

Globular cluster NGC 6558 explored with Gemini Observatory and Hubble Space Telescope

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The globular cluster NGC 6558 imaged by the Hubble Space Telescope. Credit: ESA/Hubble & NASA, R. Cohen.

Using the Gemini Observatory and the Hubble Space Telescope (HST), an international team of astronomers has investigated a Galactic globular cluster known as NGC 6558. Results of the new study, [published](#) July 22 on the pre-print server *arXiv*, deliver important insights into the properties 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 to 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.

NGC 6558 (also known as GCL 89 or ESO 456-SC62) is a Galactic bulge globular cluster located some 24,100 light years away in the constellation Sagittarius, with an angular size of about 5.4 x 5.4 arcminutes. Previous observations have found that NGC 6558 has a metallicity at a level of -1.32 dex and suggested that it may be one of the oldest objects in the Milky Way.

However, due to high reddening, the region of NGC 6558 presents challenges in deriving accurate parameters. A group of astronomers led by Stefano Souza of the University of São Paulo in Brazil, has now performed near-infrared and optical photometry of this cluster. For this purpose, they employed Gemini Observatory's Gemini-South telescope and HST's Advanced Camera for Surveys (ACS).

"We aim to refine the fundamental parameters of NGC 6558, utilizing

high-quality Gemini-South/GSAOI and HST/ACS photometries. Additionally, we intend to investigate its role in the formation of the Galactic bulge," the researchers explain.

The collected high-quality photometric data allowed the team to derive fundamental parameters of NGC 6558. By removing as much as possible of the Galactic bulge field star contamination, the astronomers were able to obtain the most accurate results than ever before.

The observations found that NGC 6558 is located about 27,400 light years away. This is farther than distances obtained by previous studies, which suggested between 20,500 and 26,900 light years.

The reddening of NGC 6558 was measured to be at a level of 0.34. The astronomers underline that this is the lowest value relative to the available literature, obtained with the differential reddening correction based on reference stars less contaminated by field stars.

Based on the obtained data, the authors of the paper estimate that NGC 6558 is some 13 billion years old. They note that this age is compatible with other clusters with similar metallicity and a blue horizontal branch in the Galactic bulge.

Summing up the results, the researchers conclude that NGC 6558, combined with other moderately metal-poor GCs, suggest that the formation time of this population is as late as 13.62 billion years and with a chemical enrichment 10-times faster than the rest of the Milky Way.

More information: S. O. Souza et al, Combined Gemini-South and HST photometric analysis of the globular cluster NGC 6558. The age of the metal-poor population of the Galactic Bulge, *arXiv* (2024). [DOI: 10.48550/arxiv.2407.15918](https://doi.org/10.48550/arxiv.2407.15918)

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