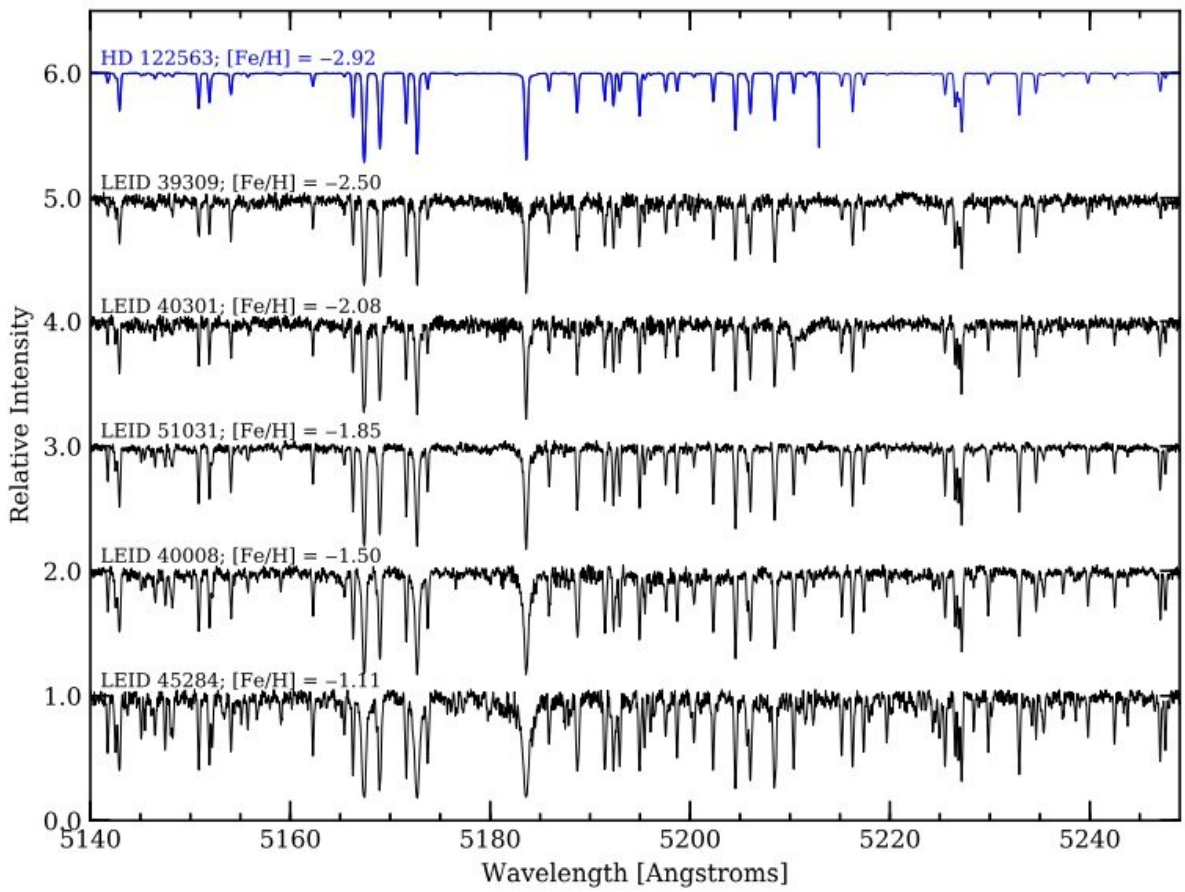
Study identifies the most metal-poor stars in the Omega Centauri cluster

April 28 2020, by Tomasz Nowakowski



Sample M2FS spectra are shown for Omega Centauri stars that span [Fe/H] = −2.50 to −1.11 in increments of approximately 0.35 dex. Credit: Johnson et al., 2020.

By analyzing spectroscopic data, astronomers have investigated the globular cluster Omega Centauri, aiming to find a population of stars with very low metallicity. The study resulted in the detection of the 11 most metal-poor stars in this cluster. The finding is reported in a paper published April 20 on *arXiv*.

Observations of globular clusters (GCs) in the Milky Way galaxy are of high importance for astronomers as they are among the oldest objects in the universe. Therefore, they are perceived as natural laboratories for the study of stellar evolution processes.

Located some 15,800 light years away, Omega Centauri (also known as NGC 5139) is the brightest and most massive galactic GC. Observations show that the cluster is chemically diverse, and astronomers assume that it may host as many as 15 unique stellar populations. The stars in Omega Centauri exhibit much higher metallicity dispersions when compared to other galactic GCs.

Although Omega Centauri has been the target of many studies, its origin and enrichment history is still an open question. It is believed that this cluster originated as a nuclear core of a now tidally disrupted dwarf galaxy. Finding and studying the cluster's most metal-poor stars could verify if this hypothesis is true.

So a team of astronomers led by Christian Johnson of the Space Telescope Science Institute in Baltimore, Maryland, investigated almost 400 of the bluest red giant branch (RGB) stars in Omega Centauri, hoping to find the cluster's most metal-poor stellar population. For this purpose, they employed the Michigan-Magellan Fiber System (M2FS) and MSpec spectrograph mounted on the Magellan-Clay 6.5m telescope at Las Campanas Observatory.

"We present [Fe/H] measurements, based on high resolution M2FS

spectra, for 395 giants in the massive globular cluster Omega Centauri. The targets were chosen to reside on the blue half of the RGB in an effort to find the most metal-poor stars in the cluster," the astronomers wrote in the paper.

The study found 11 stars with metallicities ranging from –2.30 to –2.52, hence the most metal-poor stars in Omega Centauri. The newly found stars are significantly more metal-poor than the dominant population of the cluster with metallicities of around -1.7, and its intermediate metallicity group with metallicities at a level of about -1.5.

According to the paper, the most metal-poor stars of Omega Centauri appear to be centrally concentrated, and may also be confined to a narrow declination plane. However, it was noted that these stars do not appear to exhibit any peculiar kinematic properties distinguishing them from the more metal-rich populations in the cluster.

The astronomers ponder a few possible scenarios that could explain the presence of such metal-poor stars in Omega Centauri. They assume that these population may be a result of early star formation in the unenriched primordial cloud, capture of surrounding field stars (if the cluster formed in a dwarf galaxy), or an early merger between Omega Centauri and a pre-existing but metal-poor sub-structure. According to the authors of the paper, the merger scenario is the most plausible one.

"The merging sub-clump model may have the greatest chance for describing the paucity of very metal-poor stars in other clusters, the possibly reduced light element spread for stars with [Fe/H]

More information: The Most Metal-poor Stars in Omega Centauri (NGC 5139), arXiv:2004.09023 [astro-ph.SR] arxiv.org/abs/2004.09023

Citation: Study identifies the most metal-poor stars in the Omega Centauri cluster (2020, April 28) retrieved 21 September 2024 from https://phys.org/news/2020-04-metal-poor-stars-omega-centauri-cluster.html