X-ray observations of NGC 1365: Time-resolved eclipse of the X-ray source

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NGC 1365: The best laboratory to investigate the absorber in obscured AGN

Hard X-ray observations:

ASCA (1995)	40 ks
BeppoSAX (1997)	30 ks
Chandra (Dec 2002)	15 ks
XMM 1 (Jan 2003)	17 ks
XMM 2 (Jan 2003)	10 ks
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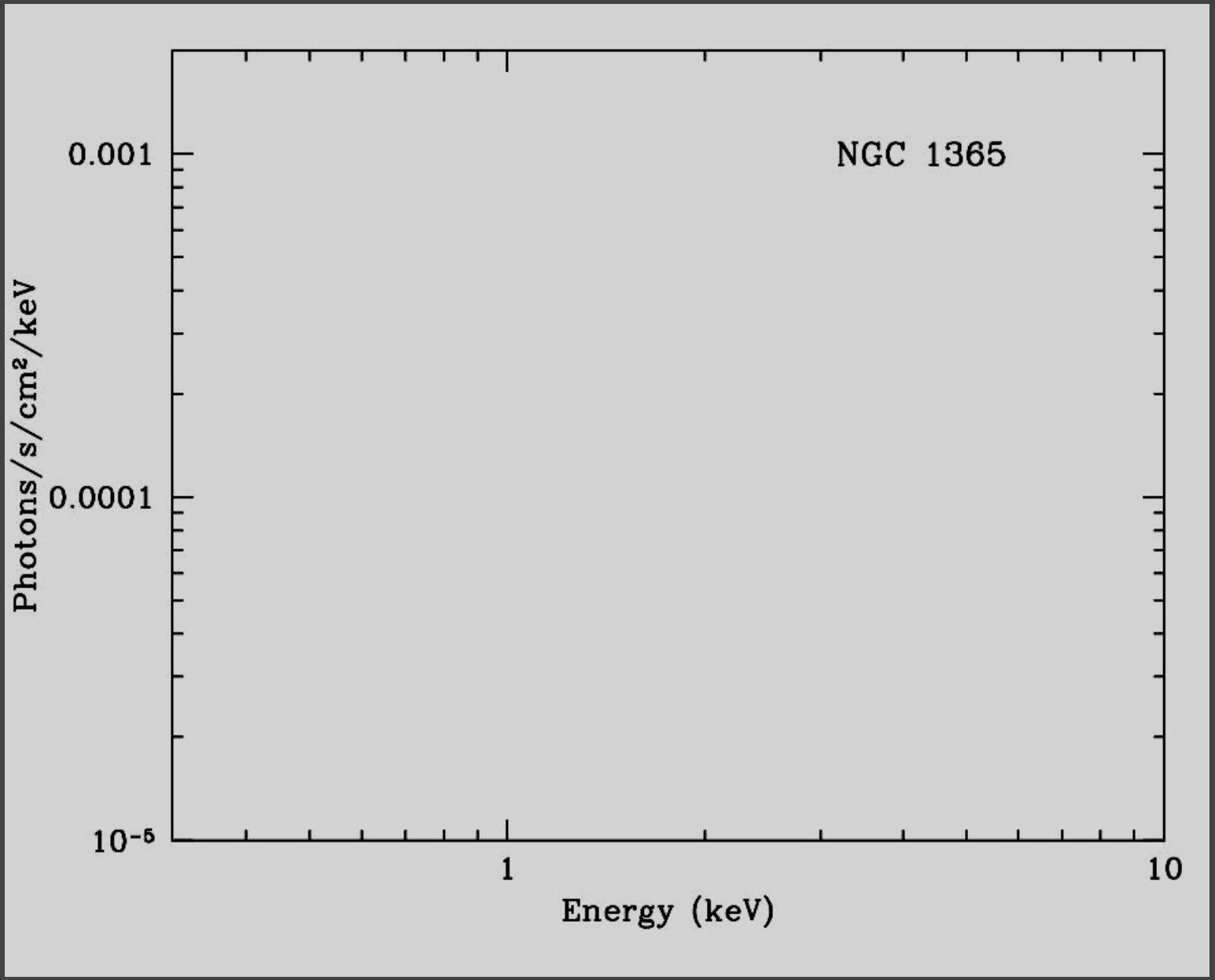
Chandra (Apr 2006):
6 x 15 ks

NGC 1365: Summary of past spectral variability



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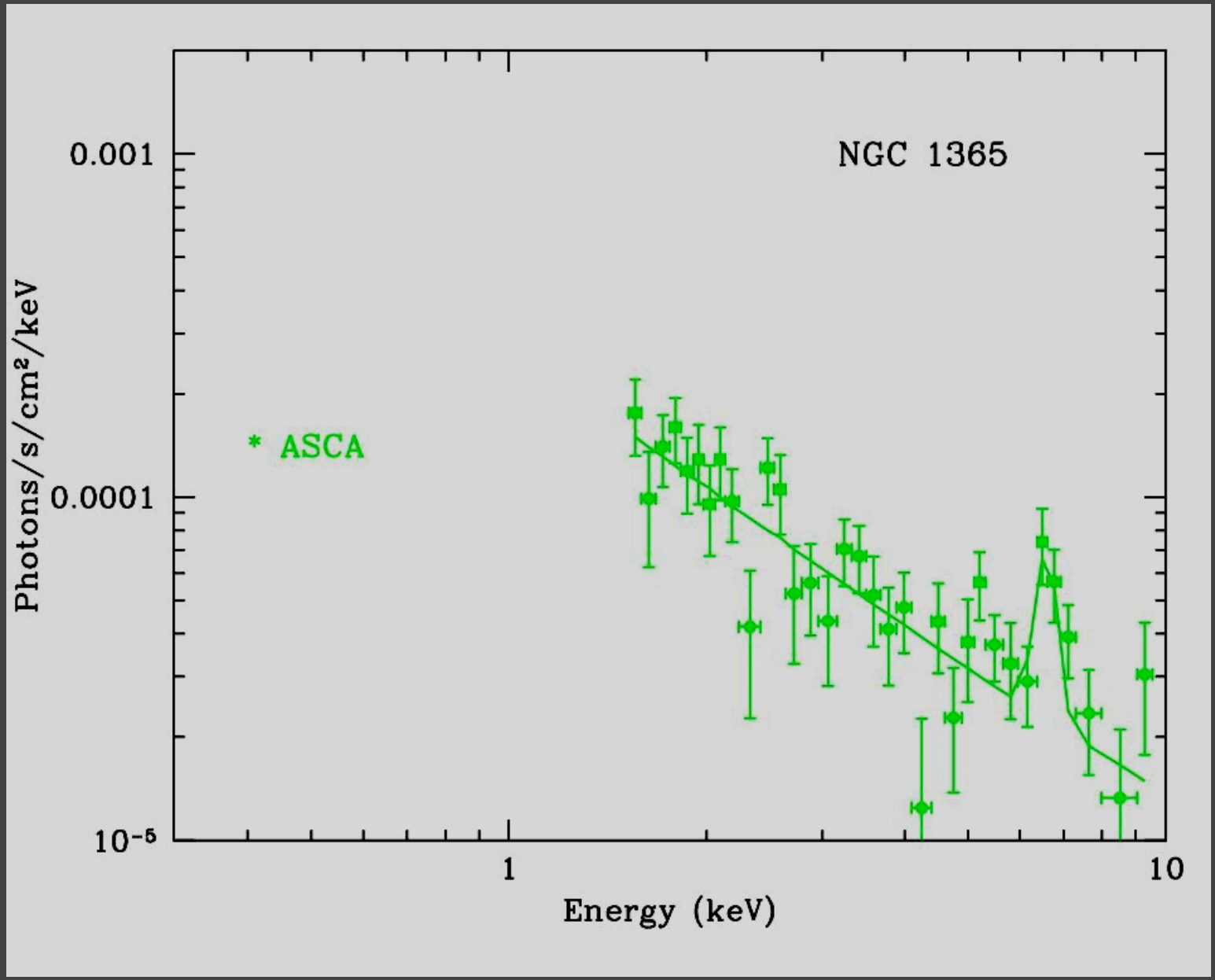

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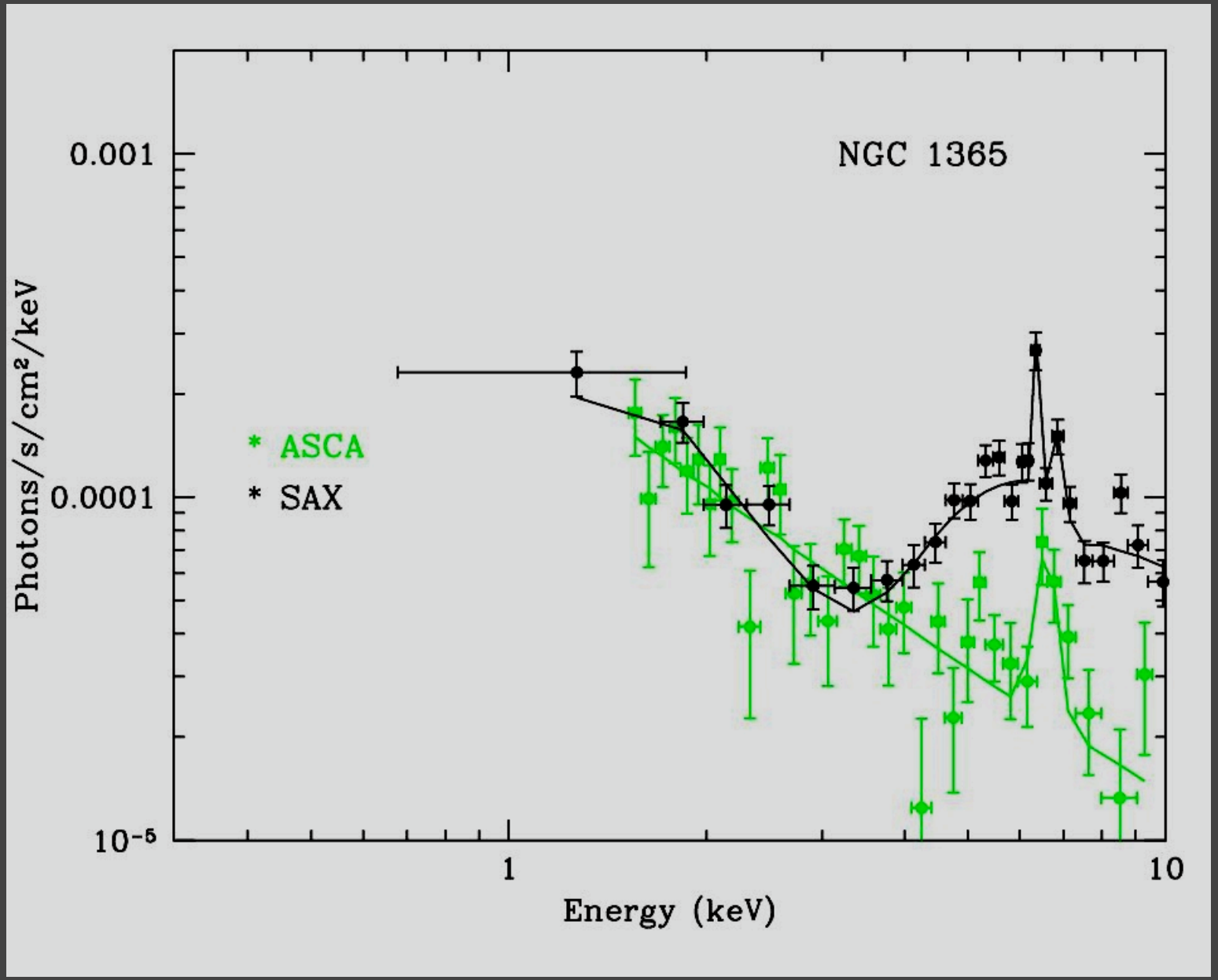

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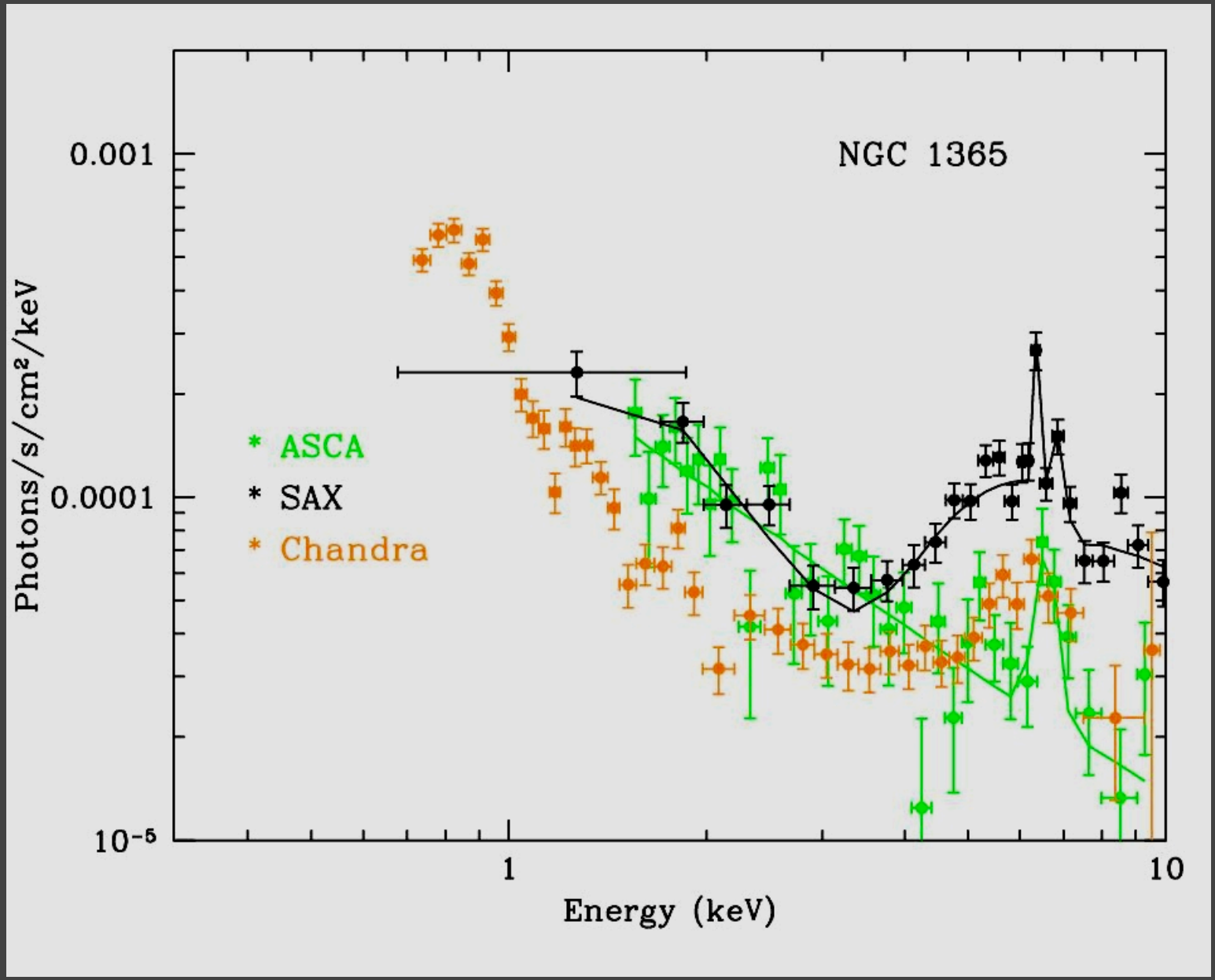

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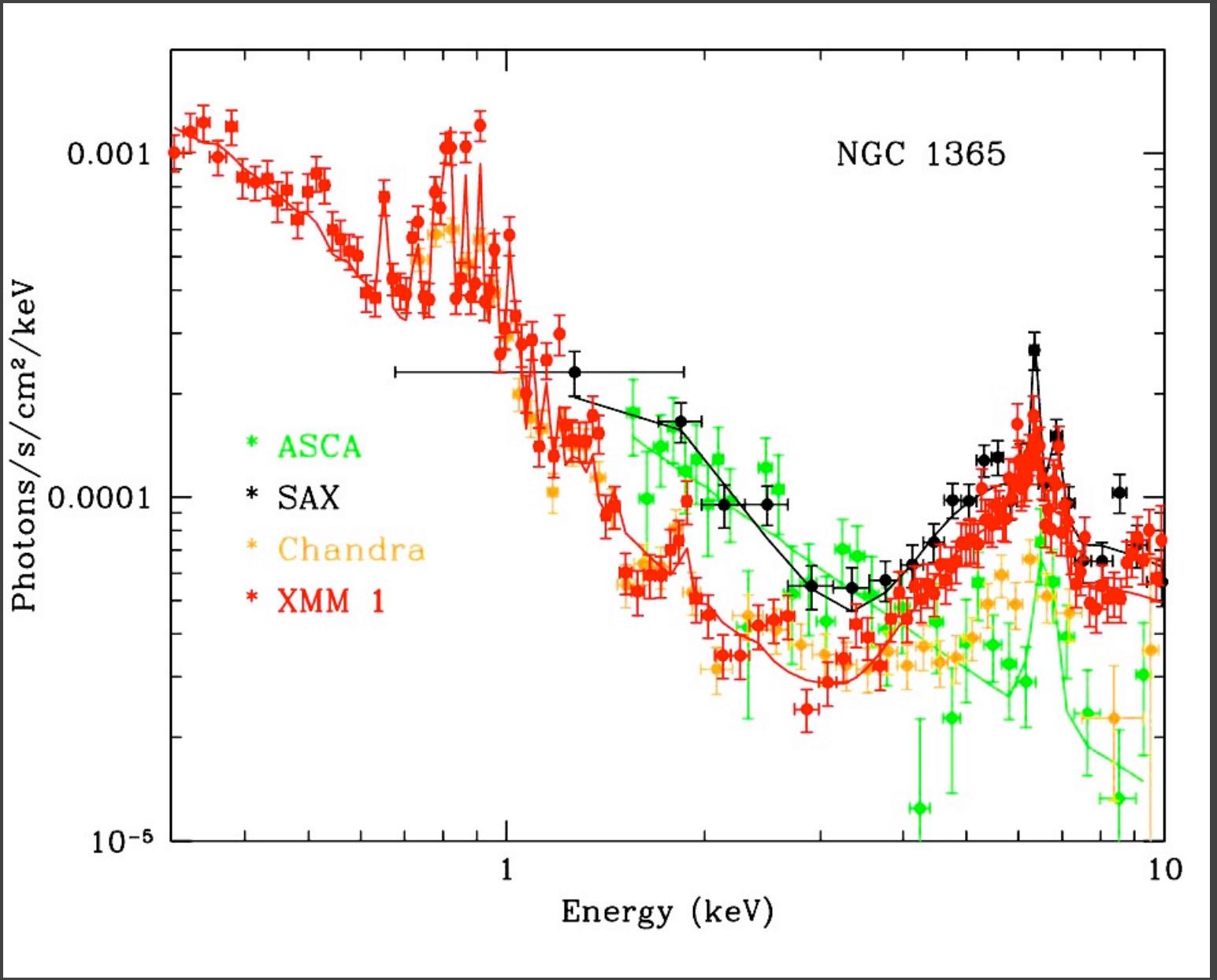

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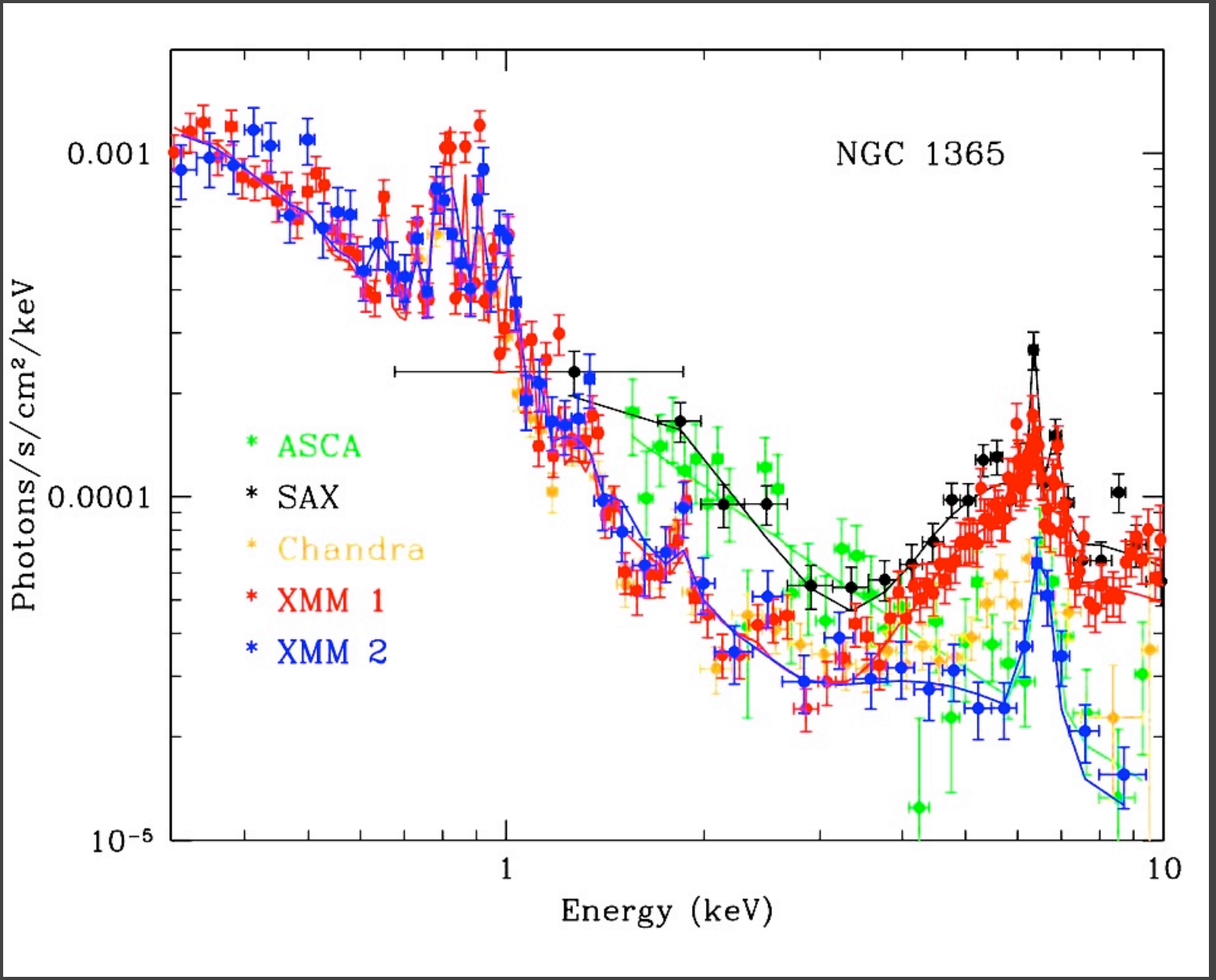

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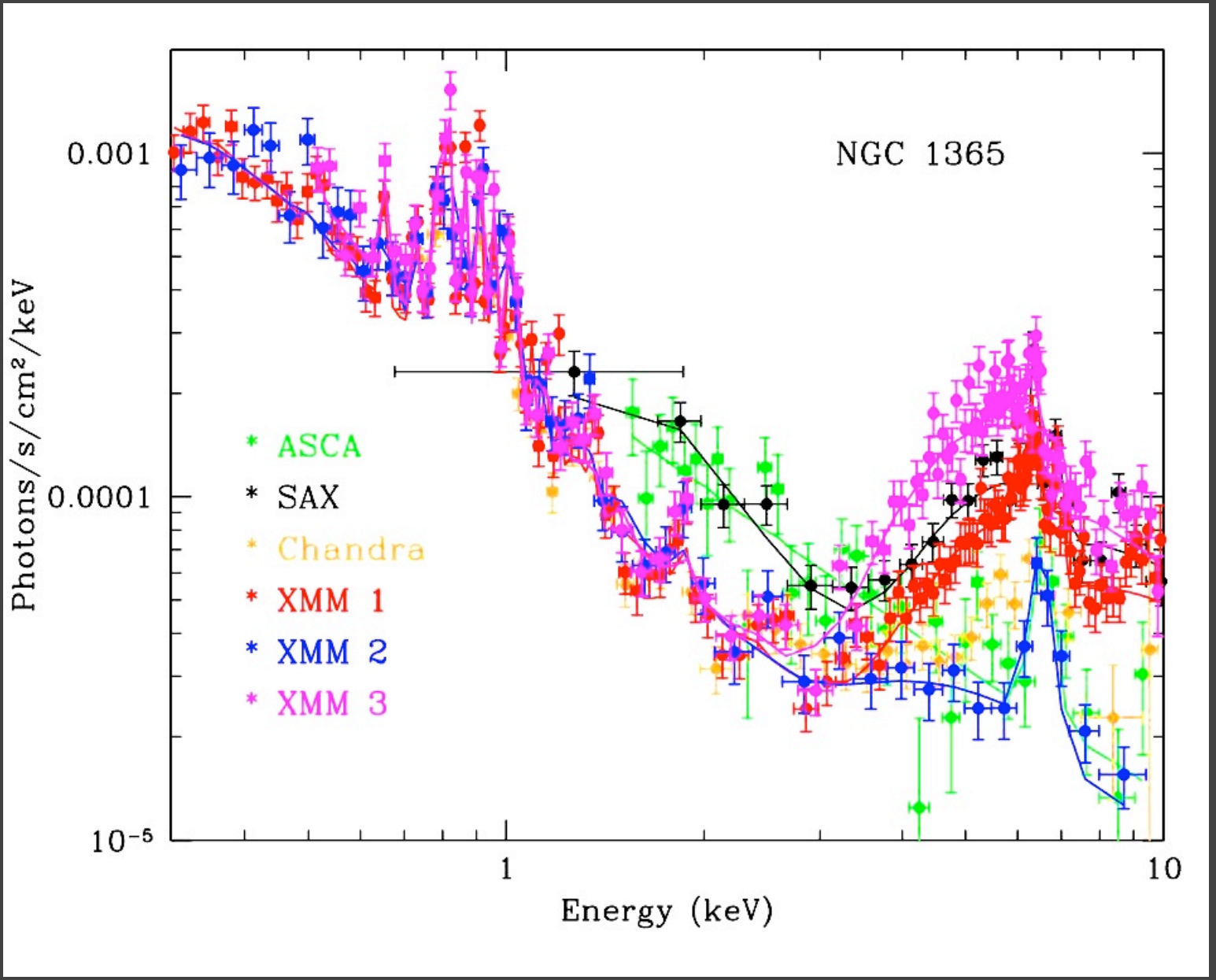

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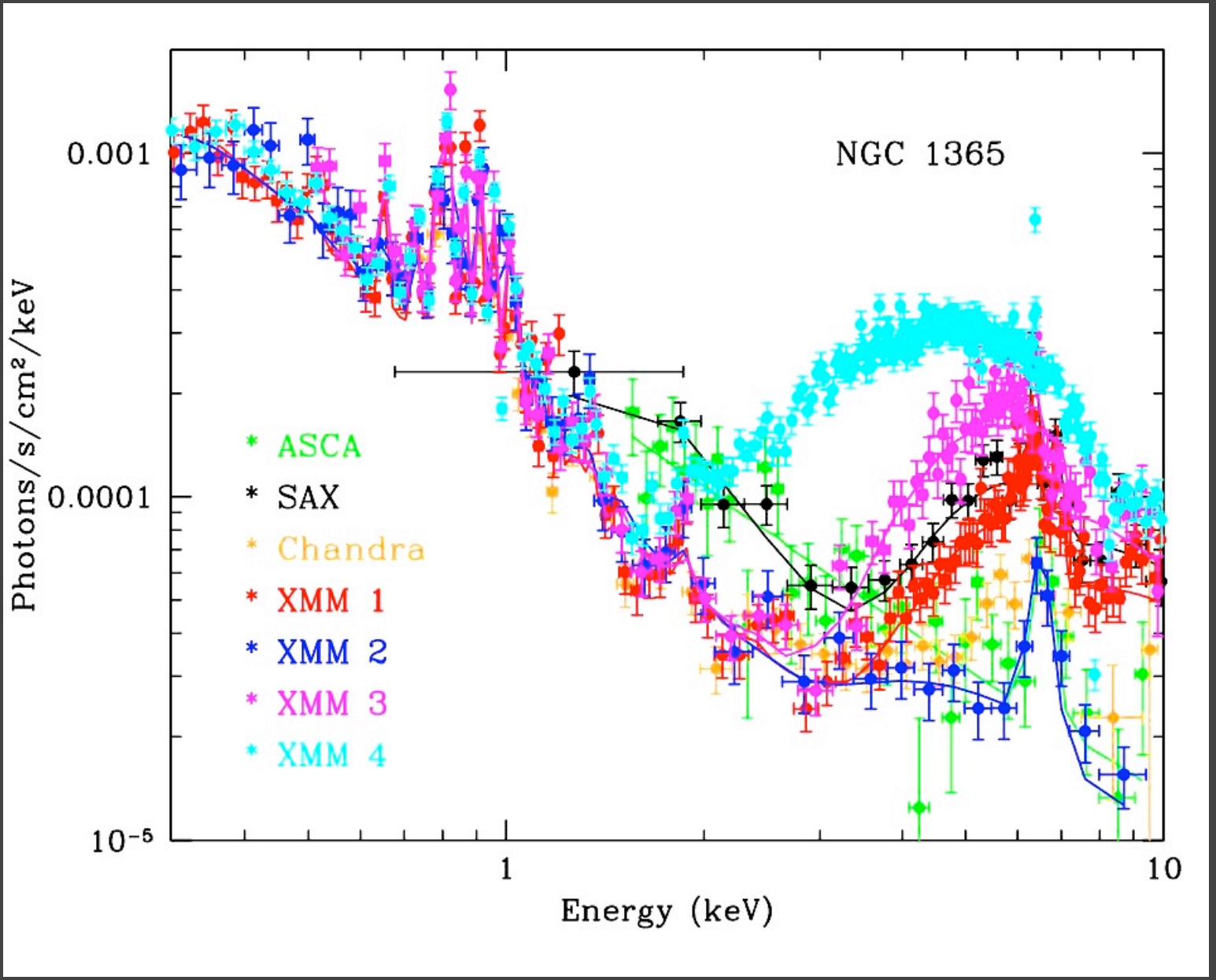

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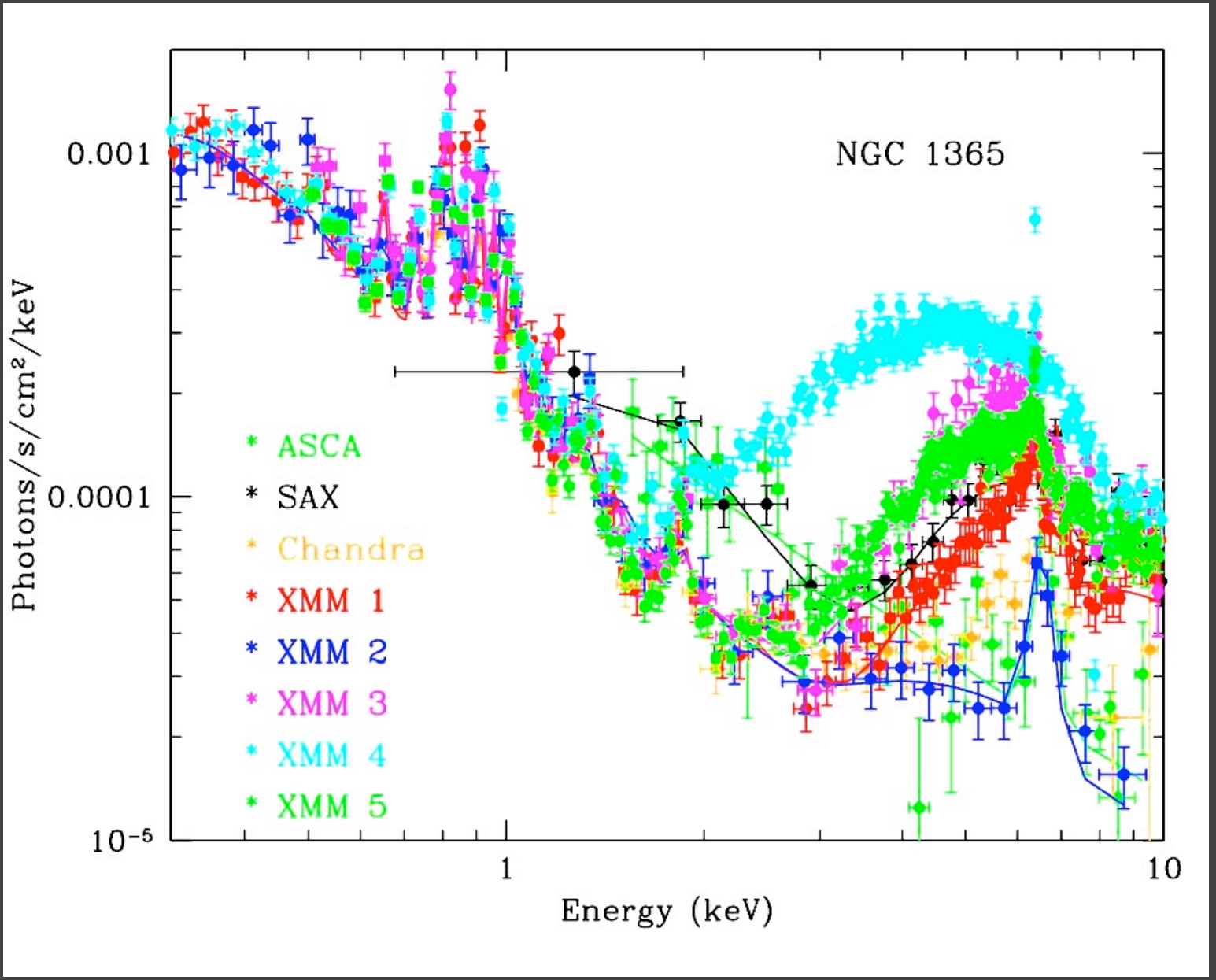

New Chandra observations

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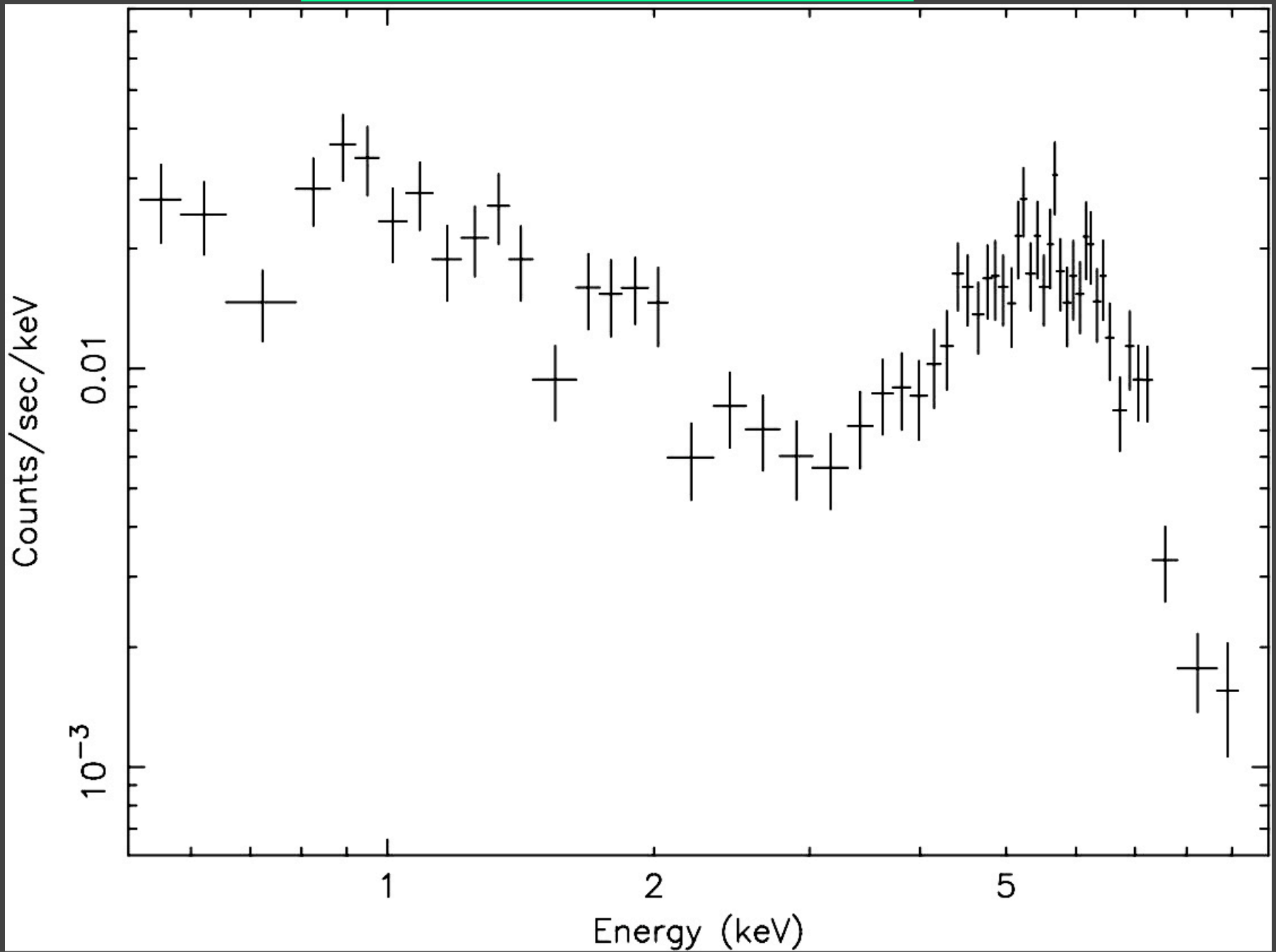

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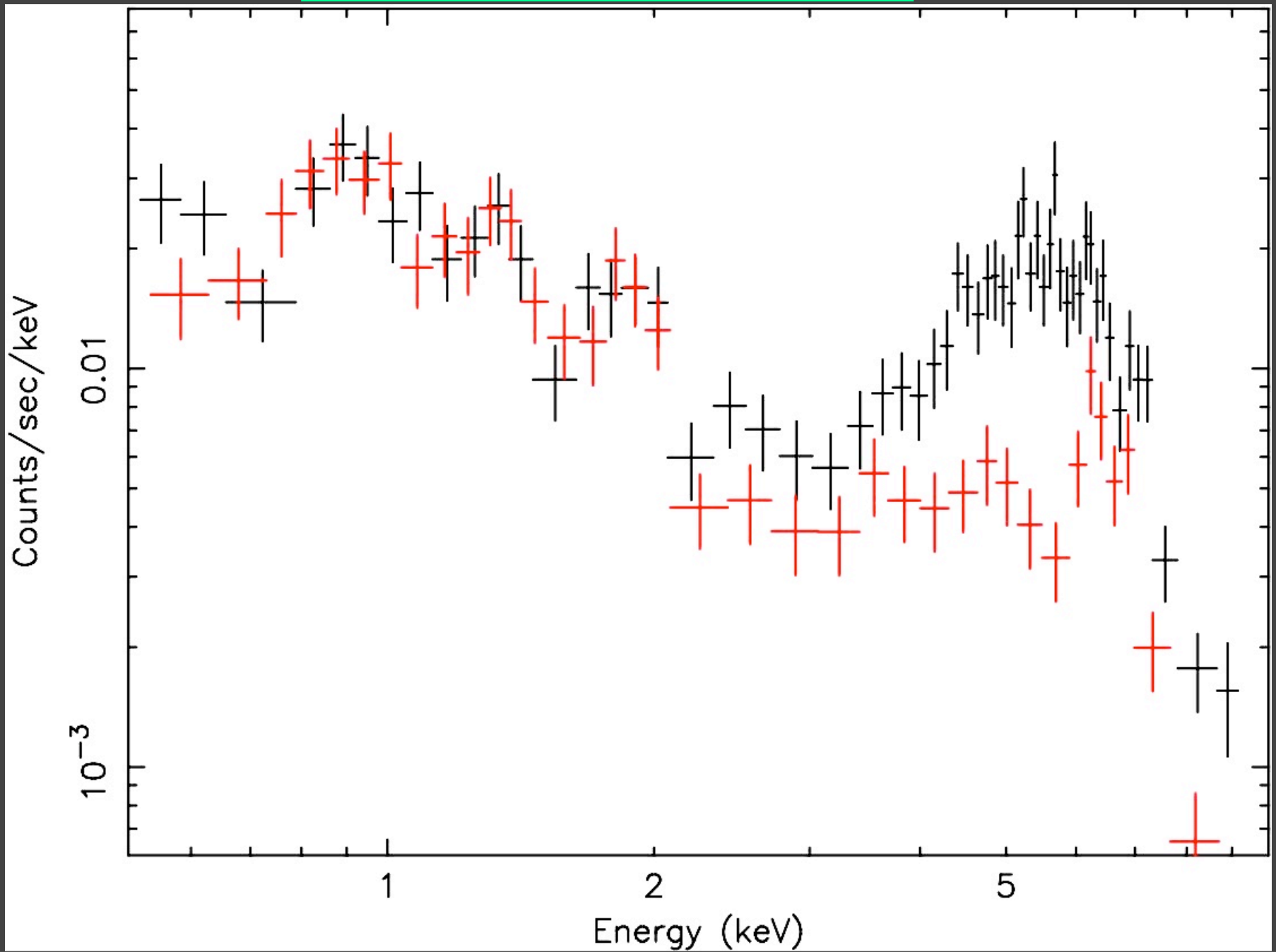

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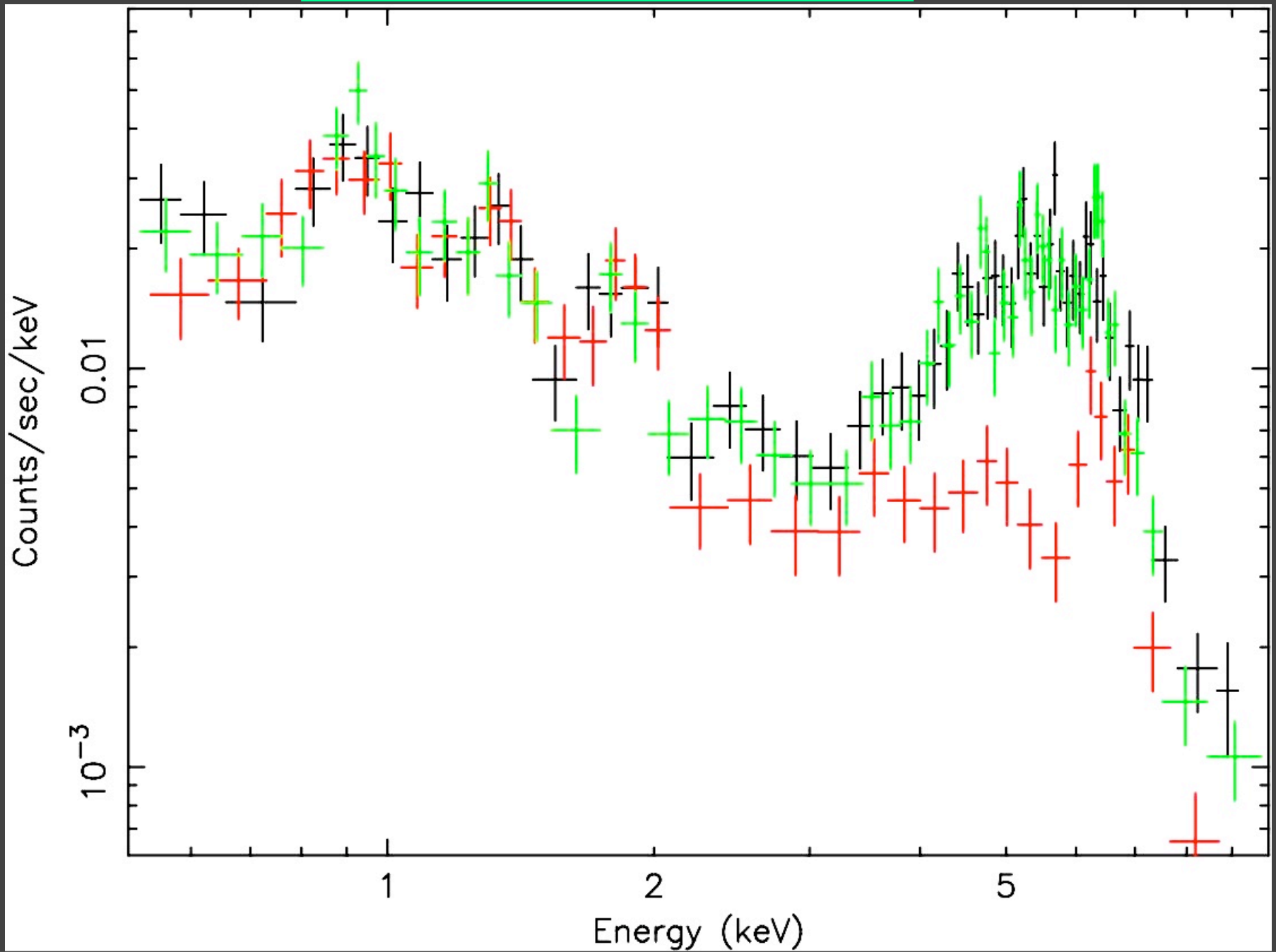

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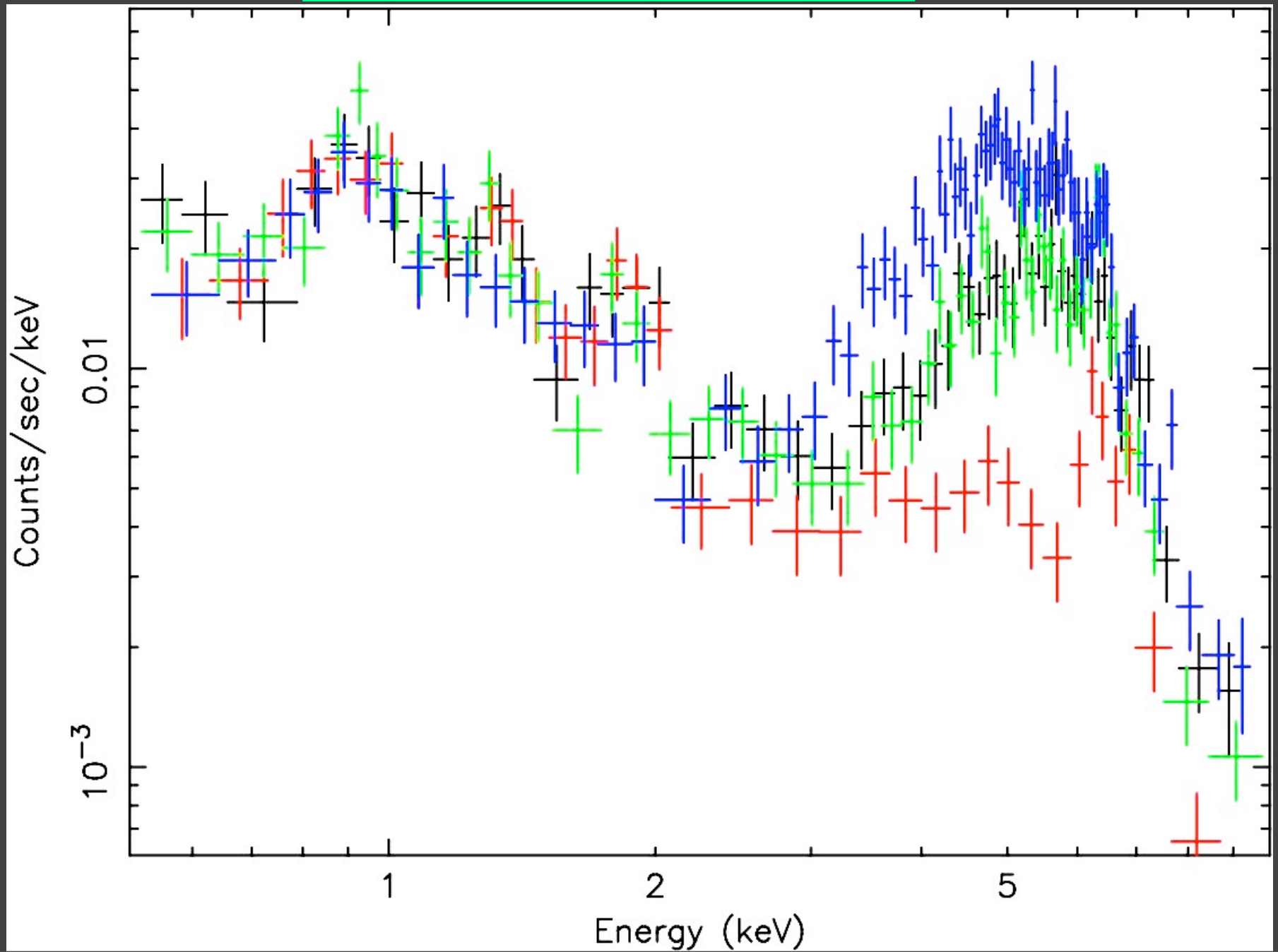

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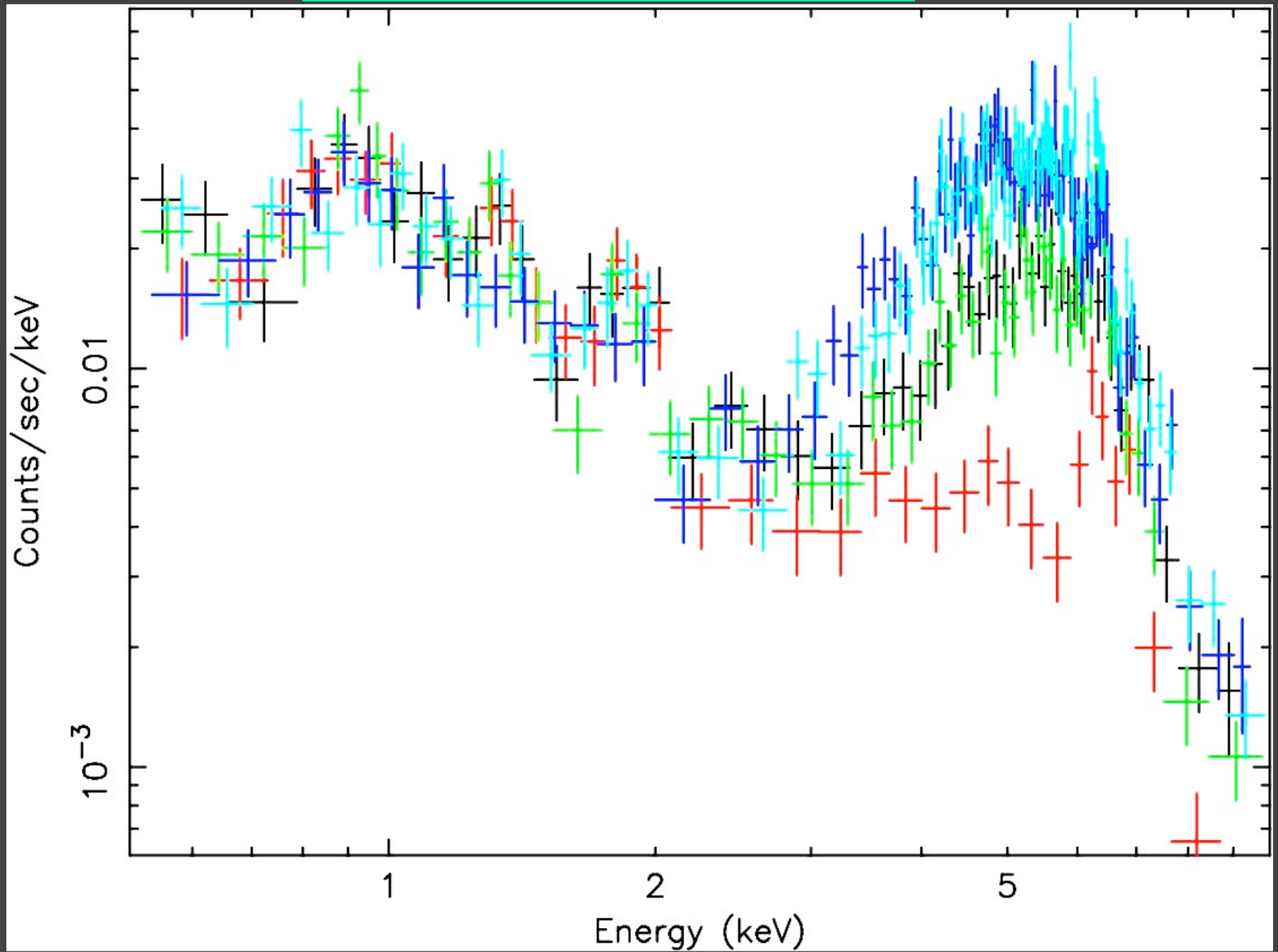

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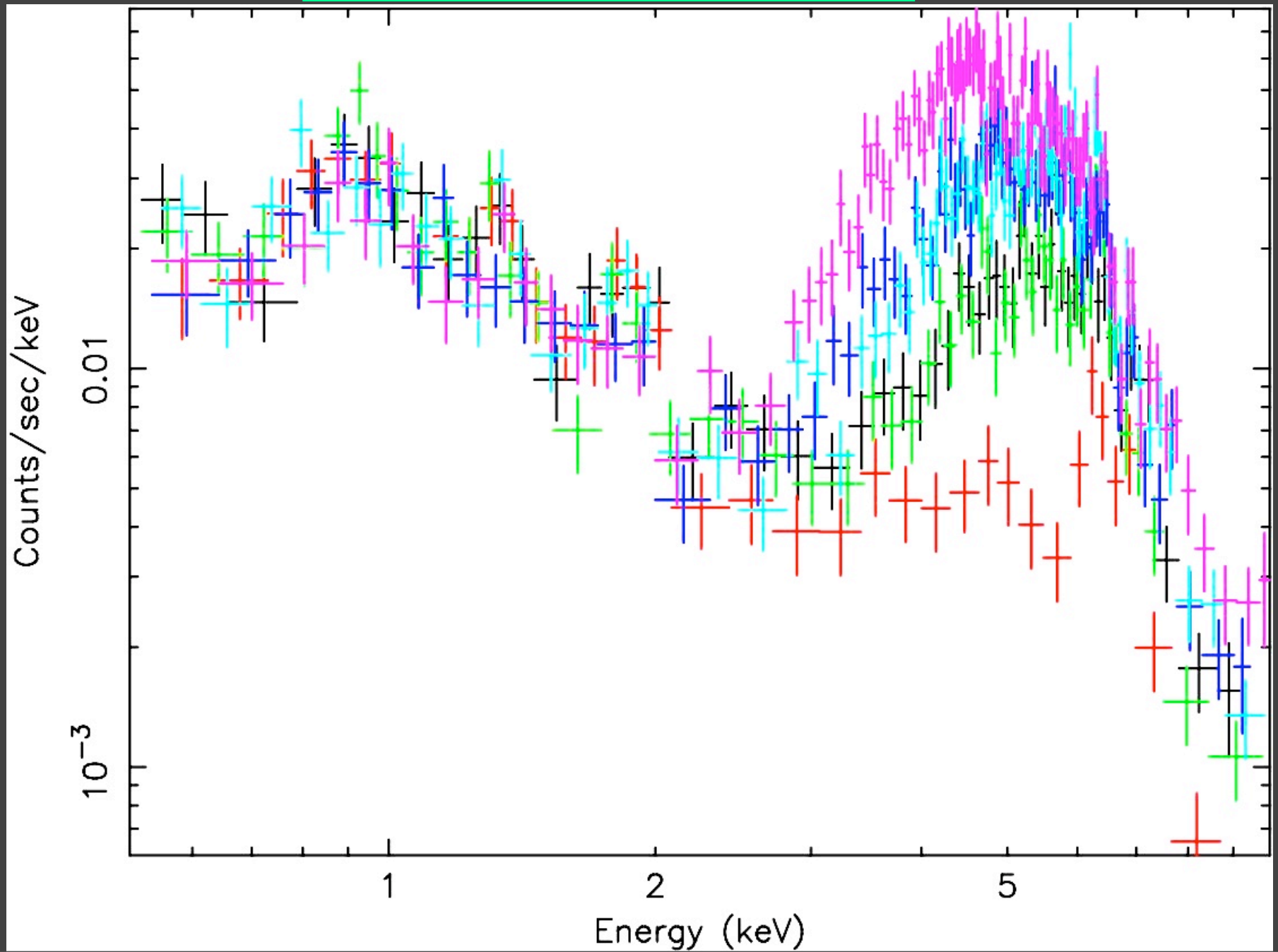
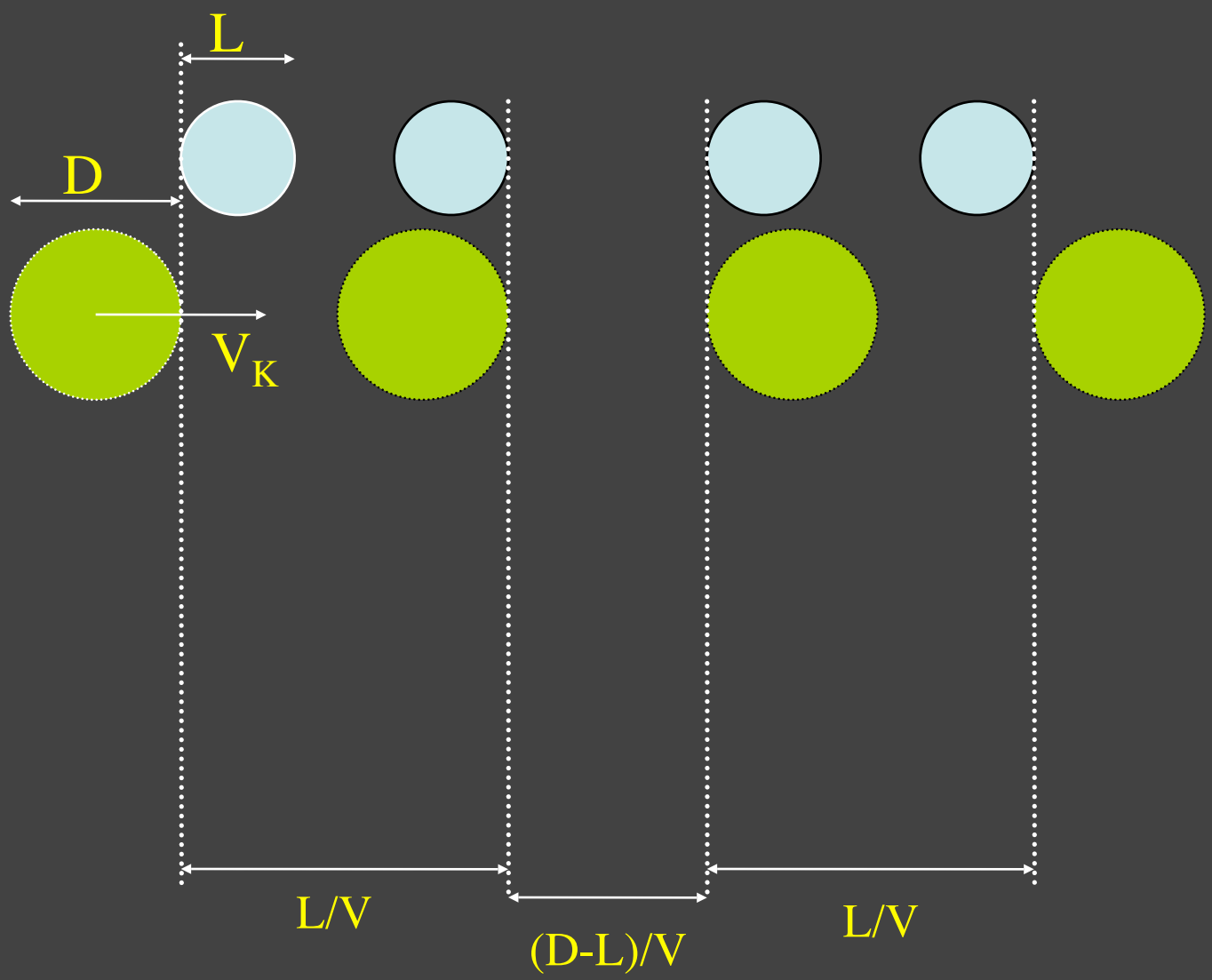


Complete occultation in ~ 2 days



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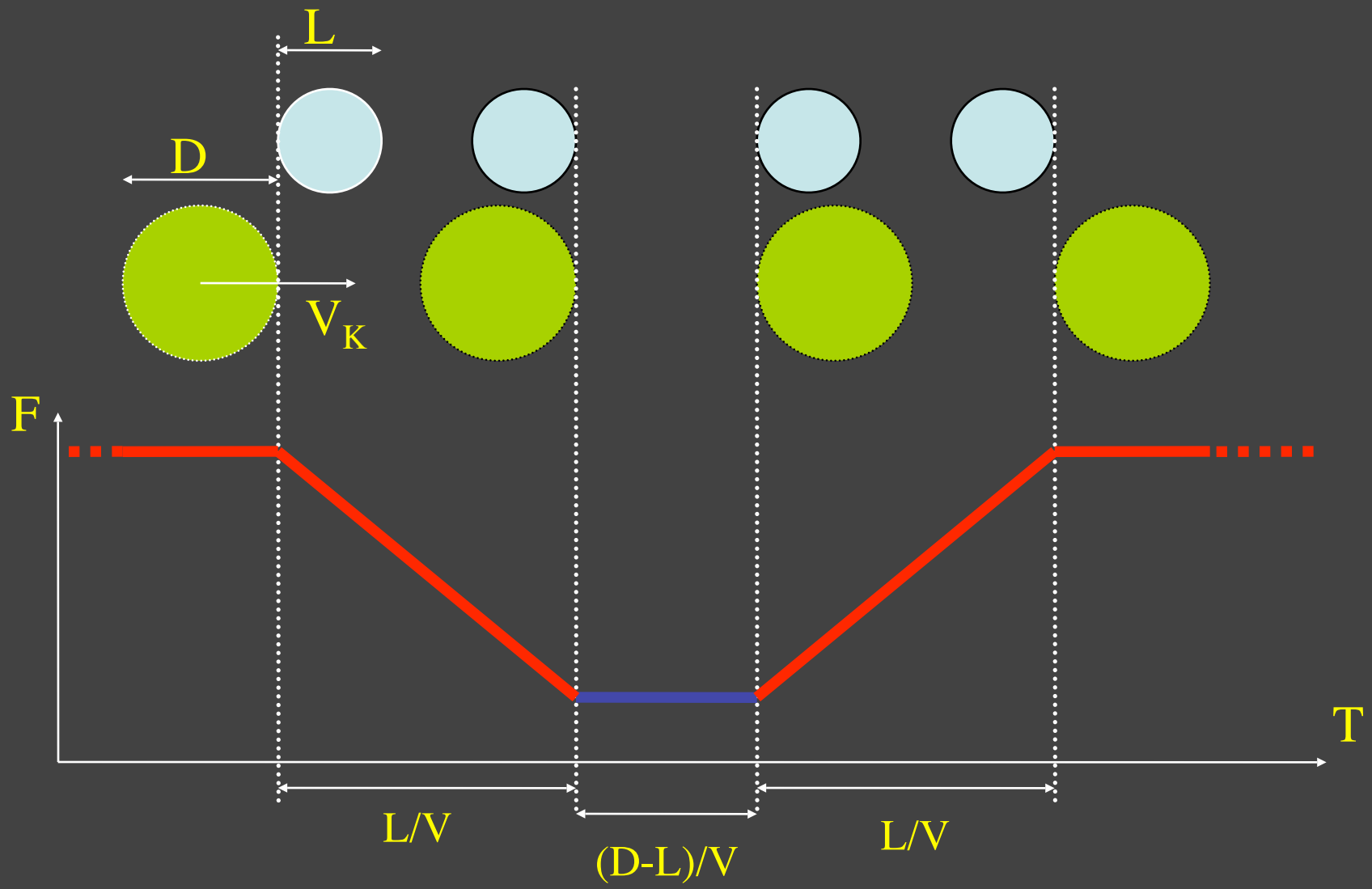

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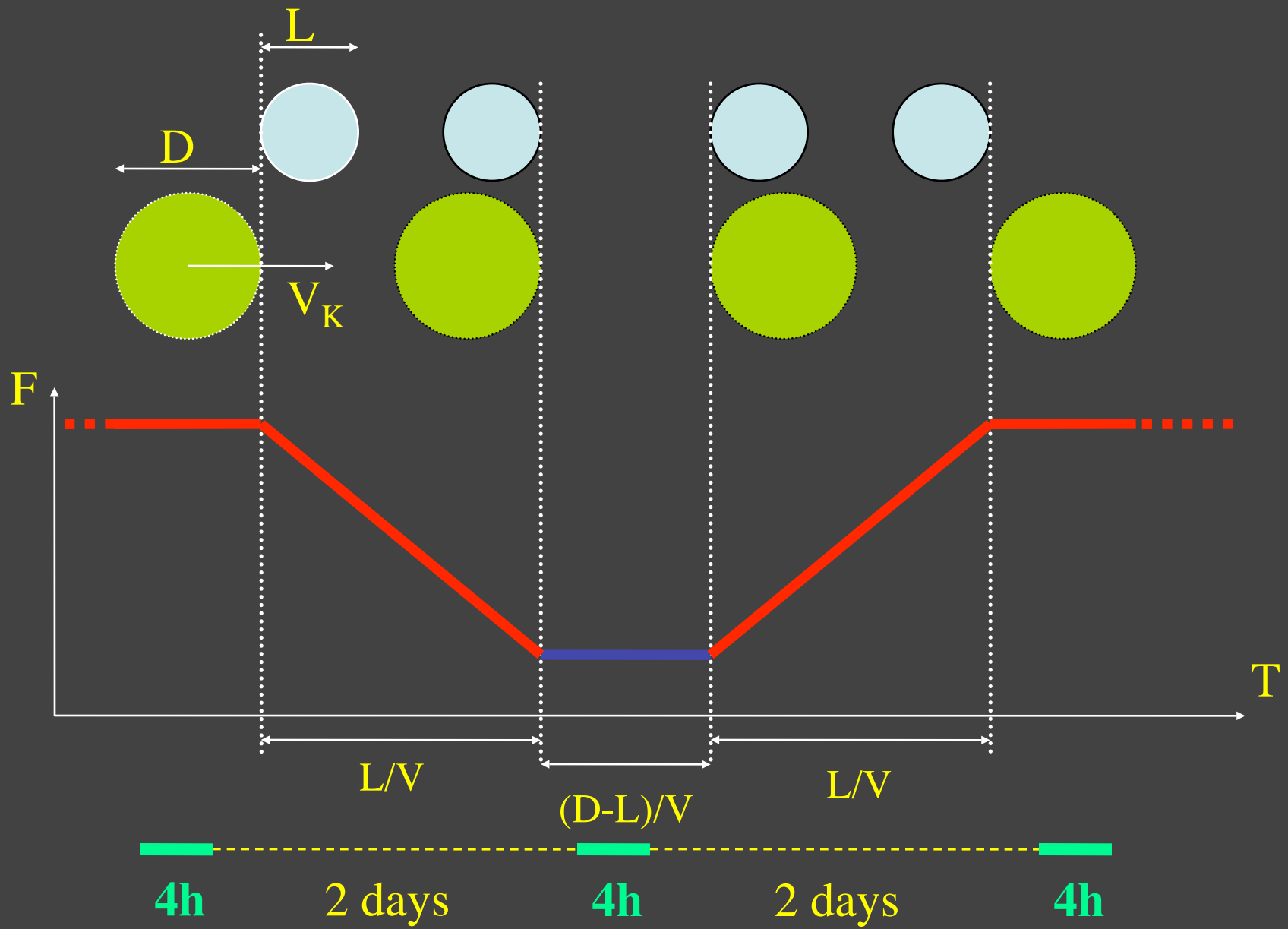

Complete occultation in ~ 2 days

→Dimensions of the X-ray source:

$D = V \times T$

If $V \sim 10^4$ km/s ----> $D \sim 10^{14}$ cm

→Can't be much higher (to avoid overionization, from iron line width)

→If lower, even smaller X-ray source

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Black hole mass in NGC 1365:

Log M_{BH} / M_{sun}= 7.3 (0.3,0.3) from M-sigma corr (Ferrarese et al. 2005)

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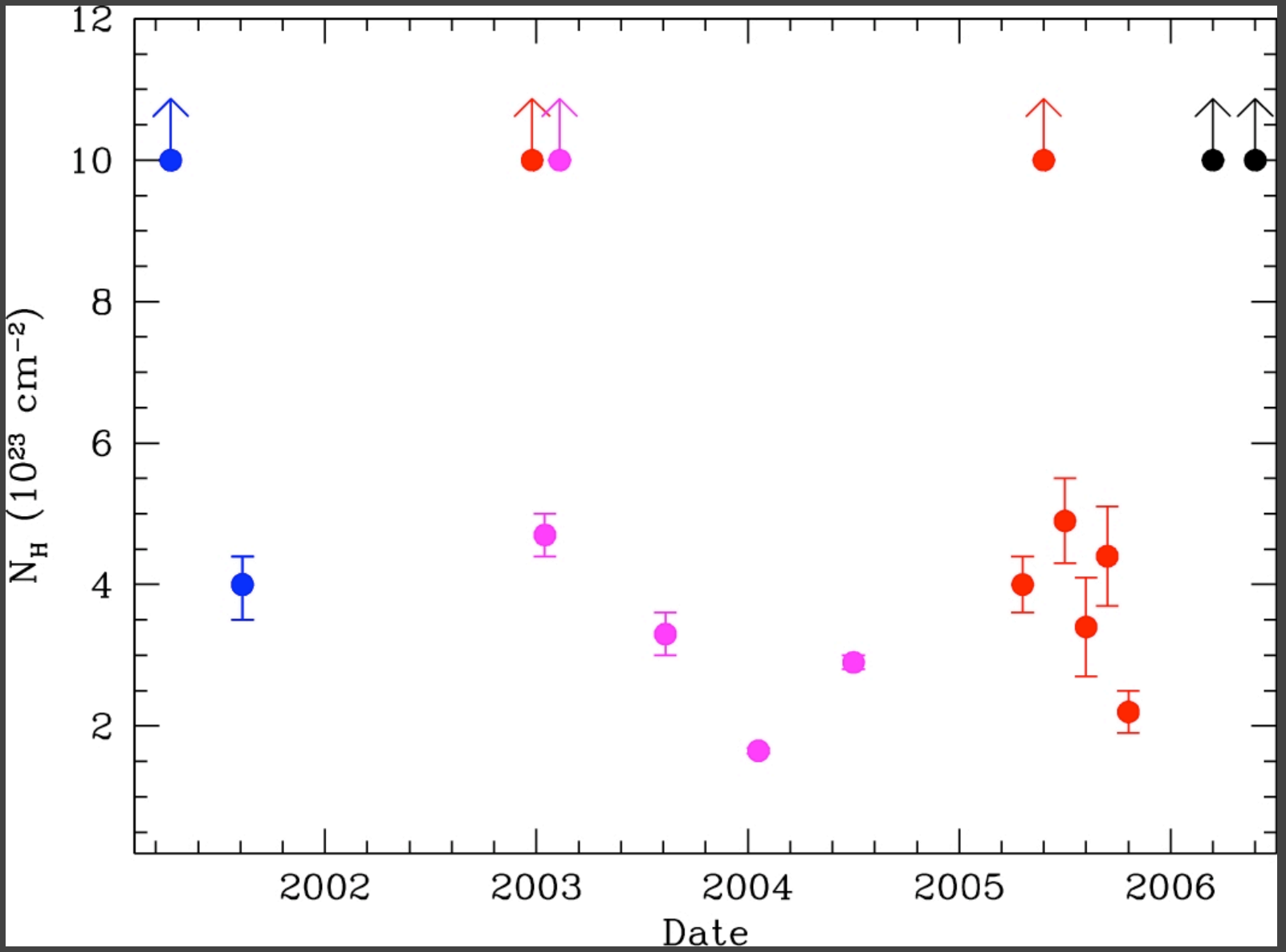
---> X-ray source within ~ 10 R_G from the black hole

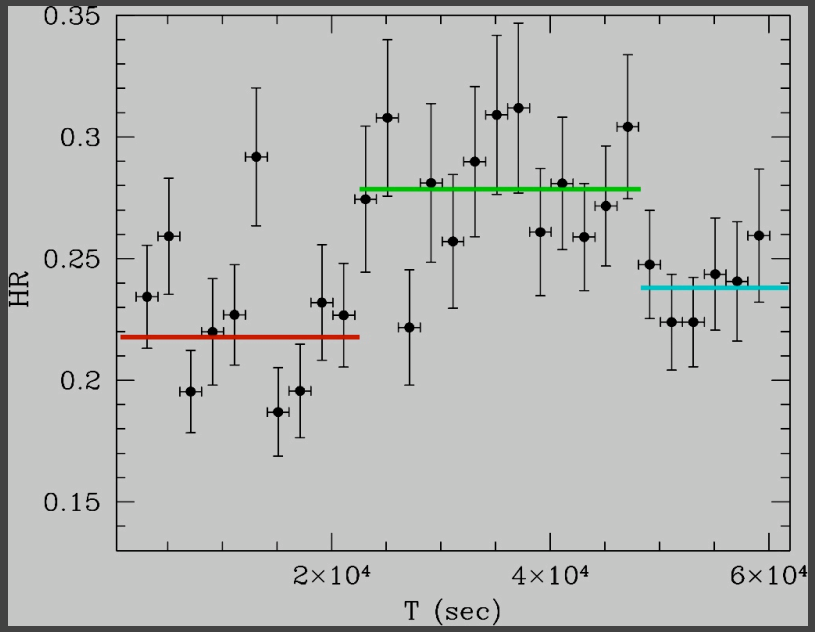
---> X-ray C-thick absorber at ~ 10^{16} cm from the BH

NGC 1365 - Historical N_H variability



Intra-day N_H variations

XMM 4: 60 ks



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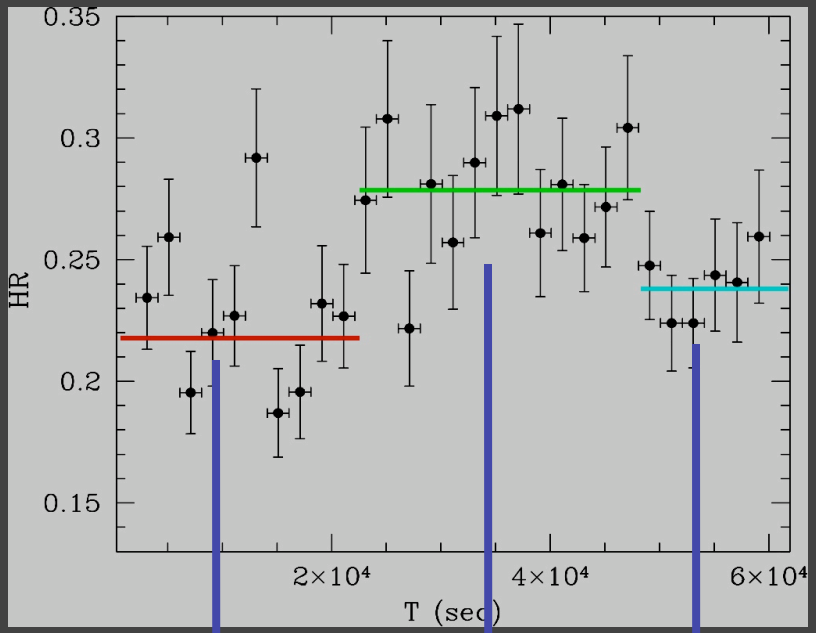

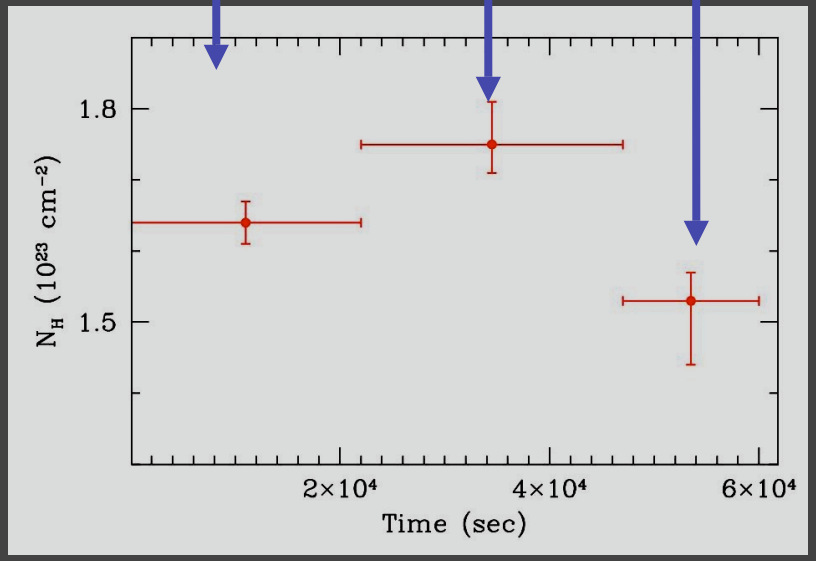

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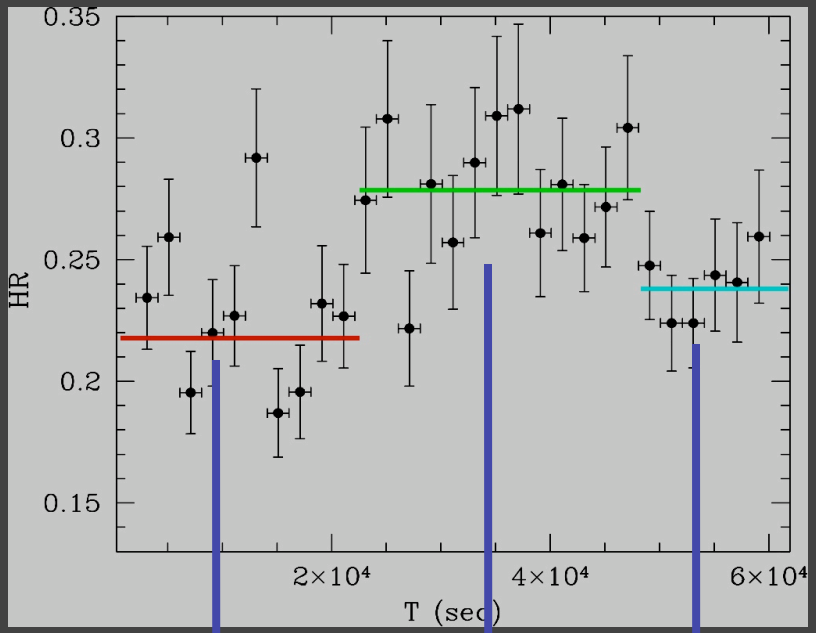

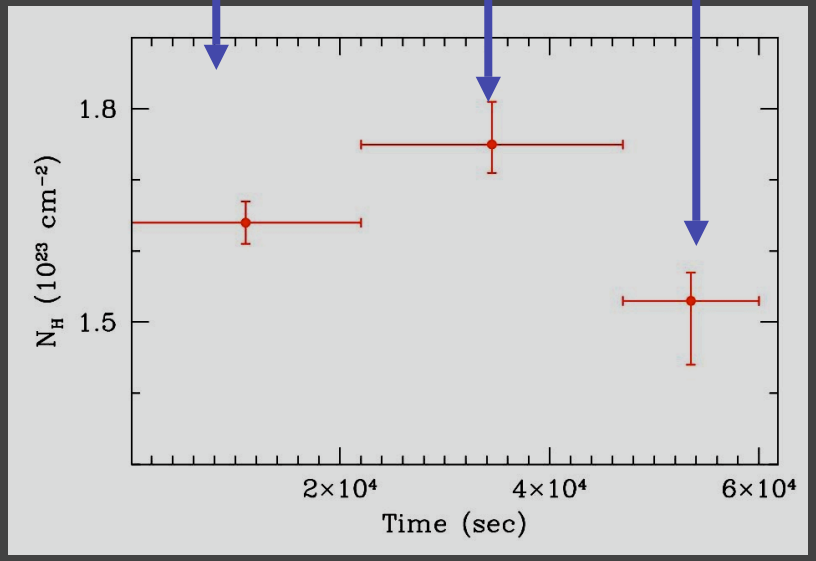

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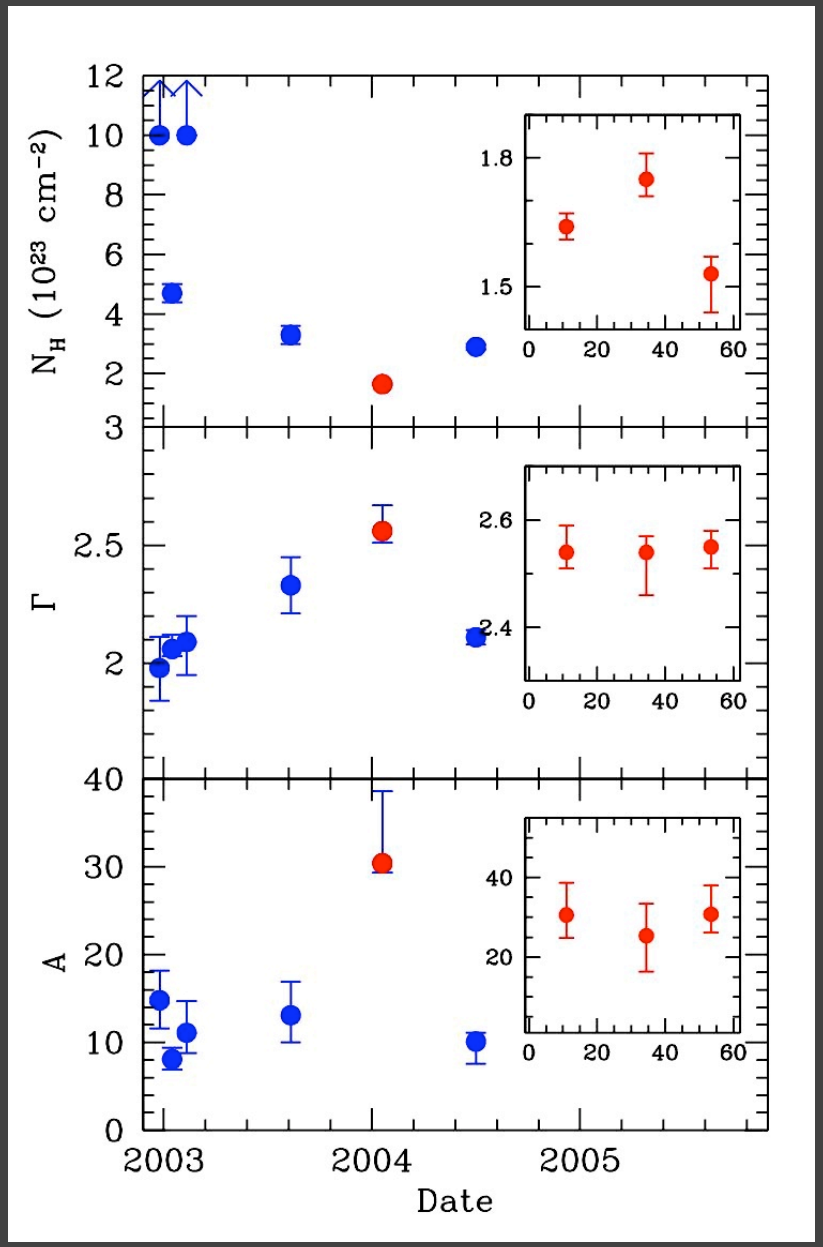


Short-time column density variability

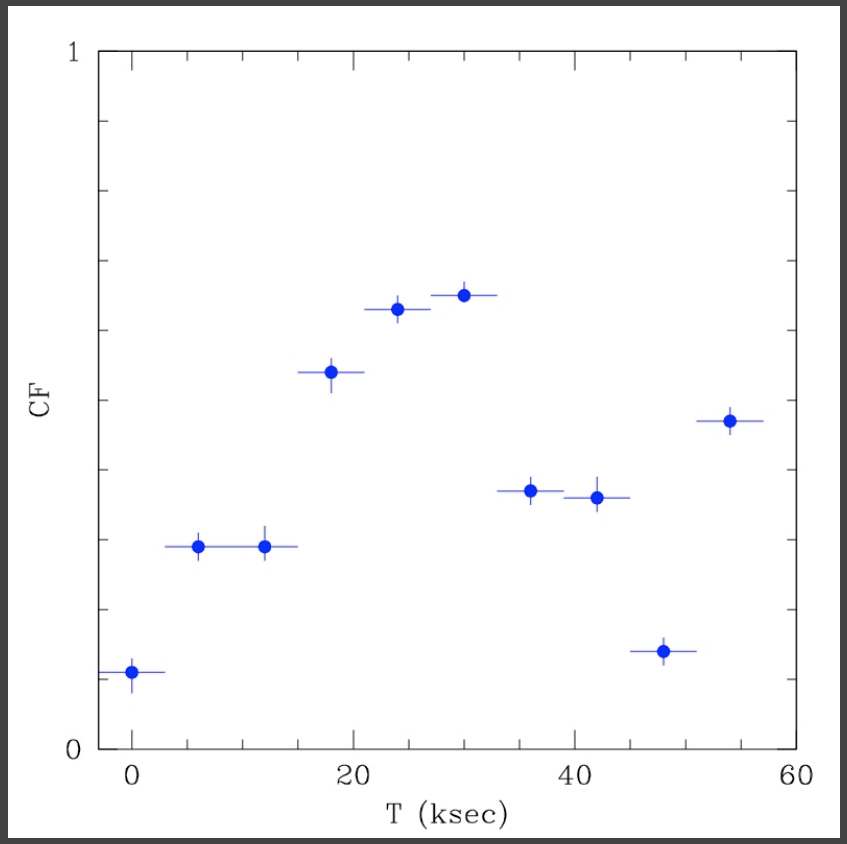
New analysis:

-10 time intervals, 6 ks each

-Constant continuum + (a) free N_H for each spectrum

(b) two N_H (the same for all spectra)

and free covering factor of N_{H2}



$N_{H1}=1.1\times10^{23}$ cm^{-2}

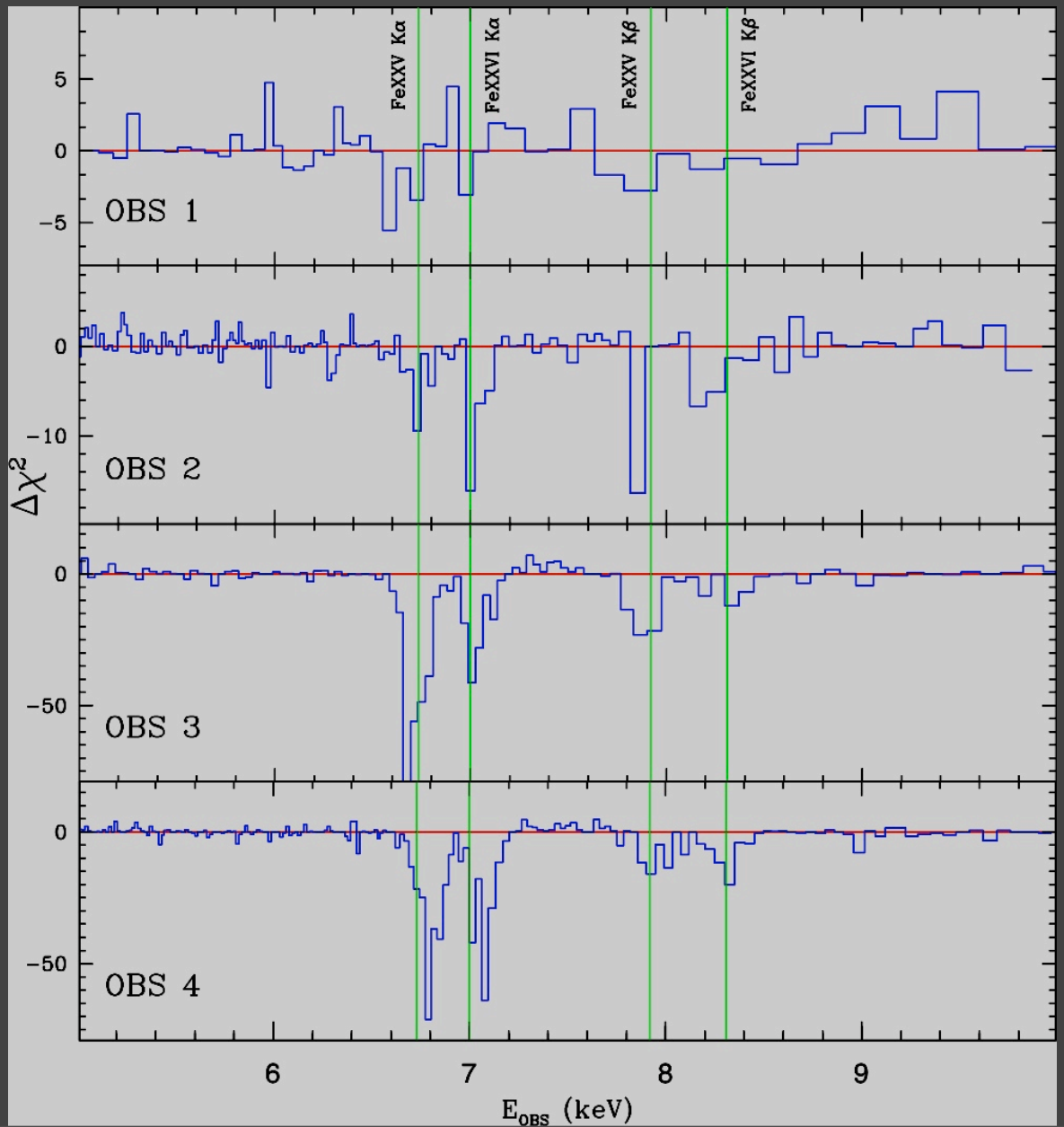
$N_{H2}=3.0\times10^{23}$ cm^{-2}

T = 25 ks

D ~ 3×10^{13} cm

Spectral analysis of XMM long observations

1. Warm absorber



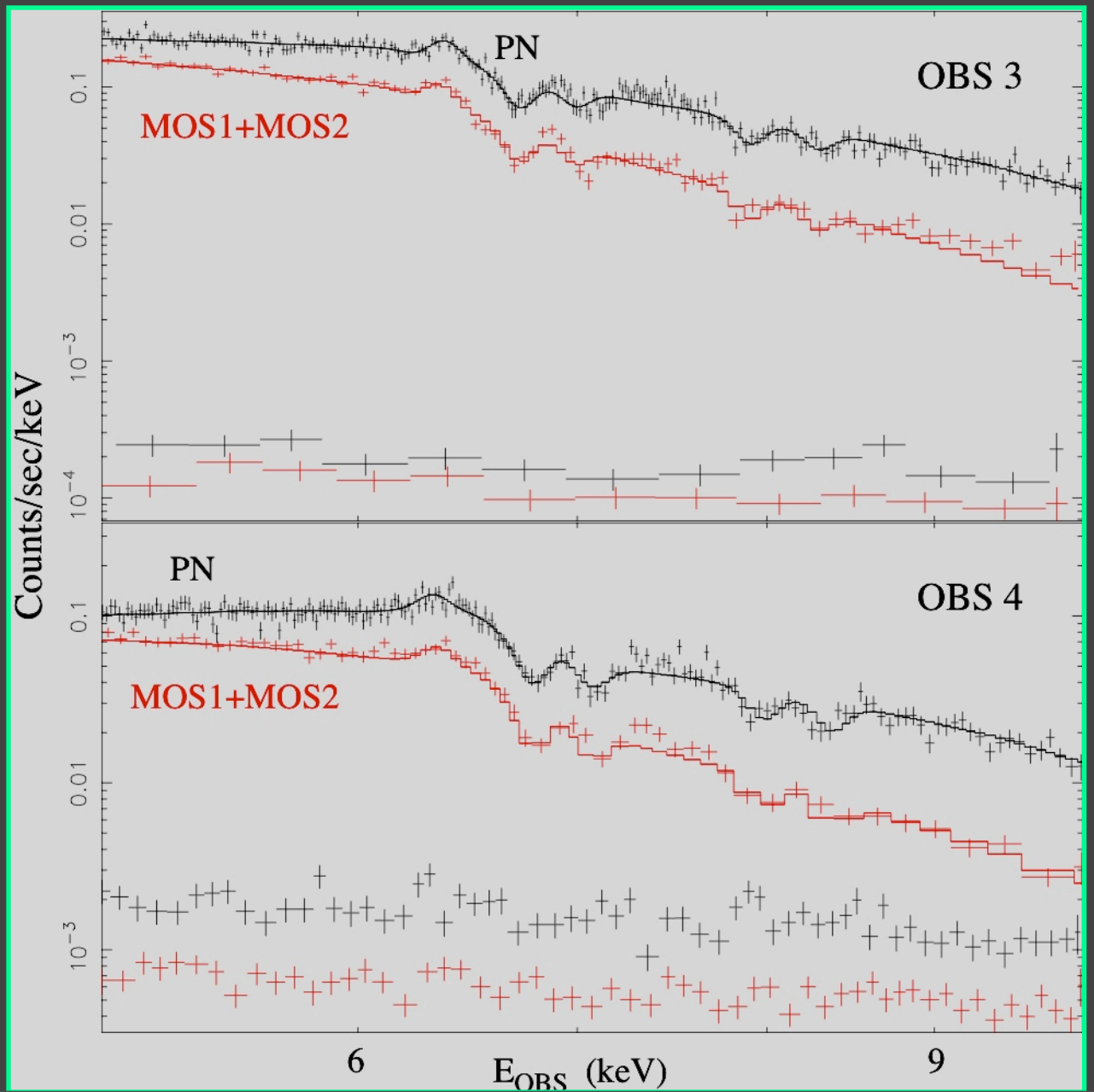
Fe XXV Kα
@ 6.70 keV

Fe XXVI Kα
@ 6.97 keV

Fe XXV Kβ
@ 7.88 keV

Fe XXVI Kβ
@ 8.27 keV

Spectral analysis of XMM long observations



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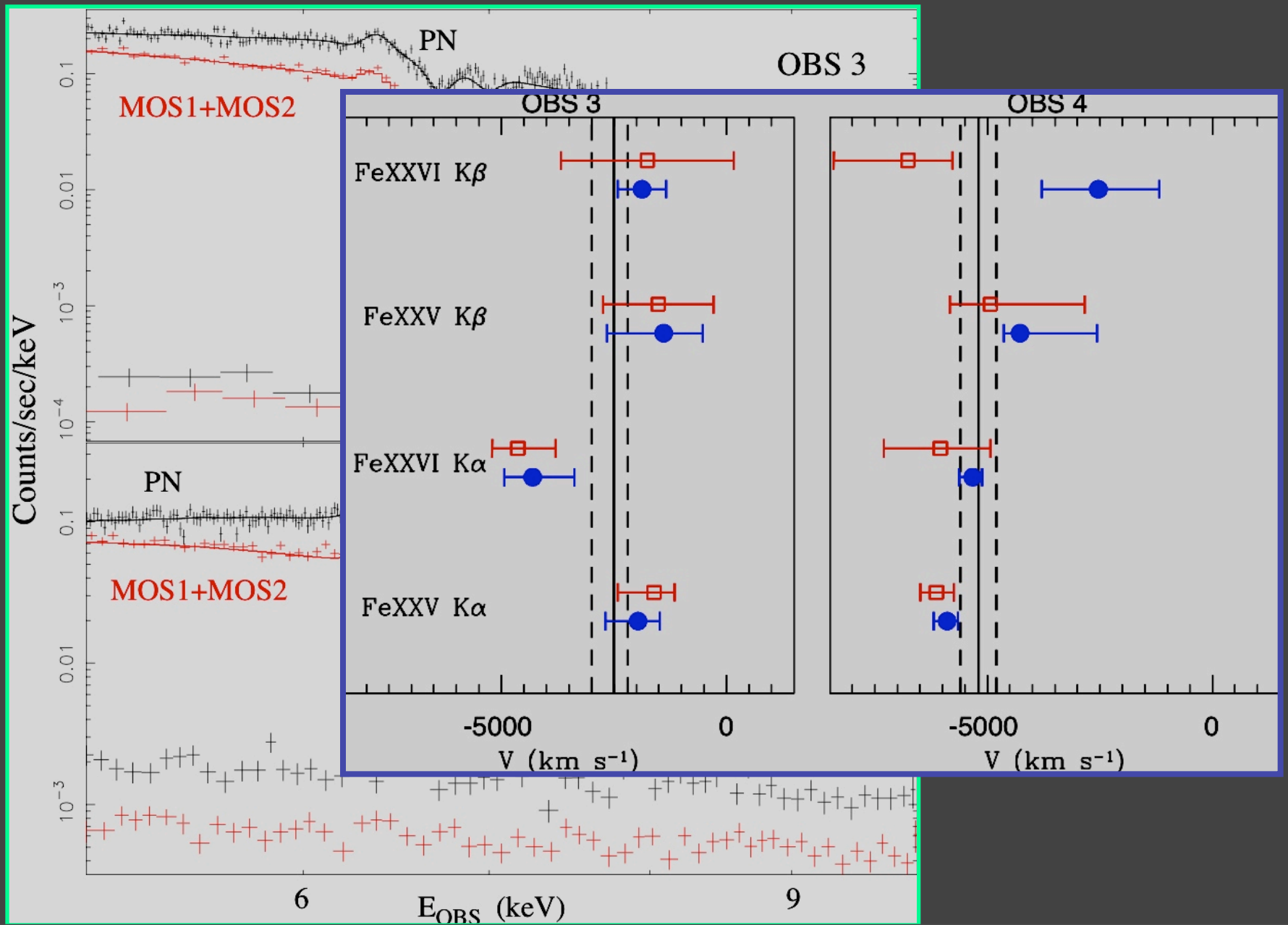
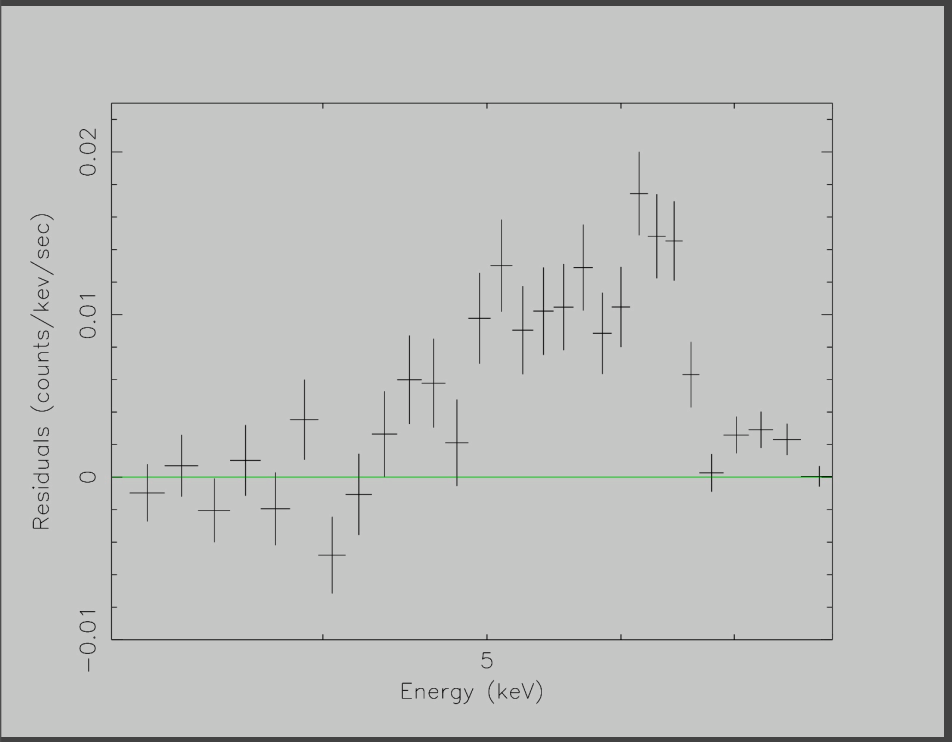
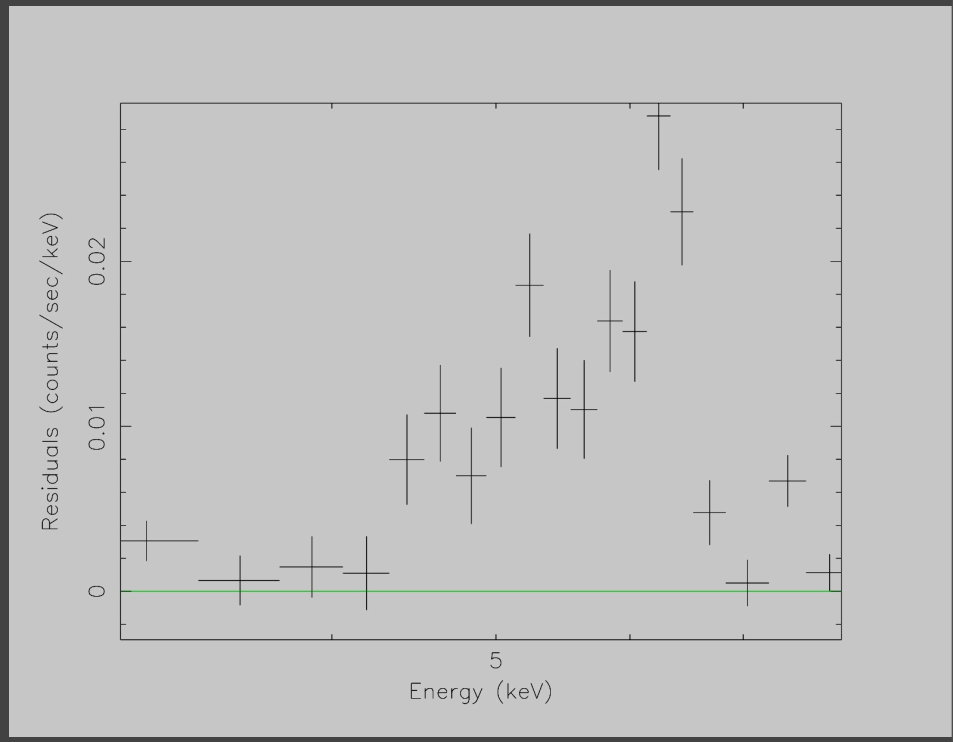


Spectral analysis of XMM long observations

2. Relativistic Iron Line

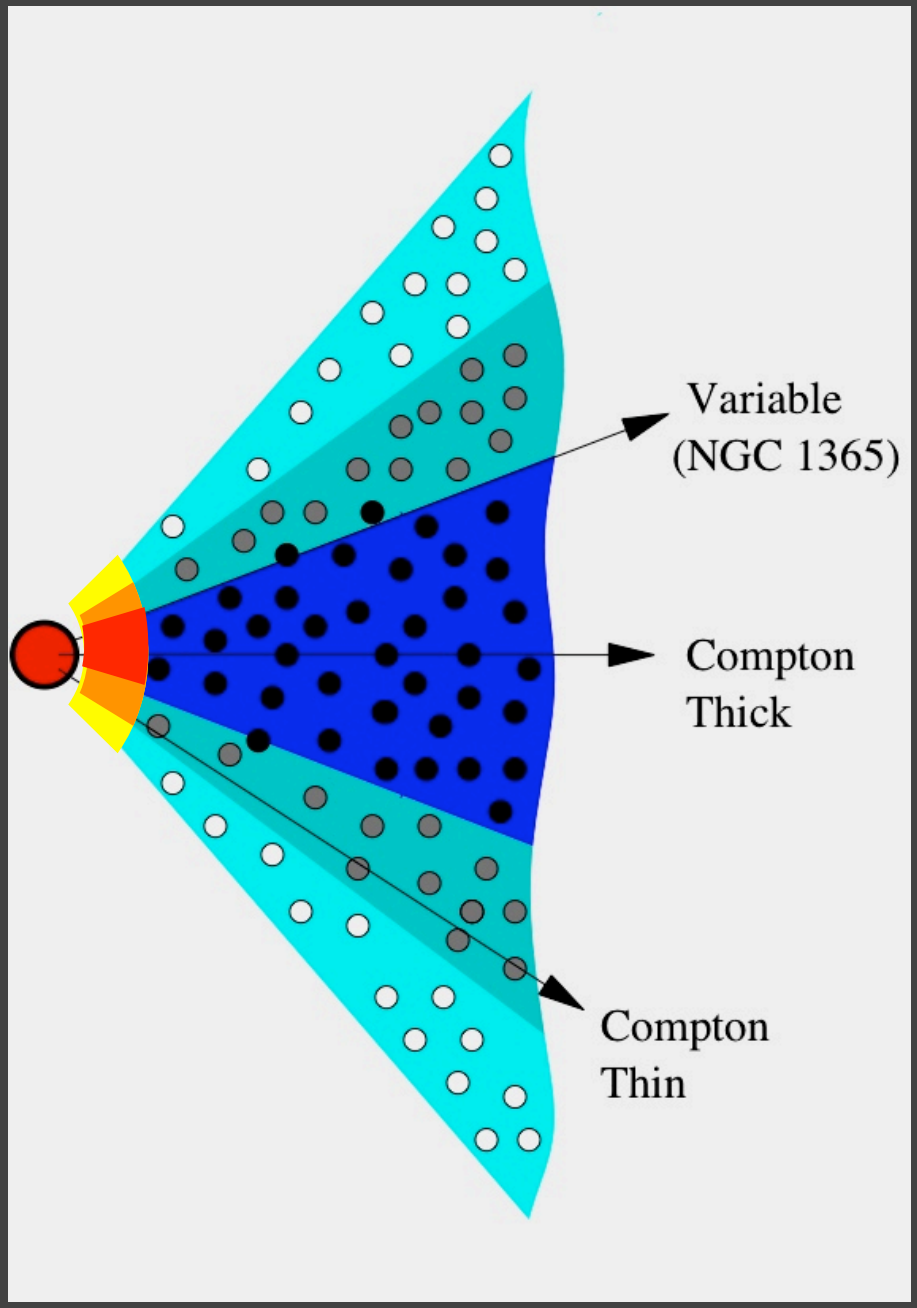




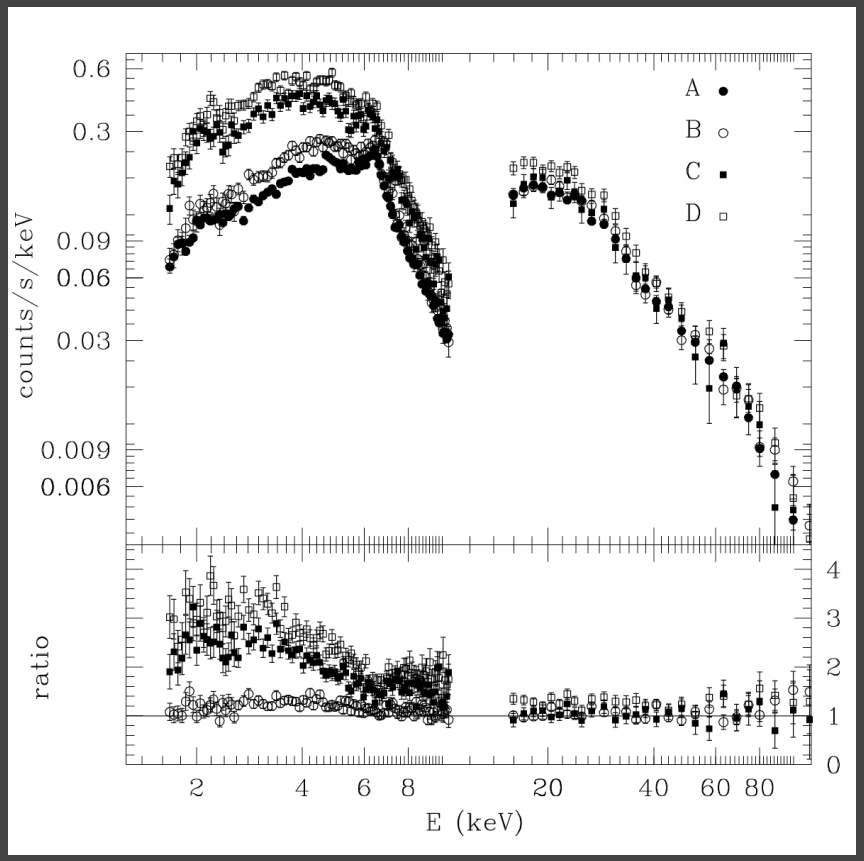
→One of the best cases, only (?) strong case in high N_H sources

→Disappearing in obscured spectrum --> within 10^{14} from the center

NGC 1365: uniqueness



→ few bright sources
with $10^{23} < N_H < 10^{24}$ cm^{-2}



NGC 4151, Puccetti et al 2007

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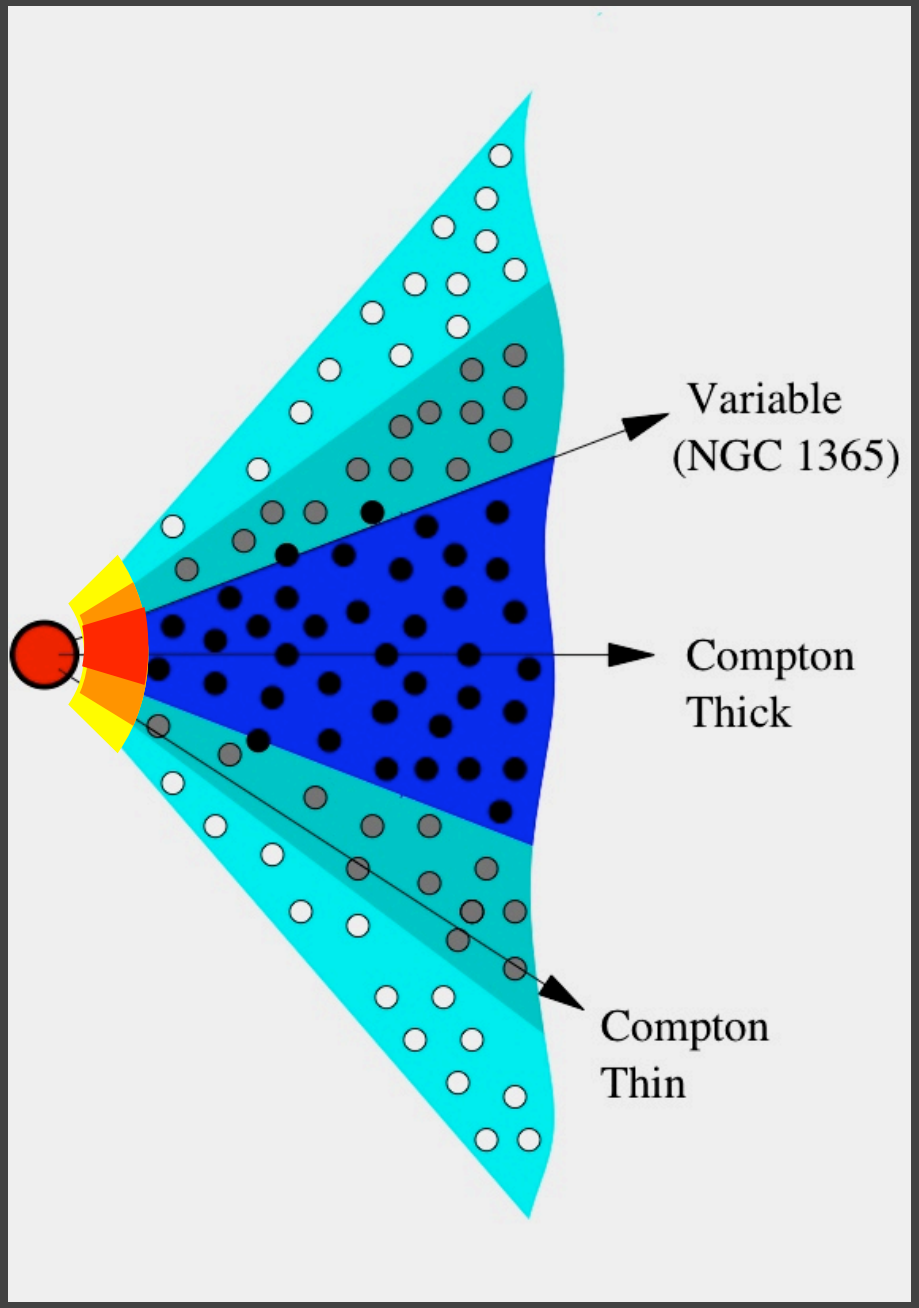

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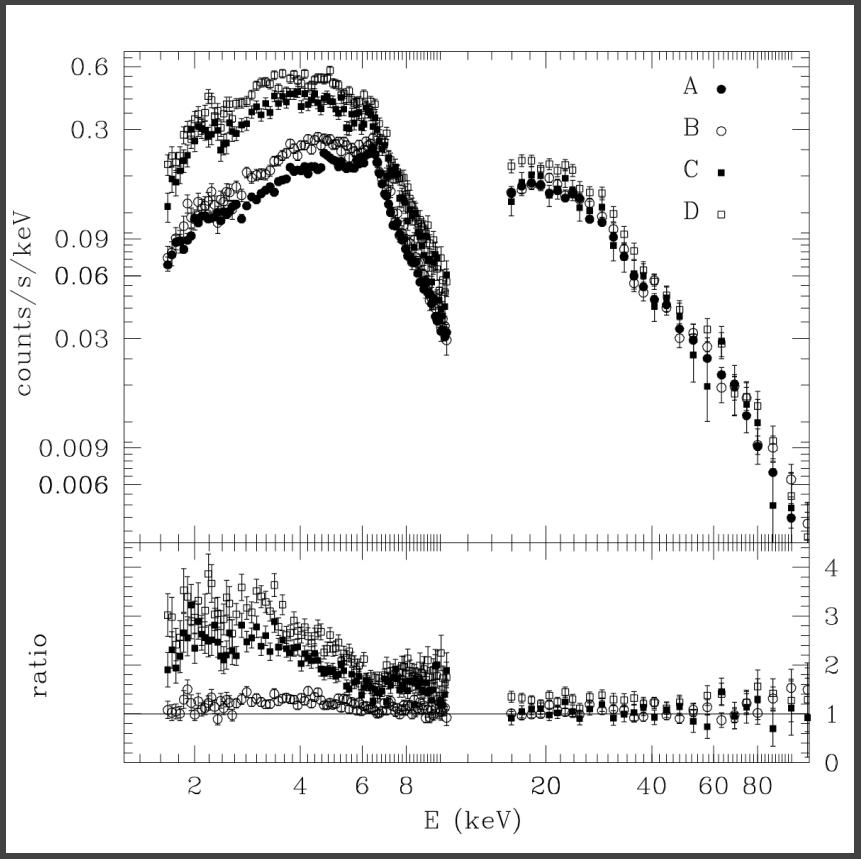
Other cases of fast variability



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