# Super Massive Galaxies

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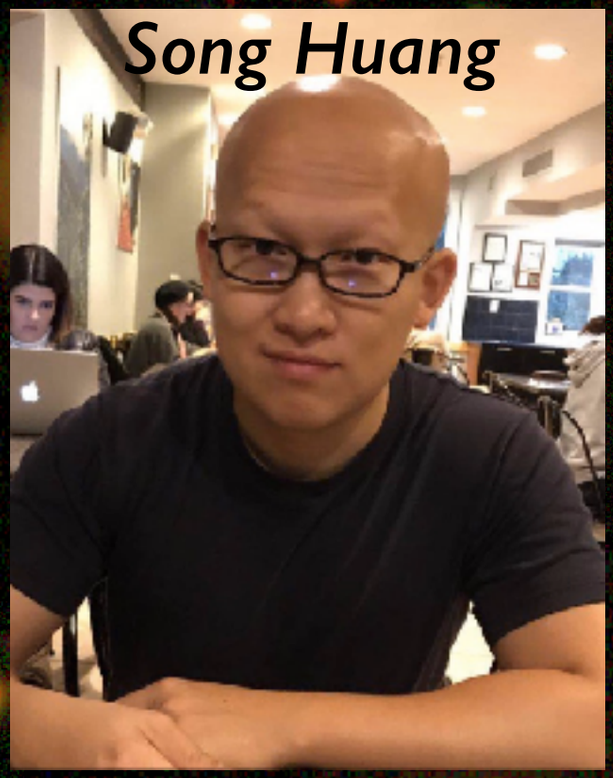
*Felipe Ardila, Jenny Greene, Andrew Hearin, Peter Behroozi, Benedikt Diemer, Annalisa Pillepich, Christopher Bradshaw, Enia Xhakaj, Yifei Luo,*
*and the HSC collaboration*



MNRAS 000, 1–?? (2017) Preprint 13 July 2017 Compiled using MNRAS LATEX style file v3.0

# Individual Stellar Halos of Massive Galaxies Measured to 100 kpc at $0.3 < z < 0.5$ using Hyper Suprime-Cam

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Yen-Ting Lin,[6] Masayuki Tanaka,[5] Satoshi Miyazaki,[5,7]
Yutaka Komiyama[5,7]
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# A Detection of the Environmental Dependence of the Sizes and Stellar Haloes of Massive Central Galaxies

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Yen-Ting Lin[5], Masayuki Tanaka[6], Rachel Mandelbaum[7], Satoshi Miyazaki[5,8],
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[4]*Department of Astrophysical Sciences, Pey*
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[6]*National Astronomical Observatory of Japa*
[7]*McWilliams Center for Cosmology, Depart*

ar 2018

# Weak Lensing Reveals a Tight Connection Between Dark Matter Halo Mass and the Distribution of Stellar Mass in Massive Galaxies

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Christopher Bradshaw[1], Felipe Ardila[1], Joshua Speagle[5], Ananth Tenneti[6],
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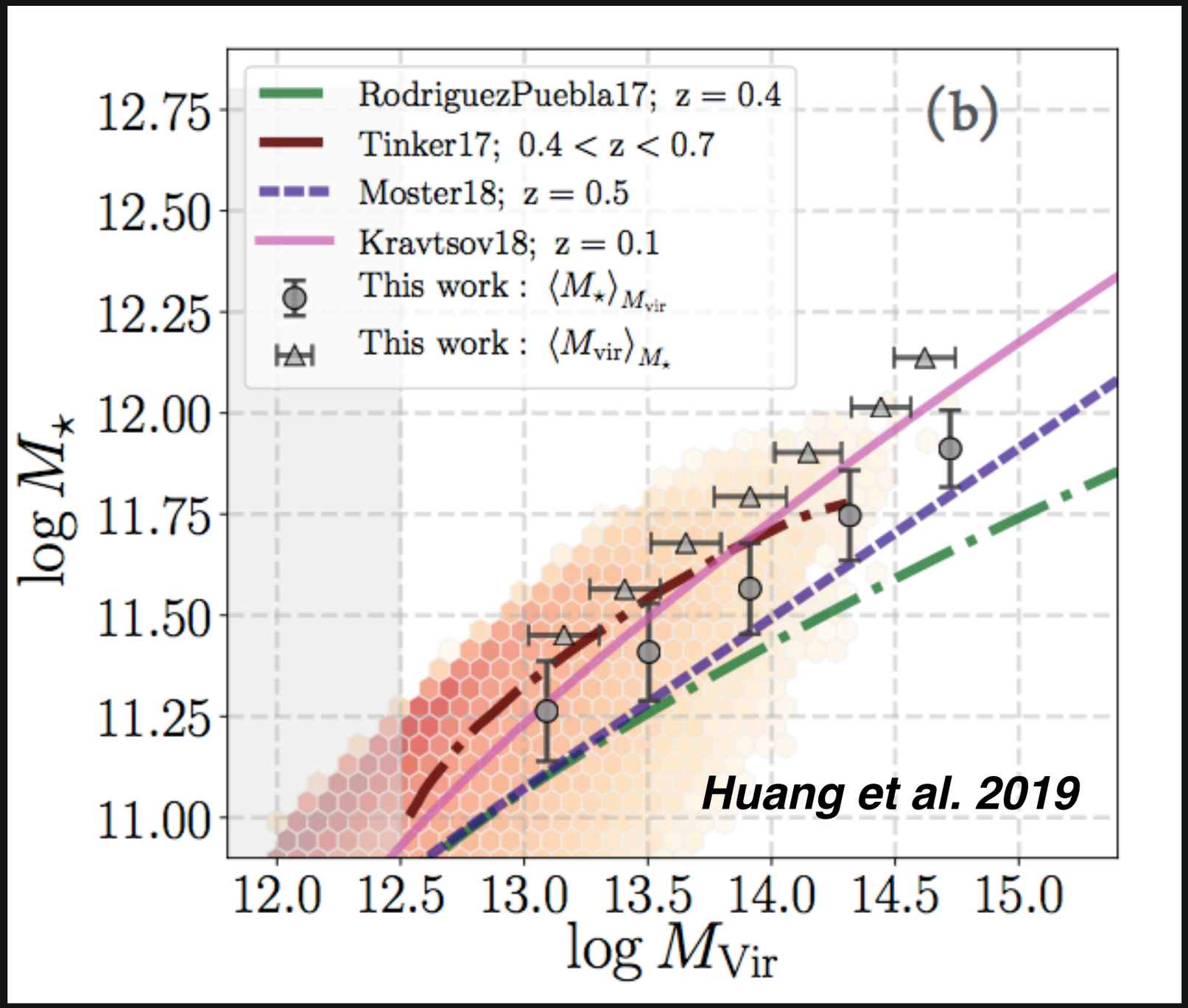
[5]*Department of Astronomy, Harvard University, 60 Garden St, MS 46, Cambridge, MA 02138, USA*

ov 2018

# What we know already:

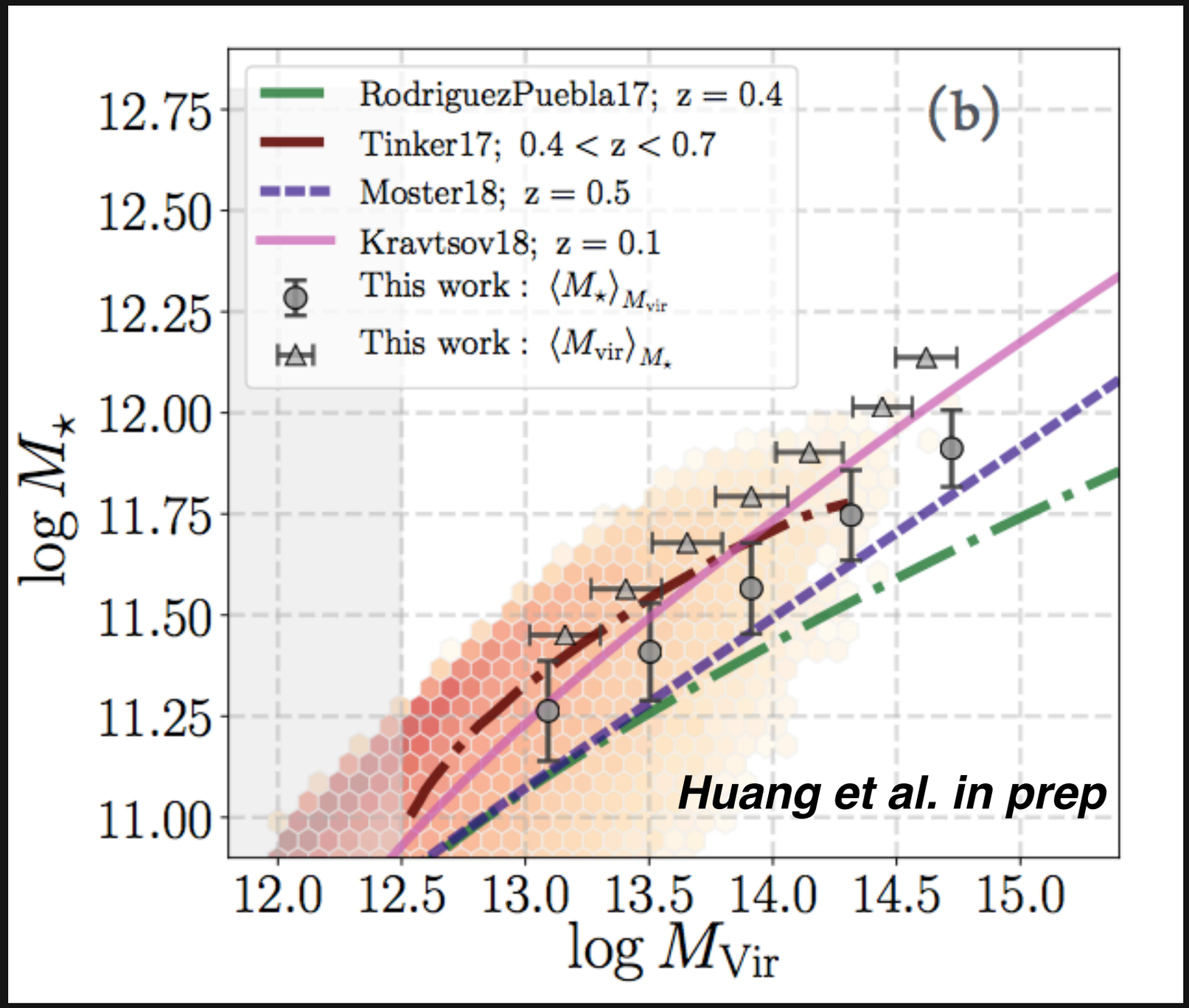



*Galaxy mass*

*Dark matter halo mass*

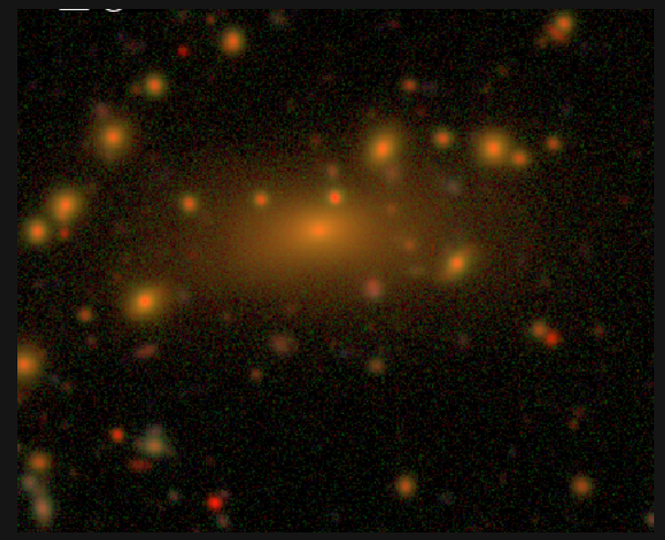
*(highly incomplete list, many other key papers on this topic)*

# What we know already:




*Galaxy mass*

*Dark matter halo mass*



does the way mass is distributed correlate with halo mass?

# HSC survey
# Wide + Deep + Lensing

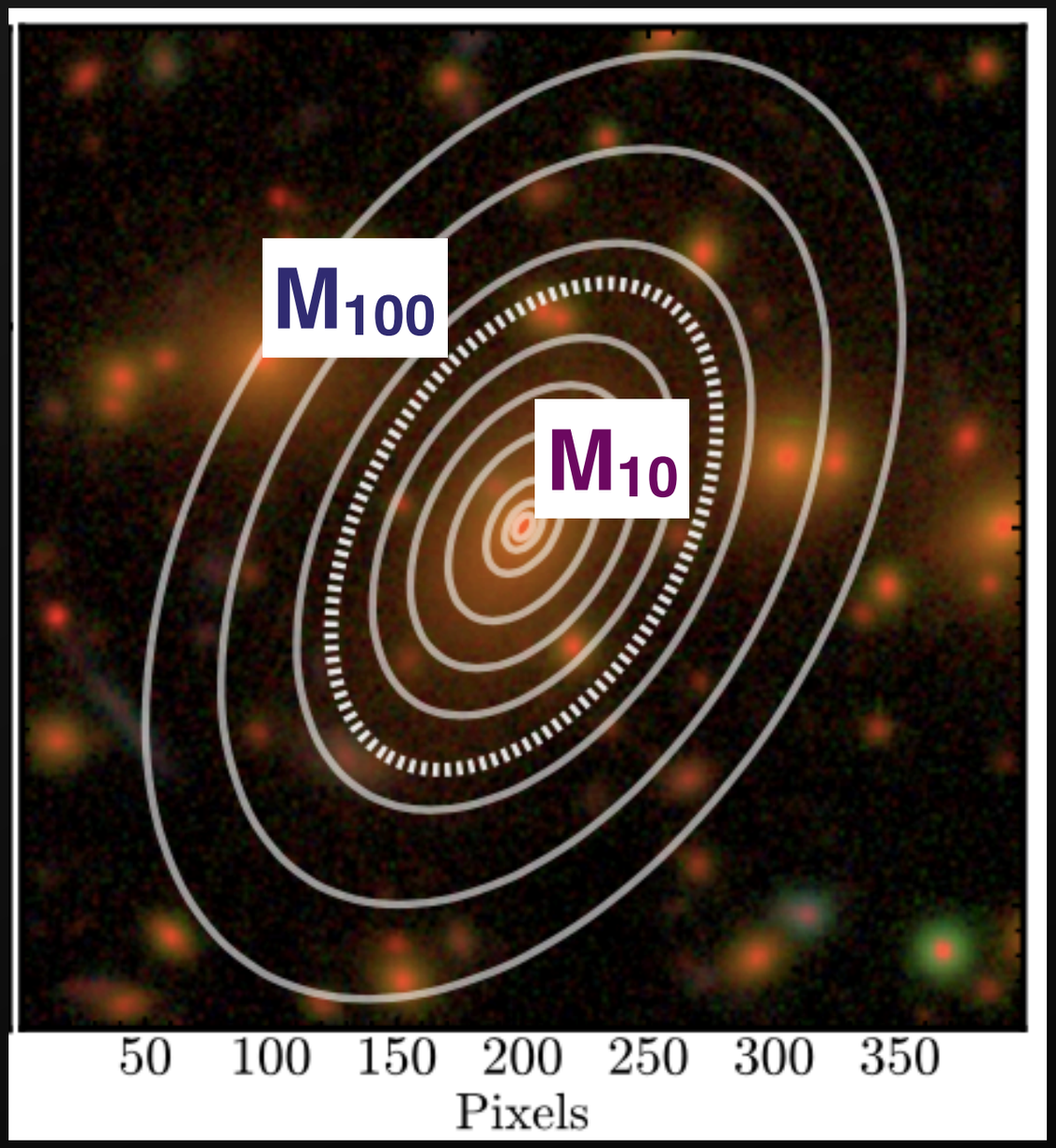
Rare objects

Faint outskirts

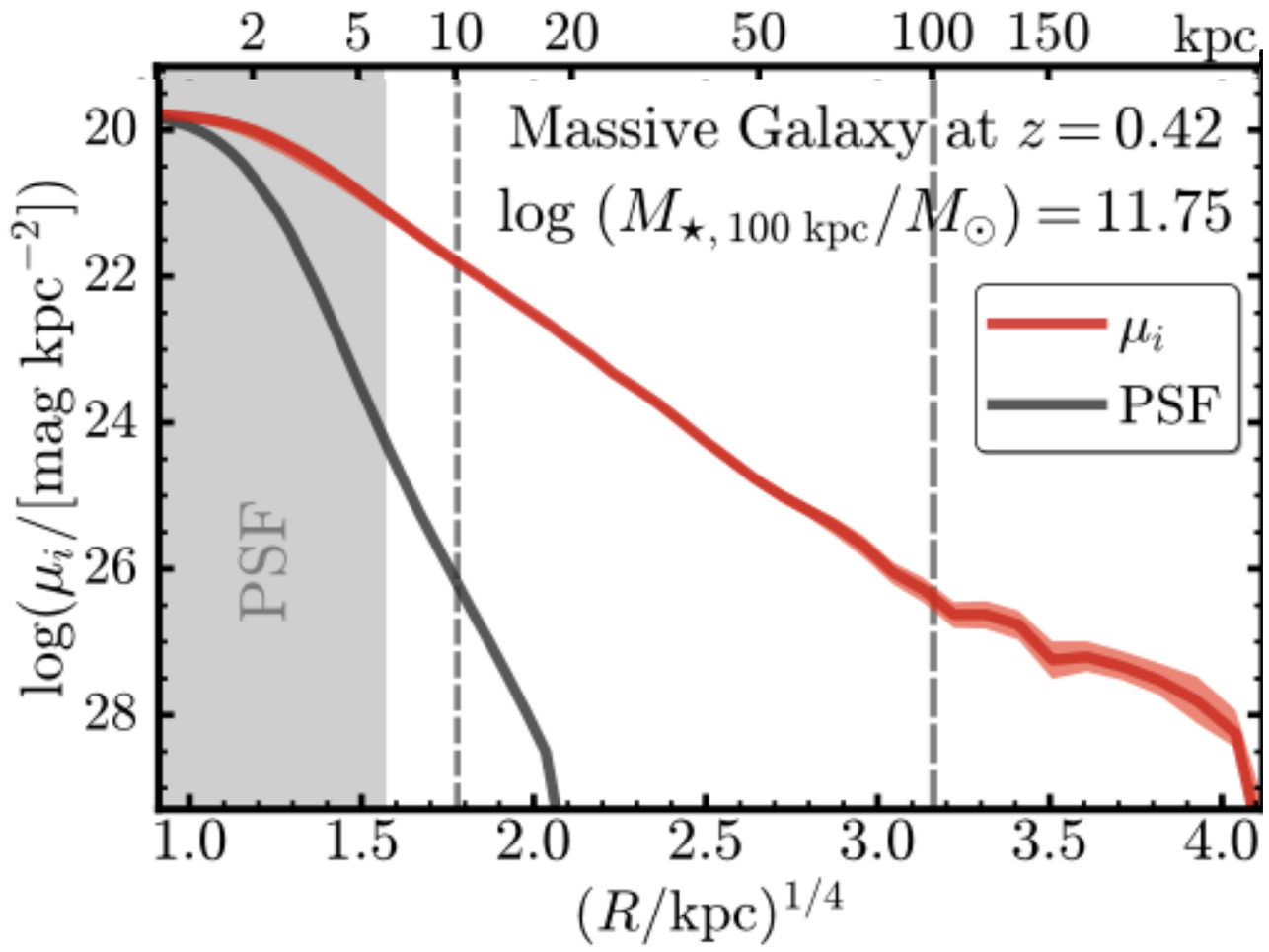
Dark Matter Halos

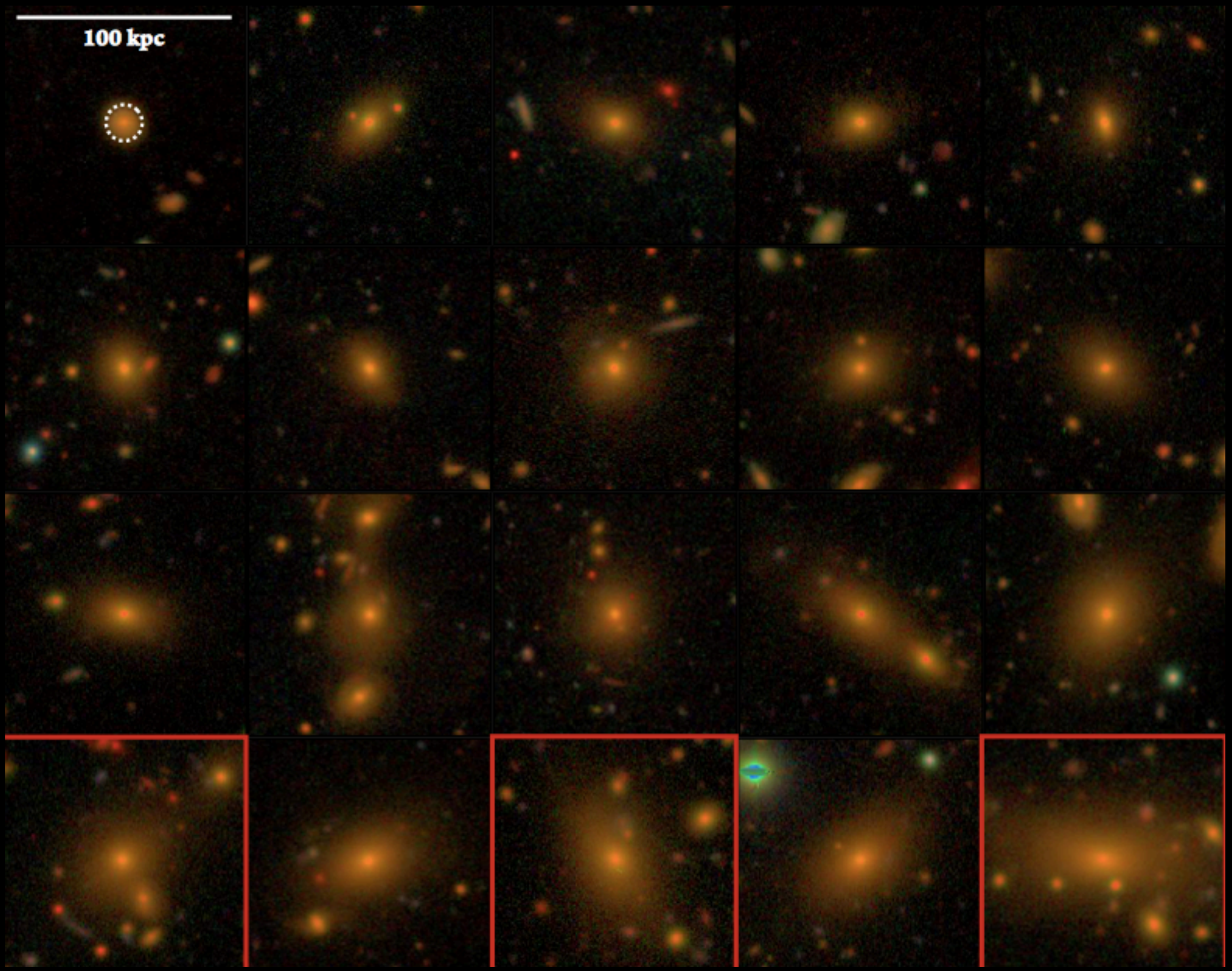
# A Large Sample of Super Massive Galaxies

3000 galaxies with $M_* > 10^{11.6}\ M_\odot$ 0.2 < redshift < 0.5

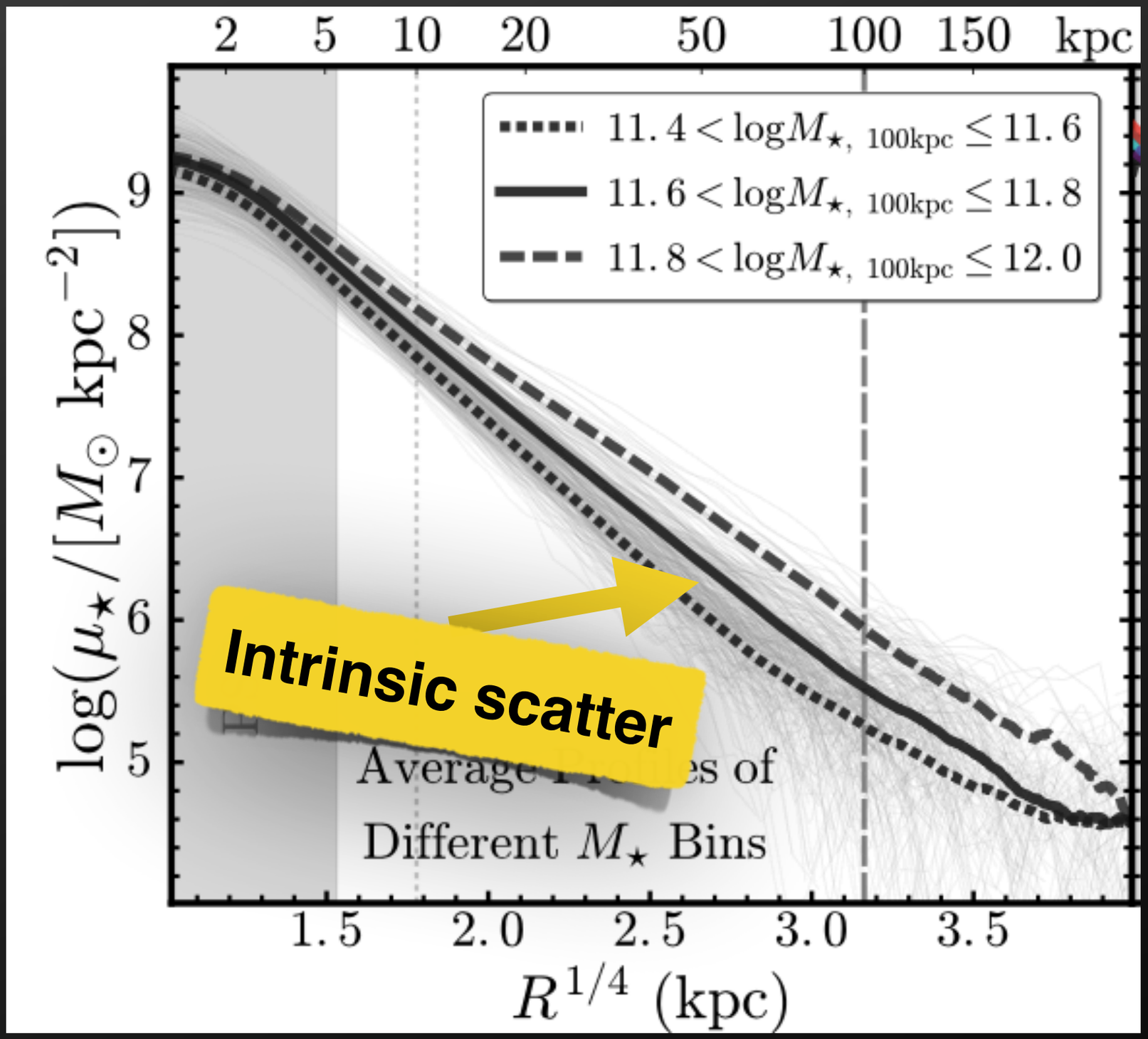



1D surface brightness profile




100 kpc

# Stellar Profiles of Super Massive Galaxies




*Huang et al. 2018a*

Profiles detected to 100 kpc

for individual galaxies

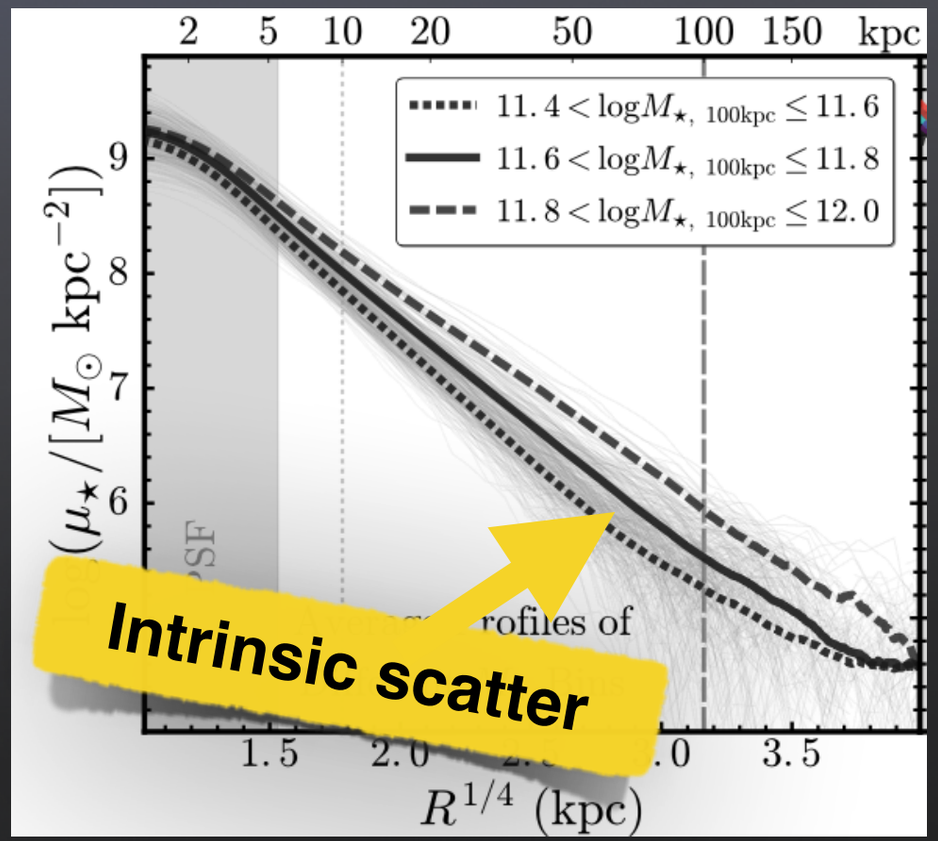
*no stacking!*

28 mag/arcsec$^2$

1. Massive Galaxies are not self similar

2. Large scatter in the outskirts (can be measured in HSC!)

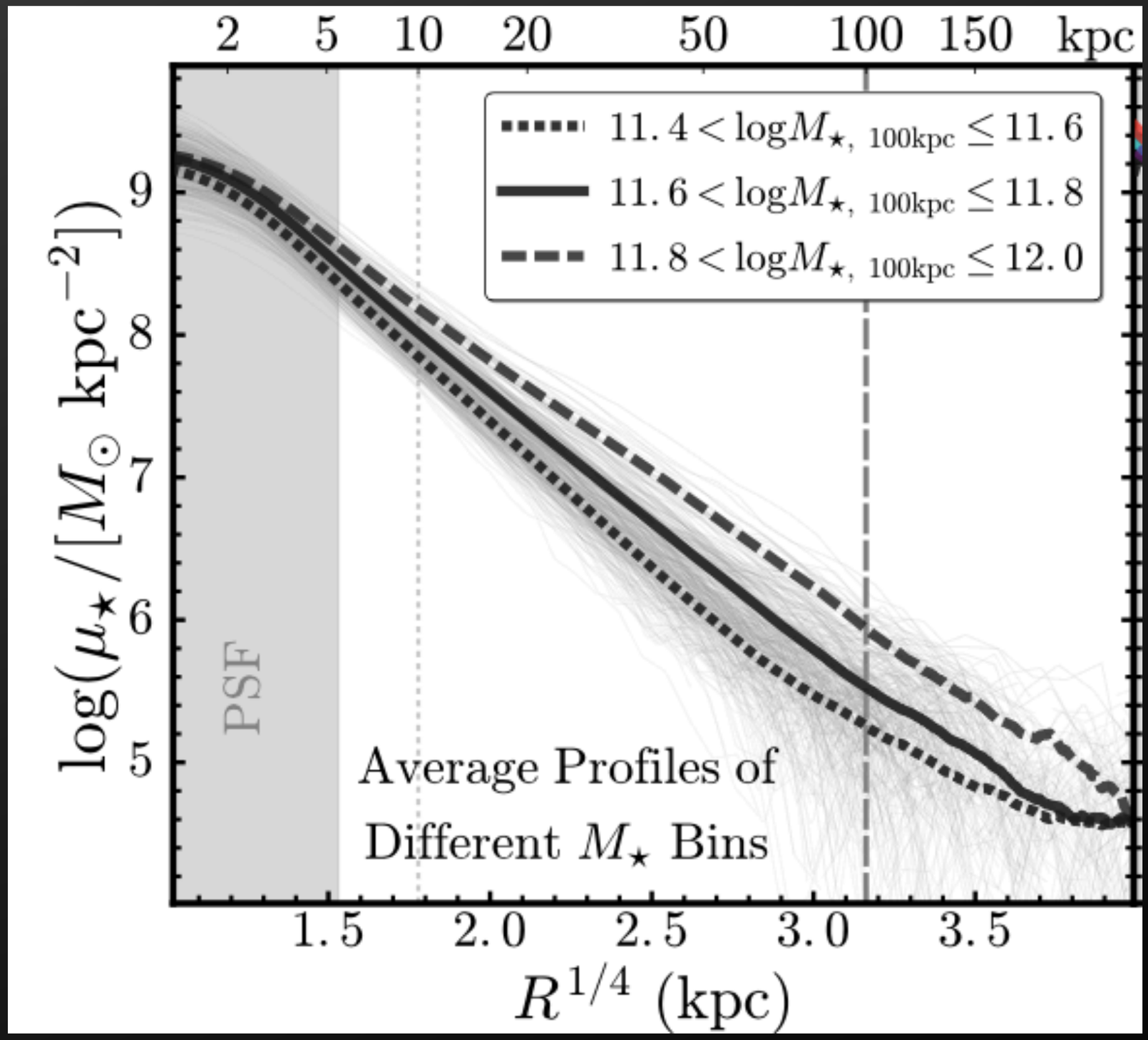
3. Diversity of massive galaxy outskirts



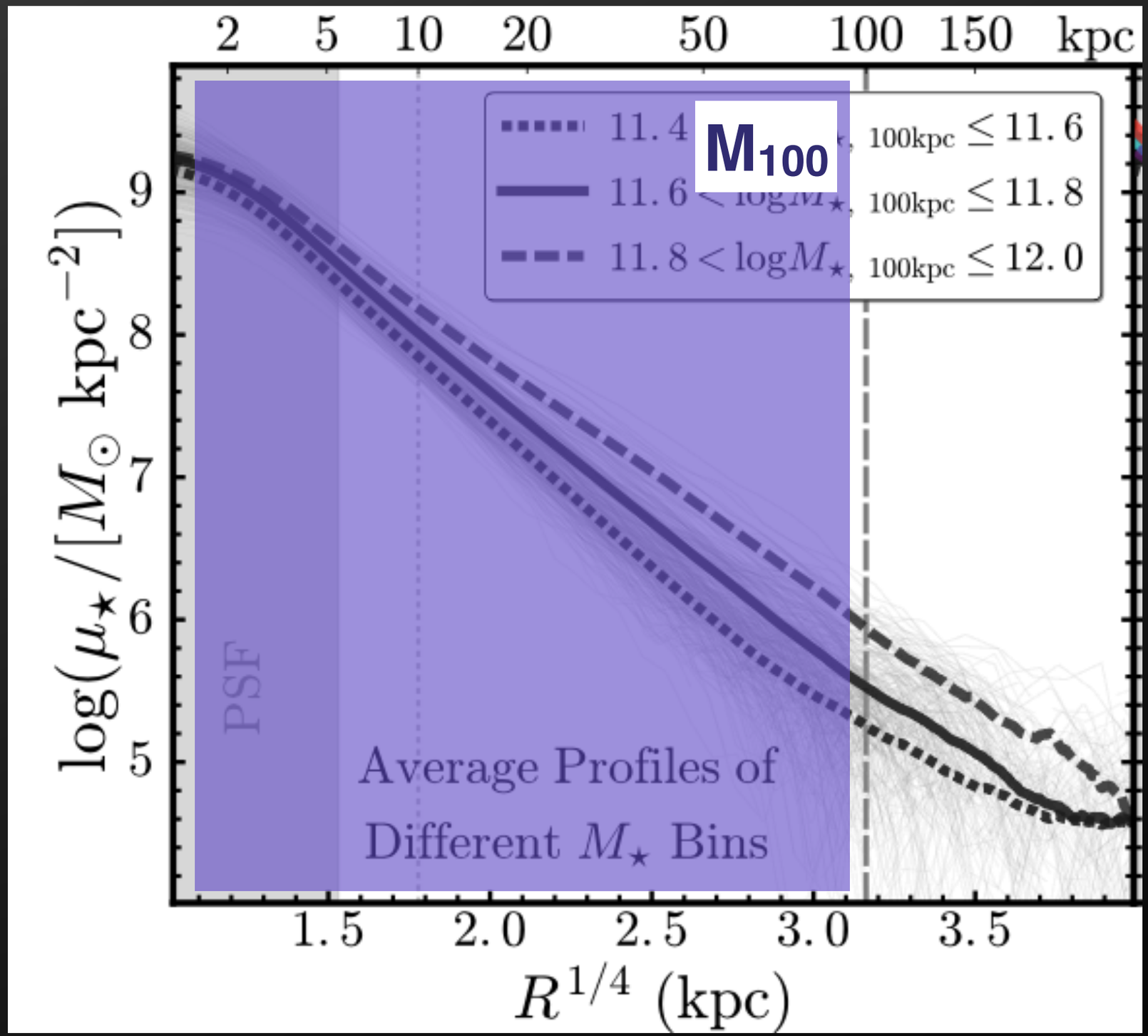

**Is the scatter amongst profiles (diversity of stellar envelopes) connected to dark matter halo mass?**

**Assembly of outer galaxy ⇔ assembly of dark matter halo?**

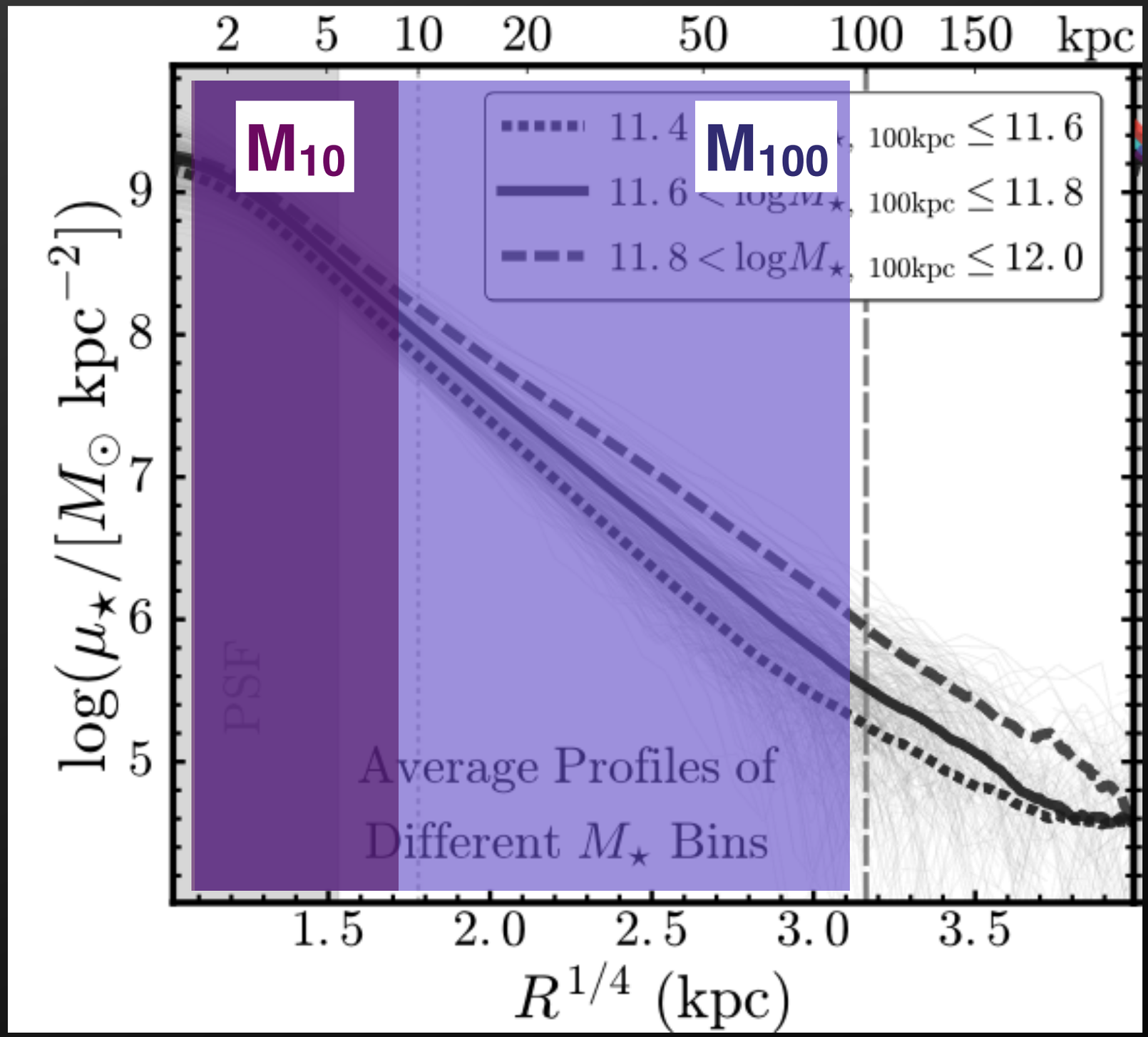
# $M_{10kpc}$ and $M_{100kpc}$ Masses



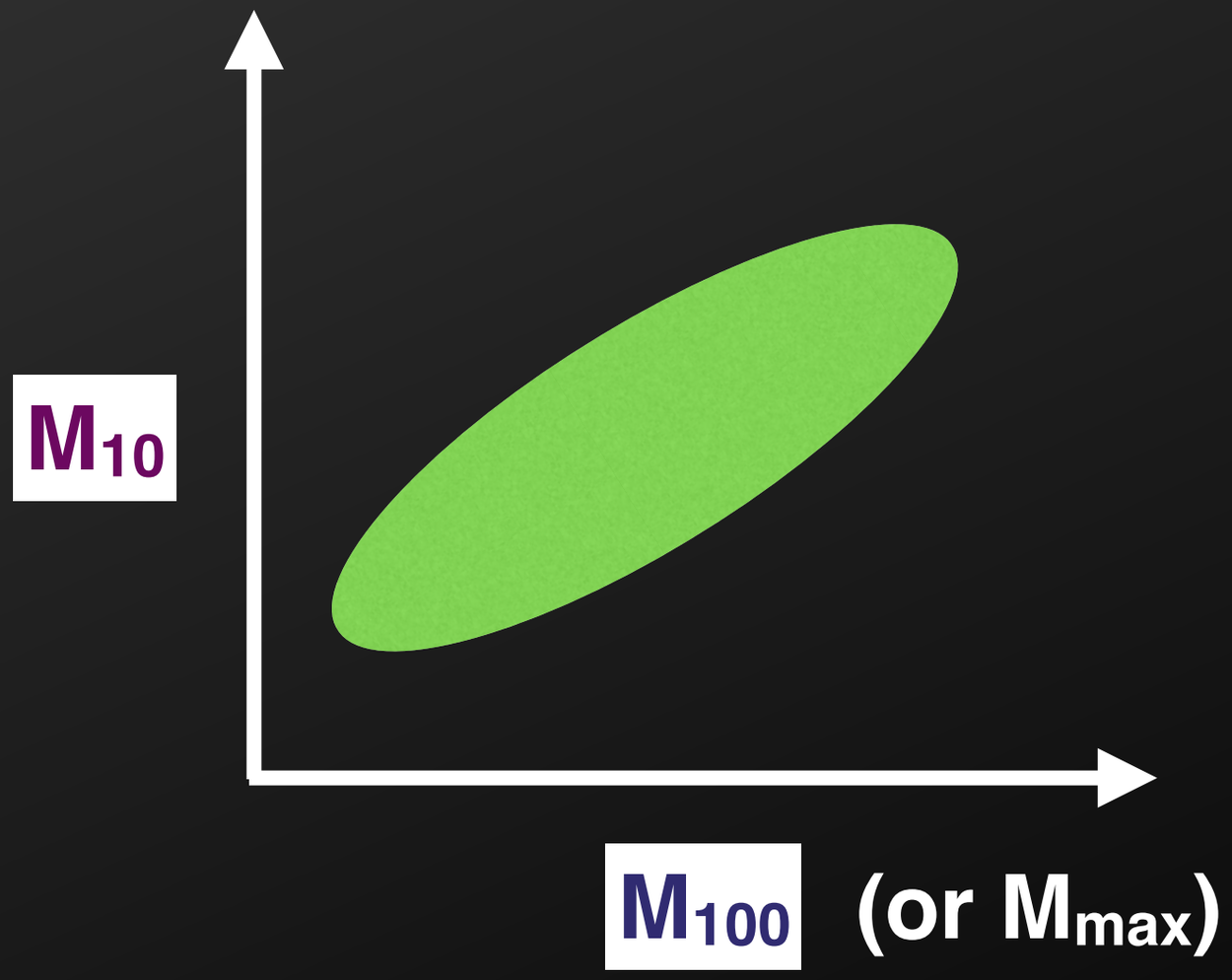
# $M_{10kpc}$ and $M_{100kpc}$ Masses

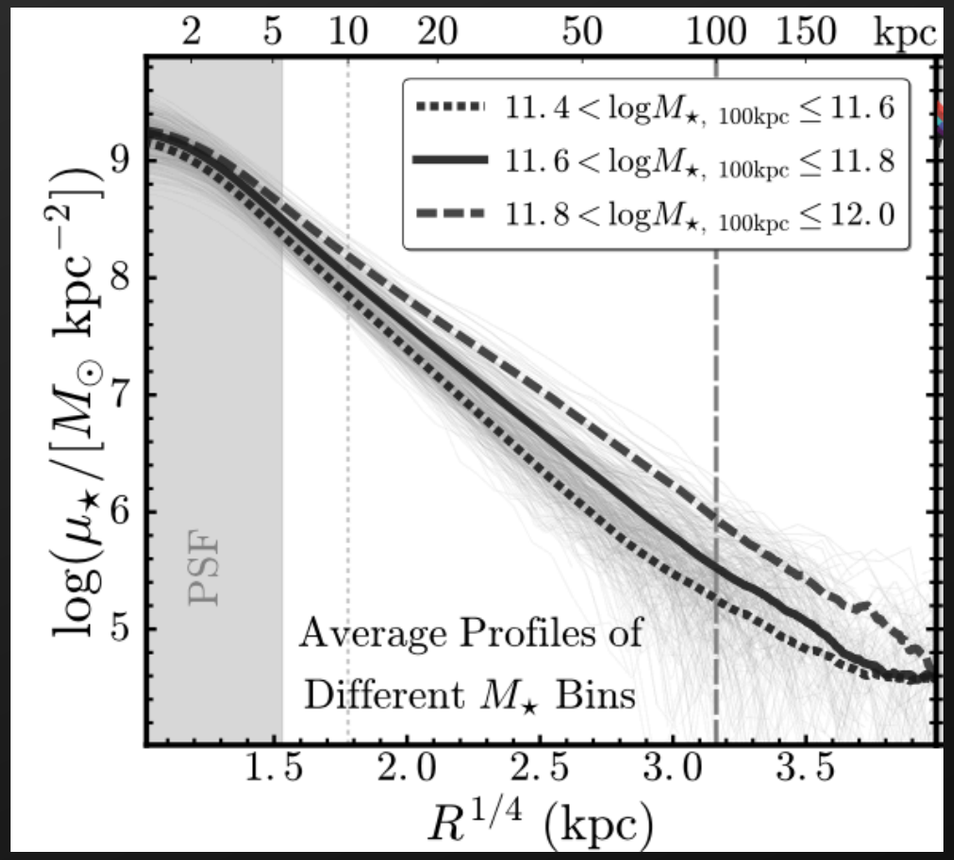


# $M_{10kpc}$ and $M_{100kpc}$ Masses

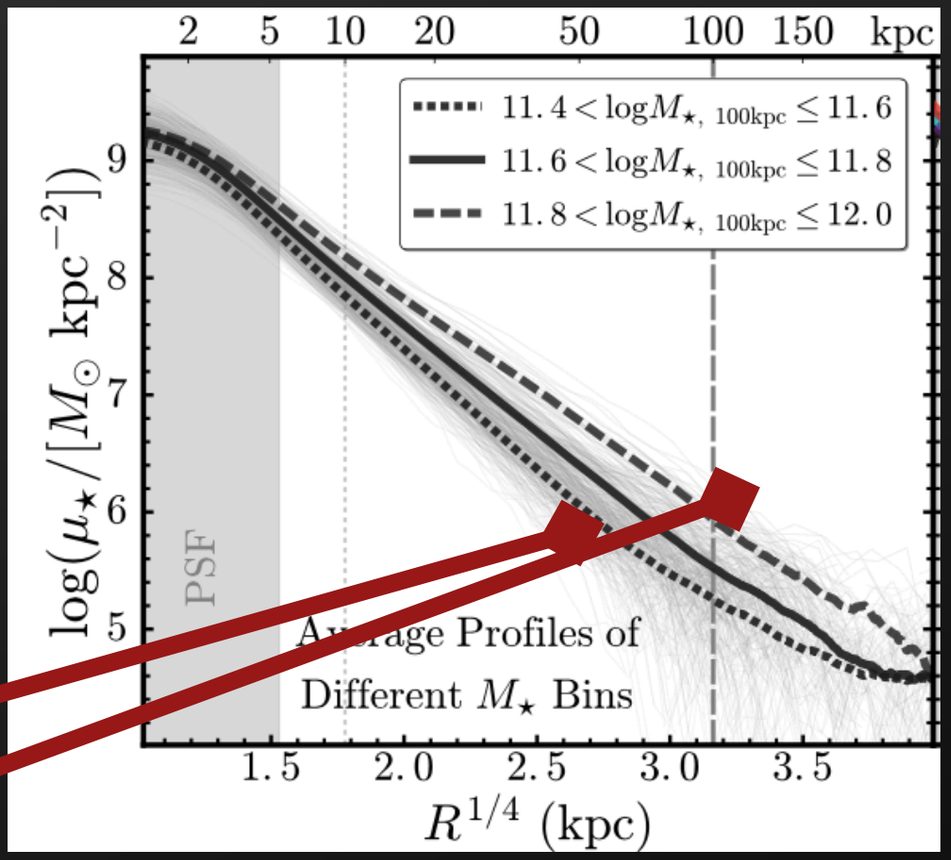


# Diversity of Stellar Envelopes



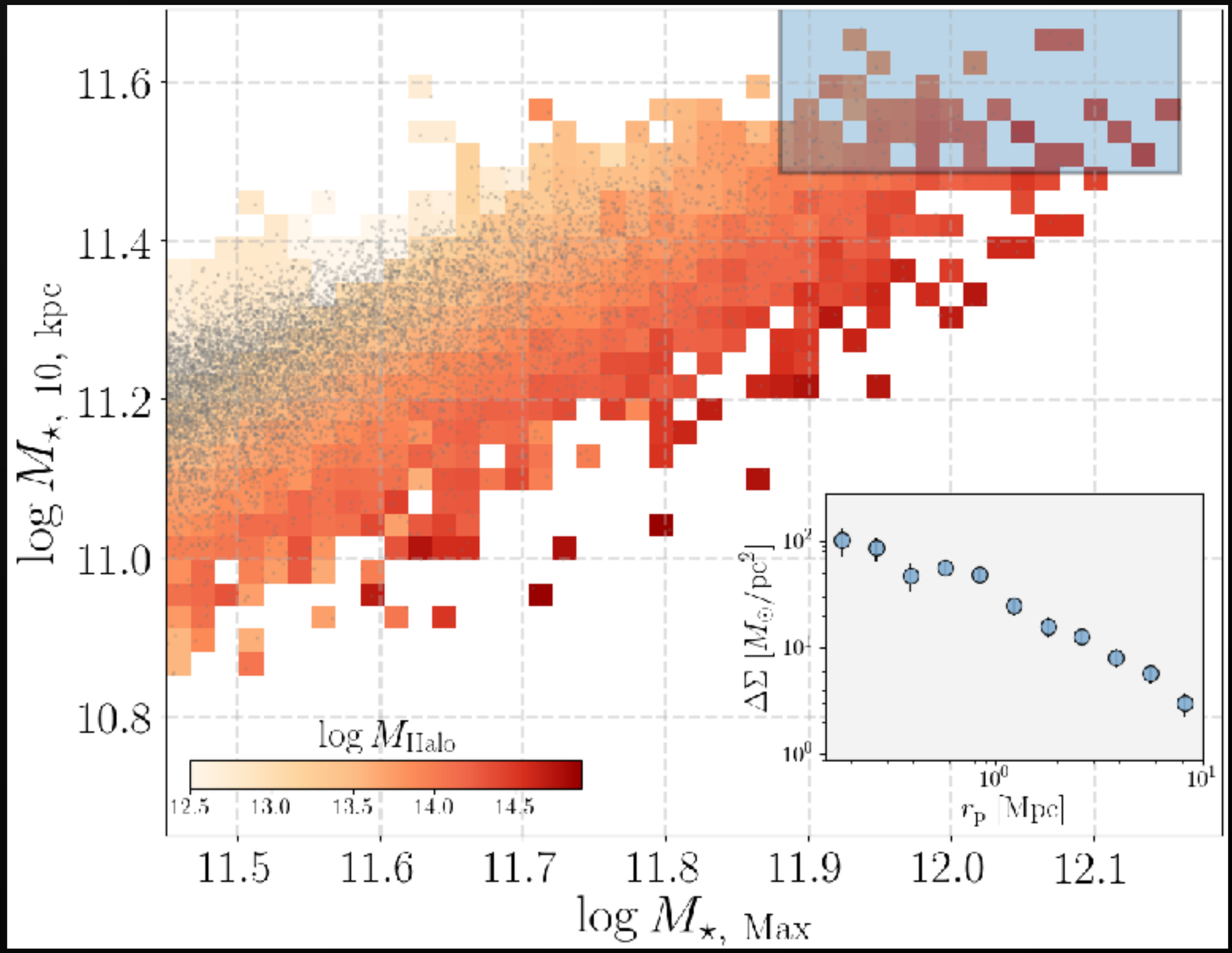
# Diversity of Stellar Envelopes




**$M_{10}$**

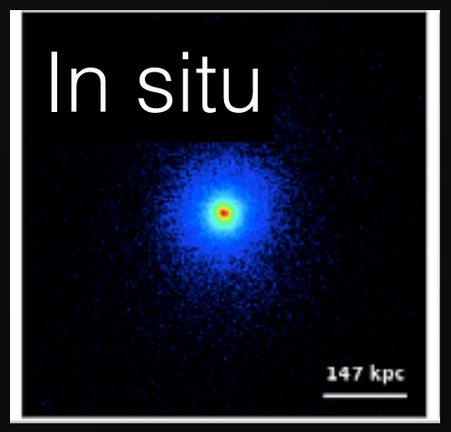
**$M_{100}$ (or $M_{max}$)**

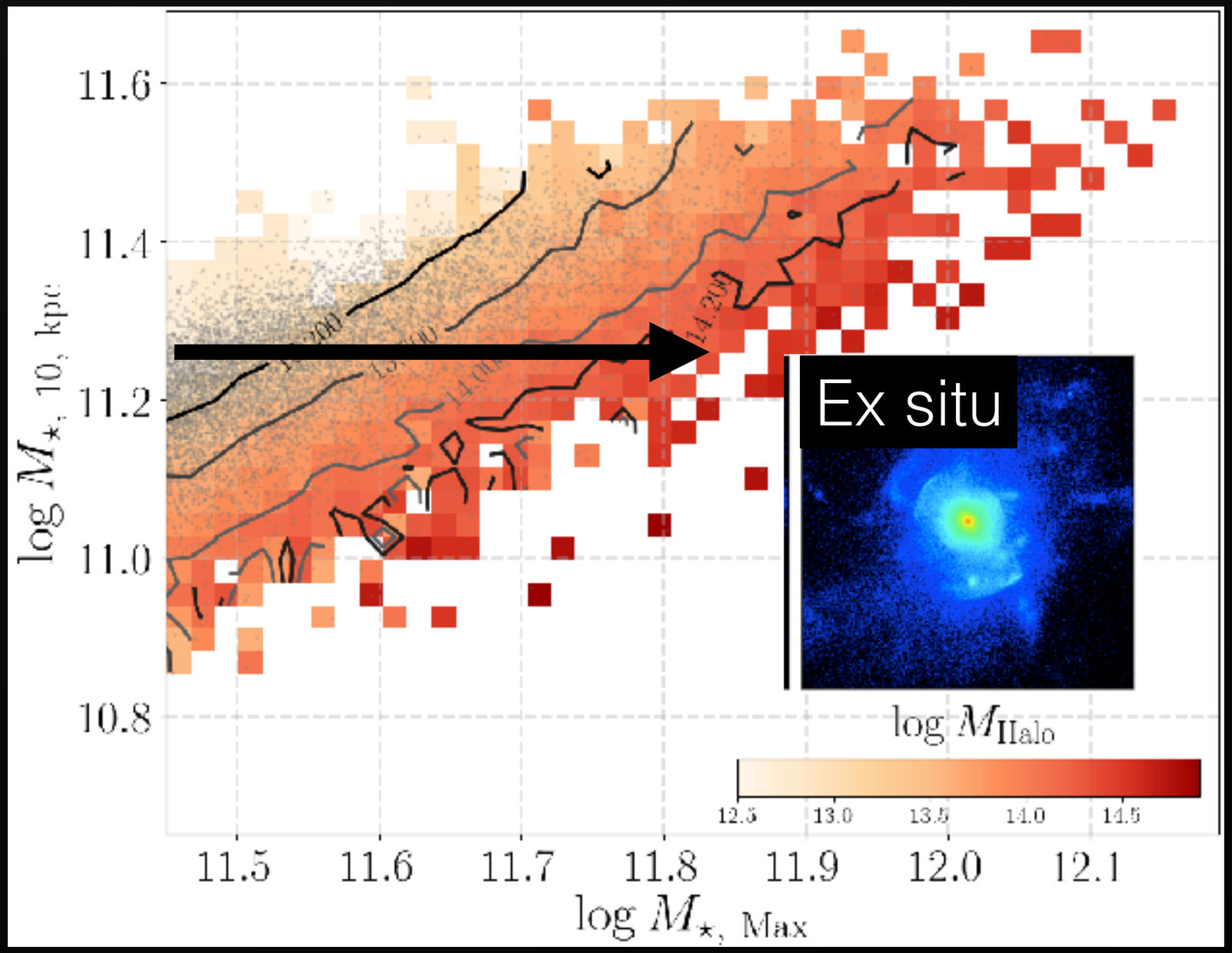
# $M_{10} \Leftrightarrow M_{100} \Leftrightarrow M_{halo}$



# Larger Envelopes = Larger Dark Matter Halo

(Halo mass dependence of the mass-size relation)



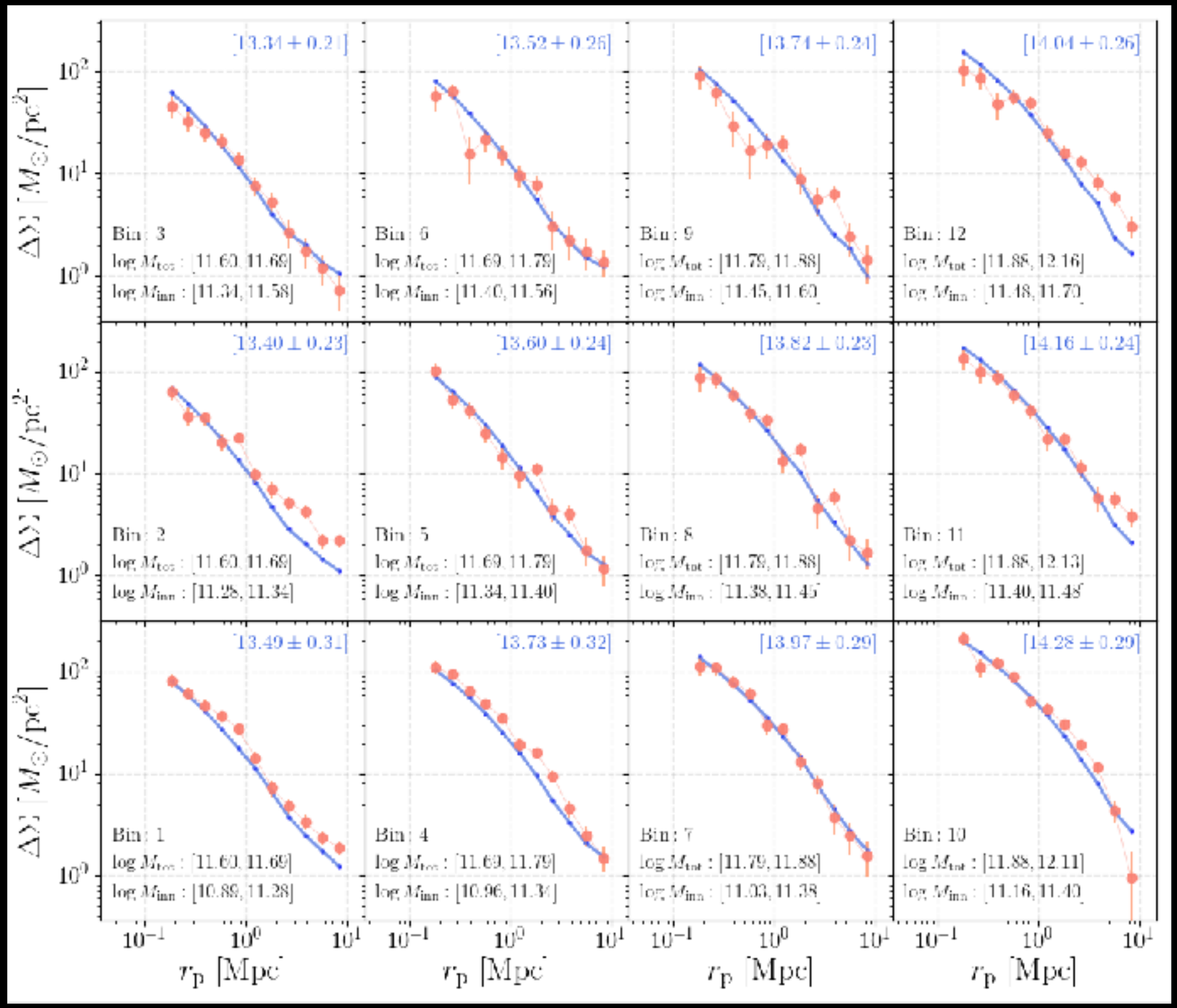



Mass within 10 kpc

Top 1/3

Middle 1/3

Bottom 1/3

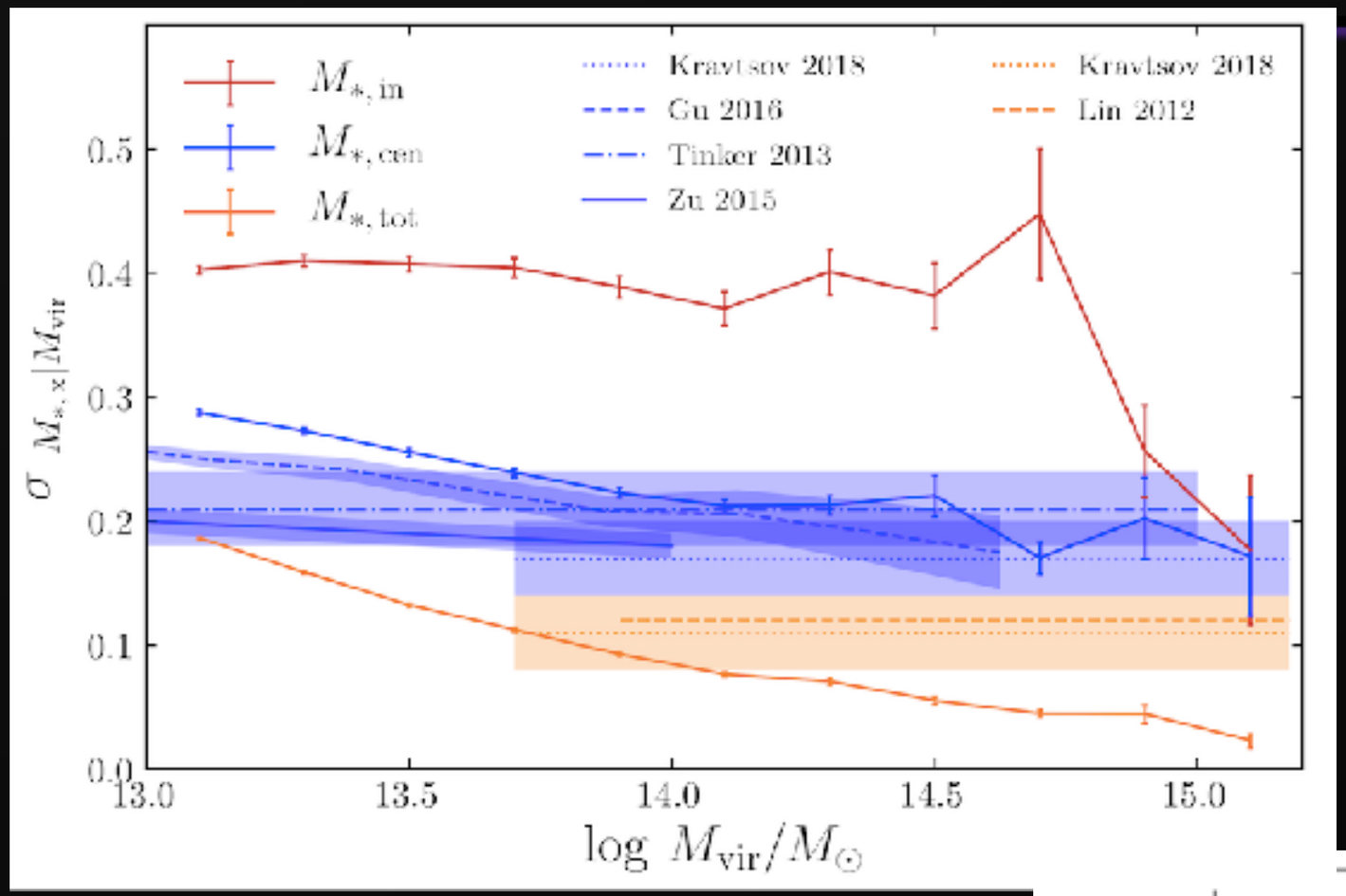



Mass within 100 kpc

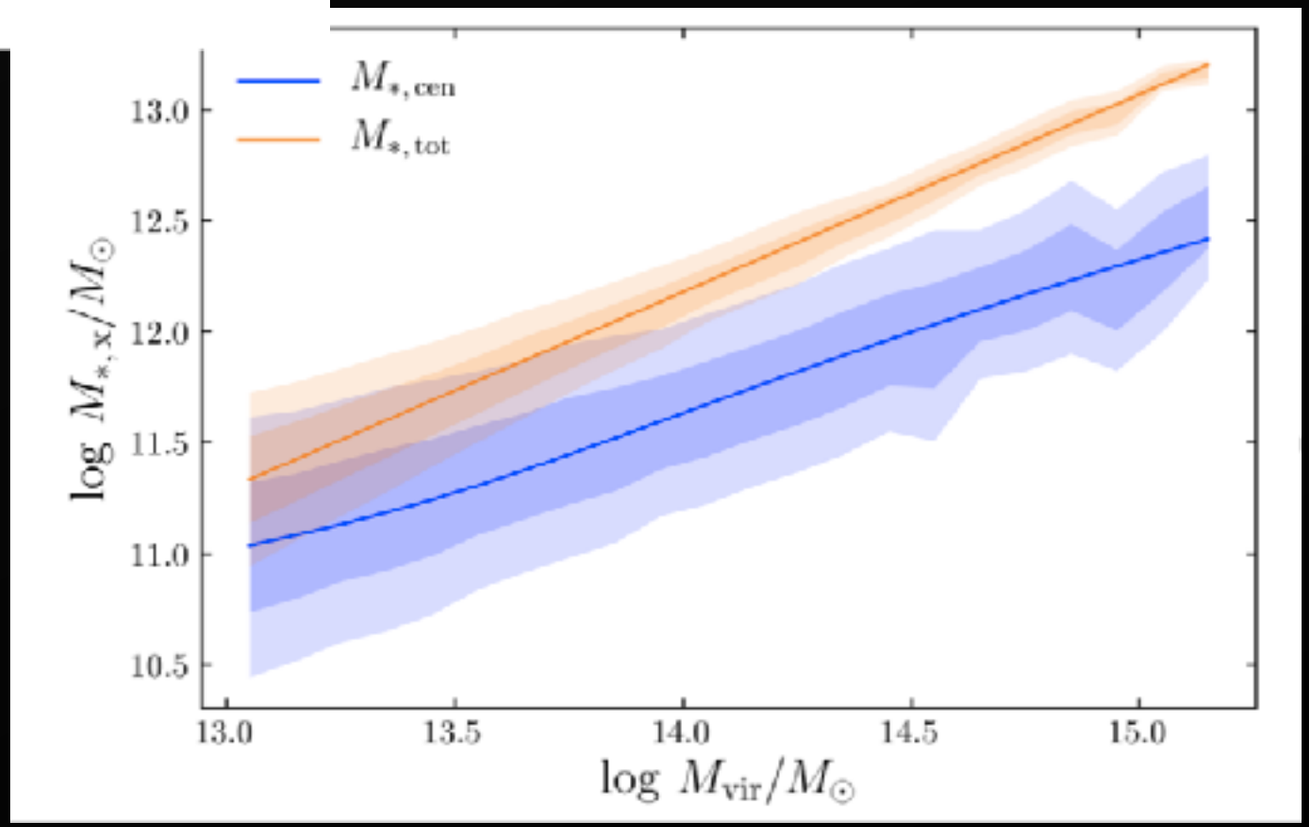
*Huang et al. 2018c in prep*

*Also see Charlton et al. 2017*

# Scatter in Stellar to Halo Mass




Christopher Bradshaw
et al in prep

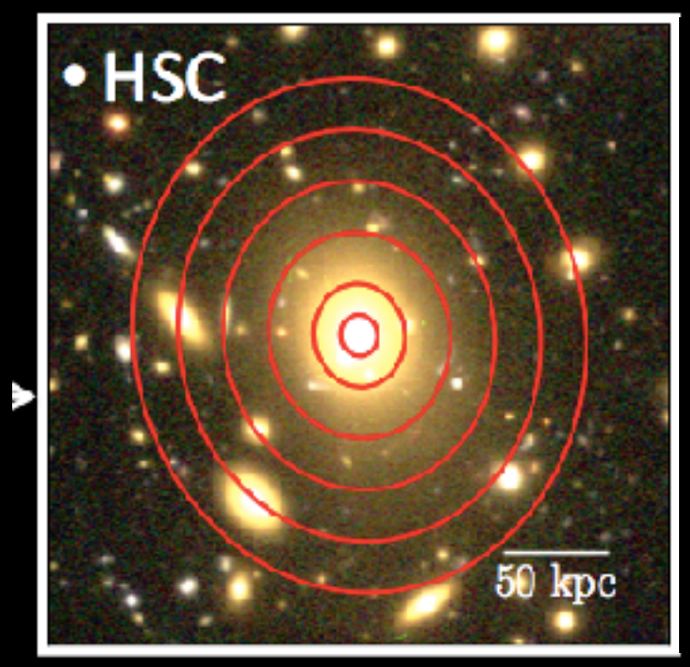


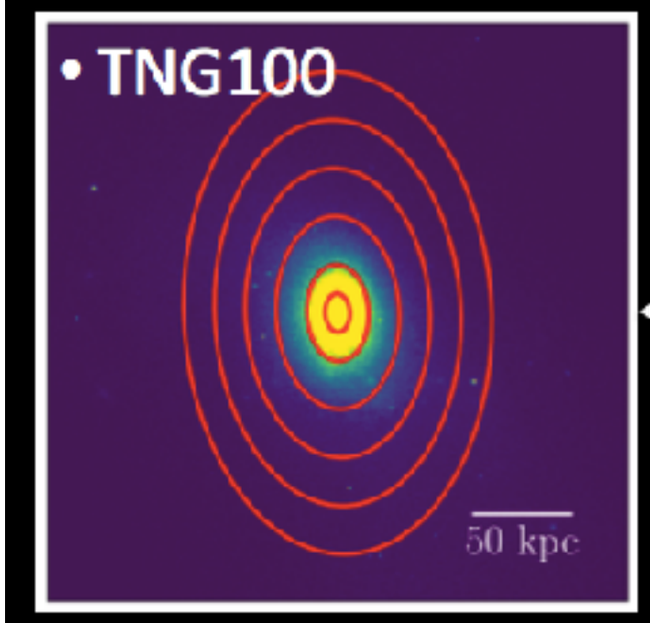
*Yifei Luo*

*Dwarf galaxies*

*Enia Xhakaj*

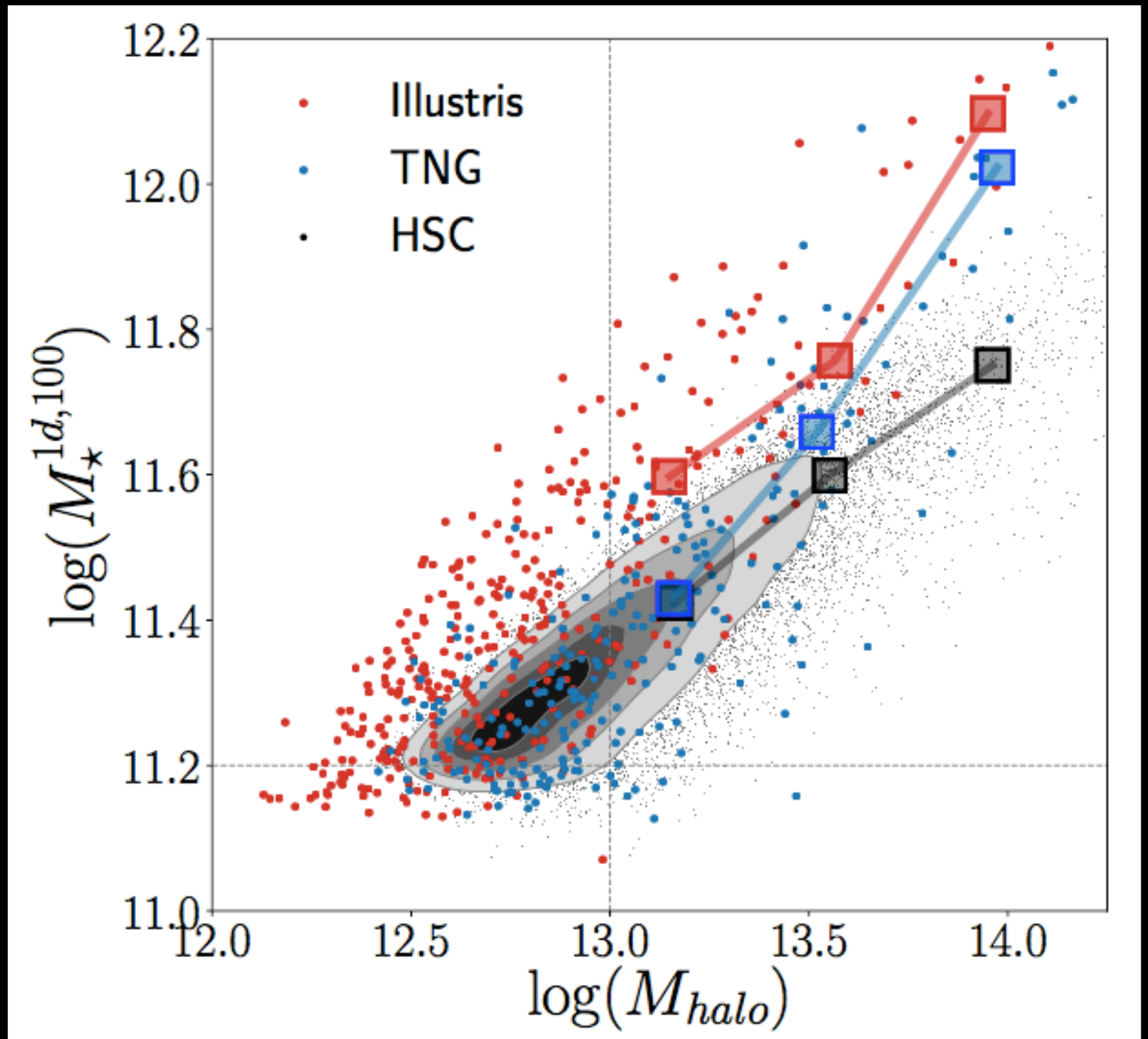
*Splashback radius with lensing*



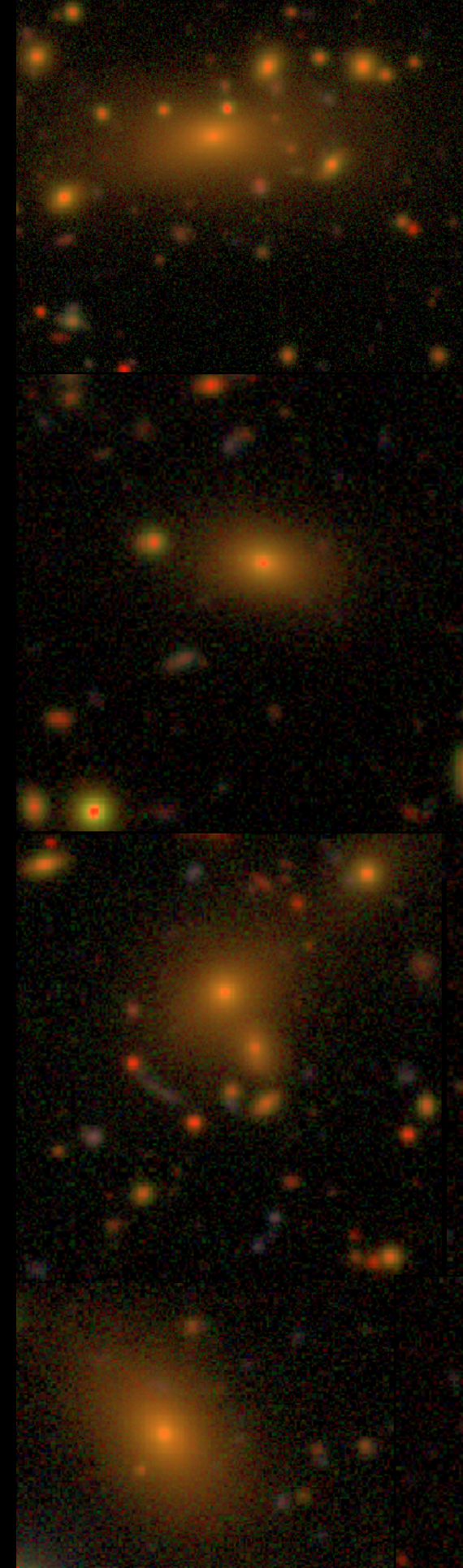

*Apples to apples comparison between HSC and predictions from hydro simulations*

*Felipe Ardila*


Illustris
TNG
HSC
12.2
12.0
11.8
11.6
11.4
11.2
11.0
12.0
12.5
13.0
13.5
14.0
$\log(M_{\star}^{1d,100})$
$\log(M_{halo})$

# Summary

- HSC detects lights of super massive galaxies to 100 kpc
- Super massive galaxies are not self similar - diversity of stellar envelopes
- Weak lensing ⇒ tight scaling relation between amplitudes/slopes of light profiles and dark matter halo mass
- References:
  *Huang et al. 2018a arXiv:1707.01904*
  *Huang et al. 2018b arXiv:1803.02824*
  *Huang et al. 2019*
- *DESI is starting soon! Lensing of DESI galaxies!*
- Christopher Bradshaw: scatter in M* - Mhalo



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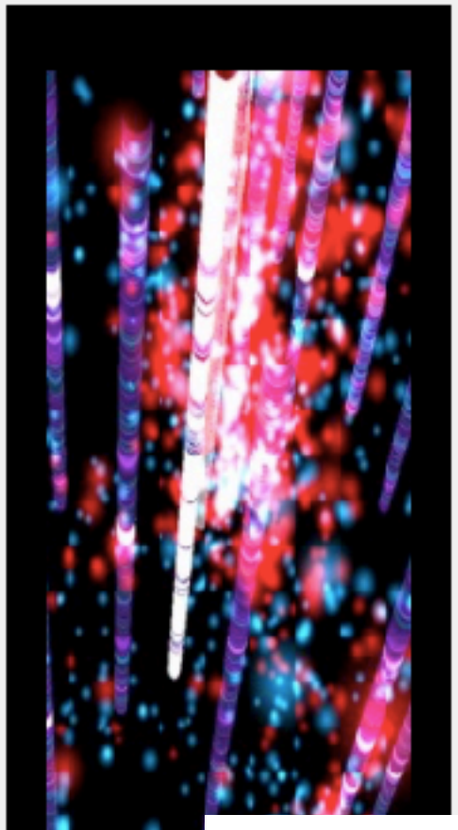

# KSPA 2019

Kavli Summer Program In Astrophysics 2019:

Machine Learning in the era of large astronomical surveys

UC Santa Cruz, July 8th - August 16th, 2019

The past decade has ushered in the era of Big Data in astronomy -- multiple surveys that image large areas of the night sky, spectroscopic programs that compile millions of spectra each comprised of thousands of data-points, and large-scale numerical simulations capable of generating Terabytes of outputs in a single run. This torrent of data is forcing the astronomical community to evolve away from traditional approaches to data analysis. Even algorithms and techniques developed for modest datasets are being overwhelmed or lack sufficient

## Galaxy-Galaxy Lensing in HSC: Validation Tests and the Impact of Heterogeneous Spectroscopic Training Sets

Joshua S. Speagle[1]*†, Alexie Leauthaud[2], Song Huang[2],
Christopher P. Bradshaw[2], Felipe Ardila[2], Peter L. Capak[3],
Daniel J. Eisenstein[1], Daniel C. Masters[4], Rachel Mandelbaum[5],
Surhud More[6,7], Melanie Simet[5] et al.

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