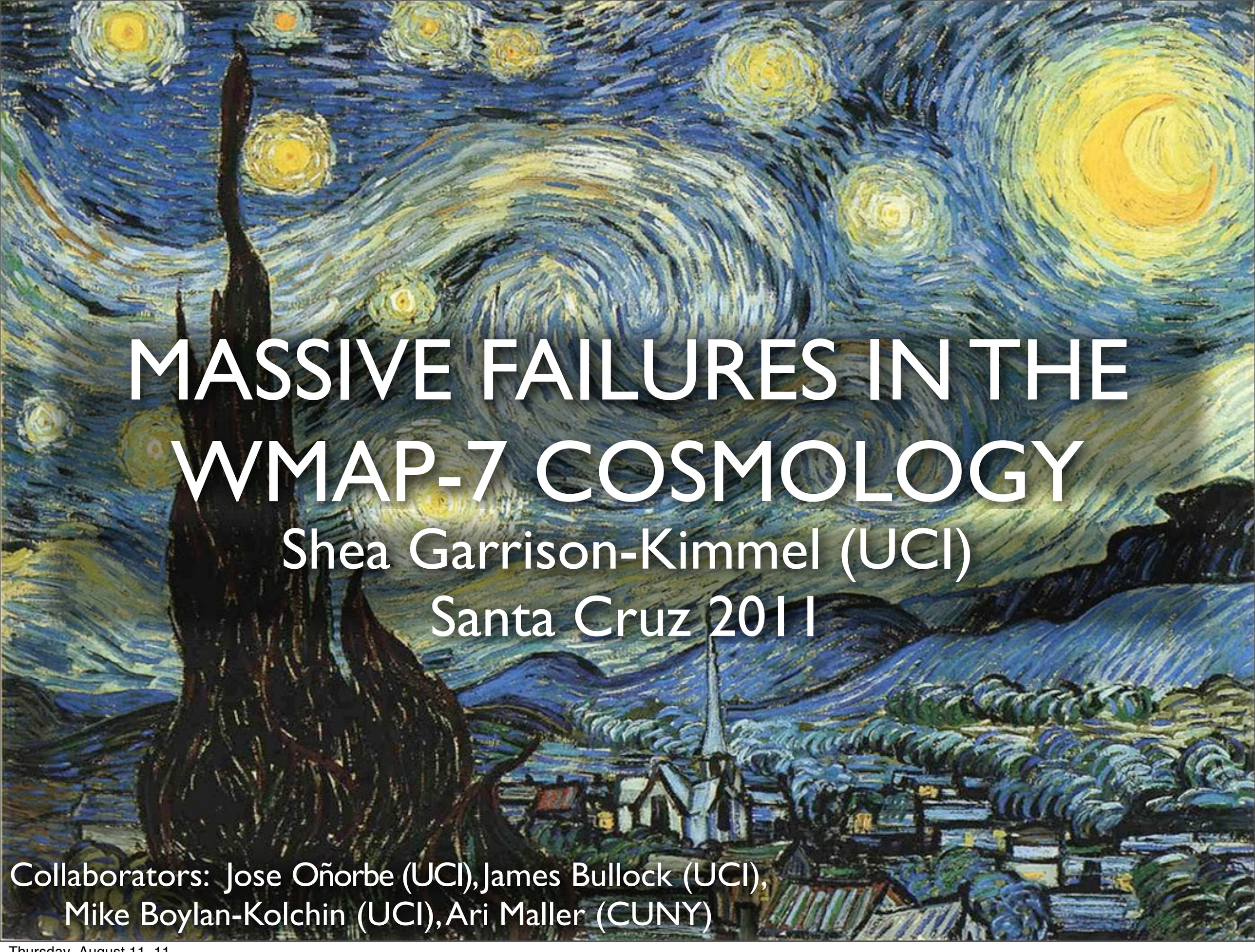


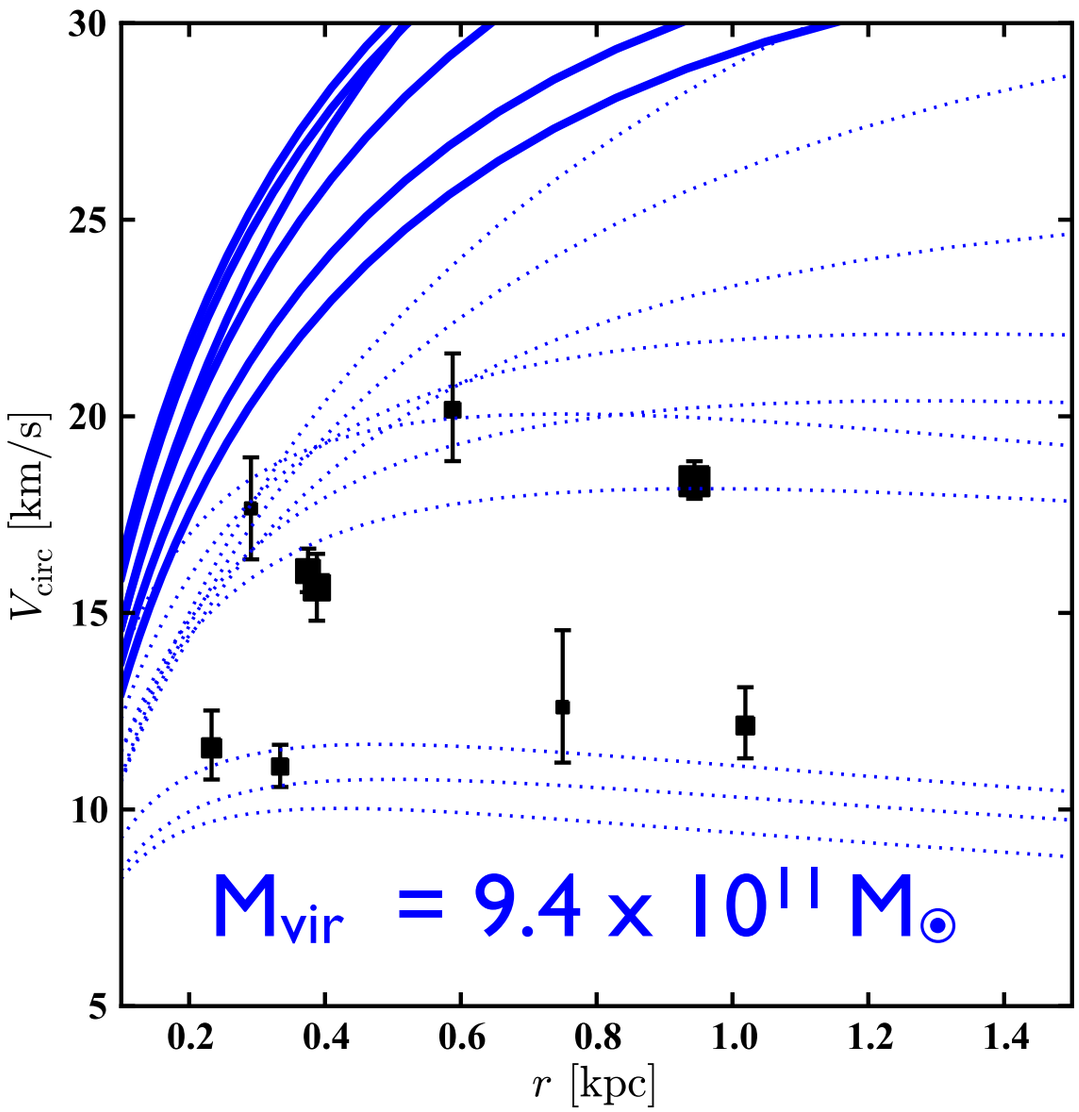
MASSIVE FAILURES IN THE WMAP-7 COSMOLOGY

Shea Garrison-Kimmel (UCI)

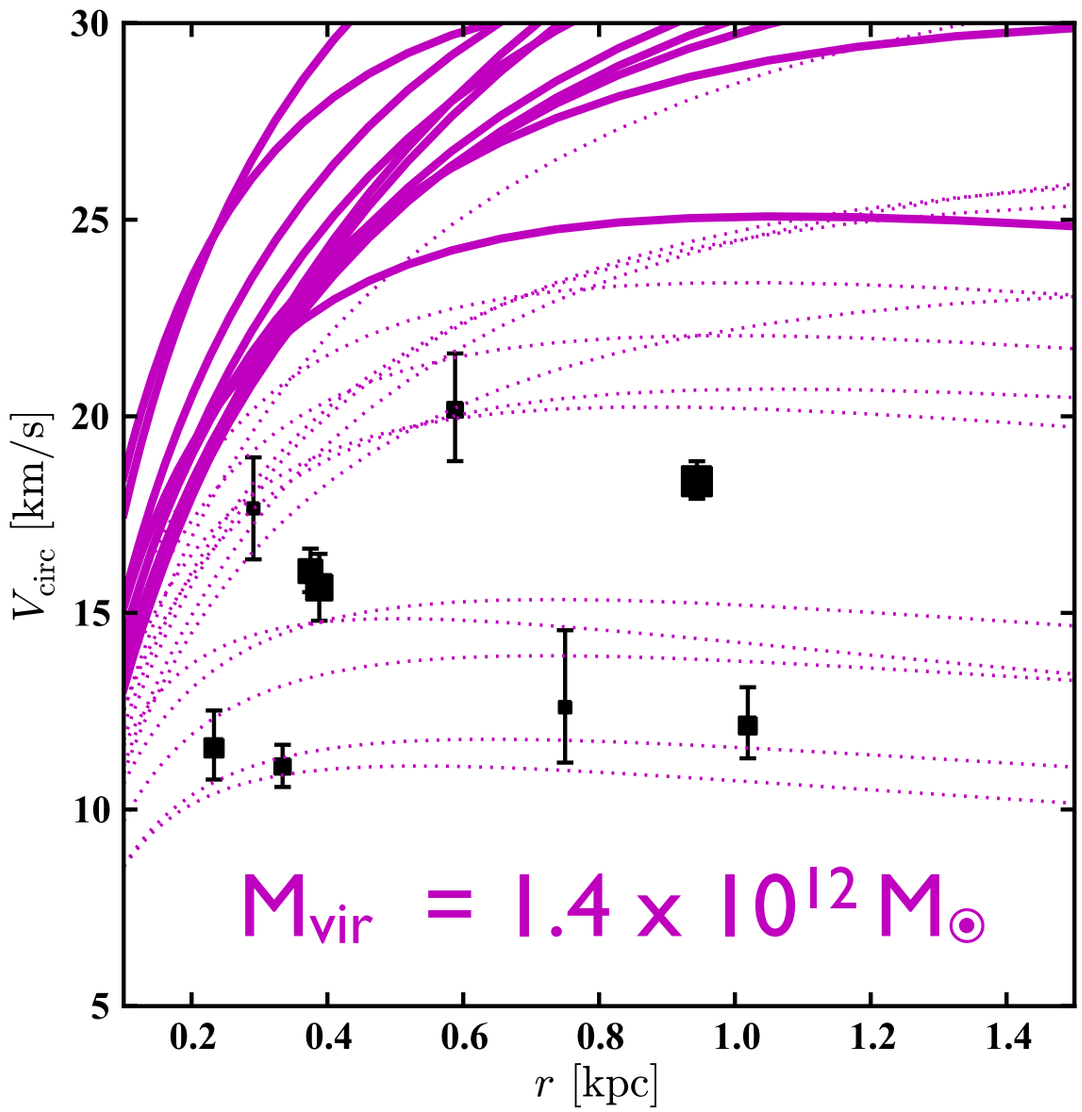
Santa Cruz 2011

Collaborators: Jose Oñorbe (UCI), James Bullock (UCI),
Mike Boylan-Kolchin (UCI), Ari Maller (CUNY)

Majority of halos in Boylan-Kolchin et al. (2011) using a high σ_8 of 0.9



Boylan-Kolchin et al. 2011



Does a corrected cosmology help to resolve the problem of overdense subhalos?

Overview

Ambrosia Properties:

M_{200_Mean} ~ 1.2e12 $M_\odot$ N_{part} ~ 26 million R_{200_Mean} ~ 340 kpc

Zoom Properties:

L ~ 70 Mpc ε ~ 70 pc m_p ~ 24000 $M_\odot$

Resolution comparable to VL1 and Aquarius level 2

WMAP-7 Cosmology:

$\sigma_8 = 0.801$ $\Omega_m = 0.266$ $n_s = 0.963$

Our Goals:

Investigate the structure of Milky Way subhalos and satellites in an up-to-date cosmology

a. Determine if Massive Failures still exist in correct cosmology
b. Find the mass and force resolution required to accurately resolve the inner structure of subhalos surrounding a range of hosts

Overview

Ambrosia Properties:

M c

L ⊙

Resolution comparable to VL1 and Aquarius level 2

Reminder:

VL2 (Diemand, Kuhlen, Madau 2008) used $\sigma_8 = 0.74$

Aquarius (Springel et al. 2008) used $\sigma_8 = 0.9$

WMAP-7 Cosmology:

$\sigma_8 = 0.801$ $\Omega_m = 0.266$ $n_s = 0.963$

Our Goals:

Investigate the structure of Milky Way subhalos and satellites in an up-to-date cosmology

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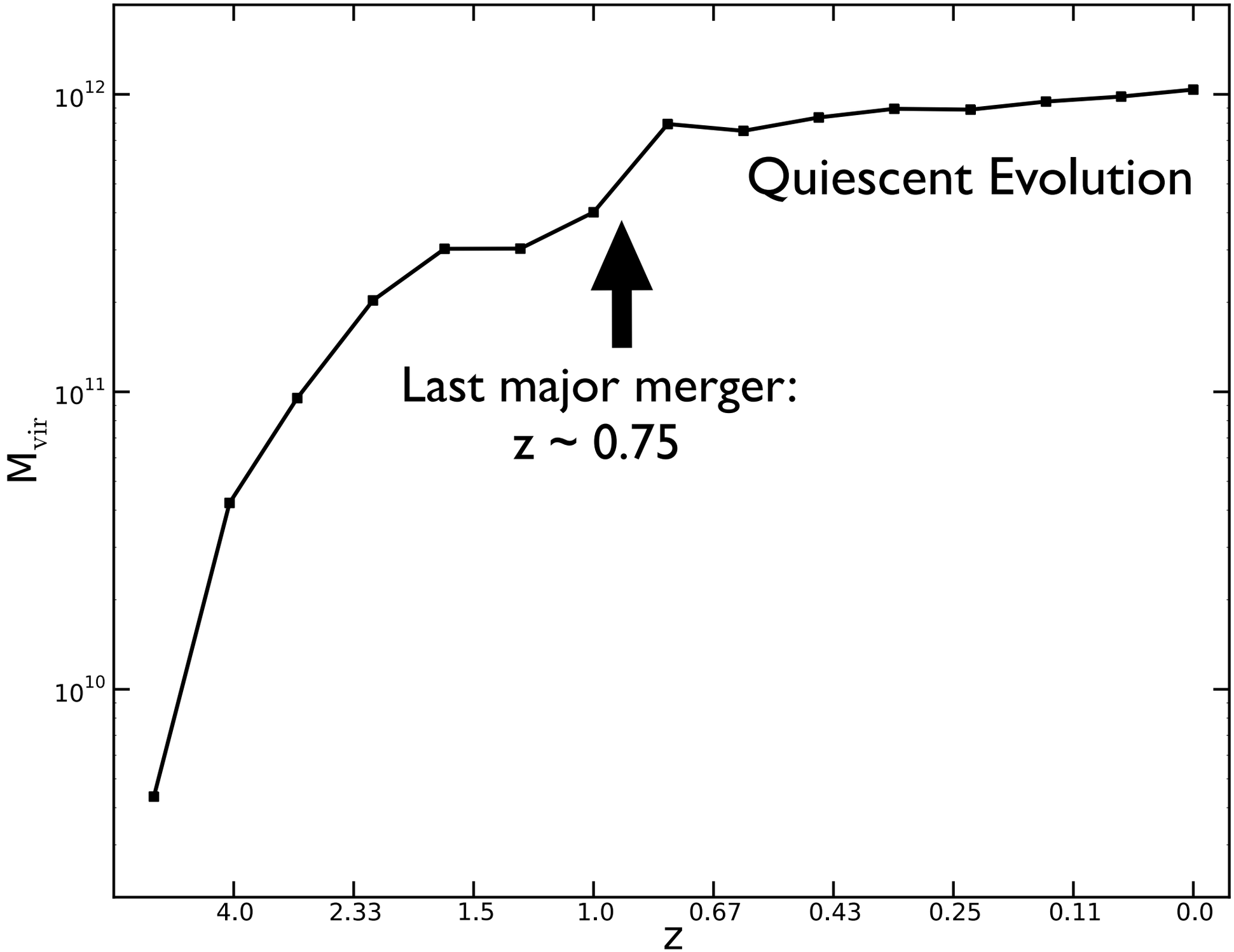
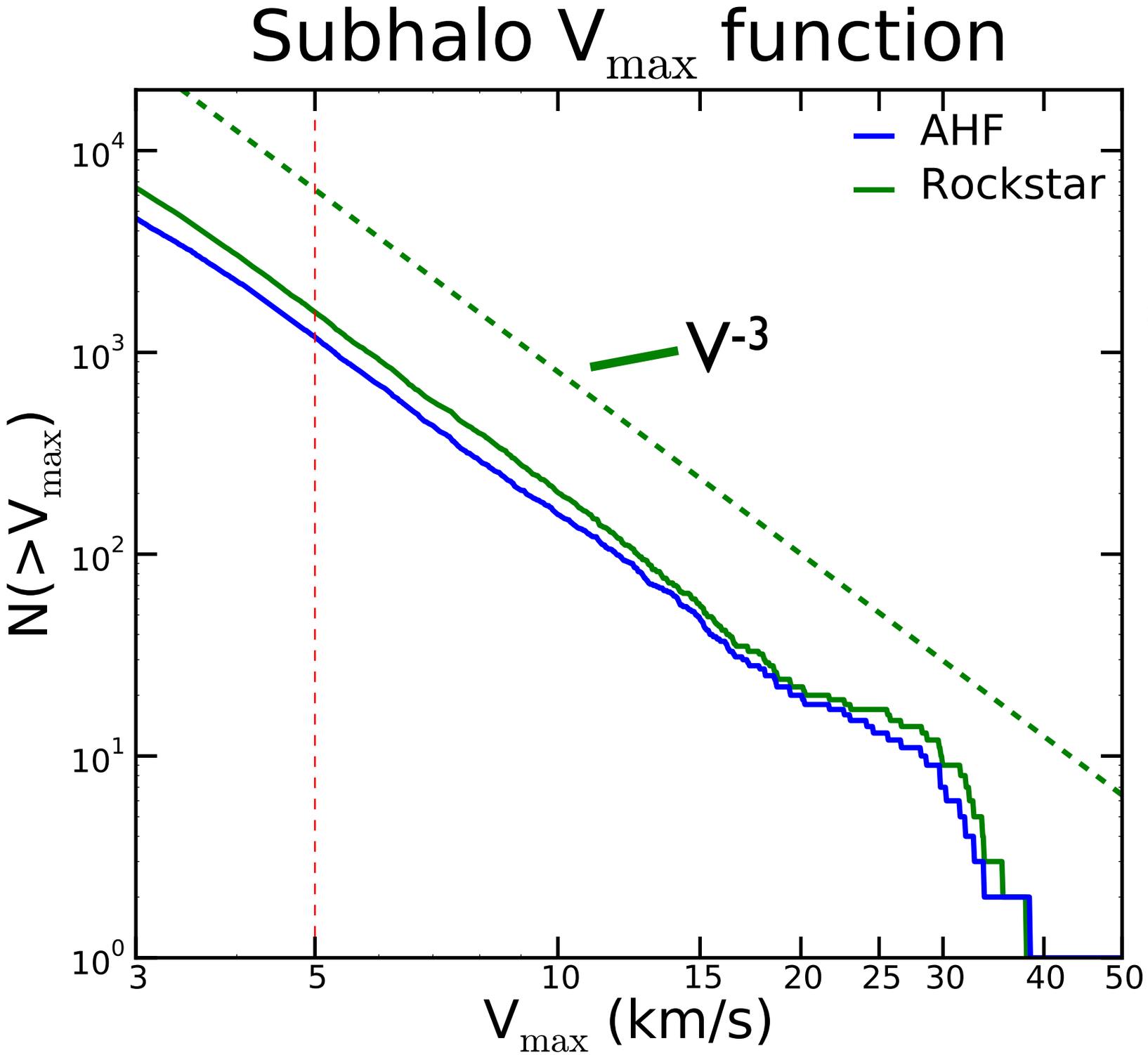
Ambrosia Mass Evolution

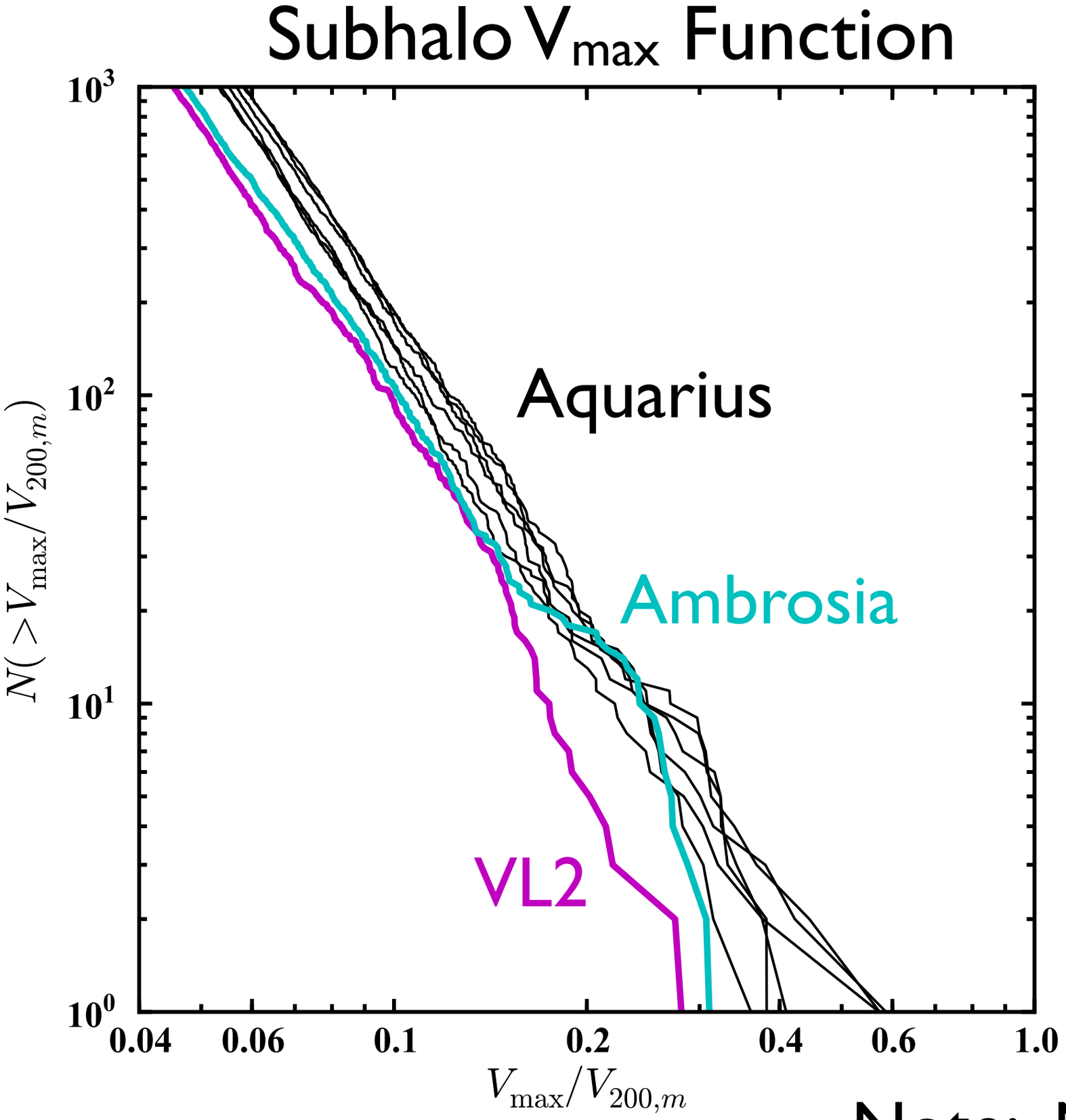




Subhalo distribution: different halo finders yield similar results, but Rockstar finds ~25% more small halos than AHF

Rockstar: Behroozi et al. (2011)
AHF: Knollmann & Knebe (2009)

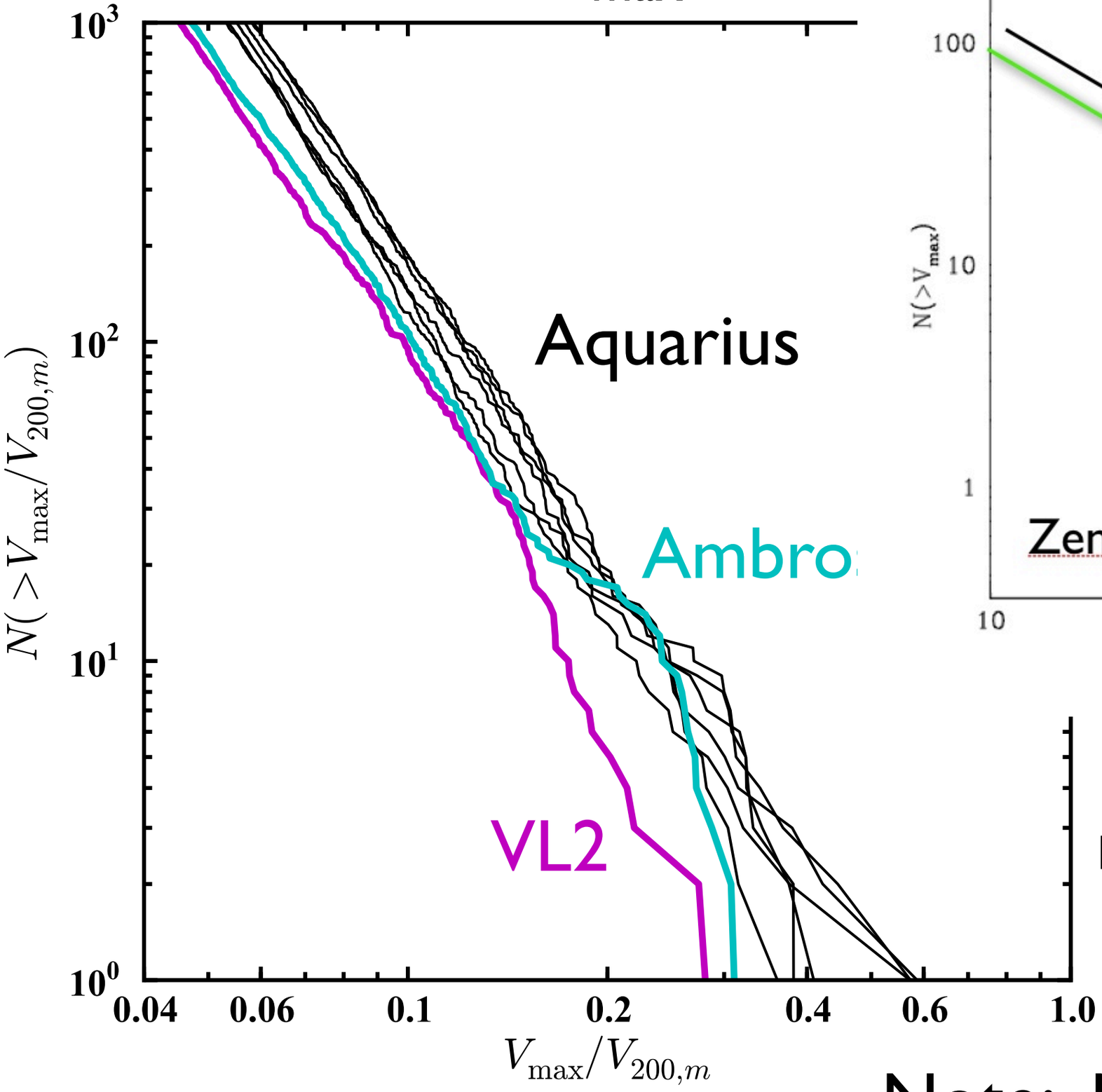
Note: No LMC or SMC in this halo

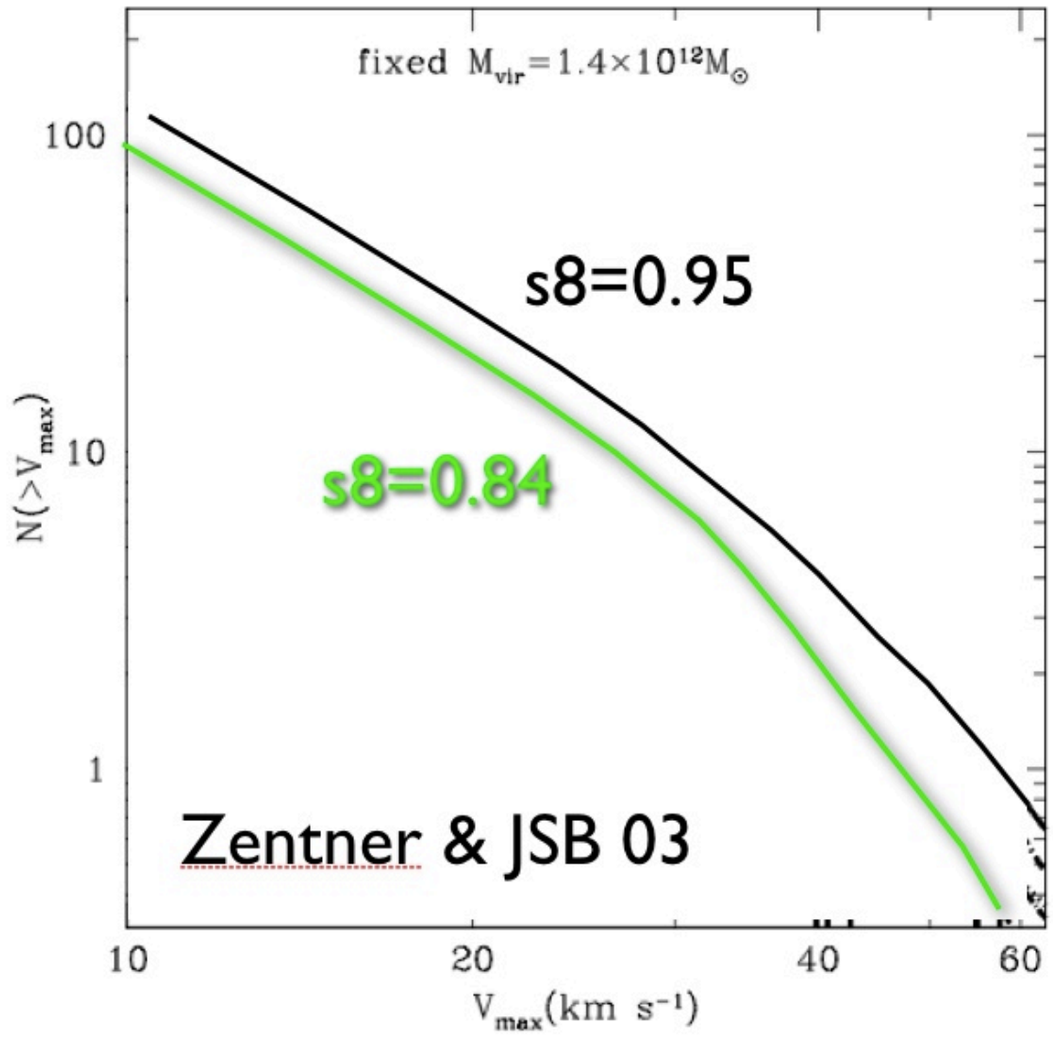


Subhalo distribution: comparison between Ambrosia, Aquarius, and VL2 is consistent

Note: No LMC or SMC in this halo

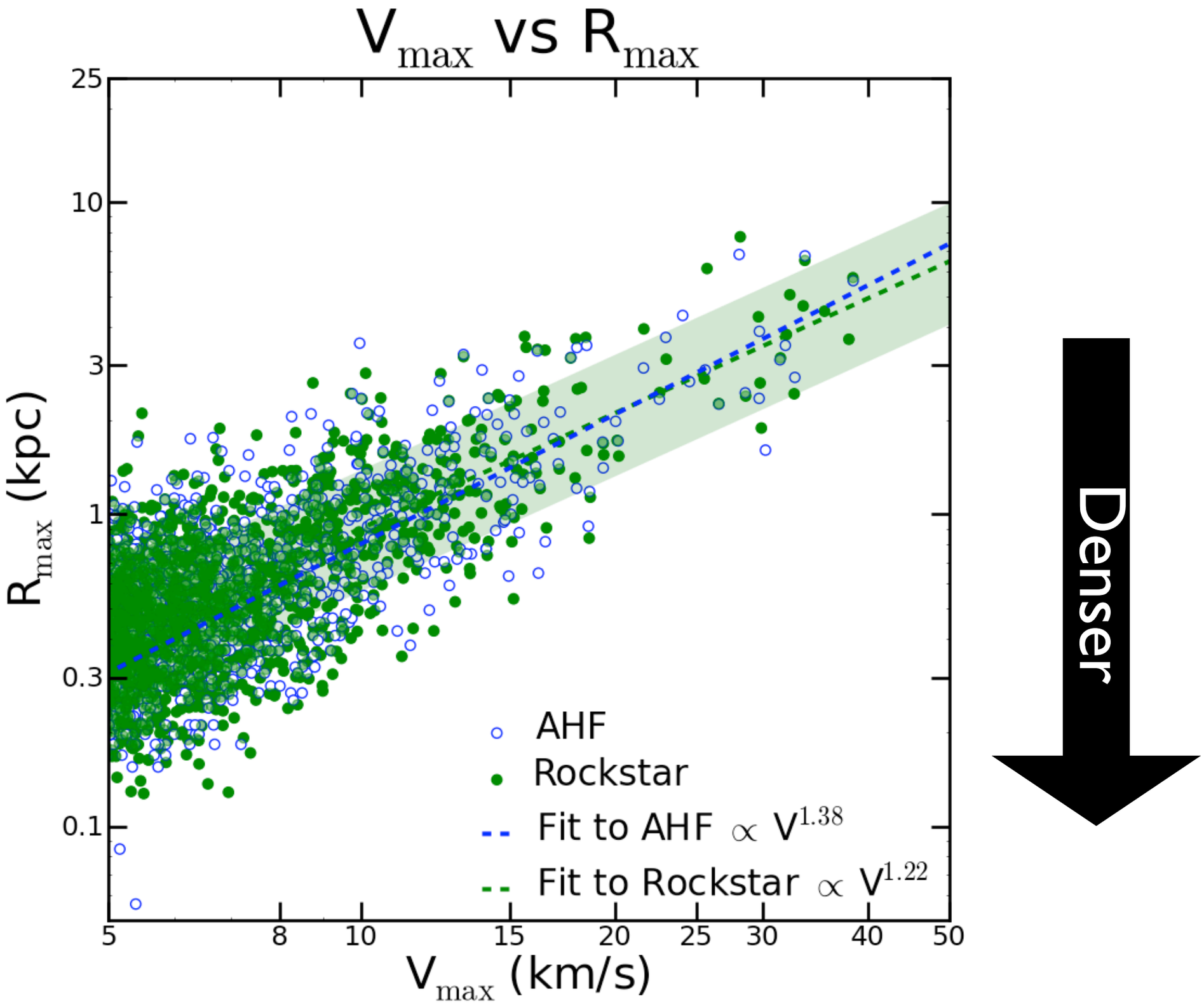
Subhalo V_{max} Func



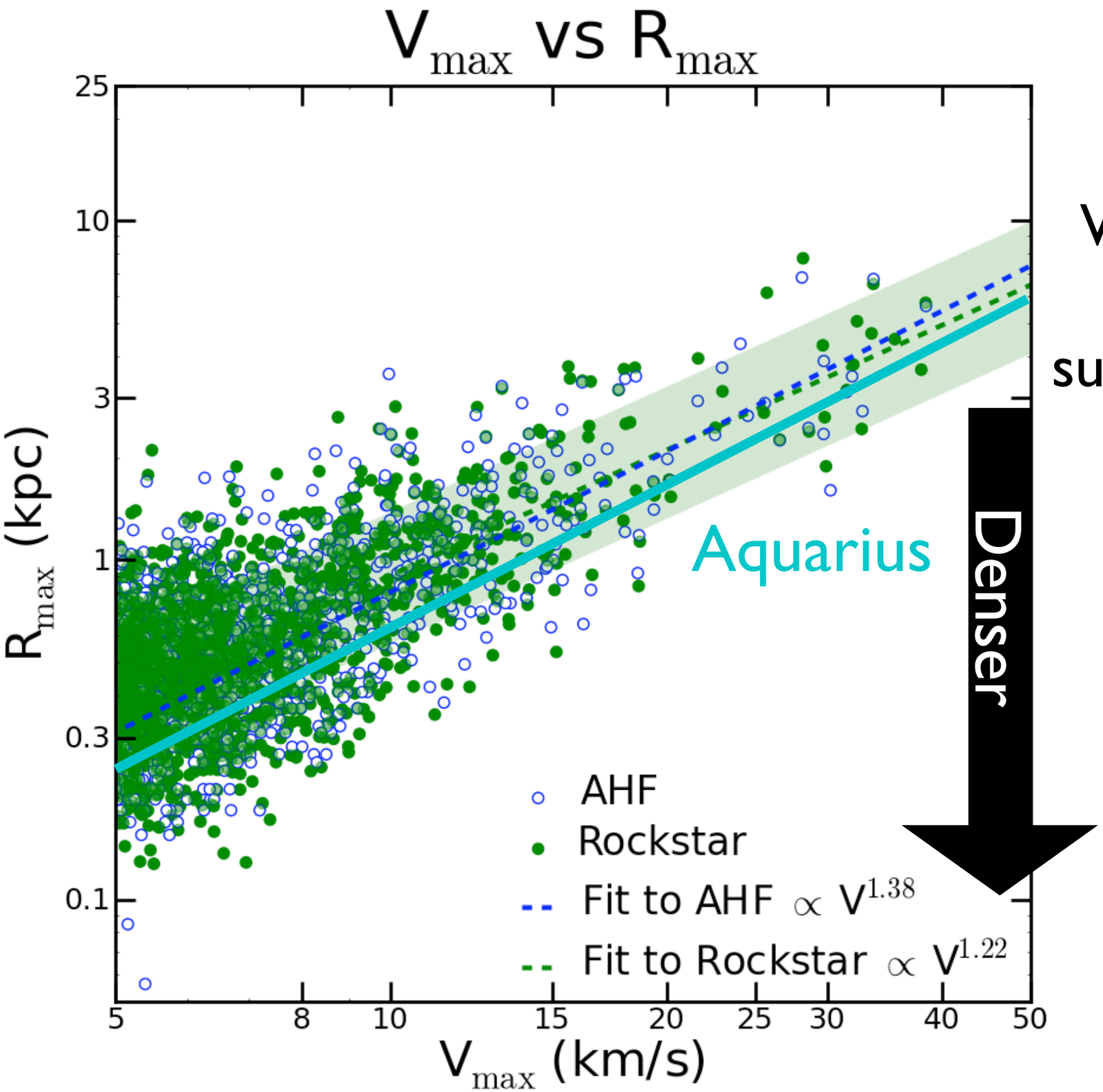


Difference in normalization likely due to σ_8

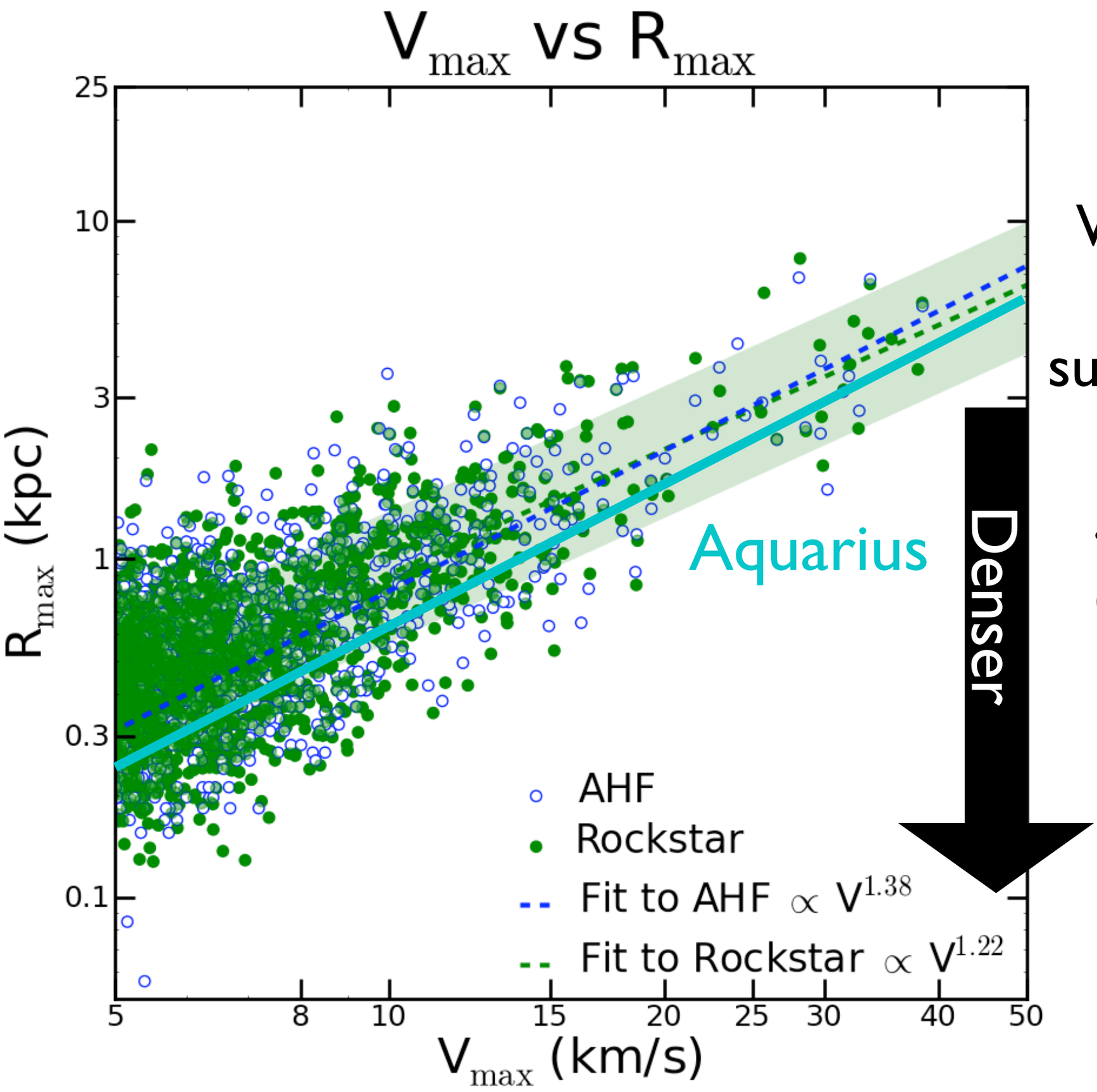
Note: No LMC or SMC in this halo



Two halo finders give consistent results for subhalo structure, but differences provide some sense of the inherent uncertainty



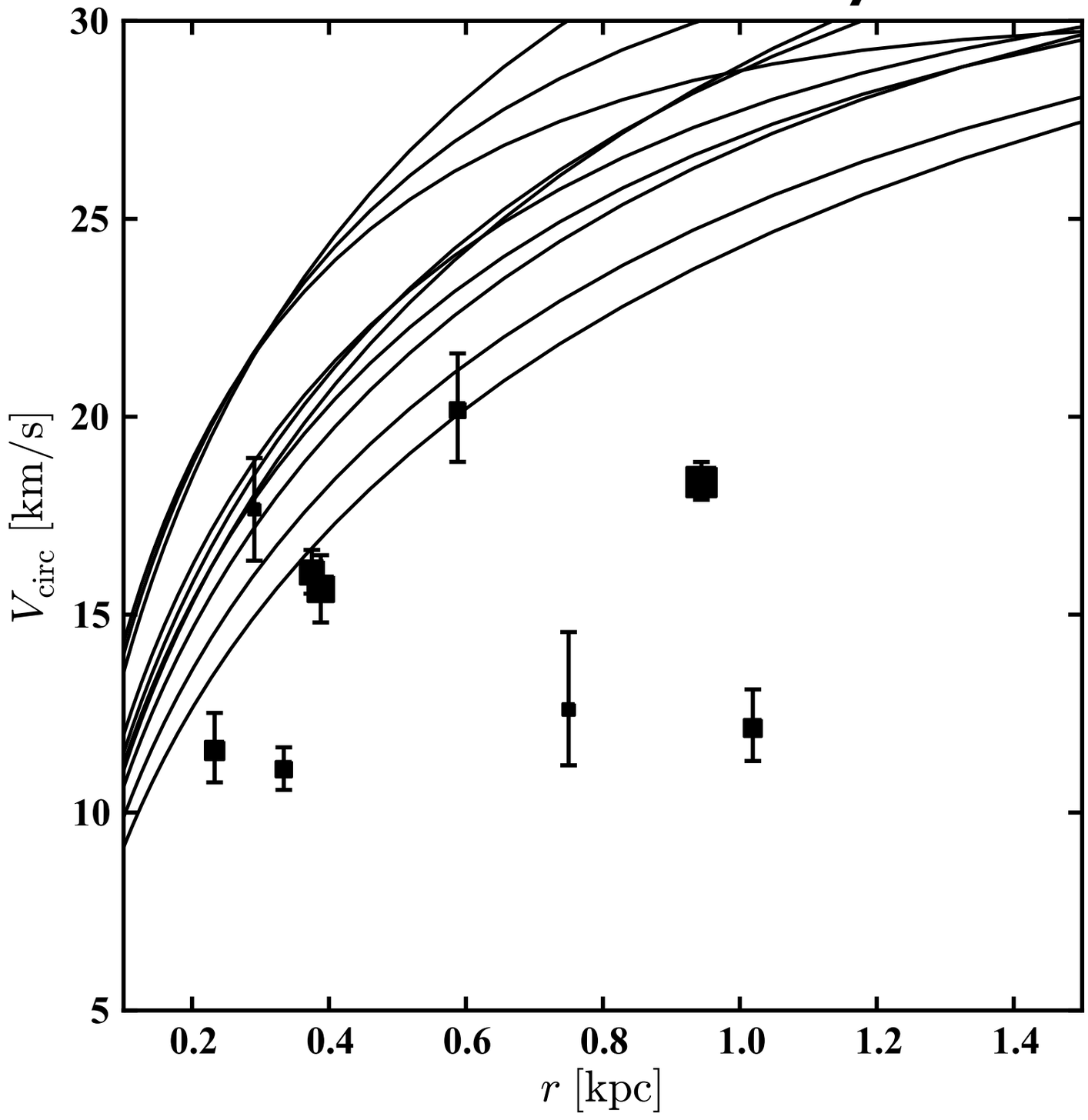
WMAP-7's lower σ_8 leads to less dense subhalos in Ambrosia...



WMAP-7's lower σ_8 leads to less dense subhalos in Ambrosia...

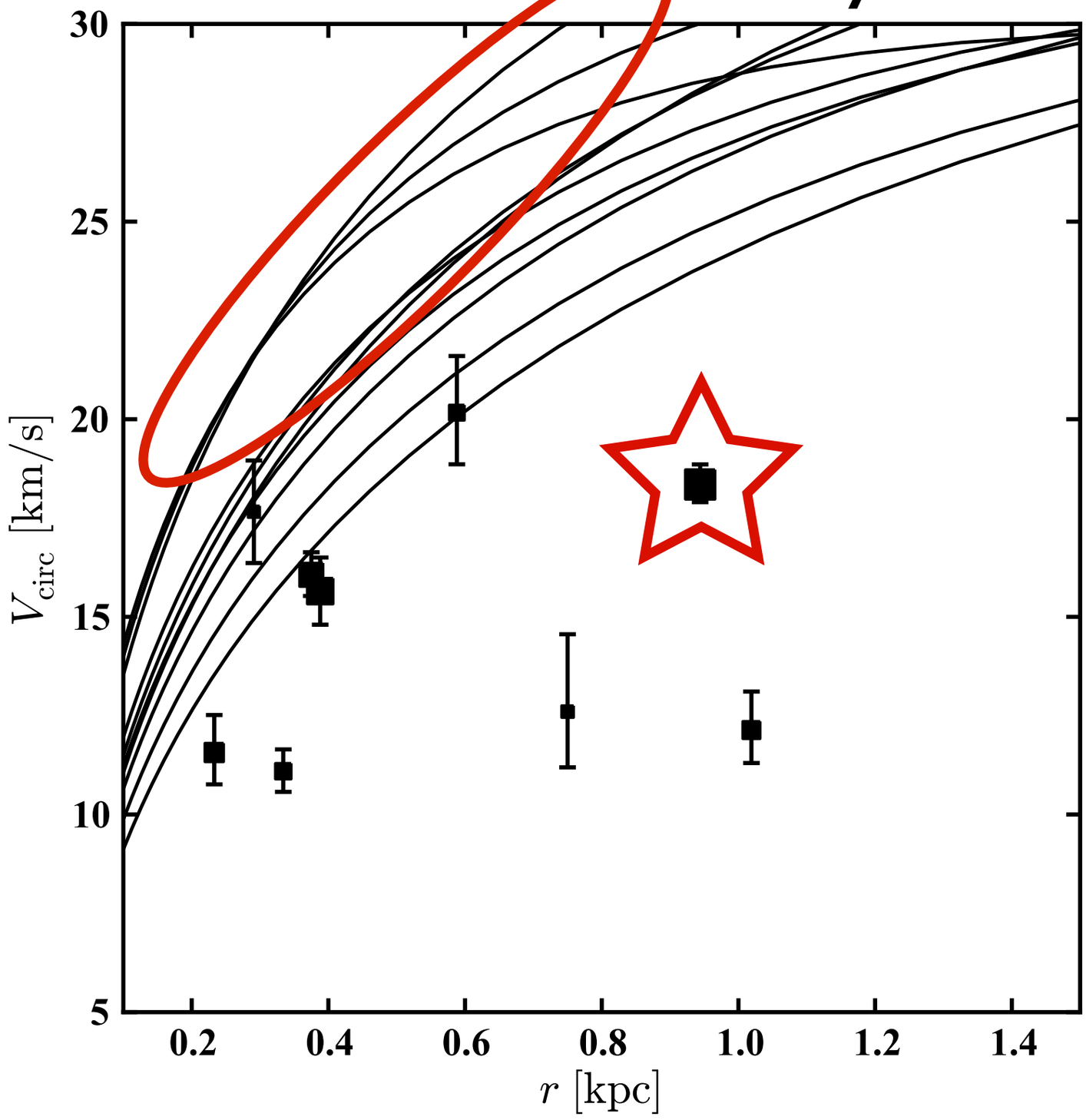
...but are they low enough density to solve the massive failures problem?

Subhalo Circular Velocity Profiles



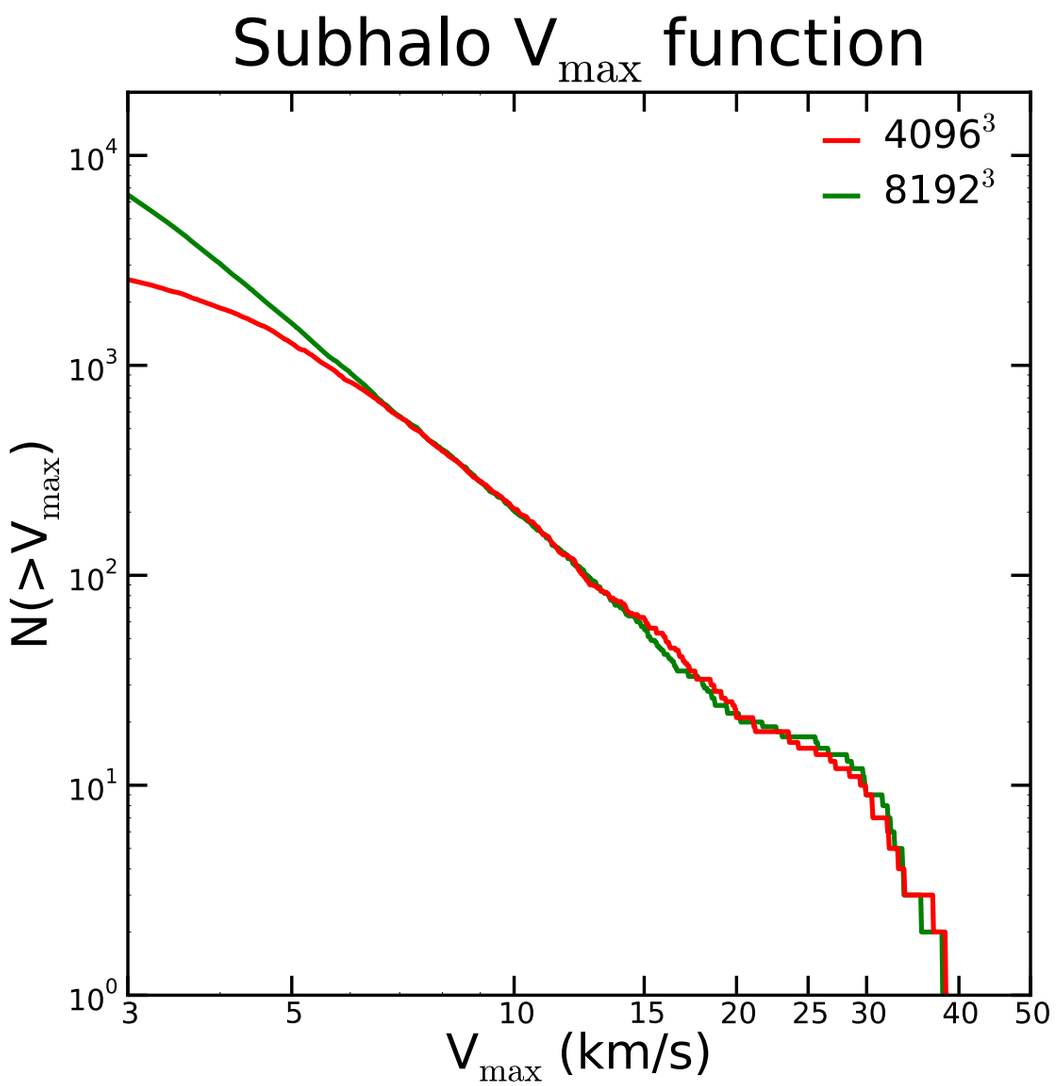
Ambrosia's ten highest V_{max} subhalos are still too dense (in the WMAP-7 cosmology) to host nearly all of the bright dSphs

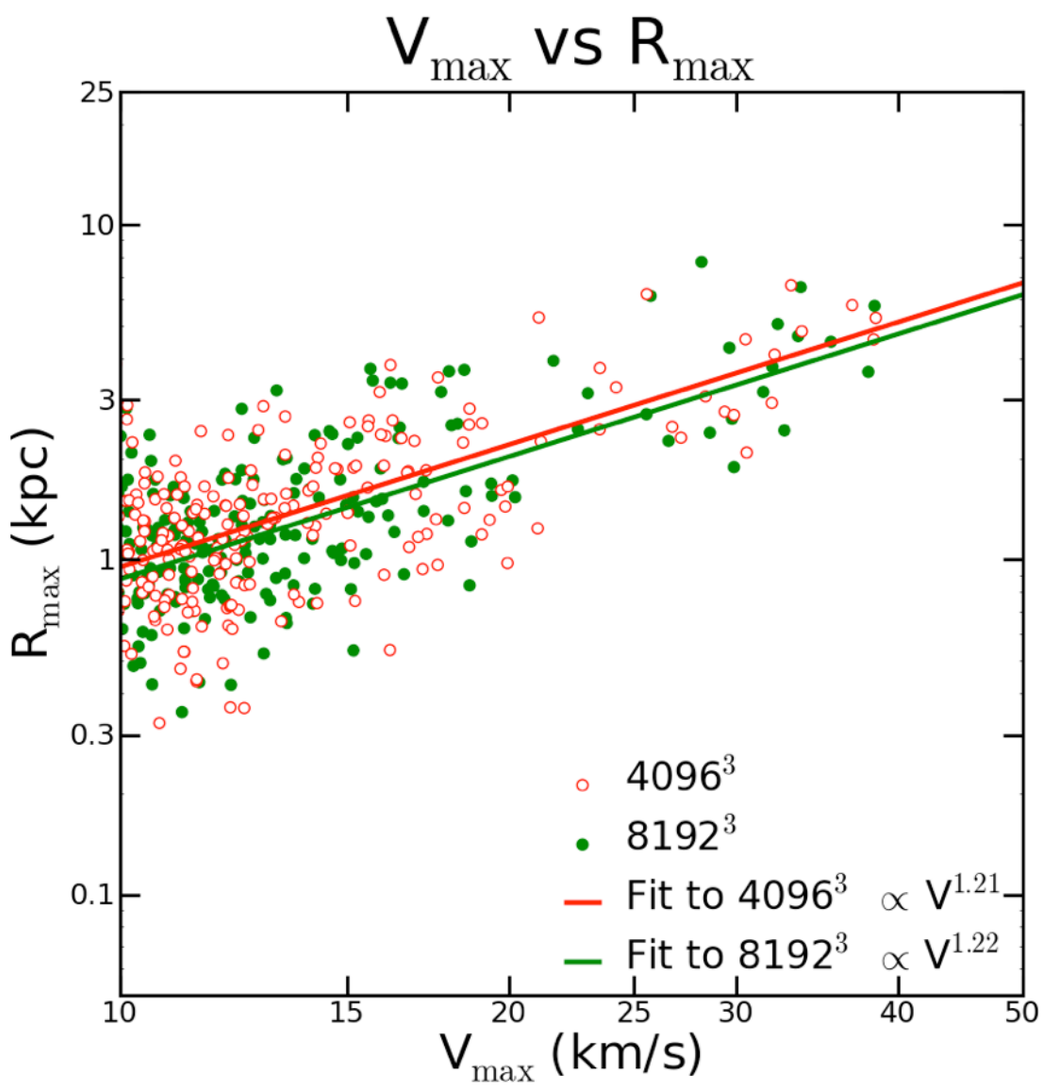
Subhalo Circular Velocity Profiles



Ambrosia's ten highest V_{max} subhalos are still too dense (in the WMAP-7 cosmology) to host nearly all of the bright dSphs

Resolution Convergence





	4096^3	8192^3
$M_{particle}$:	1.88e5 $M_\odot$	2.35e4 $M_\odot$
Softening:	140 pc	70 pc
CPU hours:	17,000	230,000

Milky Way dSphs have $V_{max} \gtrsim 10$

Well resolved with $M_p \sim 10^5 M_\odot$

CONCLUSIONS

WMAP-7 cosmology results in less dense subhalos relative to Aquarius

but

The massive failures problem persists in both cosmologies

Particle mass of at least 10^5 is necessary to resolve the inner structure of subhalos that could host Milky Way dwarfs