Swift Observations of GRB 121229A

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1 Introduction

BAT triggered and located GRB 121229A on 2012 December 29 (Trigger 544347) (Sonbas, *et al.*, 2012, *GCN Circ.* 14115). Since this is an image trigger, the BAT light curve does not show any particular structure. The peak count rate was 1000 counts/sec (15-350 keV), at 5 sec after the trigger. The mask-weighted light curve shows a broad structure beginning at least at T-60 seconds and lasting until T+60 sec.

XRT follow-up observations started $T + 145.9$ *sec* after the BAT trigger. A bright uncatalogued X - ray source located at a position as; RA, DEC (J2000) = 12h 40m 23.41s, -50d 35′ 37.2″ with and uncertainty of 4.1 arcsec (radius, 90% confidence). The initial X - ray flux in the 2.5 s image was 1.21e-09 erg cm-2 s-1 (0.2-10keV).

GRB 121229A also observed by Skynet/PROMPT observed the field and provide upper limits in B,R,I filters (LaCluyze *et al.*, 2012, *GCN Circ.* 14116). Source detected by GROND in g′, r′, i′, z′, J, H and upper limit provided in K. Fynbo *et al.*, (2012 *GCN Circ.* 14120) reported z=2.707 using Lyman-beta and -alpha features from VLT/X-shooter spectrum. The field also observed by MAXI/GSC and detected an uncatalogued X - ray source consistent with XRT position. The averaged X-ray flux were calculate as 103 ± 23 mCrab (2-20 keV) (Nakahira *et al.*, *GCN Circ.* 14118).

2 BAT Observation and Analysis

Using the data set from $T-60.0$ to $T+243.0$ *sec*, analysis of BAT GRB 121229A has been performed by Swift team (Krimm, *et al.*, *GCN Circ.* 14123). The BAT ground-calculated position is RA($J2000$) = 190.095° ($12h40m22.7s$), Dec($J2000$) = -50.588° (-50d35′16.9″) ± 2.8 *arcmin*, (radius, systematic and statistical, 90% containment). The partial coding was 39%.

The mask-weighted light curve shows a broad structure beginning (Fig.1) starting at $\sim T - 60$ sec and ending at $\sim$ T+60 sec. T_{90} could not be calculated accurately. It is reported as 100 secs.

The time-averaged spectrum from $T + 0.00$ to $T + 64.00$ sec is best fit by a simple power law. The power law index of the time-averaged spectrum is 2.43 ± 0.46. For this model the total fluence in the 15-150 keV band is $4.6 \pm 1.3 \times 10^{-7}$ erg cm^{-2} and the 1-sec peak flux measured from T+0.00 sec in the 15-150 keV band is 0.1 ± 0.0 ph cm^{-2} sec^{-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/544347/BA/`.

3 XRT Observations and Analysis

13 ks of XRT were analysed for GRB 121229A from 1357 s to 68.4 ks after the BAT trigger. The data comprise 438 s in Windowed Timing (WT) mode with the remainder in Photon Counting (PC) The enhanced XRT position is RA(J2000) = 12h 40m 24.31s, Dec(J2000) = -50d 35′ 38.9″ ± 1.8 ″ (90% confidence).

The late time (T0+3.9 ks) light curve (Fig.2) can be modelled with power-law with a decay index of α =0.23 ($^{+0.20}_{-0.22}$).

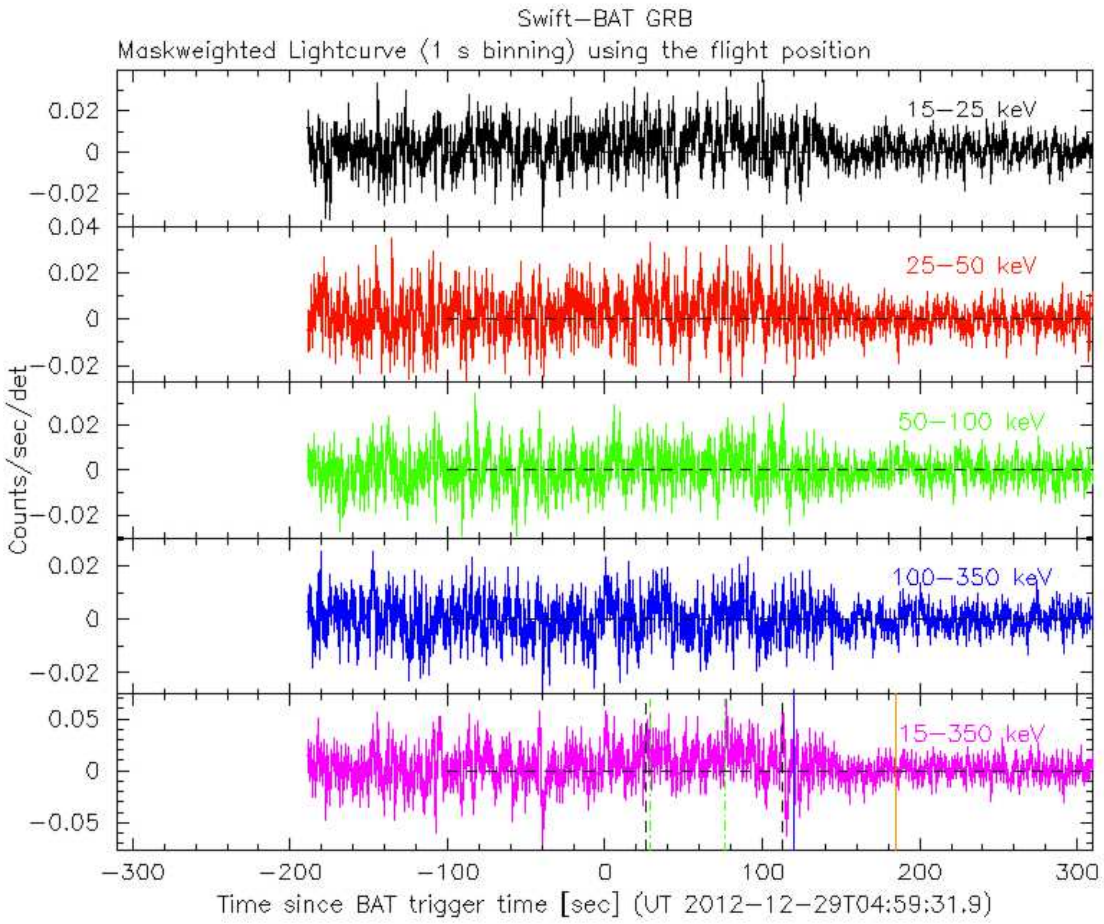

Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts $\sec^{-1}$illuminated-detector^{-1} and T_0 is 04:59:31.9 UT.

A spectrum formed from the WT mode data can be fitted with an absorbed power-law with a photon spectral index of $2.14(^{+0.05}_{-0.05})$. The best-fitting absorption column is $1.62(^{+0.24}_{-0.23}) \times 10^{22} cm^{-2}$, at a redshift 2.707, in addition to the Galactic value of $1.4 \times 10^{21} cm^{-2}$ (Kalberla et al. 2005). The PC mode spectrum has a photon index of $2.14(^{+0.33}_{-0.13})$ and a best-fitting absorption column consistent with the Galactic value. The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is $3.4 \times 10^{-11} (4.8 \times 10^{-11}) erg\ cm^{-2}\ count^{-1}$.

The results of the XRT-team automatic analysis are available at
`http://www.swift.ac.uk/xrt products/00544347`.

4 UVOT Observation and Analysis

The Swift/UVOT began settled observations of the field of GRB 121229A, 155 s after the BAT trigger (Trigger 544347, Sonbas et al., *GCN Circ.* 14115).

No optical afterglow consistent with the optical position (Varela et al., *GCN Circ.* 14117) is detected in the initial UVOT exposures. Preliminary 3-sigma upper limits using the UVOT photometric system (Breeveld et al. 2011, AIP Conf. Proc. 1358, 373) for the first finding chart (FC) exposure and subsequent exposures are shown in the Table 1.

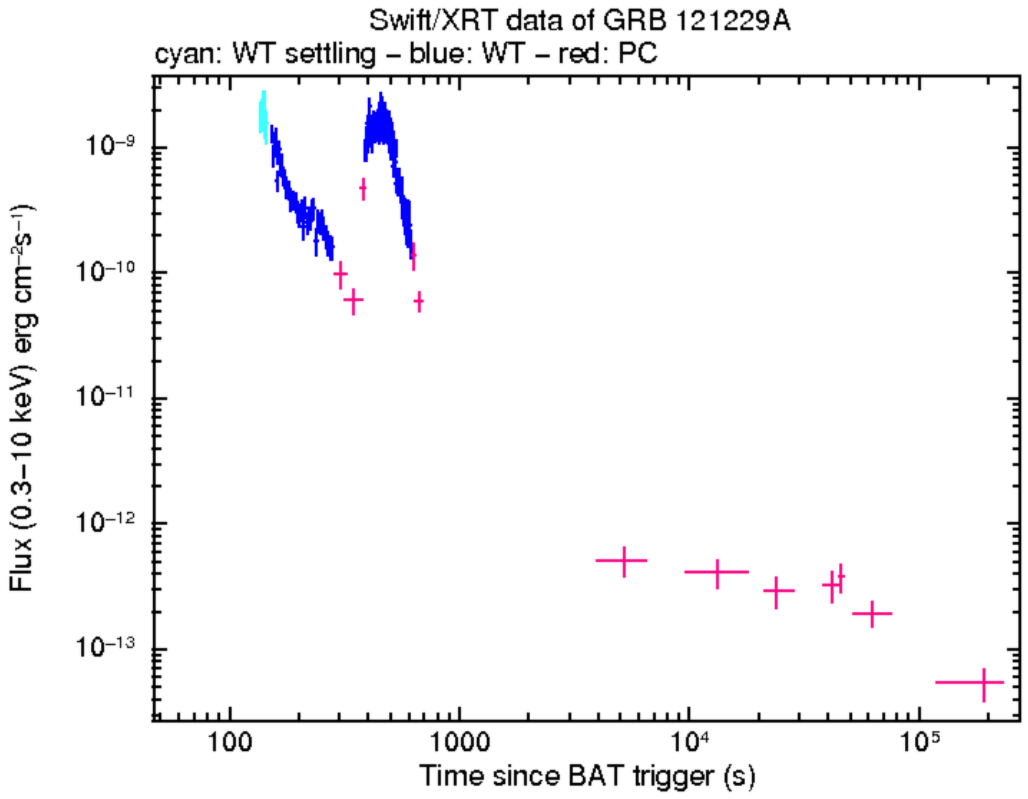

Figure 2: XRT Lightcurve in the 0.3-10 keV band: Windows Timing mode (blue) and Photon Counting mode (red). The conversion factor for this burst is 1 count = 3.4×10^{-11} $erg\ cm^{-2}$.

References

[1] Breeveld, A. A. et al. 2011, AIP Conf. Proc. 1358, 373

[2] Fynbo, J. P. U. et al. 2012, GCN Circ. 14120

[3] Kalberla, P. M. et al. 2005, A&A 440, 775

[4] LaCluyze, A. et al. 2012, GCN Circ. 14116

[5] Nakahira, S. et al. 2012 GCN Circ. 14118

[6] Schlegel, D. J. et al. 1998, ApJ. v.500, p.525

[7] Sonbas, E. et al. 2012, GCN Circ. 14115

[8] Varela, K. et al. 2012, GCN Circ. 14117

Filter	T_{Start}	T_{Stop}	Exposure (s)	Mag.
WHITE-FC	155	305	147	> 20.9
u-FC	314	563	246	>19.9
WHITE	155	6156	363	>21.2
v	644	6466	116	>18.9
b	570	5952	216	>20.5
u	314	5747	442	>20.1
uvw1	3947	4136	186	>20.0
uvm2	670	690	19	>17.6
uvw2	620	6362	216	>20.1

Table 1: Magnitude limits from UVOT observations .The magnitudes in the table are not corrected for the Galactic extinction due to the reddening of E(B-V) = 0.16 in the direction of the burst (Schlegel et al. 1998).