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A NEWLY DISCOVERED VARIABLE: THE Ap STAR HR 5153

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ABSTRACT

The Ap star HR 5153 was discovered to be a periodic variable. The mean amplitude (maximum to minimum) is 0.056 mag in B and 0.052 mag in U, but there appears to be no variation in V. The ephemeris for minimum light in B is JD (hel.) = 2440753.713 + $1^d.706E \pm 0^d.001$.

I. INTRODUCTION

The fact that HR 5153 is an Ap star with strong strontium lines was pointed out to us by Dr. Arthur Young of San Diego State College. Bidelman (1965) classified it Ap with strong strontium lines in 1965, and Cowley and Cowley (1965) and Cowley *et al.* (1969) described it as a SrCrEu star.

II. OBSERVATIONS AND DATA REDUCTION

HR 5153 was observed for 10 nights with the Kitt Peak No. 4 16-inch (41-cm) telescope in 1970 May and June, for 16 nights with the Kitt Peak No. 3 16-inch telescope in 1971 June and July, and for four nights in 1971 June with the Lowell Observatory 21-inch (53-cm) reflecting telescope. Each telescope was equipped for UBV photometry. The Kitt Peak instruments utilized refrigerated 1P21 photomultiplier tubes, and the Lowell telescope employed a refrigerated EMI 6256S photomultiplier tube.

Our primary comparison star was HD 119992 (F5), and our secondary comparison star was HD 119332 (K0). HR 5153 was observed differentially in three colors with respect to these two comparison stars, the details of our observing sequence having already been described by Burke, Rolland, and Boy (1970). The details of the data reduction of the period determination are also described in that paper.

III. RESULTS

The average difference in magnitude between our two comparison stars, in the sense HD 119332 minus HD 119992, and the standard deviation of the magnitudes determined on different nights was $\Delta V = 1.297 \pm 0.007$ mag, $\Delta B = 1.649 \pm 0.012$ mag, and $\Delta U = 2.177 \pm 0.014$ mag. One of these comparison stars may be slightly variable because the internal standard deviation of magnitudes determined within each night was considerably smaller: usually no more than 0.004 mag in B and V and only a little larger in U. However, the large standard deviations may have been caused by the fact that the comparison stars are of different spectral types, and that transformation coefficients may not be perfect since three telescopes were used. Two observing sessions were separated by about one year. Even with extensive analysis of the data we could not prove that one of the comparison stars is slightly variable.

The differential magnitudes of HR 5153 determined with respect to HD 119992 on

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TABLE I

Differential UBV Magnitudes (HD 119992 minus HR 5153)

JD (hel.) 2440000+	Phase	ΔV	ΔB	ΔU
749.764	0.686	0.182	0.584	0.507
753.713	.000	.192	.529	.480
755.695	.162	.186	.560	.491
756.707	.755	.183	.573	.515
758.731	.941	.178	.521	.461
760.736	.116	.172	.521	.463
761.690	.675	.183	.577	.515
762.693	.263	.177	.544	.496
763.696	.851	.183	.518	.452
767.718	.208	.188	.576	.505
1102.720	.552	.188	.587	.521
1103.688	.120	.182	.534	.479
1105.716	.210	.186	.580	.504
1106.707	.790	.192	.534	.473
1108.707	.061	.191	.519	.473
1109.705	.646	.178	.562	.501
1112.716	.411	.183	.568	-
1116.707	.751	.178	.528	-
1117.749	.361	.183	.577	-
1118.713	.926	.193	.537	-
1121.712	.683	.174	.537	.484
1122.694	.259	.193	.590	.519
1123.720	.860	.189	.523	.473
1125.708	.025	.175	.527	.491
1127.698	.192	.183	.533	.478
1134.688	.289	.174	.574	.518
1135.692	.877	.190	.512	.468
1136.721	0.480	0.185	0.574	0.515

28 nights are listed in table 1. The phase has been calculated with the following ephemeris for minimum light in B:

$$\text{JD (hel.)} = 2440753.713 + 1^{d}.706E \pm 0^{d}.001 .$$

A preliminary period was determined by using the method described by Burke *et al.* (1970). A light curve of all observed points in 1970 was drawn as was another for the 1971 points. The time interval between a point on the rising edge feature of each of these was divided by the number of cycles to refine the period. All observations are plotted in figure 1 versus this phase, where it can be seen that HR 5153 is definitely variable, with a mean amplitude (from maximum to minimum) of 0.056 mag in B and 0.052 mag in U but with apparently no variation in V. The average of V was 0.183 mag, with a standard deviation from night to night of only 0.011 mag. The authors know of no other Ap star which shows so large a mean amplitude variation in B but no apparent variation in V. The *uvby* photometry of Wolff and Wolff (1971) showed a somewhat similar effect in β CrB but not nearly so pronounced.

Since a number of Ap stars which show such UBV variation have been found to be magnetic variables and/or spectroscopic variables, we suggest that HR 5153 may be an appealing spectroscopic object.

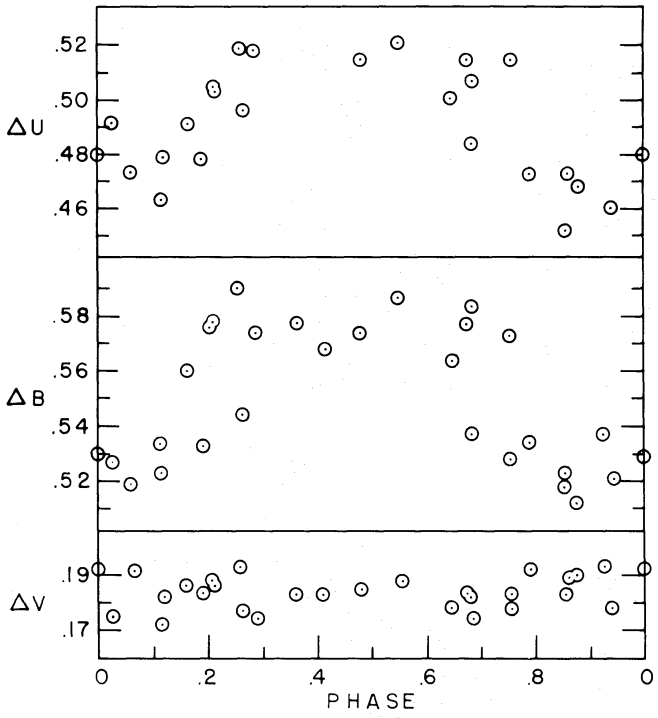

FIG. 1.—*UBV* light curves of HR 5153. The ordinates are differential magnitudes, in the sense HD 119992 minus HR 5153, on the standard *UBV* system. The abscissa is phase computed with the ephemeris given in the text.

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REFERENCES

Bidelman, W. P. 1965, *Vistas in Astronomy*, **8**, 53.
Burke, E. W., Rolland, W. W., and Boy, W. R. 1970, *J.R.A.S. Canada*, **64**, 353.
Cowley, A. P., and Cowley, C. R. 1965, *Pub. A.S.P.*, **77**, 184.
Cowley, A., Cowley, C., Jaschek, M., and Jaschek, C. 1969, *A.J.*, **74**, 375.
Wolff, S. C., and Wolff, R. J. 1971, *A.J.*, **76**, 422.