Structure of Massive Galaxies : Observation v.s Simulation

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and the HSC Collaboration

17/05/10 KITP

- 8.2 m Subaru Telescope
- 104 CCDs — 1.7 deg^2
- 5-band (grizy)
- Average i-band seeing 0.6”
- 1400 deg^2 eventually
- i-band 5-sigma limit: ~26.4 mag
- i-band surface brightness limit: ~28.5 mag/$arcsec^2$

What We Can Learn?

- What is the total stellar mass of a galaxy?

See my talk next week

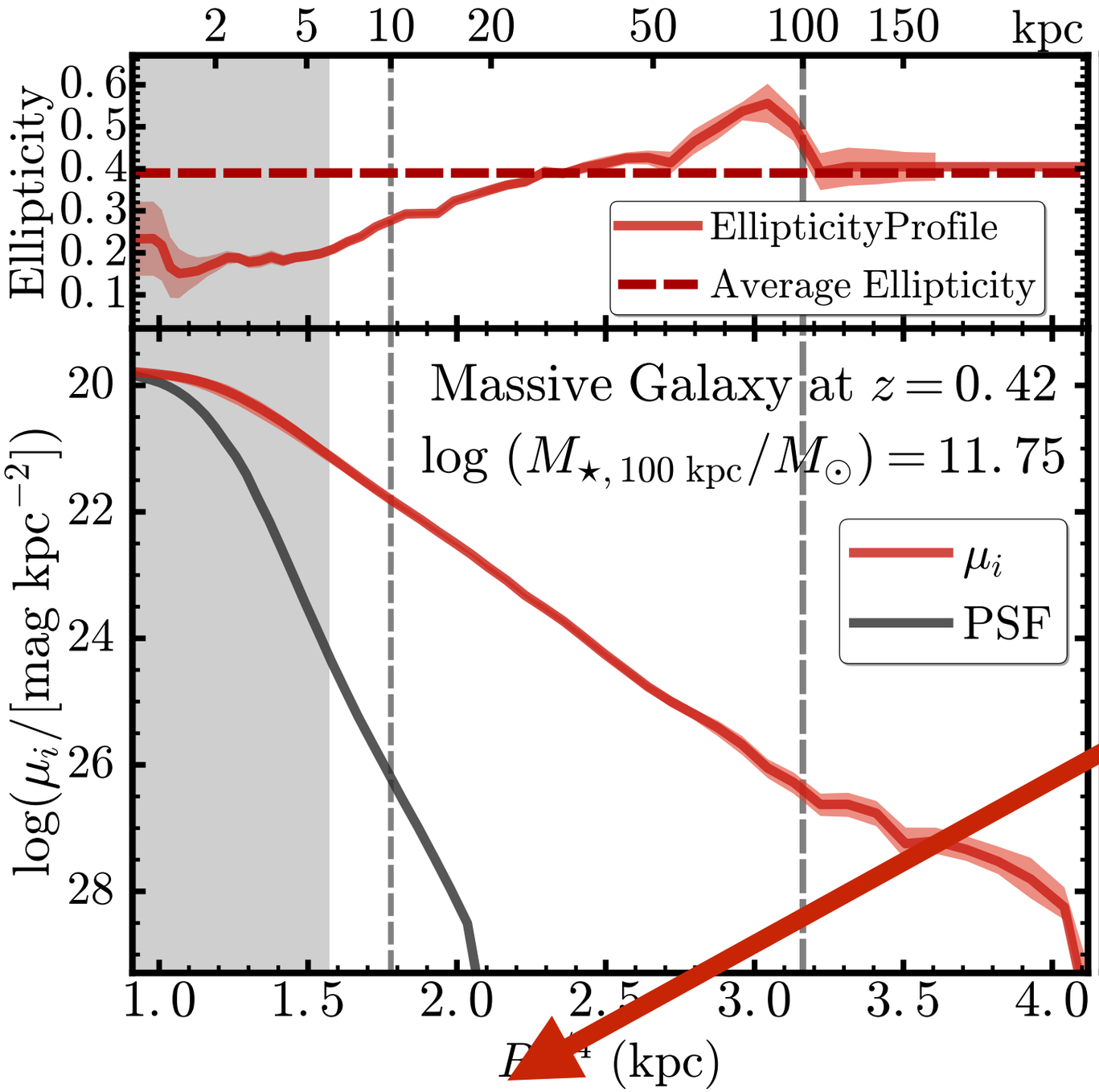
- Do the structure of massive galaxies depend on their DM environment?

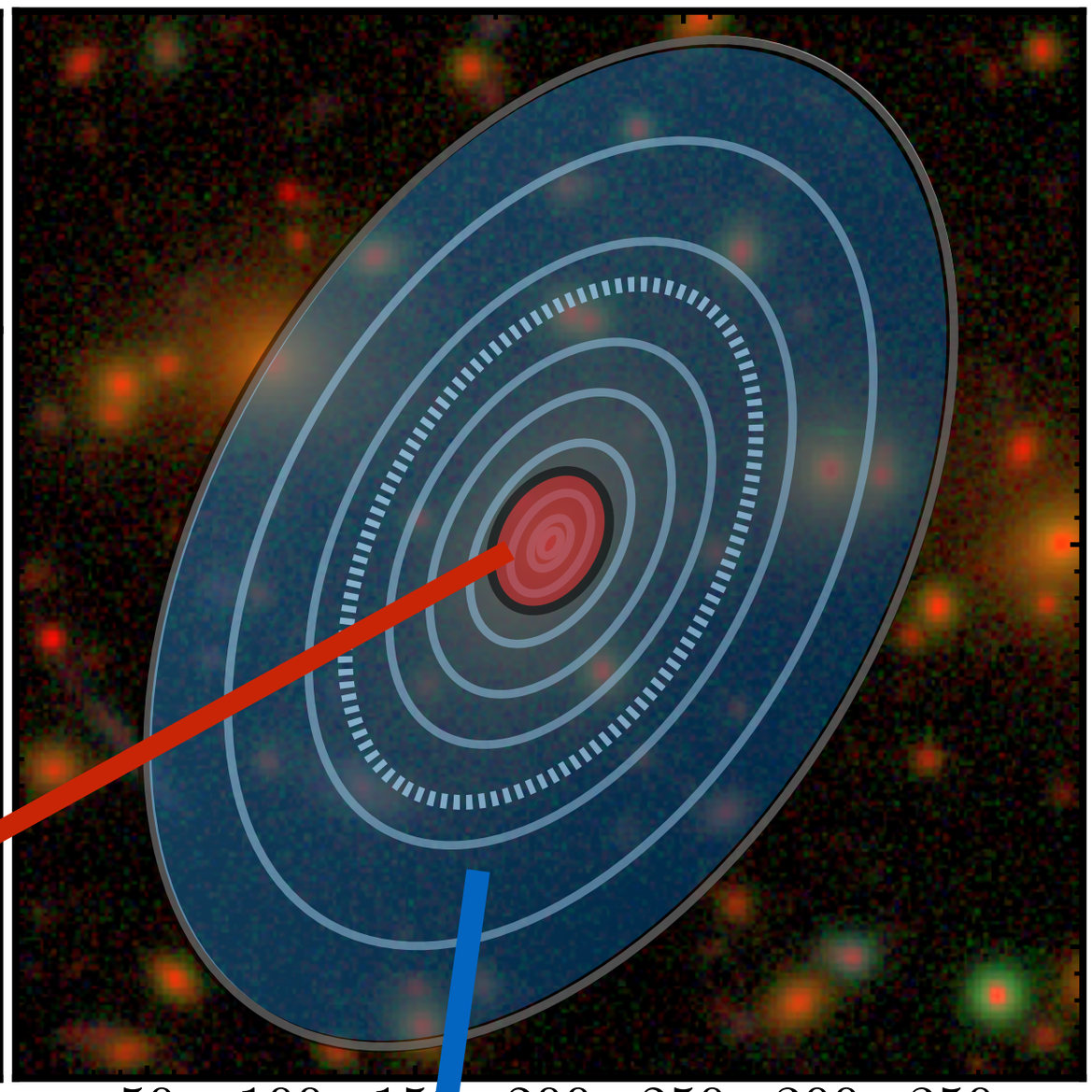
- **Comparisons with numerical simulations**

- Galaxy-halo connection with the help of weak lensing analysis

See Alexie Leauthaud's talk next week

What We Get from HSC





Mass within 10 kpc:

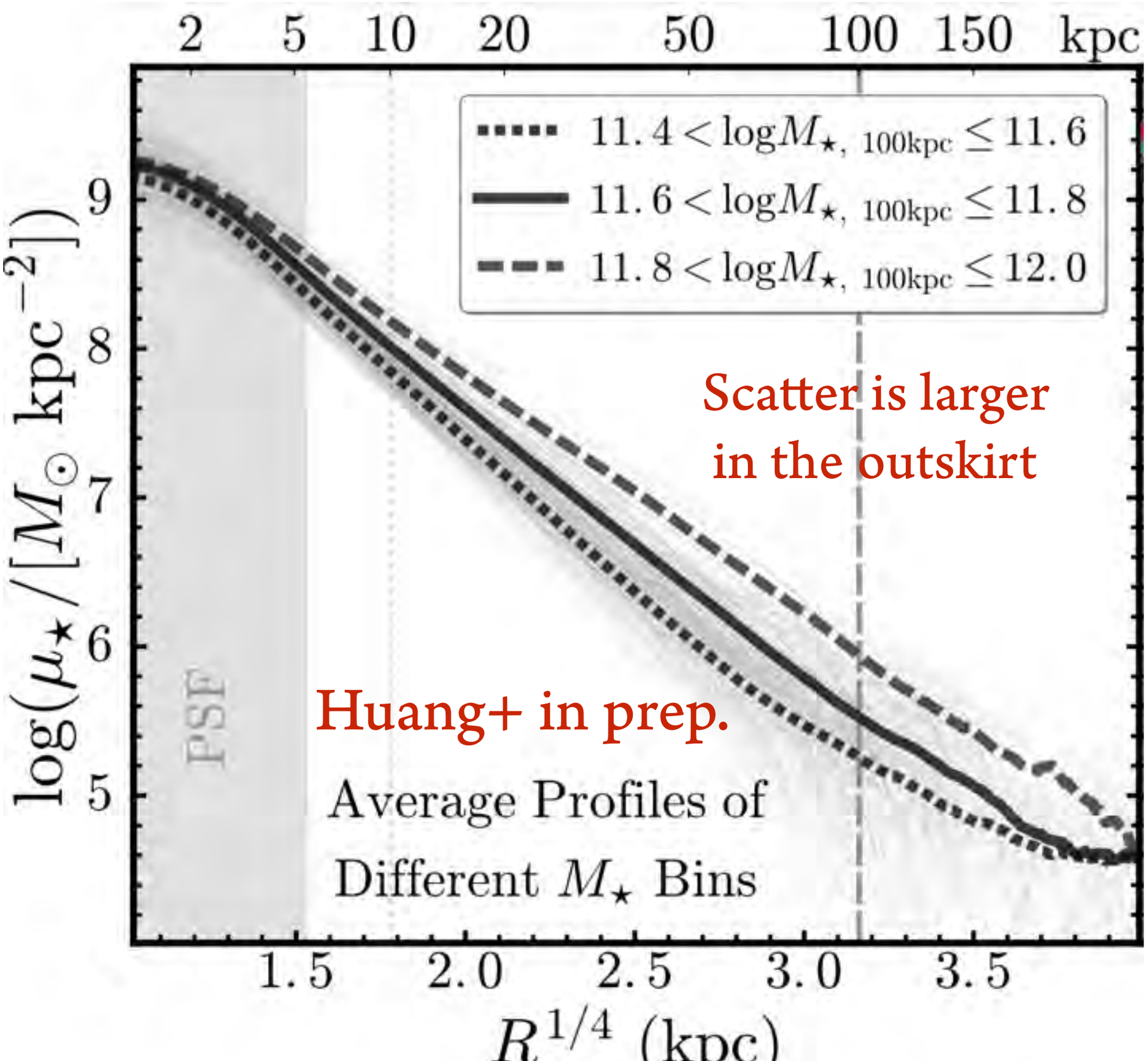
Proxy of mass formed in-situ at high-redshift

Mass within 100 kpc:

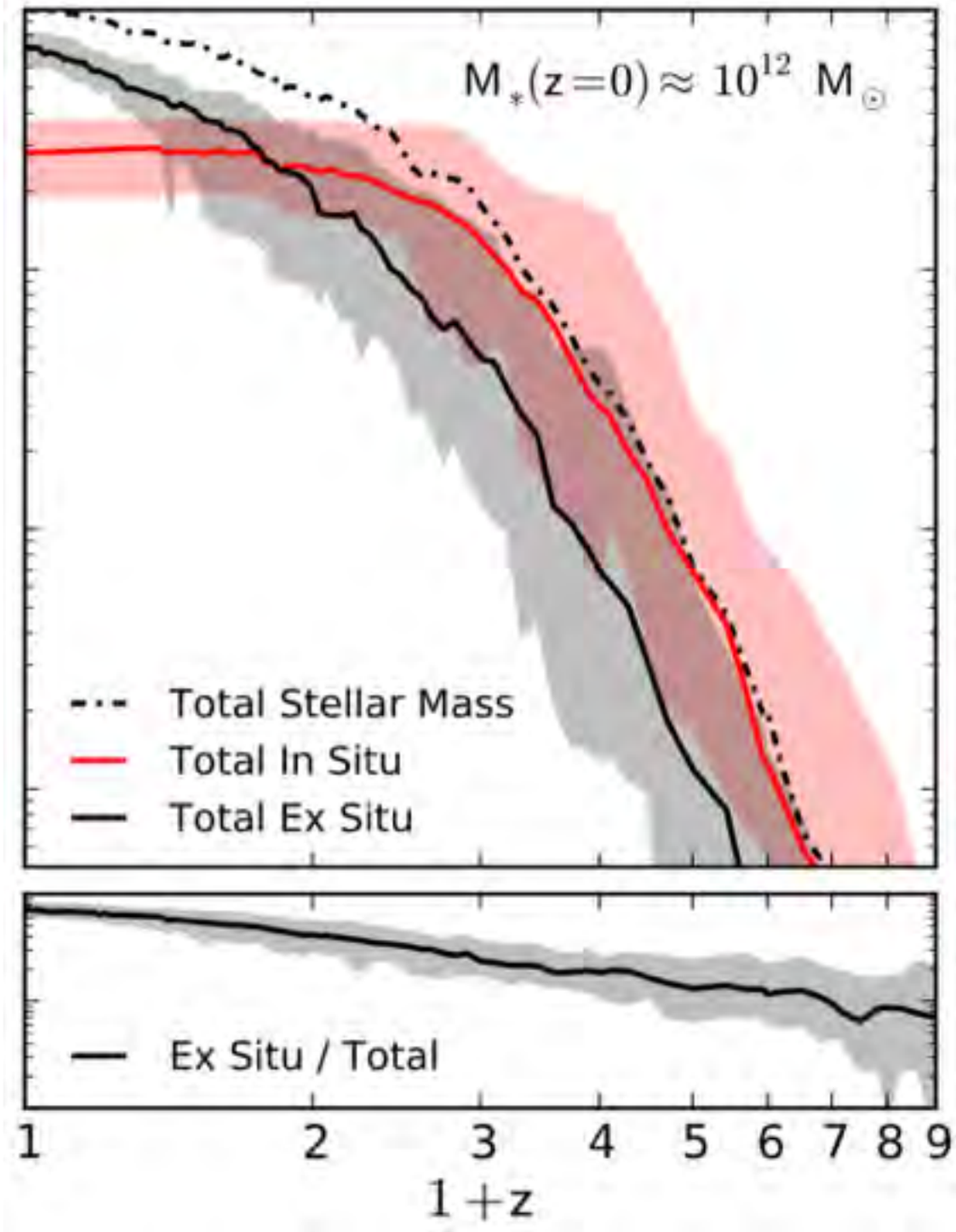
Proxy of the “total stellar mass”;

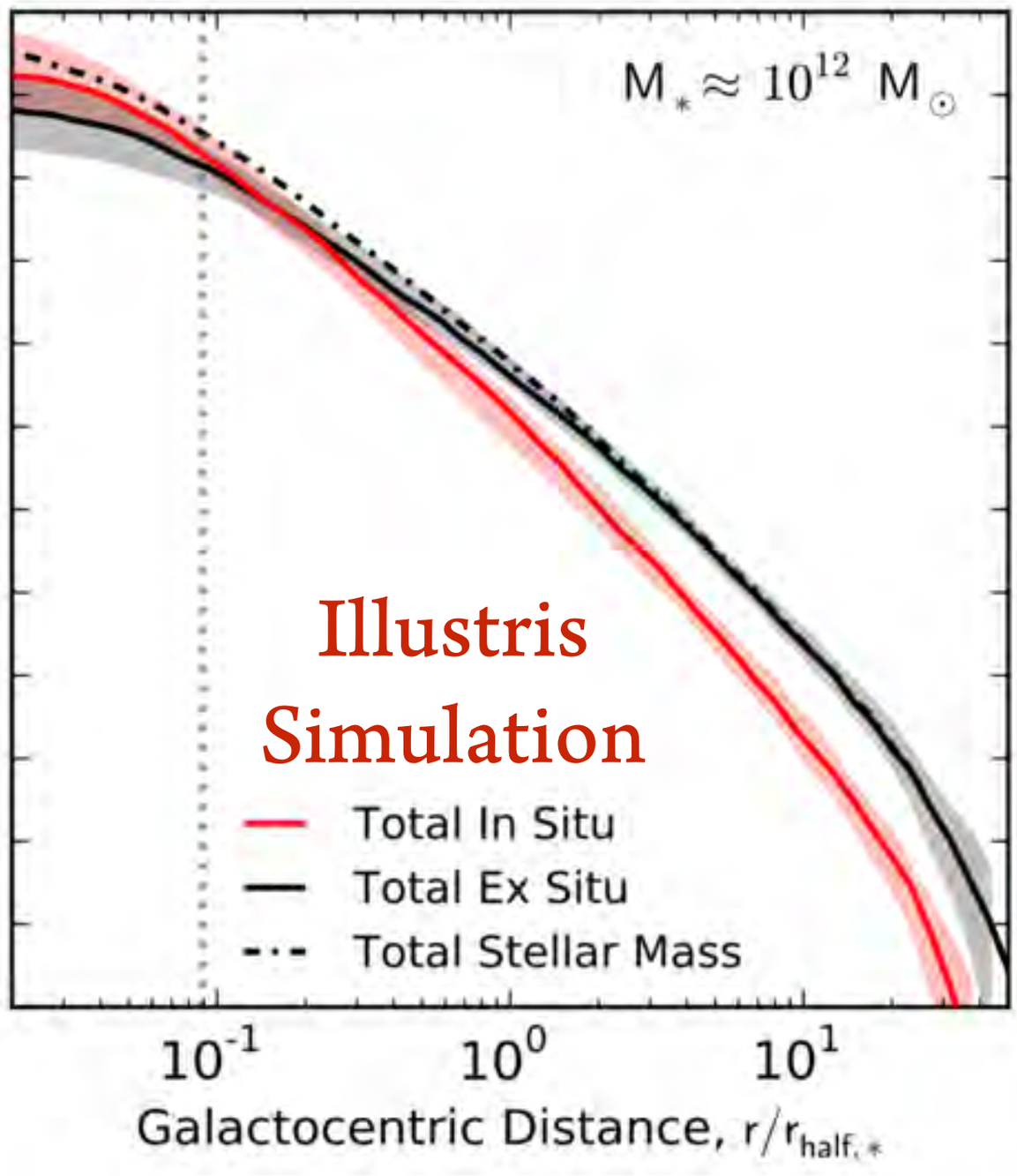
Better than cModel and single Sersic fit

Stellar Halos of Massive Galaxies are NOT Self-Similar



The "Two-Phase" Formation of Massive Galaxies





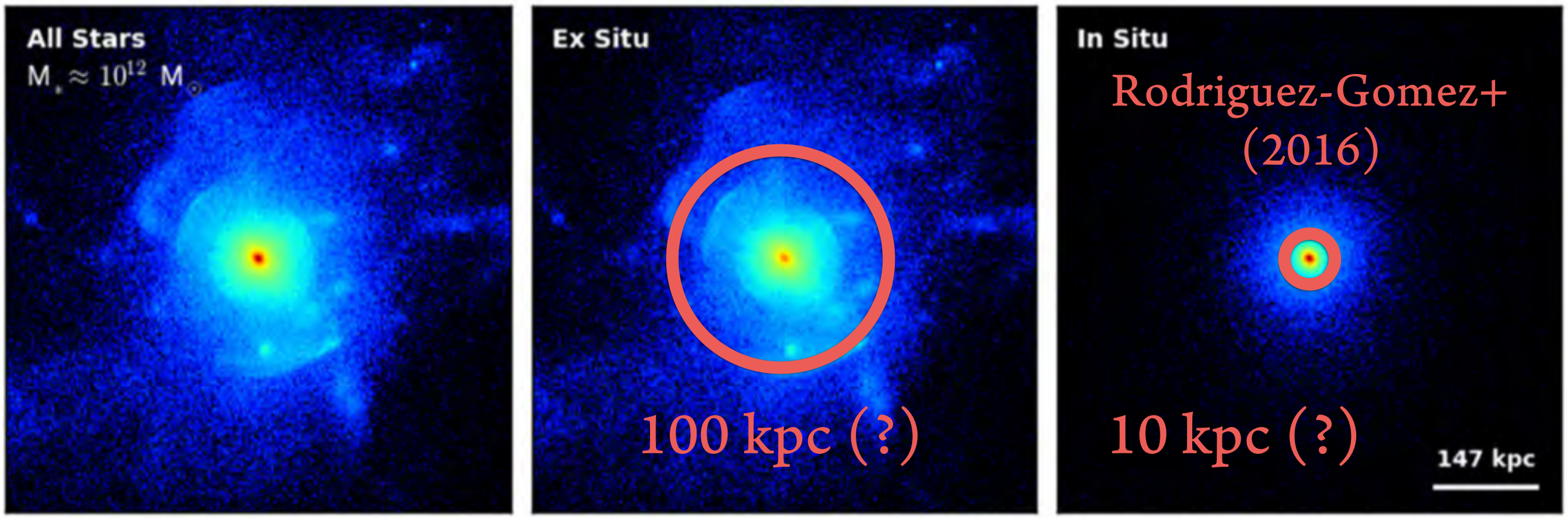
Rodriguez-Gomez+ (2016)

Observation v.s Simulation

- Can we use the comparisons of mass profiles to constrain models for AGN feedback models or satellites disruption?

- What's the best way to estimate stellar mass? Which aperture mass shows the best correlation with halo properties?

- Can we use mass within different apertures to trace the in-situ and ex-situ components? the assembly history?



Comparison with Hydrodynamic Simulations

Bahamas Project: McCarthy et al. (2017)

Horizon-AGN: Dubois et al. (2014)

http://www.horizon-simulation.org/about.html

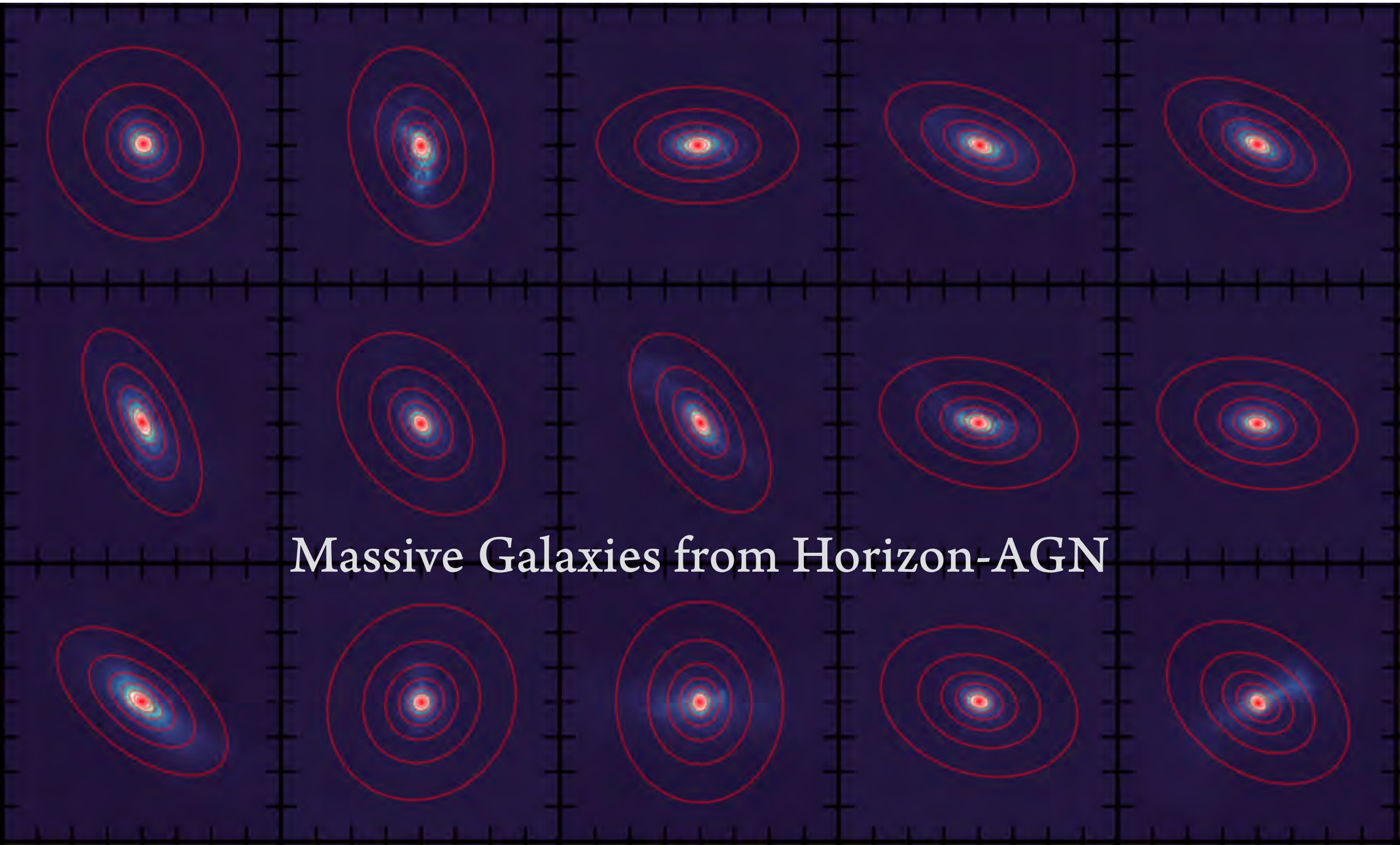
MassiveBlack II: Khandai et al. (2015)

http://mbii.phys.cmu.edu/

	Bahamas	Horizon-AGN	MassiveBlack II
Size	400 Mpc/h	100 Mpc/h	100 Mpc/h
Code	GADGET-3	RAMSES	P-GADGET
N particle	2 x 1024^3	(DM) 1024^3	2 x 1792^3
Particle Mass (Solar Mass)	$M_{DM}=3.9x10^9/h$ $Mgas=7.7x10^8/h$	$M_{DM}=8.0x10^7/h$	$M_{DM}=1.1x10^7/h$ $Mgas=2.2x10^6/h$
Resolution (kpc)	Softening Length 4 kpc	Min Cell Size 1 kpc	Softening Length 1.85/h kpc
Cosmology	WMAP9 & Planck13	WMAP7	WMAP7
Ingredients	Stellar + AGN Feedback	Stellar + AGN Feedback	Stellar + AGN Feedback

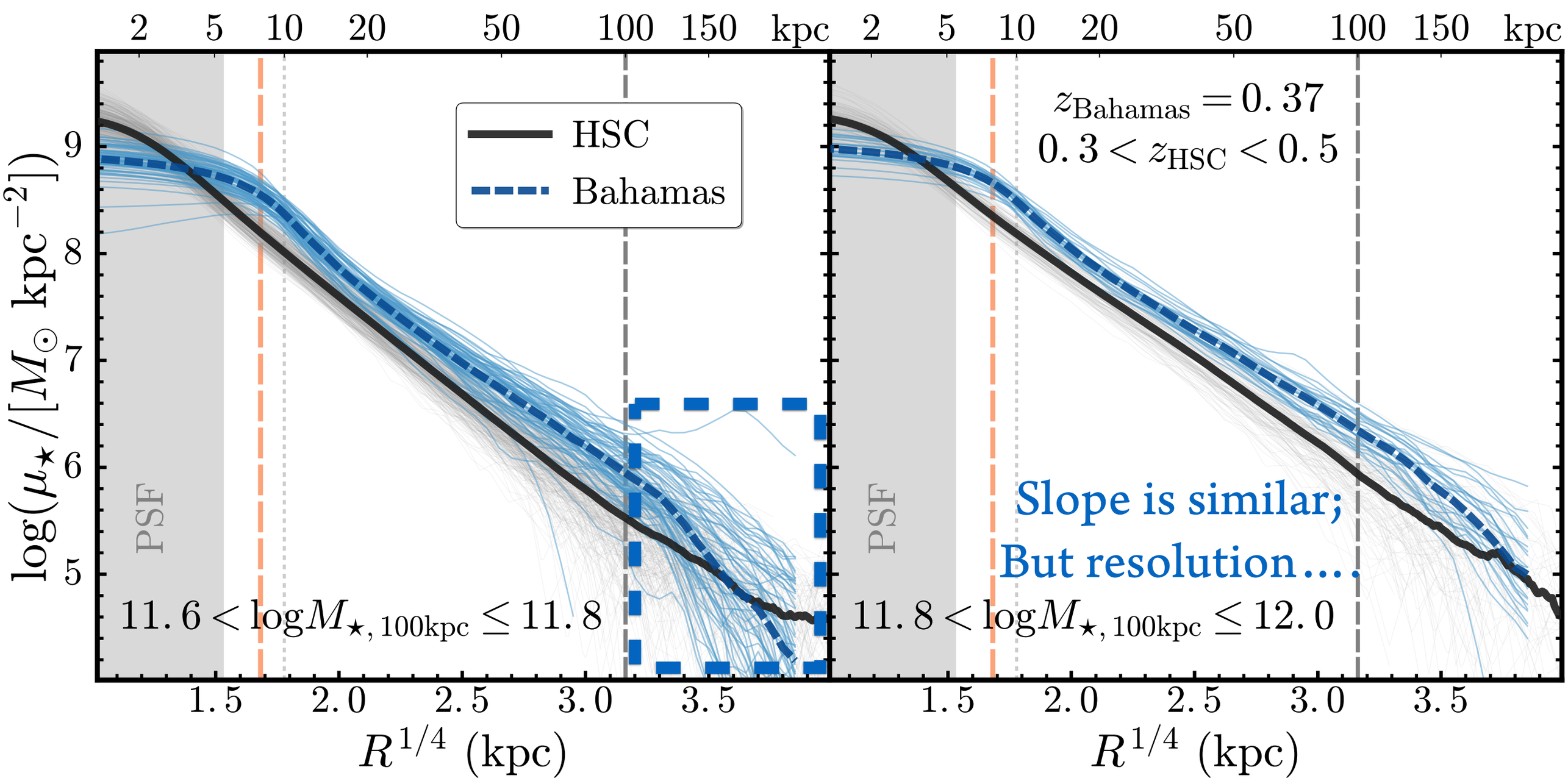
Consistent 2-D Photometry on Simulated Galaxies

$\log(M_*/M_{sun})>11.6$ Central Only; Random Projection



Comparison with Hydrodynamic Simulations

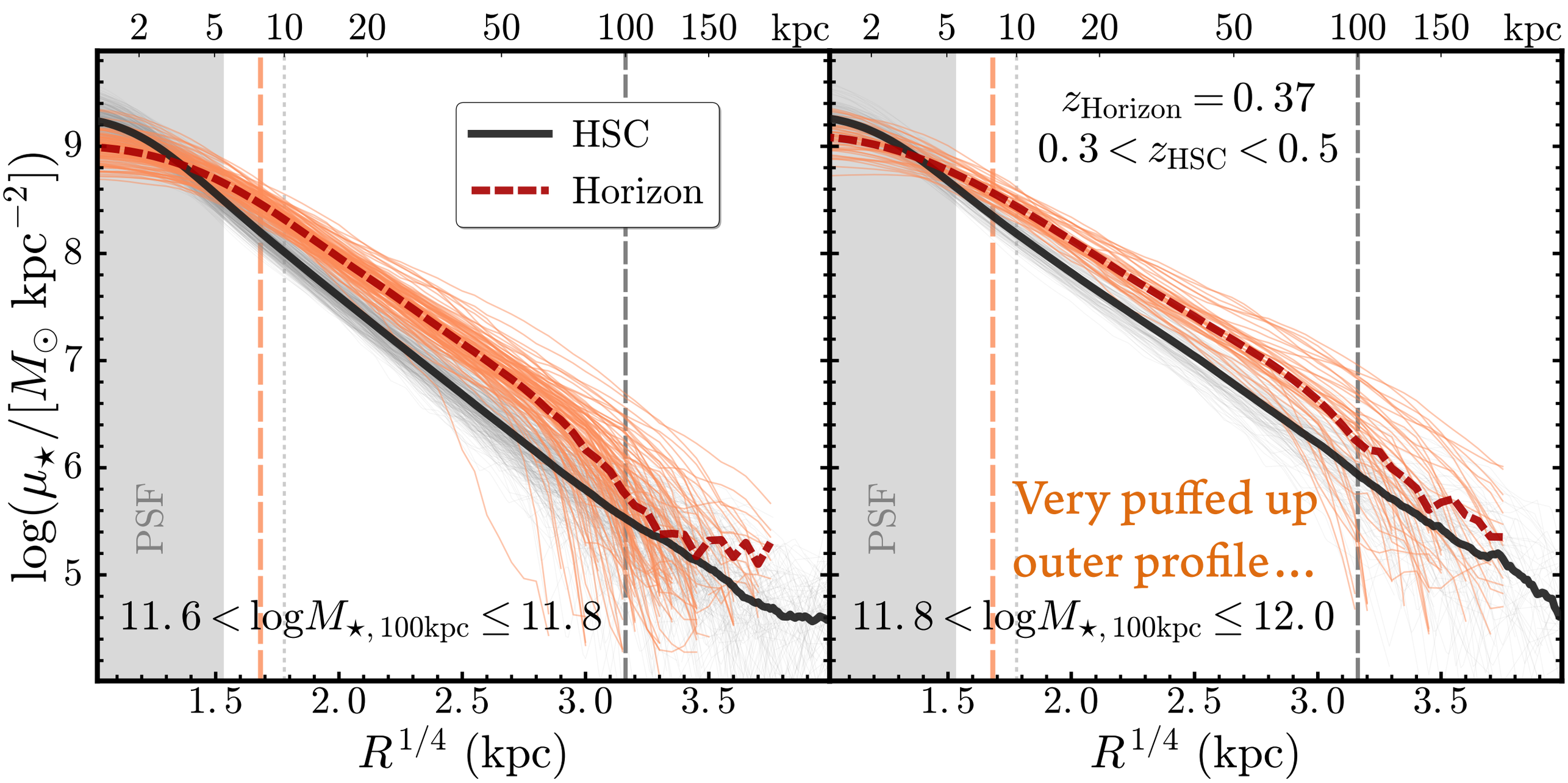
Bahamas at z=0.37



In collaboration with Ian McCarthy

Comparison with Hydrodynamic Simulations

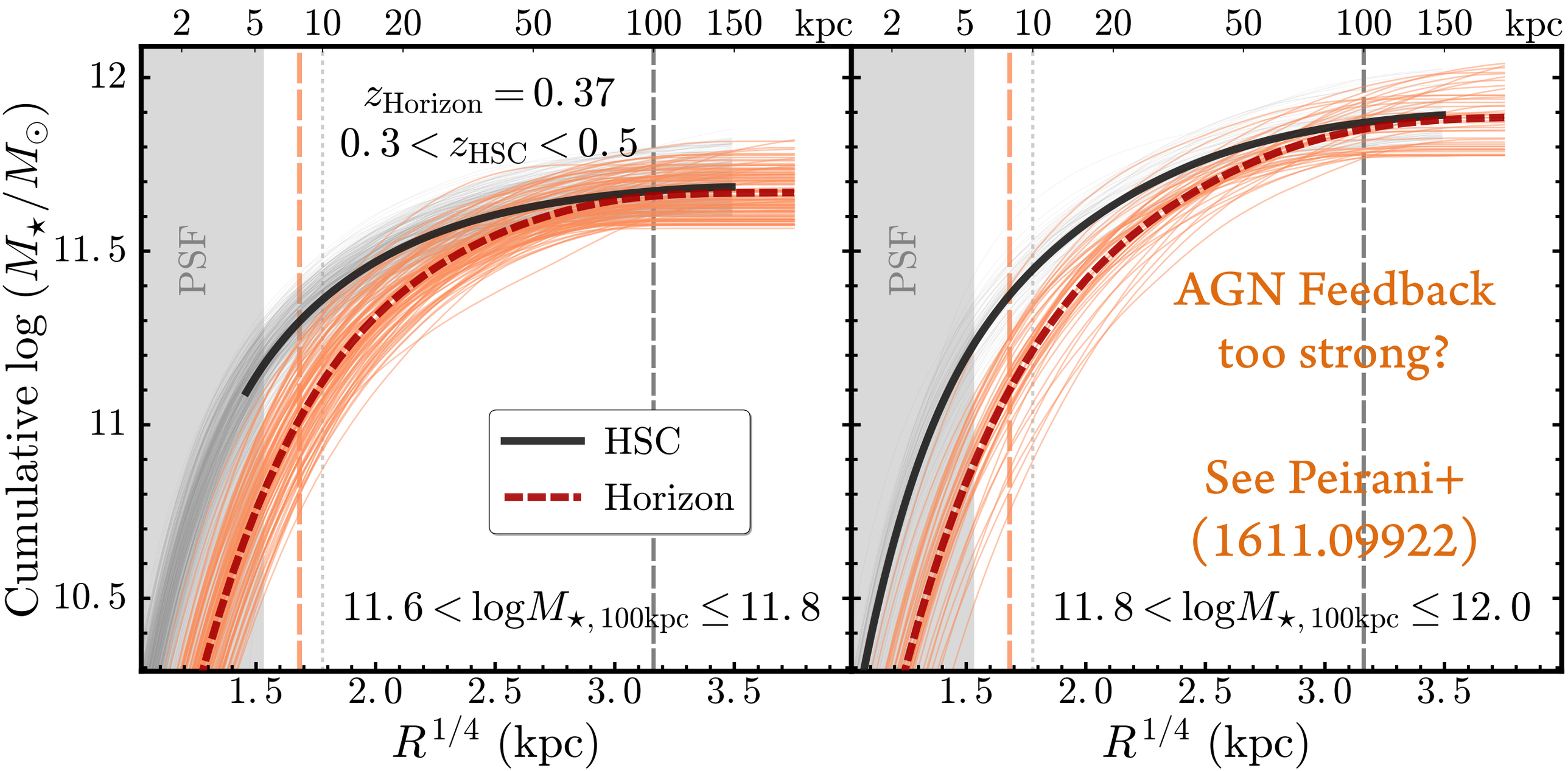
Horizon-AGN at z=0.37



In collaboration with Sébastien Peirani

Comparison with Hydrodynamic Simulations

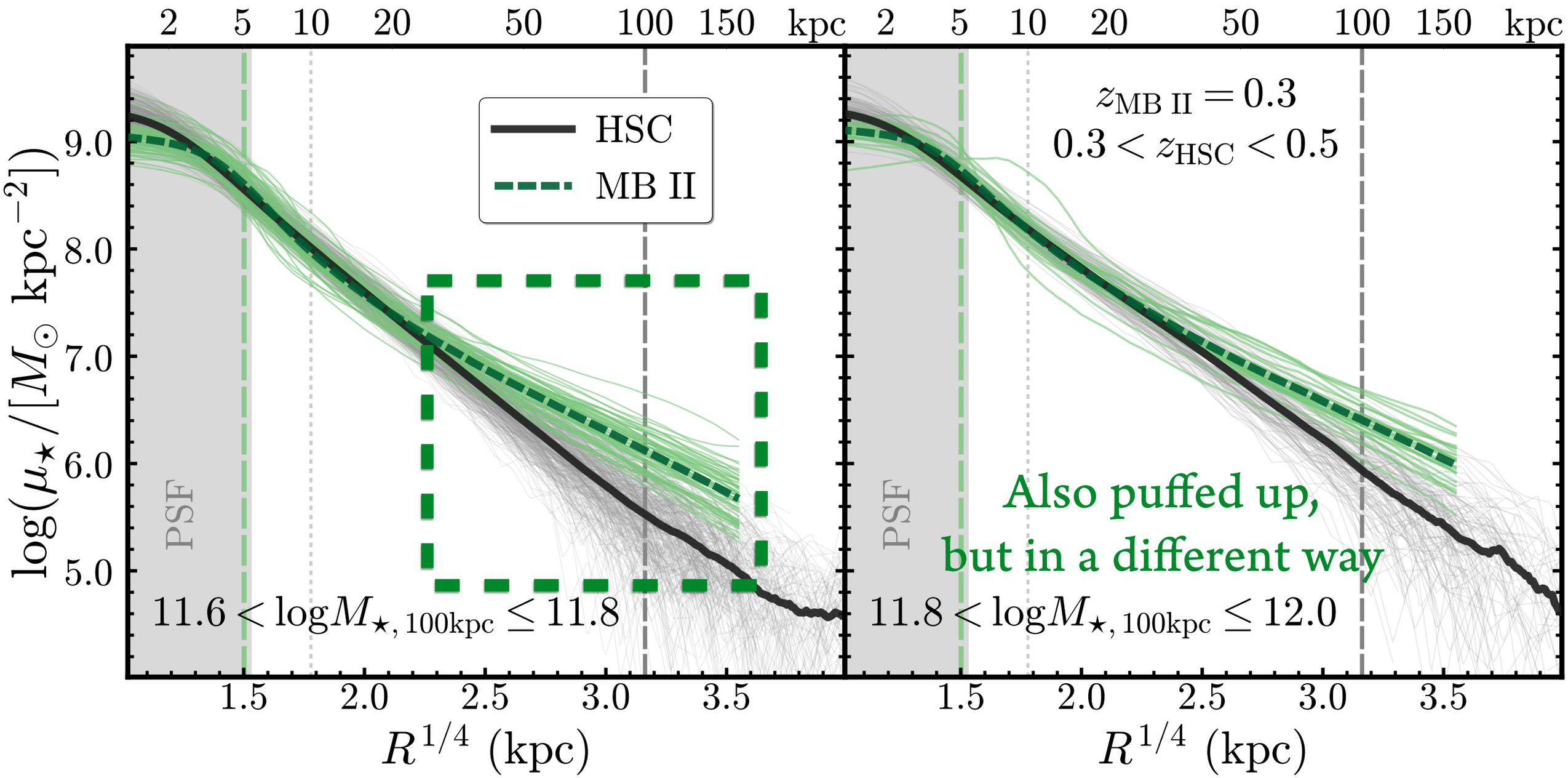
Horizon-AGN at z=0.37



In collaboration with Sébastien Peirani

Comparison with Hydrodynamic Simulations

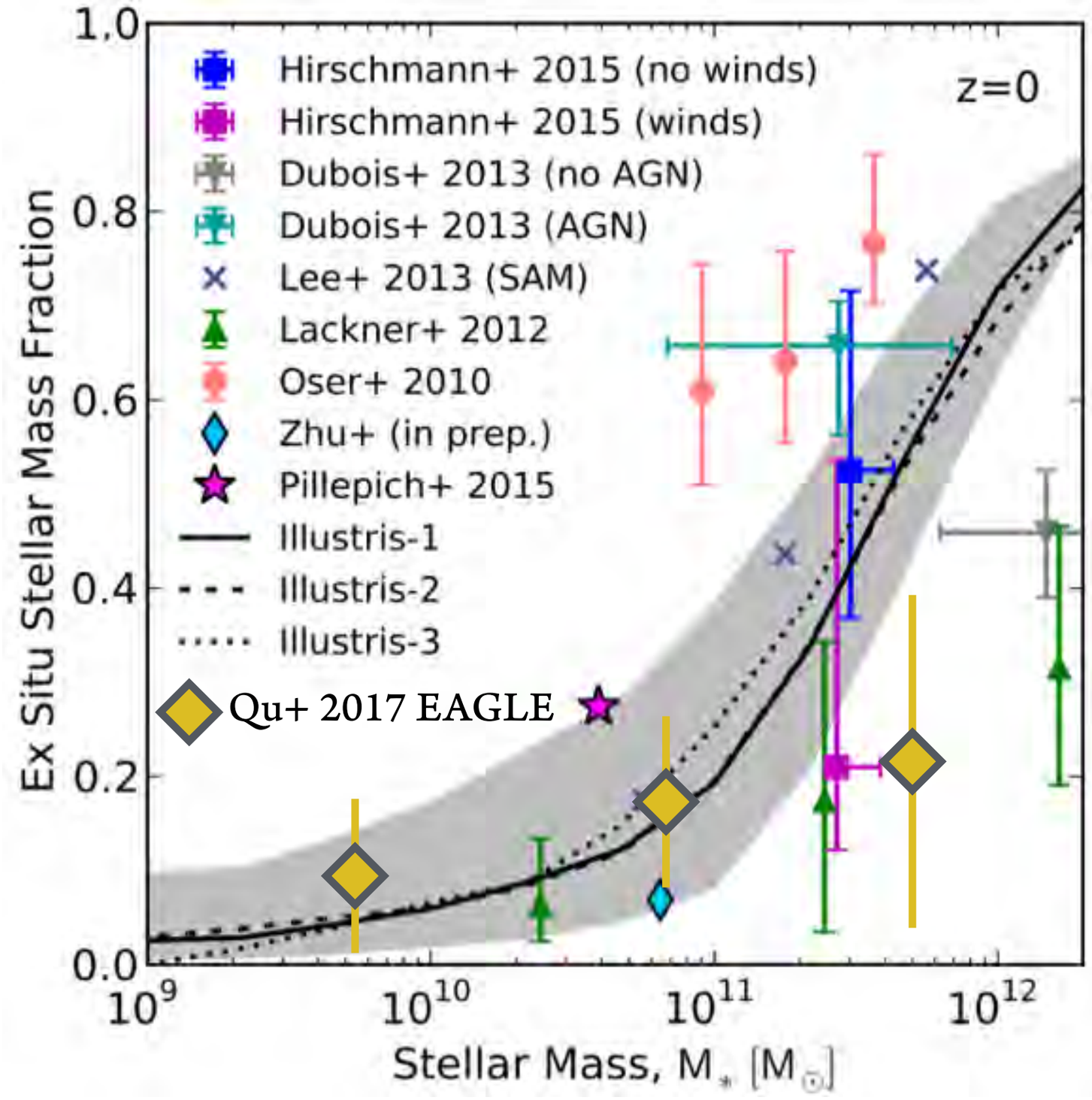
MassiveBlack-II at z=0.30



Satellite disruption too easy?

In collaboration with the MassiveBlack-II team

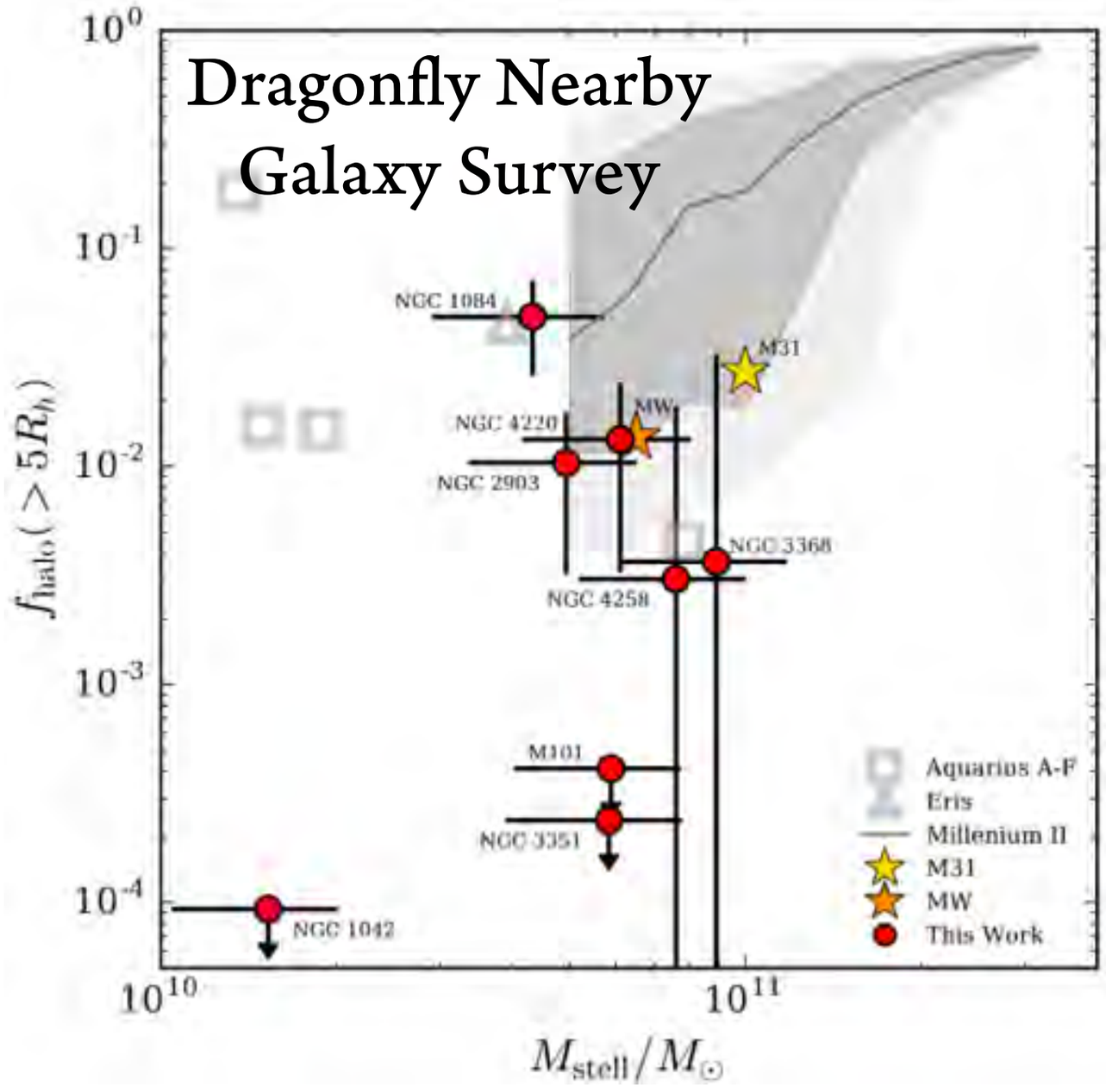
Fraction of “Ex situ” Stars



Rodriguez-Gomez+ (2016)

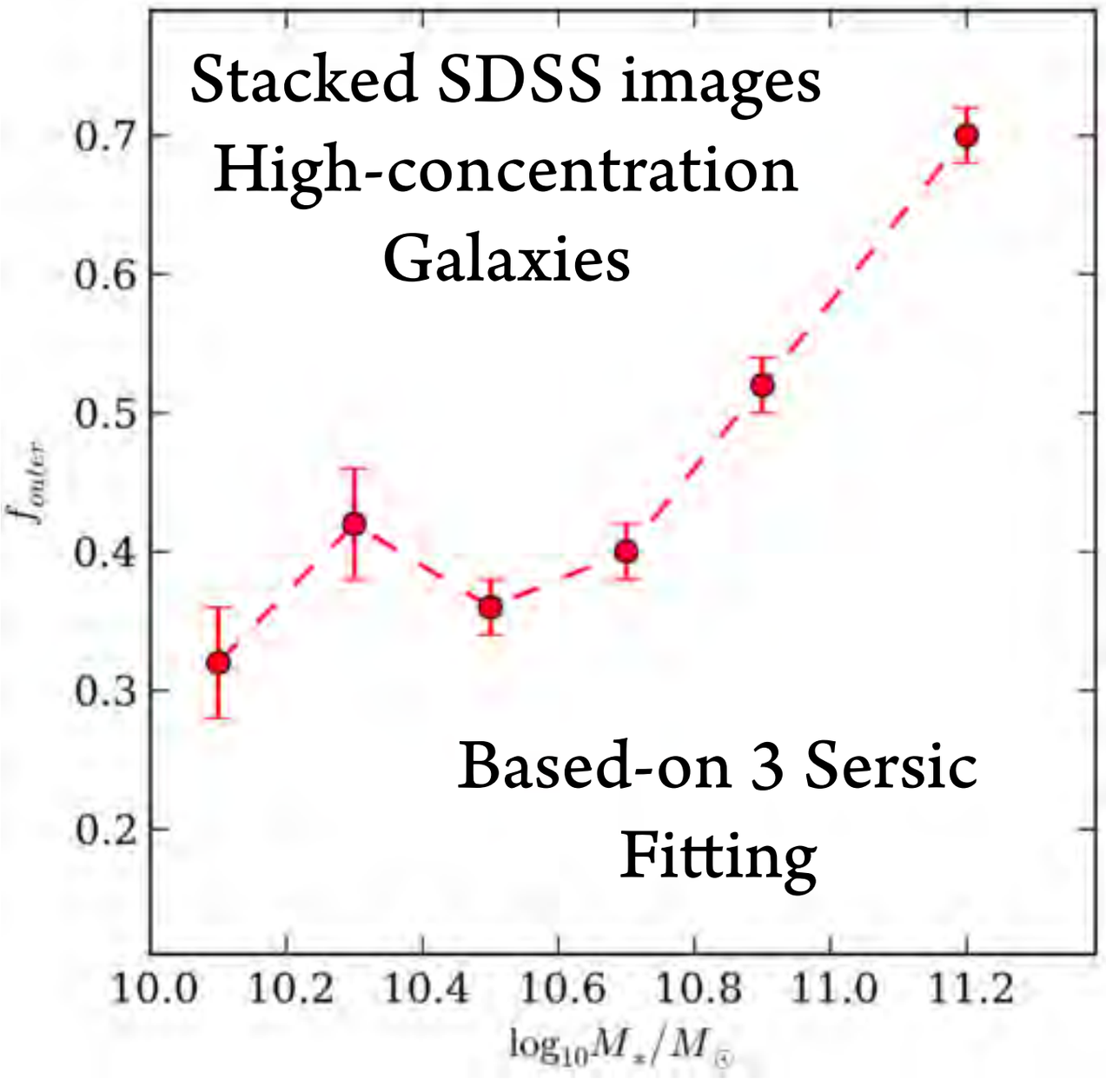
Fraction of "Ex situ" Stars

However, observational constraints are difficult.....



Merrit+ (2017)

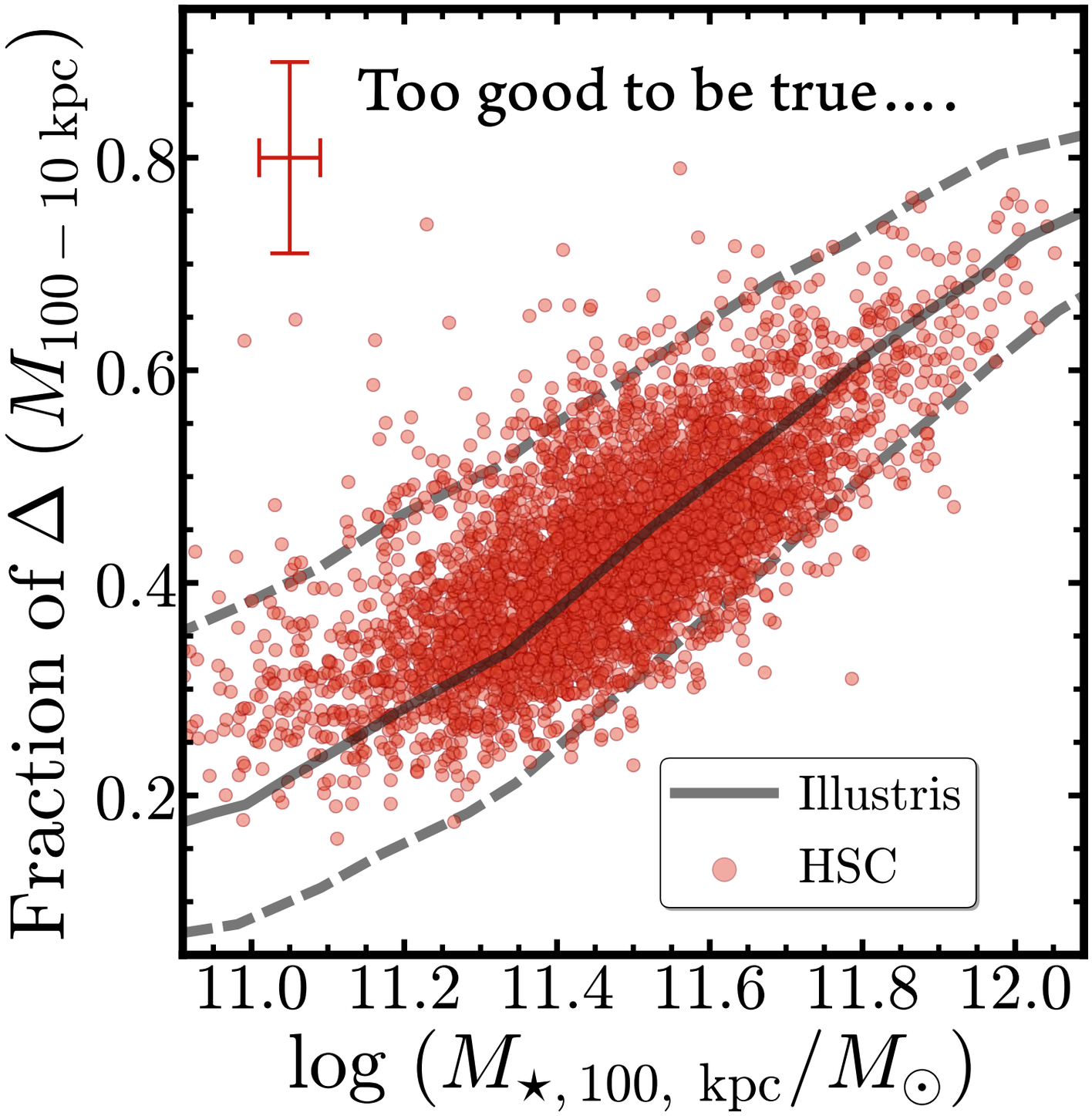
see also Harmsen+ (2017)



D'Souza+ (2014)

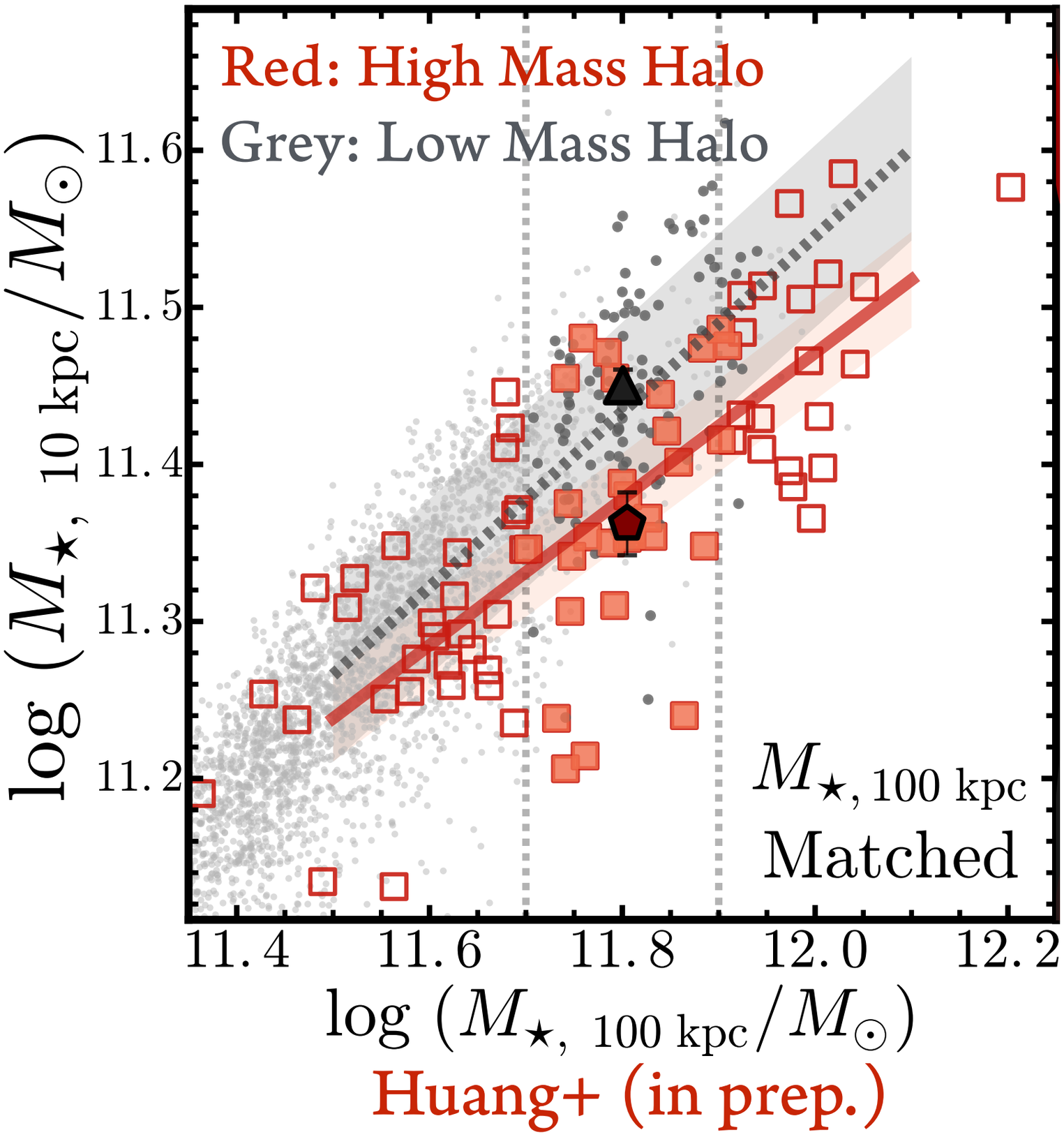
see also Huang+ (2013)

Fraction of "Ex situ" Stars



Huang+ (in prep.)

Relationships between $M_{\rm Halo}$, $M_{100\,\rm kpc}$ and $M_{10\,\rm kpc}$



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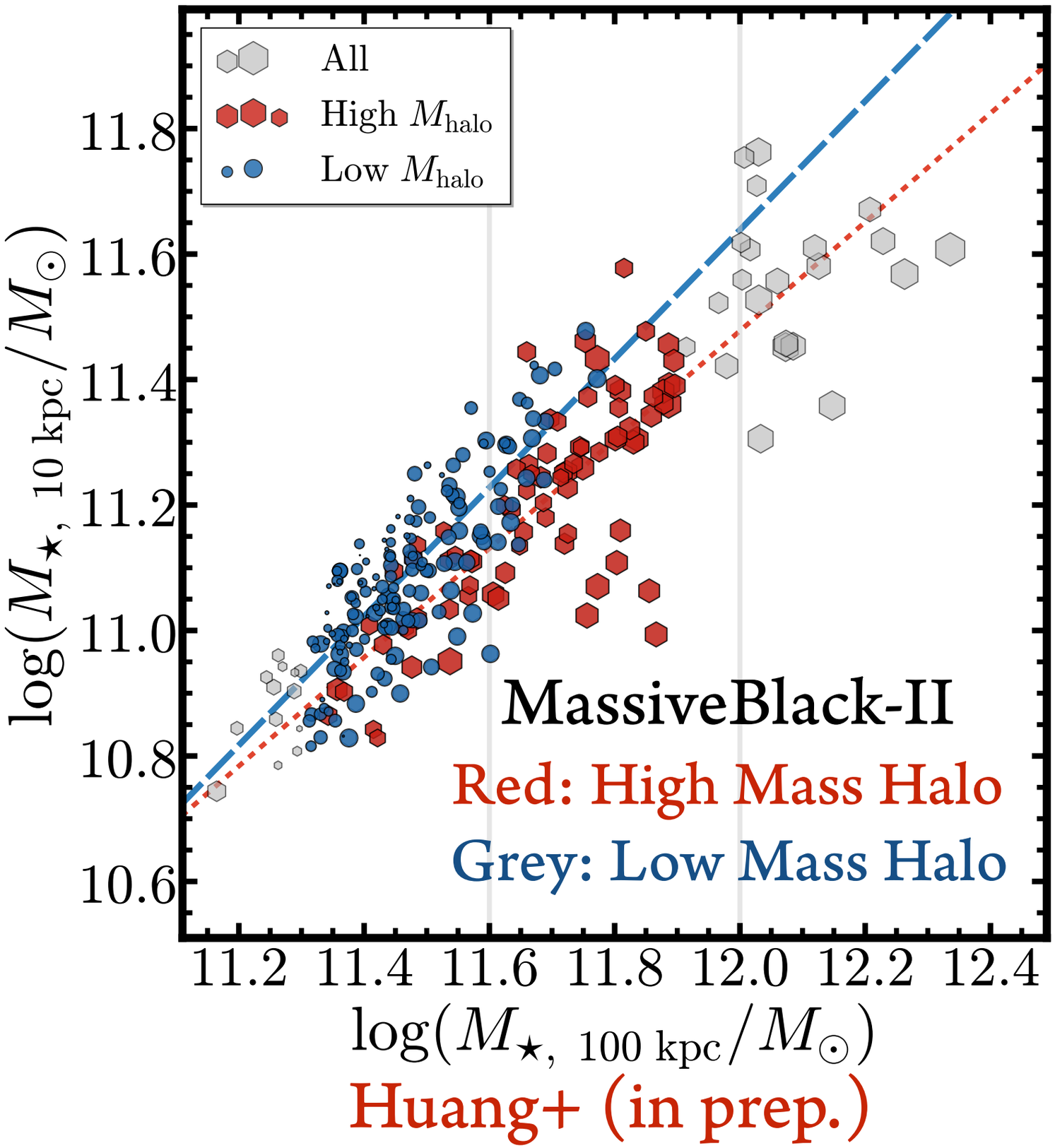

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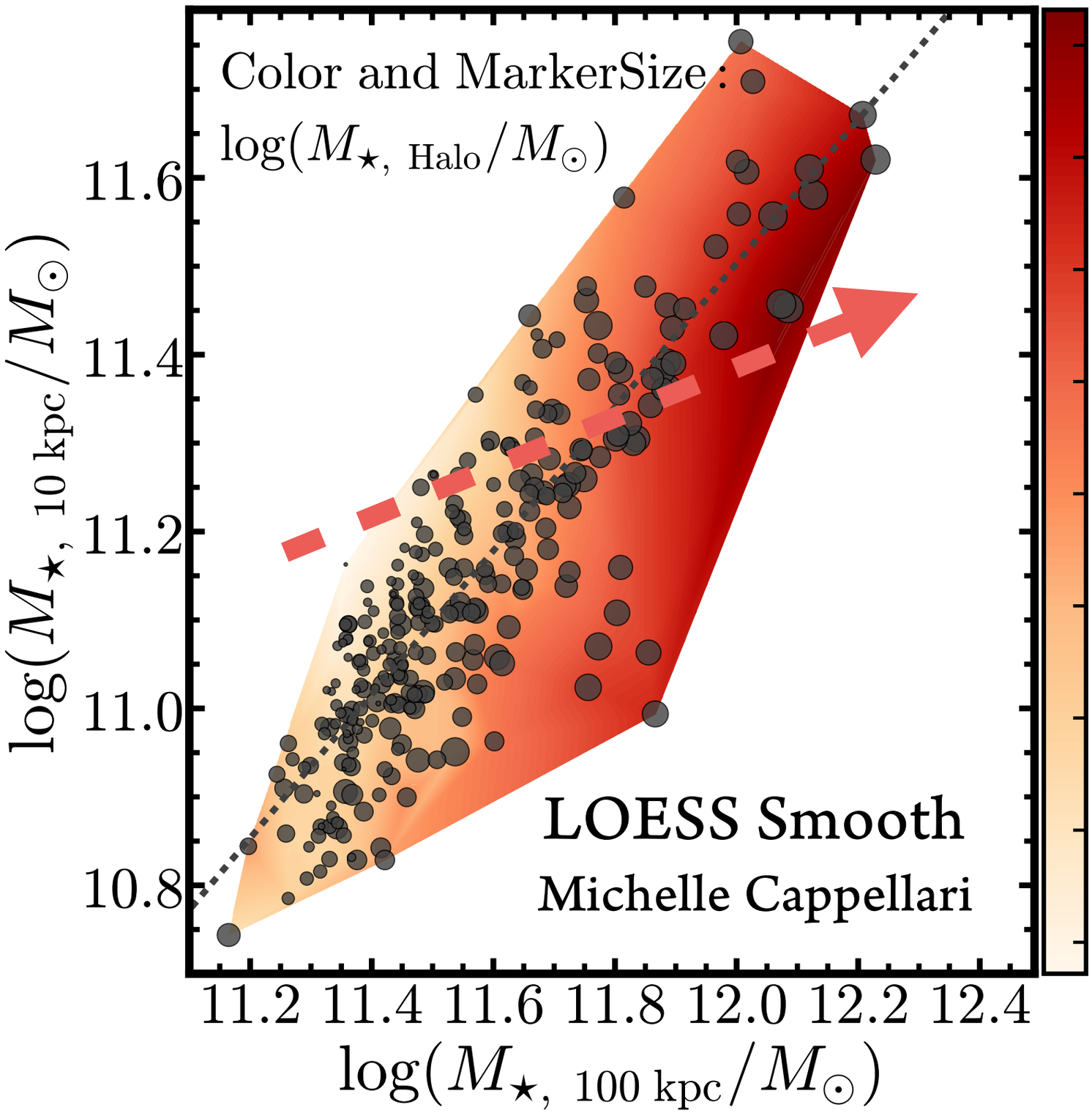

Huang+ (in prep.)

Thank You Very Much !

Enjoy HSC !