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Structure and Dynamics of the Magellanic Clouds

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Abstract

With the precise astrometry of Gaia DR3, we have detailed information about the dynamics of the Milky Way (MW), but also about two of its nearest neighbours, the Large Magellanic Cloud (LMC) and the Small Magellanic Cloud (SMC). These galaxies are unique research subjects in the Local Group due to their proximity to the MW. Using a neural network classifier, we have identified LMC sources in Gaia DR3, allowing for detailed kinematic studies that reveal rich complexities and substructures in the LMC disc (Jiménez-Arranz+23a). Due to the large distance to the LMC and the resultant small parallax angles of member stars, high uncertainties make it difficult to constrain the 3D structure of the galaxy. Using a Markov-Chain Monte Carlo (MCMC) algorithm, we explore the possibility of determining the galaxy's 3D parameters from Gaia data by testing synthetic models of the LMC 3D structure. Further projects will investigate LMC disc dynamics, including the origin of the off-centred bar, the asymmetric quadrupole in the radial and tangential velocity components, and the single spiral arm. One of the tools we are employing to study the LMC and SMC interaction is a suite of N-body simulations developed by Jiménez-Arranz+24 called KRATOS. Additionally, we are creating a python tool to generate adjustable mock catalogues of Gaia and GaiaNIR data. The tool will transform data from an input simulation into Gaia observable parameters in order to predict the performance of Gaia in various science cases. To present a versatile tool also applicable to our LMC/SMC studies, we aim to include different absorption models, stellar tracers, and instrument models.

My poster in zenodo.org can be found here.