The MiMeS Survey of Magnetism in Massive Stars: CNO surface abundances of Galactic O stars

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The evolution of massive stars is still partly unconstrained. Mass, metallicity, mass loss and rotation are the main drivers of stellar evolution. Binarity and magnetic field may also significantly affect the fate of massive stars. Our goal is to investigate the evolution of single O stars in the Galaxy. For that, we use a sample of 74 objects comprising all luminosity classes and spectral types from O4 to O9.7. We rely on optical spectroscopy obtained in the context of the MiMeS survey of massive stars. We perform spectral modelling with the code CMFGEN. We determine the surface properties of the sample stars, with special emphasis on abundances of carbon, nitrogen and oxygen. Most of our sample stars have initial masses in the range 20 to 50 Msun. We show that nitrogen is more enriched and carbon/oxygen more depleted in supergiants than in dwarfs, with giants showing intermediate degrees of mixing. CNO abundances are observed in the range of values predicted by nucleosynthesis through the CNO cycle. More massive stars, within a given luminosity class, appear to be more chemically enriched than lower mass stars. We compare our results with predictions of three types of evolutionary models and show that, for two sets of models, 80% of our sample can be explained by stellar evolution including rotation. The effect of magnetism on surface abundances is unconstrained. Our study indicates that, in the 20-50 Msun mass range, the surface chemical abundances of most single O stars in the Galaxy are fairly well accounted for by stellar evolution of rotating stars.

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Comments:

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