The Total Mass of Dark Matter Haloes

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Structure Formation

- The structure of the Universe is driven by dark matter density fluctuations (Lecture by Julien Lesgourgues).
- Fraction of collapsed objects of mass M is described by the mass function:

$$n(M,t)dM = \frac{\bar{\rho}}{M^2}\sqrt{\frac{2}{\pi}}\nu \exp\left(-\frac{\nu^2}{2}\right)\frac{d\log\nu}{d\log M}dM \qquad \left(\nu \equiv \frac{\delta}{\sigma(M)}\right)$$

- Most simple form given by the Press&Schechter formalism (1974)

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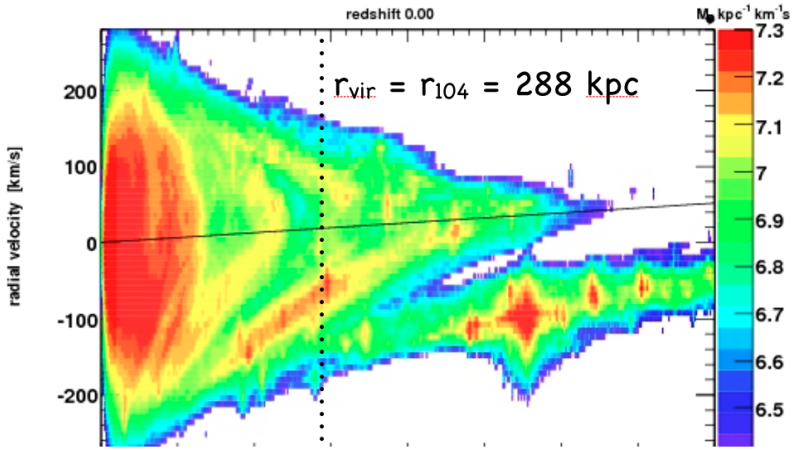
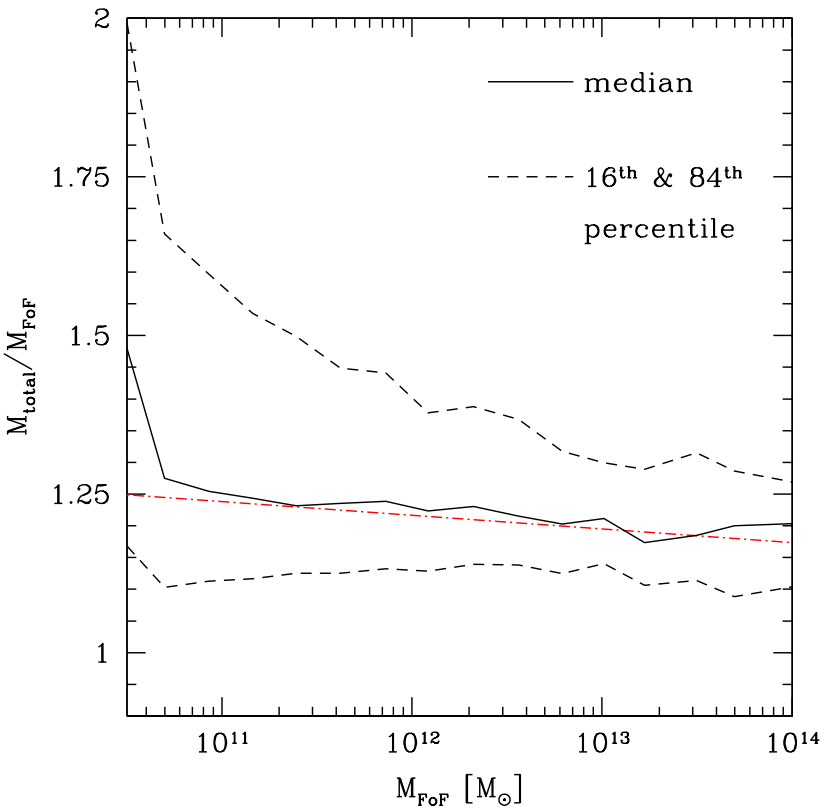
The Mass Problem



- Dark matter halo mass is essential, but how is it defined???
  - spherical / non-spherical?
  - overdensity criterion?
  - M_{FoF}, M_{200}, M_{vir},...
- All those mass definitions are heuristic, and do not cover the total collapsed mass in the sense of PS!

Results

Median Correction

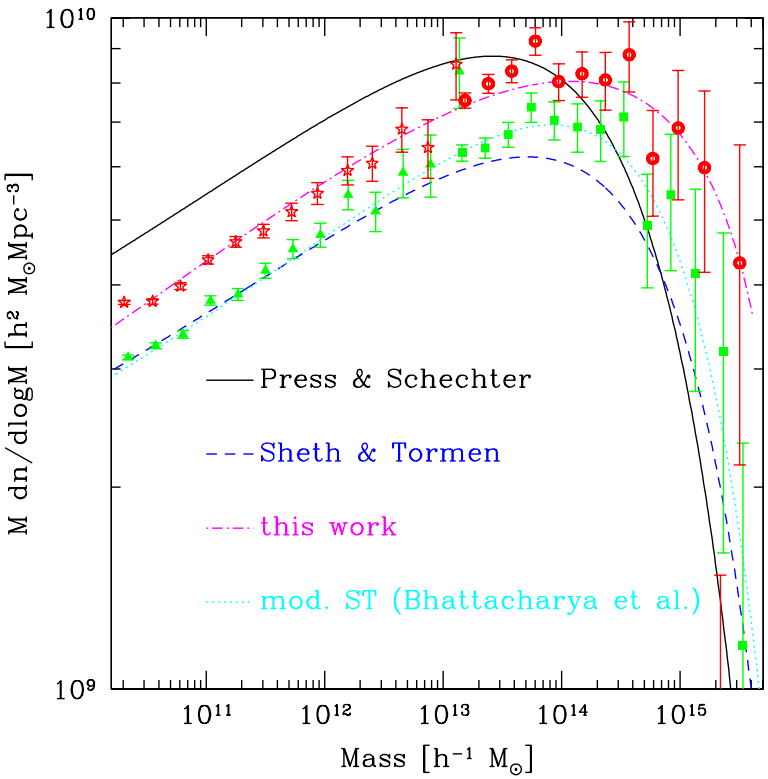


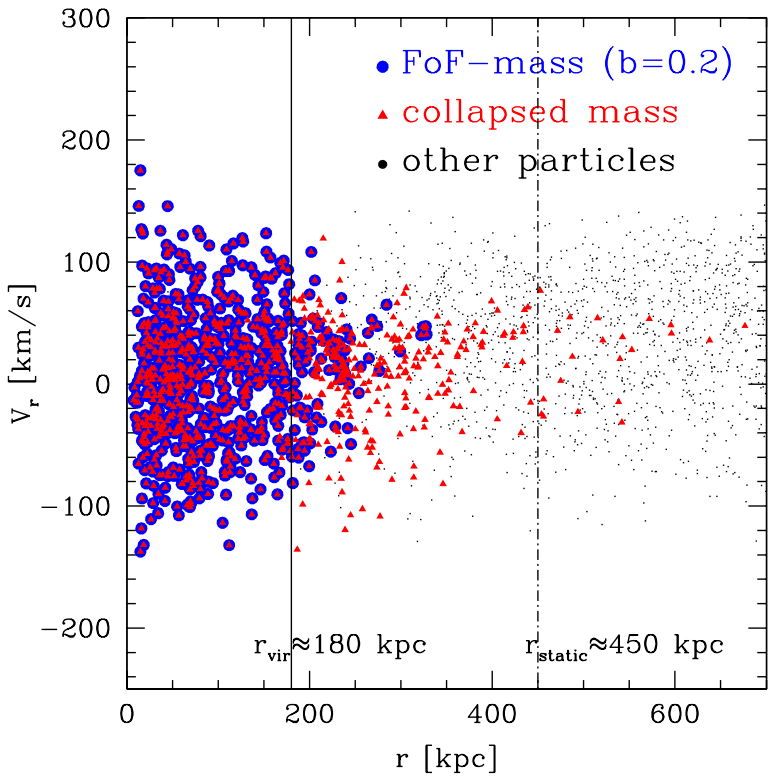
The median mass correction is very weakly dependent on mass and is well described by the linear fit:

$$\frac{M_{total}}{M_{FoF}} = 1.25 - 9 \times 10^{-3} \log\left(\frac{M_{FoF}}{3.16 \times 10^{10} M_\odot}\right)$$

Results

Mass Function & Phase-space distribution of a galaxy sized halo





$$f_{CMF}(\sigma(M), z = 0) = 2.825(\sigma^{0.138} - 0.883)\exp\left(-\frac{0.154}{\sigma^2}\right)$$

Conclusions & Outlook

Conclusions:

- **We present a group finding algorithm which identifies the total collapsed mass in the sense of the PS theory.**
- **Mass increase of order 25% for galaxy-sized objects and of order 20% for clusters.**
- **Still a gap between our corrected mass function and PS: initial conditions might not be that trivial!**

Outlook:

- **Universality of CMF?**
- **Connection to secondary infall model?**
- **Increase in mass also changes the kinematics: new binding criteria for satellites on extreme orbits?**

Mass Function

Accurate mass functions are important!

- studies of galaxy formation
- normalisation of the power spectrum
- statistics of initial density field
- determination of cosmological parameters