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SHANGHAI Key Lab for Astrophysics

Photometric Properties of LBGs at z~1

Chenggang Shu

Key Lab for Astrophysics,
Shanghai Normal University (ShNU)

with Zhu Chen (ShNU), Denis Burgarella, Veronique Buat (OAMP),
Jiasheng Huang (CfA) & Zhijian Luo (ShNU)

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OUTLINE

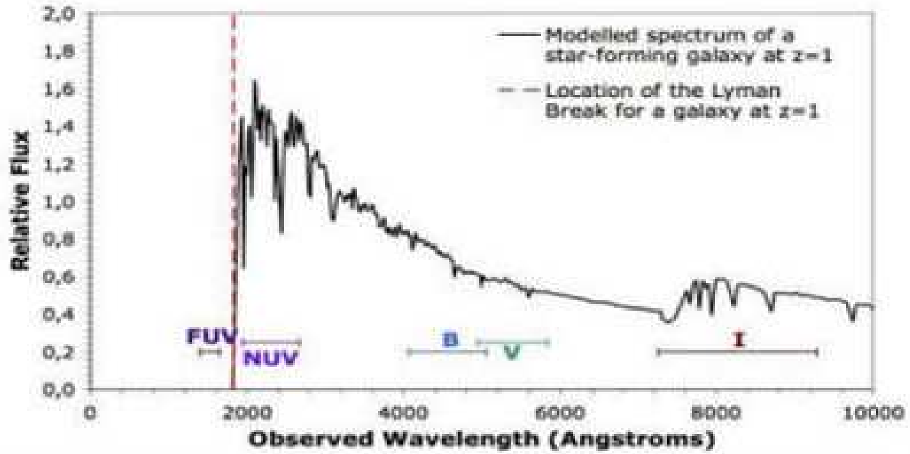
1. Sample refinement
2. Photometric properties
3. Conclusions

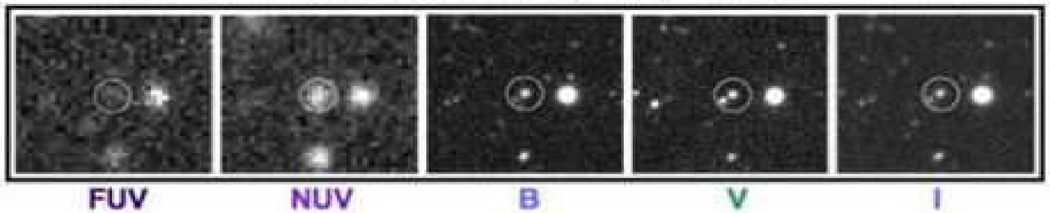
1. Sample Refinement

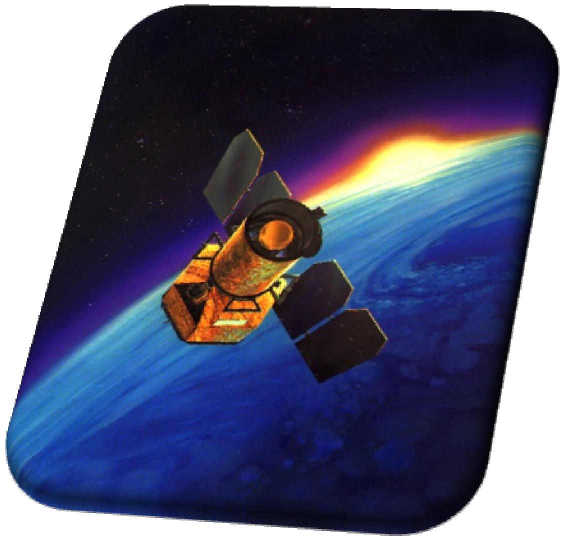
GALEX observation, E-CDF-S

FUV: λ =1516A

NUV: λ =2267A







420 LBGs candidates in E-CDF-S by *FUV-NUV >2, NUV <26.2*;
their z_p from COMBO 17 ($0.9<z<1.3$);
by cross-identification within a radius of 2”
completeness > 90% (Burgarella + , 07).

Since
(1)the space resolution of GALEX ~ 2.55”,
(2)the intrinsic astrometric precision of C-17 ~ 0.5”,
(3)the astrometric precision < 0.2” between C-17 and MUSYC,

3” is taken to re-do the cross-identification
from GALEX to C- 17, and MUSYC
the same processes proposed by B07.

MUSYC = Multiwavelength Survey by Yale-Chile
(Cardamone +, 10)

Results of the cross-identification

counterpart	COMBO	MUSYC	z_{spe}
single	379	355	64
pair	40	36 single	9
		2 pair	1
four	1	1 single	/
total	463	396	74

COMBO 17 (Wolf et al, 04) **MUSYC (Cardamone et al, 10)**

Significant differences in z_p !

Re-estimating by SED fitting

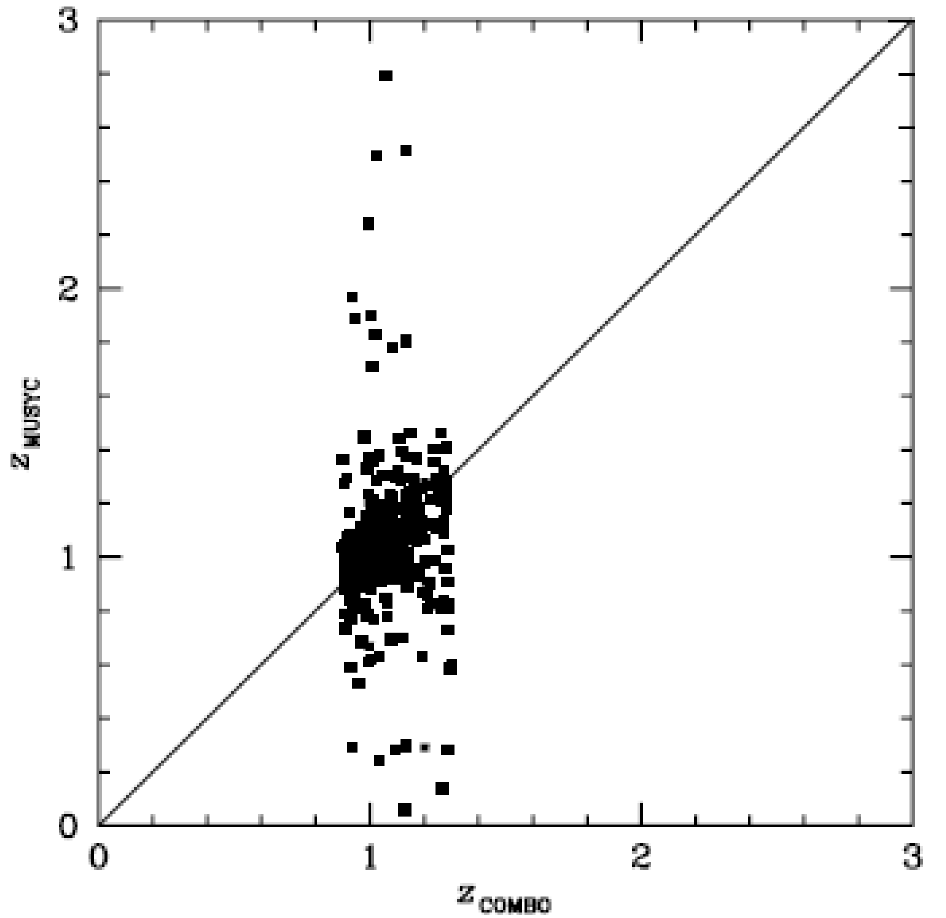
Together with *FUV* and *NUV*

For MUSYC/C- 17 sources (396)

FUV + NUV + **UBVRI** + **zJHK**
+ Ch1/2 (without 3 4 in IRAC)
13 bands (+ MIPS24)

For C-17 (only) sources (67):

FUV+NUV+**UBVRI**
7 Bands (+ MIPS24)



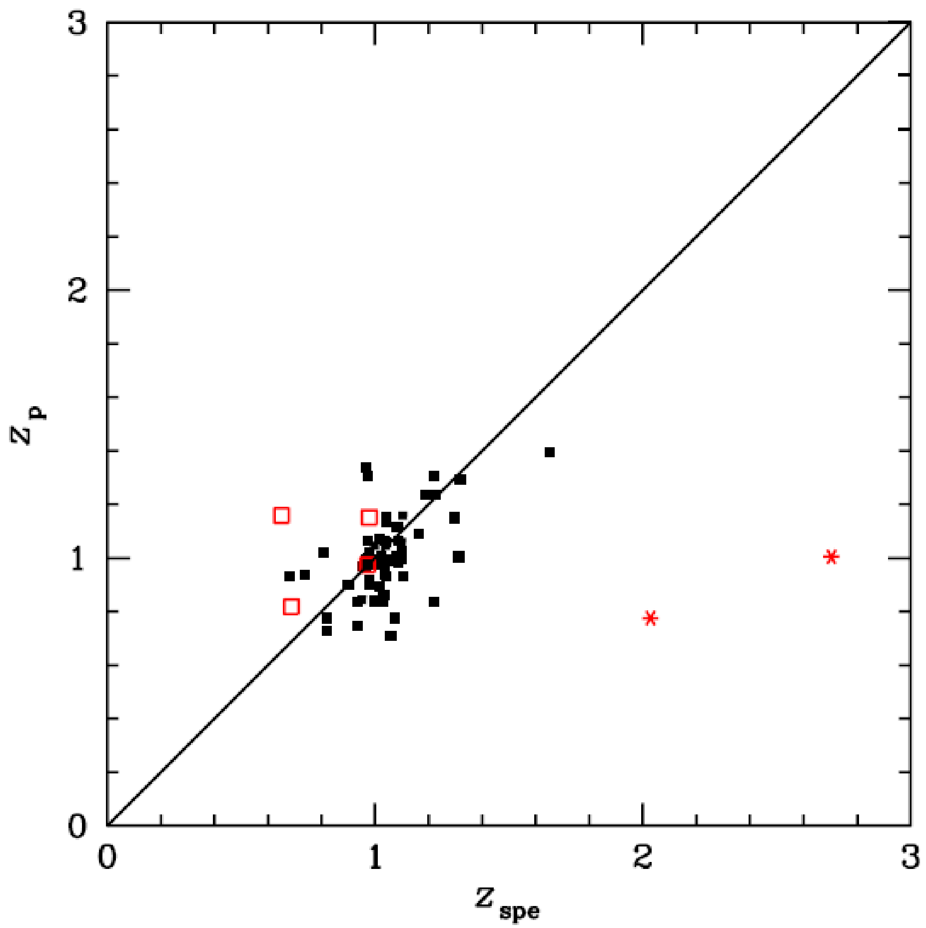
SEDs fittings by *Hyperz*

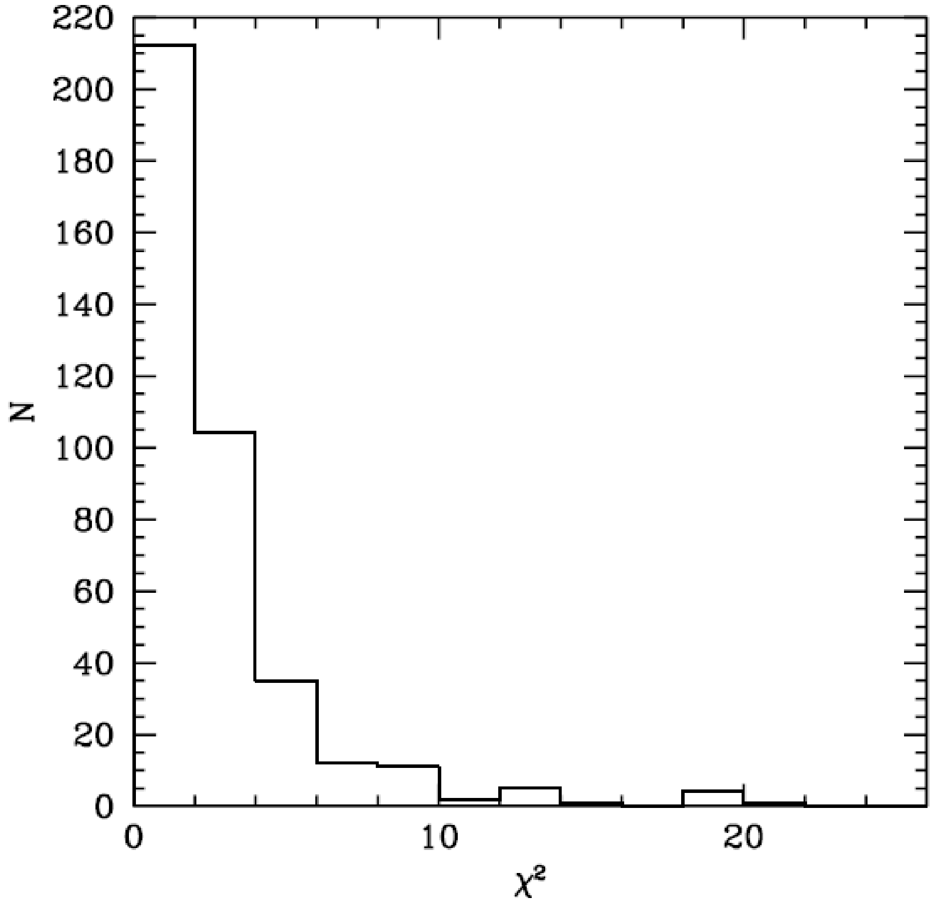
(http://webast.ast.obs-mip.fr/hyperz/)

Spectral type (SpT)	Templates
E (1)	BC03
E (2)	CWW
S0 (3)	BC03
Sa (4)	BC03
Sb (5)	BC03
Sbc (6)	CWW
Sc (7)	BC03
Scd (8)	CWW
Sd (9)	BC03
Irr (10)	BC03
Irr (11)	CWW
dusty (12)	CWW
Burst (13)	BC03
Arp220-modifying (14)	Arp220-rebuilt
Arp220 (15)	Arp220

The quality of re-estimates of z_p

74 sources with z_sp;
2 in "*" with very bad spectroscopic qualities; χ^2 ~ 1.8
⟶ **Re-estimates of z_p are good.**



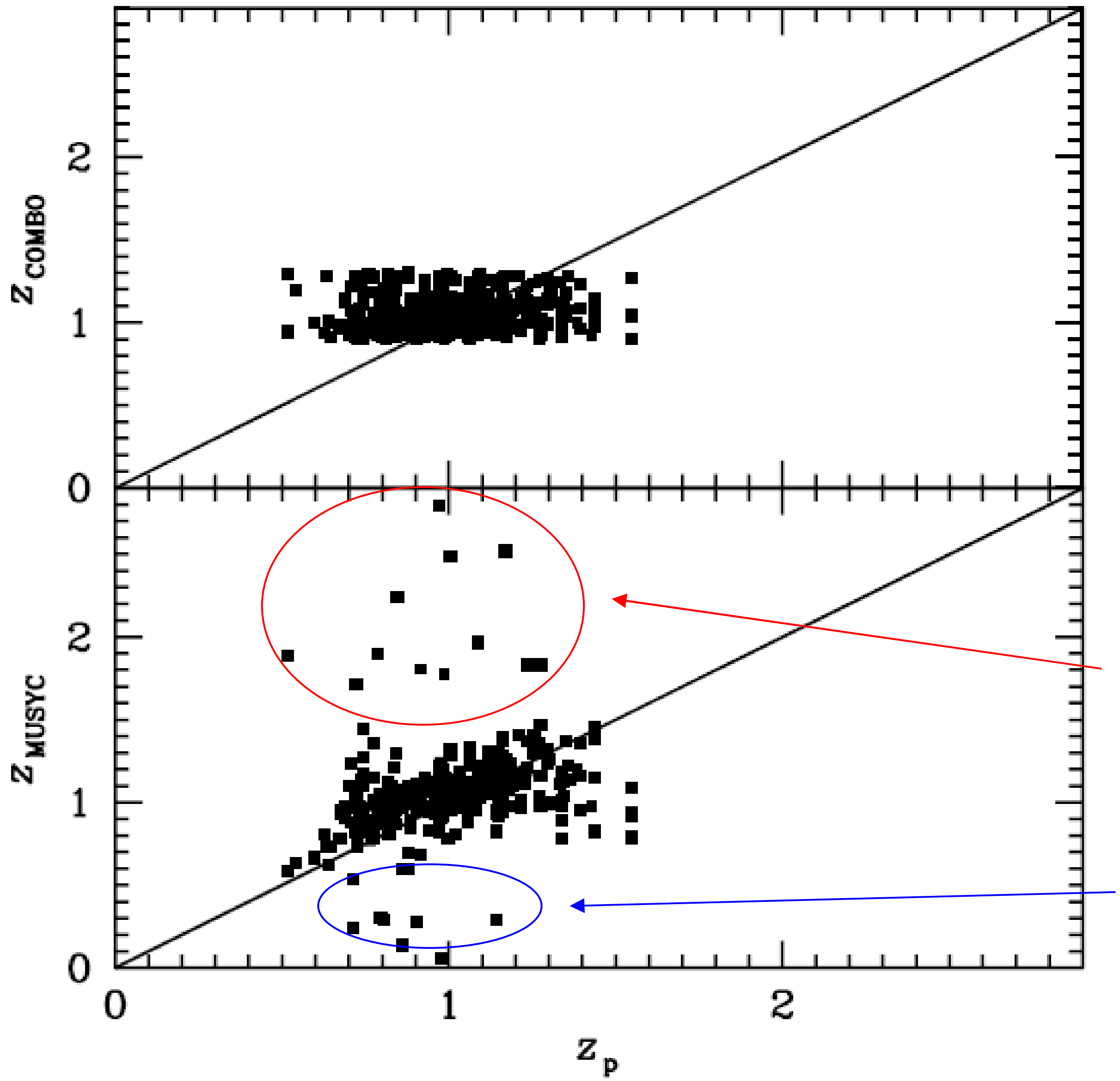


z_p accuracies vs *R*

	N(C,M)	N_{spe}(C,M)	$\frac{\Delta z}{1+z_{spe}}$ (C)	$\frac{\Delta z}{1+z_{spe}}$ (M)	$\frac{\Delta z}{1+z_{spe}}$
$R < 22$	19,16	6, 6	0.019	0.008	0.040
$22 < R < 23$	122,108	31,29	0.031	0.012	0.046
$23 < R < 24$	196,172	24,23	0.062	0.029	0.042
$24 < R$	132,100	7,6	0.094	0.025	0.068
total	463,396	68,64	0.058	0.022	0.046

better than COMBO 17, worse than MUSYC

Comparisons of z_p



Different from COMBO 17:

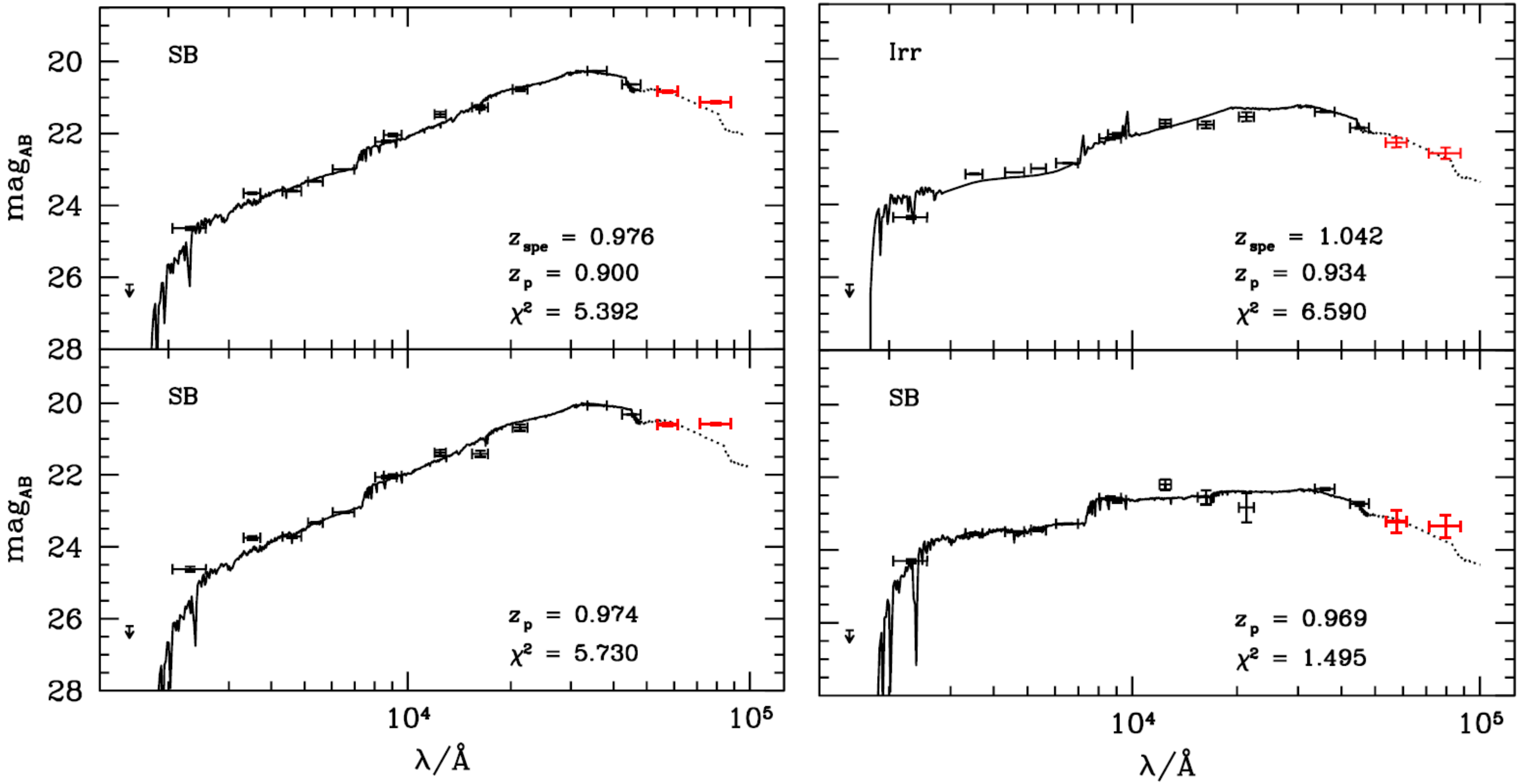
fewer bands;

Outliers from MUSYC:

Very bright

or

Very faint in IR



Examples:

2 with (up) /without (lower) spectral

2 with (left) /without (right) 24MIPS

Selection of LBGs at z~1

1. Only one counter = "true" counterpart;
2. Multi : ① z_p; and ② \chi^2 ⟶ "true" counterparts;

FUV-NUV > 2 strongly suggests z ~1

387 LBGs are selected with 0.7 < z_p < 1.4;

1. 912A to 1550A at z= 0.7, ~ FUV, 1530A;
2. 912A leaves from NUV if z> 1.4;
3. △Z ~ 0.1 at z ~1

2 AGNs excluded (0.5%) < ~2% for LBGs at z~3

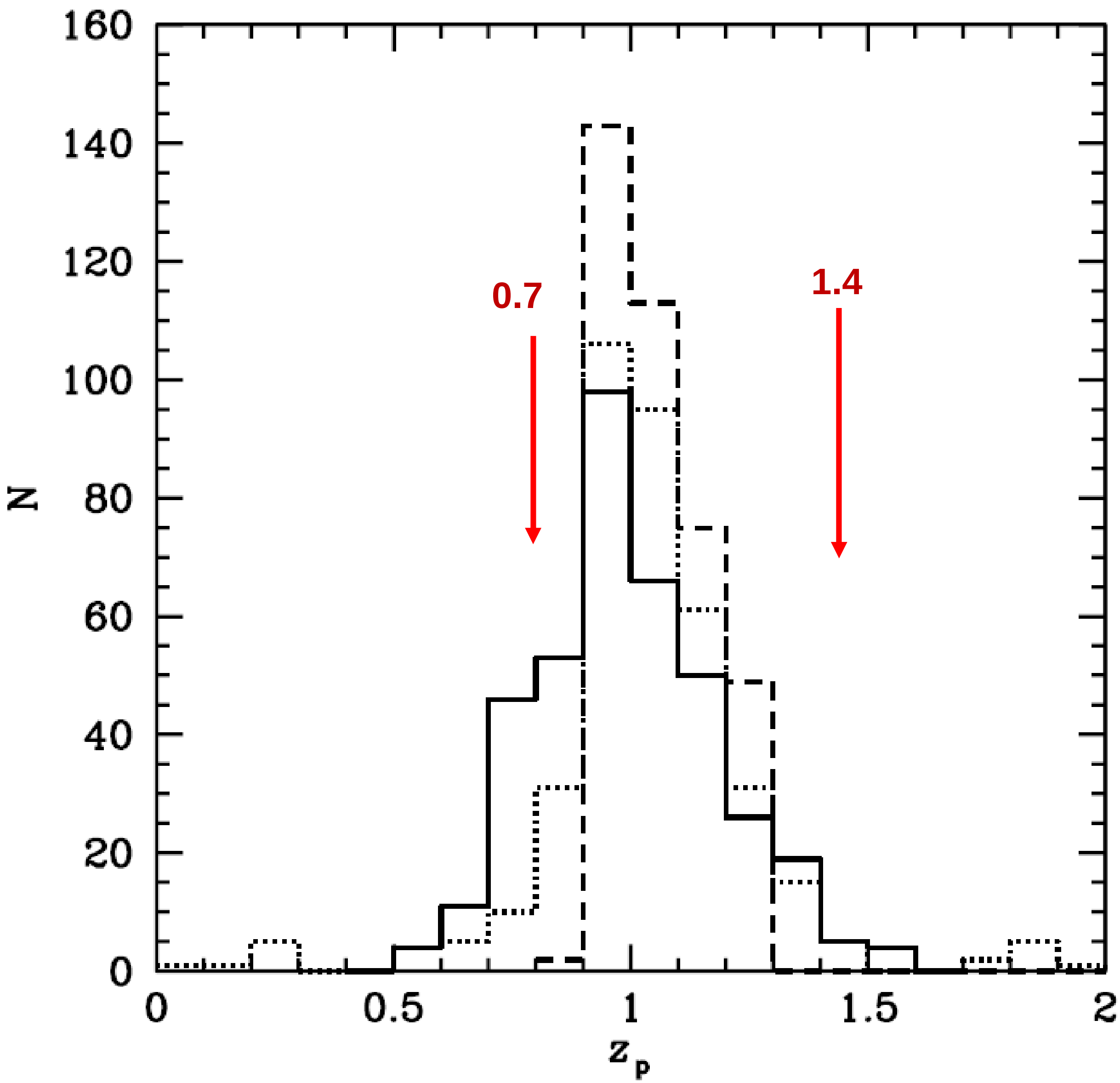
SF -- AGN connection more significant at higher z

LBGs at z~1

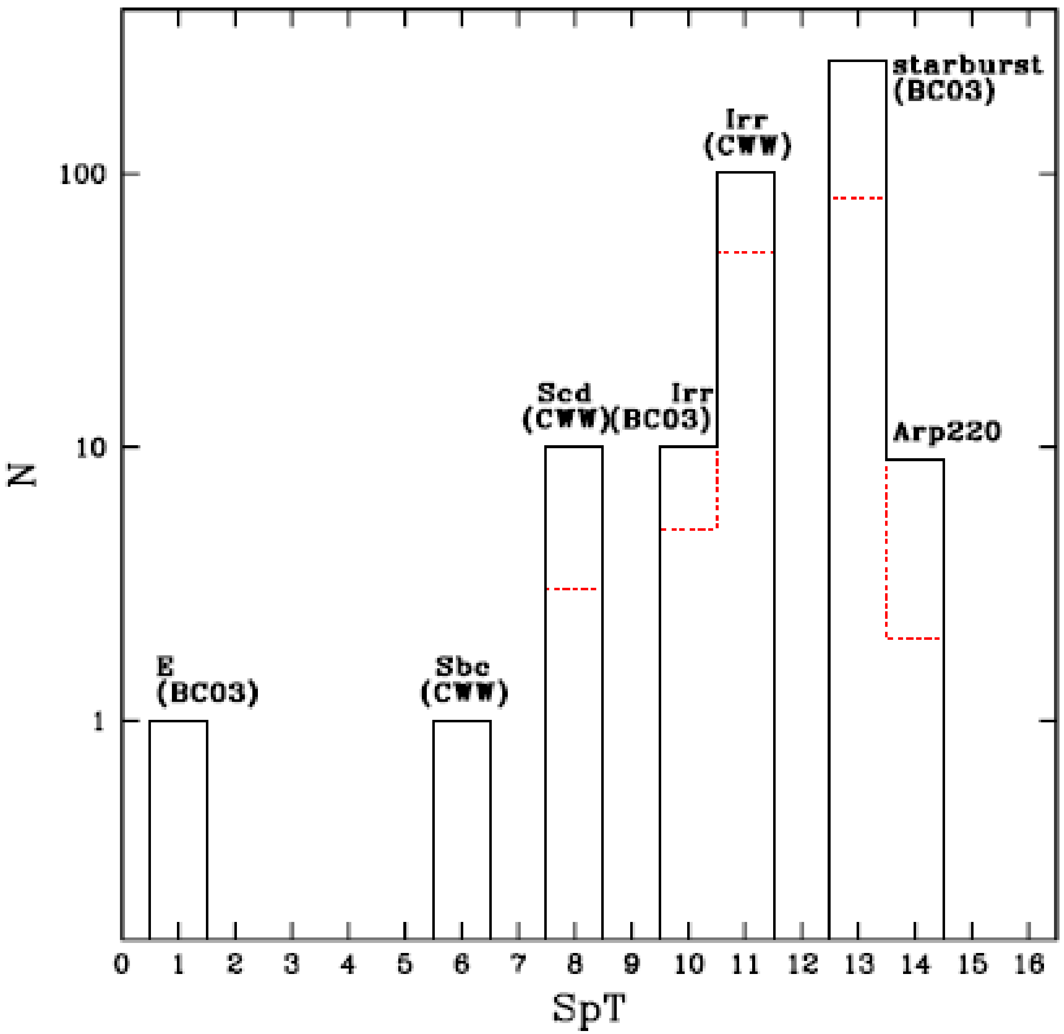
387 LBGs are selected with 0.7 < z_p < 1.4;

90% of the preliminary candidates

Solid: re-estimates
Dashed: C - 17
Dotted: MUSYC



2. Photometric Properties



(1) SpT types

255 starburst (BC03)
9 Arp220
101 irregular (CWW)
10 irregular (BC03)
10 Scd (CWW)
1 Sbc (CWW)
1 E (BC03)

} too few for statistics

dominated by late types

Starbusrt Arp200 → SB

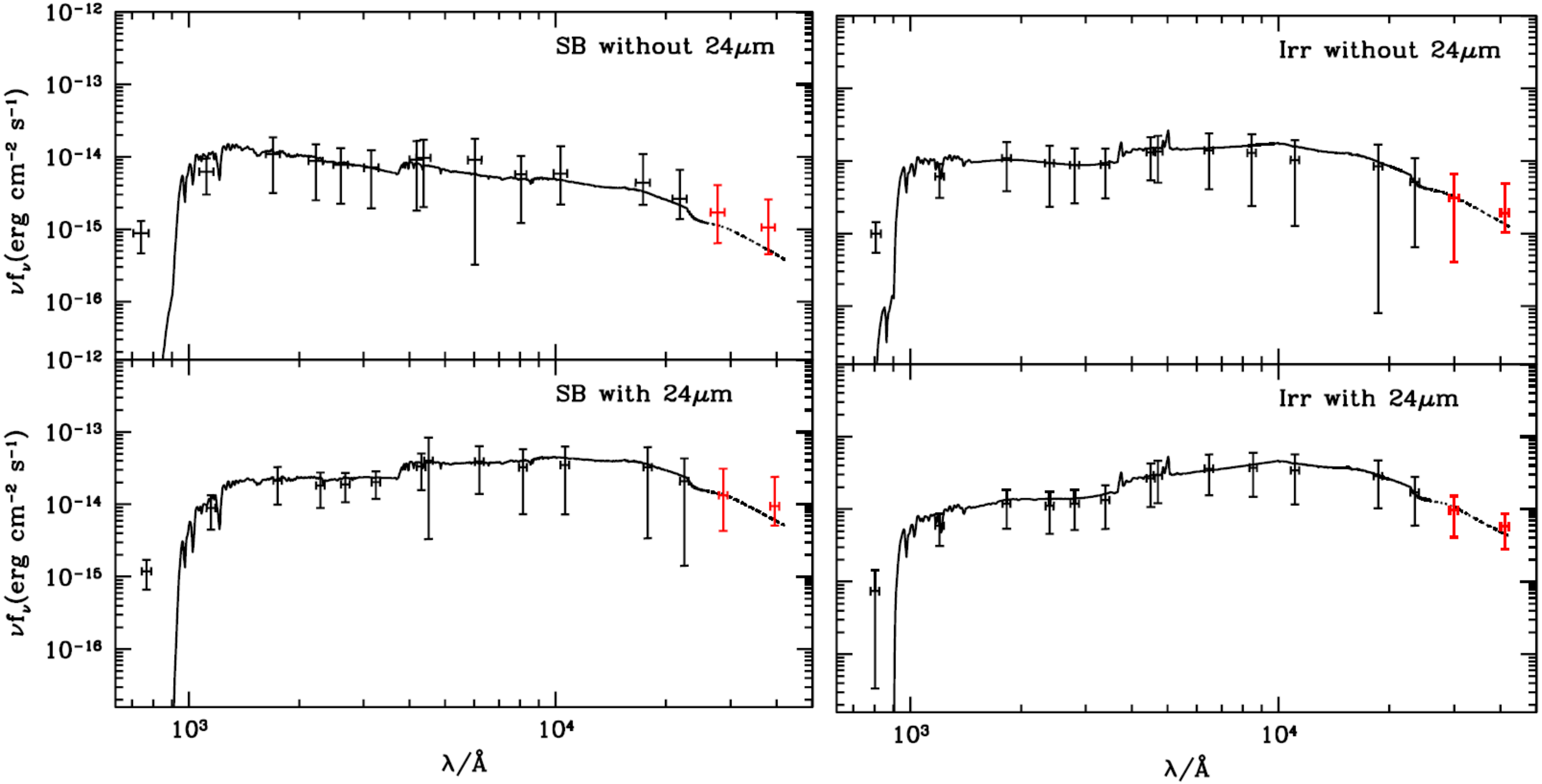
Irregular → Irr

Scd Sbc E → EST

(2) Averaged SEDs

(Red/Blue - LBG = with/without 24MIPS)

(59/328 = Red/Blue - LBG)



LBGs in the SB group brighter in their rest-frame UV, i.e., higher SFR;

Red-LBGs brighter in their rest-frame NIR and IR, i.e., more massive M_*

(3) UV LF

Based on the methods of

$1/V_{max}$ and C-

similar to the previous studies of

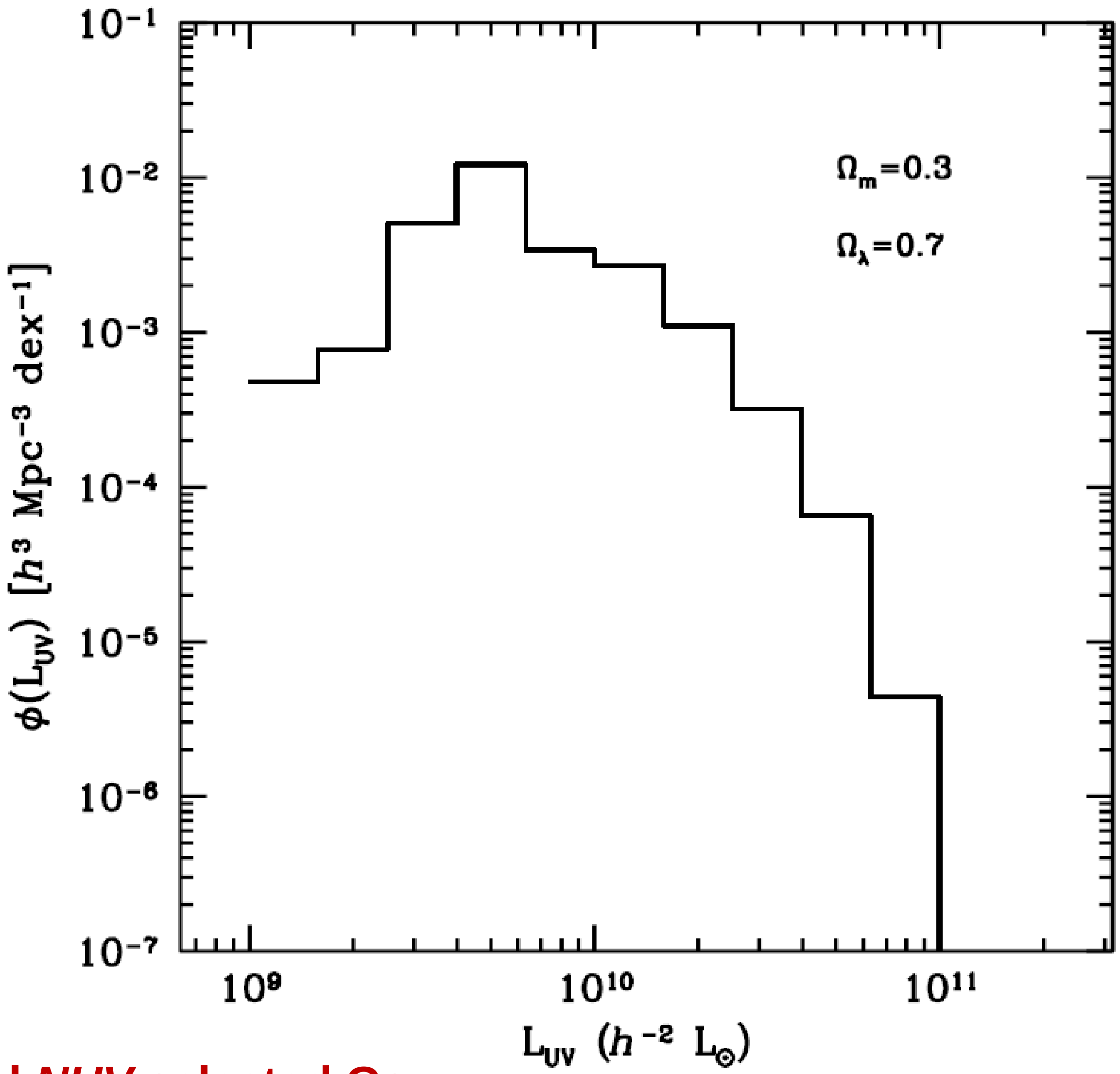
UV galaxies, LBGs at z~1.

Total *L* contribution in 1800A

Blue/Red - LBGs

$(2.6 \pm 0.6) \times 10^7 h(\mathrm{L_\odot Mpc^{-3}})$

$(2.3 \pm 0.8) \times 10^6 h(\mathrm{L_\odot Mpc^{-3}})$



75% of the *L* at 1800A of the total *NUV* selected Gs

(4) Star Formation Rates (SFRs)

$$\frac{\mathrm{SFR}}{\mathrm{M_\odot\,yr^{-1}}} = 1.4 \times 10^{-28} \frac{L_{\mathrm{NUV}}}{\mathrm{ergs^{-1}Hz^{-1}}}$$

(Kennicutt, 98)

SFRs

4 -- 220 $M_\odot$ yr $^{-1}$

Median

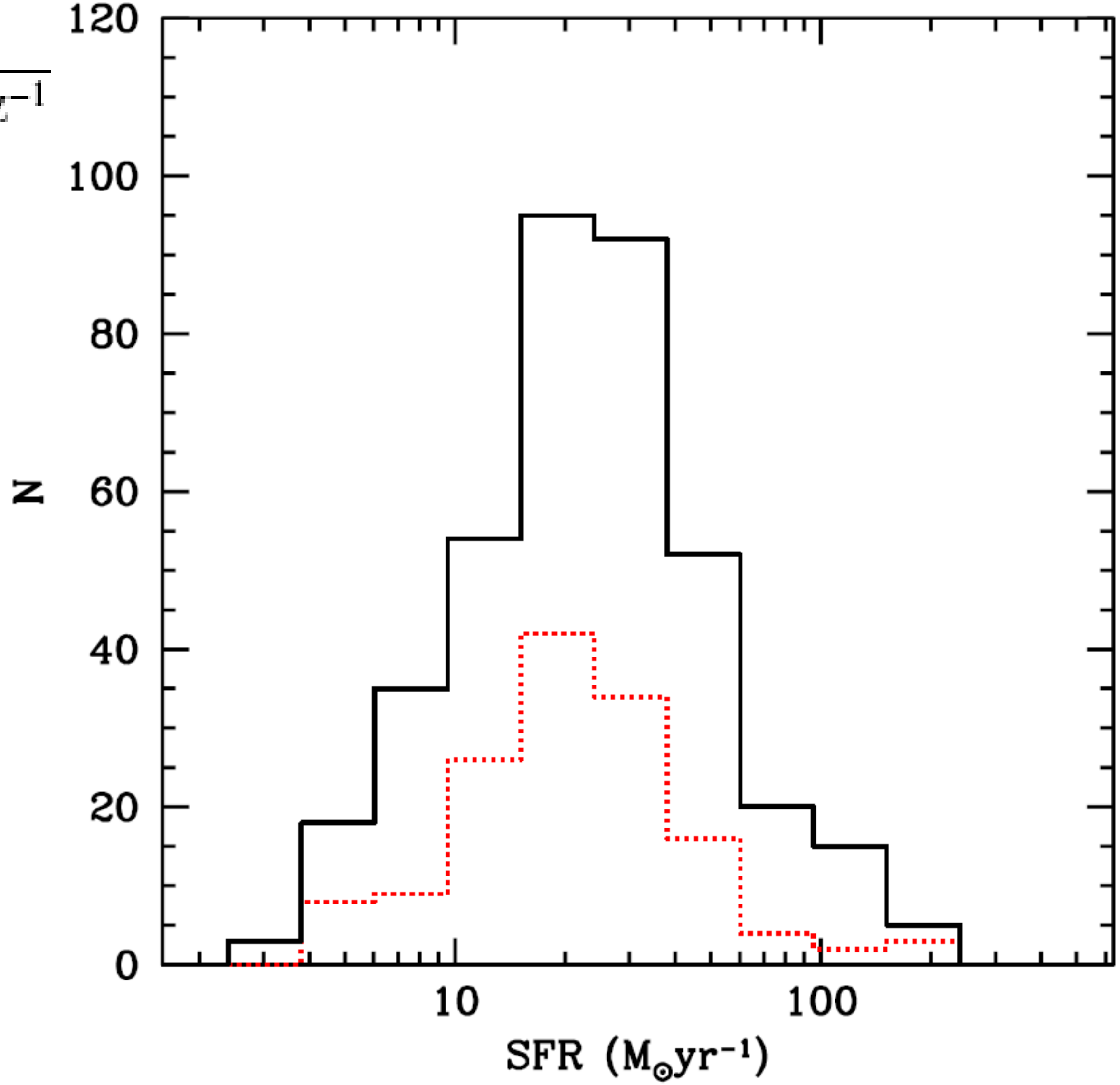
~ 30 $M_\odot$ yr $^{-1}$

Similar to LBGs at z~3,

(Steidal +, 03; Magdis +, 10)

$\overline{\mathrm{SFR}}$ (SB)~ 35 $M_\odot$ yr -1

> $\overline{\mathrm{SFR}}$ (Irr) ~ 20 $M_\odot$ yr -1



(5) Stellar Mass M_*

2.3×10^{8} ---
7.7×10^{11} $M_\odot$

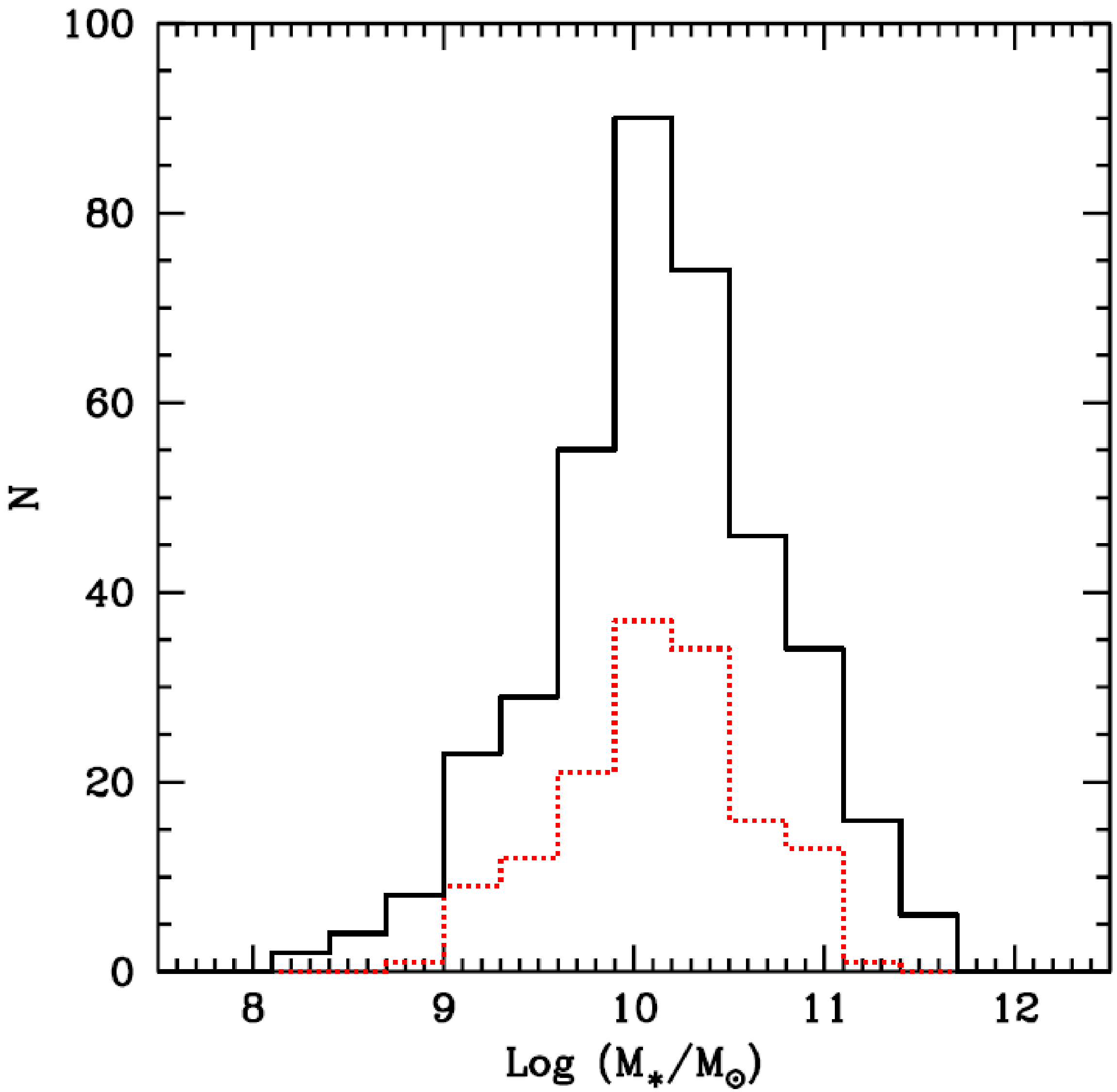
median
~ 10^{10} $M_\odot$

~ 0.5 LBGs at z~3

(Magdis +, 10)

$\overline{M^*(R-)}$ ~ 7×10^{10} $M_\odot$

> $\overline{M^*(B-)}$ ~ 9×10^{9} $M_\odot$



(6) SFR *vs* M *

LBGs in SF sequence

EST– Irr – SB ,
more distant to
the main sequence;

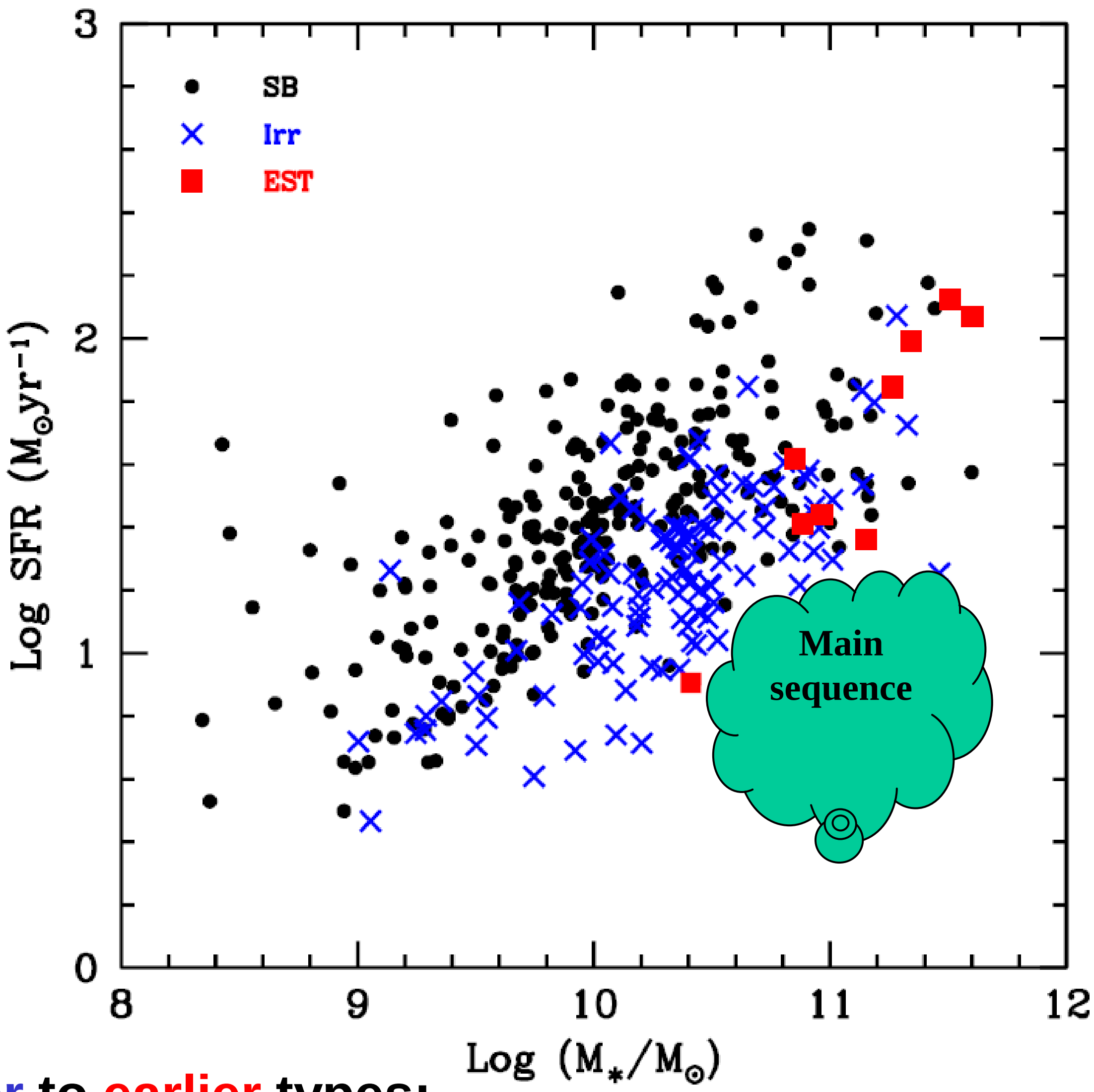
distance ~ SF timescale

⇩

EST– Irr – SB,
more dramatic in SF;

For M*_(lower limit),
SB < Irr < EST

⇩



evolution of LBGs is from later to earlier types;

LBGs have larger fractions of SBs at higher redshifts

(7) sSFR *vs* M *

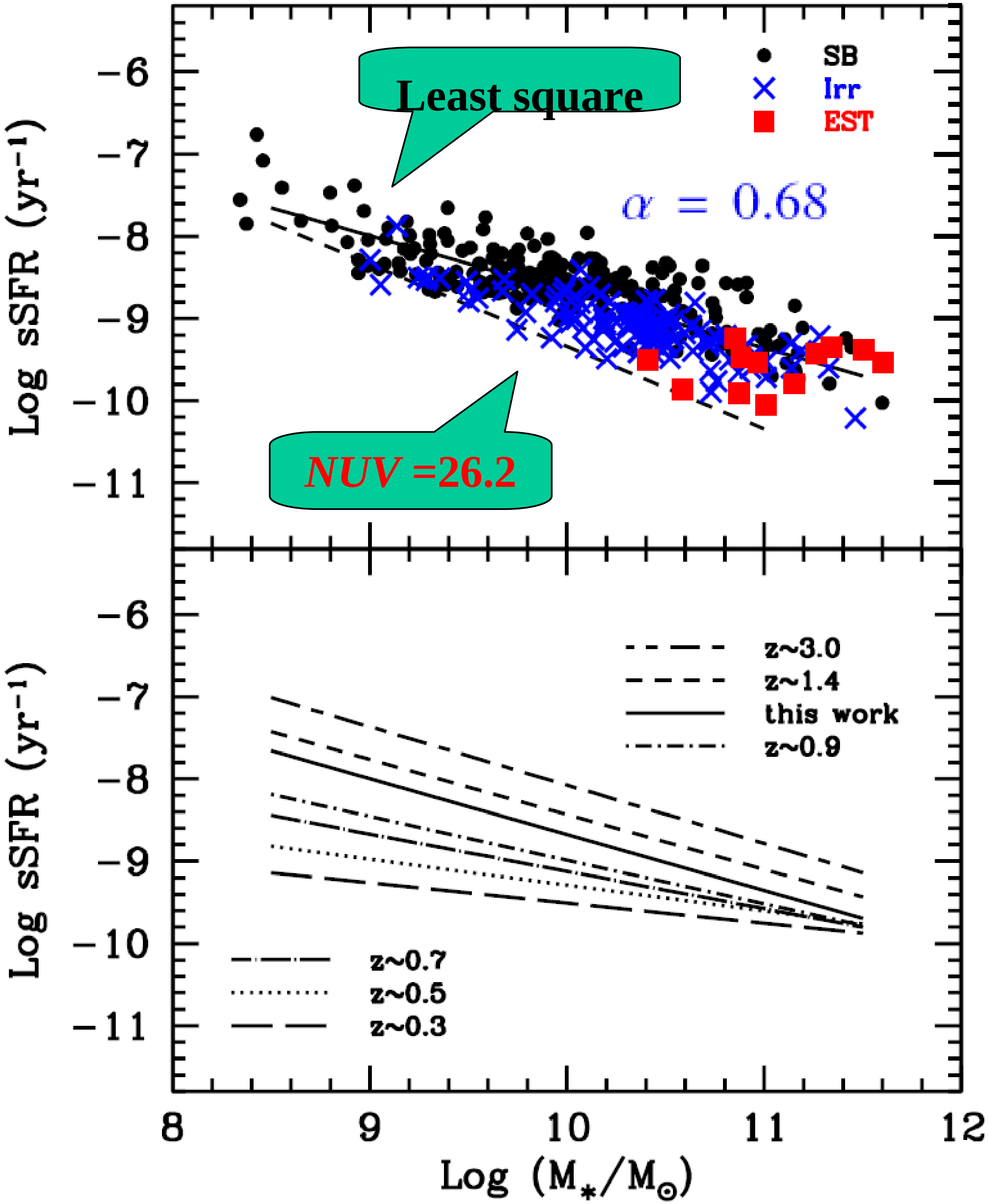
"downsizing"

EST – Irr – SB ,
more significant;

$\alpha = 0.68$

LBGs with less M_* build up their stellar blocks relatively faster.

for SF galaxies (Zheng +, 07; Buat +, 08; Elbaz + 08, 10; Dunne +, 09; Magdis + ,10;).



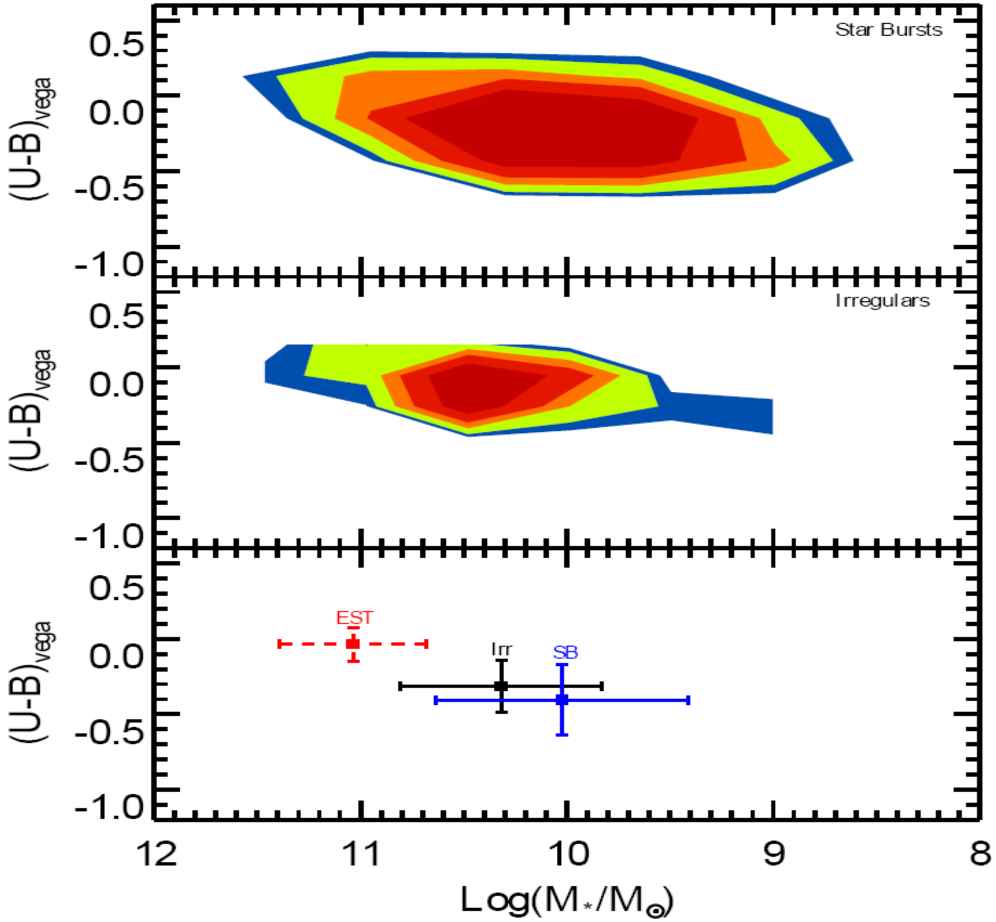
(8) *U-B* vs M *

Locate in the "blue cloud"

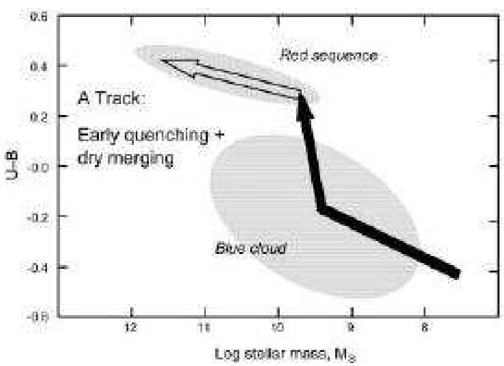
suggest evolution

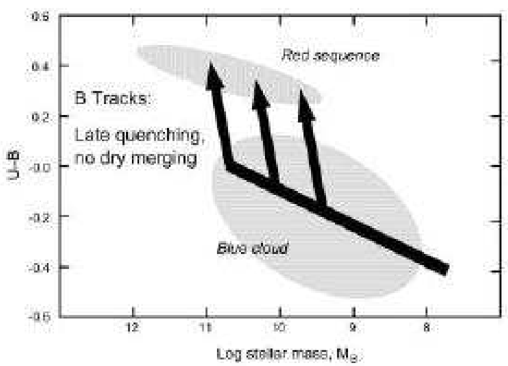
from SB – Irr – EST

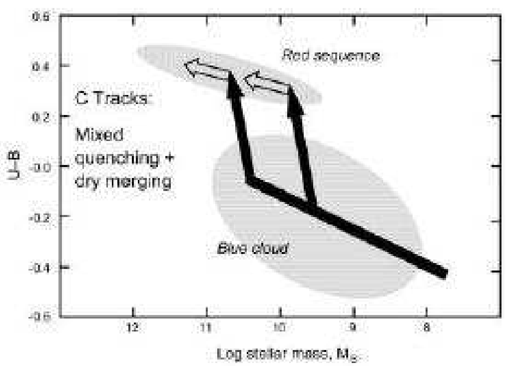
along the blue cloud



Faber et al. 07







3、Conclusions

1. An LBG sample at $0.7 < z_p < 1.4$ is refined based on Burgarella et al. (07) in CDF-S;
2. Most of the LBGs are SB and Irr galaxies;
3. The median SFR ~ 30 $\mathbf{M_\odot\ yr^{-1}}$ with the median M*~ $\mathbf{10^{10}\ M_\odot}$;
4. The contribution to the *L* in 1800A is 75% of the total NUV Gs;
5. LBGs locate in the SF sequence, with SBs being more distant.
6. The “downsizing” effect is clearly found and the effect is more significant for LBGs from the SB, Irr and EST groups;
7. “downsizing” implies that $\Sigma\mathbf{uv,c}$ displays a small dynamic range.
8. LBGs distribute in the “blue” cloud. We suggest that star forming galaxies, evolve from later to earlier types in the blue “cloud”;

Thanks

谢 谢 ！