The connection between galaxies and their halo environment

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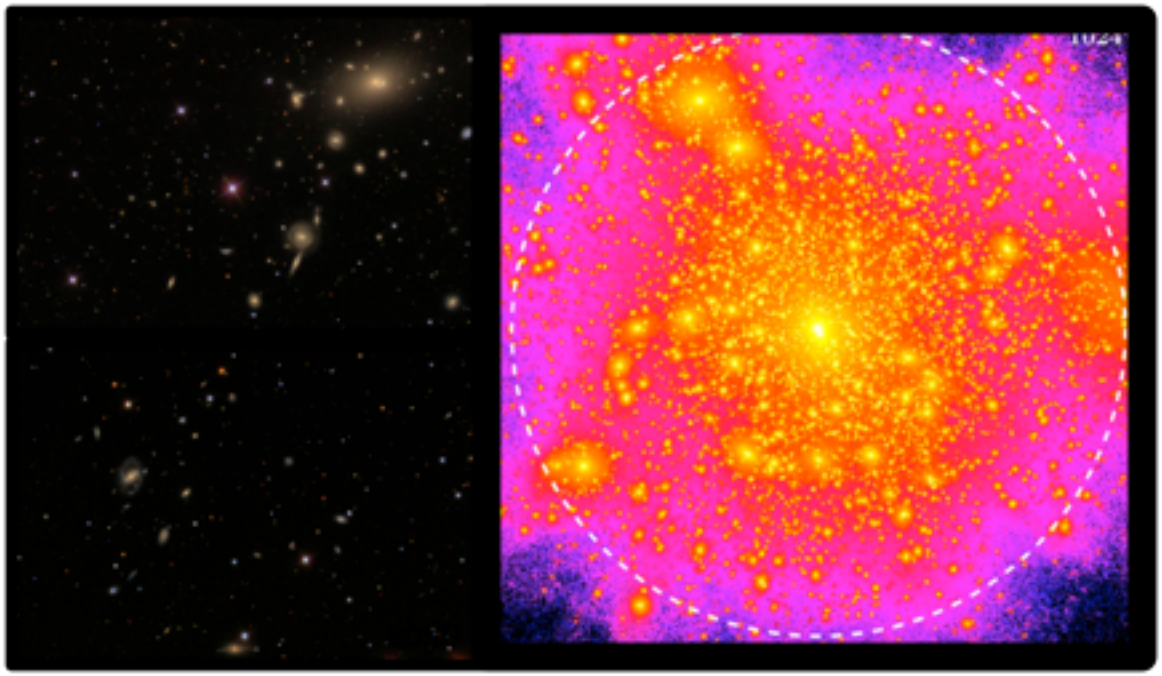
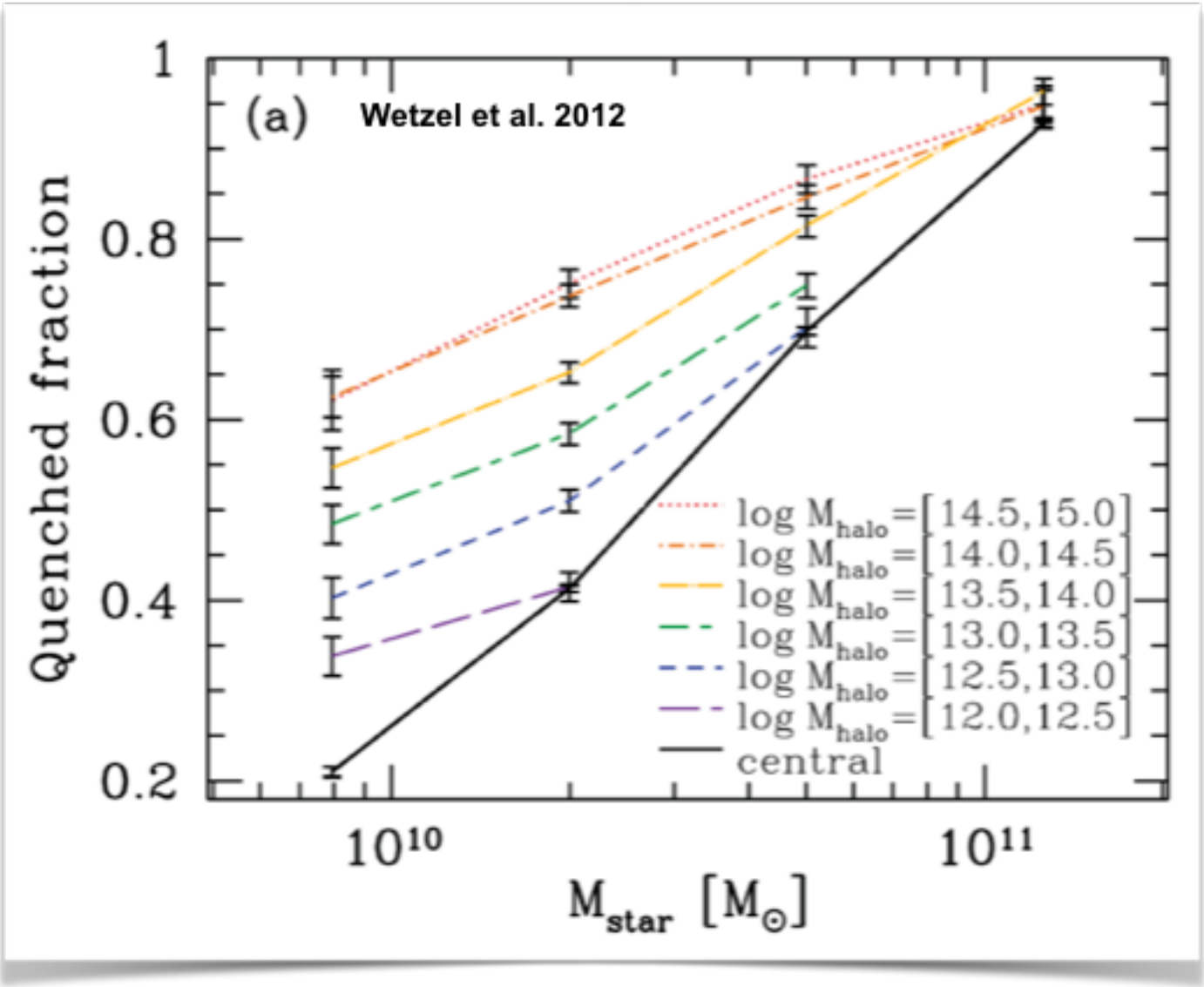
Outline

- SDSS Groups
  - Star-forming and disc fractions
  - X-ray Luminosity
  - Group Dynamics
  - Pre-Processing
- Dark Matter Simulations
  - Mass loss and pre-processing

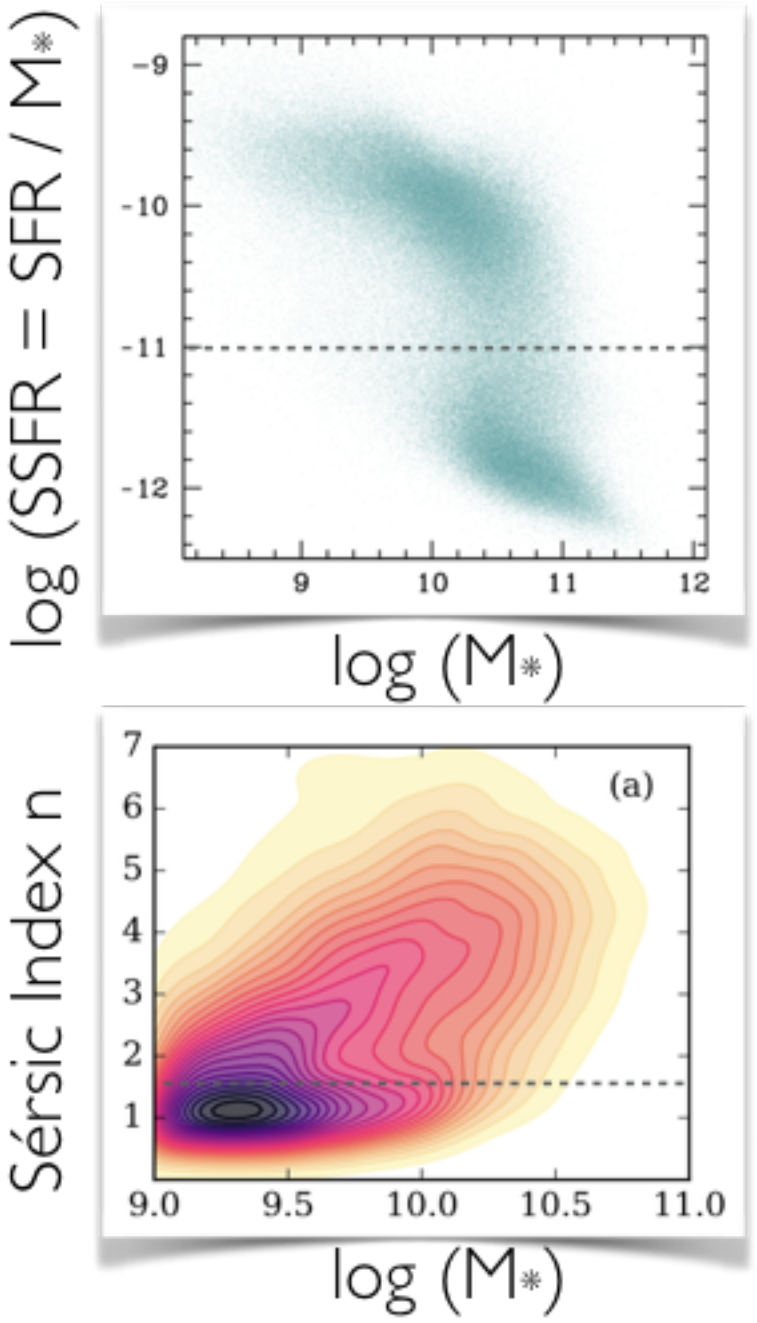


Quenched Fraction with Stellar and Halo Mass

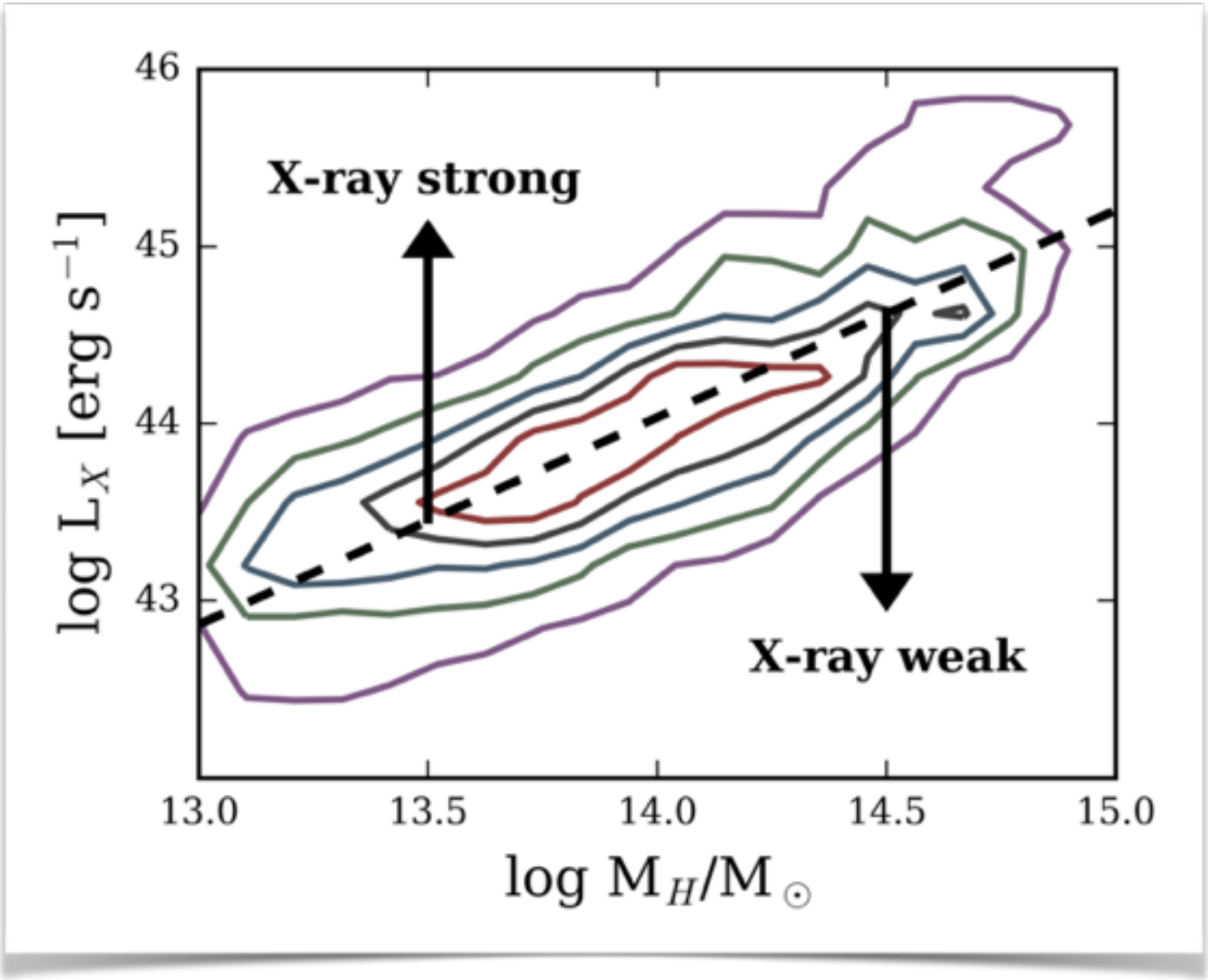


SDSS Sample

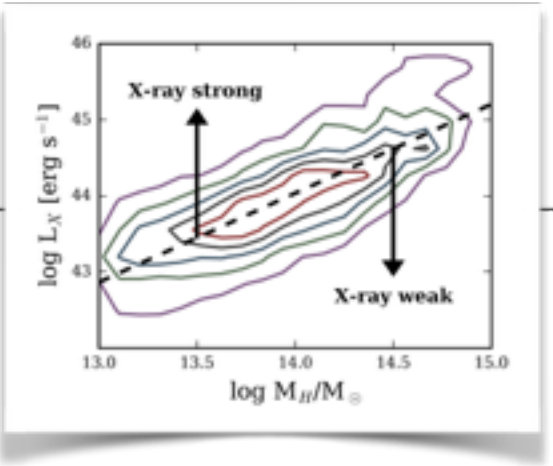
- SDSS Data Release 7
- Yang et al. 2007 group catalogue
- Group halo mass: 10^{13}-10^{15} $M_{\odot}$
- SFRs: Brinchmann et al. 2004
- Morphologies (Sérsic index): Simard et al. 2011
- X-ray luminosities: Wang et al. 2014

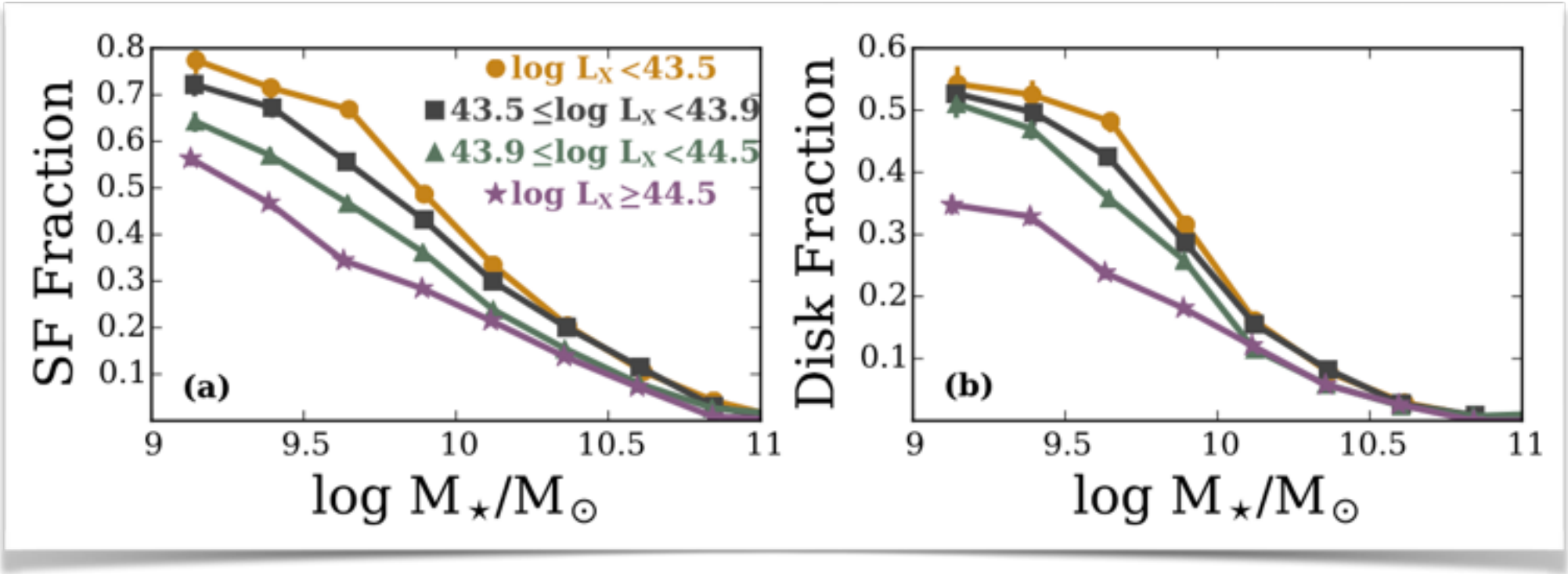


L_x - M_{halo} Relation



Galaxy Properties with X-ray

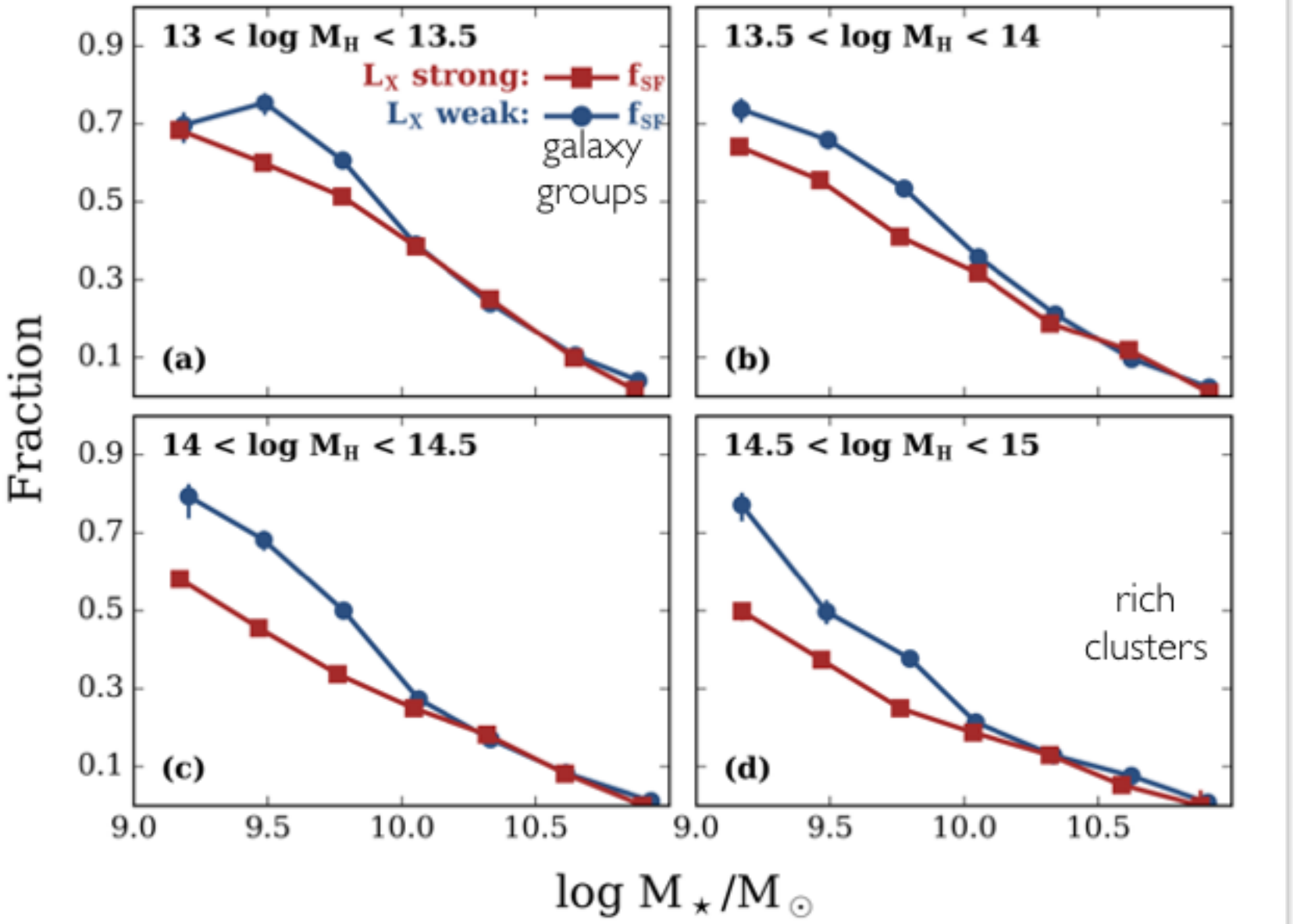




Dependence on Xray Lum., but need to control for halo mass

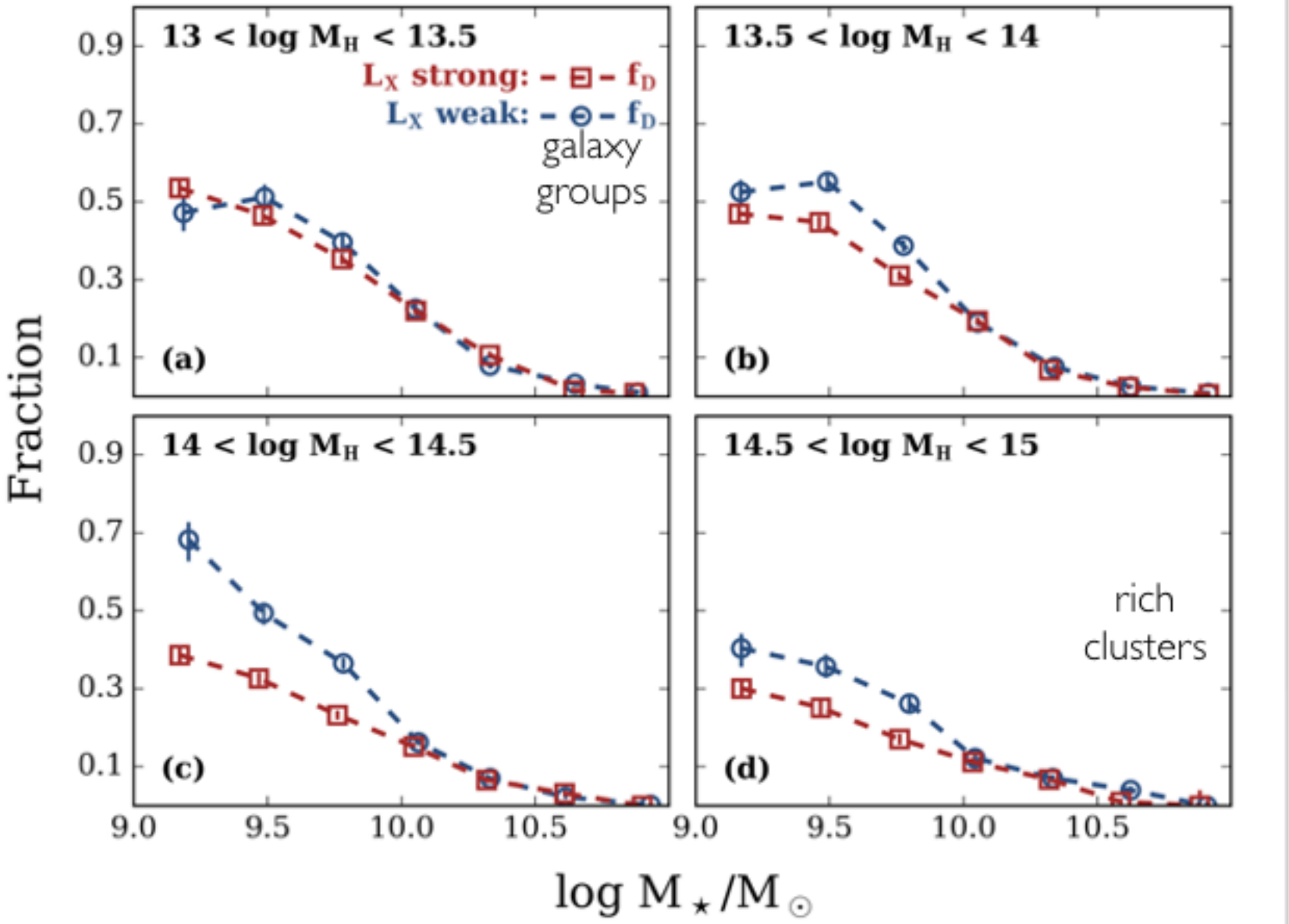
Roberts, LCP, Karunakaran 2016

Star Forming Fraction



Roberts, LCP, Karunakaran 2016

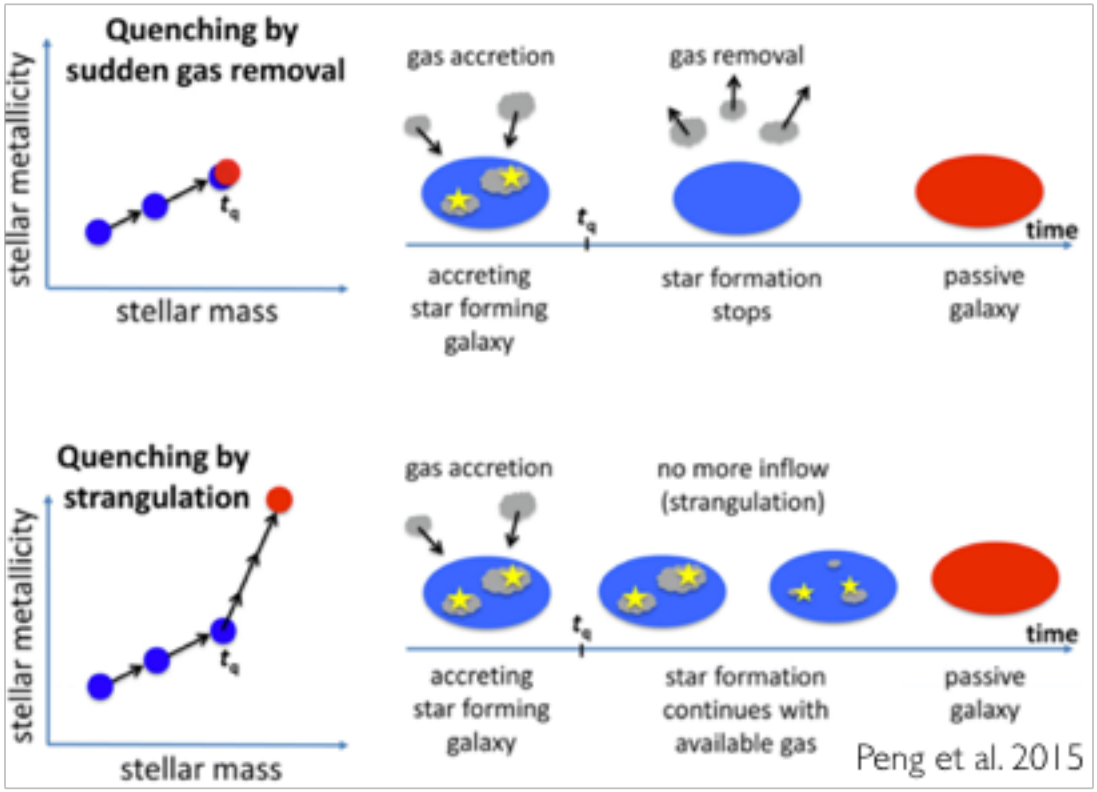
Disc Fraction

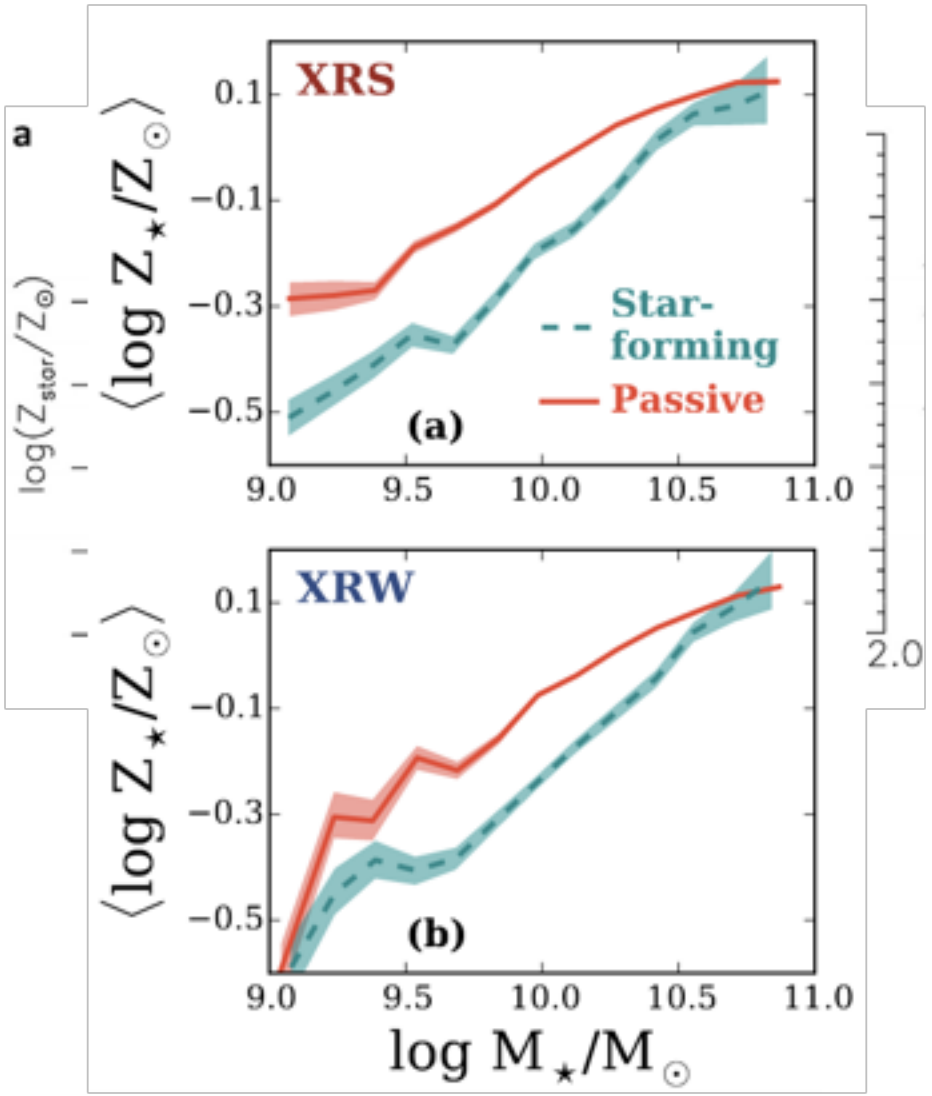


Roberts, LCP, Karunakaran 2016

Interpretation - Halo Quenching / Strangulation

novel way to observe this effect:





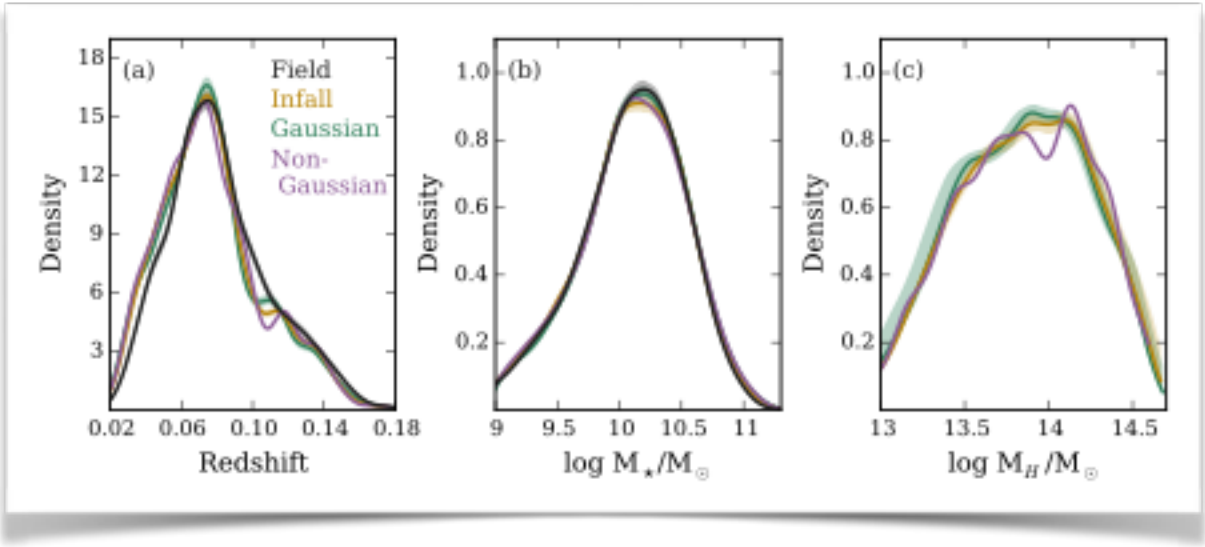
- hint of more strangulation in the X-ray strong groups

Roberts, LCP, Karunakaran 2016

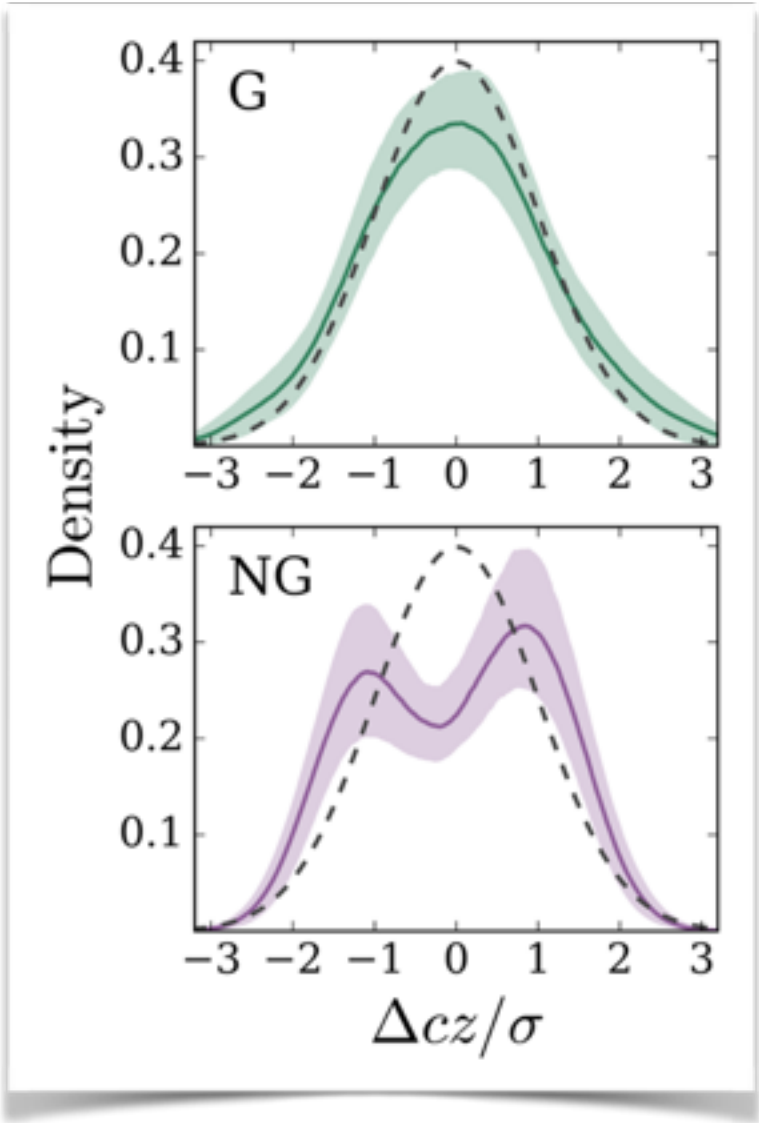
Dynamics

Define Gaussian (G) & non-Gaussian (NG) groups

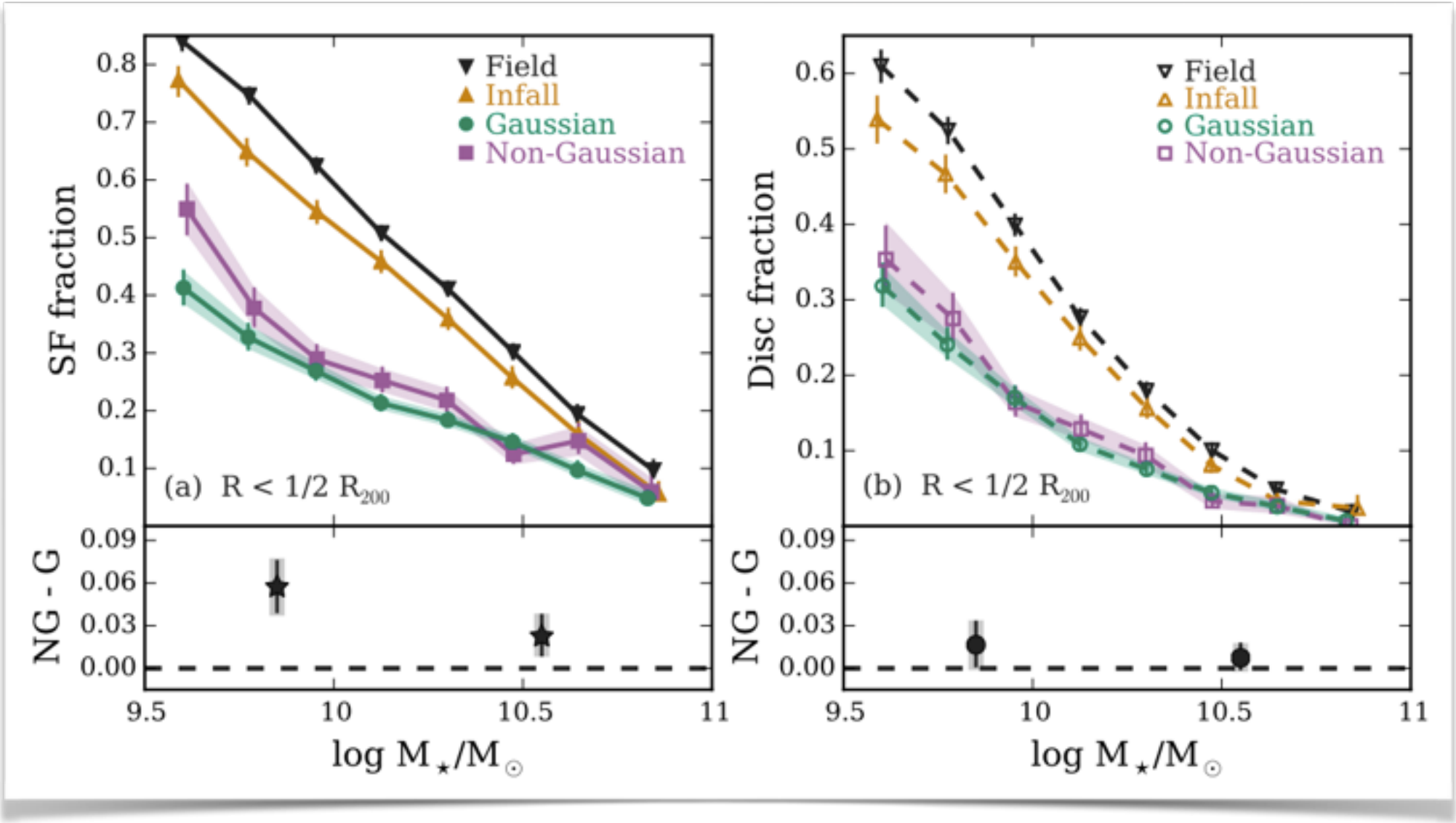
* 8 or more members
* Anderson Darling test (e.g. Hou et al. 2009)
* Dip test (e.g. Ribeiro et al. 2013)



Match field, infalling, G, & NG samples by: M★, M_H, z

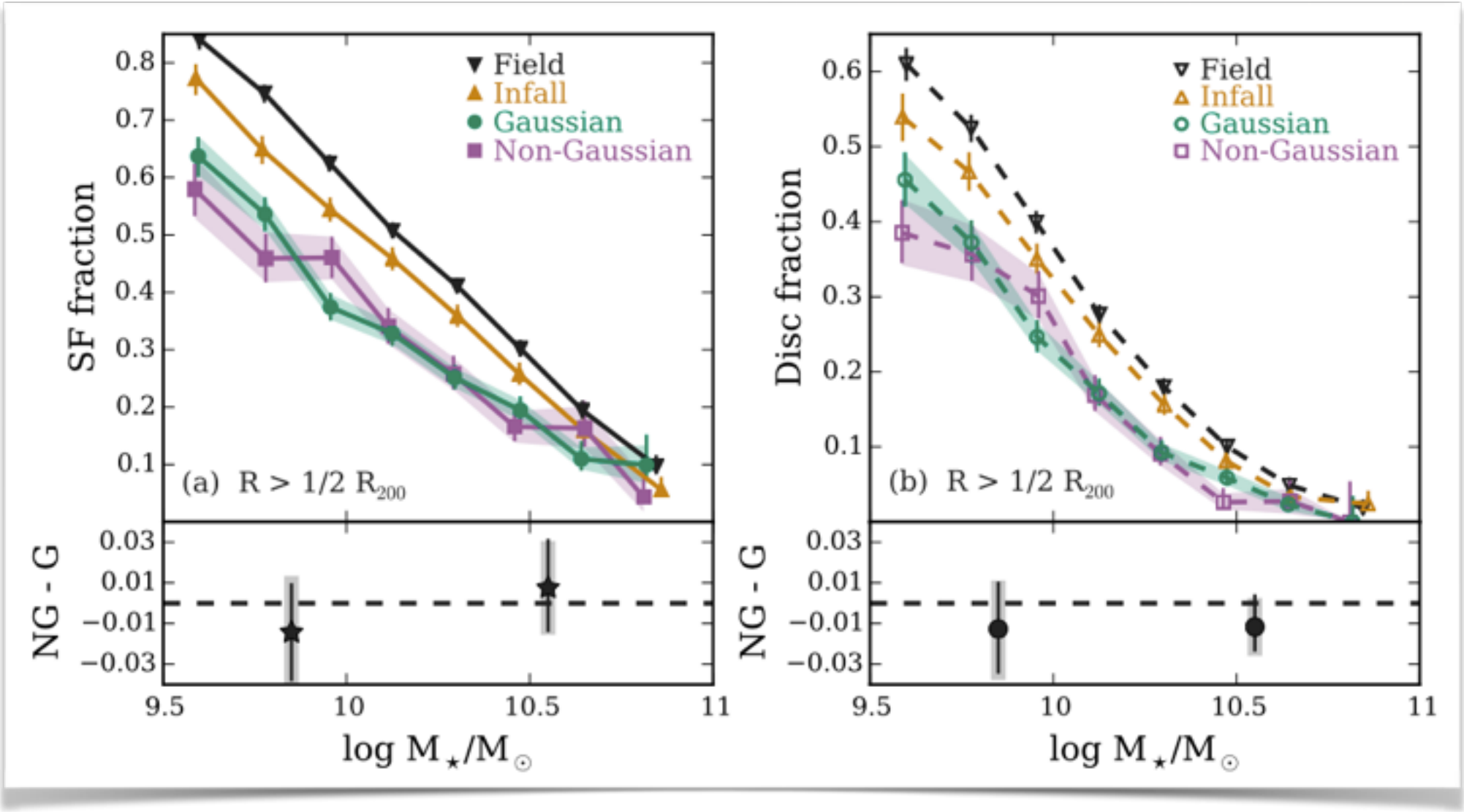


SF & Disc Fraction at Small Radii



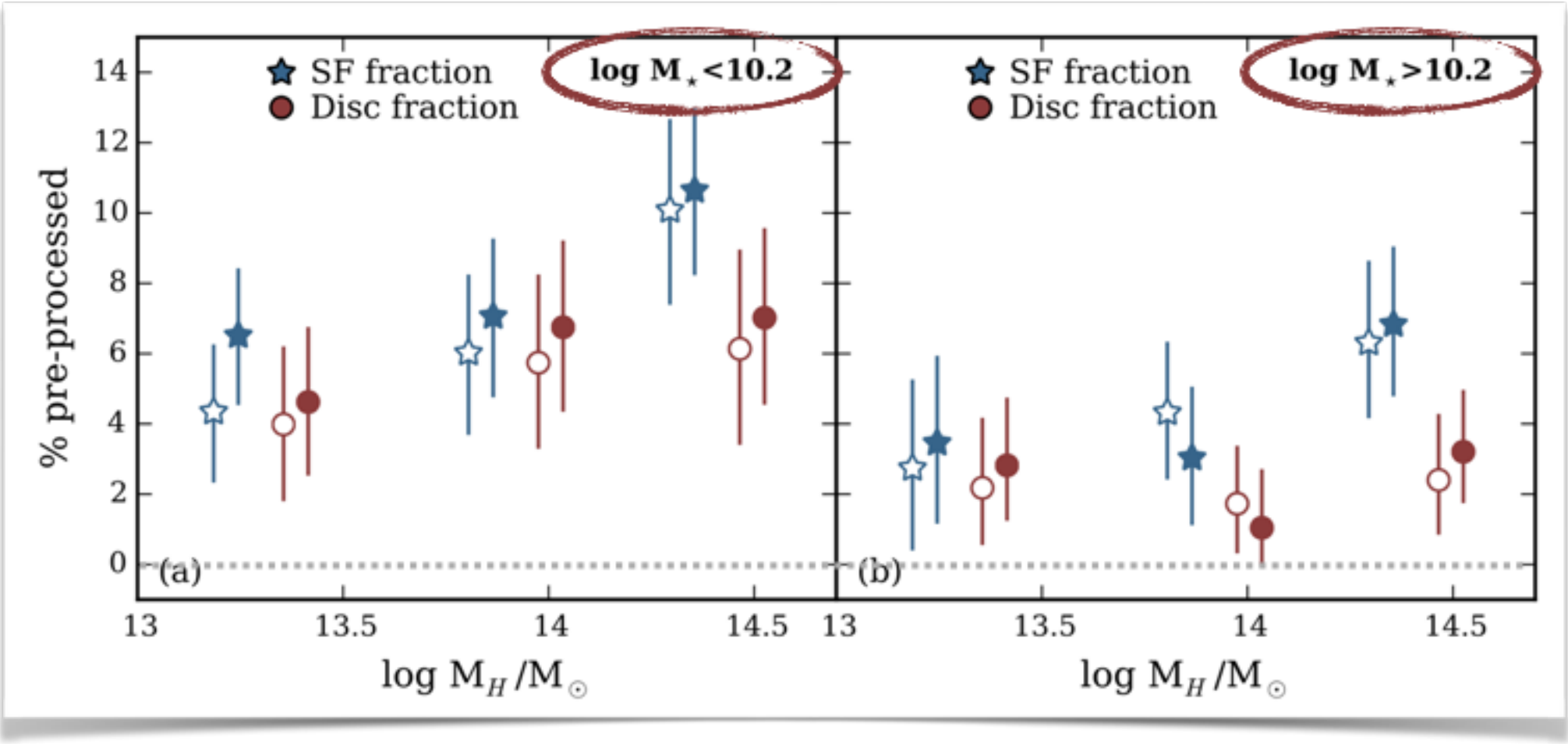
Roberts & LCP, submitted

SF & Disc Fraction at Large Radii



Roberts & LCP, submitted

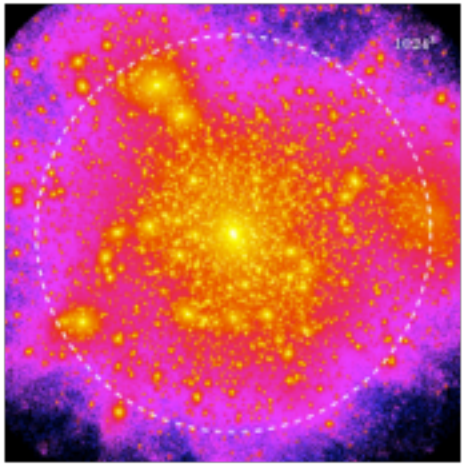
Pre-Processing: Field - Infall Difference

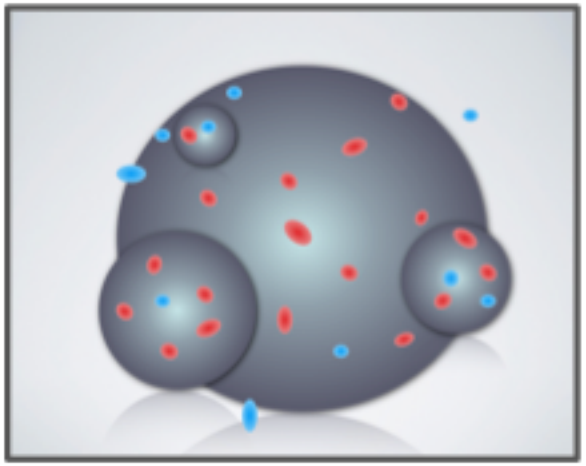


Field galaxy SF/Disc fraction - Infall galaxy SF/Disc Fraction

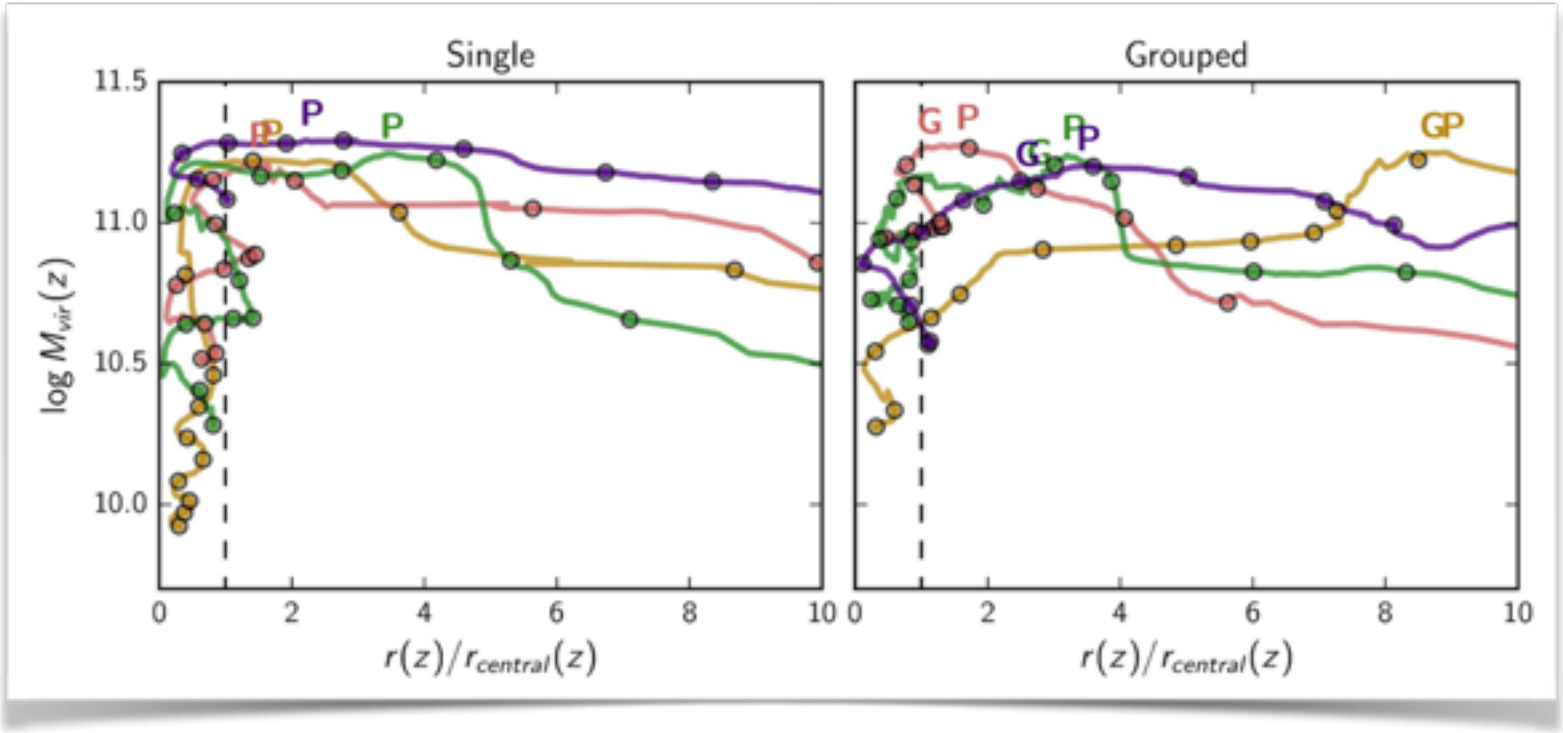
Roberts & LCP, submitted

Dark Matter Simulations





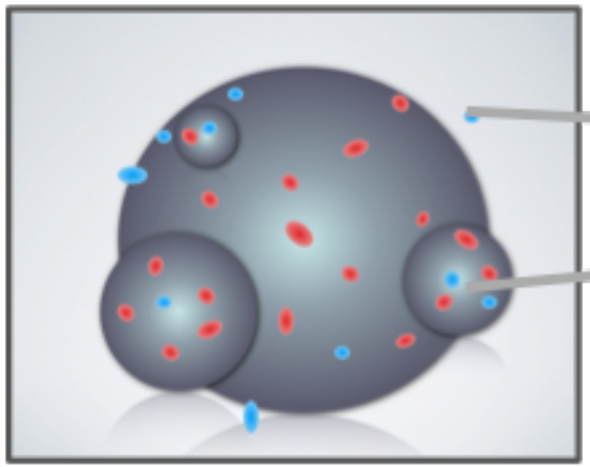
- DM Simulation (~3x10^7 M_{SUN} resolution)
- Look at merger and accretion histories of galaxy analogues
- Starting zoom-in hydro simulations of a sample of interesting groups



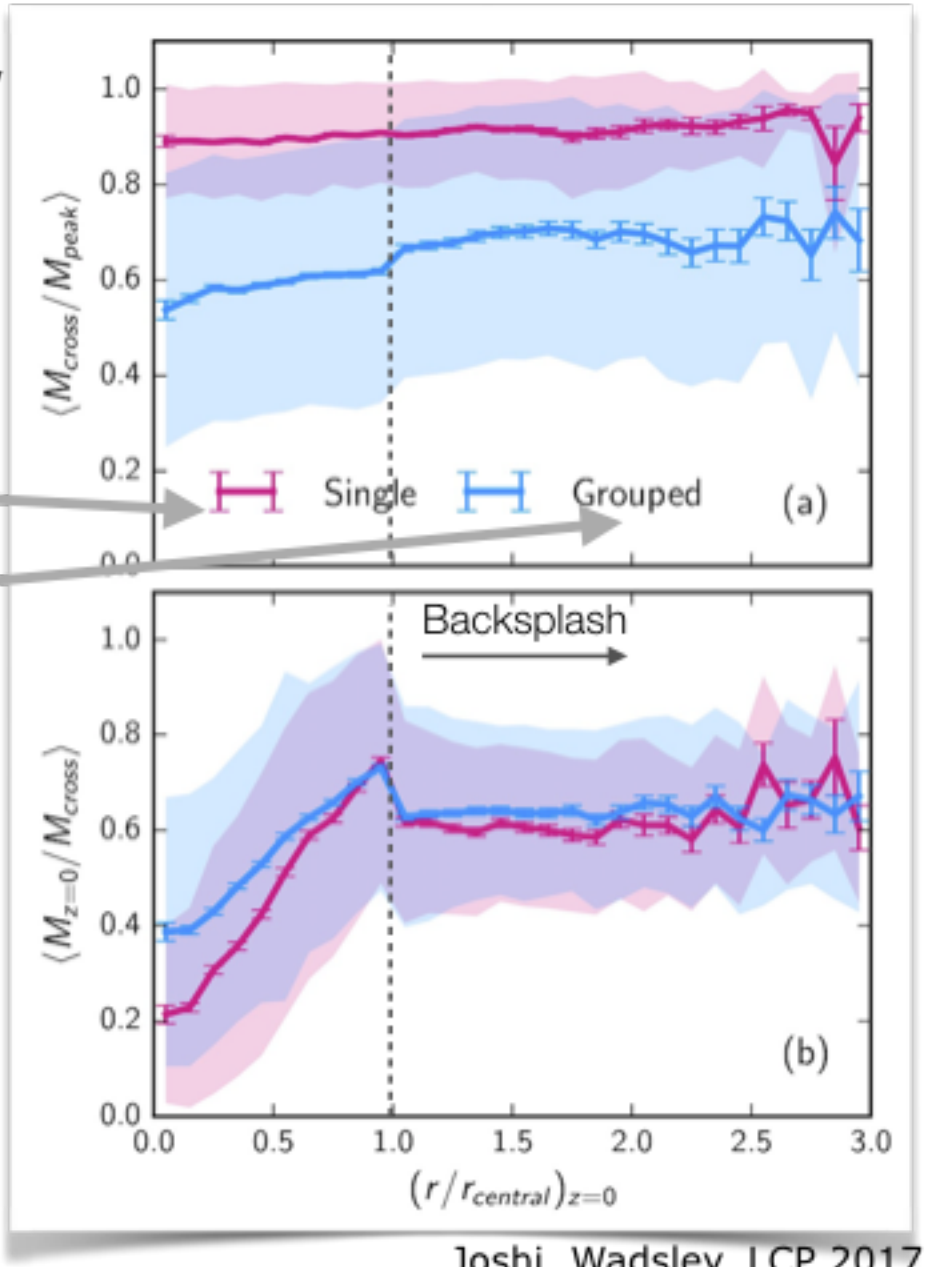
P = Peak Mass G = when they became part of a group

Galaxy Analogue Mass

crossing mass/ peak mass



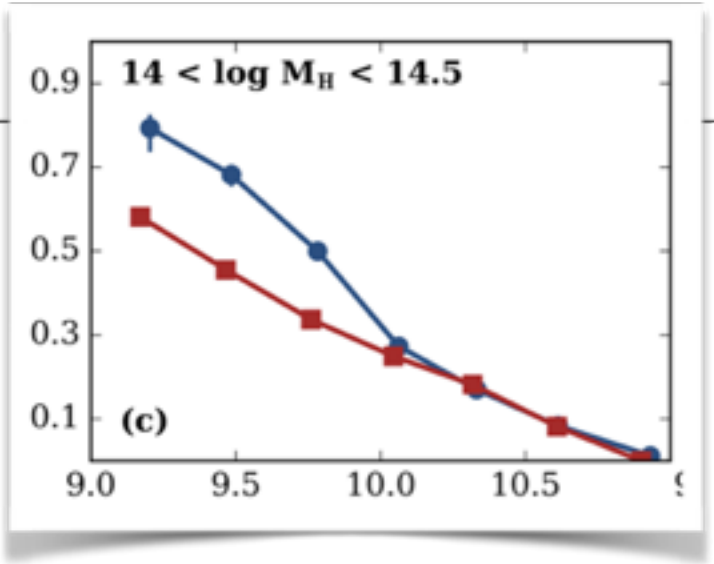
mass today/ crossing mass



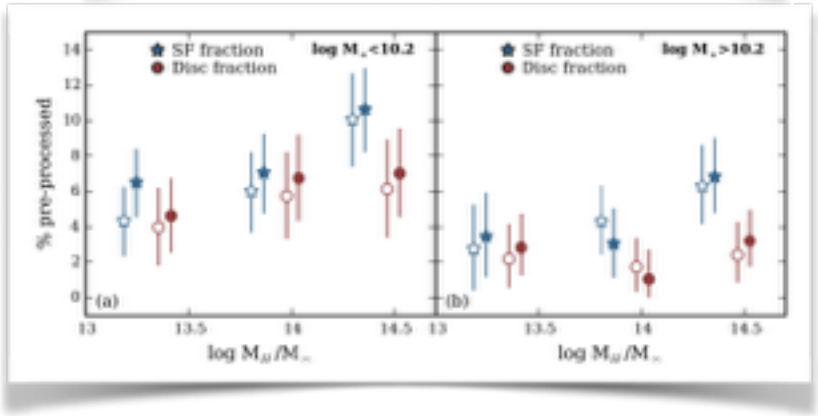
Joshi, Wadsley, LCP 2017

Summary

- At fixed stellar and halo mass galaxy properties depend on X-ray luminosity and dynamical state



- Both star formation and morphology are pre-processed
  - Strongest for low-mass galaxies accreting onto high-mass haloes



- Simulations show that galaxies that are accreted in groups lose much more mass before accretion