

Swift Observation of GRB 080520

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1 Introduction

At 22:20:24 UT on 2008 May 20, the Swift Burst Alert Telescope (BAT) triggered on GRB 080520 (Grupe et al. *GCN Circ.* 7753). The *Swift* XRT and UVOT began observing the field of GRB 080520 ~ 100 s after the burst. The burst was clearly detected in the XRT and UVOT. The best *Swift* position of the afterglow is the UVOT position at RA-2000 = 18h40m46.30s , Dec-2000 = $154^{\circ}59'31.0''$ ($0.5''$ error circle).

The afterglow was followed from the ground by GROND (Rossi et al. *GCN Circ.* 7756) and VLT which obtained a redshift at $z=1.545$ (Jacobsson et al. *GCN Circ.* 7757).

2 BAT Observation and Analysis

At 22:20:24 UT on 2008 May 20, the Swift BAT triggered on GRB 080520 (trigger #312047, Grupe et al. *GCN Circ.* 7753). The BAT ground-calculated position is RA, Dec = 280.179, -54.964 deg (Sakamoto et al. *GCN Circ.* 7761), which is

$$\text{RA(J2000)} = 18\text{h } 40\text{m } 42.9\text{s}$$

$$\text{Dec(J2000)} = -54^{\circ}57'51.2''$$

with an uncertainty of $2.4'$ (radius, 90% containment, including systematic uncertainty). The partial coding was 100%. The mask-weighted light curve shows a single peak starting at T_0 and ending at $T+3$ s. T_{90} (15-350 keV) is 2.8 ± 0.7 s (estimated error including systematics).

The time-averaged spectrum from T-0.3 to T+2.8 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 2.90 ± 0.51 . The fluence in the 15-150 keV band is $(5.5 \pm 1.4) \times 10^{-8}$ ergs cm^{-2} . The 1s peak photon flux measured from T-0.31 s in the 15-150 keV band is (0.5 ± 0.1) photons $\text{cm}^{-2} \text{s}^{-1}$. 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/312047/BA/

We note that the fluence ratio in a simple power-law fit between the 25-50 keV band and the 50-100 keV band is 1.88. This fluence ratio is larger than 1.32 which can be achieved in the Band function of $\alpha = -1.0$, $\beta = -2.5$, and $E_{\text{peak}}=30$ keV. Thus, preliminary analysis shows that E_{peak} of the burst is very likely around or below 30 keV. Therefore the burst can be classified as an X-ray flash (e.g. Sakamoto et al. ApJ, 679, 570).

3 XRT Observations and Analysis

The XRT began observing the field of GRB 080520 at 22:22:04.3 UT, 99 s after the BAT trigger (Grupe *GCN Circ.* 7754) XRT found a fading, uncatalogued X-ray source. The enhanced *Swift*-XRT

position as reported by Goad et al. (*GCN Circ.* 7755) is RA-2000 = 280.19385, Dec-2000 = -54.99160 which is equivalent to:

RA (J2000): 18h 40m 46.52s

Dec (J2000): $-54^{\circ} 59' 29.8''$

with an uncertainty of $1.9''$ (radius, 90% confidence).

The $0.3 - 10$ keV light curve (Fig.2) displays the typical canonical light curve (Nousek et al. 2006). During the first phase the afterglow decays with a decay slope $\alpha_1 = 1.17 \pm 0.11$. The light curve breaks at $T_{\text{break}} = 1.1$ ks after the burst and decays during the plateau phase with $\alpha_2 = 0.76 \pm 0.13$. After this the X-ray afterglow is not detected anymore. We can assume a break after about T+40 ks.

As reported by Grupe (*GCN Circ.* 7754), the XRT Photon Counting mode data can be modeled by an absorbed power-law with photon index $\Gamma = 2.12 \pm 0.20$ and an absorbing column that is consistent with the the Galactic value ($6.48 \times 10^{20} \text{ cm}^{-2}$; Kalberla et al. 2005).

4 UVOT analysis

The Swift/UVOT began settled observations of the field of GRB 080520, 105s after the BAT trigger (Oates & Grupe *GCN Circ.* 7761). The afterglow was detected in the White and V filters at the position:

RA(J2000.0) = 18h 40m 46.30s

DEC(J2000.0) = $-54^{\circ} 59' 31.0''$

with an estimated uncertainty of 0.5 arcsec (radius, 90% confidence). This position is consistent with the UVOT enhanced XRT position (Goad et al. *GCN Circ.* 7755).

Figure 3 displays the UVOT White light curve of GRB 080520. UVOT magnitudes and 3σ upper limits are listed in Table 1 below for the single and coadded images. These magnitudes are not corrected for the Galactic extinction corresponding to a reddening of $E_{B-V} = 0.08$ mag (Schlegel et al. 1998). The photometry is on the UVOT flight system described in Poole et al. (2008, MNRAS, 383, 627).

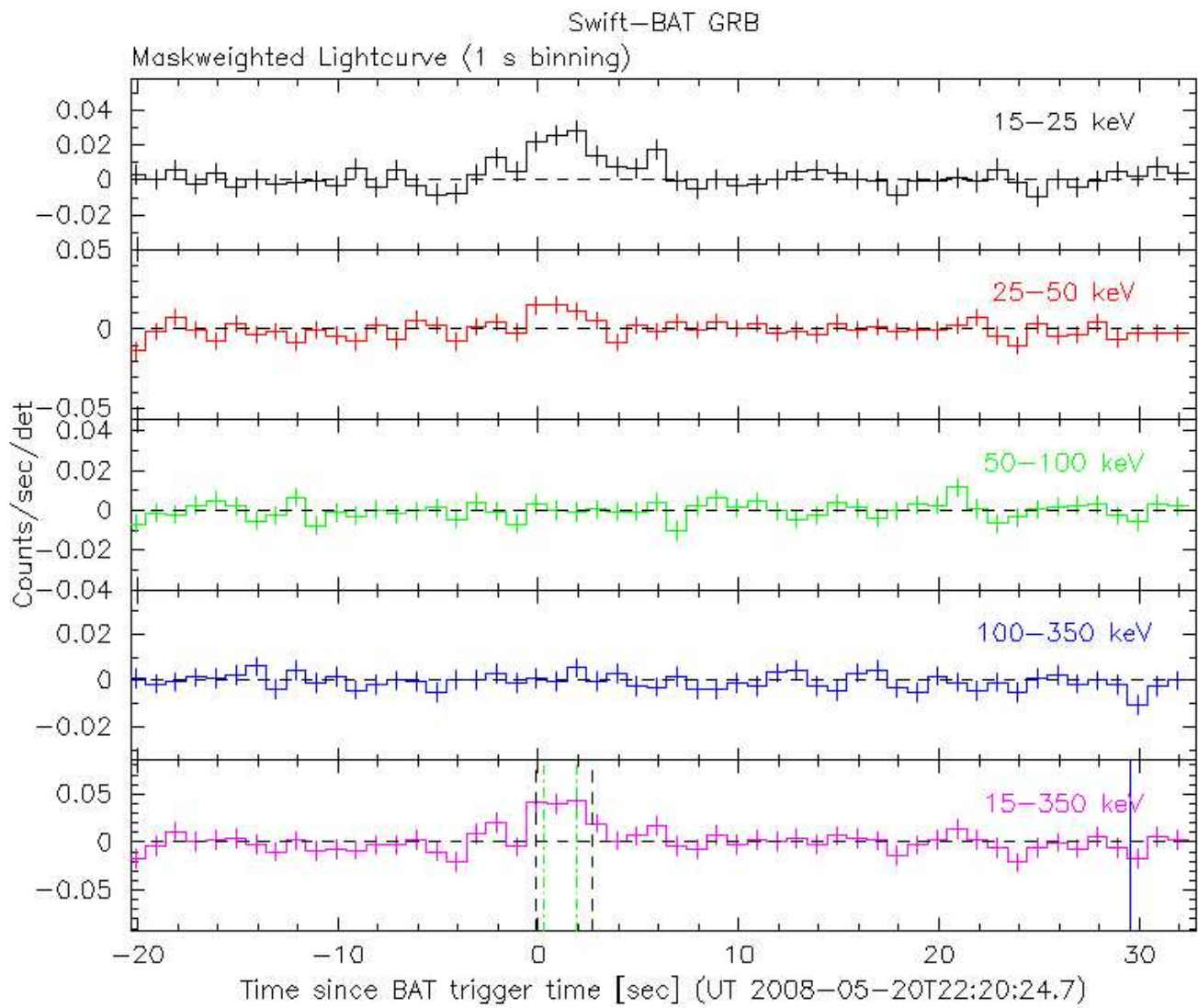


Figure 1: BAT Light curves of GRB 080520.

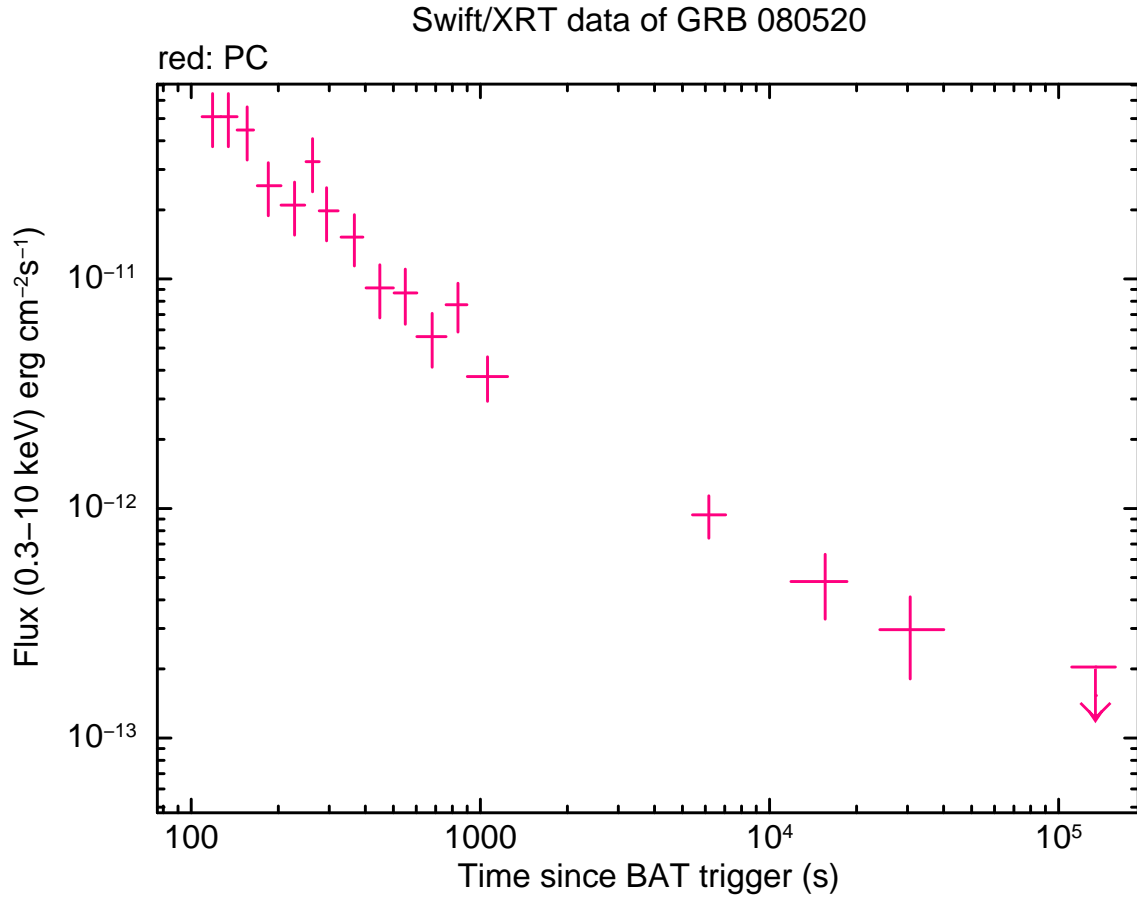


Figure 2: XRT flux light curve in the 0.3-10 keV band. The approximate conversion is $1 \text{ count s}^{-1} = \sim 5.644 \times 10^{-11} \text{ ergs s}^{-1} \text{ cm}^{-2}$ for an absorbed flux.

Filter	T_{Start}	T_{stop}	Exposure	Mag
White	105	204	98	19.59 ± 0.12
White	858	958	98	20.58 ± 0.28
V	211	610	400	20.26 ± 0.38
V	964	1299	330	19.96 ± 0.45
B	691	6273	216	> 20.92
U	666	6068	197	> 20.60
W1	641	5862	236	> 20.33
M2	617	7079	418	> 20.38
W2	720	6684	216	> 20.25

Table 1: Magnitude from UVOT observations of GRB 080520

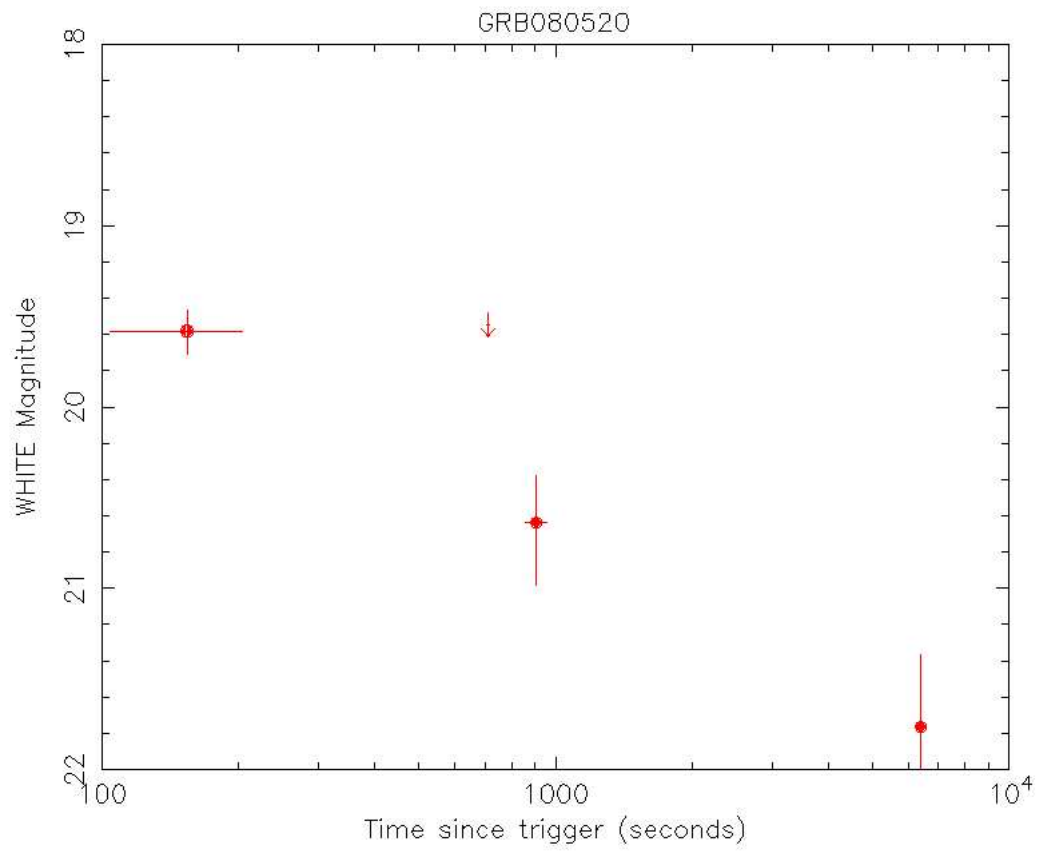


Figure 3: UVOT White light curve