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5 Ceti = HR 14 : A NEW AND PUZZLING VARIABLE STAR

We report photoelectric photometry which shows 5 Ceti to be a variable star with an amplitude a bit over $0^m.2$ in V and a period apparently very close to the orbital period of $96^d.41$ determined spectroscopically by Christie (1933). According to the 1964 edition of the Yale Bright Star Catalogue the spectral type is gK2.

Altogether this star was observed on 28 nights in 1979 (between JD 2444138.8 and 2444222.6) and 46 nights in 1980 (between JD 2444445.9 and 2444563.7) using 29 Piscium as the comparison star. The telescope was a 20-inch Cassegrain reflector at the Lines Observatory near Mayer, Arizona equipped with an unrefrigerated 1P21 photomultiplier operated at -900 V.

Nightly means are plotted in the figure, where Δv_o is differential magnitude in the sense variable minus comparison, corrected for differential atmospheric extinction but not yet transformed to V of the UBV system. Phase in this figure is computed with the ephemeris

$$JD(hel.) = 2444176.5 + 96^d.41\ n\ ,$$

where the period is the orbital period of Christie (1933) and the initial epoch is a time of primary minimum derived from this photometry. If we consider all of the relevant uncertainties, it appears primary minima are occurring at times of conjunction (with the gK2 star behind).

The fact that 5 Ceti is a spectroscopic binary, the shape of the light curve, and the occurence of minimum light at times of conjunction all suggest that 5 Ceti is an eclipsing binary. The puzzle is that a binary with such a long period can produce a light curve with a W UMa shape. Presumably one (or both) of the two stars is large enough to fill or nearly fill its Roche lobe; this would be so if one (or both) of the stars is as large as $\sim 50\ R_\odot$. Perhaps we should not be so surprised, since the one star seen in the spectrum has been classified a giant. Because that gK2 star is behind at primary minimum, we can say that the other star is cooler (spectroscopically later) than K2.

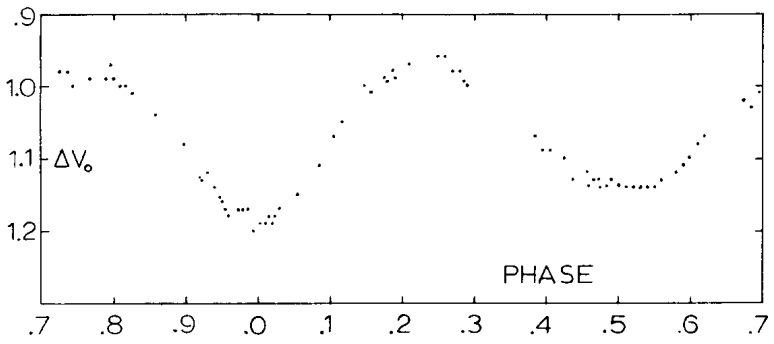

Figure 1

For 29 Piscium the 1964 Yale Bright Star Catalogue gives V = $5^{m}.10$. From this we see that 5 Ceti varies between V = $6^{m}.1$ and $6^{m}.3$. Spectroscopists should look for the fainter star in the spectrum, and photometrists should get the complete light curve in other bandpasses, such as B and U and perhaps R. In future photometry a better comparison star might be 4 Ceti. Though much bluer than 5 Ceti (29 Piscium was also), it is much closer in the sky and more nearly the same brightness.

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Reference:

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