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HD 50138: PHOTOMETRIC BEHAVIOR CONNECTED WITH ITS RECENT SHELL EPISODE

Andrillat and Houziaux (1991) have recently observed that the bright Be star HD 50138 (MWC 158) has begun an important new shell phase as of January 1991. They note that an inverted P Cyg profile has developed at the O I λ7773 Å line and that the V/R ratios for the Paschen P9 - 22 lines have changed dramatically from data taken the year before. HD 50138 has been assigned various recent spectral types: e.g., B6 IIIe (Jaschek et al., 1980), B8q[ ] (Allen, 1973) and B9.5 Ve (Gao & Cao, 1984). The star belongs to Jaschek Group I, characterized by permanent Fe II in emission and emission in the Balmer lines to higher terms. Merrill (1931) found a spectroscopic cycle time of about 5 years combined with a shorter one of 330 days from the V/R variations. Doazan (1965) has published a précis of spectrum behavior and found radial velocity and V/R changes to be seemingly periodic over 47 - 52 days with compression and relaxation phenomena occurring as a function of differential velocities within the envelope. The radial velocities for the envelope lines vary with time and for different elements; indeed, the profiles and visibilities of the shell lines can vary over as short a time period as 1 day. Merrill & Lowen (1953) consider that HD 50138 does not possess a typical Be shell because of the rapid changes in the atmospheric motions. [OI] λλ6300, 6363 is also present in the spectrum (Merrill, 1931), making the star similar in some respects to HD 45677 = FS CMa.

HD 50138 has been under photometric observation by the author at the Corralitos Observatory for five of the past six years, during the critical period in which the shell episode began and continuing to the present. Information on the light and color variations of this star is provided herein for investigators who wish to correlate it to spectrum behavior. Differential BV photometry of HD 50138 was performed primarily with the 0.6-m. telescope of the Corralitos Observatory and its single channel photon-counting photometer and ambient temperature EMI 9924A PMT, and secondarily with the Kitt Peak # 2 0.9-m. telescope and cooled 1P21 AFP photometer. Consistency between the telescopes and color systems was excellent: .003 mean magnitudes difference in both V and B-V, a value too small to require correction. Two

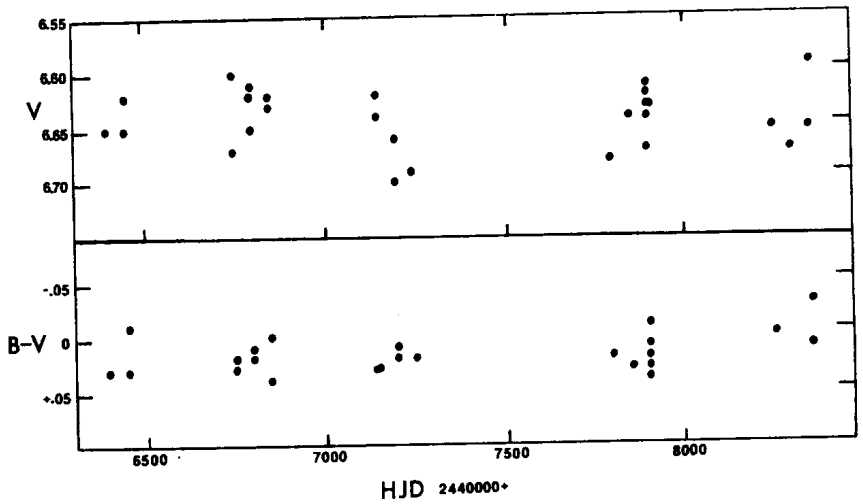

Figure 1: V and B-V for HD 50138

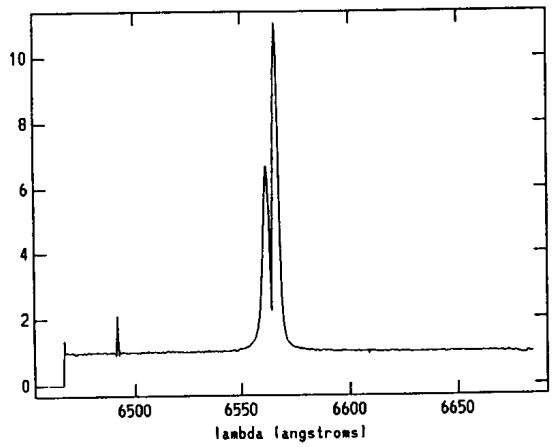

Figure 2: Coudé specrum for HD 50138. The abscissa is in Ångström units, the ordinate in those of the continuum.

TABLE 1: MAGNITUDES FOR HD 50138

HJD (2440000+)	V(SE)	B-V(SE)
6392.8896	6.641(.006)	+.017(.004)
6432.8097	6.611(.001)	-.017(.001)
6457.7392	6.638(.004)	+.016(.006)
6734.9289	6.591(.006)	+.018(.022)
6756.9624	6.660(.025)	+.013(.008)
6776.8578	6.597(.020)	+.014(.002)
6797.7701	6.613(.003)	+.004(.008)
6816.7408	6.636(.013)	+.002(.017)
6832.7993	6.606(.008)	+.027(.001)
6865.6882	6.624(.006)	-.009(.001)
7125.9238	6.633(.009)	+.019(.006)
7170.7910	6.611(.019)	+.018(.004)
7183.7825	6.688(.006)	+.007(.004)
7189.7634	6.647(.012)	+.000(.001)
7232.6666	6.675(.018)	+.007(.016)
7809.9369	6.666(.023)	+.010(.014)
7827.9572	6.627(.008)	+.015(.001)
7878.9039	6.634(.008)	+.014(.011)
7880.8672	6.621(.018)	+.022(.013)
7881.7838	6.609(.006)	+.001(.006)
7896.7868	6.659(.025)	-.017(.014)
7897.7820	6.621(.051)	+.026(.004)
7917.7747	6.600(.019)	+.030(.011)
8243.7511	6.637(.015)	-.006(.004)
8293.7715	6.658(.004)	----------
8328.6831	6.642(----)	-.038(----)
8330.6271	6.578(.001)	+.003(.054)

comparison stars were utilized: HD 49843 (V = 8.905, B-V = -.049) and HD 49886 (V = 7.610, B-V = -.100). Magnitudes for the comparison stars were obtained from all-sky photometry with the Kitt Peak telescope. Average standard errors for the comparison stars were .015 in V and .013 in B-V.

In all, observations were made on 27 nights over the time period HJD 2446392 - 8330. The values appear in Table I and graphically in Figure 1. Ponomareva (1981) has stated that while HD 50138 was then thought to be non-light variable, the star should begin to vary because of the extreme instability of the envelope. The figure shows this to be the case. HD 50138 is minorly variable in V magnitude about a nearly constant mean magnitude of 6.630 ($\pm$ .027), but probably not in B-V (B-V = + .008 $\pm$ .016). Examination of the magnitudes seasonally revealed no particular trend; the mean magnitudes remained essentially constant within the range of standard errors. The total V range observed was 0.097, in B-V 0.068. Curiously, the new shell episode is invisible in the photometry. Behavior both before and after seems identical.

A single spectrum obtained on JD 2446877 with the coudé feed telescope of the Kitt Peak Observatory and RCA CCD camera is also reproduced herein. The spectrum was centered at Hα and covered a spectral range of 250 Å with resolution 0.89 Å per 2 pixel line width. It was reduced and wavelengths, equivalent widths, emission line widths and intensities were measured via the IRAF operating system resident at Kitt Peak. Appearing in Figure 2, the spectrum shows a strong double emission - central absorption profile at Hα, with V/R = 0.6. λ6678 He I would seem to be visible faintly in absorption in a replot of the spectrum with higher vertical resolution, though not in Figure 2. There are suggestions of other very faint absorption lines, but they were too faint to be measured. The equivalent width for the Hα emission line was found to be 58.4 Å and its radial velocity in the depth of the central absorption, +61.4 km/sec.

HD 50138 will continue to be observed with higher priority at the Corralitos Observatory in the future.

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