

# Swift Observations of GRB 121202A

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## 1. Introduction

At 04:20:05 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 121202A (trigger=540255). Swift did not slew immediately because of an Earth limb observing constraint (Oates *et al.* GCN Circ. 14032). The XRT and UVOT observed the field of view of 44 minutes after the trigger. The XRT discovered an uncatalogued X-ray source, but an optical afterglow was not detected by UVOT. The best Swift position for this burst is the Swift XRT position. The best reported positions from the BAT and XRT instruments can be found in **Table 1**. The latest XRT position can be viewed at [http://www.swift.ac.uk/xrt\\_positions](http://www.swift.ac.uk/xrt_positions).

The GRB was also observed by Fermi (Tierney, GCN Circ. 14039) and TAROT (Klotz, *et al.*, GCN Circ. 14033). A summary of GCN Circulars about this GRB from observatories other than Swift can be observed in **Table 2**.

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

The analysis of the BAT data, using the data set from T-61 to T+242 sec, was reported by Stamatikos *et al.* (GCN Circ. 14037). The BAT ground-calculated position is RA, Dec = 256.790, 23.942 deg, which is RA(J2000) = 17h 07m 09.7s Dec(J2000) = +23d 56' 32.5" with an uncertainty of 1.2 arcmin, (radius, sys+stat, 90% containment). The partial coding was 70%.

The mask-weighted light curve (**Figure 1**) shows a cluster of overlapping peaks starting at  $\sim$ T-10 s and ending at  $\sim$ T+25 s.  $T_{90}(15-350 \text{ keV})$  is  $20.1 \pm 1.9$  s (estimated error including systematics).

The time-averaged spectrum from T-2.18 to T+20.84 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is  $1.59 \pm 0.11$ . The fluence in the 15-150 keV band is  $1.2 \pm 0.1 \times 10^{-6} \text{ erg cm}^{-2}$ . The 1-s peak photon flux measured from T-0.02 s in the 15-150 keV band is  $1.2 \pm 0.2 \text{ ph cm}^{-2} \text{ s}^{-1}$ . 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/540255/BA/](http://gcn.gsfc.nasa.gov/notices_s/540255/BA/).

### 3. XRT Observations and Analysis

The XRT began observing the field of GRB 121202A at 05:07:09.7 UT, 2834.6 seconds after the BAT trigger. Analysis of the XRT data was reported by Page and Oates (GCN Circ. 14040). The XRT obtained 36.5 ks of XRT data for GRB 121202A, from 2.8 ks to 300 ks after the BAT trigger. The data comprise 16 s in Windowed Timing (WT) mode with the remainder in Photon Counting (PC) mode.

The light curve (**Figure 2**) can be modelled with a triple broken power-law decay. The light curve decays initially with an index of 0.5 (+\0.9), breaks at  $3.9 (+2.0, -0.8) \times 10^3$  s, then decays with 1.77 (+\0.10), the second break is at  $(3.1 [+0.3, -0.5]) \times 10^4$  s, then rises with -1.496 (+0.866, -0.004), the final break is at  $6.0 (+\0.7) \times 10^4$  s and the final decay index is 1.8 (+0.4, -0.3).

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of  $2.13 \pm 0.15$ . The best-fitting absorption column is  $1.36 (+0.39, -0.37) \times 10^{21}$  cm<sup>-2</sup>, in excess of the Galactic value of  $3.9 \times 10^{20}$  cm<sup>-2</sup> (Kalberla et al. 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is  $3.6 \times 10^{-11}$  ( $5.4 \times 10^{-11}$ ) erg cm<sup>-2</sup> count<sup>-1</sup>.

The results of the XRT team automatic analysis are available at [http://www.swift.ac.uk/xrt\\_products/00540255](http://www.swift.ac.uk/xrt_products/00540255).

### 4. UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 121202A 2828 s after the BAT trigger. Analysis of the UVOT data was reported by Oates (GCN Circ. 14041). No optical afterglow consistent with the XRT position (Evans et al. GCN Circ. 14038) 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 0.05 mag. in the direction of the GRB (Schlegel *et al.* 1998).

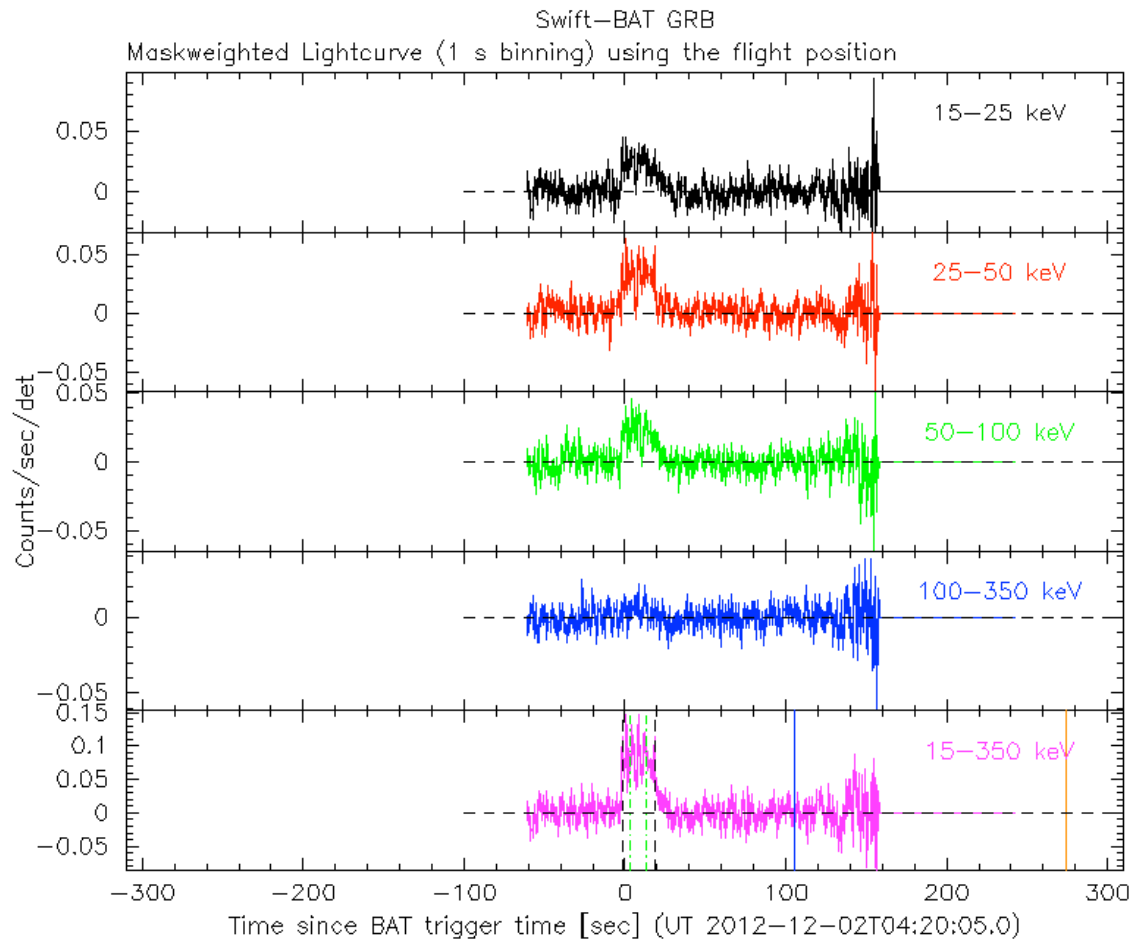


Figure 1. The BAT mask-weighted light curve in the four individual and total energy bands. The units are counts  $s^{-1}$  illuminated-detector $^{-1}$ .

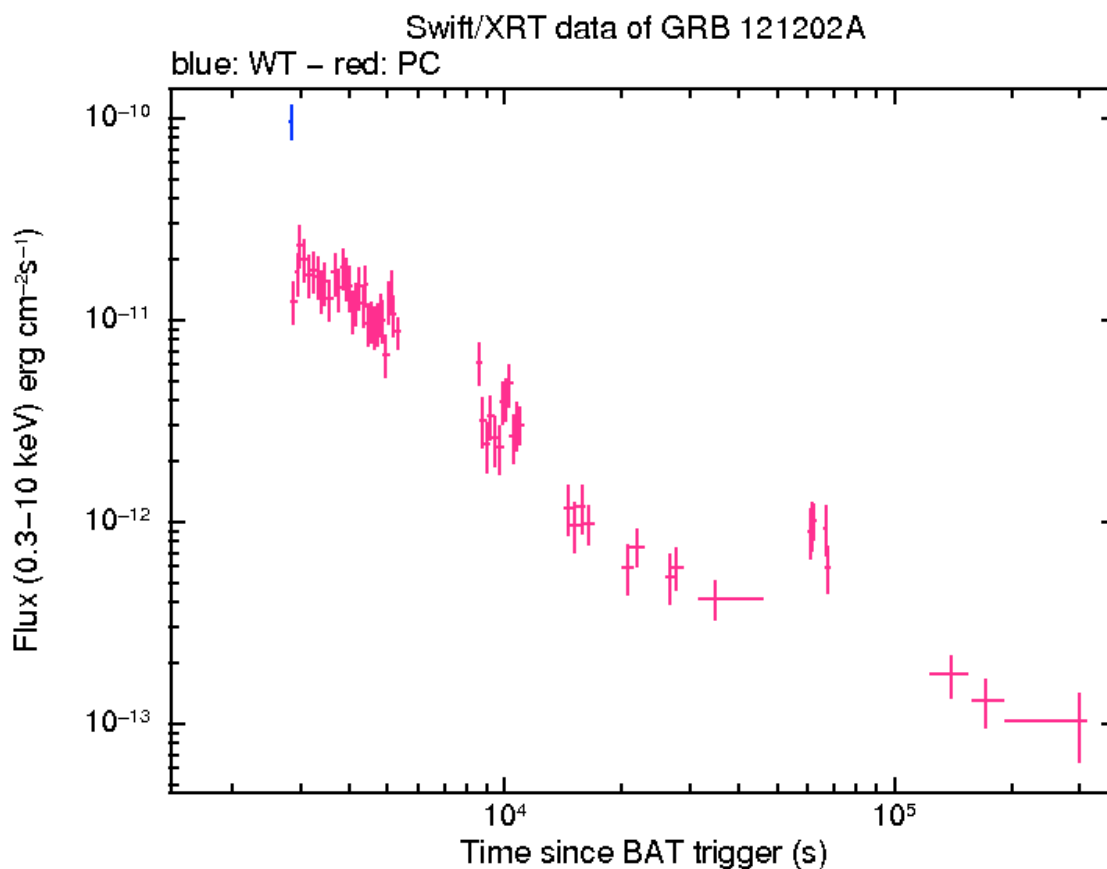


Figure 2. The XRT light curve.

RA	Dec	Error	Note	Reference
17 <sup>h</sup> 07 <sup>m</sup> 11.25 <sup>s</sup>	+23°56' 53.4"	1.4"	XRT-enhanced	Evans <i>et al.</i> GCN Circ. 14038
17 <sup>h</sup> 07 <sup>m</sup> 09.7 <sup>s</sup>	+23°56' 32.5"	1.2'	BAT-refined	Stamatikos <i>et al.</i> GCN Circ. 14037

Table 1. Positions from the Swift instruments.

<b>Band</b>	<b>Authors</b>	<b>GCN Circ.</b>	<b>Observatory</b>	<b>Notes</b>
Optical	Klotz <i>et al.</i>	14033	TAROT	upper limits
Gamma-ray	Tierney	14039	Fermi GBM	detection

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

<b>Filter</b>	<b>T_start(s)</b>	<b>T_stop(s)</b>	<b>Exp(s)</b>	<b>Mag</b>
<i>white<sub>FC</sub></i>	2828	2978	147	>20.3
<i>white</i>	2828	5033	541	>21.0
<i>v</i>	3808	16147	1205	>20.2
<i>b</i>	3192	22680	1059	>20.9
<i>u</i>	2987	28451	2637	>21.2
<i>w1</i>	4218	27811	2853	>21.4
<i>m2</i>	4012	26905	2713	>21.5
<i>w2</i>	3603	31934	1549	>21.2

Table 3. UVOT Observations. 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.

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