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THE SERENDIPITOUS DISCOVERY OF TWO NEW BRIGHT VARIABLE STARS
IN THE FIELD OF HD 108

In the course of searching for light variations of the 08fe star HD 108, light variations of two nearby stars BD+63^o0003 and BD+62^o2356 (= HR 9097) were uncovered. Hitherto, neither BD+63^o0003 nor BD+62^o2356 have been reported as variable stars. On the other hand the original object of the study, HD 108, was found to be constant in brightness within about ~ 0.02 mag over the interval investigated.

The observations were made with the 38-cm reflector at Villanova University Observatory, using a photometer equipped with a refrigerated RCA C31034 Ga-As photomultiplier. A pair of intermediate- and narrow-band interference filters centered near the rest wavelength of the Balmer H α line was used. The characteristics of the filters have been given by Guinan et al. (1982). The H α intermediate bandpass filter is centered at λ 6585 and has a bandwidth broad enough (FWHM \approx 280 \AA) that the included line feature does not significantly contribute to the measure. Thus, the intermediate bandpass measure is essentially that of the continuum centered near λ 6585. On two nights additional observations were made with an intermediate band λ 4530 interference filter, to determine the colors of the stars.

The observations were obtained on 39 nights from 1979 October through 1982 August, with most of the observations being made during 1979 and 1980. Typically about one hour of observations were made on each night. Although originally BD+63^o0003 and BD+62^o2356 were observed as comparison and check stars, respectively and HD 108 was designated as the variable, it became apparent that at least one of the comparison and check stars was variable. In order to check on the variability of these stars, an additional star, BD+62^o0005 was added to the observing program.

After several weeks it became apparent that both BD+63^o0003 and BD+62^o2356 were variable, and that HD 108 was not significantly variable. Thus, to our surprise the originally designated variable star HD 108 was constant in light while the primary comparison and check stars were both variable! The visual magnitudes and spectral types of the above stars are listed in Table I along with their corresponding BD and HD designations.

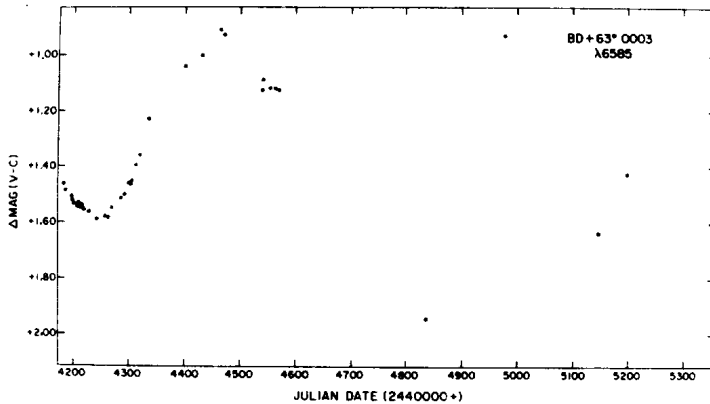


Figure 1

The $\lambda 6585$ light curve of BD+63^o0003. The comparison star is BD+63^o0005.

Table I

BD	HD	m_v	Sp. Type
+62 ^o 2363	108	+7.4	O8fe
+63 ^o 0003	-	+8.3(v)	(M2-M5)
+62 ^o 2356	225094	+6.24	B3 Ia
+63 ^o 0005	371	+6.42	G1-3 II

The light variability of BD+63^o0003 and BD+62^o2356 are shown in Figures 1 and 2, respectively, where the differential magnitudes in the $\lambda 6585$ bandpass were computed with respect to BD+62^o0005.

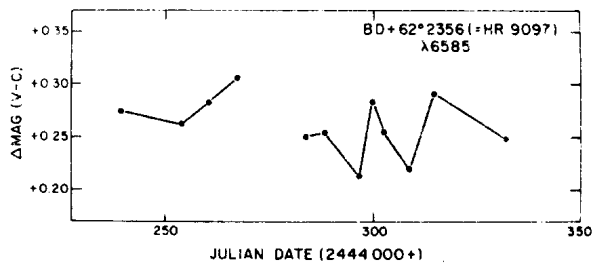


Figure 2

The $\lambda 6585$ observations of BD+62^o2356 plotted against Julian Date. BD+63^o0005 served as the comparison star.

The points plotted are nightly normals and typically contain about 8 to 12 individual 20-second integrations. Except for HD 108, the α -indices of these stars did not show any significant abnormalities or variations and are not plotted here. As shown in Figure 1, the light curve of BD+63^o0003 is well defined up to JD2444600, with a minimum and maximum occurring near JD2444250 and JD2444460, respectively. Only a few observations were obtained after JD2444600, but the observation made on JD2444835 is over 0.3 mag fainter than the previous minimum. It also appears that light variation is more rapid after JD2444800 than before. From the figure it appears that the light variation of BD+63^o0003 is cyclic rather than periodic with a full light amplitude of about ~ 1.0 mag. Although no direct spectral classification of BD+63^o0003 appears available, the color index derived from the HD catalogue of $CI = m_{pg} - m_v = +1.5$ mag indicates that it is a cool star. To verify this, BD+63^o0003 was observed on two occasions with an intermediate bandpass $\lambda 4530$ filter in addition to the H α filter set, and a (b-r) color index was formed from the intermediate band $\lambda 6585$ and $\lambda 4530$ bandpasses. This color index indicates that BD+63^o0003 is an M-type star. Since it does not appear to have a large proper motion, BD+63^o0003 is most likely a luminous star and not a dM star. From its inferred late spectral type and the cyclic form of its light variation BD+63^o0003 appears to be a semi-regular red variable with a tentative classification of SRa (Glasby 1969).

As shown in Figure 2, BD+62^o2356 appears to vary irregularly on a timescale of several days with a full amplitude of about 0.1 mag. The light curve is not well defined and does not exclude periodic variations of the order of 2 days or less. BD+62^o2356 has been assigned a B3 Ia spectral classification in the Bright Star Catalogue (Hoffleit 1964) and similar light variations have been found for other supergiant B-stars with β Ori (Rigel) being the most well known (Chentsov and Snezhko 1971).

According to de Jager (1980) many if not all luminous supergiants show irregular brightness variations. Systematic studies of the brightness variations of B- and A-type supergiants have been carried out by Sterken (1976) and by Rufener et al. (1978) in which irregular or cyclic light variations were found with time scales of 15 to 20 days and with amplitudes of \sim 0.02 mag to \sim 0.10 mag. It appears that the light variations found here for BD+62^o2356 are similar to those found for other B- and A-type supergiants. More photometric observations and a better spectral classification are needed for this star.

As for HD 108, originally the object that first prompted the study, no light variation greater than \sim 0.02 mag was apparent over the interval studied. Short-term light variations were not investigated here, and are still possible. HD 108 did show substantial H α emission, however, which appears variable on a time-scale of days. The H α emission variation will be discussed in a subsequent paper.

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