

Swift Observations of GRB 130527A

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1. Introduction

At 14:21:30 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 130527A (trigger=556753) (Gompertz *et al.* GCN Circ. [14703](#)). Swift slewed immediately to the burst. At the time of the trigger, the initial BAT position was 121° from the Sun (7.7 hours West) and 27° from the 91%-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 Baumgartner *et al.* (GCN Circ. [14708](#)), the BAT ground-calculated position is RA, Dec = 309.282, -24.726 deg, which is RA(J2000) = 20h 37m 07.6s Dec(J2000) = -24d 43' 35.1" with an uncertainty of 1.1 arcmin, (radius, sys+stat, 90% containment). The partial coding was 10%.

The mask-weighted light curve shows many overlapping peaks starting at $\sim T-10$ s, peaking at $\sim T+1$ s, and ending at $\sim T+170$ s. T_{90} (15-350 keV) is 44 ± 16 s (estimated error including systematics).

The time-averaged spectrum from T-2.9 to T+90.7 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.25 ± 0.06 . The fluence in the 15-150 keV band is $1.2 \pm 0.04 \times 10^{-5}$ erg cm^{-2} . The 1-s peak photon flux measured from T+0.06 s in the 15-150 keV band is 20.1 ± 1.4 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://gcn.gsfc.nasa.gov/notices_s/556753/BA/.

3. XRT Observations and Analysis

Analysis of the initial XRT data was reported by Mangano *et al.* (GCN Circ. [14707](#)). We have analysed 5.9 ks of XRT data for GRB 130527A, from 94 s to 18.3 ks after the BAT trigger. The data comprise 203 s in Windowed Timing (WT) mode (the first 10 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 Evans *et al.* (GCN. Circ 14704).

The late-time light curve (**Figure 2**) (from T0+4.9 ks) can be modelled with a power-law decay with a decay index of $\alpha=1.15$ (+0.24, -0.23).

A spectrum formed from the WT mode data can be fitted with an absorbed power-law with a photon spectral index of 1.70 ± 0.09 . The best-fitting absorption column is $2.4 \pm 0.3 \times 10^{21}$ cm^{-2} , in excess of the Galactic value of 3.7×10^{20} cm^{-2} (Kalberla *et al.* 2005). The PC mode spectrum has a photon index of 1.67 (+0.16, -0.15) and a best-fitting absorption column of $1.5 \pm 0.5 \times 10^{21}$ cm^{-2} . The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is 4.5×10^{-11} (5.5×10^{-11}) erg cm^{-2} count^{-1} .

A summary of the PC mode spectrum is thus:

Total column: $1.5 \pm 0.5 \times 10^{21} \text{ cm}^{-2}$

Galactic foreground: $3.7 \times 10^{20} \text{ cm}^{-2}$

Excess significance: 3.9σ

Photon index: 1.67 (+0.16, -0.15)

The results of the XRT team automatic analysis are available at http://www.swift.ac.uk/xrt_products/00556753.

4. UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 130527A 113 s after the BAT trigger (Chester and Gompertz GCN Circ. [14715](#)). No optical afterglow consistent with the XRT position (Evans *et al.* GCN Circ. [14705](#)) 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 0.04 mag. in the direction of the GRB (Schlegel *et al.* 1998).

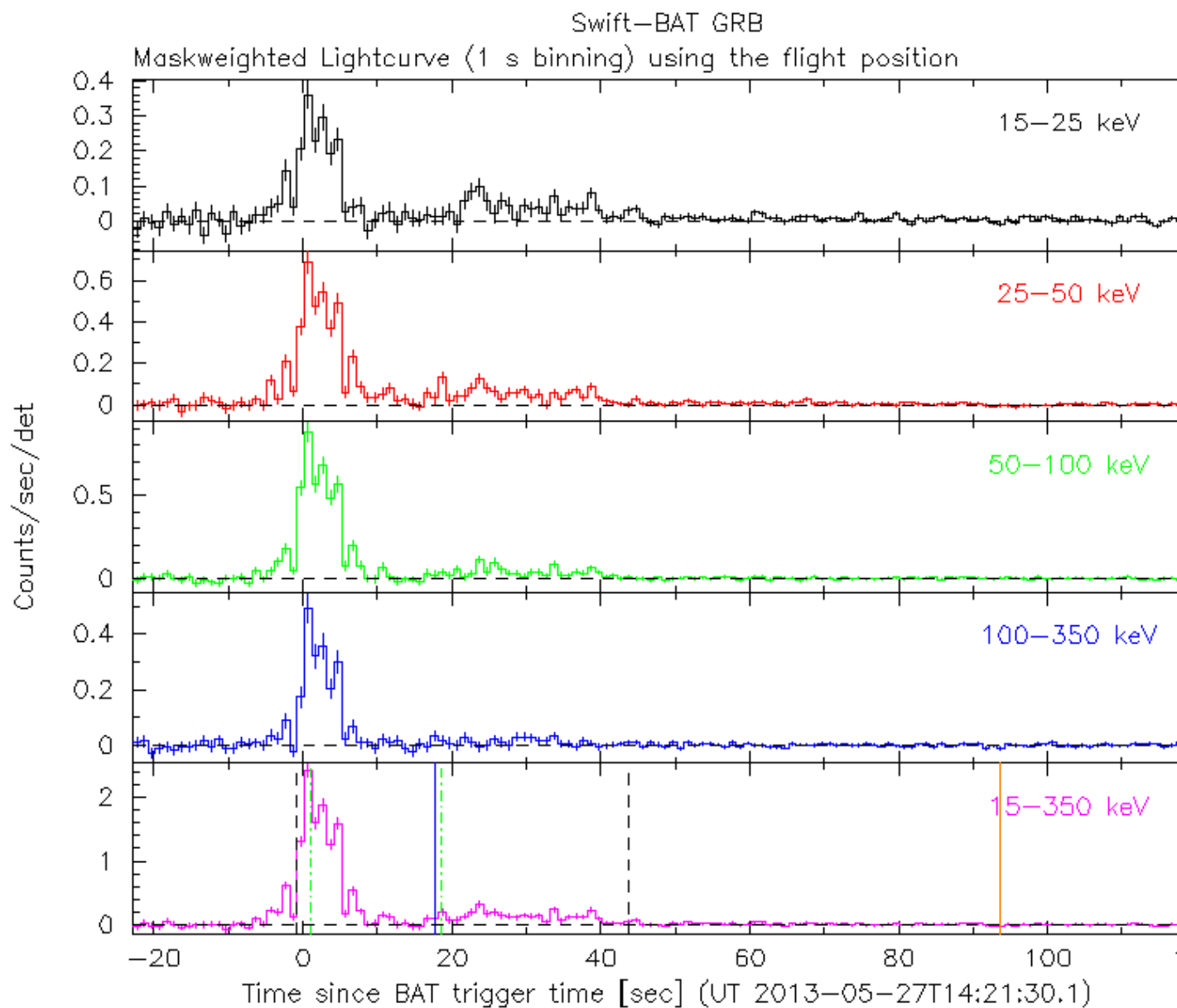


Figure 1. The BAT mask-weighted light curve in the four individual and total energy bands. The units are counts s^{-1} illuminated-detector $^{-1}$.

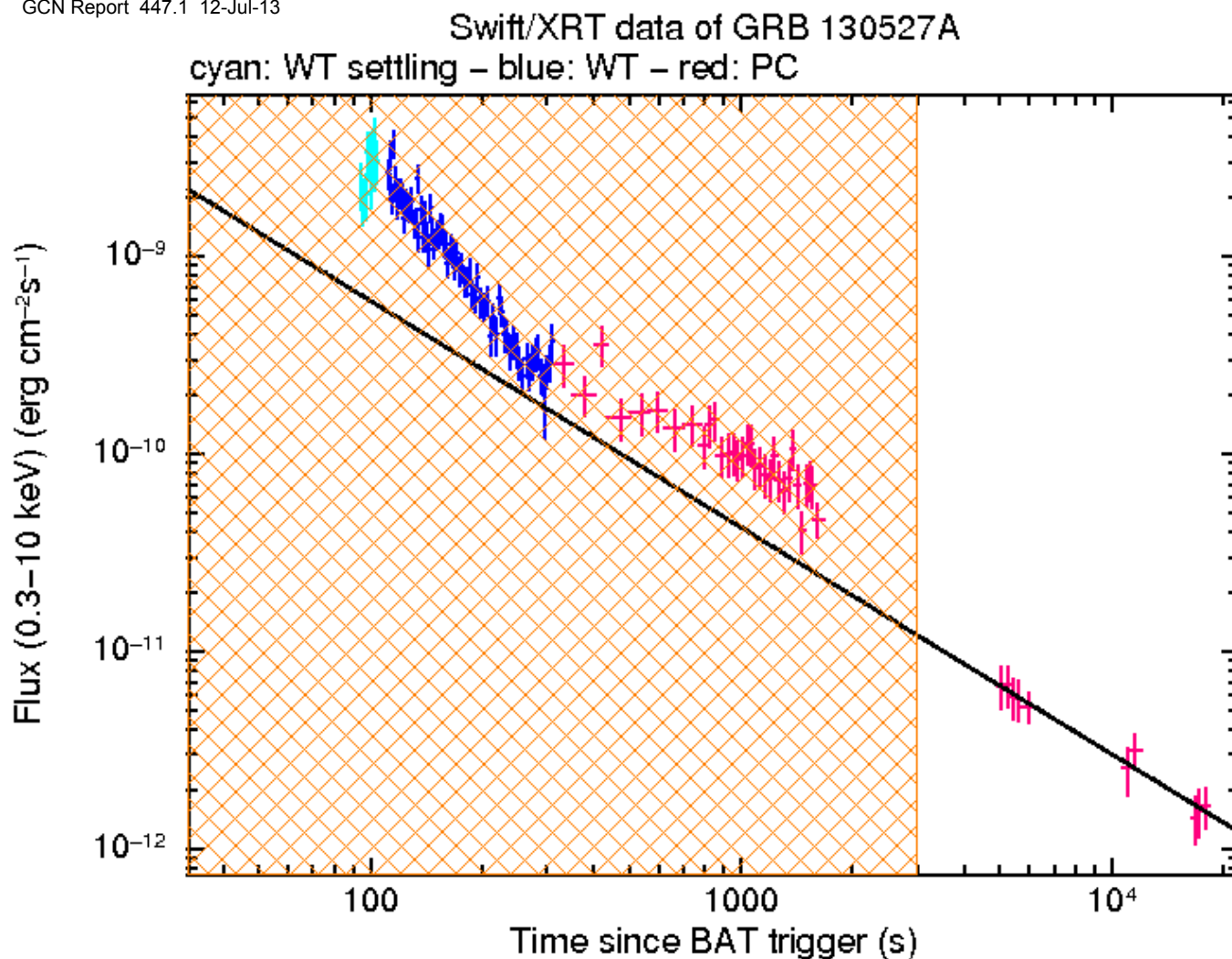


Figure 2. The XRT light curve.

RA	Dec	Error	Note	Reference
20 ^h 37 ^m 06.32 ^s	-24°43' 30.6"	1.8"	XRT-enhanced	Evans <i>et al.</i> GCN Circ. 14705
20 ^h 37 ^m 07.6 ^s	-24°43' 35.1"	1.1'	BAT-refined	Baumgartner <i>et al.</i> GCN Circ. 14708

Table 1. Positions from the Swift instruments.

Band	Authors	GCN Circ.	Subject	Observatory	Notes
Optical	Castro-Tirado <i>et al.</i>	14706	BOOTES-2 & 3.5m CAHA opt/nIR observations	BOOTES-2	
Optical	Butler <i>et al.</i>	14709	RATIR Optical and NIR Observations	RATIR	upper limits
Optical	Cano <i>et al.</i>	14710	NOT optical counterpart	NOT	detection
Gamma-ray	Golenetskii <i>et al.</i>	14720	Konus-Wind observation	Konus-Wind	detection
Gamma-ray	Ueno <i>et al.</i>	14727	Suzaku WAM observation of the prompt emission	Suzaku WAM	light curve

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}	113	263	147	>21.2
white	113	1547	392	>21.1
white	4949	12020	623	>21.8
v	655	1596	117	>18.7
v	5359	5559	197	>19.5
b	581	1693	114	>20.2
b	6179	11579	906	>21.3
u _{FC}	325	575	246	>20.3
u	325	1671	343	>20.2
u	5974	18261	1072	>21.1
w1	704	1646	97	>19.8
w1	5769	17356	1082	>21.1
m2	680	1621	117	>20.0
m2	5564	5764	197	>19.8
w2	630	1572	117	>20.6
w2	5154	5354	197	>20.2

Table 3. UVOT observations reported by Chester and Gompertz (GCN Circ. [14715](#)). The start and stop times of the exposures are given in seconds since the BAT trigger. The preliminary 3- σ upper limits are given. No correction has been made for extinction in the Milky Way.

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