

## Swift Observation of GRB 120815A

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### 1 Introduction

BAT triggered on the long GRB 120815A at 02:13:58 UT (Trigger 531003) (Pagani, *et al.*, *GCN Circ.* 13645), a burst with  $T_{90} = 9.7 \pm 2.5$  sec. *Swift* slewed to the burst at T+45 minutes due to an observing constraint. The afterglow was detected in XRT and UVOT observations starting 2.7 ksec after the trigger. (Kennea, *et al.*, *GCN Circ.* 13647; Holland, *et al.*, *GCN Circ.* 13666). The optical afterglow was also detected in observations by the GROND telescope (Sudilovsky *et al.*, *GCN Circ.* 13648). The spectroscopic redshift of this burst is  $z = 2.358$ , measured using the VLT/X-shooter spectrograph (Malesani, *et al.*, *GCN Circ.* 13649).

### 2 BAT Observation and Analysis

Using the data set from  $T - 239$  to  $T + 963$  sec, further analysis of BAT GRB 120815A has been performed by the *Swift* team (Markwardt, *et al.*, *GCN Circ.* 13652). The BAT ground-calculated position is  $RA(J2000) = 273.976deg$  (18h15m54.4s),  $Dec(J2000) = -52.125deg$  ( $-52d07'29.0''$ )  $\pm 1.8$  arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 28%.

The mask-weighted light curve (Fig.1) shows a FRED pulse starting at  $\sim T-0.3$  sec, peaking at  $\sim T+0.5$  sec, and ending at  $\sim T+30$  sec.  $T_{90}(15-350keV)$  is  $9.7 \pm 2.5$  sec (estimated error including systematics).

The time-averaged spectrum from  $T - 0.24$  to  $T + 11.97$  sec is best fitted by a simple power law model. The power law index of the time-averaged spectrum is  $2.29 \pm 0.23$ . For this model the total fluence in the 15 – 150 keV band is  $(4.9 \pm 0.7) \times 10^{-7} ergs/cm^2$ , and the 1-sec peak flux measured from  $T + 0.17$  sec in the 15 – 150 keV band is  $2.2 \pm 0.3 ph/cm^2/sec$ . All the quoted errors are at the 90% confidence level considering the statistical and usual systematic effects.

The results of the batgrbproduct analysis are available at:

[http://gcn.gsfc.nasa.gov/notices\\_s/531003/BA/](http://gcn.gsfc.nasa.gov/notices_s/531003/BA/)

### 3 XRT Observation and Analysis

Using 1694 sec of overlapping XRT Photon Counting mode data and 6 UVOT images for GRB 120815A, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue):  $RA(J2000) = 273.95807deg$  (18h15m49.94s),  $Dec(J2000) = -52.13142 deg$  ( $-52d07'53.1''$ )  $\pm 1.6$  arcsec (radius, 90% confidence) (Goad, *et al.*, *GCN Circ.* 13650).

The 0.3 – 10 keV light curve (Fig.2) can be modeled by a power-law decay with index of  $0.90 \pm 0.07$ .

The X-ray spectrum formed from the Photon Counting mode data can be fitted with an absorbed power-law with a photon spectral index of  $1.85 \pm 0.12$  and a best-fitting absorption column of  $(5.5_{-3.8}^{+4.2}) \times 10^{21} cm^{-2}$ , at a redshift of 2.358, in addition to the Galactic value of  $8.6 \times 10^{20} cm^{-2}$  in that direction (Kalberla et al. 2005). The average absorbed flux over 0.3–10 keV for the PC spectrum is  $(5.86_{-0.43}^{+0.46}) \times$

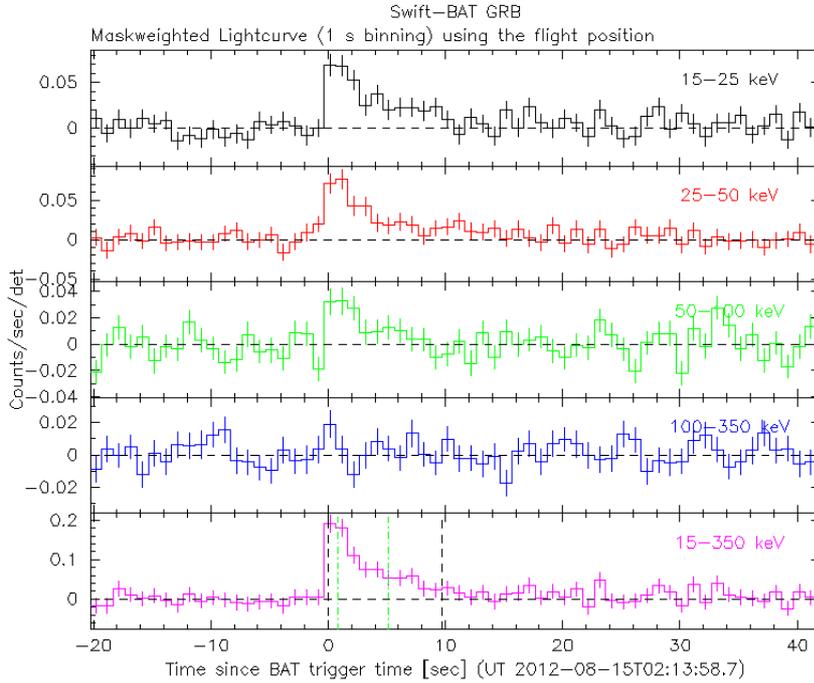


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and  $T_0$  is 02:13:58.7 UT.

$10^{-12}$  ergs/cm<sup>2</sup>/sec, which corresponds to an unabsorbed flux of  $(7.42^{+0.46}_{-0.44}) \times 10^{-12}$  ergs/cm<sup>2</sup>/sec.

## 4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 120815A 2672 sec after the BAT trigger (Holland *et al.*, *GCN Circ.* 13666).

The optical afterglow is detected at position:

$$\text{RA}(J2000) = 273.95783\text{deg} \ (18h15m49.88s), \text{Dec}(J2000) = 52.13114 = \text{deg} \ (-52d07'52.1''),$$

and an estimated uncertainty of 0.6 arcsec (radius, 90% confidence, statistical + systematic), consistent with the XRT enhanced position.

Source magnitudes and  $3\sigma$  upper limits of the afterglow are reported in Table 1. The afterglow is 4.27 arcsec northeast of the USNO-B1.0 source 0378-0977505, so the following photometry should be considered preliminary. These values are on the UVOT Photometric System described in Poole *et al.* (2008, *MNRAS*, 383,627). These values are not corrected for the Galactic extinction in the direction of the burst corresponding to a reddening of  $E_{B-V} = 0.10$  mag (Schlafly *et al.*, *ApJS*. 737, 103, 2011).

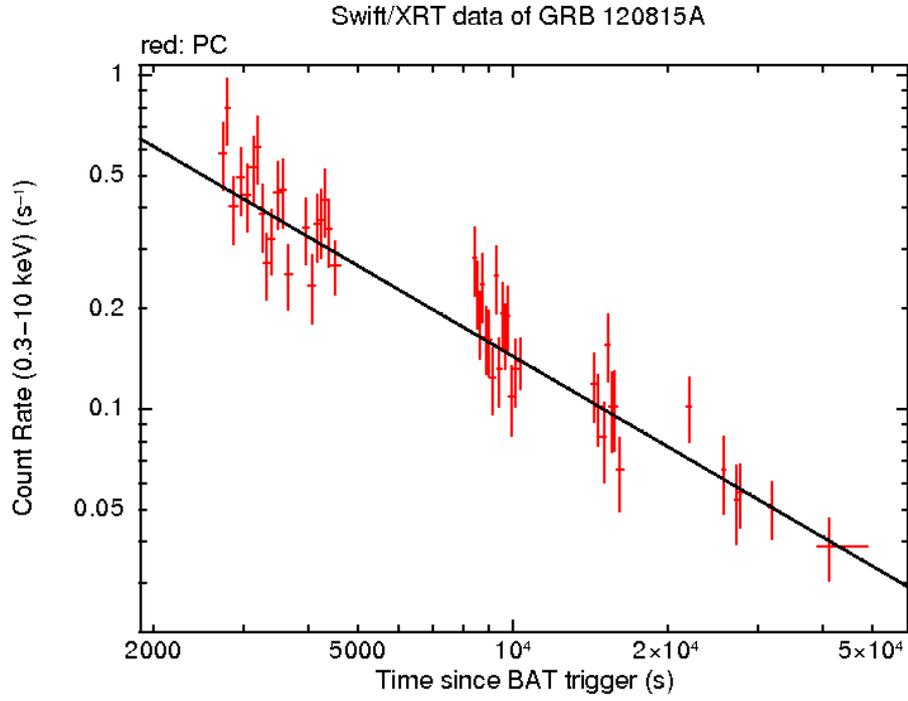


Figure 2: XRT Lightcurve. Counts/sec in the 0.3-10 keV band. The approximate conversion is 1 count/sec =  $\sim 3.9 \times 10^{-11}$  *ergs/cm<sup>2</sup>/sec*.

Filter	$T_{start}$	$T_{stop}$	Exposure	Mag	Sigma
V	2847	3046	100	$19.34 \pm 0.29$	3.9
B	3667	4120	226	$20.11 \pm 0.24$	4.7
U	3462	3661	100	> 20.5	
UVW1	3257	3457	100	> 20.2	
UVM2	3052	3252	100	> 19.9	
UVW2	4330	4530	100	> 20.3	
White	2690	2840	75	$19.94 \pm 0.19$	5.8

Table 1: Magnitudes from UVOT observations.