Neutronų pagavimo reakcijose sintetinamų elementų gausos Galaktikos evoliucijos kontekste

Abundances of neutron capture elements in revealing the evolution of the Galactic disc

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A rich variety of chemical elements found in stellar spectra is a result of multiple chemical processes that occurred in specific conditions. The analysis of elemental abundances as well as their distribution in the Galactic components allows us to draw the Galactic chemical enrichment scenarios and trace back the cosmic events that shaped the present day Galaxy. Neutron capture elements, due to the specificity of their nucleosynthesis processes, as well as their astrophysical sites of origin, provide the privileged information on the chemical evolution of the Galaxy.

The aim of this talk is to present the high potential of neutron capture elements in the context of the structure and evolution of the Milky Way. Chemical abundances as a function of metallicity (Figure 1), and gradients as a function age, the mean galactocentric distance and maximum vertical height above the galactic midplane were investigated. A special attention was also paid to their application as cosmic clocks.

Observations were made at the Molėtai Astronomical Observatory (MAO) in several northern sky fields (CVZ-TESS, preliminary PLATO STEP02 and NPF fields) during a period between 2016 - 2019 using a 1.65 m Ritchey-Chretien telescope and a high resolution fiber-fed Vilnius University Echelle Spectrograph (VUES). High-resolution spectra were analysed for a sample of 506 FGK bright stars (V <8 mag) in the solar neighbourhood.

Abundances of 10 neutron capture elements (Sr, Y, Zr, Ba, La, Ce, Pr, Nd, Sm and Eu) were determined through a differential line-by-line spectrum synthesis and accounting for the hyperfine structure effects. The referred elements cover *s*-processes, mixed and *r*-processes, which allows a broad study, given their different origin and timescales. Thanks to the Gaia space mission [1] and using the Gaia DR2 catalogue [2] and the *galpy* code [3], we determined a spatial distribution of stars with high accuracy. The stars were divided into thin and thick disc members according to chemical and kinematic criteria. The ages of our sample stars were estimated using the UniDAM code [4].

The age abundance gradients show that for the thin disc, the *s*-process dominated elements Sr, Y, and Ba have a strong negative abundance correlation with age. Our sample of thin-disc stars gives the noticeable [Y/Mg], [Sr/Mg], and [Y/Al] correlations with age. However, for the thick-disc stars, when taking into account also data from other studies, we found that e.g. [Y/Mg] cannot serve as an age indicator. We also found that the radial and vertical element-to-iron abundance ratio gradients in the thin disc are positive for the *r*-process dominated elements. In the thick disc, the radial element-to-iron abundance ratio slopes are negligible and the vertical ones are predominantly negative.

The complete results of the recent work [5] will be presented in this talk.

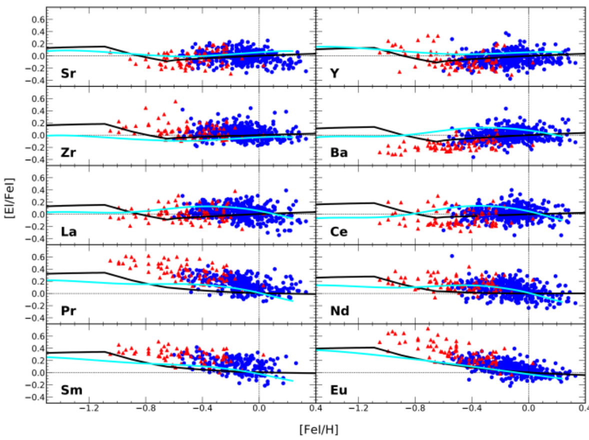

Figure 1. Abundance trends relative to [FeI/H]. The blue dots represent the thin-disc stars, and the red triangles indicate the thick-disc stars. The continuous cyan lines show the models by [6] and the black ones by [7]

Key words: Galaxy evolution, stellar chemical composition, Solar neighbourhood

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