X-ray selected AGNs in the North Ecliptic Pole field

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ABSTRACT

XMM-Newton slews repeatedly cover the Ecliptic Poles regions, which have also been deeply studied with ground radio and optical telescopes and with other space X-ray and infrared telescopes like ROSAT, IRAS and Akari. We are producing a catalogue (NEPSL) of all the sources detected when combining the information of all the slews in a 5.5 x 11 degrees region around the North Ecliptic Pole. This combination of slews is in average 3 times deeper than a single slew. The flux limit $F_{2\text{-}12keV}$ is about 1.0E-12 ergs/s/cm^2. We use all the available data to identify the AGN in this field and study their properties.

Introduction

The XMM-Newton slew survey has scanned 28000 deg^2 of the sky and has yielded more than 11,000 high-significance sources, from the analysis of individual slews (Saxton et al. 2008). It is possible to extend the survey to fainter fluxes by combining data where slews overlap. It can be seen from Figure 1 that, as occurs with most slew surveys, there is a significant number of overlapping slews at the ecliptic pole regions. The North Ecliptic Pole (NEP) has quite a high Galactic latitude (typical nH is 3E20) allowing deep multiwavelength studies, when our data are combined with other satellites, like ROSAT, IRAS, AKARI, etc, and deep ground surveys, like SDSS or FIRST.

XMM-Newton Slew Survey coverage

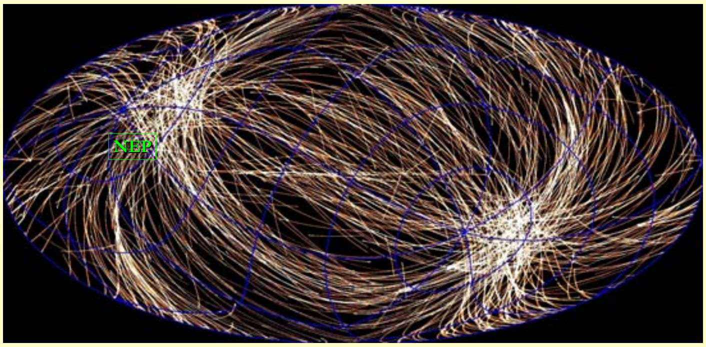

Fig.1. Paths of the XMM-Newton slew observations performed until now. The North Ecliptic Pole is indicated

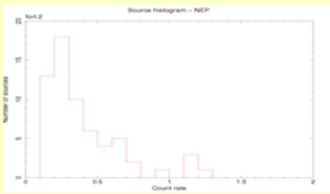

Fig.2 The overlapping slews give a typical exposure time 4 times higher than that of individual slews. This figure shows that the modal source count rate is 0.25 c/s, corresponding to a 0.2-12 keV flux of 3E-13 ergs/s/cm2. The hard-band (2-12 keV) flux limit is ~1E-12 ergs/s/cm2.

Flux ratios for the brightest objects

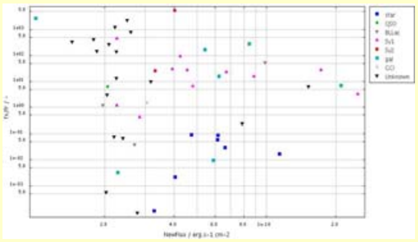

Fig.3 The plot of fluxes fx/f_opt for the brightest objects could be used as a diagnostic tool for the unknown objects

Results

In this work we have analysed the sources detected in combined XMM-Newton slews in a region of 55 deg^2 centred on The North Ecliptic Pole (NEP) (RA=270d, Dec=66d). We detected 379 unique sources in the total band (0.2-12.0 keV), from which we built a clean catalogue, NEPSL, of 269 sources. 27 sources were also detected in the hard band (2.0-12.0 keV).

We find 92 high significance (DET_ML>12) sources within our NEP area. Using virtual observatory (VO) tools like TOPCAT, Aladin and VOSpec we are identifying the sources obtaining their parameters, and building their SEDs. We identified 32 of these sources as AGN from the catalogue of Veron and Veron (2010) and another 33 as galaxies, most probably also AGN, from the SDSS DR7 and other Vizier and NED data. The data were also cross-correlated with X-ray ROSAT data (Henry, 2006, Voges et al., 2000), 2MASS, 2MASSX, radio data from the SPECFIND compilation (Vollmer et al., 2010) and AKARI FIS and IRC (Yamamura et al., 2010) . The SEDs obtained for a sample of NEPSL sources are shown in Figure 5.

An estimation of BH masses for the brightest objects in our sample is provided in Table 1.

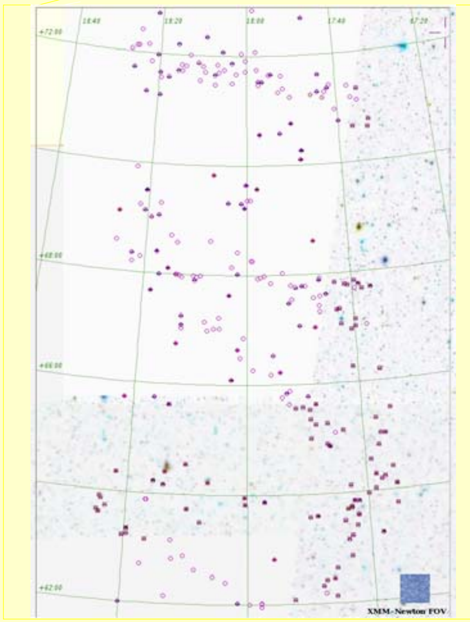

Fig.4 The figure shows the NEPSL sources (magenta circles) with obvious uneven distribution due to the irregularity of the slew paths. The sources identified from cross-correlations with different catalogues are shown as filled circles. The background shows the SDSS DR7 sources in the region covered by SDSS, The XMM-Newton Field of View is indicated at the bottom left giving an idea of the amount of pointed observations that would be required to cover this area.

SEDs FOR A SAMPLE OF NEPSL SOURCES

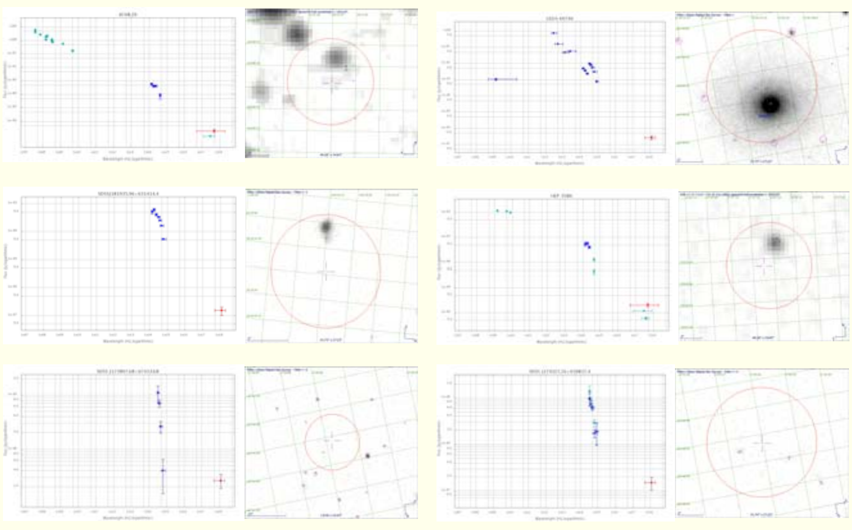

Fig.5 Six examples of SED and finding chart for detected AGN and AGN candidates. *Left*: The SED obtained with TOPCAT and VOSpec after cross matching NEPSL sources (total and hard band fluxes in red) with available catalogues in different wavelengths (blue and green), including ROSAT measurements. *Right:* red circles of 10" radius centered on the NEPSL sources, overlaid on SDSS or DSS2 r images, small symbols indicate ROSAT sources (black ovals), SDSS DR7 (brown crosses), 2MASS (green triangles), NED (magenta rhombus) and Simbad objects (blue)

BLACK HOLE MASS ESTIMATION FOR THE 12 BRIGHTEST OBJECTS OF THE NEPSL CATALOGUE

RA	Dec	Name	Class	z	BH mass
275.490380	64.342955	KUV 18217+6419	S1.2	0.297	7.5E9
266.751924	68.606979	KAZ 163	S1n	0.063	3.6E9
274.616645	67.690177	KUV 18186+6740	S1	0.314	2.9E8
269.305175	70.559246	B1757+703	BLLac	0.406	2.1E8
276.448996	69.096240	LEDA 2727500	S1	0.089	4.1E7
267.084259	70.269598	RX J17482+7016	S1	0.186	4.2E7
273.854387	68.107336	RX J17557+6249	QSO	0.23	6.2E7
271.712654	69.824106	3C 371.0	BLLac	0.05	1.3E8
270.872128	67.637327	KAZ 102	S1.2	0.136	3.6E8
267.141133	70.096475	S4 1749+70	BLLac	0.77	8.9E9
266.55858	62.447367	4C 62.29	AGN1	3.889	2.3E10
273.439858	65.637564	NEP4760	S1	0.191	7.6E7

Table.1 The black hole masses of 12 AGN in our sample are estimated from their NOMAD K magnitude and the redshifts from Veron and Veron (2010) and other references, according to the method described by Marconi & Hunt (2003)

References:

Henry, J.P. et al. 2006 ApJS **162**, 304
Marconi A, Hunt L.K. 2003, ApJ **589**, L21
Saxton R.D., Read A.M., Esquej P. et al.: 2008A&A **480**, 611
Veron-Cetty M.P., Veron P., 2010, A&A (in press)
Vollmer et a., 2010, A&A **511**, 53
Yamamura, I., Makiuti, S., Ikeda, N. et al. AKARI/FIS Bright Sources Catalogue, 2010