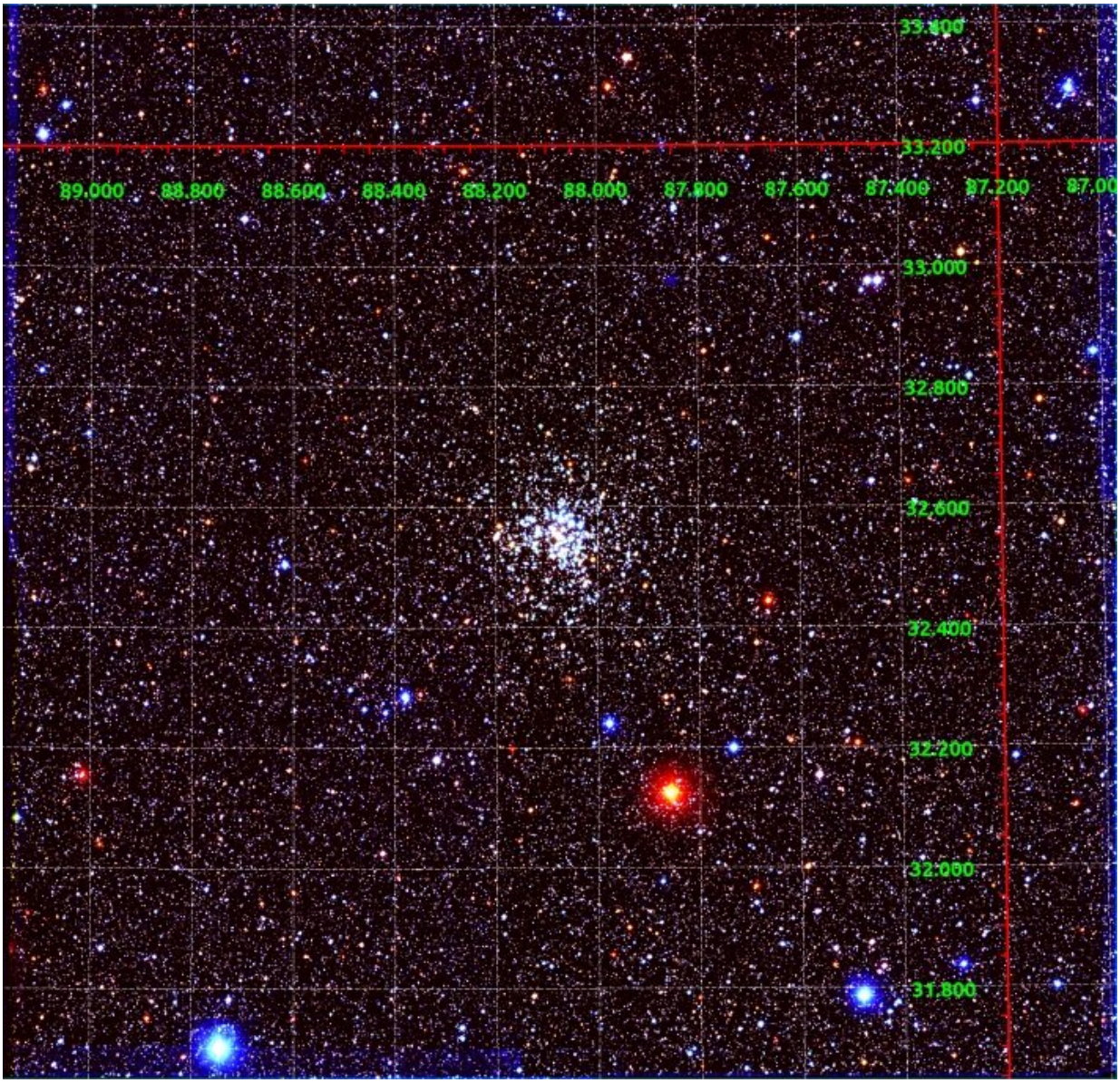
Astronomers investigate open cluster Messier 37 and its surroundings

July 14 2022, by Tomasz Nowakowski



Stacked three-color image (u,g,i) of the field of view of Messier 37, with superimposed a grid with equatorial ICRS coordinates. Credit: Griggio et al, 2022

An international team of astronomers has conducted an astrometric and photometric wide-field study of the open cluster Messier 37. As a result, the researchers completed a comprehensive catalog of more than 200,000 sources in the field of Messier 37 and identified the hottest white dwarf candidate members of this cluster. The study was detailed in a paper published July 7 on arXiv.org.

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. Studying OCs in detail could be crucial for improving our understanding of the formation and evolution of our galaxy.

Messier 37 (or M37, also known as NGC 2099) is the brightest and richest Galactic OC in the constellation Auriga, located at a distance of about 4,500 light years. The cluster has a radius of at least 10 light years and a total mass of some 1,500 solar masses. The age of Messier 37 is estimated to be between 400 and 550 million years, while its metallicity is at a level of 0.02–0.08.

Previous observations of Messier 37 have found that it hosts quite a large population of white dwarf (WD) candidates, consisting of about 50 stars. More recently, spectroscopic follow-up studies have confirmed, rejected, or identified new cluster members, including a very massive object with a mass of around 1.28 solar masses. However, the white dwarf census of Messier 37 is still not complete due to several reasons,

including source crowding, dispersal of cluster members, and unresolved binarity with main-sequence companions.

Hence, a group of astronomers led by Massimo Griggio of the University of Ferrara in Italy, have used the Schmidt 67/92 cm telescope in Asiago (Italy) in order to perform an astrometric and photometric wide-field study of Messier 37, hoping to identify more white dwarf members of this cluster.

"In this paper we employ observations of M37 collected at the Asiago Schmidt telescope in the Sloan-like ??? filters to develop and test a procedure to calibrate the geometric distortion of the instrument, exploiting the Gaia Early Data Release 3 (EDR3, Gaia Collaboration et al, 2021) absolute reference system, which will be applied also to other wide-field imager mosaics," the researchers explained.

The team managed to astrometrically and photometrically identify seven isolated and hot white dwarfs as candidate cluster members. Spectral energy distribution (SED) analysis suggests that four out of seven WD candidates are likely or very likely members of Messier 37.

The astronomers obtained follow-up low-resolution spectra for one of the newly found white dwarfs, designated WD1, confirming it as a hot (with an effective temperature above 60,000 K), hydrogen-deficient object. This star was previously identified as the likely central star of a faint planetary nebula.

As a result of the study, the researchers also completed a catalog of 210,907 sources in a 2.0 by 2.0 deg^2 region centered on Messier 37. This catalog contains photometry of these sources in the Sloan-like filters and Gaia EDR3 photometry as well as astrometry for the sources that are present also in the Gaia catalog. It complements the already existing data from the Isaac Newton Telescope (INT) Galactic Plane Survey (IGAPS).

More information: M. Griggio et al, Astro-photometric study of M37 with Gaia and wide-field ugi-imaging. arXiv:2207.03179v1 [astro-ph.SR], arxiv.org/abs/2207.03179

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