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SPECTROPHOTOMETRY OF PECULIAR SHELL STAR HD 218393

HD 218393 is a well known shell star having several interesting spectral features. Struve (1944), Merrill (1949), Holliday (1950) and Doazan and Peton (1970) observed this star spectroscopically and noticed a series of changes in the spectrum. The radial velocity variations of the circumstellar lines suggested a period of 35 to 40 days but the amplitude was not exactly the same. Doazan and Peton (1970) interpreted the radial velocity variations as caused by an expanding envelope with variable accelerations, while after analysing all the available radial velocity data of HD 218393, Kriz and Harmanec (1975) suggested that the object may be an interacting binary with a possible orbital period of $38^{d}.873$. Later on, Polidan and Peters (1976) proved the binary nature of the star by the discovery of some lines of the secondary component in the infrared part of the spectrum. According to them, the system consists of a B3e primary and gK1 secondary. Harmanec et al. (1977) observed this star photometrically and discovered its photometric variability of $0^{m}.3$, $0^{m}.1$ and $0^{m}.1$, respectively, in U, B and V filters. They observed a gradual decline taking place during about 10 days in 1974 and more rapid variation during 1976.

We observed HD 218393 spectrophotometrically in the wavelength range λλ3200-8000 Å with the Hilger and Watts scanner during two nights on 12 and 13 November 1983. The scanner was mounted at the Cassegrain focus of the 104-cm reflector of Uttar Pradesh State Observatory. In addition, the stars α Lyr and ξ^2 Cet were observed as the standard stars while the stars 2 And (A3V) and 8 Cyg (B3IV) were observed as the comparison stars. All the scans were obtained with 50 Å band pass. The observational techniques and the data reduction procedure were the same as used earlier (Goraya, 1981). The absolute monochromatic fluxes of Be star and comparison stars were extracted from the observed continuous energy distributions at about 49 wavelengths separated by 100 Å in the whole observed spectrum. The monochromatic fluxes were corrected for interstellar reddening and were normalized to λ 5500 Å. A plot of the mean monochromatic fluxes against the wavelength is shown in Figure 1.

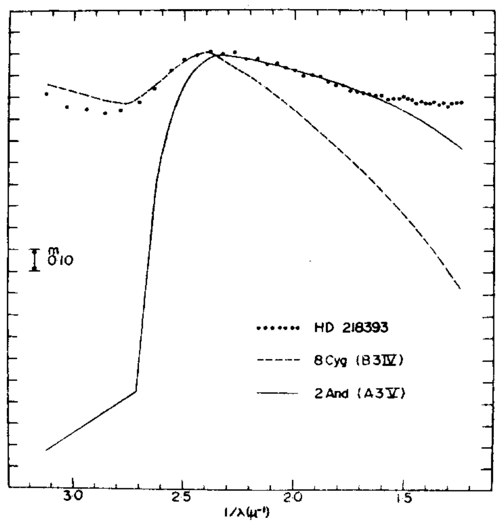

Figure 1
Observed continuous energy distribution curve of HD 218393 compared with the early type star 8 Cyg (B3IV) and the late-type star 2 And (A3V).

We compared the observed energy distributions of 2 And and 8 Cyg with Kurucz's (1979) model atmospheres. We found that the observed curves of 2 And and 8 Cyg fit well with models having T_{eff} = 8300K and 20000K, respectively over the whole spectral range. Surprisingly we noticed that the observed energy distribution curve of HD 218393 could not be fitted with any model. It is clear from Figure 1 that the observed curve of HD 218393 matches with 8 Cyg in the near ultraviolet and Balmer discontinuity region (λλ3200-4200 Å). Some part of Paschen continuum region (λλ4200-6000 Å) of HD 218393 matches well with 2 And. A near infrared excess longward of λ6000 Å was also noticed for HD 218393. From this type of peculiar continuum energy distribution we infer that the continuous spectrum of HD 218393 is a combination of the spectrum of hotter primary component (early B-type) and the spectrum of secondary cooler companion (K-type).

The observed anomalies in the continuous energy distribution of HD 218393 lead to suggest that the object is an interacting binary star, consisting of B type primary and K type secondary, in which the hotter B star is heavily obscured by a gaseous disk or ring. Outside the star, the disk itself radiates, usually as an optically thin hydrogen cloud. This continuous radiation of the disk becomes relatively stronger as we proceed towards longer wavelengths in the optical region, resulting in a near infrared excess emission.

P.S. GORAYA, MAHENDRA SINGH, U.S. CHAUBEY
Uttar Pradesh State Observatory,
Naini Tal-263129, India

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