A Story of Streams: The Dynamical Friction Effect on the Tails of Globular Clusters

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March 8, 2024

Abstract

Globular clusters travel within a galaxy, leaving behind a trail of stars in their orbits. The motions of the stream stars are governed by the potential they are in. The evaporation of these stars results in two tidal arms: the leading and the trailing. While these arms are populated symmetrically in the first approximation, Gaia data and subsequent research reveal asymmetries in the evaporation of open clusters (e.g., Pflamm-Altenburg et al., 2023). Hence, differences between the arms. We hypothesize that these asymmetries and inhomogeneities are caused by the wake of dynamical friction, primarily located on one side of the stream, thus influencing one arm more. We test this scenario by calculating the dynamical friction wake effects on the orbit of a globular cluster. We apply the method introduced by Kipper et al. (2023) to integrate the stars in the vicinity of the globular cluster into the past and then back to the present without the potential of the globular cluster. We observe a strong dependence on the stream's location: a dark matter halo environment does not induce significant asymmetries, while disc contributions are more pronounced. With every passage through the disc, the wake forms and slightly changes the velocity of the stream stars.