

Morphological Bulge-Disk Galaxy Decompositions at $1 < z < 3$

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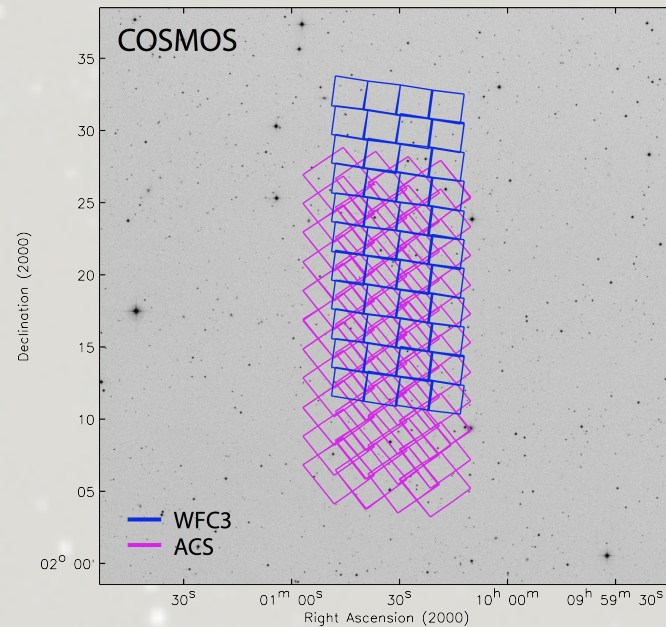
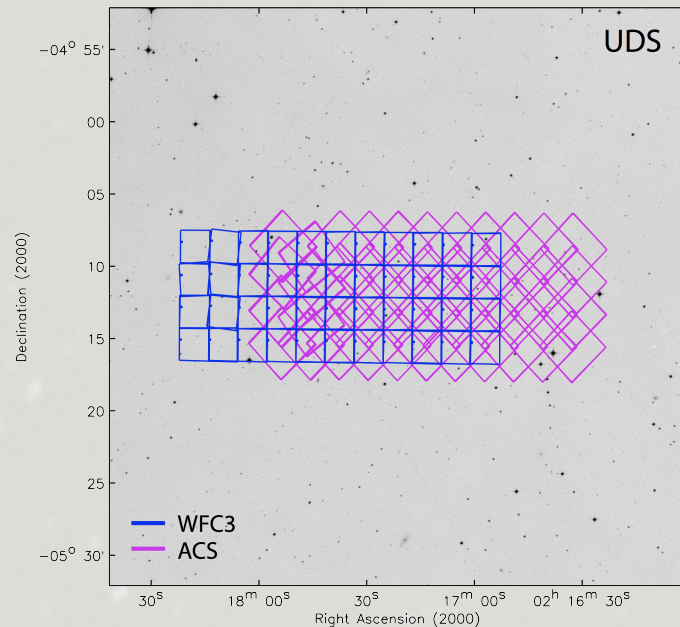
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Introduction

- How do galaxies evolve and how is star-formation quenched ? Is quenching linked to morphological transformations ?
- How can morphological bulge+disk decompositions help to answer these questions ?
- CANDELS:



Grogin et al. 2011

- Mass-selected, homogeneous sample of ~ 400 objects within $1 < z_{\text{phot}} < 3$ and with $M_{\star} > 10^{11} M_{\odot}$ (Bruce et al. 2012 +COSMOS update)

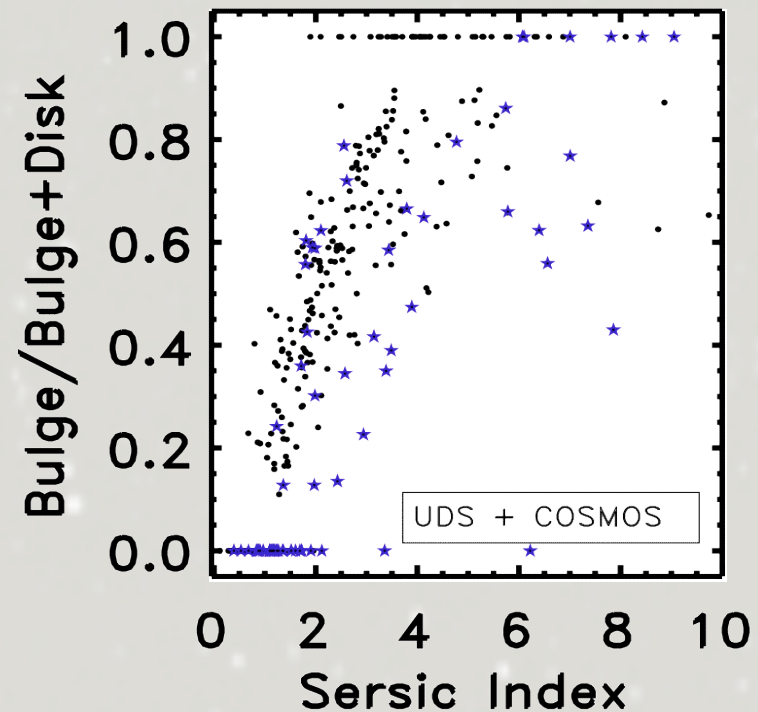
Bulge+Disk Decompositions

Define 3 components : disk n=1, bulge n=4, PSF

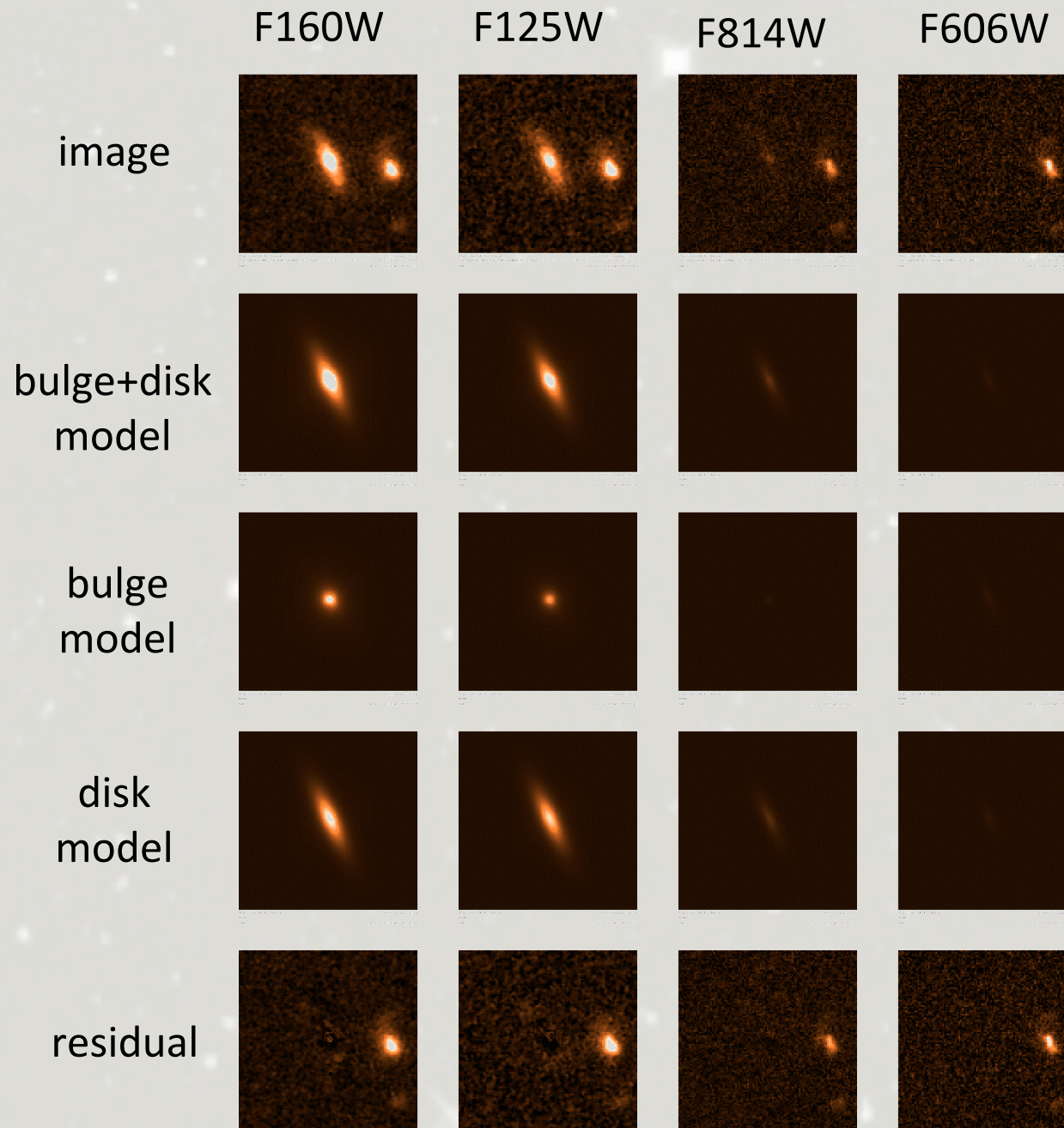
Models:

- bulge only
- disk only
- bulge + disk
- bulge + PSF
- disk + PSF
- bulge + disk + PSF

Relation between the bulge/bulge+disk light fraction and the single component model Sérsic index from the F160W decompositions.

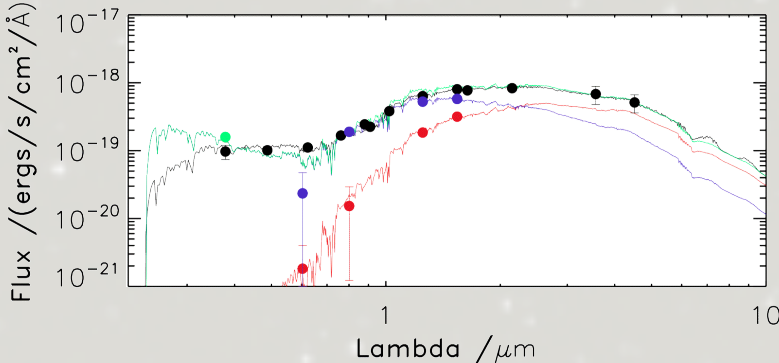


Example Morphological Decomposition

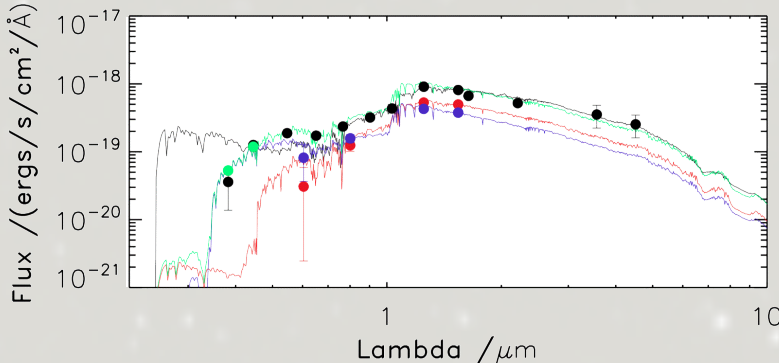


Example SED Fitting

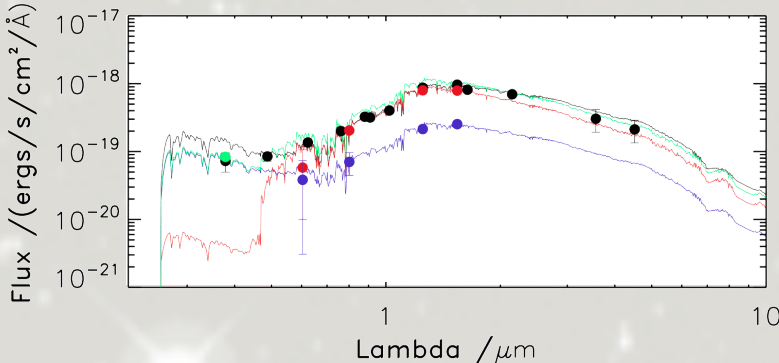
B/T < 0.5



B/T = 0.5



B/T > 0.5



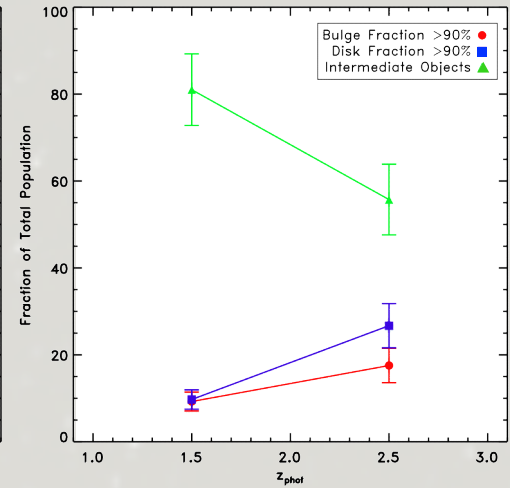
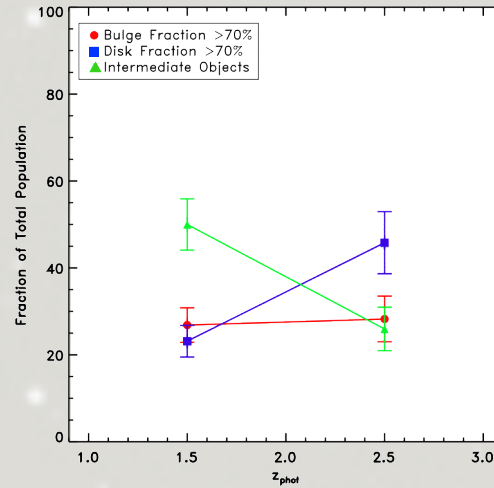
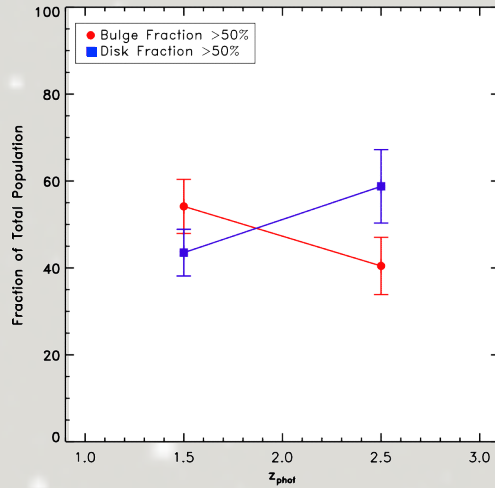
Evolution of Morphological Fractions

B/T > 0.5
D/T > 0.5

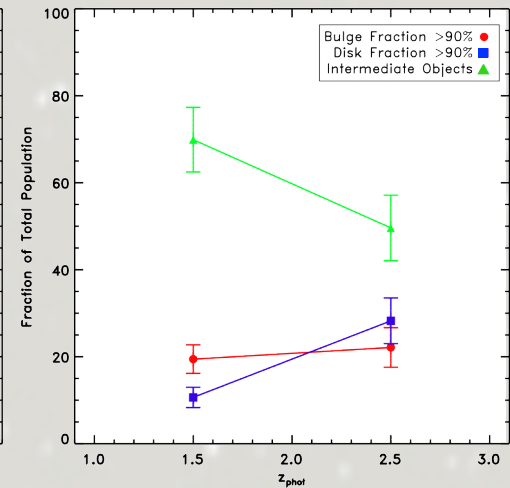
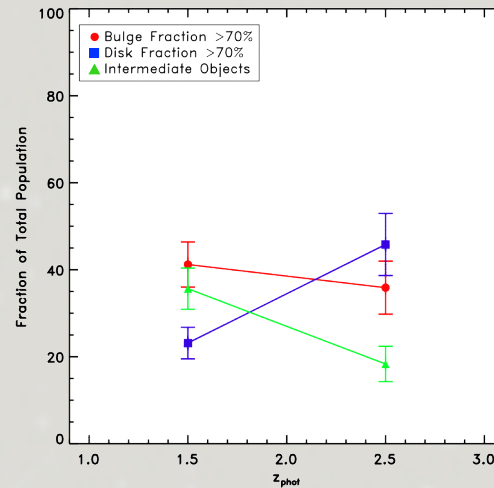
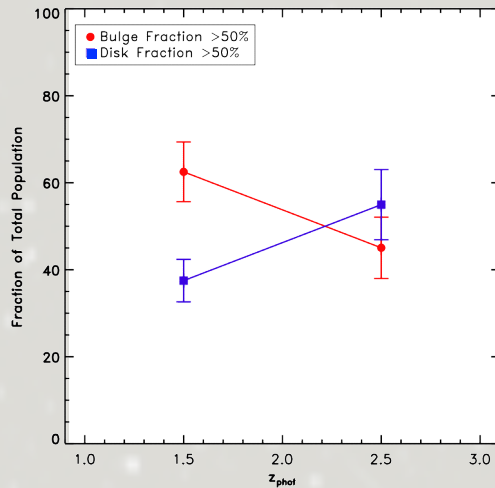
B/T > 0.7
D/T > 0.7

B/T > 0.9
D/T > 0.9

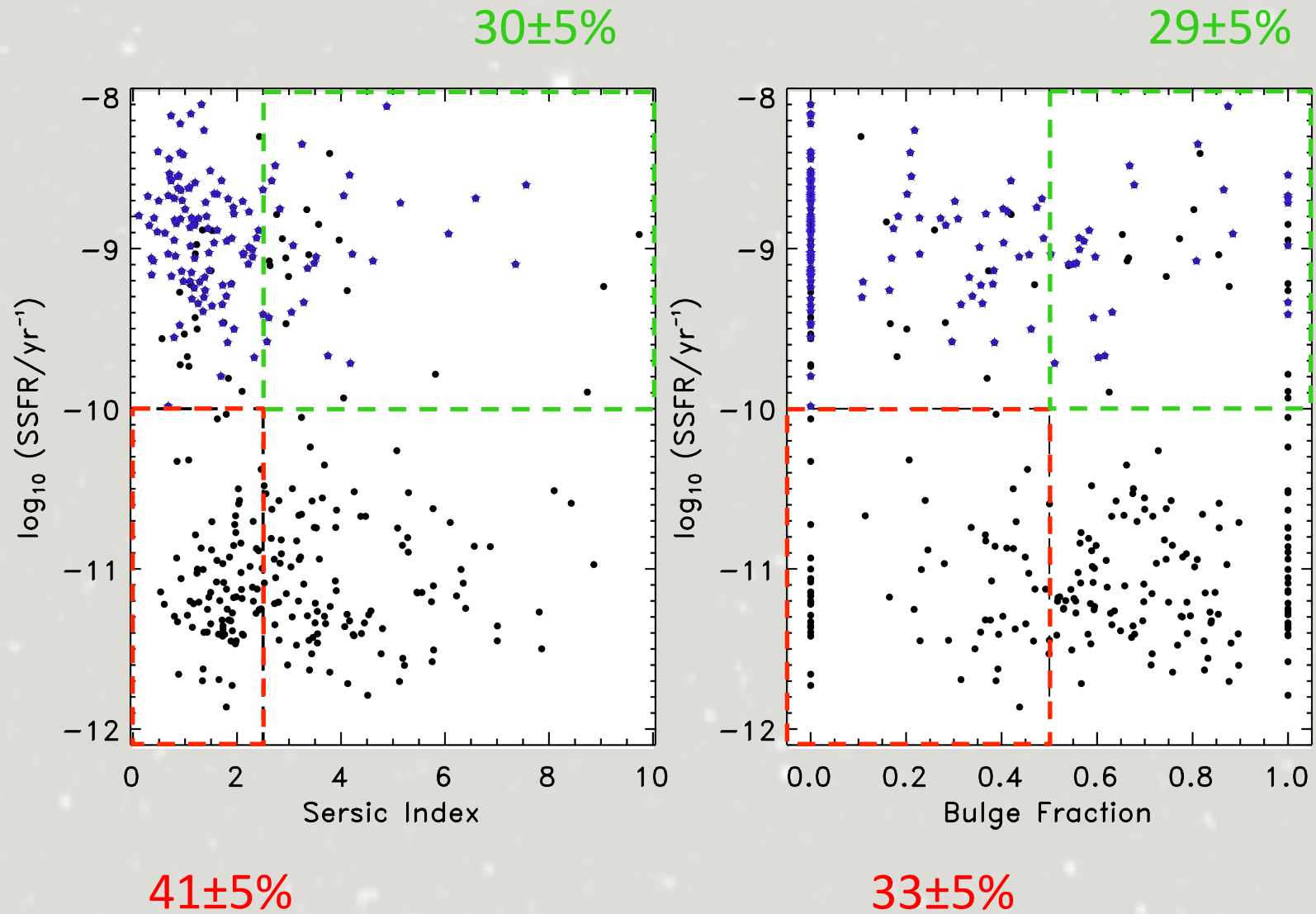
fractions
by light



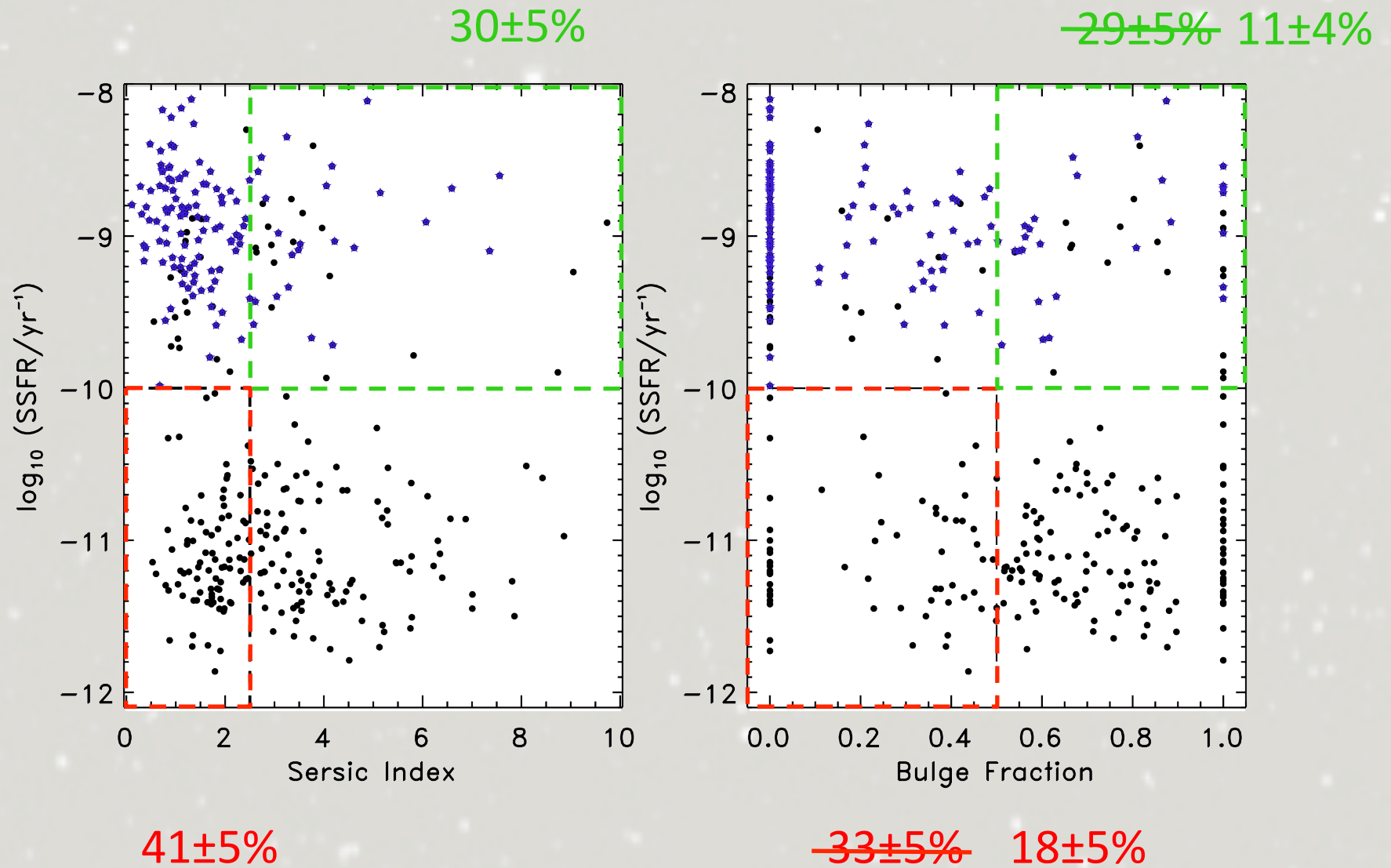
fractions
by mass



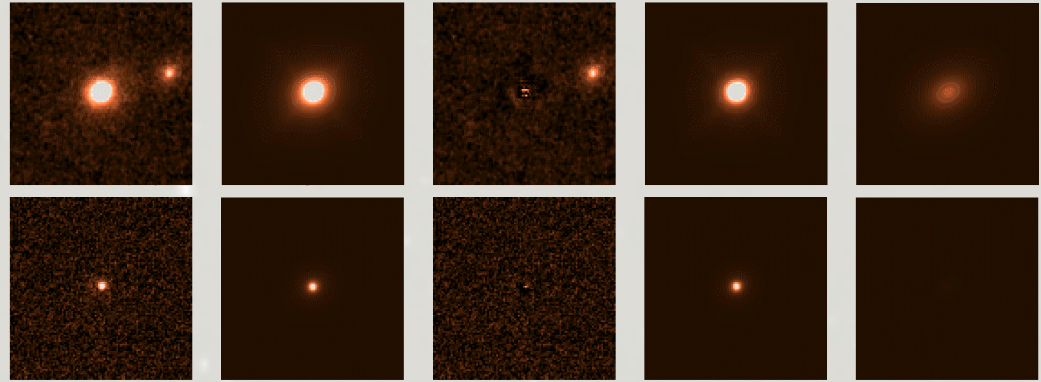
Morphology and Star-formation Rates



Morphology and Individual Star-formation Rates

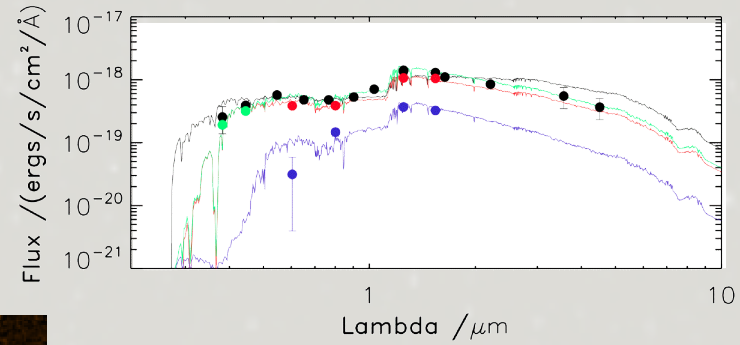
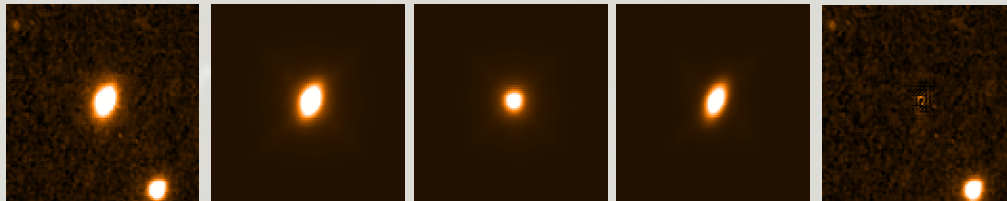


Star-forming Bulges

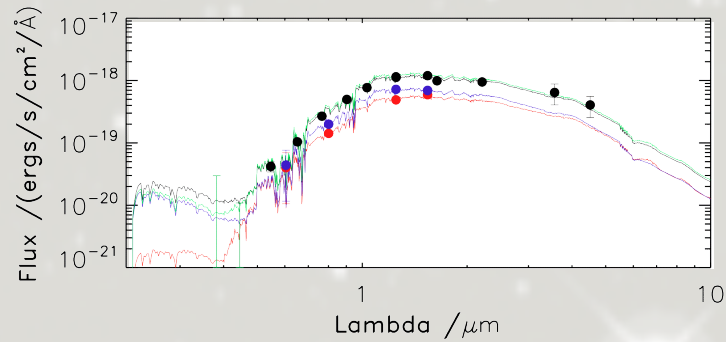


18±5%

Passive Disks

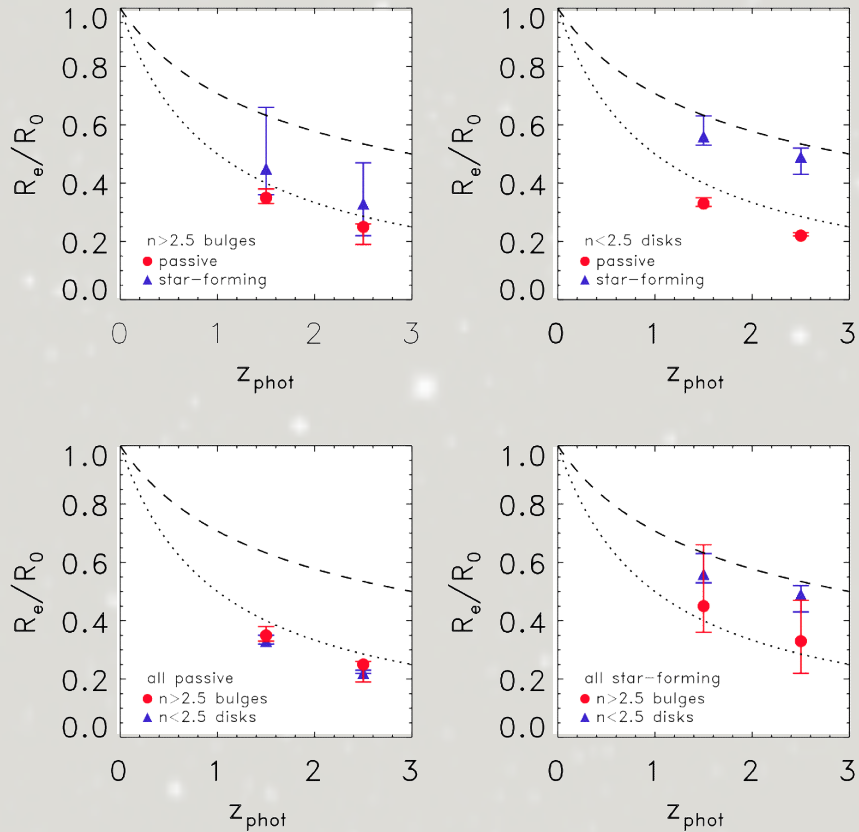


11±4%

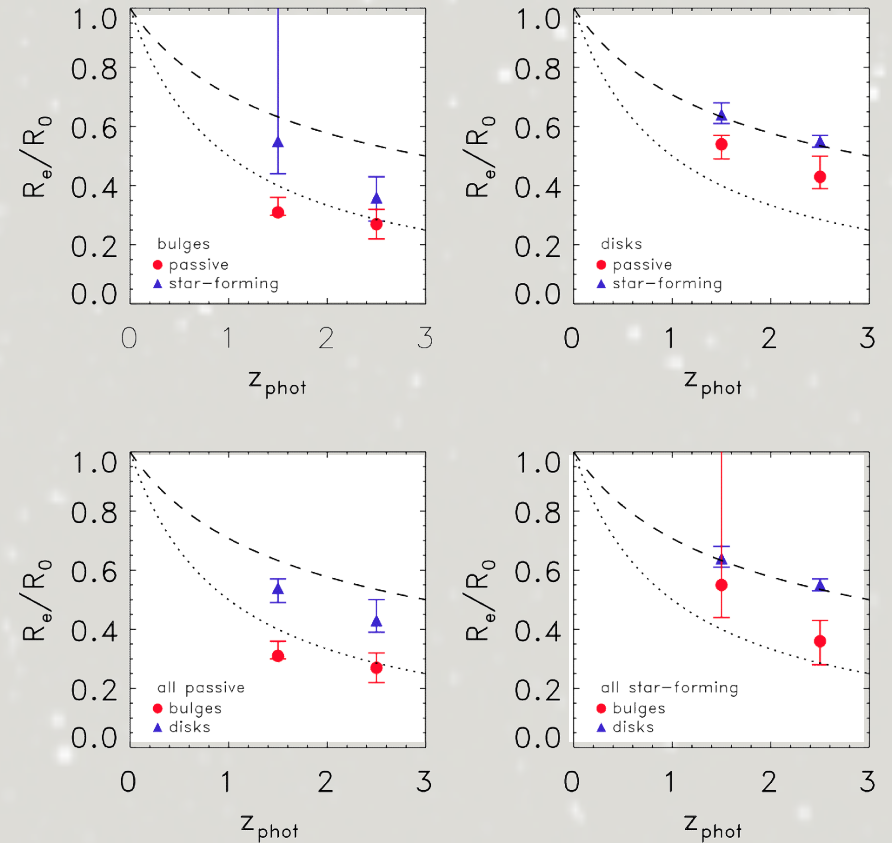


Size Evolution

single Sérsic fits using $n=2.5$



all bulge and disk components

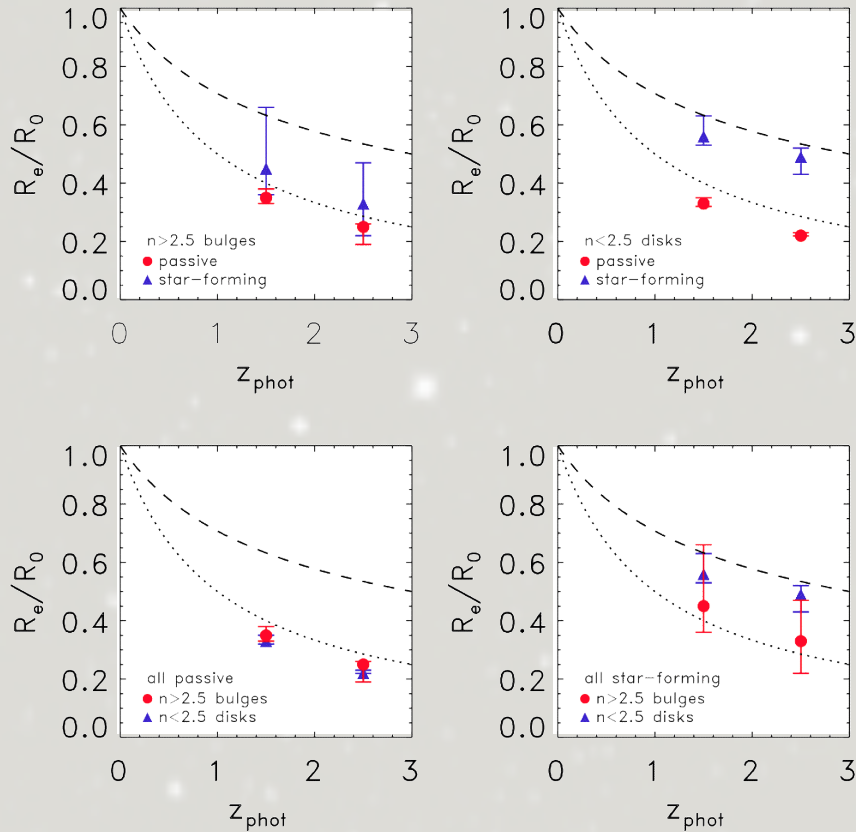


..... $R_e(z)/R_0 \propto (1+z)^{-1}$ for ETG's (van der Wel et al. 2008)

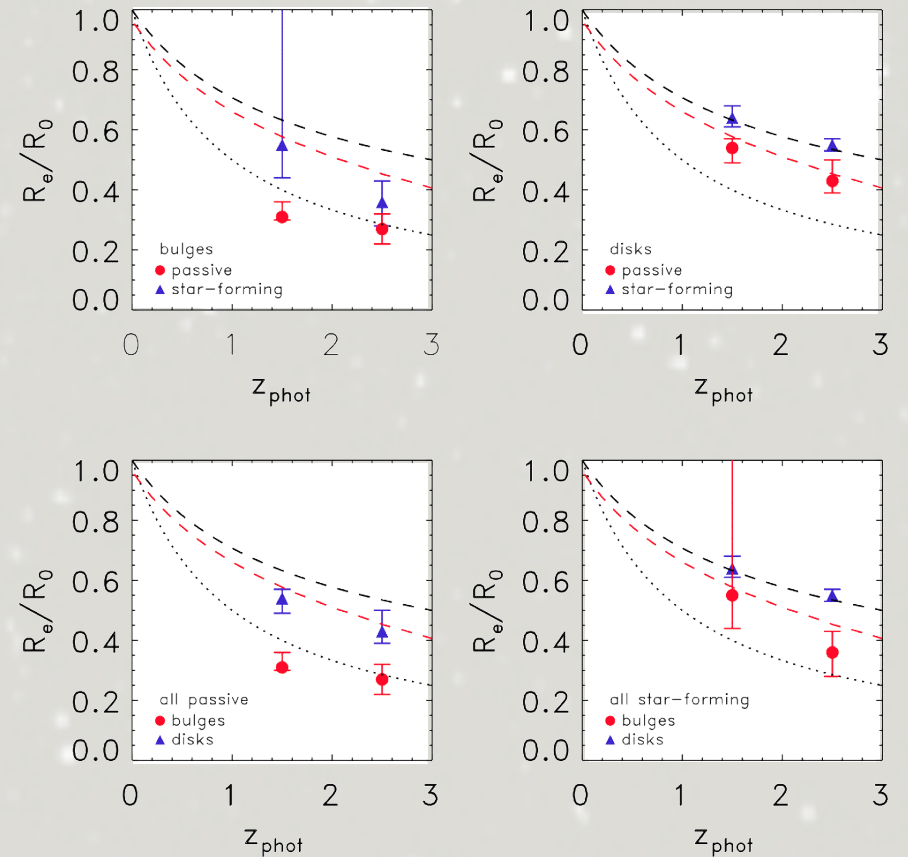
- - - $R_e(z)/R_0 \propto (1+z)^{-0.5}$ for star-forming disks

Size Evolution

single Sérsic fits using $n=2.5$



all bulge and disk components



..... $R_e(z)/R_0 \propto (1+z)^{-1}$ for ETG's (van der Wel et al. 2008)

- - - $R_e(z)/R_0 \propto (1+z)^{-0.5}$ for star-forming disks

- - - 1Gyr earlier star-forming disk relation for the progenitors of passive disks

Conclusions

- $M_{\star} > 10^{11} M_{\odot}$ galaxies are more disk-dominated above $z=2$, and below this become an increasing mix of bulges plus disks with decreasing redshift.
- Pure bulges are yet to emerge by $z=1$.
 - ➡ Therefore $1 < z < 3$ marks the era of the rise of S0 galaxies.
- $18 \pm 5\%$ of passive galaxies are disk-dominated and $11 \pm 4\%$ of star-forming galaxies are bulge-dominated.
 - ➡ Star-formation quenching is not simply connected to morphological transformations.
- Passive disks have intermediate sizes which are larger than passive and star-forming bulges but smaller than star-forming disks.
 - ➡ Passive and star-forming disks have sizes consistent with a secular evolution scenario.