THE XMM-BSS QSO2 SAMPLE: X-RAY AND ACCRETION PROPERTIES.

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SUMMARY In spite of their elusiveness, high-luminosity obscured Active Galactic Nuclei (the so-called type 2 QSOs) represent an important fraction of the AGN population, ranging from 30 to 50% of the high luminosity AGN end, thus contributing to -20% of the X-ray background (XRB). Since they are probably hosted in massive galaxies, it is clear that studying the properties of type 2 QSOs has direct and fundamental consequence on several hot topics in the current physical cosmology, such as the galaxy formation and evolution, the XRB synthesis models, and the history of accretion in the Universe.

Here we discuss the properties of the 14 QSO2s (0.3<z<2) belonging to the XMM-Newton Bright Survey, X-ray observations, combined with high-quality multi-wavelength data (Spitzer, WISE, SDSS, and APM data) allowed us to properly characterize the sources in our sample. Thanks to these data we: a) fully characterize the accretion properties of these QSO2s, through the measurement of nuclear quantities like the black hole masses and Eddington ratios, and b) test optical/IR diagnostic diagrams to select high-z QSO2.

1. The XBS-QSO2 sample

XMM-Newton Bright Serendipitous Survey (XBS; Della Ceca et al. 2004):
+ two flux-limited (F_X,0.1-10 keV = 10^{14} ergs cm^{-2} s^{-1}) serendipitous samples of X-ray selected sources
+ selection band: 0.5-4.5 keV and 4.5-7.5 keV
+ high galactic latitude (|b| > 20°)
+ spectroscopic ID: ∼320 out of 400 sources identified as AGN.

For the unabsorbed AGN population:
+ bolometric luminosities obtained from an optical/UV + X-ray SED fitting (Marchese et al. 2012)
+ black hole mass estimates using the Single Epoch method (Caccianiga et al. 2013)
+ study of the relationship between X-ray properties and accretion rate (Foschini et al. 2013)

In Fig. 1 we plot the N_BH vs. the unabsorbed L^bol for all the 320 AGN in the XBS sample (green data). Here we concentrate on the sources with

L^bol > 10^{45} ergs s^{-1}, typical of the QSO regime
N_BH > 4 x 10^8 M_{Sun}, as derived from the X-rays

14 sources (44% of the obscured AGN in the XBS; red filled squares in Fig. 1), with 0.3 < z < 1 (+ 1 object at z = 1.9).

2. UV-to-mid-IR SED & AGN-host deconvolution

At energies lower than X-rays, we have:
+ Spitzer data for 9/14 sources (7 proprietary observations, PI P. Severgnini)
+ WISE data for the whole sample
+ SDSS photometry for half of the sample
+ GALEX fluxes for 3 objects
+ sparse data collected from literature (OM@3440Å; POSS@4400Å; g’@4872Å; R-band magnitude).

with a SED modeling of the emission observed from the UV to the mid-IR, performed assuming empirical templates (Forster et al. 2007) of AGN and galaxies, we deconvolve the nuclear contribution from the host emission (see e.g. Fig. 2).

3. Intrinsic X-ray luminosity vs. observed mid-IR emission

Mid-IR luminosity as proxy for the intrinsic X-ray luminosity: local Seyferts show a tight relation between the core measurements at 12.3 μm and the unabsorbed X-ray luminosities, irrespective of the amount of obscuration (see Fig. 3) – dust clouds have significant clumpiness in the AGN tori (Gandhi et al. 2009).

Assuming the 12.3 μm (rest-frame) emission as recovered by our modeling of the nuclear emission, we extend this relation also in the QSO regime (see Fig. 3). Note that our SED modeling (and therefore the log L_{12.3}/L_{1.2}) is independent from the X-ray emission.

4. Nuclear Properties: QSO1 vs QSO2 in the XBS

Combining SED deconvolution and X-ray information we characterize the nuclear properties of the XBS-QSO2s. In Fig. 4 (A, B, and C) we compare our results (green filled circles) with the properties of the XBS AGN1s in the same range of z and L_X (blue open squares; Marchese et al. 2012, Caccianiga et al. 2013), and with results from the literature (black and grey dots).

A - a_{QSO1} and L_X vs. L_X (QSO2): Considering the (absorption corrected) QSO modeling adopted in the SED deconvolution and the unabsorbed X-ray luminosity we found that our sample follows the same relation between UV and X-ray emission previously found for X-ray detected AGN in the SDSS (mainly type 1; Vignali et al. 2003, Strateva et al. 2005, Stieff et al. 2009). Note that in our analysis the UV emission has been recovered independently from the X-ray data.

B, C - M_{QSO1} from K-band host magnitudes, as obtained from the template (Graham 2007) we obtained the M_{stellar} AGN l_2 and l_2 from the QSO template between 0.1 and 1μm (corrected for the obscuration) + the intrinsic L_{0.1-100 keV}.

The bolometric corrections we found suggest on average that the X-ray emission of the XBS-QSO2s is more important in the nuclear energy balance than the X-ray emission of XBS-QSO1s. The two samples are composed by objects hosting BH with similar masses, accreting with lower Eddington ratios in QSO2s than in QSO1s.

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