

Swift Observation of GRB 070621

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1 Introduction

BAT triggered on GRB 070621 at 23:17:39.85 UT (Trigger 282808) (Sbarufatti, *et al.*, *GCN Circ.* 6560). This was a 1.024 sec rate-trigger on a long burst with $T_{90} = 33$ sec. Swift slewed to this burst immediately and XRT began follow-up observations at $T + 111$ sec, and UVOT at $T + 120$ sec. Our best position is the UVOT-enhanced XRT location $RA(J2000) = 323.79225$ deg ($21^h35^m10.14^s$), $Dec(J2000) = -24.8175$ deg ($-24^d49'03.1''$) with an error radius of 2.0 arcsec (90% confidence, including boresight uncertainties). No optical counterpart was detected by UVOT. Malesani *et al.* (*GCN Circ.* 6565) reported a possibly extended source near the location of GRB 070621, but its position falls outside the XRT refined error circle.

2 BAT Observation and Analysis

Using the data set from $T - 240$ to $T + 962$ sec, further analysis of BAT GRB 070621 has been performed by the Swift team (Fenimore, *et al.*, *GCN Circ.* 6571). The BAT ground-calculated position is $RA(J2000) = 323.806$ deg ($21^h35^m13.5^s$), $Dec(J2000) = -24.809$ deg ($-24^d48'32''$) ± 1.0 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 31%.

The mask-weighted light curves (Fig.1) show several overlapping peaks starting at $\sim T - 20$ and ending at $\sim T + 40$ sec. There is a low-significance bump ($\sim 3\sigma$) from $T + 70$ sec to $T + 105$ sec. $T_{90}(15 - 350$ keV) is 33.3 ± 1.0 sec (estimated error including systematics).

The time-averaged spectrum from $T - 5.2$ to $T + 36.4$ sec is best fitted by a simple power law model. This fit gives a photon index of 1.57 ± 0.06 . For this model the total fluence in the 15 – 150 keV band is $(4.3 \pm 0.1) \times 10^{-6}$ ergs/cm² and the 1-sec peak flux measured from $T + 21.56$ sec in the 15 – 150 keV band is 2.3 ± 0.3 ph/cm²/sec. All the quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

Using 746 sec of overlapping data in XRT Photon Counting mode and UVOT V-band we obtained a refined position of $RA(J2000) = 323.79225$ deg ($21^h35^m10.14^s$), $Dec(J2000) = -24.8175$ deg ($-24^d49'03.1''$) ± 2.0 arcsec (90% confidence radius, including boresight uncertainties). This position is within 4.8 arcsec of the initial XRT position.

The 0.3 – 10 keV light curve (Fig.2) shows an initial steep decline with a slope of 3.8 ± 0.1 , followed by a shallow slope of 0.91 ± 0.04 , beginning at $T + 380 \pm 10$ sec.

The first two segments of the X-ray lightcurve up to $T + 5$ ks (150 sec in Window Timing mode, 1.3 ksec in Photon Counting mode) can be modeled with a single absorbed power-law with photon index of 2.5 ± 0.3 . The N_H column density is $(4.4 \pm 0.9) \times 10^{21}$ cm⁻², significantly in excess with respect to the galactic value in the direction of the burst, 3.5×10^{20} cm⁻². The average observed (unabsorbed) flux over 0.3 – 10 keV for this spectrum is 8.4×10^{-10} (2.2×10^{-9}) ergs/cm²/sec for the WT part and 1.4×10^{-11} (3.6×10^{-11}) ergs/cm²/sec for the PC part.

4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 070621 at 23:19:39.85 UT, 120 sec after the initial BAT trigger (Holland *et al.*, *GCN Circ.* 6573). No new source was detected within the XRT error circle in the white and V finding exposures, or in the co-added images in any filter down to 3-sigma magnitude. Upper limits are summarized in Table 1. These upper limits are not corrected for the Galactic extinction corresponding to a reddening of $E_{B-V} = 0.05$ mag.

Filter	Start	Stop	Exposure	3-Sigma UL
V	226	1360	806	20.2
B	702	714	10	18.6
U	680	4799	88	19.7
UVW1	656	4744	236	20.3
UVM2	631	802	38	18.8
UVW2	733	752	19	18.1
White	120	954	204	21.3

Table 1: Magnitude limits from UVOT observations.

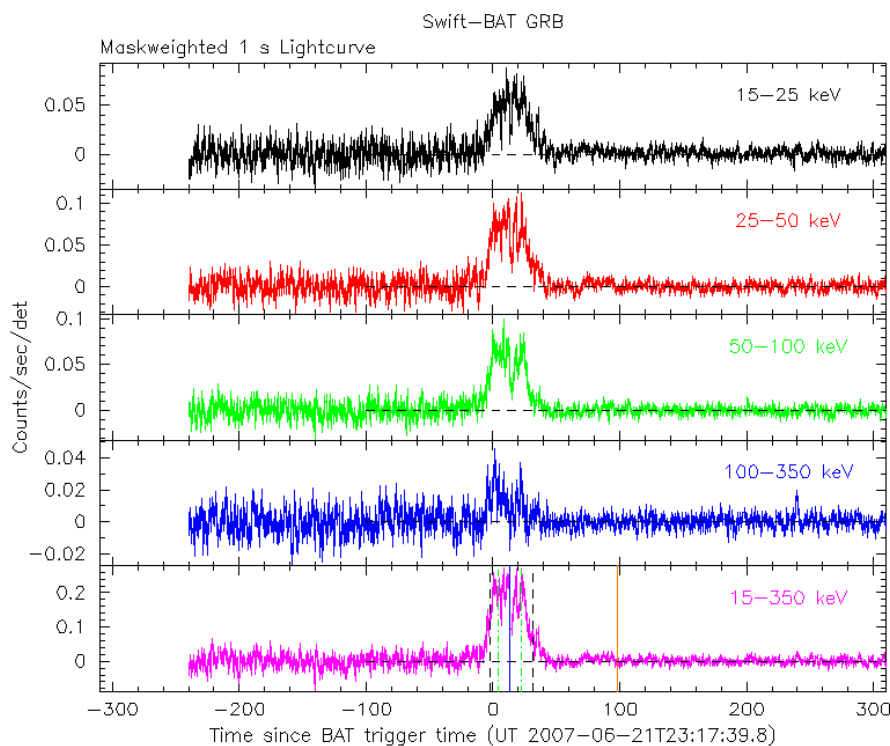


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 23:17:39.85 UT.

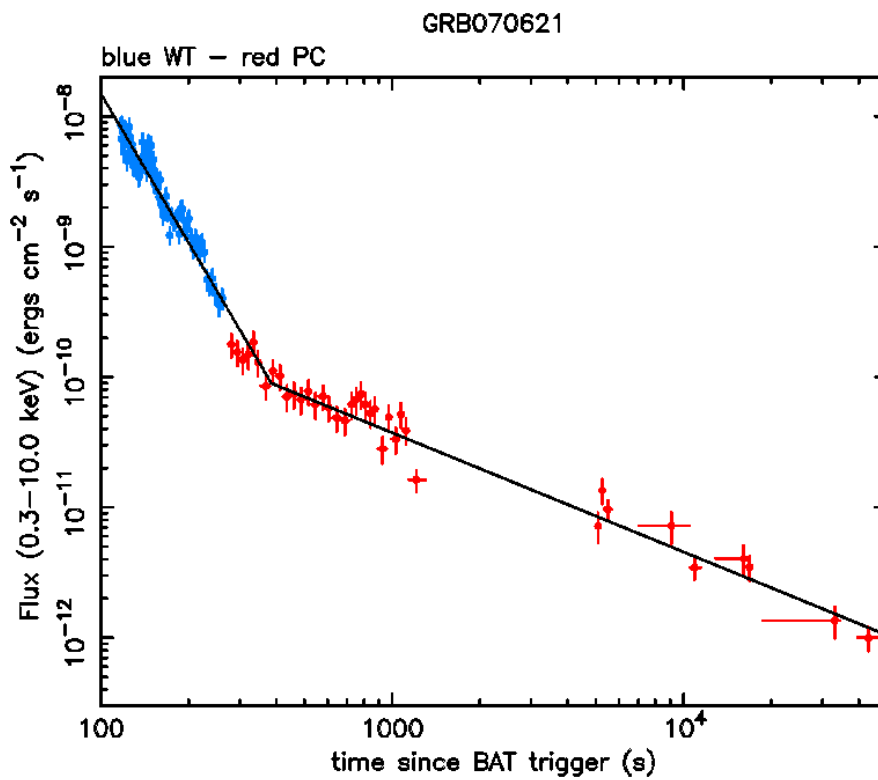


Figure 2: XRT Lightcurve. Flux ($ergs/cm^2/sec$) in the 0.3-10 keV band: Window Timing mode (blue), Photon Counting mode (red). The approximate conversion is $1 \text{ count/sec} = \sim 8.6 \times 10^{-11} \text{ ergs/cm}^2/sec$.