Swift Observation of GRB 101023A

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1 Introduction

BAT triggered on GRB 101023A at 22:50:12.4 UT (Trigger 436981) (Saxton, *et al.*, *GCN Circ.* 11363). Swift slewed to this burst immediately and XRT began follow-up observations at 84.5 sec after the trigger, and UVOT started settled exposures at 92 sec after the trigger. Our best XRT location is RA($J2000$) = 317.96358° ($21h11m51.26s$), Dec($J2000$) = −65.38824° ($-65d23'17.7''$) with an error of 1.4 arcsec (90% confidence).

2 BAT Observation and Analysis

Using the data set from $T_0 - 240.$ to $T_0 + 962$ sec, further analysis of BAT GRB 101023A has been performed by Swift team (Stamatikos, *et al.*, *GCN Circ.* 11367). The BAT ground-calculated position is RA($J2000$) = 317.949° ($21h11m47.8s$), Dec($J2000$) = −65.38852° ($-65d23'18.7''$) ± 1.4 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 11%.

The masked-weighted light curves (Fig.1) starts 3 seconds before the trigger time T_0 sec, peaking at T_0. The main emission starts at $T_0 + 54$ sec; it consists of three overlapping peaks, and returns to background at about $T_0 + 140$ sec. $T_{90}(15 - 350keV)$ is 80.8 ± 2.2 sec (estimated error including systematics).

The time-averaged spectrum from $T_0 - 11.0$ sec to $T_0 + 137$ sec is best fitted by a simple power law model with exponential cutoff. This fit gives a photon index of 1.26 ± 0.15, ($\chi^2 = 45.2$ for 56 d.o.f.) and $E_{peak} = 101.1 \pm 18.9$ keV. For this model the total fluence in the $15 - 150$ keV band is $(2.7 \pm 0.1) \times 10^{-5} ergs/cm^2$.

3 XRT Observations and Analysis

Using 11.5 ks of XRT Photon Counting mode data of GRB 101023A, the refined XRT position is RA($J2000$) = 317.96365° ($21h11m51.28s$), Dec($J2000$) = 65.38824° ($65d23'17.7''$) ± 1.4 arcsec (90% confidence level). This position is 13 arcsec of the initial XRT position, and 1.8 arcsec from the optical afterglow candidate, reported by Levan *et al.*, *GCN Circ.* 11366.

The $0.3 - 10$ keV light curve (Fig.2) shows an initial steep decline with a slope of 4.21 ± 0.10, following by a slope of $1.07^{+0.07}_{-0.09}$, beginning at $T_0 + 205^{+12}_{-18}$ sec. At $(20.3^{+3.3}_{-4.4}) \times 10^3$ sec the light curve breaks with a slope of 1.54 ± 0.08.

Three segments of the X-ray lightcurve can be modeled with an absorbed power-law with spectral indices of 1.99 ± 0.06, 2.15 ± 0.10, respectively. The NH column density is the same as galactic column density, $1.96 \times 10^{21} cm^{-2}$. The average observed (unabsorbed) flux over $0.3 - 10$ keV for this spectrum (spanning a time of 88-46108 seconds after the trigger) is 5.5×10^{-9} (1.0×10^{-11}) $ergs/cm^2/sec$.

4 UVOT Observation and Analysis

The UVOT began settled observations the field of GRB 101023A 93 sec after the initial BAT trigger (Curtis *et al.*, *GCN Circ.* 11363). A new source was detected within the XRT error circle in the white (100 sec) finding exposure. It is very marginally detected in the first u (137 sec)

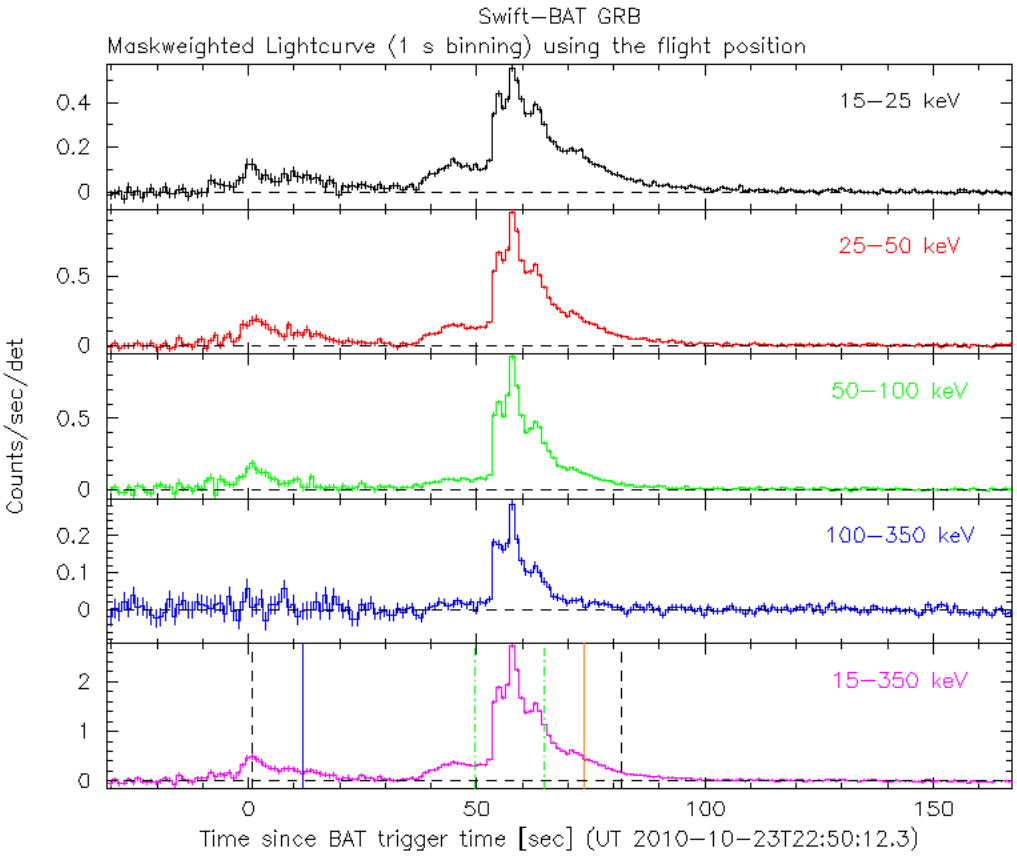

Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 22:50:12.4 UT.

filter exposure. The source is not detected in any other filter, either in single or summed exposures. The position of this transient, which we identify as the optical afterglow of GRB101023A, is RA($J2000$) = 317.96360° ($21h11m51.26s$), Dec($J2000$) = −65.38769° ($-65d23'15.7''$). This position is 1.8 from the refined XRT position, quoted above, and 0.2 arcsec from the position provided by Levan *et al.*, *GCN Circ.* 11366.

Magnitudes and 3σ upper limits for GRB101023A optical afterglow are summarized in Table 1. These upper limits are not corrected for Galactic extinction E(B-V) = 0.03.

5 Other observations

GRB101023A was detected by Fermi-GBM (Briggs *et al.*, *GCN Circ.* 11376), and Konus-Wind (Golenetskii *et al.*, *GCN Circ.* 11384). The optical afterglow was observed by the GROND, in g', r', i', z', J, H, K bands (Nardini *et al.*, *GCN Circ.* 11369) and by Gemini (Levan *et al.*, *GCN Circ.* 11366) observatory. REM Near Infrared follow up observations did not reveal any afterglow (D'Avanzo *et al.*, *GCN Circ.* 11364).

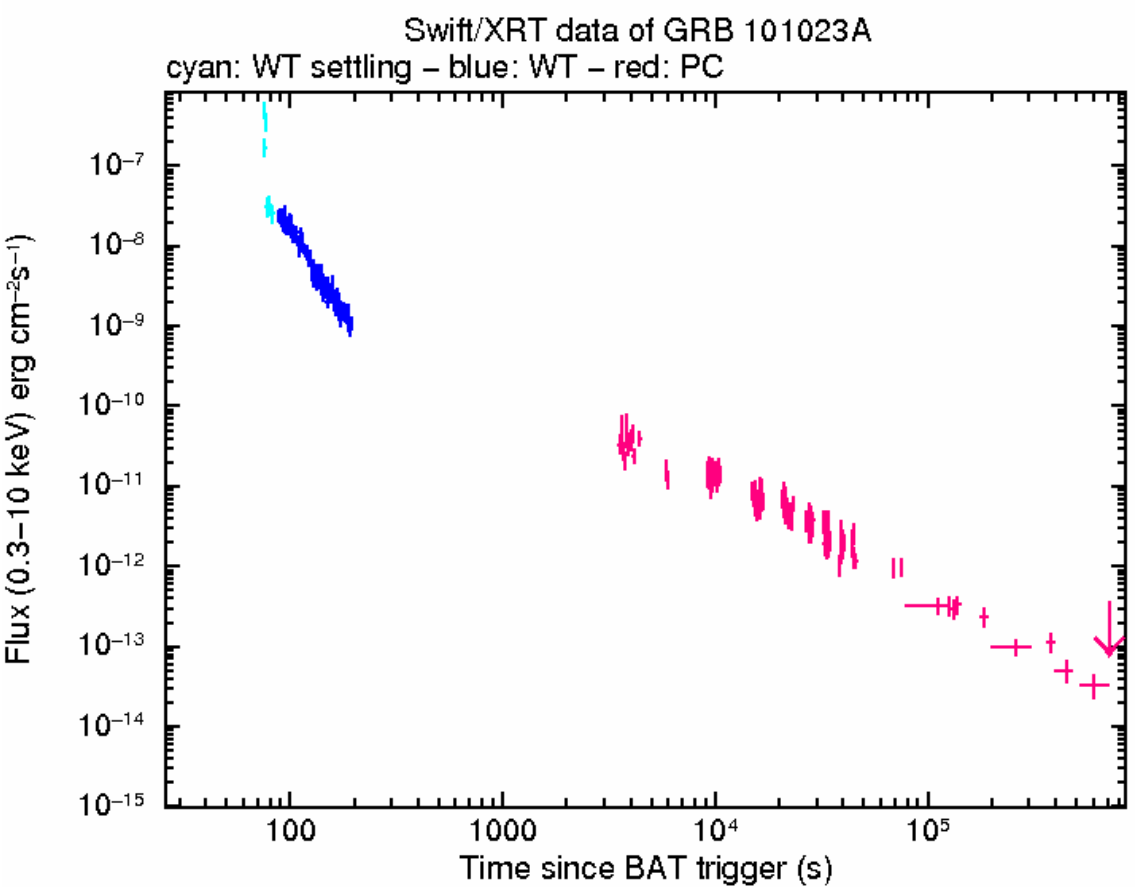

Figure 2: XRT Lightcurve. Counts/sec in the 0.3-10 keV band: Window Timing mode (black), Photon Counting mode (red). The approximate conversion is 1 count/sec = $\sim 6.2 \times 10^{-11}$ $ergs/cm^2/sec$ (unabsorbed).

Filter	Start(s)	Stop(s)	Exposure	3-Sigma UL
WHITE (finding)	93	193	100	19.4 ± 0.2
v	3524	15873	1082	> 20.2
b	4344	4483	137	20.2
u	4139	4339	200	20.5 ± 0.6
u	21640	22548	882	> 21.1
uvw11	3934	21633	1126	> 21.1
uvm2	3728	16778	1082	> 21.2
uvw2	10101	10653	544	> 21.0
WHITE	5895	10653	544	> 21

Table 1: Magnitude limits from UVOT observations