MONITORING SUPERGIANT FAST X-RAY TRANSIENTS WITH SWIFT. III. OUTBURSTS OF THE PROTOTYPICAL SUPERGIANT FAST X-RAY TRANSIENTS IGR J17544–2619 AND XTE J1739–302

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ABSTRACT

IGR J17544–2619 and XTE J1739–302 are considered the prototypical sources of the new class of High-Mass X-ray Binaries, the Supergiant Fast X-ray Transients (SFXTs), whose members have been mainly discovered with the INTEGRAL satellite (see e.g., Sguera et al. 2005). SFXTs are characterized by X-ray transient emission during short flares (a few hours long) reaching a few $10^{36}$–$10^{37}$ erg s$^{-1}$ and they are associated with blue supergiant companions (e.g., Negueruela et al. 2006b; Smith et al. 2006). The quiescent state in SFXTs has been observed only in a few sources and is characterized by a soft spectrum and X-ray luminosity at a level of $10^{32}$ erg s$^{-1}$, thus a very large dynamic range of about 1000–100000 has been observed. The short duration bright flares are part of a longer accretion phase at a lower level (Romano et al. 2007). When not in outburst, these sources spend most of their lifetime in accretion at an intermediate and (flaring) level of X-ray luminosity, of $10^{33}$–$10^{34}$ erg s$^{-1}$ (Sidoli et al. 2008b). The spectral properties are reminiscent of those of accreting pulsars; thus it is likely that several members of the class are actually hosting neutron stars, although the spin period has been measured only in two sources. SFXTs are reminiscent of those of accreting pulsars; thus it is likely that several members of the class are actually hosting neutron stars.

Key words: X-rays: individual (IGR J17544–2619, XTE J1739–302) Online-only material: color figures

1. INTRODUCTION

IGR J17544–2619 and XTE J1739–302 are confirmed members of the new subclass of High-Mass X-ray Binaries, the Supergiant Fast X-ray Transients (SFXTs), whose members have been mainly discovered with the INTEGRAL satellite (see e.g., Sguera et al. 2005). SFXTs are characterized by X-ray transient emission during short flares (a few hours long) reaching a few $10^{36}$–$10^{37}$ erg s$^{-1}$ and they are associated with blue supergiant companions (e.g., Negueruela et al. 2006b; Smith et al. 2006). The quiescent state in SFXTs has been observed only in a few sources and is characterized by a soft spectrum and X-ray luminosity at a level of $10^{32}$ erg s$^{-1}$, thus a very large dynamic range of about 1000–100000 has been observed. The short duration bright flares are part of a longer accretion phase at a lower level (Romano et al. 2007). When not in outburst, these sources spend most of their lifetime in accretion at an intermediate and (flaring) level of X-ray luminosity, of $10^{33}$–$10^{34}$ erg s$^{-1}$ (Sidoli et al. 2008b). The spectral properties are reminiscent of those of accreting pulsars; thus it is likely that several members of the class are actually hosting neutron stars, although the spin period has been measured only in two SFXTs (AX J1841.0–0536, Bamba et al. 2001; IGR J11215–5952, Swank et al. 2007).

IGR J17544–2619 was discovered (Sunyaev et al. 2003) with IBIS/ISGRI onboard INTEGRAL on 2003 September 17 during a 2 hr flare reaching 160 mCrab (18–25 keV). During a Chandra observation, both the quiescence level and the onset of an outburst was caught (in’t Zand 2005), observing a dynamic range as large as $10^4$. The optical counterpart is an O9Ib star (Pellizza et al. 2006) located at 3.6 kpc (Rahoui et al. 2008). Several other bright flares have been observed with INTEGRAL in 2003, 2004, and 2005 (Grebeniev et al. 2003, 2004; Sguera et al. 2006; Walter & Zurita Heras 2007; Kuulkers et al. 2007b), with flare durations ranging from 0.5 to about 10 hr, reaching peak fluxes of 400 mCrab (20–40 keV). More recently, two new outbursts were detected with the Swift satellite, on 2007 November 8 (Krimm et al. 2007) and on 2008 March 31 (Sidoli et al. 2008a), 144 days apart. The flux at a peak observed with Swift/Burst Alert Telescope (BAT) was 165 mCrab (20–40 keV). The source was also active on 2007 September 21, with a fainter flaring emission up to 30–40 mCrab (20–60 keV), as observed with IBIS/ISGRI onboard INTEGRAL (Kuulkers et al. 2007a). XTE J1739–302 was discovered with RXTE after a short outburst in 1997 August (Smith et al. 1998), and displayed a spectrum well fitted with a bremsstrahlung model with a temperature of $\sim$22 keV, reaching a peak flux of $3.6 \times 10^{-9}$ erg cm$^{-2}$ s$^{-1}$ (2–25 keV). Later, several other short flares were observed with the Rossi X-Ray Timing Explorer/Proportional Counter Array (RXTE/PCA; Smith et al. 2006). The optical counterpart is an O8I star (Negueruela et al. 2006a) located at 2.7 kpc (Rahoui et al. 2008). Upper limits to the quiescent emission were placed withasca observations (Sakano et al. 2002) at a level of less than $1.1 \times 10^{-12}$ erg cm$^{-2}$ s$^{-1}$. Bright outbursts (up to 300 mCrab) were detected with IBIS/ISGRI in 2003 March, and 2004 March (Sguera et al. 2006). Frequent flaring activity with INTEGRAL has been reported by Walter & Zurita Heras (2007). Recently, it triggered the Swift BAT. An immediate slew allowed us to monitor the brightest part of...
a flare at soft energies (Romano et al. 2008a) with the Swift X-ray Telescope (XRT). This outburst was also observed by the INTEGRAL/JEM-X monitor, which detected a flare starting 5 h before the flares seen with Swift (Chenevez et al. 2008).

Here we report on the detailed analysis of the Swift data of two recent outbursts from these two prototypical SFXTs: the bright flares that occurred on 2008 March 31 (Sidoli et al. 2008a) from IGR J17544−2619 and on 2008 April 8 from XTE J1739−302 (Romano et al. 2008a). These observations are part of a monitoring campaign on four SFXTs with Swift, which started on 2007 October 26. The results on the out-of-outburst emission of the earliest months of Swift monitoring program, background subtracted and corrected for pile-up, PSF losses, and vignetting. All data in one segment were generally grouped in one point (with the exception of the March 31 and April 8 outbursts). The monitoring program started on 2007 October 26 with approximately two or three observations per week, with a three-month gap between 2007 November and 2008 February, when IGR J17544−2619 and XTE J1739−302 were Sun-constrained.

Figures 2 and 3 show the detailed light curves in several energy bands during the brightest part of the two outbursts, together with the 4–10/0.3–4 keV, 25–50/15–25 keV hardness ratios. Fitting the IGR J17544−2619 4–10/0.3–4 keV hardness ratio as a function of time to a constant model yields a value of 0.63 ± 0.04 and $\chi^2_v = 1.129$ for 30 degrees of freedom (dof). For XTE J1739−302 we obtain a value of 1.86 ± 0.25 and $\chi^2_v = 0.6$ for 21 dof.

3. RESULTS

3.1. Light Curves

Figure 1 shows the Swift/XRT 0.2–10 keV light curve of IGR J17544−2619 and XTE J1739−302 throughout our 2008 monitoring program, background subtracted and corrected for pile-up, PSF losses, and vignetting. All data in one segment were generally grouped in one point (with the exception of the March 31 and April 8 outbursts). The monitoring program started on 2007 October 26 with approximately two or three observations per week, with a three-month gap between 2007 November and 2008 February, when IGR J17544−2619 and XTE J1739−302 were Sun-constrained.

3.2. Spectroscopy of IGR J17544−2619

The XRT/WT spectrum, extracted during the peak of the outburst (observation 00308224000, see Table 1), results in a quite hard X-ray emission. Adopting an absorbed power law, we obtain a photon index of 0.75 ± 0.11, and a high column density, $N_H = (1.1 \pm 0.2) \times 10^{22}$ cm$^{-2}$ ($\chi^2_v = 0.958$ for 143 dof). The unabsorbed flux in the 2–10 keV band is $1.2 \times 10^{-9}$ erg cm$^{-2}$ s$^{-1}$. A 3$\sigma$ upper limit to the equivalent width of an iron line at 6.7 keV can be placed at 62 eV. A contour plot is shown in Figure 5 for the single power-law model fit to the WT spectrum, compared with the out-of-outburst emission (Sidoli et al. 2008b), and with one of the observations performed before

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http://heasarc.gsfc.nasa.gov/docs/swift/analysis/bat_digest.html
The X-ray spectrum of the fainter emission observed just after the bright flare (PC data, observation 00035056021) is somewhat softer (1.9$\pm$0.7), indeed, fitted using Cash statistics and adopting an absorbed power-law model, the resulting photon index is 1.5$^{+0.7}_{-0.6}$. The unabsorbed flux in the 2–10 keV band is 5 $\times$ 10$^{-12}$ erg cm$^{-2}$ s$^{-1}$. A summary of the model parameters can be found in Table 2. This table also lists, for comparison, the spectral parameters obtained from other XRT observations reported in Table 1, and performed before the outburst.

We fit the simultaneous BAT+XRT spectra in the time interval 168–475 s since the BAT trigger. Several models typically used to describe the X-ray emission from accreting pulsars in HMXBs were adopted (White et al. 1983). For the spectral fitting we considered BAT counts up to 50 keV (above this energy the statistics is poor). We report our results in Table 3, and show an example of the fits in Figure 4. All models result in a satisfactory deconvolution of the 0.3–50 keV emission, resulting in a hard power-law-like spectrum below 10 keV, but a roll over of the high-energy emission clearly emerges when fitting the BAT spectrum together with the XRT data. Very recent theoretical results about the formation of the spectrum in X-ray pulsars indicate that Comptonization occurs in the shocked gas in the accretion columns onto the neutron star (Becker & Wolff 2005 and Becker & Wolff 2007). Based on these findings, Comptonization models have been used in describing the spectra observed from several accreting pulsars (see e.g., Torrejón et al. 2004, Masetti et al. 2006, Ferrigno et al. 2008). Adopting this more physical description...
of the spectrum, a Comptonization model (compTT in XSPEC, Titarchuk 1994), we obtain a cold plasma (we assumed a spherical geometry for the Comptonization plasma) with a well-constrained temperature of \( \sim 4 \) keV, and an optical depth of \( 19 \pm 3 \).

### 3.3. Spectroscopy of XTE J1739–302

The XRT/WT spectrum (observation 00308797000) extracted during the early part of the outburst was fit with an absorbed power law, obtaining a photon index of \( 1.56^{+0.6}_{-0.5} \), and a high column density, \( N_{\text{H}} = (13^{+4}_{-3}) \times 10^{22} \) cm\(^{-2}\) (\( \chi_v^2 = 1.642 \) for 35 dof). The unabsorbed flux in the 2–10 keV band is \( 1.7 \times 10^{-9} \) erg cm\(^{-2}\) s\(^{-1}\). A contour plot is shown in Figure 7 for the single power-law model fit to the WT spectrum, compared with out-of-outburst emission (Sidoli et al. 2008b). The PC data of the same sequence (observation 00308797000) show a consistent fit: photon index of \( 1.57^{+0.6}_{-0.54} \), \( N_{\text{H}} = (13^{+4}_{-3}) \times 10^{22} \) cm\(^{-2}\) (\( \chi_v^2 = 1.082 \) for 24 dof), and an unabsorbed flux in the 2–10 keV band of \( 5 \times 10^{-10} \) erg cm\(^{-2}\) s\(^{-1}\). The model parameters are summarized in Table 2.

Similar to the procedure we adopted for IGR J17544–2619, we fit the simultaneous XRT+BAT spectra of XTE J1739–302 in the 0.3–10 keV and the 14–60 keV energy bands, respectively. Adopting typical models used to describe the X-ray emission from HMXBs, as in the case of IGR J17544–2619, we obtained the spectral parameters reported in Table 4. A steep power-law model can reproduce (\( \chi_v^2 = 1.54 \) for 55 dof) the spectrum from soft to hard X-rays, with a photon index of \( 2.3^{+0.2}_{-0.1} \) and an absorbing column density of \( N_{\text{H}} = (18^{+3}_{-1}) \times 10^{22} \) cm\(^{-2}\), although significantly better fits are obtained with a cutoff at high energies. All models (power law with a cutoff or a Comptonizing
with INTEGRAL with the high-energy detector (Swift) the first time simultaneously in a broad energy range, from 302 2008-04-08 XRT/PC 12.4+1.4 10.5+0.6 1.082 (24) 3

Note. a Cash statistics and percentage of Monte Carlo realizations with statistic < C-stat.

Table 3
Spectral Fits of Simultaneous XRT and BAT Data of IGR J17544−2619

| Model  | Parameters |
|--------|------------|
| HIGHCUTPL\(^a\)  | \(N_H = 1.1 \pm 0.2\), \(\Gamma = 0.75 \pm 0.11\), \(E_c = 18 \pm 2\), \(E_t = 4 \pm 2\), \(\chi^2\) (dof) = 0.919 (157), \(L_{0.5-10}\) = 1.9, 5.3 |
| CUTOFFPL\(^a\)  | \(N_H = 0.76^{+0.15}_{-0.16}\), \(\Gamma = 0.05 \pm 0.18\), \(E_c = 7.2^{+1.2}_{-1.3}\), \(\chi^2\) (dof) = 0.989 (158), \(L_{0.5-10}\) = 1.8, 4.2 |
| COMPPT\(^b\)    | \(N_H = 0.43^{+0.19}_{-0.15}\), \(T_0 = 0.80 \pm 0.14\), \(T_e = 4.3^{+0.5}_{-0.4}\), \(\chi^2\) (dof) = 0.934 (157), \(L_{0.5-10}\) = 1.8, 4.4 |

Notes.
\(^a\) \(N_H\) is the neutral hydrogen column density (\(10^{22}\) cm\(^{-2}\)), \(\Gamma\) is the power-law photon index, \(E_c\) is the cutoff energy (keV), \(E_t\) is the exponential folding energy (keV).
\(^b\) \(T_0\) is the temperature of the Comptonized seed photons, \(T_e\) is the temperature of the Comptonizing electron plasma, \(\tau\) is the optical depth of the Comptonizing plasma (spherical geometry).
\(^c\) In units of \(10^{36}\) erg s\(^{-1}\) derived assuming a distance of 3.6 kpc.

Table 4
Spectral Fits of Simultaneous XRT and BAT Data of XTE J1739−302

| Model  | Parameters |
|--------|------------|
| HIGHCUTPL\(^a\)  | \(N_H = 12.5^{+1.5}_{-1.3}\), \(\Gamma = 1.4^{+0.5}_{-1.0}\), \(E_c = 6^{+7}_{-6}\), \(E_t = 16^{+12}_{-8}\), \(\chi^2\) (dof) = 1.37 (53), \(L_{0.5-10}\) = 1.9, 3.0 |
| CUTOFFPL\(^a\)  | \(N_H = 11.9^{+3.0}_{-2.6}\), \(\Gamma = 1.0 \pm 0.7\), \(E_c = 13^{+14}_{-10}\), \(\chi^2\) (dof) = 1.36 (54), \(L_{0.5-10}\) = 1.6, 3.1 |
| COMPPT\(^b\)    | \(N_H = 8.2^{+5.9}_{-5.4}\), \(T_0 = 1.3^{+0.4}_{-1.3}\), \(T_e = 8^{+16}_{-3}\), \(\tau = 6.8^{+2.5}_{-1.0}\), \(\chi^2\) (dof) = 1.37 (53), \(L_{0.5-10}\) = 1.1, 2.2 |

Notes.
\(^a\) \(N_H\) is the neutral hydrogen column density (\(10^{22}\) cm\(^{-2}\)), \(\Gamma\) is the power-law photon index, \(E_c\) is the cutoff energy (keV), \(E_t\) is the exponential folding energy (keV).
\(^b\) \(T_0\) is the temperature of the Comptonized seed photons, \(T_e\) is the temperature of the Comptonizing electron plasma, \(\tau\) is the optical depth of the Comptonizing plasma (spherical geometry).
\(^c\) In units of \(10^{36}\) erg s\(^{-1}\) derived assuming a distance of 2.7 kpc.

plasma model) result in equally satisfactory deconvolutions of the 0.3–60 keV emission. In Figure 6 we show the result obtained adopting a power-law with a high-energy cutoff.

4. DISCUSSION

Here we report on Swift observations of IGR J17544−2619 and XTE J1739−302 during two bright flares, observed for the first time simultaneously in a broad energy range, from 0.3 to 50–60 keV (the highest energy where the spectroscopy is meaningful with BAT in these two sources). Indeed, before Swift, the outbursts from these two SFXTs were mainly observed with INTEGRAL with the high-energy detector (\(SE > 20\) keV; e.g., Sguera et al. 2006) or at softer energy bands (Smith et al. 2006; in’t Zand 2005). The only SFXT previously observed simultaneously in a wide X-ray band was IGR J16479−4514, during a flare caught with the Swift satellite (Romano et al. 2008b).

The X-ray spectroscopy shows that these two SFXTs, which are considered the prototypes of this new class of HMXBs, have different properties during the bright flares. IGR J17544−2619 is one order of magnitude less absorbed than XTE J1739−302, and displays a significantly flatter spectrum below 10 keV, with an XRT/WT spectrum well fitted with a power-law with a photon index of 0.75 ± 0.11, compared with the XTE J1739−302 photon index, which lies in the range 1–2. The 1–10 keV spectral properties observed in IGR J17544−2619 during the flare are similar to what observed previously with Chandra (in’t Zand 2005), where the absorbed power-law fit resulted in a photon index of 0.73 ± 0.13, a column density of (1.36 ± 0.22) \(\times 10^{22}\) cm\(^{-2}\), and a peak flux of \(\sim 3 \times 10^{-9}\) erg cm\(^{-2}\) s\(^{-1}\).
The broadband analysis shows that IGR J17544−2619 displays a quite sharp cutoff at 18 ± 2 keV (when using the power-law model with a high-energy cutoff, highEcut in Table 3) or a well-constrained temperature for the Comptonizing electrons (in the comptt model in XSPEC) at 4–5 keV. Instead, in XTE J1739−302, a single power law (photon index of 2.2–2.5) can describe the whole spectrum from soft to hard energies. Part of this difference could be explained by the much higher absorption toward the line of sight of XTE J1739−302, which does not allow one to constrain well the low-energy part of the power-law model.

The observations we are reporting here are part of an ongoing monitoring campaign of four SFXTs with Swift (Sidoli et al. 2008b), which started on 2007 October 26. The two bright flares discussed here are the first from these two SFXTs, since the start of the campaign, which could be simultaneously covered with both Swift XRT and BAT. The results on the out-of-outburst X-ray emission (below 10 keV) have been reported by Sidoli et al. (2008b), where we find evidence that the accretion is still present, over long timescales of months, even outside the bright outbursts. Both XTE J1739−302 and IGR J17544−2619 show evidence that they still accrete matter even outside the outbursts, at a much fainter (100–1000 times lower) level than during the flares, with still a large flux variability (at least one order of magnitude). A complete view of the different luminosity and spectral states of the monitored SFXTs will be clearer at the end of the campaign, but it is already possible to compare the average out-of-outburst emission properties with the spectra during the flares.

Regarding the 0.3–10 keV spectra (fitted with a simple absorbed power law), XTE J1739−302 appears to be much more absorbed during the flare than during the out-of-outburst emission (see Figure 7), while the photon index is similar, within the large uncertainties (Sidoli et al. 2008b). Similar changes in the absorbing column density of XTE J1739−302 have been observed before with RXTE/PCA and ASCA (Smith et al. 2006), but during bright outbursts, where the $N_H$ ranged (from one bright flare to another) from 3 to $37 \times 10^{22}$ cm$^{-2}$. A Chandra observation (Smith et al. 2006) displaying an unabsorbed 1–10 keV flux of $\sim 10^{-11}$ erg cm$^{-2}$ s$^{-1}$, intermediate between...
the average out-of-outburst emission (Sidoli et al. 2008b) and the bright flare observed here, shows a hard power-law spectrum with a photon index of $0.62 \pm 0.23$, absorbed with a column density $N_H = (4.2 \pm 1.0) \times 10^{22} \, \text{cm}^{-2}$, which is compatible with that of the out-of-outburst emission. Thus, in XTE J1739$-$302, there does not seem to be a clear correlation between source intensity, spectral hardness, and absorbing column density to date.

Instead, IGR J17544$-$2619 shows a significantly harder spectrum during the flare, and a lower column density than during the out-of-outburst phase reported in Sidoli et al. (2008b), obtained summing together all the XRT data available from 2007 October 27 to 2008 February 28. During the out-of-outburst phase, the average observed flux was $3 \times 10^{-12} \, \text{erg} \, \text{cm}^{-2} \, \text{s}^{-1}$ (2–10 keV), the power-law photon index, $\Gamma$, was $2.1^{+0.6}_{-0.5}$, and the absorbing column density $N_H = (3.2^{+1.2}_{-0.9}) \times 10^{22} \, \text{cm}^{-2}$ (Sidoli et al. 2008b). We also compared the bright flare spectroscopy with the spectrum extracted from one of the observations obtained a few days before the bright flare from IGR J17544$-$2619 (dashed contours in Figure 5). A hardening of the IGR J17544$-$2619 spectrum during the flaring activity is evident. A similar behavior was already suggested from the analysis of different XMM-Newton observations during a low-level flaring activity (González-Riestra et al. 2004), and from the analysis of the 2004 Chandra observation (in’t Zand 2005). A proper comparison with the INTEGRAL results of a few outbursts from IGR J17544$-$2619 reported by Sguera et al. (2006) cannot be done since the energy range with INTEGRAL was limited to 20–60 keV. These authors fitted the 20–60 keV spectrum with a thermal bremsstrahlung, which is clearly not adequate to describe our XRT+BAT spectrum (reduced $\chi^2$ of 1.7, for 159 dof).

Different mechanisms have been proposed to explain the bright and short duration flaring activity in this new class of sources. Some models are related to the structure of the supergiant companion wind, involving spherically symmetric clumpy winds (see e.g., in’t Zand 2005; Negueruela et al. 2008) or anisotropic winds (Sidoli et al. 2007); other models involve the interaction of the inflowing wind with the neutron star magnetosphere (see e.g., Bozzo et al. 2008). Sidoli et al. (2007) explain the outbursts as being due to enhanced accretion onto the neutron star when it crosses, moving along the orbit, an equatorial wind disk component from the supergiant companion. Depending on the thickness and truncation of this supposed disk wind and on its inclination with respect to the orbital plane of the binary system, the compact object will cross the disk once or twice in a periodic or quasiperiodic manner, undergoing outbursts. In the framework of this model, the geometry, the structure of this disk wind, and its inclination with respect to the line of sight could explain the variability in the local absorbing column density, even during different outbursts (as observed several times in XTE J1739$-$302) and compared with the low-level activity. A lower column density during the out-of-outburst activity could be due to the fact that the source is completely outside the denser equatorial wind from the companion. In the spherically symmetric clumpy winds model, the difference in the observed column density could be due to the accreting dense clumps. In this case the clump matter should remain neutral also in proximity of the neutron star during bright flares. We think it is more likely that the absorbing column density is not related with a neutral accreting matter, but with other clumps or wind structures located probably farther away from the compact source.

In Figure 8 we compare the light curves during bright flares from four SFXTs, all observed with Swift: the two reported here from IGR J17544$-$2619 and XTE J1739$-$302, together with the one observed from IGR J11215$-$5952 (Romano et al. 2007) and from IGR J16479$-$4514 (Romano et al. 2008b). All light curves during bright flares look similar, although they were observed with a different sampling. We postpone a more quantitative comparison between the four SFXTs (duty cycle, light curve, rise time, and decay times) to a final paper at the end of the ongoing observing campaign. In any case, it is already evident that the behavior of this sample of SFXTs in outburst is similar, and that their bright emission extends for more than a few hours, contrary to what originally thought at the time of the discovery of this new class of sources (e.g., Sguera et al. 2005).

The wideband spectra during outbursts display high-energy cutoffs (assuming the model with a power-law modified at high energy by a cutoff, HIGHECUT in XSPEC), although differently constrained in the two sources: in IGR J17544$-$2619 it is at $18 \pm 2$ keV, in XTE J1739$-$302 it lies below 13 keV. These cutoff ranges are fully consistent with a neutron star magnetic field, $B$, of about $2\times10^{12}$ G in the case of IGR J17544$-$2619 and of less than about $2 \times 10^{12}$ G for XTE J1739$-$302 (Coburn et al. 2002). These estimates, although not based on a direct measurement of the magnetic field...
(which would be possible only in the case of detection of cyclotron lines), are already difficult to explain in the framework of the magnetar model recently proposed by Bozzo et al. (2008), where the magnetic field is at a level of $10^{14}$ G. The same is true for other two SFXTs, IGR J11215–5952 (Sidoli et al. 2007) and IGR J16479–4514 (Romano et al. 2008b).

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**Facilities:** Swift.

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