Title:	Dynamics of Galactic star clusters using Gaia: Exploring the Scale Height and Vertical features of Galaxy
Authors:	Arya, Aman
Keywords:	Dynamics Galactic clusters Gaia Galaxy
Issue Date:	May-2023
Publisher:	IISER Mohali
Abstract:	The formation and evolution of stars is a long process and hence difficult to understand by following a single lead. Therefore, star clusters are natural laboratories for studying stel- lar dynamics because they consist of stars that are located at the same distance, formed from the same material. Open star clusters (OCs) are irregular groups of sibling stars loosely bound by gravitational forces. OCs have orbits in the direction of galactic rotation around the Galactic center. Since OCs are locaetd in the Galactic plane, they are highly affected by galactic tidal forces. They are essential tools for studying various aspects of the Galactic Disk and have been used for this purpose for a long time, such as tracing the spiral arms using Young OCs. In contrast, the older ones are excellent tools for studying the Galactic Disk kinematics, structure, and chemistry. The kinematical signature of open star clusters as a function of age can provide important clues to the formation and evolution of the Milky Way's disk. The European Space Agency's Gaia mission provides five-dimensional kinematical data with unprecedented accuracy and radial Velocity measurements for some bright stars. This study aimed to use the latest release of the homogeneous Gaia data to trace the orbits of open clusters. The orbits help to trace details of the motion of the clusters with respect to the Galactic disk and to understand the dynamics behind them. As ages of the clusters are known, the orbital heights as a function of radial distance from the Galactic center and age will help trace the evolution of the Galactic disk. In this work, we first elaborate upon the theoretical concepts governing the orbital mo- tion of open clusters around the Galactic center. Then we explain the process of data selec- tion and methodology used to integrate large-scale orbits for our sample of open clusters. The results of the study, based on the orbits of 1145 clusters, are presented. We find that the vertical heights (Z max) of the cluster orbits are a function of age as well as the Galac- tocentric radius, such that the older clusters, as well as clusters located in the outer disk, show larger Z max . We also note specific ages and Galactocentric radii at which Z max is higher. The results of this work might point to certain dynamical events that might have perturbed the Galactic disk or the general gravitational potential as seen by these clusters. In the future, we plan to compare the features observed here with the recently discovered phase spiral and explore the reasons behind the detected vertical features.
Description:	embargo period
URI:	http://hdl.handle.net/123456789/5397
Appears in Collections:	MS-18

Files in This Item:

File	Description	Size	Format	
embargo period.pdf	embargo period	6.04 kB	Adobe PDF	View/Open

Show full item record