Suzaku First Results on Extragalactic Compact Objects

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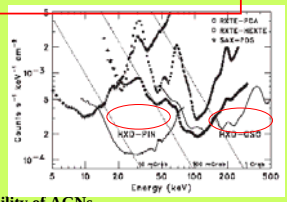
In this poster, we present the Suzaku first results of AGNs (Mrk 3, NGC4051, NGC4388, NGC4945, 3C120). This is complementary with James Reeves's talk, who gives the first results on mainly MCG-5-23-16, MCG-6-30-15, NGC2110, NGC2992, and NGC3516. Also, refer to Alex Markowitz's poster on NGC3516.

Common features:

Seyfert galaxies has a variable powerlaw component without spectral change and a constant reflection component, but for the radio galaxy 3C120.
(see also MCG-5-23-15, MCG-6-30-15)

Seyfert 2 galaxies with strong absorption show only a narrow Fe-K line, indicating that the reflector is not close to the blackhole but far from the inner region
(example: NGC4388 vs MCG-6-30-15).

Good Fe-line spectroscopy can constrain the ionization state of the reflector more tightly (see also NGC2992).



Suzaku XIS: (CCD) 0.3---12 keV
HXD: 8---600keV

Suzaku powers in observing AGNs

Wide band X-ray spectroscopy
with good signal-to-ratio
Large effective area
Low background

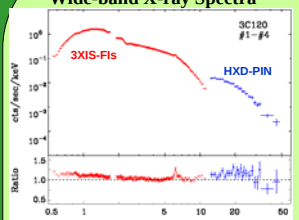
These enable us to study the time variability of AGNs.

Good energy resolution in the lower energy band and
Good calibration of energy scale
Precise line spectroscopy, especially for O and Fe

Low Background of HXD

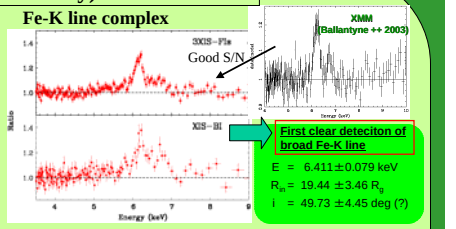
3C120 (Broad Line Radio Galaxy) Kataoka et al.

Wide-band X-ray Spectra



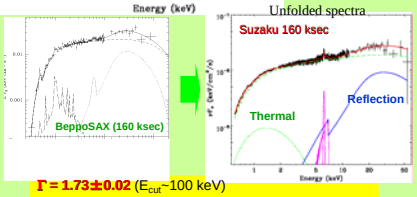
Observation
2006/2/9-10
2/16-17
2/23-24
3/2-3
40ks*4

Fe-K line complex



First clear deteciton of broad Fe-K line
E = 6.411±0.079 keV
R_{in} = 19.44 ±3.46 R_g
i = 49.73 ±4.45 deg (?)

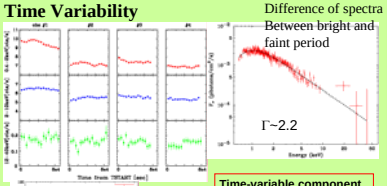
Unfolded spectra

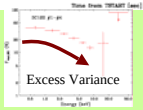


Γ = 1.73±0.02 (E_{cut}~100 keV)
Reflection Ω/2π = 0.51±0.24
Thermal kT ~ 1 keV bremss

Precise constraint on the weak reflection component.

Time Variability

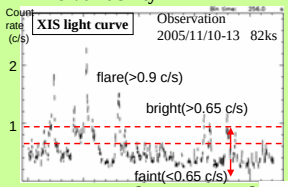




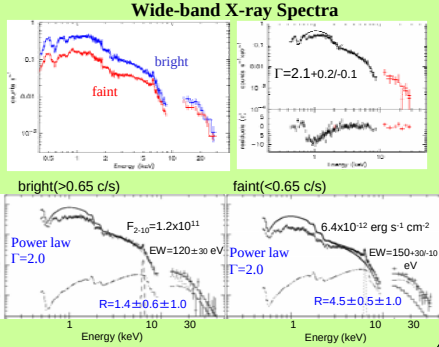
Time-variable component has a steeper slope of the powerlaw than that of the average, indicating one more emission component against the direct and Reflection.

NGC4051 (Rapid-variable Seyfert 1) Terashima et al.

Time Variability



Wide-band X-ray Spectra

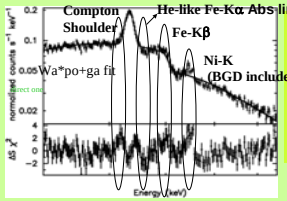


Rapid variability was also observed with Suzaku. First clear spectral variability was be measured; variable powerlaw component without spectral change and constant felfection component. This phenomenon is similar to bright Seyfert 1 galaxies.

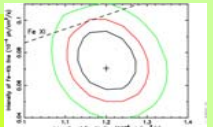
NGC4388 (Seyfert 2) Shirai and Fukazawa et al.

Fe-K line complex

Observation 2005/12/24-27 100ks (The longest than any previous satellites)

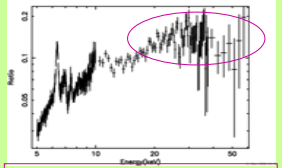


Compton Shoulder around 24% of total line flux
He-like abs line EW 13 eV
Fe-Kα line center energy 6.403±0.020 keV



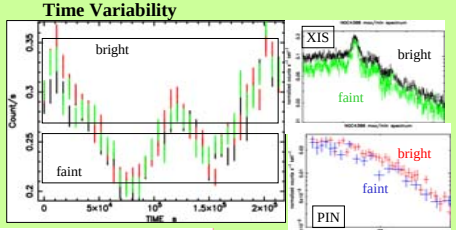
Kβ/Kα Ratio tightly constrain the ionization degree of >10. Fe-Kα center energy gives that of <15 . Then, the iron ionization in the feflector is around 10—15.

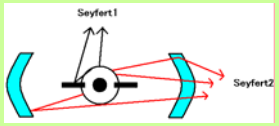
Wide-band X-ray Spectra (Crab Ratio)



Clear detection of the reflection component, apart from the absorbed direct component.

Time Variability

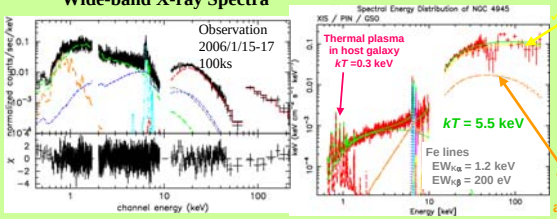




Clear time variation by a factor of 1.5 in half-day. The narrow Fe-K line and hard reflection component is less variable, indicating that the reflector is far from the blackhole.

NGC4945 (Compton-thick Seyfert 2) Itoh and Isobe et al.

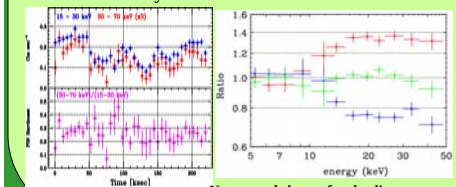
Wide-band X-ray Spectra



Abs * (Mekal + Bremss + 3 Gaussians + reflection + abs * PL)

Emission is detected upto at least 200 keV,

Time Variability

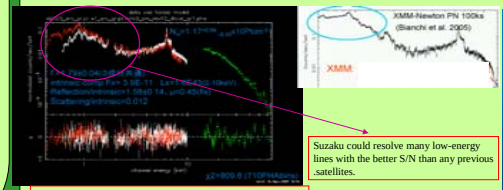


No spectral change for the direct component (consistent with weak reflection).

Mrk 3 (Compton-thick Serfert 2) Awaki et al.

Observation 2005/10/22-24 100ks

Wide-band X-ray Spectra



Suzaku could resolve many low-energy lines with the better S/N than any previous satellites.

Tight constraint of the reflection component. No significant time variability (<10%)

Low-energy Line Spectroscopy