Why Galaxies Care About AGB Stars: A Continuing Challenge through Cosmic Time
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The role of asymptotic giant branch stars in the chemical evolution of the Galaxy

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Abstract. Asymptotic giant branch stars play an important role in enriching galaxies by s-process elements. Recent studies have shown that their role in producing s-process elements in the Galactic disc was underestimated and should be reconsidered. Based on high-resolution spectra we have determined abundances of neutron-capture elements in a sample of 310 stars located in the field and open clusters and investigated elemental enrichment patterns according to their age and mean galactocentric distances.

Keywords. stars: abundances, Galaxy: evolution

1. Introduction

Young open clusters seem to have larger abundances of s-process dominated chemical elements compared to the older ones, however, it is still debatable, whether this phenomenon is similar in all s-process elements (D'Orazi *et al.* 2017 and references therein). We derived yttrium, zirconium, barium, lanthanum, cerium, praseodymium, neodymium, and europium abundances for 37 red giant branch (RGB) stars, which are probable members of 6 open clusters (NGC 5460, NGC 5822, NGC 6709, NGC 3680, NGC 6940, IC 4651). In addition, we observed all FGK dwarfs brighter than $V < 8$ mag (more than 400 stars) in two Galactic fields with the radii of 20° centered at $\alpha(2000) = 161^\circ.03552/\delta(2000) = 86^\circ.60225$ and at $\alpha(2000) = 265^\circ.08003/\delta(2000) = 39^\circ.58370$.

2. Observations and method of analysis

Spectra for the cluster stars were obtained with the 2.2 m MPG/ESO telescope at La Silla using the FEROS echelle spectrograph which provided a spectral resolving power of $R = 48\ 000$ in a spectral region of 3700–8600 Å. Galactic field stars were observed with the Vilnius University Echelle Spectrograph (VUES), mounted on the f/12 1.65 m Ritchey-Chretien telescope at the Molėtai Astronomical Observatory. With the VUES, we observed spectra in the 4000 to 8800 Å wavelength range with two spectral resolution modes ($R = 30\,000$ and $60\,000$).

For the determination of atmospheric parameters, the mean galactocentric distances $R_{\rm mean}$, and ages, we applied methods described by Mikolaitis *et al.* (2018).

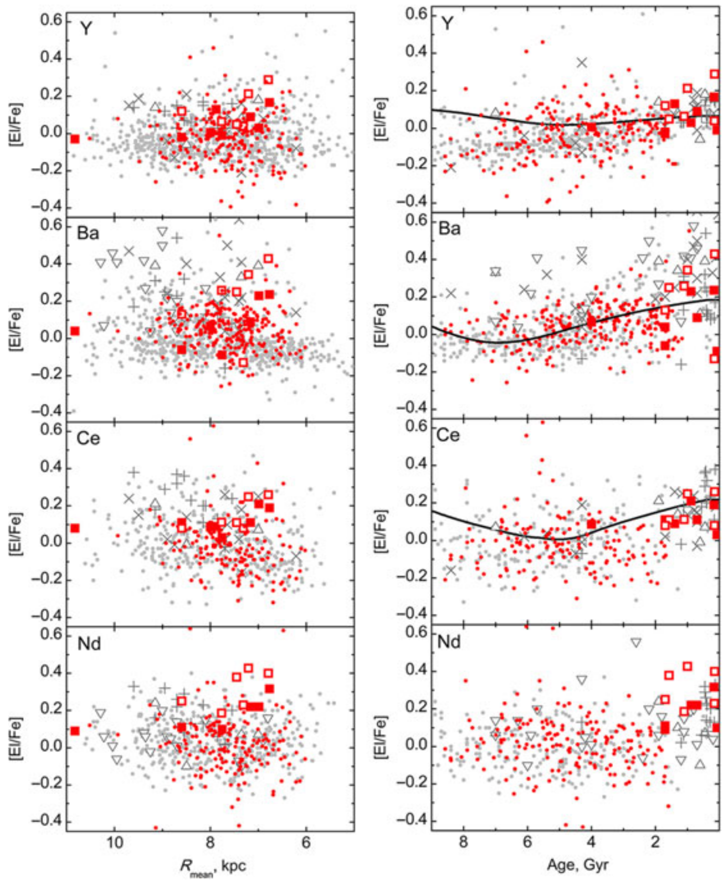

Figure 1. Elemental abundances in field stars and open clusters relatively to $R_{\rm mean}$ and ages. The dots indicate data for the Galactic field stars (the red – our results, the grey – by Bensby *et al.* 2014 and Battistini & Bensby 2016), the empty and filled red squares – our new and published data for open clusters, respectively (see Bagdonas *et al.* 2018 for references). The continuous lines indicate a chemical evolution model by Maiorca *et al.* (2012) at the solar radius.

3. Results

The available data (Fig. 1) do not show obvious s-process dominated element to iron abundance ratio gradients in respect to the $R_{\rm mean}$. A rise of abundances is visible with decreasing age. At young ages, the observations follow the chemical evolution models by Maiorca *et al.* (2012), however, we do not observe the raise of abundances in stars older than 6 Gyr predicted by the models.

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