PRIMUS: Galaxy Environment on the Quiescent Fraction at z < 0.8

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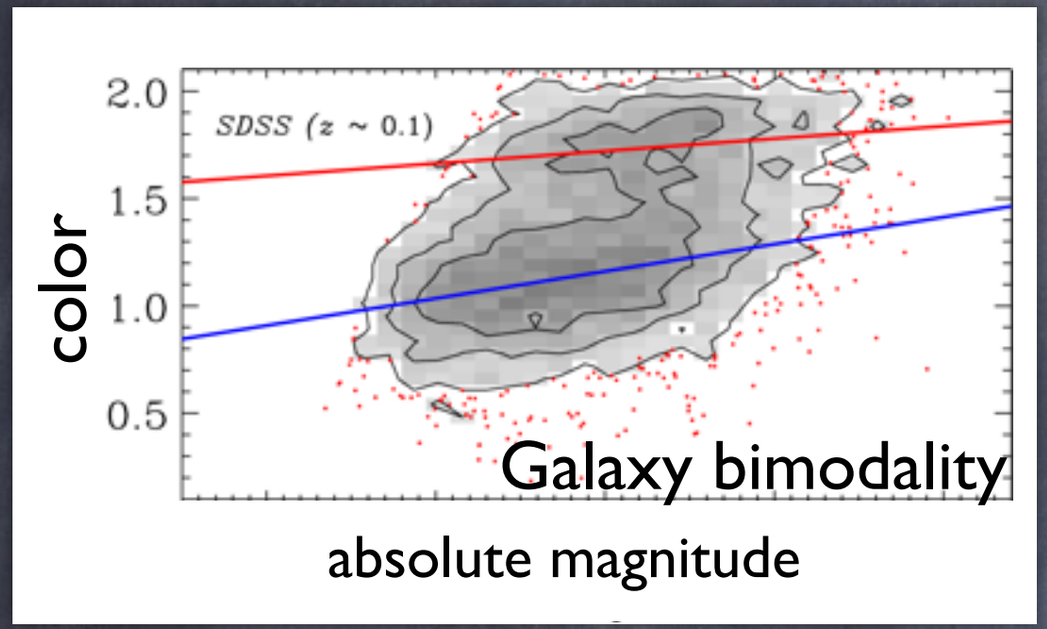
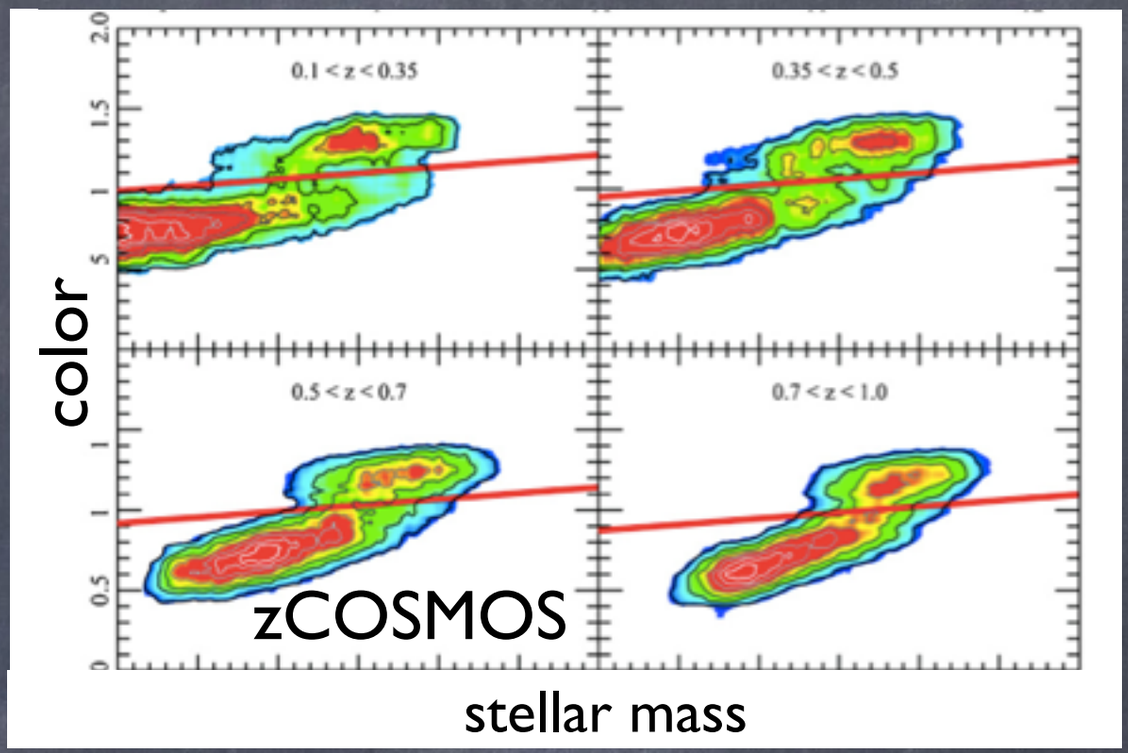
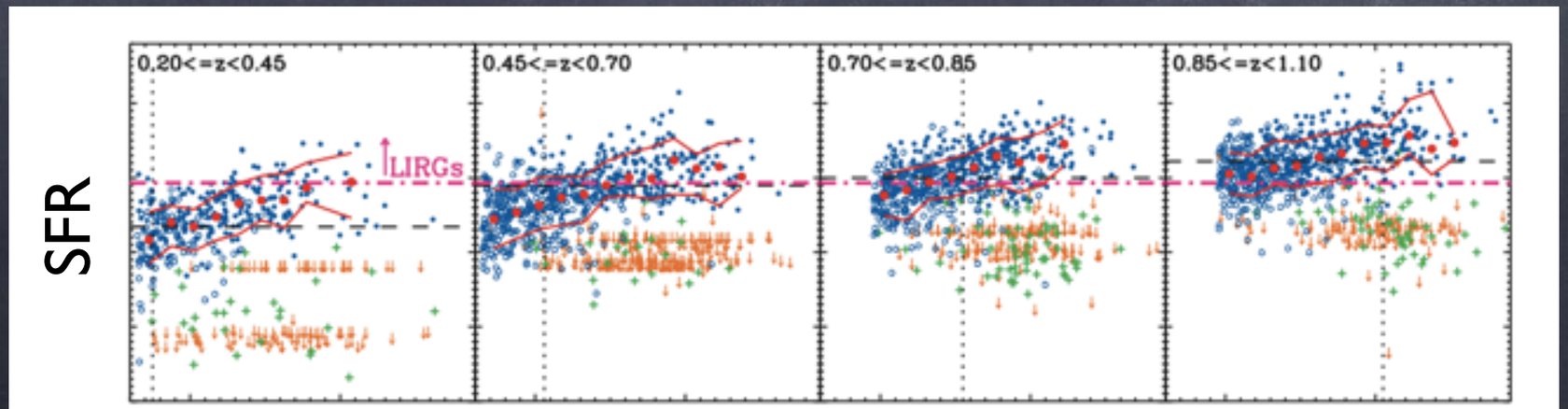
Properties of Galaxies



Blanton (2006)



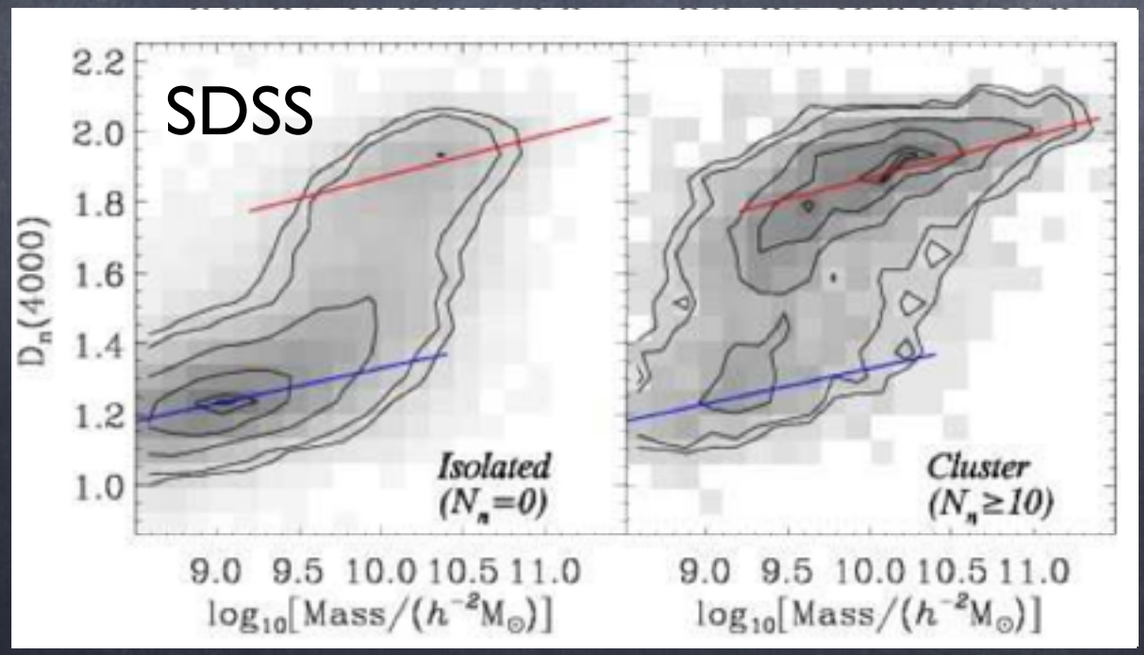
Peng et al. (2010)



Noeske et al. (2007)

Role of Galaxy Environment

- Galaxies in high density environments are redder, more massive, and have lower star formation rates
- How do galaxies in different environments evolve over cosmic time?
  - e.g. Butcher Oemler Effect (galaxies in clusters)



Blanton & Moustakas (2009)

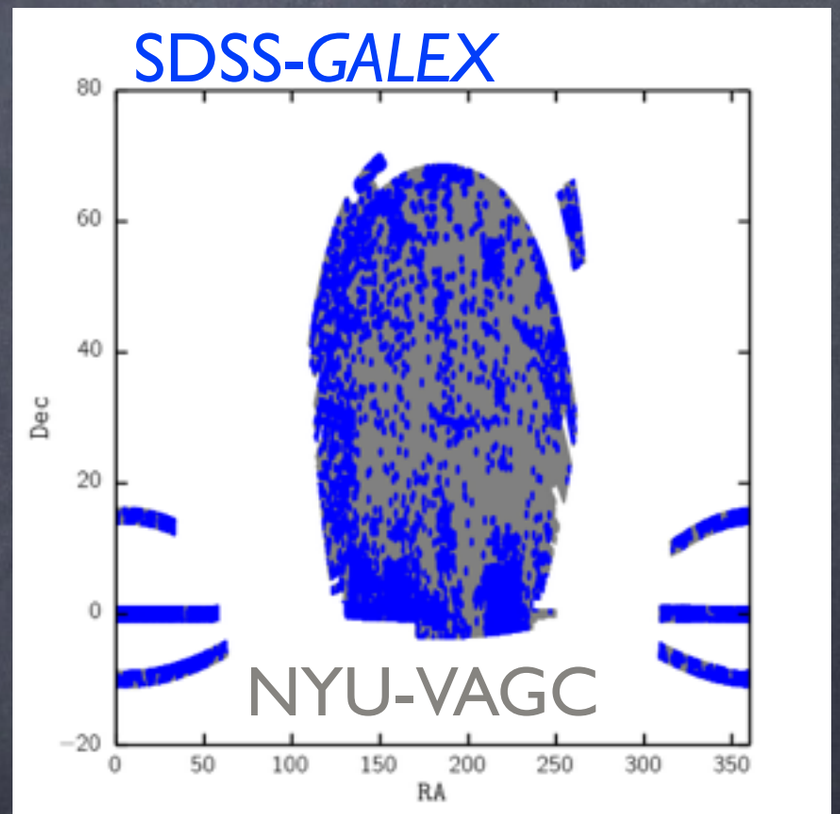
Role of Galaxy Environment

- Environmental quenching mechanisms (e.g. ram-pressure stripping, strangulation, and etc.)
- Isolating environmental effects of quenching difficult due to underlying relations among observable properties and limited statistics
- $f_Q(\mathcal{M}_*, z, \delta_{\rm env})$

Ram pressure stripping in NGC 4402 as it falls towards the Virgo Supercluster

Data

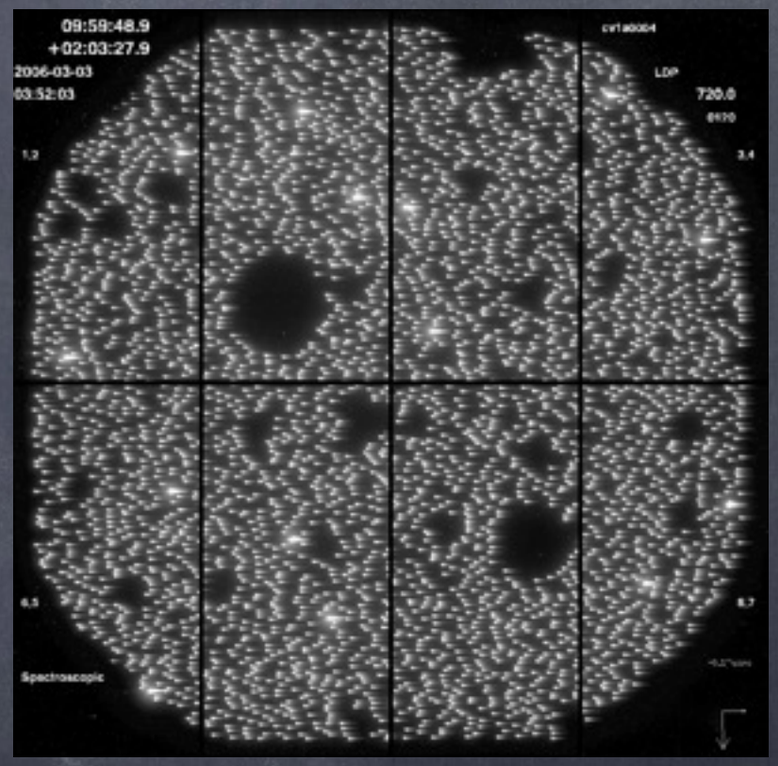
- NYU Value Added Galaxy Catalog (NYU-VAGC)
  - Blanton et al. (2005)
  - Derived from SDSS DR7 (Abazajian et al. 2009)
  - *GALEX* UV imaging
  - $0.01 < z < 0.2$
  - 169,727 galaxies over $2,505\ \mathrm{deg}^2$



NYU-VAGC and SDSS-*GALEX* footprints

Data

- **PRIsm** MUlti-object Survey (PRIMUS)
  - Coil et al. (2011), Cool et al. (2013)
  - ~120,000 spectroscopic redshift with $\sigma_z/(1+z) < 0.005$
  - *GALEX* UV imaging
  - $\sim 5.5\ \mathrm{deg}^2$ out of $\sim 9\ \mathrm{deg}^2$
- SFR and stellar masses from iSEDfit (Moustakas et al. 2013)



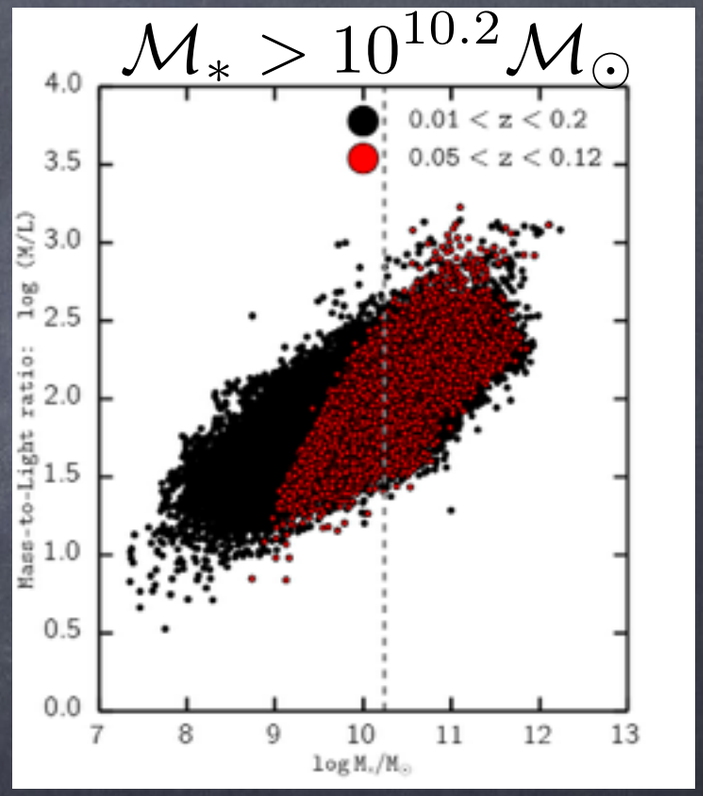
prism exposure in a PRIMUS field

Sample Selection

- Stellar mass complete
  - SDSS-GALEX : mass-to-light ratio
  - PRIMUS : Moustakas et al. (2013)

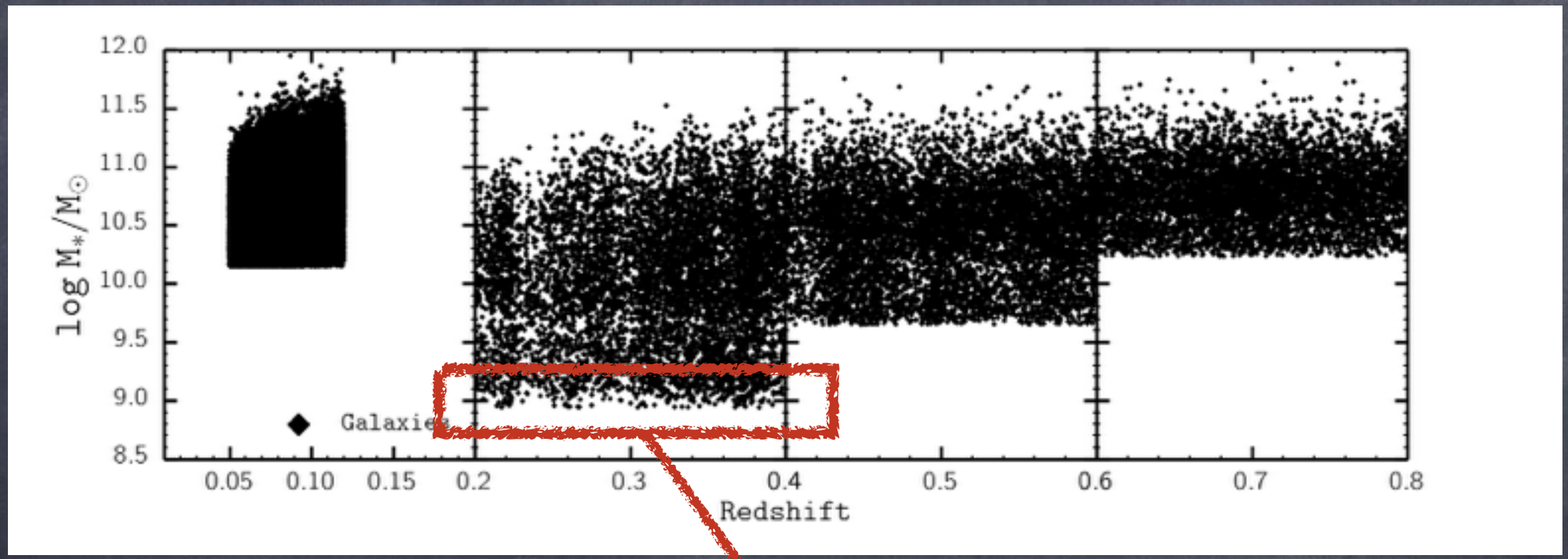
$$\log(SFR_{\rm min}) = -0.49 + 0.64\,\log(\mathcal{M}_* - 10) + 1.07\,(z - 0.1)$$

- Star-forming / Quiescent galaxy classification using "star-forming main sequence" evolution (Moustakas et al. 2013)



SDSS-*GALEX* mass-to-light ratio

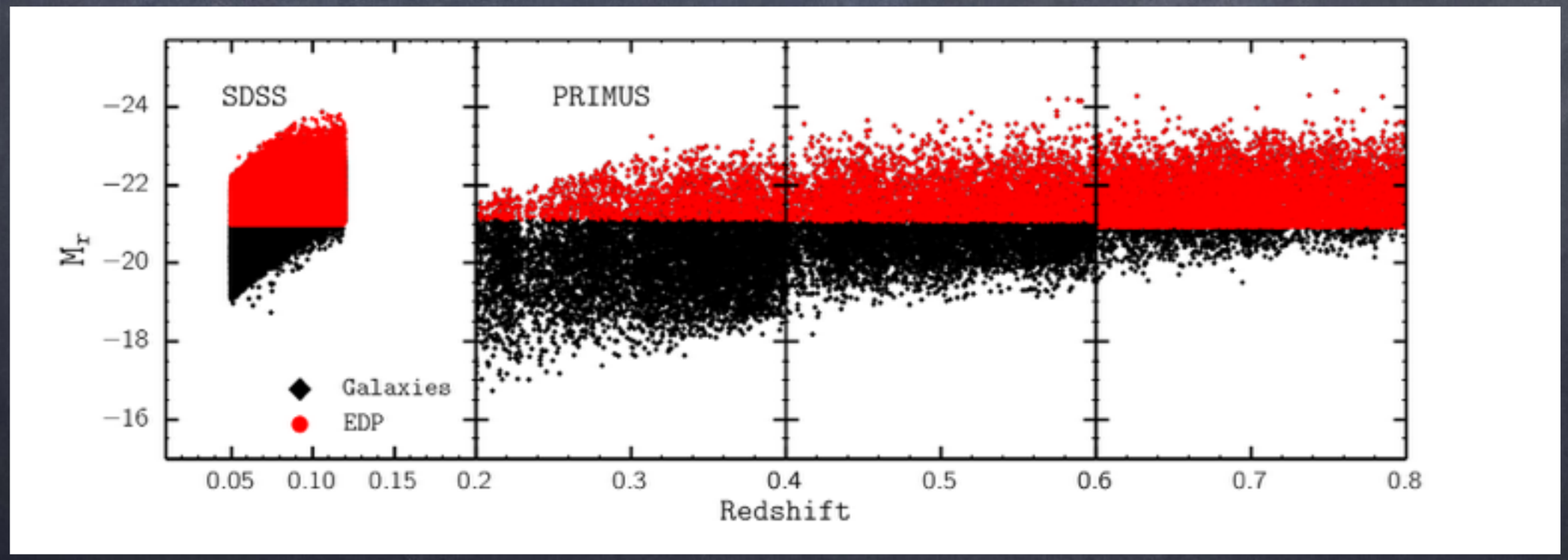
Sample Selection



Stellar mass completeness limits

Environment

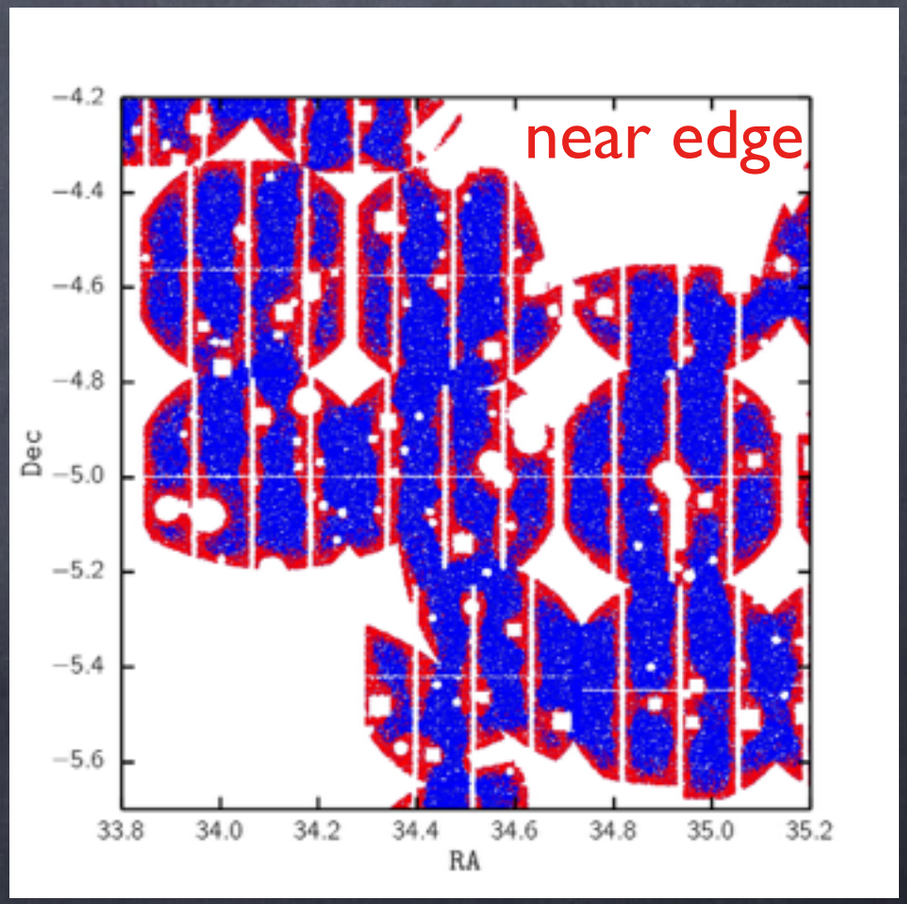
- Environment Defining Population (EDP)
  - Absolute magnitude (M_r) limits
  - Equivalent number density for all redshift bin
    - Behroozi et al. 2013; Leja et al. 2013



Hahn et al. (in prep)

Environment

- Fixed Cylindrical Aperture
  - R = 2 h^{-1} Mpc , H = 25 h^{-1} Mpc
  - Halo model (Blanton et al. 2006; Wilman et al. 2010)
  - PRIMUS σ_z , Redshift Space Distortion
  - Classification :
    - Low Density Environment : $n_{env} < 0.5$
    - High Density Environment : $n_{env} > 3.0$
- Edge Effects
  - Remove galaxies near the survey edge



Edges of a PRIMUS field

Sample Selection

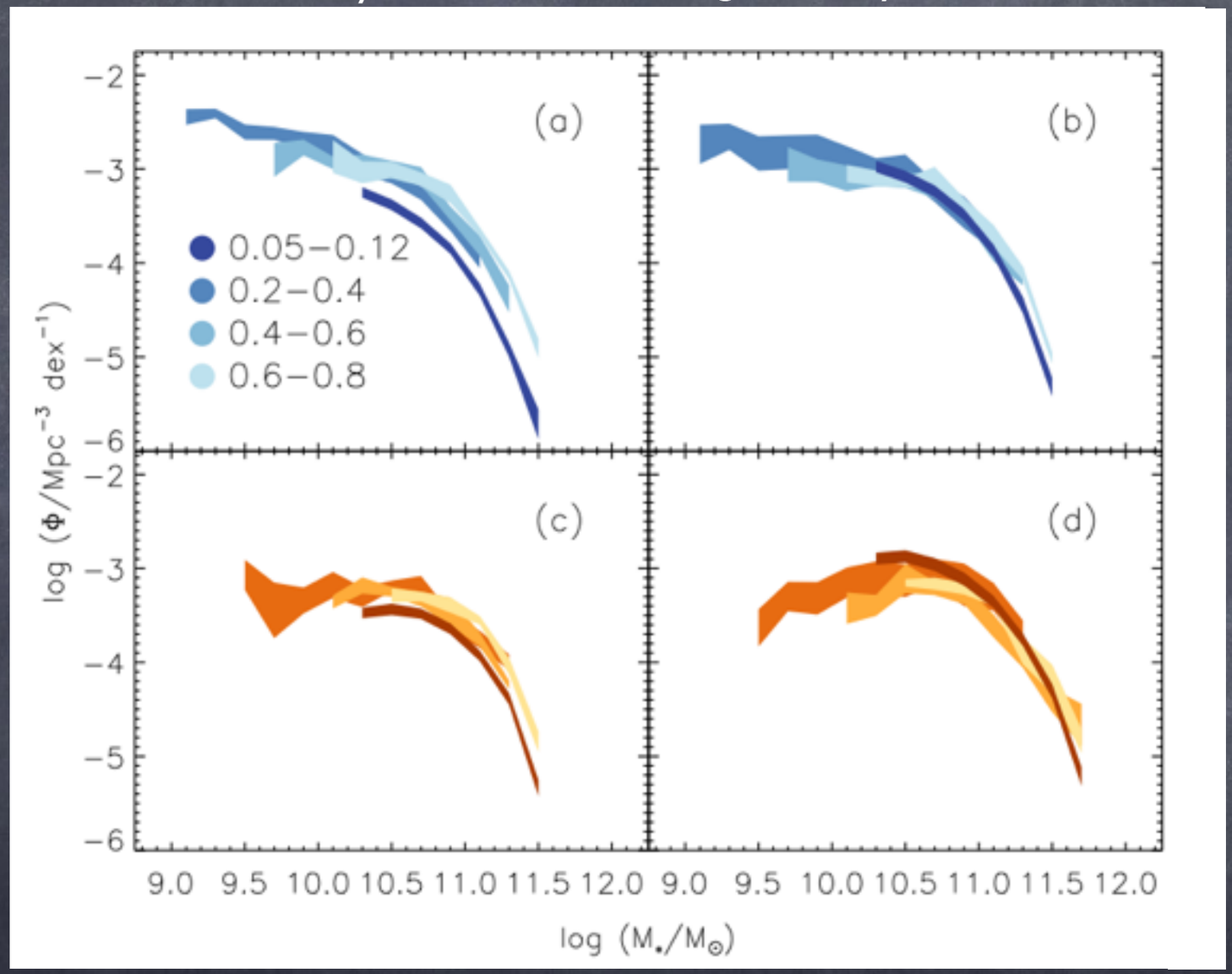
- After imposing edge-cuts and stellar mass completeness limits we have …

	Total	n	n
$0.05 < z < 0.12$	~ 64,000	~1,100	~ 30,000
$0.2 < z < 0.8$	~13,000	~ 4,300	~ 4,300

Stellar Mass Function Evolution

Low Density Environment

High Density Environment



Star-Forming

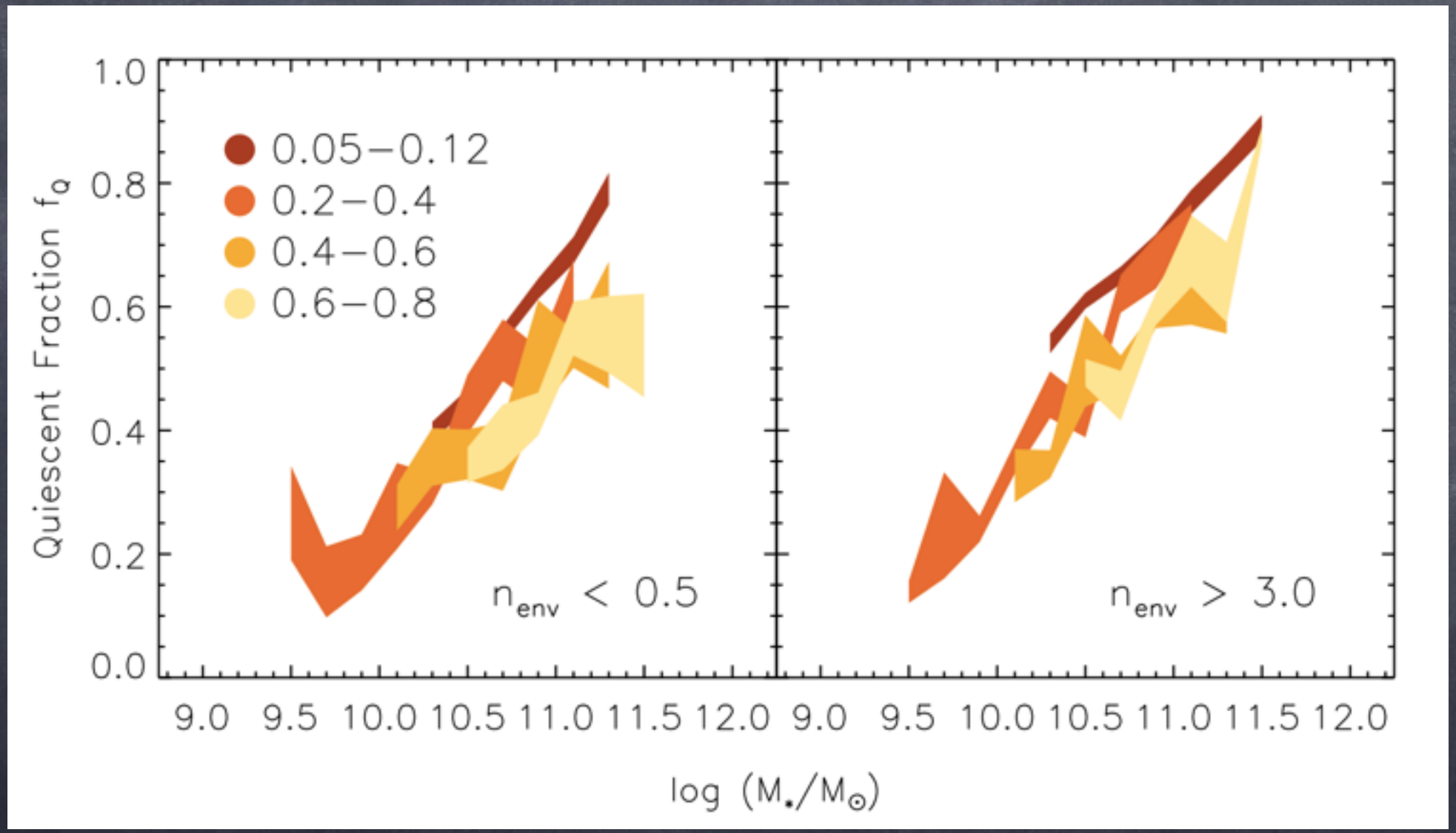
Quiescent

$$\Phi(\log \mathcal{M})\Delta(\log \mathcal{M}) = \sum_{i=1}^{N} \frac{W_i}{V_{max,avail,i}}$$

Quiescent Fraction Evolution

Low Density Environment

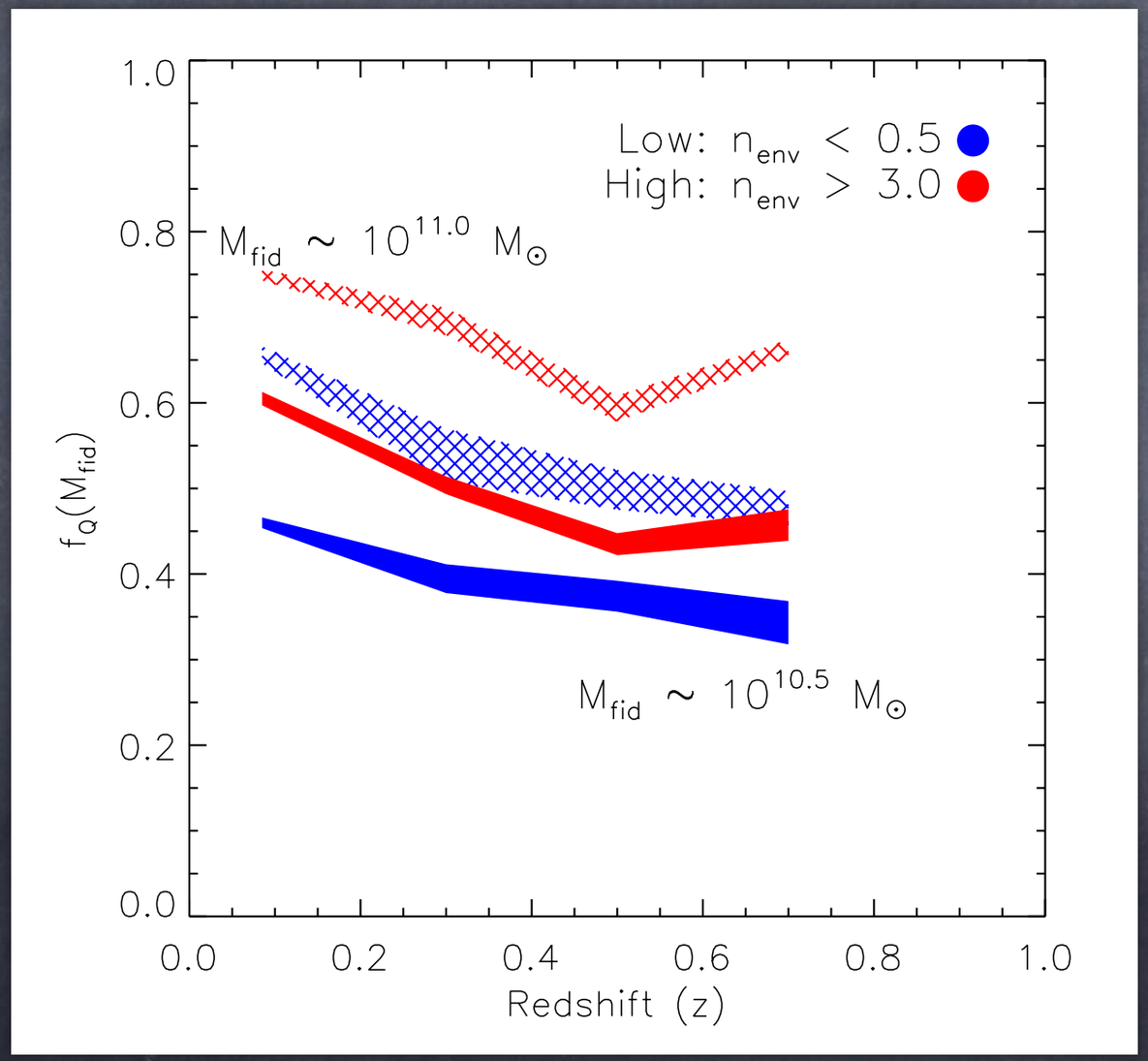
High Density Environment



$$f_Q = \frac{\Phi_Q}{\Phi_{SF} + \Phi_Q}$$

Quiescent Fraction Evolution

- $f_{\rm Q}(\mathcal{M}_*) = a\,\log(\frac{\mathcal{M}_*}{\mathcal{M}_{\rm fid}}) + b$



Hahn et al. (in prep)

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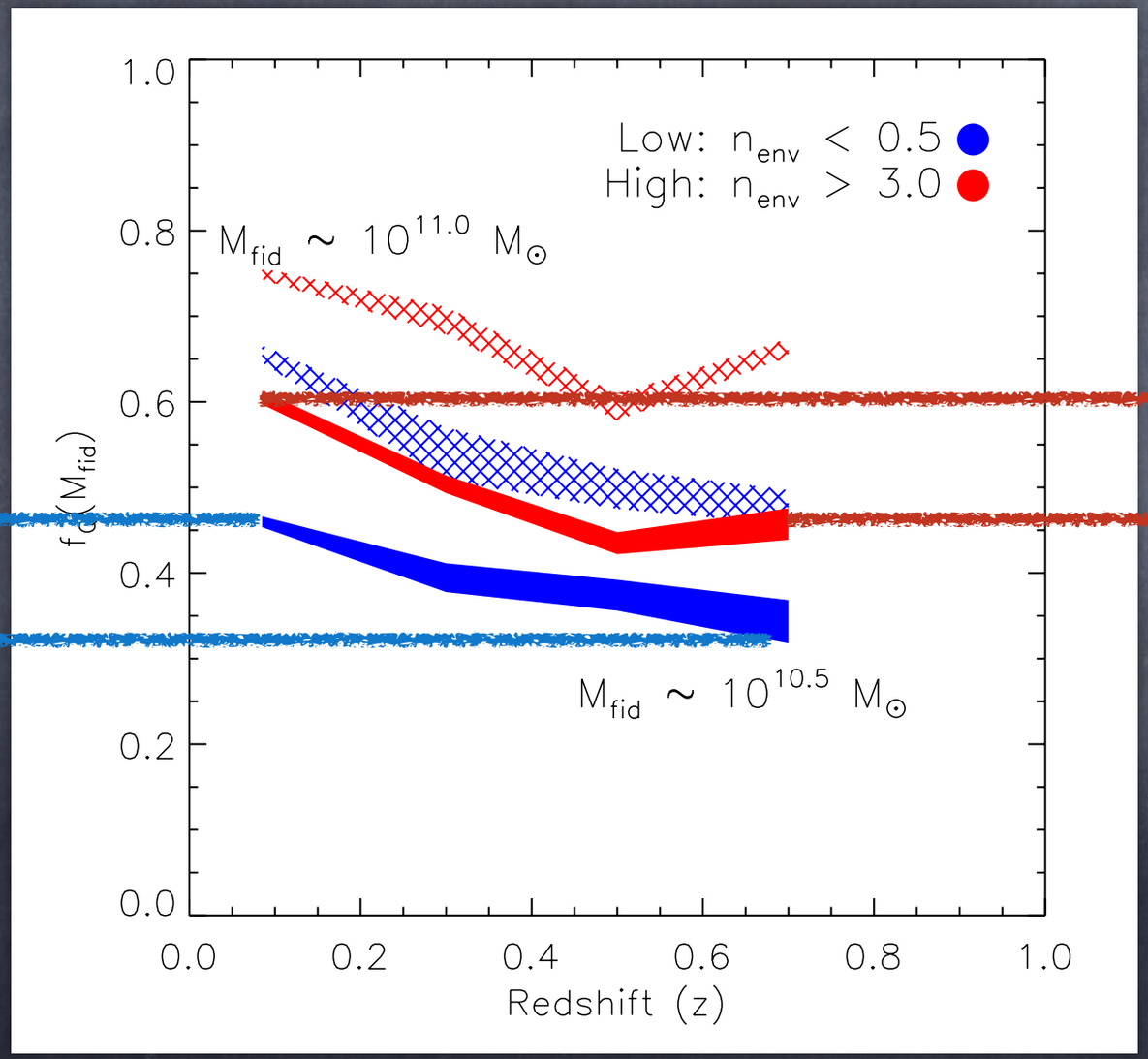


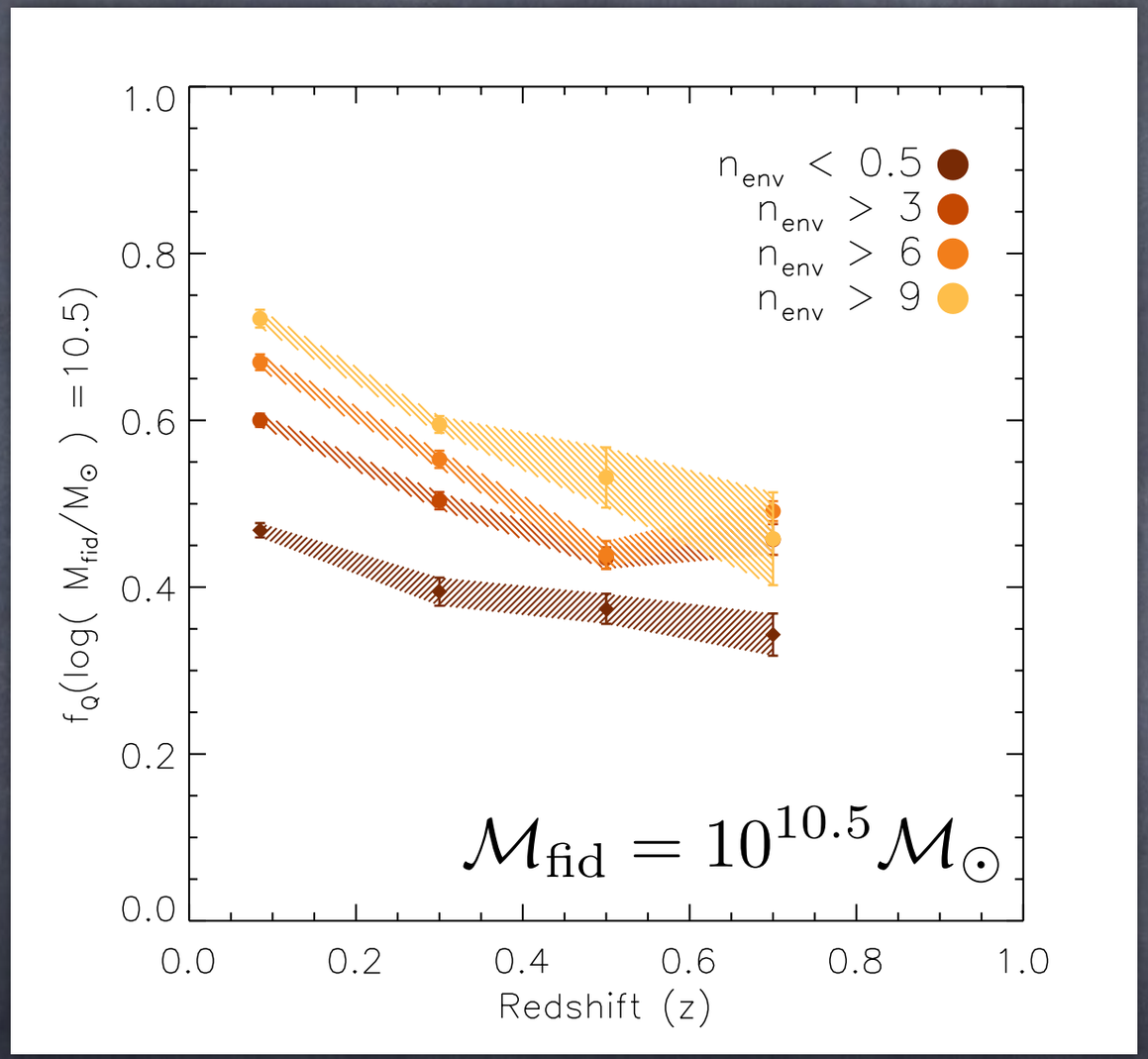
> 0.1

< 0.15

Significant f_Q evolution in low density environments

Hahn et al. (in prep)

Quiescent Fraction Evolution



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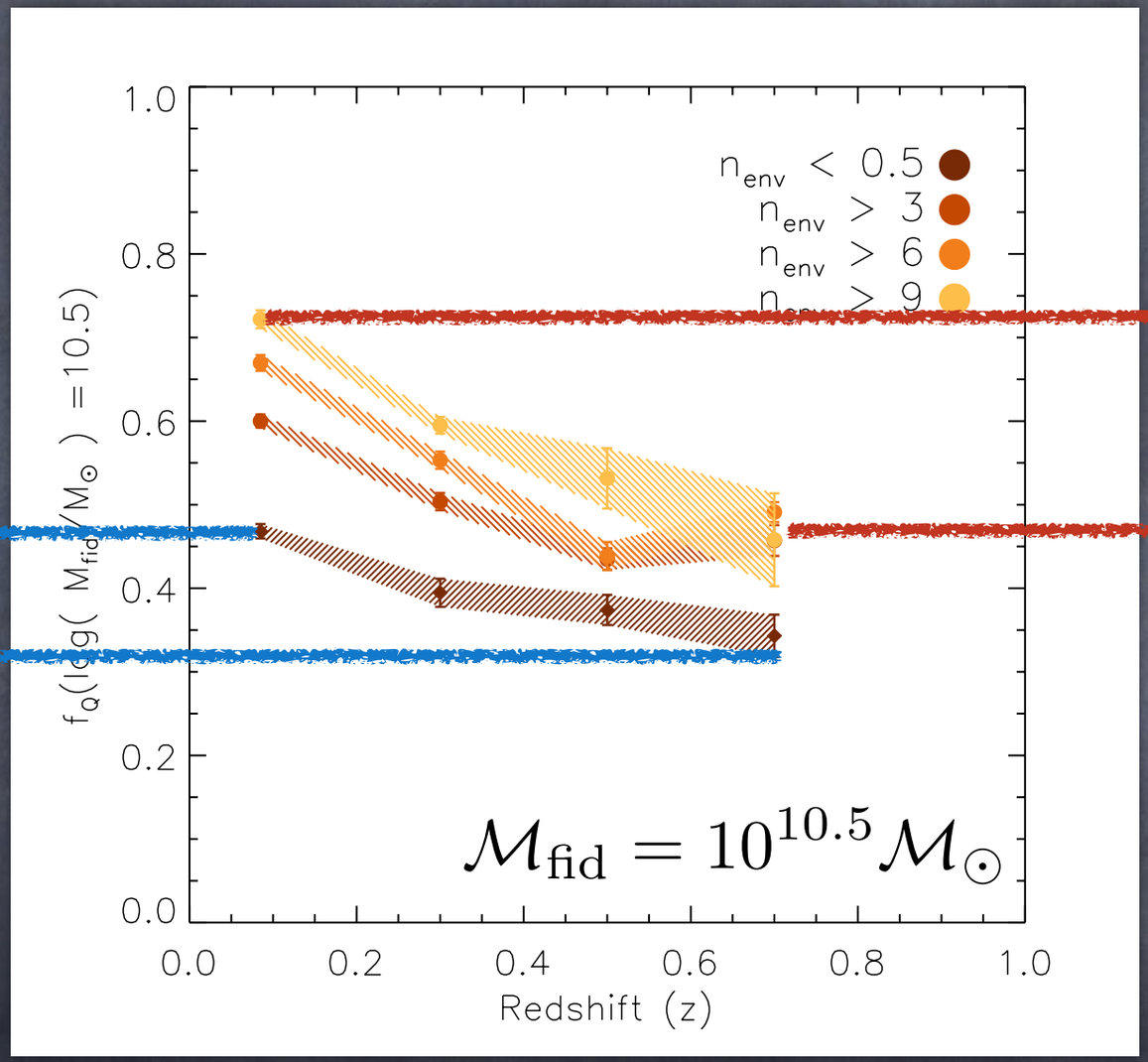


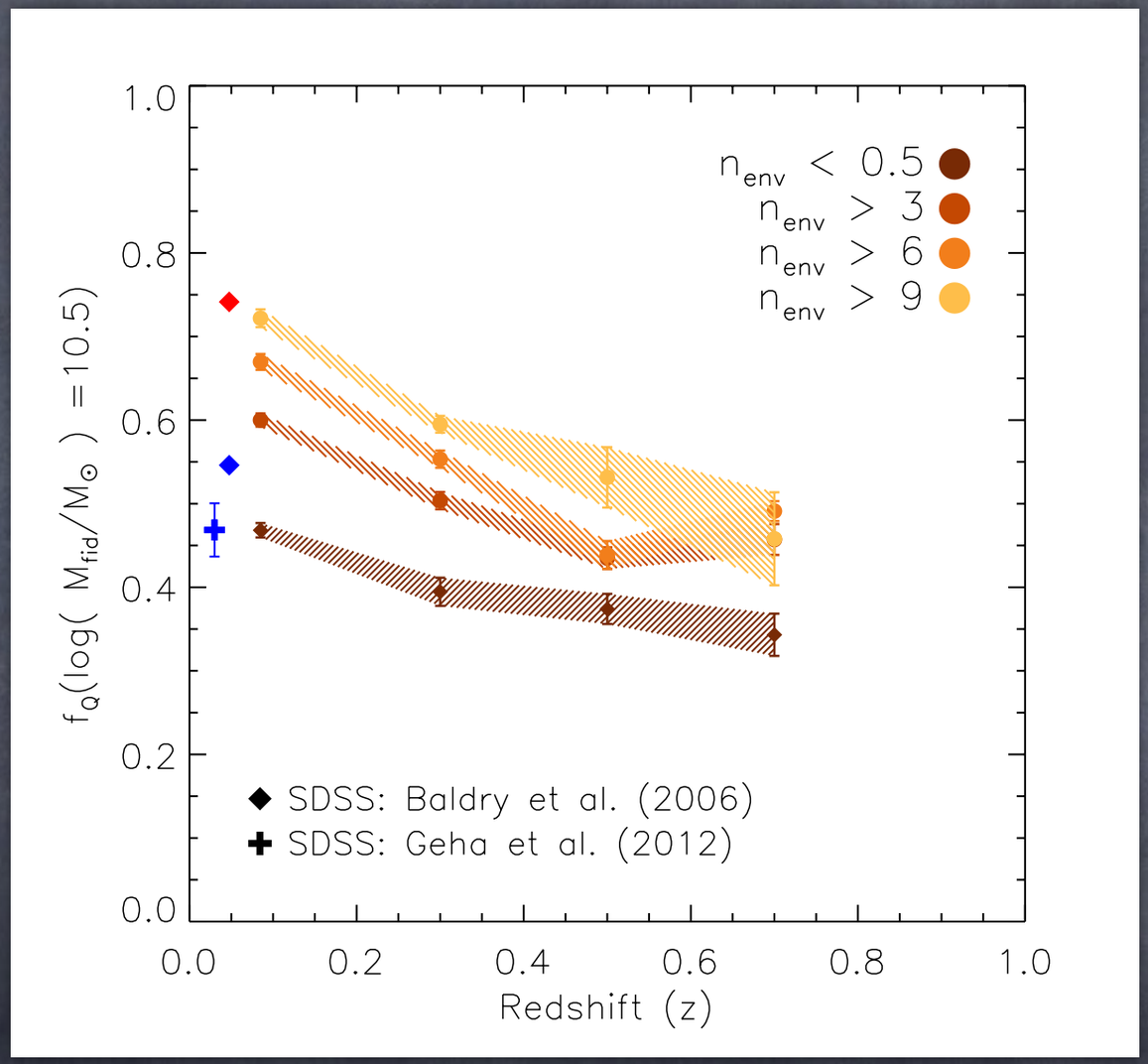
> 0.2

> 0.1

- Purer high environment subsamples reveal moderate environment dependence

Comparison to Literature

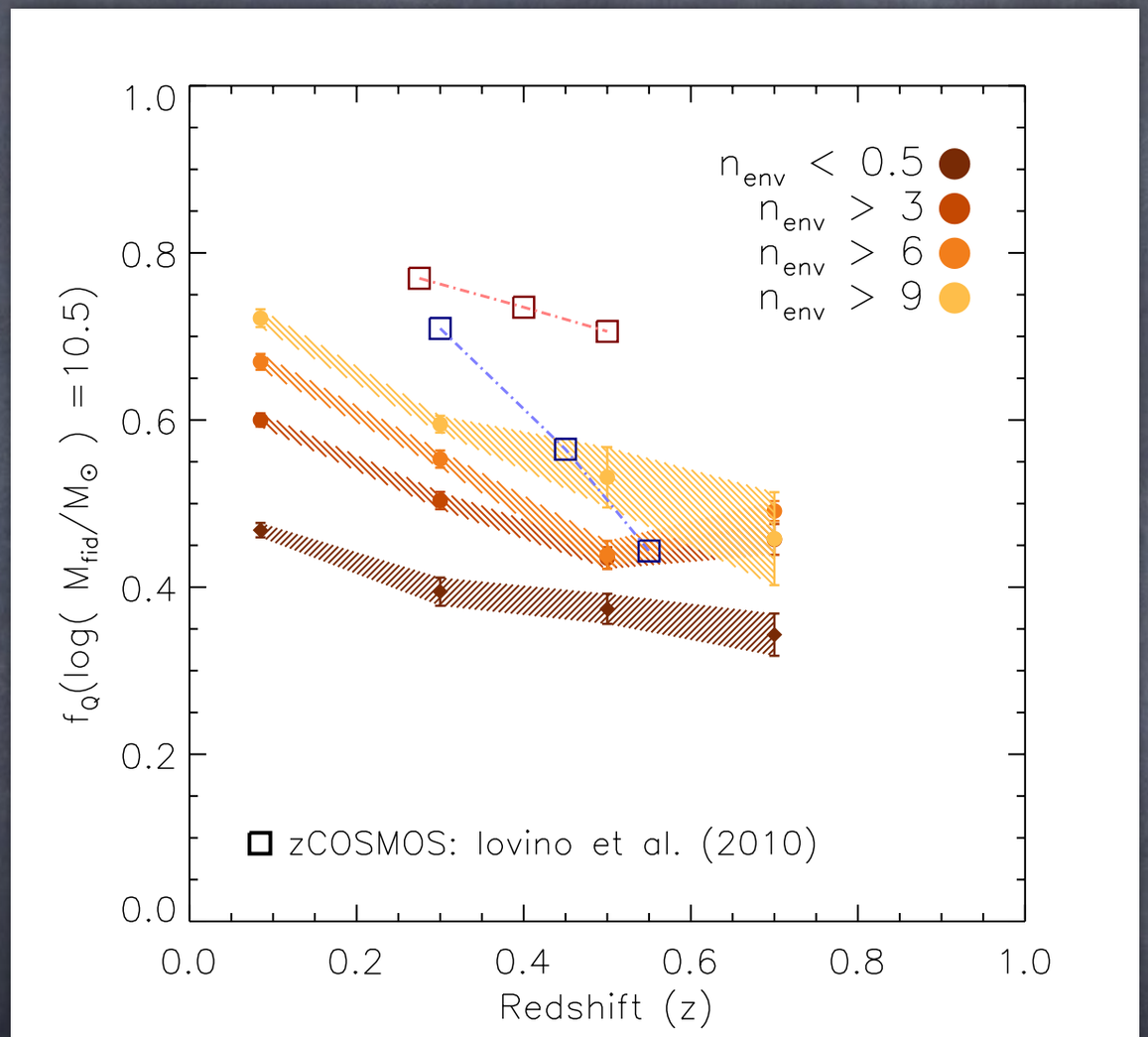
Good agreement with other SDSS results : Baldry et al. (2006), Geha et al. (2012)



Hahn et al. (in prep)

Comparison to Literature

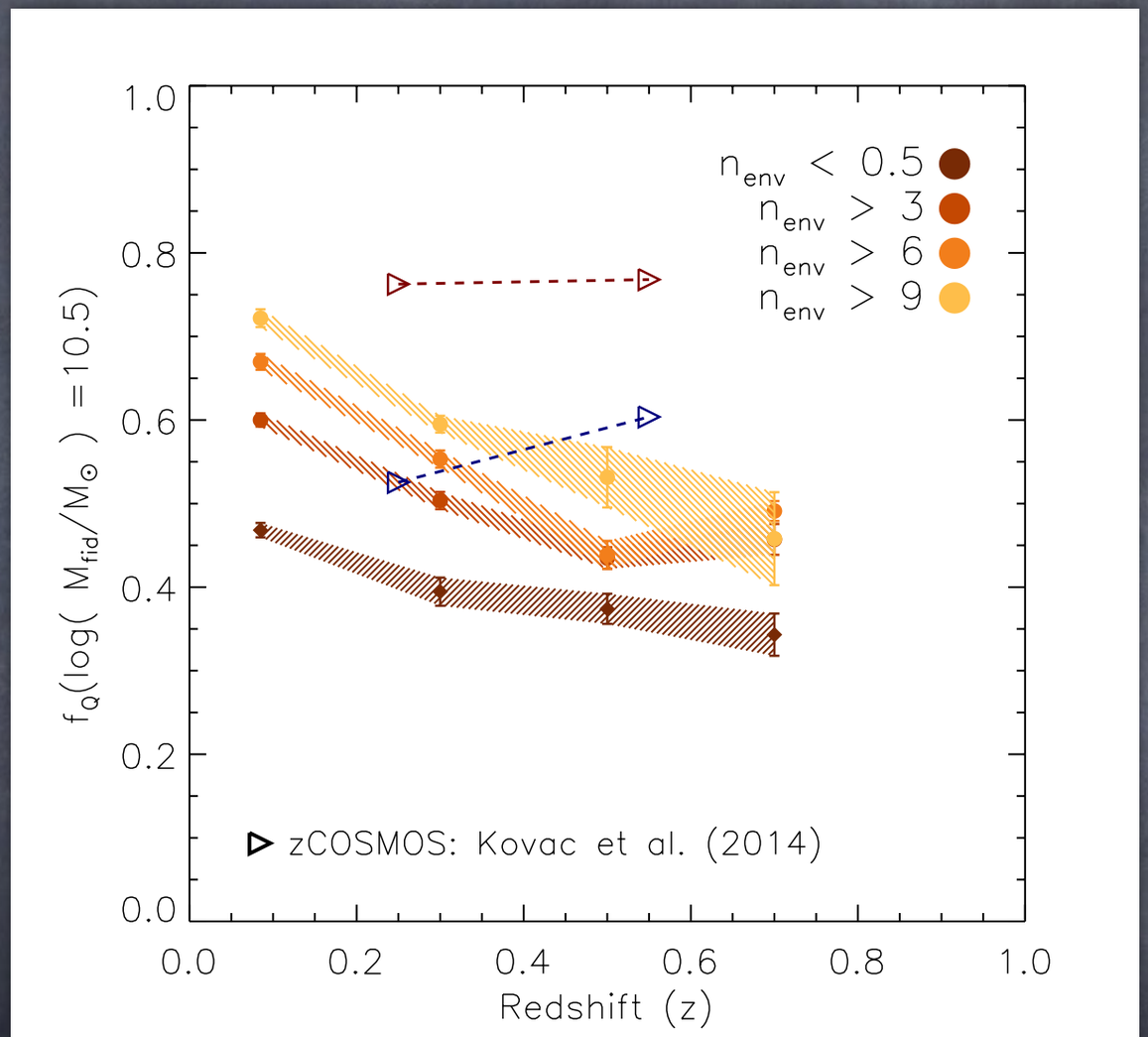
zCOSMOS :
Iovino et al. (2010)



- 617 galaxies in 0.1 < z < 0.6
- zCOSMOS sky coverage : $1.7\ \mathrm{deg}^2$

Comparison to Literature

zCOSMOS :
Kovac et al. (2014)



- 2,340 galaxies in 0.1 < z < 0.4 and 2,448 galaxies in 0.4 < z < 0.7
- zCOSMOS sky coverage : $1.7\ \mathrm{deg}^2$

Comparison to Literature

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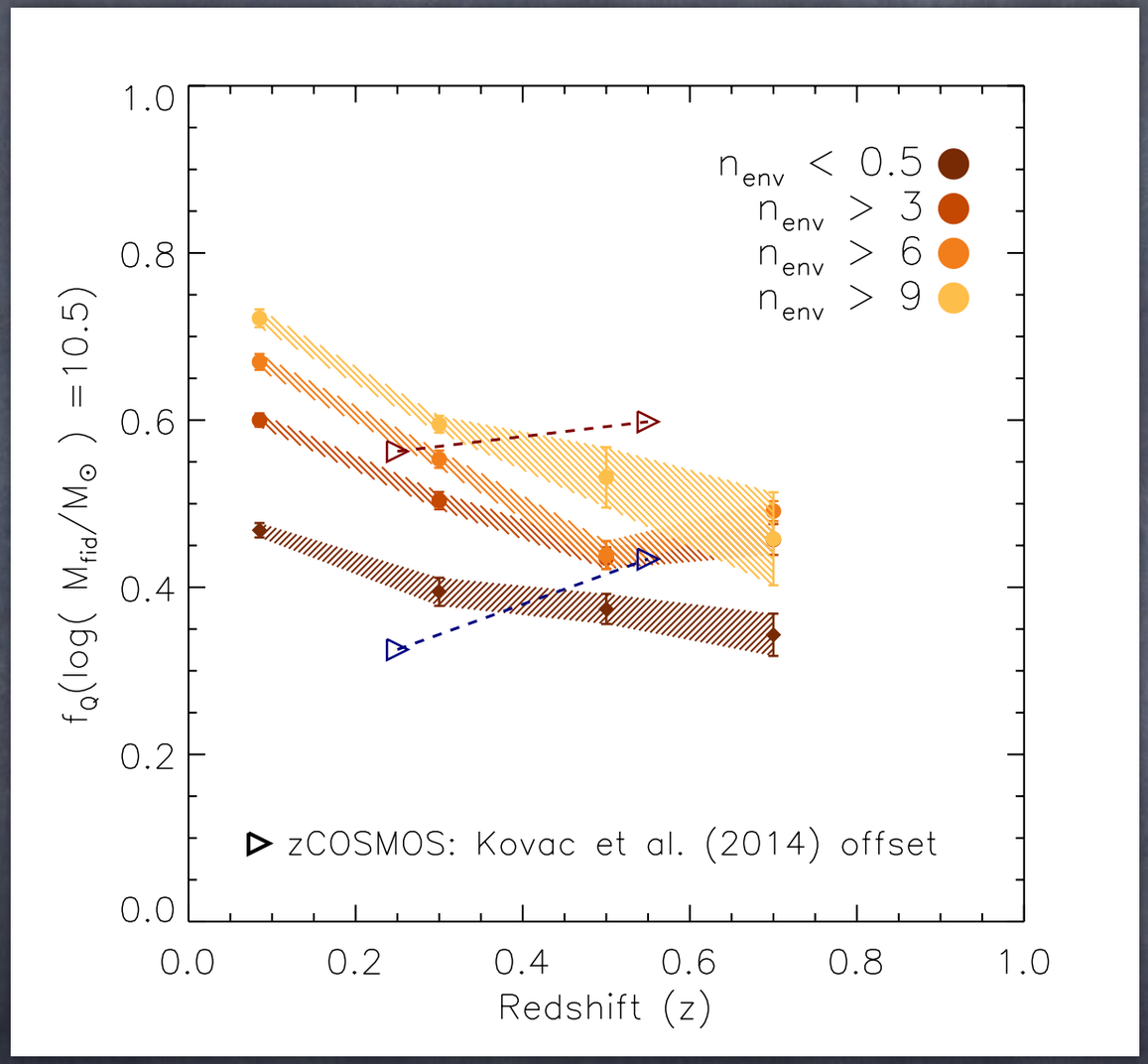

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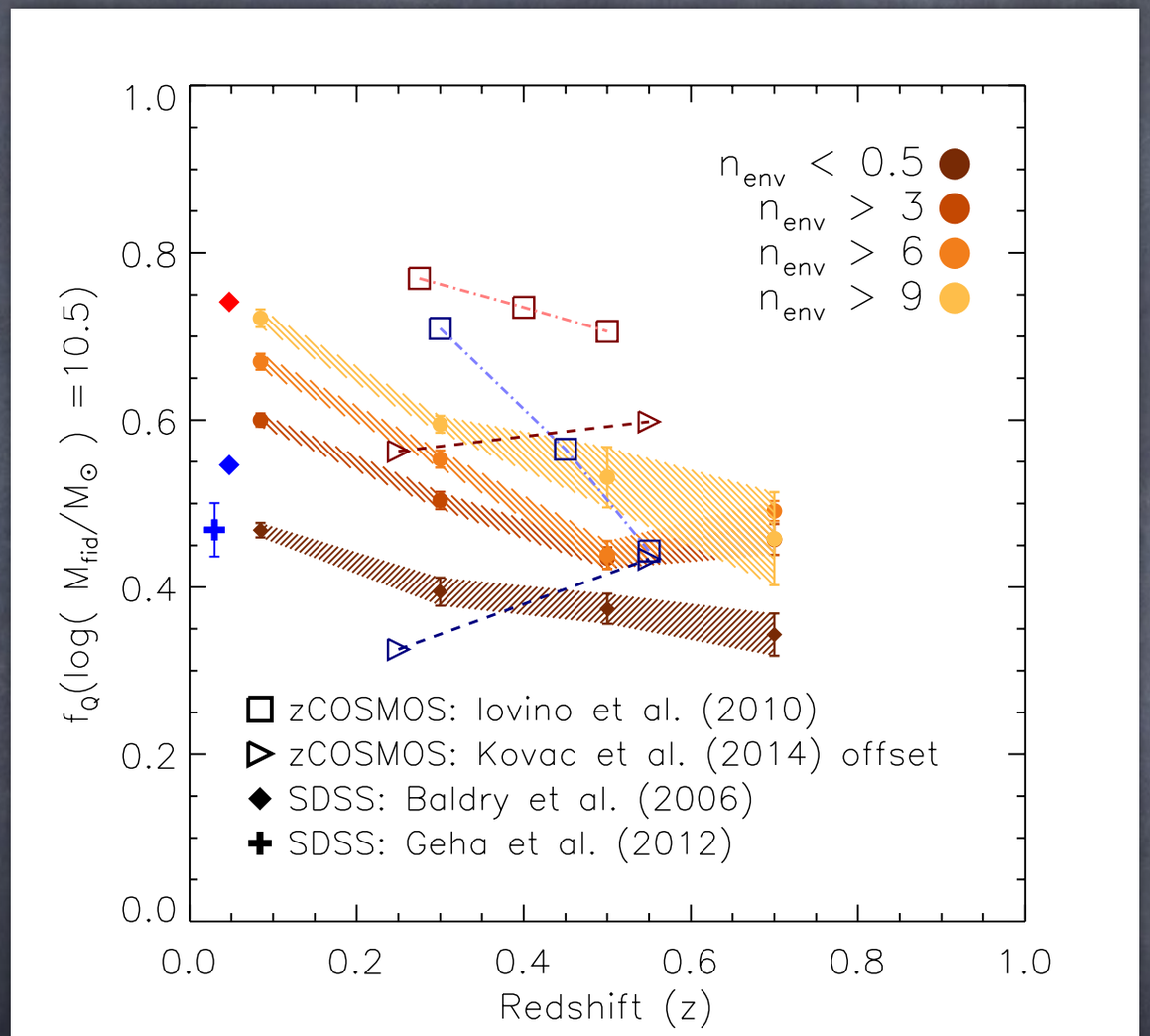

Summary

- Stellar mass complete galaxy sample derived from SDSS and PRIMUS with consistently measured galaxy environment from robust spectroscopic redshifts
- SMF evolution reflect mass-density relation and mass-segregation in different environments for $z < 0.8$
- f_Q consistent with well-known color/morphology mass dependence
- f_Q increases with redshift for both high and low density environments
- $f_{Q,\,high} > f_{Q,\,low}$ throughout $z < 0.8$
- f_Q in high density environment has evolved by a greater amount than f_Q in low density environment