Swift Observations of GRB 120911A

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1 Introduction

At 07:08:33 UT, the BAT triggered and located GRB 120911A (trigger=533268). *Swift* could not immediately slew due to the Earth limb constraint. The BAT on-board calculated location is RA, Dec = (357.961, +63.099) deg, which is {23h 51m 51s; +63d 05' 55"} (J2000) with $\sigma = 3$ arcmin (radius, 90% containment, including systematic uncertainty). The BAT light curve showed a complex structure with a duration of > 30 s. The peak count rate was ~ 2500 c s^{-1} ($15 - 350$ keV), at ~ 1 s after the trigger.

The XRT began observing the field of GRB 120911A at 08:04:07.0 UT, 3333.2 s after the BAT trigger. Using promptly downlinked data we find an uncatalogued X-ray source located at RA, Dec = (357.98152, 63.09831) which is: {23h 51m 55.56s; +63d 05' 53.9"} (J2000) with an uncertainty of 4.4 arcsec (radius, 90% containment). This location is 33 arcsec from the BAT onboard position, within the BAT error circle. A power-law fit to a spectrum formed from promptly downlinked event data gives a column density consistent with the Galactic value of 6.66×10^{21} cm^{-2} (Kalberla et al. 2005).

The burst was also seen by *Fermi* GBM ($T_0 = $ 07:08:33.99 UT; Gruber et al. GCN Circ. 13754). The GBM light curve consists of two pulses with a duration (T_{90}) of about 22 s ($50 - 300$ keV). The time-averaged spectrum from $T_0 - 4.6$ s to $T_0 + 22.0$ s is best fit by a power law function with an exponential high-energy cutoff. The power law index is -0.36 ± 0.26 and the cutoff energy, parameterized as E_{peak}, is 64.2 ± 5.1 keV The event fluence ($10 - 1000$ keV) in this time interval is $(2.34 \pm 0.04) \times 10^{-6}$ erg cm^{-2}. The 1 s peak photon flux measured starting from $T_0 - 0.38$ s in the $10 - 1000$ keV band is 4.31 ± 0.27 ph cm^{-2} s^{-1}.

2 BAT Observation and Analysis

Using the data set from $T - 239$ to $T + 863$ s, further analysis was performed (Barthelmy et al., GCN Circ. 13749). The BAT ground-calculated position is RA, Dec = (357.966, 63.090) deg, which is {23h 51m 51.9s; +63d 05' 25.6"} (J2000) with an uncertainty of 1.6 arcmin, (radius, sys+stat, 90% containment). The partial coding was 23%.

The mask-weighted light curve shows two barely overlapping peaks starting at $\sim T - 4$ s, peaking at $\sim T + 1$ s and $\sim T + 17$ s, and ending at $\sim T + 50$ s. T_{90} ($15 - 350$ keV) is 17.8 ± 3.9 s (estimated error including systematics).

The time-averaged spectrum from $T - 1.84$ to $T + 24.10$ s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.71 ± 0.16. The fluence in the $15 - 150$ keV band is $1.1 \pm 0.1 \times 10^{-6}$ erg cm^{-2}. The 1 s peak photon flux measured from $T - 0.30$ s in the $15 - 150$ keV band is 2.7 ± 0.3 ph cm^{-2} s^{-1}. All the quoted errors are at the 90% confidence level.

3   XRT Observation and Analysis

Using 2099 s of PC mode data and 5 UVOT images yields an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA, Dec = {357.97897; +63.09874} which is: {23h 51m 54.95s; +63d 05' 55.5"} (J2000) (Beardmore et al. GCN Circ. 13748) with an uncertainty of 1.8 arcsec (radius, 90% confidence).

Using 7.2 ks of XRT data in PC mode (Page et al. GCN Circ. 13750), from 3.3 ks to 17.3 ks after the BAT trigger, reveals the following. The light curve can be modelled with a power-law decay with a decay index of $\alpha = 1.31(+0.22, -0.21)$.

The spectrum can be fit with an absorbed power-law with a photon spectral index of 2.0 ± 0.4. The best-fitting absorption column is $8.4(+3.4, -1.8) \times 10^{21}$ cm^{-2}, consistent with the Galactic value of 6.7×10^{21} cm^{-2} (Kalberla et al. 2005). The counts to observed (unabsorbed) $0.3 - 10$ keV flux conversion factor deduced from this spectrum is 5.4×10^{-11} (1.0×10^{-10}) erg cm^{-2} count^{-1}.

4   UVOT Observation and Analysis

The Swift/UVOT began settled observations of the field of GRB 120911A 3323 s after the BAT trigger (Kuin et al., GCN Circ. 13751). No optical afterglow consistent with the XRT position (Beardmore et al. GCN Circ. 13748) is detected in the initial UVOT exposures.

Preliminary 3σ 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:

Filter	T_start(s)	T_stop(s)	Exp(s)	Mag
white_FC	3323	3473	147	>20.5
white	3323	11009	1229	>21.6
v	3479	15918	1278	>19.9
b	4300	10097	1160	>21.5
u	4095	5730	393	>20.4
w1	3890	5526	393	>20.0
m2	3684	5320	393	>21.1
w2	4710	11585	757	>20.9

The magnitudes in the table are not corrected for the Galactic extinction due to the reddening of $E(B - V) = 1.12$ in the direction of the burst (Schlegel et al. 1998).
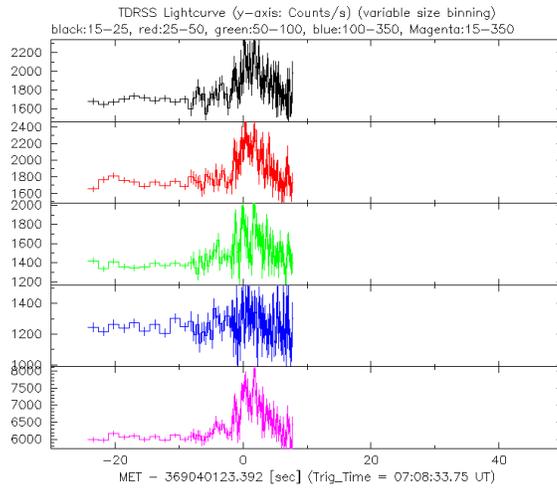
Figure 1: BAT Lightcurve. The light curve in the 4 individual plus total energy bands $(15 - 25$ keV, $25 - 50$, $50 - 100$, $100 - 350$, and $15 - 350)$.
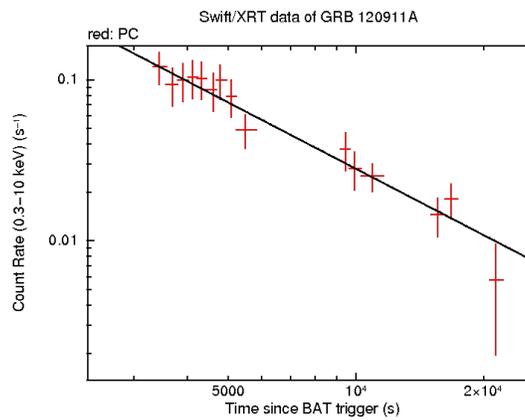

Figure 2: XRT Lightcurve. A broken powerlaw fit gives: $\alpha_1 = 1.37(+0.21, -0.19)$.