Globular cluster Terzan 9 investigated with MUSE

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Composed image of Terzan 9 obtained with MUSE in 2016. Credit: Ernandes et

al., 2019.

Using the Multi Unit Spectroscopic Explorer (MUSE), an international team of astronomers has investigated Terzan 9—one of the most central globular clusters in the Milky Way galaxy. Results of the study, presented in a paper published October 22 on arXiv, provide more information about the properties of Terzan 9, which could help astronomers to better understand the chemical composition and nature of this cluster.

Globular clusters (GCs) are collections of tightly bound stars orbiting galaxies. Astronomers perceive them as natural laboratories enabling studies on the evolution of stars and galaxies. Given that GCs are relatively rare, as there are just over 200 such clusters so far identified in the Milky Way, the hunt for new objects of this type and studying them is essential in order to improve our knowledge about our home galaxy.

Located only 2,280 light-years away from the galactic center, Terzan 9 is a very compact and moderately metal-poor globular cluster. Observations show that the cluster remains confined within about 3,260 light-years of the galactic center with an orbit co-rotating with the Milky Way's bar.

However, although many studies of Terzan 9 have been conducted to determine its fundamental properties, its chemical composition still remains poorly understood. In order to change this, a group of astronomers led by Heitor Ernandes of the University of São Paulo, Brazil, employed the MUSE instrument at ESO's Very Large Telescope (VLT) in Chile to conduct detailed observations of this cluster.

"Given its compactness, Terzan 9 was observed using the Multi Unit

Spectroscopic Explorer at the Very Large Telescope. The extraction of spectra from several hundreds of individual stars allowed us to derive their radial velocities, metallicities, and [Mg/Fe]," the astronomers wrote in the paper.

In general, MUSE observations allowed the team to obtain spectra of over 600 stars. This sample was then reduced to 67 member stars of Terzan 9. As noted in the paper, the study resulted in measuring such properties of member stars as radial velocities, metallicities and magnesium-to-iron abundance ratio, which also gave mean values for the cluster.

When it comes to the chemical composition of Terzan 9, the observations found that it has a metallicity of approximately -1.1 and a magnesium-to-iron abundance ratio at a level of about 0.27. The metallicity is consistent with previous studies pointing out to a value between -2.0 and -0.99.

The mean heliocentric radial velocity of Terzan 9 was calculated to be 58.1 km/s, which is lower than the value from derived by a previous study based on six stars. However, the astronomers noted that both results are in agreement within uncertainties.

The researchers concluded that the results make Terzan 9 a moderately metal-poor blue horizontal branch cluster like HP 1, NGC 6558, and NGC 6522. Moreover, the magnesium-to-iron abundance ratio suggest that the stars in this cluster were formed from gas resulting from an early fast chemical enrichment by core-collapse supernovae.

More information: A MUSE study of the inner bulge globular cluster Terzan 9: a fossil record in the Galaxy, arXiv:1910.09893 [astro-ph.GA] arxiv.org/abs/1910.09893