Swift Observation of GRB 071020

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1   Introduction

BAT triggered on GRB 071020 at 07:02:27 UT (Trigger 294835) (Holland, *et al.*, *GCN Circ.* 6949). This was a long burst with $T_{90} = 4.2 \pm 0.2$ s. *Swift* slewed to this burst immediately. XRT began follow-up observations at $T + 61$ s. UVOT did not make prompt observations of this burst. Our best position is the XRT location, RA(J2000) = 119.66521 deg ($07^{\rm h}58^{\rm m}39.65^{\rm s}$), Dec(J2000) = $+32.86079$ deg ($+32°51'38.8''$) with an error of 4.0 arcsec (radius, 90% containment).

The Burst Advocate for this burst is Stephen Holland (`sholland@milkyway.gsfc.nasa.gov`). Please contact the Burst Advocate by e-mail if you require additional information regarding *Swift* follow-up observations of this burst. In extremely urgent cases, after trying the Burst Advocate, you can contact the *Swift* PI by phone (see the *Swift* ToO Web site for information: `http://www.swift.psu.edu/too.html`).

2   BAT Observation and Analysis

Using the data set from $T-239$ to $T+625$ s from recent telemetry downlinks, we report further analysis of GRB 071020 (trigger 294835) (Tueller, *et al.*, *GCN Circ.* 6954). The BAT ground-calculated position is RA, Dec = 119.666, $+32.857$ deg, which is RA(J2000) = $07^{\rm h}58^{\rm m}39.9^{\rm s}$, Dec(J2000) = $32°51'25''$ with an uncertainty of 1.0 arcmin, (radius, sys+stat, 90% containment). The partial coding was 90%.

The mask-weighted light curve shows at least 8 overlapping pulses in the initial burst. They all have approximately the same peak flux values. This emission starts at $\approx T - 3$ s, peaks at $\approx T - 1.5$ s, and ends at $\approx T + 0.9$ s. T_{90} (15–350 keV) is 4.2 ± 0.2 s (estimated error including systematics).

The spectral lag for this burst is:
59^{+7}_{-9} ms for the 150–300 to 25–50 keV bands, and
10^{+8}_{-7} ms for the 50–100 to 15–25 keV bands.

The time-averaged spectrum from $T - 3.0$ to $T + 7.4$ s is best fit by a simple power-law model. The power-law index of the time-averaged spectrum is 1.11 ± 0.05. The fluence in the 15–150 keV band is $(2.3 \pm 0.1) \times 10^{-6}$ erg cm^2. The 1-s peak photon flux measured from $T - 0.36$ s in the 15–150 keV band is 8.4 ± 0.3 ph cm^2 s^{-1}. All the quoted errors are at the 90% confidence level.

Folding in the borderline results of the T_{90}, the hardness ratio, the spectral lag, and very marginal detection of extended emission in the light curve, we think this is a long burst., However, we cannot rule out the possibility of a SHB classification.

3   XRT Observations and Analysis

The *Swift*/XRT began observing GRB 071020 at 07:03:28 UT, 61 s after the BAT trigger. In a 1.23 ks exposure Photon Counting mode image obtained during the first orbit we find a refined XRT position of RA, Dec (J2000) = 119.66521, $+32.86079$ which is

RA(J2000) = $07^{\rm h}58^{\rm m}39.65^{\rm s}$
Dec(J2000) = $+32°51'38.8''$
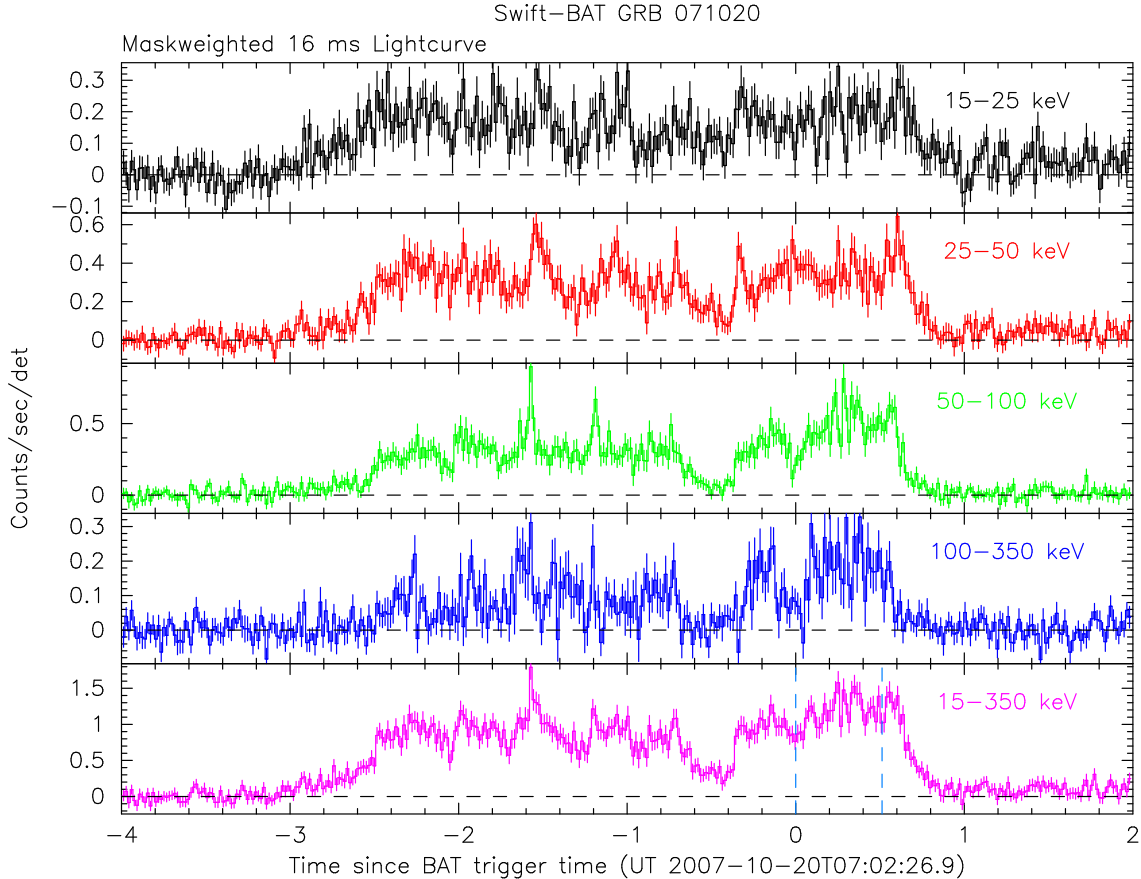
Figure 1: BAT light curve. The mask-weighted 16 ms light curves in the four individual plus total energy bands. The units are count s^{-1} illuminated-detector^{-1} and T_0 is 07:02:26.9 UT.

with an estimated uncertainty of 4.0 arcsec (radius, 90% containment). This is 13.9 arcsec from the refined BAT position (Tueller et al., GCN 6954), 4.1 arcsec from the position of the ROTSE-IIIb afterglow (Schaefer, *et al.*, *GCN Circ.* 6948), and 2.3 arcsec from the PAIRITEL position (Bloom, *et al.*, *GCN Circ.* 6953).

The 0.3–10.0 keV *X*-ray light curve from $T + 68$ s to $T + 17.6$ ks shows a power-law decline with a decay index of 1.11 ± 0.02.

The Windowed Timing mode spectrum from the first orbit ($T + 68$ s to $T + 315$ s) is well fit by an absorbed power law with a photon index of 1.86 ± 0.07 and a redshifted column density of $(4.3 \pm 1.7) \times 10^{21}$ cm^{-2} (at $z = 2.145$, Jakobsson, *et al.*, *GCN Circ.* 6952), in addition to the 5.1×10^{20} cm^{-2} Galactic column density in this direction. The observed 0.3–10.0 keV flux during this time is $(6.1 \pm 0.2) \times 10^{-10}$ erg cm^{-2} s^{-1}.

4   UVOT Observation and Analysis

The *Swift* Ultraviolet/Optical telescope (UVOT) has not made any observations of GRB 071020.
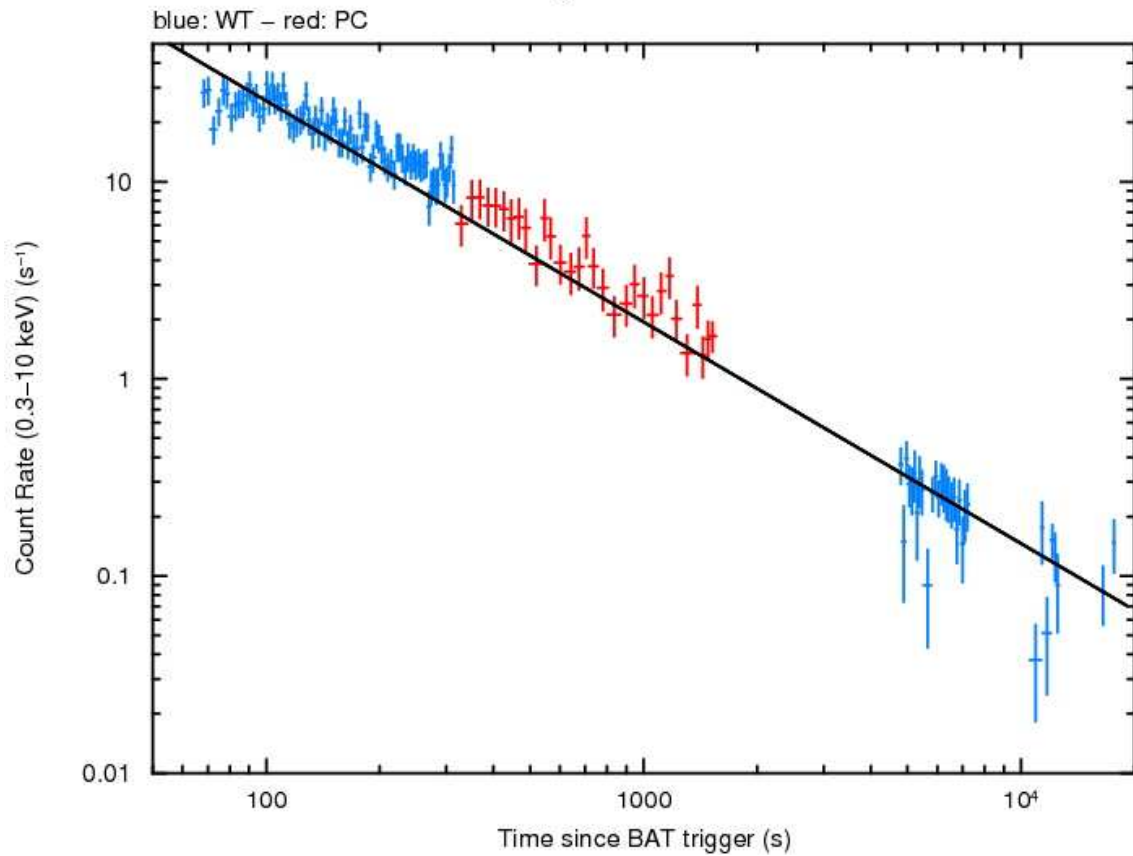
Figure 2: XRT flux light curve in count s^{-1} in the 0.3–10 keV band: Window Timing mode (blue) and Photon Counting mode (red). The conversion factor to observed 0.3–10 keV flux for this burst is 1 count s^{-1} = 4.3×10^{-11} erg cm^{-2} s^{-1}.

References

1) Dickey, J. M., & Lockman, F. J., 1990, ARAA, 28, 215