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.

Quantitative analysis of O-type stars properties, at low metallicity

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Abstract. We have investigated the properties of main-sequence O-type stars in the SMC. Mass-loss rates, luminosities and $T_{\rm eff}$ are much smaller for these stars than for Galactic ones, resulting in a steeper wind-momentum relation.

1. Introduction

The Small Magellanic Cloud is the closest companion of our galaxy known to host young populations of O-type stars of low metallicity. Comparing models and observations provide a better knowledge of the evolution, winds, and spectra of these stars in a metal poor environment. High resolution spectra of O-type stars in NGC 346, the largest H II region in the SMC have been obtained. Our *HST*-STIS data cover the spectral range 1170 - 1730 Å, for a spectral resolution $R = 46\,000$. Optical spectra have been obtained either at AAT and ESO with a spectral coverage of 3900-5200 Å and spectral resolution $R = 25\,000$.

2. Modeling

Non-LTE line blanketed models TLUSTY (Hubeny & Lanz 1995) and CMFGEN (Hillier & Miller 1998) have been used. CMFGEN has been improved to connect

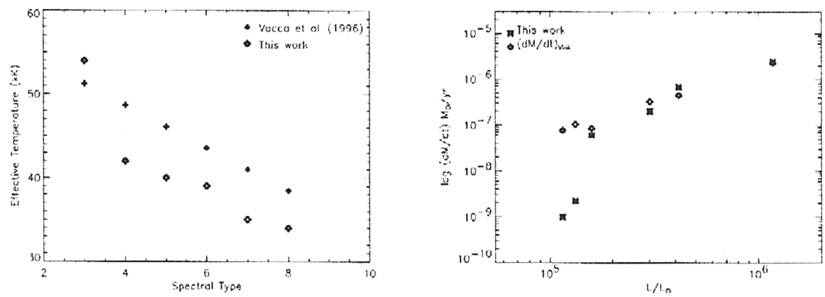

Figure 1. *Left:* Comparison of $T_{\rm eff}$ from Vacca *et al.* (1996) to those of this work. *Right:* Mass-loss rates from the models compared to those of Vink *et al.* (2001), for a metallicity $Z = 0.2\,Z_{\odot}$.

smoothly a TLUSTY hydrostatic structure in deep layers with a β-type velocity law in the wind. In a first step, photospheric parameters ($T_{\rm eff}$, $\log g$, Z) and $v \sin i$ are derived from the analysis of the optical spectrum with TLUSTY. Then, wind parameters are obtained by analysing the UV spectrum with CMFGEN, using parameters from step 1 as input. When available, Hα is used to better constrain the mass-loss rate. Abundances for metals are iterated to best fit the individual spectra features and abundance ratios are allowed to be non solar.

3. Results

Our effective temperatures are lower than the values derived from the Vacca *et al.* (1996) calibration based on plane-parallel pure H-He models (the hottest star of our sample is hotter than the upper limit of their calibration). This comes from the inclusion of massive line blanketing in our models. Lower luminosities are also obtained because lower $T_{\rm eff}$ are not compensated by larger stellar radii, as the observed visual magnitudes must be reproduced. For the hottest stars of our sample, our $\dot{M}$ agree with Vink *et al.* (2001) prediction. On the other hand, the latter is about two orders of magnitude higher than our measured $\dot{M}$ for the two coolest stars. As a consequence, the wind-momentum relation we derive is steeper than for Galactic stars.

References

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https://doi.org/10.1017/S0074180900211790 Published online by Cambridge University Press