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29 DRACONIS: A NEW VARIABLE STAR

We suspected 29 Draconis = HD 160538 is an RS CVn binary because of its late spectral type, the Ca II H & K emission in its spectrum, and its apparently variable radial velocity. The spectral type is KO III according to Bidelman (1955) or K2 III according to Roman (1955), and "strong bright lines of Ca II are present" according to Bidelman (1955). Radial velocity values published by Abt and Biggs (1972) show variations larger than we felt could reasonably be blamed on observational uncertainty; except for these variations, however, we can find no direct evidence that 29 Dra is a binary system.

Photometry was begun to search for the variability which might be expected if 29 Dra were an RS CVn binary. We observed it at four different observatories on a total of 47 different nights between JD 2 444 295.97 and 2 444 556.49 in 1980. Henry observed with the 24-inch Seyfert reflector at Dyer Observatory and the No. 4 16-inch reflector at Kitt Peak National Observatory; Louth observed with his 11-inch reflector in Sedro Woolley, Washington; Renner observed with his 10-inch reflector at Scuppernong Observatory near Dousman, Wisconsin. All observed with filters selected to match V of the UBV system, although Henry obtained also a few observations at Dyer with a filter selected to match B. All used BD $+75^{\circ}647$ as the comparison star. The individual differential magnitudes, corrected for differential atmospheric extinction with mean coefficients appropriate for each observatory and transformed differentially to the UBV system with coefficients determined previously, have been deposited in the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1979), where they are available as file no. 94. In the reductions we used a mean color difference of $\Delta(B-V) = +0^{m}.08$, in the sense variable minus comparison.

The light curve in V is shown in the figure below, where asterisks are Henry at Dyer, circles are Henry at Kitt Peak, and plusses are Louth. Each

point is a mean of the three individual differential magnitudes obtained on each night, although the earliest point ($\Delta V = 0^m.332$ at JD 2 444 295.97 by Renner) is not plotted. Here we can see that 29 Dra is very definitely variable, with an overall range of $\Delta V = 0^m.12$, a periodicity of around 30 days, and a long-term brightening trend.

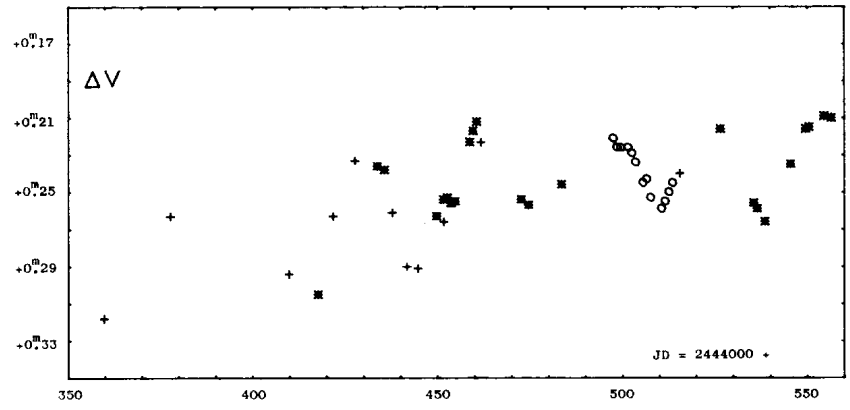

Figure 1

To determine this periodicity more precisely, we used a simple program which searched for the period which produced a magnitude vs phase plot in which the total length of line segments connecting the points was a minimum. The result was $P = 31^d.5$ with an uncertainty we estimate to be around $\pm$ 1 day. Times of maximum and minimum light, estimated graphically from the figure, are consistent with this period. A representative epoch of minimum light would be JD 2 444 445.0 $\pm 1^d.0$.

In virtually all RS CVn binaries known to be variable in light, the photometric period is within a few percent of the orbital period, as a consequence of synchronous rotation of the star responsible for the variation. Therefore we conclude this note by suggesting spectroscopic observers search for radial velocity variations in 29 Dra and predict that the period of those variations, if found, will be around 30 days. For such a bright star, $V = 6^m.55$ according to Roman (1955), this should not be difficult.

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