Swift Observation of GRB 070518

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1 Introduction

BAT triggered on GRB 070518 at 14:26:21 UT (Trigger 279592) (Guidorzi, *et al.*, *GCN Circ.* 6415). This was a 1.024-s rate-trigger on a long burst. XRT observations began at $T + 70$ s and discovered the X-ray afterglow. UVOT began observing at $T + 82$ s and found the optical counterpart with the White filter with ~ 18 mag. Our best position is the UVOT location RA(J2000)= 254.1986 deg ($16^{\rm h}56^{\rm m}47.7^{\rm s}$), Dec(J2000)= +55.2951 deg ($+55^{\rm d}17'42.3''$) with an error of 1 arcsec (90% confidence).

2 BAT Observation and Analysis

Using the data set from $T - 119$ s to $T + 183$ s from recent telemetry downlinks, the BAT ground-calculated position is RA(J2000) = 254.221 deg ($16^{\rm h}56^{\rm m}52.9^{\rm s}$), Dec(J2000)= +55.285 deg ($+55^{\rm d}17'05.6''$) with an error of 1.8 arcmin (radius, sys+stat, 90% containment). The partial coding was 84%.

The mask-weighted lightcurves (Fig. 1) shows a single peak starting a $\sim T - 5$ s and ending at $\sim T + 10$ s. T_{90} (15–350 keV) is 5.5 ± 0.2 s (estimated error including systematics).

The time-averaged spectrum from $T - 1.8$ s to $T + 4.5$ s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 2.11 ± 0.25. The fluence in the 15–150 keV band is $(1.6 \pm 0.2) \times 10^{-7}$ erg cm^{-2}. The 1-s peak photon flux measured from $T + 0.12$ s in the 15–150 keV band is 0.7 ± 0.1 ph cm^{-2} s^{-1}. All the quoted errors are at the 90% confidence level (Krimm *et al.*, *GCN Circ.* 6417).

3 XRT Observations and Analysis

Using the data from the first two orbits of XRT data of GRB 070518 (4.2 ks in Photon Counting mode), the refined XRT position is RA(J2000) = 254.1980 deg ($16^{\rm h}56^{\rm m}47.52^{\rm s}$), Dec(J2000)= +55.2944 deg ($+55^{\rm d}17'40.0''$) with an error radius of 3.9 arcsec (90% confidence). This is 2.5 arcsec from the initial X-ray position (Guidorzi *et al.*., *GCN Circ.* 6415), 2.8 arcsec from the UVOT position and 57 arcsec from the BAT refined position (Krimm *et al.*, *GCN Circ.* 6417).

We note that the on-board centroid position for this burst was offset from the correct position by an instrument configuration error resulting from a planned reboot of the XRT yesterday. This error has been corrected and will not affect future bursts.

The XRT light curve (Fig. 2) from 70 s to 29 ks exhibits an initial flaring behaviour up to T+200 s, followed by a steep decay ($\alpha_1 = 4.7 \pm 0.4$) which breaks at $t_{\rm b} = 460 \pm 40$ s to a shallower decay ($\alpha_2 = 1.11 \pm 0.13$) up to $T + 8$ ks. From $T + 8$ ks to $T + 29$ ks the flux lies significantly above the fit extrapolation. Currently we cannot assess whether this is a long flare or a further break in the decay rate.

We extracted two spectra from the WT data during the flaring activity, due to a strong spectral evolution. The first spectrum, from 77 s to 158 s, can be fit with an absorbed power law with a photon index of $\Gamma_1 = 2.3 \pm 0.1$ and column density of $(9.6 \pm 1.6) \times 10^{20}$ cm^{-2} significantly in excess of the Galactic value (2.2×10^{20} cm^{-2}; Dickey & Lockman, 1990). The second spectrum, from 165 s

to 253 s, has a photon index of $\Gamma_2 = 2.9 \pm 0.1$ and same column density as that of the first spectrum.

The absorbed (unabsorbed) 0.3–10.0keV flux for the first spectrum is 5.1×10^{-10} (7.2×10^{-10}) ergs cm^{-2} s^{-1}.

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/`.

4 UVOT Observation and Analysis

The Swift UVOT began observing the field of GRB 070518 82 s after the trigger. The afterglow was clearly detected in all the 7 filters. This suggests a redshift lower than 0.7.

The estimated magnitudes and 2-σ upper limits for all the filters are reported in Table 1 and shown in Fig. 3. The values are not corrected for the expected Galactic extinction corresponding to a reddening of $E_{B-V} = 0.017$ mag along the line of sight to the GRB (Schlegel et al. 1998).

Assuming a single power law, the decay index is $\alpha_V \sim 1.17$ in V band. The extrapolated V magnitude at $T + 10$ h is 22.59.

Filter	Start (s)	Exposure (s)	Mag
White	82	93	18.16 ± 0.06
White	680	10	19.47 ± 0.11
White	873	94	19.14 ± 0.09
White	1480	10	19.66 ± 0.56
White	1640	10	19.75 ± 0.53
White	5517	97	20.08 ± 0.14
White	6951	197	21.33 ± 0.20
V	187	391	19.31 ± 0.13
V	978	391	20.08 ± 0.24
V	1519	40	> 20.1
V	5927	363	21.05 ± 0.48
B	666	10	19.60 ± 0.59
B	816	29	20.28 ± 0.87
B	1617	20	20.93 ± 1.03
B	5313	195	19.38 ± 0.35
B	6747	197	21.43 ± 0.51
U	640	20	18.51 ± 0.27
U	791	39	19.72 ± 0.37
U	1592	20	19.45 ± 0.43
U	5108	196	20.57 ± 0.31
U	6542	196	20.34 ± 0.26
UVW1	617	39	18.65 ± 0.29
UVW1	1408	59	20.19 ± 0.5
UVW1	6336	197	20.73 ± 0.4
UVM2	1383	39	19.04 ± 0.42
UVM2	6131	534	20.98 ± 0.36
UVW2	695	39	19.46 ± 0.41
UVW2	1656	20	> 20.03
UVW2	5723	393	21.08 ± 0.35

Table 1: Magnitudes from UVOT observations. Upper limits are 2σ.

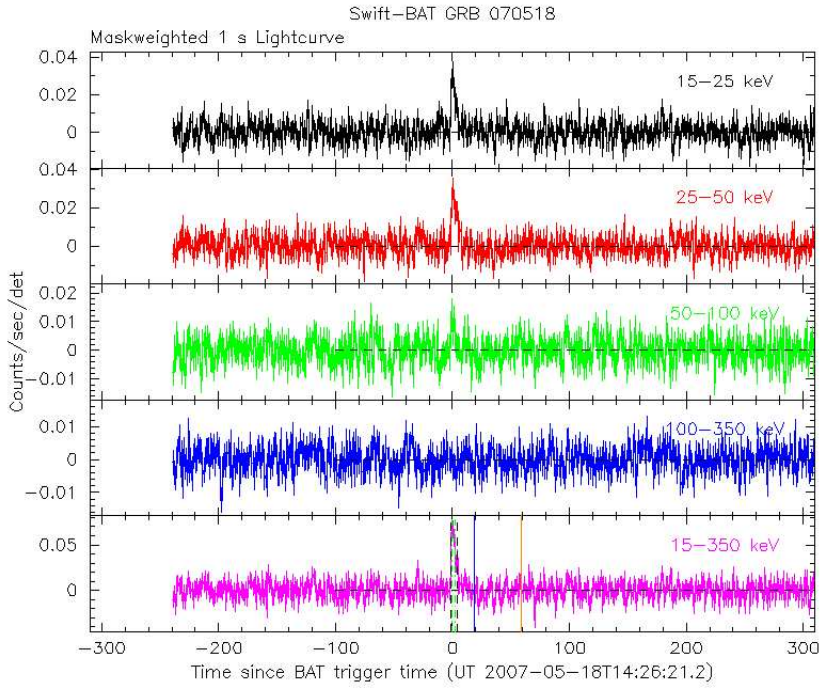

Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/s/illuminated-detector (note illum-det = 0.16 cm^2) and T_0 is 14:26:21 UT.

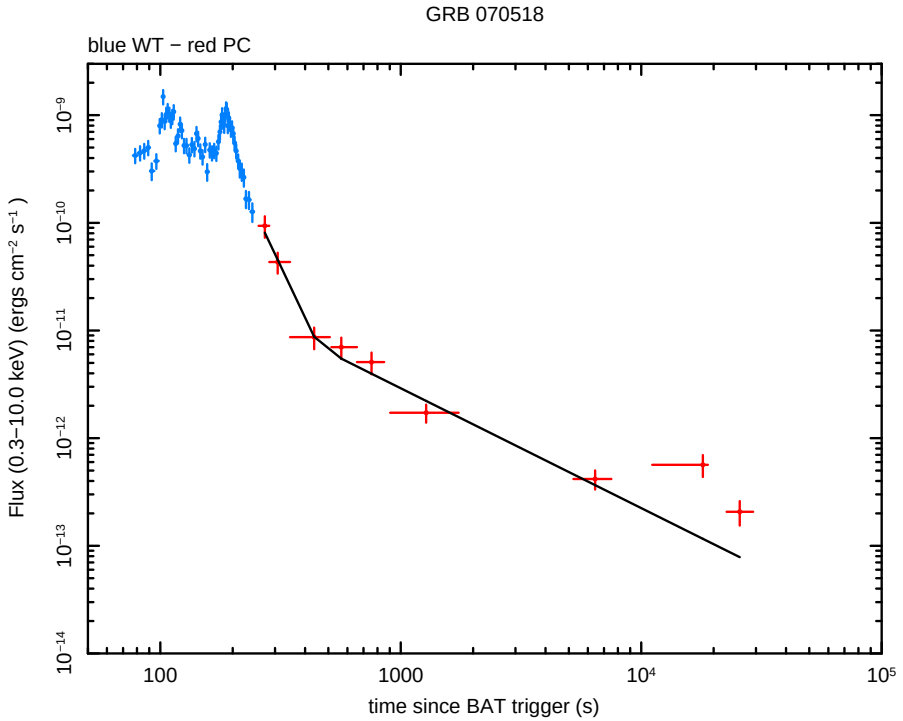

Figure 2: XRT Lightcurve. Flux in the 0.3-10 keV band: Windowed Timing (blue) and Photon Counting (red) modes. The approximate conversion is 1 count/s $\sim 3.2 \times 10^{-11}$ erg cm^{-2} s^{-1}.

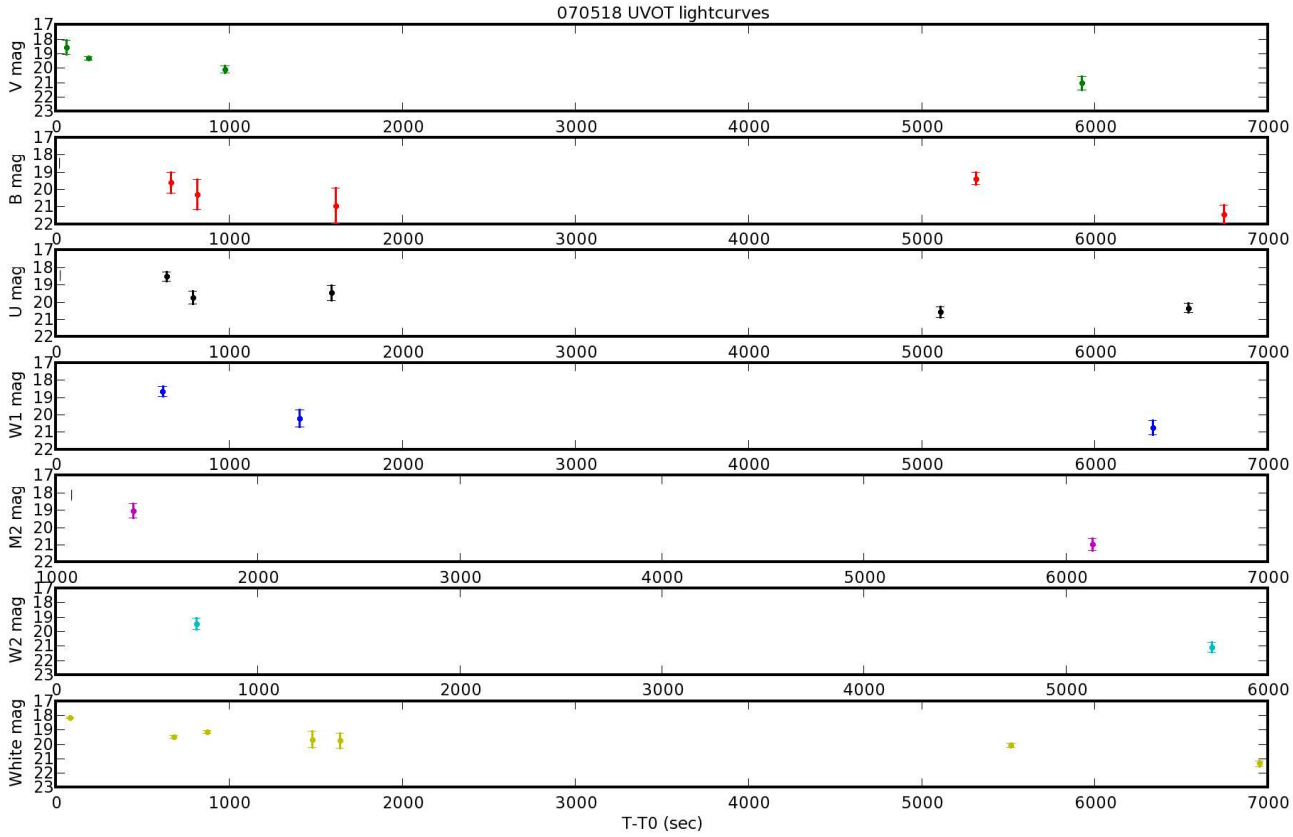

Figure 3: UVOT Lightcurve.