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

Number 3458

Konkoly Observatory
Budapest
7 May 1990

HU ISSN 0374 - 0676

PHOTOELECTRIC OBSERVATIONS OF XY LEONIS AND ITS PERIOD CHANGES

XY Leo (BD+18°2307) is a W UMa-type binary (subtype W). Its spectral type is KOn (Hill et al., 1975). Hrivnak (1985) collected all available, photoelectric times of minimum light. The O-C diagram has a sine-like shape.

Hrivnak (1985) admitted among others the possibility that period changes were abrupt more or less every 10 years with the period remaining constant between them. Such behaviour was documented for 15 W UMa systems by Kreiner (1977). Gehlich et al. (1972) first proposed that the variations in the O-C values may be due to a third body. This was confirmed by Barden (1986). He found a BY Draconis-like binary companion to the contact binary XY Leo. Because the next minimum of the "third body sinusoid" was predicted in 1990, we carried out observations of this star in B and V filters, close to the UBV system. The observations were made using the 0.6 m telescope equipped with a two-channel photometer (Szymanski and Udalski, 1989) at Mt. Suhora Observatory of Cracow Pedagogical University, and with the 0.5 m Cassegrain telescope of the Jagiellonian University Observatory in Cracow equipped with a one-channel photometer, during the 1989-1990 season. The differential observations were made with respect to the comparison star BD+18°2306 and were corrected for the atmospheric extinction using the mean extinction coefficients for the observatories. The observations allowed us to determine the times of minima by parabolic fitting to the observational points, making use of the least-squares method. New times of minimum light for XY Leo are given in Table I.

Adding all times of photoelectric minima available in the literature and a few visual minima observed before JD hel. 2434500 (the ratio of the weight of the photoelectric minimum to the visual one is equal to 5) and assuming that the period of XY Leo exhibits sinusoidal changes, a new ephemeris of minimum times is derived as follows:

$$\text{Min I JD hel.} = 2435484.0222 + 0.28410273\ E + 0.0213\ \sin(0.000243 \cdot E + 0.56)$$

$$\text{m.e.} \quad \pm 6 \qquad \pm 2 \qquad \pm 4 \qquad \pm 13 \qquad \pm 2$$

Table I. New light minima for XY Leo

JD hel 2440000+	filter	minimum type	notes
7868.6082±0.0002	V	I	Cracow
7891.6214±0.0002	B	I	Suhora
7896.5933±0.0004	V	II	Cracow
7897.5881±0.0003	V	I	Cracow
7898.5811±0.0002	B	II	Suhora
7899.4337±0.0014	B	II	Suhora
7899.5763±0.0003	V	I	Suhora
7928.5545±0.0004	V	I	Cracow
7928.5551±0.0002	V	I	Suhora
7928.6963±0.0006	V	II	Suhora
7948.4425±0.0003	V	I	Cracow
7968.3300±0.0004	V	I	Cracow
7968.4712±0.0004	V	II	Cracow
7969.3215±0.0008	B	II	Cracow
7969.3226±0.0005	V	II	Cracow
7969.4653±0.0004	B	I	Cracow
7969.4664±0.0004	V	I	Cracow

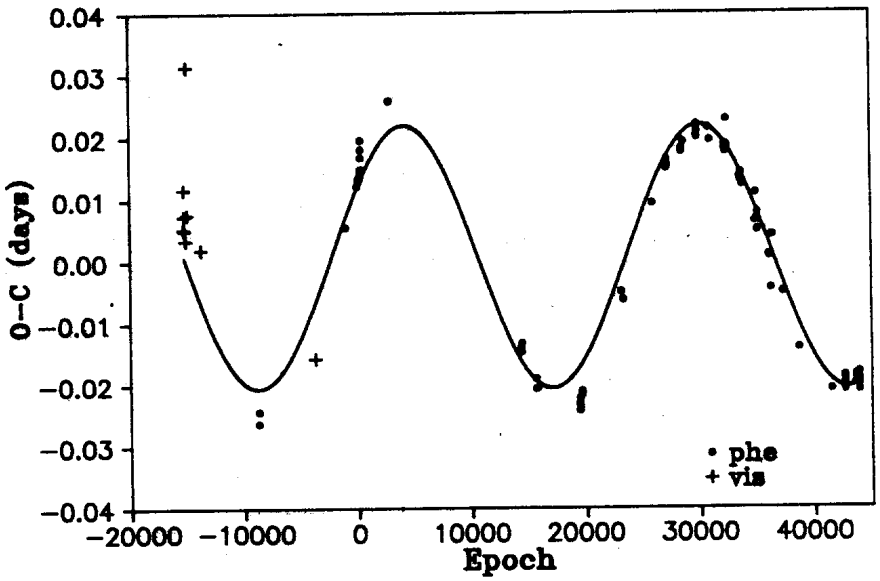

Fig. 1. O-C diagram of the times of minimum light for XY Leo

The period indicated by the sinusoidal term is about 20 $\pm$ 1 years (what is equal to 25866 epochs - see Fig. 1.). The ephemeris for the prediction of forthcoming minima can be derived from the photoelectric observations made after JD hel. 2447000, as follows:

$$\text{Min I} = \text{JD hel } 2447612.34748 + 0.2841034\ E$$
$$\text{m.e.} \quad \pm 16 \qquad\qquad \pm 2$$

We computed the orbital parameters of the third body, making use of the gradient-expansion algorithm (Bevington, 1969). Taking into account observations before JD hel. 2442000 the results were practically the same as those obtained by Gehlich, but for observations made after JD hel. 2440000 both the computed period, and the amplitude of theoretical O-C are smaller, and value of e is near zero, so changes of period of XY Leo are sinusoidal in quite good approximation.

This work was supported by a grant from Polish Ministry of Education (RR I-II).

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