

Swift Observations of GRB 131105A

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1. Introduction

At 02:04:44 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 131105A (trigger=576738) (Cummings *et al.* GCN Circ. [15446](#)). Swift slewed immediately to the burst. At the time of the trigger, the initial BAT position was 98° from the Sun (10.0 hours West) and 98° from the 3%-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.

Xu *et al.* (GCN Circ. [15447](#)) reported the discovery of the optical afterglow, and Xu *et al.* (GCN Circ. [15450](#)) determined a redshift of 1.686 from the VLT. **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. [15459](#)), the BAT ground-calculated position is RA, Dec = 70.973, -63.005 deg., which is RA(J2000) = $04^{\text{h}}43^{\text{m}}53.5^{\text{s}}$ Dec(J2000) = $-63^\circ00'17.7''$ with an uncertainty of 1.5 arcmin, (radius, sys+stat, 90% containment). The partial coding was 7%.

The mask-weighted light curve (**Figure 1**) shows a multi-peak structure starts at $\sim T+0$ s and ends at $\sim T+126$ s. The light curve consists of ~ 5 obvious peaks. T_{90} (15-350 keV) is 112.3 ± 4.1 s (estimated error including systematics).

The time-averaged spectrum from T+6.8 to T+125.6 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.45 ± 0.11 . The fluence in the 15-150 keV band is $7.1 \pm 0.5 \times 10^{-6}$ erg cm^{-2} , which is larger than that of 88% of the long GRBs in the Second BAT GRB Catalog (Sakamoto *et al.* 2011). The 1-s peak photon flux measured from T+116.64 s in the 15-150 keV band is 3.5 ± 0.6 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/576738/BA/.

3. XRT Observations and Analysis

Analysis of the initial XRT data was reported by Kennea *et al.* (GCN Circ. [15458](#)). We have analysed 43 ks of XRT data for GRB 131105A, from 276 s to 750.7 ks after the BAT trigger. The data comprise 7 s in Windowed Timing (WT) mode (taken while Swift was slewing), with the remainder in Photon Counting (PC) mode. The enhanced XRT position for this burst was given by Osborne *et al.* (GCN Circ. [15448](#)).

The light curve (**Figure 2**) can be modelled with a series of power-law decays. The initial decay index is $\alpha=8.0$ (+0.0, -1.1). At T+363 s the decay flattens to an α of 0.34 (+0.19, -0.21) before breaking again at T+4602 s to a final decay with index $\alpha=1.15 \pm 0.08$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of 2.25 ± 0.15 . The best-fitting absorption column is 2.4 (+0.5, -0.4) $\times 10^{21}$ cm⁻², in excess of the Galactic value of 2.9×10^{20} 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} (6.1×10^{-11}) erg cm⁻² count⁻¹.

A summary of the PC-mode spectrum is thus:

Total column: 2.4 (+0.5, -0.4) $\times 10^{21}$ cm⁻²

Galactic foreground: 2.9×10^{20} cm⁻²

Excess significance: 8.2σ

Photon index: 2.25 ± 0.15

The results of the XRT team automatic analysis are available at http://www.swift.ac.uk/xrt_products/00576738.

4. UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 131105A 295 s after the BAT trigger (De Pasquale and Cummings GCN Circ. [15454](#)). No optical afterglow consistent with the optical position (Xu *et al.* GCN Circ. [15447](#)) 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 0.03 mag. in the direction of the GRB (Schlegel *et al.* 1998).

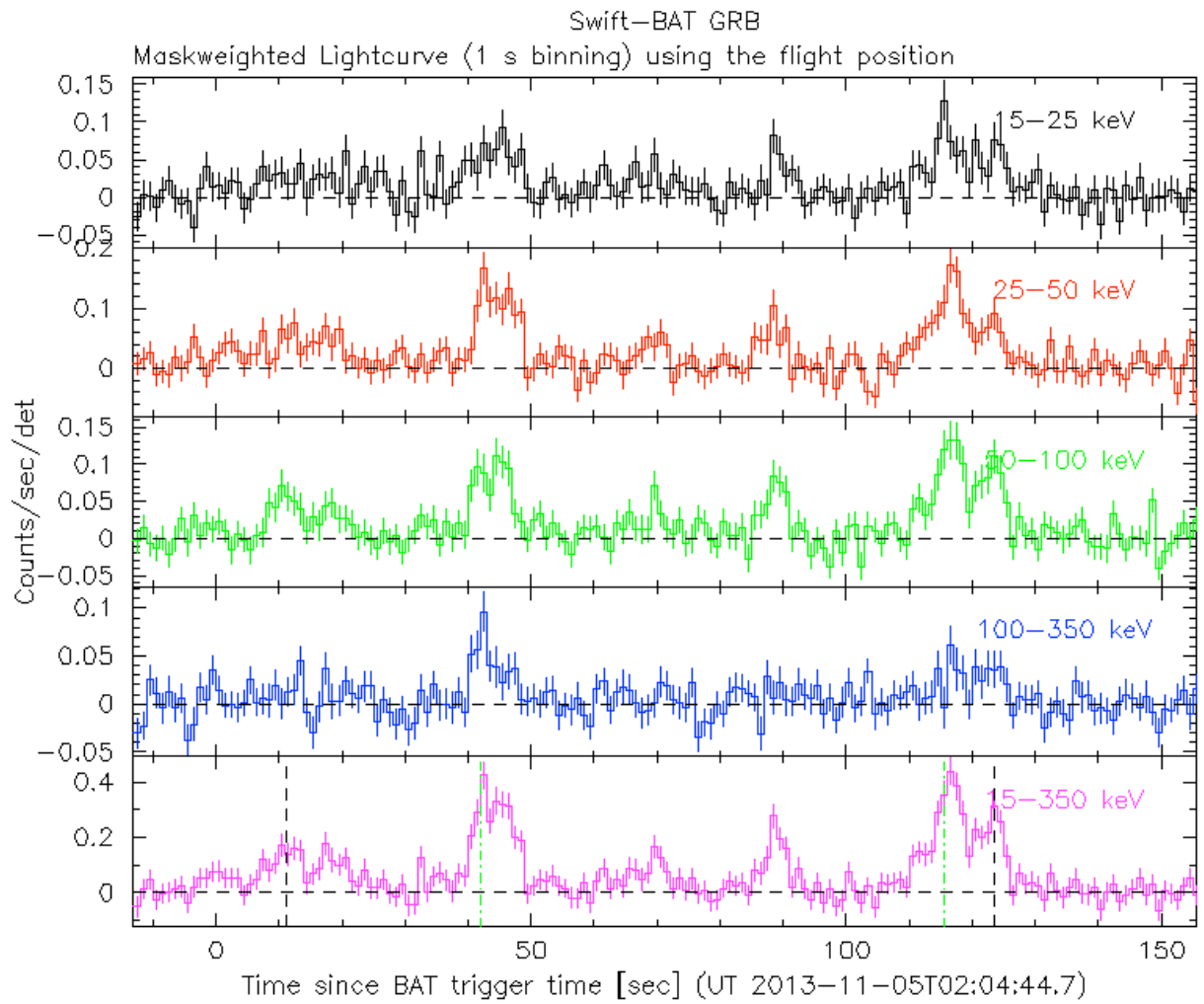


Figure 1. The BAT mask-weighted light curve in the four individual and total energy bands. The units are counts s^{-1} illuminated-detector $^{-1}$.

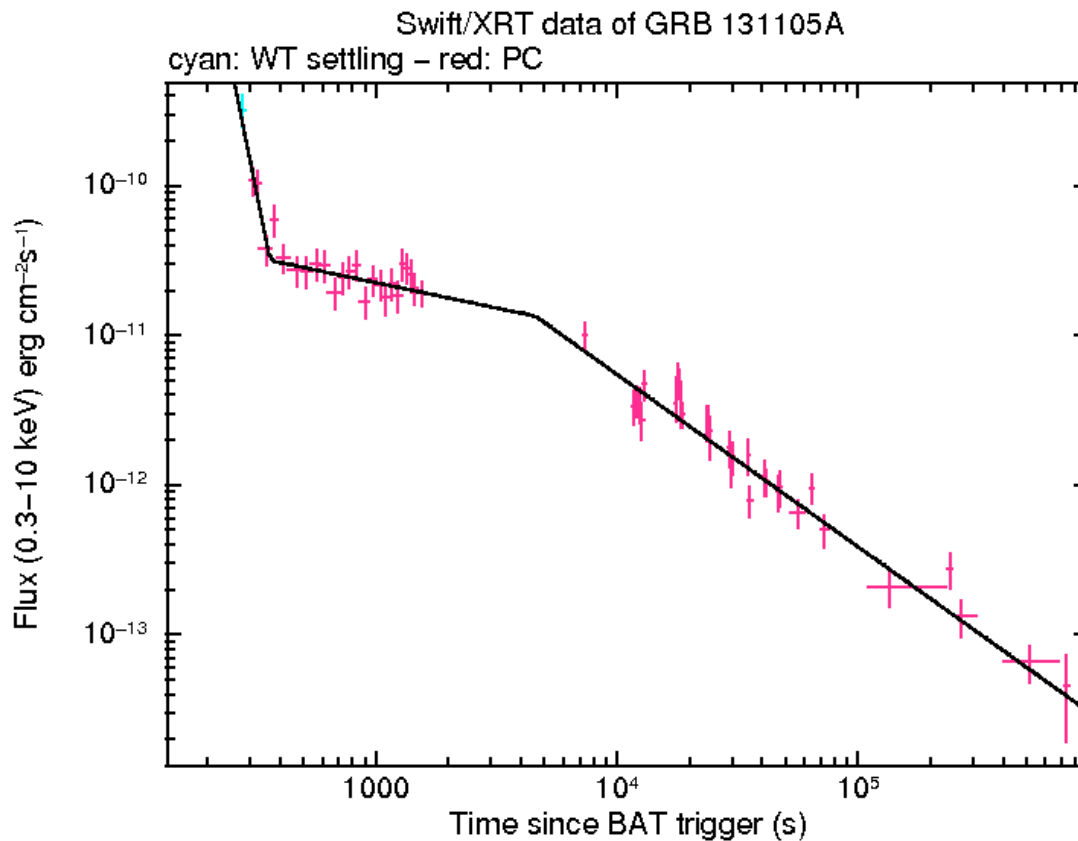


Figure 2. The XRT light curve.

RA (J2000)	Dec (J2000)	Error	Note	Reference
04 ^h 43 ^m 52.18 ^s	-62°59'42.7"	1.4"	XRT-final	UKSSDC
04 ^h 43 ^m 52.28 ^s	-62°59'42.2"	1.8"	XRT-enhanced	Osborne <i>et al.</i> GCN Circ. 15448
04 ^h 43 ^m 53.5 ^s	-63°00'17.7"	1.5'	BAT-refined	Baumgartner <i>et al.</i> GCN Circ. 15459

Table 1. Positions from the Swift instruments.

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Band	Authors	GCN Circ.	Subject	Observatory	Notes
Optical	Xu <i>et al.</i>	15447	VLT/X-shooter optical afterglow candidate	VLT	detection
Optical	Klotz <i>et al.</i>	15449	TAROT La Silla observatory optical observations	TAROT	
Optical	Xu <i>et al.</i>	15450	VLT/X-shooter redshift	VLT	redshift
Gamma-ray	Golenetskii <i>et al.</i>	15452	Konus-Wind observation	Konus-Wind	$E_{\text{peak}} = 156 \pm 38$ keV
Gamma-ray	Fitzpatrick and Jenke	15455	Fermi GBM observation	Fermi GBM	$E_{\text{peak}} = 203.9 \pm 31.1$ keV

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}	295	444	147	>21.5
white	295	1544	353	>22.0
v	774	1594	97	>19.3
b	1152	1520	58	>19.9
u	848	1495	78	>19.8
w1	823	1471	78	>19.4
m2	798	1619	39	>18.4
w2	750	1570	78	>19.5

Table 3. UVOT observations reported by De Pasquale and Cummings (GCN Circ. 15454). 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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