

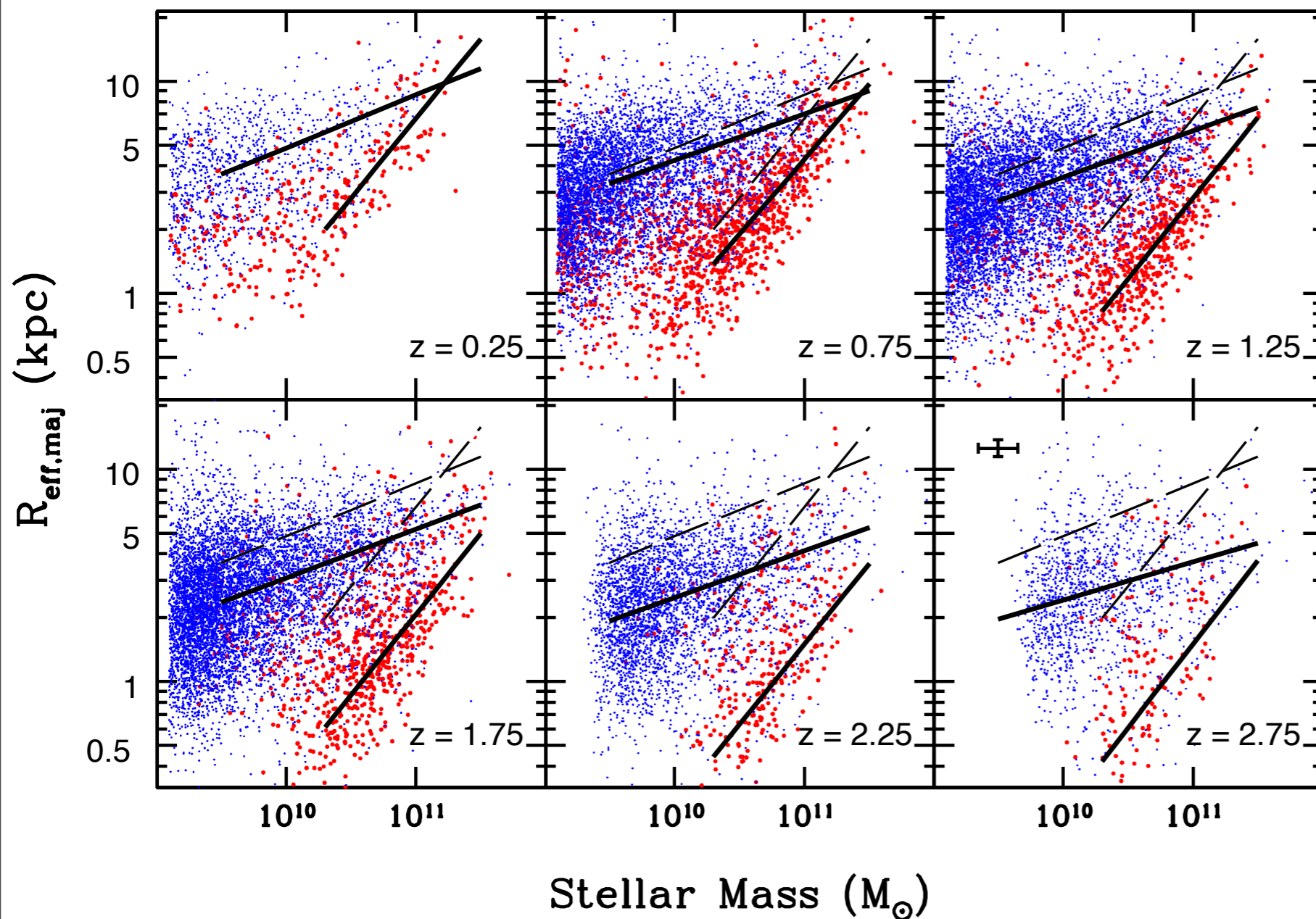
Structural Analysis of
Ultra-Massive Galaxies at
 $1.5 < z < 3.0$:
Preliminary results from WFC3
Imaging

Cemile Marsan

(Tufts University)

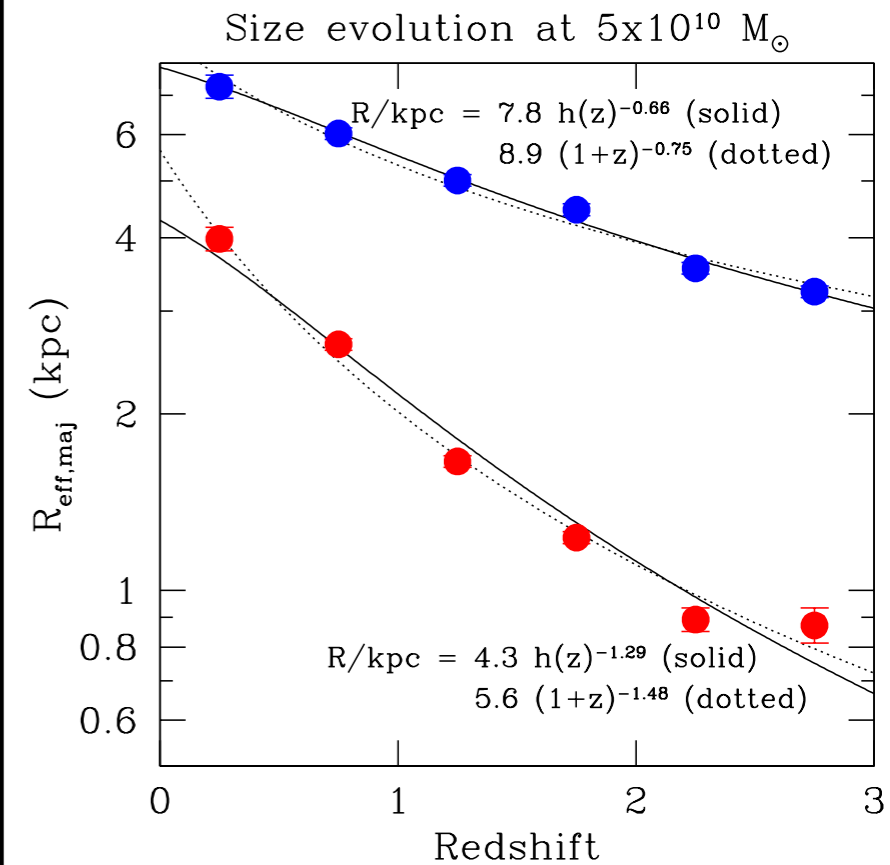
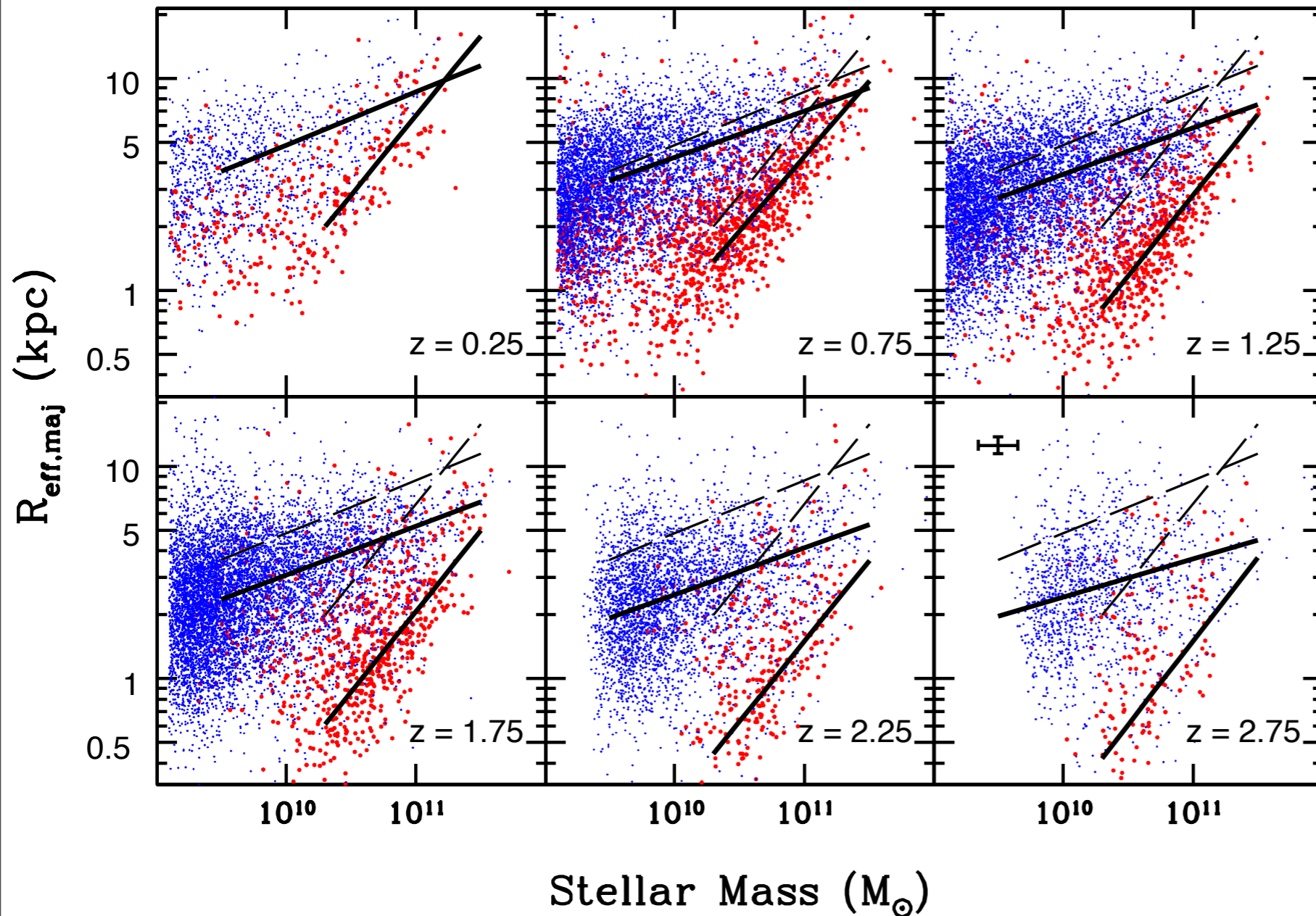
D. Marchesini, A. Muzzin, G. Brammer
+ NMBS-II and UltraVISTA collaborators

Size Evolution in Massive Galaxies



van der Wel +14 & many others

Size Evolution in Massive Galaxies



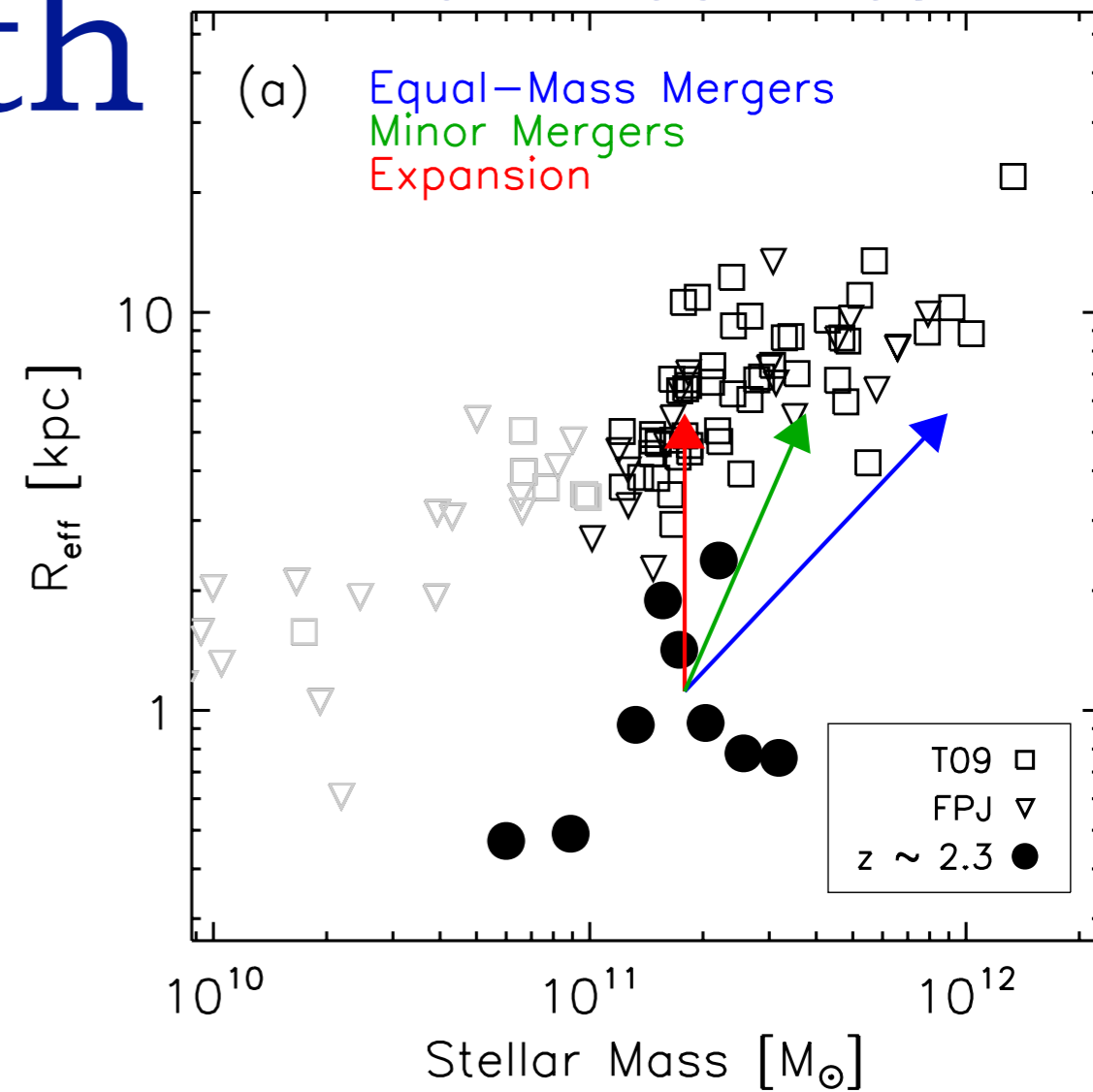
van der Wel +14 & many others

Inside-out Growth

Inside-out Growth

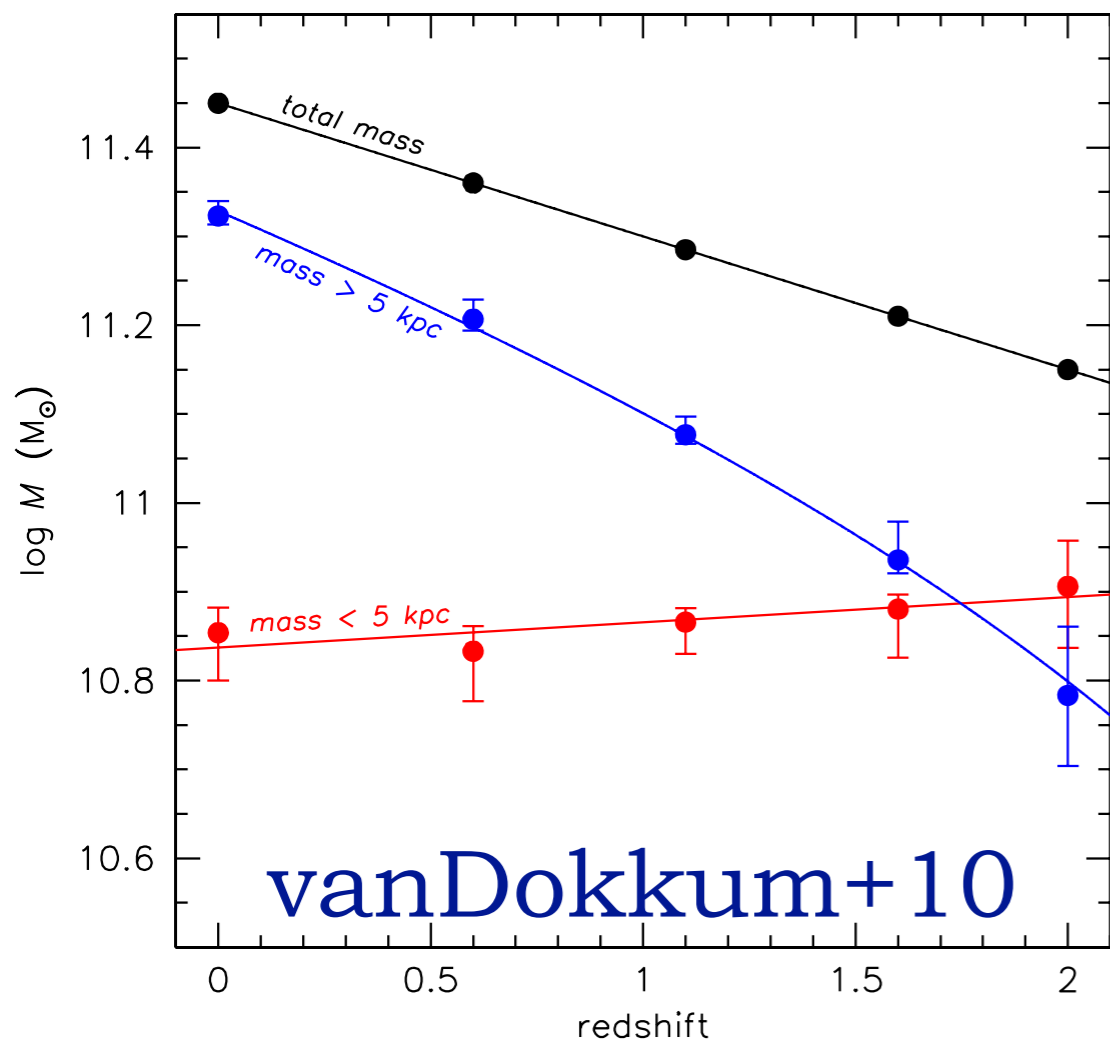
- Size growth via minor mergers

Bezanson+09

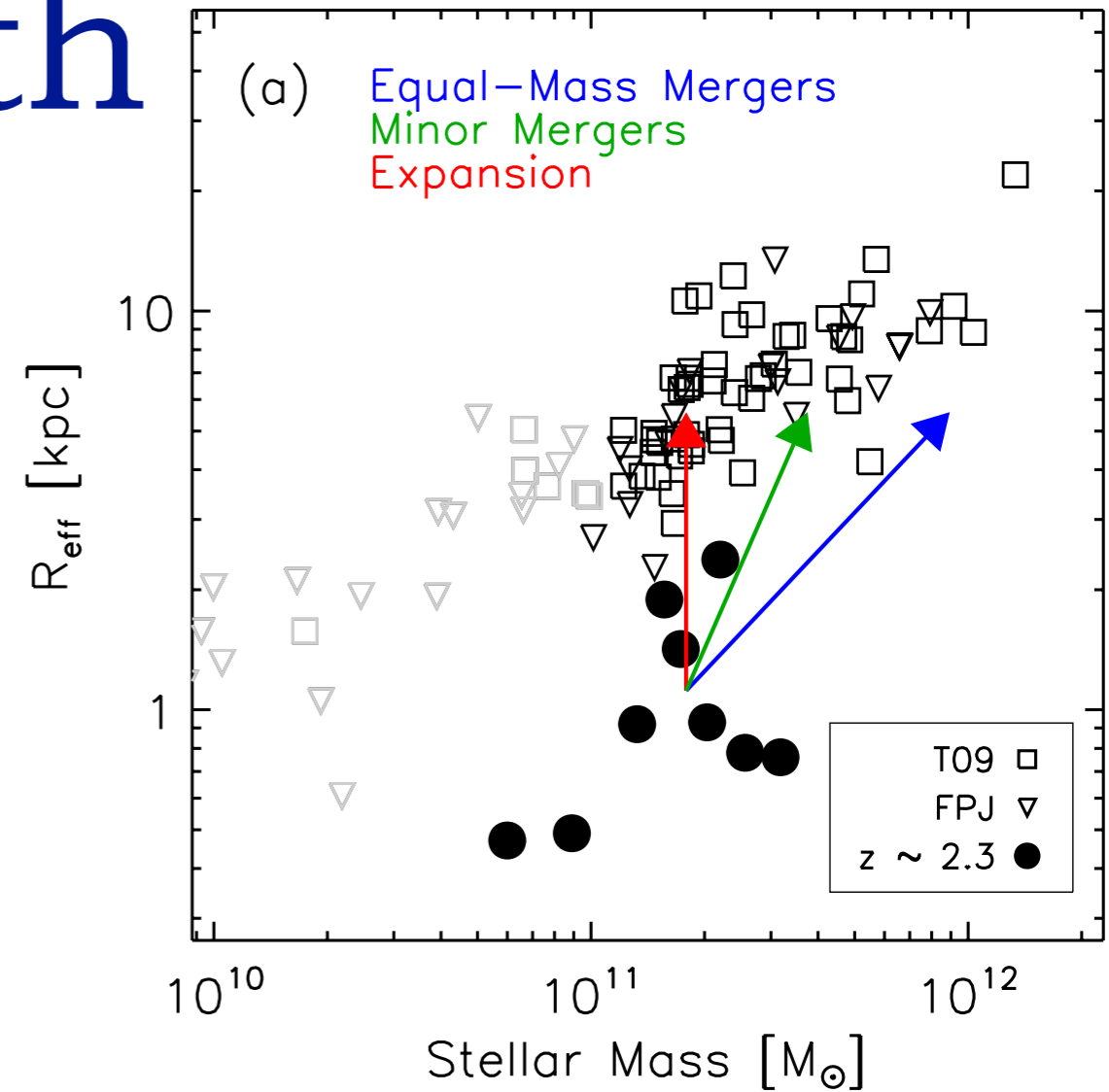


Inside-out Growth

- Size growth via minor mergers
- Dense core formed at high- z



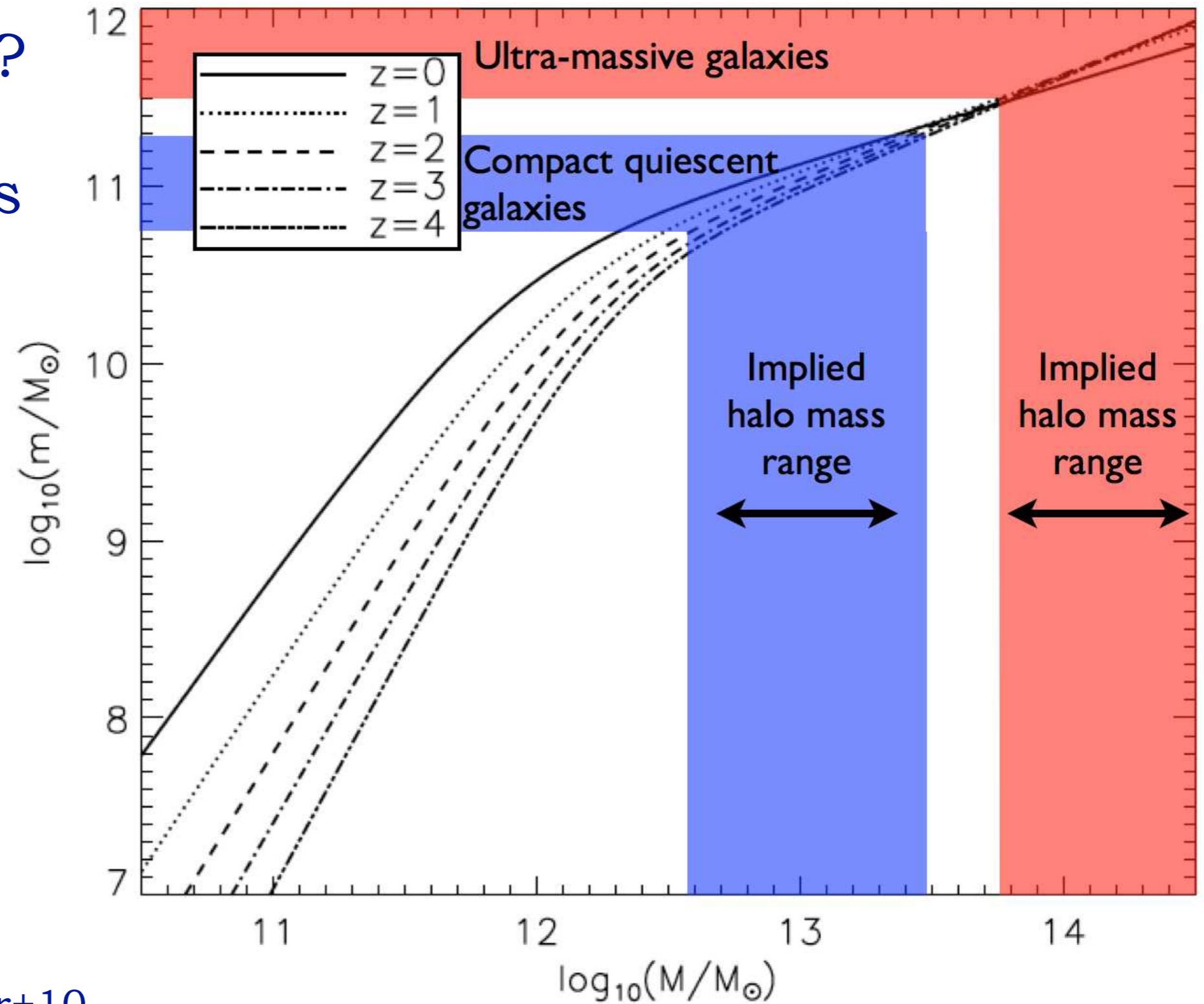
Bezanson+09



BCG Size Evolution

proto-BCGs?

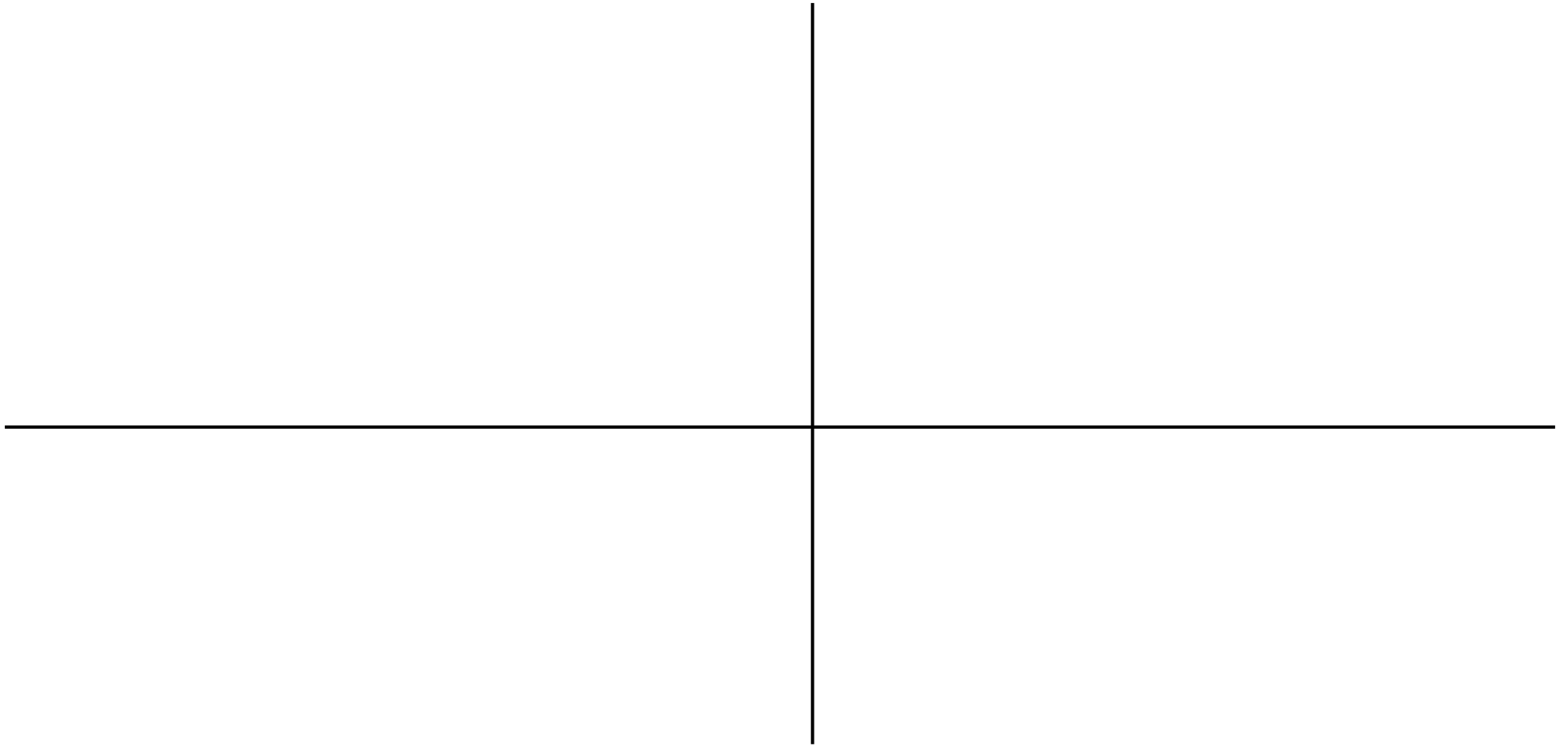
proto-BGGs



adapted from Moster+10

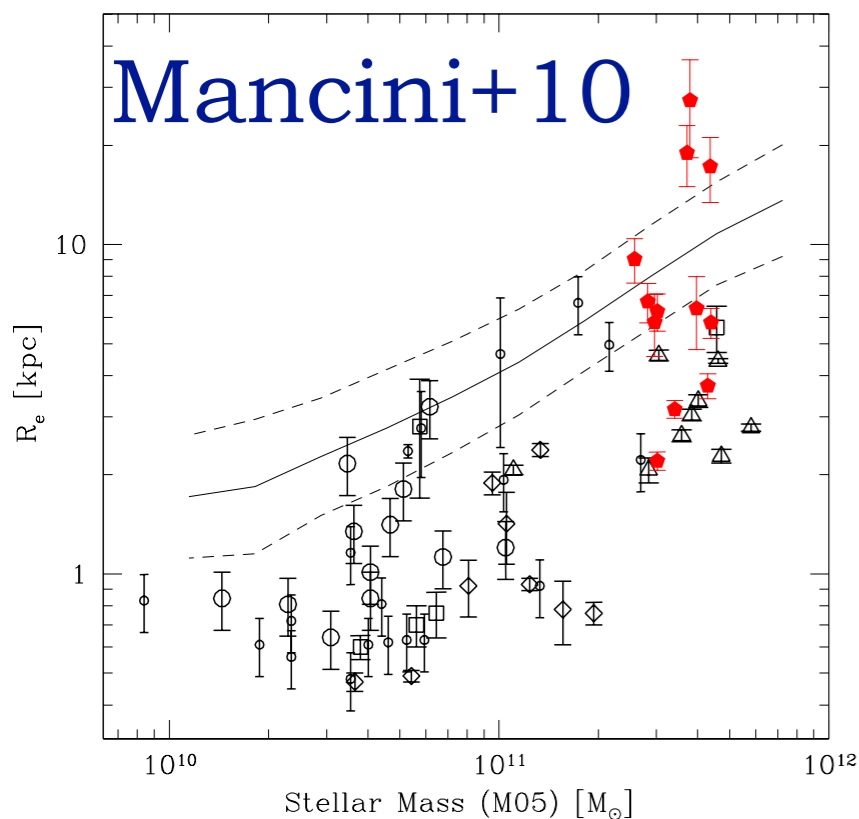
Accelerated Size Evolution in UMGs?

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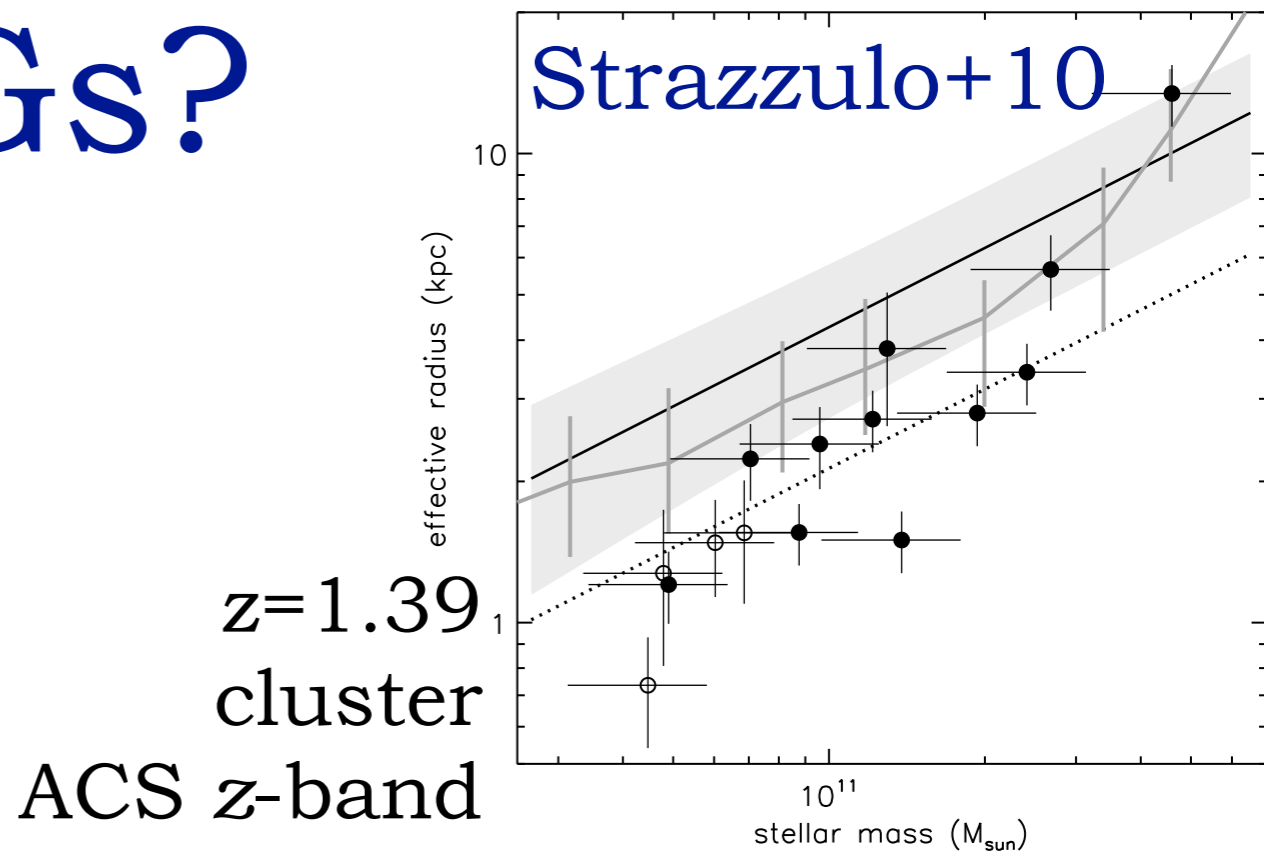


Accelerated Size Evolution in

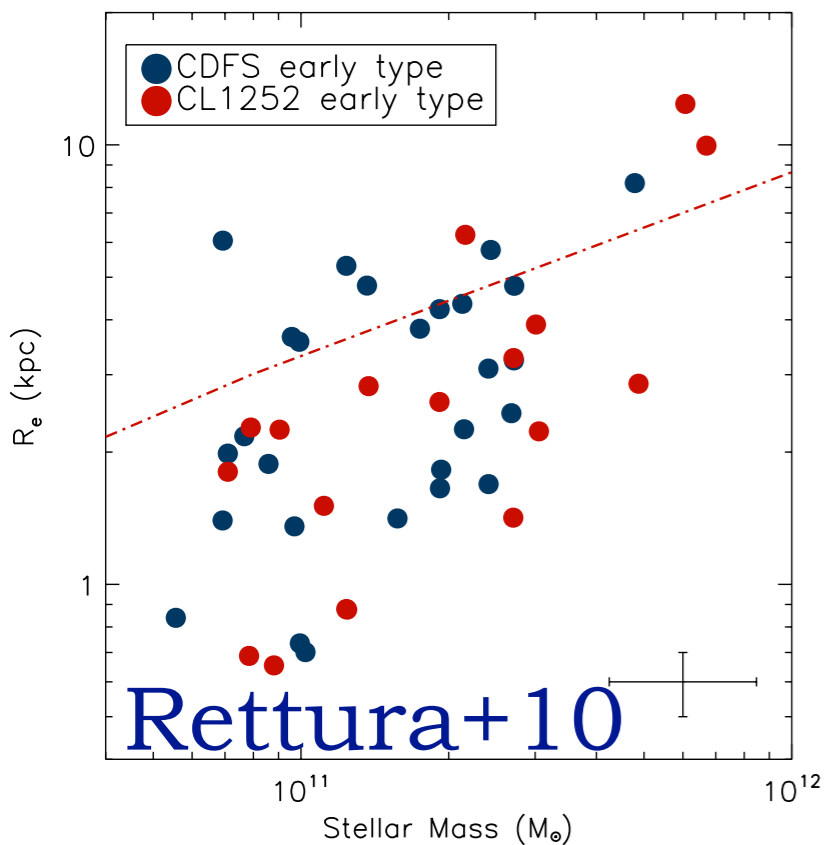
UMGs?



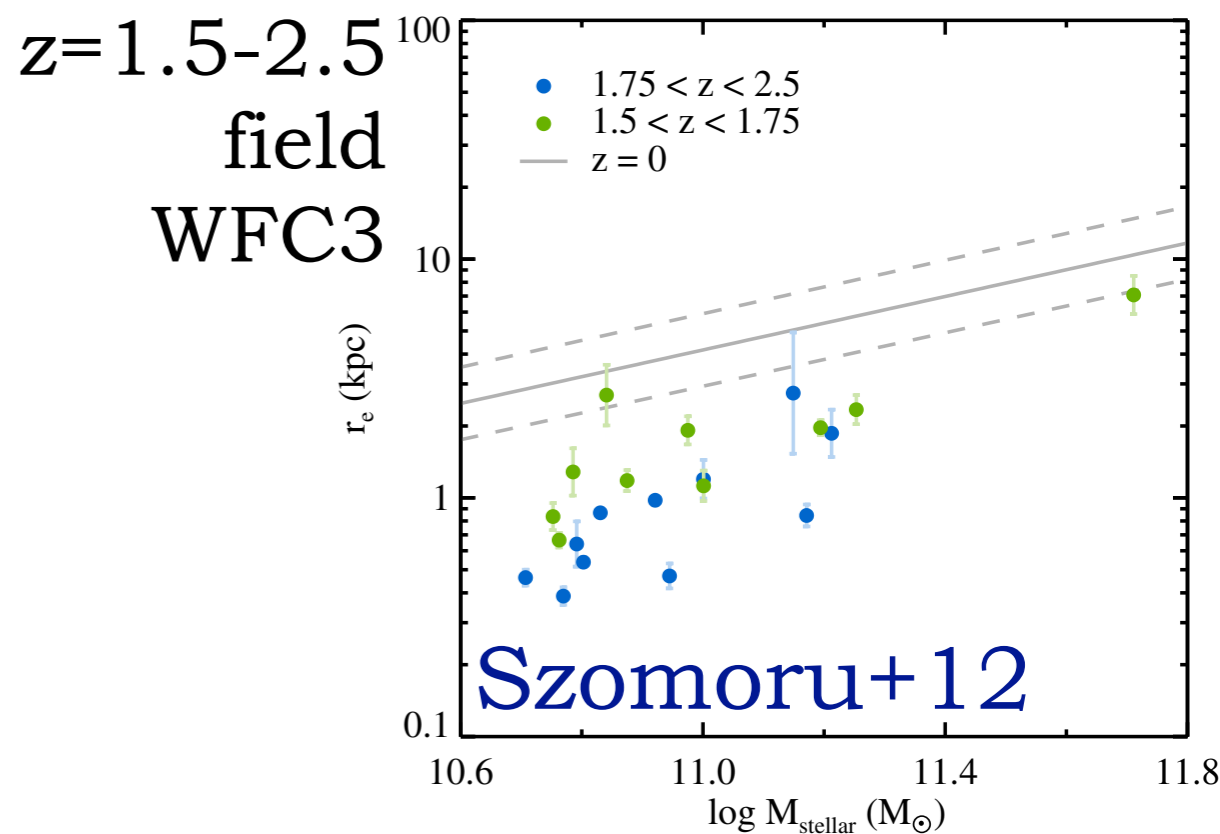
$z=1.4-1.7$
field
ACS *I*-band



$z=1.39$
cluster
ACS *z*-band



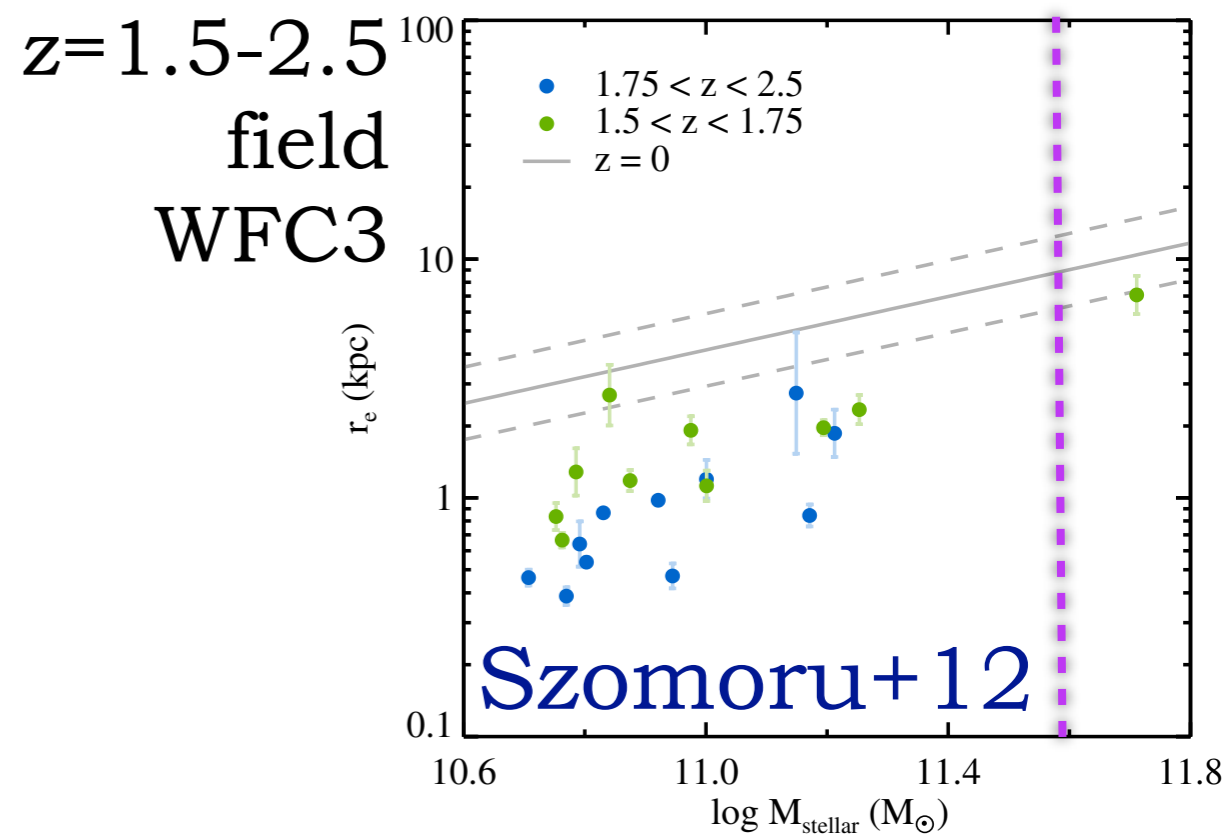
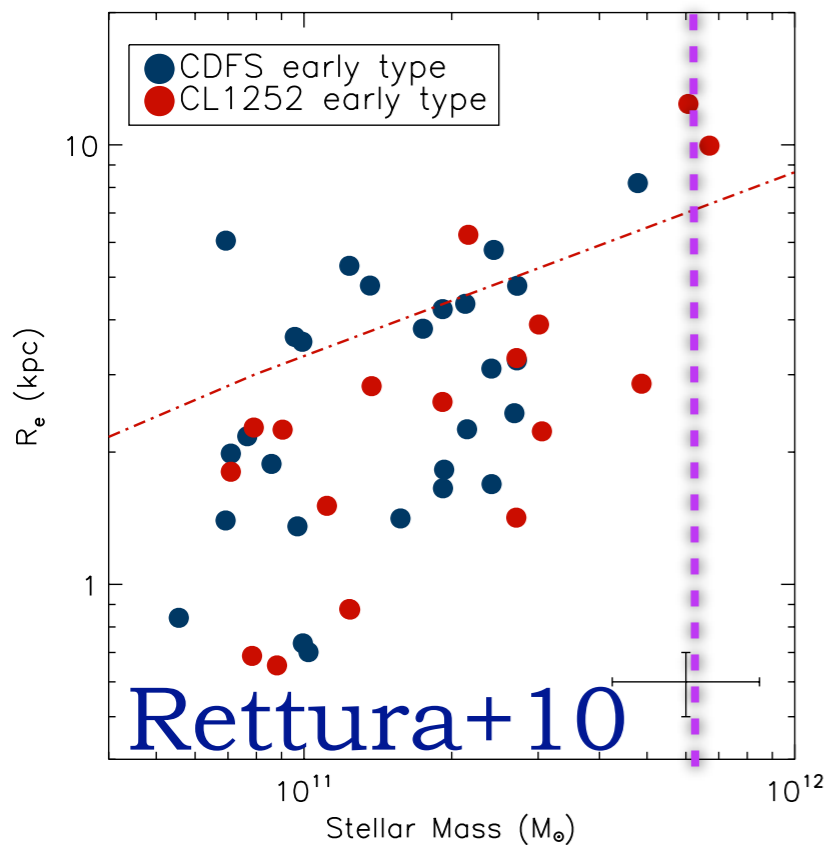
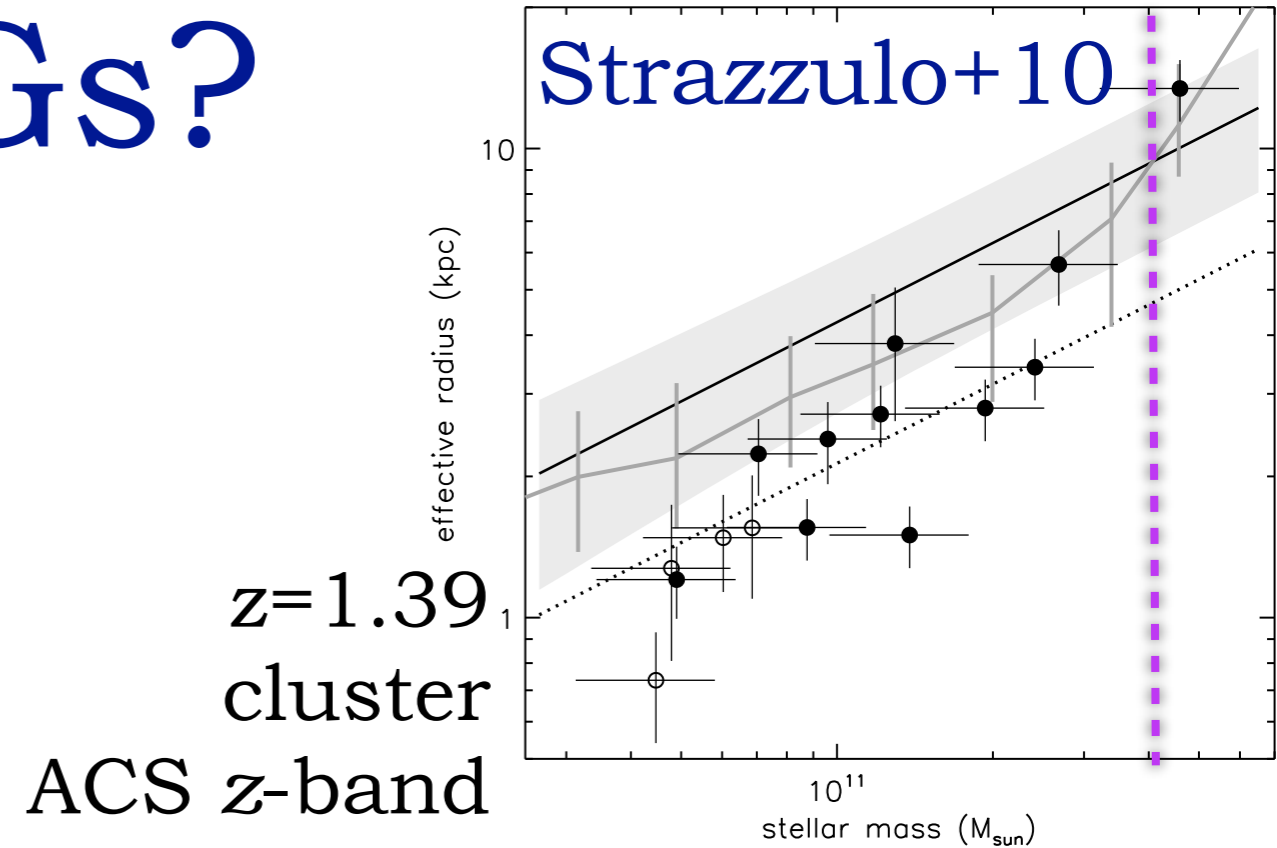
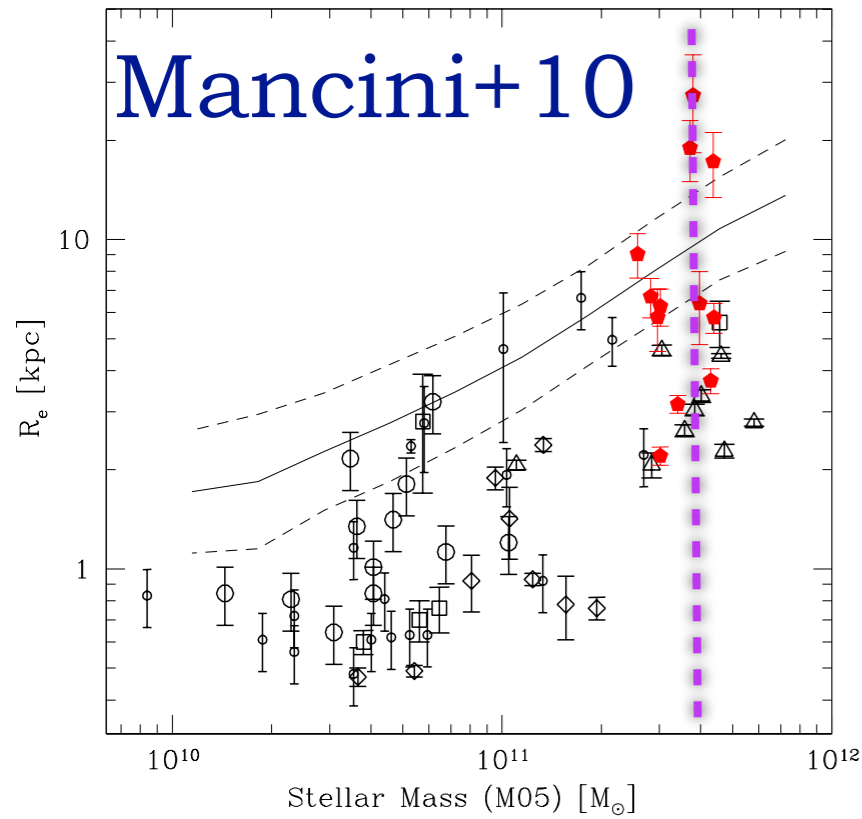
$z=1.24$
cluster+field
ACS F850LP



$z=1.5-2.5$
field
WFC3

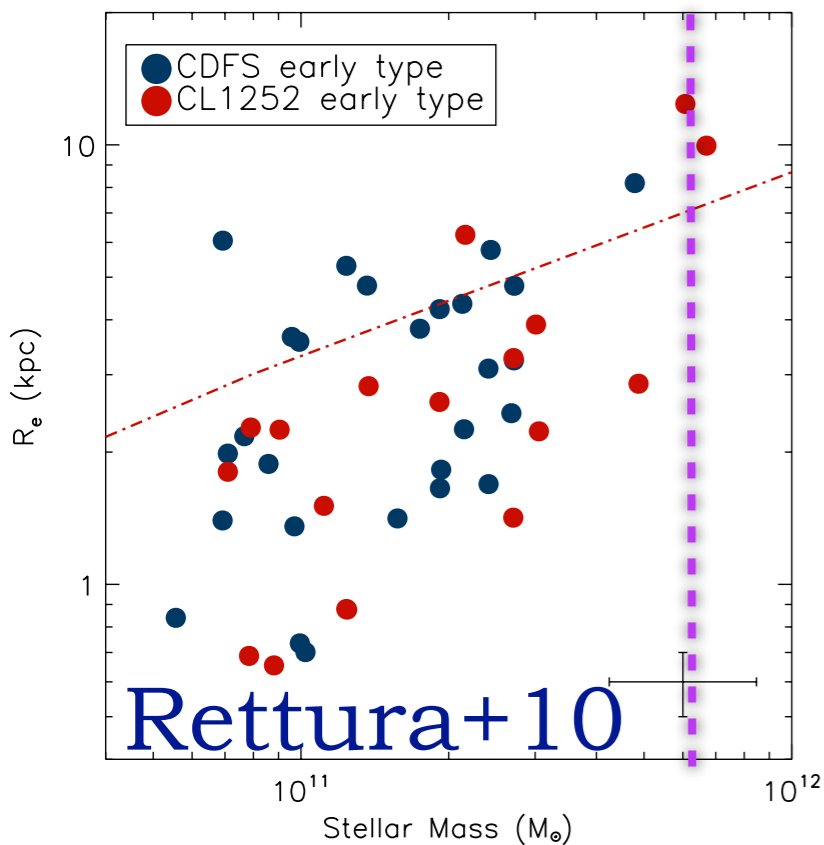
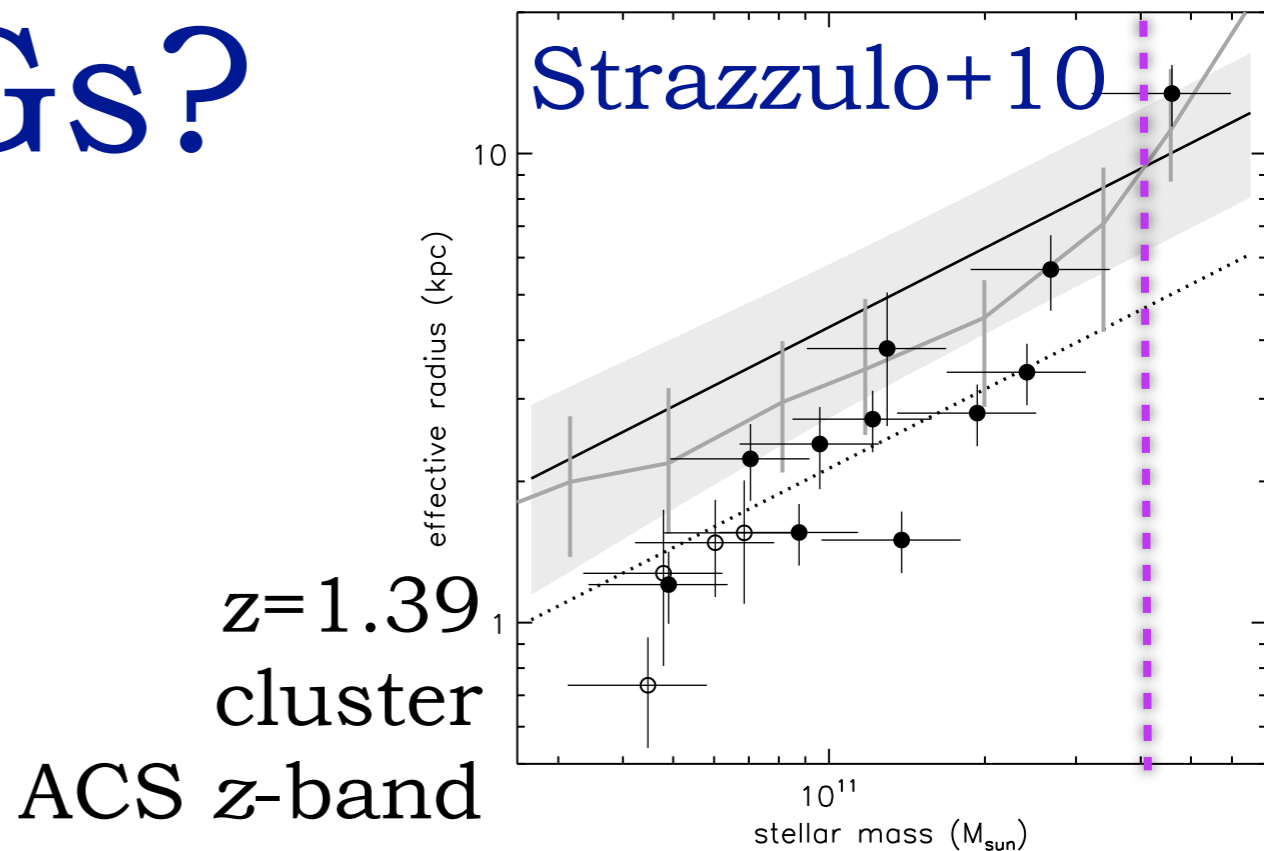
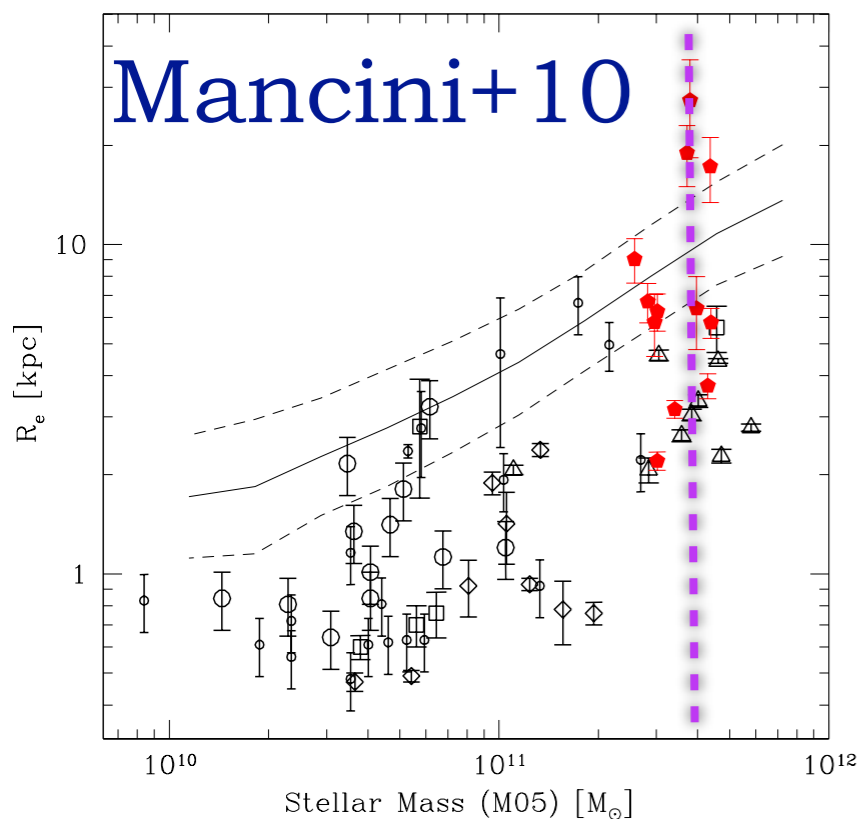
Accelerated Size Evolution in

UMGs?



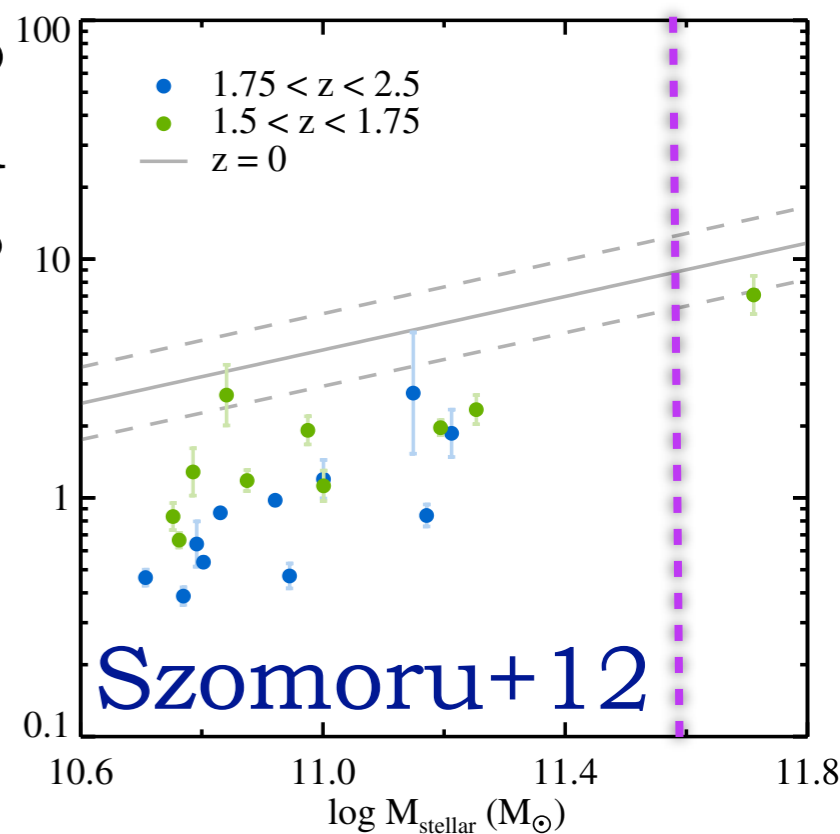
Accelerated Size Evolution in

UMGs?



$z=1.24$
cluster+field
ACS F850LP

$z=1.5-2.5$
field
WFC3



“Size downsizing”
in UMGs?

UltraVISTA & NMBS-II

UltraVISTA & NMBS-II

NEWFIRM Medium Band Survey II

(CFHTLS-D1, CFHTLS-D4, COSMOS, MUSYC)

4.75 deg^2 , $K = 21.75 \text{ AB } (5\sigma)$

Muzzin+ in prep

UltraVISTA & NMBS-II

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UltraVISTA (COSMOS)

UltraVISTA & NMBS-II

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4.75 deg^2 , $K = 21.75 \text{ AB } (5\sigma)$

Muzzin+ in prep

UltraVISTA (COSMOS)

1.4 deg^2 , $K = 23.8 \text{ AB } (5\sigma)$

McCracken+12, Muzzin+13a

Sample selection

$$1.5 < z < 3.0$$

$$K < 21.5$$

$$M_* > 4 \times 10^{11} M_{\odot}$$

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27 sources in UltraVISTA+NMBS-II

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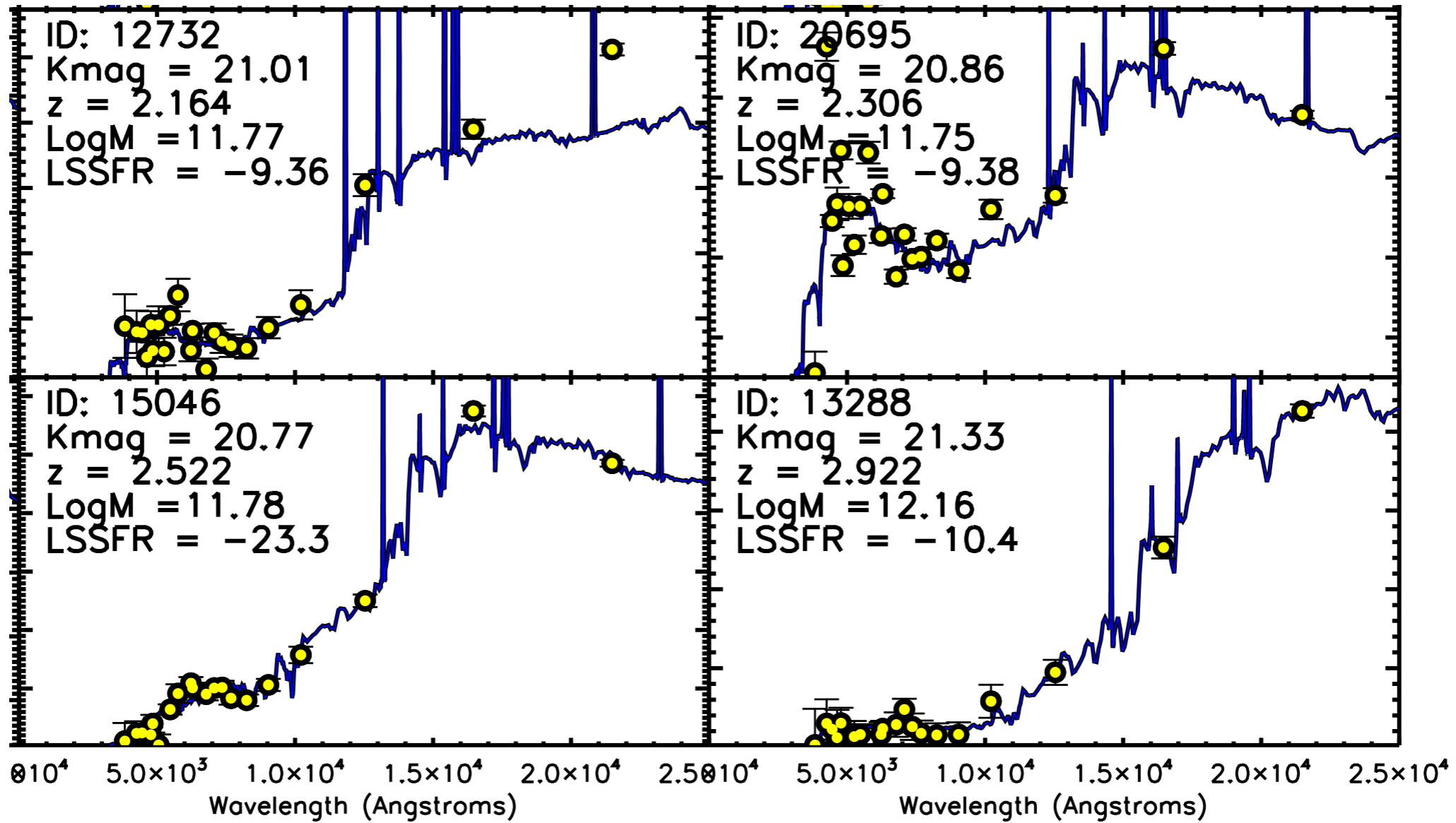
$$M_* > 4 \times 10^{11} M_{\odot}$$

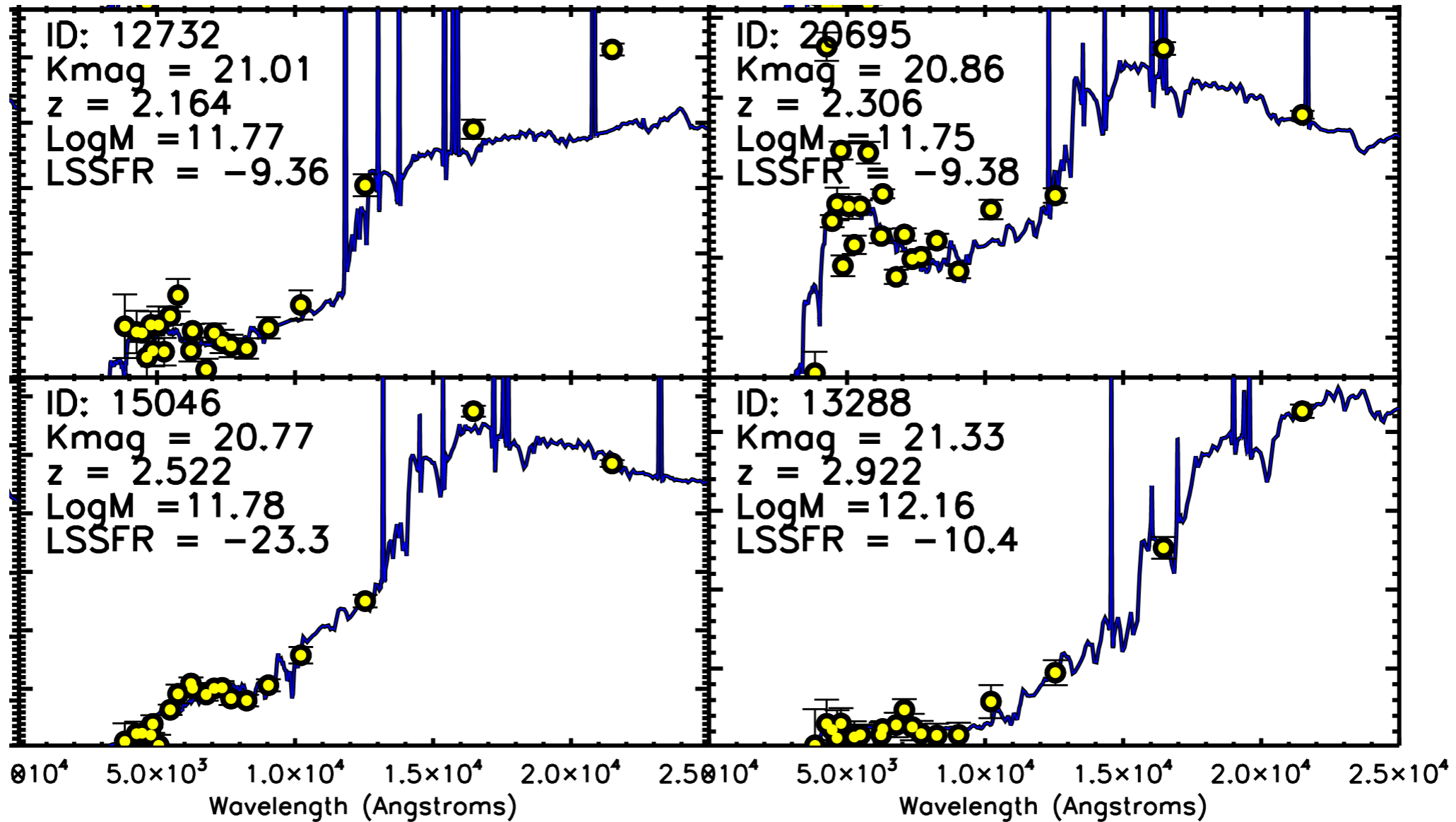
27 sources in UltraVISTA+NMBS-II

Wide range in SFRs

$$z < 2: \langle z \rangle = 1.73 \text{ (18)}$$

$$z > 2: \langle z \rangle = 2.47 \text{ (9)}$$

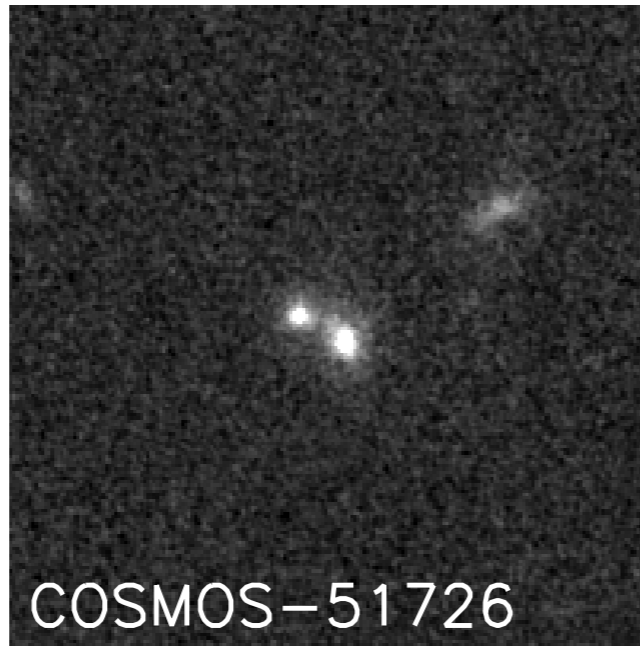
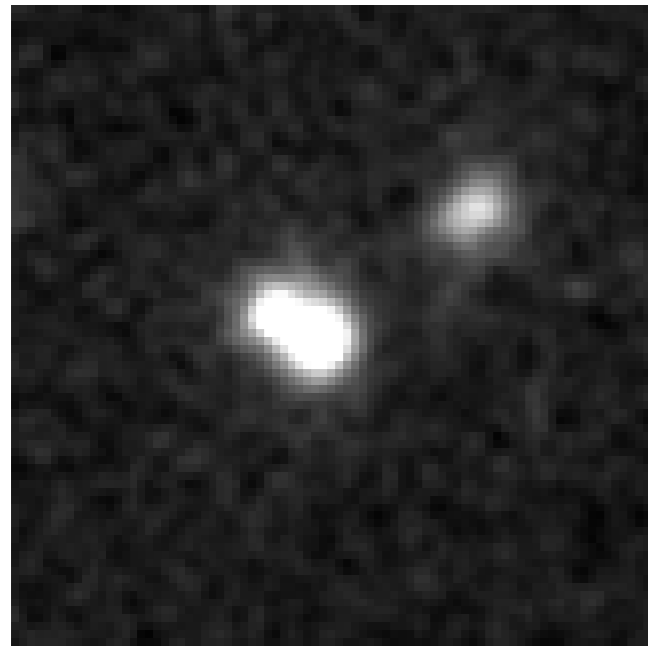




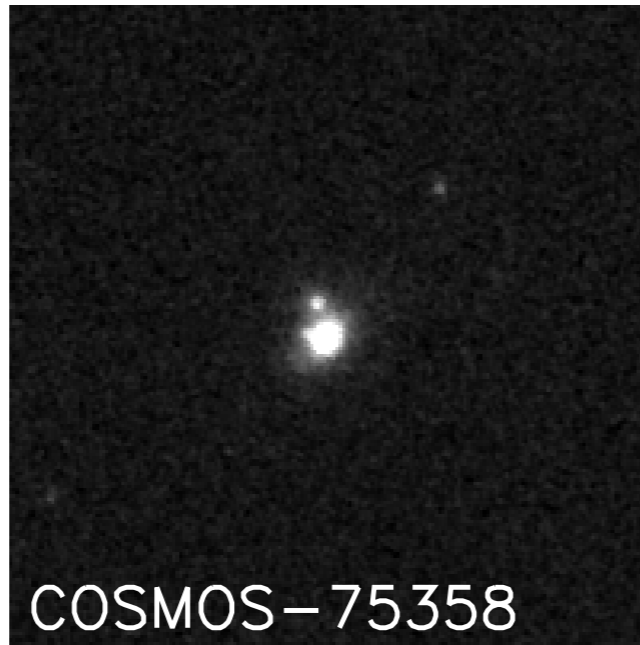
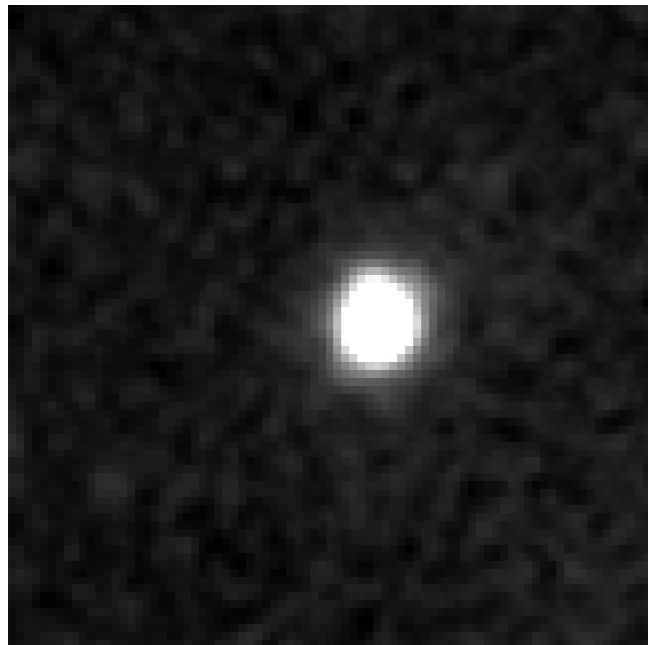
Random errors:
 $< 2\%$; z_{phot}
 $< 10\%$; M_*

Preliminary Results

I. Blending Issues

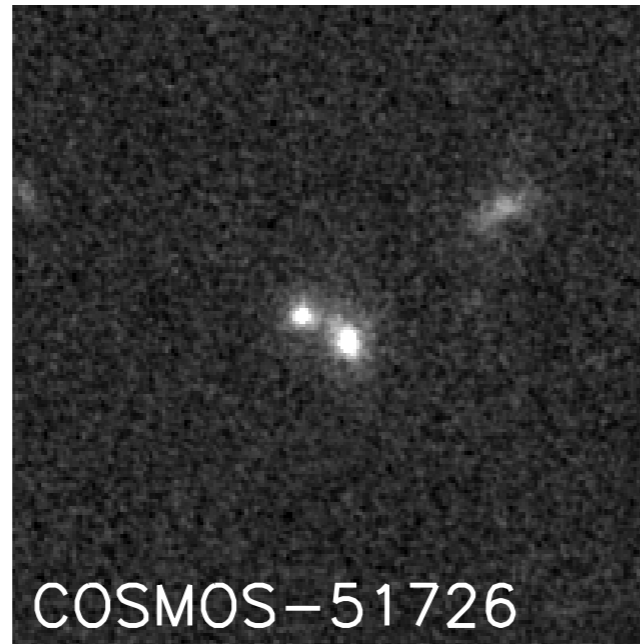
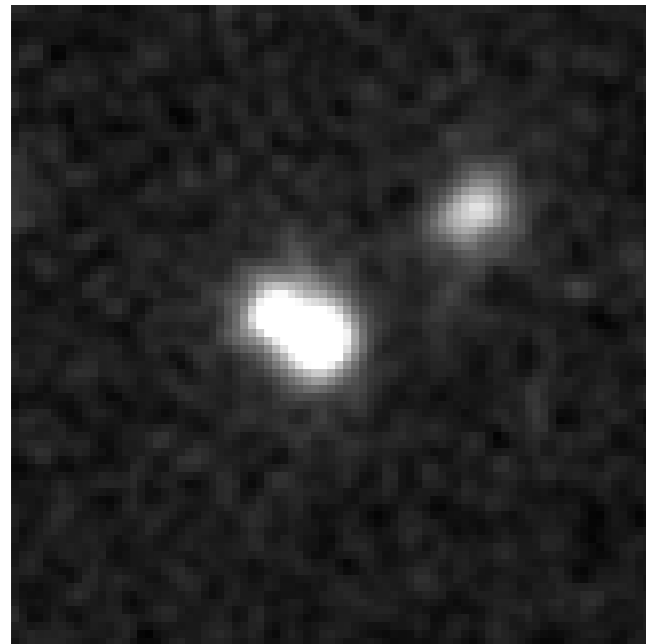


WFC3 reveals:
 $\sim 1/3$ blended

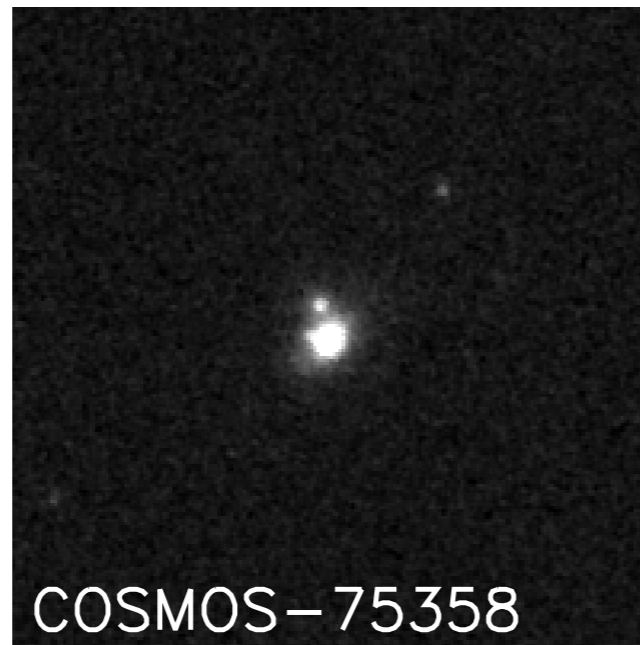
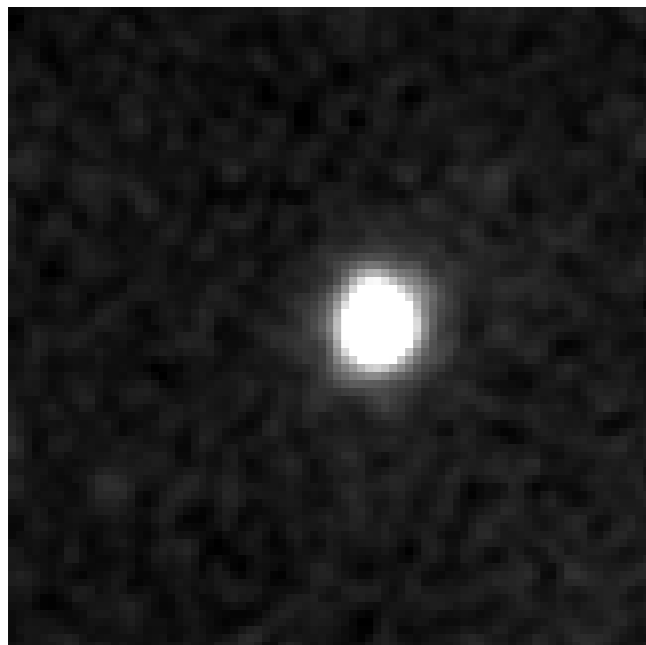


Preliminary Results

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WFC3 reveals:
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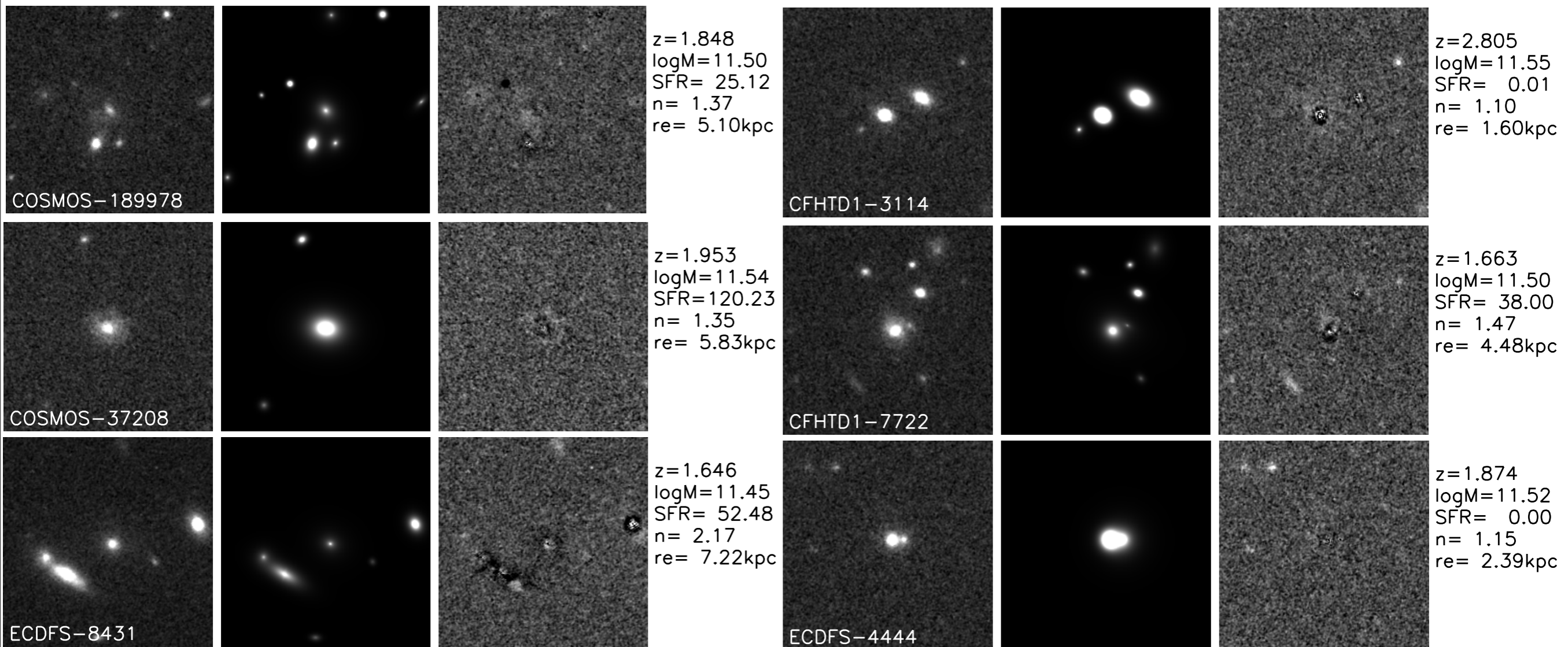
Ongoing: deblending of
multiwavelength photometry

II. Structural Fitting

Light profile modeled with single Sersic index (n)

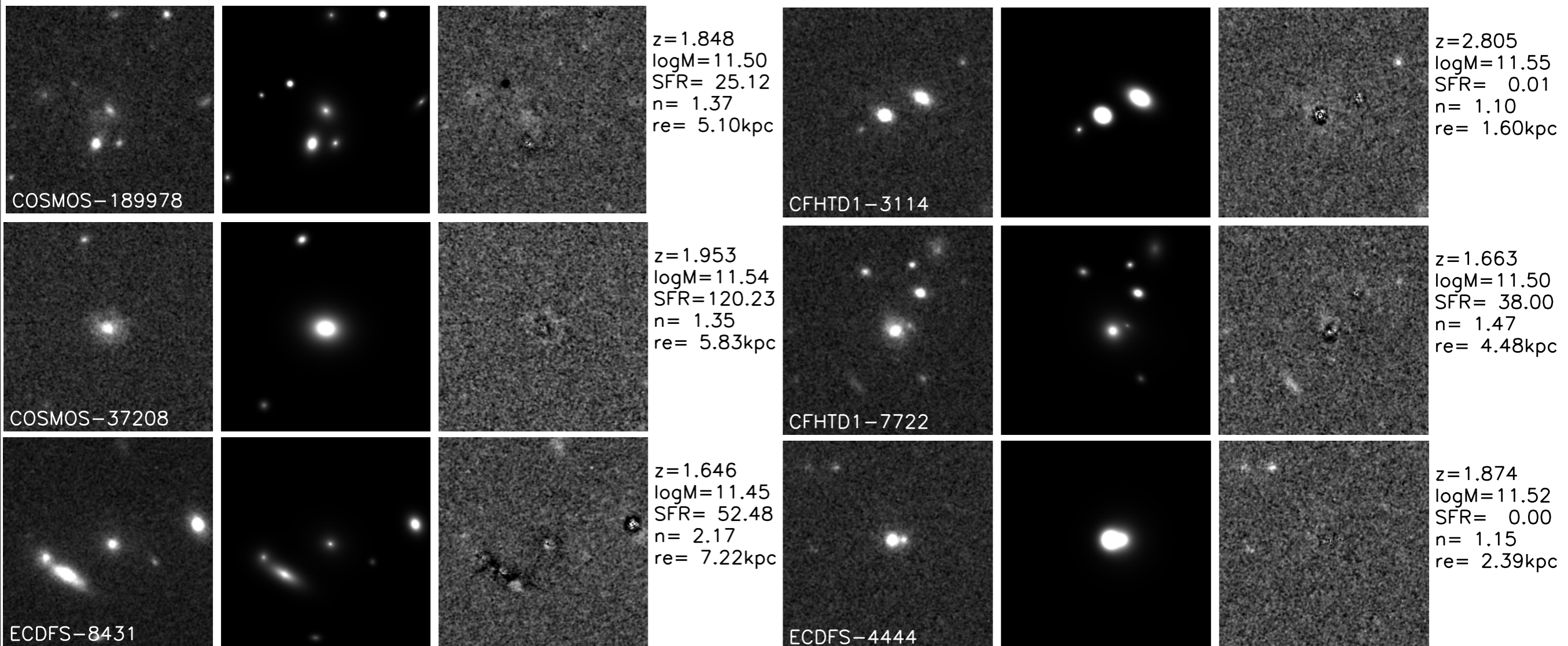
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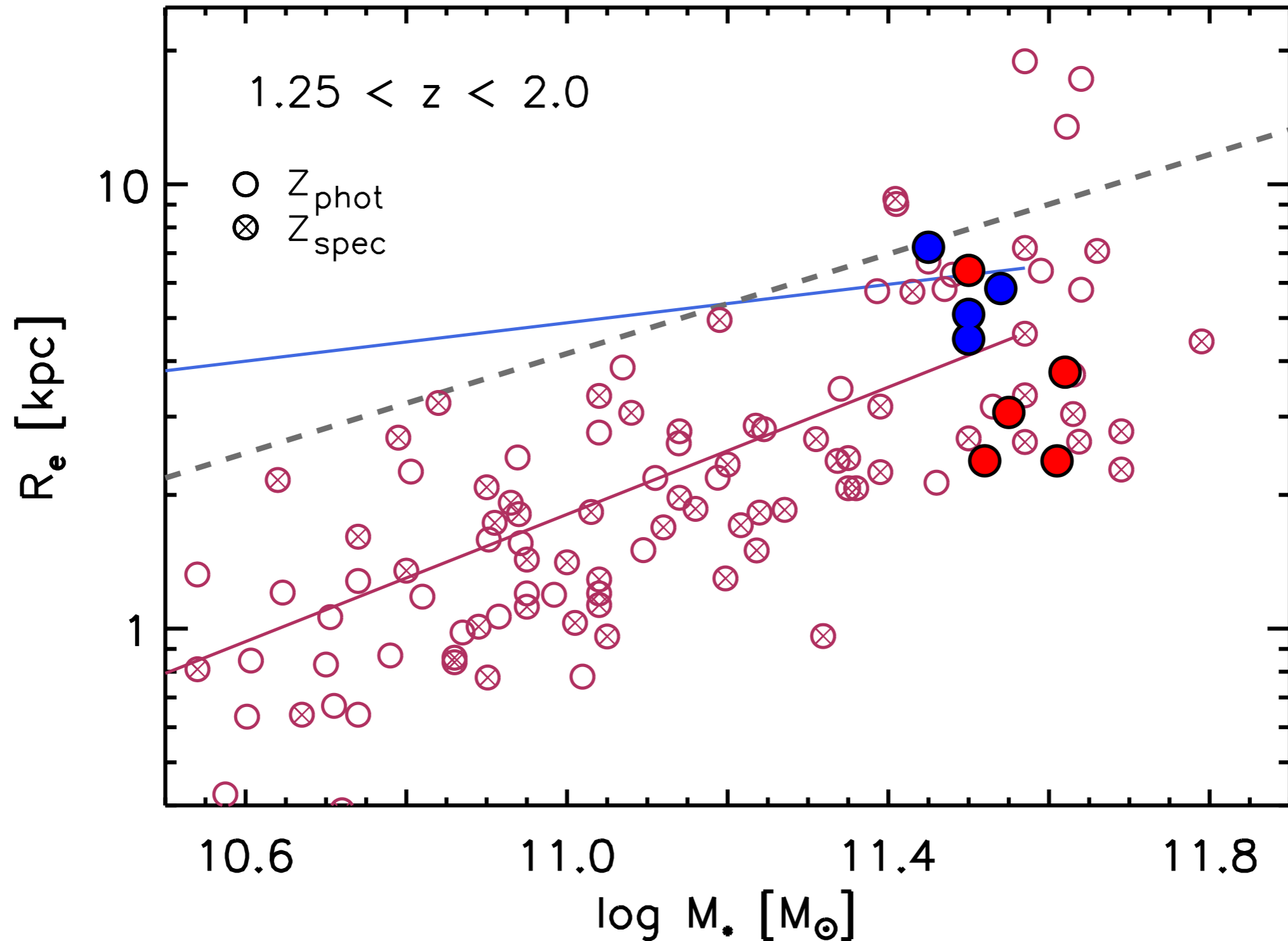
Light profile modeled with single Sersic index (n)



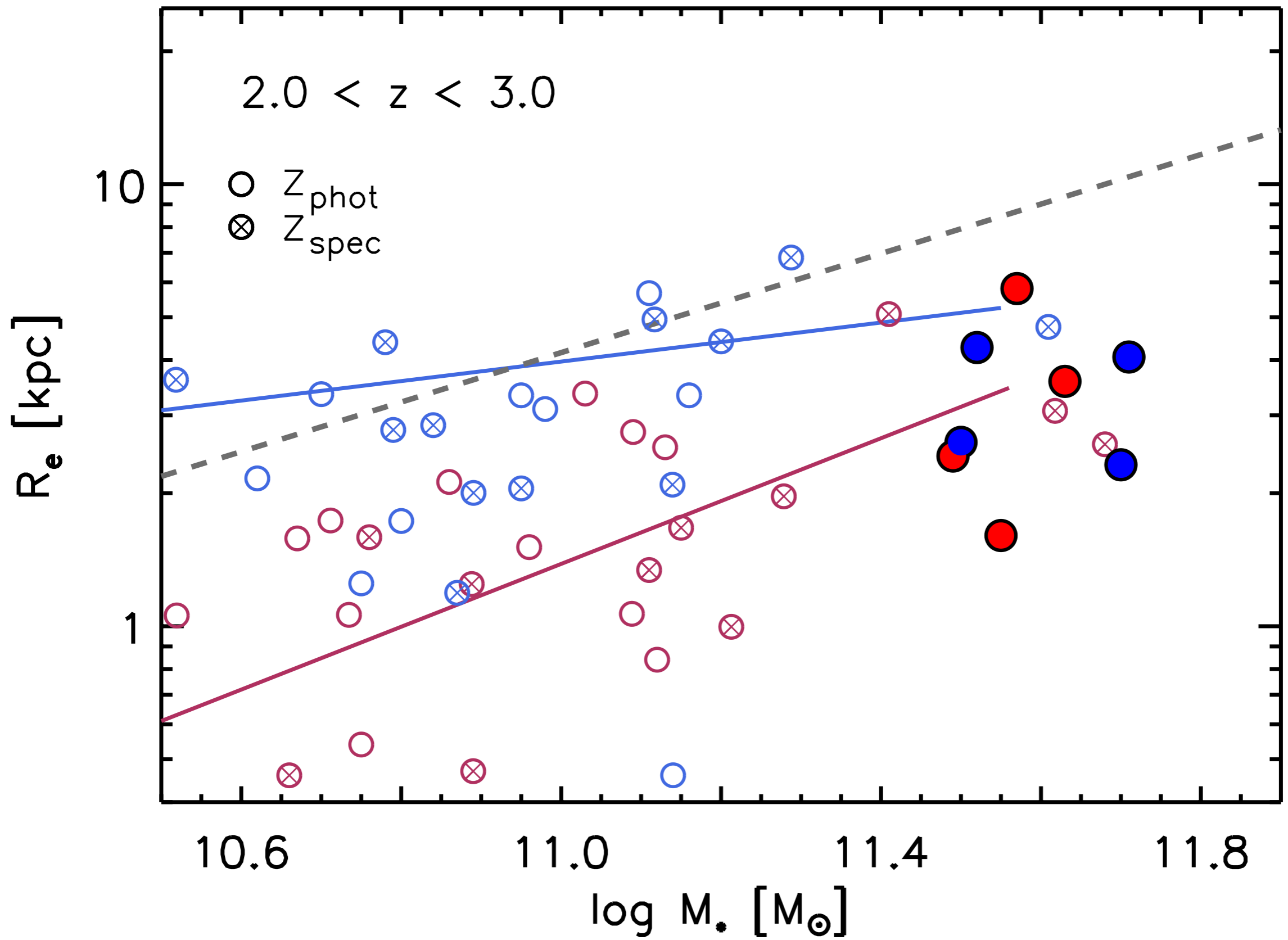
All single Sersic profiles fit with $n < 2.5$

UMG's are "disky"

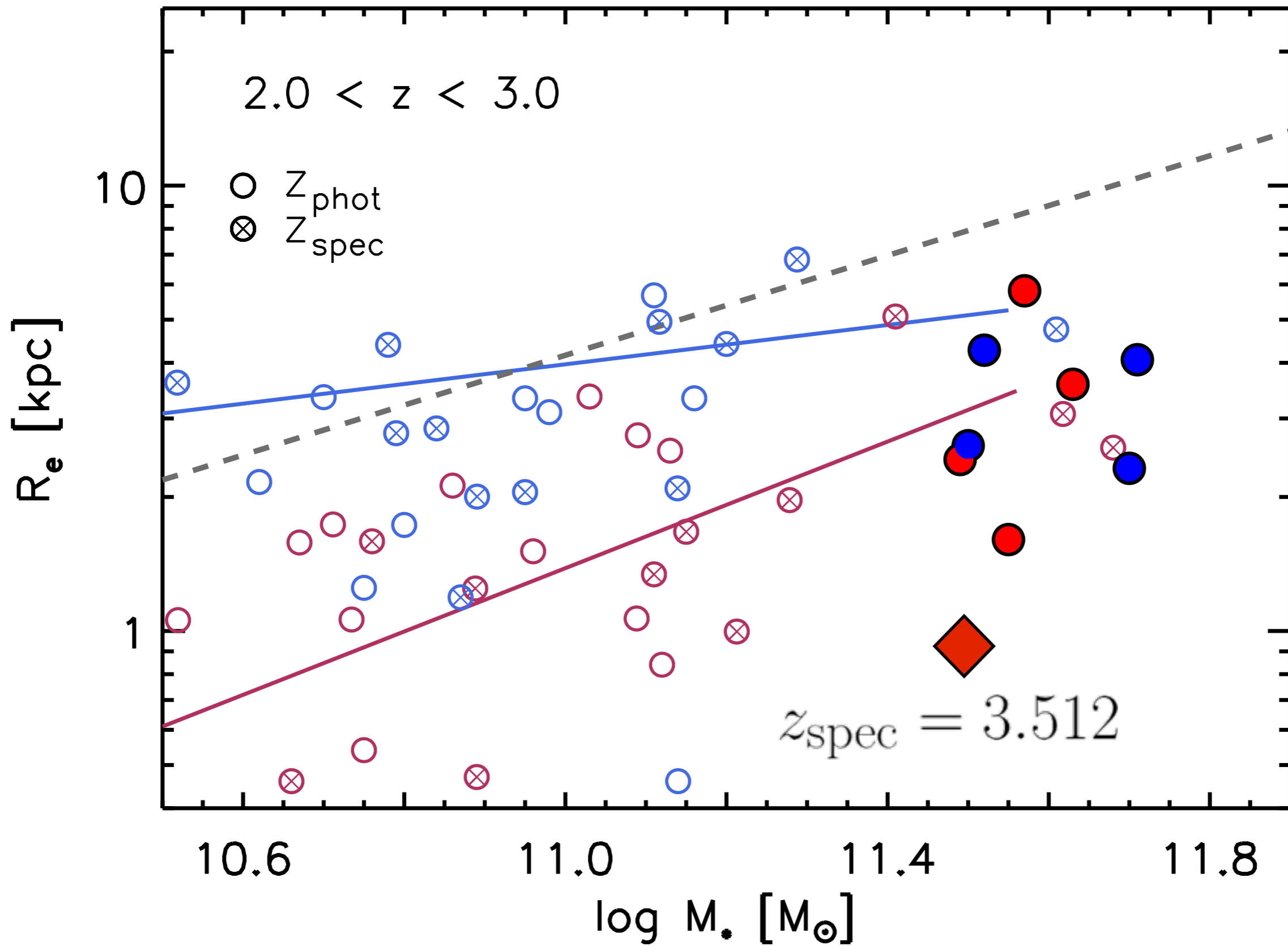
III. Mass-Size Relation



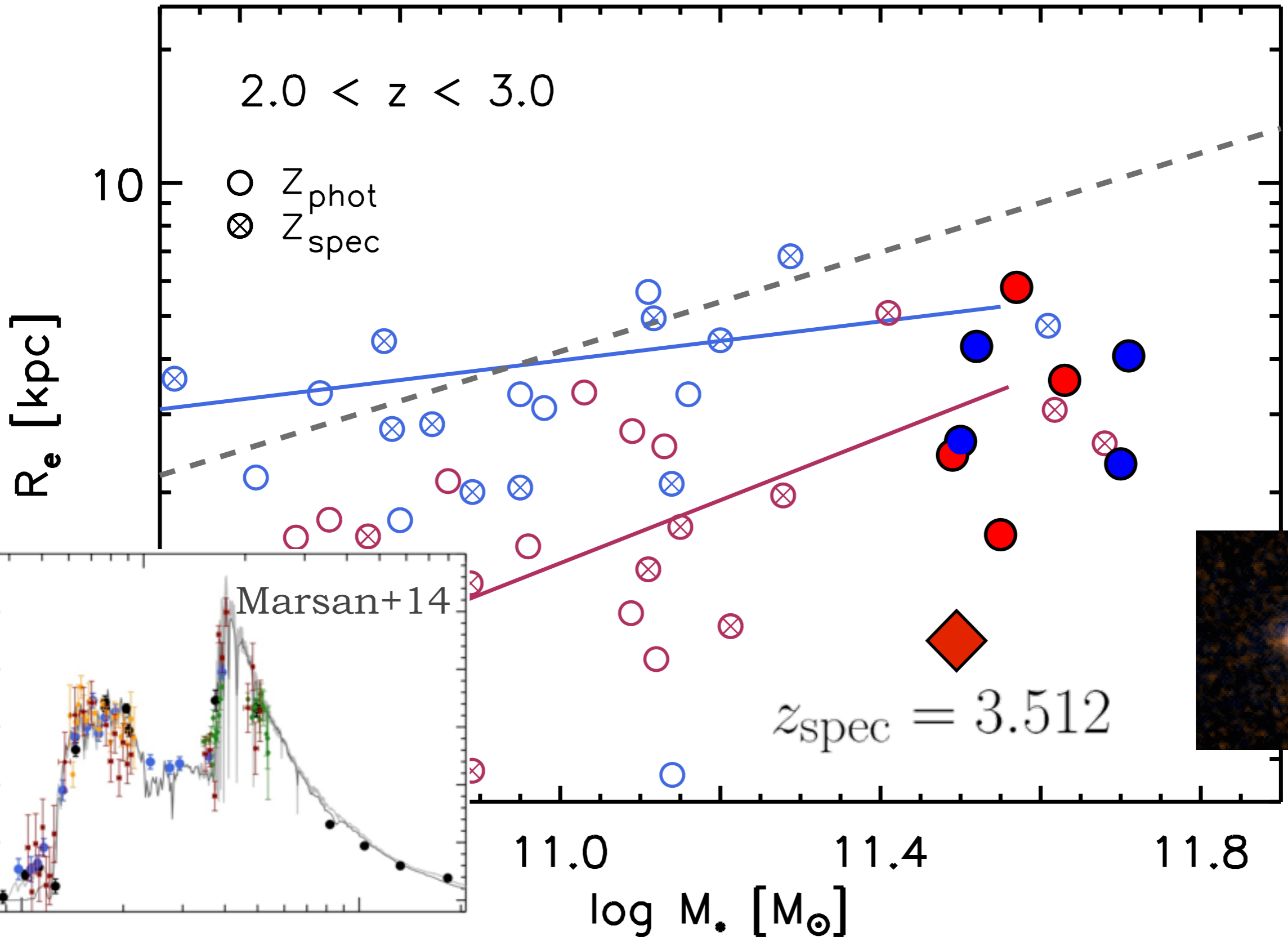
Longhetti+07, Cimatti+08, Mancini+10, Strazzullo+10, Cassatta+11, Szomoru+12, Bezanson+13, van de Sande+13, Onodera+14, van der Wel+14; $\langle z \rangle = 1.75$



Cassatta+11, Szomoru+12, Krogager+14, Tacchella+14,
van der Wel+14; $\langle z \rangle = 2.25$



Cassatta+11, Szomoru+12, Krogager+14, Tacchella+14,
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Cassatta+11, Szomoru+12, Krogager+14, Tacchella+14,
van der Wel+14; $\langle z \rangle = 2.25$

Summary

- UMGs at $1.5 < z < 3$ are “disky”; ie $n < 2.5$
- Sizes consistent with extrapolation of size-mass relation derived for lower stellar masses
- $1.5 < z < 2$: $\text{size}(Q) < \text{size}(SF)$
- $2 < z < 3$: $\text{size}(Q) \sim \text{size}(SF)$

Ongoing: de-blending

Questions

- proto-BCG's don't follow different size evolution (at $1.5 < z$) ??
- What is the formation mechanism of compact, massive galaxies?

Larger R_e for when observing shorter wavelengths: *no central starburst?*