

## Swift Observations of GRB 100206A

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### 1 Introduction

BAT triggered on GRB 100206A at 13:30:05 UT (Trigger 411412) (Krimm *et al.*, *GCN Circ.* 10376). This was an 128-msec rate-trigger on a short, hard burst with  $T_{90} = 0.12 \pm 0.03$  sec. Swift slewed immediately to the burst. The best position is the XRT enhanced position (Goad *et al.*, *GCN Circ.* 10378): RA( $J2000$ ) =  $47.16225^\circ$  (3h 08m 38.94s), Dec( $J2000$ ) =  $+13.15708^\circ$  ( $+13^\circ 09' 25''.5$ ) with an error of 3.2 arcsec (radius, systematic plus statistical, 90% containment).

The prompt emission from GRB 100206A was also detected by *Fermi*/GBM (von Kienlin, *GCN Circ.* 10381) and INTEGRAL/SPI-ACS (V. Beckmann, private communication) .

Identification of an optical afterglow and/or host galaxy is uncertain. Several optical observations before and after the burst (e.g. Miller *et al.*, *GCN Circ.* 10377, Guziy, Aceituno, & Castro-Tirado, *GCN Circ.* 10384, Leloudas *et al.*, *GCN Circ.* 10387) report the presence of an extended source consistent with the XRT error circle and suggest that this is the host galaxy of GRB 100206A. Keck spectroscopy of the extended object (Cenko *et al.*, *GCN Circ.* 10389) finds strong, clearly resolved emission lines from H- $\alpha$  and [NII] consistent with a redshift of  $z = 0.41$ . Levan *et al.*, *GCN Circ.* 10386 report an afterglow candidate in the  $i$  and  $z$  bands. However, Berger *et al.*, *GCN Circ.* 10395 and Berger & Chornock, *GCN Circ.* 10410 show that this candidate is not fading and suggest that the more compact object is a host galaxy at a greater distance than the extended object.

### 2 BAT Observation and Analysis

Using the data set from T-240 to T+962 sec, further analysis of GRB 100206A was performed by the Swift/BAT team (Sakamoto *et al.*, *GCN Circ.* 10379). The partial coding was 51%. The mask-weighted light curve (Figure 1) shows a single spike starting at T+0.0 and ending at T+0.2 s.  $T_{90}$  (15-350 keV) is  $0.12 \pm 0.03$  s (estimated error including systematics).

The time-averaged spectrum from T-0.0 to T+0.1 sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is  $0.64 \pm 0.17$ . The fluence in the 15-150 keV band is  $1.4 \pm 0.2 \times 10^{-7}$  *erg cm*<sup>-2</sup>. The 1-sec peak photon flux measured from T-0.44 sec in the 15-150 keV band is  $1.5 \pm 0.2$  *ph cm*<sup>-2</sup> *s*<sup>-1</sup>. All the quoted errors are at the 90% confidence level.

### 3 XRT Observations and Analysis

The XRT results (Evans & Krimm, *GCN Circ.* 10382) are based on 1.3 ks of XRT data for GRB 100206A from 82 s to 1.3 ks after the BAT trigger. The data are entirely in Photon Counting (PC) mode. The light curve (Fig 2) can be modelled with a power-law decay with a decay index of  $\alpha = 2.1_{-0.8}^{+1.1}$ . Only an upper limit is found for the final 38 ks beginning at T+5000 s. A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of  $2.0_{-0.9}^{+1.2}$ . The best-fitting absorption column is  $3.5_{-0.0}^{+5.3} \times 10^{21}$  *cm*<sup>-2</sup>, in excess of the Galactic value of  $1.3 \times 10^{21}$  *cm*<sup>-2</sup> (Kalberla *et al.*, 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is  $4.6$  ( $7.4$ )  $\times 10^{-11}$  *erg cm*<sup>-2</sup> *count*<sup>-1</sup>. Errors are given at the  $1\sigma$  level.

## 4 UVOT Observation and Analysis

The Swift/UVOT began settled observations of the field of GRB 100206A 78 s after the BAT trigger (Marshall & Krimm, *GCN Circ.* 10394). No optical afterglow consistent with the refined XRT position or the candidate optical afterglow position (Levan *et al.*, *GCN Circ.* 10386) is detected in the initial UVOT exposures. Preliminary  $3\sigma$  upper limits using the UVOT photometric system (Poole *et al.*, 2008, *MNRAS*, **383**, 627) for the first finding chart (FC) exposures and subsequent exposures are:

Filter	Start	Stop	Exposure (s)	Magnitude
white (FC)	78	228	147	> 20.5
white	78	7046	647	> 21.4
u (FC)	290	540	246	> 20.1
u	290	12756	1464	> 20.5
b	545	13655	1223	> 21.2
v	619	7457	553	> 20.1
w1	668	7866	510	> 20.7

Table 1: Magnitude limits from UVOT observations.

The quoted magnitudes and upper limits have not been corrected for the Galactic extinction due to the reddening of  $E_{B-V} = 0.38$  mag in the direction of the burst (Schlegel *et al.*, 1998, *ApJ Suppl.* **500**, 525).

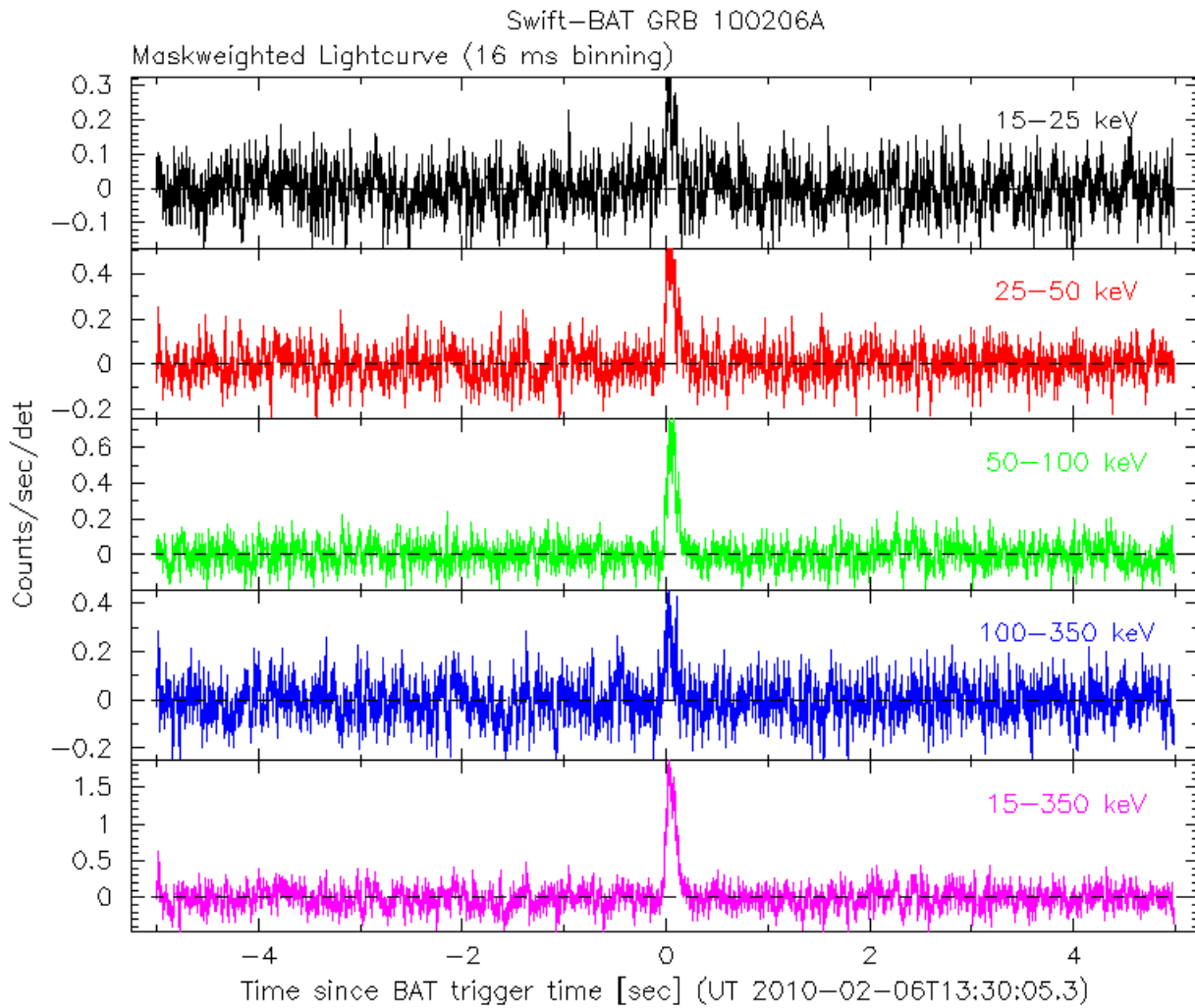


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector (note illum-det =  $0.16 \text{ cm}^2$ ).

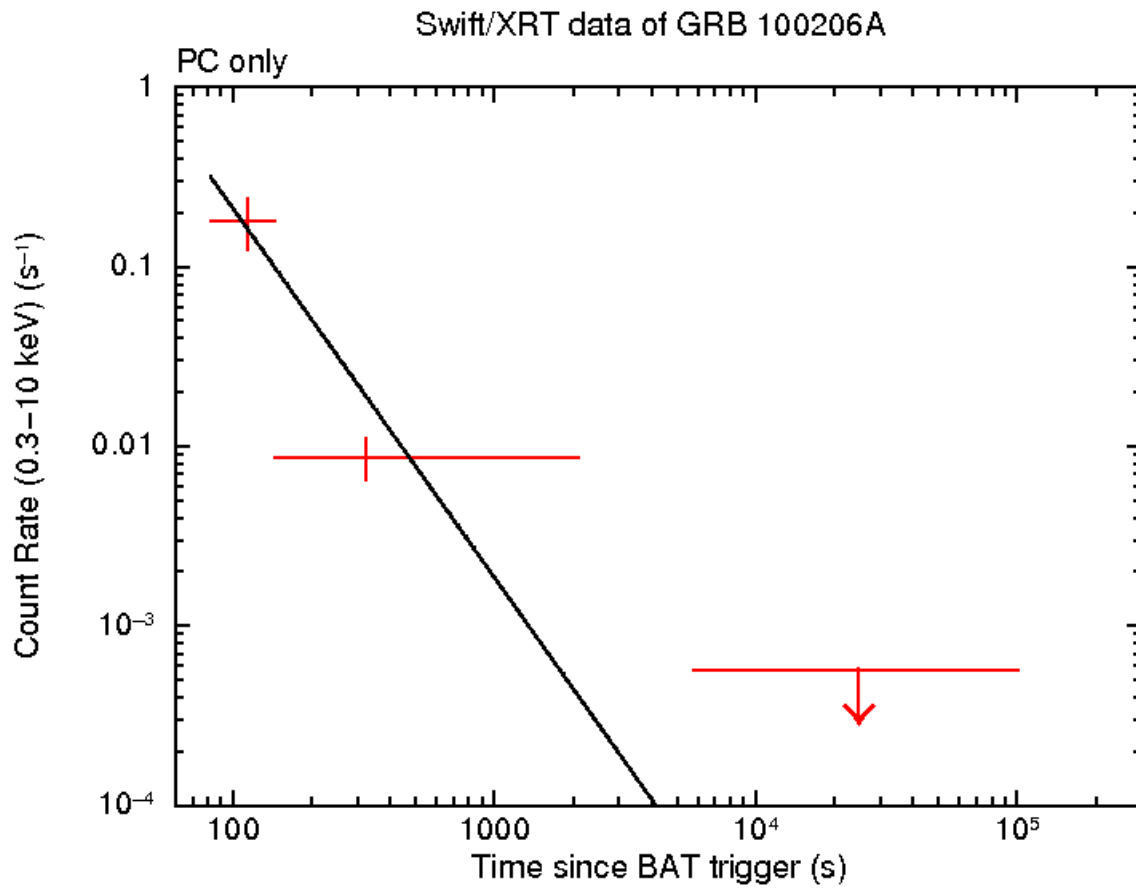


Figure 2: XRT light-curve. Counts  $s^{-1}$  in the 0.3-10 keV band for the Photon Counting mode (red). The approximate conversion of the 0.3 – 10 keV observed flux is  $1 \text{ count } s^{-1} \sim 4.6 \times 10^{-11} \text{ erg } cm^{-2} s^{-1}$ .