

The blue supergiant Sher 25 and its intriguing hourglass nebula

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The blue supergiant Sher,25 is surrounded by an asymmetric, hourglass-shaped circumstellar nebula. Its structure and dynamics have been studied previously through high-resolution imaging and spectroscopy, and it appears dynamically similar to the ring structure around SN,1987A. Here we present long-slit spectroscopy of the circumstellar nebula around Sher,25, and of the background nebula of the host cluster NGC,3603. We perform a detailed nebular abundance analysis to measure the gas-phase abundances of oxygen, nitrogen, sulphur, neon and argon. The oxygen abundance in the circumstellar nebula ($12 + \log \{O/H\} = 8.61 \pm 0.13$, dex) is similar to that in the background nebula (8.56 ± 0.07), suggesting the composition of the host cluster is around solar. However, we confirm that the circumstellar nebula is very rich in nitrogen, with an abundance of 8.91 ± 0.15 , compared to the background value of 7.47 ± 0.18 . A new analysis of the stellar spectrum with the {sc fastwind} model atmosphere code suggests that the photospheric nitrogen and oxygen abundances in Sher,25 are consistent with the nebular results. While the nitrogen abundances are high, when compared to stellar evolutionary models they do not unambiguously confirm that the star has undergone convective dredge-up during a previous red supergiant phase. We suggest that the more likely scenario is that the nebula was ejected from the star while it was in the blue supergiant phase. The star's initial mass was around 50msun, which is rather too high for it to have had a convective envelope stage as a red supergiant. Rotating stellar models that lead to mixing of core-processed material to the stellar surface during core H-burning can quantitatively match the stellar results with the nebula abundances.

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Comments:

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