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A new tool for chemical tagging based on iron-peak elements

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The homogeneous comparison between the chemical composition of the Milky Way (MW) and its more massive satellites (Large Magellanic Cloud - LMC and Sagittarius - Sgr) reveals that the latter galaxies have different chemical abundances with respect to the MW stars for almost all the species. In particular the largest difference is measured for [V/Fe] and [Zn/Fe], reaching up to 0.5/0.7 dex for stars with [Fe/H] > -0.5 dex. We interpret these low abundance ratios in LMC/Sgr stars in terms of a lower contribution from massive stars to the chemical
enrichment, compared to that experienced by the MW, since these elements are mainly produced by hypernovae, Type II supernovae or electron-capture supernovae with high-mass stellar progenitors.
We propose to use the chemical abundance ratios of iron-peak elements (in particular Sc, V and Zn) as tools to identify possible extra-galactic stars.

Here we present the homogeneous analysis of high-resolution spectra of RGB stars belonging to four metal-rich GCs, namely NGC 5927, NGC 6496, NGC 6388 and NGC 6441. According to their dynamical properties, the first two have been clearly identified as in-situ clusters, while the other two seem to share an accreted origin, but their orbital properties make their classification more uncertain.

We found that the α-elements Si, Ca and Ti and the slow (La and Ba) and rapid (Eu) neutron-capture elements show similar abundance ratios in all the four GCs. Instead, Sc, V and Zn display a stark difference, where NGC 6388 and NGC 6441 have abundance ratios for these iron-peak elements similar to those of LMC/Sgr stars, and significantly lower to the ones measured in NGC 5927 and NGC 6496, in agreement to those of MW stars.
Therefore, our analysis provides an independent confirmation that NGC 5927 and NGC 6496 formed in-situ, as already suggested by the kinematics. Also, it allows identify NGC 6388 and NGC 6441 as likely formed in an external environment with a low star formation efficiency and where the gas has been poorly enriched by massive stars.

Type

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