COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 1662

Konkoly Observatory
Budapest
1979 August 27

STRÖMGREN y and b LIGHT CURVES OF W UMa

The short period eclipsing system W UMa was observed on 10 nights from April through July 1977. The observations were obtained using the 51 cm, f/13.5 Cassegrain reflector at Biruni Observatory, Shiraz, Iran. The photoelectric photometer is equipped with an unrefrigerated RCA 4509 multiplier photocell and a Leeds and Northrup Speedomax was used to record the amplified signal from the photomultiplier. Intermediate-bandpass blue and yellow interference filters having characteristics nearly identical with the b and y filters of the Strömgren uvby system were employed in making the observations. The comparison star was BD+56°1399 and BD+56°1398 served as the check star. The comparison star was the same used in previous investigations of W UMa. At the level of ±0.004 mag in yellow and ±0.007 mag in blue no significant variations were detected between the comparison and check stars. Several uvby standard stars were also observed.

The observing sequence was the usual pattern of sky-comparison-variable-comparison-sky, with each observation consisting of a 40 sec deflection. The faint ~12.5 mag companion star ADS 7494 B, about 7" from W UMa, was included in all measurements of the variable. The effects of differential atmospheric extinction were removed, but because of the angular proximity of the comparison star to the variable star, the extinction corrections were always very small. The differential y and b magnitudes in the sense (V-C) are plotted against phase in Figure 1 where the phases were computed according to: Min I = JD Hel. 2443863.7583 + 0.33363793· E.
The epoch is from the present study and the period was obtained from Rigterink (1972).

A determination of the time of secondary minimum was made by combining observations of four nights on which secondary eclipse was observed. The method of Szafraniec (1948) was used to compute the timing, yielding the epoch:

JD Hel. Min II = 2442863.5915. No precise determination of the time of primary eclipse could be made since only a portion of the ingress was observed. In computing the phases it was assumed that primary and secondary minima are separated by exactly 1/2 period.

The present light curves are well defined except for the descending branch of primary minimum which is only partially covered. As shown in Figure 1, both the y

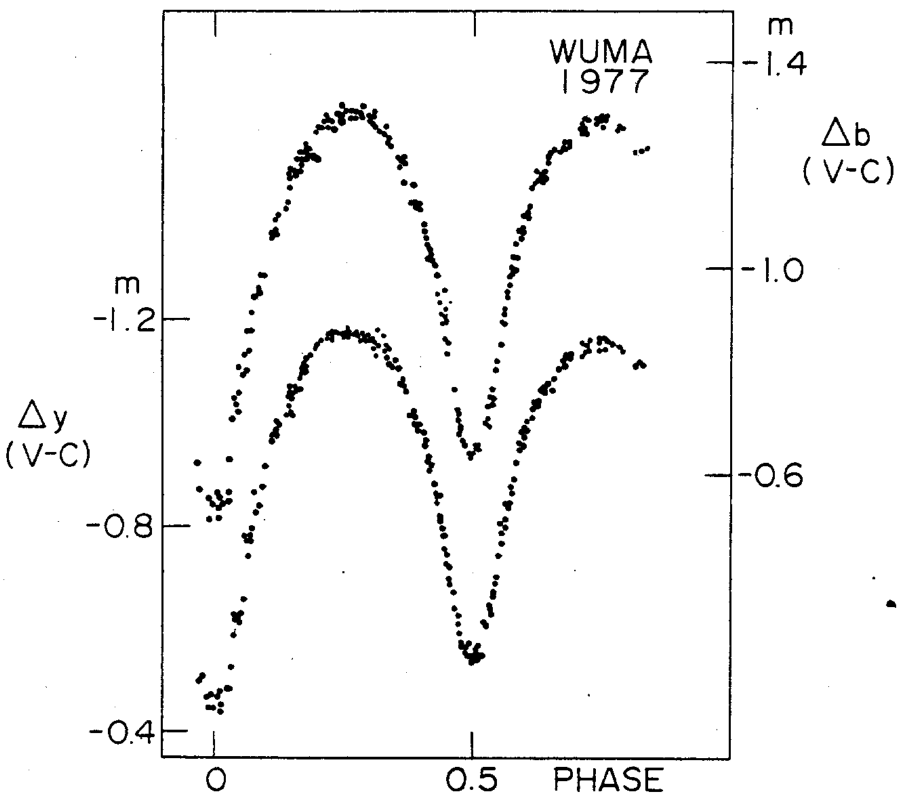

Figure 1. The y and b light curves of W UMa.

and b light curves are asymmetrical where the maximum near 0.25 phase is brighter than the corresponding maximum at 0.75 phase. The difference in the mean heights of the maxima at 0.25 phase relative to the maxima at 0.75 phase are 0.022 mag and 0.012 mag for the y and b observations, respectively. The loss of light at primary eclipse relative to the brighter maximum at 0.25 phase is 0.715 mag and 0.755 mag in y and b, respectively. The loss of light at secondary minimum is 0.632 mag and 0.660 mag in y and b, respectively.

Rigterink (1972) has made a study of the long term behavior of the outside eclipse light variations of W UMa and found evidence that the changes may be periodic with possible periods of ~500 days or ~1000 days. An analysis of all the available photoelectric light curves of W UMa up to 1979 is currently underway. Preliminary results suggest the existence of a migrating wave with a light amplitude of about 0.025 mag in yellow and a period of ~1100 days. It has already been pointed out by Hall (1976) that W UMa has several properties in common with RS CVn-type binaries-namely components of F to K spectral types, Ca II emission, and the possible migrating wave phenomenon. It has been suggested by Hall and others that many of the unusual properties of RS CVn systems can be accounted for by recourse to a model in which surface activity in the form of starspots cooler than their surroundings gives rise to the observed light variations. If the wave-like distortion apparently present in the light variation of W UMa arises from subluminous regions on one of the components, the migrating of the wave can be attributed to the effects of differential rotation where the subluminous region is centered perhaps 10° to 20° from the stellar equator. By analogy with the sun, differential rotation would cause the spotted region to move with a rotational period slightly longer than the equatorial rotational period. For W UMa where the rotational and orbital periods are expected to be synchronized, the small difference between orbital period and the rotational period of the spotted zone will cause the spotted region to move with the observed ~1100 day period relative to the frame of reference of the binary system. The observations indicate that the spotted region has persisted for at least 25 years. Continued monitoring of the light curve of W UMa would be very useful.

EDWARD F. GUINAN

Biruni Observatory
Shiraz, Iran. and
Department of Astronomy
Villanova University
Villanova, Pennsylvania 19085

SEYED - IRAJ NAJAFI
and
FARID ZAMANI - NOOR
Biruni Observatory
Shiraz, Iran

References:

Hall, D.S., (1976), IAU Colloq. No. 29, part 1. p. 287.

Rigterink, P.V., (1972), Astron. J., 77, 230.

Szafraniec, R., (1948), Acta Astron., 4, Series C, 81.