

Swift Observations of GRB 131128A

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1 Introduction

BAT triggered and located GRB 131128A on 2013 November 28 (Trigger 579683) (Sonbas, *et al.*, 2013, *GCN Circ.* 15533). The BAT light curve showed a single FRED peak structure with a duration of ~ 3 sec with a possible precursor around T-8. The peak count rate was 3000 counts/sec (15-350 keV), at 0 sec after the trigger.

XRT follow-up observations started $T + 86.8$ sec after the BAT trigger. A bright uncatalogued X - ray source located at a position; RA, DEC (J2000) = 23h 41m 14.02s, +31d 18' 20.7'' with an uncertainty of 2.2 arcsec (radius, 90% confidence).

From the initial products, No credible afterglow candidate has been found in 150 secs UVOT White filter image.

GRB 131128A also observed by ground based facilities promptly after the detection. The source was detected with 19 mag in R band by 1m telescope located on Mt. Nanshan, Xinjiang, China Xu *et al.*, (2013 *GCN Circ.* 15535). Object was monitored using same telescope and reported that the candidate decayed by > 1 mag 1.95 hr after the BAT trigger. The field was also observed simultaneously in g'r'i'z'/JHK with GROND 9.5 hrs after the trigger Schmidl *et al.*, (2013 *GCN Circ.* 15547) and 1.5-m Kanata telescope at Higashi-Hiroshima Observatory 360 sec after the trigger (Kawabata *et al.*, (2013 *GCN Circ.* 15541). Optical afterglow discovered at same position by Xu *et al.*, (2013 *GCN Circ.* 15535) with $r' = 22.6 \pm 0.1$ mag with GROUND and R = 17.5 mag with Kanata telescope. The afterglow of GRB 131128A has not found by MASTER II robotic telescope (Gorbovskoy *et al.*, (2013 *GCN Circ.* 15536), 1m T100 telescope (Sonbas *et al.*, (2013 *GCN Circ.* 15540), AROMA-N (Kawamura *et al.*, (2013 *GCN Circ.* 15544), and a robotic telescope in Bassano Bresciano Observatory (Quadri *et al.*, (2013 *GCN Circ.* 15556).

The Fermi Gamma-Ray Burst Monitor triggered and located GRB 131128A on 28 November 2013. The GBM light curve also showed a single peak with T_{90} of ~ 2 sec in 50 - 300 keV band. Time-averaged spectrum best fitted with -0.9 ± 0.3 power law index and a 61.0 ± 9.0 keV E_{peak} (Hoi-Fung Yu *et al.*, 2013 *GCN Circ.* 15554).

2 BAT Observation and Analysis

Using the data set from $T - 240.0$ to $T + 962.0$ sec, analysis of BAT GRB 131128A has been performed by Swift team (Barthelmy, *et al.*, *GCN Circ.* 15539). The BAT ground-calculated position is RA(J2000) = 355.305° (23h41m13.3s), Dec(J2000) = $+31.293^\circ$ (+31d17'34.1'') ± 1.6 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 41%.

The mask-weighted light curve shows a single symmetric peak (Fig.1) starting at $\sim T - 2$ sec, peaking at $\sim T + 0.2$ sec, and ending at $\sim T + 2.5$ sec. T_{90} is calculated as 3.0 ± 1.41 sec at 15 - 350 keV.

The time-averaged spectrum from $T - 0.90$ to $T + 2.10$ sec is best fit by a simple power law model. The power law index of the time-averaged spectrum is 1.81 ± 0.17 . For this model the total fluence in the 15-150 keV band is $3.2 \pm 0.4 \times 10^{-7}$ erg cm^{-2} and the 1-sec peak flux measured from T+0.1 sec in the 15-150 keV band is 2.7 ± 0.3 ph cm^{-2} sec^{-1} . 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_s/579683/BA/.

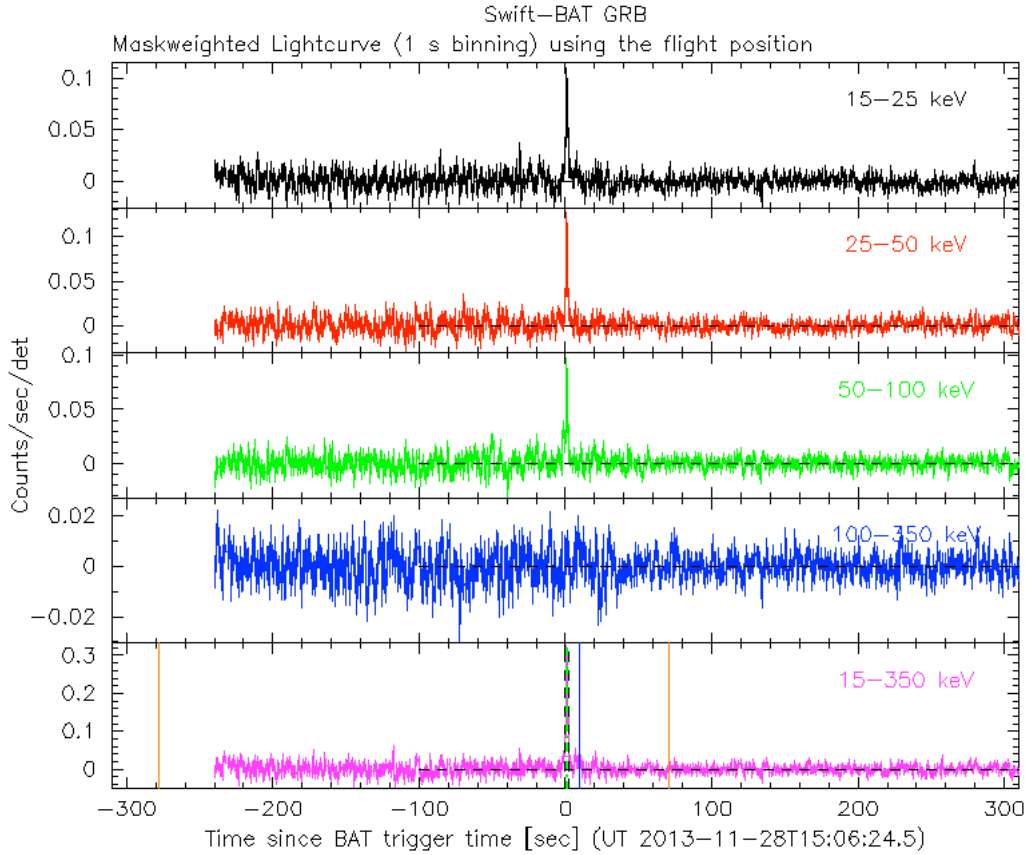


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts $\text{sec}^{-1}\text{illuminated-detector}^{-1}$ and T_0 is 15:06:24.5 UT.

3 XRT Observations and Analysis

7.6 ks of XRT data were analysed for GRB 131128A from 72 s to 40.8 ks after the BAT trigger. The data comprise 7 s in Windowed Timing (WT) mode with the remainder in Photon Counting (PC) mode. The enhanced XRT position is $\text{RA}(J2000) = 23\text{h } 41\text{m } 13.88\text{s}$, $\text{Dec}(J2000) = +31\text{d } 18' 22.9'' \pm 1.8''$ (90% confidence) (Goad *et al.* *GCN Circ.* 15538).

The late time light curve (Fig.2) can be modelled with a series of power-law decays. The initial decay index of $\alpha = 1.9 \pm 0.4$. At $T+423$ s the decay flattens to an alpha of $0.38^{+0.08}_{-0.14}$ before breaking again at $T+16.0$ ks to a final decay with index $\alpha=1.7^{+0.7}_{-0.6}$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of $1.53^{+0.18}_{-0.12}$. The best-fitting absorption column is $5.8^{+4.6}_{-0.7} \times 10^{20} \text{cm}^{-2}$, consistent with the Galactic value of $5.2 \times 10^{20} \text{cm}^{-2}$ (Kalberla *et al.* 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is $4.6 \times 10^{-11} \text{erg cm}^{-2} \text{count}^{-1}$.

The results of the XRT-team automatic analysis are available at http://www.swift.ac.uk/xrt_products/00579683.

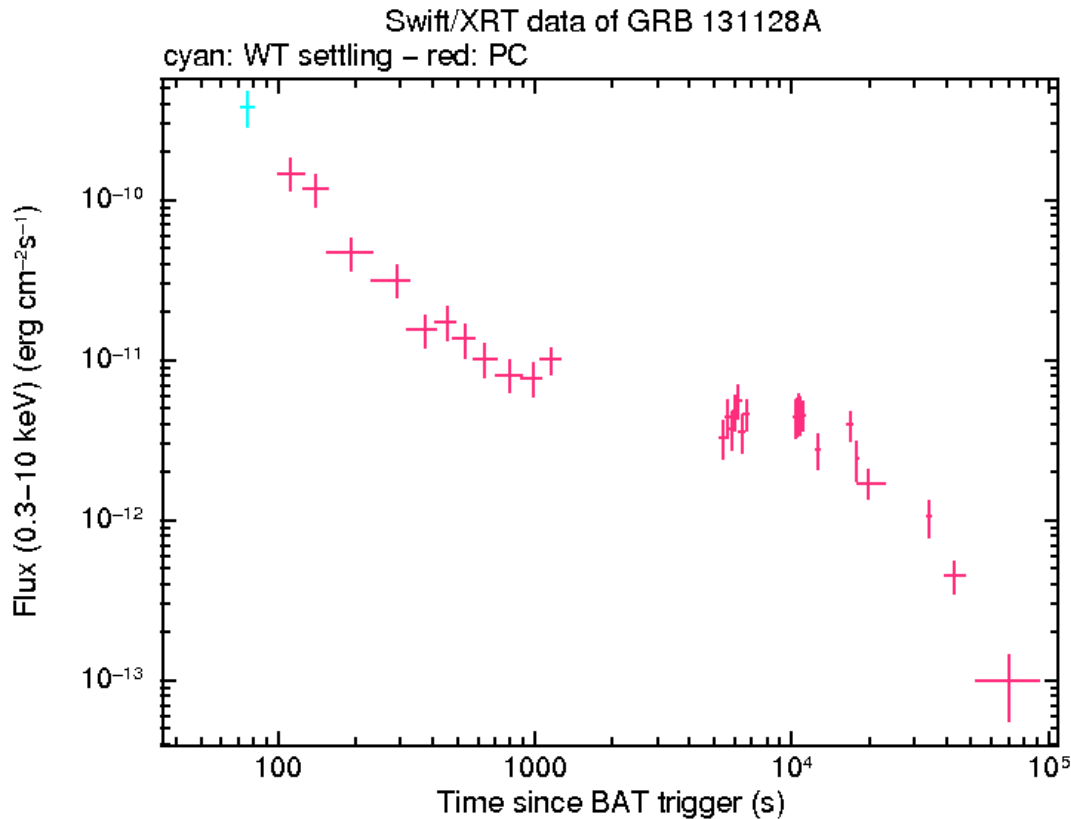


Figure 2: XRT Lightcurve in the 0.3-10 keV band: Windows Timing mode (blue) and Photon Counting mode (red). The conversion factor for this burst is 1 count = $4.6 \times 10^{-11} \text{ erg cm}^{-2}$.

4 UVOT Observation and Analysis

The Swift/UVOT began settled observations of the field of GRB 131128A, 91 s after the BAT trigger (Trigger 15545, Sonbas et al., *GCN Circ.* 15533). A source consistent with the optical position (Xu et al., *GCN Circ.* 15535) and the enhanced Swift-XRT position (Goad et al., *GCN Circ.* 15538) is detected in the first UVOT white exposure only. A USNO-B1 catalogued star heavily contaminates the position of the optical candidate afterglow making the measurement very complicated (Oates et al., *GCN Circ.* 15545) is detected in the initial UVOT exposures. Preliminary 3-sigma upper limits using the UVOT photometric system (Breeveld et al. 2011, AIP Conf. Proc. 1358, 373) for the early exposures are shown in the Table 1.

References

- [1] Barthelmy, S. et al. 2013 GCN Circ. 15539
- [2] Breeveld, A. A. et al. 2011, AIP Conf. Proc. 1358, 373
- [3] Goad, M. R. et al. 2013 GCN Circ. 15538
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- [6] Kawabata, K. S. et al. 2013 GCN Circ. 15541

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- [8] Quadri, U. et al. 2013 GCN Circ. 15556
- [9] Schmidl, D. et al. 2013, GCN Circ. 15547
- [10] Sonbas, E. et al. 2013, GCN Circ. 15533
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- [12] Xu et al. 2013, GCN Circ. 15535
- [13] Yu, H. F. et al. 2013, GCN Circ. 15554

Filter	T_{Start}	T_{Stop}	Exposure (s)	Mag.
WHITE-FC	91	241	147	19.11 ± 0.11
u-FC	303	552	245	>20.2
WHITE	583	1181	206	>21.44
u	303	1130	285	>20.3
v	632	1231	78	>19.0
b	558	1155	58	>19.8
w1	683	1275	53	>18.9
m2	657	1255	78	>19.0
w2	608	1206	78	>19.4

Table 1: Magnitude limits from UVOT observations. The magnitudes in the table are not corrected for the Galactic extinction due to the reddening of $E(B-V) = 0.07$ in the direction of the burst (Schlegel et al. 1998).