MCG-5-23-16
The XMM long look

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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

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* (Weaver et al. '97, '98) and confirmed by previous short XMM observations (Exp~25 ksec, Dewangan et al. 2003, Balestra et al. 2004).

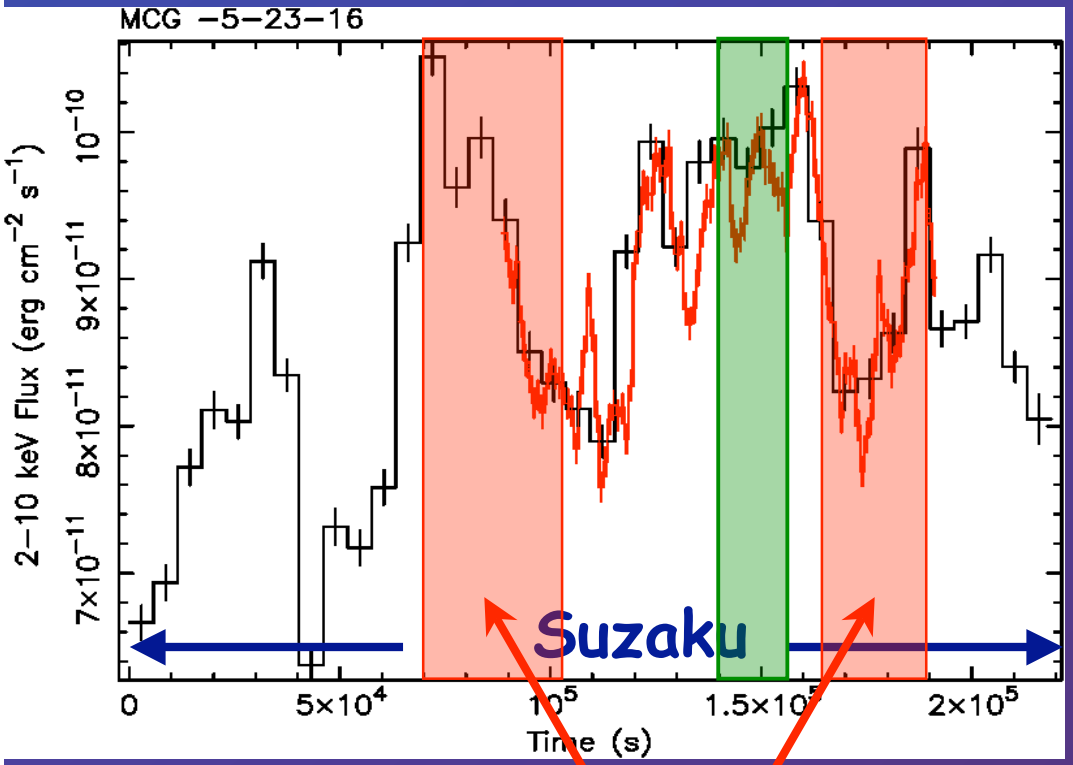
SCIENTIFIC GOALS

- characterize Fe line profile → Geometry accretion disk, ionization
- variability of the narrow and broad components → Localization of the emitting regions
- combined Chandra HEG → Resolve the narrow core
- combined RXTE and Suzaku observations → 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

THE 2005 CAMPAIGN



Suzaku 240 ksec (net 100 ksec)

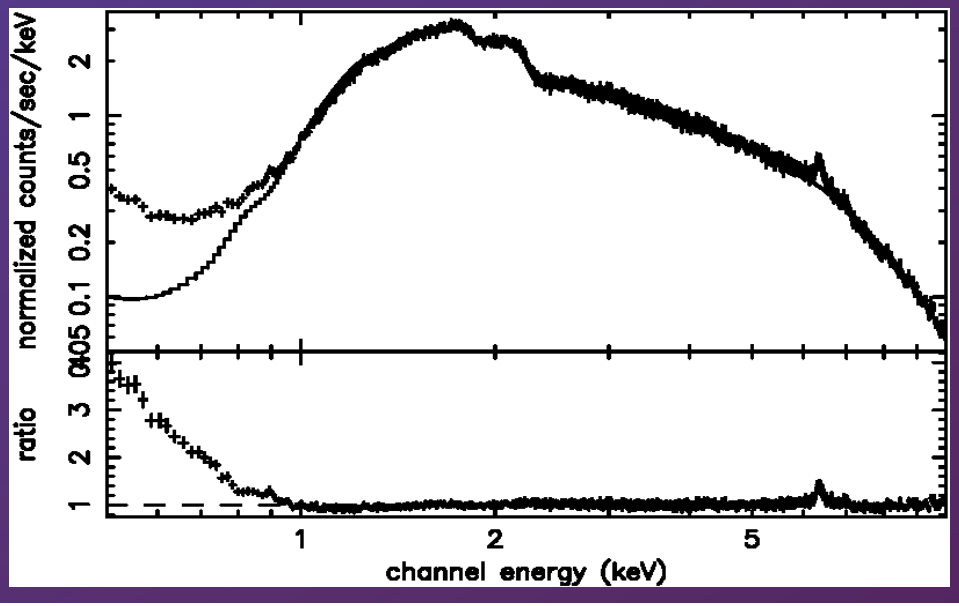
XMM 130 ksec (net 100 ksec)

2-10 kev net cts~7×10^5

Chandra: 2 observations with HETG for a total of ~50 ksec

RXTE 16.6 ksec (net 15 ksec)

XMM pn ratio to Absorbed PL (Γ =1.8 $N_H=1.5\times10^{22}cm^{-2}$)

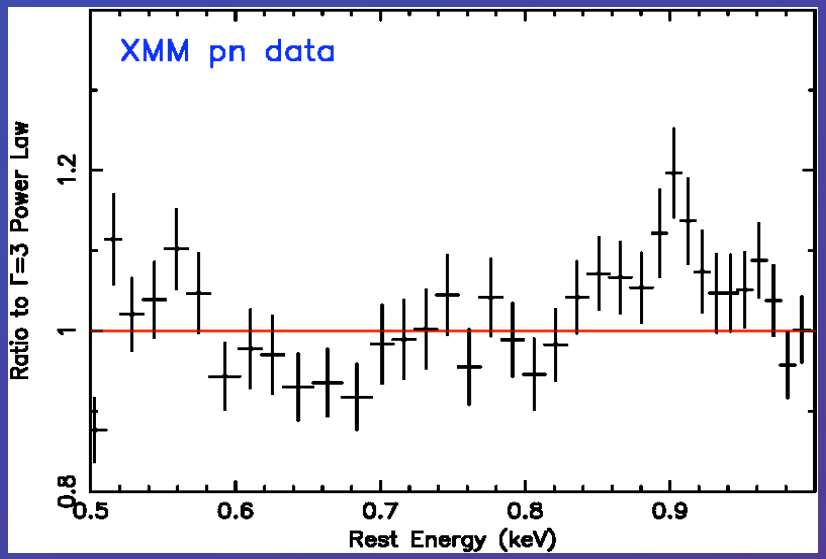


Evident residuals:

Soft band -> scattered emission (PL + emission lines, thermal ?)

Fe complex -> broad line

The emission below 2 keV

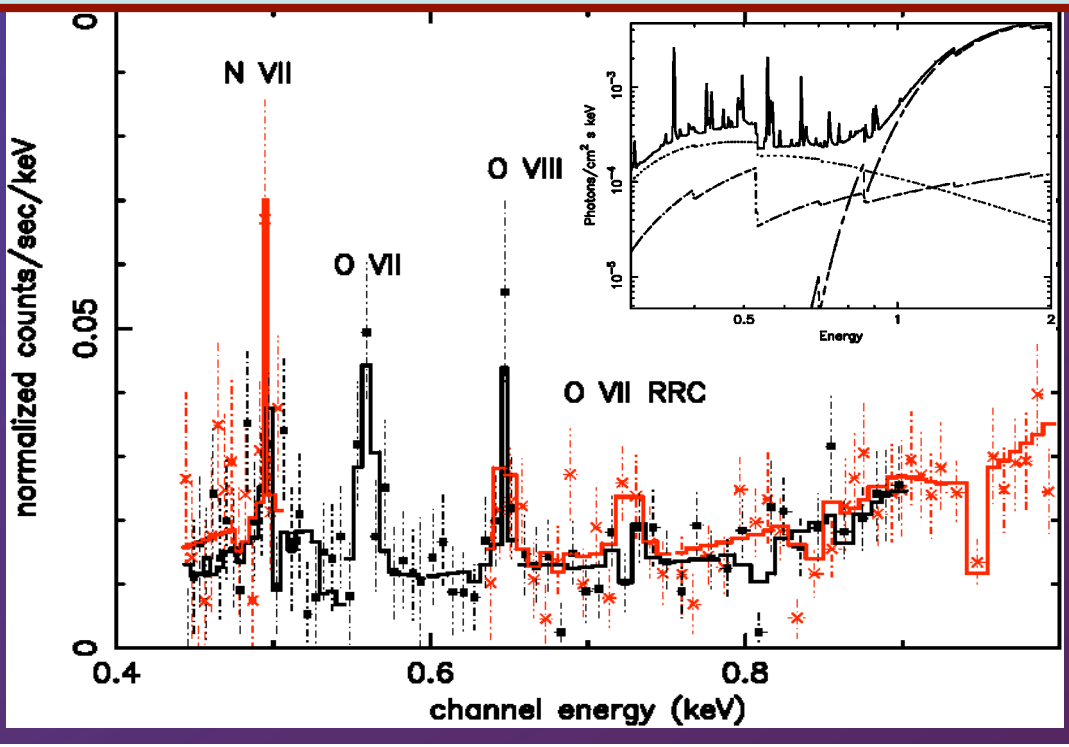


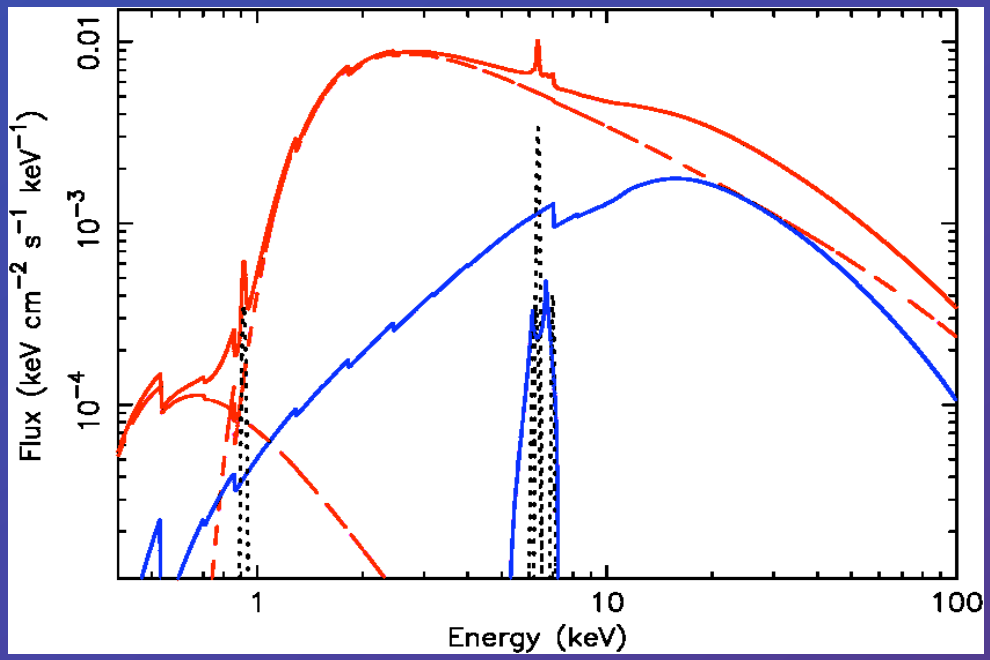
- scattered emission is <1% of direct continuum
- steep photon index (Γ~3).
- The PL component leaves line like residuals.

Inspection of the RGS data shows narrow emission lines with EW~30 eV.

2 models: multi temperature thermal or photoionization with log(ξ)~1.2 and Γ~1.8.

Lack of Fe L shell and presence of OVII RRC, suggestive of photoionized emission (i.e. from NRL)





Suzaku cleary detects the reflection hump and resolves the 6-7 keV Fe line complex (Reeves et al. in prep).

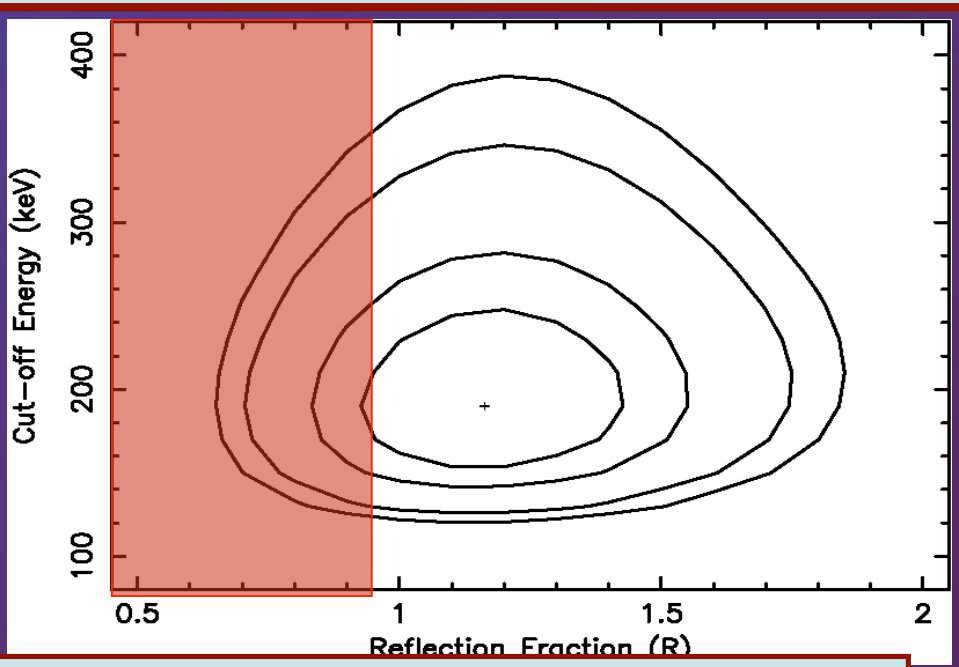
Combined Suzaku and XMM fitting show good agreement for Normalization, Γ, N_H

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

Reflection fraction measured with Suzaku seems higher then the BeppoSAX one (Risaliti 2002, Perola et al. 2002, Balestra et al. 2004).

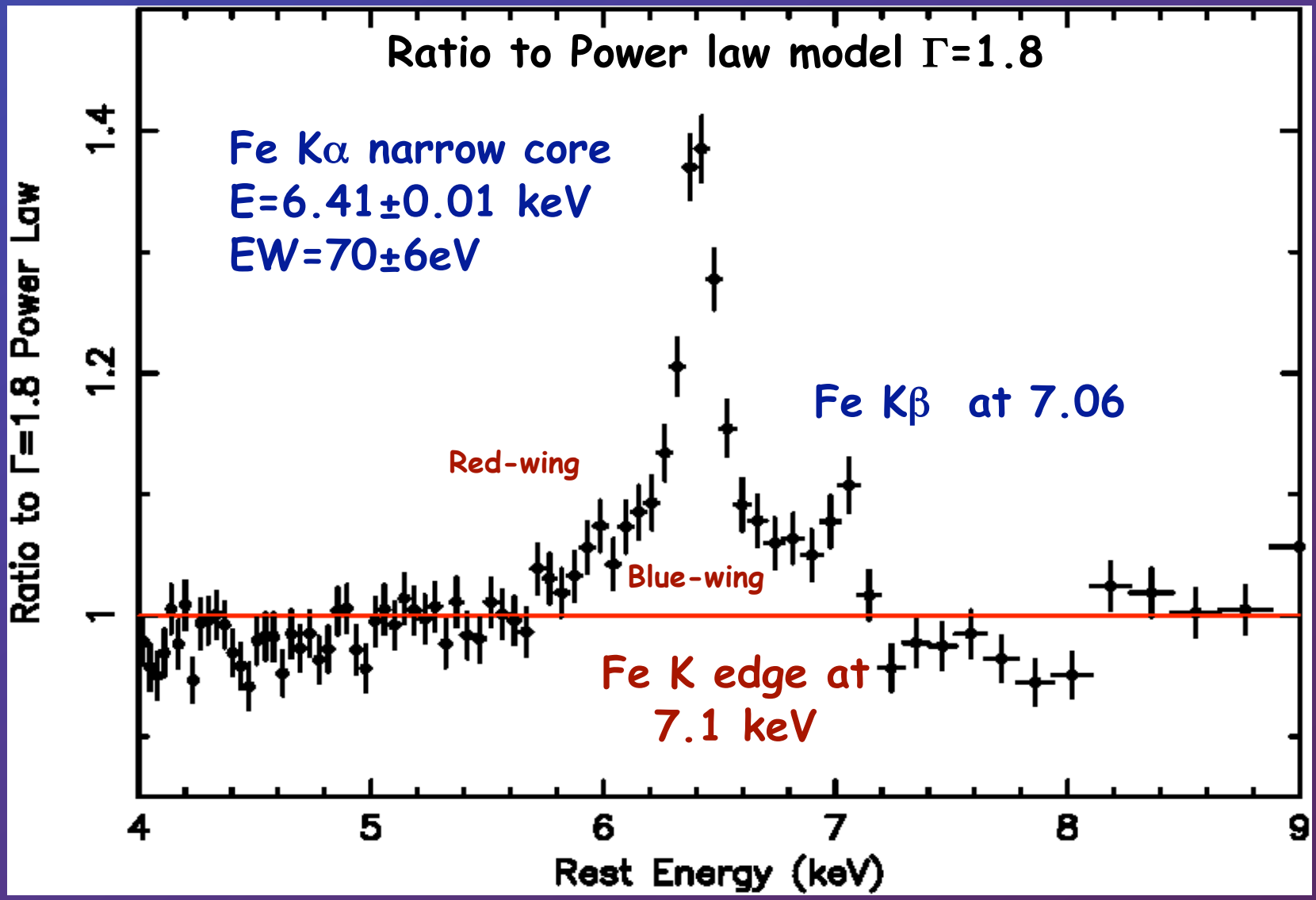
Suzaku R confirmed by RXTE.

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

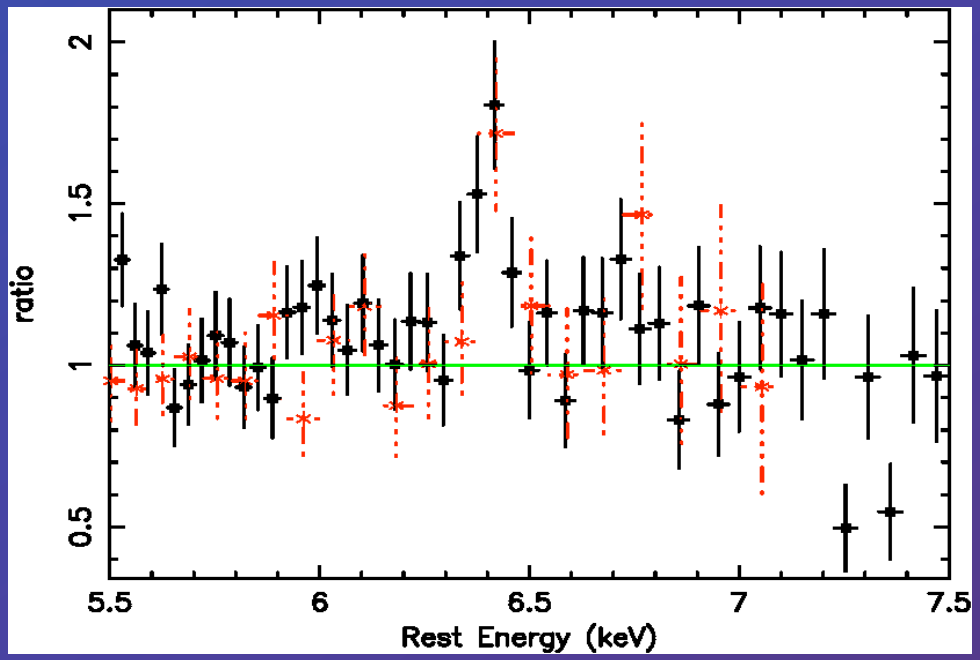


Strong dependence of R with Γ we cannot rule out SAX-R ~ 1

XMM-pn Fe line profile

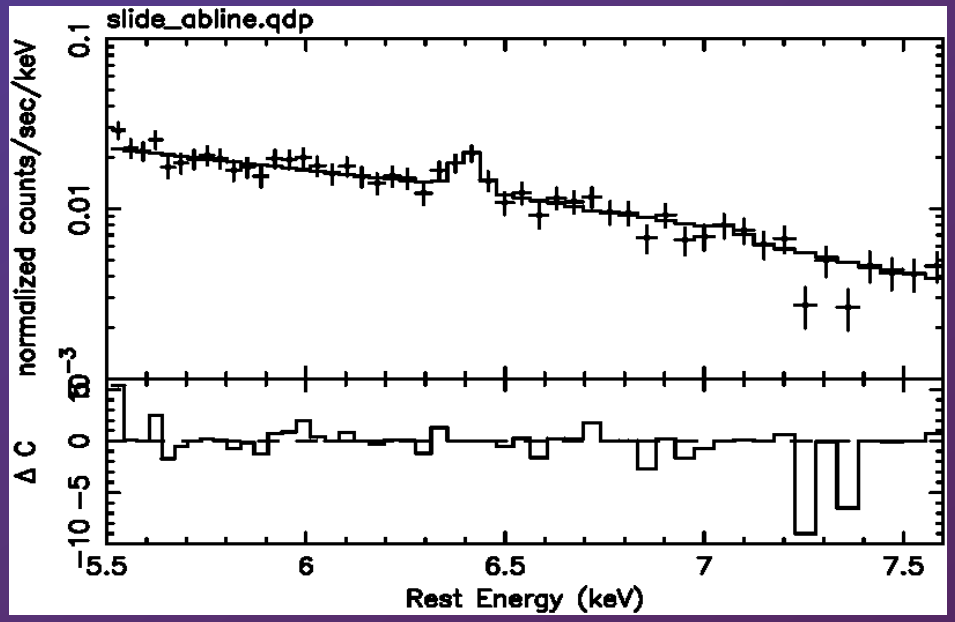


Simultaneous Chandra observation



Ratio of the HEG and MEG spectra from an absorbed PL model (Γ~1.9 N_H ~1.7×10^{22})

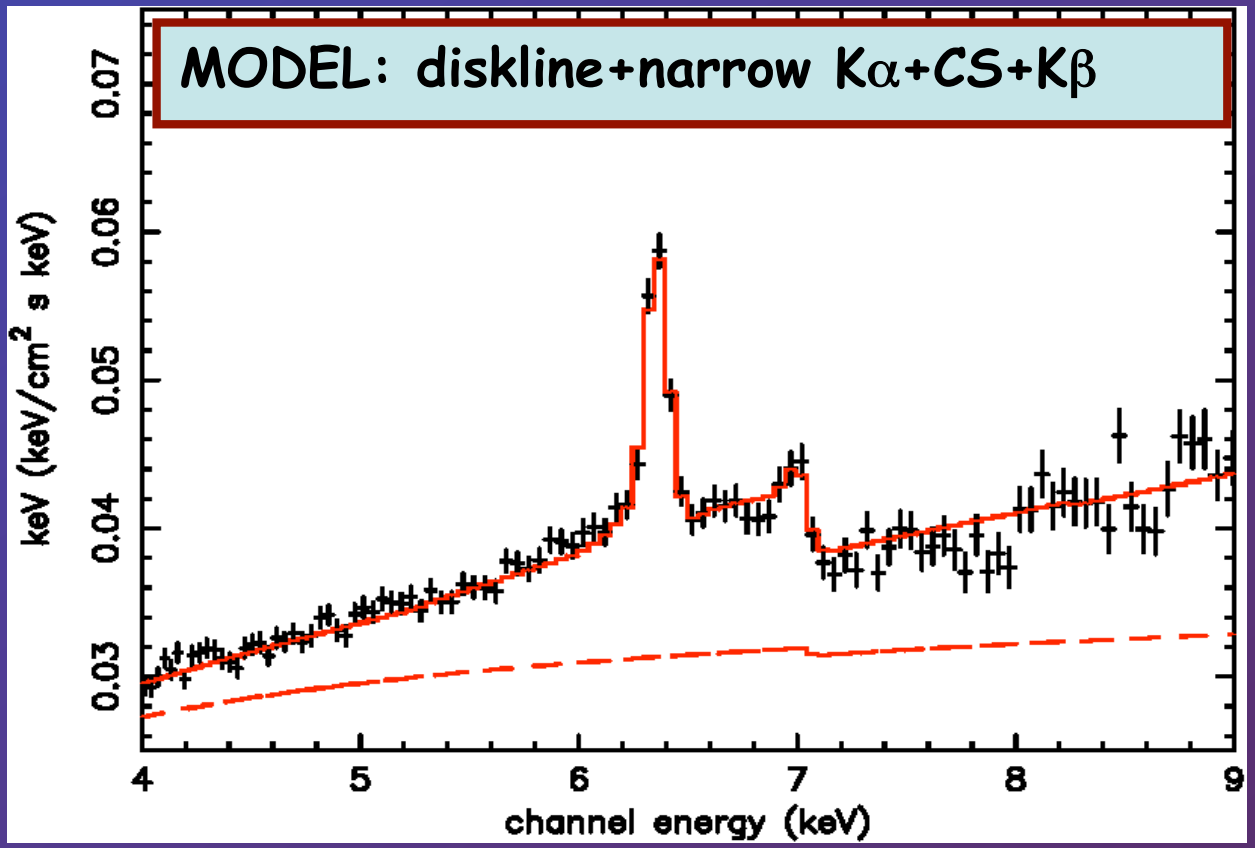
- Fe Kα resolved
- TOT EQW Fe complex ~110 eV
- EQW narrow core ~65eV σ=35± 15eV (FWHM~4000km/s)



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=0.5xsolar

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

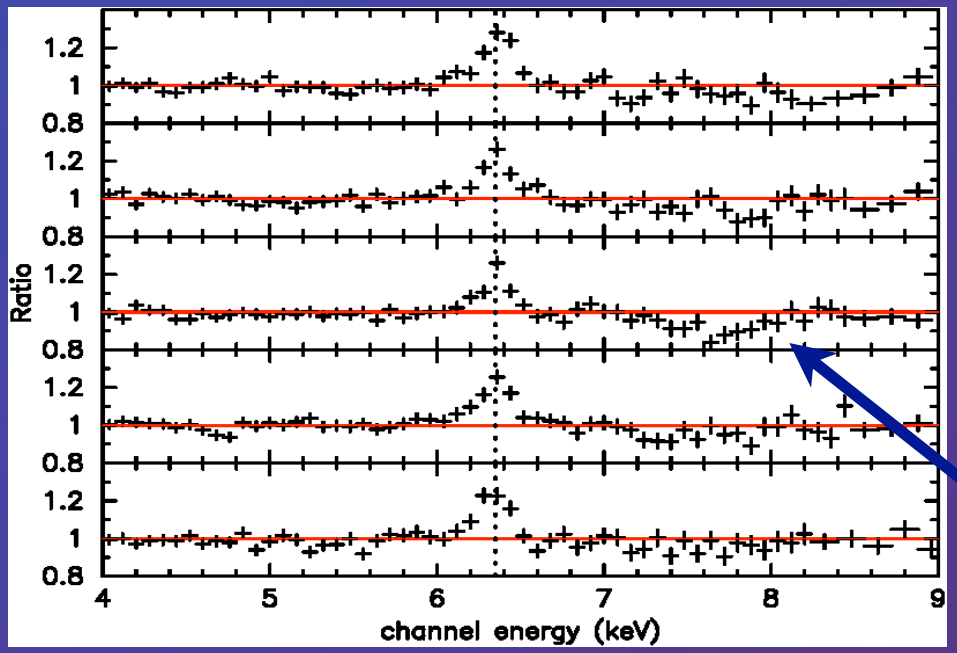


Narrow Fe Kα
E=6.41±0.01 keV
EW=70±6 eV
agreement with HETG

Diskline: *i*=52°±20°
EW=55±17eV
Rin=50Rg

Time resolved spectral analysis

Fit with baseline continuum model

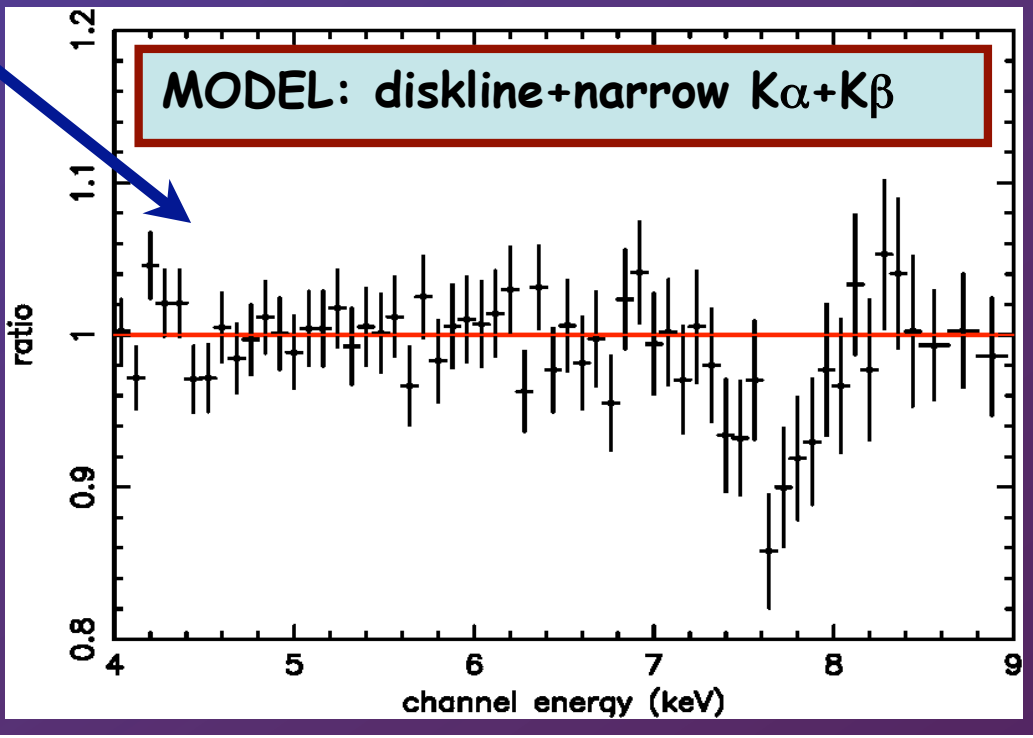


Flux (2-10keV) ranges from 7.34×10^{-11} to 8.91×10^{-11} cgs

The Fe narrow core consistent with being constant.

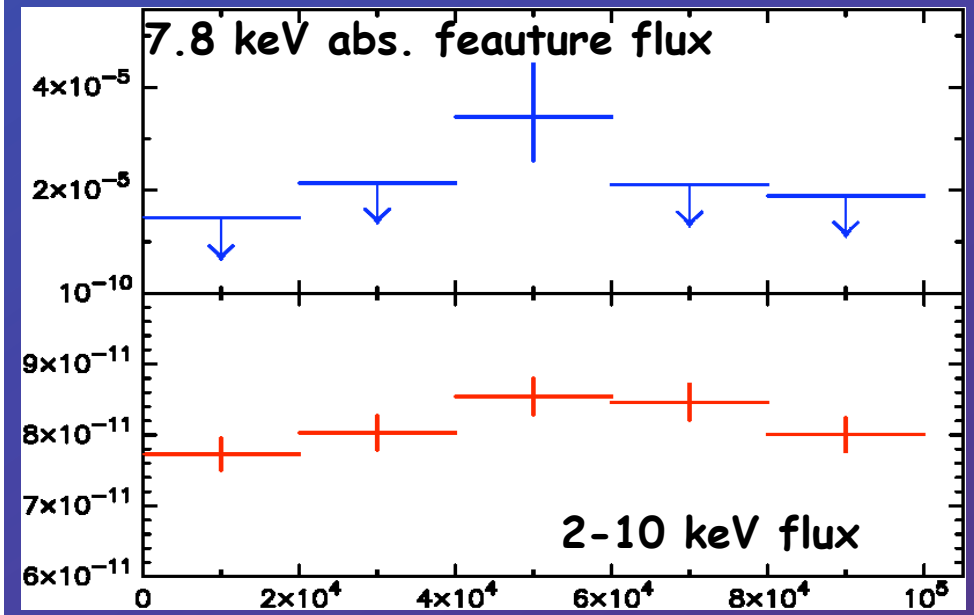
We cannot exclude possible weak variation of the broad component.

MODEL: diskline+narrow Kα+Kβ



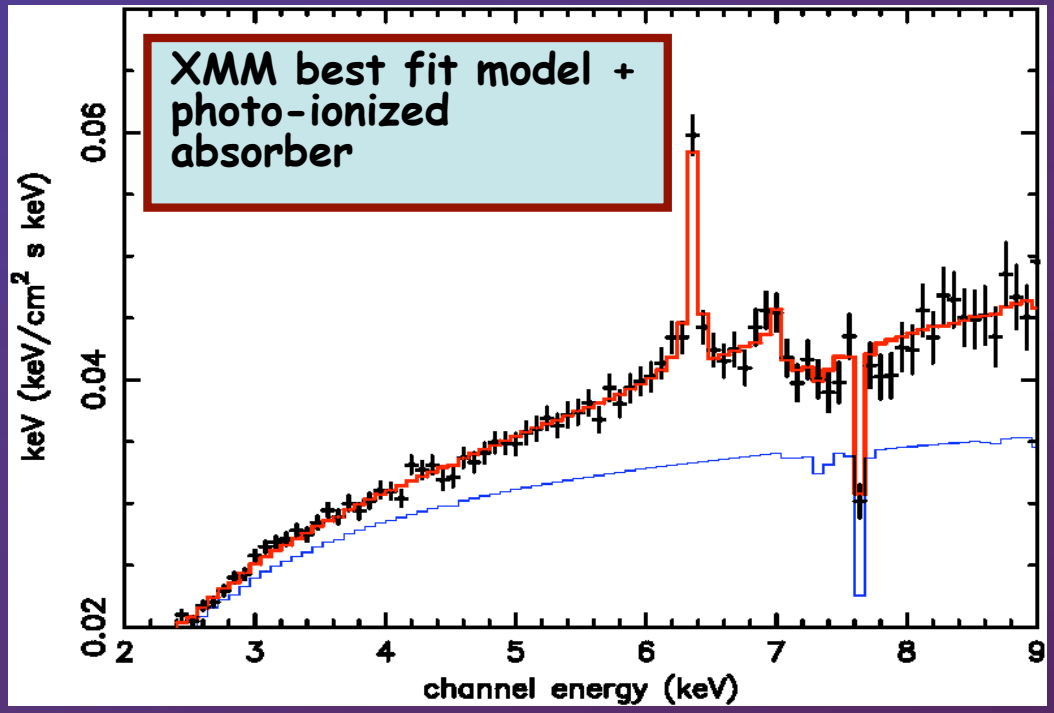
In the 3rd spectrum a possible absorption feature is present at ~7.8 keV (Rest Frame). |EW|~50 eV ($\Delta\chi^2$~35).

Time resolved spectral analysis II



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 ->~0.1c



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

Good fit with XSTAR with ionization parameter log(ξ)=3.76±0.22

Variability within the long exposure and comparison with other observations

- Comparison with previous SAX, RXTE, Chandra observations shows no compelling evidence for Γ and N_H variability
- During the present observation the 2-10 keV flux ranges from 7-9 $x10^{-11}$ 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

SUMMARY

- 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