Swift Observations of GRB 120521A

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1   Introduction

At 05:59:42 UT on 2012-05-21, the Swift Burst Alert Telescope (BAT) triggered and located the short hard GRB 120521A (trigger=522578). Swift slewed immediately to the burst and found a fading uncatalogued X-ray source (Chester et al., *GCN Circ.* 13302).

The best *Swift* position of this burst is the Swift XRT position given in Goad et al. (*GCN Circ.* 13304) with RA-2000 = 09h 54m 53.91s, and Dec-2000 = $-49° 25' 02.4''$ with an uncertainty of $1.9''$ (radius, 90% confidence).

Optical follow-up observations of this burst were only reported by TAROT and GROND (Klotz et al. *GCN Circ.* 13303 and Rossi et al. cir13335, respectively) which did not detect an optical afterglow of the burst. In addition, GRB 120521A was also observed by the Australia Telescope Compact Array at 34GHz, however, no source detected at the position of GRB 120521A (Hancock et al. *GCN Circ.* 13338).

2   BAT Observation and Analysis

At 05:59:42 UT on 2012-05-21, the Swift Burst Alert Telescope (BAT) triggered and located GRB 120521A (trigger=522578, Chester et al., *GCN Circ.* 13302). Using the data set from T-239 to T+363 s, the BAT ground-calculated position is RA, Dec = 148.692, -49.422 deg which is

RA(J2000) = 09h 54m 46.1s

Dec(J2000) = $-49° 25' 17.8''$

with an uncertainty of 1.7 arcmin, (radius, sys+stat, 90% containment). The partial coding was 100% (Cummings et al. *GCN Circ.* 13310).

The mask-weighted light curve (Figure 1) shows a FRED pulse starting at T-0.0 s, peaking at T+0.1 s, and ending at T+1.0s. The T_{90} (15-350 keV) is 0.45±0.08 s (estimated error including systematics).

The time-averaged spectrum from T+0.02 to T+0.56 s is best fit by a single power law. This fit gives a photon index of 0.98±0.22 ($\chi^2 = 50.0$ for 57 d.o.f.). For this model the total fluence in the 15-150 keV band is 7.8 ±1.1 × 10^{-8} erg cm^{-2}. The 1s peak flux measured from T-0.21 s in the 15-150 keV band is 0.9 ±0.1 photons 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/522578/BA/.

3   XRT Observations and Analysis

The XRT began observing the field of GRB 120521A at 06:00:56.6 UT on 2012-05-21, 73.8 seconds after the BAT trigger. Using 508 s of XRT Photon Counting mode data and 1 UVOT image for GRB 120521A, Goad et al. (*GCN Circ.* 13304) found an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA, Dec = 148.72462, -49.41733 which is equivalent to:

RA (J2000): 09h 54m 53.91s

Dec (J2000): $-49° \ 25' \ 02.4''$

with an uncertainty of $1.9''$ (radius, 90% confidence). The latest position can be viewed at http://www.swift.ac.uk/xrt_positions. Position enhancement is described by Goad et al. (2007, A&A, 476, 1401) and Evans et al. (2009, MNRAS, 397, 1177).

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of $\Gamma = 1.57^{+0.31}_{-0.30}$. The absorption column is consistent with the Galactic value of 2.1×10^{21} cm^{-2} (Kalberla et al. 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is 4.6×10^{-11} (6.3×10^{-11}) erg cm^{-2} count^{-1}.

The $0.3 - 10$ keV light curve given below (Fig.2) can be modeled by a broken power-law model, with a decay slope during the plateau phase of $\alpha_2 = 0.00 \pm 0.80$, a break after the plateau phase at $T_{\mathrm{break},2} = 250 \pm 15$ s. The decay slope after the plateau phase is only defined by one data point and can therefore not be constrained.

The results of the XRT-team automatic analysis are available at

http://www.swift.ac.uk/xrt_products/00522578.

4   UVOT analysis

The Swift/UVOT began observations of the field of GRB 120521A 77 s after the BAT trigger (Chester et al., *GCN Circ.* 13302). with the finding chart in the white filter. Oates & Chester (*GCN Circ.* 13312) reported that no source was detected in the initial UVOT exposures. The 3σ upper limits for the summed images are listed in Table 1.

Filter	T_{Start}	T_{stop}	Exposure	Mag
white_FC	77	227	147	>21.4
u_FC	289	539	246	>20.9
white	77	5491	363	>21.9
v	4266	5901	393	>19.7
b	545	11343	766	>21.9
u	289	10775	1386	>21.6
w1	4676	6312	393	>20.4
m2	4470	6106	393	>20.6
w2	4061	5697	393	>20.2

Table 1: 3σ upper limits from UVOT observations of GRB 120521A. The quoted values have not been corrected for the expected Galactic extinction along the line of sight of $E_{\text{B}-\text{V}} = 0.43$ mag (Schlegel et al., 1998). All photometry uses the UVOT photometric system as described in Poole et al. (2008, MNRAS, 383, 627) and Breeveld et al. (2011, AIP Conf. Proc., Vol. 1358, 373)
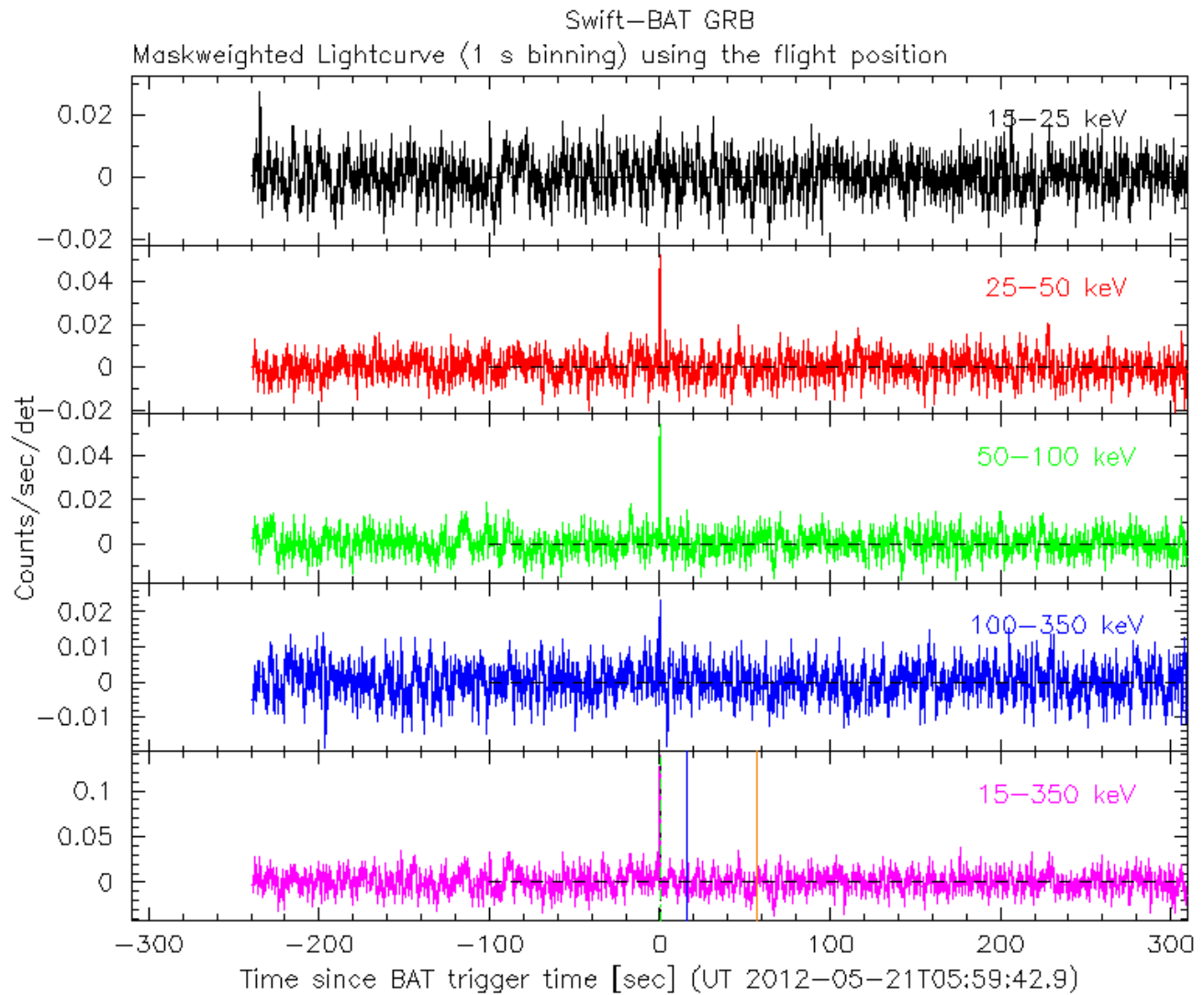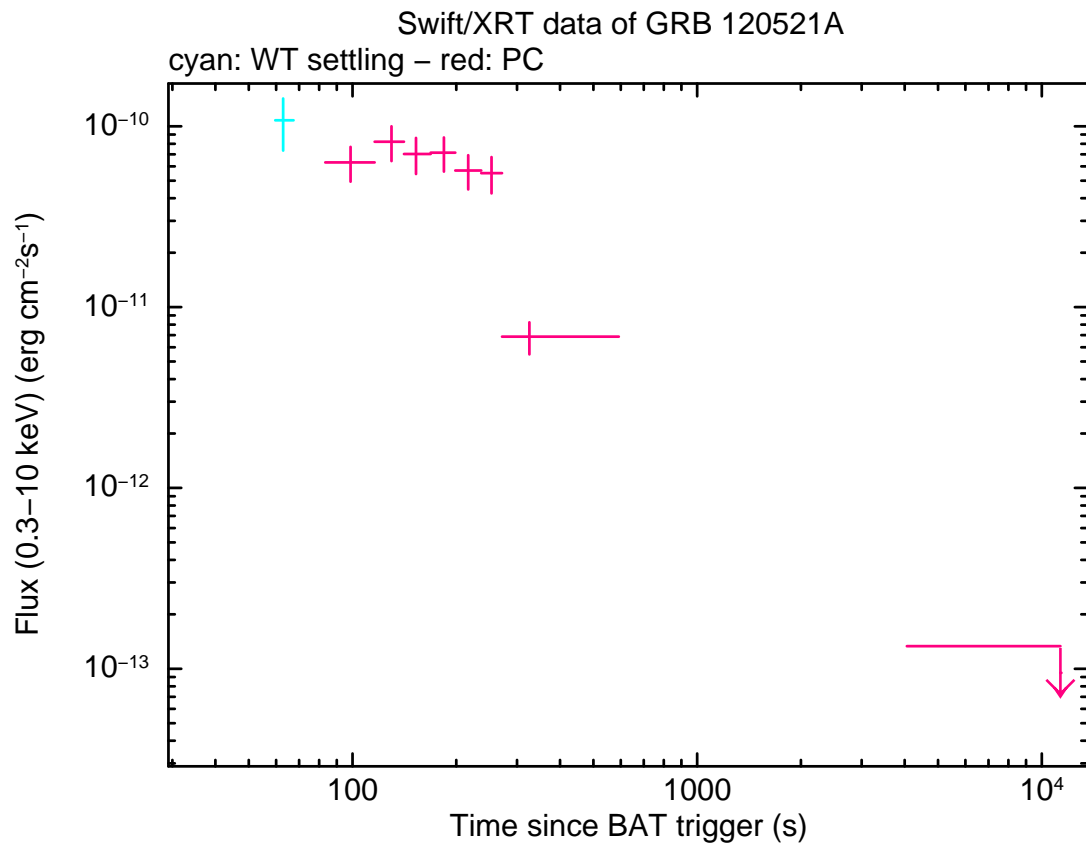
Figure 1: BAT Light curve of GRB 120521A.

Figure 2: XRT flux light curve of GRB 120521A in the 0.3-10 keV band. The approximate conversion is 1 count s^{-1} = $\sim 4.6 \times 10^{-11}$erg s^{-1} cm^{-2}.