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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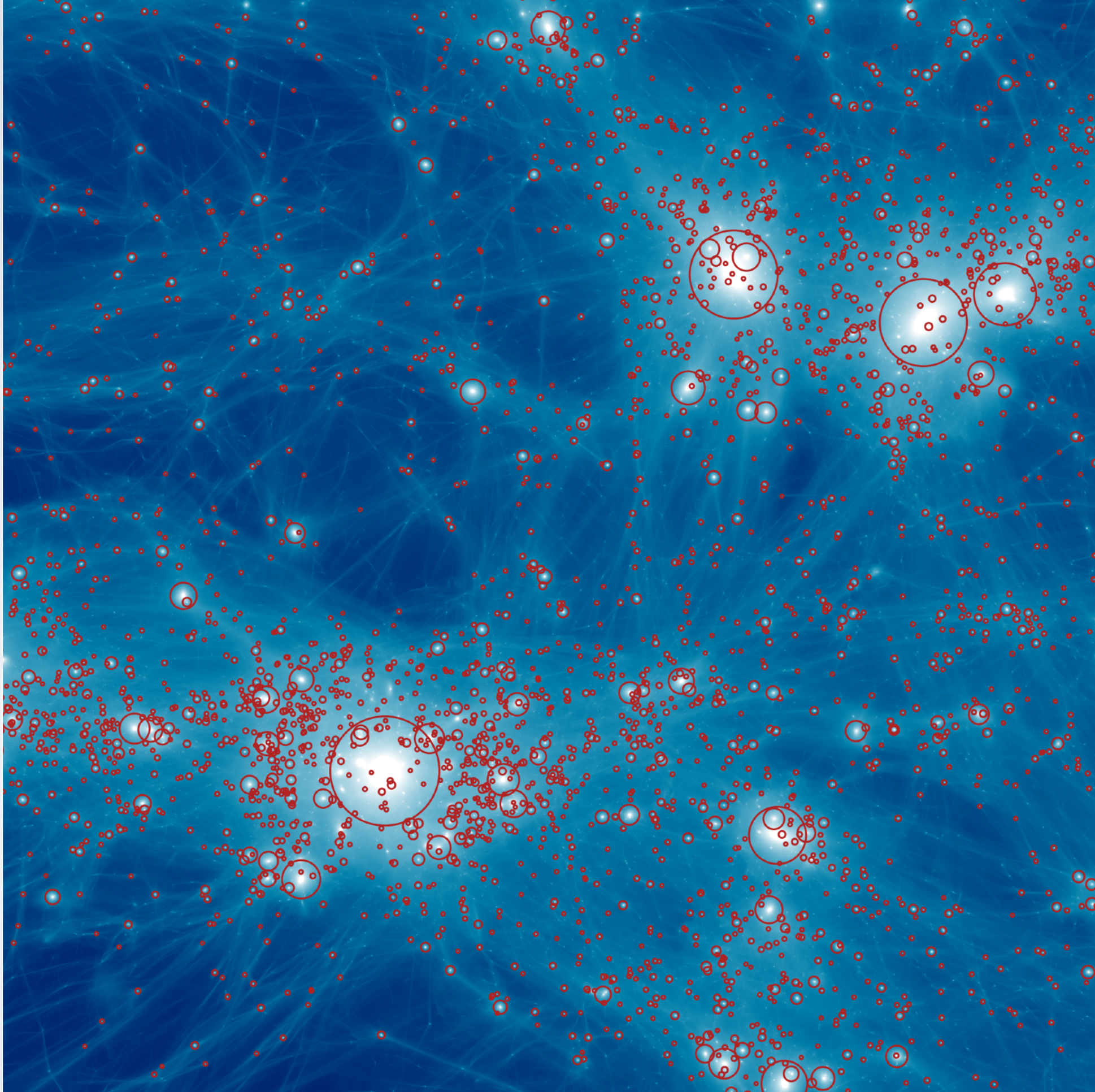
R_{500c}



Visualization code:
Phil Mansfield

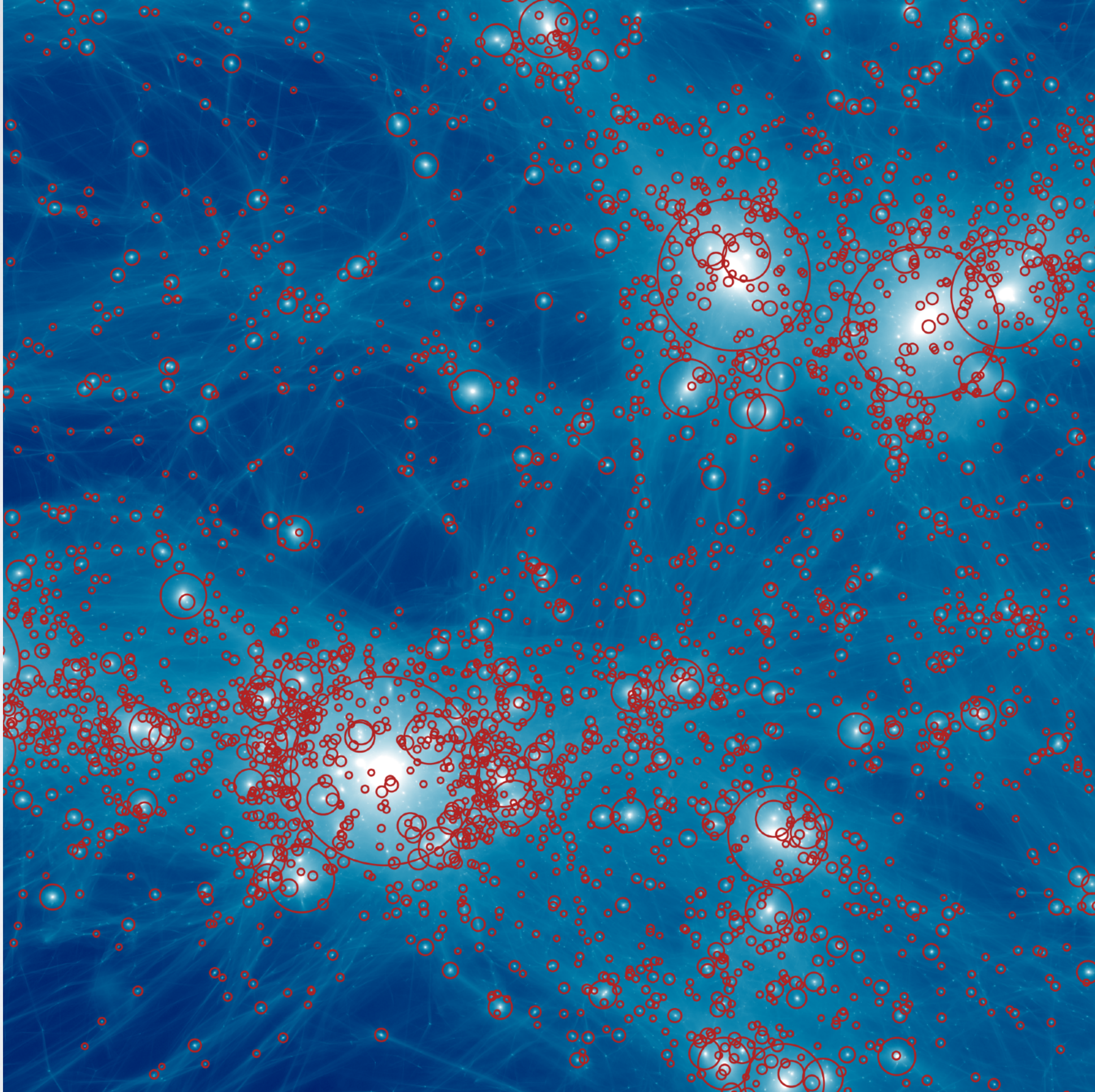
Halo finder: Rockstar
(Behroozi et al. 2013)

R_{200c}

Visualization code:
Phil Mansfield

Halo finder: Rockstar
(Behroozi et al. 2013)

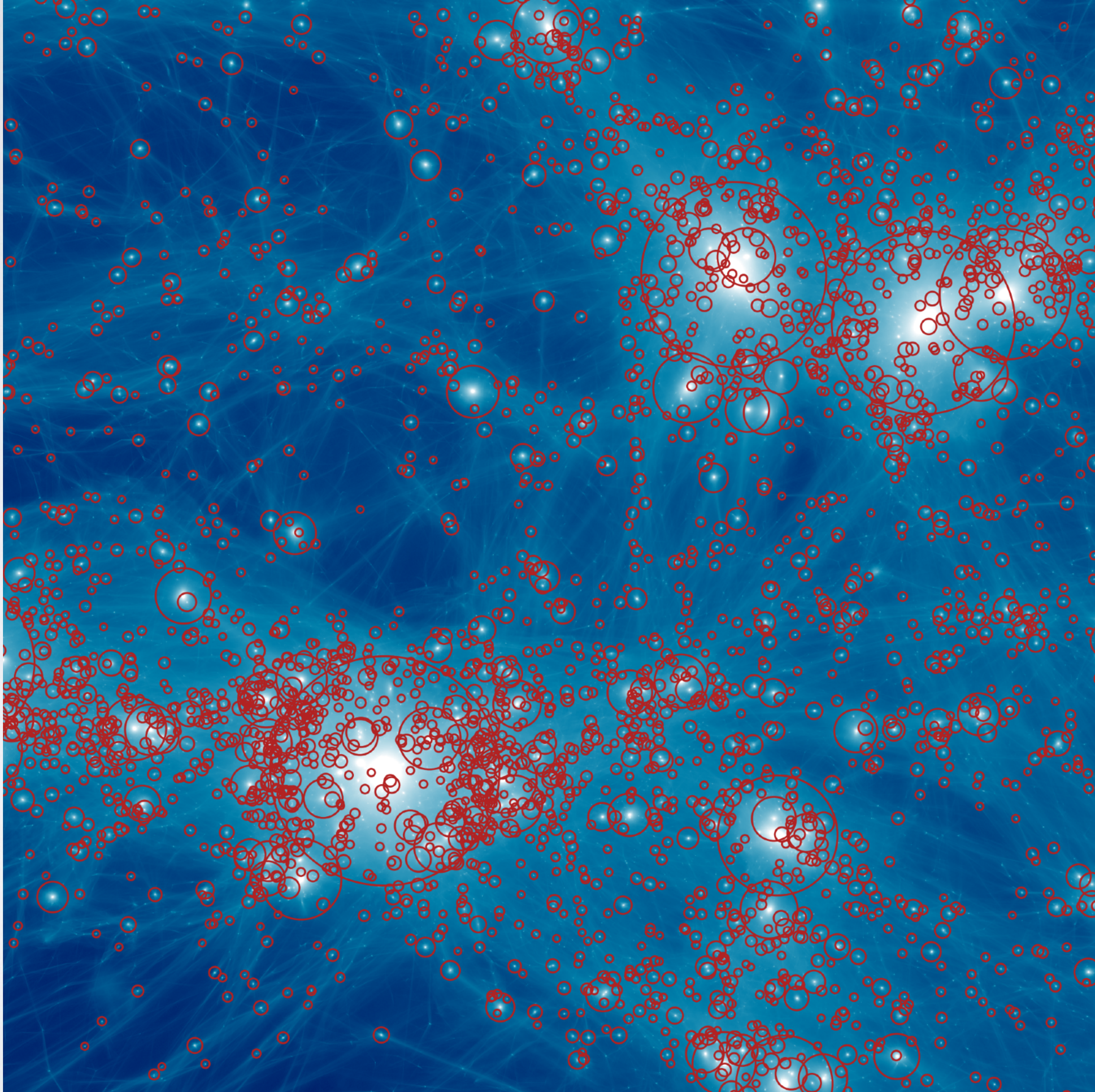
R_{vir}



Visualization code:
Phil Mansfield

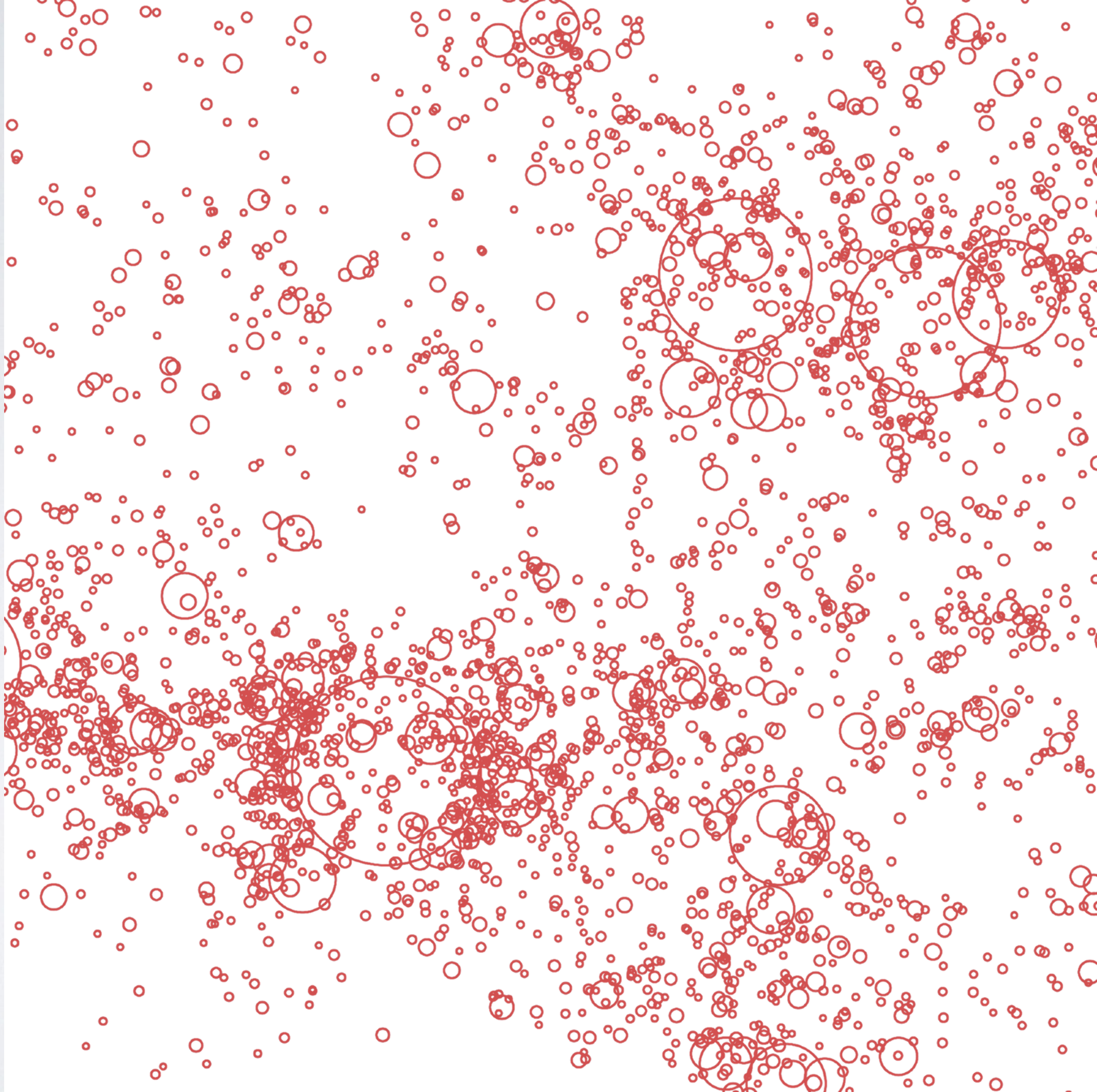
Halo finder: Rockstar
(Behroozi et al. 2013)

R_{200m}



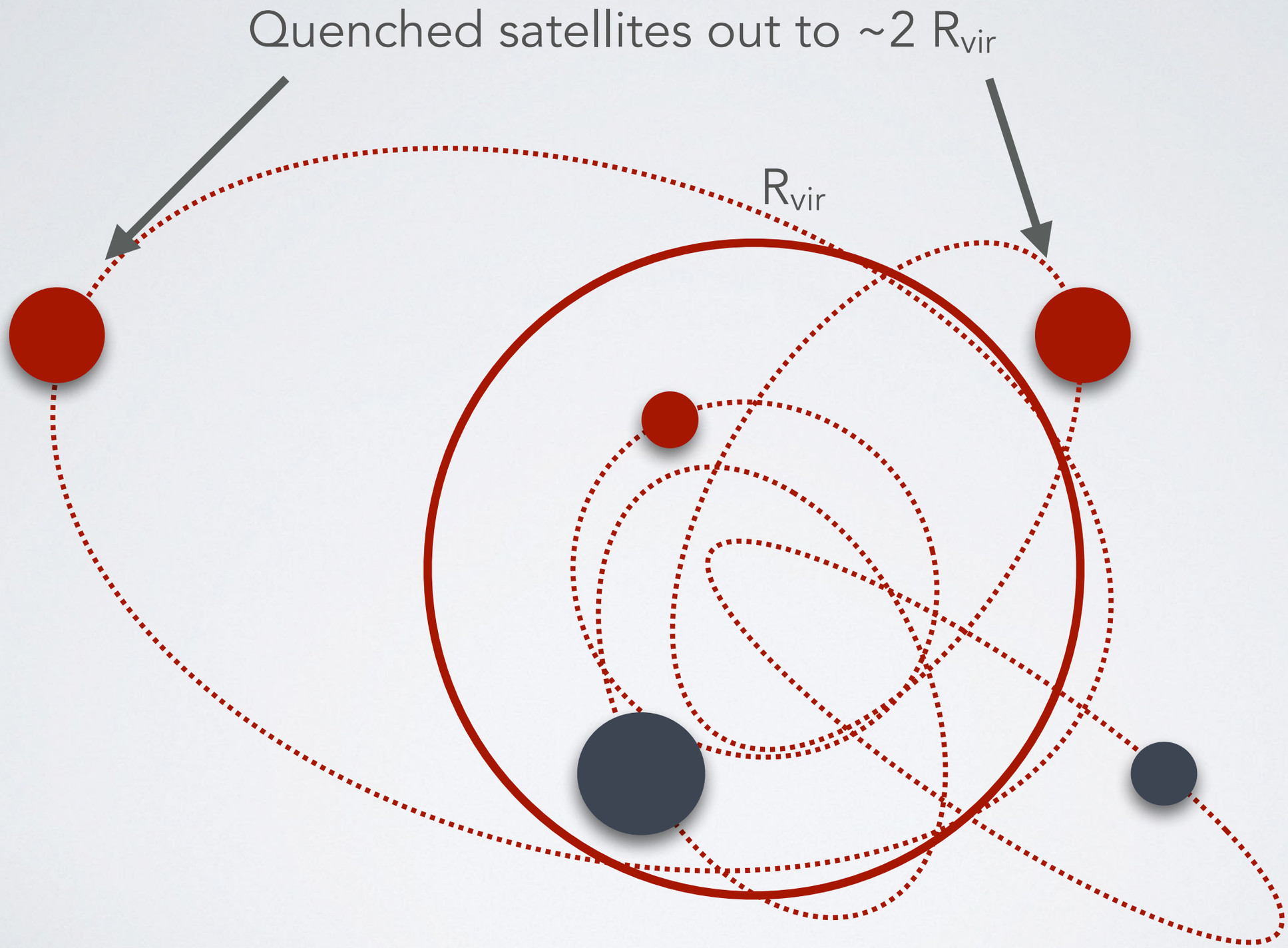
Visualization code:
Phil Mansfield

Halo finder: Rockstar
(Behroozi et al. 2013)



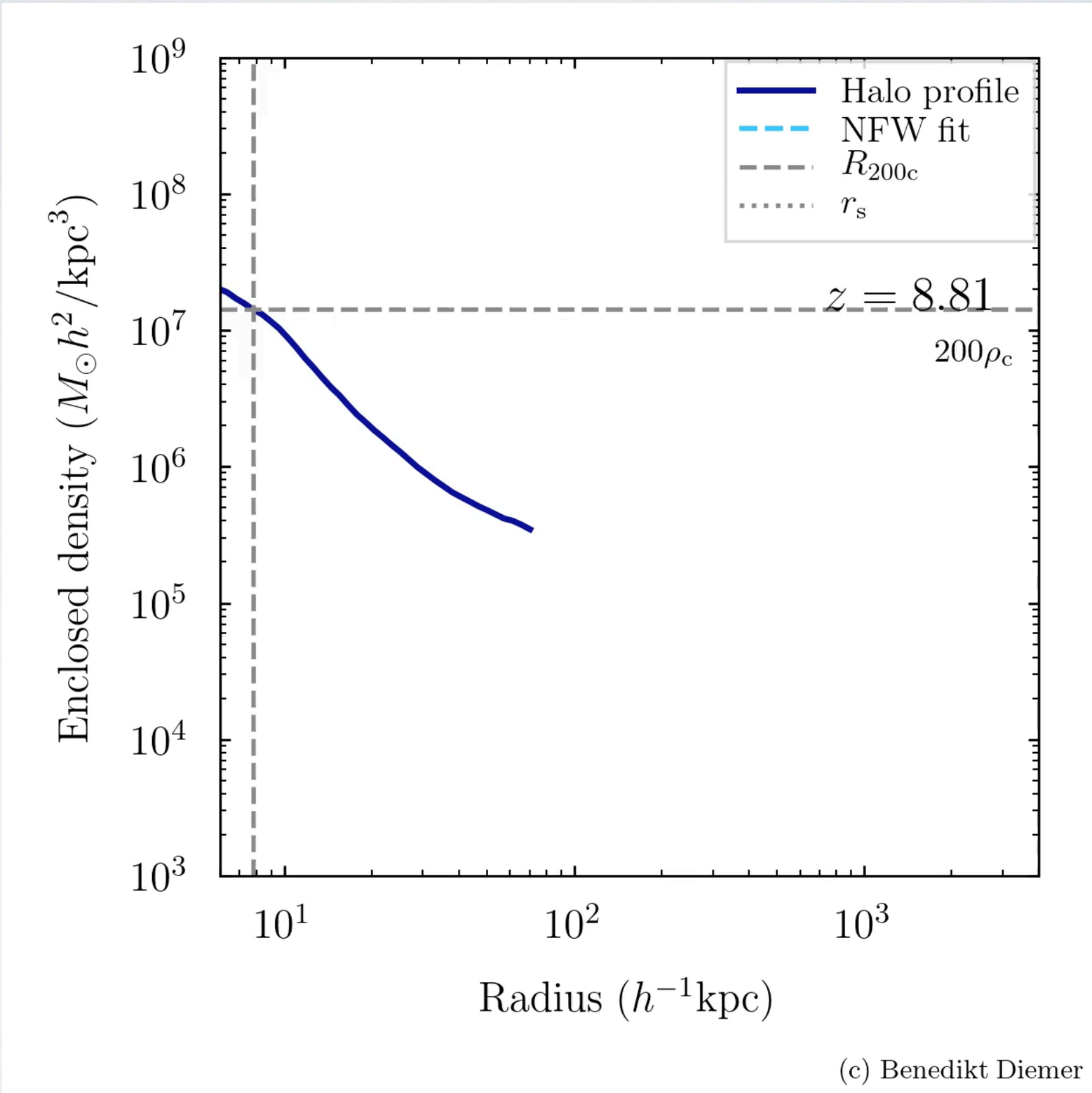
Halo finder: Rockstar
(Behroozi et al. 2013)

“Ejected” satellites

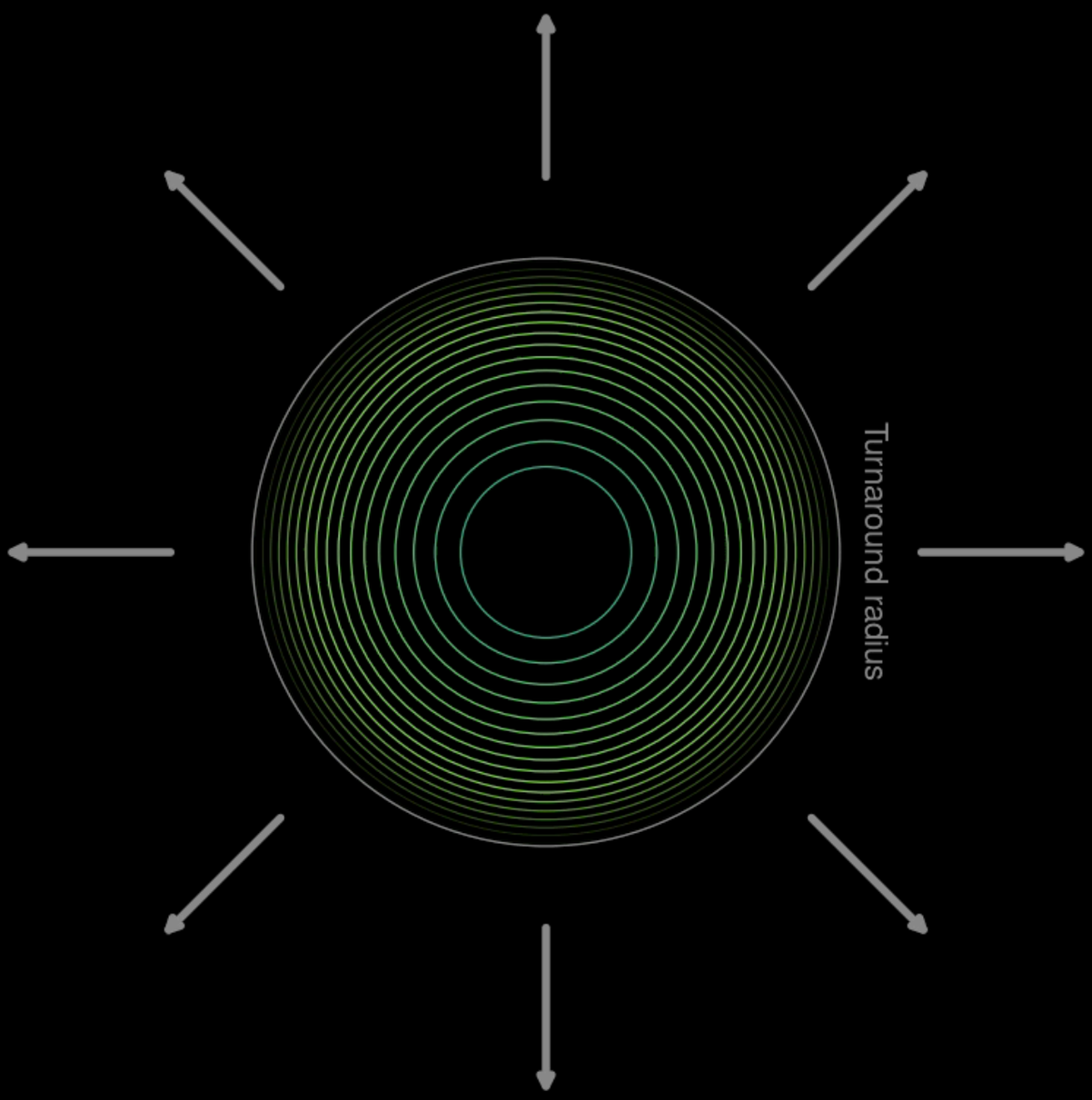


Balogh et al. 2000 • Mamon et al. 2004 • Gill et al. 2005 • Wetzel et al. 2014

Pseudo-evolution

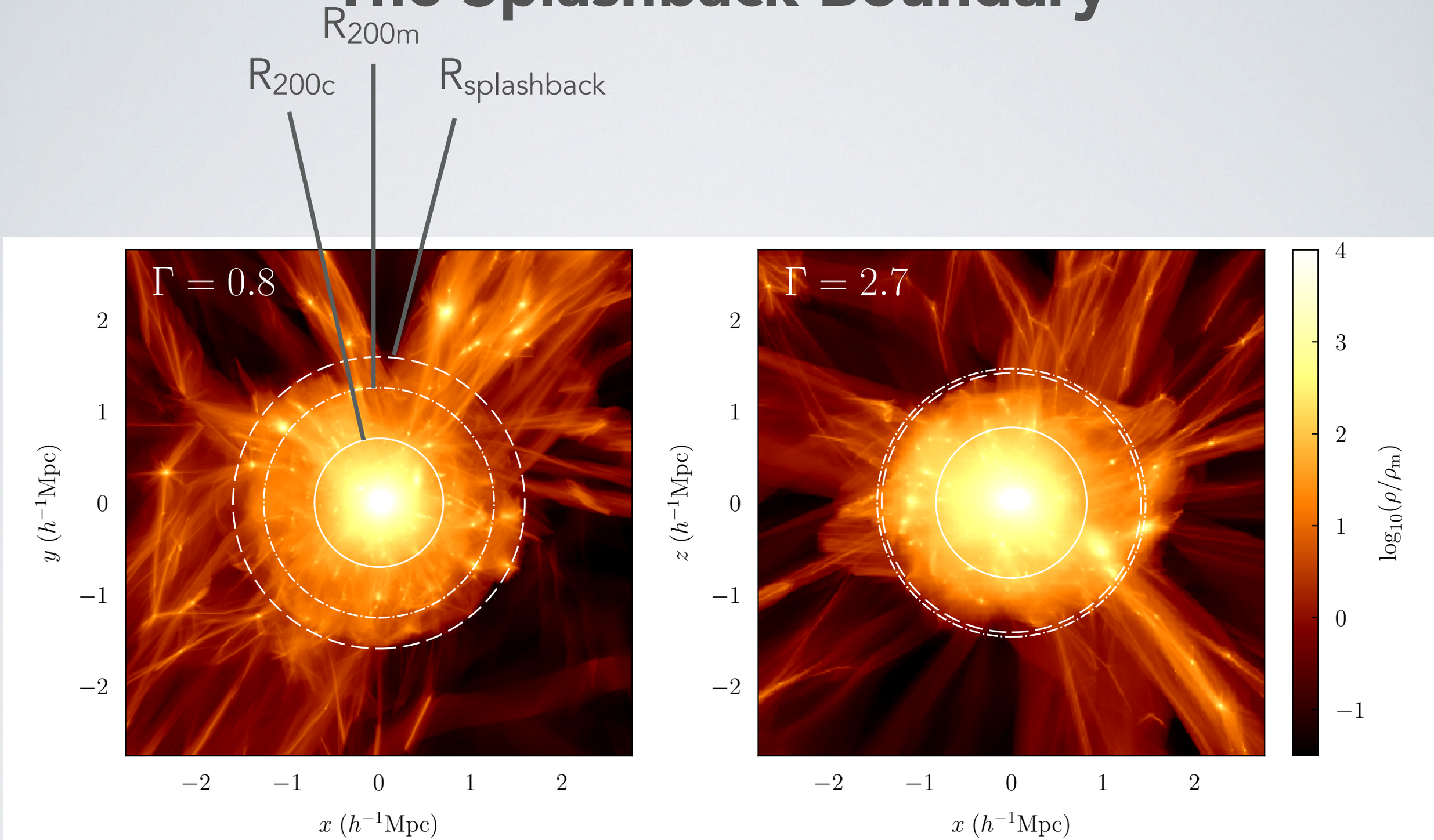


Diemer et al. 2013ab • Cuesta et al. 2008 • Zemp 2014 • More et al. 2015 • Wetzel & Nagai 2015



Fillmore & Goldreich 1984 • Bertschinger 1985 • Lu et al. 2006 • Diemand & Kuhlen 2008
Vogelsberger et al. 2011 • Lithwick & Dalal 2011 • Adhikari et al. 2014 • Shi 2016

The Splashback Boundary

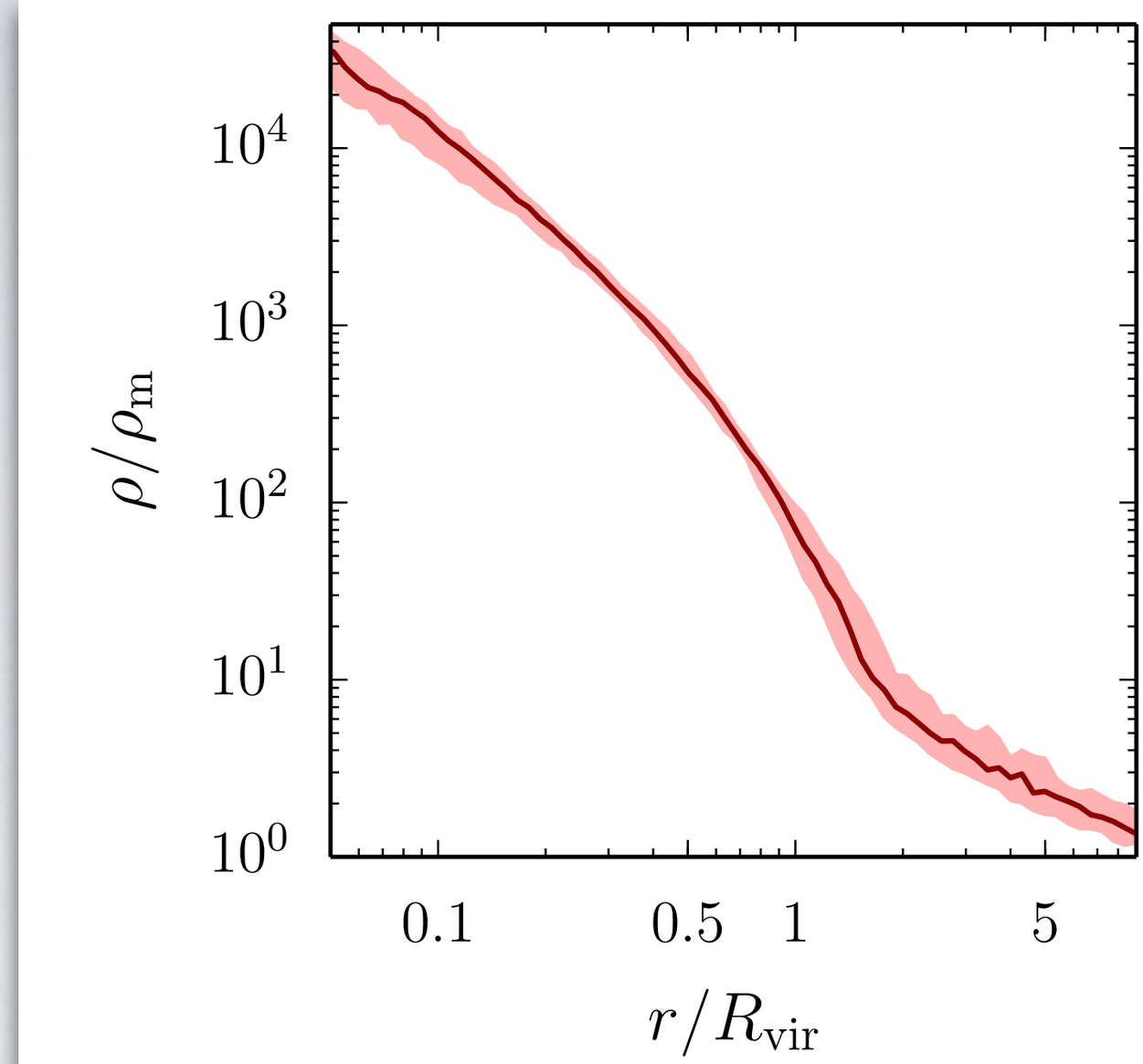


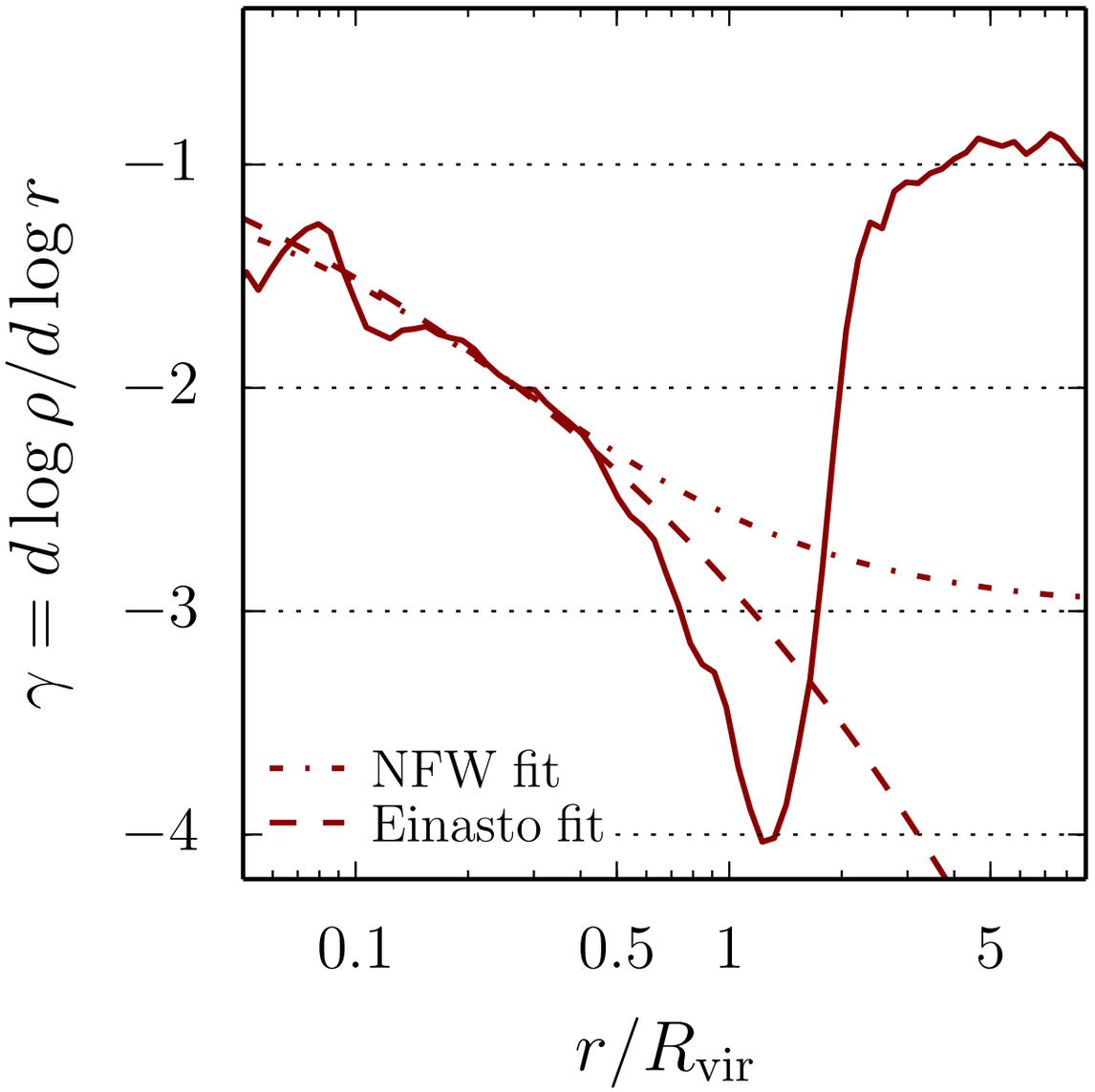
Low accretion rate

High accretion rate

Diemer & Kravtsov 2014 • Adhikari, Dalal & Clampitt 2014 • More, Diemer & Kravtsov 2015

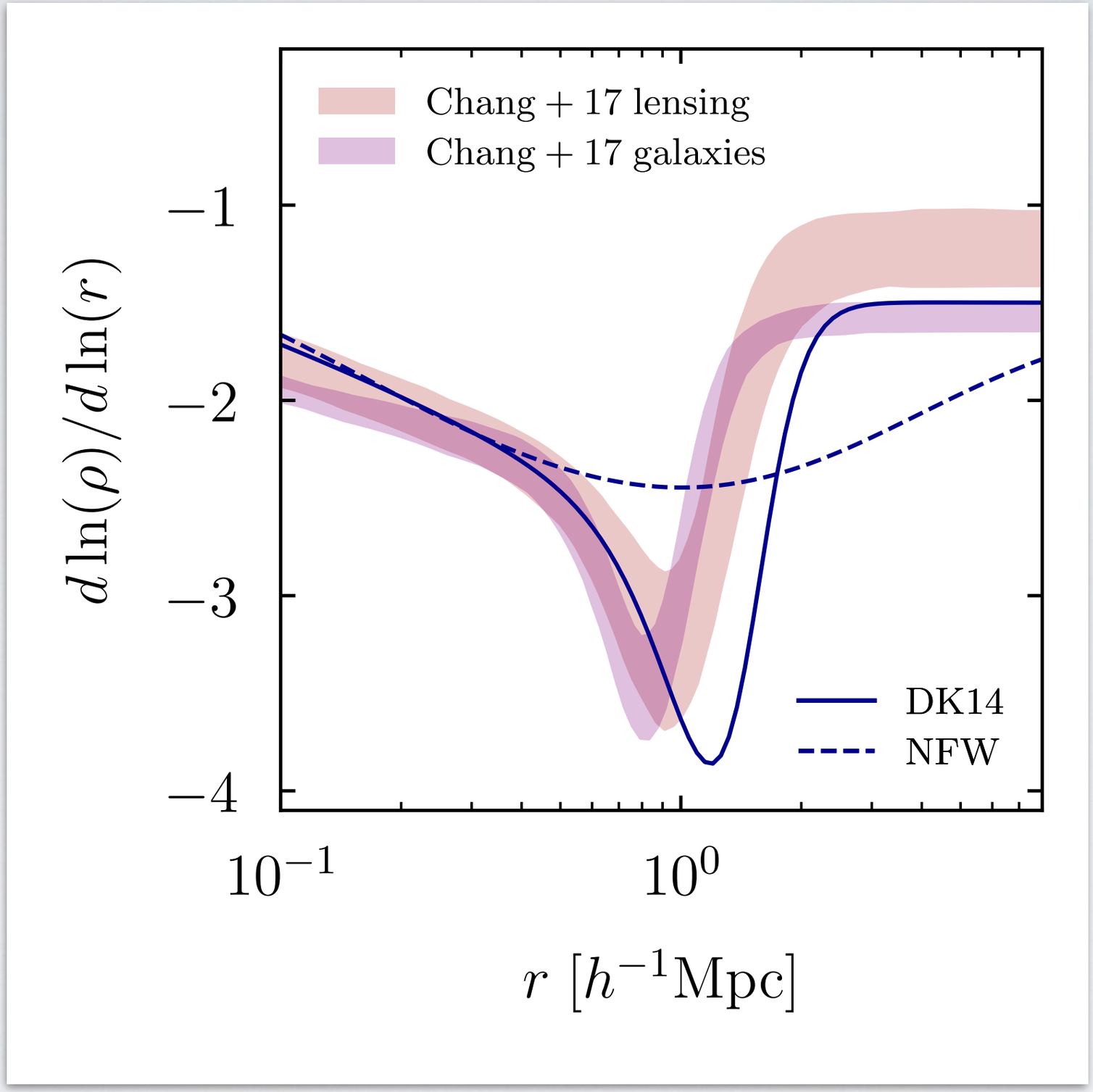
Large halos
(M>10^{15})





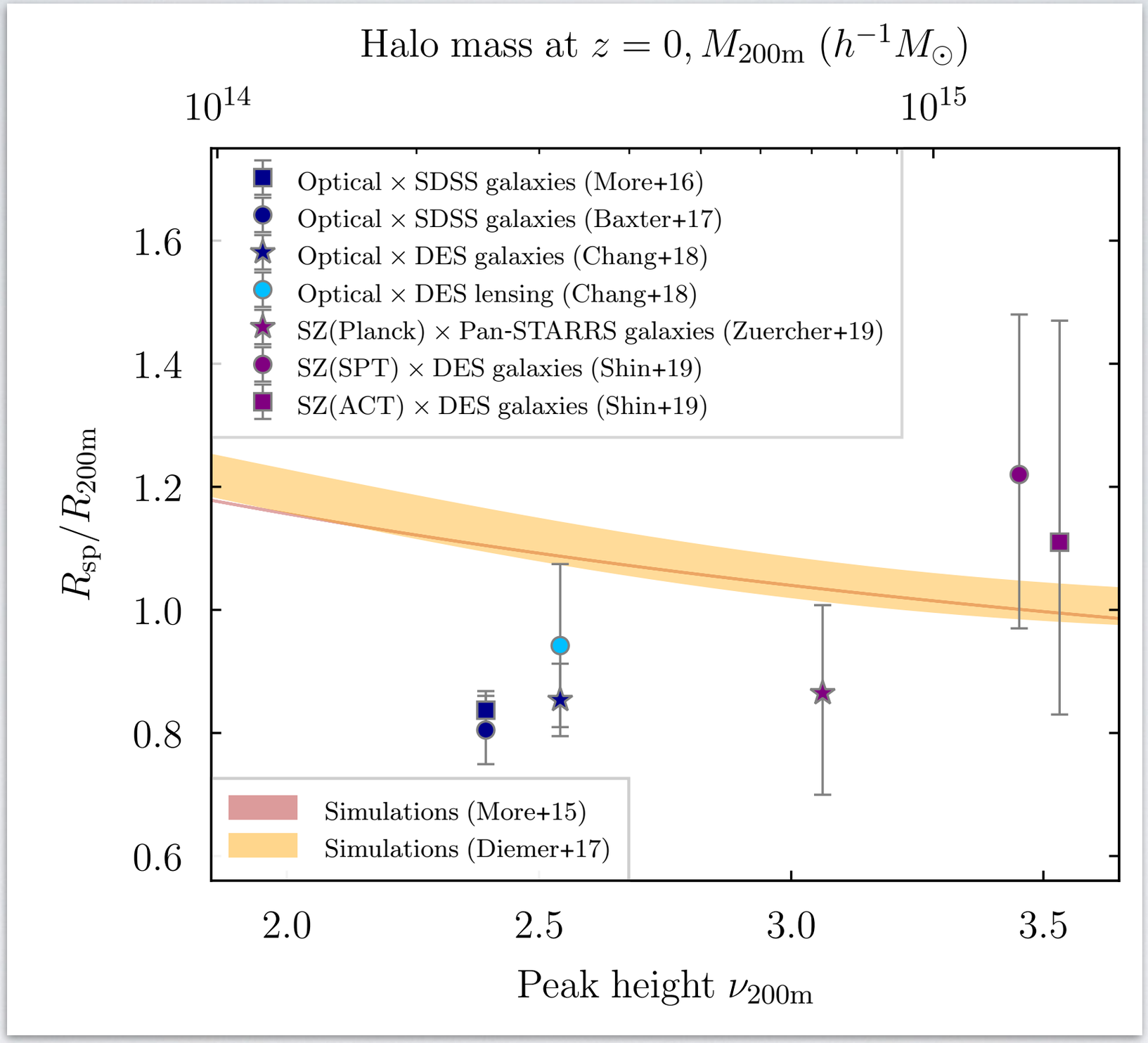
Diemer & Kravtsov 2014

Splashback in the real Universe



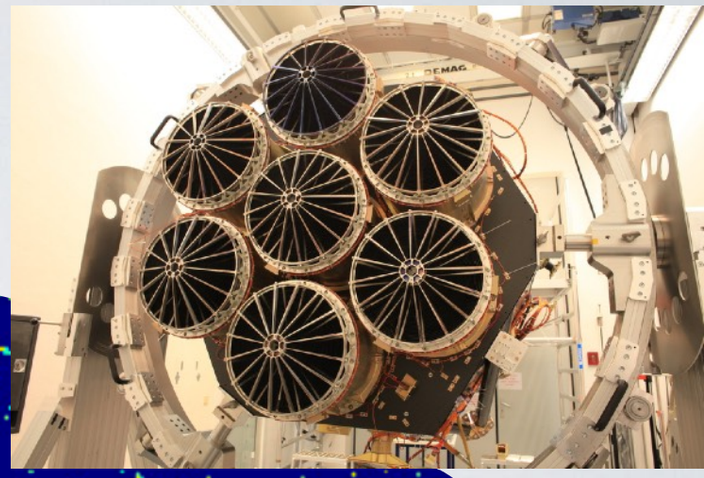
Chang et al. 2017 • Diemer & Kravtsov 2014 • Navarro et al. 1997

Splashback in observations and simulations



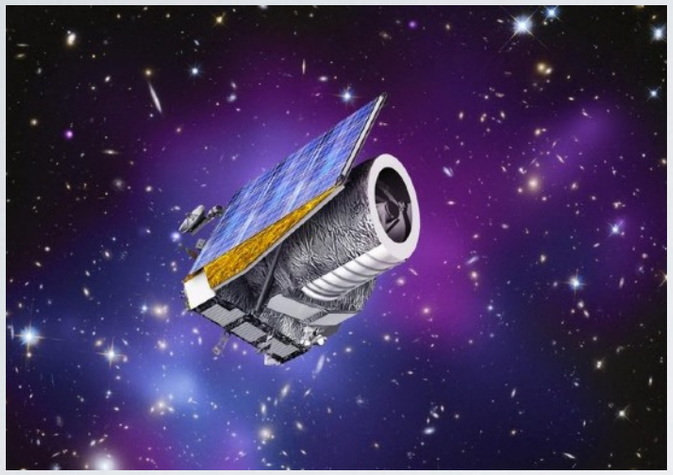
Simulations: More et al. 2015 • Diemer et al. 2017
Observations: More et al. 2016 • Baxter et al. 2017 • Chang et al. 2017 • Shin et al. 2019 • Zuercher & More 2019
See also: Tully 2015 • Zu et al. 2017 • Busch & White 2017 • Patej & Loeb 2016 • Umetsu & Diemer 2017

eROSITA X-ray selection

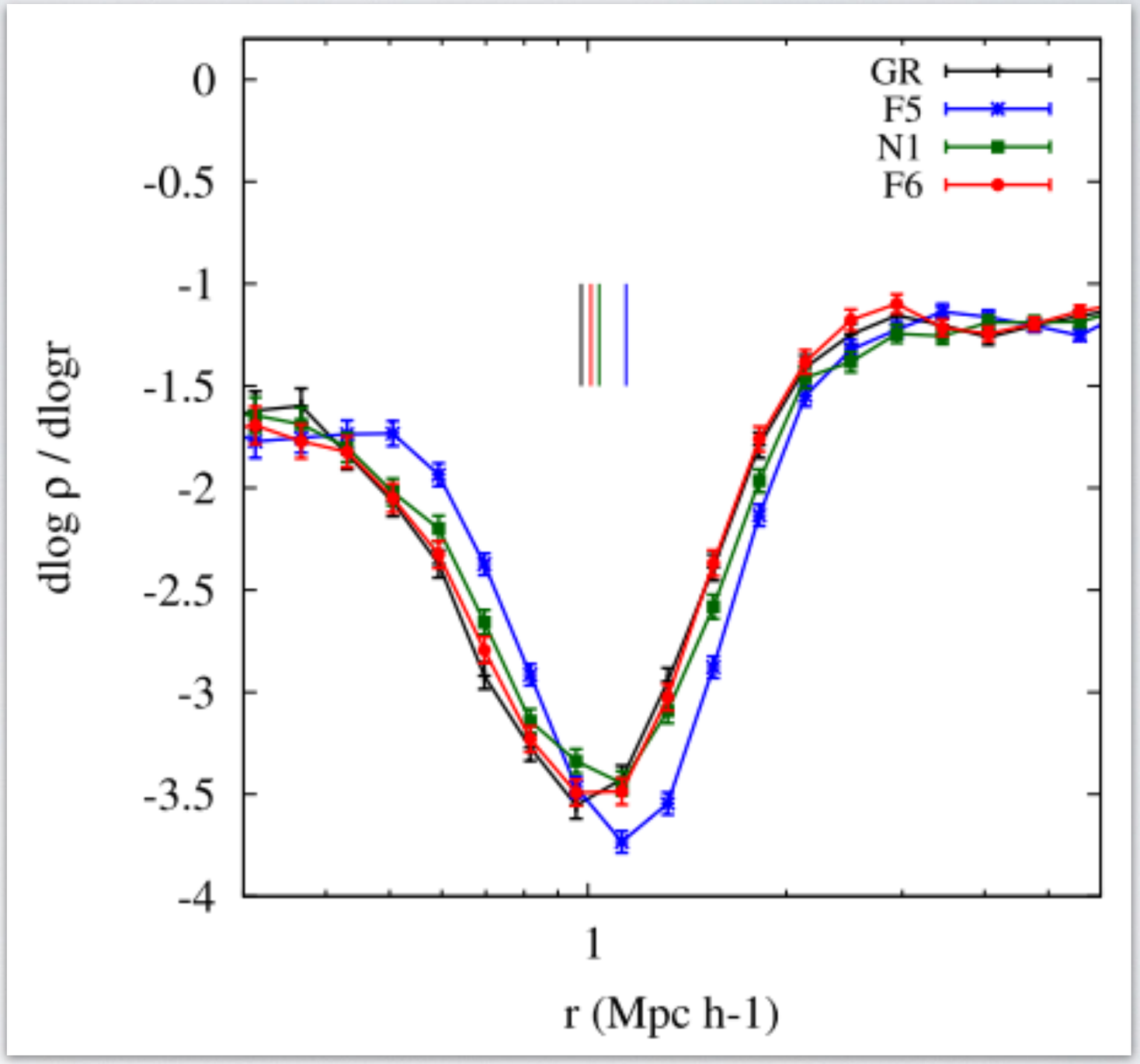


Zandanel et al. 2018

Cosmology with the splashback boundary?

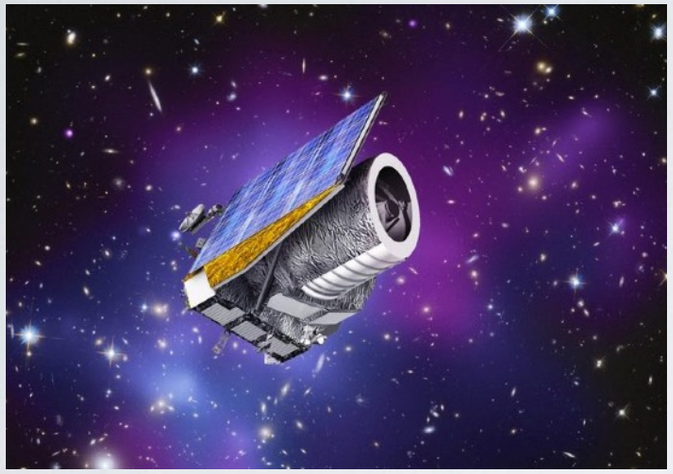


Euclid

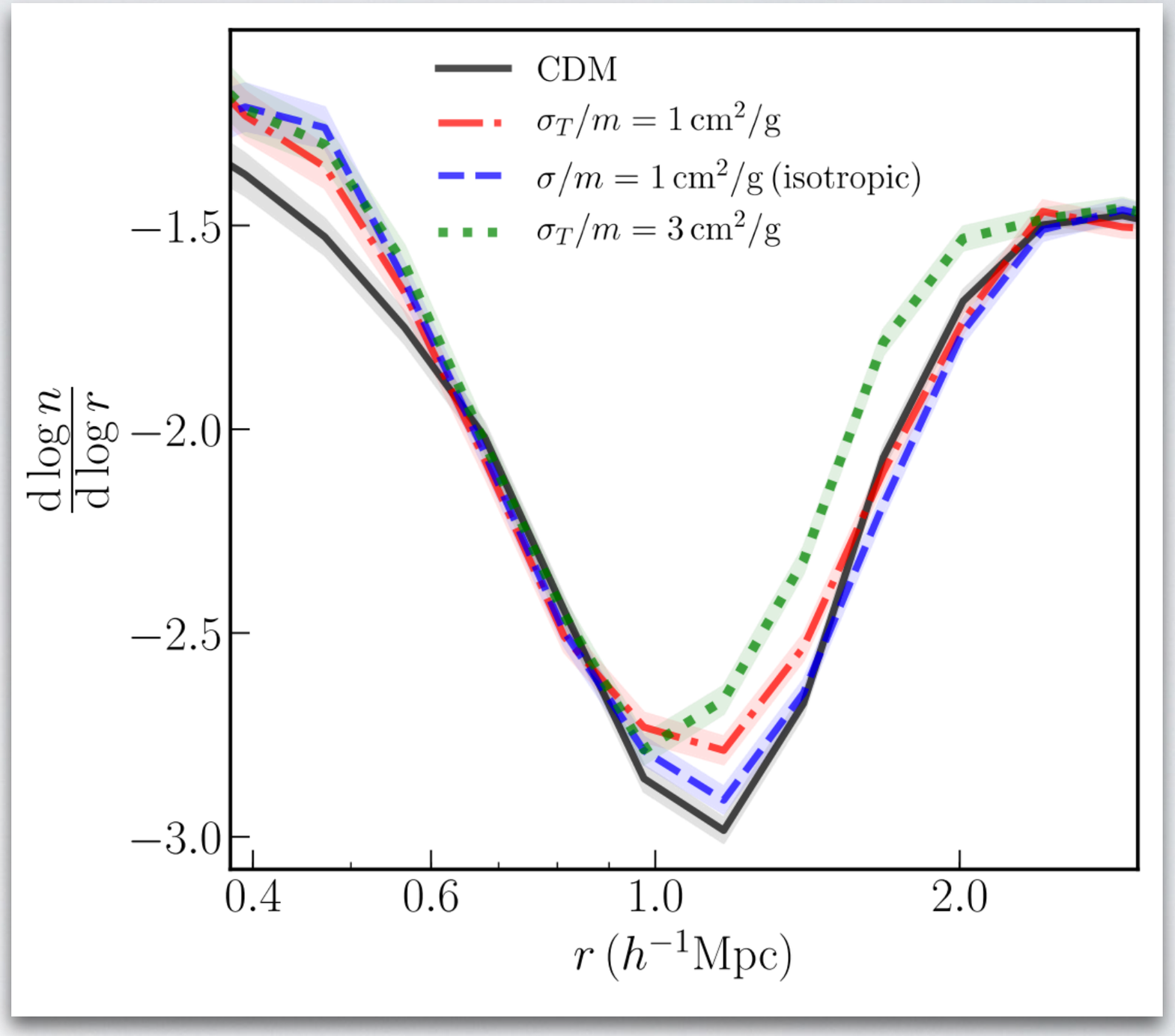


Adhikari et al. 2018

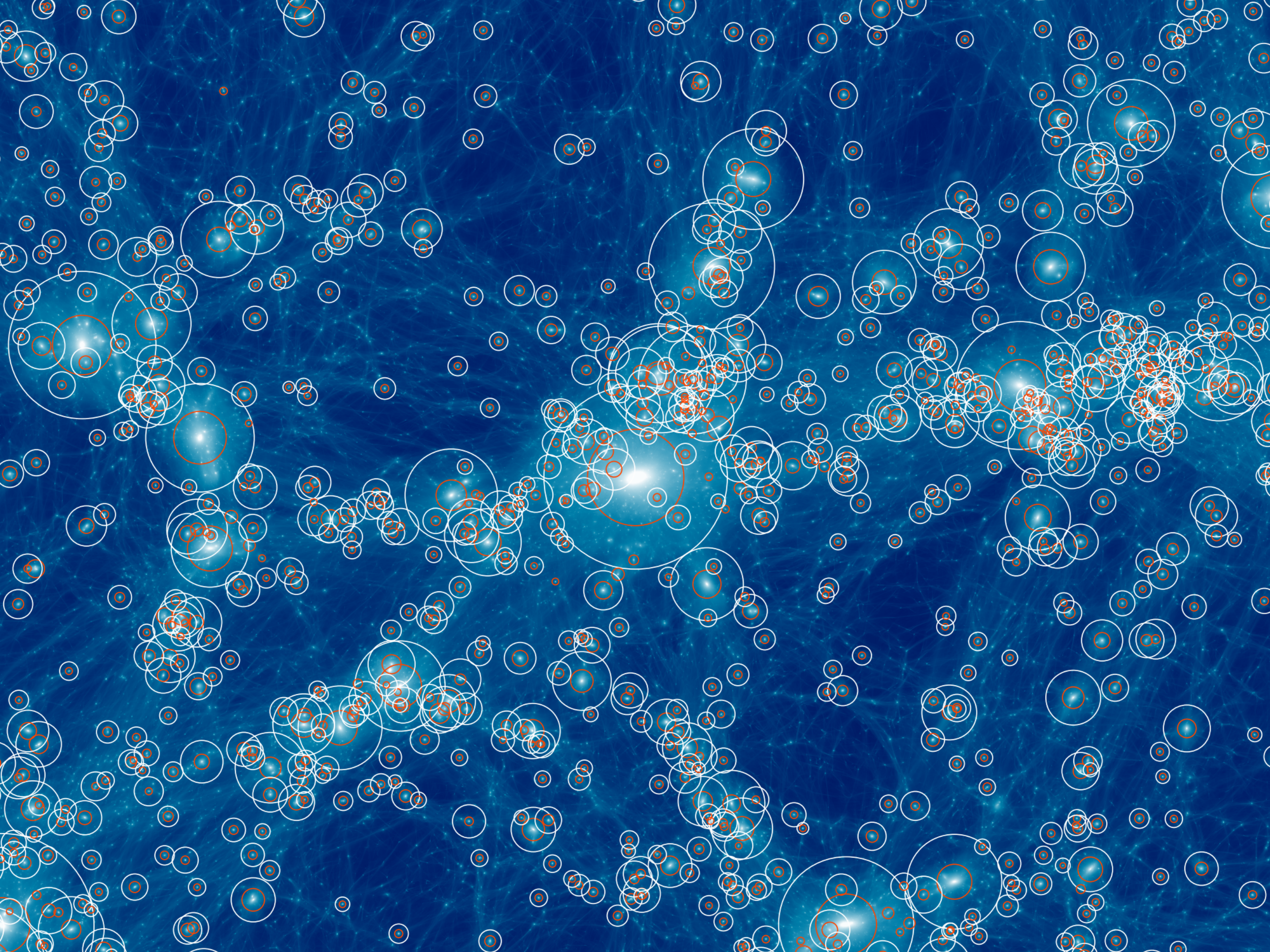
Splashback and SIDM

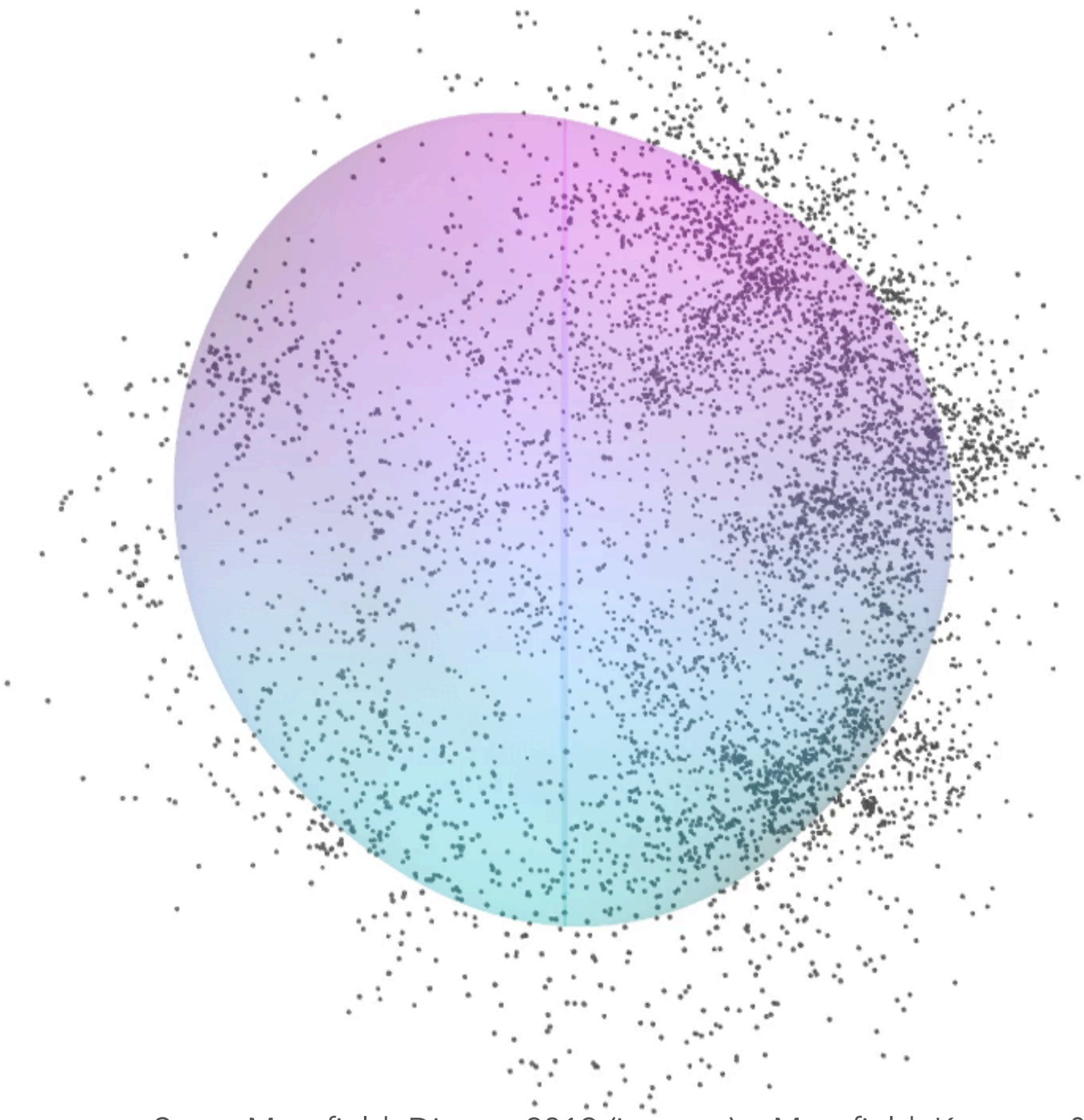


Euclid



Banerjee et al. 2019





Spencer Scott

Philip Mansfield

Scott, Mansfield, Diemer 2019 (in prep.) • Mansfield, Kravtsov & Diemer 2017 • Penna & Dines 2007

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