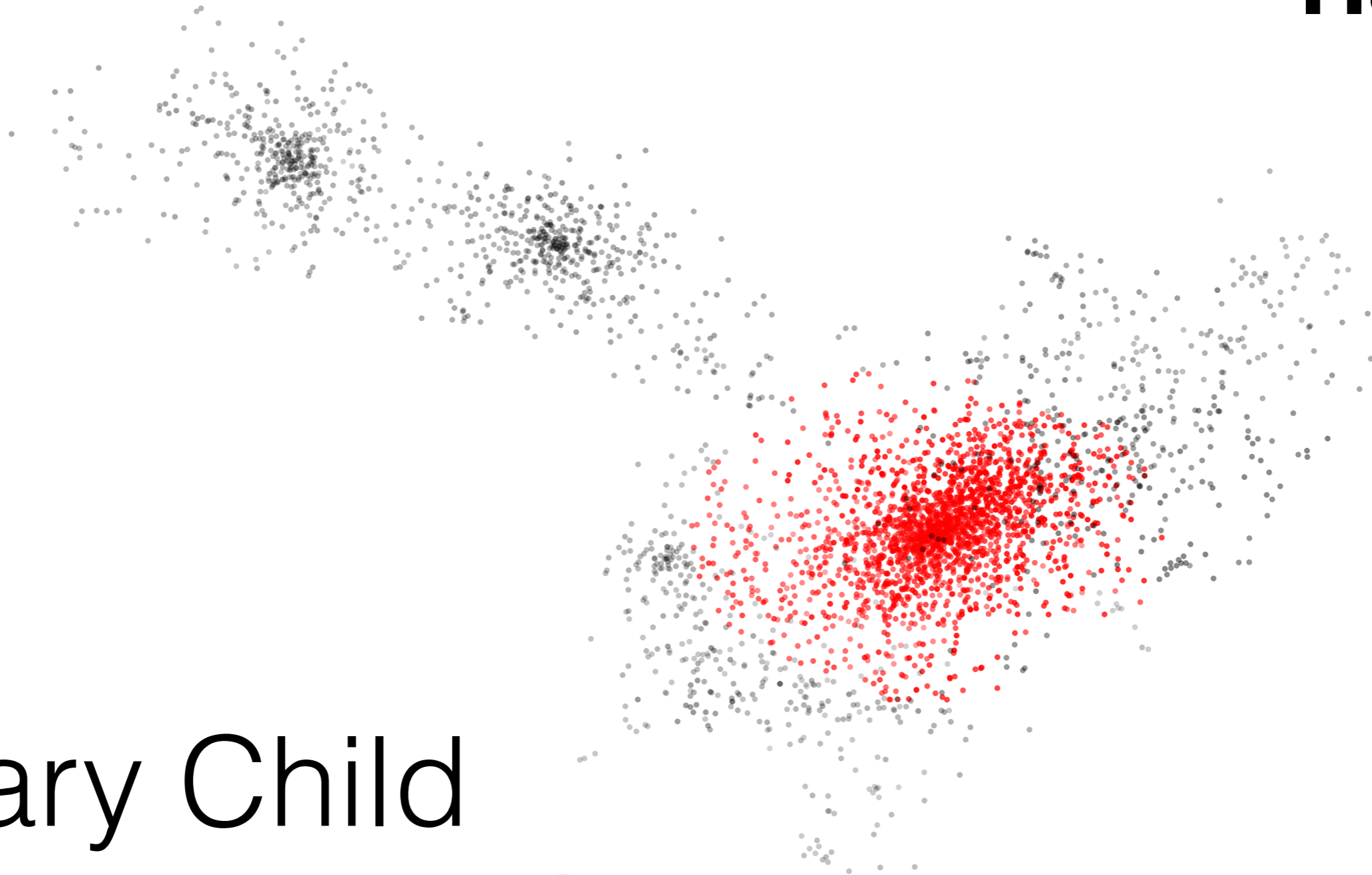


Concentrations of Simulated Dark Matter Halos



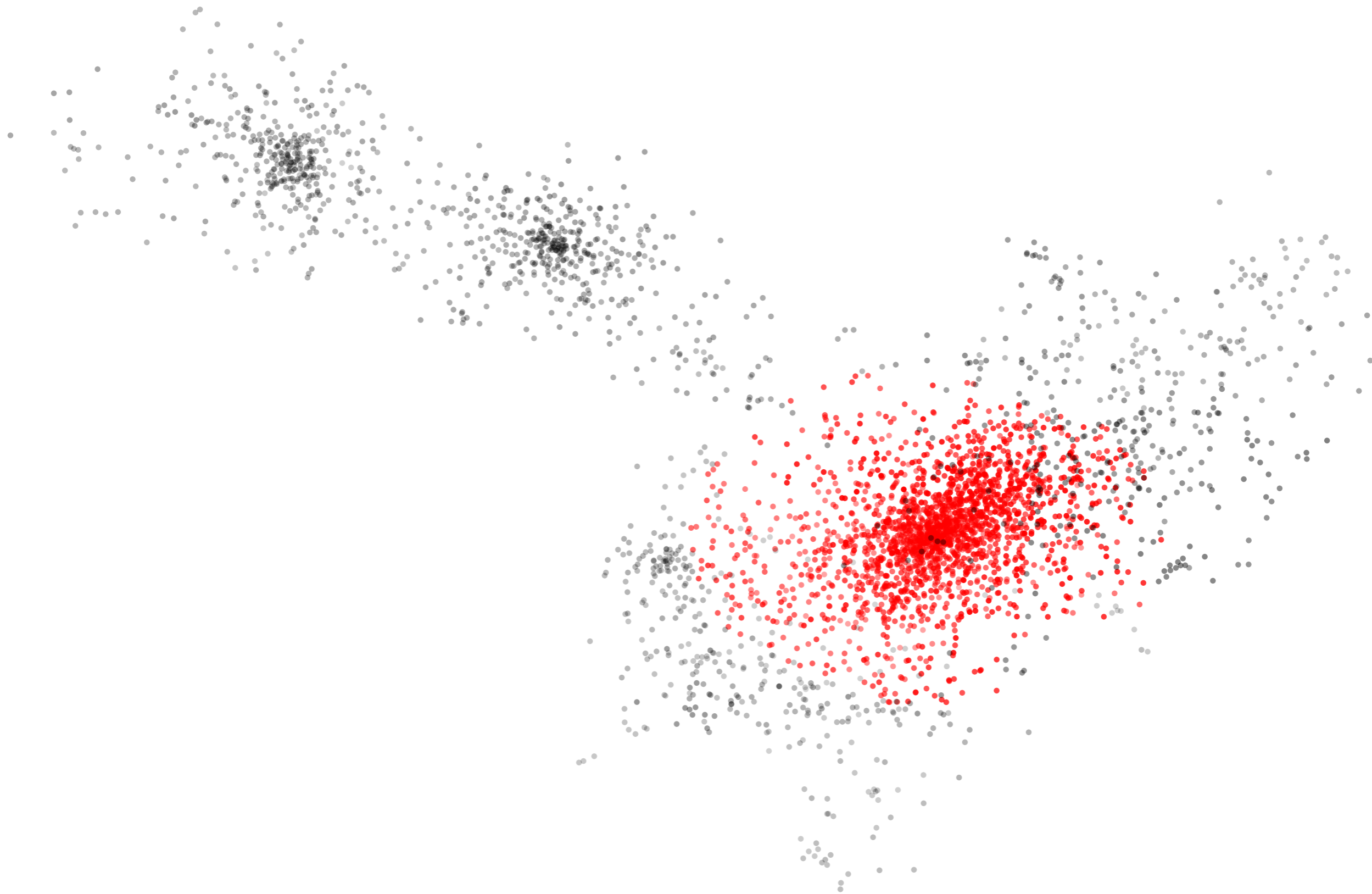
Hillary Child



THE UNIVERSITY OF
CHICAGO



**Why
Concentrations?**

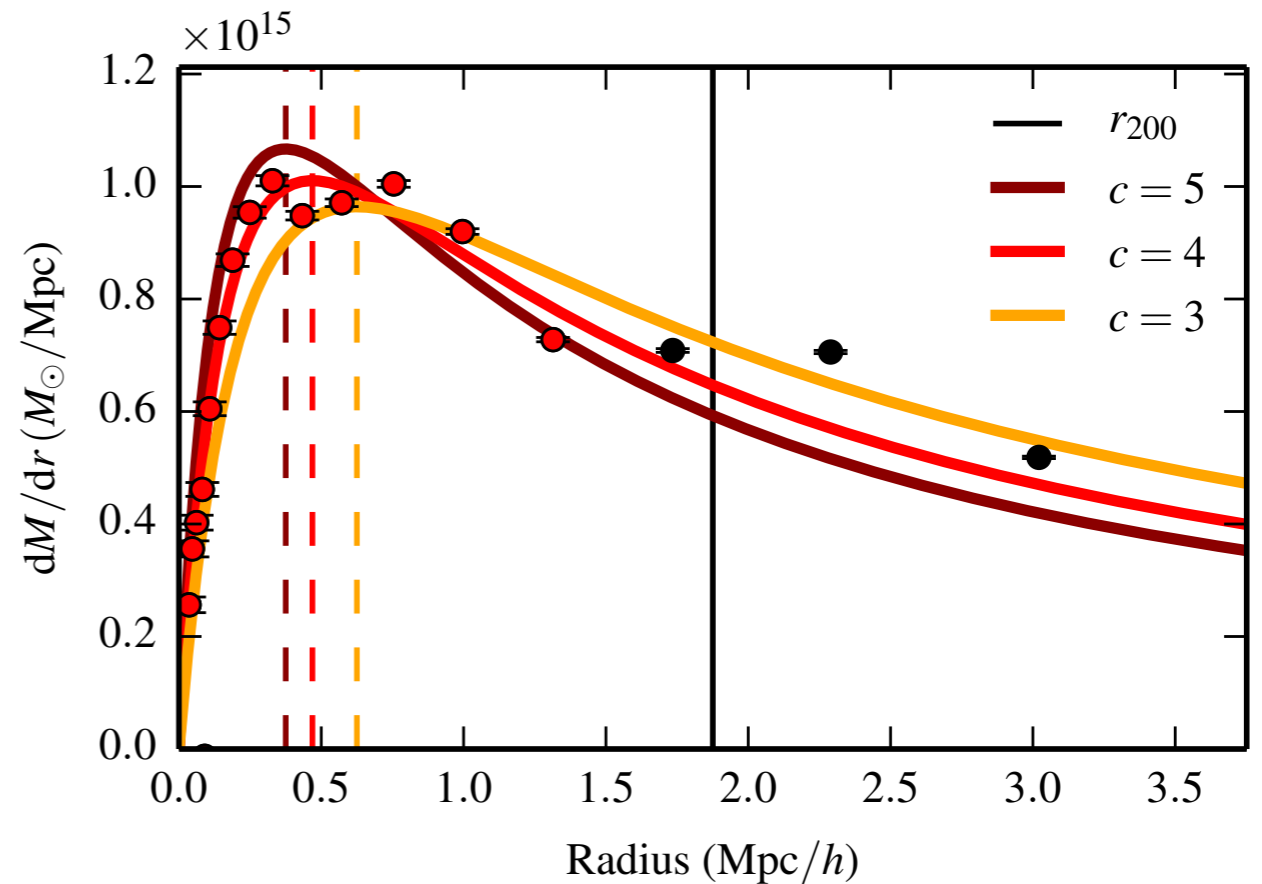


Navarro-Frenk-White (NFW) Profile

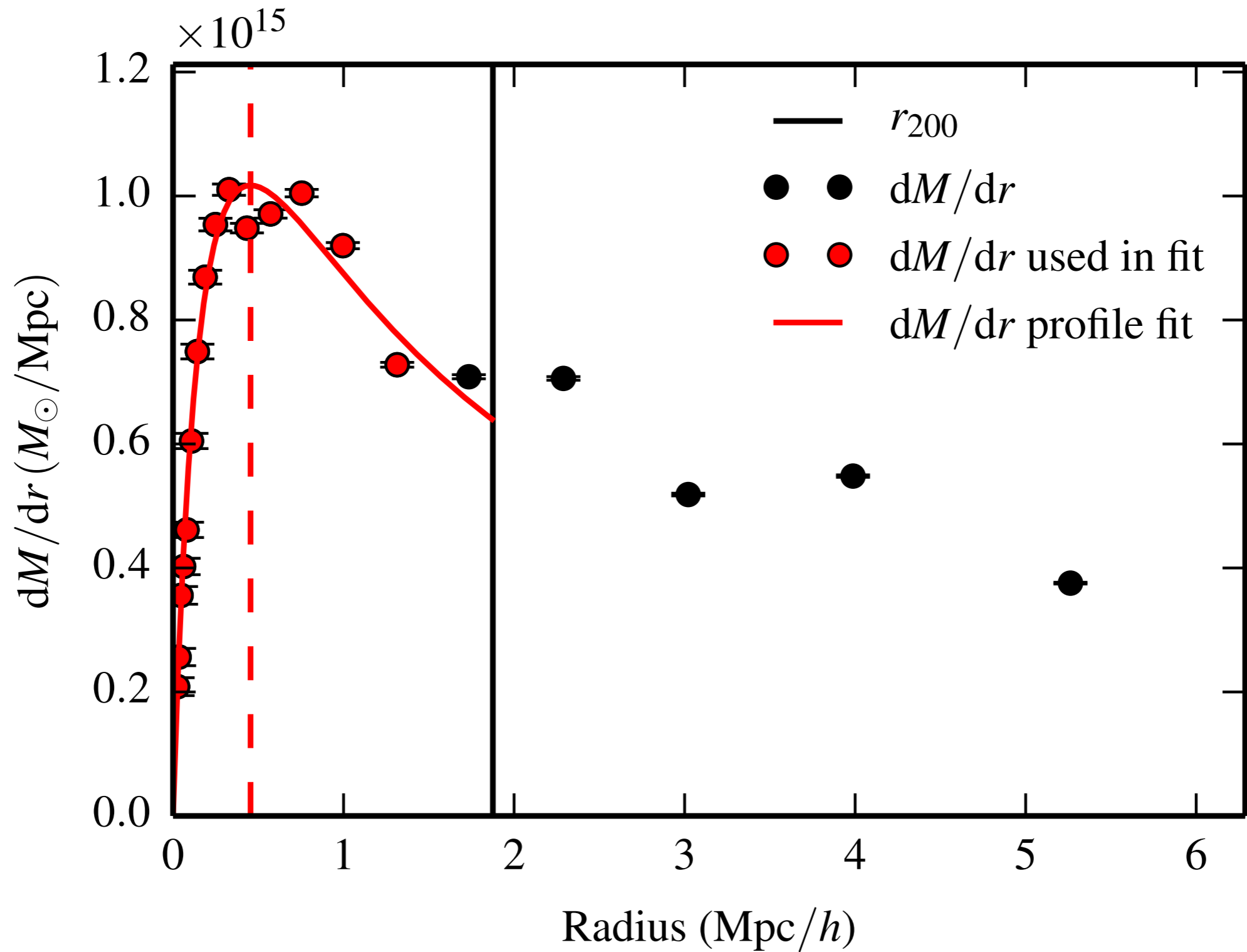
$$\frac{dM}{dr} = \frac{M_{\Delta}}{A(c_{\Delta})} \frac{r}{(r_s + r)^2}$$

$$A(c_{\Delta}) = \ln(1 + c_{\Delta}) - \frac{c_{\Delta}}{1 + c_{\Delta}}$$

Concentration: $c_{\Delta} = \frac{r_{\Delta}}{r_s}$

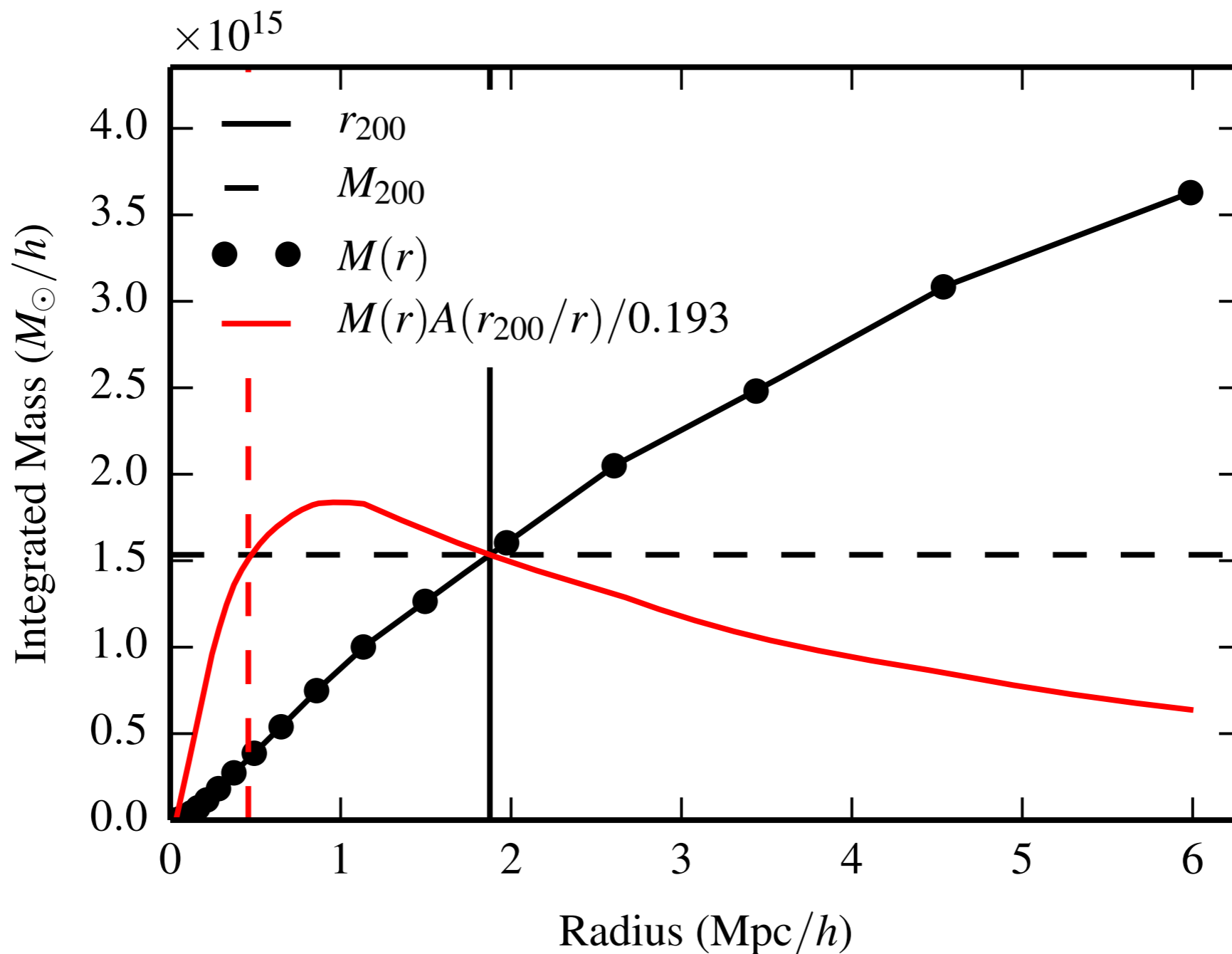


Profile Fit

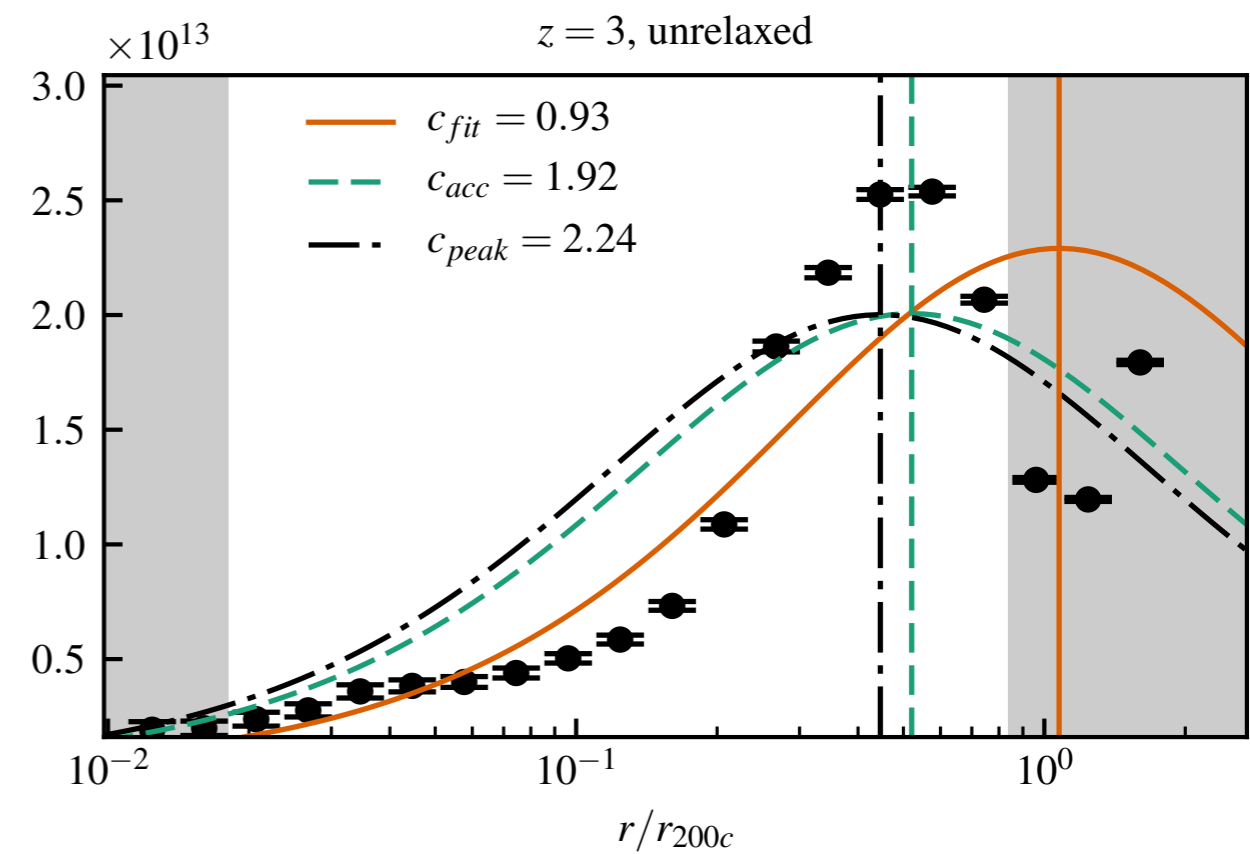
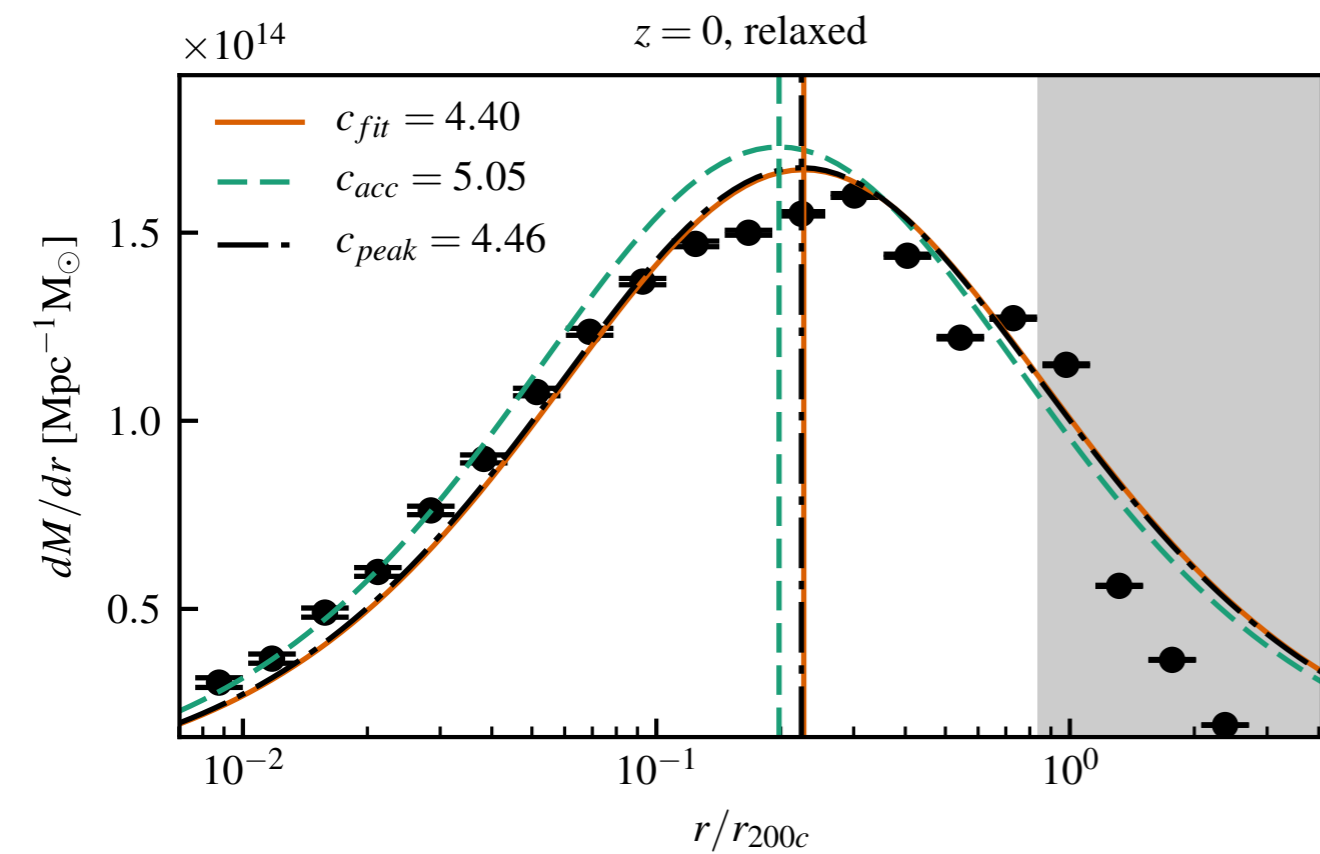


Accumulated Mass Method

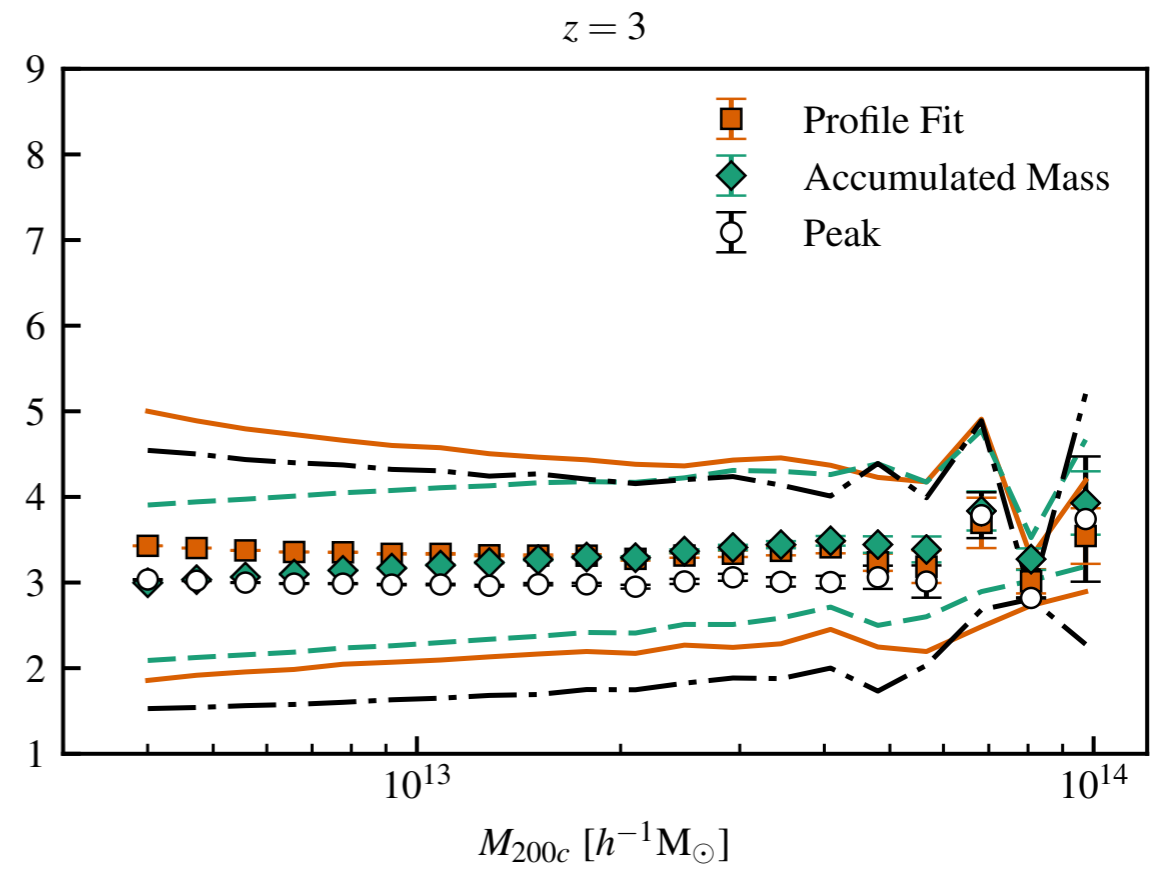
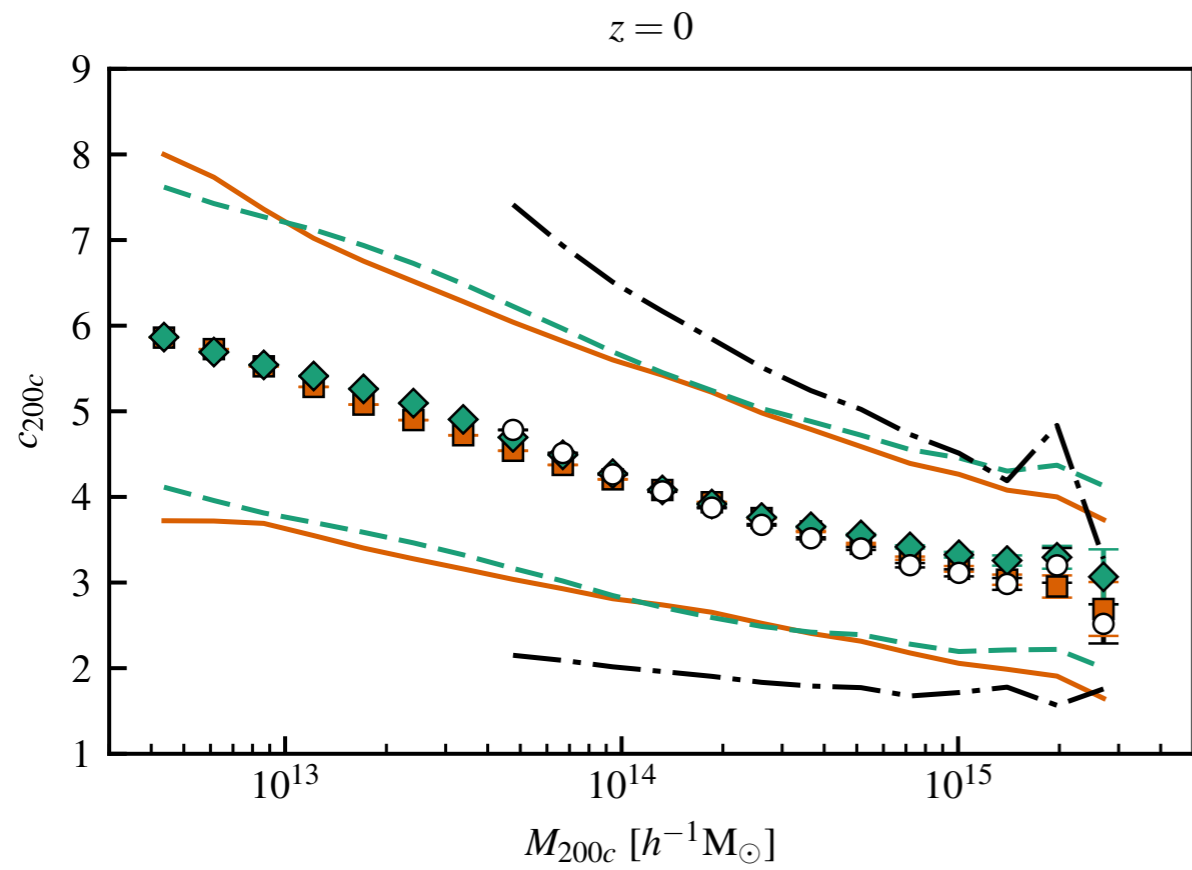
$$M(r_s) = 0.193 \frac{M_\Delta}{A(c_\Delta)} \quad A(c_\Delta) = \ln(1 + c_\Delta) - \frac{c_\Delta}{1 + c_\Delta}$$

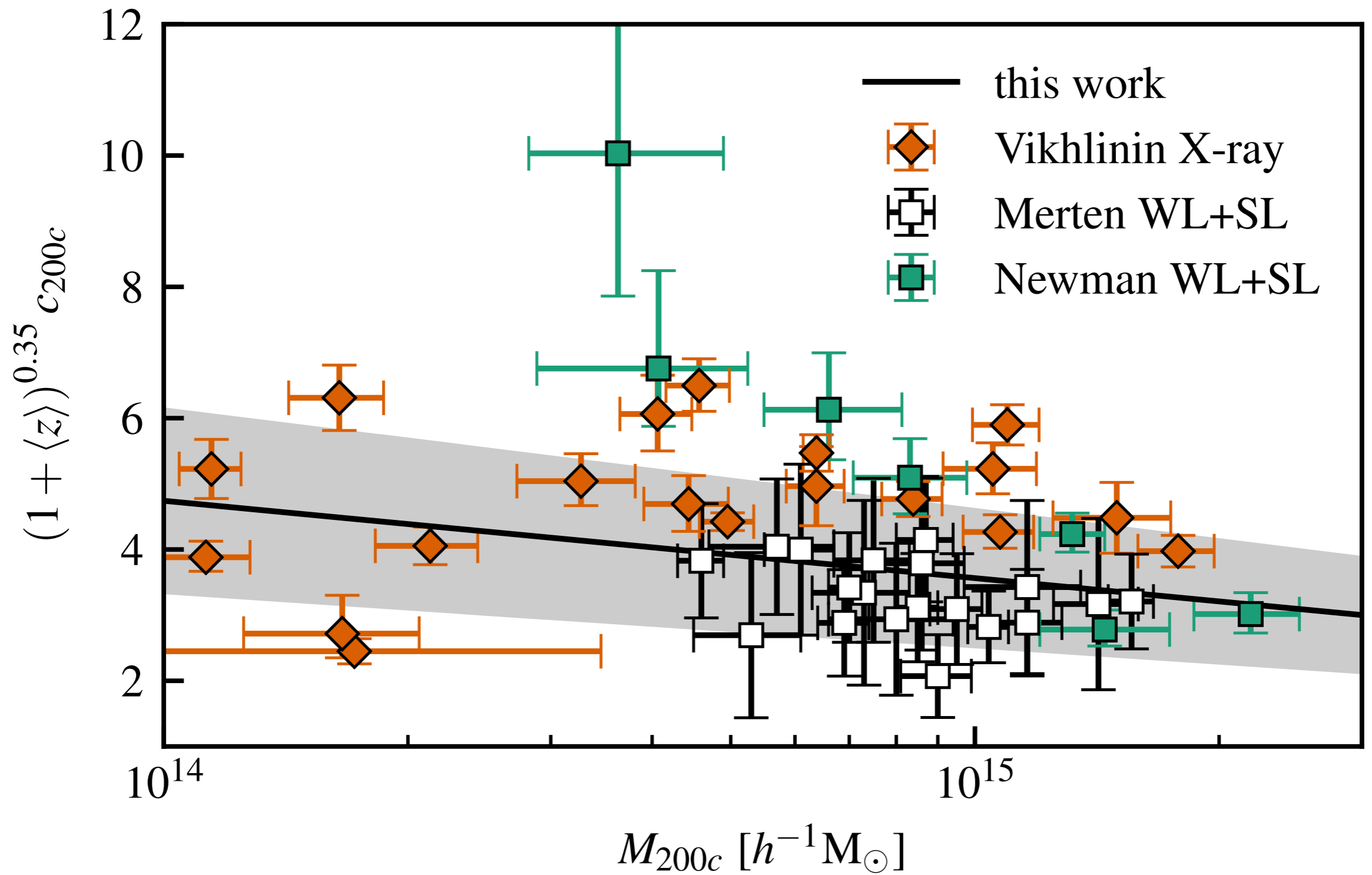


Fit vs. Accumulated Mass vs. Peak

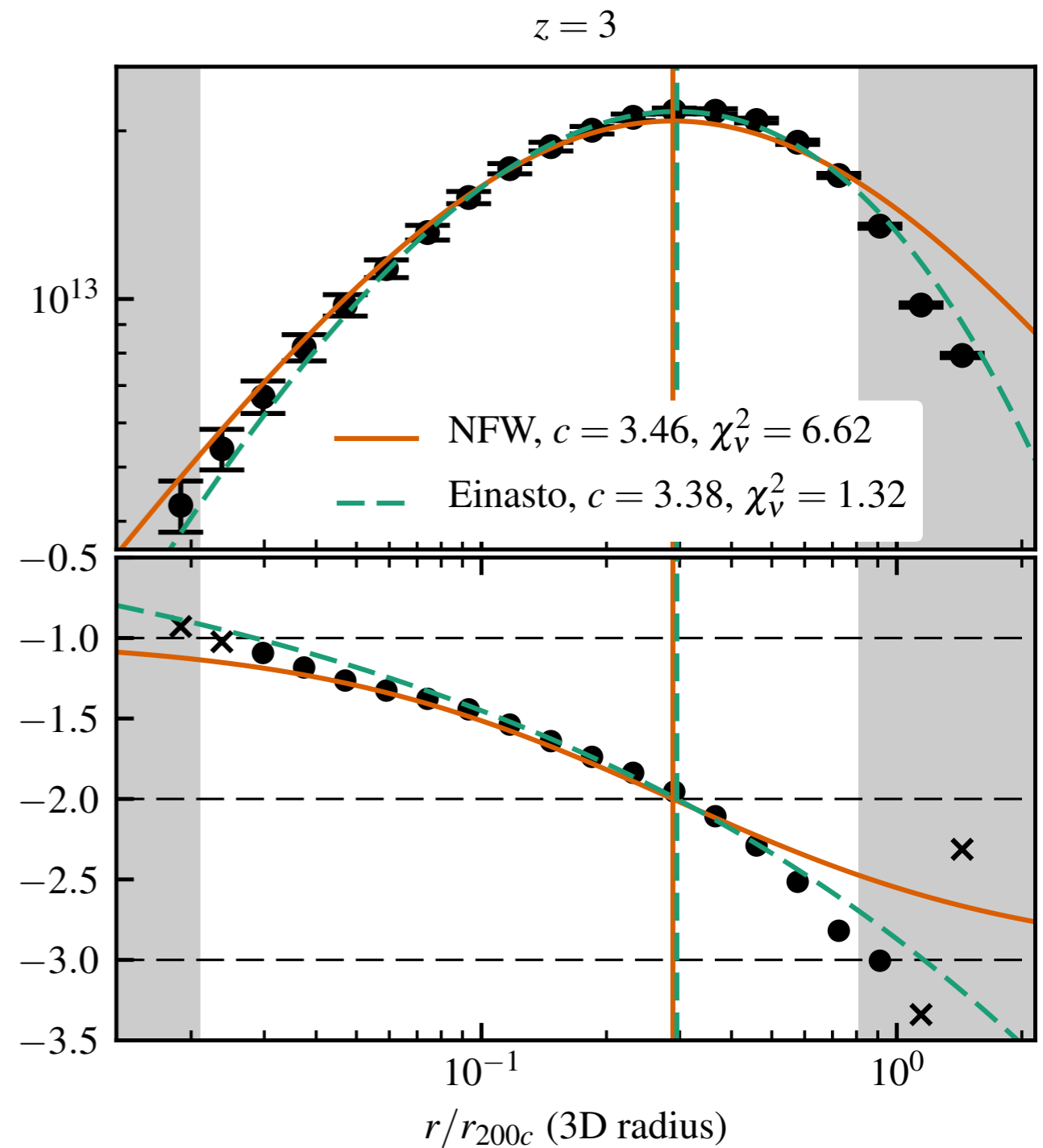
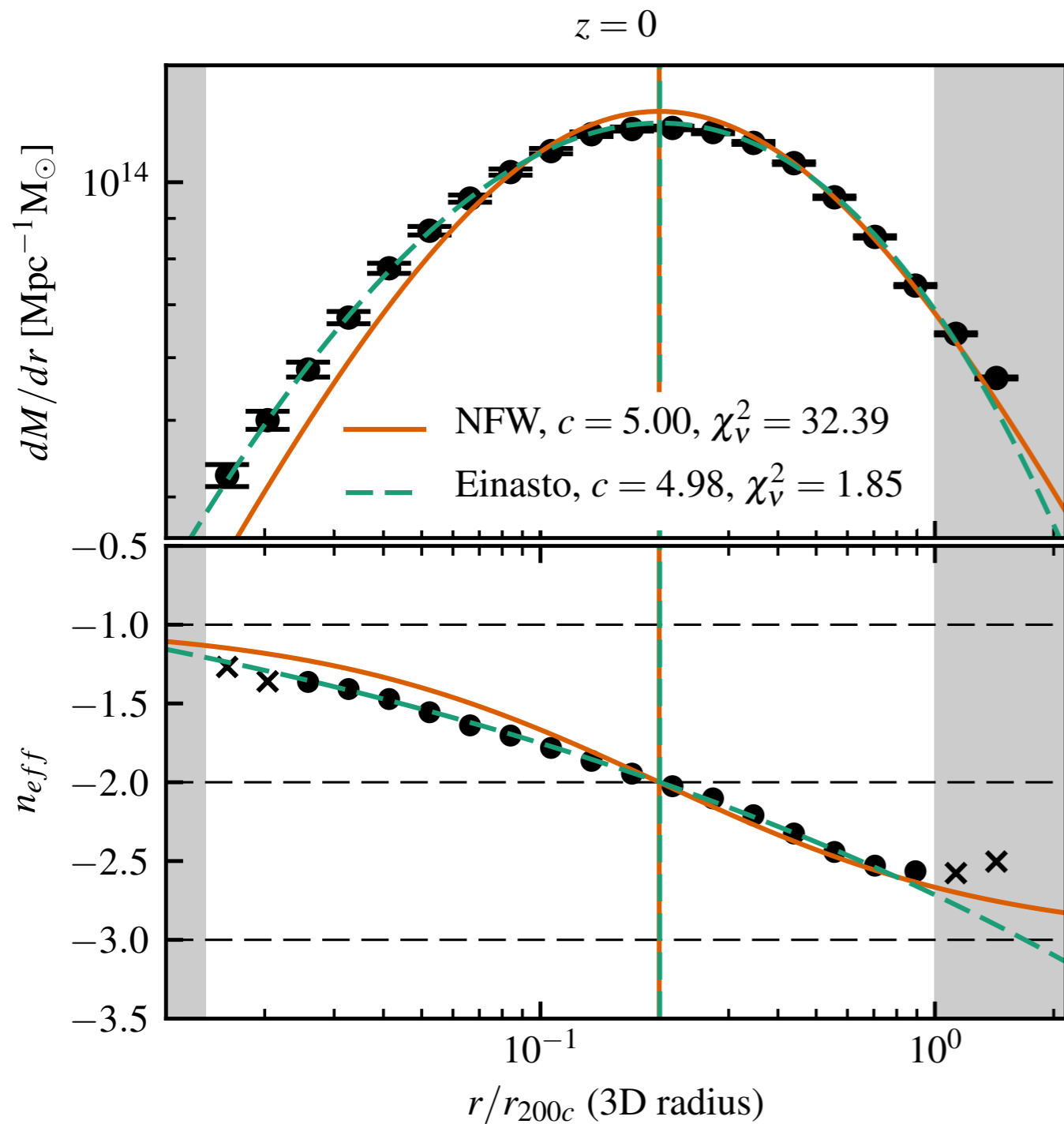


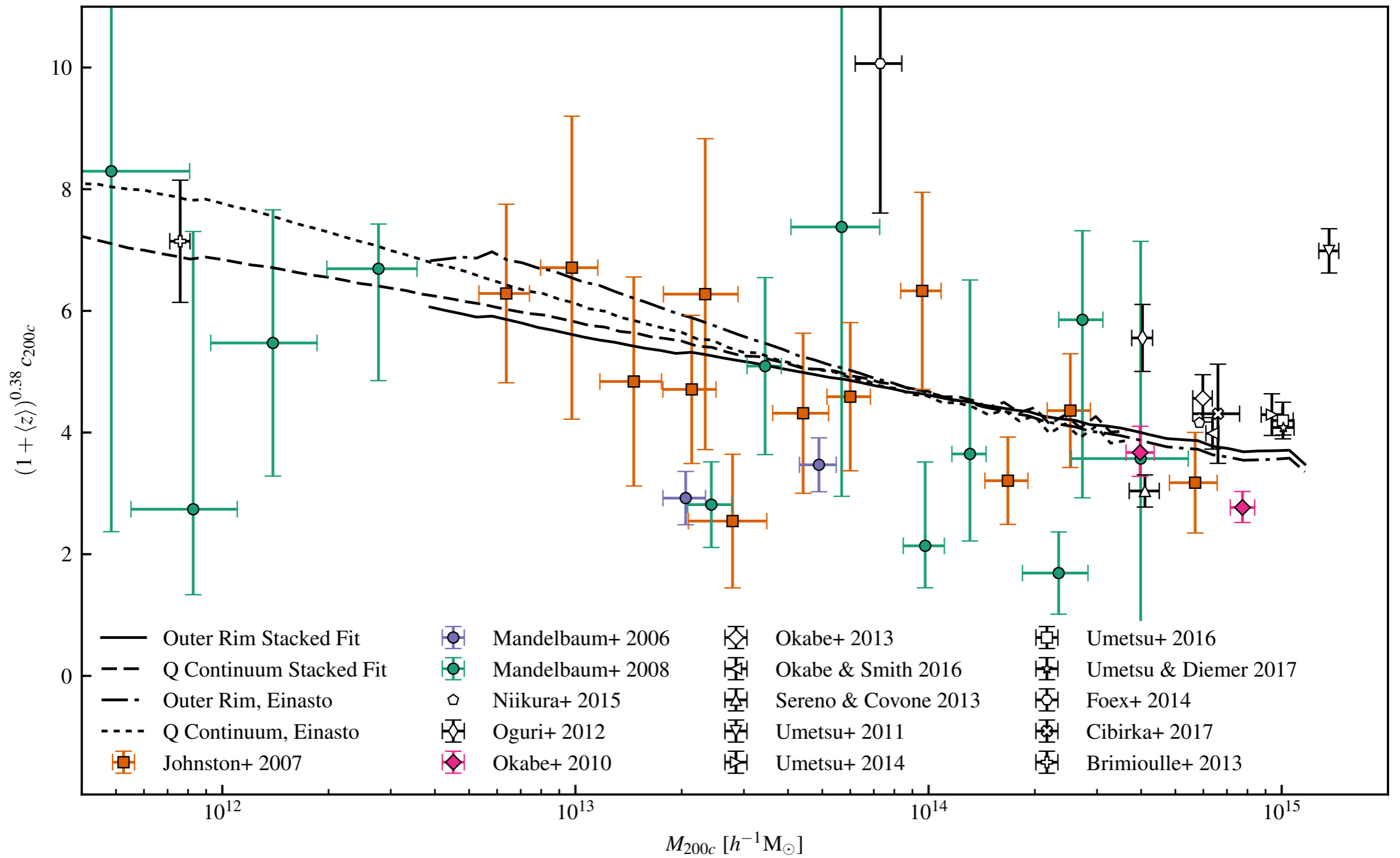
c-M Relation



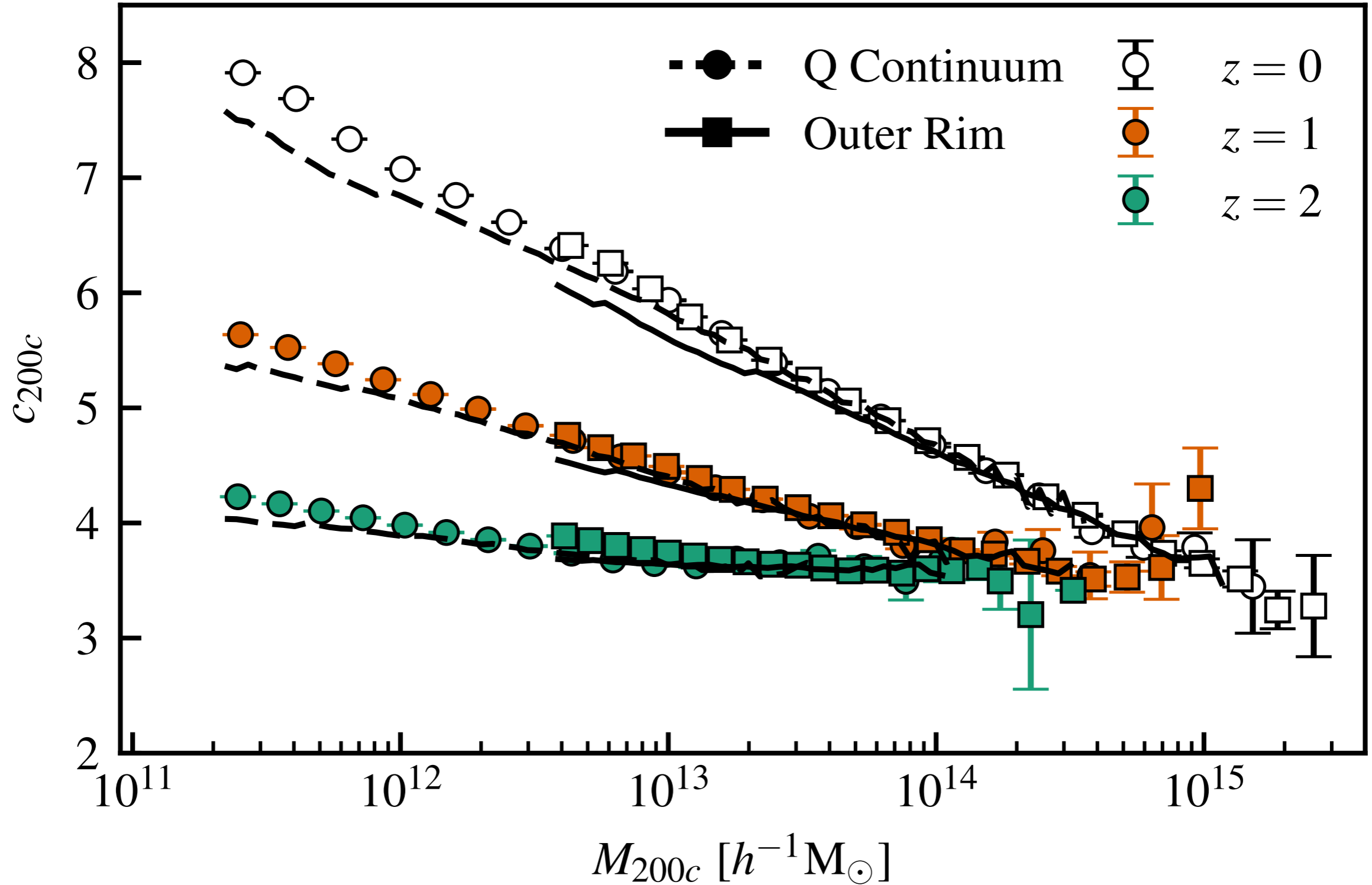


Stacked Profile

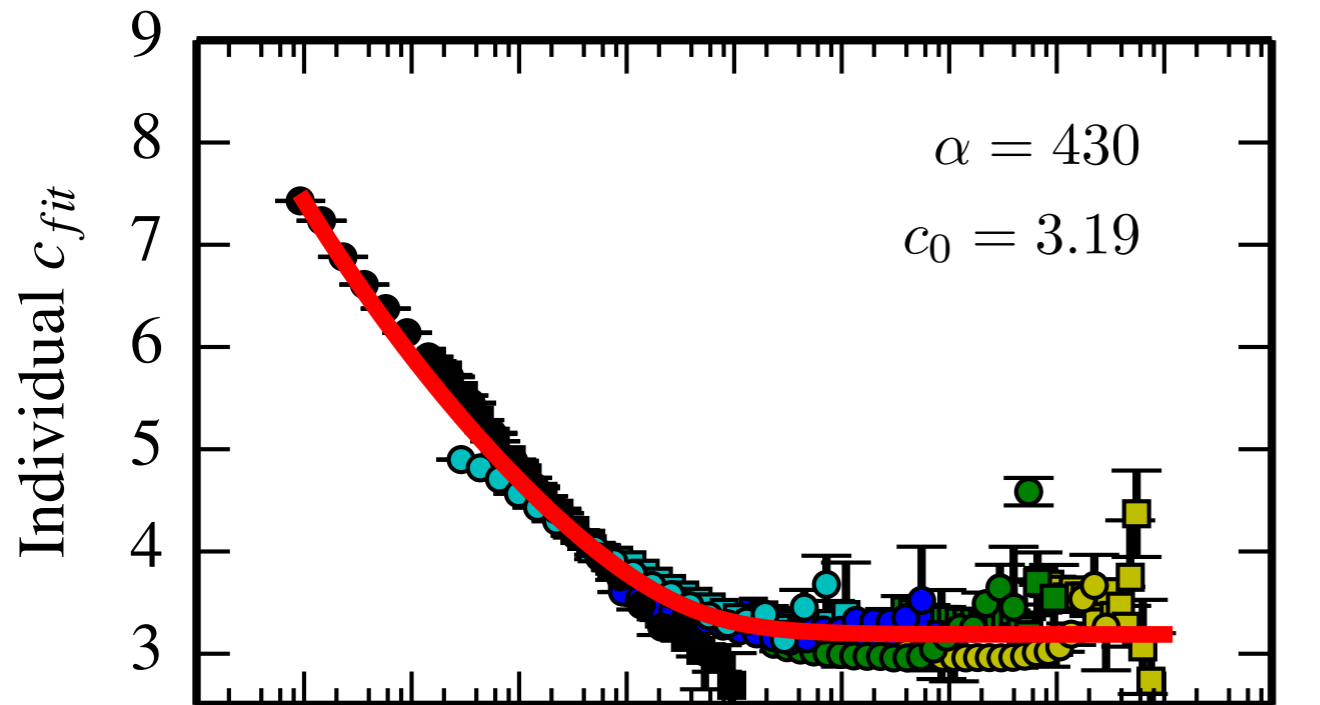




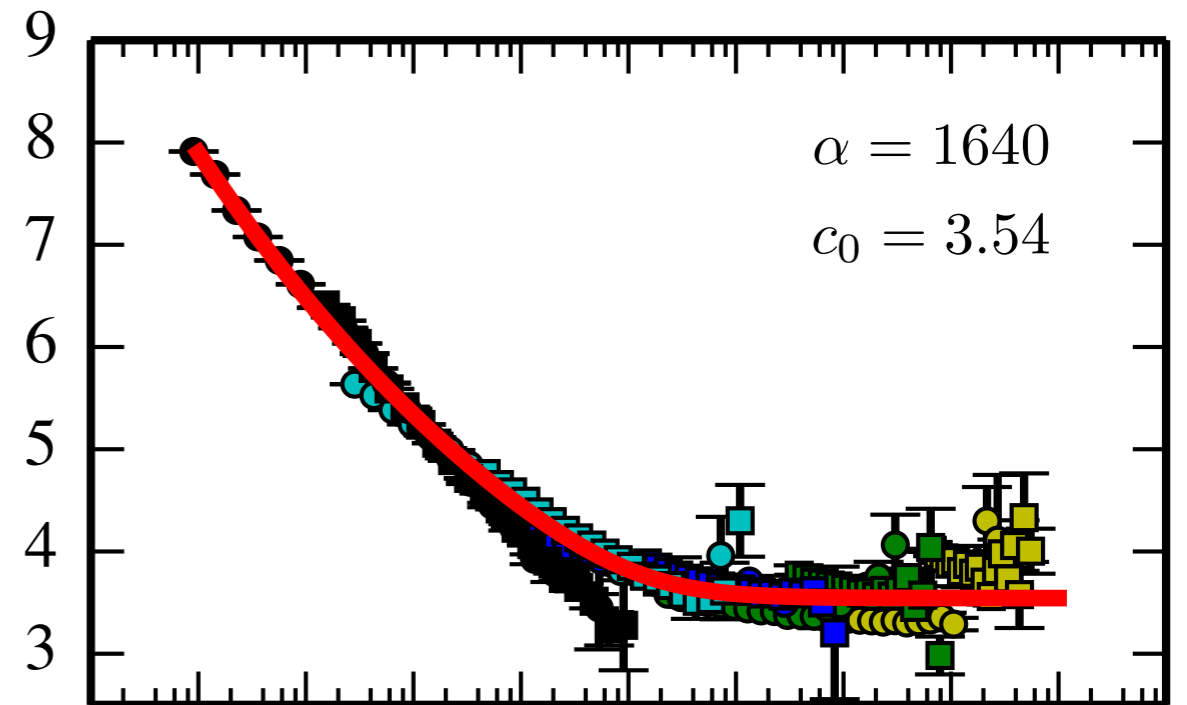
Stacked c-M



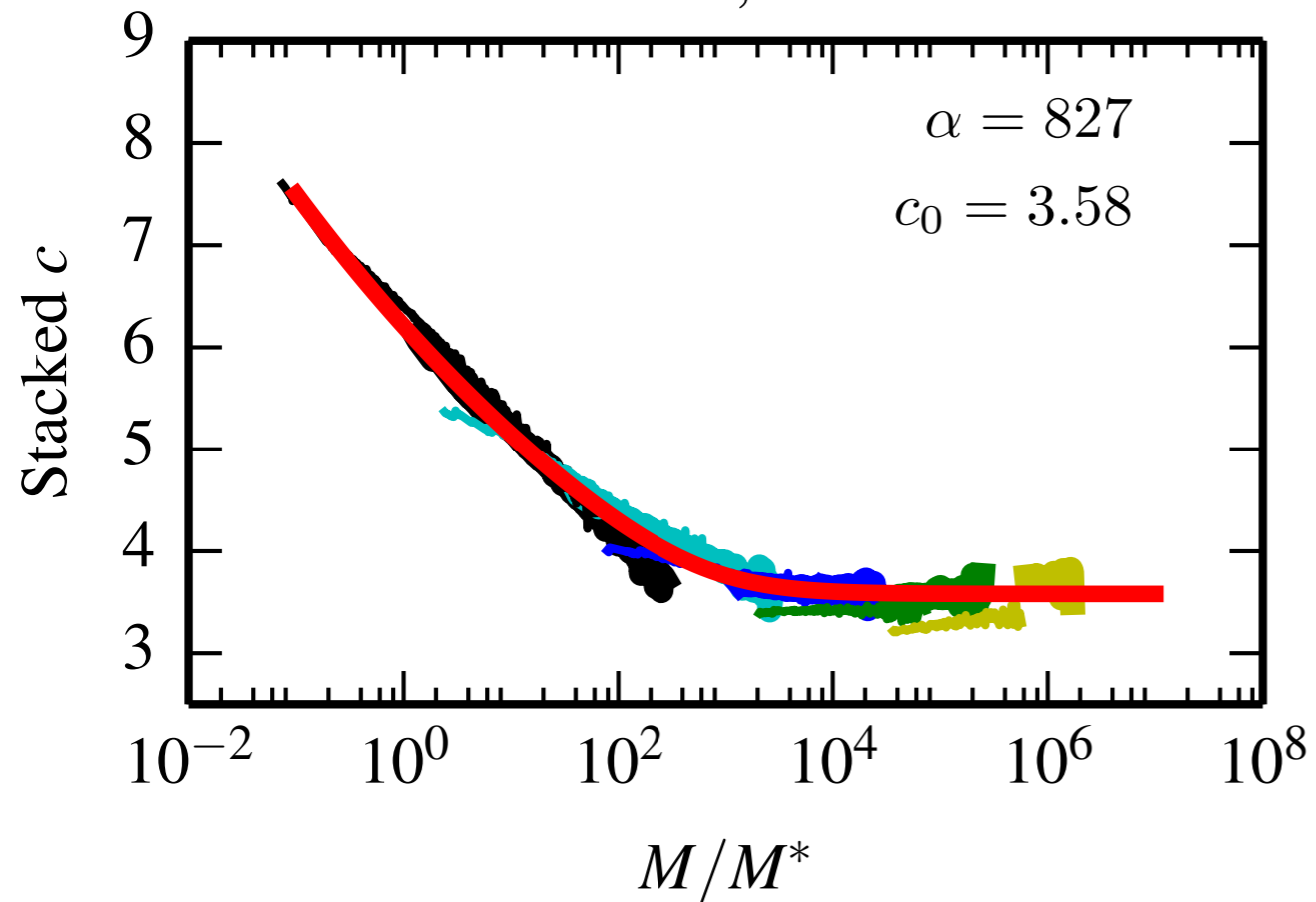
all halos



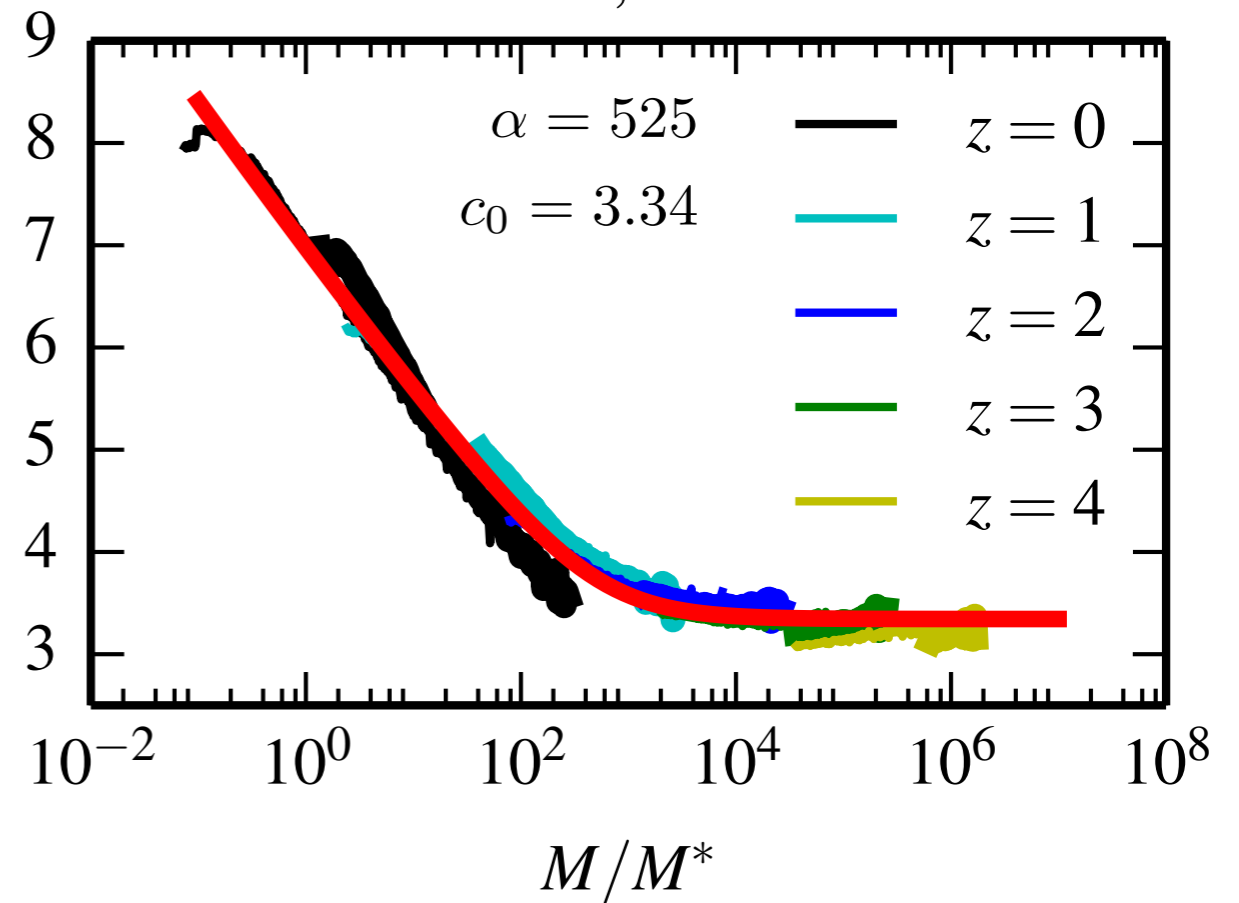
relaxed halos



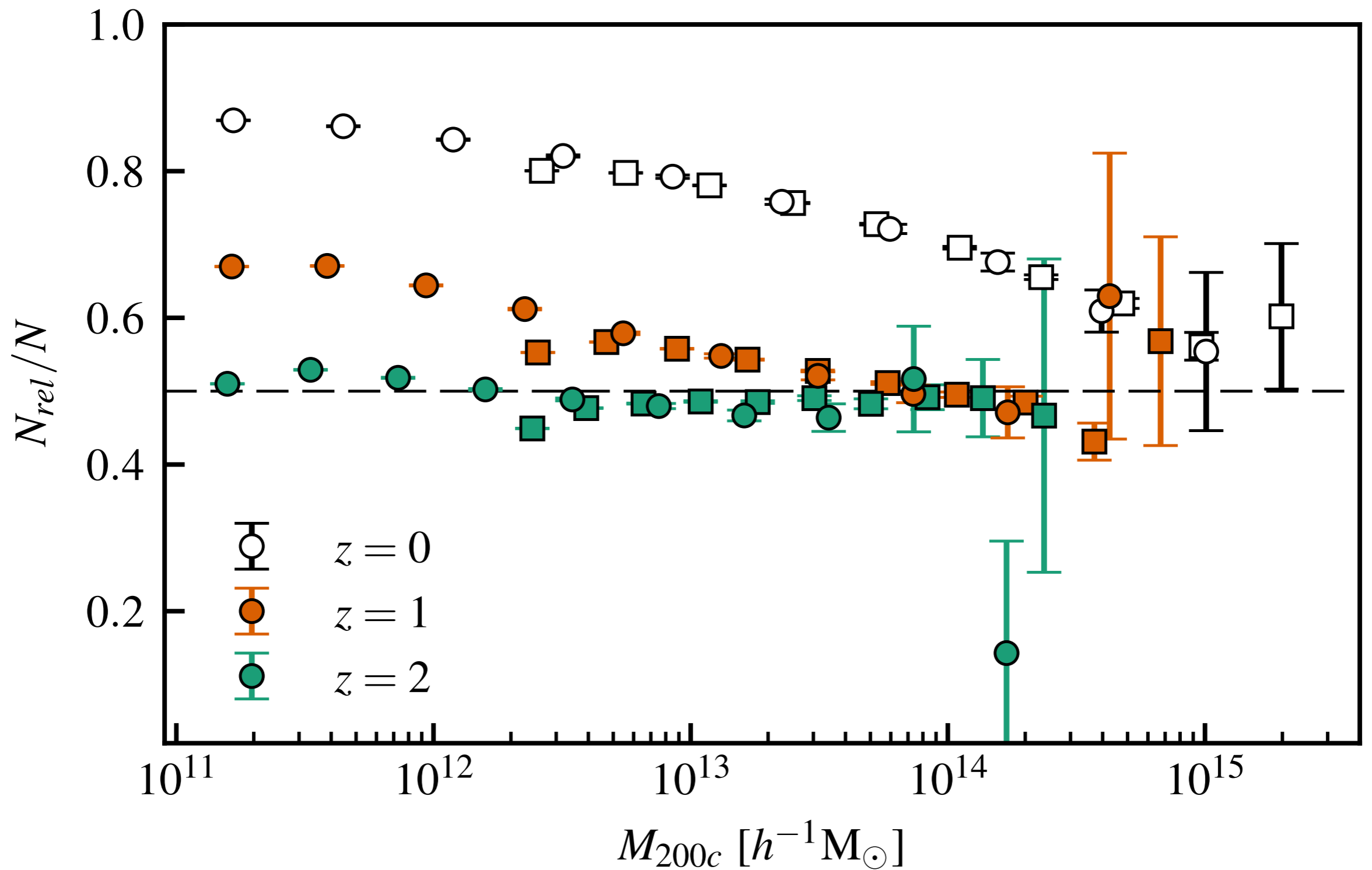
stacked, NFW



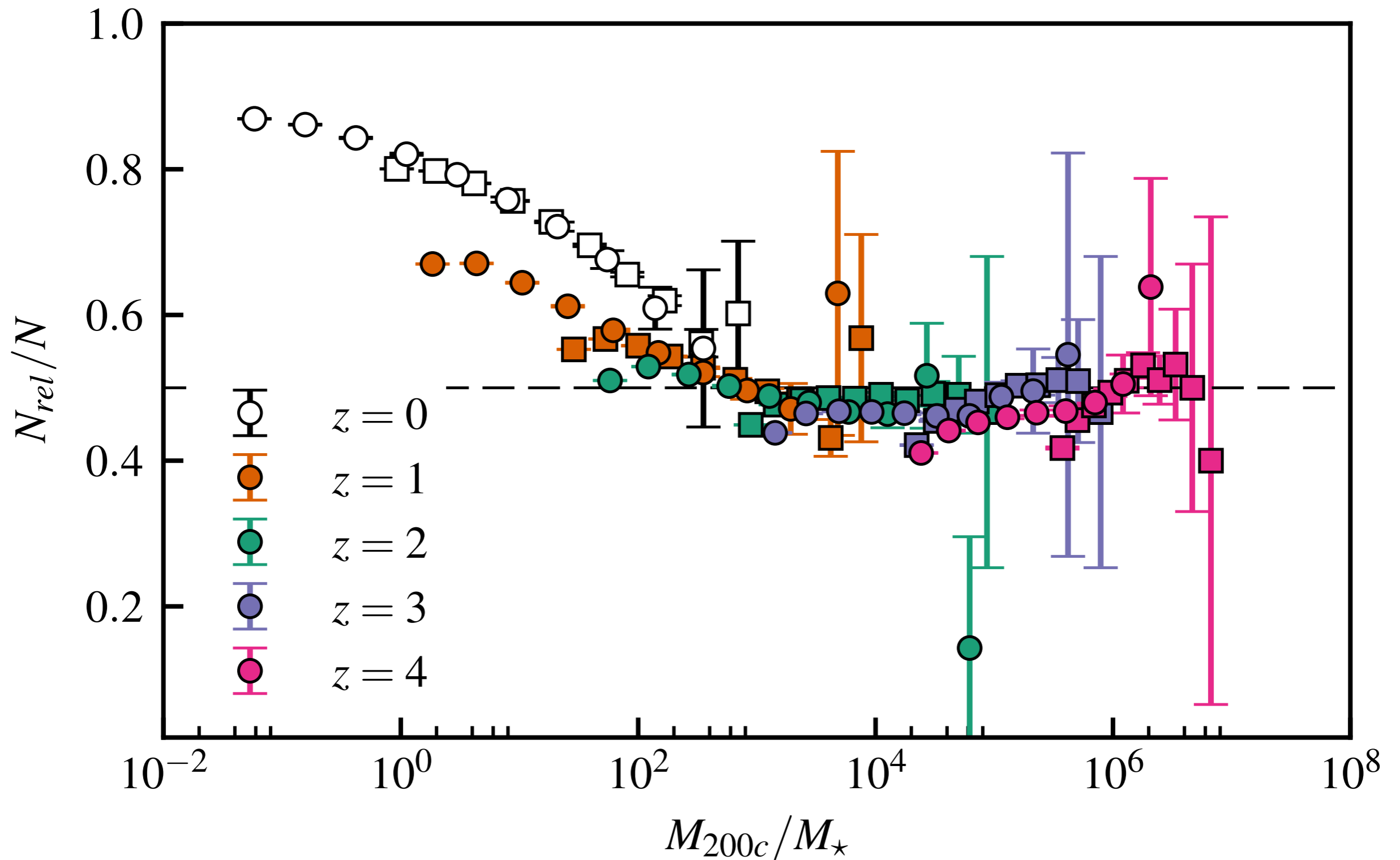
stacked, Einasto



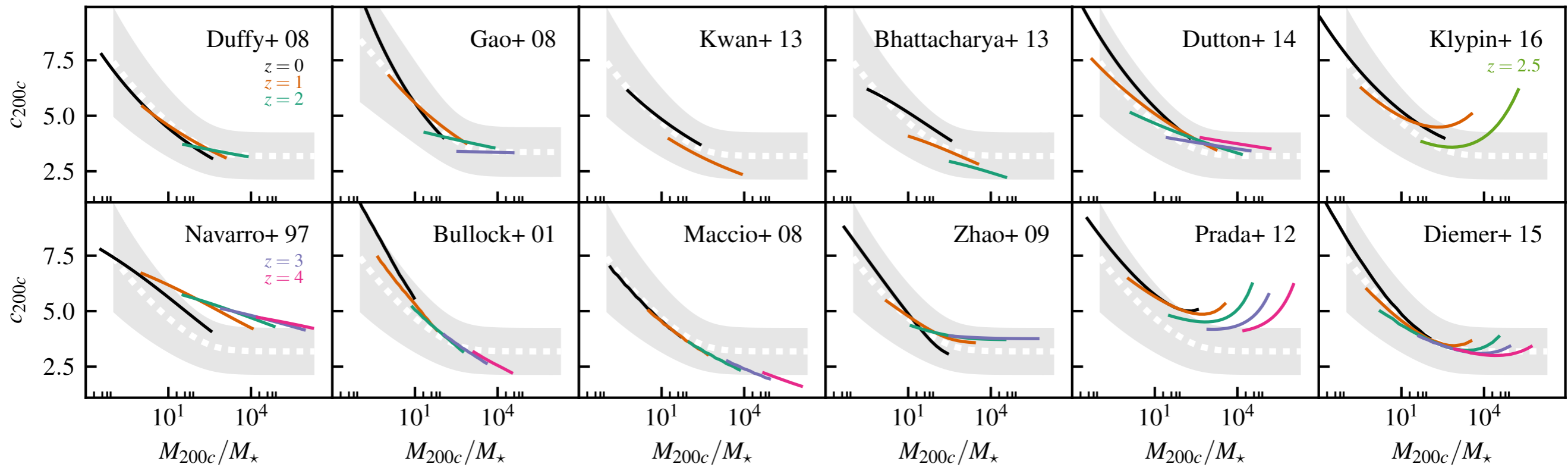
Relaxed Fraction



Relaxed Fraction



Other Simulations



Conclusion

- State-of-the-art simulations provide superior statistics for concentration measurement
- Two methods to find the concentration of (stacked and individual) simulated halos
- Concentration-mass relation: agreement with observations and other simulations
- Scaling by M^* : power-law behavior below a threshold mass, transition to constant