Swift Observations of the GRB 080613B

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for the Swift Team:

1. INTRODUCTION

At 11:12:37 UT on 2008-06-13, the Swift Burst Alert Telescope (BAT) triggered and located GRB 080613B (Swift trigger 313954). Swift slewed immediately to the burst. Our best position is from the Swift XRT, which is:

   RA(J2000) = 11h 35m 11.46s
   Dec(J2000) = -07d 06' 18.0"

with an uncertainty of 2.3 arcsec (90% confidence). The gamma-ray light curve shows several overlapping peaks with a duration of about 180 seconds. Konus-Wind also detected GRB 080613B, from which a value of E_{peak} was determined (E_{peak} = 733 (+285,-200) keV; Golenetskii et al. GCN Circ. #7884). The INTEGRAL SPI anti-coincidence shield also detected the burst (V. Beckmann, priv. comm.). A rapidly fading X-ray counterpart was detected, but no optical or infrared counterpart was detected. Swift observations of GRB 080613B are complete.

2) BAT OBSERVATION AND ANALYSIS

The following BAT results use the data set from T-240 to T+962 sec (Ukwatta et al., GCN Circ #7876). The BAT ground-calculated position is RA, Dec = 173.806, -7.102 deg, which is

   RA(J2000) = 11h 35m 13.3s
   Dec(J2000) = -07d 06' 06.5"

with an uncertainty of 1.0 arcmin, (radius, sys+stat, 90% containment). The partial coding was 89%.

The mask-weighted light curve shows several overlapping peaks in a FRED-like envelope lasting out to ~T+180 sec (Figure 1). T90 (15-350 keV) is 105±35 sec (estimated error including systematics).

The time-averaged spectrum from T-5.3 to T+236.5 sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.39±0.06. The fluence in the 15-150 keV band is $5.8 \pm 0.2 \times 10^{-6}$ erg/cm^2. The 1-sec peak photon flux measured from T+2.23 sec in the 15-150 keV band is 2.7 ± 0.2 ph/cm^2/s. All the quoted errors are at the 90% confidence level.

3. XRT OBSERVATION AND ANALYSIS

The Swift-XRT began observing GRB 080613B in Windowed Timing (WT) mode, 76 s after the BAT trigger. The data of the first orbit consist of 149 s in Windowed Timing mode and the rest in Photon Counting mode.

Using 757 s of overlapping XRT Photon Counting mode and UVOT data, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue) of RA, Dec = 173.79773, -7.10501, which is equivalent to:

   RA (J2000): 11h 35m 11.46s
   Dec (J2000): -07d 06' 18.0"

with an uncertainty of 2.3 arcsec (radius, 90% confidence).

The light curve from 76 to 219 s can be modeled as a power law with a photon index of 2.15 ± 0.11 (90%), followed by a sudden drop of about 2 orders of magnitudes up to ~400 s (Figure 2). Then, the lightcurve shows a flat decay with the index of 0.2, until about 7000 s. After that, the light curve resumes a steeper decay with index 1.1 until it becomes undetectable by the XRT (around T+100000 sec).

The WT mode spectrum spanning from 76 to 219 s can be fit by a power-law model, with a spectral photon index of 1.17 ± 0.07 and an absorbing column density of 3.7 $(+2.3,-2.0)$ x 10^{20} cm^{-2} , consistent with the average Galactic one, 3.2 x 10^{20} cm^{-2}. The corresponding observed (unabsorbed) 0.3-10 keV flux is 1.05 x 10^{-9} $(1.09$ x $10^{-9})$ erg/cm^2/s.

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/. For count rate light curves, the approximate flux conversion is 1 count/sec = 5.9 x 10^{-11} erg/cm^2/s (absorbed) in the 0.3-10 keV band.

4. UVOT OBSERVATION AND ANALYSIS

The Swift Ultra-Violet/Optical Telescope (UVOT) began settled observations of GRB 080613B 79 seconds after the BAT trigger (Landsman et al., GCN Circ. 7877). No afterglow is detected at the enhanced XRT position in the initial white finding chart or subsequent summed images.

In Table 1, we report the 3 sigma upper limits for a putative optical transient in each filter (for a 5" radius aperture). The values quoted in the table are in the UVOT photometric system (Poole et al. 2008, MNRAS, 383, 627). They are not corrected for the expected Galactic extinction, corresponding to a reddening of E(B-V)=0.04 mag in the direction of the burst (Schlegel et al. 1998).
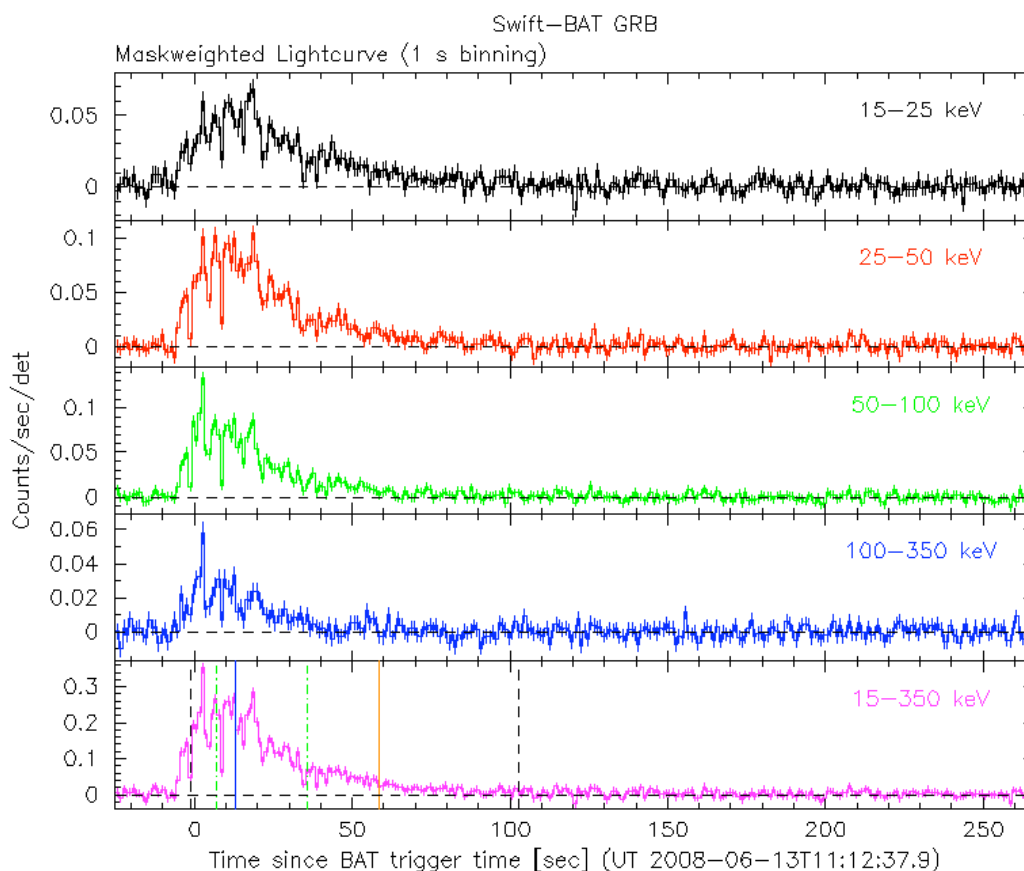

Fig.1: BAT lightcurve with 1 sec time bins. The lightcurve has 4 individual energy bands (15-25 keV, 25-50, 50-100, 100-350, starting from top), plus the total band (bottom). The vertical dashed lines indicate the T50 (green) and T90 (black) intervals. The blue and red lines indicate the spacecraft slew start and stop times, respectively.
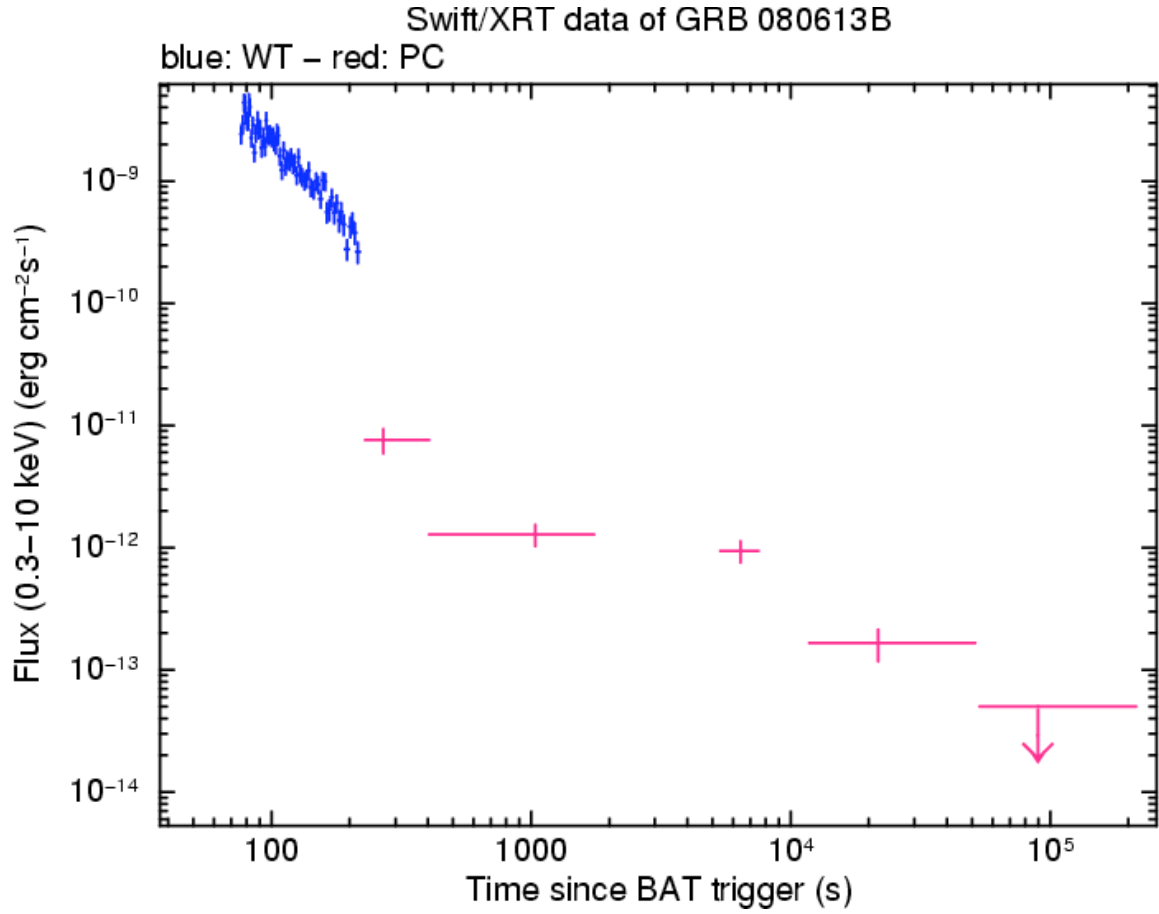
Fig. 2: Swift XRT lightcurve in flux units, with blue points corresponding to Windowed Timing (WT) mode, and magenta points corresponding to Photon Counting (PC) mode.

Table 1: UVOT Upper Limits.

Filter	Time (s)	Expo(s)	Mag (3-σ UL)
WHITE	79-180	98	20.4
WHITE	79-7227	627	21.4
V	185-7566	1167	20.1
B	665-7023	451	20.5
U	640-13348	312	20.1
UVW1	616-13323	1179	20.8
UVM2	591-12415	1102	21.2
UVW2	695-18103	936	21.0

(Times are given in seconds after the BAT trigger.)