

Swift Observations of GRB 090307

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1 Introduction

BAT triggered on GRB 090307 at 03:46:37 UT (Trigger 345551) (Evans, *et al.*, *GCN Circ.* 8943). This was a weak trigger, to which Swift reacted as part of the subthreshold experiment (c.f. *GCN Circ.* 8943) and deemed to be of astrophysical origin by virtue of the rapid detection of a source by XRT. The burst has $T_{90} = 22$ sec. Swift slewed to this burst immediately and XRT began follow-up observations at $T + 135$ sec, and UVOT at $T + 120$ sec. Our best position is the enhanced XRT location RA($J2000$) = 244.9944deg (16h19m58.64s), Dec($J2000$) = -28.6333deg (-28d37'59.9") with an error of 2.1 arcsec (radius, 90% confidence).

2 BAT Observation and Analysis

Using the data set from $T - 60$ to $T + 303$ sec, analysis of GRB 090307 has been performed by Swift team (Barthelmy, *et al.*, *GCN Circ.* 8945). The BAT ground-calculated position is RA($J2000$) = 245.007deg (16h20m01.7s), Dec($J2000$) = -28.647deg (-28d38'48.2") ± 3.3 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 87% .

The mask-weighted light curve (Fig.1) shows a weak pulse starting at $T - 7$ sec and ending at $\sim T + 20$ sec. $T_{90}(15 - 350keV)$ is 22 ± 8 sec (estimated error including systematics).

The time-averaged spectrum from $T - 7.4$ to $T + 16.6$ sec is best fitted by a simple power law model. This fit gives a photon index of 1.08 ± 0.39 . For this model the total fluence in the 15 - 150 keV band is $(2.6 \pm 0.6) \times 10^{-7}$ ergs/cm² and the 1-sec peak flux measured from $T + 5.57$ sec in the 15 - 150 keV band is 0.2 ± 0.1 ph/cm²/sec. All the quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

Swift-XRT observed the field of GRB 090307 (BAT trigger 345551; GCN Circs. 8943, 8945) for 4.6 ks, from 135 s to 80 ks after the BAT trigger. All of the data were taken in Photon Counting (PC) mode. The enhanced XRT position is RA($J2000$) = 244.9944deg (16h19m58.64s), Dec($J2000$) = -28.6333deg (-28d37'59.9") with an error of 2.1 arcsec (radius, 90% confidence).

The light curve (Fig. 2) shows a power-law decay, with an index 0.7 (+0.2, -0.1).

The PC mode spectrum can be fitted with an absorbed power-law, with a photon index of 2.21 (+0.72, -0.60) and an absorbing column of $3.5 (+2.7, -1.1) \times 10^{21}$ cm⁻², in excess of the Galactic value of 1.3×10^{21} cm⁻² . The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is 4.1×10^{-11} (7.6×10^{-11}) erg/cm²/count.

4 UVOT Observation and Analysis

The UVOT began settled observations of the field of GRB 090307 128 s after the BAT trigger (Evans *et al.*, GCN 8943). We do not detect any source at the enhanced Swift XRT position. Upper limits are summarized in Table 1. These upper limits are not corrected for Galactic extinction $E(B - V) = 0.528$.

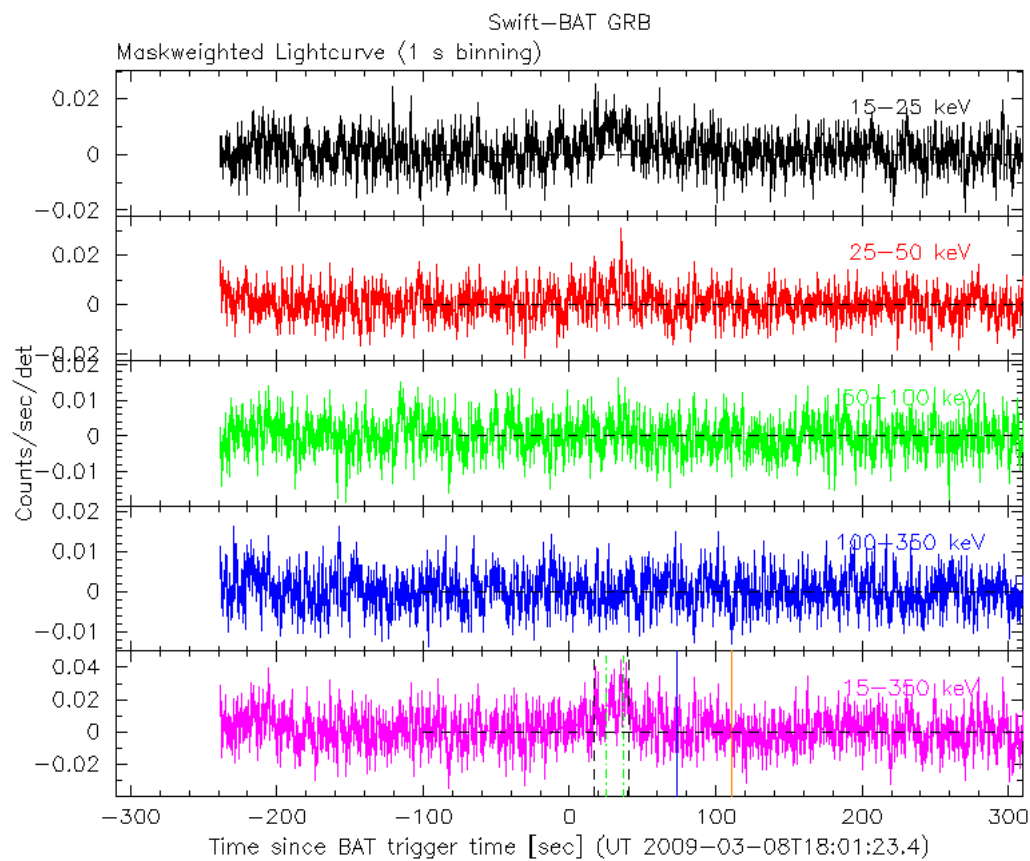


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector.

Filter	Start	Stop	Exposure	3-Sigma UL
white	128	757	185	20.71
v	615	807	38	18.00
b	542	733	38	18.89
u	286	708	265	19.76
uvw1	664	684	19	17.86

Table 1: Magnitude limits from UVOT observations

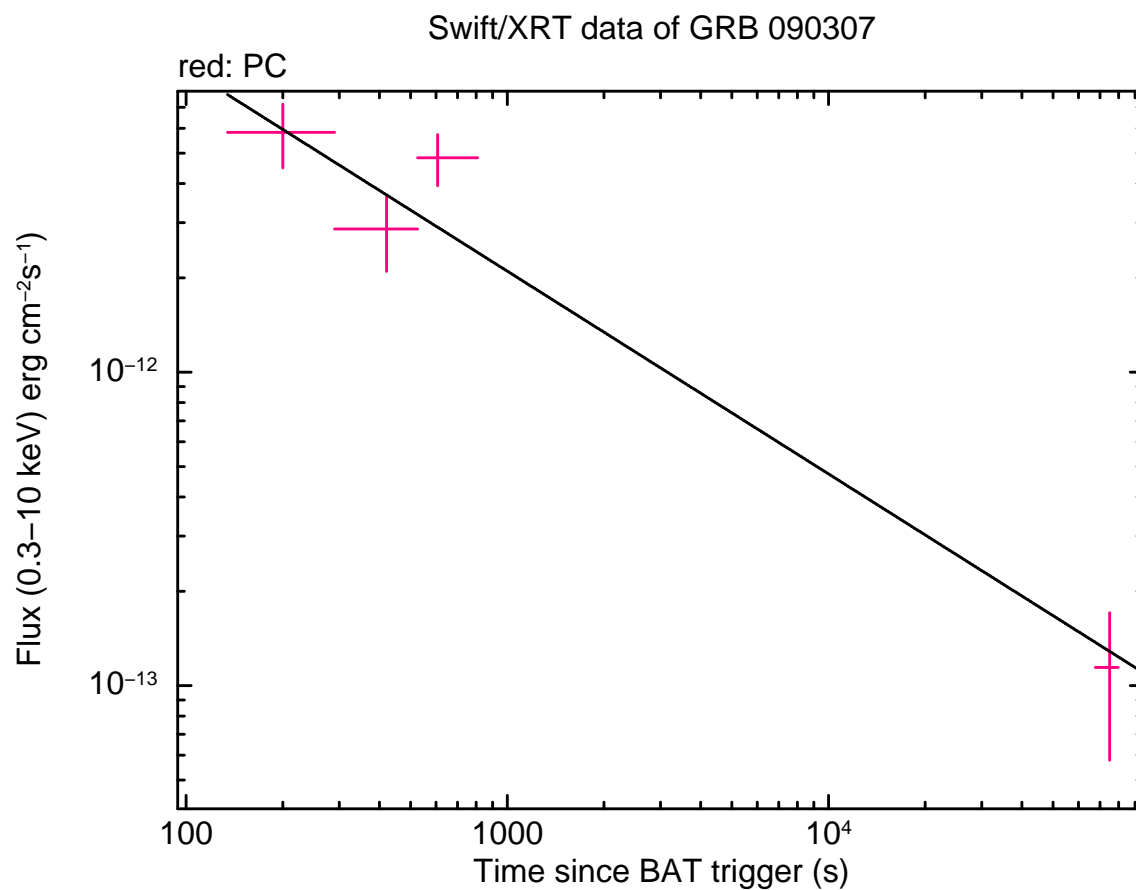


Figure 2: XRT Lightcurve. Flux in the 0.3-10 keV band. The counts-to-flux conversion is $1 \text{ count/sec} = 4.1 \times 10^{-11} \text{ ergs/cm}^2/\text{sec}$.