

X-ray Spectroscopic Study of the Largest X-ray Selected AGN Sample in the XMM-XXL North



Zhu Liu^{1,2}, Andrea Merloni¹, Antonis Georgakakis¹, Marie-Luise Menzel¹, Johannes Buchner¹ & Kirpal Nandra¹

1. Max-Planck-Institute for Extraterrestrial Physics, Germany 2. National Astronomical Observatories, China

Overview of the Survey

- \Rightarrow A large XMM survey covers ~25 deg² sky region
- \Rightarrow ~8000 point-like X-ray sources
- ⇒ With the dedicated ancillary SDSS-III/BOSS survey, ~2400 sources have reliable spectroscopic redshift (Menzel et al. in prep.)

Method

X-ray spectral stacking

- \Rightarrow Select sources with rest-frame 2-10 keV net photon counts > 20
- ⇒ Divided into subsamples according to the redshift and luminosity (Figure 1)
- \Rightarrow Stack the X-ray spectra in each subsample

X-ray spectral modeling

- \Rightarrow Select a completeness subsample from the survey
- ⇒ Modeling the X-ray spectra with Bayesian X-ray Analysis method (BXA, Buchner et al. 2014)





Sample	Redshift (median)	Luminosity (ergs s·1)	Gamma	<i>EW</i> (6.4 keV) (eV)	EW(6.9 keV) (eV)	Source No.	Spectra No.	Photon Counts
Type 1	1.412	2.40×1044	1.87±0.02	75 ⁺²⁸	41_{-24}^{+29}	775	1300	73927
Bright Type 1	0.827	3.17×1044	1.76±0.05	68 ⁺³⁶ -35	-	50	82	42534
Subsample 1	0.616	4.44×1043	1.77±0.05	77 ⁺⁵³	-	170	280	16032
Subsample 2	1.084	1.84×1044	1.86±0.04	96 ⁺⁴⁴ _50	80_55	168	304	19580
Subsample 3	1.755	2.82×1044	1.96±0.04	68_{-43}^{+46}	70^{+49}_{-53}	267	416	17109
Subsample 4	2.090	7.45×1044	$1.94_{-0.07}^{+0.03}$	67 ⁺⁶⁸	26 ⁺⁵² _26	143	255	17832
Type 2	0.385	2.49×1043	1.49±0.07	140_68	31 ⁺⁴⁷	72	127	8328

Table 1: Properties of each sample.

Reference

Bianchi S. et al., 2007, A&A, 467L, 19 Iwasawa K., & Taniguchi Y., 1993, ApJ 413L, 15 Menzel M. et al., 2014, in prep. Buchner J. et al., 2014, A&A 564, 125





Figure 3: The equivalent width of the neutral Fe K line and photon index versus the 2-10 keV X-ray luminosity and redshift.

X-ray spectral modeling



Figure 4: *Left panel*: The best-fit column density and photon index of sources in the completeness sample using the BXA software. *Right panel*: distribution of the photon index for each sub-samples in the completeness sample.

Conclusion

- \Rightarrow Neutral Fe K line is ubiquitously found
- ⇒ EW(6.4keV) and the 2-10 keV X-ray luminosity follows the IT relation (Iwasawa & Taniguchi 1993; Bianchi et al. 2007) within 90% uncertainty
- \Rightarrow A potential correlation between the photon index and luminosity and/or redshift
- \Rightarrow Highly ionized Fe K lines are found in the median or high luminosity sample