

# Environmental dependence of HI-Mass functions in cosmological simulations

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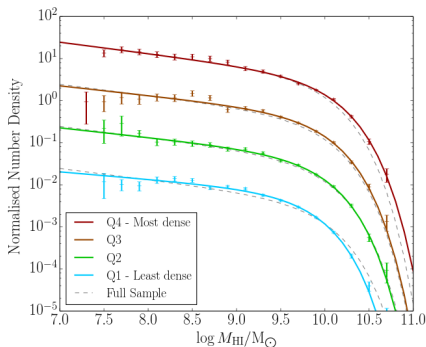
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# Outline

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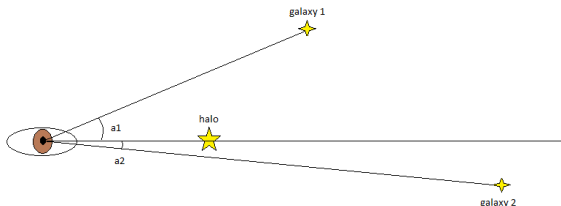
- Histogram of masses of galaxies and halos
- Logarithmic scales are needed for better interpretation
- Press-Schechter adjusts surprisingly well to observations

$$n(M) = \phi_* \left( \frac{M}{M_*} \right)^{\alpha+1} e^{-\left( \frac{M}{M_*} \right)}$$

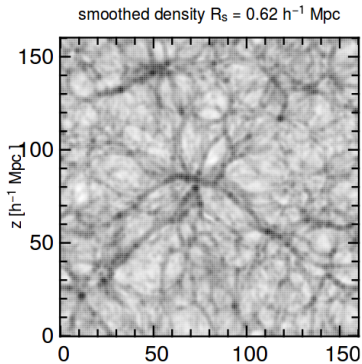


- Related to the mass density
- Useful to verify its effect on the physics of galaxy formation
- Great variety of methods to quantify environment
- Nearest neighbour, control volume [2].
- 3rd Nearest neighbour (Observational) [1]
- T-Web structures (Theoretical) Forero-Romero et al. [3]

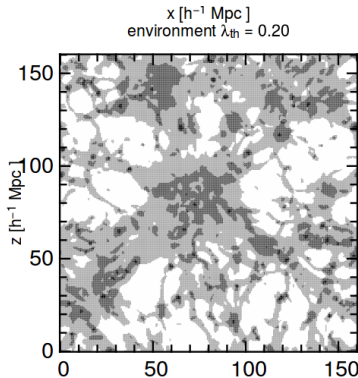
- Projected distance on sky.
- Velocity cut is needed.
- Distance to 3rd (not 1st) neighbour is required to avoid noise.



- Hessian of gravitational potential.
- 3 eigenvalues can identify 4 structures
- Clusters, sheets, filaments and voids.



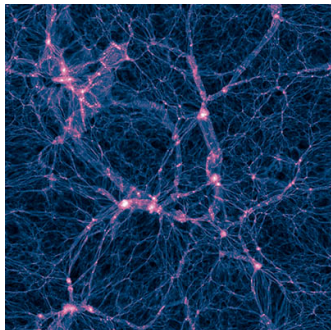
Forero-Romero et al. [3]



Forero-Romero et al. [1]

- HIPASS and ALFALFA big surveys allow the study of HI-Mass functions.
- The effect of environment on the physics of galaxy formation.
- Mass tendency to cluster.
- Voids: slow evolution. Sample HIMF at earlier times.
- Studies are so recent and sometimes contradict each others (Springob, Haynes & Giovanelli) [4] and Stierwalt et al. [5].

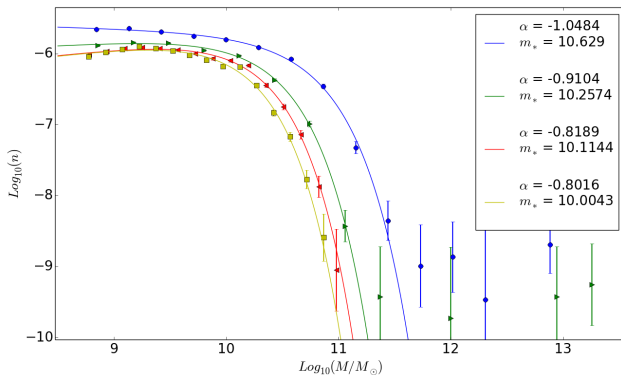
- Illustris run
- $106.5 Mpc$
- $1820^3$  particles
- $6.3 \cdot 10^6 M_{\odot}$  DM resolution
- $1.3 \cdot 10^6 M_{\odot}$  Gas resolution
- Detailed galaxy characteristics

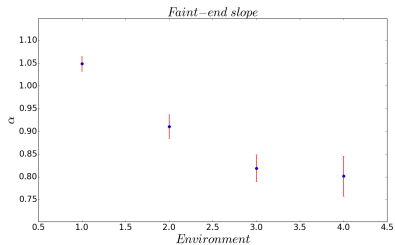
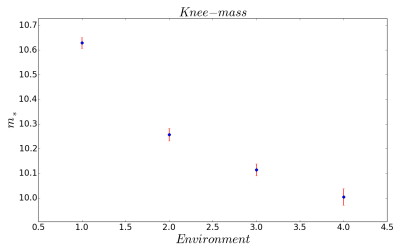


<http://www.illustris-project.org/media/>

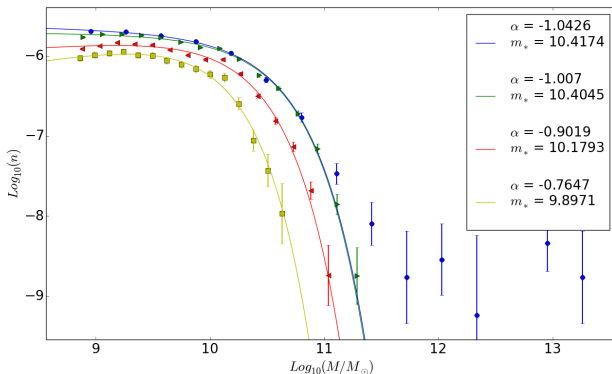


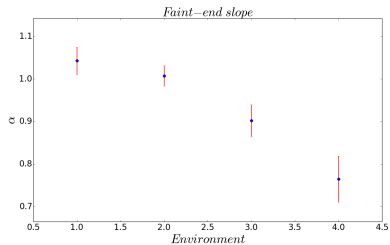
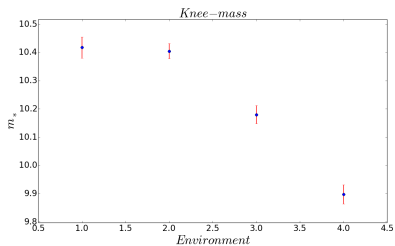
- Distance to 3rd nearest neighbour for galaxies with gas.
- Divided group in quartiles and obtained Schechter fits.





- Divided galaxies into Cluster, Sheet, filament and void groups.
- Obtained Schechter fits.





- We obtained a clear general tendency for the knee-mass and the faint-end slope in both methods.
- For high density environments from T-web, both tendencies becomes more diffuse.
- For low density neighbouring environments, the faint-end slope relation is diffuse.

- The knee-mass increases with neighbouring density in a range from  $10.00 \pm 0.03$  to  $10.62 \pm 0.02$ .
- For Cosmic web environment the range is from  $9.90 \pm 0.03$  to  $10.41 \pm 0.04$ .
- Faint-end ranges are  $[-0.80 \pm 0.04, -1.05 \pm 0.02]$  and  $[-0.76 \pm 0.05, 1.04 \pm 0.03]$ .

- Detailed analysis of effects for big-scale environments using both methods.
- Relation between of different mass functions (DM-SMBH-gas).
- Incorporate a reasonable approximation for HI mass in terms of gas mass.

# Referencias I

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