Non-LTE Analysis of Massive Stars in the Magellanic Clouds*

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The massive stars of the Magellanic Clouds are of considerable current interest with regard to questions of initial mass function, star formation mechanisms, stellar evolution with mass loss and the chemical evolution of galaxies. The effective temperatures, surface gravities and helium abundances of 6 main sequence O-type stars, obtained by fitting non-LTE model atmospheres to high quality spectra, are presented here; these are the first results from a long-term program to determine accurately the parameters and chemical abundances of massive stars in the Magellanic Clouds. The program stars were selected to be main sequence objects, according to the classification of Conti et al. (1985, in prep.), with He II λ 4686 Å in absorption, and to have minimal reddening and nebular emission. Spectra were obtained in 1984 December with the Cassegrain echelle spectrograph (CASPEC) and a CCD detector at the ESO 3.6 m telescope. A preliminary analysis of these spectra has been carried out by fitting the equivalent widths of He I λ 4471 Å and the profiles of Hγ and the Pickering lines (for details of the technique, see Kudritzki, 1980). The resulting values of effective temperature and gravity are given in Table I, along with the identification, spectral type and m_V of each star.

Table I

	Star	Sp. Type	m_V	T_{eff}	log g	M_V	log $L/L_\odot$
LMC:	Sk172-66^O	03/04	13.11	50000±3000K	4.20±0.2	-6.20±0.1	6.18±0.1
	Sk 69-70^O	03/04	13.90	46500K	4.10	-4.82±0.1	5.54±0.1
	LH 81-43^O	07	13.6:	45000K	4.05		
SMC:	AV 388	04	14.12	47000K	4.00	-5.21±0.1	5.71±0.1
	AV 243	05/06	13.87	45000K	4.00	-5.43±0.1	5.74±0.1
	AV 239	08.5	13.77	35000K	3.75	-5.53±0.1	5.45±0.1

The absolute magnitudes M_V are obtained using distance moduli of 18.6 for the LMC and 18.9 for the SMC and $A_V = 3.1\ E_{B-V}$. The stellar radii

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

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are then estimated from M_V and the stellar atmosphere flux of the final models (see Kudritzki, 1980), from which the luminosities given in Tab. I follow.

In Figure 1 we compare values of T_{eff}, log g and L with the evolutionary tracks of Pylyser, Doom and de Loore (1985), which have been computed for LMC and SMC abundances (Z = 0.0083 and 0.003 respectively) allowing for mass loss and overshooting. The upper panel contains the L, T_{eff} diagram, while the bottom panels gives the log g, T_{eff} form. The degree of agreement between the mass of a particular star inferred from the two diagrams gives a measure of the consistency between the spectroscopic determination of T_{eff} and g, the photometric data, and the evolutionary theory. Within the error bars, we see that we have substantial agreement, which was not the case using the earlier tracks of Brunish and Truran (1982), Maeder (1980) and Hellings and Vanbeveren (1981).

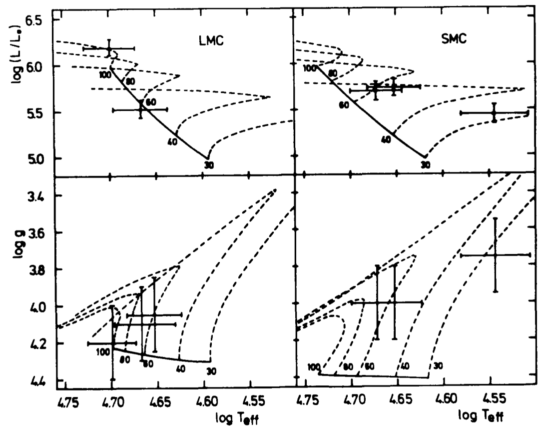

Fig. 1 (see text)

The preliminary results given here may be modified slightly when the observations are re-analyzed using models containing more than one free level of He and He^+ in NLTE, and accounting for wind blanketing, which according to Abbott and Hummer (1985) can change the inferred temperatures by several thousands degrees for the stars considered here. As the two effects cause changes of opposite sign, and since the decrease in T_{eff} from wind-blanketing will become smaller with Z, we expect the temperature change to be small, and of unknown sign.

A more thorough analysis of these stars and of other, more highly evolved, O-stars in the MC will be published in due course.

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