Zenodo doi:10.5281/zenodo.4964818

Wavelenght calibration with WR lines

M. Messineo[1,2]

[1]Dipartimento di Fisica e Astronomia, Universita' di Bologna, Via Gobetti 93/2, 40129, Bologna, Italy
[2]INAF-Osservatorio di Astrofisica e Scienza dello Spazio di Bologna, Via Gobetti 93/3, I-40129 Bologna, Italy

Received ⟨reception date⟩; Accepted ⟨acception date⟩

Abstract

Key words: stars: evolution — stars: supergiants — stars: massive

Table 1. Prominent lines in WC stars (red lines)

Line Å	Element	
4650	CIII	
5696	CIII	WC8/WC9
5800	CIV	WC6
6580	CII	
7231.36	CII	
8772-8780	CIII	
9238-9267	CII	
9733-9747	CII/III blend	

- Lines are taken from Marin et al. (2024) and Crowther (2007).

Table 2. Prominent lines in WR stars (green lines)

Line Å	Element
4686	HeII
6560	HeII
7115	NIV
7592	He II
8237	He II
10124	He II (5-4)
10830	He I

- Lines are taken from Marin et al. (2024), Hamann et al. (1995), Groh et al. (2007), and Howarth & Schmutz (1992).

1 Introduction

Wolf–Rayet stars exhibit strong emission lines in their spectra. They can be identified even at the low resolution of the Gaia BP/RP spectra. An example of line identification is provided in Marin et al. (2024).

A catalog of Wolf-Rayet stars in the Milky Way is mantained by Prof. Crowther and is available on Crowther's webpage.

2 A set of reference spectra

The database compiled by Crowther comprises about 700 Wolf–Rayet (WR) stars, all of which are already identified with Gaia DR3 sources. For the present study, I have used a subset of 397 stars, assembled from the lists of van der Hucht (2001), Mauerhan et al. (2011), Shara et al. (2012), and Kanarek et al. (2015).

These 397 stars were cross-correlated with the 2MASS database and subsequently with the Gaia DR3 catalog using the 2MASS identifiers, yielding 204 secure sources with available BP/RP spectra. The Gaia sources were verified against the SIMBAD database.

Known binary stars were excluded, as well as stars with poor BP/RP spectra or spectra with ambiguous classifications (reported as WN or WC but showing mixed features indicative of binarity). Only Gaia point sources with RUWE values smaller than 1.4 were retained.

In the end, a list of 82 WN stars and 31 WC stars was obtained.

As noted above, additional stars can be incorporated from Crowther's comprehensive compilation (but, this will require a new round of visual inspection, cannot be done automatically).

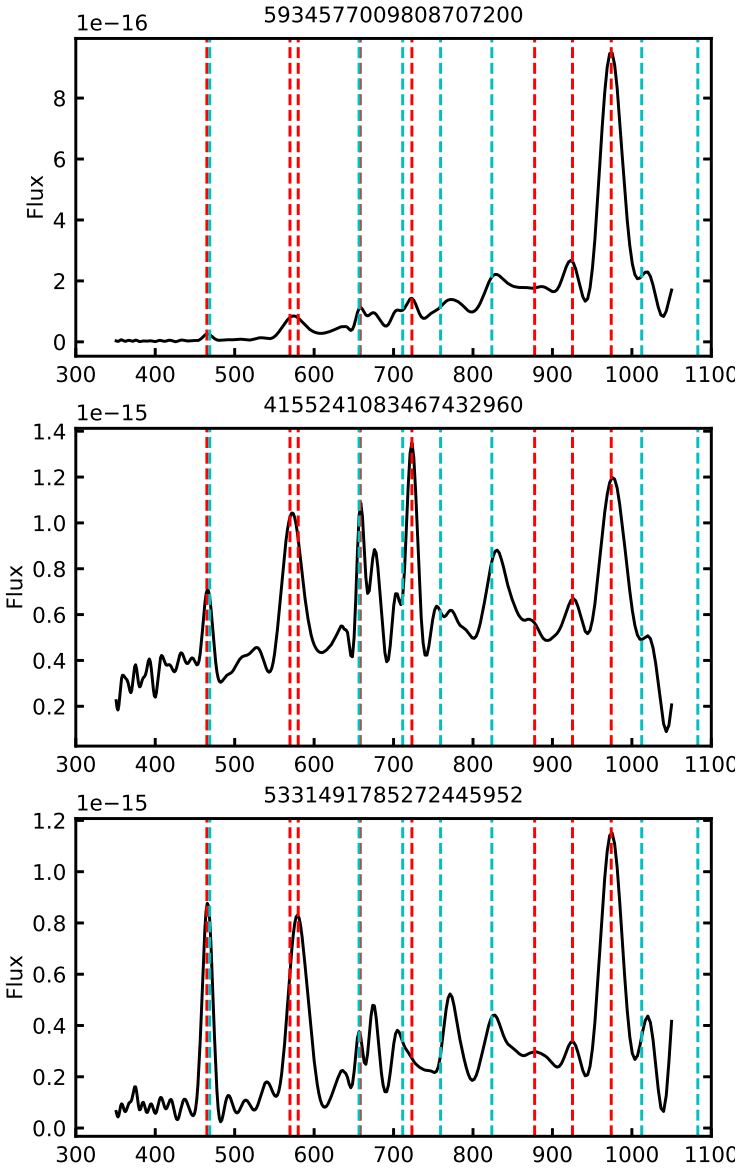

Fig. 1. Example of a WC spectrum: a WC9 at the top, a WC9d in the middle, and a WC6 in the lower panel. Lines prominent in WC spectra are plotted in red, while those characteristic of WN stars are shown in green. Note that the lines around 550nm vary with spectral type; therefore, precise knowledge of the spectral type is required, as indicated in the table.

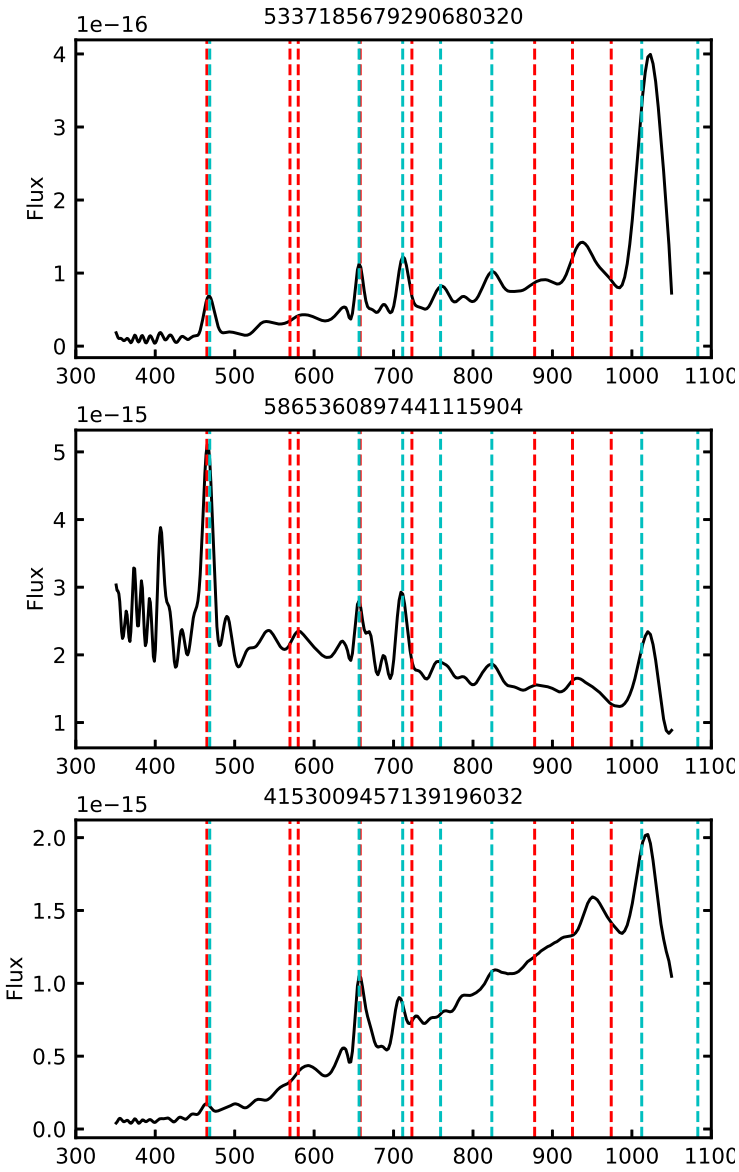

Fig. 2. Example of WN spectra: a WN4-s at the top, a WN7 in the middle, and a WN8h in the bottom panel. Lines prominent in WC spectra are plotted in red, while those characteristic of WN stars are shown in green.

3 High-resolution spectra

I have quickly found 16 nice spectra.

UVES_POP library contains the spectra of 8 WR stars.

Aadland et al. (2022) analyzed high-quality UV, optical, and near-IR (NIR) data on six WC-type stars and two WO. The spectra are on VIZIER.

A direct comparison of BPRP spectra and high-resolution is therefore possible.

4 News of PNs

In preparation for the calibration of Euclid data, several planetary nebulae (PNs) were observed with VLT/X-shooter (Euclid Collaboration et al. 2023). The corresponding FITS files are available at VizieR (Fits at VIZIER).

section**References**

Aadland, E., Massey, P., Hillier, D. J., & Morrell, N. 2022, ApJ, 924, 44
Crowther, P. A. 2007, ARA&A, 45, 177
Euclid Collaboration, Paterson, K., Schirmer, M., et al. 2023, A&A, 674, A172
Groh, J. H., Damineli, A., & Jablonski, F. 2007, A&A, 465, 993
Hamann, W.-R., Koesterke, L., & Wessolowski, U. 1995, A&AS, 113, 459
Howarth, I. D. & Schmutz, W. 1992, A&A, 261, 503
Kanarek, G., Shara, M., Faherty, J., Zurek, D., & Moffat, A. 2015, MNRAS, 452, 2858
Marin, L. C., Massey, P., Skiff, B. A., & Farrell, K. A. 2024, AJ, 168, 167
Mauerhan, J. C., Van Dyk, S. D., & Morris, P. W. 2011, AJ, 142, 40
Shara, M. M., Faherty, J. K., Zurek, D., et al. 2012, AJ, 143, 149
van der Hucht, K. A. 2001, , 45, 135

paolo reference for the PN is Paterson 2023 A&A 674, A172