Studying Infrared Properties of LBGs with Subaru: from HSC to ULTIMATE

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what can we learn from CANDELS to understand a larger sample from CLAUDS?

CLAUDS

CFHT **L**arge-**A**rea **U**-band **D**eep **S**urvey

250hr of Deep U band imaging in the Hyper Suprime Cam Deep Layer

S. Arnouts on behalf of the CLAUDS team

based on PI programs

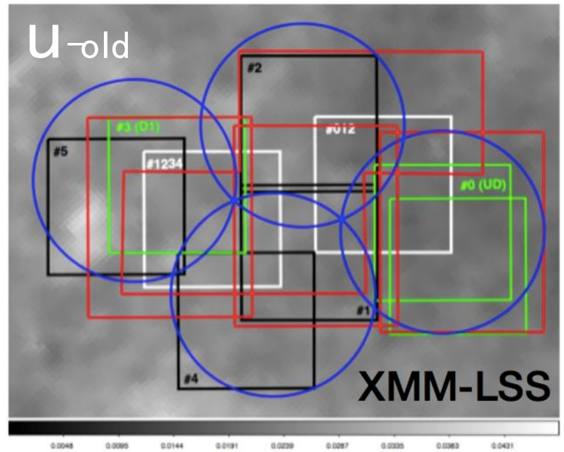
co-PIs	
China	Jiasheng HUANG (Sebastien FOUCAUD)
Canada	Marcin SAWICKI
France	Stéphane ARNOUTS

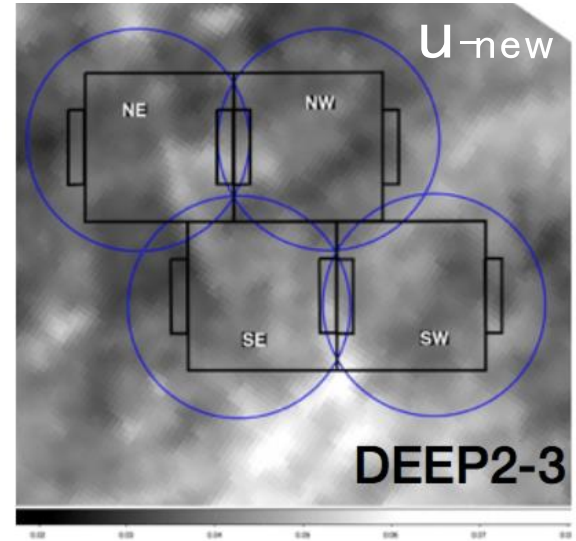
co-Is	
Shangai	Jing Y., Yang X. , Li C.
Japan	Yamada T., Bundy K., Iwata I., Matsuda Y., Nagao T., Ouchi M., Shimasaku K., Silverman J., Tanaka M.
Canada	Balogh M., Chapman S., Gwyn S., Willott C., Yee H.
France	Ilbert O., Le Fèvre O., de La Torre S., Tresse L., Moutard T, Coupon J.

HSC Deep Fields

＊Located in Extragalactic regions with multi-wavelength & spec-z informations

* HSC pointings
* MegaCam pointings
  u archives
  u CLAUDS

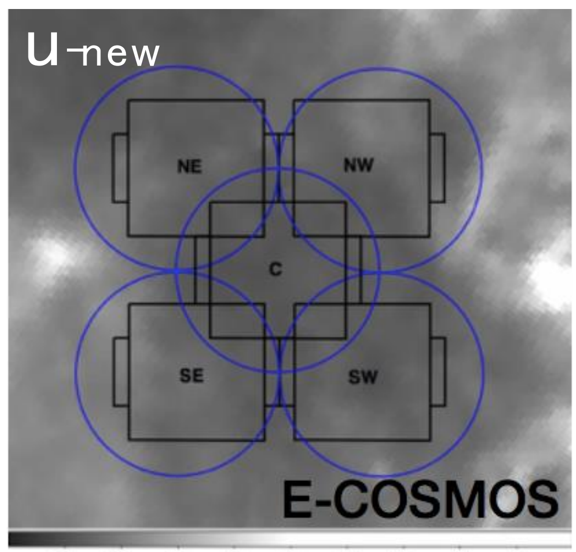


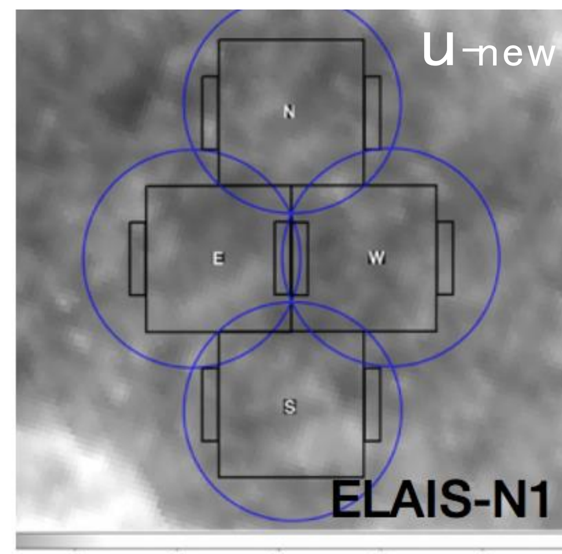


CFHT observations

- T_{exp} ~16hr with u-old
- T_{exp} ~15hr with u-new

Total: ~**300hr program**
＊**Dark Time + IQ<1"**
＊**4 sem.** (14B – 16A)
＊**based on PI prog** (C/F/S)



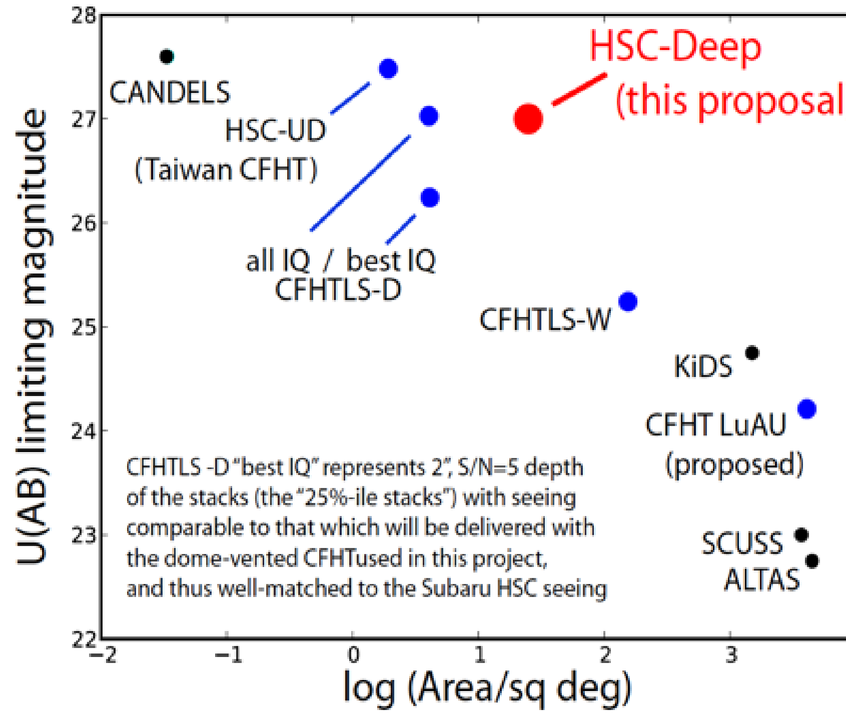


CFHT Large Area U-band Deep Survey

Extending Deep depth to **u^*_{AB}=27 over 27deg^2**: 60 nights required!

Canada (Marcin Sawicki), France (Stephane Arnouts) and China (Seb Foucaud)

- ~80h (15n) / semester for 4 semesters (tentative 30h/30h/20h)
- regular proposal joint for the 3 agencies
- China: Telescope Access Program
- Involving 5 Canadian, 3 French and 3 Chinese (in addition to PIs) + students & postdocs: *External collaborators*
- Strong science cases (U-band driven): SFR in z~1 clusters, LAEs (NB387), lensed/bright z~3 LBGs, …



CLAUDS enables new HSC science

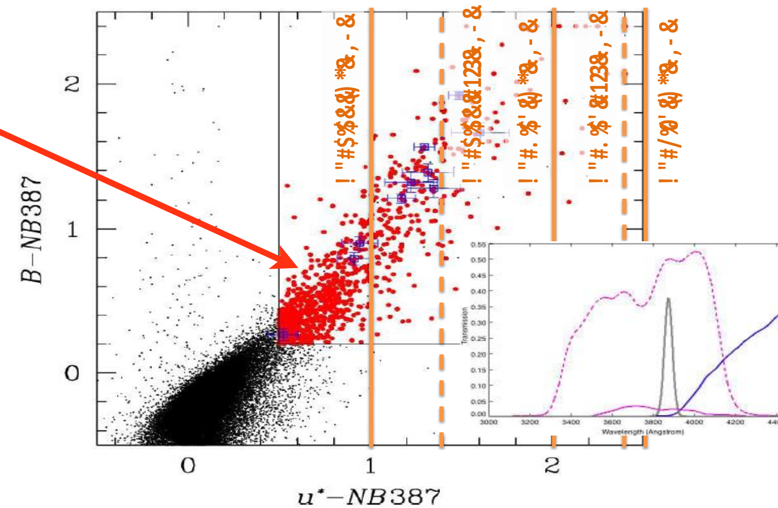
The samples assembled with HSC Deep will be unique

Table 3: Expected number of objects

$<z>$	sample	Vol(Gpc^3)	$M_*(M_\odot)$	N of galaxies
0.1	photo-z	0.001	$10^{8.7}$	7.2k
0.3	photo-z	0.008	$10^{9.3}$	38.3k
0.5	photo-z	0.019	$10^{9.8}$	71.8k
0.7	photo-z	0.029	$10^{10.1}$	94.4k
0.9	photo-z	0.040	$10^{10.2}$	137.3k
2.3	BM/BX	0.341	–	2.5M
3.0	U-dropout	0.340	–	0.9M
3.0	QSOs	0.340	–	1000
2.2	LAE / LAB	0.017	–	9k / 700

Lensing shape measurement is limited by low shear S/N for sources at z>1

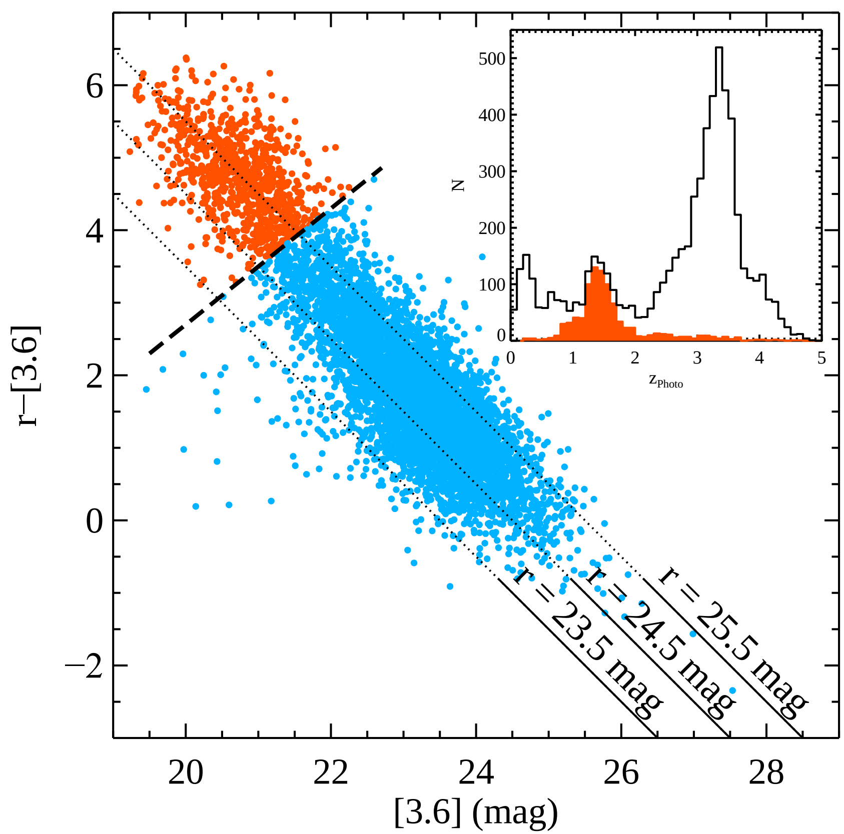
⇨ CLAUDS+HSC-Deep perfect for lensing magnification bias studies with LBG sample



LBGs in XMM-LSS(CLAUDS+HSC): A Large LBG sample at z~3

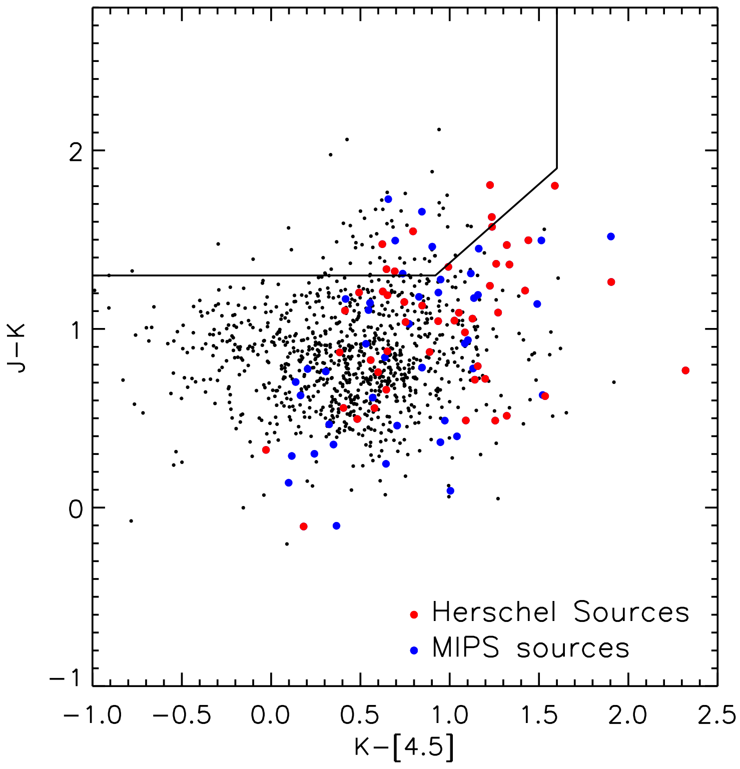
- 22400 LBGs with R<25.5
- 43200 LBGs with R<26.0
- 14400 LBGs detected at 3.6 micron----(SERV)
- 1015 LBGs detected at 8.0 micron ----(SERV)
- 509 LBGs detected at 24 micron----(SWIRE)
- 418 LBGs detected at 250 micron---(HerMES)

The "Red LBGs" puzzle in CLAUDS? Or photz Issue?

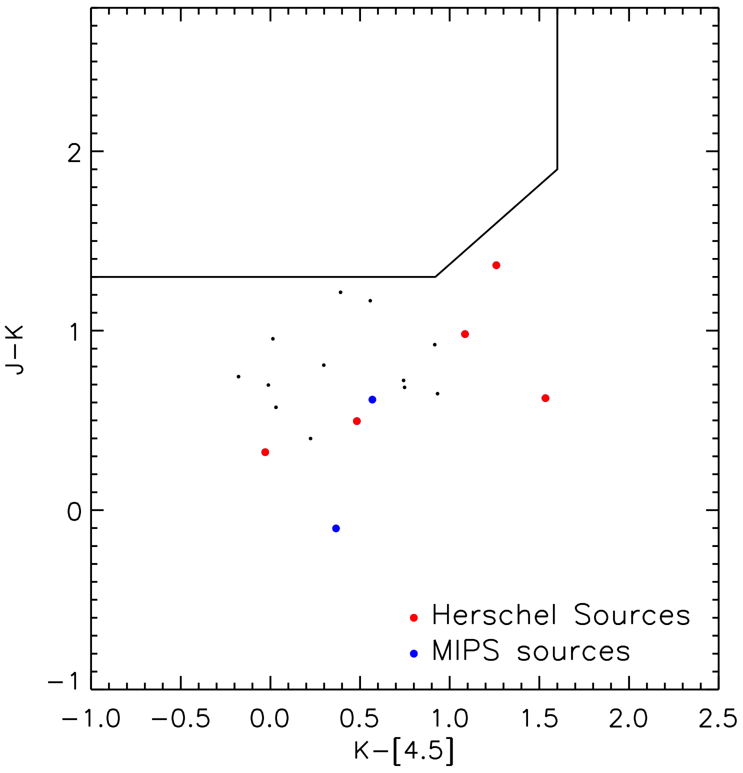


IR properties of luminous LBGs in XMM-LSS

Photometry Sample



REDSHIFT SAMPLE



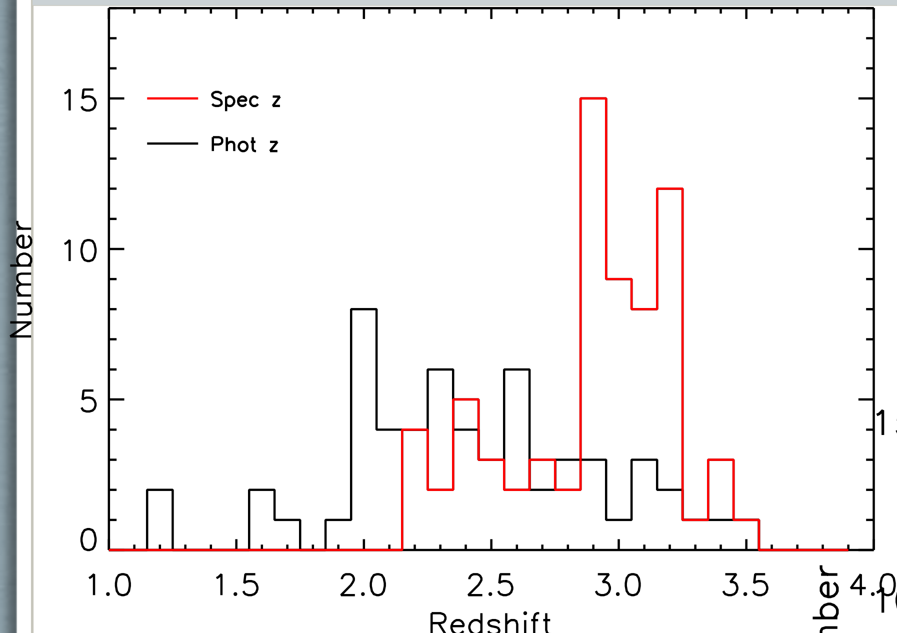
Issues with LBGs or galaxies at z~3

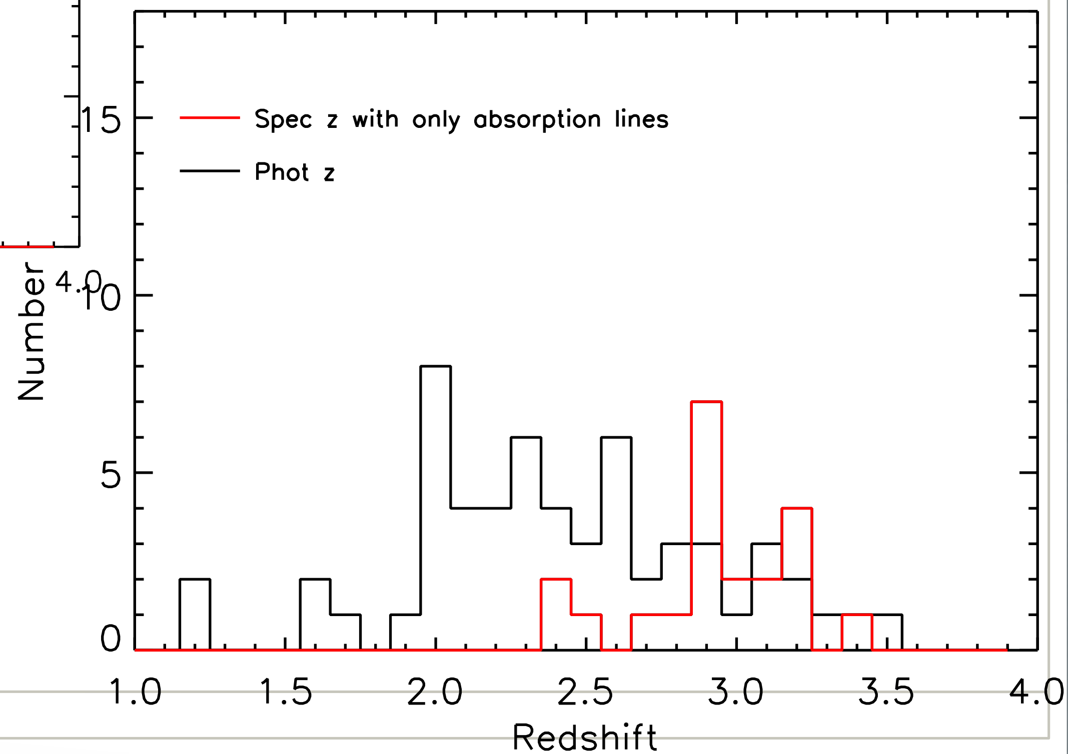
- Does photz really work for galaxies at z>=3?
- Does (N+M)IR emission really come from LBGs?
- How bad is the confusion? Or what is fraction of close pair in LBG samples.
- LBG masses, morphologies, color bimodalities.

LBGs in GOODSN
Steidel et al. 2003

- 144 LBGs in GOODSN
- ~70 have Spec z, most around z=3

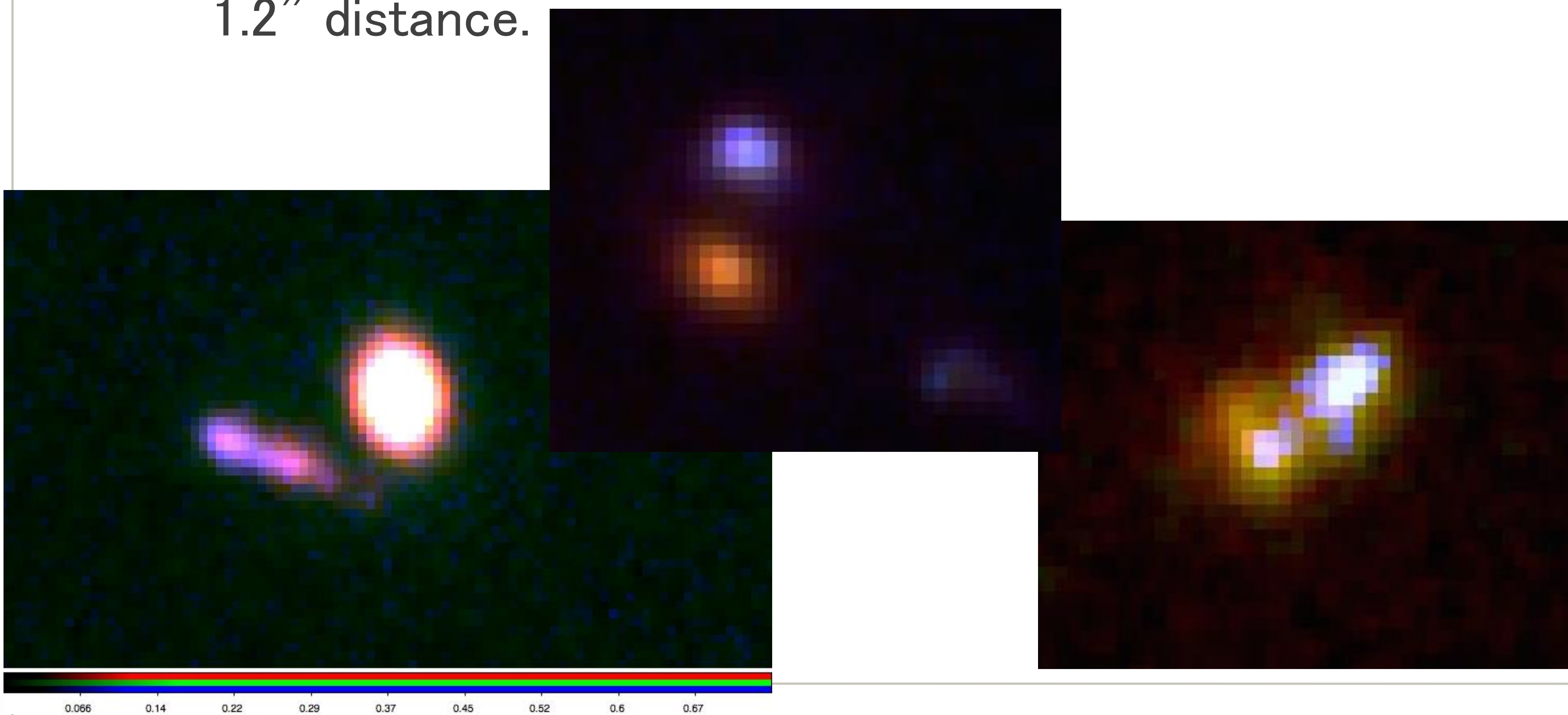
CANDELS Photz for LBGs in Steidel et al. 2003

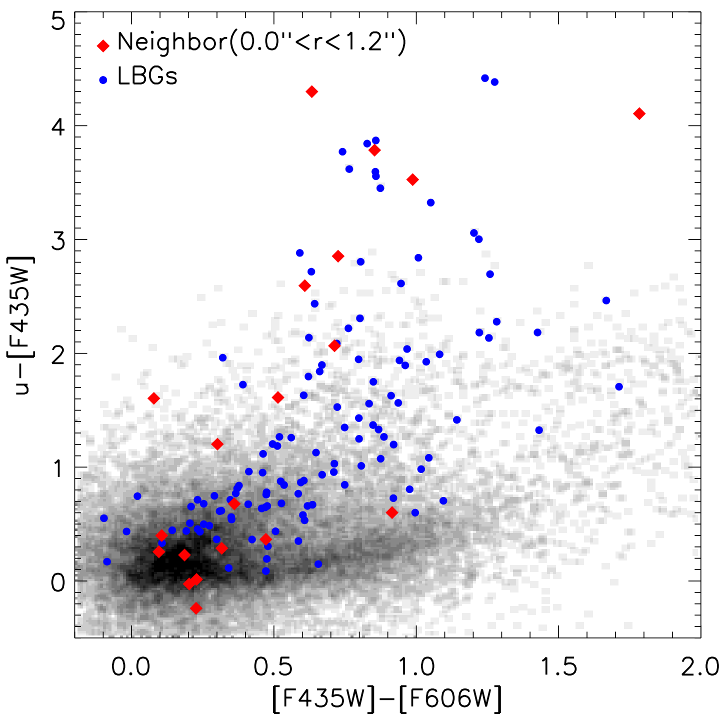




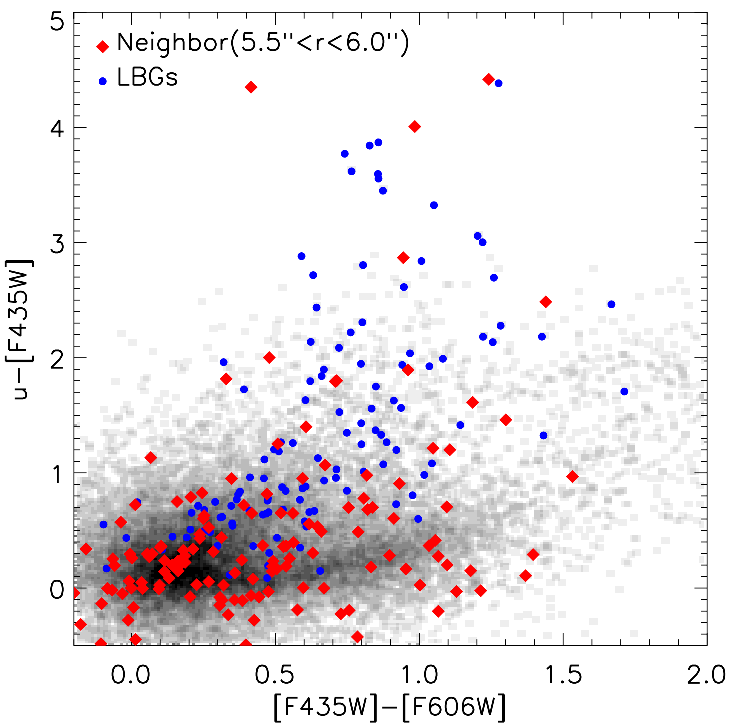
LBGs resolved by the HST image in GOODSN

- 22 LBGs in GOODSN have neighboring objects within 1.2” distance.



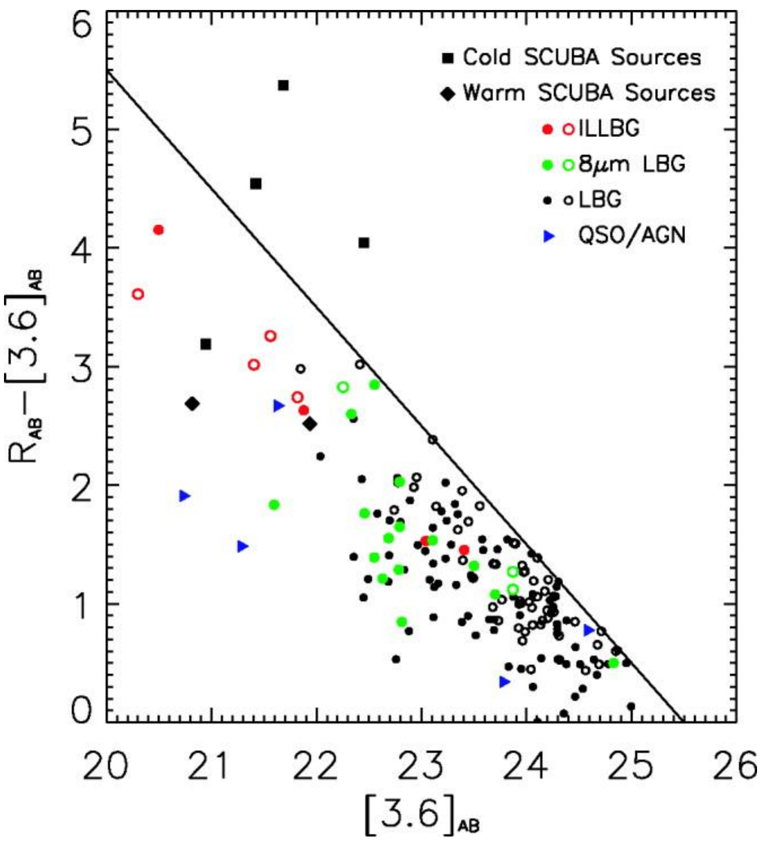


Neighbor(0.0''<r<1.2'')
LBGs
u−[F435W]
[F435W]−[F606W]

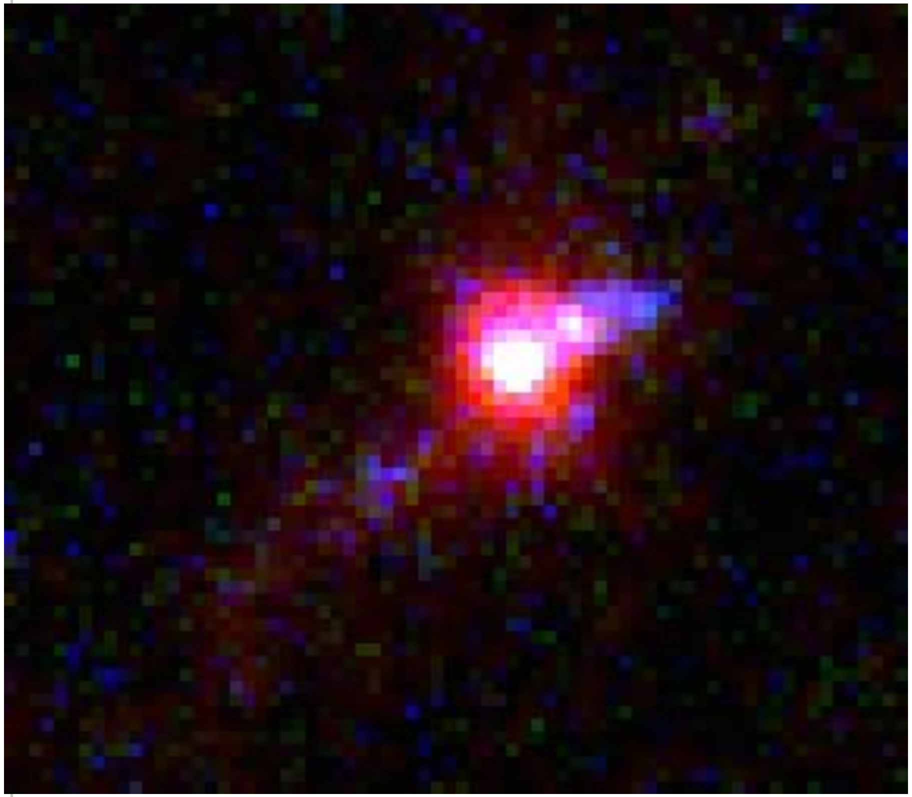


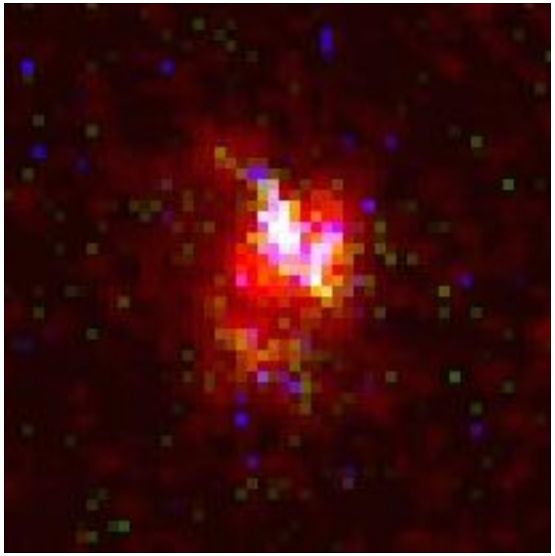
Neighbor(5.5''<r<6.0'')
LBGs
u−[F435W]
[F435W]−[F606W]

The IR Color–Magnitude relation

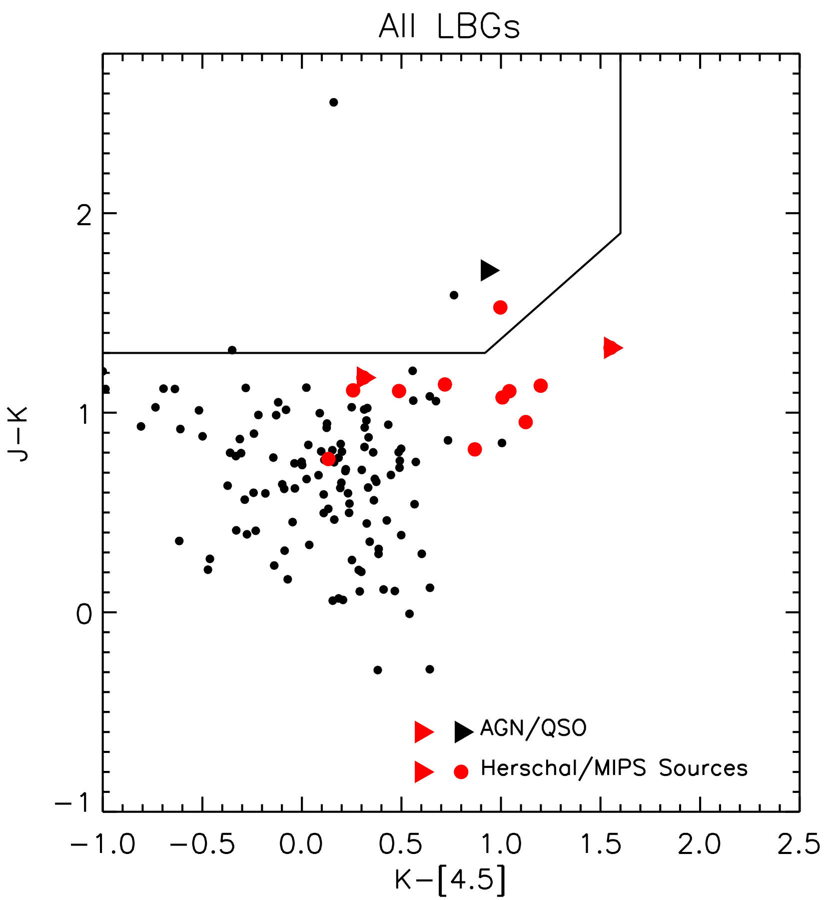


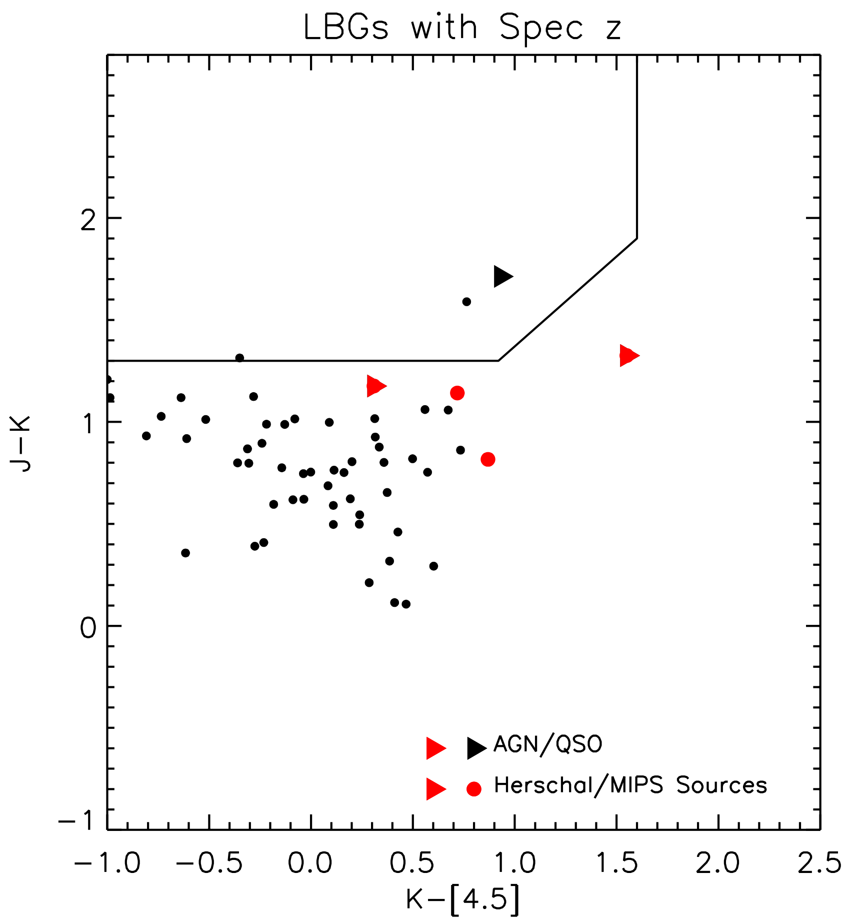
Hidden Stellar Mass for red LBGs





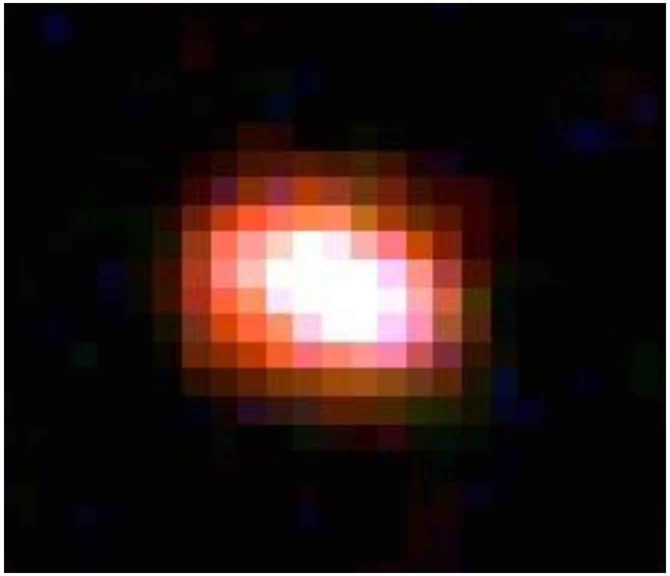
Color–Color diagrams for LBGs in GOODSN



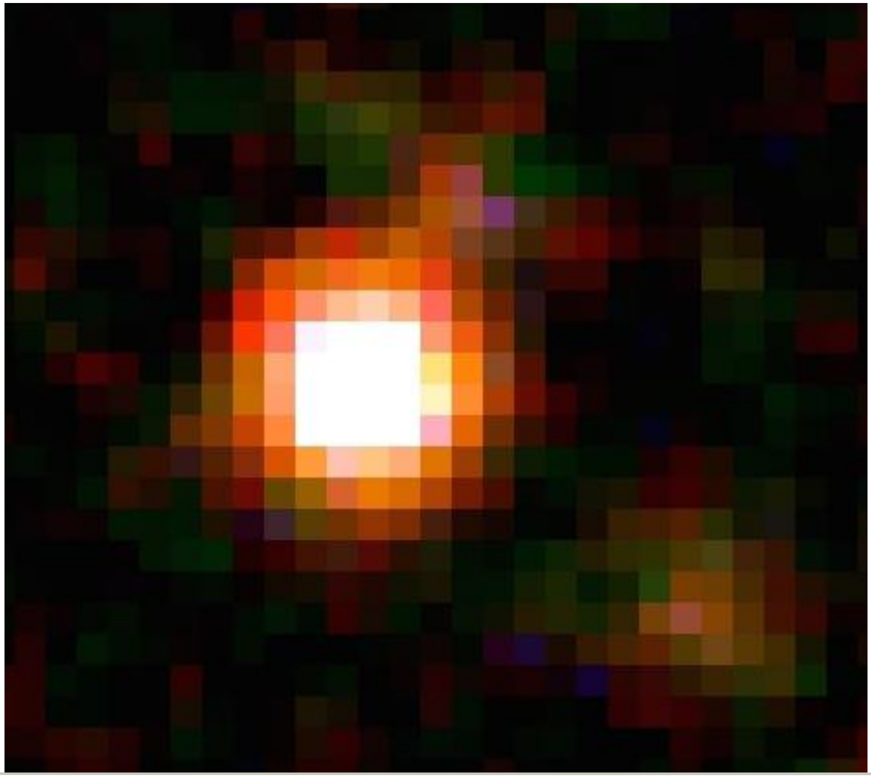


"Red Galaxies" in UV selecetd LBGs?

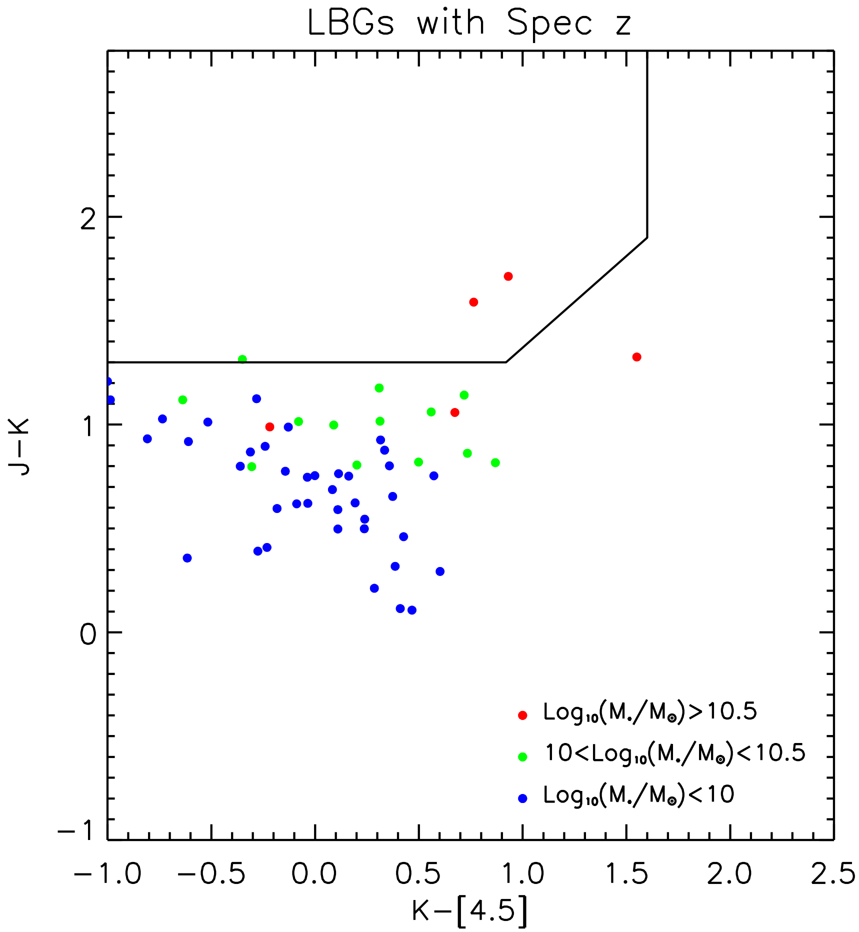
X-ray Source



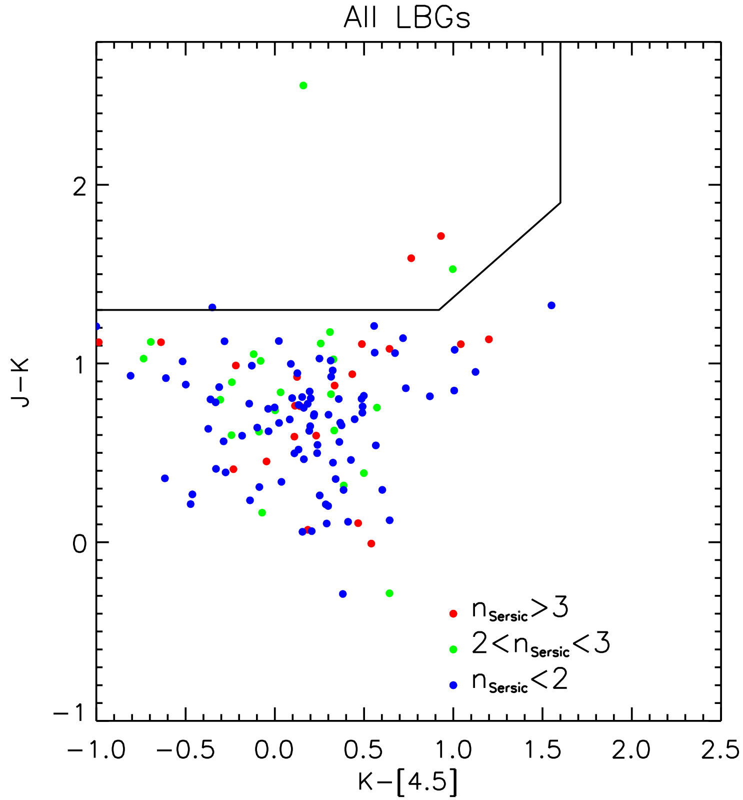
QSO?

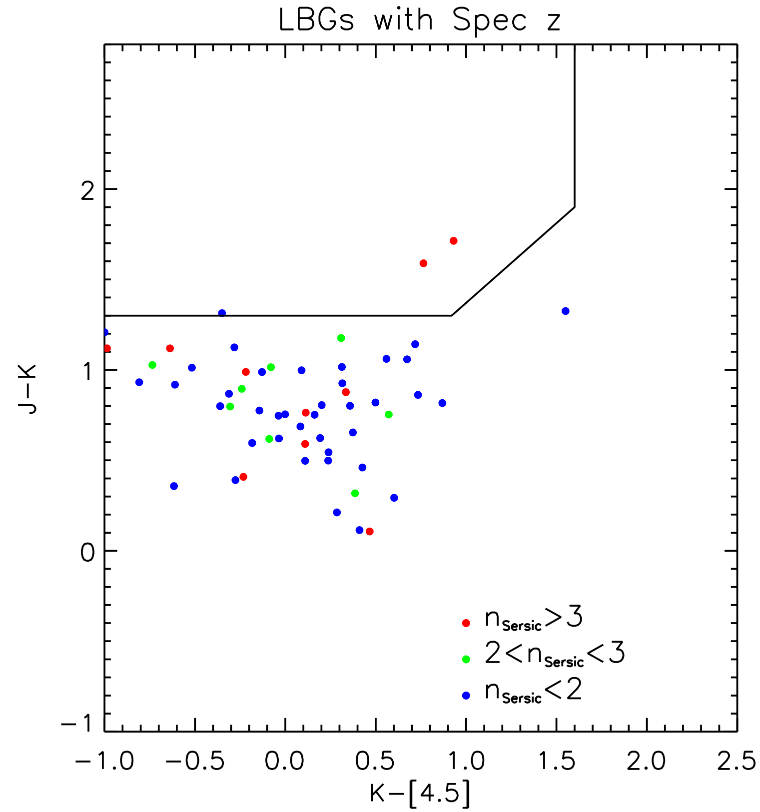


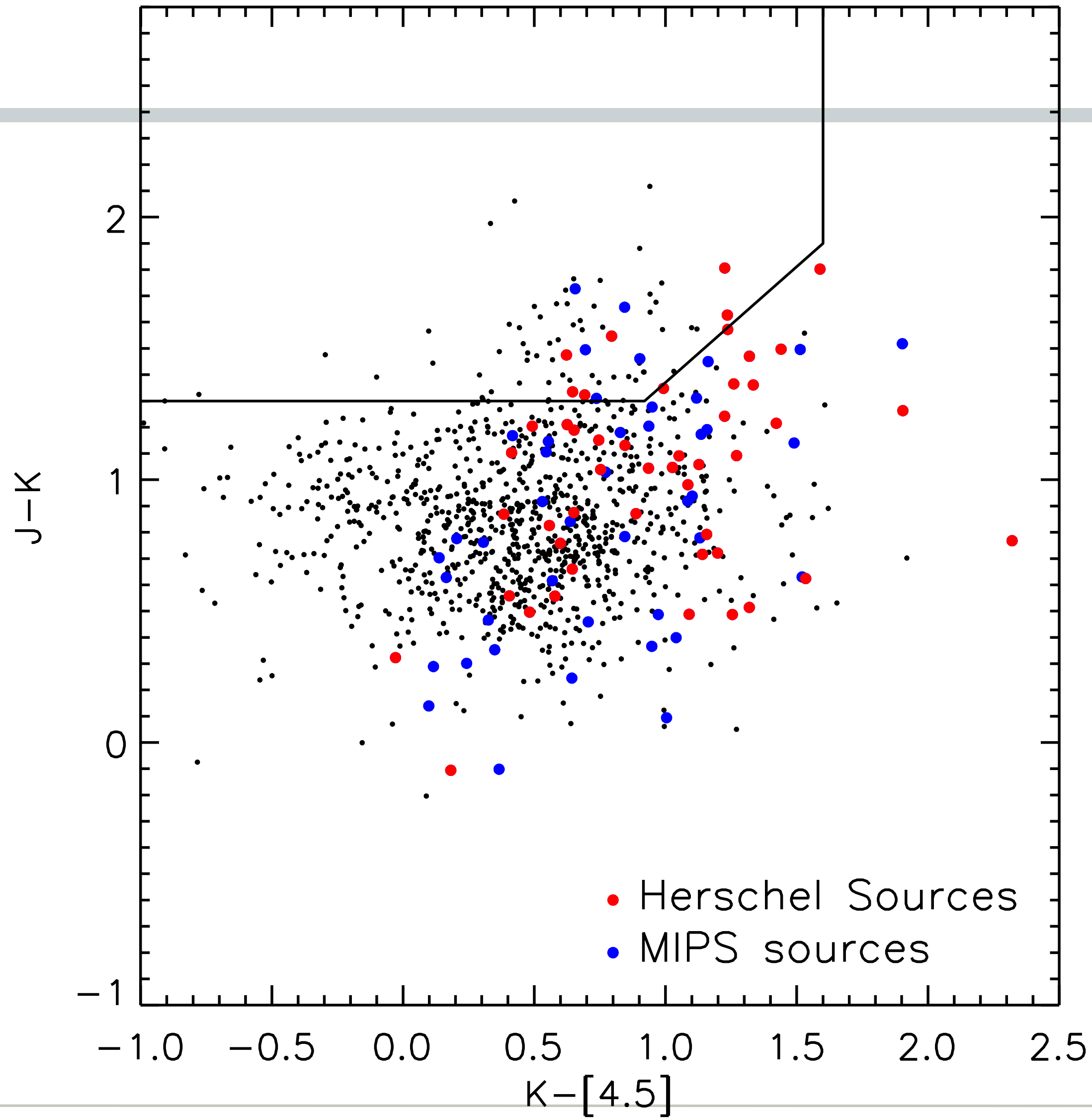
Stellar Mass segregation in the C-C diagram



Sersic Index







Herschel Sources
MIPS sources
J−K
K−[4.5]
−1
0
1
2
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5

Summary

- Lyman Break selection is probably better than photz
- There may be large stellar mass hidden behind dust in LBG.
- There are a few passive galaxies in the LBG sample
- We will detect a sample of ULIRG/HyperLIRG at z=3 with Lyman Break technique.