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Gaia DR3: rotation curve of the Milky Way and the infall epoch of dwarfs

Tuesday, 9 July 2024 15:00 (30 minutes)

The ESA Gaia astrometric mission has revolutionized our understanding of the Milky Way (MW) by providing six-dimensional phase-space measurements of its stars. Utilizing the third data release (Gaia DR3), we have derived a precise MW rotation curve (RC) extending up to 26.5 kpc. For the first time, we detect a Keplerian decline in the RC from 19 to 26.5 kpc. We estimate the MW dynamical mass to be $2.06^{+0.24}_{-0.13} \times 10^{11} \text{ Msun}$. I'll discuss this result in the context of other mass estimates as well as in comparison to other spiral galaxies showing flat rotation curves.

Gaia DR3 also provides accurate values of the orbital energy for most dwarfs lying within 150 kpc from the Milky Way center. Satellite orbital energy anti correlates with their infall time since the Galaxy assembled its mass through the cosmic epoch and thus cannot bind high orbital energy objects at early epochs. Dwarf orbital energies are found 10 times (4 times) larger than those of the Gaia-Sausage-Enceladus (Sgr infall) events, respectively. It is very unlikely that most dwarfs entered the halo 8-10 Gyr ago, while the tension is alleviated if most of them arrived less than 3 Gyr ago. This late fall of dwarfs may affect estimates of their mass content as well as it prevents to determine the Milky Way mass from their orbital motions.

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Session Classification: Dark matter halos: its nature, modeling & tracers

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