

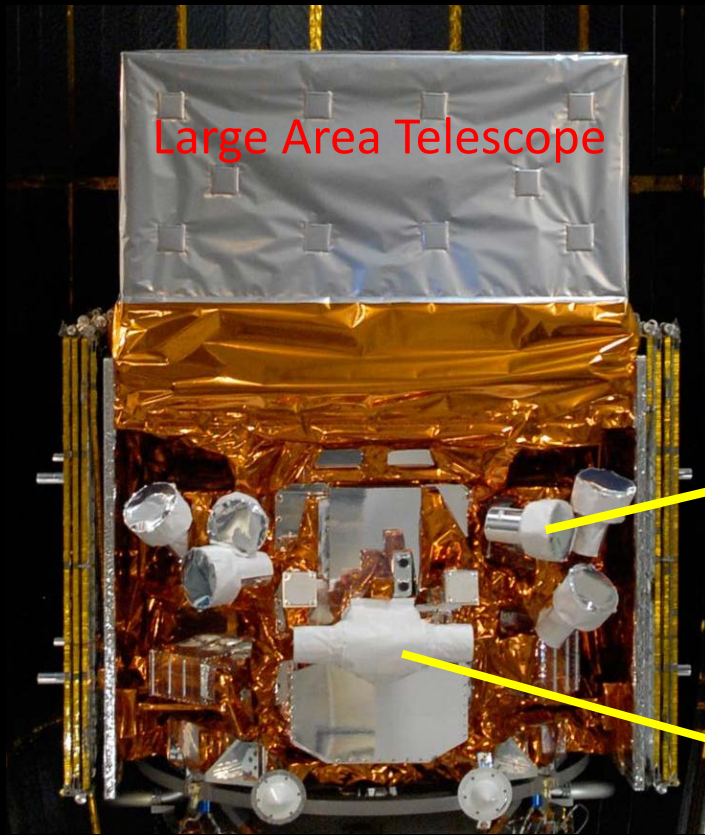
Time Domain Astronomy with Fermi GBM in the Multimessenger Era



Colleen A. Wilson-Hodge
(NASA/MSFC)

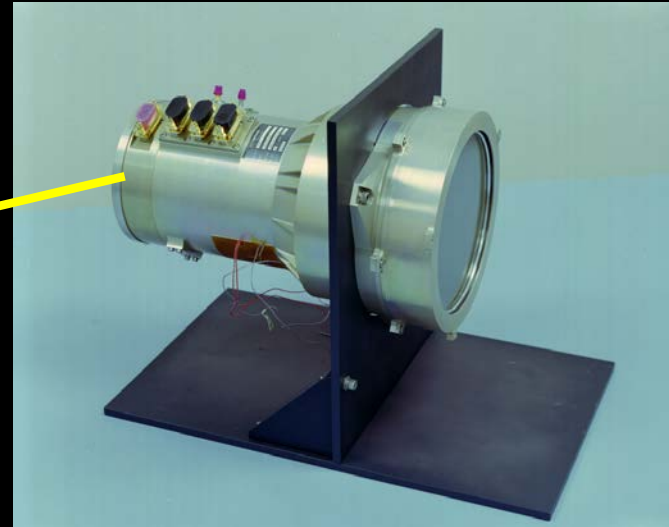
on behalf of the Fermi GBM team

The Fermi Gamma-ray Burst Monitor (GBM)

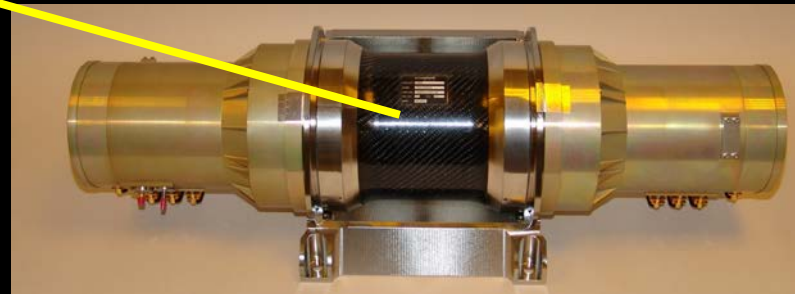


Large Area Telescope

NaI (1 of 12) 8 keV-1MeV



BGO (1 of 2) 200 keV-40 MeV



- Views 70% of the sky
- 85% Livetime

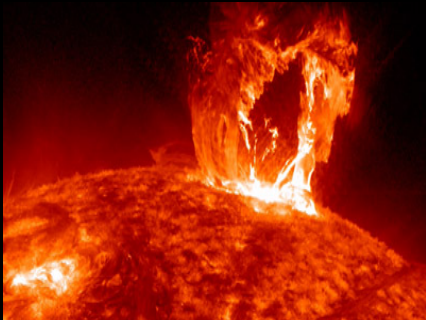
iPoster 379.07 Jan 7 5:30-6:30pm: Goldstein et al. Evaluation of Automated Fermi GBM Localizations of Gamma-ray Bursts

7002 Fermi GBM triggers (need to update this slide!)

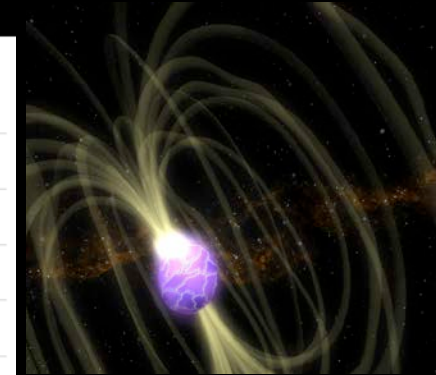
2663 GRBs



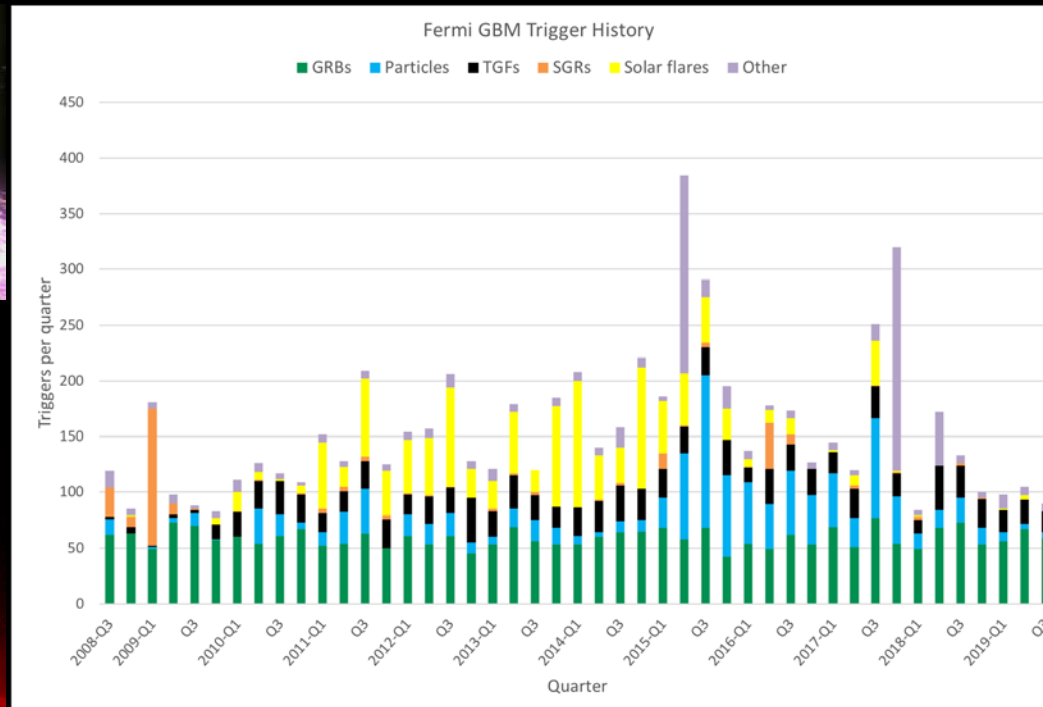
1182 Solar Flares



281 Magnetars

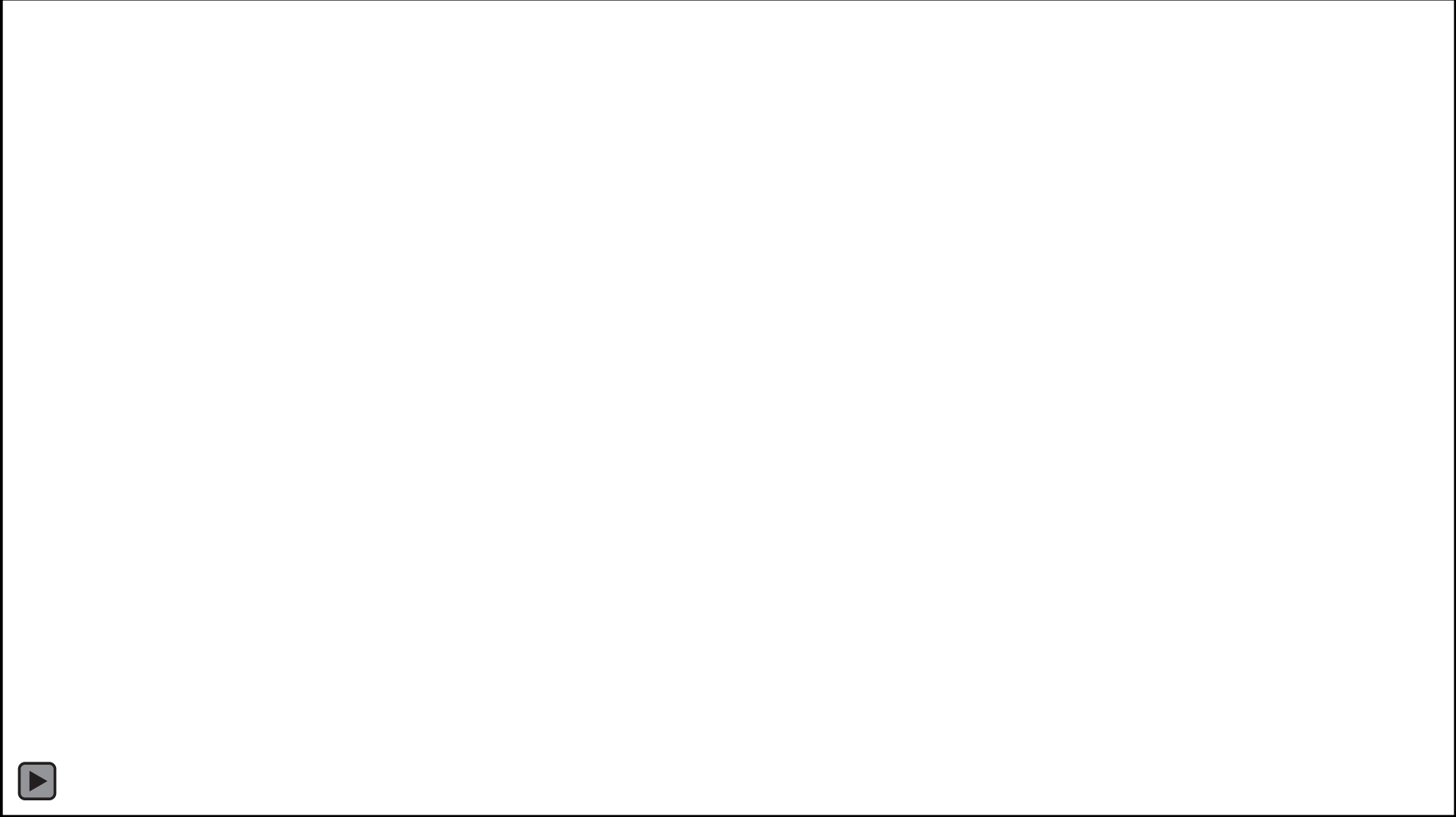


991 TGFs



10 year GBM GRB catalog – von Kienlin et al 2020, submitted
40 Short Gamma-ray Bursts per year
200 Long Gamma-ray Bursts per year

August 17, 2017

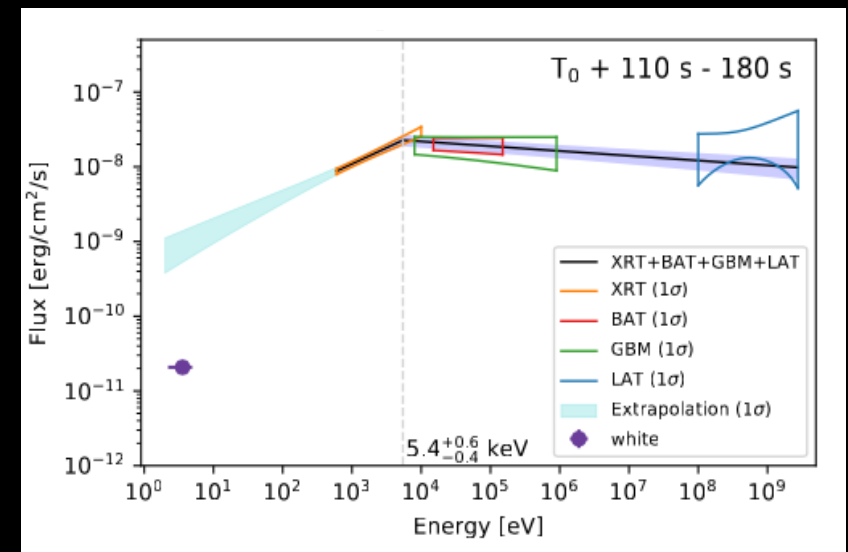
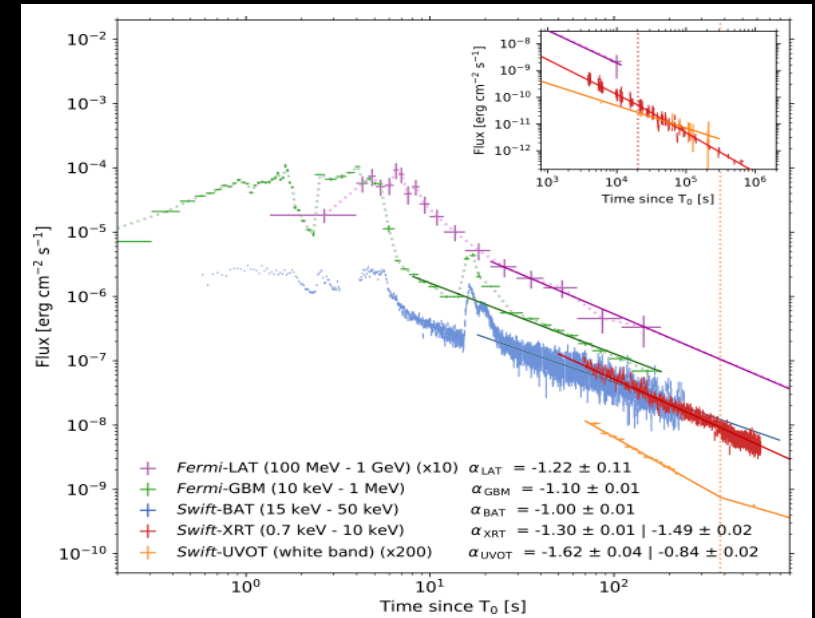


240.07 Jan 6 11:10-11:20am (HCC Room 323B) E. Burns, A very brief summary of Neutron Star Mergers

Video and image Credit: NASA GSFC, Caltech/MIT/LIGO Lab and ESA

High Energy Emission from GRB 190114C

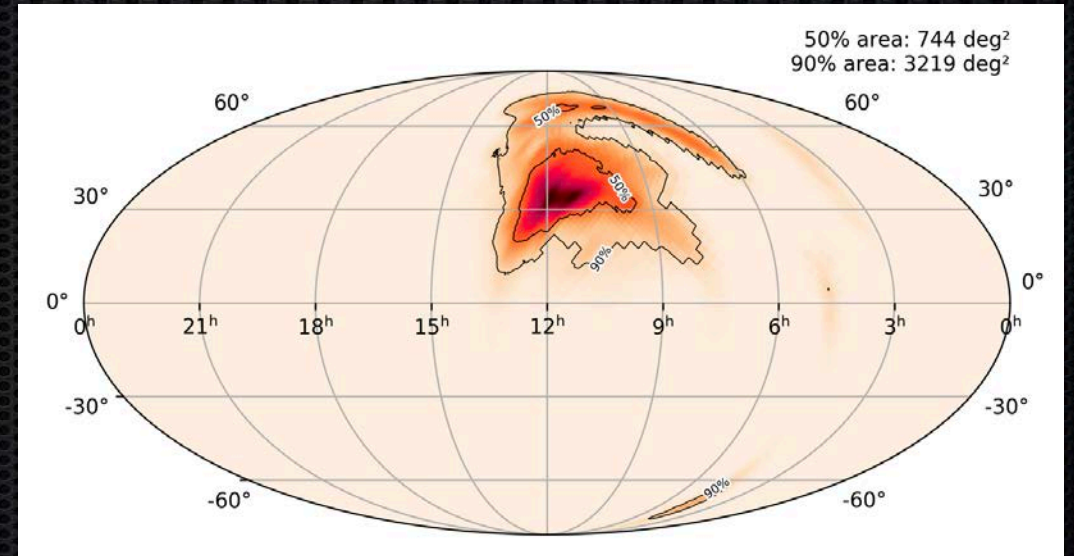
- GRB 190114C well detected across the electromagnetic spectrum
 - Triggered both Swift-BAT and Fermi-GBM
- Smoothly decaying emission is observed in all Fermi and Swift instruments
 - First prominent examples of afterglow emission in the GBM
- MAGIC detection at > 20 sigma starting at T_0+50s
 - First reported TeV detection of a GRB!
- Fermi & Swift observations can constrain the burst energetics, bulk Lorentz factor, and afterglow onset
- MAGIC detection points to synchrotron self-Compton emission as the most likely origin of the TeV photons



434.02 Jan 8 2:10-2:20pm (HCC Room 313 C): D. Kocevski
Fermi and Swift Observations of GRB 190114C

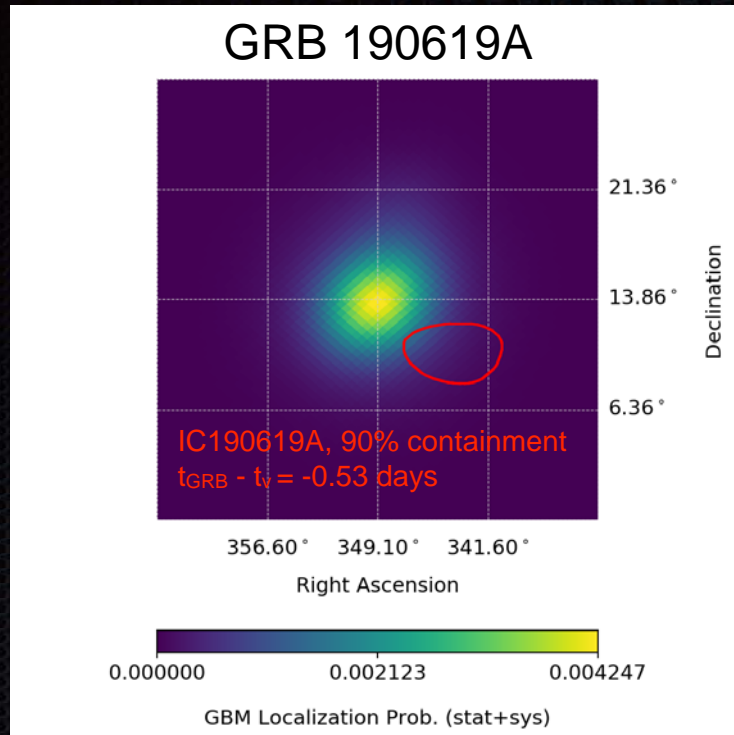
Joint Sub-Threshold Candidate GBM-190816

- L1 & V1 compact binary merger candidate
 - Did not exceed public FAR limit
 - Lighter compact object $< 3 M_{\text{sun}}$
 - Shared with GBM through GBM-LIGO MOU
- GBM Targeted search identified weak candidate
 - $T_{0\text{GW}} + 1.5 \text{ s}$
 - 0.1 s duration
 - GCN #25406, Goldstein et al. 2019
- Joint false alarm rate of $\sim 1\text{-}2$ per month
- Follow-up observations
 - No kilonova or afterglow

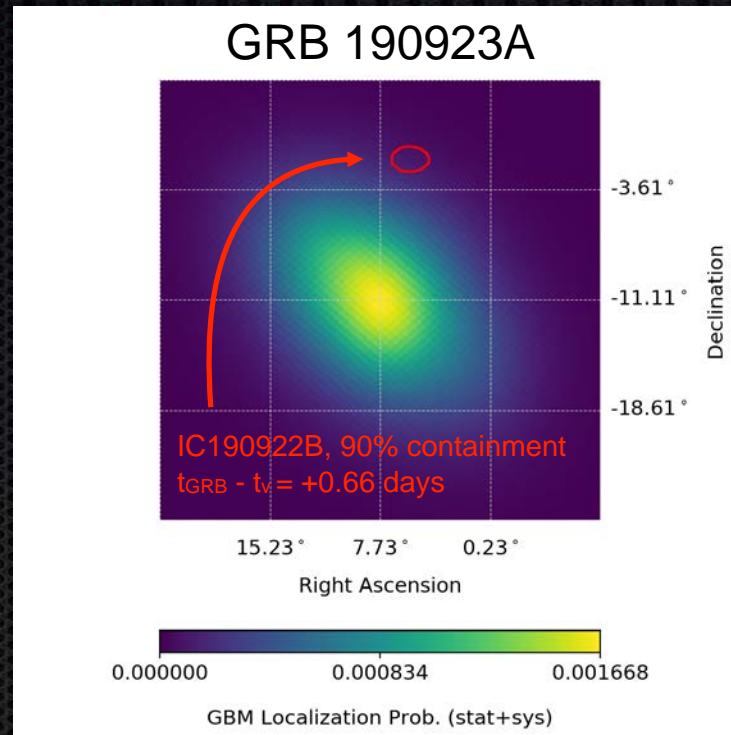


351.02 Jan 7 2:10-2:20pm (HCC Room 316 B): C. Fletcher
Fermi GBM Follow-up of LIGO/Virgo Gravitational Wave Candidates

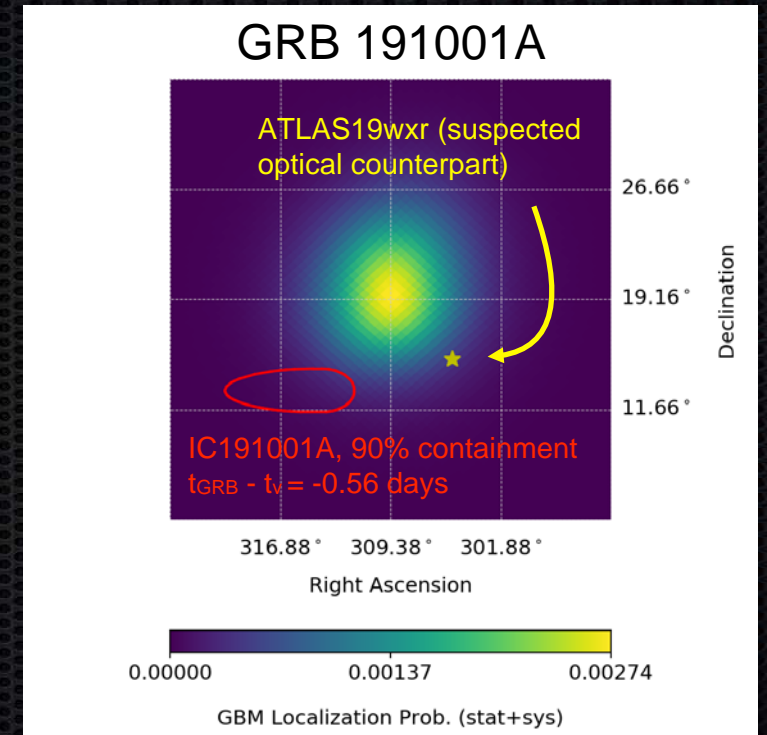
Associations between GRBs and neutrinos?



98% Spatial association prob.



89% Spatial association prob.



90% Spatial association prob.

- No interesting subthreshold candidates so far, but there are three GBM triggered GRBs within +/- 1 day of Gold reported neutrinos with spatial associations of 90% or better
- Best spatial association was 70% within 1-day before Gold/Bronze neutrino reporting.
- Still working to understand the chance coincidence probability

Summary

- Fermi GBM has triggered on and localized more GRBs than any other instrument
- GW 170817/GRB 170817A is the first coincident detection of gravitational waves and gamma-rays from a neutron star merger. This is GBM's most famous triggered GRB.
- On Jan 14, 2019 GBM and Swift triggered on GRB 190114C. This was the first reported GRB with TeV emission!
- On Aug 16, 2019, a sub-threshold compact merger candidate was detected in gravitational waves and a subthreshold gamma-ray event was detected 1.5 s later. No kilonova or afterglow was detected.
- Three GBM triggered GRBs were detected within 1 day of Gold reported neutrinos with 90% or better spatial coincidence. Chance probability is still being estimated.
- Fermi GBM is making exciting contributions to the multimessenger and multiwavelength era. We are looking forward to many new events!