

Swift Observation of GRB 070311

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1 Introduction

At T+7 ks Swift executed a target of opportunity (ToO) observation of GRB 070311, which triggered INTEGRAL at 01:52:35 UT on March 11, 2007 (Mereghetti *et al.*, *GCN Circ.* 6189), resulting in a localization of RA, DEC (J2000) = 87.5411 deg, 3.3748 deg with an uncertainty of 2.5 arcmin (90% c.l.). Consequently, no BAT observations were made. REM (Covino *et al.*, *GCN Circ.* 6190) began observing 51 s after the GRB trigger time and found the afterglow in optical/IR bands at the following position RA, DEC (J2000)= 87.53421 deg (05h 50m 08.21s), +3.37508 deg (+03d 22' 30.3"). The afterglow was confirmed by PAIRITEL (Bloom *et al.*, *GCN Circ.* 6191). We report on UVOT upper limits and on the detection of a fading XRT source consistent with the optical afterglow position.

2 BAT Observation and Analysis

No BAT observations were made for this GRB, since Swift slewed in the context of a ToO at T+7 ks. Analysis by INTEGRAL resulted in a burst duration of ~ 50 s, with a peak flux of $0.9 \text{ ph cm}^{-2} \text{ s}^{-1}$ (1 s integration time) and a fluence of $2 \times 10^{-6} \text{ erg cm}^{-2}$ in the 20–200 keV energy band (Mereghetti *et al.*, *GCN Circ.* 6189).

3 XRT Observations and Analysis

Using the data from the first two orbits of XRT data of GRB 070311 (4.2 ks in Photon Counting mode), the refined XRT position is RA(J2000) = 87.5351 deg (05h 50m 08.43s), DEC(J2000) = +03.3750 deg (+03d 22' 30.0") with an error radius of 3.8 arcsec (90% confidence). This position lies 3.3 arcsec from the optical afterglow reported by Covino *et al.*(*GCN Circ.* 6190).

The time-averaged spectrum of the first two orbits (from T+7 ks to T+14 ks) can be fit with an absorbed power-law with a photon index of 1.9 ± 0.4 (90% c.l.) and an absorption column of $(3.8 \pm 1.6) \times 10^{21} \text{ cm}^{-2}$ (90%). Alternatively, the spectrum can be fit equally well by fixing the absorbing column to the Galactic value in the direction of the burst ($2.6 \times 10^{21} \text{ cm}^{-2}$): in this case the photon index turns out to be 1.6 ± 0.2 . In the latter case the mean observed (unabsorbed) flux in the 0.3–10 keV energy band is 3.9×10^{-12} (4.9×10^{-12}) $\text{erg cm}^{-2} \text{ s}^{-1}$ (Guidorzi *et al.*, *GCN Circ.* 6192).

The 0.3–10 keV light curve from T+7 ks to T+ 6.8×10^5 s can be fit with a double broken power law with slopes of 1.4 ± 0.1 , -0.1 ± 0.1 and $3.2_{-0.4}^{+0.5}$ and break times of (31 ± 3) ks and 1.7×10^5 s, respectively ($\chi^2/\text{dof} = 17.0/24$; see Fig. 1). The late steep decay of ~ 3.2 is consistent with the contemporaneous decay rate estimated in the optical (Kann, *GCN Circ.* 6209) and probably connected with the decay of a major rebrightening. Notably, the last point of the XRT light curve also lies on the extrapolated power law preceding the rebrightening. With the present XRT data it is not possible to determine whether the decay after T+ 6.8×10^5 s will resume to the pre-break rate (slope of 1.4) or it will remain constant (slope of 3.2).

4 UVOT Observation and Analysis

The Swift UVOT began observing the GRB 070311 field 7004 s after the INTEGRAL/IBAS trigger. UVOT did not detect any source at the location of the infrared afterglow (Covino, *et al.*, *GCN Circ.* 6190), relative to the DSS, down to the 3-sigma upper limits, summarized in Table 1. These upper limits are not corrected for the Galactic extinction corresponding to a reddening of $E(B-V) = 0.76$ mag along the line of sight to the GRB.

Filter	Start	Stop	Exposure	3-Sigma UL
V	7618	36,909	1967	20.8
B	7004	54,918	1966	21.7
U	8232	54,379	4490	21.8
UVW1	8027	49,221	4448	21.6
UVM2	7823	48,494	4400	21.4
UVW2	7414	35,997	1968	21.1
White	7208	7408	197	21.1

Table 1: Magnitude limits from UVOT observations

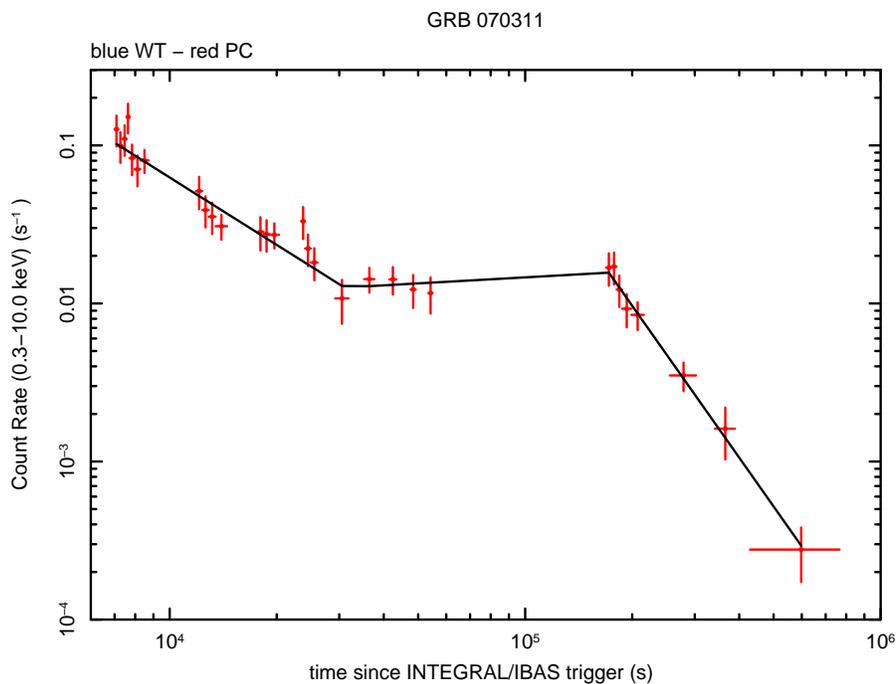


Figure 1: XRT Lightcurve. Counts/s in the 0.3-10 keV band: Photon Counting mode. The approximate conversion is $1 \text{ count/s} \sim 5.9 \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}$.