

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

Number 3698

Konkoly Observatory  
Budapest  
2 March 1992

HU ISSN 0374 - 0676

## The Eclipsing Binary TX UMa - a Period Change Again

**Abstract.** On the basis of the published visual times of minima and our UBV photometric observations of the eclipsing binary TX UMa, another change of its period is presented. The new photometric ephemeris was computed.

### 1. Introduction

Recently we have been involved in the detailed analysis of the spectroscopic observational material of the eclipsing binary TX UMa obtained at the D.A.O. in 1969-70 and at the Ondřejov Observatory in 1972-80, (Hric *et al.*, 1990; Grygar *et al.*, 1991; Komžík *et al.*, submitted to the *Astrophys. Space Sci.*). The spectroscopic detection of the interacting processes in this system showed the need for a further photoelectric monitoring.

The photoelectric observations in the UBV system were taken at the Skalnaté Pleso and Stará Lesná Observatories of the Astronomical Institute of the Slovak Academy of Sciences with the identical 60 cm Cassegrain reflecting telescopes equipped with single-channel pulse-counting photometers and photomultipliers. Observed data were recorded and processed using PC IBM-compatible computers.

### 2. Observations and Conclusions

The first observed minimum (JD 2 448 303) shows the (O-C) value approximately +2 hours (computed using the photometric ephemeris by Oh and Chen, 1984). The last investigation of TX UMa's (O-C) diagram was carried out by the above mentioned authors. The new times of minima (visual, taken from the literature including Cracow database, as well as our photoelectric) can be found in Table I. These new data together with those published by Oh and Chen were used to construct the new (O-C) diagram shown in Fig.1.

The times of our photoelectric minima were determined using parabola fitting method, separately for each colour, and their errors were estimated

TABLE I  
Observed times of primary minima of TX UMa

$JD_{hel}$ +2 440 000	Error (days)	Epoch	Type	Observer	Source	Note
6122.372		-807.	VI	Hollis, A.	Isles, J.	
6171.395		-791.	VI	Duncan, H.	Isles, J.	*
6566.535		-662.	VI	Cluyse, L.	Isles, J.	*
6872.887		-562.	VI	Vyatavél, R.	Silhán, J.	
6903.505		-552.	VI	Csipes, J.	Silhán, J.	*
6903.5208		-552.	VI	Renz, W.	BAV Rundbr.37	
7151.6452		-471.	VI	Renz, W.	BAV Rundbr.37	
7531.503		-347.	VI	Renz, W.	Hübscher, J. <i>et al.</i>	
7565.200		-336.	VI	Enskonatus, P.	MVS 12, Nr.2	
7626.477		-316.	VI	Enskonatus, P.	MVS 12, Nr.3	*
7966.496		-205.	VI	Pietz, J.	Hübscher, J. <i>et al.</i>	
8303.46340	0.00005	-95.	PE U	Gliviak, M., Komžík, R.	this paper	
8303.46341	0.00008	-95.	PE B	Gliviak, M., Komžík, R.	this paper	
8303.46352	0.00007	-95.	PE V	Gliviak, M., Komžík, R.	this paper	
8306.5254	0.0002	-94.	PE U	Hric, L., Komžík, R.	this paper	
8306.5258	0.0002	-94.	PE B	Hric, L., Komžík, R.	this paper	
8306.52515	0.00012	-94.	PE V	Hric, L., Komžík, R.	this paper	
8306.5272	0.0004	-94.	PE U	Gliviak, M., Kandra, M.	this paper	
8306.527	0.001	-94.	PE B	Gliviak, M., Kandra, M.	this paper	
8306.5277	0.0003	-94.	PE V	Gliviak, M., Kandra, M.	this paper	
8444.373		-49.	VI	Dědoch, A.	private comm.	
8594.4786	0.0003	0.	PE U	Hric, L., Komžík, R.	this paper	
8594.4792	0.0002	0.	PE B	Hric, L., Komžík, R.	this paper	
8594.4792	0.0003	0.	PE V	Hric, L., Komžík, R.	this paper	

Notes to Table I.

VI-visual, PE-photoelectric, U-filter U, B-filter B  
V-filter V, \* -omitted

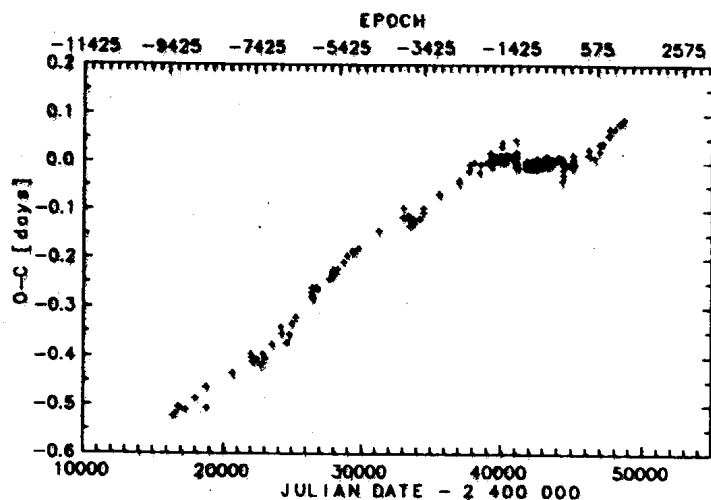


Fig. 1. (O - C) diagram for the times of primary minima of TX UMa, based on the ephemeris by Oh and Chen (1984):  $Min_{hel} = 2\,444\,998.1475 + 3.^d.0632382 \times E$

considering Kwee and Van Woerden (1956) method. The shapes of minima do not exhibit significant deviations from the symmetry.

We were lucky enough to gain two simultaneous observations of TX UMa minimum (JD 2 448 306) one at the Skalnaté Pleso Observatory and the other at the Stará Lesná Observatory. These two sets of data lead to a difference in the time of minimum determination which can not be explained by the data inaccuracy. We see the reason of this difference in the deterioration of the observational conditions at the Skalnaté Pleso Observatory, and a subsequent sudden change of the extinction, which caused the drop of the observed brightness (in all colours) at the ascending branch of the eclipse, resulting in the time of minimum delay. This effect can be of more general relevance and we intend to study it in the future in more detail.

The new photometric ephemeris of the system TX UMa was derived by means of the least-squares method using the data from the Table I. Four times of minima were omitted due to their great inherent inaccuracy (marked in the last column of the Table I.) The resulting photometric ephemeris is:

$$\begin{aligned} \text{Min. I} = & \text{JD}_{hel} 2\,448\,594.47957 + 3^d.0633292 \times E \\ & \pm 0.00008 \quad \pm 0.0000008 \end{aligned}$$

Finally we can summarize our results and their interpretation:

1. Between JD 2 445 111 and JD 2 446 122 a new period change of the TX UMa system occurred, the fourth one in this century;
2. The new value of the period is  $3.0633292 \pm 8. \times 10^{-7}$  days. This period is longer than that found by Oh and Chen; the difference is  $0.^d0000910$ ;
3. The reason for the period change of TX UMa is the mass transfer from the less massive cooler secondary component F 6 IV to the hot component B 5 V. If the masses of the components  $M_1 = 6.1M_{\odot}$  (hot one) and  $M_2 = 1.8M_{\odot}$  (cooler one) (Grygar *et al.*, 1991) are assumed the new value of  $\frac{\Delta P}{P} = 0.000029706$  yields to the value of the transferred matter  $\Delta M = 2.53 \times 10^{-5}M_{\odot}$ .

It is interesting to notice an increase of the value  $\frac{\Delta P}{P}$  during last ninety years.

#### Acknowledgements

The authors wish to thank Mr. Milan Gliviak and Mr. Miroslav Kandra for their observational work at the Skalnaté Pleso Observatory. Our thanks are also due to Mgr. Jindřich Šilhán and to prof. J. M. Kreiner for their help with the search for archival data .

Ladislav HRIC  
Richard KOMŽÍK  
Astronomical Institute  
Slovak Academy of Sciences  
059 60 Tatranská Lomnica  
CZECH and SLOVAK  
FEDERAL REPUBLIC

#### References

- Dédoch, A.: 1991, *private comm.*  
 Grygar, J., Hric, L., Komžík, R., Šíma, Z.: 1991, *Astrophys. Space Sci.* **185**, 189-193.  
 Hric, L., Komžík, R., Grygar, J.: 1990, *Astrophys. Space Sci.* **169**, 241-243.  
 Hübscher, J., Lichtenknecker, D., Wunder, E.: 1989, *BAV Mitt.* **52**,  
 Hübscher, J., Lichtenknecker, D., Wunder, E.: 1990, *BAV Mitt.* **56**.  
 Isles, J.: 1989, *BAAVSS Circ.* **68**, 30.  
 Komžík, R., Hric, L., Grygar, J.; submitted to *Astrophys. Space Sci.*  
 Kwee, K. K., Van Woerden, H.: 1956, *BAN* **12**, No.464, 327.  
 MVS: 1989, **12**, Nr. 2, 17.  
 MVS: 1990, **12**, Nr. 3, 51.  
 Oh, K. D., Chen, K. Y.: 1984, *Astron. J.* **89**, No.1, 126.  
 Renz, W.: 1988, *BAV Rundbrief* **37**, No. 1, 12.  
 Šilhán, J.: 1991, *private comm.*