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Metallicity variations among the primordial stellar population in Galactic globular clusters: A MUSE spectroscopic survey.

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Galactic globular clusters (GGCs) are known to have some degree of chemical complexity, indicating that they do not consist of a "single" stellar population. Instead, some stars have an atmospheric composition showing evidence of material processed by nuclear reactions. Recently, the issue has also been raised about how "mono-metallic" GGCs are. Intrinsic Fe dispersions among RGB stars of GGCs were found to be small but inconsistent with zero (Bailin 2019). The presence of Fe dispersion was also recently suggested as an explanation for the color spread (in F275W-F814W color) observed among the primordial population (P1), that with a normal chemistry, of RGB stars in GGCs. Iron abundance determinations for a handful of P1 stars in three GGCs indicated variations of about 0.1 dex (Marino et al, 2019,2023, Lardo et al. 2023).
In this work, I present metallicity measurements for P1 stars in 20 GGCs based on MUSE spectroscopy. Thanks to the observations conducted as part of the MUSE globular clusters survey, we derive metallicities for up to 250 P1 stars per cluster. In 17 of these clusters, we find a statistically significant correlation between the pseudo-color (Δ F275W-F814W) of the stars and their metallicity. This demonstrates the sensitivity of this filter combination to changes in metallicity. For the first time, we provide robust and homogeneous metallicity spreads, directly measured from spectroscopy, among the P1 stars of 17 GGCs and we find it to range between 0.03 and 0.2 dex. We also find a correlation between the metallicity spreads and the cluster's mass. This supports the idea of self-enrichment during the formation of globular clusters because a deeper gravitational potential well retains supernova ejecta more efficiently.

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