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

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 inital 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 +/- 0.4 (1 sigma error; Chi^2_red = 0.6 for 16 dof), although a black-body model cannot be formally ruled out (Chi^2_red = 1.1 for 16 dof). The latter model gives for the effective temperature a value of kT = 6.9 +/- 1.5 keV, which is significantly higher than the maximum value reached during any XRB (~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 +/- 0.3 (Chi^2_red = 0.5 for 5 dof), whereas a power-law model provides a rather bad fit (Chi^2_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 ~60 keV,
we favour GRB 040903 being a XRF.

This message can be cited.