The Gaia-ESO Survey: radial distribution of abundances in the Galactic disc from open clusters and young-field stars

Magrini, L. A. U. R. A., Randich, S., Kordopatis, G., Prantzos, N., Romano, D., Chieffi, A. L. E. S. S. A. N. D. R. O., ... & Zaggia, S. (2017). The Gaia-ESO Survey: radial distribution of abundances in the Galactic disc from open clusters and young-field stars. Astronomy & Astrophysics, 603, A2. <10.1051/0004-6361/201630294 > Accessed 07 May 2024.

Abstract

Context. The spatial distribution of elemental abundances in the disc of our Galaxy gives insights both on its assembly process and subsequent evolution, and on the stellar nucleogenesis of the different elements. Gradients can be traced using several types of objects as, for instance, (young and old) stars, open clusters, HII regions, planetary nebulae. Aims. We aim to trace the radial distributions of abundances of elements produced through different nucleosynthetic channels-the α-elements O, Mg, Si, Ca and Ti, and the iron-peak elements Fe, Cr, Ni and Sc-by use of the Gaia-ESO IDR4 results for open clusters and young-field stars. Methods. From the UVES spectra of member stars, we have determined the average composition of clusters with ages > 0.1 Gyr. We derived statistical ages and distances of field stars. We traced the abundance gradients using the cluster and field populations and compared them with a chemo-dynamical Galactic evolutionary model. Results. The adopted chemo-dynamical model, with the new generation of metallicity-dependent stellar yields for massive stars, is able to reproduce the observed spatial distributions of abundance ratios, in particular the abundance ratios of [O.Fe] and [Mg.Fe] in the inner disc (5 kpc <RGC< 7 kpc), with their differences, that were usually poorly explained by chemical evolution models. Conclusions. Oxygen and magnesium are often considered to be equivalent in tracing α-element abundances and in deducing, for example, the formation timescales of different Galactic stellar populations. In addition, often [α.Fe] is computed combining several α-elements. Our results indicate, as expected, a complex and diverse nucleosynthesis of the various α-elements, in particular in the high metallicity regimes, pointing towards a different origin of these elements and highlighting the risk of considering them as a single class with common features.

Keywords

Galaxy abundances, Open clusters and associations general