COMMISSION 27 OF THE I.A.U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3603

Konkoly Observatory
Budapest
13 May 1991
HU ISSN 0374 - 0676

NEW EPHEMERIS OF THE ECLIPSING SYMBIOTIC STAR AX Per

The light-curve of the symbiotic star AX Per has been studied since 1887 photographically (e.g. Lindsay, 1932, Payne-Gaposhkin, 1946, Mjalkovskij, 1977). The light variations amount to about Δm = 0.2 - 0.3 mag at a quiescence and of Δm = 2 - 3 mag at outbursts, but with practically the same minima separation were observed. Lindsay (1932) estimated period of 650 days and Payne-Gaposhkin (1946) 675 days respectively. Recently, Kenyon (1982) analysed mathematically photographic and photovisual light-curves obtained by Mjalkovskij (1977) and found a periodicity of 681.6 days with the ephemeris:

JD(min) = 2436679.4($\pm$8) + 681.6($\pm$7.2) days x E.

Since January 1988, when the last outburst started (IAU Circ. No. 4544), AX Per has been monitored intensively both visually and photoelectrically. Two well defined primary minima, observed during this recent star's activity, were used to determine the new ephemeris of the light-minima more accurately.

Photometric observations of AX Per were carried out in the standard UBV system using a one-channel photoelectric photometer installed in the Cassegrain focus of the 0.6/7.5 m reflector of the Skalnaté Pleso (1780 m above sea level) and Tatranská Lomnica (870 m above sea level) Observatories, operating on the principle of the method of pulse counting. HD 10063 (SAO 22481), V = 7.39, B-V = 0.25, U-B = -0.33 was used as the comparison star and SAO 22444, V = 7.427, B-V = 1.016, U-B = 0.632 (Hric et al., 1991) and a star near AX Per (α(1950) = $01^h33^m.5$, δ(1950) = $53^o59'.5$) as the check stars. The measurements were reduced to the international system.

The visual magnitude estimates were obtained from the data published in the IAU Circulars (Nos. 4544, 4549, 4558, 4563, 4566, 4593, 4621, 4685, 4696, 4745, 4820, 4915, 4994, 5113, 5126, 5167)

and those ones supplied by British Astronomical Association (Hric et al., 1991). Comparing the visual with the photoelectric V-magnitude or the photovisual Mjalkovskij's data during the eclipses, the former seem to be shifted by about 0.7 mag. The visual and photoelectric data are shown in Fig. 1. They will be published in the form of a table in Contr. Astron. Obs. Skalnaté Pleso 22.

As one can see in the Fig. 1, the shape of the deep, symmetrical central primary minima evidently reflects an eclipse of the hot component by the M giant. The second degree polynomial least squares fit gives the times of their middles at JD 2447551.7 ± 1.0 from visual observations and at JD 2448231.6 ± 0.6 from the U, B and V photoelectric measurements. These two last observed minima obviously do not comply with the ephemeris published by Kenyon (1982), see Fig. 1. Provided the orbital period is constant, but different from Kenyon's one, we can write the linear O-C relation as

$$O\text{-}C = \Delta JD(Min) = \Delta JDo + \Delta P \times E \qquad (1)$$

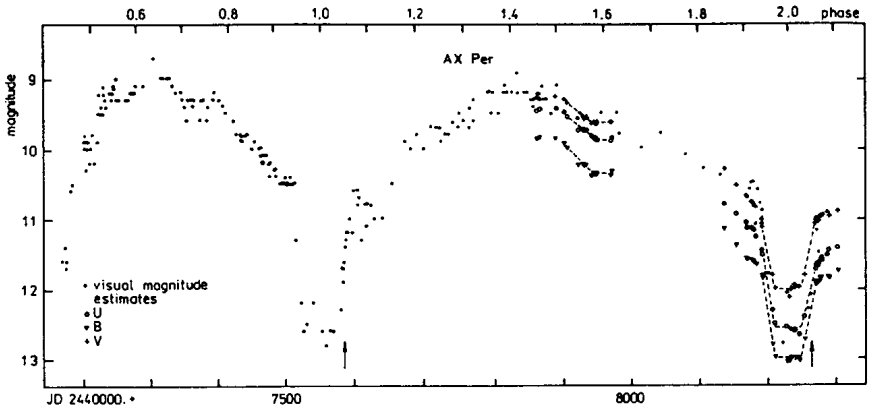

Fig. 1. The light-curve of the recent outburst phase of the symbiotic star AX Per compiled from visual magnitude estimates and photoelectric measurements. Arrows denote the times of the primary eclipses according to the old ephemeris. The orbital phase, on the top of figure, was calculated according to the new ephemeris (2).

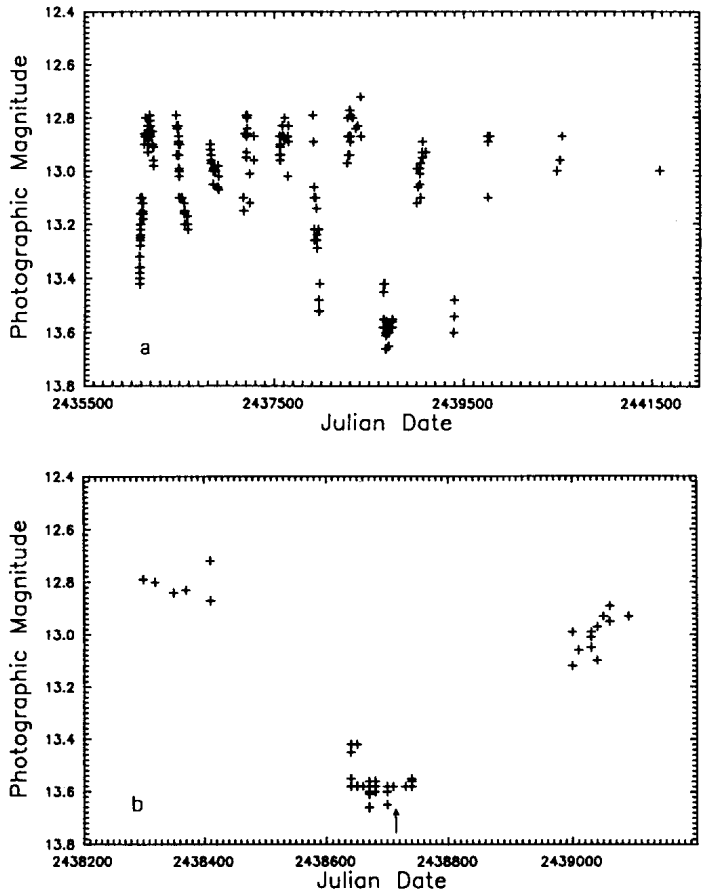

Fig. 2. Photographic data from Mjalkovskij (1977) - a). Only the data at about JD 2438700 seems to cover well the primary eclipse - b). Its determined middle (arrow) agree with the minimum according to the new ephemeris in 0.1 day.

where ΔJDo is a correction to the original epoch (JD 2436679.4) and ΔP is a correction to the old (681.6 day) period. The differences between the observed (JD 2447551.7 and JD 2448231.6) and computed (JD 2447585.0 and JD 2448266.6) times of the minima, -33.3 and -35.0 days respectively, imply the change in period ΔP = -1.7 days. Linear extrapolation of the relation (1) to JD 2436679.4 gives the correction ΔJDo = -6.1 days. So, the new ephemeris of

the primary minima of the symbiotic star AX Per is

$$JD(Min) = 2436673.3(\pm 0.6) + 679.9(\pm 1.2) \times E \qquad (2)$$

Since only these two last minima were defined during the history of the AX Per observations, a confirmation of the new ephemeris (2) is not simple.

Only three minima had been tolerably defined since 1887. They were determined at JD 2412160 ± 40 (from the figure in Lindsay, 1932), at JD 2424435 ± 15 (from the Fig. 2 in Payne-Gaposhkin, 1946) and at JD 2438712 ± 1.6 fitting Mjalkovskij's photographic and photovisual data between JD 2438300 and 2439090, as his the best defined minimum, (Fig. 2). These times of primary minima agree with the new ephemeris. The differences are 36.9, 0.1 and 0.1 days respectively. Nevertheless, only further new, better photoelectric, systematic observations can unambiguously confirm or improve our new ephemeris (2).

A. SKOPAL

Astronomical Institute
Slovak Academy of Sciences,
059 60 Tatranská Lomnica
Czechoslovakia

References:

Hric, L., Skopal, A., Urban, Z., Dapergolas, A., Hanžl, D., Isles, J.E., Niarchos, P., Papoušek, J., Pigulski, A., Velič, Z.: 1991, Contr. Astron. Obs. Skalnaté Pleso 21, 303 (in press).

Kenyon, S.J.: 1982, Publ. Astron. Soc. Pacific 94, 165.

Lindsay, E.M.: 1932, Bull. Harv. Coll. Obs. No. 888.

Mjalkovskij, M.I.: 1977, Perem. Zvezdy Pril. 3, 71.

Payne-Gaposhkin, C.: 1946, Astrophys. J. 101. 362.