HIGH-DISPERSION SPECTROSCOPY OF THE B[e] SUPERGIANT S 111

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ABSTRACT. We studied the luminous emission-line star S 111 in the LMC with high-dispersion spectroscopy and classified it as a new member of the class of B[e] supergiants.

S 111 is a little studied emission-line star in a dense cluster in the LMC which is known as HDE 269599. A finding chart with the identification of the star in the cluster is given by Appenzeller et al. (1984). Stahl and Wolf (1986) discuss the evidence for a circumstellar shell around the star. More recently McGregor et al. (1988) found from photometry and spectroscopy in the near-IR that the star (their HDE 269599s) has an infrared excess due to hot dust. We obtained high-dispersion and high S/N-ratio spectra in the wavelength ranges 3900-4950 Å and 5750-6800 Å with CASPEC and one LWP-IUE spectrogram.

The optical spectrum of S 111 is dominated by the Balmer lines which are strongly in emission. These lines have P Cygni structure and the absorption component is clearly split in two components. The terminal velocity of the wind as measured from the Balmer lines is 645 km sec^{-1}. The He I lines also have P Cyg structure with a very similar edge velocity (640 km sec^{-1}). In addition to the Balmer lines and the He I lines, the optical spectrum of S111 shows many narrow emission lines of FeII, TiII, CrII, VII and NaI. Forbidden lines of [FeII], [NII], [SII], [NiII] and [OI] are also present. A section of the red spectrogram of S 111 is shown in Figure 1. Gaussian profiles have been fitted to the profiles of selected, unblended emission lines. Both the allowed and forbidden lines give an emission line velocity of 266 km sec^{-1}, which we use as the systemic velocity. The FWHM of the emission lines (uncorrected for the instrumental width) are 75 km sec^{-1} for the lines from allowed transitions (mainly FeII lines) and 40 km sec^{-1} for the forbidden lines. The instrumental width is about 15 km sec^{-1}, so the lines are well resolved.

The IUE UV spectrum shows many multiplets of FeII and the resonance doublet of MgII. The FeII lines in the UV show P Cyg structure with a smaller terminal velocity than the P Cyg lines in the optical ($\approx$ 250 km sec^{-1}). MgIIλ2800 is in emission. A P Cyg absorption component seems to be present, but in this case most of the absorption is probably of interstellar origin. The observations clearly show that S111 should be classified as a new B[e] supergiant. The characteristics of these

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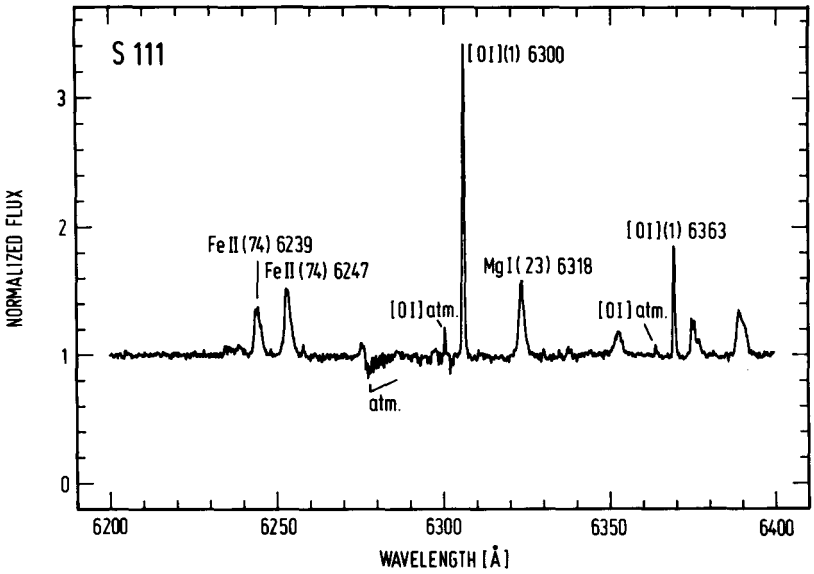

Figure 1: Section of the red spectrogram of S111 around the [OI] lines at 6300, 6363 Å. The [OI] lines are clearly much sharper than the lines of FeII and MgI.

stars are (see e.g. Zickgraf et al. 1986) strong Balmer emission lines and lines of FeII, [FeII] and other forbidden emission lines, most strongly usually [OI]$\lambda\lambda$6300, 6363. Likewise the LWP-spectrum with the numerous FeII-lines is typical for B[e]-stars (cf. e.g. the case of R66 described by Stahl et al. 1983). All these stars also have a strong IR excess indicative of hot circumstellar dust. In all known cases the forbidden emission lines are much narrower than the stellar wind velocity, thus suggesting a different zone for the origin of these lines. This region most likely is a circumstellar disk.

References

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