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THE LIGHT VARIATIONS OF HR 9070

It is sobering to realize that even among the stars in the Yale Catalogue of Bright Stars (YCBS), there are probably several hundred variable stars yet to be discovered, and several hundred more whose variability is not well understood. One example is HR 9070 (HD 224559, R.A. (1900) =  $23^{\text{h}}53^{\text{m}}41^{\text{s}}$ , Dec. (1900) =  $+45^{\circ}51'$ ). This star has been variously classified as B3 IV, B3:nne and B4 V nnne; the B3 IV classification (which appears in the YCBS) is not necessarily an indication that the emission is variable, but may simply be due to the different plate material used. Recent plates taken with the 1.9 m reflector at the David Dunlap Observatory show emission at H $\beta$  quite clearly (Fraquelli, private communication).

The star is listed as VAR? in the YCBS, probably on the basis of the extensive observations by Provin (1953), who used it as a comparison star for HR 9080. Provin found variations of 0.<sup>m</sup>03 in a few hours, when comparing HR 9070 with HR 1. The star was reobserved by Percy and Lane (1977), who also found variations of about 0.<sup>m</sup>03 in a few hours.

Further photometric observations have now been made, using the 0.4 m reflector at Kitt Peak National Observatory (Percy and Lane 1977) and, on one night only, the 0.4 m reflector on the campus of the University of Toronto. The observations are shown in Figure 1, which indicates the filters (Strömgren b or y or Johnson B) and the comparison star used. A table of the observations can be obtained by writing to the author.

On each night, the star varies with a quasi-period of about 6<sup>h</sup> and a range of 0.<sup>m</sup>02 to 0.<sup>m</sup>06. In this sense, the star mimics the light variations of a  $\beta$  Cephei star exactly. Perhaps the star is a  $\beta$  Cephei star; if so, it would be the first  $\beta$  Cephei star with Be star characteristics. The period

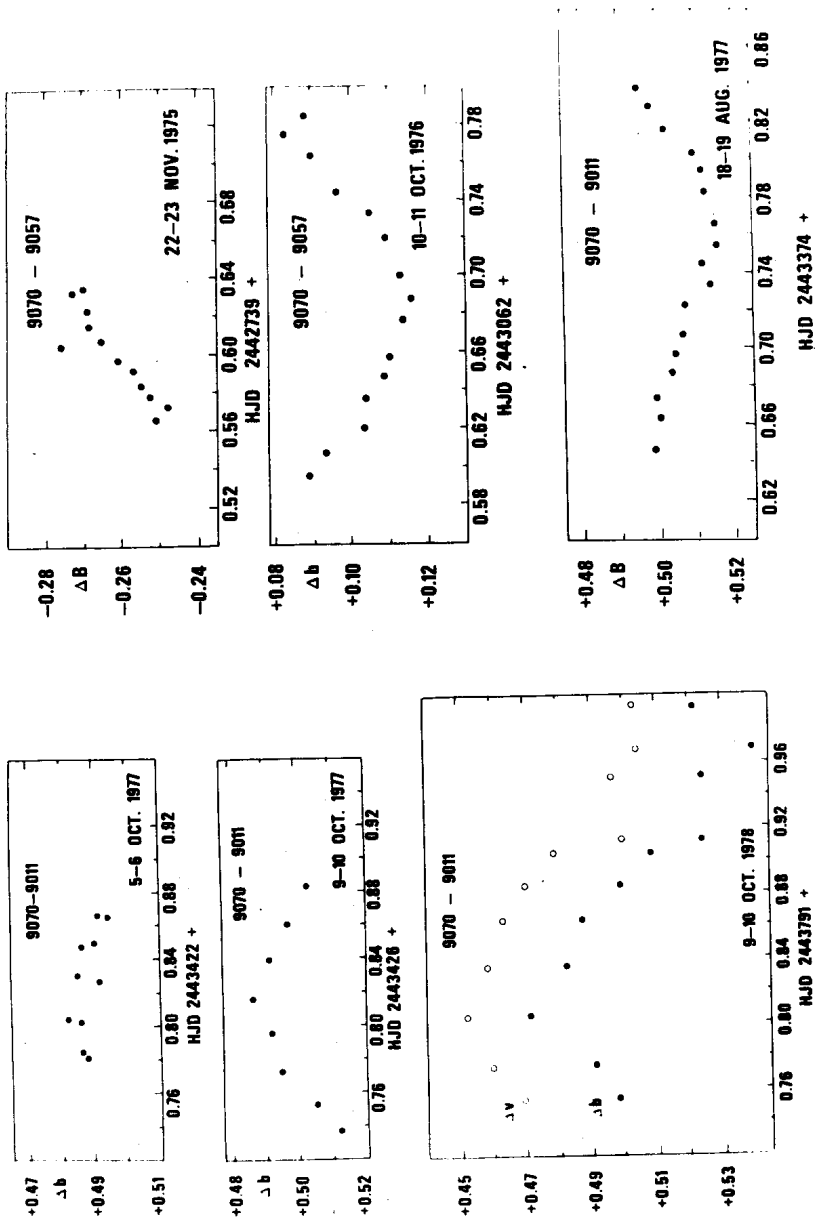


Figure 1. Photometric observations of HR 9070 on six nights. The filter and comparison star are indicated.

(6<sup>h</sup>) is longer than would be expected for a  $\beta$  Cephei star of this luminosity, although the luminosity of HR 9070 is difficult to determine because of the nature of the spectrum.

On the other hand, it is well known that the Be stars tend to be variable in light, and it is becoming increasingly evident that the major light variations of Be stars occur on a time scale of hours rather than a time scale of days or weeks as previously believed (Percy and Lane 1977, Jakate 1979); the cause of these short-period variations is not known. Yet another kind of variable star has recently been discovered in this same part of the HR diagram: the non-radial pulsators of which 53 Per is the prototype (Percy and Lane 1977; Buta and Smith, preprint).

Spectroscopic observations would obviously shed some further light on the nature of HR 9070. The radial velocity is marginally variable according to Petrie (1958) but probably constant according to Wilson and Joy (1950). With such a difficult spectrum, small velocity variations due to pulsation might well go unnoticed.

The purpose of this paper, then, is to point out that (i) the identification of specific types of variables among the early B stars is no longer simple, so that searches for  $\beta$  Cephei stars (for instance) must be conducted with great care and (ii) at least one Be star shows quasi-regular light variations with a short period. There may in fact be some relationship between the classical  $\beta$  Cephei stars and the Be star variables.

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