A Consistent Spectral Model of WR 136 and its Associated Bubble NGC 6888

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We analyse whether a stellar atmosphere model computed with the code CMFGEN provides an optimal description of the stellar observations of WR 136 and simultaneously reproduces the nebular observations of NGC 6888, such as the ionization degree, which is modelled with the pyCloudy code. All the observational material available (far and near UV and optical spectra) were used to constrain such models. We found that even when the stellar luminosity and the mass-loss rate were well constrained, the stellar temperature T_* at tau = 20, can be in a range between 70 000 and 110 000 K. When using the nebula as an additional restriction we found that the stellar models with T_* sim 70 000 K represent the best solution for both, the star and the nebula. Results from the photoionization model show that if we consider a chemically homogeneous nebula, the observed N+/O+ ratios found in different nebular zones can be reproduced, therefore it is not necessary to assume a chemical inhomogeneous nebula. Our work shows the importance of calculating coherent models including stellar and nebular constraints. This allowed us to determine, in a consistent way, all the physical parameters of both the star and its associated nebula. The chemical abundances derived are 12 + log(N/H) = 9.95, 12 + log(C/H) = 7.84 and 12 + log(O/H) = 8.76 for the star and 12 + log(N/H) = 8.40, 12 + log(C/H) = 8.86 and 12 + log(O/H) = 8.20. Thus the star and the nebula are largely N- and C- enriched and O-depleted.

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