

DM
Gas Dens
Gas Temp
Star [age & mass]

$z = 7.90$

NewCluster status report

Sukyoung K. Yi (Yonsei)

NewCluster

Yonsei-IAP collaboration

$$M_{200} = 5 \times 10^{14} M_{\odot} \sim 4.1\sigma$$

$$dx_{\text{best}} = 70 \text{ pc}$$

$$dm_* = 2 \times 10^4 M_{\odot}$$

$$dt = 15 \text{ Myr} (\sim 1000 \text{ snapshots})$$

RAMSES-yOMP

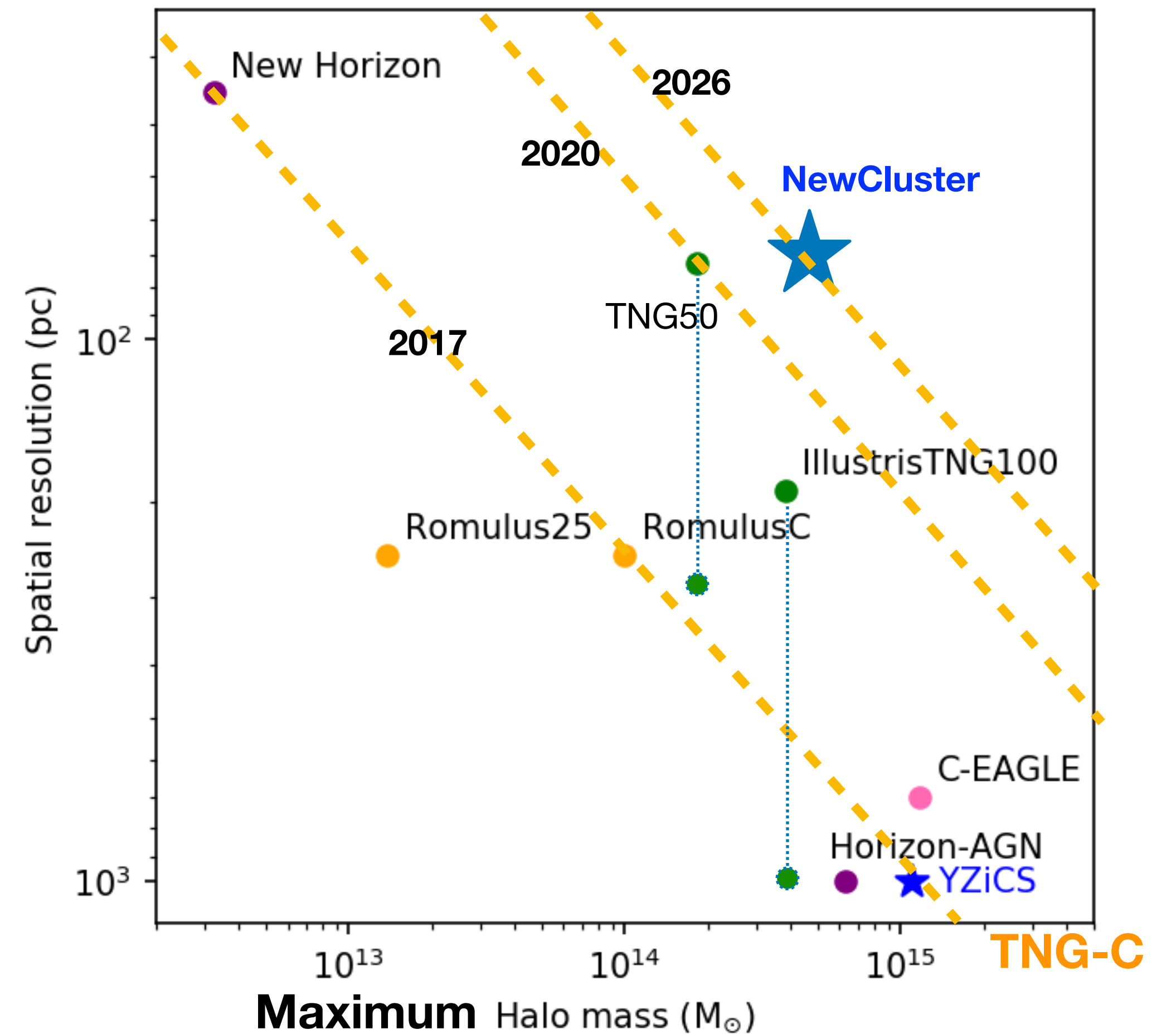
Gas tracer particles

Chemical evolution: D, C, N, O, Mg, Si, S, Fe

“Live” dust (pre-Dubois et al. 2024 prescription)

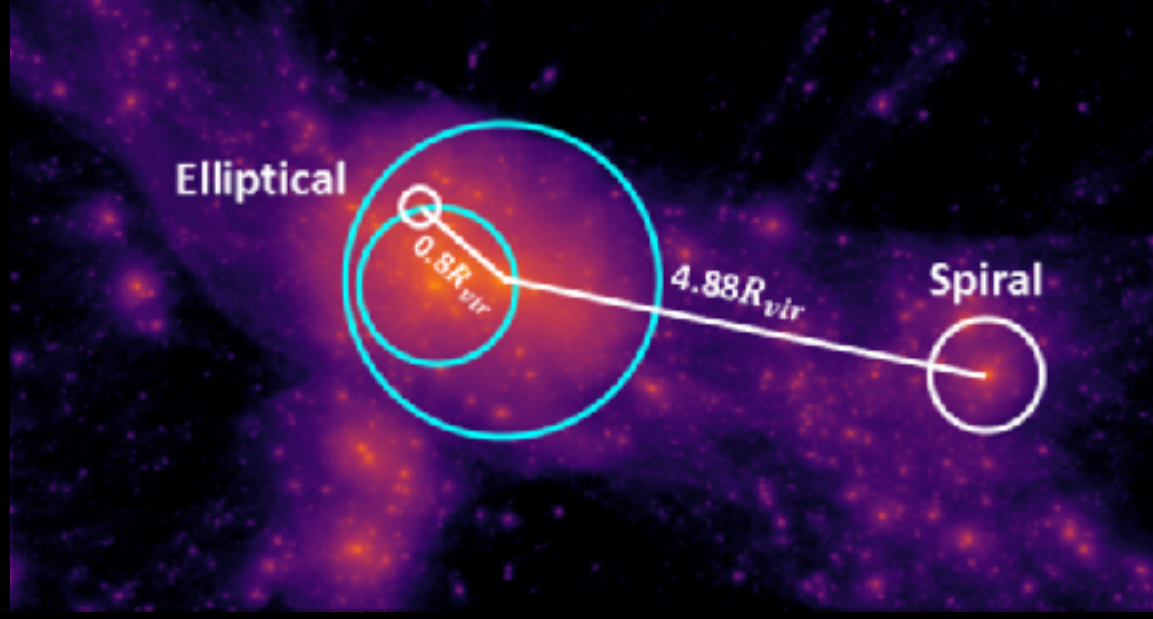
Running since 5/2022

Currently at $z \sim 0.44$



$\log_{10}(M/M_{\odot}) = 9.43$

$\log_{10}(M/M_{\odot}) = 9.44$



$z = 4.59$

7 kpc

$z = 5.70$

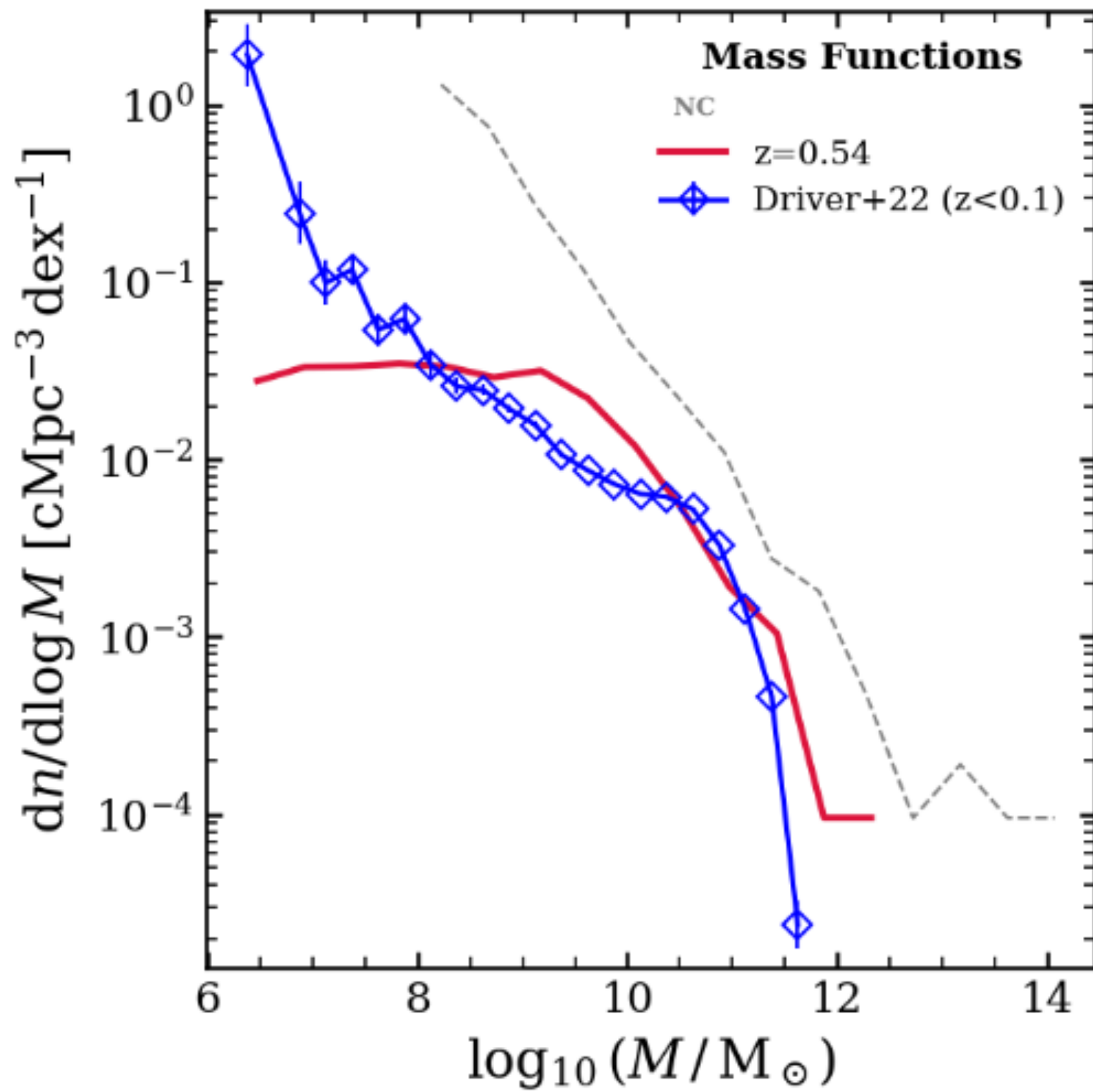
2 kpc

Movie by CJ Seo

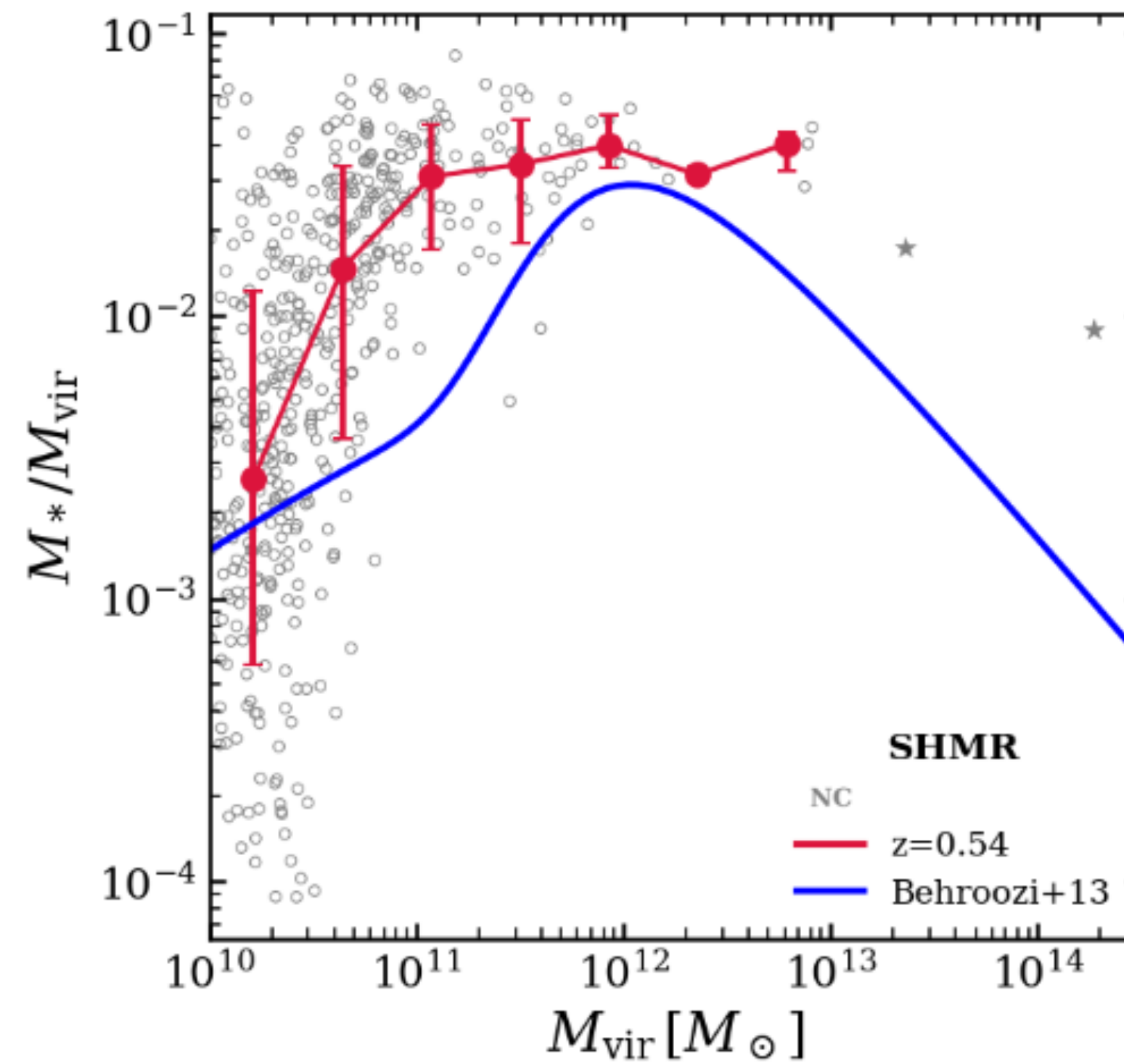
Galaxy properties @ z=0.55 (preliminary)

mass, size

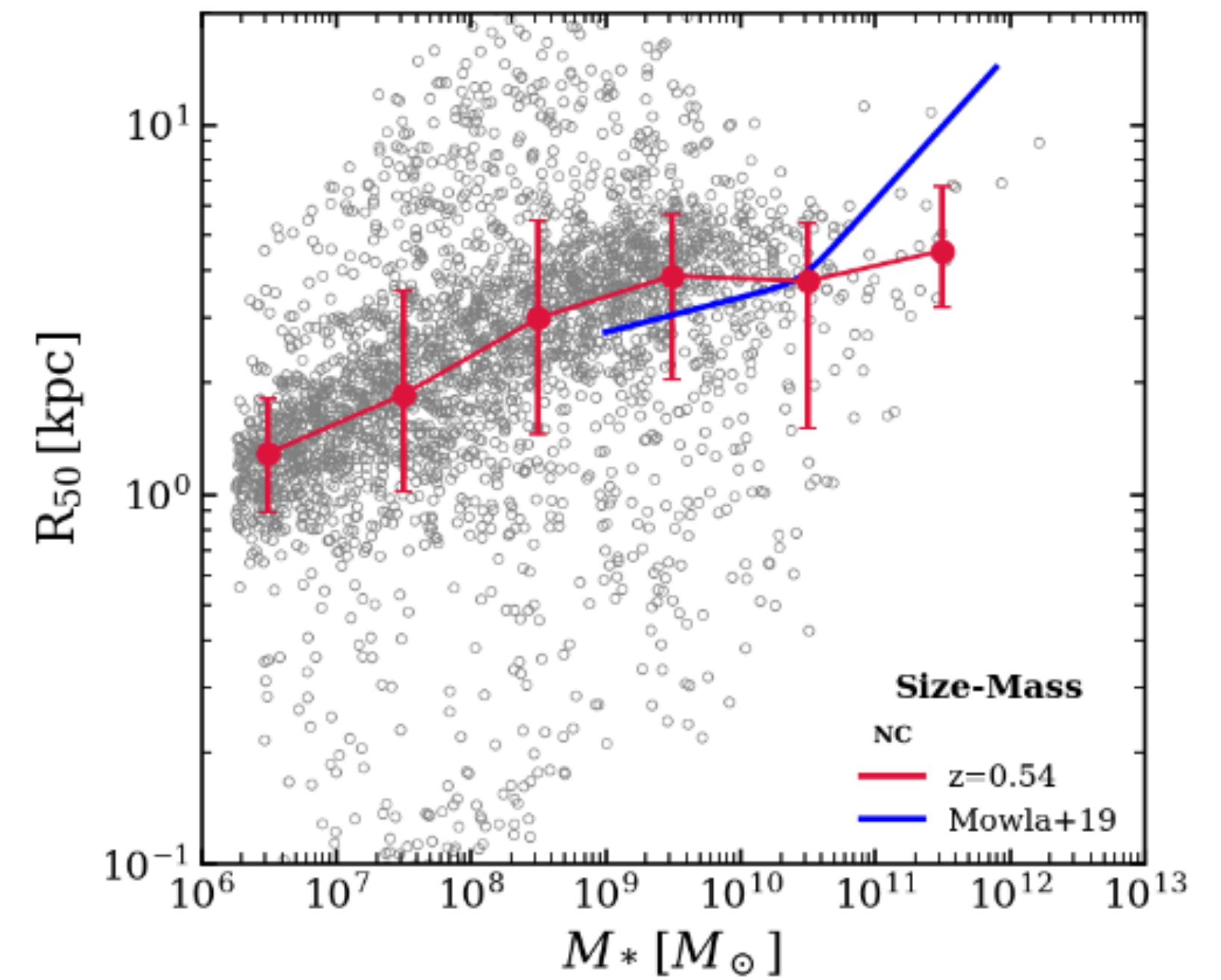
Stellar mass function



Star-to-halo mass ratio



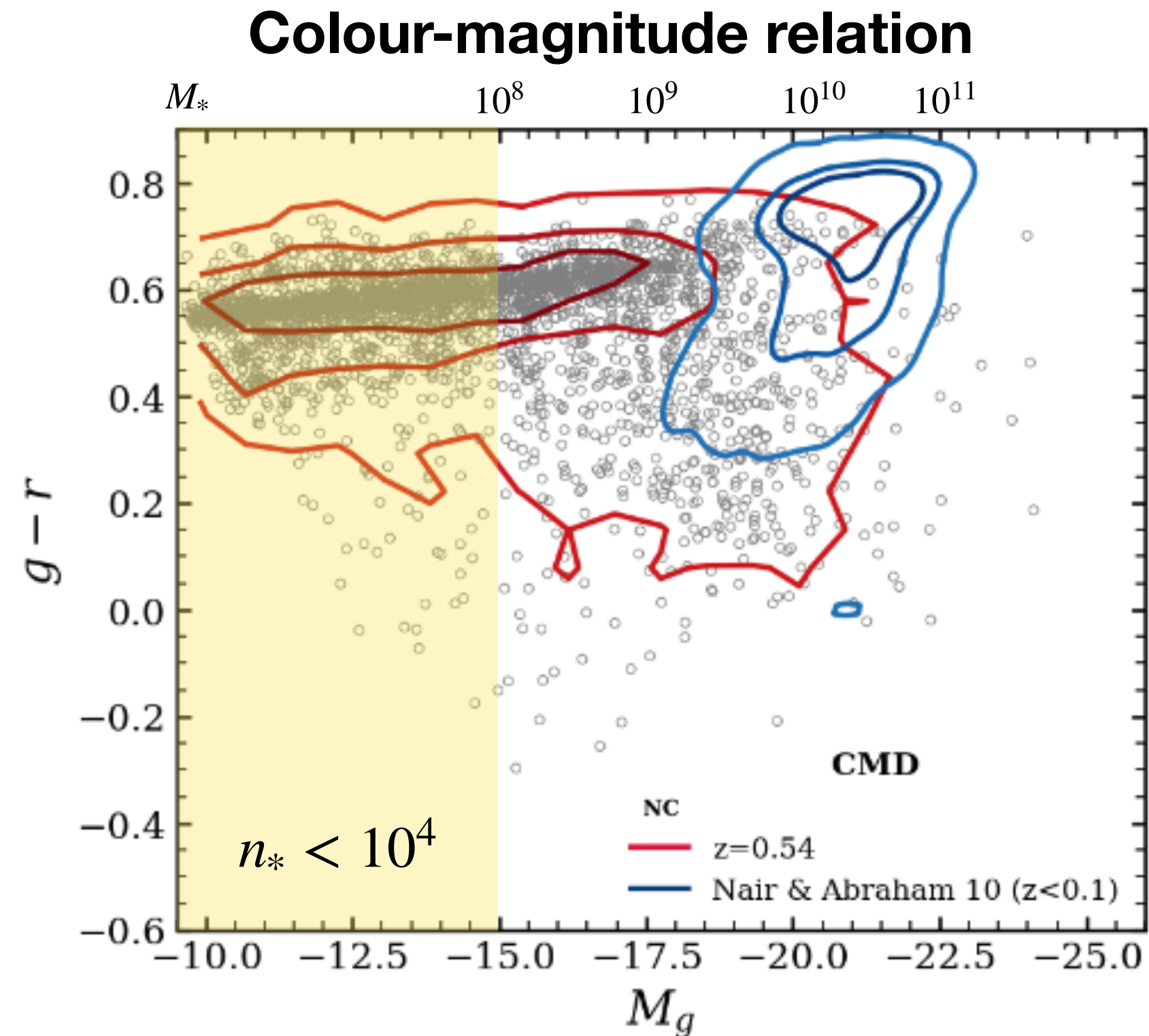
Size-mass relation



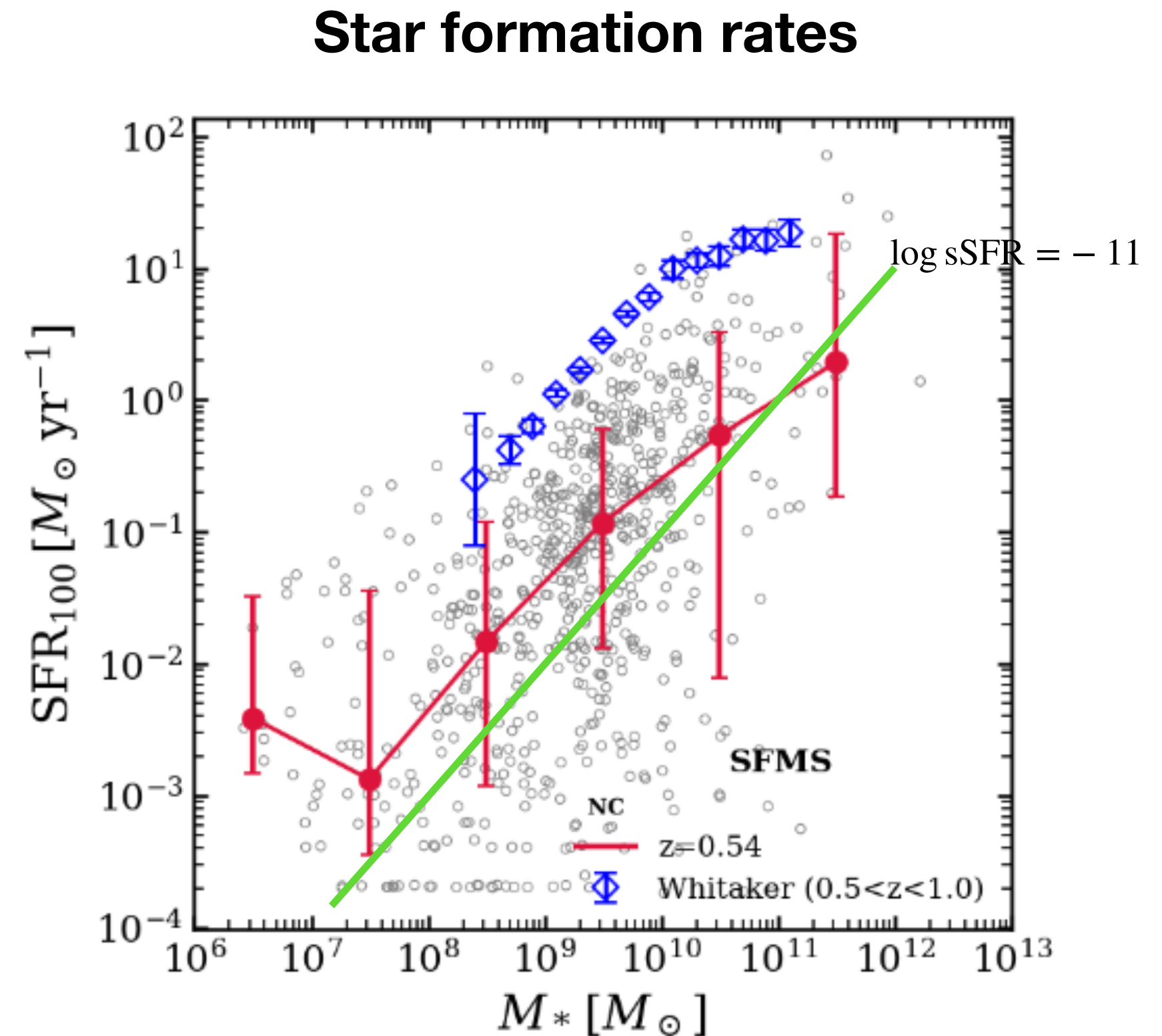
Massive galaxies too small?

Galaxy properties @ $z=0.55$ (preliminary)

stellar populations



CMR very clear in cluster.
But, a large scatter at high mass end. Why?

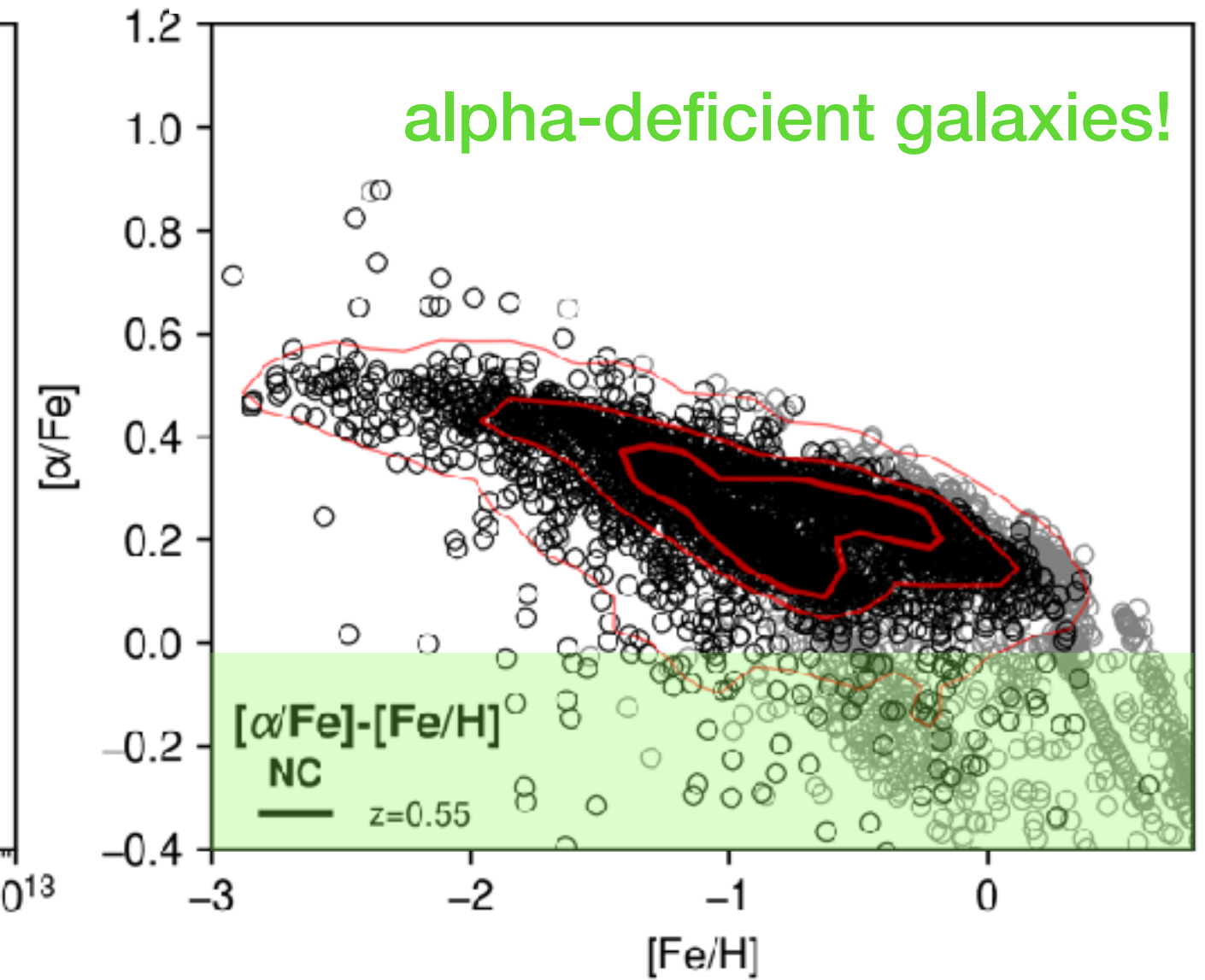
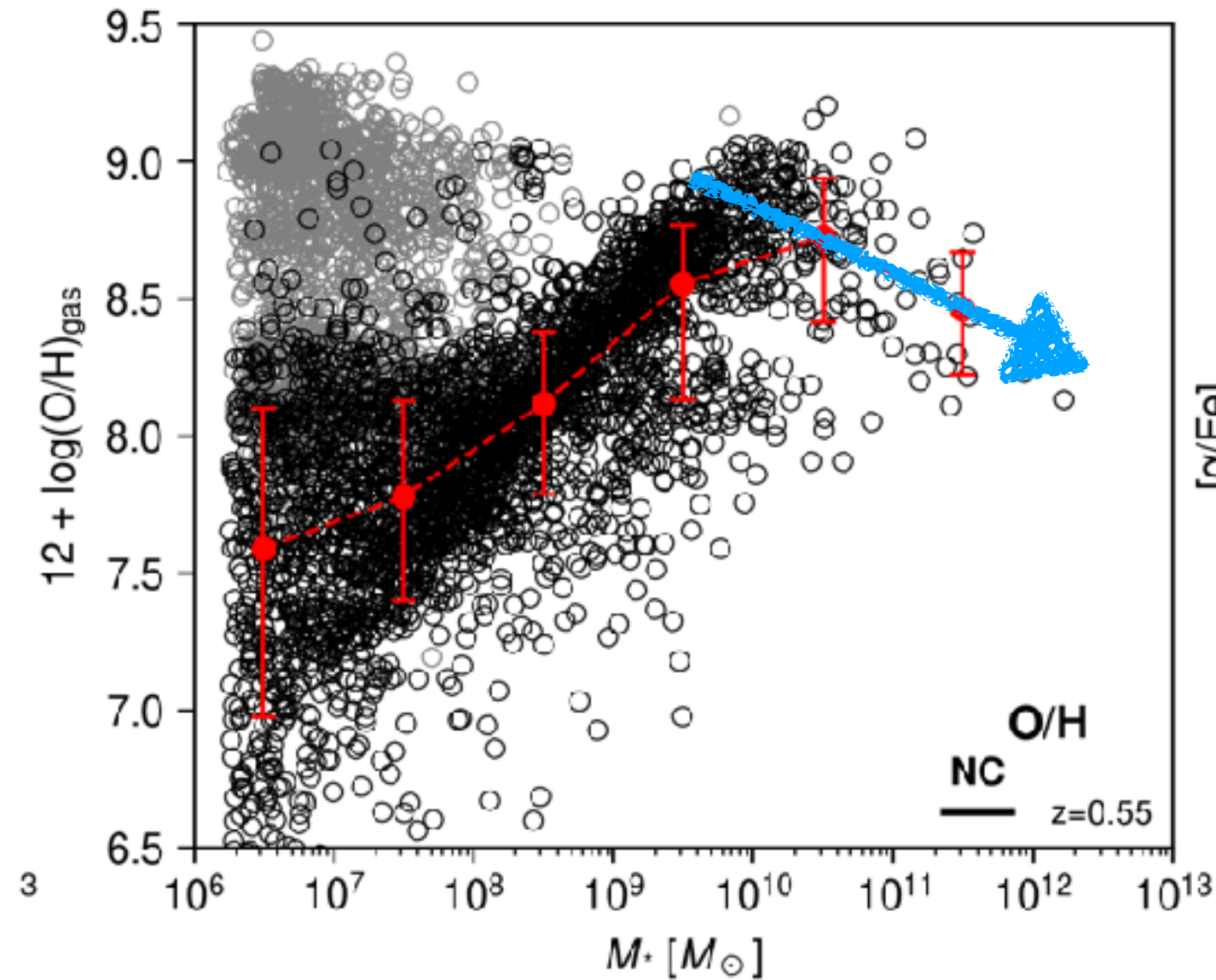
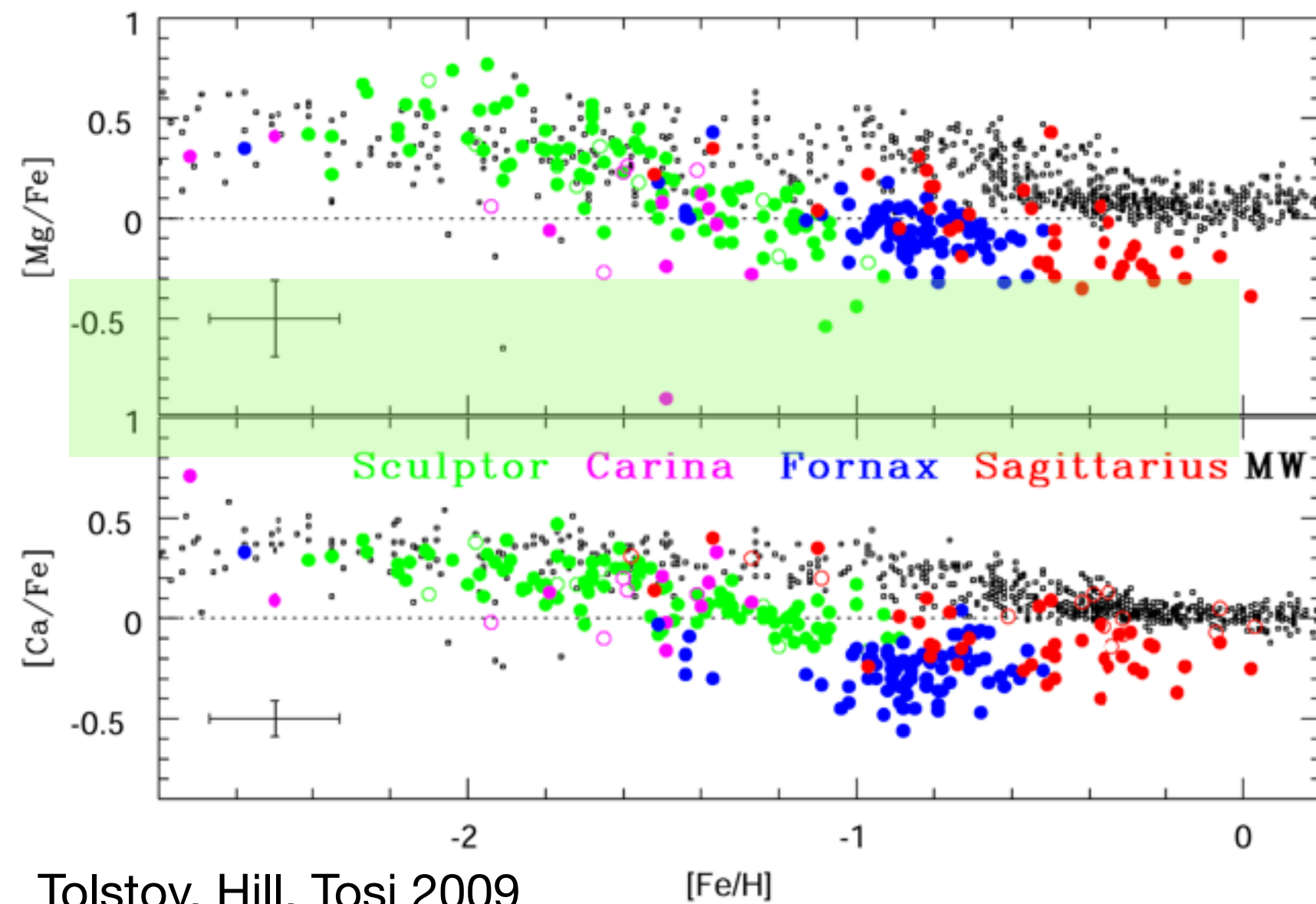
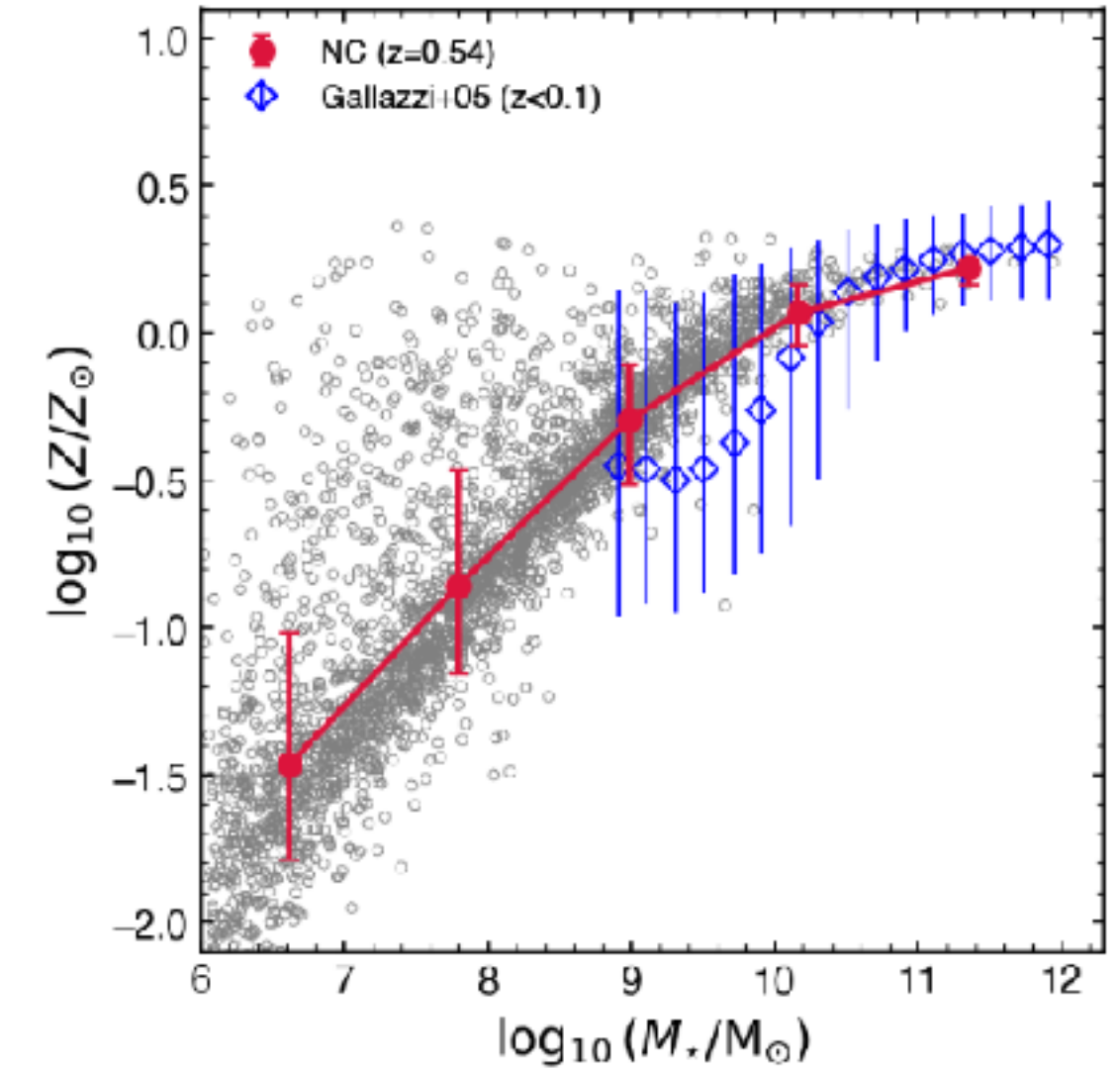
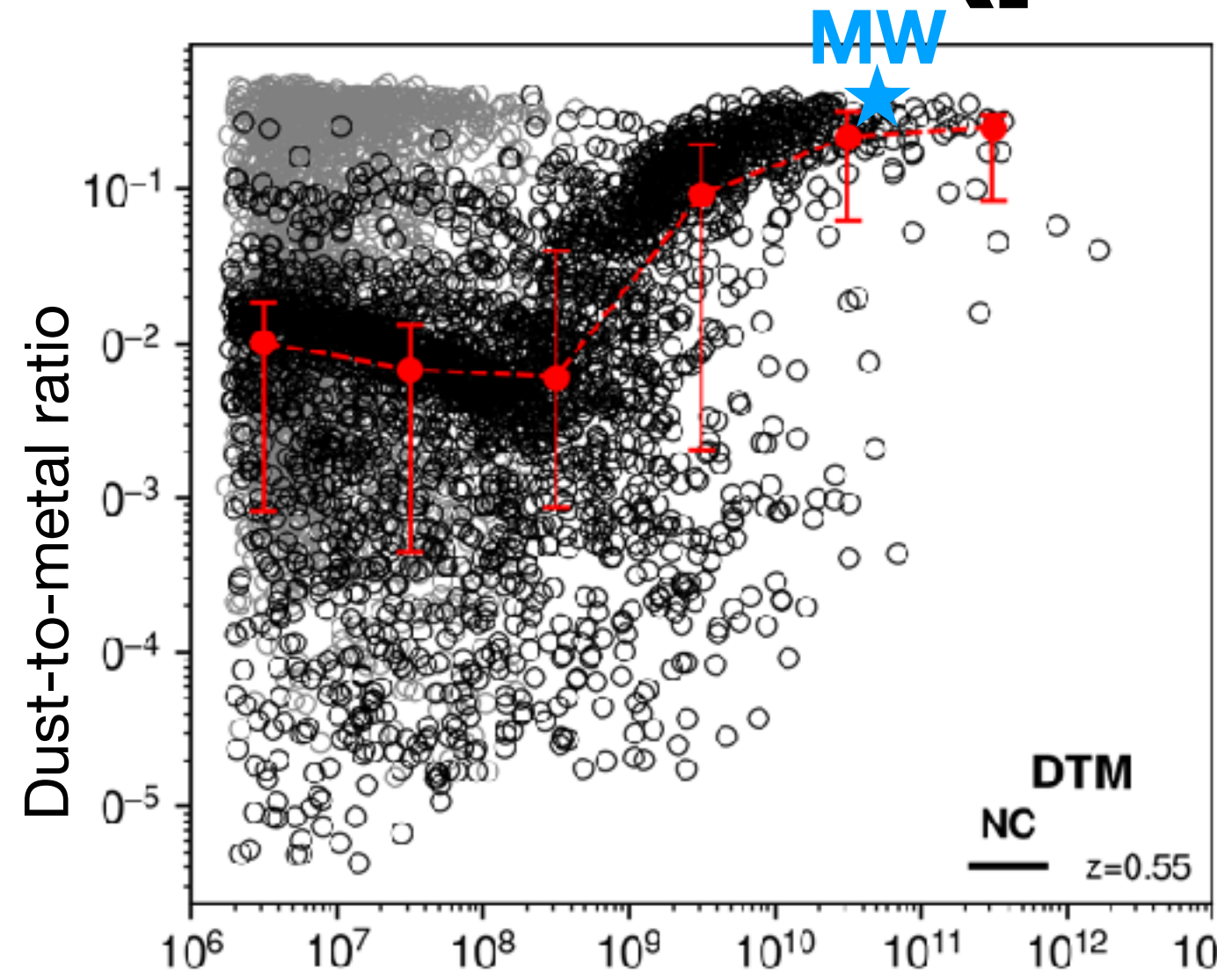


Most massive galaxies are SF-passive.
 $f(E) \sim 0.5$ by morphology

Galaxy properties @ $z=0.55$ (preliminary)

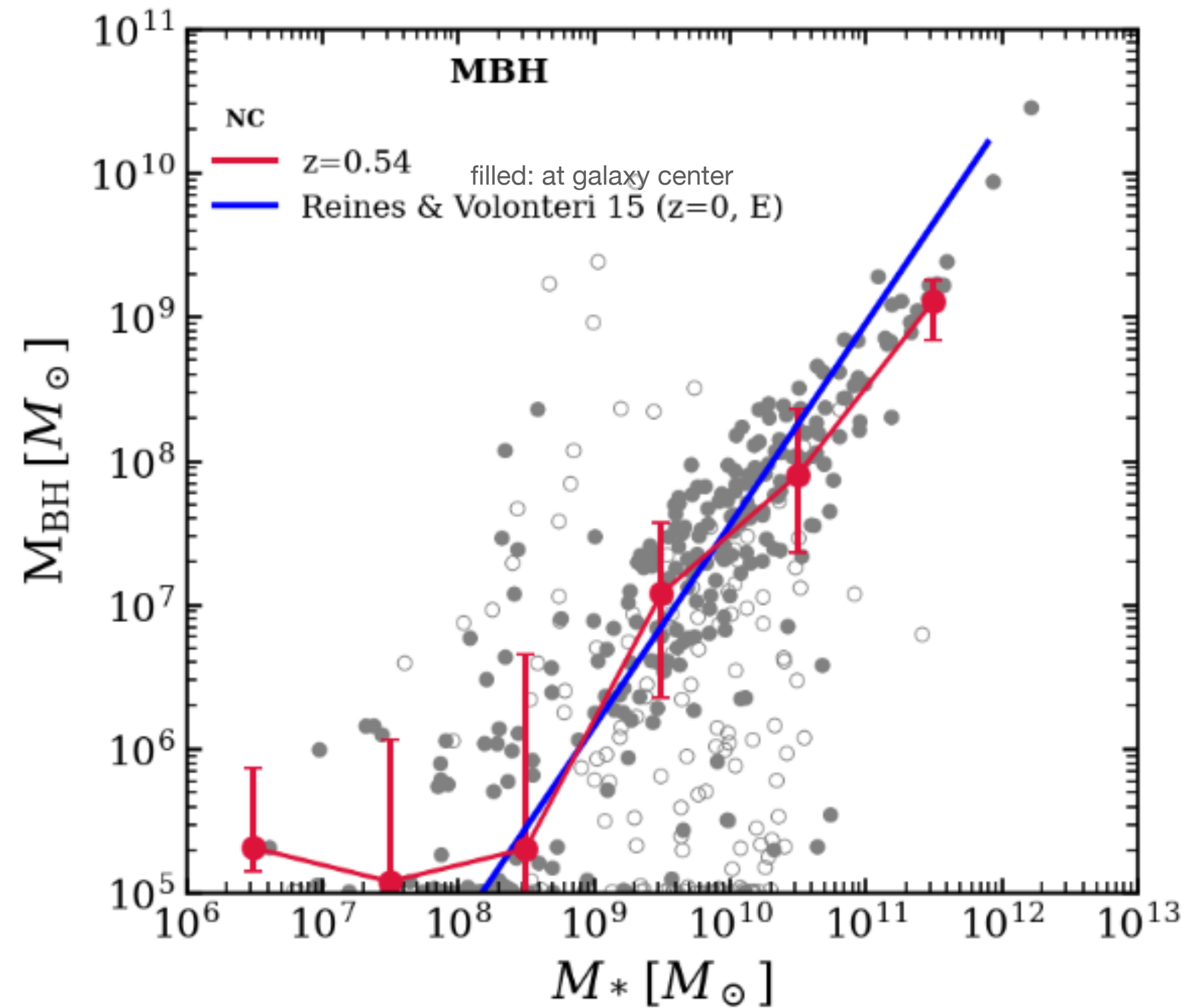
chemistry

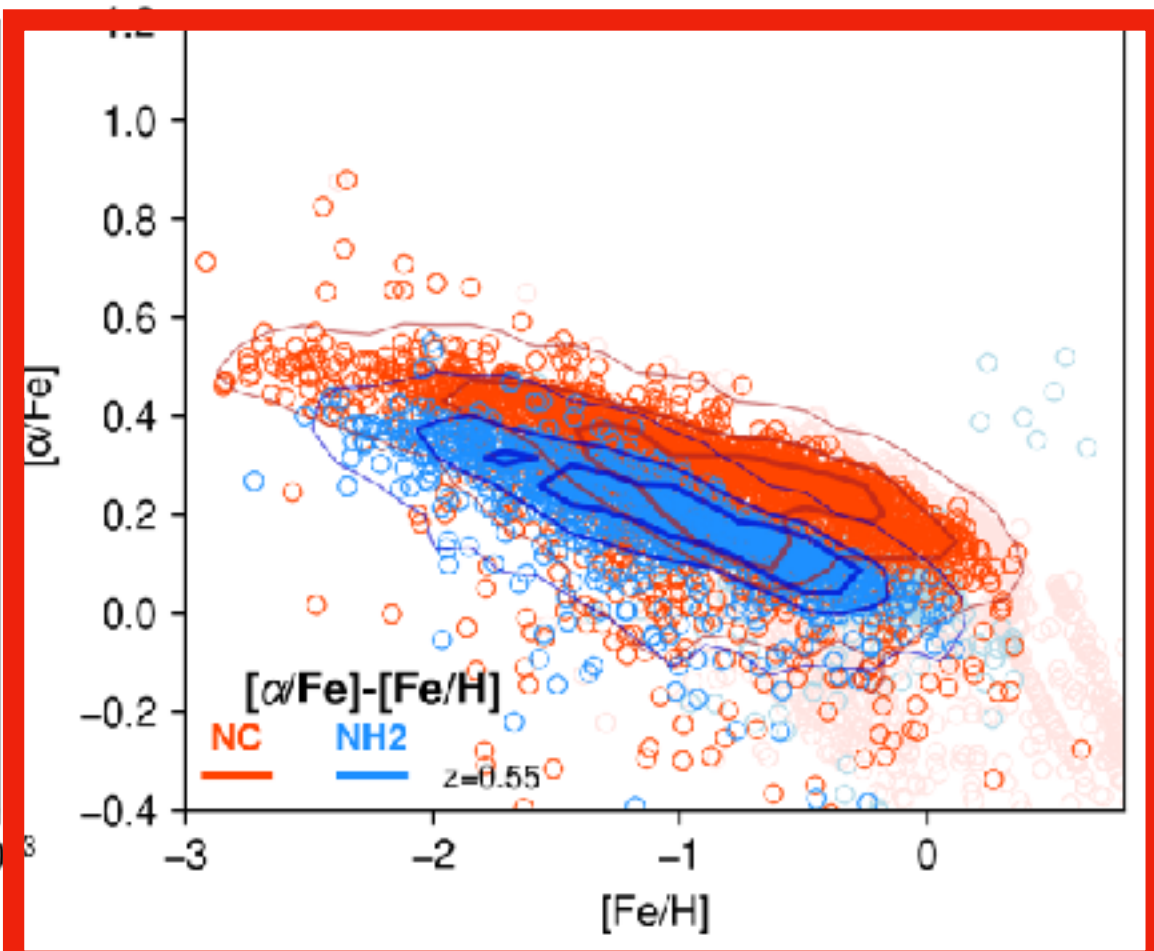
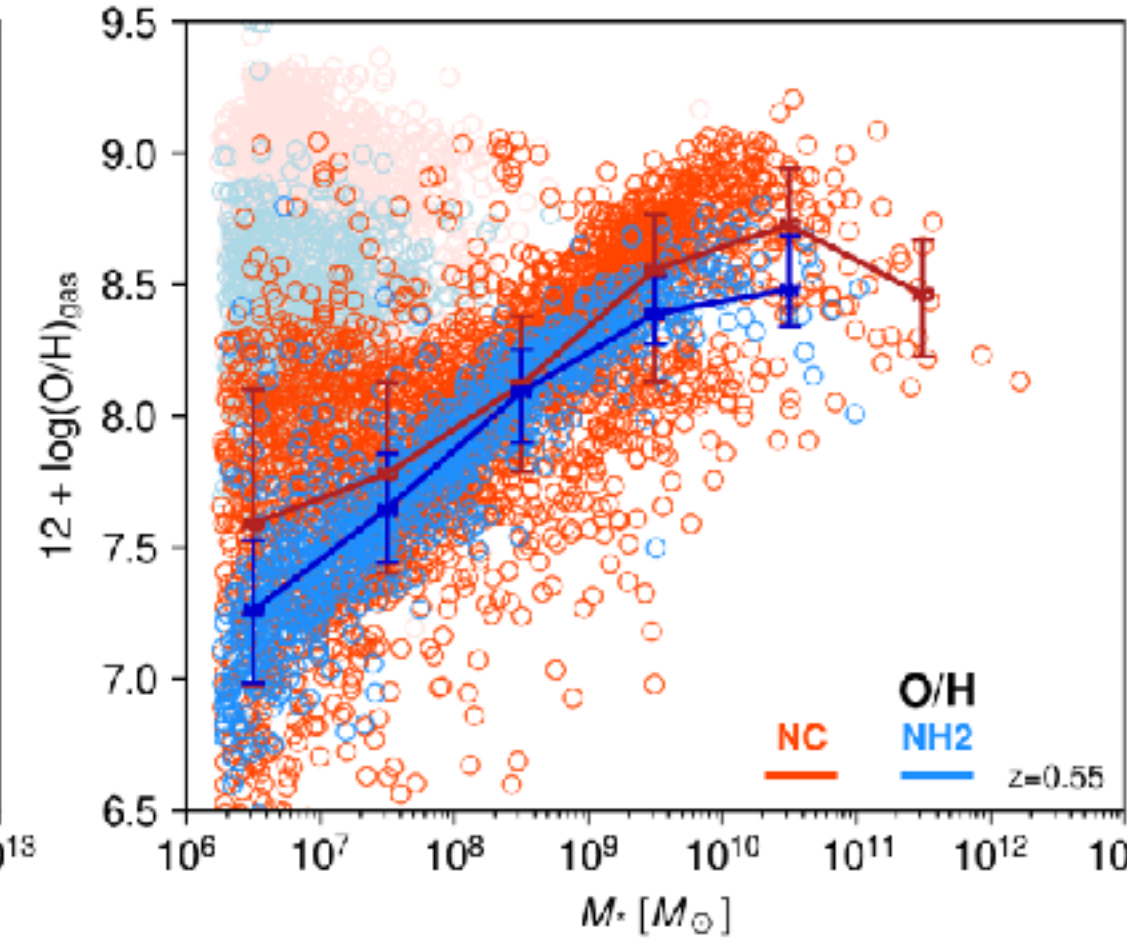
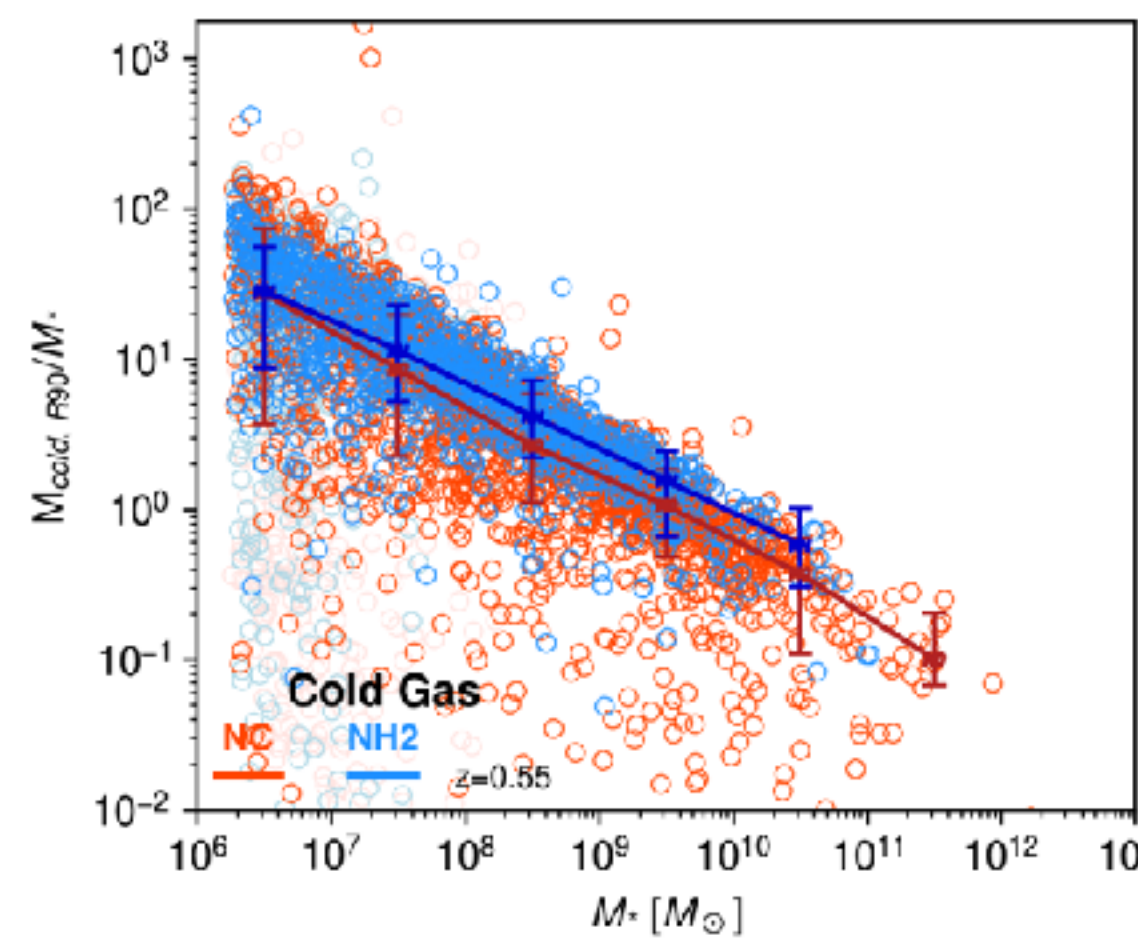
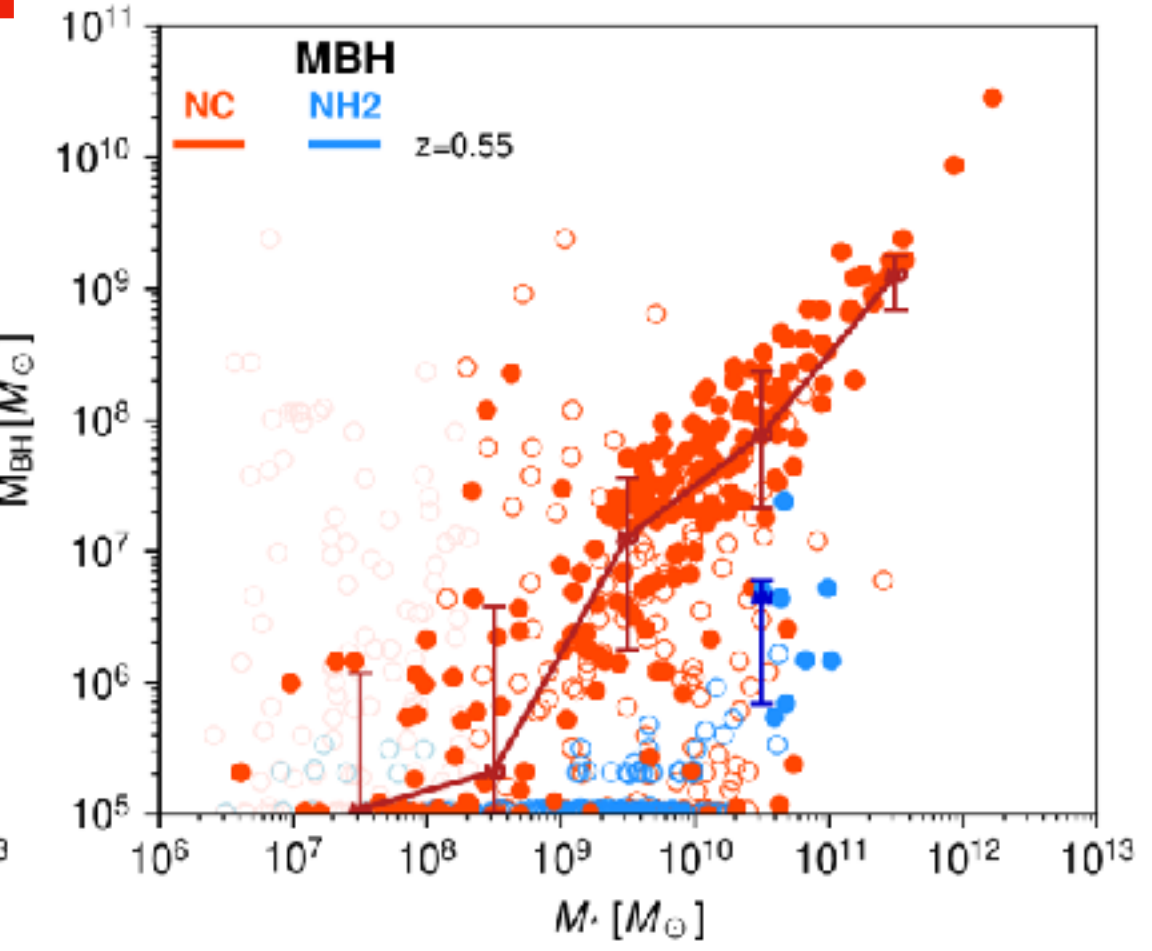
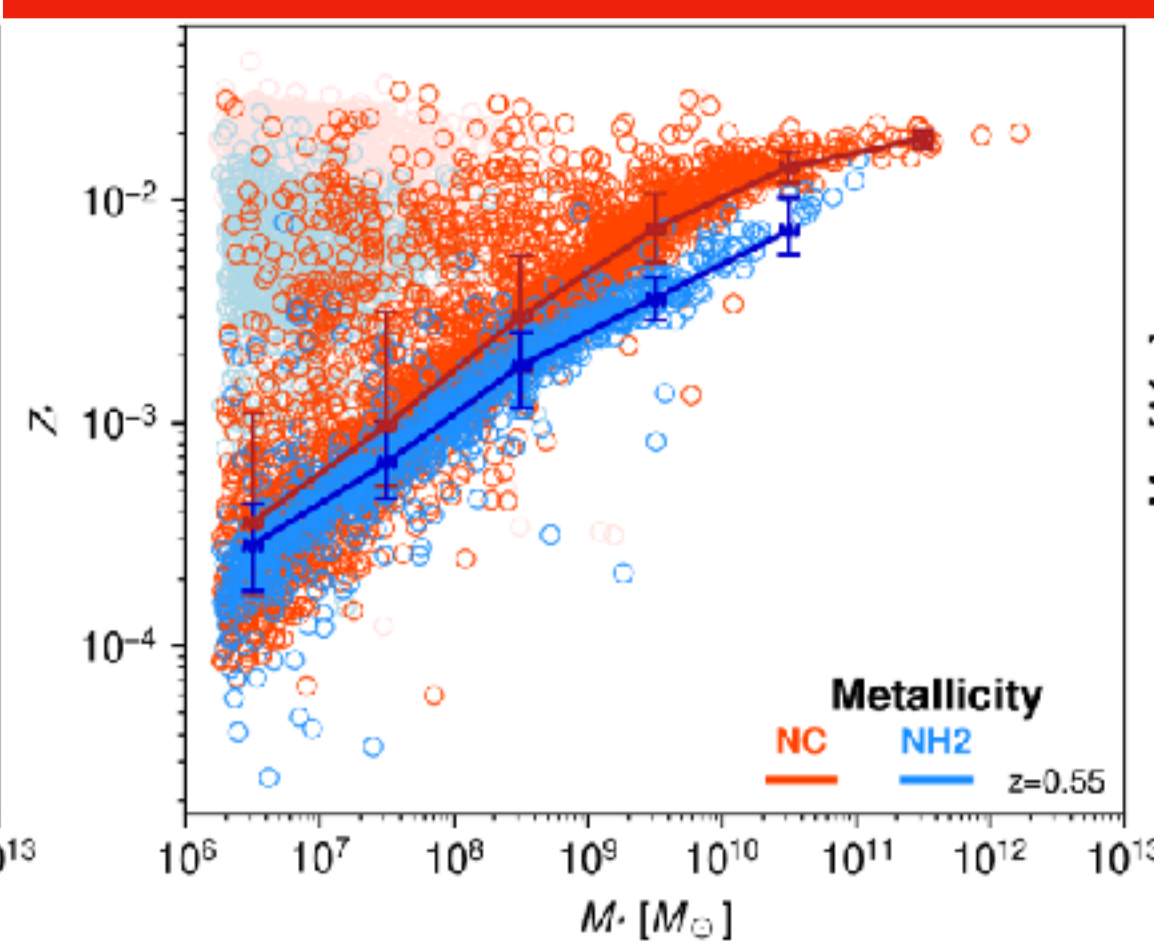
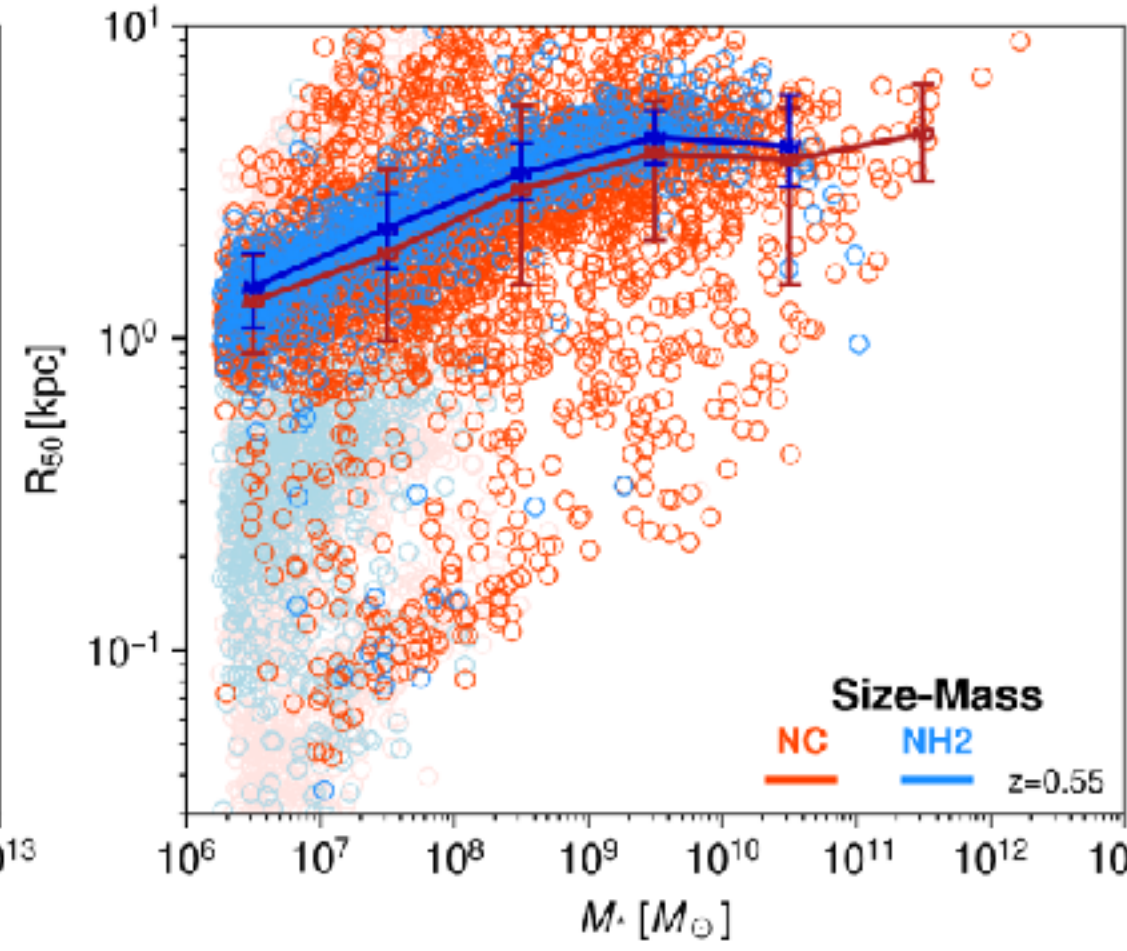
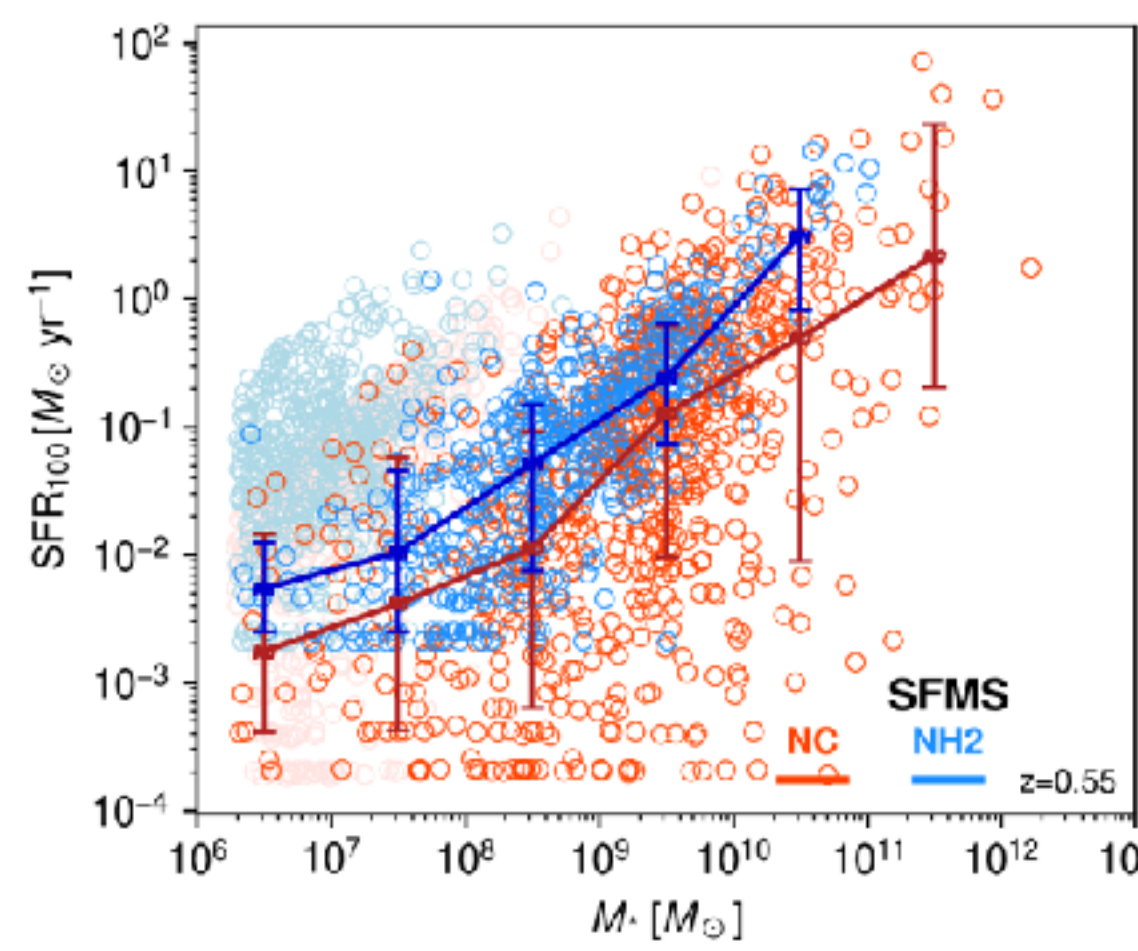
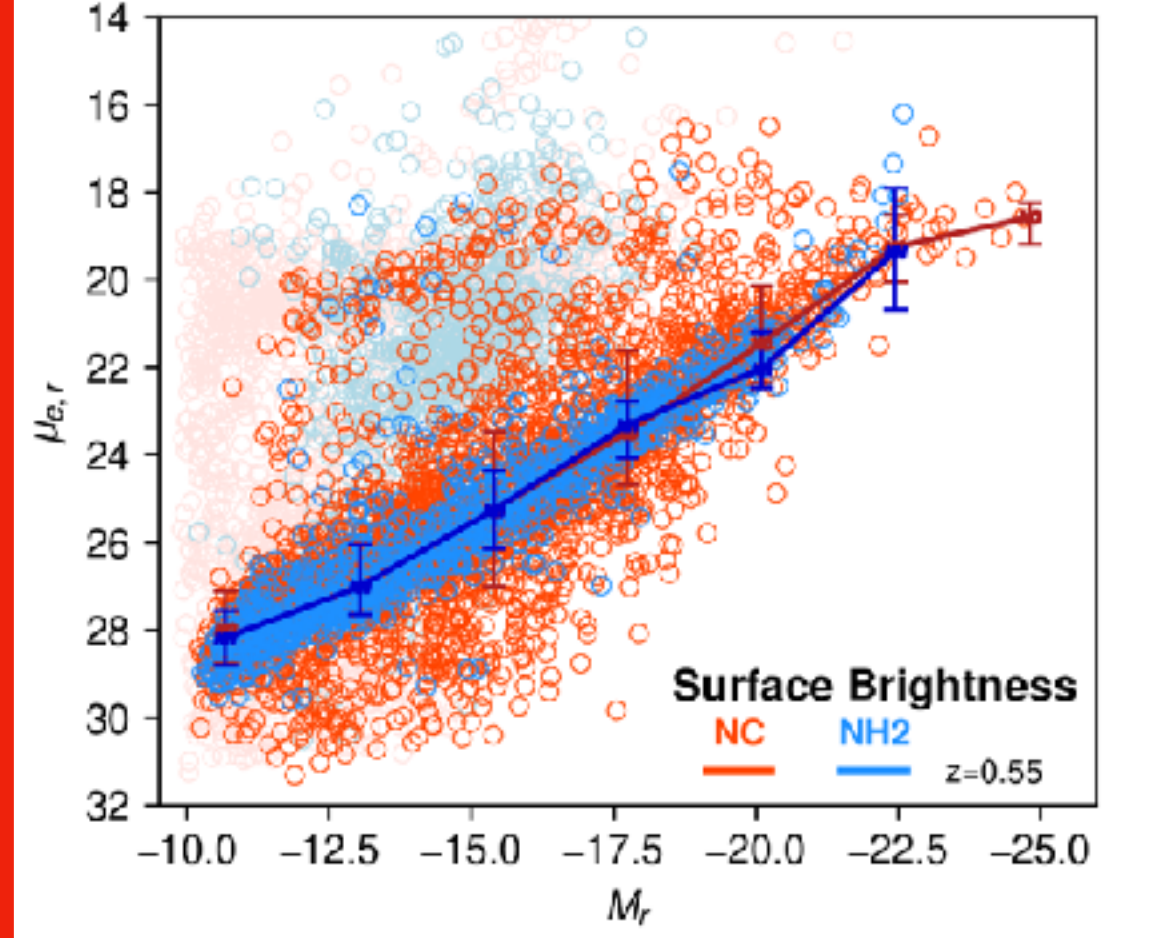
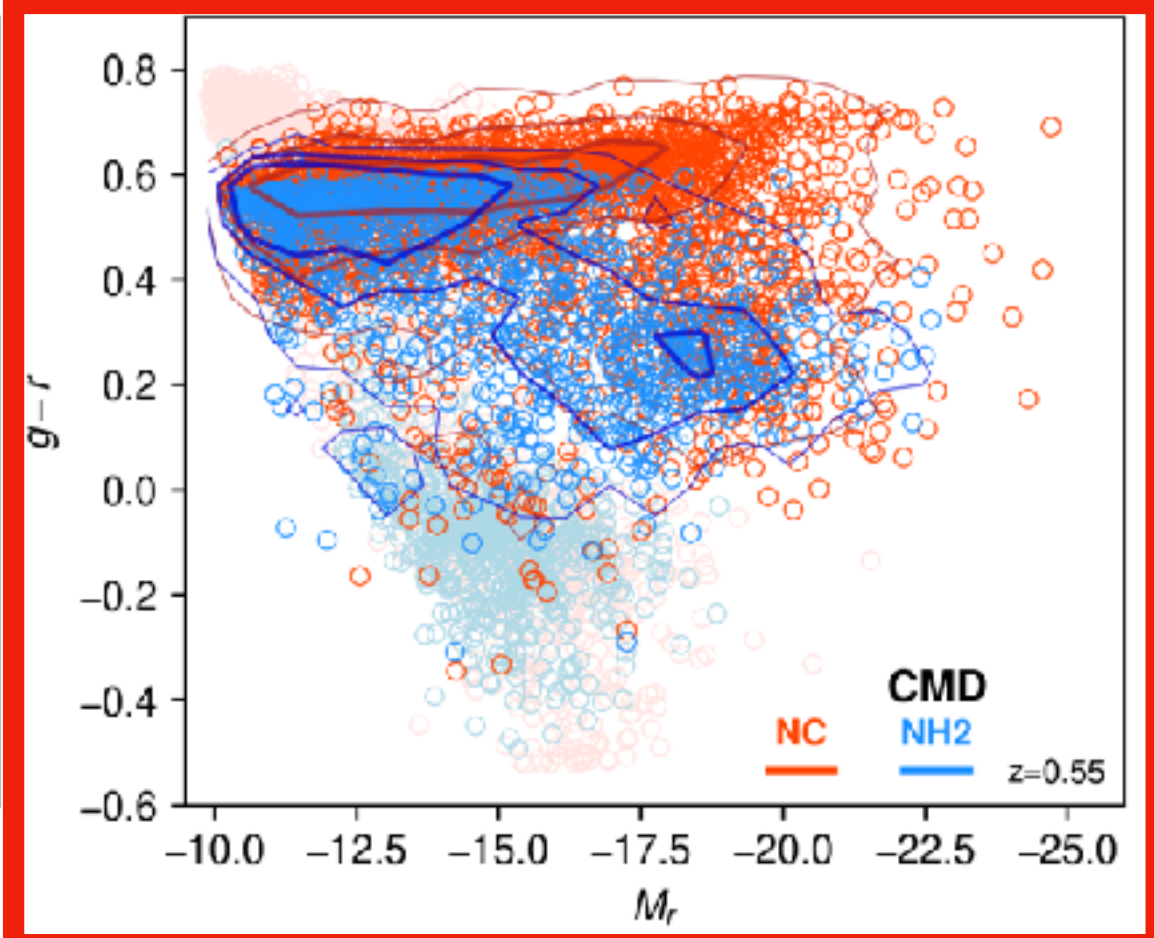
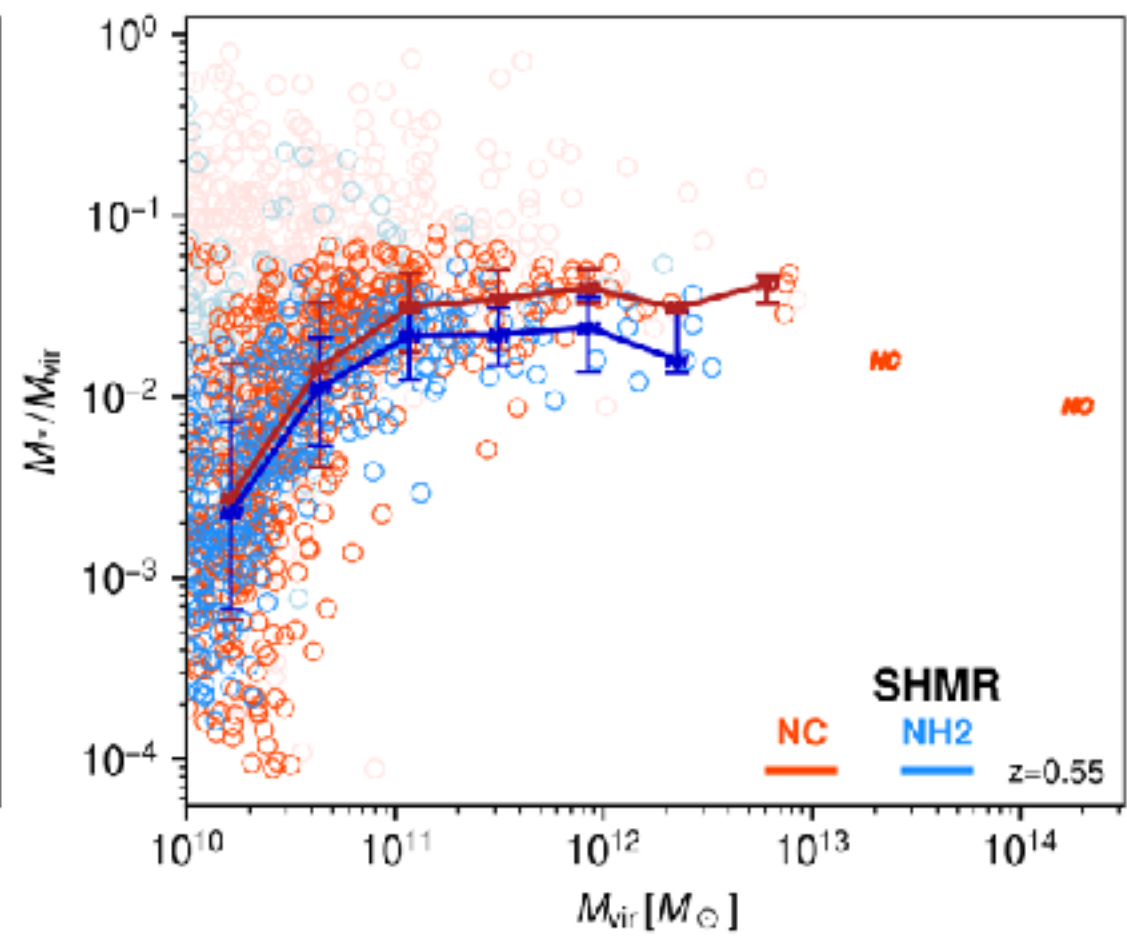
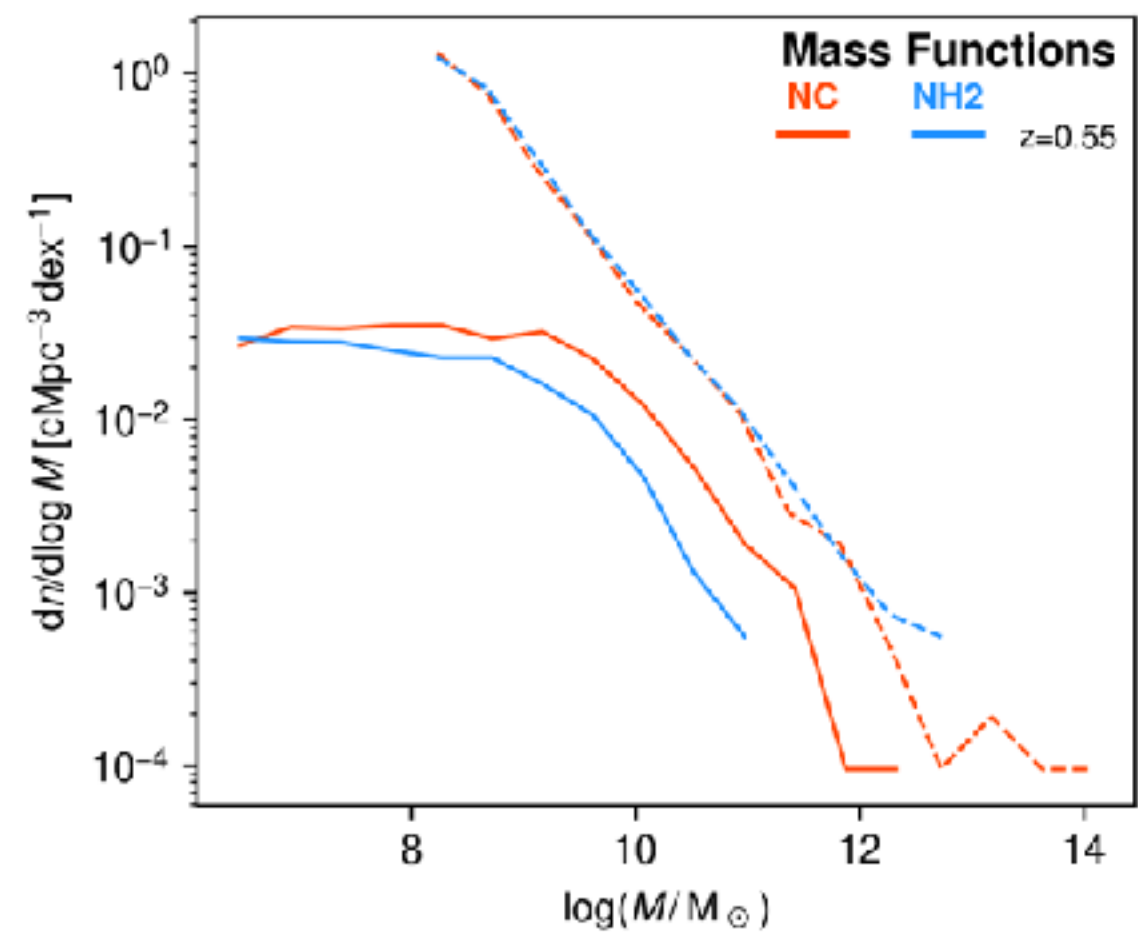
$[O/H]_{\text{gas}}$ turns over at high M .
 \Rightarrow Central SF? small galaxy accretion?



Galaxy properties @ $z=0.55$ (preliminary)

black holes (see San's talk?)

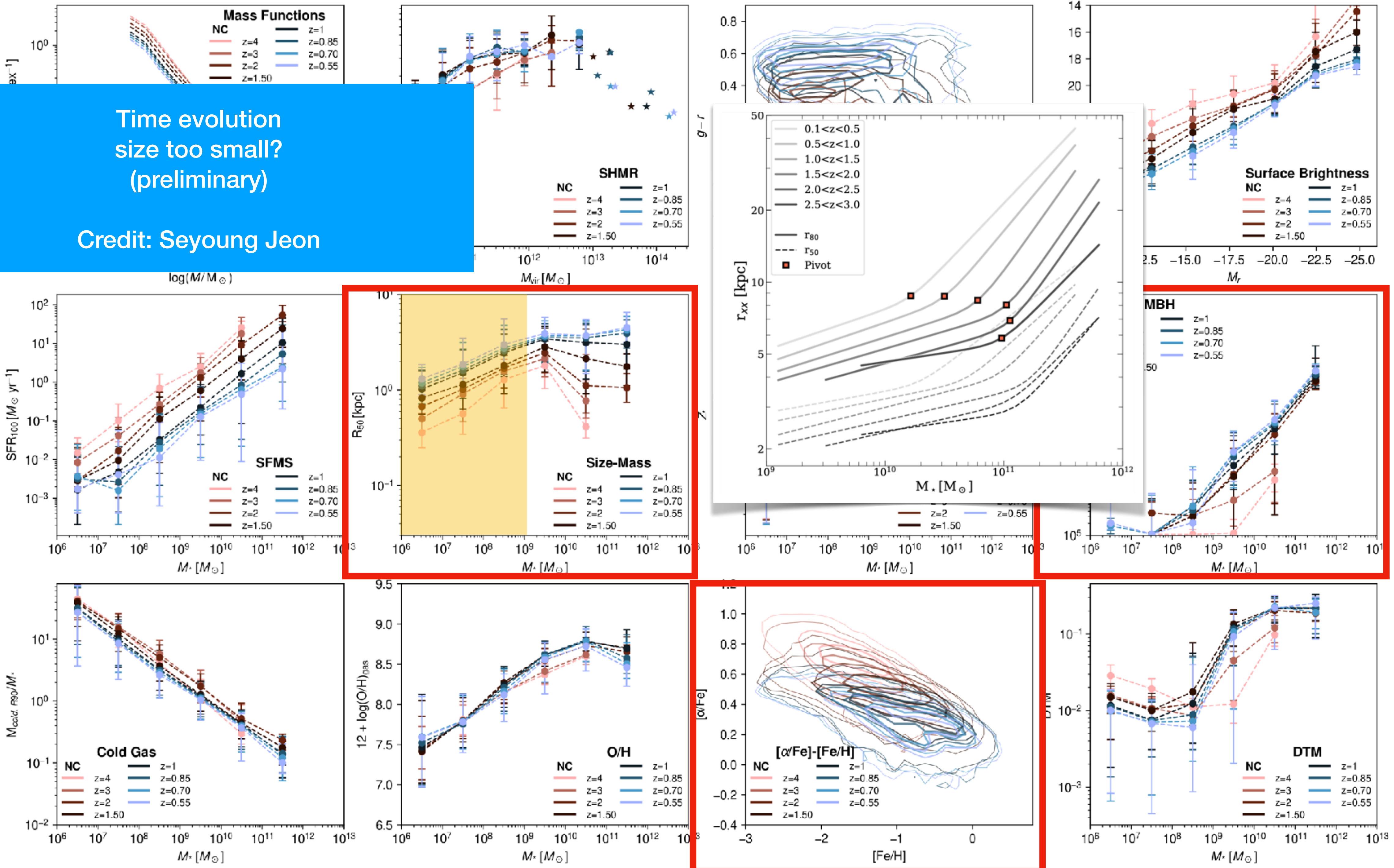


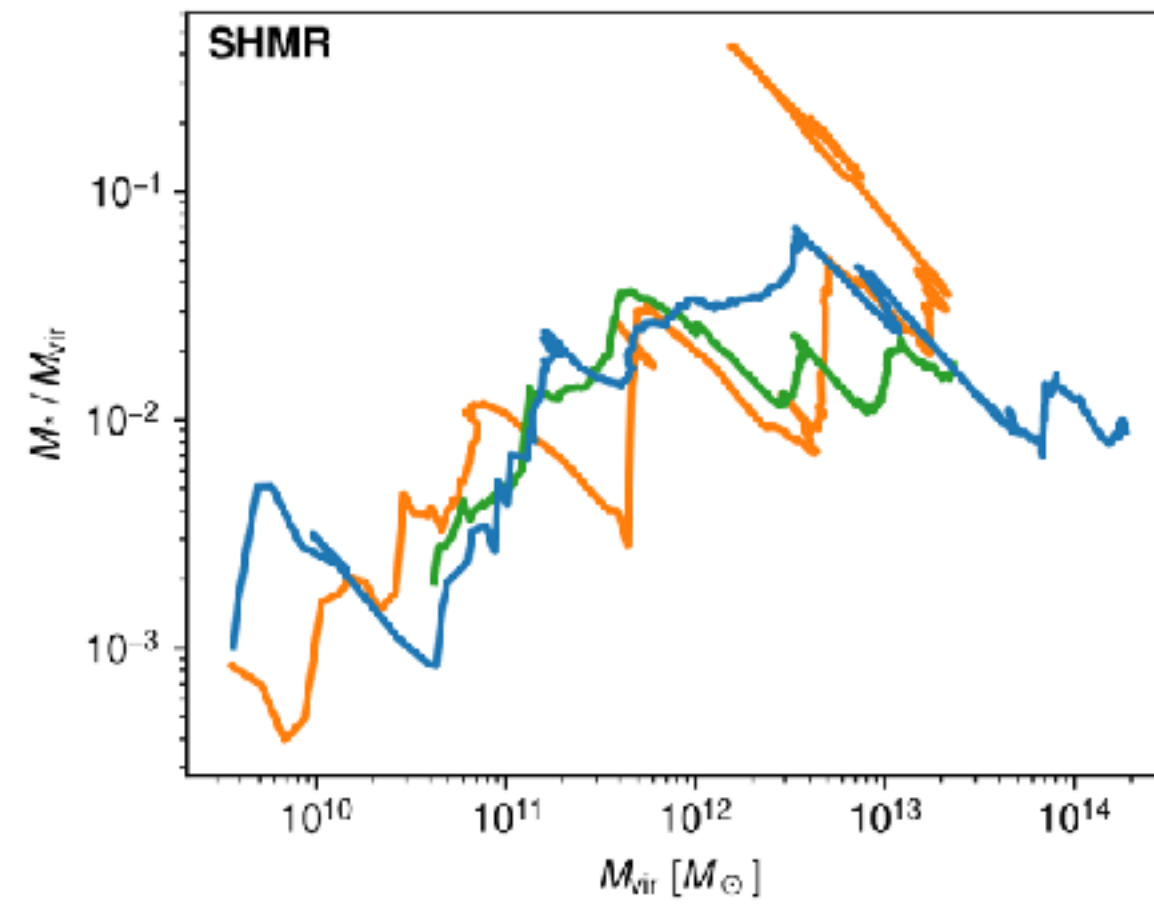
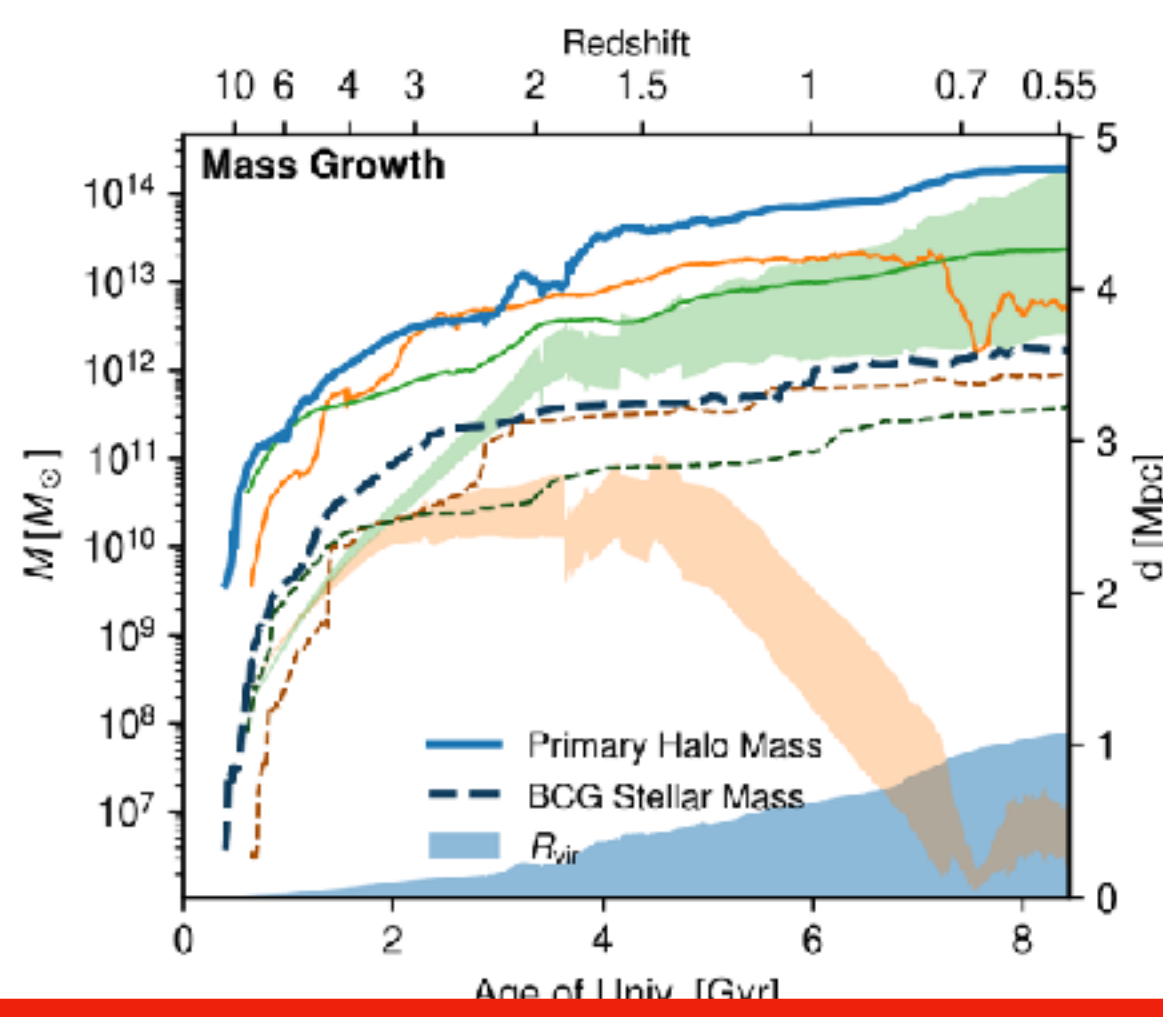


NC vs. NH2 @ $z=0.55$
 Differences make sense.
 (preliminary)
 Credit: Seyoung Jeon

Time evolution
size too small?
(preliminary)

Credit: Seyoung Jeon





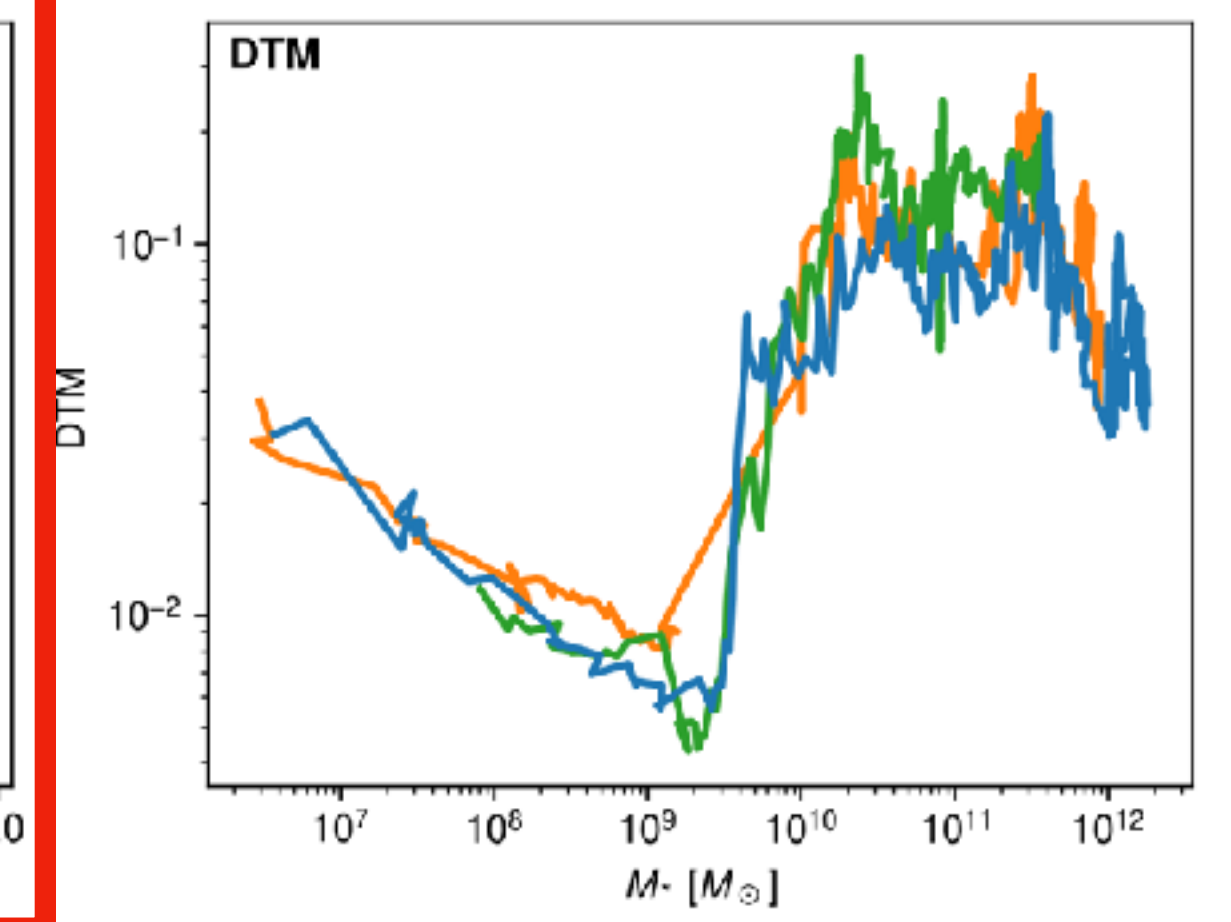
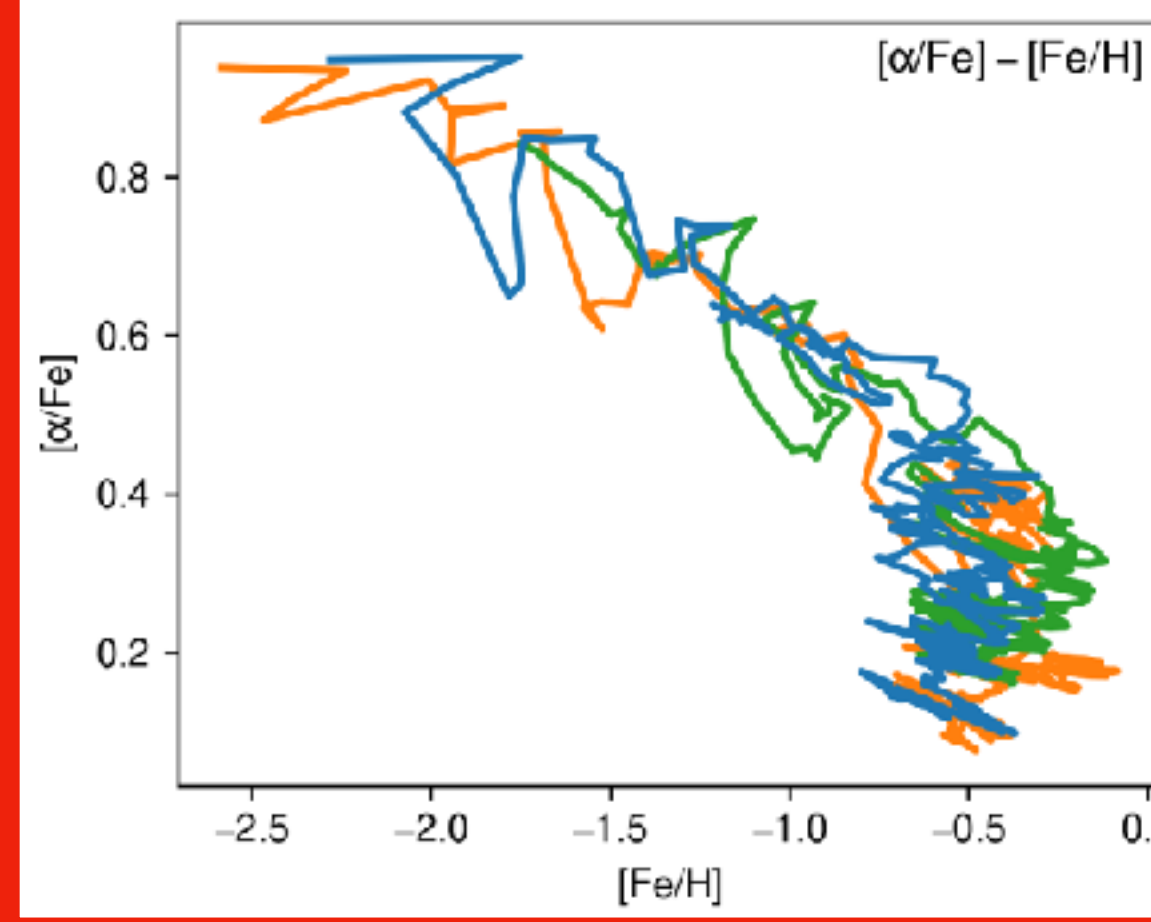
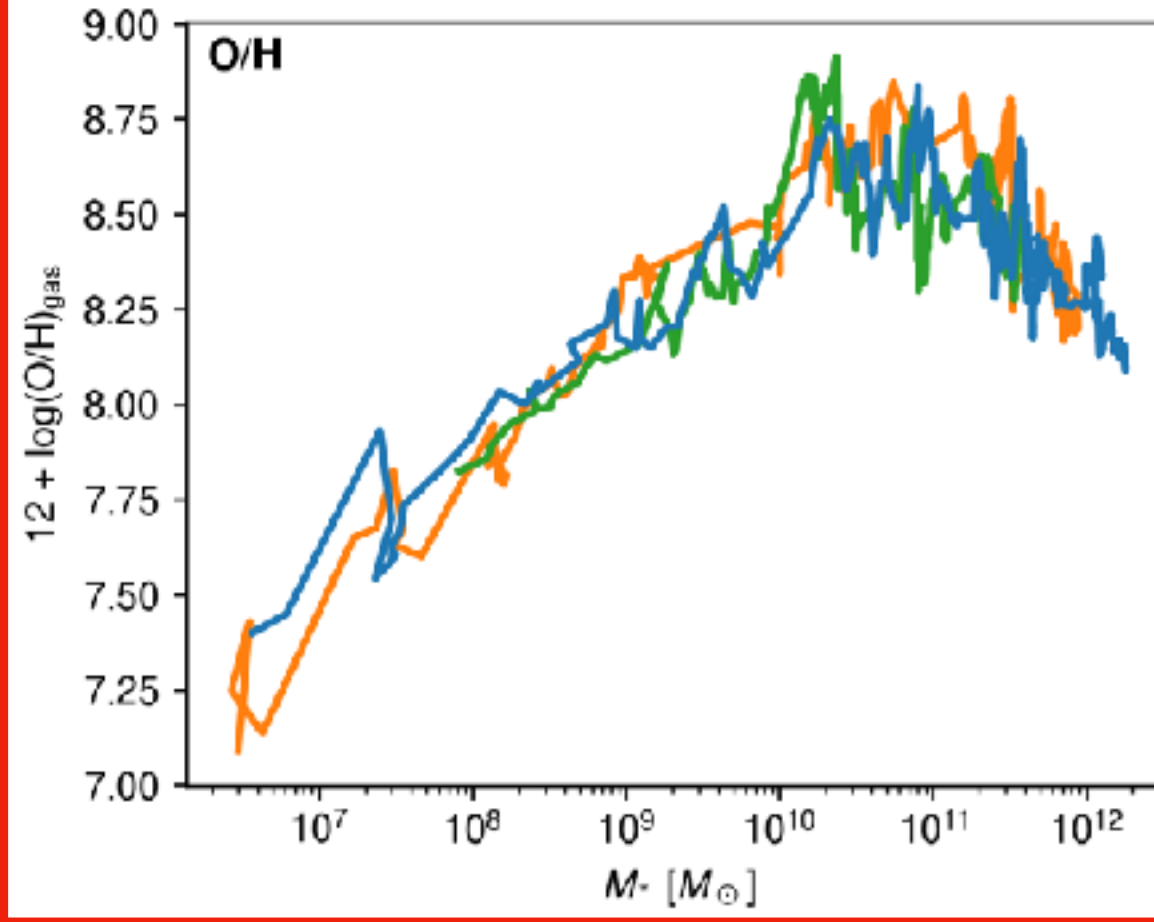
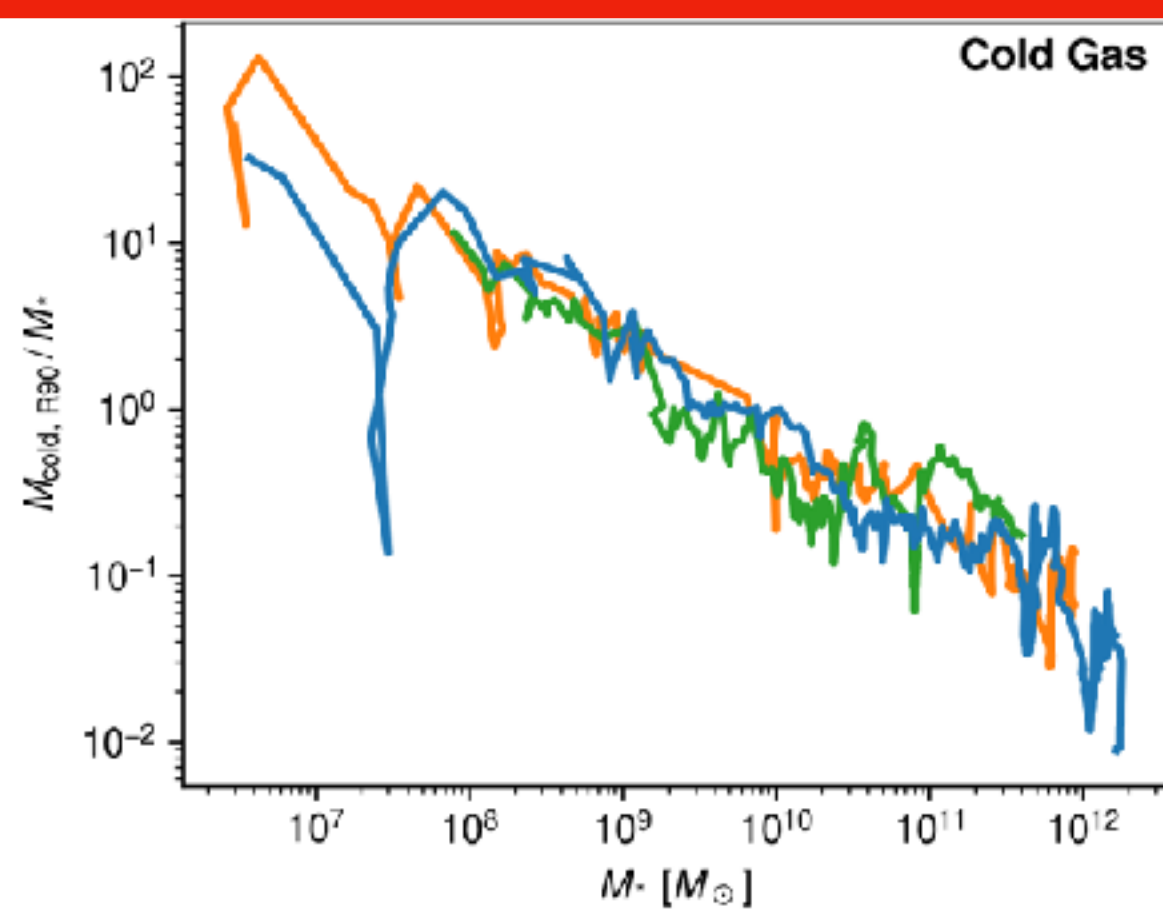
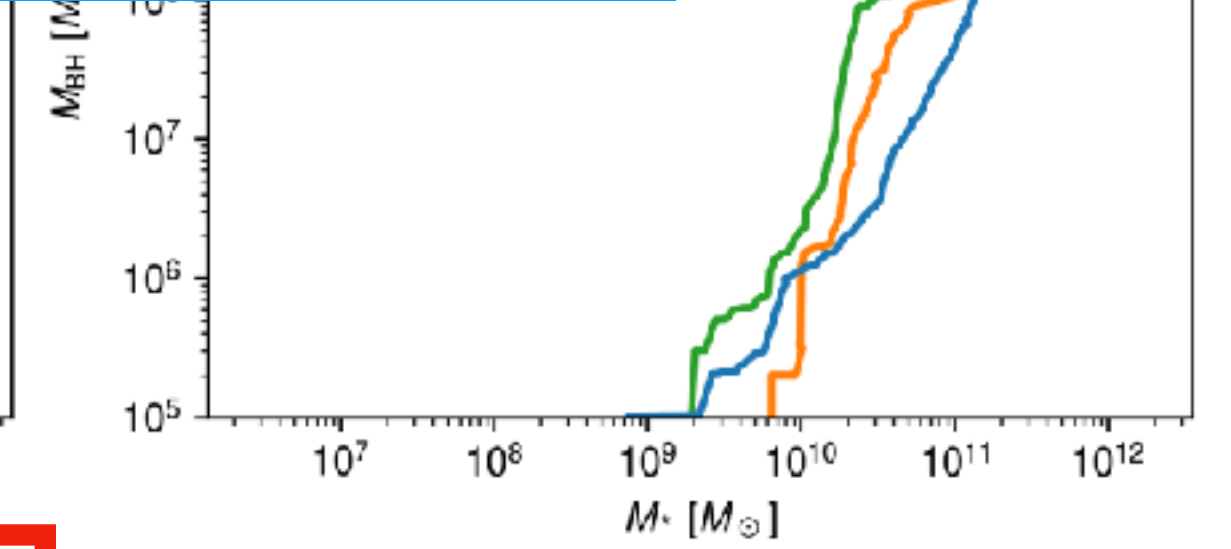
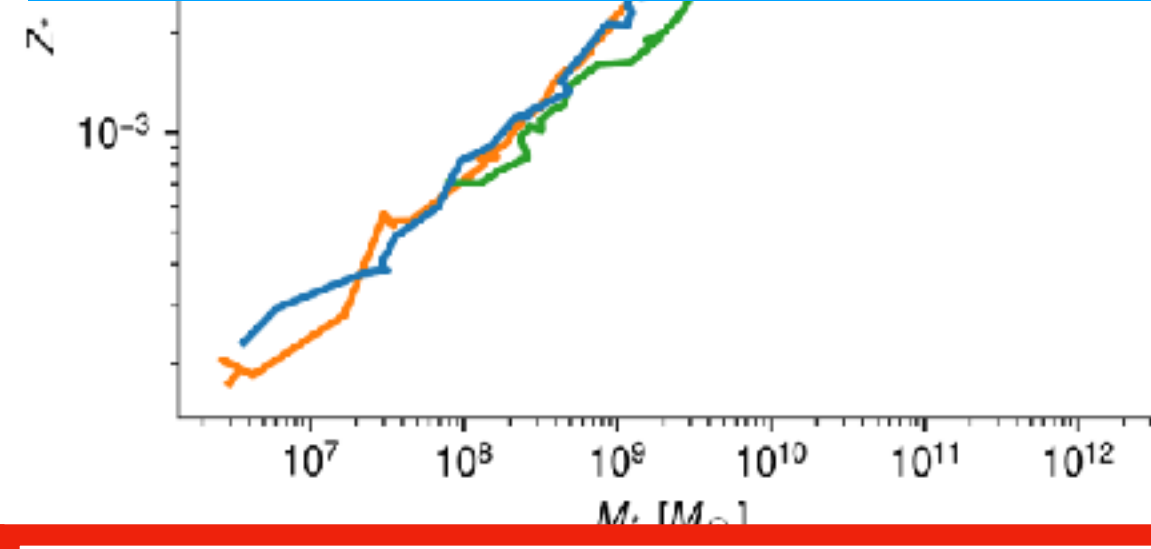
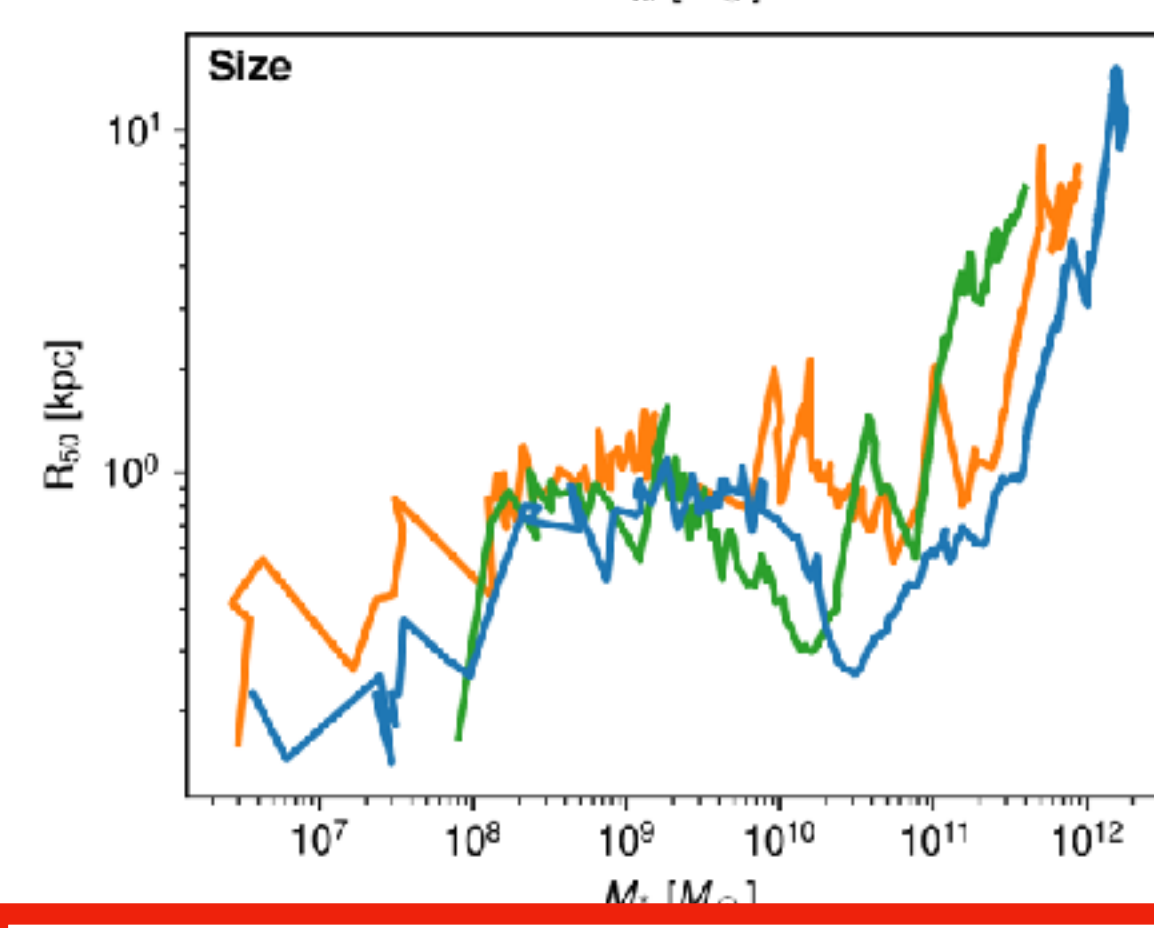
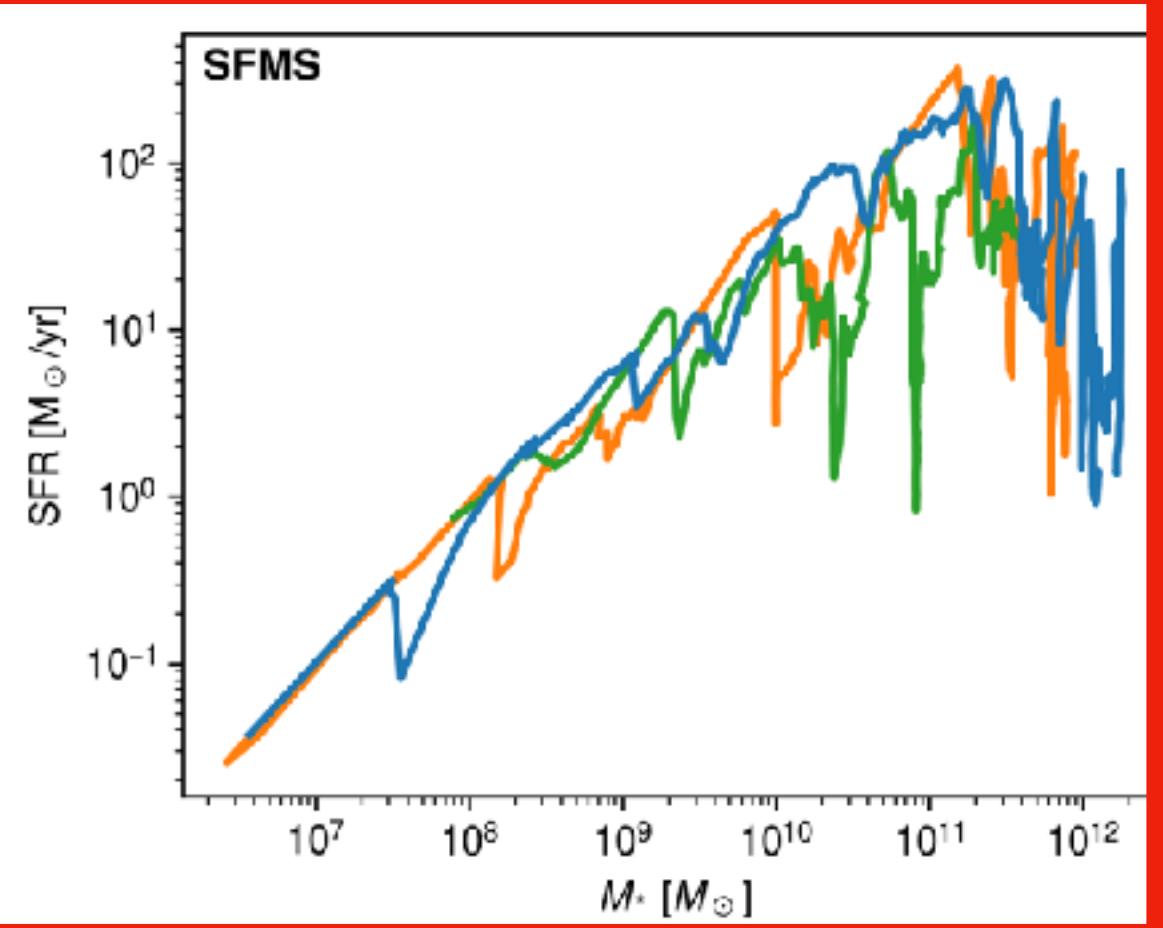
CMD **Surface Brightness**

3 central galaxies
 Since $z \sim 2$ ($t = 3 \text{ Gyr}$), $M_{*} = 10^{11}$,
 SFR decreases: mass quenching?

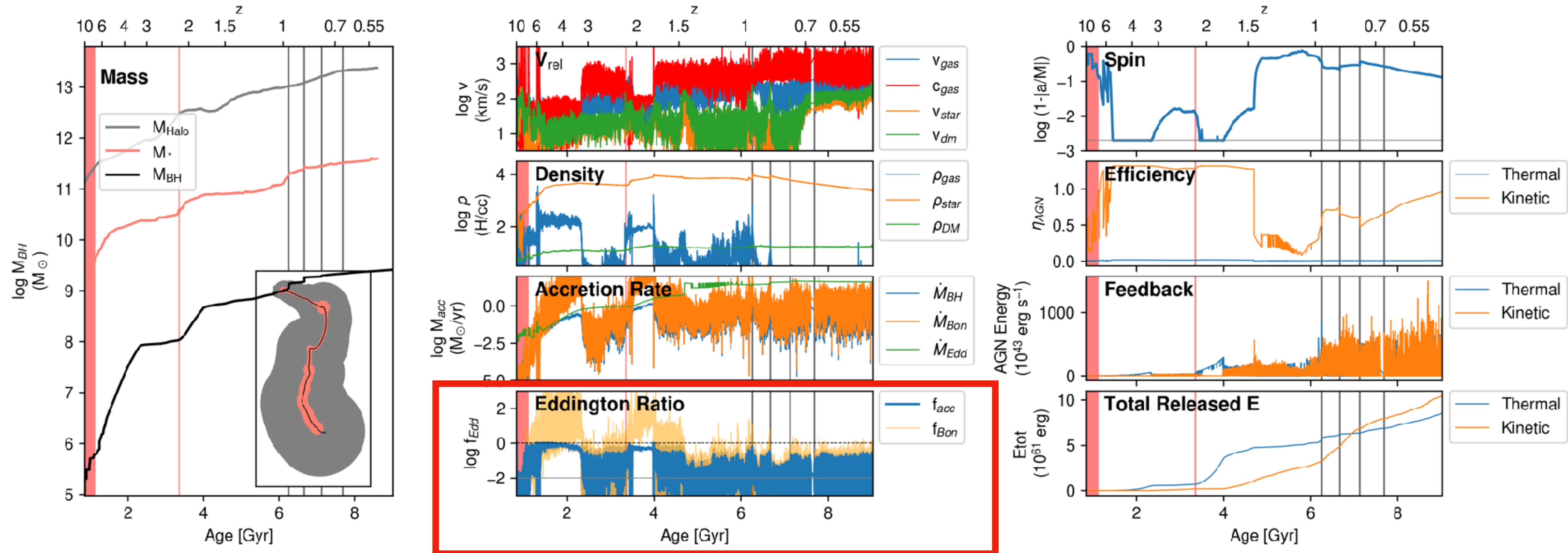
O/H and $[\alpha/\text{Fe}]$ decrease.
 Why? accretion of small galaxies?

(preliminary)

Credit: Seyoung Jeon



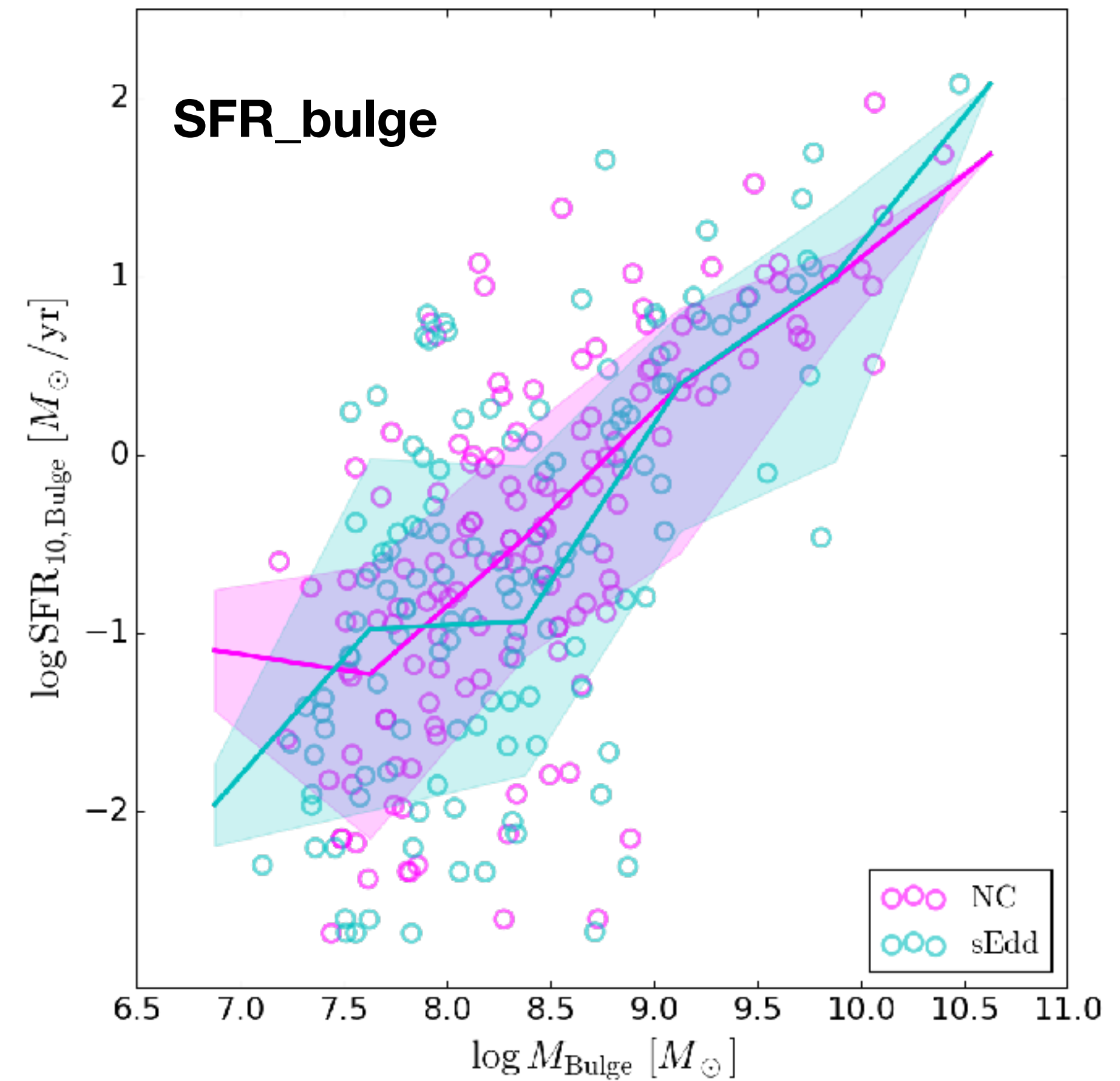
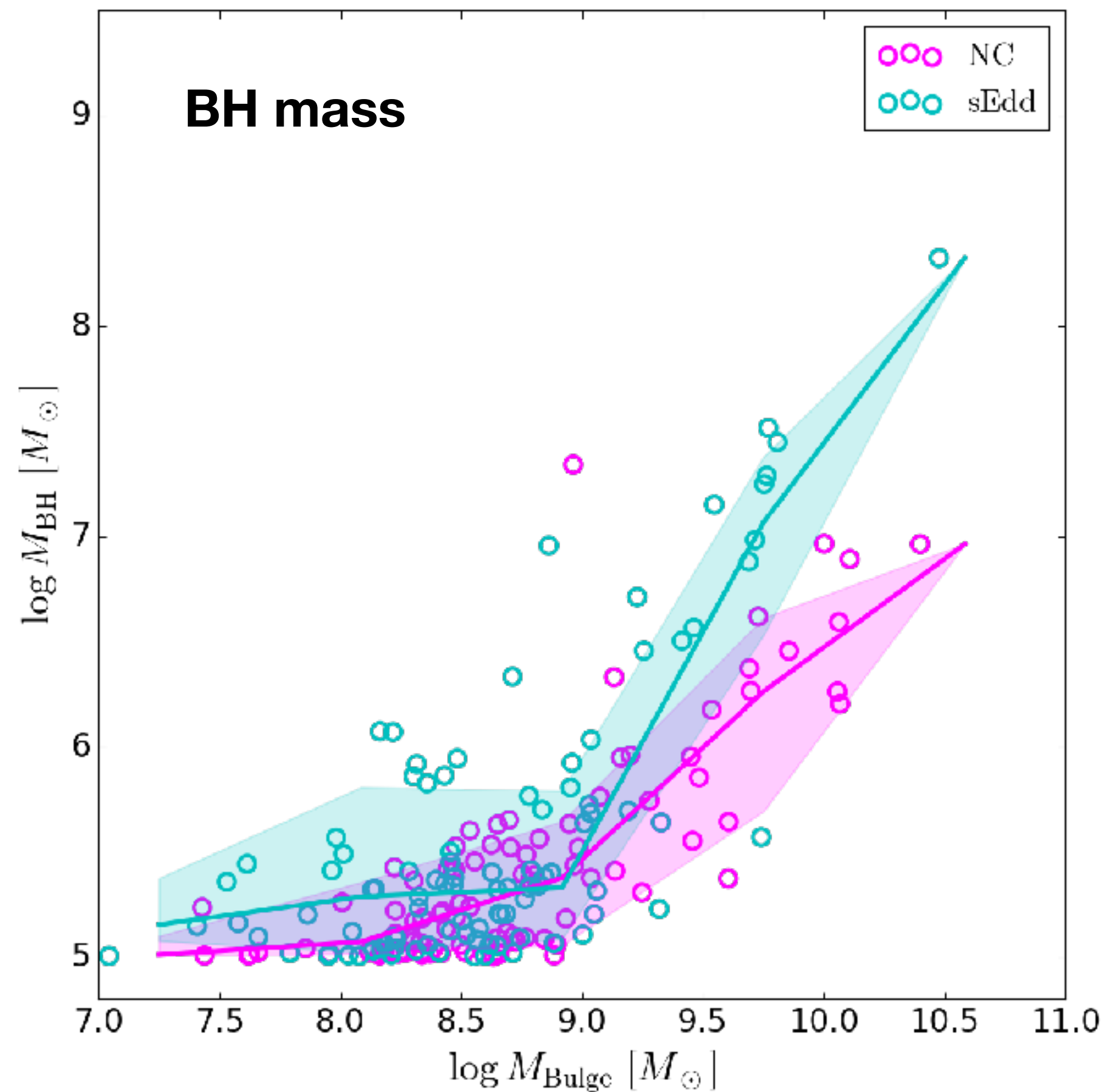
Black hole accretion



Bondi accretion rate often exceeds the Eddington limit.

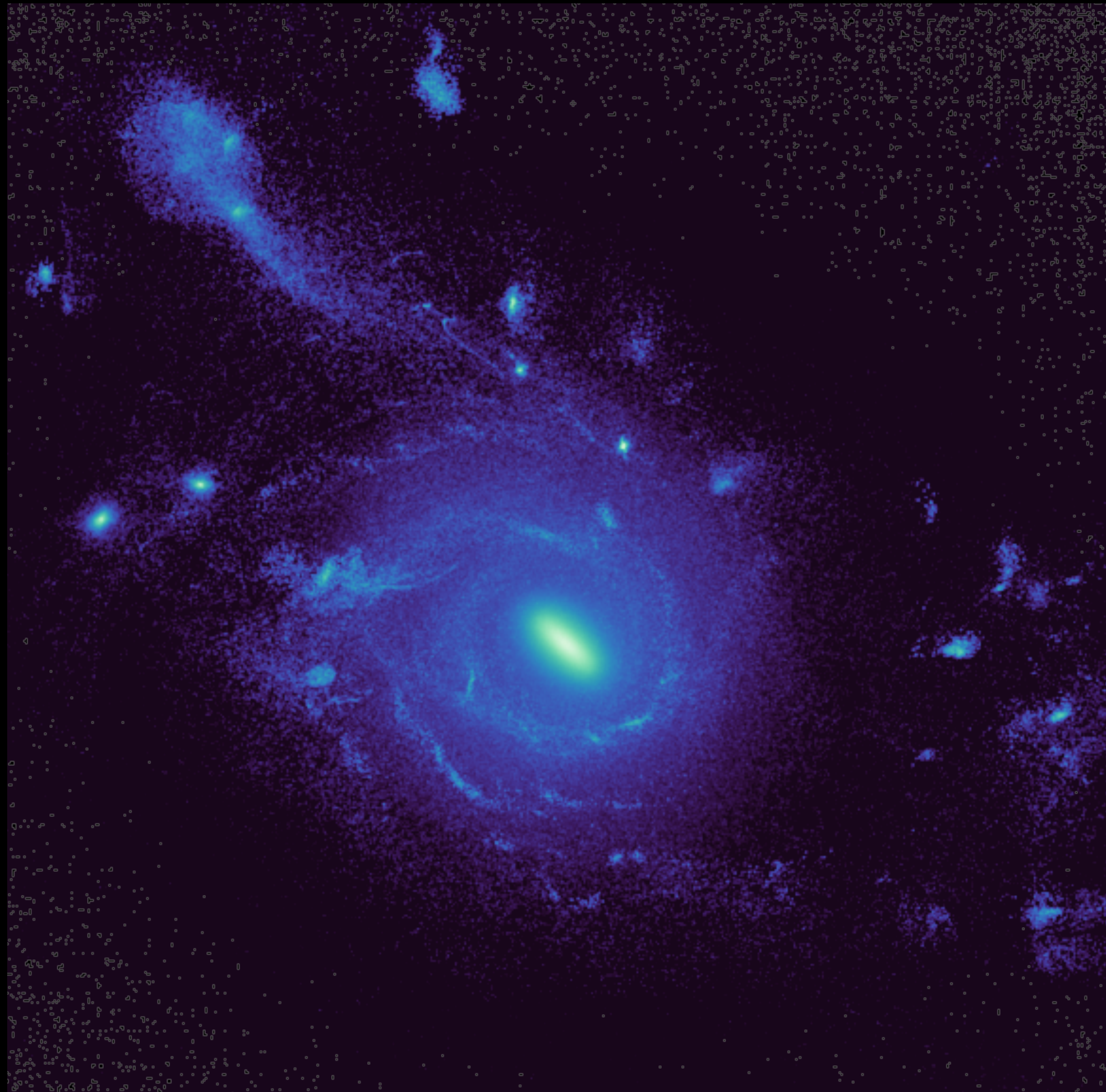
NewCluster **super-Eddington (spin-off simulation until z=4)**

Snapshot 110 --- [z ~ 4] Bulge: * < 0.5 kpc

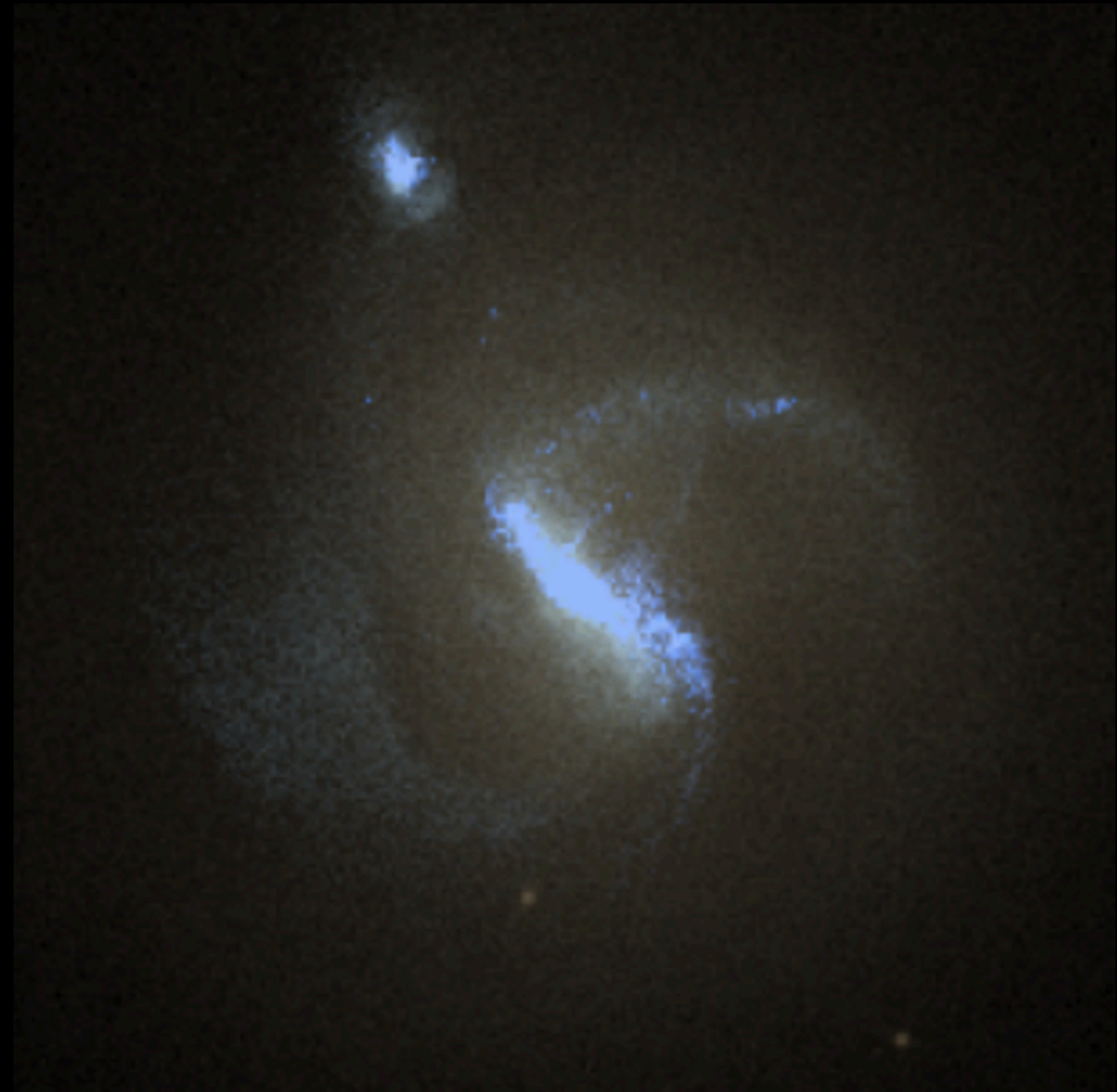


Bars (5 out of 111 at $z=0.6$)

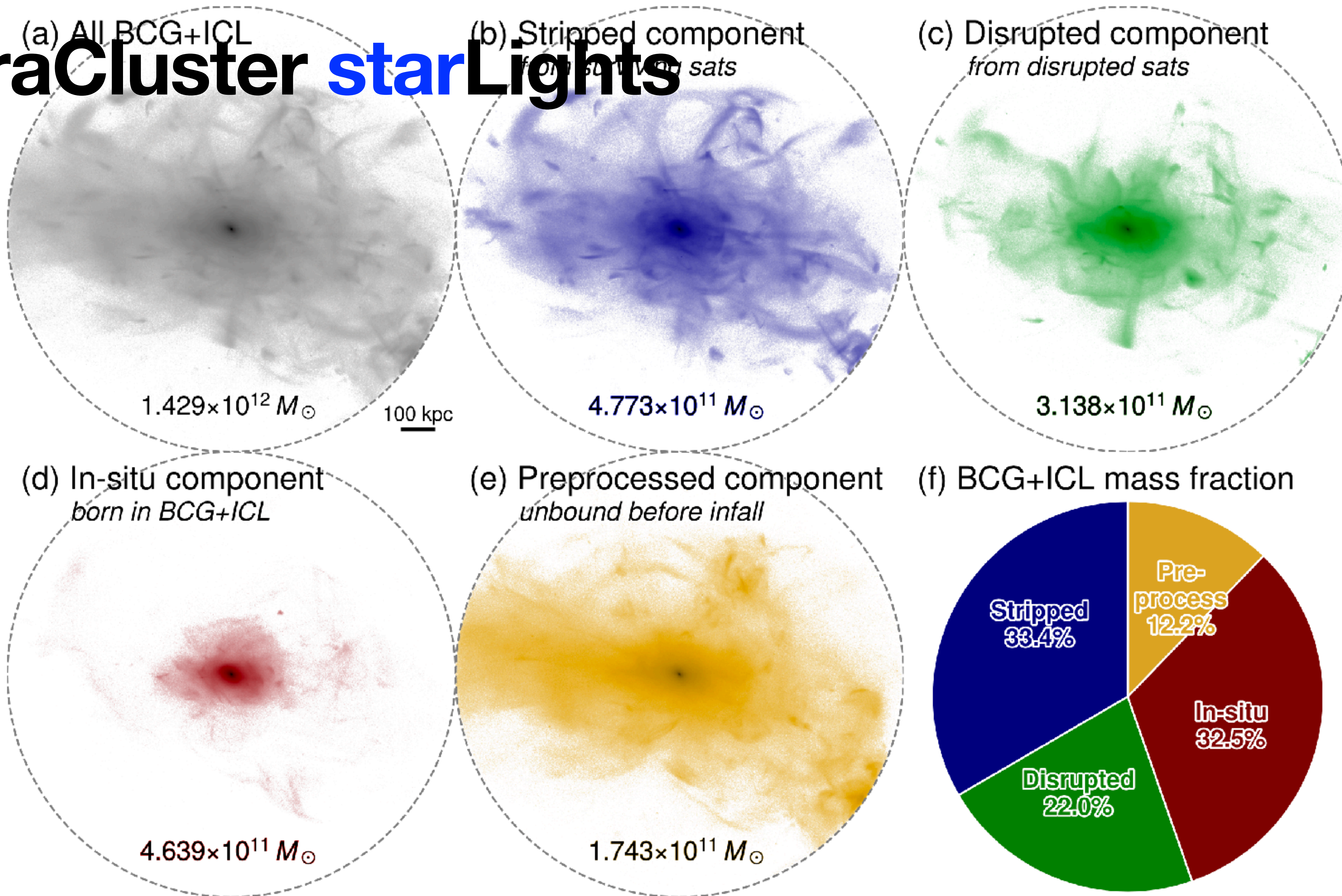
ID 3 at $z=1.17$



ID 189 at $z=0.6$



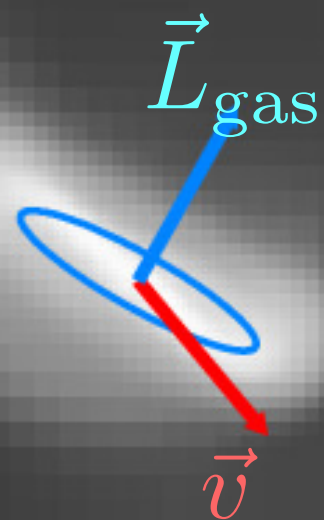
IntraCluster **star**Lights



ICM builds up from stripped **gas**

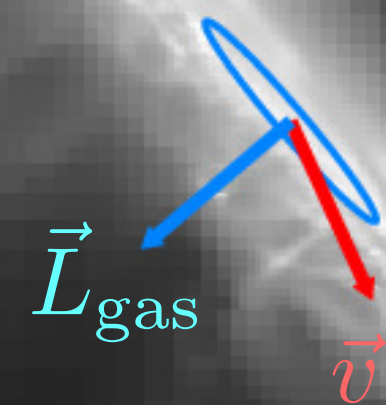
NC at $z=1$

$$M_* = 5.0 \times 10^{10} M_{\text{sun}}$$
$$r/R_{\text{vir}} = 0.14$$
$$P_{\text{ram}}/k_B = 6.9 \times 10^5 \text{ cm}^{-3} \text{ K}$$



Ram pressure

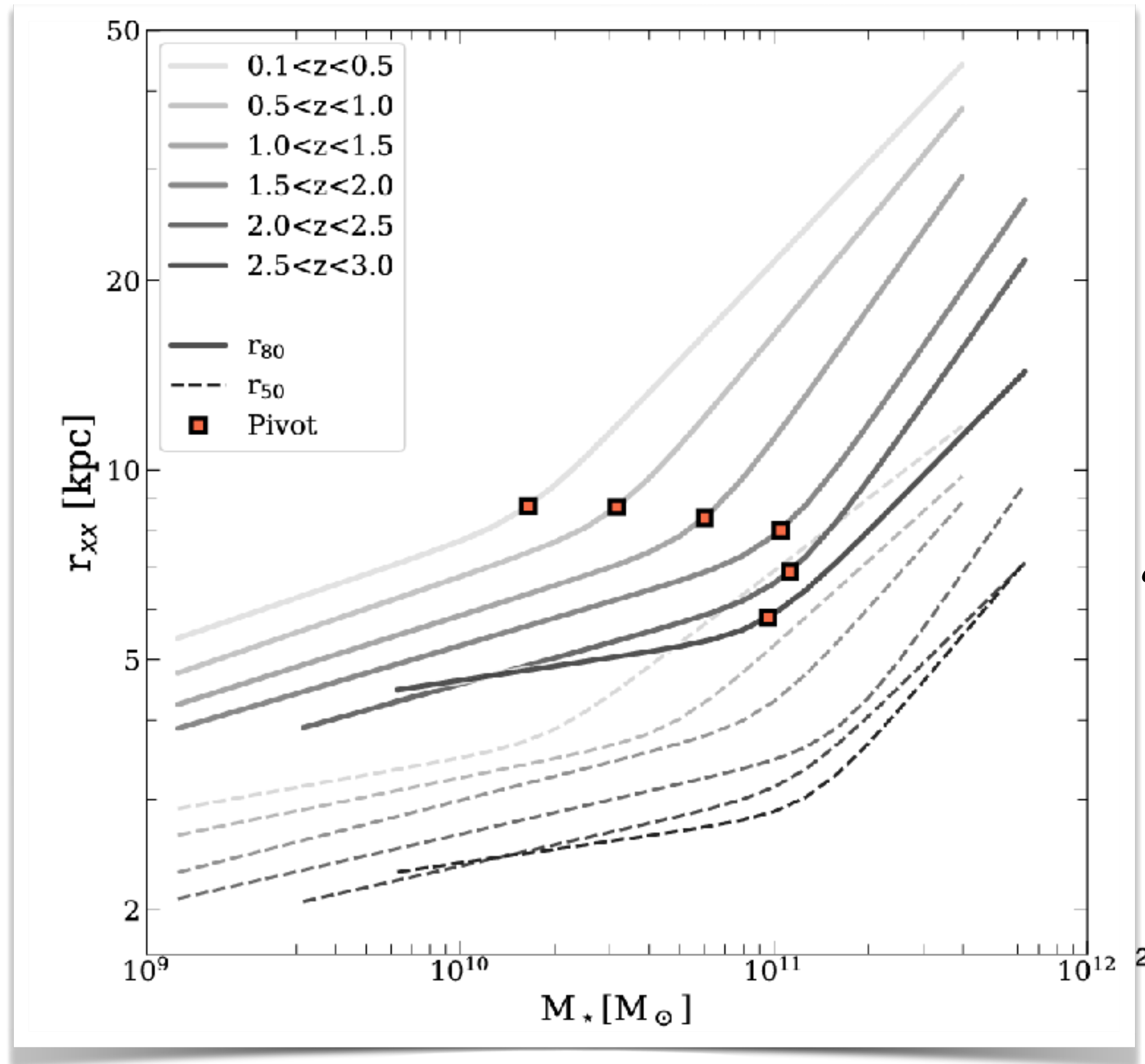
$$M_* = 9.4 \times 10^{10} M_{\text{sun}}$$
$$r/R_{\text{vir}} = 2.18$$
$$P_{\text{ram}}/k_B = 1.3 \times 10^4 \text{ cm}^{-3} \text{ K}$$



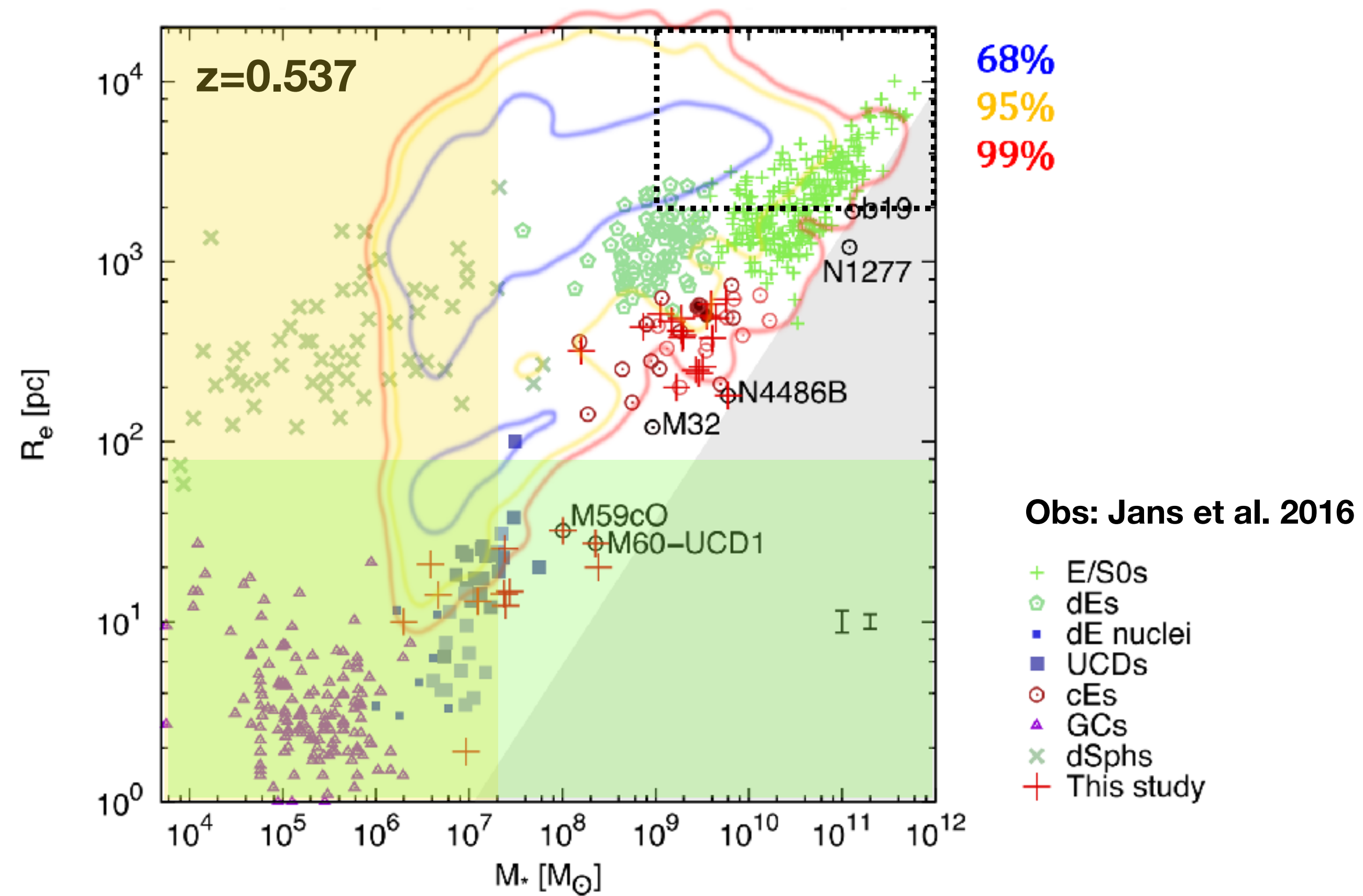
Stellar feedback outflow

Dwarf galaxies

cEs, UDGs?



$\delta x = 70 \text{ pc}$



#	Paper #	Topic	Lead Author	key co-authors	Submitted	status (update often)
	1	Dusty morphology	Byun	JK, Eunmo, Zack	5/1/2025	published in Oct 2025
	2	Intro	Han		7/1/2025	published in Jan 2026
	3	ICL	Jeon	Ema	10/1/2025	published in Feb 2026
	4	SFR tracers	Ismail, Diana		1/1/2026	review response in Mar 2026
	5	Dust	Jang			draft circulated in Apr 2026
	6	Baryon fraction	Seo			draft circulated in Apr 2026
	7	Dusty morphology	Yu			draft in progress
	8	ICM metallicity	Jaehyun Lee			draft aiming for Fall 2026
	9	gas inflow from cosmic web	Song (Hyunmi)	Corentin		actively refining and discussing the project's specific dir
	10	super-Eddington accret				<h1 style="text-align: center; color: white;">ETA (z=0.2)~12/2026</h1> <h2 style="text-align: center; color: white;">Data at Yonsei & IAP(?)</h2>
	11	Positive AGN feedback				
	12	Pre-processing				
	13	off-centre black holes				
	14	S0 galaxy formation				
	15	Cluster merger: Gas evolution	Byun			
	16	UDGs, or some dwarf galaxies	Jeon			draft aiming for Fall 2026?
	17	Jellyfish galaxies	?			
	18	Morphology transformation	JK			
	19	Galactic fountain effect	Yuri			undergrad student project starts in 2026
	20	bars (a la Reddish et al.)				
	21	Baryon rich/poor halos formation	Seo			