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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new classes:
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IGR J16318−4848

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:
$N_H \sim 2 \times 10^{24} \text{ cm}^{-2}$


- $\text{sgB[e]} \Rightarrow \text{HMXB}$
- NS or BH?
after Ibarra et al., 2007, A&A 465, 501

- $N_H = 1.82^{+0.05}_{-0.03} \times 10^{24} \text{ cm}^2$
- $\Gamma = 1.46 \pm 0.03$
- $E_{\text{Fold}} < 16 \text{ keV}$
- $E_{\text{Fe K}\alpha} = 6.43 \text{ keV}$
- $E_{\text{Fe K}\beta} = 7.10 \text{ keV}$
- $E_{\text{Ni K}\alpha} = 7.45 \text{ keV}$
- Compton shoulder?

- 3 × XMM-EPIC and INTEGRAL-ISGRI
- average flux varies by factor 3
average flux in 0.2–80 keV

4.2 \text{(Suzaku)}
8.7 \text{(high XMM/INT)}
\left[10^{10} \text{ ergs cm}^{-2} \text{ s}^{-1}\right]

⇒
\text{Suzaku} \sim \text{weak XMM}

- 70 ks exposure
- 2006–08–14 (data in spring 2007)
\( \chi^2_{\text{red}} = 1.1 \)

- \( N_H = 1.92 \pm 0.03 \times 10^{24} \text{ cm}^2 \)
  \text{TBabs (Wilms et al. 2000)}

- \( A_{\text{Fe}} = 1.05^{+0.04}_{-0.03} \text{ wrt ISM}, \text{ explains previous under-abundance wrt solar} \)
\[ \chi_{\text{red}}^2 = 1.1 \]

- \( \Gamma = 0.68 \pm 0.04 \)
- as well constrained as with XMM+INTEGRAL, considerably harder
\( \chi_{\text{red}}^2 = 1.1 \)

- \( E_{\text{Fold}} = 21.5 \pm 1.1 \text{ keV} \)
- 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)
$E_{\text{Fe K}\alpha} = 6.405(3) \text{ keV}$
$E_{\text{Fe K}\beta} = 7.06(1) \text{ keV}$
$E_{\text{Ni K}\alpha} = 7.50(7) \text{ keV}$

EW=892 eV
EW=112 eV
EW=37 eV

_Residuals ⇔ Compton shoulder?_
**Norma Arm & IGR Sources**

**Previous Observations**

**Suzaku Observation**

**Broad Band Spectrum**

**Lines**

**Light curves**

**Summary & Outlook**

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**2006 August**

![Graph showing light curve data with JD−2400000 on the x-axis and counts/s on the y-axis. The graph includes data for XIS-PIN and XIS+PIN, with some variable data points.](image)

- Satellite orbit averaged
- Variable by a factor of a few
- Hardness vs time
- ⇒ hard dips, absorption

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IGR J16318—4848
Satellite orbit averaged

Variable by a factor of a few

Hardness vs intensity

⇒ Hard dips, absorption

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Summary

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

\textit{Suzaku} is uniquely suited to study Compton-thick absorption: lines & curvature

Outlook

- time-resolved spectroscopy
- expand \texttt{TBabs} to full transmission model
  \(\Rightarrow\) consistent with Compton hump?
  \(\Rightarrow\) consistent with Compton shoulder?