A Massive Star Odyssey, from Main Sequence to Supernova
Proceedings IAU Symposium No. 212, © 2003 IAU
K.A. van der Hucht, A. Herrero & C. Esteban, eds.

FUSE far-ultraviolet spectroscopy of Wolf-Rayet stars

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Abstract. An overview of a new far-ultraviolet spectral atlas of Wolf-Rayet stars in the Galaxy and the Large and Small Magellanic Clouds is presented.

1. Introduction

The *FUSE* satellite has secured far-ultraviolet (912 - 1200 Å) spectroscopy at high resolution ($R = 25\,000$) of a large sample of Wolf-Rayet stars in the Galaxy and, in particular, in the Large and Small Magellanic Clouds. The survey includes most subtypes in both the WN and WC sequences. This contribution presents an overview of these new, unique spectra. It highlights the wide range of IP and EP transitions that are available in the *FUSE* wavelength range, especially in C, N, O, He, Si, S and P ions, for subsequent detailed atmospheric and wind analyses. In particular, the *FUSE* data, coupled with *IUE*, *HST* and optical-IR spectra, provide a superb dataset, with which to investigate the wind velocity laws and chemical composition of individual stars as a function of WR class and subtype, and intercompare objects in the different galaxies. Compared to *IUE* and *HST*, the *FUSE* spectroscopy covers a much wider range of chemical species additional to C, N and He, including a wider range of I.P. transitions, from N II (IP = 30 eV) to O VI (IP = 138 eV). Our new *FUSE* data cover twelve single WR stars in the Galaxy and eleven single WR stars in the LMC and SMC.

https://doi.org/10.1017/S007418090021231X Published online by Cambridge University Press

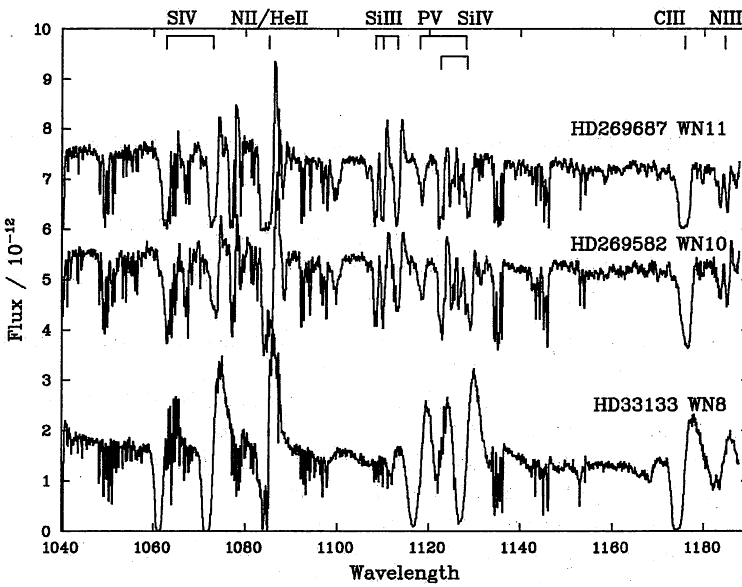

Figure 1. *FUSE* spectra of three late-type WN stars in the LMC.

2. Far-UV spectral morphology

Figure 1 illustrates the quality of the new *FUSE* spectra, showing a montage of late-type WN spectra in LMC stars, covering the wavelength range 1040 - 1190 Å. Our complete atlas shows the following far-UV spectral morphology.

At WN4-5 the dominant wind lines (P-Cyg profiles) are P V λ1118,1128, O VI λ1031,1037 and S VI λ933,944. At WN6, P V, O VI and S VI are still present, but S IV λ1062,1072 P-Cyg lines become prominent, with C III λ977,1175 and N III λ991 showing well developed P-Cyg profiles. At WN8, Si IV λ1122,1128 become strong P-Cyg profiles, with C III, N III, S IV and P V still prominent. O VI and S VI are present but weak. WN10 and WN11 stars are exemplified by pronounced P-Cyg profiles in Si III λ1108,1110,1113, with N II λ1085 replacing He II λ1085 as a P-Cyg transition.

In the WC stars, C III λ1175 P-Cyg profiles dominate throughout the WC sequence, reaching peak strength at WC7/WC8. C IV λ948,1108 emissions are seen from WC4 to WC9, with O VI λ1032,1037 and S VI P-Cyg profiles strong wind features at WC4, WC5 and WC6, but weaker at WC7-8, probably replaced by C II λ1036 at WC9. C III λ977 is a prominent P-Cyg feature throughout the WC sequence, with N III λ991 absent, as expected. P V and S IV P-Cyg profiles are evident from WC4-8; Si IV clear at WC7-WC9, with Si III only present at WC9.

A complete far-UV spectral Atlas of these new WR spectra will shortly be submitted for publication in ApJ.