

Swift Observation of GRB 110801A

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1 Introduction

BAT triggered on GRB 110801A at 19:49:42.s UT (Trigger 458521) (De Pasquale, *et al.*, *GCN Circ.* 12228). This was a long burst with $T_{90} = 385 \text{ sec}$. Swift slewed to this burst immediately and XRT began follow-up observations at $T + 99 \text{ sec}$, and UVOT took the first settled exposure at $T + 109 \text{ sec}$. Our best position is the UVOT location $\text{RA}(J2000) = 89.43695 \text{ deg}$ (05h57m44.87s), $\text{Dec}(J2000) = 80.95592 \text{ deg}$ (80d57'21.1'') with an error of 0.5 arcsec (90% confidence, including boresight uncertainties).

2 BAT Observation and Analysis

Using the data set from $T - 239$ to $T + 963 \text{ sec}$, further analysis of BAT GRB 110801A has been performed by Swift team (Barthelmy, *et al.*, *GCN Circ.* 12237). The BAT ground-calculated position is $\text{RA}(J2000) = 89.415 \text{ deg}$ (05h57m39.6s), $\text{Dec}(J2000) = 80.958 \text{ deg}$ (80d57'28.5'') $\pm 1.1 \text{ arcmin}$, (radius, systematic and statistical, 90% containment). The partial coding was 78%

The masked-weighted light curves (Fig.1) shows two groups of peaks. They starts at trigger time $T - 30 \text{ sec}$, peaking with the first cluster of peaks, after which they return exponentially to background, but at $T + 310 \text{ sec}$ we see a second cluster of activity, which then ends at $T + 550 \text{ sec}$ $T_{90}(15 - 350 \text{ keV})$ is 385 ± 10.0 (estimated error including systematics).

The time-averaged spectrum from $T - 24.8$ to $T + 385 \text{ sec}$ is best fitted by a simple power law model. This fit gives a photon index of 1.84 ± 0.10 , ($\chi^2 = 77.42$ for 57 d.o.f.). For this model the total fluence in the $15 - 150 \text{ keV}$ band is $(4.7 \pm 0.3) \times 10^{-6} \text{ ergs/cm}^2$ and the 1-sec peak flux measured from $T + 341.78 \text{ sec}$ in the $15 - 150 \text{ keV}$ band is $1.1 \pm 0.2 \text{ ph/cm}^2/\text{sec}$. All the quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

Using the data from the first orbit of XRT data of GRB 110801A (1.9 *ksec* in Photon Counting mode), the refined XRT position is $\text{RA}(J2000) = 89.43603 \text{ deg}$ (05h57m44.65s), $\text{Dec}(J2000) = +80.95615 \text{ deg}$ (80d57'22.s'') $\pm 1.8 \text{ arcsec}$ (90% confidence, including boresight uncertainties). This position is within 5.7 *arcsec* of the initial XRT position, and 1.3 *arcsec* from the optical afterglow candidate, reported by De Pasquale *et al.*, *GCN Circ.* 12228.

The 0.3 – 10 *keV* light curve (Fig.2) shows an initial flaring activity lasting about 1000 sec. The last flare is the brightest and is detected by BAT as well. After the end of the flaring activity, we have a powerlaw decay with a slope of $0.94^{+0.09}_{-0.10}$, beginning at $T1000$. At $(8.22^{+1.35}_{-1.11}) \times 10^3 \text{ sec}$ the light curve breaks with a slope of $1.53^{+0.07}_{-0.06}$.

The last two segments of the X-ray lightcurve can be modeled with an absorbed power-law with powerlaw; the energy index of the powerlaw is $1.07^{+0.05}_{-0.04}$, while the NH column density is higher than the galactic column density at 3σ confidence level. We find an excess of $2.4^{+0.9}_{-0.8} \times 10^{21} \text{ cm}^{-2}$. The average observed (unabsorbed) flux over 0.3 – 10 *keV* for this spectrum (spanning a time of 0.6-600 ks after the trigger) is 5.45×10^{-12} (7.0×10^{-12}) *ergs/cm}^2/\text{sec}.*

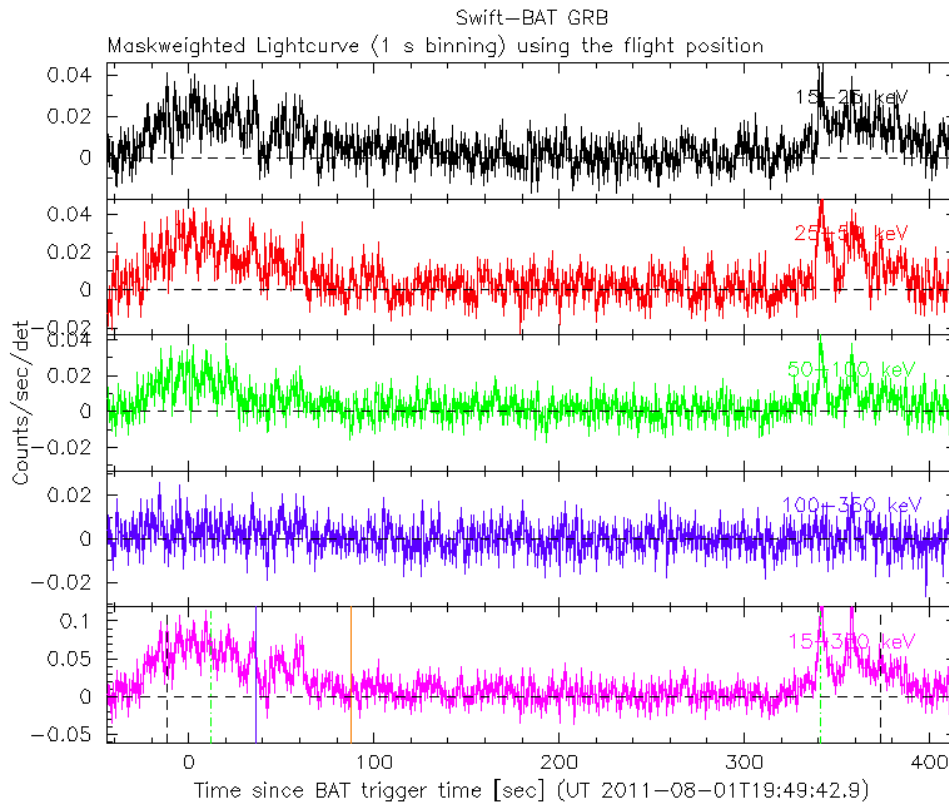


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector (note T_0 is 19:49:42 UT).

4 UVOT Observation and Analysis

The UVOT began settled observations of the field of GRB 110801A at 19:51:31 UT, 109 sec after the initial BAT trigger (De Pasquale *et al.*, *GCN Circ.* 12228). A new source was detected within the XRT error circle in the white (150 sec) and u (250 sec) finding exposures, and in the co-added images in any filter but in the m2 filter. Magnitudes and the upper limit for the afterglow are summarized in Table 1. These upper limits are not corrected for the modest Galactic extinction corresponding to a reddening $E(B-V) = 0.08$.

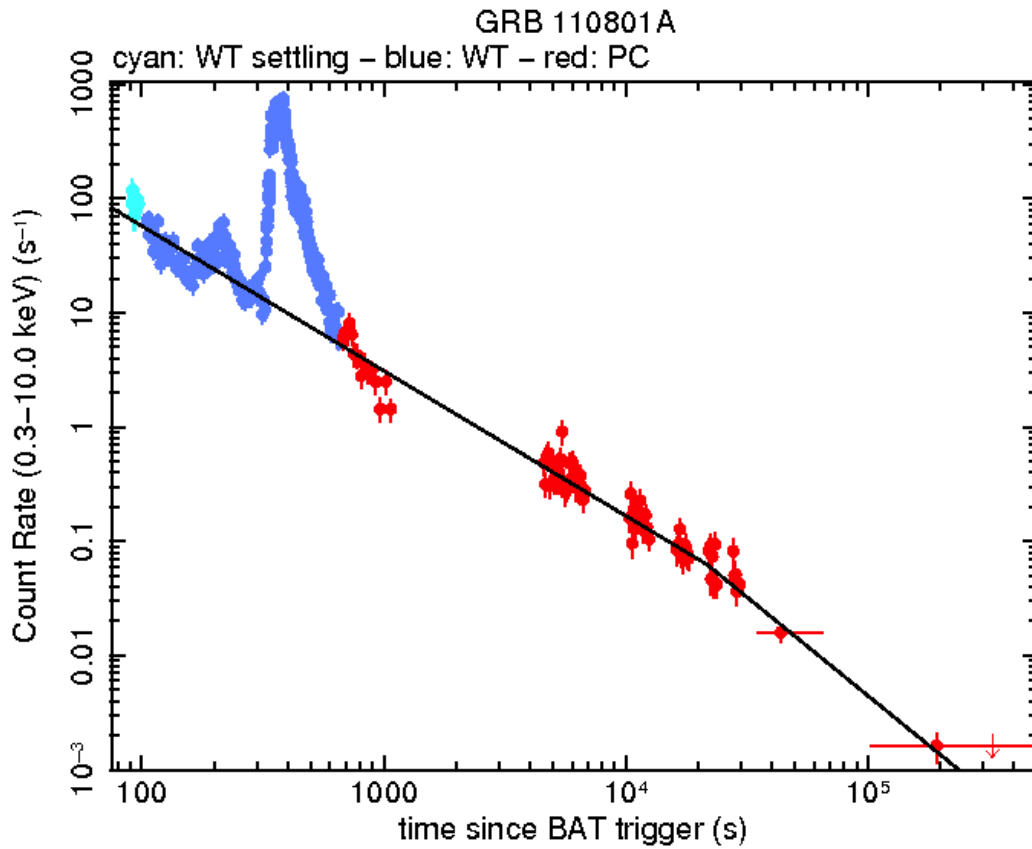


Figure 2: XRT Lightcurve. Counts/sec in the 0.3-10 keV band: Window Timing mode (blue), Photon Counting mode (red). The approximate conversion is 1 count/sec $\sim 3.4 \times 10^{-11}$ *ergs/cm²/sec*.

Filter	Start	Stop	Exposure	Mag and 3-Sigma UL
WHITE (finding)	109	259	147	18.06 ± 0.07
u (finding)	267	517	246	15.89 ± 0.05
v	598	6747	451	17.07 ± 0.06
b	523	6132	432	17.47 ± 0.05
u	267	5927	488	15.68 ± 0.04
UVW1	647	5722	255	17.92 ± 0.11
UVM2	622	6904	404	> 20.2
UVW2	573	6543	452	20.48 ± 0.41
WHITE	109	6336	727	17.23 ± 0.05

Table 1: Magnitude from UVOT observations