



## GCN GRB OBSERVATION REPORT 2699, GRB040903 - a XRF?

**Kuulkers, E.; Gotz, D.; Mereghetti, S.; Goldoni, P.; Goldwurm, A.; Brandt, Søren**

*Publication date:*  
2004

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Kuulkers, E., Gotz, D., Mereghetti, S., Goldoni, P., Goldwurm, A., & Brandt, S. (2004, Sept 9). GCN GRB OBSERVATION REPORT 2699, GRB040903 - a XRF? <http://gcn.gsfc.nasa.gov/gcn/gcn3/2699.gcn3>

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

TITLE: GCN GRB OBSERVATION REPORT  
NUMBER: 2699  
SUBJECT: GRB040903 - A XRF?  
DATE: 04/09/09 11:22:45 GMT  
FROM: Erik Kuulkers at ESA/ESTEC-Integral(ISOC) <ekuulker@rssd.esa.int>

E. Kuulkers (ESA/ESTEC), D. Gotz, S. Mereghetti (IASF-Milano), P. Goldoni, A. Goldwurm (CEA/Saclay) and S. Brandt (DSRI, Copenhagen)  
report:

Prompted by the message (GCN #2695) that the possible GRB 040903 (GCN #2690, #2691) discovered by IBAS might be either a X-ray flash (XRF) or a type I X-ray burst (XRB), we further investigated this event.

The initial light curve of GRB 040903 shows basically two peaks, which is reminiscent to that seen in hard X-ray light curves of strong photospheric radius expansion XRBs from, e.g., 4U 1812-12 (see Cocchi et al. 2000, A&A 357, 527). Also, both the GRB and XRBs reach peak intensities a few seconds after the start of the events. We compared in more detail the temporal and spectral behaviour of GRB 040903 with that of XRBs from 4U 1812-12, both as seen with the IBIS/ISGRI instrument onboard INTEGRAL. The XRBs we focussed on were observed on 2003 April 25 and 27.

The 20-100 keV GRB spectrum integrated over the burst can be well fit by a power-law model with a photon index of  $2.9 \pm 0.4$  (1 sigma error;  $\chi^2_{\text{red}} = 0.6$  for 16 dof), although a black-body model cannot be formally ruled out ( $\chi^2_{\text{red}} = 1.1$  for 16 dof). The latter model gives for the effective temperature a value of  $kT = 6.9 \pm 1.5$  keV, which is significantly higher than the maximum value reached during any XRB ( $\sim 3$  keV). The 20-100 keV spectrum of the XRB integrated over the burst can be well fit by a black-body model with effective temperature  $kT = 2.9 \pm 0.3$  ( $\chi^2_{\text{red}} = 0.5$  for 5 dof), whereas a power-law model provides a rather bad fit ( $\chi^2_{\text{red}} = 1.6$  for 5 dof).

We used three energy bands to investigate the temporal behaviour at a time resolution of 1 sec: 13-26 keV, 26-60 keV and 60-500 keV. The main differences between GRB 040903 and the XRBs are the following. The GRB is clearly seen in the 13-26 keV and 26-60 keV bands, whereas the XRBs are only seen in the 13-26 keV band. During the first peak of the GRB the event is harder with respect to the second peak, whereas the XRB is soft during both peaks (as well as in between).

The light curves (and the hardness curve, i.e., the ratio of the counts in the 26-60 keV band to that of the counts in the 13-26 keV band, versus time) can be retrieved from <ftp://astro.estec.esa.nl/pub/ekuulker/4u1812-12.ps> and <ftp://astro.estec.esa.nl/pub/ekuulker/grb040903.ps>.

Given that

- 1) GRB 040903 is significantly harder than the XRBs from 4U 1812-12,
  - 2) the spectral evolution of the GRB is unlike that seen for the XRBs, but more common for GRBs (and XRFs),
  - 3) the integrated spectrum of the GRB is consistent with being due to power-law emission, but not with black-body emission as expected during XRBs,
  - 4) the GRB is not significantly detected above  $\sim 60$  keV,
- we favour GRB 040903 being a XRF.

This message can be cited.