Swift Observation of GRB 080319A
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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 detected 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($J2000$) = 206.352$^{\circ}$ (13h45m24.6s), Dec($J2000$) = 44.080$^{\circ}$ (44d04'47.3")$\pm$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 $\sim T + 70$sec. $T_{90}(15 - 350keV)$ is $64 \pm 36$ 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 $1.60 \pm 0.13$. 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 $1.2 \pm 0.2 ph/cm^2/sec$. 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($J2000$) = 206.33318$^{\circ}$ (13h45m19.96s), Dec($J2000$) = $44.08038^{\circ}$ (44d04'49.4")$\pm$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 $2.6^{+1.0}_{-1.1}$ 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 $(1.0^{+0.7}_{-0.5}) \times 10^{21} cm^{-2}$ 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 $1.6 \times 10^{-11} ergs/cm^2/sec$, which corresponds to an unabsorbed flux of $2.1 \times 10^{-11} ergs/cm^2/sec$. 

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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 = \(3.7 \times 10^{-11}\) ergs/cm\(^2\)/sec.

Table 1: Magnitude limits from UVOT observations

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