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Size and Structure Evolution of Massive Galaxies Over 0.5<z<2.5

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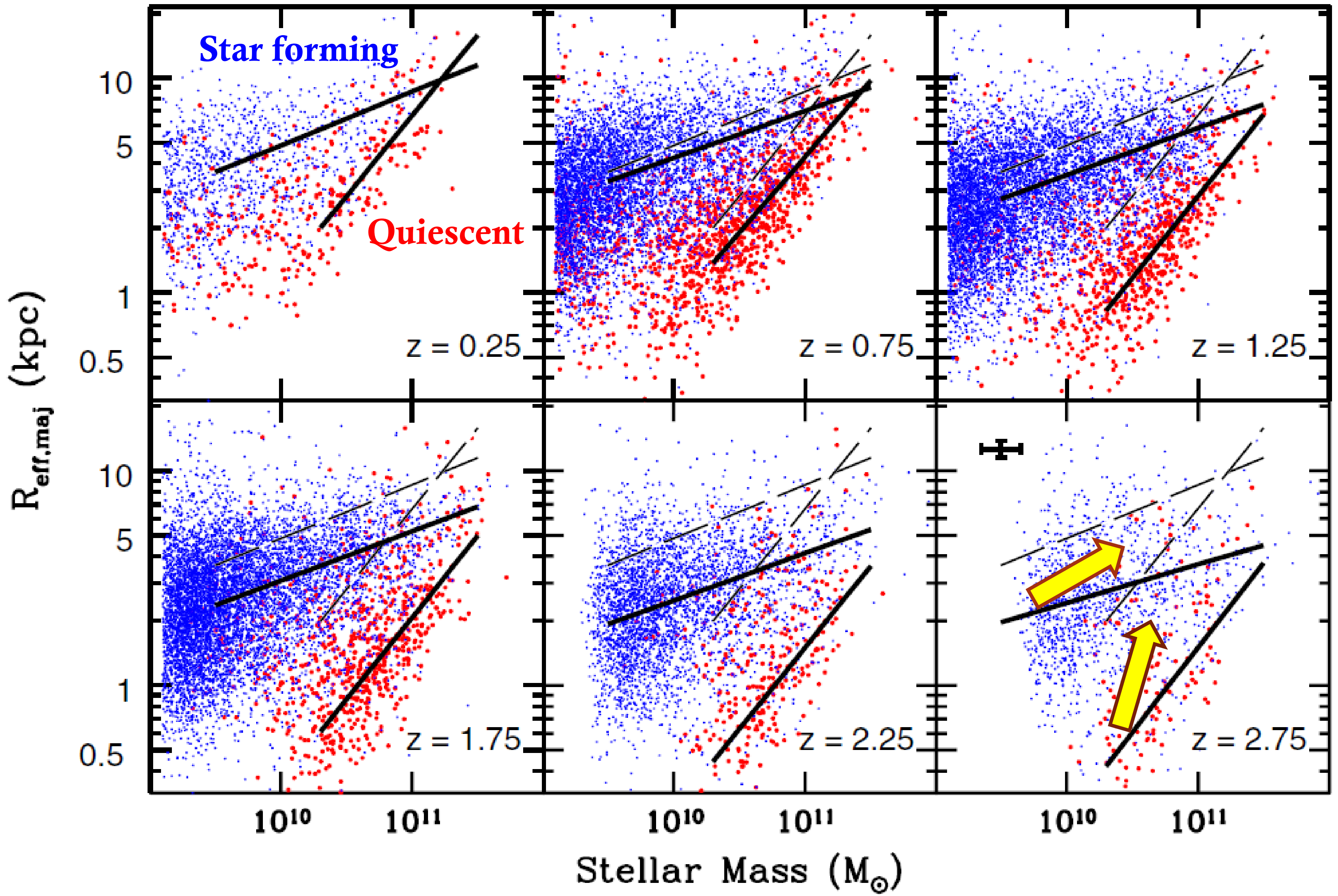
R_e v.s. M_*(CANDELS Sample)

Van der Wel et al. 2014



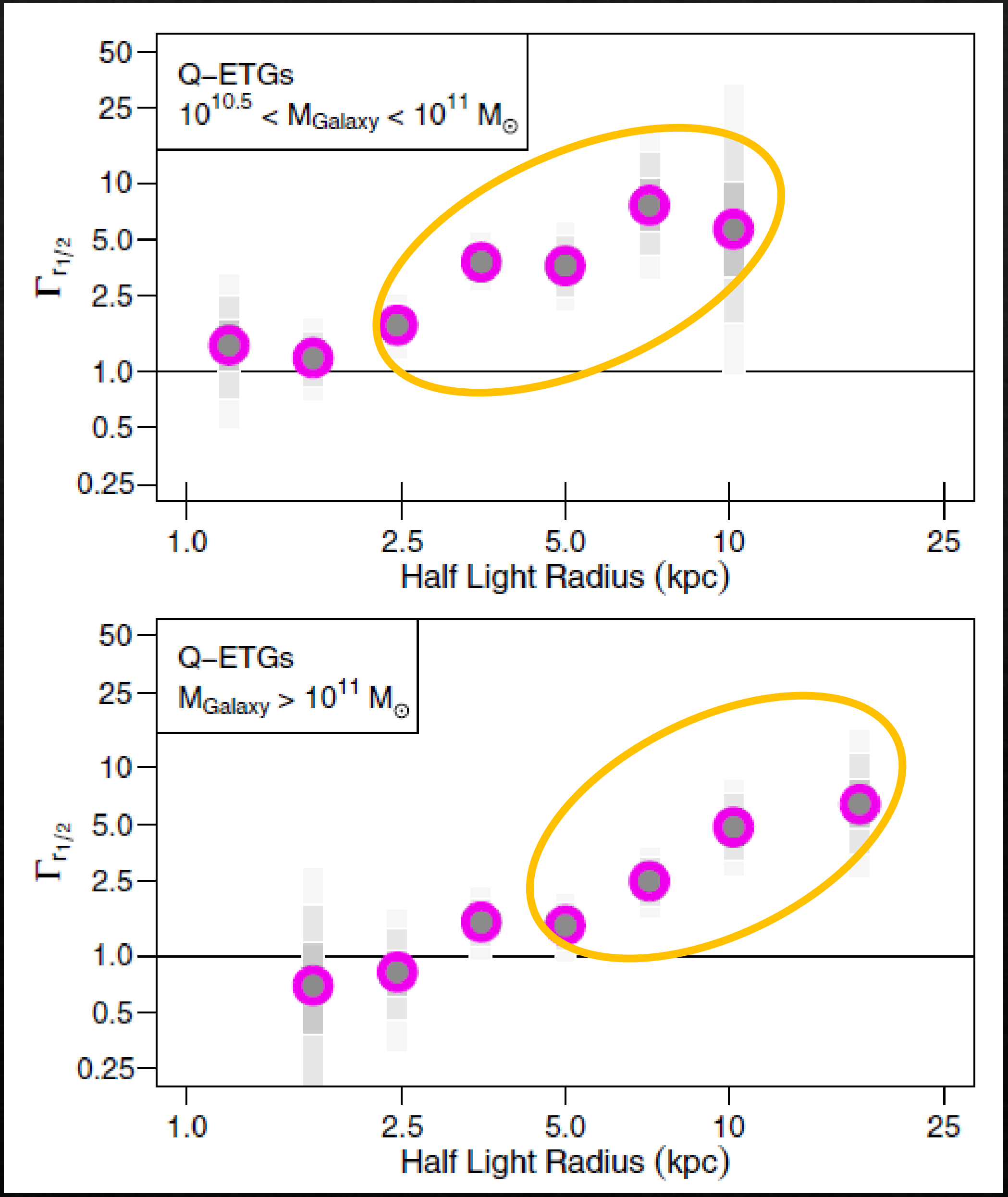
Progenitor bias

Carollo et al. 2013

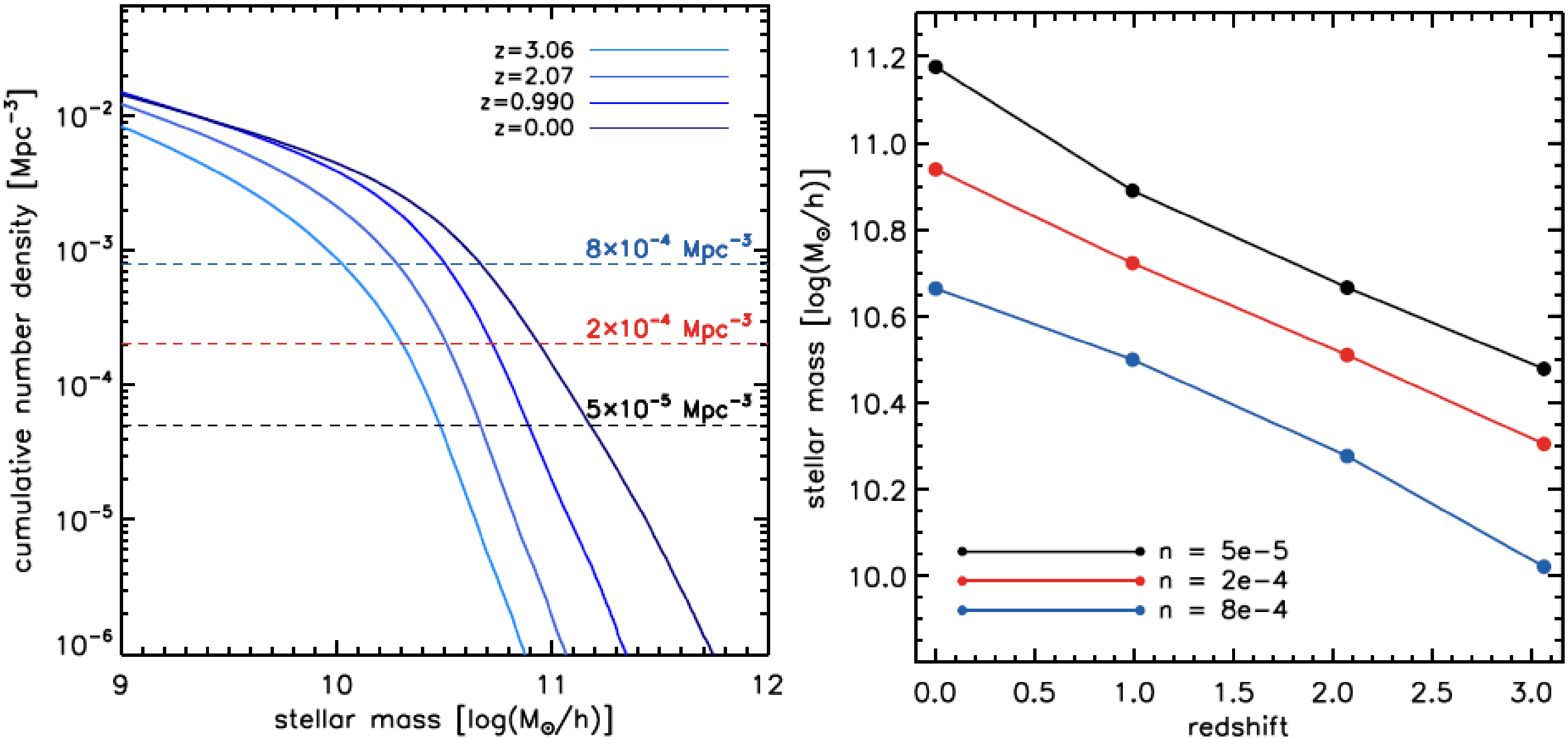
Newly quenched galaxies as the cause for the apparent evolution in average size of the population

$$\Gamma_{r_{1/2}} = \frac{\Phi_{r_{1/2}}(0.2 < z < 0.4)}{\Phi_{r_{1/2}}(0.8 < z < 1)}$$

Larger size quenched galaxies add to the quenched population at lower redshift



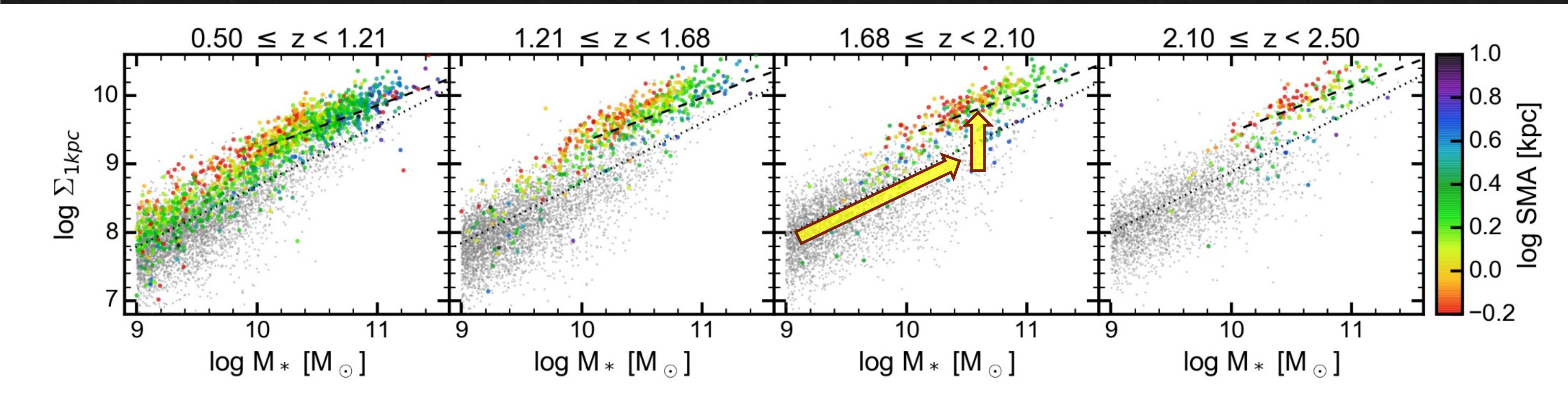
Abundance matching



Leja, van Dokkum & Franx, 2013

Σ_1 v.s. M_*

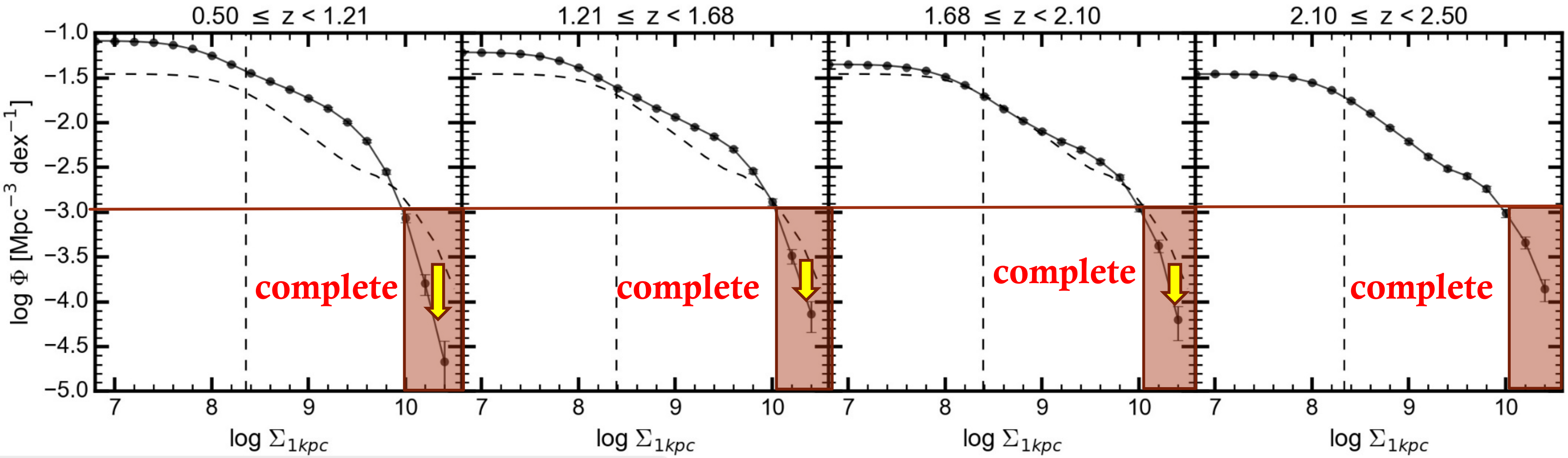
$\sum_{1kpc}$: Stellar mass density inside 1kpc

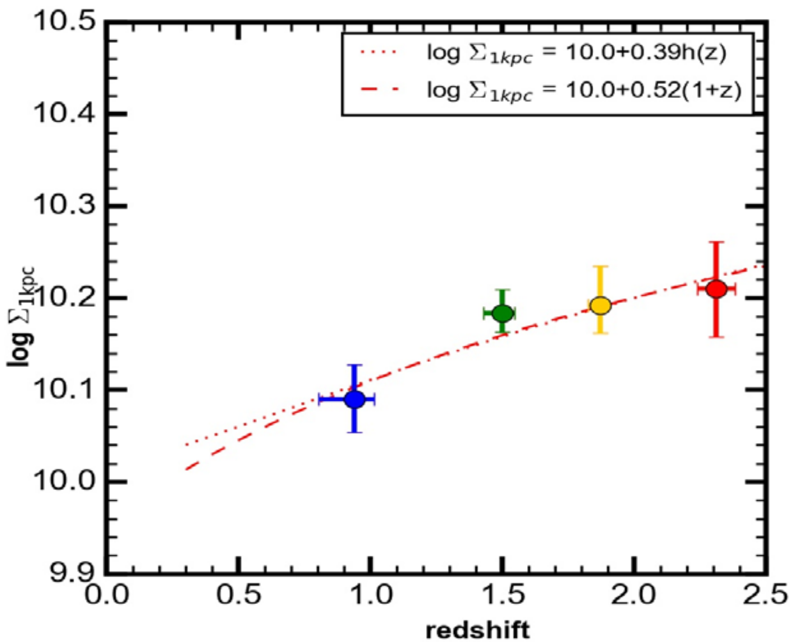


Low z **Age of Univ.** **High z**

- The $\sum_{1kpc}$ vs. Mass has tight correlation, the scatter of the correlation shows no evolution
- The slope of the $\sum_{1kpc}$ vs. Mass relation is almost constant with cosmic time
- $\sum_{1kpc}$ represent the central properties of galaxies, less fluctuate by the mass accretion activities at outer part. More stable and therefore closer to a clock to track galaxies in transit from the star-forming to the quiescent phase

Σ_{1kpc} Cumulative Function

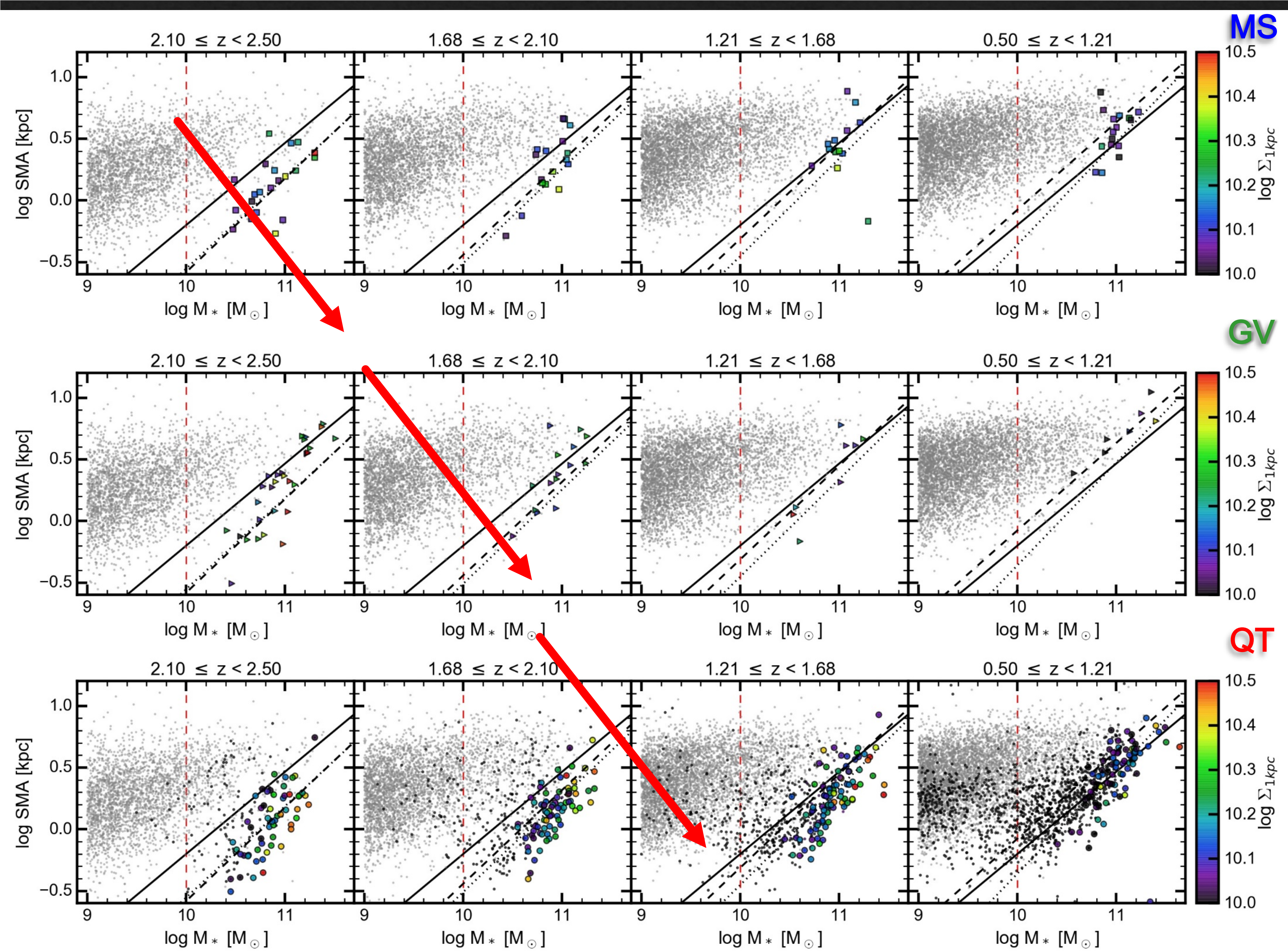




The number density of log Σ_{1kpc} >10 is slightly decrease with cosmic time, but keep roughly constant near log Σ_{1kpc} ~ 10

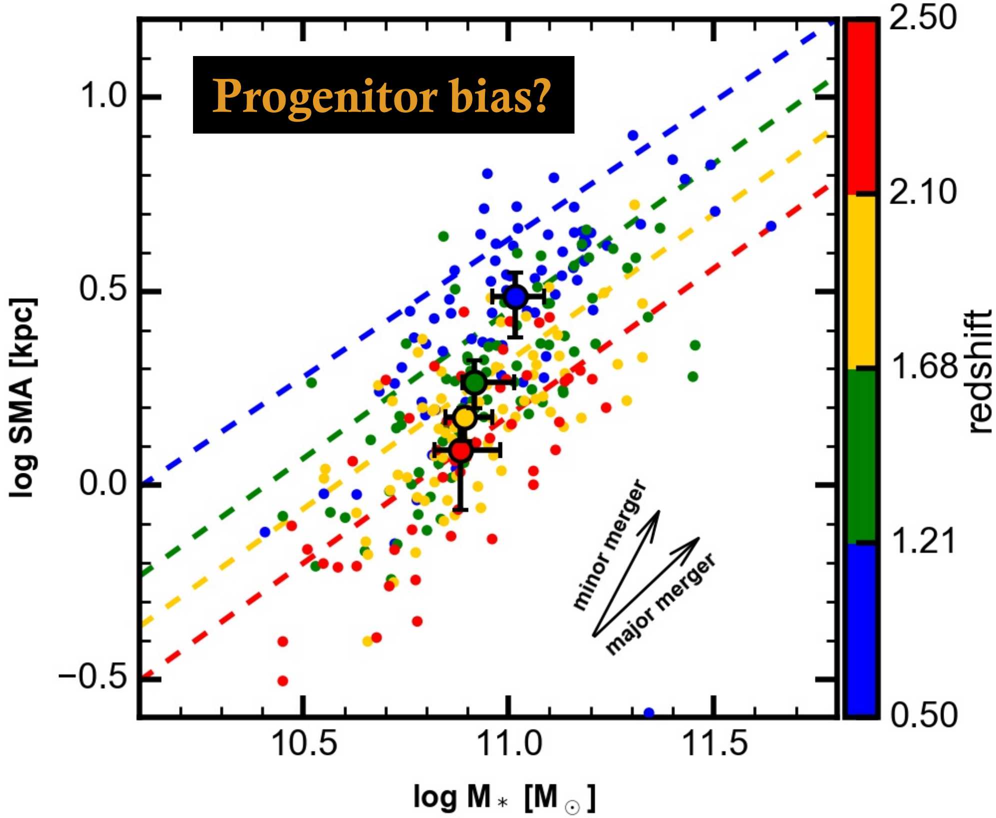
The central density of the high Σ_{1kpc} galaxies is slightly decrease (~0.1 dex) with cosmic time:

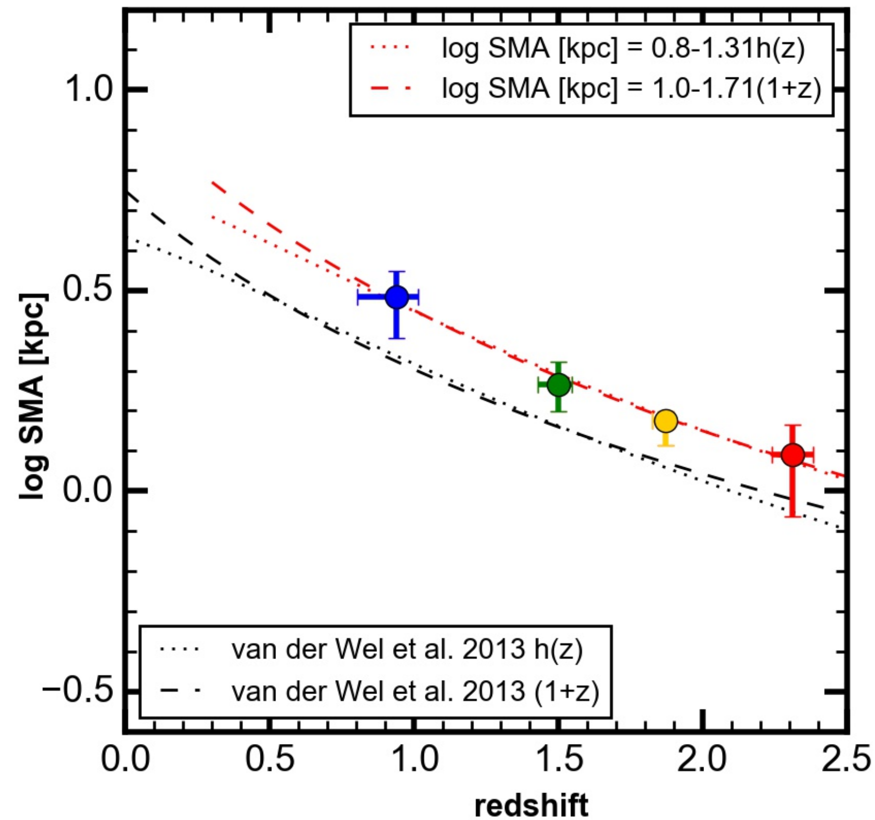
- mass loss of old stellar population in the central
- Adiabatic expansion
- BH scouring et al.



MS
GV
QT
2.10 ≤ z < 2.50
1.68 ≤ z < 2.10
1.21 ≤ z < 1.68
0.50 ≤ z < 1.21
log SMA [kpc]
log M* [M⊙]
log Σ1kpc

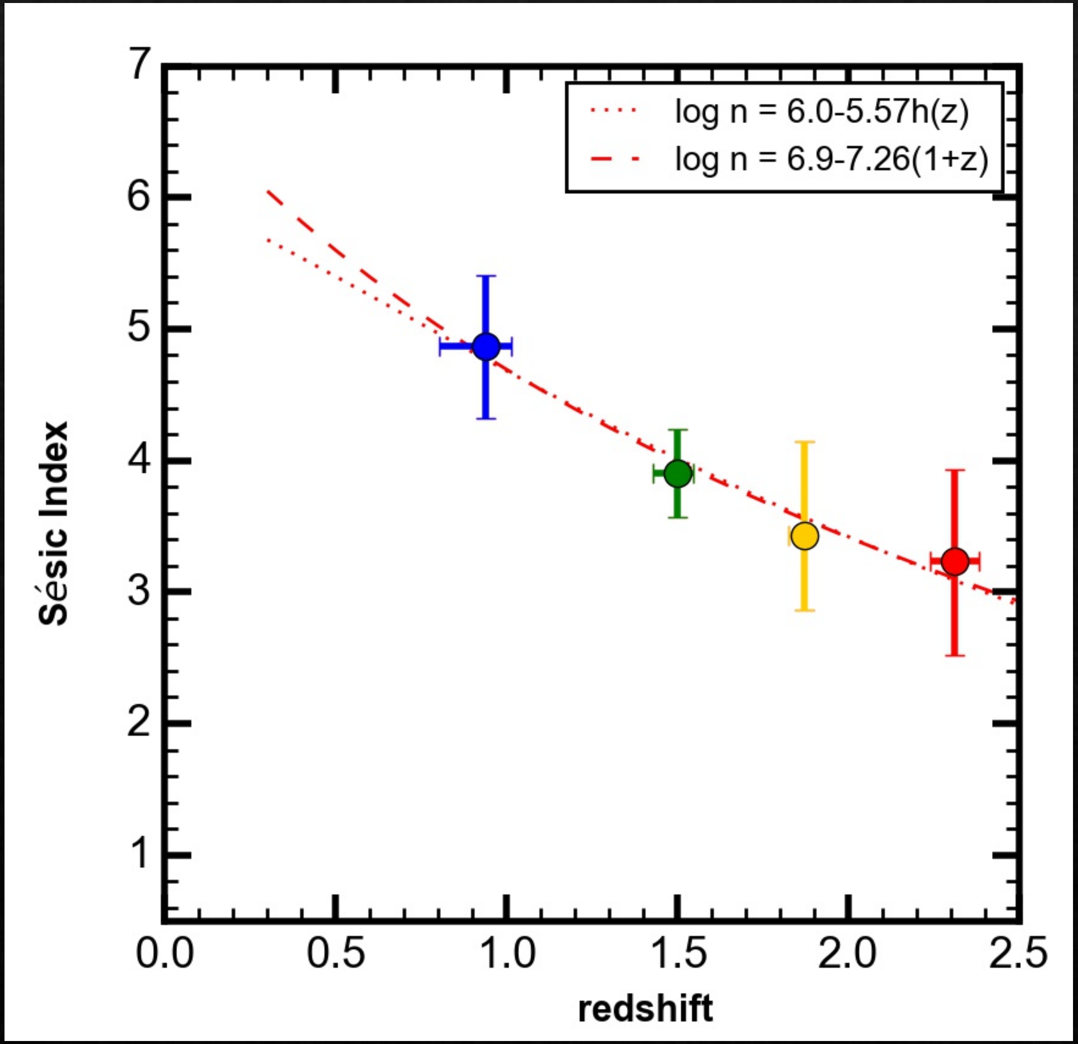
Size v.s. Mass





The size increase is about 0.4 dex with cosmic time, while the mass increase is about 0.15 dex

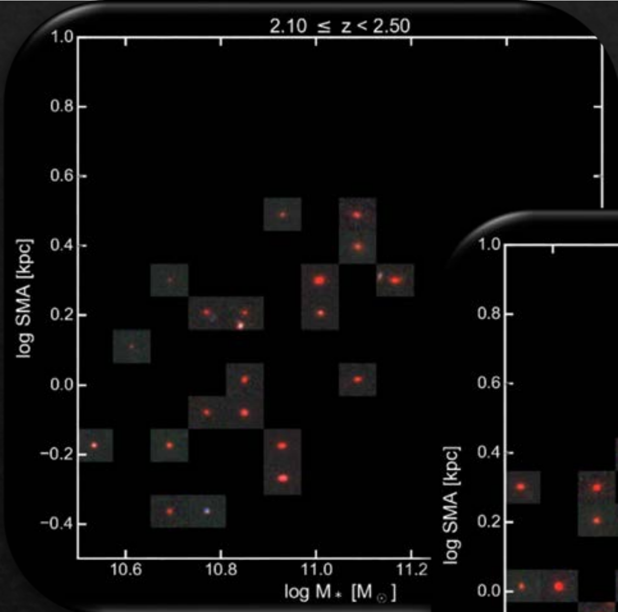
Sersic vs. Redshift



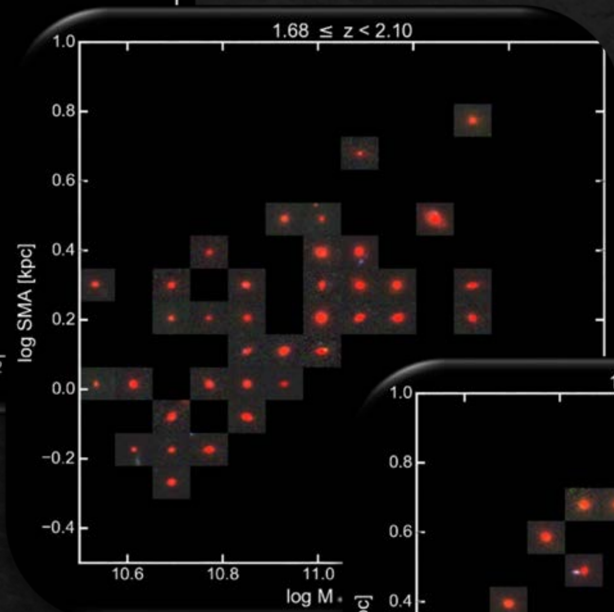
The selected galaxies are on average spheroidal like

The Sersic index is increase with cosmic time.

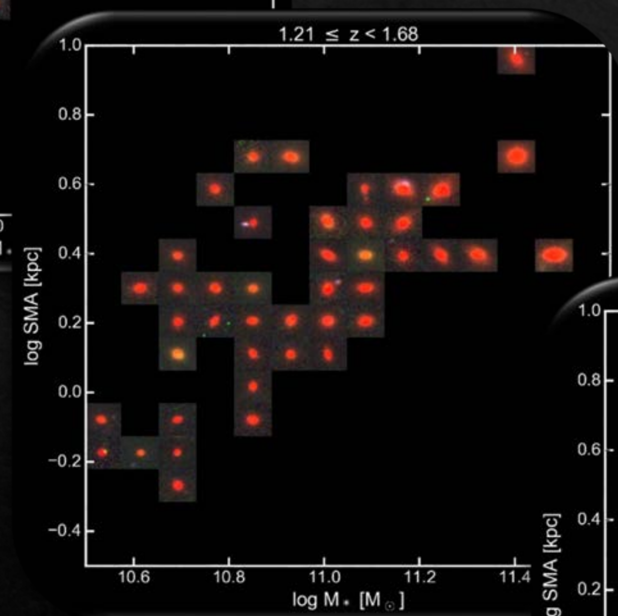
Size v.s. Mass



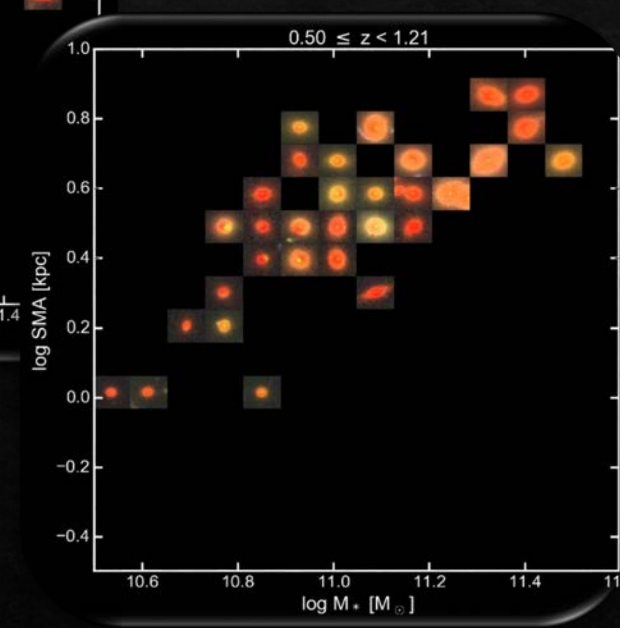
2.10 ≤ z < 2.50
log SMA [kpc]
log M* [M☉]



1.68 ≤ z < 2.10
log SMA [kpc]
log M*



1.21 ≤ z < 1.68
log SMA [kpc]
log M* [M☉]



0.50 ≤ z < 1.21
log SMA [kpc]
log M* [M☉]

Conclusions

- We use the constant number density of $\sum_{1kpc}$ technique to link massive galaxies to their progenitor to study the morphological evolution of the sample
- The size of massive quiescent galaxies at high redshift are about 2-3 times larger than low redshift quiescent galaxies, while the mass growth is 0.15 dex over from z=2.5 to 0.5.
- The evolution of size and mass of the selected sample indicates minor merger is the main mechanism for size growth of the massive quiescent galaxies.
- The Serisic index of the selected sample is increase with cosmic time.
- The evolution of size and mass of the selected sample confirmed the size growth of the quiescent population is partly due to progenitor bias.