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PHOTOELECTRIC PHOTOMETRY OF THE SHORT-PERIOD ECLIPSING BINARY HW VIRGINIS

During a UBV survey of UV-bright objects HW Vir (BD−07°3477) was discovered to be an eclipsing binary (P_{orb}∼0.1167 days) by Menzies and Marang (1986). As a part of this survey Berger and Fringant (1980) obtained spectroscopy of HW Vir and classified it as an sdB star. Menzies (1986) obtained UBVRI light curves of this system and then Menzies and Marang (1986) analysed these light curves by WD-code. They also measured the radial velocity of the primary star and calculated the absolute dimensions of the components. Wood et al. (1993) also made UBVR photometry of the system and analysed the light curves using WD-code. In the recent annual report of SAAO Marang and Kilkenny (1994) announced that HW Vir shows a definite period decrease.

We included HW Vir in our observing program in 1992 and observed the system on one night in 1992, one night in 1993 and seven nights in 1994. Differential observations with respect to the comparison star BD−08°3411 were obtained with the 30cm Maksutov telescope of Ankara University Observatory. We used an OPTEC SSP-5A photometer head which contains a side on R-1414 Hamamatsu photomultiplier. We used BD−07°3467 as a check star and the magnitude differences between the check star and comparison star were constant within probable errors of ±0.022, ±0.013 and ±0.016 in U, B and V bands respectively. The light curves formed by these differential observations (in the sense variable minus comparison) are shown in Figure 1 for different filters with their respective B−V color curve (U observations are shifted vertically by +0.5 mag). Differential atmospheric extinction and heliocentric corrections were made. The phases of the light curves were calculated with the light elements

$$\mathrm{HJD(Min\ I)}=2448294.886472+0\overset{\mathrm{d}}{.}11671953\times\mathrm{E}$$

We derived ten mean times of minima from the new observations (six primary, four secondary) by using the well-known method of Kwee–Van Woerden (1956). The new estimates in different filters and their mean values are listed in Table I. Mean times of minima and their mean errors were generated with the formula

$$t_{min(mean)} = \frac{\sum_i (t_i/\sigma_i^2)}{\sum_i (1/\sigma_i^2)}$$

$$\text{and } \sigma^2_{mean} = \frac{1}{\sum_i (1/\sigma_i^2)}$$

Light curves in all filters exhibit a large reflection effect as mentioned before by several authors. In all wavelength bands, there is a shoulder of extra light in 0.06-0.12 phase interval which may be interpreted as a mass transfer effect.

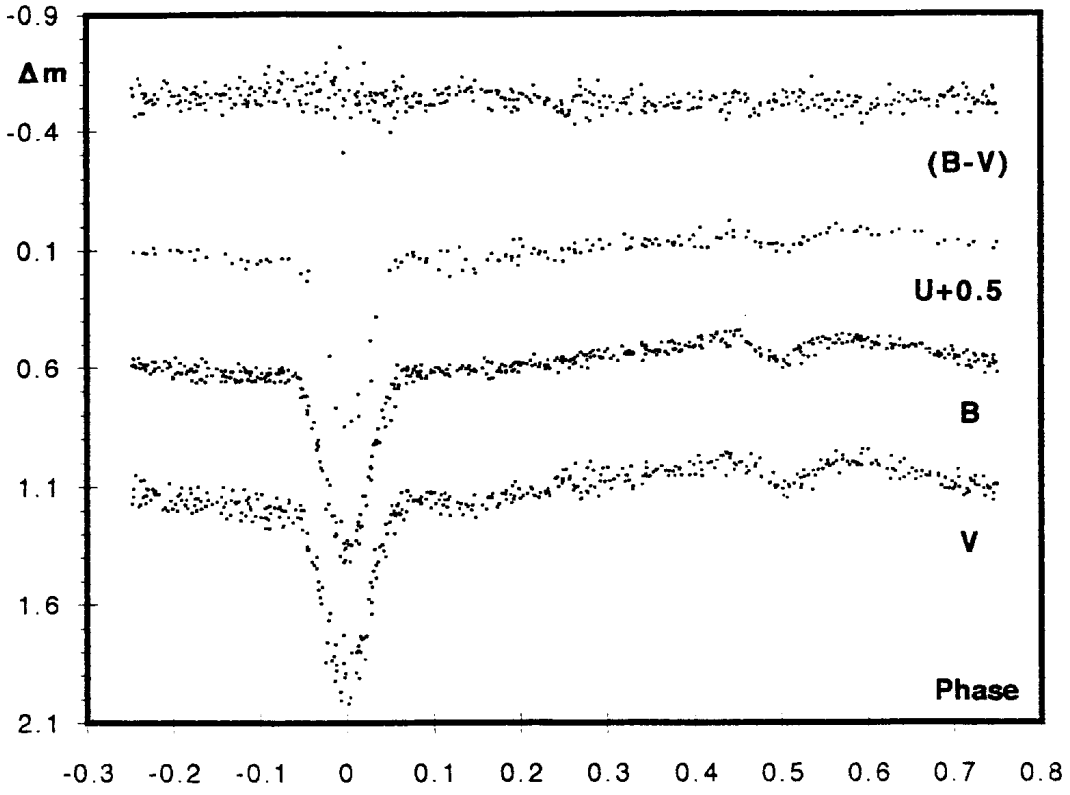

Figure 1

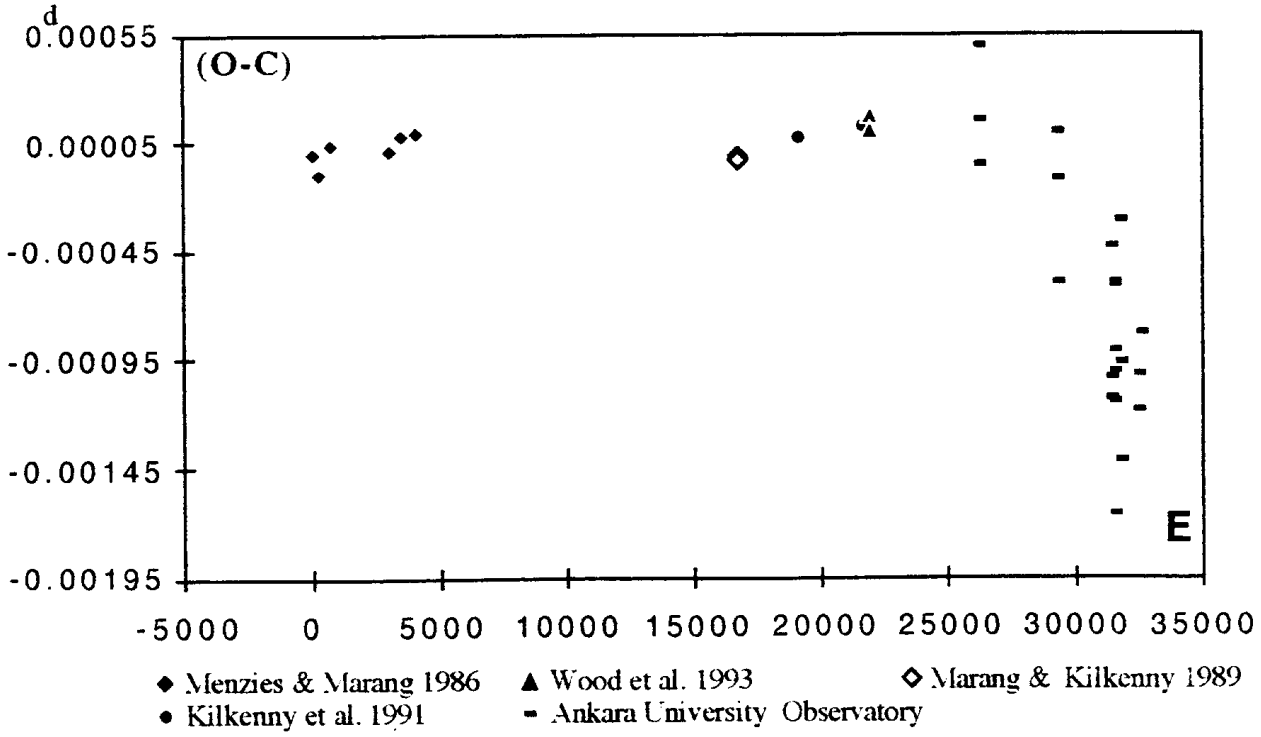

Figure 2

Table 1

Min. Type	HJD min +2400000	Mean err.	Filter	HJD Min(mean) +2400000	Std err.	Obs
I	48776.3548	±0.00046	V	48776.3552	±0.00013	SS
I	48776.3550	±0.00021	B			
I	48776.3553	±0.00018	U			
II	49149.3318	±0.00021	U	49149.3323	±0.00011	ZM
II	49149.3323	±0.00026	B			
II	49149.3325	±0.00015	V			
II	49393.5095	±0.00032	B	49393.5095	±0.00032	BA
I	49393.5671	±0.00017	V	49393.5672	±0.00005	BA
I	49393.5672	±0.00006	B			
II	49400.5114	±0.00050	B	49400.5121	±0.00013	SÖ
II	49400.5119	±0.00017	V			
II	49400.5125	±0.00023	U			
I	49400.5704	±0.00007	U	49400.5705	±0.00005	SÖ
I	49400.5705	±0.00008	B			
I	49400.5708	±0.00021	V			
II	49427.4739	±0.00010	B	49427.4742	±0.00009	BG
II	49427.4750	±0.00017	V			
I	49427.5327	±0.00010	V	49427.5327	±0.00005	BG
I	49427.5327	±0.00005	B			
I	49511.3372	±0.00016	V	49511.3373	±0.00008	BG
I	49511.3373	±0.00009	B			
I	49518.3407	±0.00008	B	49518.3407	±0.00008	BG

Observers: SS: S. Selam, ZM: Z. Müyesseroğlu, BA: B. Albayrak, SÖ: S. Özdemir, BG: B. Gürol.

We collected all available times of minima from the literature and constructed the O−C diagram which is shown in Figure 2. The E epochs were calculated with the light elements given by Menzies and Marang (1986) as,

$$\text{HJD (Min I)}=2445730.556074+0^{\text{d}}.1167196311\times\text{E}$$

Both primary and secondary times of minima follow the same trend of O−C variation which indicates zero eccentricity for the binary orbit. The O−C diagram shows a clear rapid period decrease which can be interpreted as active mass change between component stars. But, Wlodarczyk (1994) pointed out from his analysis of their own light curves, both components are well located inside its Roche lobe, and he suggests that period

changes most likely are resulting from are extended common envelope, remaining after the giant phase. Only the future accurate observations will help to settle the true nature of this period variation.

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Birol GÜROL
Selim SELAN
Ankara University Observatory
Science Faculty, 06100, Tandoğan
Ankara, Turkey

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