# Swift Observation of GRB 110107A

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## 1 Introduction

GRB 110107A occurred at 21:15:51 UTC. It was observed by Fermi GBM (trigger 316127753) and occurred during a Swift slew with BAT event capture (Cummings, GCN Circ. 11545). There is a strong source in a mosaic of BAT images at RA (J2000)=$19^h$ $59^m$ $33.6^s$ and Dec (J2000) = +41d 53m 19s, with an estimated 90% uncertainty of 3 arcmin radius. The burst was about 100 seconds long, starting at about T-70 sec and lasting until about T+40 sec. The BAT event data ended at about T+21 sec. The burst had multiple peaks, with the largest flux at about T0, the time of the Fermi GBM trigger. The peak count rate in BAT was about 4000 counts $s^{-1}$. A Swift Target of Opportunity observation was requested and approved.

No detection from ground-based facilities has been reported.

## 2 BAT Observation and Analysis

Using the data set from T-70 to T+22 sec from telemetry downlinks, the mask-weighted light curve shows low level multiple overlapping peaks starting at ∼T-70 sec and ending at ∼T+22 sec (Cummings and Barthelmy GCN Circ. 11546). The event-by-event data captured during the slew stops at T+22 sec. Using the on-board raw rates, there is a weak indication that the burst continued out to T+45 sec. The time-averaged spectrum from T-70 to T+22 sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is $1.58 \pm 0.03$. The fluence in the 15-150 keV band is at least $(5.8 \pm 0.5) \times 10^{-6}$ erg cm$^{-2}$. All the quoted errors are at the 90% confidence level.

## 3 XRT Observations and Analysis

Swift began a target of opportunity observation on January 8, 2011 at 15:07 UT, approximately 17.8 hours after the burst detected by Fermi (Stratta et al., GCN Circ. 11547). Swift data for these observations utilize Target ID 20154. The XRT began observing the field at 15:12:43 UT, 64.8 ks after the Fermi trigger, finding an X-ray source. Using 2517 s of XRT Photon Counting mode data and 1 UVOT images, the astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue) is: RA=299.90910 deg and Dec=41.91400 deg, which is equivalent to: RA (J2000)=$19^h$ $59^m$ $38.20^s$ and Dec (J2000)= +41d 54m 50.3s with an uncertainty of 3.6 arcsec (radius, 90% confidence). This position is 1.7 arcminutes from the BAT position. The count rate level was $(1.2 \pm 0.2) \times 10^{-2}$ counts s$^{-1}$.

Swift performed a second target of opportunity observation on January 12, 2011. The XRT began observing the field at 2011-01-12 18:07:47 UT, that is T+420.7 ks (4.87 days) (Cummings, GCN Circ. 11545). Using 2.1 ks of Photon Counting mode data the source has been found to have faded down to a 3-sigma upper limit of 0.007 counts s$^{-1}$ (Fig. 1). Assuming a power law decay starting from the first source detection (Stratta et al., GCN Circ. 11547), the upper limit is consistent with a decay index steeper than $\alpha$ = -0.4. The fading nature of the source confirms its afterglow origin.

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/00020154

# 4 UVOT Observation and Analysis

Swift UVOT started observing the field of GRB 110107A on January 8, 2011 at 15:12 UT, approximately T+17.9 hours (Immler et al., GCN Circ 11551). No optical afterglow consistent with the XRT position (Stratta et al., GCN Circ. 11547) is detected in individual or merged UVOT exposures. Preliminary 3-sigma upper limits using the UVOT photometric system (Poole et al. 2008, MNRAS, 383, 627) are reported in Table 1. The quoted upper limits have not been corrected for the expected Galactic extinction along the line of sight corresponding to a reddening of $E_{B-V} = 0.459$ mag (Schlegel et al., 1998, ApJS, 500, 525). All photometry is on the UVOT photometry system described in Poole et al. (2008, MNRAS, 383, 627).

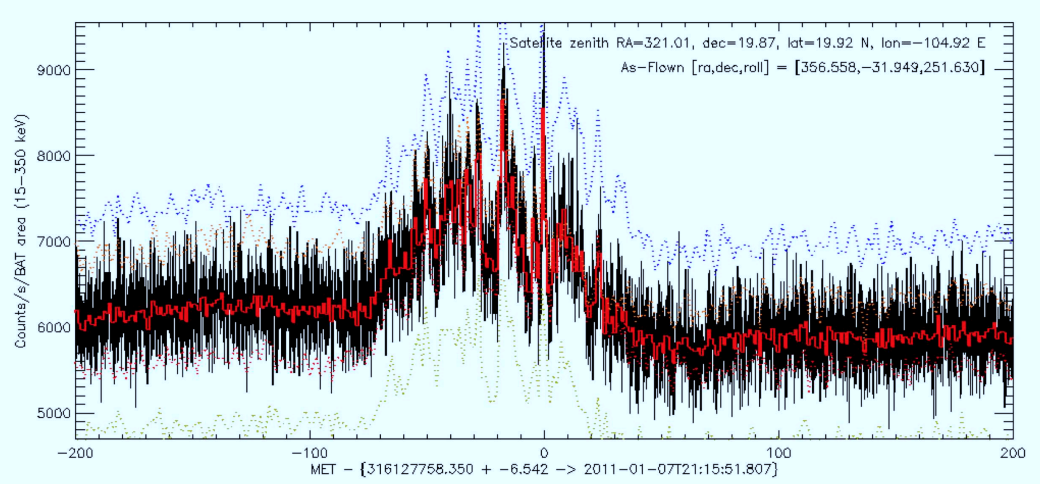


Figure 1: BAT Light curve. The units are counts $s^{-1}$ BAT area $^{-1}$ in the 15-350 keV energy band

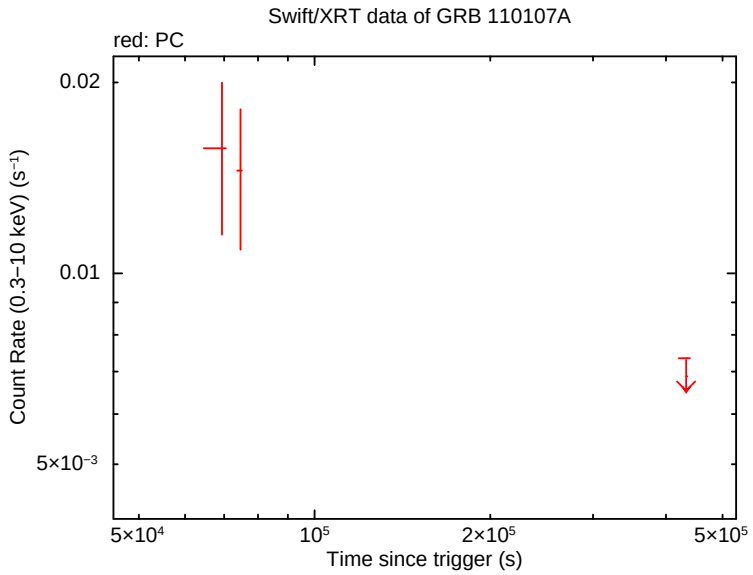


Figure 2: XRT Lightcurve. Counts $s^{-1}$ in the 0.3-10 keV band taken in Photon Counting mode. The approximate conversion to observed (unabsorbed) flux is 1 count $s^{-1} \sim 3.1(4.9) \times 10^{-11}$ erg $cm^{-2}$ $s^{-1}$.

| Filter | T_start (s) | T_stop (s) | Exp (s) | 3-sigma UL mag |
|---|---|---|---|---|
| v | 64646 | 75090 | 2247 | >20.5 |
| u | 64609 | 74538 | 1638 | >21.2 |

Table 1: Magnitude limits from UVOT observations.