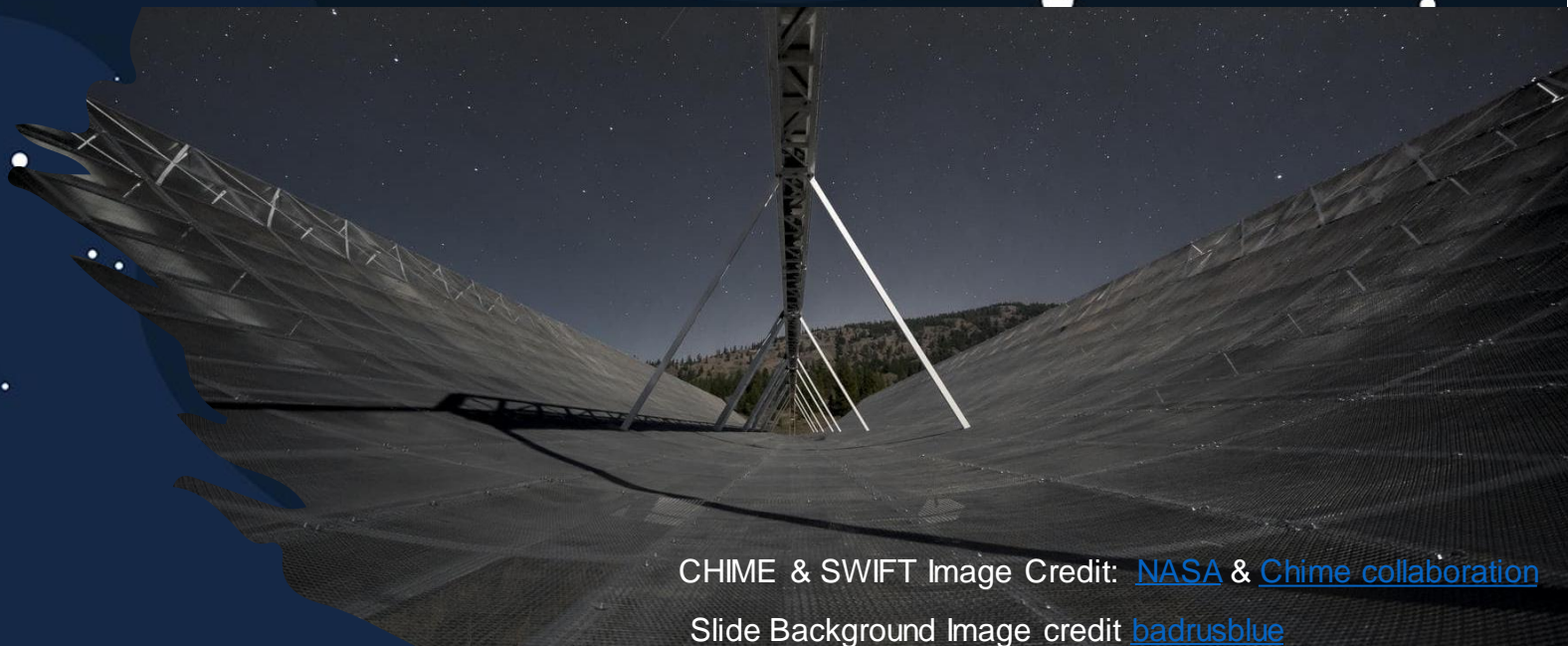
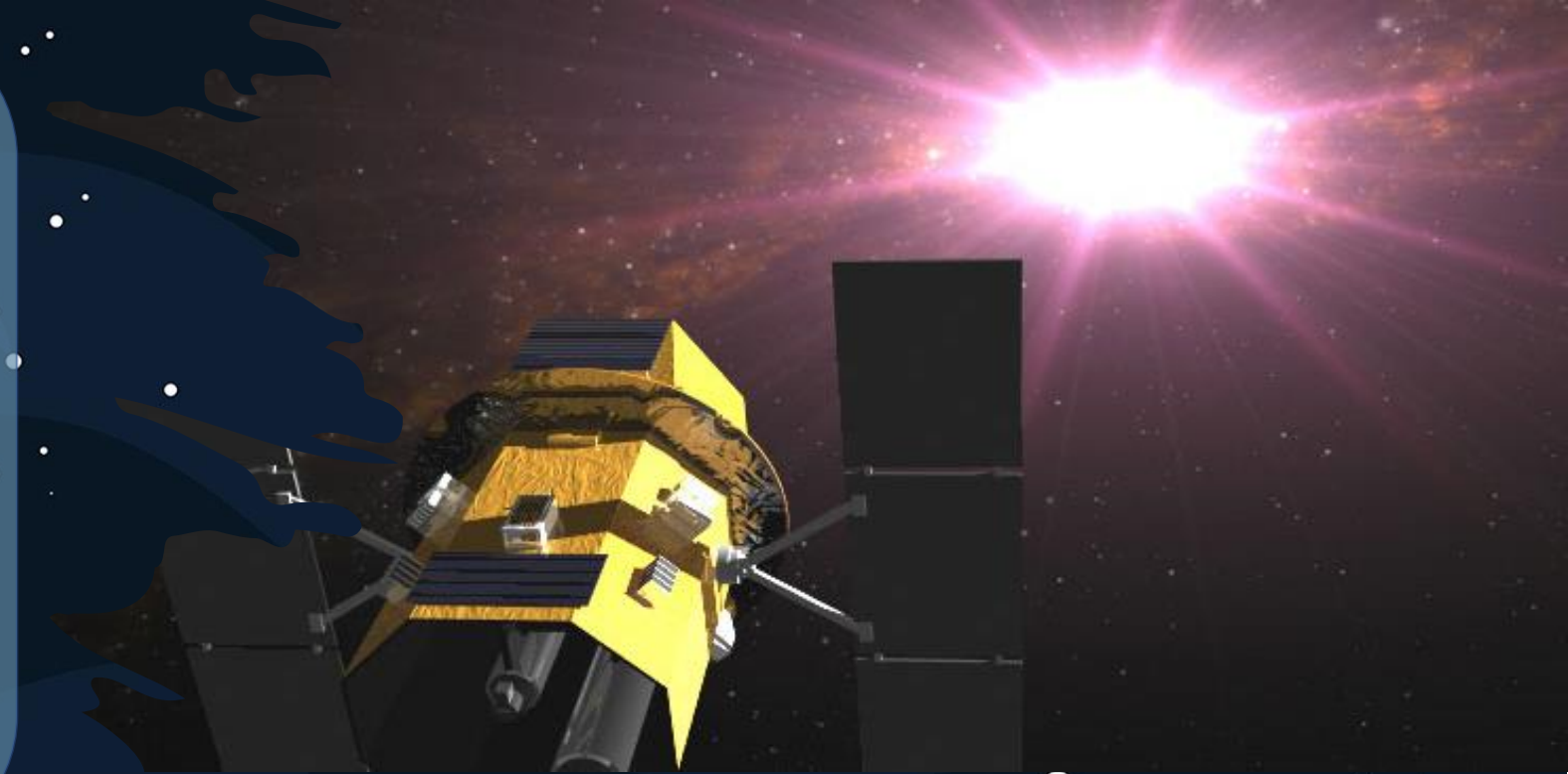


Hunting for γ -rays from Fast Radio Bursts (FRBs) using *Swift*/BAT & GUANO

By: Maxwell A. Fine

Advised by: Dr. Ziggy Pleunis, Dr. Paul
Scholz,
Prof. Bryan Gaensler

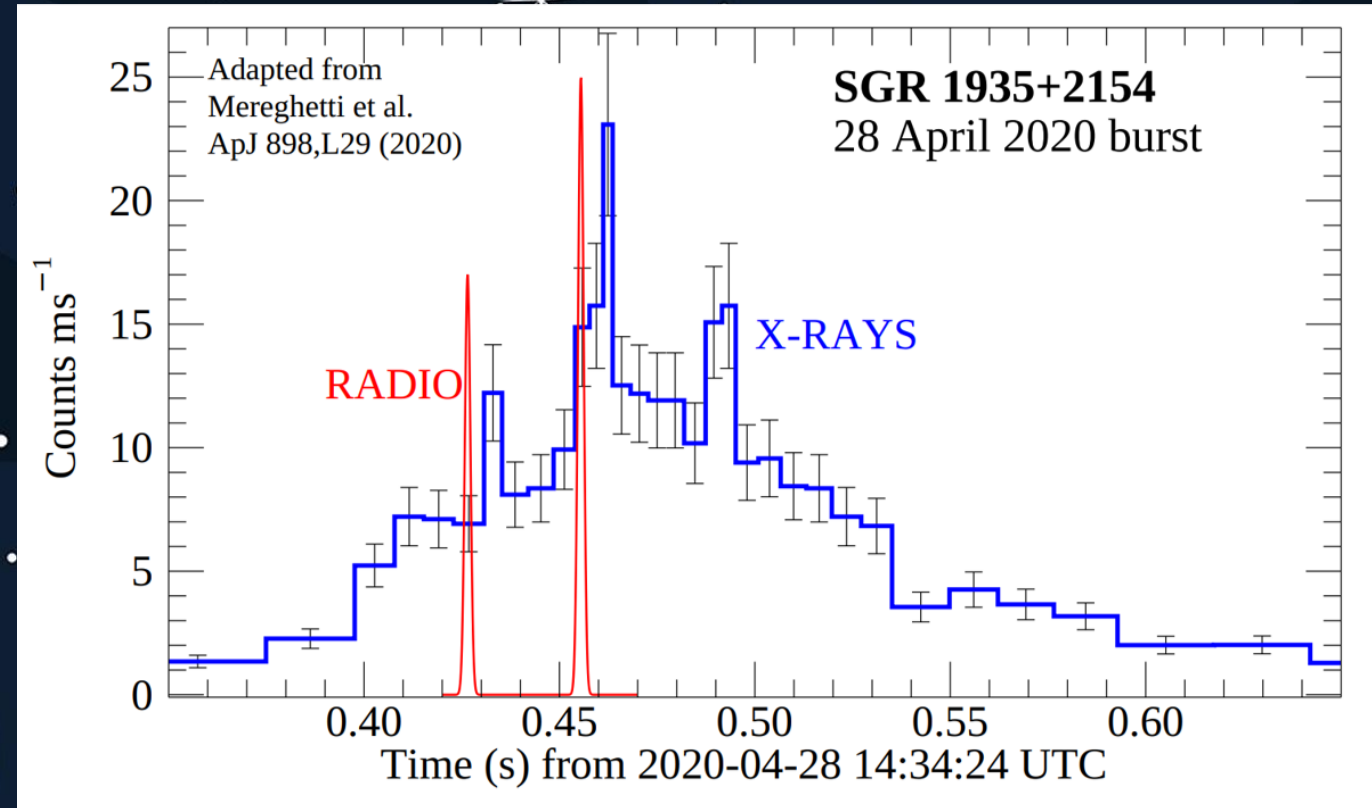


CHIME & SWIFT Image Credit: [NASA & Chime collaboration](#)

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



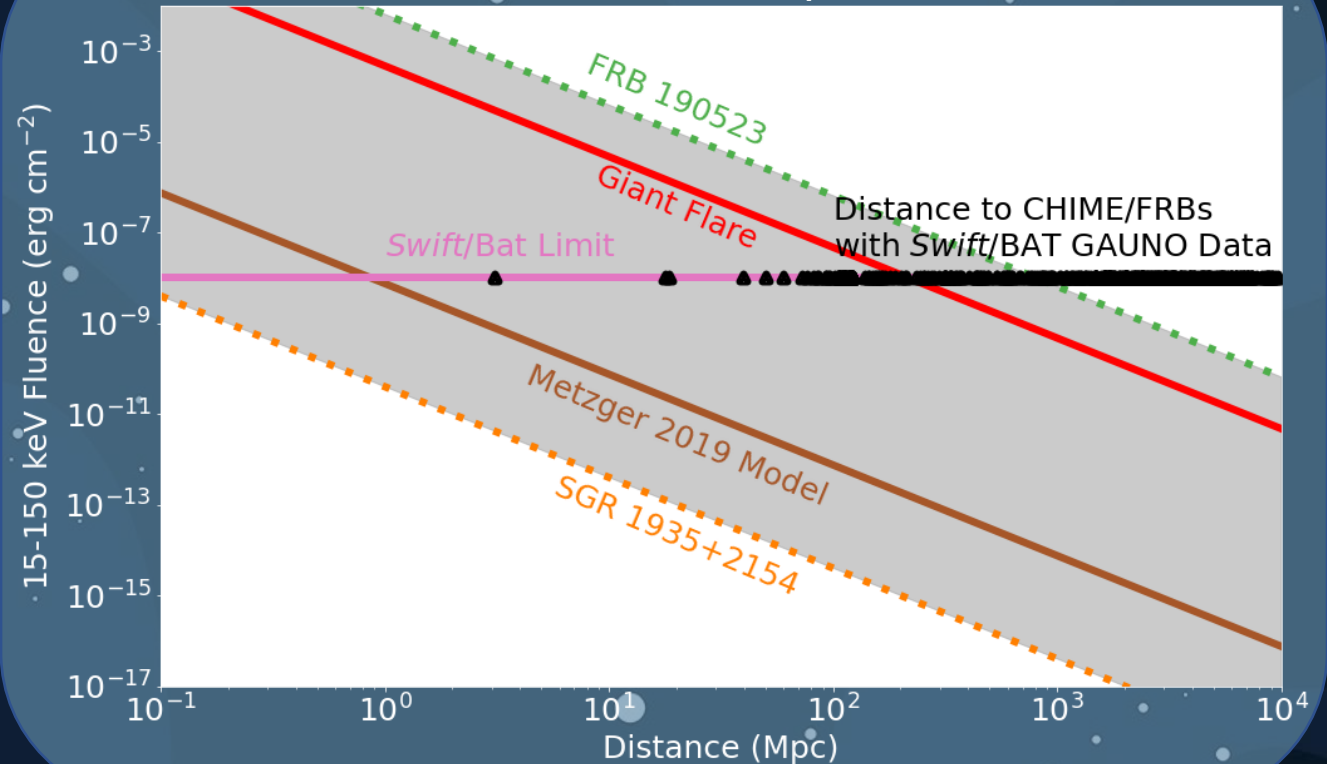
Source: Petroff E., Hessels J. W. T., Lorimer D. R.,
2022, Astron. Astrophys. Rev., 30, 2

Project Motivation:

- Previous γ -ray searches looked at a **single repeating FRB**, and established fluence limits of $\sim 10^{-7}$ erg/cm²
- 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

Source: Nicastro L., Guidorzi C., Palazzi E., Zampieri L., Turatto M., Gardini A., 2021, Universe, 7, 76

Swift/BAT Prospects



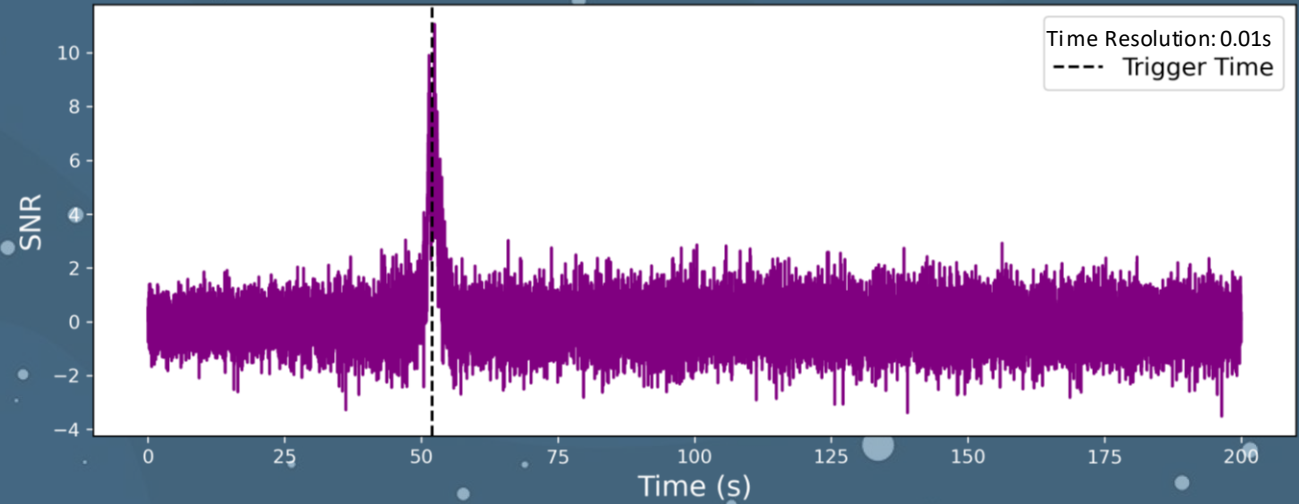
Lightcurve Analysis:

- *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 $\pm 3s$ centered on the CHIME detection time

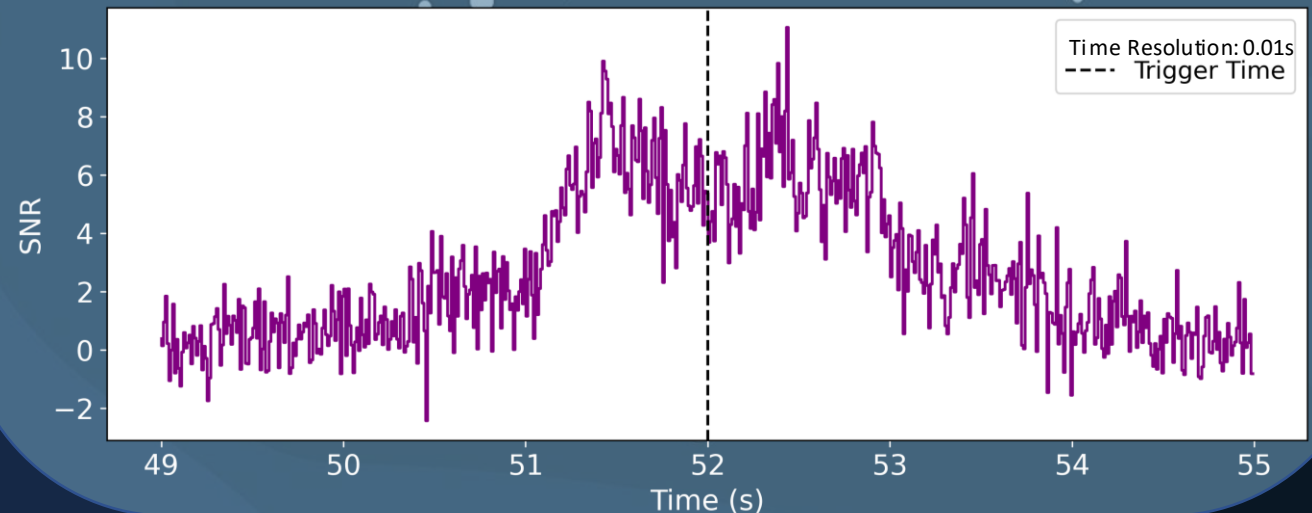
GRB: 2002A

SWIFT ID: 03110079007

SNR of Lightcurve



SNR of Search Window



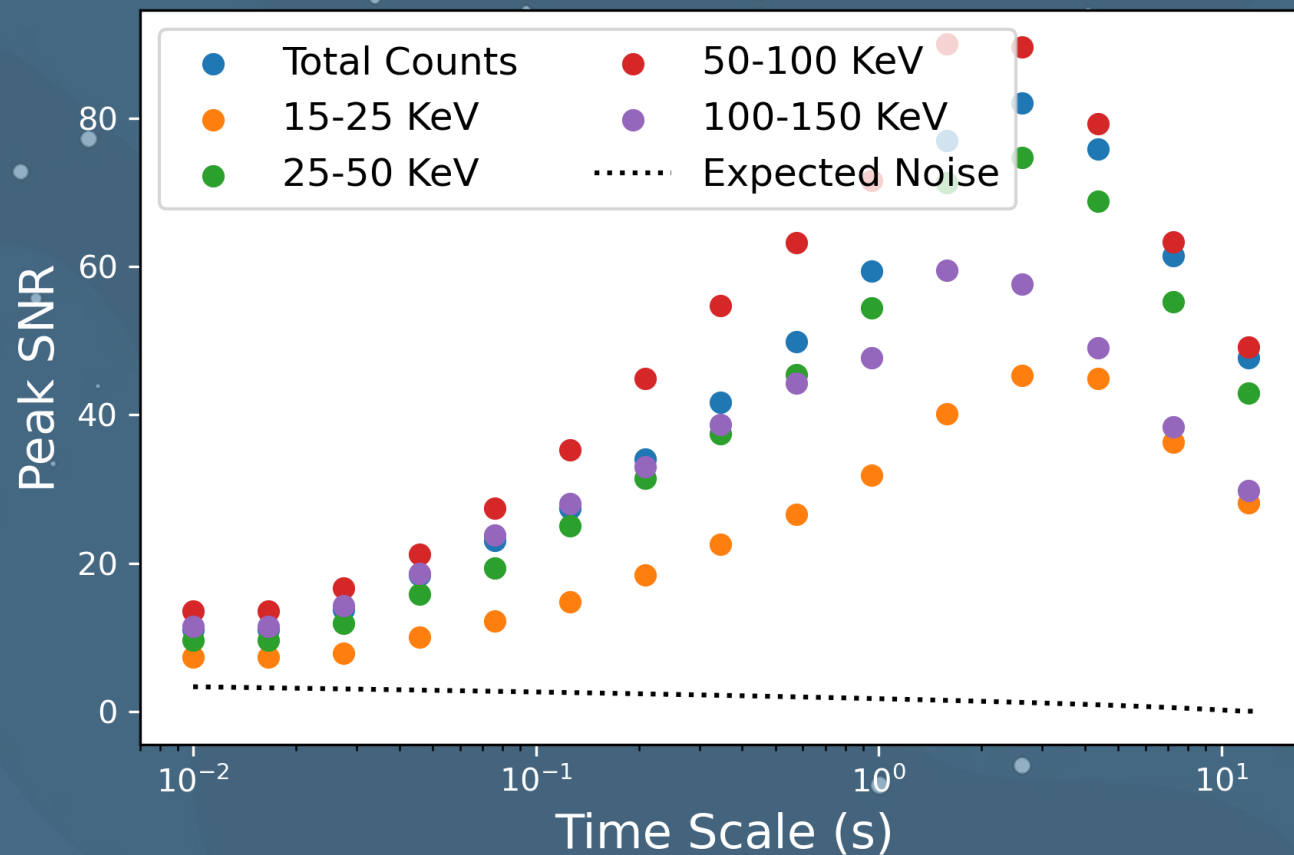
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Time Scale vs Peak SNR

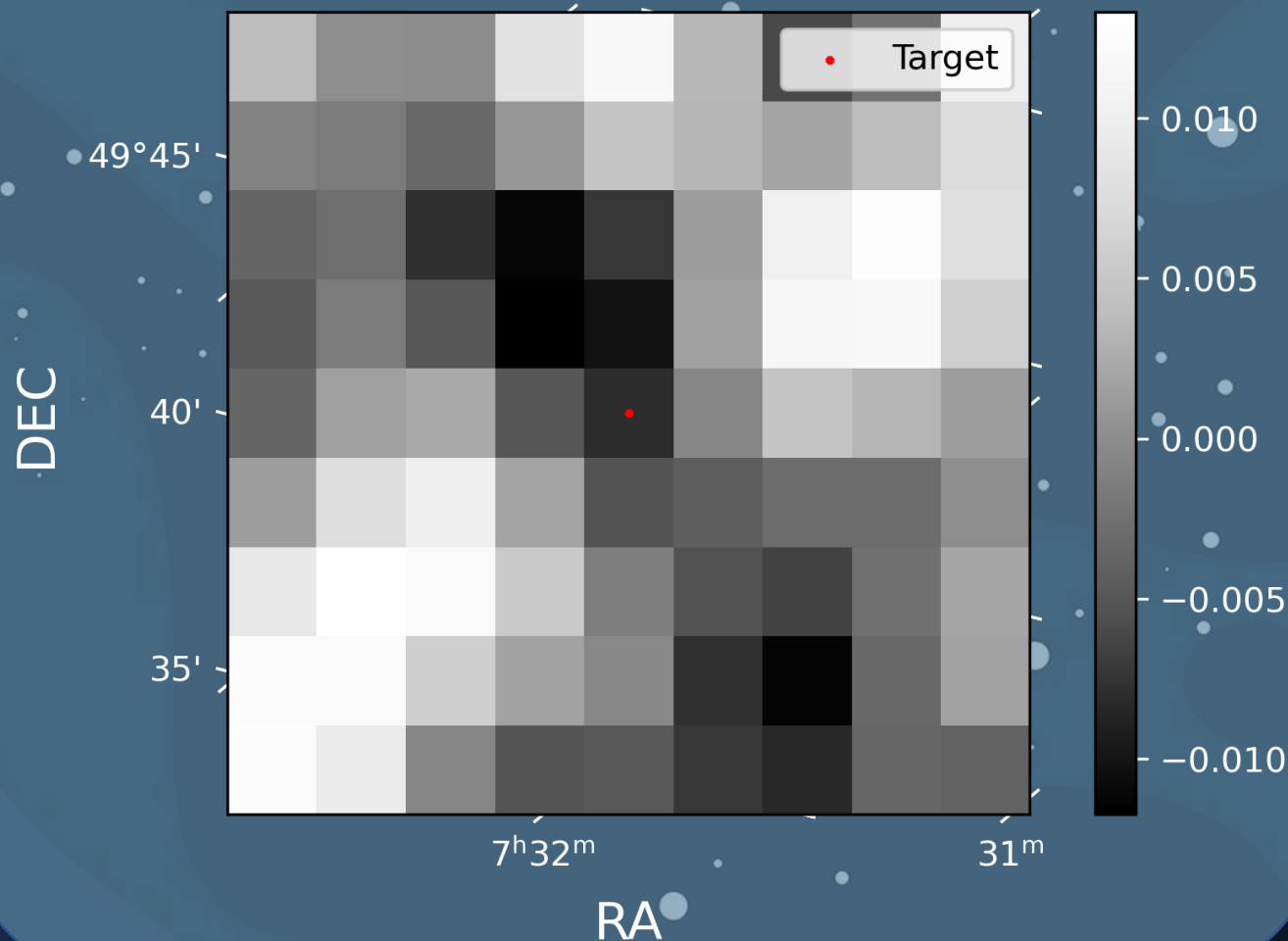


Sky Image Analysis:

- 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 **~1/8 the sky**
- Sky images are made with 6s exposures centered on the CHIME detection time

SWIFT ID: 03103240001

CHIME ID: 199583879



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/cm² in the 15-150 KeV band.

