The Host Galaxies of X-ray AGN

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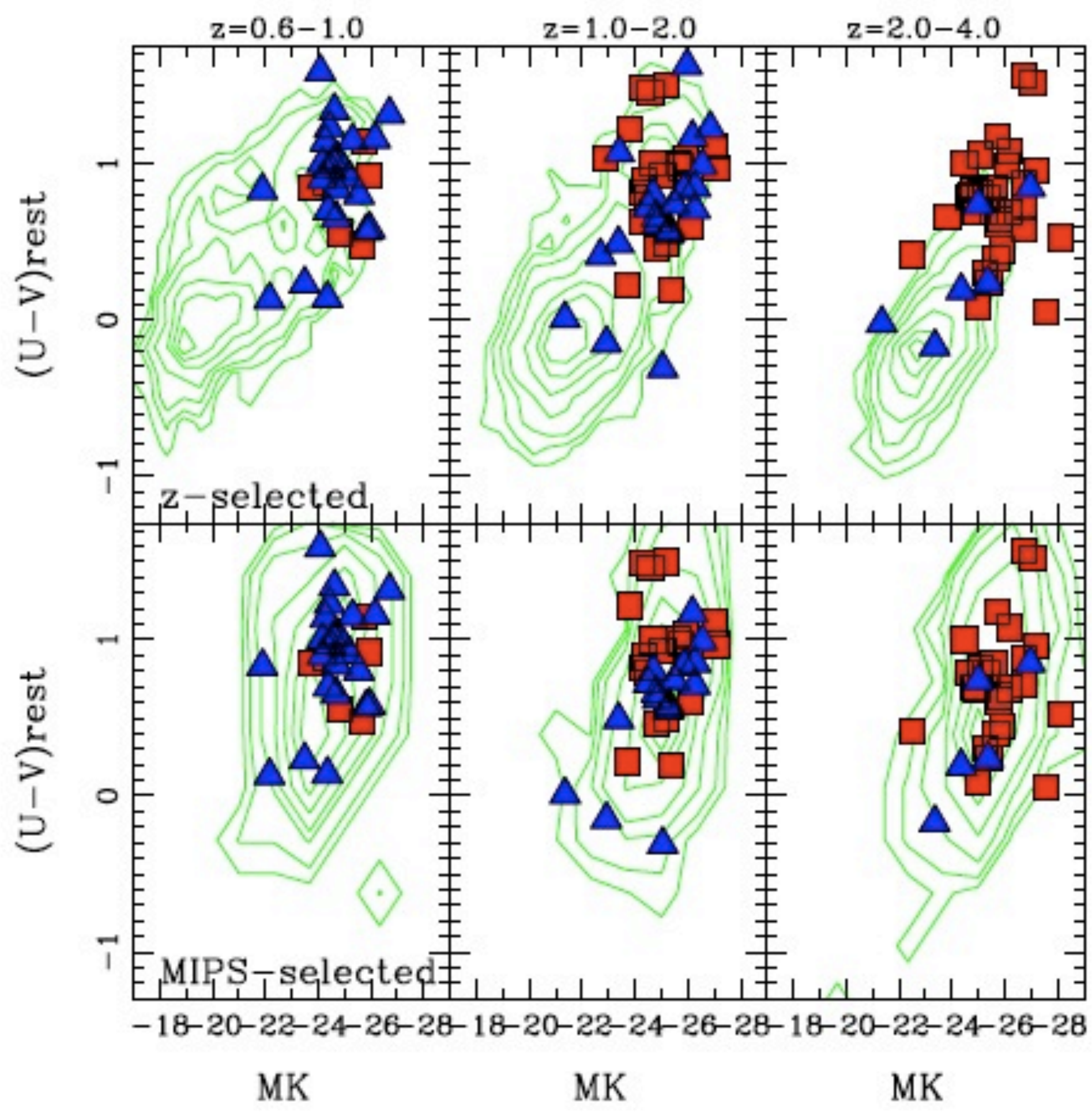
Are AGN Important?

- AGN tend to be in massive/red(ish) galaxies at z<1 (Kauffmann+ 2003, Nandra+ 2007, Brusa+ 2009, Xue+ 2010 -- but see Cardamone+ 2010 on aph)
- Is this the case at z>1? Apparently so (Brusa+ 2009)


z=0.6−1.0
z=1.0−2.0
z=2.0−4.0
z−selected
MIPS−selected
(U−V)rest
1
0
−1
−18
−20
−22
−24
−26
−28
MK

Brusa+ 2009

Are AGN Important?

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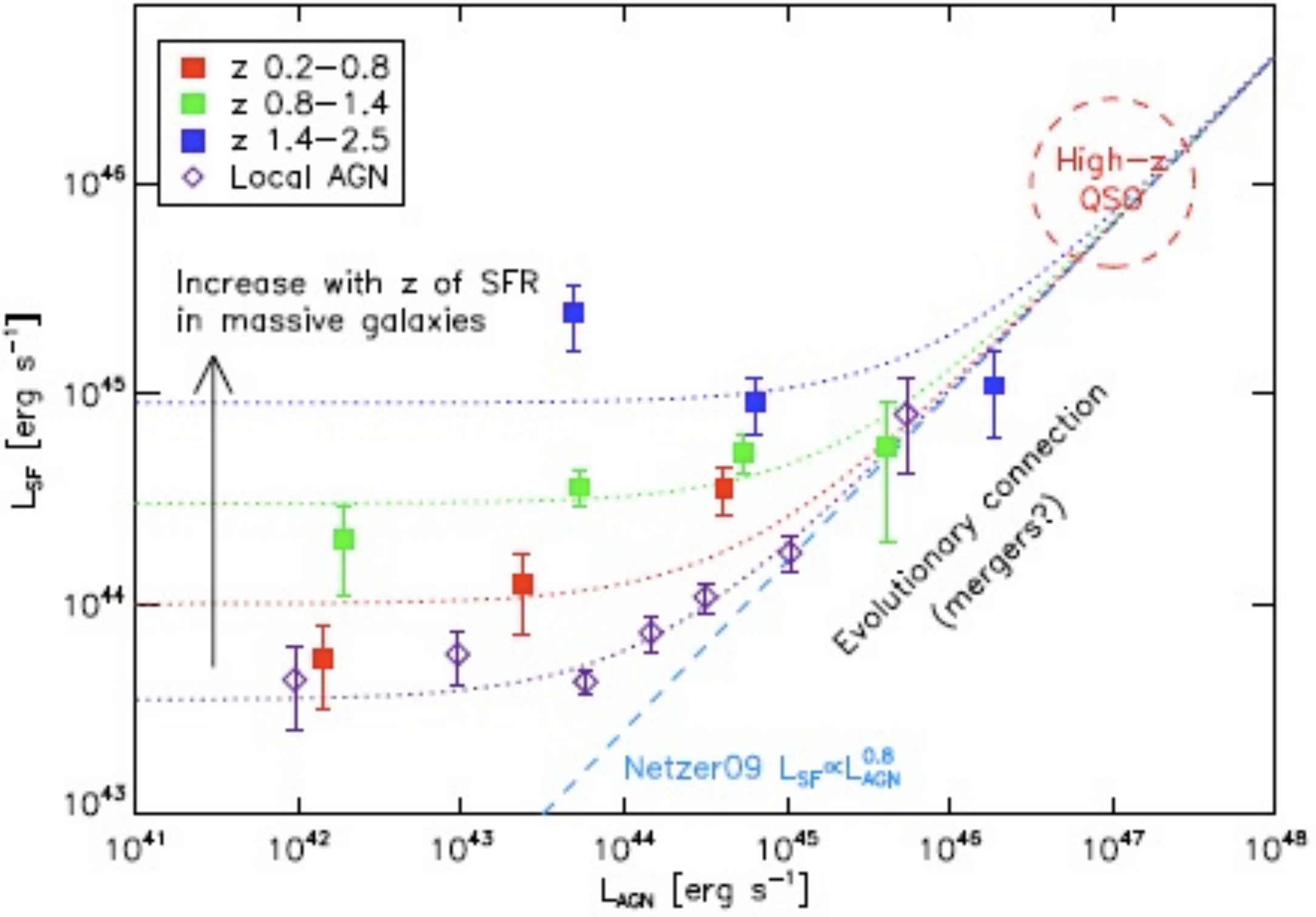
Q: Are AGN responsible for the transition of galaxies from red to blue?


z 0.2–0.8
z 0.8–1.4
z 1.4–2.5
Local AGN
High–z QSO
Increase with z of SFR in massive galaxies
Evolutionary connection (mergers?)
Netzer09 $L_{SF} \propto L_{AGN}^{0.8}$
L_{SF} [erg s^{-1}]
L_{AGN} [erg s^{-1}]
10^{43}
10^{44}
10^{45}
10^{46}
10^{41}
10^{42}
10^{43}
10^{44}
10^{45}
10^{46}
10^{47}
10^{48}

Shao+ 2010

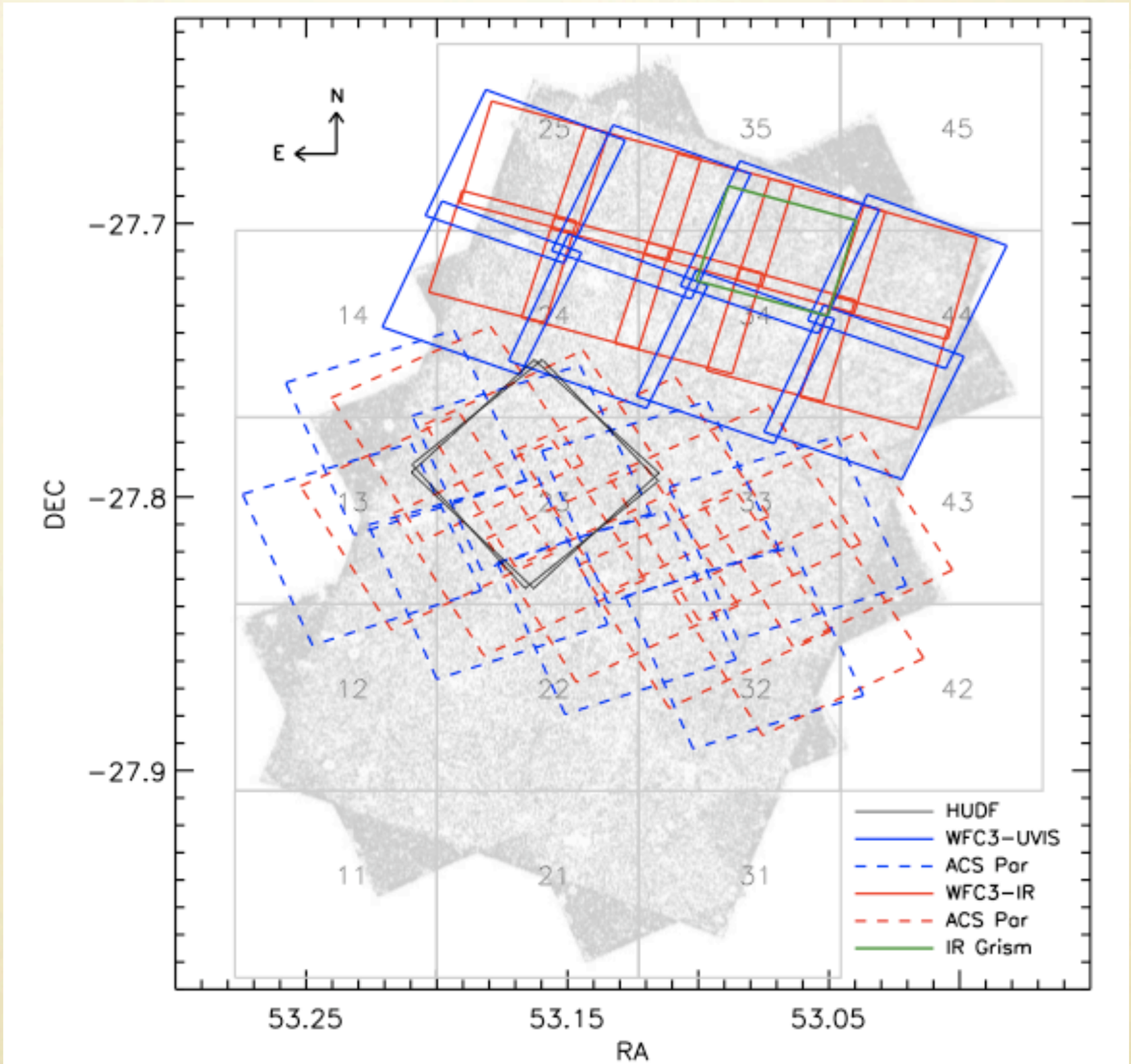
Are AGN Important?

- AGN tend to be in massive/red galaxies at z<1
  (Kauffmann+ 2003, Nandra+ 2007, Brusa+ 2009, Xue+ 2010)
- Is this the case at z>1? Apparently so (Brusa+ 2009)

Q: Are AGN responsible for the transition of galaxies from red to blue?

- Uncovering the stellar content of AGN hosts -- free of nuclear emission -- is key. Deep, high resolution NIR imaging is needed.

WFC3 ERS-2



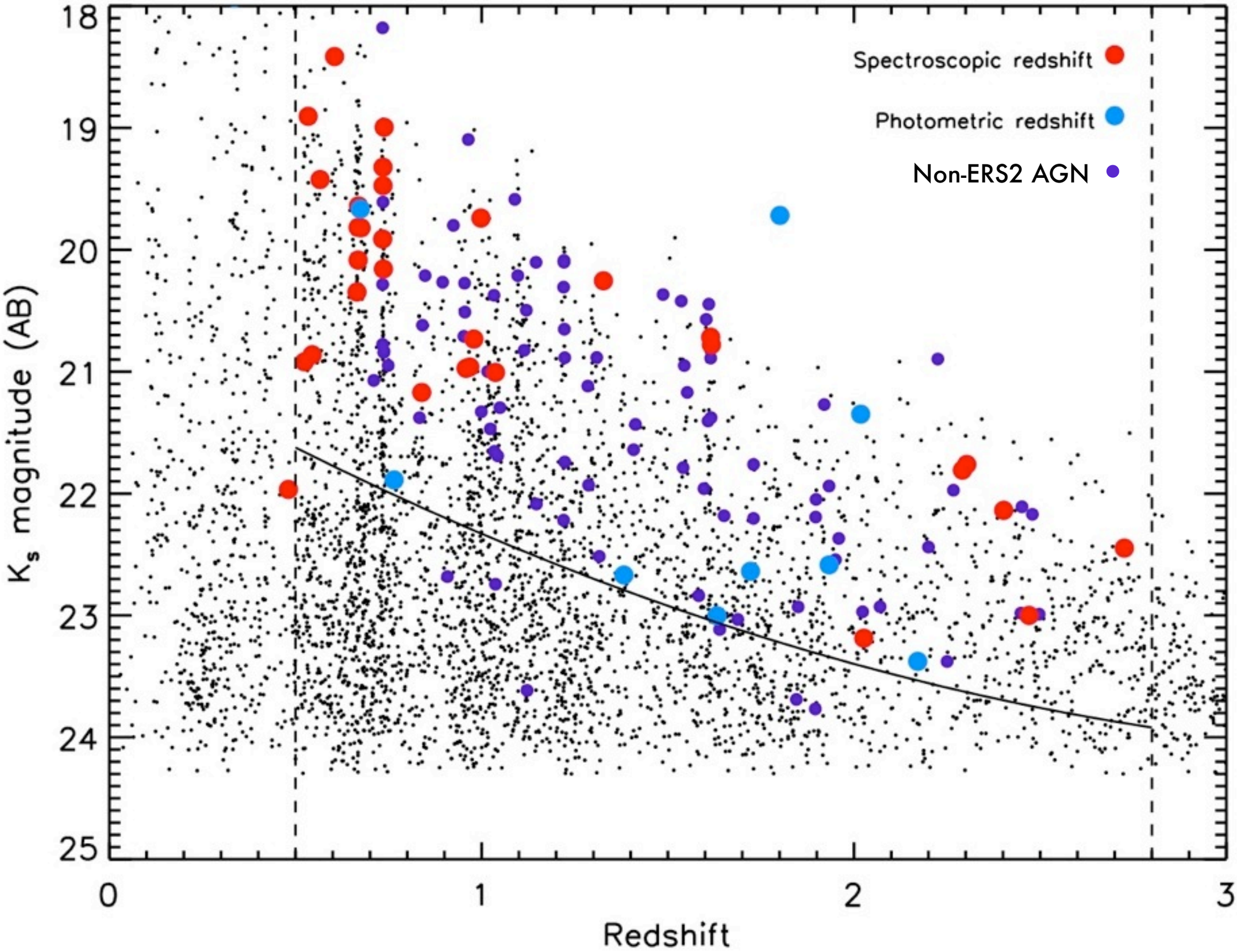
Windhorst+ 2010

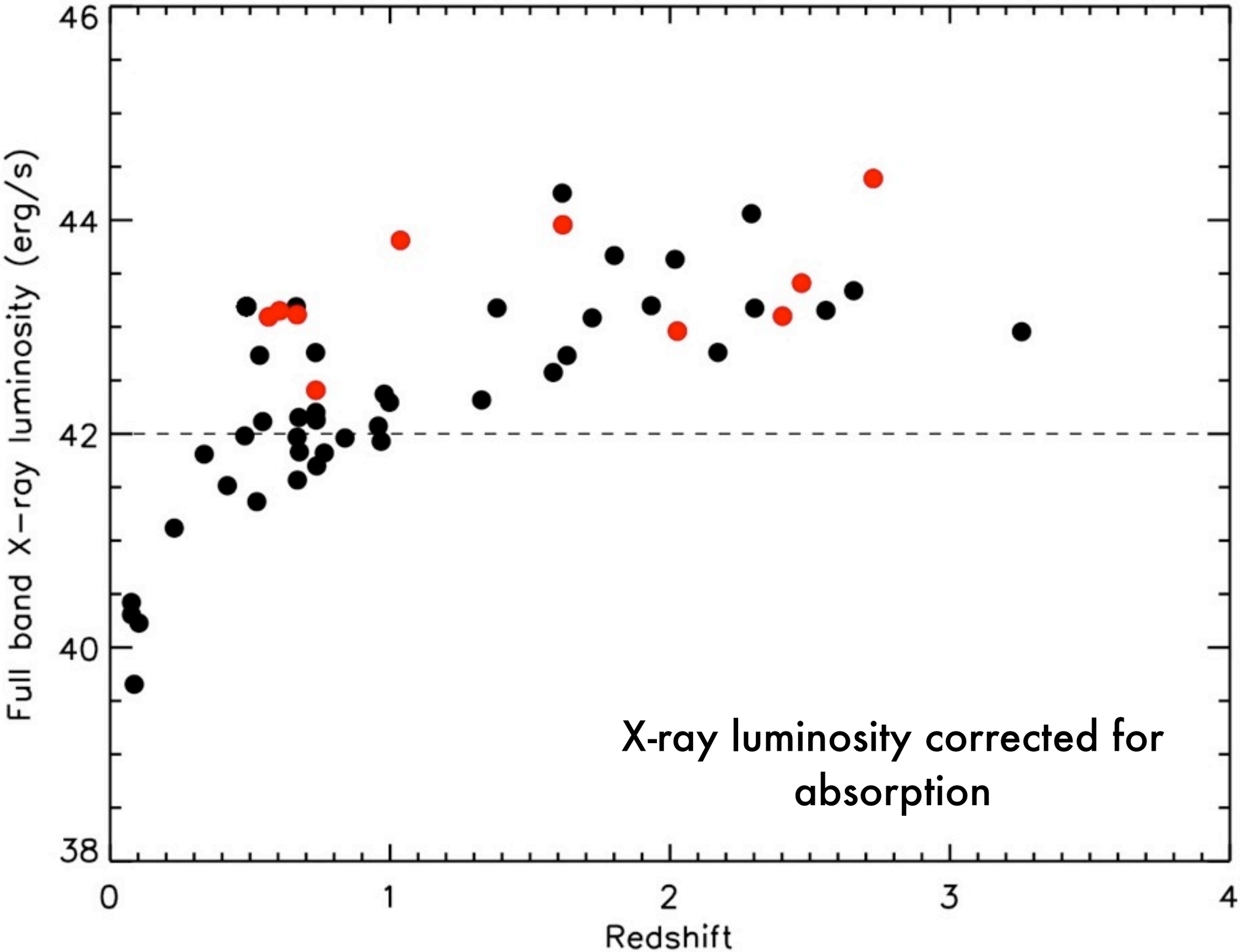
WFC3 ERS-2

~ 30 sq-arcmin 7500 sources Overlaps with CDF-S

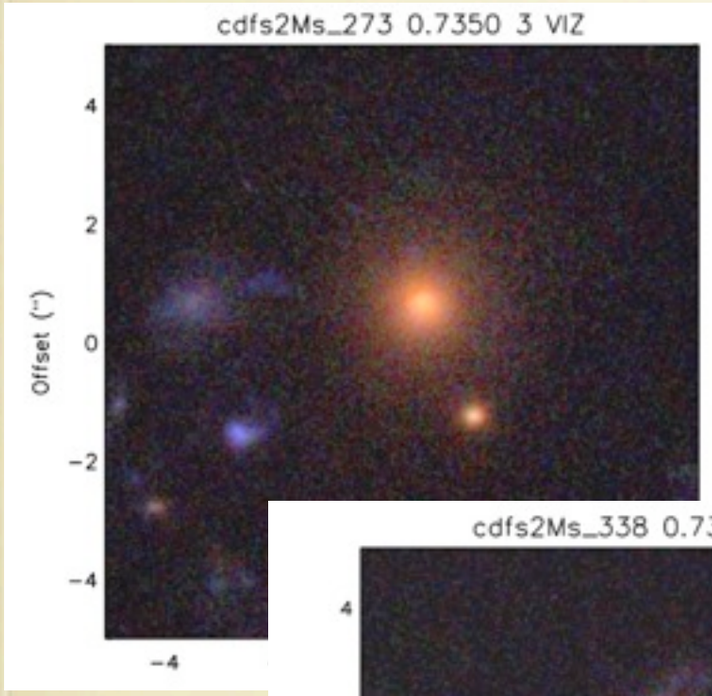
Datasets

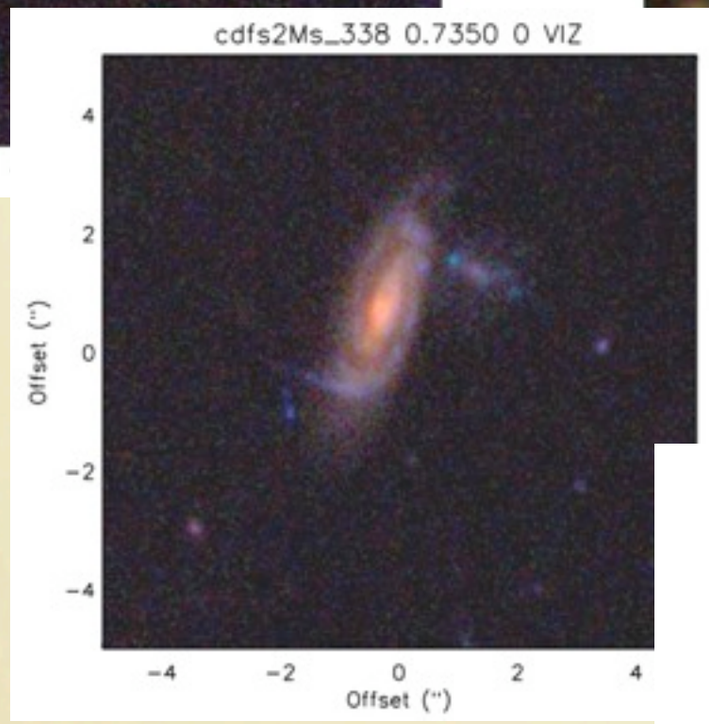
- WFC3 YJH mosaics of the ERS2 region
  F098M, F125W, F160W
- Chandra/ACIS CDF-S 2 Ms source catalog, re-reduced by Imperial X-ray group.
- Publicly available GOODS v2.0 ACS images.
  F435W, F606W, F775W, F850LP
- FIREWORKS K-selected multi-wavelength and redshift catalog (Wuyts+ 2008).

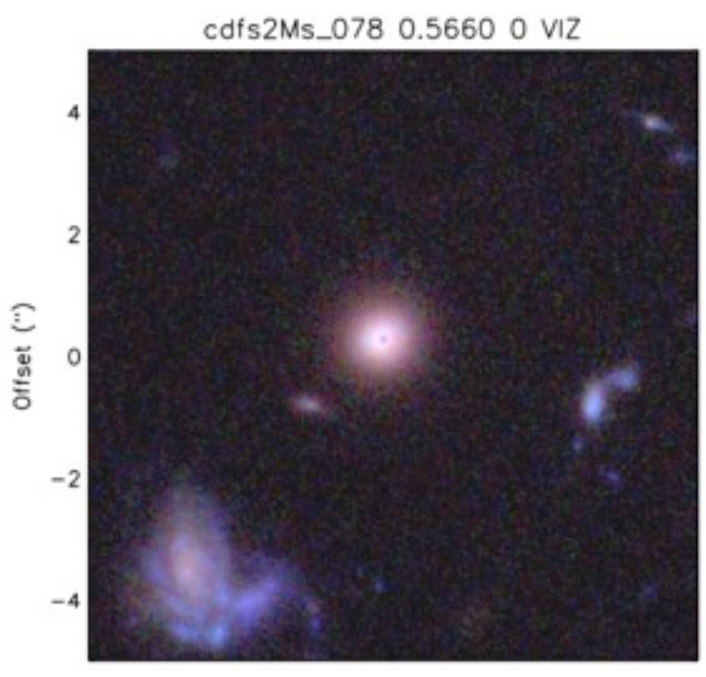

Spectroscopic redshift
Photometric redshift
Non-ERS2 AGN
K_s magnitude (AB)
18
19
20
21
22
23
24
25
0
1
2
3
Redshift

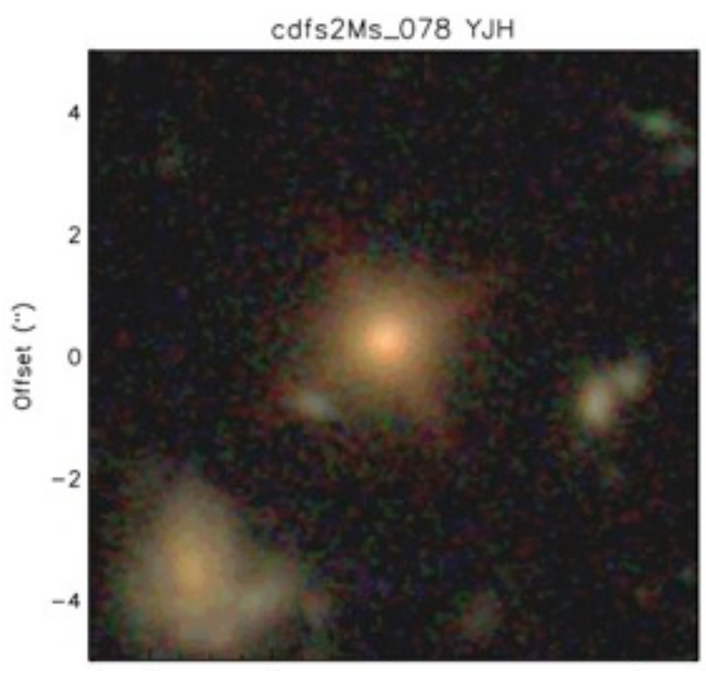

46
44
42
40
38
Full band X-ray luminosity (erg/s)
0
1
2
3
4
Redshift
X-ray luminosity corrected for absorption

Low Redshift AGN (0.5 < z< 1.5)

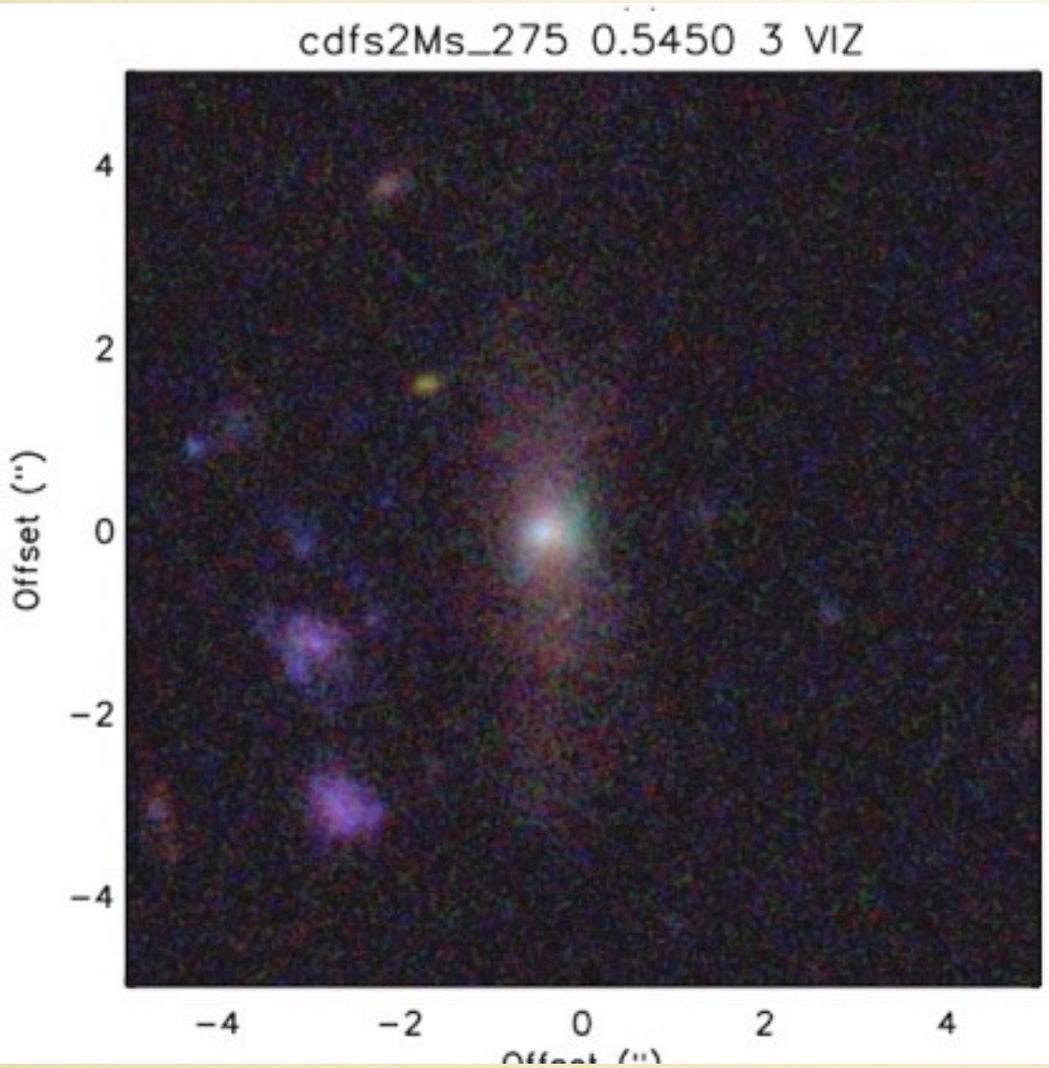


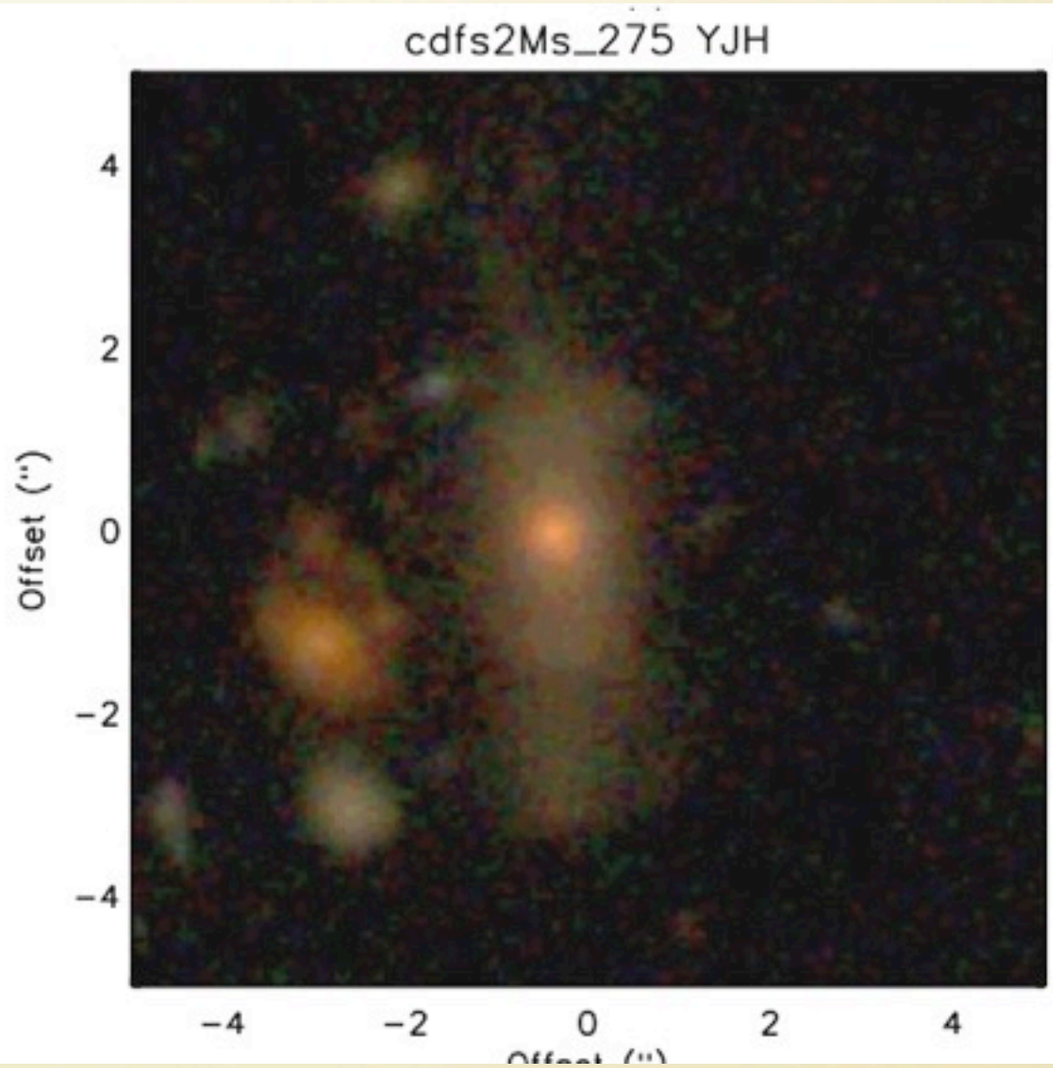




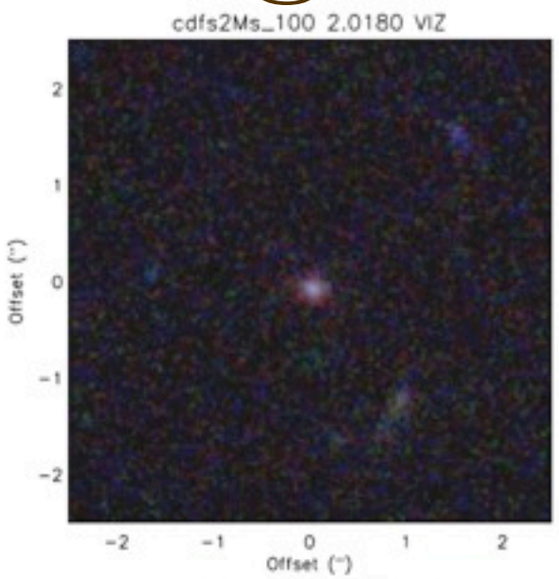


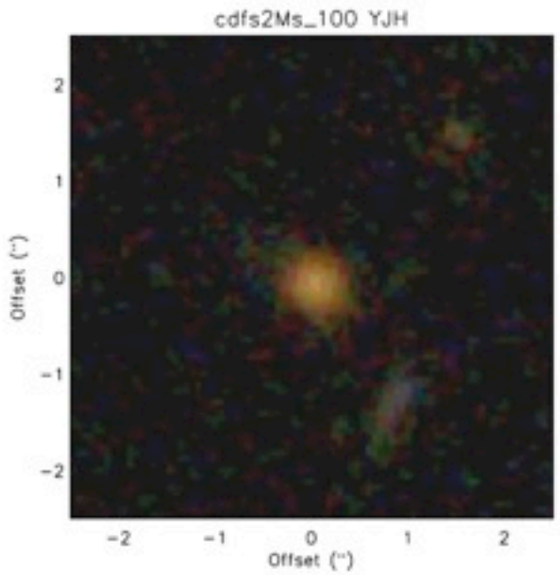
Low Redshift AGN (0.5 < z< 1.5)

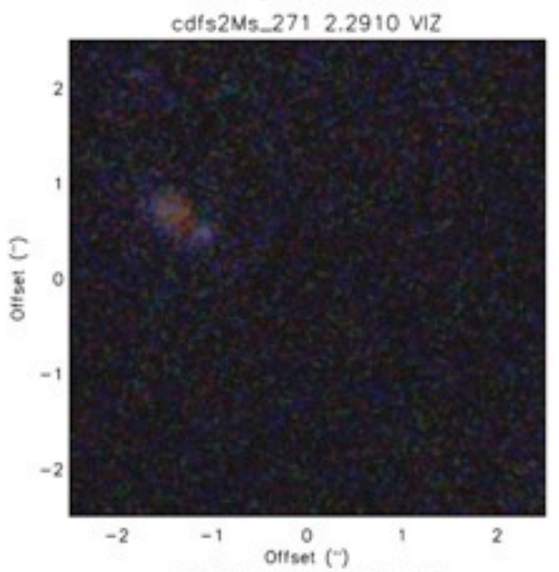


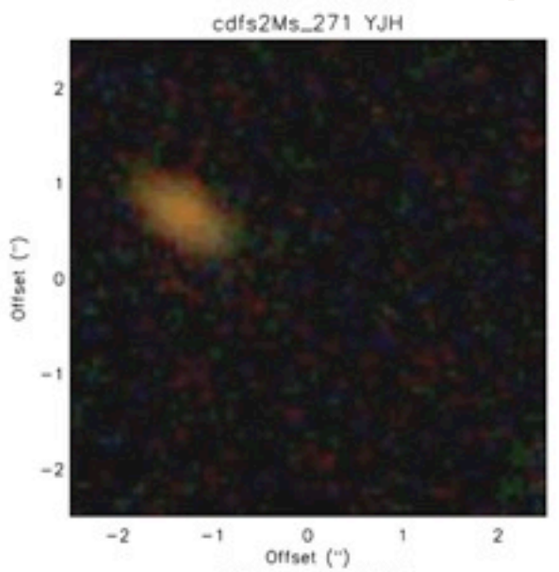


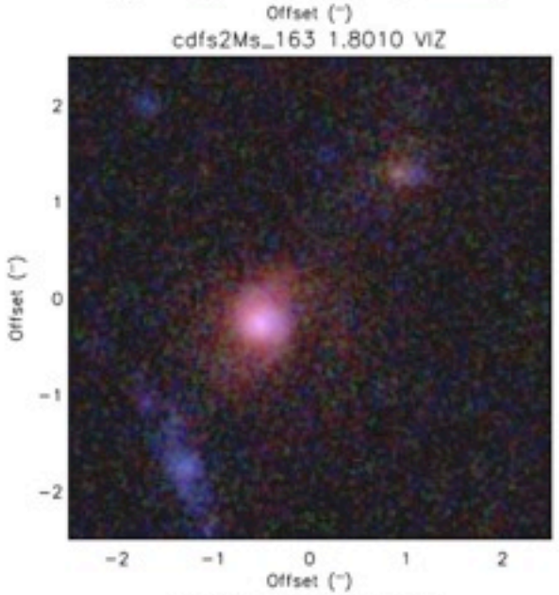
High Redshift AGN (1.5 < z< 3.0)

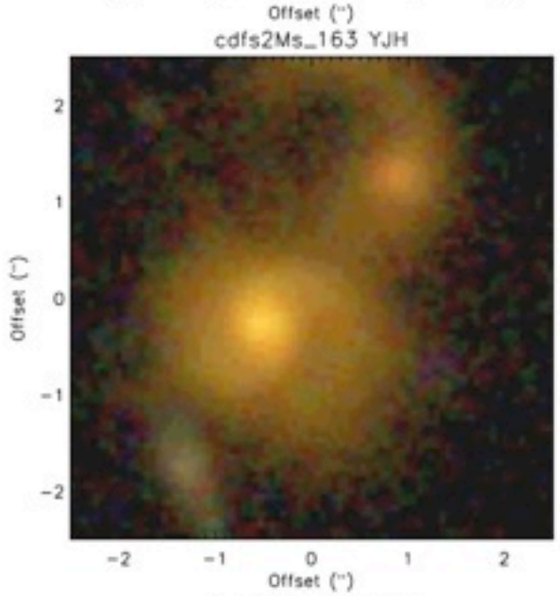


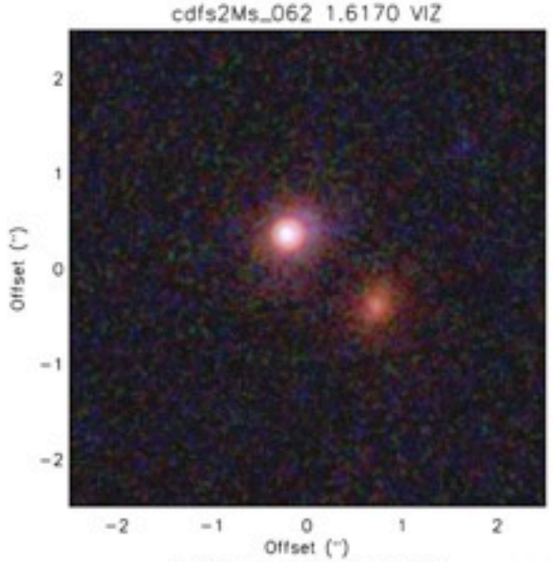


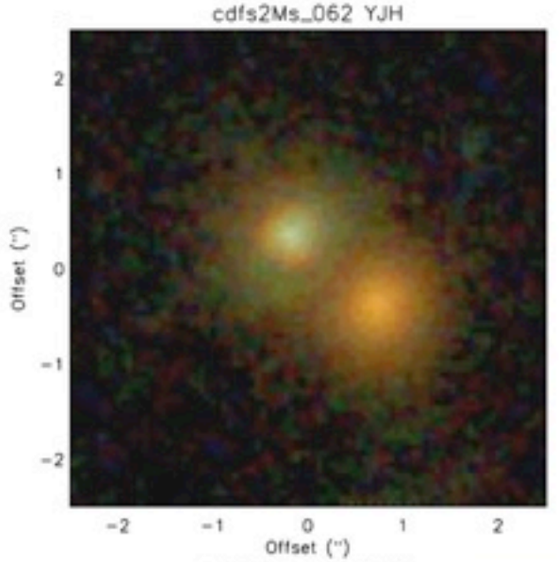


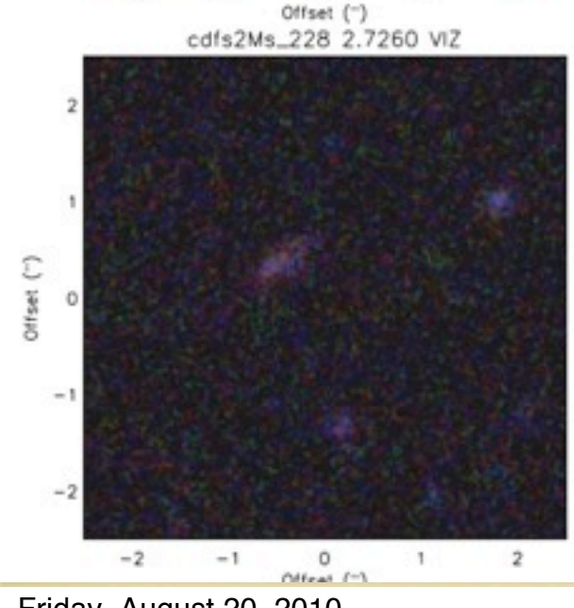


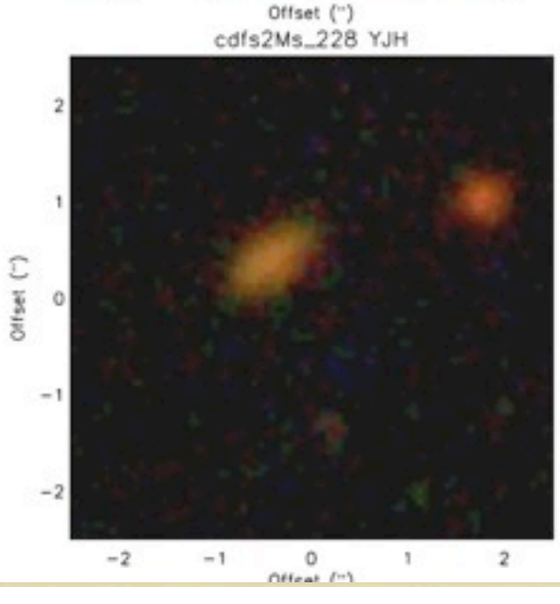


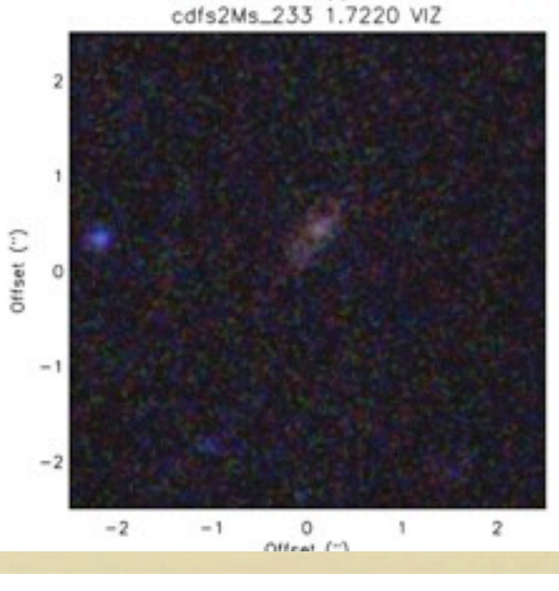


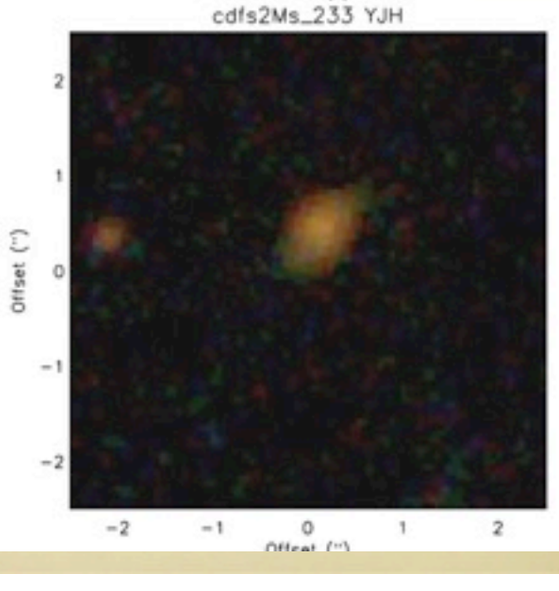




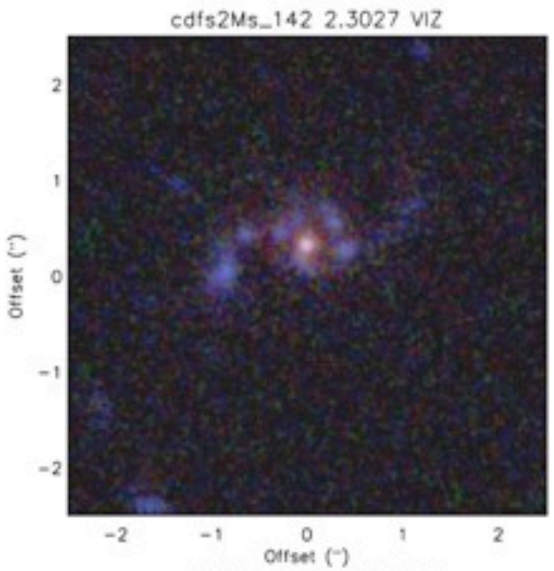


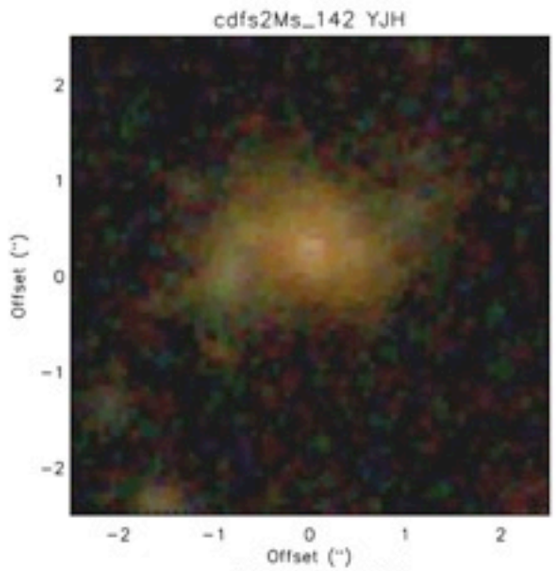


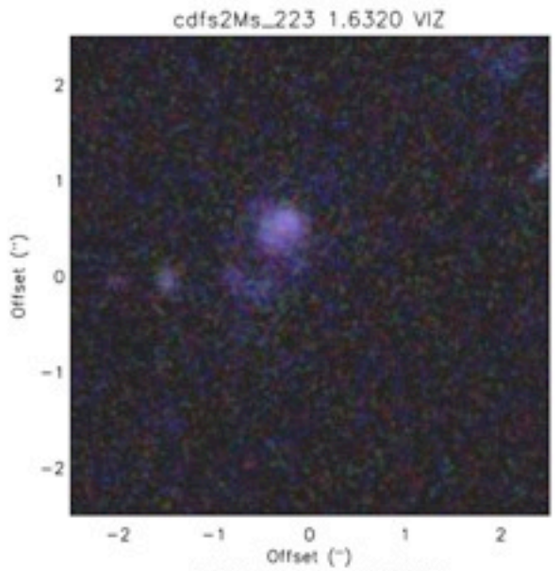


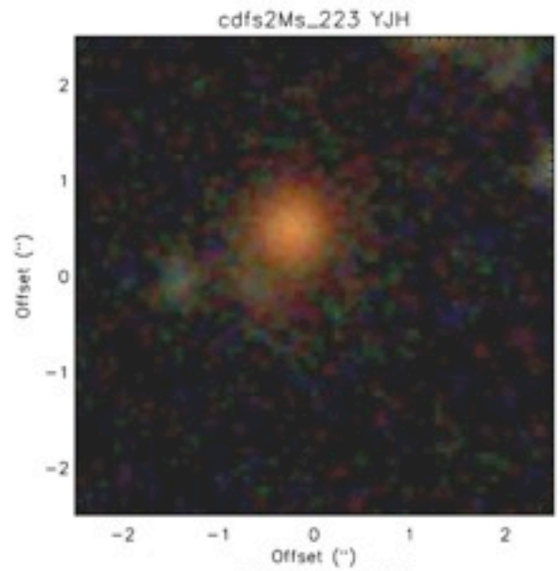


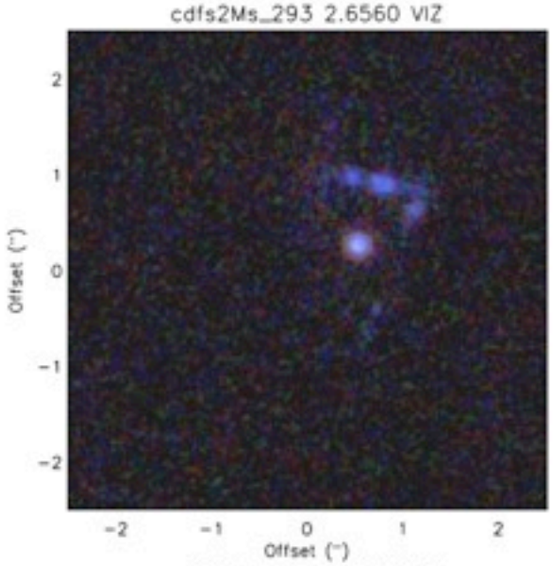
High Redshift AGN (1.5 < z< 3.0)

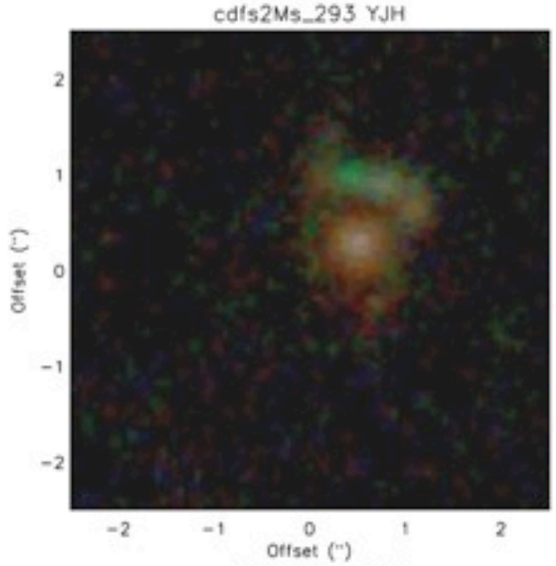


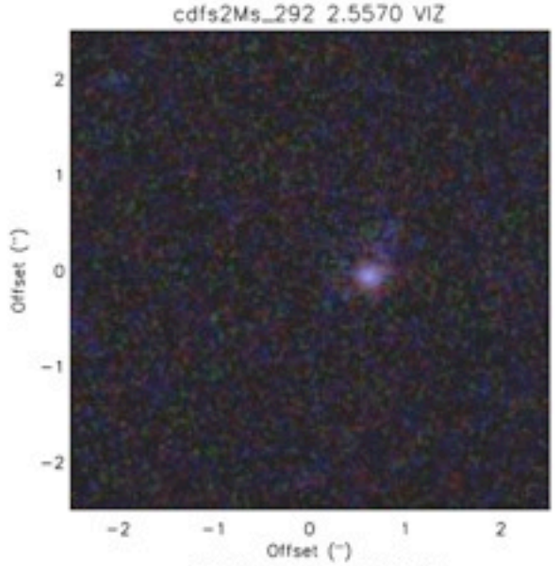


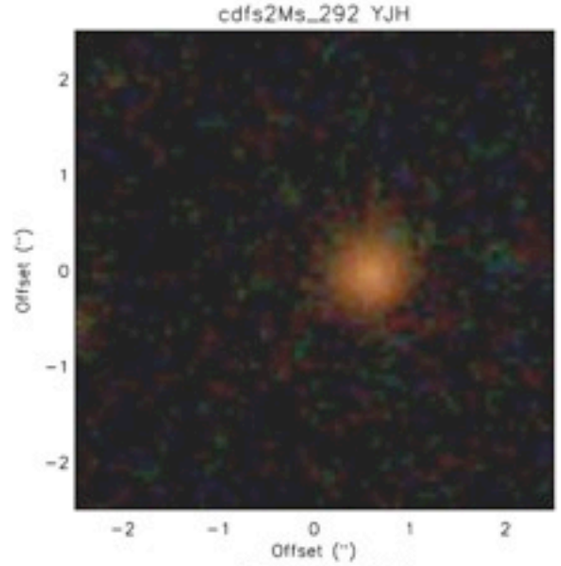


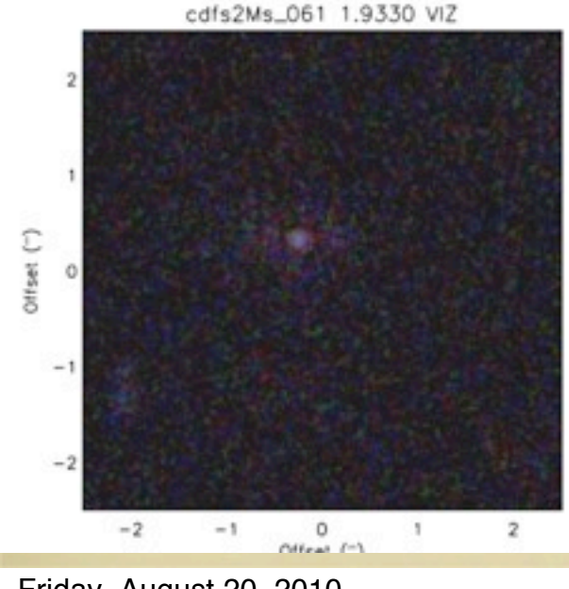


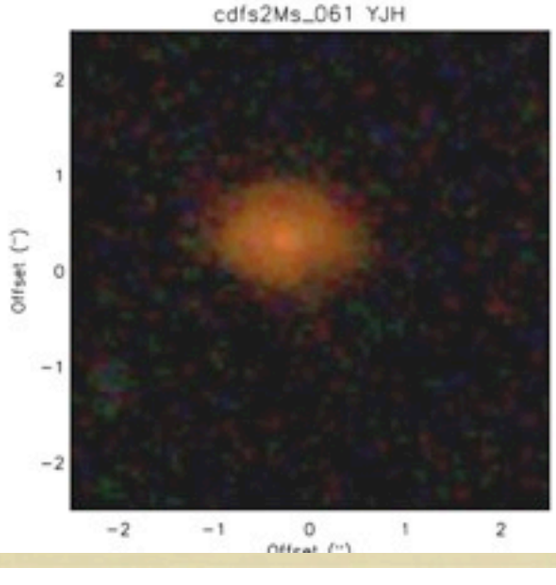


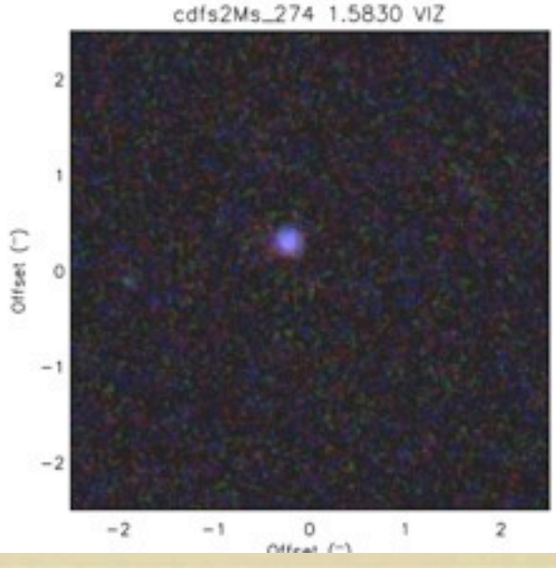


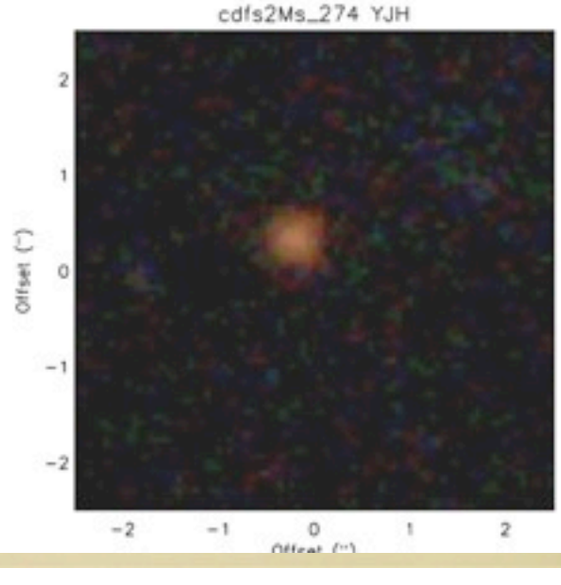












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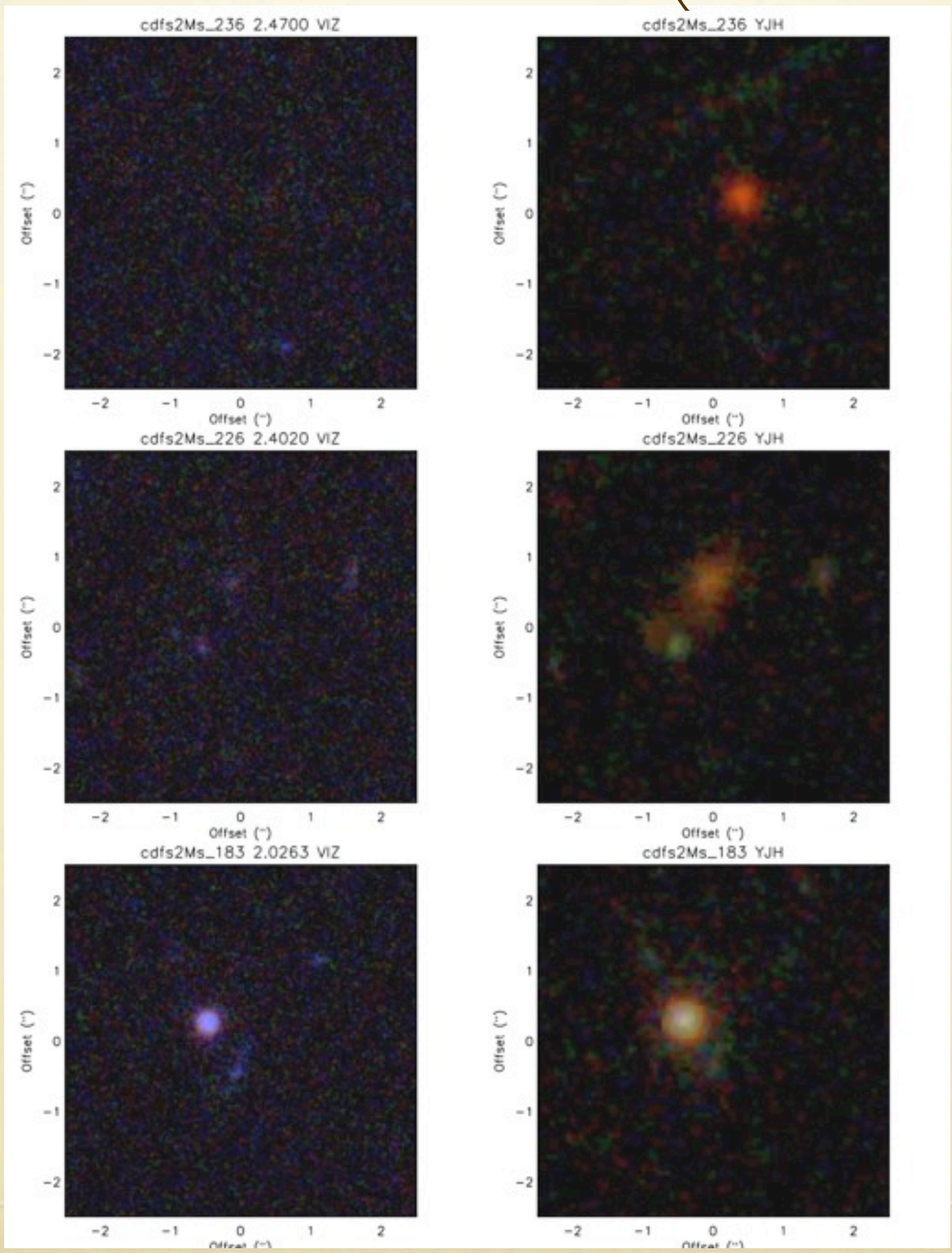
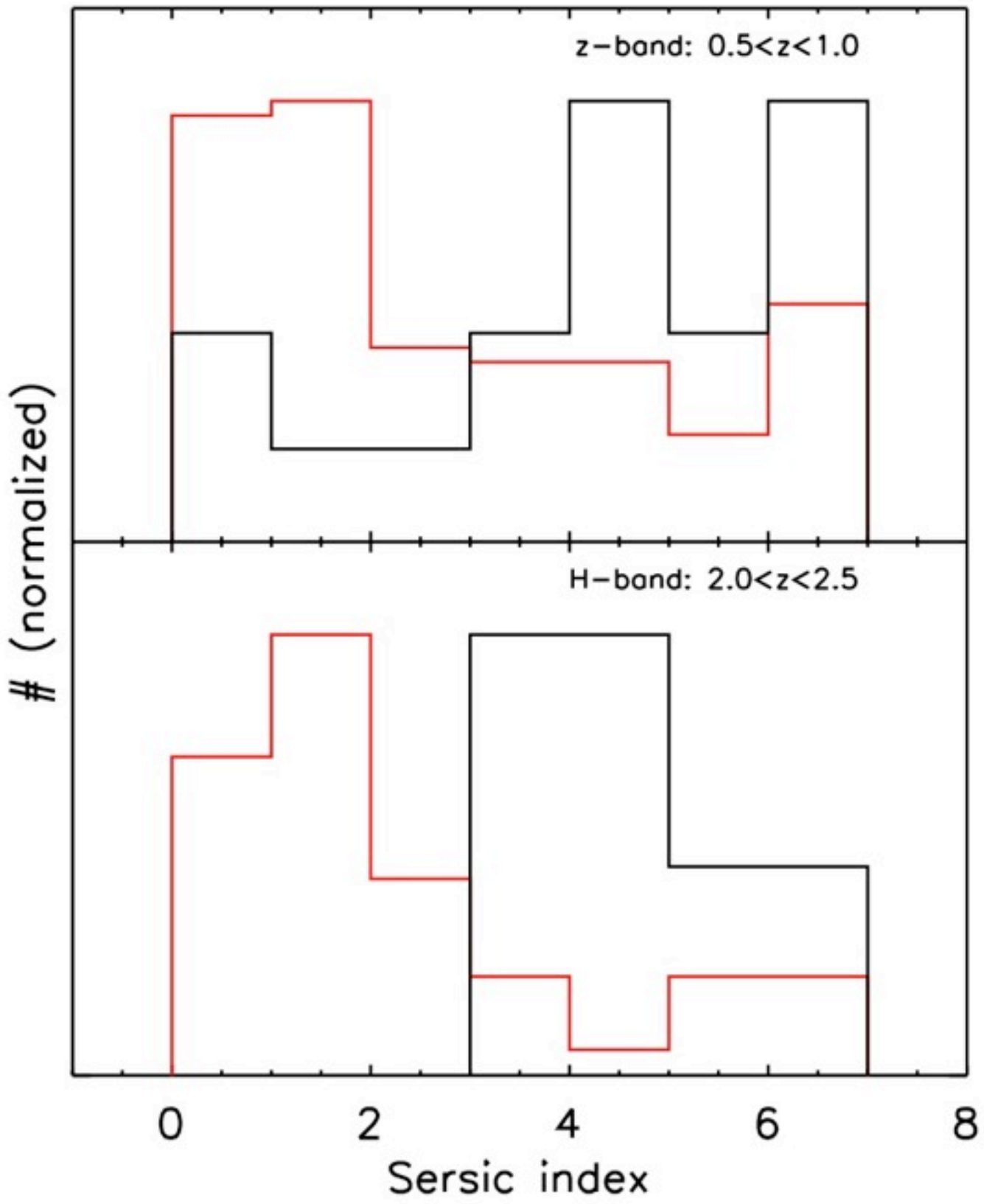


Structure of high-z AGN

Low-z and High-z AGN compared at similar rest-frame bands.

AGN are mostly in high sersic (bulgy) systems, especially at z~2.



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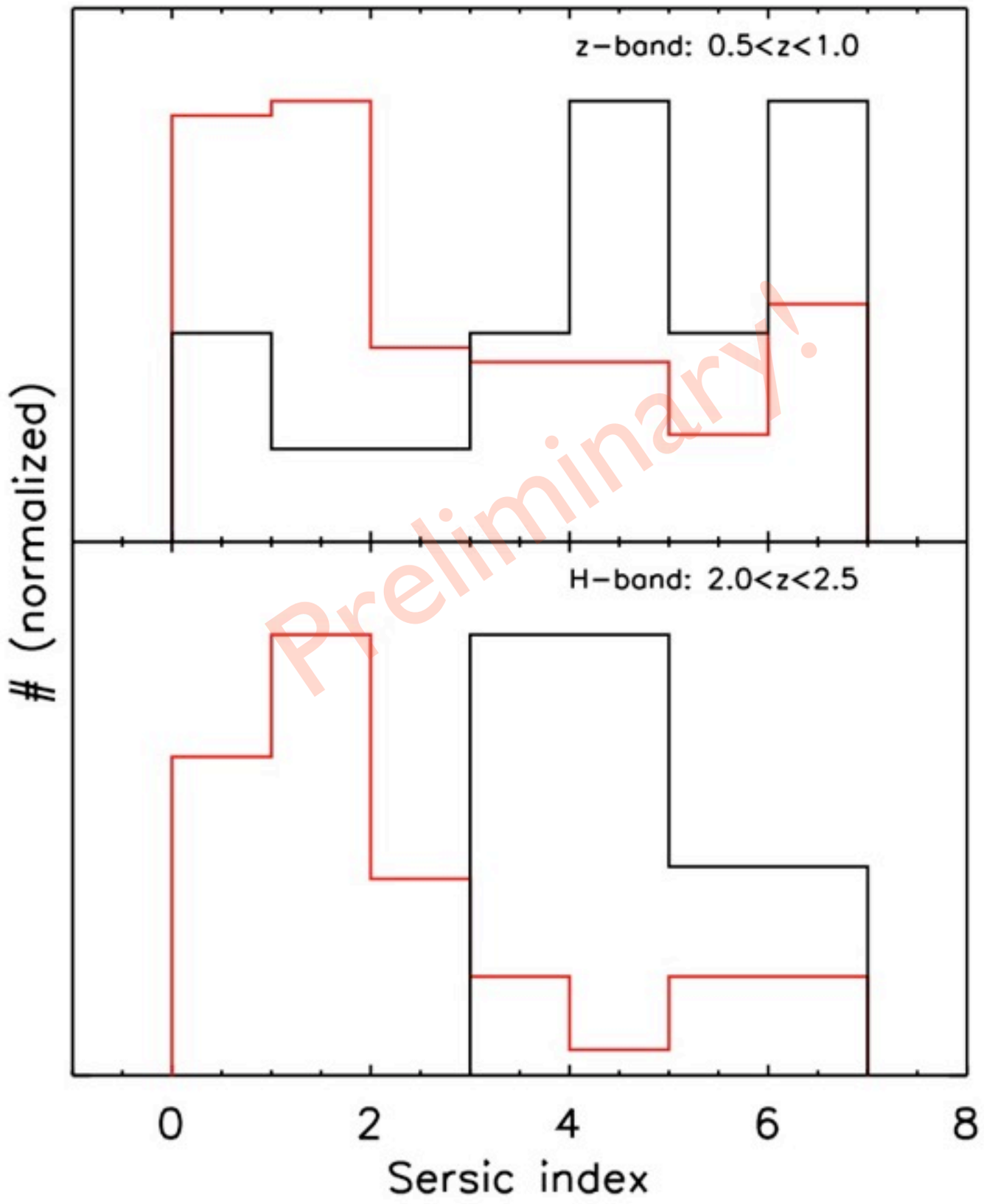
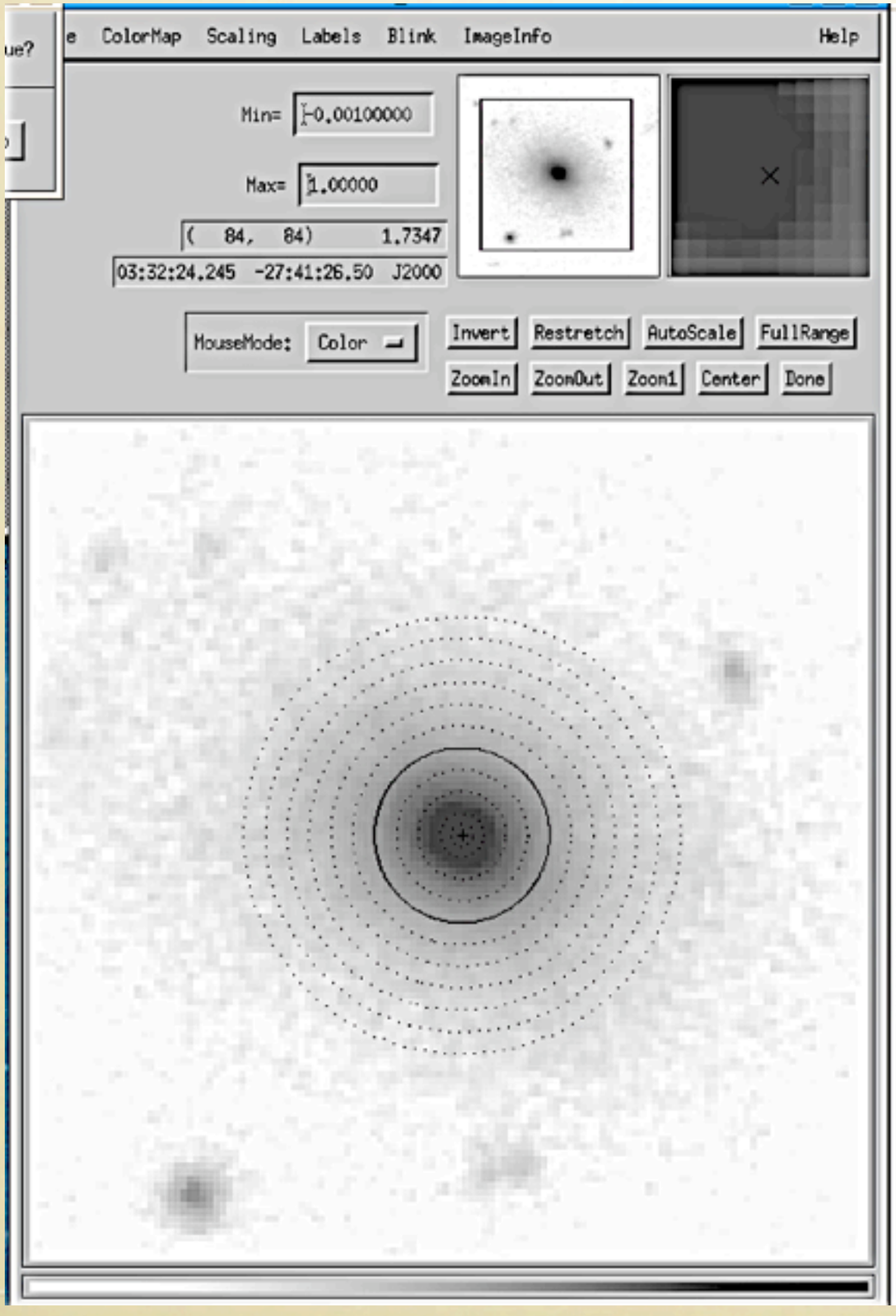
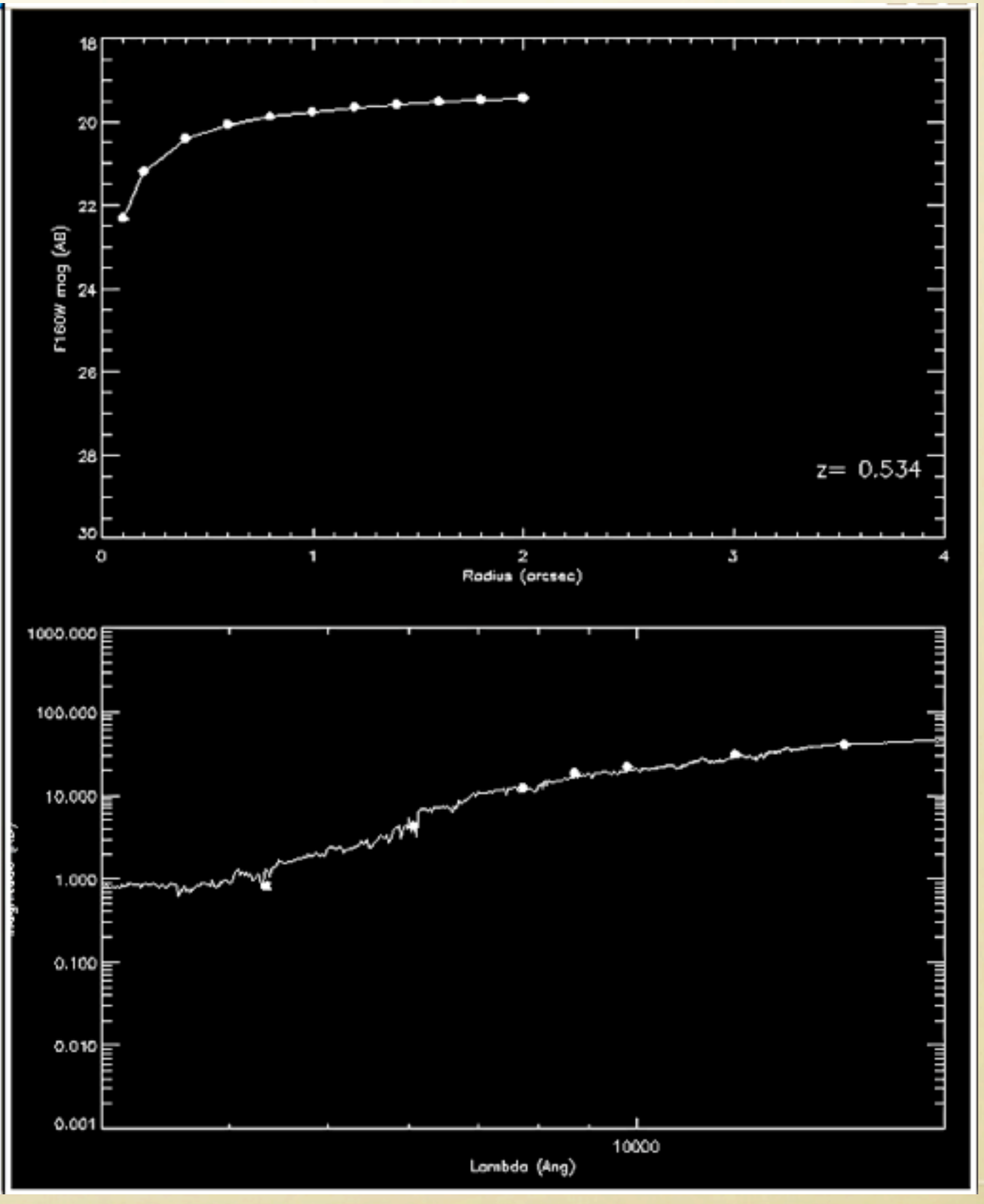
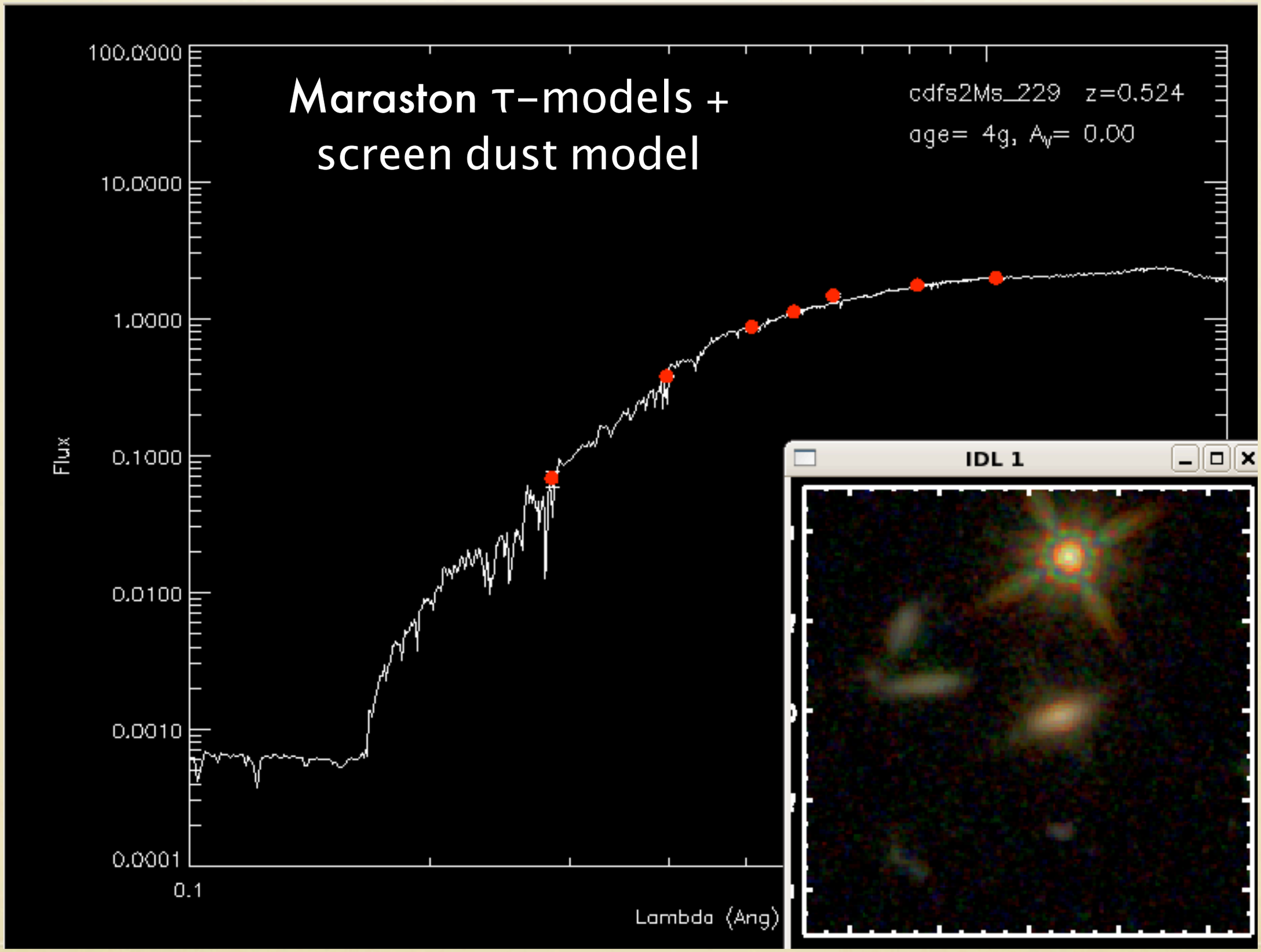


Circular Aperture Photometry





Stellar population synthesis model fits

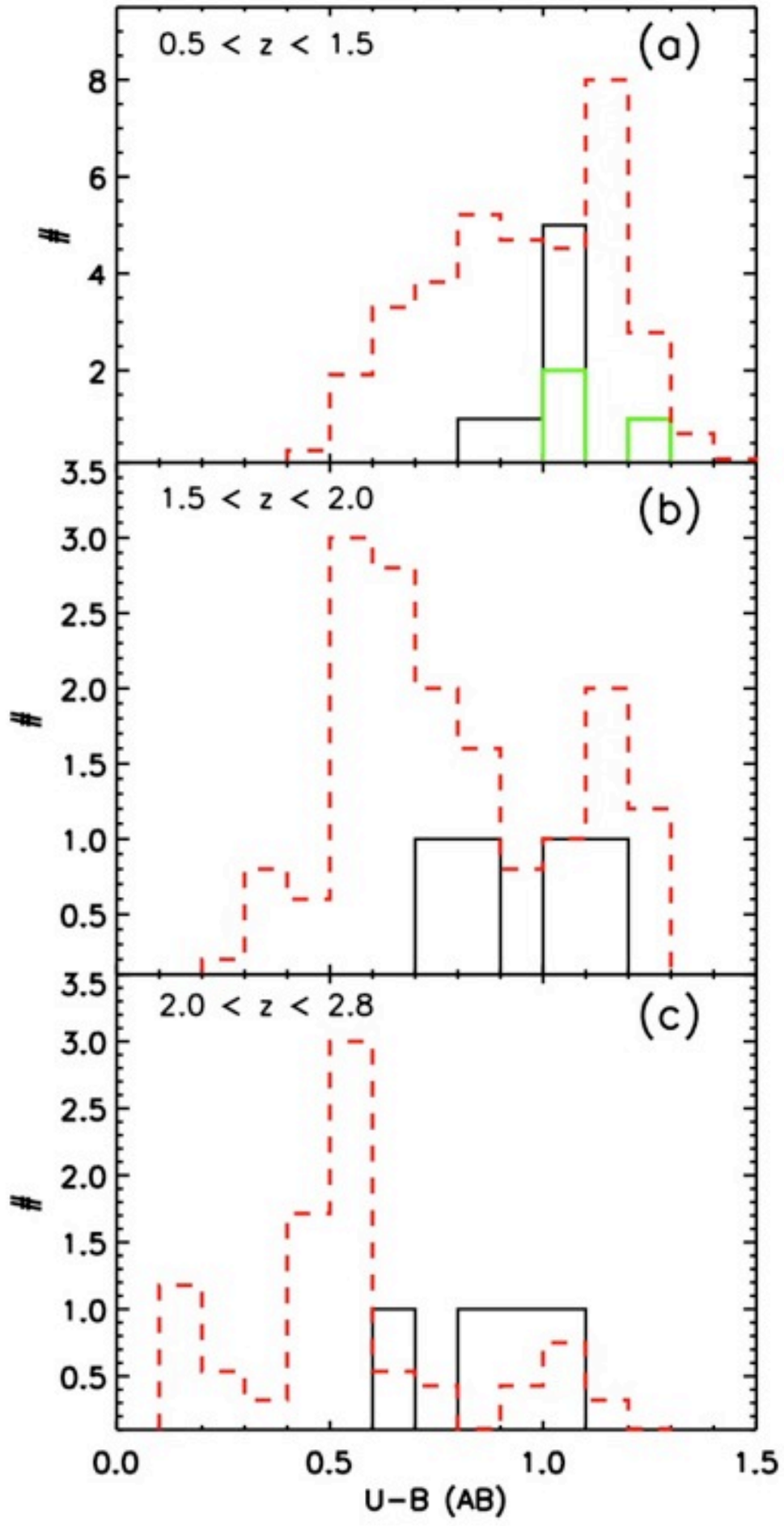


Rest-frame Extended Colors

Colors measured directly from the stellar population model that best fits the 7-band photometry in an annulus of radius 0.2” - 0.6”.

Mean colors are bluer at high redshifts.

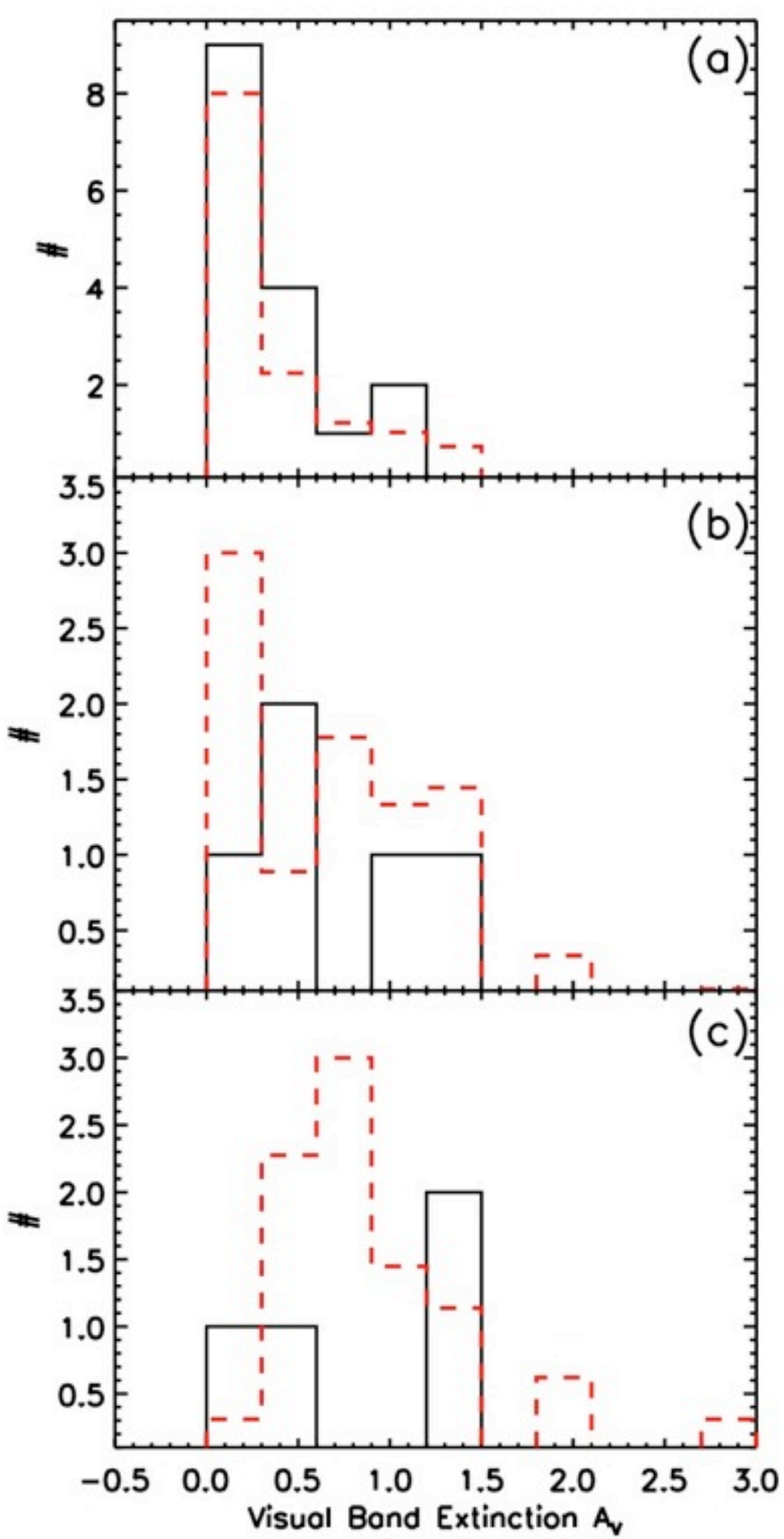
AGN extended colors span the ‘red-green’ part of the galaxy color distribution even at z~3.



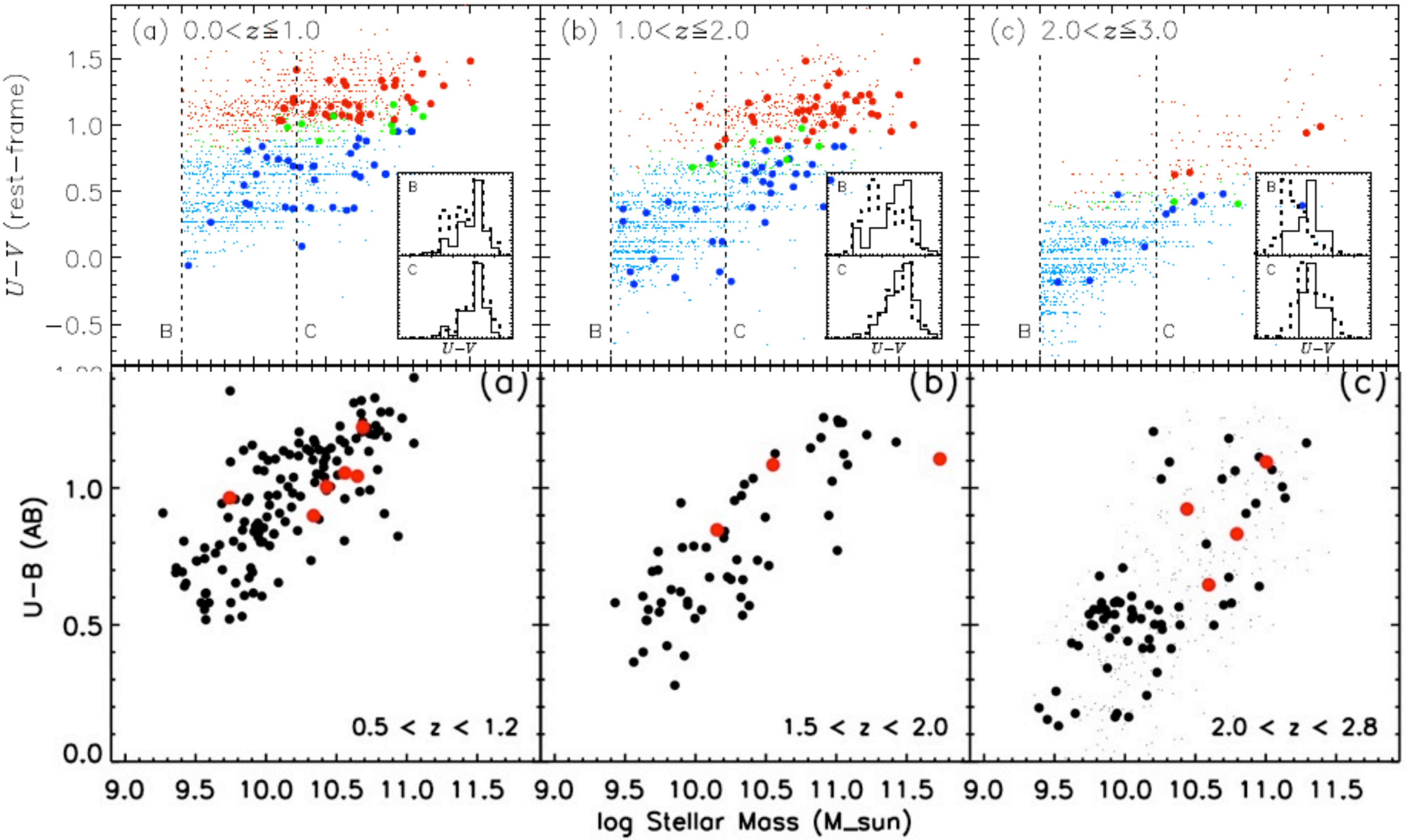
Are variations in color due to dust?

The characteristic extinction of AGN at z~1 is lower than at z~2, but the range is similar.

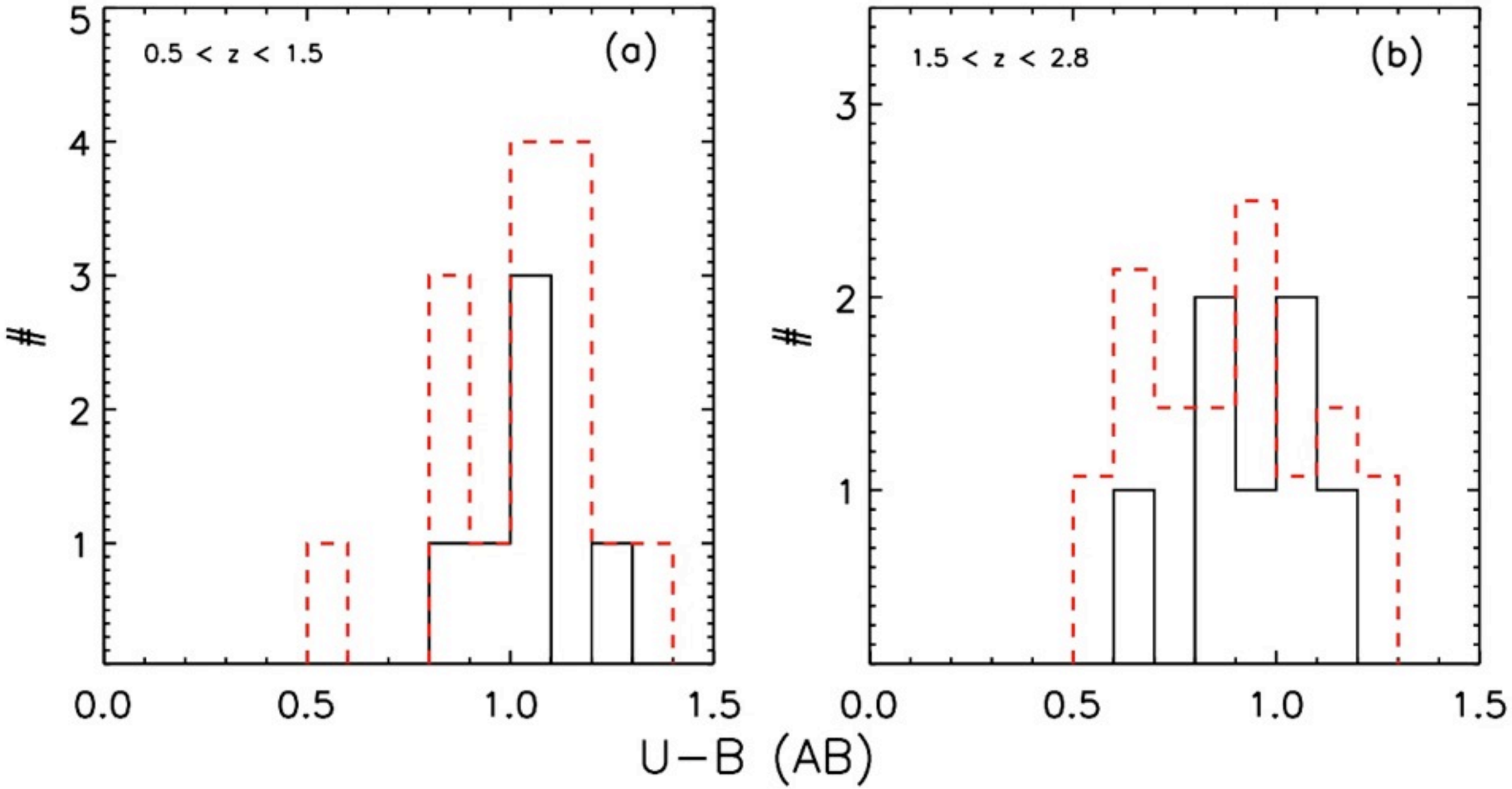
AGN and normal galaxies at z~2 have comparable dust extinctions at r ~ few kpc.



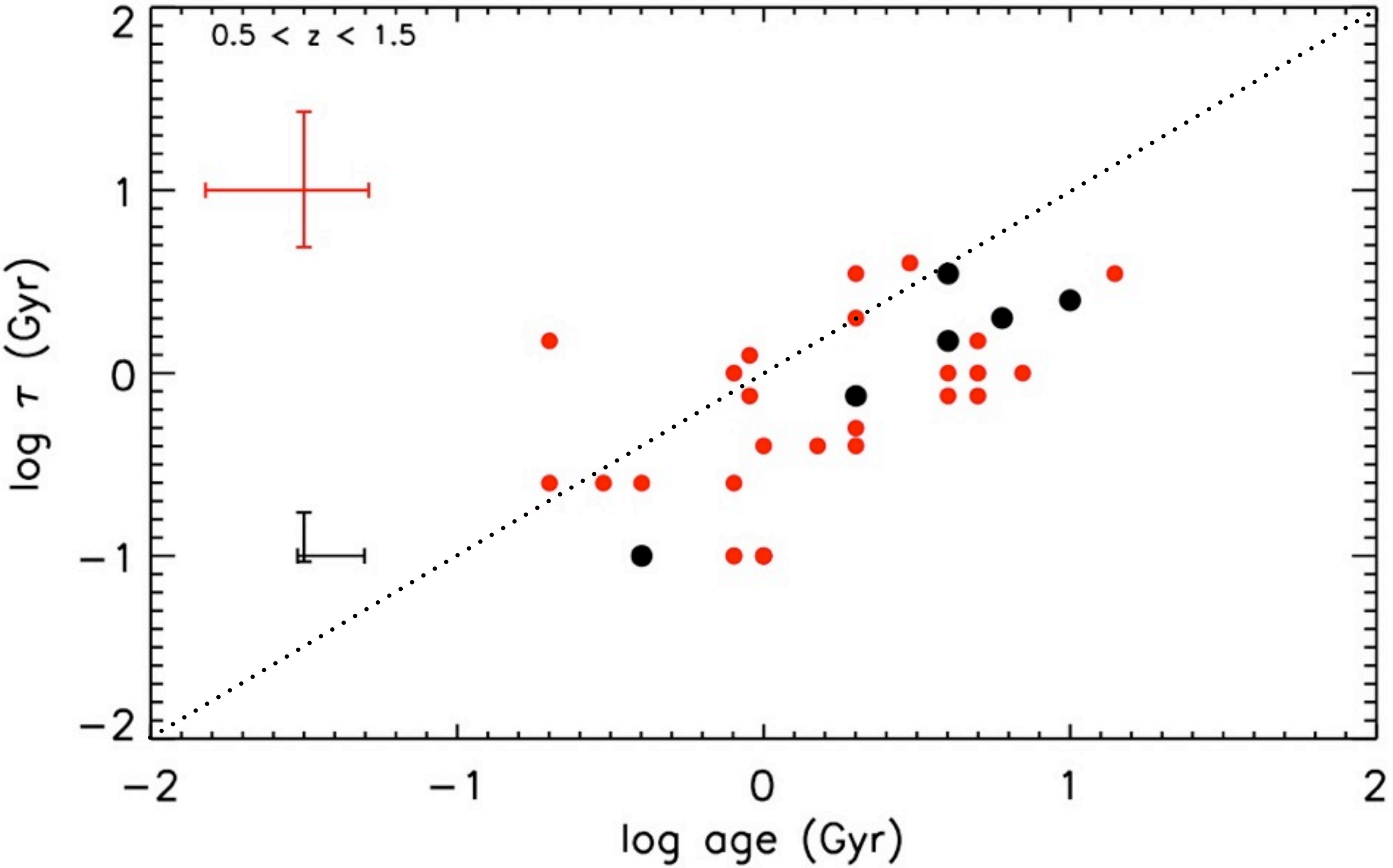
Stellar mass selection effects



Mass-matched Comparisons



Mass-matched Comparisons



The question still remains.....

Why do hosts of moderately luminous AGN occupy a particular range in stellar mass?!

Because they are involved in the process of transition?

or

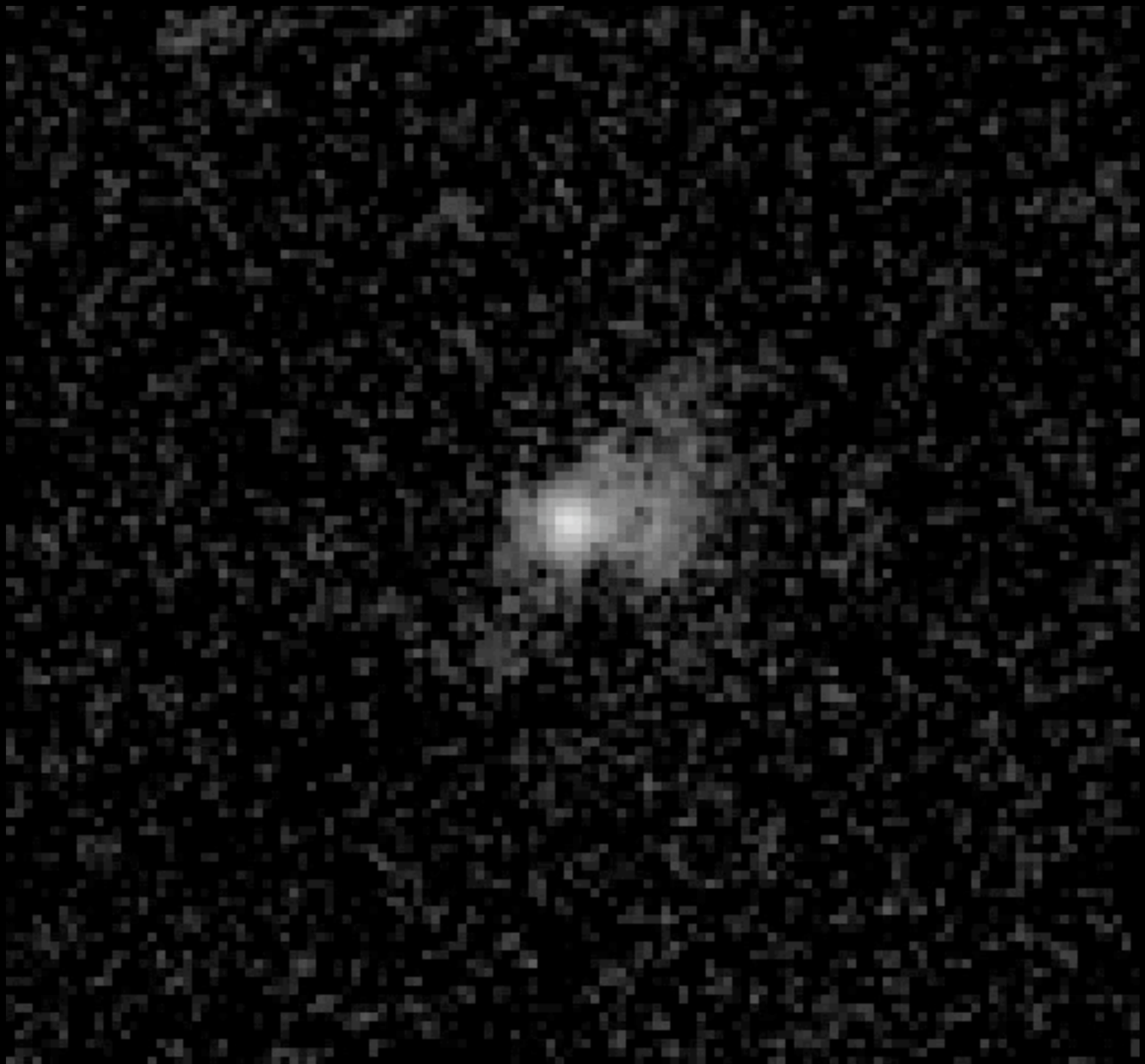
Because galaxies of such a mass host massive BHs and enough gas to fuel them?

Conclusions

- Hosts of low/moderate luminosity AGN exhibit a characteristic range of colors relative to normal bright galaxies z<3, i.e, they are green.
- The relative difference between AGN and normal galaxies is probably not an effect of dust.
- Mass-matched comparisons hint at real differences between AGN and normal galaxies, i.e, AGN may have older mean stellar ages.

Conclusions

- We can now probe the structure of high-z AGN hosts. They seem to be mostly in bulgy or compact galaxies, but this needs to be tested.
- CANDELS will image ~1000 X-ray sources, build statistics and bring in more high-luminosity AGN. PSF modeling is key, especially for z~2 and higher!



Friday, August 20, 2010