COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 4082

Konkoly Observatory
Budapest
13 September 1994
HU ISSN 0374 - 0676

PHOTOELECTRIC OBSERVATIONS OF GR TAURI

GR Tau (=BD+20°0685) was discovered as an eclipsing binary by Strohmeier et al. (1957). Yamasaki and Okazaki (1984) published the first photoelectric light curves and the radial velocity curves with the revised spectral type A5 V and the orbital period P=0.4298525 days for the system. The remarkable characteristics of GR Tau are its short orbital period and asymmetric light curve with total eclipse. The photometric solution obtained by Yamasaki and Okazaki (1984) showed that the system might be a noncontact but near-contact detached binary.

The new photoelectric BV observations were carried out with the single-channel photon-counting photometer at the 60 cm telescope of Beijing Astronomical Observatory during the 1985 and 1993 seasons. The stars BD+20°0684 and BD+19°0642 were used as the comparison and check star, respectively. All the observations were corrected for differential extinction and transformed into the standard Johnson UBV system. Two sets of complete BV light curves and three primary minima were obtained. Using the new times of minima, together with all published p.e. minima as listed in Table 1, a new linear ephemeris was derived as follows:

$$\begin{matrix}\text{Min.I.=HJD}\,2446415.0208 + 0^{d}.42985142 \times E \\ \qquad\qquad\quad \pm 3 \qquad\quad \pm 7\end{matrix} \tag{1}$$

The O−C values in Table 1 are calculated from new ephemeris (1) and are all plotted in Figure 1. It shows that the period of GR Tau appears to have appreciable long-term changes. Therefore, a quadratic fitting of minima is carried out by the least squares method, which gives the following ephemeris:

$$\begin{matrix}\text{Min. I=HJD}\,2446415.0216 + 0^{d}.42985146 \times E - 6^{d}.26 \times 10^{-11} \times E^{2} \\ \qquad\qquad\quad \pm 4 \qquad\quad \pm 6 \qquad \pm 2.12\end{matrix} \tag{2}$$

The fit of the quadratic ephemeris (2) to the observations is also shown in Figure 1. The rate of the period decrease of GR Tau turns out to be $\Delta P/P = -2.91 \times 10^{-10}$ ($\sim$0.0092 sec/yr).

By using the linear ephemeris (1), the observations in 1993 were combined into B and V normal light curves as shown in Figure 2. The light curves exhibit obviously asymmetry with the Max I brighter than the Max II by about 0.05 in V and 0.07 in B. The behaviour of the light curve remains almost the same as that observed in 1980 by Yamasaki and Okazaki (1984) and in 1989 by Hanžl (1990) and no migration of the distortion on the light curves was found yet. The asymmetry of the light curve is probably due to the mass transfer in the system.

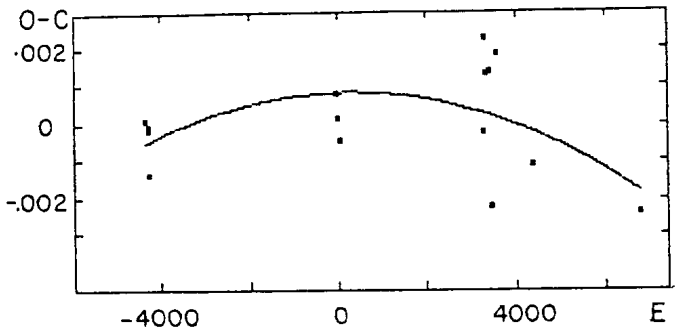

Figure 1. O−C diagram of minimum times for GR Tau.

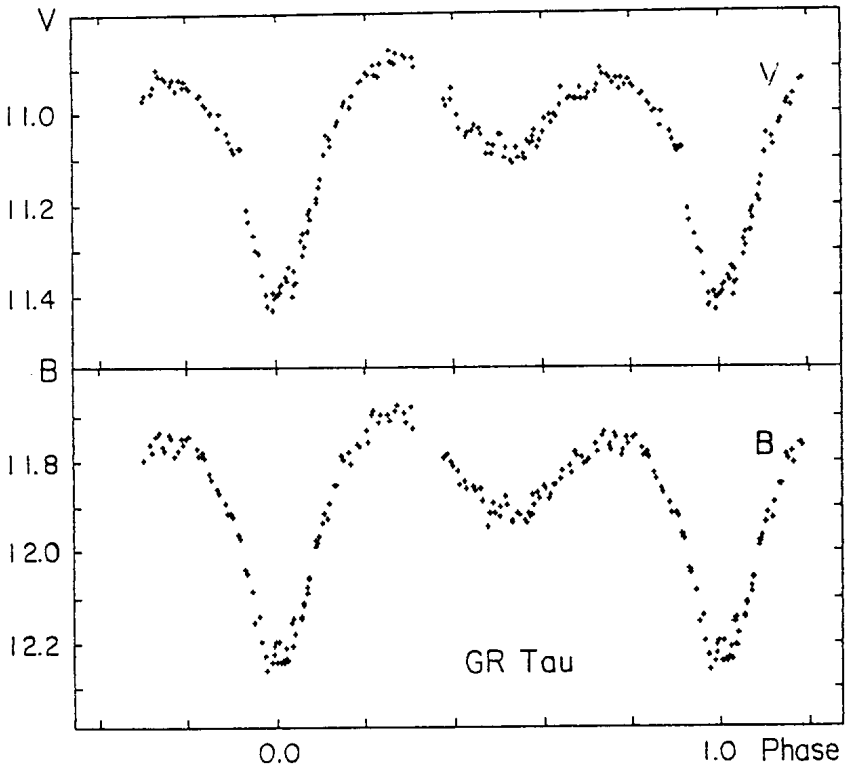

Figure 2. BV light curves of GR Tau in 1993.

Table 1
The times of minima and their O−C values

JD(Hel.)2440000+	E	O−C	Source
4544.3075	−4352	0.0001	Yamasaki and Okazaki (1984)
4573.1074	−4285	0.0000	〃
4578.2643	−4273	−0.0014	〃
4579.1252	−4271	−0.0002	〃
6414.1619	−2	0.0008	This paper
6415.0209	0	0.0001	〃
6438.6622	55	−0.0004	Mullis and Faulkner (1991)
7821.4944	3272	−0.0002	Wunder et al. (1992)
7827.5148	3286	0.0023	Hanžl (1990)
7849.4363	3337	0.0013	〃
7881.6752	3412	0.0014	Mullis and Faulkner (1991)
7889.4089	3430	−0.0023	Hanžl (1990)
7945.2937	3560	0.0019	Hanžl (1991)
8288.3122	4358	−0.0011	Agerer (1991)
9334.1394	6791	−0.0024	This paper

The further photometric analysis of the light curves will be published in a forthcoming paper.

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References:

Agerer, F., 1991, *BAV-Mitteilungen*, No. 59
Hanžl, D., 1990, *Inf. Bull. Var. Stars*, No. 3423
Hanžl, D., 1991, *Inf. Bull. Var. Stars*, No. 3615
Mullis, C. R., Faulkner, D. R., 1992, *Inf. Bull. Var. Stars*, No. 3593
Strohmeier, W., Knigge, R., and Ott, H., 1963, *Veröff. Remeis-Sternw. Bamberg*, 5, No. 17
Wunder, E., Wieck, M., Kilinc, B., Gülmen, O., Tunca, Z., Evren, S., 1992, *Inf. Bull. Stars*, No.3760
Yamasaki, A., Okazaki, A., 1984, *Publ. Astron. Soc. Japan*, **36**, 175