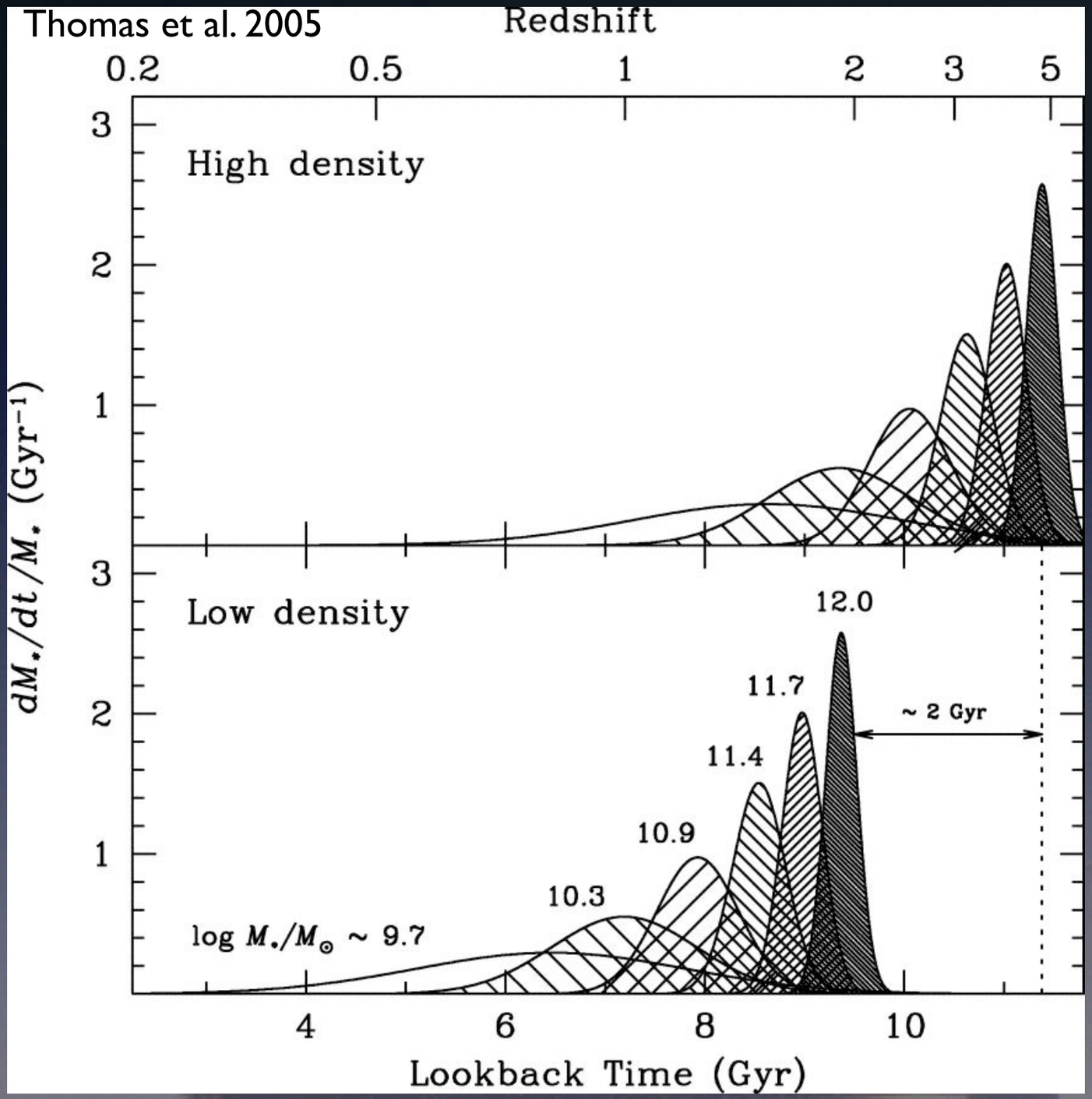
Science with the Intermediate Layer

20 deg^2 to depth of grizY=28.6,28.1,27.7,27.1,26.6
10^7 Mpc^3 at z≈2

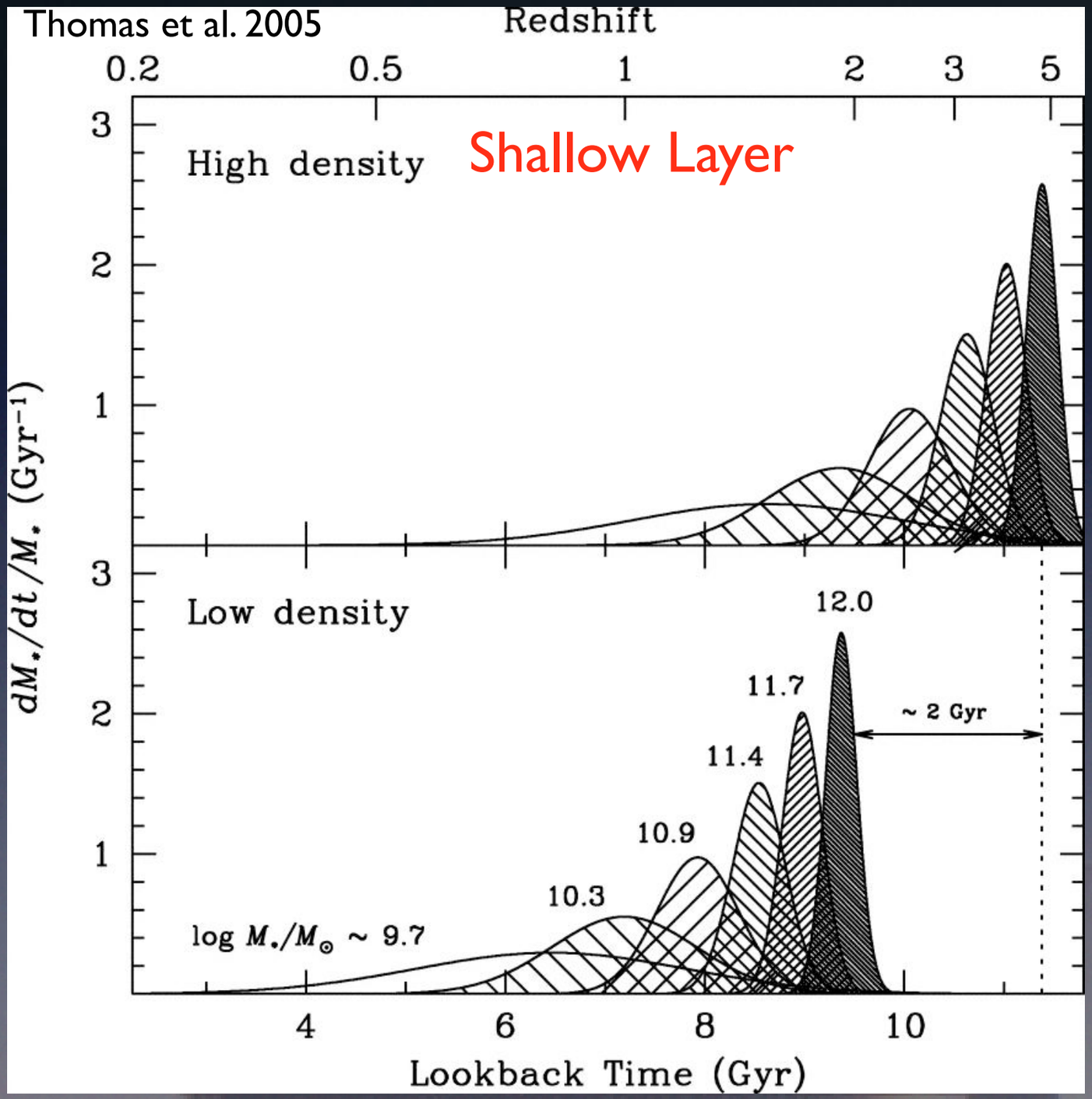
Jenny E. Greene (Princeton/Carnegie, Hubble Fellow)

Watching Galaxies Assemble



structure and stellar populations of local galaxies contain a fossil record of galaxy formation

Watching Galaxies Assemble



structure and stellar populations of local galaxies
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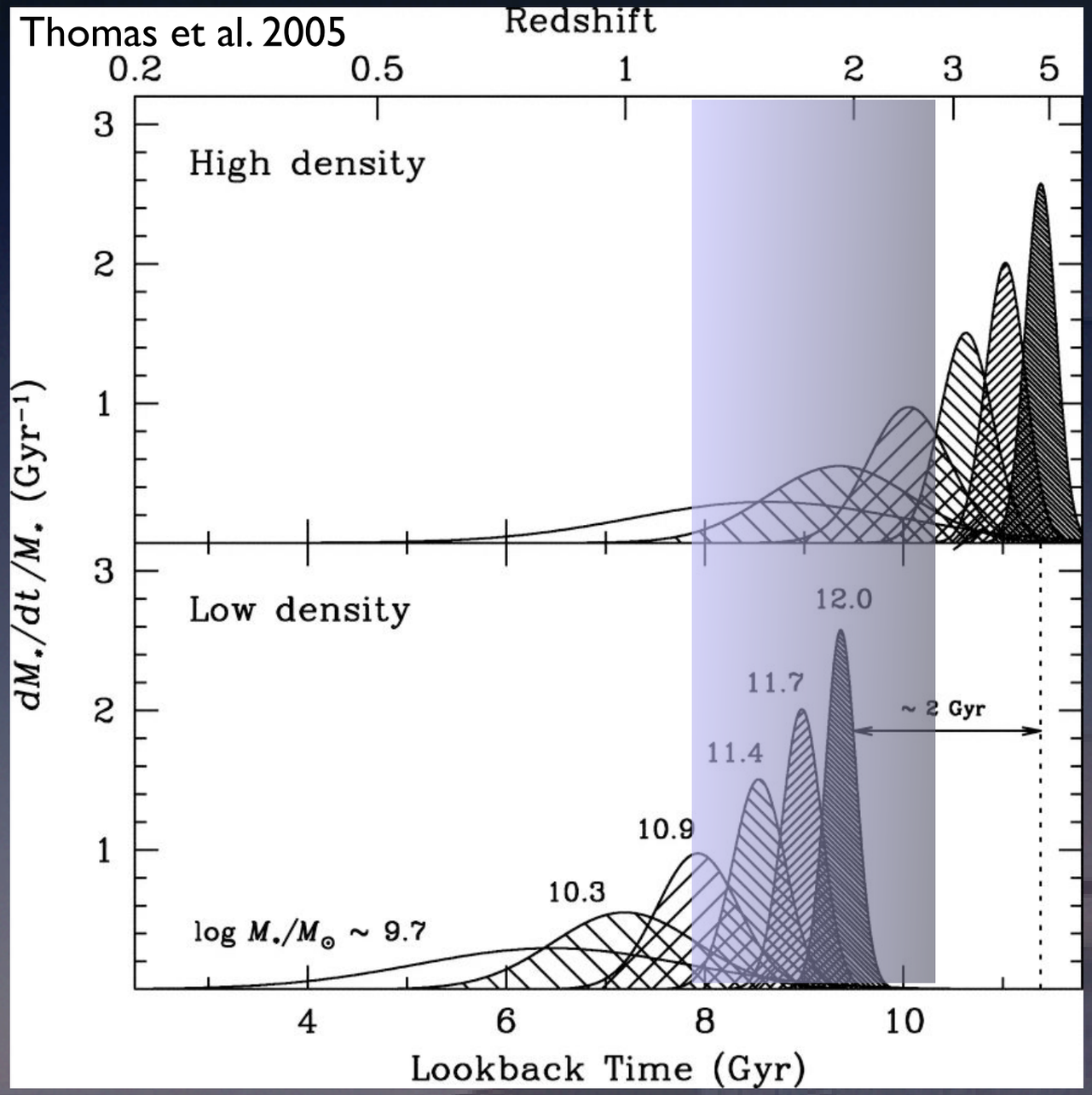
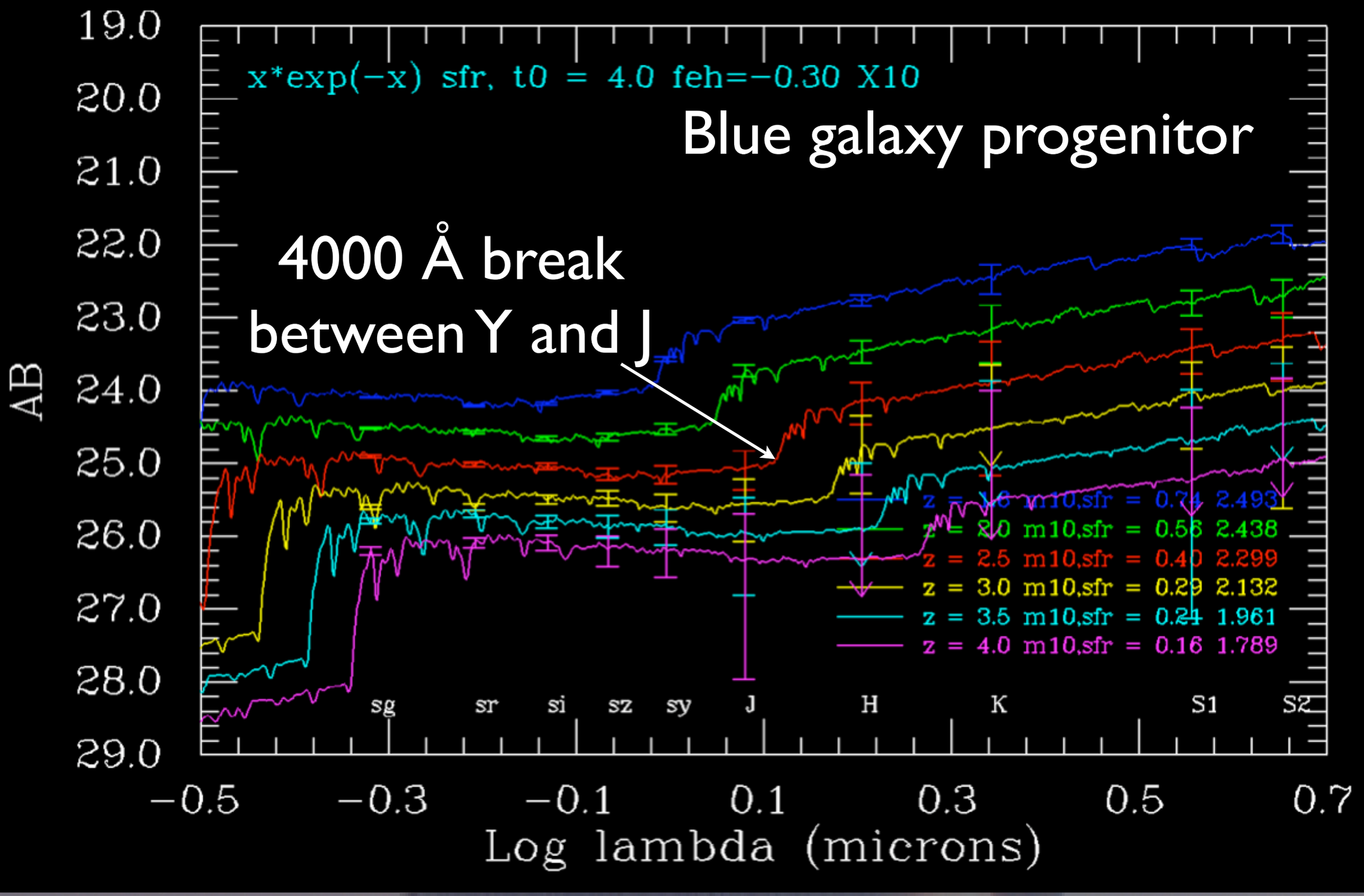
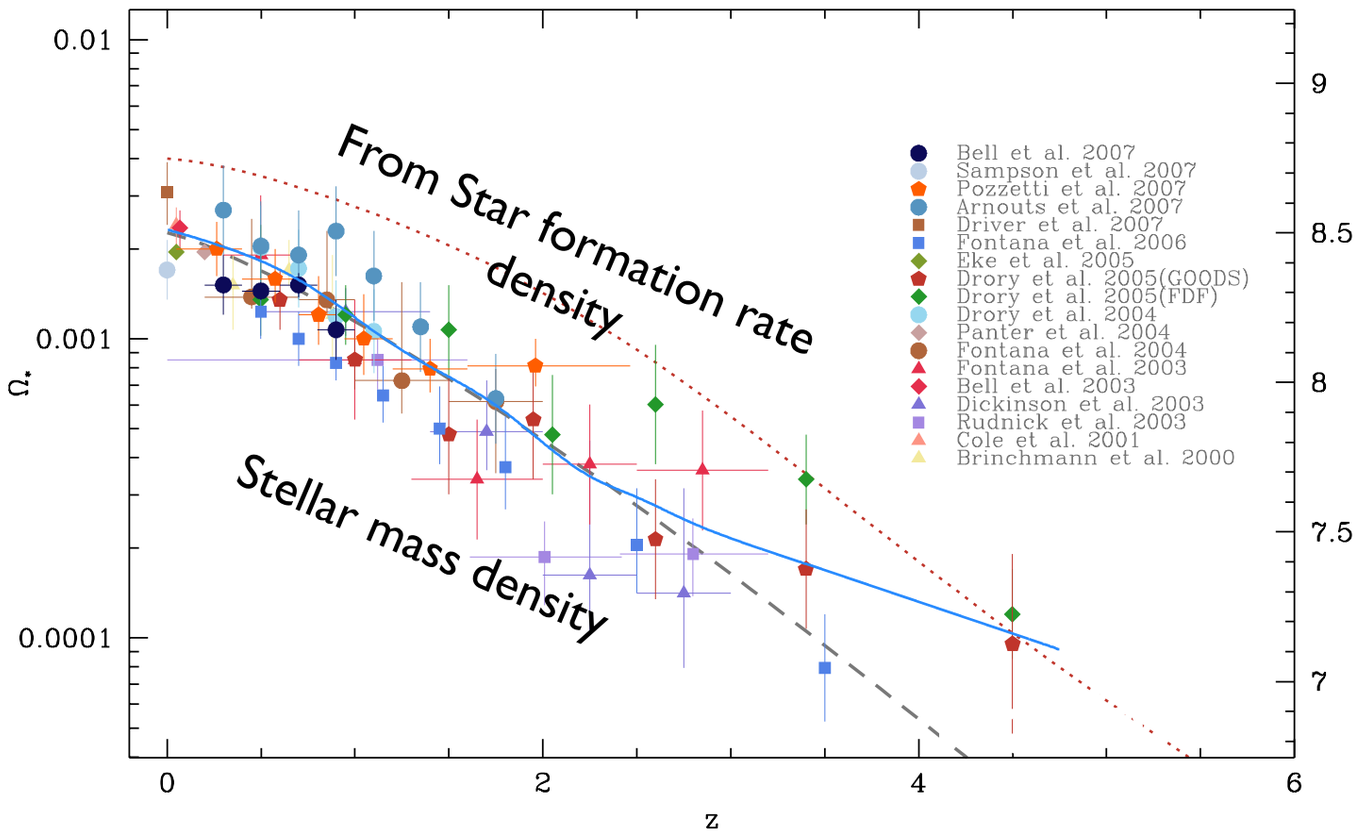
Intermediate Layer



- Star formation density rapidly rising
- QSO number density peaks
- Field elliptical galaxies are forming their stars

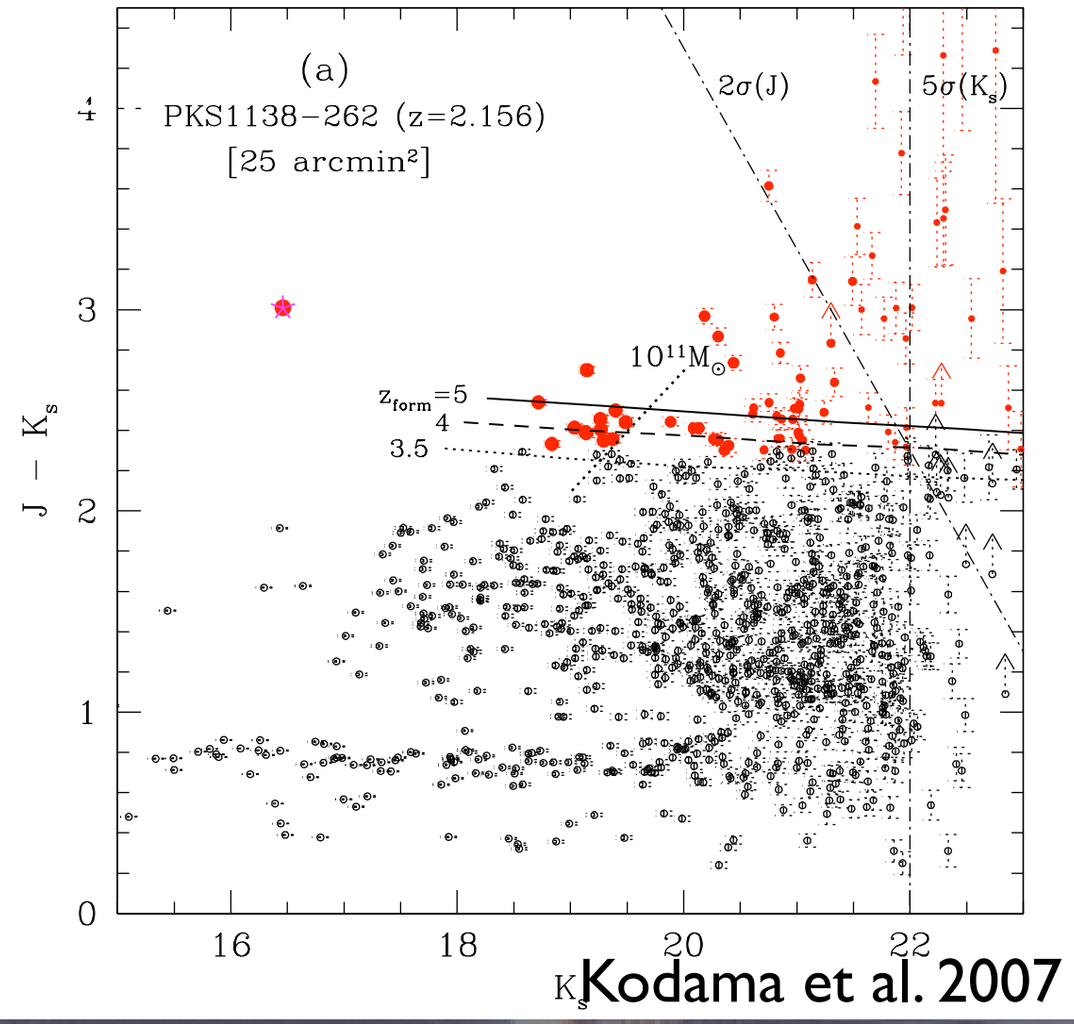

x*exp(−x) sfr, t0 = 4.0 feh=−0.30 X10
Blue galaxy progenitor
4000 Å break
between Y and J
z = 1.6 m10,sfr = 0.74 2.493
z = 2.0 m10,sfr = 0.56 2.438
z = 2.5 m10,sfr = 0.40 2.299
z = 3.0 m10,sfr = 0.29 2.132
z = 3.5 m10,sfr = 0.24 1.961
z = 4.0 m10,sfr = 0.16 1.789
sg
sr
si
sz
sy
J
H
K
S1
S2
AB
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
−0.5
−0.3
−0.1
0.1
0.3
0.5
0.7
Log lambda (microns)

Wilkins et al. 2008



When do stars form?

Build-up of the red sequence as a function of environment



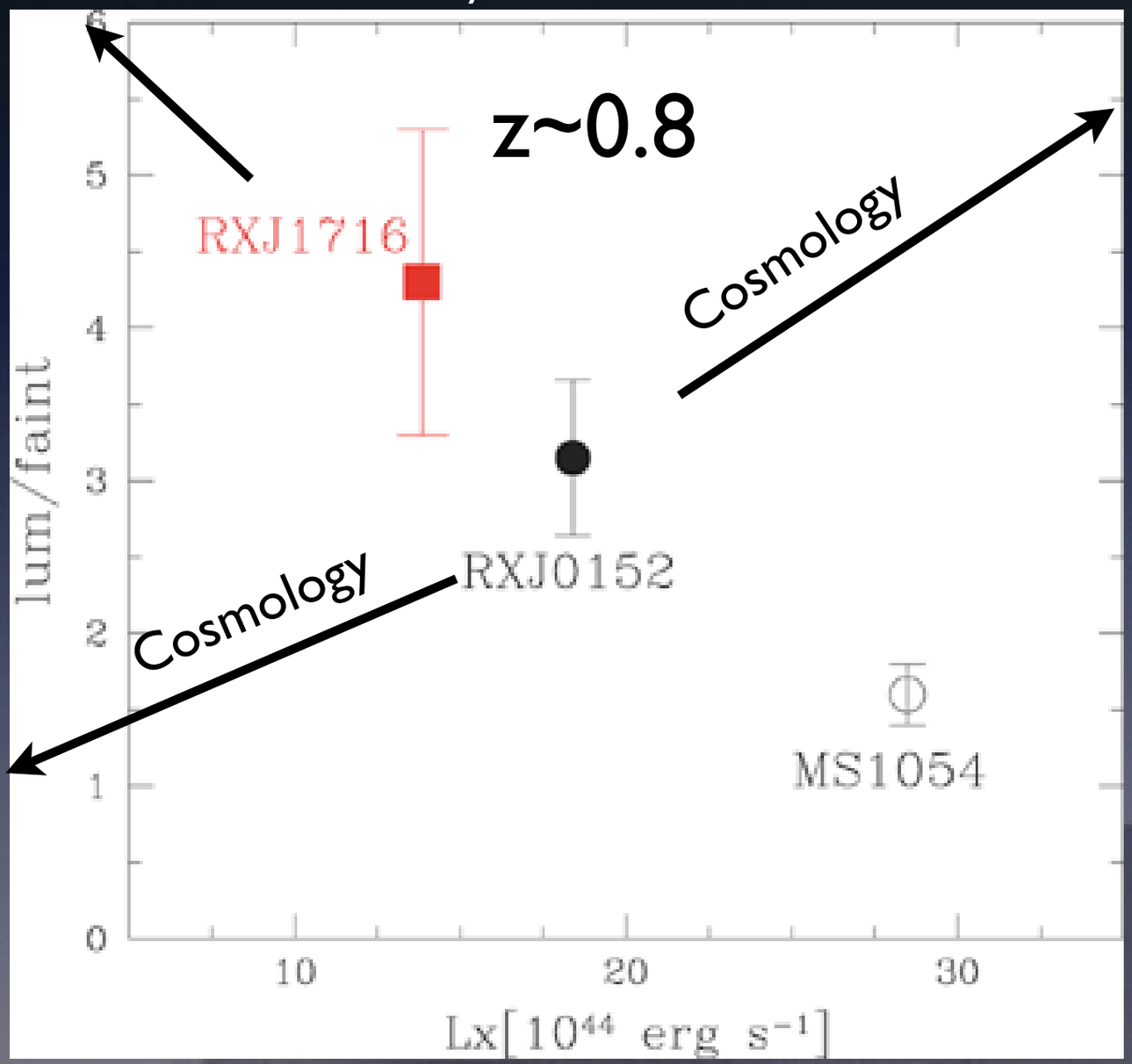
Kodama et al. 2007

- Current 1 < z < 2.5 population studies are limited to ~1 deg^2 fields and i ~ 26 (Subaru *XMM* Deep Survey is i ~ 27.2)
- ~60% field-to-field variations
- HSC plans to go to i = 27.7 and 20 deg^2 (10^7 Mpc^3 at $1.7 < z < 2.4$)

Large Volume is Crucial

What about in groups?

Koyama et al. 2007



z~0 clusters (SDSS)
Which processes turn the blue galaxies red?

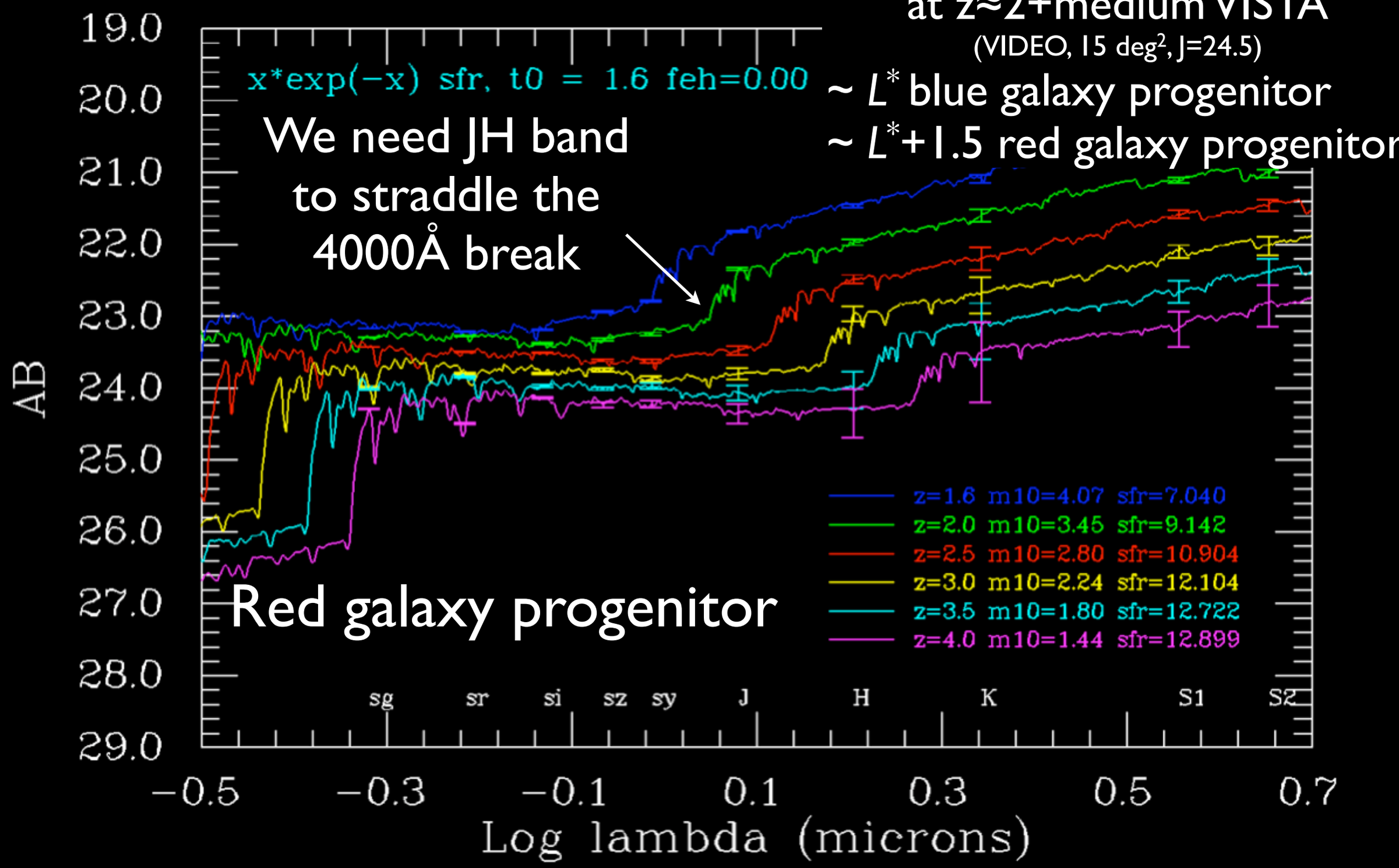
z~2 proto-clusters (e.g. from medium survey)

HSC survey has the volume and depth to sample evolution in faint-end luminosity function in all environments

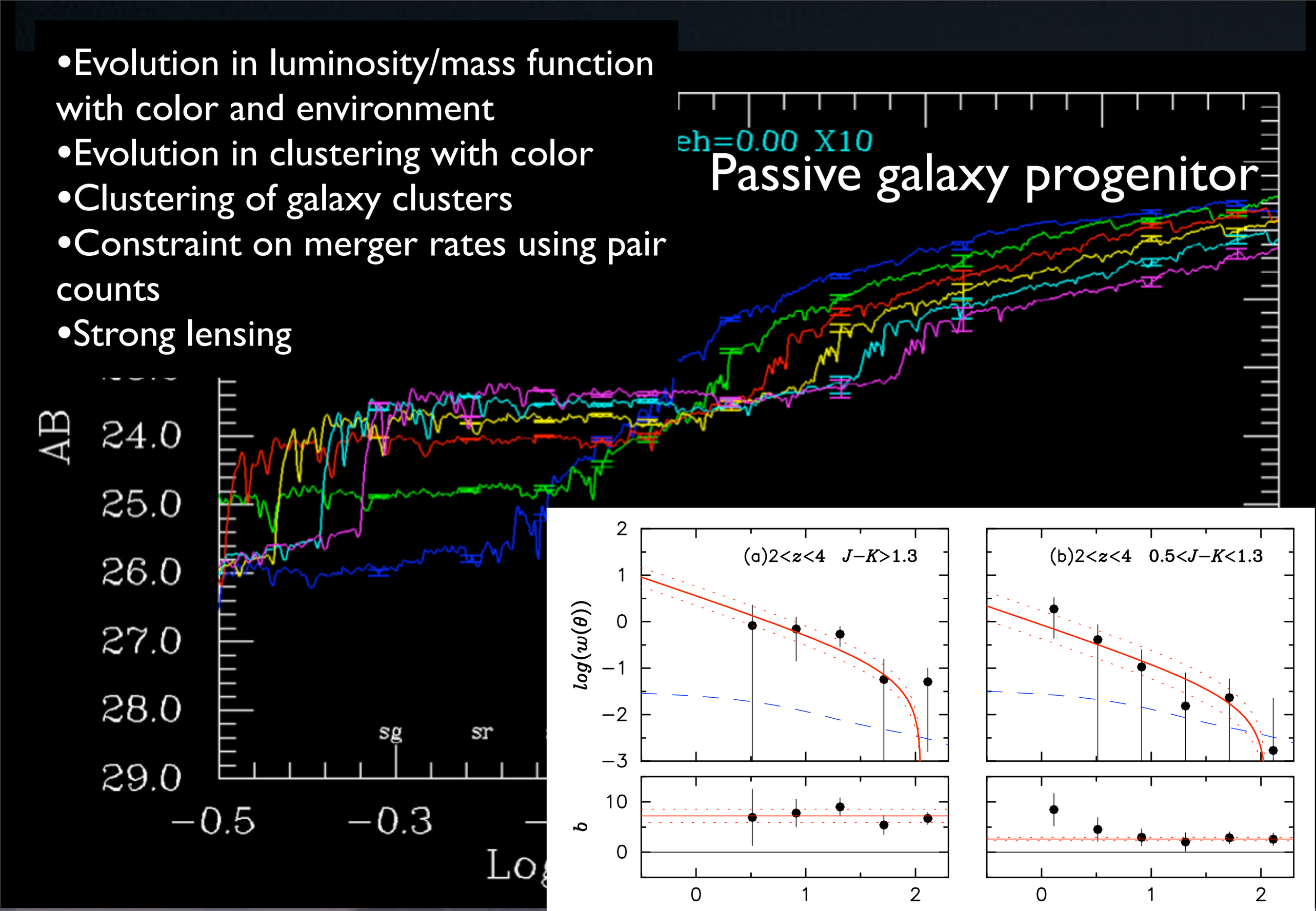
at z≈2
~ L^*+2 blue galaxy progenitor
~ L^*+3 red galaxy progenitor

at z≈2+UKIDSS
(35 deg^2, J=23.4)
~ 2L^* blue galaxy progenitor
~ L^* red galaxy progenitor

at z≈2+medium VISTA
(VIDEO, 15 deg^2, J=24.5)
~ L^* blue galaxy progenitor
~ L^*+1.5 red galaxy progenitor



- Evolution in luminosity/mass function with color and environment
- Evolution in clustering with color
- Clustering of galaxy clusters
- Constraint on merger rates using pair counts
- Strong lensing

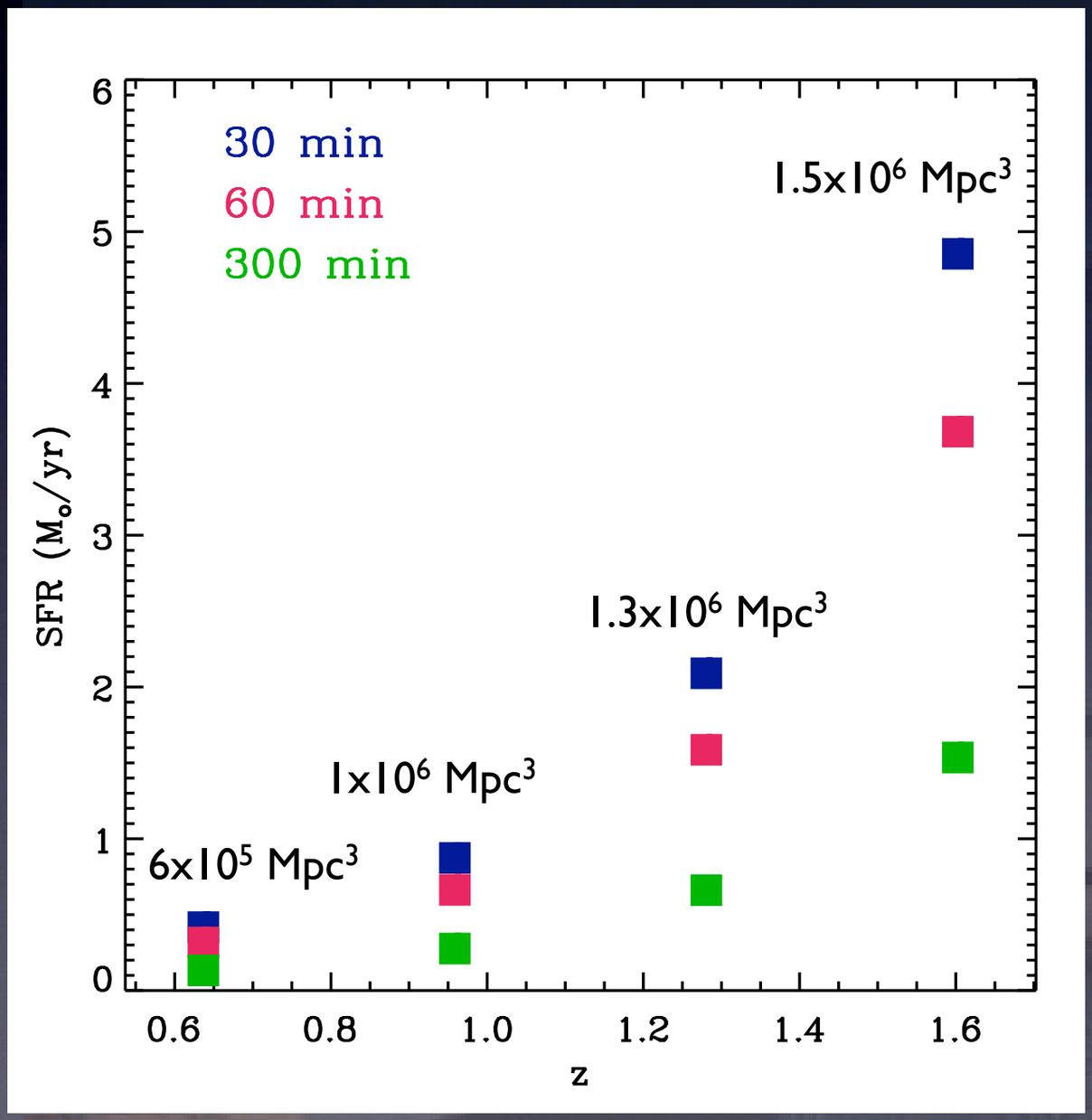


Ichikawa et al. 2007
MOIRCS deep survey: 24.4 arcmin^2

+ (NIR) Spectroscopy

- Really reliable redshifts + calibration of photometric redshifts
- Star formation rates, more detailed stellar populations, metallicity information, Tully-Fisher evolution, AGNs, and on and on
- FMOS is the ideal instrument

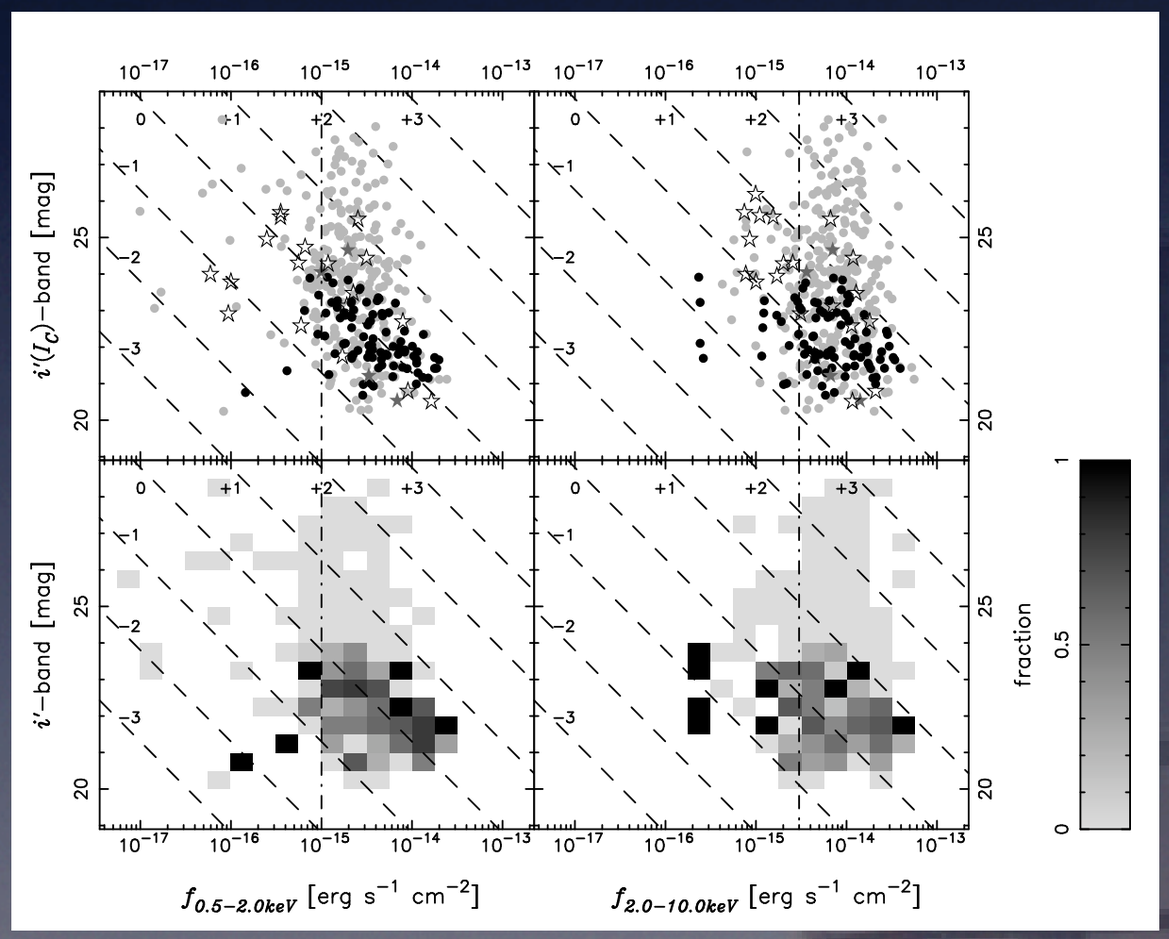
[OII] 'Interlopers' in Narrow-band Survey



- Recognize by detection of continuum
- Get spectroscopic z's for star-forming (and AGN) populations at z~1.6
- evolution in star formation rate as a function of galaxy mass and clustering strength
- low-z counterparts to Lya blobs?

Black Holes & Galaxies

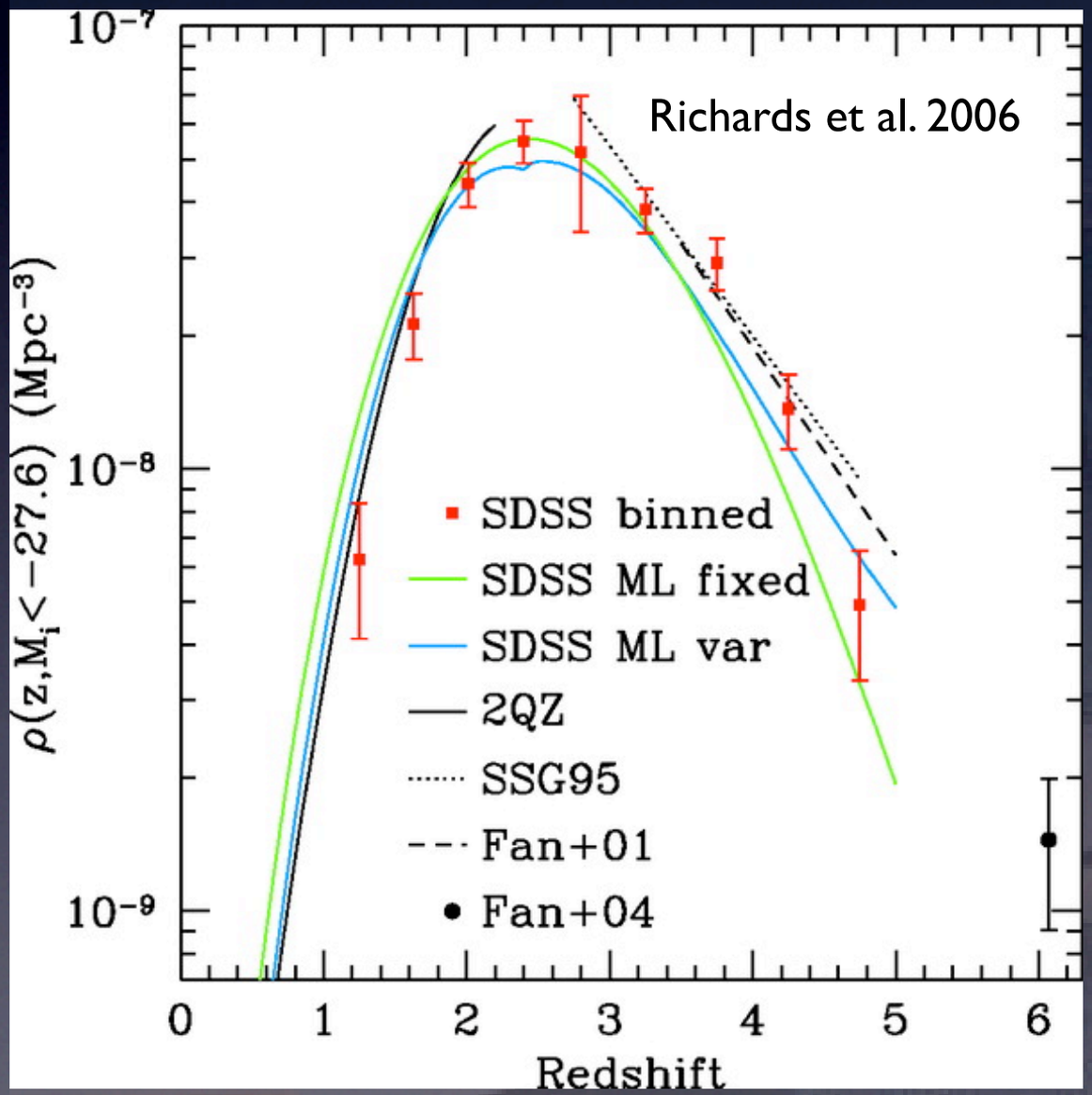
Morokuma et al 2008 (astroph/0712.3106)



finding ~200 AGNs/sq. deg with comparable depth to the shallow survey

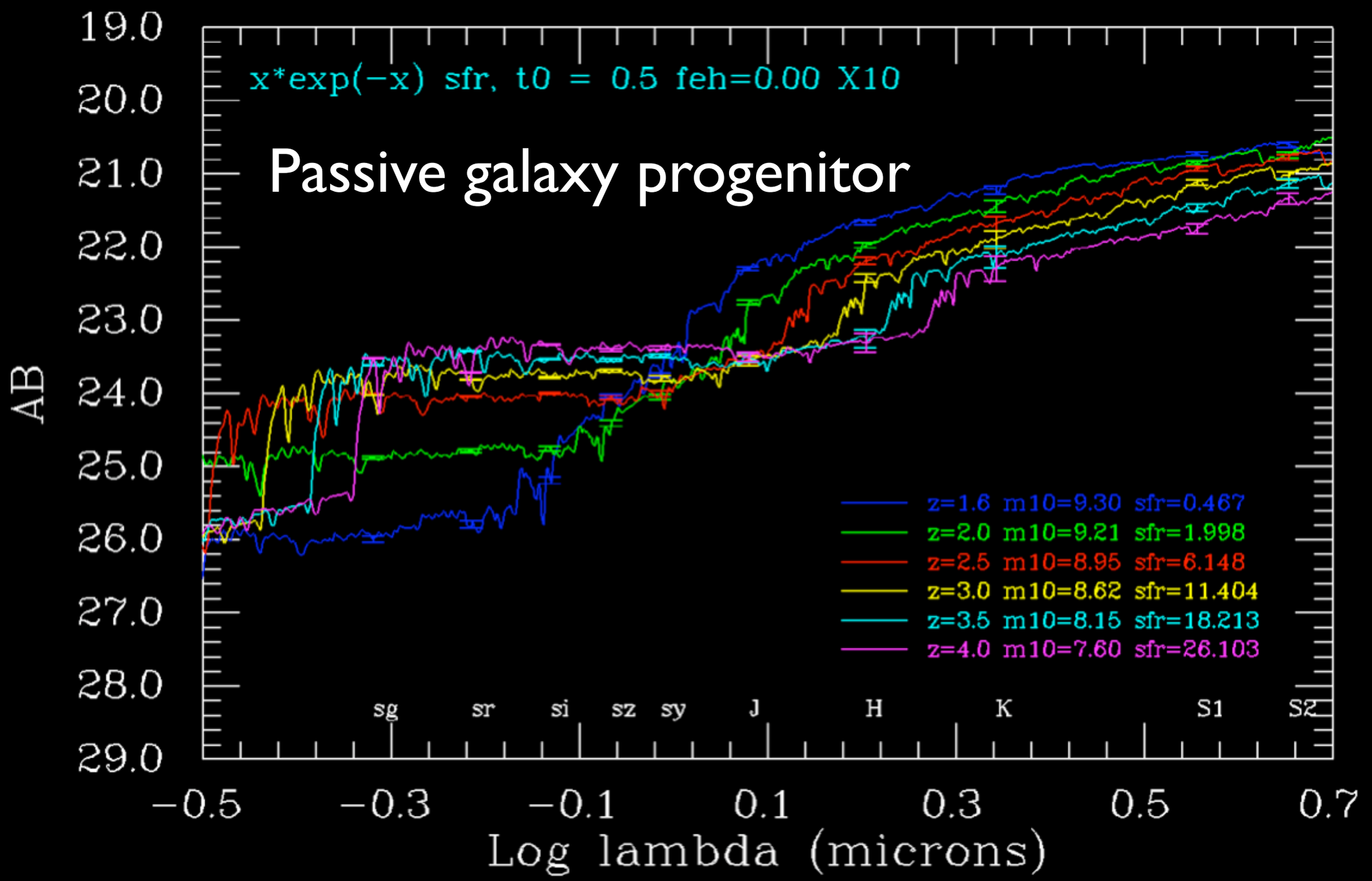
- Sesar et al. 2007 (w/SDSS Southern stripe) show that variability selection as efficient as color selection
- CRUCIALLY, Morokuma et al 2008 show that variability is also competitive with X-ray selection at z~1 AND is sensitive to BHs in a range of accretion states
- Perfect to investigate BH-Bulge relations at intermediate z (peak in low-luminosity AGN activity)

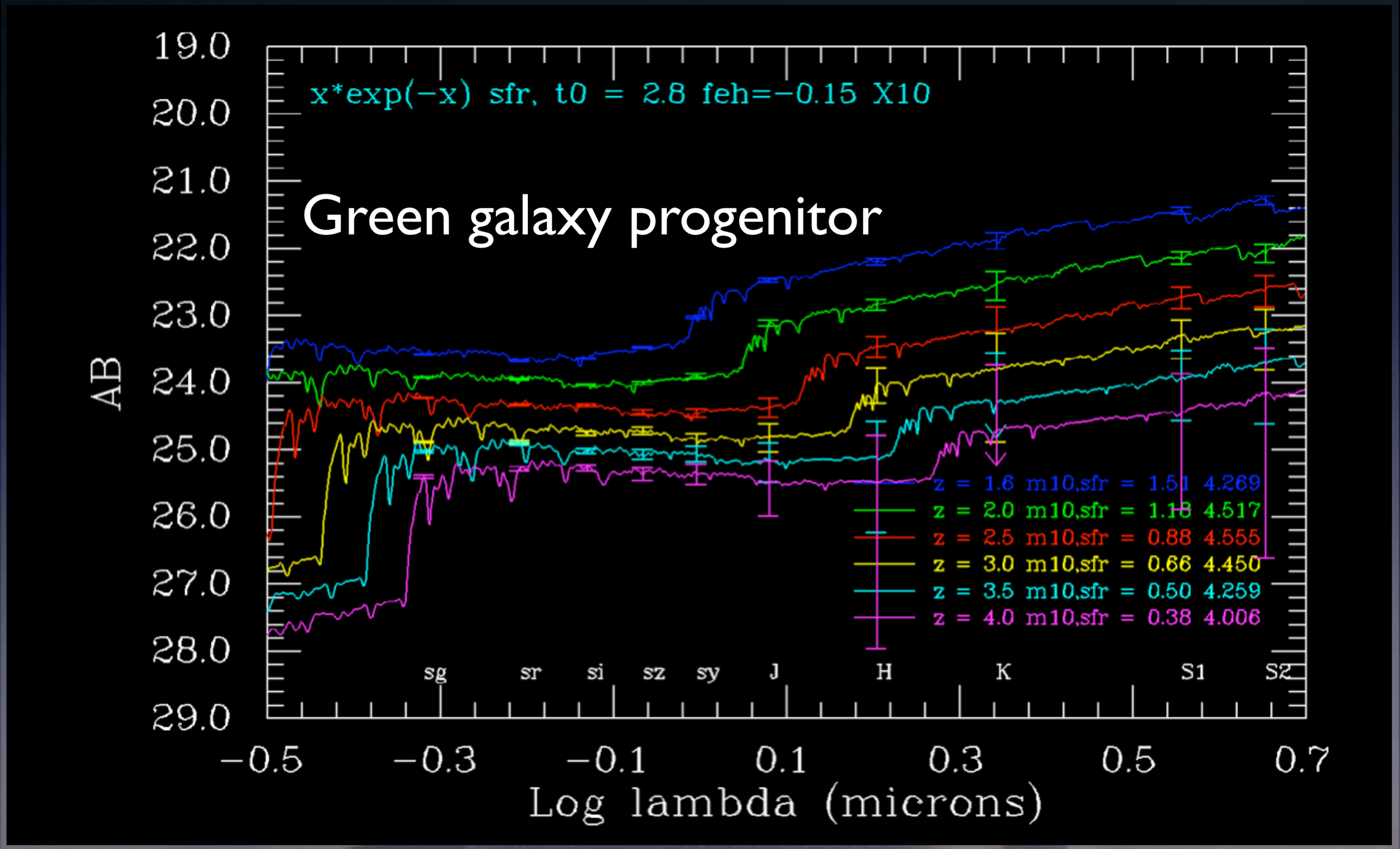
High-z QSOs



- Using *i*-band dropouts, we expect ~500 z~6 QSOs (5 mags deeper than SDSS), except for break in LF, color changes or dust
- Using z-band dropouts, we can push to z~7 QSOs; we expect ~50 (assuming a factor of 3 per unit z)
- QSO clustering/lifetimes with *L*, *z*
- What about their progenitors/ descendants?

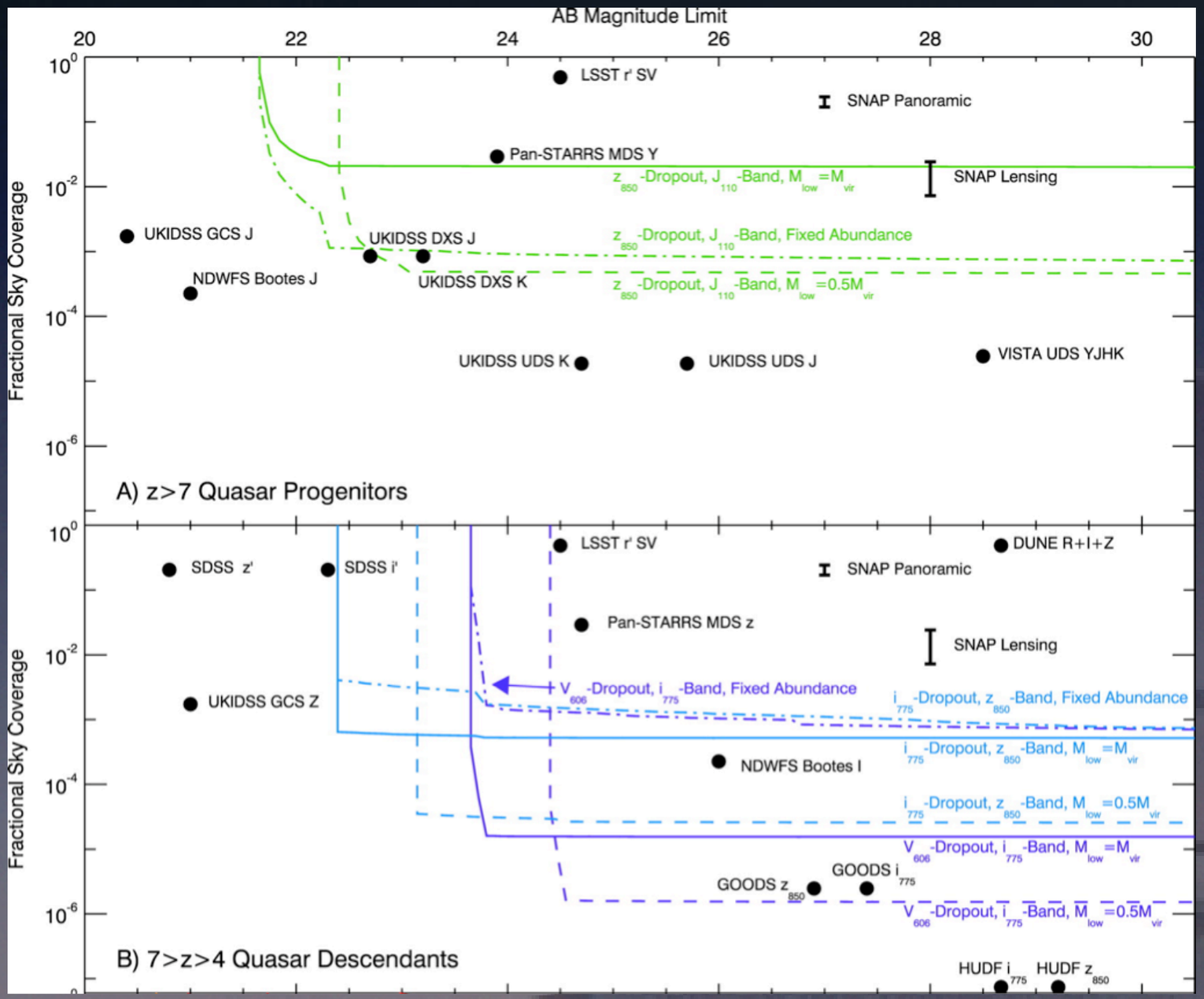
Passive galaxy progenitor




x*exp(−x) sfr, t0 = 2.8 feh=−0.15 X10
Green galaxy progenitor
z = 1.6 m10,sfr = 1.51 4.269
z = 2.0 m10,sfr = 1.13 4.517
z = 2.5 m10,sfr = 0.88 4.555
z = 3.0 m10,sfr = 0.66 4.450
z = 3.5 m10,sfr = 0.50 4.259
z = 4.0 m10,sfr = 0.38 4.006
sg
sr
si
sz
sy
J
H
K
S1
S2
AB
19.0
20.0
21.0
22.0
23.0
24.0
25.0
26.0
27.0
28.0
29.0
−0.5
−0.3
−0.1
0.1
0.3
0.5
0.7
Log lambda (microns)

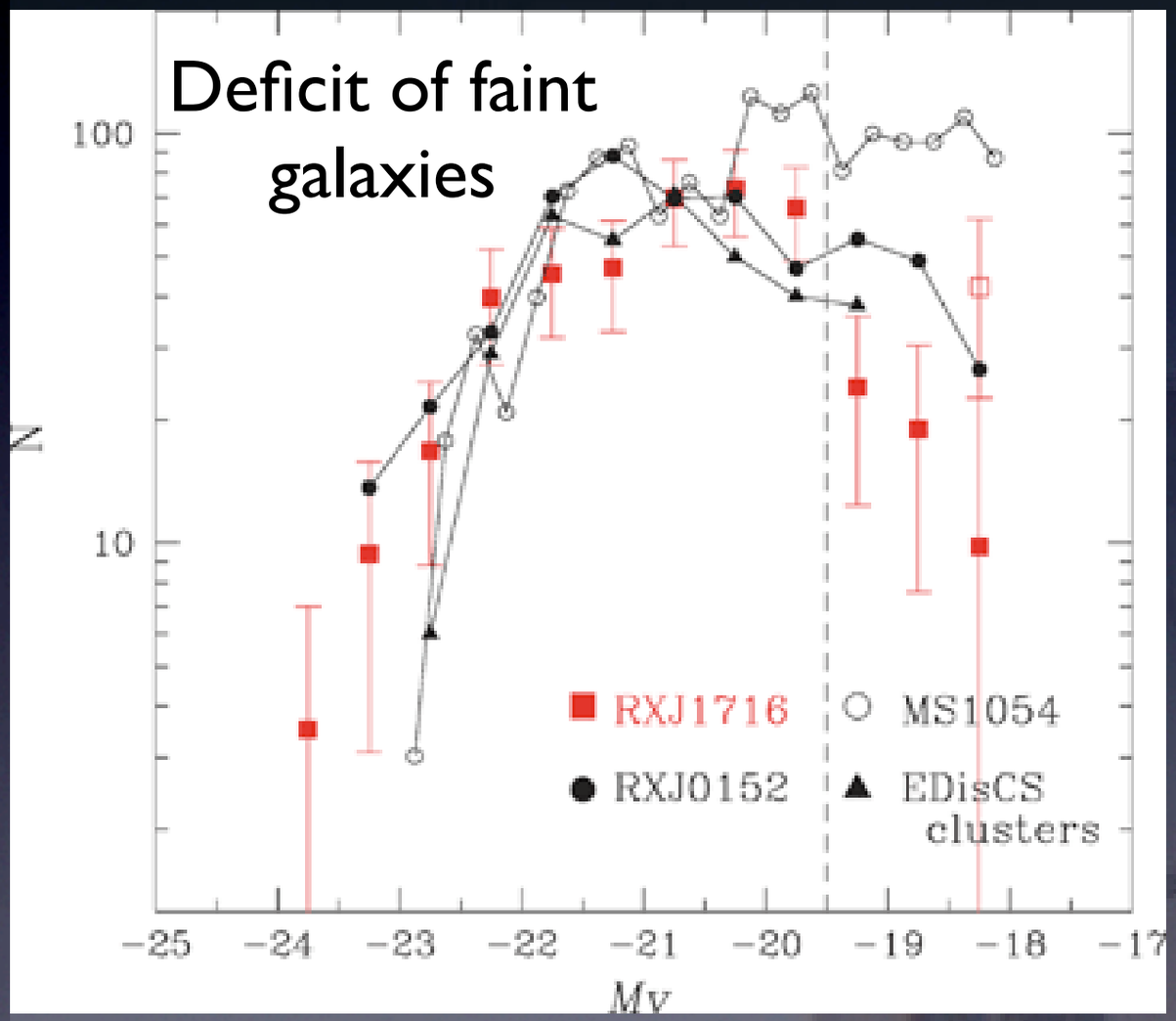
QSO Descendants

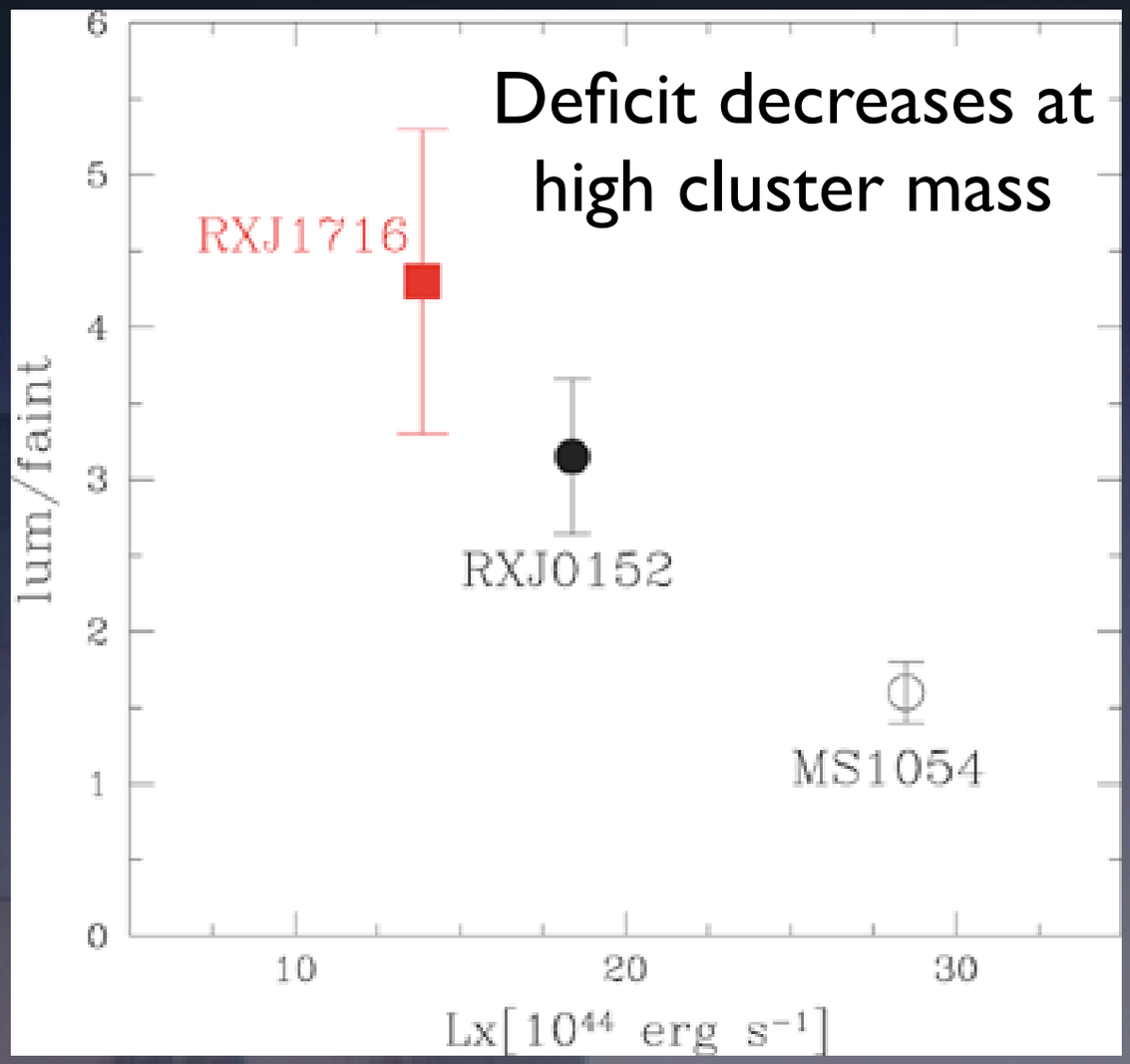
Robertson et al. 2007



Large Volume is Crucial

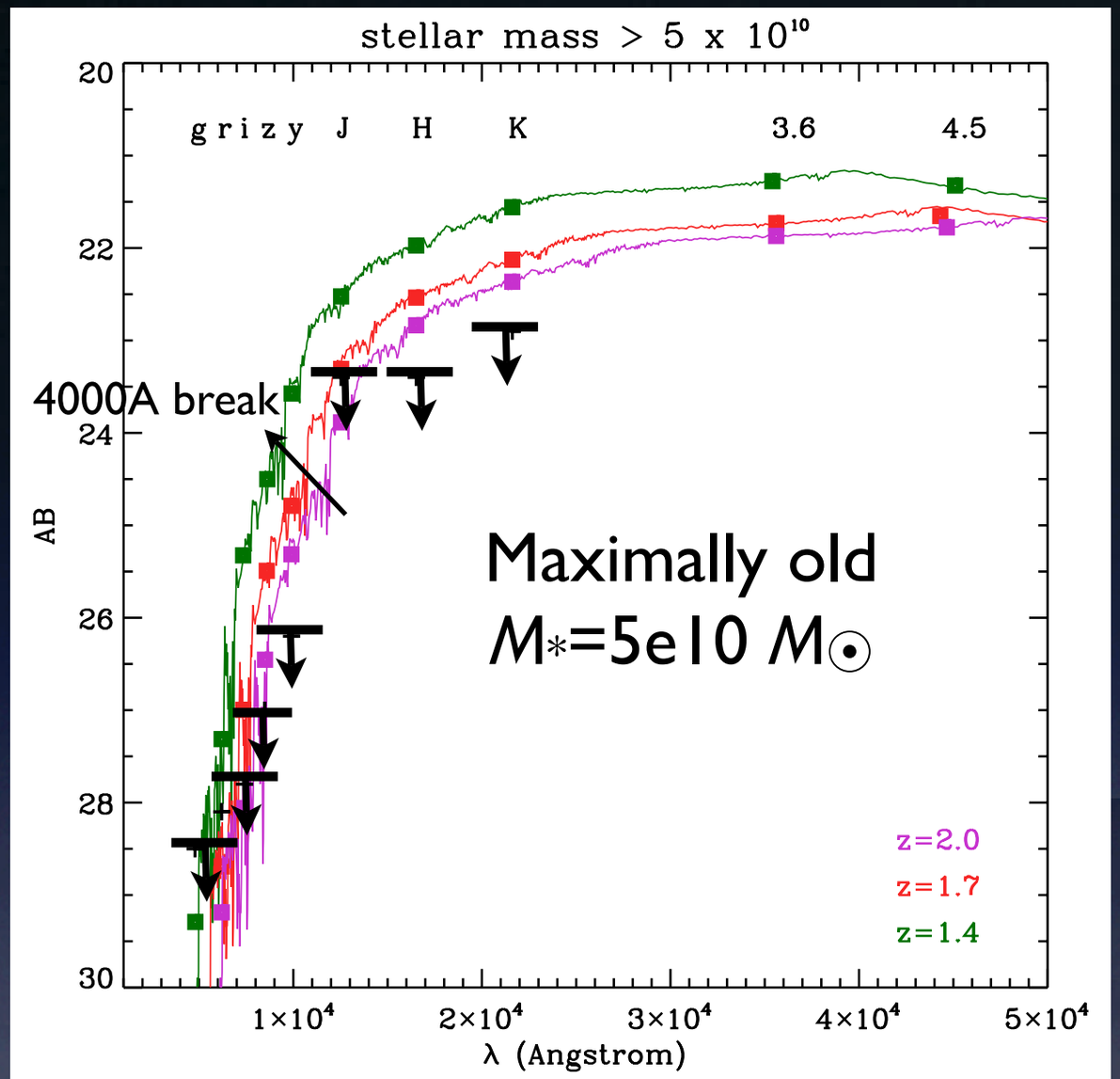
Koyama et al. 2007

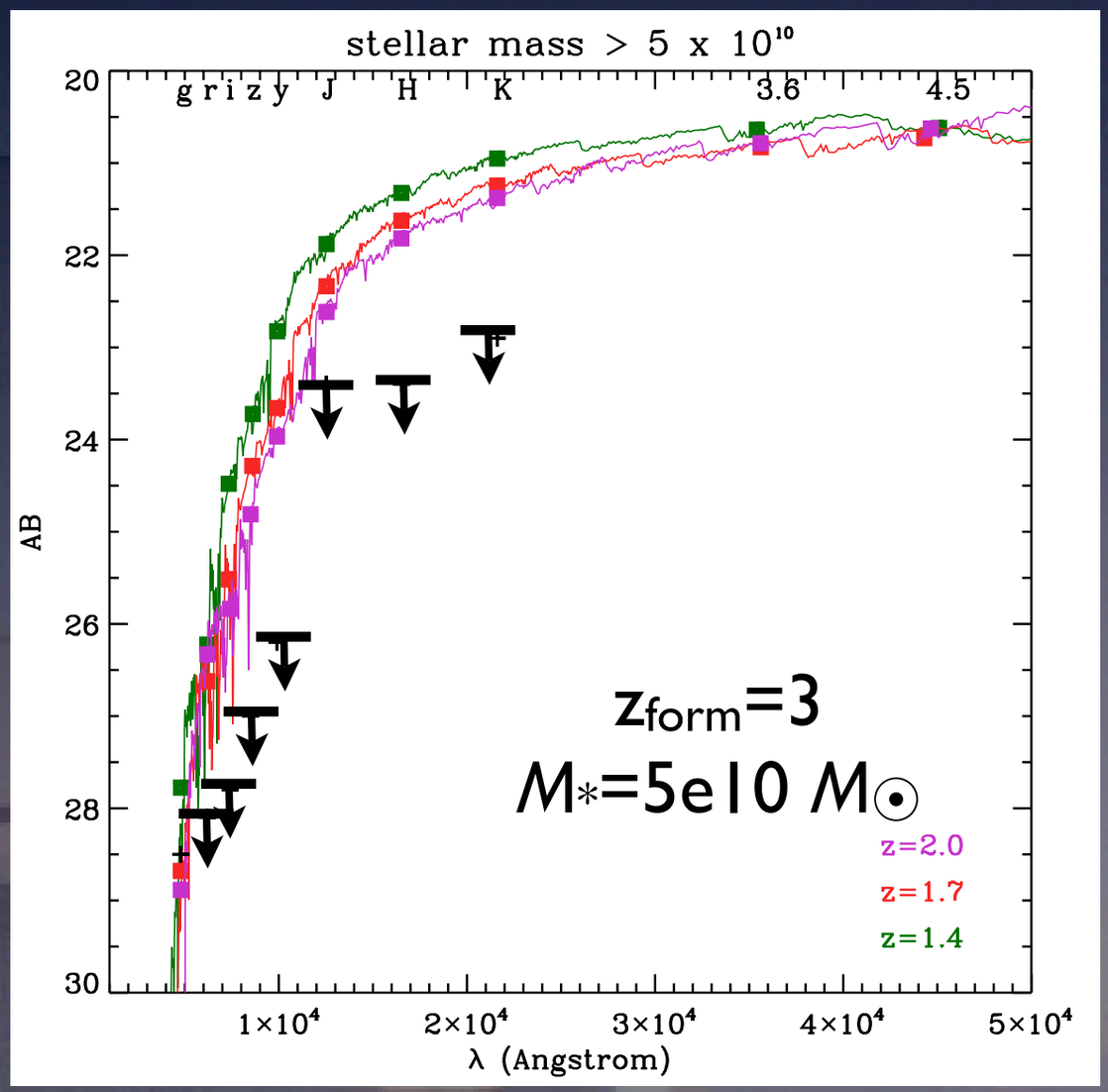




HSC limits
S/N=10

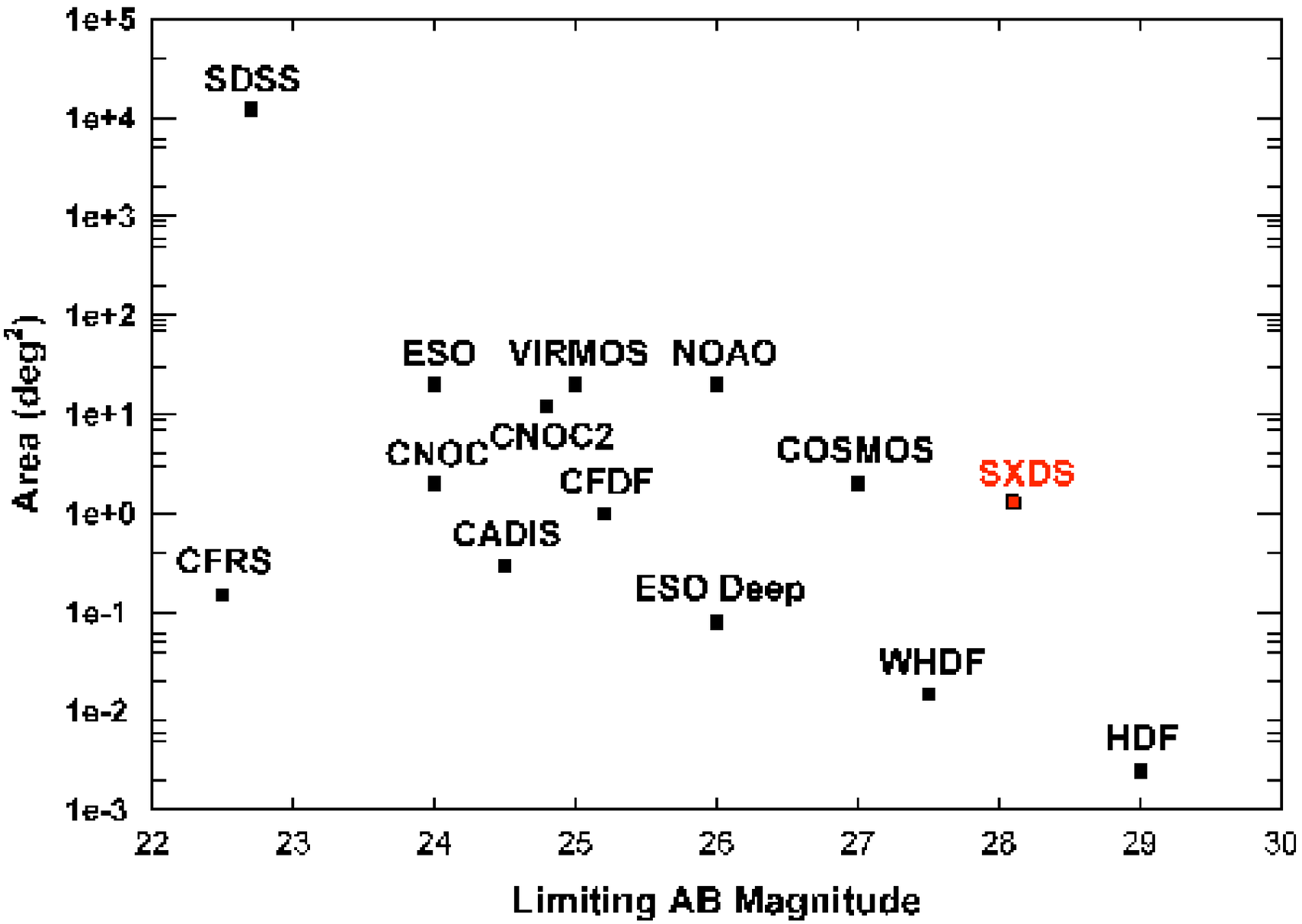
M_V~-16.5 XXX

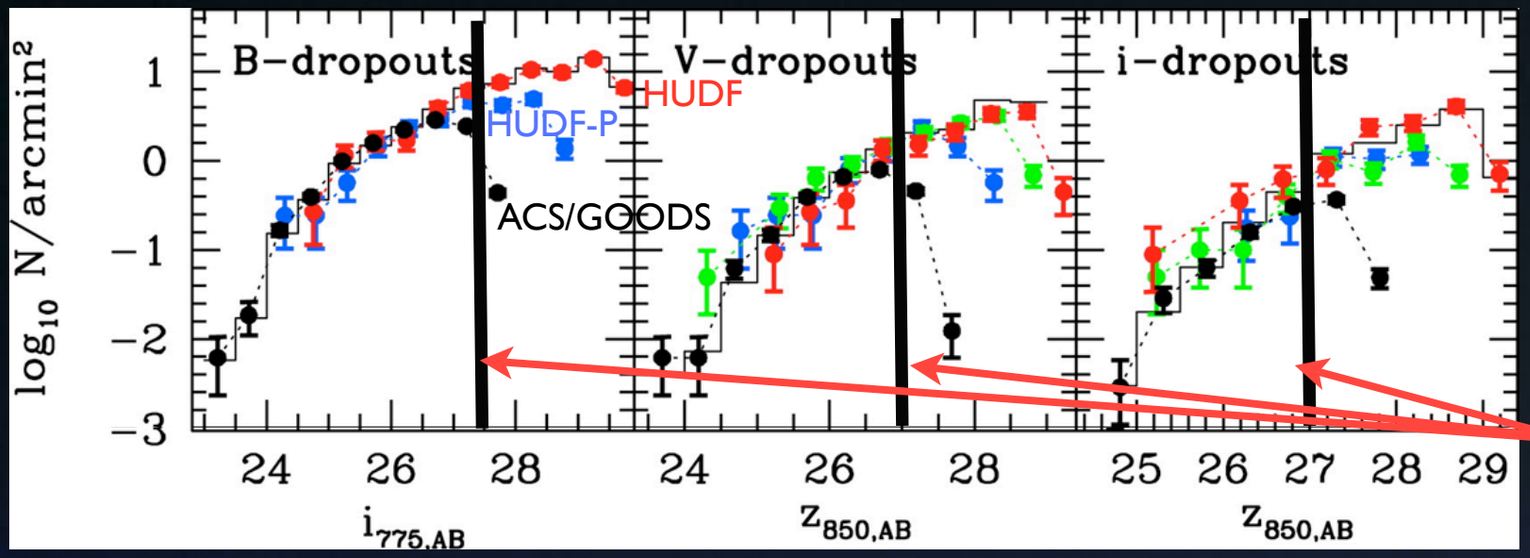




Luminosity/mass functions, color-magnitude evolution, clustering as a function of color

Optical Imaging Survey





HSC Medium
Survey Limits

Bouwens et al. 2007

Dropouts