STUDY OF OPEN STAR CLUSTER NGC 2632 WITH GAIA EDR3

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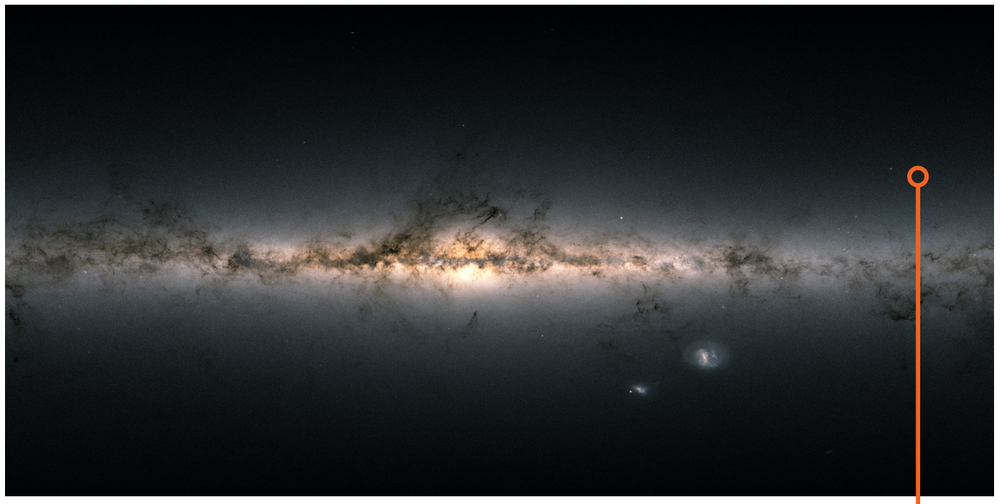
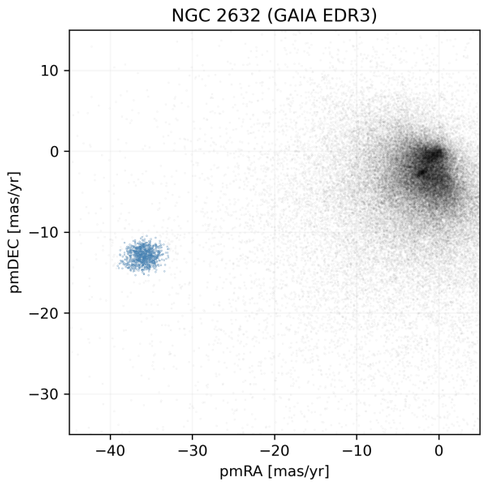


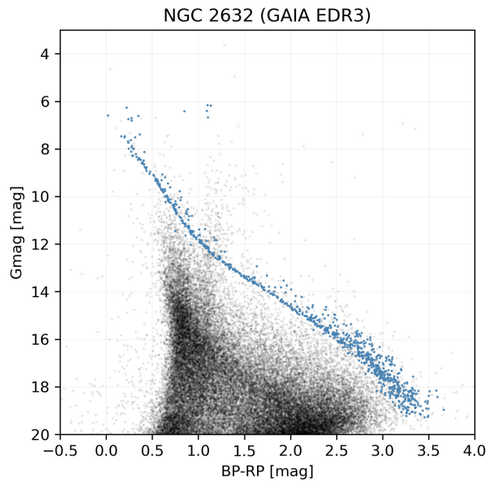
The study of open star cluster NGC2632 is presented based on data of Gaia EDR3. 495 probable members of the cluster were discovered. The kinematic and some other sensitive parameters of the open cluster NGC2632 were obtained and discussed.

Recently, many expressions that previously seemed fantastic (for example, Artificial Intelligence, machine learning, neural networks and Big Data) become usual in scientific terminology, research articles, data processing techniques. The technologies behind these terms are increasingly becoming commonplace and a necessary tool for a modern researcher. In this regard, astronomy, as a multidisciplinary science, is at the forefront. It is known that one of the urgent fundamental problems of modern astronomy is a detailed study of our Galaxy and its components – star clusters, associations and complexes. With the introduction of high-precision and high-resolution observational equipment installed at new ground-based and orbital astronomical observatories, deep observational study of star clusters are receiving a new impetus. In this sense, the launch and successful operation of the Gaia orbital observatory (see, for example, Brown, et al, 2016) has made a truly revolutionary breakthrough in the amount and accuracy of observational data. The global goal of Gaia is to create a unique 5D - parametric observational survey of the stellar population, planets, comets, asteroids and exoplanets of our Galaxy up to a distance of 20 kpc from the Sun, as well as quasars that fall into the field of view (Svitak, 2013). By now, observational data of the first, second stages (GaiaDR1&DR2, 2016-2018) and third stage Early Release EDR3 (GaiaEDR3, 2020) have been obtained and made available, which we used in this work.

Object and research methods

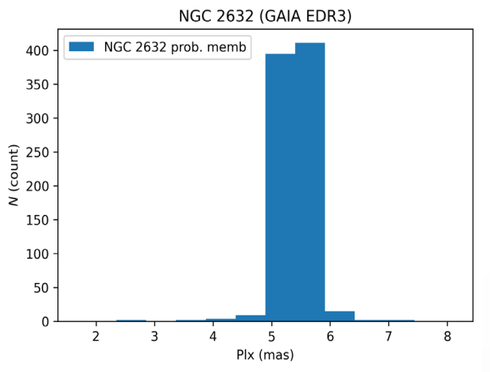
The open star cluster NGC2632 = M44 = Melotte 88 = MWSC 1527 (RA = 08 40 24.0 Dec = + 19 40 00, 205.9195 +32.4843 Gal, ep=J2000) also known as Praesepe (in en., the Manger) cluster is one of the closest to the Earth (according to updated data, its distance from the Sun is about 187 pc) (Zhen-Yu, 2009; Babusiaux, 2018) and rich open star clusters along with the Pleiades and Hyades (presumably genetically related to NGC2632, since they have the same kinematics and velocity vector in space, that probably means, they originated in one molecular cloud) is quite interesting and convenient object for the comprehensive study. At the same time it is very important qua an experimental laboratory for testing modern methods in the framework of international SAGE project we involved, as well as, for testing, deep improving (perfecting) the methods for study of star clusters and associations. The apparent diameter of open cluster NGC2632 was estimated as about 70 arcmin (Wang, et al, 2014), but it is most likely that the cluster's corona extends far beyond its visible contours. We have processed and analysed the extensive databases of Gaia DR1 - EDR3. The TOPCAT, ASteCA, StarGO software were applied, involving the principles of distributed computing in neural networks and machine learning.





Results and discussion

The pictorial distribution of cluster members in projection onto the sky plane, a vector diagram of proper motions, histograms of the distribution of cluster stars by proper motions, radial velocities, parallaxes, the initial mass function and the luminosity function for members of the cluster were obtained On the basis of targeted processing of data on stars in the area of open cluster NGC2632. As an illustration, in Figure 1 we present a diagram of proper motions in a wide field (4 deg in diameter), covering open cluster NGC2632. General field stars which not associated with the open cluster are focused around pmRA | pmDE {0; 0}, while cluster members are clearly revealed as a dark-blue spot around pmRA | pmDE {–36.383; –12.654} with δ {–32.582 ÷ –40.185; –12.424 ÷ –12.885},



just below and to the left of the location of field stars. We have identified 495 probable members, which significantly exceeds the number of members of the cluster discovered before us (about 200). We have built a Hertzsprung-Russell evolutionary diagram of stars in the area of open cluster NGC2632, which is shown in Figure 2. The dark-blue dots represent the stars - members of the open cluster NGC2632. The zero age Main Sequence (ZAMS), the giant star branch, and also subdwarfs and likely white dwarfs (below the ZAMS) are well distinguished. The gray dots represent the general field stars. The histogram with distribution of the cluster members' parallaxes is shown in Figure 3 demonstrating the sharp profile at 5-6 mas.

References

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