COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4379

Konkoly Observatory
Budapest
7 October 1996

HU ISSN 0374 – 0676

PHOTOMETRIC INVESTIGATION OF Y CANUM VENATICORUM

The carbon star Y CVn (BD +46°1817 = HD 110914, $\alpha_{2000} = 12^{\rm h}45^{\rm m}07^{\rm s}\!.8$, $\delta_{2000} = 45°26'25''$) was discovered as a variable star by Cannon (Pickering 1910). Zverev (1936) was the first who determined a periodicity in its variations described by the light elements:

$$T_{\max} = 2426117 + 160.0 \times E$$

The most systematic photometric investigation has been carried out by Gaposhkin who studied the star on plates of the Harvard Observatory taken at the beginning of this century. He has found the period P = 157±23 days (Gaposhkin 1952). This is the period given in the General Catalogue of Variable Stars (Kholopov 1985). Gaposhkin derived the mean maximum brightness $8^{\rm m}\!.71 \pm 0^{\rm m}\!.19$ and the mean minimum brightness $9^{\rm m}\!.33 \pm 0^{\rm m}\!.16$ and the extreme maximum and minimum brightnesses $8^{\rm m}\!.18$ and $10^{\rm m}\!.00$ as well.

Nevertheless, the recent observations give evidence that mean period is longer and the character of the light variations is somewhat more complicated. The star was observed photoelectrically by Dzervitis and Vetesnik from 1979 to 1982. Vetesnik (1983) estimated the period of the star P=251.8 days and new light elements for the times of the minimum:

$$T_{min} = 2436097.5 + 251.8 \times E$$

The BV photoelectric observations of Y CVn presented in this paper were performed by Jiri Papousek at the Brno University Observatory in the course of the years 1979–1994. The photometer attached to the 60 cm telescope was equipped with an EMI 9656 photomultiplier and its filter combinations ensured the measurements in the BV colours of the Johnson standard photometric system. The data reduction method was the standard one. The comparison star and the check one was HD 110 834 and HD 110 450, respectively. The mean standard deviation of one observation was better than 0.04 mag, most of them even smaller than 0.007 mag. The total number of all observations was 138 in V band and 135 in B band. The original data will be provided by the author upon request.

The resulting light curves are plotted in Figures 1 and 2. The data used may represent the longest continuous light curve of Y CVn obtained up to now.

The data shows that mean maximum brightness of Y CVn $5^{\rm m}\!.35$ and the mean minimum brightness $5^{\rm m}\!.61$ in V band, while the corresponding values are $8^{\rm m}\!.33$ and $8^{\rm m}\!.73$ in B band. The extreme maximum and minimum brightnesses are $5^{\rm m}\!.18$ and $6^{\rm m}\!.02$ in V band and $7^{\rm m}\!.97$ and $9^{\rm m}\!.76$ in B band. The colour index B−V varies from $2^{\rm m}\!.73$ to $3^{\rm m}\!.75$.

After thorough treatment of data we have concluded:

- The period of light variations determined by Date-Compensated Discrete Fourier Transform (Kleczek 1987) is 267.8 days.

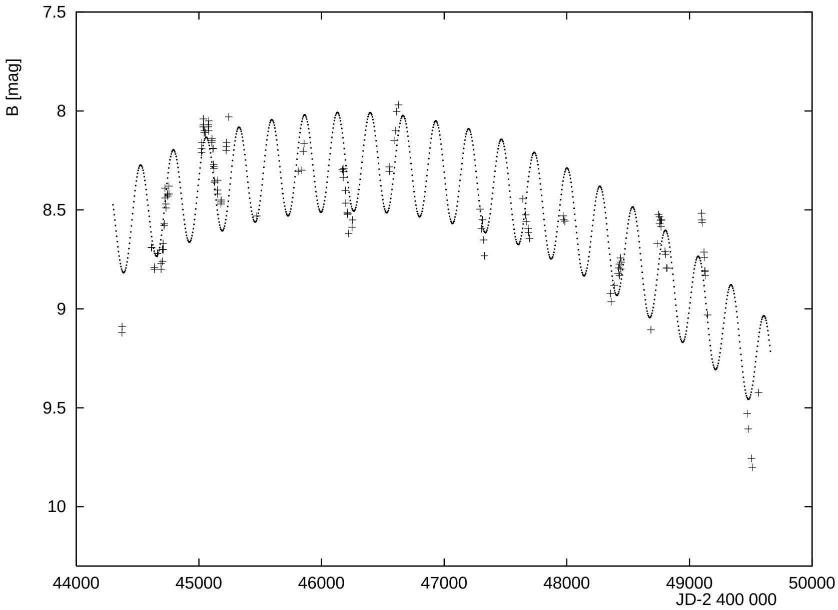

Figure 1. The light curve of Y CVn in photometric band B between the years 1979–1994. The data have been fitted by the curve described by the formula (1).

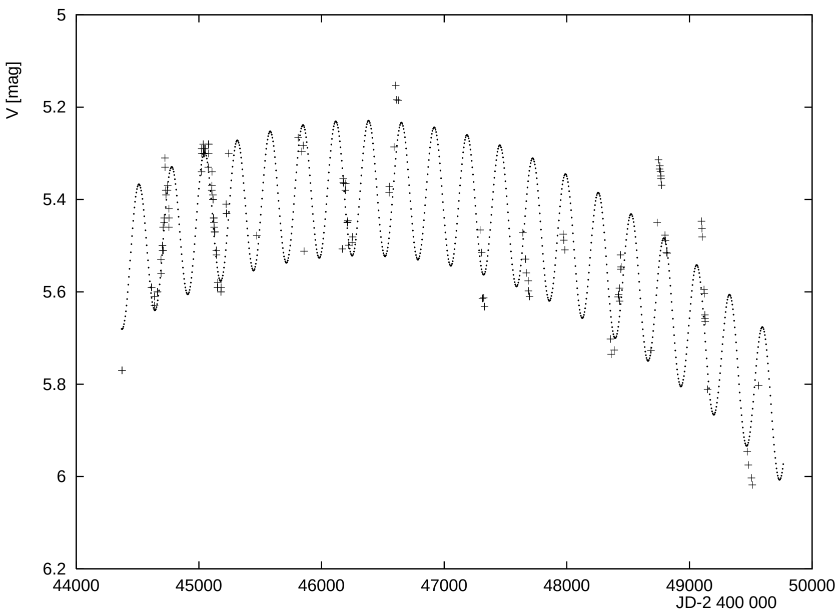

Figure 2. The light curve of Y CVn in photometric band V between the years 1979–1994. The data have been fitted by the curve described by the formula (1).

Table 1. The coefficients of the light curves (1)

band	a_0 [mag]	a_1 [mag]	a_2 [mag]	a_3[mag]	$\Delta\phi$
V	5.376±0.014	0.003±0.002	0.003±0.001	0.146±0.009	-0.027 ± 0.011
B	8.261±0.026	0.011±0.003	0.007±0.001	0.250±0.022	0.025±0.013

- There is a pronounced secular change.
- Some additional irregularities typical for this type of star are present.

The observed variations of Y CVn can be described by secular change of the mean brightness, which may be represented by a part of a parabola, superimposed on nearly sinusoidal variations of constant amplitude and the period $P = 267.8$ days.

Hence, the light curve in particular colour may be expressed by the following formula with five parameters:

$$m = (a_0 + a_1\,E + a_2\,E^2) + a_3\,\sin[2\pi(E + \Delta\phi)], \qquad (1)$$

where $E = (JD_{hel} - 2446458)/P$ and $\Delta\phi$ is a phase shift of the zero point of the sinusoidal component. The coefficients have been found using a sophisticated least-squares method (Mikulasek 1995). The coefficients found for B and V colours are presented in Table 1.

As is seen from Table 1, the phase shifts $\Delta\phi$ in B a V band are not too different, so we could consider them to be the same and being equal to zero. This conclusion is quite natural from the physical point of view, too. So, we can write

$$m = a_0 + a_1\,E + a_2\,E^2 + a_3\,\sin(2\pi E) \qquad (2)$$

Acknowledgement. I am thankful to Jiri Papousek for kindly providing me with his observations of Y CVn and Zdenek Mikulasek for his help with the treatment of data.

Jiri DUSEK
Nicholas Copernicus Observatory
Kravi hora 2
CZ – 616 00 Brno
Czech Republic
Internet: `dusek@physics.muni.cz`

References:

Gaposhkin, S., 1952, *Ann. of Harv. Col. Obs.*, **118**, 22
Kholopov, P.N. et al., 1985, *General Catalogue of Variable Stars*, Nauka, Moscow
Kleczek, J., 1987, *Exercises in Astronomy*, D. Reidel Publishing Co.
Mikulasek, Z., 1995, priv. comm.
Pickering, E.C., 1910, *HC*, No. 159
Vetesnik, M., 1983, *IBVS*, No. 2271
Zverev, 1936, *Sternberg Publ.*, **8**, 1