# Swift Observations of GRB 090715B

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## 1. Introduction

At 21:03:14 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 090715B (trigger=357512). Swift slewed immediately to the burst. UVOT reported a candidate optical afterglow candidate in the initial Swift GCN, and it was confirmed with ground-based observations.

## 2. BAT Observations and Analysis

The data from T-240 to T+962 s were used for the BAT analysis (Cummings et al., GCN Circ. 9672).
The BAT ground-calculated position is RA, Dec = 251.337, 44.837 deg, which is:

RA(J2000) = $16^h\ 45^m\ 20.9^s$
Dec(J2000) = +44 ° 50' 12.6"

with an uncertainty of 1.0 arcmin, (radius, sys+stat, 90% containment).
The partial coding was 100%.

The mask-weighted light curve (Fig.1) shows a series of peaks. The first starts at ~T-10 s, peaks at ~T+7 s, and returns almost to background at T+35 s. The second peak start at ~T+45 s and ends at ~T+100 sec. The third peak starts at ~T+230 s and ends at ~T+290 sec. T90 (15-350 keV) is 266 ± 11 s (estimated error including systematics).

The time-averaged spectrum from T-11.6 to T+292.3 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.57 ±0.07. The fluence in the 15-150 keV band is 5.7 ± 0.2 x 10^-6 erg/cm$^2$. The 1-s peak photon flux measured from T+6.46 s in the 15-150 keV band is 3.8 ± 0.2 ph/cm2/sec. 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/357512/BA/

## 3. XRT Observations and Analysis

The XRT began observing the field at 21:04:00.9 UT, 46.2 seconds after the BAT trigger (Vetere et al., GCN Circ. 9668).. Using 2329 s of XRT Photon Counting mode data and 5 UVOT images for GRB 090715B, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA, Dec = 251.33969, +44.83889 which is equivalent to:

RA(J2000): $16^h 45^m 21.53^s$
Dec(J2000): +44 ° 50' 20.0"

with an uncertainty of 1.5 arcsec (radius, 90% confidence).

The light curve (Fig. 2) shows multiple peaks in WT and a multiple broken power-law decay in PC.
A spectrum formed from the WT mode data can be fitted with an absorbed power-law with a photon spectral index of 1.84 (+/-0.02). The best-fitting absorption column is 1.09 (±0.02) x $10^{21}$ cm$^{-2}$, in excess of the Galactic value of 1.3 x $10^{20}$ cm$^{-2}$ (Kalberla et al. 2005). The PC mode spectrum has a photon index of 2.3 (±0.3) and a best-fitting absorption column of 1.4 (±0.1) x $10^{21}$ cm$^{-2}$.

The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is 3.8 x $10^{-11}$ (5.8 x $10^{-11}$) erg $cm^{-2}$ $count^{-1}$ .

## 4. UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 090715B 53 s after the BAT trigger (Vetere et al., GCN Circ. 9668). The optical afterglow reported in Vetere et al., GCN 9668 and confirmed by Smith et al., GCN 9670, Malesani et al., GCN 9671, Wiersema et al., GCN 9673 and Antonelli et al., GCN 9675 is detected by the UVOT only in the initial white exposure. The detected magnitude and 3-σ upper limits obtained using a 3" aperture and the UVOT photometric system (Poole et al. 2008, MNRAS, 383, 627) for the first finding chart (FC) exposure and subsequent summed exposures are given in Table 1. The values quoted in the table are not corrected for the Galactic extinction due to the reddening of E(B−V)=0.01 in the direction of the burst (Schlegel et al. 1998).

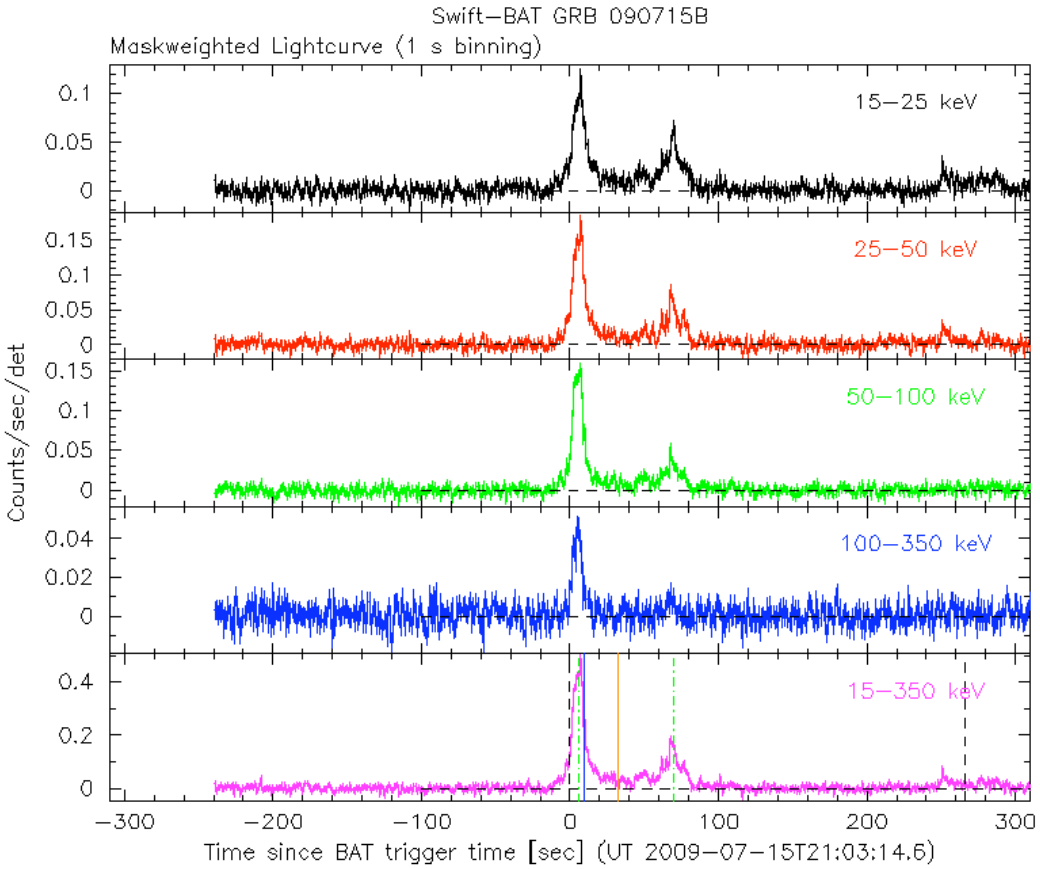


Fig.1: BAT light-curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are count $s^{-1}$ (illuminated-detector) $^{-1}$ (note illum-det = 0.16 $cm^2$).

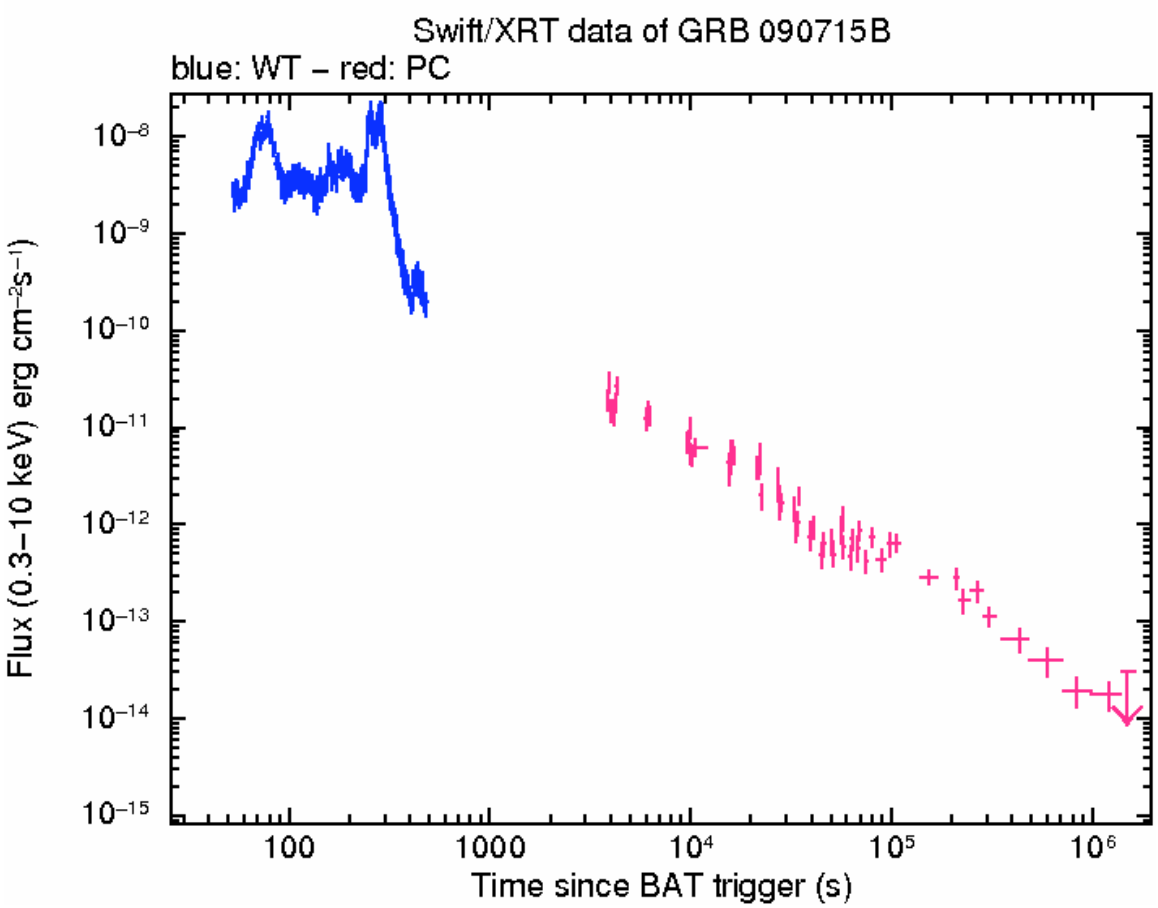


Fig. 2: XRT Lightcurve. Counts/s in the 0.3–10 keV band taken in Window Timing mode (blue) and Photon Counting mode (red).

| Filter | $T_{start}$(s) | $T_{stop}$(s) | Exp(s) | Mag |
|---|---|---|---|---|
| white_FC | 53 | 203 | 147 | 20.37 ±0.15 |
| white | 4052 | 4252 | 196 | >21.3 |
| v | 5989 | 22687 | 795 | >21.0 |
| b | 3848 | 4047 | 197 | >20.3 |
| u | 266 | 16495 | 428 | >21.2 |
| w1 | 12053 | 16278 | 894 | >21.2 |
| m2 | 6195 | 10367 | 826 | >21.0 |
| w2 | 4258 | 22065 | 995 | >21.4 |

Table 1: UVOT Observations. The values quoted above are not corrected for the Galactic extinction due to the reddening of E(B–V)=0.01 in the direction of the burst (Schlegel et al. 1998).