Welcome to the 11th Fermi Symposium!

- 2007 – Stanford, CA — Prelaunch - no data!
- 2009 – Washington, D.C. — Public data released
- 2011 – Rome, Italy
- 2012 – Monterey, CA
- 2014 – Nagoya, Japan
- 2015 – Arlington, VA — Pass 8 and 1st Multimessenger session
- 2017 – Garmisch-Partenkirchen, Germany — GW + GRB
- 2018 – Baltimore, MD — 10th Anniversary
- 2021 – Virtual — 2020 cancellation and replan
- 2022 – Johannesburg, South Africa — Brightest of all time GRB

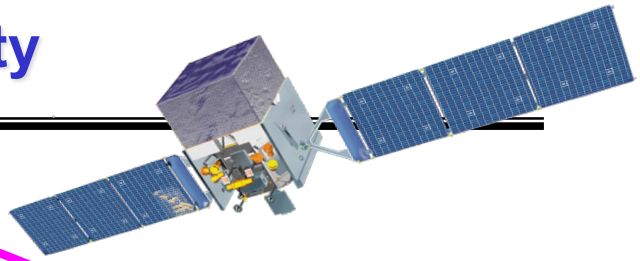
Fermi

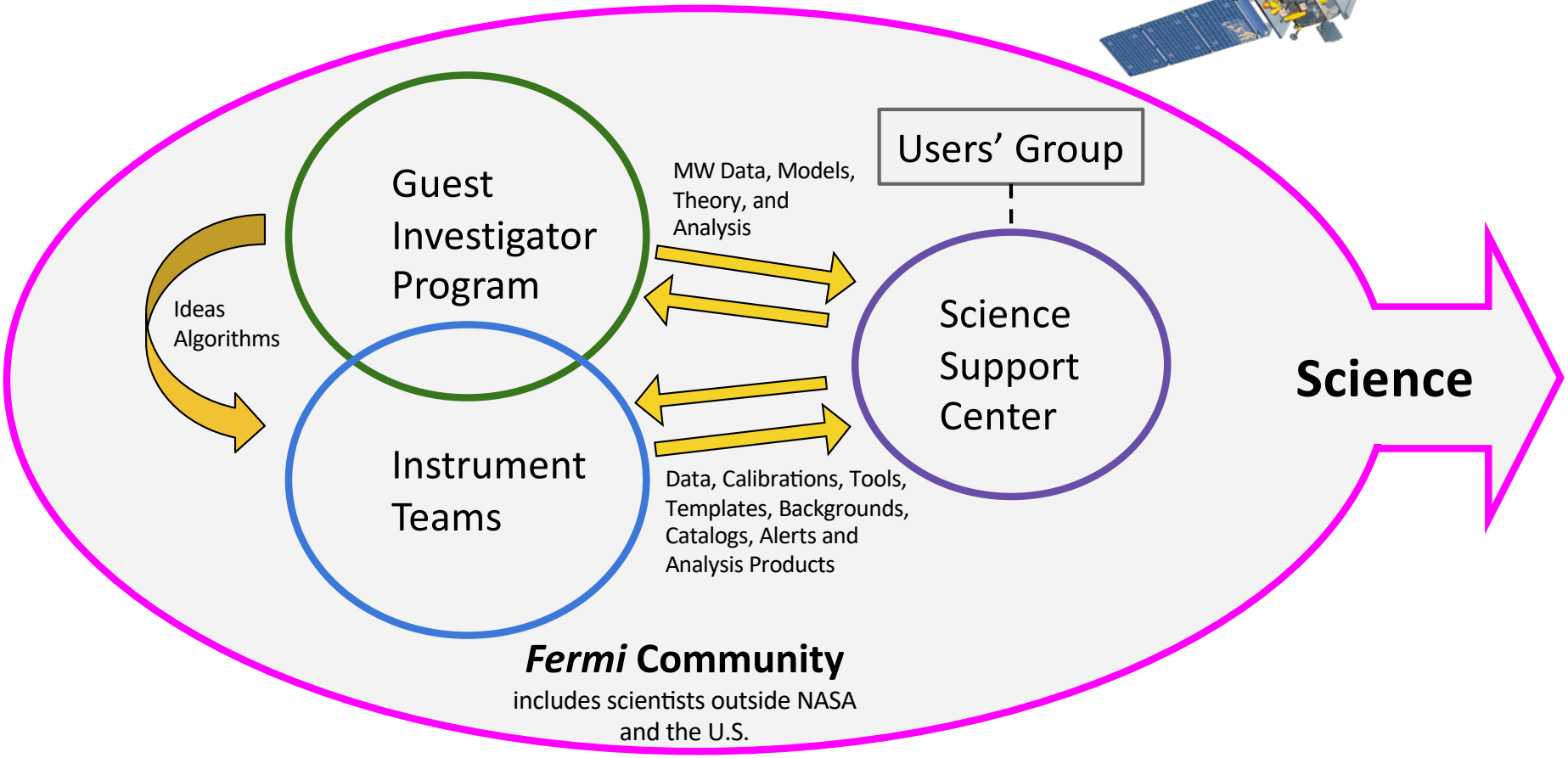
Gamma-ray Space Telescope

Mission Update
September 9, 2024

E. Hays (GSFC) — **Project Scientist**
J. Racusin (GSFC) — **Deputy Project Scientist**

Welcome, *Fermi* Community





Fermi Mission Overview

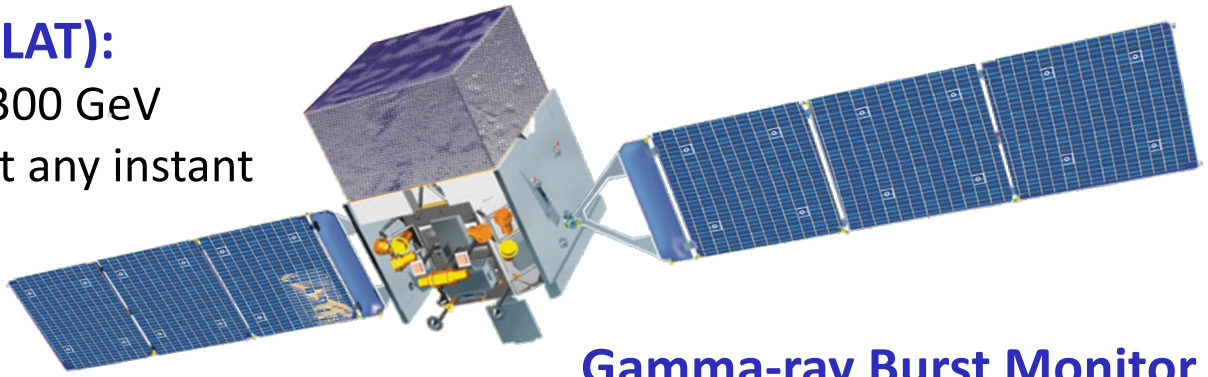
Probe class mission to study the extreme high-energy Universe

Large Area Telescope (LAT):

20 MeV to more than 300 GeV

Views 20% of the sky at any instant

Entire sky in ~3 hrs



International and interagency collaboration between NASA and DOE in the US and agencies in France, Germany, Italy, Japan and Sweden

Gamma-ray Burst Monitor (GBM):

8 keV to 40 MeV

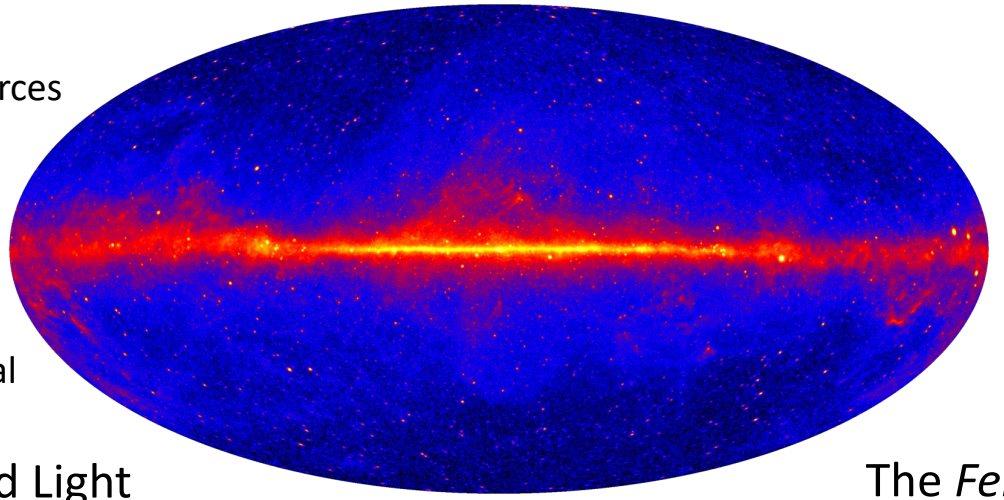
Views unocculted sky

- Community involvement is central to the mission
  - Guest Investigator program supports NASA-funded *Fermi* science
  - Data available publicly immediately after processing
- Science operations rely on integrated effort from instruments (LAT: SLAC/Stanford/NRL/ GSFC; GBM: MSFC/UAH), *Fermi* Science Support Center (FSSC; GSFC), and Flight Operations Team (FOT; GSFC)

New Views of the Energetic Universe from >16 Years of *Fermi* Survey and Monitoring

Unveiling the sky

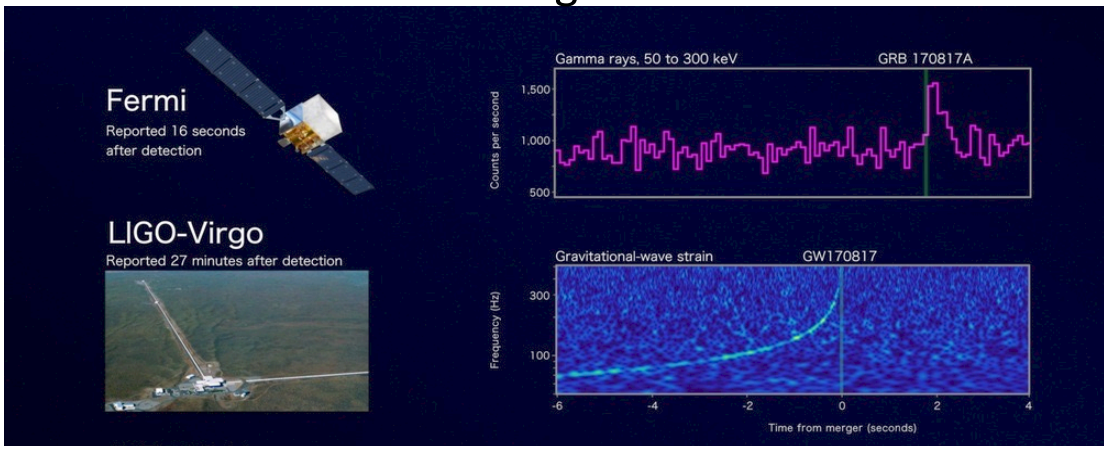
- >20x gamma-ray catalog sources
  - New source classes
  - New large-scale features
- >6000 transients
  - Gamma-ray bursts, magnetars, novae, solar flares and terrestrial gamma-ray flashes



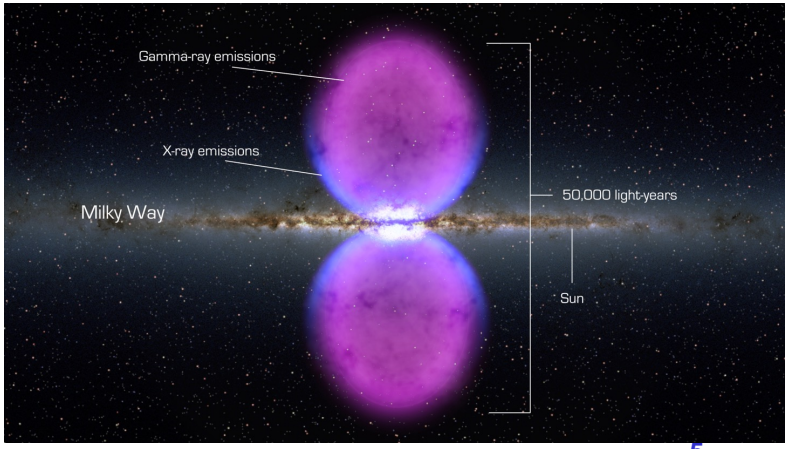
Enabling Discovery

- Immediate availability of photon data
- Automated public alerts
- Open access to analyzed source characteristics
- Continued development of public data products

Gravitational Waves and Light



The *Fermi* Bubbles



Observatory Highlights

- Spacecraft and instrument performance is excellent at 16 years
  - No consumables or rapid degradation of spacecraft or instrument components
  - One solar array drive no longer rotates; modified survey strategy maintains power margin while avoiding loss of observational efficiency
  - Gradual degradation in instrument components is compensated by calibration
- Orbit outlook
  - Lifetime of orbit extends into the mid-2030s. Propulsion system has potential to make adjustments.
- Communications outlook
  - TDRS used for commanding, data, and real-time alerts – phase out planned in 2030s
- Recent operational improvement highlights
  - Rapid alert message efficiency improved
  - GBM trigger adjustments to enhance onboard detection of short GRBs
  - LAT completing migration of Level 1 data processing to the new data facility at SLAC this year.
- We will propose a 3-year (+2 notional) extension to the NASA Astrophysics senior review of operating missions this year.

Fermi Science Support Center Highlights

- **Welcome to new FSSC lead scientist Andrea Prestwich**

- **Data, software and catalog highlights**
  - **LAT 14-year catalog 4FGL-DR4**
  - **LAT third catalog of gamma-ray pulsars (3PC**
  - **LAT Lightcurve Repository: updated flux measurements on 3-day, 1-week, and 1-month cadences for sources detected as variable in 4FGL-DR2 (>1500 sources)**
  - **Python-based tools for GBM available through the Gamma-ray Data Tool kit**
  - **Fermipy governance and organization plan agreed on by LAT and Fermi Science Support Center.**
- **Community events**
  - **Visit our AAS 245 booth in National Harbor, Maryland, January 8-12, 2025**
  - **GI proposers' workshop planned for January 2025**
  - **Fermi Summer School – May 28 – June 7, 2025**

Subscribe to Fermi mailing lists for news and updates at https://fermi.gsfc.nasa.gov/ssc/library/newsletter/)




Fermi Summer School 2024

Registration for 2025 opens in Dec.
Dates: May 27 – June 6, 2025

24 graduate students and postdocs from 13 countries for 10 days of gamma-ray science and analysis

Fermi Press Highlights

- [NASA's Fermi Finds New Feature in Brightest Gamma-Ray Burst Yet Seen] – Jul 2024
- [Explore the Universe with the First E-Book from NASA's Fermi] – Apr 2024
- [NASA's Fermi Mission Sees No Gamma Rays from Nearby Supernova] – Apr 2024
- [NASA's Fermi Detects Surprise Gamma-Ray Feature Beyond Our Galaxy] – Jan 2024
- [NASA's Fermi Mission Creates 14-Year Time-Lapse of the Gamma-Ray Sky] – Dec 2024
- [NASA Fermi Mission Nets 300 Gamma-ray Pulsars…and Counting] – Nov 2023
- [NASA Looks Back at 50 Years of Gamma-ray Burst Science] – Jun 2023

Credits: A. Simonnet (Sonoma State Univ.) and NASA's Goddard Space Flight Center


Thanks
LOC
CRESST/SURA
SOC
Riggs Staff
Thank you to many people who have made this event possible
FSSC
Presenters
Attendees


Now on to the Science!
Let’s have a great meeting!

Fermi Transient Searches 2008-2009

Transients Timescale Pipelines

Pipeline
Method
Timescale
Distribution
Status

***Fermi* LAT Monitored Sources (21)**
Daily, Weekly above 10^{-6} $cm^{-2}s^{-1}$

LAT Automated Science Processing (ASP) + Flare Advocates
Likelihood
6 & 24 hour
ATels

LAT Catalogs
Likelihood, associations
FGL

GBM Onboard Triggers
rate triggers
16 ms - minutes
GCN Notices

μs ***ms*** ***s*** ***minutes*** ***hours*** ***days*** ***months*** ***years***

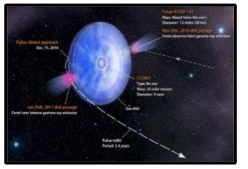
Photon Timing

All Sky Cadence

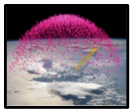
Pulsars

Solar Flares

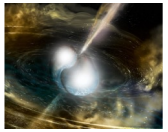
γ-ray Binaries



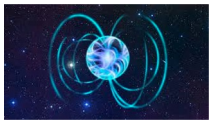
Terrestrial γ-ray Flashes



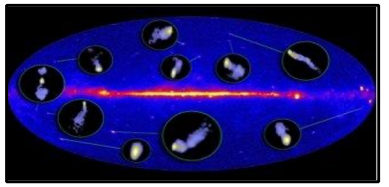
GRBs



Magnetar Flares



Blazar Flares



Not to scale

Fermi Transient Searches

Transients Timescale Pipelines

Pipeline
Method
Timescale
Distribution
Status

LAT Transient Factory (LTF)
Likelihood Around GBM/BAT triggers
seconds to orbits
LAT Team - Results in GCNs
Triggered + Blind Search

***Fermi* All-sky Variability Analysis (FAVA)**
Aperture Photometry, 1 week
ATels, FAV catalogs

***Fermi* LAT Light Curve Repository**
Likelihood LAT Catalog Sources
3 days, 1 week, 1 month

***Fermi* LAT Monitored Sources (187)**
Daily, Weekly above 10^{-6} cm^{-2}s^{-1}

GBM Targeted Search
ground search
ms - s
Temporal/Spatial Input

LAT Burst Advocate Tool
Likelihood Around GBM/BAT triggers
100 s, 1000 s
LAT Team - Results in GCNs

GBM Untargeted Search
ground search
ms - s
GCN Notices

GBM Onboard Triggers
rate triggers
16 ms - minutes
GCN Notices

LAT Automated Science Processing (ASP) + Flare Advocates
Likelihood
6 & 24 hour
ATels, GCN notices (on AGN)

LAT Catalogs
Likelihood, associations
FGL, FHL, LAC, FLE, PSR+

μs ***ms*** ***s*** ***minutes*** ***hours*** ***days*** ***months*** ***years***

Photon Timing

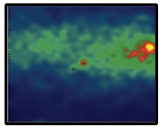
All Sky Cadence

Pulsars

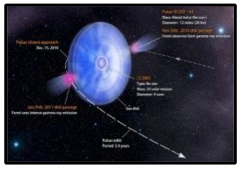
Solar Flares

Crab Flares

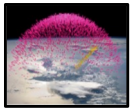
Novae



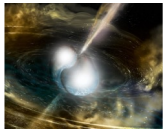
γ-ray Binaries



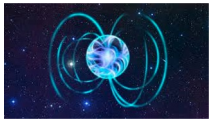
Terrestrial γ-ray Flashes



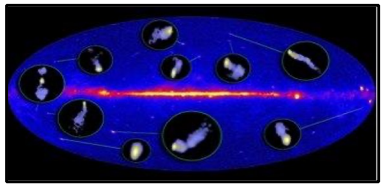
GRBs



Magnetar Flares



Blazar Flares



Not to scale