

## Swift Observation of GRB 081024

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### 1 Introduction

At 05:53:08 UT Swift/BAT triggered and located the short, hard GRB 081024 (trigger=332516). Swift slewed immediately to the burst. A fading, uncatalogued X-ray source was found within the BAT error circle with no UVOT counterpart. Using 1443 s of XRT Photon Counting mode data and one UVOT image, the astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue) is RA(J2000)= 27.8738 deg, Dec(J2000)= +61.3314 deg which is equivalent to RA(J2000)= 01<sup>h</sup>51<sup>m</sup>29.72<sup>s</sup>, Dec(J2000)= +61<sup>d</sup> 19' 53.0'' with an uncertainty of 1.9 arcsec (radius, 90% confidence) (Beardmore et al. GCN Circ. 8403). The position in galactic coordinates is l=130deg, b=-0.7 deg. It is not impossible that GRB 081024 is a galactic transient or even an SGR.

No detection from ground-based facilities has been reported.

### 2 BAT Observation and Analysis

Using the data set from T-239 to T+963 sec the BAT ground-calculated position is RA(J2000)= 27.891 deg, Dec(J2000)= +61.352 deg, that is RA(J2000)= 01<sup>h</sup>51<sup>m</sup>33.8<sup>s</sup>, Dec(J2000)= +61<sup>d</sup> 21' 08.2'', with an uncertainty of 1.7 arcmin (radius, sys+stat, 90% containment). This position is 1.3 arcmin from the enhanced XRT position (Beardmore et al. GCN Circ. 8403). The partial coding was 97%. The mask-weighted lightcurve shows a slightly softer precursor peak about 0.05 sec long at T-1.7 sec, a peak about 0.3 seconds long at T-0.2 sec and the largest peak 0.1 seconds long at T0. T90 (15-350 keV) is  $1.8 \pm 0.6$  sec (estimated error including systematics) (Figure 1). The time-averaged spectrum from T-1.7 to T+0.3 sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is  $1.23 \pm 0.21$ . The fluence in the 15-150 keV band is  $(1.2 \pm 0.2) \times 10^{-7}$  erg cm<sup>-2</sup>. The 1-sec peak photon flux measured from T-0.73 sec in the 15-150 keV band is  $(1.1 \pm 0.1)$  ph cm<sup>-2</sup> sec<sup>-1</sup>. All the quoted errors are at the 90% confidence level (Barthelmy et al. GCN Circ. 8404).

### 3 XRT Observations and Analysis

During the first orbit of the XRT data, from T+78 s to T+105 s after the burst, data were collected in Windowed Timing mode and then XRT switched to Photon Counting mode. The 0.3-10 keV flux from T+78 s to T+355 s shows a very steep decay with a possible small re-brightening between  $\sim T + 145$  s to  $\sim T + 205$  s. Excluding the re-brightening and assuming a power law decay, the best fit decay index is  $\alpha = 3.7_{-0.5}^{+0.8}$  (Figure 2). The spectrum of the WT data, with an integration time of 27s, can be modelled with a power-law model with photon index of  $1.6_{-0.3}^{+0.6}$ . The total absorbing equivalent hydrogen column density is consistent with the Galactic one  $N_H = 7.71 \times 10^{21}$  cm<sup>-2</sup> (Kalberla et al. 2005). The observed (unabsorbed) 0.3-10 keV flux is  $4.1(6.1) \times 10^{-10}$  erg cm<sup>-2</sup> s<sup>-1</sup>. No source counts are detected after the first orbit, likely due to the very steep flux decay (Stratta et al. GCN Circ. 8405).

Detailed light curves in both count rate and flux units are available in both graphical and ASCII formats at [http://www.swift.ac.uk/xrt\\_curves/](http://www.swift.ac.uk/xrt_curves/).

## 4 UVOT Observation and Analysis

The Swift/UVOT observed the field of GRB 081024 starting 77 s after the BAT trigger (De Pasquale et al. CGN Circ. 8406). No new source is detected within the XRT refined position in any of the UVOT observations. The 3-sigma upper limits for detecting a source inside the XRT error circle in the co-added frames are reported in Table 1. The reported upper limits are uncorrected for the estimated Galactic reddening of  $E(B - V) = 1.64$  mag towards the direction of the burst (Schlegel et al. 1998) (De Pasquale et al. GCN Circ. 8406).

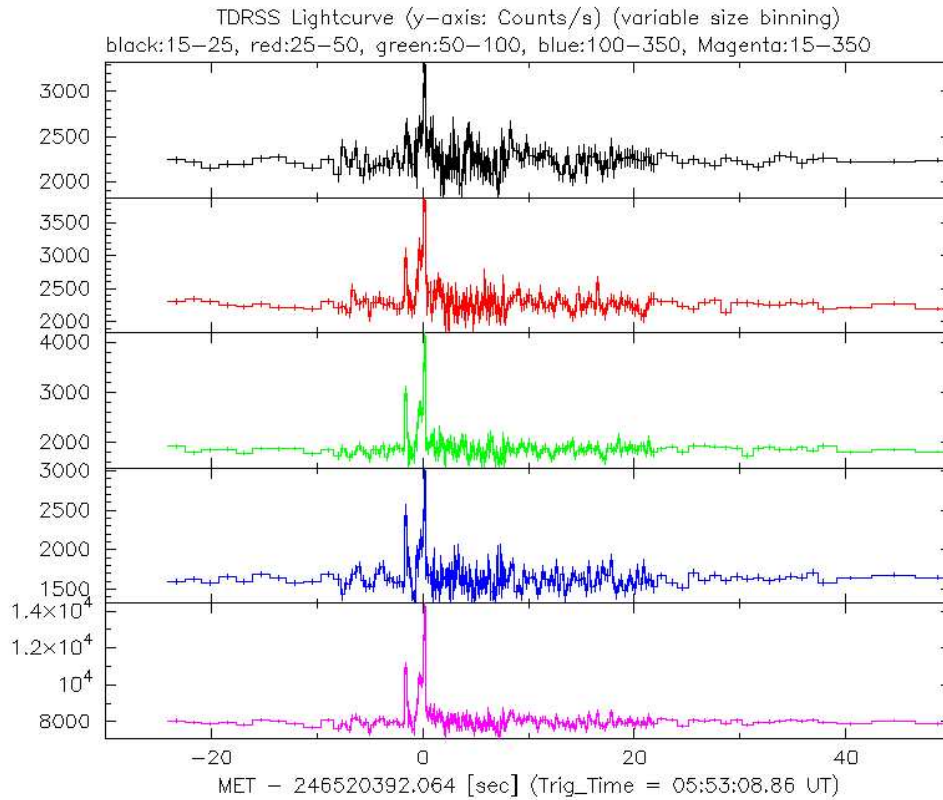


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands: 15-25 keV (black), 25-50 keV (red), 50-100 keV (green), 15-350 keV (magenta). The units are counts  $\text{s}^{-1}$  illuminated-detector $^{-1}$  (note illum-det =  $0.16 \text{ cm}^2$ ).

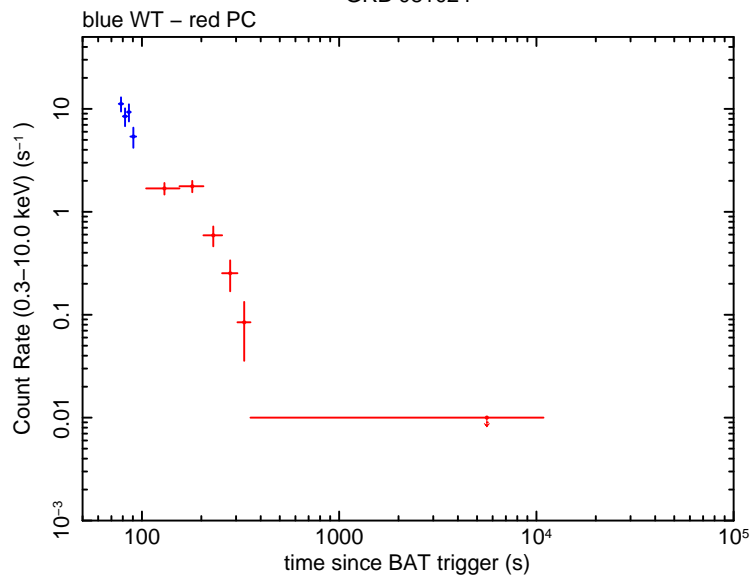


Figure 2: XRT Lightcurve. Counts  $s^{-1}$  in the 0.3-10 keV band: Window Timing mode (blue), Photon Counting mode (red). The approximate conversion is  $1 \text{ count } s^{-1} \sim 8.2 \times 10^{-11} \text{ erg cm}^{-2} s^{-1}$ .

Filter	T_start (s)	T_stop (s)	Exp (s)	3-sigma UL mag
white	77	227	147	> 20.8
white	516	13395	1258	> 22.0
v	565	758	39	> 18.5
v	1041	7298	490	> 19.9
b	491	856	58	> 19.6
b	1140	12771	1358	> 21.4
u	235	485	250	> 20.1
u	639	11859	807	> 21.0
uvw1	615	7615	436	> 20.2
uvm2	590	7503	529	> 20.5
uvw2	541	7093	529	> 20.6

Table 1: Magnitude limits from UVOT observations.