THE PECULIAR Be STAR HD 87643

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SUMMARY: IUE observations as well as optical spectral of the peculiar star HD 87643 were obtained. The observed optical Fe II lines are probably formed in a expanding envelope and the rate of mass-loss derived from the analysis of these lines is about 7×10^{-7} $M_{\odot}$ y^{-1}.

HD 87643 is an emission line object which besides the H-Balmer lines present also Fe II and Ca II in emission.

The star is surrounded by a nebulosity, which direct narrow band plates taken recently indicate a reflective origin(Surdej et al.,1981). Besides that, this object seems to be part of a small group of early-type stars with the following characteristics: (a) spectra in the optical region without photospheric features; (b) Balmer lines with P-Cygni profiles;(c) optical Fe II lines in emission (sometimes presenting also P-Cygni profiles); (d) strong infra-red excess.

Our low resolution IUE spectra show a rather unusual appearence and they are unlike any other early-type star. In the long wavelength range we have identified the Mg II lines with P Cygni profile and absorption features due to Fe II resonance transitions and lines from low lying metastable levels. In the short wavelength range it was possible to identify the Si IV, Al III, Si III, C IV features attributable to the star. A high resolution spectrum in the short wavelength range convinced us that the spectrum is essentially an absorption spectrum. The most remarkable thing is that the major part of the spectrum is dominated by the envelope absorption lines. Fe II multiplets dominate the short wavelength spectrum also and some of the lines have only recently been identified in the laboratory.For example, the lower metastable level of some lines at 1400 Å is a^4G. From this level, forbidden emission lines are seen in the spectrum(multiplet 21F). Following our analysis, the IUE fluxes at the epoch of our observations (July 1979) were definitively higher than the ANS fluxes measured four years before. We atribute this difference probably to variable continuous opacity or to a weaker Balmer continuum. Recent infrared

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measurements (Epchtein and Lépine, 1980) are marginally consistent with a decrease in the circumstellar dust opacity. However this point still requires more observations to be cleared.

Our optical observations clearly display the P-Cygni characteristics of the Hβ line, showing a rather strong emission and a blue edge velocity exceding 1200 km s^{-1}. The optical Fe II emission lines are probably radiatively excited. Such a fluorescent mechanism is favoured by the strong UV Fe II observed absorption lines. The higher resolution spectra by Carlson and Henize (1979) would indicate that besides hydrogen, iron and calcium lines present also P-Cygni profiles. This lead us to the interpretation that all the lines of these ions are formed in the expanding envelope.

Using the Sobolev's approximation, the equivalent width of multiplet 42 is given by

$$W_{42} \simeq 8 \left(\frac{R}{D}\right)^2 \left(\frac{V_\infty}{C}\right) \frac{F_{3UV}}{f_{42}} \left(\frac{\lambda_{3UV}}{\lambda_{42}}\right) \lambda_{3UV} \, G(\tau_0) \qquad (1)$$

where R is the star radius, D is the distance to the star, V_∞ is the wind terminal velocity, c is the light velocity, F_{3UV} is the stellar photospheric flux at the weighted wavelength λ_{3UV} of multiplet 3UV, f_{42} is the observed (de-reddened) continuum flux at the weighted wavelength λ_{42} of multiplet 42 and $G(\tau_0)$ is a function of the effective (Sobolev) optical depth of the multiplet 3UV. From our data and our calculations using equation (1), we have obtained a rate of mass loss equal to 7.9×10^{-7} $M_\odot$ y^{-1}. A similar analysis of the Hβ line lead us to a mass loss rate of about 7×10^{-7} $M_\odot$ y^{-1}. In spite of the very simplified nature of our model, both mass-loss estimates are in very good agreement. The rarity of objects like HD 87643 means that this is a very short lived phase in stellar evolution, conclusion also supported by the fact that the estimated mass loss rate is about two orders of magnitude higher than the values derived for other Be stars through the analysis of the UV lines.

REFERENCES

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Surdej, A., Surdej, J., Swings, J.P. and Wamsteker, W., 1981, Astron. Astrophys., 93, 285.

DISCUSSION

Thomas: You assume a mass-loss occuring in a cone-shaped sector, at and above a semi-quiet equatorial cylinder. How much would you increase your F_M if you assumed spherical symmetry?

de Freitas Pacheco: The equatorial disc occupies only a small fraction of the total solid angle viewed by the star. The assumption of spherical symmetry introduces an error which is certainly smaller than the uncertainties in the mass-loss estimate that I have made.

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