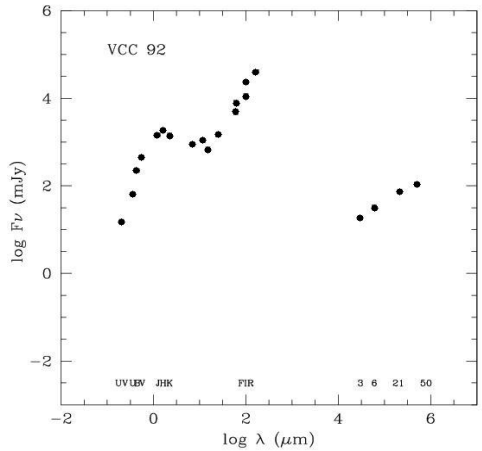
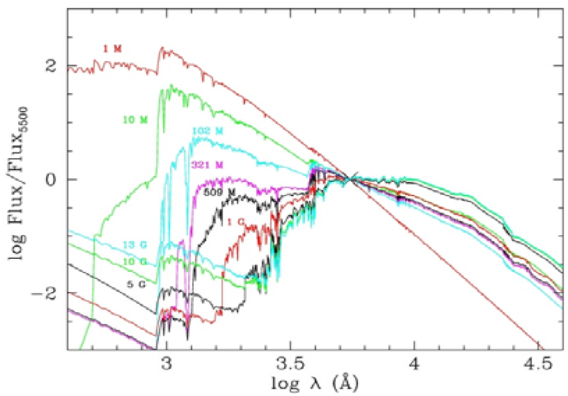
SPECTRO-PHOTOMETRIC ANALYSIS OF VVDS GALAXIES IN THE REDSHIFT RANGE $0 < Z < 1.5$

$SED_{observed}$



$SED_{simulated}(T, \tau, Z)$

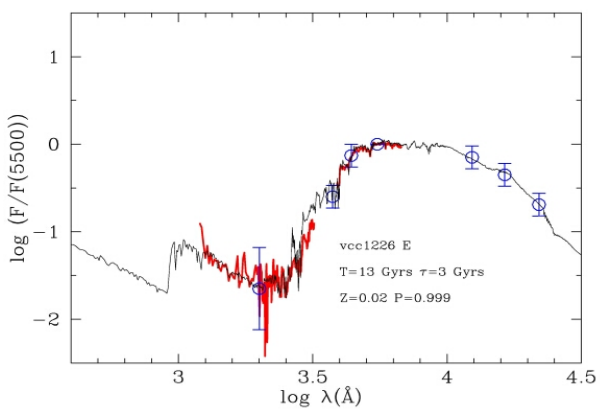


F
I
T

T

τ

Z



The sample

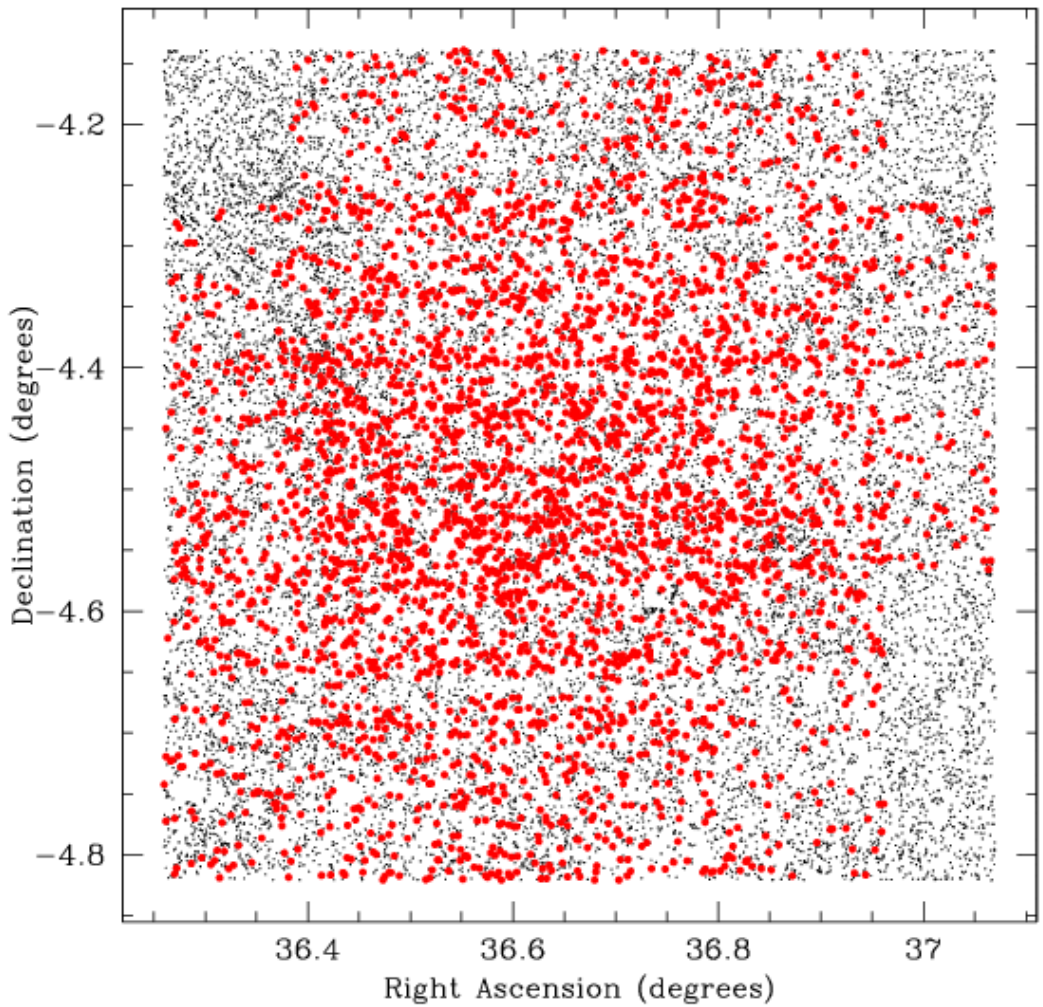
- High continuum intensity
- High signal to noise
- Low photometric errors on magnitudes

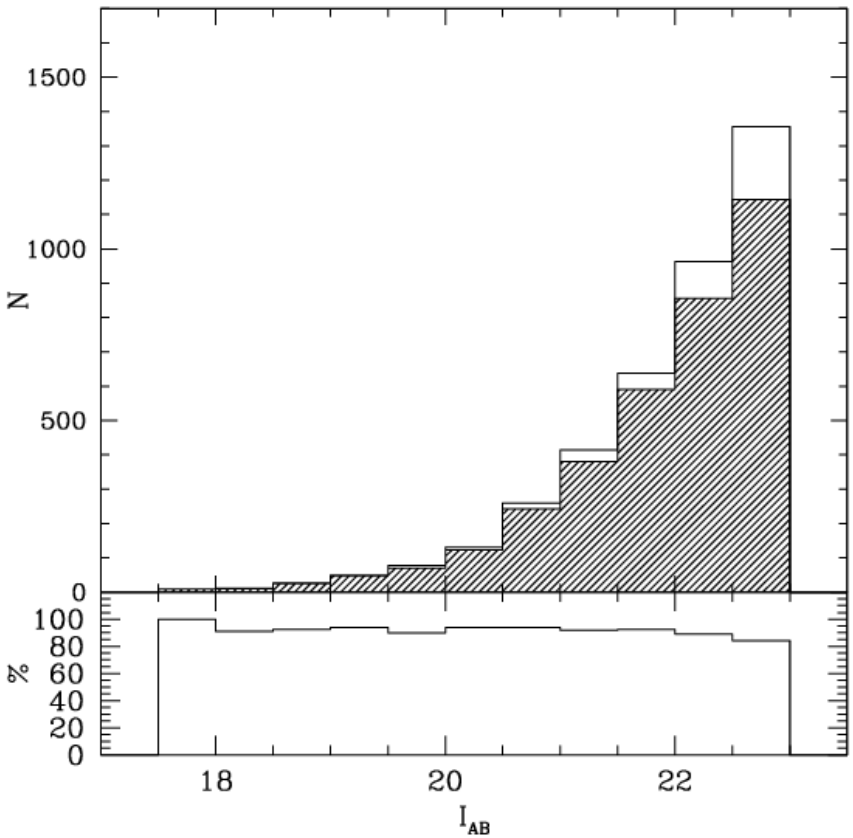
$0<z<1.5$

$I_{AB} < 23$

No Flag 1 objects

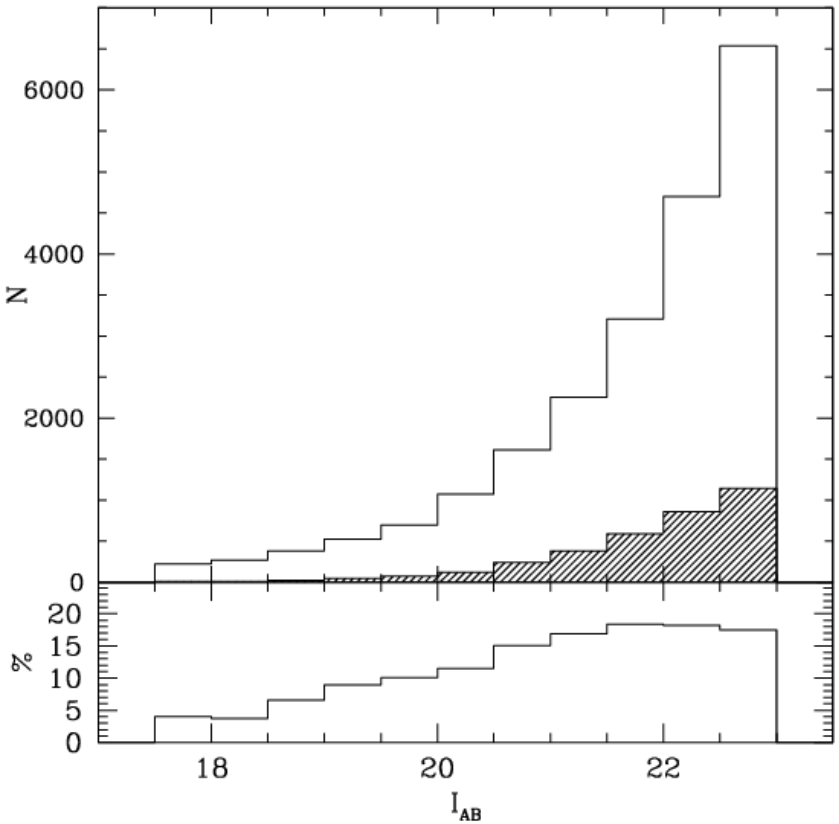
3498 galaxies





With respect to the whole spectroscopic sample

completeness 88.9 %



With respect to the whole photometric sample

completeness 16.3 %

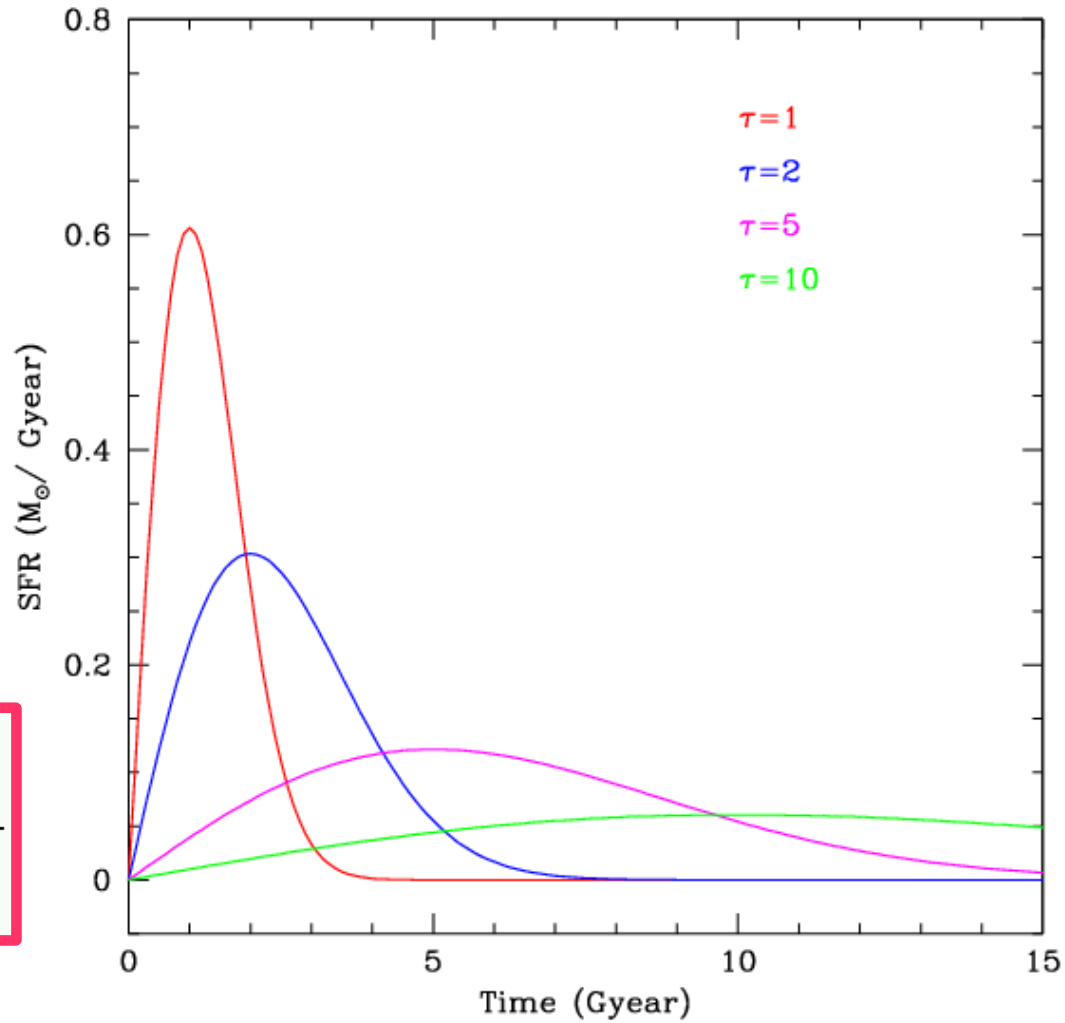
The method

The “Sandage” star formation history

Sandage A&A 161, 89 (1986)

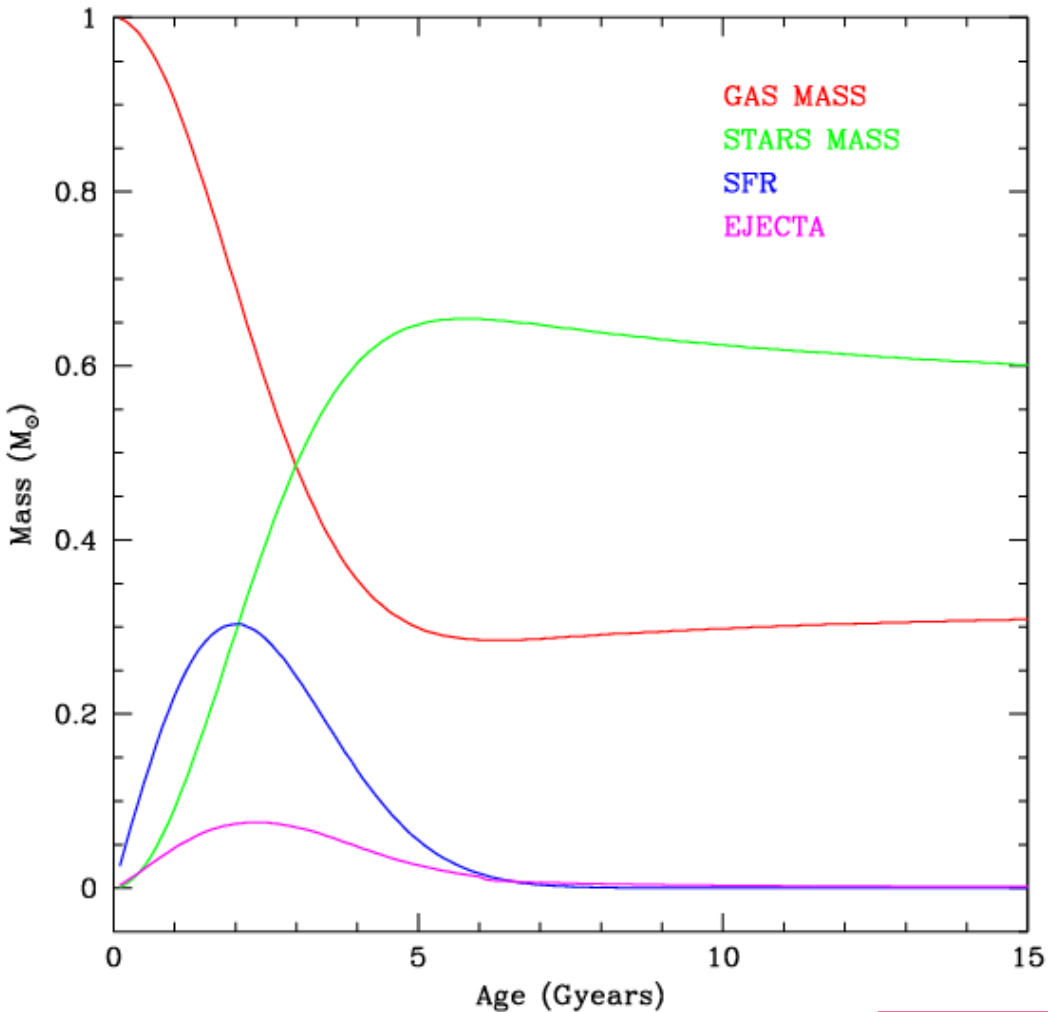
Gavazzi et al. ApJ 576,135 (2002)

$$SFR_{san}(t,\tau) = \frac{t}{\tau^2} \cdot \exp - \frac{t^2}{2 \cdot \tau^2}$$



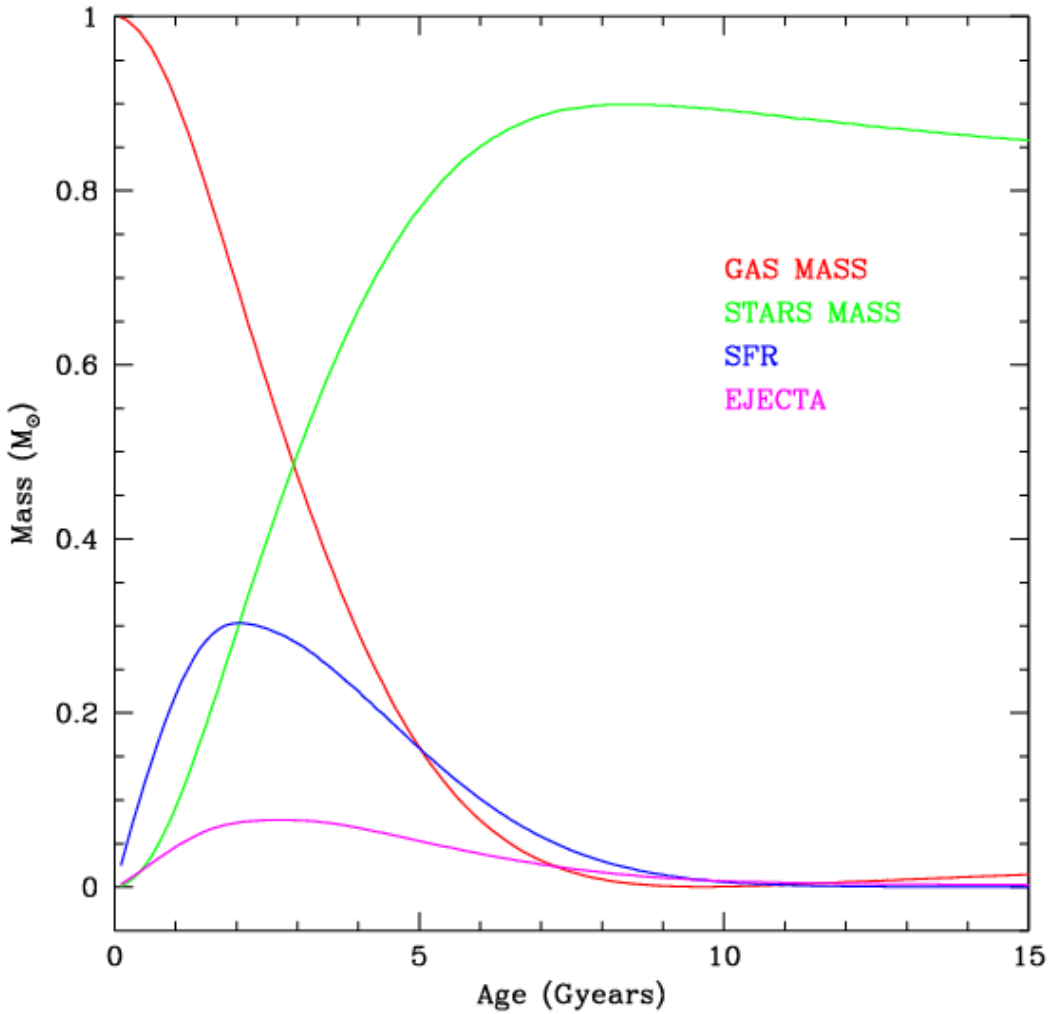
The residual gas problem

These SFHs are not able to reproduce all observed galaxies



$$SFR_{san}(t,\tau) = \frac{t}{\tau^2} \cdot \exp -\frac{t^2}{2 \cdot \tau^2}$$

The “Modified Sandage” star formation history



$$SFR_{modsan}(t,\tau) = N \cdot \frac{t + C(\tau)}{[\tau + C(\tau)]^2} \cdot \exp - \frac{[t + C(\tau)]^2}{2 \cdot [\tau + C(\tau)]^2}$$

The age approaches

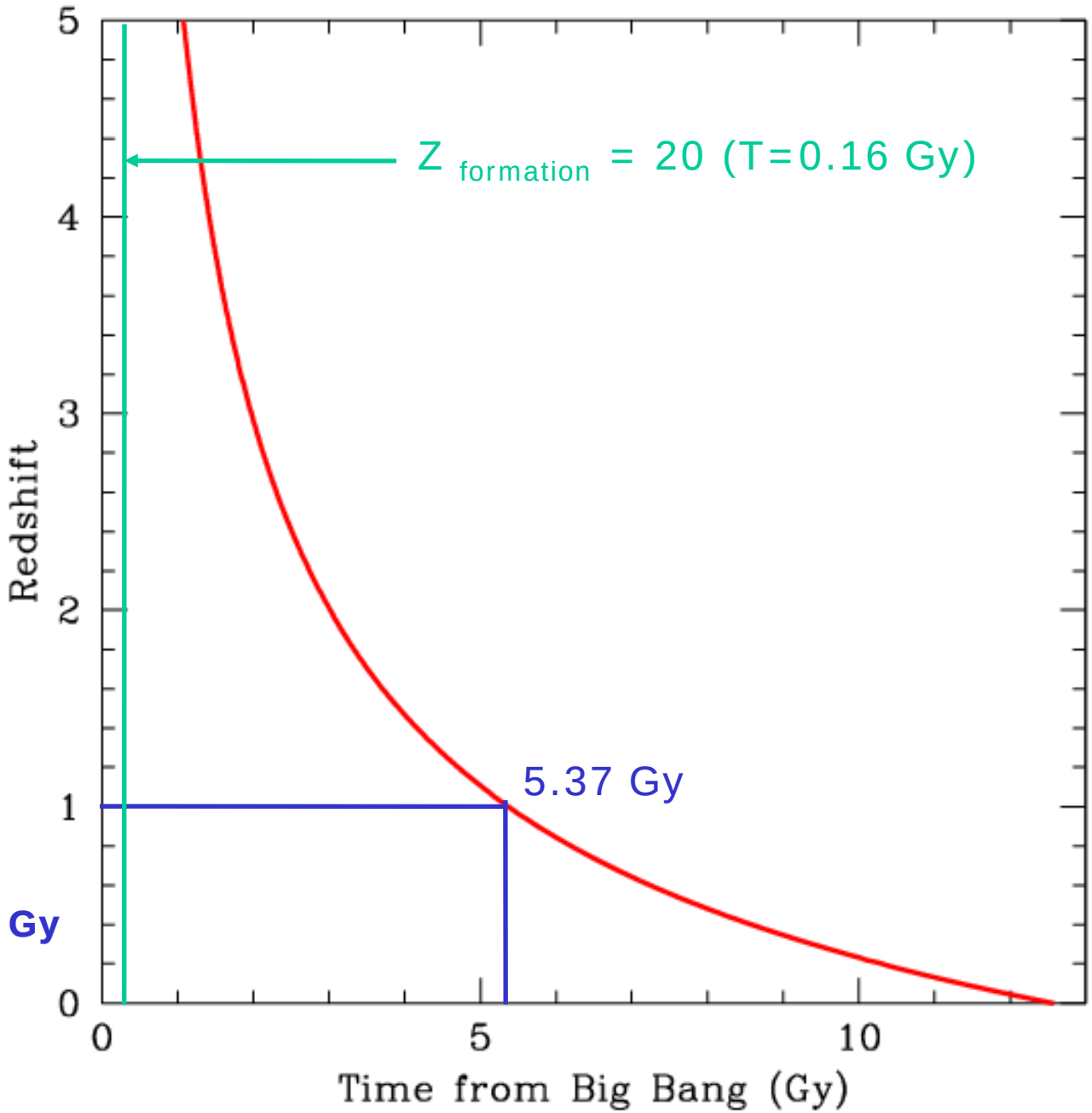
Galaxy observed at Z=1

1- “Best fit” approach

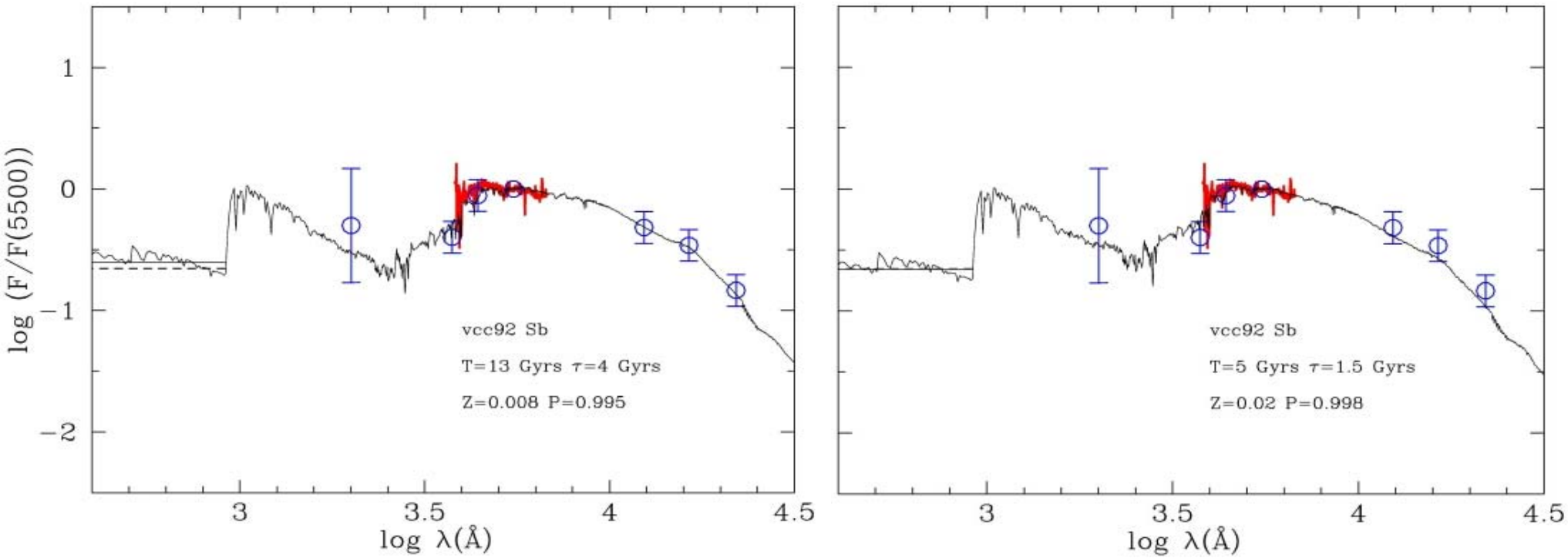
All ages up to 5.37 Gy

2- “Fixed Age” approach

Age = 5.37 – 0.16 = 5.21 Gy



Age / τ degeneracy



Age = 13 Gy
τ = 4 Gy

→ Age / τ = 3.3 ←

Age = 5 Gy
τ = 1.5 Gy

VCC 0092

The models framework

- Synthethic models code

PEGASE models

metallicity evolution

internal extinction computation

37500 models

- Star formation history

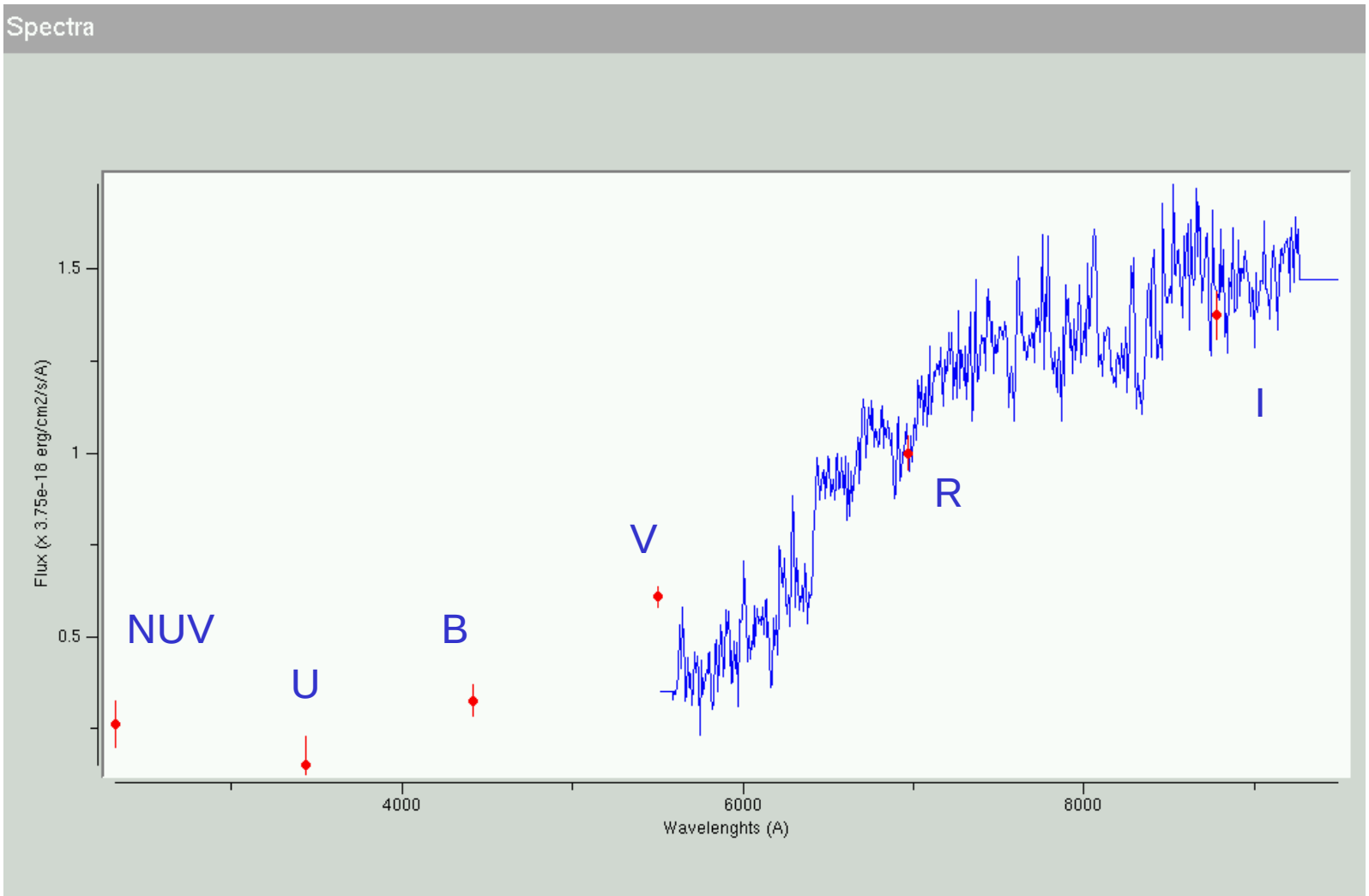
Sandage

- Age approach

“Fixed age”

Degeneracy problem

Spectrum-photometry normalization in the R band



FOR EACH MODEL OF THE GRID

$$F_{obs} = L_{model} \cdot L_{\odot} \; / \; [4\pi \cdot D_L^2 \cdot (1+z)]$$

Observed flux of a model (galaxy) of 1 solar mass
at redshift z

$$\frac{\text{“Real” galaxy flux (in R band)}}{F_{obs} \quad \text{(in R band)}} = \text{Normalization factor}$$

FOR EACH MODEL OF THE GRID

Reduced χ^2 computation

$$\overline{\chi}^2 = \frac{1}{d}\sum_{i=1}^{N}\left(\frac{F_{i,obs} - F_{i,sim}}{\sigma_i}\right)^2$$

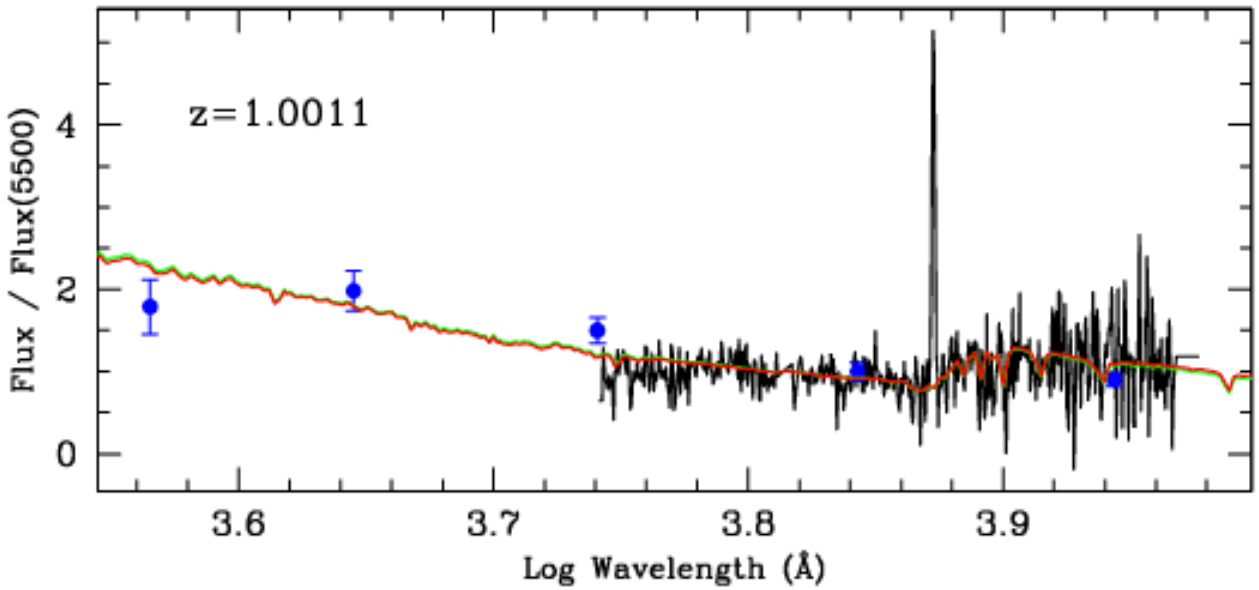
Best χ^2 model

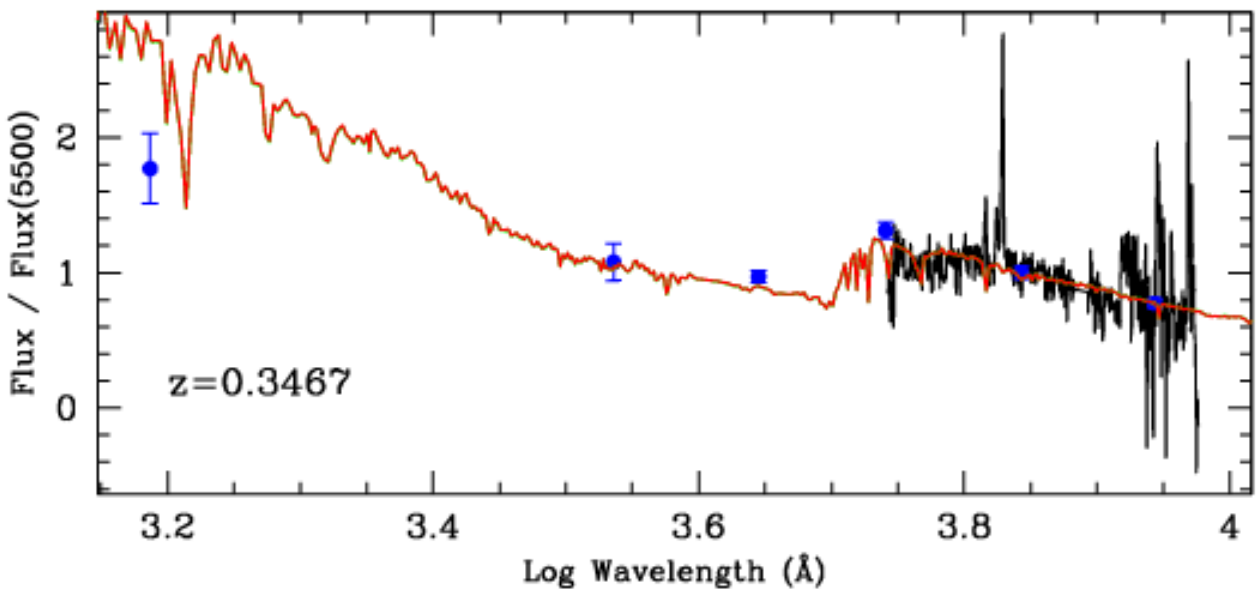
- Model parameters = Galaxy parameters

- Model × Normalization factor = SED ⇒ Absolute rest frame magnitude
  Absolute rest frame colors

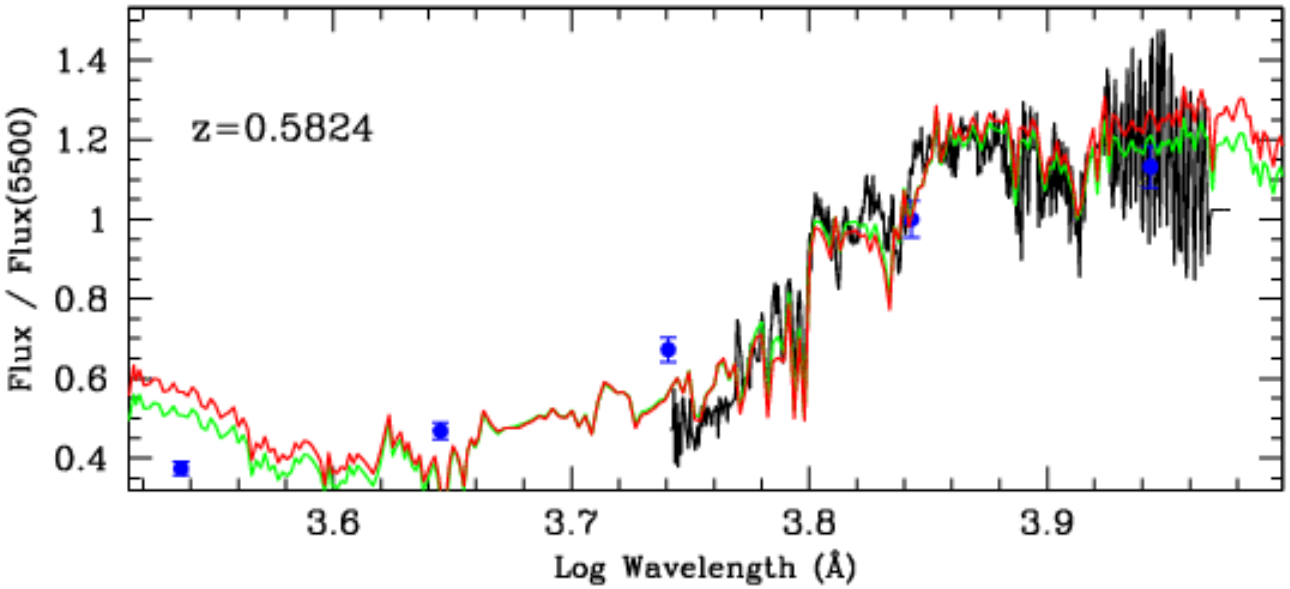
- Model stellar mass × Normalization factor = Galaxy stellar mass

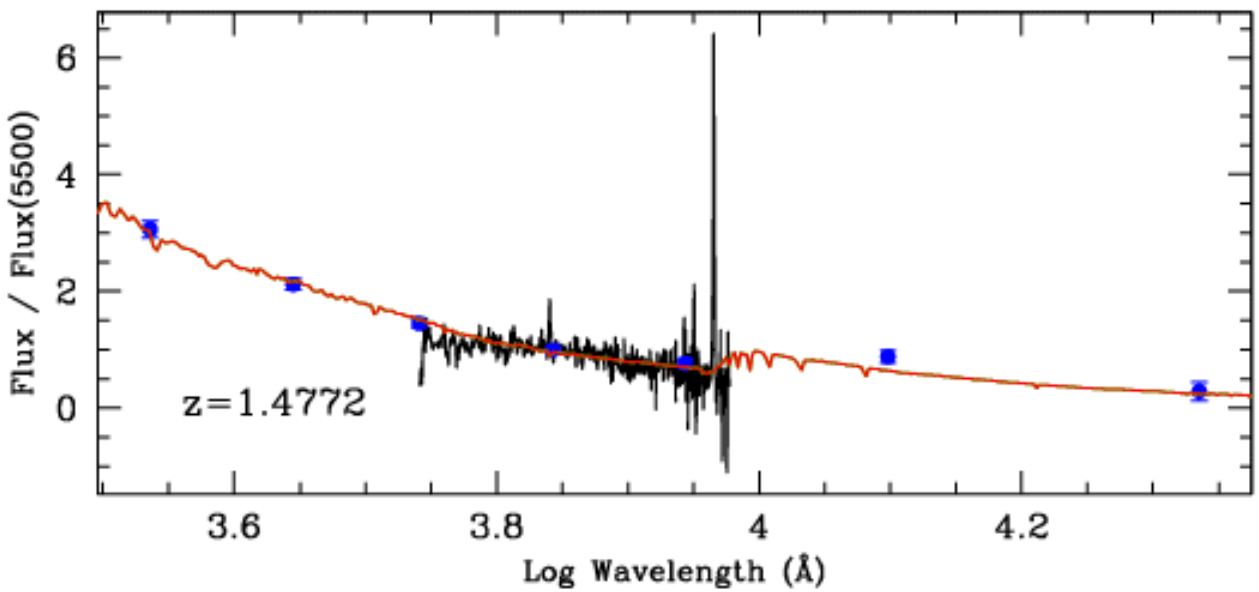
Best fit
Fixed age



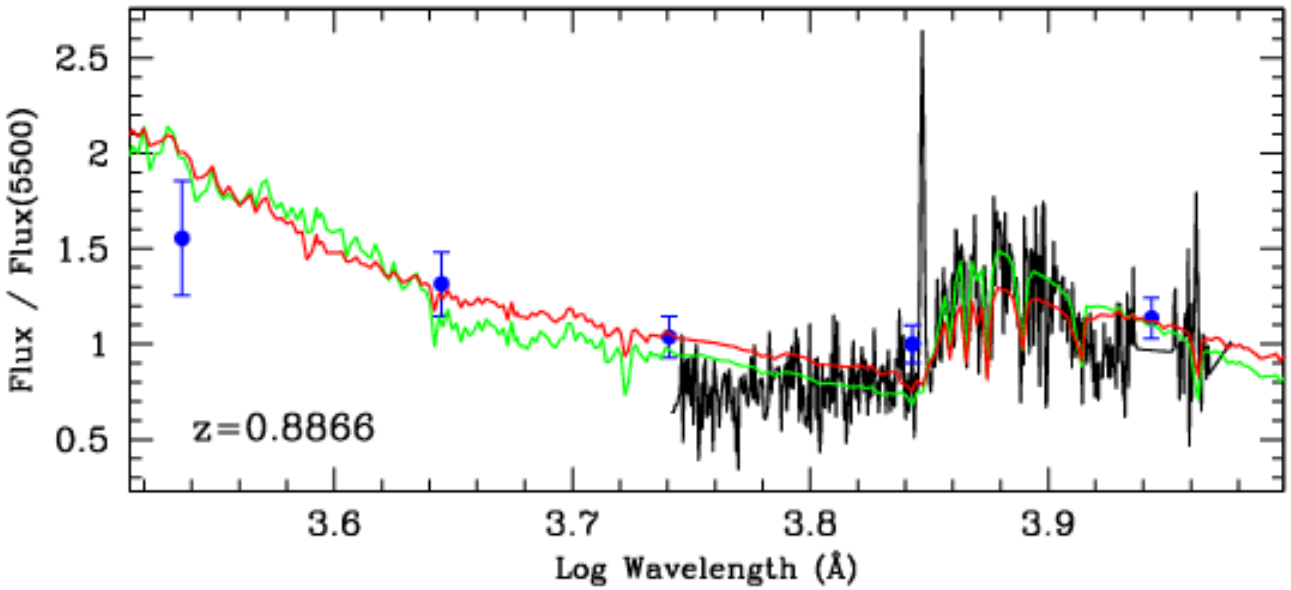


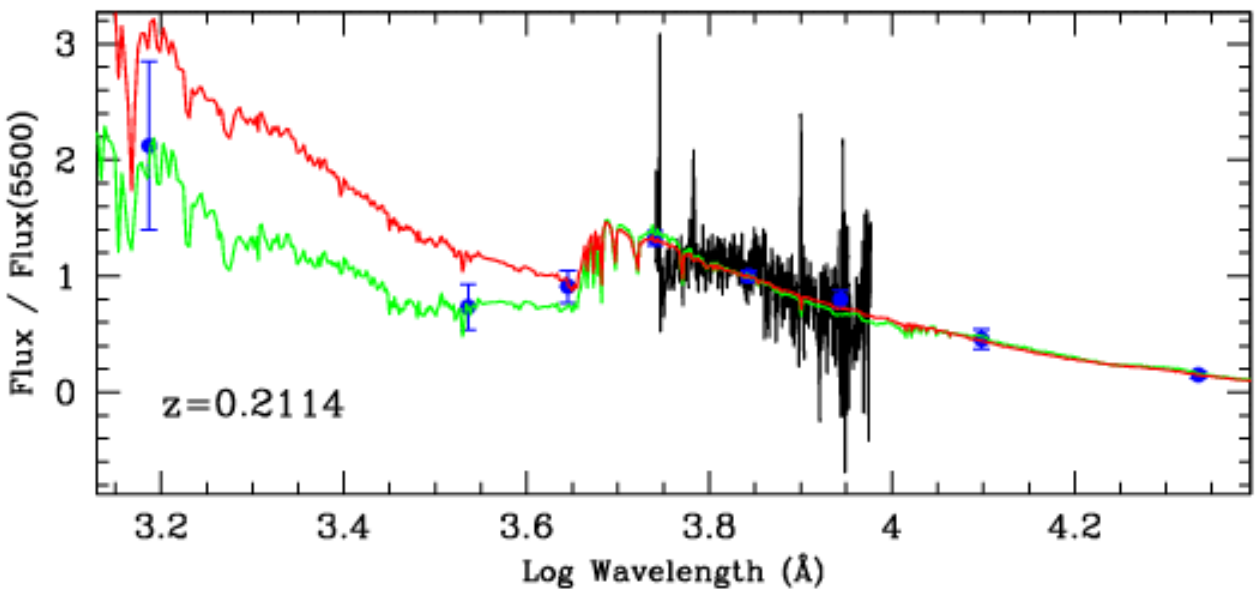
Best fit
Fixed age





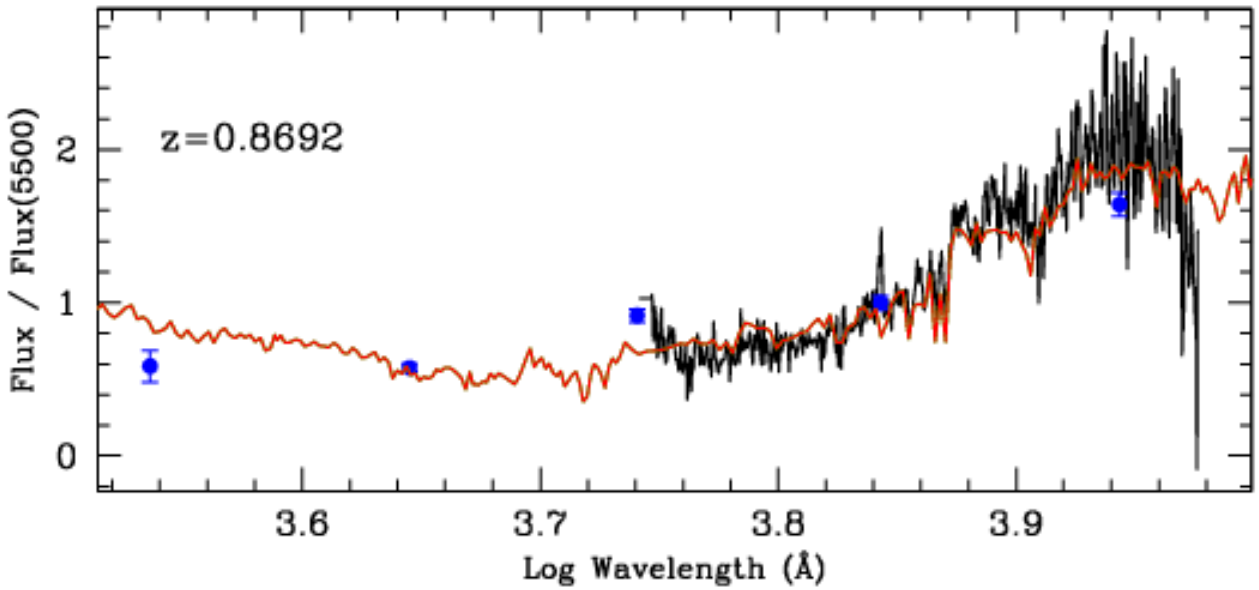
Best fit
Fixed age

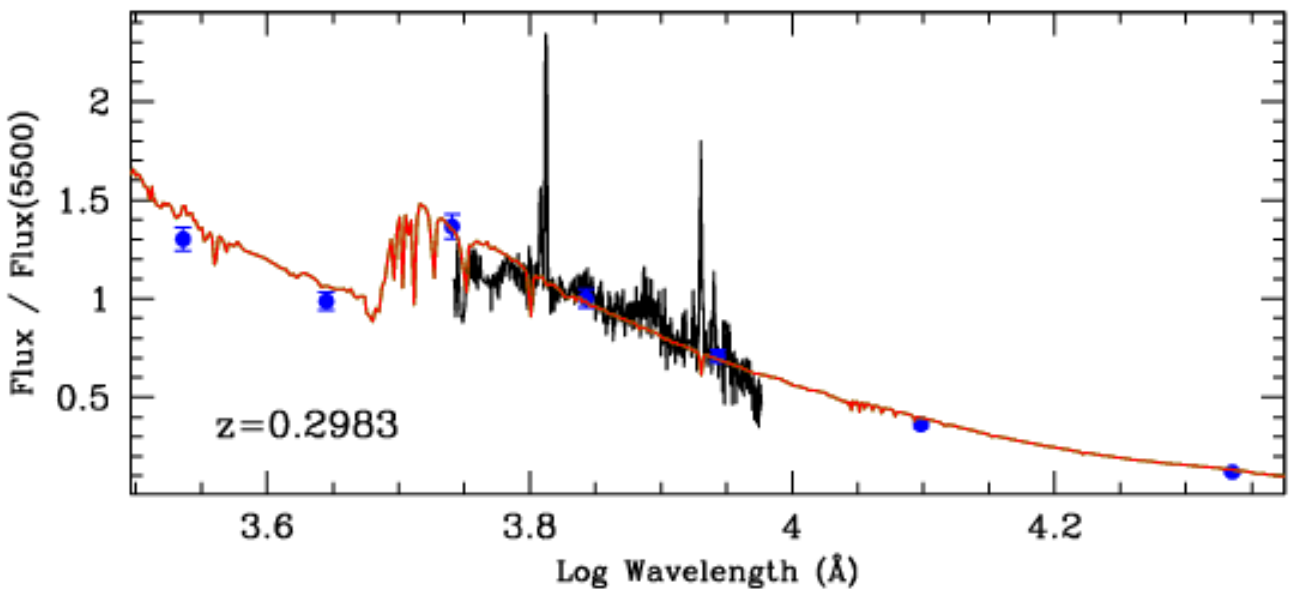




Best fit

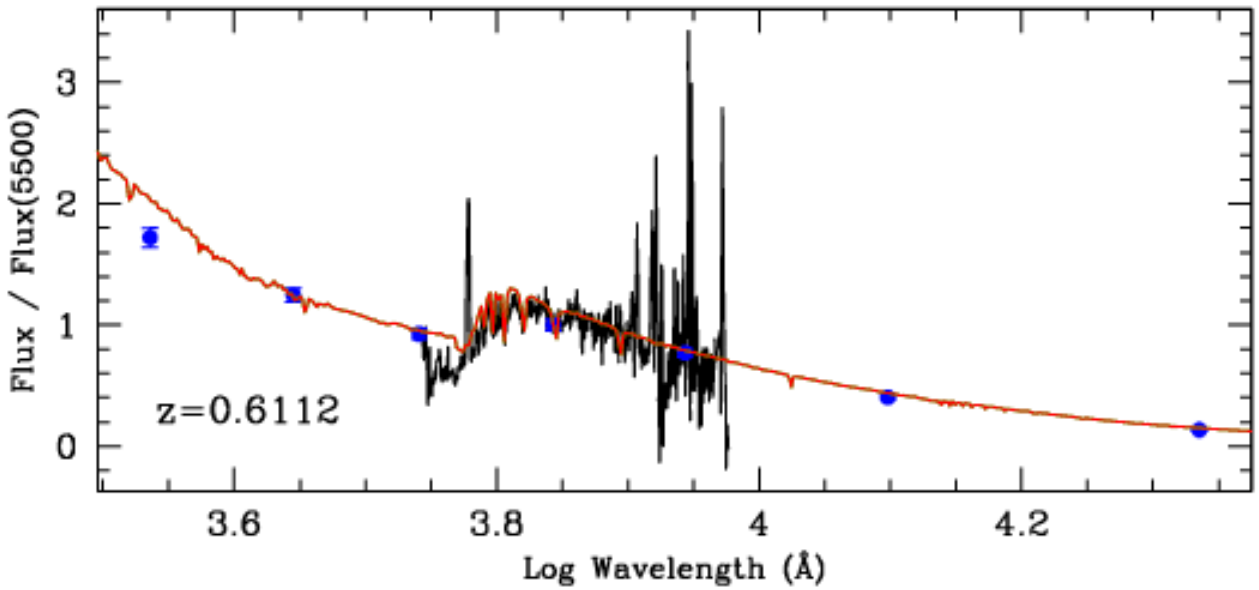
Fixed age

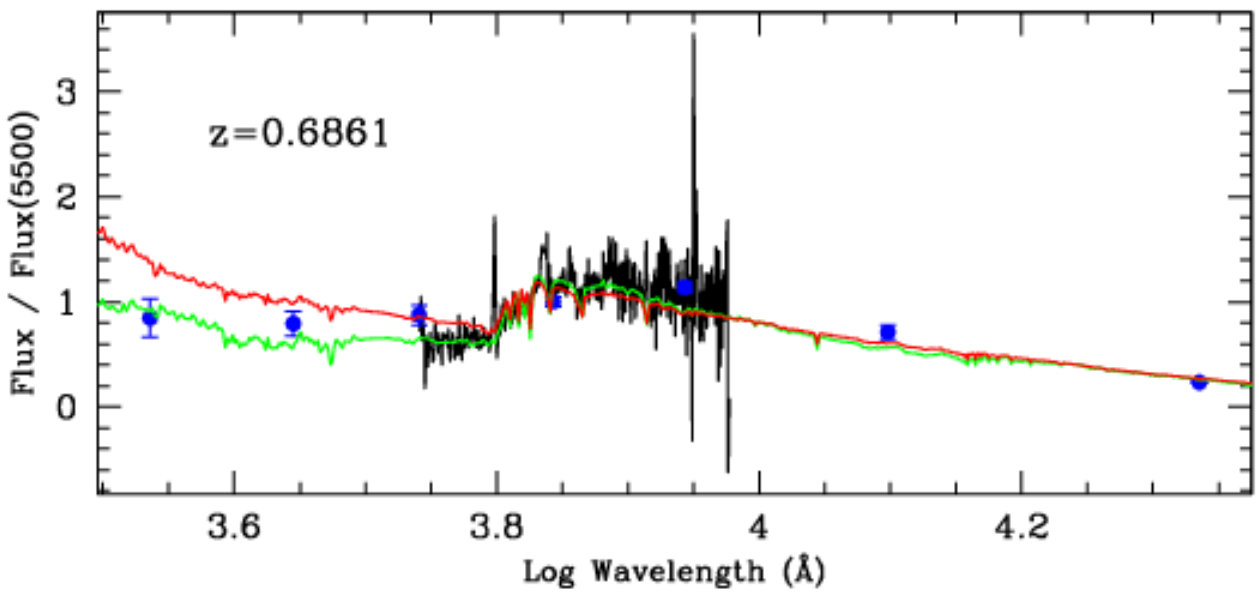




Best fit

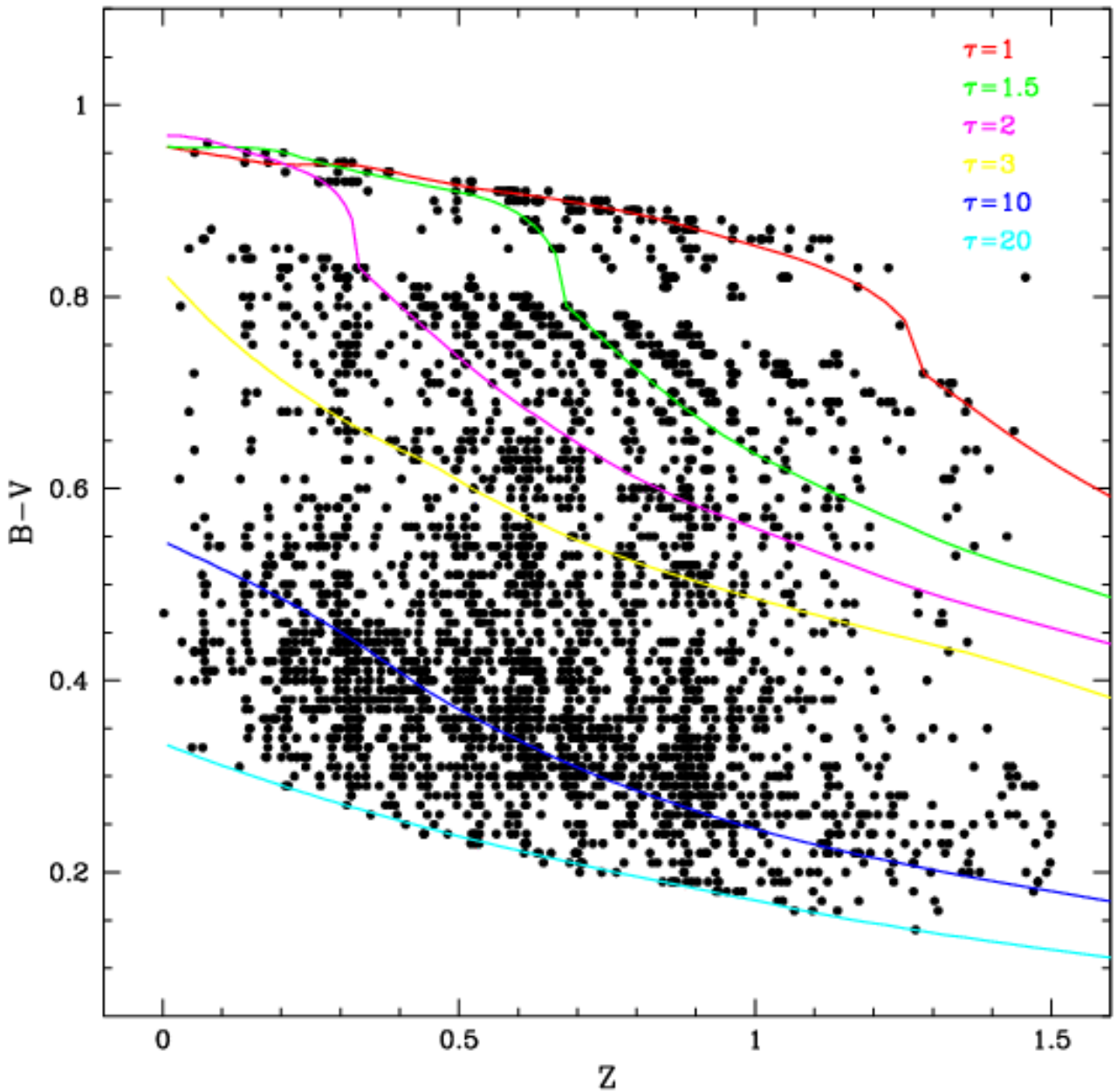
Fixed age





Results

Rest frame colors vs redshift



Rest frame colors bimodality

Local Universe:

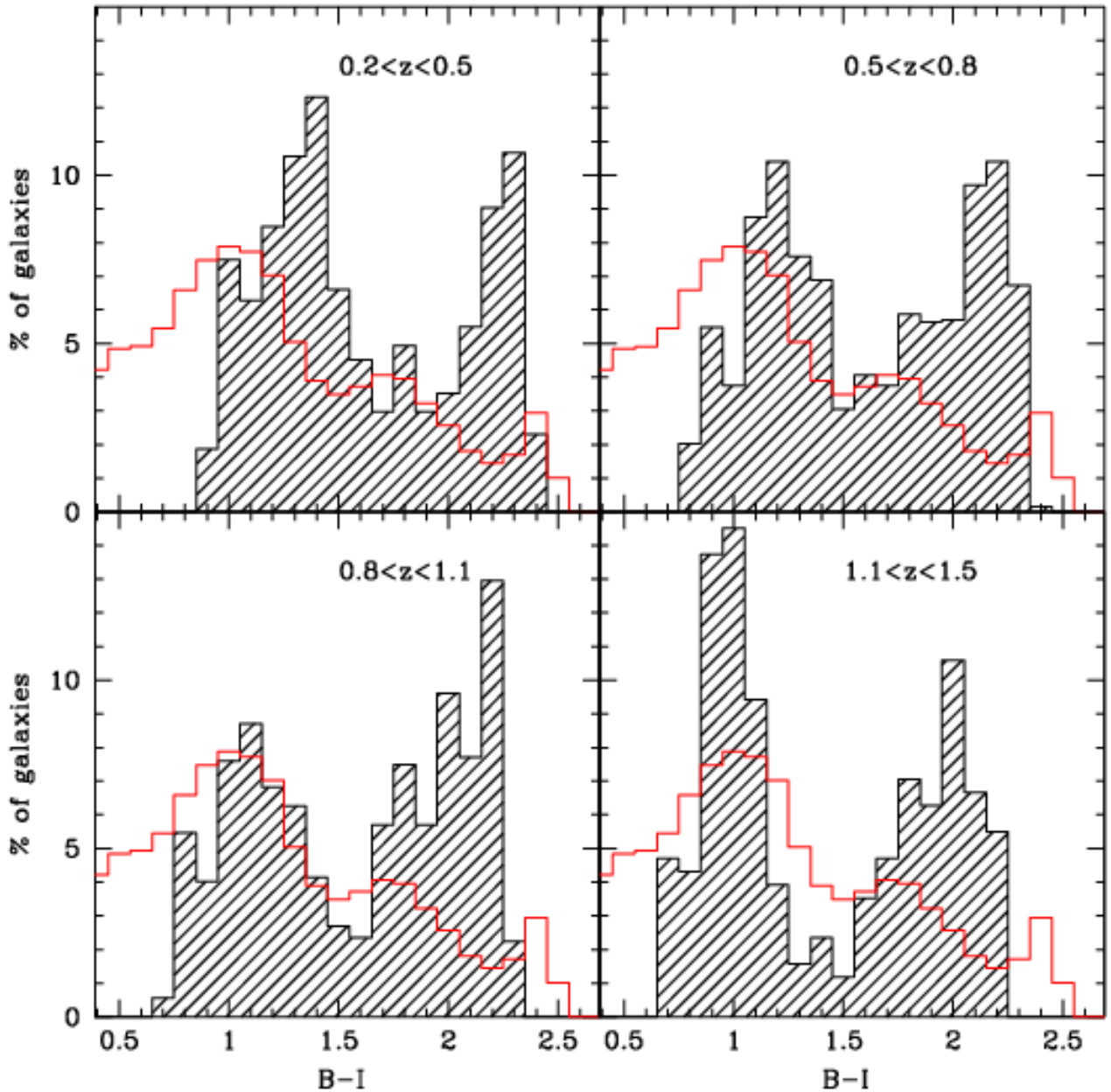
SDSS Strateva et al.
AJ 122, 1861 (2001)

2dF Madgwick et al.
MNRAS 333, 133 (2002)

Up to z~1:

COMBO-17 Wolf et al.
A&A 421, 913 (2004)

DEEP Weiner et al.
astroph-0411128 (2004)

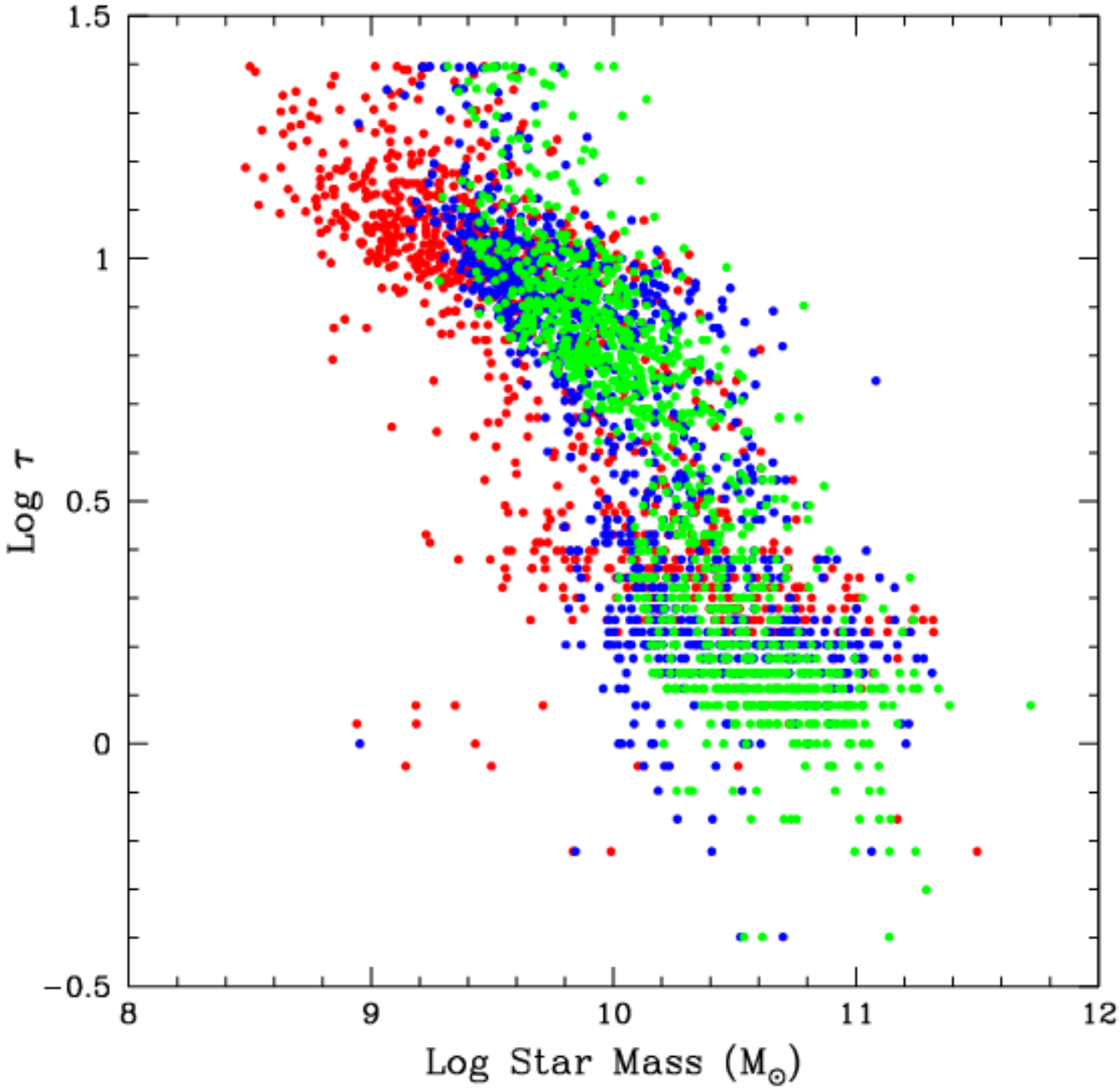


τ - stellar mass

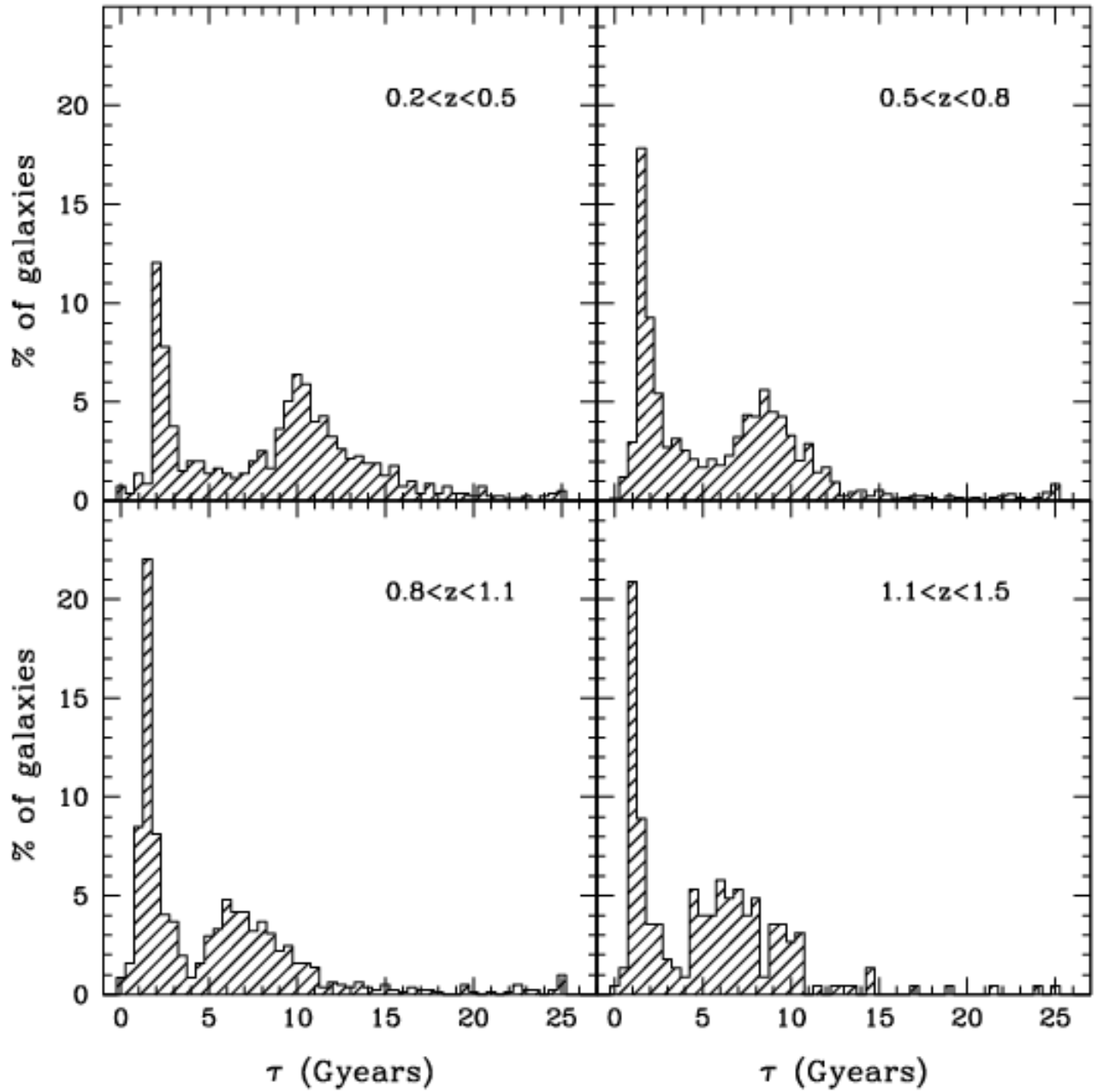
0.2-0.55

0.55-0.8

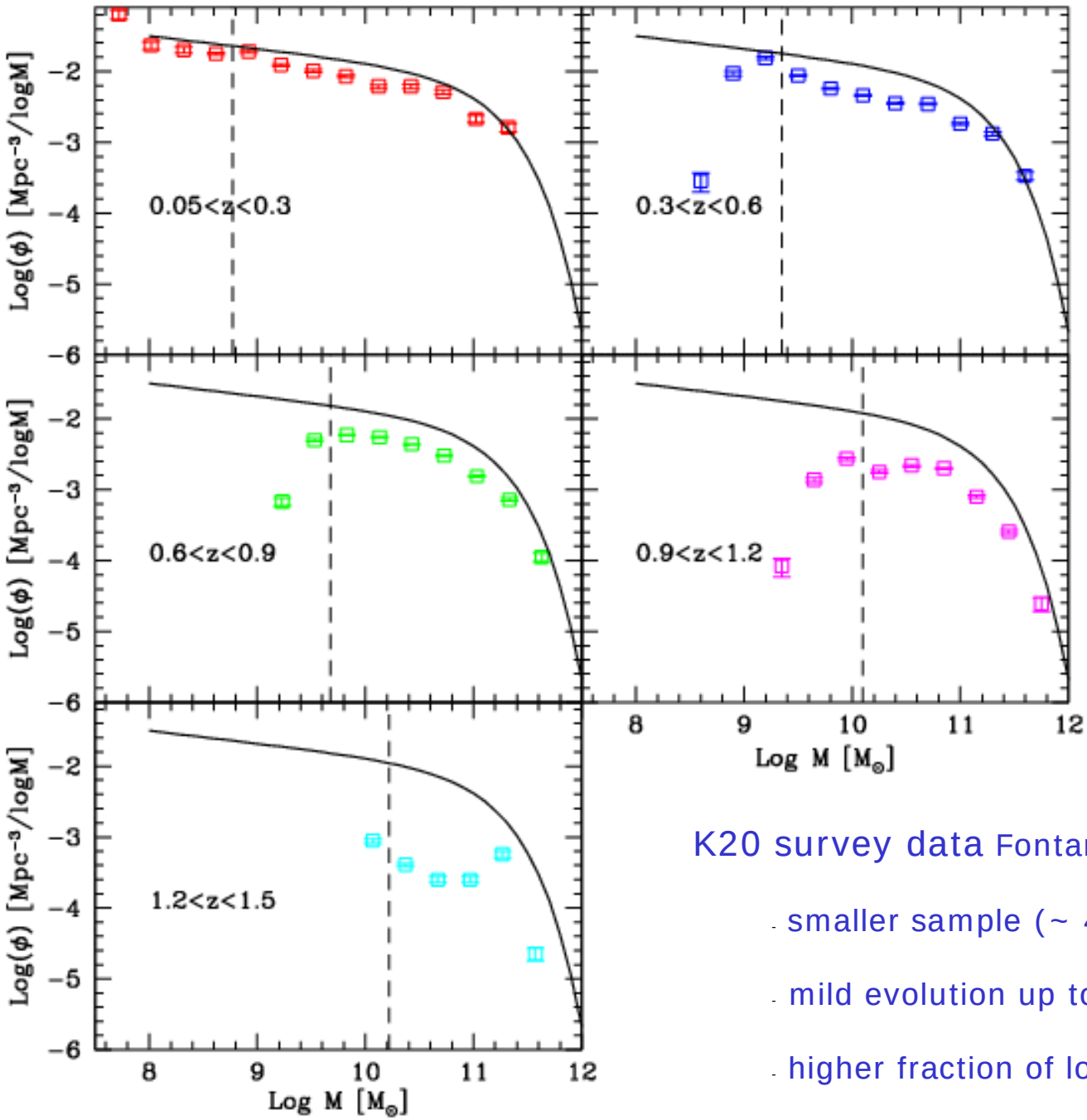
0.8-1.5



SFH bimodality



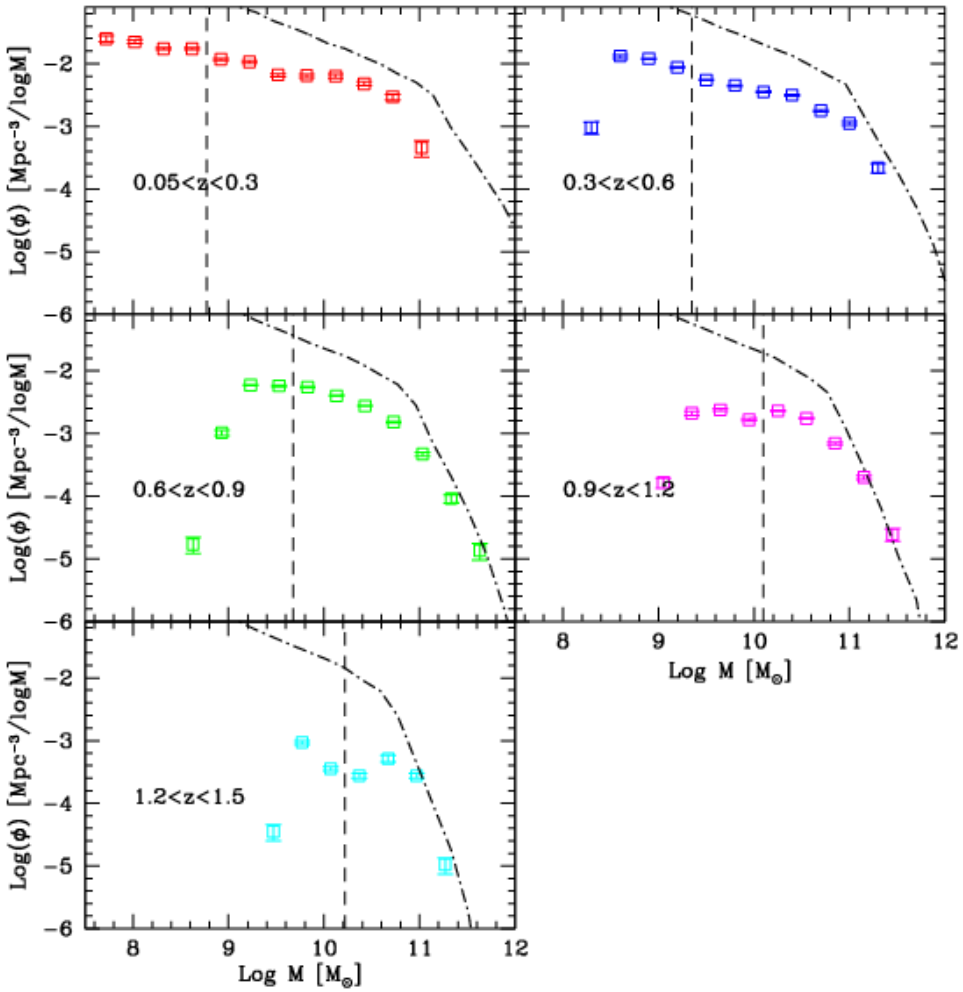
Galaxy stellar mass function



K20 survey data Fontana et al. A&A 424, 23 (2004)

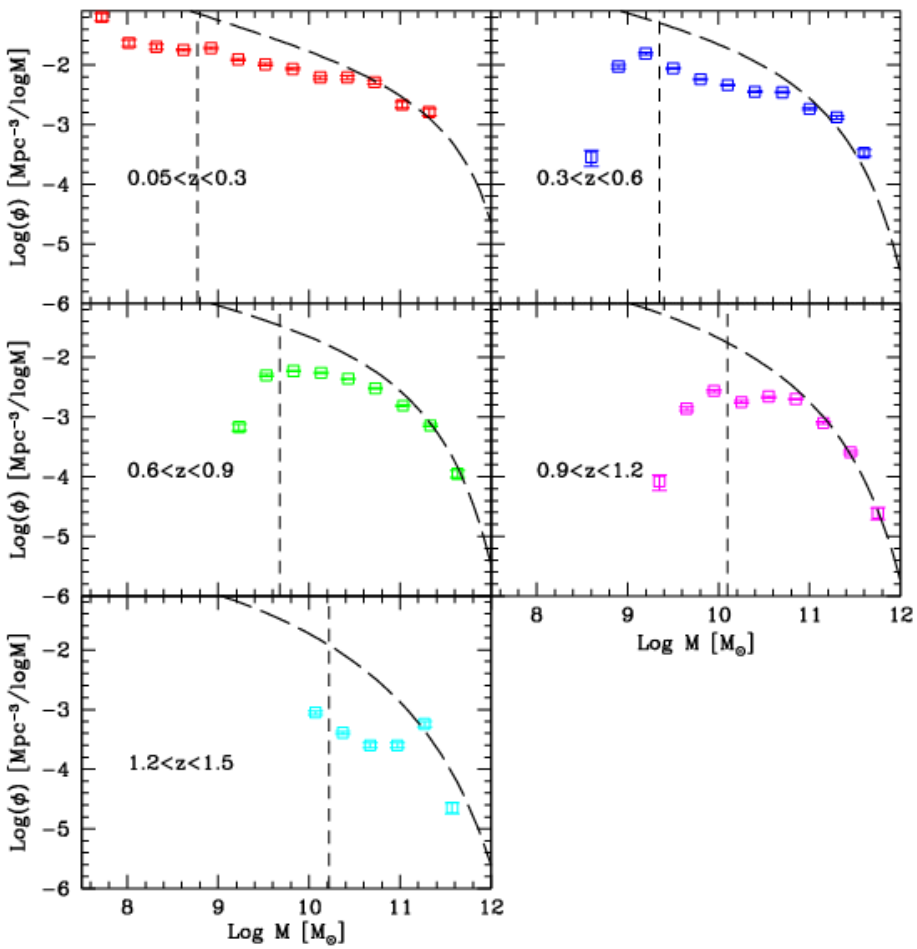
- smaller sample (~ 400 objects)
- mild evolution up to z ~ 1
- higher fraction of low mass galaxies

GSMF: comparison with models

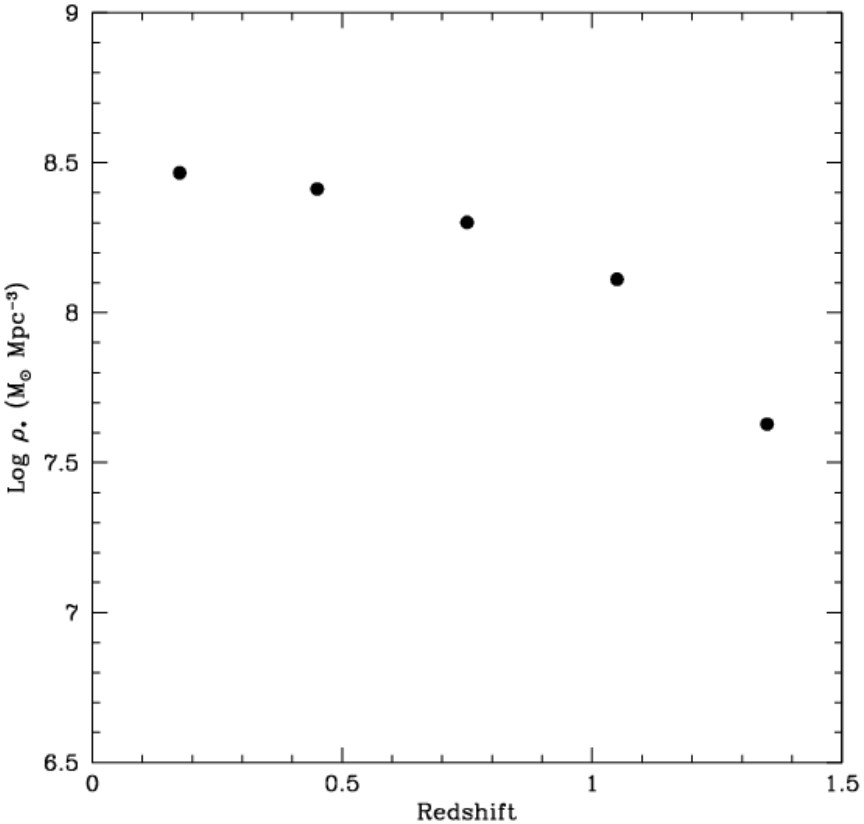


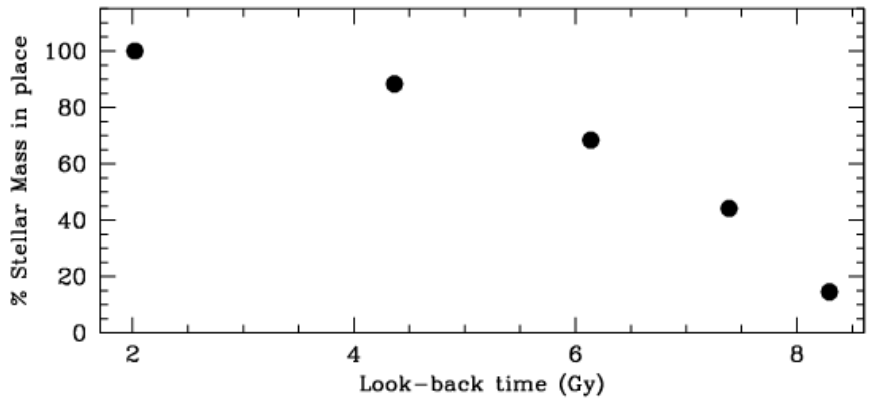
Cole et al. MNRAS, 319, 168 (2000)
courtesy of Carlton Baugh

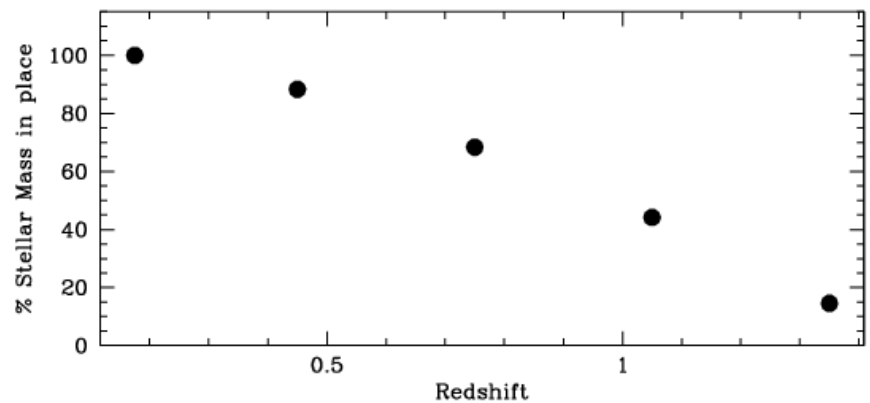
Menci et al. ApJ, 604, 12 (2004)
courtesy of Nicola Menci



Galaxy stellar mass density







K20 survey data Fontana et al. A&A 424, 23 (2004)

- 30% of present day stellar mass in place at z=2