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ON THE SECONDARY MINIMUM OF THE ECLIPSING BINARY ZZ UMa

ZZ UMa was discovered as an eclipsing binary by Kippenhahn (Geyer et al., 1955). The photographic light curve (Döppner, 1962) is of Algol type with the shallow secondary minimum of uncertain depth. The results of the first photoelectric observations of ZZ UMa in two colours were published by Lavrova and Lavrov (1988). According to the light curves obtained by them, the reflection and ellipticity effects are small. Due to the lack of measurements of the secondary eclipse the photometric orbital elements were derived from the primary minima only.

The present paper reports 144 photoelectric U, B, V observations of ZZ UMa in each colour at the orbital phases 0.45- 0.56. The measurements were made on the night of March 16/17, 1988, using the 48 cm Cassegrain reflector of Abastumani Observatory. Typical standard deviation of one observation, as deduced from the maxima, is $0^m.018$, $0^m.014$, $0^m.009$ in U, B, V respectively. The normal points are presented in Figure 1. The magnitude differences are given with respect to BD+62°1138. They are averages of four observations, close in time. For calculations of the phases the light elements given by Döppner (1962) were used.

The orbital elements of the system have been derived using the method and programs of Lavrov (1971, 1976). The solutions could be obtained only for a total occultation in the secondary minimum.

The final results and their probable errors are listed in Table I. The subscript 1 denotes the hot primary component and the subscript 2 - the cooler component. Only for V curves $\cos^2 i=0$ and $i=90^\circ$. The elements for this curve at $i=90^\circ$ are listed in column headed V'. When our results are compared with those published by Lavrova and Lavrov (1988), a good agreement is found for all parameters with the exception of L_1. Our p.e. for L_1 is considerably smaller than the previous one.

Thus the new values of L_1 are more reliable. The values of the amplitudes of the secondary minima A_2 are listed in the last line of Table I. The

Table I :The orbital elements of ZZ UMa

X_2 (adopted)	U 0.75	B 0.75	V 0.60	V' 0.60
k	0.693±0.031	0.710±0.011	0.700±0.042	0.754±0.015
r_1	0.162±0.010	0.149±0.004	0.160±0.011	0.155±0.005
r_2	0.112±0.005	0.106±0.002	0.112±0.004	0.117±0.002
L_1	0.796±0.004	0.756±0.002	0.741±0.007	0.743±0.002
$\cos^2 i$	0	0	0.0020±0.0021	0(adopted)
i	90°	90°	87°.5	90°
A_2	0.m25	0.m30	0.m33	

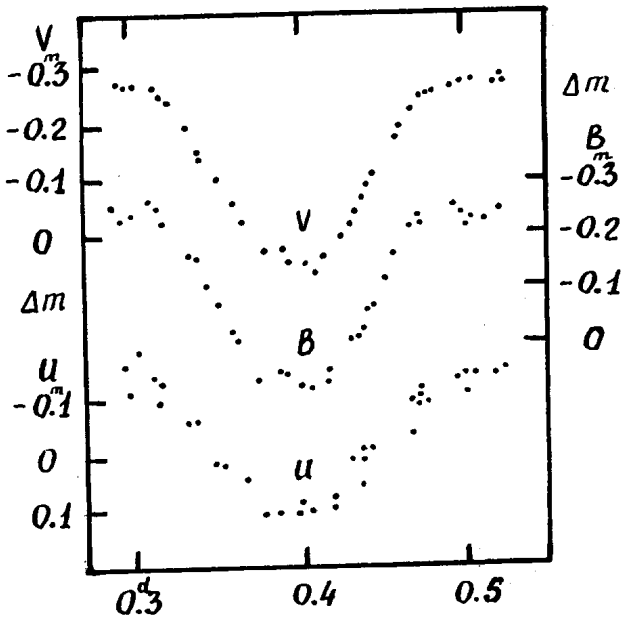

Figure 1

spectral class of the secondary star is about G6–G8. Determination of the epochs of mid-eclipse were made for all colours using Lavrov's (1976) program: J.D. hel. 2447 237 + $0^d.3990 \pm 0^d.0009$ (in U), $0^d.3992 \pm 0^d.0004$ (in B), $0^d.3999 \pm 0^d.0004$ (in V).

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