MCG-5-23-16
The XMM long look

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MGC-5-23-16 is a bright nearby Compton-Thin Sy 1.9 (z=0.0085), with 2-10 keV flux ~7-9 x 10^{-11} erg cm^{-2} s^{-1}

One of the best examples of a relativistically broadened Fe line detected with ASCA and confirmed by previous short XMM observations (Exp~25 ksec).

INTRODUCTION

Broad Fe Ka is a key feature to study the innermost region of AGNs.

Chandra and XMM observations showed:

- in some cases the lack of the expected broad component
- the ubiquitous presence of a narrow 6.4 keV core
- the complexity and ambiguity of modelling these features
SCIENTIFIC GOALS

- Characterize Fe line profile
- Variability of the narrow and broad components
- Combined Chandra HEG observations
- Combined RXTE and Suzaku observations

Geometry accretion disk, ionization
Localization of the emitting regions
Resolve the narrow core
Constrain continuum
Measure the amount of reflection.

Only with this broad band coverage is possible to break the degeneracy when modelling the Fe K line+reflection.
Evident residuals:
Soft band -> scattered emission (PL + emission lines, thermal?)
Fe complex -> broad line
The emission below 2 keV

- scattered emission is <1% of direct continuum
- steep photon index ($\Gamma \sim 3$).
- The PL component leaves line like residuals.

Inspection of the RGS data shows narrow emission lines with EW $\sim$ 30 eV.

2 models: multi temperature thermal or photoionization with $\log(\xi) \sim 1.2$ and $\Gamma \sim 1.8$.

Lack of Fe shell and presence of OVII RRC, suggestive of photoionized emission (i.e. from NRL)
Suzaku clearly detects the reflection hump and resolves the 6-7 keV Fe line complex.

Combined Suzaku and XMM fitting show good agreement for Normalization, $\Gamma$, $N_H$

68%, 90%, 99% and 99.9% confidence levels

Reflection fraction measured with Suzaku seems higher than the BeppoSAX one.

Suzaku R confirmed by RXTE.

Possible that SAX amount of reflection was due to previous lower flux of MCG-5-23-16?

Strong dependence of R with $\Gamma$ we cannot rule out SAX-R $\sim$ 1
**XMM-pn Fe line profile**

Fe $K\alpha$ narrow core

- $E = 6.41 \pm 0.01$ keV
- $EW = 70 \pm 6$ eV

Fe $K\beta$ at 7.06 keV

Fe K edge at 7.1 keV

Red-wing

Blue-wing

Ratio to Power law model $\Gamma = 1.8$
Ratio of the HEG and MEG spectra from an absorbed PL model ($\Gamma \sim 1.9$ $N_H \sim 1.7 \times 10^{22}$)

- $\text{Fe K}\alpha$ resolved
- TOT EQW Fe complex $\sim 110$ eV
- EQW narrow core $\sim 65$ eV
  $\sigma = 35 \pm 15$ eV (FWHM $\sim 4000$ km/s)

- 2 possible narrow abs. features after fitting the XMM/Suzaku best fit. Ec $\sim 7.26$ keV; 7.35 keV
- If associated with Fe XXVI this lines would correspond to outflow velocities of $\sim 0.04c$ and $\sim 0.05c$
- More checks to be done...
Results on the Fe line model

For the XMM pn analysis we adopted the Suzaku best fit values for R=1.2±0.1 and Z=0.4xsolar

- Constrains of the underlying continuum -> determination of the Fe line parameters

MODEL: diskline+narrow Kα+CS+Kβ

Narrow Fe Kα
E=6.41±0.01 keV
EW=70±6 eV
agreement with HETG

Diskline: i=52°±20°
EW=55±17eV
Rin=50Rg
Time resolved spectral analysis

Flux (2-10keV) ranges from $7.34 \times 10^{-11}$ to $8.91 \times 10^{-11}$ cgs

The Fe narrow core consistent with being constant.

We cannot exclude possible weak variation of the broad component.

MODEL: diskline+narrow Kα+Kβ

In the 3rd spectrum a possible absorption feature is present at $\sim 7.8$ keV (Rest Frame). $|EW| \sim 50$ eV ($\Delta \chi^2 \sim 35$).
The analysis of the other 4 spectra shows the sporadic nature of this feature.

If 7.8 keV is due to Fe XXVI (6.97keV) the blueshift $\rightarrow$~0.1c

More check to be done to assess the significance of the feature.

Good fit with XSTAR with ionization parameter $\log(\xi) = 3.76 \pm 0.22$
Variability within the long exposure and comparison with other observations

- Comparison with previous SAX, RXTE, Chandra observations shows no compelling evidence for $\Gamma$ and $N_H$ variability.

- During the present observation the 2-10 keV flux ranges from $7-9 \times 10^{-11}$ cgs, comparable to the flux variability shown in the last 10 years.

- The reflection component and the Fe line complex do not vary during the present observation, to confirm or rule out possible variability of the amount of reflection more broadband observations are needed.

- We detected a transient absorption feature -> indicative of a possible high velocity outflow.
MCG-5-23-16 shows a complex Fe line profile with narrow and broad components.

The Fe diskline profile is explained with emission from outer part of the accretion disk (Rin>20Rg) with inclination angle ~52°

No compelling evidence for variability in the broad and narrow Fe Kα component.

Constancy of narrow core component indicative of origin from distant matter i.e. torus/BLR

Detection of strong reflection and CS in the Fe line supports the presence of both Compton-Thick and Compton-Thin matter