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The $z > 3$ AGN population in the 4 Ms CDFS

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Abstract. We present results from a spectral analysis of a sample of 34 high-redshift ($z > 3$) X-ray selected AGN in the 4 Ms *Chandra* Deep Field South, the deepest X-ray survey to date. The intrinsic column density distribution, corrected for observational biases using spectral simulations, and the source number counts down to flux $F_{0.5-2\mathrm{keV}} \sim 4 \times 10^{-17} \mathrm{erg\,s^{-1}cm^{-2}}$ are compared with the expectations from X-ray background synthesis models. All the results are presented and discussed in Vito et al. (2013).

Key words. methods: data analysis – techniques: imaging spectroscopy – surveys – galaxies: active – galaxies: high-redshift – X-rays: galaxies.

1. Introduction

The formation and evolution of Active Galactic Nuclei (AGN) are among the open issues in modern astrophysics. The early accretion phases are indeed almost unexplored and observations at high redshift are required. Deep X-ray surveys are the best tools to study the high-redshift AGN population, being less biased against obscuration with respect to optical surveys.

2. The sample

We built a sample of 34 X-ray selected AGN at $z > 3$ in the 4 Ms CDFS (Xue et al. 2011) us-

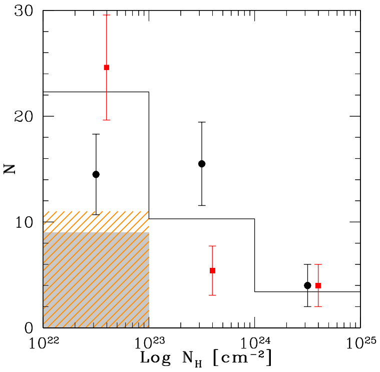

Fig. 1. Corrected N_H distribution assuming $\Gamma = 1.8$ (black circles) and $\Gamma = 1.6$ (red squares). The shaded and striped areas account for sources with upper limits on N_H in the two cases, respectively. The histogram shows the prediction of the Gilli et al. (2007) X-ray background synthesis model, assuming a decline in the AGN space density at high redshift.

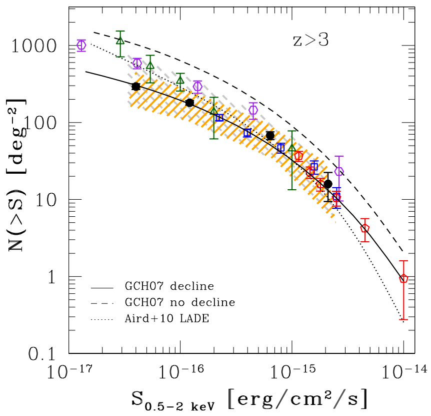

Fig. 2. Source number counts of our high-redshift sample (black circles), compared with results in the COSMOS field from Brusa et al. (2009, red pentagons) and Civano et al. (2011, blue squares), and in the CDFS from Fiore et al. (2012, green triangles) and Lehmer et al. (2012, purple exagons). The data are compared with the predictions of different models. The error budget is computed by relaxing the selection method (gold region) and including all the sources in the field with no redshift information (gray region).

ing the most up-to-date spectroscopic (15 objects) and photometric (19 objects) redshifts available in this field (see Vito et al. (2013) for details). The median redshift is $z = 3.7$. The X-ray spectrum of each source was extracted, and spectral analysis was performed assuming an absorbed power-law as spectral model. The median net (i.e. background subtracted) counts of the sample are 80.

3. Results

The observed distribution of column density (N_H) suggests the presence of a significant fraction ($\sim 68\%$) of highly obscured sources ($N_H > 10^{23}$cm^{-2}), but this result suffers from uncertainties in the N_H determination due to the high redshift and the low photon counting statistics of our sample. We corrected the observed N_H distribution (Fig. 1) using extensive spectral simulations, assuming a photon index $\Gamma = 1.8$ (as expected from intrinsic AGN emission, black circled), and $\Gamma = 1.6$ (i.e., assuming some contribution from a reflection component, red squares). The intrinsic distribution probably lies between the two estimates. Our results are fully consistent with the Gilli et al. (2007) model at the 2σ confidence level.

The number counts of the sample are reported in Fig. 2. The data are compared with the predictions of different models. We find a good agreement assuming a decline scenario, and a marginal consistency with the Aird et al. (2010) model. The discrepancy between the results obtained by different works at faint fluxes is caused by the different methods used to select high-redshift AGN. Our procedure is likely the most conservative.

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