

Looking for the Sources of Reionization at the Edge of the Universe



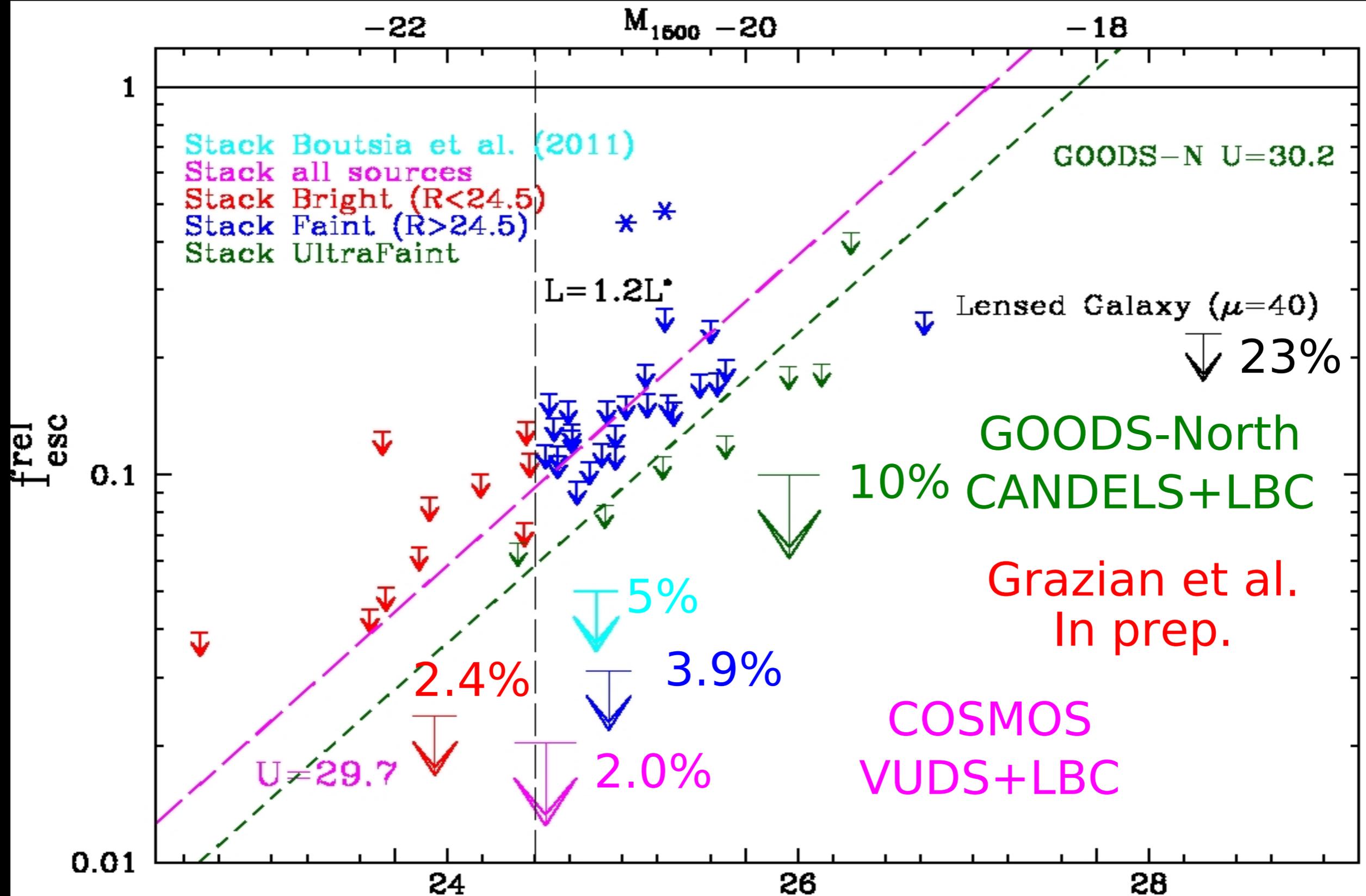
Andrea Grazian (INAF-OAR)

E. Giallongo, F. Fiore, E. Vanzella, et al.

March 15th-19th, 2015 Sintra (Portugal)

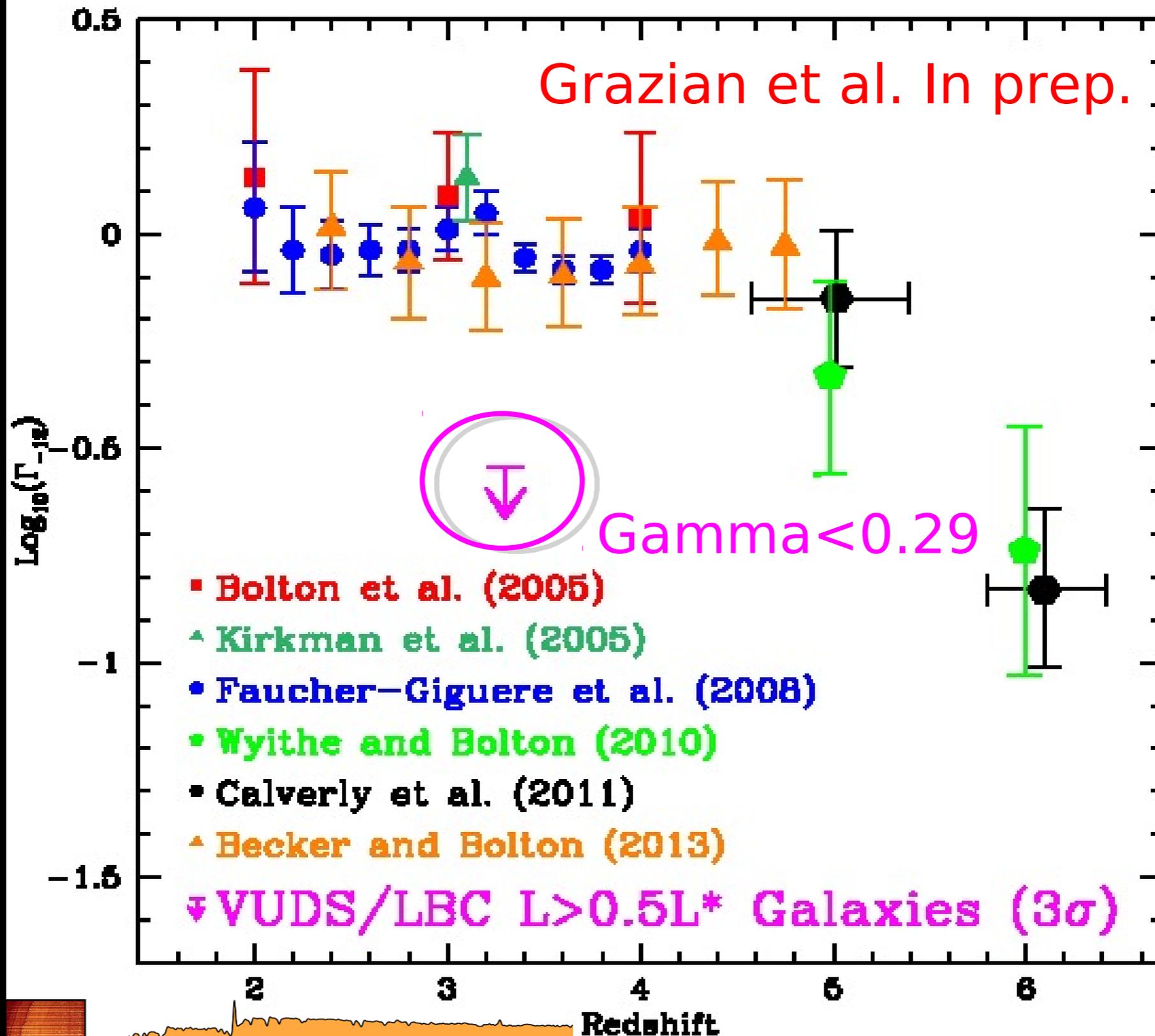
Back at the Edge of the Universe

LyC Escape Fraction of $z \sim 3$ Galaxies



See also Siana et al. 2015 magR

HI Photoionization rate



Bright Galaxies have low f_{esc}

Faint Galaxies: if low f_{esc} , they cannot keep the Universe reionized, unless there is a significant increase of f_{esc} towards high redshift and/or low luminosity;

Bright QSOs are very rare.

What about Faint AGNs ?....

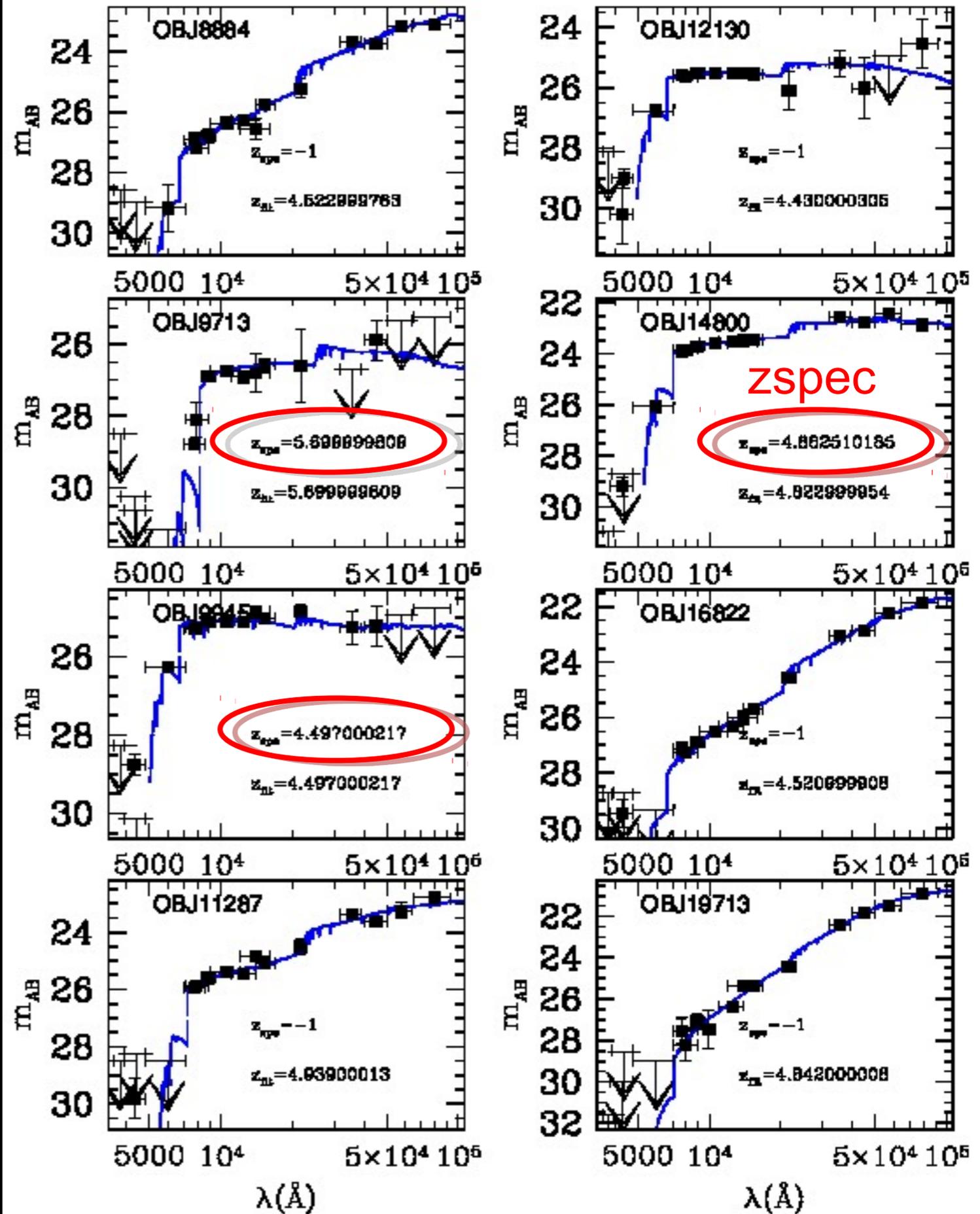
Parent sample:
CANDELS HAB<27.0
galaxies
with $z>4$ in GOODS-South

Photometric z from
galaxy SEDs fitting (Dahlen
et al. 2013)

redshift constrained by
UV-rest dropout due to IGM
absorption

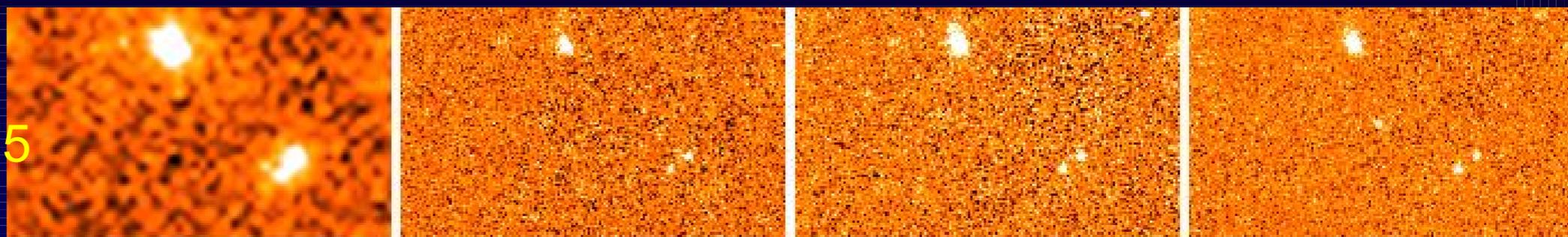
22 AGN candidates with X-ray
detection in 4 Msec Chandra
5 zspec available

Giallongo et al. 2015 in press
ArXiv:1502.02562

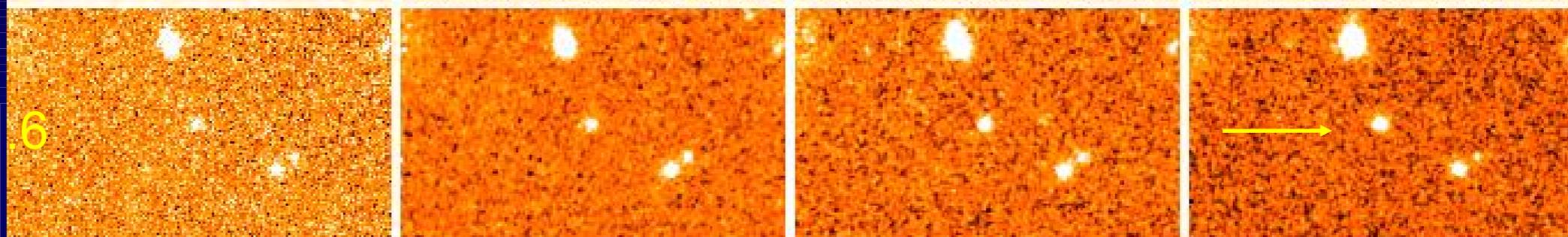


Candels 16822 zphot=4.52

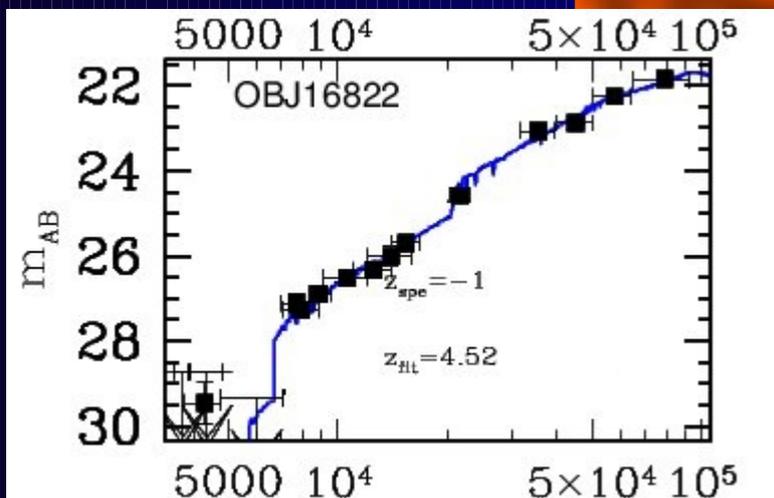
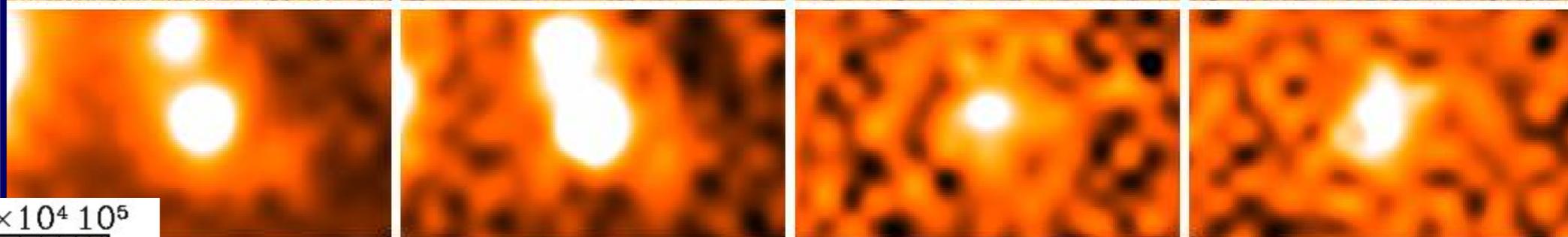
U,B435,V606,I775



I350,Y1.05,J1.25,H1.6

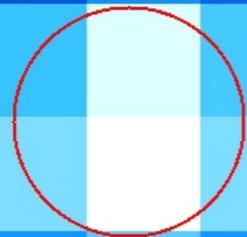


Irac 3.6,4.5,5.8,8



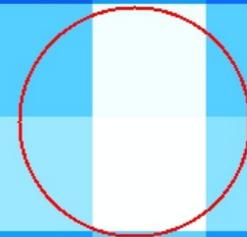
0.5-2 keV

16822 4.510 25.70

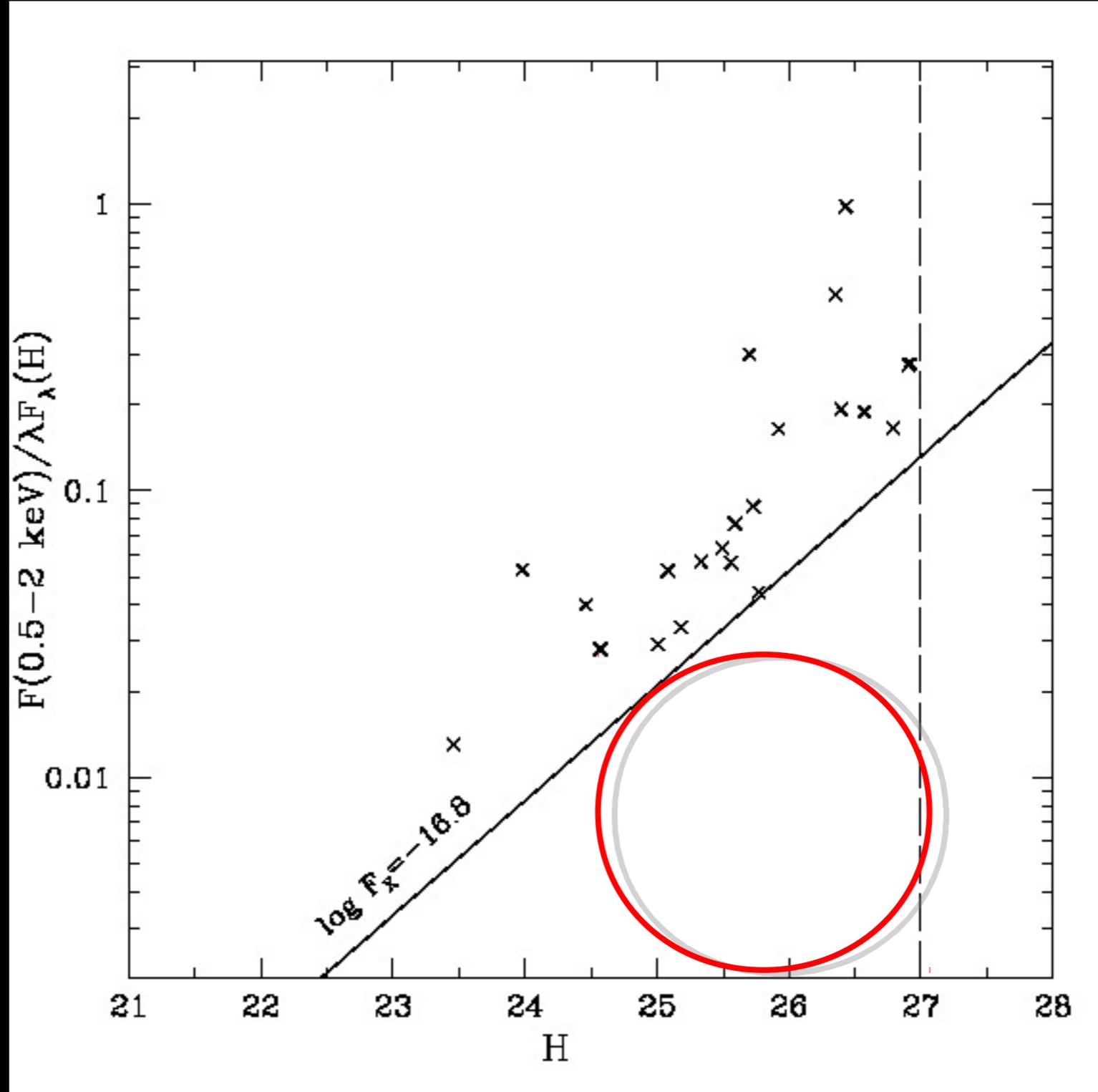


0.8-4 keV

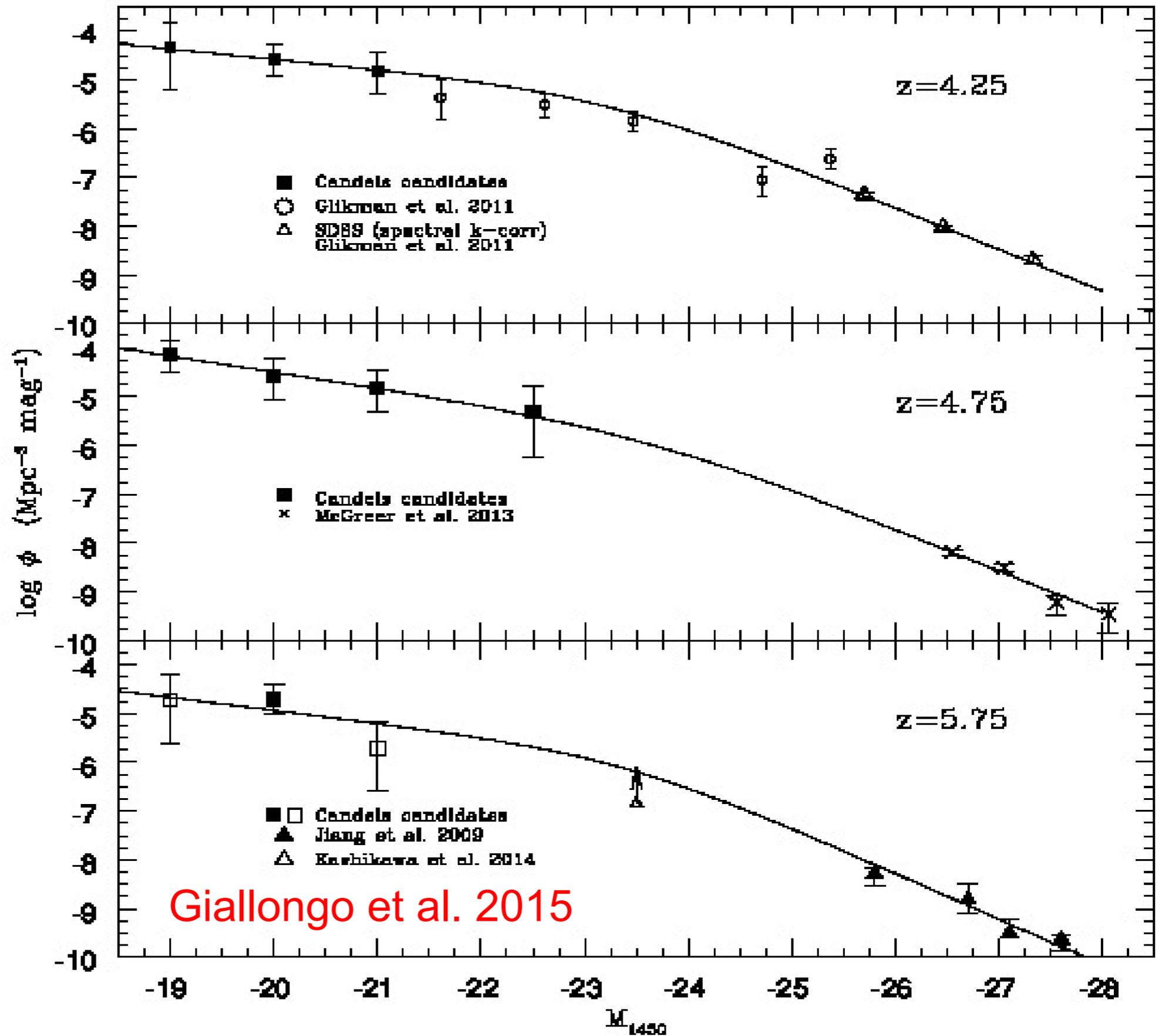
16822 4.510 25.70



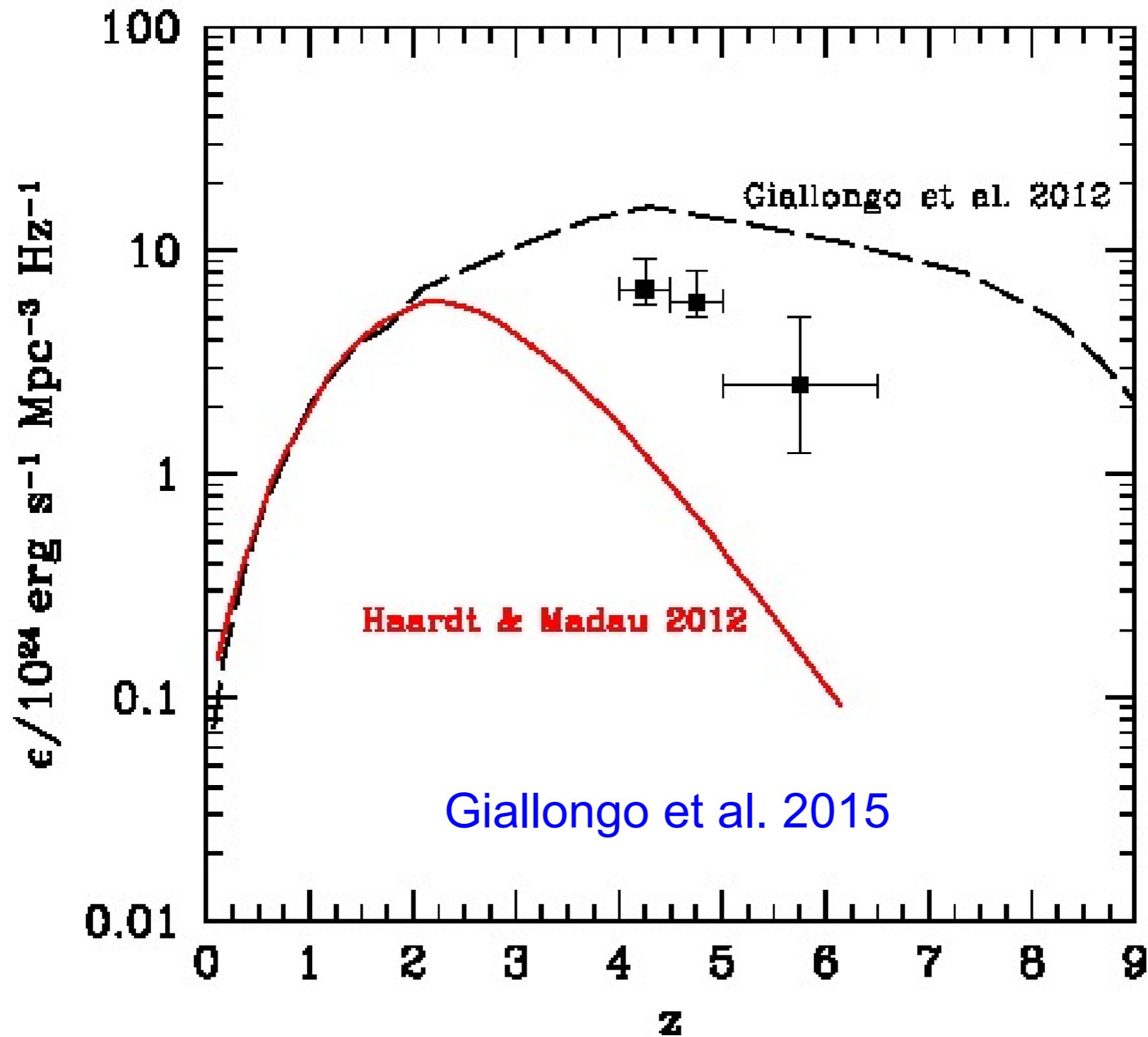
Average correction for incompleteness: ~factor 2



LF corrected for
H160 incompl.
and
X/H incompl.

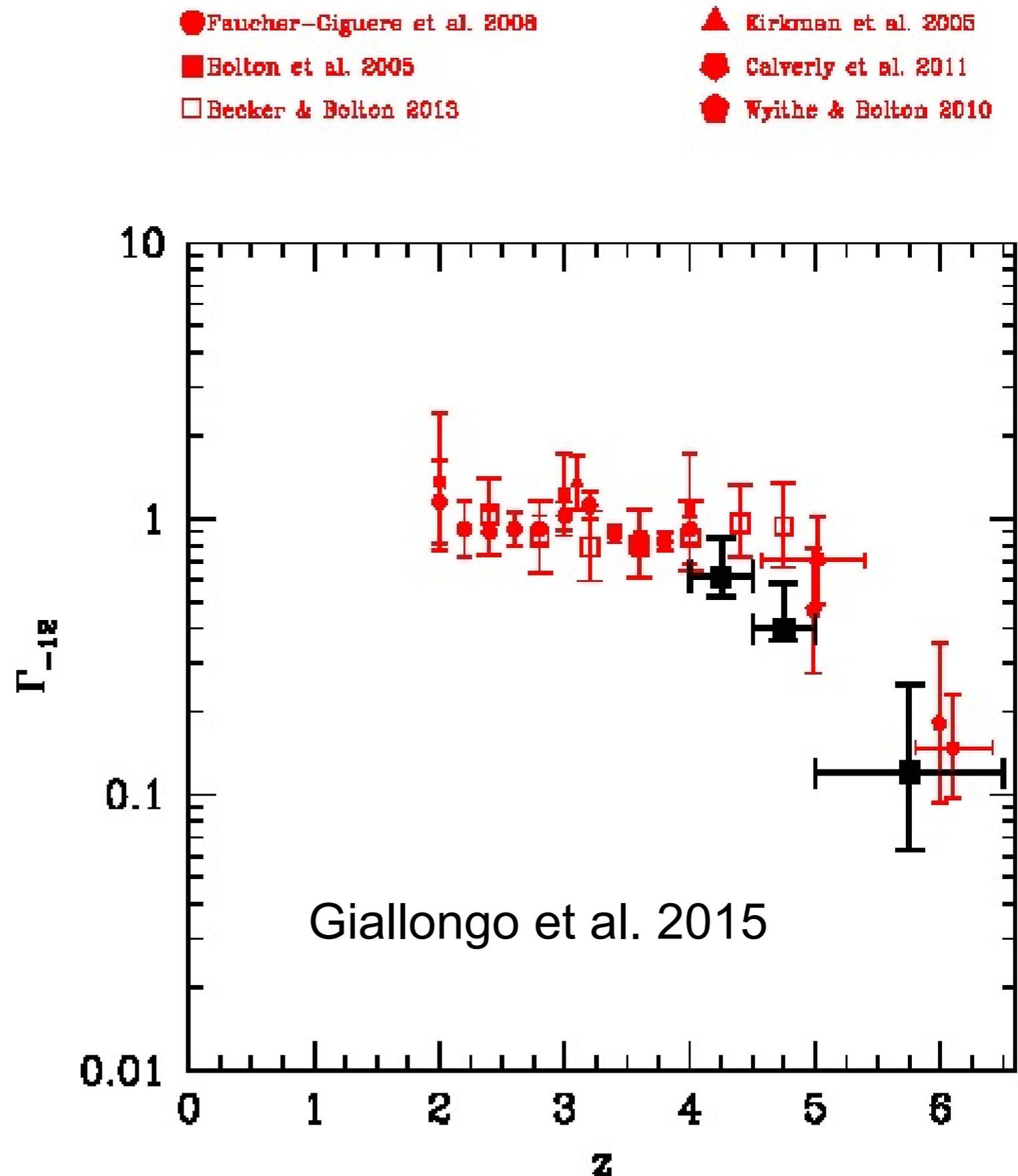


AGNs Ionizing Emissivity at 912 Å



A decline by a factor ~ 10 from $z \sim 4$ to $z \sim 6$ due to decrease of both emissivity and mean free path

Still consistent with the degree of ionization of IGM



The presence of a significant density of faint AGNs in Candels/Chandra GOODS-S is consistent with mild z -evol. of HeII IGM absorption and HeII reionization at $z > 4$ (Worseck et al. 2014)

IGM. An explanation of the low He II effective optical depths at $z \simeq 3.4$ may require additional, more exotic sources of hard photons at high redshift, such as Bremsstrahlung from gas shock heated by cosmic structure formation (Miniati et al. 2004) or X-ray emission from stellar binaries (Power et al. 2009) or black holes in high-redshift galaxies (Ricotti & Ostriker 2004). Likewise, current theoretical models do not readily produce a density-dependent He II photoionization rate in a predominantly ionized IGM.

See also Compostella et al. 2014

Conclusion

It's time to reconsider the role of AGNs as main driver of the ionization history of the Universe!

Thank
you!