INTRINSIC REDDENING OF Be STARS AND ITS RELATION WITH H_α EMISSION INTENSITIES

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ABSTRACT :

The intrinsic reddening and its relation with H_α emission has been determined for 32 Be/Shell stars observed simultaneously at high dispersion at H_α and between $\lambda\lambda$3000-and 6200 Å with the Chalonge spectrograph. A trend toward higher reddenings when Hα emission is stronger is observed, together with a large scatter which indicates that for a given emission at Hα , intrinsic reddening can be quite different for different stars.

I . INTRODUCTION

The continuous spectrum of Be stars have long been known to show a different energy distribution, in the visual, relative to normal B stars of same spectral type. The intrinsic nature of the observed reddening has been demonstrated by the large variations in colour temperature of γ Cas in 1936 (Chalonge and Safir, 1936). The statistical properties of the energy distribution of Be stars (intrinsic reddening in the visible and near UV, and peculiar Balmer jump), clearly established by Barbier and Chalonge (1941) have been largely confirmed by subsequent studies (see for ex., Mendoza 1958, Feinstein 1968, Schild 1978, Divan 1979). Individual stars have shown during the course of their variations, that an increase in Balmer line emission is accompanied by an increase in reddening and in luminosity in the visual. Such a behavior can be accounted for by b-f and f-f emission produced in the outer atmosphere of the star. We have raised the question to see whether there exists, for a sample of Be/shell stars, some relation between the intensity of Hα emission and the intrinsic reddening of the Paschen continuum i.e between the regions where continuous and line spectrum are formed in the outer atmosphere.

II. THE OBSERVATIONS

We have carried out observations of 32 Be/shell stars at the Haute-Provence Observatory simultaneously in the region of Hα (dispersion 12.2 and 20 Å/mm) and between $\lambda\lambda$3000 and 6200 Å with the Chalonge spectrograph at a dispersion of 220 Å/mm at Hγ . The Hα equivalent widths were converted to intensities using the fluxes of Kurucz's models (1979) at the effective temperatures of the stars, normalized to the type B2V.

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We have used the calibration of spectral type vs. T_{eff} given by Underhill et al.(1979). To deredden the fluxes, the values of interstellar reddening were taken from Beeckmans (1978) using the interstellar bump at λ2200 Å. The minimum error estimated for the derived E(B-V) is $\simeq$ 0.04. We have determined, after dereddening of the flux, the (intrinsic) gradient of the star Φ^{o}_{rb}, in the range $\lambda\lambda$4000 - 6200 Å and its BCD spectral type. The intrinsic reddening of the Be star is then $\Delta\phi^{o}_{rb} = \phi^{o}_{rb} - \phi^{ST}_{rb}$, where ϕ^{ST}_{rb} is the gradient of a normal star having the same spectral type.

Figure 1. shows the behavior of $\Delta\phi^{o}_{rb}$ as a function of Hα emission intensity for the sample of Be/Shell stars considered. A large scatter is observed in the diagram. Part of the scatter can be attributed to the uncertainty of the interstellar extinction correction, indicated by the error bar. The uncertainty in the equivalent widths of Hα comes principally from saturation effects of the photographic plate when emission is strong, ie. for values of $WH_{\alpha} \gtrsim 50$ Å. This uncertainty can be quite large, up to rougthly 20 % for the strongest lines ; for $WH_{\alpha} < 50$ Å the uncertainty is less than 10 %.

There exists a trend toward large reddening for strong Hα emission, but the fact that a given value of the Hα emission can correspond to quite different intrinsic reddenings seems to be well established. No systematic effect with vsini could be found.

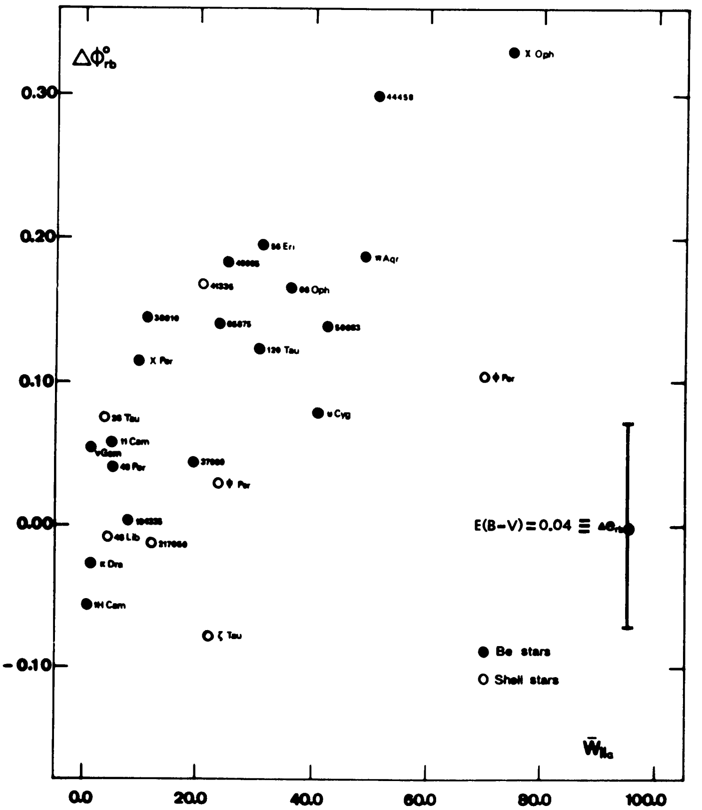

Figure 1.

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Shell spectra deserve particular attention : they show a different degree of reddening or even a bluening, and a different behavior of their Balmer jump characteristics (for details see Divan, 1979). Moreover, for ζ Tau, Φ Per and HD 41335, shell characteristics are not seen in the Hα line, but only in the Hβ line (for HD41335) and higher members (ζ Tau and Φ Per). This will be discussed in a separate paper.

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DISCUSSION

Peters: The "shell" lines seen in HR2142 (HD41335) and ϕ Per are "gas stream" features which are quite variable with phase. Strong visible shell features in HR2142 persists for less than 5% of the binary period of 80.86 days.

Zorec: With the term "shell" we distinguish these objects that had some "shell absorption features" at the time we observed them. I do not know whether these stars may or may not be considered like other objects (binaries or not) that have "shell" characteristics during longer time scales.

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