THE NEAR ULTRAVIOLET SPECTRUM OF FE III AS A CLASSIFICATION CRITERION

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The Utrecht Orbiting Ultraviolet Stellar Spectrophotometer S59 on board the ESRO TD-1A satellite has observed ultraviolet spectra of about 200 stars in the wavelength regions 2060-2160 Å, 2490-2590 Å and 2770-2870 Å with a resolution of 1.8 Å (cf. de Jager et al., 1974). The spectra are analyzed in order to find UV criteria for stellar classification. Particular attention has been given to Fe III lines since no strong lines of this ion occur in the visible part of the spectrum. As one of the most striking results, it is found that the feature at 2078 Å, which is mainly due to Fe III, is very sensitive to luminosity.

We calculated the ratio R between the residual flux in the central part of the feature (2077-2080 Å) and the mean residual flux in the two adjacent wavelength bands (the local continuum : 2074-2076 Å and 2081.5-2082.5 Å) in order to avoid inaccuracies introduced by drawing the continuum. Stars with a high signal to noise ratio have been selected and by preference stars of which more than one observation is available.

Figure 1 shows the relation between R and Q, where Q is defined as $Q = (U-B) - s(B-V)$ (cf. Heintze, 1973). The values of s proposed by Heintze for main sequence stars have been adopted also for giants and supergiants. The standard deviation for stars observed more than once is indicated, except for class III, IV and V, where only stars with $\sigma \leq .015$ were taken.

The separation between the supergiants and the other stars is clear; therefore we are able to confirm the classification given by Hiltner et al. (1969) of γ Ara (B1 Ib) and υ Sco (B2 IV), which is in contradiction with the classification given by Hoffleit (1964) (B1 III and B3 Ib respectively).

The Be stars have Fe III at least partly in emission ($R \gtrsim 1$). The shell stars ζ Tau and o And show a very strong Fe III absorption feature at 2070 Å, the strength of which is comparable with that of a B5 Ia or B8 Ia star respectively. This suggests that Fe III is mainly formed in the shell surrounding the star.

A comparison is made with theoretical values derived from line spectra, which have been computed with classical methods (plane-parallel atmosphere, hydrostatic and radiative equilibrium, LTE) (cf. Burger and van der Hucht, 1976). The resulting spectra were convoluted with a profile

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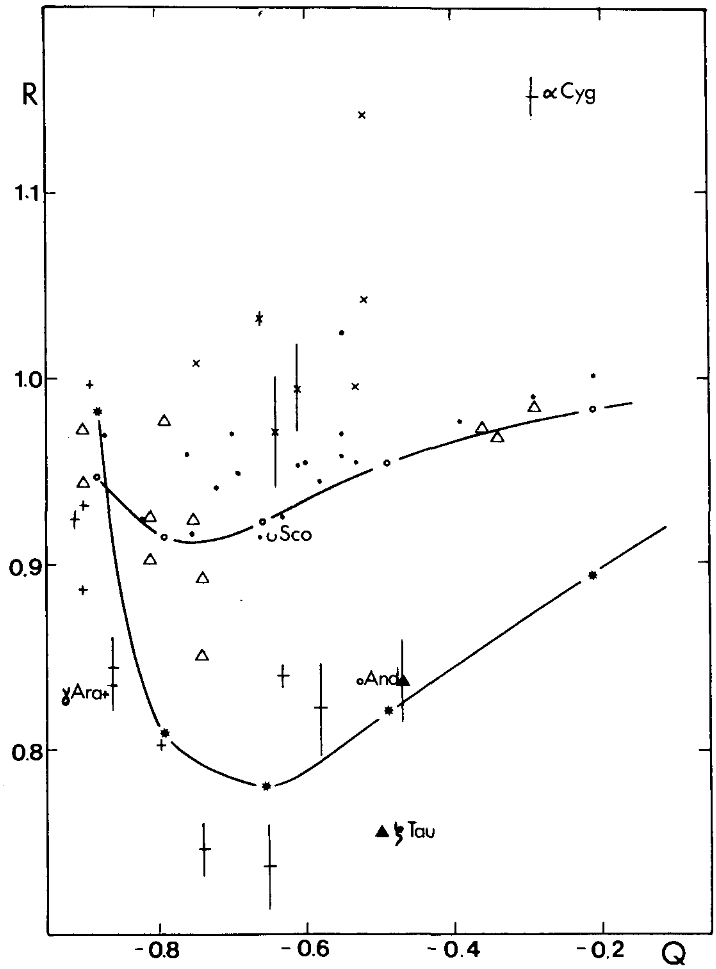

Figure 1. The relation between R and Q (see text for definition).
. Luminosity class IV, V; Δ class III; + class I, II;
x Be stars; ▲ shell stars
o—o theoretical values for log g = 4 (ξ_t = 0 km/s)
✱—✱ theoretical values for log g = 2.5 or 3 (ξ_t = 10 km/s).

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of 1.8 Å halfwidth, after which the ratio R was derived in exactly the same way as was done for the observed spectra. The difference between the minimum value of R for stars of class IV or V and the supergiants, which can be seen both in the observations and in the theoretical curves, reflects the shift of the ionization equilibrium as a function of wavelength.
More details will be published elsewhere.

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