

## 1 Introduction

BAT triggered on GRB 080218B at 23:57:47 UT (Trigger 303631) (Schady, et al., *GCN Circ.* 7314). This was a 4.096 sec rate-trigger with a significance of 11.78 on a long GRB with  $T_{90} = 6.2 \pm 1.2$  sec. Our best position is the XRT location, RA( $J2000$ ) = 177.95723 deg (11h51m49.73s), Dec( $J2000$ ) =  $-53.09695$  deg ( $-53d05'49.0''$ ) with a 90% error circle of 1.4 arcsec. No optical afterglow was detected by either UVOT or any ground based observatories down to deep limits [e.g.  $r' > 24.2$ ; Rossi, et al., *GCN Circ.* 7319].

## 2 BAT Observation and Analysis

Using the data set from  $T - 198$  to  $T + 962$  sec, the BAT ground-calculated position is RA( $J2000$ ) = 177.927 deg (11h51m42.4s), Dec( $J2000$ ) =  $-53.086$  deg ( $-53d05'11''$ )  $\pm 2.0$  arcmin, (radius, systematic and statistical, 90% containment) (Krimm, et al., *GCN Circ.* 7325). The partial coding was 10%.

The masked-weighted light curve (Fig.1) shows a roughly triangular peak starting at  $\sim T - 3$  sec, peaking at  $T + 1$  sec, and ending at  $\sim T + 7$  sec.  $T_{90}$  (15 – 350 keV) is  $6.2 \pm 1.2$  sec (estimated error including systematics).

The time-averaged spectrum from  $T - 0.8$  to  $T + 6.6$  sec is best fitted by a power law with an exponential cutoff. This fit gives a photon index of  $0.11 \pm 2.44$ , and a peak energy of  $E_{peak} = 23.6 \pm 14.6$  ( $\chi^2 = 49.02$  for 56 d.o.f.). For this model the total fluence in the 15 – 150 keV band is  $(5.1 \pm 1.0) \times 10^{-7}$  erg cm $^{-2}$  and the 1-sec peak flux measured from  $T + 0.28$  sec in the 15 – 150 keV band is  $2.63 \pm 0.29$  ph cm $^{-2}$  sec $^{-1}$ . A fit to a simple power law gives a photon index of  $2.63 \pm 0.29$  ( $\chi^2 = 55.36$  for 57 d.o.f.). All the quoted errors are at the 90% confidence level.

## 3 XRT Observations and Analysis

As the spacecraft slewed to the target it entered the South Atlantic Anomaly, and XRT observations were therefore delayed. The XRT began observations of GRB 080218B 931 sec after the BAT trigger and detected a bright X-ray source with an approximate count rate of 0.2 counts/sec. Using 14 ks of overlapping XRT Photon Counting mode and UVOT data, the astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue) is RA( $J2000$ ) = 177.95723 deg (11h51m49.73s), Dec( $J2000$ ) =  $-53.09695$  deg ( $-53d05'49.0''$ )  $\pm 1.4$  arcsec (radius, 90% confidence). This position uses the new release of the XRT position enhancement code (Evans, et al., *GCN Circ.* 7328).

The 0.3 – 10 keV light curve (Fig.2) decays as a broken power law with an initial decay index of  $\alpha_{X,1} = 0.84 \pm 0.09$  that breaks at  $t_{break} = (8.83 \pm 0.89) \times 10^4$  sec to a decay index of  $\alpha_{X,2} = 2.01 \pm 0.64$ .

The X-ray spectrum using the first 4 orbits (4.6 ks of exposure, up to  $T + 10$  ks) can be fit with an absorbed power-law with a photon index of  $\Gamma = 2.46_{-0.47}^{+0.53}$  and a column density of  $5.17_{-0.18}^{+0.24} \times 10^{21}$  cm $^{-2}$ , significantly in excess of the Galactic value of  $1.35 \times 10^{21}$  cm $^{-2}$  in this direction [2]. All errors are at the 90% confidence level.

Given the excess absorption, the relation given in [1] suggests that this burst lies at a redshift  $z < 3.3$  at the 90% confidence level.

The UVOT observed the field of GRB 080218B 551 s after the BAT trigger. No new source was detected with the refined XRT error circle in any of the UVOT co-added observations. The  $3\sigma$  upper limits are given in Table 1.

## References

- [1] Grupe, D., Nousek, J. A., vanden Berk, D. E., Roming, P. W. A., Burrows, D. N., Godet, O., Osbourne, J., & Gehrels, N. 2007, *AJ.*, 133, 2216
- [2] Kalberla, P. M. W., Burton, W. B., Hartmann, D., Arnal, E. M., Bajaja, E., Morras, R., Pöumlppel, W. G. L. 2005, *A&A.*, 440, 775
- [3] Schlegel, D. J., Finkbeiner, D. P., & Davis, M. 1998, *ApJ.*, 500, 525

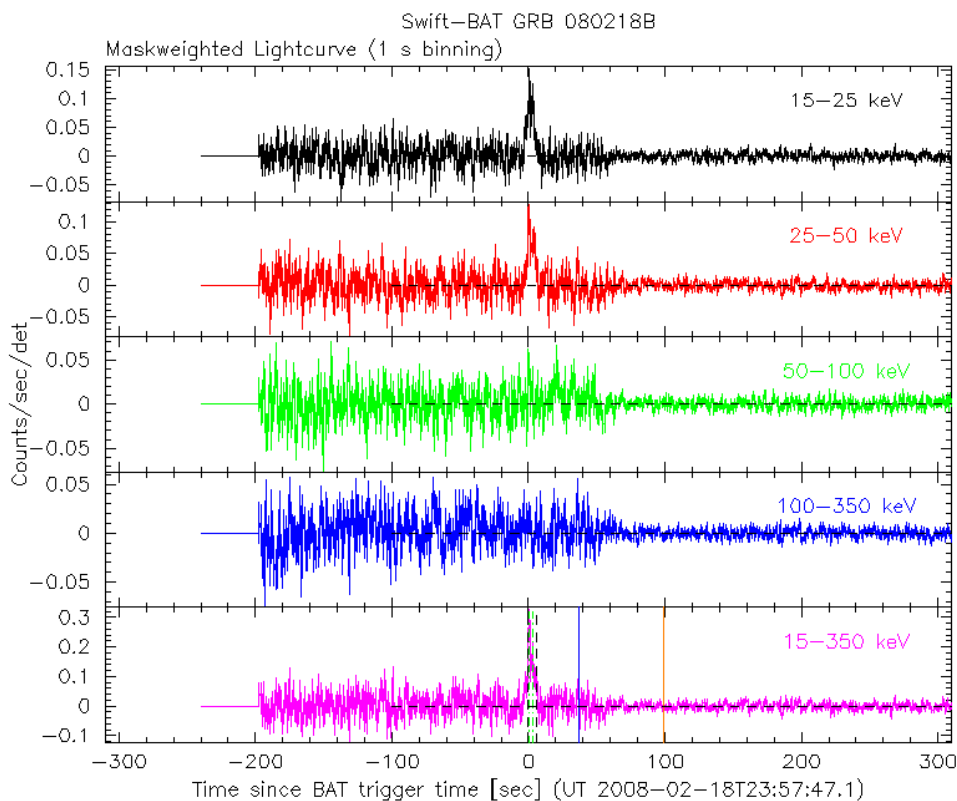


Figure 1: BAT Light curve. The mask-weighted 1-sec light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and  $T$  is 23:57:47 UT.

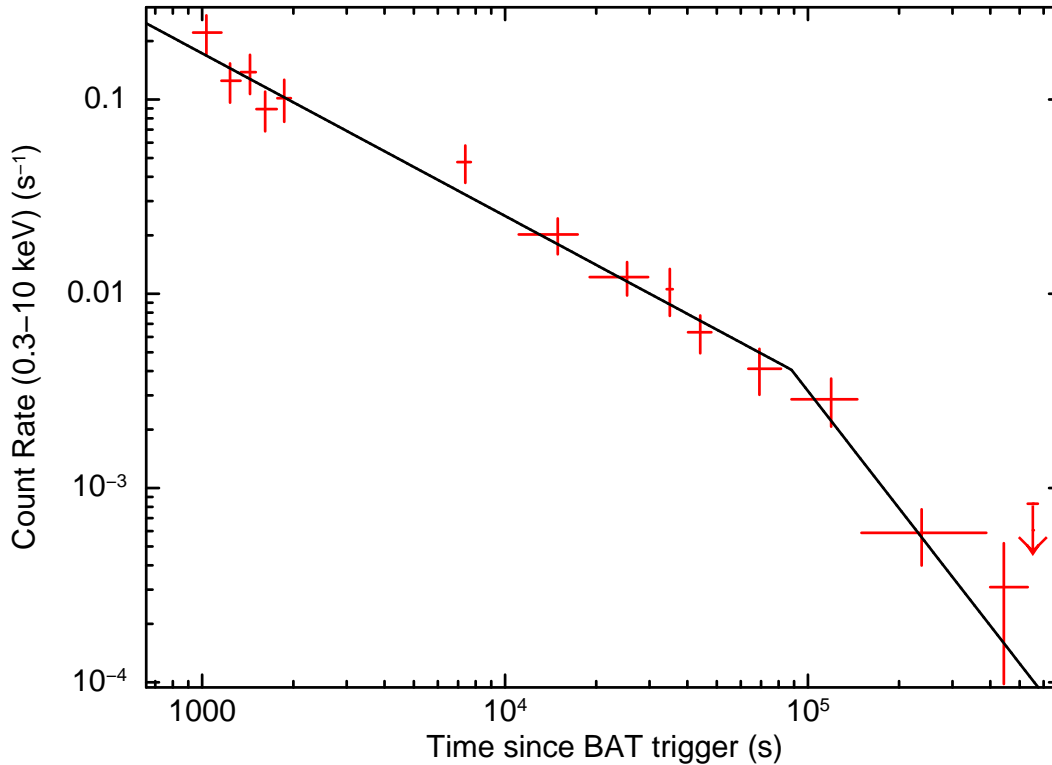


Figure 2: XRT Light curve. Counts/sec in the 0.3 – 10 keV band taken in Photon Counting mode (red). The broken power law fit is shown in black and has an initial decay index  $\alpha_{X,1} = 0.84 \pm 0.09$ , which breaks at  $t_{break} = (8.83 \pm 0.89) \times 10^4$  s to a decay index  $\alpha_{X,2} = 2.01 \pm 0.64$ . The approximate conversion of the absorbed flux is 1 count/sec  $5.7 \times 10^{-11}$  erg cm $^{-2}$  sec $^{-1}$ .

Filter	$T_{mid}$ (sec)	Exposure (sec)	Mag/ $3\sigma$ UL
White	4178	420	> 21.09
v	2955	494	> 19.87
b	4126	283	> 20.24
u	4098	294	> 19.98
uvw1	3984	294	> 19.77
uvm2	3868	313	> 19.67
uvw2	6056	281	> 19.91

Table 1: Magnitudes from UVOT observations.  $T_{mid}$  is the weighted mid time of the co-added observations. The values quoted are not corrected for the expected Galactic extinction corresponding to a reddening of  $E(B-V)=0.17$  mag in the direction of the burst [3].