COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 1459

Konkoly Observatory
Budapest
1978 August 16

HR 5110: A NEW VARIABLE STAR

We obtained photoelectric photometry of the bright ($V=5^{m}.0$) non-eclipsing RS CVn binary HR 5110 (=HD 118216) to see if there is a distortion wave in its light curve. We did discover it to be a variable star, but the light variation was very small, $\Delta V=0^{m}.010$. Ironically, we are probably not seeing a distortion wave afterall but rather just the familiar reflection effect.

Relevant recent references on HR 5110 are Conti (1967), Popper and Ulrich (1977), and Eggen (1978). Because we expect a light variation in a short period binary to be a function of orbital phase, we computed phases with the ephemeris

$$JD\ (hel.) = 2{,}417{,}021.60 + 2^{d}.6131738 \cdot E. \qquad (1)$$

The initial epoch here is a time of conjunction with the F-star behind and the K-star in front; it was derived from the time of periastron given by Harper (1938). The orbit is not necessarily eccentric, because the eccentricity is within one standard deviation of zero. The period is the value derived recently by Conti (1967).

On 54 different nights between 1-2 March and 23-24 June 1978, we obtained a total of 181 differential magnitudes at 6 different observatories. Several nights were observed at more than one observatory. A tally is given below, where n is the number of individual observations and m is the number of nights.

Observatory	Aperture	n	m
Dyer	24-in.	38	14
Kitt Peak	16	28	12
Hickox	10	33	10
Landis	8	32	12
Louth	11	42	26
Schlegel-McHugh	20	8	4

Most of the observations were made in one color (V of the UBV system) and were made differentially with respect to the same comparison star (25 CVn, including the faint visual companion 1.5 arcseconds away). All individual differential magnitudes were corrected for atmospheric extinction with mean extinction coefficients and transformed to the UBV system with known transformation coefficients and a mean value of $\Delta(B-V)$ between the variable and the comparison. Then we formed normals of all those observations made at one observatory on one night.

The normals were analyzed separately in two groups: the first two observatories in Group A and the last four observatories in Group B. Group A included observations between JD 2,443,606.8 and 2,443,673.7; Group B included observations between 2,443,569.7 and 2,443,683.7. The light was expressed as a truncated Fourier series,

$$\ell = A_o + A_1\cos\theta + A_2\cos 2\theta + B_1\sin\theta \ , \qquad (2)$$

with $\ell = 1$ fixed at $\Delta V = 0\overset{m}{.}145$. The resulting coefficients and their errors are given below.

	Group A	Group B
A_o	1.0012 ±0.0006	1.0019 ±0.0010
A_1	-0.0040 ±0.0009	-0.0051 ±0.0016
A_2	-0.0016 ±0.0009	-0.0001 ±0.0014
B_1	-0.0024 ±0.0008	-0.0001 ±0.0014
θ(min.)	$0\overset{p}{.}08$ ±0.03	$0\overset{p}{.}00$ ±0.05
ΔV(max. to min.)	$0\overset{m}{.}010$ ±0.002	$0\overset{m}{.}011$ ±0.003
ΔV at $\ell=A_o$	$+0\overset{m}{.}1437$ ±0.0006	+0.1429 ±0.0010

Also given are (1) the value of θ(min), the phase of the minimum of the distortion wave /although in this case we do not believe it is a distortion wave/, (2) the value of ΔV, the amplitude of the wave from maximum to minimum, in magnitude units, and (3) the mean magnitude, ΔV at $\ell=A_o$.

Although the variation we have found is quite small, total amplitude only $0\overset{m}{.}010$, we believe it is real because the agreement between Groups A and B so close. Notice that the amplitude,

the mean magnitude, and θ(min) all agree within their respective errors.

Because the variation has its maximum so near the phase when the facing hemisphere of the cooler star is towards earth, we are most probably seeing the differential reflection effect. It should be mentioned that there is some question about the constancy of the orbital period, with Harper (1938) having found $2^{d}.61312$ and $2^{d}.61314$ at two different epochs and Conti (1967) having derived $2^{d}.6131738$ at a later epoch. The accumulated effect of a $0^{d}.00002$ or $0^{d}.00003$ error in equation (1) would produce an uncertainty of $\sim 0^{p}.1$ in our phases.

Although HR 5110 has never been listed as a variable or suspected variable in any of the editions of the General Catalogue of Variable Stars or its supplements, we point out that the 3 values of V listed in the U.S. Naval Observatory UBV Catalogue show a range of $0^{m}.05$. Therefore HR 5110 perhaps ought to be reobserved from time to time in case a distortion wave of variable amplitude does exist and we happen to have observed it at minimum amplitude.

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References:

Conti, P.S., 1967, Ap.J. 149, 629
Eggen, O.J., 1978, I.B.V.S. No. 1426
Harper, W.E., 1938, P.D.A.O. 7, 141
Popper, D.M. and Ulrich, R.K., 1977, Ap.J. 212, L131