No strong evidence for a significant AGN contribution to cosmic Hydrogen Reionization

Shaghayegh Parsa[1⋆], James S. Dunlop[1]†, Ross J. McLure[1]
[1] *Institute for Astronomy, University of Edinburgh, Royal Observatory, Edinburgh, EH9 3HJ*

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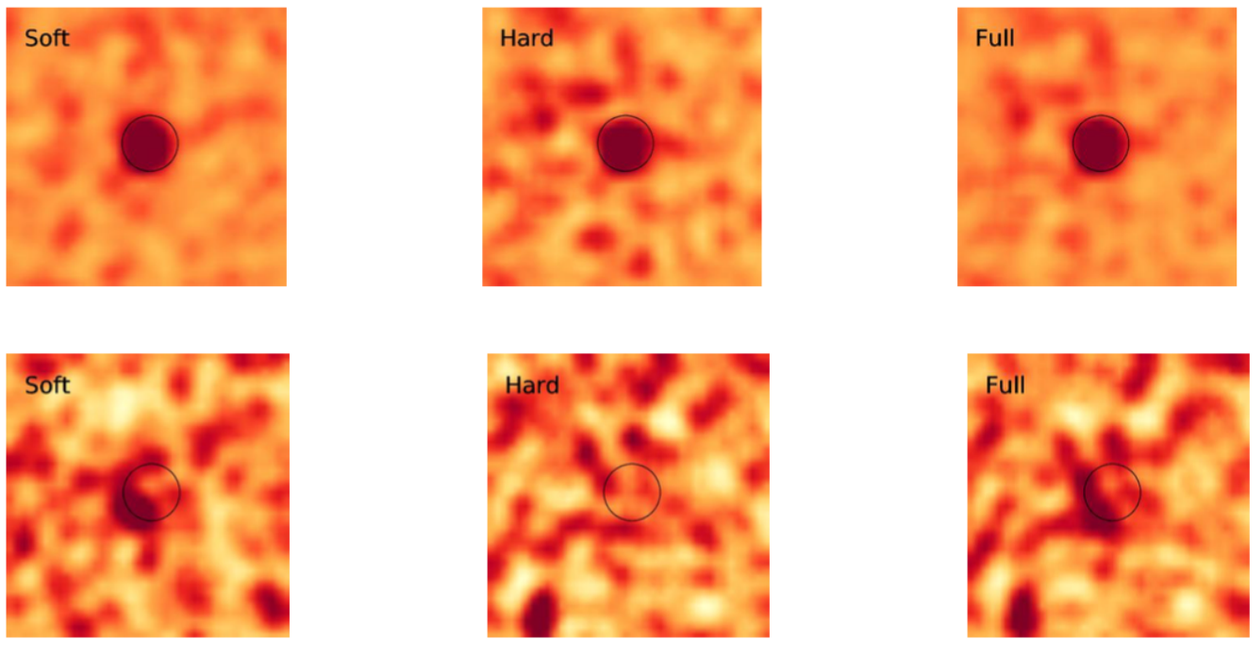
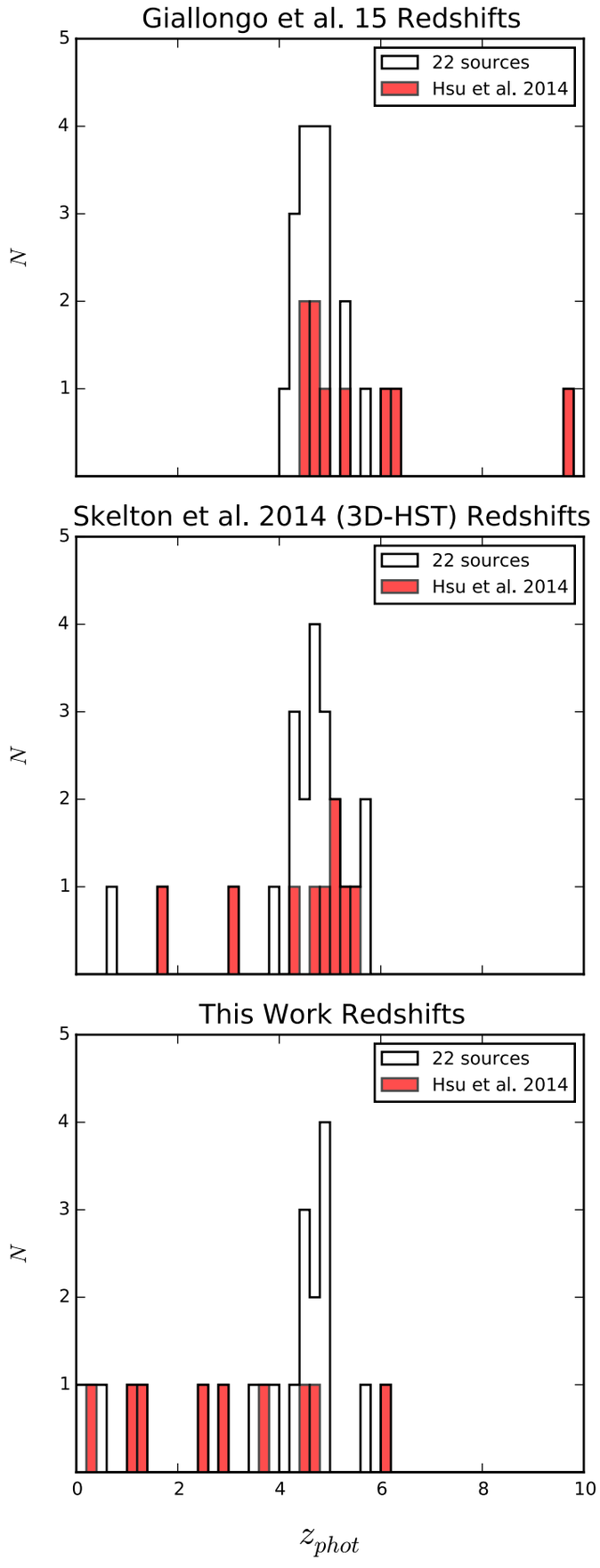
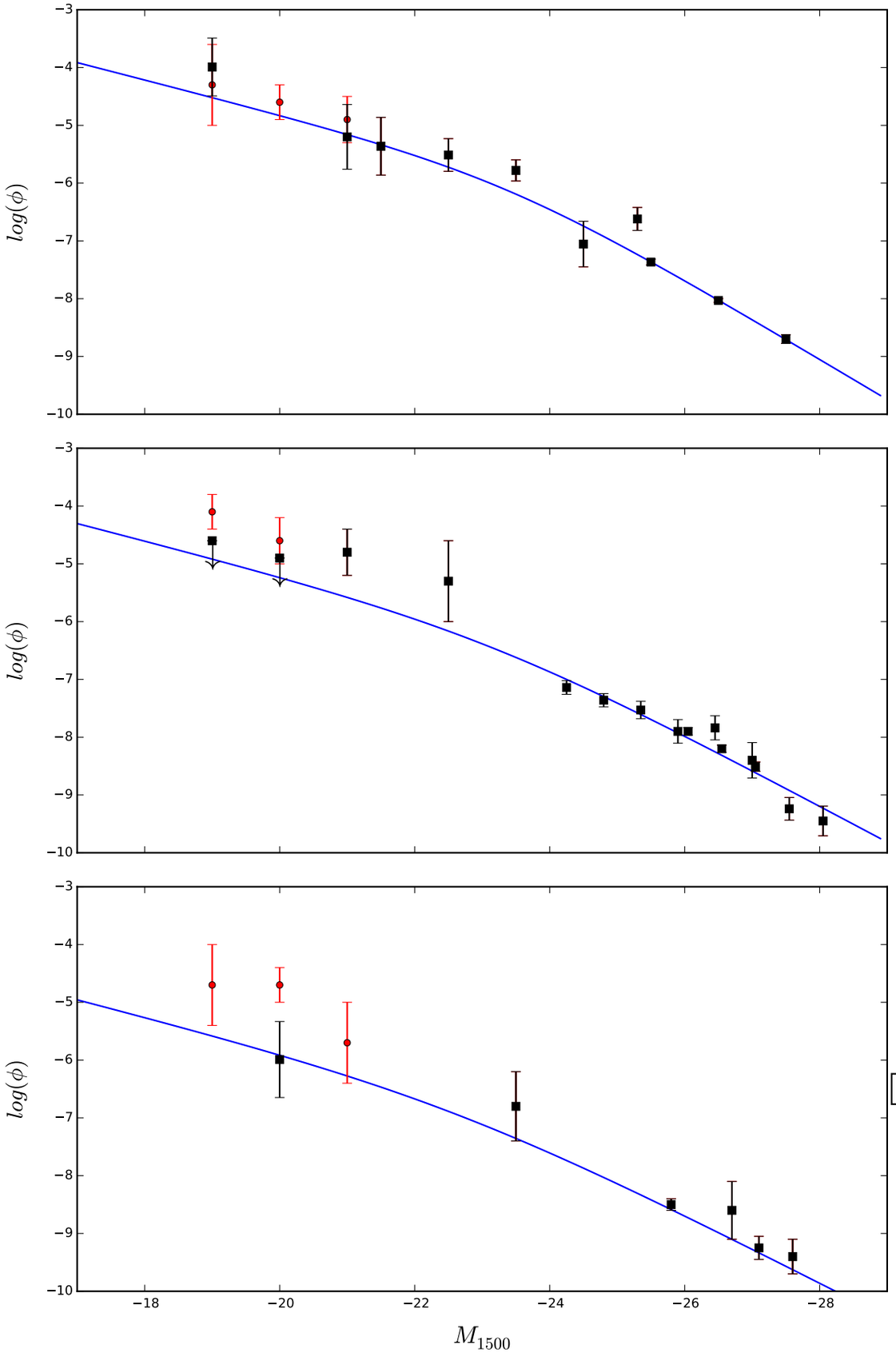
ABSTRACT

In this paper we present a new investigation on the redshift distribution of a sample of 22 X-ray detected AGNs, claimed to be high redshift, within the CANDELS/GOODS-S region and study further the Lyman continuum emissivity of these sources. Based on recent observational studies applying the 4Ms Chandra CDF-S X-ray imaging, it has been claimed that the faint high-redshift AGNs can be the responsible population for the hydrogen reionization at $z \sim 6$. However, there has not been an agreement between recent observational and theoretical studies about the presence of considerable number of AGNs at high redshift. In this work, we have determined the photometric redshift of these AGNs by applying a template fitting technique based on galaxy and AGN template model SEDs over sufficient reddening ranges. Furthermore, by visually inspecting each individual source in X-ray images, we only detect 15/22 galaxies and our results show smaller number of X-ray detected AGNs at $z > 4$ and lower UV emissivity than claimed previously for this sample. Interestingly, our final emissivity results for these 15 sources agree very well with the Haardt & Madau (2012) theoretical model shifted vertically by a factor of 2. This indicates that detecting faint AGNs completes their model while keeping its redshift evolutionary trend showing a sharp decline of the UV emissivity after $z \sim 3$. Overall, we conclude that the AGN population at high redshift cannot produce sufficient ionizing photons to keep the Universe fully ionized at $z \sim 6$ and there is no strong evidence for responsibility of these sources on the hydrogen reionization.

Key words: galaxies: redshifts - galaxies: spectroscopy - galaxies: photometry - galaxies: reionization






log(ϕ)
−3
−4
−5
−6
−7
−8
−9
−10
log(ϕ)
−3
−4
−5
−6
−7
−8
−9
−10
log(ϕ)
−3
−4
−5
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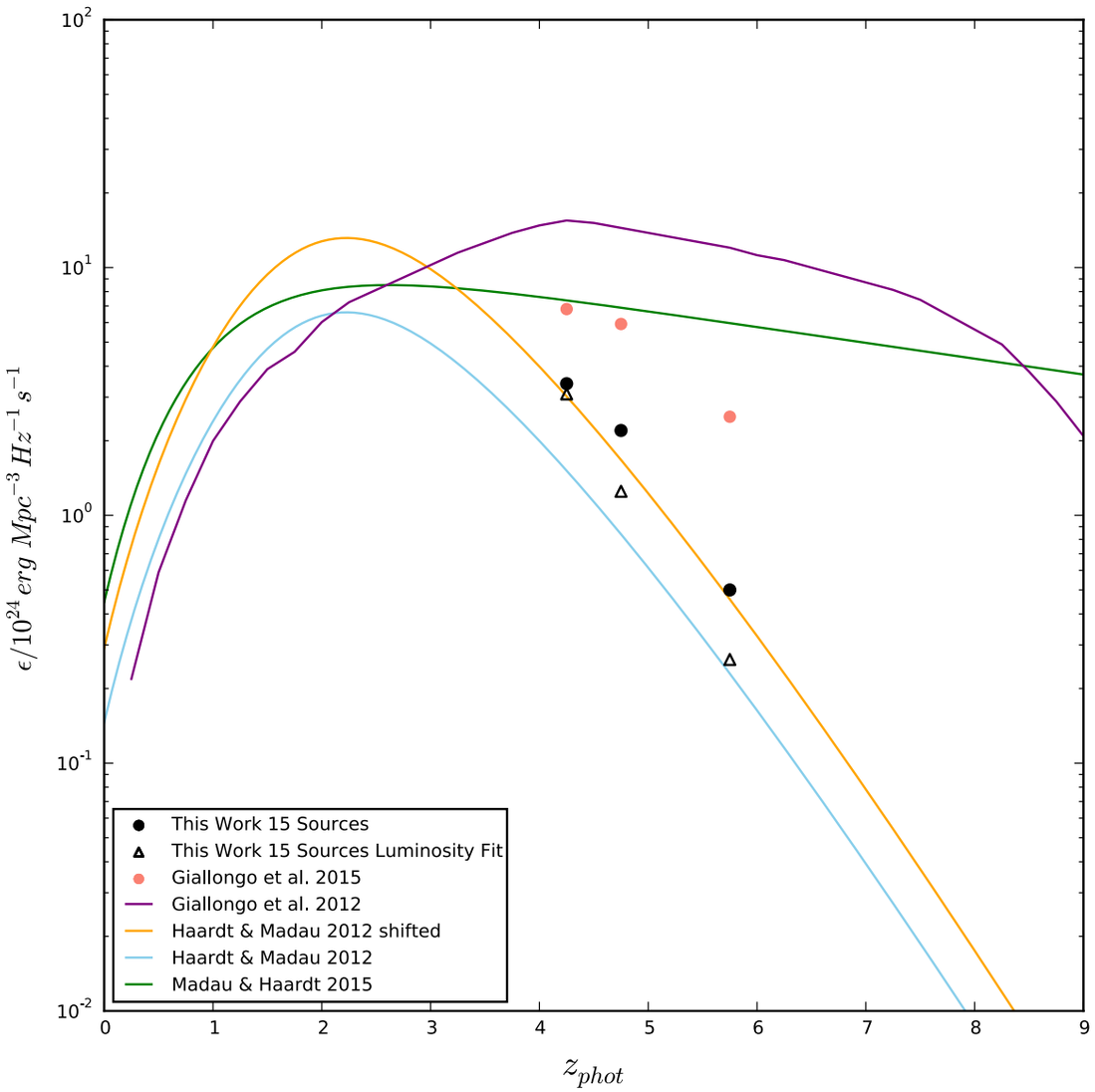
−9
−10
Lit
15
−18
−20
−22
−24
−26
−28
M_{1500}


$\epsilon/10^{24} erg\ Mpc^{-3}\ Hz^{-1}\ s^{-1}$
10^2
10^1
10^0
10^{-1}
10^{-2}
0
1
2
3
4
5
6
7
8
9
z_{phot}
This Work 15 Sources
This Work 15 Sources Luminosity Fit
Giallongo et al. 2015
Giallongo et al. 2012
Haardt & Madau 2012 shifted
Haardt & Madau 2012
Madau & Haardt 2015

Conclusion

- Detection of 15/22 sources are reliable

- New estimation of photometric redshifts based on galaxy and AGN SED models results in lower redshifts than previously estimated for these sources

- New UV emissivity of these sources, calculated based on the new LF determination of the 15 AGNs, is about an order of magnitude smaller than the required value to reionize the hydrogen at z~6