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THE MINIMA OF THE ECLIPSING BINARY SYSTEM Y Cyg

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Y Cyg (HD 198846) ($7\overset{m}{.}30 - 7\overset{m}{.}90$ (V), Sp O9.8V, P = $2\overset{d}{.}9963328$) is an eclipsing binary with many remarkable properties. Popper (1980) gives a spectral type of O9.8V for both components, so Y Cyg is one of a small number of O–type binary stars for which we can determine physical parameters. These parameters will provide (Hill and Holmgren, 1995) important constraints on evolutionary models of O–type stars. This binary system has a most awkward orbital period of 2.9963328 days (approximately 5 minutes shorter of three sidereal days), making it impossible to observe a complete orbital cycle from one observatory in a single observing season.

Y Cyg is the classic example of apsidal motion, with the period of this effect being 47.6 ± 0.2 years (Gimenez et al., 1987). Gies and Bolton (1986) have shown that Y Cyg is an OB runaway star, due to its large space velocity.

The author observed this system in 1989 at Kazan Station in Special Astrophysical Observatory (Russia) using the 48 cm reflector with an UBV photometer around Min I in V filter, and in 1990 at Crimean Station of Sternberg Astronomical Institute (Russia) using a $WBVR$ photometer at the Zeiss-600 telescope around Min II also in V filter. BD+34°4196 was used as a comparison star. Reduction for atmospheric absorption was applied.

The first complete photometric study of Y Cyg was that by Dugan (1931). Magalashvili and Kumsishvili (1959) (MK hereafter) presented a complete photometric light curve but only in one "colour" (actually the unfiltered photomultiplier response) (Hill and Holmgren, 1995). Both Dugan and MK presented analyses of their data. The data of MK were reanalyzed by Giuricin et al. (1980), using WINK light curve synthesis code (Wood, 1971). An international campaign by O'Connell (1977) resulted in an improved apsidal period, but an incomplete UBV light curve for Y Cyg. Stickland et al. (1992) observed it with IUE for radial velocity and also derived a light curve. Zaitseva, Lyutyi and Martynov (1971) observed also this system near Min I, II in accordance with the recommendations of the Commission 42 of the IAU. The quality of all the available light curves is not satisfactory (Hill and Holmgren, 1995).

From our observations we have determined the times of minima I, II using the method of Khaliullina and Khalliulin (1984) from our observations :

$$\begin{aligned} \text{Min I} &= \text{JD Hel } 2447767.657\pm0.003 \\ \text{Min II} &= \text{JD Hel } 2448179.3802\pm0.0002 \end{aligned}$$

We obtained our observations many years ago, but to publish these minima still has importance, because there is a gap in photoelectric minima observations in that time :

$$\text{Min I} \quad \begin{cases} 2446287.4210 - \text{ Pohl et al. (1987)} \\ 2448528.7316 - \text{Caton and Burns (1993)} \end{cases}$$

$$\text{Min II} \quad \begin{cases} 2447304.4480 - \text{BBSAG (1988)} \\ 2450672.3717 - \text{Agerer and Hubscher (1998)} \end{cases}$$

As an example in Figure 1 we show our observations in V filter obtained at Crimean Station (Min II) in 1990. The ΔV is the difference between V magnitudes of Y Cyg and the comparison star. The phases on the figure were calculated by the ephemeris of O'Connell (1977) :

$$\text{Min I} = \text{JD Hel } 2409453.4192 + 2^{\text{d}}.9963328\ \text{E} .$$

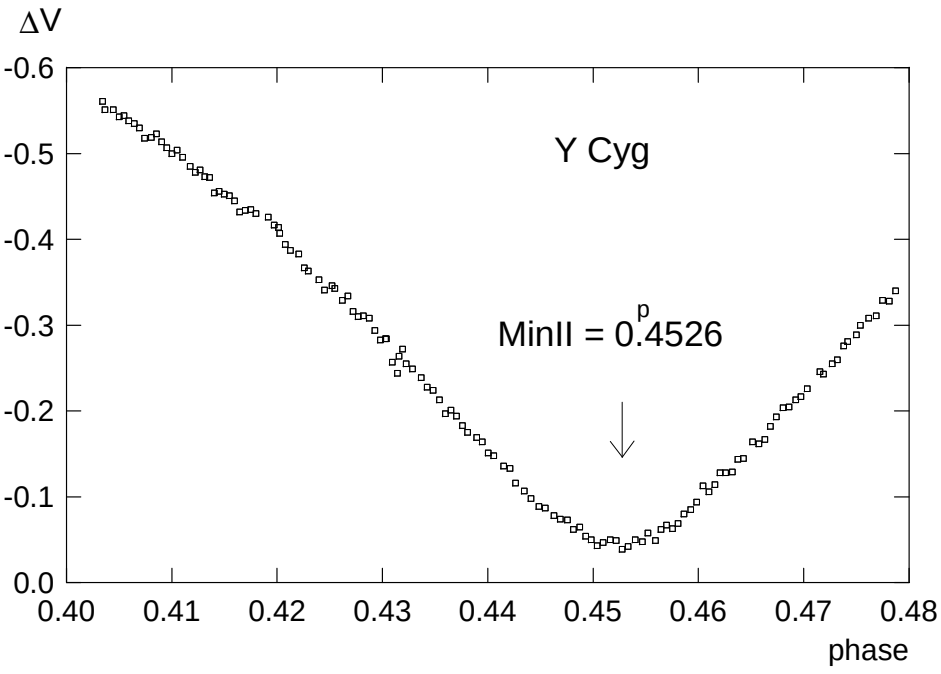

Figure 1. The light curve for Y Cyg in the secondary minimum (The Crimean observations).

The depth of MinII is $0^{\text{m}}.59(V)$ according to our estimation, the mean out-of-eclipse ΔV is $-0^{\text{m}}.630$ evaluated from six observations outside eclipses.

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