Researchers conduct chemical analysis of globular cluster NGC 5824

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NGC 5824 imaged by the Hubble Space Telescope. Credit: NASA/ESA

Italian researchers have investigated the chemical composition of NGC 5824, a massive globular cluster in the Milky Way galaxy. Their analysis, based on observational data provided by the Very Large Telescope array, offers some hints into the nature of this cluster. The study was published March 26 in a paper on arXiv.org.

Located some 105,000 light years away in the constellation Lupus, NGC 5824 is a massive globular cluster in the outer halo of the Milky Way galaxy. The cluster's chemical composition is still puzzling astronomers; thus, many studies are focused on determining elemental abundances of the sample of its stars.

In May 2015, NGC 5824 was observed with the Fibre Large Array Multi Element Spectrograph (FLAMES) mounted on ESO's Very Large Telescope (VLT) in Chile. Using FLAMES a team of researchers led by Alessio Mucciarelli of the University of Bologna in Italy, obtained high-resolution spectra of 117 giant stars of the cluster. The collected data allowed the scientists to determine chemical abundances of these stars, revealing important information about chemical composition of NGC 5824.

"In this paper we investigate the chemical composition of NGC 5824 using a sample of high-resolution spectra collected with FLAMES at the Very Large Telescope for a total of 117 member stars," the astronomers wrote in the paper.

Previous studies suggested that NGC 5824 has an intrinsic spread in its iron content, but the research conducted by Mucciarelli's team does not confirm this assumption. They found that the cluster has an average iron

abundance of –2.14 dex and shows no evidence of intrinsic spread. Therefore, the researchers classified it as a normal globular cluster, not showing any evidence of internal self-enrichment in terms of iron.

The astronomers also found evidence of chemical anomalies like sodium-oxygen (Na-O) and magnesium-aluminum (Mg-Al) anticorrelations, which are typical for globular clusters. The study emphasizes that a very small star-to-star scatter in their iron abundance and the presence of star-to-star variations in the chemical abundances of some light elements (like Na-O and Mg-Al) are the two key features confirming that a stellar system is, indeed, a globular cluster.

Moreover, they found that NGC 5824 showcases a huge range of magnesium to iron abundance ratio observed only in a few metal-poor and massive clusters. This could be due to an efficient self-enrichment driven by massive asymptotic giant branch stars.

The derived chemical abundances allowed the scientists to conclude that NGC 5824 is a standard globular cluster with one peculiarity.

"We conclude that NGC 5824 is a standard globular cluster, without spread in [Fe/H] and with the presence of usual chemical anomalies (both Na-O and Mg-Al anticorrelations), but showing a large (and rare) spread in Mg," the paper reads.

More information: The chemical composition of NGC5824, a globular cluster without iron spread but with an extreme Mg-Al anticorrelation, arXiv:1803.09759 [astro-ph.SR]
arxiv.org/abs/1803.09759

Abstract
NGC5824 is a massive Galactic globular cluster suspected to have an intrinsic spread in its iron content, according to the strength of the

calcium triplet lines. We present chemical abundances of 117 cluster giant stars using high-resolution spectra acquired with the multi-object spectrograph FLAMES. The metallicity distribution of 87 red giant branch stars is peaked at [Fe/H]=-2.11+-0.01 dex, while that derived from 30 asymptotic giant branch stars is peaked at [Fe/H]=-2.20+-0.01 dex. Both the distributions are compatible with a null spread, pointing out that this cluster did not retain the ejecta of supernovae. The small iron abundance offset between the two groups of stars is similar to those already observed among red and asymptotic giant branch stars in other clusters. The lack of intrinsic iron spread rules out the possibility that NGC5824 is the remnant of a disrupted dwarf galaxy, as previously suggested. We also find evidence of the chemical anomalies usually observed in globular clusters, namely the Na-O and the Mg-Al anticorrelations. In particular, NGC5824 exhibits a huge range of [Mg/Fe] abundance, observed only in a few metal-poor and/or massive clusters. We conclude that NGC5824 is a normal globular cluster, without spread in [Fe/H] but with an unusually large spread in [Mg/Fe], possibly due to an efficient self-enrichment driven by massive asymptotic giant branch stars.