Morphological Bulge-Disk Decompositions of Massive Galaxies at z=1-3 in CANDELS

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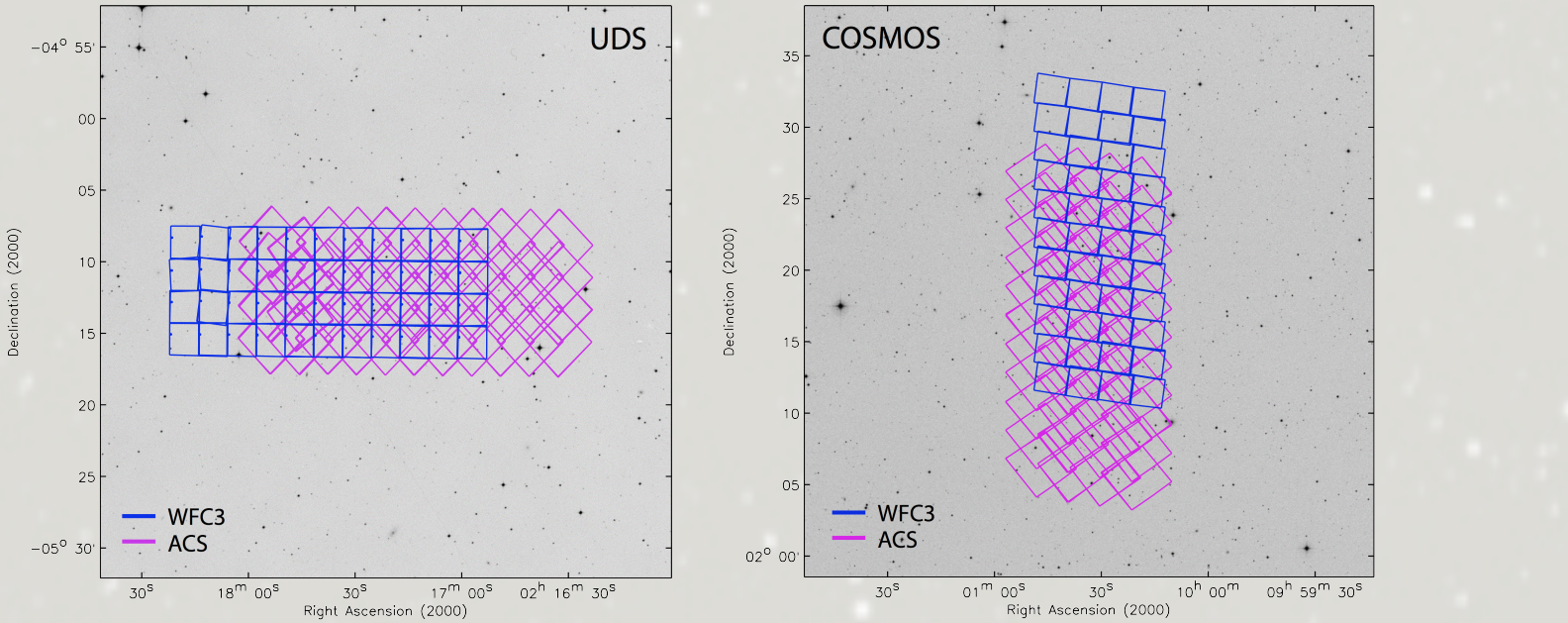
Introduction

- How is star-formation quenched in massive galaxies and how is this 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 $1<z_{phot}<3$ and with $M_{\star}>10^{11}M_{\odot}$

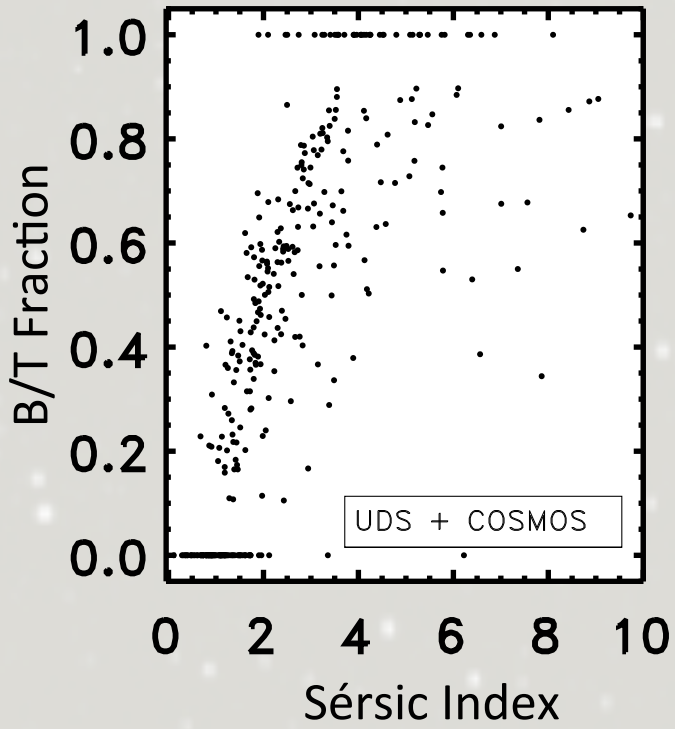
Bulge+Disk Decompositions

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

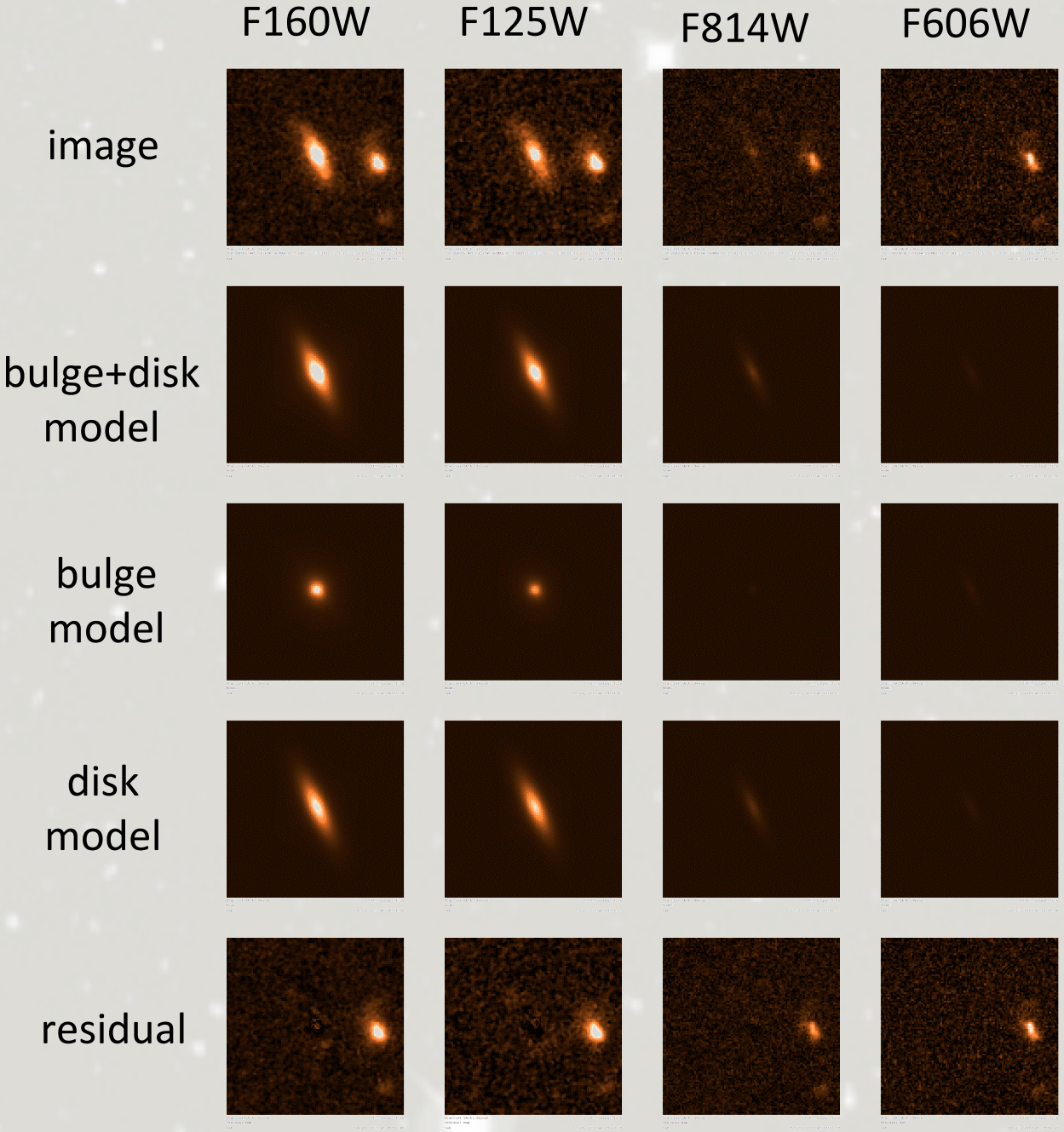
Models:

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

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

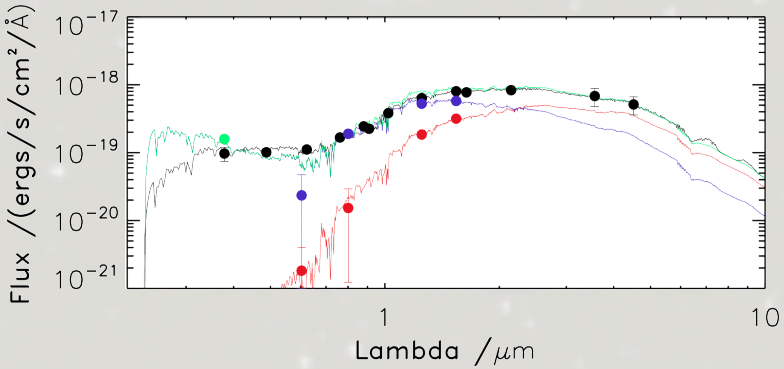


Example Morphological Decomposition

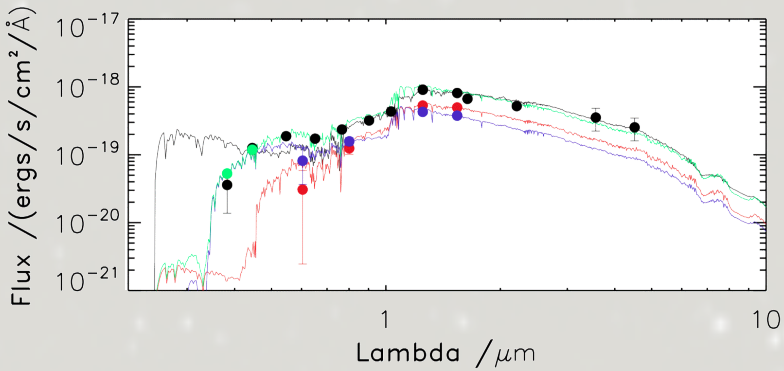


Example SED Fitting

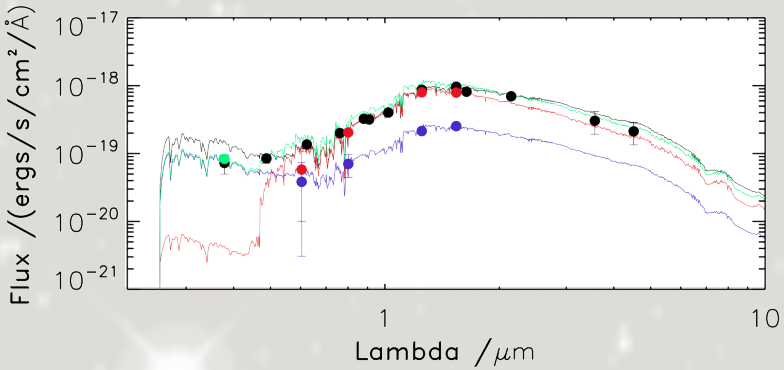
B/T<0.5



B/T=0.5



B/T>0.5



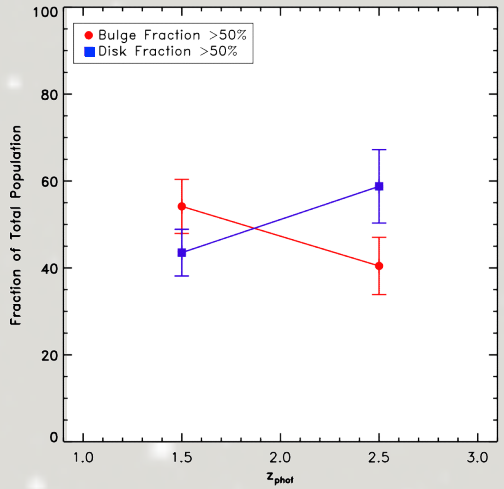
Evolution of Morphological Fractions

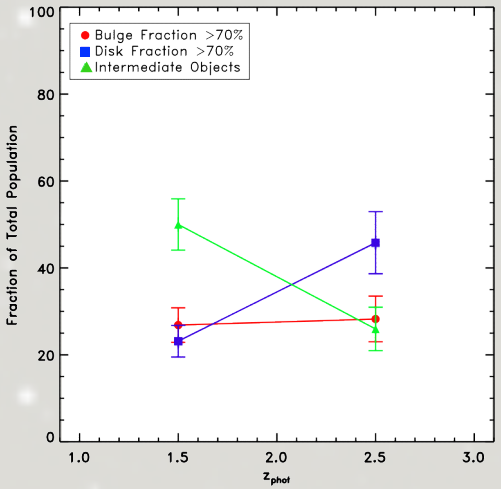
B/T>0.5
D/T>0.5

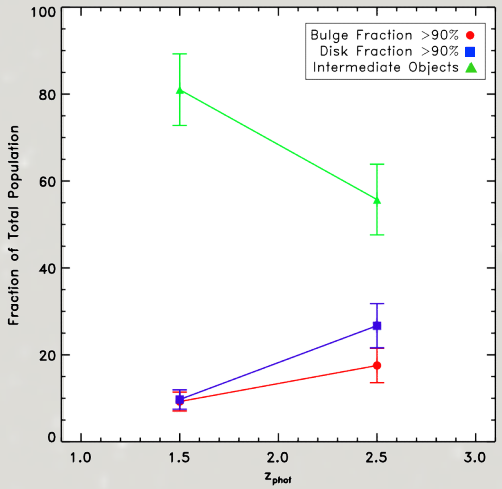
B/T>0.7
D/T>0.7

B/T>0.9
D/T>0.9

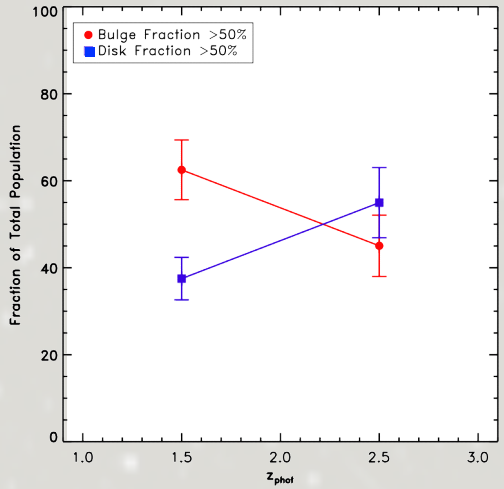
fractions by light

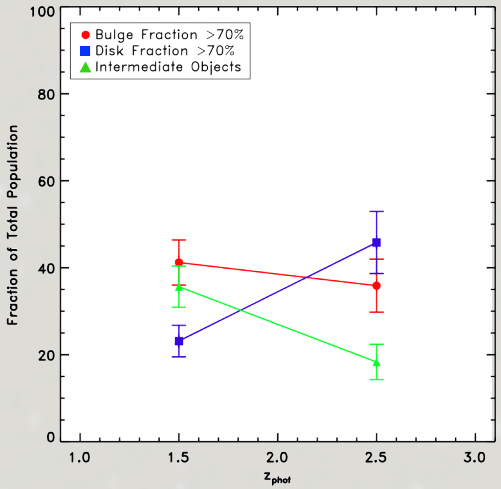


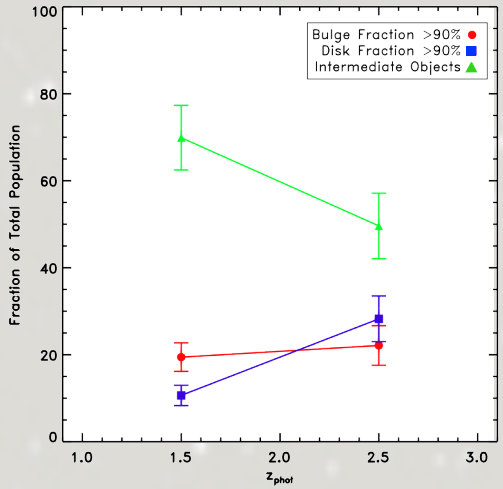




fractions by mass



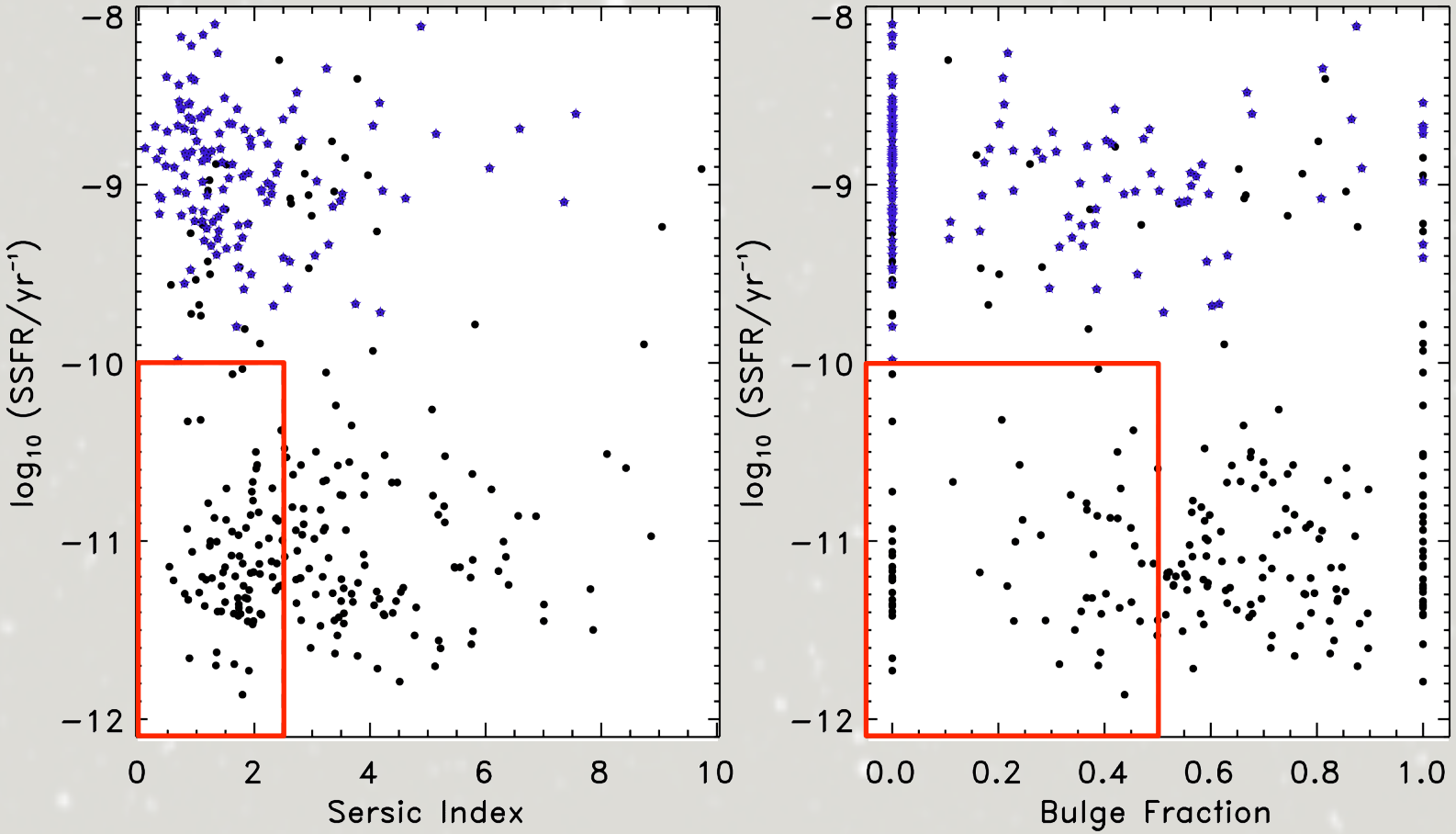




Morphology and Star-formation Rates

40±7%

25±6%

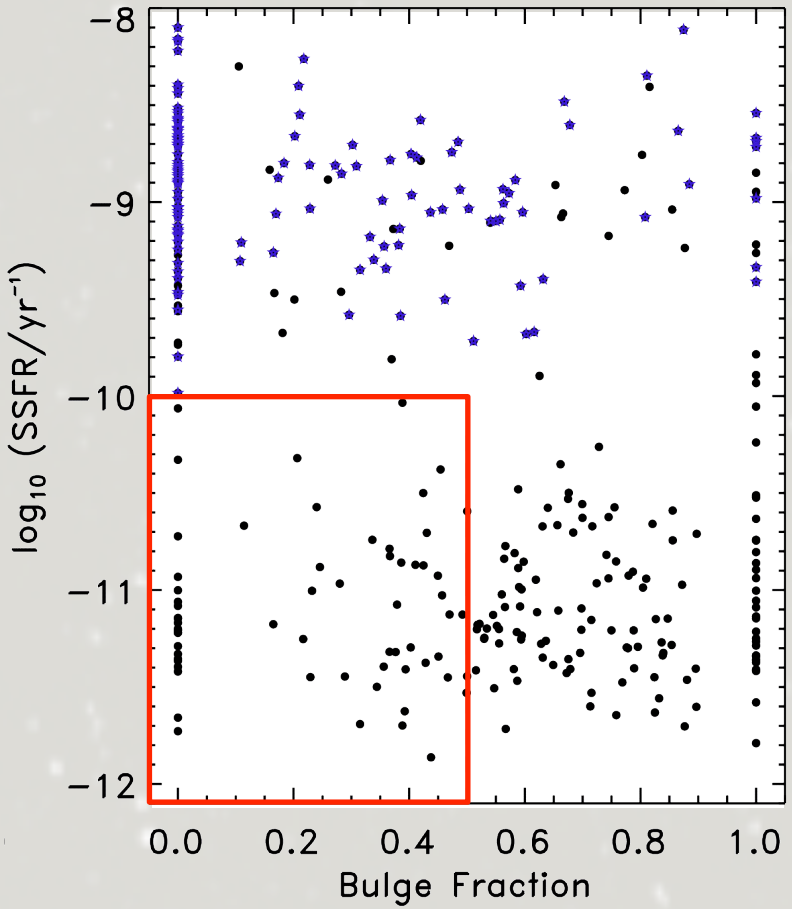


Morphology and Star-formation Rates

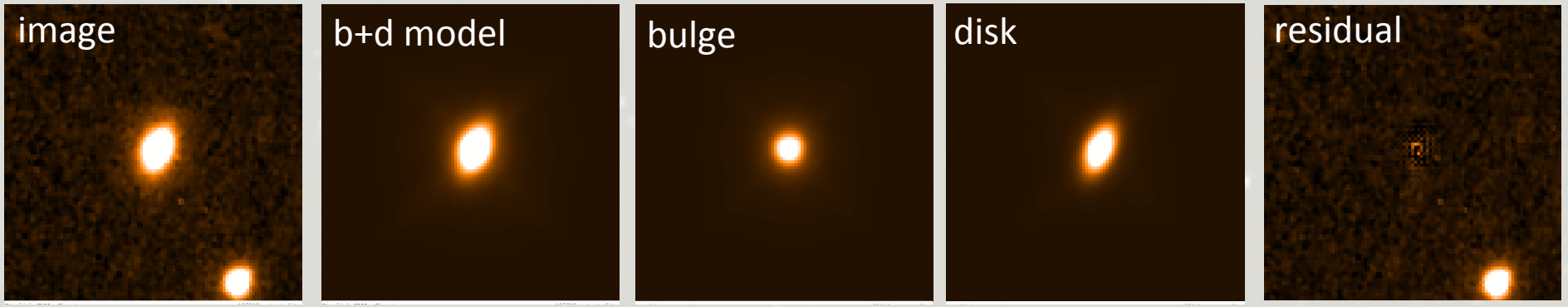
- 61/184 passive galaxies are disk-dominated by bulge light fraction.
- Out of those : 22 are “pure” disks, 39 have best-fit bulge+disk models.
- 30/39 have double component SED fits.
- Only 11/30 are classified as passive disk-dominated galaxies by all criteria.

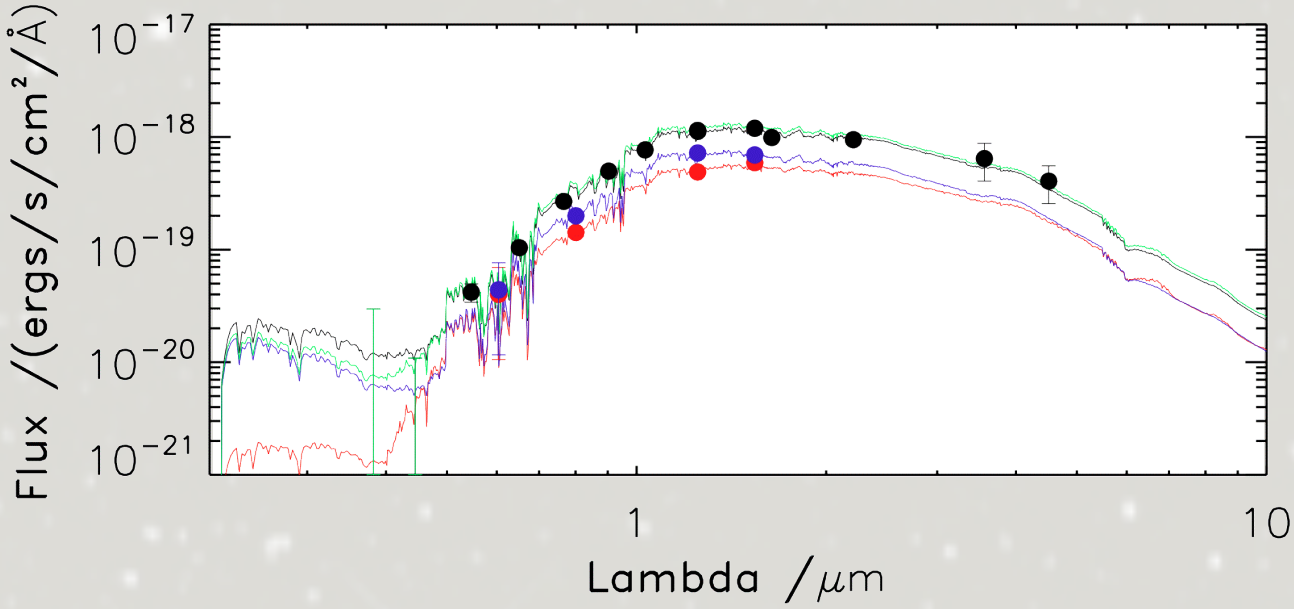
18±4%

25±6%



Passive Disks



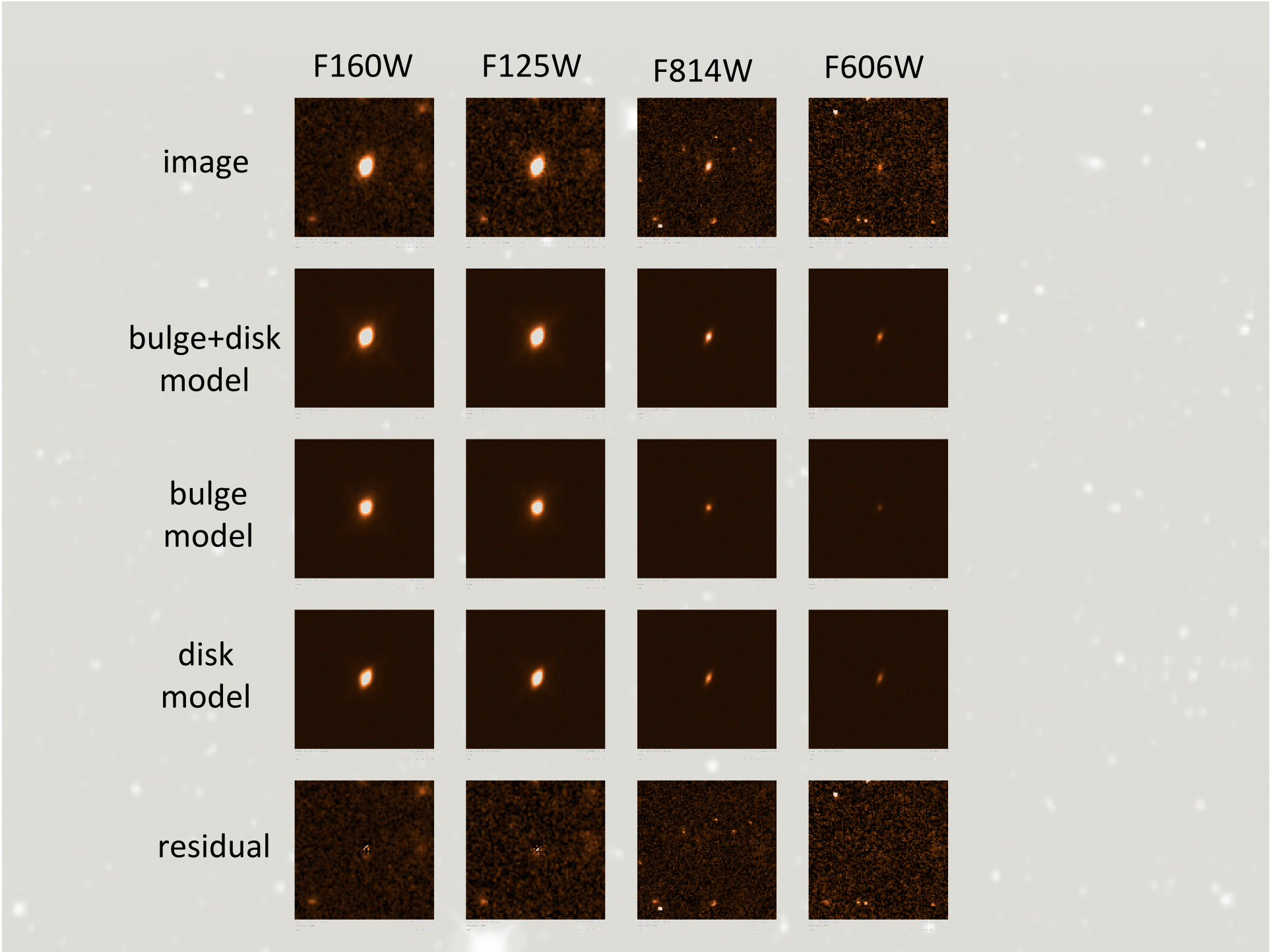


Conclusions

- Above z=2 massive galaxies become increasingly disk-dominated systems, both in terms of their light and mass fractions.
- Pure bulges are yet to emerge by z=1.
- 1<z<3 marks the era of the rise of S0 galaxies.
- A significant fraction of passive galaxies are disk-dominated.
- Star-formation quenching is not simply connected to morphological transformations.

Cold Streams:
Keres et al. 2005
Dekel et al. 2009a
Birnboim & Dekel 2003
Dekel & Birnboim 2006

Violent Disk Instabilities:
Dekel et al. 2009b
Ceverino et al. 2010
Cacciato et al. 2012


F160W
F125W
F814W
F606W
image
bulge+disk model
bulge model
disk model
residual