A Bayesian Estimation of the Milky Way's Circular Velocity Curve using Gaia DR3

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Motivation

DM density measurements are crucial to DM detection experiments

↓

Encourages us to transcend disciplinary boundaries and foster interdisciplinary collaboration - we need to work together!

↓

Our work provides the astro part in the DM detection machinery

Observations

DM experiments

From observables to constraints

Astrophysical observables

We provide this

DM density

Measurements not perfect: Systematic biases stemming from assumptions in tracer star modelling

Direct searches

Indirect searches

Particle physics constraints

Our analysis in a nutshell

Sample of 1.6 million stars on the Red Giant Branch within 5-15 kpc

Gaia DR3 data

Jeans equations
+
kinematic model

Circular velocity curve

(total)
dynamical mass
+
baryons

DM density profile

Uncertainties included in our error bars:

Statistical ← Negligible due to large sample

+

Spatial-kinematic morphology of tracer sample

+

Sun's galactocentric distance

} Systematics - 3%

Our results

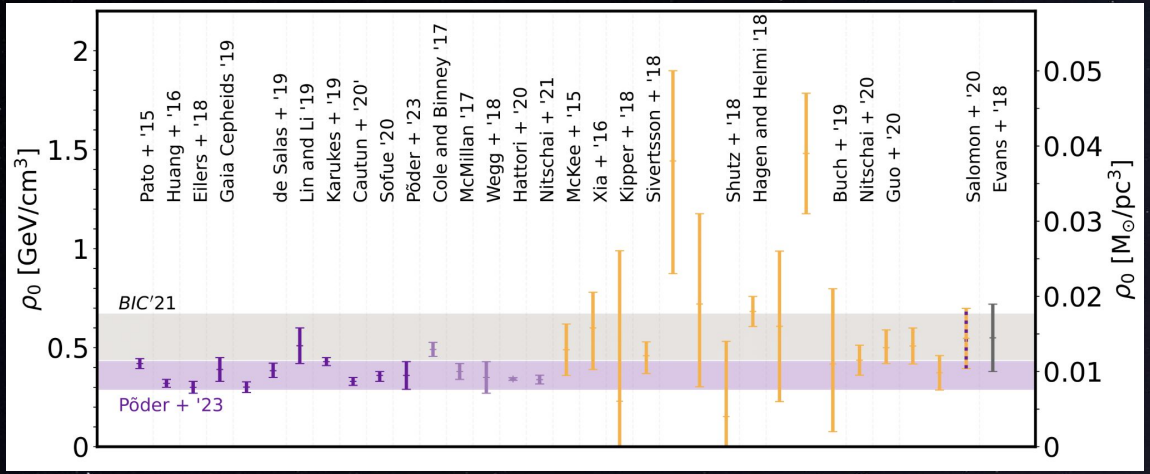
Local (spherically-average) DM density

$$\rho_{\mathrm{DM}}(R_0) = (0.37^{+0.08}_{-0.07})\,\mathrm{GeV/cm^3}$$

DM mass within 15 kpc

$$M_{\mathrm{DM}}(R < 15\,\mathrm{kpc}) = 10^{10.9^{+1.6}_{-1.8}}\,M_\odot$$

New result lower than Benito et al. ‘21



Source: Adapted from Benito et al. (2021)

Thank you!

Contact

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