The Physical Nature of Cosmic Accretion of Baryons & Dark Matter into Halos and their Galaxies

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Outline

1. Physical Cosmic Accretion of Dark Matter
2. Physical Cosmic Accretion of Baryons
Standard picture of cosmic accretion into halos

Wechsler et al 2002

Scale factor = 1/(1+z)
Physical nature of cosmic accretion into galactic halos

see Diemand et al 2007, Cuesta et al 2008, Diemer et al 2013
Physical nature of cosmic accretion into galactic halos

see Diemand et al 2007, Cuesta et al 2008, Diemer et al 2013

“pseudo-evolution”
Physical Cosmic Accretion of Dark Matter (simulation of only dark matter)

\[ \frac{d^2r}{dt^2} = -\frac{G m(< r)}{r^2} + \frac{8\pi G}{3} \rho_{\Lambda} r \]

Adhikari, Dalal & Chamberlain 2014
Physical Cosmic Accretion of Dark Matter

from simulation with only dark matter

\[ \frac{m(<r, z)}{m(<r, z=0)} \]

\[ M_{200m}(z) \]

\[ \log M_{200m}(z=0) = [11, 12] \]
Outline

1. Physical Cosmic Accretion of Dark Matter

2. Physical Cosmic Accretion of Baryons
Physical accretion of gas & dark matter from simulation with gas - non-radiative
Physical accretion of baryons & dark matter from simulation with star formation + thermal feedback
Physical significance of $R_{200m}$?
Physical accretion of baryons & dark matter from simulation with star formation + feedback

$M_{200m}(z) = \log \frac{m(<r, z=0)}{m(<r, z=0)}$

$logM_{200m}(z=0) = [11,12]$
Physical Cosmic Accretion of Dark Matter & Baryons

- Dark matter growth is subject to pseudo-evolution
  - at $z < \sim 1$, no significant growth of mass at any radius

- Baryon growth is not subject to pseudo-evolution
  - Physical growth at all radii because gas is dissipational
  - Accretion rate at all $r < R_{200m}$ (nearly) tracks that at $R_{200m}$
  - Accretion radius of low-mass halos not increase at $z < \sim 1$

- Most meaningful radius to measure cosmic accretion of both dark matter and gas is $\sim 2 R_{200m}(z)$