Study inspects young open cluster NGC 3293

August 2 2022, by Tomasz Nowakowski

Image of NGC 3293 taken by the Wide Field Imager on the MPG/ESO 2.2-meter telescope. Credit: ESO/G. Beccari.

Using the Very Large Telescope (VLT), an international team of astronomers has conducted a spectroscopic study of a young open cluster NGC 3293. Results of the research, published July 26 on the arXiv pre-print repository, shed more light into the properties and chemical

composition of this cluster.

Open clusters (OCs), formed from the same giant molecular cloud, are groups of stars loosely gravitationally bound to each other. So far, more than 1,000 of them have been discovered in the Milky Way, and scientists are still looking for more, hoping to find a variety of these stellar groupings. Expanding the list of known galactic open clusters and studying them in detail could be crucial for improving our understanding of the formation and evolution of our galaxy.

Discovered in 1751, NGC 3293 (also known as the Gem Nebula) is a young (about 12 million years old) open cluster in the Carina Nebula, located some 8,400 light years away from the Earth. It is one of the most populous stellar aggregates in the Carina Nebula region, containing tens of relatively unevolved early B stars, along with a few blue and red supergiants.

Although many photometric observations of NGC 3293 have been conducted, only few spectroscopic studies of this cluster have been performed to date. Therefore, a group of astronomers led by Thierry Morel of the University of Liège in Belgium conducted a spectroscopic analysis of NGC 3293, mainly to investigate the properties of its stellar B-type population in terms of spectral variability, chemical abundances, and rotational velocities.

"We present a homogeneous analysis of the Galactic open cluster NGC 3293 based on GES [Gaia-ESO public survey] and FS VLT-FLAMES observations of about 160 B-type member candidates spanning a wide range of physical properties. To our knowledge, it is the most comprehensive spectroscopic study of this cluster to date," the researchers explained.

The study found that NGC 3293 has a Gaussian-like velocity distribution

of stars that peaks around 200–250 km/s. It turned out that most stars in the cluster appear to rotate at about 50 to 60% of their critical velocity. However, significantly lower spin rates were observed for more massive cluster members.

The age of NGC 3293 was estimated to be approximately 20 million years, thus the cluster is older than previously thought. This means that NGC 3293 appears to be the oldest stellar aggregate in the Carina Nebula complex. The new result is based on a realistic distribution of the spin rates and a detailed correction on a star-to-star basis for the effect of stellar rotation, while the old value was obtained from photometric studies that made use of non-rotating isochrones.

The chemical analysis found that NGC 3293 is devoid of objects exposing core-processed material at their surface despite the fact that most of them are fast rotators. This may be due to the fact that most members of this cluster are most likely low-mass B dwarfs. The study also acknowledged the lack of strongly nitrogen-enriched stars in NGC 3293 as only the two brightest B-type members of this cluster showcase some evidence for a mild nitrogen enrichment.

More information: T. Morel et al, The Gaia-ESO survey: A spectroscopic study of the young open cluster NGC 3293. arXiv:2207.12792v1 [astro-ph.SR], arxiv.org/abs/2207.12792