Swift Observations of GRB 130812A

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1   Introduction

At 22:22:52 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 130812A (trigger=566228) (D'Elia et al. GCN Circ. 15088). Swift slewed immediately to the burst. At the time of the trigger, the initial BAT position was 57° from the Sun (2.8 hours East) and 123° from the 35%-illuminated Moon. Table 1 contains the best reported positions from Swift, and the latest XRT position can be viewed at `http://www.swift.ac.uk/xrt_positions`.

Table 2 is a summary of GCN Circulars about this GRB from observatories other than Swift.

Standard analysis products for this burst are available at `http://gcn.gsfc.nasa.gov/swift_gnd_ana.html`.

2   BAT Observations and Analysis

As reported by Palmer et al. (GCN Circ. 15092), the BAT ground-calculated position is RA, Dec = 92.387, -13.285 deg, which is RA(J2000) = 06h 09m 32.8s Dec(J2000) = -13d 17' 06.6" with an uncertainty of 1.0 arcmin, (radius, sys+stat, 90% containment). The partial coding was 75%.

The mask-weighted light curve (figure 1) shows multiple spikes peaking at T_0, $T_0 + 4$ s and $T_0 + 7$ s. T_{90} $(15 - 350$ keV) is 7.6 ± 0.5 s (estimated error including systematics).

The time-averaged spectrum from $T - 0.3$ to $T + 8.5$ s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 2.52 ± 0.11. The fluence in the $15 - 150$ keV band is $5.9 \pm 0.3 \times 10^{-07}$ erg cm^{-2}. This fluence is larger than 24% of the long GRBs in the Second BAT GRB Catalog (Sakamoto et al. 2011). The 1-s peak photon flux measured from $T + 0.14$ s in the $15 - 150$ keV band is 2.8 ± 0.2 ph cm^{-2} s^{-1}. All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at:

`http://swift.gsfc.nasa.gov/results/BATbursts/566228/bascript/top.html`.

3   XRT Observations and Analysis

Analysis of the initial XRT data was reported by Evans et al. (GCN Circ. 15090). We have analysed 17 ks of XRT data for GRB 130812A, from 62 s to 75.2 ks after the BAT trigger. The data comprise 8 s in Windowed Timing (WT) mode with the remainder in Photon Counting (PC) mode. The enhanced XRT position for this burst was given by Evans et al. (GCN. Circ 15089).

The light curve (Figure 2) can be modelled with a power-law decay with an index of $\alpha = 0.873 \pm 0.028$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of $2.01(+0.17, -0.16)$. The best-fitting absorption column is $2.8(+0.6, -0.5) \times 10^{21}$ cm^{-2}, in excess of the Galactic value of 1.5×10^{21} cm^{-2} (Kalberla et al. 2005). The counts to observed (unabsorbed) $0.3-10$ keV flux conversion factor deduced from this spectrum is $4.1 \times 10^{-11} (6.4 \times 10{-11})$ erg cm^{-2} count^{-1}.

A summary of the PC-mode spectrum is thus:

Total column: $2.8(+0.6, -0.5) \times 10^{21}$ cm^{-2}

Galactic foreground: 1.5×10^{21} cm^{-2}

Excess significance: 3.9σ

Photon index: $2.01(+0.17, -0.16)$

The results of the XRT team automatic analysis are available at:

`http://www.swift.ac.uk/xrt_products/00566228`.

4   UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 130812A 139 s after the BAT trigger (Breeveld and D'Elia GCN Circ. 15093). No optical afterglow consistent with the XRT position (Evans et al. GCN Circ. 15089) is detected in the initial UVOT exposures. Table 3 gives preliminary magnitudes using the UVOT photometric system (Breeveld et al. 2011, AIP Conf. Proc., 1358, 373). No correction has been made for the expected extinction in the Milky Way corresponding to a reddening of E(B-V) of 0.23 mag. in the direction of the GRB (Schlegel et al. 1998).
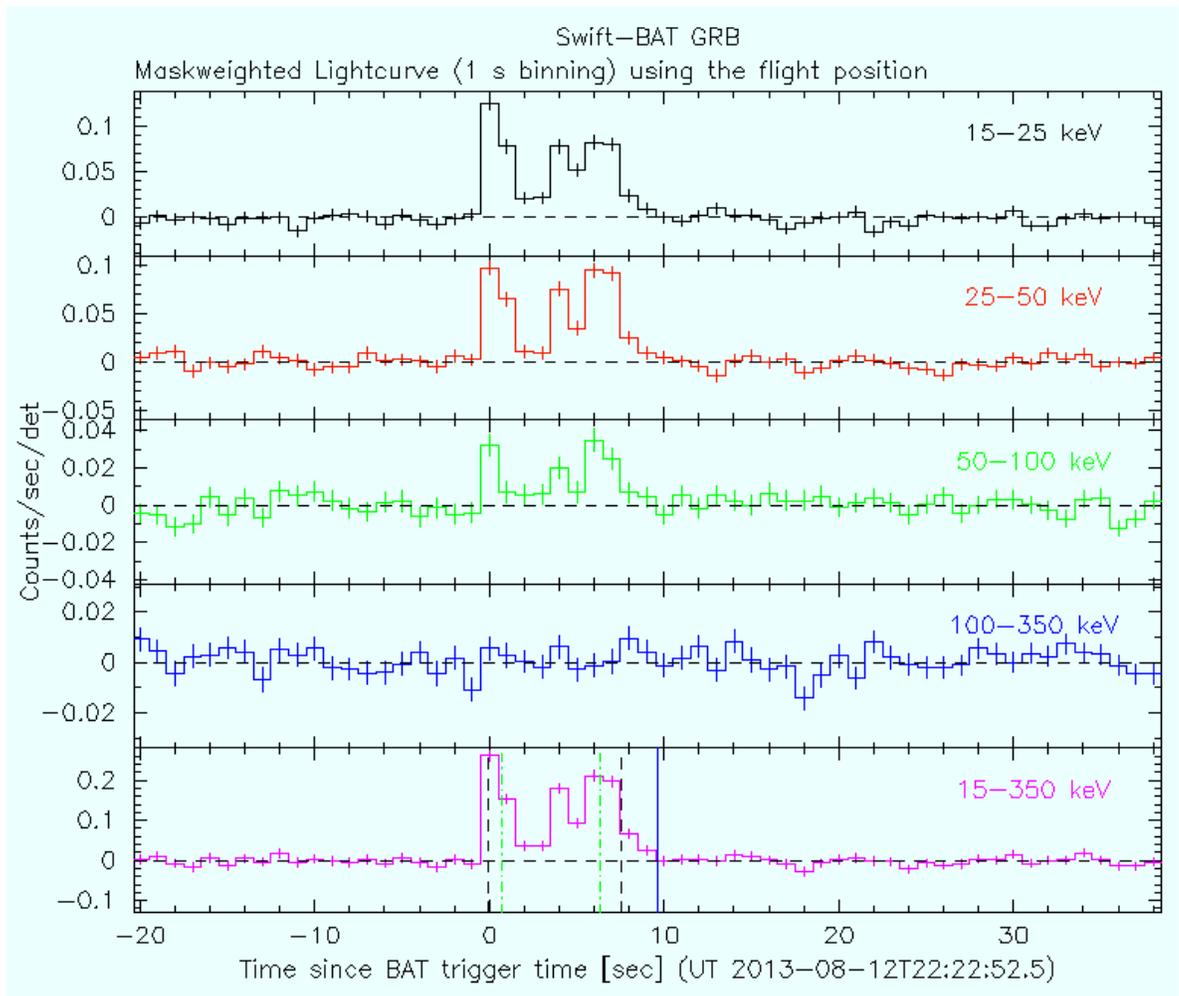

Figure 1: The BAT mask-weighted light-curve in the four individual and total energy bands. The units are counts s^{-1} illuminated-detector^{-1} (note illum-det = 0.16 cm^2).
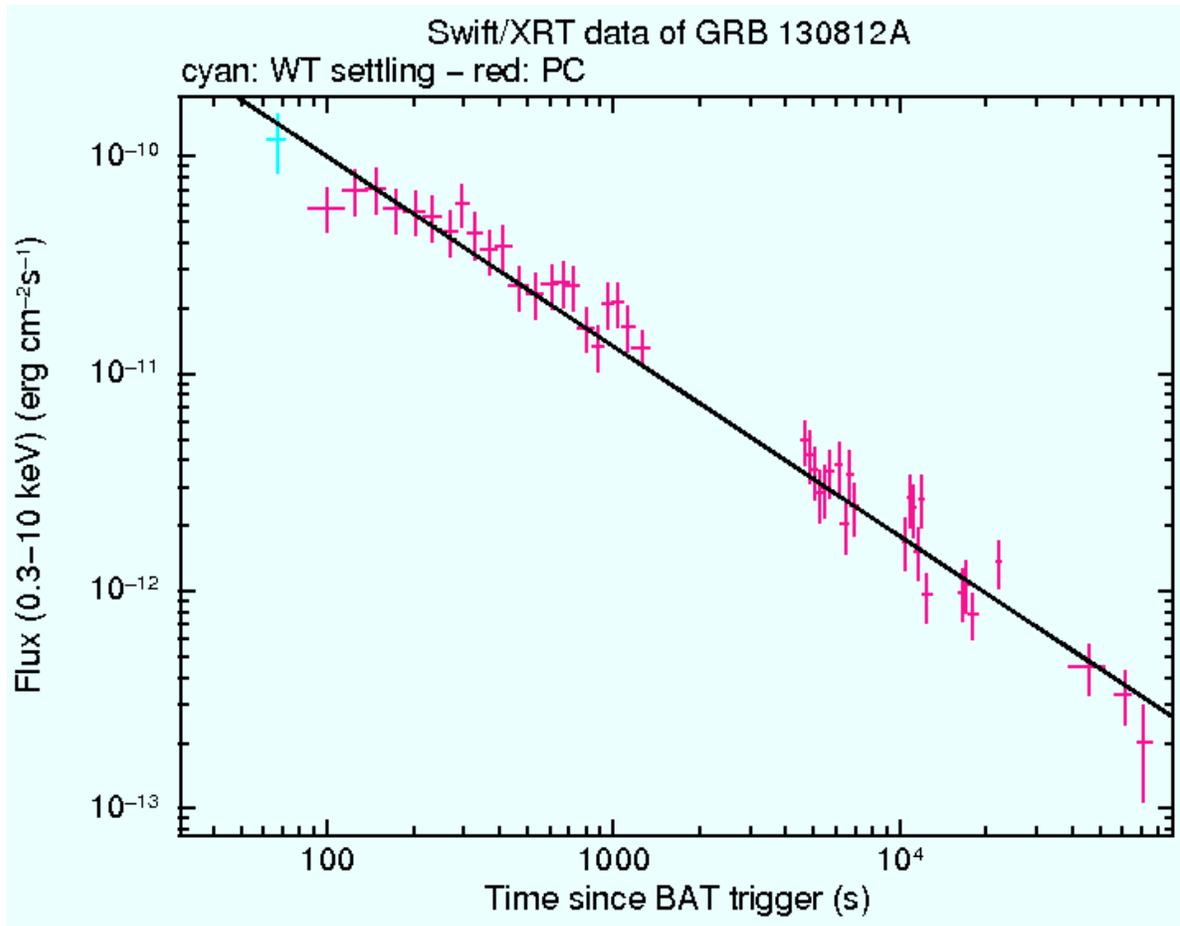
Figure 2: XRT Light curve. Flux in the 0.3 - 10 keV band is plotted with Windowed Timing (WT) in cyan and Photon Counting (PC) mode data in red.

RA	Dec	Error	Note	Reference
$06^h09^m35.00^s$	$-13°17'17.3"$	1.5"	XRT-final	UKSSDC
$06^h09^m35.00^s$	$-13°17'17.3"$	1.5"	XRT-enhanced	Evans et al. GCN Circ 15089
$06^h09^m32.8^s$	$-13°17'06.6"$	1.0'	BAT-refined	Palmer et al. GCN Circ 15092

Table 1: Positions from the *Swift* instruments.

Band	Authors	GCN Circ.	Subject	Observatory	Notes
Optical	Varela et al.	15091	GROND upper limits	GROND	upper limits

Table 2: Summary of GCN Circulars from other observatories sorted by band and then circular number.

Filter	T_start (s)	T_stop (s)	Exp (s)	Mag
U (FC)	139	389	246	> 20.3
v	445	12868	1191	> 20.5
b	394	11236	1459	> 21.7
u	139	7030	884	> 20.8
uvw1	494	6825	491	> 20.5
uvm2	469	6619	452	> 20.3
uvw2	421	12142	1376	> 21.3

Table 3: UVOT observations reported by Breeveld and D'Elia (GCN Circ. 15093). The start and stop times of the exposures are given in seconds since the BAT trigger. The preliminary 3σ upper limits are given. No correction has been made for extinction in the Milky Way.