Rev. Mexicana Astron. Astrof. 12, 185-187 (1986)

SPECTROSCOPIC OBSERVATIONS OF Be STARS

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RESUMO. Informa-se sobre resultados preliminares de uma campanha observacional para detetar linhas do Fe II em estrelas Be.

ABSTRACT. We report some preliminaries results of an observational campaign for detecting Fe II lines in Be stars.

There is currently at the Observatório Nacional (ON), an observational campaign which searches for Fe II lines originated in the envelopes of Be stars . The objective is to determine the physical conditions in the envelopes, the excitation mechanism of these lines and the driving mechanism of the eventual expansion of the envelope.

We have selected about 40 objects, which have displayed for once at least, Fe II lines. All the exposures were obtained at the Coudé focus of the 1.60 m telescope of the Observatório Astrofísico Brasileiro and the dispersions are of 9 Å/mm or 18 Å/mm. The spectral range includes Hβ and the multiplet 42 (λλ 4924, 5018 and 5169). This multiplet is adequate for studying the excitation mechanism because its upper level belongs to a resonant transition (UV3) and the lower one is metastable.

Using the facilities of the Image Processing Laboratory at the ON, 40 spectrograms were scanned. Only six of them show multiplet 42 in emission or absorption: HD 142983 (48 Lib) and HD 209409 (o Aqr) in absorption; HD 148184 (χ Oph), HD 164284 (66 Oph), HD 212571 (π Aqr) and HD 87643 in emission.

Up to now, the most interesting result is concerned with HD 87643, a peculiar Be star , which also was the "leit motiv" for the campaign.

That star, whose spectrum is dominated by Balmer lines, displays P-Cygni profiles and Fe II optical lines in emission, was object of a paper by Freitas Pacheco et al. (1982). In that paper, the authors suggest continuum fluorescence as the excitation mechanism for the optical lines, based on the very strong Fe II UV lines. Also, the authors examined the possibility of using the strength of multiplet 42 for mass loss rate diagnosis. Supposing Fe to be completely ionized throughout the envelope, they estimated a rate of $\dot{M} \sim 7.9 \times 10^{-7}\ M_{\odot}.yr^{-1}$, which is in good agreement with the rate obtained from the equivalent width of the absorption profile of Hβ.

Recently, this object was restudied by Freitas Pacheco et al (1985) using new observational material, that is a high resolution IUE image at long wavelengths, a low resolution image at short wavelengths and a Coudé spectrogram obtained during our campaign.

The dominant elements are once ionized metals, with Fe II as the main contributor through the spectrum. Its lines show several kinds of features. "Grosso modo", the lines are in pure absorption in the far UV, with some emission and P-Cygni profiles in near UV and in pure emission in the optical. This is coeherent with the previously suggested Fe II excitation mechanism, i.e., the continuum fluorescence in the far UV followed by decay towards the visible. This allied with optical depth effects explains the spectral lines features.

A striking feature in this object is the Mg II resonance doublet which shows a rather peculiar structure (fig. 1) As far as we know, there is only another object with such a feature, the peculiar supergiant R66 (Aeq) the LMC (Stahl et al., 1983). This suggests a complex envelope, wich is further corroborated by the different structures of Hβ (fig. 2).

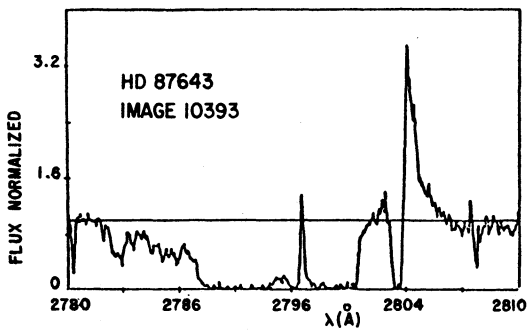

Figure 1

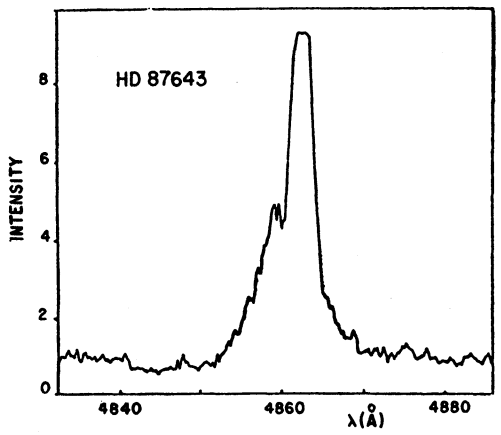

Figure 2

An estimate of the distance by means of the equivalent width of the Na I D lines and the statistical mean relation from Allen (1973), gives a value of approximately four times the previous estimate. This result, together with the spectral ressemblances with R66 and the high mass loss rate, 10^{-7} $M_{\odot}.yr^{-1}$, estimated via detailed ionization equilibrium calculations throughout the envelope in supersonic expansion, are typical of supergiants and therefore suggests HD 87643 to be a more luminous object than was previously suspected.

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