Swift Observations of GRB 140423A

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1 Introduction

At 08:31:53 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 140423A (Trigger 596901) (Sonbas, *et al.*, 2014, *GCN Circ.* 16142). Swift did not slew immediately due to an observing constraint. At the time of the trigger, the initial BAT position was 117 from the Sun (11.1 hours East) and 118 from the 38% -illuminated Moon. The BAT light curve shows a multi-peak structure with a duration of about 80 sec. The peak count rate was ∼2000 counts/sec (15-350 keV), at ∼20 sec after the trigger.

GRB 140423A also observed promptly from ground based telescopes and magnitudes are reported as 14.2 by Ferrante et al. (Rotse-IIIb) 51.5 s after the trigger, 17.11±0.17 and 17.60 ± 0.21 by Elenin et al. (2014 *GCN Circ.* 16143)(ISON-NM) 0.02043 days, and 0.02426 days after the trigger. These magnitudes were extracted from unfiltered images. Spectroscopic observations showed a redshift of z=3.26 (Tanvir et al. 2014 *GCN Circ.* 16150). Burst also detected in optics and NIR wavelengths by Kaur et al. (2014 *GCN Circ.* 16144) with pODI/WIYN at KPNO, Ferrante et al. (2014 *GCN Circ.* 16145) with ROTSE-III, Maehara et al. (2014 *GCN Circ.* 16151) with KWFC, Cenko & Perley (2014 *GCN Circ.* 16153) with P60, Zheng et al. (2014 *GCN Circ.* 16156) with KAIT, Kuroda et al. (2014 *GCN Circ.* 16160) and Fujiwara et al. (2014 *GCN Circ.* 16173) with MITSuME, Akitaya et al. (2014 *GCN Circ.* 16163) with Kanata/HONIR, Pandey et al. (2014 *GCN Circ.* 16164) with Nainital, Harbeck et al. (2014 *GCN Circ.* 16165) with pODI/WIYN, D′Avanzo et al. (2014 *GCN Circ.* 16166) with TNG, Takahashi & Arai (2014 *GCN Circ.* 16167) with Nishi-Harima, Cano et al. (2014 *GCN Circ.* 16169) with NOT, Littlejohns et al. (2014 *GCN Circ.* 16170) and Butler et al. (2014 *GCN Circ.* 16174) with RATIR, Bikmaev et al. (2014 *GCN Circ.* 16185) with RTT150, Sahu (2014 *GCN Circ.* 16172) with Himalayan Chandra Telescope , and Volnova et al. (2014 *GCN Circ.* 16318) with TShAO.

The Fermi Gamma-Ray Burst Monitor triggered and located GRB 140423A on 23 April 2014. The GBM light curve shows a multiple-peak structure with a duration (T90) of about 95 s (50-300 keV). Time-averaged spectrum best fitted by a Band function with α=-0.25 ± 0.11 , β=-1.97 ± 0.06, and a 125.0 ± 9.0 keV E_{peak} (A. von Kienlin *et al.*, 2014 *GCN Circ.* 16152).

GRB 140423A was also detected by Konus-Wind.

2 BAT Observation and Analysis

As reported by Cummings et al. (GCN *GCN Circ.* 16161) the BAT ground-calculated position is RA($J2000$) = 197.276° ($13h09m06.2s$), Dec($J2000$) = +49.838° (+49d50′18.3″)±1.0 $arcmin$, (radius, systematic and statistical, 90% containment). The partial coding was 39%.

The mask-weighted light curve shows a multi-peak episode (Fig.1) starting at $\sim T - 50$ sec, peaking at $\sim T + 45$ sec, and ending at ∼ T+140 sec. T_{90} is calculated as 134 ± 23 sec at 15 - 350 keV.

The time-averaged spectrum from $T-130.13$ to $T+108.91$ sec is best fit by a simple power law model. The power law index of the time-averaged spectrum is 1.33 ± 0.06. For this model the total fluence in the 15-150 keV band is 9.4 ± 0.3 × 10^{-6} erg cm^{-2} and the 1-sec peak flux measured from T+44.19 sec in the 15-150 keV band is 2.1 ± 0.2 ph cm^{-2} sec^{-1}. All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at

http://gcn.gsfc.nasa.gov/notices_s/596901/BA/.

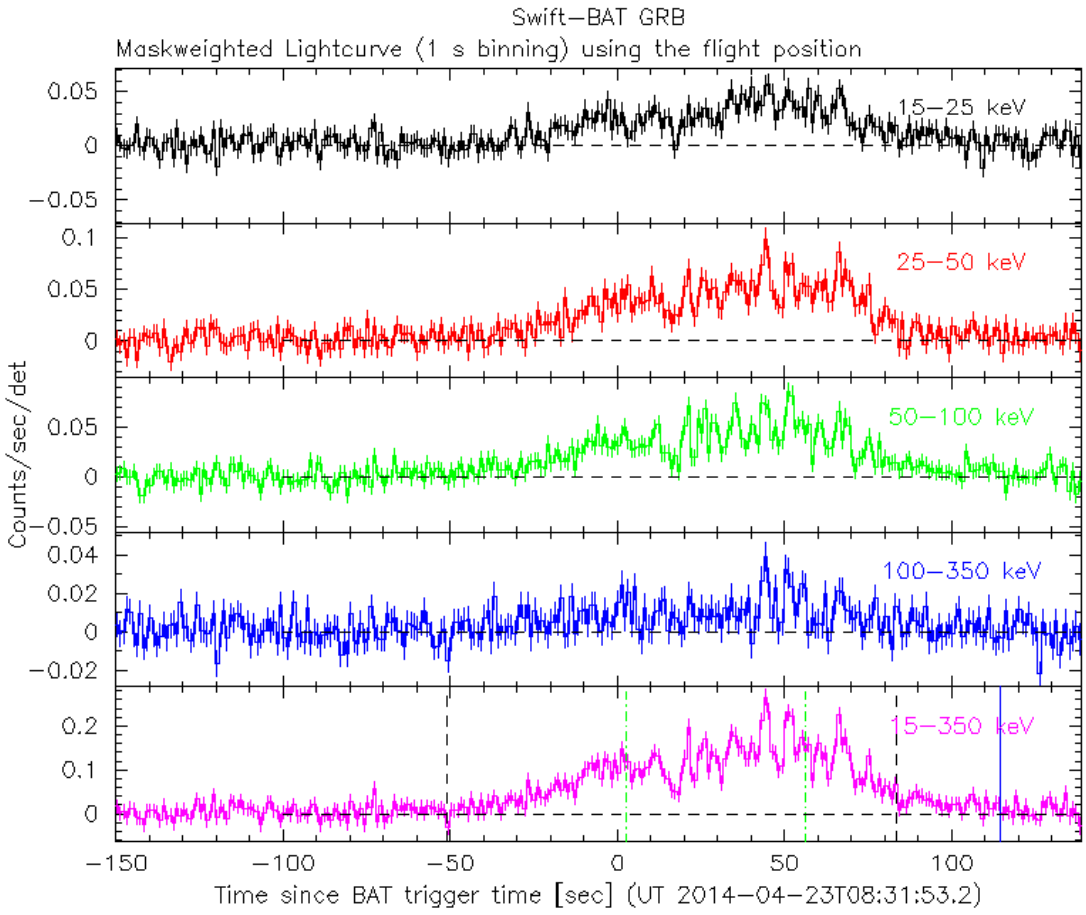

Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts $\sec^{-1}$illuminated-detector^{-1} and T_0 is 08:31:53.2 UT.

3 XRT Observations and Analysis

27 ks of XRT data were analysed for GRB 140423A from 3 ks to 483.0 ks after the BAT trigger. The data are entirely in Photon Counting (PC) mode. The enhanced XRT position is RA(J2000) = 13h 09m 8.51s, Dec(J2000) = +49d 50′ 29.5″ ± 1.4 ″ (90% confidence) (Beardmore *et al.GCN Circ.* 16155).

The light curve (Fig.2) can be modelled with an initial power-law decay with an index of α =0.97 ± 0.06 followed by a break at T+26.2 ks to analpha of 1.49 $(^{+0.16}_{-0.14})$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of $2.06(^{+0.09}_{-0.08})$. The best-fitting absorption column is $6.6(^{+3.2}_{-3.0}) \times 10^{21} cm^{-2}$, at a redshift of 3.26, in addition to the Galactic value of $1.1 \times 10^{20} cm^{-2}$ (Willingale et al. 2013). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is $3.1 \times 10^{-11} erg\ cm^{-2} count^{-1}$.

The results of the XRT-team automatic analysis are available at
http://www.swift.ac.uk/xrt_products/00596901.

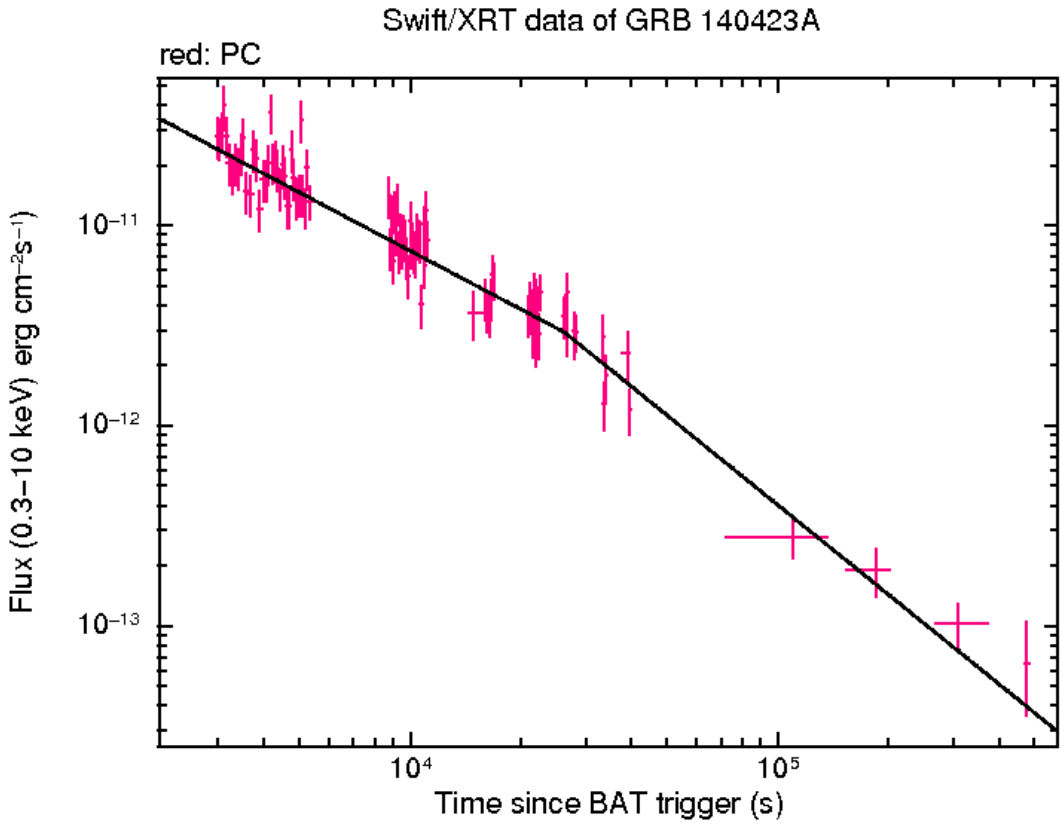

Figure 2: XRT Lightcurve in the 0.3-10 keV band: Windows Timing mode (blue) and Photon Counting mode (red). The conversion factor for this burst is 1 count = 4.6×10^{-11} $erg\ cm^{-2}$.

4 UVOT Observation and Analysis

Swift/UVOT took a finding chart exposure of 150 seconds with the White filter starting 2946 seconds after the BAT trigger. A faint source (19.6 0.4 mag) is detected in the White filter which is consistent with the candidate reported by (Elenin et al., *GCN Circ.* 16143) but not consistent with the Swift/XRT position reported by Burrows et al. (GCN *GCN Circ.* 16146). Preliminary magnitudes using the UVOT photometric system (Breeveld et al. 2011, AIP Conf. Proc. 1358, 373) are shown in the Table 1.

Filter	T_{Start}	T_{Stop}	Exposure (s)	Mag.
White	2947	3097	147	19.80 ± 0.09
v	3104	3303	197	19.33 ± 0.19
b	3924	4123	197	19.96 ± 0.16
u	3719	5353	393	>21.3
w1	3513	5148	393	>21.7
m2	4743	4943	197	>20.7
w2	4334	11161	808	>22.1

Table 1: Magnitudes from UVOT observations reported by Chester et al. (GCN *GCN Circ.* 16157). No correction has been made for the expected extinction in the Milky Way corresponding to a reddening of E_{B-V} of 0.01 mag. in the direction of the GRB (Schlegel et al. 1998).

References

[1] Akitaya et al. 2014, GCN Circ. 16163

[2] Beardmore et al.GCN Circ. 16155

[3] Bikmaev et al. 2014 GCN Circ. 16185

[4] Breeveld, A. A. et al. 2011, AIP Conf. Proc. 1358, 373

[5] Burrows, D. N. et al. (GCN GCN Circ. 16146)

[6] Butler et al. 2014 GCN Circ. 16174

[7] Cano et al. 2014 GCN Circ. 16169

[8] Cenko & Perley 2014, GCN Circ. 16153

[9] Chester et al. GCN Circ. 16157

[10] Cummings et al. GCN Circ. 16161

[11] D′Avanzo et al. 2014 GCN Circ. 16166

[12] Elenin et al. 2014, GCN Circ. 16143

[13] Ferrante et al. 2014, GCN Circ. 16145

[14] Fujiwara et al. 2014, GCN Circ. 16173

[15] Harbeck et al. 2014 GCN Circ. 16165

[16] Kaur et al. 2014, GCN Circ. 16144

[17] von Kienlin, A. et al., 2014 GCN Circ. 16152

[18] Kuroda et al. 2014, GCN Circ. 16160

[19] Littlejohns et al. 2014 GCN Circ. 16170

[20] Maehara et al. 2014, GCN Circ. 16151

[21] Pandey et al. 2014 GCN Circ. 16164

[22] Sahu 2014 GCN Circ. 16172

[23] Sonbas, et al., 2014, GCN Circ. 16142

[24] Takahashi Arai 2014 GCN Circ. 16167

[25] Tanvir et al. 2014 GCN Circ. 16150

[26] Volnova et al. 2014 GCN Circ. 16318

[27] Willingale et al. 2013

[28] Zheng et al. 2014 GCN Circ. 16156