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DETERMINATION OF THE UNIQUE PERIOD FOR THE Ap STAR HD 184905

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ABSTRACT

This Ap star was discovered to be variable by Burke, Rolland, and Boy in 1970 with the period of 1.855 days. Morrison and Wolff in 1971 reported their data were better fit by a period of 2.17 days. Since that time different observers preferred one or the other of these periods. These observations show the unique period of variation of this star to be 1.84532 ± 0.00004 days.

Key words: period determination–Ap star

I. Introduction

This star was listed as a magnetic variable by Babcock (1958). Burke, Rolland, and Boy (1970) observed it with *UBV* photometry and discovered that it is variable. We stated that the period was 1.855 days. Morrison and Wolff (1971) observed this star photoelectrically and found that their data were better fit by a 2.17-day period. They pointed out that either set of data was fitted by either period and that additional observations would be necessary to eliminate the spurious period.

Tanner (1948) showed that whenever observations are made at any constant interval, such as one day, to determine period of any sort of periodic variable there will always be three other periods which can be fit by that data. Any period determined from such data can be used to predict the three additional periods and such data can never be used to eliminate the three of those four periods which are spurious. Our period and that suggested by Morrison and Wolff are so related. For this star, the other two predicted periods are so short that the approximate interval of one day between observations is not precise enough for the data to be fitted by those very short periods, so those two periods cannot be found in the data.

Rice (1976), using a spectroscopic technique, preferred the period 2.17 days. Magalashvili and Kumsishvili (1976) using *UBV* photometric data stated that their data were better fit by the 2.17-day period. Renson (1978) used his own technique for period search of our original data and reported that the shorter period, actually about 1.845 days, produced a better fit for the data. Two more recent publications, one by Brodskaja (1978) and one by Musielok *et al.* (1980), found the photometric period to be 1.84540 and 1.84539 ± 0.00005 days, respectively.

II. Results of This Investigation

To eliminate the spurious period, we observed the star over extended time periods each night for several weeks during May and June 1981. Observational techniques and equipment were the same as those described by Burke and Barr (1981). The average probable error for a differential measure in V is about $0^m.005$. We changed the comparison star and adopted HD 184787 since its brightness was closer to the average brightness of the variable than that of the comparison star used in our original work.

The results can be seen from Figure 1 and Figure 2. In Figure 1 the data are plotted with the longer period. A period search of these data using the method described in our initial paper on this star indicated that the best period near the value given by Morrison and Wolff is 2.1825 days. The points observed with the V filter are scattered and there is no indication of periodicity. However, if only the observations made at regular intervals of one day had been obtained (the points represented by triangles), then one might have concluded that the period was 2.1825 days. In Figure 2 we show all the points, including the ones represented by triangles in Figure 1, plotted with the actual period of 1.84532 days. This period was determined by utilizing our initial epoch, which was obtained from data taken in 1968 and published in our initial paper on this star, and combining it with these observations (see Table I). The ephemeris for maximum light with the V filter is:

$$\mathrm{HJD}\,(V_{max}) = 2440017.86 + 1.84532\,E \text{ days.}$$
$$\pm 0.09 \pm 0.00004 \text{ day}$$

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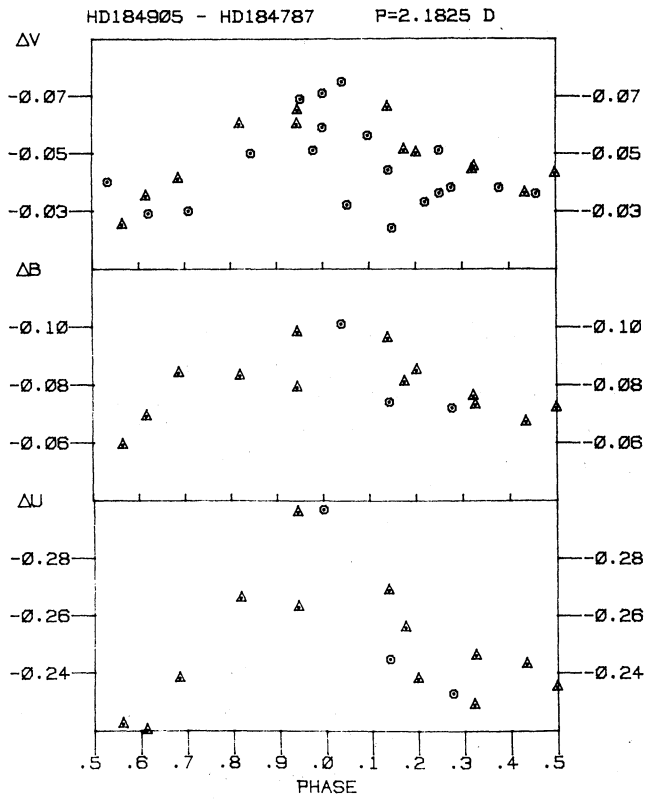

FIG. 1–Photometric observations are plotted according to the period 2.1825 days. Triangles indicate observations made at regular one-day intervals. Circles indicate other observations.

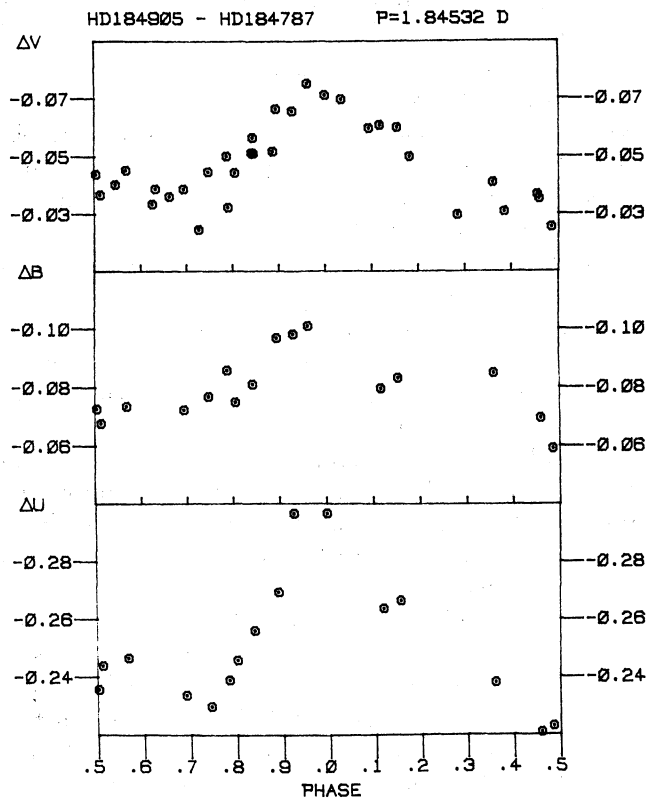

FIG. 2–The same photometric observations plotted according to the ephemeris HJD(V_{max}) = 2440017.856 + 1.84532 E days.

TABLE I

HD184905 - HD184787 P=1.84532 D

HJD 2444000+	PHASE	V	B	U
761.8213	0.802	-0.044	-0.074	-0.245
761.8893	0.839	-0.051	-0.081	-0.256
764.9260	0.485	-0.025	-0.059	-0.222
765.7468	0.929	-0.065	-0.098	-0.296
765.8760	0.000	-0.071	0.000	-0.296
766.8211	0.512	-0.036	-0.067	-0.243
767.9377	0.117	-0.060	-0.079	-0.263
768.7689	0.567	-0.045	-0.073	-0.246
768.8849	0.630	-0.038	0.000	0.000
769.8502	0.153	-0.060	-0.083	-0.266
769.9009	0.181	-0.050	0.000	0.000
770.7196	0.624	-0.033	0.000	0.000
770.7876	0.661	-0.036	0.000	0.000
770.8446	0.692	-0.038	-0.072	-0.233
770.9425	0.745	-0.044	-0.076	-0.229
772.7485	0.724	-0.024	0.000	0.000
772.8631	0.786	-0.050	-0.085	-0.238
772.9700	0.844	-0.051	0.000	0.000
773.7804	0.283	-0.029	0.000	0.000
773.9207	0.359	-0.041	-0.084	-0.238
773.9672	0.384	-0.030	0.000	0.000
774.7158	0.790	-0.032	0.000	0.000
774.8144	0.843	-0.056	0.000	0.000
774.9061	0.893	-0.066	-0.096	-0.269
775.9491	0.458	-0.035	-0.069	-0.220
776.7408	0.887	-0.051	0.000	0.000
776.8769	0.961	-0.075	-0.101	0.000
777.7873	0.454	-0.036	0.000	0.000
777.8762	0.503	-0.043	-0.072	-0.235
777.9532	0.544	-0.040	0.000	0.000
778.8560	0.034	-0.069	0.000	0.000
778.9643	0.092	-0.059	0.000	0.000

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REFERENCES

Babcock, H. W. 1958, *Ap. J. Suppl.*, **11**, 216.
Burke, E. W., and Barr, T. H. 1981, *Pub. A.S.P.*, **93**, 344.
Burke, E. W., Rolland, W. W., and Boy, W. R. 1970, *J.R.A.S. Canada*, **64**, 353.
Brodskaja, E. S. 1978, *Variable Stars*, **20**, 517.
Magalashvili, N. L., and Kumsishvili 1976, *Inf. Bull. Var. Stars*, No. 1167.
Morrison, N. D., and Wolff, S. C. 1971, *Pub. A.S.P.*, **83**, 474.
Musielok, B., Lange, D., Schoeneich, W., Hildebrandt, E., Zelwanowa, E., Hempelmann, A., and Salmanov, G. 1980, *Astr. Nach.*, **301**, 71.
Renson, P. 1976, private communication.
Rice, J. B. 1976, *Pub. A.S.P.*, **88**, 940.
Tanner, R. W. 1948, *J.R.A.S. Canada*, **42**, 177.