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UBV PRECISION LIGHT CURVES OF THE NEAR OR SHALLOW CONTACT BINARY, HW PERSEI

RONALD G. SAMEC[1,3], BRIAN J. CARRIGAN[2], RICHARD McDERMITH[2,3]

[1] Department of Physics, Bob Jones University, Greenville, SC 29614, USA
[2] Millikin University, Decatur, IL 62522, USA
[3] Visiting Astronomer, Lowell Observatory

As a part of our recent studies of particular eccentric binary candidates (Hegedüs, 1988), we have obtained UBV photoelectric light curves of HW Persei [S 3381, 54.1943 $\alpha(2000) = 3^{\rm h}58^{\rm m}46\overset{\rm s}{.}1$; $\delta(2000)=+44^\circ44'04''$]. Hoffmeister (1943) discovered the variability of HW Per and identified it as an Algol variable. Van de Voorde (1947) published 5 timings of minimum light and gave a photographic range of 13–13.7. Gessner (1966) published a photographic light curve with the secondary eclipse displaced to phase 0.45, along with several timings of minimum light and an ephemeris:

$$\text{JD Hel. Min. I} = 2428023.527 + 0\overset{\rm d}{.}634828 \times E. \qquad (1)$$

In addition, BBSAG observer Marek Wolf (1995), has provided one precision (CCD) epoch of minimum light.

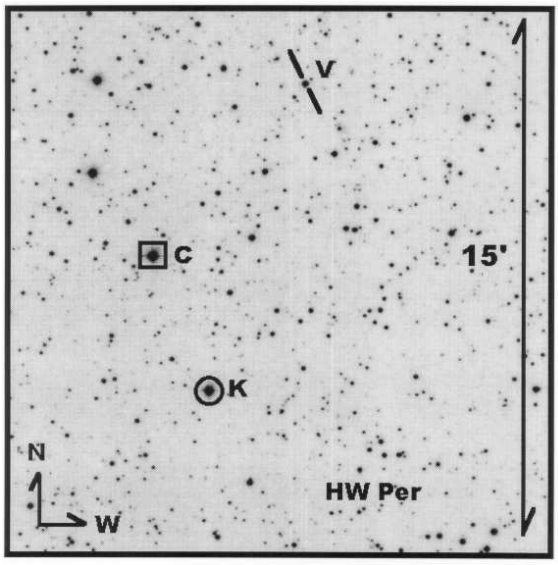

Figure 1. Finding chart for HW Per modified from a Digitized Sky Survey image

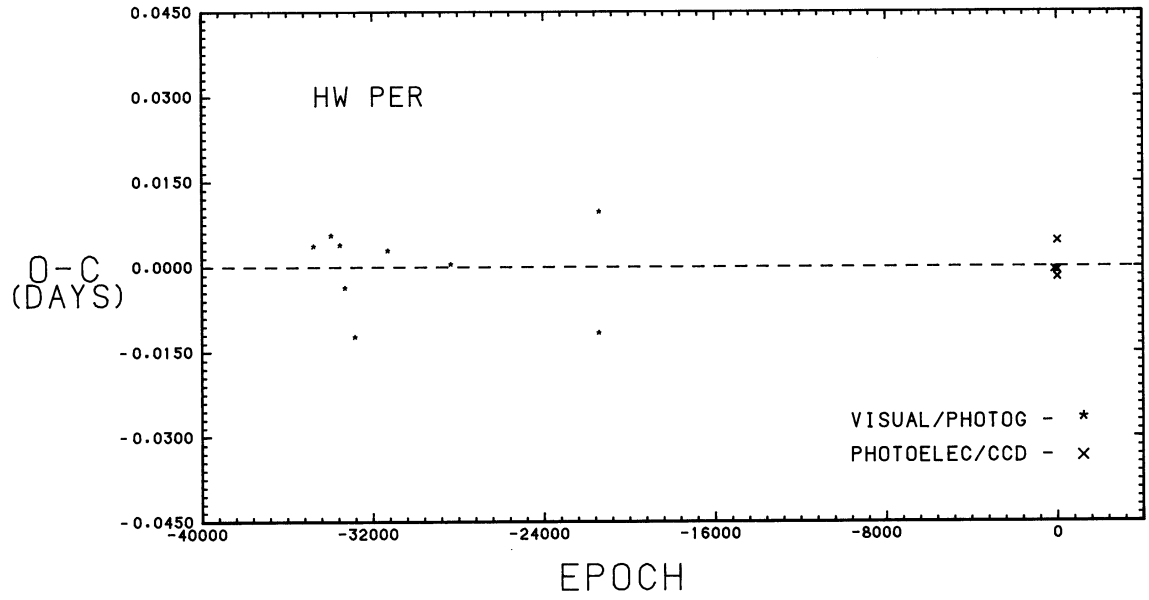

Figure 2. O−C residuals as calculated from equation 2

Table 1: Epochs of minimum light, HW Per

JD Hel 2450000+	Cycles	Minimum	Weight	O−C	Ref
13.350	−133.0	I	1.0	−0.0006	MW
97.7831(5)	0.0	I	1.0	−0.0007	PO
98.7340(12)	1.5	II	0.5	−0.0019	PO
100.6450(11)	4.5	II	0.5	0.0045	PO

Note: MW = Wolf 1995, PO = Present Observations

Our present observations were taken on 1996 January 14–19 at Lowell Observatory, Arizona. The 0.79-m Lowell telescope was used in conjunction with a thermoelectrically cooled S-13 type PMT and a set of standard UBV filters. Two nearby non-varying stars were used as comparison ($\alpha(2000) = 03^{\rm h}59^{\rm m}10\overset{\rm s}{.}7$, $\delta(2000) = 44°39'24''$) and check ($\alpha(2000) = 03^{\rm h}59^{\rm m}2\overset{\rm s}{.}5$, $\delta(2000) = 44°35'37''$) stars. The variable, comparison and check stars are given as V, C and K, respectively, on the finding chart given as Figure 1.

Our photometry and transformations give a magnitude range of V = 12.50–13.31, B−V = 0.55–0.60 for the variable, and V = 10.47, B−V = 0.459 and V = 9.72, B−V = 0.31 for the comparison and check stars, respectively. Dereddening calculations give photometric spectral types of A8 (phase 0.5), F4 and A7 for the variable, comparison and check stars, respectively.

Three mean epochs of minimum light were determined from observations made during one primary and two secondary eclipses. Bisection of chords was utilized in their determination. These epochs of minimum light are given in Table 1 accompanied by their probable errors in parentheses, along with the one by Wolf (1995).

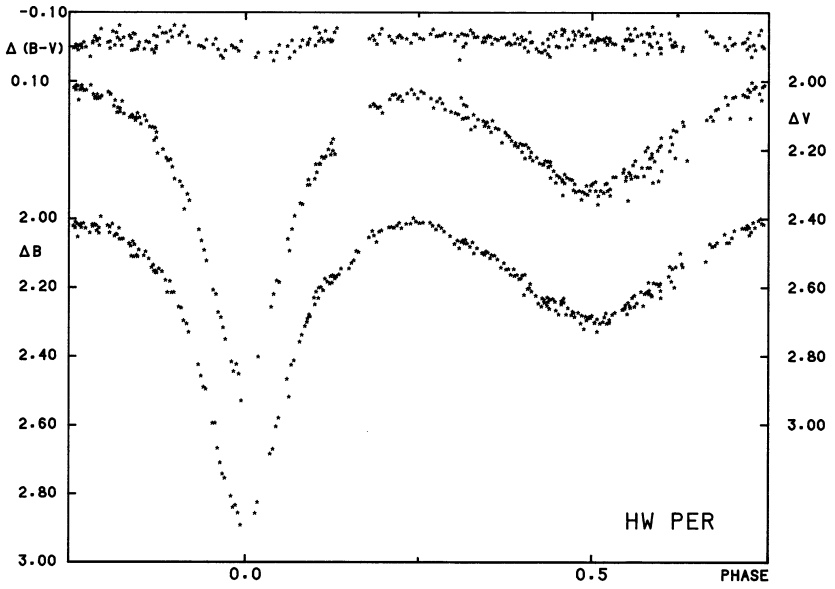

Figure 3. B, V and B−V photoelectric light and color curves as defined by the individual observations

From all available timings we calculated the improved ephemeris,

$$\text{JD Hel. Min. I} = 2450097.7838(26) + 0^{\text{d}}.63482861(18) \times E. \qquad (2)$$

Weightings for the shallow secondary eclipse timings were given a smaller value. O−C residuals calculated from Equation (2) are shown in Figure 2. The period appears to have remained fairly constant over the past sixty years.

The BV light curves and the B−V color curve as defined by the individual observations are shown as Figure 3 as differential magnitude (V−C), versus phase. Modern synthetic light curve calculations reveal that both shallow contact solutions with fillouts of $< 5\%$ and semi-detached solutions with secondary fillouts $< 5\%$ fit the observations quite well. The large temperature difference in components, T1∼7600, T2∼4800, would seem to preclude contact.

RM did a much of the preliminary work on this system in the Summer and Fall of 1996 as a part of research sponsored by the American Astronomical Society REU program.

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