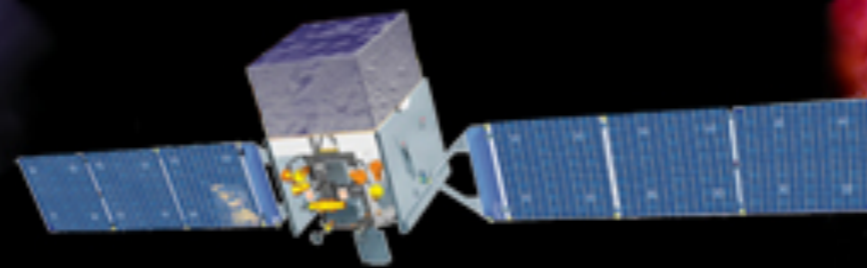


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Gamma-ray Burst Monitor



## Highlights from the New Catalog of Type 1 X-ray Bursts And other Transients Detected by GBM

*Peter A. Jenke*

Fermi 2014 Nagoya Japan

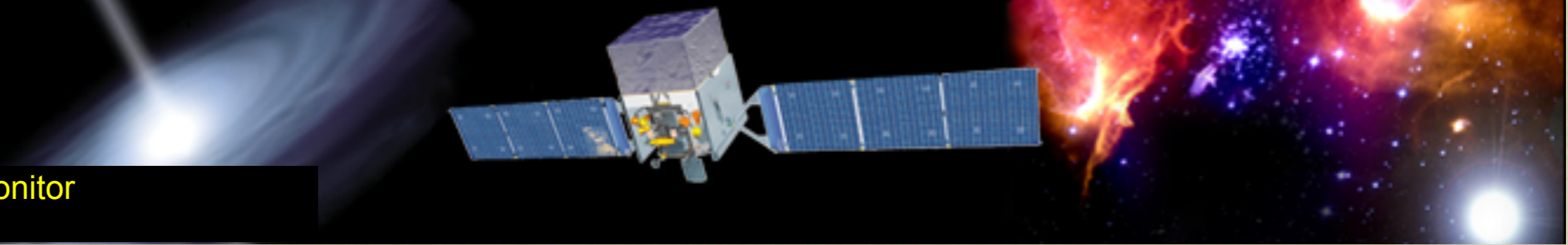
*Collaborators:*

*M. Linares<sup>1</sup>, V. Connaughton<sup>2</sup>, M. Finger<sup>3</sup>, C. Wilson-Hodge<sup>4</sup>, Michael Burgess<sup>2</sup>, Elif Beklen<sup>5</sup>*

*1 - Instituto de Astrofísica de Canarias (IAC), 2 - University of Alabama in Huntsville, 3 - USRA, 4 - MSFC, 5 - SDU/NRAO*

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## Type 1 X-ray Burst

Neutron star accreting matter from a low mass companion.



$$\dot{M} \sim 2\% \text{ Eddington}$$

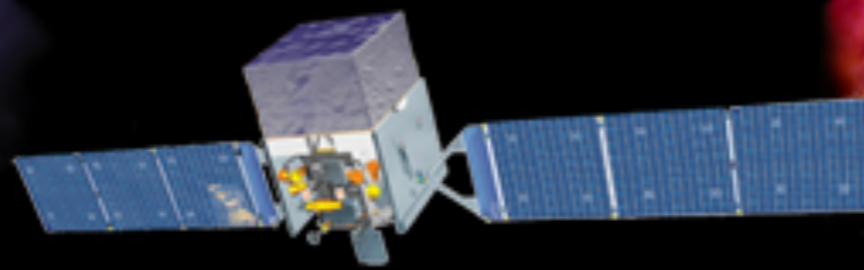
## May be 3 Types of Type 1 X-ray Burst

- Normal: 10-100 seconds H, He  $L \sim 10^{39} - 10^{40} \text{ ergs}$
- Long : 10-30 Minutes He  $L \sim 10^{41} \text{ ergs}$
- Super : Hours-Days C  $L \sim 10^{42} \text{ ergs}$

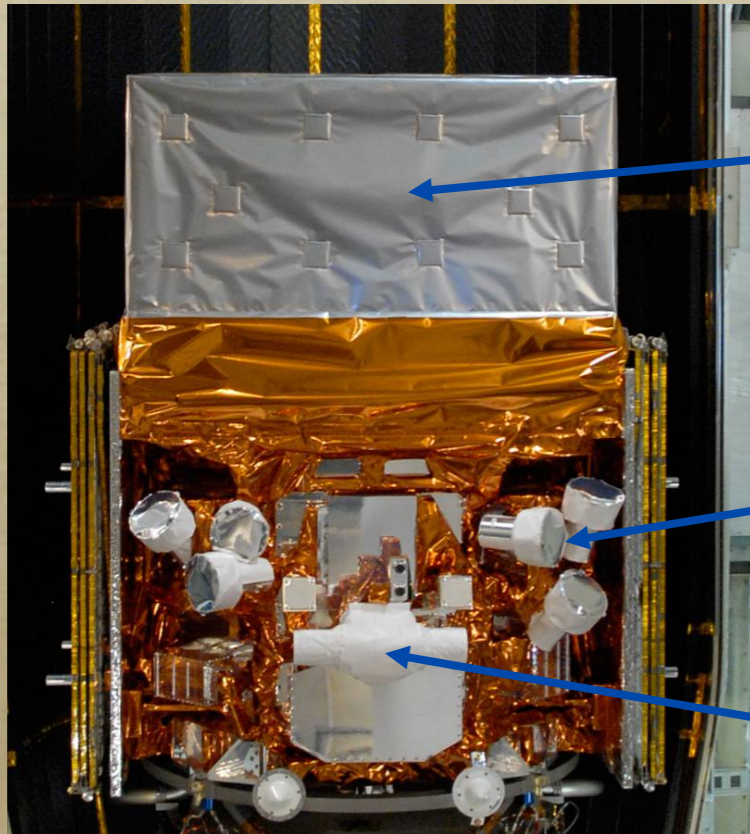
*Currently 104 known bursters*

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Gamma-ray Burst Monitor



Launched June 11, 2008



Large Area Telescope (LAT)  
20 MeV -- 300 GeV

## Gamma-ray Burst Monitor

12 NaI detector.  
8 keV -- 1000 keV  
126 cm<sup>2</sup>, 1.27 cm  
Triggering, localization, spectroscopy.

2 BGO detector.  
200 keV -- 40 MeV  
126 cm<sup>2</sup>, 12.7 cm  
Spectroscopy  
Bridges gap between NaI and LAT.

Primary science for GBM is detection of Gamma-ray Bursts

CTIME - 0.256 s time resolution, 8 channels

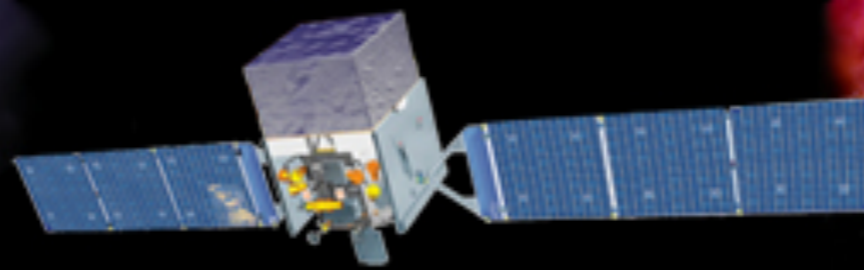
CSPEC - 4.096 s time resolution, 128 channels

Time Tagged Events (TTE), 128 channels

*Products*

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Gamma-ray Burst Monitor



## Visual Inspection of CTIME Data

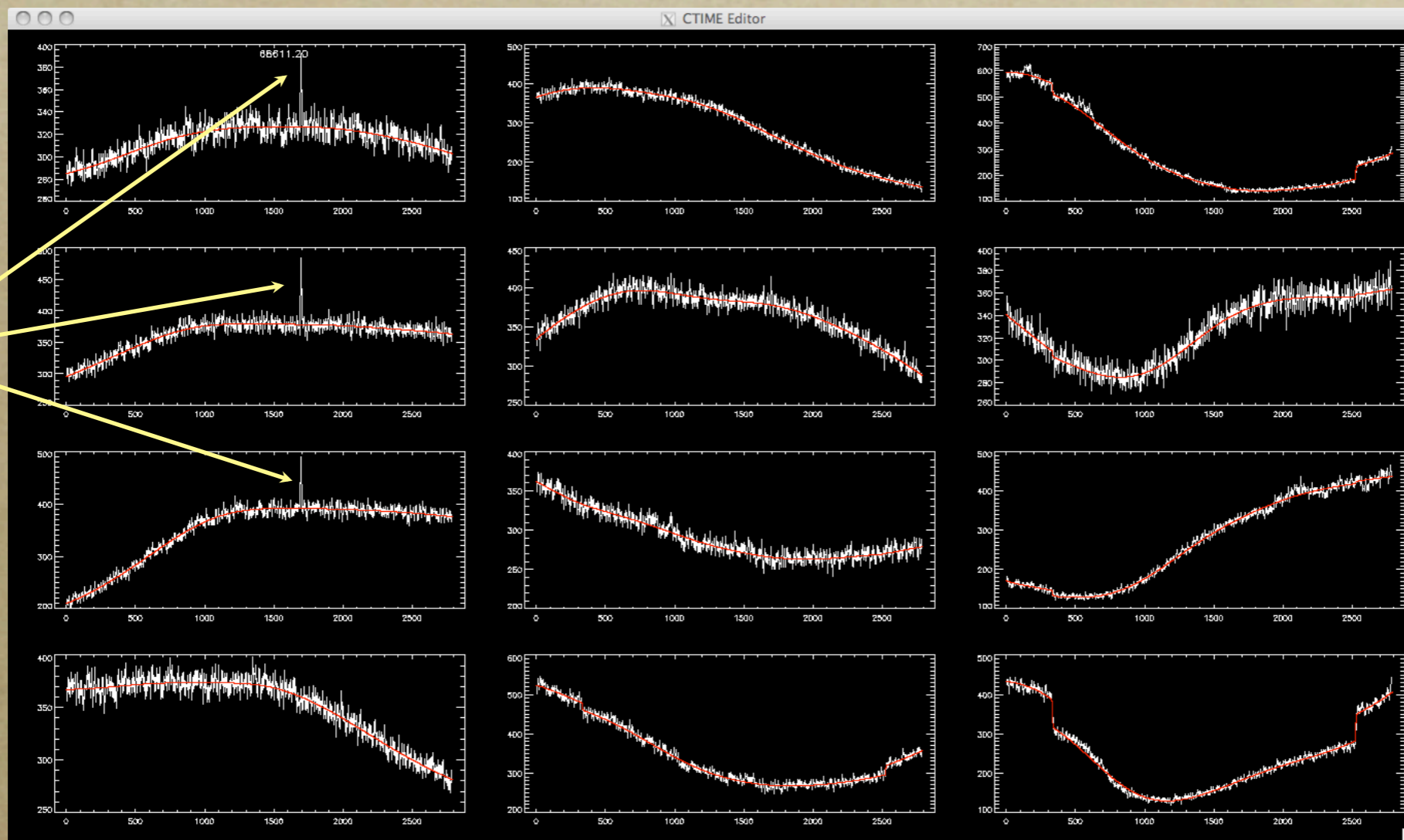
*12 NaI detectors*

*12-25 keV*

*8 second bins*

GBM Pulsar Project  
PI Mark Finger

4U 0614+09

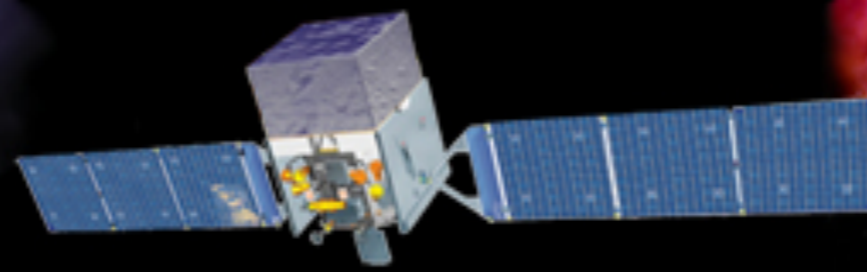


*Initiated March 12, 2010*

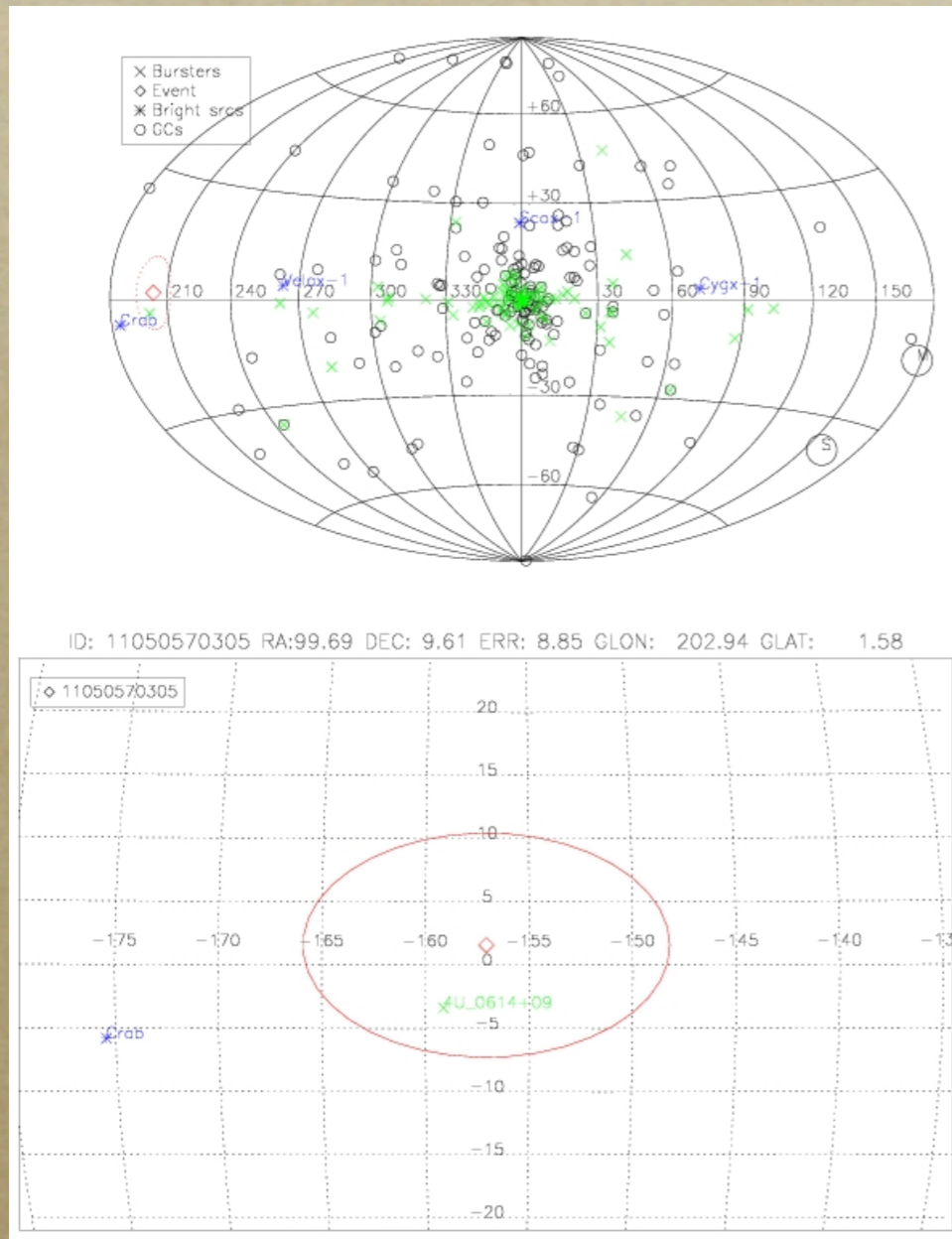
<http://gammamay.nsstc.nasa.gov/gbm/science/pulsars.html> P. Jenke

# Fermi

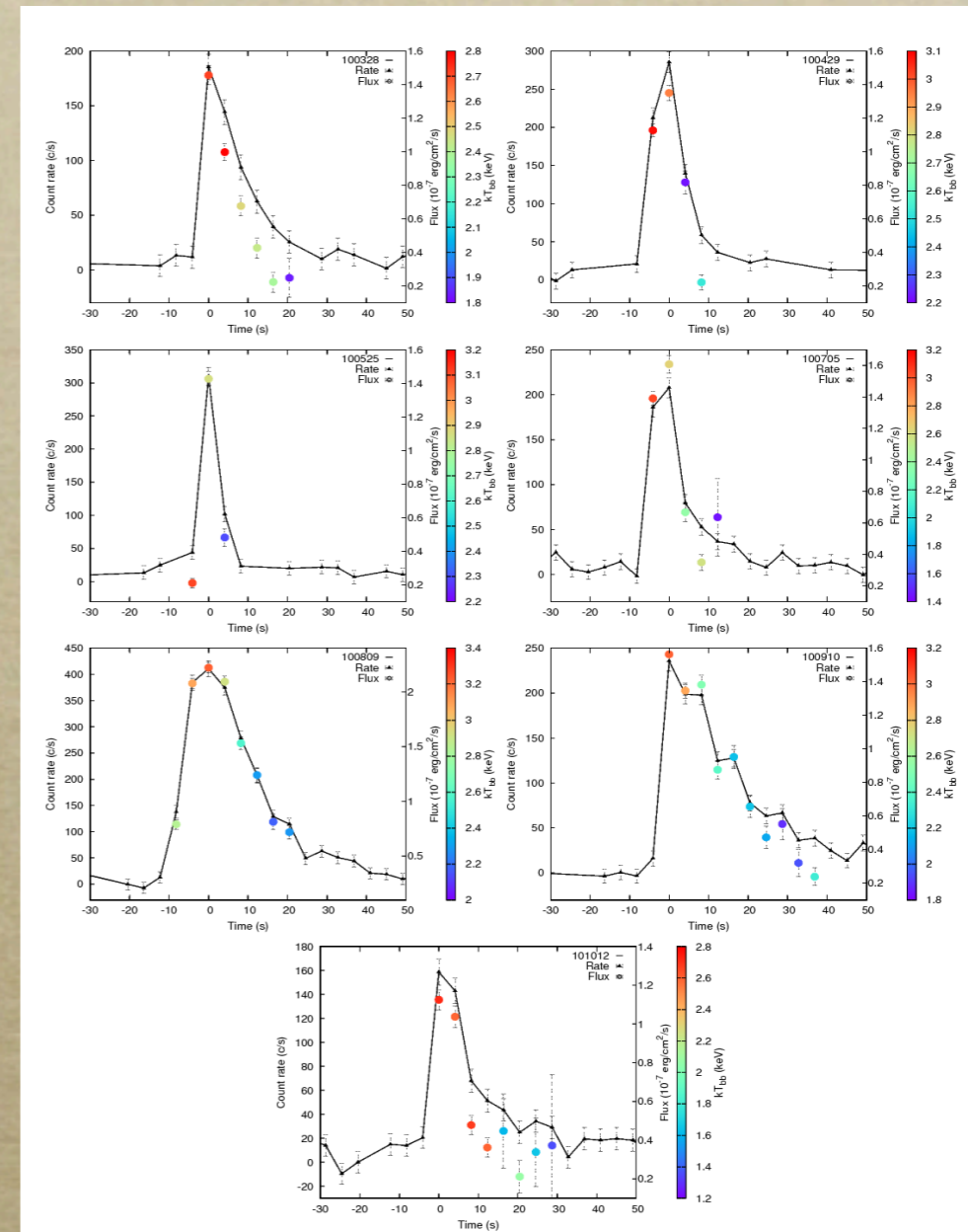
Gamma-ray Burst Monitor



## Identification Process

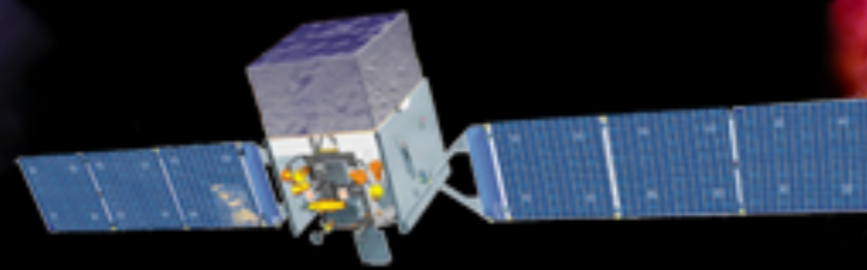


4U 0614+09

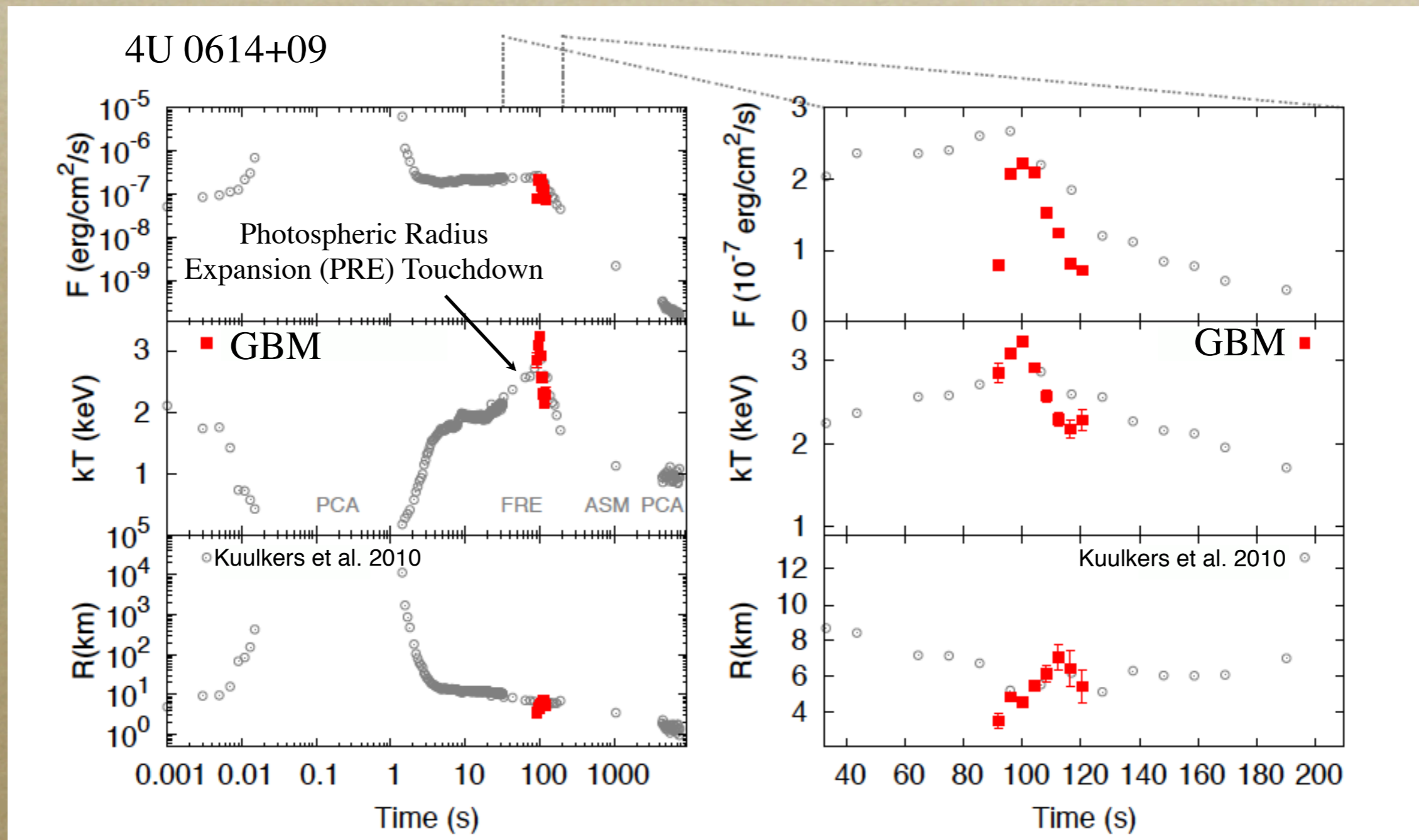


Location

Spectral

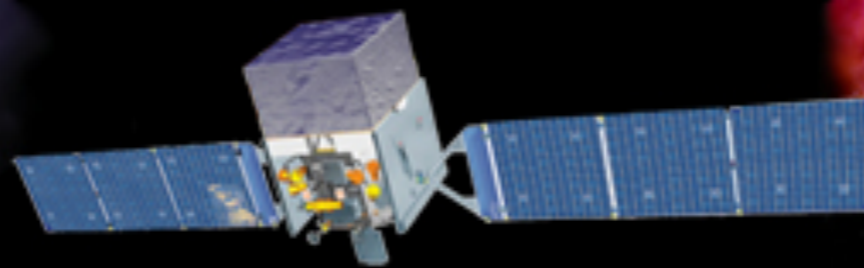


## What Does GBM See?

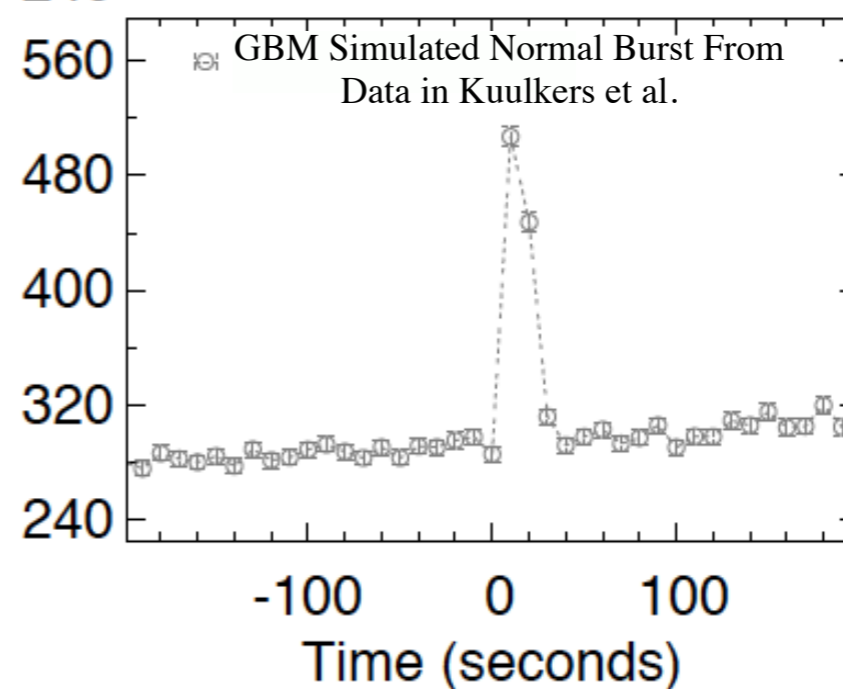
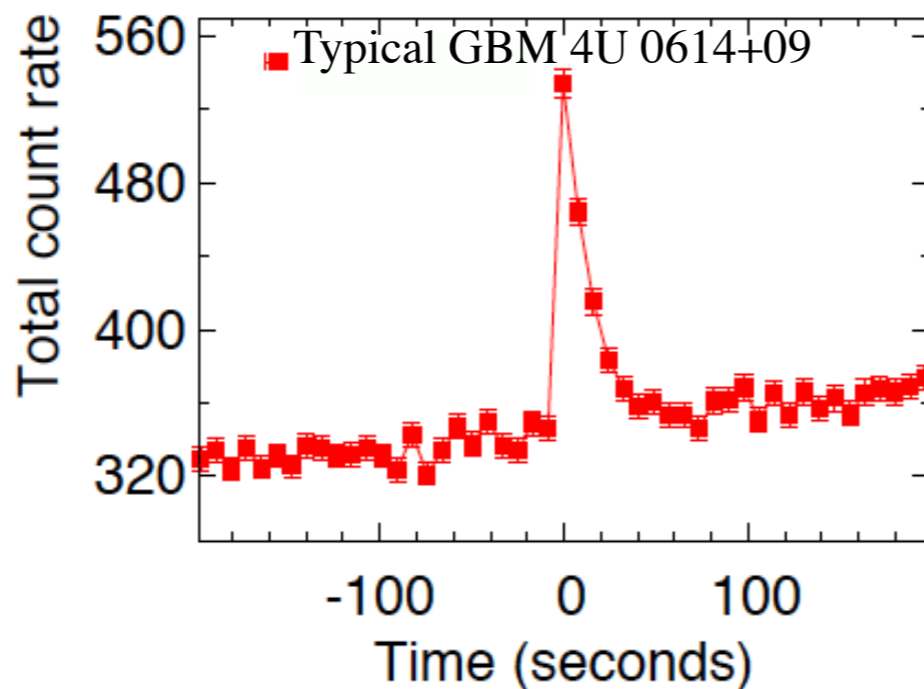
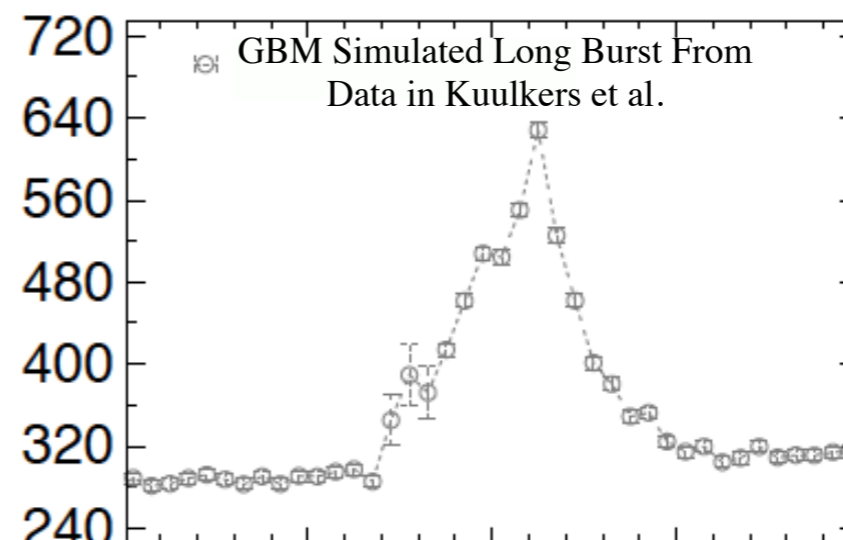
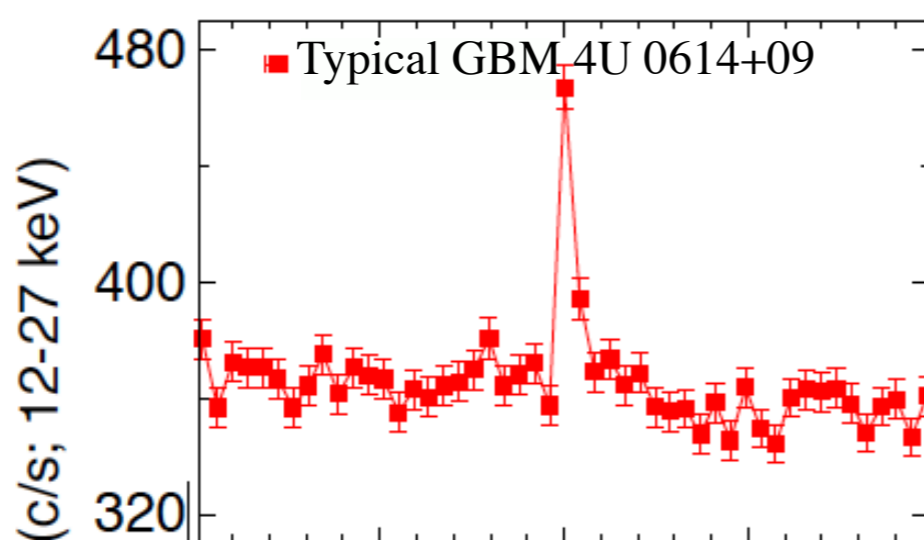


# Fermi

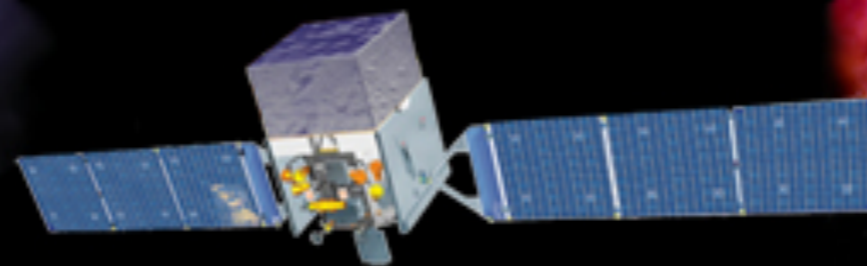
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## Comparing Observed GBM Light Curves to Simulations







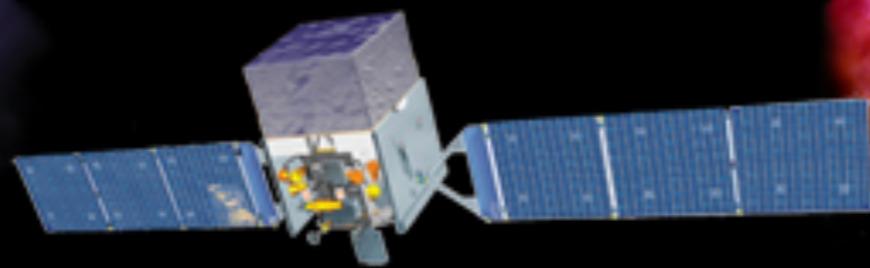
From 2010 March 12 - 2013 Feb 24

5093 Total Events

- 1947 XRB Candidates
- 2768 Solar Events
- 378 Particle Events

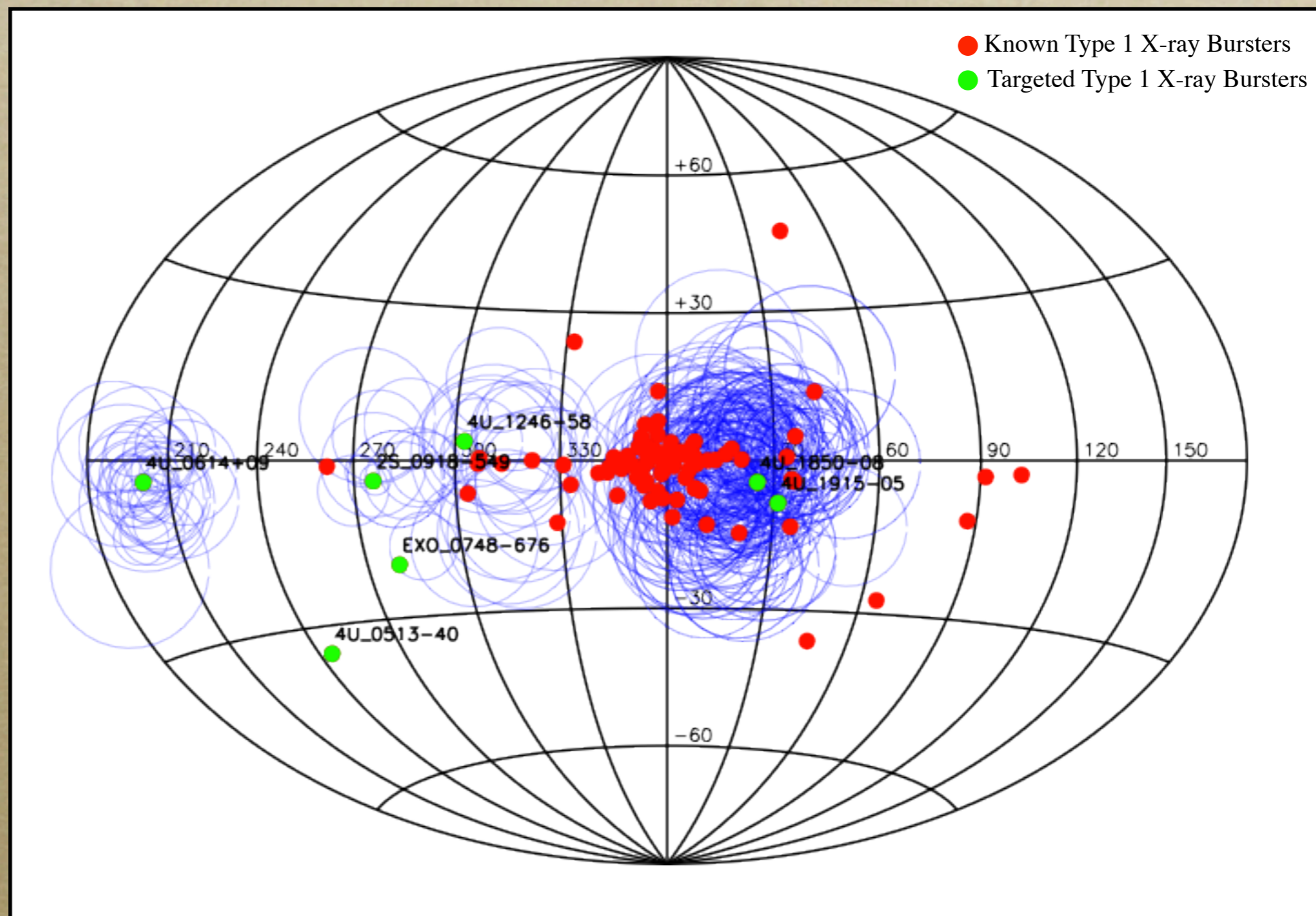
Spectral Refinement

- 776 Refined XRB Candidates (soft GRB/XRF)
- 655 Solar Events
- 95 GBM Triggered GRB
- 68 Untriggered GRB (Some Swift/BAT)
- 195 Sco X-1
- 80 Weak
- ~few A0535+26 and Vela X-1



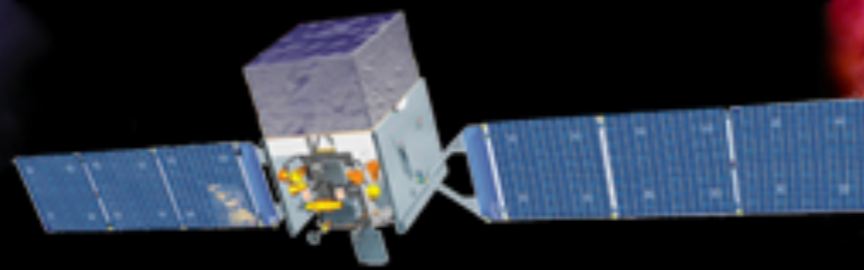
## Associations For Low $\dot{M}$ Accretors

- 30 - 4U 0614+09
- 10 - 2S 0918-549
- 21 - 4U 1246-58
- 2 - EXO 0748-676
- 0 - 4U\_0513-40
- Ind - 4U\_1915-05
- Ind - 4U\_1850-08
- More to Come

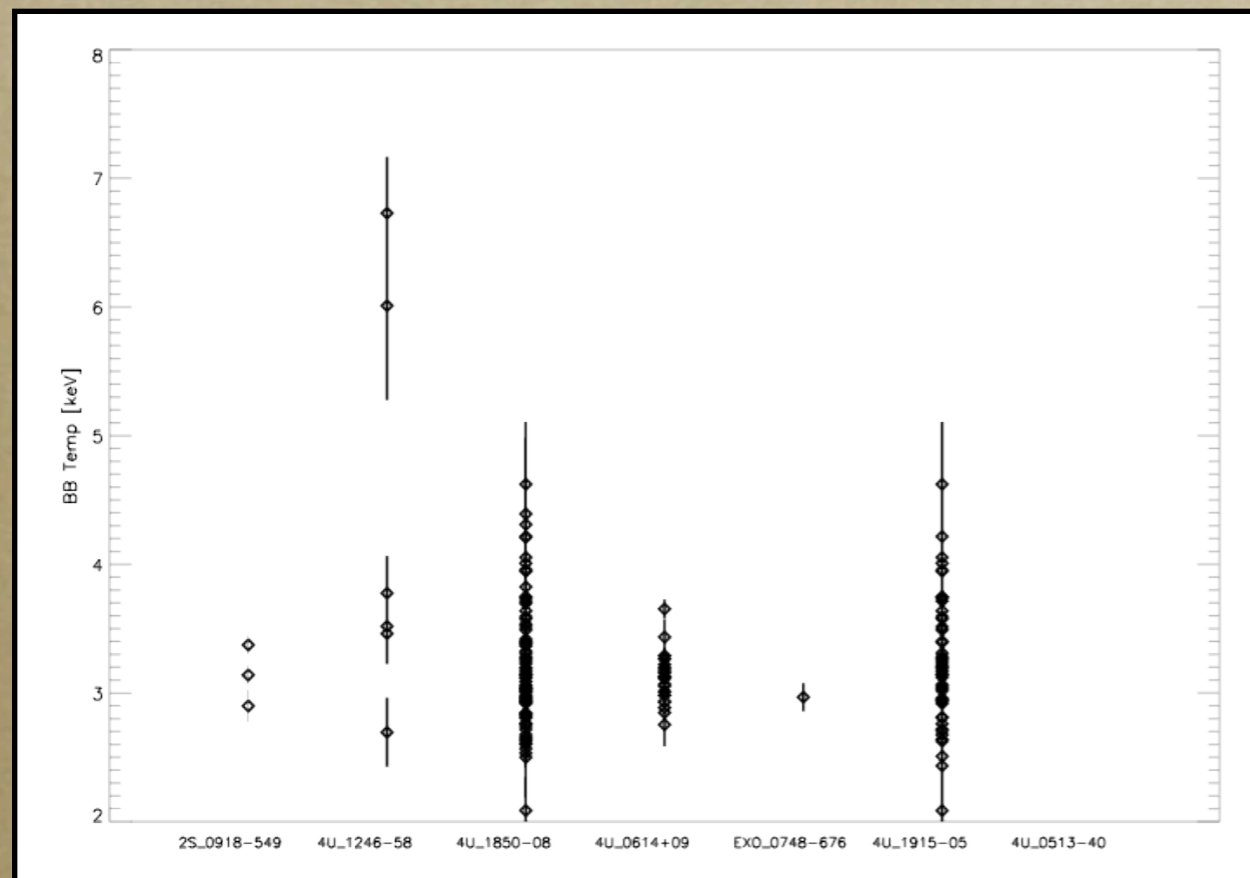


# Fermi

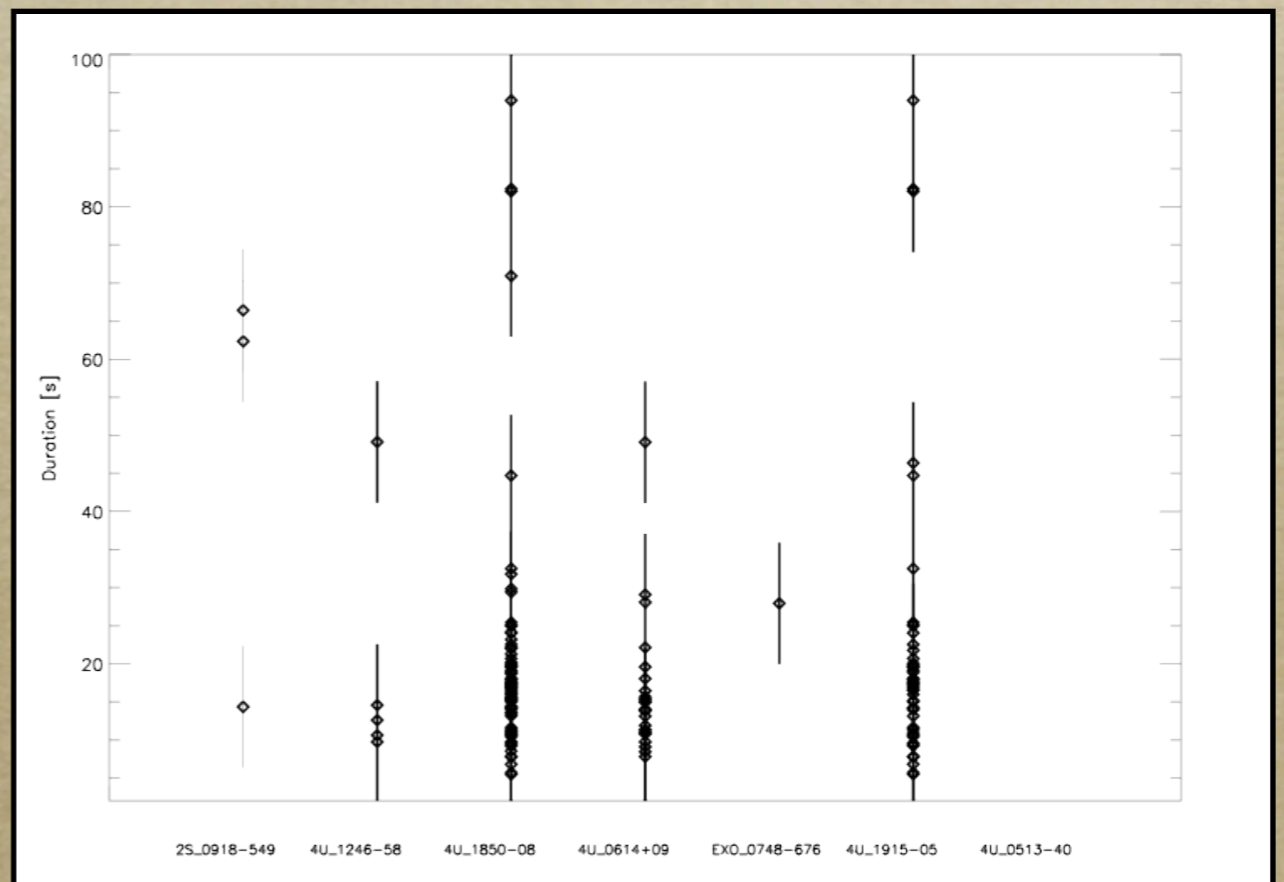
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## BB Temperatures for Targeted XRBs

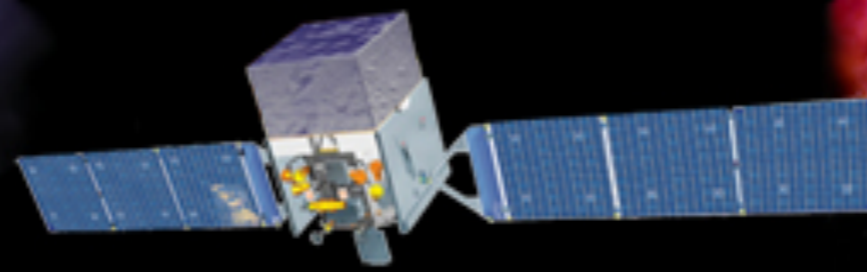


## Durations for Targeted XRBs

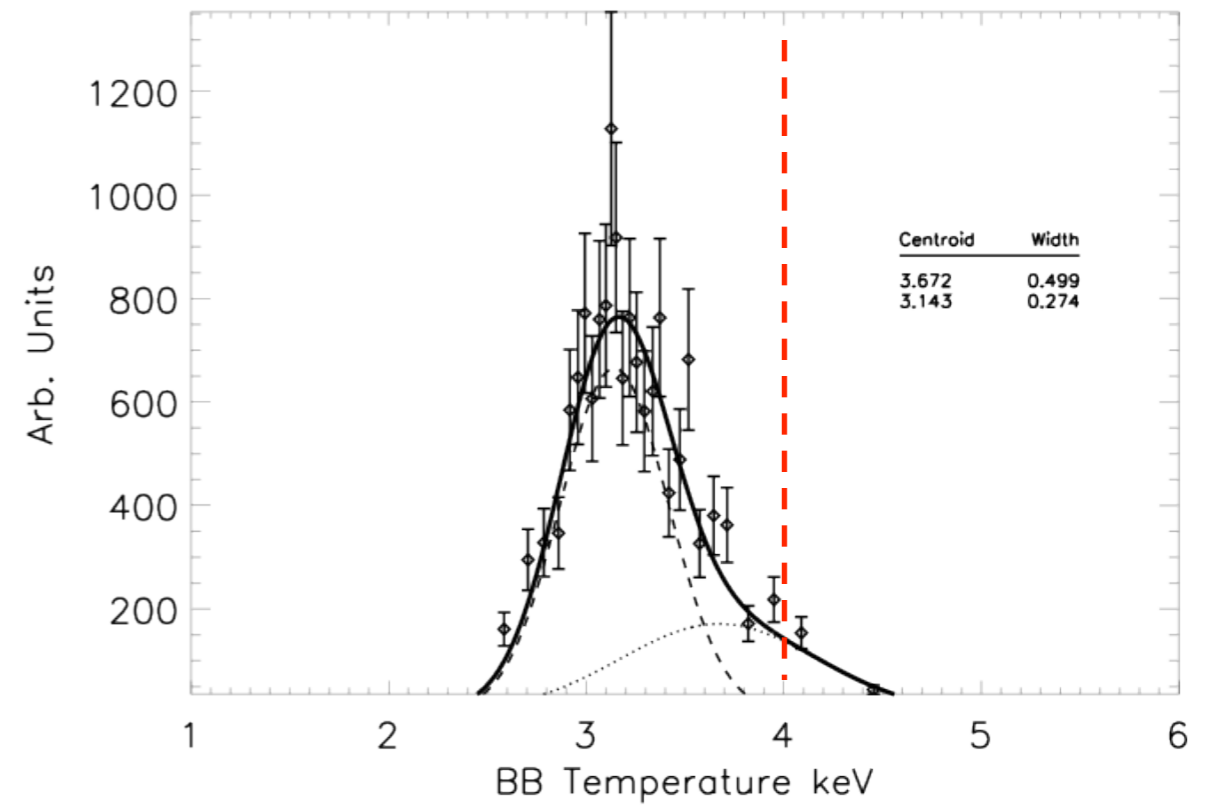
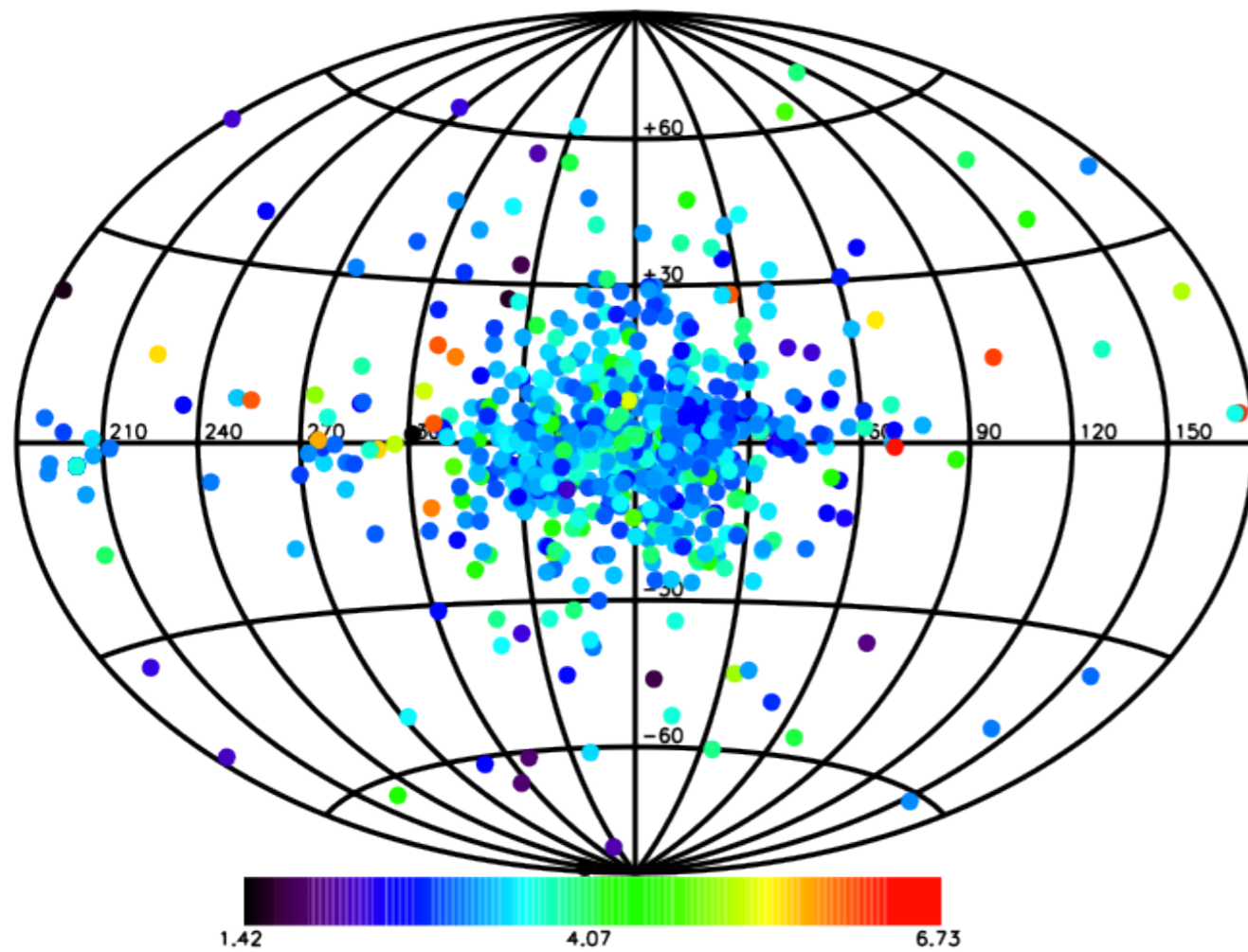


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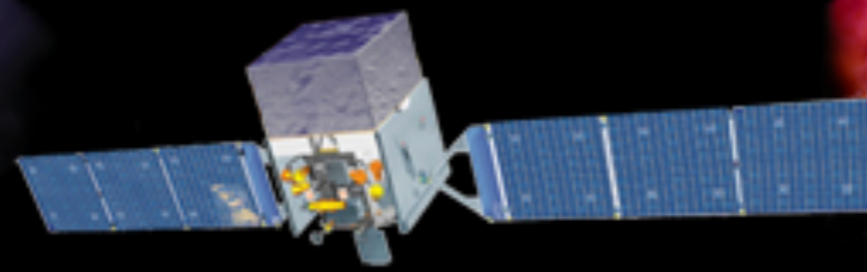


## Black Body Temperature

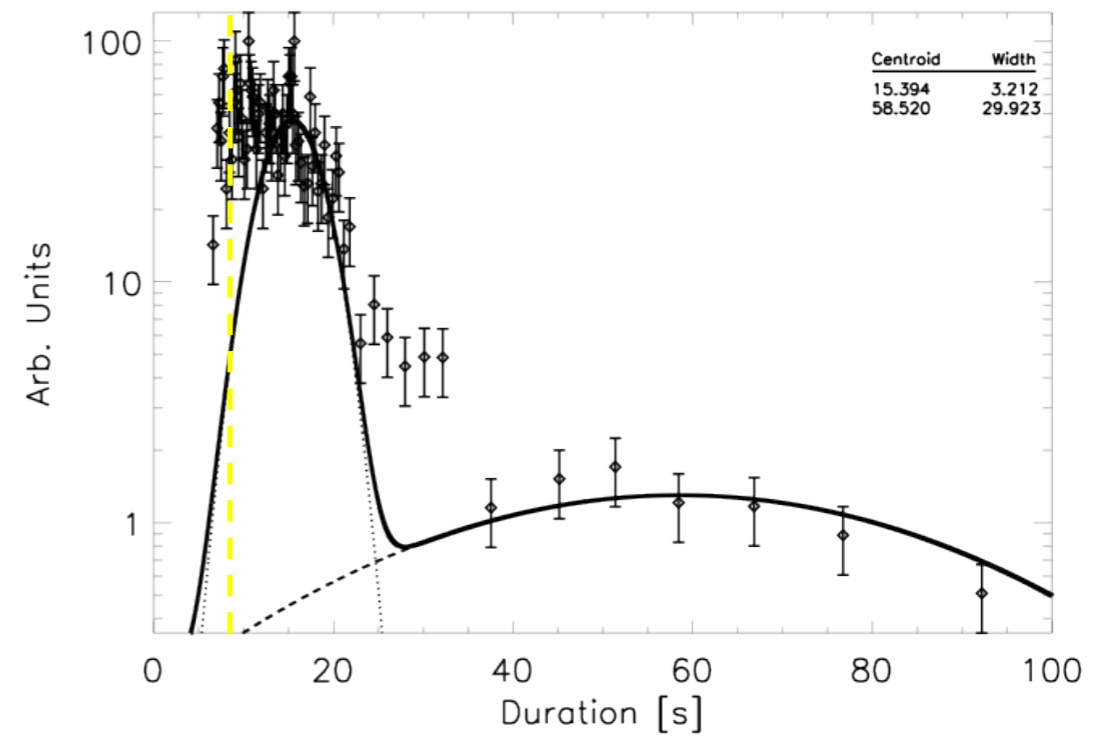
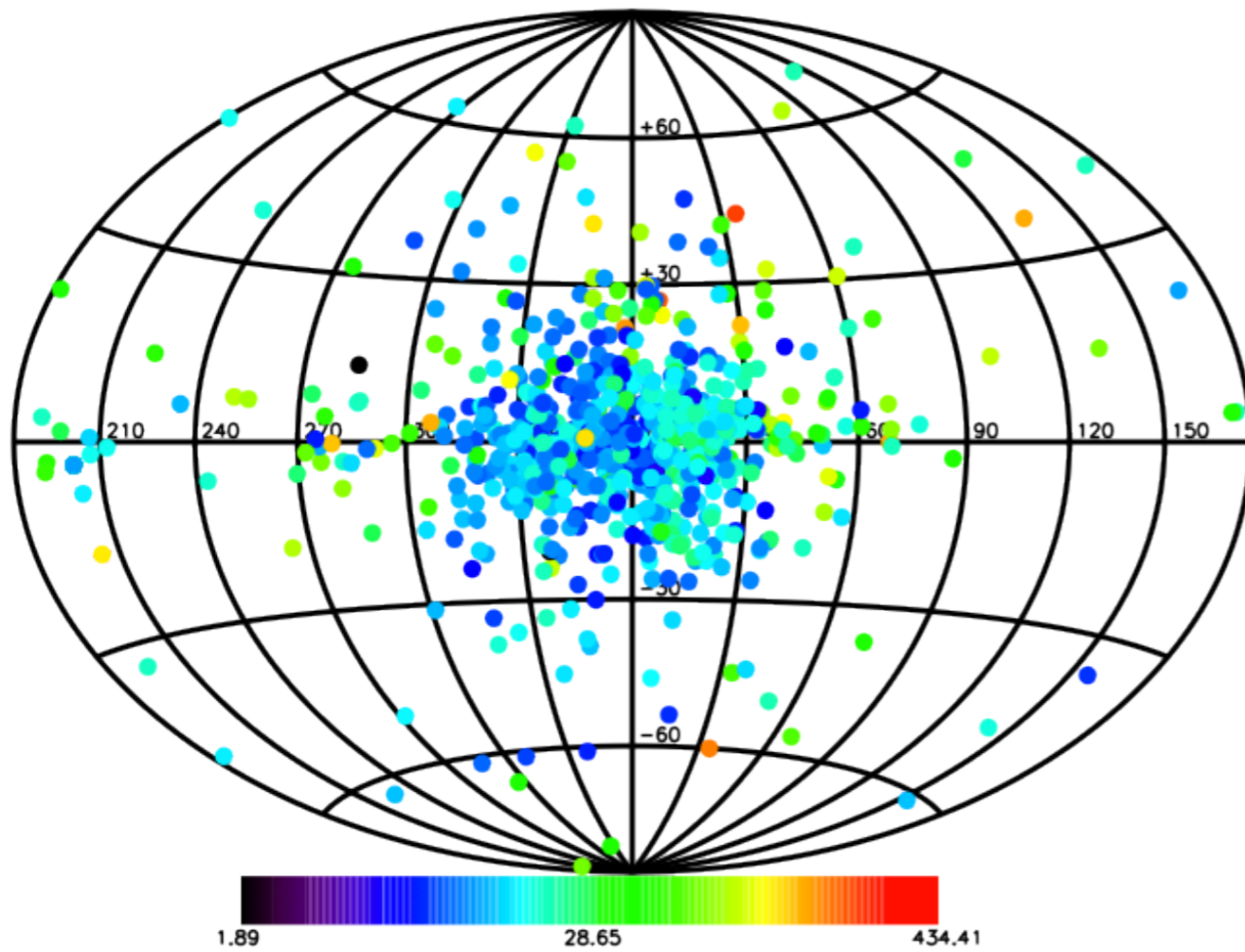


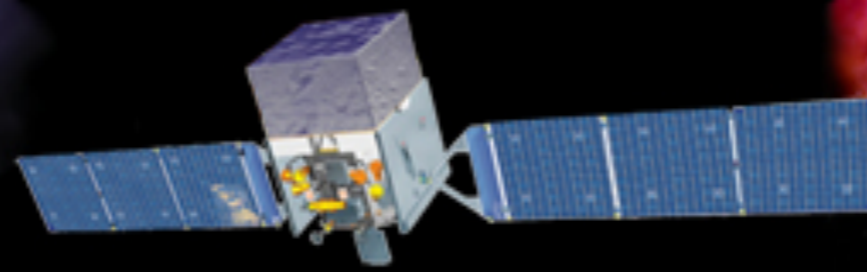
# Fermi

Gamma-ray Burst Monitor



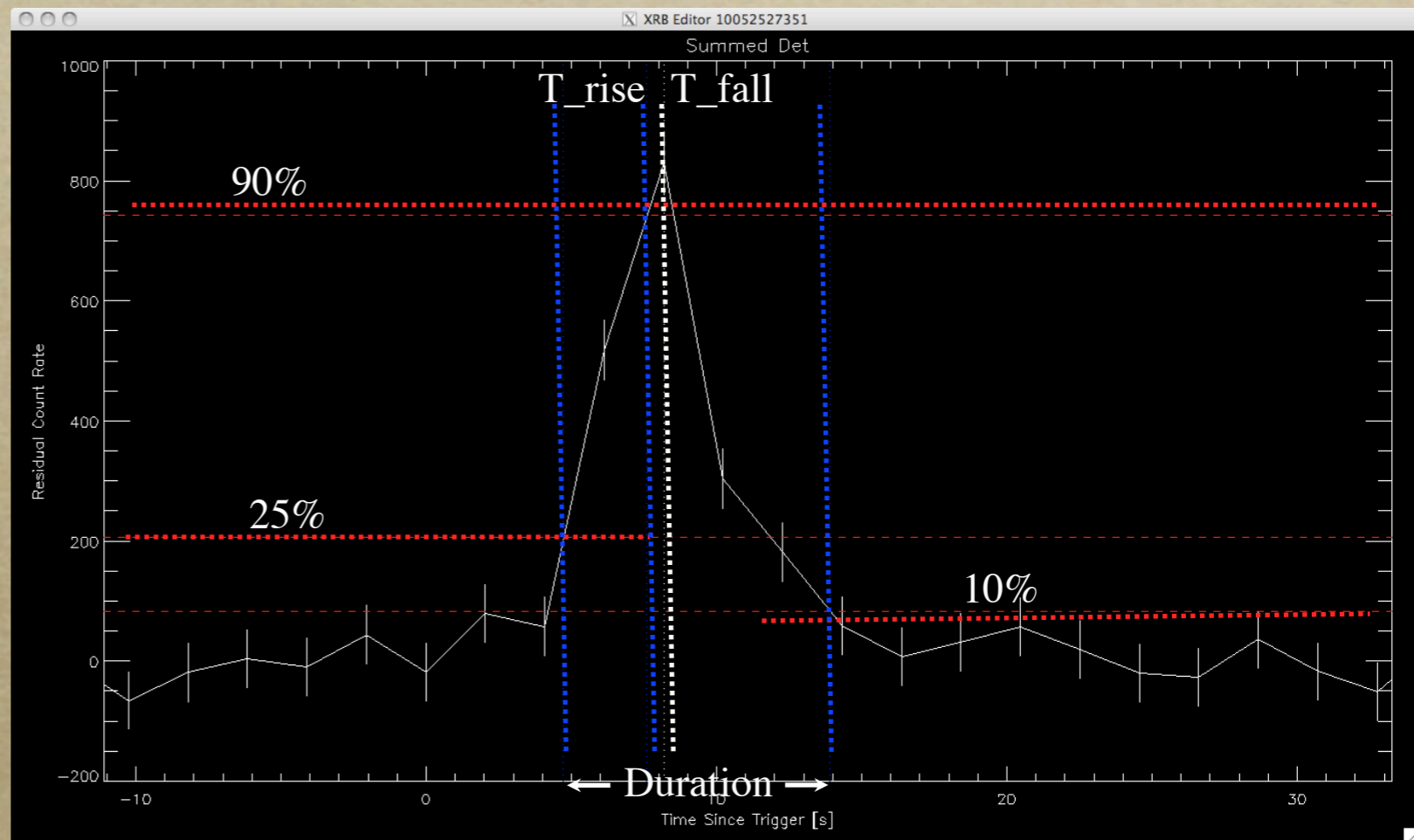
## Duration

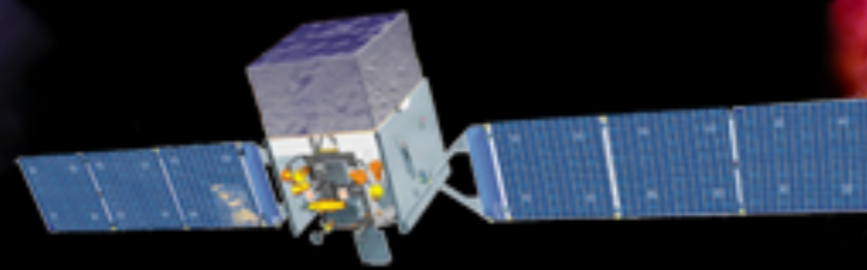




## GBM XRB Catalog

- Time of Event
- Ra, Dec, 1 sig error radius
- Association
- BB temp
- BB energy flux
- BB energy fluence
- PL index
- PL energy flux
- PL energy fluence
- Rise Time (25% - 90%)
- Fall Time (T<sub>peak</sub> - 10%)
- Duration (25% - 10%)
- Structure





## Conclusions

- GBM is capable of detecting a multitude of X-ray transient events.
- GBM's low energy response is well modeled.
- GBM's wide field of view makes it an excellent tool for studying Type 1 XRBs
- The majority of these event will be Photospheric Radius Expansion Event.