Swift Observations of GRB 120102A

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1. INTRODUCTION

At 02:15:55 UT the Swift Burst Alert Telescope (BAT) triggered on GRB 120102A (trigger 510922). Swift slewed immediately to the burst and found a bright, uncatalogued X-ray source and an optical afterglow (Marshall *et al*. GCN Circ. 12794). The best Swift position for this burst is the UVOT position (Breeveld & Marshall GCN Circ. 12796) of RA (J2000) = 18h 24m 53.89s and Dec (J200) = 24° 42' 47.1" with an uncertainty of 0.51".

The GRB was poorly placed for ground-based optical observations, and no ground-based circulars had been submitted as of January 13, 2012.

Standard analysis products for this burst are available at http://gcn.gsfc.nasa.gov/swift_gnd_ana.html.

2) BAT OBSERVATION AND ANALYSIS

The BAT ground-calculated position (Markwardt *et al*. GCN Circ. 12799) is RA (J2000) = 18h 24m 53.8s and Dec (J2000) = 24° 42' 46.7" with an uncertainty of 1.0' (90% containment radius including both statistical and systematic errors).

The mask-weighted light curve (Figure 1) shows a weak peak starting at T+0 sec and returning to baseline at T+20 sec. The main emission starts at ~T+25 sec with 2, or possibly 3, overlapping peaks with the peak emission at T+33 sec. The emission then decays in an approximately exponential fashion out to at least 510 sec. T_{90} (15-350 keV) is 38.7 ± 3.5 sec (estimated error including systematics).

The time-averaged spectrum from T+0.77 to T+53.94 sec is best fit by a simple power-law model. The power law index is 1.59 ± 0.05. The fluence in the 15-150 keV band is $4.3 \pm 0.1 \times 10^{-6}$ erg cm^{-2}. The 1-sec peak photon flux measured from T+32.75 sec in the 15-150 keV band is 10.3 ± 0.4 ph cm^{-2} sec^{-1}. All the quoted errors are at the 90% confidence level.

3. XRT OBSERVATIONS AND ANALYSIS

The XRT began observing GRB 120102A about 119 sec after the BAT trigger (Littlejohns *et al*. GCN Circ. 12797). 240 sec of data were taken in Windowed Timing (WT) mode, and the remainder was taken in Photon Counting (PC) mode. The best XRT position is RA (J2000) = 18h 24m 53.93s and Dec (J200) = 24° 42' 48.7" with an uncertainty of 1.8" (Beardmore *et al*. GCN Circ. 12795). The late-time light curve (after T+4.5 ks) can be modeled as an initial power-law decay with a decay index of 1.99 (+0.27, - 0.11) followed by a break at T+13.0 ks to an index of 0.97 (+0.27, -0.22).

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of 2.04 ± 0.08. The best-fitting absorption column is 2.59 (+0.26, -0.25) x 10^{21} cm^{-2}, in excess of the Galactic value of 1.0 x 10^{21} cm^{-2} (Kalberla *et al*. 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced for this spectrum is 4.0 x 10^{-11} (6.2 x 10^{-11}) erg cm^{-2} count^{-1}.

4. UVOT OBSERVATIONS AND ANALYSIS

UVOT began settled observations of the GRB 120102A 121 sec after the BAT trigger, and a fading afterglow was detected in the initial UVOT exposures (Marshall *et al*. GCN Circ. 12794; Breeveld & Marshall GCN Circ. 12796). The preliminary detections and 3-σ upper limits using the UVOT photometric system (Breeveld *et al*. 2011, AIP Conf. Proc., 1358, 373) are given in Table 1. No correction has been

made for the expected extinction in the Milky Way corresponding to a reddening of E_{B-V} of 0.13 mag. in the direction of the GRB (Schlegel *et al*. 1998).

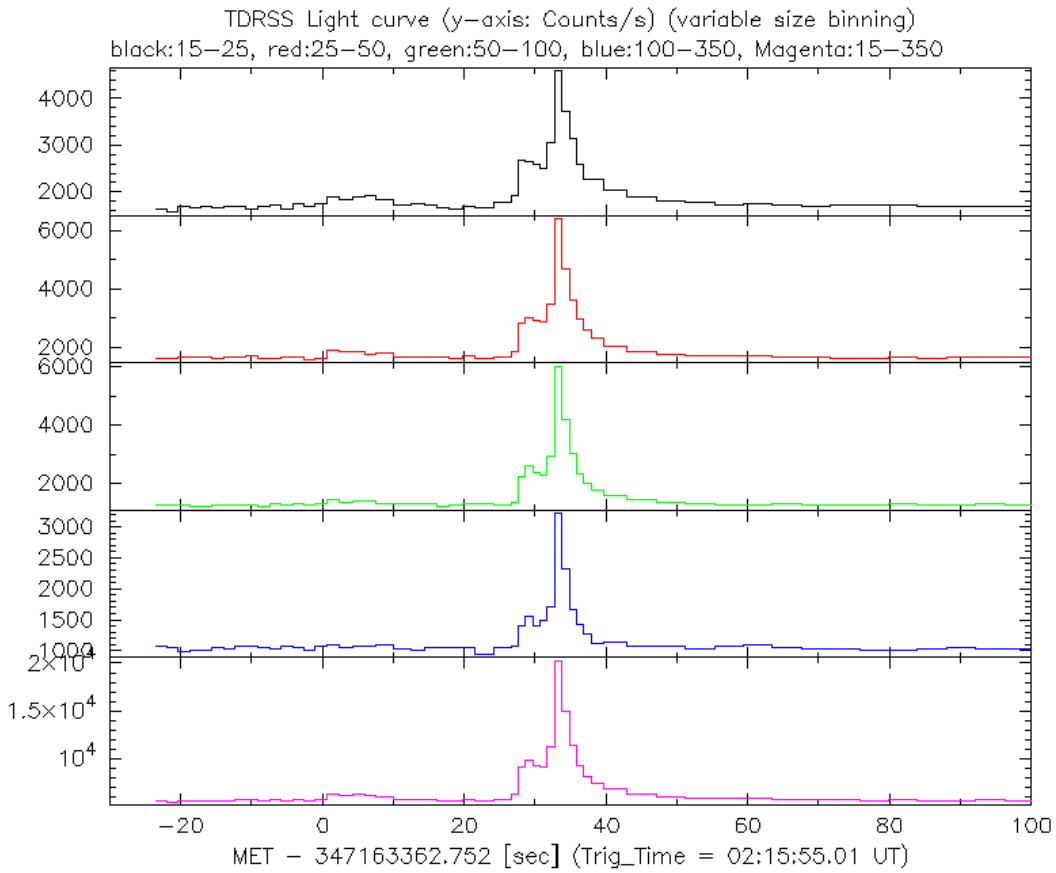

Figure 1: The BAT light curve in multiple energy bands.

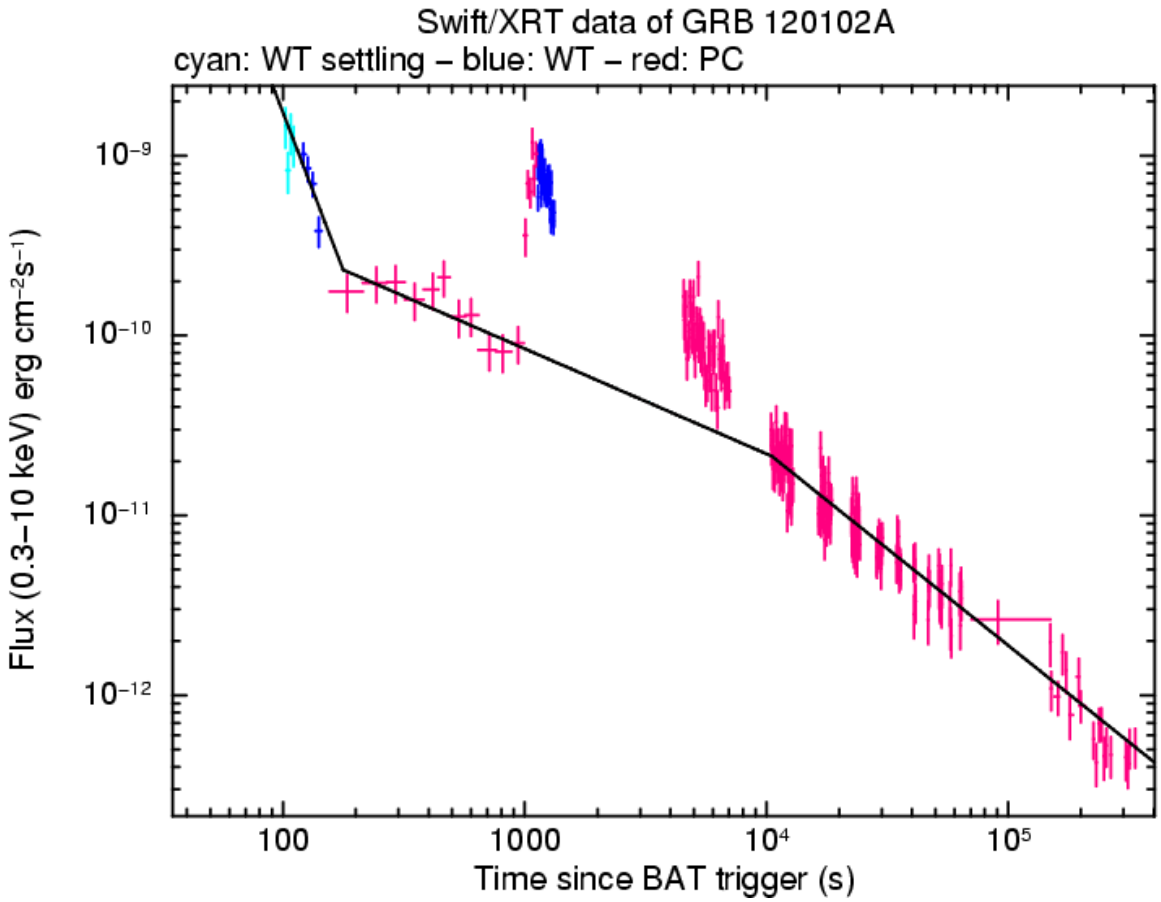

Figure 2: The XRT light curve.

Filter	T_{start}	T_{stop}	Exposure	Magnitude
	(seconds)	(seconds)	(seconds)	
white (FC)	121	271	147	18.10 ± 0.06
white	788	1014	167	19.9 ± 0.2
v	663	1239	78	18.16 ± 0.31
b	589	11310	1147	>20.8
u	334	583	246	18.52 ± 0.14
uvw1	713	6983	452	>20.2
uvm2	688	6778	452	>20.1
uvw2	639	12879	1112	>20.9

Table 1: UVOT Observations. The start and stop times of the exposures are given in seconds since the BAT trigger. The preliminary detections and 3-σ upper limits are given. No correction has been made for the expected extinction in the Milky Way (Schlegel *et al*. 1998).