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88 HER : ANOTHER SHELL STAR OF PLEIONE TYPE

Harmanec et al. (1978) discovered the long-term variations in light and color of the shell star, 88 Her (B6e). The variation is characterized by a gradual increase during 1968-1972, by a phase of more or less constant light in 1972-1976, and by a steep decline in 1977. The brightening of the star was accompanied by gradual disappearance of the hydrogen emission in its spectrum (Doazan 1973; Harmanec et al. 1974, 1978). These behaviors resemble closely to those of Pleione (B8e) in 1960-1972 (Hirata and Kogure 1976; Sharov and Lyuty 1976). In the case of Pleione, the shell lines appeared in 1972, and the H $\alpha$  emission reappeared at the same time or immediately thereafter when the brightness decrease was remarkable (Hirata and Kogure 1976; Gulliver 1977). The broad component of the CaII K line appeared prior to the brightness decrease and strengthened in the subsequent shell phase.

From the resemblance of the variations of these two stars, we have planned to examine the spectroscopic behavior of 88 Her in the dark phase. The coude spectrograms in the blue and red regions were obtained with the 188-cm reflector at the Okayama Astrophysical Observatory in August 11 and 14, 1978, respectively. The respective inverse linear dispersion was about 10 and 20 Å/mm in the blue and red regions. Figure 1 shows the microphotometric tracing of the H $\alpha$  line. Although this plate was underexposed, the double emission components well above the continuum level are clearly seen, together with the strong central shell component. In the blue region, the metallic shell lines of rather diffuse appearance and the strong shell components of the hydrogen Balmer lines up to H28 were detected. Figure 2 shows the

Relative Intensity

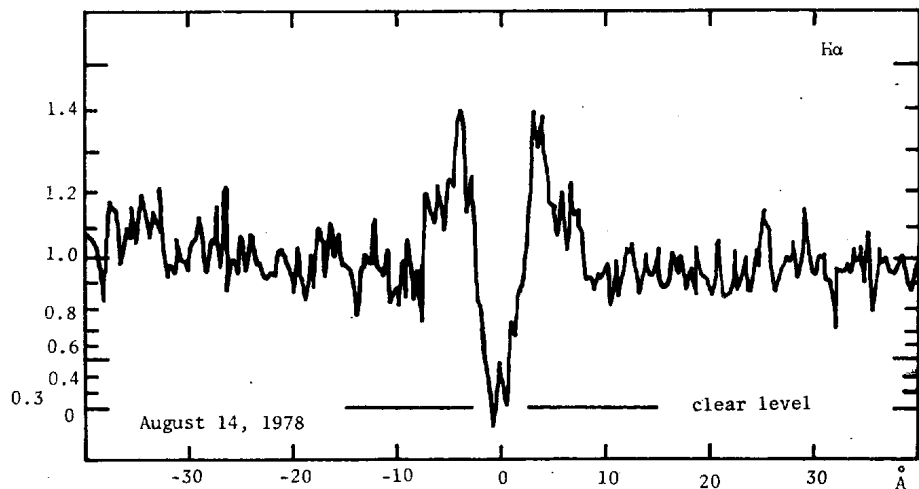


Figure 1

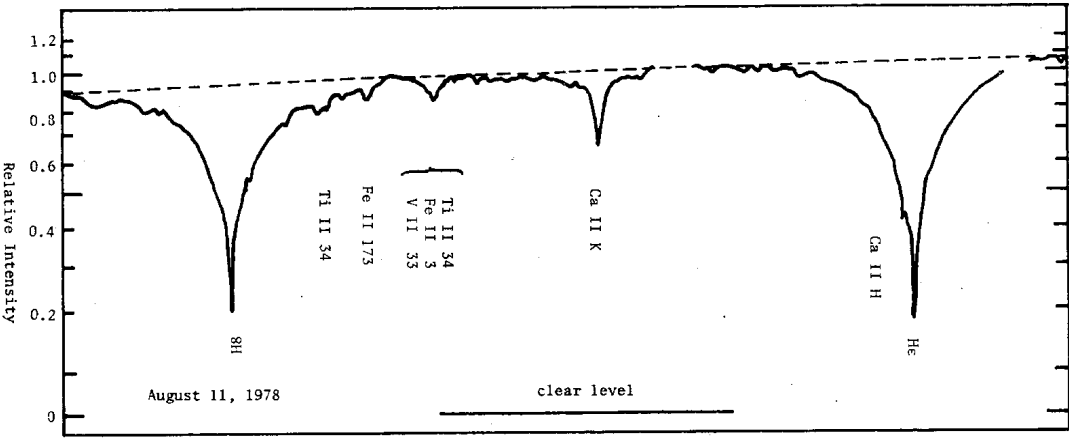


Figure 2

microphotometric tracing in the H8-H $\epsilon$  region. The general trend of the shell appearance is clearly seen. We also notice that the broad component of the CaII K line with a half half-width of about 200 km/sec is traced in addition to its sharp shell component.

The UB $\bar{V}$  data of 88 Her were kindly offered to the author from M. Nakagiri of the Tokyo Astronomical Observatory. The differential observation to HD 162132 (A0) was made in 1978, August, 19.53 UT with the 30-cm reflector at the Tokyo Astronomical Observatory. The results were:

$$V = 6.^m83 \pm 0.^m00, \quad B-V = -0.^m09 \pm 0.^m00, \quad \text{and} \quad U-B = -0.^m38 \pm 0.^m00.$$

The results for the comparison star, HD 162132, were

$$V = 6.^m48 \pm 0.^m00, \quad B-V = +0.^m08 \pm 0.^m00, \quad \text{and} \quad U-B = +0.^m13 \pm 0.^m01,$$

while Harmanec et al. (1978) gave for this star

$$V = 6.^m493, \quad B-V = +0.^m070, \quad \text{and} \quad U-B = +0.^m080.$$

The values of  $V$  and  $B-V$  of HD 162132 agree well in both observations, but the  $U-B$  color is redder in our observation by an amount of  $0.^m05$ . When compared with the latest observation (December 4, 1977) of Harmanec et al. (1978):

$$V = 6.^m870 \pm 0.^m006, \quad B-V = -0.^m102, \quad \text{and} \quad U-B = -0.^m421,$$

we can conclude that 88 Her is still in the dark phase and brightened slightly. It cannot be judged at present whether this slight brightening corresponds to the steady recovery of the brightness or to the irregular change with a shorter time scale.

The common behaviors of 88 Her and Pleione are summarized as follows.

1. Gradual brightening and subsequent rapid decline in the  $U, B$ , and  $V$  magnitudes.

2. Reddening in the B-V color in the steep decline stage.
  3. Gradual disappearance of the emission feature in the brightening phase and its recovery in the dark phase.
  4. Appearance of the shell absorption feature in the midst of dark phase.
  5. Existence of the broad component of the CaII K line in the dark phase.
- Several different behaviors of these two stars can be also pointed out:

1. The variations of magnitude and color are more conspicuous in Pleione than in 88 Her. The magnitude differences between the brightest and subsequent faintest stages are

	$\Delta V$	$\Delta B$	$\Delta U$
88 Her	$-0^m.19$	$-0^m.23$	$-0^m.33$
Pleione	$-0^m.37$	$-0^m.40$	$-0^m.37$

Here, we tentatively adopt the latest observation of Harmanec et al. (1978) as the faintest. In addition, the decrease in brightness of 88 Her was more conspicuous in the shorter wavelength, while Pleione exhibited the same order-of-magnitude decrease in all bands. As a result, the U-B color became redder in 88 Her, while it became even bluer in Pleione.

2. Pleione has experienced Be $\rightarrow$ B $\rightarrow$ shell phase in its recent spectroscopic behavior, while 88 Her exhibited shell $\rightarrow$ weak Be (or B) $\rightarrow$ shell phase.

88 Her is a spectroscopic binary with a period of about 87 days (Harmanec et al. 1972). Any evidence of binary character has not yet been found in Pleione (Gulliver 1977).

Further monitoring in both photoelectric and spectroscopic observations is of great interest.

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