

Workshop summary

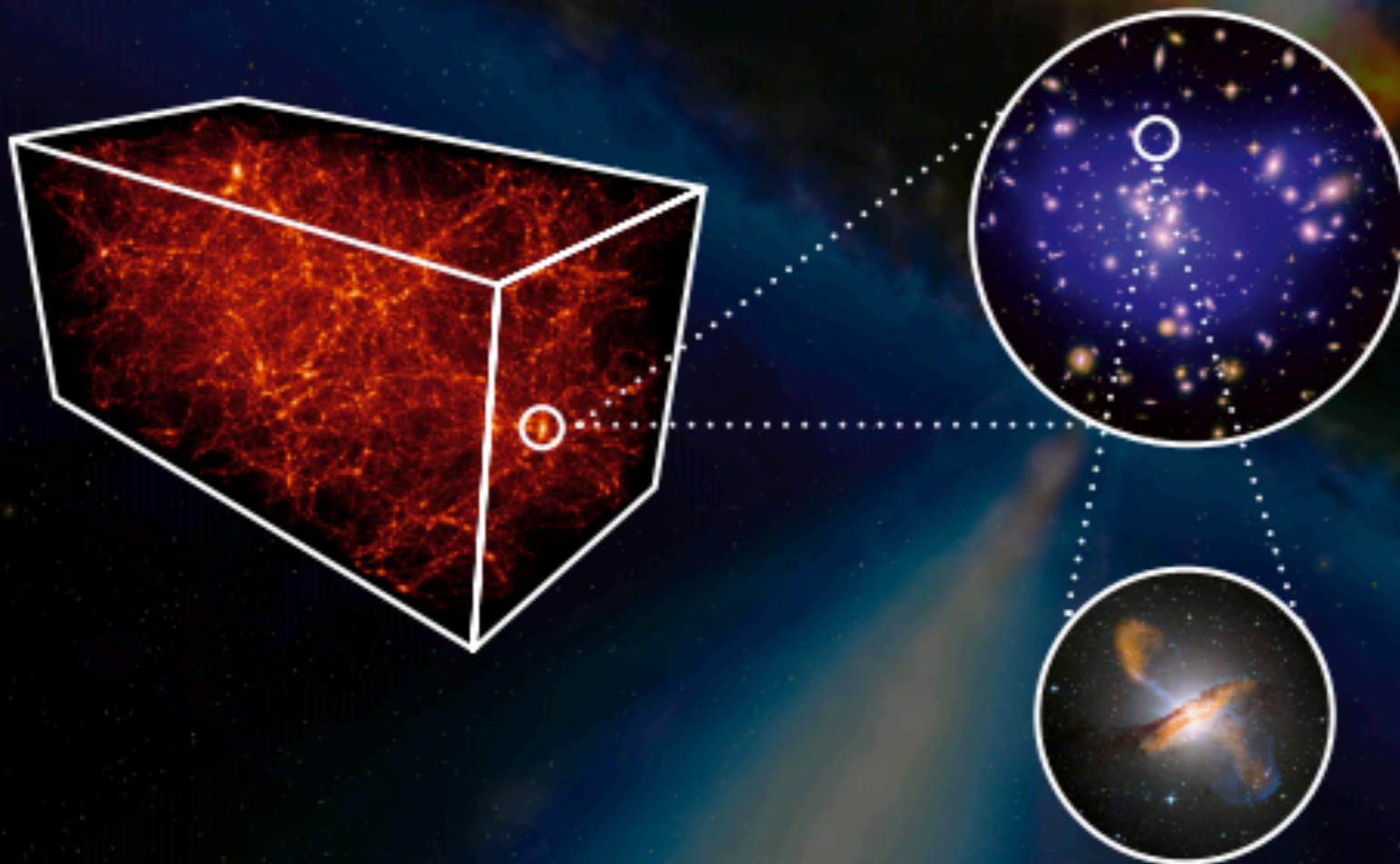
Ryan C. Hickox



First ever workshop dedicated to:

Clustering Measurements of Active Galactic Nuclei

ESO Garching, 14–18 July 2014



Motivation

BLACK
HOLE

HOST
GALAXY

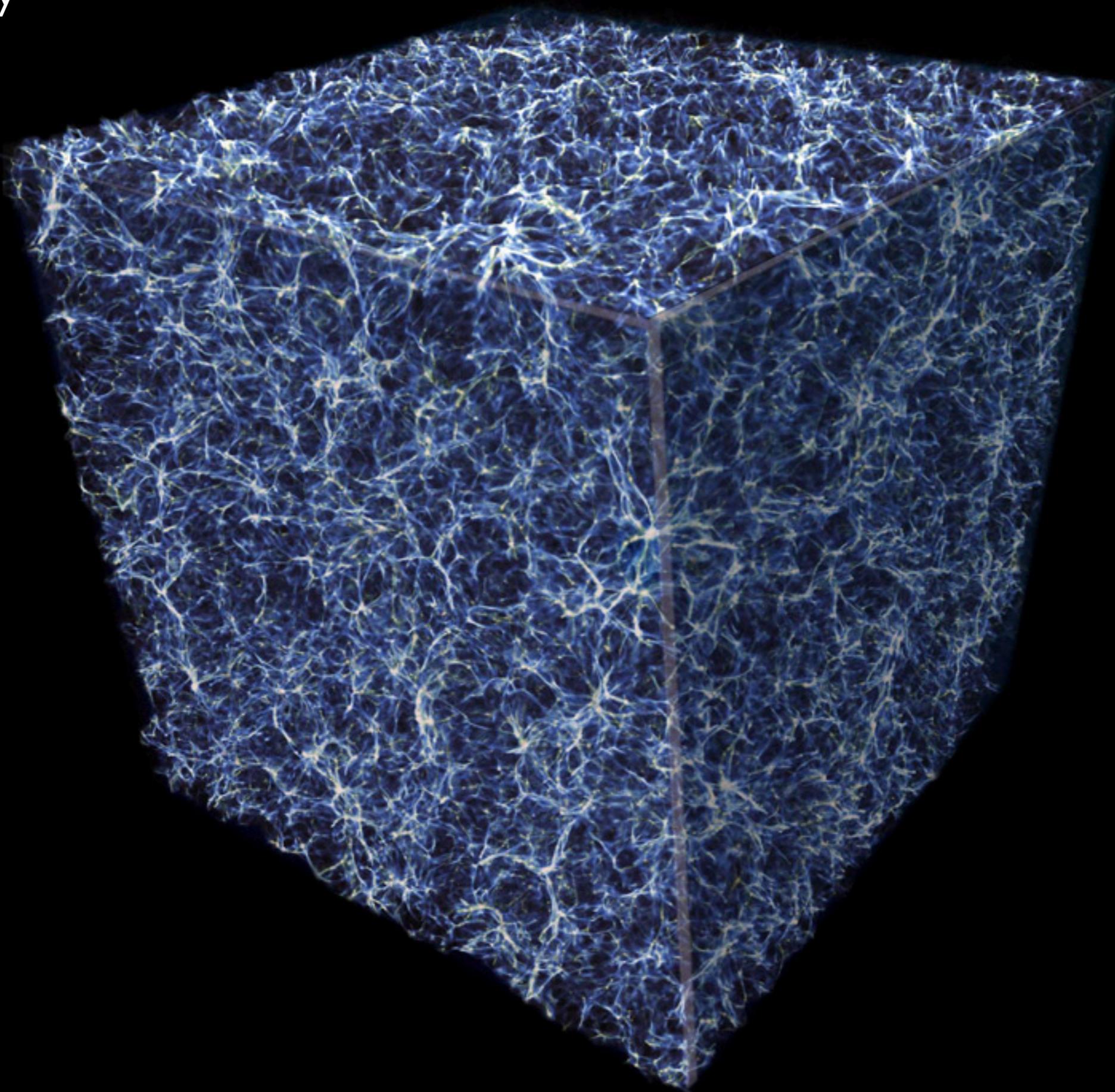


"You are doing the right thing here:
Clustering is a powerful theoretical
constraint" - V. Springel

DM HALO

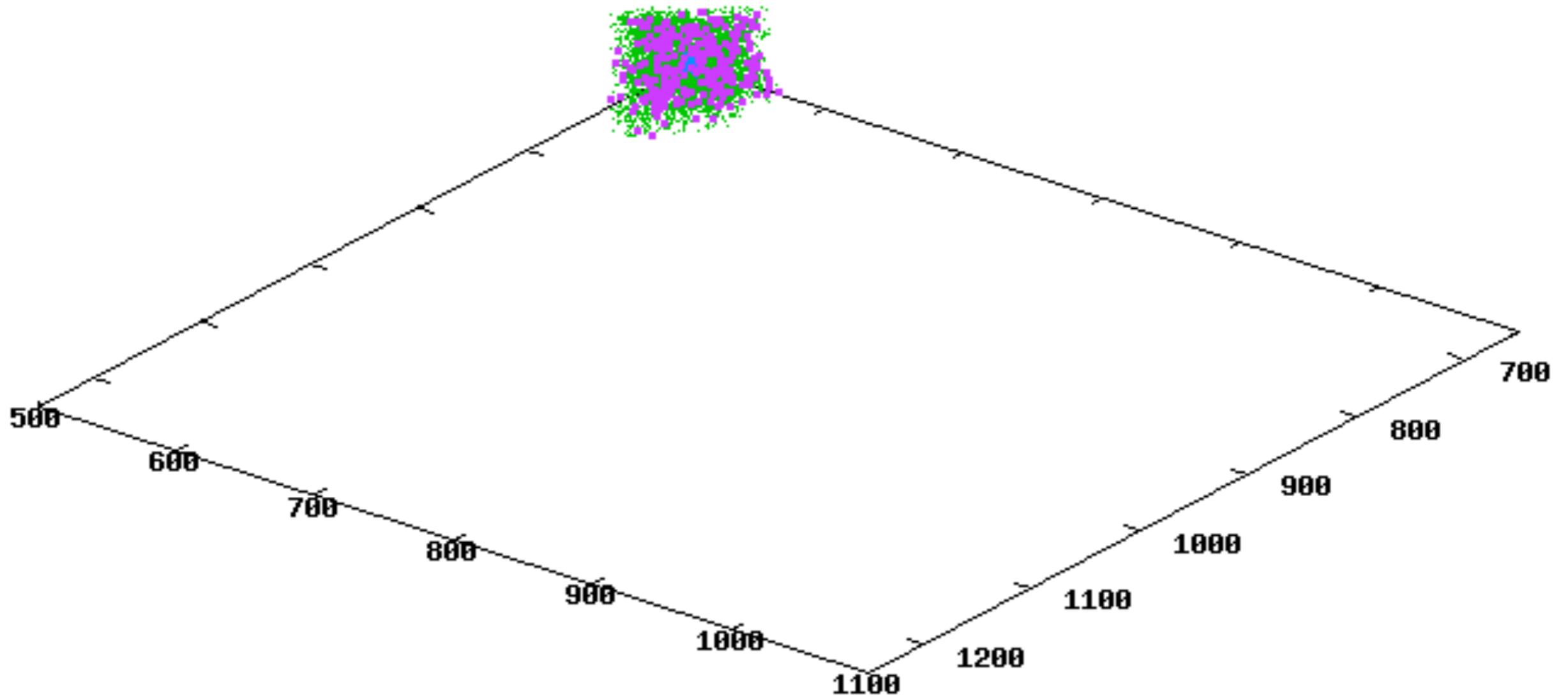
Measure **halo mass** via clustering
Learn about **cosmological evolution**

Theory

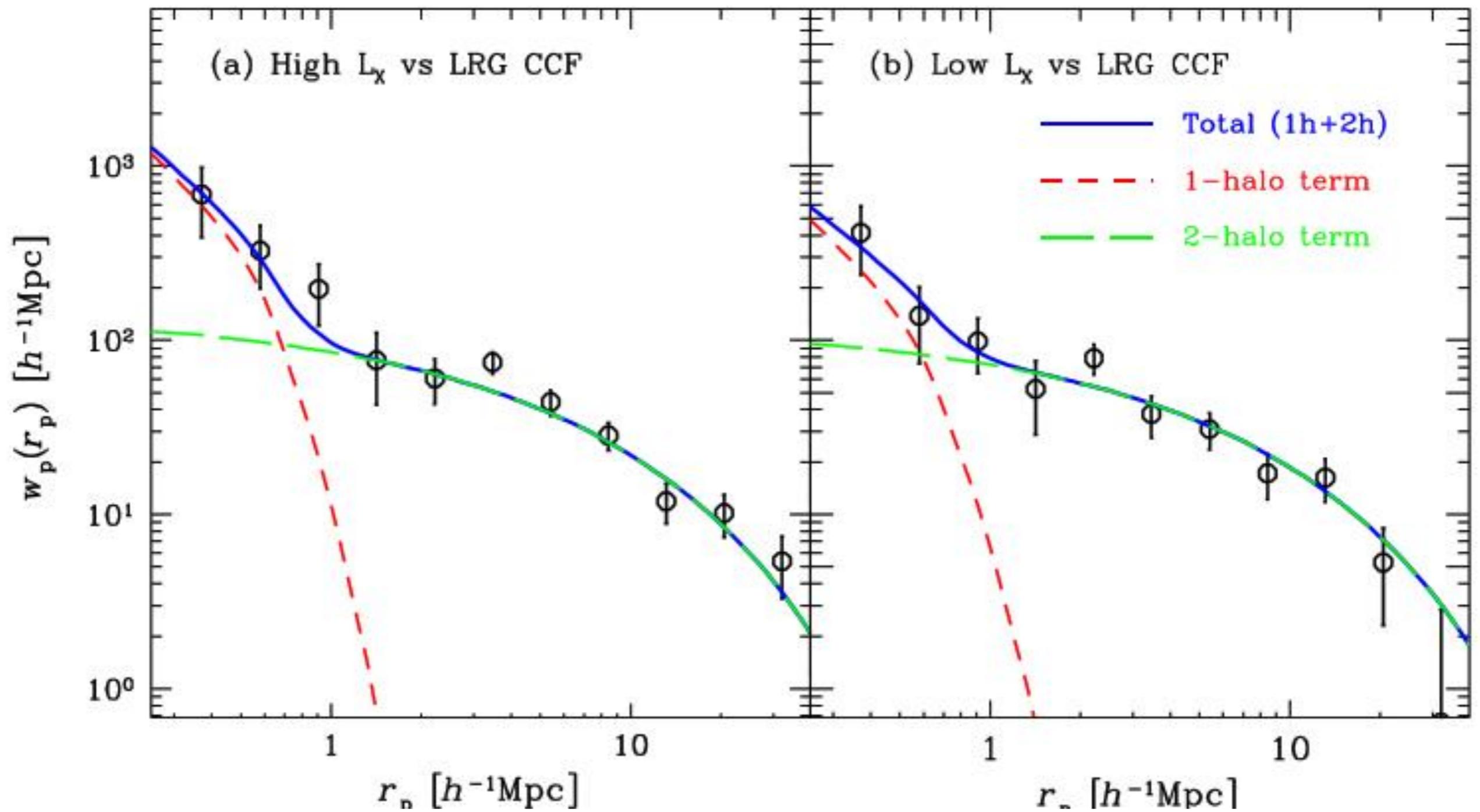


Observation

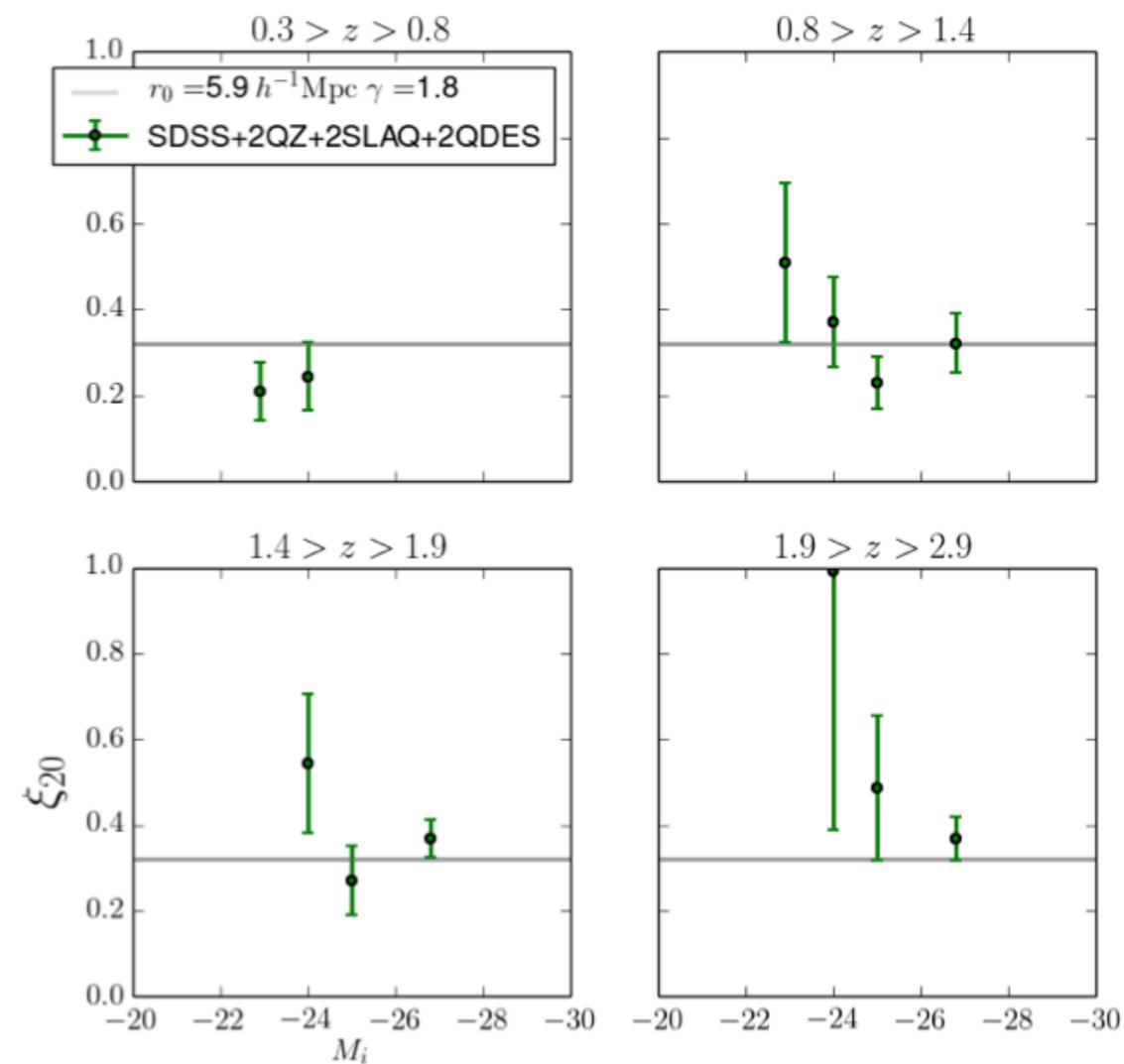
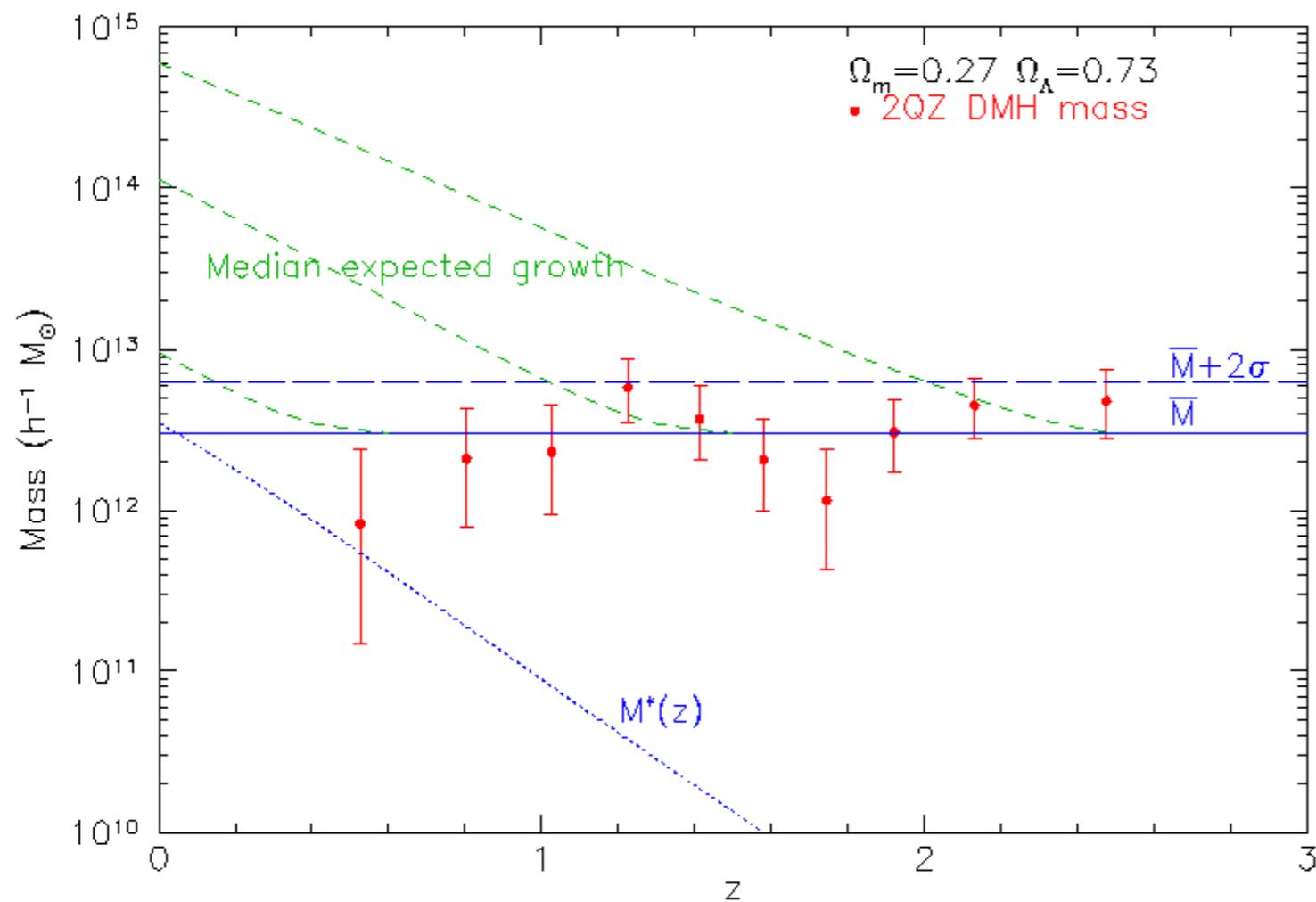
- galaxies
- X-ray AGN



This is **amazing**

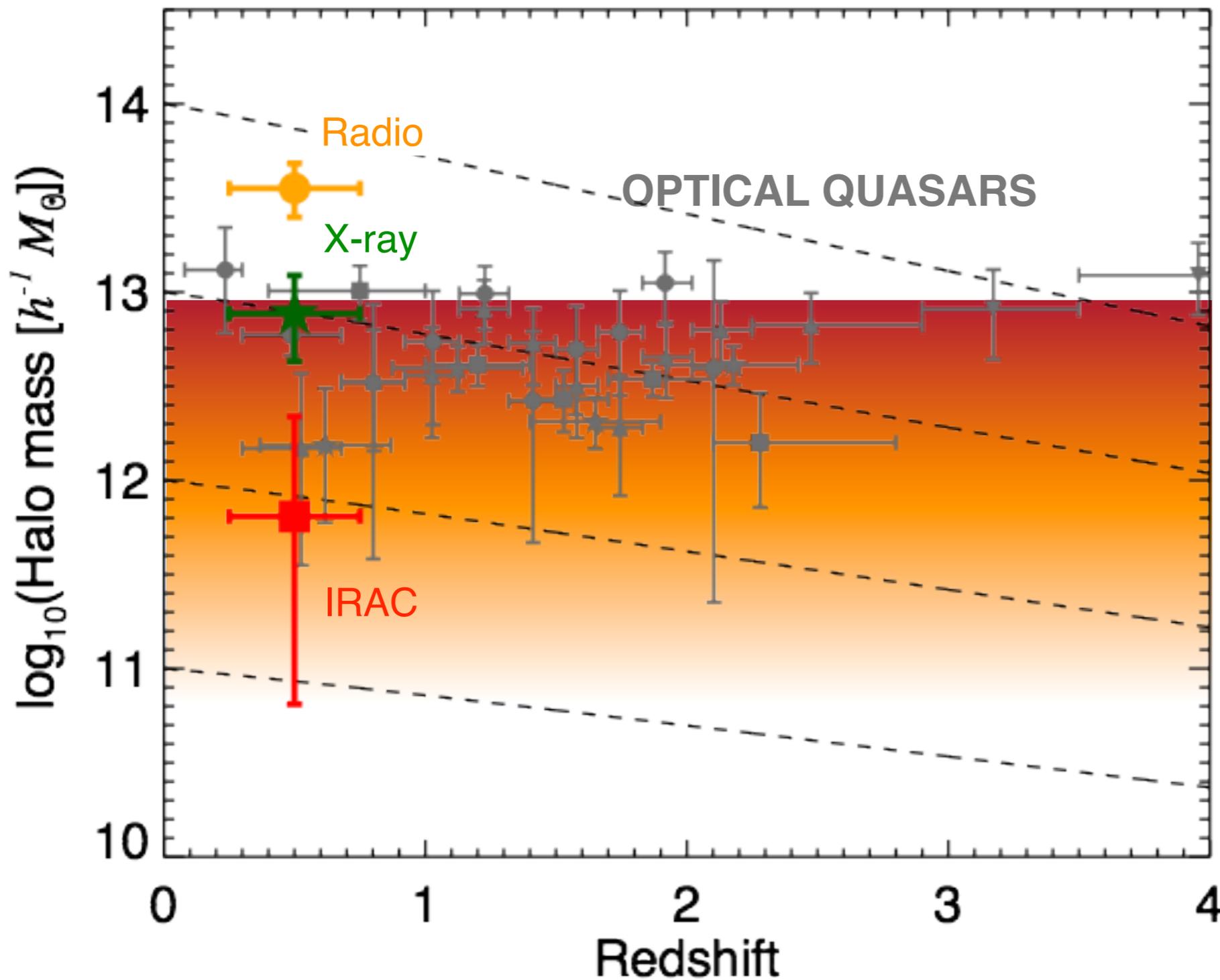


Optical quasars reside in halos of **~constant mass** with luminosity and redshift



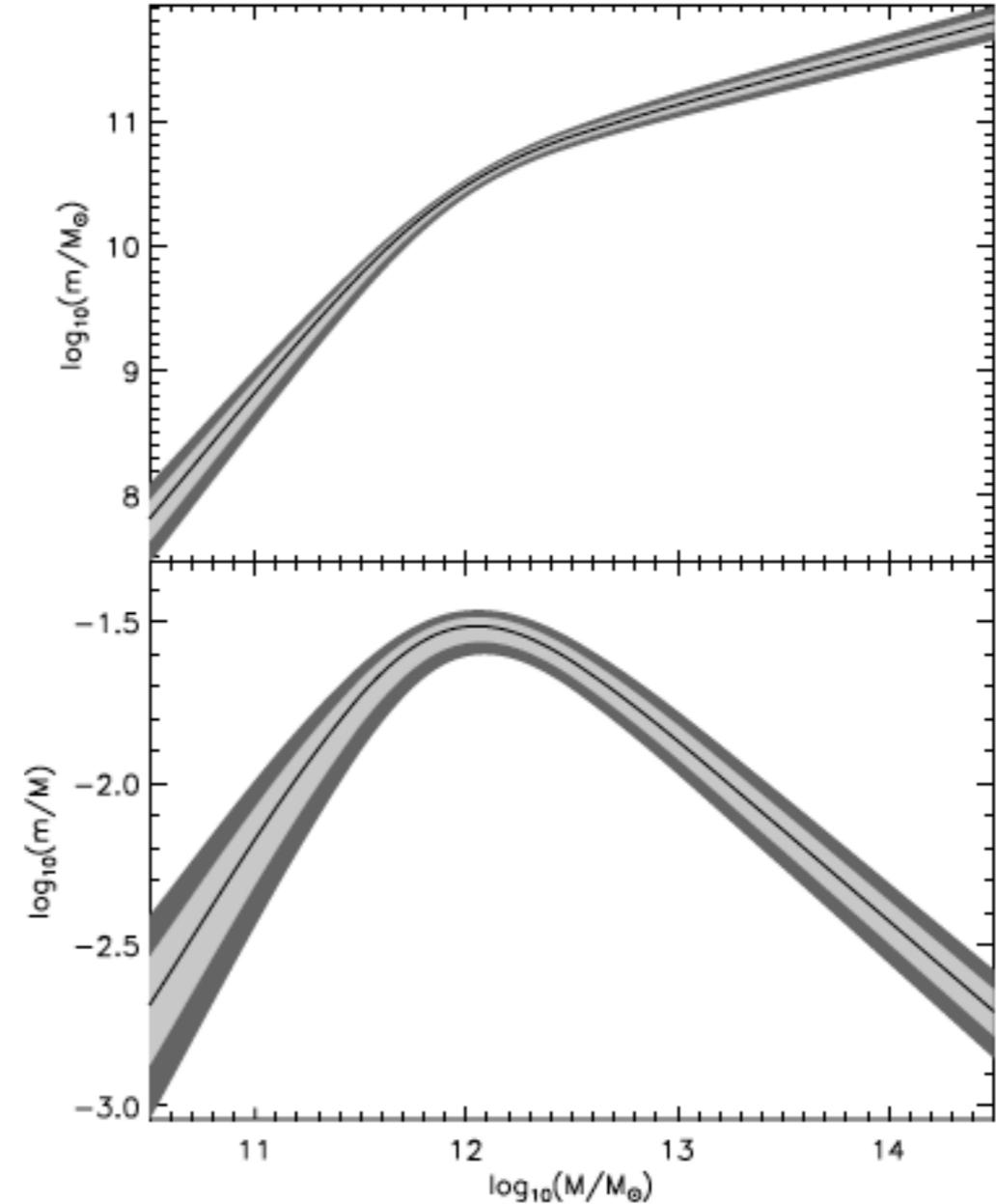
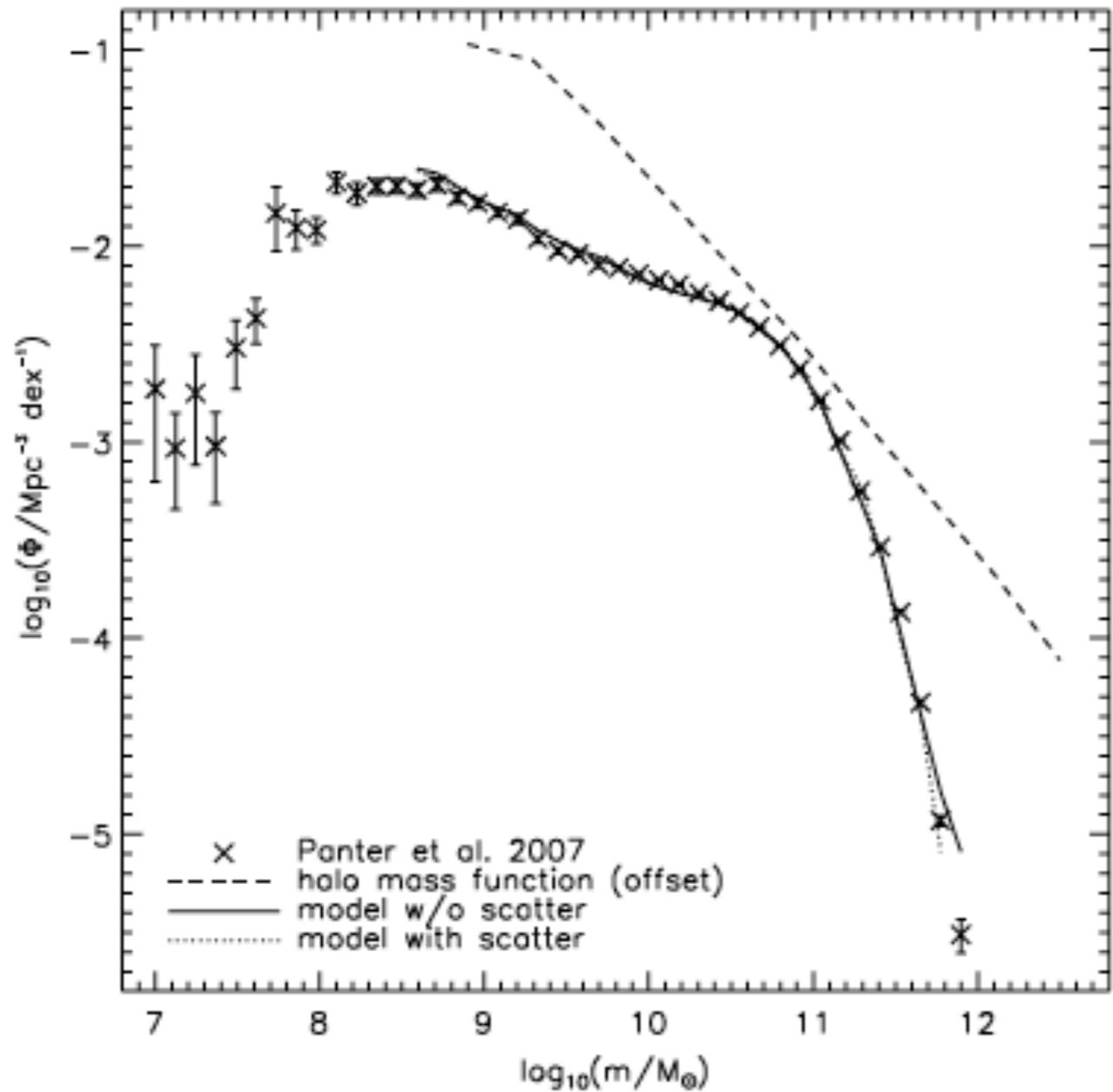
[Croom, Chehade, Rentana-Montenegro]

Importance of **AGN selection methods**



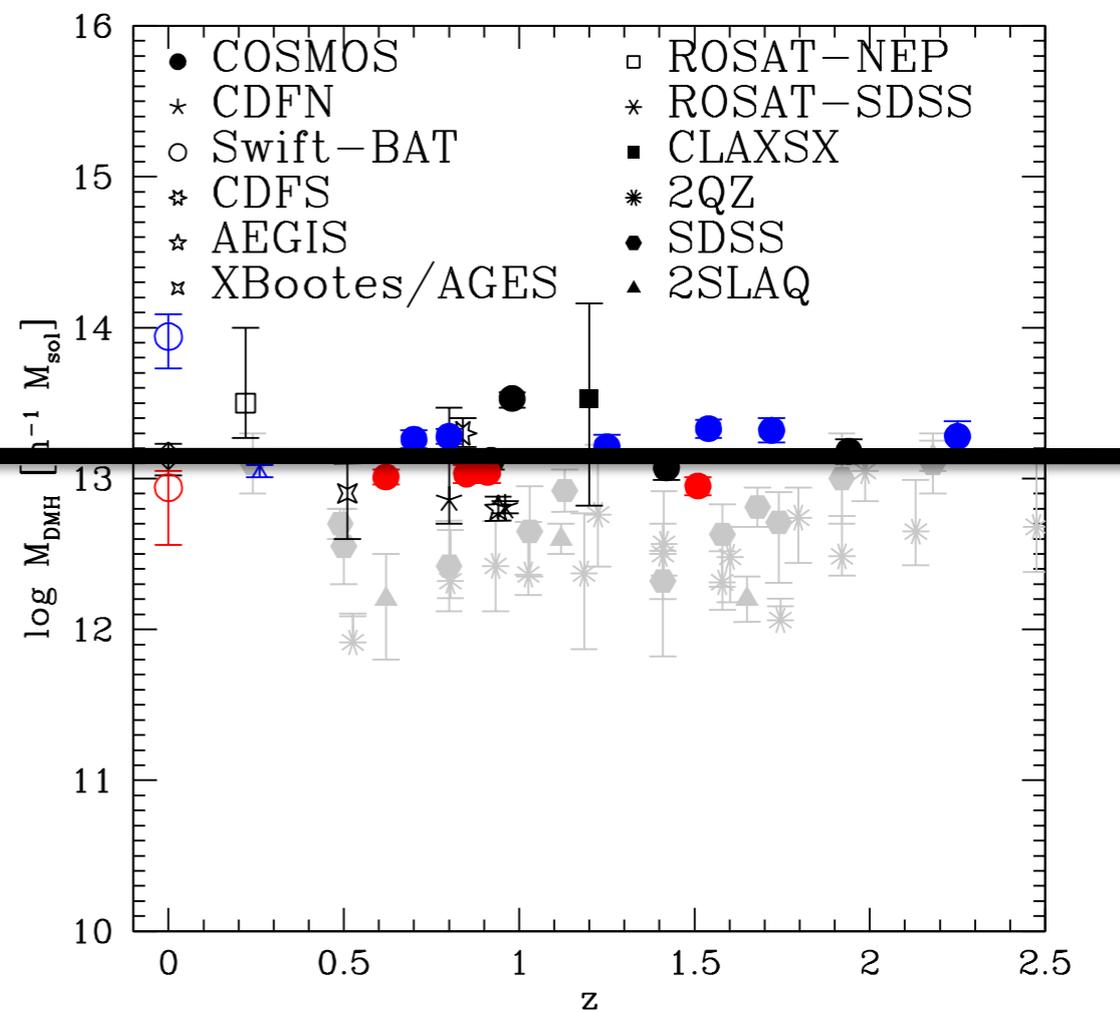
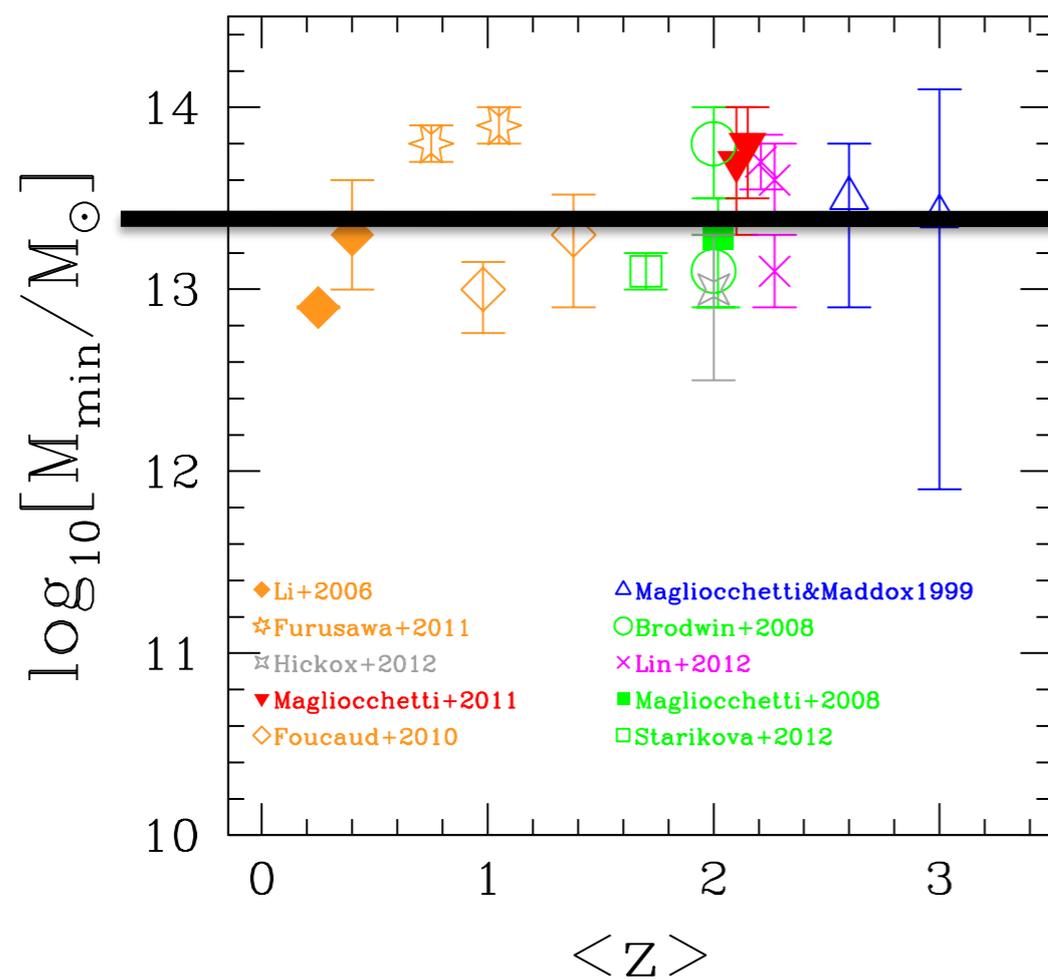
[Hickox, Chehade, Mendez, Myers, Willett]

Halo mass is **very important** for galaxy formation; galaxy clustering **well understood**



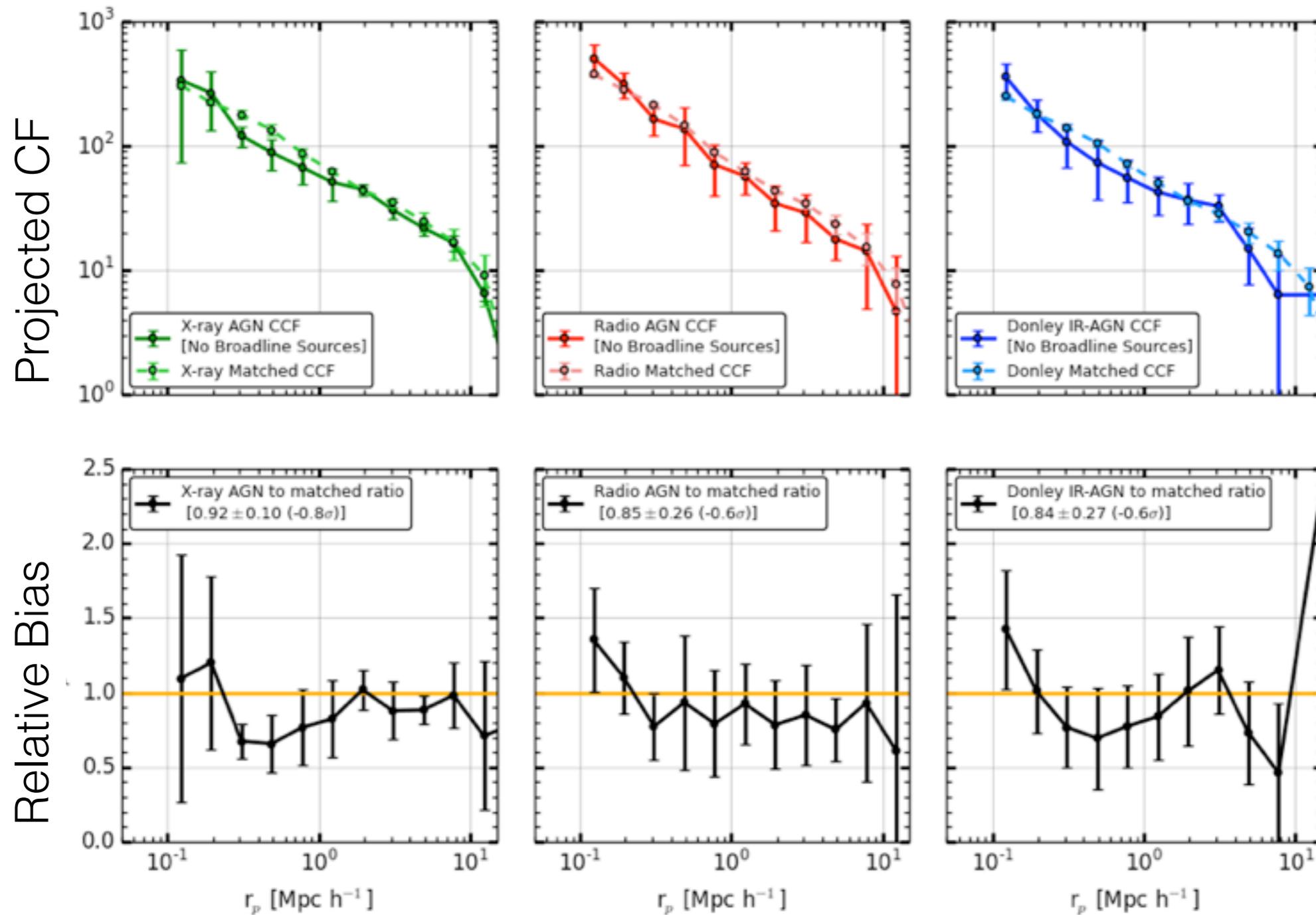
[Coil, Cole, Springel, Fanidakis]

Does AGN activity **follow** star formation in galaxies?



[Hickox, Wang, Coil, Magliocchetti]

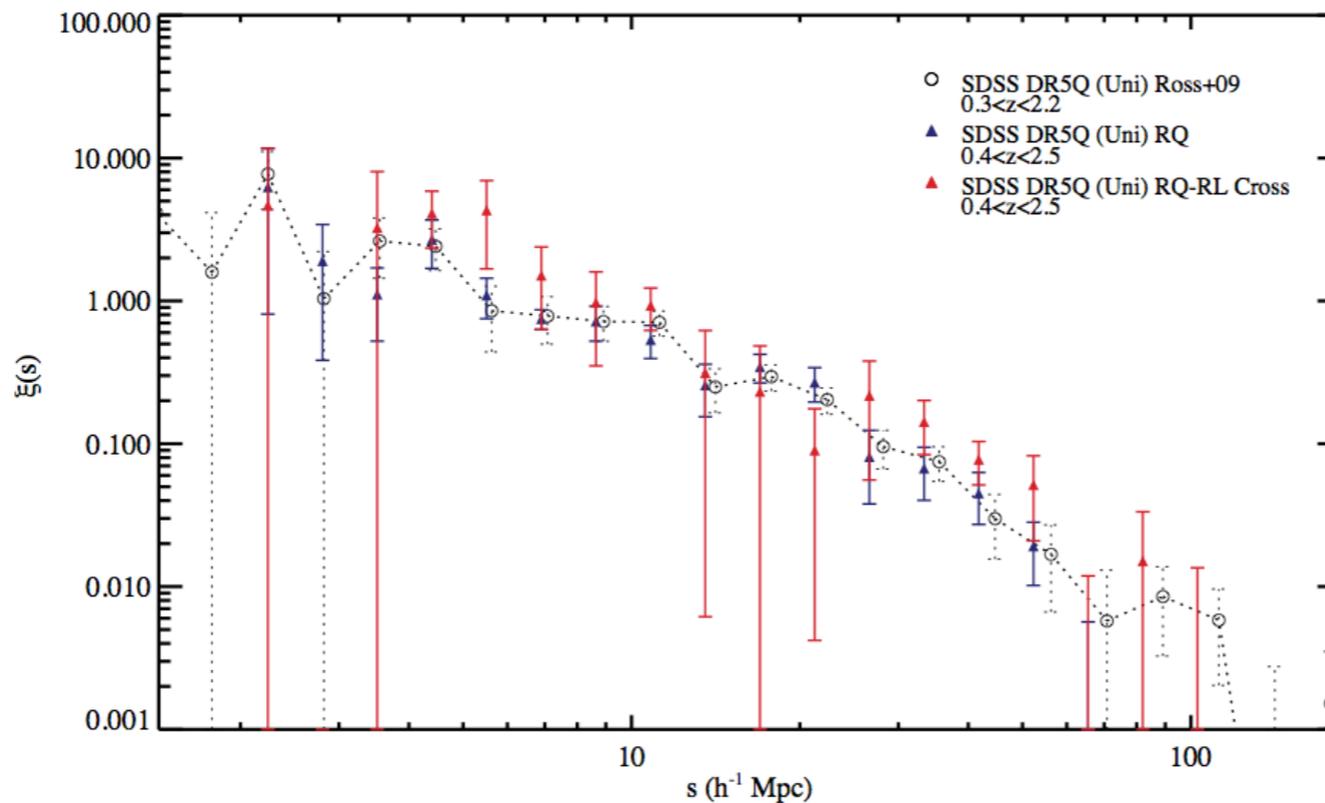
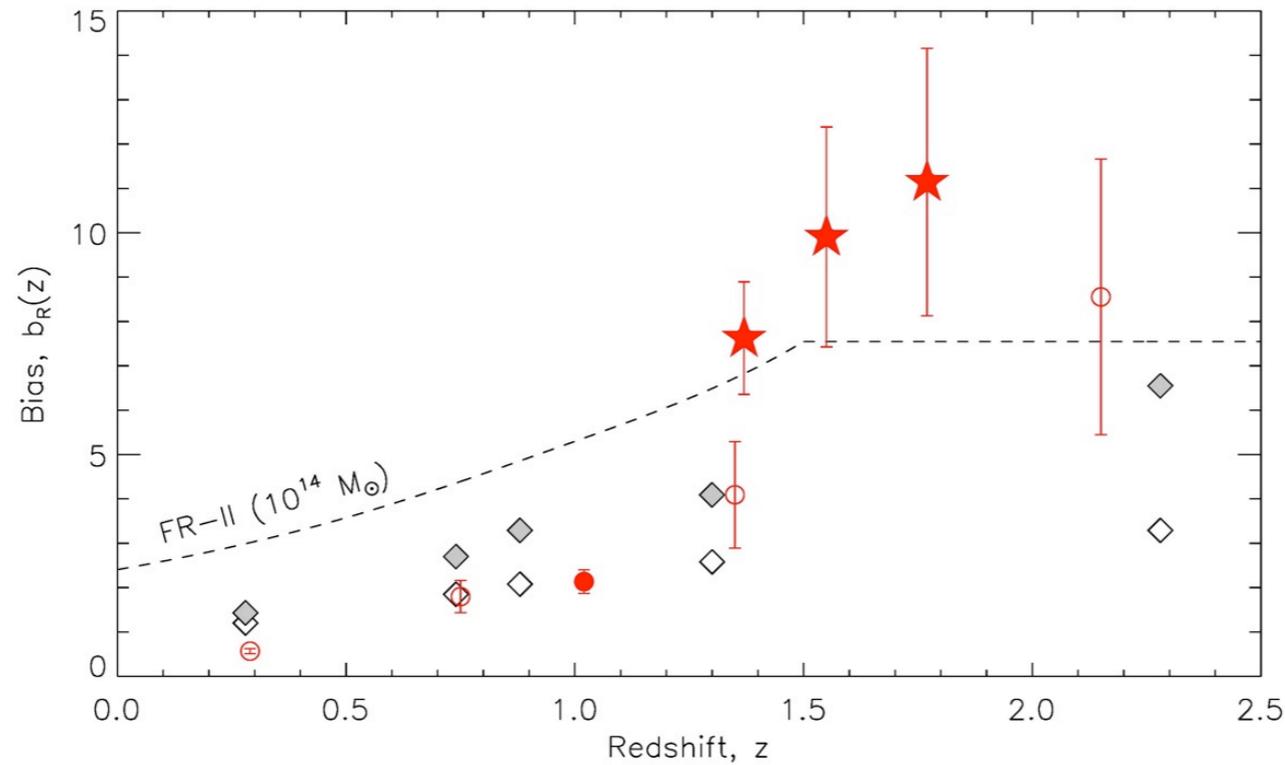
AGN are in general clustered **consistently to matched host galaxies**



X-ray
Radio
IR:Donley

[Georgakakis, Coil,
Mendez, Karhunen]

“Radio-mode” AGN are very **strongly clustered** and in **massive halos**

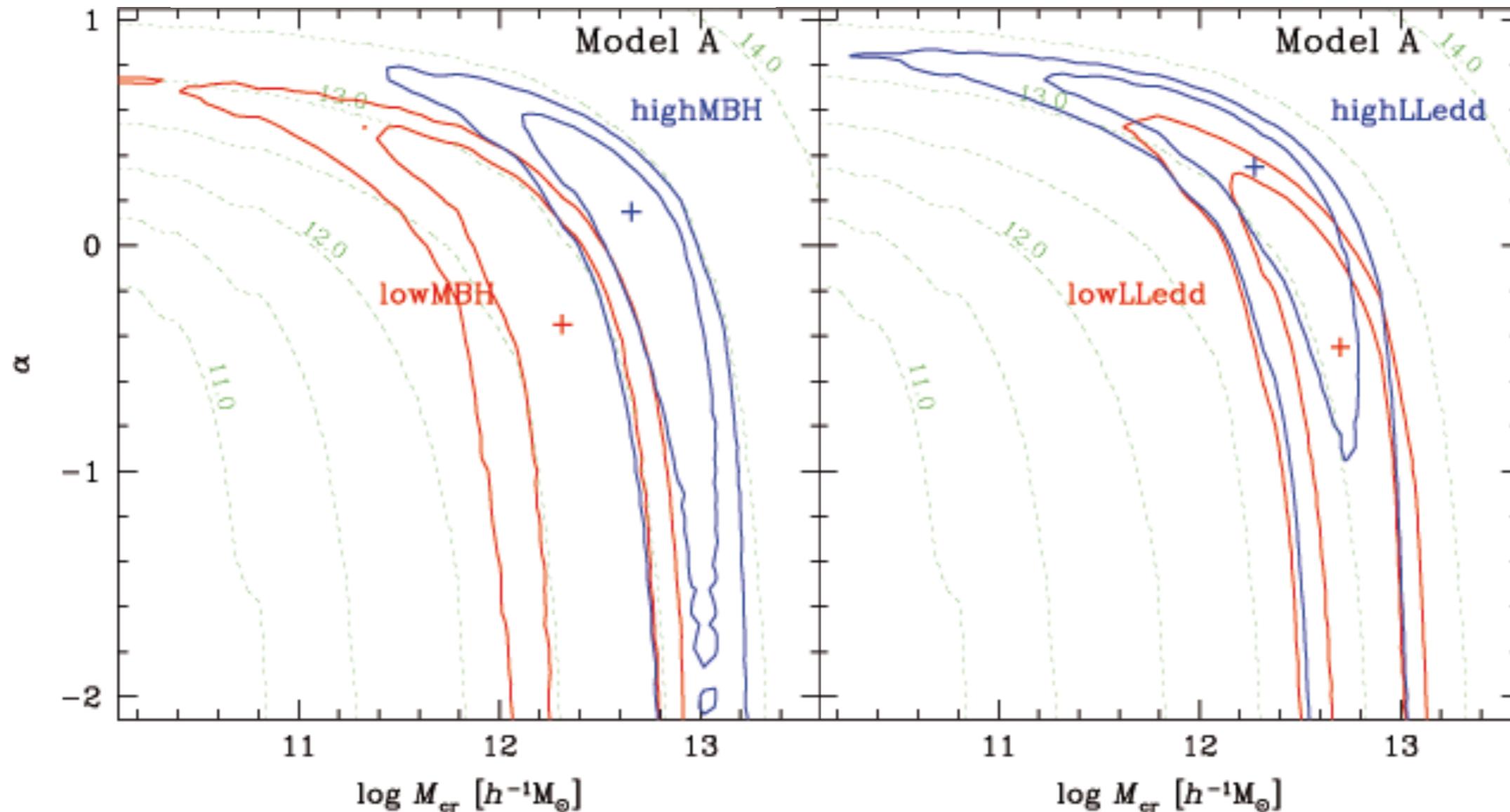


[Rentana-Montenegro, Mendez, Ramos-Almeida, Lindsay, Willett, Hickox]

AGN clustering depends strongly on **black hole mass**, not on **Eddington ratio**

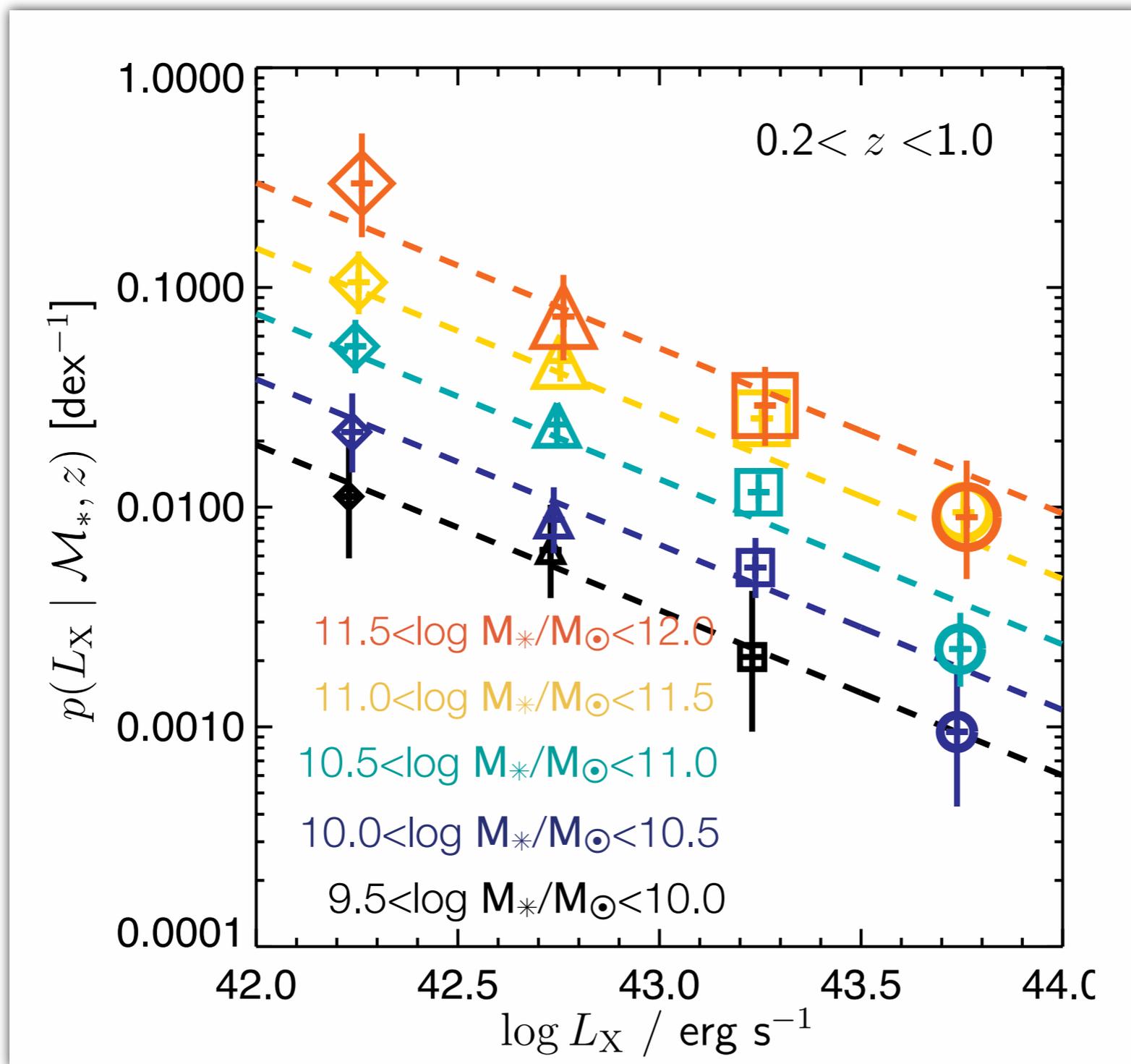
low vs high M_{BH}

low vs high L/L_{EDD}



[Rentana-Montenegro, Krumpe, Shiarasaki]

Importance of **stochasticity** in the AGN population



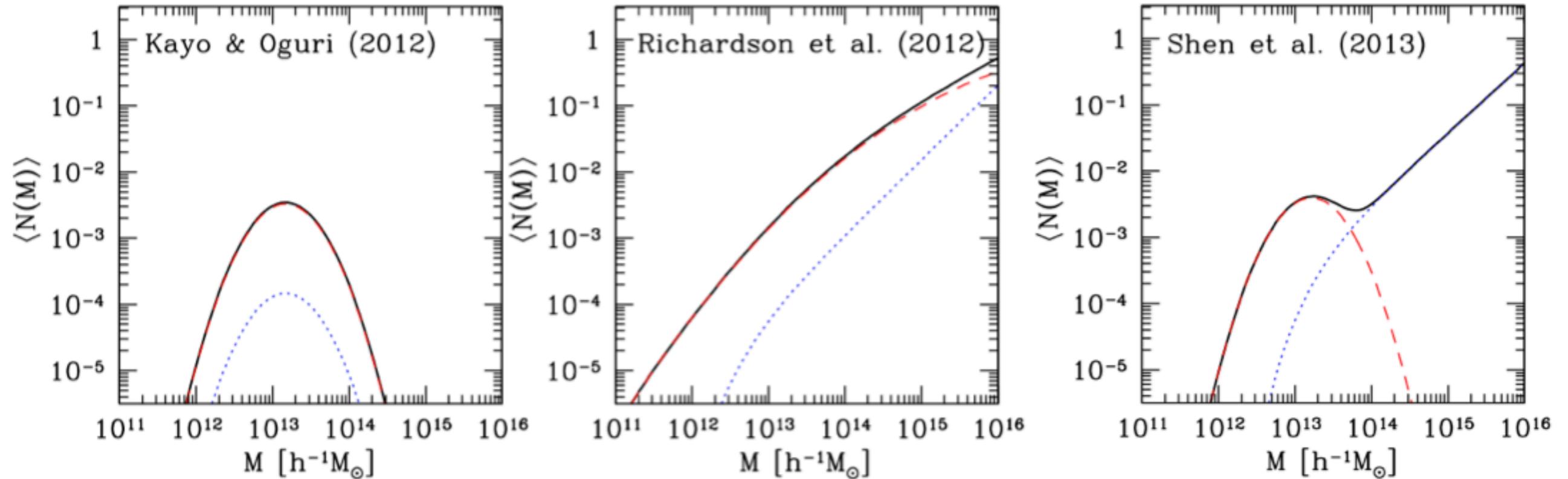
[Coil, Springel]



Time since the Big Bang: 5.7 billion years

ILLUSTRIS

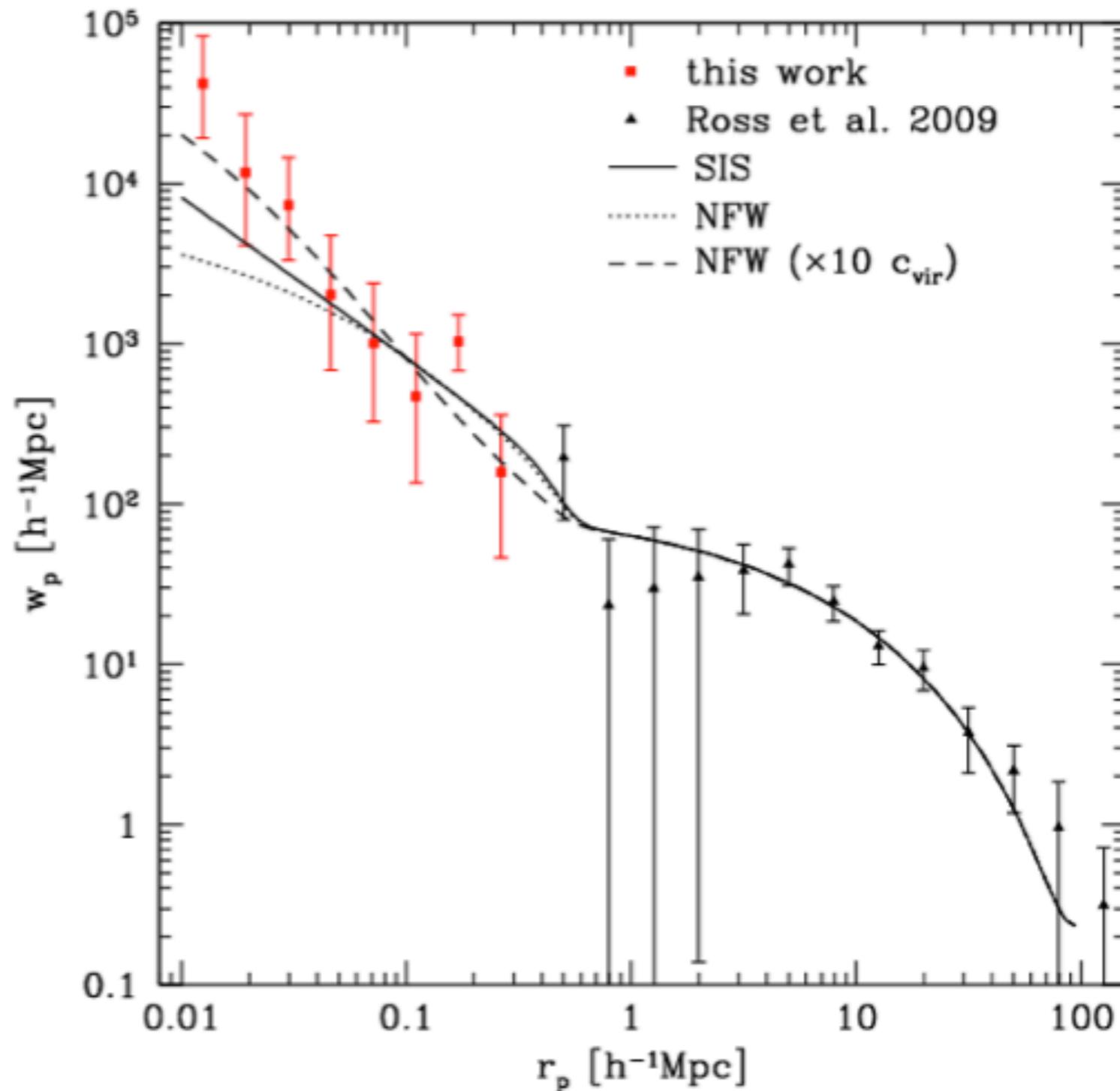
What is the AGN halo occupation distribution?



Difference between
average and **median**
halo mass

[Coil, Miyaji, Kayo,
Finoguenov, Finoguenov,
Nguyen, Altamirano-Divora]

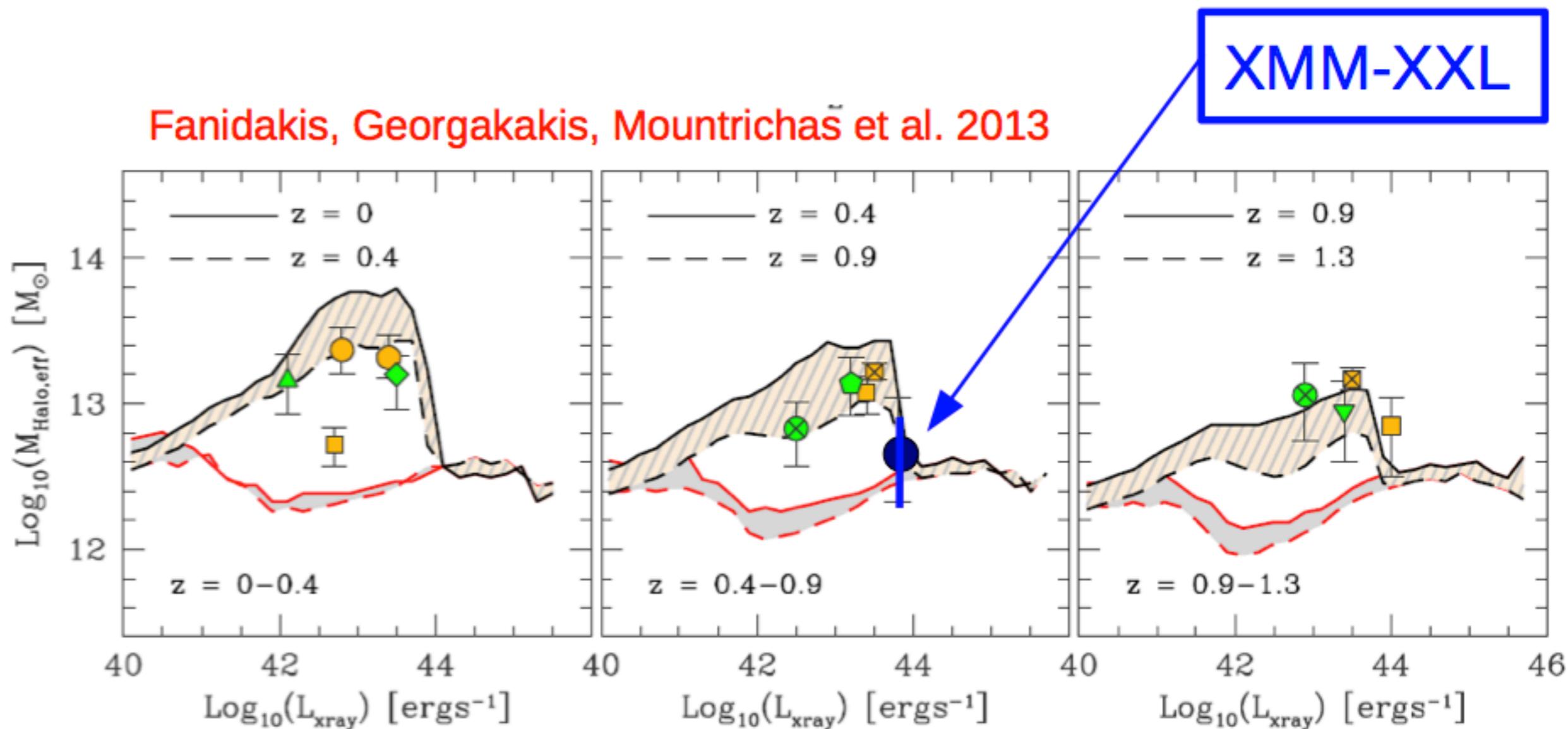
Can clustering constrain the importance of mergers?



[Ramos-Almeida,
Altamirano-Divora,
Kayo, Oogi]

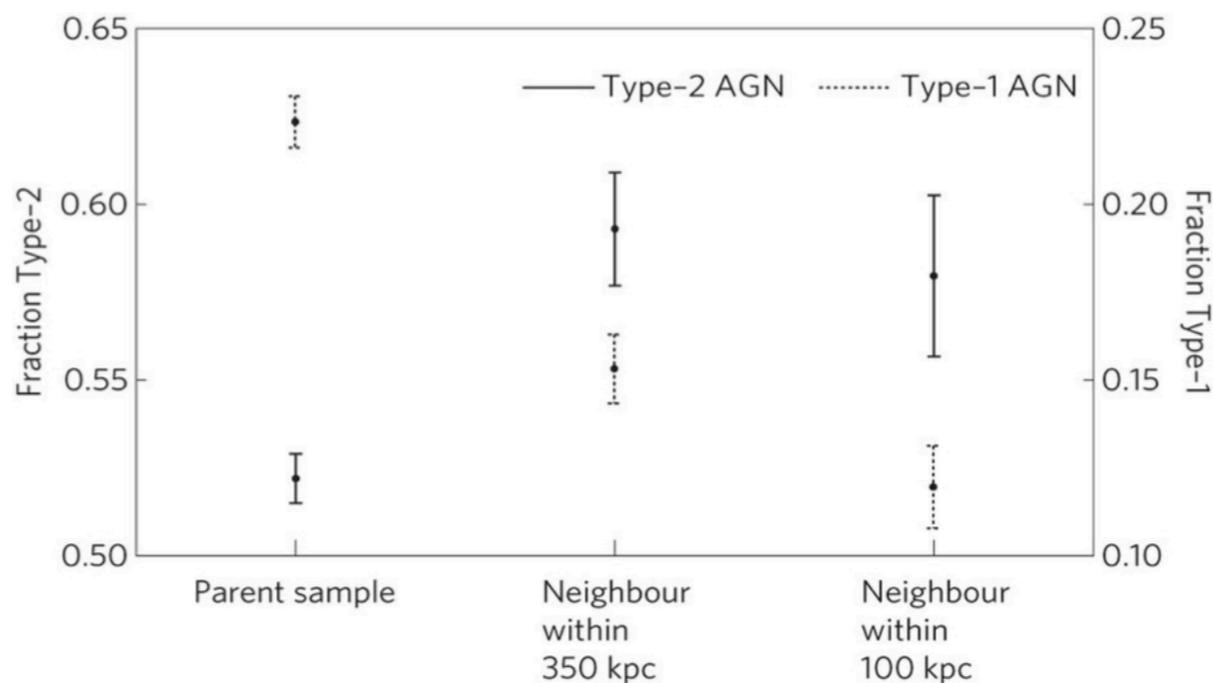
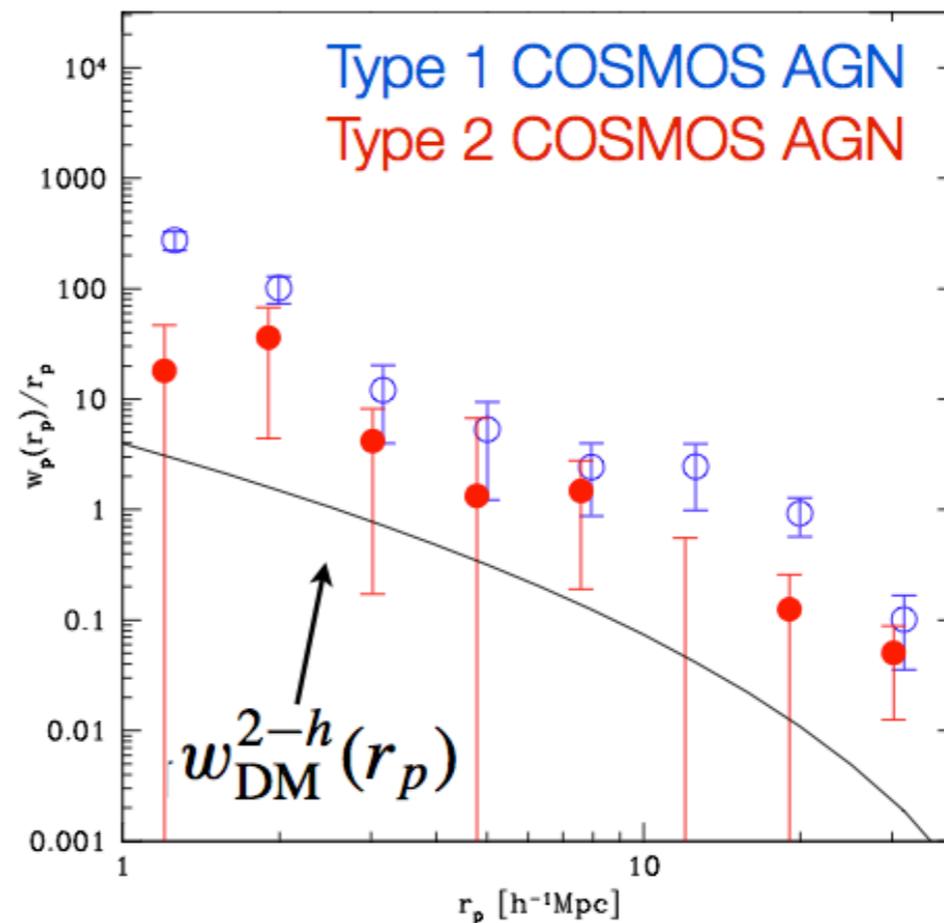
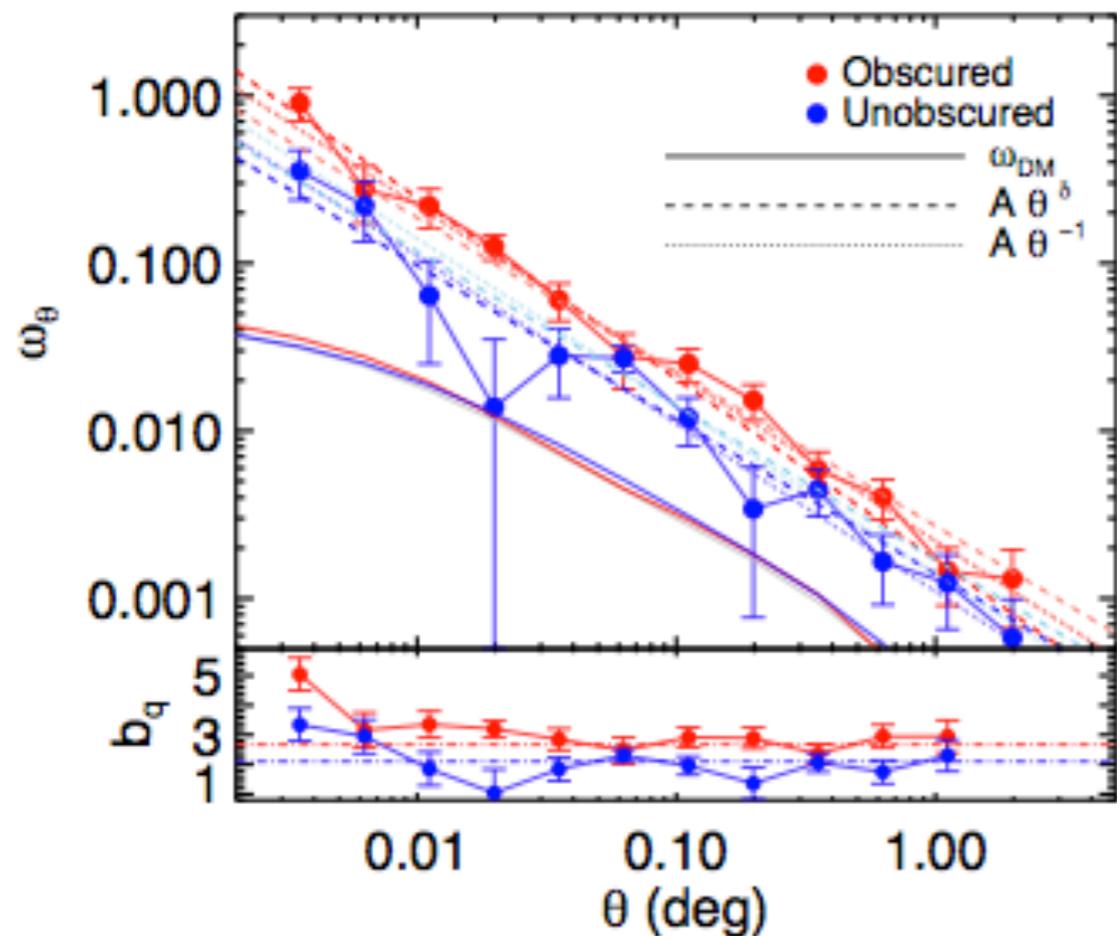
Importance of different **modes of accretion** and **feedback**

Fanidakis, Georgakakis, Mountrichaš et al. 2013



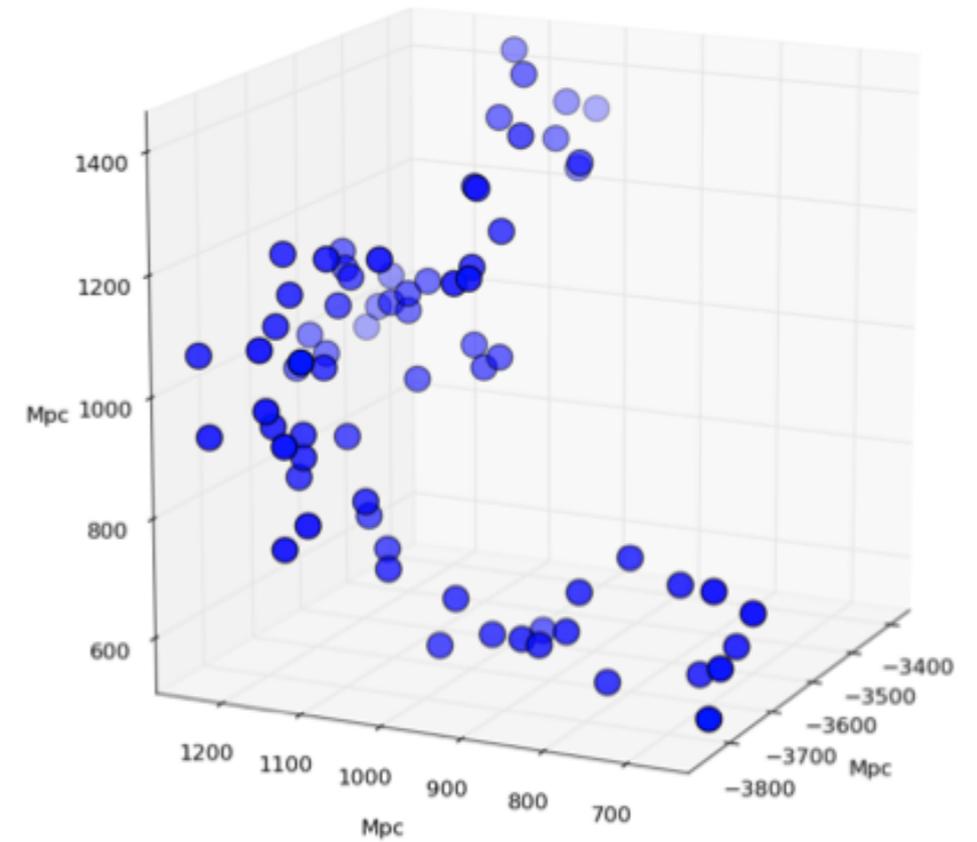
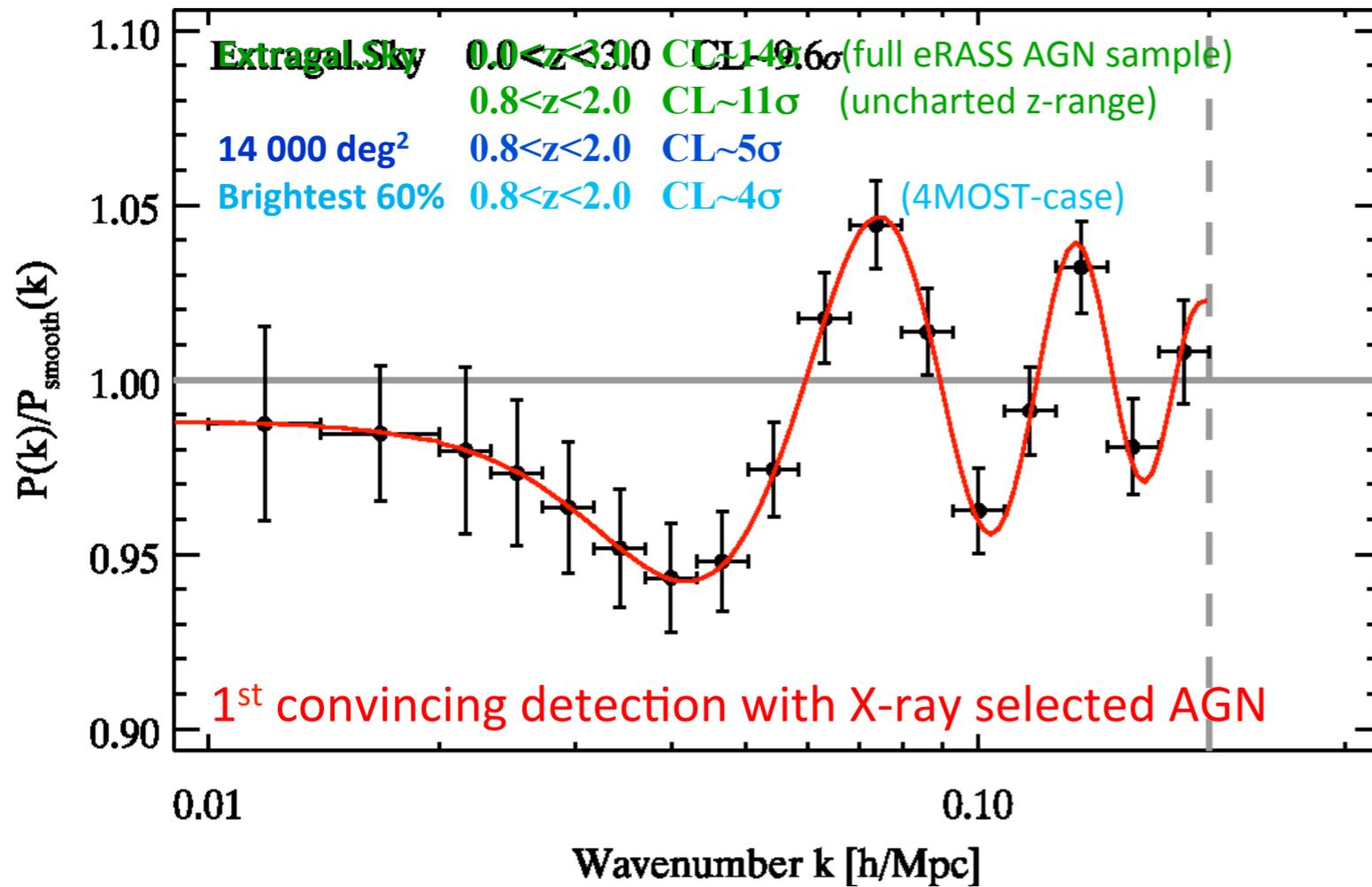
[Georgakakis, Springel, Fanidakis]

Clustering of **obscured and unobscured** (or Type 1/Type 2) AGN and the unified model



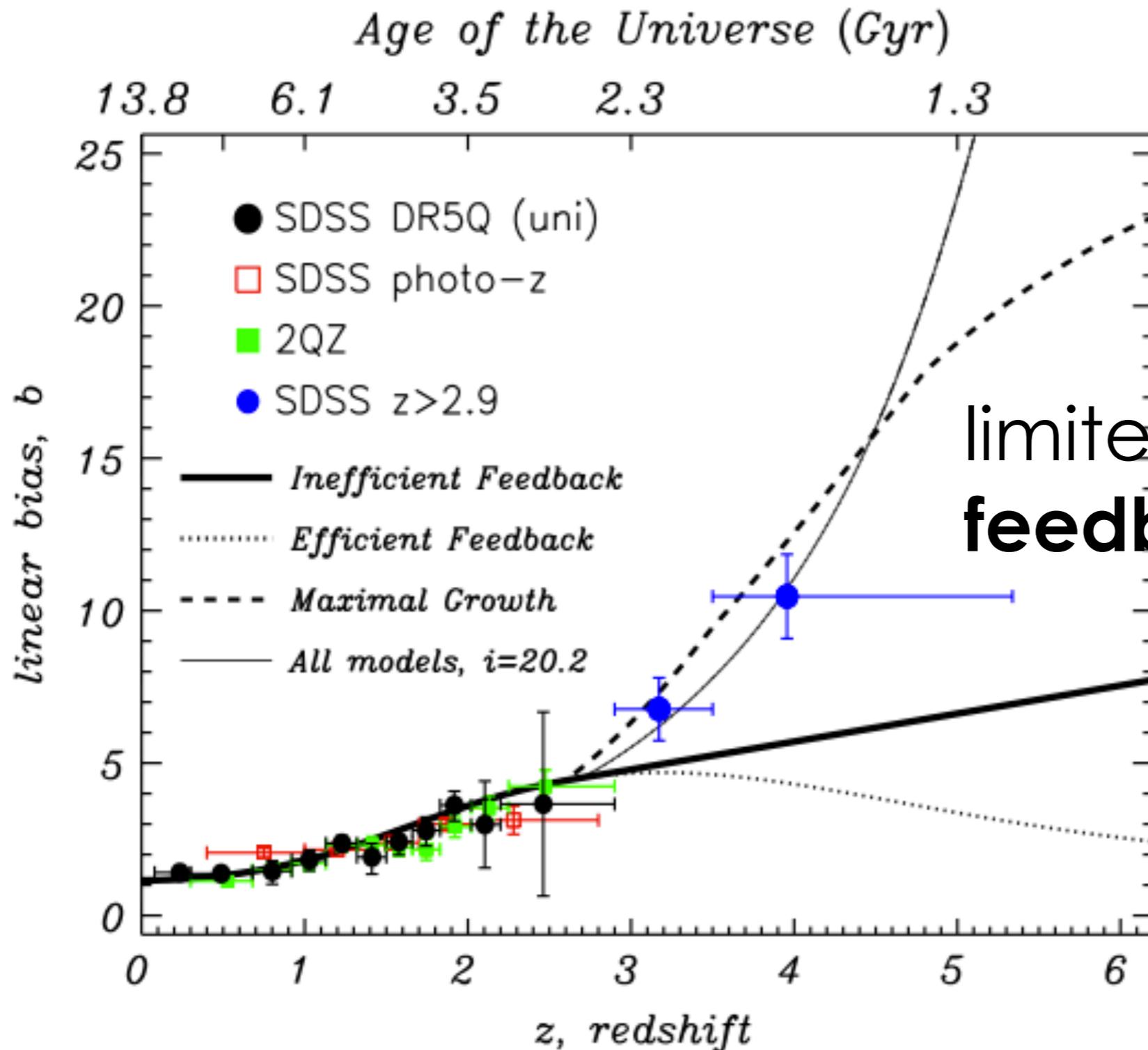
[Hickox, Koutoulidis, Alleinato, Mendez, Villaruel]

AGN clustering and cosmology



[Cole, Marinello,
Campusano, Kolodzig,
Norris]

Importance of clustering at **high redshift**

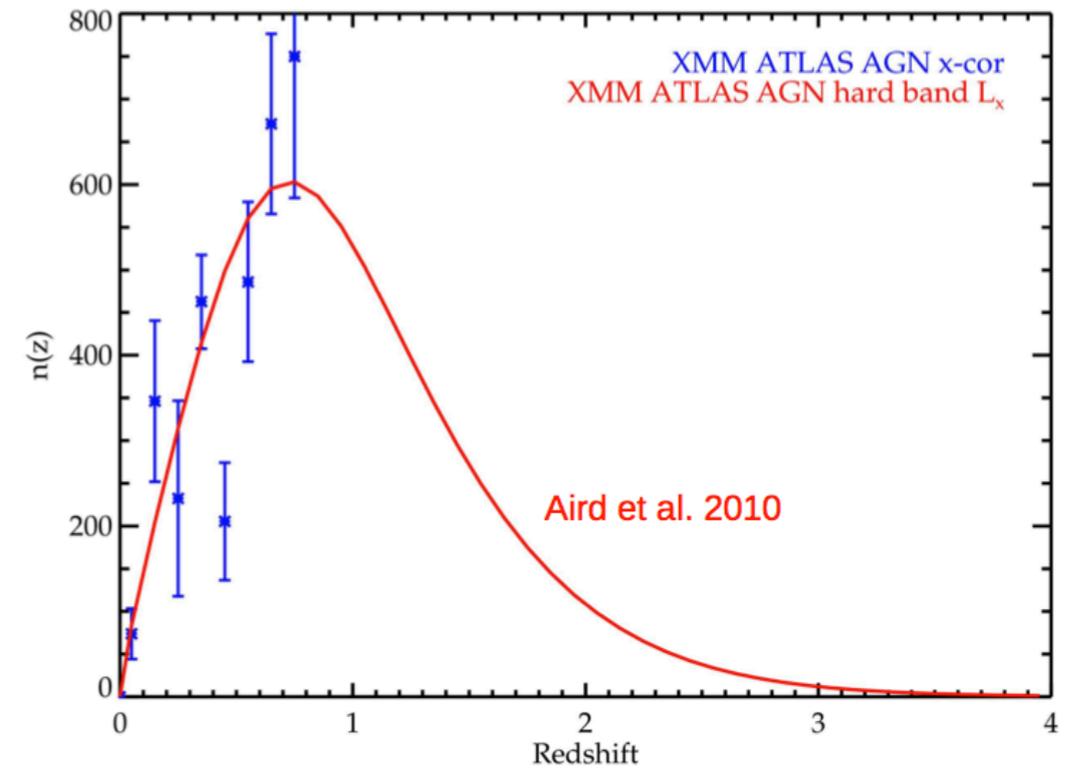
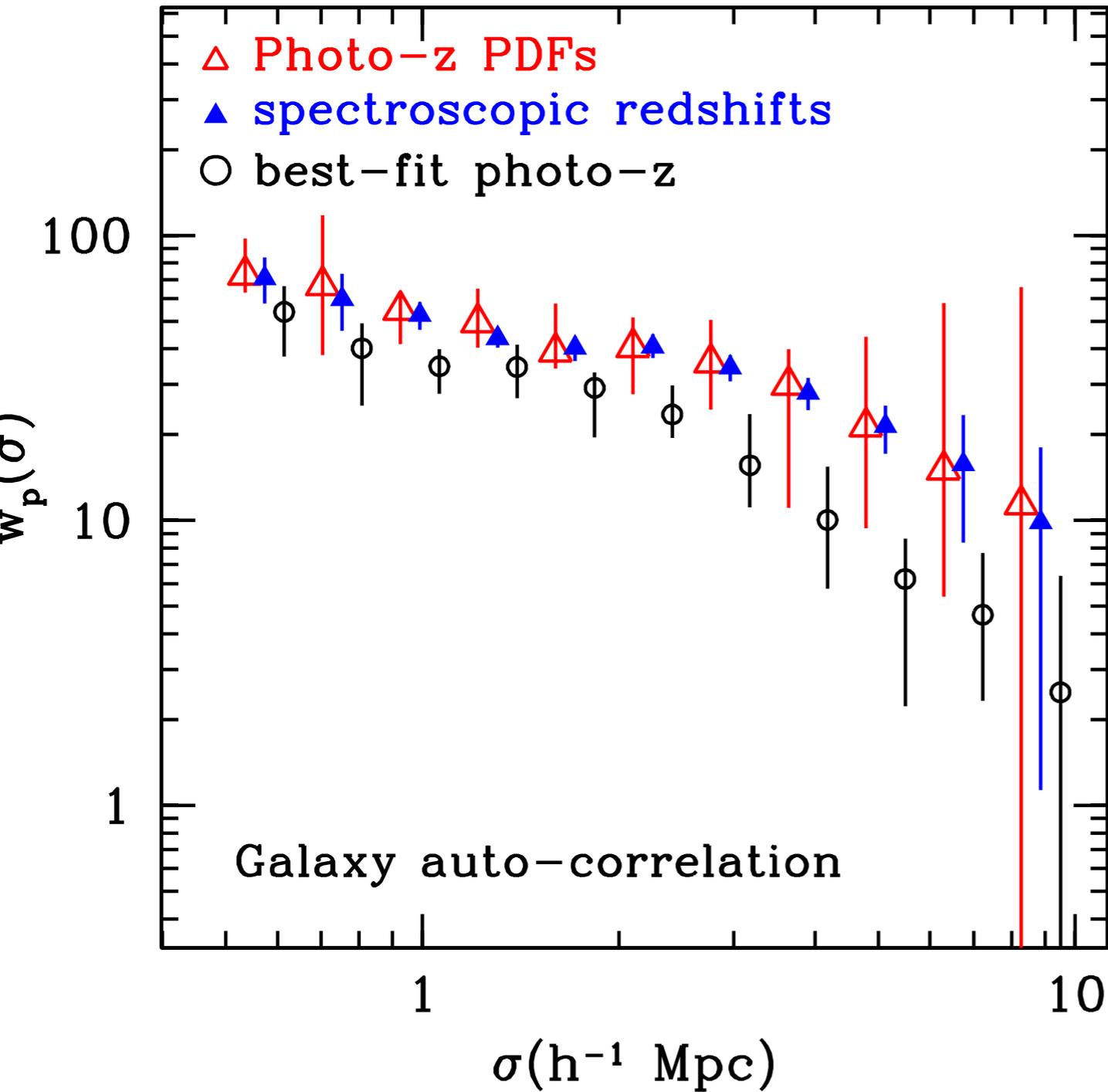


limited by
feedback

limited by **gas supply**

[Croom, Allevato,
Garcia Vergara,
Schulze]

New AGN clustering techniques

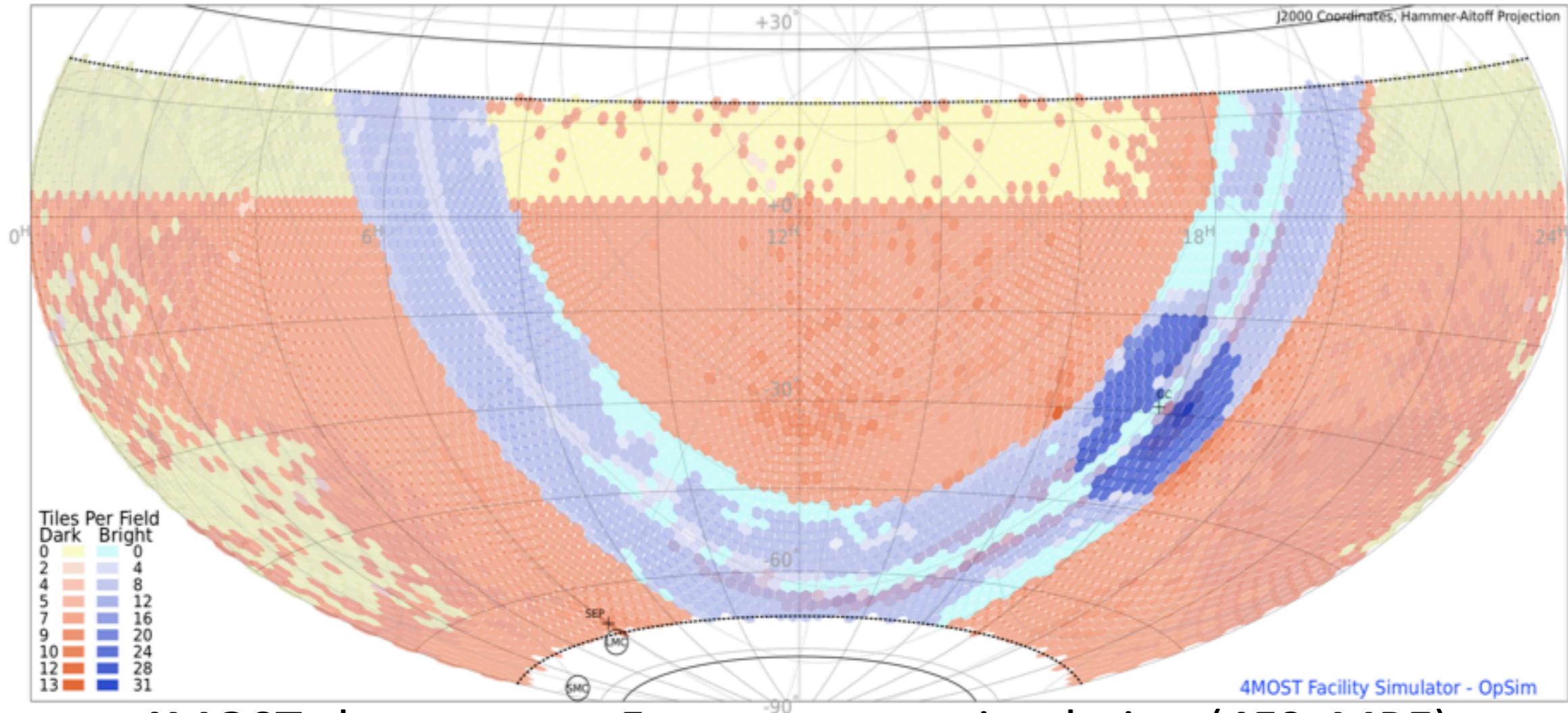


[Nikoloudakis,
Mountrichas, Norris,
Schulze]

The **future** and **large surveys**

4MOST Sky Tiling layout

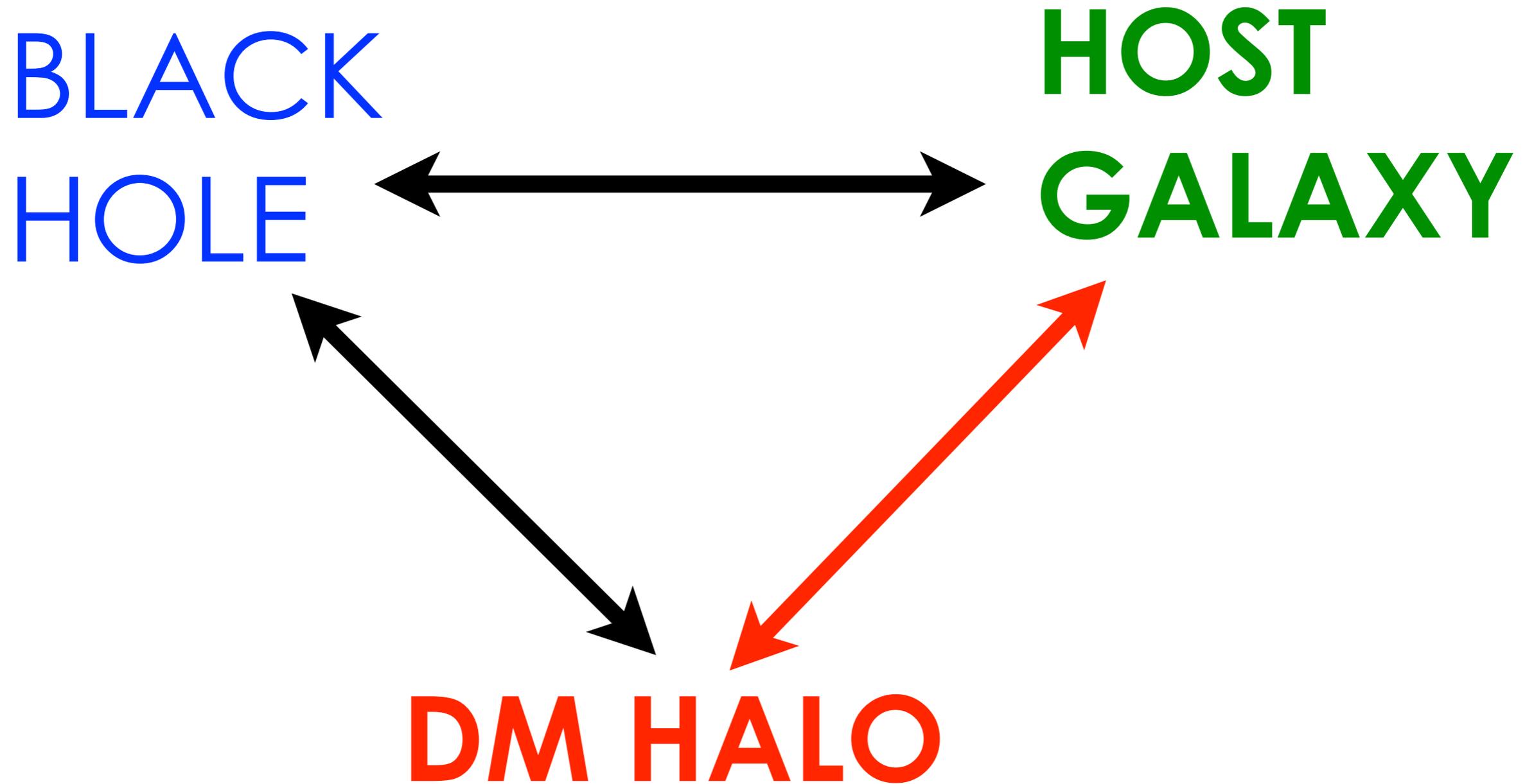
Tele=VISTA Positioner='Echidna-like' Geodesic- $N_{\text{pnts}}=10242$, FOV=4.059deg², 5 year survey



4MOST sky coverage 5 years survey simulation (4FS, MPE)

[Merloni, Kolodzig,
Myers, Schulze,
Geisbuech]

Motivation

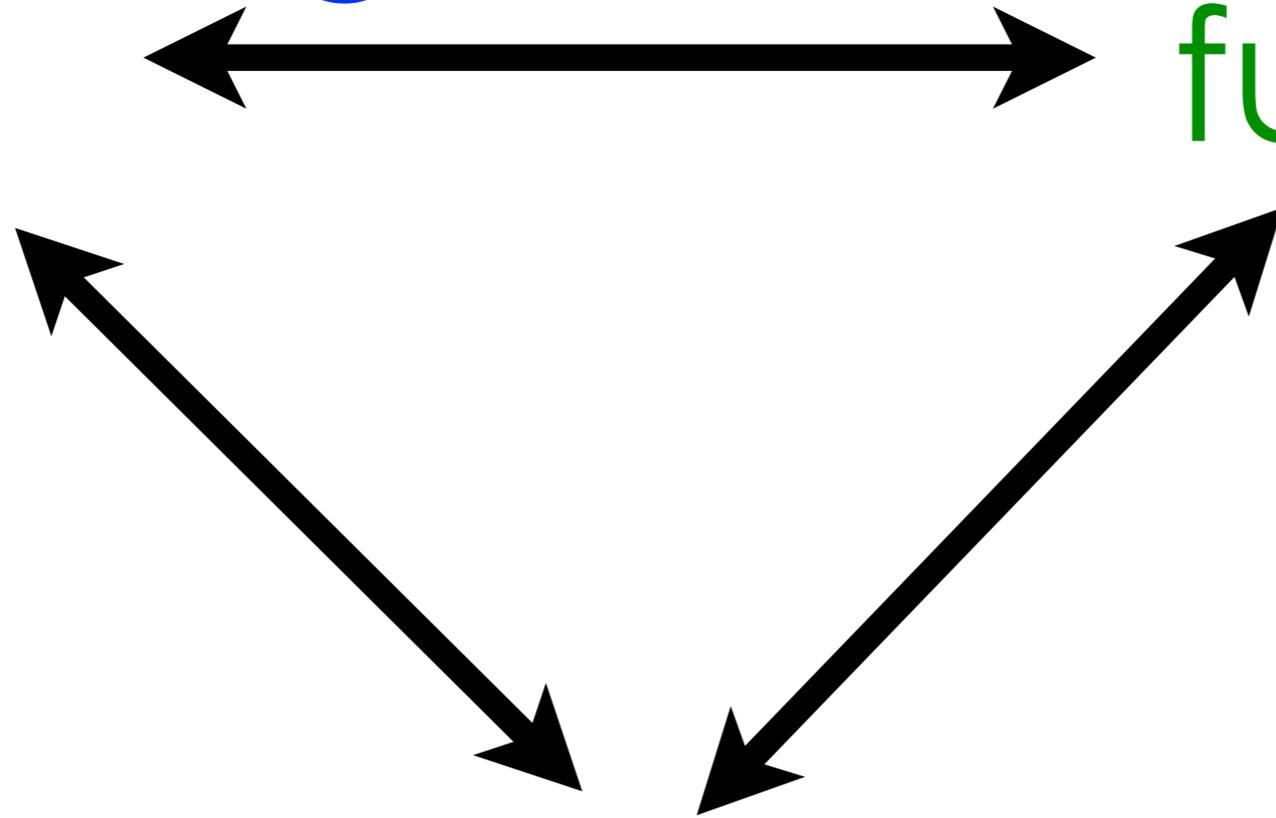


Measure **halo mass** via clustering
Learn about **cosmological evolution**

The way forward

Clustering

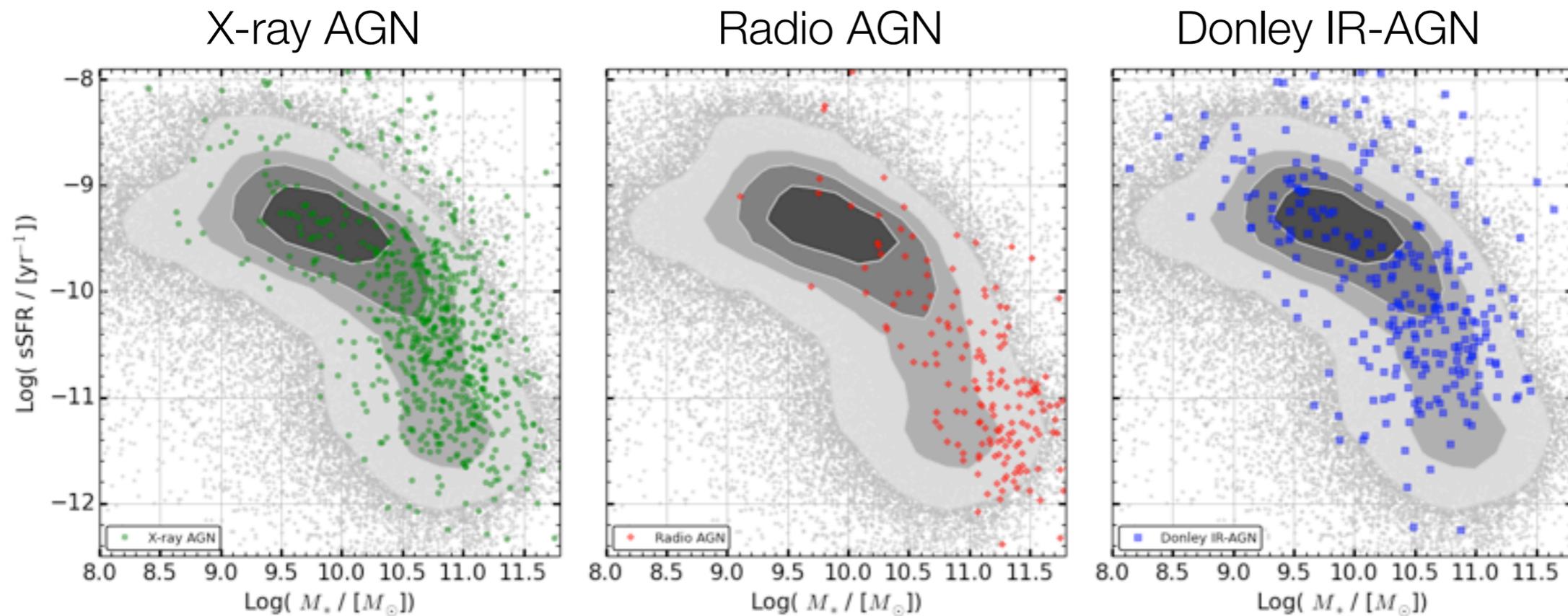
Luminosity
function



Host galaxies

The way forward

Understand **selection effects!!**



X-ray Radio IR:Donley











**Thanks to Mirko and all the organizers
for a fantastic week!**