Observing IGR J16318−4848 with *Suzaku*: Probing Compton-thick Absorption

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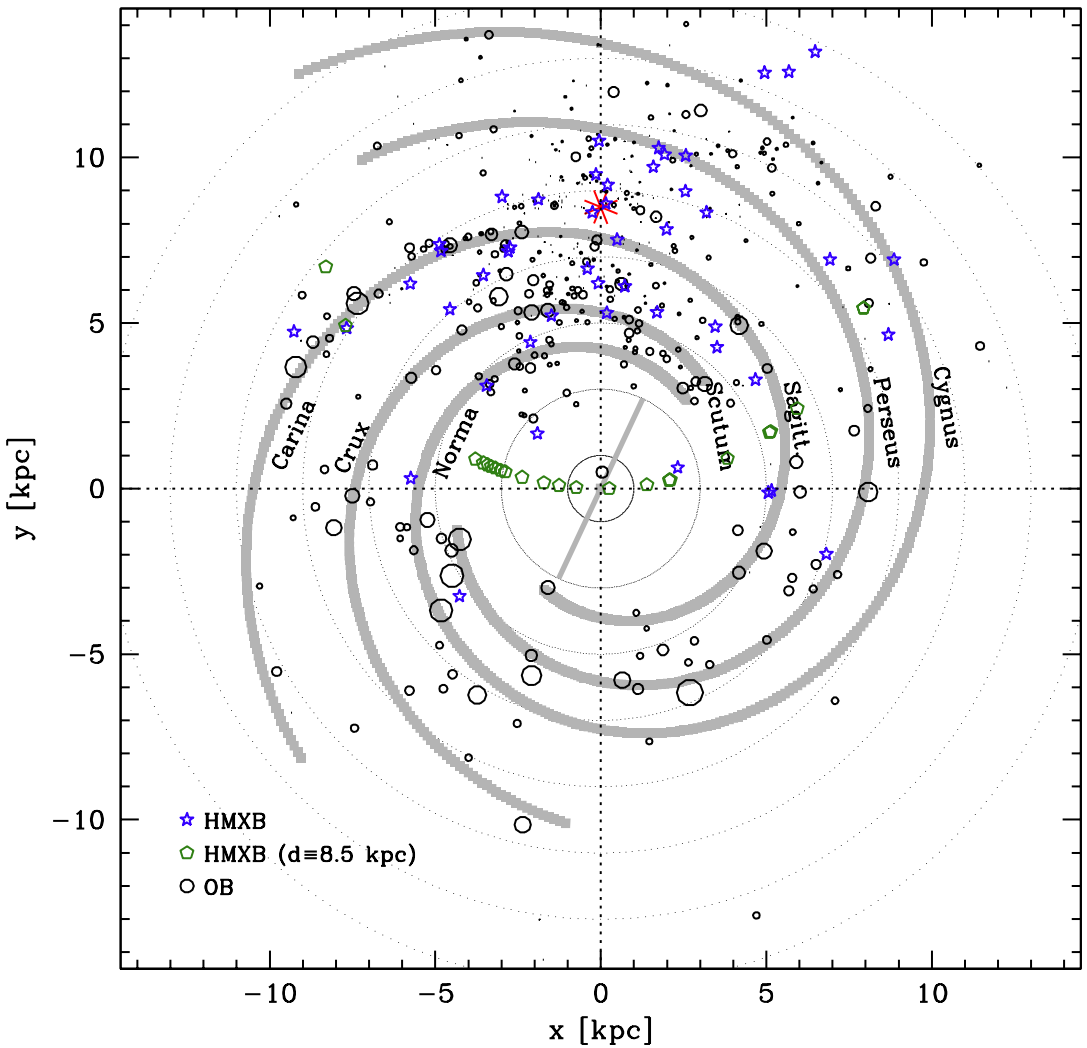
The *Suzaku* X-ray Universe, 2007 December 12

Sources discovered by *INTEGRAL*



Bodaghee et al., 2007, A&A, 467, 585

- ∼200 new @ 20–100 keV
- 50% classified
- mainly HMXBs

new classes:
1. supergiant FXT
2. Norma region: highly absorbed

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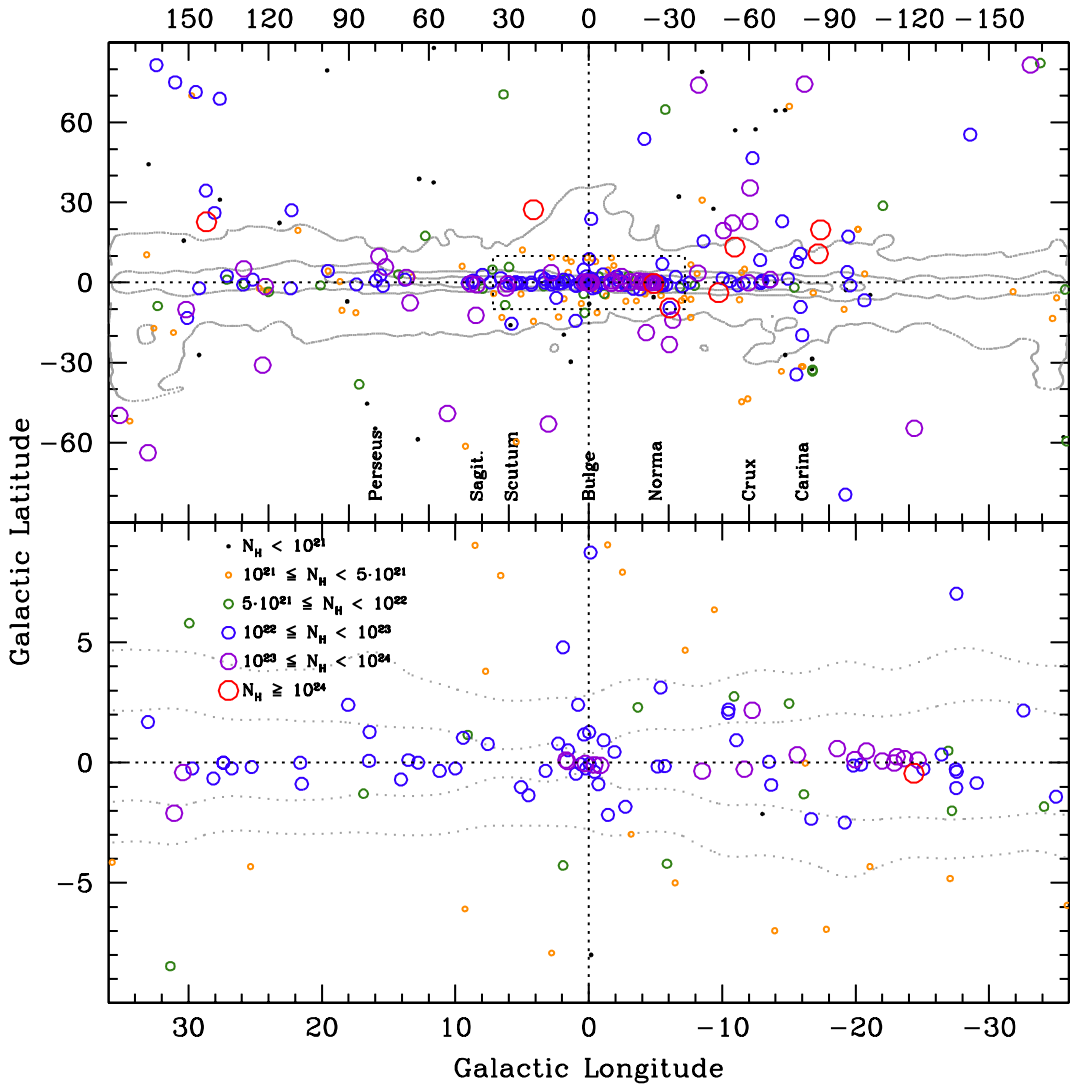

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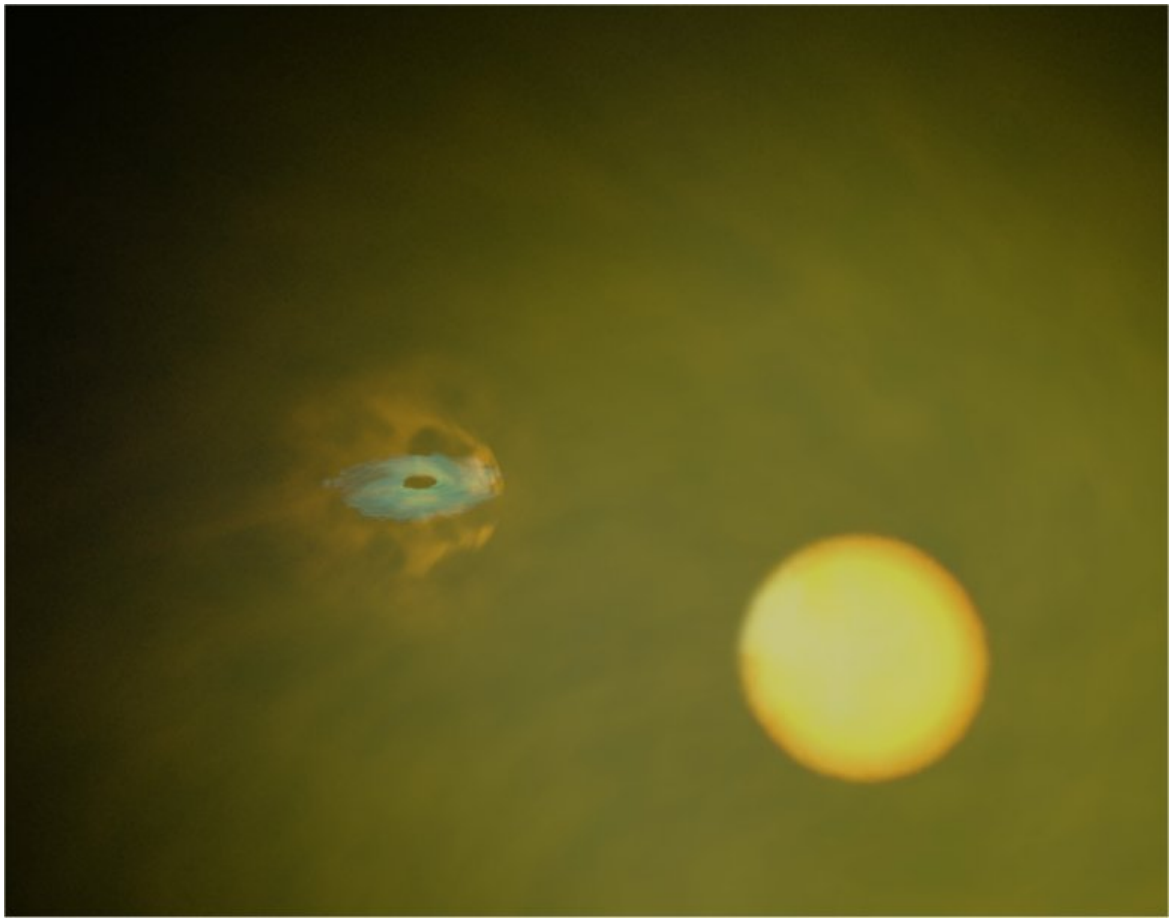
IGR J16318−4848



Artist's impression

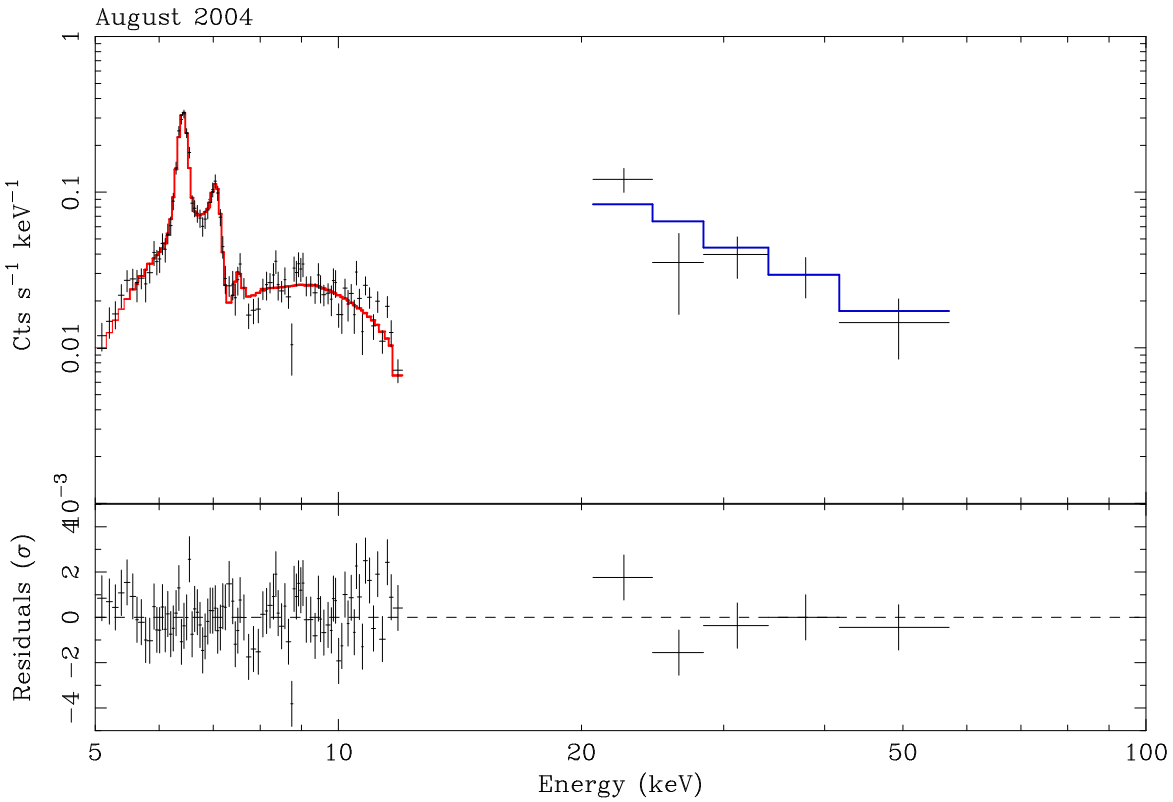
Courvoisier et al., 2003, IAUC 8063

- first new transient with IBIS/ISGRI
- 2003–01–29 during Galactic Plane Scan

one of the most highly absorbed sources: $N_H \sim 2 \times 10^{24}\,\mathrm{cm}^{-2}$

Filliatre & Chaty, 2004, ApJ 616, 469

- **sgB[e]** $\Rightarrow$ HMXB
- NS or BH?



after Ibarra et al., 2007, A&A 465, 501

- 3 × *XMM*-EPIC and *INTEGRAL*-ISGRI
- average flux varies by **factor 3**

e.g., August 2004:

- $N_{\mathrm{H}} = 1.82^{+0.05}_{-0.03} \times 10^{24}\,\mathrm{cm}^2$

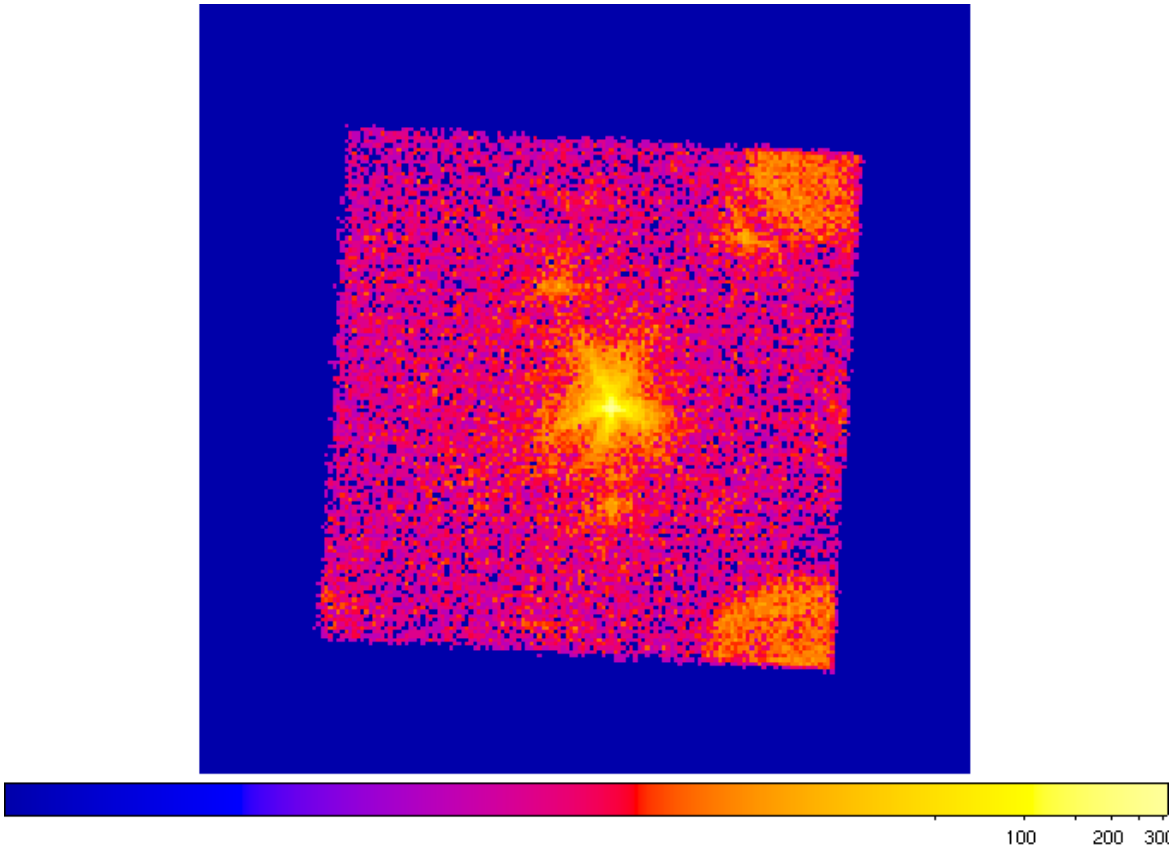
  $\Gamma = 1.46 \pm 0.03$

  $E_{\mathrm{Fold}} < 16\,\mathrm{keV}$
- $E_{\mathrm{Fe\ K}\alpha}$=6.43 keV
  EW=800 eV

  $E_{\mathrm{Fe\ K}\beta}$=7.10 keV
  EW=230 eV

  $E_{\mathrm{Ni\ K}\alpha}$=7.45 keV
  EW=50 eV
- Compton shoulder?

XIS0 Image



average flux in 0.2–80 keV

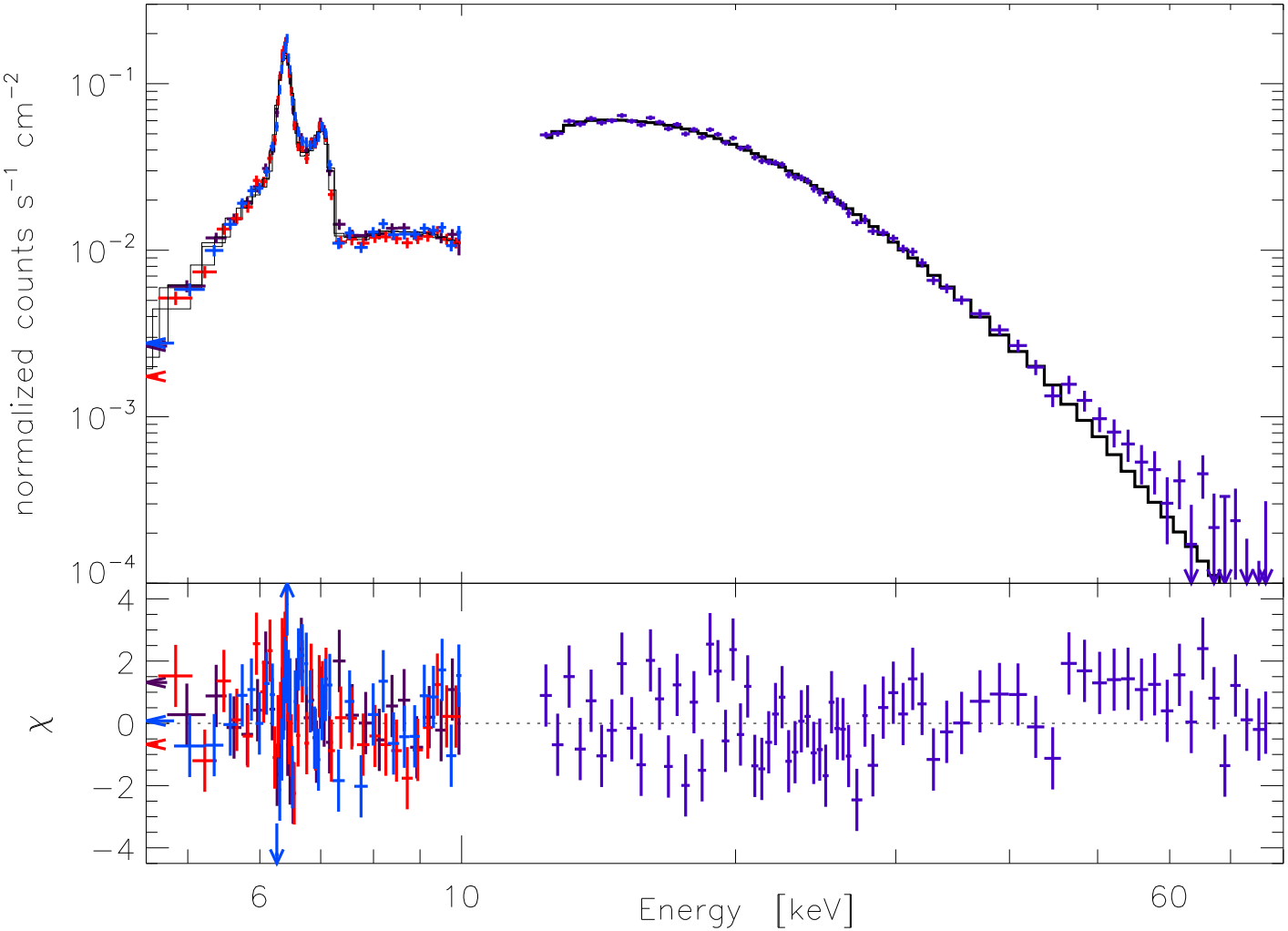
4.2 (*Suzaku*)
8.7 (high *XMM/INT*)

$[10^{10}\,\mathrm{ergs\,cm^{-2}\,s^{-1}}]$

$\Rightarrow$

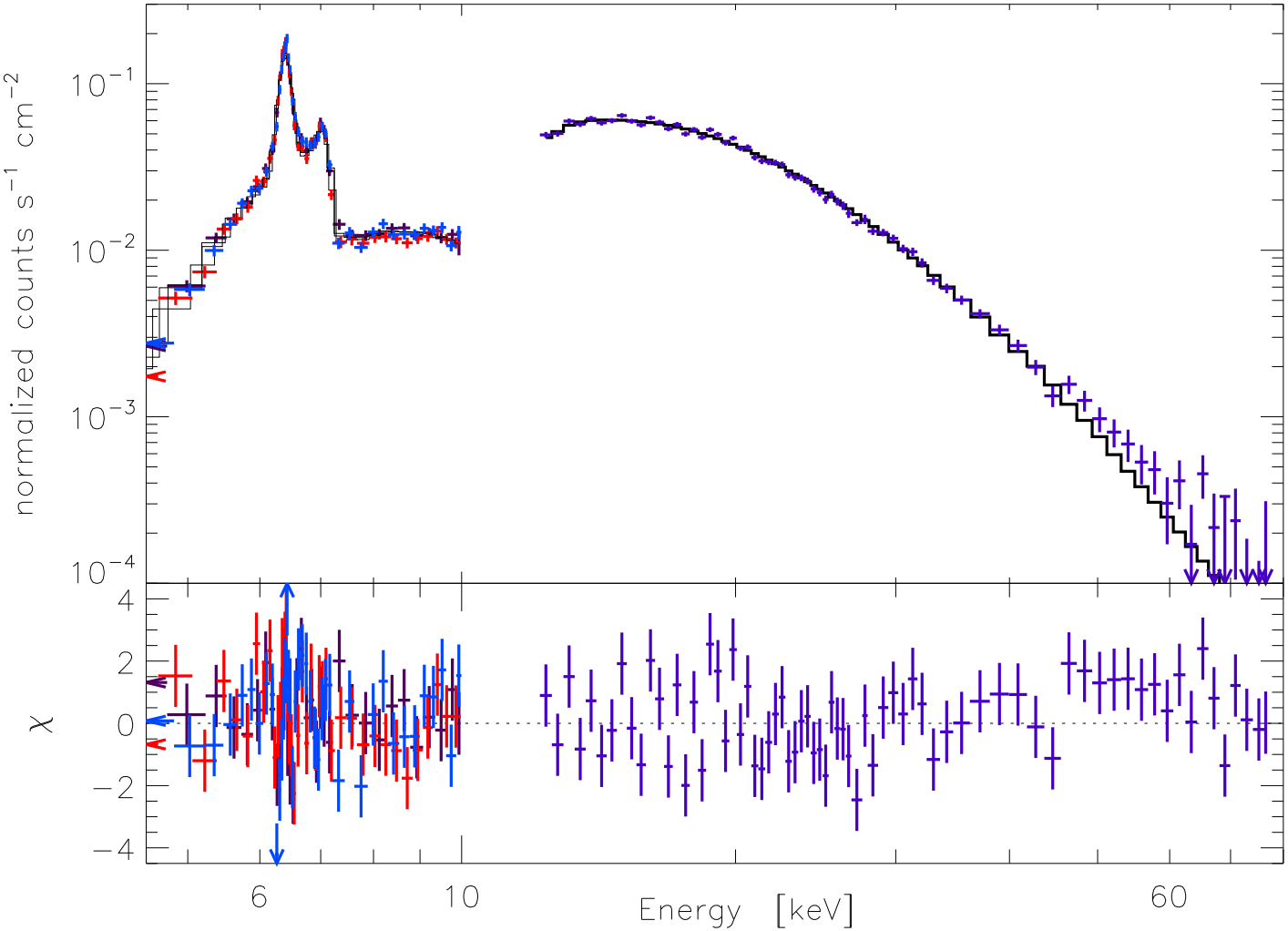
Suzaku $\sim$ weak *XMM*

- 70 ks exposure
- 2006–08–14 (data in spring 2007)
- Barragan et al., 2008, ApJ, in prep.



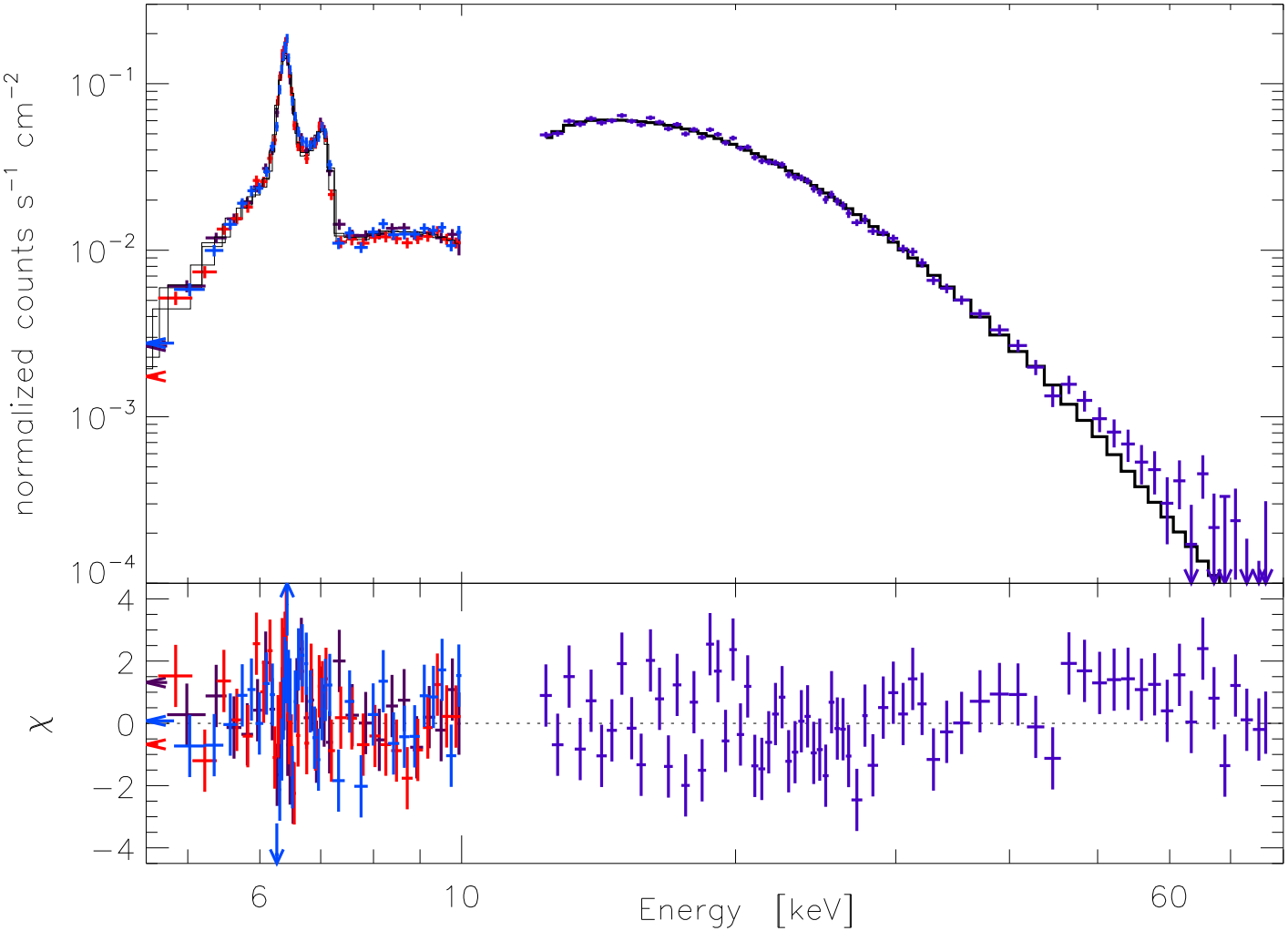
$\chi^2_{\text{red}} = 1.1$

- $N_H = 1.92 \pm 0.03 \times 10^{24}$ cm^2 **TBabs** (Wilms et al. 2000)
- $A_{Fe} = 1.05^{+0.04}_{-0.03}$ **wrt ISM**, explains previous under-abundance **wrt solar**



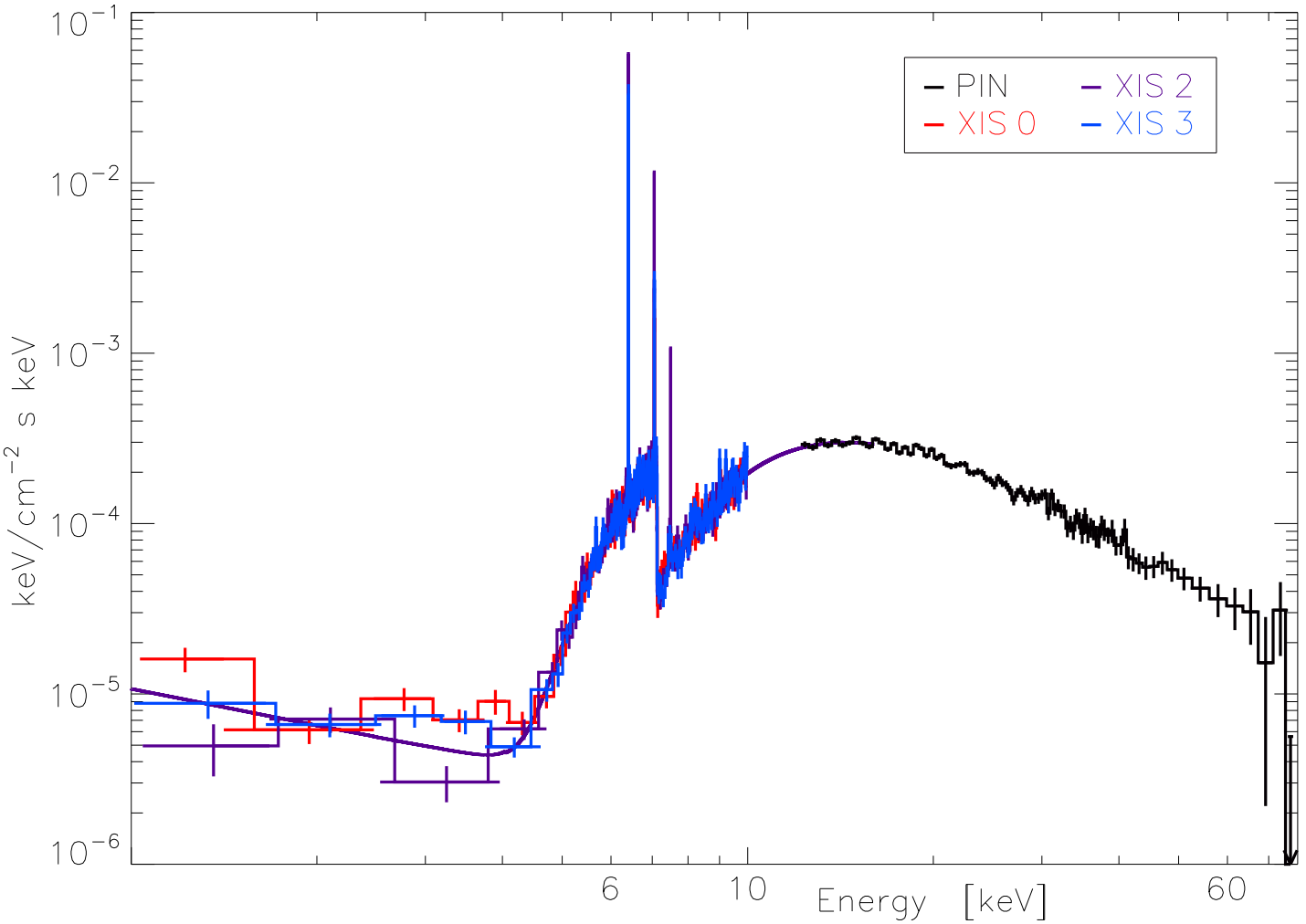
$\chi^2_{\text{red}} = 1.1$

- $\Gamma = 0.68 \pm 0.04$
- as well constrained as with *XMM+INTEGRAL*, considerably harder



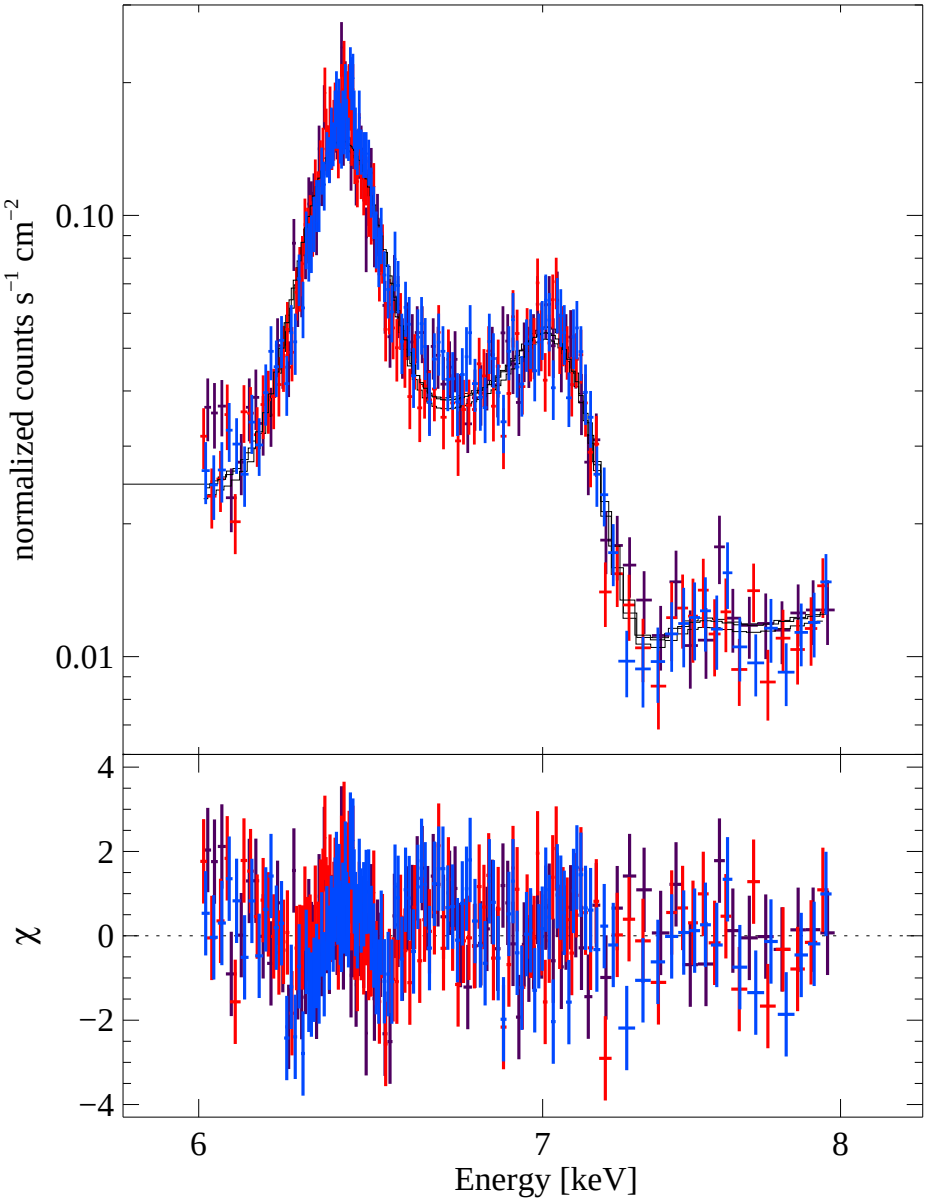
$\chi^2_{\text{red}} = 1.1$

- $E_{\text{Fold}} = 21.5 \pm 1.1\,\text{keV}$
- could not be constrained before, Compton hump?, no “reflection”



$\chi^2_{\text{red}} = 1.1$

- Soft Excess, shape not constrained (here: power-law)
- probably partly due to nearby source (30″, Ibarra et al., 2007)



$E_{\text{Fe K}\alpha}$=6.405(3) keV

EW=892 eV

$E_{\text{Fe K}\beta}$=7.06(1) keV

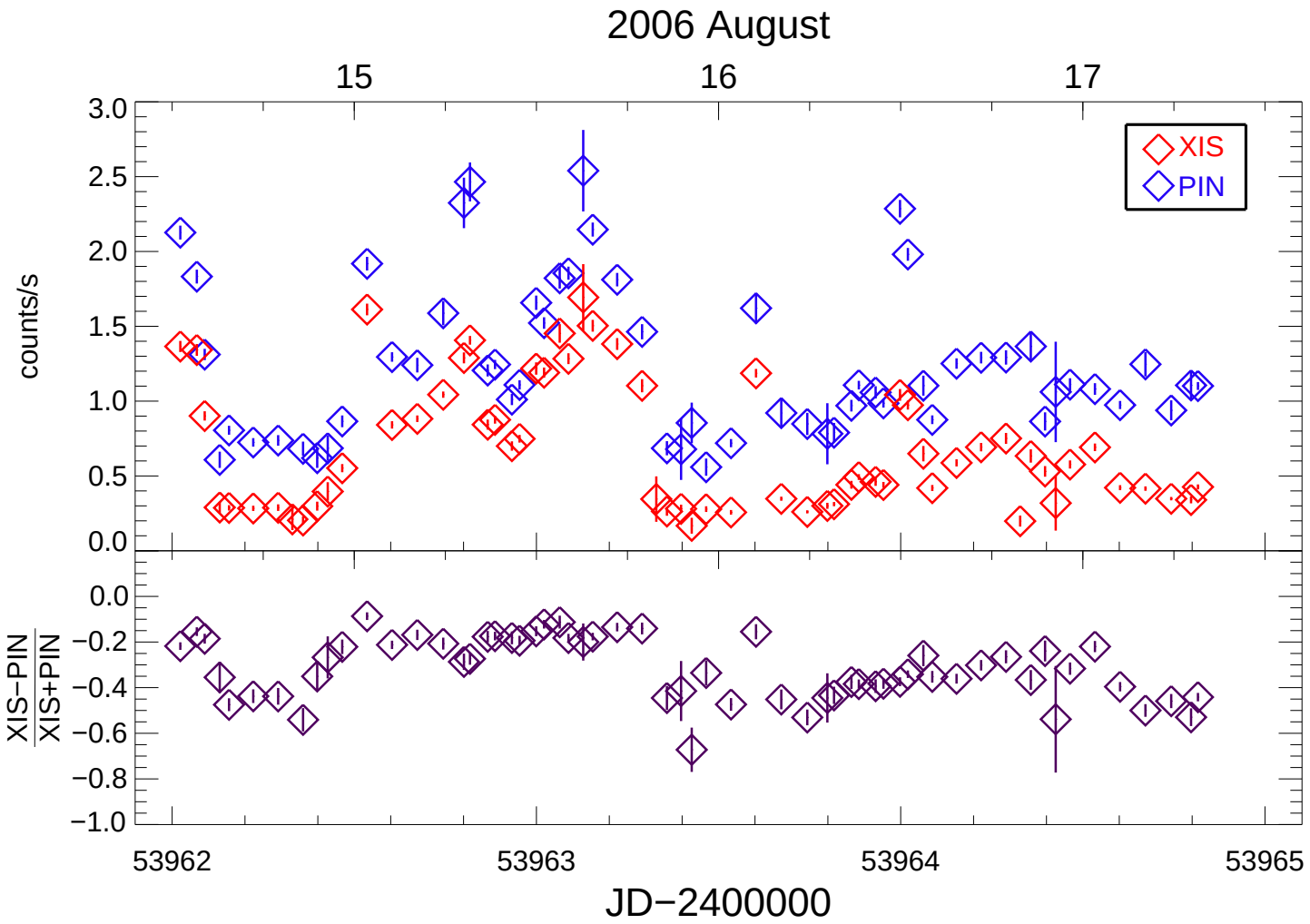
EW=112 eV

indication:

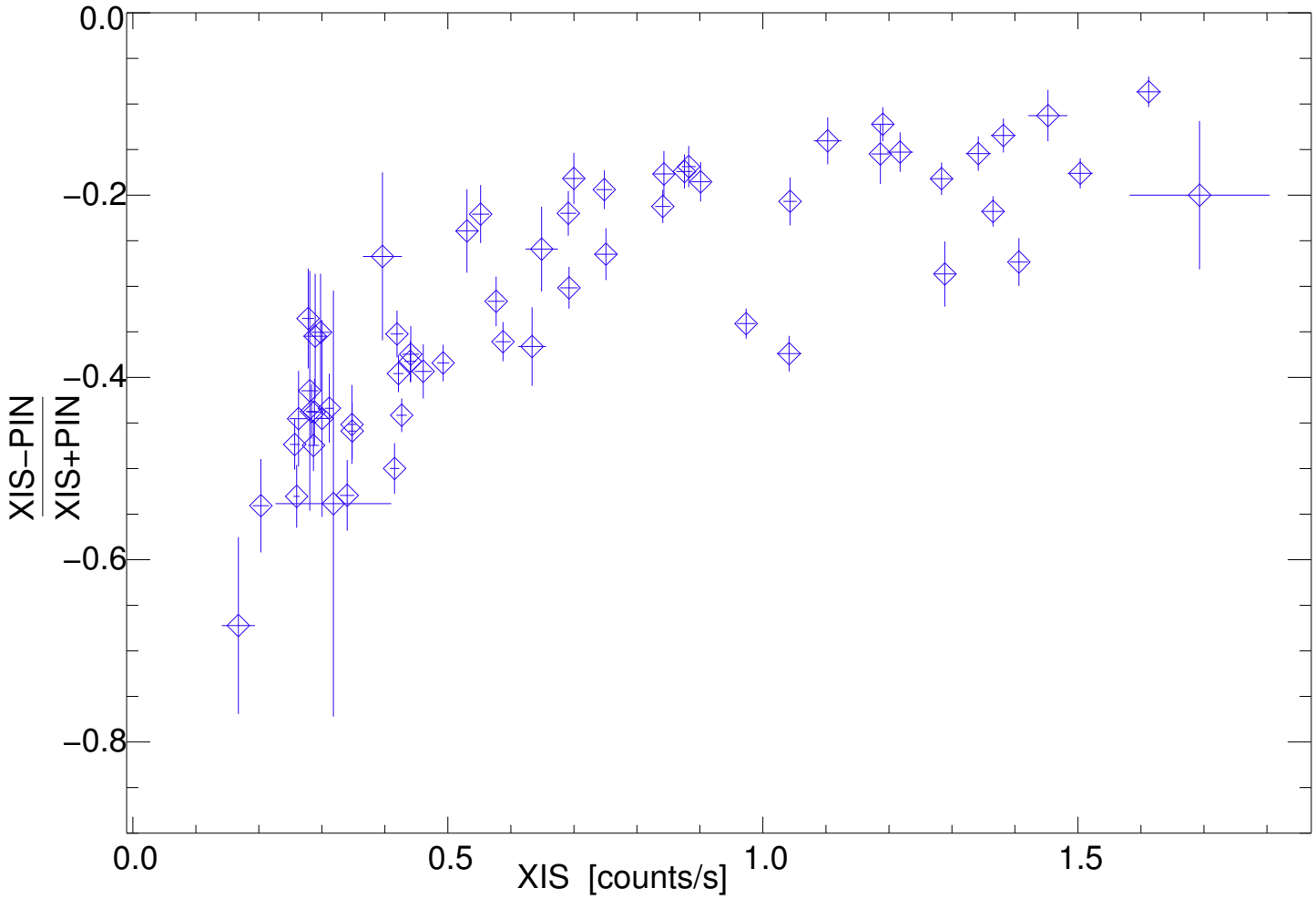
$E_{\text{Ni K}\alpha}$=7.50(7) keV

EW=37 eV

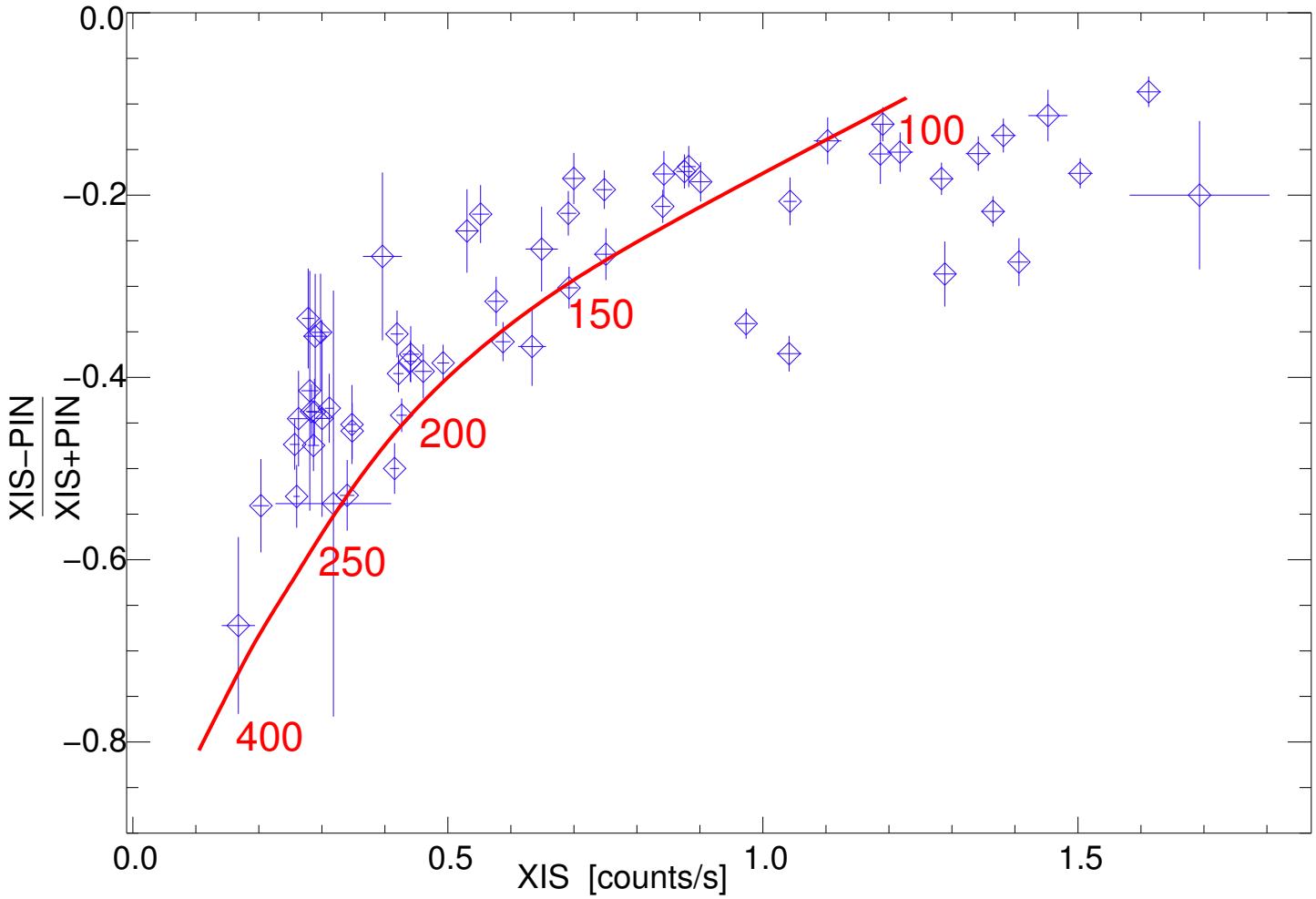
Residuals ⇔ Compton shoulder?



- satellite orbit averaged
- **variable** by a factor of a few
- hardness vs time
- $\Rightarrow$ hard dips, **absorption**



- satellite orbit averaged
- **variable** by a factor of a few
- hardness vs intensity
- $\Rightarrow$ hard dips, **absorption**



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Summary

- N_H, line parameters (E, EW) consistent with *XMM/INTEGRAL*
- Γ considerably harder
- E_{Fold} can be constrained
- variability to first order due to absorption

Suzaku is uniquely suited to study Compton-thick absorption: lines & curvature

Outlook

- time-resolved spectroscopy
- expand TBabs to full transmission model
  $\Rightarrow$ consistent with Compton hump?
  $\Rightarrow$ consistent with Compton shoulder?