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HR 5 = ADS 61: A NEW VARIABLE STAR

We obtained differential photoelectric photometry of the bright (V = $6^m.0$) visual binary HR 5 = ADS 61 in late 1981 and in late 1982 at five different observatories, finding it to be variable with a period of $1^d.08$. All observers used HD 225257 as the comparison star.

Fried observed with the 16-inch at Braeside Observatory in Flagstaff, Arizona. Brettman observed with the 10-inch at the Braeside-Midwest Observatory in Huntley, Illinois. DuVall observed with the 16-inch at the Modine-Benstead Observatory in Racine, Wisconsin. Poe observed with the 24-inch at Dyer Observatory in Nashville, Tennessee. Shaw observed with the 24-inch at the University of Georgia Observatory in Athens, Georgia. Poe observed in V and B of the UBV system. Shaw observed in the five bandpasses of the Washington photometric system, which includes ultraviolet (c), blue (m), visual (v), red (T1), and infrared (T2). All of the others observed only in the V of the UBV system.

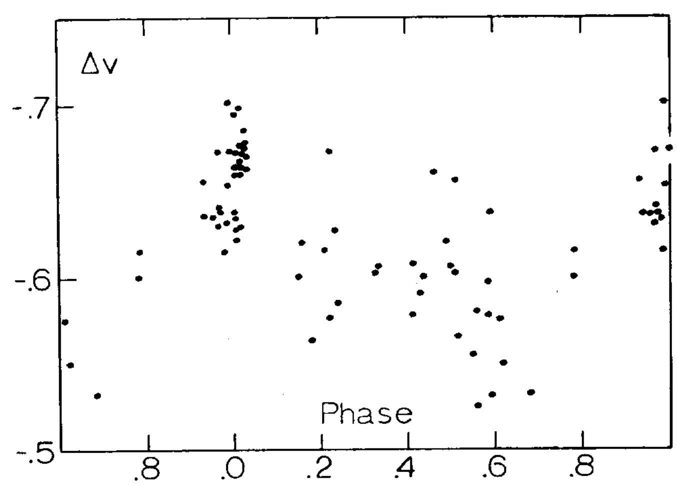

Figure 1

Differential visual magnitudes on 11 nights observed at the Braeside and Braeside-Midwest Observatories. Phase is computed with the period $1^d.082$. Zero phase corresponds to JD 2444900.0.

Analysis of the Braeside and Braeside-Midwest data, including observations on 11 nights between JD 2444901.7 and 2444948.7, indicated a period of $1\overset{d}{.}082 \pm 0\overset{d}{.}002$. Fourier analysis of that light curve, shown in Figure 1, with a sine-curve fit indicated a total amplitude of $\Delta V = 0\overset{m}{.}066 \pm 0\overset{m}{.}012$. Zero phase in that light curve is placed arbitrarily at JD 2444900.0 but the Fourier analysis indicated a minimum at $0\overset{P}{.}592 \pm 0\overset{P}{.}036$, which corresponds to $2444915.79 \pm 0\overset{d}{.}04$.

Shaw observed only on two consecutive nights, shown in Figure 2, but those two nights defined a minimum very clearly at JD $2445270.66 \pm 0\overset{d}{.}01$. Because the two minima thus determined are separated by almost precisely 328 cycles, it seems that cycle count has not been lost. This lets us take advantage of the long baseline between the two years and refine the period to $1\overset{d}{.}0819 \pm 0\overset{d}{.}0001$. If the separation was 327 or 329 cycles, however, the implied period would be $1\overset{d}{.}085$ or $1\overset{d}{.}079$, both marginally consistent with the 1981 determination of $1\overset{d}{.}082 \pm 0\overset{d}{.}002$.

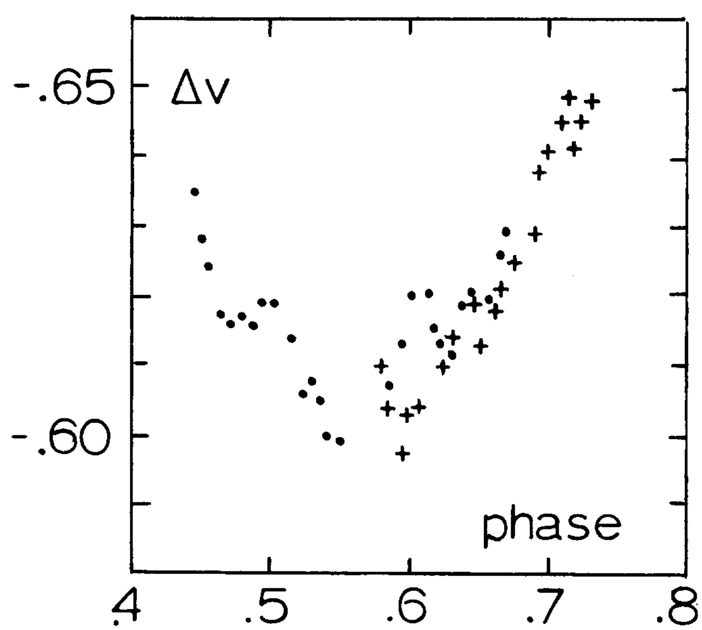

Figure 2

Differential visual magnitudes on two consecutive nights observed at the University of Georgia Observatory. Phase is the same as in Figure 1. Crosses are the first night, circles are the second.

Although Shaw's photometry evidently did not cover the full range of the light variation, we can say how the amplitude depends on wavelength. The ratios in the sense ultraviolet : blue : visual : red : infrared are 1.41 : 0.99 : 1.00 : 0.74 : 0.48, respectively. Thus we see that, compared to the infrared, the variation is about twice as large in the visual and about three times as large in the ultraviolet.

The comparison star HD 225257 is a good choice in that it is only a few arcminutes away from the variable. The color match, however, is not good, with Poe's photometry showing $\Delta(B-V) = +0^{m}.64$. The data plotted in Figures 1 and 2 have not been transformed to V of the UBV system, but that is not important here since they have been used primarily to determine the period.

According to Lippincott (1963) HR 5 = ADS 61 is a visual binary with a semi major axis of $1''.43$ and an orbital period of 106.83 years. The two components are dG4 and dG8, differing in visual magnitude by $0^{m}.75$. She derived a total mass of $2.8 \pm 0.6\ M_{\odot}$. According to the Fourth Edition of the Yale Bright Star Catalogue, HR 5 is of additional interest in that an invisible companion may be orbitting the dG8 component with a period of 6.9 years. Since both the dG4 and the dG8 components were measured together in our photometry, we have no way of knowing which one is responsible for the 1.08-day variability we have discovered. Spectroscopic observations may help determine the mechanism for the photometric variability. One of the two stars may be a rapidly-rotating unevenly-spotted star, or one of the two may be a spectroscopic binary with an orbital period of $1^{d}.08$.

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Reference :

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