

## Swift Observation of GRB 090720A

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### 1 Introduction

At 06:38:08.28 UT on 20 July 2009, the Fermi Gamma-Ray Burst Monitor triggered on, and found a position for GRB 090720A (Rau, *et al.*, *GCN Circ.* 9688). Later during ground processing of Swift BAT data a rate trigger was found at 06:38:08 UT (Trigger 357811, Cummings, *et al.*, *GCN Circ.* 9694). A target of opportunity was uploaded to Swift and observations with the narrow field instruments began 11 hours after the trigger. Our best position is the UVOT enhanced XRT position at RA(*J*2000) = 203.68020 *deg* (13h34m43.25s), Dec(*J*2000) = -10.33480 *deg* (-10d20'05.3") with an uncertainty of 3.0 arcsec (radius, 90% confidence).

GRB 090720A was also detected in Gemini-North imaging (Cucchiara, *et al.*, *GCN Circ.* 9699). They detected the afterglow in the *R* band at a magnitude of 21.50 1.0 days after the trigger, which faded by the second epoch 2.0 days after the trigger. The Gemini-North position is within our error circle at a distance of 1.2" from the enhanced XRT position.

### 2 BAT Observation and Analysis

At 06:38:08 UT on July 20, 2009 Swift-BAT rate-triggered on GRB 090720A (Trigger 357811, Cummings, *et al.*, *GCN Circ.* 9694). No source was found by onboard automated processing. A significant source on the edge of the BAT field of view was found in ground processing. The position was RA(*J*2000) = 203.694 *deg* (13h34m46.6s), Dec(*J*2000) = -10.335 *deg* (-10d20'06") with an error radius of 3 arcmin (estimated 90% containment). This was 6 degrees from the Fermi GBM ground position, just outside the GBM 1-sigma radius.

As seen in BAT, the burst was a single weak pulse about 3 seconds long. Partial coding was 1.9%. The non-maskweighted light curve, responding mostly to photons through the side of the instrument, indicates the spectrum was not unusual for a GRB. The BAT light curve is shown in Figure 1.

### 3 XRT Observations and Analysis

XRT observations of GRB 090720A began 11 hours after the trigger (Grupe, Oates, & Hoversten, *GCN Circ.* 9697). The UVOT enhanced XRT position is RA(*J*2000) = 203.68020 *deg* (13h34m43.25s), Dec(*J*2000) = -10.33480 *deg* (-10d20'05.3") with an uncertainty of 3.0 arcsec (radius, 90% confidence).

The 0.3-10 keV light curve (Fig.2) clearly demonstrates that the source is fading and is thus the afterglow. Due to the low number of counts no spectral analysis can be performed.

### 4 UVOT Observation and Analysis

The Swift UltraViolet/Optical Telescope (UVOT) began observations of GRB 090720A 11 hours after the BAT trigger with the UVOT *u* and white filters (Grupe, Oates, & Hoversten, *GCN Circ.* 9697). No source was detected at the XRT position. The 3-sigma magnitude limits are given in Table 1. The values quoted in the table are on the UVOT Photometric System (Poole, et al, 2008). They are

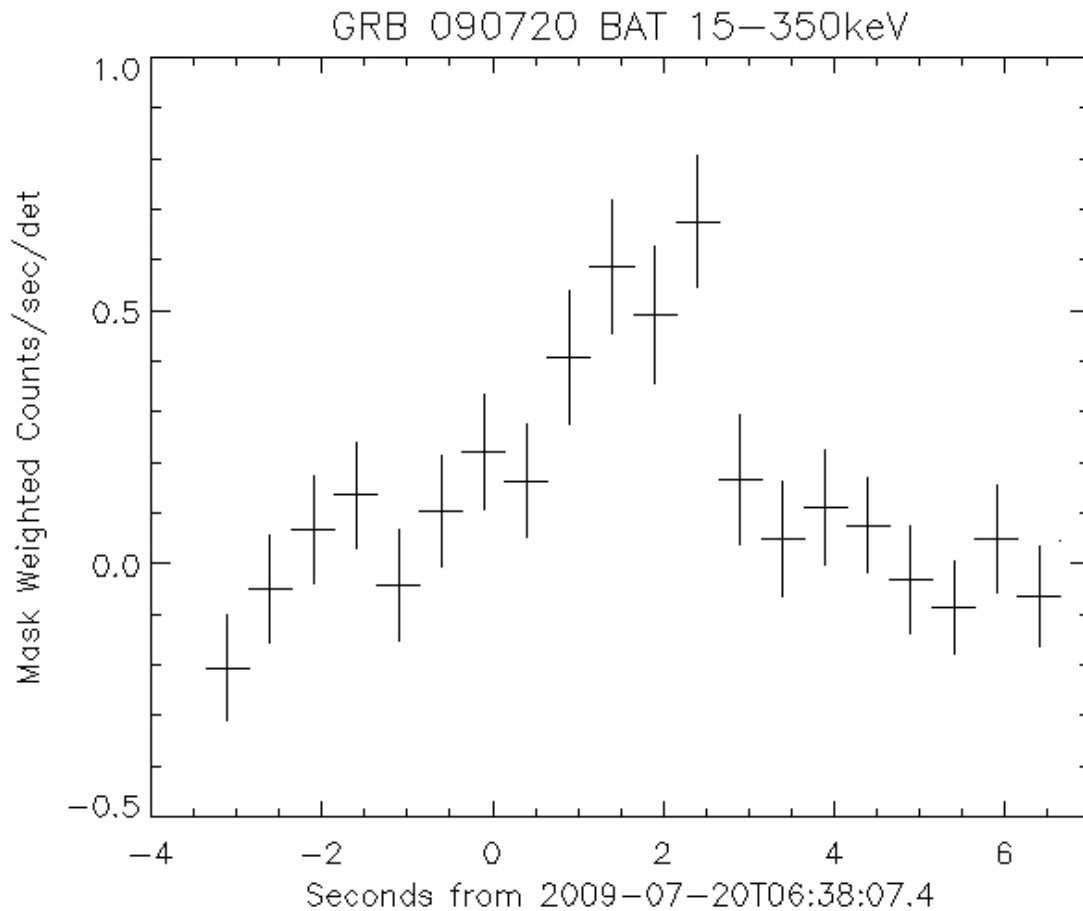


Figure 1: BAT Light curve. The mask-weighted light curve over all energy bands. The units are counts/s/illuminated-detector (note illum-det =  $0.16\text{cm}^2$ ) and  $T_0$  is 06:38:07.4 UT.

not corrected for the expected galactic reddening of  $E(B - V) = 0.034$  in the direction of the burst (Schlegel, Finkbeiner, & Davis, 1998).

## References

- [1] Cucchiara, A., et al. 2009, *GCN Circ.* 9699
- [2] Cummings, J. R., et al. 2009, *GCN Circ.* 9694
- [3] Grupe, D., Oates, S. R., & Hoversten, E. A. 2009, *GCN Circ.* 9697
- [4] Poole, T. S., et al. 2008, *MNRAS*, 383, 627
- [5] Rau, A., et al. 2009, *GCN Circ.* 9688
- [6] Schlegel, D. J., Finkbeiner, D., & Davis, M. 1998, *ApJ.*, 500, 525

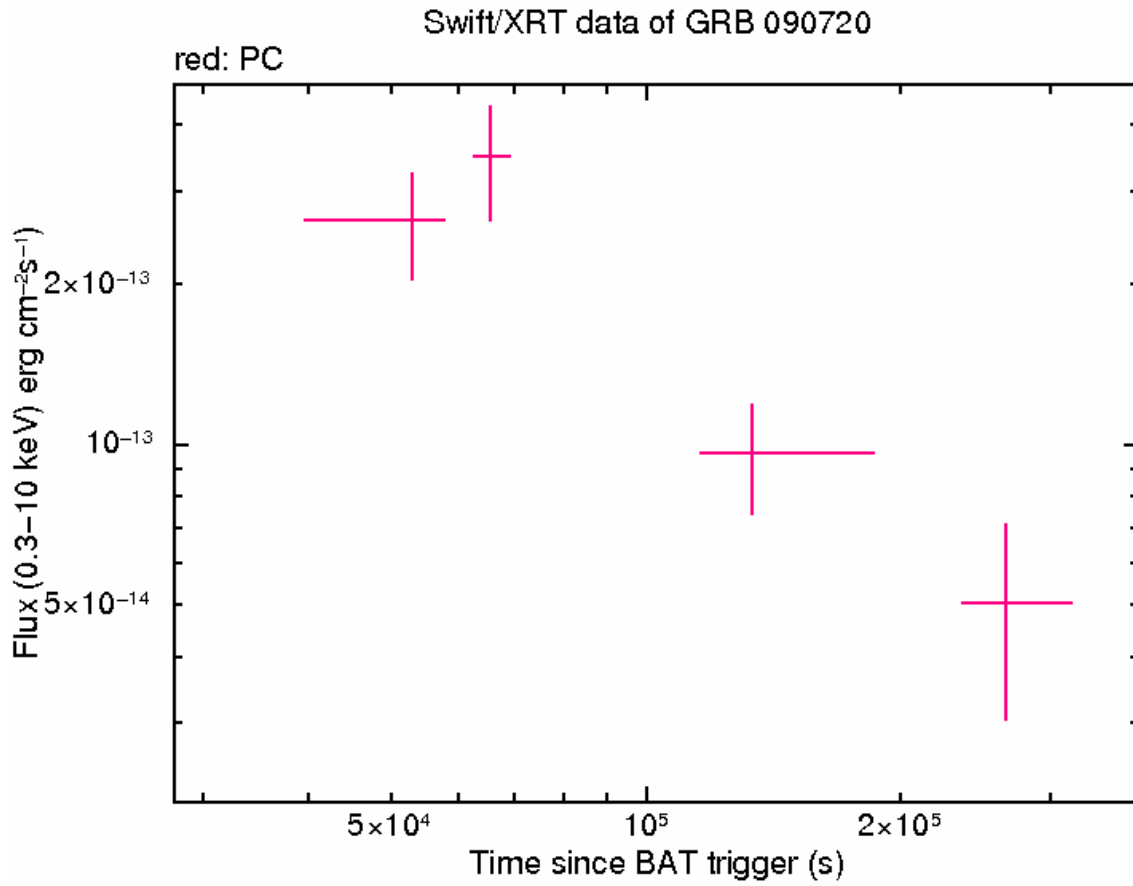


Figure 2: XRT Light curve. Flux in the 0.3-10 keV band: Photon Counting mode (red). Due to the low count rate at the time of the late slew there were no data taken in Window Timing. The approximate conversion is  $1 \text{ count/s} \simeq 3.0 \times 10^{-11} \text{ ergs cm}^{-2} \text{ s}^{-1}$ .

Filter	Start	Stop	Exposure	Magnitude
white	41,773	63,949	579	> 21.28
<i>u</i>	39,570	63,852	3513	> 21.10

Table 1: UVOT observations