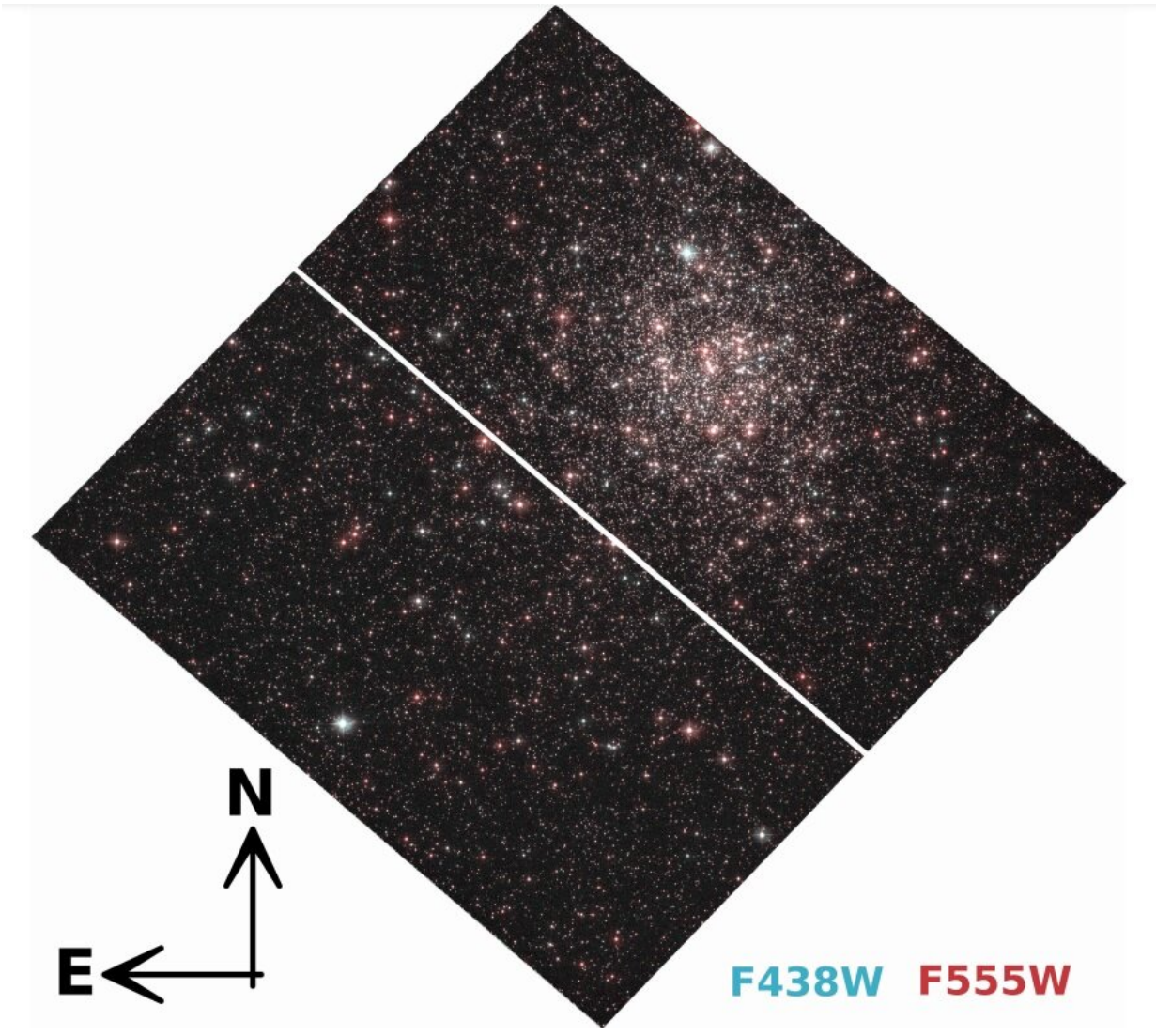
Researchers explore the properties of globular cluster NGC 6355

January 23 2023, by Tomasz Nowakowski



F438W/F555W combined color image from the HST WFC3 camera for NGC 6355. Credit: Souza et al., 2023.

An international team of astronomers has performed a chrono-chemodynamical analysis of a Galactic globular cluster known as NGC 6355. Results of the study, presented in a paper published January 12 on the *arXiv* preprint server, deliver important insights into the properties and chemical composition 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. In particular, globular clusters could help researchers better understand the formation history and evolution of early type galaxies, as the origin of GCs seems to be closely linked to periods of intense star formation.

At a distance of some 28,300 light years away from the Earth, NGC 6355 (also known as GCl-63 or ESO 519-SC15) is a globular cluster in the constellation Ophiuchus. It is a well-known cluster that has been studied since the 1900s. Previous observations of NGC 6355 have found that it has a relatively high mass of about 101,000 solar masses, reddening at a level of 0.82 and its metallicity is approximately -1.46. The absolute age of the cluster is estimated to be 13.2 billion years.

Recently, a group of astronomers led by Stefano O. Souza of the University of São Paulo in Brazil, has investigated NGC 6355 with the main aim of shedding more light on its history and properties.

"In the present work, we combine the chemical information with photometric and dynamical properties of the cluster to constrain its history. The chemical information is based on the UVES spectrograph (Dekker et al, 2000) in FLAMES-UVES mode at the ESO-VLT, the photometry on HST data, and the dynamical properties are provided by orbital integration employing the McMillan (2017) Galactic potential,"

the researchers explained.

In general, the team analyzed the globular cluster NGC 6355 in the context of the evolution of the Galactic bulge. They performed a deep and careful analysis, including photometry, chemical abundances, and dynamics.

The study found that NGC 6355 has a metallicity of −1.39, which confirms that it is one of the most metal-poor clusters of the Galactic bulge. The mean abundance ratio of alpha elements to iron of NGC 6355 was measured to be 0.37, suggesting an enrichment from Type II supernovae. All in all, the astronomers concluded that the abundance pattern of NGC 6355 is compatible with bulge field RR Lyrae stars and in-situ well-studied GCs.

The research confirmed that NGC 6355 is about 13.2 billion years old and refined its distance as it turned out that the cluster is closer than previously thought—approximately 27,800 light years away. Moreover, the orbital parameters of NGC 6355 and its extinction coefficient at a level of 2.84, indicate that the cluster is currently confined within the Galactic bulge volume.

The authors of the paper concluded that this GC seems to have originated from the main-bulge progenitor, with a low probability of an ex-situ origin; however, more spectroscopic data of the cluster stars are required in order to confirm this.

More information: Stefano O. Souza et al, Chrono-chemodynamical analysis of the globular cluster NGC 6355: Looking for the fundamental bricks of the Bulge, *arXiv* (2023). DOI: 10.48550/arxiv.2301.05227