Swift Observations of GRB 090726

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1   Introduction

BAT triggered on GRB 090726 at 22:42:27 UT (Trigger 358422) (Page et al., GCN Circ. 9706). Because of an Earth-limb observing constraint, Swift could not slew to the position of the burst for 49 minutes. At this time, the XRT initially centroided on a cosmic ray, but the X-ray afterglow was then correctly identified in the promptly downlinked SPER data. The best Swift position is that derived from the UVOT: RA, Dec = 248.68060, 72.884664 deg, which is equivalent to

RA (J2000): 16^h 34^m 43.34^s
Dec (J2000): $+72^o$ 53' 04.8"

with an uncertainty of 0.78" (radius, 90% confidence).

The optical afterglow was also detected by the SAO RAS telescope in Caucasus between 2.1 and 6.8 ks after the burst (Moskvitin, Fatkhullin & Valeev, GCN Circ. 9709), the 50 cm telescope in Ondrejov starting 194 s after the burst (Polasek et al., GCN Circ. 9714) and the Crni Vrh Observatory, between 154 and 1502 s after the burst (Maticic & Skvarc, GCN Circ. 9715). Fatkhullin et al. (GCN Circ. 9712) determined the redshift to be 2.71, using the SAO RAS 6-m.

2   BAT Observation and Analysis

The data from T−240 to T+962 s were used for the BAT analysis (Krimm et al., GCN Circ. 9716). The BAT ground-calculated position is RA, Dec = 248.681, 72.866 deg, which is equivalent to

RA(J2000): 16^h 34^m 43.5^s
Dec(J2000): $+72^o$ 51' 56.5"

with an uncertainty of 1.7 arcmin, (radius, sys+stat, 90% containment). The partial coding was 85%.

The masked-weighted light curves (Fig.1) shows a weak single peak starting at ∼ T−40 s, peaking at ∼ T+5 s, and ending at ∼ T+70 s. T90 (15-350 keV) is 67.0 ± 15.2 s (estimated error including systematics).

The time-averaged spectrum from T-34.7 to T+47.3 s is best fitted by a simple power-law model. The power law index of the time-averaged spectrum is $\Gamma = 2.25 \pm 0.19$. The fluence in the 15–150 keV band is $(8.6 \pm 1.0) \times 10^{-7}$ erg cm^{-2}. The 1-s peak photon flux measured from T+7.30 s in the 15–150 keV band is 0.7 ± 0.2 photon cm^{-2} 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/358422/BA/

3   XRT Observations and Analysis

The XRT began observing the burst 3.6 ks after the trigger (Page, GCN Circ. 9711). Using 6689 s of XRT Photon Counting mode data and 9 UVOT images, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue) of RA, Dec = 248.67985, 72.88426 deg, which is equivalent to:

RA (J2000): 16^h 34^m 43.27^s
Dec (J2000): $+72^o$ 53' 03.2"

with an uncertainty of 1.5 arcsec (radius, 90% confidence; Evans et al., GCN Circ. 9710).

The X-ray light-curve can be modelled with a broken power-law, with an initial decay $\alpha_1 = 1.27 \pm 0.09$, breaking at 51^{+18}_{-7} ks to a steeper slope of $\alpha_2 = 2.7^{+1.2}_{-0.7}$.

There is no evidence for spectral evolution across the temporal break. A spectrum formed from all the X-ray data can be fitted with an absorbed power-law of $\Gamma = 2.43^{+0.14}_{-0.12}$ and an intrinsic absorbing column (at z = 2.71) of $(1.2 \pm 0.4) \times 10^{22}$ cm^{-2}, in addition to the Galactic value of 3.83×10^{20} cm^{-2} (Kalberla et al. 2005).

The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor is 3.2×10^{-11} (4.8×10^{-11}) erg cm^{-2} count^{-1}.

The results of the XRT-team automatic analysis are available at
http://www.swift.ac.uk/xrt_products/00358422.

4 UVOT Observation and Analysis

The UVOT began settled observations of the field of the burst 3610s after the BAT trigger, detecting the afterglow in the white, v, and b filters, at a position of RA, Dec = 248.68060, 72.884664 deg, which is equivalent to

RA (J2000): 16^h 34^m 43.34^s
Dec (J2000): $+72^o$ 53' 04.8"

with an uncertainty of 0.78" (radius, 90% confidence).

The magnitudes and upper limits are given in Table 1 and a light-curve shown in Figure 3. The non-detections in the u and UV filters are consistent with the redshift of z= 2.71 reported by Fatkhullin et al (GCN Circ. 9712).

The values quoted in the table are not corrected for the Galactic extinction due to the reddening of E(B-V) = 0.045 in the direction of the burst. The photometry is on the UVOT photometric system described in Poole et al. (2008, MNRAS, 383, 627).

Filter	Start (s since trigger)	Exposure (s)	Magnitude
white	3610	147	20.62 ± 0.18
white	4179	197	21.36 ± 0.29
v	4589	197	19.98 ± 0.36
b	3974	197	20.80 ± 0.44
u	3769	197	>20.9
uvw1	5000	197	>20.6
uvm2	4794	197	>20.6
uvw2	4385	197	>21.0

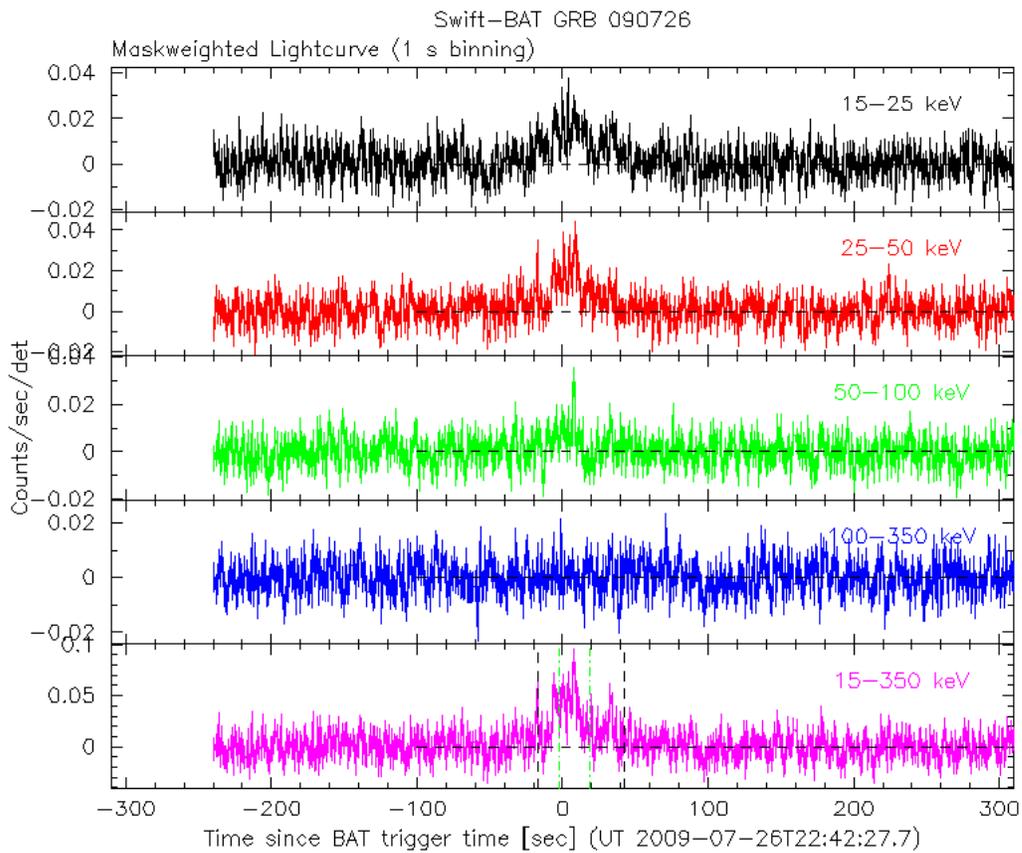Table 1: UVOT magnitudes or limits in all filters. The upper limits are at the 3σ level.

Figure 1: BAT light-curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are count s^{-1}(illuminated-detector)$^{-1}$ (note illum-det = 0.16 cm^2).
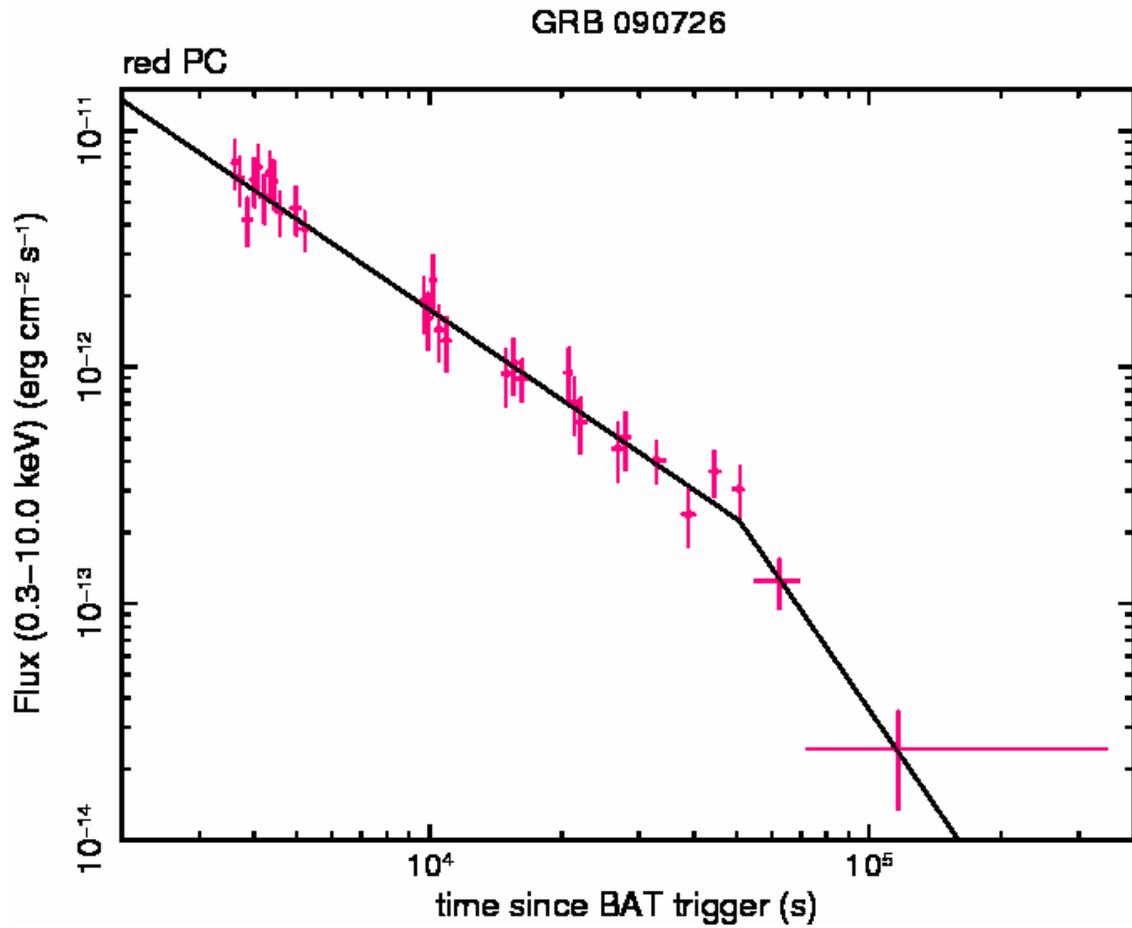
Figure 2: XRT light-curve; all data were collected in Photon Counting mode.The approximate counts to flux conversion is 1 count s^{-1} = 3.2 × 10^{-11} erg cm^{-2} s^{-1}.
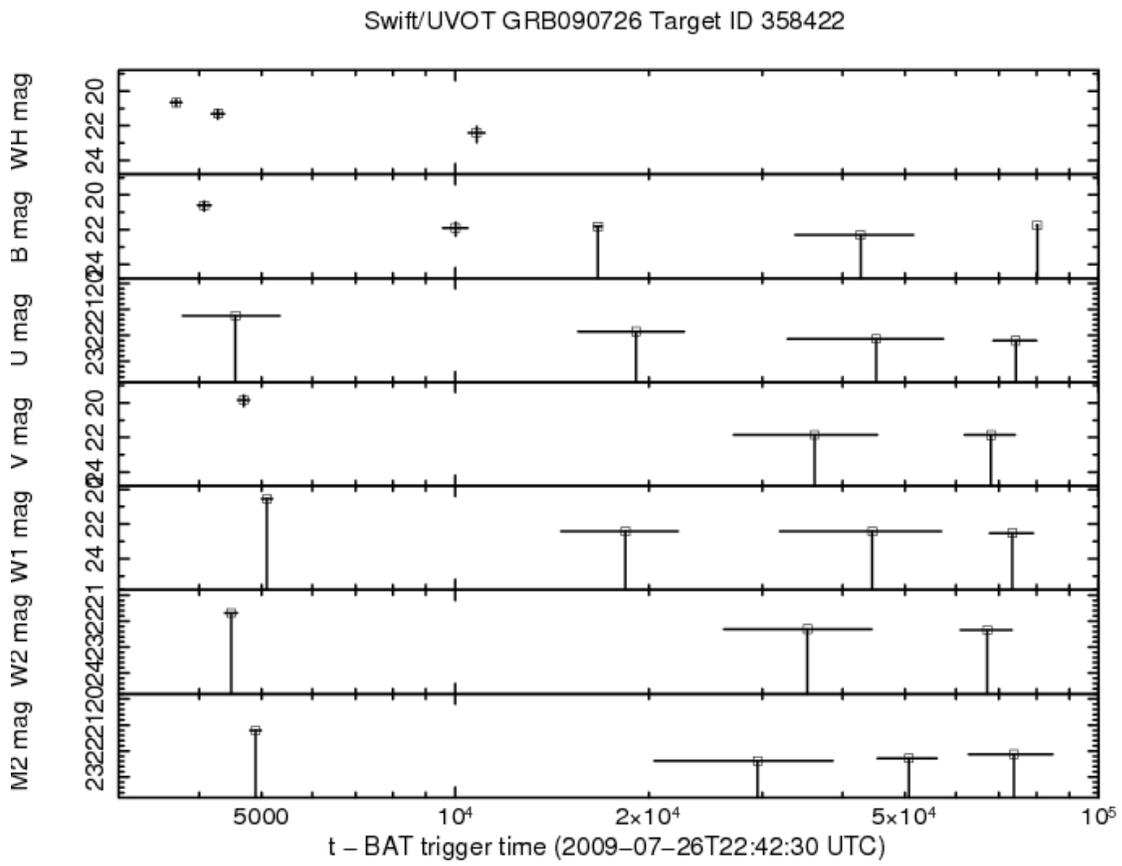
Figure 3: UVOT light-curve. Magnitudes and upper limits are plotted for the various filters.