The splashback radius as a physical halo boundary

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(in collaboration with Andrey Kravtsov, Surhud More, Philip Mansfield, Spencer Scott, Alexie Leauthaud, and many others)

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Visualization code:
Phil Mansfield

Halo finder: Rockstar
(Behroozi et al. 2013)
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“Ejected” satellites

Quenched satellites out to \( \sim 2 \, R_{vir} \)

Pseudo-evolution

(c) Benedikt Diemer

Diemer et al. 2013ab • Cuesta et al. 2008 • Zemp 2014 • More et al. 2015 • Wetzel & Nagai 2015
The Splashback Boundary

$\Gamma = 0.8$

$\Gamma = 2.7$

Low accretion rate  High accretion rate

Diemer & Kravtsov 2014 • Adhikari, Dalal & Clampitt 2014 • More, Diemer & Kravtsov 2015
Large halos (M > 10^{15})

\[ \rho / \rho_m \quad r / R_{\text{vir}} \]

\[ \gamma = d\log \rho / d\log r \quad r / R_{\text{vir}} \]

- NFW fit
- Einasto fit

Diemer & Kravtsov 2014
Splashback in the real Universe

\[ \frac{d \ln(\rho)}{d \ln(r)} \}

Chang + 17 lensing
Chang + 17 galaxies

NFW
DK14

\[ r \ [h^{-1}\text{Mpc}] \]

Chang et al. 2017 • Diemer & Kravtsov 2014 • Navarro et al. 1997
Splashback in observations and simulations

Simulations: More et al. 2015 • Diemer et al. 2017
See also: Tully 2015 • Zu et al. 2017 • Busch & White 2017 • Patej & Loeb 2016 • Umetsu & Diemer 2017
eROSITA X-ray selection
Cosmology with the splashback boundary?

Euclid

Adhikari et al. 2018
Splashback and SIDM

Euclid

Banerjee et al. 2019
Conclusions

• The **structure of CDM halos** is not a solved problem, particularly wrt their dynamics

• The **splashback radius** provides a physical halo boundary

• Observations of the halo **outskirts** can tell us about the physics of dark matter and gravity