COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4554

Konkoly Observatory
Budapest
13 February 1998
*HU ISSN 0374 – 0676*

# BI CVn: A STUDY OF ITS PERIOD AND A NEW PHOTOELECTRIC LIGHT CURVE

J. VANDENBROERE
Group Européen d'Observations Stellaires (GEOS), 3 Promenade Venezia, F–78000 Versailles

BI CVn ($13^h03^m17^s$; $+36°37'.1$; 2000.0) is an eclipsing binary on which no detailed study is published even if the GCVS states that its period is suspected to be variable. For this reason the star was included in the observing programme carried out by the GEOS using the 76–cm telescope of Geneva Observatory located on the Jungfraujoch. 43 measurements were obtained in B and V filters of the Geneva system during several missions, devoted to the systematic observations of neglected variable stars. Moreover, the GEOS continued to monitor the star visually.

76 new minima were collected (13 photoelectric, 4 CCD in $V$–light, 4 CCD in white light, 43 visual, 12 photographic). 49 of them were already published (Vandenbroere 1996; a copy can be requested from the GEOS), 6 are reported by Liu and Tan (1988). Table 1 lists all the CCD and photoelectric minima observed photoelectrically by GEOS, by Franz Agerer using CCD with a $V$ filter and by Anthon Paschke using CCD in white light.

Table 1. Recent photoelectric and CCD times of minima of BI CVn

| Type of minima | HJD 2400000+ | Method | Type of minima | HJD 2400000+ | Method |
|---|---|---|---|---|---|
| I | 49137.486 | CCD | I | 49761.4375 | CCD V |
| I | 49479.430 | CCD | II | 49761.6308 | CCD V |
| II | 49516.508 | CCD | II | 50152.3673 | CCD V |
| I | 49722.6325 | p.e. | I | 50152.5589 | CCD V |
| II | 49810.4258 | p.e. | I | 50252.453 | CCD |

The GCVS reports a period of $0^d.3846$ (see also Zhukov 1982 and 1986), but the related ephemeris cannot be used further to predict times of minima. Several attempts were made to rely on all the available minima (see Vandenbroere 1996 for a detailed discussion), but large O−C's were obtained, strongly suggesting a period change. In particular, two different periods are necessary to fit the minima before and after JD 24 445 760. The resulting ephemeris valid after this date is

$$\begin{array}{rcccc} \text{MinI} = & \text{HJD} & 2445769.538 & + & 0^d.3842059 \times \text{E} \\ & & \pm 0.002 & & \pm 0.0000004 \end{array}$$

while before this date a period of $0^d.3842120$ was calculated. The difference between the depths of the primary and the secondary minima is very small and only the good–quality

photoelectric data collected at Jungfraujoch allowed us to distinguish between them (Figure 1). The above ephemeris predicts primary minima according to this distinction.

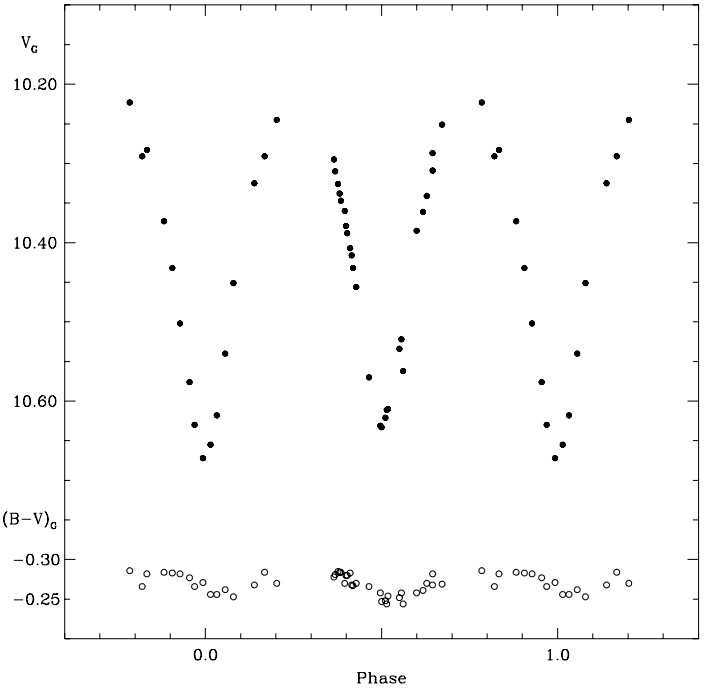


**Figure 1.** V and B−V (Geneva system) phase curves of BI CVn

From the 43 new $BV$ measurements carried out in the Geneva photometric system we found that BI CVn is ranging from $10\overset{\mathrm{m}}{.}22$ to $10\overset{\mathrm{m}}{.}67$ in $V$ light (Minimum II $10\overset{\mathrm{m}}{.}63$ at phase 0.5), while $(B-V)_G$ varies from $-0\overset{\mathrm{m}}{.}29$ to $-0\overset{\mathrm{m}}{.}24$, which corresponds to a range $0\overset{\mathrm{m}}{.}55$–$0\overset{\mathrm{m}}{.}59$ in $(B-V)_J$. The $B-V$ colour curve does not mimic perfectly the $V$ light curve, suggesting some surface irregularities as spots. The comparison with the previous photoelectric curves also suggests some little changes in the shape; this fact, combined with the period change surely occurred in the past, makes BI CVn an interesting object for further studies. It should be noted that different classifications as a W UMa system can be found in the literature: W subclass according to Demircan (1987), A subclass according to Maceroni and Van't Veer (1996).

Recently Rucinski and Duerbeck (1997) supplied a $M_V$ calibration for the W UMa stars based on the Hipparcos data. They emphasized that one of the limitations of the calibration is the inadequate quality of the ground–based photometric data, especially the $B-V$ index value. Since in our photometric run we always performed a careful transformation by measuring a lot of standard stars, the mean $(B-V)_J$ value we obtained ($0\overset{\mathrm{m}}{.}57$) is as good as the transformations from the Geneva to Johnson systems are. By the above quoted values, we derived $M_V$=3.68, in excellent agreement with the Rucinski and Duerbeck sample.

Table 2. New photoelectric measurements of BI CVn in the Geneva system

| HJD 2440000+ | V | B–V | HJD 2440000+ | V | B–V |
|---|---|---|---|---|---|
| 9715.5806 | 10.309 | −0.282 | 9810.3762 | 10.326 | −0.285 |
| 9721.6957 | 10.562 | −0.244 | 9810.3779 | 10.338 | −0.284 |
| 9721.7214 | 10.341 | −0.270 | 9810.3793 | 10.347 | −0.284 |
| 9722.5499 | 10.223 | −0.286 | 9810.3835 | 10.360 | −0.270 |
| 9722.5686 | 10.283 | −0.282 | 9810.3849 | 10.379 | −0.280 |
| 9722.5874 | 10.373 | −0.284 | 9810.3862 | 10.388 | −0.280 |
| 9722.5964 | 10.432 | −0.283 | 9810.3894 | 10.407 | −0.283 |
| 9722.6048 | 10.502 | −0.282 | 9810.3911 | 10.416 | −0.268 |
| 9722.6152 | 10.576 | −0.277 | 9810.3925 | 10.432 | −0.267 |
| 9722.6207 | 10.630 | −0.266 | 9810.3960 | 10.456 | −0.270 |
| 9722.6298 | 10.672 | −0.271 | 9810.4099 | 10.570 | −0.266 |
| 9722.6381 | 10.655 | −0.256 | 9810.4224 | 10.631 | −0.258 |
| 9722.6450 | 10.618 | −0.256 | 9810.4237 | 10.633 | −0.247 |
| 9722.6541 | 10.540 | −0.262 | 9810.4279 | 10.621 | −0.248 |
| 9722.6631 | 10.451 | −0.253 | 9810.4293 | 10.611 | −0.244 |
| 9722.6860 | 10.325 | −0.268 | 9810.4307 | 10.610 | −0.254 |
| 9722.6971 | 10.291 | −0.284 | 9810.4432 | 10.534 | −0.252 |
| 9722.7103 | 10.245 | −0.270 | 9810.4453 | 10.522 | −0.258 |
| 9807.3953 | 10.361 | −0.261 | 9810.4619 | 10.385 | −0.258 |
| 9807.4731 | 10.291 | −0.266 | 9810.4793 | 10.287 | −0.268 |
| 9810.3717 | 10.295 | −0.278 | 9810.4897 | 10.251 | −0.269 |
| 9810.3731 | 10.310 | −0.281 | | | |

References:

Demircan, O., 1987, *Astrophys. Space Sci.*, **135**, 169
Liu, X.F., Tan, H.S., 1988, *Acta Astronomica Sinica*, **29**, 23
Maceroni, C., Van't Veer, F., 1996, *Astron. Astrophys.*, **311**, 523
Rucinski, S.M., Duerbeck, H.W., 1997, submitted to AJ (astro-ph 9710214)
Vandenbroere, J., 1996, *GEOS Circular EB*, **23**
Zhukov, G.V., 1982, *IBVS*, No. 2191
Zhukov, G.V., 1986, *Trans. Kazan-Gorod. Astron. Obs.*, **50**