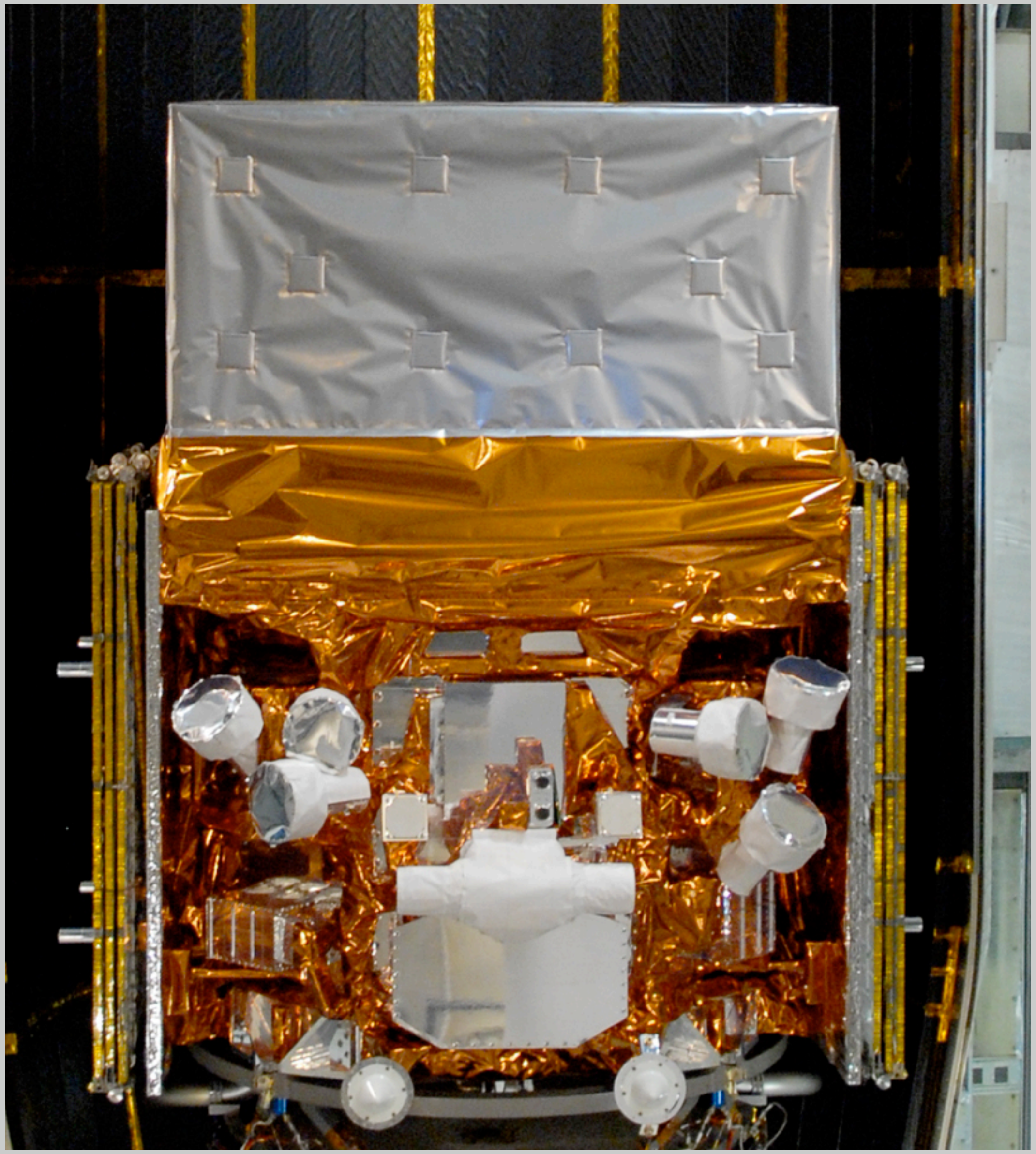
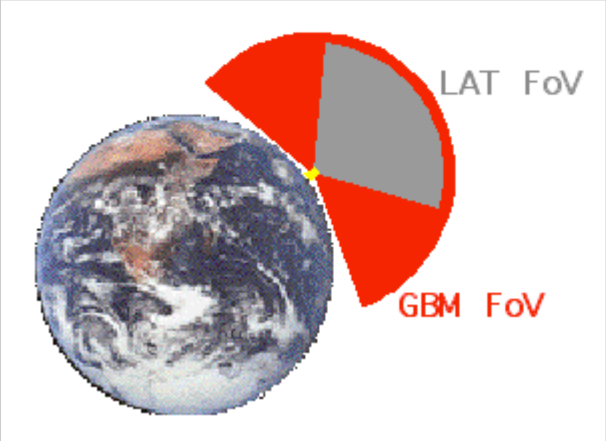
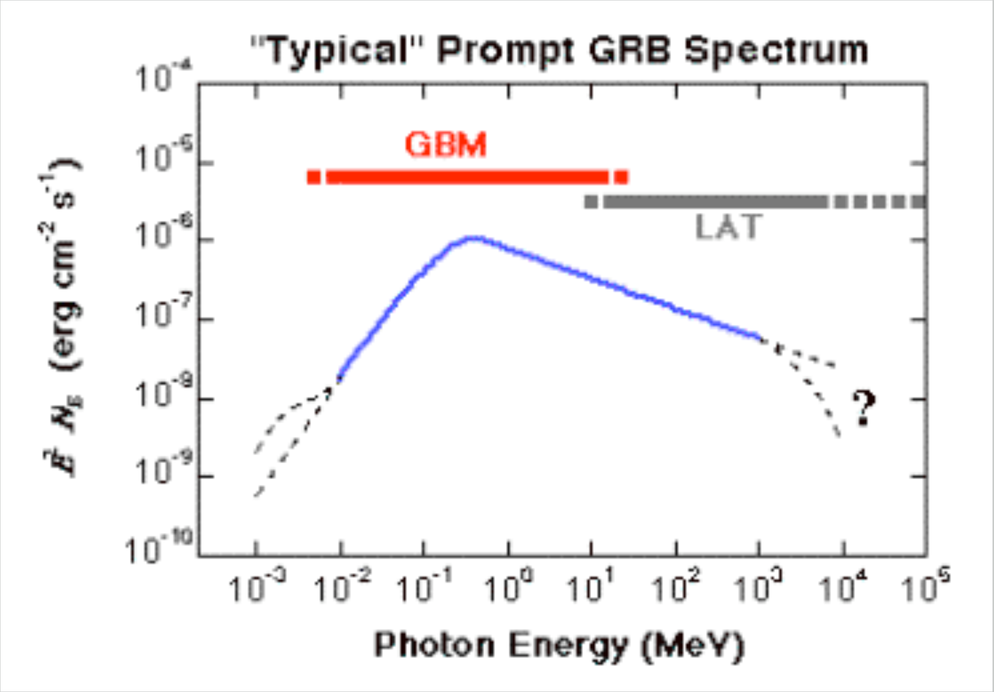
The Fermi Observatory







Pre-launch Studies. 1. GBM

- *BATSE used a single energy band to trigger (nominally 50 -- 300 keV), on 3 time-scales (64 ms, 256 ms, 1 s).*

TRADE STUDIES FOR THE GBM TRIGGER

David Band

1. Introduction

To assist the design effort for the GBM burst trigger, I am undertaking a number of trade studies. This memo describes the results; it will evolve as I add additional studies. Currently the memo addresses time binning and the choice of the trigger energy bands ΔE.

- *GBM is capable of triggering on up to 120 independent algorithms but currently has 68 active algorithms, with energy ranges (20 - 50 keV --> 300 keV) and overlapping time windows (16 ms -- 4.096 s).*

Pre-launch studies: 2. LAT Sensitivity & Expectations.

✴ *An effort that culminated in:*

Prospects for GRB Science with the Fermi Large Area Telescope

D. L. Band, M. Axelsson, L. Baldini, G. Barbiellini, M. G. Baring, D. Bastieri, M. Battelino, R. Bellazzini, E. Bissaldi, G. Bogaert, J. Bonnel, J. Chiang, J. Cohen-Tanugi, V. Connaughton, S. Cutini, F. de Palma, B. L. Dingus, E. do Couto e Silva, G. Fishman, A. Galli, N. Gehrels, N. Giglietto, J. Granot, S. Guiriec, R. E. Hughes, T. Kamae, N. Komin, F. Kuehn, M. Kuss, F. Longo, P. Lubrano, R. M. Kippen, M. N. Mazziotta, J. E. McEnery, S. McGlynn, E. Moretti, T. Nakamori, J. P. Norris, M. Ohno, M. Olivo, N. Omodei, V. Pelassa, F. Piron, R. Preece, M. Razzano, J. J. Russell, F. Ryde, P. M. Saz Parkinson, J. D. Scargle, C. Sgrò, T. Shimokawabe, P. D. Smith, G. Spandre, P. Spinelli, M. Stamatikos, B. L. Winer, R. Yamazaki

(Submitted on 4 Jun 2009)

The LAT instrument on the Fermi mission will reveal the rich spectral and temporal gamma-ray burst phenomena in the > 100 MeV band. The synergy with Fermi's GBM detectors will link these observations to those in the well explored 10-1000 keV range; the addition of the > 100 MeV band observations will resolve theoretical uncertainties about burst emission in both the prompt and afterglow phases. Trigger algorithms will be applied to the LAT data both onboard the spacecraft and on the ground. The sensitivity of these triggers will differ because of the available computing resources onboard and on the ground. Here we present the LAT's burst detection methodologies and the instrument's GRB capabilities.

Comments: Accepted by ApJ
Subjects: **High Energy Astrophysical Phenomena (astro-ph.HE)**; Instrumentation and Methods for Astrophysics (astro-ph.IM)
Cite as: arXiv:0906.0991v1 **[astro-ph.HE]**

✴ *Accepted for publication in ApJ, 08 July 2009.*

✴ *David: ‘’ I think there was a mistake as my name is listed first.”*

Pre-launch studies: 3. The GRB Group & Data Challenges.

- *The Fermi GRB Group: A cross-instrument collaboration for Fermi GRB.*
- *Prior to launch, the LAT team undertook DATA CHALLENGES! What are we going to see and how are we going to analyse it?*
- *David wrote a suite of IDL programs to simulate GBM data in all its varieties based on current file specifications. GBM joined in DC2 and further efforts using David's code as a starting point.*
- *A sequence of ever-more realistic data sets were generated for both LAT and GBM, based on BATSE bursts & what one might expect for LAT bursts.*
- *Tools, knowledge, inter-team collaboration were CHALLENGED.*
- *By launch, we were prepared to work together and deal with our very different instruments.*

Pre-launch studies: 4. The Curmudgeons.

- *I'm one of them!!!!*
- *We preached of the importance of doing careful, time-resolved spectroscopy, choosing each background model and source interval lovingly and with care...*
- *Mostly, we were right... but...*

David Band says:

My comment is with regards to the multiwavelength plan.

While you are preaching to the choir that we need:
1. Good afterglow followups for GLAST, particularly when GLAST will not have the onboard X-ray and optical-UV capabilities that Swift does;
2. All burst missions need more IR afterglow coverage;
3. Prompt emission coverage needs to be broadband;

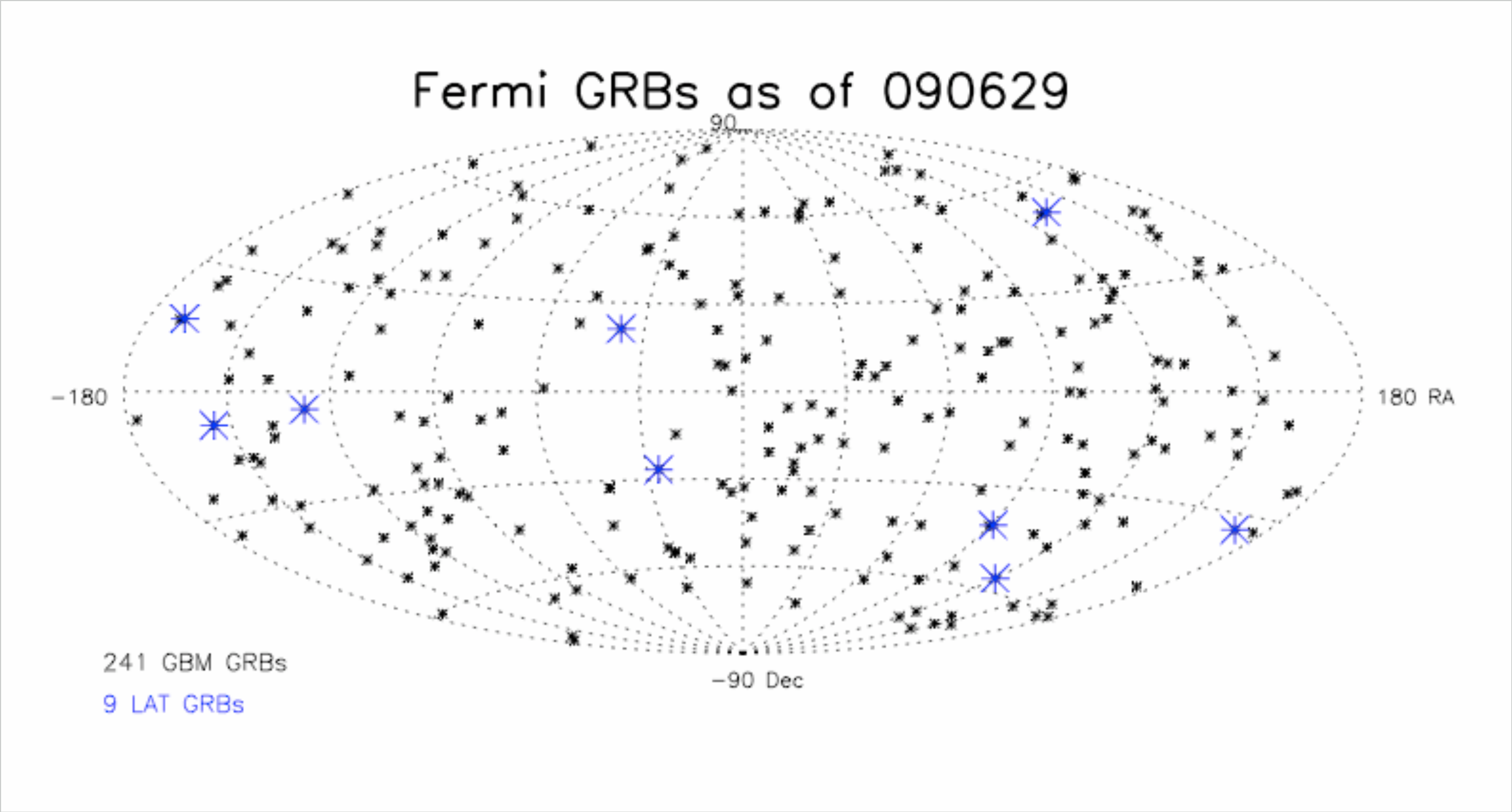
However, we need to recognize that:
1. GBM bursts will on average be much brighter than Swift bursts because the GBM will be less sensitive than Swift is;
2. To the extent that the LAT emission correlates with an extrapolation of the GBM spectrum to the LAT band (I recognize that there will be additional LAT components may correlate with an extrapolation of the GBM spectrum), the bursts that result in detectable LAT emission will generally be hard and bright (i.e., high fluence);
3. There is a general correlation of high fluence with low redshift (yes, the trend has a great deal of scatter--the z=6.3 burst was moderately fluent);
4. Consequently, the fraction of GLAST bursts at high z will be smaller than for Swift.

Therefore we should not bias our afterglow capabilities too heavily towards high z bursts.

June 11 2008

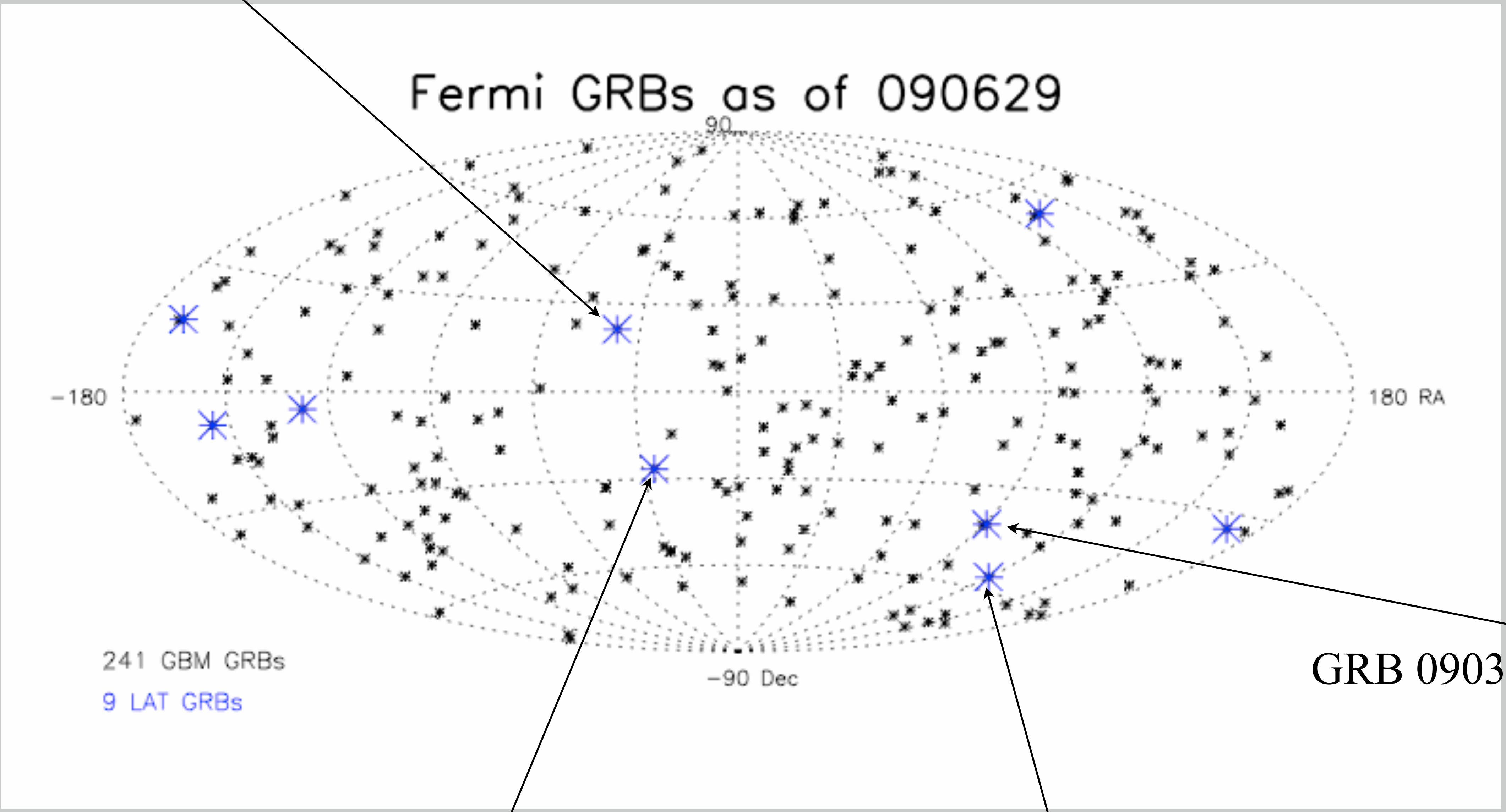
- *Photo by MSB*

One year of GRBs



One year of GRBs

GRB 090323 z = 3.6



GRB 090328 z = 0.7

GRB 090510 z = 0.9

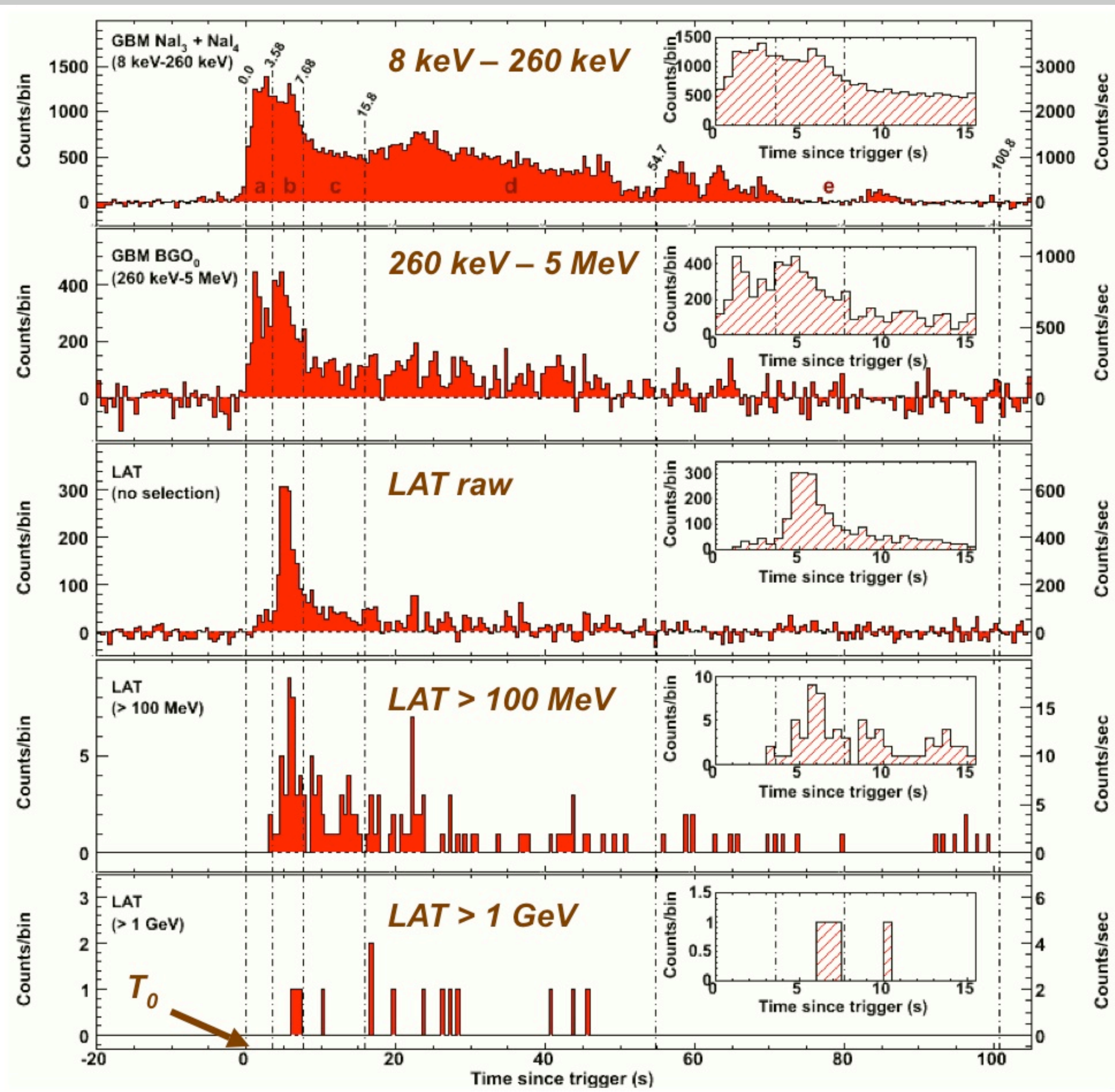
GRB 080916C z = 4.4

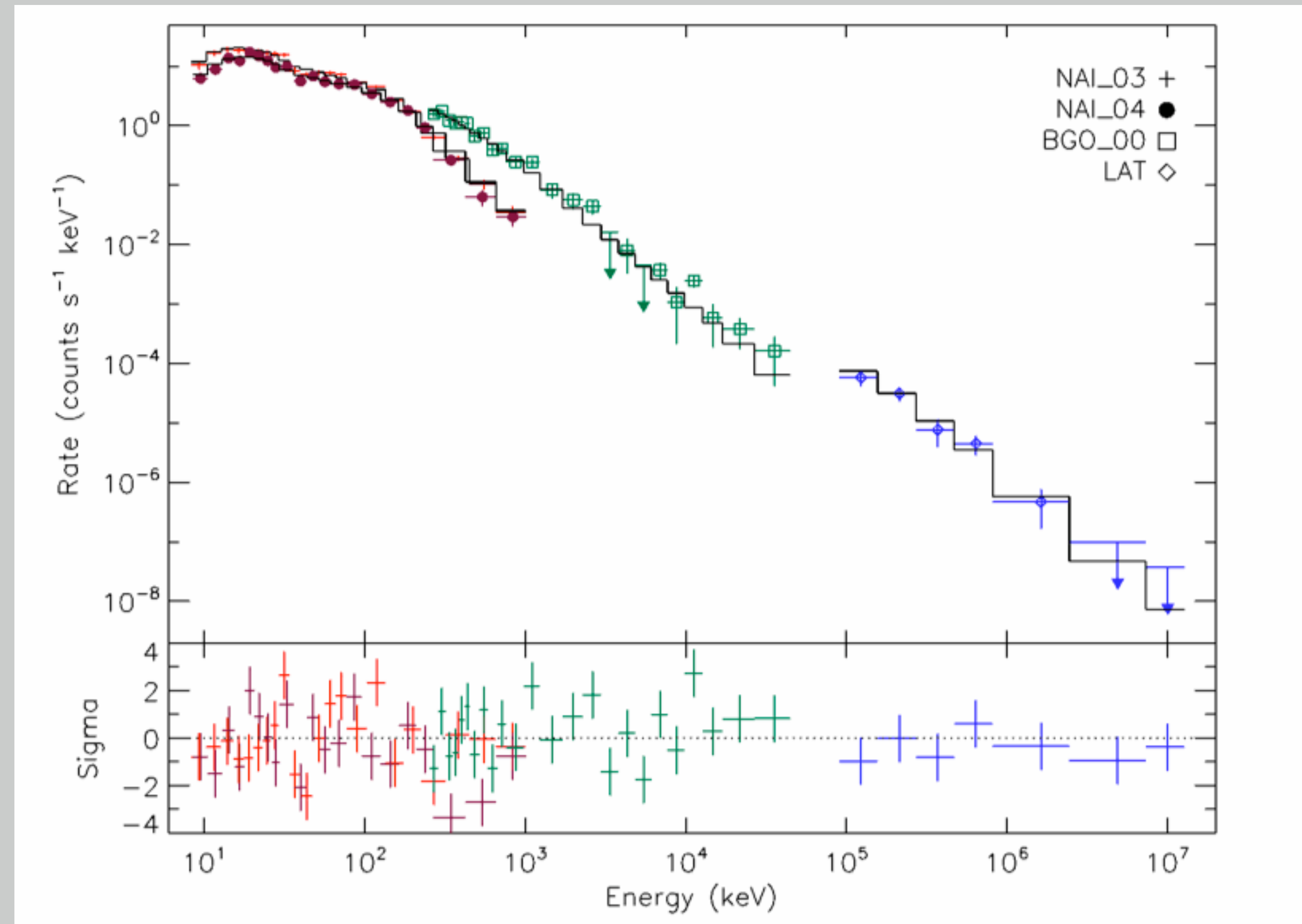
Science 27 March 2009:
Vol. 323. no. 5922, pp. 1688 - 1693
DOI: 10.1126/science.1169101

RESEARCH ARTICLES

Fermi Observations of High-Energy Gamma-Ray Emission from GRB 080916C

The Fermi LAT and Fermi GBM Collaborations‡





5 time intervals, 6 decades of energy, all beautifully fit by the Band function.