

Swift Observations of GRB 130912A

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1 Introduction

At 08:34:57 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 130912A (trigger=570465) (D'Elia et al. GCN Circ. 15212). Swift slewed immediately to the burst. At the time of the trigger, the initial BAT position was 120° from the Sun (8.2 hours West) and 154° from the 46%-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.

Tanga et al. (GCN Circ. 15214) reported the position from GROND for the optical afterglow of this GRB. 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 Krimm et al. (GCN Circ. 15216), the BAT ground-calculated position is RA, Dec = 47.606, 13.999 deg which is RA(J2000) = $03^h10^m25.6^s$ Dec(J2000) = $+13^\circ59'55.7''$ with an uncertainty of 1.6 arcmin, (radius, sys+stat, 90% containment). The partial coding was 31%.

The mask-weighted light curve (Figure 1) shows two overlapping peaks. T_{90} (15–350 keV) is 0.28 ± 0.03 s (estimated error including systematics).

The time-averaged spectrum from $T + 0.00$ to $T + 0.32$ s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.20 ± 0.20 . The fluence in the 15 – 150 keV band is $(1.7 \pm 0.2) \times 10^{-7}$ erg cm^{-2} . This fluence is larger than that of 82% of the short GRBs in the Second BAT GRB Catalog (Sakamoto et al. 2011). The 1-s peak photon flux measured from $T - 0.34$ s in the 15 – 150 keV band is 2.2 ± 0.3 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/570465/BA/.

3 XRT Observations and Analysis

Analysis of the initial XRT data was reported by Kennea et al. (GCN Circ. 15221). We have analysed 32 ks of XRT data for GRB 130912A, from 79 s to 143.5 ks after the BAT trigger. The data comprise 524 s in Windowed Timing (WT) mode (the first 8 s were taken while Swift was slewing) with the remainder in Photon Counting (PC) mode. The enhanced XRT position for this burst was given by Beardmore et al. (GCN Circ. 15217).

The light curve (Figure 2) can be modelled with a power-law decay with a decay index of $\alpha = 1.20 \pm 0.04$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of $1.57^{+0.20}_{-0.16}$. The best-fitting absorption column is $1.49^{+0.69}_{-0.25} \times 10^{21}$ cm^{-2} , consistent

with the Galactic value of $1.2 \times 10^{21} \text{ cm}^{-2}$ (Kalberla et al. 2005). The counts to observed (unabsorbed) 0.3 – 10 keV flux conversion factor deduced from this spectrum is 4.8×10^{-11} (5.7×10^{-11}) $\text{erg cm}^{-2} \text{ count}^{-1}$.

A summary of the PC-mode spectrum is thus:

Total column: $1.49_{-0.25}^{+0.69} \times 10^{21} \text{ cm}^{-2}$

Galactic foreground: $1.2 \times 10^{21} \text{ cm}^{-2}$

Excess significance: $< 1.6\sigma$

Photon index: $1.57_{-0.16}^{+0.20}$.

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

http://www.swift.ac.uk/xrt_products/00570465.

4 UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 130912A 99 s after the BAT trigger (Chester and D’Elia GCN Circ. 15229). No optical afterglow consistent with the enhanced XRT position (Beardmore et al. GCN Circ. 15217) 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 0.28 mag. in the direction of the GRB (Schlegel et al. 1998).

RA	Dec	Error	Note	Reference
$03^h 10^m 22.21^s$	$+13^\circ 59' 49.3''$	1.5''	XRT-final	UKSSDC
$03^h 10^m 22.24^s$	$+13^\circ 59' 49.3''$	1.6''	XRT-enhanced	Beardmore et al. GCN Circ 15217
$03^h 10^m 25.6^s$	$+13^\circ 59' 55.7''$	1.6'	BAT-refined	Krimm et al. GCN Circ 15216

Table 1: Positions from the *Swift* instruments.

Band	Authors	GCN	Subject	Observatory	Notes
Optical	Zheng et al.	15213	KAIT upper limit	KAIT	upper limits
Optical	Tanga et al.	15214	GROND observations	GROND	
Optical	D’Avanzo et al.	15215	REM optical/NIR upper limits	REM	upper limits
Optical	Trotter et al.	15218	DSO-14/Yerkes-41/PROMPT obs.	PROMPT	upper limits
Optical	Cenko et al.	15222	P60 Observations	Palomar	60-inch
Optical	Tanvir et al.	15224	WHT confirmation of counterpart	WHT	detection
Optical	Butler et al.	15226	RATIR Optical/NIR Upper Limits	RATIR	upper limits
Radio	Fong et al.	15227	5.8 GHz VLA upper limit	VLA	upper limits
Gamma	Zhang et al.	15219	Fermi GBM detection	Fermi GBM	$E_p = 1225 \pm 599 \text{ keV}$
Gamma	Golenetskii et al.	15225	Konus-Wind observation	Konus-Wind	$E_p = 580 \pm 65 \text{ keV}$

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

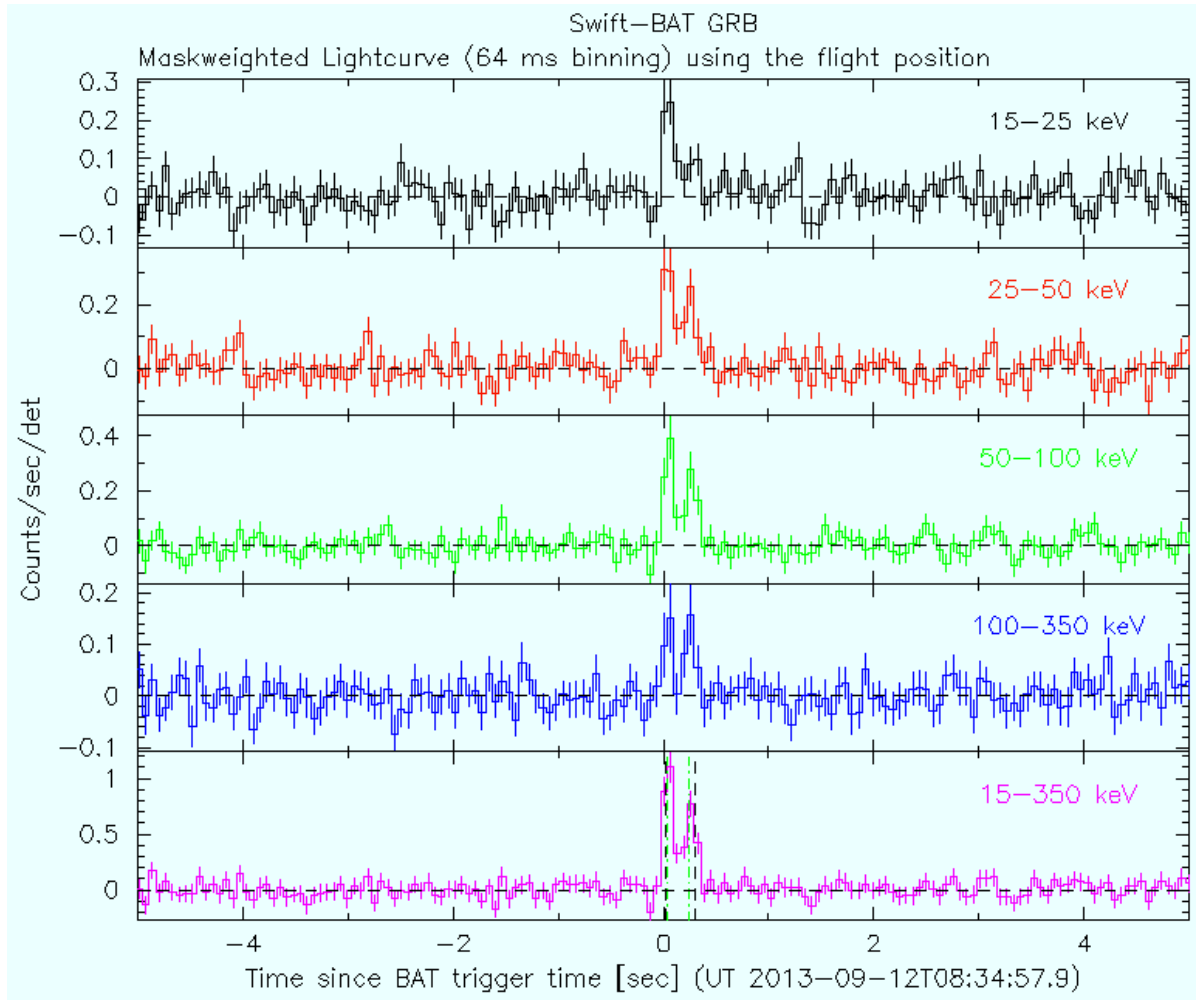


Figure 1: The BAT mask-weighted light-curve in the four individual and total energy bands. The units are counts s^{-1} illuminated-detector $^{-1}$ (note illum-det = 0.16 cm^2).

Filter	T_start (s)	T_stop (s)	Exp (s)	Mag
whiteFC	99	249	147	> 20.7
uFC	311	561	246	> 20.2
white	99	6848	785	> 21.4
v	640	23984	1395	> 20.3
b	566	30470	1907	> 21.6
u	311	36236	3907	> 21.6
w1	690	35508	3836	> 22.1
m2	1070	34601	2827	> 21.8
w2	616	23070	1376	> 21.6

Table 3: UVOT observations reported by Chester and D’Elia (GCN Circ. 15229). 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.

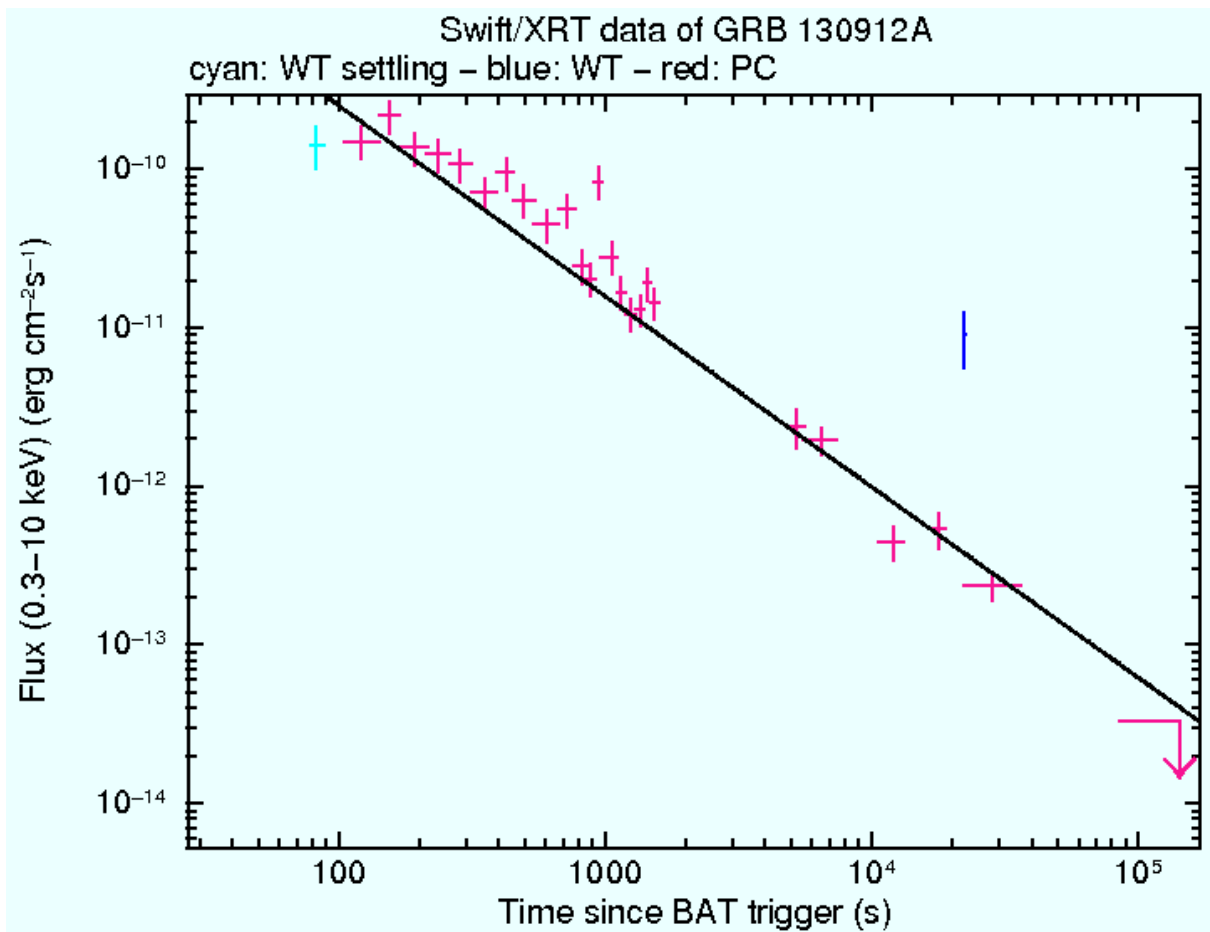


Figure 2: XRT Light curve. Flux in the 0.3 - 10 keV band is plotted with Windowed Timing (WT) in cyan and Photon Counting (PC) mode data in red.