Swift Observations of GRB 110928A
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1 Introduction

At 01:51:31 UT on 28 September 2011 BAT triggered on and located GRB 110928A (Hoversten et al., GCN Circ. 12394, Trigger #504215). Due to an Earth limb constraint Swift was unable to slew to this burst until 55 minutes after the trigger. XRT and UVOT began follow up observations at $T + 3.3$ ks. Our best position is the UVOT-enhanced XRT position at RA(J2000) = 257.73295 deg (17h10m55.91s), Dec(J2000) = +36.53571 deg (+36d32'08.5") with an uncertainty of 2.2 arcsec (radius, 90% confidence).

Ground-based observations of GRB 110928A were reported by numerous observatories, however all of these observations yielded upper limits. Optical limits were reported by ROTSE-III (Schaefer et al., GCN Circ. 12395), Palomar 60 inch telescope (Cenko, GCN Circ. 12401), RAPTOR (Wren et al., GCN Circ. 12407, and Skynet (Haislip et al., GCN Circ. 12408, 12409). Near infrared upper limits were reported by PAIRITEL (Morgan et al., GCN Circ. 12400).

2 BAT Observation and Analysis

Using the data set from $T - 60$ to $T + 243$ s further analysis of GRB 110928A (trigger #504215) was performed by the Swift team (Barthelmy, et al., GCN Circ. 12399). The BAT ground-calculated position is RA(J2000) = 257.745 deg (17h10m58.7s), Dec(J2000) = 36.547 deg (+36d32'49.3") with an uncertainty of 2.3 arcmin, (radius, sys+stat, 90% containment). The partial coding was 37%.

The light curve can be modelled with a power-law decay with a decay index of $\alpha = 0.55^{+0.17}_{-0.19}$. A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of $2.07^{+0.34}_{-0.27}$. The best-fitting absorption column is $4.8^{+2.5}_{-1.7} \times 10^{21}$ cm$^{-2}$, in excess of the...
Galactic value of $3.1 \times 10^{20} \text{ cm}^{-2}$ (Kalberla et al. 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is $4.4 \times 10^{-11} \ (8.1 \times 10^{-11}) \ \text{erg cm}^{-2} \ \text{counts}^{-1}$. The XRT light curve is shown in Figure 2.

4 UVOT Observation and Analysis

The Swift/UVOT began settled observations of the field of GRB 110928A 3.3 ks after the BAT trigger (Hoversten GCN Circ. 12406). No optical afterglow consistent with the XRT position (Osborne et al., GCN Circ. 12402) is detected in the initial UVOT exposures. The 3-sigma upper limits using the UVOT photometric system (Poole et al. 2008) for the first finding chart (FC) exposure and subsequent exposures are given in Table 1. The magnitudes are not corrected for Galactic extinction which is $E(B-V) = 0.03$ along the line of sight to the burst (Schlegel, Finkbeiner, & Davis, 1998).

References

Figure 1: BAT Light curve. The mask-weighted light curve over all energy bands. The units are counts/s/illuminated-detector (note illum-det = 0.16 cm$^2$) and $T_0$ is 01:51:31.7 UT.

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Table 1: UVOT observations
Figure 2: XRT Light curve. Flux in the 0.3-10 keV band: in Photon Counting mode (red). The approximate conversion is $1 \text{ count s}^{-1} \simeq 4.14 \times 10^{-11} \text{ ergs cm}^{-2} \text{ s}^{-1}$. 