

Phenomenology 2023 Symposium



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Measuring Dark Matter in the Solar Neighborhood using Normalizing Flows and Gaia DR3

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Density estimation utilizing normalizing flows enables novel data-driven analyses of galactic dynamics. We train Masked Autoregressive Flows on the kinematic coordinates of 6 million nearby bright stars from the Gaia DR3 catalog within 4 kpc of the Solar location to learn their underlying phase space distribution $f(x,v)$. Assuming dynamic equilibrium, we use f to estimate the local acceleration and mass density field via the collisionless Boltzmann equation. We present a minimal-assumption and model-free measurement of the gravitational acceleration and dark matter mass density in the solar neighborhood.

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