



Fermi

Gamma-ray Space Telescope

WP4:
Fermi-LAT DATA
ANALYSIS

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News MB+SB KickOff
Meeting

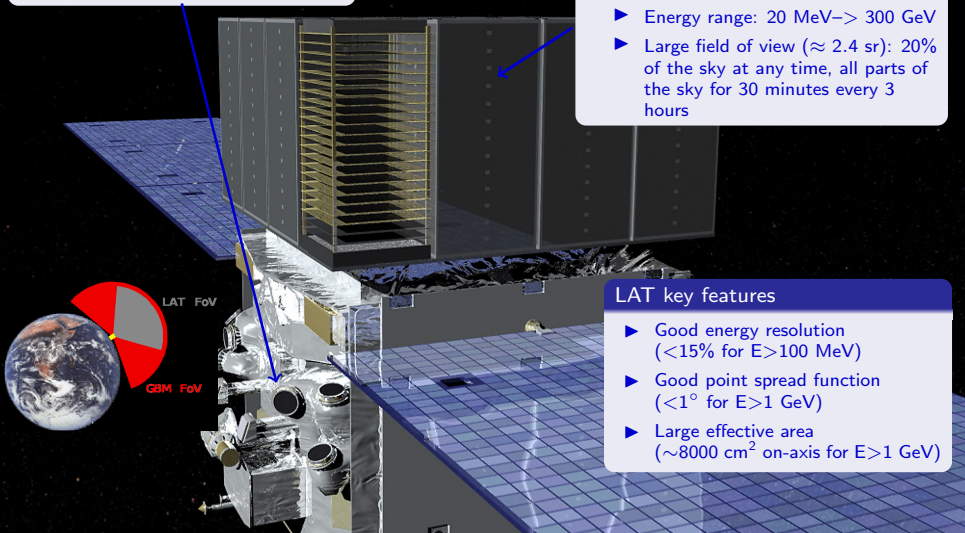
THE *Fermi* SPACE TELESCOPE

Gamma-ray Burst Monitor (GBM)

- ▶ 12 NaI and 2 BGO detectors
- ▶ Energy range: 8 keV–40 MeV

The Large Area Telescope (LAT)

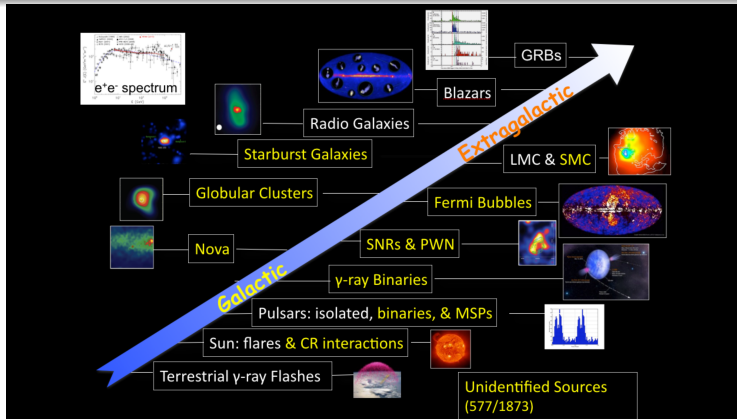
- ▶ Pair conversion telescope
- ▶ Energy range: 20 MeV–> 300 GeV
- ▶ Large field of view (≈ 2.4 sr): 20% of the sky at any time, all parts of the sky for 30 minutes every 3 hours



LAT key features

- ▶ Good energy resolution ($<15\%$ for $E > 100$ MeV)
- ▶ Good point spread function ($<1^\circ$ for $E > 1$ GeV)
- ▶ Large effective area (~ 8000 cm² on-axis for $E > 1$ GeV)

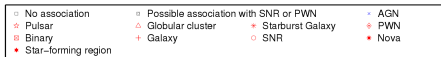
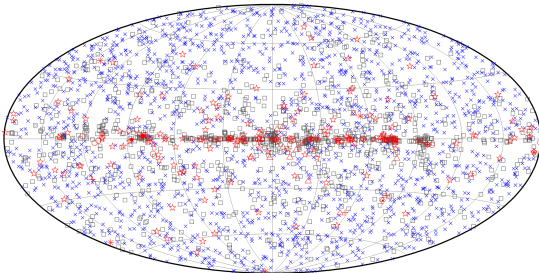
Fermi-LAT SCIENCE MENU



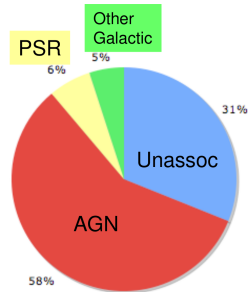
WP4: Focus on four topics

- ▶ *Fermi*-LAT source catalog (4FGL)
- ▶ WIMP dark matter searches
- ▶ Cosmic-Ray Electron science
- ▶ Electromagnetic counterparts to gravitational wave events

THE 3th Fermi GAMMA-RAY SOURCE LIST



Acero et al 2015, ApJS 218, 23



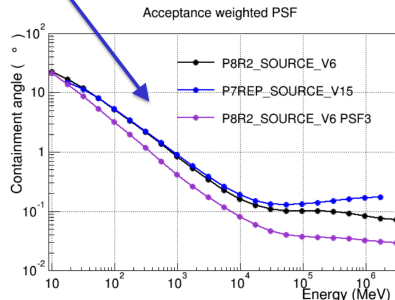
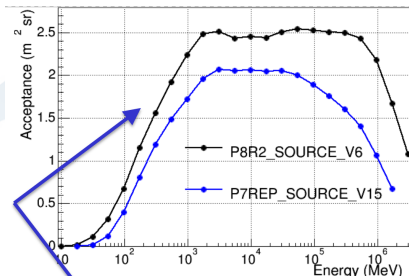
3FGL
(3033 sources)

- ▶ 3FGL has 3033 gamma-ray sources seen by the LAT at energies above >100 MeV in the first 4 years of the mission
- ▶ Catalog reports position, significance, association, basic SED and light curve for each source

THE 4th Fermi GAMMA-RAY SOURCE LIST

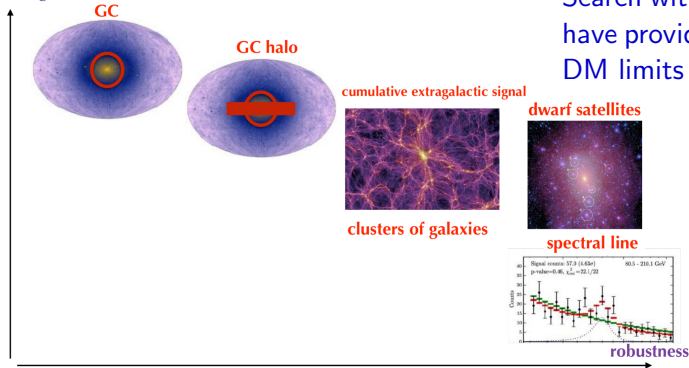
WP4 team will work on the 4th Fermi Gamma-Ray Source List (4FGL)

- ▶ Follow-up unassociated sources
- ▶ Deeper and better data/calibration
 - ▶ 3FGL was based on Pass7
 - ▶ 4FGL will use Pass8
- ▶ Update underlying interstellar emission model
- ▶ Look for variable sources
- ▶ Based on 8 years of data

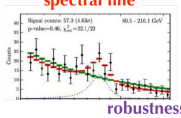


WIMP DARK MATTER SEARCHES

signal strength



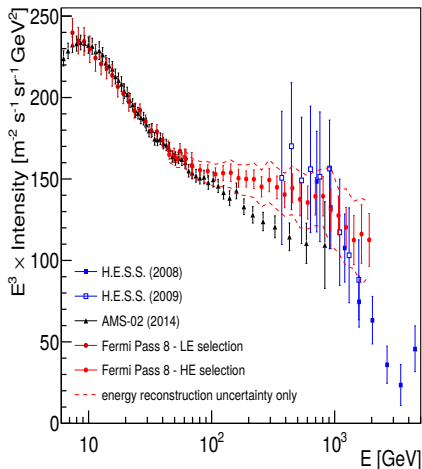
Search with dwarf satellites have provided the strongest DM limits to date!



[adapted from: H.-S. Zechlin]

- ▶ *Fermi*-LAT team has performed several dark matter searches over a wide range of astrophysical targets
- ▶ WP4 team will contribute in the development of the analysis framework
 - ▶ Applying to new targets such as the dwarf galaxies found by DES

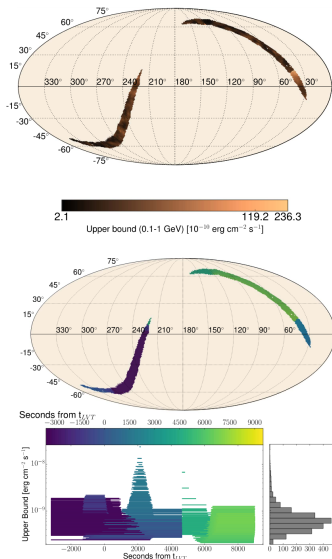
COSMIC-RAY ELECTRON (e^-) SCIENCE



Phys. Rev. D 95, 082007

- ▶ Cosmic-ray $e^+ + e^-$ spectrum from 7 GeV to 2 TeV measured by *Fermi*-LAT
 - ▶ First space-based instrument to explore the region above 1 TeV
 - ▶ High-energy cutoff excluded up to 1.8 TeV at 95% CL
- ▶ Thanks to large amount of statistics we can now perform anisotropy searches to help constrain existence of local CRE sources
- ▶ WP4 team will contribute in the effort of the spectral and anisotropy studies of the CRE with *Fermi*-LAT

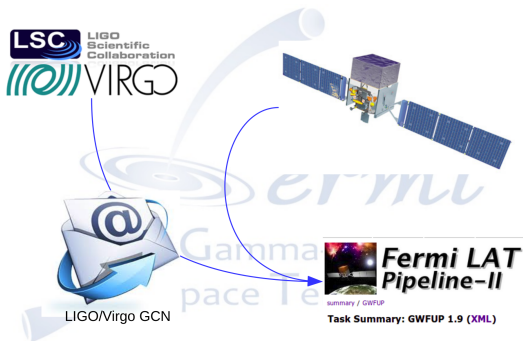
EM FOLLOW-UP TO GRAVITATIONAL WAVE EVENTS



Racusin et al. 2017, ApJ, 835, 1

- ▶ *Fermi*-LAT is continuously observing the entire sky
- ▶ Covering localization probability maps of gravitational wave events within hours of their detections
- ▶ In the case of a detection of an EM counterpart, the LAT could substantially reduce the localization uncertainty
- ▶ Facilitating follow-ups at other wavelengths
- ▶ Four papers published so far
 - ▶ Ackermann, M., et al. 2016, ApJ, 823, 2
 - ▶ B.P. Abbott et al. 2016, ApJL, 826, 1
 - ▶ Racusin, J. L., et al. 2017, ApJ, 835, 1
 - ▶ Vianello, G., et al. 2017, ApJ, 841, L16
- ▶ Fifth submitted to ApJL on follow-up

EM FOLLOW-UP TO GRAVITATIONAL WAVE EVENTS



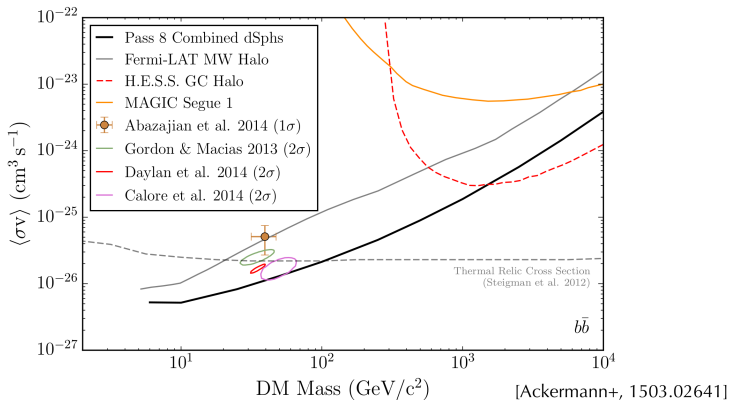
- ▶ WP4 team has helped to set up pipeline to automatically perform dedicated analyses to search for electromagnetic counterparts to gravitational wave events in Fermi-LAT data
 - ▶ The pipeline is triggered by the arrival of a LIGO/Virgo Gamma-ray Coordinates Network (GCN)
- ▶ Team will help in rapidly distributing GCN notices on potential EM counterparts to the community

A large, light blue stylized graphic of the Fermi logo, consisting of a curved tube-like shape and a central circular element with concentric rings.

SPARE SLIDES

fermi
Gamma-ray
Space Telescope

WIMP DARK MATTER SEARCHES



- ▶ *Fermi*-LAT team has performed several dark matter searches over a wide range of astrophysical targets
- ▶ Using the joint likelihood to combine info from 15 dSphs
- ▶ One of the strongest DM limits to date