Suzaku Observation of IGR J16318−4848

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Abstract

IGR J16318−4848 is the first example of a new class of highly absorbed X-ray binaries that has been discovered by the INTErnational Gamma-Ray Astrophysics Laboratory (*INTEGRAL*) in the last years. We analysed the first *Suzaku* observation of this source (2006 August 14-17), and its spectral characteristics suggest a neutron star as the compact object in the binary system. However no pulsations were found between 1 s and 10 ks, and we could not conclude this suggestion.

The lightcurve varies significantly in hours; however the source remains always in a hard state.

Key words: stars: individual (IGR J16318−4848) — binaries: general — X-ray: binaries

1. IGR J16318−4848

IGR J16318−4848 was discovered on 2003 Jan 29 with the IBIS/ISGRI soft gamma-ray detector onboard *INTEGRAL*. It has been proposed (e.g. Filliatre et al. 2004; Walter et al. 2004) that the source is a High Mass X-ray Binary (HMXB) with an sgB[e] star as the mass donor surrounded by a dense and absorbing circumstellar material. The distance is estimated to be between 0.9 and 6.2 kpc.

Observations of some of the other newly-discovered *INTEGRAL* sources have revealed that some of them share similar spectral properties (e.g. Rodriguez et al. 2003, Patel et al. 2004), and IGR J16318−4848 would then be one of the most extreme examples of this new class of highly absorbed X-ray binaries (see, e.g., Kuulkers et al. 2005).

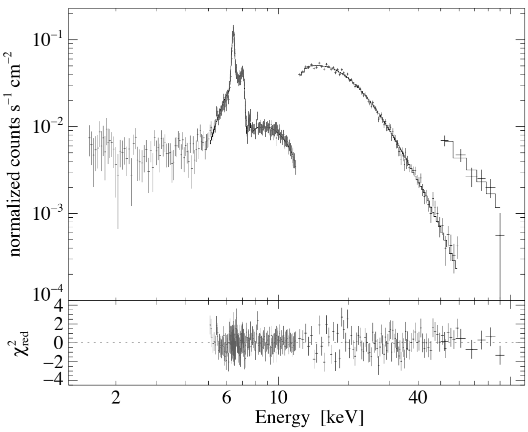

Fig. 1. Broad-band spectrum of IGR J16318-4848 covered by the Suzaku instruments XIS (1.2–12 keV), PIN (1.2–60 keV) and GSO (40–100 keV).

2. Spectral Analysis

Fig. 1 shows the spectrum in the 1.2 − 100 keV band. The soft excess below 5 keV is most problably due to a serendipitous source close to IGR J16318−4848 (Ibarra et al. 2007; Matt et al. 2003), thus it was not included in our fit model. We described the spectral continuum with an absorbed cutoff powerlaw, taking into account non-relativistic Compton scattering; photoabsorption was modeled with a revised version of the TBabs model (Wilms et al. 2000; Wilms et al. 2006) and the strong fluorescent emission lines appearing in the spectrum: Fe Kα_1, Kα_2, Kβ_1, Kβ_2 and Ni Kα as Gaussians fixed to a width of $\sigma = 0.1$ eV (Fig. 2).

The fit to the model was good ($\chi^2/\mathrm{dof} = 305.6/264$), and revealed a very high column density 1.95(3) ×

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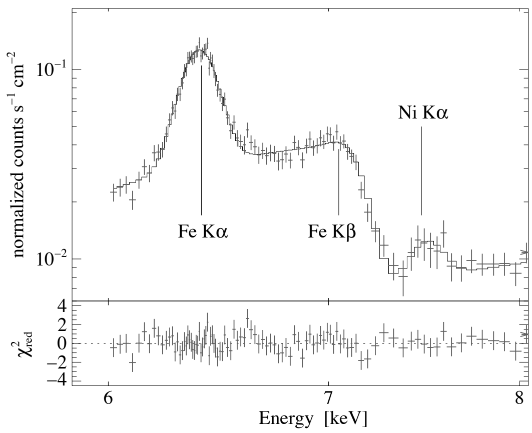

Fig. 2. Close up of the spectrum focusing on the fluorescent emission lines interval [6–8 keV]. No clear Compton shoulder was detected in the spectrum.

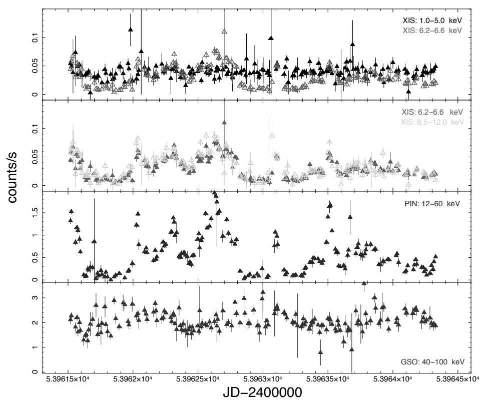

Fig. 3. Light curves for the XIS, the PIN and GSO.

$10^{24}\,\mathrm{cm}^{-2}$, however no clear Compton shoulder was detected in the spectrum, consistent with previous results, e.g., Walter et al. (2003), which could be due to a strongly inhomogeneous absorbing medium. The folding energy, 20.5(6) keV, together with the other spectral characteristics derived from the fit as the hard photon index (0.68(4)) are typical parameters for accreting neutron stars (Naik et al. 2004; Hill et al. 2008), suggesting this might be the nature of IGR J16318−4848, as already pointed out by Walter et al. 2004). Our fit requires a slight overabundance of iron with respect to the ISM values of Wilms et al. (2000), as one would expect for an evolved star. Furthermore, the flux ratio of Fe and Ni also points towards a Ni overabundance by a factor of ∼2 with respect to Fe.

3. Variability

The light curves for the energy range 1.2–100 keV of the combined XISs, the PIN and the GSO are shown

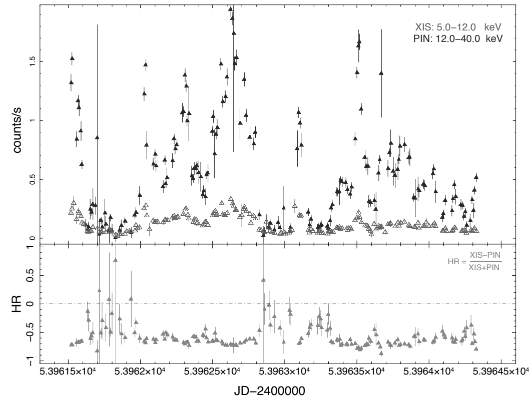

Fig. 4. Light curve for the XIS (5.0–12.0 keV) and the PIN (12–60 keV), together with the hardness ratio.

in Fig. 3. The source is varying significantly in time as shown by the behavior on different energy bands. The light curves for the Kα region (6.2–6.6 keV), the XIS continuum (8–12 keV) and the PIN (12–60 keV) follow a similar trend, but not the one for the soft excess in the XIS (1.2–5.0 keV), which may be due to the fact that this excess is caused by another source in the vicinity of IGR J16318−4848 (Ibarra et al. 2007).

Fig. 4 shows the light curves for the XIS (5.0–12 keV) and the PIN (12–60 keV) together with the hardness ratio (HR). We can see that the source remains always in a hard state (the points where it seems to be softer have large error bars, still compatible with the hard state) although it varies slightly over the time of the observation.

No pulsations were found between 1 s and 10 ks, so it cannot be concluded unambiguously that the compact object of the binary system is a neutron star (although the spectral values are pointing to this fact).

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