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TÍTULO:
ESTUDIO DE ESTRELLAS MASIVAS CON ESPECTROS DE ALTA RESOLUCIÓN EN EL UV-LEJANO, UV Y VISIBLE
A STUDY OF MASSIVE STARS FROM HIGH RESOLUTION SPECTROSCOPY IN THE FAR-ULTRAVIOLET, ULTRAVIOLET AND OPTICAL RANGES

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RESUMEN/*ABSTRACT*:

Massive stars play a crucial role in the chemical and mechanical evolution of structures in the Universe, for their feedback of momentum and energy to the interstellar medium and their contribution to the cosmic and galactic nucleosynthesis. The atmospheres of hot massive stars are governed by their strong radiation fields, which induce departures from the LTE regime and drive the atmospheric expansion. Imprints of the stellar winds of hot massive stars are found at all wavelength regions. They can be identified in medium resolution spectra individually observable out to the Virgo cluster and dominate the integrated spectra of starburst regions in even farther galaxies. The UV and Far-UV ranges are particularly rich in wind spectral features.

In this thesis work we have studied the Far-UV spectra of a sample of hot massive stars observed with the "Far Ultraviolet Spectroscopic Explorer"(FUSE, 905-1187 Angstroems),

together with archival UV data (1150-1800 Angstroems) from the "International Ultraviolet Explorer" (IUE) and the "Hubble Space Telescope" (HST). We have used synthetic spectra calculated with the WM-basic code to analyze the data. WM-basic applies an accurate consistent treatment of non-LTE and line-blocking to the entire atmosphere and solves the hydrodynamical structure of the spherically expanding envelope, with a smooth transition from the quasi-static photosphere to the high velocity outflow. We have built a grid of WM-basic synthetic spectra that makes a powerful tool for quantitative spectroscopic analyses in the UV--Far-UV range.

The grid allows us to set upper and lower limits to the stellar parameters by comparison to the observed spectra and to study the variations of the spectral features as a function of the different stellar properties. Other possible applications of the grid surpass spectral analyses and include the study of HII regions and the extinction law. An extended version of the grid can be used as input stellar library for population synthesis codes.

The main part of the thesis work consists on the tailored quantitative analysis of the FUSE and IUE spectra of a sample of Galactic early- and mid-O type stars with WM-basic models. The FUSE range contains unsaturated wind lines, and the analysis of the combined spectra allows a finer tuning of the wind parameters than the IUE lines alone. By fitting simultaneously the spectral features in the 905-1800Angstroem range, we obtain a consistent solution of all the stellar parameters (effective temperature, gravity, stellar radius, mass loss rate, terminal velocity and shocks in the wind) and the ionization equilibrium in the expanding atmosphere. FUSE data are essential to quantify shocks in the wind since they include the OVI 1031.9,1037.6 doublet, formed because of K-shell ionization of oxygen by the EUV/X-ray radiation emitted in the shock cooling zones.

Our most important result is a new temperature scale for the spectral types spanned by the sample, O3-O7. The temperature values derived for the sample of stars are consistently lower than previously determined in the literature or assigned by the calibrations of Vacca et al. (1996) and Martins et al. (2005) to their spectral type.

We have also presented the first Far-UV spectra of stars in M31 and M33, feasible with FUSE's improved sensitivity. However, the FUSE spectra are contaminated by the contribution of nearby objects, impairing a quantitative analysis. Yet, the composite spectra provides important

information regarding the metallicity and the stellar winds in M31 and M33. The sample of stars in M33 includes three "Ofpe/WN9" objects whose spectra indicate that they are not undergoing an episode of extreme mass loss. The FUSE spectra of another subset of M33 targets are consistent with the existent of a metallicity gradient in this galaxy, and indicate that the spiral arm hosting M33-UIT311 has intermediate metallicity between the Milky Way and the Large Magellanic Cloud. Our qualitative study of the variation of the Far-UV spectral morphology with metallicity is a fundamental prerequisite for future quantitative works.

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