

## Swift Observation of INTEGRAL GRB 070309

*S.D. Vergani (Dunsink Observatory, DIAS-DCU), P. Romano (Univ Bicocca&INAF-OAB), C. Guidorzi (Univ Bicocca&INAF-OAB), A. Moretti (INAF-OAB), S. T. Holland (CRESST/USRA/GSFC), Cucchiara A. (PSU), J. Cummings (GSFC), S.D. Barthelmy (GSFC), D.N. Burrows (PSU), P. Roming (PSU), N. Gehrels (GSFC) for the Swift Team*

### 1 Revisions

- added final analysis based on a ToO performed starting from  $T + 4.1 \times 10^6$  s;
- definitive identification of the GRB X-ray counterpart.

### 2 Introduction

At T+13.9 ks Swift executed a target of opportunity (ToO) observation of GRB 070309, which triggered INTEGRAL at 10:01:03 UT on March 09, 2007 (Paizis *et al.*, *GCN Circ.* 6182), resulting in a localization of RA, DEC (J2000) = 263.6848 deg, -37.9446 deg with an uncertainty of 2.5 arcmin (90% c.l.). The burst was below the horizon from Swift, so BAT did not see it. We report on UVOT upper limits and on the XRT afterglow detection at RA(J2000) = (263.6629 deg), Dec(J2000) = (-37.9300 deg). No detections from ground-based facilities has been reported.

### 3 BAT Observation and Analysis

No BAT observations were made for this GRB, since the burst was below the horizon from Swift and the satellite then slewed in the context of a ToO at T+13.9 ks. Analysis by INTEGRAL resulted in a burst duration of  $\sim 50$  s, with a peak flux of  $0.2 \text{ ph cm}^{-2} \text{ s}^{-1}$  (20-200 keV, 1 s integration time) and a fluence of  $5 \times 10^{-7} \text{ erg cm}^{-2}$  (Paizis *et al.*, *GCN Circ.* 6182).

### 4 XRT Observations and Analysis

Using the first two segments of XRT data of GRB 070309 ( $\sim 17$  ks in Photon Counting mode), inside the INTEGRAL error circle we find one source (Vergani *et al.*, *GCN Circ.* 6187, see Fig. 1) at the position RA(J2000) = 17h 34m 39.1s (263.6629 deg) Dec(J2000) = -37d 55' 48.2" (-37.9300 deg) with an estimated error radius of  $\sim 5$  arcsec (90% confidence). This position lies 81 arcseconds from the INTEGRAL position. The source has an average count rate of  $1.4 \pm 0.4 \times 10^{-3}$  counts/s and, assuming a Crab spectrum, an observed flux of about  $5 \times 10^{-14} \text{ erg cm}^{-2} \text{ s}^{-1}$ . We collected a total of 21 counts. It is not possible to extract a proper light curve or spectrum. The average count rate of the first segment of observations is  $2.5 \pm 0.6 \times 10^{-3}$  counts/s, for the second segment we only have a 3-sigma upper limit of  $2.04 \times 10^{-3}$  counts/s. The probability that this source is constant is less than  $10^{-2}$ .

To put stronger constraints on the nature of this source, we took another set of  $\sim 17$  ks XRT data between April 26 and 27, 2007 (about 50 days after the trigger). No source is detected at the afterglow candidate position down to a count rate of  $1.43 \times 10^{-3}$  counts/s (3-sigma) (see Vergani *et al.* *GCN Circ.* 6369), therefore we conclude that the candidate suggested by Vergani *et al.* in *GCN Circ.* 6187 and *GCN Circ.* 6200 was the afterglow of GRB 070309.

## 5 UVOT Observation and Analysis

Swift/UVOT observed the field of GRB 070309 starting 13,906 s after the INTEGRAL/IBAS trigger. UVOT did not detect any source inside the INTEGRAL error circle, down to the following 3 sigma upper limits, summarized in Table 1. These upper limits (Holland *et al.*, *GCN Circ.* 6185) are not corrected for the Galactic extinction, corresponding to a reddening of  $E_{B-V} = 1.46$  mag (Schlegel et al. 1998), in the direction of this burst. We note that this burst lies in the Galactic plane towards the Galactic centre and the field is very crowded.

Filter	Start	Stop	Exposure	3-Sigma UL
V	14,525	14,868	274	19.3
B	14,215	14,365	147	20.0
U	14,061	14,211	147	19.7
UVW1	13,906	14,056	147	19.6
UVM2	14,930	15,080	147	19.5
UVW2	14,371	14,446	147	19.8

Table 1: Magnitude limits from UVOT observations

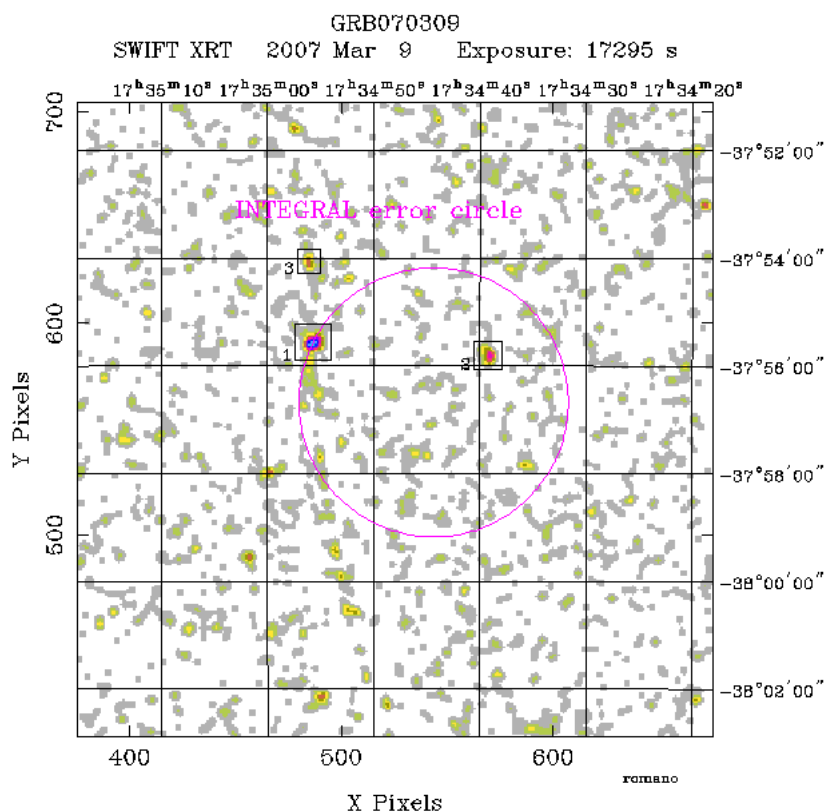


Figure 1: XRT field image of the first two segments of observations showing the afterglow candidate as source number 2.