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THE PERIOD OF THE HELIUM-WEAK VARIABLE STAR HR 1063

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Photoelectric *UBV* observations of the helium-weak variable star HR 1063 (HD 21699) have been obtained. These have been combined with other such observations to derive a period of 2.49246 ± 0.00035 days for the star. The "resonance period" near 1.7 days has been ruled out.

Key words: photometry, individual–stars, peculiar–stars, variable

I. Introduction

HR 1063 (HD 21699, V396 Persei) is a bright helium-weak star which is a member of the Alpha Persei cluster. Winzer (1974) found it to be variable in brightness and color with a period of 2.4761 (or 1.678) days and with amplitudes of 0.027, 0.035, and 0.050 in *V*, *B*, and *U*, respectively. Mallama and Molnar (1974) used a few pseudo-*U* and -*B* observations to refine the period to 2.4928 (or 1.6857) days, which is probably within the uncertainty of Winzer's value. Unfortunately, Mallama and Molnar's results have only been published in the form of an abstract.

A variety of UV and optical spectroscopic and polarimetric observations of this star have since been obtained (Brown et al. 1984), and it has become apparent that a more accurate and well-documented period must be determined in order to phase these observations with each other and with the photometry. At the suggestion of C. T. Bolton, I therefore obtained new *UBV* observations of this star in late 1984. Shortly afterward, we became aware of some *V* observations which had been obtained in 1983–84 for the same purpose. These observations have now been described and analyzed (Landis, Louth, and Hall 1985) and deposited in the IAU Archives of Unpublished Photoelectric Observations. Sufficient observations are now available to derive an accurate period for the star.

II. New Observations

New photometric observations of HR 1063 were made in late 1984 with the No. 4 0.4-m telescope at Kitt Peak National Observatory near Tucson, Arizona. The photometer employed a 1P21 photomultiplier and pulse-count electronics. The observations were made through standard *UBV* filters, and a neutral density filter was used to reduce the count rate. Unfortunately, the neutral density filter proved to be highly nonneutral in the violet, and it proved impossible to transform the *U* observations accurately to the standard *UBV* system. The comparison stars were HR 1051 (HD 21551, B8 Vnn) and HR 1059 (HD 21661, B9 III). Both of these stars appear to be constant; the rather large scatter in ΔU (HR 1051 − HR 1059) in Table I is probably of instrumental origin. The observations were made at a variety of hour angles in order to be able to choose between the 2.5- and 1.7-day periods. The observations, corrected for differential extinction and transformed to the (*U*)*BV* system, are listed in Table I.

III. Results

The observations, phased with a period of 2.49 days, are shown in Figure 1. The fit is satisfactory. The amplitudes of 0.023, 0.032, and 0.049 in *V*, *B*, and U, respectively, compare favorably with those obtained by Winzer (1974). The resonance period of 1.69 days does *not* fit the observations.

All of the published *V* observations (and subsets thereof) were then analyzed using the period-finding method of Deeming (1975). Those of Landis et al. (1985) alone gave a best period of 2.486 ± 0.036 days; the error is the half-width of the power at half-maximum. Adding the observations in Table I gave a best period of 2.4919 ± 0.0055 days. Adding those of Winzer (1974) gave a best period of 2.49246 ± 0.00035 days, with 2.49097 days as a close second-best. The first period, however, is in close agreement with that obtained by Mallama and Molnar (1974) and is most likely the correct one.

The mean magnitude differences $\langle \Delta V \rangle$ and $\langle \Delta B \rangle$ in Figure 1 agree with those obtained by Winzer (1974) and Landis et al. (1985), but $\langle \Delta U \rangle$ does not. As stated earlier, this is most likely due to the effect of the "neutral" density filter, and the $\langle \Delta U \rangle$ obtained by Winzer (1974) should probably be taken as correct and constant.

The following ephemeris represents the photometric variations of this star.

$$\text{HJD (maximum light)} = 2446001.659 + 2.49246\,N \ .$$

I am grateful to Dr. C. T. Bolton for pointing out the need for more observations of this star, and for reading

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TABLE I

UBV Photometric Observations of HR 1063 (HD 21699)

HJD	Phase*	HR 1063 - HR 1051			HR 1051 - HR 1059		
2400000+		ΔV	ΔB	ΔU	ΔV	ΔB	ΔU
46002.7132	0.423	-0.348	-0.408	-0.540	-0.575	-0.708	-0.770
46002.8701	0.486	-0.346	-0.403	-0.536	-0.580	-0.715	-0.767
46004.6792	0.212	-0.356	-0.424	-0.576	-0.582	-0.700	-0.768
46004.9792	0.332	-0.348	-0.408	-0.552	-0.576	-0.709	-0.762
46005.6493	0.601	-0.346	-0.411	-0.537	-	-	-
46005.9583	0.725	-0.357	-0.421	-0.546	-0.568	-0.708	-0.771
46006.6965	0.021	-0.370	-0.436	-0.583	-0.578	-0.703	-0.755:
46006.9729	0.132	-0.359	-0.426	-0.556	-	-	-
46007.7507	0.444	-0.353	-0.411	-0.531	-0.571	-0.708	-0.780
46007.9208	0.512	-0.349	-0.405	-0.540	-	-	-
46008.7681	0.852	-0.364	-0.432	-0.567	-0.577	-0.706	-0.762
46008.9597	0.929	-0.366	-0.438	-0.574	-0.582	-0.704	-0.772
46009.7604	0.250	-0.362	-0.421	-0.557	-0.570	-0.699	-0.772
46009.9625	0.331	-0.360:	-0.405:	-0.540:	-0.575	-0.705	-0.762
46010.6903	0.623	-0.349	-0.410	-0.535	-0.575	-0.707	-0.773

*Ephemeris: HJD (maximum light) = 2446001.659 + 2.49246 N

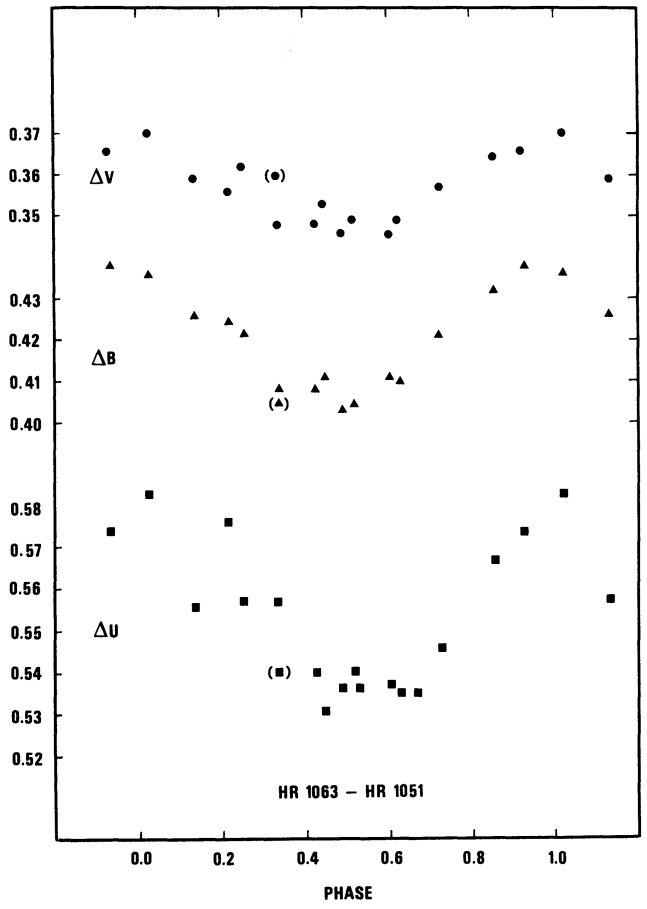

FIG. 1–Photoelectric *UBV* observations of HR 1063 relative to HR 1051, phased together with a period of 2.49246 days. A possible zero-point error in the Δ*U* scale is discussed in the text.

the manuscript. I also thank Dr. D. S. Hall for sending a preprint of the paper by Landis et al. and a copy of the observations on which it was based. This work was made possible by an allotment of observing time at Kitt Peak National Observatory, and by a grant from the Natural Sciences and Engineering Research Council of Canada.

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