

Swift Observation of GRB 071028A

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0 Revisions

Final report of Swift observations includes full XRT light curve which extends out to 87 ks with updated corresponding temporal and spectral analysis.

1 Introduction

BAT triggered on GRB 071028A at 17:41:01 UT (Trigger 295527) (Racusin, *et al.*, *GCN Circ.* 7012). This was an image-trigger on a burst with $T_{90} = 27 \pm 1$ sec. Swift slewed to this burst immediately and XRT began follow-up observations at $T + 118$ sec, and UVOT at $T + 128$ sec. Our best position is the XRT-UVOT astrometrically corrected X-ray position location $RA(J2000) = 119.81936deg$ (07h59m16.65s), $Dec(J2000) = +21.48482deg$ (+21d29'05.4") with an error of 1.9 arcsec (radius, 90% confidence).

2 BAT Observation and Analysis

Using the data set from $T - 239$ to $T + 541$ sec, further analysis of BAT GRB 071028A has been performed by Swift team (Cummings, *et al.*, *GCN Circ.* 7013). The BAT ground-calculated position is $RA(J2000) = 119.828deg$ (07h59m18.6s), $Dec(J2000) = +21.473deg$ (+21d28'22") with an error of 2.2 arcmin (radius, systematic and statistical, 90% containment). The partial coding was 100%.

The masked-weighted light curve (Fig.1) shows a single FRED-like peak starting at T_0 , peaking at $\sim T + 35$ sec, and ending at $\sim T + 110$ sec. $T_{90}(15 - 350keV)$ is 27 ± 1 (estimated error including systematics).

The time-averaged spectrum from $T + 19.2$ to $T + 48.9$ sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.87 ± 0.26 . The fluence in the 15 – 150keV band is $3.0 \pm 0.5 \times 10^{-7} ergs/cm^2$. The 1-sec peak photon flux measured from $T + 41.75$ sec in the 15 – 150keV band is $0.3 \pm 0.1 ph/cm^2/sec$. All the quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

Using 399 sec of overlapping XRT Photon Counting mode and UVOT V-band data, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): $RA(J2000) = 119.81936deg$ (07h59m16.65s), $Dec(J2000) = +21.48482deg$ (21d29'05.4" with an uncertainty of 1.9arcsec (radius, 90% confidence). This position is within 6.5 arcsec of the initial XRT position (Racusin *et al.*, *GCN Circ.* 7012), and 51 arcsec from the refined BAT position (Cummings *et al.*, *GCN Circ.* 7013).

The 0.3 – 10 keV light curve (Fig.2) shows an initial steep decline with a slope of $3.25_{-0.19}^{+0.21}$, breaking to a shallow decline at $T + 1026_{-235}^{+334}$ sec with a slope of $0.14_{-0.28}^{+0.33}$. At $T + 34_{-8.7}^{+6.3}$ ks the light curve breaks to a slope of $3.5_{-1.3}^{+7.9}$.

Three segments of the X-ray lightcurve can be modeled with an absorbed power-law with spectral indices of $1.9_{-0.1}^{+0.3}$, $1.7_{-0.5}^{+1.0}$, and $2.4_{-0.9}^{+1.9}$ respectively. The total absorption column density is found to be $5.5 \pm 5.0 \times 10^{20} cm^{-2}$ which is consistent with the galactic column density of $5.1 \times 10^{20} cm^{-2}$. The

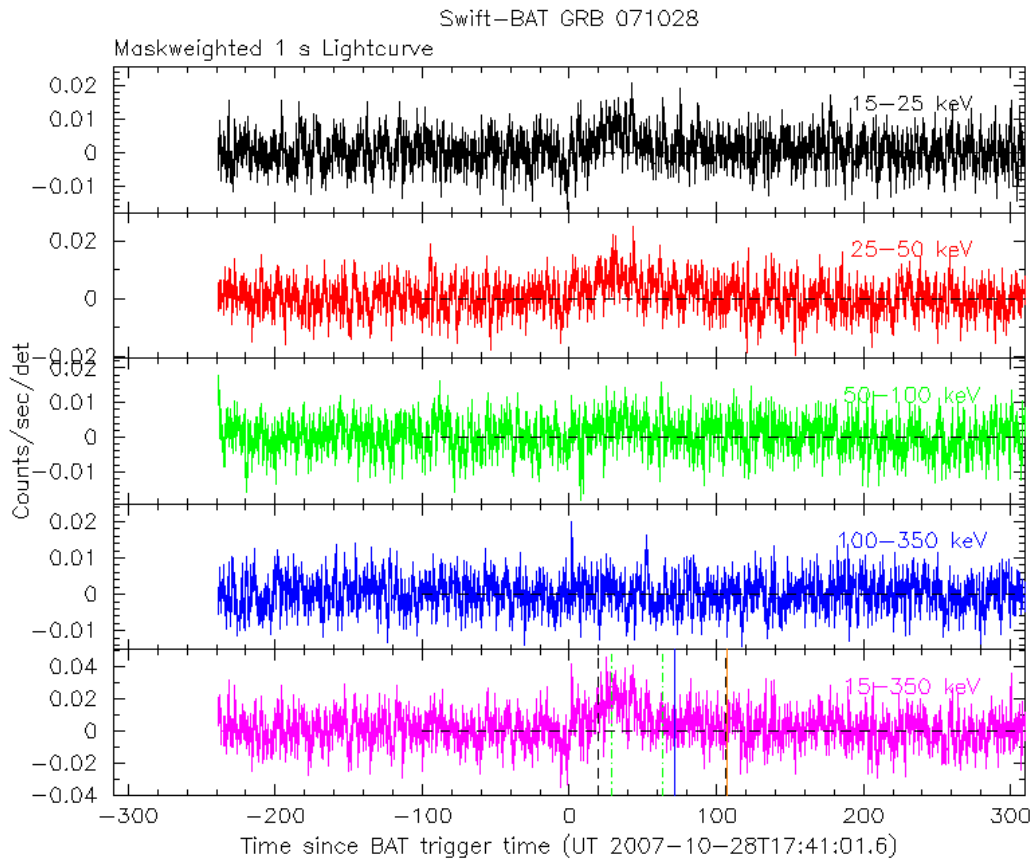


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 17:41:01.s UT.

average observed (unabsorbed) flux over $0.3 - 10$ keV for this spectrum (spanning a time of 124-87330 seconds after the trigger) is 1.22×10^{-12} (1.45×10^{-12}) $ergs/cm^2/sec$.

4 UVOT Observation and Analysis

The Swift/UVOT observed the field of GRB 071028A (Racusin *et al.*, *GCN Circ.* 7012) beginning 128 seconds after the BAT trigger. No afterglow is detected in any of the UVOT filters within the XRT error circle (Racusin *et al.*, *GCN Circ.* 7014). As already noted by Xin *et al.* (*GCN Circ.* 7015), the refined XRT position (Racusin *et al.*, *GCN Circ.* 7014) lies next to a very bright star ($v < 10$ mag), severely limiting the detection of an optical afterglow.

In the case of the white band and optical filters (v,b,u), contamination from the nearby bright star is causing the exposures to be affected by coincidence loss to a degree that is outside the photometrically calibrated range of UVOT. This limits the depth of our observations at the XRT position in these filters to white > 13.9 , v > 11.5 , b > 12.7 and u > 11.9 . The 3-sigma upper limits at the XRT position in the co-added UV bands are summarized in Table 1. The values quoted above are not corrected for the expected Galactic extinction corresponding to a reddening of $E_{B-V} = 0.06$ mag in the direction of the burst (Schlegel *et al.* 1998).

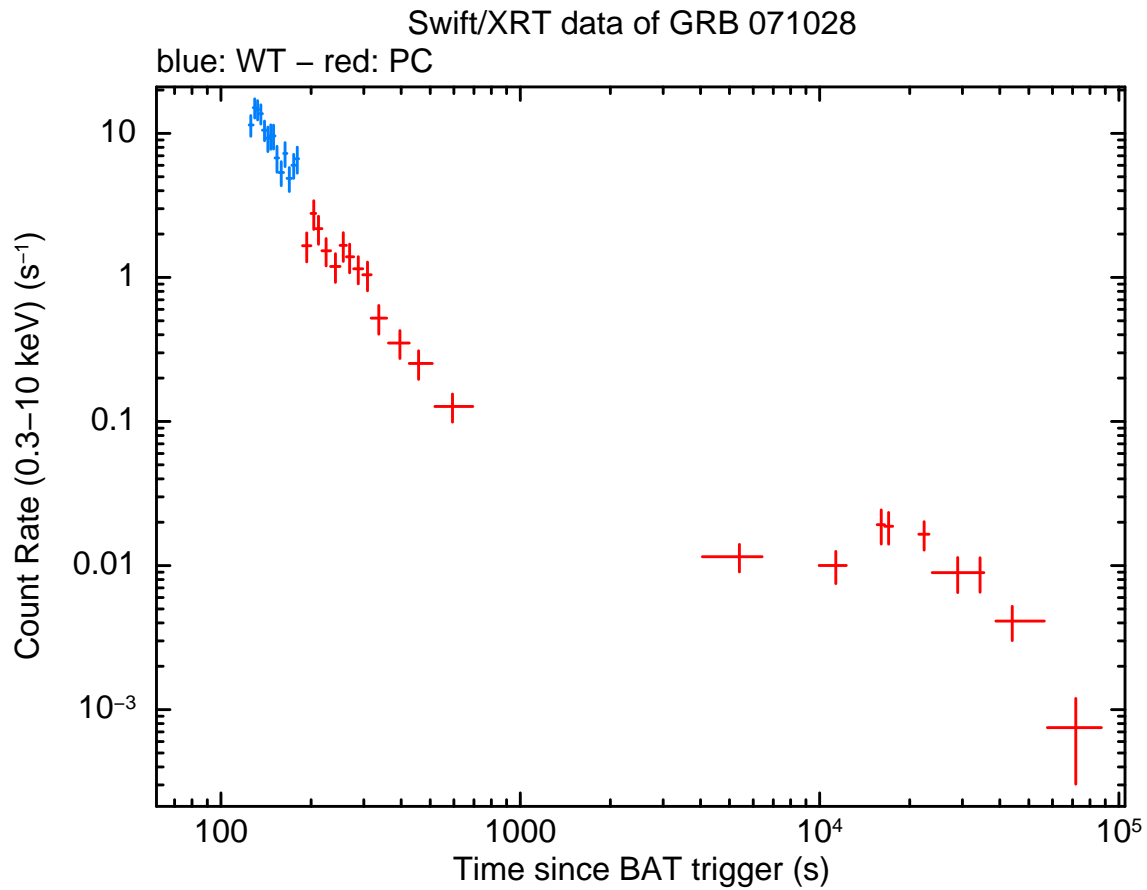


Figure 2: XRT Lightcurve. Counts/sec in the 0.3-10 keV band: Window Timing mode (blue), Photon Counting mode (red). The approximate conversion is 1 count/sec = $\sim 8 \times 10^{-11}$ *ergs/cm²/sec*.

Filter	T_{mid} (s)	Exposure (s)	3-Sigma UL
uvs1	5044	412	> 19.9
uvm2	4847	413	> 20.3
uvw2	5014	213	> 19.7

Table 1: Magnitude limits from UVOT observations