Preliminary result

Realistic Sub-halo mass function

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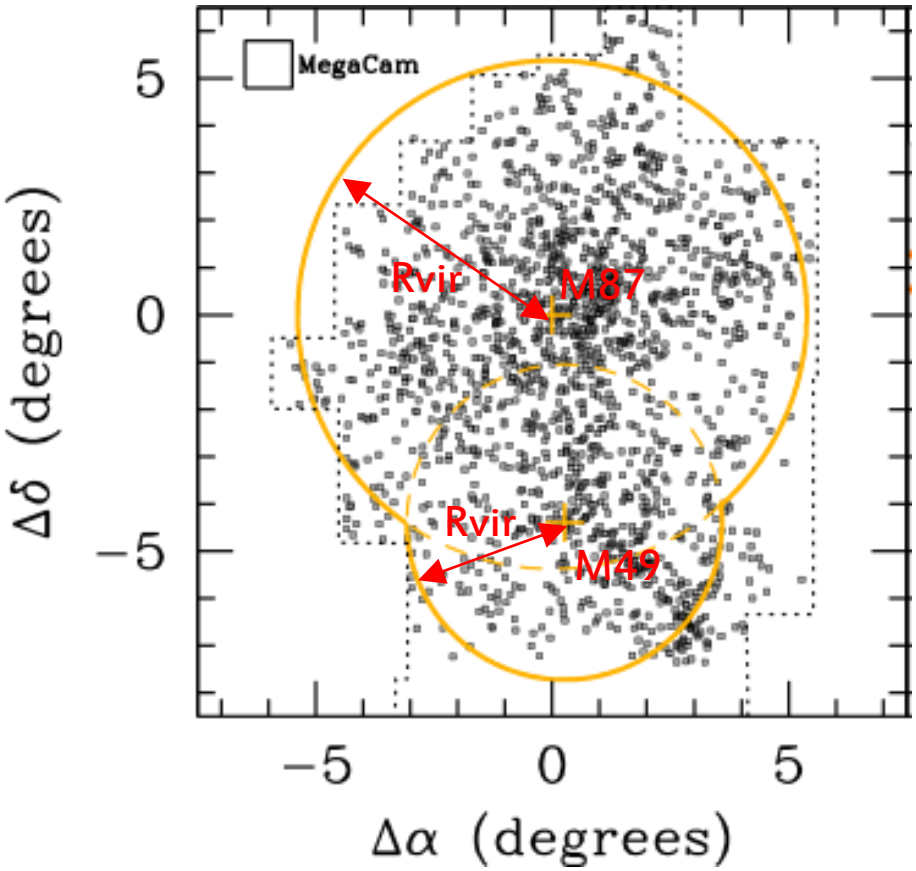
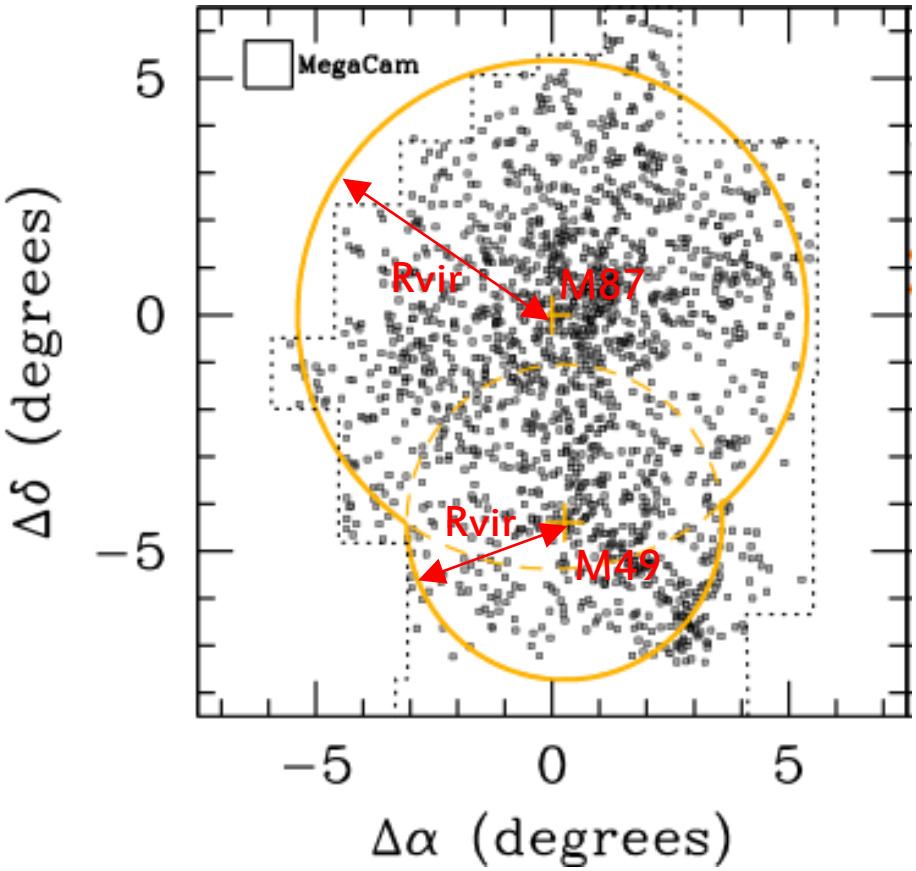
NGVS – Next Generation Virgo cluster Survey



Ferrarese et al. 2012

NGVS – Next Generation Virgo cluster Survey



-> Multipassband (ugriz) optical survey with MegaCam at the CFHT

-> cover ~104 degree^2 (R_{vir} of M87 and M49)

-> spatial resolution : 0.6" (~48pc)

-> surface brightness : ~ 29 mag/arcsec^2

-> detection limit : ~25.9 mag

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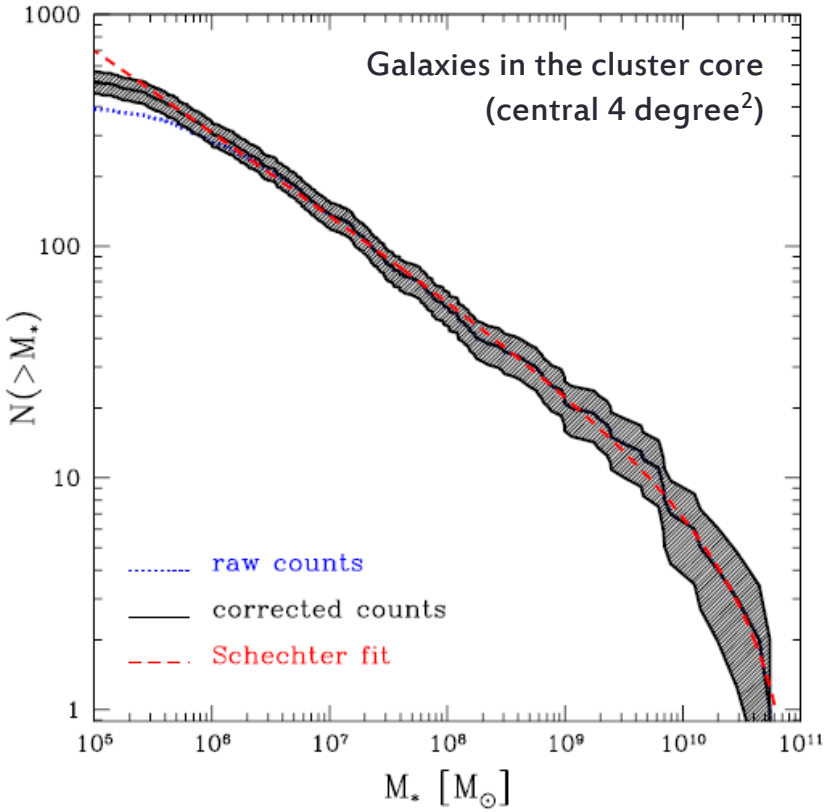

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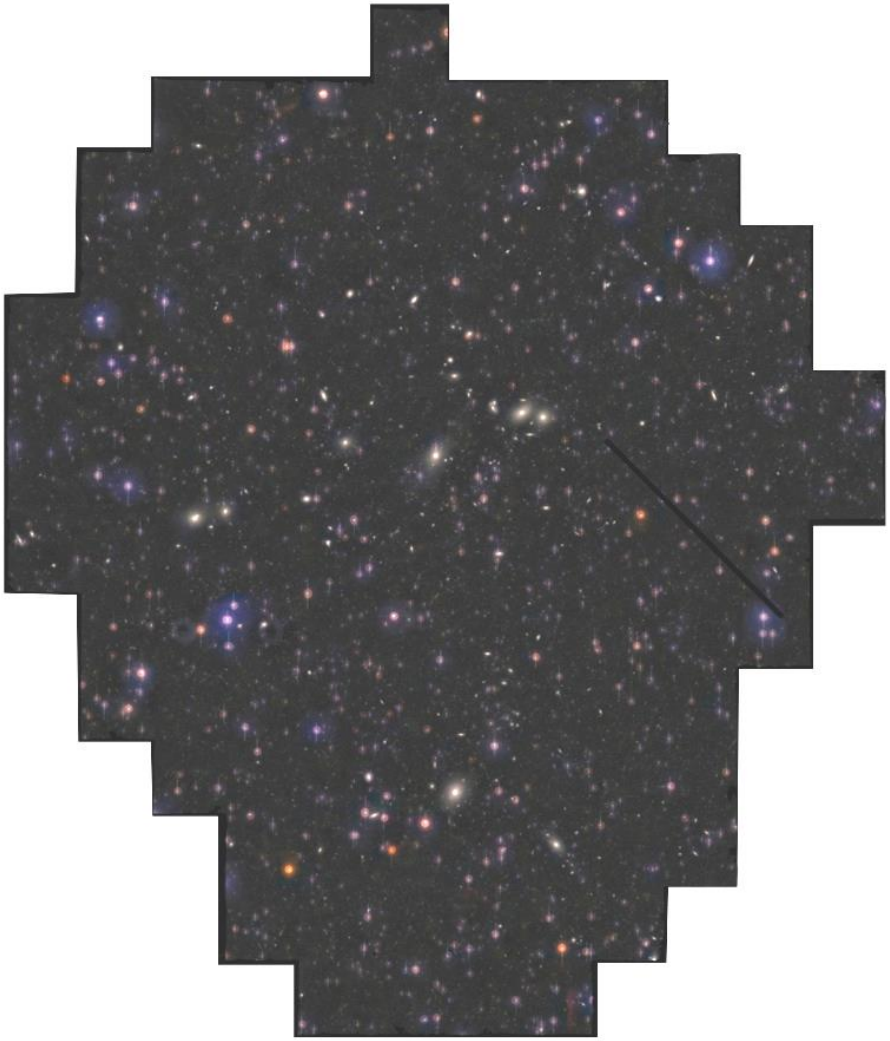
= ~5 mag fainter than VCC

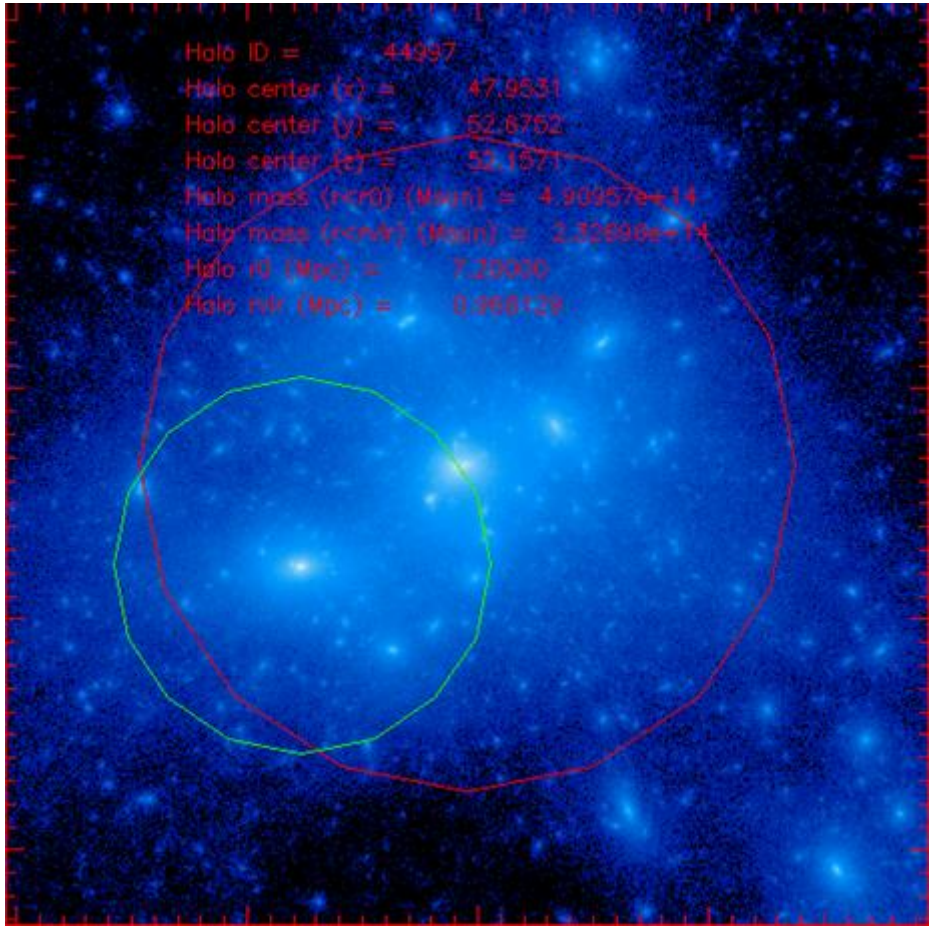
(Binggeli et al. 1985)

Identification of all Virgo cluster members is still ongoing.
-> Ferrarese et al. in prep.

To characterize galaxies



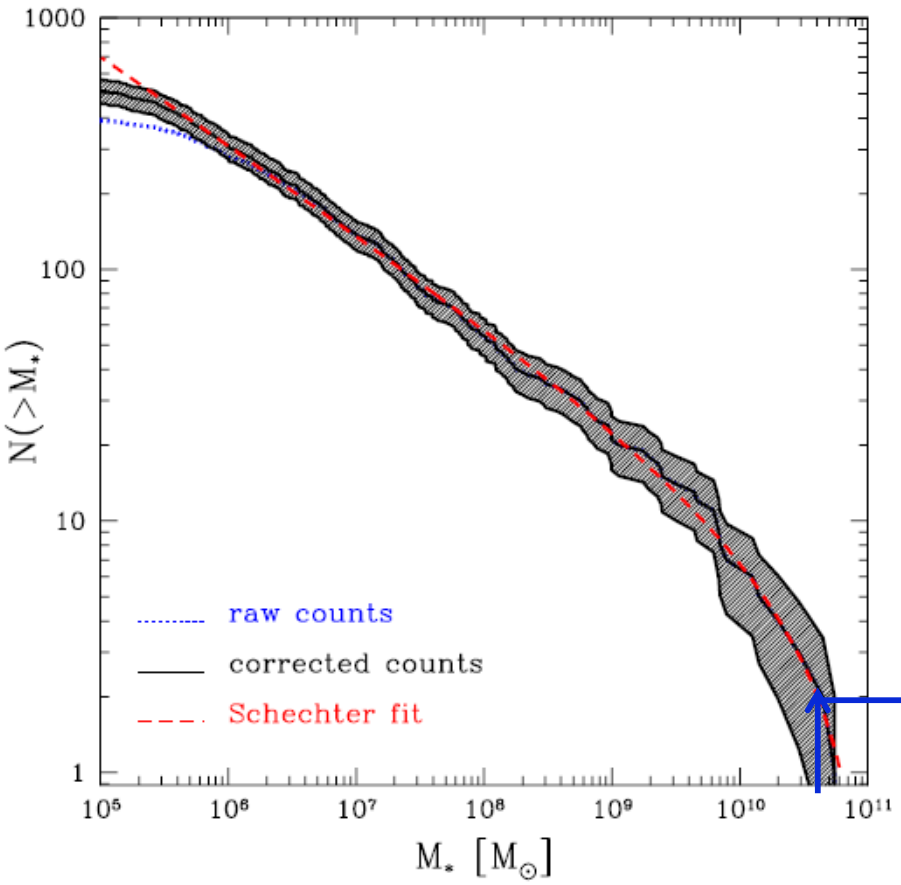
Luminosity from observation
(FOV of NGVS)



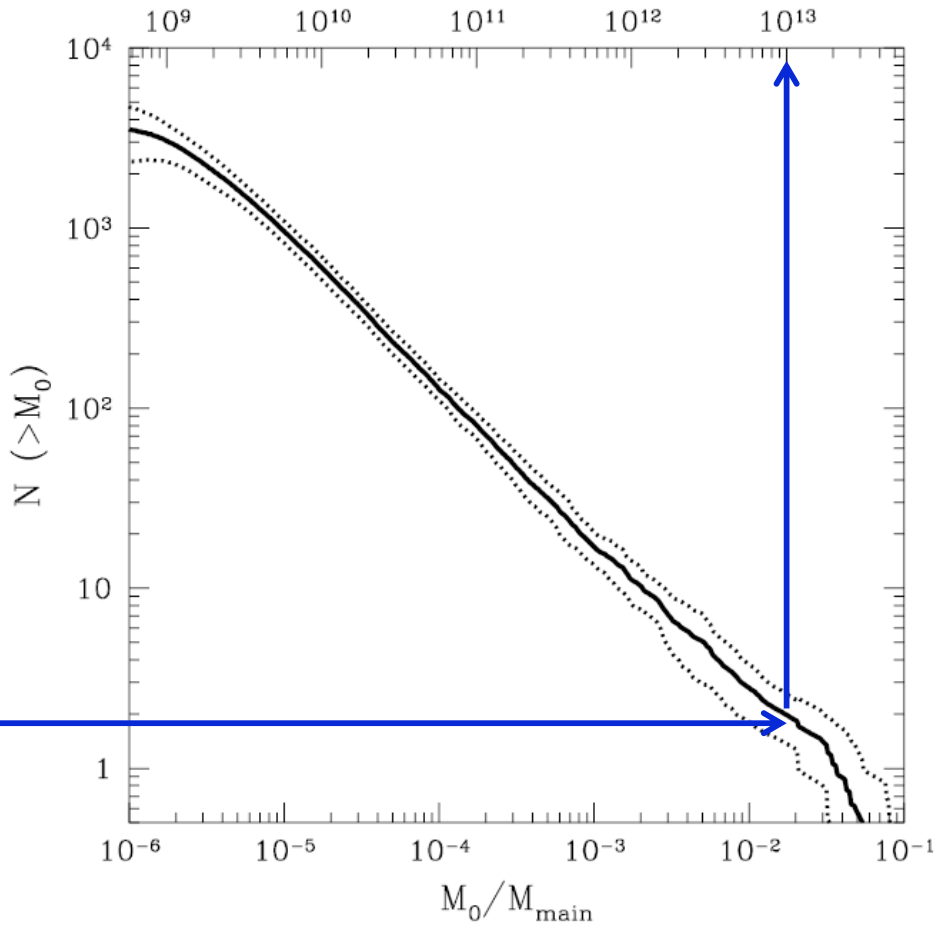
Mass from simulation
(Virgo cluster-like halo)

Abundance matching

Stellar mass function



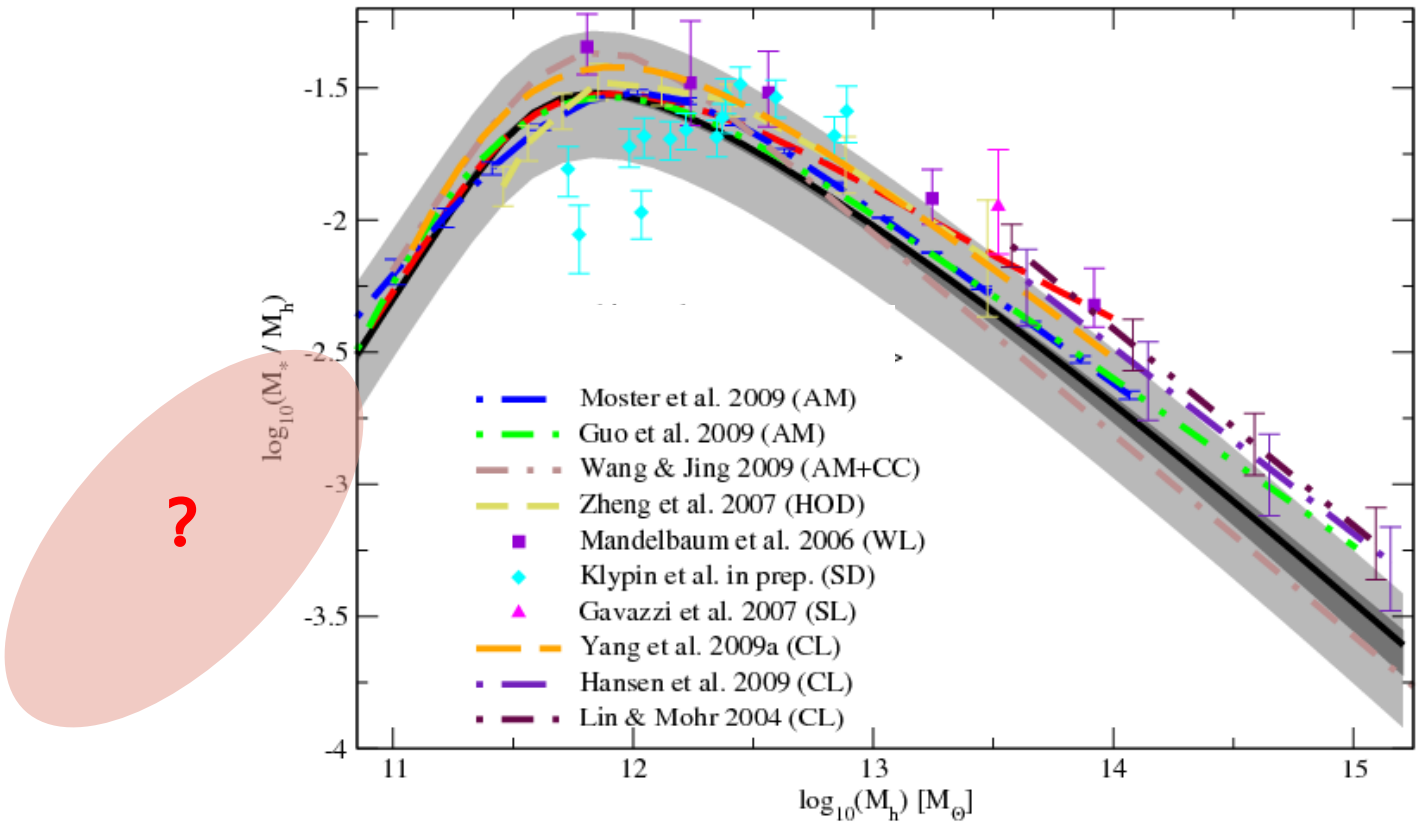
Sub-halo mass function



key assumptions - one galaxy per dark matter clump

- galaxy luminosity tightly correlated with halo mass

Abundance matching



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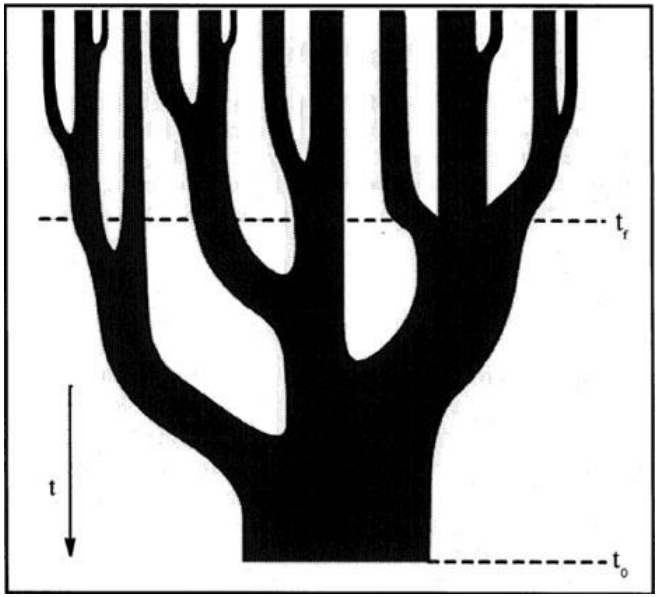
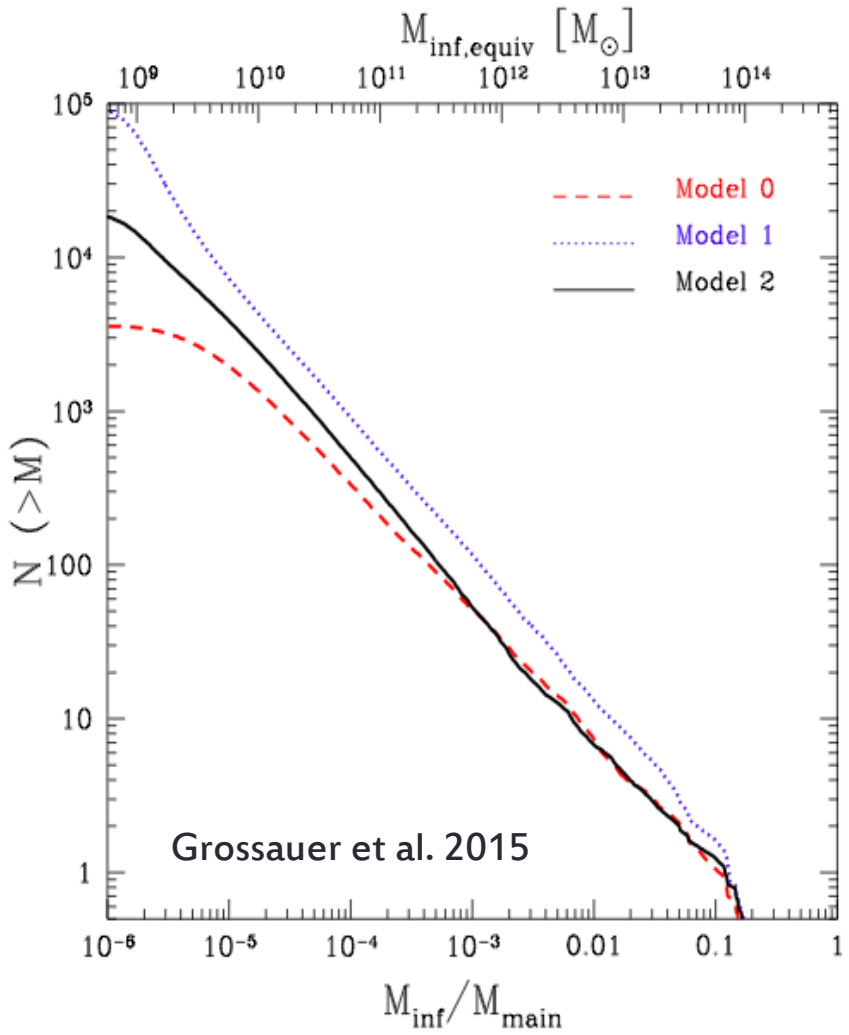
Sub-halo mass functions

Model 0 : sub-halos identified by sub-halo finding algorithms (e.g. AHF, ROCKSTAR)
-> lower limit on the sub-halo MF

Model 1 : mini-halos that have merged with the main halo
-> using merging trees
-> upper limit on the sub-halo MF



Model 2 : merging trees + pruning algorithms
-> considering sub-halo survival/disruption
-> the most realistic sub-halo MF



Strategy of this work

We aim to construct the most realistic sub-halo mass function.

- Performing the highest resolution simulation for a Virgo cluster-like halo
: M_{vir} = 2~5x$10^{14}M_{sun}$, m = 3x$10^{6}M_{sun}$, N_p(main halo)= ~40M

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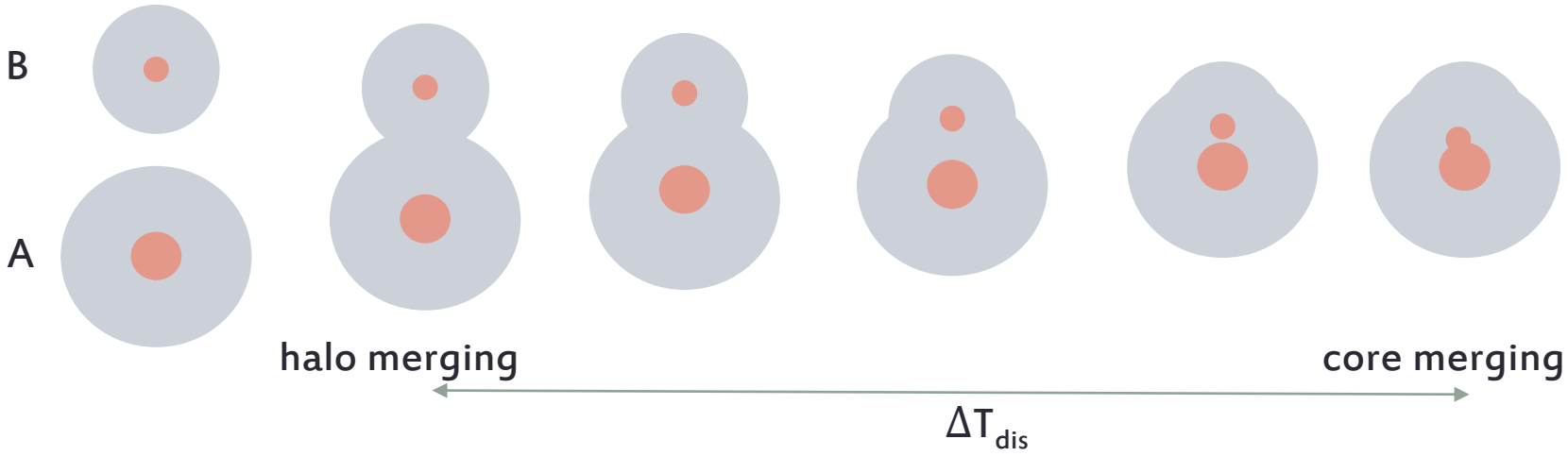
- Tracing real survival/disruption of sub-halos using their core structure
- Measuring disruption timescale as function of M_{sub}/M_{main}, z, and ε

$$\Delta T_{dis} = f(M_{sub}/M_{main,}\ z,\ \varepsilon)$$

- Constructing realistic pruning algorithms for the merger trees



Simulation

Cosmological zoom simulation using GADGET-2

Initial condition : Power-spectrum (CAMB) at z=199 (using MUSIC)

Cosmology : Ω_m=0.3, Ω_Λ=0.7, h=0.68, σ_8=0.82, n_s= 0.96

Time resolution : 120 snapshots from z=9 to z=0

Target : five different halos of M_{vir} = 2-5x10^{14} M_{sun}

Halo identification : - Amiga Halo Finder (AHF) for sub-halo structures

- FoF algorithm for halos

Model	Mass resolution [Msun]	# of particles for the main halo
Level 9	1.70 x 10^9	~0.08 M
Level 10	2.13 x 10^8	~0.6 M
Level 11	2.66 x 10^7	~5 M
Level 12	3.32 x 10^6	~40 M

Core structure

FoF halo finding
with different linking length

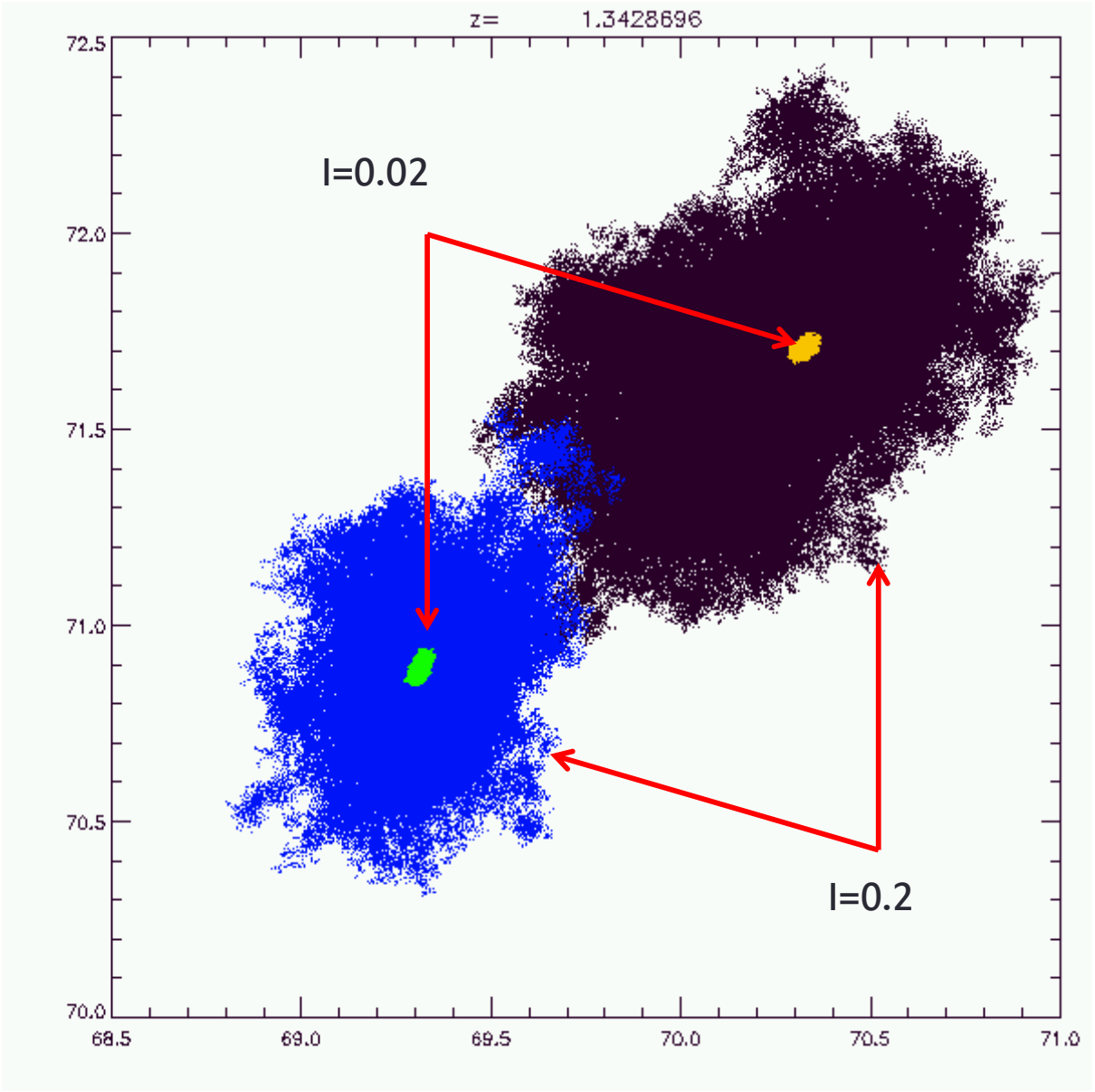
- halo structures with l=0.2
- core structures with l=0.02

-> $M_{core}/M_{halo} \sim 0.1$

-> core : galaxy

Galaxy merging

-> when cores merge



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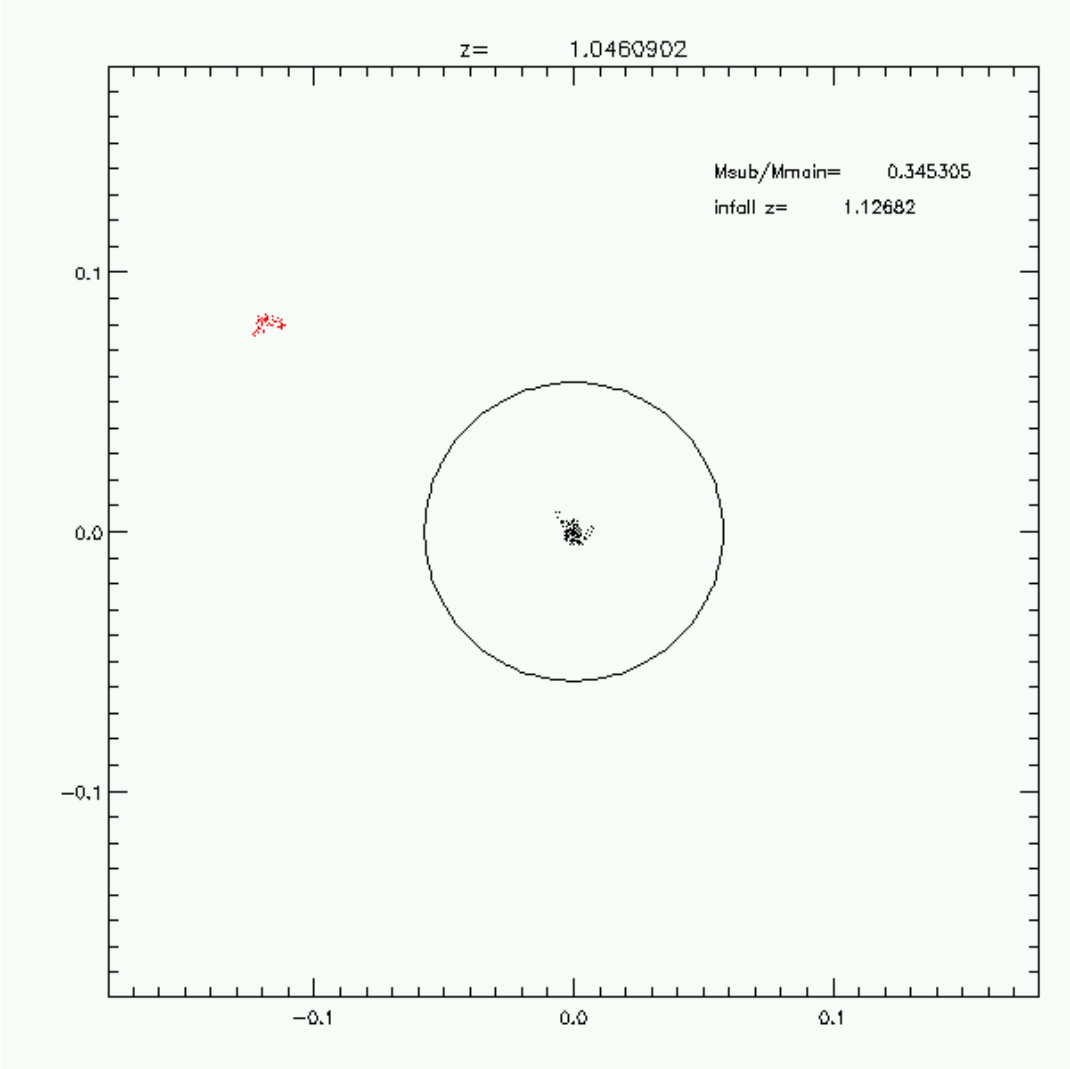
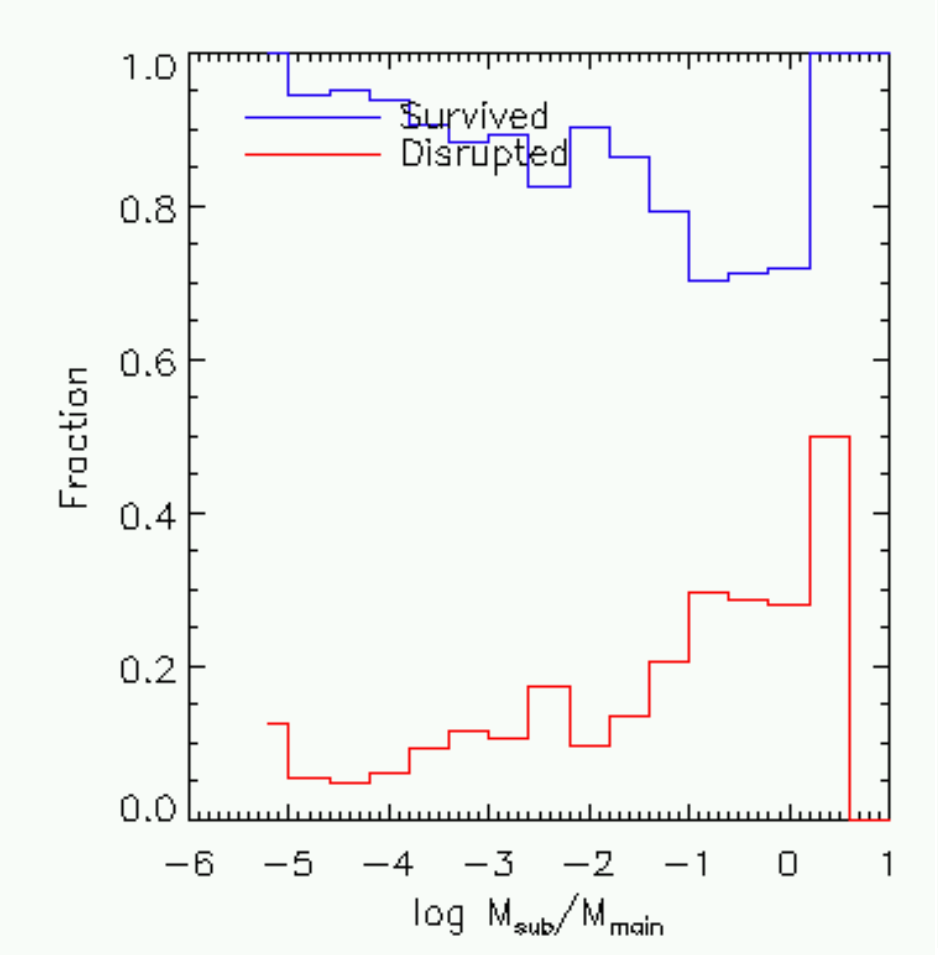
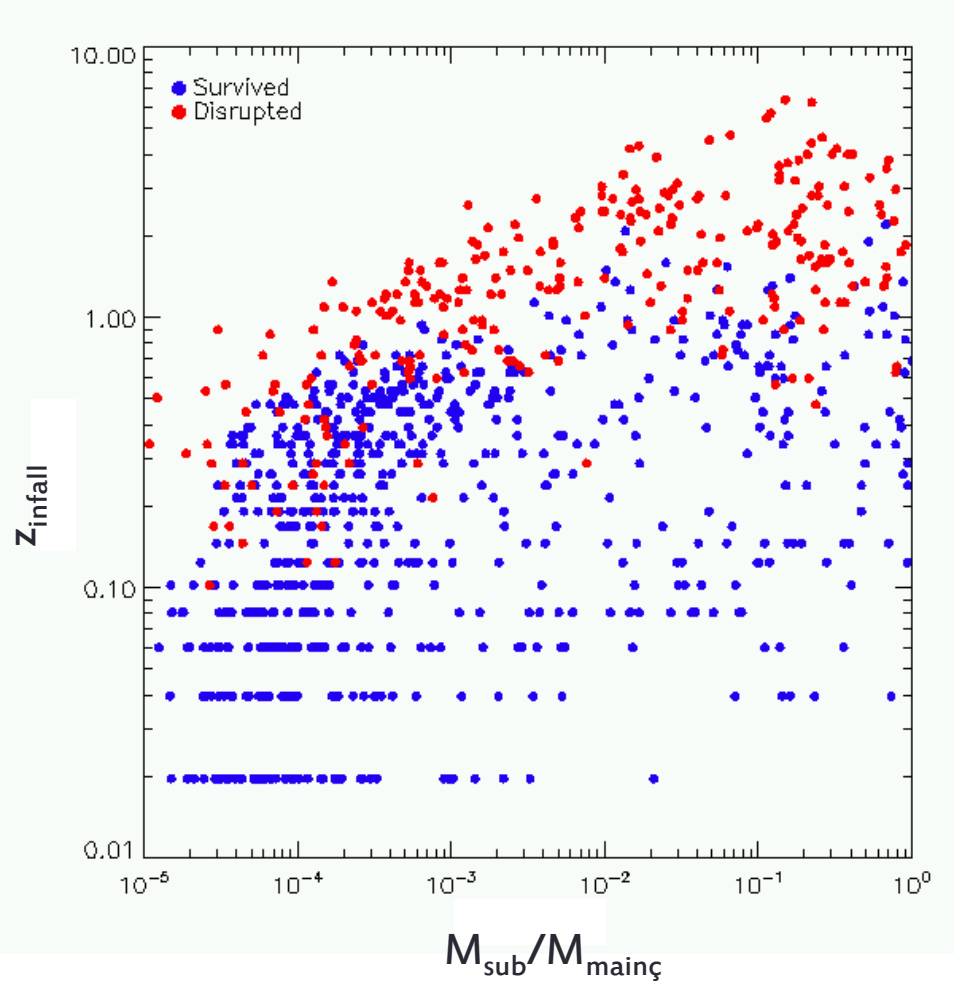


Core structure





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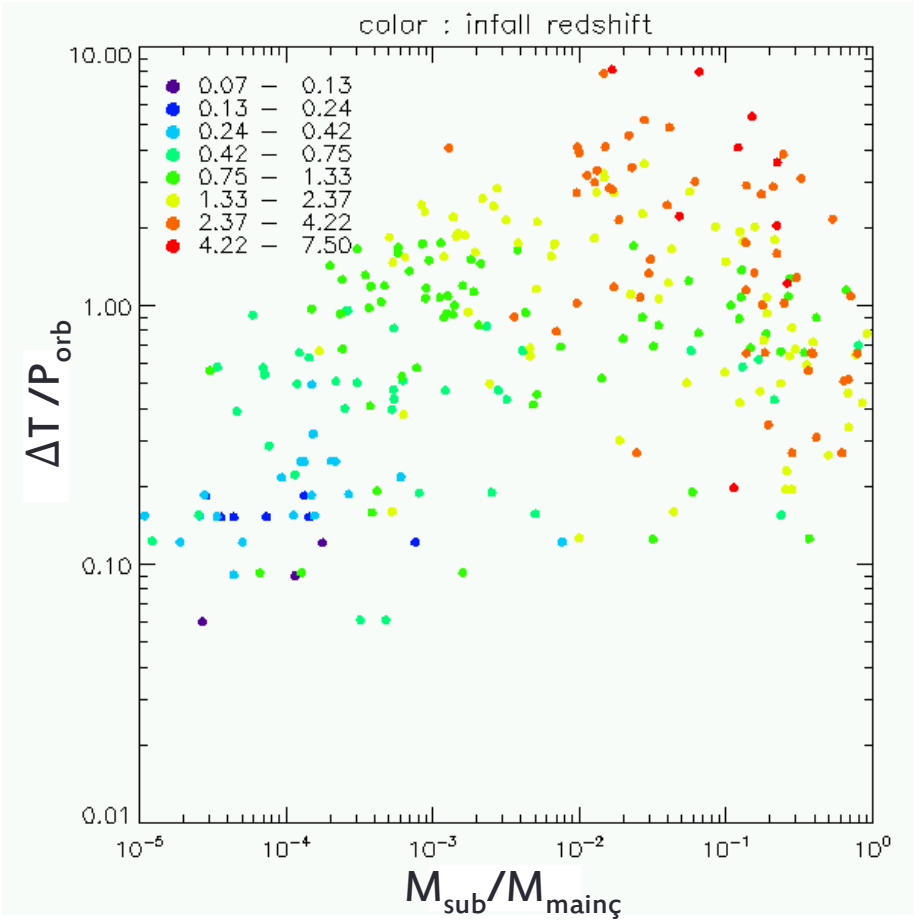

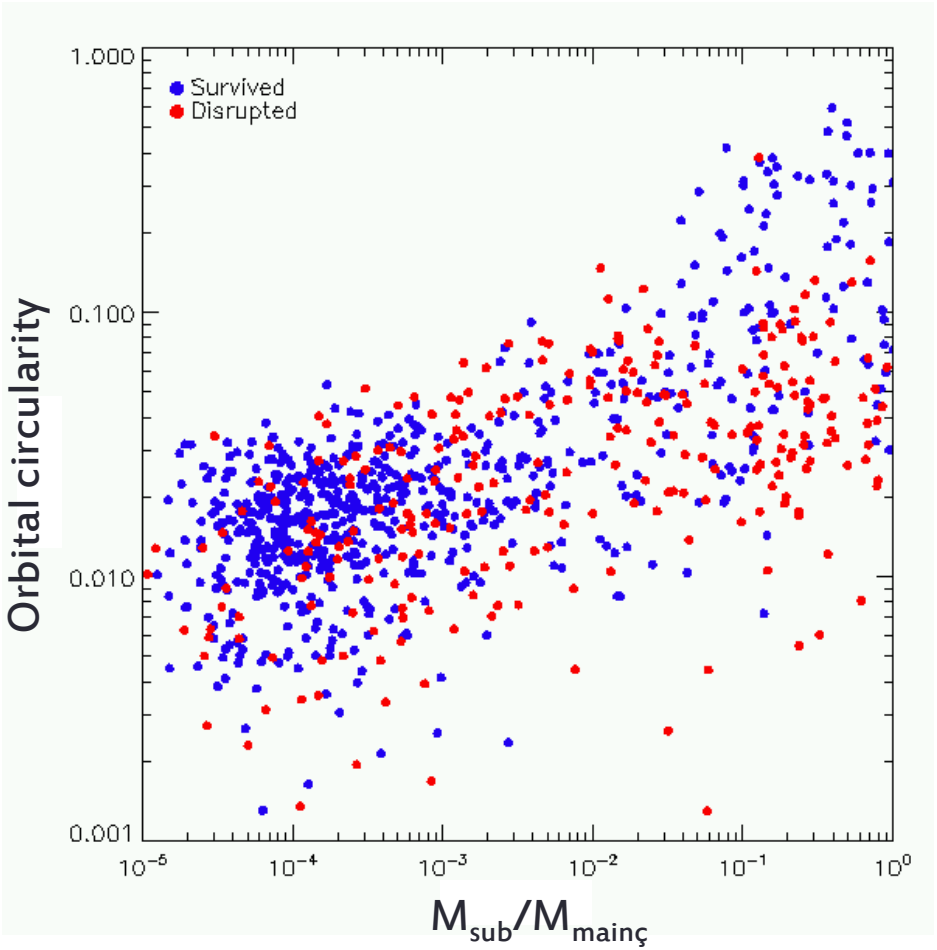

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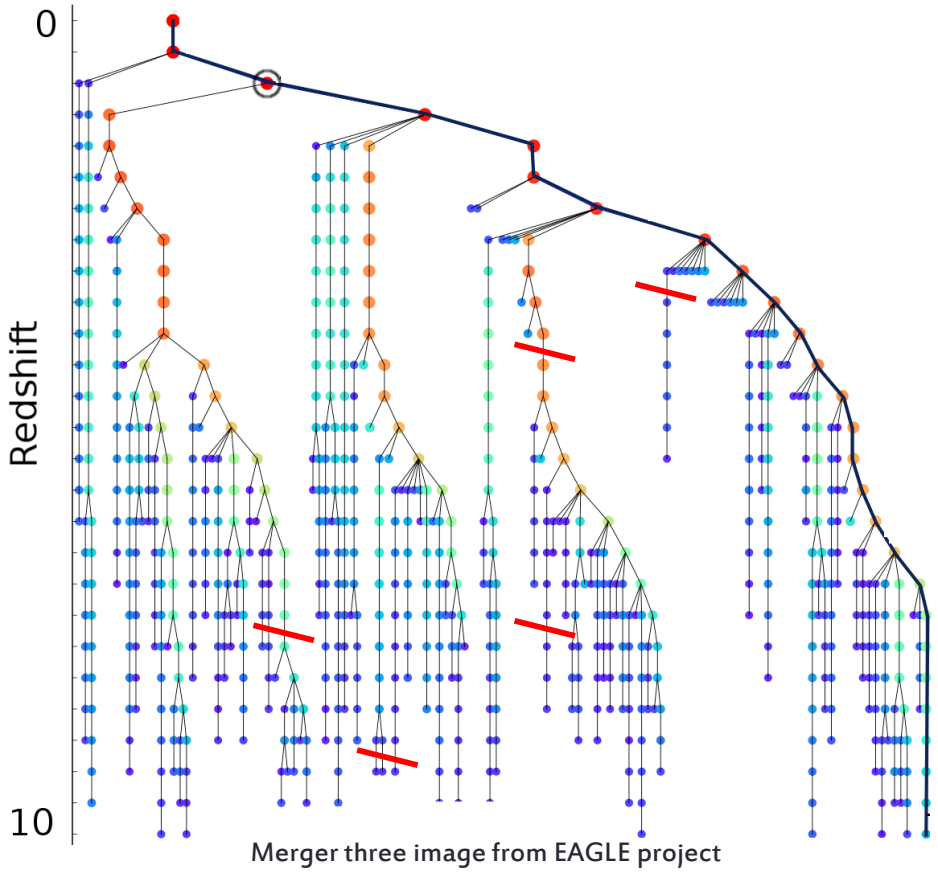
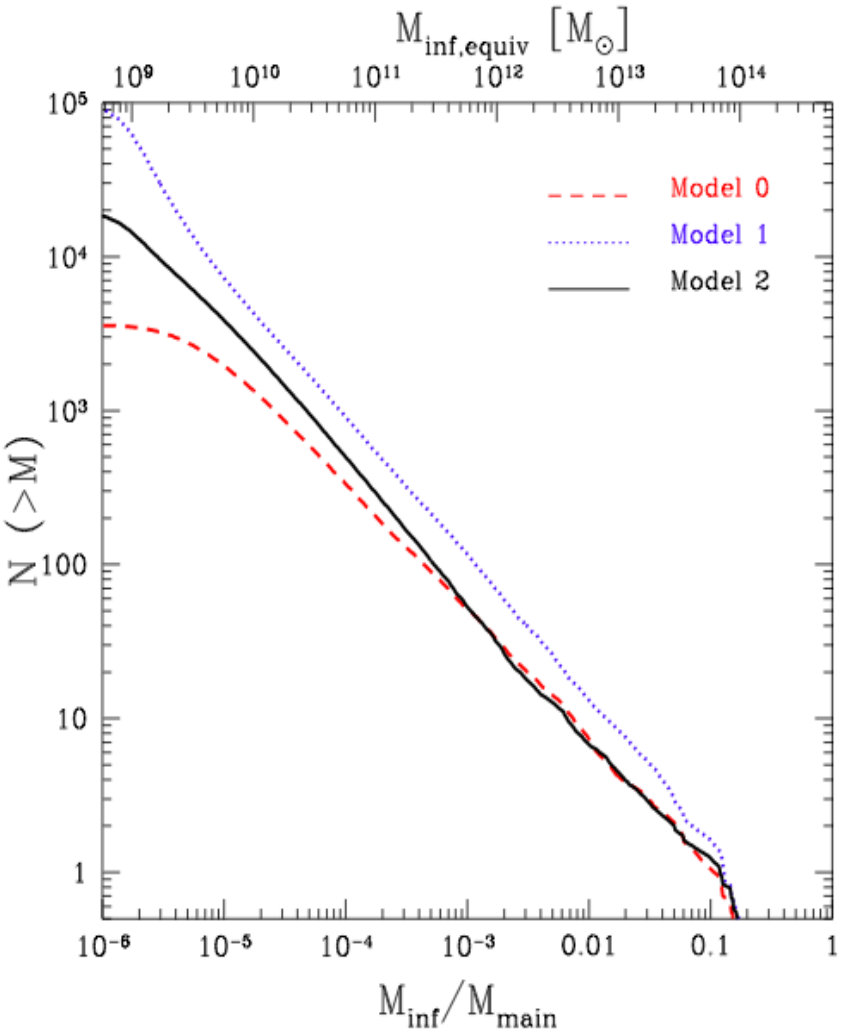


Merger three image from EAGLE project



Summary

Galaxy catalog of a Virgo cluster from NGVS

+ Realistic sub-halo mass function (realistic disruption of sub-halos)

= M/L of individual galaxies

= M/L of low-mass galaxies

= mass growth history of individual galaxies