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The structure of iron-blanketed WR atmospheres

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Abstract. We report on the ionization structure of iron line-blanketed Non-LTE models for Wolf-Rayet (WR) stars of the nitrogen (WN) and carbon (WC) sequence. The atmospheres are strongly stratified with a rapid change of leading ionization stages within a thin sphere.

The spectra of WR stars are dominated by emission lines of helium, carbon, nitrogen and oxygen. In the vast majority of spectra, lines of more than one ionization stage are visible. All spectra show typically lines of He I and He II, supplemented by lines of N III to N V (WN sequence) and lines of C III, C IV and O IV to O VI (WC sequence), respectively.

The reason for this variety of spectral lines is the strong stratification of the atmospheres of WR stars. The leading ionization stage of each element changes several times in the outer part of the atmosphere (Fig. 1). The line-forming regions follow this sequence of ionization stages, because all lines except the resonance lines are fed by recombination cascades (lines of a specific ionization stage i are formed in a sphere dominated by the ionization stage $i + 1$).

The stratification itself is a direct consequence of the Non-LTE situation. The atmospheres are dominated by radiation processes and therefore, in principle, a specific ionization stage can be sustained as long as the photons below the ionization edge are not consumed.

The models are calculated with the Potsdam Non-LTE code for expanding atmospheres which is based on the standard model for WR stars — spherical symmetry, homogeneity and stationarity of the flow — augmented by iron-line blanketing (Gräfener et al., these procedings) and clumping (Hamann et al., these procedings). A similar code by John Hillier (Hillier & Miller 1998) leads, in principle, to the same results.

References

Hillier D.J., Miller D.L. 1998, ApJ 496, 407

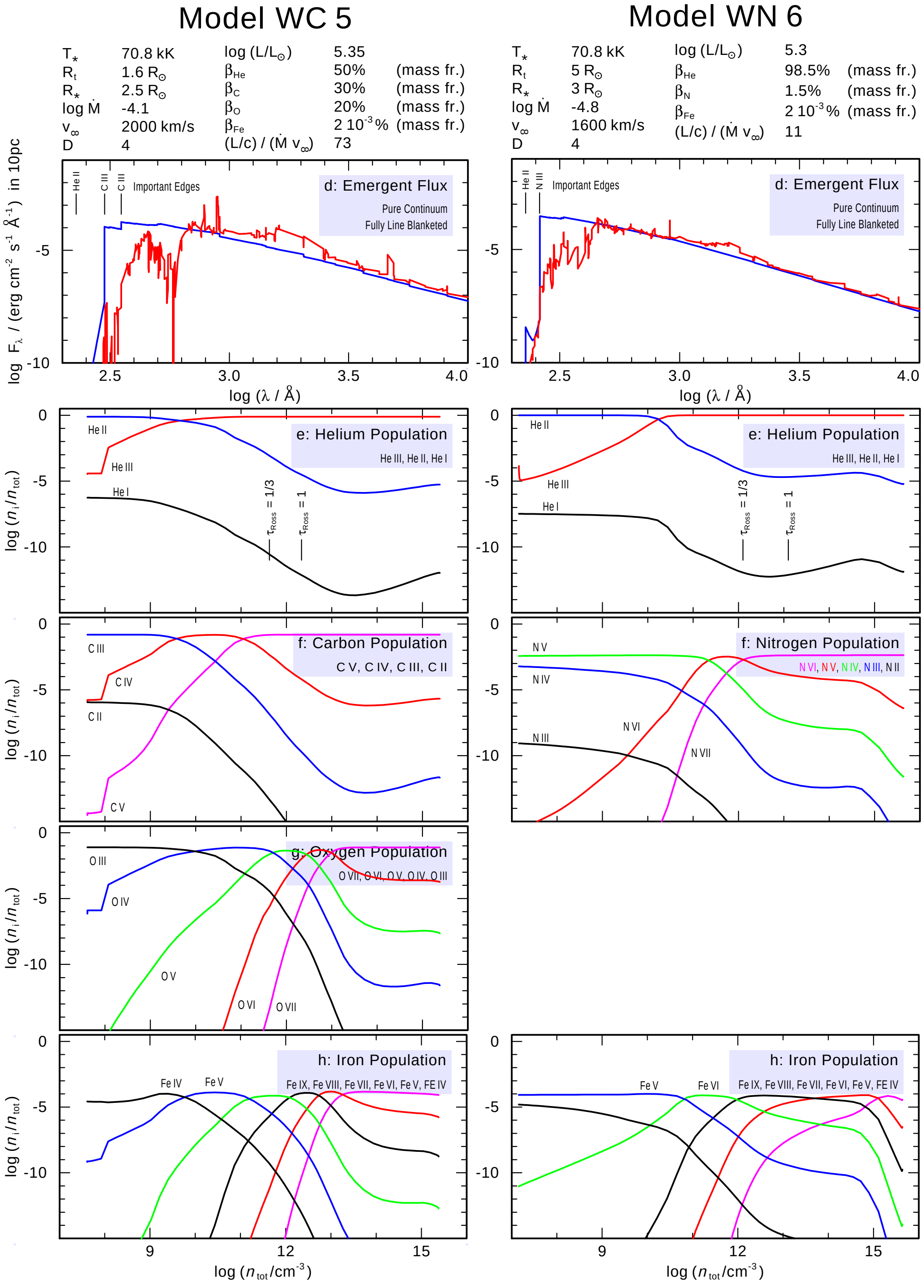

Figure 1. Ionization structures and emergent fluxes of a typical WC- (left panels) and a typical WN-type (right panels) model.