

NEAR INFRARED SPECTRA OF SOUTHERN Be STARS ^{*}

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Spectra of northern Be stars in the near infrared region have been already described by some authors (see Slettebak, 1979 for a brief review). This paper presents general results for southern Be stars obtained from more than 100 spectrograms in the region $\lambda\lambda 7750-9000 \text{ \AA}$; the spectra were taken in four nights of February 1985 at the 1.5m ESO telescope with the reticon instrumentation; the dispersion is 58 \AA mm^{-1} . All the available southern Be stars (right ascension between 4^{h} and 17^{h}) listed in the Bright Star Catalogue (Hoffleit and Jaschek, 1982) were observed. Table 1 lists the number of stars vs. spectral type (columns 1 and 2) and the number of stars which display emission at the Paschen series, OI $\lambda 8446 \text{ \AA}$ and CaII triplet (columns 3 to 5).

The Paschen lines (P11 and higher) range from a form of pure absorption which are practically indistinguishable from those of normal B stars of the same spectral type, to very complex and broad lines with more or less defined absorption and emission components, and to pure emission lines. The emission is present in 43% of the observed stars with a peak at B2. After B6 no traces of emission can be detected. The same results were obtained from other samples of northern Be stars (Slettebak, 1979).

Table 1

Spectral type	No. of observed stars	No. of stars with emission at		
		Paschen	OI	CaII
B0	3	2	2	2
B1	10	6	7	-
B2	32	20	20	4
B3	9	4	4	-
B4	11	6	7	4
B5	7	1	2	-
B6	9	4	6	3
B7	4	-	2	1
B8	8	-	6	4
B9	10	-	1	1

About 60% of the recorded spectra show emission at the OI $\lambda 8446 \text{ \AA}$ line; the explanation of this high percentage was pointed out by Bowen (1947) as a result of a fluorescence with the L β line. The behaviour of the emission along spectral types for both OI $\lambda 8446 \text{ \AA}$ and Paschen series is roughly the same, however, unlike hydrogen lines, oxygen was found in emission even at B7-B8 types and, in one case, at B9 (HD 61224), though the intensity at these types is weak.

The CaII triplet (8498 \AA , 8542 \AA and 8662 \AA) is blended with the P13, P15 and P16 lines and it can strongly affected their equivalent widths. We assume that a spectrum shows emission (or absorption) at CaII triplet when the regular decrease of the equivalent width that occurs along the Paschen series is not satisfied for P13, P15 and P16. Among the 104 observed Be stars, 19% show emission at Ca triplet; unlike other authors (reported in Slettebak, 1979), we found that the emission is present even at B7 (HD 87543), B8 (HD 58715, HD 93563, HD 124639, HD 135734) and B9 (HD 158643). The lines have the same intensities rather than the expected 1:9:5 which implies that the emitting region is optically thick; moreover the emission does not correlate with either the spectral type or the emission envelope strength or any other feature of the spectrum. Polidan (1976) connected the presence of the CaII infrared emission to the binary nature of the star; in our sample over twenty Ca emission-line stars, two (HD 41335 and HD 41511) are well-known binary systems. Of the remainder stars, eleven (HD 50123, HD 56139, HD 58715, HD 58978, HD 63462, HD 88825, HD 110335, HD 110432, HD 124367, HD 131492, HD 158643) are classified as variable radial velocity stars and seven (HD 42054, HD 45995, HD 83953, HD 87543, HD 93563, HD 124639, HD 135734) look as 'normal' Be stars. It is obvious that the validity of the binary model to explain the nature of the Be stars depends upon the number of the binary systems that will be discovered, so next step will be to monitor extensively the above mentioned stars in order to look for periodicities in the radial velocity trend which may be ascribed to a binary motion. A detailed study will be published in *Astronomy & Astrophysics*.

*Based on observations obtained at the European Southern Observatory, La Silla

REFERENCES

- Bowen, I.S.: 1947, *Publ. Astron. Soc. Pacific* **59**, 196
 Hoffleit, D., and Jaschek, C.: 1982, *The Bright Star Catalogue* (4th ed.; New Haven: Yale University Obs.)
 Polidan, R.S.: 1976, in A. Slettebak (ed.) 'Be and Shell Stars', IAU Symp. **70**, 401 (Dordrecht: Reidel)
 Slettebak, A.: 1979, *Space Sci. Review* **23**, 541

DISCUSSION FOLLOWING PASTORI

Buscombe:

Some of the spectral types of southern Be stars in the Bright Star Catalogue should be listed as earlier subtypes with reference to the stellar photosphere.

Polidan:

IR CaII emission is much more difficult to produce in stars earlier than \sim B7 than for B7 and later Be stars. Photoionization by the Balmer continuum (below 1210 Å) easily ionizes CaII to CaIII. In my study I found a greater (apparent) incidence of binary nature in the early-Be stars with CaII emission than in the late-Be stars.