CIFAR G+EU meeting
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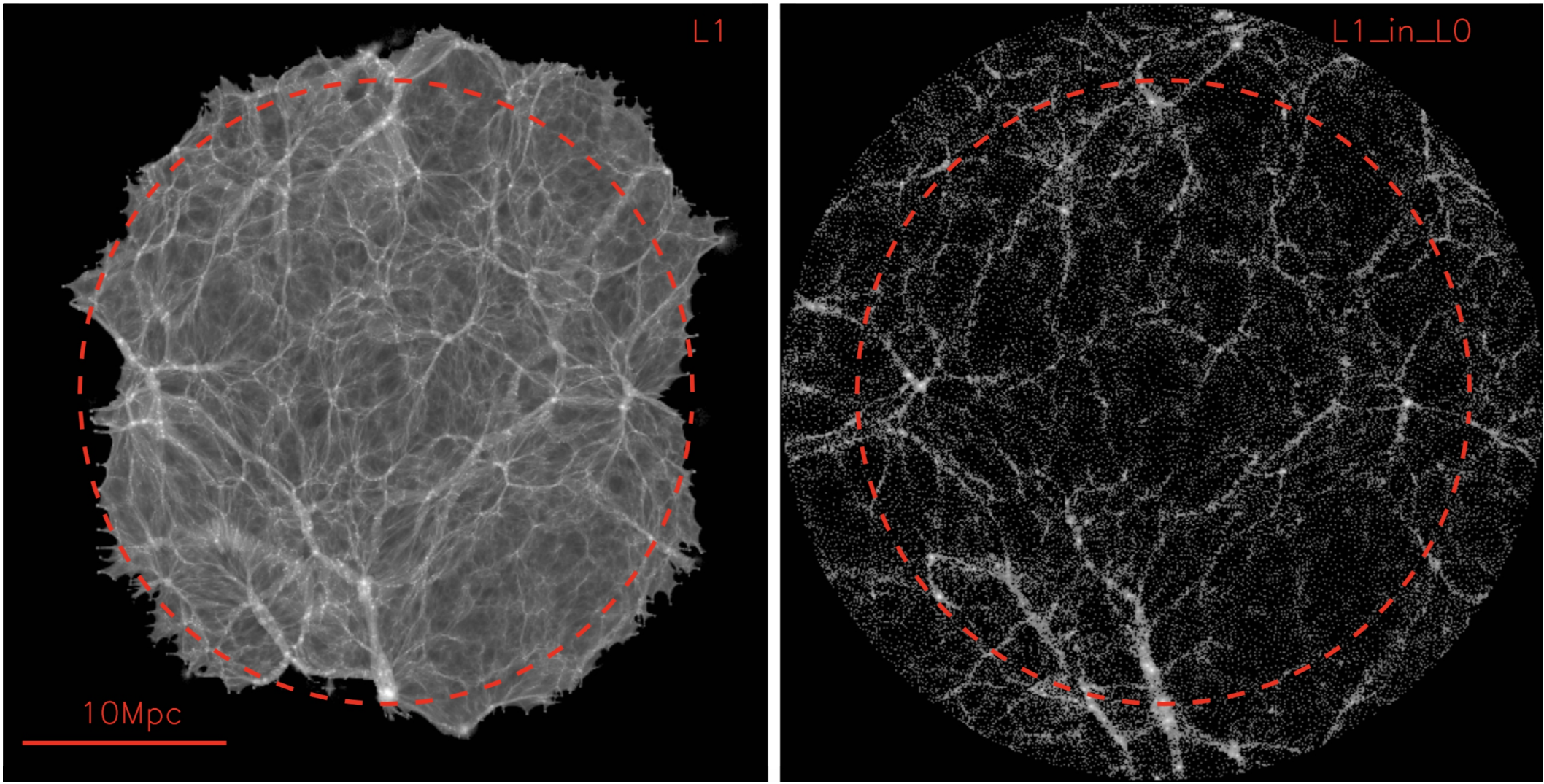
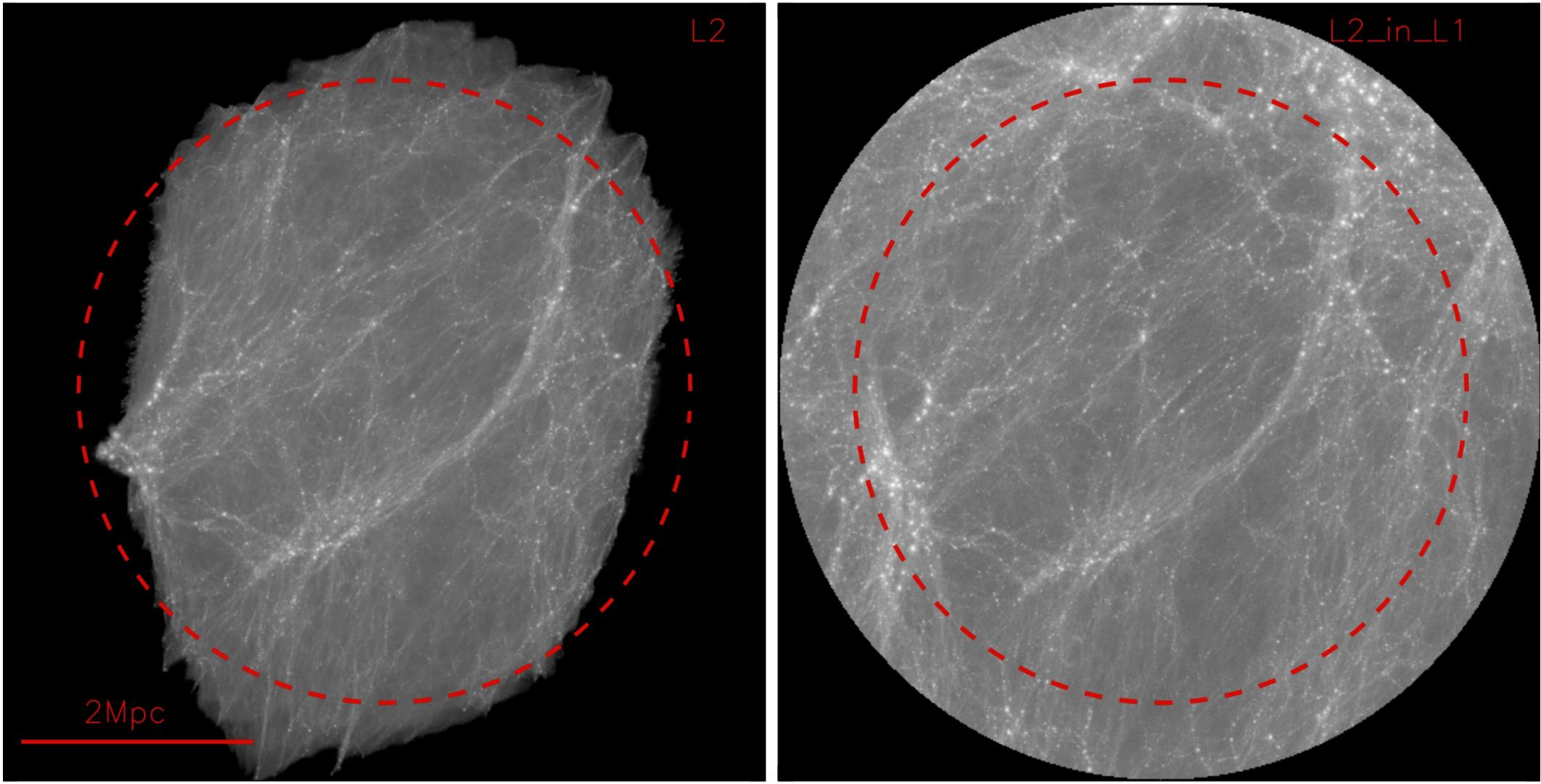
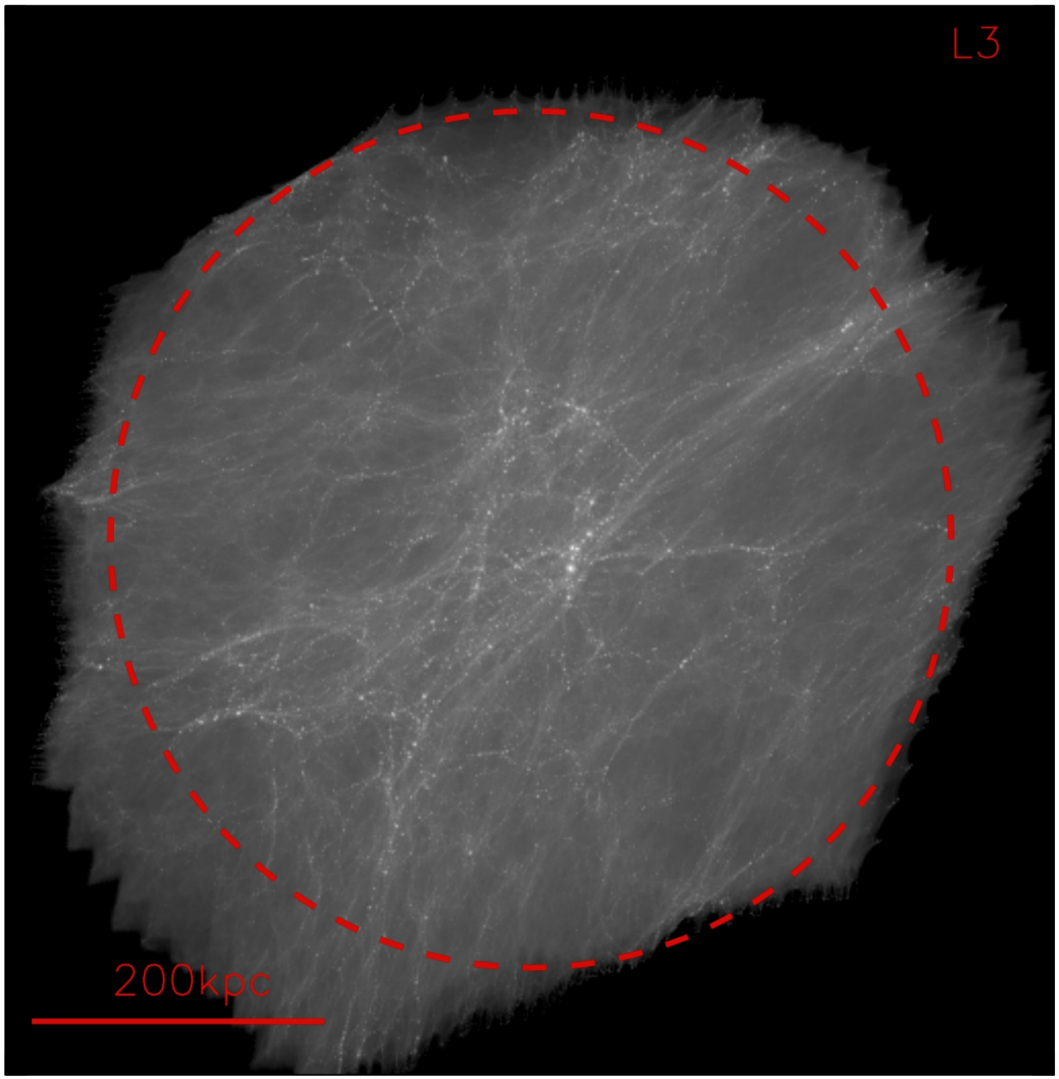
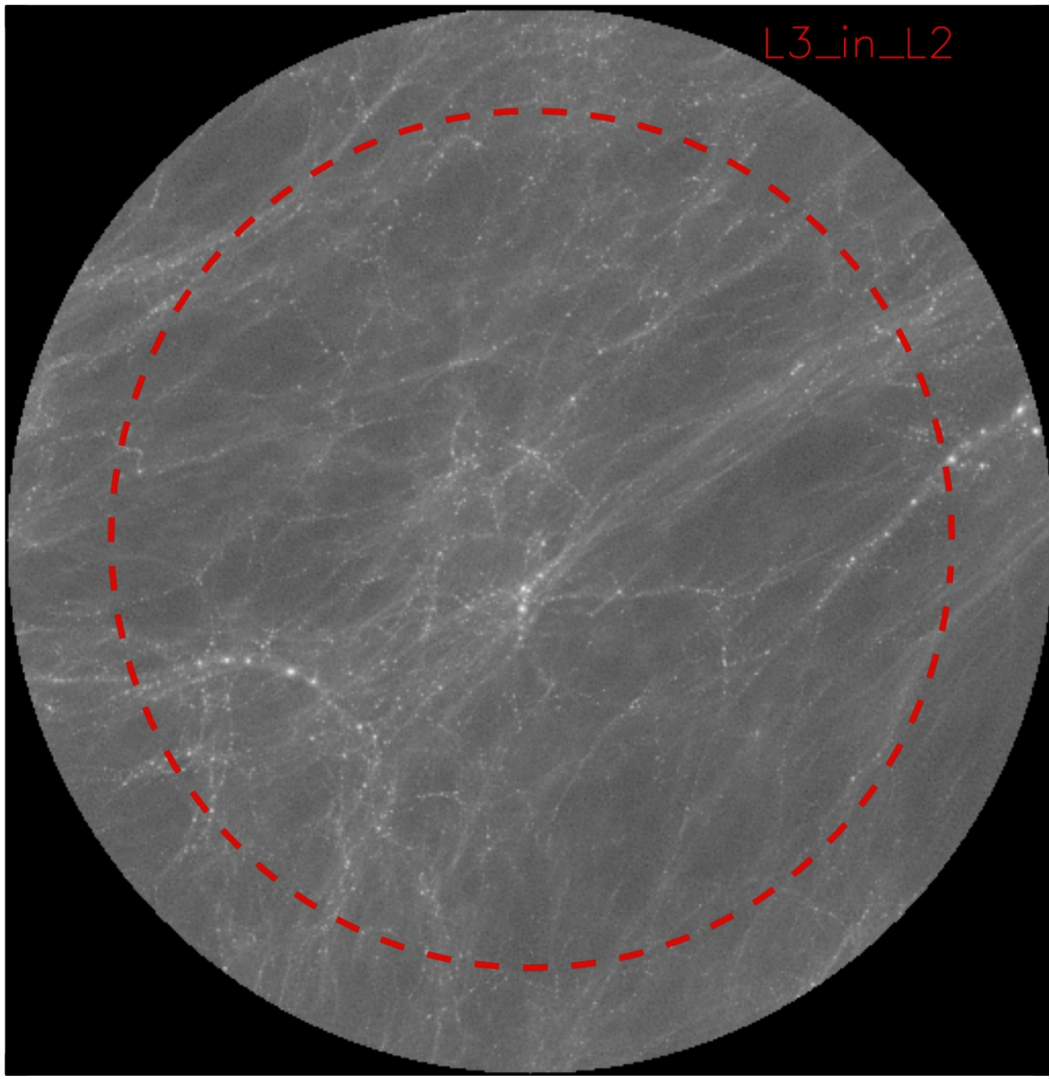
Dark matter halo profiles over 20 orders of magnitude in halo mass

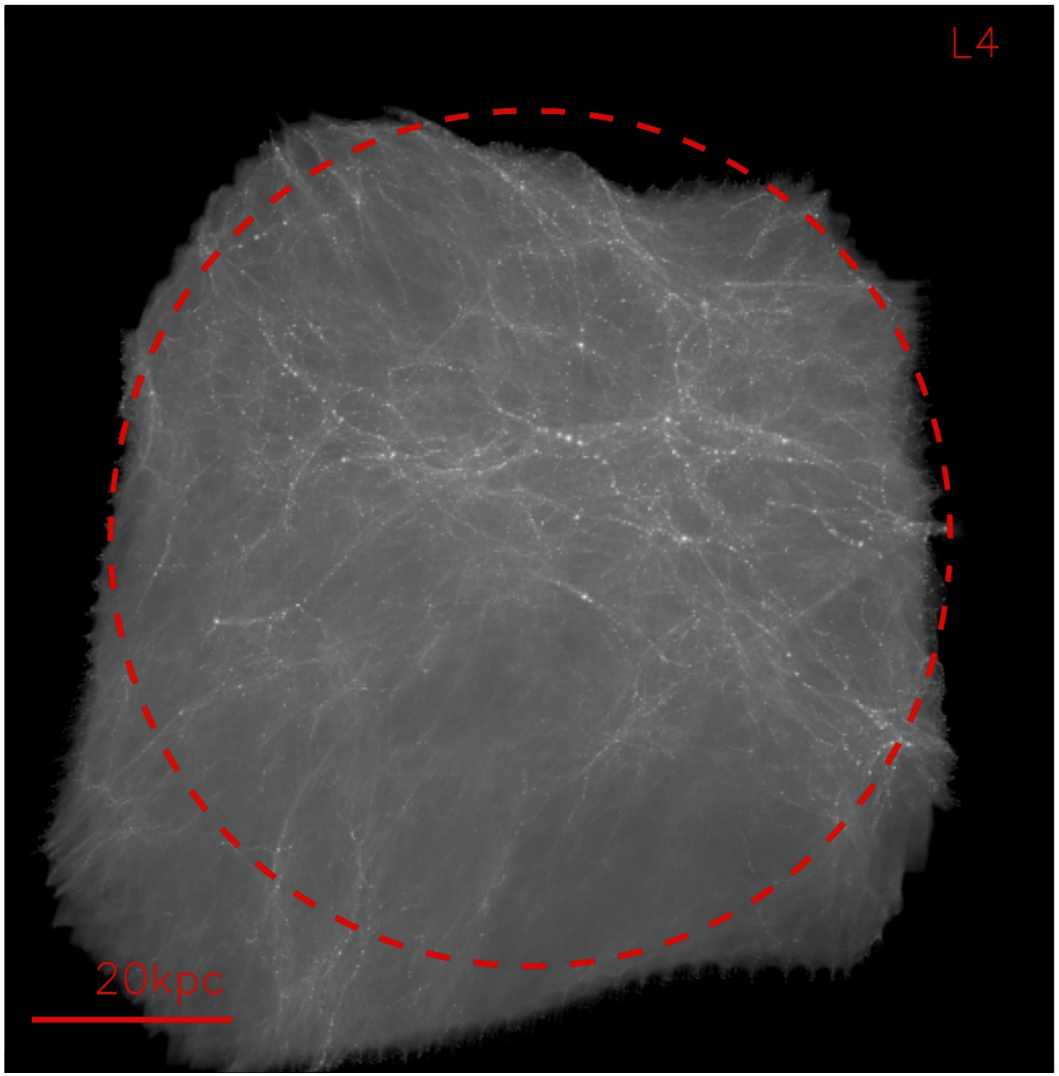
Simon White
Max Planck Institute for Astrophysics

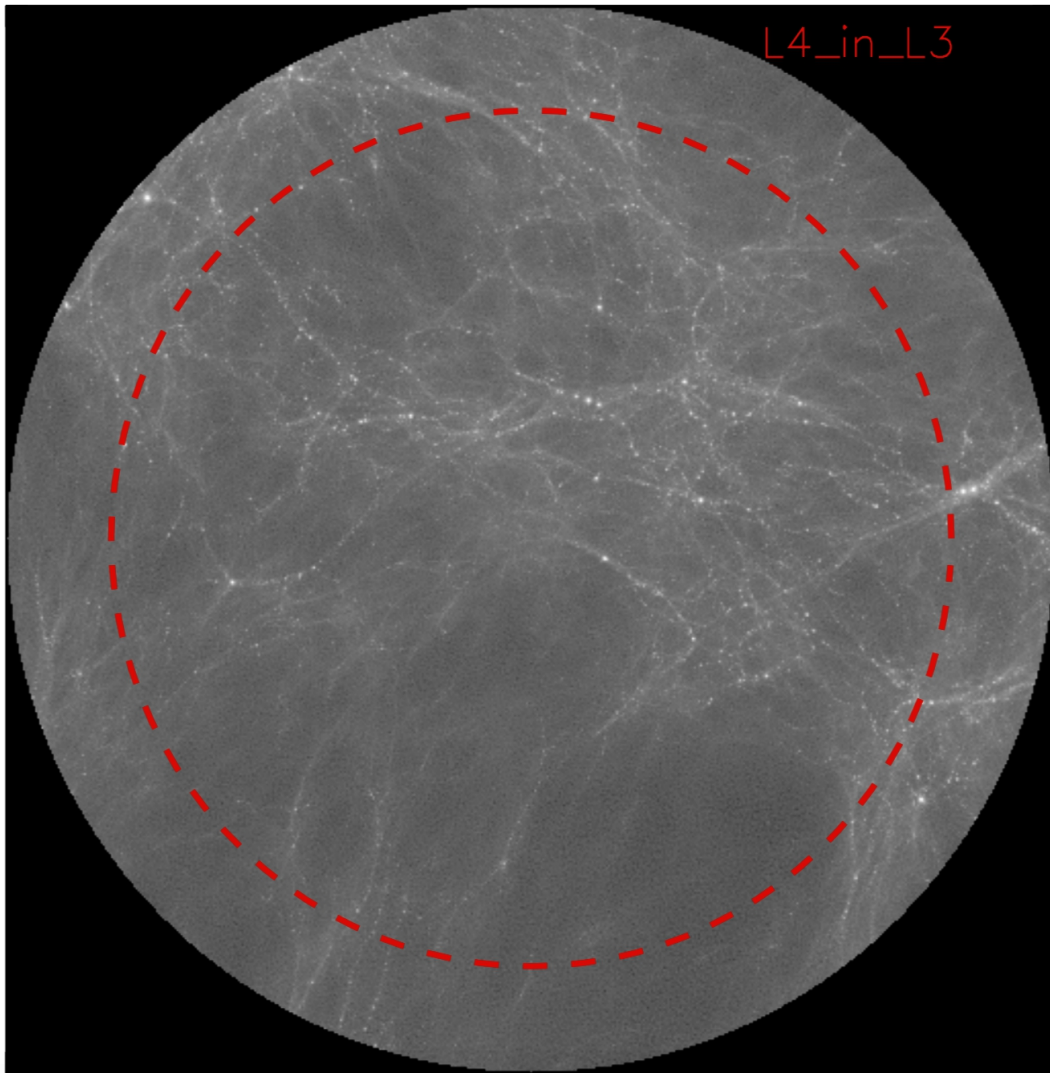

L1
10Mpc
L1_in_L0

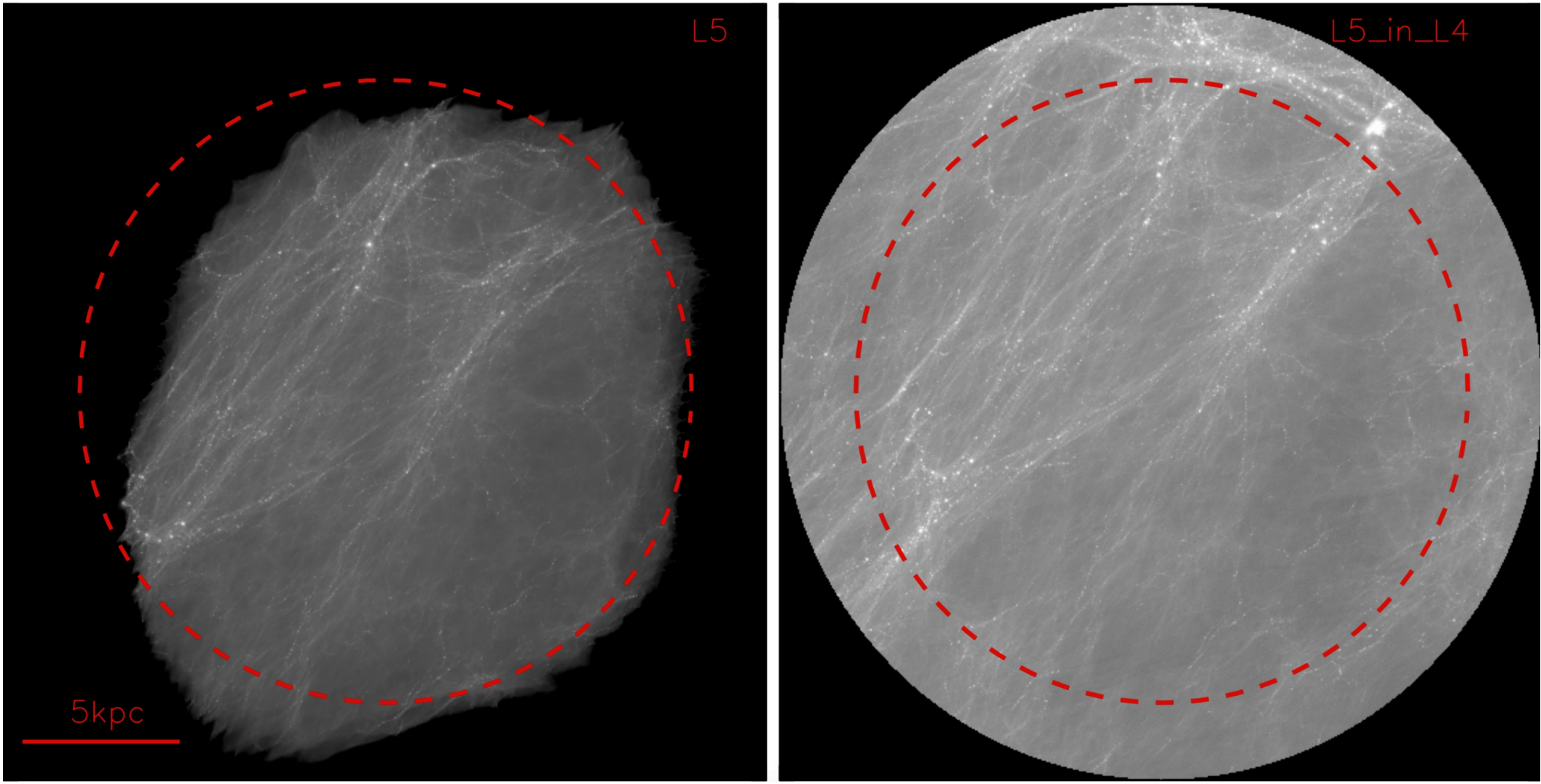

L2
2Mpc
L2_in_L1

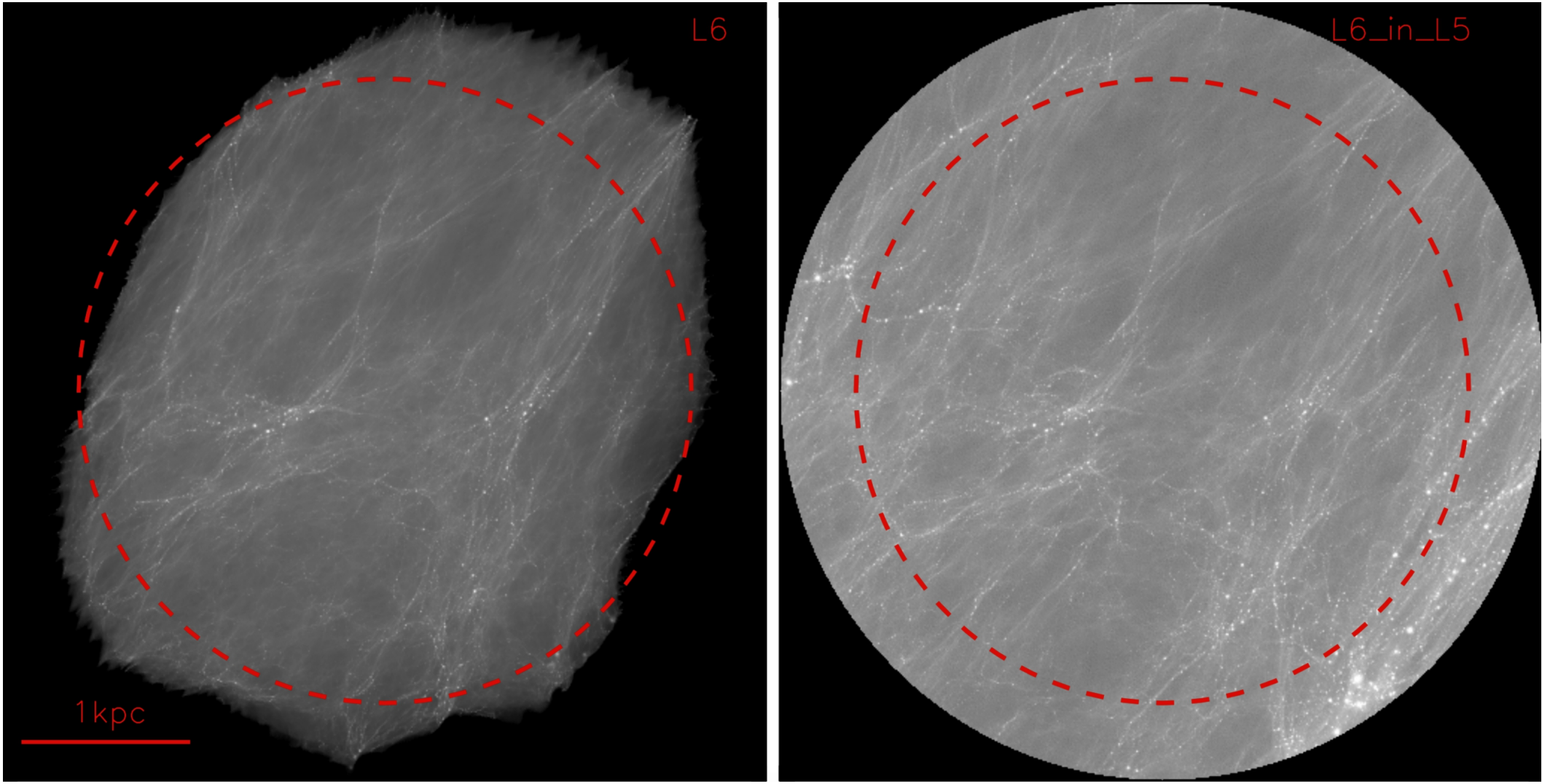

L3
200kpc

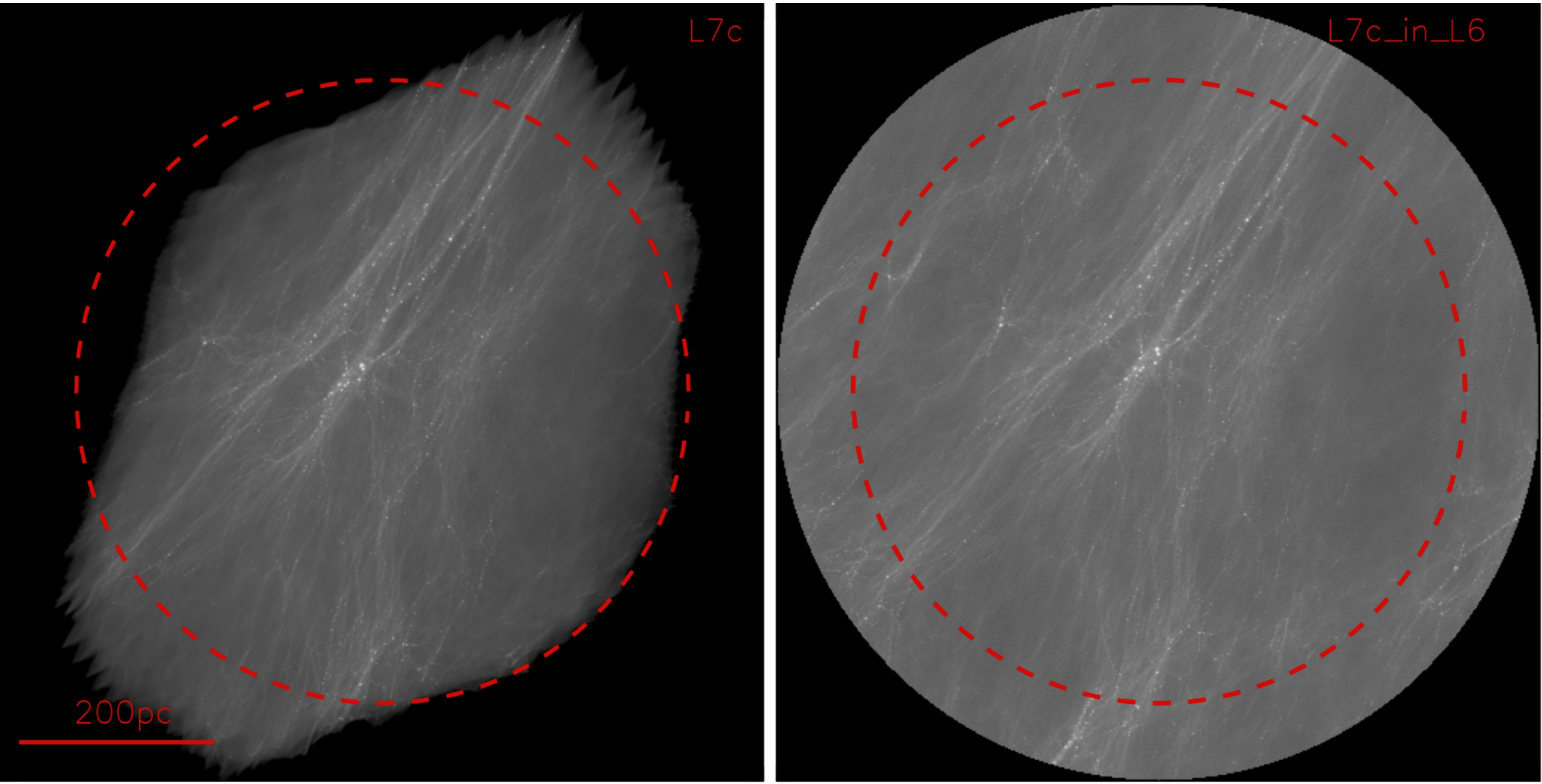

L3_in_L2

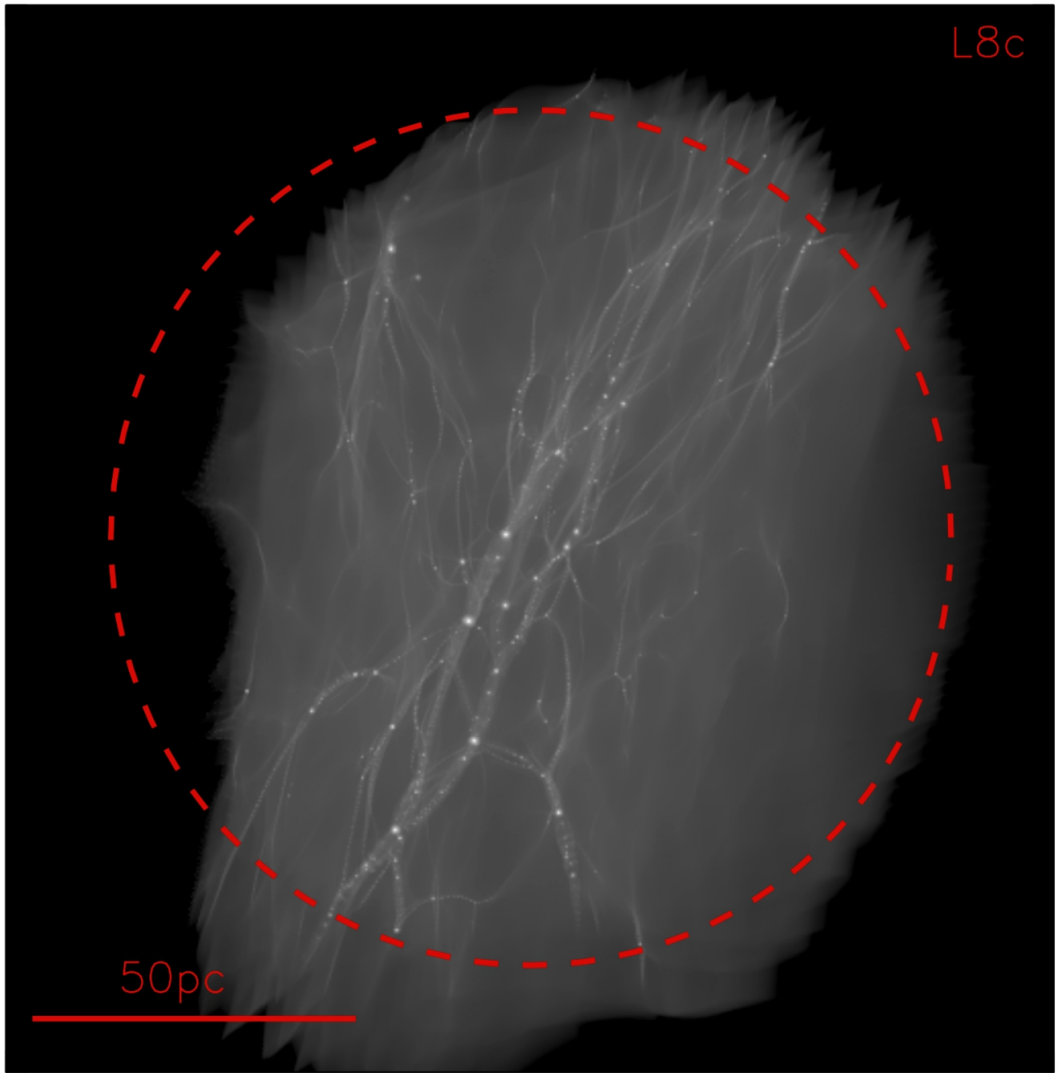

L4
20kpc

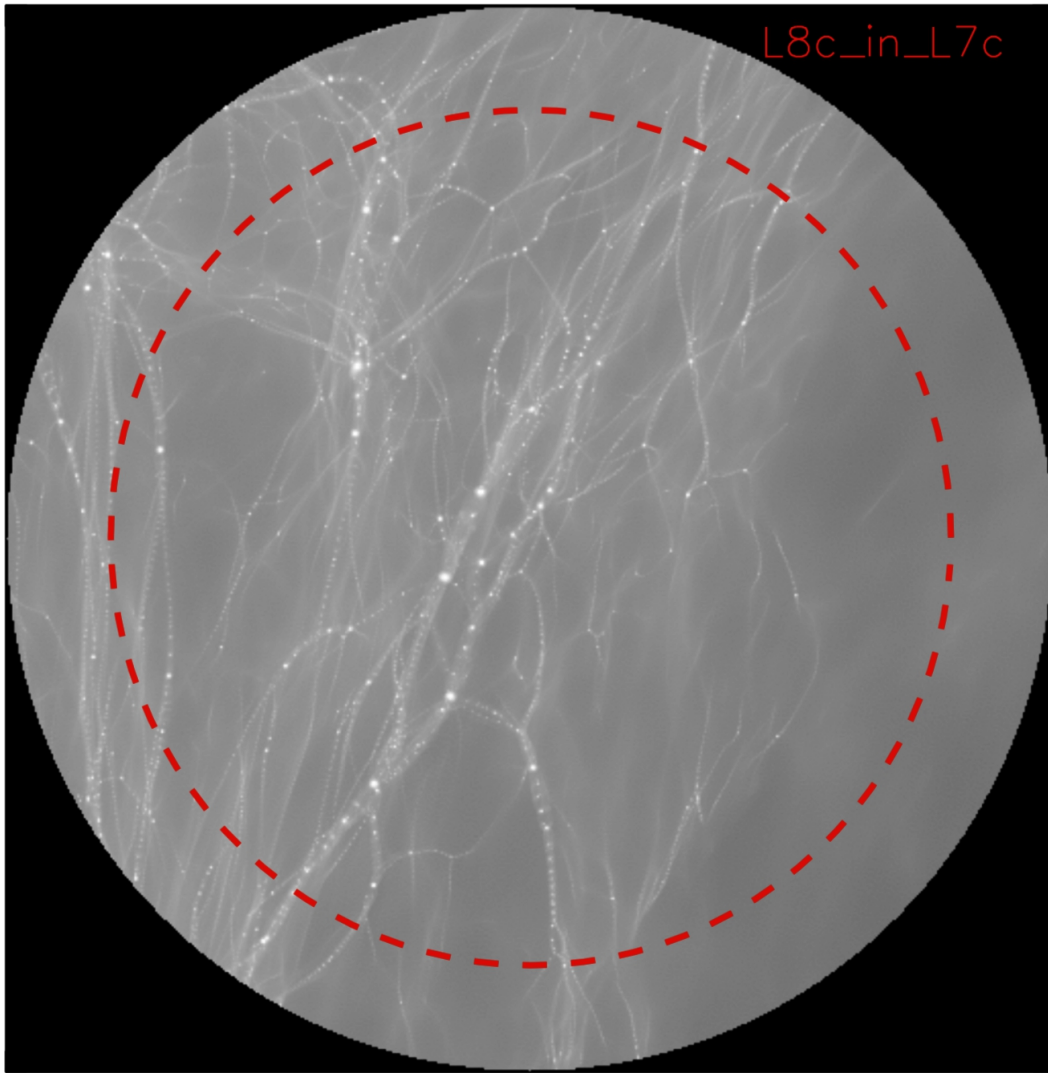

L4_in_L3


L5
5kpc
L5_in_L4


L6
1kpc
L6_in_L5


L7c
200pc
L7c_in_L6


L8c
50pc

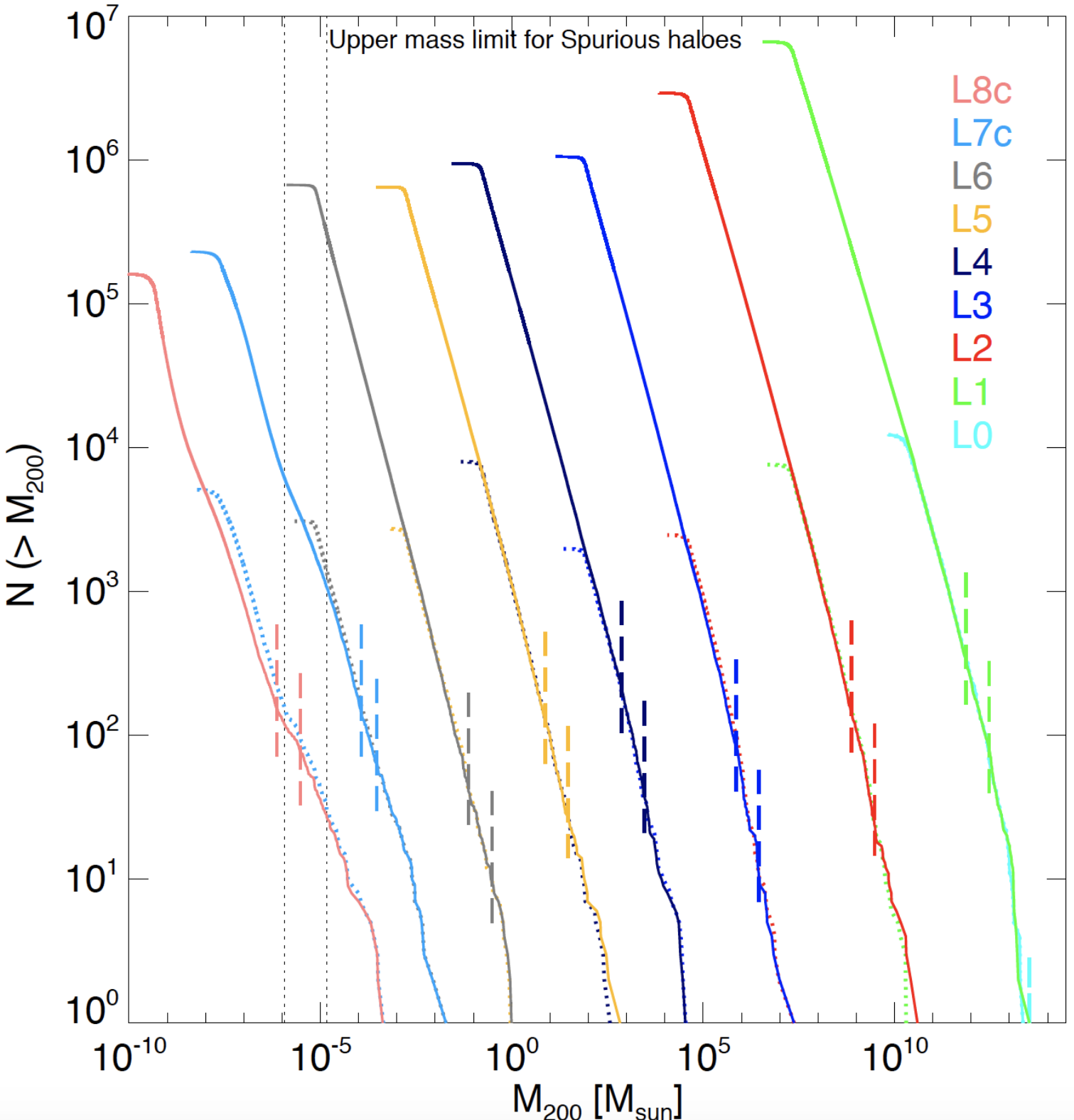

L8c_in_L7c

The main simulations of the VVV project

Sownak Bose, Carlos Frenk, Liang Gao, **Adrian Jenkins**, **Volker Springel**, **Jie Wang**, Simon White

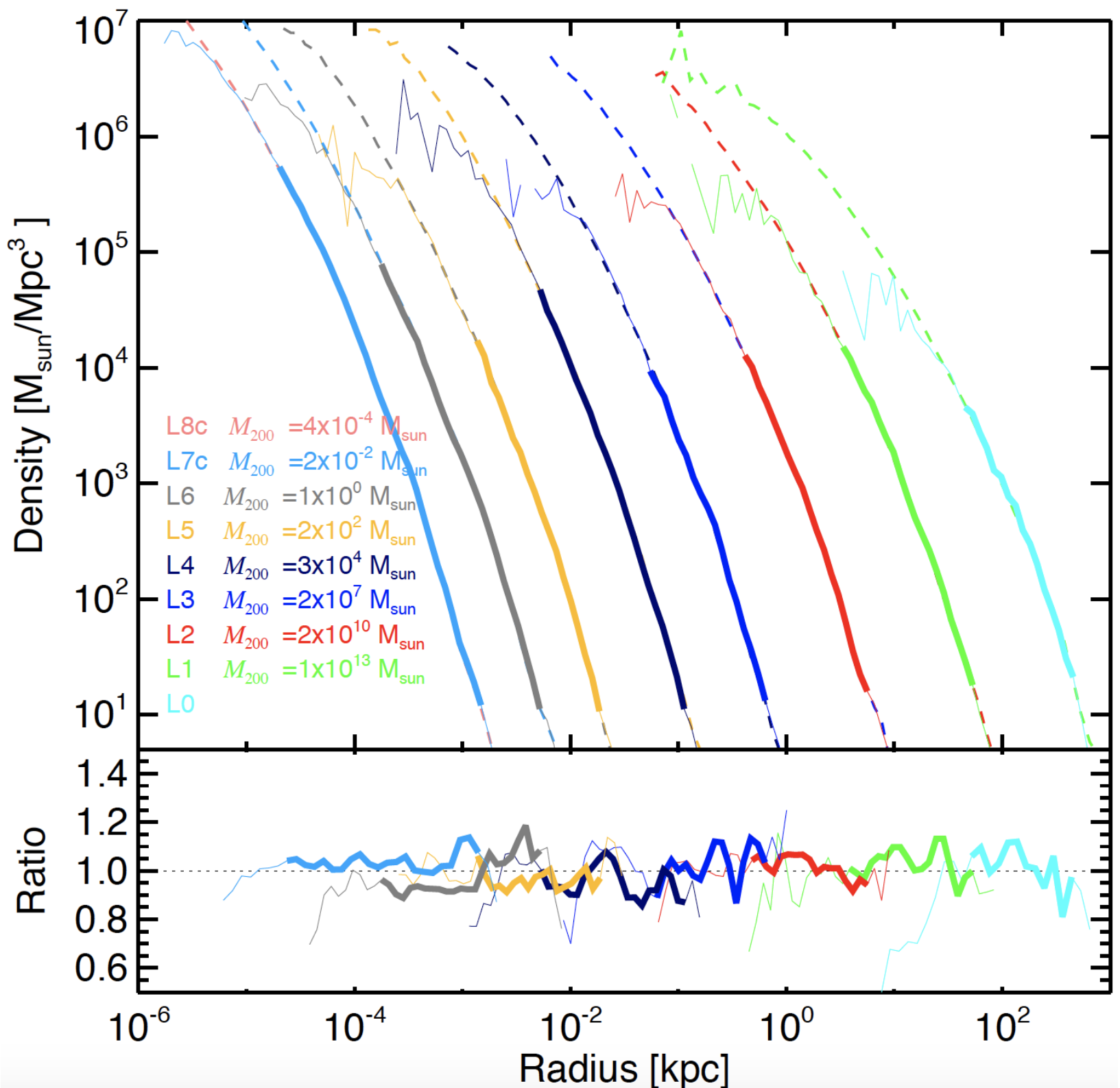
Dark matter only – IC's assume a 100 GeV thermal WIMP

run	$D_{\rm high}$[Mpc/h]	$n_{\rm p}$	ϵ[kpc/h]	$m_{\rm p}[M_\odot/h]$	ρ/ρ_{mean}
L0	500	1.0e10	5	9.3e8	1.
L1	35	1.0e10	3.e-1	5.0e5	0.2
L2	6	5.4e9	3.8e-2	9.8e2	0.07
L3	1.4	1.8e9	5.6e-3	1.9	0.04
L4	0.18	2.0e9	7.1e-4	3.7e-3	0.03
L5	0.03	1.5e9	1.5e-4	3.9e-5	0.02
L6	0.008	1.7e9	2.6e-5	1.8e-7	0.01
L7	0.0015	2.5e9	3.6e-6	5.8e-10	0.01
L7c	0.0015	2.5e9	3.6e-6	5.8e-10	0.01
L8c	0.00025	1.5e9	9.4e-7	1.1e-11	0.005



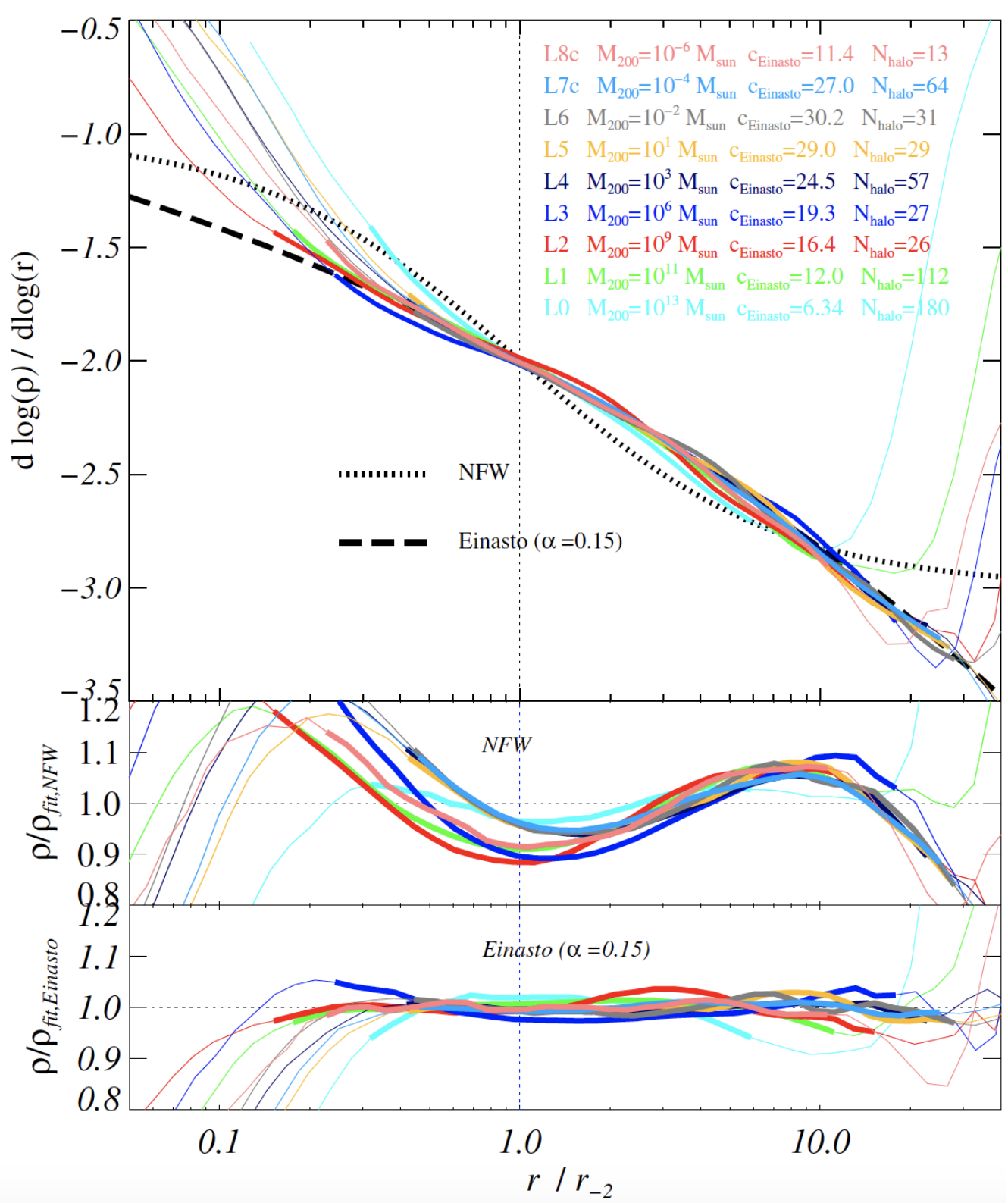
Convergence in halo abundance

The number of halos in the maximal spherical subregion of each simulation compared to that in the same region of its parent



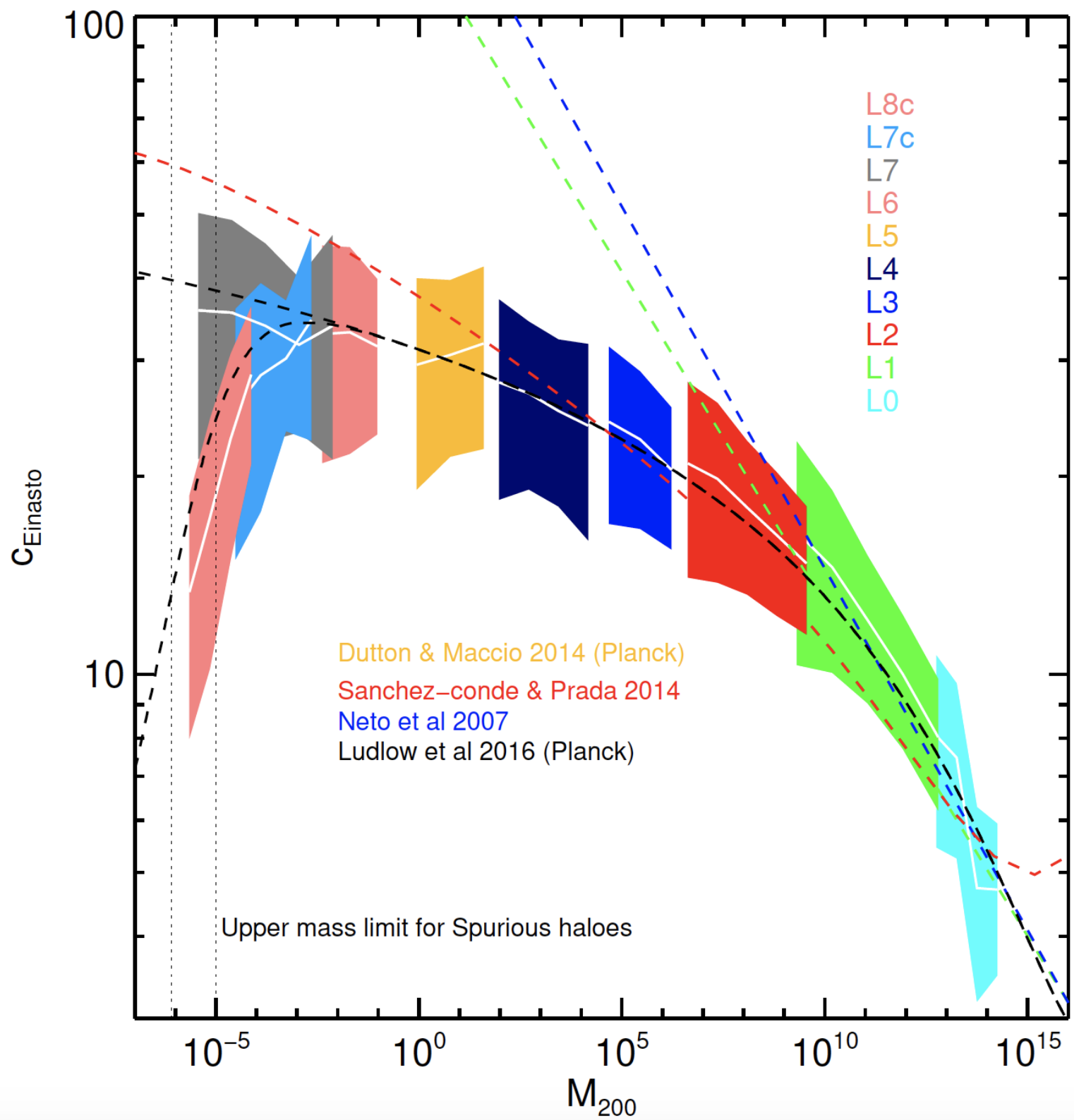
Convergence in halo profile

The density profile of one of the most massive halos in each simulation compared to that of the same halo in the parent simulation



Density profile shapes

Over 19 orders of magnitude in halo mass and 4 orders of magnitude in halo density, the mean density profiles of halos are fit by NFW to within 20% and by Einasto with $\alpha = 0.15$ to within 7%

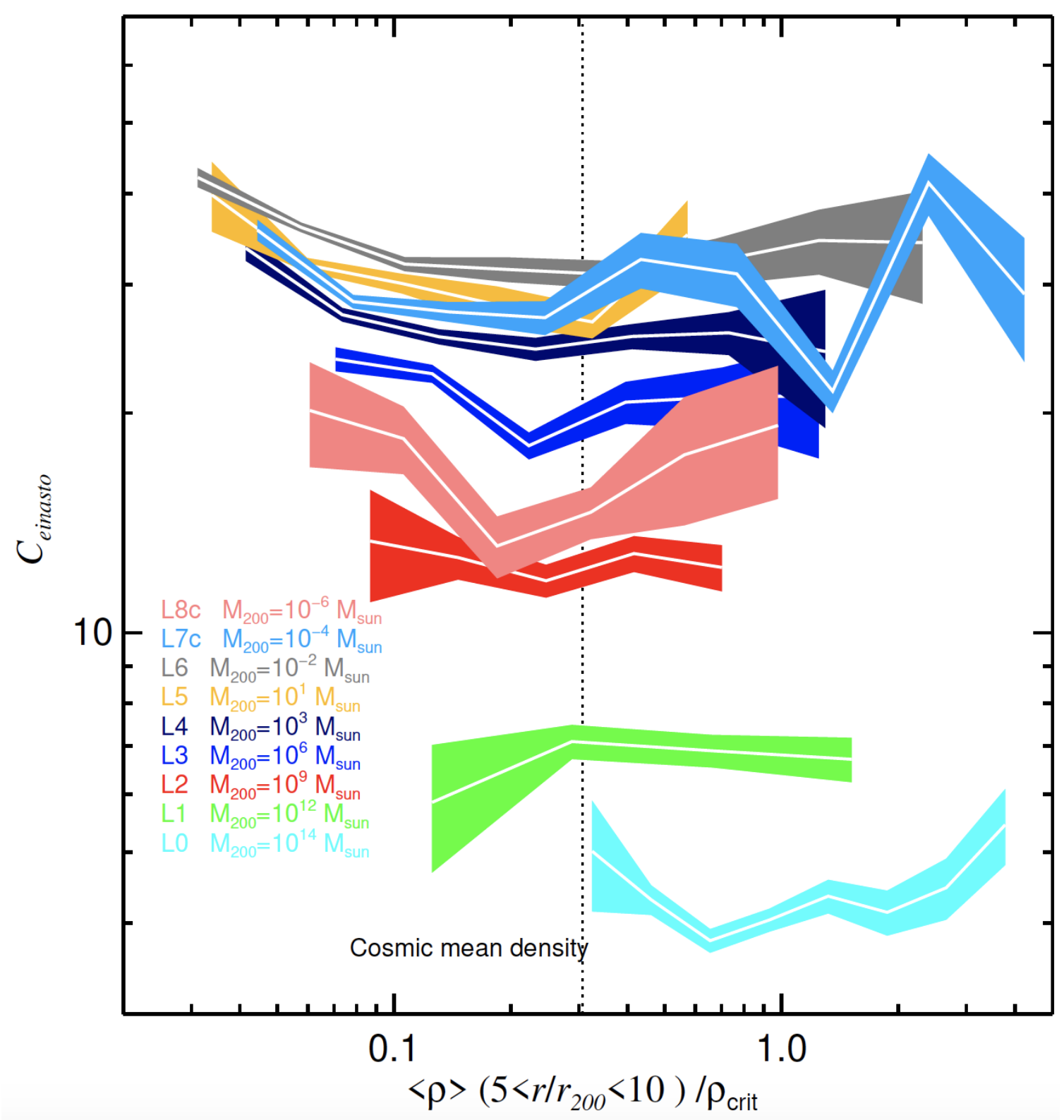


Concentration-mass relation

Over the full 20 orders of magnitude probed, the relation of Ludlow et al (2016) is followed precisely.

There is a turndown at 1000 Earth masses due to the free-streaming limit.

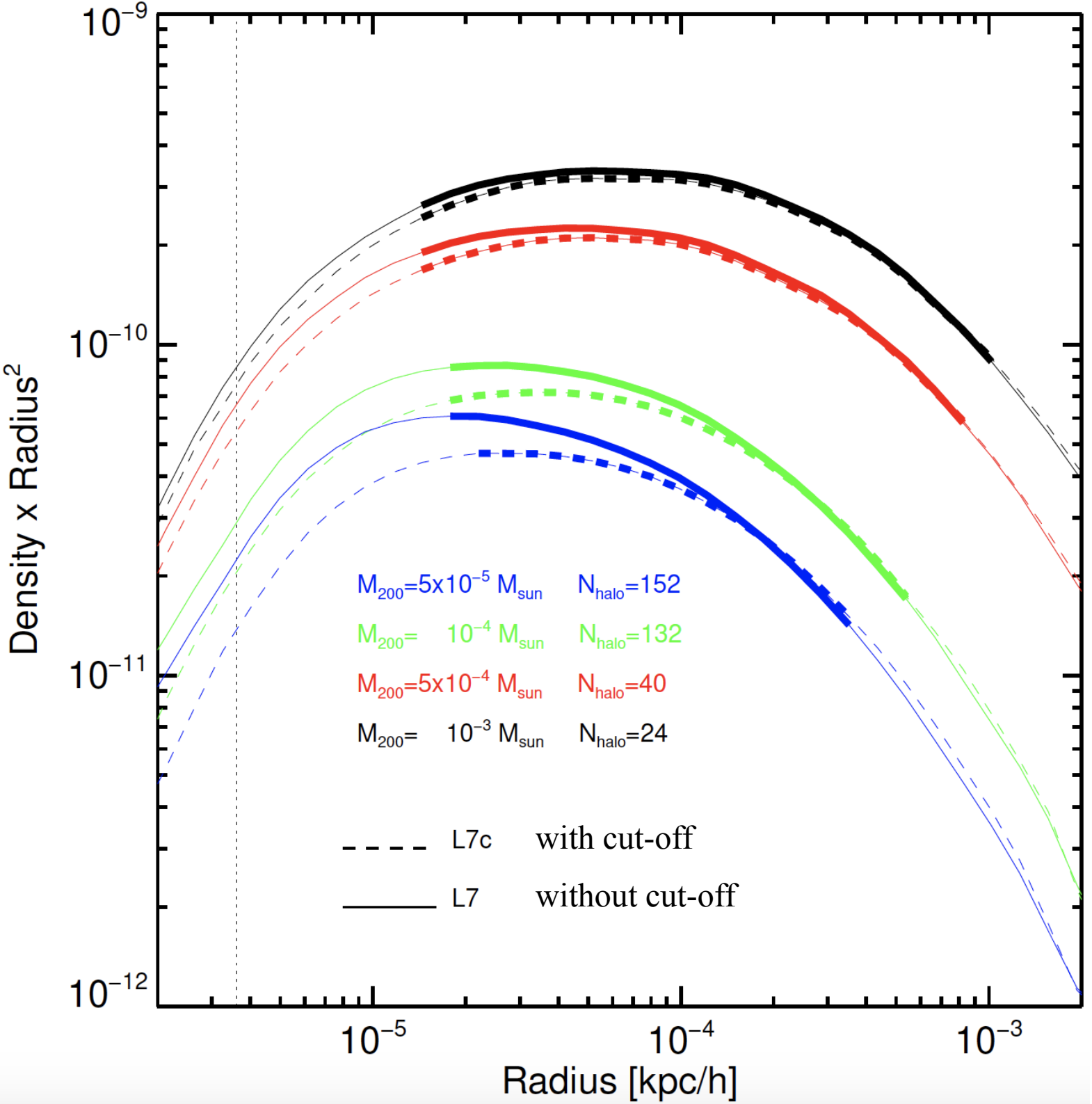
The scatter does not depend strongly on halo mass.



Concentration-density relation

At given halo mass, concentration does not depend on *local* environment density.

The *range* of local environment density does not depend strongly on halo mass



Free-streaming effects on halo density profiles

The concentration of halos near the cut-off mass is reduced by free-streaming