Spectroscopy and hydrodynamics of dense stellar winds

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Analyzing the spectra from Wolf-Rayet stars requires adequate non-LTE modeling of their expanding atmosphere. The numerical schemes for solving the radiative transfer in the co-moving frame of reference have been developed by Mihalas and co-workers 30 years ago. The most elaborate codes can cope today with many hundred explicit non-LTE levels or super-levels and account for metal-line blanketing.

The limited agreement with observed spectra indicates that the model simplifications are still severe. One approximation that has to be blamed is homogeneity. Stellar-wind clumping on small scales was easily implemented, while "macro-clumping" is still a big challenge. First studies showed that macro-clumping can reduce the strength of predicted P-Cygni line profiles in O-star spectra, and largely affects the X-ray line spectra from stellar winds.

The classical model for radiation-driven winds by Castor, Abbot and Klein fails to explain the very dense winds from Wolf-Rayet stars. Only when we solved the detailed non-LTE radiative transfer consistently with the hydrodynamic equations, mass-loss rates above the single-scattering limit have been obtained.

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Comments:

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