Gaia DR3 determination of the Galactic bar pattern speed

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Abstract

New 3D kinematic maps are derived based on Gaia DR3 proper motions and line-of-sight velocities for red giant branch stars, but now, unlike those published in Gaia Collaboration, Drimmel, Romero-Gómez+2022, considering the correlations between the proper motions, which contribute to the correlations between the derived kinematic variables. The large-scale correlations between the planar and vertical motions are studied, highlighting the impact of the bar and spiral perturbations on the stellar dynamics. Additionally, and taking advantage of the homogeneity of Gaia DR3 data, these maps are used to compute the pattern speed of the Galactic bar using to independent and complementary methods. First, we use the bisymmetric modelling (as used in the Gaia Collaboration paper and in Jiménez-Arranz+2024 for the Large Magellanic Cloud). The method provides the corotation radius, which together with the tangential velocity curve, we estimate the bar pattern speed. Second, we apply the Tremaine-Weinberg method (Bovy+2019, Leung+2021). The robustness and possible systematics of each method are tested using a set of test particle simulations of different bar pattern speeds and considering the expected observational errors. The value recovered using both the bisymmetric modeling and the Tremaine-Weinberg method is compatible with the one found in the Gaia Collaboration paper and previous works.

My poster in zenodo.org can be found here