Contribution ID: **44** Type: **not specified**

Mapping Dark Matter in the Milky Way using Normalizing Flows and Gaia DR3

Thursday, 15 June 2023 16:30 (20 minutes)

We present a novel, data-driven analysis of Galactic dynamics, using unsupervised machine learning – in the form of density estimation with normalizing flows – to learn the underlying phase space distribution of 6 million nearby stars from the Gaia DR3 catalog. Solving the collisionless Boltzmann equation with the assumption of approximate equilibrium, we calculate – for the first time ever – a model-free, unbinned, fully 3D map of the local acceleration and mass density fields within a 3 kpc sphere around the Sun. As our approach makes no assumptions about symmetries, we can test for signs of disequilibrium in our results. We find our results are consistent with equilibrium at the 10% level, limited by the current precision of the normalizing flows. After subtracting the known contribution of stars and gas from the calculated mass density, we find clear evidence for dark matter throughout the analyzed volume. Assuming spherical symmetry and averaging mass density measurements, we find a local dark matter density of 0.47±0.05GeV/cm3. We fit our results to a generalized NFW, and find a profile broadly consistent with other recent analyses.

Secondary category for the parallel session (optional)

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