中華民國天文學會
The Astronomical Society of the Republic of China (Taiwan)

Contribution ID: **46** Type: **Either**

Aged but Populous: Deciphering Survival Galactic Open Clusters

Friday, May 16, 2025 4:30 PM (15 minutes)

The presence of old open clusters but remaining rich in members challenges the conventional view that such systems dissociate within 1 Gyr in the typically inhospitable Galactic disk. We present a study of eight such clusters—Collinder 261, NGC 2158, NGC 2477, NGC 2506, NGC 6791, NGC 6819, NGC 7786, and Trumpler 5—each with an age comparable to those of globular clusters yet harbors thousands of members. Using Gaia DR3, we determined the most reliable member list so far for these clusters, hereafter fitting the post-main sequence members with isochrones model to derive their ages. For example, NGC 6791, with a cluster radius of 20.6 arcmin and more than 5000 members, lies 4.4 kpc away and has an age of 8.5 Gyr, confirming the longevity and rich membership. With a comparison sample of "false positives", i.e., stars way outside the cluster region yet sharing the same proper motion and parallax ranges, the luminosity function and hence the mass function are derived. A comparison of the Gaia catalog (limiting mag of 21.5) against Pan-STARSS (limiting mag of 23.5) suggests the top-heavy mass function, i.e., depletion of low-mass members in each of these clusters is not due to data incompleteness, lending clear evidence of cluster dissociation. We propose a possible explanation for the survival of these elusive clusters to be their relative orbital isolation from the Galactic disk perturbation.

Section

Stars/Star Clusters

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Session Classification: Stars and star clusters