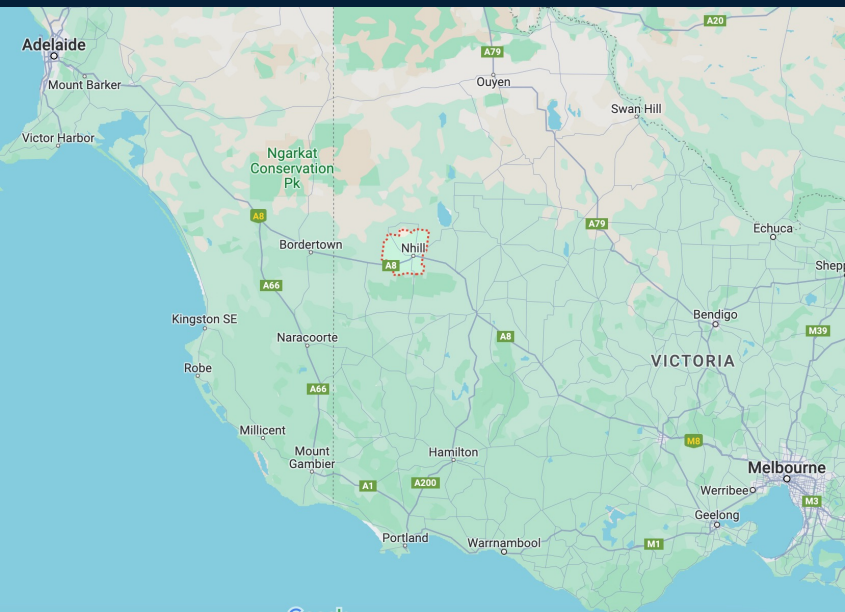


Cosmic dust as a dark matter discriminator

Adam Ussing

Supervisors: Darren Croton, Alan Duffy, Robert Mostoghiu Paun
In collaboration with Celine Boehm

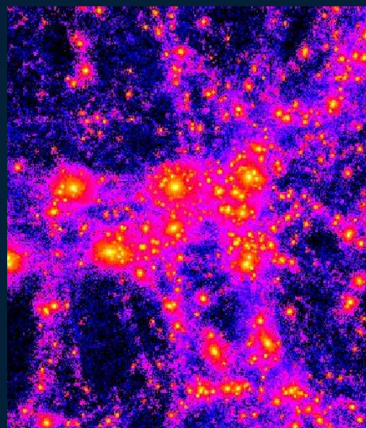


Different Particle Models

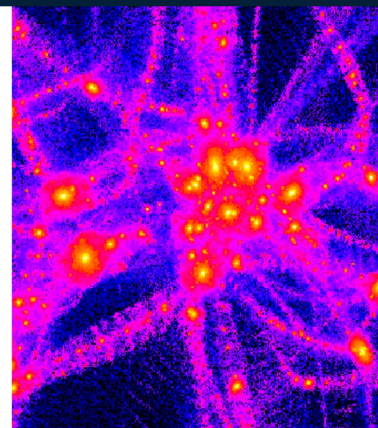


Different Astronomical Models

Cold

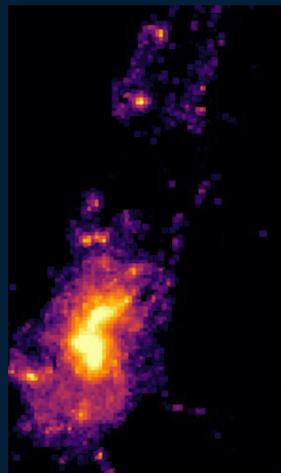


Warm

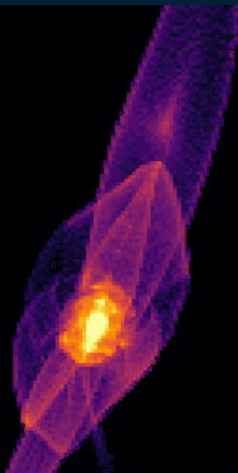


Maccio+ 2012

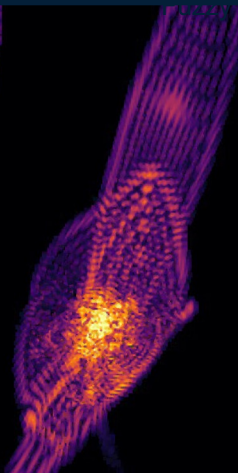
Cold



Interacting

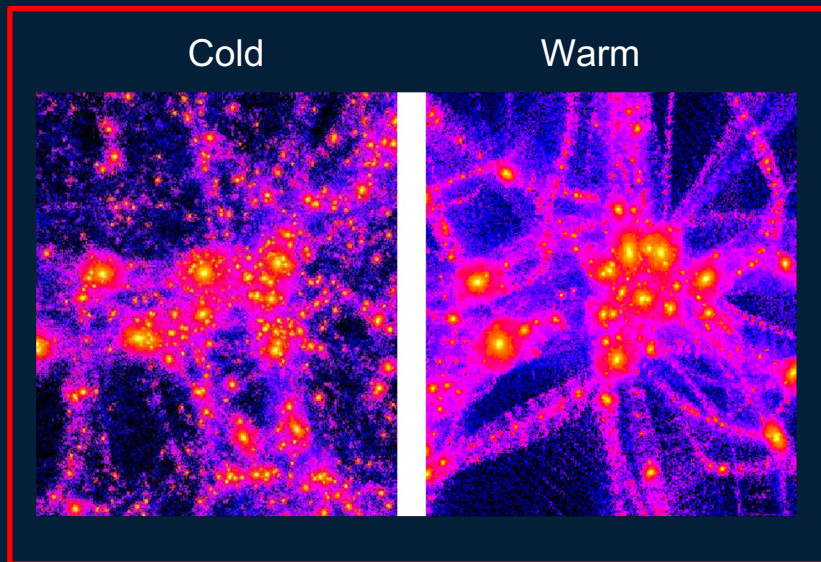


Fuzzy

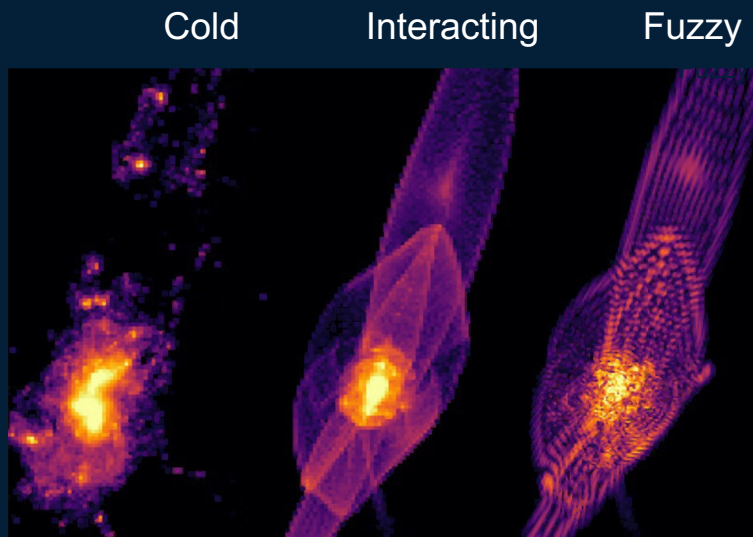


Mocz+ 2019

Different Astronomical Models



Maccio+ 2012



Mocz+ 2019

But first... Jargon

Jargon

- Particle Types – Not actually *Particles*

Jargon

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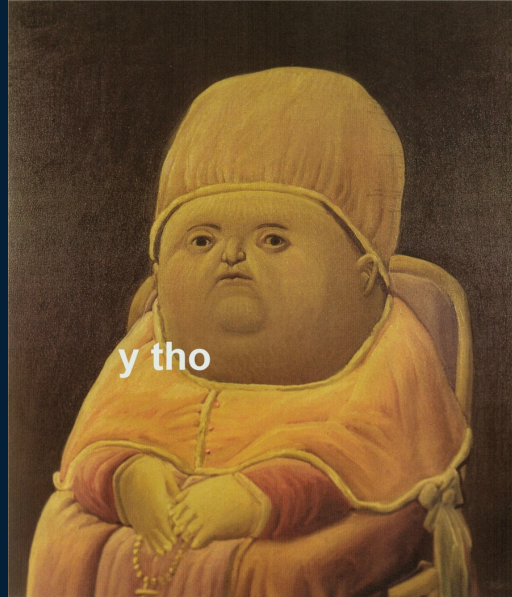
Jargon

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 - Dark matter – Phase space tracers of density $\sim 10^6$ Solar Masses
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- Particle mass $\sim 10^5 M_{\text{sun}} \sim 10^{62} \text{ GeV}$

But why?



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But why?

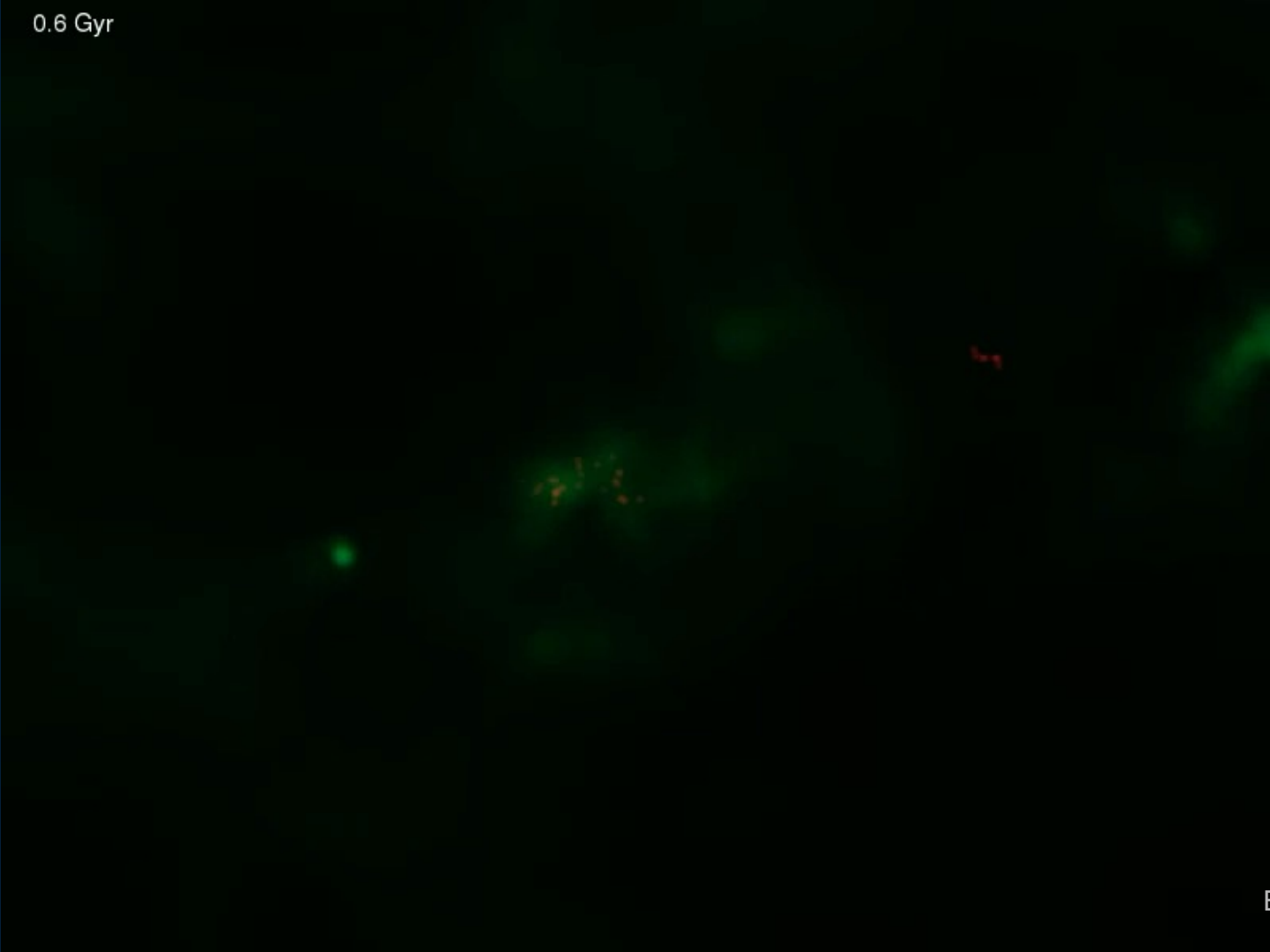
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- Observable?

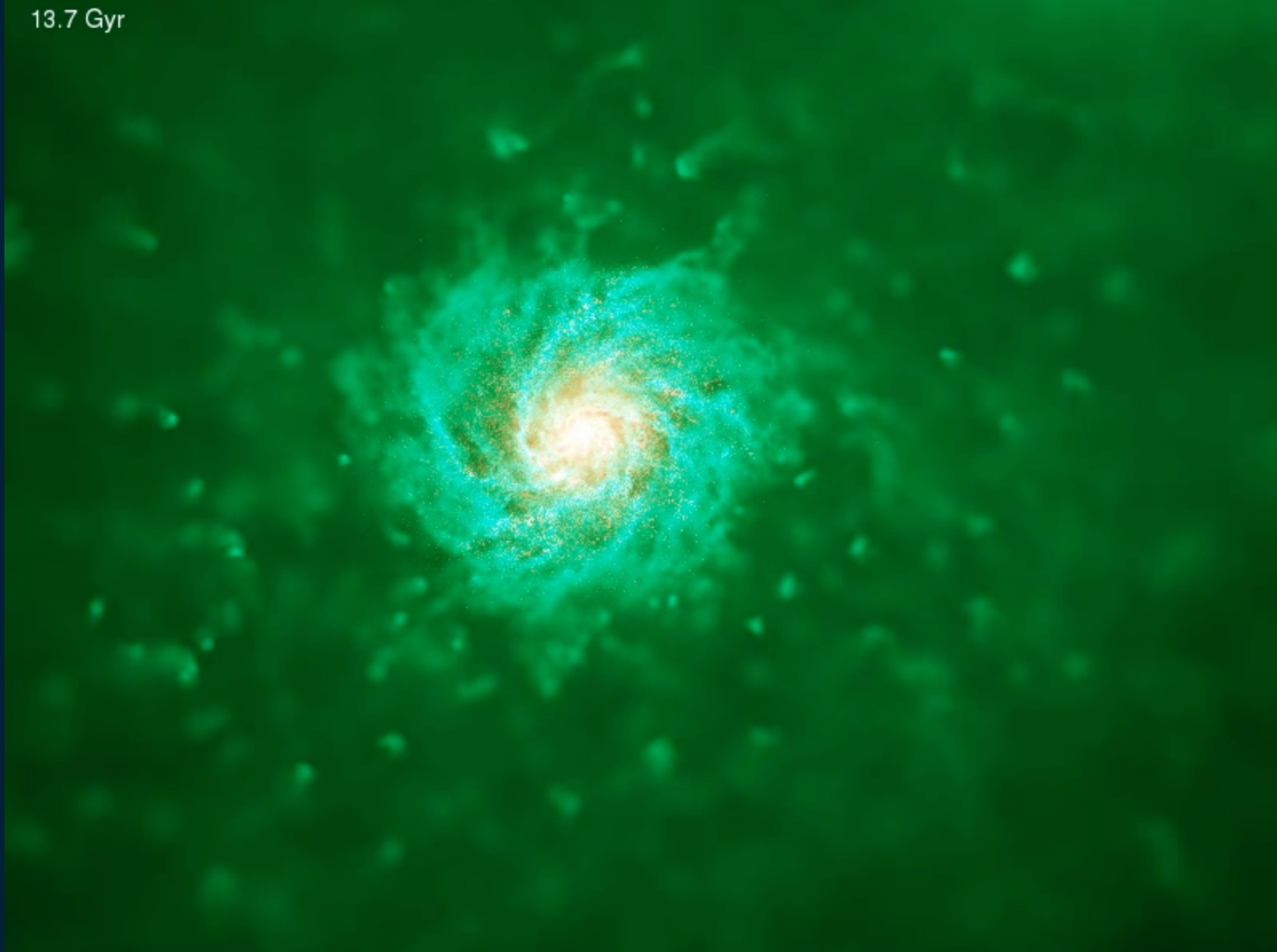
Sims



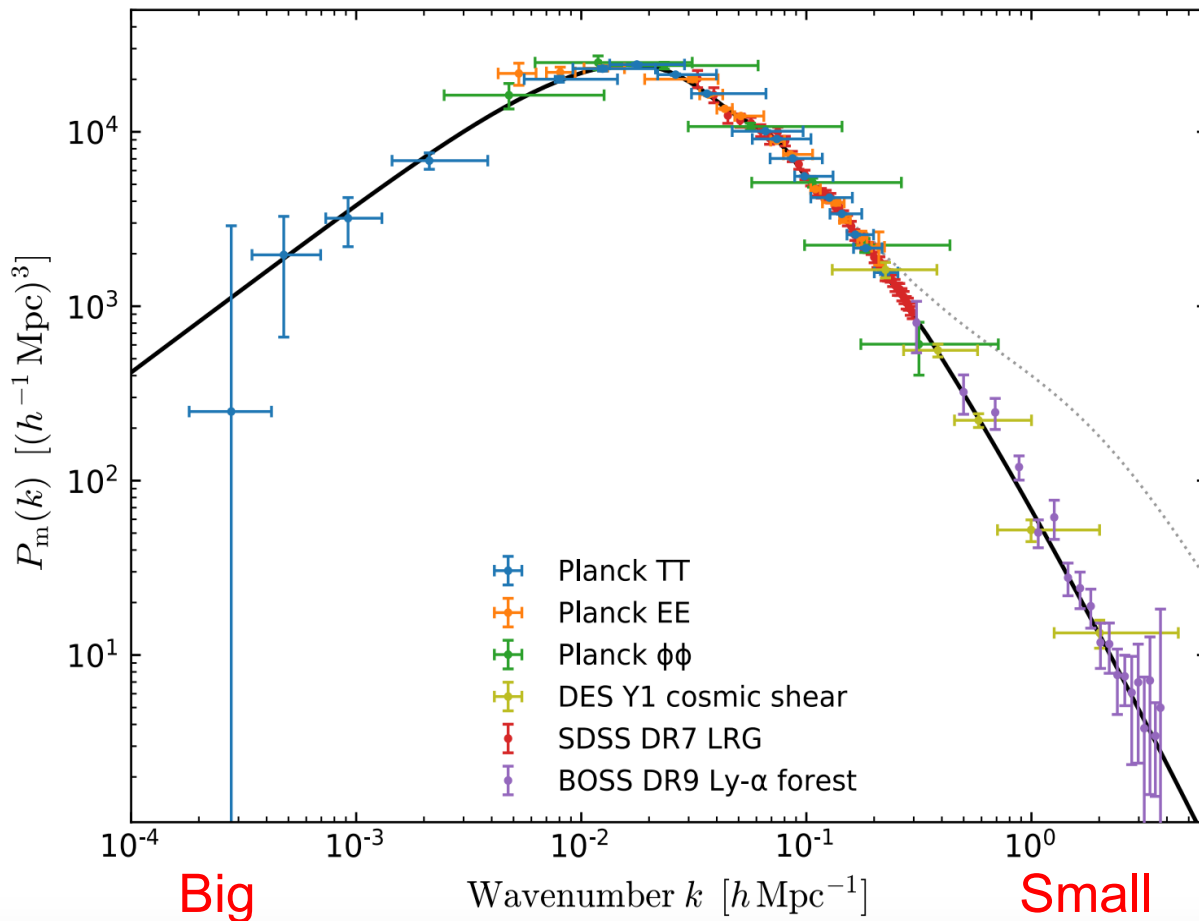
0.6 Gyr

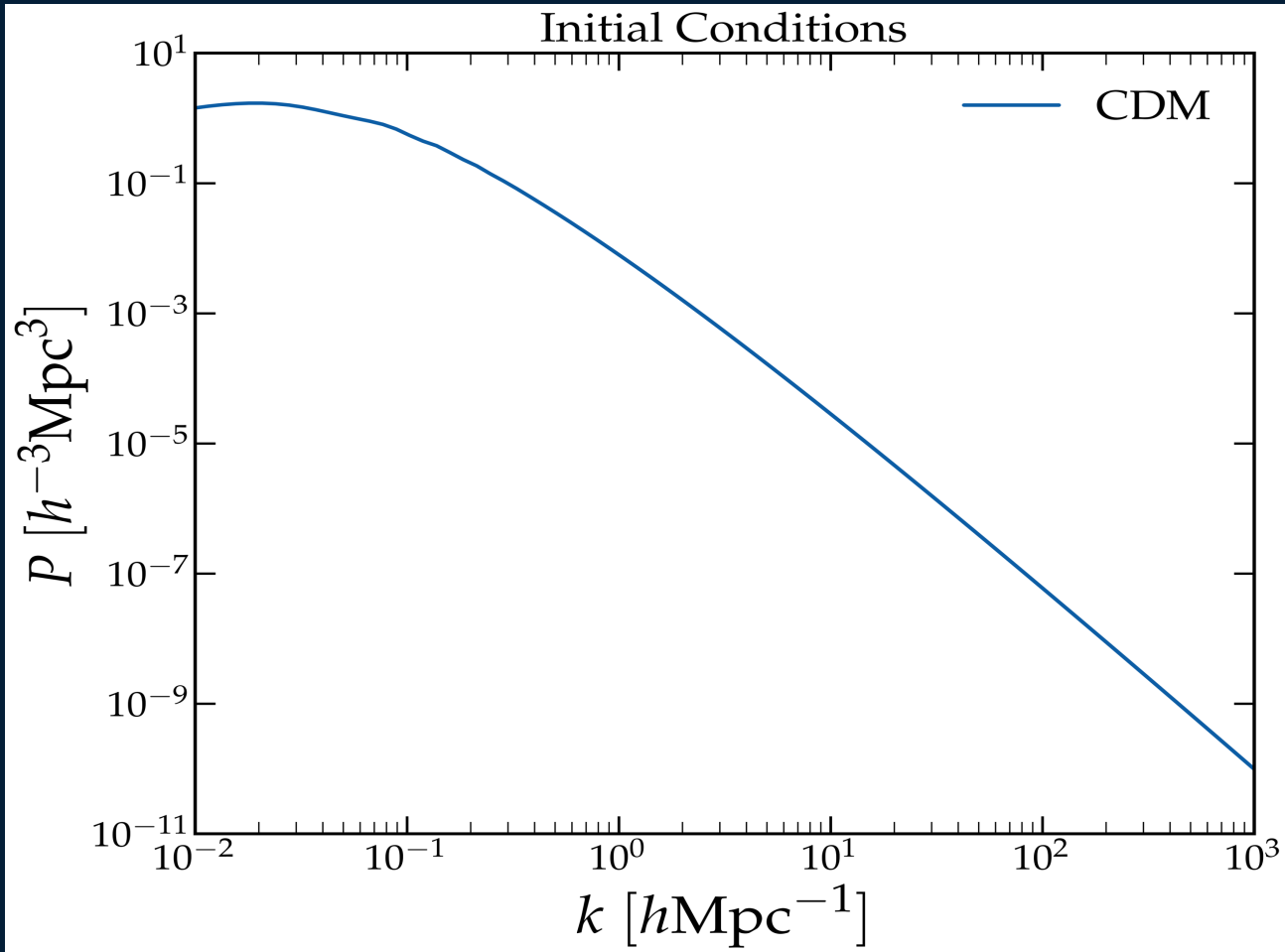


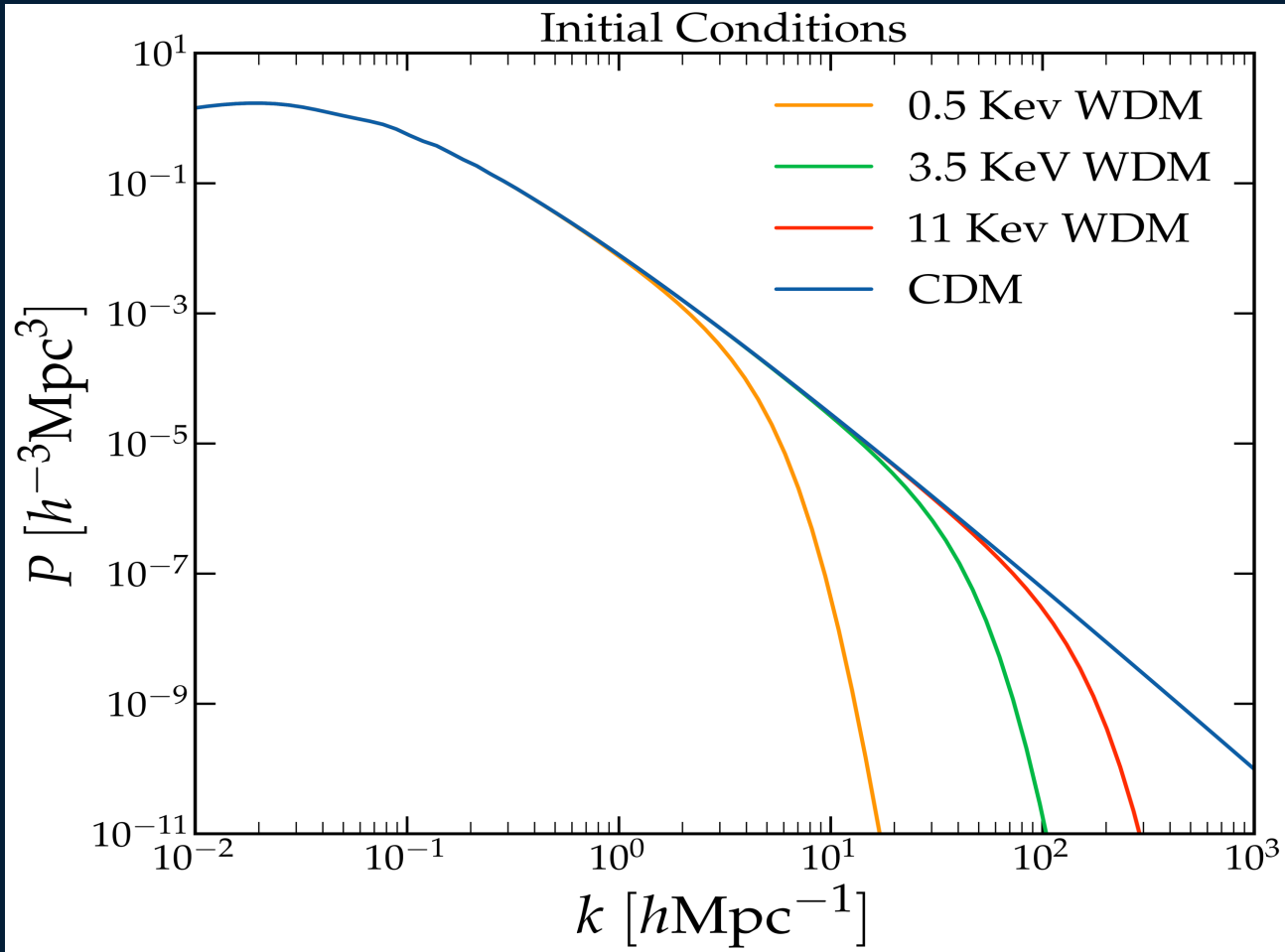
13.7 Gyr

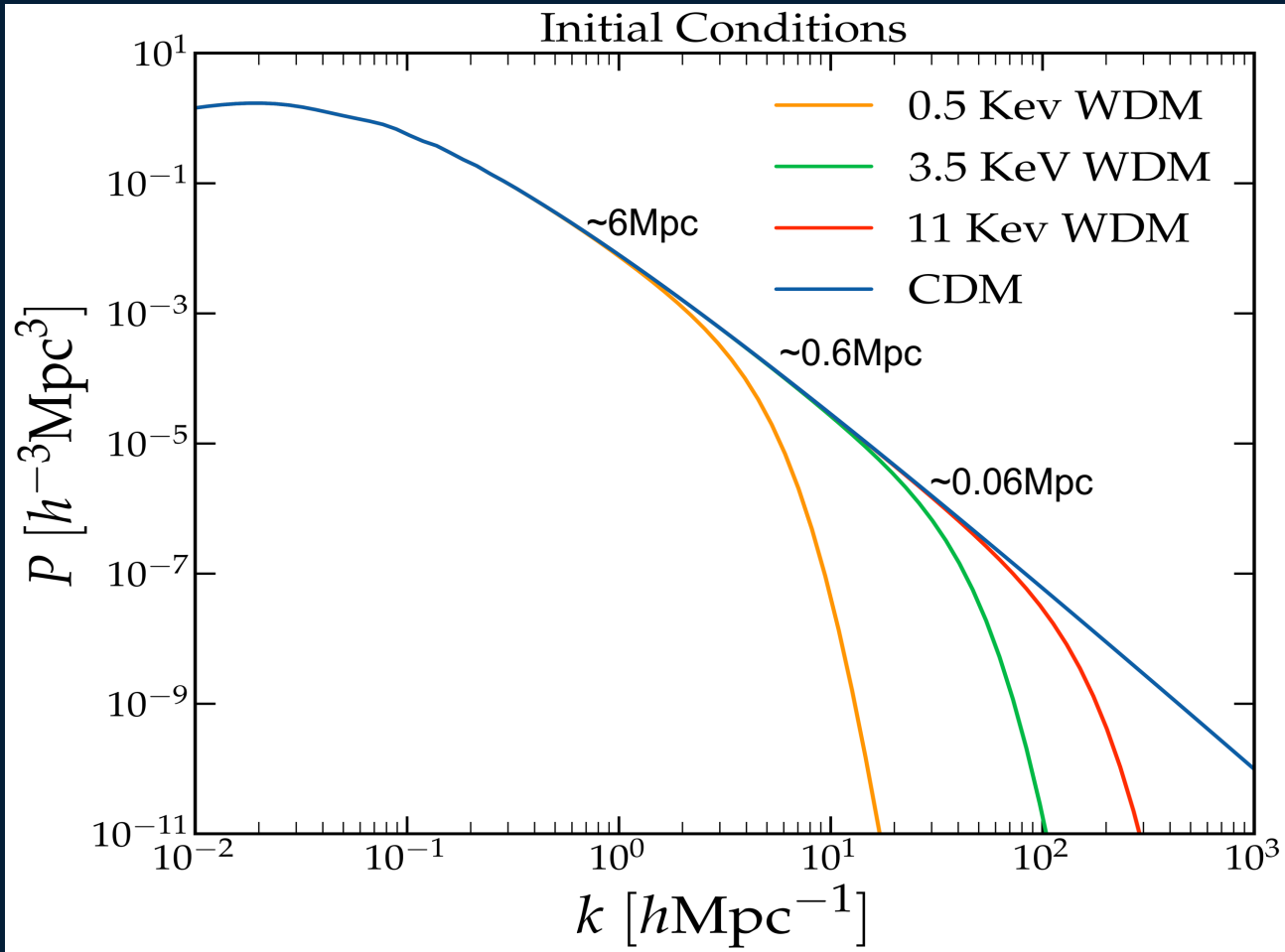


Generating initial conditions





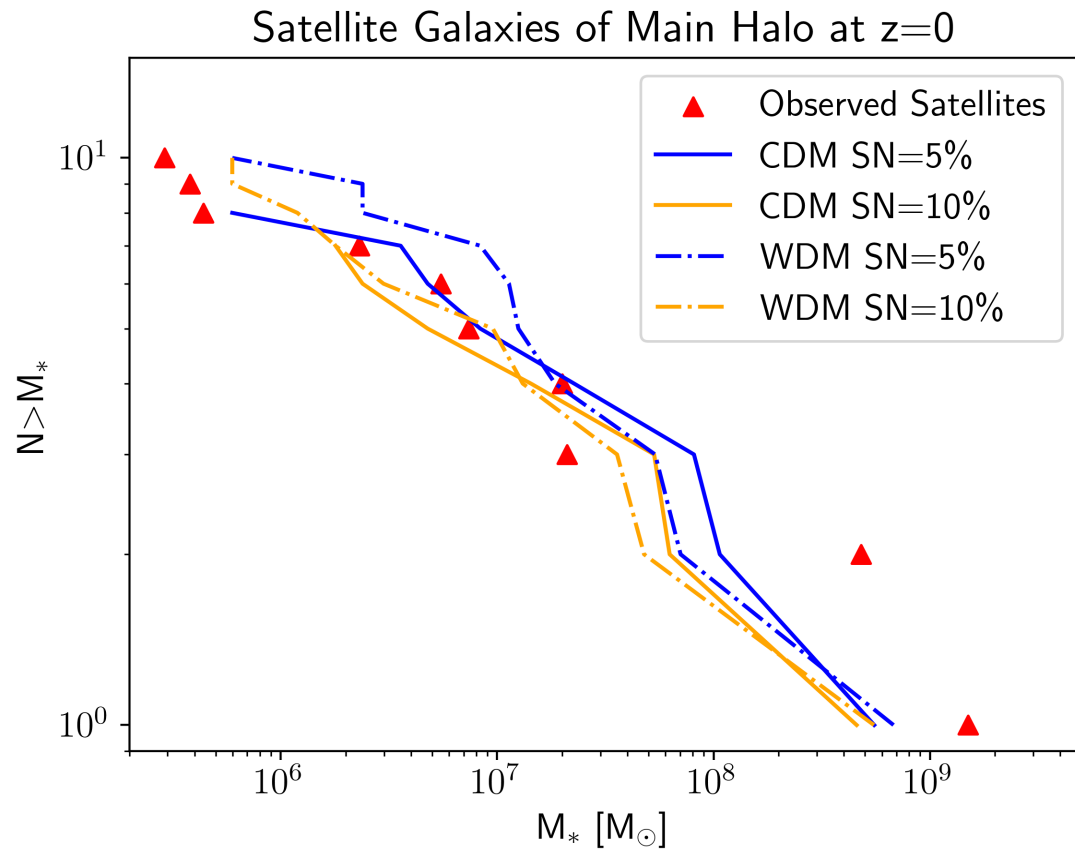




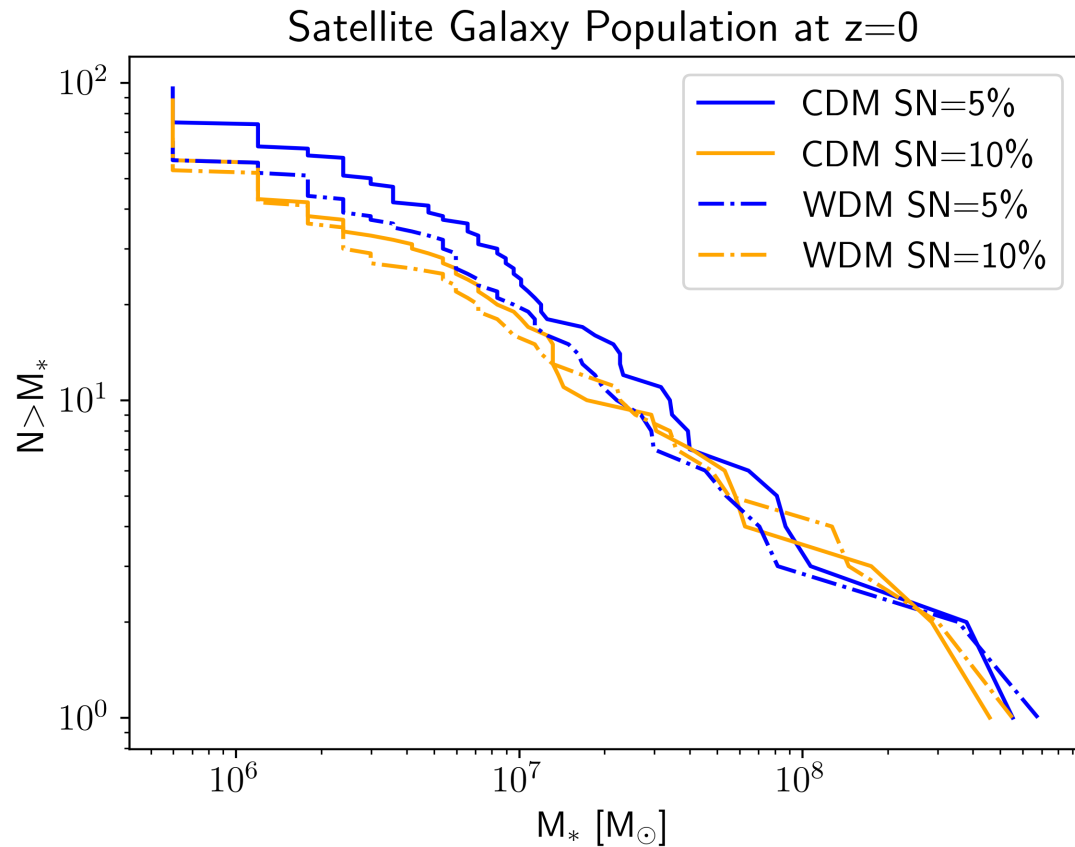
Results



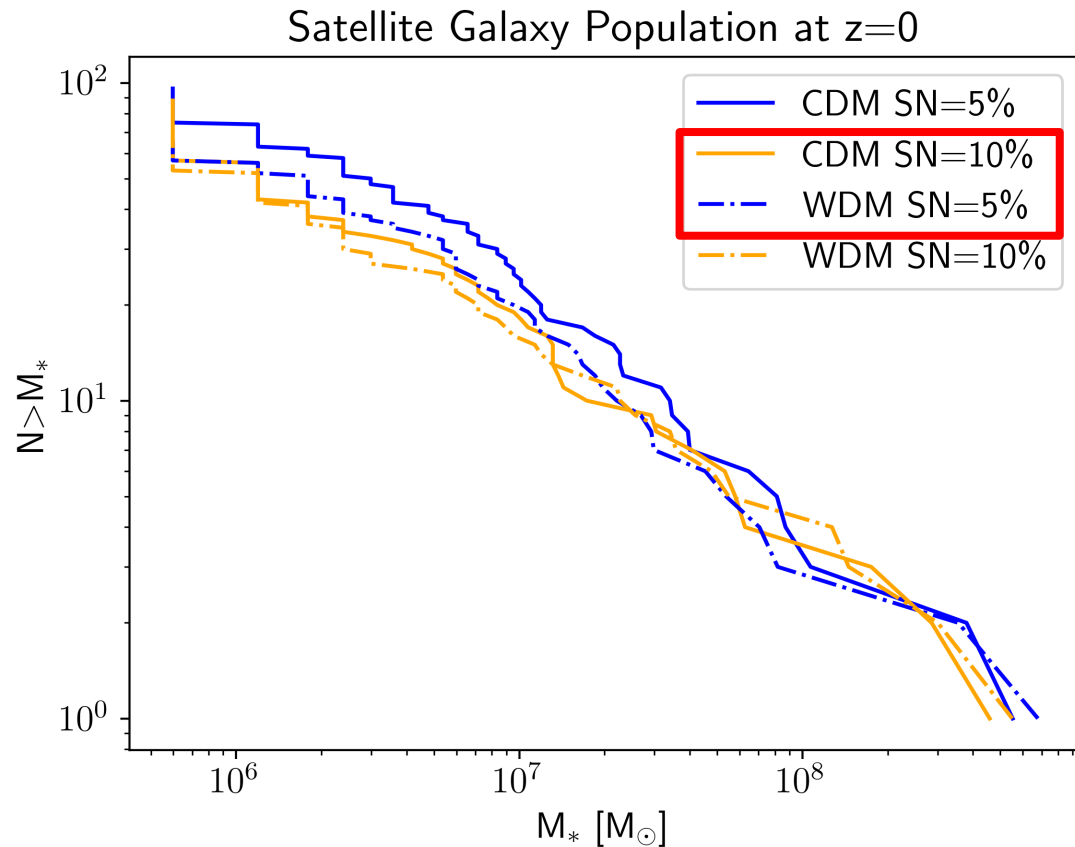
- Satellite galaxies around our “Milky Way”
- Tuned with different supernova efficiencies



- All satellites in the simulation

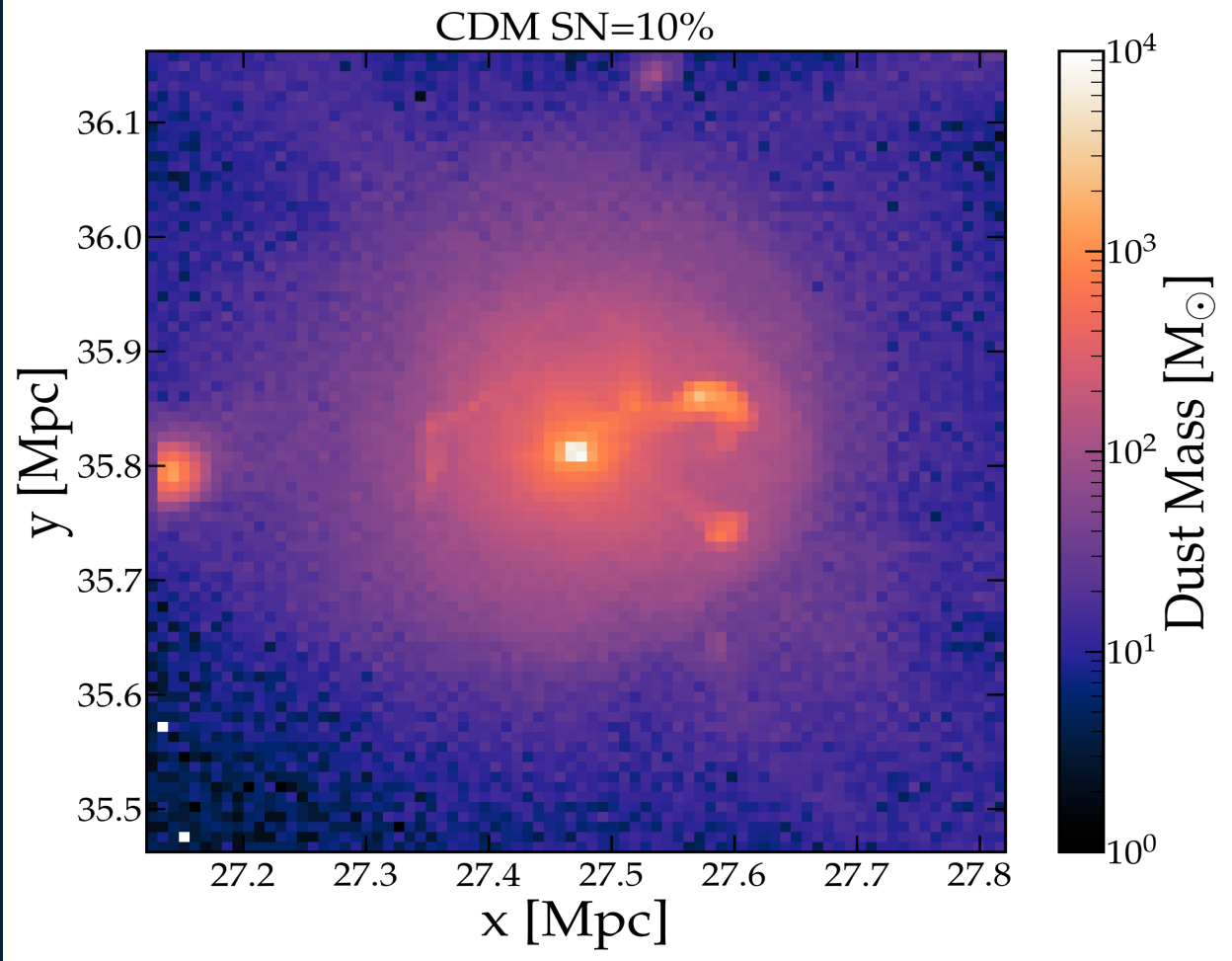


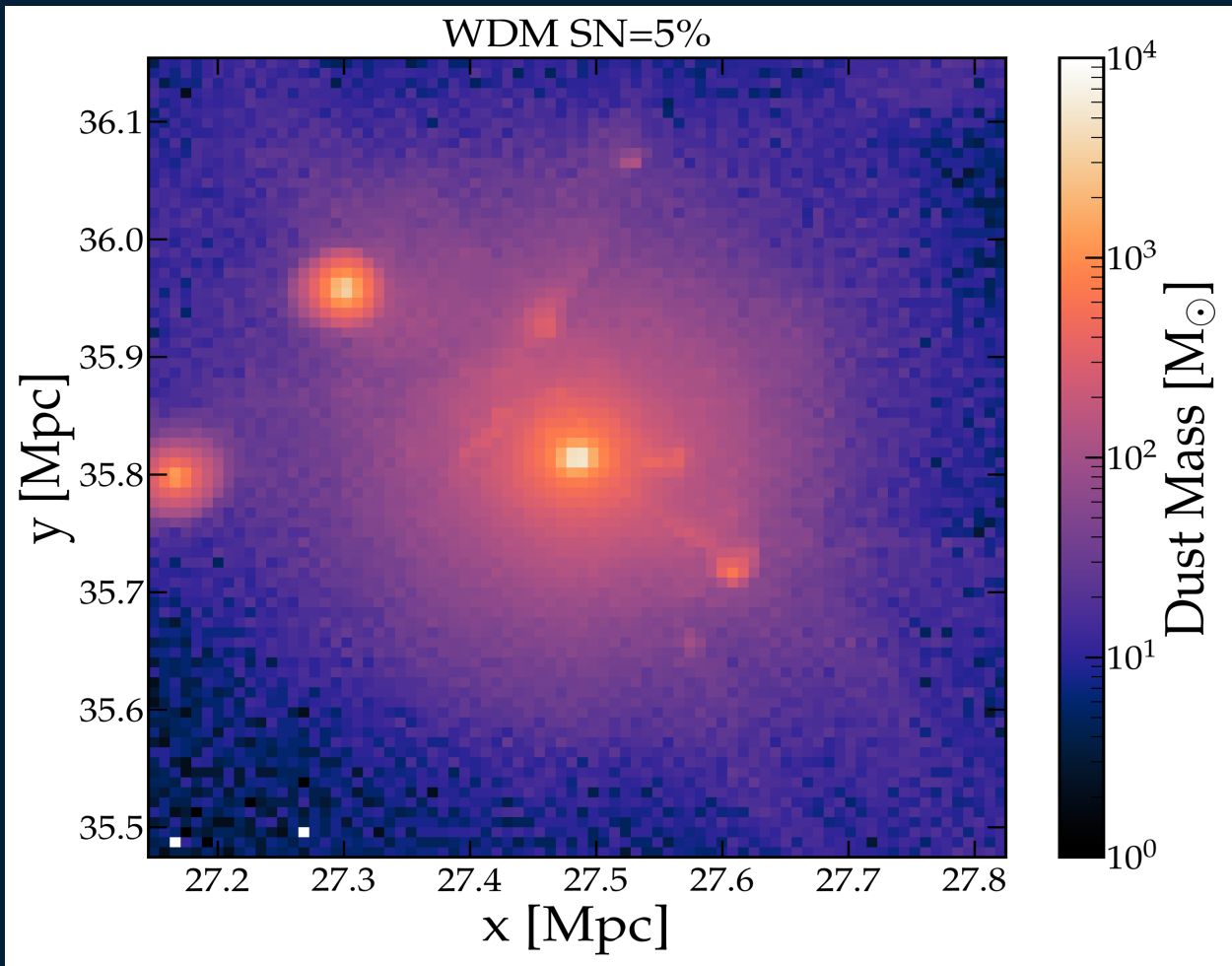
- All satellites in the simulation
- Best match – CDM 10% & WDM 5%



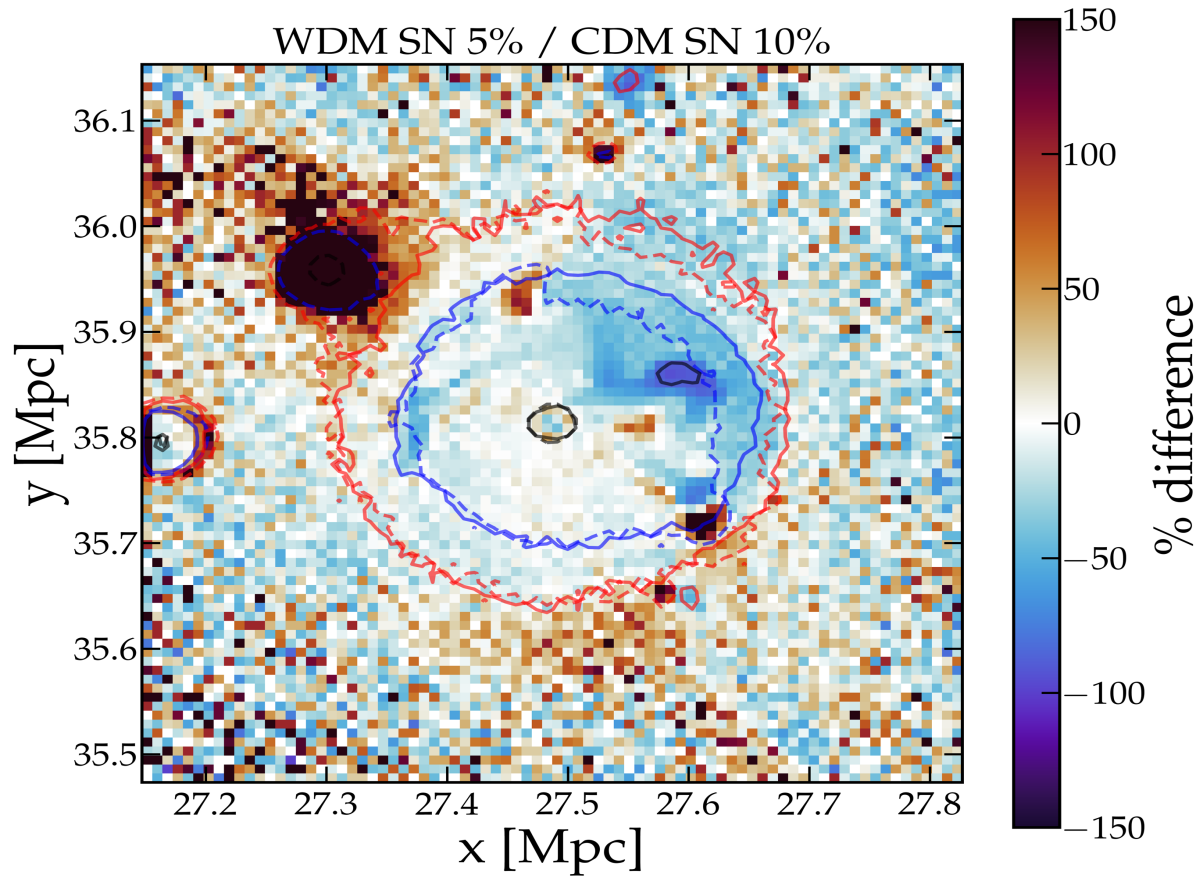
Simulation	Dust Mass
CDM: Supernova 10%	$11.17 \times 10^7 M_{\text{solar}}$
WDM: Supernova 5%	$1.33 \times 10^7 M_{\text{solar}}$

88% More dust in CDM

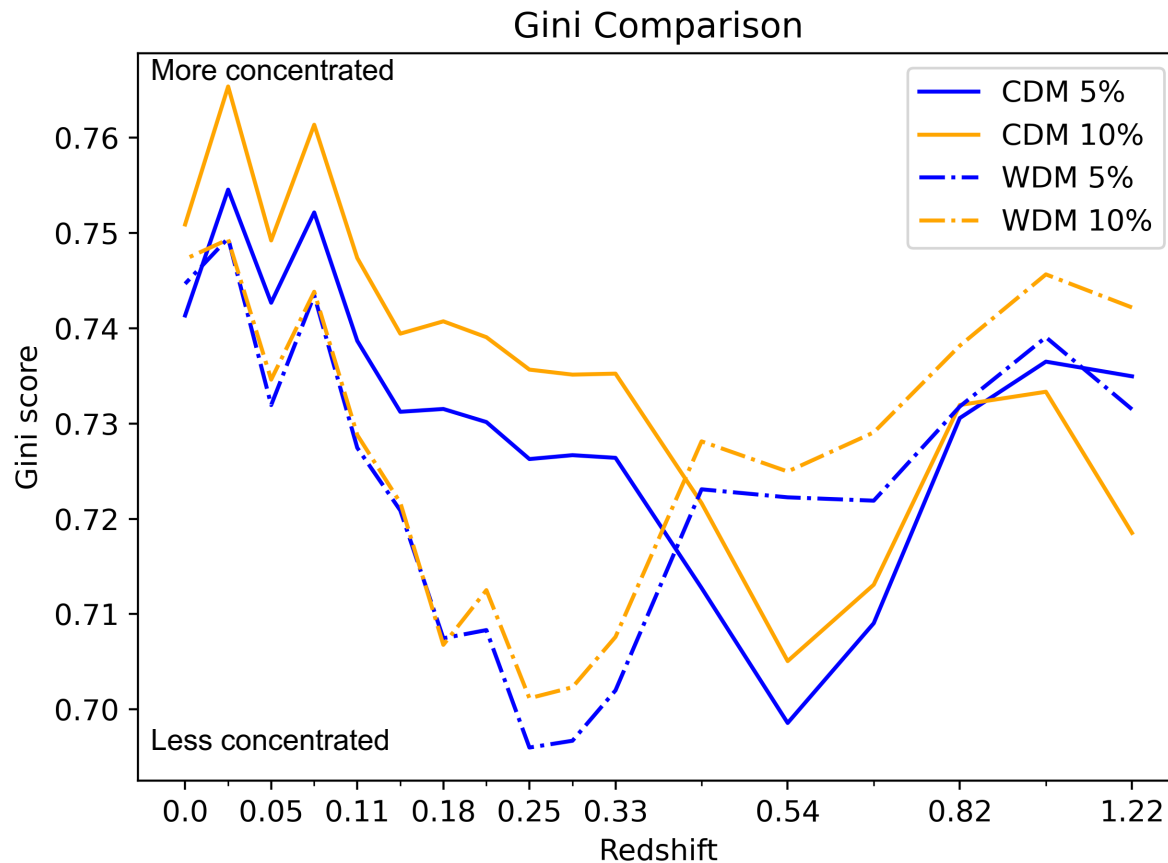




- Residual dust maps
- Blue = more CDM dust
- Red = more WDM dust



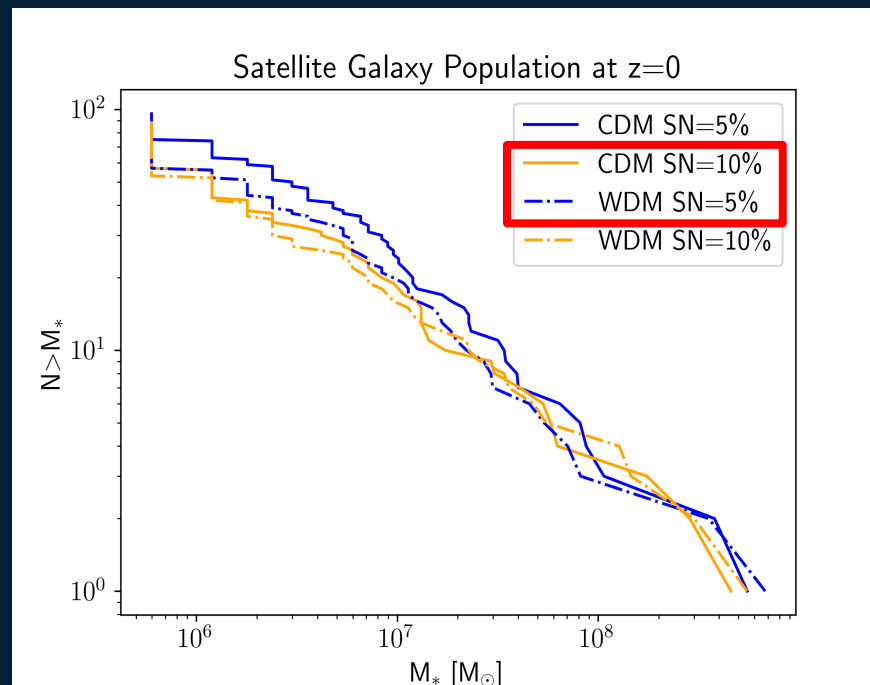
- Gini index – Data concentration
- WDM has on average lower correlations in recent times



Conclusions

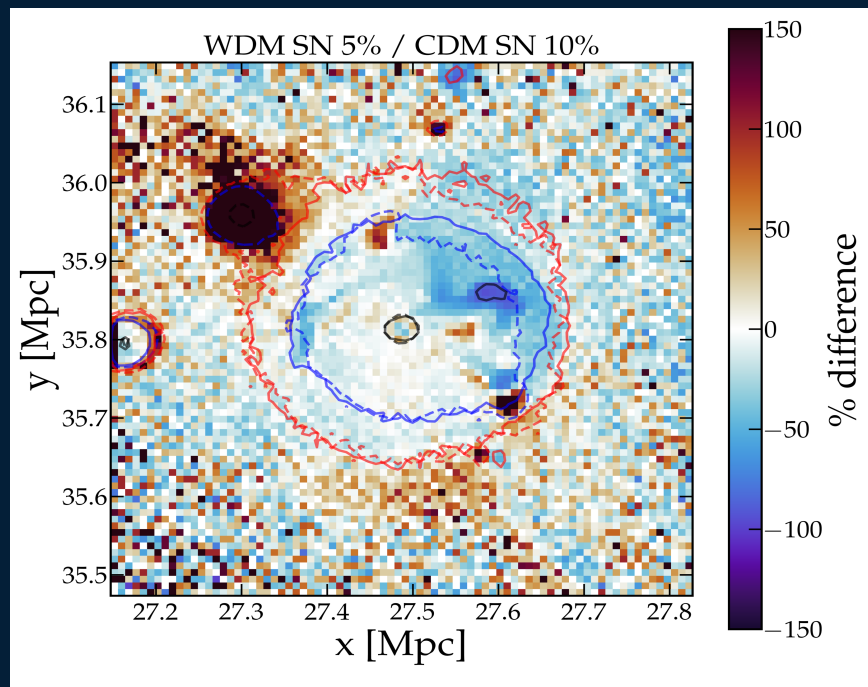
Conclusions

- Different dark matter models produce similar universes



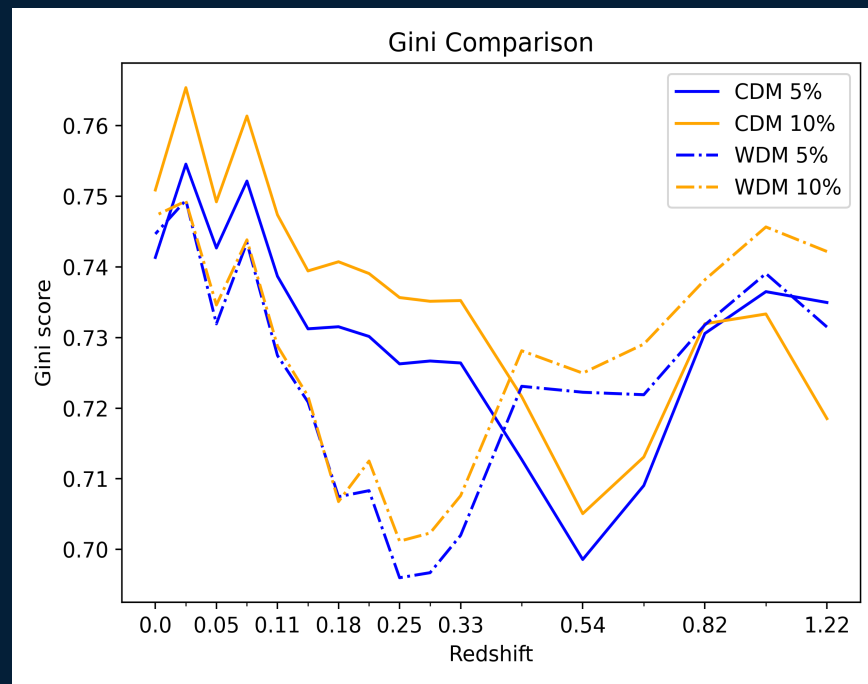
Conclusions

- Different dark matter models produce similar universes
- Different supernova models do produce different dust masses

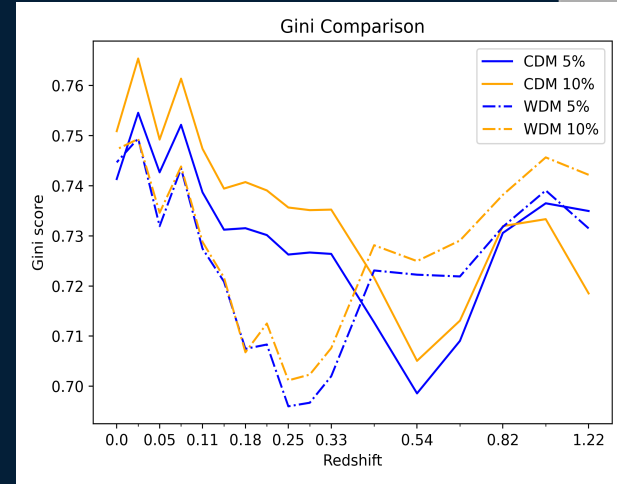
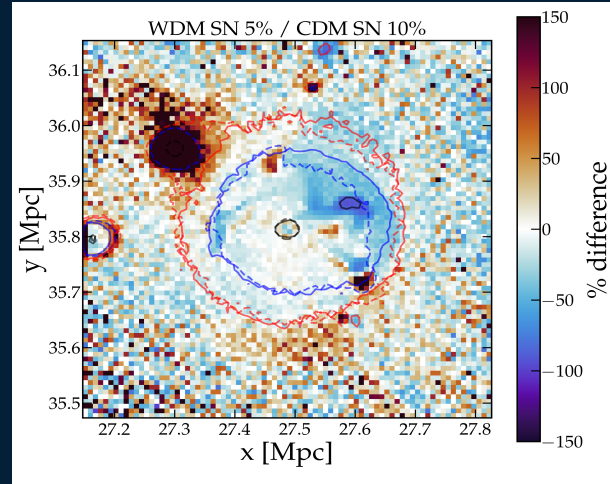
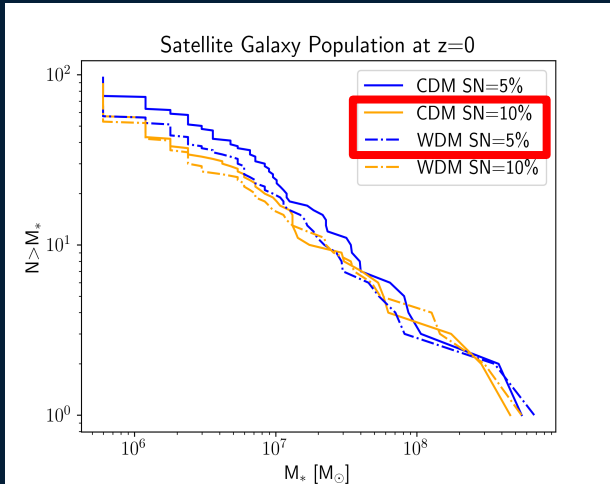


Conclusions

- Different dark matter models produce similar universes
- Different supernova models do produce different dust masses
- We expect a lower dust concentration in WDM

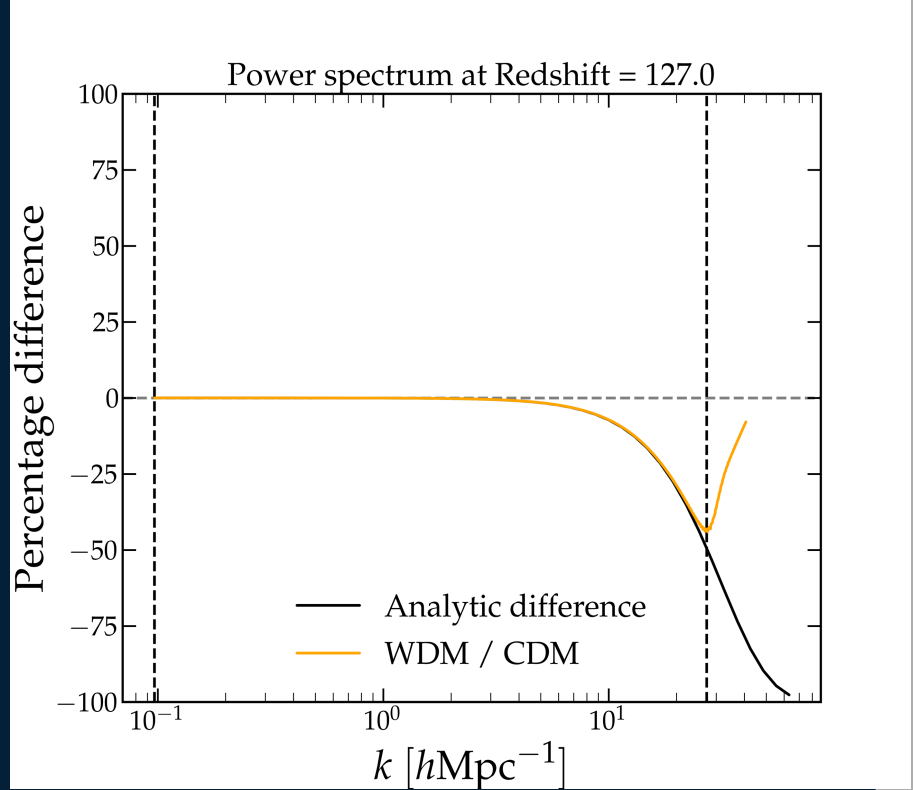
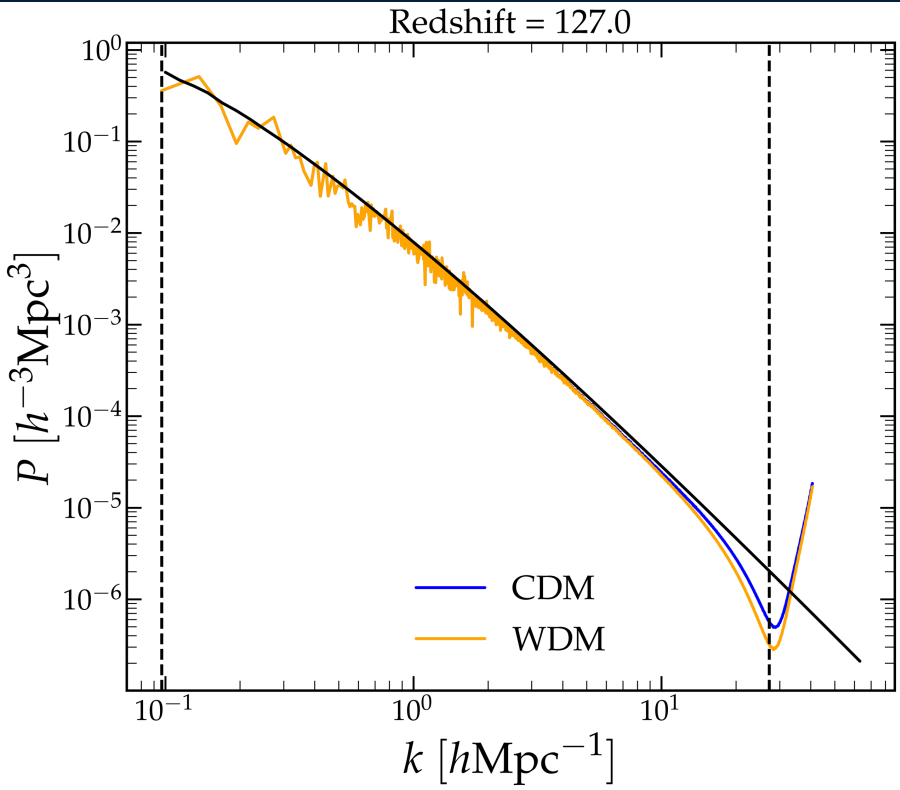


Thank you

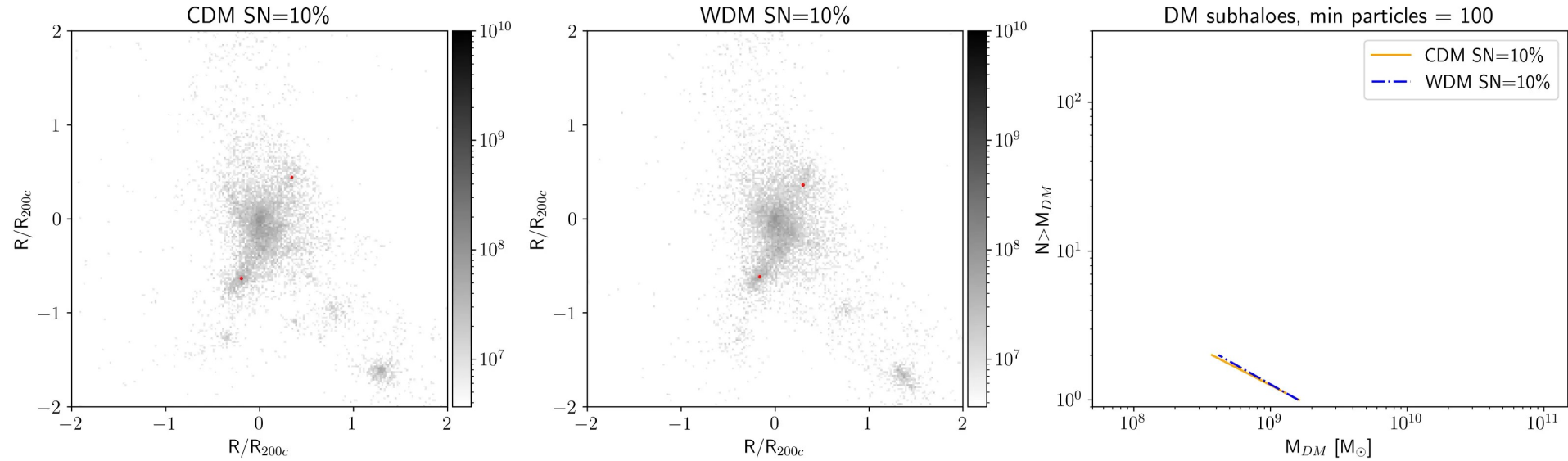


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Bonus Slides

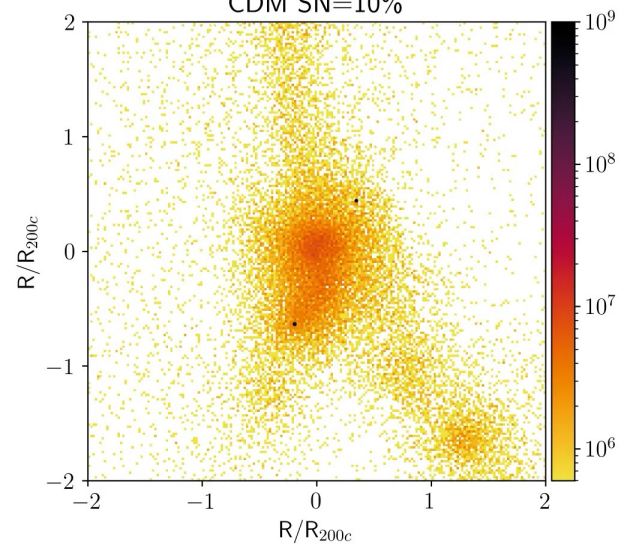


Dark Matter distribution at $z=5.65$

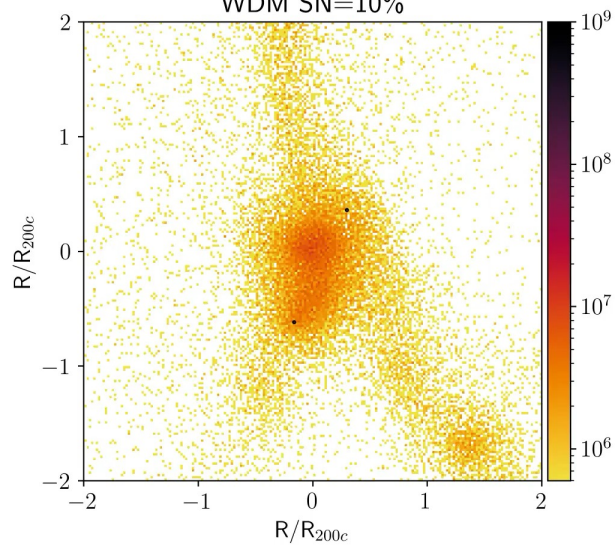


Gas distribution at $z=5.65$

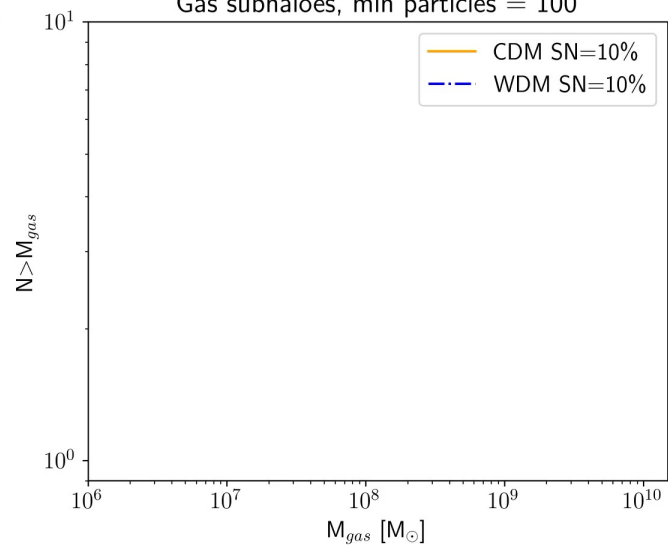
CDM SN=10%



WDM SN=10%



Gas subhaloes, min particles = 100



Stellar distribution at $z=5.65$

