Fermi GBM and Spectral Fitting GRBs

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Others before launch: Giselher Lichti, Fred Berry, Ron Al English, Fred Kroeger, …
- Sodium iodide (NaI)
  - 12.7 cm diameter X 1.27 cm thick
  - 8 keV to 1 MeV

- Bismuth germanate (BGO)
  - 12.7 cm diameter X 12.7 cm long
  - 200 keV to 40 MeV
Very wide field-of-view / non-imaging / high background.

Well suited for transients such as GRBs, solar flares, SGRs, and TGFs.

Persistent or long-timescale sources can be detected by timing analysis (pulsars) or detecting Earth occultation steps.
71 AGN are being monitored. There are 12 clear detections:

- Seyfert 2 galaxies:
  - NGC 1275
  - NGC 2110
  - NGC 4388
  - Cen A
  - NGC 5252
  - Circinus Galaxy
  - NGC 5506
- Seyfert 1 galaxies:
  - NGC 4151
  - IC 4329A
- radio galaxy: IGR J21247+5058)
- quasars:
  - 3C 273
  - 3C 454.3
Mass attenuation coefficient $\mu$: $T/T_0 = \exp (-\mu x)$, where $x$ is the column density of NaI traversed in g cm$^{-2}$. 
Iodine K X-ray escape

Compton scatter

Backscatter

Iodine K X-ray escape

R. M. Kippen
Count spectrum (binned) = DRM \times \text{ photon model}

so:

\text{Photons} = \text{DRM}^{-1} \times \text{Data}
Forward-folding fitting

1) Assume a parameterized photon model.
2) Select a fitting statistic – likelihood or C-Stat (or $\chi^2$)
3) Calculate the count model using the DRM / IRF,
4) Calculate the fitting statistics,
5) Change the photon model parameters to improve the fitting statistic,
6) Repeat steps 3 to 5 to optimize the model.
7) The answer is based upon the model that you assumed – the process cannot automatically find the true model.
What not do do!
GBM Datatypes

GBM datatypes: designed to meet a stringent telemetry requirement. Currently 2% of the mission volume.

- **Triggered:**
  - CSPEC: 128 channels, binned at 1.024 s
  - CTIME: 8 channels, binned at 0.064 s
  - TTE: 128 channels, individual counts at 2 μs

- **Continuous / daily:**
  - CSPEC: 128 channels, binned at 4.096 s
  - CTIME: 8 channels, binned at 0.256 s
  - **NEW:** TTE: 128 channels, individual counts at 2 μs