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

Number 2543

Konkoly Observatory
Budapest
27 June 1984

HU ISSN 0374-0676

HD 8358 AND HD 106225: TWO NEW VARIABLE STARS

We began photometry and spectroscopy because there was spectroscopic evidence that they are chromospherically active stars of the RS CVn or BY Dra type. Bidelman (1981) reported spectral type G and slightly fuzzy spectral lines (suggestive of rapid rotation) for HD 8358 and spectral type gK and strong Ca II H and K emission (evidence of strong chromospheric activity) for HD 106225. HD spectral types and approximate V magnitudes are G0 and $8^m.43$ for HD 8358 and K0 and $8^m.1$ for HD 106225.

Photometry was obtained in the UBV bandpasses with the 48-inch telescope at Cloudcroft Observatory and with the 30- and 36-inch telescopes at McDonald Observatory. The comparison star was SAO 109848 for HD 8358 and SAO 138628 for HD 106225. Radial velocity measures were obtained for

Table I

Photometry of HD 8358

JD(hel.)	ΔV	ΔB	ΔU
2445153.949	-1.007	-	-
167.970	-0.999	-	-
168.946	-0.897	-1.124	-
187.866	-0.865	-1.106	-
188.959	-0.857	-1.089	-
191.948	-0.953	-	-
320.664	-0.937	-1.190	-1.653
321.614	-0.941	-1.200	-1.676
325.607	-1.003	-1.274	-1.762
327.608	-0.931	-1.188	-1.656
332.612	-0.946	-1.196	-1.667
337.616	-0.991	-1.260	-1.744
338.624	-0.994	-1.264	-1.748
339.620	-0.968	-1.234	-1.717
340.599	-0.894	-1.149	-1.620
341.616	-0.874	-1.115	-1.580
342.631	-0.861	-1.103	-1.564
343.624	-0.879	-1.123	-1.589
344.649	-0.891	-1.140	-1.604
345.611	-0.943	-1.203	-1.662
357.626	-0.911	-1.168	-1.631
360.619	-0.950	-1.206	-1.696
2445361.615	-0.958	-1.217	-1.687

Table II

Photometry and Spectroscopy of HD 106225

JD(hel.)	ΔV	ΔB	JD(hel.)	V_r
2445110.713	0.566	0.489	2444736.764	- 7.0
111.695	.588	.516	737.665	+13.3
113.696	.688	.623	738.685	+35.0
116.674	.834	-	2444739.757	+45.7
119.677	.631	-	2445075.814	-20.4
120.685	.577	-	076.786	-37.1
121.689	.600	-	077.814	-40.2
128.671	.811	-	078.762	-29.6
141.689	.577	-	079.834	+ 0.5
146.639	.726	-	356.994	-41.1
2445153.639	.604	-	358.929	-41.7
			360.922	+ 8.2
			361.954	+34.6
			717.980	+21.9
			720.000	-27.8
			2445721.990	-51.8

HD 106225 at Kitt Peak National Observatory. The data are presented in Tables I and II. For the photometry Δ means variable minus comparison, the differential magnitudes have been corrected for differential extinction and transformed differentially to the UBV system, and each value is a nightly mean of three separate differential measures between variable and comparison. Before JD 2445200 the photometry was obtained at Cloudcroft; after that date it was obtained at McDonald.

When the ΔV data for HD 8358 were analyzed by the method of Lafler and Kinman (1965), no satisfactory period was found. In subsequent analysis we excluded the six (Cloudcroft) nights which were obtained 130 days earlier than the other (McDonald) nights; the result was three periods which gave comparably good fits: $0^{d}.520 \pm 0^{d}.001$, $1^{d}.805 \pm 0^{d}.002$, and $12^{d}.75 \pm 0^{d}.25$. Because the McDonald observations were made at very nearly the same time of night each night, i.e., they are separated by very nearly integral multiples of a day, we suspected those three values might be beat periods of each other. This is probably so, because they are related by the expression

$$\frac{1}{0.520} - 1 = \frac{1}{1.085} = 1 - \frac{1}{12.75}$$

to within their respective uncertainties. The early (Cloudcroft) photometry was not able to resolve the ambiguity, because it gave equally good light curves with all three periods. We also point out that its light curve shape was significantly different from that given by the McDonald photometry, and that the 130-day gap separating the two was too long to let the two be phased together reliably.

In Figure 1 we plot the McDonald photometry from Table I versus phase computed with the ephemeris

$$JD\ (hel.) = 2445214.7 + 0^{d}.520\ n\ ,$$

where the initial epoch is arbitrary and the value of the period is not necessarily preferred over the other two. The total amplitude of the light variation is $0^{m}.14$ in V and the shape is noticeably asymmetric.

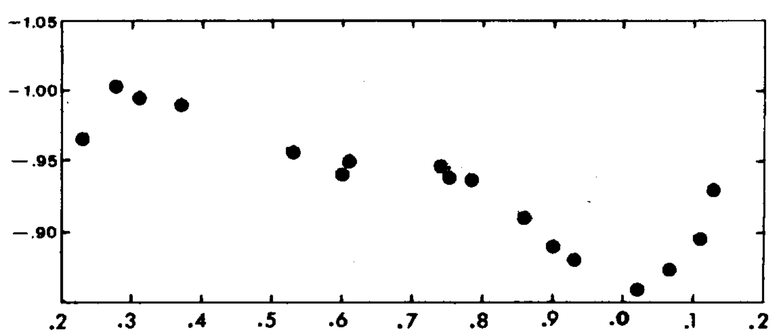

Figure 1

When the ΔV data for HD 106225 in Table II were analyzed with the method of Lafler and Kinman (1965), the best light curves were obtained with periods of $0^{d}.91 \pm 0^{d}.01$ and $10^{d}.6 \pm 0^{d}.1$. As with HD 8358, because the data were obtained at nearly integral-day multiples, we suspected these two values are beat periods of each other. Indeed they are related by the expression

$$\frac{1}{10.6} = \frac{1}{0.91} - 1$$

to within their respective uncertainties.

When the radial velocity data for HD 106225 in Table II were analyzed with the method of Lafler and Kinman (1965), the best fits were obtained with periods of $6^{d}.851 \pm 0^{d}.001$ and $10^{d}.389 \pm 0^{d}.001$. We are inclined to rule out the smaller of these, because it produces a radial velocity curve very skewed in shape and hence indicative of an unreasonably large orbital ec-

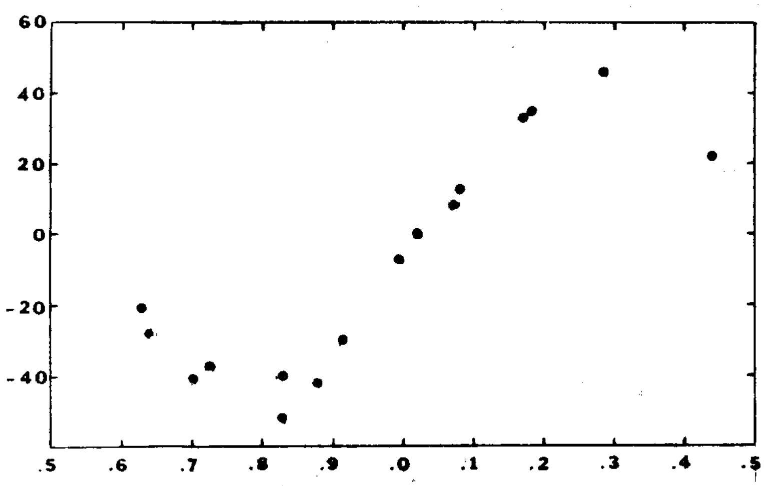

Figure 2

centricity. Figure 2 is a plot of the radial velocity values in Table II versus phase computed with the ephemeris

$$JD(hel.) = 2445214.7 + 10^{d}.389\ n\ ,$$

where the initial epoch is arbitrary.

The Ca II H and K emission observed in HD 106225 makes us think it probably is an RS CVn binary. In most RS CVn binaries photometric variability results from rotational modulation as one of the two stars, its surface darkened unevenly by large-scale spot activity, rotates approximately synchronously with the orbital period. Consequently we believe the photometric (rotational) period should be close to the spectroscopic (orbital) period and on that basis prefer $10^{d}.6$ rather than $0^{d}.91$ as the correct photometric period. Figure 3 is a plot of the ΔV values from Table II versus phase computed with the ephemeris

$$JD(hel.) = 2445214.7 + 10^{d}.60\ n\ ,$$

where the initial epoch is arbitrary. The total amplitude of the light variation is approximately $0^{m}.25$ in V and the shape is very nearly sinusoidal. Comparing the photometric period ($10^{d}.6 \pm 0^{d}.1$) with the spectroscopic period ($10^{d}.389 \pm 0^{d}.001$), we see the rotation is synchronized with the orbital motion to within 2.0% ± 1.0%.

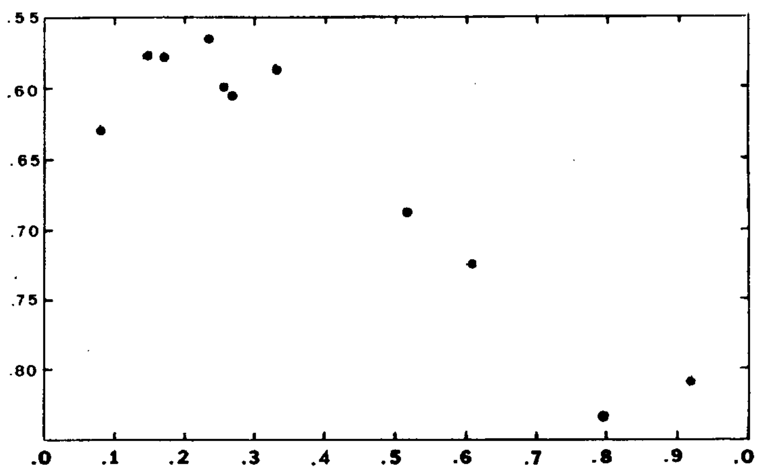

Figure 3

For HD 8358 we need more photometry, obtained throughout a single night, to determine whether $0^{d}.52$ or $1^{d}.083$ or $12^{d}.75$ is the correct period; and we need radial velocity data to determine whether it is a close binary or a rapidly rotating single star. For HD 106225 we need more photometry, over a longer baseline of time, to improve the precision of the photometric period.

FRANCIS C. FEKEL
DOUGLAS S. HALL

Dyer Observatory
Vanderbilt University
Nashville, Tennessee 37235

GREGORY W. HENRY

McDonald Observatory
Fort Davis, Texas 79734

References:

Bidelman, W. P. 1981, A.J. 86, 553.

Lafler, J. and Kinman, T. D. 1965, Ap.J. Suppl. 11, 216.