N-body simulations: shortcomings

Francesc Ferrer

Washington University in St. Louis

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Indirect detection of DM

$$\Phi = \frac{N_i}{8\pi m_\chi^2} \langle \sigma v \rangle \int_{\text{line of sight}} \mathrm{d}s \, \rho^2$$

$$\frac{1}{2} \langle \sigma v \rangle \rho^2 \to m_\chi \Gamma \rho$$

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Outline

The density

Velocity averaged cross-section

Next decade

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Astrophysical input

- Gamma-rays $\rightarrow$ Mpc - npc
- Antimatter $\rightarrow$ local, kpc
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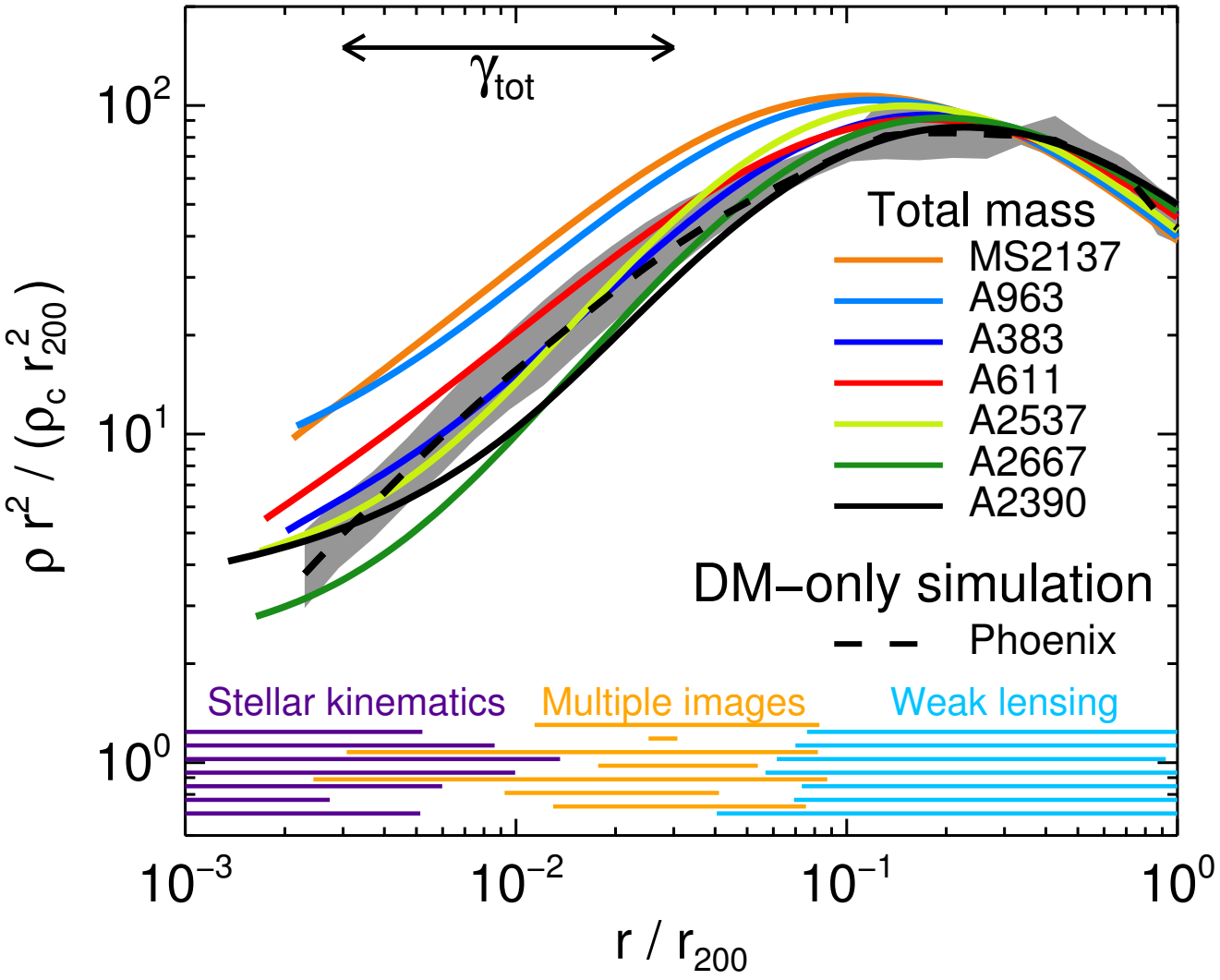

Newman et al. 13

NFW profile is too good a fit!

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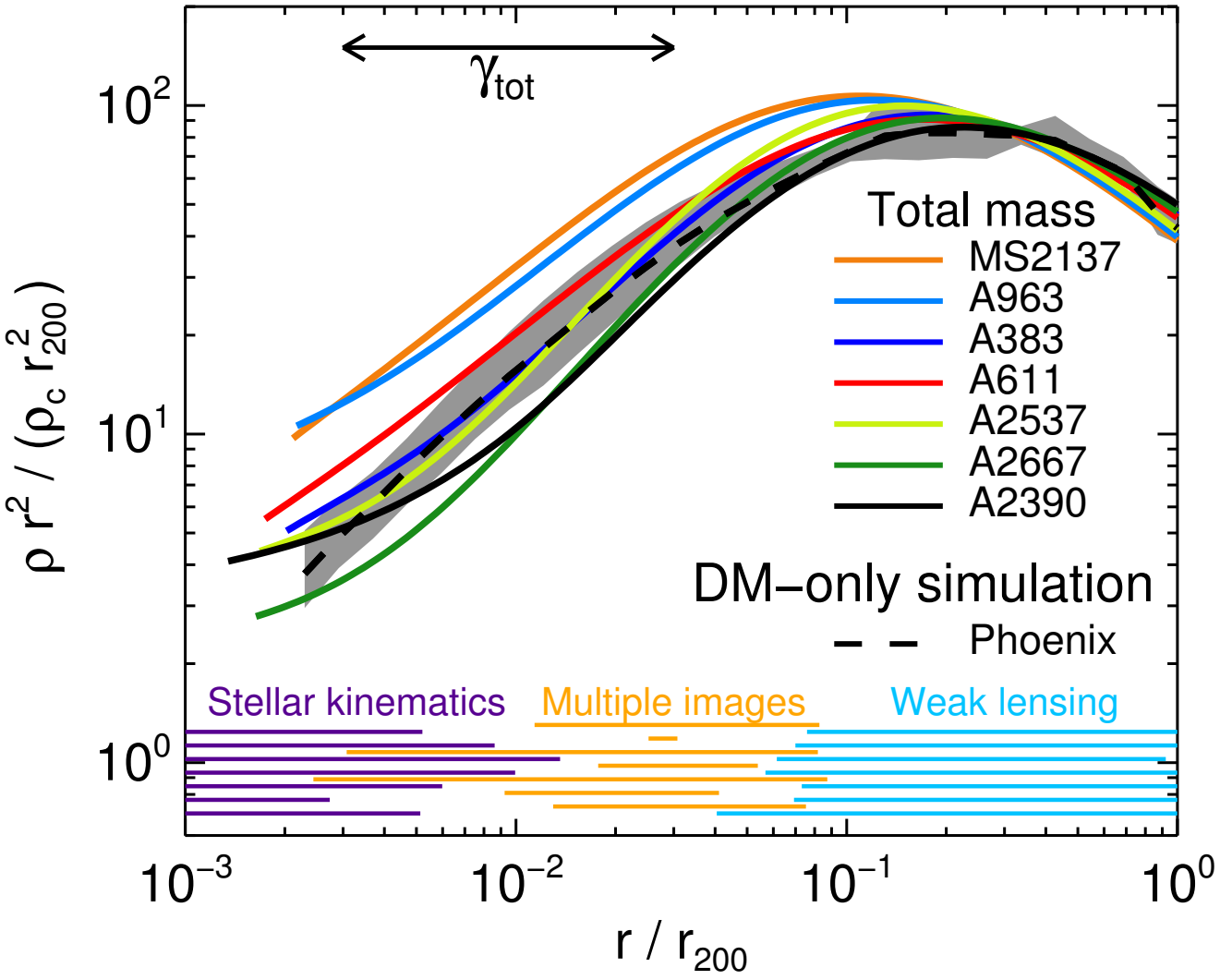

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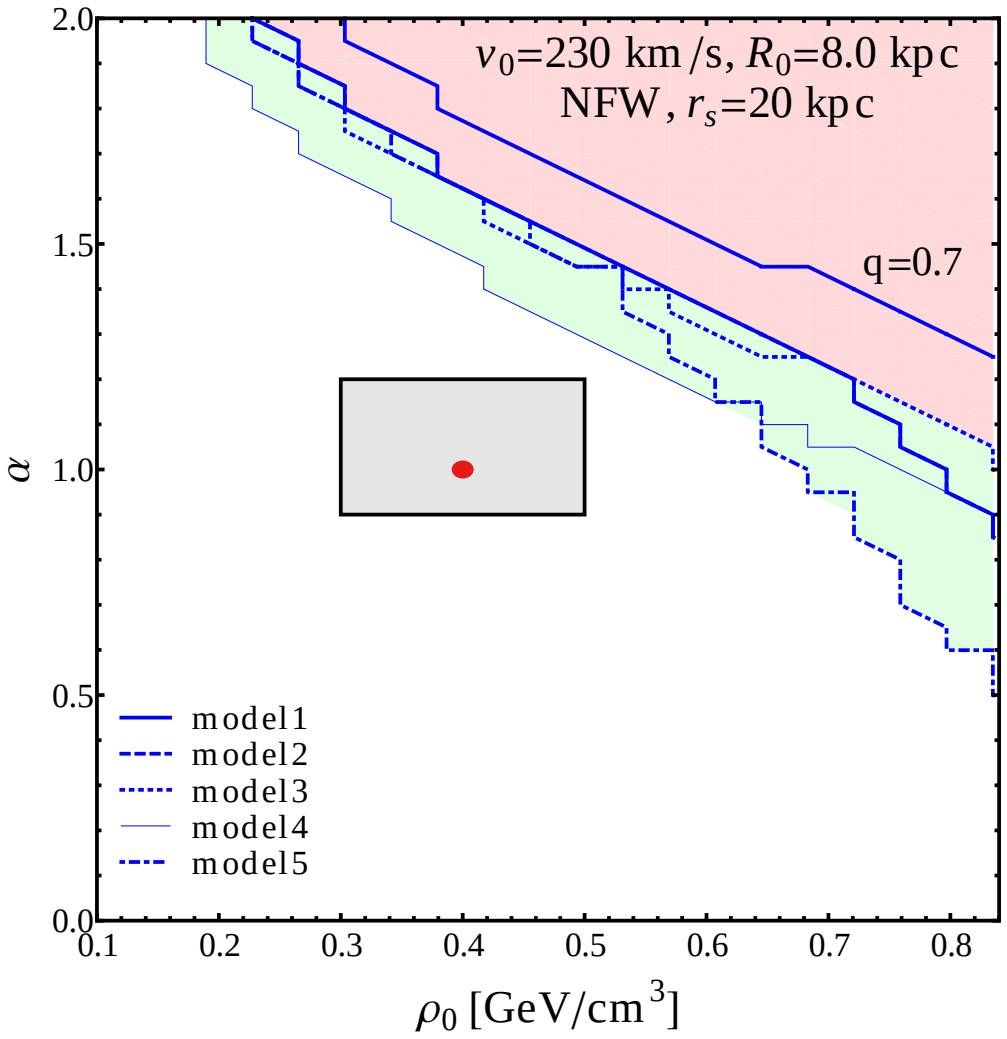

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Hardly constraining. But, see Donato et al 09 study of 1000 spiral galaxies.

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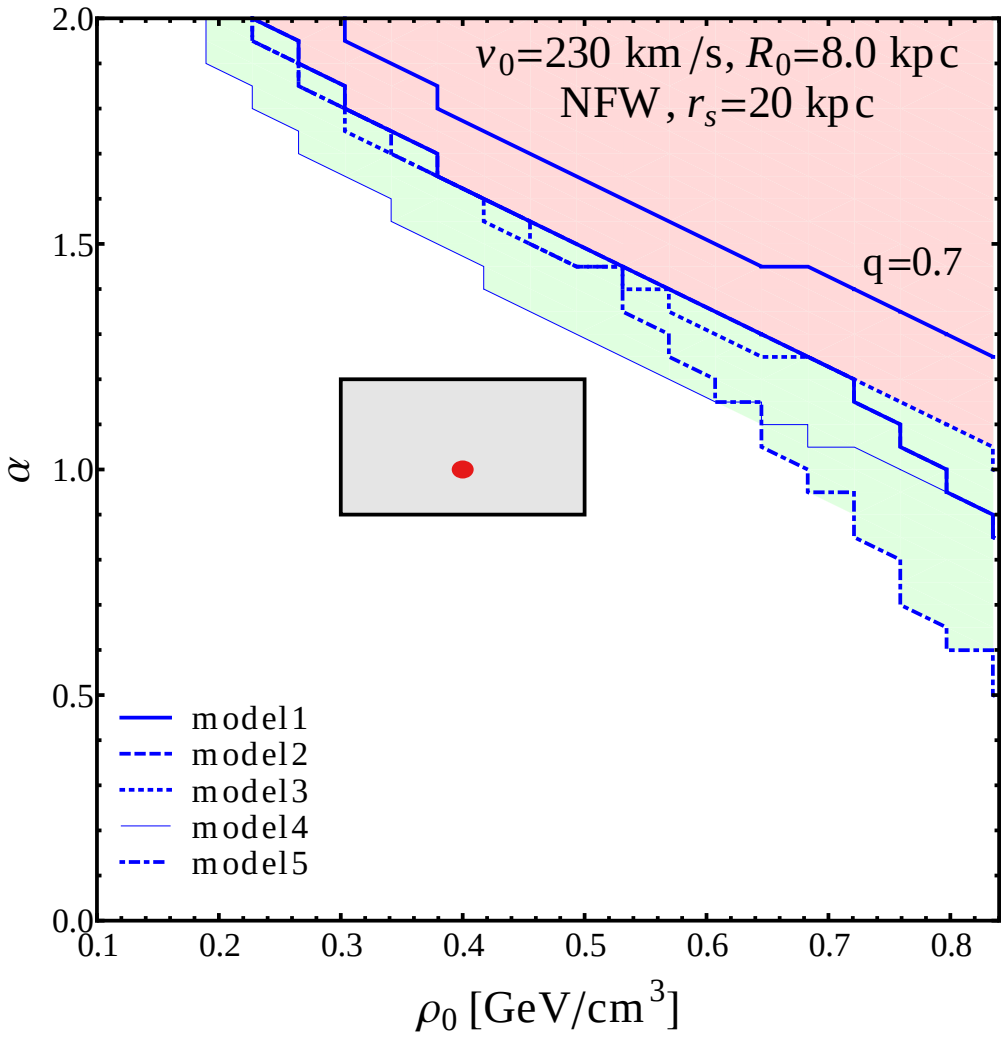

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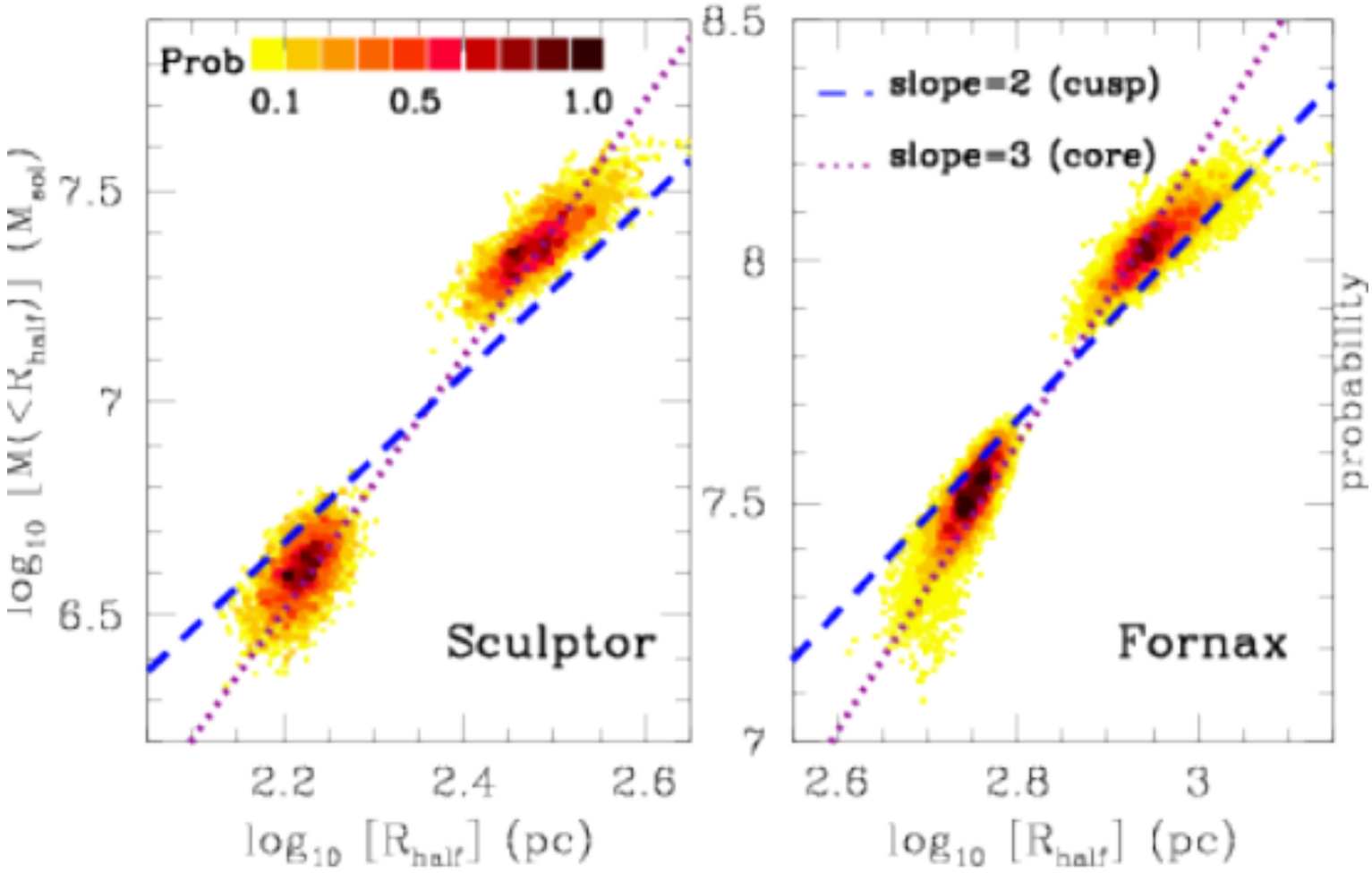

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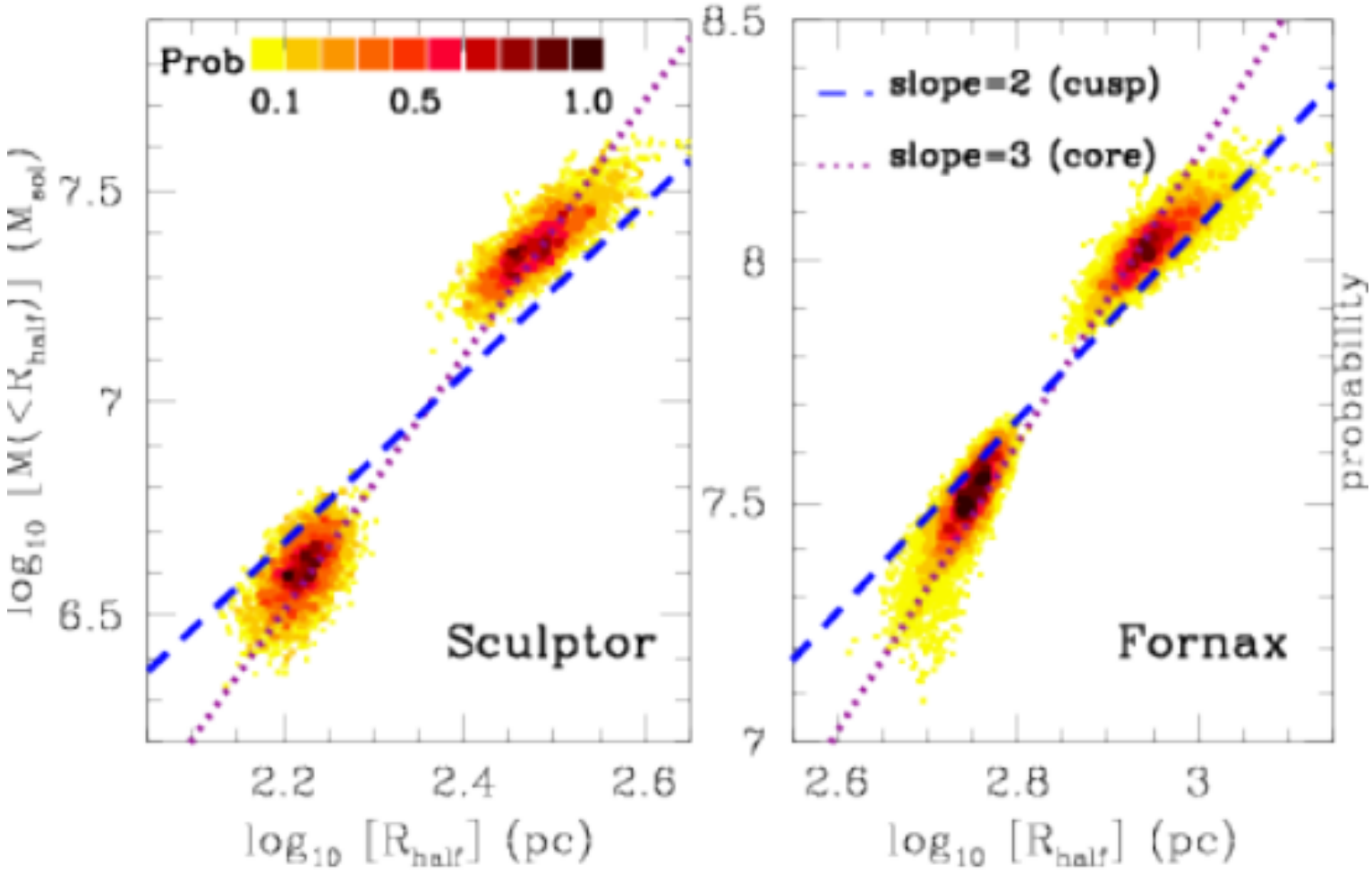

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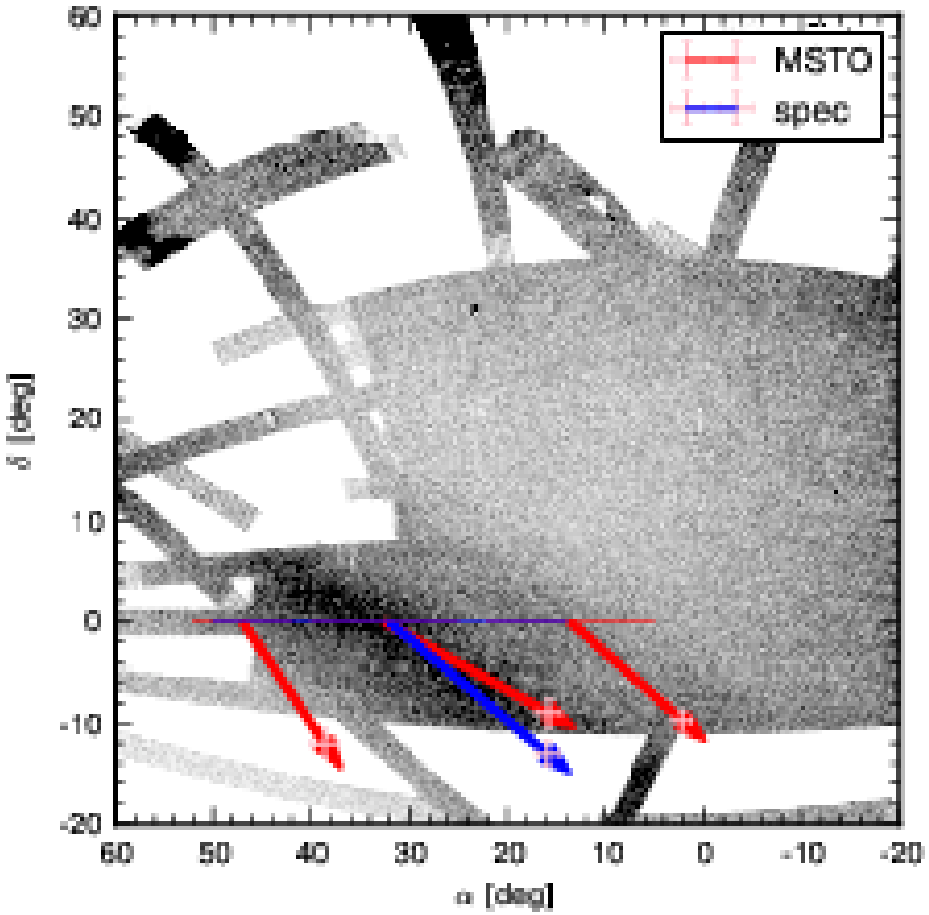

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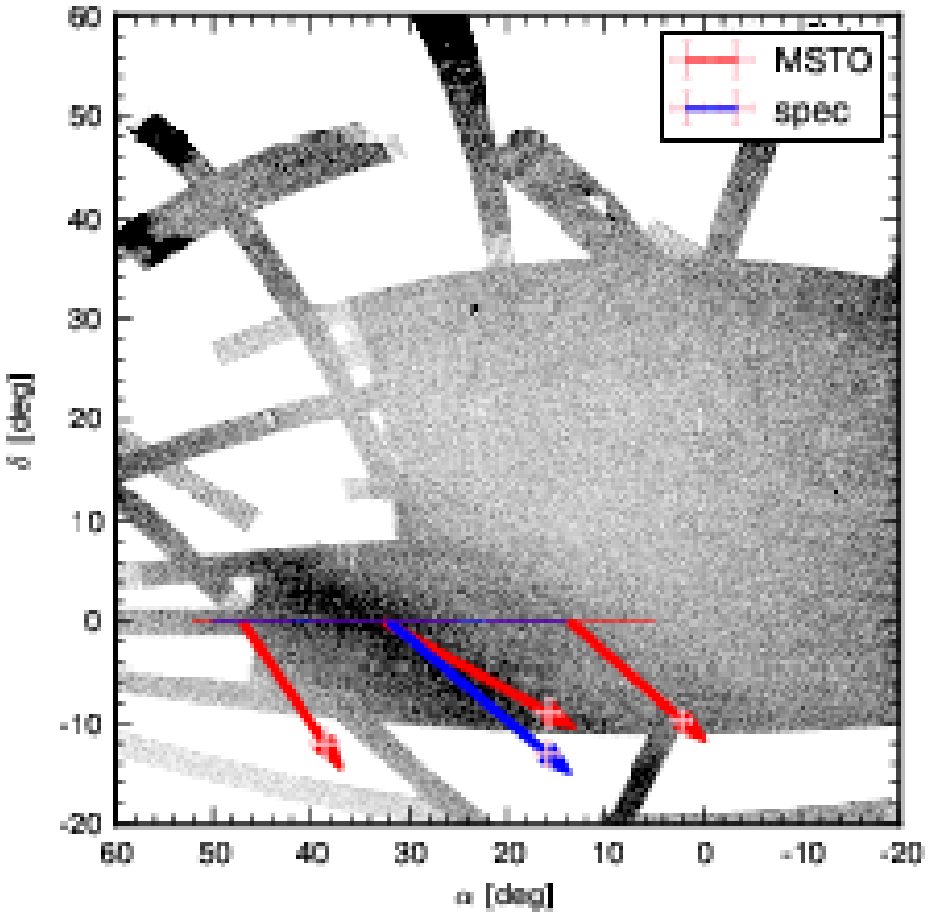

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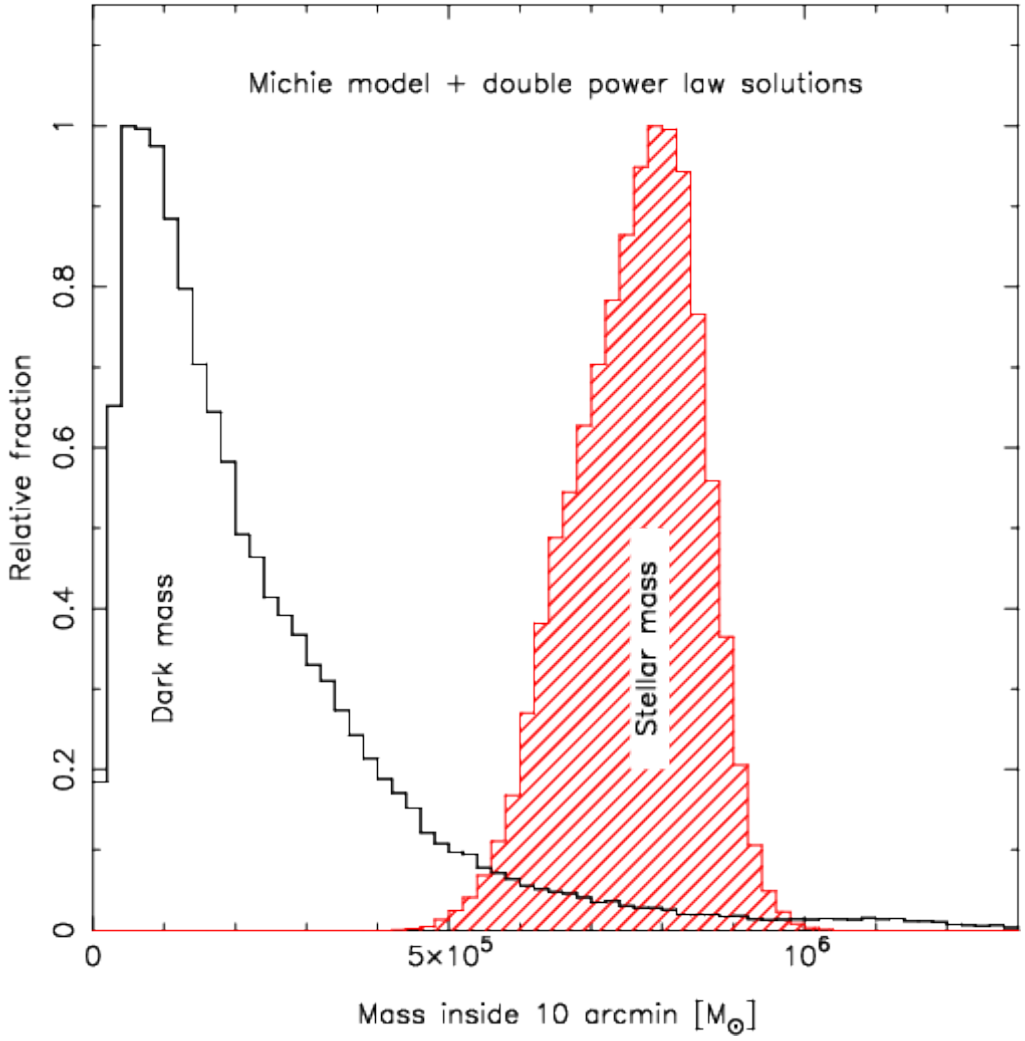

Ibata et al. 12

NGC 2419 shows $\lesssim$ 10% dark matter.

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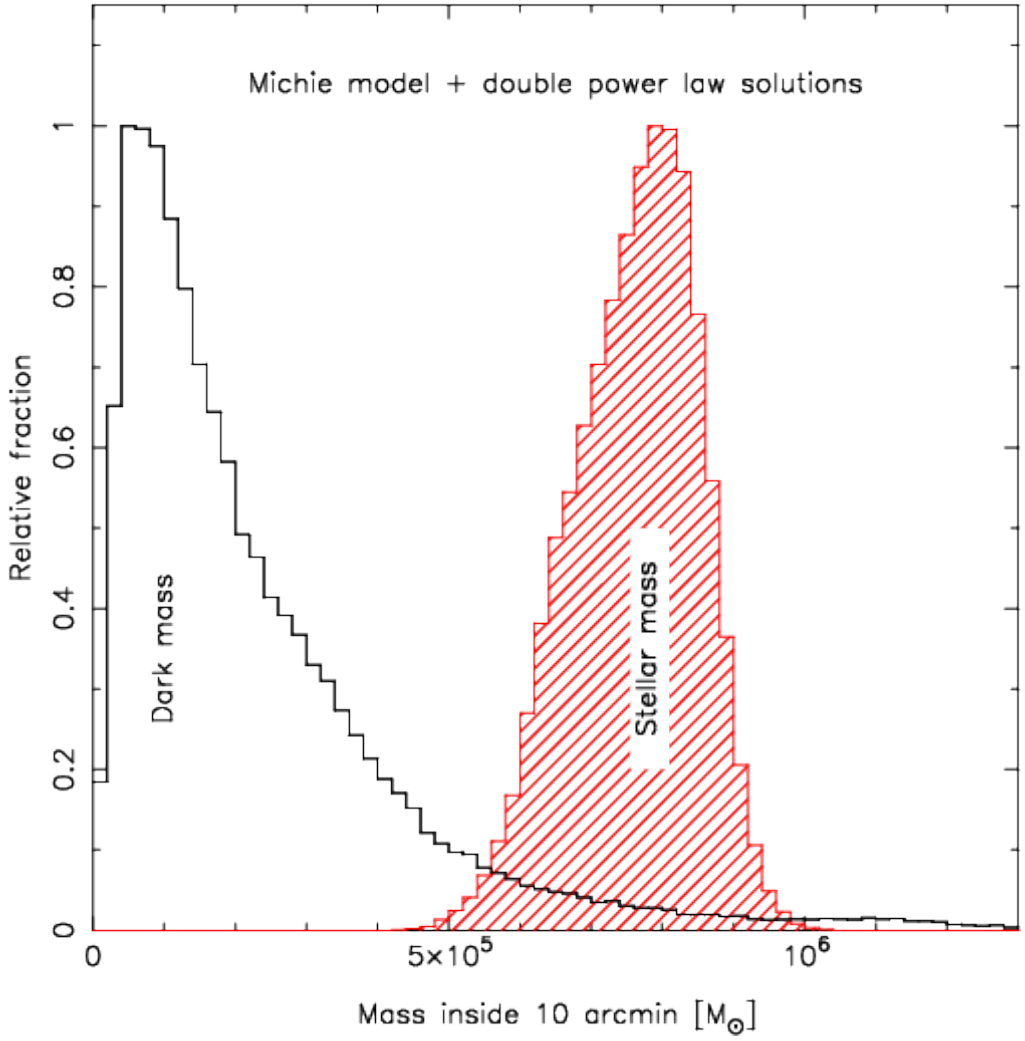

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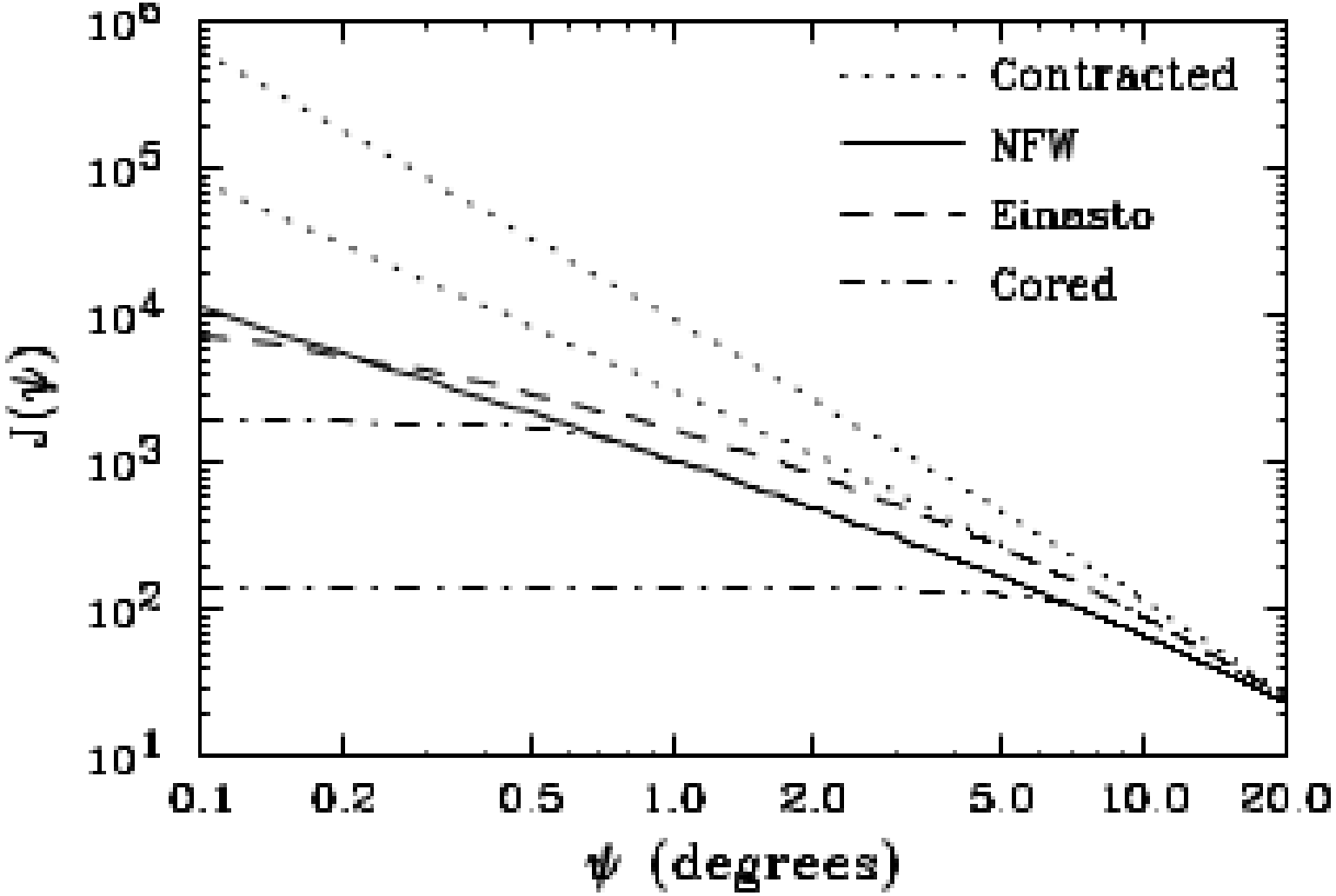

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MW and dSph flux reduced by 10 if profile is cored.

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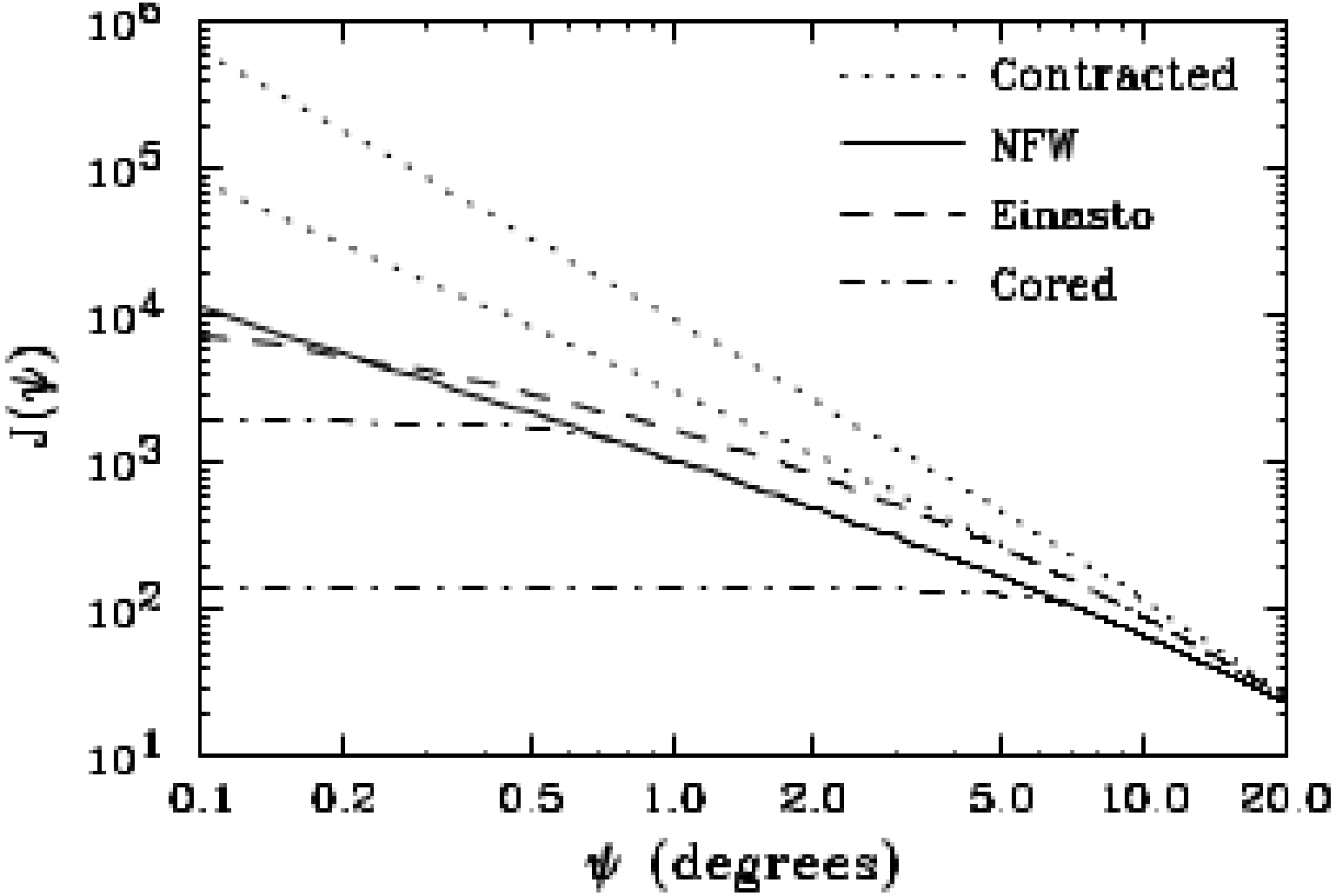

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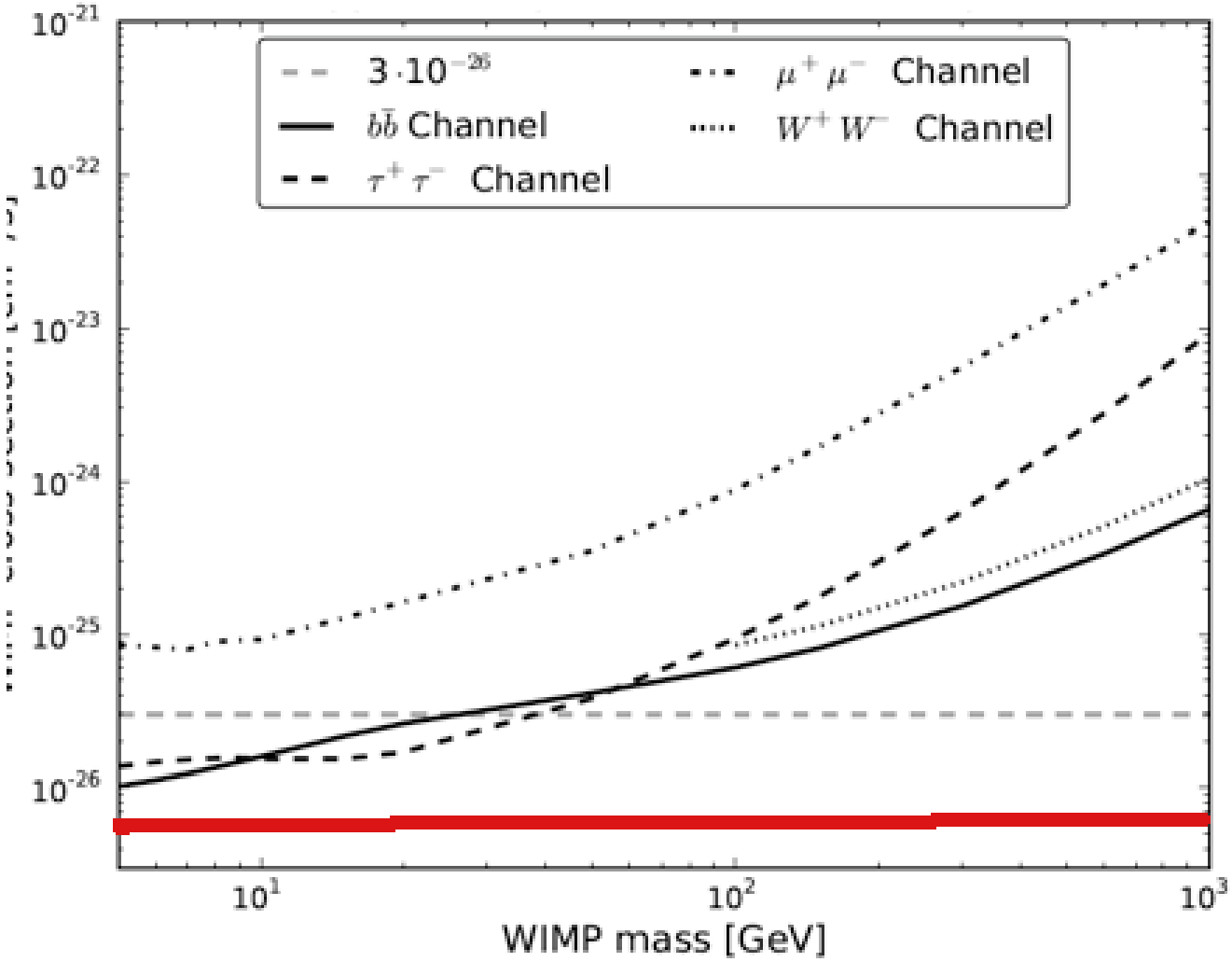

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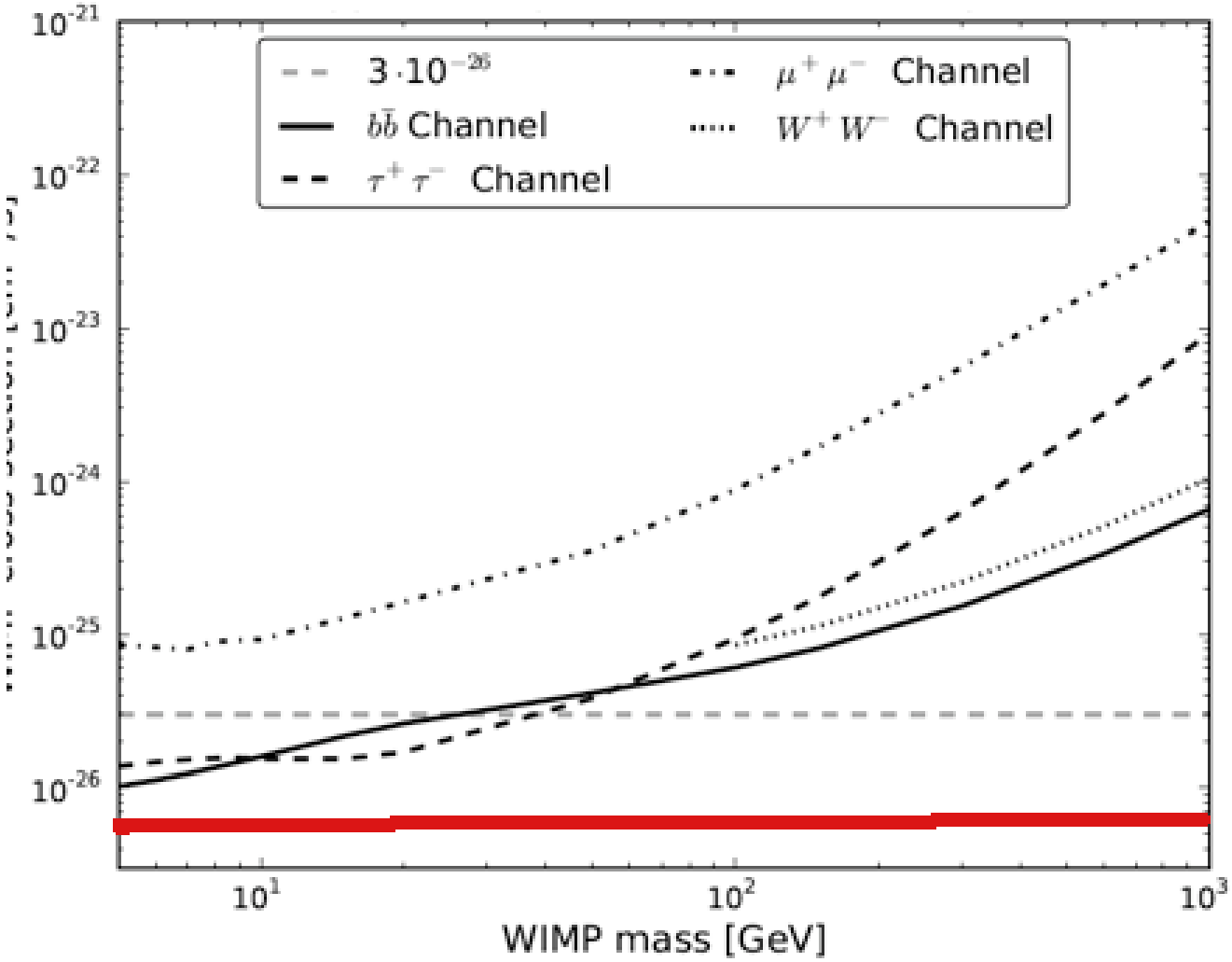

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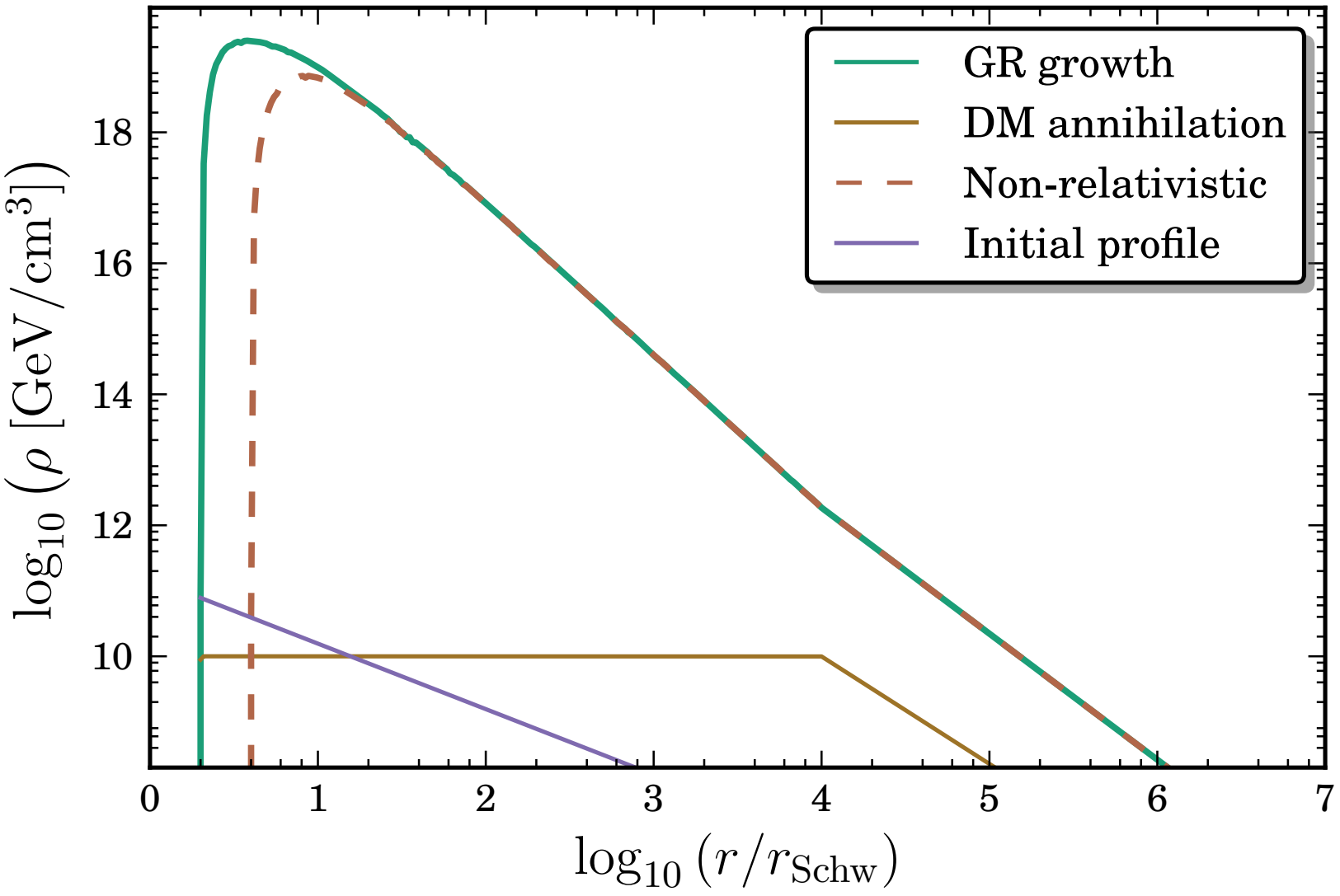

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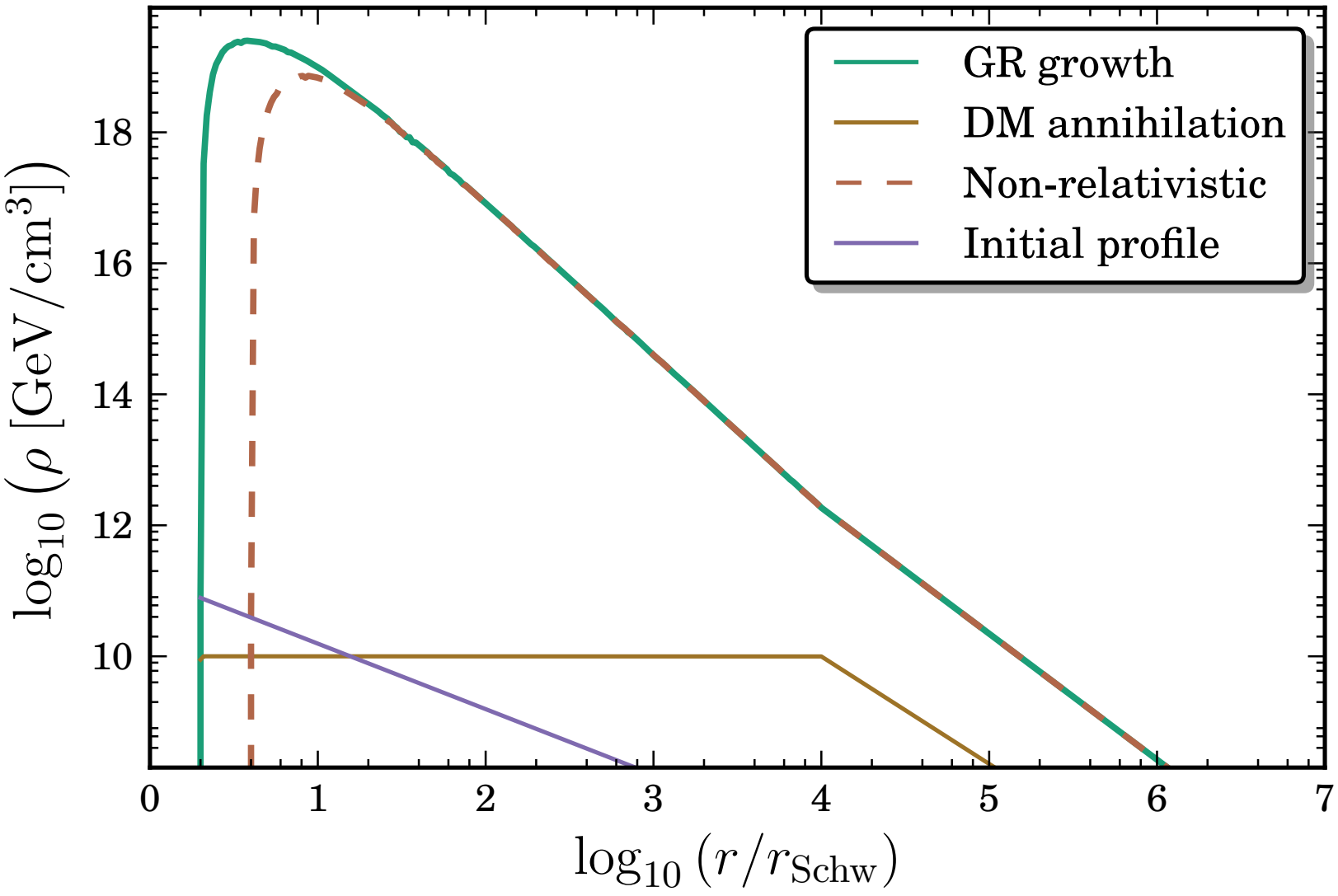

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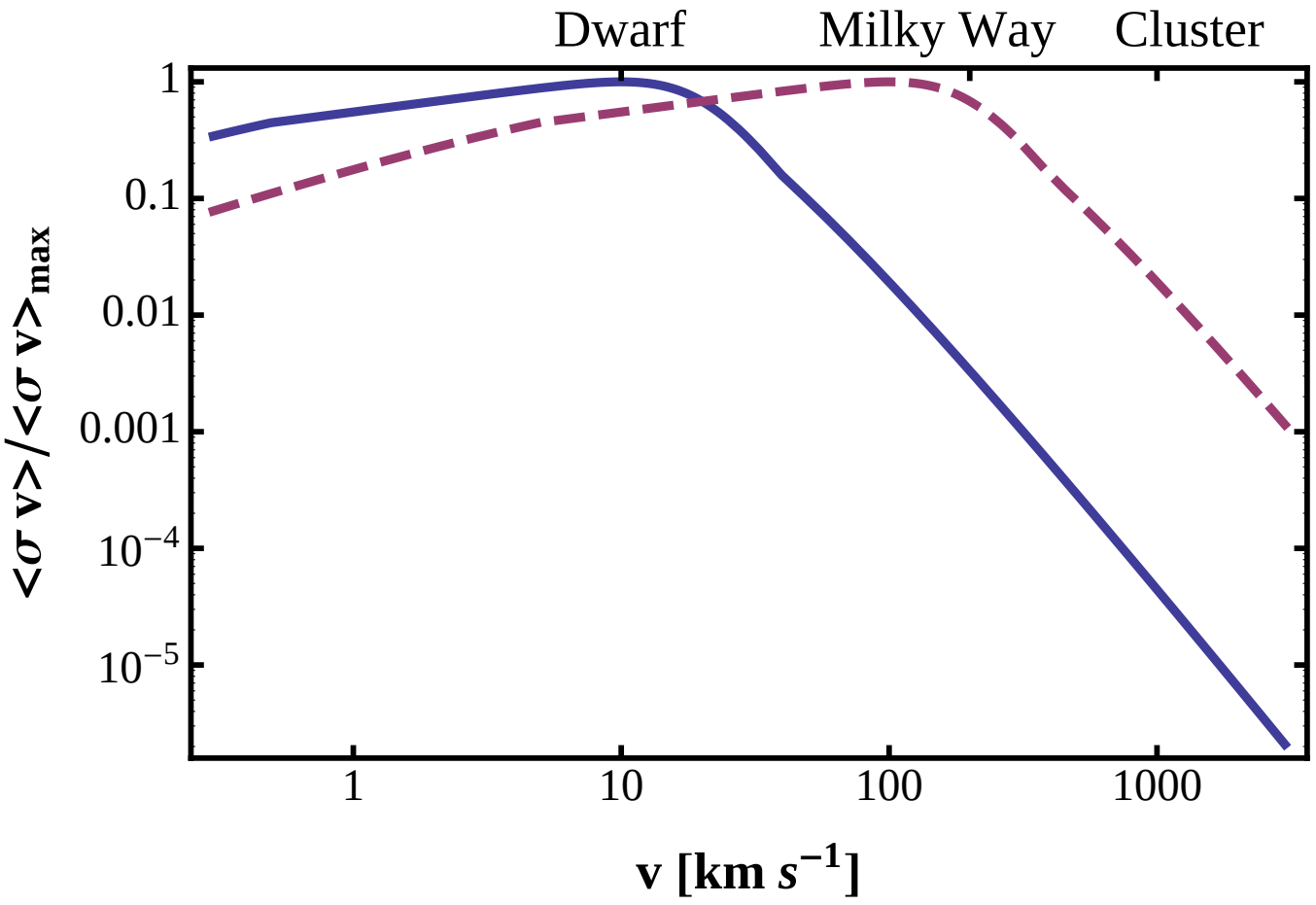
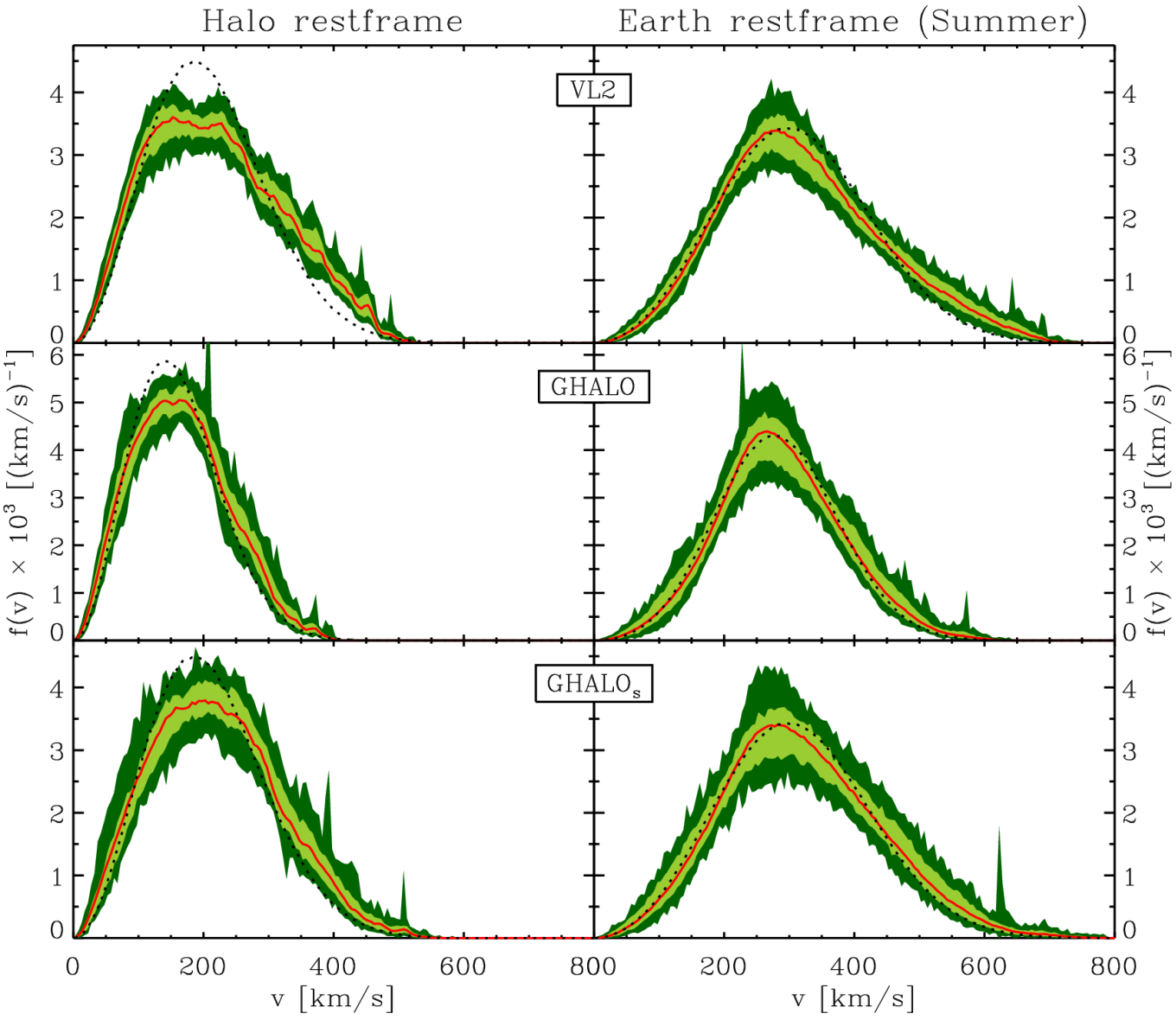


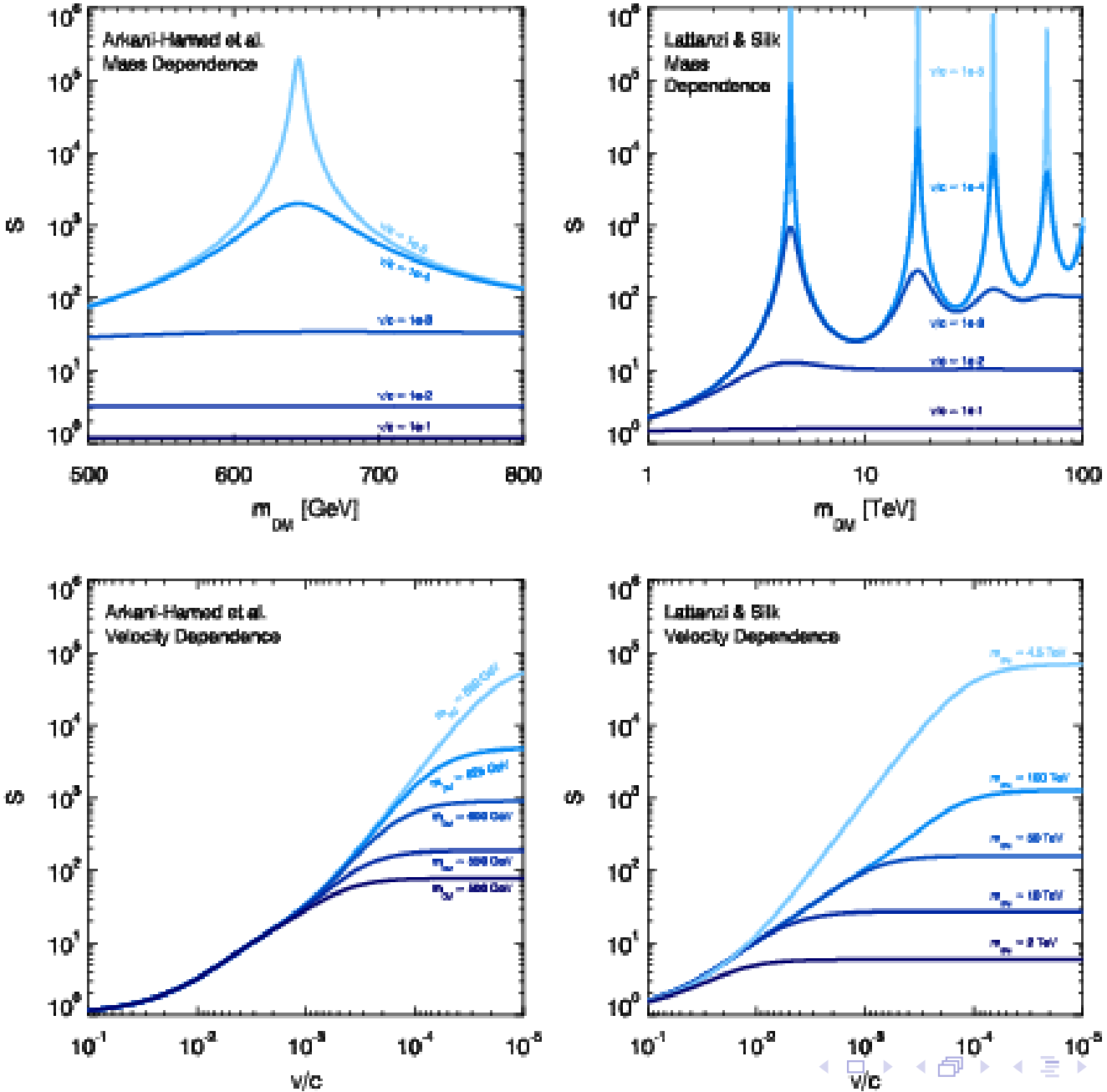
Weiner & Loeb 10

Velocity distribution: N-body (local)



Kuhlen et al. 09

Velocity distribution: Jeans



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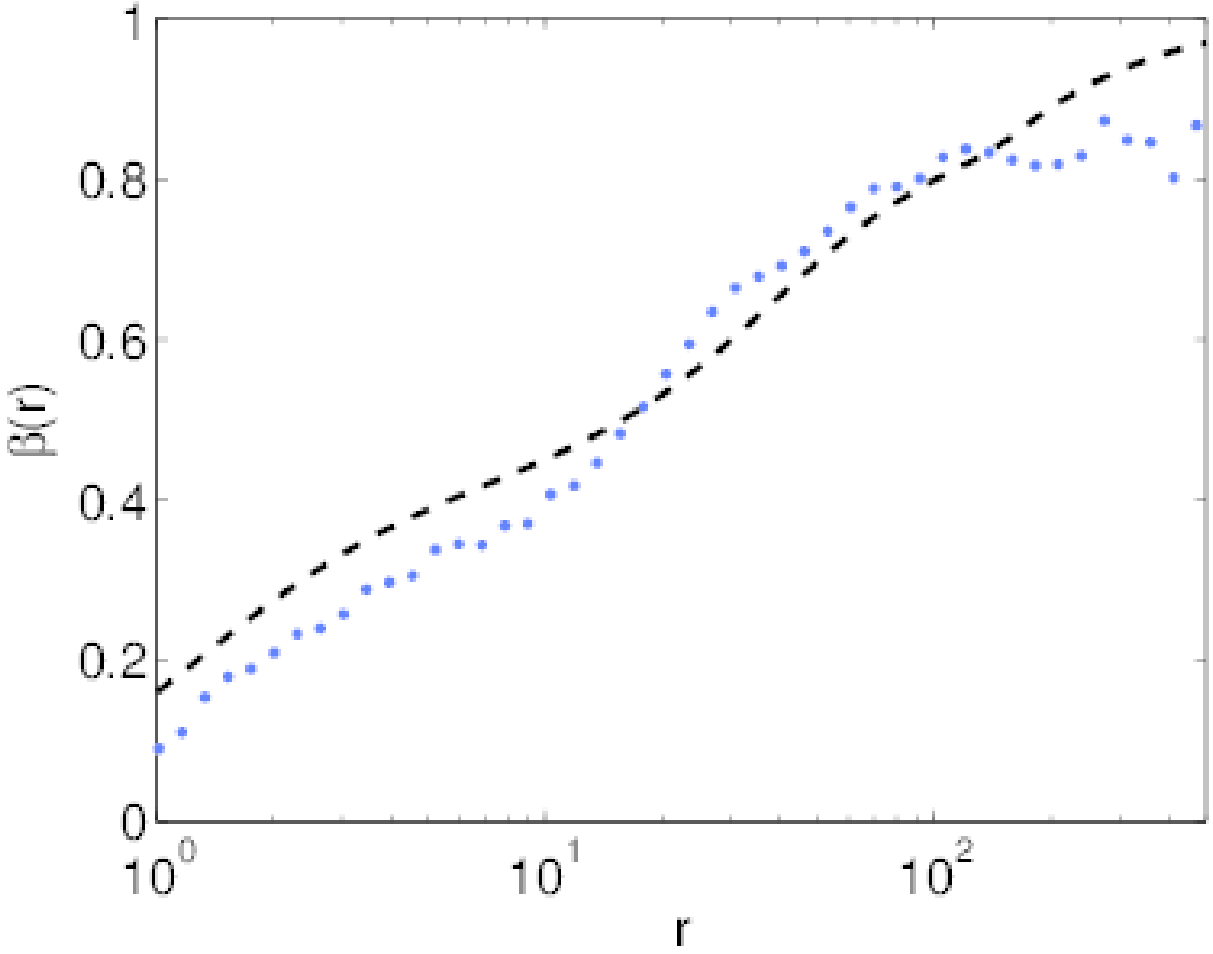

Visbal, Loeb & Hernquist 12

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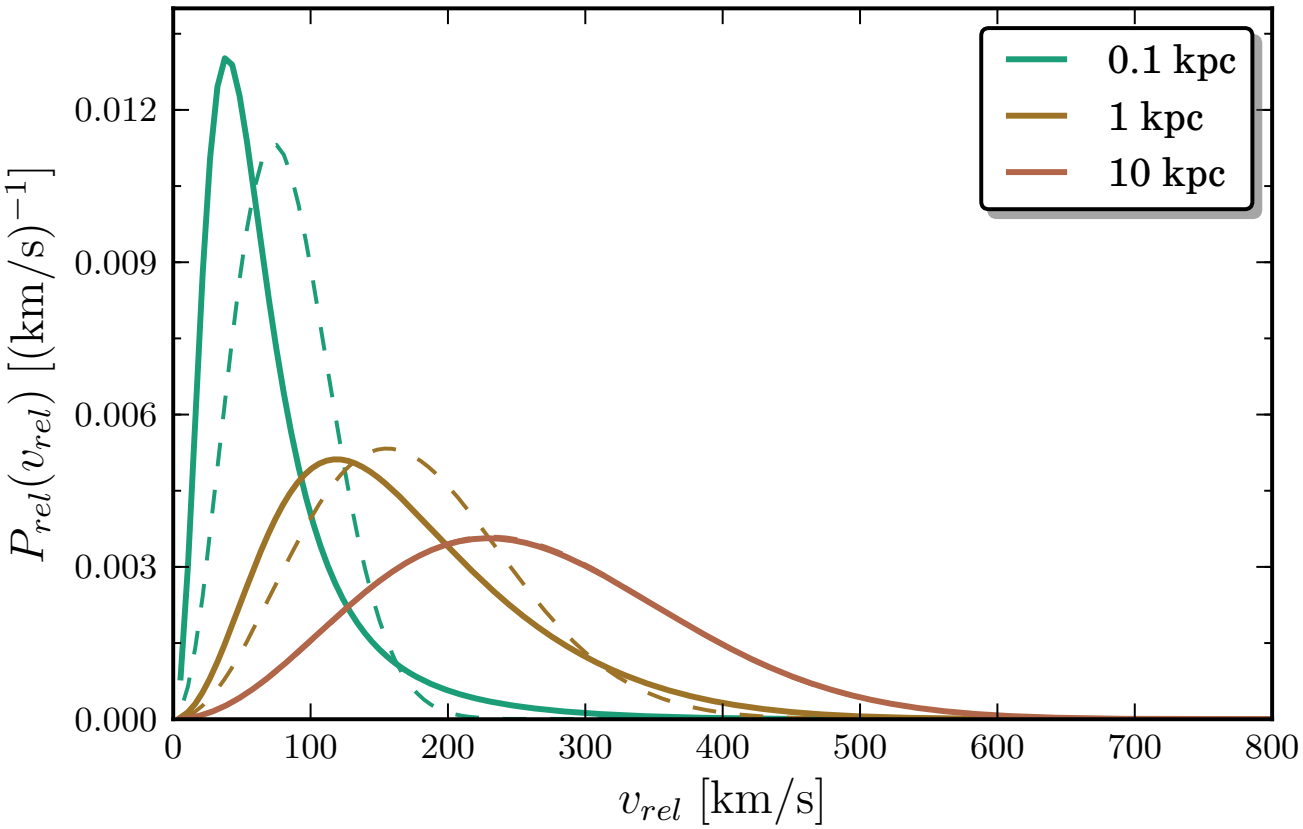

FF, D. Hunter 13

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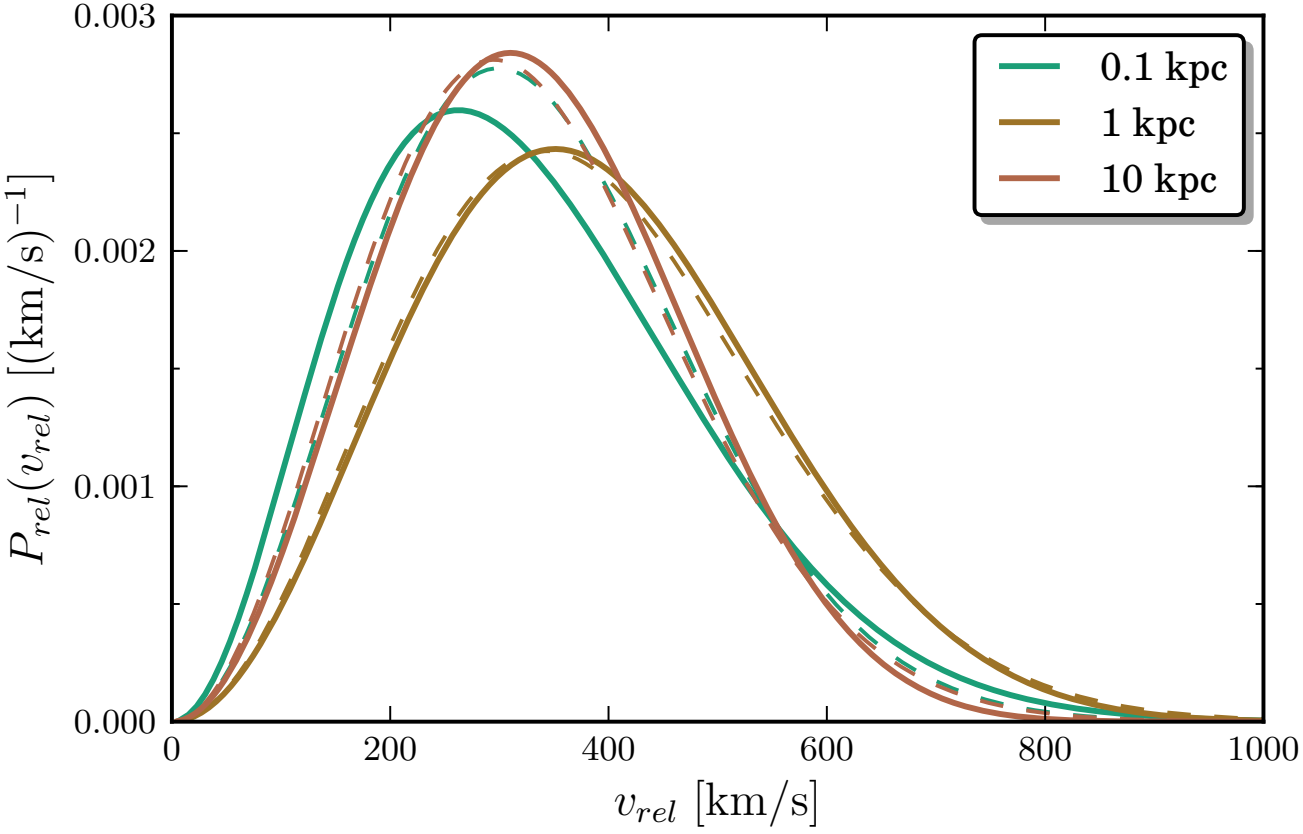

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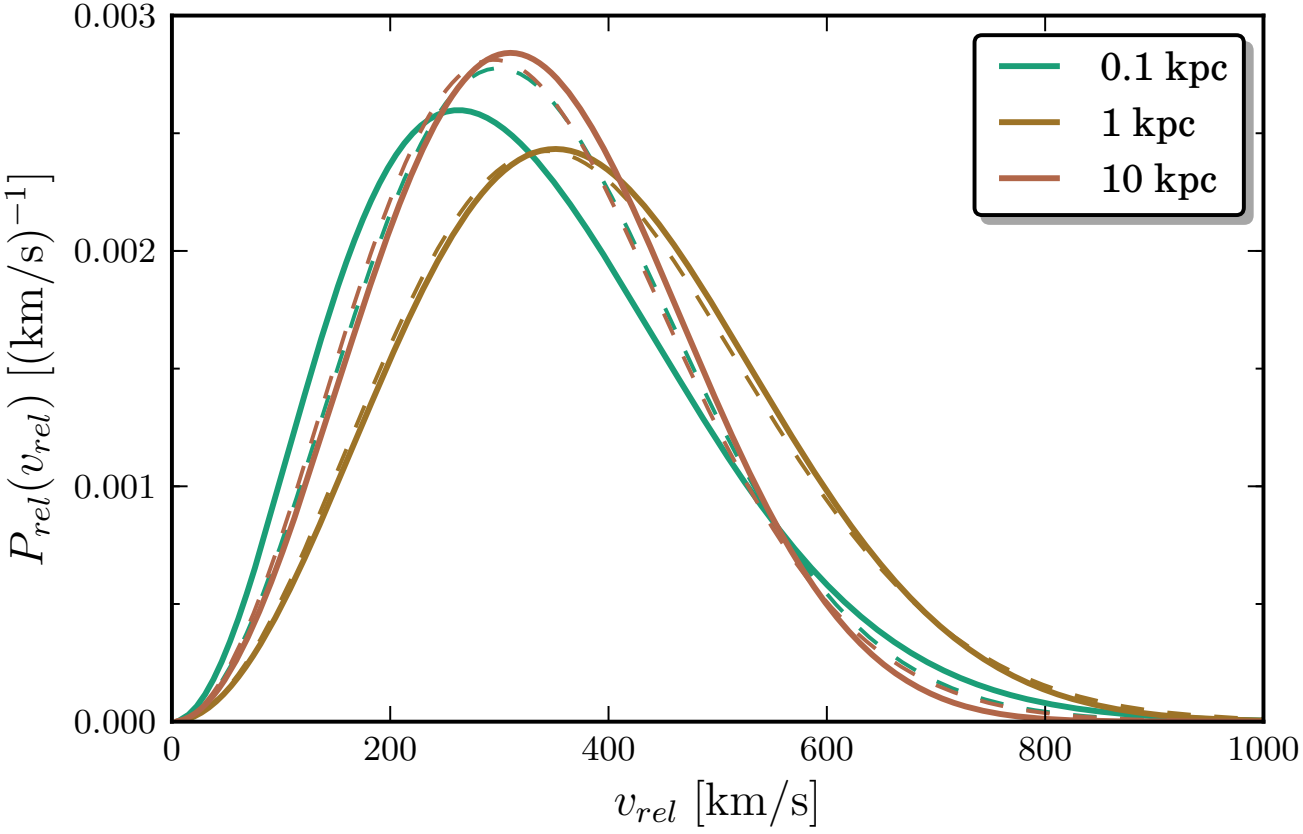

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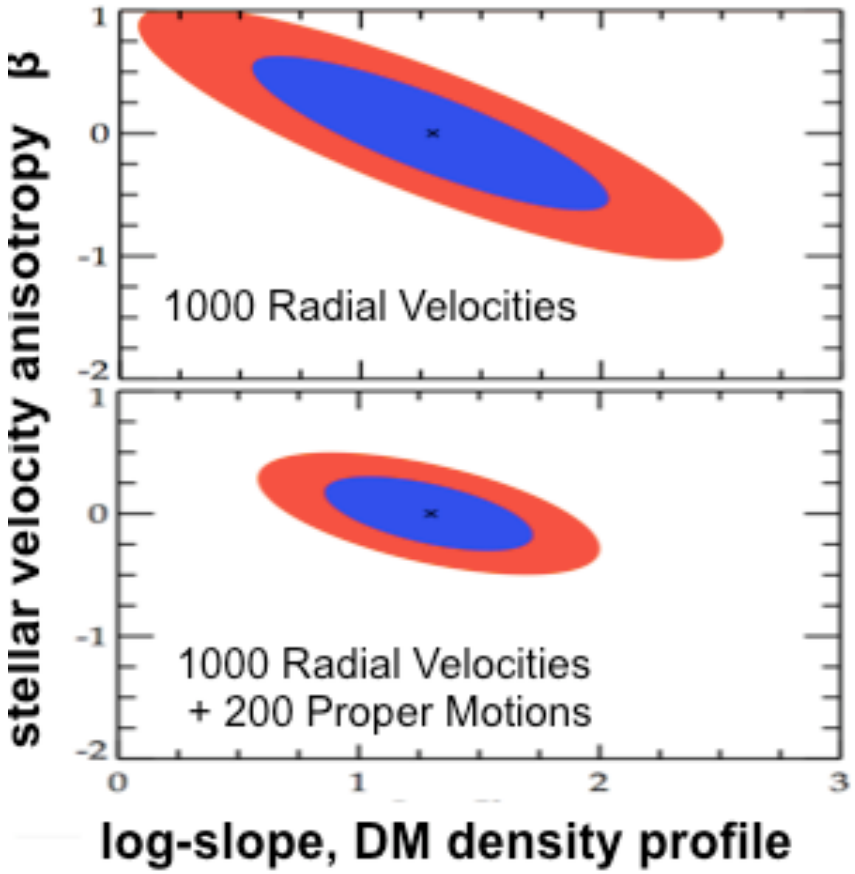

Bullock et al 09

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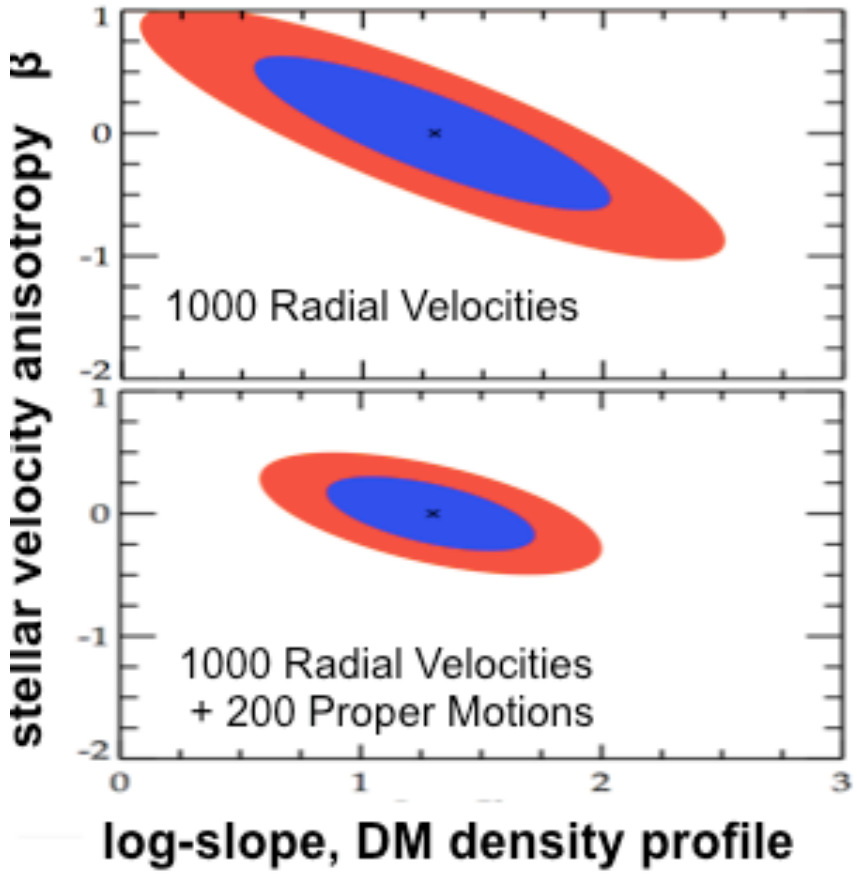

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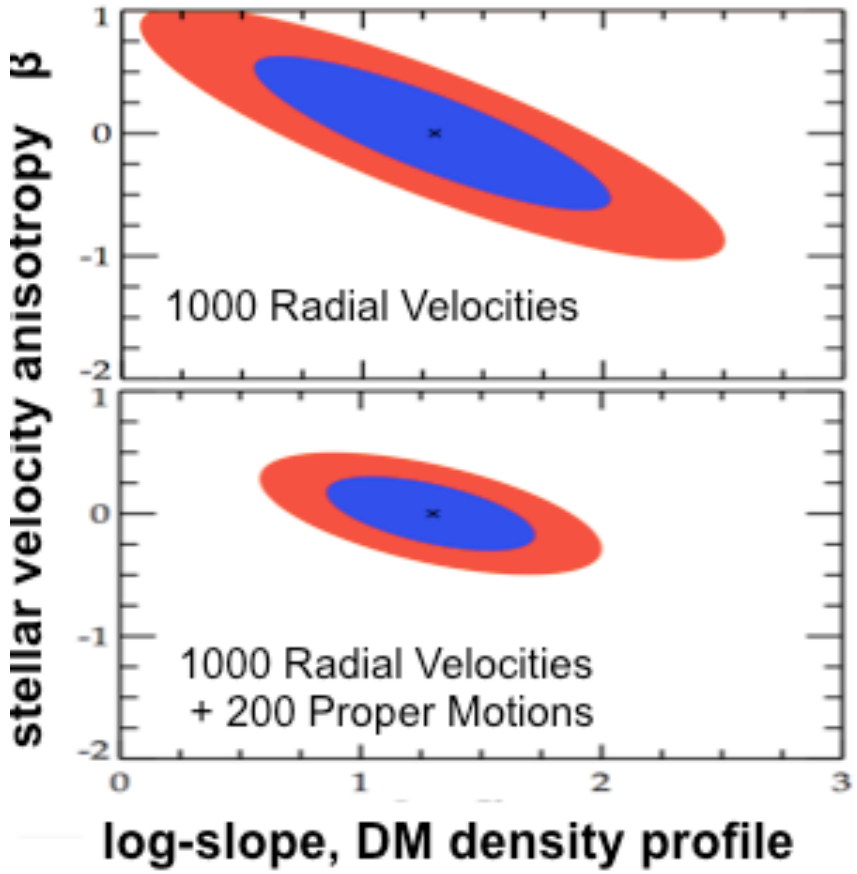

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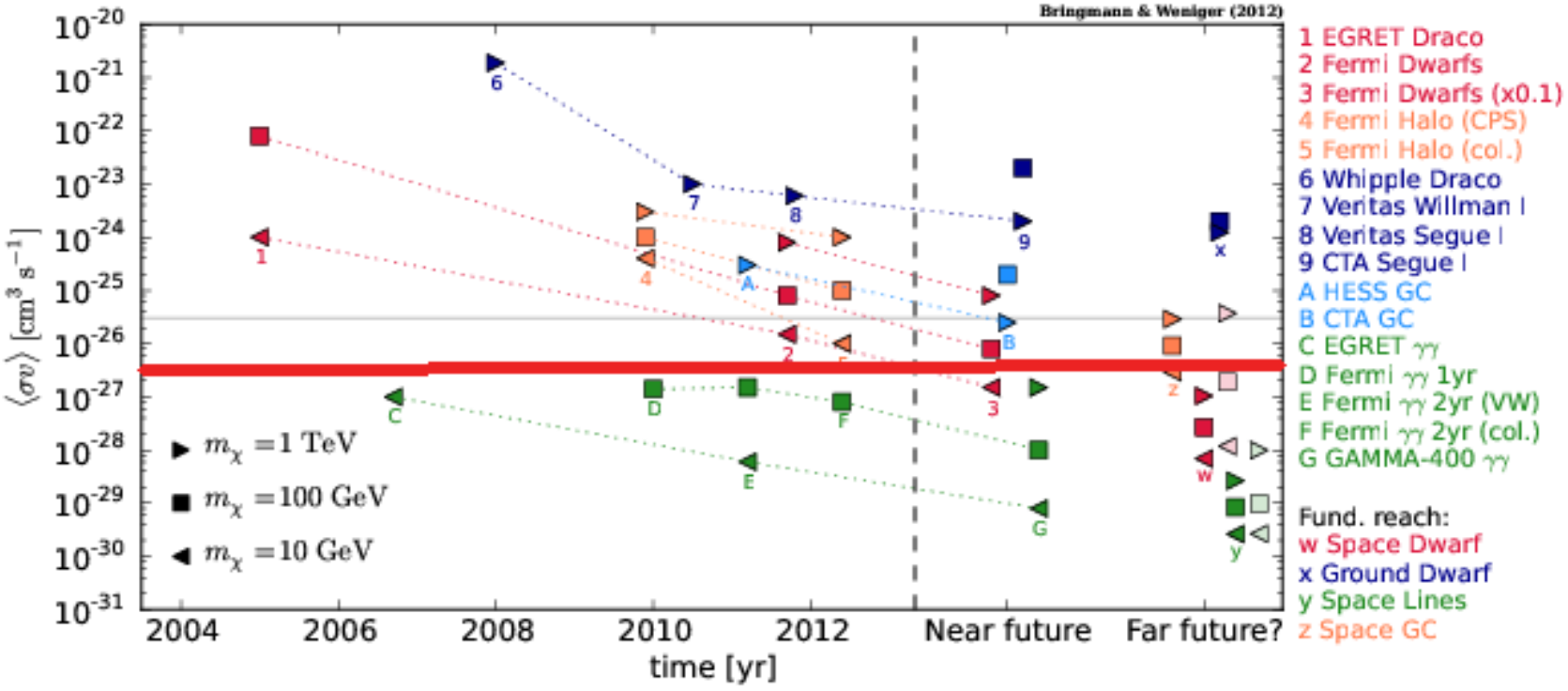

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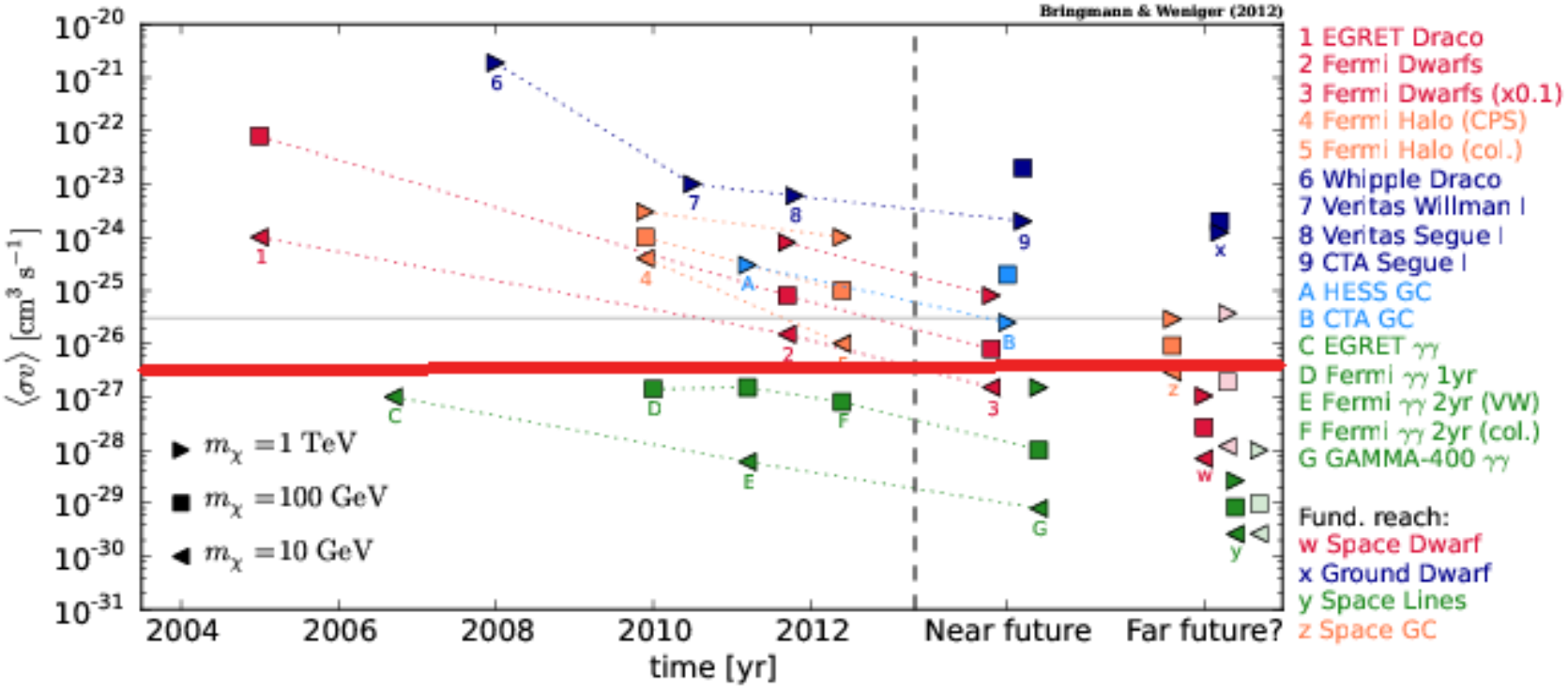

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Summary

- N-body simulations supplemented with baryonic physics support the CDM paradigm.
- Dark matter flux predictions might be overestimated $\times 10$. Baryon influence is time-dependent.
- Predictions for velocity-dependent annihilation cross-section require knowledge of the velocity distribution.

- Thermal cross-section will be robustly tested in the next decade.
- Knowledge of the density distribution at small-scales will be crucial.