SPECTROSCOPIC ANALYSIS OF OB STARS IN THE CARINA NEBULA

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Introduction

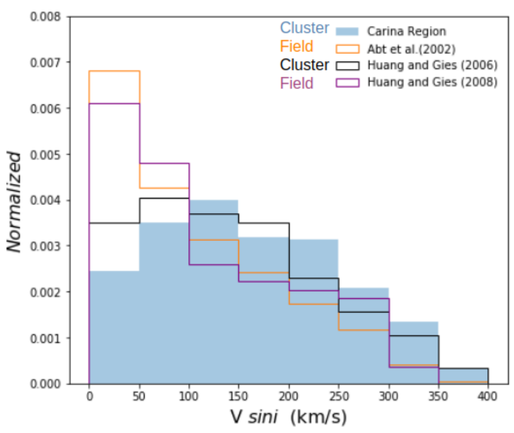
Massive OB stars are luminous and young objects, being easily observed and located close to their place of birth, allowing the mapping of the present-day abundances of the Galaxy. OB stars are generally found in OB associations, one of them is Car OB, a large, very active star-forming region in the Carina-Sagittarius spiral arm. Its stellar population is split into several open clusters associated with the Carina Nebula. In this work, we present a detailed spectroscopic study for a sample of OB stars located in 8 open clusters in the Carina Nebula: Trumpler 14, Trumpler 15, Trumpler 16E/W, Collinder 228, Collinder 232, Bochum 11 and NGC 3293.

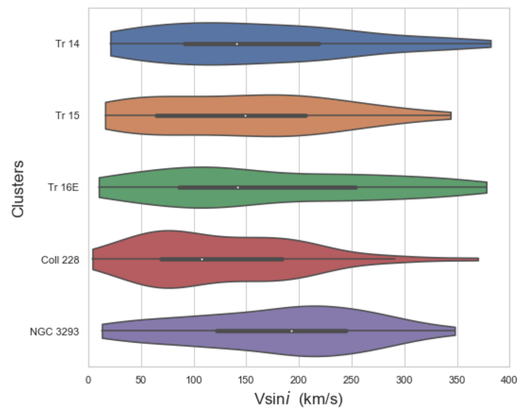
Data

This study is based on high-resolution spectra obtained with the FLAMES/GIRAFFE spectrograph coupled to the UT2 VLT 8 m telescope, in the context of the Gaia-ESO Public Spectroscopic Survey. The GIRAFFE configurations are optimized to detect important features in the spectra of early-type stars such as Hγ line, an important $\log g$-indicator and some important lines for $T_{\rm eff}$ diagnosis, as for example, C III, O II, Si III, and Si IV lines.

Projected rotational velocity

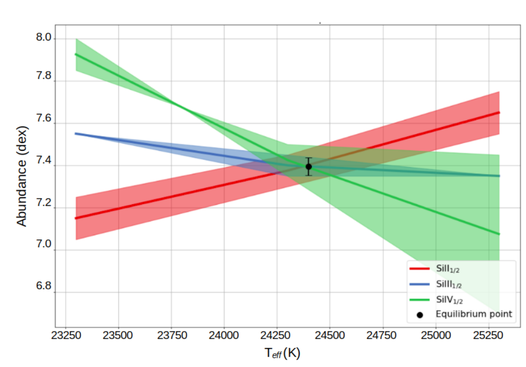
We obtained the projected rotation velocity $V \sin i$ for a sample of 330 OB stars, probable members of 8 open clusters in the Carina Nebula, based on a calibration for the widths of two He I lines, at λ 4388 and 4471Å[2]. The $V \sin i$ distribution for the full sample represented by the blue histogram (Fig 1) is consistent with typical $V \sin i$ distributions for open clusters while the $V \sin i$ distributions for field OB stars tend to peak at lower $V \sin i$. Fig 2 presents the violin distributions for the 5 clusters of our sample with more than 40 studied stars: the average $V \sin i$ for individual clusters varies between 126±77 km s^{-1}, for Collinder 228, and 180±84 km s^{-1}, for NGC 3293.

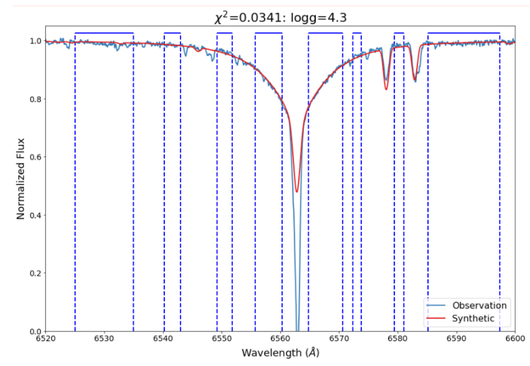




Stellar Parameters and Abundances

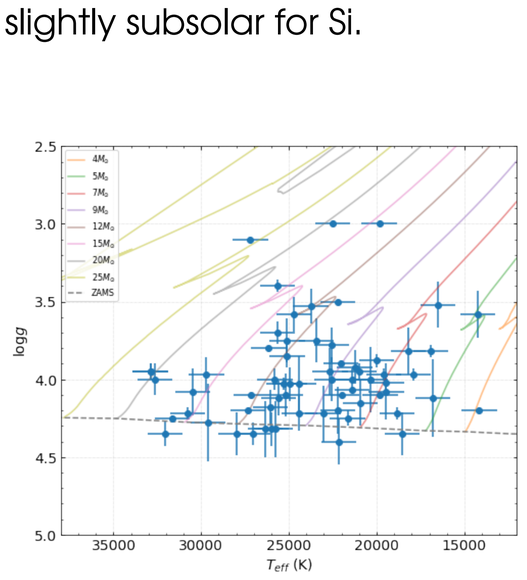
We use a semi-automatic routine based on non-NLTE model atmospheres and synthetic spectra (TLUSTY/SYNPLOT) [1, 3] to perform a self-consistent analysis and determine the atmospheric parameters $T_{\rm eff}$, $\log g$, $V \sin i$, microturbulence and macroturbulence, as well as abundances of Silicon, Oxygen, Carbon and Nitrogen, for a subsample of 65 sharp-lined stars. The effective temperature has been defined from the ionization balance between Si II, Si III, and Si IV (Fig 3), while $\log g$ has been derived from the fits of H wings (Fig 4).

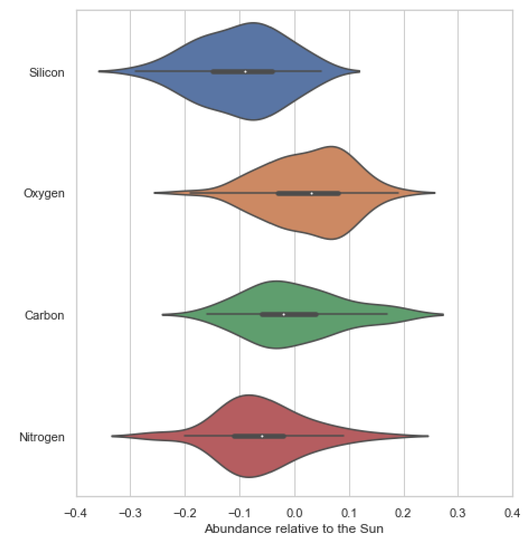




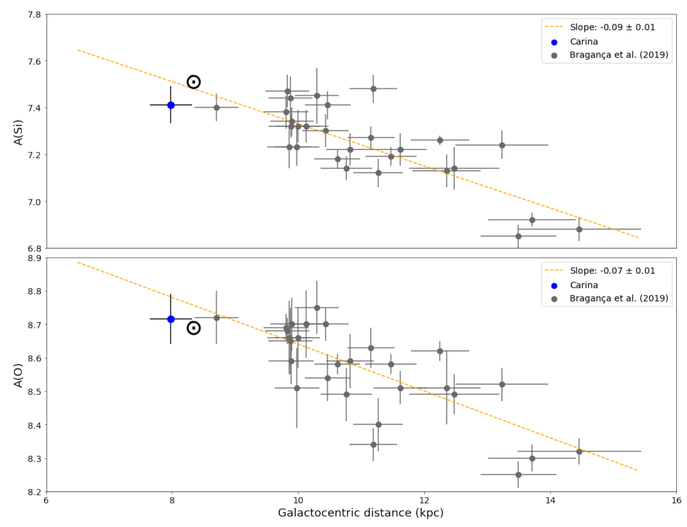
Results

The stars in our sample are mainly on the main sequence, with $T_{\rm eff}$ between 14,000 and 33,000 K and $\log g$ between 3.00 and 4.50 (Fig 5). In Fig 6 we present the violin distributions for the abundances of studied species. The average abundances of C, N, and O are consistent with the solar value while being slightly subsolar for Si.





Our results suggest that the Carina Nebula is chemically homogeneous to within $\sim$ 0.10 dex and the average abundances of O and Si are consistent with its radial position in the Galactic disk (Fig 7), as expected by [1].



References

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[2] S. Daflon, K. Cunha, F. X. de Araújo, S. Wolff, and N. Przybilla. *The Astronomical Journal*, 134:1570–1578, 2007.

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