SPECTROPHOTOMETRY OF EARLY-TYPE SUPERGIANTS IN THE LMC

K. Nandy, G.I. Thompson, D.H. Morgan
Royal Observatory, Edinburgh, Scotland

L. Houziaux
Institut d'Astrophysique, Liège, Belgium

ABSTRACT. Measures of the equivalent widths of major stellar features in the visible and UV regions of a sample of the LMC supergiants whose types range from O5 to A1 have been derived. Their low resolution UV spectra were obtained with the IUE and complemented in the visual with spectra from ESO 3.6 m and SAAO 1.95 m telescopes. The methods used are entirely numerical and as far as possible free from subjective estimates. The data for the LMC members have been compared with those obtained for their Galactic counterparts. The variation of CIV 1550 Å and Si IV 1400 Å absorptions with spectral type has been investigated. It may be that the intensity of HeI lines is smaller for the middle and late B supergiant members of the LMC as compared with those Galactic standards, otherwise there is no systematic difference within the observational errors between the Galactic and LMC supergiants in the strengths of the principal stellar features observed in the visible as a function of spectral type. Galactic O and early B supergiants have greater equivalent widths of Si IV λ 1400 and C IV λ 1550 absorptions than the LMC supergiants of similar spectral types, confirming earlier observations of Hutchings.

As a part of a programme oriented to study the interstellar medium, ultraviolet and visible spectra of thirteen O and B supergiants have been studied and the spectroscopic features have been measured.
The programme stars include SK-67-111 (O5f), -67-108 (O7IIIf) -68-135 (O9,5), -68-107 (B0), -69-253 (B0), -67-110 (B1(e)), -65-91 (B1), -69-213 (B1), -68-177 (B2), -69-274 (B2,5), -69-108 (B3), -65-11 (B5), -69-247 (B8). For fourteen other objects we have either UV or visible spectra. Comparison stars were the white dwarfs L 870-2E and E 99. They have been observed either with the ESO 3.6 m telescope (cassegrain spectrograph equipped with IDS) or with the SAAO 1.9 m telescope and the IPCS.

S. van den Bergh and K. S. de Boer (eds.), Structure and Evolution of the Magellanic Clouds, 233–234.

The ultraviolet wavelength range has been observed from the I.U.E. in the usual ranges and with the low resolution mode. ESO observations cover the region 400-480 nm at 2.9 nm/mm reciprocal dispersion and the region 480-550 nm at 11nm/mm, while the SAAO spectra are taken at 6 nm/mm and extend from 395 to 510 nm.

The 29 nm/mm dispersion spectra were reduced to give data points every 0.3 Å, and subsequently averaged over five data points. The accuracy of the wavelength scale was found to be $\pm$ 0.05 nm. Lower dispersion spectra were averaged over three pixels leading to a resolution of 0.5 nm.

Spectral features observed are mostly blends. HeI lines include 4388, 4471, 4713, and 4920 Å. HeII lines at 4542, 4686 and 5412 Å are present in the spectra of stars hotter than B1. In order to improve the statistical accuracy, we have made sums of HeI equivalent widths (sum HeI) and compared to corresponding sums in galactic supergiants of the same spectral subclasses taken from previous work published at ROE. While there is a close agreement between LMC and galactic OB stars in both HeI and HeII, the HeI line strengths for LMC stars later than B2 are consistently weaker in the LMC stars than in their galactic counterpart. There is also agreement between the observed sum (HeI and equivalent widths computed in non-LTE by Auer and Mihalas using our previous temperature determinations), except for SK-68-107 where the observed Sum (HeI) is almost twice the computed value. In the ultraviolet, CIV and SIV doublets have P Cygni profiles. They are weaker than galactic stars. Terminal velocities ranging from 1000 to 2500 km/s have been determined.

The only metal line represented throughout the sequence is Mg II 4481 Å. This line is stronger in our LMC stars than in the galactic standards, especially around BO-B1. Other features observed include Hβ (in emission in SK-68-135 and SK-67-110) Hγ, blends of NIII at 4511-4515 Å, SiIII at 4568-4575 Å, FeII 4584 Å in SK-65-11, -69-247, -69-250, and NII/CIII/OII blend at 4642-4650 Å, and finally one feature at 4662-4676 Å.

As a conclusion, we can state that no significant difference is found in the strengths of the major stellar features for LMC and galactic O and early B supergiants. There is however a suggestion that HeI lines may be weaker in middle and late B LMC supergiants.

References

Auer L., and Mihalas D : 1972 Astrophys. J. Suppl. Ser. 24,193
——————————— : 1973 Astrophys. J. Suppl. Ser. 25,433
Thompson G.I., Nandy K., Morgan D.H., Willis A.J., Wilson R., and Houziaux L. : 1982 Monthly Notices R. Astron. Soc. 200,551

https://doi.org/10.1017/S0074180900040274 Published online by Cambridge University Press