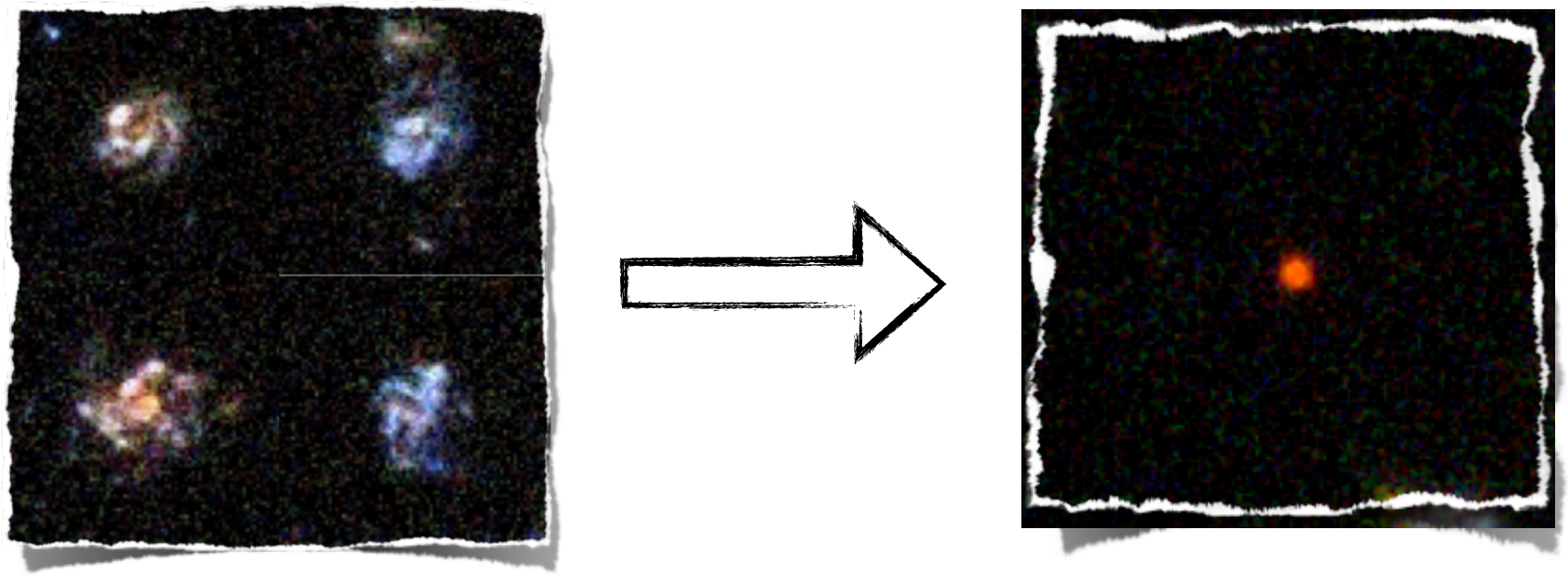
Live fast, die... small:

The progenitors of the first quiescent galaxies



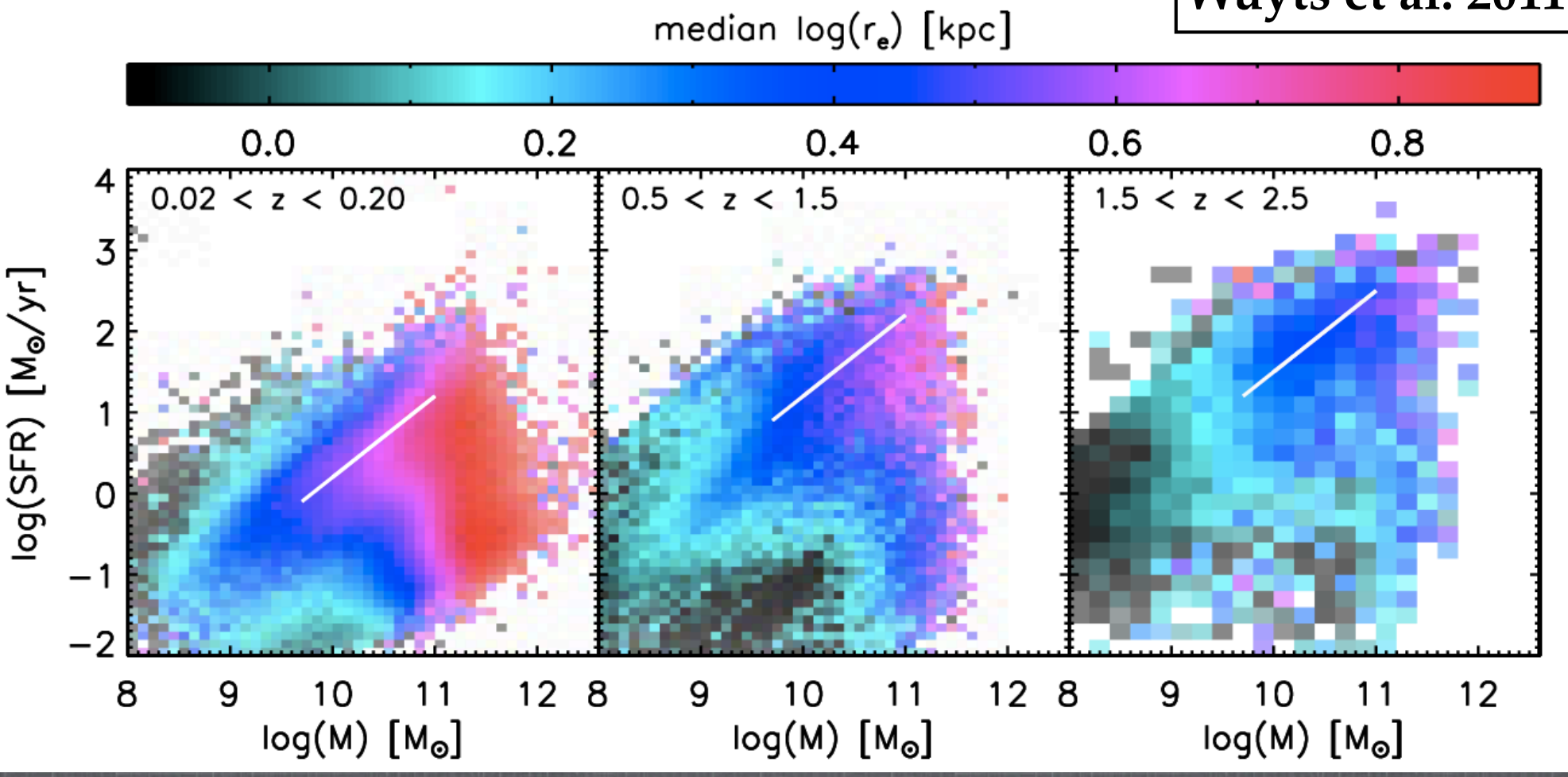
Guillermo Barro (UCSC)

S. Faber, P. Perez-Gonzalez, D. Koo, J. Trump, D. Kocevski, E. McGrath, L. Porter, J. Primack, C. Pacifici, C. Moody, P. Kollipara, A. van der Wel, S. Wuyts + CANDELS

June 21th 2013, UCM - *SHARDS team meeting*

The SFR-M plane

Wuyts et al. 2011

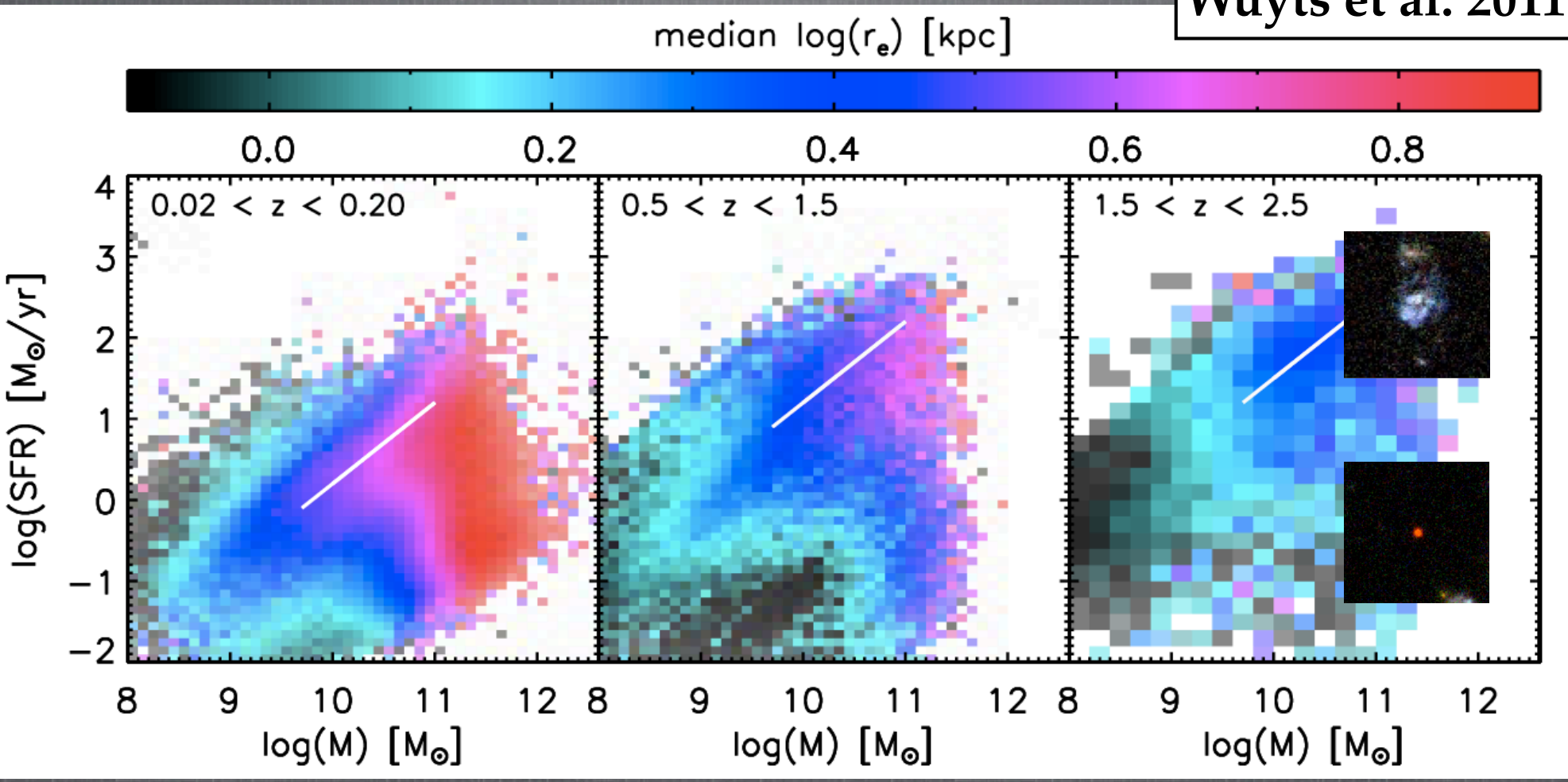


$SFR \approx M^{\alpha}$

- SFGs are bigger at a given mass

The SFR-M plane

Wuyts et al. 2011

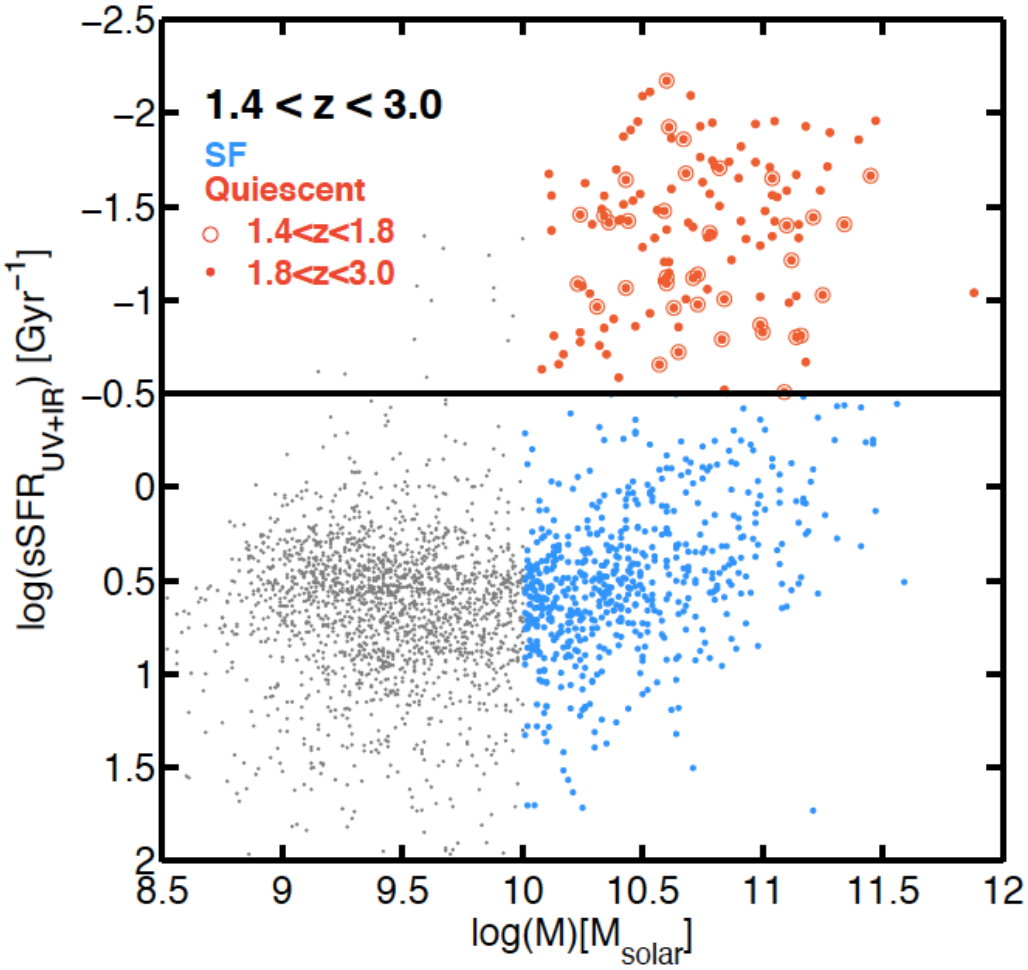


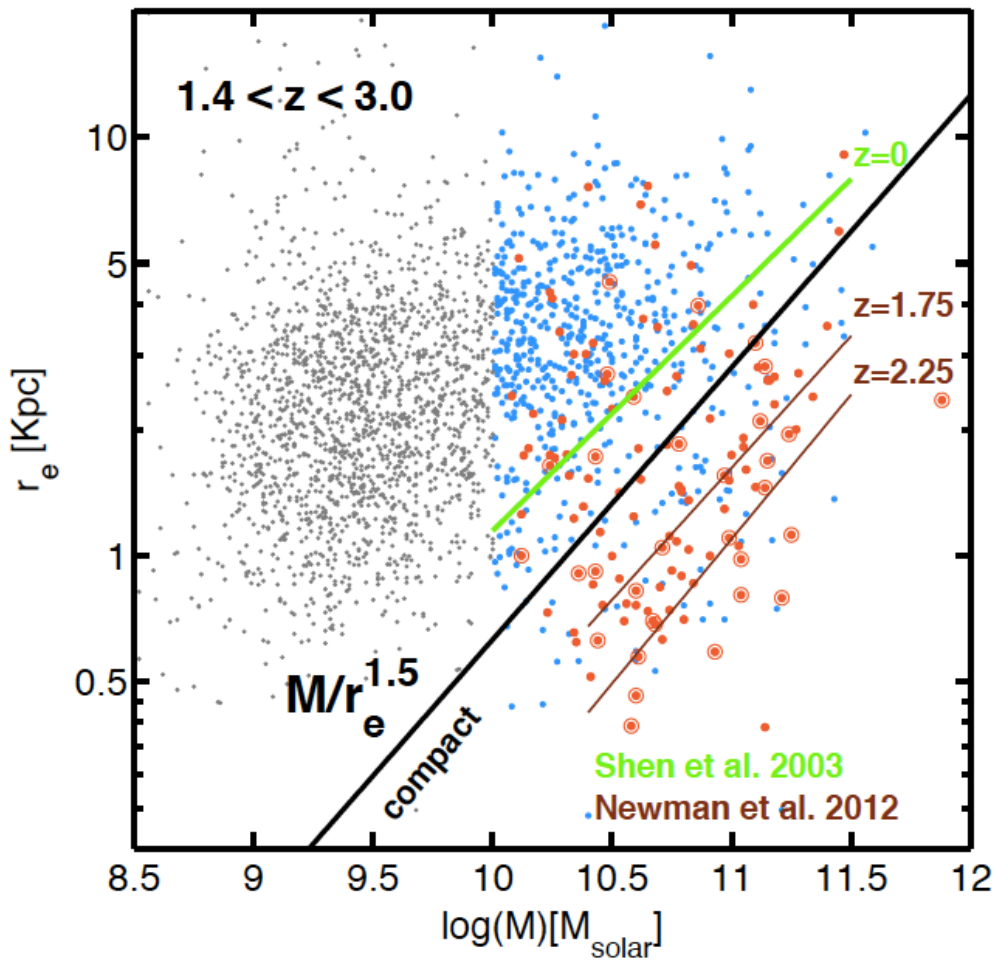
$SFR \approx M^{\alpha}$

- SFGs are bigger at a given mass

sSFR-M and Mass-Size

Barro et al. 2013

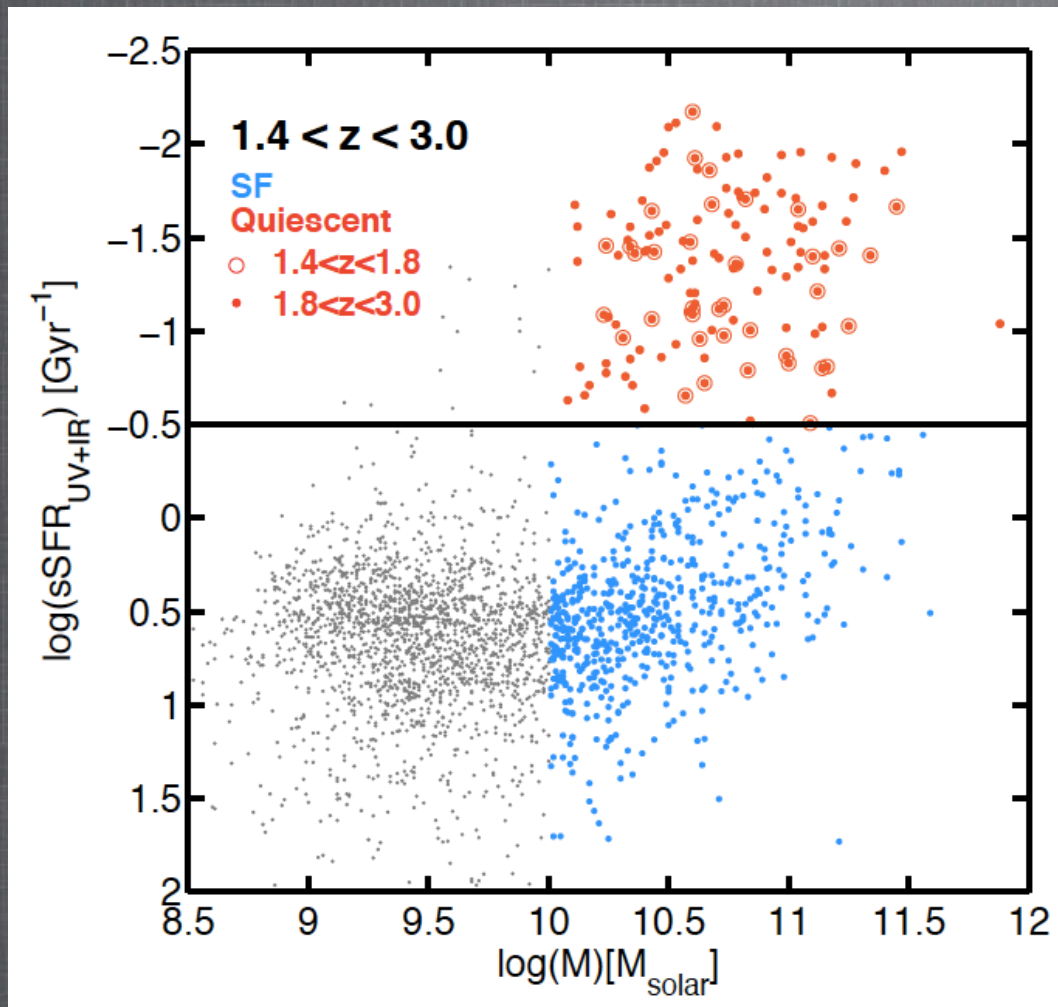


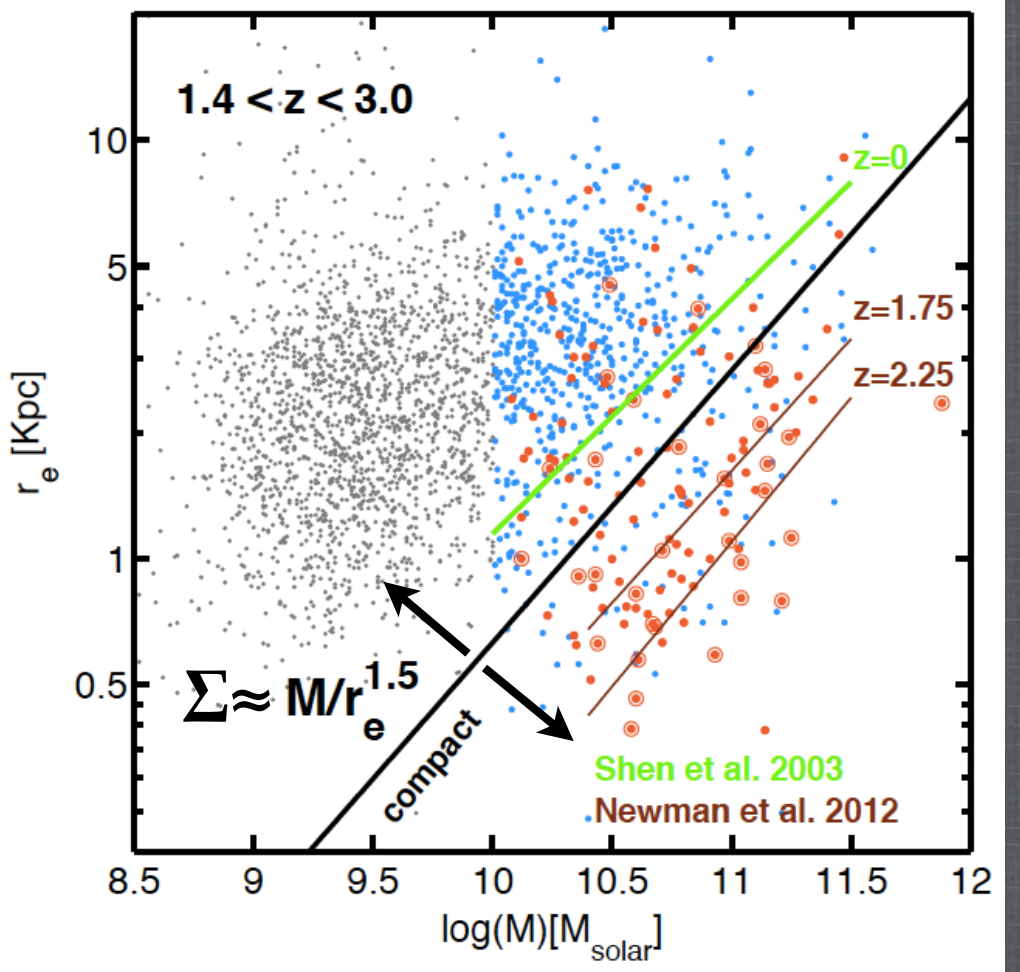


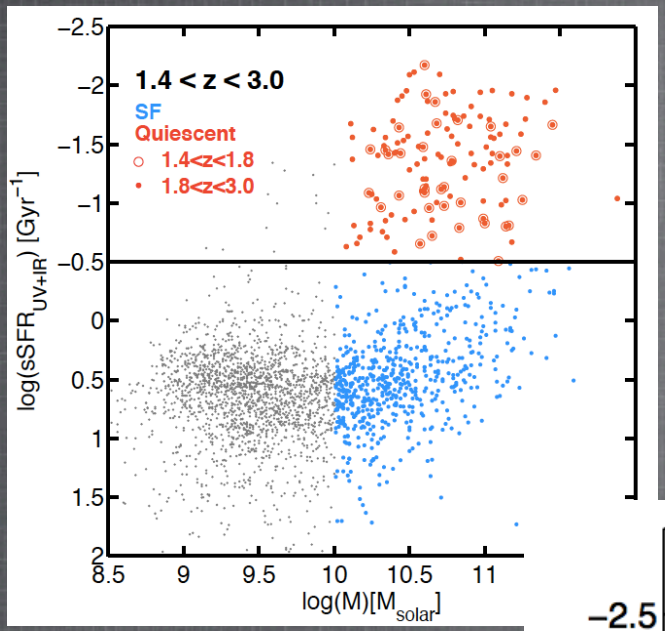
- CANDELS H-band selected in GOODS-S & UDS , log(M)>10
- Photo-z's (spec-z), stellar masses, (UV+IR) SFRs, GALFIT morphologies

sSFR-M and Mass-Size

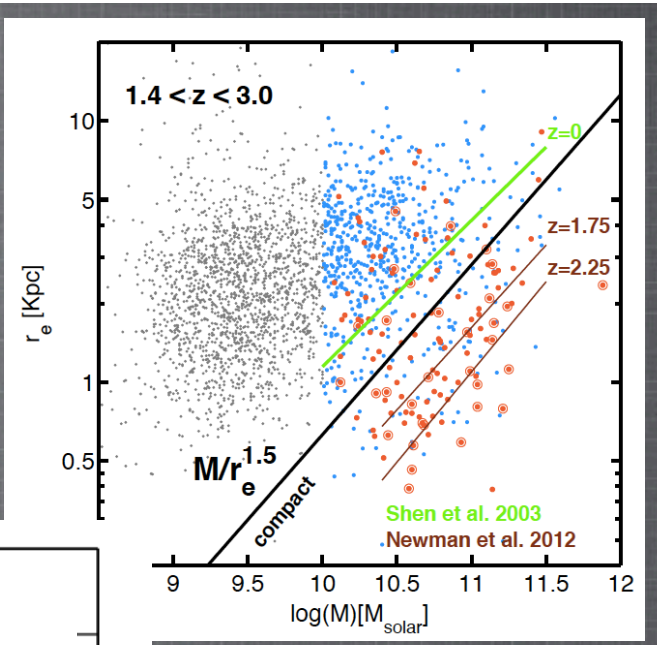
Barro et al. 2013

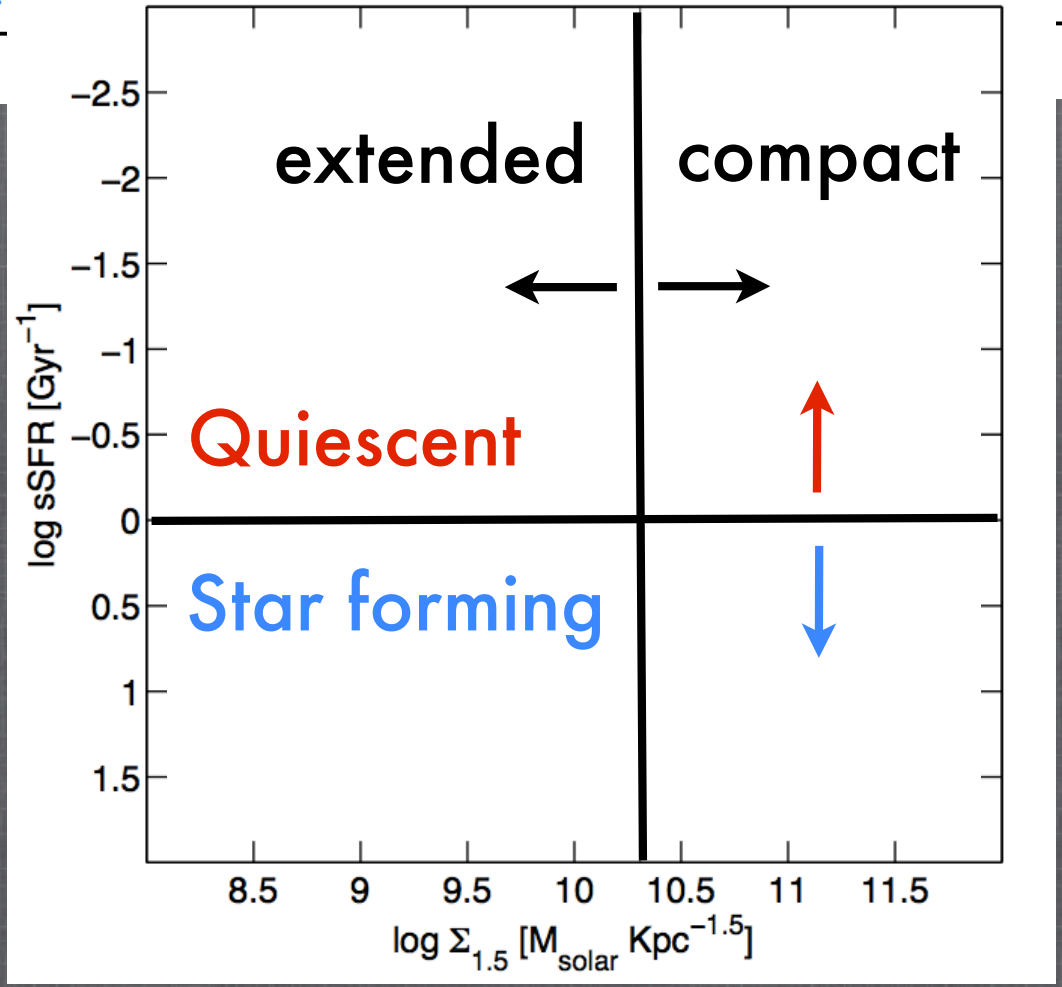


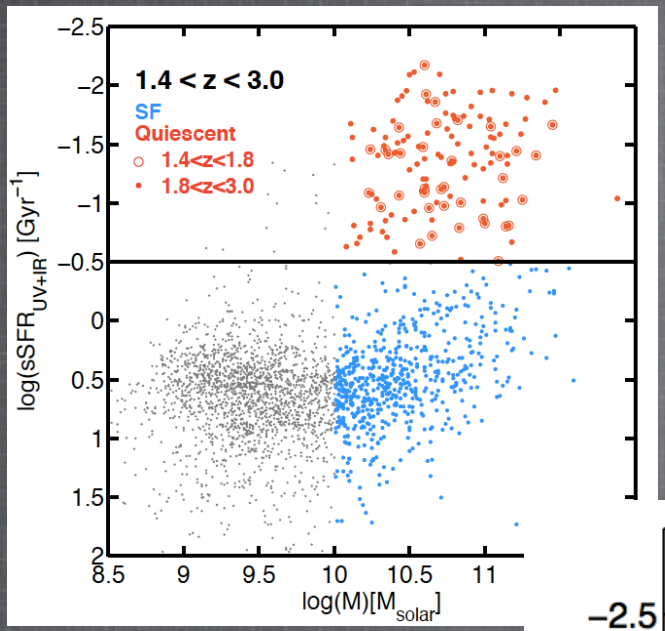


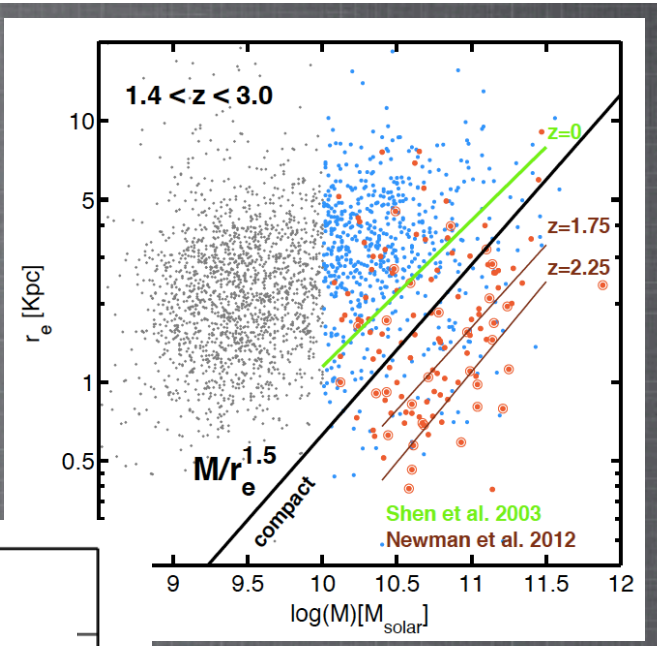

1.4 < z < 3.0
SF
Quiescent
1.4<z<1.8
1.8<z<3.0
log(sSFR$_{UV+IR}$) [Gyr^{-1}]
log(M)[M$_{solar}$]

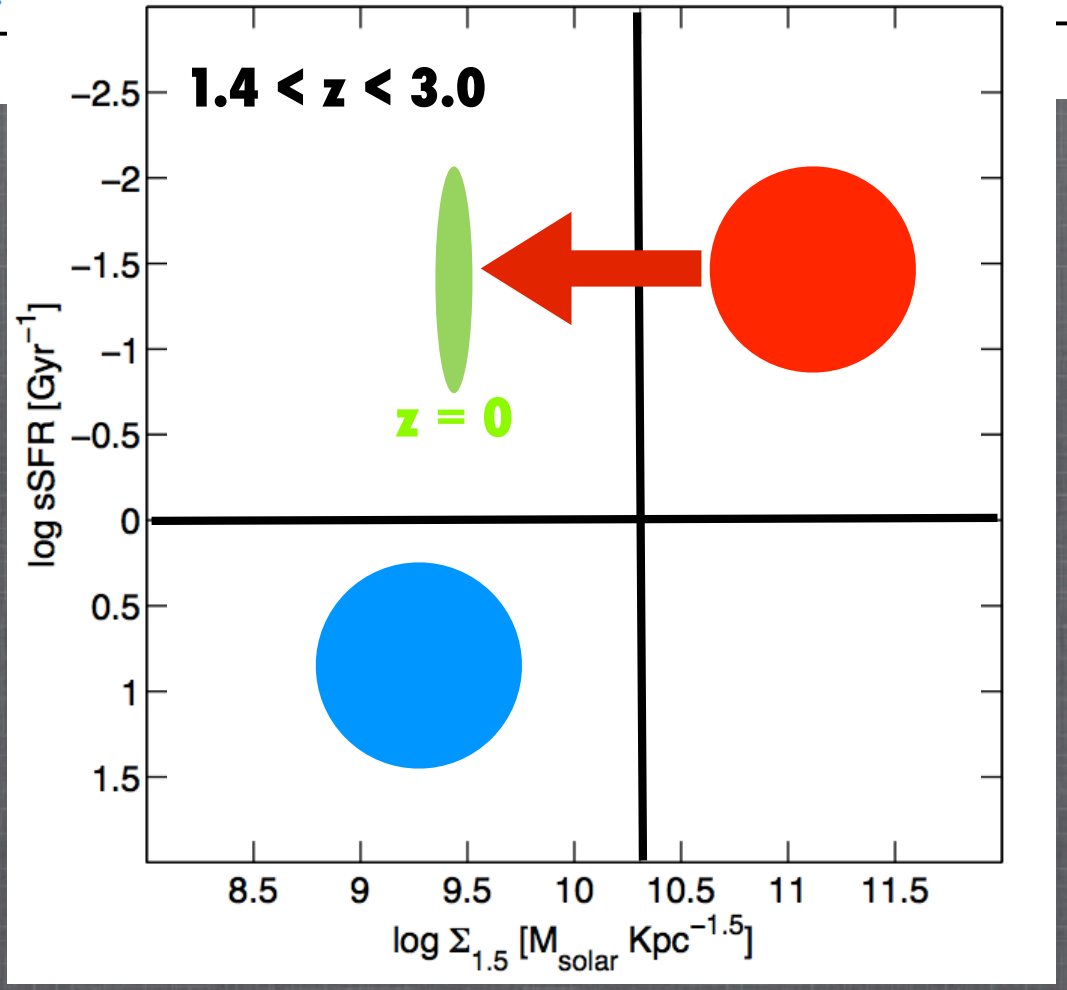
1.4 < z < 3.0

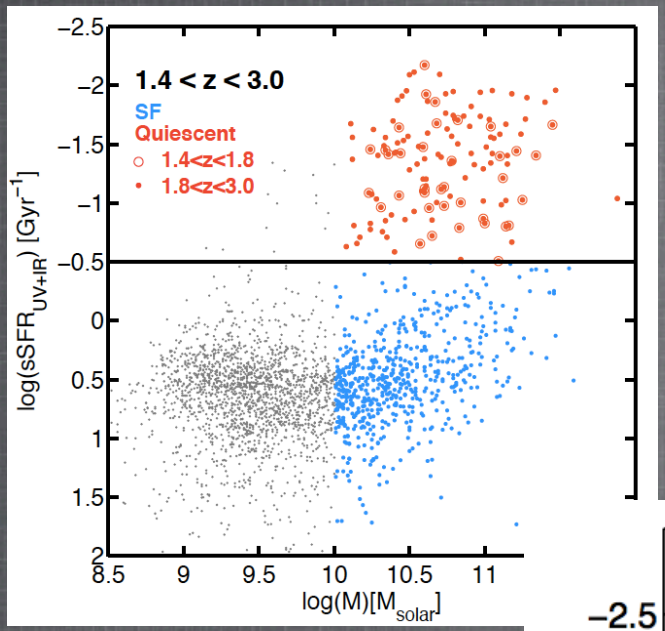

1.4 < z < 3.0
z=0
z=1.75
z=2.25
M/r$_e^{1.5}$
compact
Shen et al. 2003
Newman et al. 2012
r$_e$ [Kpc]
log(M)[M$_{solar}$]


extended
compact
Quiescent
Star forming
log sSFR [Gyr^{-1}]
log Σ$_{1.5}$ [M$_{solar}$ Kpc$^{-1.5}$]

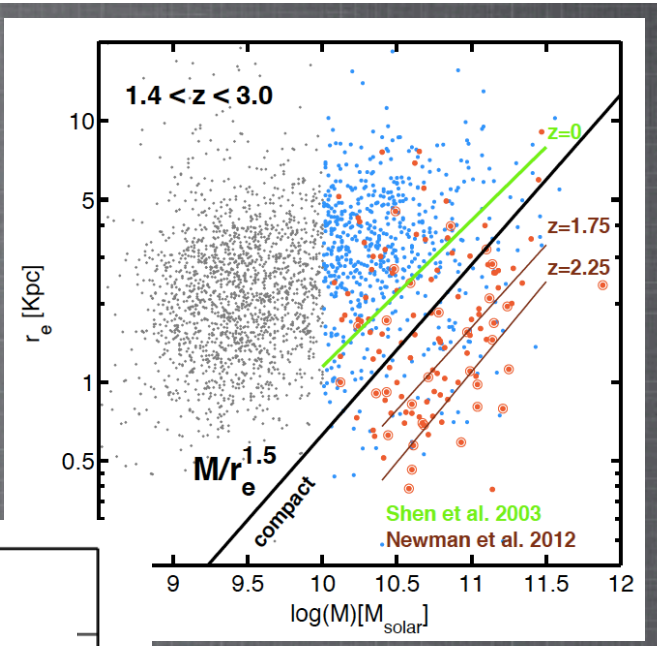

1.4 < z < 3.0
SF
Quiescent
1.4<z<1.8
1.8<z<3.0
log(sSFR$_{UV+IR}$) [Gyr^{-1}]
log(M)[M$_{solar}$]

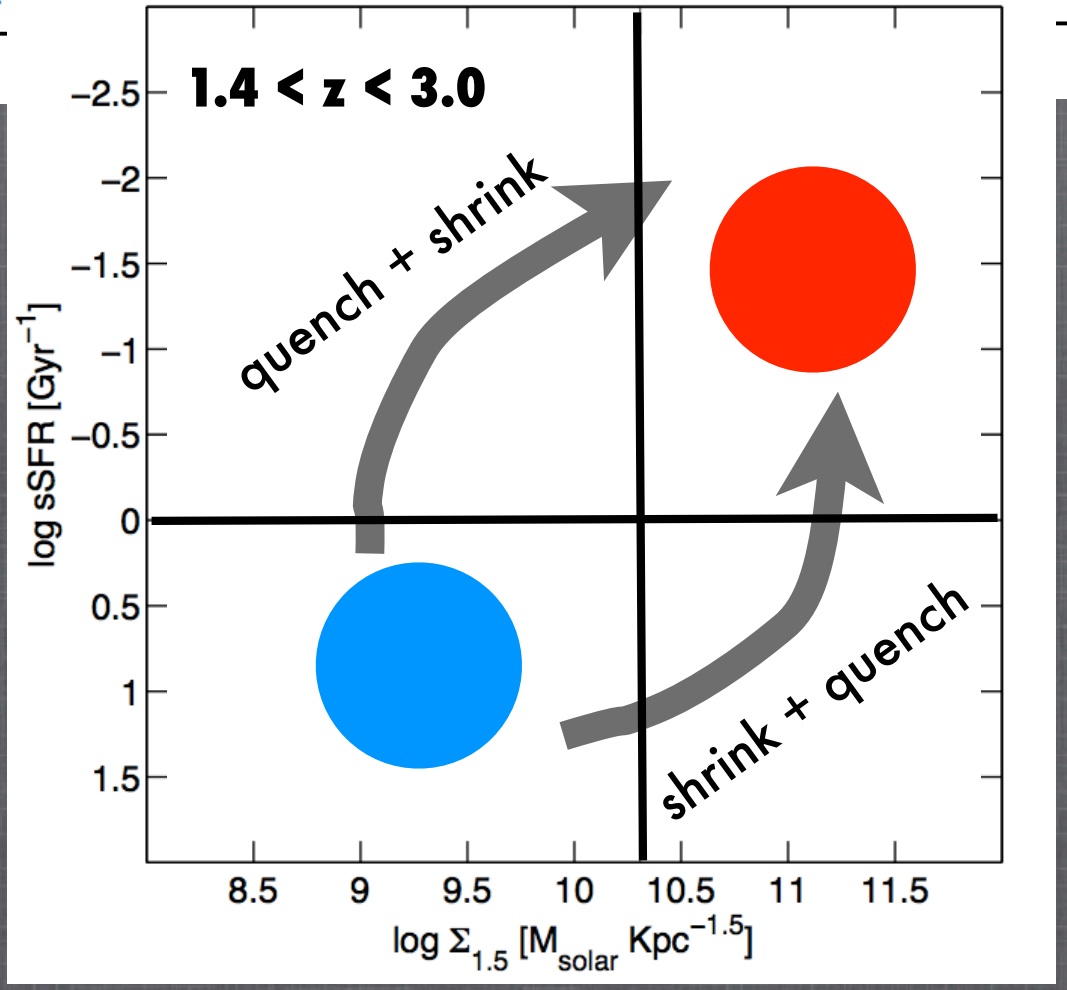

1.4 < z < 3.0
z=0
z=1.75
z=2.25
M/r$_e^{1.5}$
compact
Shen et al. 2003
Newman et al. 2012
r$_e$ [Kpc]
log(M)[M$_{solar}$]

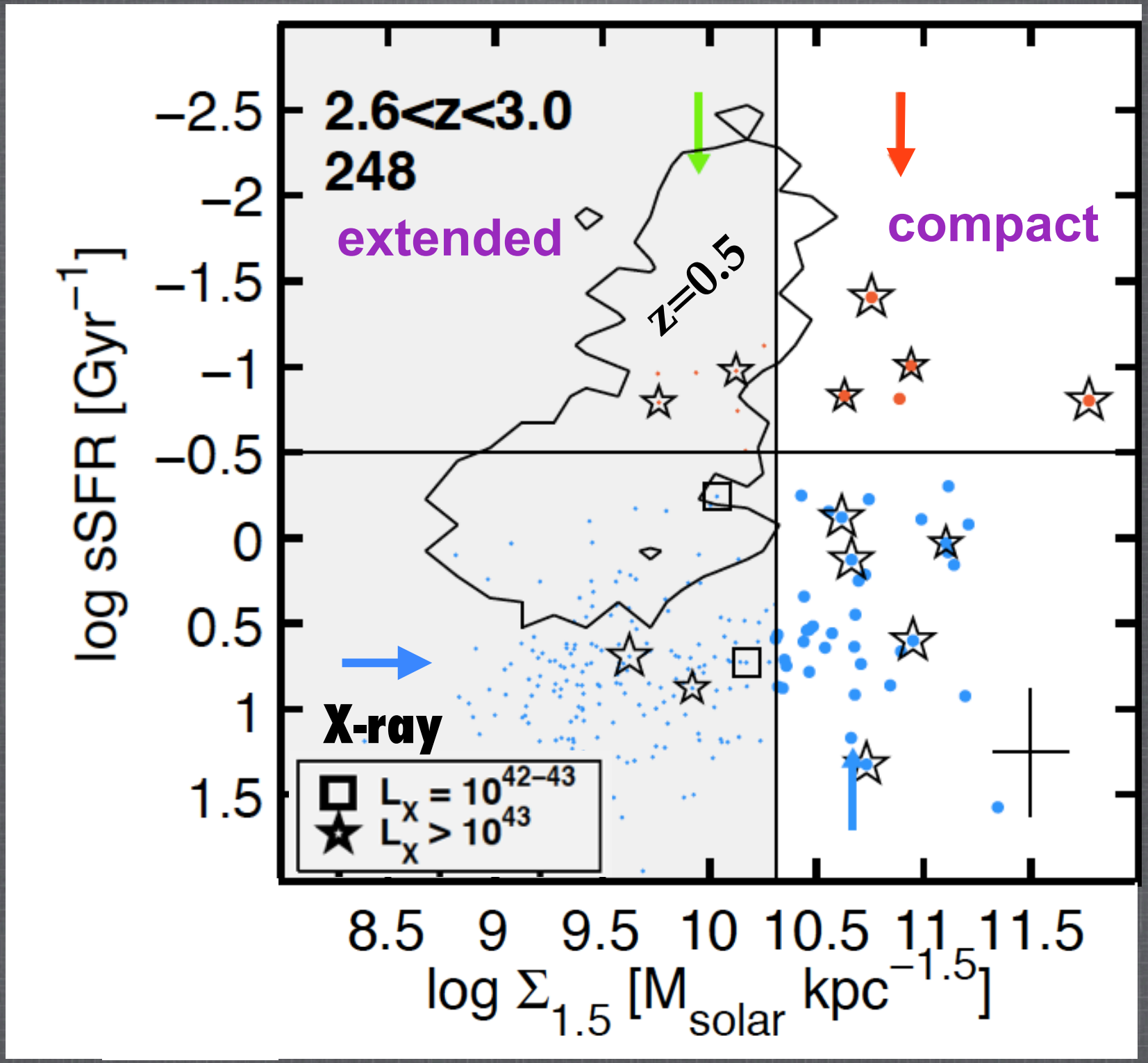

1.4 < z < 3.0
z = 0
log sSFR [Gyr^{-1}]
log Σ$_{1.5}$ [M$_{solar}$ Kpc$^{-1.5}$]

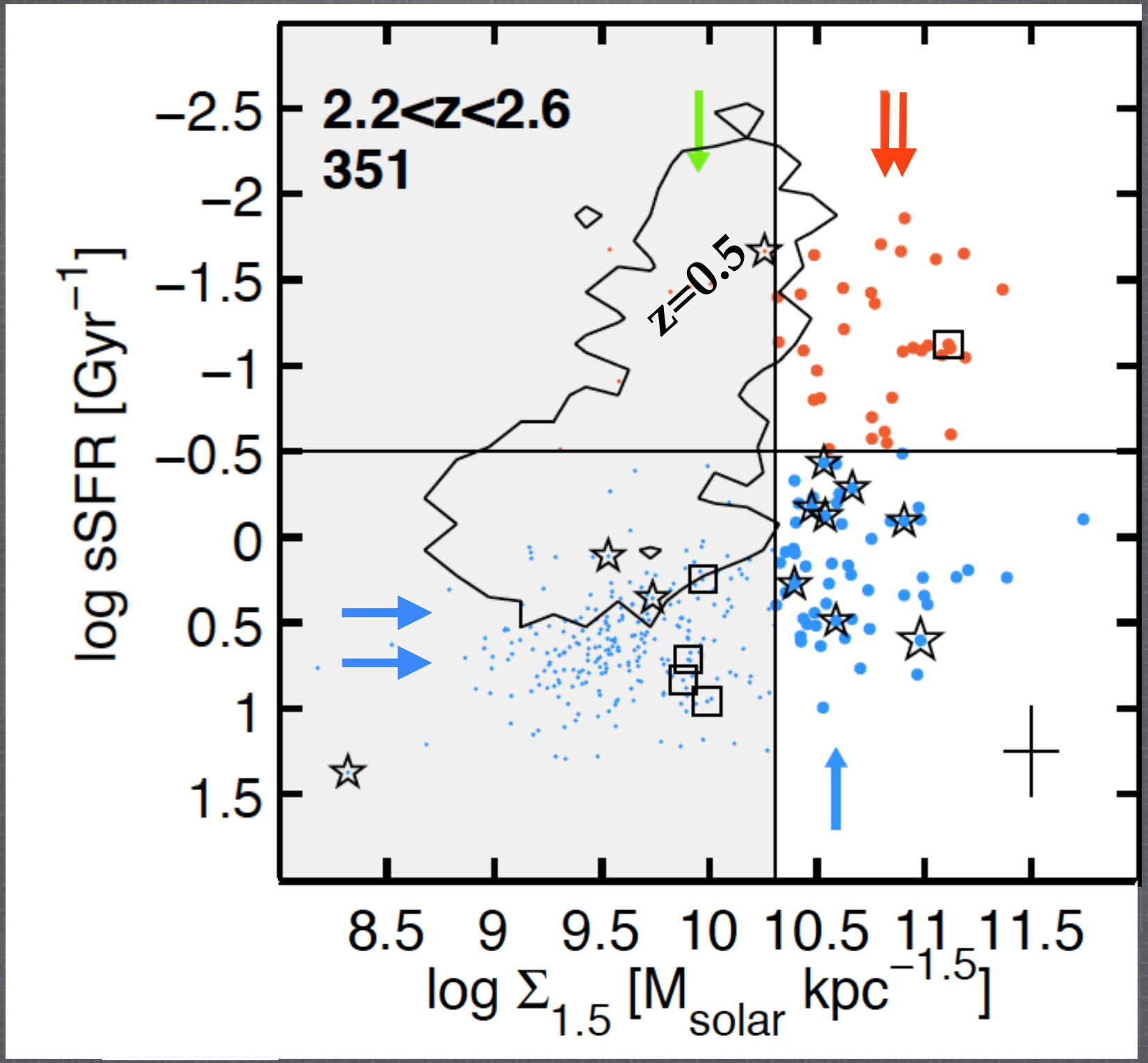

1.4 < z < 3.0
SF
Quiescent
1.4<z<1.8
1.8<z<3.0
log(sSFR$_{UV+IR}$) [Gyr^{-1}]
log(M)[M$_{solar}$]

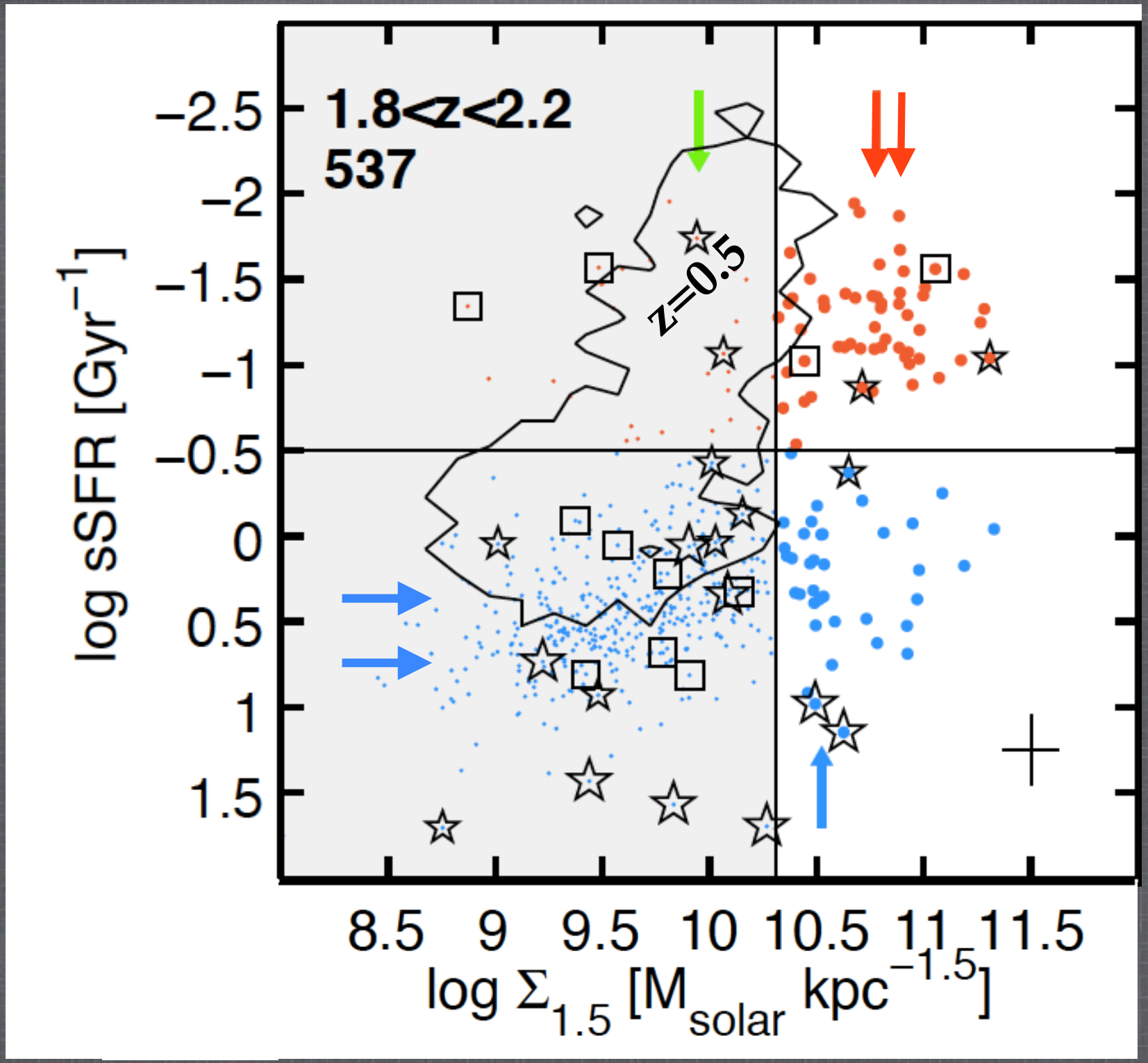
?

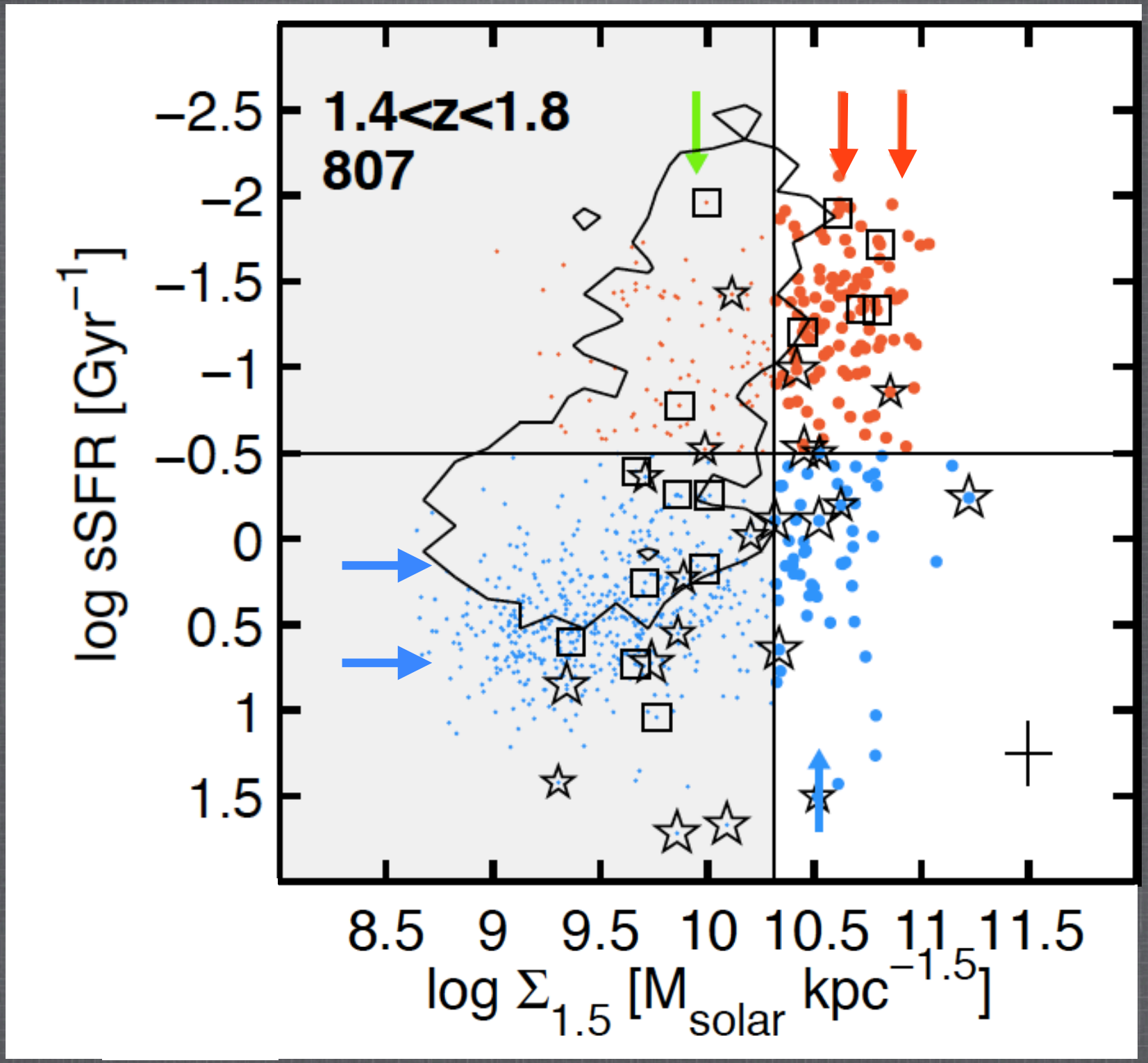

1.4 < z < 3.0
z=0
z=1.75
z=2.25
M/r$_e^{1.5}$
compact
Shen et al. 2003
Newman et al. 2012
r$_e$ [Kpc]
log(M)[M$_{solar}$]

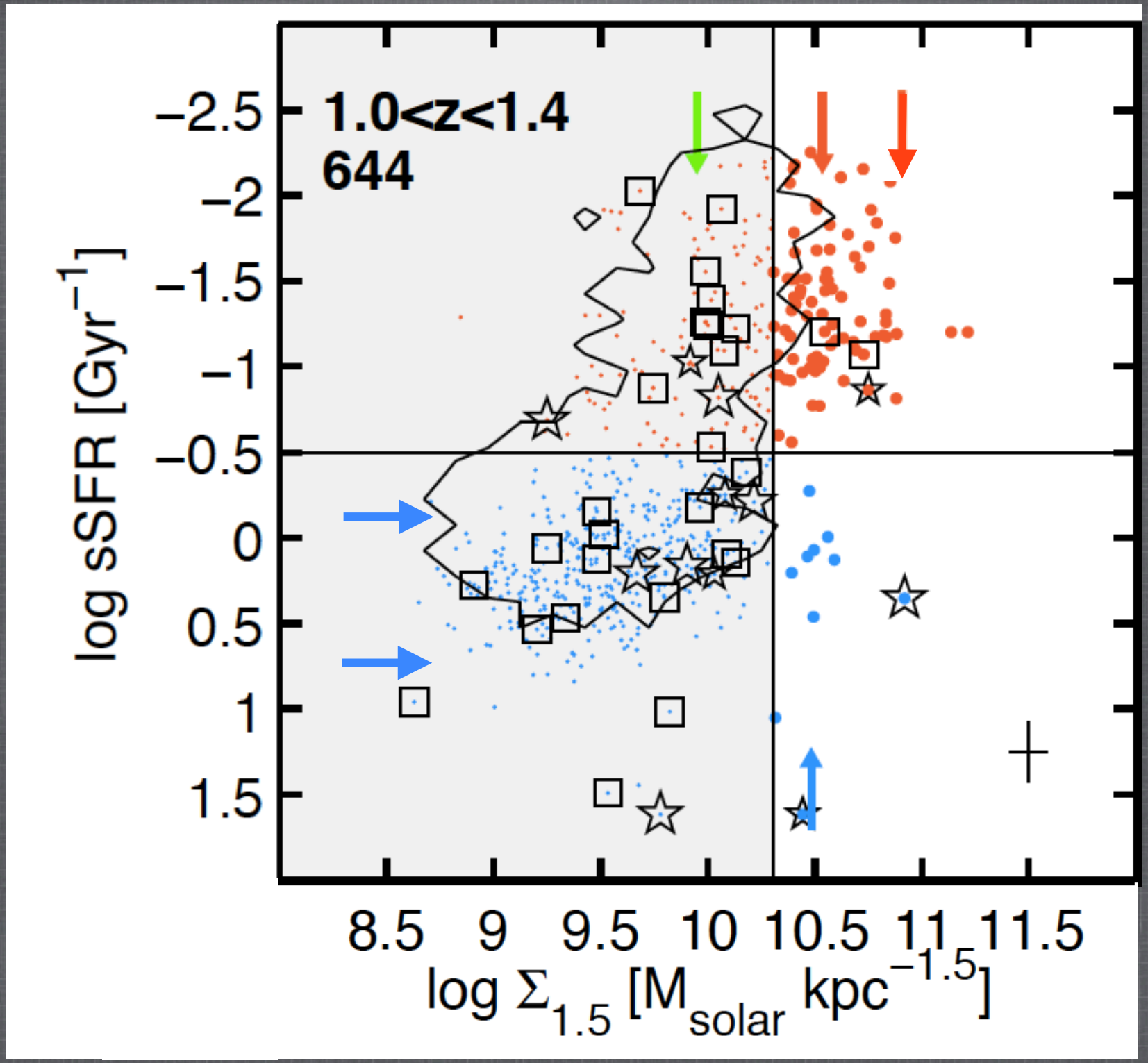

1.4 < z < 3.0
quench + shrink
shrink + quench
log sSFR [Gyr^{-1}]
log Σ$_{1.5}$ [M$_{solar}$ Kpc$^{-1.5}$]

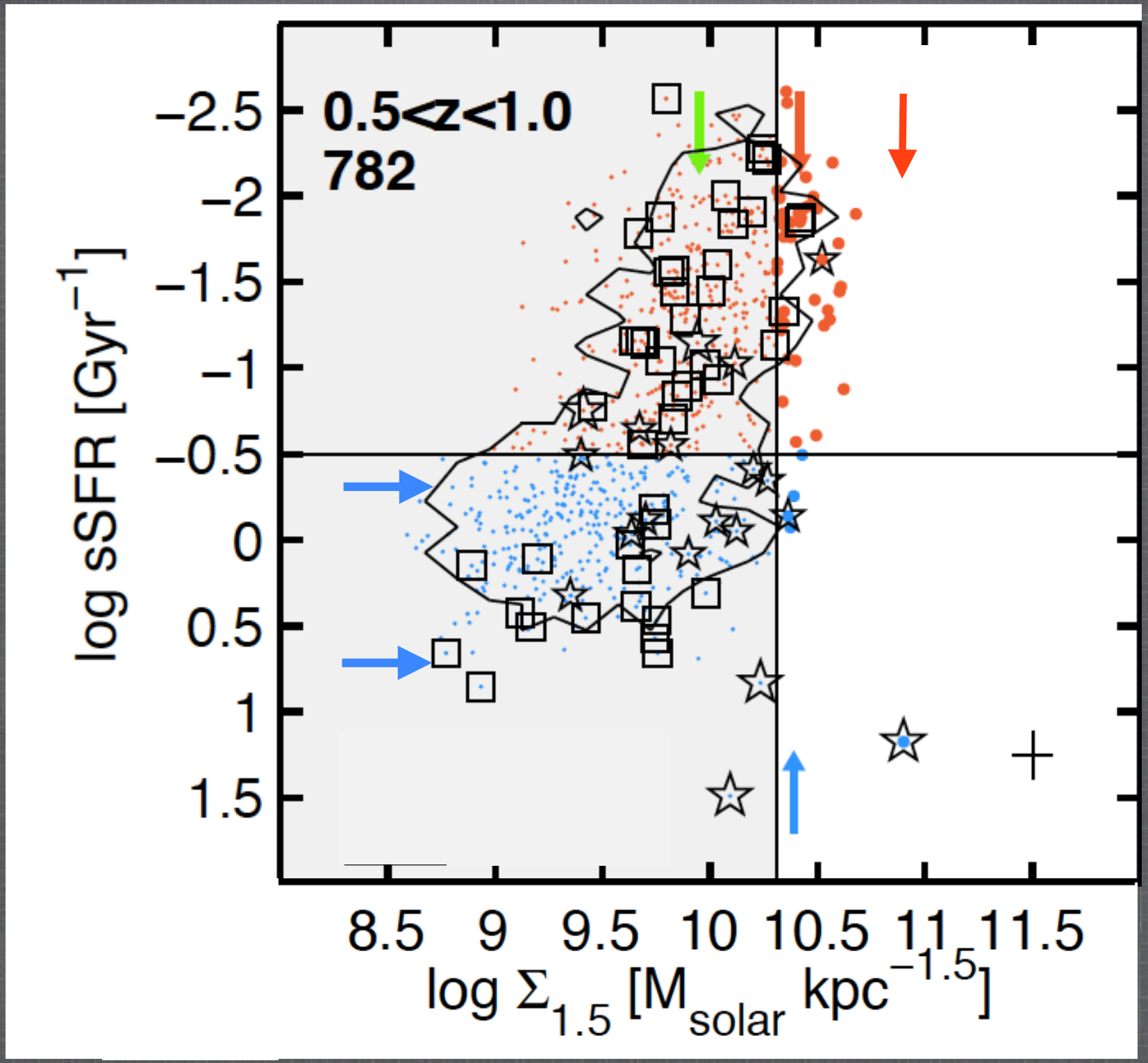

2.6<z<3.0
248
extended
compact
z=0.5
X-ray
$L_X = 10^{42-43}$
$L_X > 10^{43}$
log sSFR [Gyr^{-1}]
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
8.5
9
9.5
10
10.5
11
11.5
log $\Sigma_{1.5}$ [M_{solar} kpc$^{-1.5}$]


2.2<z<2.6
351
z=0.5
log sSFR [Gyr^{-1}]
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
8.5
9
9.5
10
10.5
11
11.5
log $\Sigma_{1.5}$ [M_{solar} kpc$^{-1.5}$]


1.8<z<2.2
537
z=0.5
log sSFR [Gyr^{-1}]
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
8.5
9
9.5
10
10.5
11
11.5
log $\Sigma_{1.5}$ [M_{solar} kpc$^{-1.5}$]

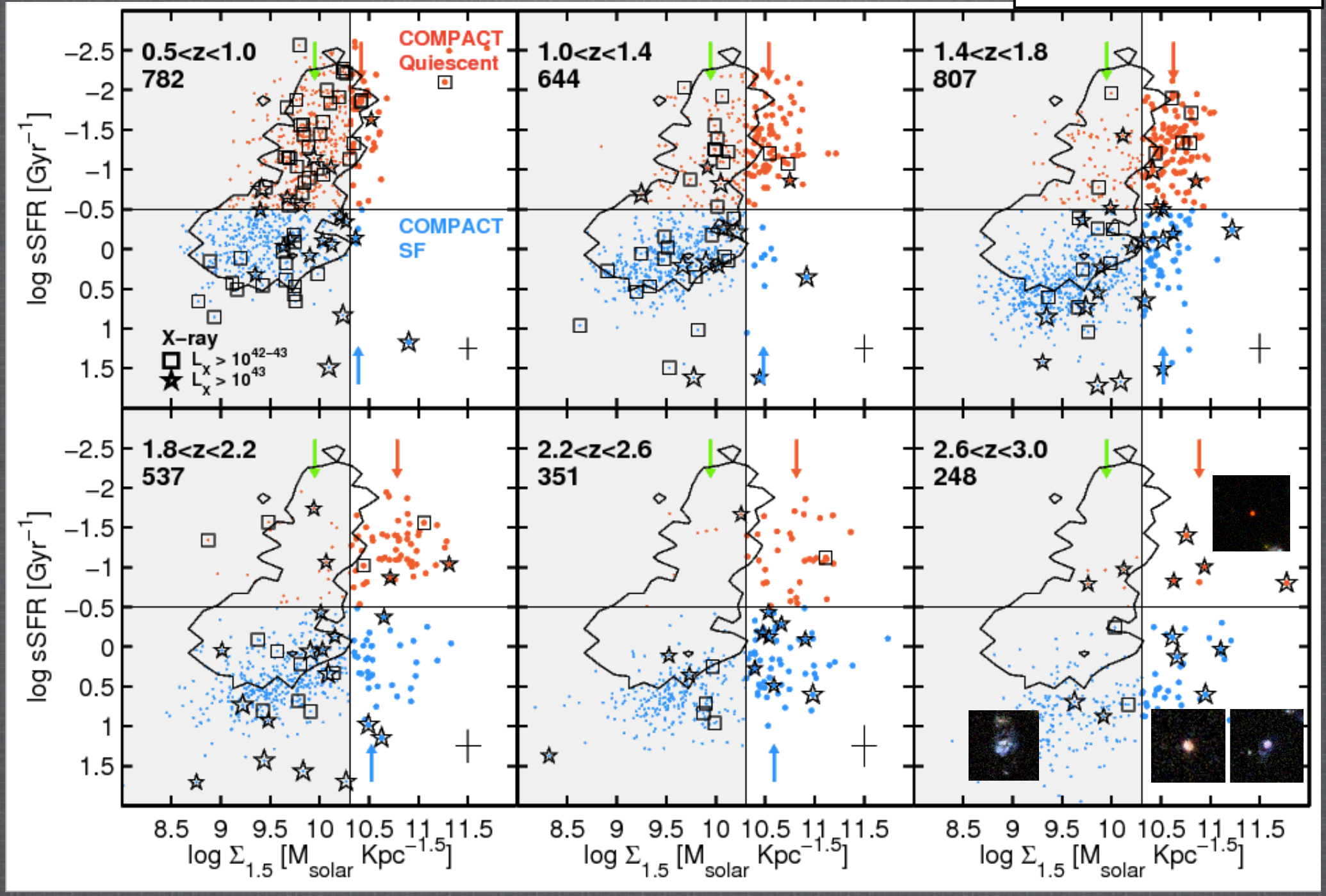

1.4<z<1.8
807
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
log sSFR [Gyr^{-1}]
8.5
9
9.5
10
10.5
11
11.5
log $\Sigma_{1.5}$ [M_{solar} kpc$^{-1.5}$]


1.0<z<1.4
644
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
log sSFR [Gyr^{-1}]
8.5
9
9.5
10
10.5
11
11.5
log $\Sigma_{1.5}$ [M_{solar} kpc$^{-1.5}$]

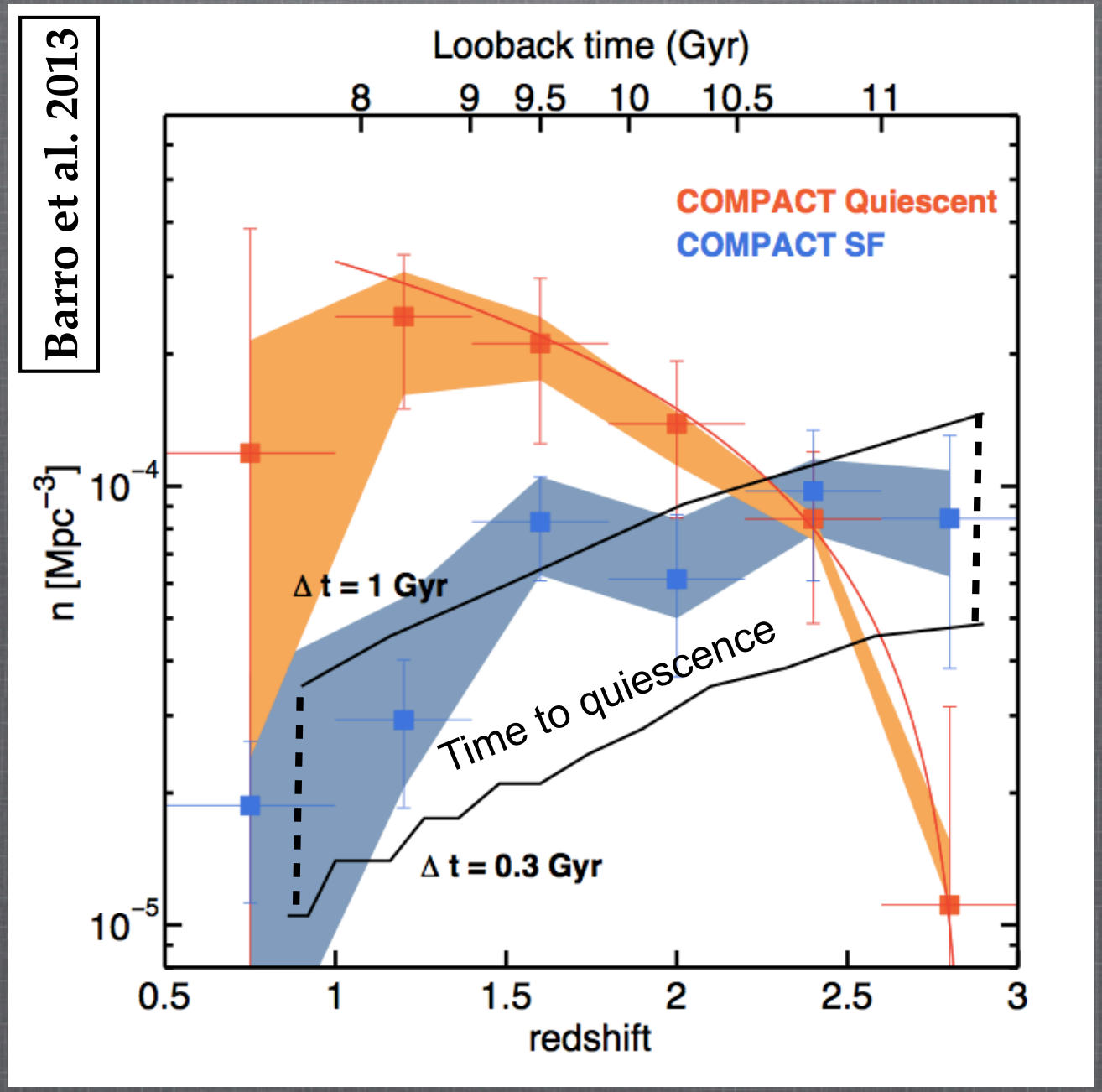

0.5<z<1.0
782
−2.5
−2
−1.5
−1
−0.5
0
0.5
1
1.5
log sSFR [Gyr^{-1}]
8.5
9
9.5
10
10.5
11
11.5
log $\Sigma_{1.5}$ [M_{solar} kpc$^{-1.5}$]

Compact quiescent and SFGs

Barro et al. 2013

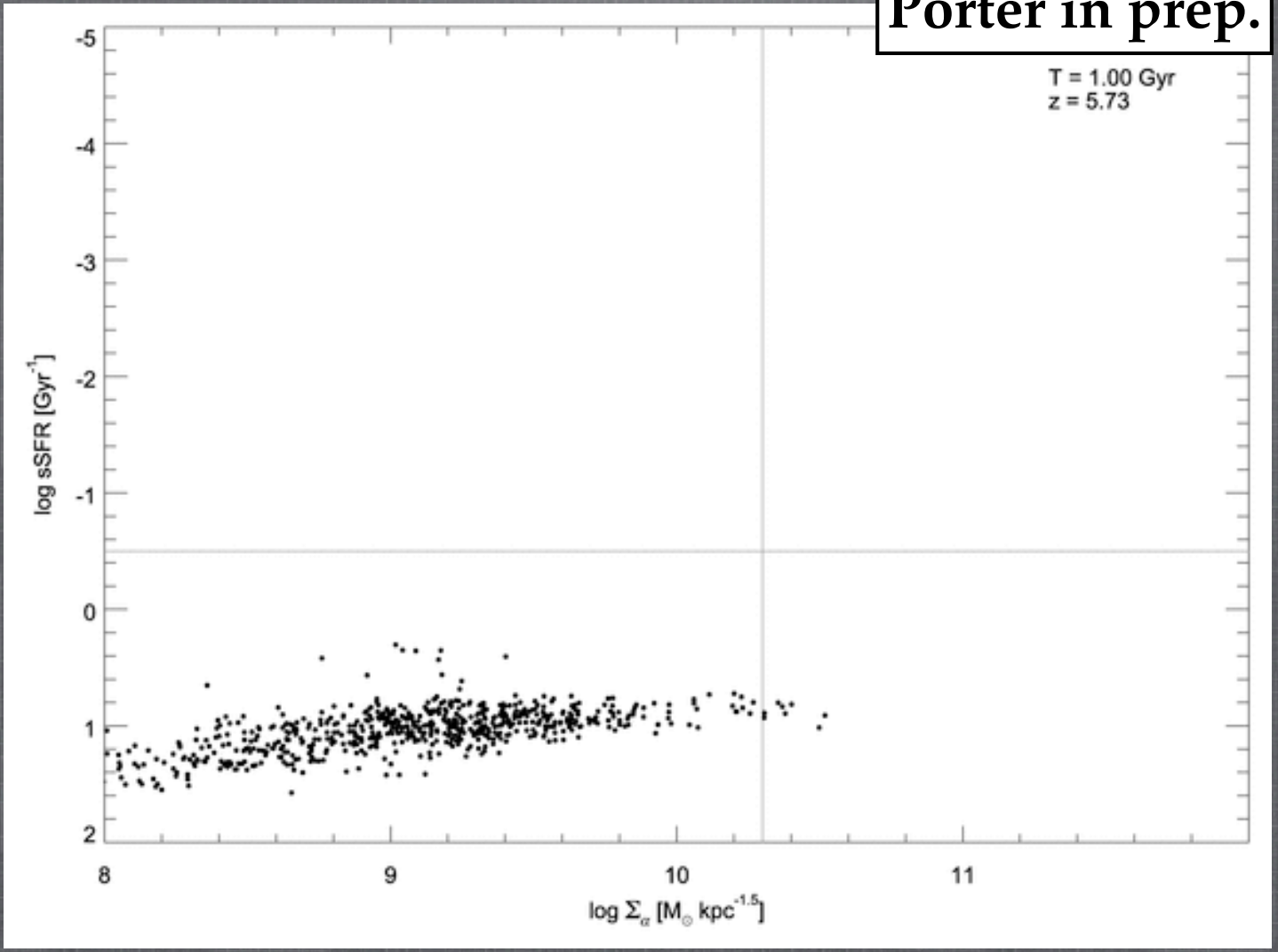


Density of compact galaxies



Life-paths of cSFGs from SAMs

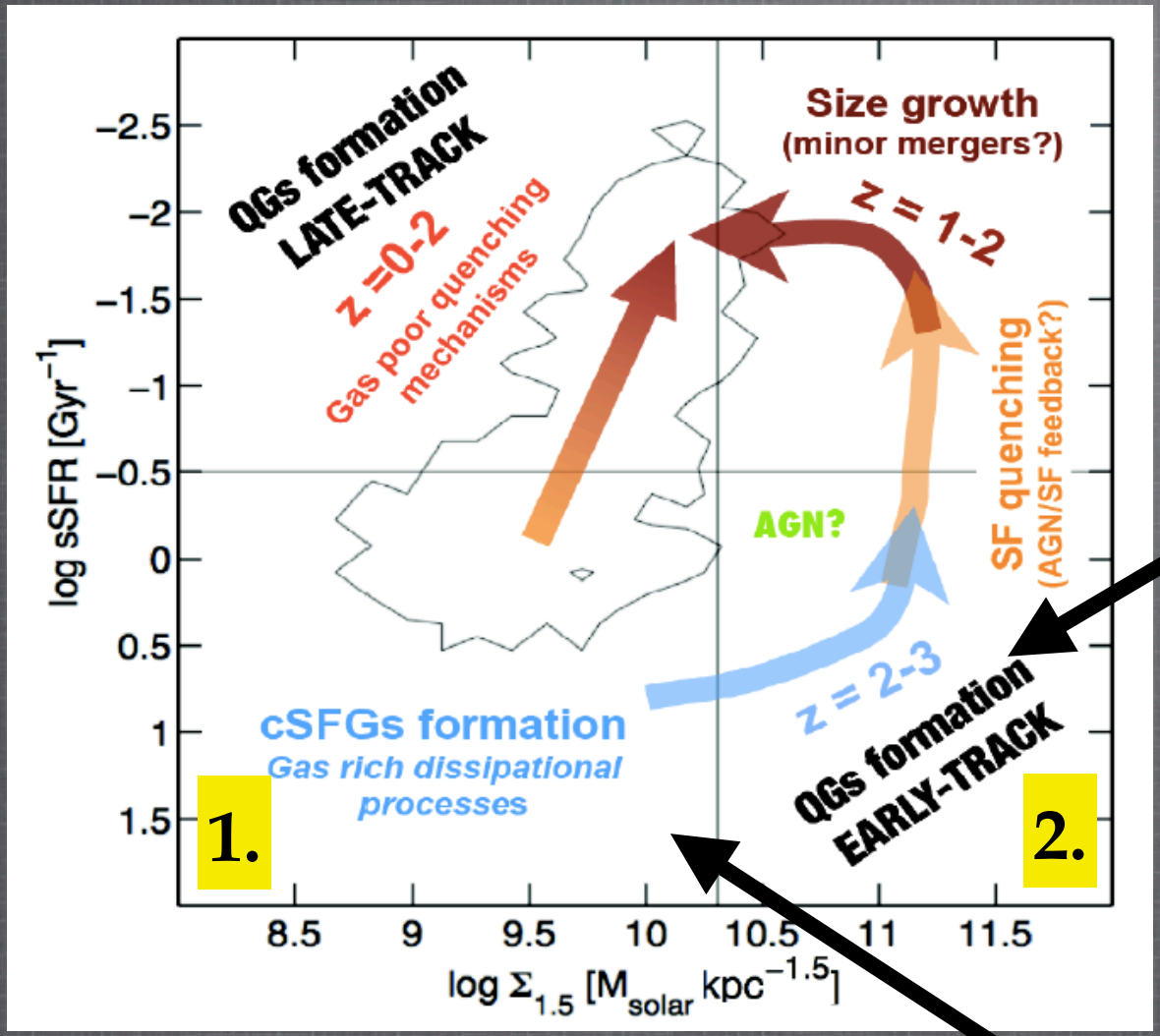
Porter in prep.



Semi-analytic model (Somerville+2010)
Bolshoi DM simulation (Klyping+2011)
Halo merger tree (Behroozi +2011)

Gas-rich merger in past Gyr
Gas-poor merger in past Gyr

Conclusions



Compact SFGs properties

- 80% dusty (IR-) star-formation.
- high-sersic, undisturbed app.
- 40% AGN det. fraction.
- 300 Myr -1 Gyr quenching times.
- AGN/SF feedback (outflows?)

2.

Compact SFGs formation

- SAMs - DI (60%) % wet mergers
- SAMs - Preferentially in already compact gal.
- ART-hydro - VDI time-scale 300 - 500 Myrs.

1.

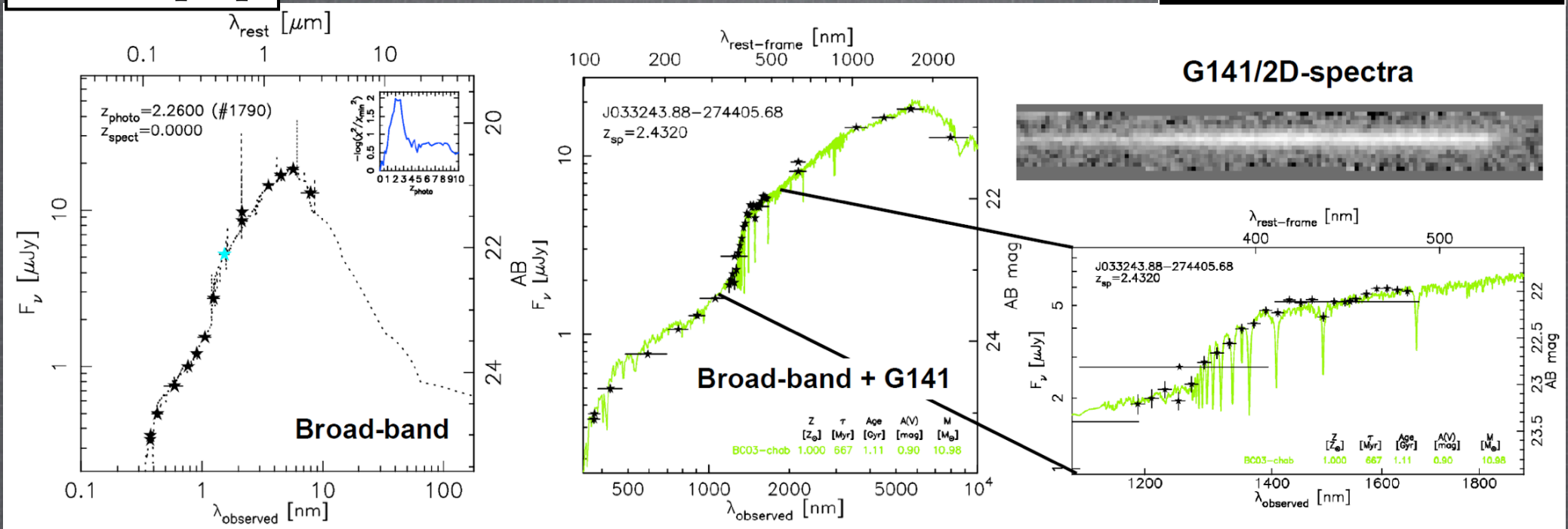
Improving the age estimates for cSFGs

- Will they quench in 300 Myr - 1 Gyr ?

- SED-based stellar properties for 2 < z < 3 cSFGs

Barro in prep.

Higher resolution SEDs

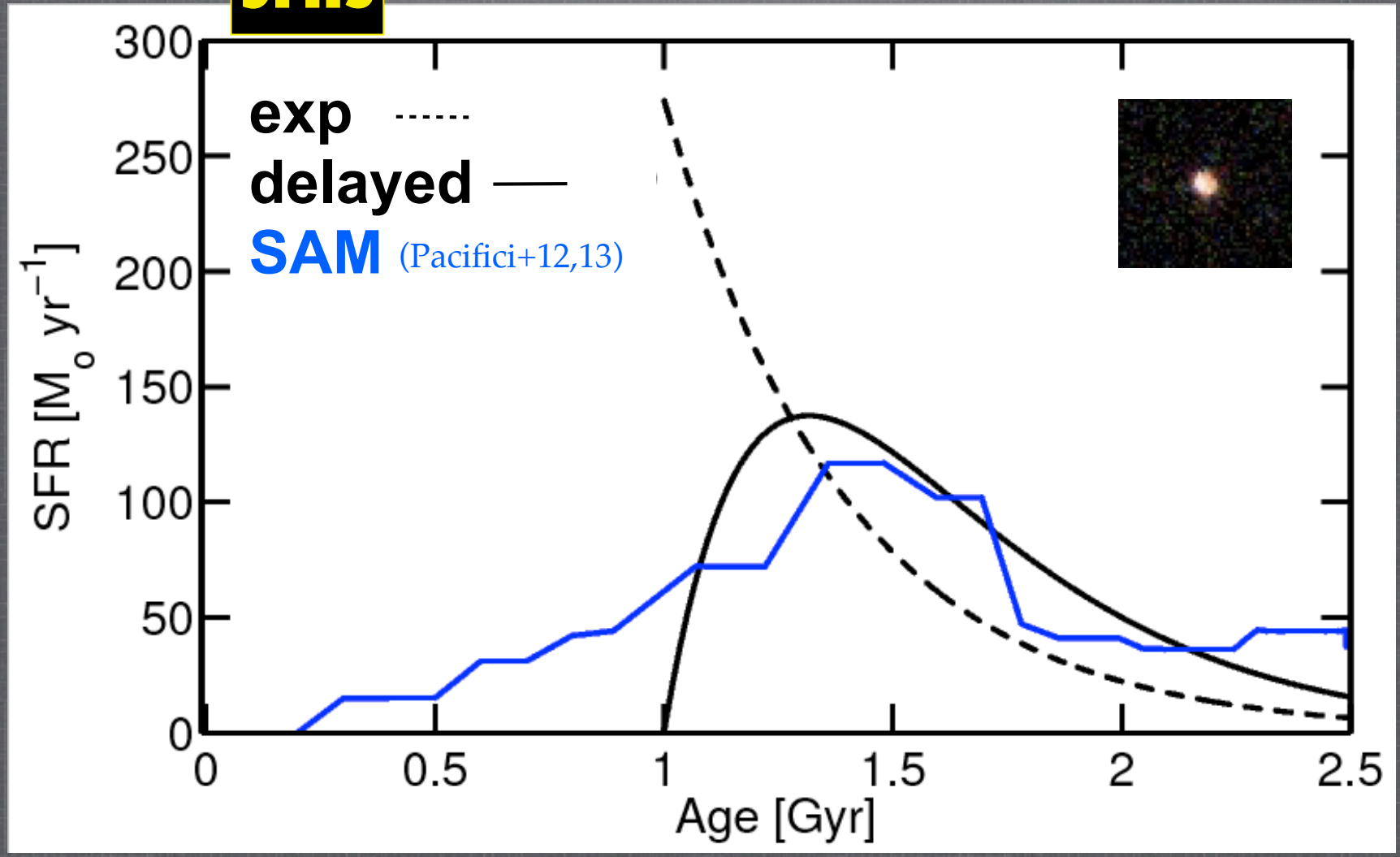


3D-HST (Brammer+12), NIR (1.1-1.7microns) grism spectroscopy

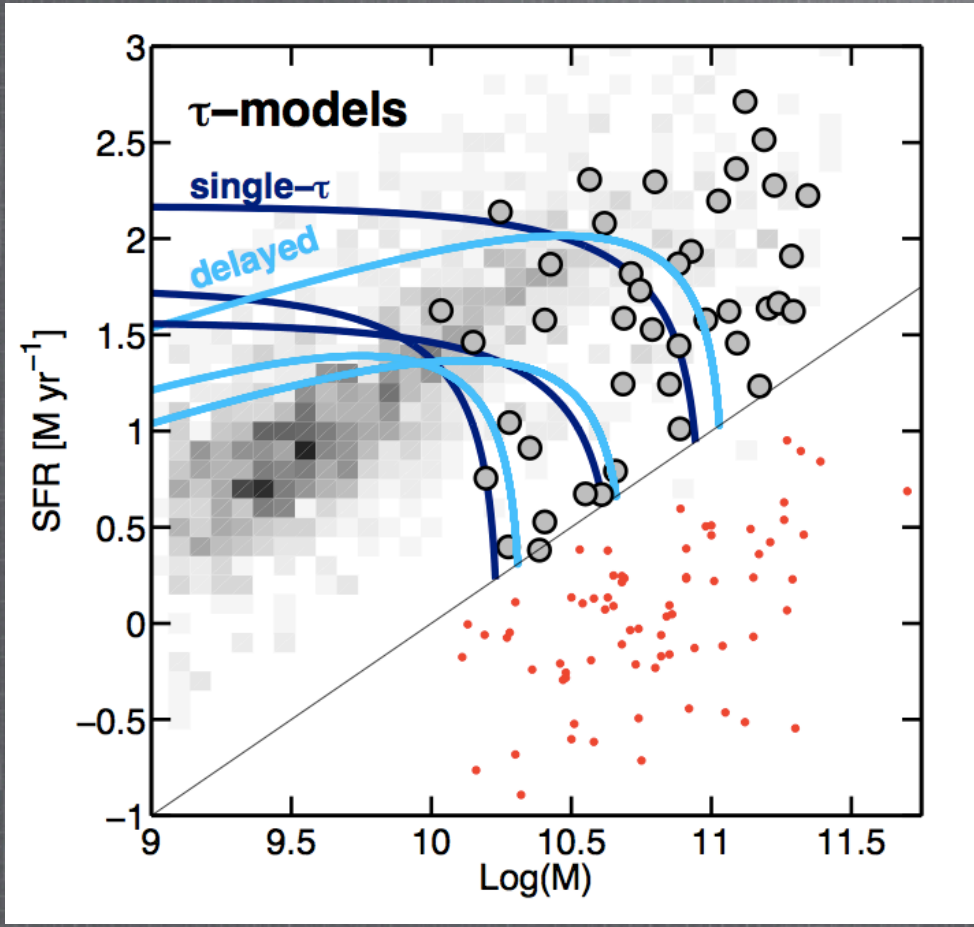
SED modeling

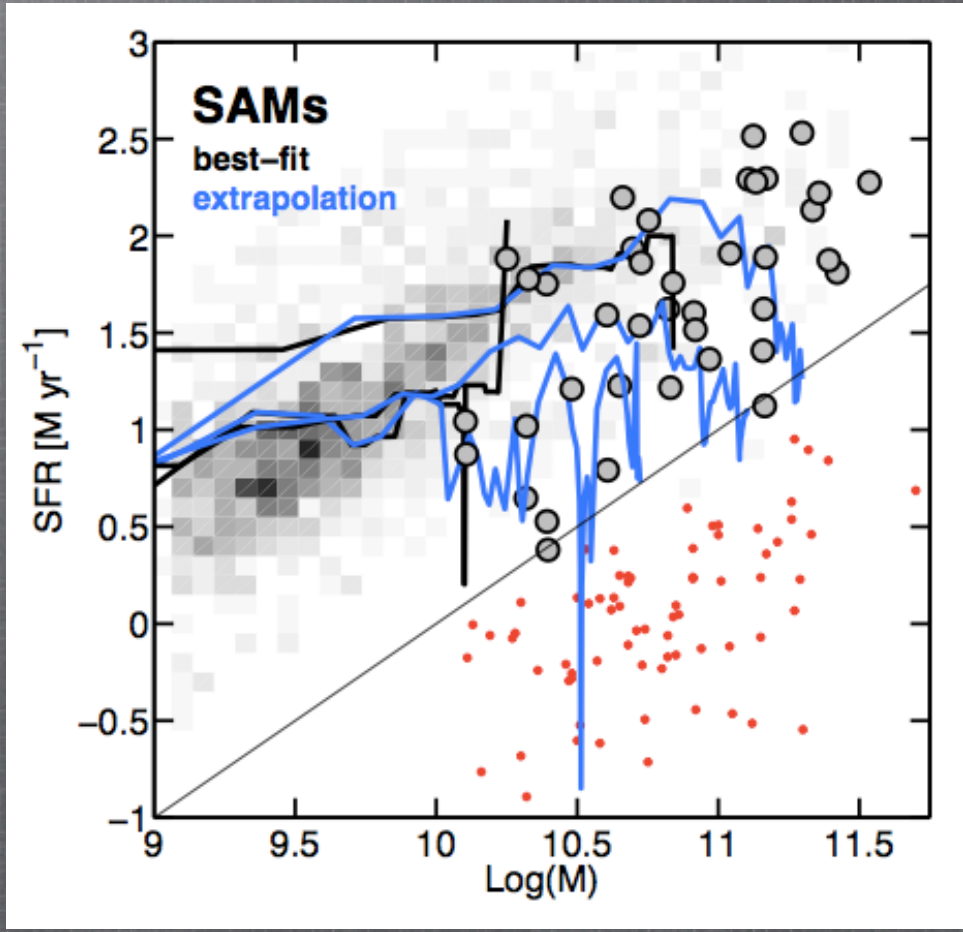
- Different SPS models, IMFs, metallicities and ..

SFHs

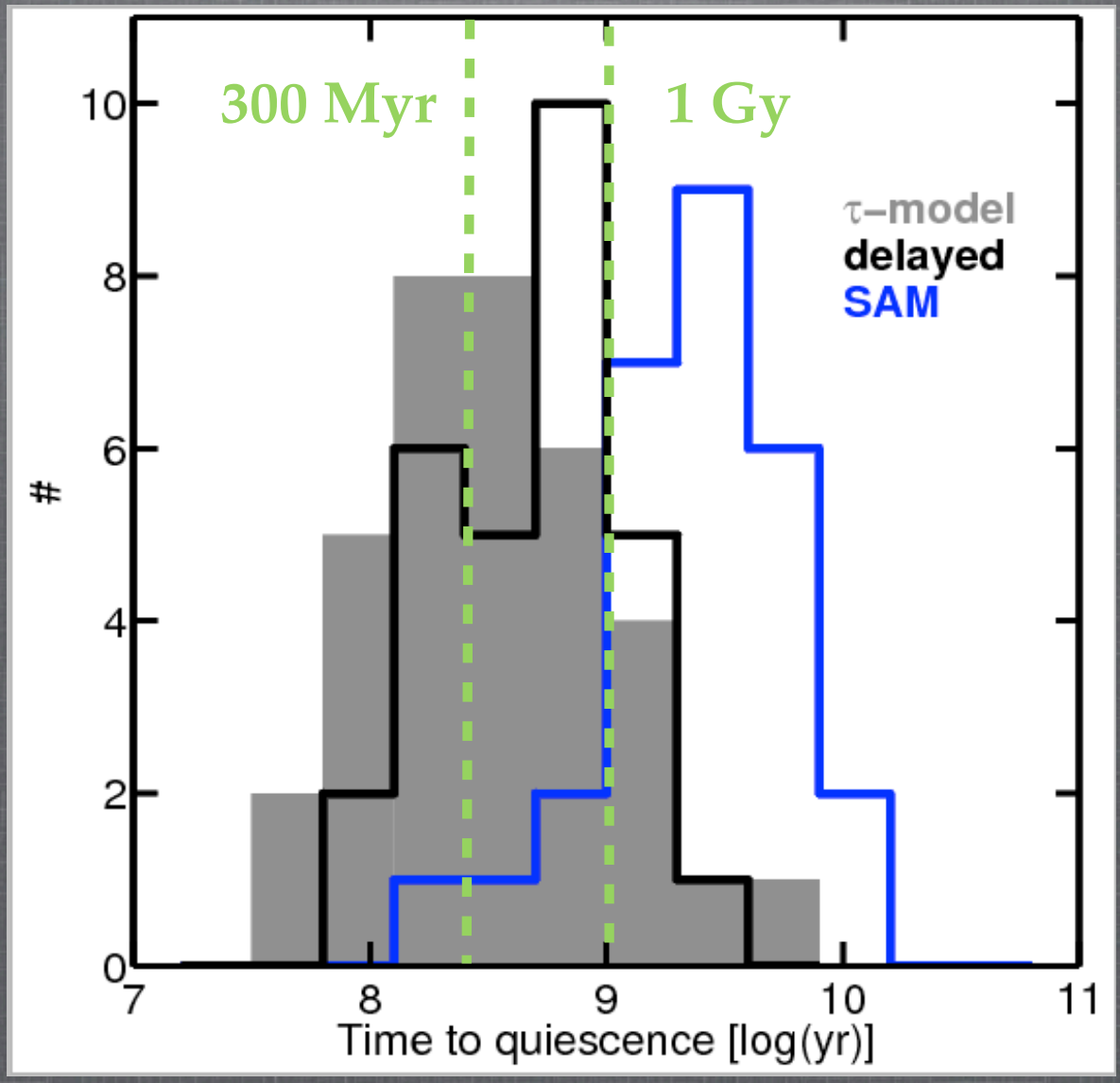


Life paths on the main-sequence

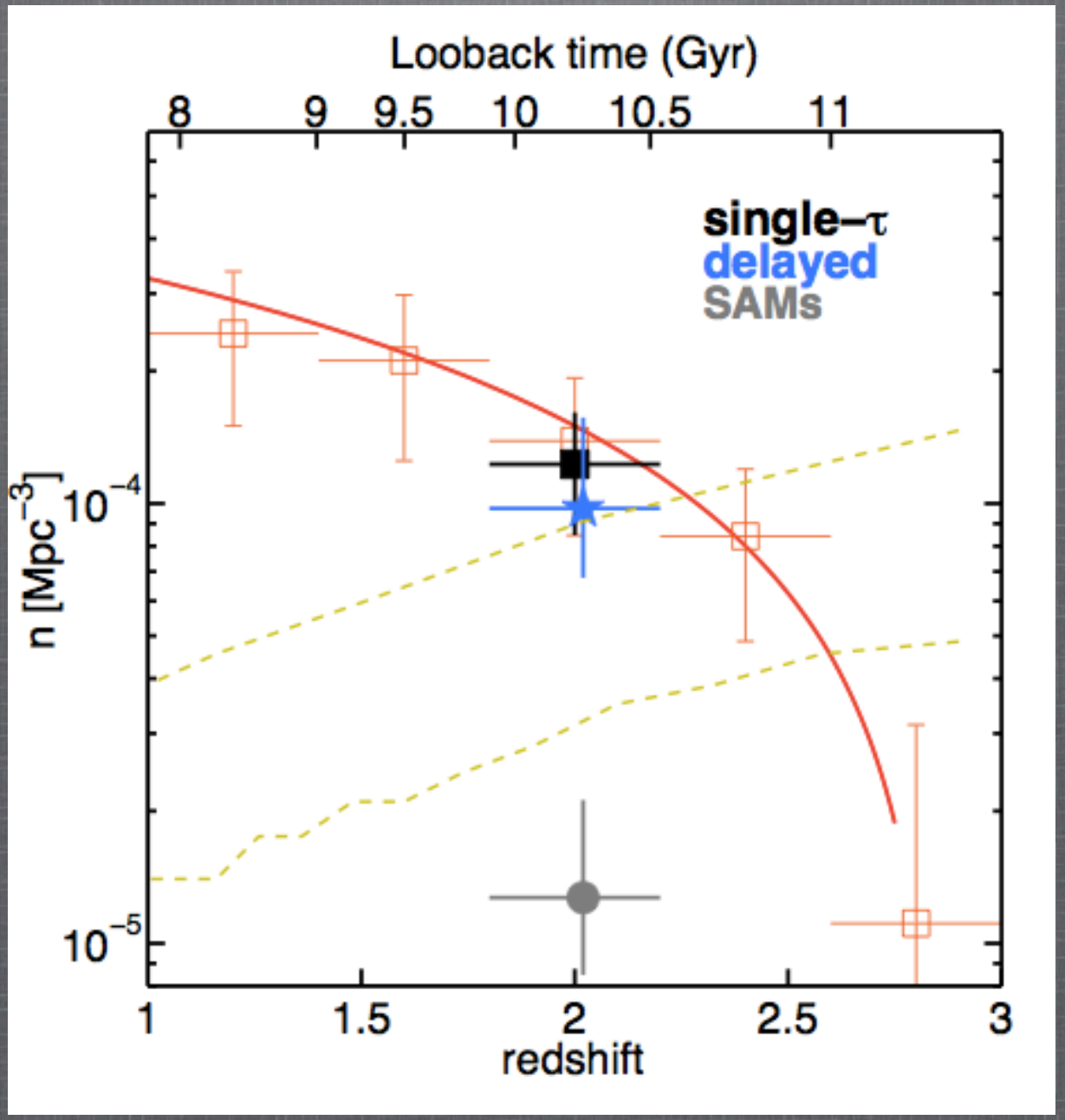




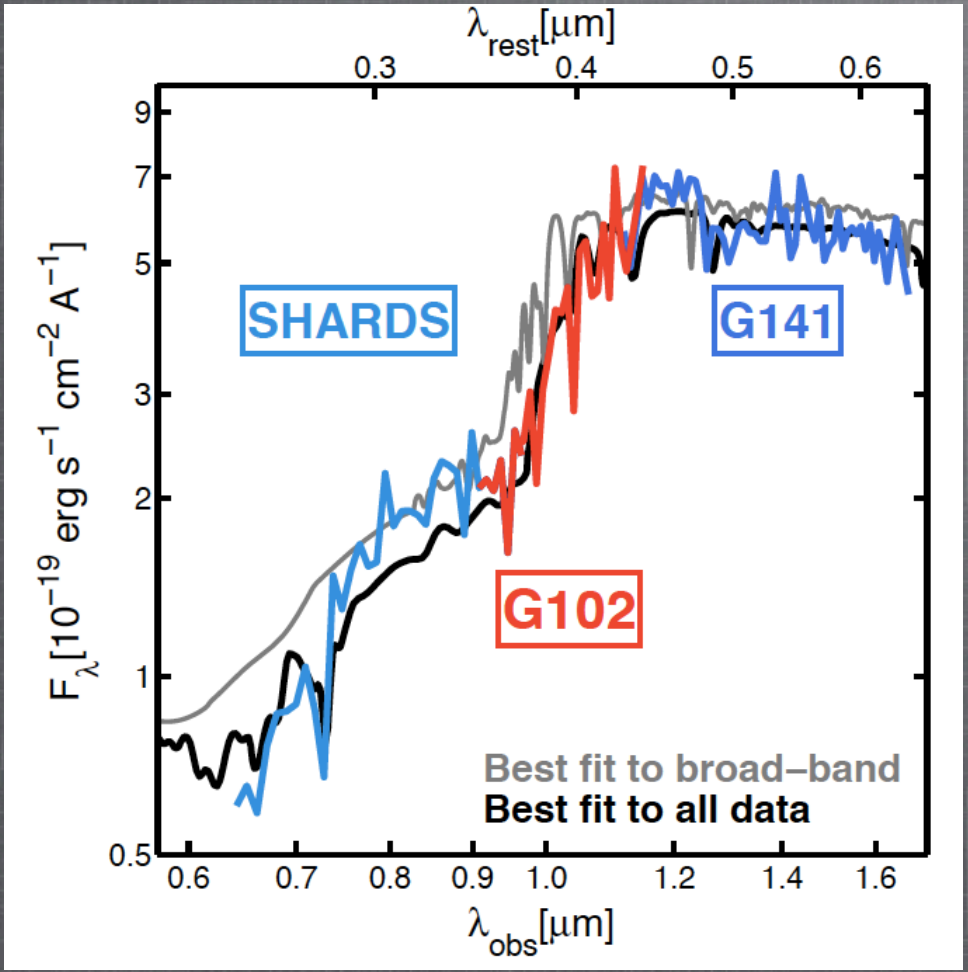
Elapsed times to quiescence

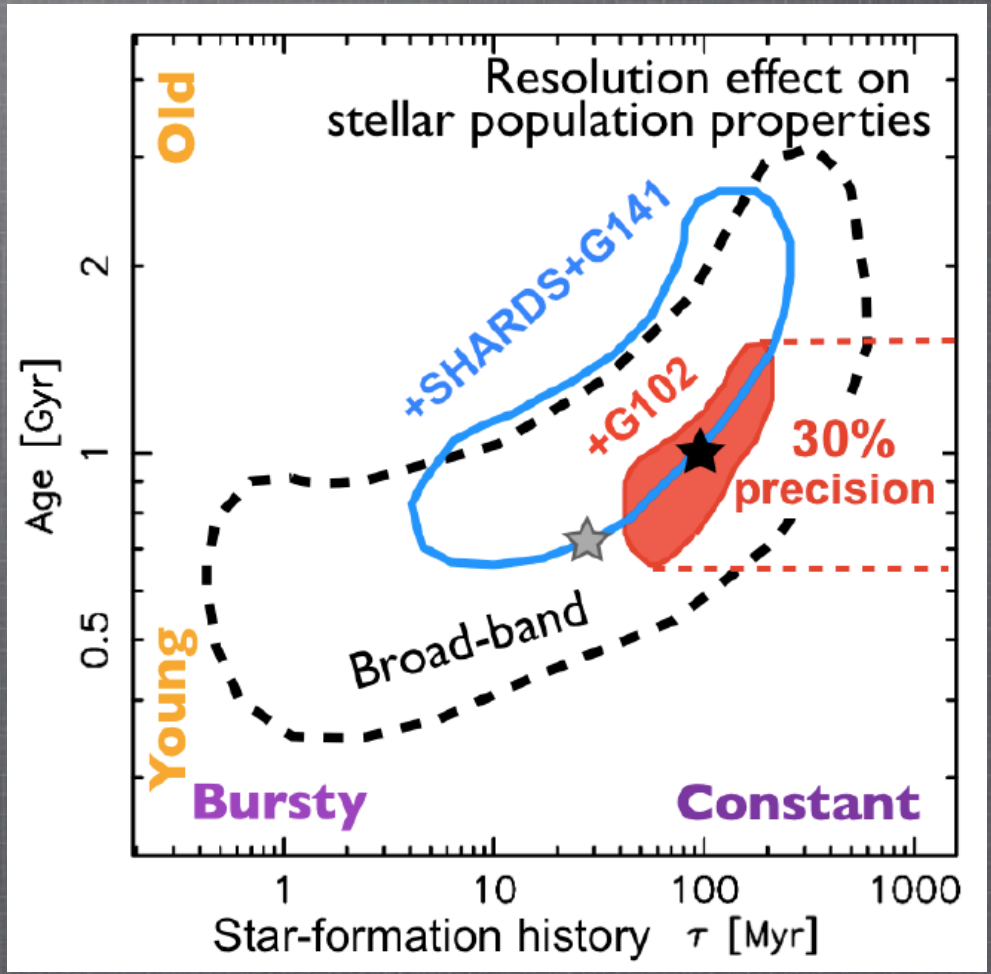


Predicted number densities

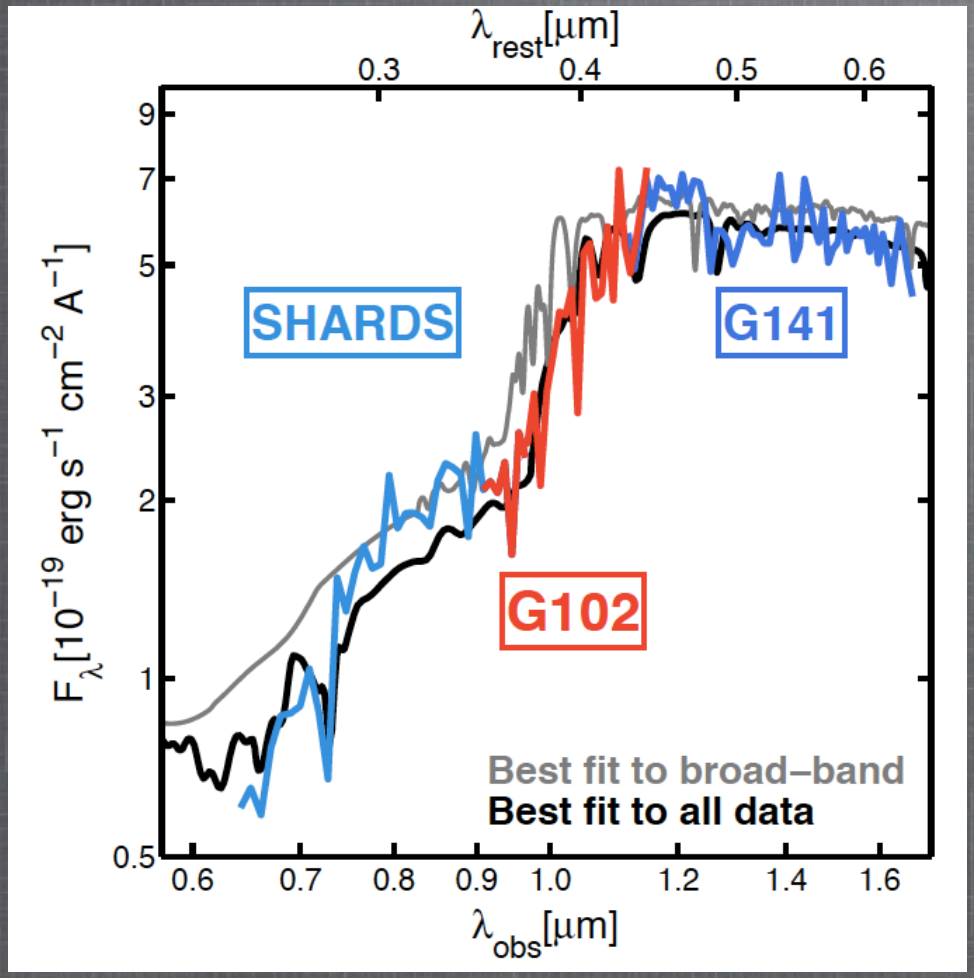


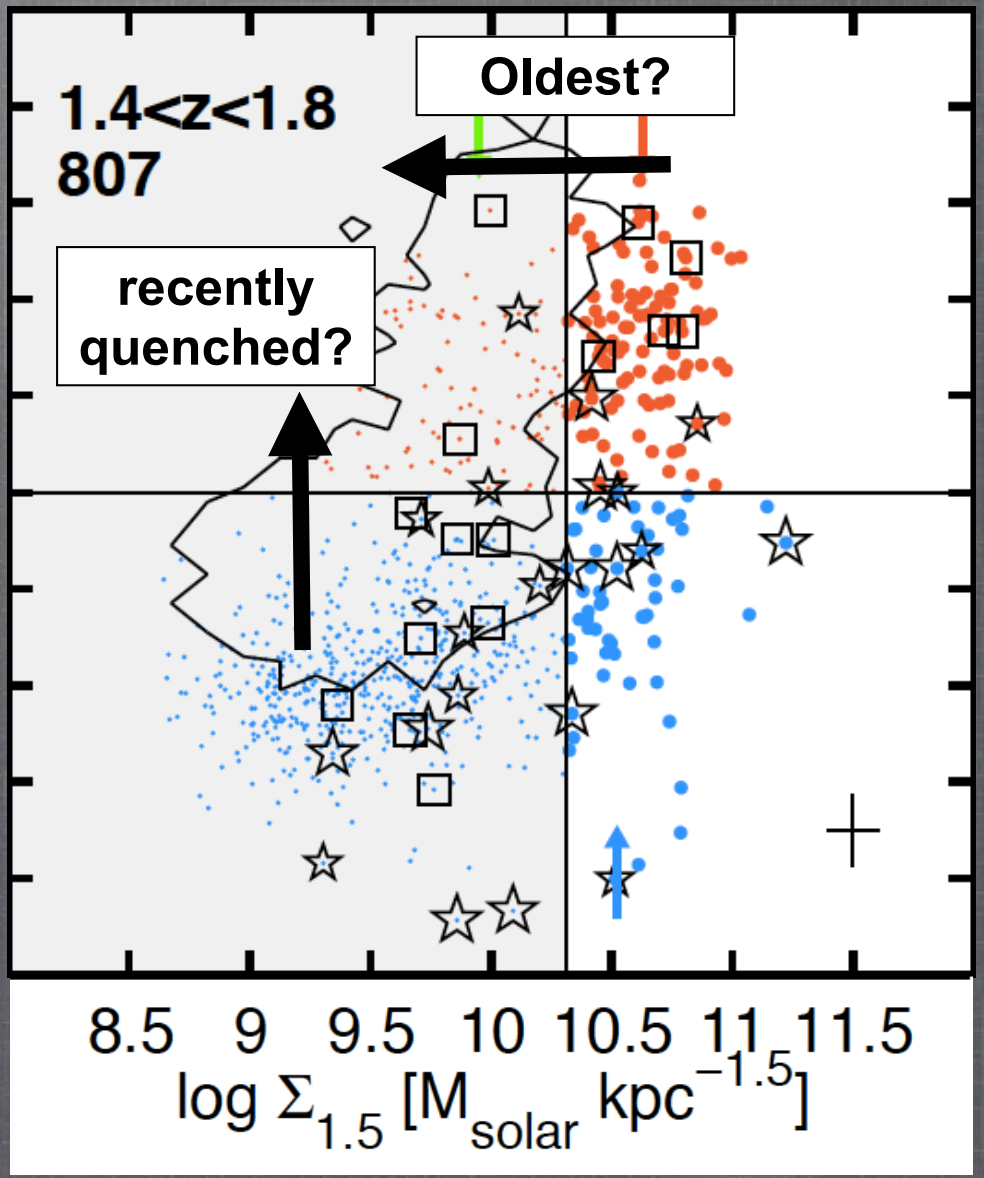
SHARDS + HST/GRISM at 1<z<2





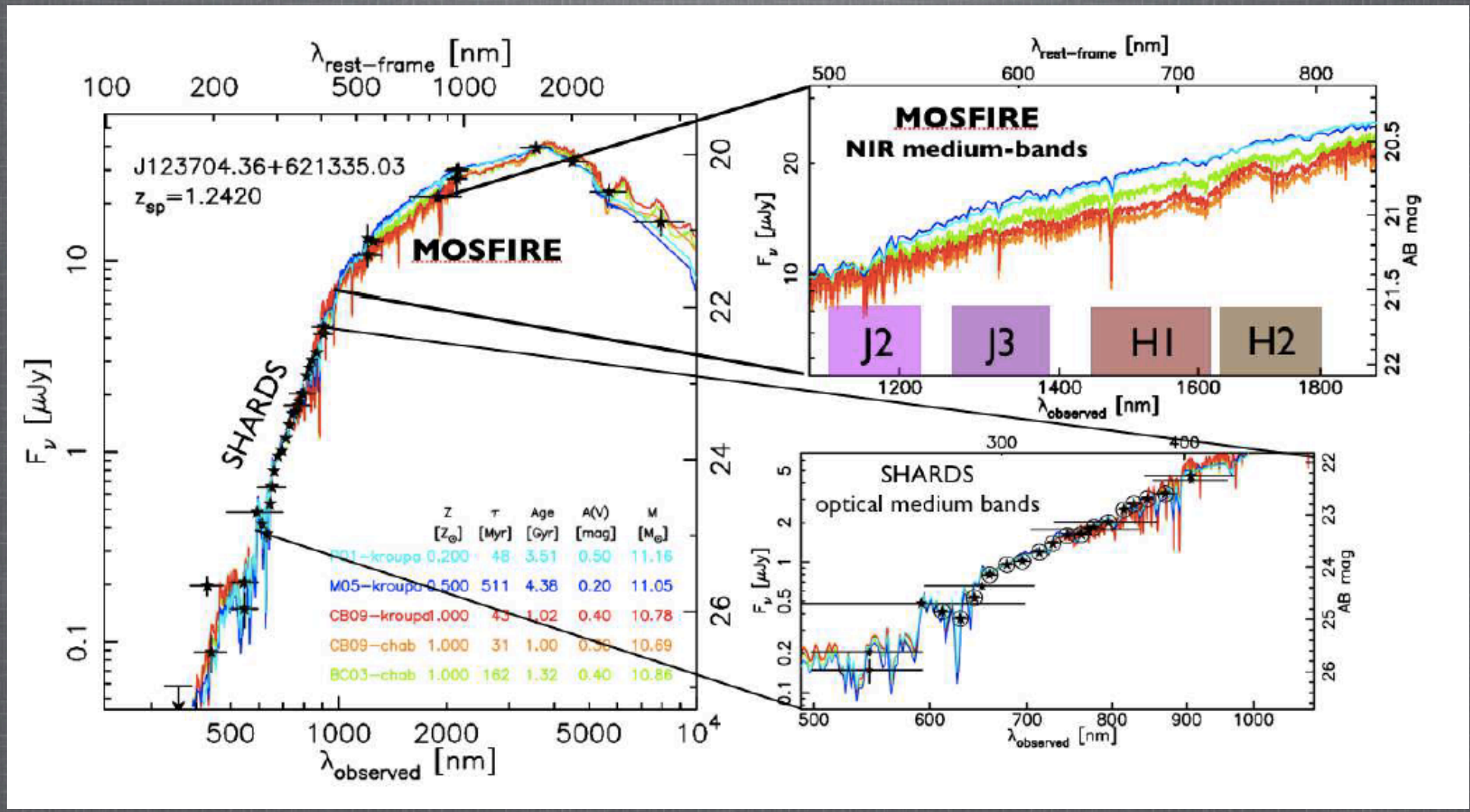
SHARDS + HST/GRISM at 1<z<2



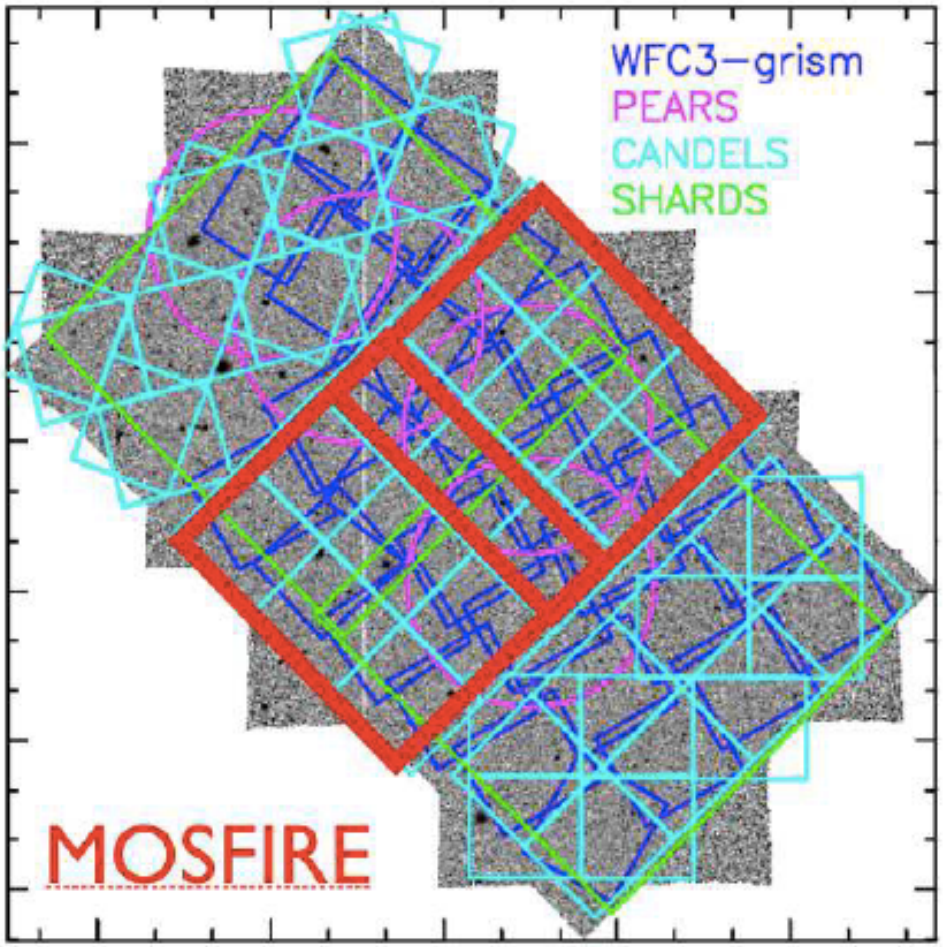


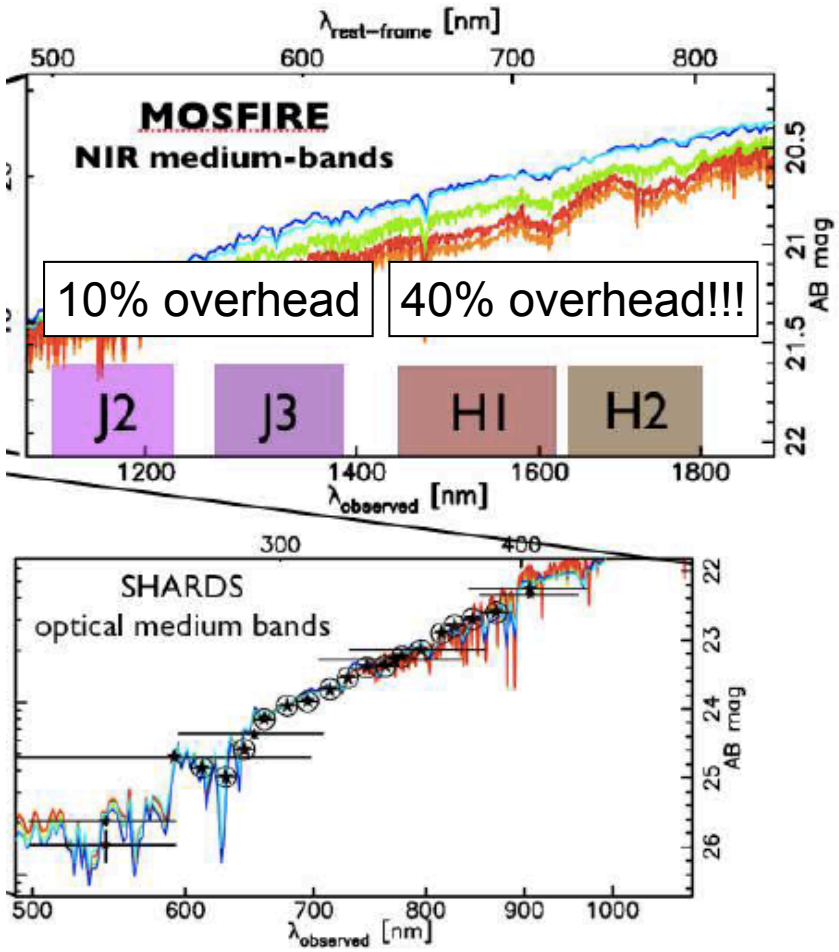
- Precision ages
- Correlation with structural properties/visual appearances

SHARDS + Keck/MOSFIRE (3 nights)



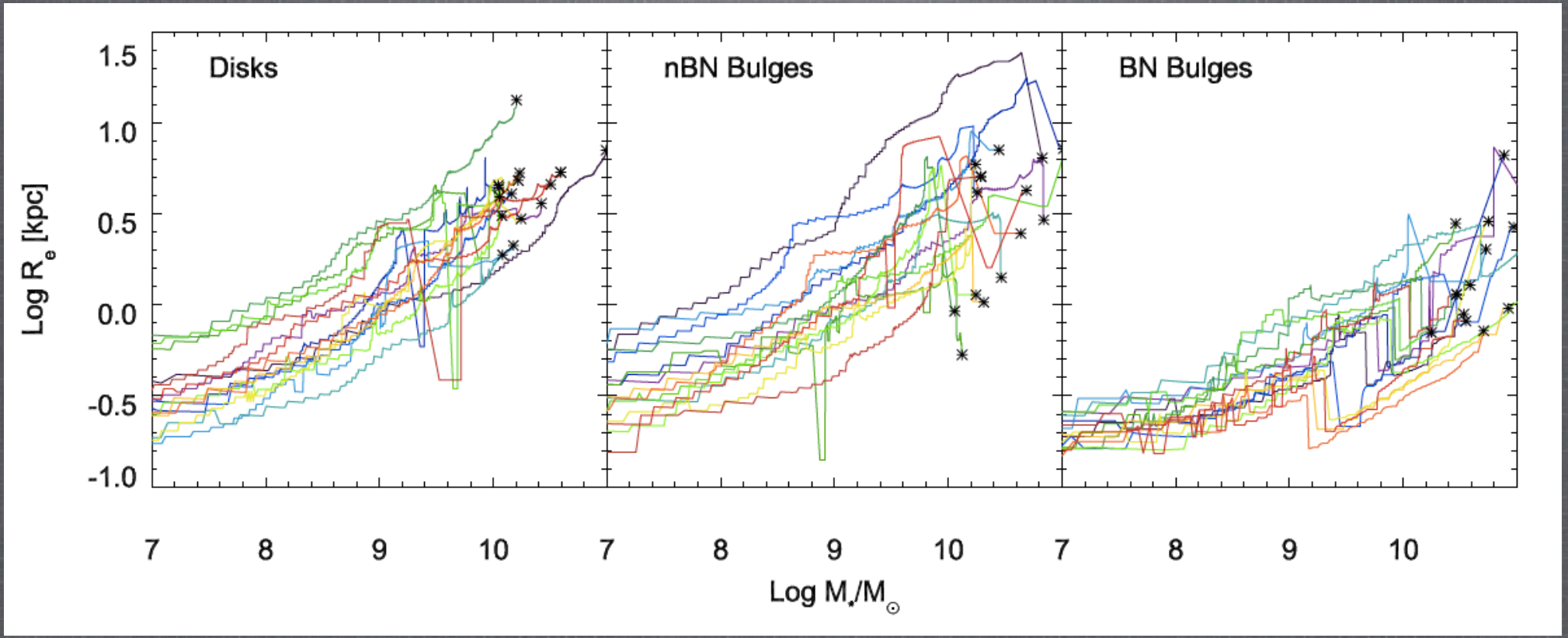
SHARDS + Keck/MOSFIRE (3 nights)





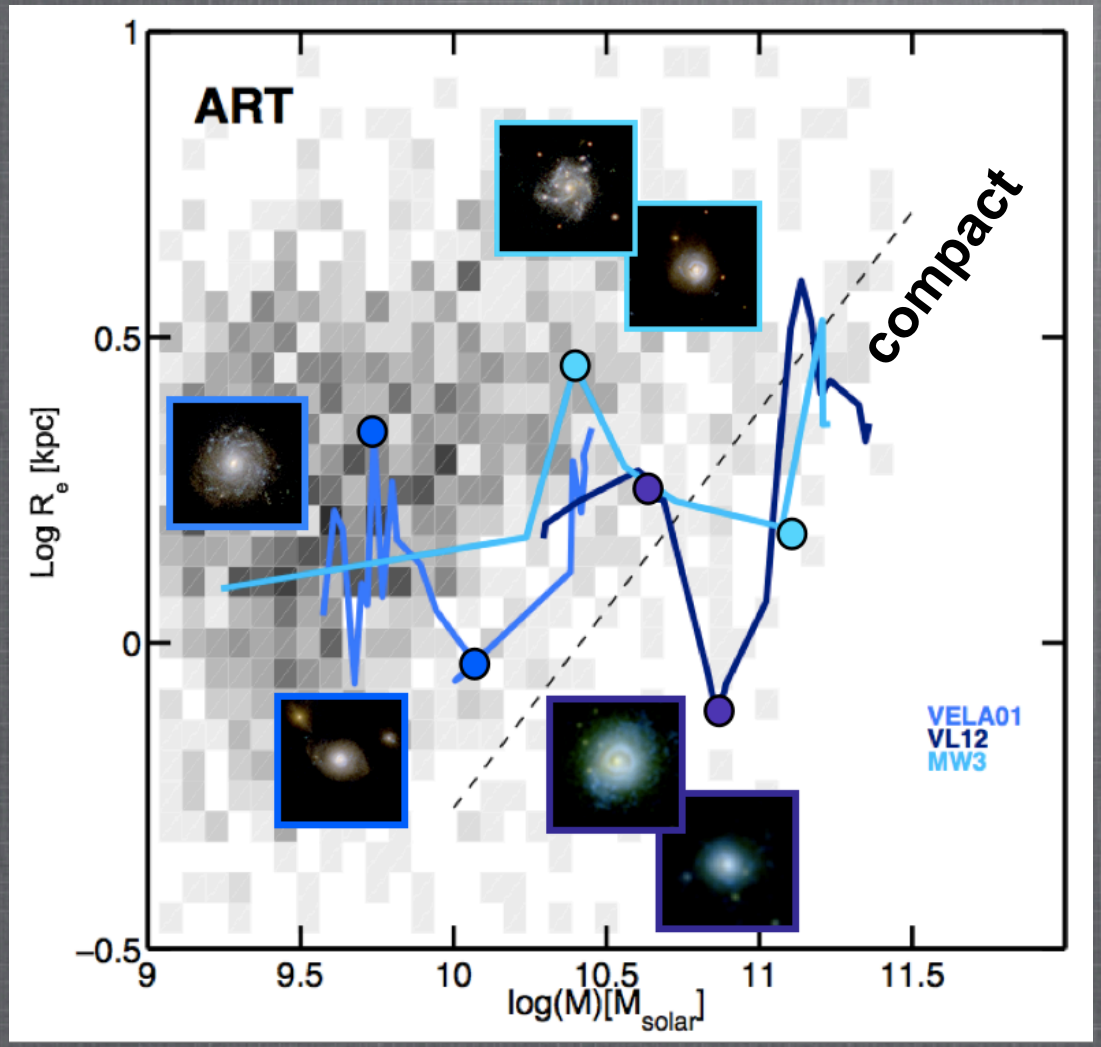
Life-paths of cSFGs from SAMs

Porter in prep.



- Sharp truncations are caused by disk instabilities more often (62%) than mergers

Life-paths of cSFGs from ART-Hydro



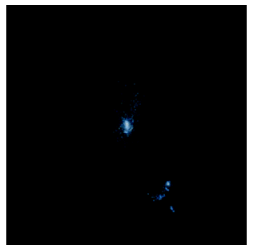
Moody in prep.

SUNRISE + PSF-match + noise

Kollipara in prep.

GALFIT

VL12



- ART-Hydro simulations (Ceverino+10,12, Dekel+13b)
- Violent disk instabilities, clump migration bulge growth