

## Swift Observation of GRB 070520B

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### 1 Introduction

BAT triggered on GRB 070520B at 17:44:53 UT (trigger=279898) (Moretti *et al.*, *GCN Circ.* 6425). This was a 1.024-s rate-trigger on a long burst. XRT observations began at  $T + 104$  s and discovered the X-ray afterglow. UVOT began observing at  $T + 107$  s and did not find any afterglow candidate.

### 2 BAT Observation and Analysis

Using the data set from  $T - 239$  to  $T + 592$  s from recent telemetry downlinks, the BAT ground-calculated position is RA(J2000) = 121.886 deg ( $8^{\text{h}}7^{\text{m}}32.7^{\text{s}}$ ), Dec(J2000) =  $+57.588$  deg ( $+57^{\text{d}}35'15.3''$ ) with an error of 1.8 arcmin (radius, sys+stat, 90% containment). The partial coding was 59%. The mask-weighted light curve (Fig. 1) shows two overlapping peaks starting at  $T - 4$  s, peaking at  $T + 1$  s, and ending with a long tail at  $T + 200$  s.  $T_{90}$  (15–350 keV) is  $66 \pm 4$  s (estimated error including systematics).

The time-averaged spectrum from  $T - 5.0$  s to  $T + 71.3$  s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is  $1.15 \pm 0.21$ . The fluence in the 15–150 keV band is  $9.2 \pm 1.1 \times 10^{-7}$  erg cm $^{-2}$ . The 1-sec peak photon flux measured from  $T + 0.74$  s in the 15–150 keV band is  $0.4 \pm 0.1$  ph cm $^{-2}$  s $^{-1}$ . All the quoted errors are at the 90% confidence (Sakamoto *et al.*, *GCN Circ.* 6417).

### 3 XRT Observations and Analysis

The first three orbits data of XRT data consist of 284 s in Windowed Timing mode (from  $T + 104$  s to  $T + 388$  s) and 5.2 ks in Photon Counting mode (from  $T + 388$  s). The Photon Counting mode image provides a refined XRT position at RA(J2000) = 121.8796 deg ( $8^{\text{h}}7^{\text{m}}31.11^{\text{s}}$ ), Dec(J2000) =  $+57.6089$  deg ( $+57^{\text{d}}36'32.3''$ ) with an error radius of 4.0 arcsec (90% confidence). This is 1.0 arcsec from the initial X-ray position (Moretti *et al.*, *GCN Circ.* 6425) and 76 arcsec from the BAT refined position (Sakamoto *et al.*, *GCN Circ.* 6429).

The XRT light curve (Fig. 2) exhibits an initial mildly steep decay (slope  $\sim 2.5$ ) in the interval (100,170) seconds from the trigger. An intense FRED-like flare is present between 170 and 390 seconds. In the second and third orbits the LC shows a decay with a slope is  $1.0 \pm 0.3$ .

The first WT spectrum, extracted before the flare from 100 s to 170 s, can be fit with an absorbed power law with a photon index of  $\Gamma_1 = 2.5 \pm 0.3$  and column density of  $(2.5 \pm 0.2) \times 10^{21}$  cm $^{-2}$  significantly in excess of the Galactic value ( $4.2 \times 10^{20}$  cm $^{-2}$ ; Dickey & Lockman, 1990). The mean WT spectrum, extracted during the flare, can be fit with an absorbed power law with a photon index of  $\Gamma_2 = 2.6 \pm 0.1$  and a column density of  $(2.1 \pm 0.2) \times 10^{21}$  again significantly in excess of the Galactic value. The absorbed (unabsorbed) 0.3–10.0keV flux for the flare spectrum is  $9.4 \times 10^{-10}$  ( $2.1 \times 10^{-9}$ ) ergs cm $^{-2}$  s $^{-1}$ .

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/](http://www.swift.ac.uk/xrt_curves/).

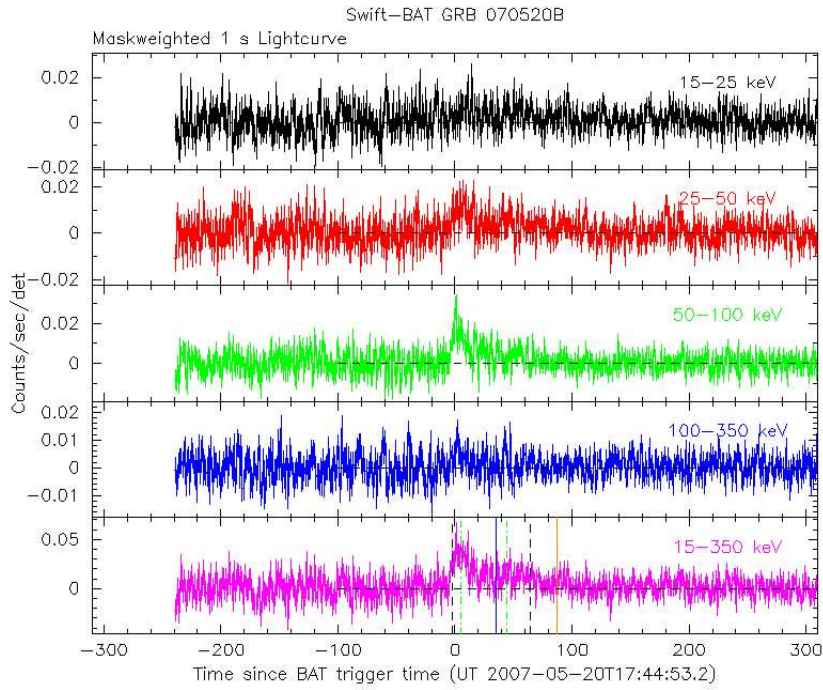


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/s/illuminated-detector (note illum-det = 0.16 cm<sup>2</sup>) and  $T_0$  is 17:44:53 UT.

## 4 UVOT Observation and Analysis

No source was found in any of the UVOT observations inside the refined XRT error circle (Moretti et al., GCN Circ. 6438). The 3-sigma upper limits for detecting a source inside the XRT error circle in the first finding chart (FC) exposure and co-added frames are reported in Tab.1

Filter	T-start(s)	T-stop(s)	Exp(s)	Mag (3-sigma UL)
White (FC)	107	207	98	>20.7
White	107	6197	491	>21.5
V	213	11338	1356	>20.5
B	4360	5992	393	>20.7
U	4155	5788	393	>20.3
UVW1	3950	5583	393	>20.5
UWM2	3745	12043	1094	>21.2
UVW2	4769	10411	1152	>21.2

Table 1: Upper limits are  $3\sigma$ . The values quoted above are not corrected for the expected Galactic extinction corresponding to a reddening of  $E(B-V) = 0.04$  mag towards the direction of the burst (Schlegel et al. 1998).

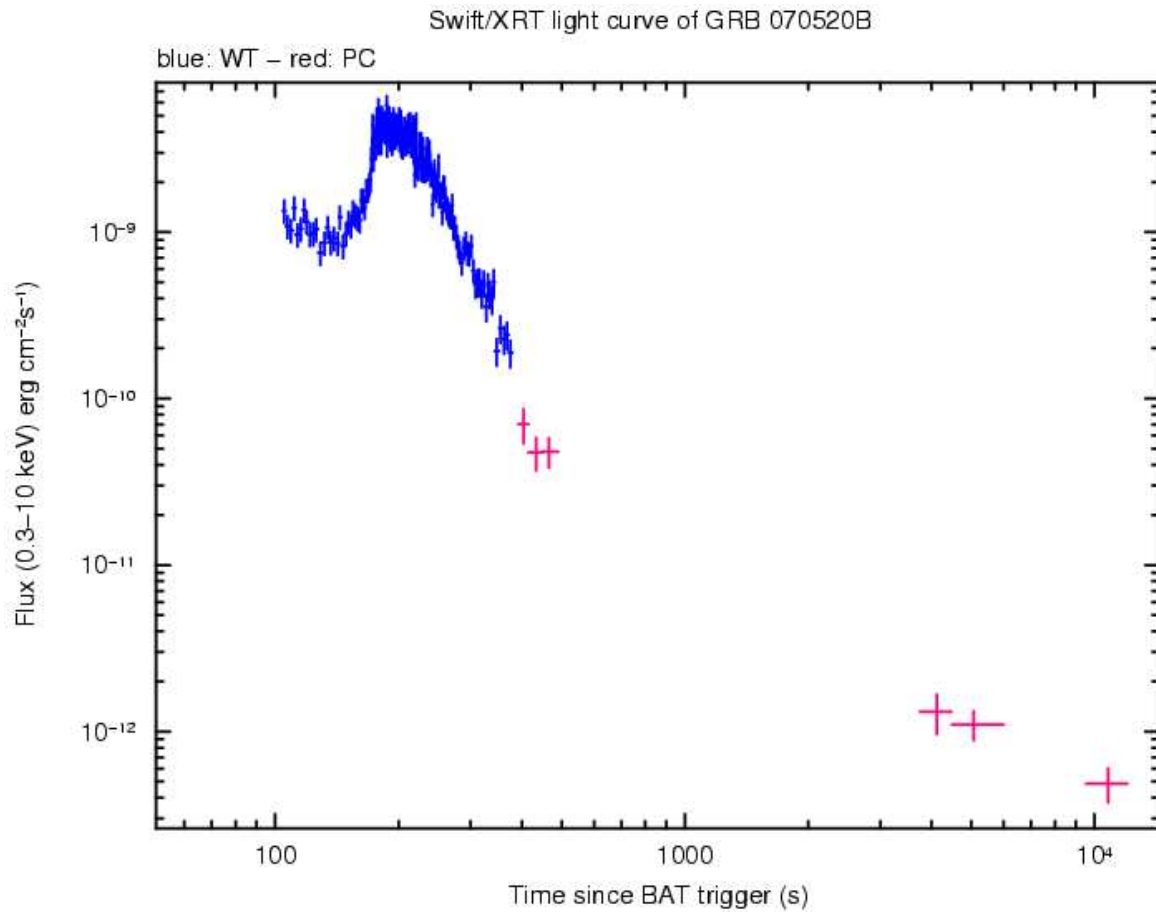


Figure 2: XRT Lightcurve. Flux in the 0.3-10 keV band: Windowed Timing (blue) and Photon Counting (red) modes. The approximate conversion is  $1 \text{ count/s} \sim 5.2 \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}$ .