

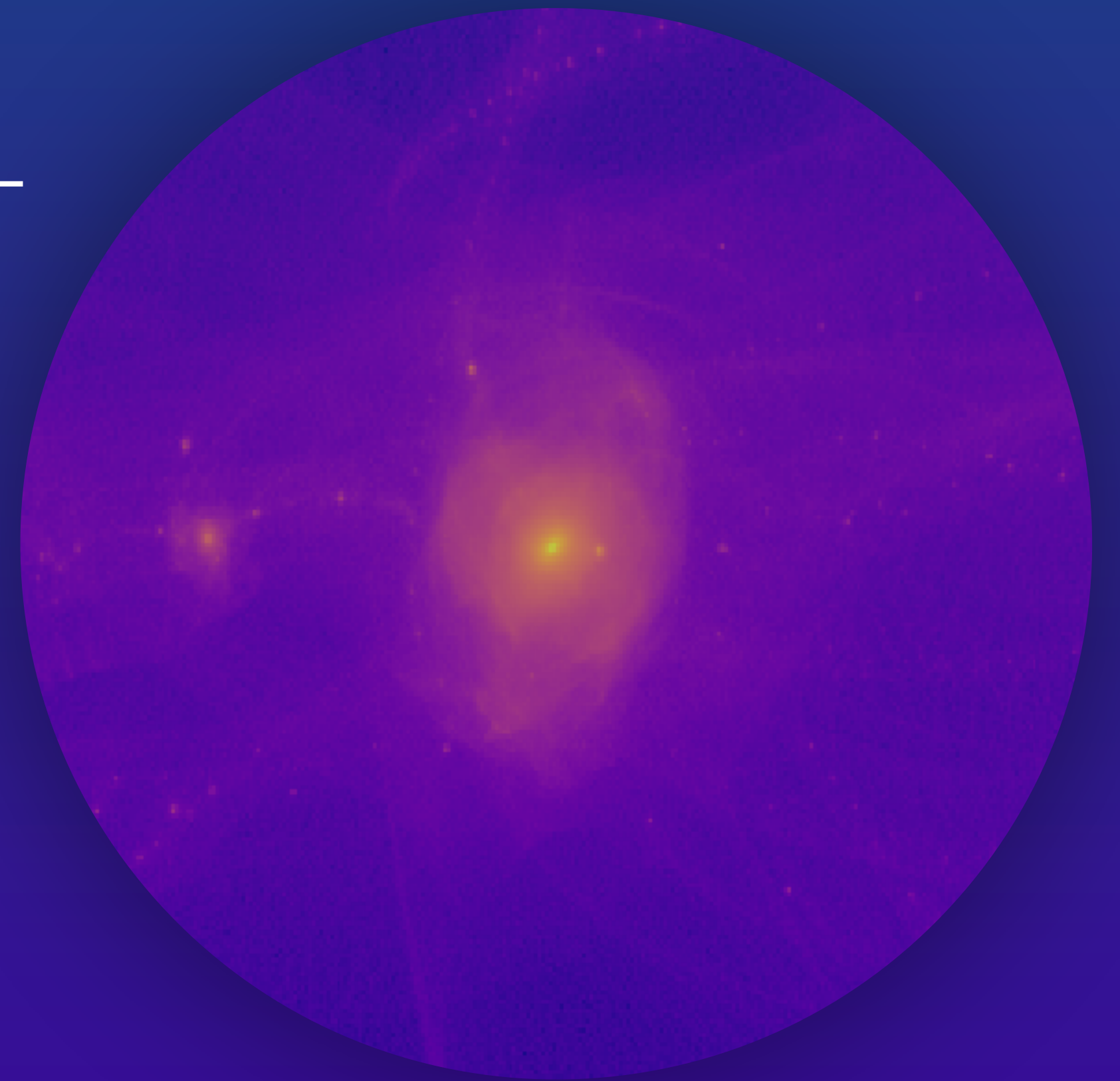
The Nature of Dark Matter with Dwarf Galaxies

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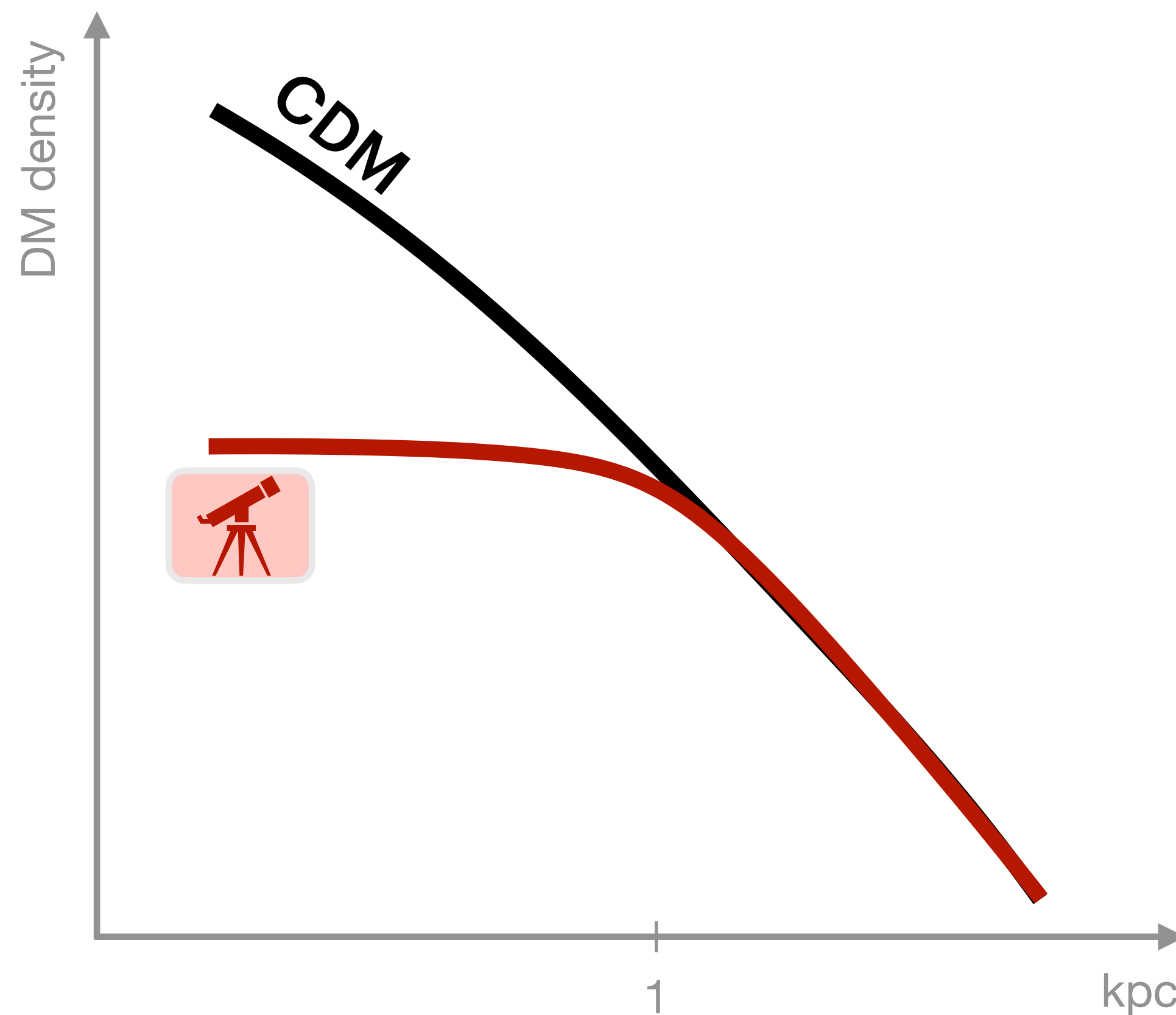
CosmoBrainstorm 2026

24/04/26



Dark matter density profiles as probes of dark matter

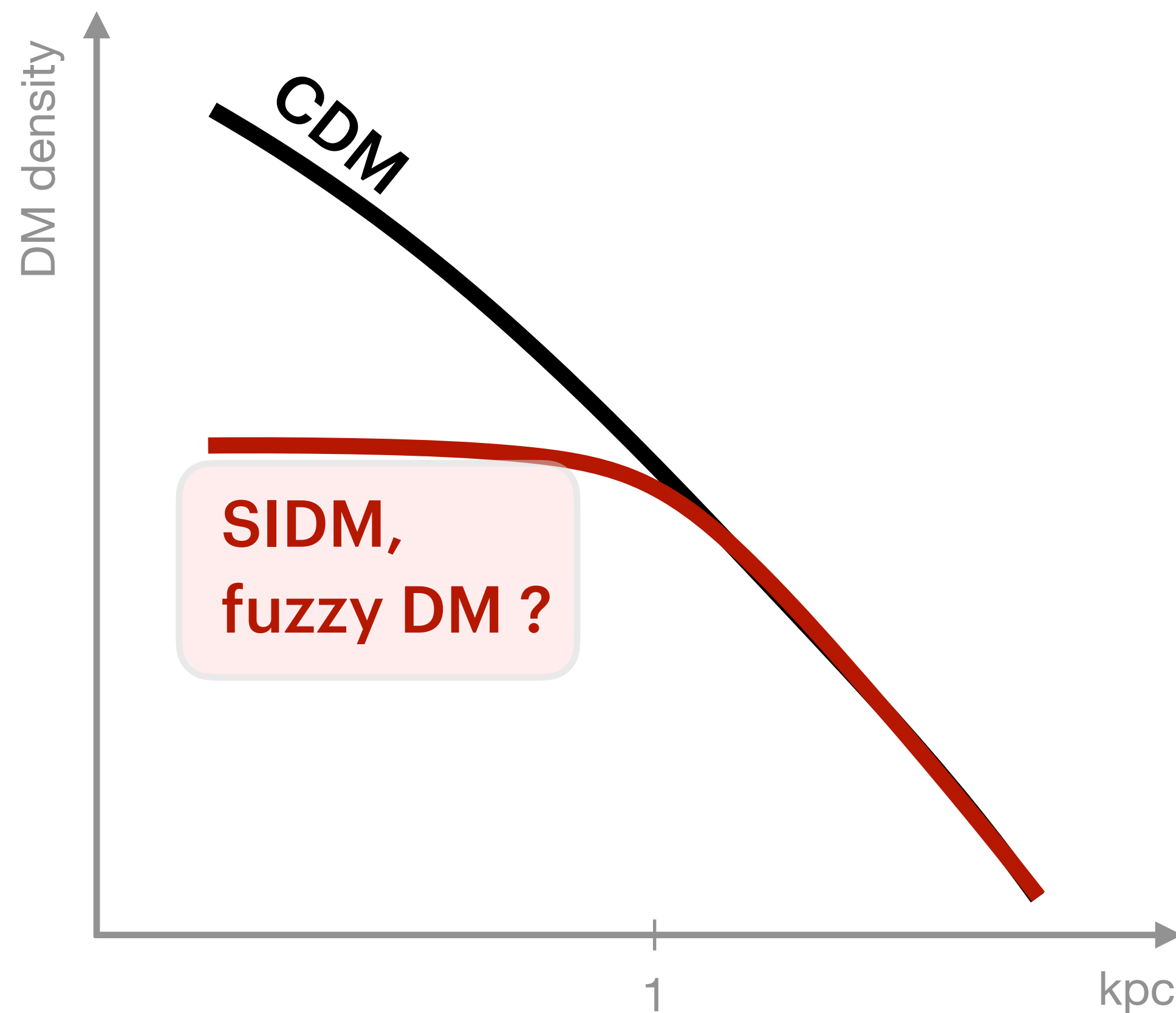
The “cusp - core problem”



- ◆ **CDM** predicts cusps: inner density diverges
- ◆ **Observations** suggest at least some cores
e.g. Oh et al. (2015), Read et al. (2017), Adams et al. (2014)

Dark matter density profiles as probes of dark matter

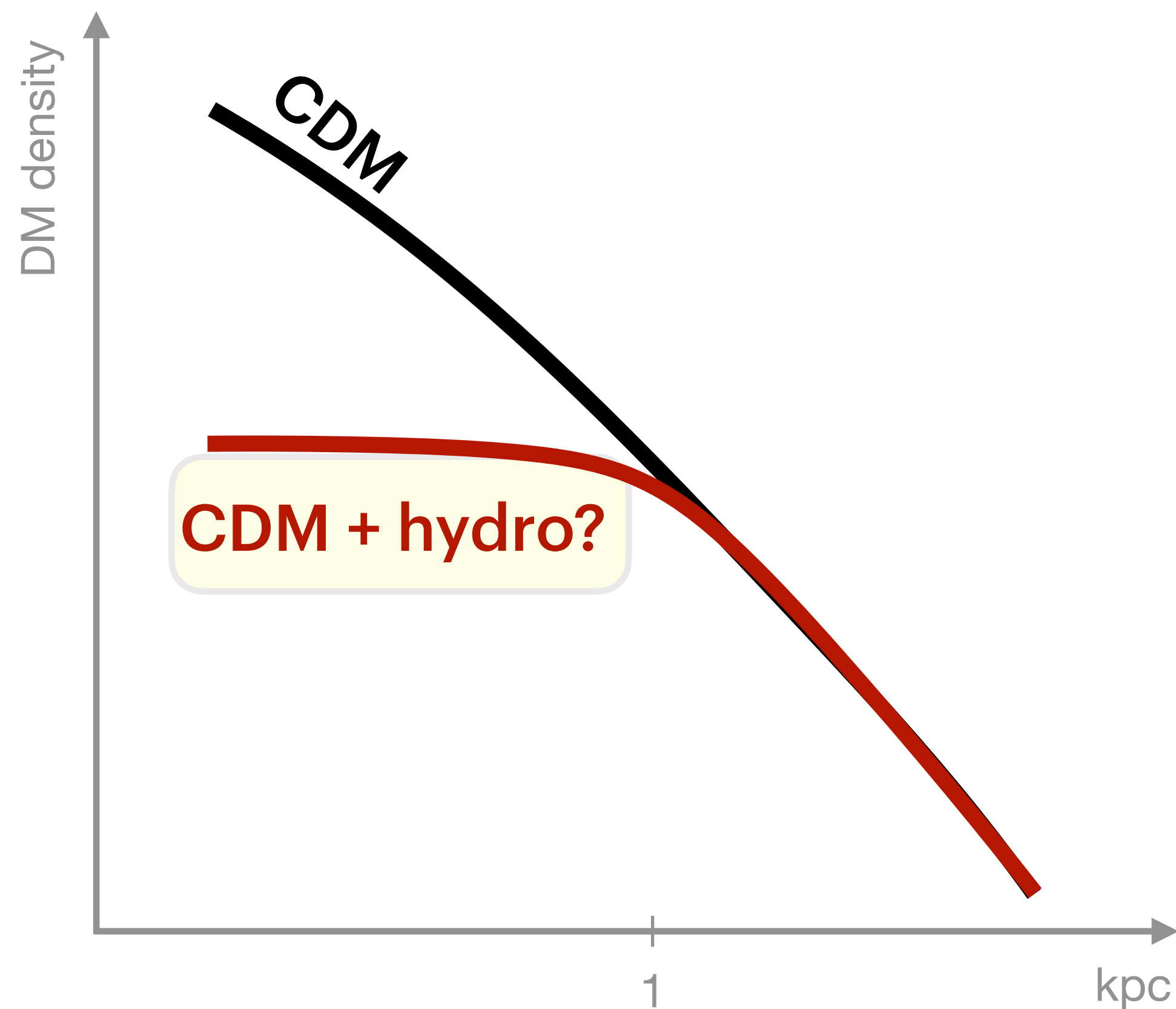
The “cusp - core problem”



- **Solution 1: alternative DM models**

e.g. Rocha et al (2013), Tulin & Yu (2017), Burkert (2020)

Dark matter density profiles as probes of dark matter



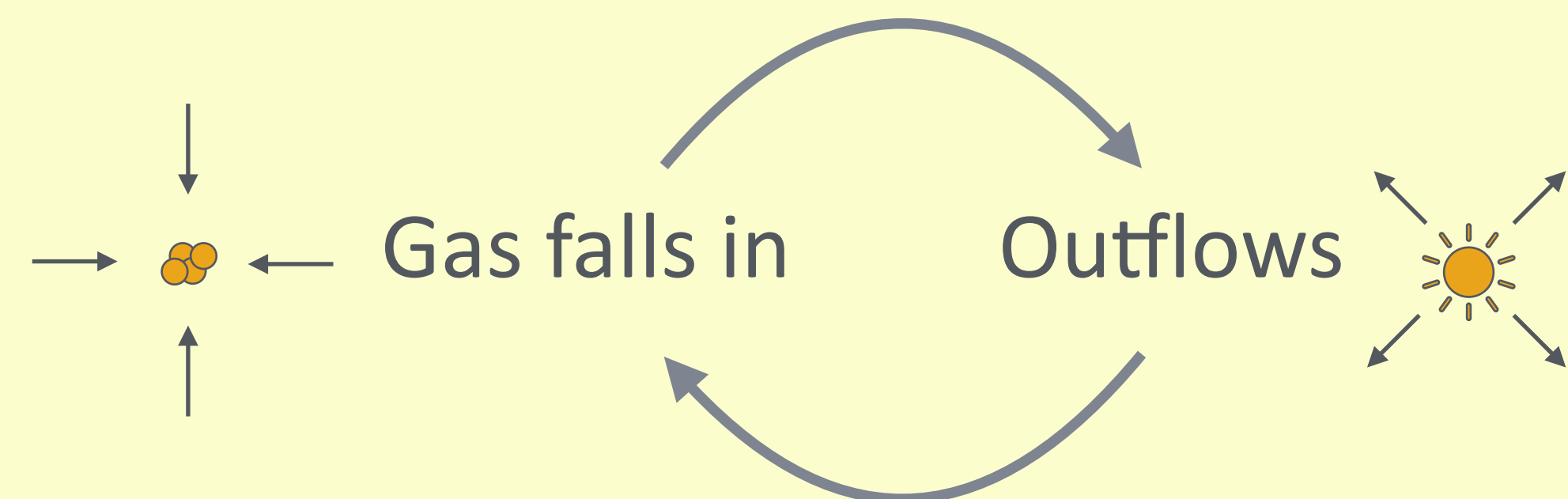
The “cusp - core problem”

- **Solution 1: alternative DM models**

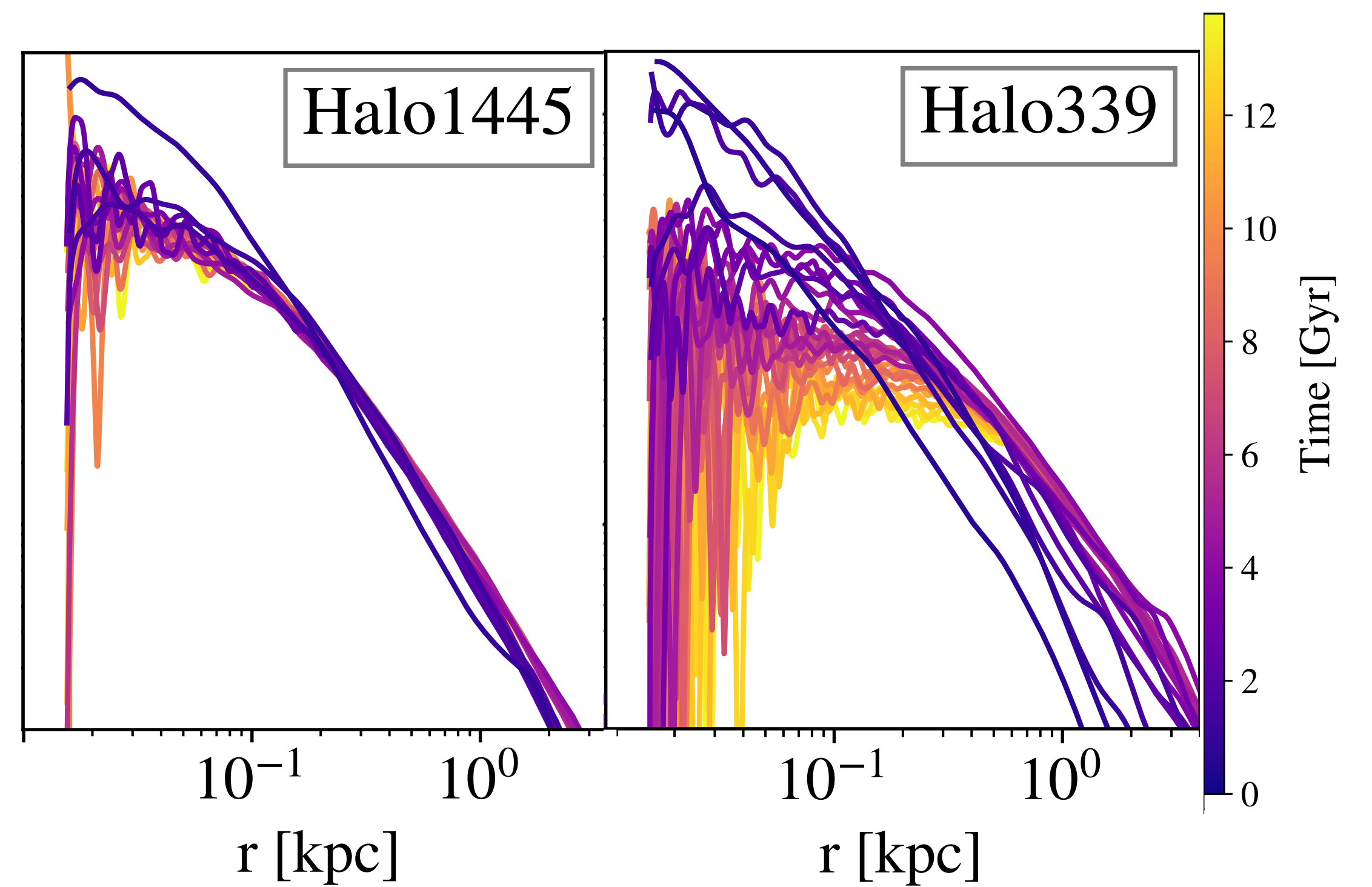
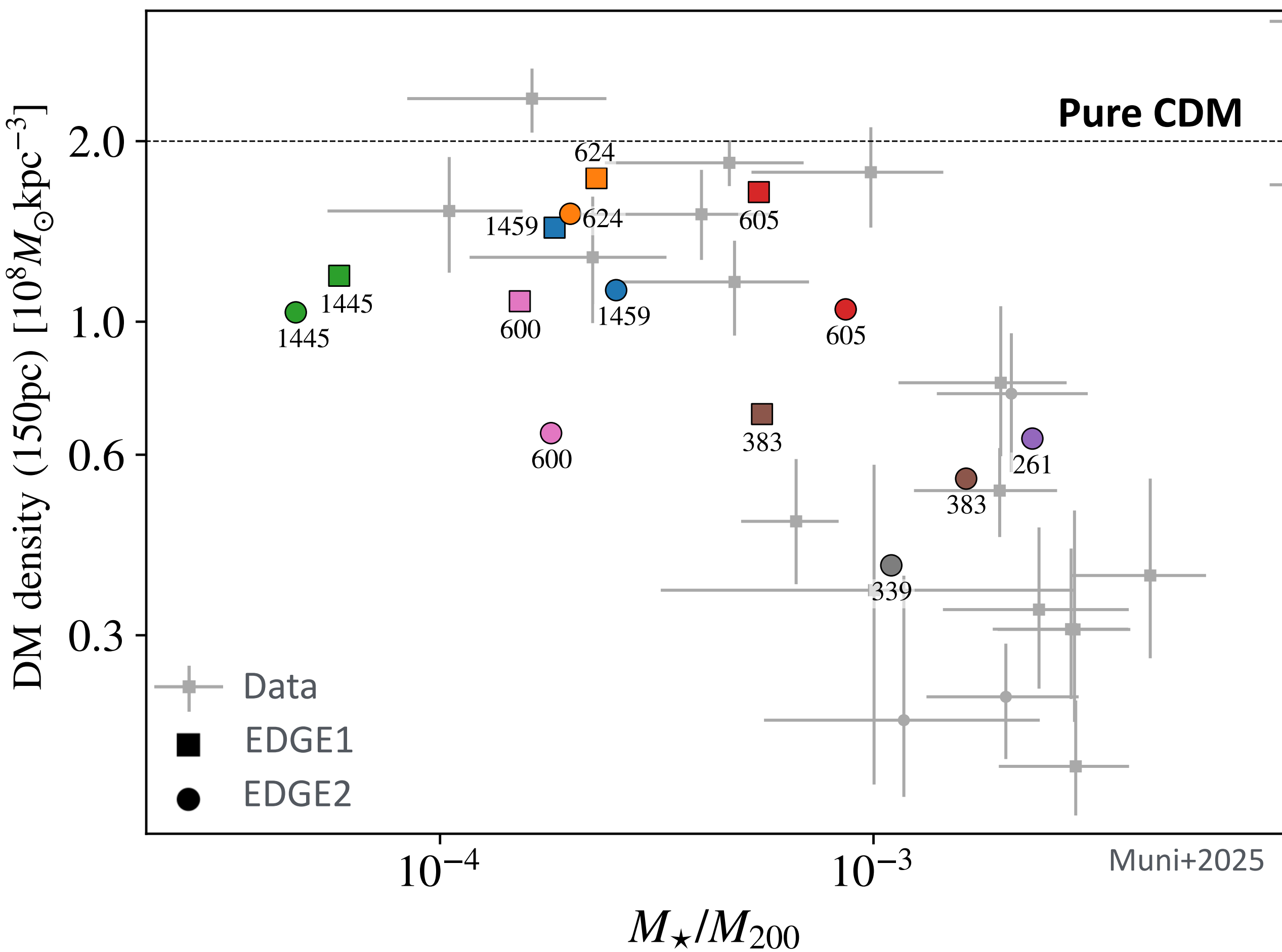
e.g. Rocha et al (2013), Tulin & Yu (2017), Burkert (2020)

- **Solution 2: Baryonic feedback (within CDM)**

e.g. Navarro et al. (1996), Read et al (2005), Pontzen et al. (2012)

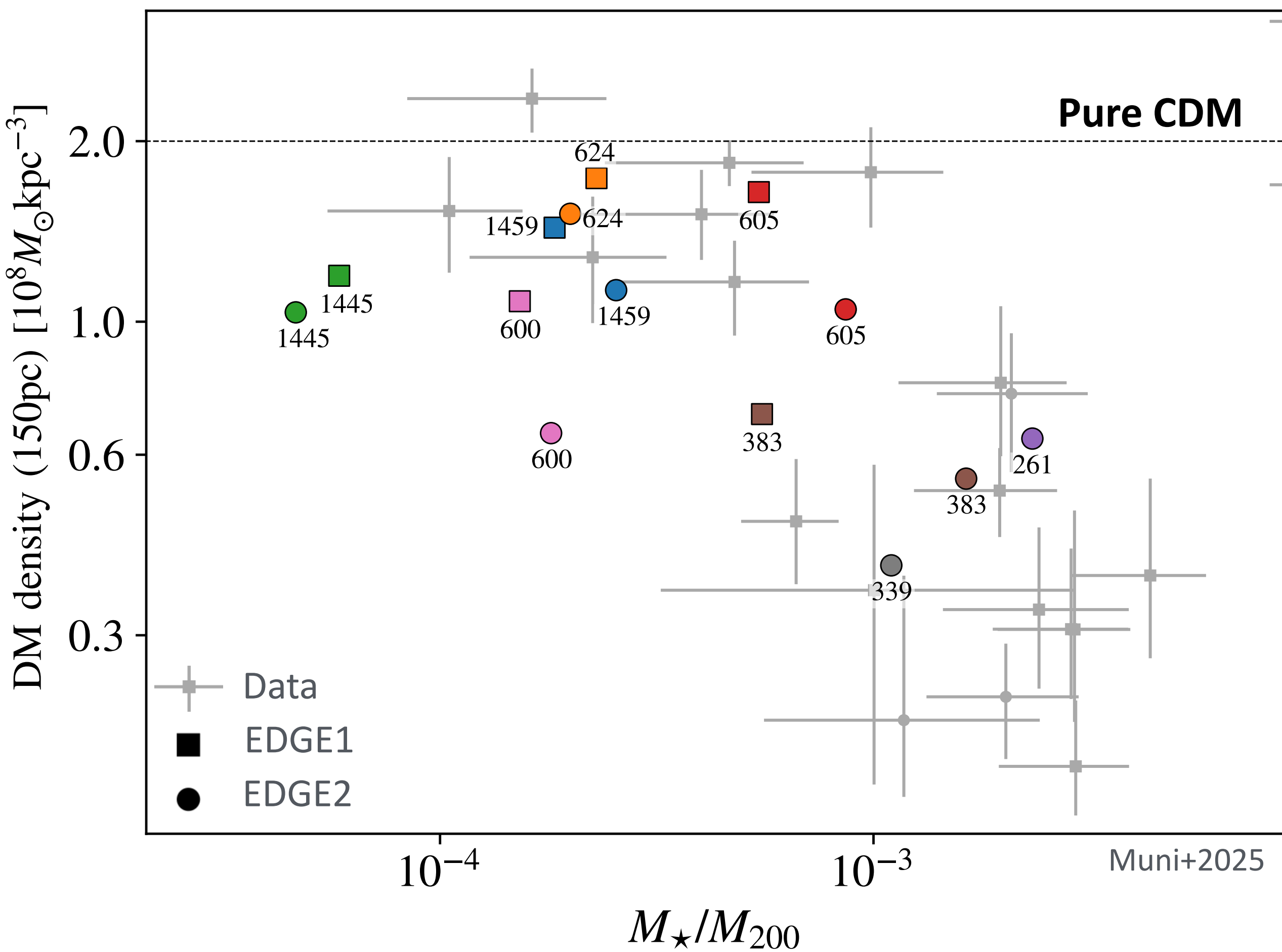


The EDGE simulations and dark matter cores

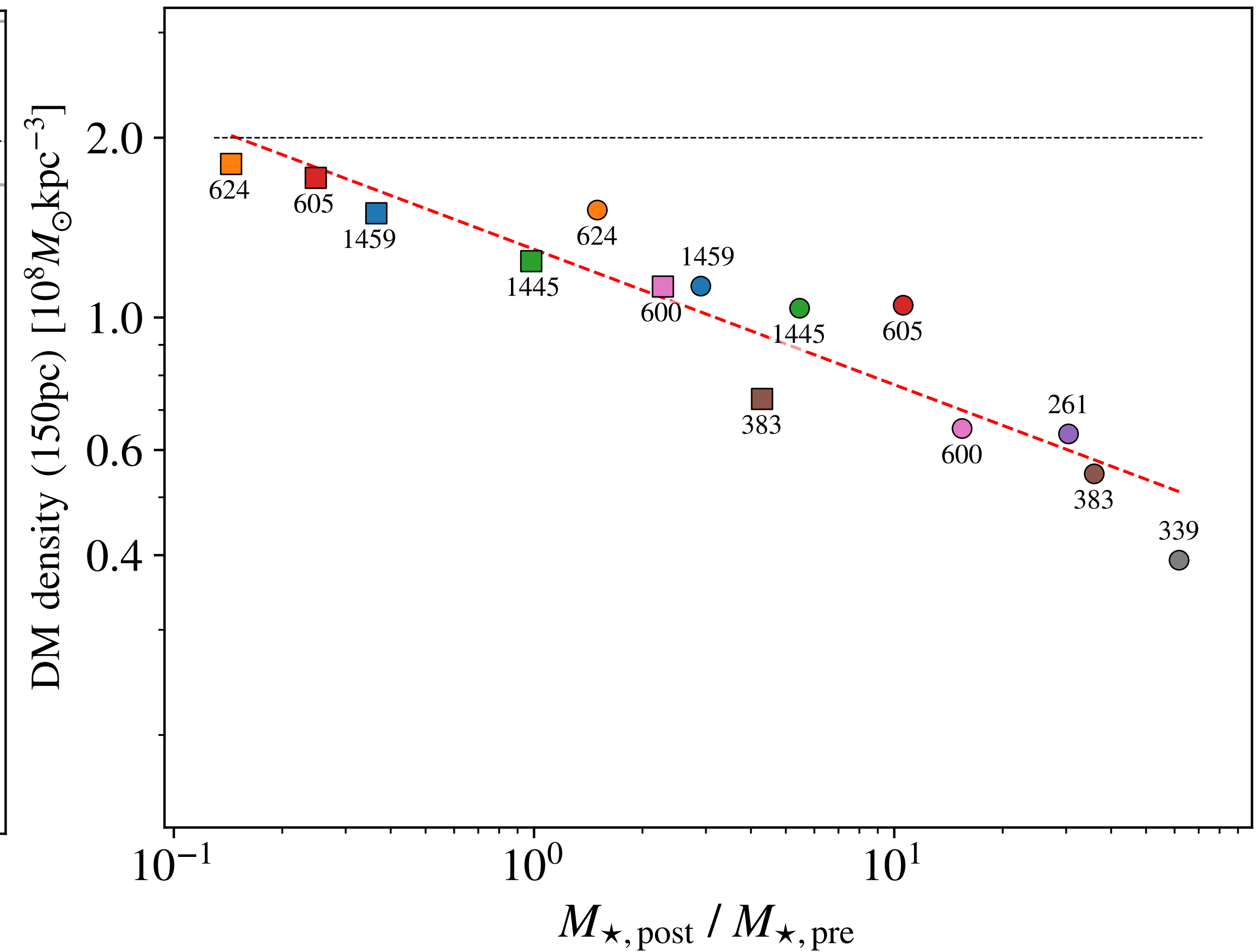


Energy injection
 (cf Penarrubia, Pontzen, Walker 2013)

The EDGE simulations and dark matter cores

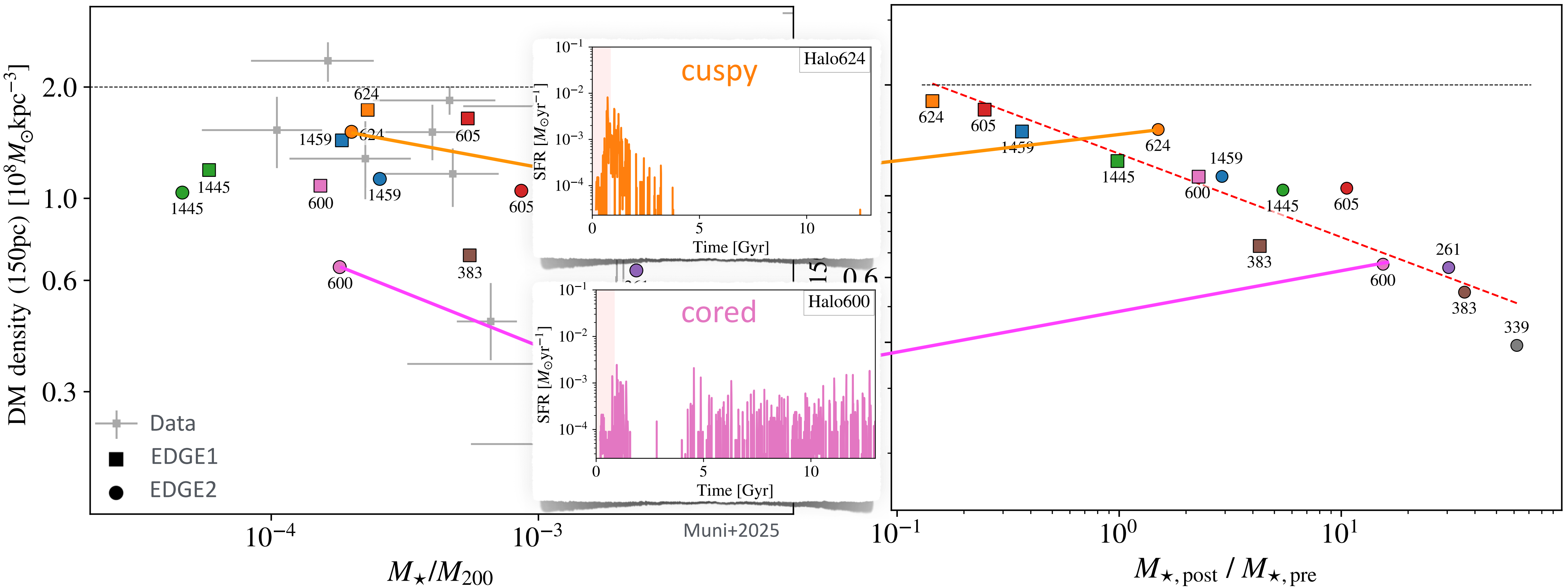


Energy injection
(cf Penarrubia, Pontzen, Walker 2013)



Sustained energy injection

The EDGE simulations and dark matter cores



Energy injection
(cf Penarrubia, Pontzen, Walker 2013)

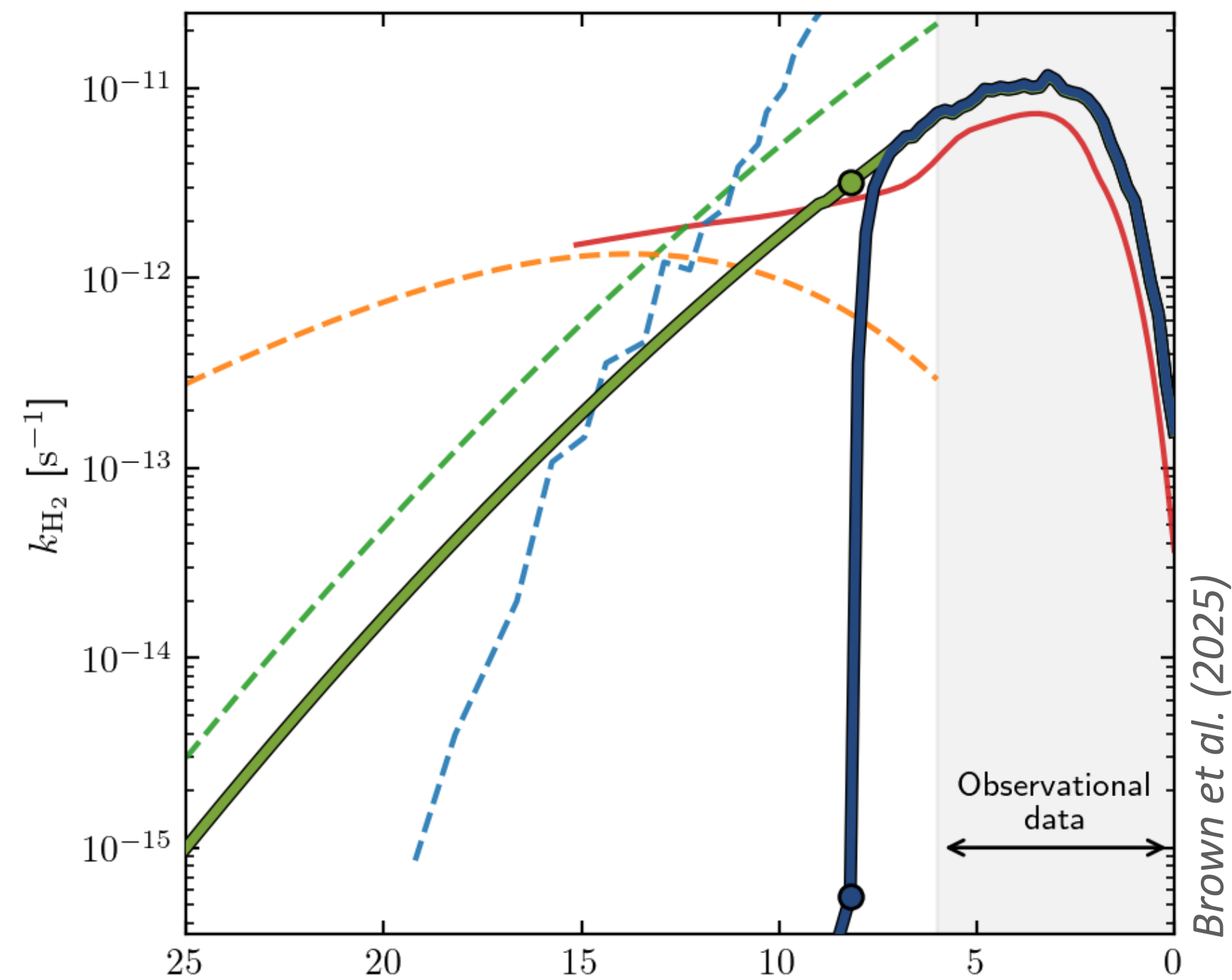
Sustained energy injection

Dark matter in ultra-faints with LYRA

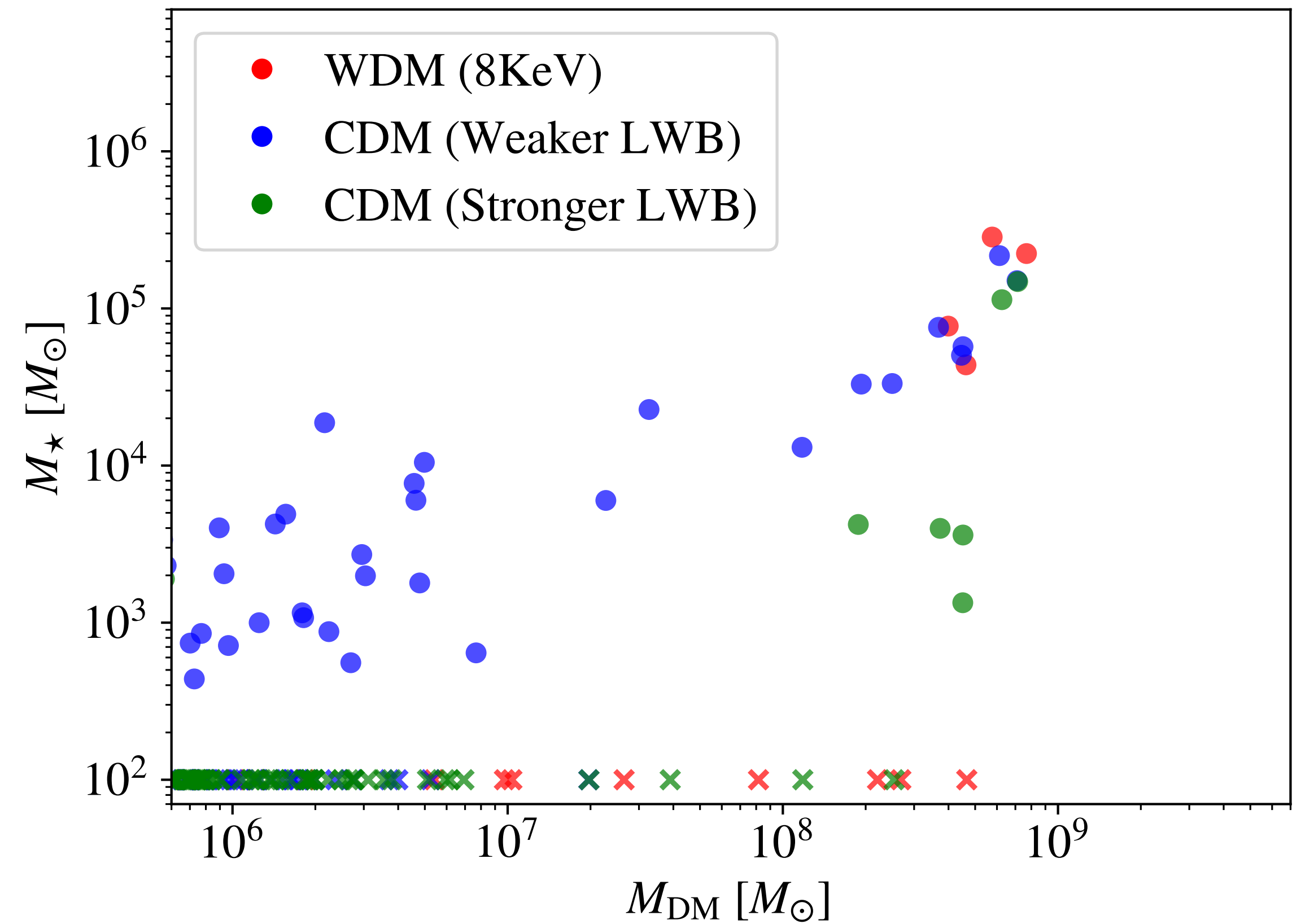
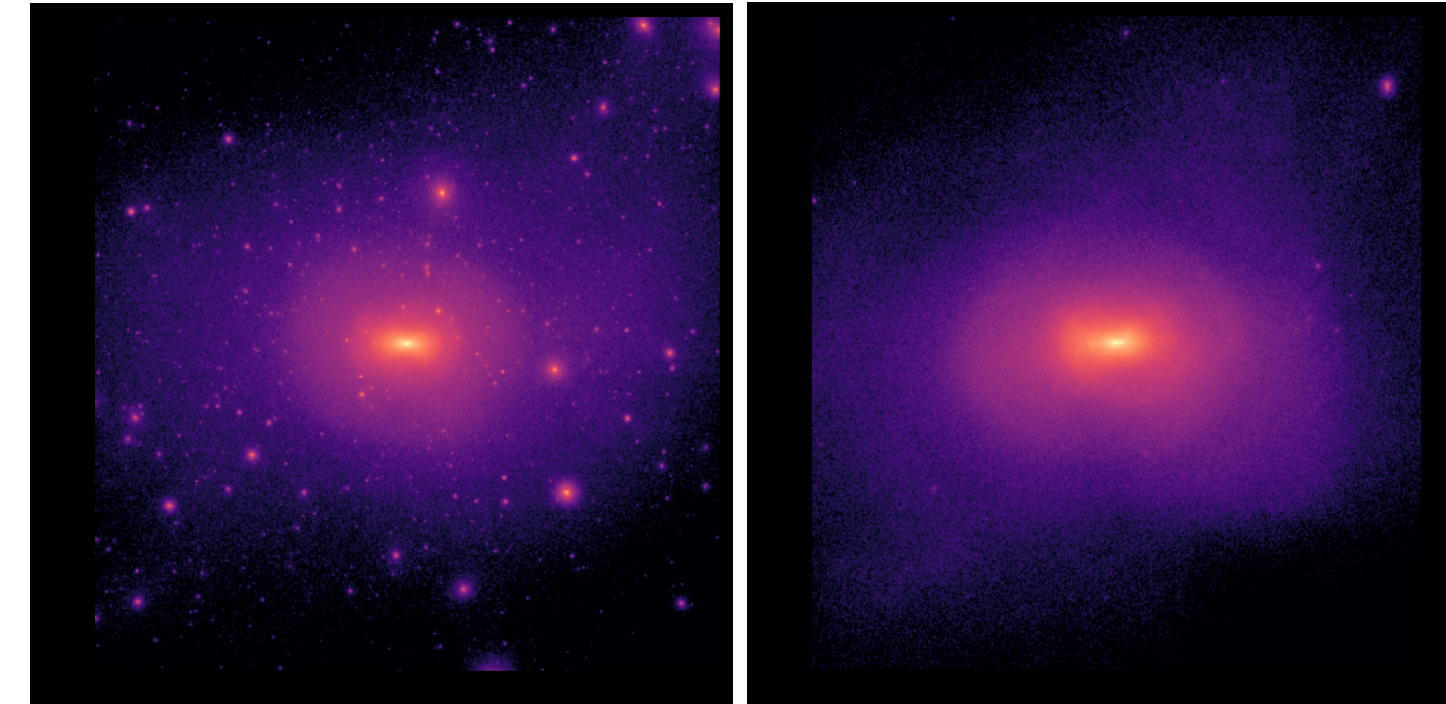
LYRA

Ultra high-resolution
cosmological dwarfs

Ultra-faints
($M_{\star} < 10^5 M_{\odot}$)



- Faucher-Giguere 20 (Weaker LWB) \approx
- FG20 + modInc23 (Stronger LWB)
- Haardt & Madau 12



Summary

- Dwarf galaxies can tell us a lot about the nature of dark matter
- Density cores can indicate alternative DM or SN feedback in CDM
- Need better understanding of baryonic effects on DM
 - ♦ $M_{\star,\text{post}} / M_{\star,\text{pre}}$ can help
- Can we distinguish between the effect of WDM and LW background in ultra-faint dwarfs?

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