

Swift Observations of GRB 090607

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1. INTRODUCTION

At 05:30:17 UT the Swift Burst Alert Telescope (BAT) triggered on and located GRB 090607 (trigger 354299; Marshall *et al.* GCN Circ. 9491). Swift slewed immediately to the burst. GRB 090607 is a short, hard burst with narrow peaks at T+0.1 and T+2.2 s (Barthelmy *et al.*, GCN Circ. 9494). A fading X-ray afterglow was detected with the XRT (Page *et al.*, GCN Circ. 9496), and XRT provides the most accurate Swift position for the burst of RA (J2000) = 12h 44m 40.59s and Dec (J2000) = +48° 06' 18.10" with a 90% confidence error radius of 3.7". No optical afterglow was found with UVOT (Curran and Marshall, GCN Circ. 9495) or ground-based observatories (Guidorzi *et al.*, GCN Circ. 9492; Nissinen and Hentunen, GCN Circ. 9493).

2) BAT OBSERVATION AND ANALYSIS

The BAT ground-calculated position (Barthelmy *et al.* GCN Circ. 9494) is RA (J2000) = 12h 44m 46.7s and Dec (J2000) = 44° 06' 28.4" with an uncertainty of 1.9' (90% containment radius including both statistical and systematic errors). The partial coding was 96%.

The mask-weighted light curve (Figure 1) shows two narrow peaks. The first starts at T-0.1 s, peaks at T+0.1 s, and ends at T+0.7 s. The second starts at T+1.7 s, peaks at T+2.2 s, and ends at T+2.5 s. T_{90} (15-350 keV) is 2.3 ± 0.1 s (estimated error including systematics).

The time-averaged spectrum from T+0.1 to T+2.5 s is best fit by a simple power-law model with an index of 1.25 ± 0.30 . The fluence in the 15-150 keV band is $1.1 \pm 0.2 \times 10^{-7}$ erg-cm². The 1-s peak photon flux measured from T-0.01 s in the 15-150 keV band is 0.7 ± 0.1 photons-cm⁻²-s⁻¹. All the quoted errors are at the 90% confidence level.

3. XRT OBSERVATIONS AND ANALYSIS

The XRT began observing GRB 090607 70 s after the BAT trigger. Using 9.6 ks of data from the initial four orbits, Page *et al.* (GCN Circ. 9496) reported the position given above and the following temporal and spectral results.

The X-ray light-curve (Figure 2) initially brightens slightly, with a power-law index of $\alpha = -0.8 \pm 0.5$ until 150 (+10, -8) s, at which point the afterglow starts to decay with $\alpha = 5.6 (+0.5, -0.3)$. Between ~200 and 400 s after the trigger there is a deviation from the decay in the form of a flare. The afterglow is no longer detected after the end of the first orbit of data (~2365 s after the trigger).

The initial 108 s of WT data show a softening trend with time. A spectrum formed from the PC mode data from the first orbit can be fitted with a power-law of photon index $\Gamma = 1.88 \pm 0.21$, absorbed by the Galactic column of 1.8×10^{20} cm⁻². The observed (unabsorbed) 0.3-10 keV flux over this time is 5.5×10^{-12} (5.8×10^{-12}) erg cm⁻² s⁻¹, which corresponds to a counts to observed (unabsorbed) flux conversion factor of 3.9×10^{-11} (4.1×10^{-11}) erg cm⁻² count⁻¹.

4. UVOT OBSERVATIONS AND ANALYSIS

The Swift/UVOT began settled observations of the field of GRB 090607 75 s after the BAT trigger. Because the image significance for the BAT trigger was below the nominal threshold, the usual UVOT finding charts were not taken. No optical afterglow consistent with the XRT position is detected in the initial UVOT exposures. Preliminary 3- σ upper limits using the UVOT photometric system (Poole *et al.*

2008, MNRAS, 383, 627) are given in Table 1. No corrections have been made for the expected extinction in the Milky Way corresponding to $E_{B,V}$ of 0.02 (Schlegel *et al.* 1998).

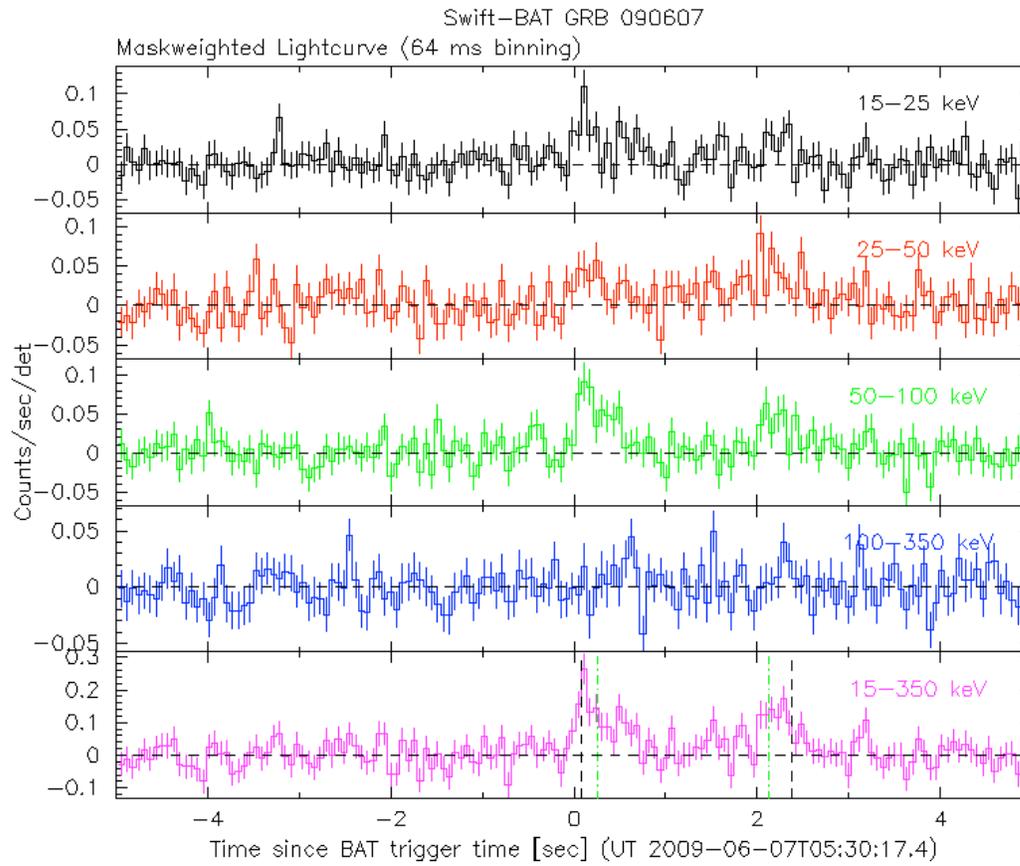


Figure 1: The BAT mask-weighted light curve in the 4 individual plus total energy bands. The units are counts s^{-1} illuminated-detector $^{-1}$. Each illuminated detector has an area of 0.16 cm^2 .

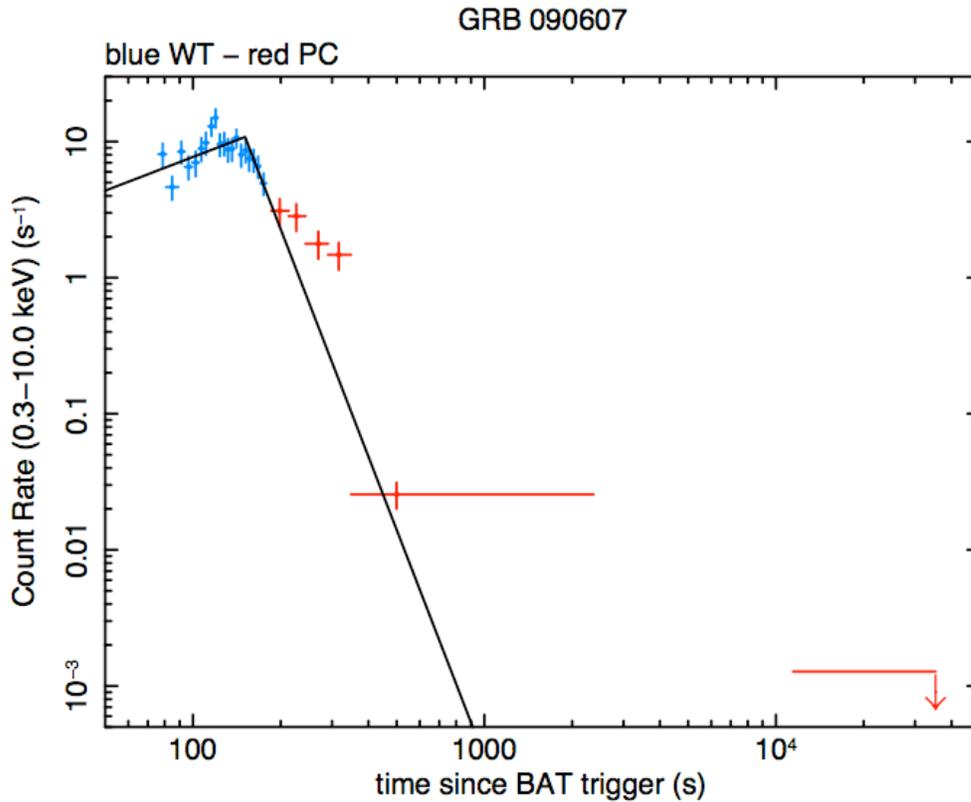


Figure 2: The XRT light curve plotted as a function of the time since the BAT trigger. One $\text{count}\cdot\text{s}^{-1}$ is about $3.9 \times 10^{-11} \text{ erg}\cdot\text{cm}^{-2}\cdot\text{s}^{-1}$ (observed) in the 0.3–10 keV band.

Filter	T_{start}	T_{stop}	Exposure	Magnitude
	(seconds)	(seconds)	(seconds)	
u	75	1233	1140	>21.2
v	11448	12707	1239	>20.4
uvw1	12715	13943	1209	>20.8

Table 1: UVOT Observations. The start and stop times of the exposures are given in seconds since the BAT trigger. Preliminary $3\text{-}\sigma$ upper limits are given for each filter. No corrections have been made for the expected extinction in the Milky Way corresponding to $E_{B,V}$ of 0.02 (Schlegel *et al.* 1998).