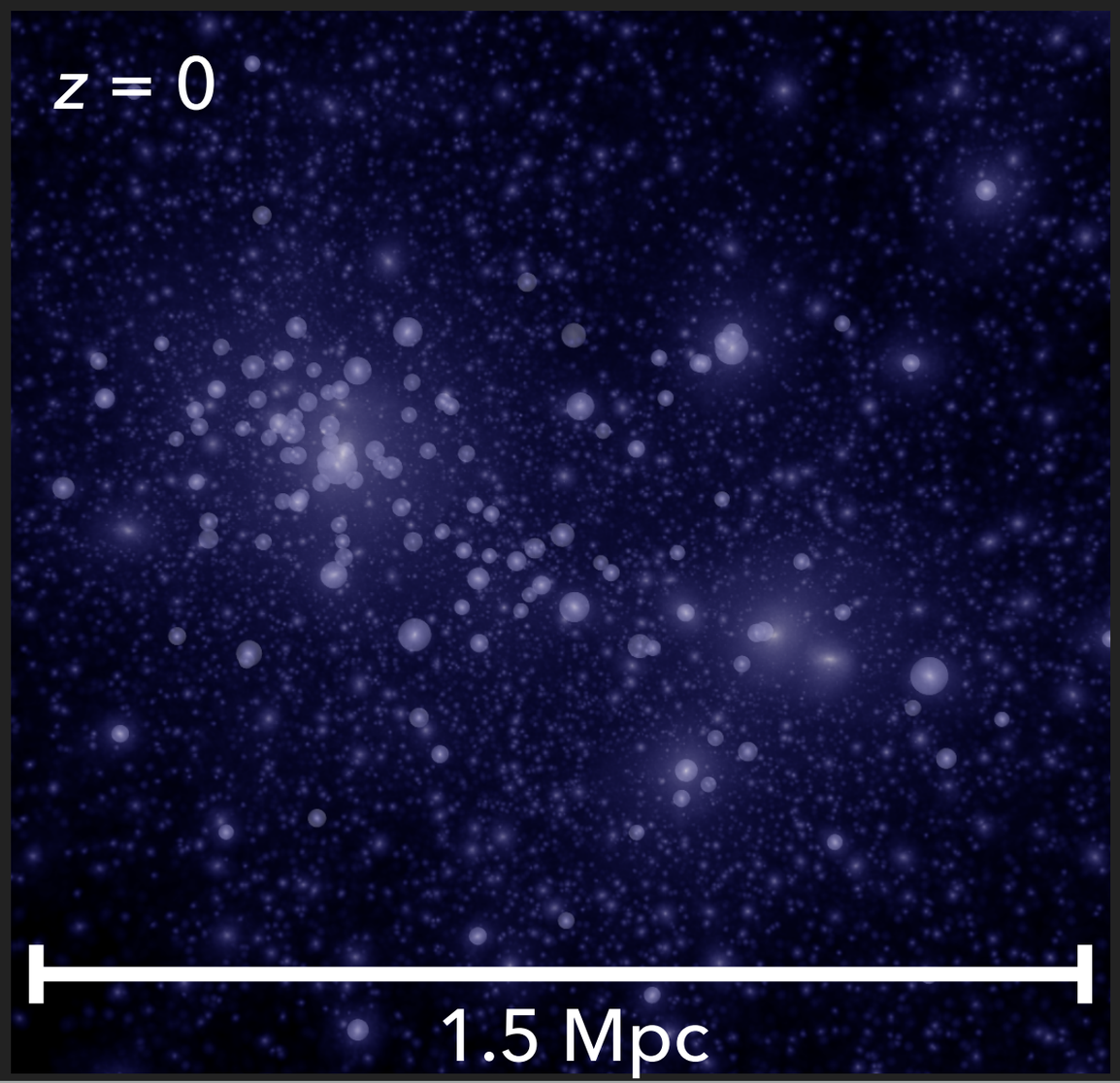
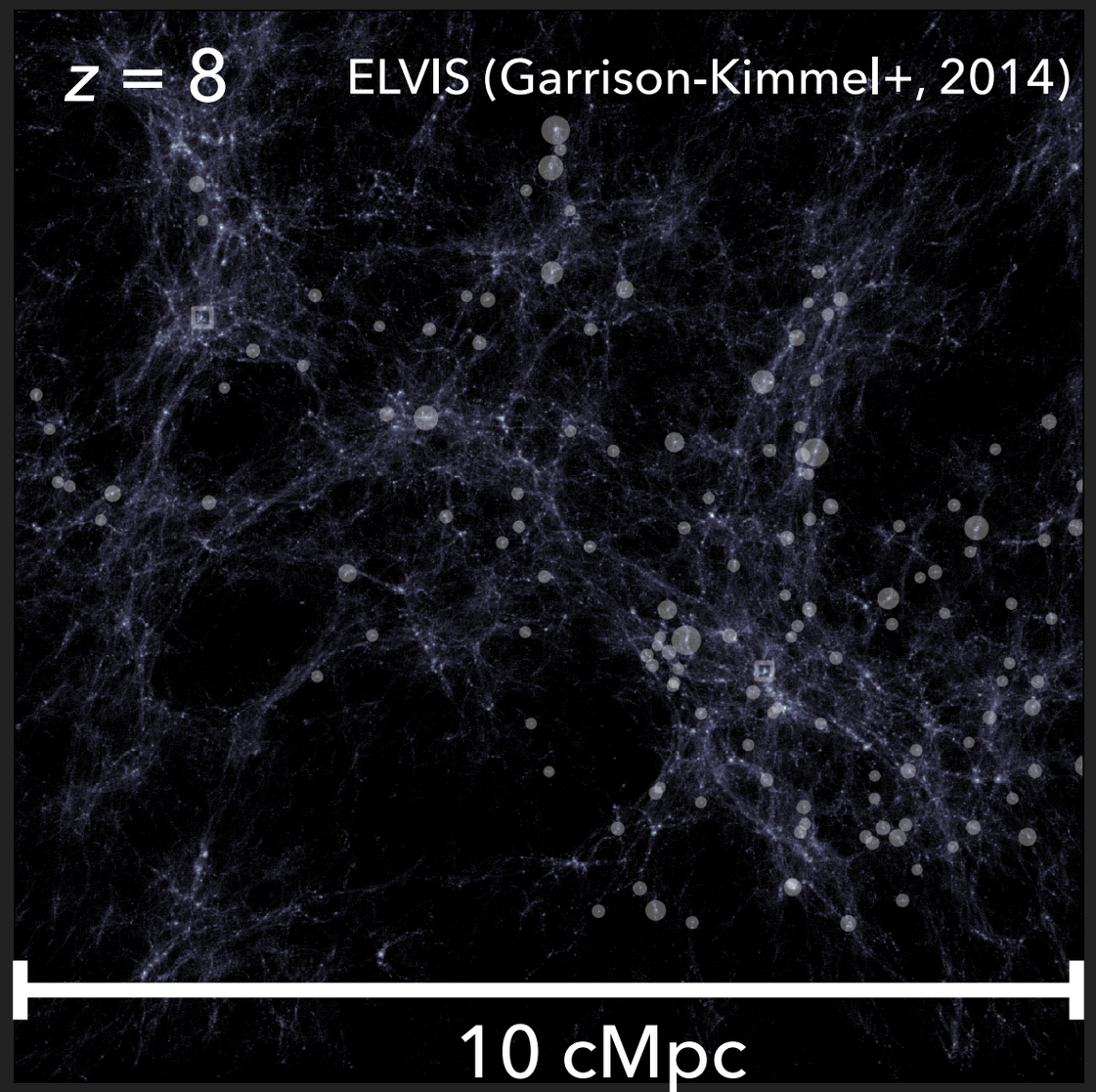
THE LOCAL GROUP AS A TIME MACHINE

ANDREW GRAUS, JAMES BULLOCK, MIKE BOYLAN-KOLCHIN, DAN WEISZ

Using Local Group galaxies as probes of the high-z universe

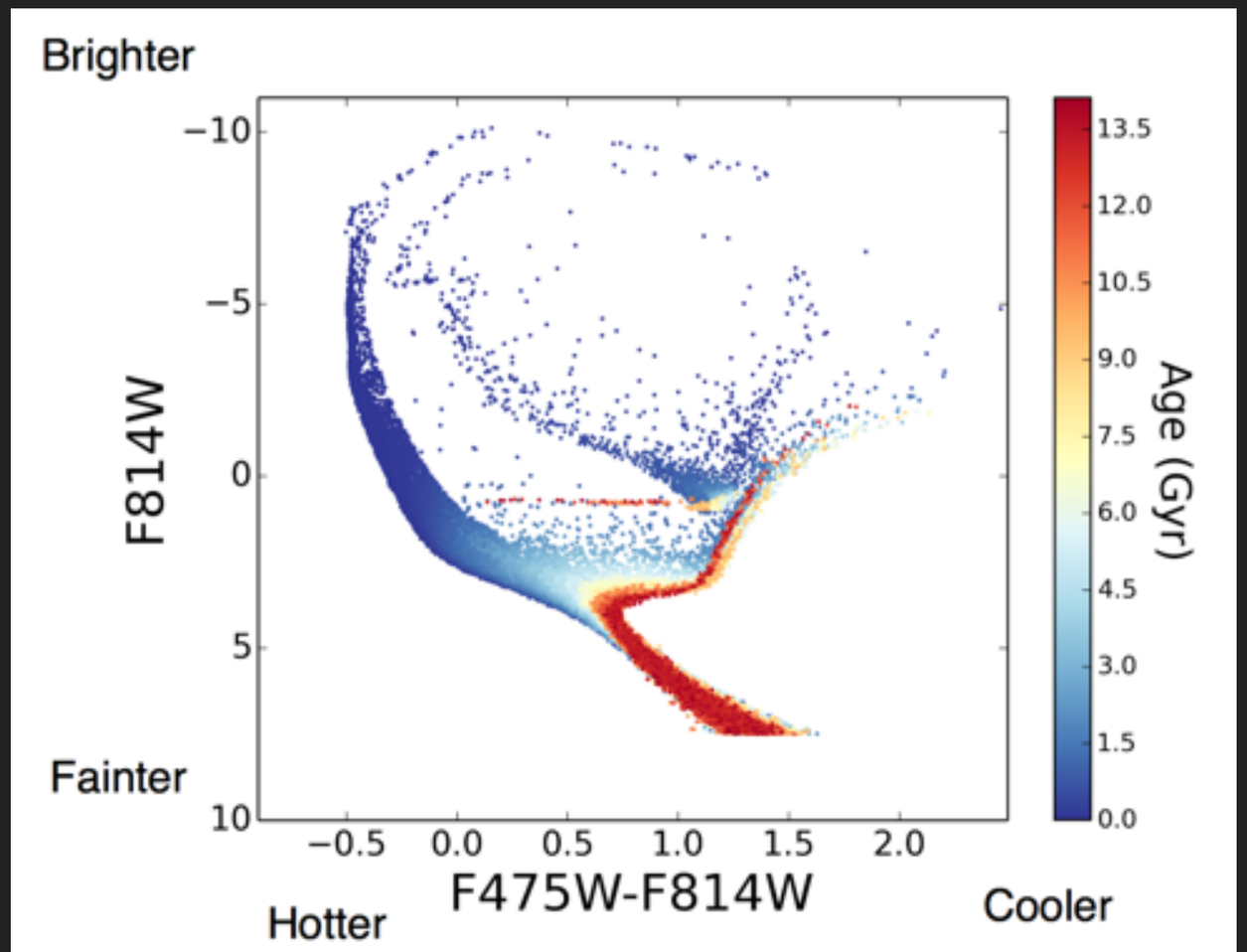
- We can place constraints on the high redshift universe by studying the time evolution of the Local Group, using a combination of simulations and Star Formation Histories.

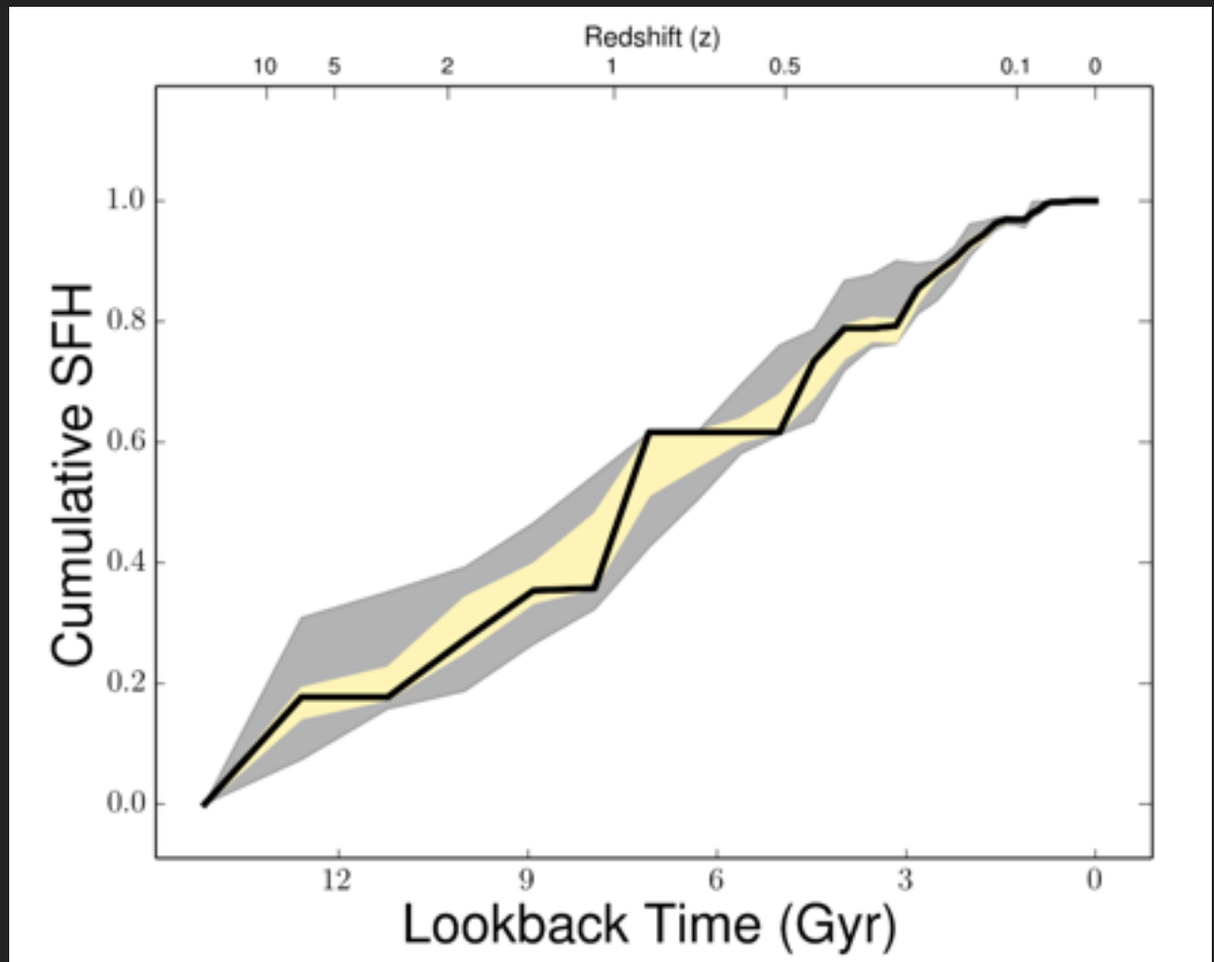




Star formation histories

- Stellar mass information from SFHs





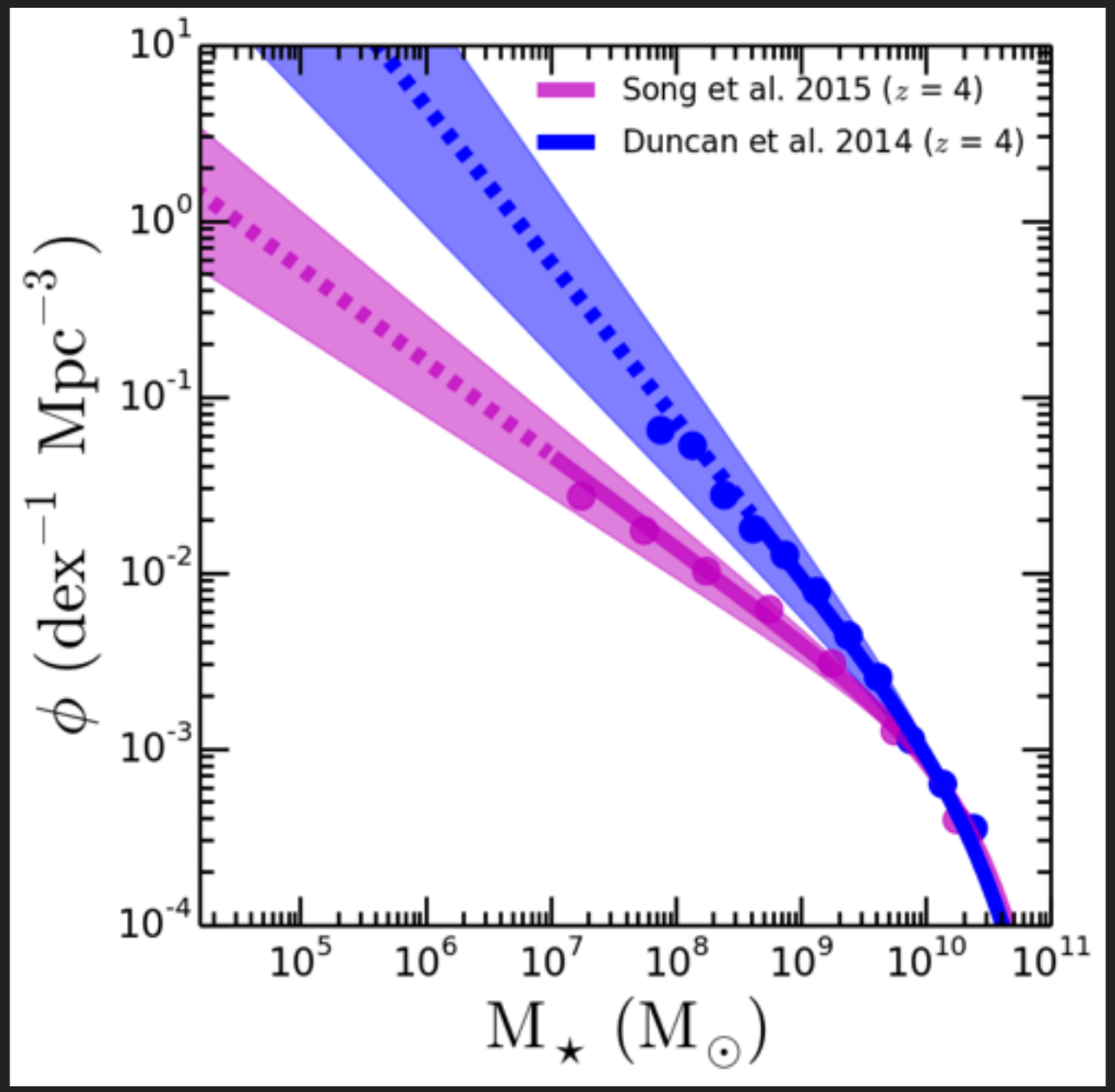
Weisz +, 2014

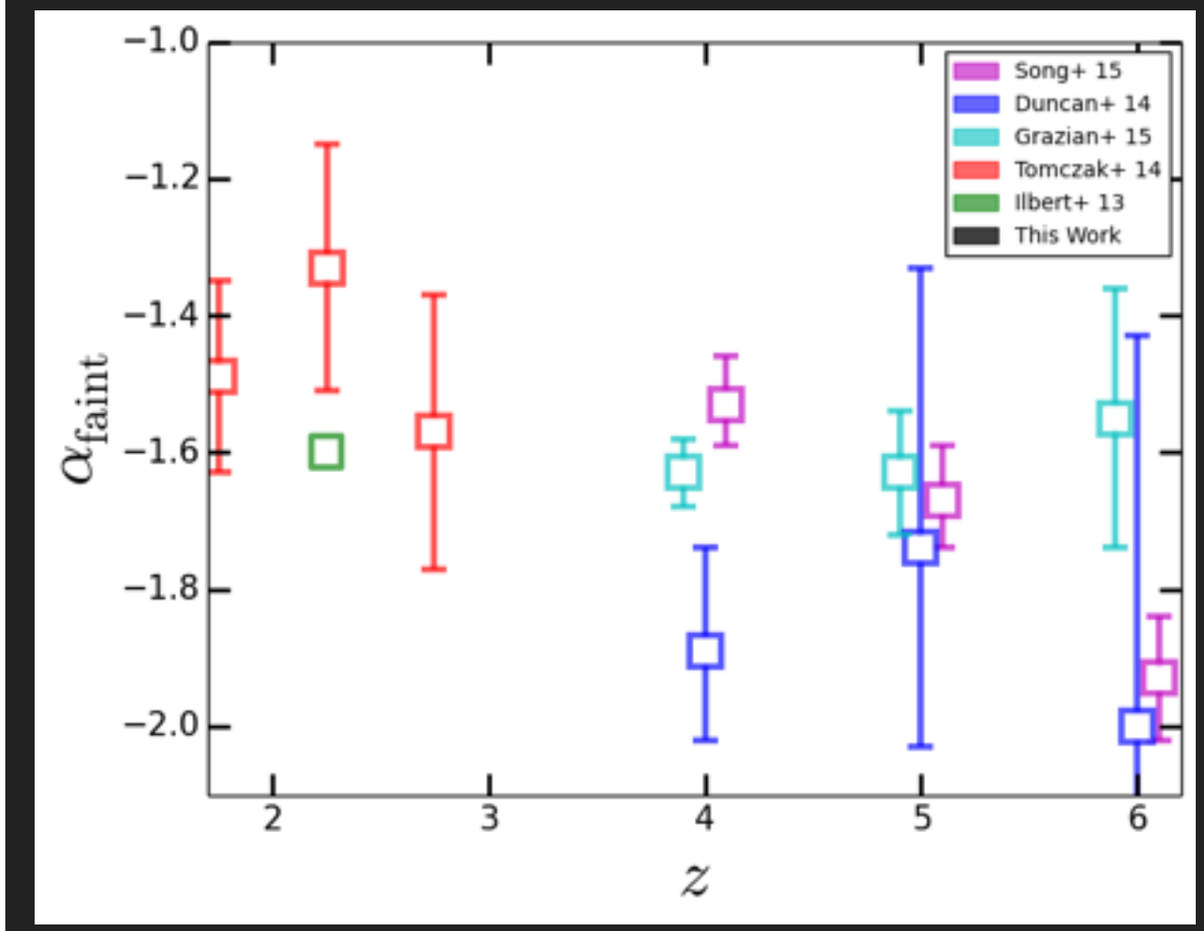
- What can this be used for?
    1. Place constraints on the stellar mass function
    2. Identify the descendants of the sources of reionization

Part 1: Constraints on the stellar mass function

Graus et al. 2016: arXiv:1509.01250

Part 1: Constraints on the stellar mass function





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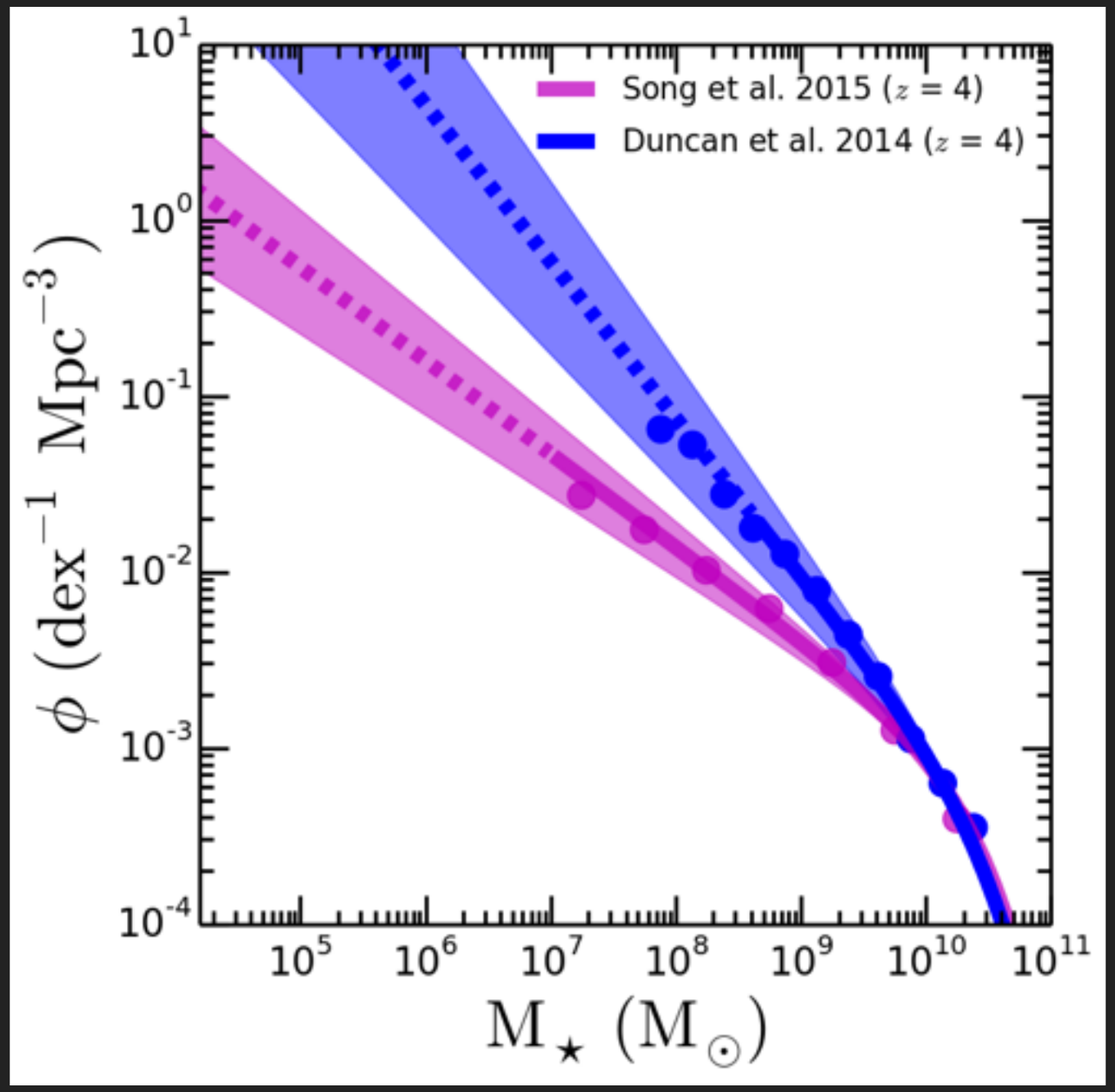

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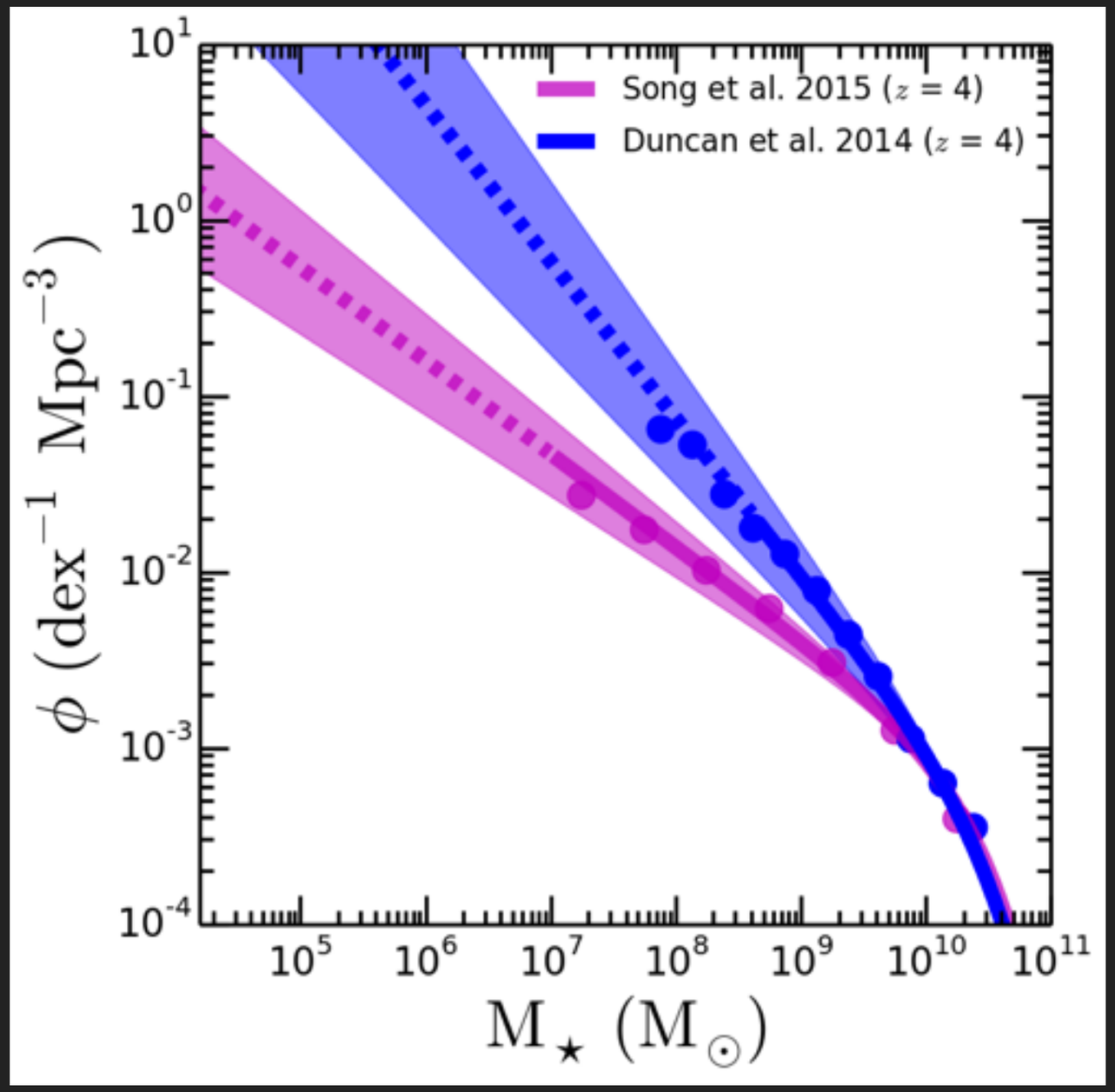

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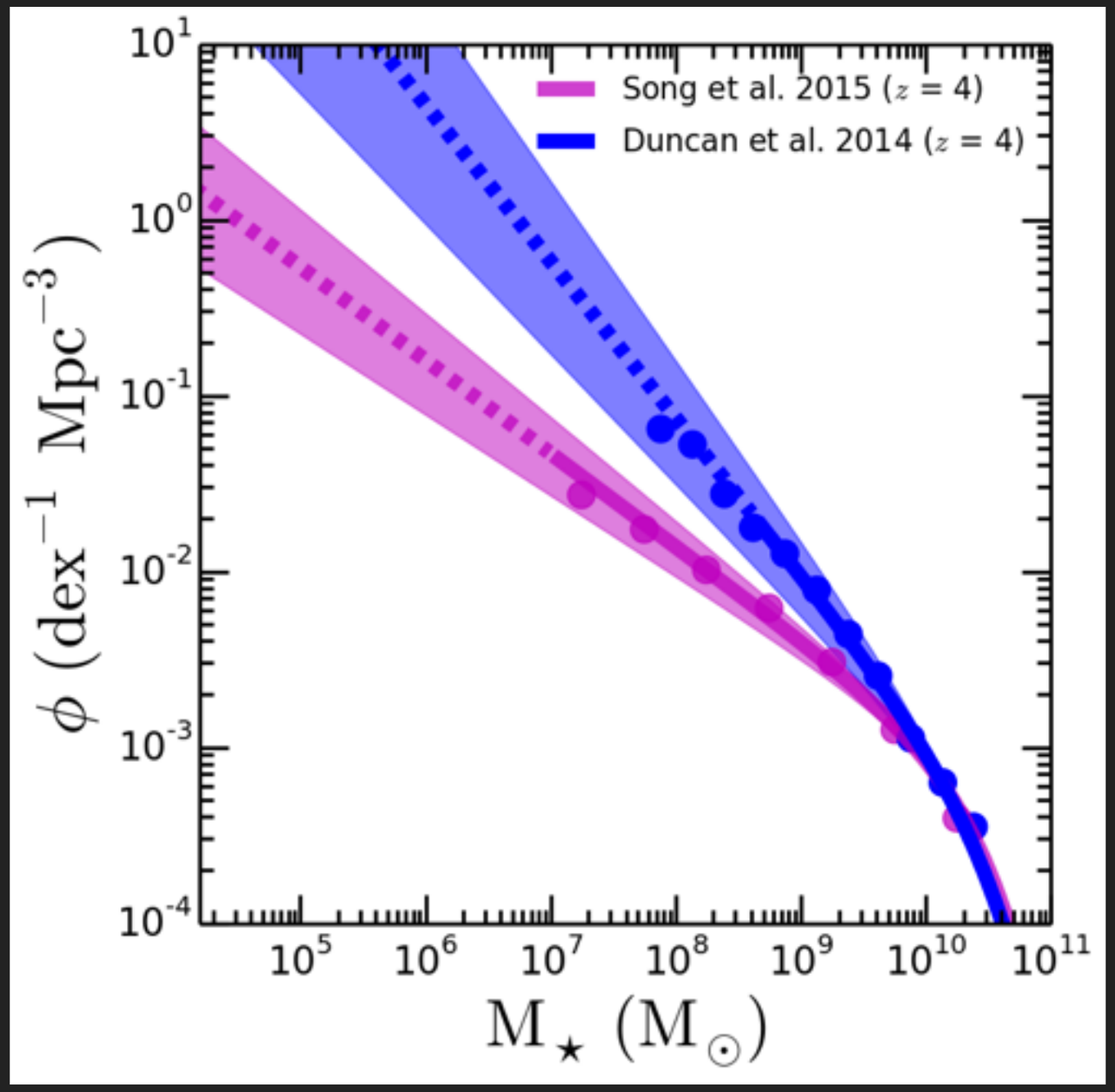

- The size of the Milky Way is ~300 kpc or 0.11 Mpc^3
- At z = 4 this increased by ~$10^{2.5}$ to 34 Mpc^3
- At dwarf scales (~10^6 $M_\odot$) this is the difference between 300 and 10!

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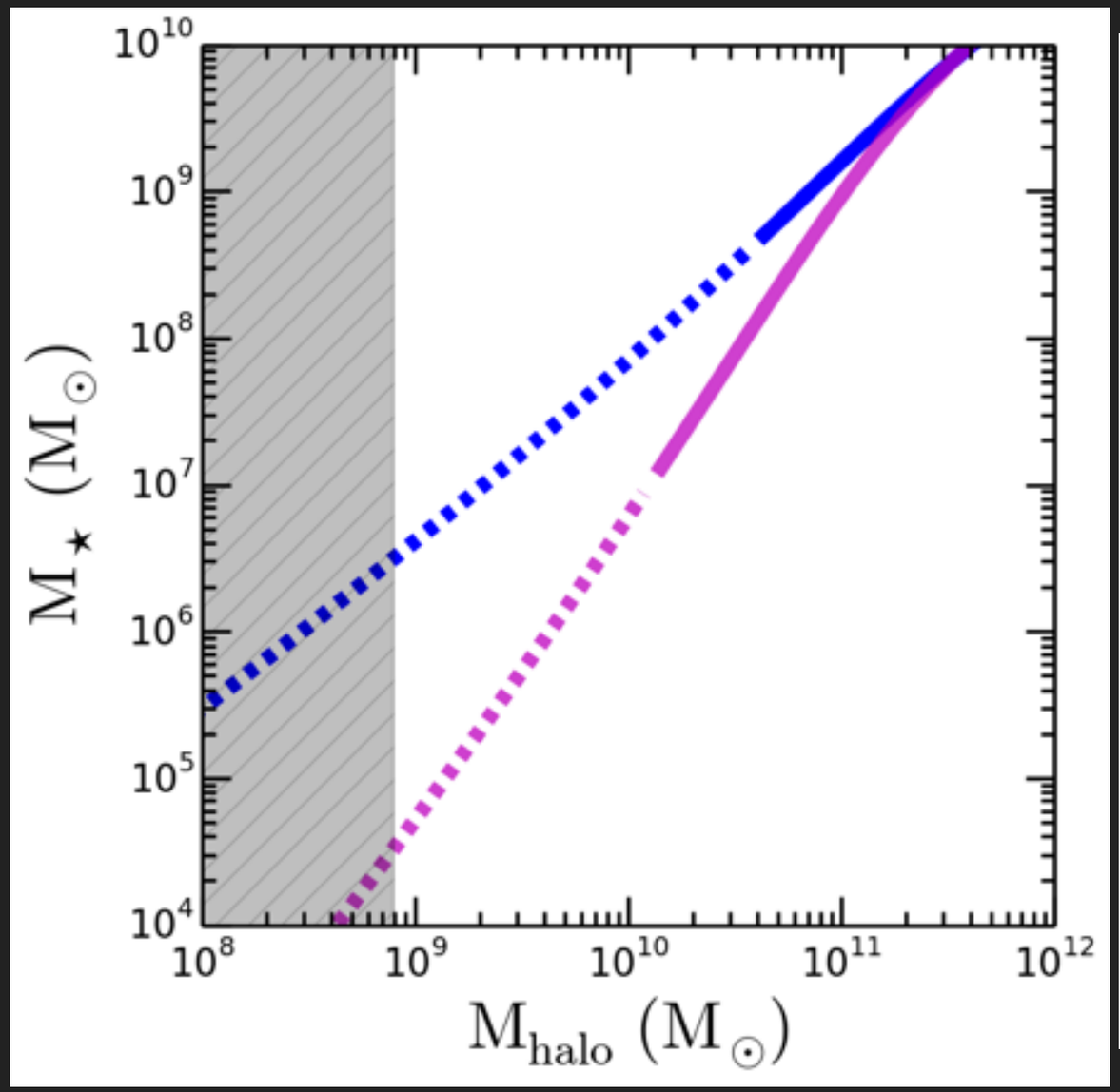

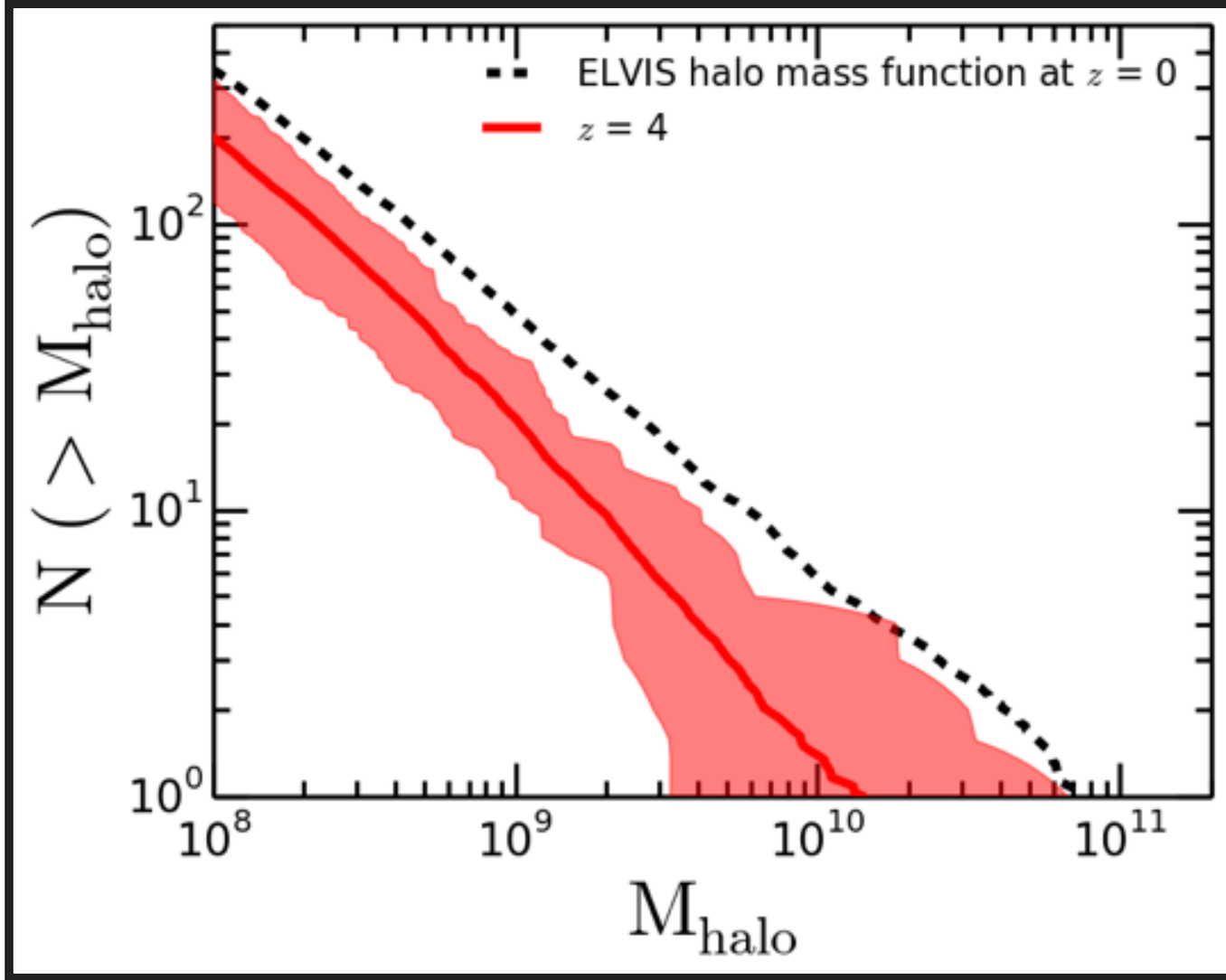

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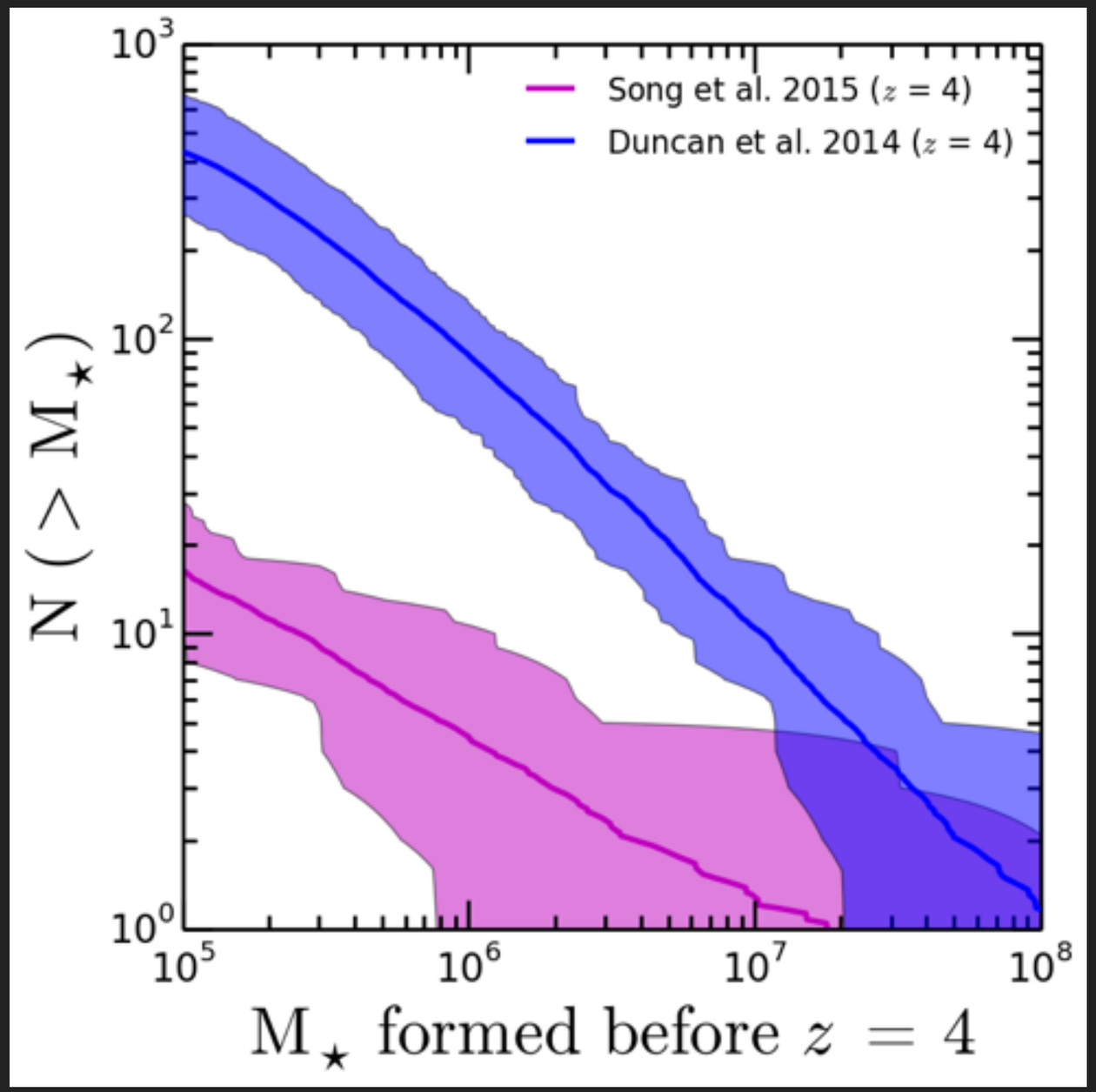

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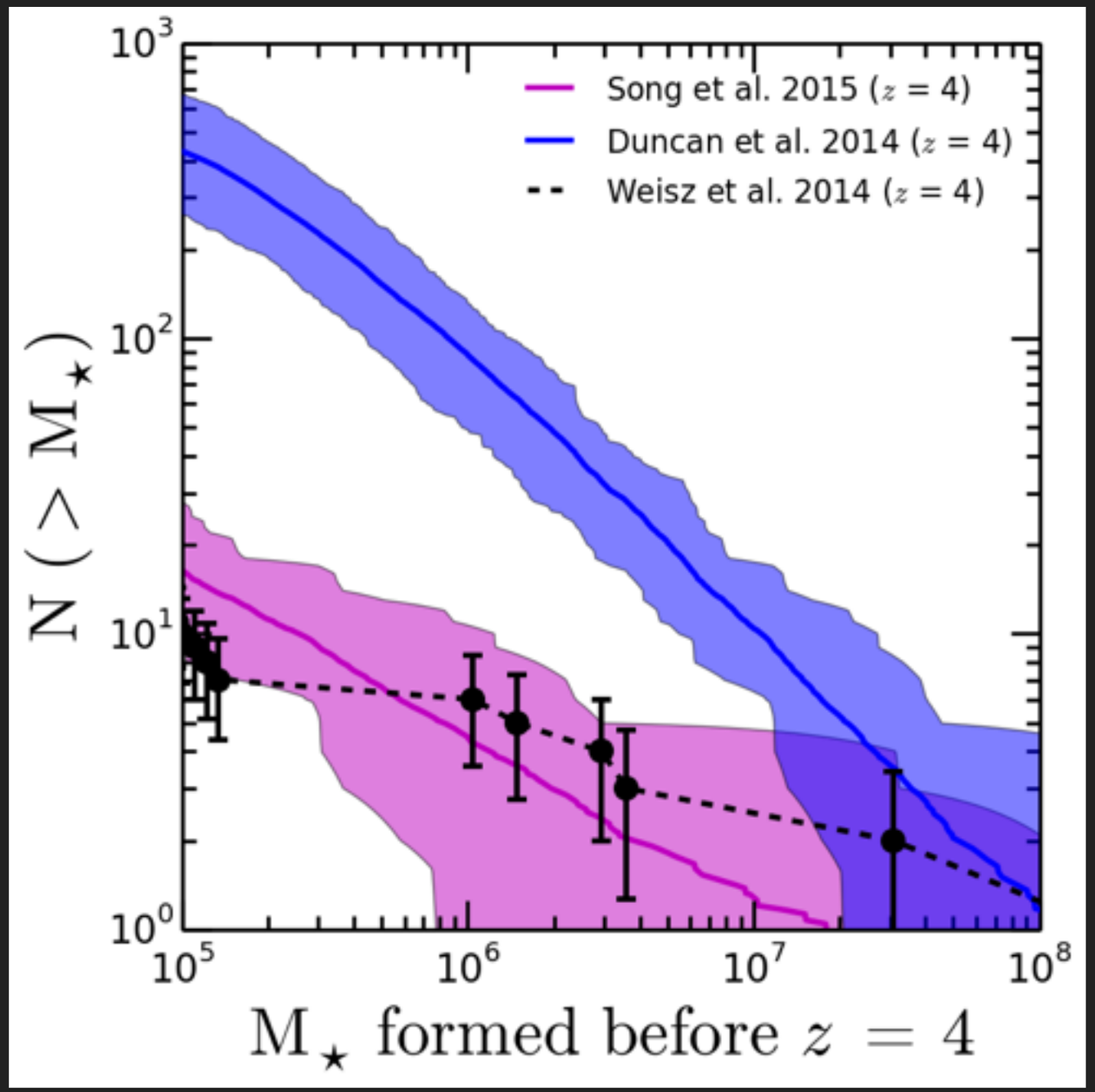

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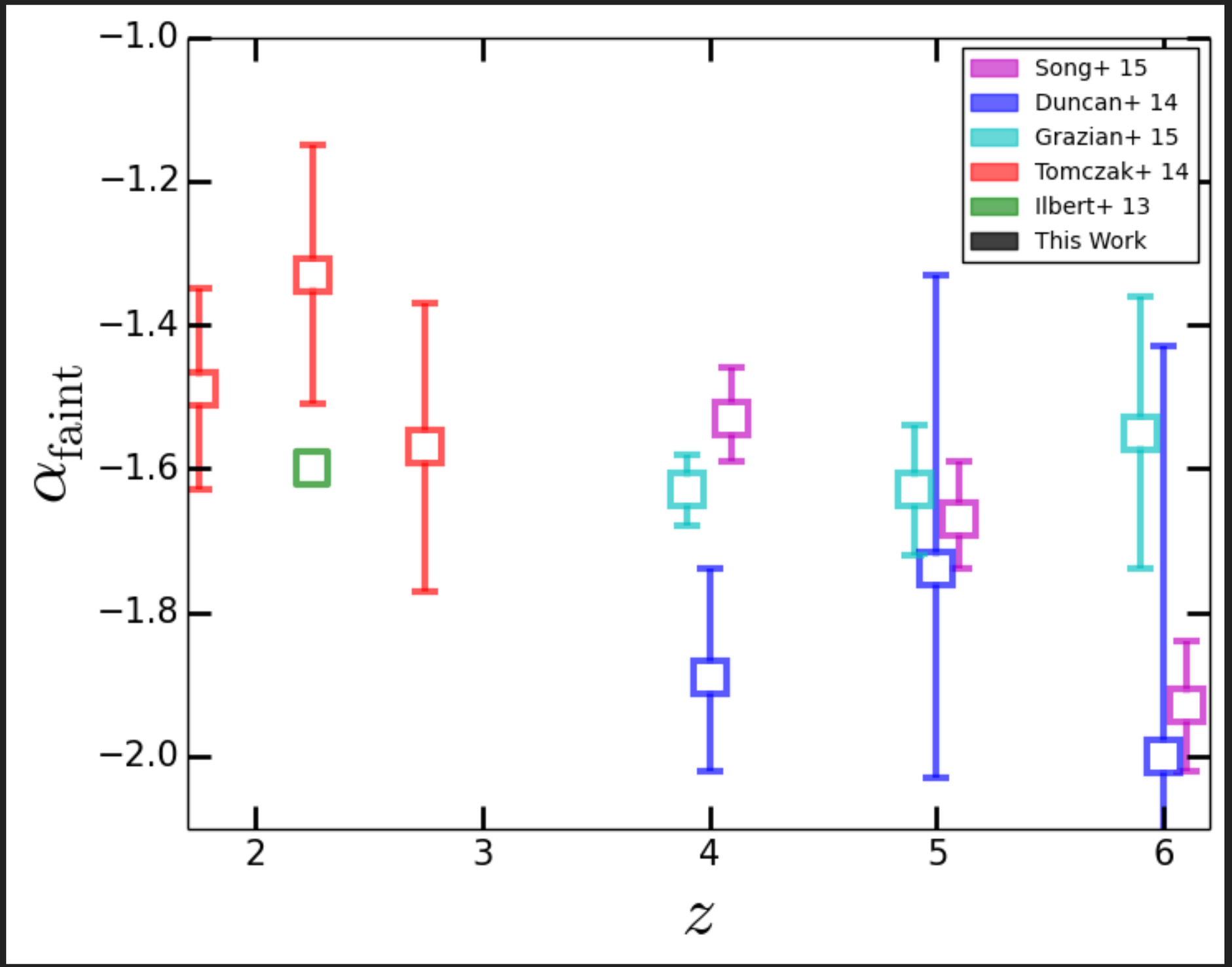

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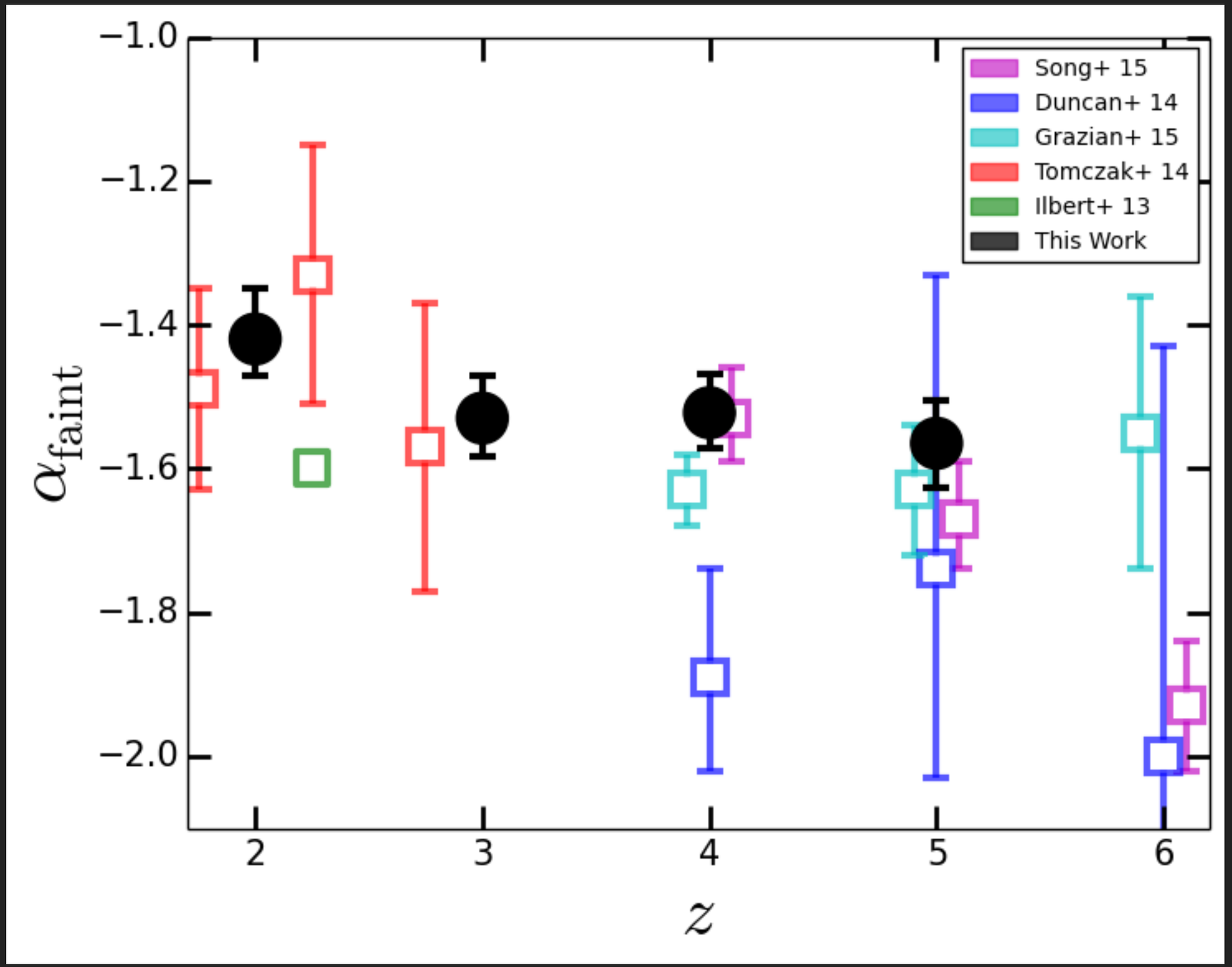
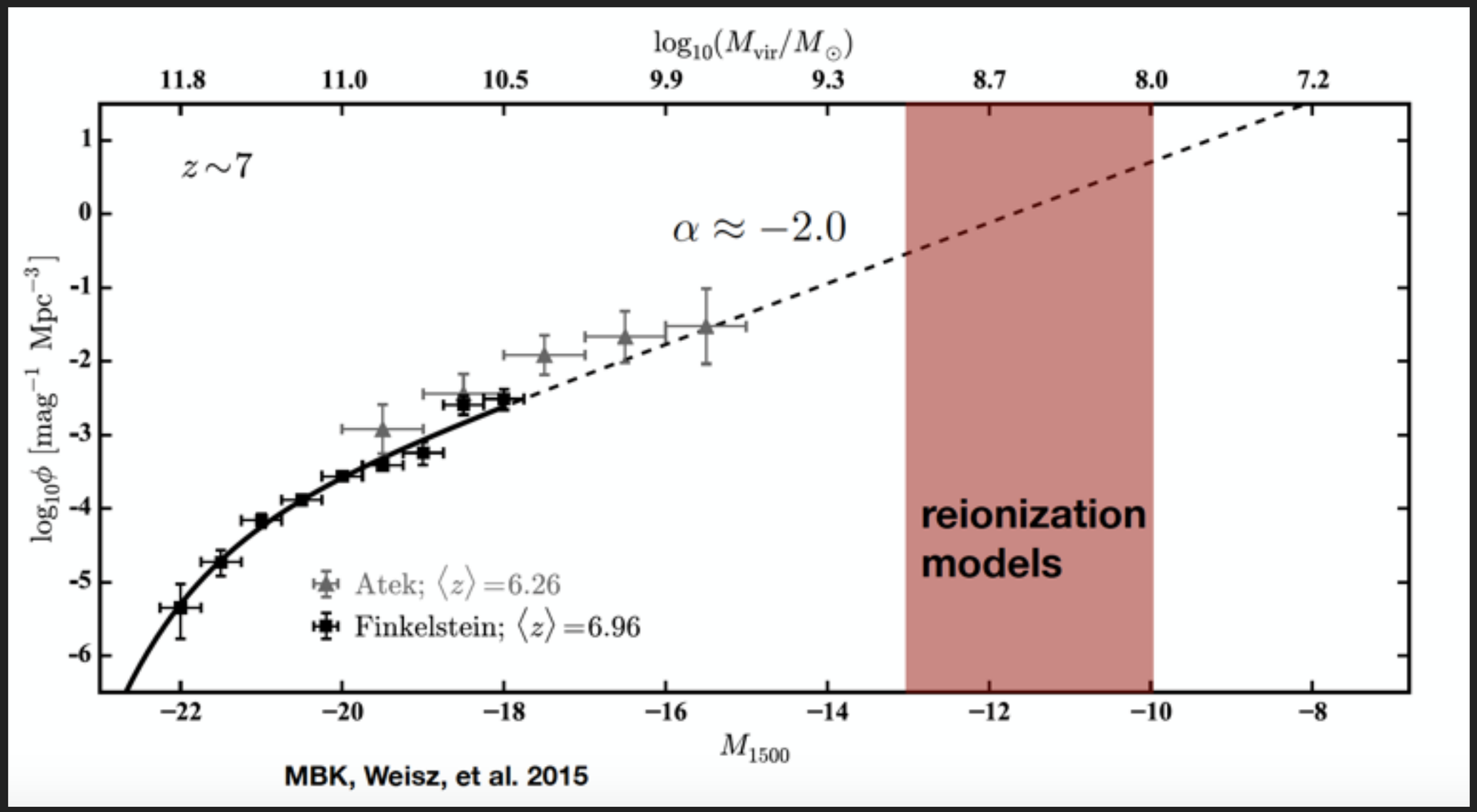


Part 2: descendants of the sources of reionization

Boylan-Kolchin et al. 2015: arXiv:1504.06621

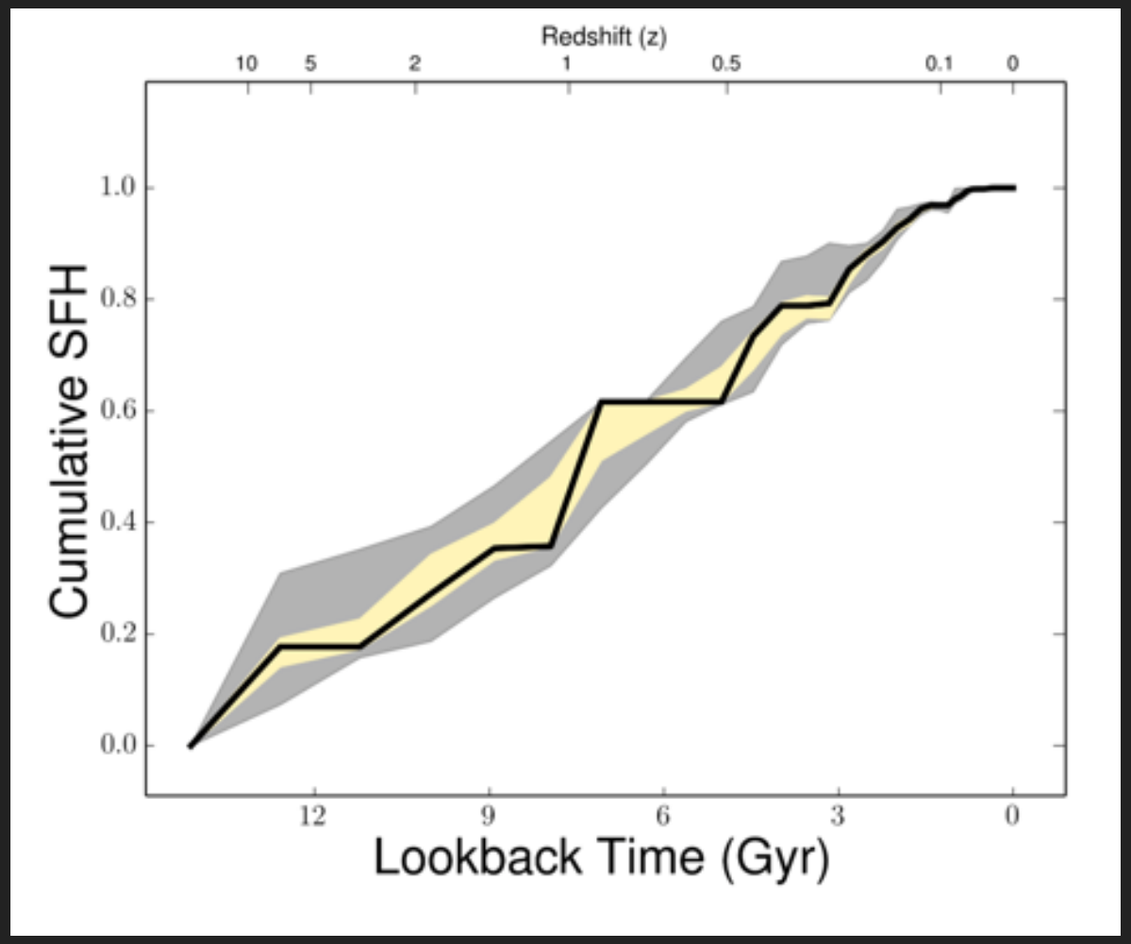
Part 2: descendants of reionization

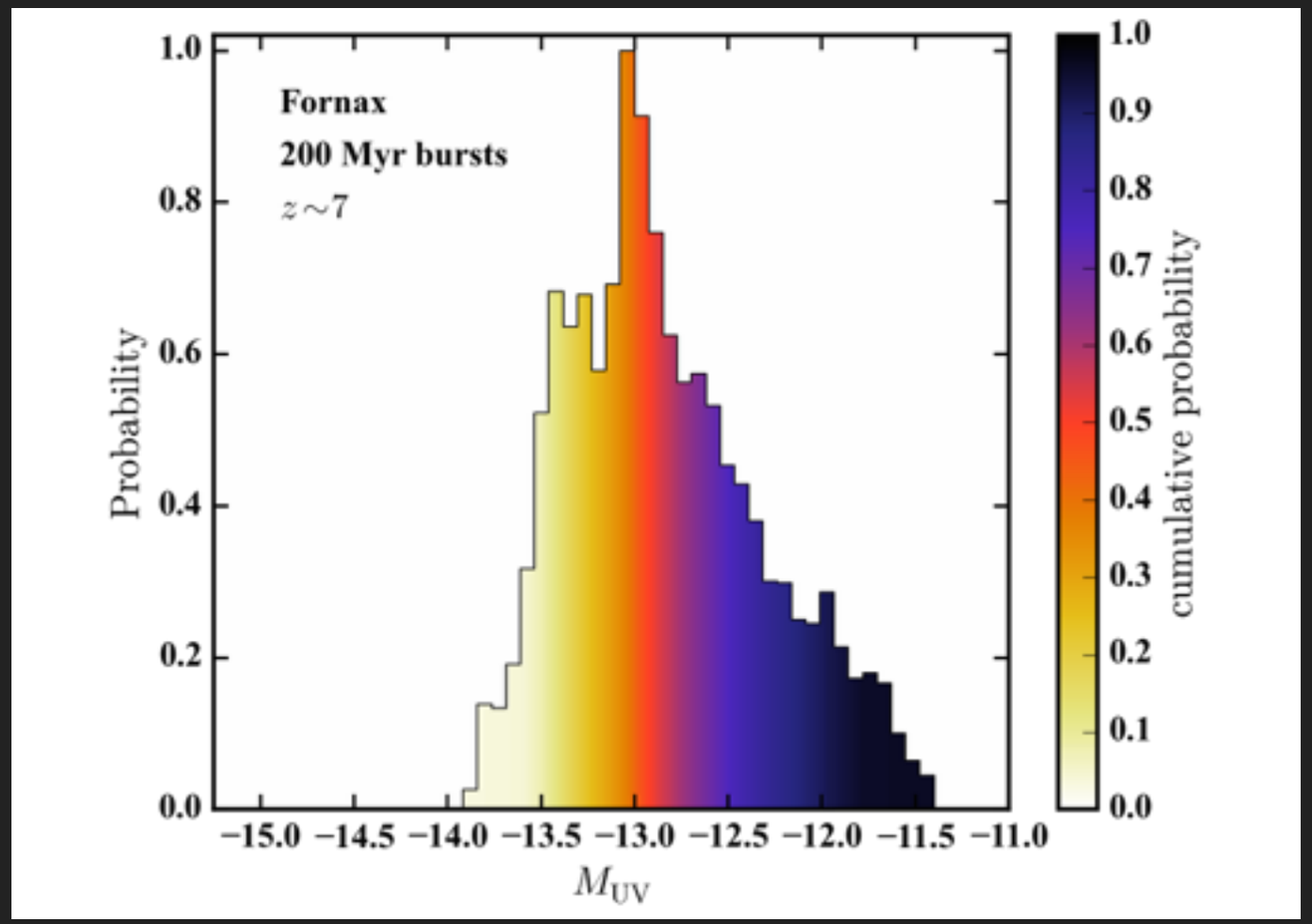
- We can see very small galaxies in the Local Group
  - possibly generators of reionization?



Part 2: descendants of reionization

- Can we see the galaxies responsible for reionization in the Local Group?





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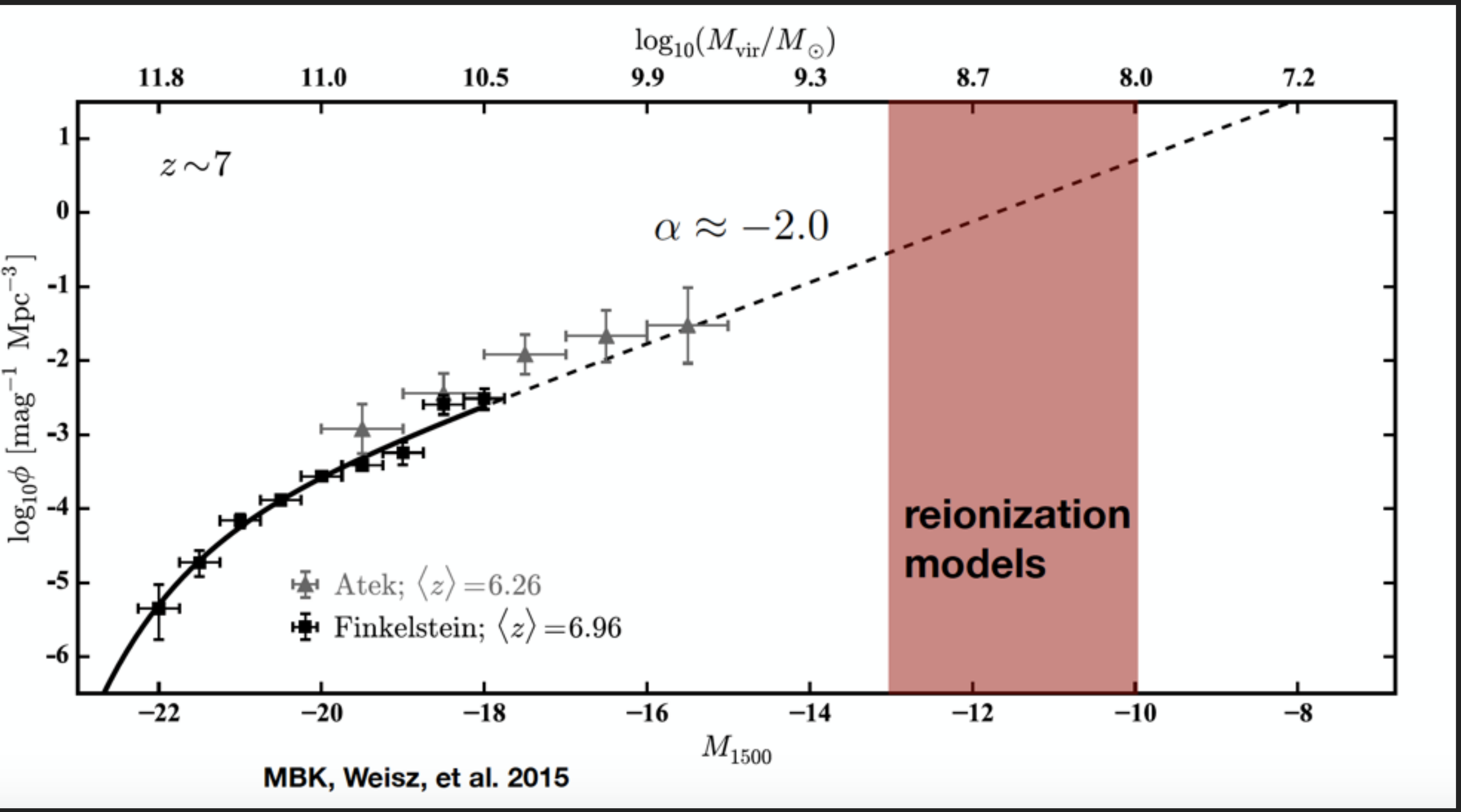

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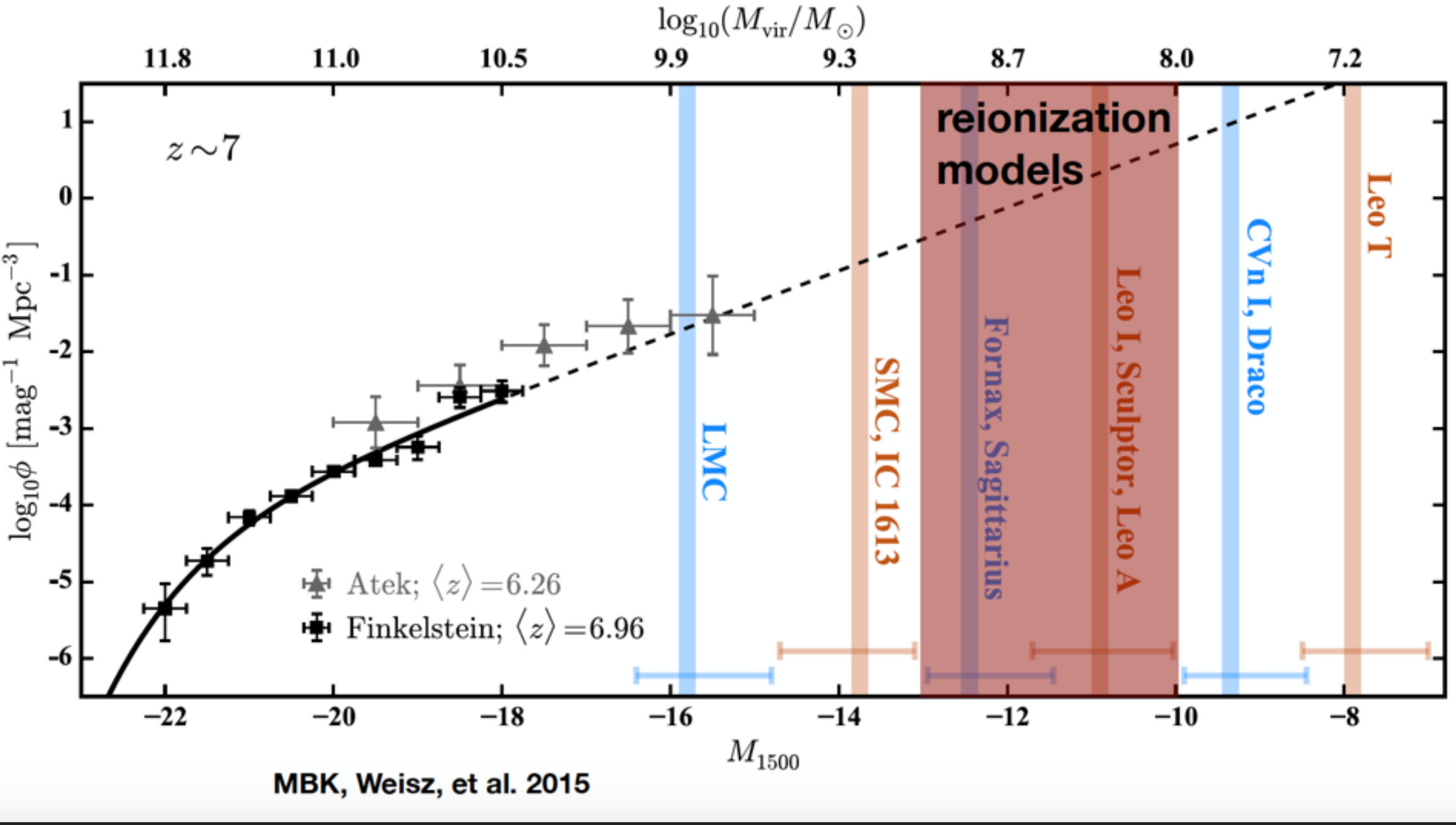
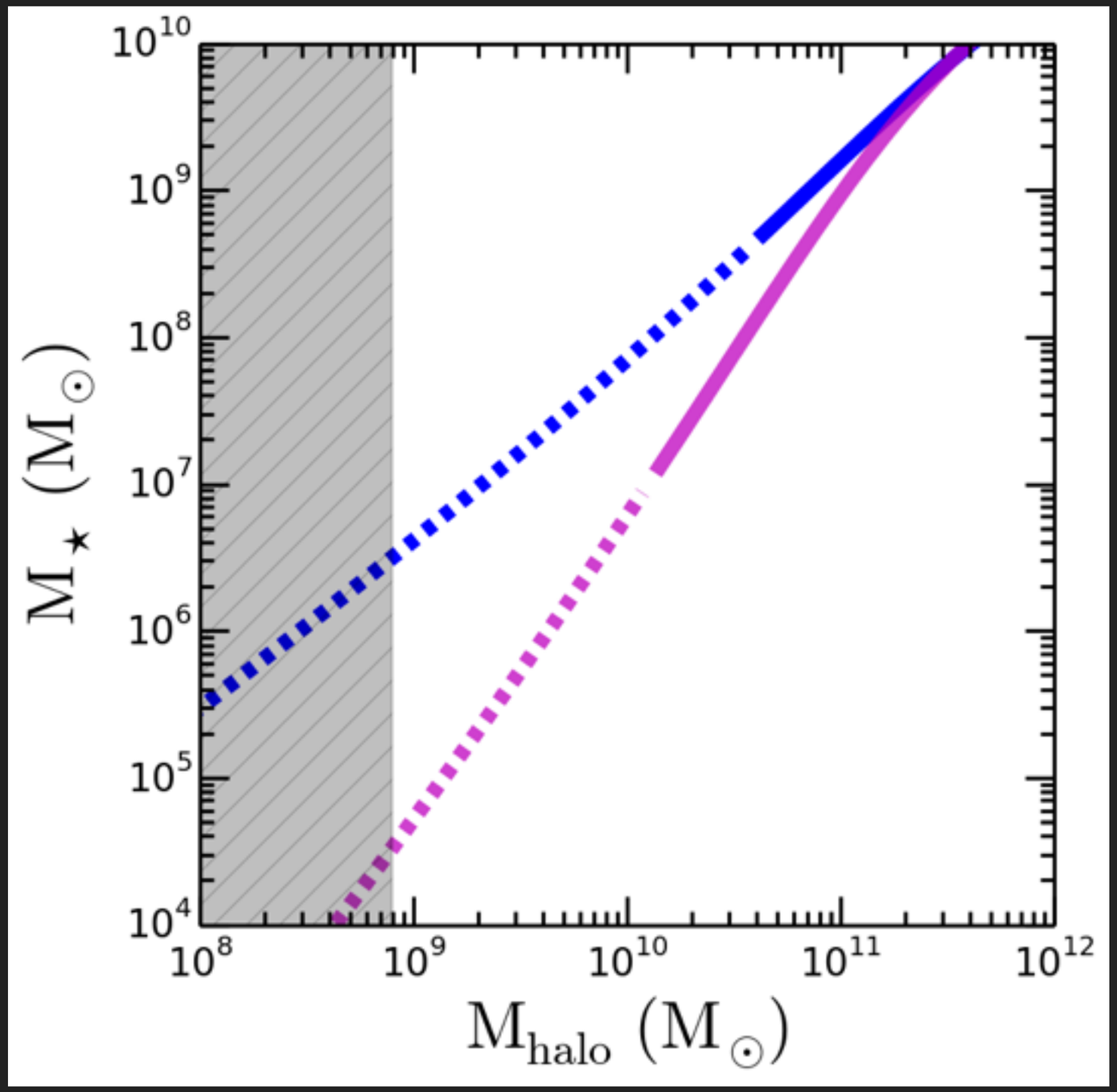
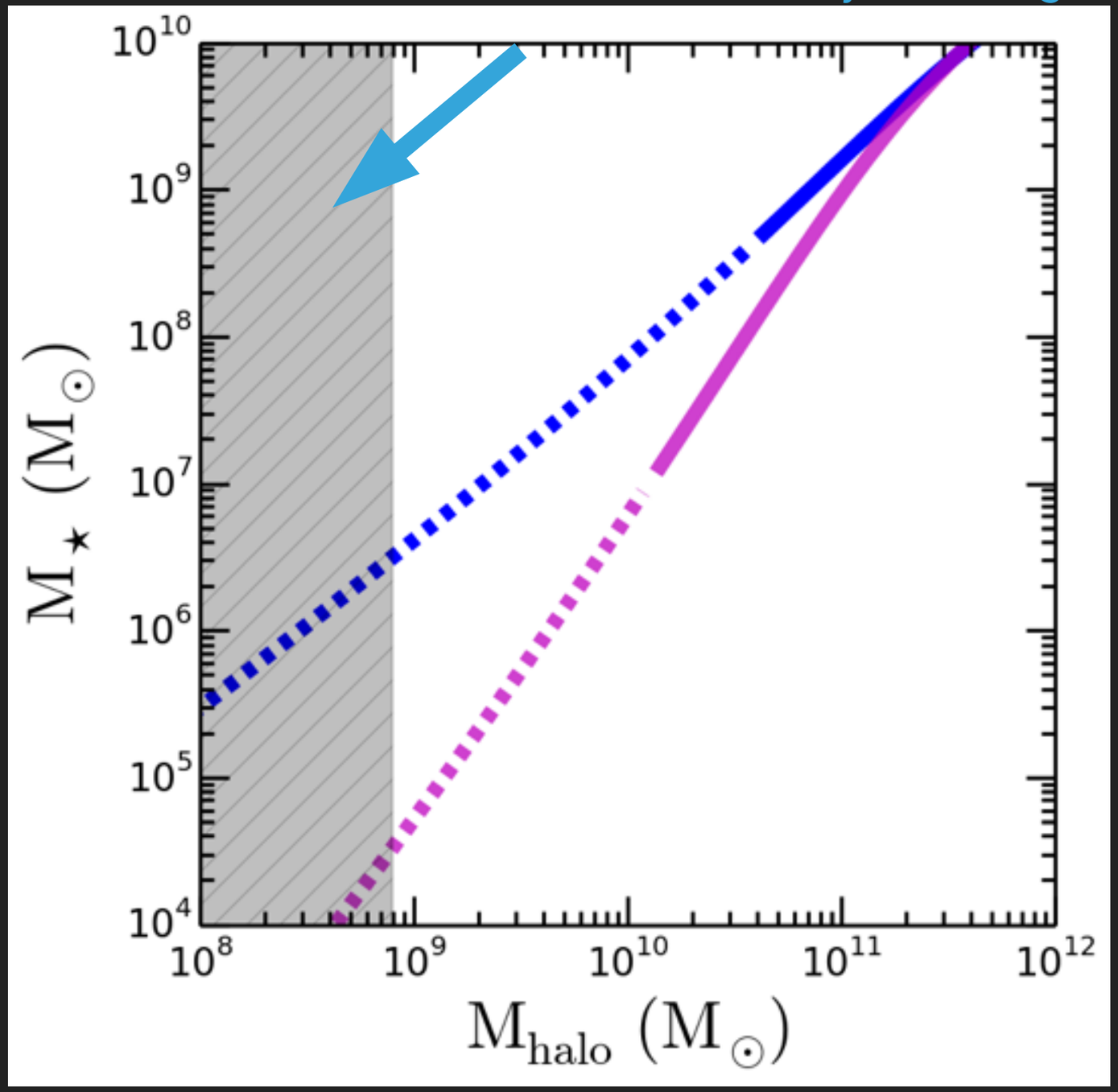


Future Prospects



Future Prospects

Galaxies cut off by UV -background (Okamoto+, 2008)



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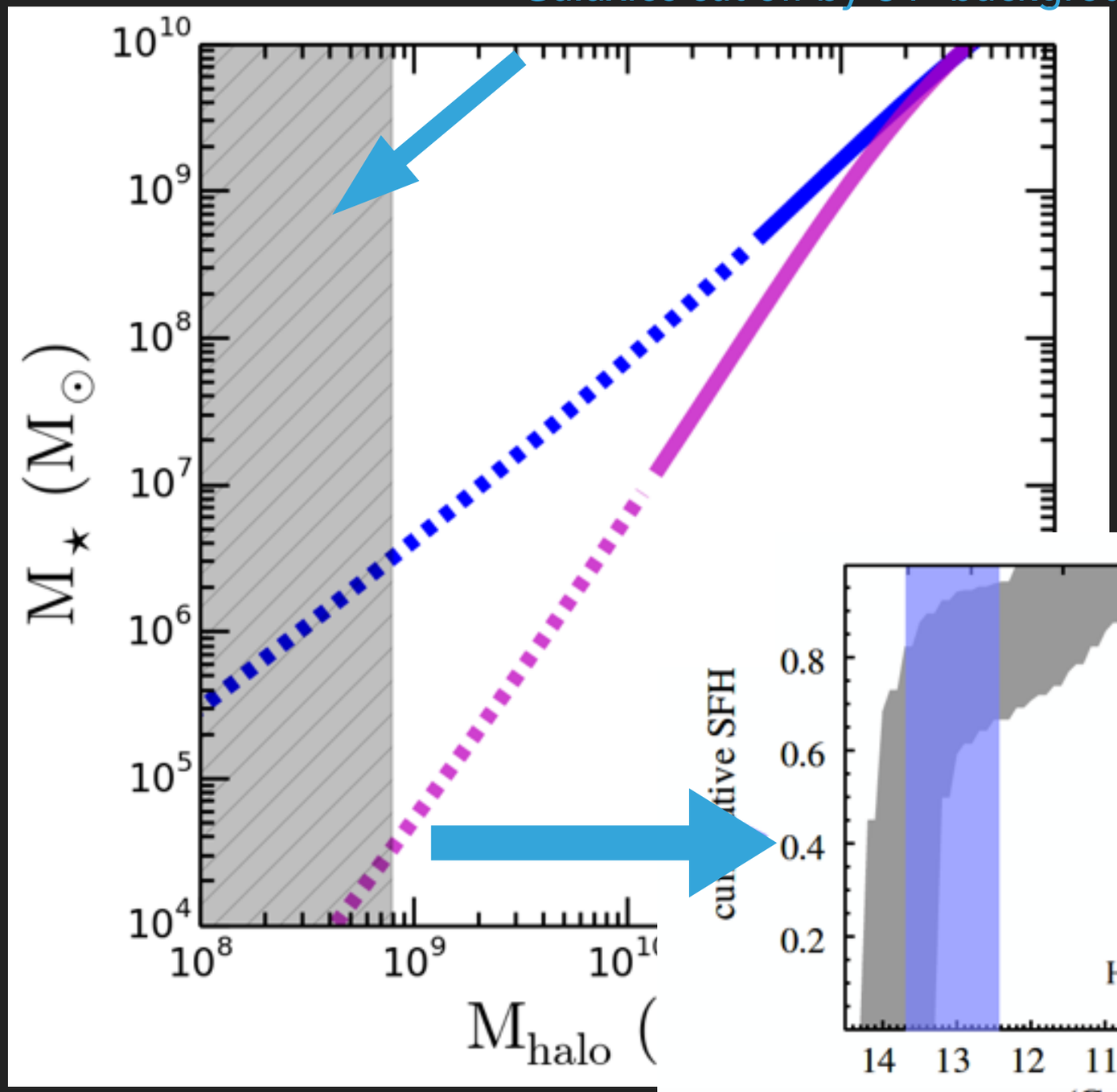

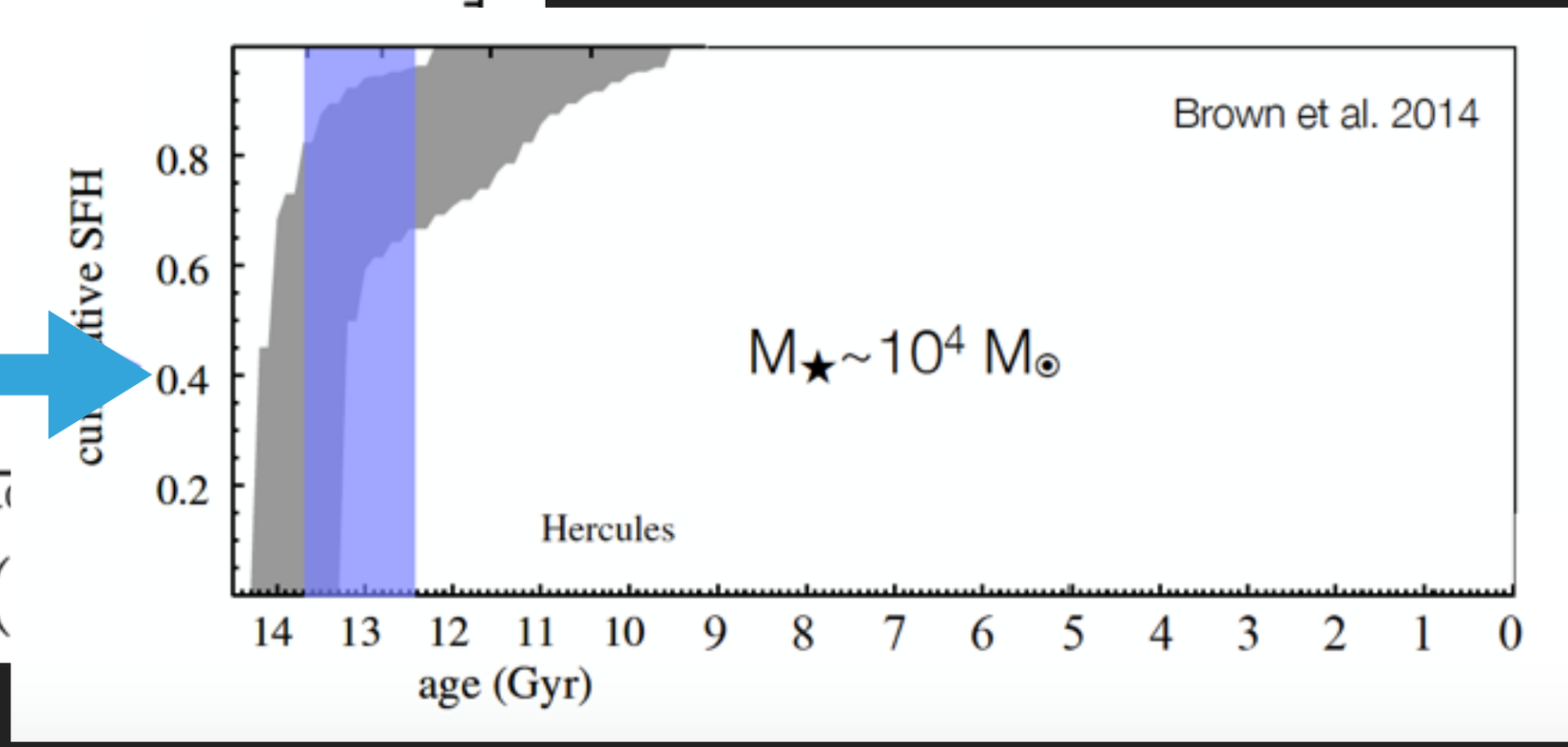

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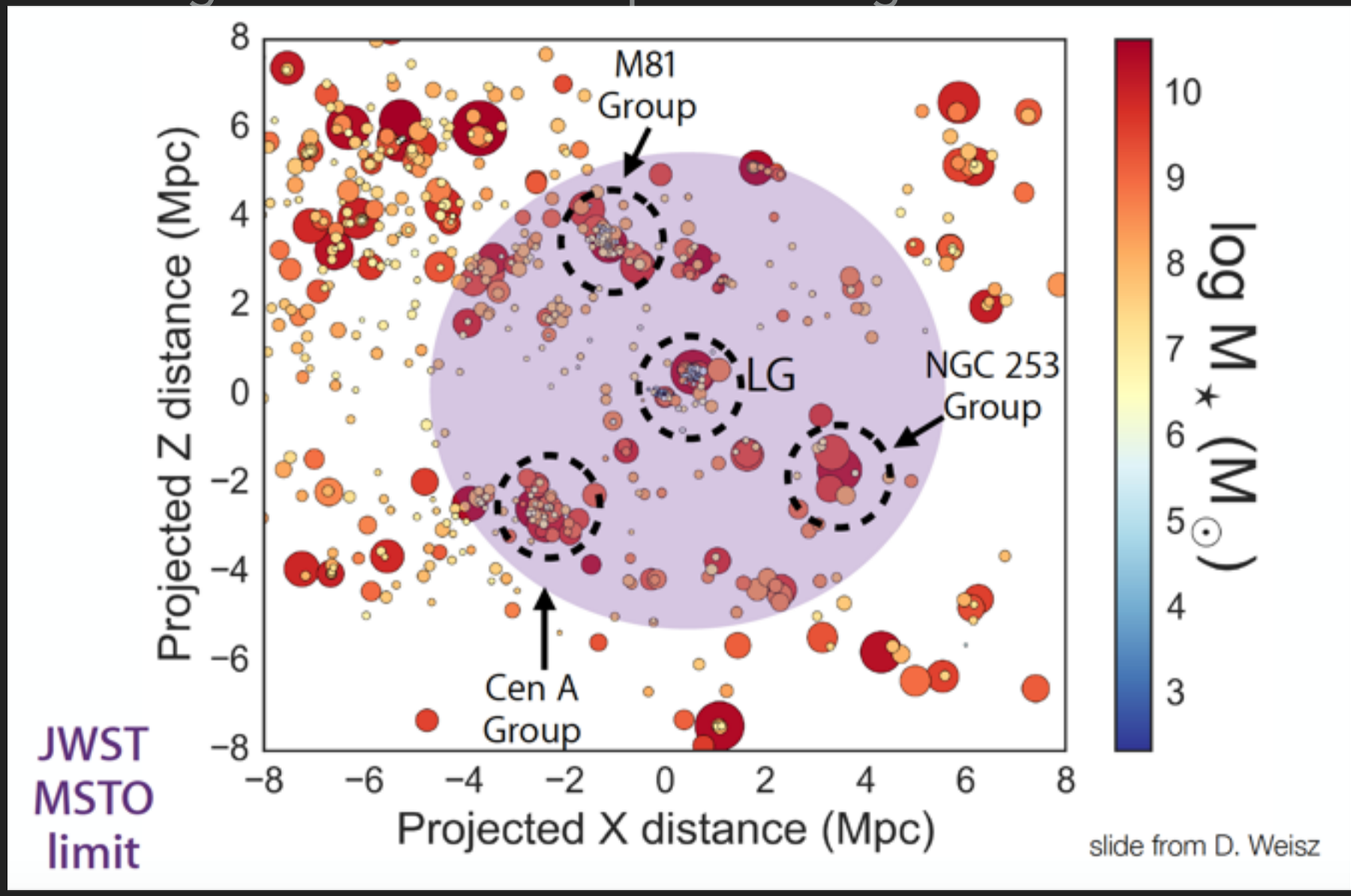
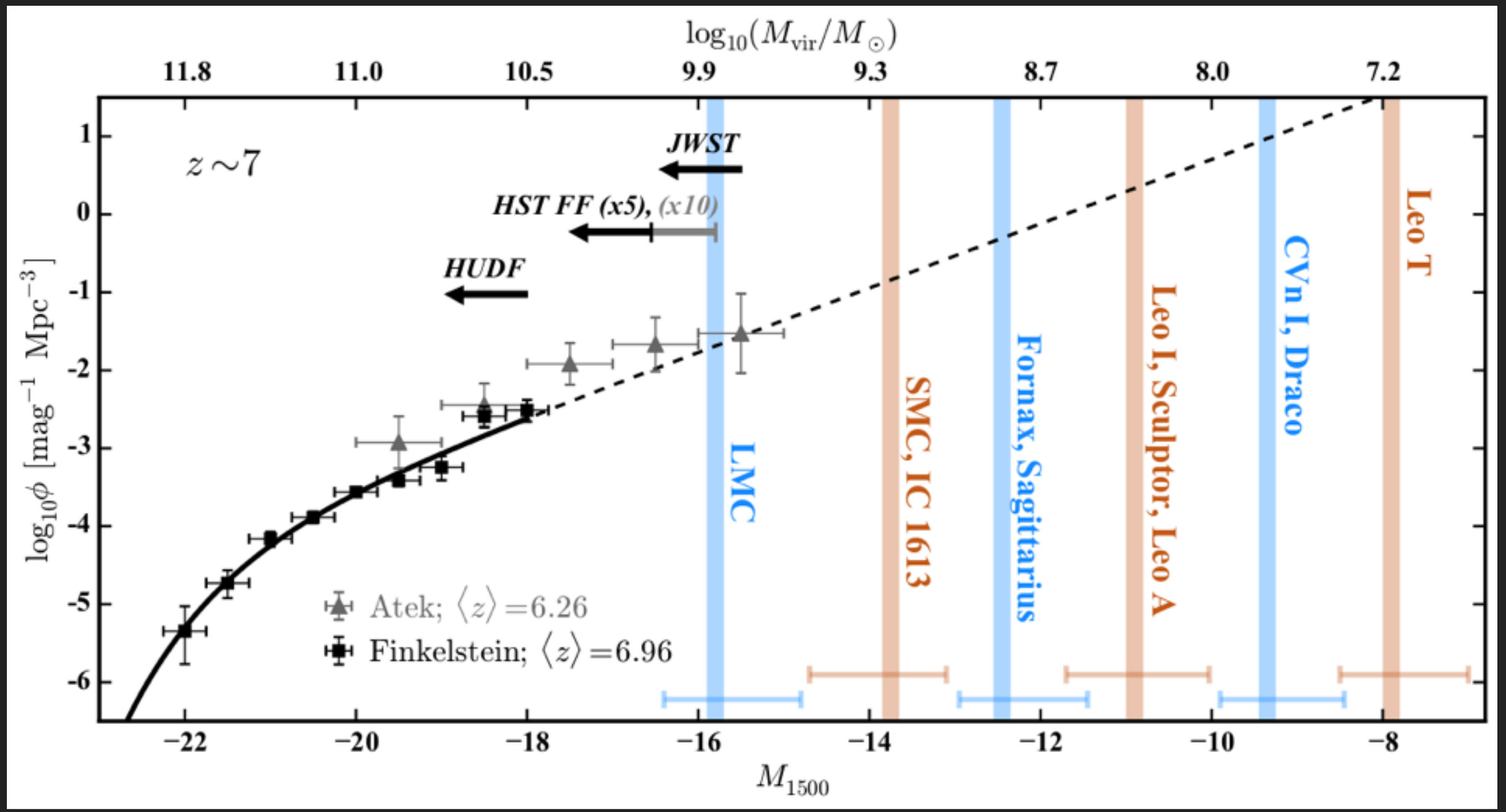


JWST limits


$\log_{10}(M_{\rm vir}/M_\odot)$
11.8
11.0
10.5
9.9
9.3
8.7
8.0
7.2
$z\sim7$
JWST
HST FF (x5), (x10)
HUDF
LMC
SMC, IC 1613
Fornax, Sagittarius
Leo I, Sculptor, Leo A
CVn I, Draco
Leo T
Atek; $\langle z\rangle=6.26$
Finkelstein; $\langle z\rangle=6.96$
$\log_{10}\phi$ [mag^{-1} Mpc^{-3}]
1
0
-1
-2
-3
-4
-5
-6
−22
−20
−18
−16
−14
−12
−10
−8
M_{1500}

Constraints on UV LF