Swift Observations of GRB 110318B

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1   Introduction

BAT triggered on GRB 110318B at 15:27:09 UT (Trigger 449549) (Margutti *et al.*, *GCN Circ.* 11799). This was a 1.024-s rate-trigger on a long burst. XRT observations began at $T + 72.8$ s and discovered a fading X-ray afterglow. UVOT began settled observations at $T + 76$ s and found no credible afterglow candidate (Holland *et al.*, *GCN Circ.* 11801).

Ground based telescopes imaged the field of GRB 110318B and found no optical counterpart, with limiting magnitudes $I > 20.7$ (MOA-II, $T + 780$ s, Suzuki *et al.*, *GCN Circ.* 11822); $g' > 23.7$, $r' > 23.6$, $i' > 23.6$, $z' > 23.4$, (GROND, $T + 16.2$ hr, Kruehler *et al.*, *GCN Circ.* 11809).

2   BAT Observations and Analysis

Using the data set from $T - 60$ to $T + 243$ s, the BAT ground-calculated position is RA(J2000) $= 211.691$ deg ($14^{\rm h}06^{\rm m}45.9^{\rm s}$), Dec(J2000)$= -51.577$ deg ($-51^{\rm d}34'35.7''$) with an uncertainty of 1.7 arcmin (radius, sys+stat, 90% containment). The partial coding was 85%.

The mask-weighted light curve shows a single peak starting at $\sim T - 2$ s, peaking at $\sim T + 1$ s, and ending at $\sim T + 5$ s (see Fig. 1). T_{90} (15–350 keV) is 4.8 ± 0.6 s (estimated error including systematics).

The time-averaged spectrum from $T - 1.7$ to $T + 3.7$ s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.09 ± 0.17. The fluence in the 15–150 keV band is $(2.9 \pm 0.3) \times 10^{-7}$ erg cm^{-2}. The 1–s peak photon flux measured from $T + 0.76$ s in the 15–150 keV band is 0.7 ± 0.1 ph cm^{-2} s^{-1}. All the quoted errors are at the 90% confidence level (Markwardt *et al.*, *GCN Circ.* 11804).

The results of the batgrbproduct analysis are available at
`http://gcn.gsfc.nasa.gov/notices_s/449549/BA/`.

3   XRT Observations and Analysis

The XRT began observing GRB 110318B in Photon Counting mode, 73 s after the BAT trigger. Using 3 ks of overlapping XRT and UVOT data, the UVOT-enhanced XRT position was found to be RA(J2000)$= 211.67833$ deg ($14^{\rm h}06^{\rm m}42.80^{\rm s}$), Dec(J2000)$= -51.57886$ deg ($-51^{\rm d}34'43.9''$), with an uncertainty of 1.5 arcsec (radius, 90% confidence),
(`http://www.swift.ac.uk/team/xrt_positions/00449549/image.php`).

The light curve (Fig. 2), spanning from 73 to 3.5×10^4 s, can be modelled with a simple power-law with best-fitting slope: $\alpha = 1.10 \pm 0.10$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of 2.3 ± 0.3 and column density of $5.2^{+1.5}_{-1.3} \times 10^{21}$ cm^{-2} which is in excess of the average Galactic column density in this direction of 2.4×10^{21} cm^{-2}. The corresponding observed (unabsorbed) 0.3–10 keV flux conversion factor deduced from this spectrum is 4.3×10^{-11} (9.8×10^{-11}) (Margutti *et al.*, *GCN Circ.* 11806).

Detailed light curves in both count rate and flux units are available in both graphical and ASCII formats at `http://www.swift.ac.uk/xrt_curves/`.

4   UVOT Observations and Analysis

The UVOT observed the field of GRB 110318B starting at 58 s after the BAT trigger: settled observations started at 76 s. No credible optical counterpart was found. Table 1 reports the UVOT upper limits (Holland *et al.*, *GCN Circ.* 11816).

Filter	T_{start} (s)	T_{stop} (s)	Exposure (s)	Mag
White	76	226	147	> 21.5
White	868	1018	147	> 21.5
v	619	7035	529	> 20.6
b	545	7693	370	> 21.1
u	289	7649	756	> 21.2
uvw1	668	7445	529	> 20.8
uvm2	5602	7239	393	> 20.5
uvw2	1024	6829	236	> 20.3
White	76	6623	626	> 22.2

Table 1: Upper limits from UVOT observations.

These magnitudes are not corrected for the Galactic extinction corresponding to a reddening of $E_{B-V} = 0.46$ mag (Schlegel *et al.*, 1998). The photometry is on the UVOT flight system described in Poole *et al.* (2008, MNRAS, 383, 627).
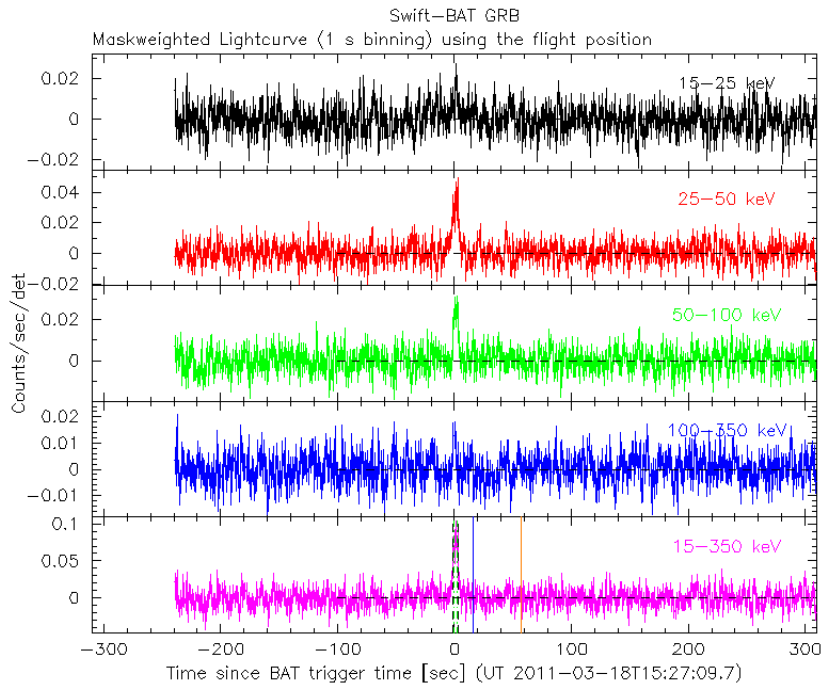

Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/s/illuminated-detector (note illum-det = 0.16 cm^2) and T_0 is 15:27:09 UT.
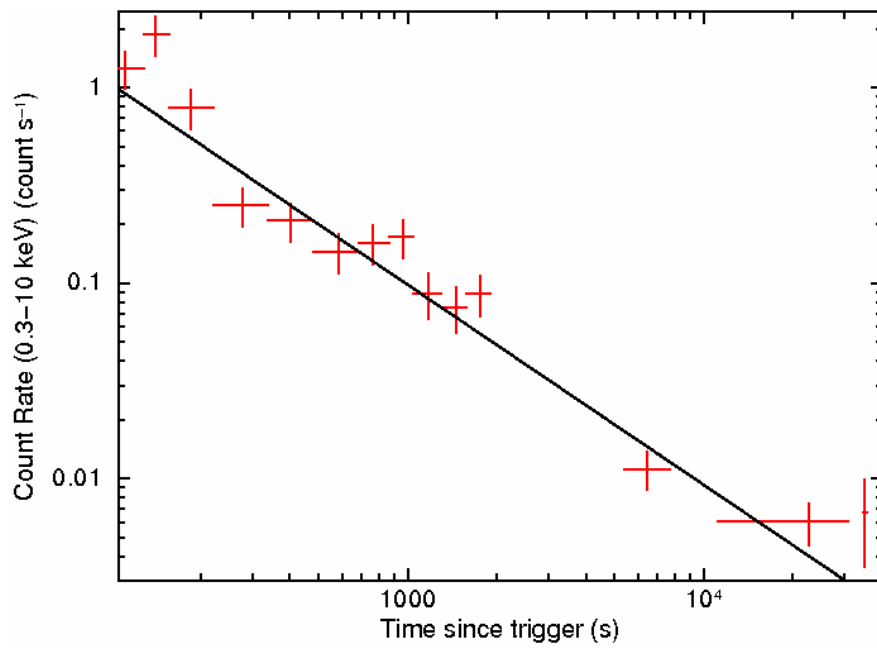
Figure 2: XRT Lightcurve in the 0.3-10 keV band with best fit superimposed (black line). The approximate conversion is 1 count/s $\sim 4.3 \times 10^{-11}$ erg cm^{-2} s^{-1} (absorbed value).