A COMPACT NEBULOSITY SURROUNDING THE PECULIAR BLUE EMISSION-LINE SUPERGIANT HD 37836 OF THE LMC

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HD 37836 (= R 123; Feast et al., 1960) is one of the brightest slightly variable (V ≈ 10.5-10.7; Stahl et al., 1984) emission-line stars of the LMC. Since it is also likely to be a hot star (see below) it is also bolometrically very bright ($M_{bol} \leq -11$).

We have observed HD 37836 in the ultraviolet with IUE (1200 Å ≤ λ ≤ 3100 Å) and in the optical with CASPEC (3900 Å ≤ λ ≤ 4950 Å and 5750 Å ≤ λ ≤ 6800 Å) with high dispersion. In addition we derived the continuum energy distribution from low dispersion IUE spectra and ground-based broad-band photometry (UBVRIJHKL). A strong IR excess was found. The most prominent absorptions in the IUE spectrum are stellar-wind lines of NV, SiIV and CIV with a terminal velocity of 2400 km sec^{-1}. This is typical for an O star.

By far the strongest emission lines in the visual spectrum of HD 37836 are the Balmer lines and the HeI lines (see Stahl et al., 1985). From the CASPEC spectra we found in addition lines of FeII, [FeII], [FeIII], SiII, SiIII, [SIII], MgI, MgII, NaI and [NII]. Three different groups of lines can be distinguished.

a) The forbidden lines [NII] λλ5755,6548,6583, [SIII] λ6312 and [FeIII] λλ4658,4702 are narrow and approximately gaussian shaped with a FWHM of ≈ 40 km sec^{-1}.

b) The low-excitation lines of allowed transitions (FeII, SiII λλ6347,6371, MgI λ6318, NaID) are much wider and double-peaked. The separation of the peaks is about 70 km sec^{-1}.

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c) Emission lines of higher excitation, i.e. the Balmer lines, the HeI lines and SiIII]λ1892 are also wider than the forbidden lines but do not show a double-peak structure.

The different line-widths of the various emission lines indicate that the velocity is decreasing outwards since the forbidden lines are particularly narrow. It appears that the blue-shifted absorption lines in the UV are formed in a normal stellar wind whereas the emission lines and the IR excess form in a region of considerably lower velocity, which could be a disk.

From the line intensity ratio [NII] λ5755 / (λ6548 + λ6583) we derived $n_e > 4 \cdot 10^6$ cm^{-3}. Assuming the nebula to be photoionized by the star, the linear size cannot be larger than $\approx 10^{-2}$ pc and the mass of the ionized gas is $< 10^{-1}$ $M_\odot$. The small size of the nebula indicates that it is very different from the nebula surrounding R 127 which has a linear size of ≈ 1 pc (Appenzeller et al., 1987). The ring nebulae around Wolf-Rayet and Of stars are even much larger. In the LMC they have a diameter of 20 pc or more (Chu and Lasker, 1980). Thus, low-velocity gas can be present around luminous hot stars at a large range of distances.

A more detailed paper is forthcoming in Astronomy and Astrophysics.

References

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