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UBV PHOTOMETRY OF HD 80 715 DURING 1986 AND 1987

Barden and Nations (1985) classify HD 80 715 (= BD + 40°2197 = No.70 in the catalog of Strassmeier et al. 1988) as a BY Dra star with a 3.8025 day period. They find strong Hα and CaII emission. Rufener and Bartholdi (1982) find evidence for microvariability based on 4 photometric observations, but additional photometry is obviously needed to characterize the photometric behavior of this system.

We observed HD 80 715 between April and July 1986 and between February and July 1987 on the 24" telescope operated by San Diego State University at Mt. Laguna, CA. The photometer has an EMI 6256 phototube cooled to -10°F, operates at -1300 V, and is equipped with standard Johnson UBV filters. We used a 19" aperture except on a few nights of poor seeing when we used a larger aperture. Data were transformed to the standard Johnson UBV system. We used SAO 61 417 and SAO 61 403 as the comparison and check stars.

We present our data in Figures 1-3 and Table 1. We plot the V data on the check star in Figure 4 and find no evidence for variability in the comparison star. We computed the orbital phase using φ = JD 2446 502.472 + $3^d.8025$ (Nations).

TABLE 1

Julian Day	Phase	V	(B-V)	(U-B)
2446548.744	0.169	1.034	0.068	0.213
2446549.743	0.432	1.105	0.084	0.242
2446589.707	0.941	1.011	0.060	0.198
2446590.704	0.204	1.059	0.062	0.212
2446883.667	0.249	1.109	0.085	0.213
2446886.656	0.035	1.072	0.072	0.211
2446887.646	0.295	1.056	0.070	0.207
2446888.755	0.587	1.041	0.069	0.208
2446890.751	0.112	1.099	0.069	0.220
2446891.808	0.389	1.024	0.061	0.204
2446959.732	0.252	1.048	0.065	0.199
2446960.693	0.505	1.063	0.076	0.218
2446961.693	0.768	1.127	0.075	0.210
2446962.695	0.032	1.082	0.054	0.233
2446964.692	0.557	1.065	0.065	0.193

The ΔV light curve (Fig. 1) shows the 1986 and 1987 data. We have only 4 points for 1986, but they suffice to show that the light curve changed between 1986 and 1987. We find a ΔV amplitude of about 0.12 mag. Our 1987 data were taken after Nations' APT data from the first quarter of 1987. Nations

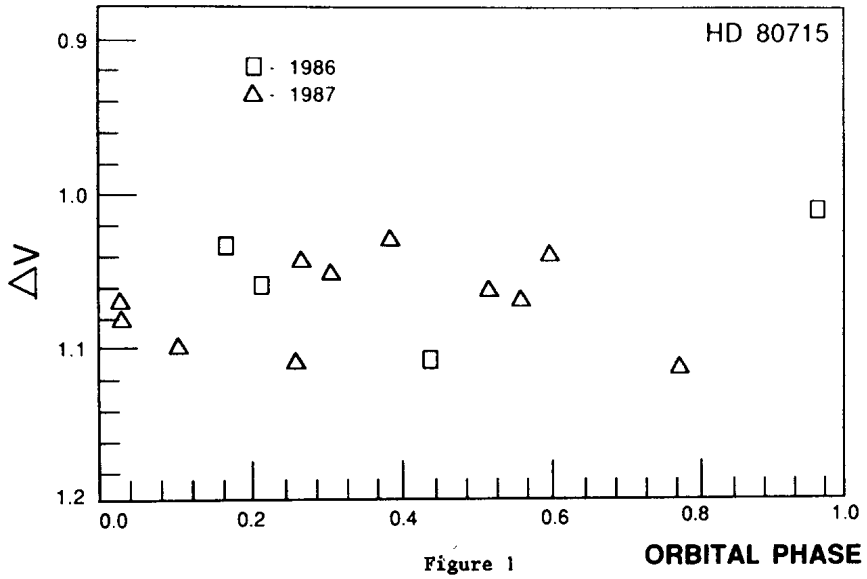

Figure 1

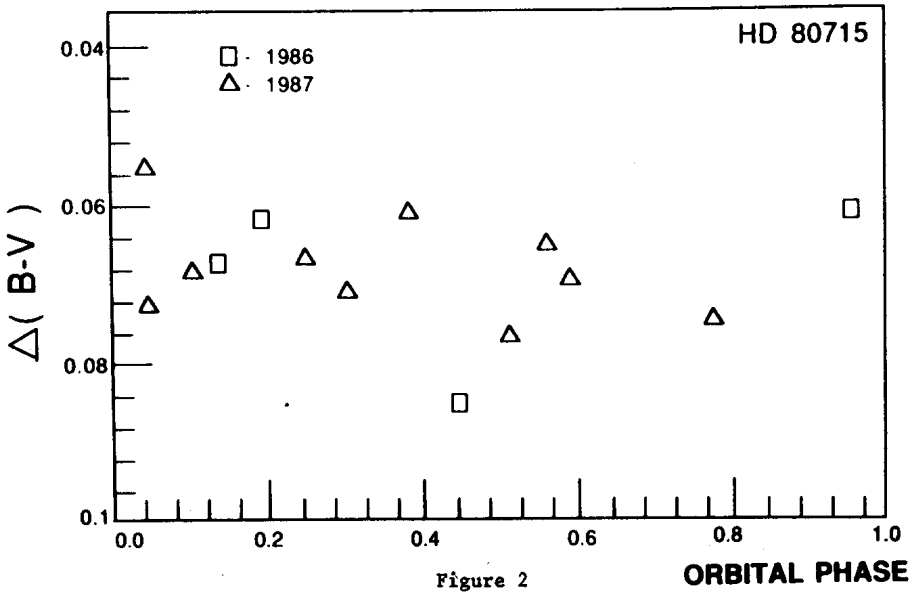

Figure 2

finds significant evolution on a timescale of about 10 orbital periods. Our 1987 light curve differs from the curve by Nations; so HD 80 715 continued to evolve. From a preliminary analysis of second quarter 1987 APT data, Nations also finds continued evolution. Combining the 1986 and 1987 data indicates that this evolution continued for a period of at least 2 years.

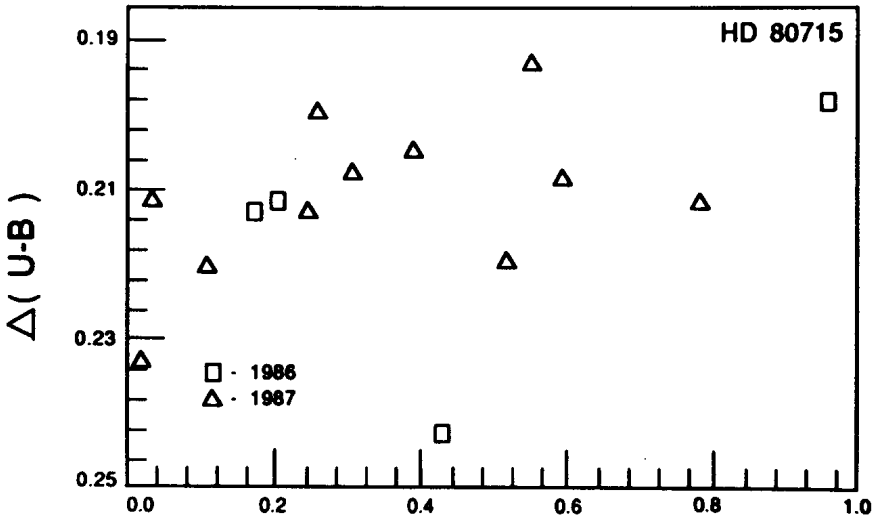

Figure 3

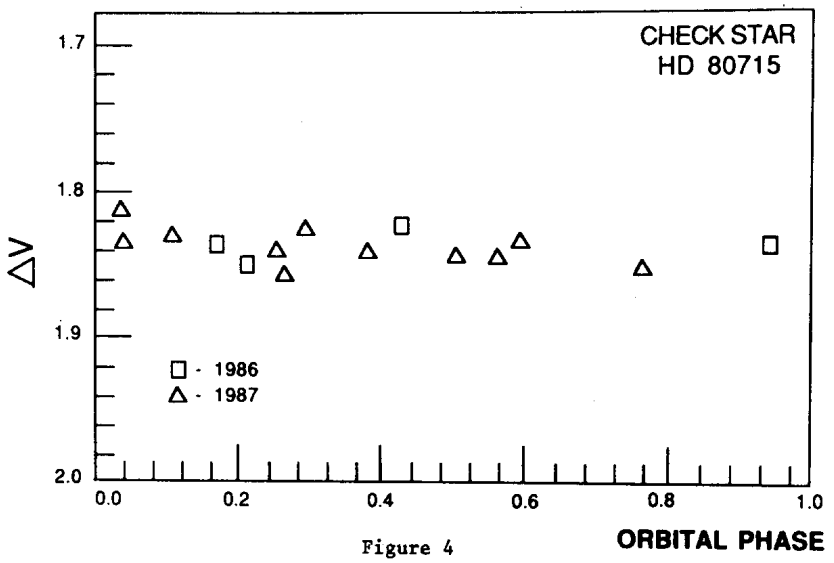

Figure 4

Our Δ(B-V) and Δ(U-B) color curves show maxima and minima at roughly the same phase as the ΔV light curve. The star is reddest at minimum light, as would be expected if cool spots cause the observed minima.

The color curves also evolve rapidly. For example note that at about phase 0.03 there are two points on the color curves with nearly identical phase but different magnitude. The corresponding points on the ΔV curve agree fairly well. One might initially conclude that there is a great deal of scatter in the color curves. However this star has a history of rapid evolution and the reported 1987 observations span almost 3 months. These apparent color discrepancies actually represent observations near the beginning and end of this time interval. Specifically, the phase 0.035 data were taken on 1 April 1987 (Δ(B-V)= 0.072). Near the end of this interval, the phase 0.032 data were taken on 16 June 1987 (Δ(B-V) = 0.054). During this interval the ΔV brightness did not change much but the colors did. Apparently the total area covered by starspots changed only a small amount but the spot temperatures changed significantly. One might be able to explain some of the apparent scatter in the curves by separating the April and June light curves, however the data points would then become very sparse. We do however present our data in Table 1 giving both Julian Day and phase so our data can be more easily compared to data at other epochs. It is clear that future work on this rapidly evolving system will require light curves taken in a short time period and near continuous monitoring to sort out the evolutionary trends in this rapidly changing system.

In conclusion, HD 80 715 shows rapid evolutionary changes in the amount of starspot activity and in the spot temperatures. Changes in the light curve take place on time scales as small as a month (∿10 orbital period) and have persisted for at least 2 years. We plan to continue monitoring this system to determine long term cycles.

Ron Angione scheduled generous amounts of time on the Mt. Laguna 24" telescope for this work. Harold Nations suggested observing this system.

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