Hunting for γ-rays from Fast Radio Bursts (FRBs) using Swift/BAT & GUANO

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CHIME & SWIFT Image Credit: NASA & Chime collaboration
Slide Background Image credit badrusblue
Fast Radio Bursts (FRBs):

- Transient radio emission of unknown extragalactic origin, there are more than 600 CHIME reported FRBs.
- Timescale of burst in radio wavelengths is ~1ms to 1s.
- Most FRB progenitor models involve magnetars, and predict associated γ-ray emission.
- So far, FRBs have only been detected at radio wavelengths.

Project Motivation:

- Previous γ-ray searches looked at a single repeating FRB, and established fluence limits of ~ $10^{-7}$ erg/cm$^2$.

- Thanks to GUANO, there is corresponding Swift/BAT data for more than 500 FRBs.

- No one has yet searched these CHIME/FRBS with Swift/BAT data.

- Project: systematic survey to establish fluence limits from FRBs.

Lightcurve Analysis:

- *Swift/BAT* light curves are more sensitive than *Swift/BAT* images.

- Searches the lightcurve in signal to noise (SNR) for a peak using a boxcar convolution with the size of the boxcar adjusted to search for different timescales.

- Boxcar search is looking around a window ± 3s centered on the CHIME detection time.
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**GRB: 20022A**
**SWIFT ID: 03110079007**

**Time Scale vs Peak SNR**

- Total Counts
- 15-25 KeV
- 25-50 KeV
- 50-100 KeV
- 100-150 KeV
- Expected Noise
Sky Image Analysis:

- Fluence limits require an estimated Poisson count limit, a Spectral Response File (RSP) file, and model spectra.

- The RSP file provides information about the effective area of the telescope for a specific sky position as a function of photon energy.

- *Swift/BAT* RSP files are generated for sky images, not lightcurves.

- *Swift/BAT* Sky Images look at \( \sim \frac{1}{8} \) the sky.

- Sky images are made with 6s exposures centered on the CHIME detection time.
Results:

• Searched a catalog of 380 FRBs sources

• SNR estimates for 246 FRBs, No detections

• Established fluence limits for 49 FRBs at \(\sim 10^{-7}\) erg/cm\(^2\) in the 15-150 KeV band.