Black Holes from Stars to Galaxies – Across the Range of Masses
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XMM-Newton study of the spectral variability in NLS1 galaxies

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Abstract. Preliminary results of the study of the X–ray spectral variability of 12 Narrow Line Seyfert 1 (NLS1) galaxies are presented. Rms spectra are calculated and compared for the whole sample to search for possible variations with black hole mass. A larger sample of AGN is under investigation.

Keywords. X-rays: galaxies – galaxies: Seyfert – methods: data analysis – black hole physics

We have been studying Root Mean Square (rms) variability of 12 NLS1 galaxies. This sample comprises all NLS1s (at $|b| \geqslant 15°$) detected in the RASS with a PSPC count rate higher than 0.2 c/s that have been observed with *XMM-Newton* for more than 30 ks (public data up to July 2006). Figure 1 shows the rms spectra calculated with time bins of a few ks (Ponti *et al.* 2004). All the sources exhibit significant degree of variability.

Rms spectra have been ordered with increasing black hole mass M from left to right and from top to bottom. All sources with $M < 10^7 M_\odot$ show a peak of variability between about 0.5 and 2 keV. The decrease of variability at low energy is likely associated to the strong soft excess present in all these sources, the origin of which is highly debated (e.g. Gierliński & Done 2004). The lower variability at high energy could be due to a pivoting power law (Markowitz & Edelson 2004; Haardt *et al.* 1997). Alternatively the whole shape of the rms spectrum could also be due to a variable power law with the presence of either an almost constant ionized disc reflection component (Crummy *et al.* 2006; Ponti *et al.* 2006), or a variable absorbing medium (Gierliński & Done 2006; Chevallier *et al.* 2006).

For the objects of higher black hole mass the rms spectra become flatter and the variability lower, except for I Zw 1 which shows the maximum of variability at low energy.

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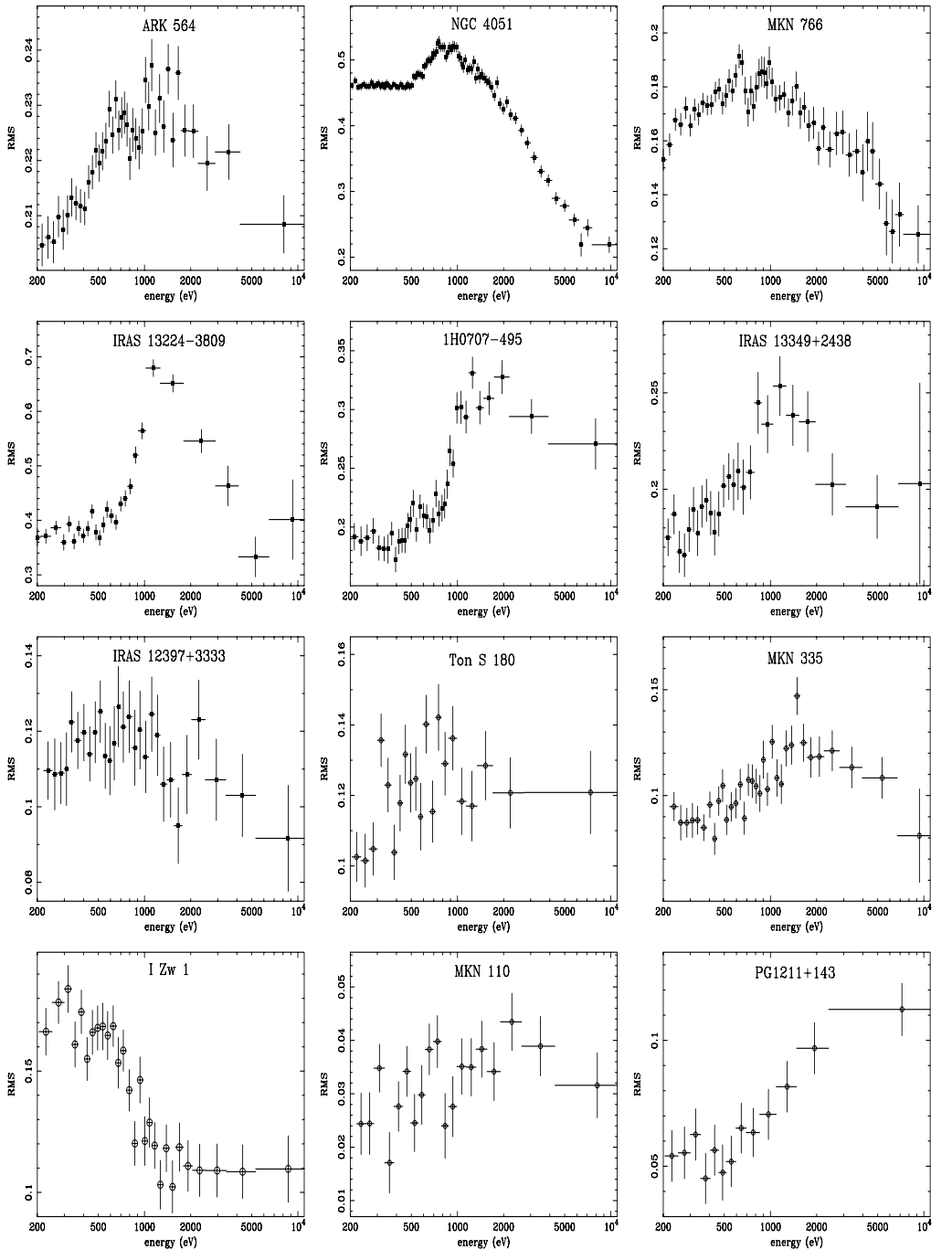

Figure 1. RMS spectra of all the NLS1 of the *ROSAT* All Sky survey, with a PSPC count rate higher than 0.2 s^{-1} and a Galactic latitude $|b| \geqslant 15°$, observed with *XMM-Newton* for more than 30 ks. The sources are sorted according to the black hole masses: filled squares, open circles, and stars indicate objects with the black hole mass lower than $10^7 M_\odot$, between 10^7 and $10^8 M_\odot$, and higher than $10^8 M_\odot$, respectively. Note: Black hole masses have been all taken from literature (see O'Neill *et al.* 2005) except for IRAS13224-3809 and 1H0707-495 for which these were assumed based on their strong and fast variability.

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