Study determines fundamental parameters of four open clusters

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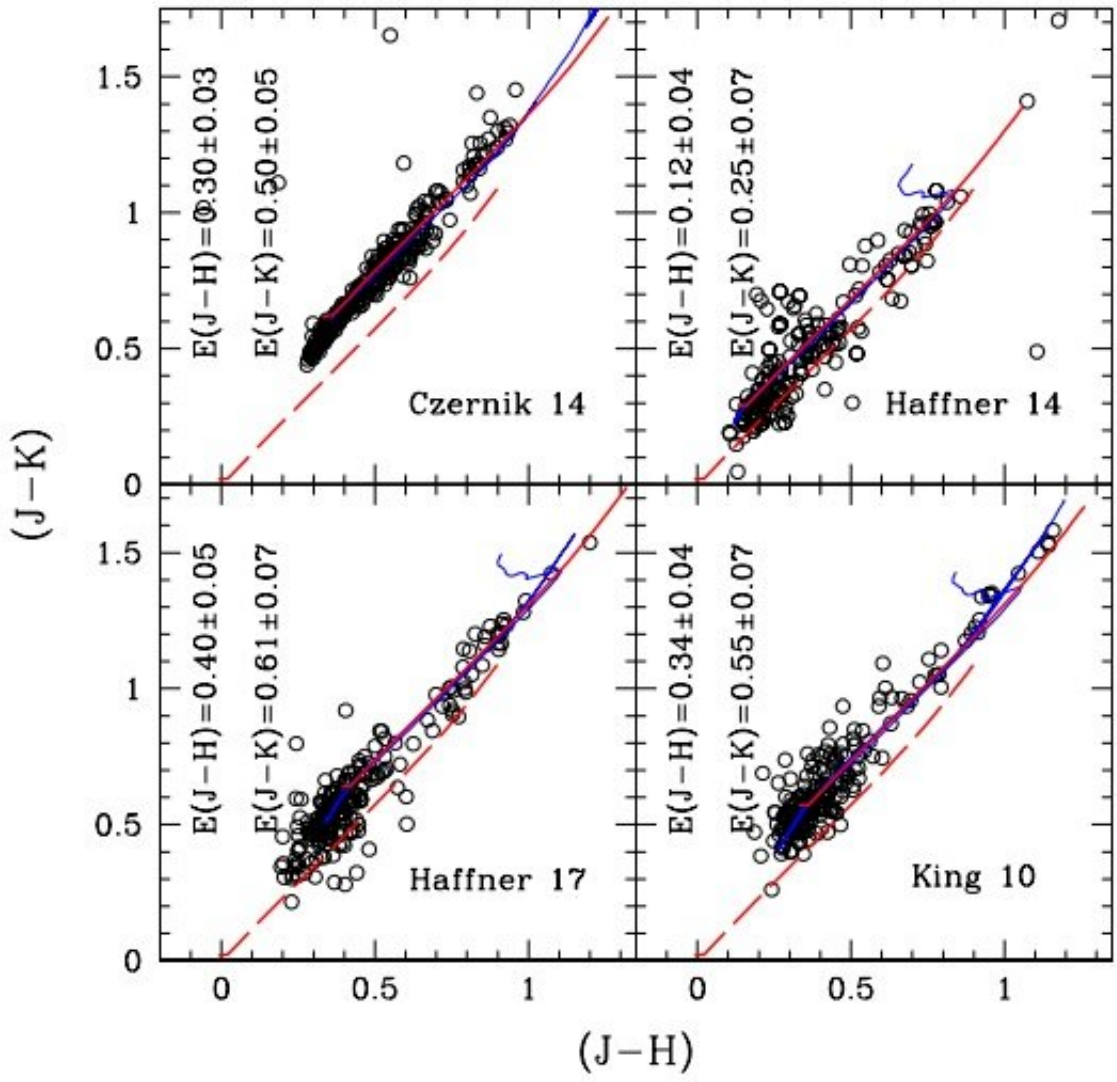

The color-color diagrams (CCDs) for clusters Czernik 14, Haffner 14, Haffner 17 and King 10 using probable cluster members. Credit: Bisht et al., 2020.

Using data from various astronomical surveys, a team of researchers from China and India has investigated four poorly studied open clusters in our Milky Way galaxy. The new study, presented in a paper published March 5 on arXiv.org, determines fundamental parameters of these clusters.

Open clusters, 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.

Recently, a team of astronomers led by Devendra Bisht of the University of Science and Technology of China in Hefei, China, has conducted a comprehensive study of four open clusters located near the Milky Way's Perseus arm, namely Czernik 14, Haffner 14, Haffner 17 and King 10. For this purpose, they analyzed data mostly from ESA's Gaia spacecraft, available in the second data release (DR2), but also from surveys like 2MASS, WISE, APASS and Pan-STARRS1.

"In this paper, we attempt to investigate the members, distances and mean proper motion of open clusters Czernik 14, Haffner 14, Haffner 17 and King 10 using the high-precision astrometry and photometry taken from the Gaia DR2 catalog," the scientists wrote in the paper.

According to the study, Czernik 14 is located some 9,450 light years away from the Earth and is about 570 million years old. The cluster has a radius of around 9.45 light years and a mass of approximately 348 solar masses. The number of cluster members identified is 225, what gives an average mass of a star in Czernik 14 of 1.55 solar masses.

Haffner 14 was found to be about 320 million years old, and is located at a distance of around 15,650 light-years away. The observations show that the cluster has a radius of approximately 14.7 light years and consists of 353 confirmed member stars. The total mass of of Haffner 14 was calculated to be about 595 solar masses, with an average mass of one star of about 1.68 solar masses.

The radius of Haffner 17 was estimated to be some 21.2 light years, which makes it the largest cluster of the studied sample. Given that the cluster has 350 confirmed members and its total mass is about 763 solar masses, the average mass of one star was calculated to be 2.18 solar masses. The distance to the cluster was measured to be some 11,700 light years and its age was found to be 90 million years.

With an age of about 45 million years and a total mass of approximately 1,088 solar masses, King 10 is the youngest and the most massive cluster out of the four observed systems. It has a radius of about 20.5 light years, 395 confirmed members and an average mass of one star at a level of 2.75 solar masses. The cluster is located around 12,400 light years away from the Earth.

The study also reports evidence for the existence of mass-segregation effect in each cluster and acknowledges that all four systems follow a circular path around the center of the Milky Way galaxy.

More information: A Comprehensive study of open clusters Czernik 14, Haffner 14, Haffner 17 and King 10 using multicolour photometry and Gaia DR2 astrometry, arXiv:2003.02448 [astro-ph.GA] arxiv.org/abs/2003.02448