

Swift Observations of GRB 130211A

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1. Introduction

At 03:36:32 UT, the *Swift* Burst Alert Telescope (BAT) triggered and located GRB 130211A (trigger=548276) (Oates *et al.* GCN Circ. 14195). *Swift* slewed immediately to the burst. **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.

Knust *et al.* (GCN Circ. 14196) 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 Ukwatta *et al.* (GCN Circ. 14197), the BAT ground-calculated position is RA, Dec = 147.524, -42.330 deg which is RA(J2000) = 09h 50m 05.7s Dec(J2000) = -42d 19' 47.1" with an uncertainty of 2.1 arcmin, (radius, sys+stat, 90% containment). The partial coding was 40%.

The mask-weighted light curve (**Figure 1**) shows multiple, weak, overlapping peaks starting at $\sim T-10$ s, peaking at $\sim T-2$ s, and ending at $\sim T+30$ s. $T_{90}(15-350 \text{ keV})$ is 25.1 ± 6.3 s (estimated error including systematics).

The time-averaged spectrum from T-1.56 to T+32.00 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.81 ± 0.24 . The fluence in the 15-150 keV band is $6.4 \pm 1.0 \times 10^{-7} \text{ erg cm}^{-2}$. The 1-s peak photon flux measured from T-1.58 s in the 15-150 keV band is $0.7 \pm 0.2 \text{ ph cm}^{-2} \text{ s}^{-1}$. 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/548276/BA/.

3. XRT Observations and Analysis

Analysis of the initial XRT data was reported by Burrows *et al.* (GCN Circ. 14198). We have analysed 20.1 ks of XRT data for GRB 130211A, from 104 s to 74.4 ks after the BAT trigger. The first 8 s were taken while *Swift* was slewing, the rest of the data comprise of 201 s in Windowed Timing (WT) mode with the remainder in Photon Counting (PC) mode.

The late-time light curve (**Figure 2**) (from T0+1.1 ks) can be modeled with a power-law decay with a decay index of $\alpha=0.57 (+0.16, -0.15)$.

A spectrum formed from the WT mode data can be fitted with an absorbed power-law with a photon spectral index of $3.53 (+0.14, -0.13)$. The best-fitting absorption column is $3.71 (+0.39, -0.37) \times 10^{21} \text{ cm}^{-2}$, in excess of the Galactic value of $2.2 \times 10^{21} \text{ cm}^{-2}$ (Kalberla *et al.* 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is $2.5 \times 10^{-11} (2.3 \times 10^{-10}) \text{ erg cm}^{-2} \text{ count}^{-1}$.

A summary of the WT-mode spectrum is thus:

Total column: $3.53 (+0.39, -0.37) \times 10^{21} \text{ cm}^{-2}$

Galactic foreground: $2.2 \times 10^{21} \text{ cm}^{-2}$

Photon index: $3.53 (+0.14, -0.13)$

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of $2.20 (+0.47, -0.21)$. The best-fitting absorption column is $0.0 (+1.2, -0.0) \times 10^{21} \text{ cm}^{-2}$, consistent with no excess above the Galactic value of $2.2 \times 10^{21} \text{ cm}^{-2}$ (Kalberla *et al.* 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is 3.5×10^{-11} (5.8×10^{-11}) $\text{erg cm}^{-2} \text{ count}^{-1}$.

A summary of the PC-mode spectrum is thus:

Total column: $0.0 (+1.2, -0.0) \times 10^{21} \text{ cm}^{-2}$

Galactic foreground: $2.2 \times 10^{21} \text{ cm}^{-2}$

Photon index: $2.20 (+0.47, -0.21)$

The results of the XRT team automatic analysis are available at http://www.swift.ac.uk/xrt_products/00548276.

4. UVOT Observations and Analysis

The *Swift*/UVOT began settled observations of the field of GRB 130211A 125 s after the BAT trigger (Oates GCN Circ. 14199). No optical afterglow consistent with the optical position (Knust *et al.* GCN Circ. 14196) 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 0.53 mag. in the direction of the GRB (Schlegel *et al.* 1998).

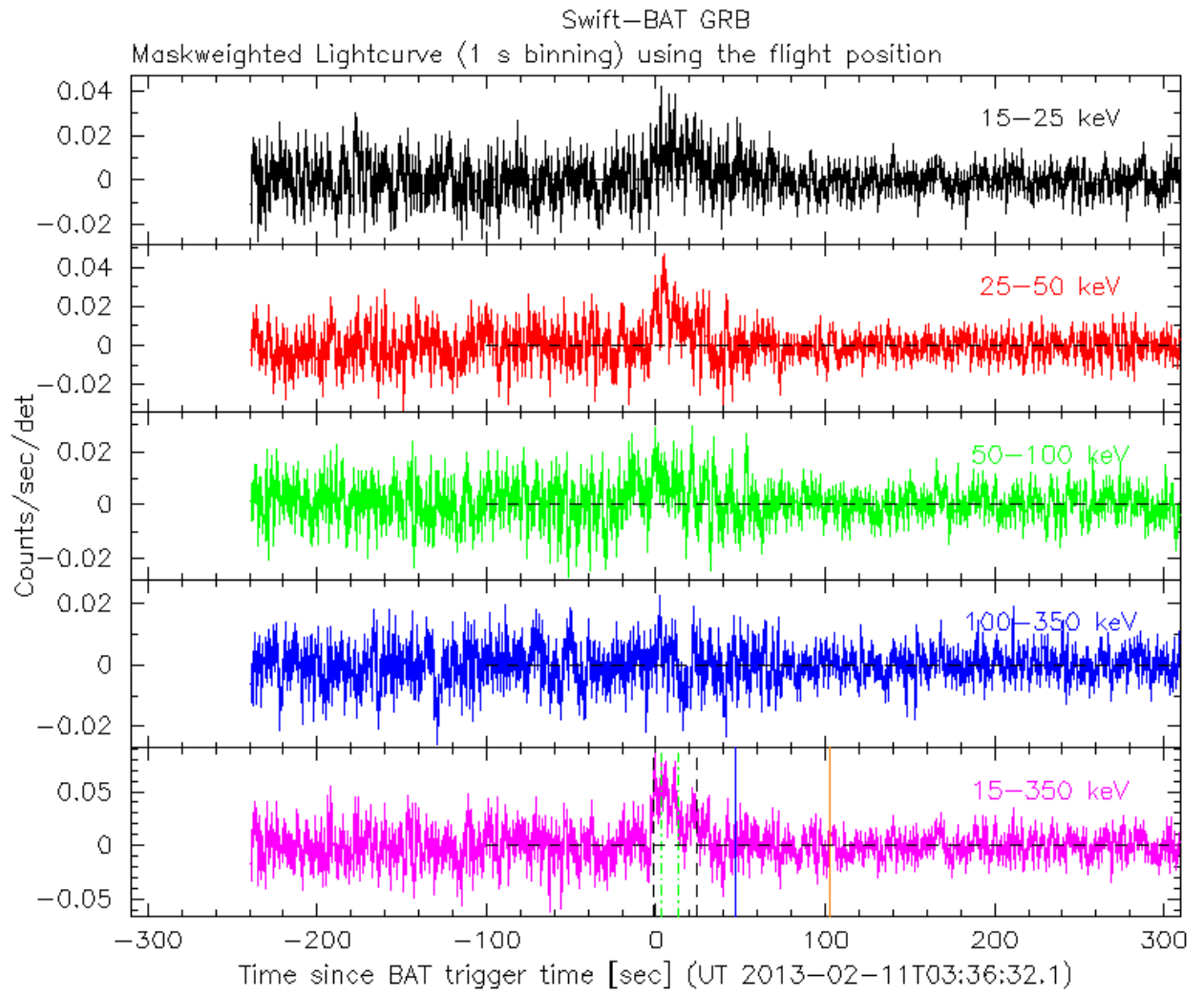


Figure 1. The BAT mask-weighted light curve in the four individual and total energy bands. The units are counts s^{-1} illuminated-detector $^{-1}$.

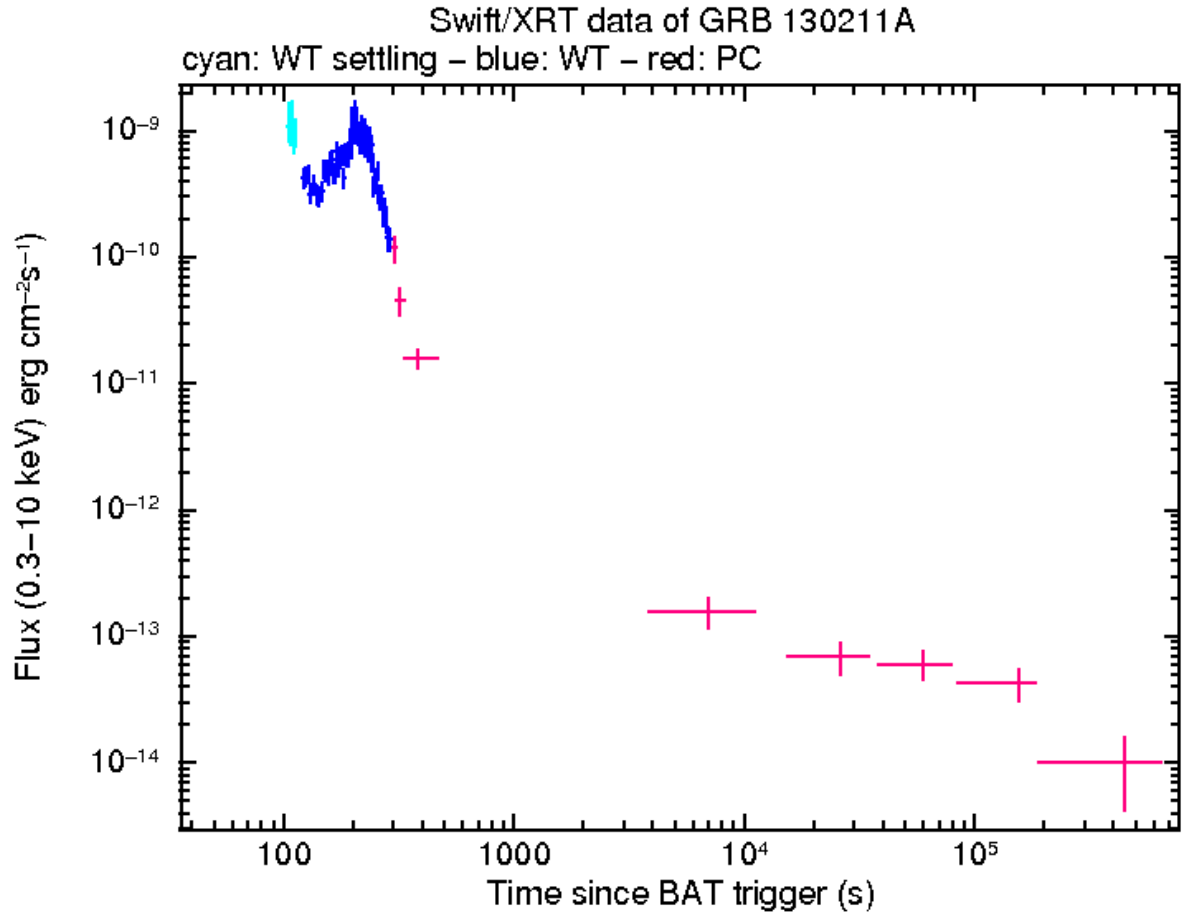


Figure 2. XRT flux light curve of GRB 130211A in the 0.3-10 keV band. The approximate conversion is $1 \text{ count s}^{-1} = 2.5 \times 10^{-11} \text{ erg cm}^{-2}$ (observed flux).

RA	Dec	Error	Note	Reference
09 ^h 50 ^m 08.68 ^s	-42°20' 32.5"	3.6"	XRT-refined	Burrows <i>et al.</i> GCN Circ. 14198
09 ^h 50 ^m 05.7 ^s	-42°19' 47.1"	2.1'	BAT-refined	Ukwatta <i>et al.</i> GCN Circ. 14197

Table 1. Positions from the *Swift* instruments.

Band	Authors	GCN Circ.	Subject	Observatory	Notes
Optical	Knust <i>et al.</i>	14196	GROND detection of the afterglow	GROND	detection

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

Filter	T _{start} (s)	T _{stop} (s)	Exp(s)	Mag
white _{FC}	125	275	147	>21.8
white	125	17061	1076	>22.9
v	4470	22933	1646	>21.7
b	3854	16303	1278	>22.4
u	284	29091	650	>21.3
w1	4880	28760	1082	>21.8
m2	4674	27853	1175	>21.6
w2	4265	22020	1968	>22.2

Table 3. UVOT Observations. 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.

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