New windows on massive stars: asteroseismology, interferometry, and spectropolarimetry
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Fundamental properties of single O stars in the MiMeS survey

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Abstract. We present preliminary results of the determination of fundamental parameters of single O-type stars in the MiMeS survey. We present the sample and we focus on surface CNO abundances, showing how they change as stars evolve off the zero-age main sequence.

Keywords. stars: fundamental parameters, stars: abundances

1. Introduction

The MiMeS survey of massive stars was designed to establish the magnetic characteristics, including the statistical properties, of the magnetic fields of O and B stars (Wade *et al.* 2012). In total, 100 O stars were observed with at least one of the following instrument: ESPaDOnS (CFHT, Hawaii), NARVAL (Télescope Bernard Lyot, France) and HARPSpol (ESO 3.6m, Chile). A magnetic field was detected in about 7% of the sample (Grunhut *et al.*, in prep.). For the entire sample, the collected high signal-to-noise (S/N>100), high resolution (R > 65000) optical spectra represent a unique database to determine the fundamental properties of O-type stars.

We have undertaken such a task, focussing on single O stars. We have removed all known spectroscopic binaries (SB1 and SB2) from the initial sample. We were left with 65 stars. Special care was taken to derive the surface abundances which provide important constraints on the evolution and internal mixing of massive stars.

2. Spectroscopic analysis and surface abundances

We performed a spectroscopic analysis using atmosphere models and synthetic spectra computed with the code CMFGEN (Hillier & Miller 1998). We determined the following parameters: effective temperature, surface gravity ($\log g$), projected rotational velocity ($v \sin i$), macroturbulent velocity ($v_{\rm mac}$) and CNO surface abundances. For the latter we

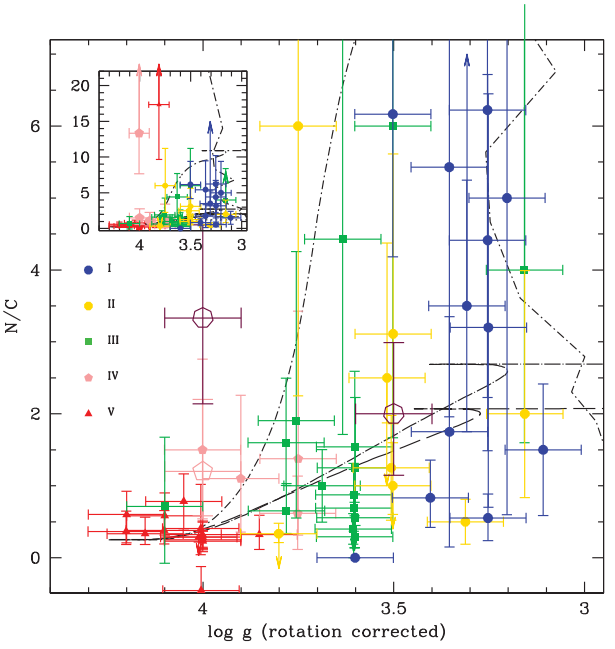

Figure 1. N/C as a function of surface gravity $\log g$ (corrected for rotation) for the sample stars. Different symbols/colors correspond to different luminosity classes. Open symbols stand for magnetic stars. The evolutionary tracks of Ekström *et al.* (2012) for initial masses of 20, 25 and 40 $M_\odot$ are overplotted. The upper insert is the same figure on a wider scale.

used between 5 and 15 lines depending on the element and the star's spectral type. The uncertainties on the derived parameters were based on a χ^2 analysis.

Fig. 1 shows the ratio of nitrogen to carbon surface abundances as a function of $\log g$. The error bars on the surface abundances remain large because of uncertainties in the line formation processes. However, a clear trend of higher values of N/C at lower gravities is seen: dwarfs have N/C lower than 1.0, while in supergiants this ratio can reach values up to 6.0. This indicates that the products of hydrogen burning through the CNO cycle are transported to the stellar surface as stars evolve off the zero-age main sequence. The observed N/C values are also broadly consistent with those predicted by the rotating models of Ekström *et al.* (2012).

The open symbols in Fig. 1 correspond to magnetic O stars. They do not stand out as chemically peculiar, except perhaps in one case. Once fundamental parameters are available for the entire sample, we will compare the properties of magnetic and non-magnetic stars to investigate possible effects of magnetism on surface properties.

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References

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