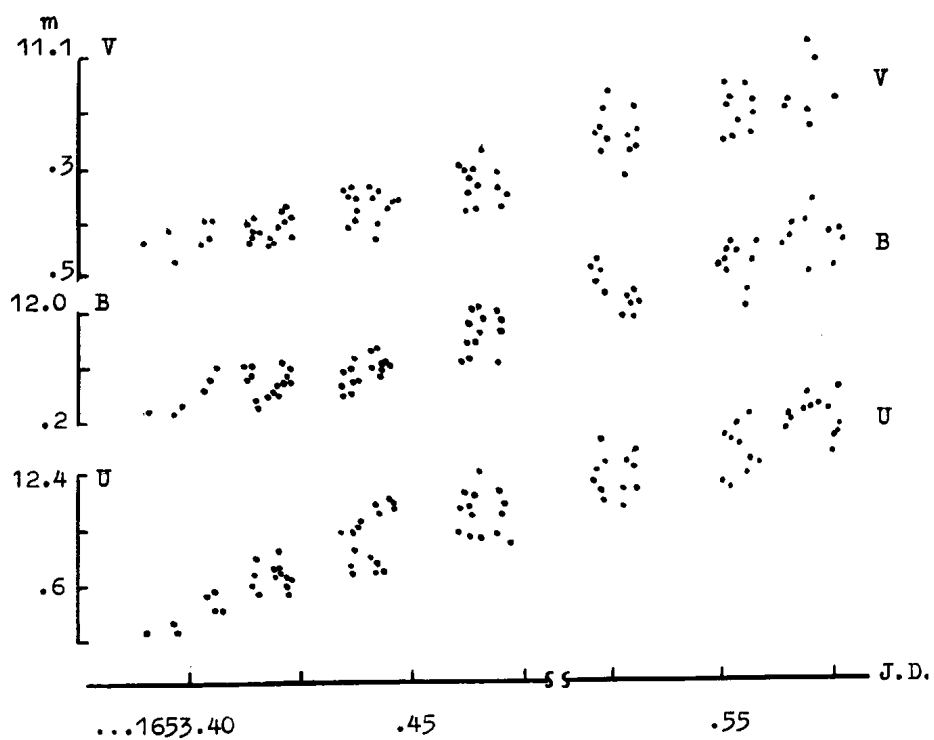


Figure 1

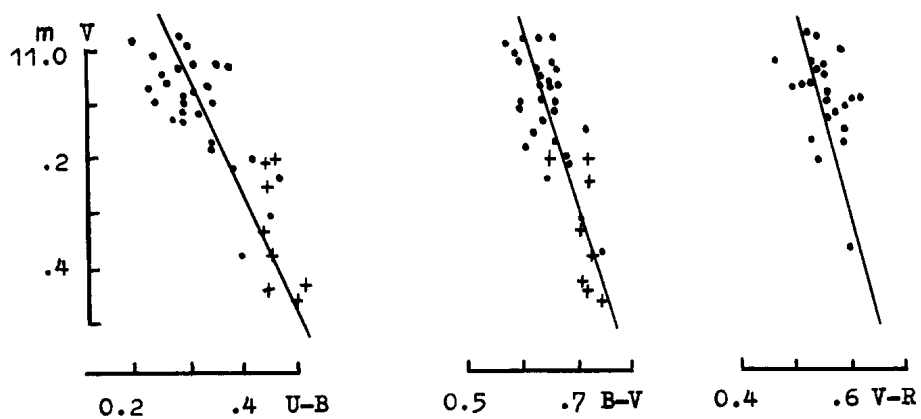


Figure 2

The B-monitoring observations covering the time span of an hour were carried out on J.D. 2442632. The scatter of the monitoring data is within the photometric uncertainty. Power spectrum analysis of the monitoring data reveals no periodic variations exceeding  $0.0035^m$ .

A. F. PUGACH  
Main Astronomical Observatory of the  
Ukrainian Academy of Sciences  
252127 Kiev, USSR.

#### References :

- Hoffmeister, C., 1949, Astron. Nachr., 278, 24.  
Pugach, A.F., Kovalchuk, G.U., 1983, Variable Stars (Moscow), 22, 9.  
Wenzel, W., Brückner, V., 1978, Mitt.Veränderl.Sterne, 8, 35.  
Zaytseva, G.V., Kolotilov, E.A., 1972, Astrofizika, 9, 185.  
Zhelezniakova, A.I., Kardopolov, V.I., 1980, Variable Stars (Moscow), 21, 301.

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

Number 3182

Konkoly Observatory  
 Budapest  
 4 May 1988  
 HU ISSN 0374-0676

## ON THE LIGHT VARIABILITY OF V530 Cyg

It is not clear what type of light variability an interesting star V530 Cyg shows. During the past four decades the variable was considered as an eclipsing system (Hoffmeister, 1949), as an irregular star of RW Aur type (Meinunger, 1966), and even as a non-variable (Philip'ev, 1980).

Our UBVR photoelectric measurements of V530 Cyg were carried out during the period of 1966-1983 on 107 nights with a single-channel pulse-counting photometer. The 0.5 m reflector was used firstly in Kiev, then, after 1971, at Caucasus (Peak Terskol,  $h=3100$  m). Besides, the brightness of V530 Cyg was sixty times estimated visually but no noticeable light fading has been recorded. During 167 nights the star showed only three plausible light fadings with an amplitude near  $0^m.5$  in V (Figure 1). In other cases the average V-magnitude and colour indices were:

$$V=11^m.75 \quad U-B=0^m.26 \quad B-V=0^m.61 \quad V-R=0^m.50.$$

Julian date of the three minima along with V-magnitudes and colour indices are presented in Table I.

Table I

J.D.	V	B-V	U-B	V-R
24 39685.434	12.28	0.58	0.31	-
42278.280	12.27	0.65	0.22	-
45226.419	12.27	0.55	- 0.05	0.63

One should consider the photometric features as evidence for eclipsing nature of variability since a formal period

$$P = 35^d.519958$$

fits the minima observed. But that is not the case.

At first, period P contradicts to our observations on J.D. 2441958 and J.D. 2442313 as well as Philip'ev's ones on J.D.2443699 when the stellar brightness was normal.

Secondly, the colour indices B-V and particularly U-B noticeably vary from one minimum to another.

The duration of the fading stage is unknown. However, in two of three cases

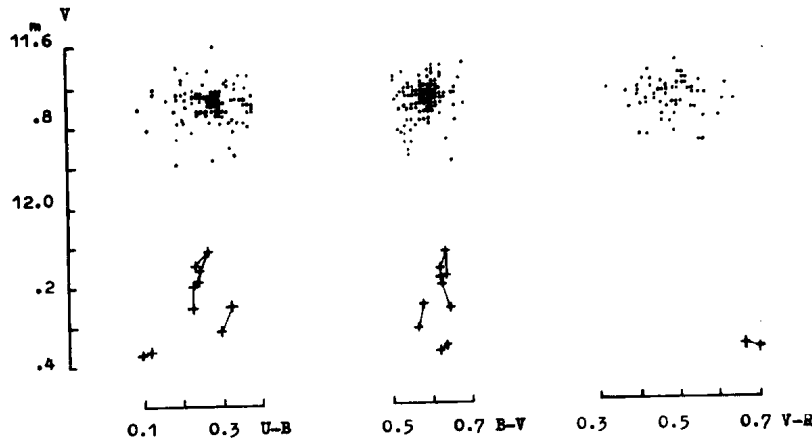


Figure 1. Nightly mean U-B, B-V and V-R colour indices versus V-magnitudes of V530 Cyg. Individual colour indices at minimum are denoted with +.

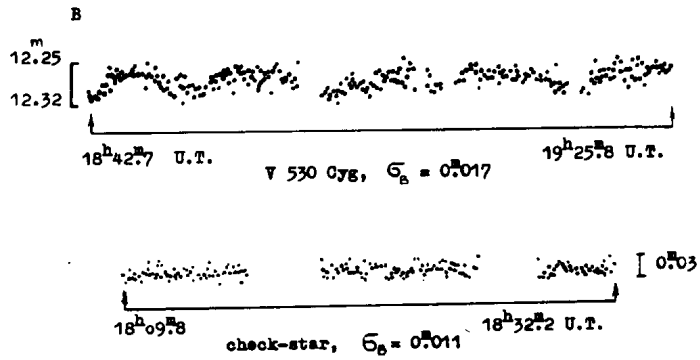


Figure 2. Comparison of the B-monitoring data of V530 Cyg and check-star on J.D. 2442724. Check-star has no catalogue identification.

the star was bright one day before and one day after the minima. That points out to the short time scale of the minima.

On the night of J.D. 2442724 V530 Cyg showed rapid light variations with the amplitude about  $0^m.05$ . The characteristic time of the variations seems to be near 3 minutes (Figure 2, upper part). No light variations have been previously found when monitoring the reference star in B with an accuracy of  $0^m.011$  (Figure 2, lower part).

While the star is getting dimmer the colour indices slightly vary. The UV radiation increases and the long-wave radiation decreases at minimum light as the colour indices U-B and V-R change in opposite direction. The B-V remains unchanged. Such photometric and colorimetric behaviour implies that the cause of variations has the physical rather than geometrical nature. So the variable star would be considered as a rapid irregular variable star with non-periodic random light fadings.

In contrast to the other stars similar to V530 Cyg no clear evidence was found for a presence of the H $\alpha$  emission. Earlier spectral investigation of Zaitseva and Esipov (1972) and our 5 spectrograms of H $\alpha$  region showed a shallow H $\alpha$  absorption line. Shallow profile of the line seems to be preferentially associated with the undetected trace of H $\alpha$  emission.

UBVR data will be published in the forthcoming issues of the Perem. Zvezdy (Variable Stars).

A. F. PUGACH

Main Astronomical Observatory of  
Ukrainian Academy of Sciences,  
Kiev, 252127, USSR

#### References:

- Hoffmeister, C., 1949, Veröff. Sternwarte Sonneberg, 1, 291.  
Meinunger, L., 1966, Mitt. Veränderl. Sterne, 3, 137.  
Philip'ev, G.K., 1980, Astron. Tsirk., No.1089, 7.  
Zaitseva, G.V., Esipov, V.F., 1972, Astron. Tsirk., No.712, 7.

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

Number 3183

Konkoly Observatory  
Budapest  
5 May 1988  
*HU ISSN 0374-0676*

OTHER MAXIMUM FOR THE PULSATING STAR

V1719 Cyg (HD 200925)

HD 200925 (=V1719 Cyg) was discovered as a new short period variable star by Gonzalez-Bedolla and Pena (1979) in a search for variability in metallic-line stars (Am). In those data, as Dupuy (1981) first suggested, the observations during the night of September 26-27, 1978, actually suffered from an artificial zero-point displacement of 0.08 mag. (due to the particular procedure of reduction). The pulsational characteristic for this star was first suggested by Payne-Gaposchkin (1979) (as  $\delta$  Scuti star) and was first clearly established by Imbert (1980). However, at present the real nature of this star is somewhat confused, viz.  $\delta$  Scuti, RRc, dwarf Cepheid or Am / Fm pulsating star (Joner and Johnson (1985) and Johnson and Joner (1986)). The radial velocity curve for HD 200925 was obtained by Imbert (1980) and Johnson and Joner (1986) obtained the first provisional physical parameters for this star. UBV photometry for HD 200925 was obtained by Poretti (1984) and uvby $\beta$  photometry by Joner and Johnson (1985) and Johnson and Joner (1986). The amplitude of the light curve varies from 0.36 to 0.31 mag. in V, from 0.50 to 0.42 in B and from 0.49 to 0.40 in U according to Poretti (1984).

HD 200925 presents small changes in the period from one cycle to another. This suggests that the star is multiperiodic; Poretti (1984) and Mantegazza and Poretti (1986) proposed double mode pulsation in the first and second radial overtones with  $P_1 = 0^d.267298$  and  $P_2 = 0^d.2138$ .

It is known that the study of the secular period variation is an important contribution to the understanding of the nature and state of evolution of the stars. For this star, Poretti (1984, Table IV) lists the maxima known up to 1984 for HD 200925, hence, with the aim of completing this Table, we present in this paper other photometric maximum that has not been published yet.

HD 200925 was observed in October 6, 1980, in Johnson's V band with the 33-inch telescope of San Pedro Martir Observatory, Baja California, Mexico, a refrigerated 1P21 photomultiplier was used. The comparison stars were the same

Table I. Differential photometry of HD 200925 in the V Filter

HJD 2444518.0+	$\Delta V$	HJD	$\Delta V$	HJD	$\Delta V$	HJD	$\Delta V$
.599	-0.129	.674	-0.009	.744	+0.191	.806	-0.059
.601	-0.129	.676	-0.006	.746	+0.191	.808	-0.062
.603	-0.127	.677	-0.001	.748	+0.176	.810	-0.069
.605	-0.124	.679	+0.001	.750	+0.176	.813	-0.074
.608	-0.114	.681	+0.009	.751	+0.174	.814	-0.089
.610	-0.114	.683	+0.014	.753	+0.169	.816	-0.084
.612	-0.114	.685	+0.014	.755	+0.156	.817	-0.089
.615	-0.114	.687	+0.036	.757	+0.141	.819	-0.092
.617	-0.109	.690	+0.046	.758	+0.146	.822	-0.104
.619	-0.104	.692	+0.056	.760	+0.136	.824	-0.114
.621	-0.102	.693	+0.066	.763	+0.134	.825	-0.114
.623	-0.114	.695	+0.081	.764	+0.121	.827	-0.117
.624	-0.089	.697	+0.081	.765	+0.114	.829	-0.114
.626	-0.097	.699	+0.096	.767	+0.101	.831	-0.127
.628	-0.084	.701	+0.106	.769	+0.096	.833	-0.137
.631	-0.089	.703	+0.121	.771	+0.094	.835	-0.137
.633	-0.082	.706	+0.126	.772	+0.084	.837	-0.139
.635	-0.084	.707	+0.141	.774	+0.076	.838	-0.139
.637	-0.067	.709	+0.149	.776	+0.066	.840	-0.144
.639	-0.064	.711	+0.159	.777	+0.064	.842	-0.147
.641	-0.064	.713	+0.166	.779	+0.051	.843	-0.147
.643	-0.064	.715	+0.179	.781	+0.046	.845	-0.147
.645	-0.057	.717	+0.181	.783	+0.041	.847	-0.147
.646	-0.054	.719	+0.196	.784	+0.029	.848	-0.152
.649	-0.047	.722	+0.199	.785	+0.026	.850	-0.159
.651	-0.057	.724	+0.201	.788	+0.024	.851	-0.147
.653	-0.032	.726	+0.204	.789	+0.011	.854	-0.154
.656	-0.044	.727	+0.211	.790	-0.012	.855	-0.144
.658	-0.039	.729	+0.214	.792	-0.006	.857	-0.149
.660	-0.029	.731	+0.216	.794	-0.009	.858	-0.139
.662	-0.042	.733	+0.214	.796	-0.012	.860	-0.144
.644	-0.024	.735	+0.211	.798	-0.024	.861	-0.147
.666	-0.019	.737	+0.211	.799	-0.039	.863	-0.137
.667	-0.014	.739	+0.211	.801	-0.037	.864	-0.137
.669	-0.012	.740	+0.199	.803	-0.054	.868	-0.134
.672	-0.009	.742	+0.201	.805	-0.054		

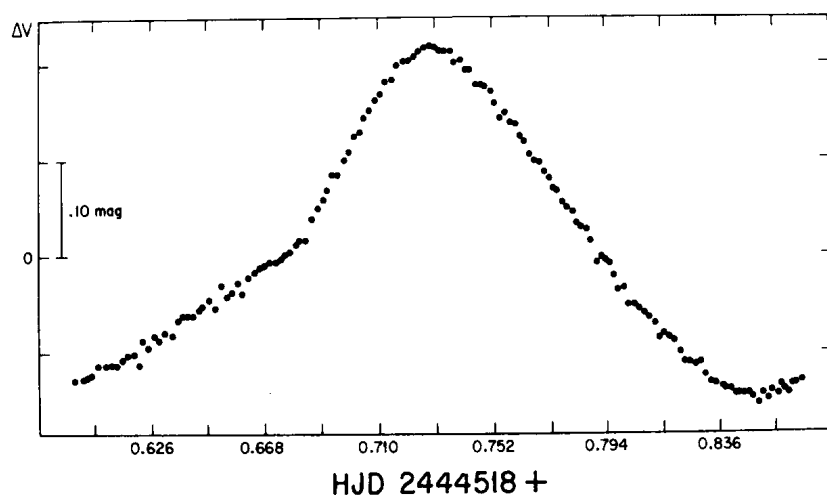


Figure 1. Differential photometry of HD 200925 in the V filter.

as in the original paper (HD 200926 and HD 200739), these stars have a high photometric constancy (Johnson and Joner 1986, Gonzalez et al. 1980), the observational sequence was C1, V, C2, V, C1,... followed uninterruptedly whole night, with an average interval between successive observations of the variable star being 3 minutes. Each observation consisted of 5 integrations of 10 seconds of the star followed by one 10-second integration of the sky.

Table I shows the differential photometry obtained for HD 200925 in the V filter, the accuracy of each observation is better than 0.003 mag., time is given in Heliocentric Julian dates, and its precision is 0.001 day, these values are shown plotted in Figure 1, where the photometric maximum is given as follows:

$$T_{\max} = \text{HJD } 2444518.731$$

The classical "bumps" observed on the ascending branch of the light curve of HD 200925 are also seen in Figure 1 of this paper.

Regrettably, for the size of the light curve we cannot assign with assurance time for the photometric minimum, because the observations were made after the minimum, and towards the end of our observations the photometric minimum is not well defined, either, and the scatter of the data is higher than for the rest of the observations. This may be caused by the relative increase of the air mass of these observations with respect to the rest of the

light curve, hence, we cannot assign with assurance the correct period and amplitude based on this light curve. In any case, the amplitude of this light curve seems to be in accordance with the range of amplitude variation (0.36-0.31 mag.) mentioned for this star by Poretti (1984).

S.F. GONZALEZ-BEDOLLA and DANIEL FLORES  
 Universidad Nacional Autonoma de México  
 Apdo. Postal 70-264  
 04510 México, D.F.  
 Mexico

#### References :

- Dupuy, D.L., 1984, Pub. A.S.P., 93, 126.  
 González-Bedolla, S., and Pena, J.H., 1979, Inf.Bull.Var.Stars No. 1615.  
 González-Bedolla, S.F., Warman, J., and Pena, J.H., 1980, Astron. J., 85, 1361.  
 Imbert, M., 1980, Astron. Astrophys., 86, 259.  
 Johnson, S.B., and Joner, M.D., 1986, Pub. A.S.P., 98, 581.  
 Joner, M.D., and Johnson, S.B., 1985, Pub. A.S.P., 97, 153.  
 Mantegazza, L., and Poretti, E., 1986, Astron. Astrophys., 158, 389.  
 Payne-Gaposchkin, C., 1979, Personal communication.  
 Poretti, E., 1984, Astron. Astrophys. Suppl., 57, 435.

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

Number 3184

Konkoly Observatory  
Budapest  
5 May 1988  
*HU ISSN 0374-0676*

BIBLIOGRAPHICAL CATALOGUE OF RR LYRAE STARS

We felt necessary to update the bibliographical catalogue of RR Lyrae stars by Heck and Lakaye (1977), essentially after the publication of the three volumes of the fourth edition of the General Catalogue of Variable Stars (Kholopov et al. 1985a,b, 1987 a), referred in the following as GCVS IV.

In a first step, GCVS IV was taken as a reference for the selection of RR Lyrae stars together with the 67th and 68th nominating lists (Kholopov et al., 1985 c, 1987 b). A few other stars were added from the general literature. All RR Lyrae stars identified are listed in the first table of the catalogue.

Then SIMBAD, the CDS database (see Egret and Wenger, 1988, and the references quoted therein) was searched for all the bibliographical references available at the end of 1987 for these stars. This database provides references from 1950 onwards. However the number of journals scanned for building up the bibliography contained in SIMBAD has increased during the years. Presently about 90 journals as well as conference proceedings are scanned.

Additional references were taken from Heck and Lakaye (1977) and from the general literature previously not included. We did not repeat here the references listed in GCVS IV and the 67th and 68th nominating lists.

The tables have been arranged as follows:

1. list of the 6367 RR Lyrae stars of the catalogue, they are listed under their variable-star names and presented in the alphabetical order of the constellations, a few stars still without designation in the variable-star system are given at the end of the table;
- 2a. list of the acronyms used in the subsequent cross-identification tables together with their explicitations and the relevant bibliographical references;
- 2b. cross-identifications with the identifiers of Table 1 as references, only the stars with several identifiers are listed;
- 2c. cross-identifications with all other identifiers as references presented in the alphabetical order of the acronyms used;

3. bibliographical catalogue; only the stars with bibliographical references are listed in the same order as Table 1, the bibliographical codes refer to the list in Table 4;
4. bibliographical references used in the catalogue;
5. statistics on the quotations of the individual references;
6. index of individual authors, the bibliographical codes refer to the list in Table 4.

Two appendices completing the catalogue list the stars from Heck and Lakaye (1977) not appearing in this catalogue (Appendix A) and the stars from the present catalogue not appearing in Heck and Lakaye (1977) (Appendix B).

The catalogue is available as CDS Special Publication No. 11 as well as on magnetic tape and two (5"1/4) floppy disks from CDS (Observatoire Astronomique, 11 rue de l'Université, F-67000 Strasbourg, France).

This work has been made significantly easier by the existence of SIMBAD, the CDS database. We thank M. Wenger for his assistance in dealing with huge SIMBAD outputs.

A. HECK

C.D.S.

Observatoire Astronomique

11 rue de l'Université

F-67000 Strasbourg, France

#### References:

- Egret, D., Wenger, M., 1988, in *Astronomy from Large Databases*, eds. F. Murtagh and A. Heck, ESO Conf. and Workshop Proc. **28**, p. 323
- Heck, A., Lakaye, J.M., 1977, *Astron. Astrophys. Suppl.* **30**, 397 (CDS catalogue 6008)
- Kholopov, P.N., Samus', N.N., Frolov, M.S., Goranskij, V.P., Gorynya, N.A., Kireeva, N.N., Kukarkina, N.P., Kurochkin, N.E., Medvedeva, G.I., Perova, N.B., Shugarov, S.Yu., 1985a, *General Catalogue of Variable Stars*, Fourth Edition, Volume I, Nauka, Moscow
- Kholopov, P.N., Samus', N.N., Frolov, M.S., Goranskij, V.P., Gorynya, N.A., Kazarovets, E.V., Kireeva, N.N., Kukarkina, N.P., Kurochkin, N.E., Medvedeva, G.I., Perova, N.B., Rastorguev, A.S., Shugarov, S.Yu., 1985b, *General Catalogue of Variable Stars*, Fourth Edition, Volume II, Nauka, Moscow
- Kholopov, P.N., Samus', N.N., Frolov, M.S., Goranskij, V.P., Gorynya, N.A., Karitskaya, E.A., Kazarovets, E.V., Kireeva, N.N., Kukarkina, N.P., Medvedeva, G.J., Pastukhova, E.N., Perova, N.B., Shugarov, S.Yu., 1987a, *General Catalogue of Variable Stars*, Fourth Edition, Volume III, Nauka, Moscow
- Kholopov, P.N., Samus', N.N., Kazarovets, E.V., Kireeva, N.N., 1987b, *IAU Comm.* **27**, Inf. Bull. Var. Stars, No. 3058
- Kholopov, P.N., Samus', N.N., Kazarovets, E.V., Perova, N.B., 1985c, *IAU Comm.* **27**, Inf. Bull. Var. Stars, No. 2681

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3185

Konkoly Observatory  
Budapest  
5 May 1988  
HU ISSN 0374-0676

PHOTOELECTRIC MINIMA OBSERVATIONS OF THE SHORT PERIOD  
ECLIPSING BINARY BP VELORUM

The variability of the thirteenth - magnitude star BP Velorum ( $\alpha=08^h 16^m 29^s$ ,  $\delta=-45^\circ 14'.1$ , 1950.0) was announced by de Kort (1941). He obtained a photographic light curve and classified this system as a W UMa - type eclipsing binary. From his observations 29 times of minimum were determined which yielded the following ephemeris:

$$\begin{aligned} \text{Min I} = \text{Hel. J.D. } 2426710.6711 + 0.^d 26498500 \text{ E} \\ \pm 0.0015 \quad \pm 0.00000054 \quad (1) \end{aligned}$$

During an observational run at the Complejo Astronomico El Leoncito -CASLEO- (San Juan, Argentina) in March 1988, BP Velorum was observed photoelectrically using the 215 cm telescope. Observations were carried out with the Vatican Observatory polarimeter VATPOL (Magalhaes et al., 1984) used as a photometer. Two dry-ice cooled RCA 31034 Ga-As photomultipliers were employed as detectors. A standard BV set of filters and diaphragms of 5 and 8 seconds of arc were also employed.

The measurements were made differentially with respect to the comparison star which is the first faint one directly north of the variable in de Kort's finding chart. All the observations were corrected for first and second order differential extinction. As the comparison is located very near BP Velorum, the corrections were small.

A total of 930 observations (465 in each band) covering the whole light curve have been obtained. From these observations twelve times of minimum were calculated. The bisection-of-chords procedure was used to determine six times of the primary minimum and six of the secondary one. A linear least square solution using our photoelectric data yielded this updated ephemeris:

$$\begin{aligned} \text{Min I} = \text{J.D. hel } 2447232.58031 + 0.^d 265092 \text{ E} \\ \pm 0.00015 \quad \pm 0.000026 \quad (2) \end{aligned}$$

The photoelectric minima, reported in this note, together with the epoch numbers and O-C residuals, calculated from ephemeris given in equation (2), are listed in Table I.

Table I. Photoelectric times of minimum light of BP Velorum

Min	JDhel. 2440000.+	E	O-C
II	7230.5920	-7.5	-0.00013
II	7230.5915	-7.5	-0.00064
I	7232.5814	0.0	0.00112
I	7232.5809	0.0	0.00056
II	7232.7129	0.5	0.00009
II	7232.7124	0.5	-0.00042
I	7233.6408	4.0	0.00014
I	7233.6408	4.0	0.00017
II	7234.5689	7.5	0.00036
II	7234.5678	7.5	-0.00074
I	7234.7006	8.0	-0.00044
I	7234.7010	8.0	-0.00007

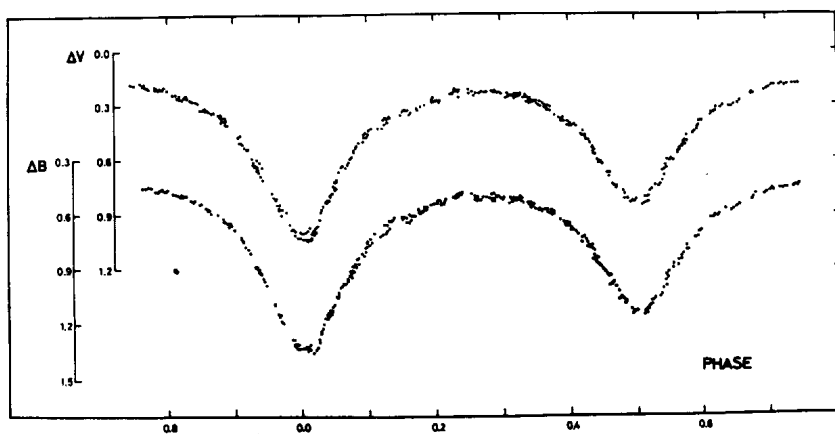


Figure 1  
BV light curves of the eclipsing binary BP Velorum

As shown in this table, the differences between the observed minima and those calculated from ephemeris (2), yield very small randomly distributed O-C residuals, all being smaller than 0.001 day. Because of the shortness of the period and the large amount of time elapsed without observations, it is difficult to join unambiguously our minima with the older photographic ones. Consequently, although from equations (1) and (2) it would seem to exist a slight tendency to a longer period, no variability of the period can be asserted.

The differential light curves in B and V bands are shown in Figure 1. There is no doubt that we are dealing with a close (contact) system. The depth of primary and secondary minima is about 0.8 and 0.6 magnitudes, respectively. Besides, the light curves at maxima clearly show the variations due to the tidal deformation and the reflection effect of the components.

The observations of this system will be continued in order to complete the poor coverage of the maximum following the secondary minimum.

A detailed photometric analysis of this star by means of a synthetic method of solutions will be published later.

We wish to express our thanks to Mr. Gabriel Sanchez for his helpful assistance during observations.

This work was partially supported by CONICET and CONICOR of Argentina.

E. LAPASSET and M. GÓMEZ  
Observatorio Astronómico  
Universidad Nacional de Córdoba  
Laprida 854, 5000 Córdoba  
Argentina

#### References :

- de Kort, J., 1941, Bulletin of the Astron. Institutes of the Netherlands,  
9, 245.  
Magalhaes, A.M., Benedetti, E., and Roland, E.H., 1984, Publ.Astron. Soc.  
Pacific., 96, 383.

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

Number 3186

Konkoly Observatory  
Budapest  
16 May 1988  
HU ISSN 0374-0676

HR 7923 IS A VARIABLE STAR

The bright star HR 7923 (SAO 106396) was observed by the author with the 10 inch cassegrain reflector of the Nessa observatory. Photoelectric observations were carried out in V band on 29 nights between 27 October 1986 and 20 January 1988. The star SAO 106376 was used as the comparison star. The observations are given in the table (the magnitude differences are in the sense variable minus comparison).

Table I

J.D.	$\Delta V$	J.D.	$\Delta V$
2446731.296	-0.578	2447071.325	-0.566
6737.238	-0.560	7079.354	-0.446
6762.200	-0.601	7083.326	-0.497
6763.192	-0.478	7095.256	-0.512
6766.308	-0.435	7096.258	-0.532
6768.308	-0.618	7107.242	-0.537
6770.300	-0.585	7115.188	-0.545
7014.438	-0.541	7129.190	-0.618
7029.417	-0.683	7133.200	-0.595
7034.371	-0.617	7140.188	-0.628
7042.367	-0.604	7160.229	-0.612
7048.346	-0.500	7162.221	-0.593
7050.325	-0.606	7164.250	-0.586
7069.317	-0.613	7171.221	-0.530
7070.329	-0.635		

From these observations I found an amplitude of 0.2 mag. in V and a cycle length of 100 days. The spectral type of HR 7923 is G8III and it is possible that this star is a semiregular variable or an RS CVn variable. Further observations of HR 7923 are necessary to determine the type of variability more exactly.

D. BÖHME  
DDR-4851 Nessa Nr.11  
German Democratic Republic

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

Number 3187

Konkoly Observatory  
Budapest  
16 May 1988  
HU ISSN 0374-0676

VARIABILITY OF THE HERBIG Be STAR BHJ 71

The star BHJ 71 as well as two other Herbig Be-Stars (HD 216629 (B2e) and LkHa 350 (B2-5e)) are members of the Cep OB3 association. BHJ 71 is the star No. 71 in the catalogue compiled by Blaauw et al. (1959).

125 UBVR observations of BHJ 71 were made at Maidanak Observatory between July 1984 and January 1988. The observations were carried out with the 48-cm and 60-cm reflectors equipped with identical photometers. The star underwent unique changes in the U-B colour. Figure 1 shows the light curve in V. The observed amplitude of the light variability is 0.<sup>m</sup>5 in B, V, and R bands, and 1<sup>m</sup> in U.

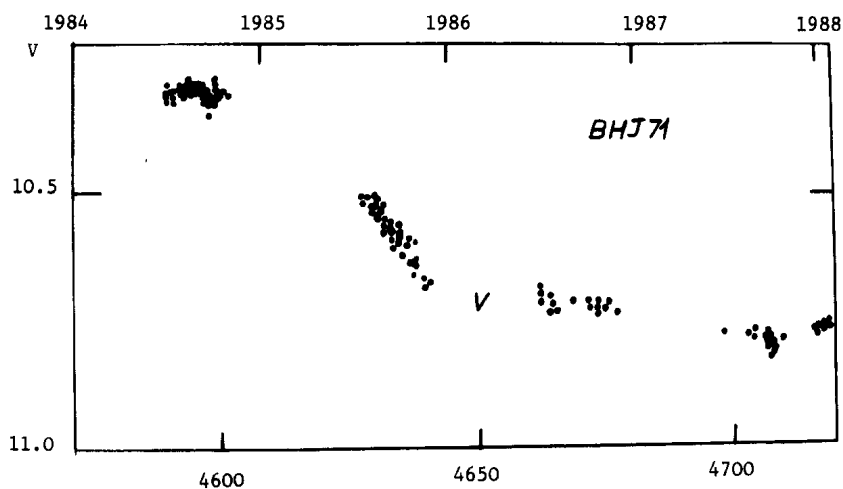


Figure 1

Figure 2 shows the position of the star on the two-colour diagram. The U-B colour index increased up to  $\sim +0.<sup>m</sup>6$  between July 1984 and mid-1987, and then decreased.

Five days before the beginning of the photometric observations on 23 July 1984, a spectrum of BHJ 71 was obtained with the 1-m Schmidt telescope of the

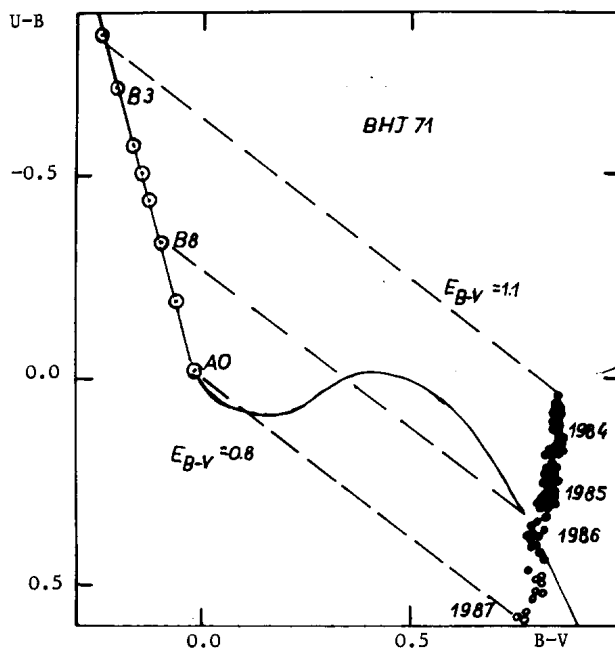


Figure 2

Byurakan Astrophysical Observatory using a  $3^\circ$  objective prism. The spectral class of BHJ 71 was estimated to be B2-3. Brodskaya (1953) estimated it as B0, while Finkenzeller and Mundt (1984) published B0-B8. The latest spectral class, B8, seems to be based on the estimation made by the Q-method (Blaauw et al., 1959). The same method was applied to our photometric observations, and we obtained the same result for the minimum brightness. The analysis of the two-colour diagram gives us different mean values of the extinction during the brightness maximum and minimum, viz.  $E_{B-V}^{\text{max}} = 1.2$ ,  $E_{B-V}^{\text{min}} = 0.8$ .

It has to be noted that there are no analogies between the light curves of early type Ina irregular variables (including Herbig Ae/Be stars) and that of BHJ 71.

N.D. MELIKIAN

Byurakan Astrophysical Observatory  
Byurakan, Armenia, USSR

V.S. SHEVCHENKO

M.A. IBRAGIMOV

S.D. JAKUBOV

A.V. CHERNYSHEV

Astronomical Institute

A.N. Uz.SSR, Tashkent, USSR

#### References:

- Blaauw, A., Hiltner, W.A., Johnson, H.L., 1959, *Astrophys. J.*, **130**, 69.  
 Brodskaya, E.S., 1953, *Izv. Kr. A.O.*, **10**, 104.  
 Finkenzeller, U., Mundt, R., 1984, *Astron. Astrophys. Suppl. Ser.*, **55**, 109.

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

Number 3188

Konkoly Observatory  
Budapest  
18 May 1988  
HU ISSN 0374-0676

## BD+0°3566, A NEW SHORT PERIOD VARIABLE STAR

A new variable star was found during a photometric study of the W UMa type star V502 Oph.

The comparison stars were chosen according to the standard criteria: they must be of approximately the same magnitude and less than two degrees from the program star. The characteristics of the observed stars are shown in Table I.

The observations were made with the 0.84m reflector at the Observatorio Astronomico Nacional, San Pedro Martir, Mexico during the nights of 13/14 and 14/15 June 1987. A Lowell photon counting system was utilized with Johnson's V filter.

Each observation is the result of one 40 s integration on each star. The sequence C1, C2, V was followed except at the time of the eclipse of V502 Oph when a continuous monitoring of the eclipsing star was undertaken. This explains the gaps in the photometry of this new variable star. The photometric values reported in Table II and shown schematically in Figure 1 are the magnitude differences between BD+0°3566 (C2) and BD+0°3569 (C1). On each night the average of the points has been subtracted to establish the zero baseline. The data points are accurate to 0.<sup>m</sup>005 the average time span between successive points is 0.01<sup>d</sup> and the accuracy in time is 0.0014<sup>d</sup>. From Figure 1 it can be seen that the amplitude of the variation is 0.<sup>m</sup>04, although it is changing from one day to another. If the star is pulsating, this suggests the existence of several simultaneously interacting modes. The Fourier transform of the two nights confirms this result.

Table I

Characteristics of the observed stars

	BD	V	Sp.	$\alpha$ (1950)	$\delta$	Type
V502 Oph	SAO +0°3562 121784	8.4-8.98	G2V+F9V	16 <sup>h</sup> 38 <sup>m</sup> 48 <sup>s</sup>	+0°36'8".5	WUMa
C1	+0°3569 121805	8.5	G0	16 40 19	+0 10 6.9	Comp.
C2	+0°3566 121803	8.45	A3	16 40 07	+0 37 11.3	New

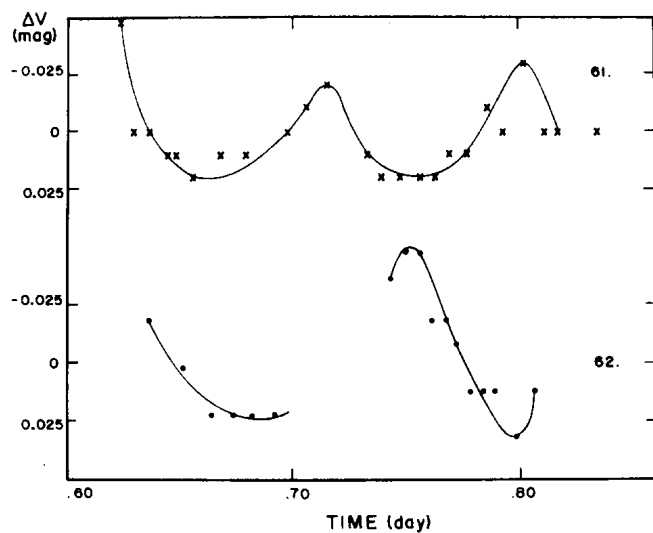


Figure 1. Light curve of the new variable star  
BD +0°3566. On top, night HJD 2446961; bottom,  
night HJD 2446962.

Table II  
Photoelectric photometry of BD +0°3566

HJD	$\Delta V$	HJD	$\Delta V$
2446960+		2446960+	
1.6221	-0.049	1.8103	0.000
1.6304	0.000	1.8179	0.000
1.6373	0.000	1.8262	-0.040
1.6450	0.010	1.8346	0.000
1.6485	0.010	2.6367	-0.018
1.6561	0.020	2.6512	0.002
1.6686	0.010	2.6644	0.022
1.6797	0.010	2.6728	0.022
1.6894	0.010	2.6818	0.022
1.6978	0.000	2.6915	0.022
1.7061	-0.010	2.7436	-0.038
1.7151	-0.020	2.7492	-0.048
1.7318	0.010	2.7554	-0.048
1.7387	0.020	2.7610	-0.018
1.7471	0.020	2.7665	-0.018
1.7554	0.020	2.7714	-0.008
1.7623	0.020	2.7776	0.012
1.7693	0.010	2.7832	0.022
1.7762	0.010	2.7887	0.022
1.7853	-0.010	2.7978	0.032
1.7929	0.000	2.8054	0.022
1.8012	-0.030		

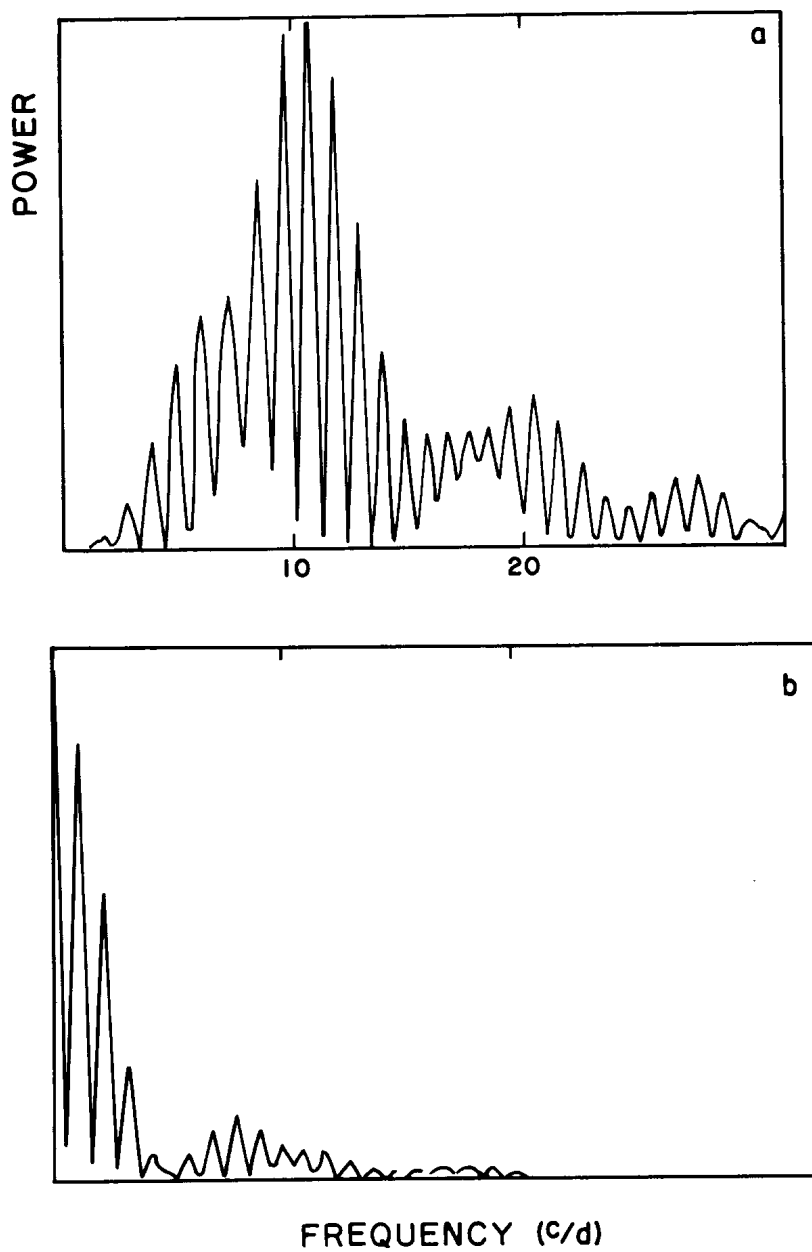


Figure 2a. Power spectrum of the two nights.

Figure 2b. Window function.

Figure 2b represents the window function, whereas Figure 2a the power spectrum of the two nights, with peaks at 9.70 and 18.45 c/d or, corresponding, periods at  $0.103^d$  and  $0.05^d$ . Since the spectral class of the newly found variable has been reported in the SAO Catalogue as A3, one might speculate from the observational characteristics, that it might be a pulsating star of Delta Scuti type, especially since it shows a relatively small and changing amplitude, two close and short periods of pulsation and a spectral type of A3. More detailed observations are needed to univocally decide on its nature.

We would like to acknowledge the assistance of the staff of the Observatorio Astronomico Nacional. Fruitful discussions with R. Peniche are also acknowledged. Proofreading was done by J. A. Miller and typing by D. A. Ramos.

T. GOMEZ

Instituto de Astronomia-UNAM  
Apdo. Postal 70-264  
C.P. 04510  
Mexico, D.F.

J.H. PENA<sup>1</sup> and M. A. HOBART<sup>2</sup>

Instituto Nacional de Astrofisica,  
Optica y Electronica  
Apdo. Postal 51 y 216  
ZC 72000  
Puebla, Pue

1

On leave from Instituto de Astronomia-UNAM  
Apdo. Postal 70-264  
C.P. 04510  
Mexico, D.F.

2

On sabbatical from University Veracruzana  
Facultad de Fisica  
Apdo. Postal 270  
Xalapa, Veracruz

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

Number 3189

Konkoly Observatory  
Budapest  
20 May 1988  
HU ISSN 0374-0676

PHOTOGRAPHIC UVB PHOTOMETRY OF FLARE STARS  
IN THE GAMMA CYGNI REGION

The observations in the investigated  $4^{\circ} \times 4^{\circ}$  area in Cygnus (central star BD+40<sup>0</sup>4165 with coordinates R.A. 1950 = 20<sup>h</sup>24<sup>m</sup>35<sup>s</sup> and D. 1950 = 41<sup>0</sup>12'52") were initiated in view of the presence of some young objects appearing as active star formation indicators. The close relationship between the T Tau stars, H $\alpha$  emission stars and flare stars is already well established. Thus one can expect the presence of flare stars in every group containing T Tau stars and related objects. In the investigated region only two probable UV Cet type stars were known - V 1381 Cyg and LD21 (Dahlmark, 1982) up to our special searches for flare stars. Fifteen new flare stars were discovered (Melikian et al., 1980, Tsvetkova, 1980, 1982, Tsvetkova et al., 1983).

The identification charts of the discovered flare stars obtained from the E-print of the Palomar Observatory Sky Survey Atlas are presented in Figure 1. Where the nebulae worsen the visibility of the stars the O-print is used. On these charts, north is at the top, east is to the left.

The photometric observations were made with the 40"/52" Schmidt telescope of the Byurakan Astrophysical Observatory in September, 1980. The photometry was carried out with an Ascania iris photometer. Doing the photometry, we adopted the existing photoelectric standards in the association Cygnus OB2 and the photographic standards in the region of the nebula IC 5070. The second photographic standards in this region are in the interval 11.6<sup>m</sup> - 18.3<sup>m</sup> (V). The presence of dark and emission nebulae in the investigated region requires to determine the influence of the uneven background. The mean quadratic errors are respectively  $\pm 0.10^m(V)$ ,  $\pm 0.09^m(B)$ ,  $\pm 0.10^m(U)$ .

In Table I the results from the UVB photographic photometry of the flare stars in quiet state (minimum of the brightness) are given.

The designation of the flare stars is according to the General Catalogue of Variable Stars (Kholopov et al., 1985) and to the 67<sup>th</sup> Name-List of Variable Stars (Kholopov et al., 1985).

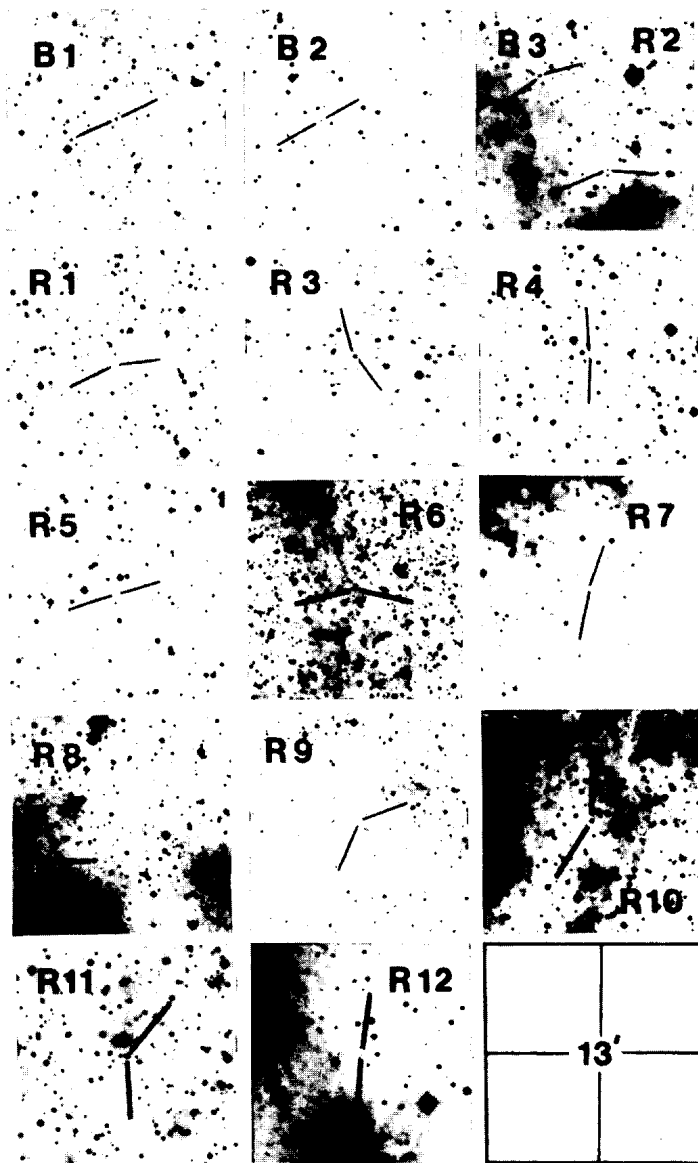


Figure 1

Table I

Name	V	B-V	U-B
V1695Cyg	16. <sup>m</sup> 03	1. <sup>m</sup> 23	1. <sup>m</sup> 02
V1750Cyg	17.39	0.76	0.14
V1752Cyg	17.90	-	-
V1753Cyg	17.74	-	-
V1754Cyg	17.60	0.85	-
V1755Cyg	15.44	1.37	0.99
V1756Cyg	17.79	-	-
V1757Cyg	18.02	-	-
V1772Cyg	15.76	2.17	-
V1778Cyg	16.42	0.87	0.33
V1779Cyg	16.61	0.97	0.73
V1780Cyg	17.82	1.31	-
V1781Cyg	15.19	1.09	0.71
V1785Cyg	15.52	1.34	0.92

Table II

Name	B <sub>POSS</sub>	B-V <sub>POSS</sub>
V1752Cyg	20. <sup>m</sup> 00	2. <sup>m</sup> 10
V1753Cyg	19.55	1.75
V1756Cyg	21.00	3.20
V1757Cyg	21.00	3.00
V1777Cyg	21.00	2.20

Table III

Name	Date of flare-up	Telescope	m <sub>U</sub> (min)	Δm <sub>U</sub>
V1695Cyg	12 Sept. 1977	40"/52"	18. <sup>m</sup> 28	2. <sup>m</sup> 16
V1750Cyg	13 Sept. 1980	-"-	18.29	3.34
V1752Cyg	29 Oct. 1980	20"/28"	21.00*	5.40
V1753Cyg	18 June 1980	-"-	20.55*	4.78
V1754Cyg	12 Sept. 1980	40"/52"	19.45*	3.33
V1755Cyg	15 Aug. 1980	20"/28"	17.80*	1.50
V1756Cyg	16 Aug. 1980	-"-	22.00*	6.24
V1757Cyg	17 July 1980	-"-	22.00*	6.10
V1772Cyg	19 Sept. 1981	-"-	18.93*	2.13
V1777Cyg	17 Sept. 1982	-"-	22.00*	6.32
V1778Cyg	27 Aug. 1981	-"-	17.62	1.50
V1779Cyg	03 Aug. 1981	-"-	18.31	3.05
-"-	20 Sept. 1981	-"-	-"-	3.19
V1780Cyg	03 June 1981	-"-	20.13*	4.22
V1781Cyg	31 July 1981	-"-	16.99	1.31
V1785Cyg	29 Aug. 1981	-"-	17.78	1.62

\* The stellar magnitudes are obtained on the basis of the approximate relation  $(U-B)_{\min} = +1$ .

The magnitudes of the flare stars fainter than the limit of the photometric plates were obtained by measuring the diameters of the stellar images on the POSS prints with a mean quadratic error of  $\pm 0.17^m$  in the magnitude interval  $17^m-21^m(B_{POSS})$  (Table II).

A summary of the flare-ups is given in Table III.

In some cases there are differences reaching one magnitude between the stellar magnitudes in the maximum brightness given earlier and estimated now. The reason is in the higher accuracy of the estimation of stellar magnitudes with an iris photometer and in the determination of the influence of the uneven background.

We obtained V- and B-magnitudes of V1381 Cyg, a probable UV Cet type star (Romano, 1969). The star shows rapid changes in the V-light from  $16.95^m$  to  $18.30^m$  and in the B light with a smaller amplitude from  $18.33^m$  to  $18.97^m$ . It is not clear whether these are short time scale irregular changes of the brightness or flare-ups because the star is below the limit on our patrol U-plates.

KATYA P. TSVETKOVA, M.K. TSVETKOV  
Department of Astronomy and  
National Astronomical Observatory  
blvd. Lenin 72, Sofia-1784  
Bulgaria

#### References:

- Dahlmark, L. 1982, IBVS, No. 2157.  
Kholopov, P.N. et al., 1985a, General Catalogue of Variable Stars, 4th Ed., Vol. II., Nauka, Moscow.  
Kholopov, P.N. et al., 1985b, IBVS, No. 2681.  
Melikian, N.D., Jankovics, I., Tsvetkova, K.P., and Tsvetkov, M.K., 1980, IBVS, No. 1750.  
Romano, G., 1969, Pubbl. Oss. Astron. Padova, No. 156.  
Tsvetkova, K.P., 1980, IBVS, No. 1887.  
Tsvetkova, K.P., 1982, IBVS, No. 2131.  
Tsvetkova, K.P., Hambarian, V.V., Brutian, G.H., 1983, IBVS, No. 2365.

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

Number 3190

Konkoly Observatory  
Budapest  
20 May 1988  
HU ISSN 0374-0676

FLARE STAR OBSERVATIONS IN ORION BY THE METHOD OF  
PHOTOGRAPHIC STELLAR TRACKS

The purpose of our study was the application of the method of photographic stellar tracks (Chavushian, 1986) at the National Astronomical Observatory, Rozhen, Bulgaria. The stellar aggregate Orion (M 42) was chosen for its relatively high flare activity.

The observations were carried out in the period 1 November - 3 December, 1986 with the 50/70/172 cm Schmidt telescope of the Rozhen Observatory using ORWO ZU 21 plates without filter, and exposure time of 30 minutes. The average limit of the plates was  $15^m.2$  (pg). The effective observational time was 13 hours. The plates were analysed with a Carl Zeiss Jena blink-comparator (16 x magnification, then the detected events were measured with a G2 schnell photometer.

After surveying the material, 3 flares were found. The data obtained are listed in Table I. The successive columns of the table contain the following data:

- 1.- the serial number of the event
- 2.- other designations
- 3.- the date of observation
- 4-6.- U.T. of the beginning of the flare ( $U.T._b$ ), U.T. of the maximum ( $U.T._{max}$ ) and the duration
- 7.- the magnitude in the quiet state and the amplitude  $\Delta m_{pg}$  during the flare
- 8.- the standard deviation of random noise fluctuations  $\sigma(mag)$ .

We used photometric sequence No. 2 in Orion according to Andrews (1970) for our photometry.

Flare event No. 1 took place in the star Tonantzintla No. 26. This is the second flare observed in this star. The first was observed on 15 December 1963 with an amplitude  $\Delta m_U = 2^m.0$  by the multiexposure method (Haro and Chavira, 1964).

Flare event No. 2 was observed in the In type variable star PZ Ori.

Table I

No.	Other design.	Date	U.T. begin.	U.T. max	Dura- tion	$m_{pg}$ min	$m_{pg}$ max	$\sigma$ (mag)
1.	T 26	1 Dec. 1986	2 <sup>h</sup> 12 <sup>m</sup> 06 <sup>s</sup>	2 <sup>h</sup> 15 <sup>m</sup> 35 <sup>s</sup>	3 <sup>m</sup> 36 <sup>s</sup>	17.7	3.8	0.15
2.	PZ Ori	1 Dec. 1986	1 49 36	1 51 45	3 13	14.6	1.2	0.15
3.	Anon	2 Dec. 1986	1 45 07	1 48 41	~10	21.5	6.7	0.10

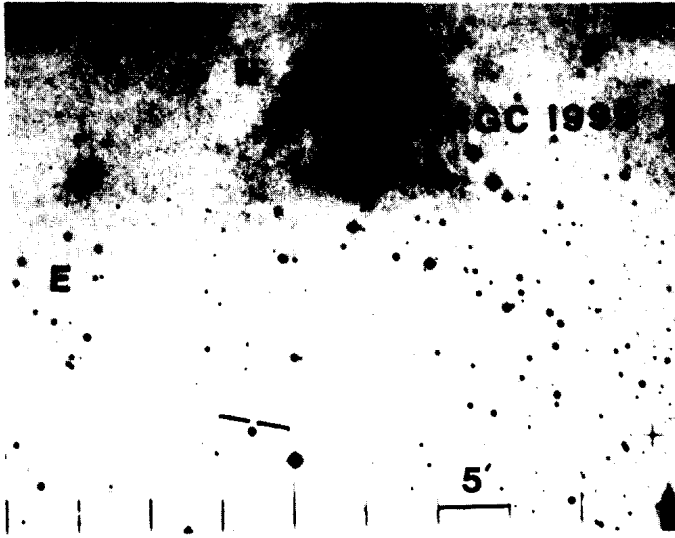


Figure 1

This flare was observed when the star was in a state of increased activity. Usually, this star is near the plate limit on our plates ( $m_{pg}$  limit=15.2) but in the period 2-10 November the star increased its brightness to  $m_{pg}$  =14.6 and remained with this magnitude up to the end of our observations. In the General Catalogue of Variable Stars (Kholopov et al., 1985) it is mentioned that this star has  $m_{pgmin}$  =15.7. PZ Ori is unknown as a star exhibiting flares.

Flare event No. 3 belongs to a very faint star which has not been known to be variable. On the chart No. J-3828 from the U.K.S.T.U. Atlas of the Royal Observatory, Edinburgh, we identified this event with a star of  $m_B \approx 21.5$ . The

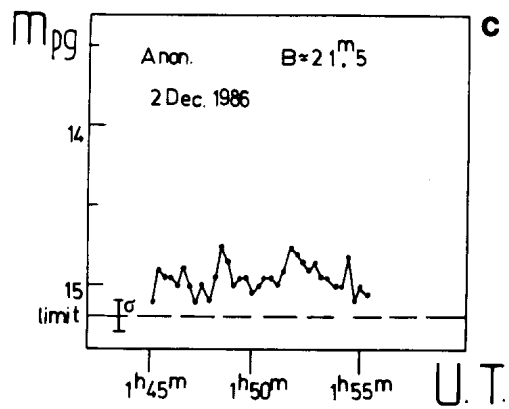
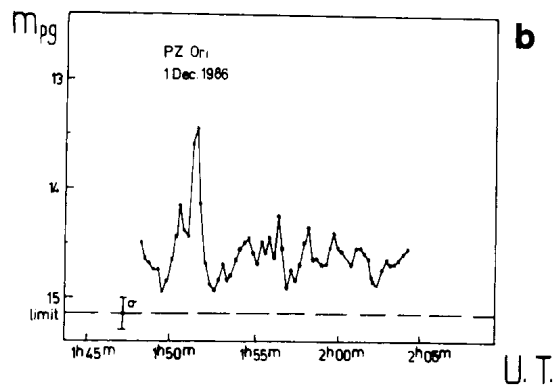
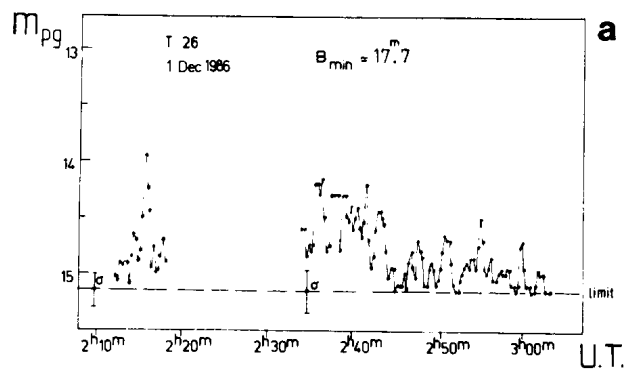


Figure 2

identification chart is given in Figure 1. The coordinates of the star are  
 $R.A._{1950.0} = 5^h 34^m 05^s$ ,  $D_{1950.0} = -7^\circ 01'.3$ .

The light curves of the observed flares are given in Figure 2.

Thanks are due to the relevant authorities of the ROE for the U.K.S.T.U. observational material offered by them for the programme.

RENADA K. KONSTANTINOVA-ANTOVA

M.K. TSVETKOV

Department of Astronomy and  
 National Astronomical Observatory  
 72 Lenin Blvd., Sofia-1784  
 Bulgaria

#### References:

- Andrews, A.D., 1970., Bulletin Tonantzintla y Tacubaya Obs. 5, No. 34, p. 195.  
 Chavushian, H.S., 1986, Proc.Symp. "Flare Stars and Related Objects",  
 Byurakan, ed. L.V. Mirzoyan, p. 125.  
 Haro, G., Chavira, E., 1964, The Galaxy and the Magellanic Clouds, I.A.U.  
 - U.R.S.I. Symposium No. 20. ed. F.G. Kerr and A.W. Rodgers,  
 Canberra, p. 30.  
 Kholopov, P.N. et al., 1985, General Catalogue of Variable Stars, vol. II.,  
 Moscow, "Nauka", p. 288.

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

Number 3191

Konkoly Observatory  
 Budapest  
 20 May 1988  
 HU ISSN 0374-0676

PHOTOGRAPHIC UBV PHOTOMETRY OF H $\alpha$  EMISSION  
 IN THE GAMMA CYGNI REGION

The investigated region around Gamma Cyg is rich in H $\alpha$  emission stars. The catalogue of the detected H $\alpha$  emission stars in this region compiled by us contains 98 stars. In 1982 we undertook the task to get spectral plates with an objective prism on the 40"/52" Schmidt telescope of the Byurakan Astrophysical Observatory to search for new H $\alpha$  emission stars in view of the greater possibilities of the used telescope than the telescopes used by other authors before and to check the variability of H $\alpha$  intensity in known H $\alpha$  emission stars. We discovered 18 new emission stars (Tsvetkova and Tsvetkov, 1982).

Here we present the identification charts of these 18 H $\alpha$  emission stars obtained from the O- and E- prints of the Palomar Observatory Sky Survey Atlas (Figure 1). North is at the top, east - to the left. Since H $\alpha$  emission stars No. 4 and No. 5 are difficult to be seen owing to the nebula where they are found, we present the chart obtained from 40"/52" Schmidt plate with a Kodak 103 emulsion through an RG 610 filter using a 60 minute exposition.

Table I

No.	V	B-V	U-B
1	18 <sup>m</sup> 00	0 <sup>m</sup> 38	-
2	17.50	1.95*	-
3	15.53	1.31	0 <sup>m</sup> 15
4	13.21	0.40	0.32
5	14.78	0.94	0.70
6	17.00	0.80	0.16
7	15.51	2.88	-
9	17.00	0.73	0.27
11	16.38	1.43	-
12	17.36	0.59	0.53
13	17.54	0.78	0.10
14	16.69	0.60	0.62
16	18.17	2.90*	-
18	15.30	0.94	0.72

\* (B-V)<sub>poss</sub> magnitudes are given because the stars are below the limit of our B photometric plates.

No.	Table II		
	$\Delta V$	$\Delta B$	$\Delta U$
8	$15^{\text{m}}88 - 16^{\text{m}}68$	$17^{\text{m}}82 - 18^{\text{m}}15$	$18^{\text{m}}18 - 18^{\text{m}}25$
10	$15.92 - 16.86$	$16.96 - 17.44$	$17.96 - 18.30$
V1391 Cyg=15	$15.96 - 16.90$	$17.58 - 17.87$	$17.89 - 18.16$
17	$15.78 - 16.85$	$17.43 - 17.64$	$18.08 - 18.32$

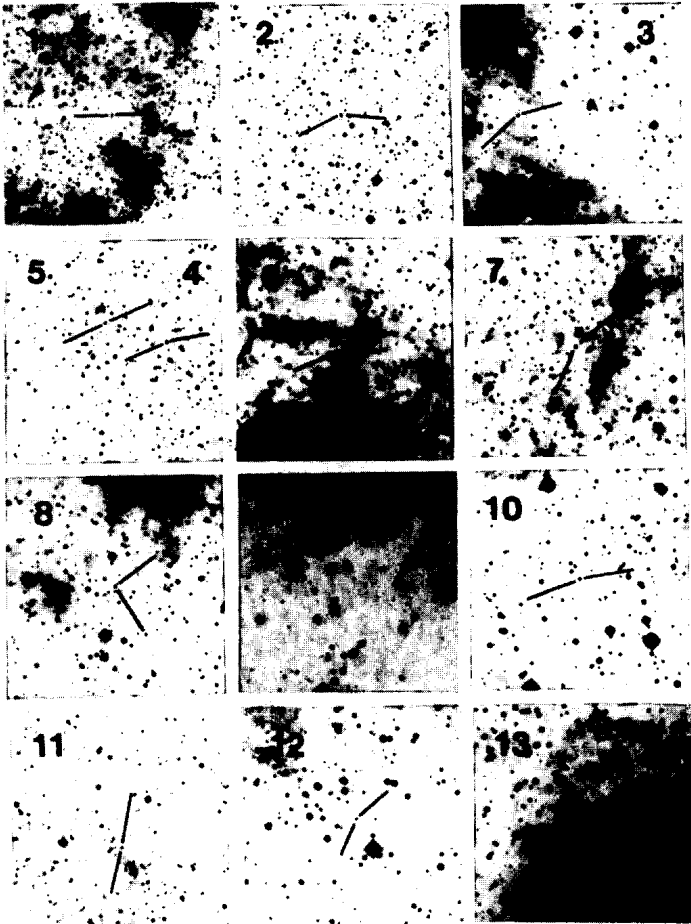


Figure 1

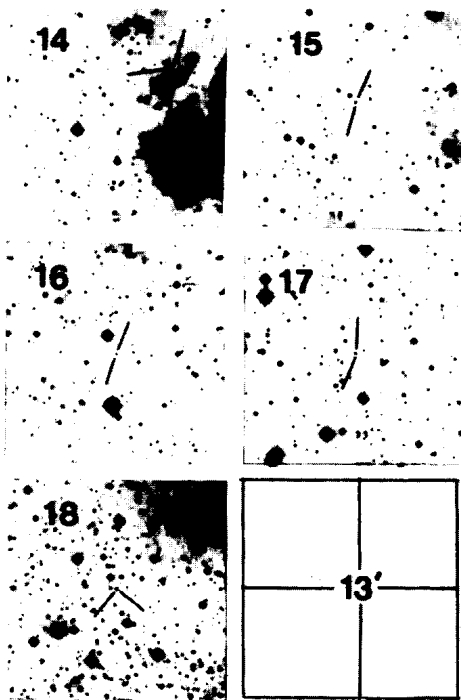


Figure 1 (cont)

Table I contains the data of the photographic UVB photometry of the H $\alpha$  emission stars carried out simultaneously with the photometry of the flare stars in this region, (Tsvetkova and Tsvetkov, 1988).

The mean quadratic errors of the magnitude determination for stars No. 5 and No. 11 do not exceed those for a photographic photometry. But the difference between B magnitudes estimated now and  $B_{\text{POSS}}$  magnitudes published in the earlier paper for these stars reached 1.<sup>m</sup>1 and 1.<sup>m</sup>5 magnitudes respectively. Such a big difference for the star No. 5 might be explained with the location in the emission nebula IC 1318a, and it is therefore impossible to determine the influence of the background on the Palomar print. For star No. 11 we can suspect the brightness changes between the epochs when the Palomar print and our photometric plates were obtained.

Brightness changes for the stars Nos. 8, 10, 15 and 17 were also noticed. Only one of them (No. 15) is known to be a variable star - V1391 Cyg. It is interesting to note that V1391 Cyg is classified as an RR Lyrae type star in the GCVS. The wavelength dependence of the amplitude does not support this classification. The ranges of variation are given in Table II. The same tendency of amplitudes as for V1391 Cyg is seen for all four stars in this table.

KATYA P. TSVETKOVA, M.K. TSVETKOV  
Department of Astronomy and  
National Astronomical Observatory  
Lenin Blvd. 72 1784-Sofia  
Bulgaria

References:

- Tsvetkova, K.P., Tsvetkov, M.K., 1982, IBVS, No. 2134.  
Tsvetkova, K.P., Tsvetkov, M.K., 1988, IBVS, No. 3189.

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

Number 3192

Konkoly Observatory  
Budapest  
24 May 1988  
HU ISSN 0374-0676

PERIOD CHANGES IN AC HERCULIS

AC Herculis is a well-known RV Tauri star. Its period is 75.01 days according to the 4th edition of the GCVS, while in the 3rd edition it was 75.4619 days. O-C diagrams were published by Zakharov (1953) and Erleksova (1971), both showing period changes. Neither of these diagrams used all of the available minimum observations, so it was considered worthwhile to have another look at the period variations.

In addition to the times of primary minima found in the literature, published photoelectric observations were also examined, and, whenever possible, the times of minima were estimated from them. Because there are few photoelectric observations in the 80's, the observations of the French (AFOEV) and Hungarian (Pleione) amateurs were also used for minimum determination. The O-C values were calculated using the elements

$$\text{Min.} = 2410010.24 + 75.4255 \cdot E$$

This formula was received by changing the period and epoch until a least-squares solution gave a satisfactory approximation of the O-C=0 line. The resulting O-C diagram is plotted in Figure 1. The references for the minima, for photoelectric observations and for amateur observations are below the Figure 1.

The O-C diagram of AC Herculis is very interesting. It clearly shows a wave, with a period of 9323.3 days. This period is in reasonable agreement with the value of 9400 days mentioned in the GCVS (3rd ed.). A wave is also

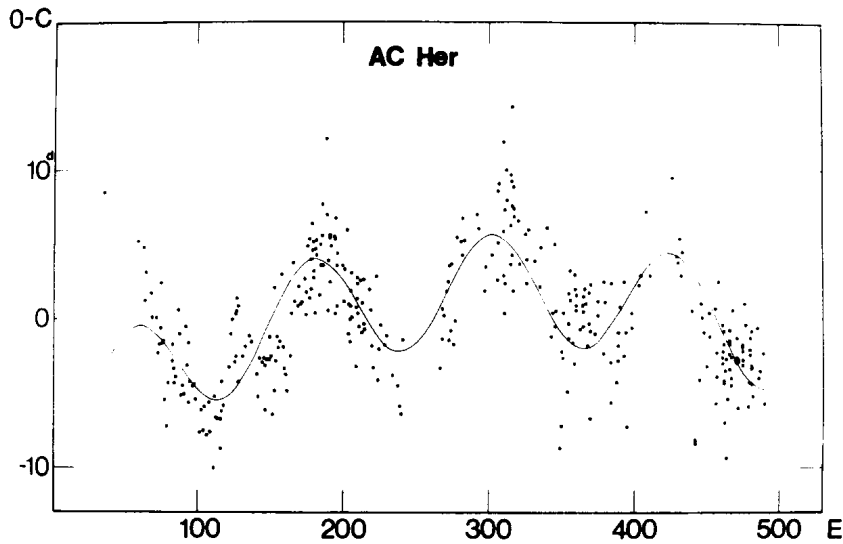


Figure 1: The O-C diagram of AC Herculis. References: AFOEV (1985-87), Beyer (1930), Blasberg (1972), Cardelli (1985), Colacevich and Masani (1941), Dawson (1979), Domke and Pohl (1953), DuPuy (1973), Dziewulski and Brzeska (1958), Eggen (1961,1986), Erleksova (1971), Erleksova et al. (1986), Hagedorn (1950), Huth (1964), Lause (1930,1931,1933,1934), Leiner (1924), Loreta (1941,1942), Magalashvili and Kumsishvili (1972), Matzek (1977), Mizser and Szánthó (1988), Model (1942,1964), Nakagiri and Yamashita (1979), Parenago (1938), Pettit (1948), Preston et al. (1963), Rosino (1951), Santangelo (1987), Satanova (1958), Szafraniec (1961), Tsessevich (1952), Waterfield (1927), Zakharov (1928,1953).

present in the diagram of Zakharov (1953), though his period is much shorter. Erleksova (1971) used straight lines to fit the diagram.

Removing this wave, there are two possibilities. The residuals may be fitted with either another wave with a period of about 33000 days, or with a parabola. As the difference between the last and first minima is only 34000 days, the second option is the more likely one. This parabola indicates a continuous decrease of the period. Figure 1 shows the fit using the wave and the parabola. The equation of the wave is

$$O-C=0.244+3.690\cdot\sin(0.05096\cdot E+5.015),$$

while the equation of the parabola after removing the wave is

$$O-C=-7.639+6.023\cdot 10^{-2}\cdot E-9.658\cdot 10^{-5}\cdot E.$$

According to Jura (1986), RV Tauri stars are in the post-red giant phase, evolving to the blue in the HRD. A continuously decreasing period is certainly not in contradiction with this picture. The cause of the wave is, however, rather uncertain. It is clearly not the result of a binary companion (though AC Herculis may have one), because the amplitude of the wave is too large. If the star has two frequencies which are close to each other, that might cause a wave in the O-C diagram. The photoelectric observations, unfortunately, are too few to give some support to this idea.

My thanks are due to Mr. A. Mizser and Mr. L. Szánthó, who supplied me with minima observed by Hungarian amateur astronomers.

E. ZSOLDOS

Konkoly Observatory  
Budapest, P.O. Box 67  
1525 Hungary

## References:

- AFOEV 1985-87, AFOEV Bulls. 34-42  
 Beyer, M. 1930, Astr. Abh. 8, No. 3  
 Blasberg, H. J. 1972, MVS 6, 57  
 Cardelli, J. A. 1985, A. J. 90, 1494  
 Colacevich, A., Masani, A. 1941, Oss. Mem. Arcetri No. 59, p. 91  
 Dawson, D. A. 1979, Ap. J. Suppl. 41, 97  
 Domke, K., Pohl, E. 1953, A. N. 281, 113  
 DuPuy, D. L. 1973, Ap. J. 185, 597  
 Dziewulski, W., Brzeska, H. 1958, Torun Bull. No. 17, p. 43  
 Eggen, O. J. 1961, RGO Bull. No. 29  
 --- 1986, A. J. 91, 890  
 Erleksova, G. E. 1971, Per. Zv. 18, 53  
 Erleksova, G. E., Zubarev, A. V., Rakhimov, V. Yu., Chernova, G. P., Kayumov, V. 1986, Per. Zv. 22, 311  
 Hagedorn, H. 1950, MVS No. 119, p. 1  
 Huth, H. 1964, MVS 2, 112  
 Jura, M. 1986, Ap. J. 309, 732  
 Lause, F. 1930, A. N. 238, 265  
 --- 1931, A. N. 242, 57  
 --- 1933, A. N. 248, 413  
 --- 1934, A. N. 252, 265  
 Leiner, E. 1924, A. N. 221, 247  
 Loreta, E. 1941, Beob. Zirc. 23, 124  
 --- 1942, Beob. Zirc. 24, 130  
 Magalashvili, N. L., Kumsishvili, Ya. I. 1972, Abastumani Bull. No. 43, p. 3  
 Matzek, O. 1977, MVS 8, 7  
 Mizser, A., Szánthó, L. 1988, private communication  
 Model, A. 1942, Beob. Zirc. 24, 29  
 --- 1964, MVS 2, 129  
 Nakagiri, M., Yamashita, Y. 1979, Tokyo Astron. Bull. (2), No. 260, p. 2969  
 Parenago, P. P. 1938, Sternberg Publ. 12, 1  
 Pettit, E. 1948, P. A. S. P. 60, 66  
 Preston, G. W., Krzeminski, W., Smak, J., Williams, J. A. 1963, Ap. J. 137, 401  
 Rosino, L. 1951, Ap. J. 113, 60  
 Santangelo, M. 1987, IBVS No. 3094  
 Satanova, E. A. 1958, Astr. Tsirk. No. 195, p. 16  
 Szafraniec, R. 1961, Acta Astron. Suppl. No. 4  
 Tsessevich, V. P. 1952, Astr. Tsirk. No. 128, p. 10  
 Waterfield, W. F. H. 1927, Harvard Bull. No. 845, p. 11  
 Zakharov, G. 1928, Tashkent Publ. 1, 33  
 --- 1953, Per. Zv. 9, 271

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

Number 3193

Konkoly Observatory  
Budapest  
24 May 1988  
*HU ISSN 0374-0676*

VARIABLE C IN M33

Variable C is a Luminous Blue Variable (LBV, see Lamers 1987). Its variability was discovered by Hubble and Sandage (1953). Photographic and UBV(R) magnitudes or light curves were published by Hubble and Sandage (1953), Humphreys (1975), Humphreys et al. (1984), Rosino and Bianchini (1973), Sharov (1973, 1981) and van den Bergh et al. (1975).

As a result of the supernova search carried out in Konkoly Observatory (by M. L.) there are eighty plates of M33 which were used to estimate the magnitudes of the LBVs of this galaxy (results for Var. B and Var. 2=Y Tri will be reported later). The observations were made between 1965 and 1987 with the 60/90/180 cm Schmidt-telescope of Konkoly Observatory in Piskés-tető using Kodak 103a0 plates without filters. The magnitudes, given in Table I, are eye estimates using the sequence of Hubble and Sandage (1953). The uncertainty in these values is about 0.5 mag.

The light curve of Var. C is shown in Figure 1. It can be seen that the star is in its maximum phase. Previously only one bright maximum was observed by Hubble and Sandage (1953), though Rosino and Bianchini (1973) also reported a small, flat maximum in the middle 60's.

Lamers (1987) divided the light curve changes of the LBVs into three classes. The observed variation of Var. C clearly belongs to the second class, i.e. the moderate variations (the photographic amplitude is  $\sim 1.5$  mag). This means that the change in brightness is connected with increased

Table I

Photographic observations of Variable C

J.D.	m <sub>pg</sub>	J.D.	m <sub>pg</sub>	J.D.	m <sub>pg</sub>
2400000+		2400000+		2400000+	
39090.51	16.6	41714.34	16.5	44136.58	16.6
39498.38	16.3	41903.53	16.7	44167.47	16.6
39529.3	16.5	41921.55	16.7	44256.3	16.7
39711.55	16.1	42008.55	16.7	44554.47	16.6
39766.41	16.4	42066.4	16.7	44912.59	16.8
39796.44	16.5	42095.3	16.7	44989.29	16.6
39827.53	16.7	42278.44	16.7	45018.31	16.7
40073.56	16.4	42397.36	16.8	45197.53	16.8
40092.48	16.1	42473.31	16.8	45230.43	16.8
40144.49	16.6	42695.46	16.7	45261.46	16.7
40157.49	16.1	42725.47	16.8	45347.26	16.6
40183.42	16.5	42754.44	16.7	45593.5	16.0
40203.38	16.4	42756.5	16.8	45615.46	16.0
40230.24	16.4	43013.52	16.7	45647.49	15.6
40654.31	16.6	43072.49	16.7	45940.56	15.5
40798.54	16.6	43191.3	16.7	46026.43	15.4
40837.56	16.7	43344.57	16.6	46030.28	15.3
40916.47	16.7	43399.43	16.8	46321.43	15.4
41164.53	16.7	43430.5	16.6	46355.55	15.6
41183.5	16.7	43464.5	16.7	46441.35	15.3
41213.45	16.6	43489.29	16.7	46468.36	15.3
41518.55	16.4	43720.55	16.7	46677.57	15.4
41520.51	16.6	43756.43	16.7	46706.41	15.5
41625.46	16.6	43757.56	16.8	46738.5	15.7
41679.26	16.6	43787.54	16.8	46763.46	15.6
41687.38	16.5	43809.56	16.6	47060.48	15.5
41689.28	16.6	43815.28	16.6		

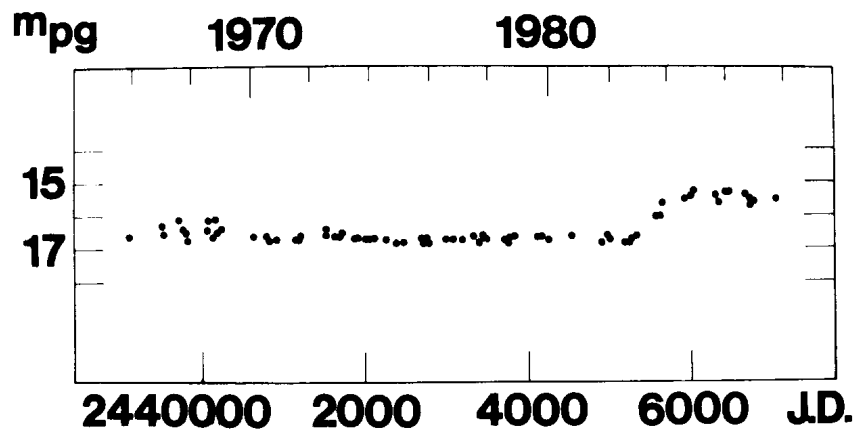


Figure 1

mass loss, while the bolometric magnitude is constant ( $M_{\text{bol}} = -9.8$  mag, Humphreys et al. 1987). Using the theoretical calculations of Davidson (1987), Lamers (1987) derived various relations between temperature, magnitude and mass loss rate. For small rates the connection between the change in mass loss and change in magnitude is

$$\Delta \log \dot{M} \approx -0.3 \Delta m_v$$

Unfortunately, we have photographic amplitude instead of visual, so the values of  $\Delta \log \dot{M}$  were calculated for several values of  $\Delta m_v$ . Adopting the value of  $\dot{M} = 3 \cdot 10^{-5} M_{\odot}/\text{yr}$  for the mass loss rate in maximum (Humphreys et al. 1987), the calculated minimum rates are given in Table II.

Table II

$\Delta m_v$	$\Delta \log \dot{M}$	$\dot{M} (M_{\odot}/\text{yr})$
1.0	-0.30	$1.5 \cdot 10^{-5}$
1.5	-0.45	$1.1 \cdot 10^{-5}$
2.0	-0.60	$7.5 \cdot 10^{-6}$

M. LOVAS and E. ZSOLDOS

Konkoly Observatory  
Budapest, P.O. Box 67  
1525 Hungary

#### References:

- Davidson, K. 1987, Ap.J. 317, 760  
Hubble, E., Sandage, A. 1953, Ap.J. 118, 353  
Humphreys, R.M. 1975, Ap.J. 200, 426  
Humphreys, R.M., Blaha, C., D'Odorico, S., Gull, T.R., Benvenuti, P. 1984, Ap.J. 278, 124  
Humphreys, R.M., Leitherer, C., Stahl, O., Wolf, B., Zickgraf, F.-J. 1987, B.A.A.S. 19, 1053  
Lamers, H.J.G.L.M. 1987, in: *Instabilities in Luminous Early Type Stars*, eds. H.J.G.L.M. Lamers, C.W.H. de Loore, D. Reidel, p.99  
Rosino, L., Bianchini, A. 1973, A.Ap. 22, 453  
Sharov, A.S. 1973, Per.Zv. 19, 3  
--- 1981, Per.Zv. 21, 485  
van den Bergh, S., Herbst, E., Kowal, C.T. 1975, Ap.J. Suppl. 29, 303

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

Number 3194

Konkoly Observatory  
Budapest  
26 May 1988  
*HU ISSN 0374-0676*

PHOTOMETRIC BEHAVIOUR OF KR AURIGAE IN THE SEASON 1987/1988

In supplementing and completing the light curve in B the star was measured on 21 blue-sensitive plates (ORWO-ZU21+GG13+BG12) from 12 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory, covering the time interval between 2 October 1987 and 10 April 1988, using the comparison star sequence given by Popova (1965). The observations are listed in Table I and shown in Figure 1.

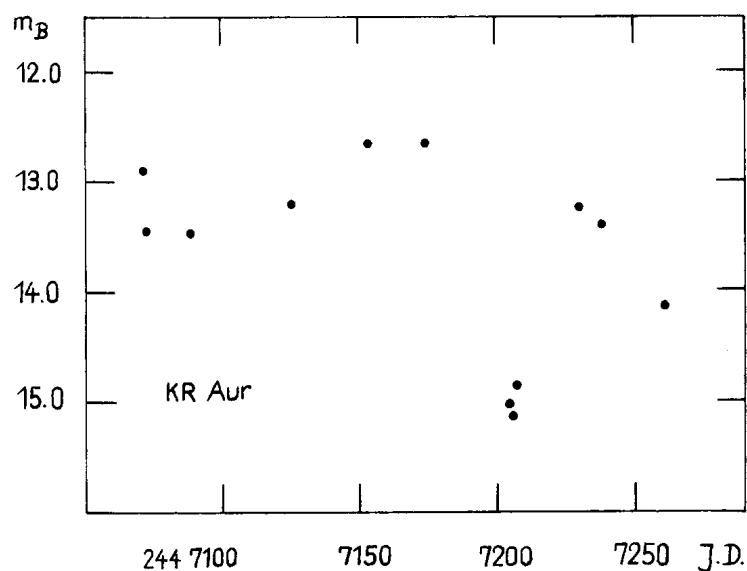


Figure 1

Table I

J.D. 244...	$m_B$	J.D. 244...	$m_B$
7071.572	12. <sup>m</sup> 91	7206.394	15. <sup>m</sup> 08
7072.597	13.43	7206.413	15.16
7099.624	13.47	7207.401	15.00
7099.645	13.39	7207.419	14.70
7126.578	13.21	7230.342	13.39
7153.435	12.71	7230.363	13.08
7153.452	12.63	7239.370	13.55
7174.457	12.61	7239.390	13.23
7174.480	12.64	7262.327	14.13
7205.496	15.05	7262.345	14.13
7205.515	15.04		

The light curve in Figure 1 shows a minimum, which is of short duration in comparison with the former ones. The brightness of the star decreased from the high state at  $m_B = 12.<sup>m</sup>63$  to  $m_B = 15.<sup>m</sup>12$  to the low state within 31<sup>d</sup>. In the subsequent 24<sup>d</sup> its brightness increased to  $m_B = 13.<sup>m</sup>23$  again.

W. GÖTZ

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

Reference:

Popova, M., 1965, *Peremennye Zvezdy*, 15, 534.

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

Number 3195

Konkoly Observatory  
Budapest  
26 May 1988  
HU ISSN 0374-0676

PHOTOMETRIC BEHAVIOUR OF DR TAURI IN THE SEASON 1987/1988

In completing and supplementing the light curve in B the star was measured on 21 blue-sensitive plates (ORWO-ZU21+GG13+BG12) from 11 nights obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 2 October 1987 and 9 March 1988. The measurements, which are listed in Table I and which are given in the light curve in Figure 1 are linked to the previous sequence of comparison stars given by Götz (1982).

Table I

J.D.	$m_B$	J.D.	$m_B$
244...		244...	
7071.546	12. <sup>m</sup> 23	7175.347	12. <sup>m</sup> 00
7072.556	11.95	7175.363	11.87
7099.578	11.89	7205.453	12.40
7099.603	11.93	7205.472	12.52
7126.454	12.01	7206.437	12.15
7126.474	12.08	7206.458	12.09
7126.499	12.01	7207.320	11.42
7153.400	11.67	7207.338	11.83
7153.417	11.56	7230.302	11.91
7174.375	11.19	7230.320	12.00
7174.395	11.15		

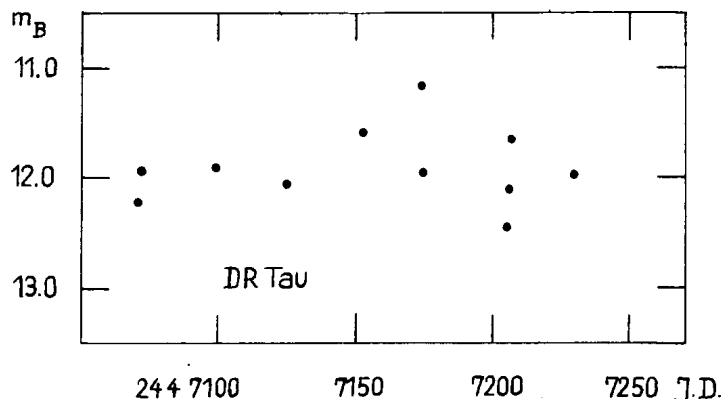


Figure 1

The light curve shows the star in an active phase, which is characterized by short time scale light depressions and brightness increase. The mean brightness of the star in the season 1987/1988 amounts to  $m_B = 11.90$  at a total amplitude of  $\Delta m_B = 1.37$ .

W. GÖTZ  
Akademie de Wissenschaften  
de DDR, Zentralinstitut für  
Astrophysik, Sternwarte Sonneberg  
DDR

Reference:

Götz, W., 1982, Inf. Bull. Var. Stars No. 2172.

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

Number 3196

Konkoly Observatory  
Budapest  
27 May 1988  
*HU ISSN 0374-0676*

NSV 03005: A PROBABLE LONG-PERIOD ECLIPSING BINARY

NSV 03005 (BD +17° 1281, HD 258878, SAO 095781) is an 8th-magnitude star, spectral type F2II, at RA 6<sup>h</sup> 28<sup>m</sup> 47.7<sup>s</sup> Dec 17° 07' 8.2" (1950). It was listed as a possible variable by Hill and Schilt (1952), but the New Catalogue of Suspected Variable Stars (Kholopov et al. 1982) classifies variability as doubtful or erroneous.

One of us, Kaiser, is conducting a photographic nova search by the PROBLICOM method (Mayer 1977) using 35mm Ektachrome 400 color slide film. While blinking slides taken on 21 March 1988 UT, he noted a marked decrease in the brightness of NSV 03005 compared to images on three earlier dates. On 23 March, Baldwin established a provisional visual comparison star sequence, and he and Kaiser began visual observations while photography continued. On 28 March, Williams began photoelectric observations with a 28-cm Schmidt-Cassegrain and Optec SSP-3 photometer. In addition to observing NSV 03005, he determined V and B magnitudes for the comparison star sequence (Table I) by differential measures linked to the Johnson standard star Gamma Geminorum, +1.92 V, +0.00 B-V (Astronomical Almanac 1988).

The observations of NSV 03005 are listed in Table II. The visual and color-film estimates have been interpolated from the observers' provisional step values to the V magnitude scale given in Table I. The light curve (Figure 2) strongly resembles what would be expected for an eclipsing variable.

The observations are not adequate to indicate whether there is a constant interval at minimum. However, reflecting the ascending branch

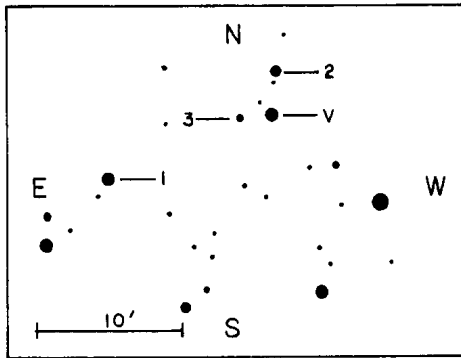


Figure 1. Finder chart for NSV 03005. Coordinates and magnitudes are listed in Table I.

TABLE I.

Star (Fig. 1)	RA (1950)	DEC (1950)	V	B
1 = SAO 095810	6 <sup>h</sup> 29 <sup>m</sup> 47.4 <sup>s</sup>	+17° 03' 59.2"	+7.92 $\pm$ 0.01	+8.42 $\pm$ 0.01
2 = SAO 095777	6 <sup>h</sup> 28 <sup>m</sup> 43.7 <sup>s</sup>	+17° 10' 29.5"	8.96 $\pm$ 0.02	9.32 $\pm$ 0.02
3 - - - -	6 <sup>h</sup> 29 <sup>m</sup> 02 <sup>s</sup>	+17° 08' 05"	9.90 $\pm$ 0.06	10.51 $\pm$ 0.15
V = SAO 095781	6 <sup>h</sup> 28 <sup>m</sup> 47.7 <sup>s</sup>	+17° 07' 08.2"	8.24* $\pm$ 0.02	8.96* $\pm$ 0.03

\* At post-eclipse maximum.

to fit the single observation on the descending branch sets a limit to any such total phase, which could not be much longer than 1 day, and also suggests that the faintest observations are very close to minimum light. The rise to the level of constant maximum required 6-7 days, indicating that the duration of eclipse is 12-14 days. With reasonable allowances for the possible error of the single observation on the descending branch, we estimate mid-eclipse at JD 2447243.4  $\pm$ 0.5.

If NSV 03005 is indeed an eclipsing binary, it has exceptional characteristics. The F2II primary is luminous enough to have a cooler, fainter giant companion, though two giants in a binary system would be unusual. Except for Beta Lyrae-type stars, only ten of the 881 eclipsing binaries listed in the Cracow Supplement (S.A.C. 1988) have longer durations of eclipse, and only one of those ten has an amplitude greater than 1<sup>m</sup>.5.

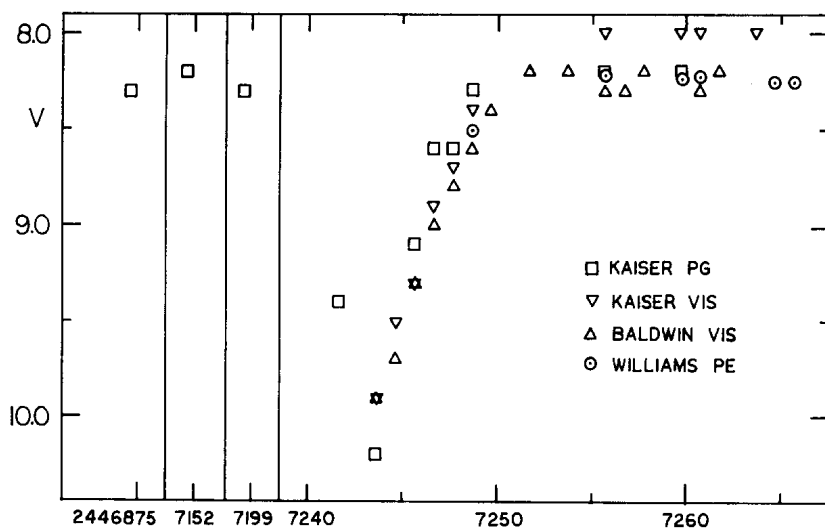


Figure 2. NSV 03005, light curve plotted from observations in Table II.

TABLE II.

HJD 2440000+	K (pg)	K (vis)	B (vis)	W (pe) *
6874.6	+8.3			
7151.7	8.2			
7198.6	8.3			
7241.6	9.4			
7243.6	10.2	+9.9	+9.9	
7244.6	-	9.5	9.7	
7245.6	9.2	9.3	9.3	
7246.6	8.6	8.9	9.0	
7247.6	8.6	8.7	8.8	
7248.568	-	-	-	+8.51 V +0.03
7249.6	8.3	8.4	8.6	-
7251.6	-	-	8.4	-
7251.6	-	-	8.2	-
7253.6	-	-	8.2	-
7255.570	-	-	-	8.22 V +0.01
7256.6	8.2	8.0	8.3	-
7257.6	-	-	8.3	-
7259.6	8.2	8.0	8.2	-
7260.602	-	-	-	8.24 V +0.02
7260.593	-	-	-	8.23 V +0.02
7261.6	-	8.0	8.3	-
7263.6	-	-	8.2	-
7264.571	-	8.0	-	-
7265.566	-	-	-	8.26 V +0.01
				8.26 V +0.02

\* Comparison star = SAO 095810 (Table I).

For an 8th magnitude star with an amplitude of  $1^m8$  to escape earlier discovery, observable eclipses must be very infrequent. Hill and Schilt (1952) do not give the epoch at which variability was suspected, so this reference does not help to identify a possible second minimum. A search of archival plate collections, or radial velocity measures over a sufficient time interval, could provide additional information needed to determine the period. One possibility is a period slightly less than  $365^d(n)$ , with  $(n)$  being a whole integer, so that eclipses have occurred near solar conjunction for many years.

We wish to thank Dr. Janet Mattei, AAVSO Director; Richard Hill, Resident Observer, Warner and Swasey Observatory (Kitt Peak); Dr. Dorrit Hoffleit, Yale University; and Dr. John Percy, University of Toronto, for very helpful discussions and assistance.

DANIEL H. KAISER	MARVIN E. BALDWIN	DAVID B. WILLIAMS
2631 Washington Street	Route 1	9270-A Racquetball Way
Columbus, IN 47201	Butlerville, IN 47223	Indianapolis, IN 46260
USA	USA	USA

#### REFERENCES:

- Astronomical Almanac, 1988, UBVRI Standard Stars, page H32. United States Government Printing Office, Washington.
- Hill, S. J., and Schilt, J., 1952, Contributions from the Rutherford Observatory of Columbia University, No. 32, IV-V.
- Kholopov, P. N., editor, et al., 1982, New Catalogue of Suspected Variable Stars, "Nauka" Publishing Office, Moscow.
- Mayer, B., 1977, Sky and Telescope 54, 246.
- Supplemento ad Annuario Cracoviense, 1988, Rocznik Astronomiczny Obserwatorium Krakowskiego, International Supplement No. 59, Nakladem Uniwersytetu Jagiellonskiego, Cracow.

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

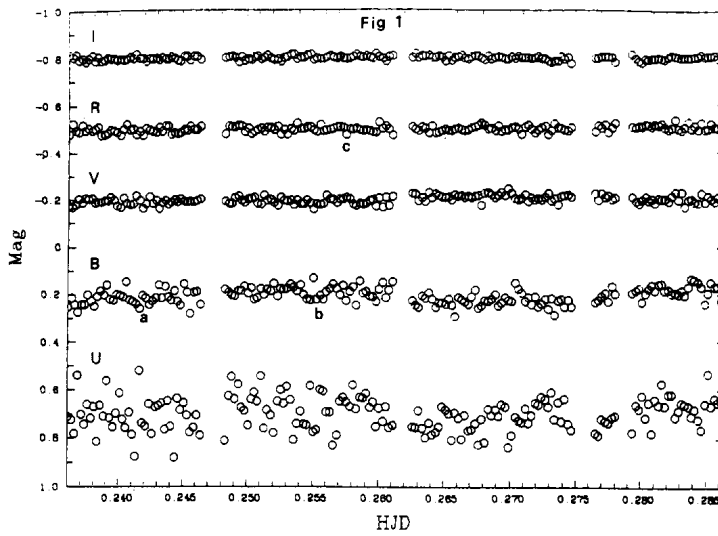
Number 3197

Konkoly Observatory  
Budapest  
30 May 1988  
HU ISSN 0374-0676

**AUTO-CORRELATION TECHNIQUES IN SEARCHES FOR RAPID  
QUASI-PERIODIC MODULATION IN dMe FLARE STARS**

Outside the classical flares in the dMe stars, variability has been reported on several short time-scales, excluding rotational modulation by starspots : slow quasi-periodic modulation ( $\sim 30$  mins to a few hours), small-amplitude fluctuations ( $\sim 1$  to 30 minutes), temporary pulse-like oscillations (a small number, each lasting a few seconds to about 1 minute) and large-amplitude spikes (usually randomly-spaced individual events, with duration only 0.1 to about 2 seconds). See Chugainov et al. 1969, 1984, Cristaldi and Rodono 1970 and 1973, Rodono 1974, Moffett 1974, Jarrett and van Rooyen 1979, Zalinian and Tovmassian 1987, Doyle and Butler 1987. The importance of investigations into photometric micro-variability of dMe stars lies in relation to (i) the contribution to the total energy budget of the flaring mechanism, (ii) the understanding of the processes involved in the flaring and quiescent flux, (iii) the evolutionary status of low-mass stars, and their past and present interaction with the stellar environment, and (iv) the predictions of global oscillations from asteroseismology.

**Observations** Sequential UBV(RI) pulse-counting photometry (Kron - Cousins RI) of the dM2e flare star, V1285 Aql (= Gliese 735,  $18^h53^m03^s$ ,  $+8^\circ20'18''$ , Equinox 1950), was obtained with the 50cm telescope at the South African Astronomical Observatory. Flares on this star were first detected by Shakovskaya and Maslennikov (1970) and the star was subsequently studied by Byrne et al. (1984). V1285 Aql was observed for 4.6 hours over a 6-hour interval on 26 August 1985 (Table I). Combined with earlier observations from 20 and 23 August 1985, mean photometry for 3 nights gave  $V = 10.110 \pm 0.009$ ,  $U - B = 1.077 \pm 0.041$ ,  $B - V = 1.526 \pm 0.010$ ,  $(V - R) = 1.090 \pm 0.011$ ,  $(V - I) = 2.468 \pm 0.014$ , using 10 observations per night. On 26 August five-colour UBV(RI) pulse-counts of variable, sky and standard stars were made, and over some intervals two-colour (U and B)



**Figure 1**

Sequential UBVR(I) monitoring of V1285 Aql from 17:35 to 18:48 UT on 26 August 1985 (HJD 244,6304.0 days). The time intervals for the multi-colour measurements are given approximately by :

$$t_U = t, t_B = t + 6, t_V = t + 10, t_R = t + 13.5, t_I = t + 17, t'_U = t + 22.5(\text{secs}).$$

N.B. (a) Fragmented B-band eyeball "wave" of duration about 5 to 6 minutes and full-amplitude 0.05 mag. at 17:46:00 UT. (b) Another B-band "wave" at 18:02:20 UT, possibly associated with (c) an R-band "wave" with a maximum at 18:05:20 UT. with full-amplitude 0.013 mag.

observations were made for improved time resolution. These multi-colour observations were made during bright moon but in excellent seeing conditions, when the star passed maximum altitude (airmass 1.32) within a range of airmasses from 1.46 to 1.33. Figure 1 shows the five-colour observations from 17:35 to 18:48 UT using 5,2,1,1,1 sec integrations in UBVR(I), respectively. Sky measurements were taken about every 20 minutes and a standard star measured at the beginning and end of this run of 1.2 hours. A change to two-colour, U and B, monitoring immediately followed this run (Figure 2 and Table I). With print-out and on-line reductions the mean observing cycle in UBVR(I) was 22.5 seconds. Several variations atypical of classical flares with their sharp rise to maximum were suspected in the B, R and I bands, some with wave-like features. Quasi-periodic R band "waves" with a semi-amplitude of 0.007 magnitude were suspected from an inspection of the multi-colour plots. Also, wave-like features were detected in the B band with semi-amplitudes of about 0.025 mag. However, intrinsic stellar fluctuations cannot easily be unambiguously distinguished from brief moments of changing transparency and sky brightness. We do not know of any instrumental effects, e.g. periodic errors in the drive of the 50-cm telescope, which would account for these "waves".

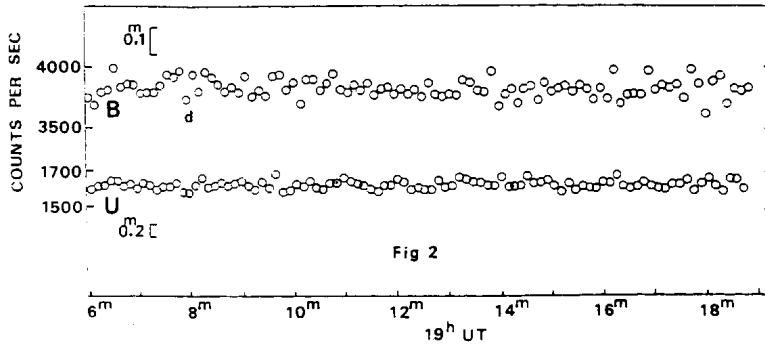


Figure 2

Sequential U and B monitoring of V1285 Aql from 19:06 to 19:19 UT on 26 August 1985 at a time resolution of 7 seconds. We see a B-band "wave" with duration (minimum to minimum) of 160 seconds and full-amplitude approximately 0.1 mag. at 19:08 UT., and continuously maintained U-band fluctuations of about the same "period". These data were not utilized in the analysis contained in the present paper, but illustrate the emergence of a further 2.5-minute "characteristic time interval" in B

**Auto-correlation techniques** Initially, we utilized Fourier techniques to construct periodograms of the time-series for the UBVR(I) magnitudes of V1285 Aql during the interval, 17:35 to 18:48 UT (HJD-2446304.0 = 0.236 to 0.286) which comprised  $5 \times 179$  data sets. A test of significance was carried out using the false-alarm probability calculated for the strongest peaks in the power spectra for the UBVR(I) data (Scargle 1982). Quasi-periodicity was suspected at the 99% confidence level in the R and I bands, for periods of about 3.9 to 3.7 minutes, respectively, with a relative error in the period of 2%. Estimates of the relative error in the peak power for our data demonstrated that 50% errors were common in the presence of noise, and this strongly affects the calculation of the false-alarm probability. It is also difficult to unambiguously separate quasi-periods from atmospheric variations.

Auto-correlation analysis was found to be a preferable tool for detecting quasi-periodic trends in the time series. The auto-correlation parameter,  $\Theta(\tau)$ , used by Burki et al. 1978, where  $\tau$  is the time lag or trial period, possesses several properties which allow the detection of trends in segments of data in the presence of noise. Their method of analysis was applied to the quasi-sinusoidal periodicity of supergiants where the amplitude and period are not constant over many cycles. The relatively small amount of data on the dMe stars and the short quasi-periods we are examining means, in fact, that a treatment similar to that in the case studied by Burki et al. is more appropriate.

From the observed B-band light curve,  $B(t)$ , between times  $t_o$  and  $t_f$ , a second time series,  $B'(t + \tau)$ , was constructed in the range  $t_o + \tau$  to  $t_f + \tau$ , where  $\tau$  was the trial period. In the range  $t_o + \tau$  to  $t_f$  over which  $B(t)$  and  $B'(t + \tau)$  overlap, the

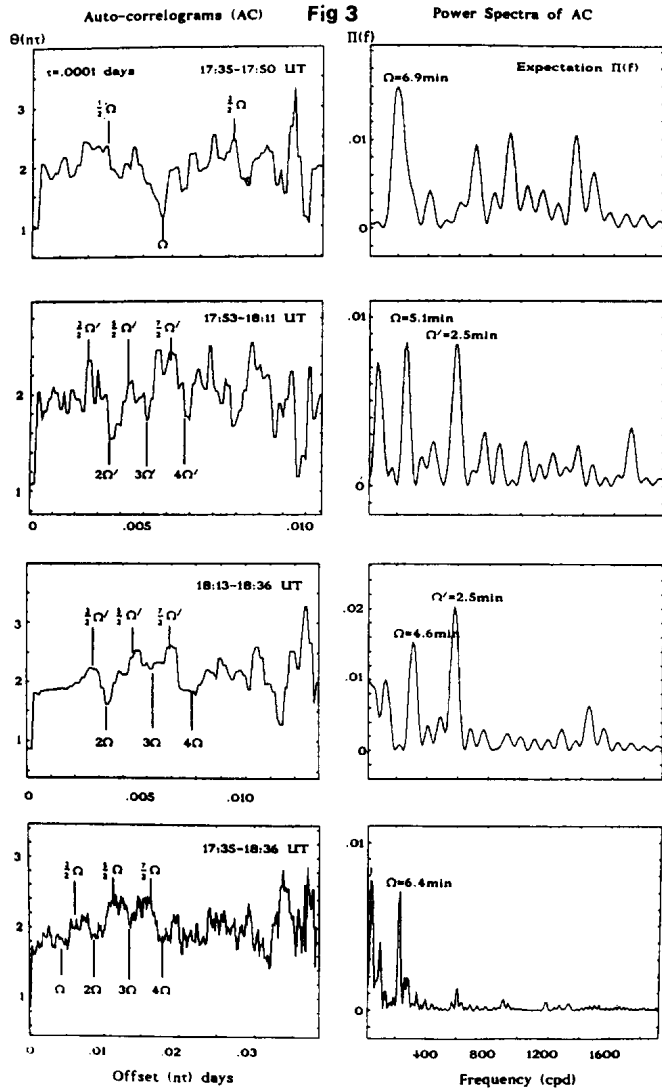


Figure 3

The auto-correlograms using the method of Burki et al. 1978 for the UBV(RI) data of V1285 Aql in Figure 1. The periodograms of the auto-correlation parameter,  $\Theta(\tau)$ , are shown on the right of their respective auto-correlograms, for the intervals 17:35-17:50, 17:53-18:11 and 18:13-18:36 UT (allowing for breaks in the data due to sky measurements), and for the total time, 17:35-18:36 UT. An auto-correlation time-lag,  $\tau$ , of 0.0001 days (8.6 seconds) was used throughout. The suspected periods are indicated as multiples of the half-period (peaks) and the period (minima). When grouping the data we find periods of 6.9 and 2.5 minutes, compared with only 6.4 minutes in the total time interval.

two time series were re-ordered chronologically and an auto-correlation parameter,  $\Theta(\tau)$ , defined by the ratio of the mean square successive difference,  $\delta^2$ , and the variance,  $\sigma^2$  :

$$\Theta(\tau) = \delta^2 / \sigma^2 = \sum [B'_{i+1} - B'_i]^2 / \sum [B'_i - B'_{mean}]^2 \quad (1)$$

was evaluated. By substituting  $\Delta_i = B'_i - B'_{mean}$ , we have :

$$\delta^2 / \sigma^2 \approx 2 - 2[\sum (\Delta_{i+1} \Delta_i) / \sum \Delta_i^2] \quad (2)$$

neglecting  $(\Delta_1^2 + \Delta_n^2) / \sum \Delta_i^2$ . The parameter  $\Theta(\tau)$  has the property that if the data do not possess a trend with time,  $\Theta(\tau)$  remains approximately constant and close to the value 2. A quasi-periodic trend of *period*,  $\Omega$ , causes  $\Theta(\tau)$  to increase from zero until  $\tau = \Omega/2$ , and then to oscillate according to this *period* (see Figure 3). In practice the first and, possibly, the second peak is only seen, but when there is only "limited confusion" in the identification of peaks, use may be made of periodograms of the auto-correlation parameter to measure a periodic trend in the auto-correlograms themselves. In some cases an upward curvature also appears in the auto-correlograms indicative of a much slower trend, and oscillations appear superposed on the better-defined features in the auto-correlograms which may not be entirely noise. In the simplest cases, statistical levels of confidence may be estimated in the auto-correlograms using tables from Crow et al. (1960). The maximum *expectation* of the power spectrum (in the range  $f = 100$  to  $1900$  cpd) as given by the peak in the Fourier transform of the auto-correlation parameter occurred at  $f = 226$  cpd, corresponding to a period of 6.37 minutes (see bottom of Figure 3). This procedure produced a "period" which was approximately the duration (peak-to-peak) of the B-band "eyeball waves", but the overall fit to the B-band data using this period was poor, probably due to the increased noise in the latter half of the data in Figure 1.

We also divided the B data into three groups according to gaps occurring when sky measurements were taken, and formed auto-correlograms and periodograms for each group. We found a "period" of 6.92 minutes in the first group, but somewhat smaller periods in the second and third groups, and in addition, periods of 2.46 and 2.49 minutes, respectively, in the latter groups (see top three panels of Figure 3). There were confusing elements in this procedure due to the presence of additional peaks in the periodograms of the auto-correlograms. In Figure 2, however, we see a further fragments of a 2.5-minute "wave" in the B-band data (not used in the analysis) occurring half-an-hour later at 19:08 hrs U.T., during U and B monitoring only. It would appear that the procedure is capable of detecting a "characteristic time interval" between photometric outbursts.

## Conclusions

From periodogram analysis for V1285 Aql we found (a) quasi-periodicity at the 99% confidence level in the R and I bands with periods of 3.9

and 3.7 minutes, respectively, with amplitudes of about 0.01 mag. (max.to.min), sustained during the interval of our observations, i.e. for up to one hour, and (b) no significant periods in U, B or V. However, using auto-correlation techniques, we detected (c) waves in the B-band with two quasi-periods of about 6.4 and 2.5 minutes, which we interpret as "characteristic time intervals" between low-amplitude outbursts. We note that the R-band period given by our initial analysis is approximately related to those detected in the B band by auto-correlation analysis by :  $[\Omega_R]^{-1} = [\Omega_B]^{-1} + [\Omega'_B]^{-1}$ , i.e. we possibly have interfering frequencies (370, 226 and 590 cpd). We do not appear to be observing micro-flares since the amplitude of flaring is invariably greater in the ultraviolet, and there was no evidence of flare-like events in the ultraviolet although this could be due to the poorer S/N ratio in the U band.

A.D. ANDREWS

Armagh Observatory  
 Armagh BT61 9DG  
 Northern Ireland

#### References:

- Burki, G., Maeder, A., and Rufener, F., 1978, *Astron. Astroph.* 65, 363.  
 Byrne, P.B., Doyle, J.G., Butler, C.J., and Andrews, A.D., 1984, *Mon. Not. Roy. Astr. Soc.* 211, 607.  
 Chugainov, P.F., et al., 1969 *IAU Comm.* 27 I.B.V.S. 343.  
 Chugainov, P.F., 1984, *IAU Comm.* 27 I.B.V.S. 2471.  
 Cristaldi, S., and Rodono, M., 1970, *Astron. Astroph. Suppl.* 2, 223.  
 Cristaldi, S., and Rodono, M., 1973, *Astron. Astroph. Suppl.* 10, 47.  
 Crow, E.L., Davis, F.A., and Maxfield, M.W., 1960, *Statistics Manual*, Dover Publ., New York, p.63.  
 Doyle, J.G., and Butler, C.J., 1987 (to be submitted to *Astron. Astroph.*).  
 Jarrett, A.H., and vanRooyen, J., 1979, *IAU Comm.* 27 I.B.V.S. 1612.  
 Moffett, T.J., 1974, *Astron. Journ. Suppl.* 29, 1.  
 Rodono, M., 1974, *Astron. Astroph.* 32, 337.  
 Scargle, J.D., 1982, *Astroph. Journ.* 263, 835.  
 Shakovskaya, N.I., and Maslennikov, K.L., 1970, *IAU Comm.* 27 I.B.V.S. 487.  
 Zalinian, V.P. and Tovmassian, H.M., 1987, *IAU Comm.* 27 I.B.V.S. 2992.

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

Number 3198

Konkoly Observatory  
Budapest  
30 May 1988

HU ISSN 0374-0676

**FURTHER AUTO-CORRELATION ANALYSIS OF dMe  
FLARE STARS**

**PROXIMA CENTAURI (V645 CEN)**

A modified auto-correlation technique which utilizes least-square successive differences was previously applied to multi-colour photometric data of the flare star, V1285 Aql (= G735), and found to reveal quasi-periodic trends in the B- and R-bands of a few minutes sustained for up to 1 hour (Andrews 1988). Burki et al. (1978) developed the method we follow for quasi-periodic trends, which stems from a paper by Baines (1951). The most probable "period" for V1285 Aql for the 0.013 mag. oscillations in the R-band was about 160 seconds. The wave-like variations do not appear to be micro-flares since these were not detected in the ultraviolet where amplitudes are invariably larger than in the longer-wavelength photometric bands, and the amplitude of the corresponding B-band "waves" would suggest that flaring in the U-band should certainly have been detectable. The interpretation of the results is difficult except perhaps in terms of a "characteristic time-scale" of re-processing of radiation within a remnant dust cloud in the stellar environment (Kenyon and Hartmann 1987), although asteroseismological pulsations are an attractive alternative.

The technique has been applied to another flare star, Proxima Centauri (= V645 Cen = Gliese 551, Sp. dM5e,  $V = 11.0$  mag.). The photometric material was obtained in 1985 using the 50-cm telescope at the South African Astronomical Observatory using pulse-counting techniques already described (Andrews 1988). Prox Cen was monitored on 25 August 1985 from 17<sup>h</sup>50<sup>m</sup> to 19<sup>h</sup>14<sup>m</sup> UT using 1<sup>s</sup> integrations in the U band, and from 19<sup>h</sup>18<sup>m</sup> to 20<sup>h</sup>01<sup>m</sup> UT using continuous multi-colour  $UBV(RI)_{KC}$  integrations of 5,2,1,1,1 seconds, respectively. We have selected a subset of the 1<sup>s</sup> data, consisting of 14.4 minutes of continuous U-band data, 860 data points, obtained during good sky conditions. Auto-correlation analysis using a time lag of 2.5 seconds was performed and, following previous methods, the power spectrum of the auto-correlation parameter was constructed for frequencies

## Power Spectrum of Auto-correlation Function

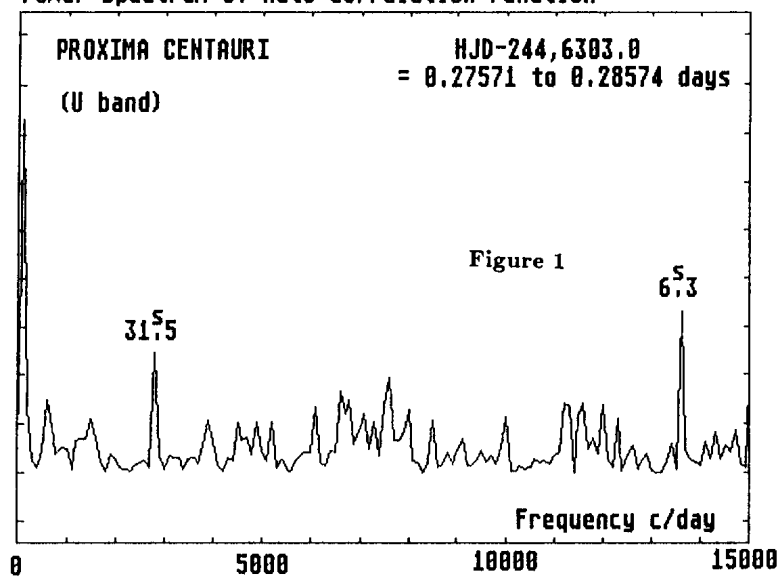


Figure 1

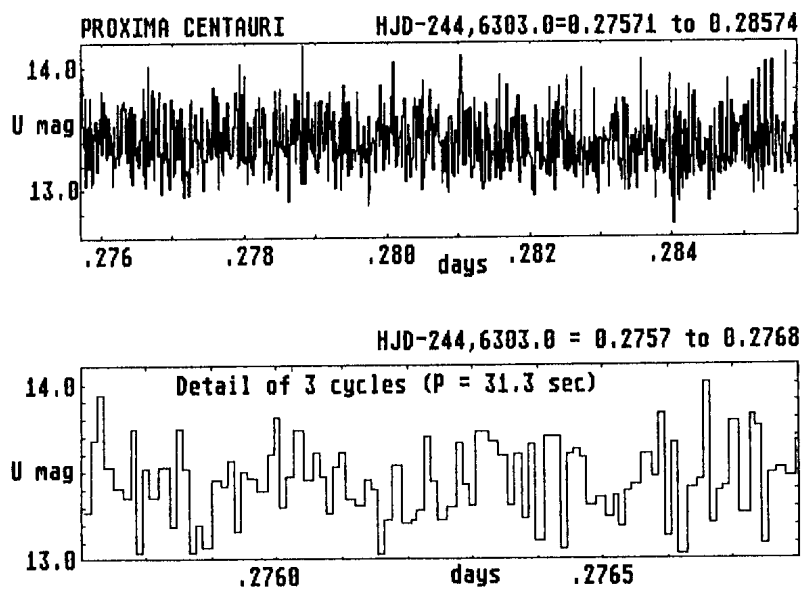


Figure 2

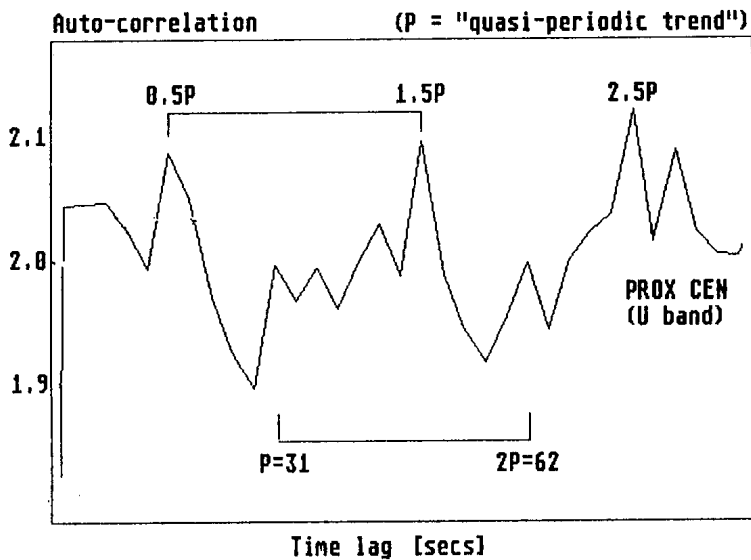


Figure 3

from zero to 15000 cycles per day (down to periods of 5.76 seconds). In the frequency domain we find three peaks, the lowest frequency corresponding to the gradual trend in the data due to slight departure from the adopted mean atmospheric extinction, and two lesser peaks at frequencies corresponding to periods of 31.3 and 6.3 seconds (Figure 1). The longer of these two periods is almost exactly five times the shorter period. During the observations we repeatedly noticed flare-like features of duration about 7 seconds. In Figure 2 we show the subset of U-band data and the first section of the data in more detail for exactly three "periods" of 31.3 seconds. A quasi-sinusoidal fit to the running mean shows an amplitude of about 0.3 mag. Clearly the data is very noisy and the statistics is shown to be poor from the auto-correlation. Crow et al. (1960) give tables for the significance level of our auto-correlation parameter for up to only 60 data points, from which we can only estimate a value of 85 to 90 percent confidence level. In Figure 3 we show the auto-correlation parameter plotted against multiples ( $m$ ) of the time lag in seconds, up to  $m = 35$ . We see peaks and troughs corresponding to the "period" of 31.3 seconds. No large flares occurred during this subset nor during the total 2 hours' monitoring of Prox Cen. The "period" may

be another example of a characteristic time scale of fluctuations, as was found in V1285 Aql. As a light travel time, the "periods" of 31.3 and 6.3 seconds correspond to 45 and 9 stellar radii (c.f. 230 radii for V1285 Aql). It is, however, possible that we are recording atmospheric fluctuations, and it would be essential to eradicate this possibility. Further analyses of Prox Cen will be performed for the R- and I-band data which was obtained on the same night, and for which the signal-to-noise is considerably better.

A.D. ANDREWS

Armagh Observatory,  
 Armagh BT61 9DG,  
 Northern Ireland

References:

- Andrews, A.D., 1988, IAU Comm.27.Inf.Bull.Var.Stars. No. 3197.  
 Baines, A.H.J., 1951, "Statistical Manual: Methods of making experimental inferences", 1951 revised edition, ed. Churchmann.C.W., Frankford Arsenal, Philadelphia USA.  
 Burki, G. et al. 1978, Astron. Astroph. 65, 363.  
 Crow, E.L., Davis, F.A., and Maxfield, M.W., 1960, Statistics Manual, Dover Publ., New York, p.63.  
 Kenyon, S.J., and Hartmann, L., 1987, Astroph. Journ. 323, 714.

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

Number 3199

Konkoly Observatory  
Budapest  
6 June 1988

*HU ISSN 0374-0676*

THE PERIOD OF THE A0p Si PROBABLE  
BLUE STRAGGLER NGC 6281-9

The star HD 153947=DM-37°11215=NGC 6281-9 is listed as a probable blue straggler in the cluster NGC 6281 by Mermilliod (1982). Like several other blue stragglers, it is classified as A0p Si, so that it could be considered as potentially variable, like all magnetic peculiar stars. It was included in our programme of determination of periods of Ap stars in clusters, although its membership is not firmly established: proper motions and radial velocity are still lacking, and the star lies at 1.5 cluster radii from the cluster centre, in projection on the sky. Pending confirmation of its membership of NGC 6281, this star may be considered a most interesting object.

The first measurements, made in 1987 at La Silla with the 70-cm Swiss telescope, in the seven filters of the Geneva photometric system, show a large amplitude but were insufficient to disentangle the two possible periods  $p=2.7$  or  $P=0.73$  days. More measurements have been made from La Silla in May 1988, which clearly show that the longer period should be preferred. The most probable

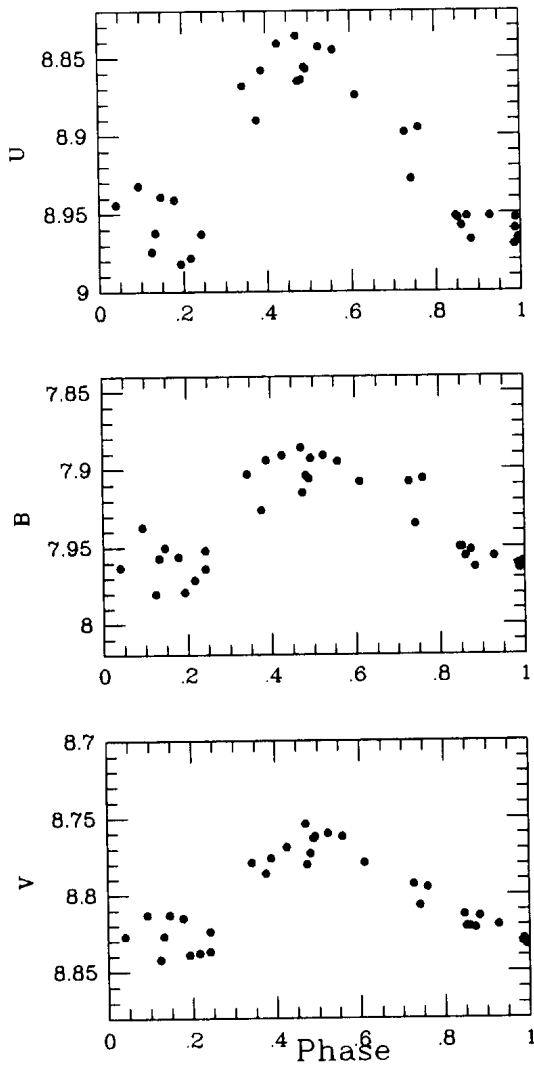


Figure 1. Lightcurves of the star NGC 6281-9 in three Geneva passbands

period is thus

$$P = 2.662 \pm 0.003 \text{ days}$$

although some other nearby periods may be possible too, such as  $P=2.640$  or  $2.686$ , the latter being less satisfactory. This ambiguity is due to the almost one-year gap between the observations of 1987 and those of 1988. It should be suppressed by future measurements later in the season.

Fig. 1 shows the lightcurves of NGC 6281-9 in the three Geneva bandpasses [U], [B] and V. The zero phase corresponds to the first 1987 observation, i.e. HJD 2446965.645. We see that the amplitude increases from about  $0^m.07$  in V to  $0.12$  in [U], which is rather typical of Si stars. The period, too, is rather typical of old Si stars (NGC 6281 has a  $\log(\text{age}) \approx 8.35$ ): it is only slightly greater than the value (about 1.8) corresponding to the maximum of the period distribution of these stars (North, 1987).

P. NORTH  
Institut d'astronomie  
de l'Université de  
Lausanne  
CH-1290 CHAVANNES-DES-BOIS  
Switzerland

G. JASNIEWICZ  
Observatoire de Strasbourg  
11, rue de l'Université  
F-67000 STRASBOURG  
France

Ch. WAELEKENS  
Astronomisch Instituut  
Katholieke Universiteit Leuven  
Celestijnenlaan 200B  
B-3030 HEVERLEE  
Belgium

#### References:

- Mermilliod, J.-C.: 1982, Astron. Astrophys. 109, 37  
North, P.: 1987, Astron. Astrophys. Suppl. Ser. 69, 371

COMMISSION 27 OF THE I. A. U.  
INFORMATION BULLETIN ON VARIABLE STARS  
Number 3200

Konkoly Observatory  
Budapest  
7 June 1988  
HU ISSN 0374-0676

1988 BVRI PHOTOMETRY OF XY UMa

The eclipsing system XY UMa (= BD+55° 1317, SAO 27143, #69 in the catalog of Strassmeier et al. (1988)) is an outstanding member of the short-period RS CVn group. Geyer (1980) has observed XY UMa since 1955, he interprets the large and long-term changes of the system's distortion wave as arising from starspot activity on the hotter ( $\sim$  G2-5V), primary star. Geyer (private communication) has also seen short-term brightness spikes in the light curve, and Zeilik et al. (1983) have made multicolor observations of a flare-like event in January 1982. Budding et al. (1982) noted that XY UMa had the strongest Mg II lines of the short-period RS CVn systems, and Budding and Zeilik (1986) demonstrated that XY UMa is by far the most active of these, based on three activity descriptors (rotation, photometric distortion, and chromospheric lines' flux). Budding and Zeilik (1987) analyzed the 1982 Capilla observations in the context of a starspot model and found two active regions on the primary star at longitudes  $81^\circ$  and  $203^\circ$  with radii of  $13.0^\circ$  and  $15.9^\circ$ . Jassur (1986) concluded, from his 1979 observations, that one spot group appeared at longitude  $180^\circ$ , radius  $17.2^\circ$ .

Aside from the work of Geyer, XY UMa has been little observed. We therefore selected it as part of our renewed effort on the RS CVn stars with the Capilla Peak 61-cm telescope and a CCD camera (Laubscher et al., 1988) used in the mode of a multichannel photometer. Observations were made on 6, 9, 15 and 19 Mar 1988 UT. The star BD+55° 1320 (F8) was taken as a comparison star, its fainter companion was included in the reduction aperture, which covered a diameter of  $54''$ . Our filters have effective wavelengths of B, 466.1 nm; V, 537.5 nm; R, 667.0 nm, and I, 806.4 nm. Figures 1-4 show our results in instrumental delta magnitudes. The overall errors amount to 1.1%. Note the scatter in the data near  $90^\circ$ , we believe that these are intrinsic variations in the system. Other short-period RS CVn stars show this phenomenon, especially ER Vul.

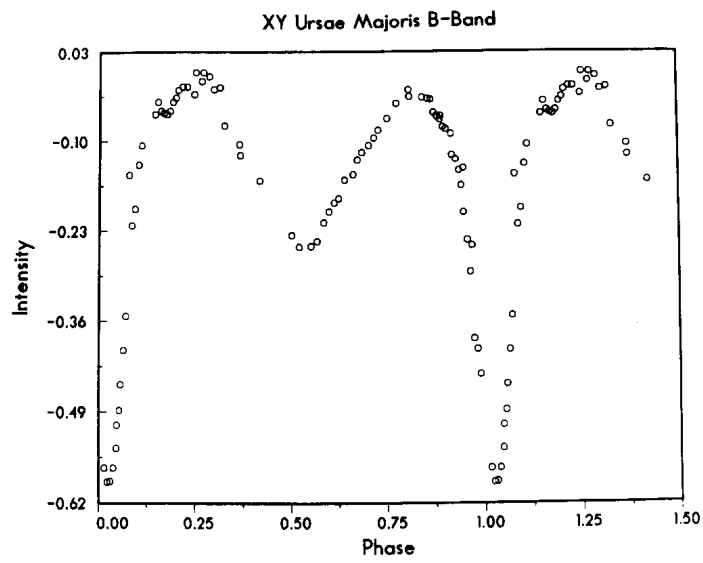


Figure 1

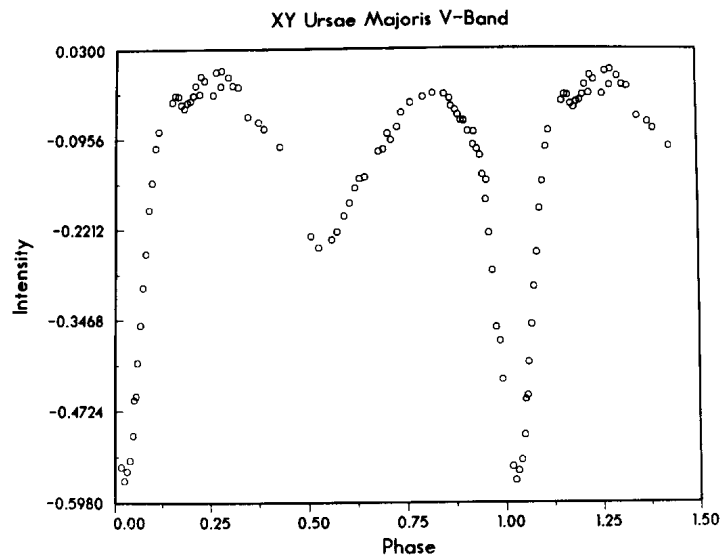


Figure 2

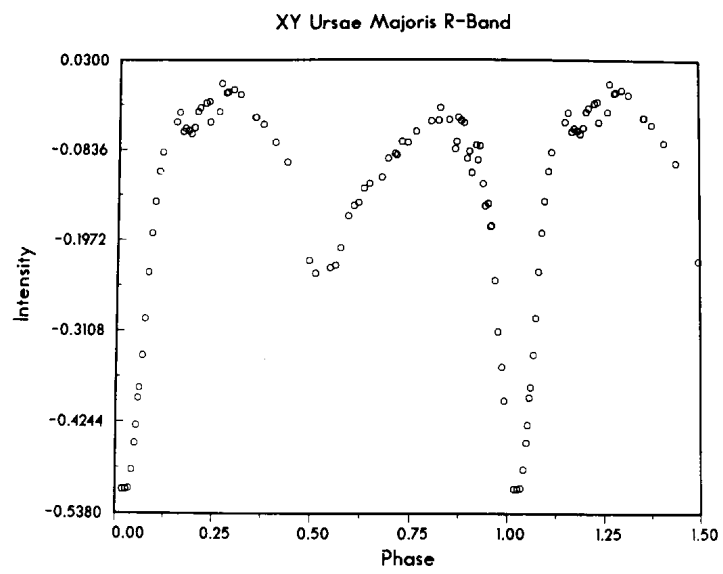


Figure 3

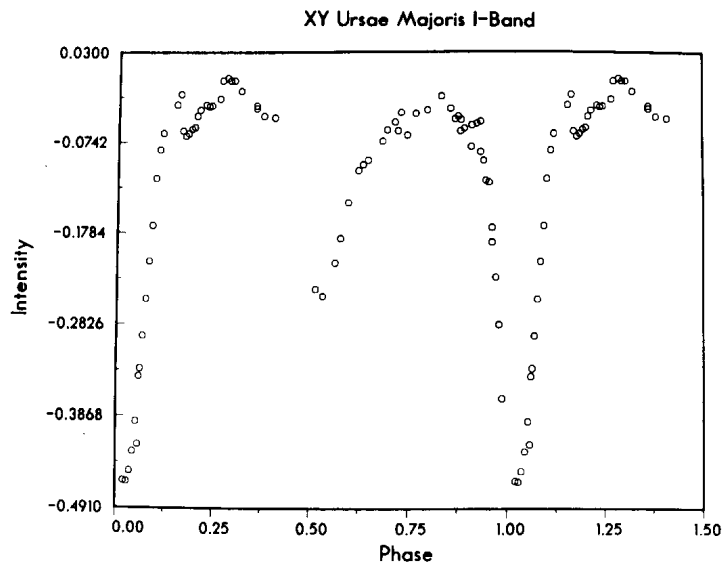


Figure 4

We followed the starspot parameterization procedure of Budding and Zeilik (1987) to analyze the V-band light curve. Our numerical fits gave us a single spot group with longitude  $242^{\circ}$ , latitude  $60^{\circ}$ , and radius  $18.3^{\circ}$ . Our data do not show clear evidence for a second spot group at the epoch. But the one active region does appear at quadrature, as is common in these systems.

MICHAEL ZEILIK, DAVID COX, CECILIA DE BLASI, MICHAEL LEDLOW,  
MICHAEL RHODES, and TOM WILLIAMS  
Capilla Peak Observatory,  
University of New Mexico  
Albuquerque, NM 87131, U.S.A.

#### References:

- Budding, E. and Zeilik, M., 1986, in "Cool Stars, Stellar Systems and the Sun" ed. M. Zeilik, D. Gibson, Springer-Verlag, p.290.  
Budding, E. and Zeilik, M., 1987, Ap.J., 319, 827-835.  
Budding, E., Kadouri, T.H., and Gimenez, A., 1982, Astrophys. and Space Sci., 88, 453-468.  
Geyer, E.H., 1980, in "Close Binary Stars: Observations and Interpretation", edited by M.J. Plavec, D.M. Popper, and R.K. Ulrich (Reidel, Dordrecht) pp. 423-427.  
Jassur, D.M.Z., 1986, Astrophys. and Space Sci. 128, 369-375.  
Laubscher, B., Gregory, S., Bauer, T., Zeilik, M., and Burns, J., 1988, Pub. Astron. Soc. Pacific, 100, 131-136.  
Strassmeier, K.G., Hall, D.S., Zeilik, M., Nelson, E., Eker, Z., Fekel, F.C., 1988, Astron. Astrophys. Suppl. Ser. 72, 291-345.  
Zeilik, M., Elston, R., and Henson, G., 1983, A.J., 88, 532-534.