

## 1 Introduction

At 16:41:23 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 130528A (trigger=556870) (D'Elia et al. GCN Circ. 14711). Swift slewed immediately to the burst. At the time of the trigger, the initial BAT position was  $68^\circ$  from the Sun (5.0 hours East) and  $109^\circ$  from the 83%-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](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](http://gcn.gsfc.nasa.gov/swift_gnd_ana.html).

## 2 BAT Observations and Analysis

As reported by Krimm et al. (GCN Circ. 14718), the BAT ground-calculated position is RA, Dec = 139.405, 87.300 deg, which is RA(J2000) = 09h 17m 37.2s Dec(J2000) = -87d 18' 01.5" with an uncertainty of 1.0 arcmin, (radius, sys+stat, 90% containment). The partial coding was 100%.

The mask-weighted light curve shows the burst starting at  $\sim T + 0$  s, peaking at about  $T + 4$  s, and ending at  $\sim T + 80$  s.  $T_{90}$  (15 – 350 keV) is  $59.4 \pm 3.6$  s (estimated error including systematics).

The time-averaged spectrum from  $T + 0.12$  to  $T + 79.34$  s is best fit by a power-law with an exponential cutoff model. This gives a photon index of  $1.39 \pm 0.19$ , and  $E_{peak}$  of  $118.3 \pm 79.7$  keV ( $\chi = 42.3$  for 56 d.o.f.). For this model the total fluence in the 15 – 150 keV band is  $5.1 \pm 0.2 \times 10^{-06}$  erg  $\text{cm}^{-2}$ . The 1-s peak photon flux measured from  $T + 6.06$  s in the 15 – 150 keV band is  $3.0 \pm 0.2$  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/556870/BA/](http://gcn.gsfc.nasa.gov/notices_s/556870/BA/).

## 3 XRT Observations and Analysis

Analysis of the initial XRT data was reported by Melandri et al. (GCN Circ. 14716). We have analysed 19 ks of XRT data for GRB 130528A, from 54 s to 143.3 ks after the BAT trigger. The data comprise 859 s in Windowed Timing (WT) mode (the first 9 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 Goad et al. (GCN. Circ 14714).

The late-time light curve (Figure 2) (from  $T_0 + 4.9$  ks can be modelled with a power-law decay with an index of  $\alpha = 1.11(+0.07, -0.06)$ .

A spectrum formed from the WT mode data can be fitted with an absorbed power-law with a photon spectral index of  $1.69 \pm 0.07$ ). The best-fitting absorption column is  $3.6 \pm 0.3 \times 10^{21}$   $\text{cm}^{-2}$ , in excess of the Galactic value of  $5.2 \times 10^{20}$   $\text{cm}^{-2}$  (Kalberla et al. 2005). The PC mode spectrum has a photon index of  $1.91(+0.15, -0.14)$  and a best-fitting absorption column of  $3.4 \pm 0.6 \times 10^{21}$   $\text{cm}^{-2}$ . The counts to observed (unabsorbed) 0.3 – 10 keV flux conversion factor deduced from this spectrum is  $4.4 \times 10^{-11}(6.8 \times 10^{-11})$  erg  $\text{cm}^{-2}$   $\text{count}^{-1}$ .

A summary of the PC-mode spectrum is thus:

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 Total column:  $3.4 \pm 0.6 \times 10^{20} \text{ cm}^{-2}$

Galactic foreground:  $5.2 \times 10^{20} \text{ cm}^{-2}$

Excess significance:  $8.5\sigma$

Photon index:  $1.91(+0.15, -0.14)$

The results of the XRT team automatic analysis are available at [http://www.swift.ac.uk/xrt\\_products/00556870](http://www.swift.ac.uk/xrt_products/00556870).

## 4 UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 130528A 75 s after the BAT trigger (De Pasquale and D’Elia GCN Circ. 14721). No optical afterglow consistent with the XRT position (Goad et al. GCN Circ. 14714) 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 0.16 mag. in the direction of the GRB (Schlegel et al. 1998).

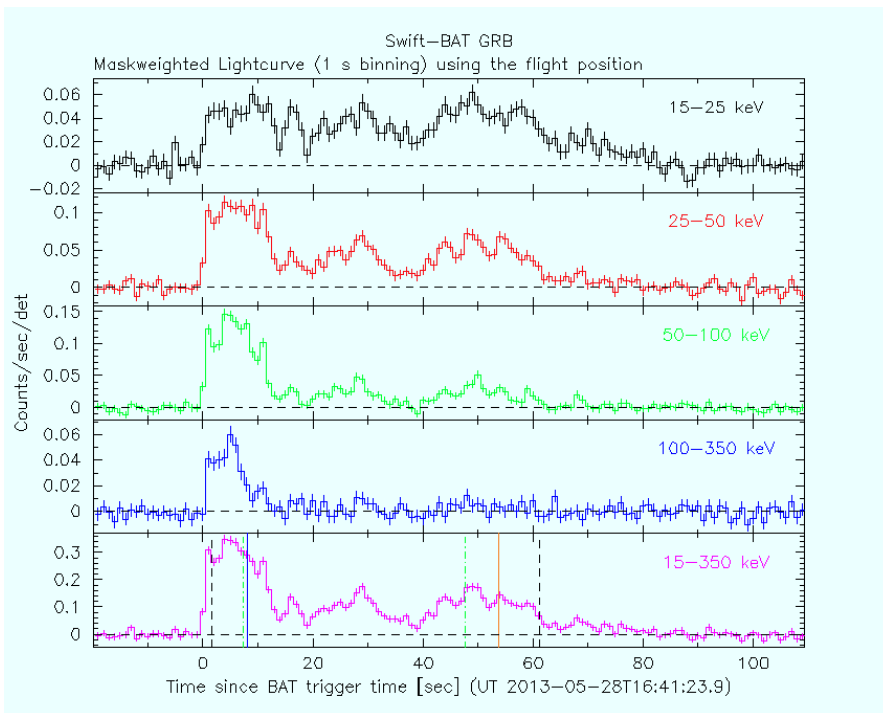


Figure 1: The BAT mask-weighted light-curve in the four individual and total energy bands. The units are counts  $\text{s}^{-1}$  illuminated-detector $^{-1}$  (note illum-det =  $0.16 \text{ cm}^2$ ).

RA	Dec	Error	Note	Reference
$09^h 18^m 00.12^s$	$+87^\circ 18' 03.7''$	$1.8''$	XRT-enhanced	Goad et al. GCN Circ 14714
$09^h 17^m 37.2^s$	$+87^\circ 18' 01.5''$	$1.0'$	BAT-refined	Cummings et al. GCN Circ 14718

Table 1: Positions from the *Swift* instruments.

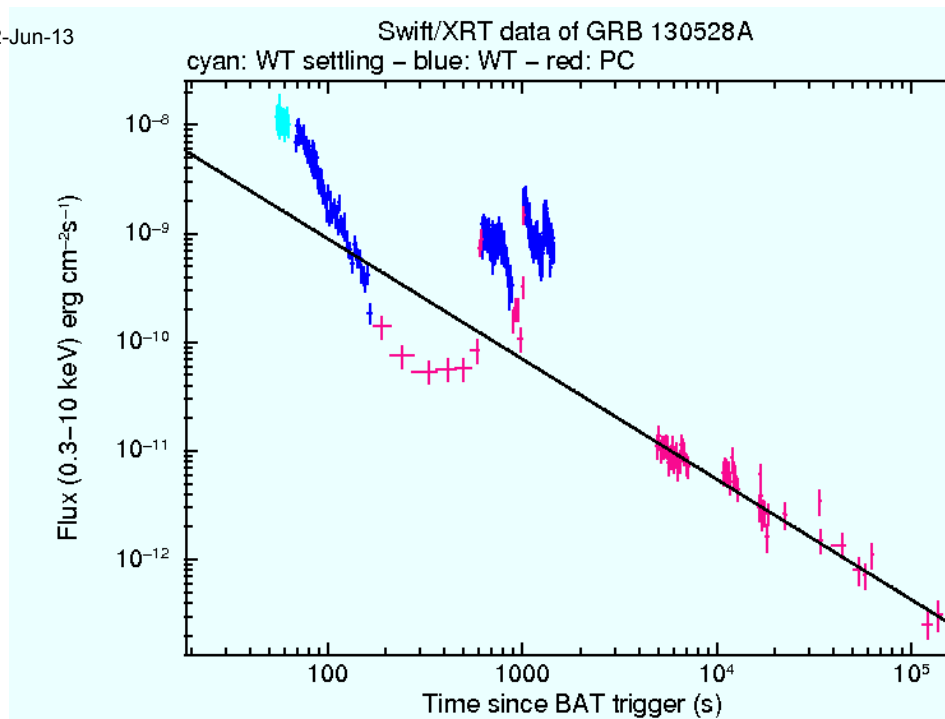


Figure 2: XRT Light curve. Count rate in the 0.3 - 10 keV band is plotted with Windowed Timing (WT) in blue (cyan for data taken in slewing) and Photon Counting (PC) mode data in red.

Band	Authors	GCN Circ.	Subject	Observatory	Notes
Optical	Volnova et al.	14712	optical upper limits	ISON-Kitab	upper limits
Optical	Golenetskii et al.	14722	Konus-Wind detection	Konus-Wind	detection
Optical	Jenke et al.	14729	Fermi GBM detection	Fermi GBM	detection

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
white (fc)	75	225	147	> 20.3
U (FC)	287	537	246	> 19.5
white	75	18737	1239	> 21.7
v	617	11553	1245	> 19.9
b	543	18247	1356	> 20.8
u	287	17334	1583	> 21.0
uvw1	667	22765	1443	> 20.7
m2	641	12495	1179	> 20.7
uvw2	592	7143	491	> 20.5

Table 3: UVOT observations reported by De Pasquale and D’Elia (GCN Circ. 14721). The start and stop times of the exposures are given in seconds since the BAT trigger. The preliminary  $3\sigma$  upper limits are given. No correction has been made for extinction in the Milky Way.