

Swift Observations of GRB 130102A

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1. Introduction

Page *et al.* (GCN Circ. 14127) reported the initial Swift results. At 18:10:53 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 130102A (trigger=544784). Swift slewed immediately to the burst. **Table 1** contains the best reported positions from Swift. 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

Analysis of the BAT data was reported by Markwardt *et al.* (GCN Circ. 14133). The BAT ground-calculated position is RA, Dec = 311.435, 49.838 deg which is RA(J2000) = 20h 45m 44.4s Dec(J2000) = +49d 50' 16.4" with an uncertainty of 2.3 arcmin, (radius, sys+stat, 90% containment). The partial coding was 99%.

The mask-weighted light curve (**Figure 1**) shows a peak starting at $\sim T+10$ s, peaking at $\sim T+22$ s, and ending around $T+180$ s. There is a possibility of emission out to at least $T+230$ s. $T_{90}(15-350 \text{ keV})$ is 77.5 ± 18.2 s (estimated error including systematics).

The time-averaged spectrum from $T+12.51$ to $T+100.43$ s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.39 ± 0.18 . The fluence in the 15-150 keV band is $7.2 \pm 0.9 \times 10^{-7}$ erg cm^{-2} . The 1-s peak photon flux measured from $T+23.54$ s in the 15-150 keV band is 0.4 ± 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/544784/BA/.

3. XRT Observations and Analysis

Analysis of the XRT data was reported by D'Avanzo *et al.* (GCN Circ. 14131). We have analysed 21.2 ks of XRT data for GRB 130102A, from 109 s to 76.5 ks after the BAT trigger. The data comprise 66 s in Windowed Timing (WT) mode (the first 5 s were taken while Swift was slewing) with the remainder in Photon Counting (PC) mode.

The light curve (**Figure 2**) can be modelled with a series of power-law decays. The initial decay index is $\alpha=1.39$ (+0.19, -0.20). At $T+459$ s the decay steepens to an α of 5.5 (+1.9,

-1.2) ~~GCN Report 1414198 Jan 12~~ before breaking again at T+968 s to a final decay with index $\alpha=0.7 \pm 0.3$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of 2.0 (+0.4, -0.3). The best-fitting absorption column is 1.14 (+0.34, -0.28) $\times 10^{22}$ cm⁻², in excess of the Galactic value of 8.0×10^{21} cm⁻² (Kalberla et al. 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is 5.8×10^{-11} (1.3×10^{-10}) erg cm⁻² count⁻¹.

The results of the XRT team automatic analysis are available at http://www.swift.ac.uk/xrt_products/00544784.

4. UVOT Observations and Analysis

Analysis of the UVOT data was reported by Pritchard and Page (GCN Circ. 14136). The Swift/UVOT began settled observations of the field of GRB 130102A 126 s after the BAT trigger. No optical afterglow consistent with the XRT position (Osborne et al. GCN Circ. 14129) 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 1.90 mag. in the direction of the GRB (Schlegel *et al.* 1998).

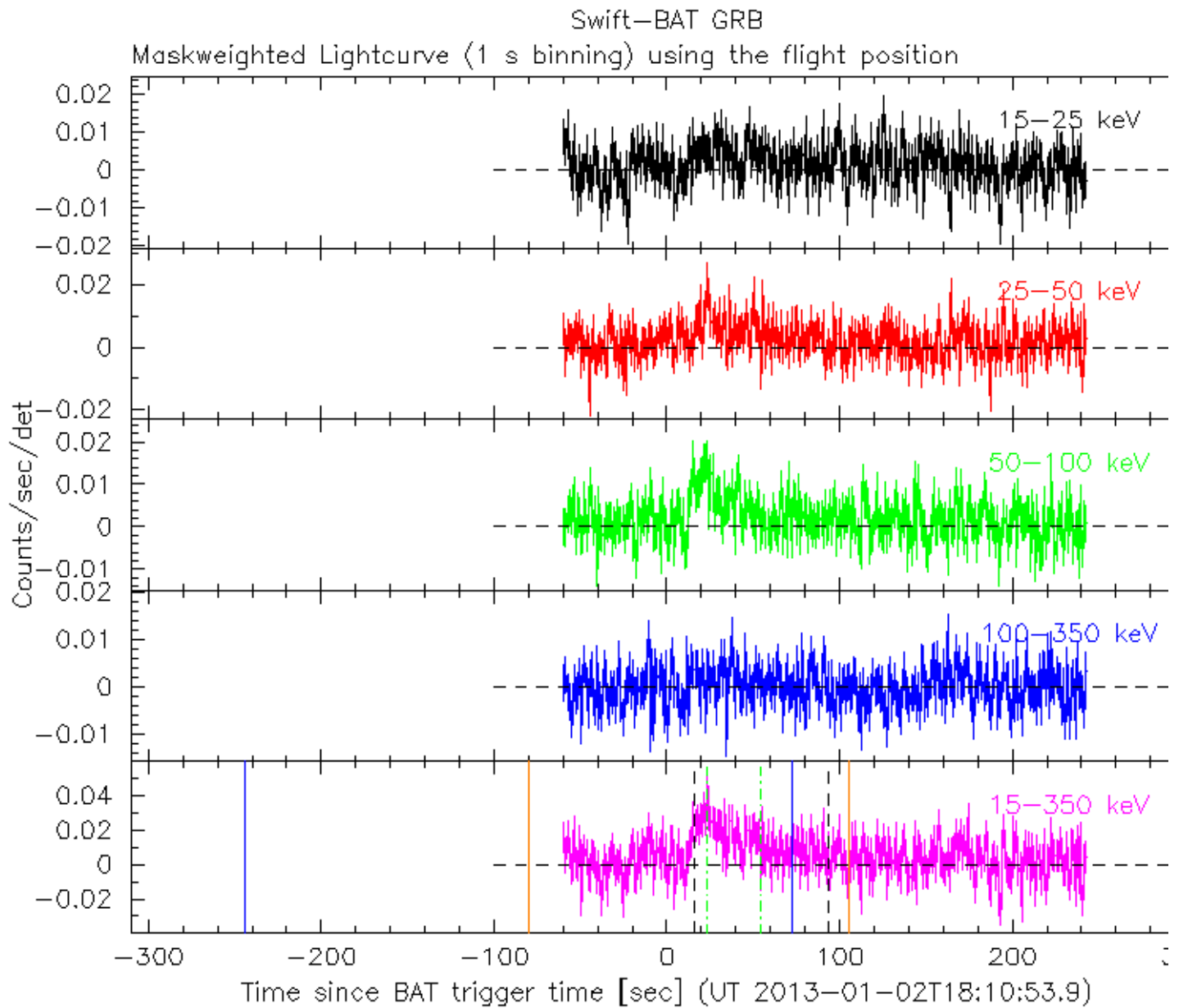


Figure 1. The BAT mask-weighted light curve in the four individual and total energy bands. The units are counts s^{-1} illuminated-detector $^{-1}$.

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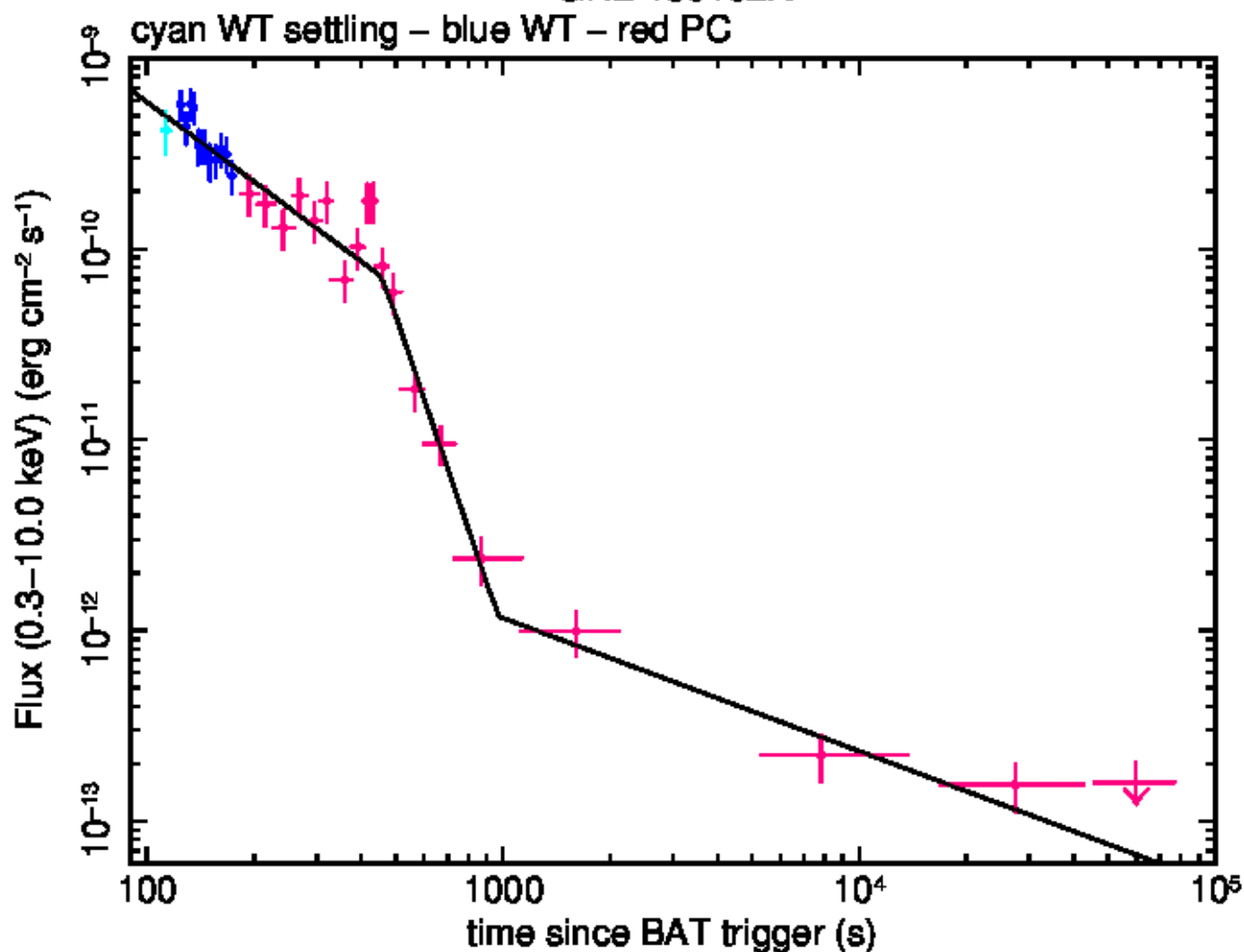


Figure 2. The XRT light curve.

RA	Dec	Error	Note	Reference
$20^{\text{h}}45^{\text{m}}41.63^{\text{s}}$	$+49^{\circ}49' 03.5''$	1.6"	XRT-enhanced	Osborne <i>et al.</i> GCN Circ. 14129
$20^{\text{h}}45^{\text{m}}44.4^{\text{s}}$	$+49^{\circ}50' 16.4''$	2.3'	BAT-refined	Markwardt <i>et al.</i> GCN Circ. 14133

Table 1. Positions from the Swift instruments.

Band	Authors	GCN Circ.	Observatory	Notes
Optical	Gorosabel and &.L. Toribio	14128	IAC80	
Optical	Gorbovskoy <i>et al.</i>	14132	MASTER	
Optical	Cenko	14134	Palomar 60-inch	

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}	126	276	147	>21.1
u _{FC}	284	534	246	>20.4
white	126	7587	844	>22.4
v	614	12045	1343	>20.9
b	540	7382	549	>20.8
u	284	7177	775	>20.5
w1	664	6972	549	>20.2
m2	639	12641	934	>20.7
w2	590	7794	568	>20.7

Table 3. UVOT Observations. 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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