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

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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
From observables to constraints

Astrophysical observables

DM density

We provide this

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

Direct searches
Indirect searches

Particle physics constraints

DM

SM

DM

SM

DM

SM

SM
Our analysis in a nutshell

Gaia DR3 data

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

Jeans equations + kinematic model

Circular velocity curve

DM density profile

(total) dynamical mass + baryons

Circular velocity curve

Statistical + Negligible due to large sample

Spatial-kinematic morphology of tracer sample + Systematics - 3%

Sun's galactocentric distance

Uncertainties included in our error bars:

Sven Põder
Our results

Local (spherically-average) DM density

\[ \rho_{DM}(R_0) = (0.37^{+0.08}_{-0.07}) \text{ GeV/cm}^3 \]

DM mass within 15 kpc

\[ M_{DM}(R < 15 \text{ kpc}) = 10^{10.9^{+1.6}_{-1.8}} M_\odot \]

New result lower than Benito et al. '21

Source: Adapted from Benito et al. (2021)
Thank you!