

Swift Observation of GRB 130206A

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1 Introduction

BAT triggered on GRB 130206A at 19:36:28 UT (Trigger 547918) (De Pasquale *et al.*, *GCN Circ.* 14181). This was a long burst with $T_{90} = 128 \pm 51$ sec (90% confidence level, C.L.). Due to an observing constraint, Swift did not slew until $T+48.5$ minutes. Swift XRT began follow-up observations at $T + 3090$ sec, and UVOT at $T + 3081$ sec. Our best position is the XRT location $RA(J2000) = 140.37670deg$ (09h21m30.41s), $Dec(J2000) = -58.19362deg$ ($-58d11'37.0''$) with an error of 4.6 arcsec (90% C.L.).

2 BAT Observation and Analysis

Using the data set from $T - 61$ to $T + 242$ sec, further analysis of BAT GRB 130206A has been performed by Swift team (Stamatikos, *et al.*, *GCN Circ.* 14186). The BAT ground-calculated position is $RA(J2000) = 140.387deg$ (09h21m32.9s), $Dec(J2000) = -58.193deg$ ($-58d11'35.6''$) ± 1.9 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 52%

The mask-weighted light curve (Fig.1) shows two clusters of peaks. The first runs from approximately $T - 10$ sec to $T + 15$ sec and the second from $T + 20$ sec to $T + 60$ sec, though the count rate does not return to baseline between the two clusters. Each of these clusters consists of multiple sub-peaks. There is also some low-level emission extending out to $T + 150$ sec. T_{90} (15 – 350keV) is 128.0 ± 50.6 sec (estimated error including systematics).

The time-averaged spectrum from $T - 12.78$ to $T + 147.21$ sec is best fitted by a simple power law model. This fit gives a photon index of 1.56 ± 0.17 , ($\chi^2 = 58.5$ for 57 d.o.f.). For this model the total fluence in the 15 – 150 keV band is $(2.0 \pm 0.2) \times 10^{-6} ergs/cm^2$ and the 1-sec peak flux measured from $T + 42.72$ sec in the 15 – 150 keV band is 0.3 ± 0.2 ph/cm²/sec. All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at http://gcn.gsfc.nasa.gov/notices_s547918/BA/

3 XRT Observations and Analysis

XRT started observing the field of GRB130206A at 20:27:58 UT, 3090 s after the trigger. Using early XRT data (obsid 001) of GRB 130206A for a total of 10.3 ksec of integration time in Photon Counting mode, Beardmore *et al.*, *GCN Circ.* 14188, found an uncatalogued source at astrometrically corrected position at $RA(J2000) = 140.37670 deg$ (09h21m30.41s), $Dec(J2000) = -58.19362, deg$ ($-58d11'37.0''$) ± 5.6 arcsec (90% confidence). This position is located 20 arcsec from the BAT refined position. The source had a count rate of $1.9_{-0.5}^{+0.6} \times 10^{-3}$, corresponding to a 0.3 – 10 keV flux of $3.61 \times 10^{-14} ergs/cm^2/sec$. This X-ray source is not detected anymore in XRT observations performed between 33 and 550 ksec after the trigger, for a total of 35.2 ksec of integration time. The 3 sigma upper limit is 0.00089 count/s, appreciably lower than the count rate observed in previous observations. Because of the fading behaviour of this source, we conclude it was likely the X-ray afterglow of GRB130206A.

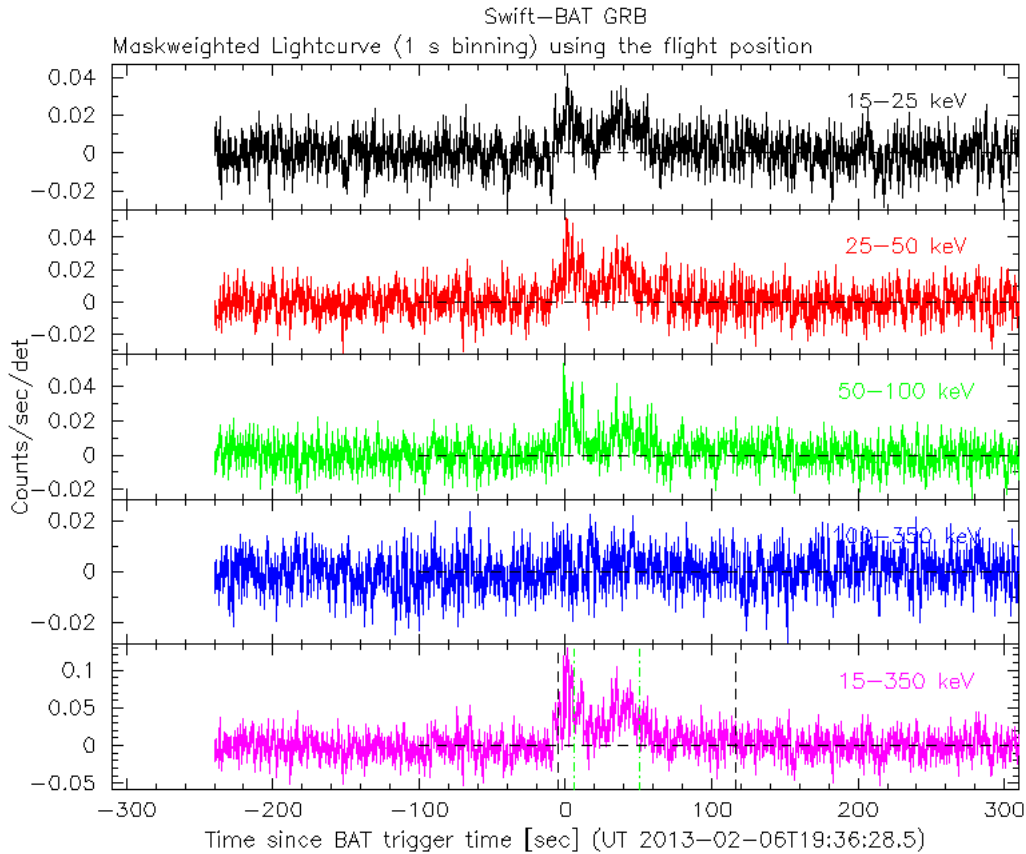


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 19:36:28 UT.

4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 130206A at 20:27:49 UT, 3081 sec after the initial BAT trigger (De Pasquale *et al.*, *GCN Circ.* 14181). No new source was detected within the XRT error circle in the white (150 sec) finding exposure, 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 strong Galactic extinction $E(B-V) = 0.48$.

5 Other observations

GRB130206A was detected by Fermi-GBM (Goldstein *et al.*, *GCN Circ.* 14189). It has a $T_{90} = 91$ sec. The total fluence in the 10 – 1000 keV band is $(3.3 \pm 0.4) \times 10^{-6}$ ergs/cm². The burst was in the LAT field of view but was not detected (Racusin *et al.*, *GCN Circ.* 14190). The 95 % confidence level upper limit in the 100 MeV - 10 GeV energy range is 2.4×10^{-8} ergs/cm²/sec. The prompt emission was also detected by INTEGRAL/SPI-ACS, with a brightest peak at $T_0+4.7$ sec. (http://www.isdc.unige.ch/integral/ibas/cgi-bin/ibas_acs_web.cgi/?trigger=2013-02-06T19-36-28.5900-00000-00000-0). Zadko observatory (Klotz *et al.*, *GCN Circ.* 14185) performed prompt observation of the field of GRB130206 but found no optical counterpart. The GROND observatory

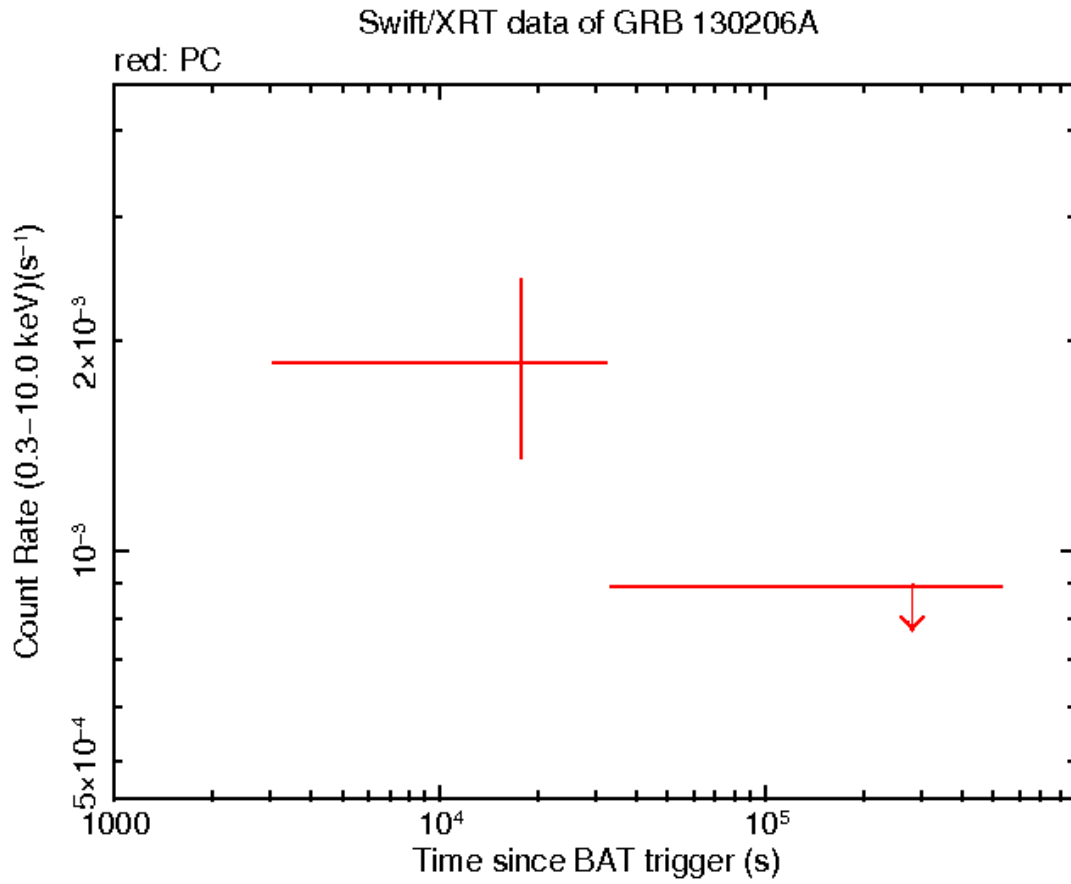


Figure 2: XRT Lightcurve. Counts/sec in the 0.3-10 keV band: Window Timing mode (black), Photon Counting mode (red). The approximate conversion is 1 count/sec = $\sim 1.9 \times 10^{-11}$ ergs/cm²/sec.

(Knust *et al.*, *GCN Circ.* 14191) detected sources in the BAT error circle, but none of these is inside the XRT error circle of the likely afterglow of GRB130206A.

| Filter | Start | Stop | Exposure | 3-Sigma UL |
|-----------------|-------|-------|----------|------------|
| WHITE (finding) | 3081 | 3231 | 147 | 21.4 |
| WHITE | 3081 | 16409 | 2114 | 23.1 |
| V | 4062 | 22199 | 1319 | 20.3 |
| B | 3445 | 15497 | 1278 | 22.3 |
| U | 3239 | 28222 | 634 | 21.2 |
| UVW1 | 4473 | 27971 | 1082 | 21.0 |
| UVM2 | 4268 | 27065 | 1312 | 20.7 |
| UVW2 | 3857 | 32412 | 2546 | 21.3 |

Table 1: Magnitude limits from UVOT observations