

## Swift Observation of GRB 120817A

*B.P. Gompertz (U.Leicester), D.M. Palmer (LANL), S. Immler (CRESST/GSFC/UMD), S.D. Barthelmy (GSFC), D.N. Burrows (PSU), M.H. Siegel (PSU) & N. Gehrels (GSFC) for the Swift Team*

### 1 Introduction

BAT triggered on GRB 120817A at 06:49:42 UT (Trigger number 531267; Gompertz et al. GCN Circ. 13661). Swift slewed to this burst after a  $\sim 3000$ s delay due to Earth limb constraint and located an X-ray afterglow. The best *Swift* position (Beardmore et al., GCN Circ. 13667) is the XRT location: RA, Dec(J2000) =  $16^h 42^m 45.38^s$ ,  $-38^\circ 21' 16.0''$ , with an uncertainty of 1.8 arcsec (radius, 90% confidence).

The 2-m Faulkes Telescope North detected a faint, possibly fading optical source (Guidorzi et al., GCN Circ. 13664) consistent with the XRT position. Faulkes Telescope South also observed the source and found marginal evidence for fading (Guidorzi et al., GCN Circ. 13664). RAPTOR also observed the field, but detected no new object (Wren et al., GCN Circ. 13694).

### 2 BAT Observation and Analysis

Using the data set from T-60 to T+243 s, analysis of the BAT data for GRB 120817A was performed. The BAT ground-calculated position is RA, Dec = 250.692, -38.377 deg, which is equivalent to:

$$\text{RA(J2000)} = 16^h 42^m 46.2^s \quad \text{Dec(J2000)} = -38^\circ 22' 36.8''$$

with an uncertainty of 1.5 arcmin, (radius, sys+stat, 90% containment). The partial coding was 85%.

The mask-weighted light curve (Fig. 1) shows two slightly overlapping peaks starting at  $\sim T-2$  s, peaking at  $\sim T+0.0$  s and  $\sim T+11$  s, with a tail ending at  $\sim T+65$  s.  $T_{90}$  (15–350 keV) is  $28.2 \pm 6.8$  s (estimated error including systematics).

The time-averaged spectrum from T-2.24 to T+30.77 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is  $\Gamma = 1.97 \pm 0.16$ . The fluence in the 15–150 keV band is  $6.9 \pm 0.6 \times 10^{-7}$  erg  $\text{cm}^{-2}$ . The 1-sec peak photon flux measured from T-0.12 s in the 15–150 keV band is  $0.8 \pm 0.1$  ph  $\text{cm}^{-2} \text{s}^{-1}$ . All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at [http://gcn.gsfc.nasa.gov/notices\\_s/531267/BA/](http://gcn.gsfc.nasa.gov/notices_s/531267/BA/)

### 3 XRT Observations and Analysis

The XRT began observing the burst 3.1 ks after the trigger (Gompertz et al., GCN Circ. 13673). Using 2321 s of XRT Photon Counting mode data and 5 UVOT images (Beardmore et al., GCN Circ. 13667) for GRB 120817A, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA, Dec = 250.68918, -38.35451 deg which is equivalent to:

$$\begin{aligned} \text{RA (J2000): } & 16^h 42^m 45.38^s \\ \text{Dec (J2000): } & -38^\circ 21' 16.0'' \end{aligned}$$

with an uncertainty of 1.8 arcsec (radius, 90% confidence).

The light curve (Fig. 2) can be modelled with a power-law decay with a decay index of  $\alpha = 0.70 \pm 0.18$ .

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index,  $\Gamma = 2.0_{-0.3}^{+0.4}$ . The best-fitting absorption column is  $(5.9_{-1.9}^{+2.6}) \times 10^{21} \text{ cm}^{-2}$ , in excess of the Galactic value of  $2.9 \times 10^{21} \text{ cm}^{-2}$  (Kalberla et al. 2005). The counts to observed (unabsorbed) 0.3–10 keV flux conversion factor deduced from this spectrum is  $4.8 \times 10^{-11}$  ( $8.9 \times 10^{-11}$ )  $\text{erg cm}^{-2} \text{ count}^{-1}$ .

The results of the XRT-team automatic analysis are available at [http://www.swift.ac.uk/xrt\\_products/00531267](http://www.swift.ac.uk/xrt_products/00531267).

## 4 UVOT Observation and Analysis

The *Swift*/UVOT began settled observations of the field of GRB 120817A 3115 s after the BAT trigger (Gompertz et al., GCN Circ. 13661). No optical afterglow consistent with the XRT (Beardmore et al., GCN 13667) or the FTN positions (Guidorzi et al., GCN 13664) is detected in the initial UVOT exposures.

Preliminary 3-sigma upper limits using the UVOT photometric system (Breeveld et al. 2011, AIP Conf. Proc. 1358, 373) for the first finding chart (FC) exposure and subsequent exposures are:

Filter	T_start (s since trigger)	T_stop (s since trigger)	Exp (s)	Mag
white.FC	3115	3265	147	>19.4
white	3115	4496	344	>20.4
v	3272	10816	1278	>20.2
b	4092	17166	945	>21.1
u	3887	22943	1904	>21.1
w1	3682	22294	2164	>20.3
m2	3476	21386	1838	>20.2
w2	4503	9902	1082	>20.0

Table 1: Magnitude limits from UVOT observations

The magnitudes in the table are not corrected for the Galactic extinction due to the reddening of  $E(B-V) = 0.84$  in the direction of the burst (Schlegel et al. 1998).

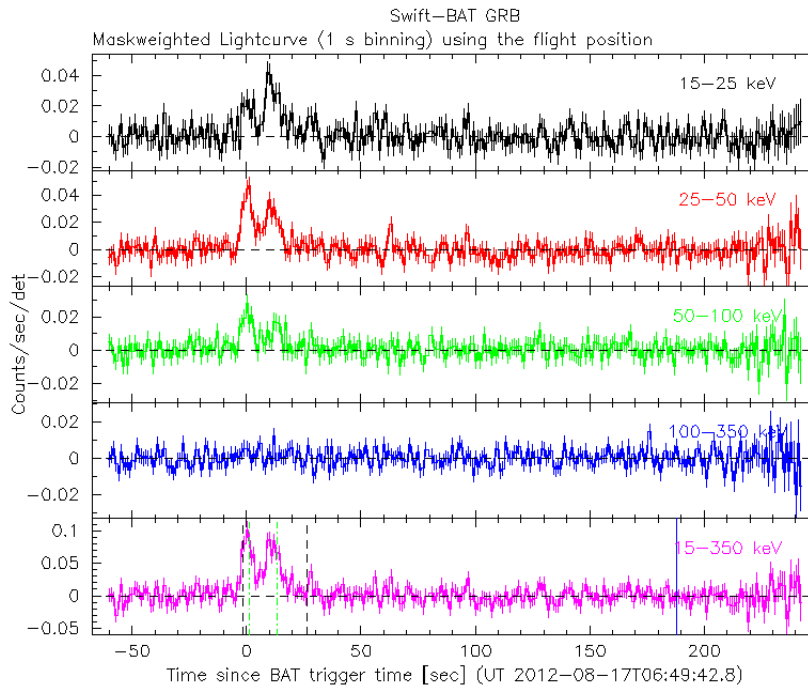


Figure 1: BAT light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector (note illum-det =  $0.16 \text{ cm}^2$ ) and  $T_0$  is 06:49:42 UT.

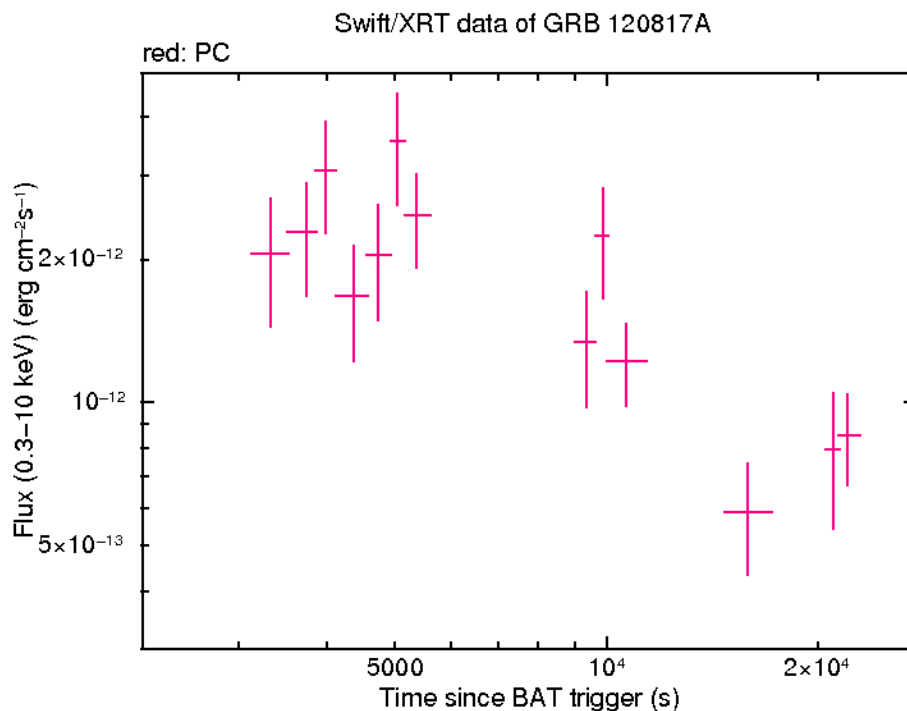


Figure 2: XRT light curve. Flux light curve in the 0.3-10 keV band; all the data were collected in Photon Counting mode. The approximate conversion is  $1 \text{ count s}^{-1} = \sim 4.8 \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}$ .