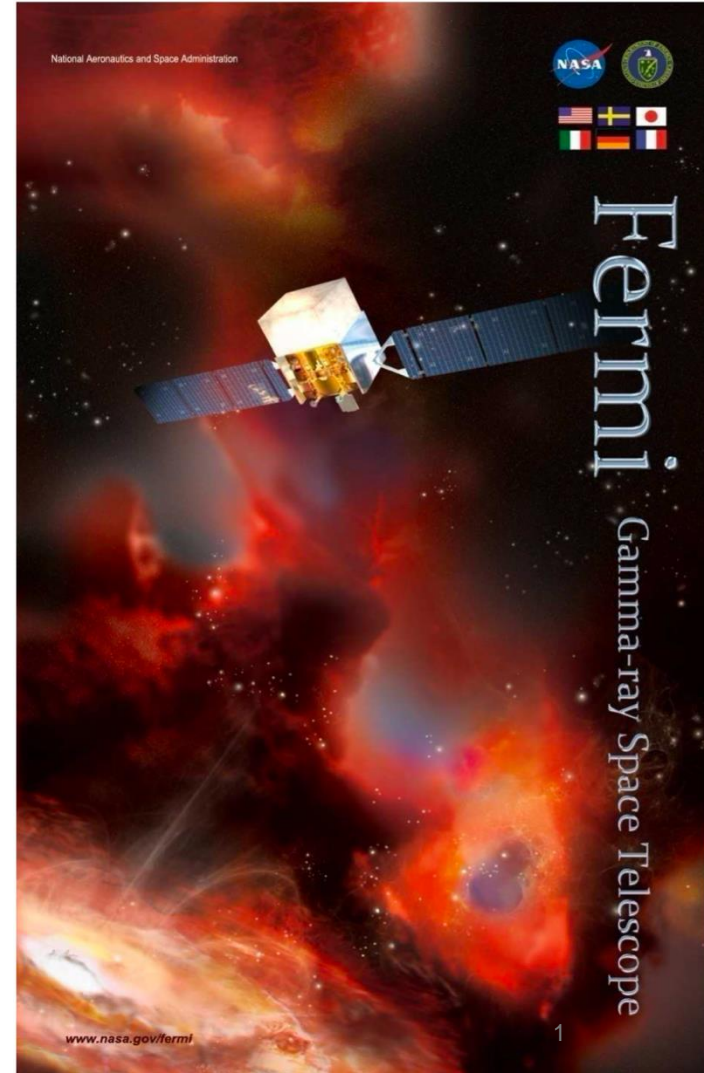


Fermi LAT Status and current activities

Peter F. Michelson

LAT Principal Investigator
& LAT Collaboration Spokesperson
Stanford University

FUG meeting – 29 August 2024





- A very busy and very productive collaboration more than 16 years after launch.
- Recent Collaboration Meeting in Madrid last March 11-15, 2024. (featured in 'El País' newspaper!)





- **The production of very diverse gamma-ray catalogs remains a priority for the Collaboration**
 - ‘4FGL-DR4’, with nearly 7200 sources (Ballet et al. 2023).
 - ‘3PC’, with 294 pulsars (Smith et al. 2023).
 - Other recent catalogs including 4LAC-DR3 (Ajello et al. 2022), FLSF (Ajello et al. 2021), FERMILGRB (Ajello et al. 2019), FGES (Ackermann et al. 2017).
- **Several catalogs currently under production:**
 - 5FGL coming up soon, based in a new Galactic diffuse emission model.
 - 2FGES catalog of extended sources, approaching journal submission.
 - PWN catalog under internal review.
 - 2FLE catalog of low-energy sources in an advanced stage, will be ready within the next few months.
 - 4FHL catalog of ‘hard’ sources in preparation, should be ready in 2025.
- **Comprehensive study on the bright GRB 221009A (*aka* ‘the B.O.A.T.’) just submitted! (Axelsson et al. 2024).**
 - Unusable data for standard analysis pipelines recovered and critical for obtained results.
 - Additional cat 2 paper (Tak et al. 2024) submitted simultaneously that performs a MW analysis (optical, X-rays, gammas).
- **Legacy study on the search of dark matter signals from 50 Milky Way dwarf satellites (McDaniel et al. 2024).**
 - Upper limits to the WIMP annihilation cross section the best and most robust in the field so far.

Ongoing and future efforts



- **Intense and continuous work to develop a new Galactic diffuse emission model:**
 - **Tightly connected and necessary for the generation of the 5FGL.**
 - **Different approaches under consideration (IFT method, template fitting...)**
- **New work in preparation on unID sources (>2,000 in the 4FGL-DR4).**
 - **Comprehensive multi-wavelength analysis of many unIDs.**
 - **Study of potential mismodeling due to diffuse emission.**
 - **Application of machine learning tools.**
- **Multi-wavelength and multi-messenger studies.**
 - **For 3PC and unID follow ups.**
 - **Gravitational waves EM counterpart localization, LAT follow up analyses publicly available at <http://fermigrb.stanford.edu/GWTable/>**
- **Public data release of Flare Advocate analyses soon available.**
 - **Will be posted at the FSSC data webpage on a continuous basis.**

Fermipy: an analysis tool for the community



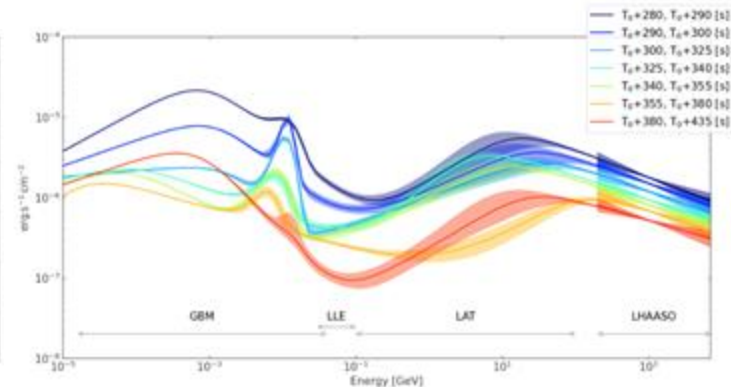
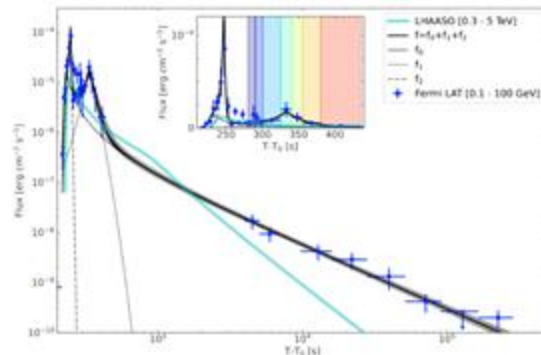
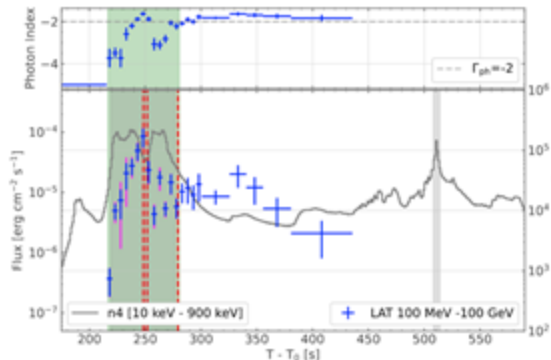
- Fermipy: a python package that facilitates analysis of LAT data with Fermi Science Tools.
- Boost in activity and people involved, following one-day workshop in Madrid past March 2024.
- In July 2024, project organization established - key roles and responsibilities defined.
 - Key personnel within the LAT collaboration took ownership of the Fermipy project, still fostering participation from the community (<https://fermipy.readthedocs.io/en/latest/team.html>)
 - Maintenance; issue tracking and community support (via github); development
- Recent development/updates include:
 - psmmap (code implementation described in Bruel (2021)) added.
 - Updated documentation to use latest version of catalogs/data products.
 - Added and updated a series of tutorials (via jupyter notebooks) -- available in documentation page (<https://fermipy.readthedocs.io/en/latest/index.html>).
- New version of Fermipy (v1.3.1) just released!
 - Available in pip, soon will be available in conda too.
- ‘EasyFermi’ as a friendly environment for Fermipy (developed by Raniere de Menezes).
 - Enhanced accessibility to LAT data analysis for e.g. educational purposes.

backup slides

The B.O.A.T. has shipped!

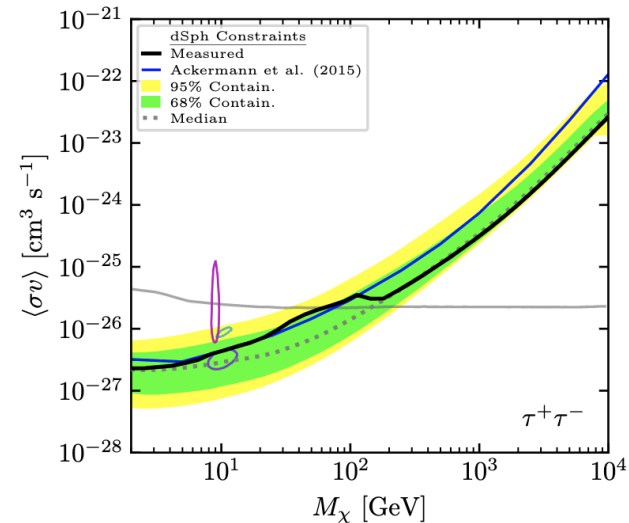
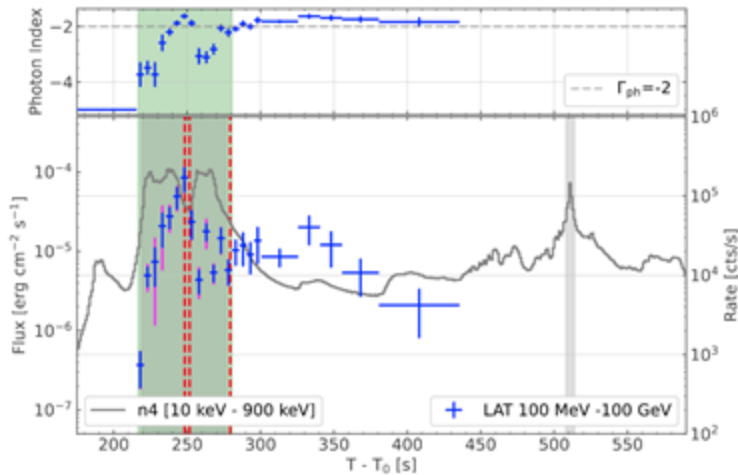


- Meticulous effort from members of the Fermi LAT collaboration (Bruehl, Omodei) to recover and analyze LAT data from the bright GRB 221009A.
 - It exhibited intense X-ray and soft gamma-ray flux during its main episode, rendering data from this period unusable for standard LAT analysis due to induced noise in all subsystems.
- Comprehensive study of GRB 221009A (paper submitted!):
 - Flux estimation during the affected LAT time interval;
 - Detail analysis of the light curve, with comparison with TeV emission (LHAASO)
 - Temporal evolution of spectrum from GBM to LHAASO, including assessment of the ~ 10 MeV line.





- Legacy study on the search for dark matter signals from 50 Milky Way dwarf satellites (McDaniel et al. 2024).
 - Upper limits to WIMP annihilation the best and most robust in the field so far.



Other relevant technical activities



- **Complete transition of data pipeline processing and computing infrastructure ongoing at SLAC.**
 - **A tremendous coordinated work by many people over the past 1.5 years.**
 - **Most of the transition already in place since early Spring.**
 - **Should be accomplished within the next few months.**