Swift Observation of GRB 080319A

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report on behalf of the Swift Team

1 Introduction

BAT triggered on the long GRB 080319A at 05:45:42 UT (Trigger 306754) (Pagani, *et al.*, *GCN Circ.* 7426), a burst with $T_{90} = 64 \pm 36$ *sec*. The *Swift* slew to the burst was delayed because of an Earth constraint. The optical afterglow was detected by UVOT in the white filter and from the ground with the Palomar 60-inch telescope at a magnitude of $R \sim 20.25$ (Cenko, *GCN Circ.* 7429) and with the Nordic Optical Telescope at $R = 21.03 \pm 0.09$. The burst was also deteced by the *INTEGRAL* SPI Anti-Coincidence System (Beckmann *et al.*, *GCN Circ.* 7450)

2 BAT Observation and Analysis

Using the data set from $T - 120$ to $T + 182$ *sec*, further analysis of BAT GRB 080319A has been performed by the *Swift* team (Barthelmy, *et al.*, *GCN Circ.* 7447). The BAT ground-calculated position is RA($J2000$) = $206.352deg$ ($13h45m24.6s$), Dec($J2000$) = $44.080deg$ ($44d04'47.3''$) ± 1.7 $arcmin$, (radius, systematic and statistical, 90% containment). The partial coding was 7%.

The masked-weighted light curves (Fig.1) shows two main over-lapping FRED-like peaks starting at $\sim T - 5$ *sec*, peaking at $T + 5$ and $T + 25$ *sec*, and ending at $\sim T + 70sec$. $T_{90}(15 - 350keV)$ is 64 ± 36 *sec* (estimated error including systematics).

The time-averaged spectrum from $T - 7.7$ to $T + 72.3$ *sec* is best fitted by a simple power law model. This fit gives a photon index of 1.60 ± 0.13. For this model the total fluence in the $15 - 150$ keV band is $(4.8 \pm 0.4) \times 10^{-06} ergs/cm^2$, and the 1-sec peak flux measured from $T + 31.80$ *sec* in the $15 - 150$ keV band is 1.2 ± 0.2 $ph/cm^2/sec$. All the quoted errors are at the 90% confidence level considering the statistical and usual systematic effects.

3 XRT Observation and Analysis

Using 596 *sec* of overlapping XRT Photon Counting mode and UVOT data for GRB 080319A, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA($J2000$) = $206.33318deg$ ($13h45m19.96s$), Dec($J2000$) = 44.08038 deg ($44d04'49.4''$) ± 1.8 $arcsec$ (radius, 90% confidence) (Beardmore *et al.*, *GCN Circ.* 7448).

The $0.3 - 10$ keV light curve (Fig.2) can be best fitted by a broken power law with initial slope of $0.78^{+0.28}_{-0.10}$, followed by a steeper decay with decay index of $2.5^{+1.0}_{-1.1}$ after a break at $T + 35$ $ksec$

The X-ray spectrum of the PC data from $T + 560$ *sec* to $T + 1632$ *sec* can be well fitted by an absorbed powerlaw with spectral index $2.1^{+0.3}_{-0.3}$. The NH column density is $(1.0^{+0.7}_{-0.7}) \times 10^{21} cm^{-2}$ in excess of the Galactic column density of $1.45 \times 10^{20} cm^{-2}$ in that direction. The average unabsorbed flux over $0.3 - 10$ keV for this spectrum is 1.6×10^{-11} $ergs/cm^2/sec$, which corresponds to an unabsrobed flux of 2.1×10^{-11} $ergs/cm^2/sec$.

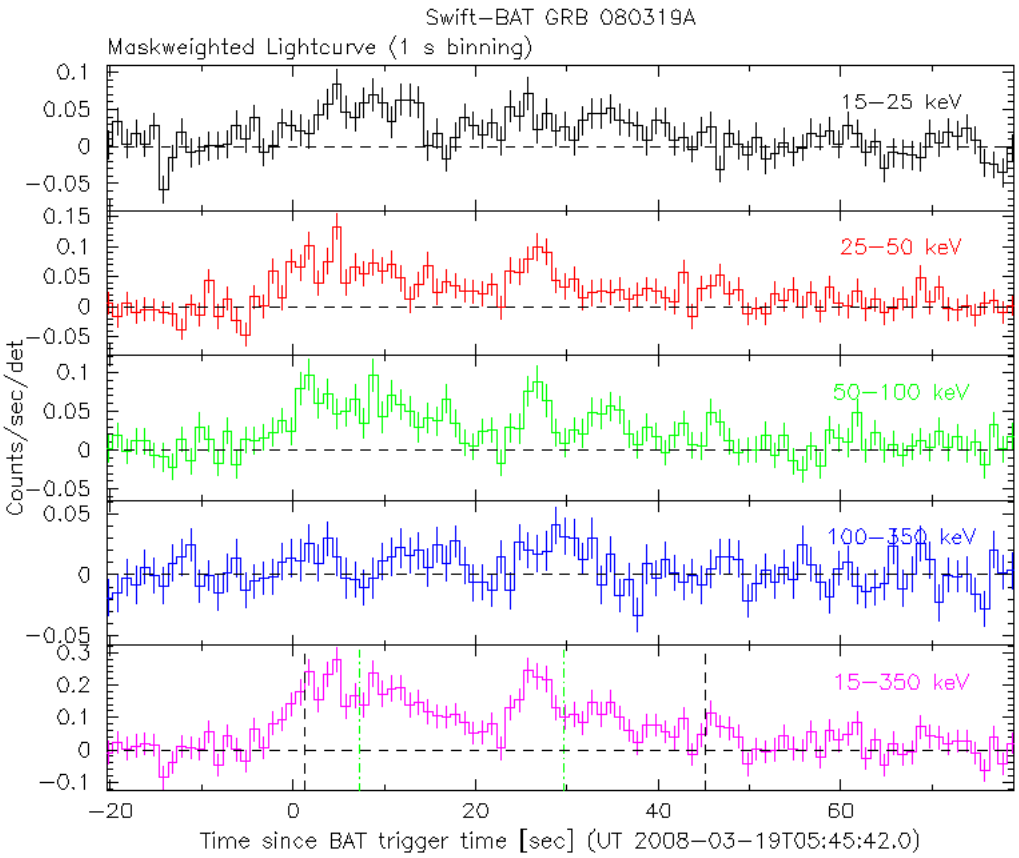

Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 05:45:42 UT.

4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 080319A 542 *sec* after the initial BAT trigger (Holland *et al.*, *GCN Circ.* 7495). The afterglow is detected at the location of the P60 source (Cenko *et al.*, *GCN Circ.* 7429). Magnitudes and upper limits are summarized in Table 1. These upper limits are not corrected for Galactic extinction E(B-V) = 0.02 mag (Schlegel *et al.*, *ApJ.* 500:525-553, 1998). The photometry is on the UVOT flight system described in Poole et al. (2008, *MNRAS*, 383,627). No early-time upper limits are available for the uvw1, uvm2, and uvw2 filters due to the lack of data resulting from the slew to GRB 080319B, which occurred 25 minutes after GRB 080319A.

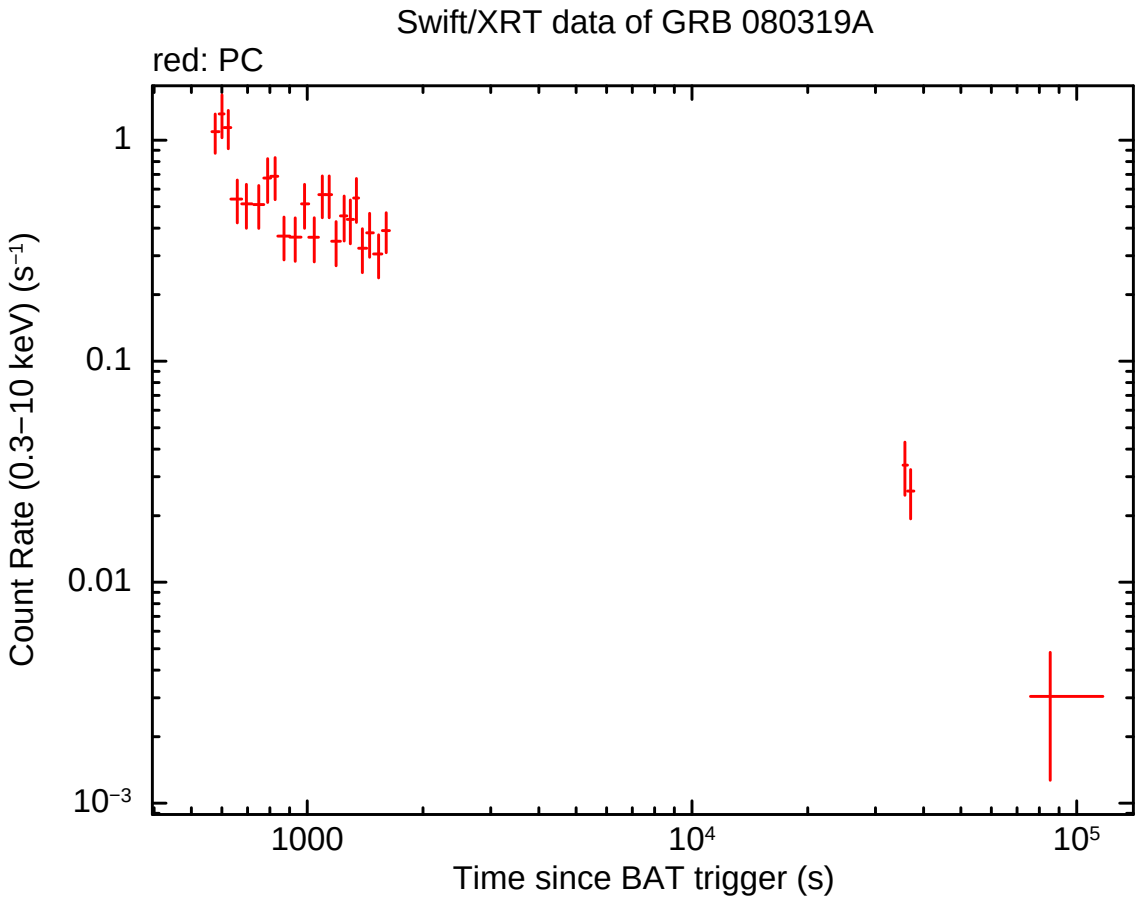

Figure 2: XRT Lightcurve. Counts/sec in the 0.3-10 keV band: Photon Counting mode. The approximate conversion is 1 count/sec = $\sim 3.7 \times 10^{-11}$ $ergs/cm^2/sec$.

Filter	Start	Stop	Exposure	3-Sigma UL
V	669	1544	432	$20.7(3\sigma\ UL)$
B	767	1480	29	$19.8(3\sigma\ UL)$
U	743	1618	58	$19.9(3\sigma\ UL)$
White	562	662	98	21.1 ± 0.3
White	875	975	98	$21.4(3\sigma\ UL)$

Table 1: Magnitude limits from UVOT observations