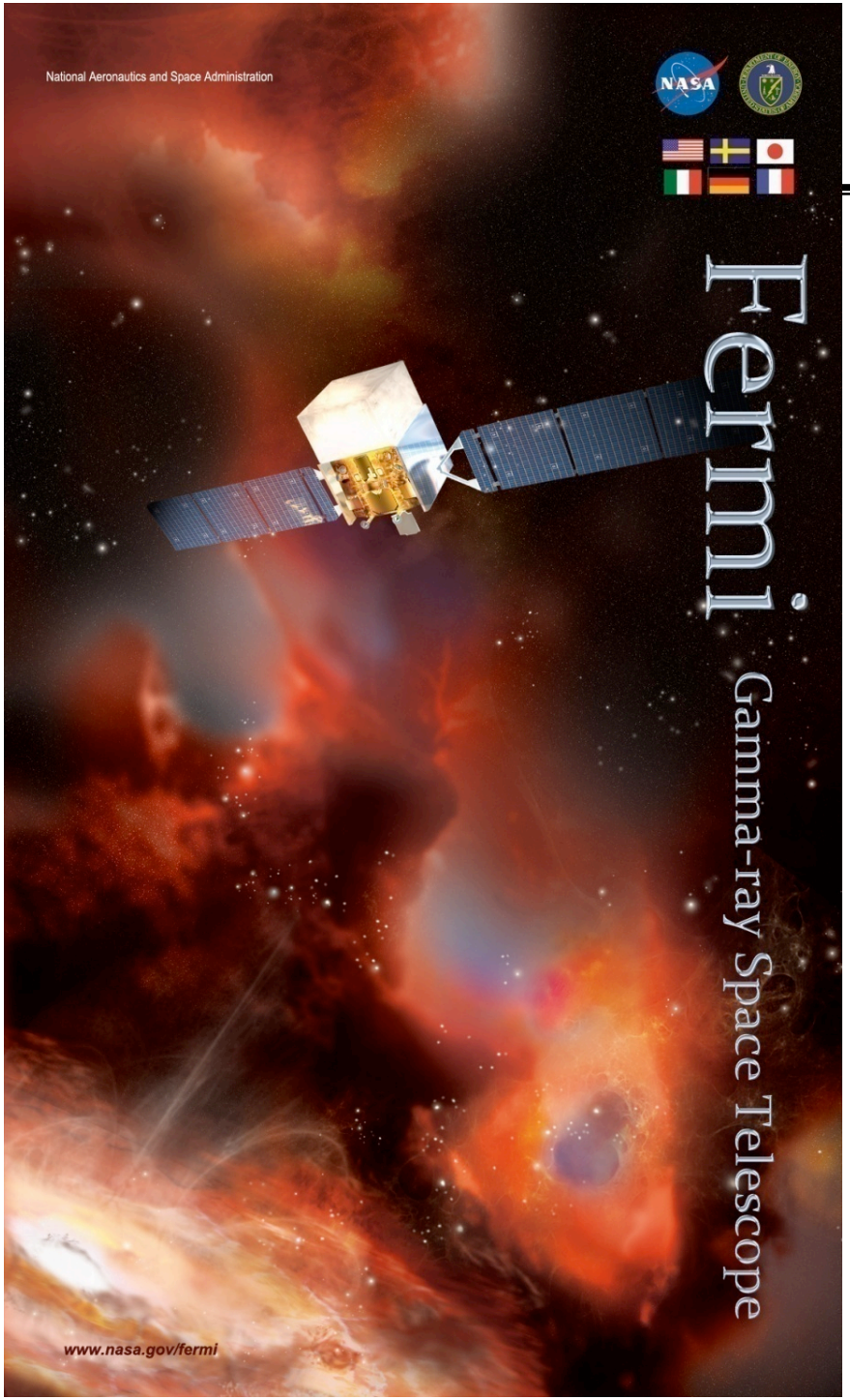


Fermi

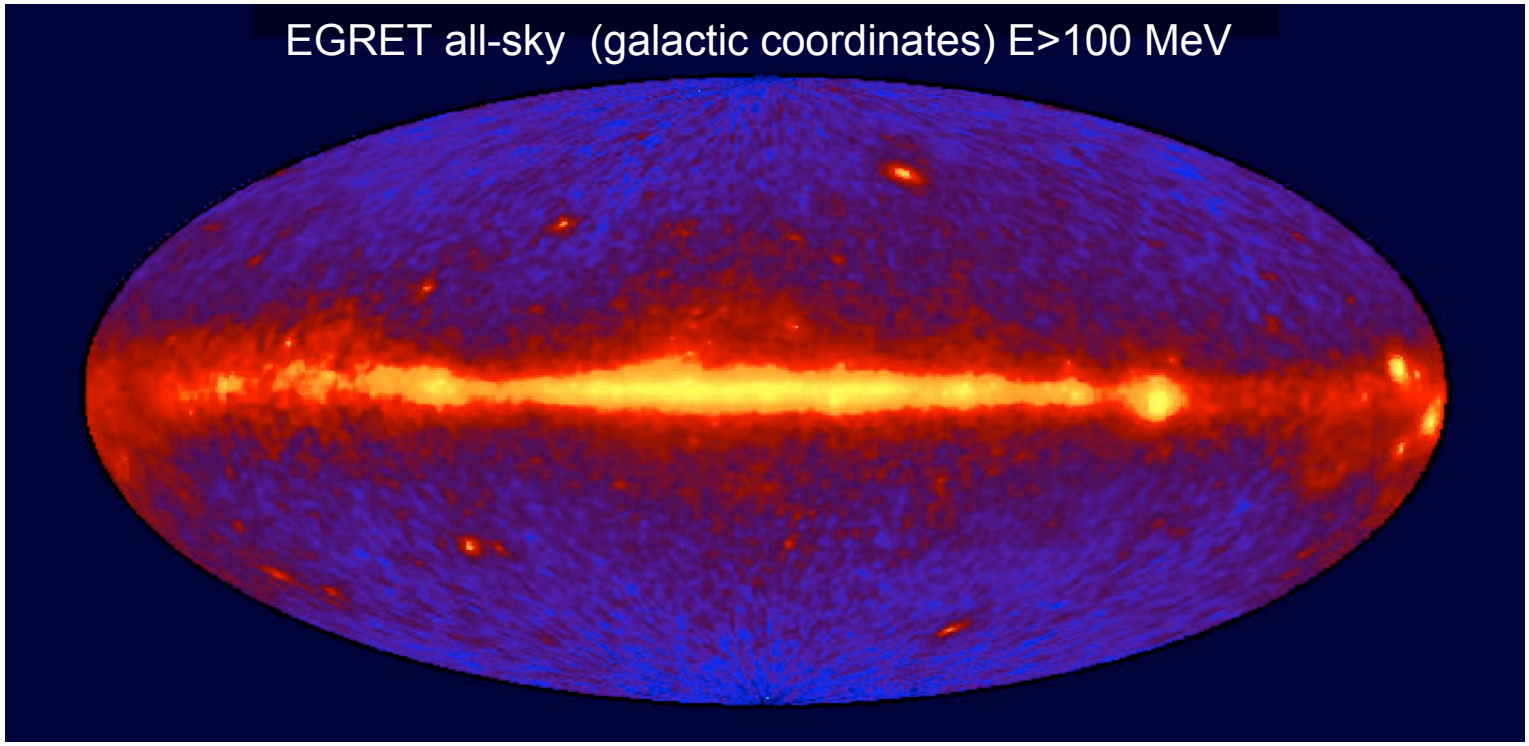
Gamma-ray Space Telescope

At Six Months

S. Ritz
NASA GSFC and U. Maryland
on behalf of the Fermi Mission Team

see *http://www.nasa.gov/fermi* and *http://fermi.gsfc.nasa.gov/* and links therein

Features of the EGRET gamma-ray sky



diffuse extra-galactic background (flux ~ 1.5×10^{-5} $cm^{-2}s^{-1}sr^{-1}$)
galactic diffuse (flux ~30 times larger)
high latitude (extra-galactic) point sources (typical flux from EGRET sources $O(10^{-7} - 10^{-6})$ $cm^{-2}s^{-1}$)
galactic sources (pulsars, un-ID'd)

An essential characteristic: VARIABILITY in time!

Field of view important for study of transients.

Fermi Science

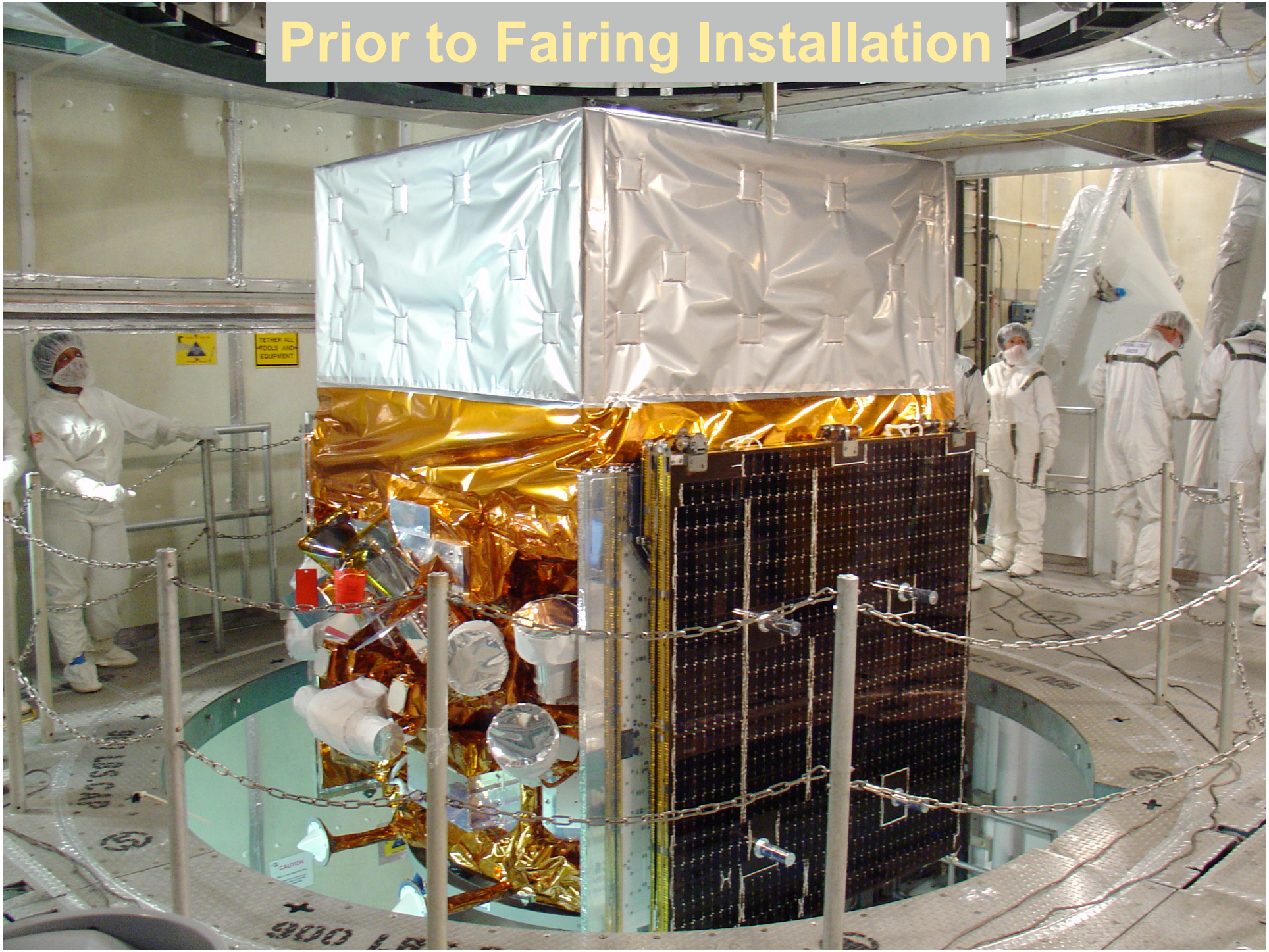
A very broad menu that includes:

- Systems with supermassive black holes (Active Galactic Nuclei)
- Gamma-ray bursts (GRBs)
- Pulsars
- Supernova remnants (SNRs), PWNe, Origin of Cosmic Rays
- Diffuse emissions
- Solar physics
- Probing the era of galaxy formation, optical-UV background light
- Solving the mystery of the high-energy unidentified sources
- Discovery! New source classes. Particle Dark Matter? Other relics from the Big Bang? Other fundamental physics checks.

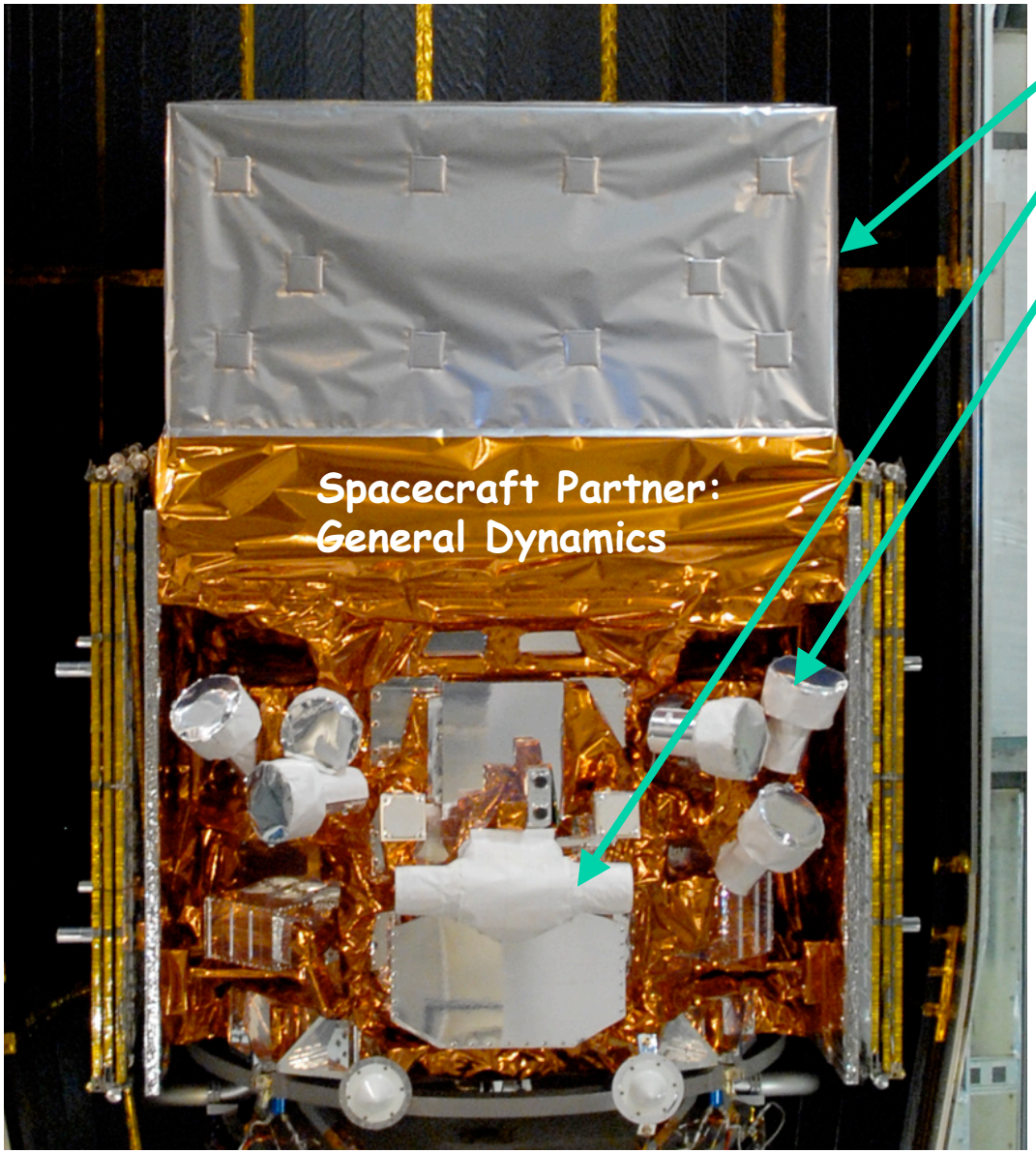
Huge increment in capabilities.

Draws the interest of both the High Energy Particle Physics and High Energy Astrophysics communities.

Prior to Fairing Installation



The Observatory



Large AreaTelescope (LAT)
20 MeV - >300 GeV

Gamma-ray Burst Monitor (GBM)
NaI and BGO Detectors
8 keV - 30 MeV

KEY FEATURES

- **Huge field of view**
  - –LAT: 20% of the sky at any instant; in sky survey mode, expose all parts of sky for ~30 minutes every 3 hours. GBM: whole unocculted sky at any time.
- **Huge energy range, including largely unexplored band 10 GeV - 100 GeV. Total of >7 energy decades!**
- **Large leap in all key capabilities. Great discovery potential.**

Fermi Gamma-ray Space Telescope

The Accelerator

Launch!

- **Launch from Cape Canaveral Air Station 11 June 2008 at 12:05PM EDT**
- **Circular orbit, 565 km altitude (96 min period), 25.6 deg inclination.**

Fermi
Gamma-ray
Space Telescope

A moment later…

Fermi
Gamma-ray
Space Telescope

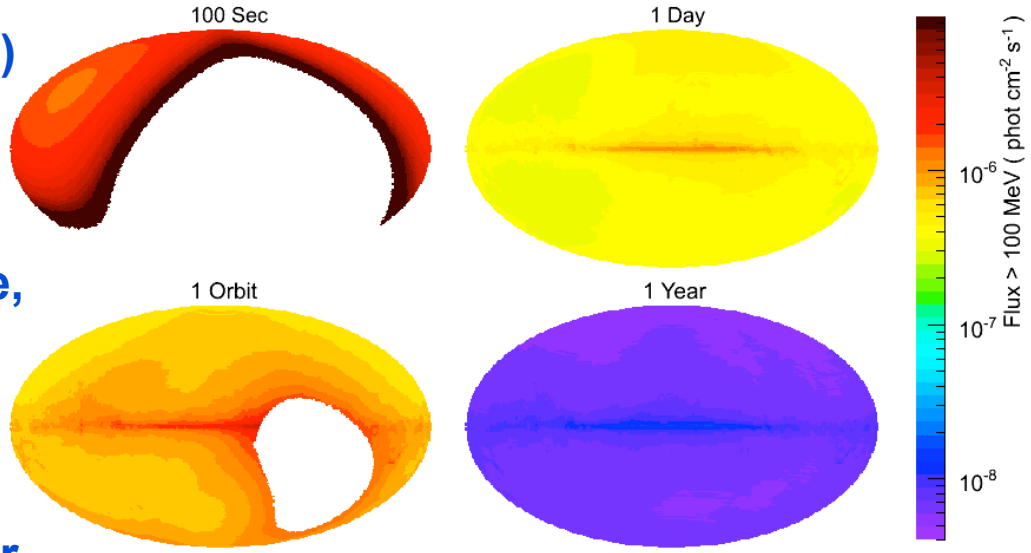
… and then …

Fermi
Gamma-ray
Space Telescope

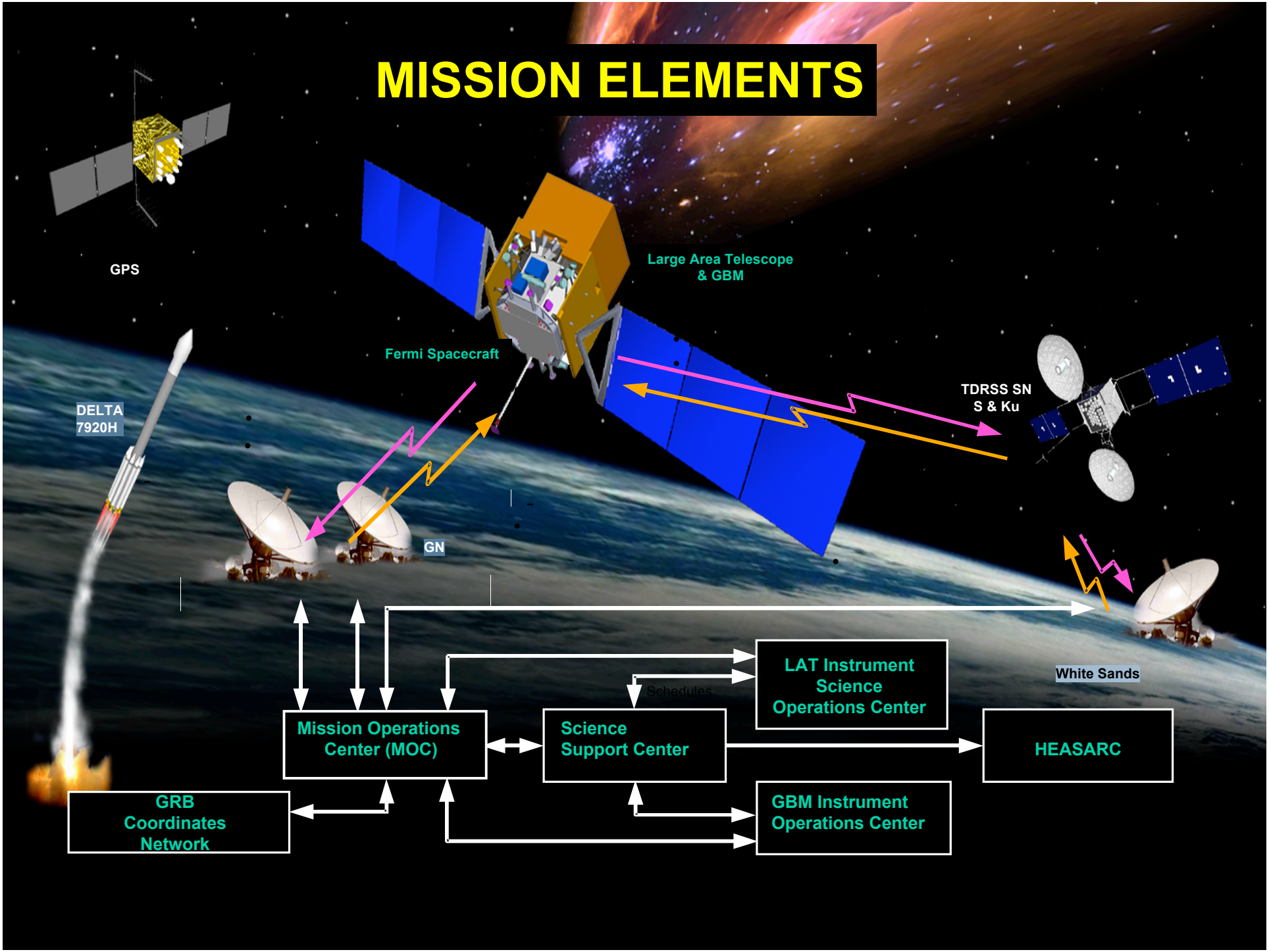
… on its way!

Operating modes

- **Primary observing mode is Sky Survey**
  - **Full sky every 2 orbits (3 hours)**
  - **Uniform exposure, with each region viewed for ~30 minutes every 2 orbits**
  - **Best serves majority of science, facilitates multiwavelength observation planning**
  - **Exposure intervals commensurate with typical instrument integration times for sources**
  - **EGRET sensitivity reached in days**

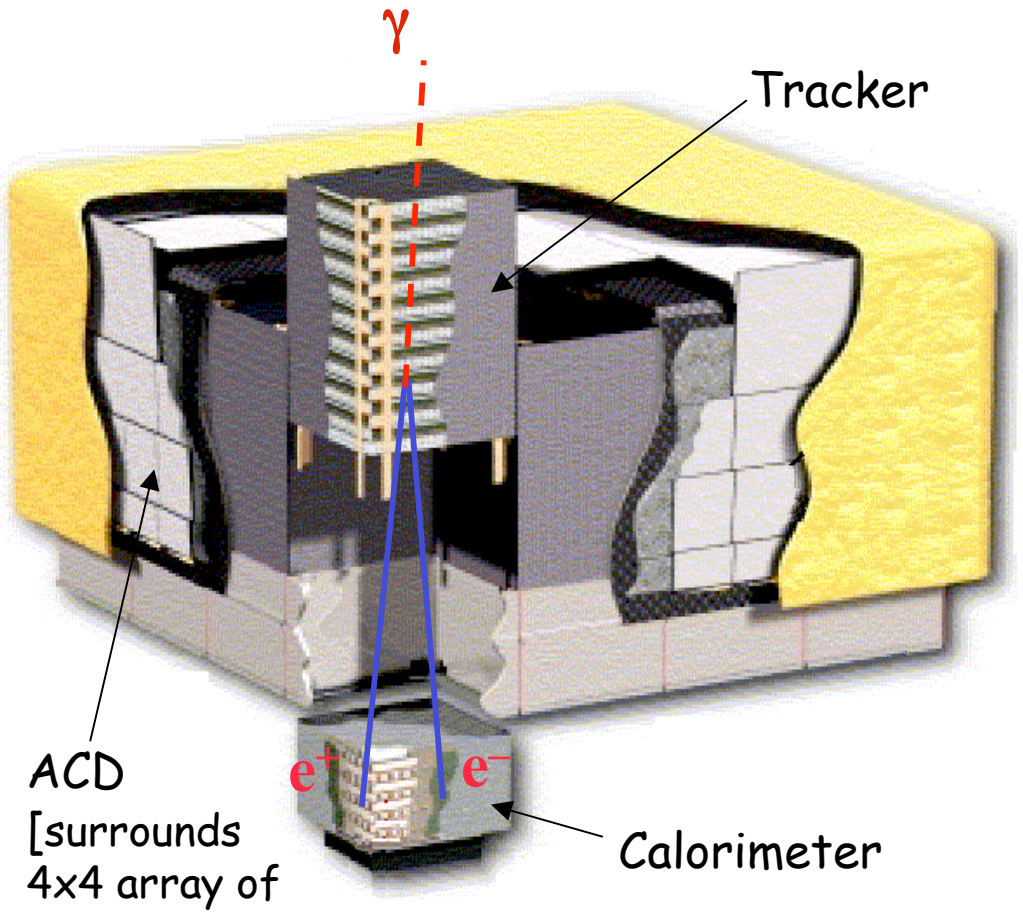


- **Pointed observations when appropriate (selected by peer review in later years) with automatic earth avoidance selectable. Target of Opportunity pointing.**
- **Autonomous repoints for onboard GRB detections in any mode.**


MISSION ELEMENTS
GPS
Large Area Telescope
& GBM
Fermi Spacecraft
TDRSS SN
S & Ku
DELTA
7920H
GN
White Sands
LAT Instrument
Science
Operations Center
Schedules
Mission Operations
Center (MOC)
Science
Support Center
HEASARC
GRB
Coordinates
Network
GBM Instrument
Operations Center

Overview of LAT: How it works

- Precision Si-strip Tracker (TKR) Measure the photon direction; gamma ID.
- Hodoscopic CsI Calorimeter (CAL) Measure the photon energy; image the shower.
- Segmented Anticoincidence Detector (ACD) Reject background of charged cosmic rays; segmentation removes self-veto effects at high energy.
- Electronics System Includes flexible, robust hardware trigger and software filters.



Atwood et al, ApJ submitted

Systems work together to identify and measure the flux of cosmic gamma rays with energy 20 MeV - >300 GeV.

LAT Collaboration

- **France**
  - CNRS/IN2P3, CEA/Saclay
- **Italy**
  - INFN, ASI, INAF
- **Japan**
  - Hiroshima University
  - ISAS/JAXA
  - RIKEN
  - Tokyo Institute of Technology
- **Sweden**
  - Royal Institute of Technology (KTH)
  - Stockholm University
- **United States**
  - Stanford University (SLAC and HEPL/Physics)
  - University of California, Santa Cruz - Santa Cruz Institute for Particle Physics
  - Goddard Space Flight Center
  - Naval Research Laboratory
  - Sonoma State University
  - The Ohio State University
  - University of Washington

PI: Peter Michelson
(Stanford)

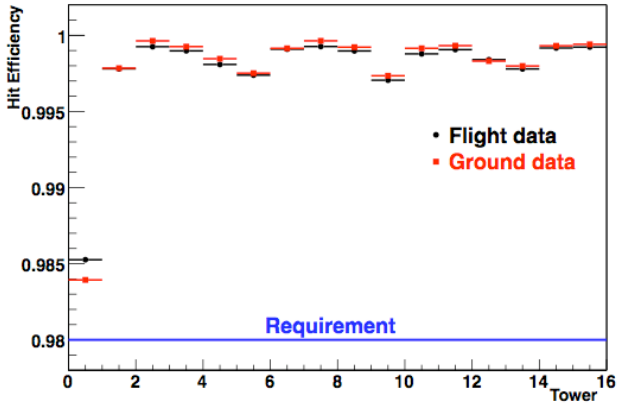
~390 Scientific Members (including 96 Affiliated Scientists, plus 68 Postdocs and 105 Students)

Cooperation between NASA and DOE, with key international contributions from France, Italy, Japan and Sweden.

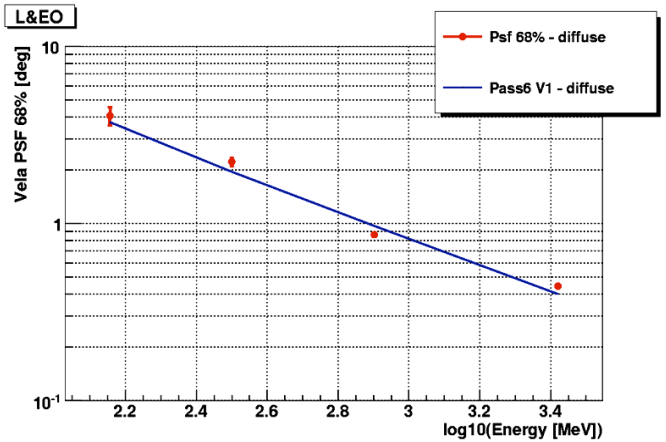
Managed at SLAC.

LAT Working Very Well On Orbit!

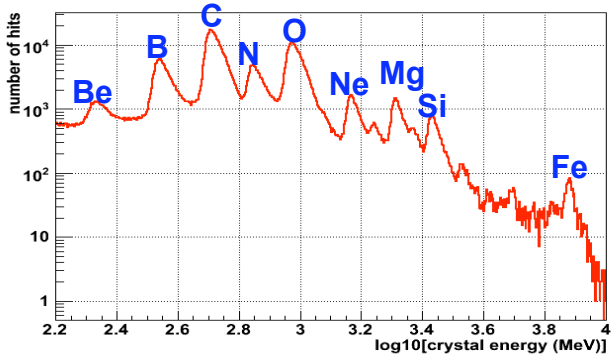
- **Total background rates very close to expectation (non-trivial!)**
- **Spectacular charged-particle hit efficiency:**



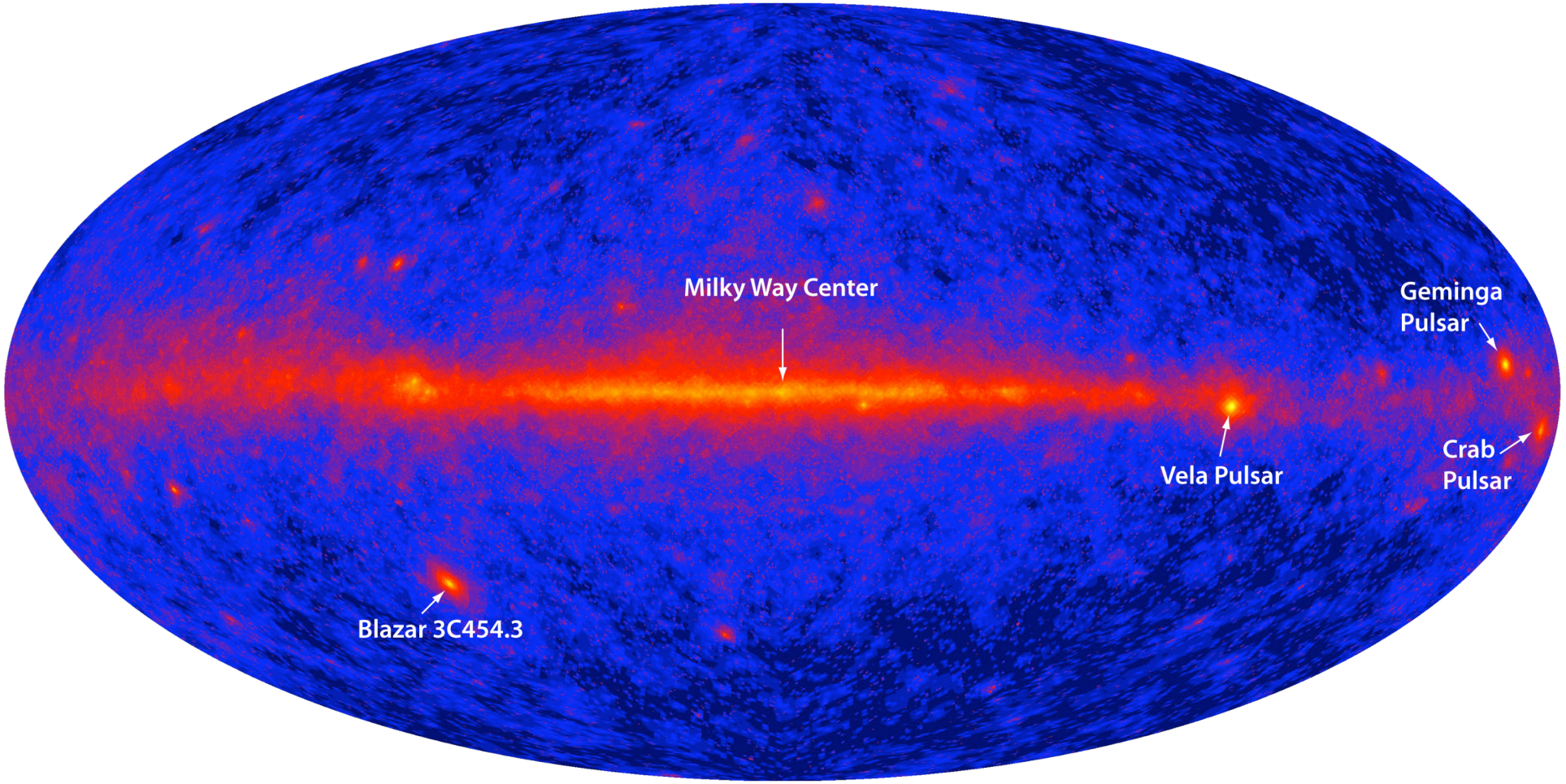
- **PSF on-orbit as expected (note intrinsic energy dependence => localization is source-dependent)**
  - **verify using on-pulse photons from Vela, compare with detailed MC simulation:**



- **On-orbit calorimeter calibration stable**
  - **use cosmic ray heavy ions:**

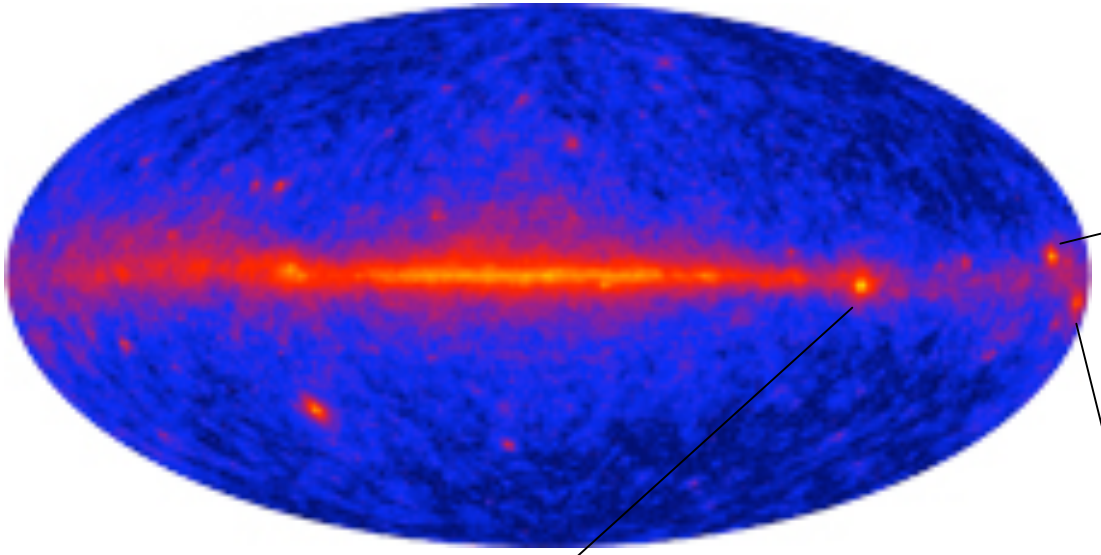


First Light!

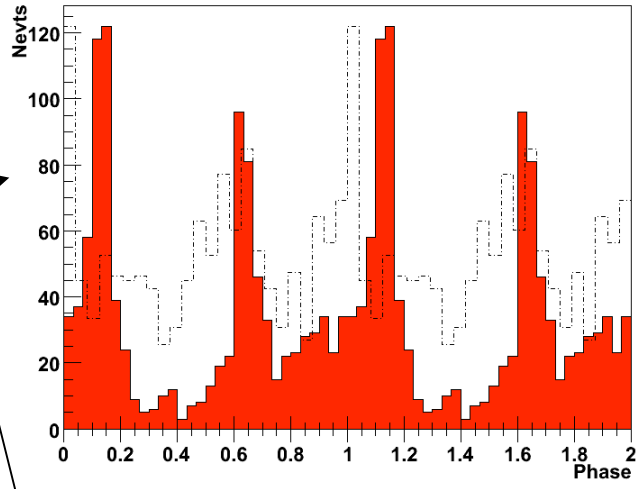


Four days of all-sky survey engineering data.

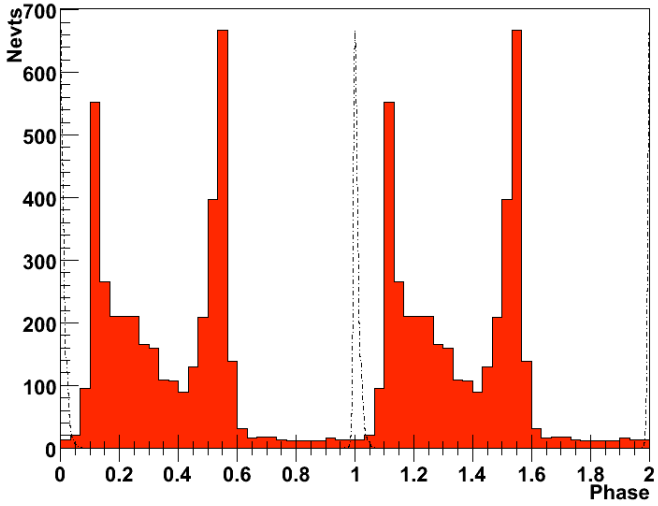
Pulsars (using early engineering data)



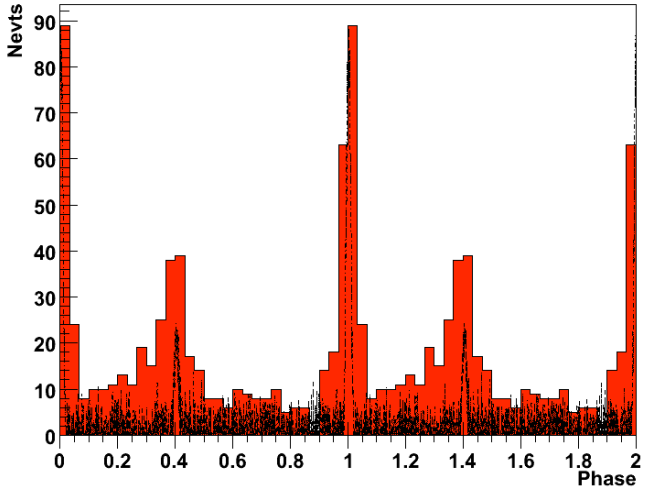
Geminga: P=237 ms



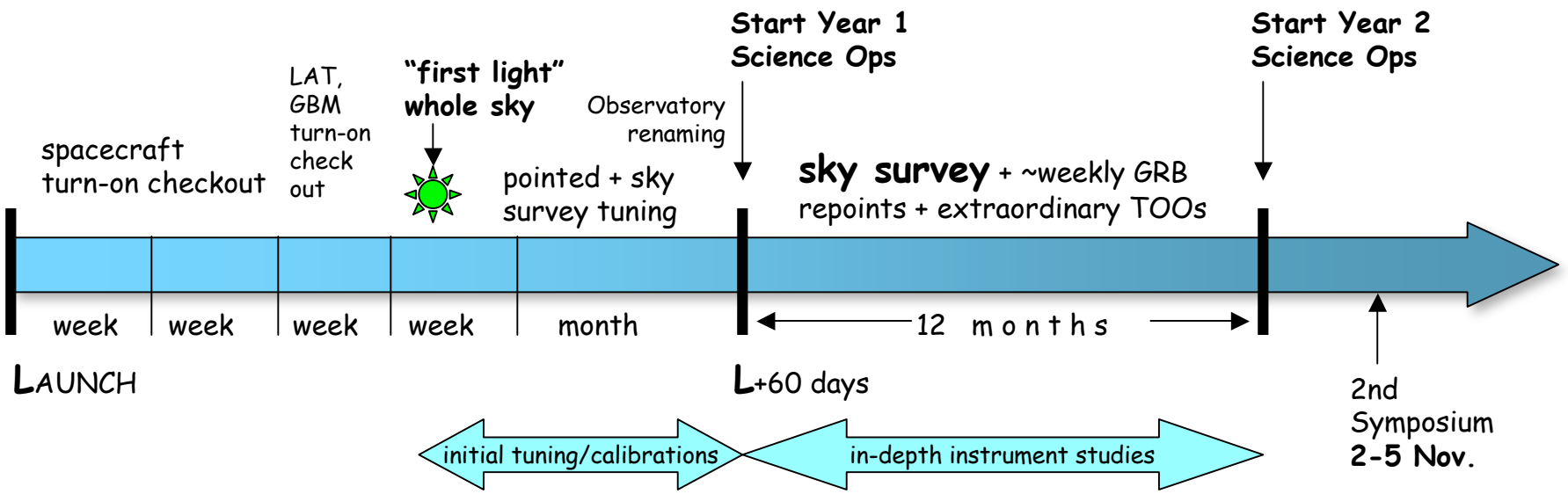
Vela: P=89.3 ms



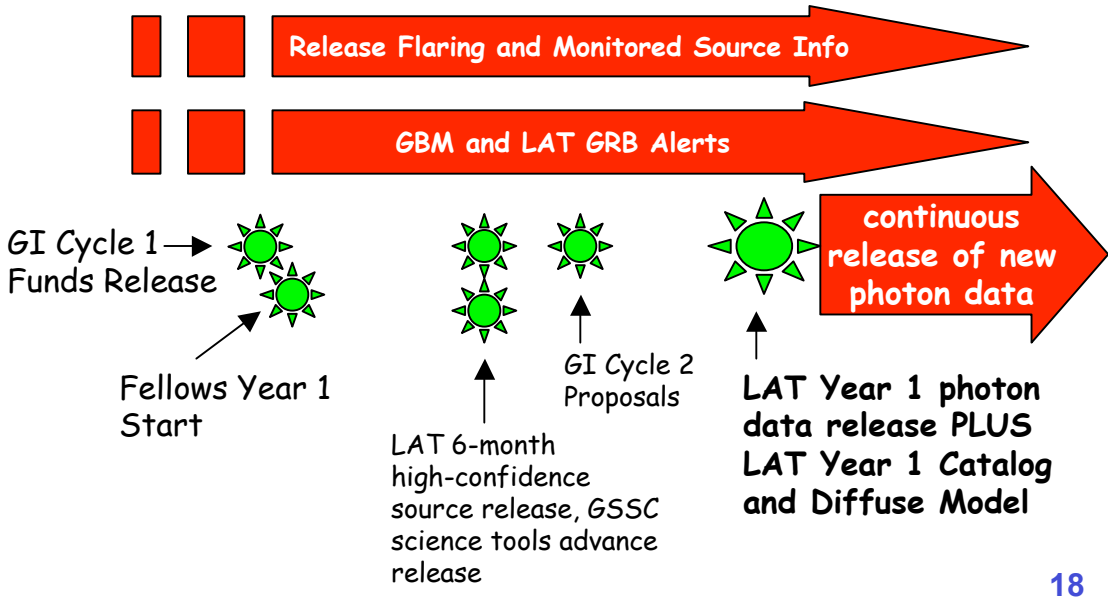
Crab: P =33 ms



Year 1 Science Operations Timeline Plan



Thus far:
14 Atels on flaring sources
>100 GRB alerts (GCN)



Big Questions From EGRET Era

- How and where do pulsars emit gamma rays? How common are radio-quiet pulsars?
  - necessary clue to magnetic field configurations and dynamics
- What are the EGRET Unidentified Sources?
  - most of the EGRET source identifications are a mystery
- What are the energy budgets of gamma-ray bursts? What are the temporal characteristics of the high-energy emission?
  - not well characterized yet, key tests of models.
- What are the origins of the diffuse emissions?
  - galactic: cosmic-ray and matter distributions; sources
  - extragalactic: populations
  - new sources (Dark Matter annihilations, clusters, …)
- How do the supermassive black hole systems of AGN work? Why do the jets shine so brightly in gamma rays?
  - temporal and spectral variability over different timescales
- What remains to be discovered with great new capabilities??
  - EGRET showed us the tip of the iceberg. New sources and probes for new physics.

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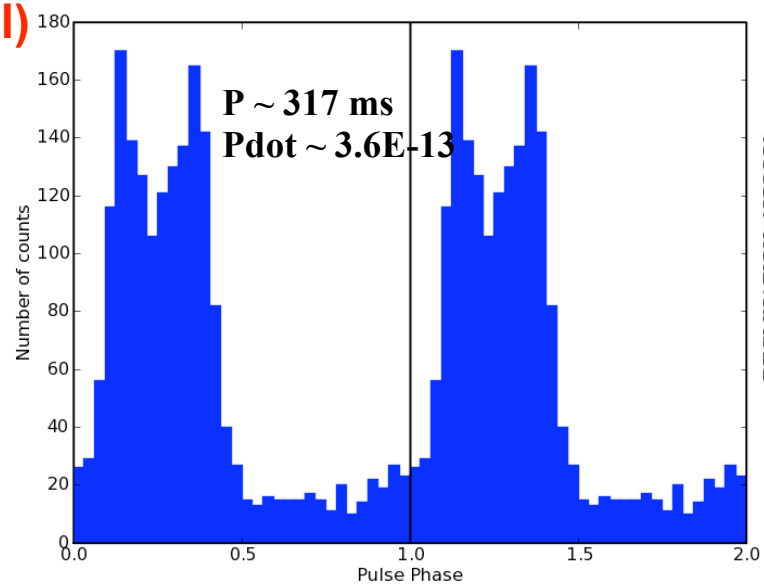
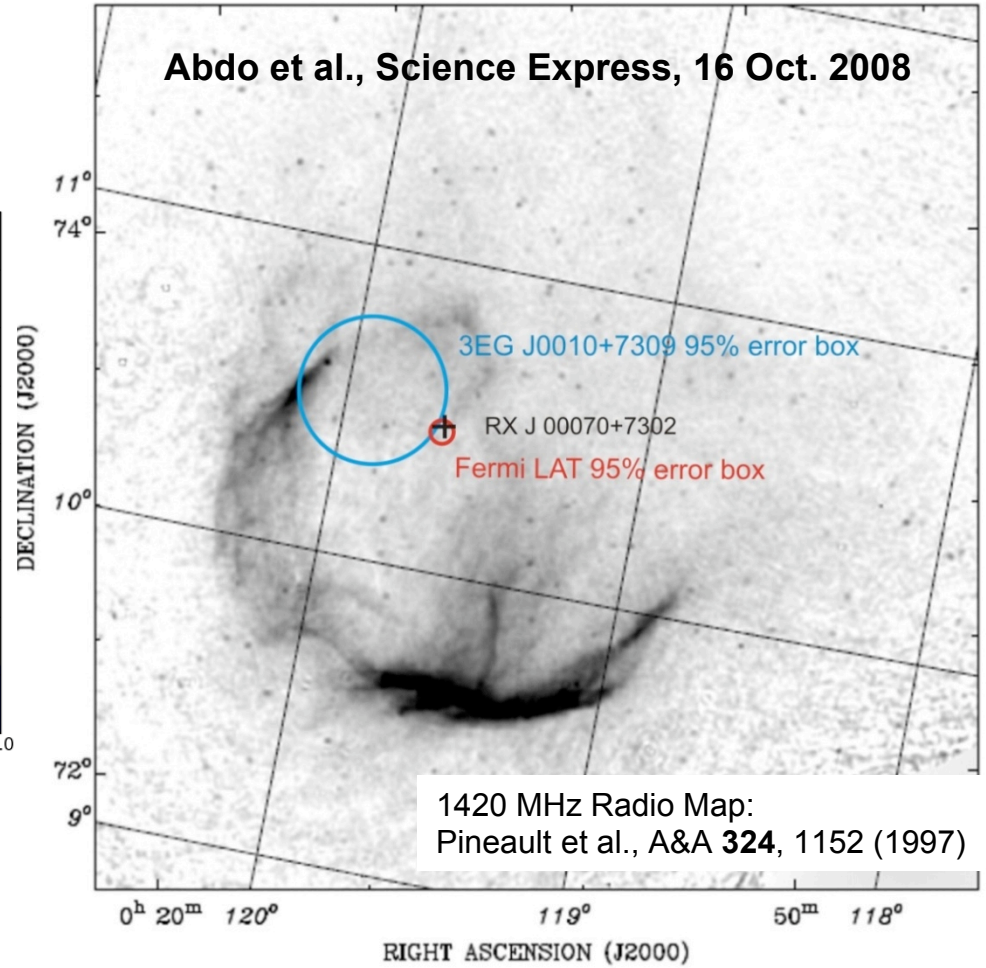
Discovery of First Gamma-ray-only Pulsar

A radio-quiet, gamma-ray only pulsar, in Supernova Remnant CTA1

Quick discovery enabled by

- **large leap in key capabilities**
- **new analysis technique (Atwood et al)**



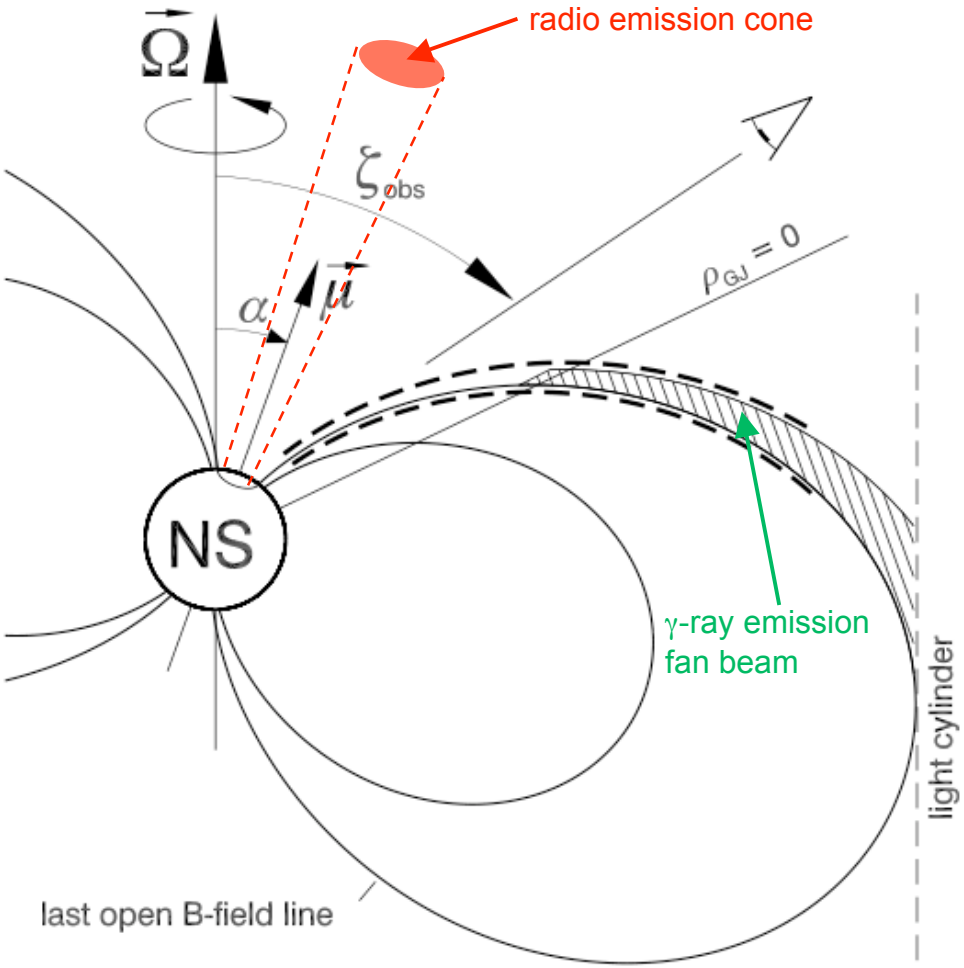


- Spin-down luminosity ~10^{36} erg s^{-1}, sufficient to supply the PWN with magnetic fields and energetic electrons.

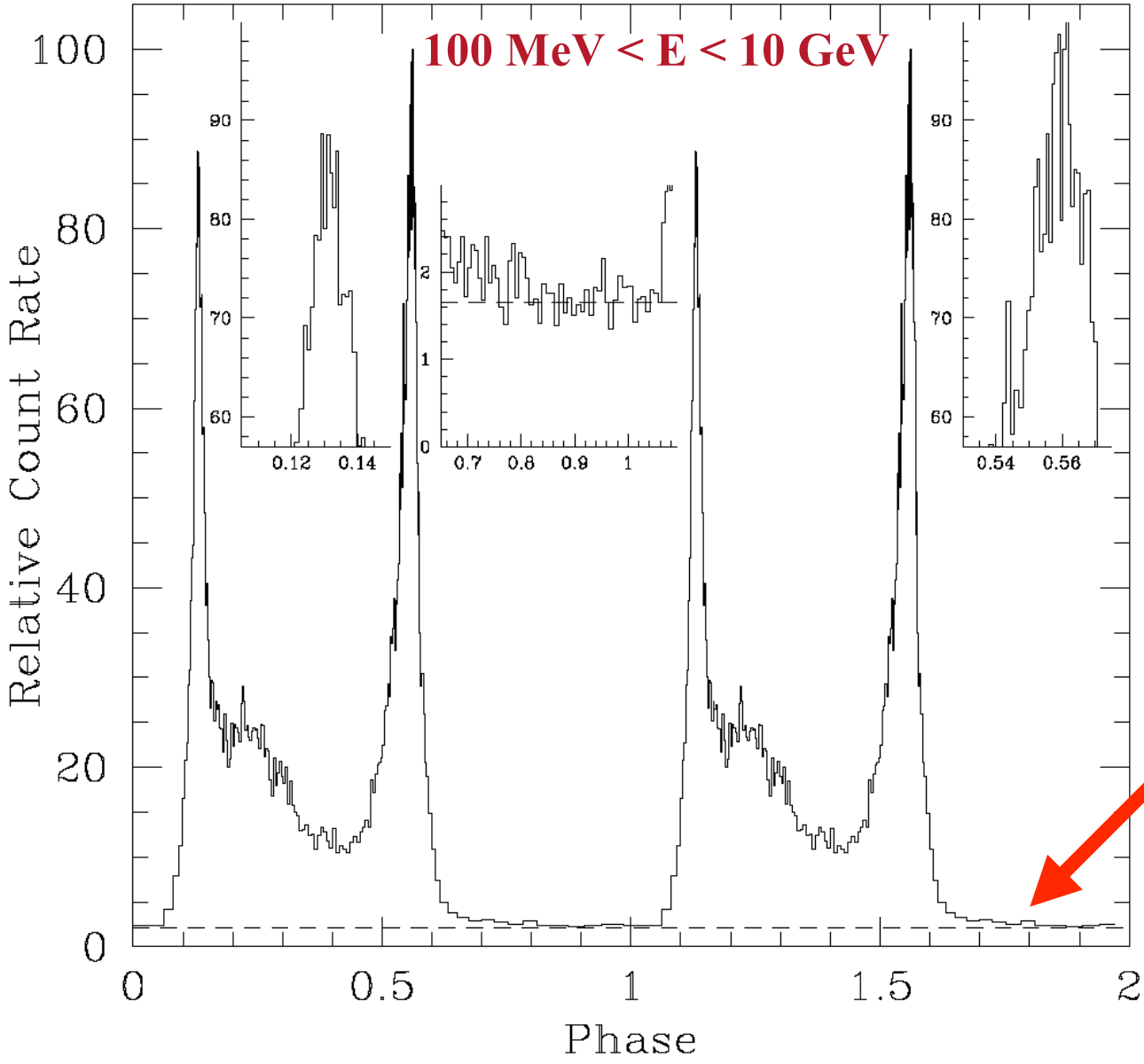
- The γ-ray flux from the CTA 1 pulsar corresponds to about 1-10% of E_{rot} (depending on beam geometry)

Age ~(0.5 – 1)x10^4 years
Distance ~ 1.4 kpc
Diameter ~ 1.5°

Pulsar Field Geometry Simplified



First *Fermi* view of the Vela Pulsar



Remarkably sharp peaks; features to ~0.3ms.

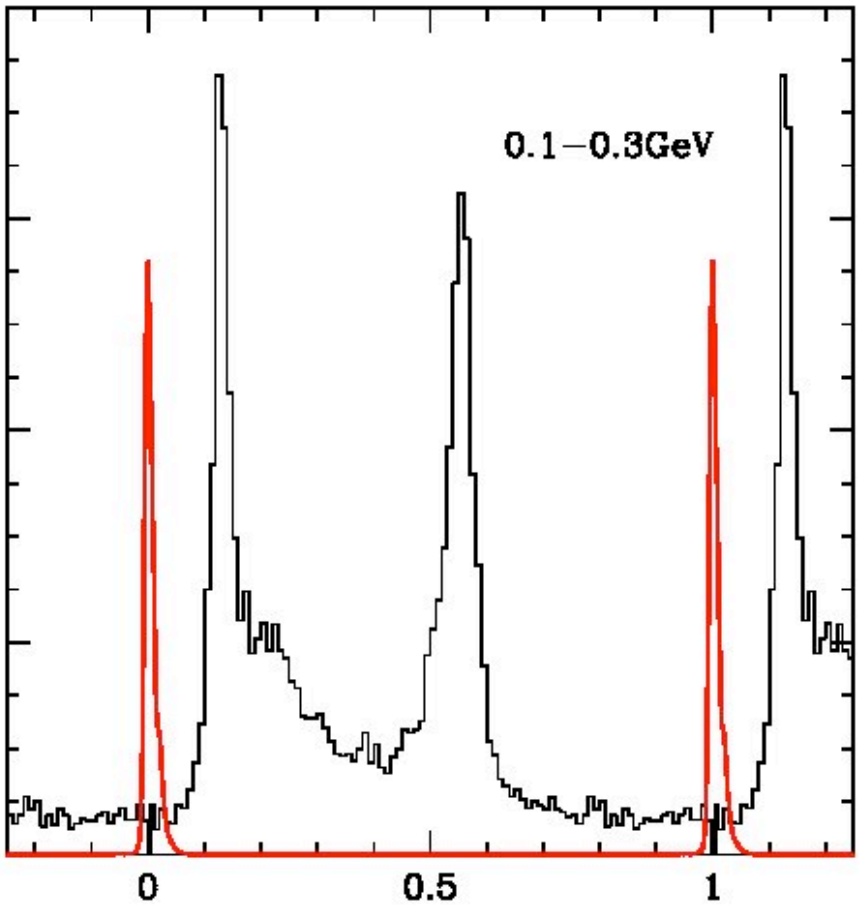
Turns nearly completely off between the double pulses.

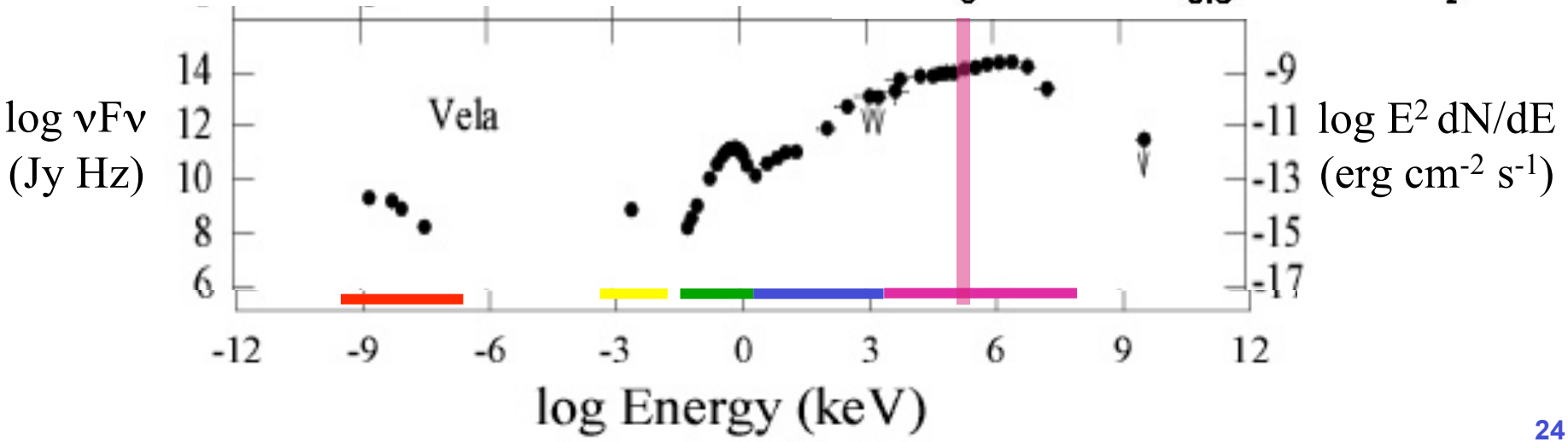
- **<2.8% of phase-averaged pulsed emission, 95% confidence**
- **Stringent limits or measurement will be available with more livetime**

Vela Lightcurves in Energy Bins

Fermi LAT

- **Abdo et al. 2008 ApJ in press, arXiv:0812.2960**





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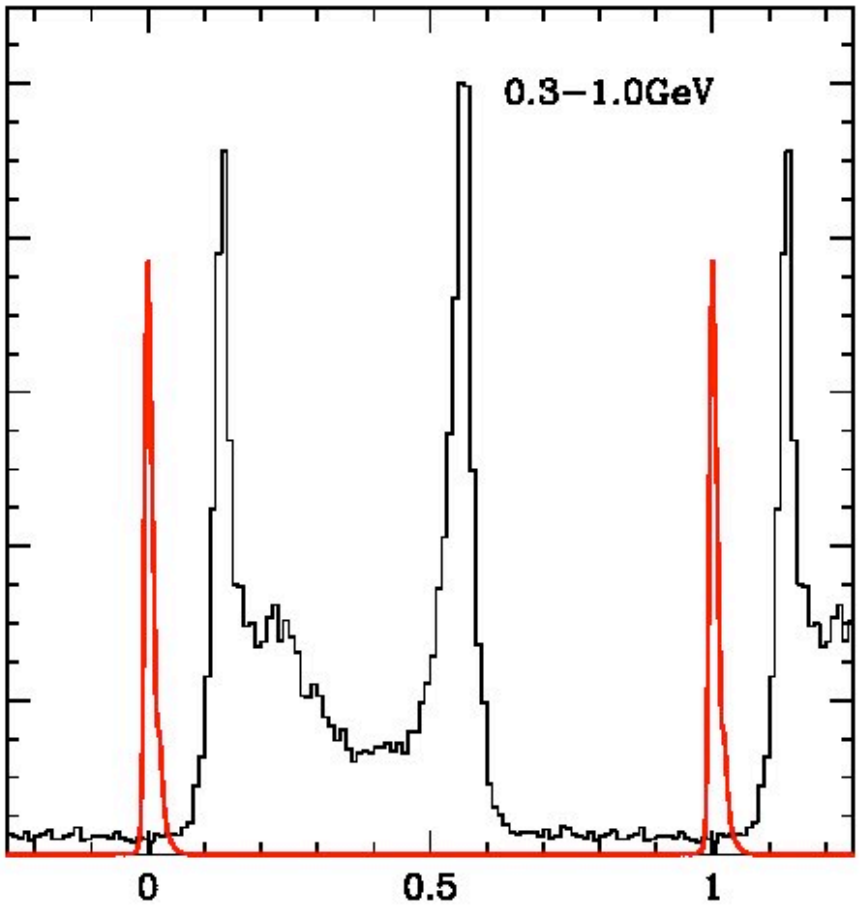

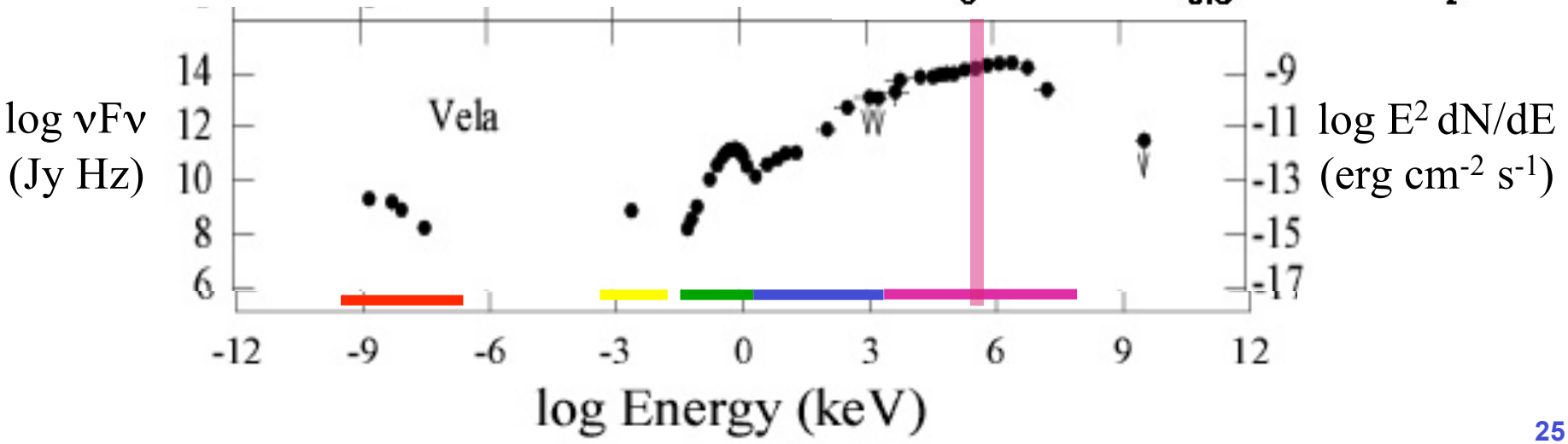

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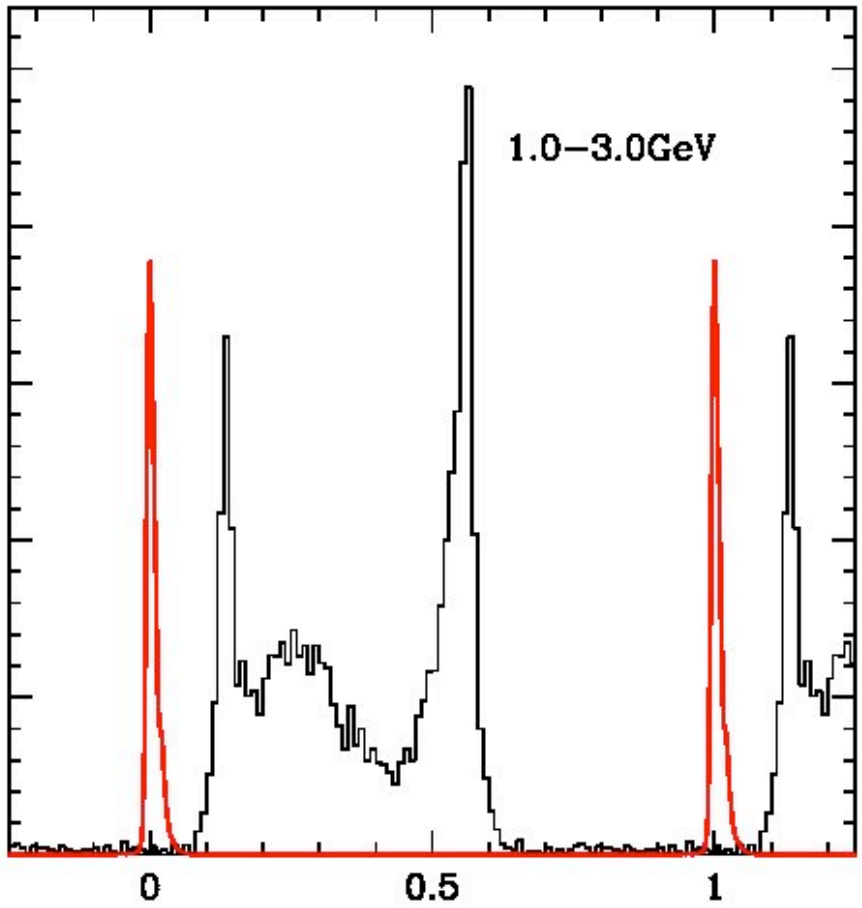

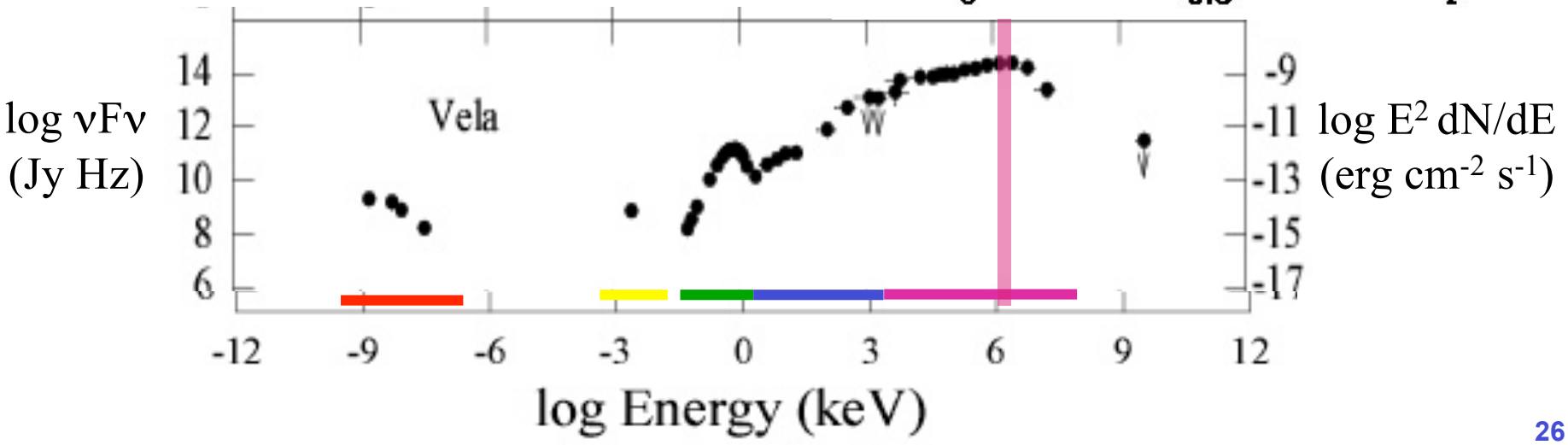

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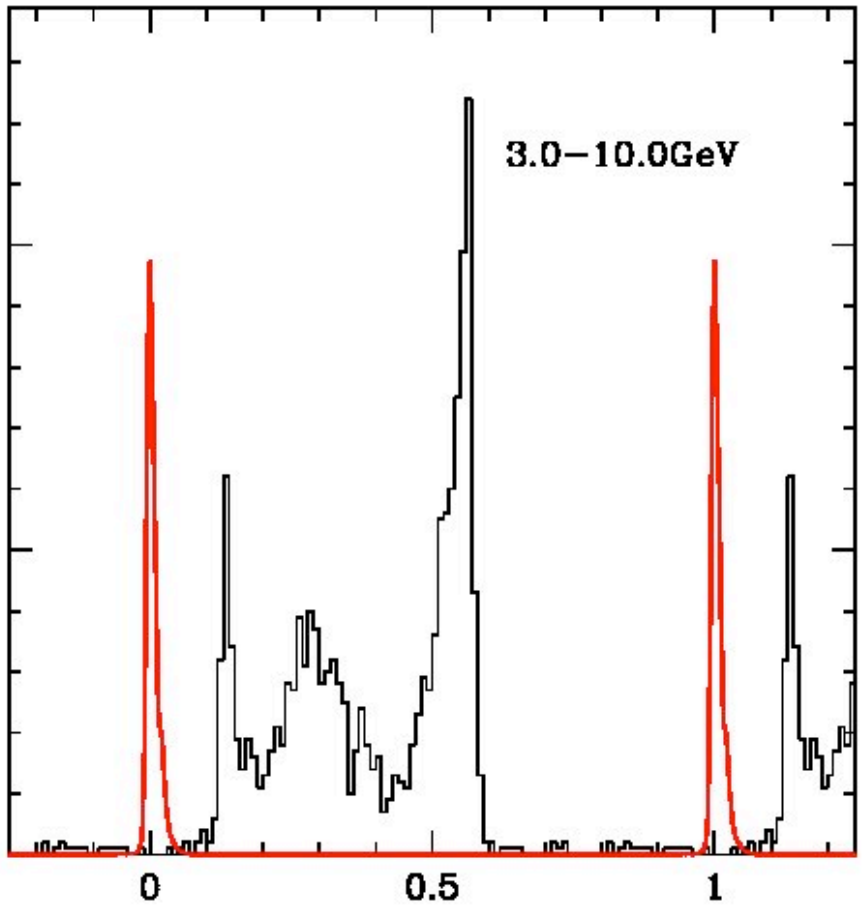

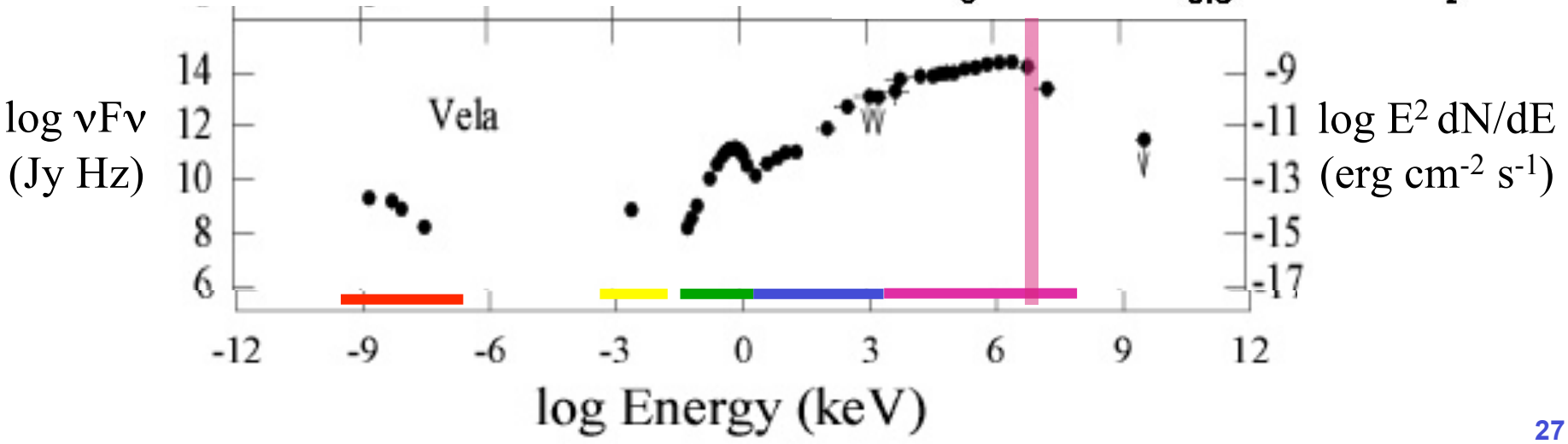

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Fermi LAT

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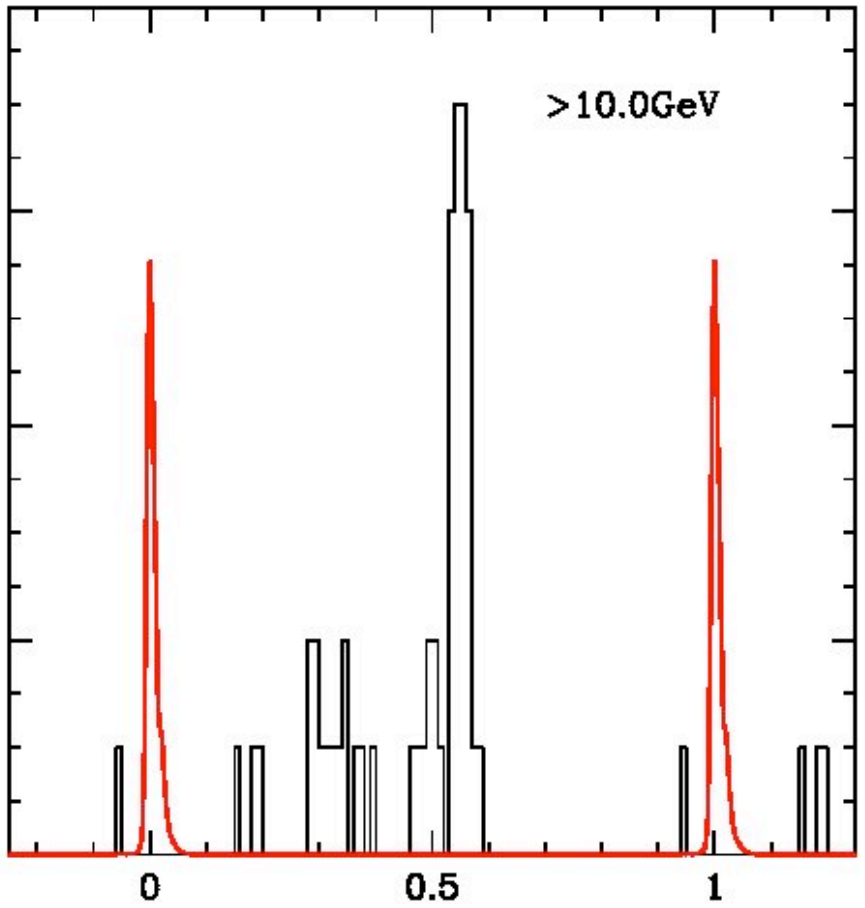
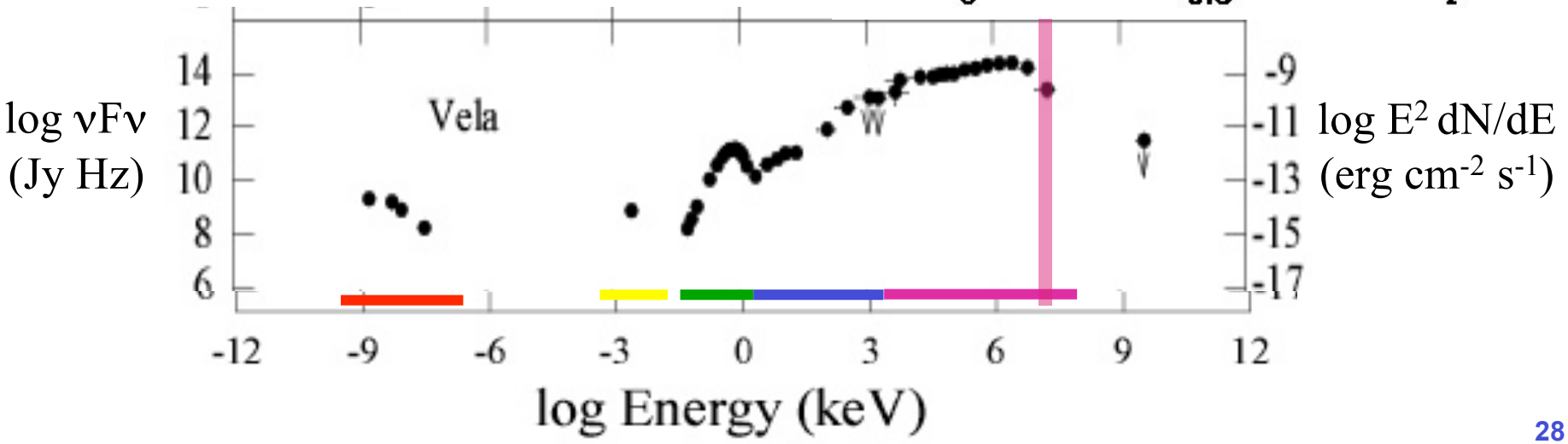
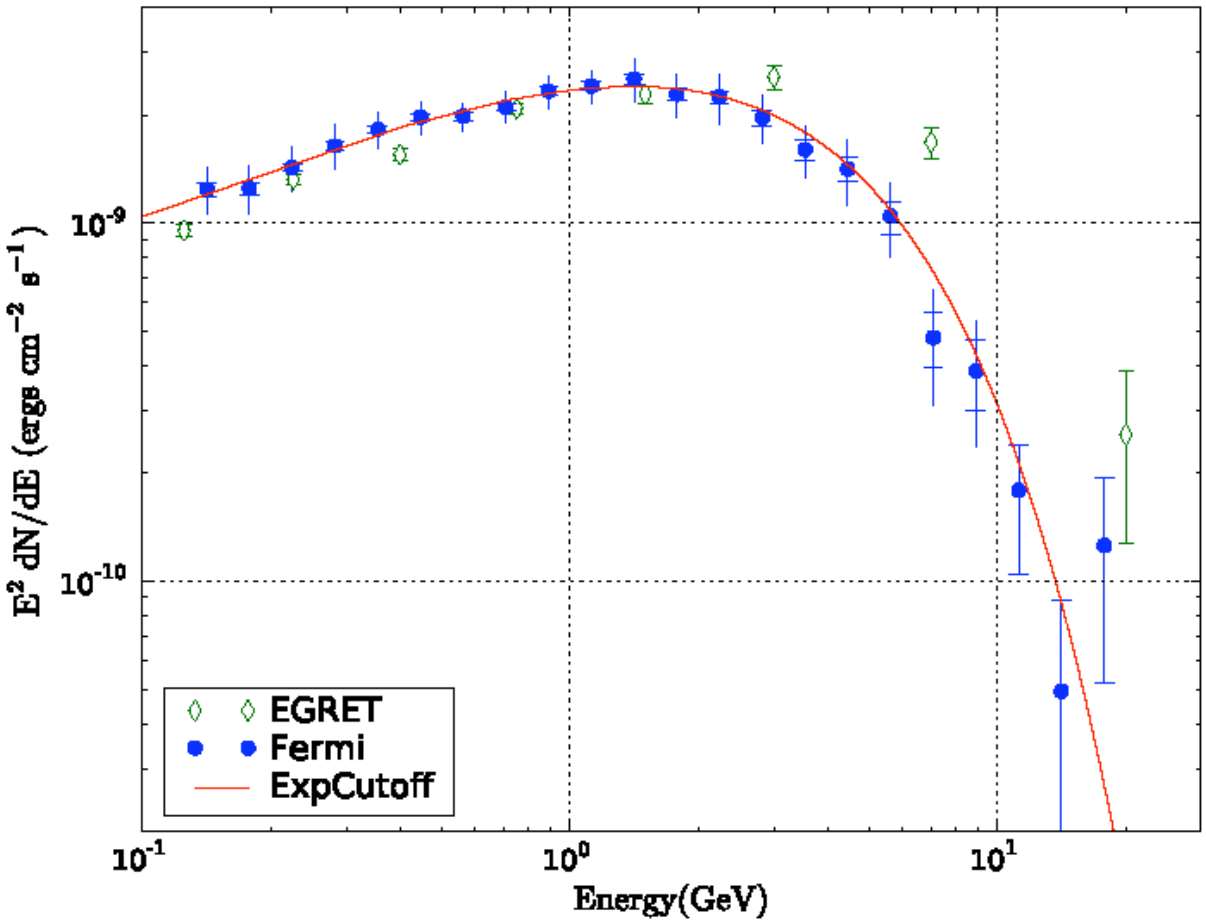




Vela Pulsar – Phase-averaged SED

$$N(E) = N_0 E^{\Gamma} e^{-(E/E_c)^b}$$



Consistent with b=1 (simple exponential)

$$\Gamma = -1.51^{+0.05}_{-0.04}$$

$$E_c = 2.9 \pm 0.1 \text{ GeV}$$

b=2 (super-exponential) rejected at 16.5σ

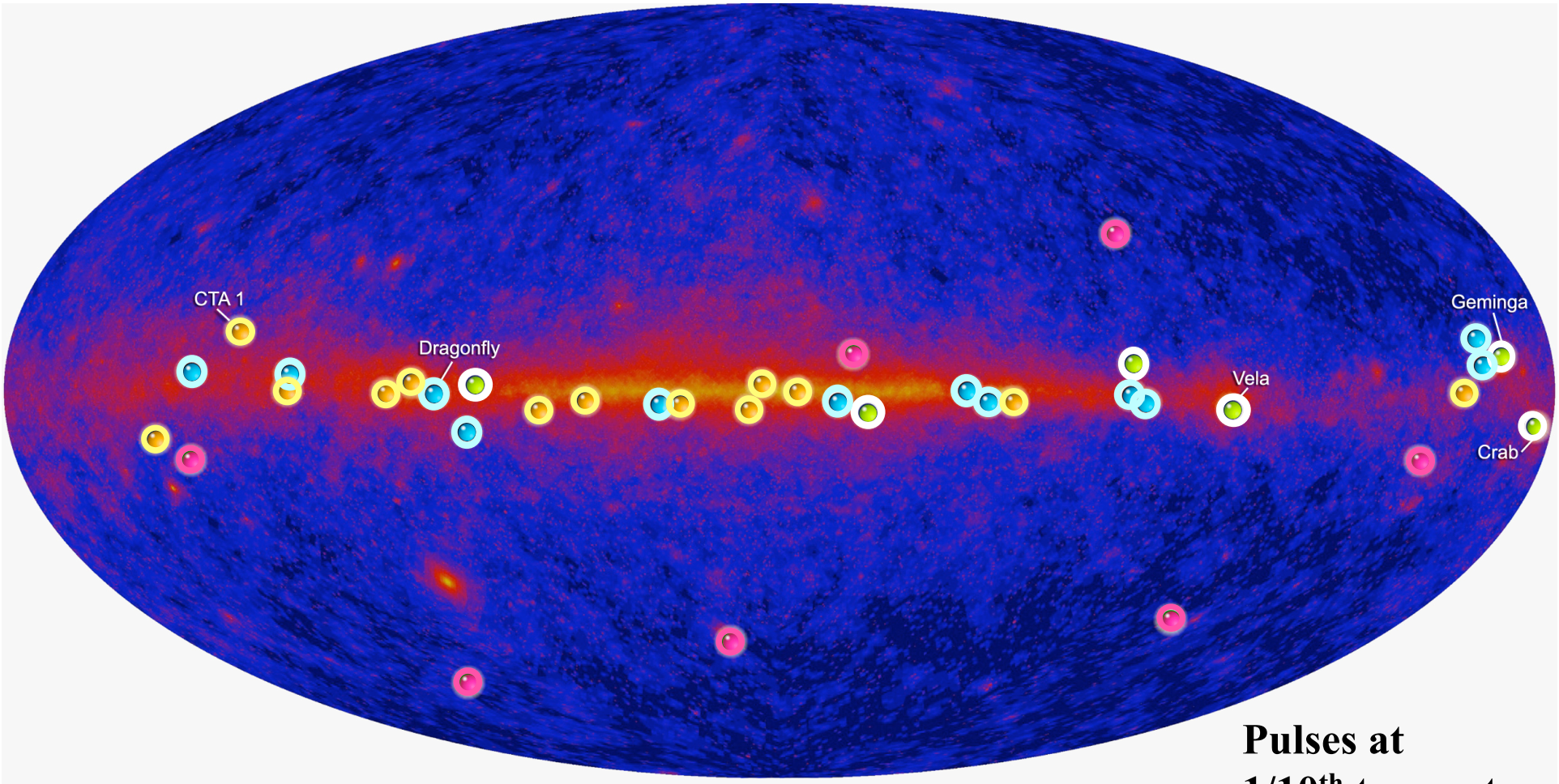
No evidence for magnetic pair attenuation: **Near-surface emission ruled out**

Summary: Fermi LAT Pulsar Discoveries

- **In the first 4 months of the mission, over 3 dozen pulsars detected!**
  - **confirmed 6 known EGRET pulsars (and several EGRET candidates)**
  - **Found 12 new young radio pulsars**
  - **Found 13 young pulsars pulsing in Gamma-rays alone**
  - **Found 7 'Millisecond' Gamma-ray pulsars, establishing new class of gamma-ray pulsars (EGRET low-significance candidate, PSR J0218+4232, confirmed)**

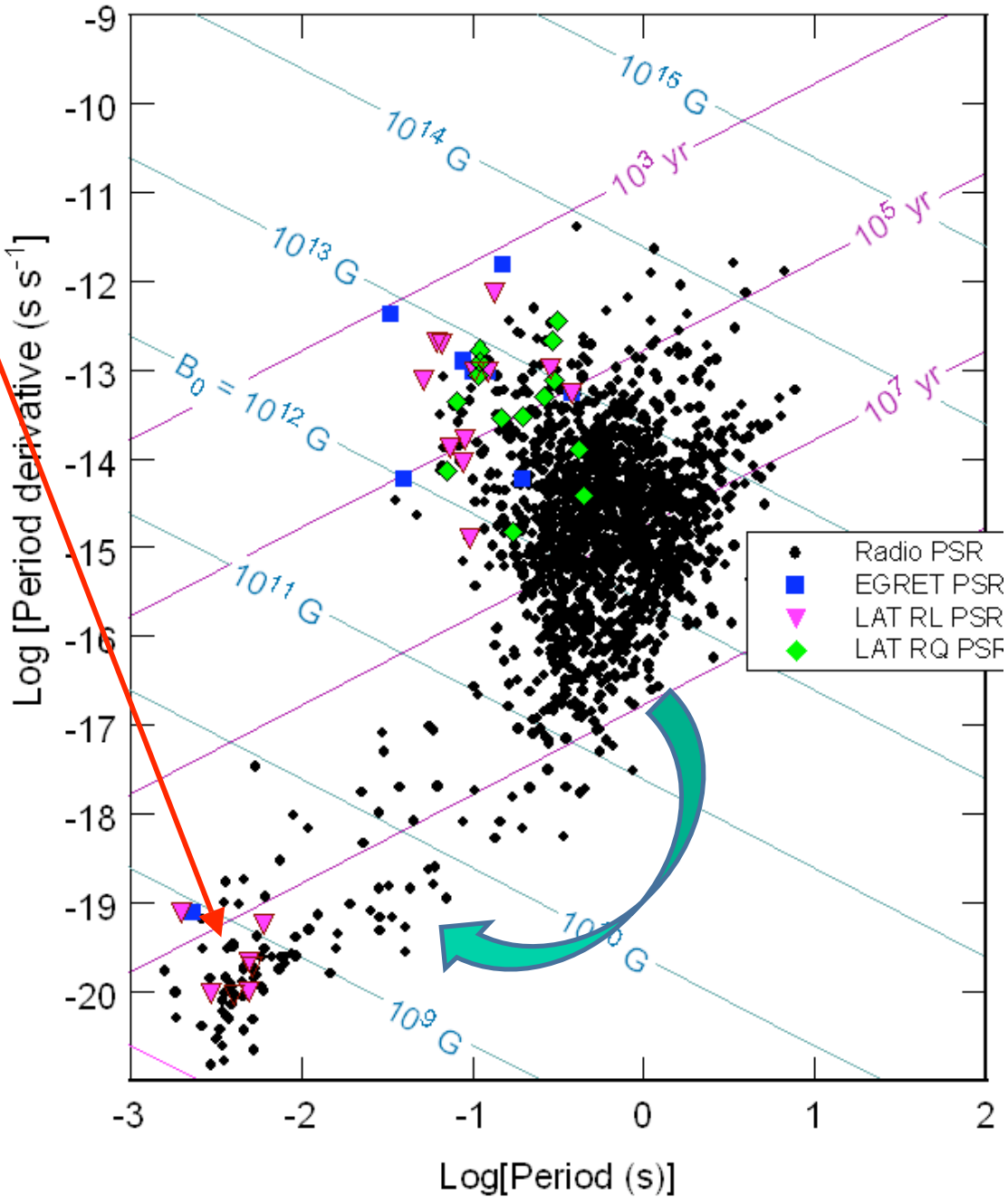
- **12 new pulsars found directly in the gamma-rays (blind searches) and**
- **18 additional pulsars seen for the first time as gamma-ray emitters.**

The Pulsing Sky



ms γ-ray pulsars

- **Very different characteristics from the normal γ-ray pulsars:**
  - **Spinning 100 times faster**
  - **Magnetic fields ~10,000 times lower**
  - **~10,000 times older**
- **"Recycled" pulsars spun-up by binary companion stars (movie)**
  - **Old recycled pulsars can accelerate particles to very high (TeV) energies**
  - ***Fermi* is seeing so far the nearby ms pulsar population**
  - **This may be the tip-of-the-iceberg with many more to be discovered**



Alice Harding

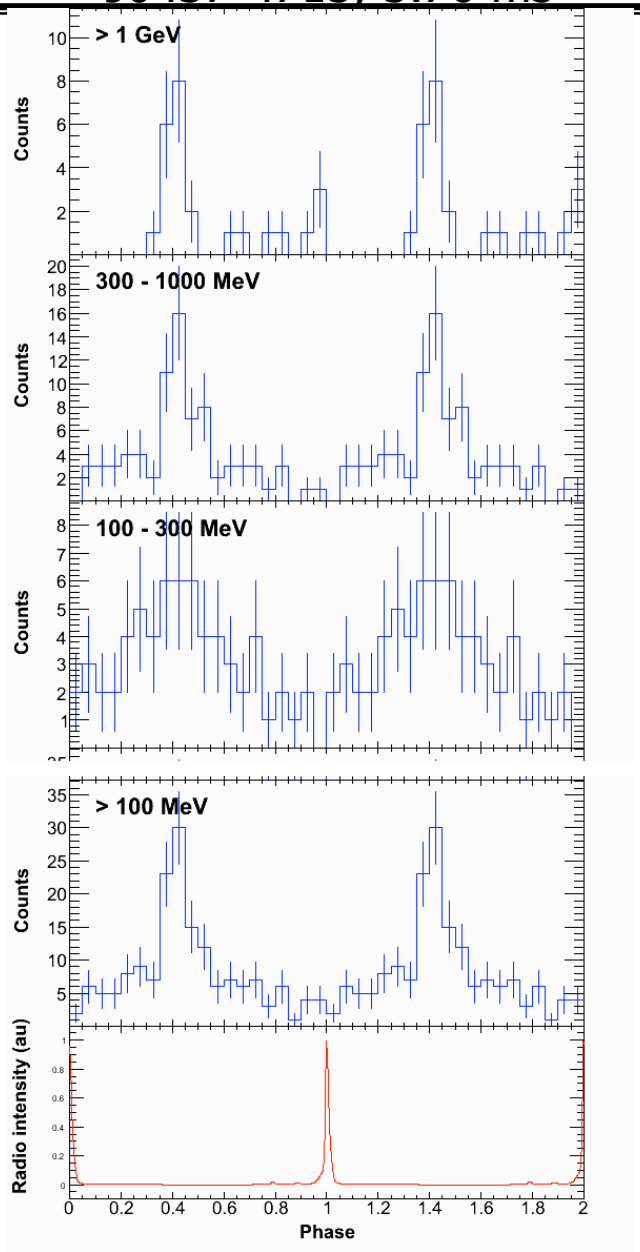
Millisecond pulsars detected by *Fermi*

PULSAR	PERIOD (ms)	PERIOD DERIV. (10^{-20} s/s)	D (kpc)	Edot (erg/s)	# PHOTONS	H-TEST TS	CHANCE PROB
J0030+0451	4.86	1	0.317	3.44E+33	361	306.8	< 4e-08
J0218+4232	2.32	7.74	3.2	2.44E+35	455	12	0.0084
J0437-4715	5.76	5.73	0.15	1.18E+34	166	89.1	< 4e-08
J0613-0200	3.06	0.96	0.48	1.32E+34	549	60	< 4e-08
J1024-0719	5.16	1.85	0.53	5.31E+33	135	14	0.0038
J1744-1134	4.07	0.89	0.48	5.21E+33	1014	25.1	5.04E-05
J2124-3358	4.93	2.1	0.25	6.91E+33	277	57.7	< 4e-08

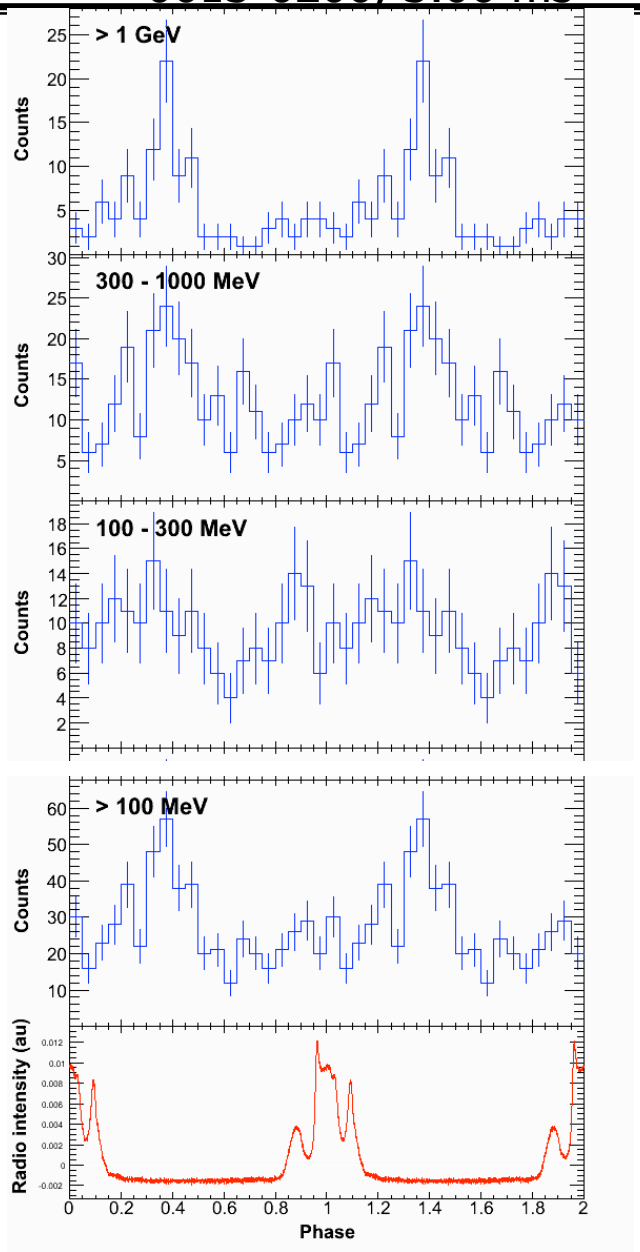
More gamma-ray millisecond pulsars

PRELIMINARY

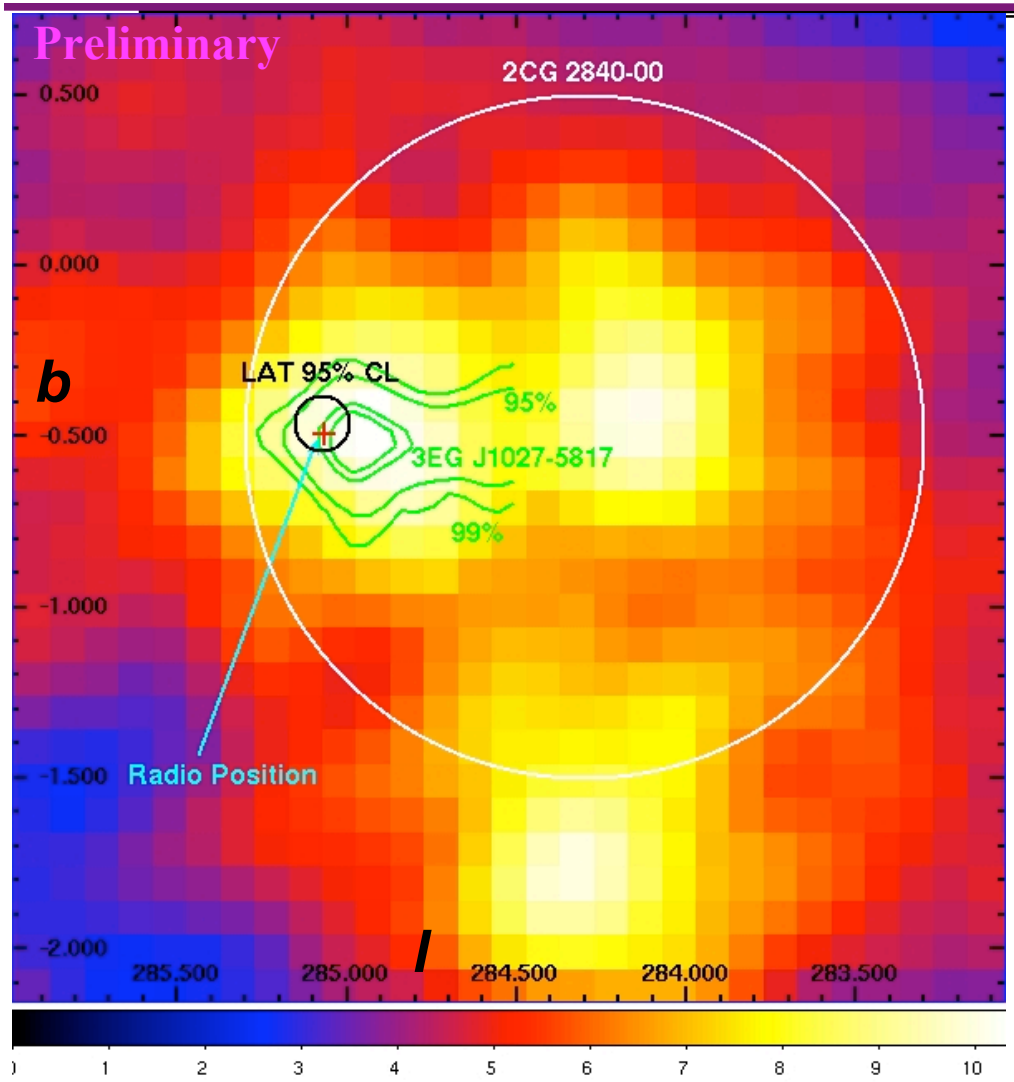
J0437-4715, 5.76 ms



0613-0200, 3.06 ms



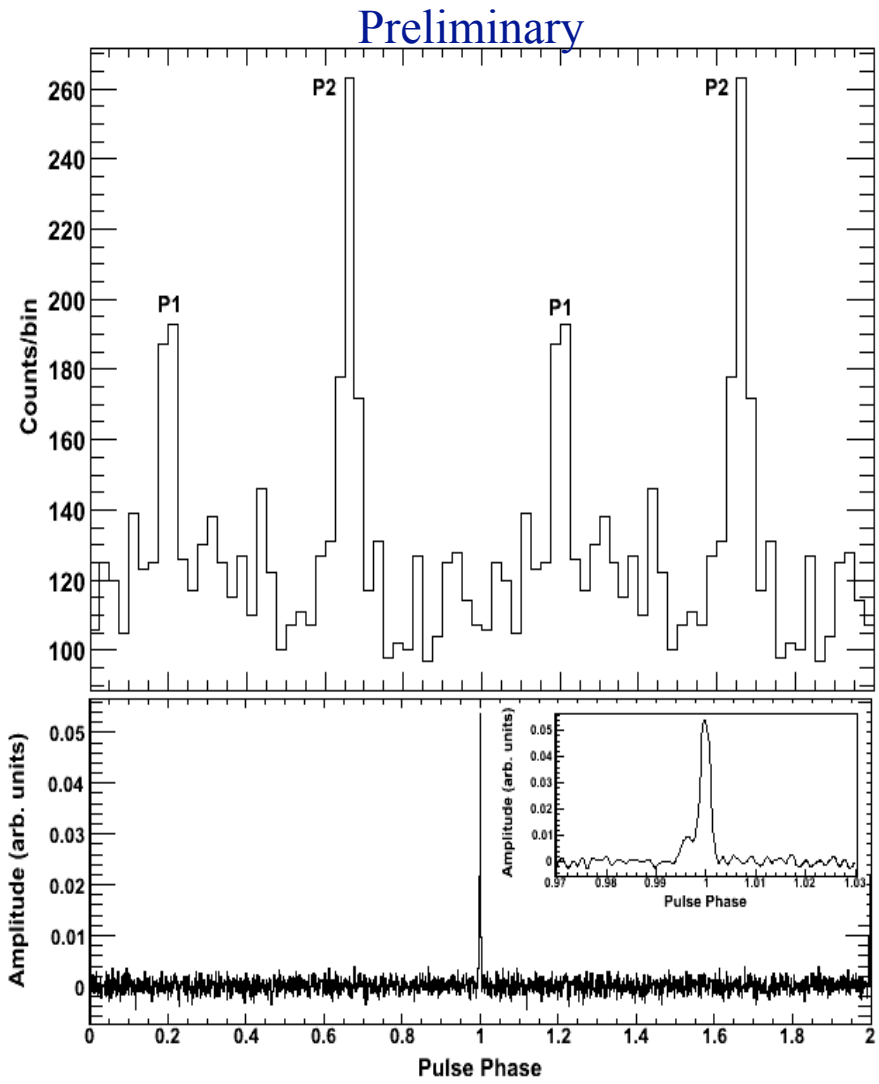
Solving EGRET UNIDs Example: Pulsar J1028



- LAT point source
  - $(l,b)=(285.074,-0.459)$
  - 95% CL radius of 0.079^{o}
- Power law with a simple exponential cutoff
  - Cutoff ~2-3 GeV
  - Index ~1.2
  - Integrated flux (0.1-30GeV) 1.62±0.27±0.32 e-7 ph/cm^2/s
- 3EG flux 6.6±0.7 e-7 ph/cm^2/s
  - From power law with index 2
  - No cutoff modeled
  - Low energy contribution from nearby source
- COS-B source
  - Flux 2.7 e-6 ph/cm^2/s
  - Actually multiple sources

Counts map above 100MeV, gaussian smoothing applied with kernel radius of 3. Also plotted, 2CG position (Swanenberg et al 1981), 3EG countors (Hartman et al 1999), and radio position.

Pulsar J1028 Gamma-ray Light Curve



- Radio pulsar discovered in error circle of 3EG J1027-5817 (Keith et al. 2008) just prior to launch of *Fermi*.
  - P = 91.4ms
  - dP/dt = 1.61 e-14 s/s
  - Characteristic age 9.21e-4 yr
  - Spin-down power 8.43 e35 erg/s
  - Dispersion measure derived distance 2.3kpc
- Within 2 weeks of start of 'first light' 3.5σ pulsed detection with the LAT.
- Also detected in blind search of unid 3EG error circles
  - No signal with 3EG position
  - Highly significant with early LAT position

- Two narrow peaks
  - P1 @ phase 0.200±0.003, FWHM=0.040±0.004
  - P2 @ phase 0.661±0.002 FWHM=0.035±0.007
  - Peak separation 0.460±0.004

Top: LAT light curve of PSR J1028-5819 above 100MeV with energy dependent cut.
Bottom: 1.4 GHz radio light curve.

Big Questions From EGRET Era

- How and where do pulsars emit gamma rays? How common are radio-quiet pulsars?
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  - most of the EGRET source identifications are a mystery
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  - **not well characterized yet, key tests of models.**
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  - galactic: cosmic-ray and matter distributions; sources
  - extragalactic: populations
  - new sources (Dark Matter annihilations, clusters, …)
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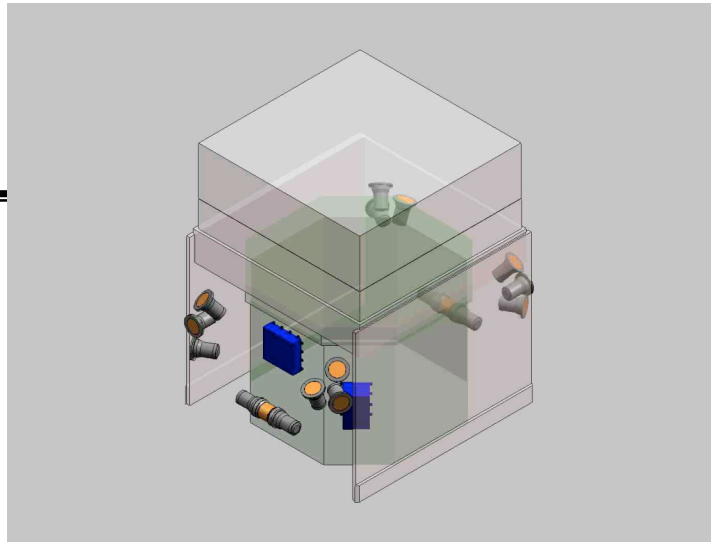
- What remains to be discovered with great new capabilities??
  - EGRET showed us the tip of the iceberg. New sources and probes for new physics.

GBM Collaboration



National Space Science & Technology Center

University of Alabama in Huntsville

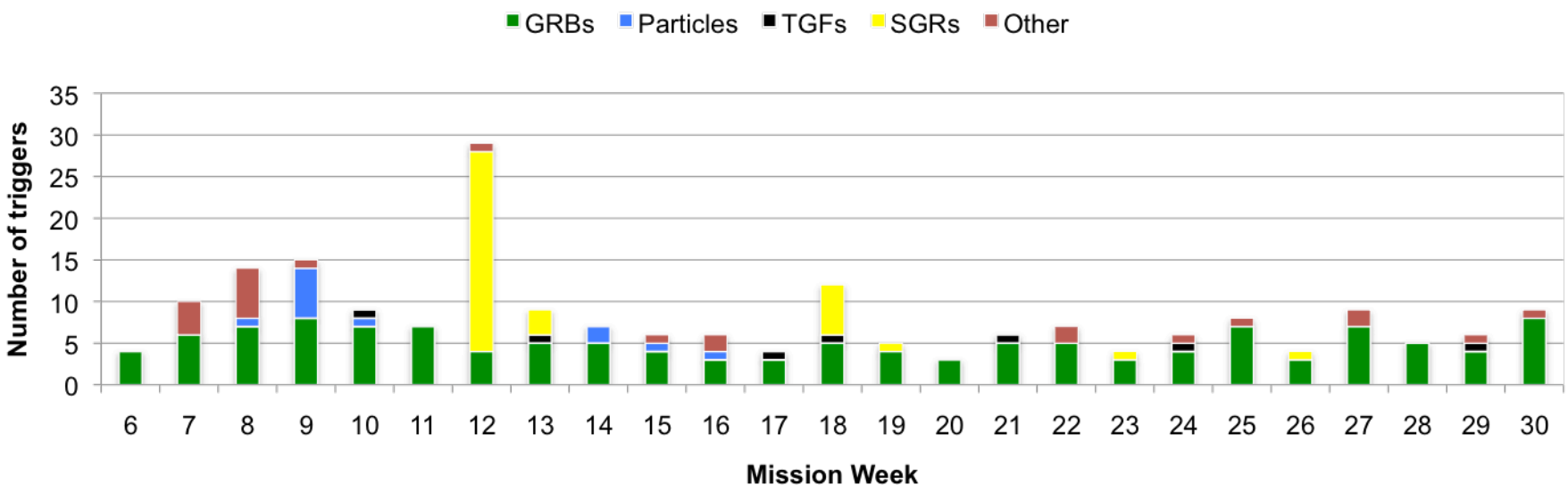
NASA Marshall Space Flight Center

Max-Planck-Institut für extraterrestrische Physik

Los Alamos NATIONAL LABORATORY

Charles Meegan (PI)
Jochen Greiner (Co-PI)

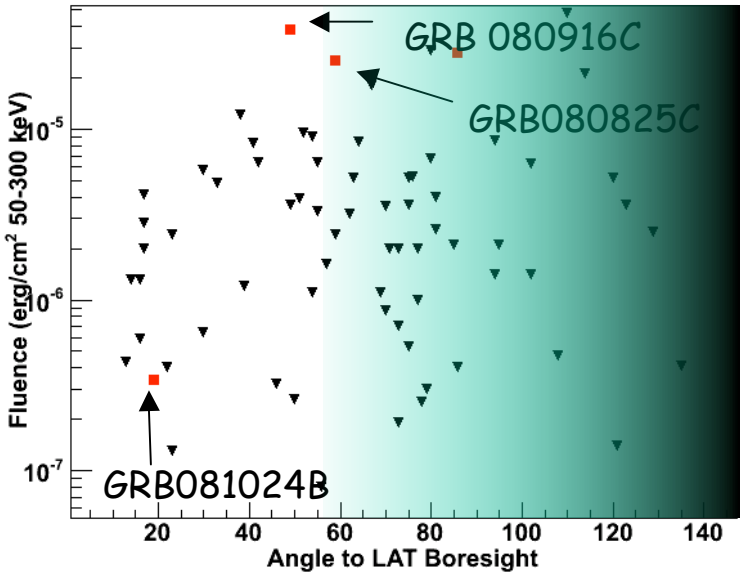
GBM Trigger Rate (weekly)



Now have 129 GBM detected GRBs, two SGRs (SGR 0501+4516, SGR 1806-20), one AXP (AXP 1E1547.0-5408), over 5 TGFs

39

Summary: Gamma-ray Bursts Thus Far



- **Four LAT detections:**
  - **GRB080825C**
    [GCN 8183 – Bouvier, A. et al., GCN 8141, 8184 – van der Horst, A. et al.]
    - **More than 10 events above 100 MeV**
  - **GRB080916C**
    - **[GCN 8246 – Tajima, H. et al., GCN 8245, 8278 – Goldstein, A. et al.]**
    - **More than 10 events above 1 GeV and more than 140 events above 100 MeV (used for spectral analysis) E_{iso} =8.3x10^{54} ergs!**
  - **GRB081024B**
    - **[GCN 8407 – Omodei, N. et al., GCN 8408– Connaughton, V. et al.]**
    - **First short GRB with >1 GeV emission**
  - **GRB081215A**
    - **[GCN 8684 – McEnery, J. et al., GCN 8678– Preece, R. et al.]**
    - **At 86 deg to LAT boresight, LAT excess seen in raw count rates**

Big Questions From EGRET Era

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  - necessary clue to magnetic field configurations and dynamics
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  - most of the EGRET source identifications are a mystery
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  - **extragalactic: populations**
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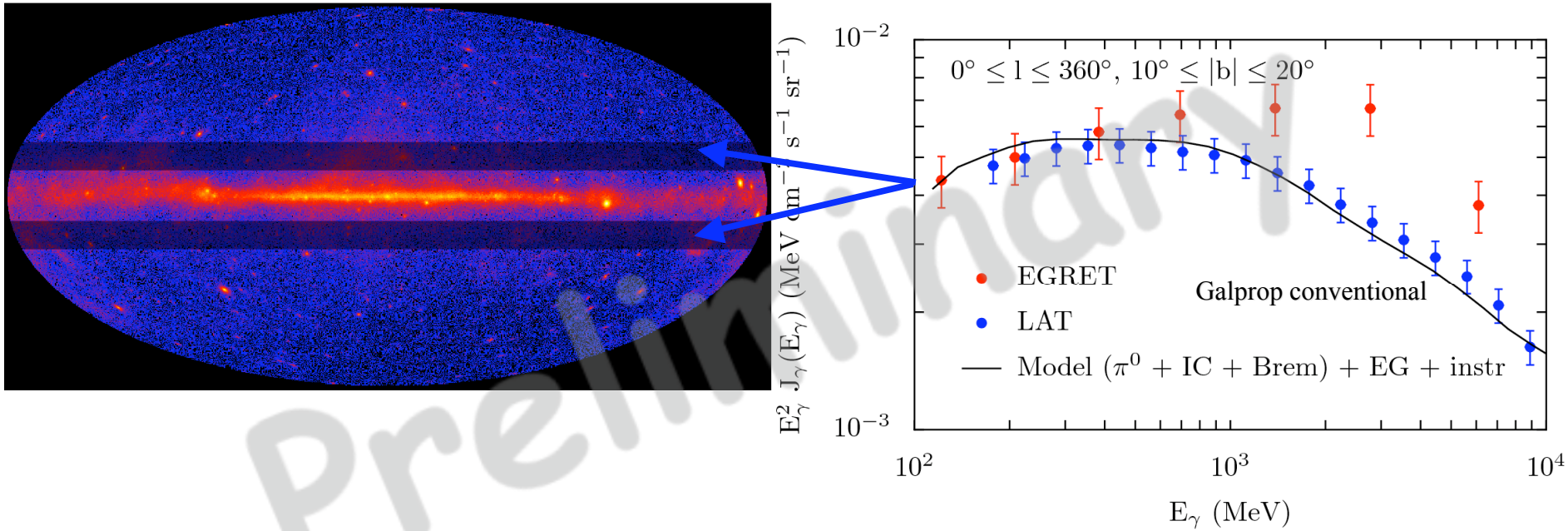
  - EGRET showed us the tip of the iceberg. New sources and probes for new physics.

Diffuse Emission, Nailing the EGRET "GeV Excess"



- Spectra shown for mid-latitude range → GeV excess in this region of the sky is not confirmed.
- Sources are not subtracted but are a minor component.
- LAT errors are dominated by systematic uncertainties and are currently estimated to be ~10% → this is preliminary.
- EGRET data is prepared as in Strong, et al. 2004 with a 15% systematic error assumed to dominate (Esposito, et al. 1999).
- EG + instrumental is assumed to be isotropic and determined from fitting the data at $|b| > 10°$.

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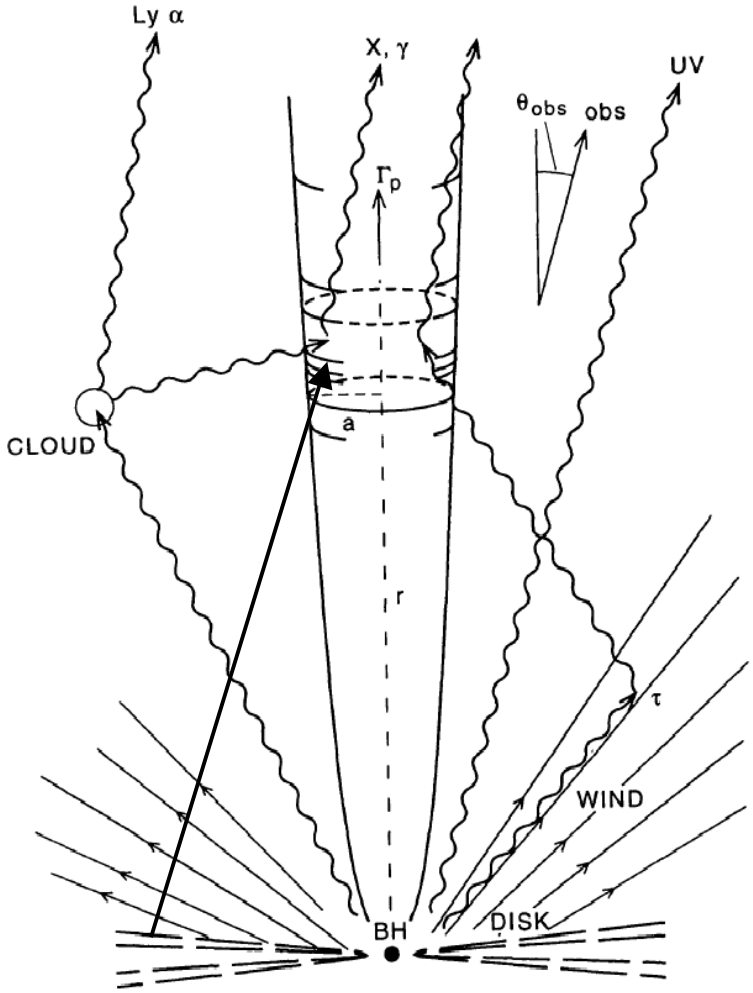
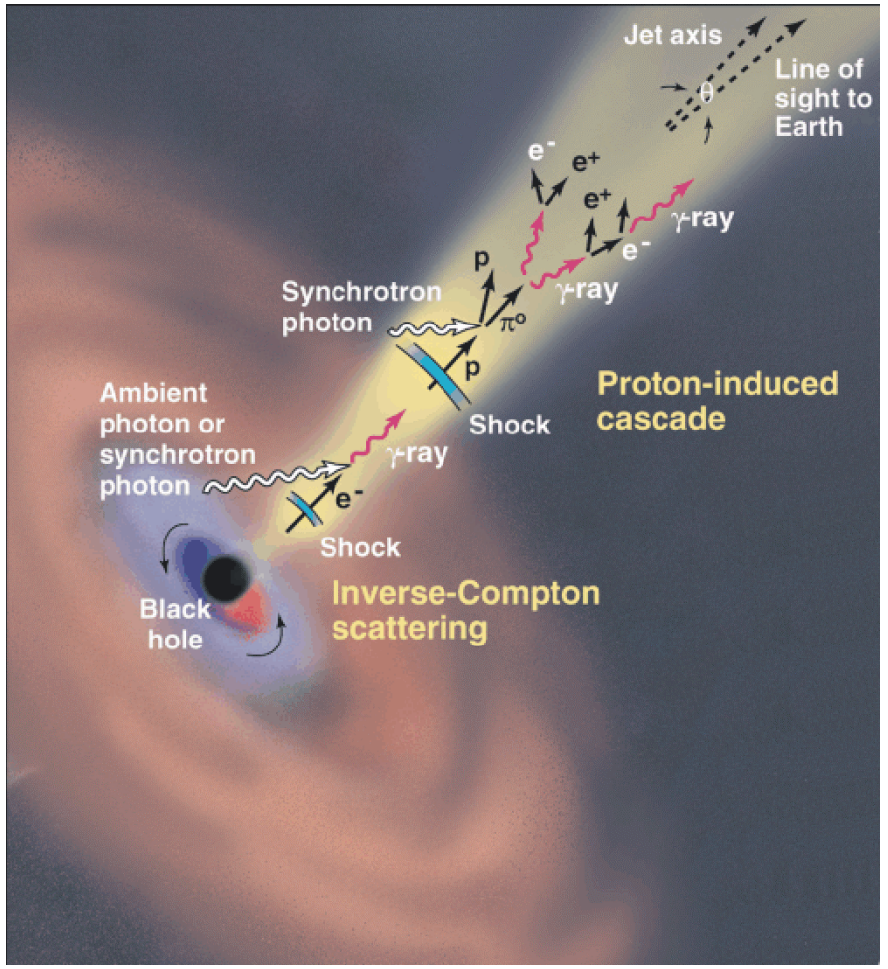
Models of AGN Gamma-ray Production



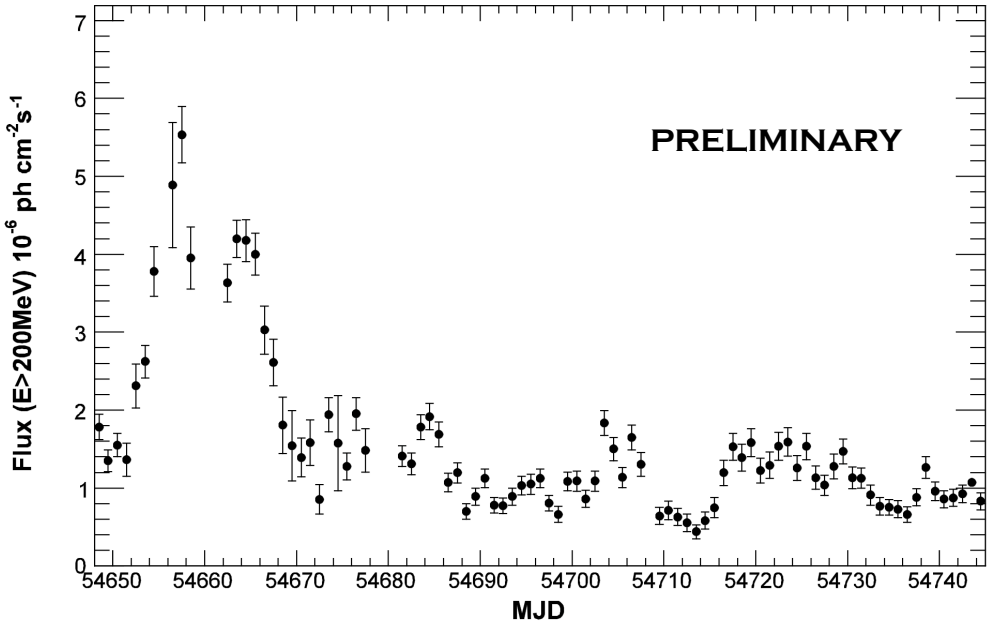
(from Sikora, Begelman, and Rees (1994))



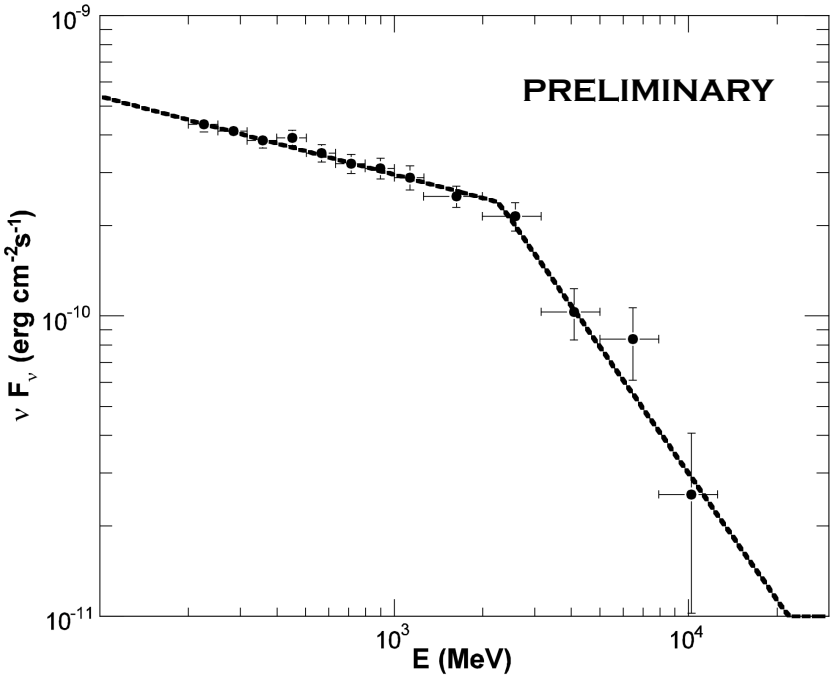
(credit:J. Buckley)

3C454.3 with LAT

- Well-known radio source, identified with an OVV quasar at z = 0.859; also detected by EGRET, AGILE

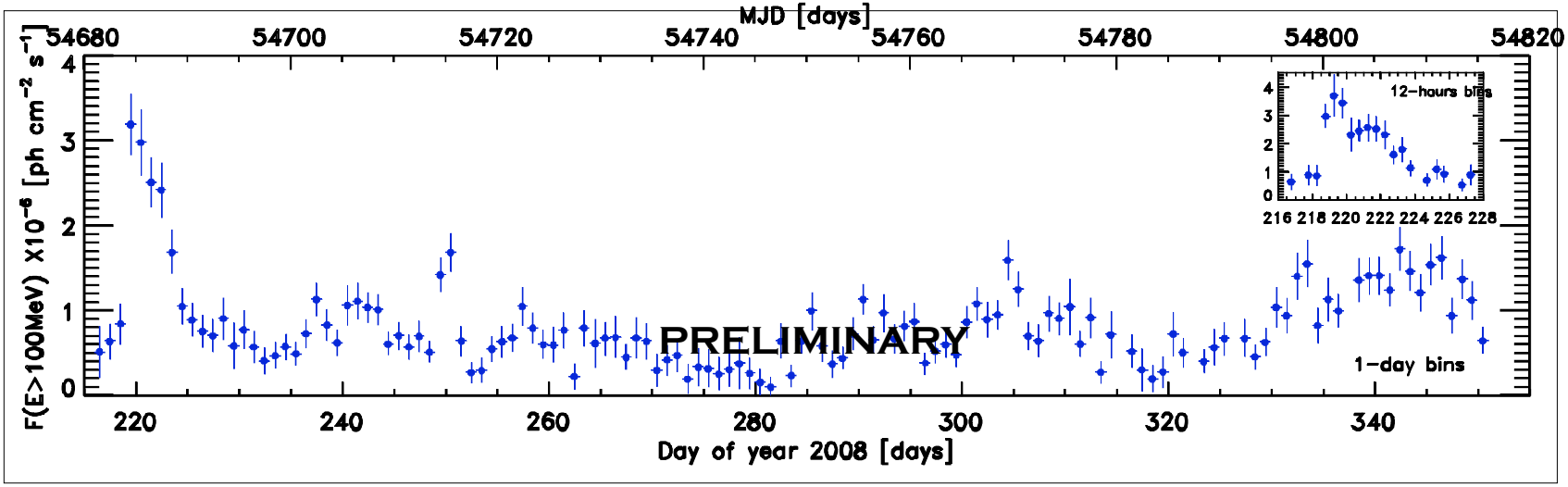


- Not a simple power law
  - Can describe as a broken power law with a break, Γ_1 ~ 2.3 to Γ_2 ~3.5 at E_{br} ~ 2 GeV
- Origin of the break?

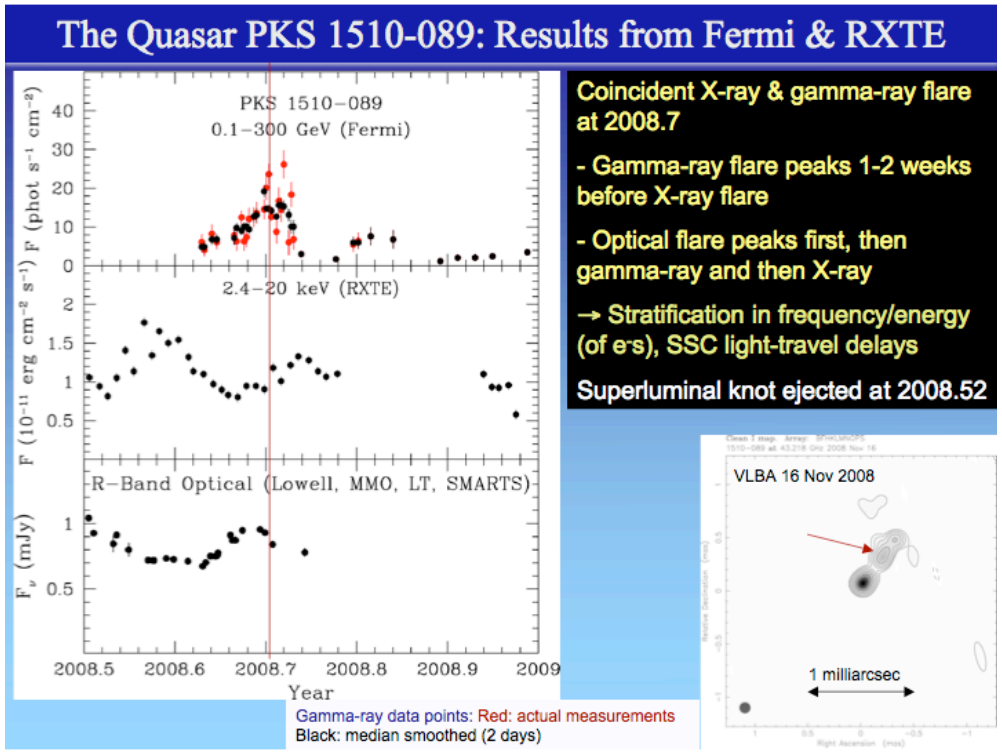


PKS 1502+106

- z=1.84 (SDSS)
- Extremely rapid flare
- Not initially on the LAT Monitored Source list



Guest Investigator AGN Studies



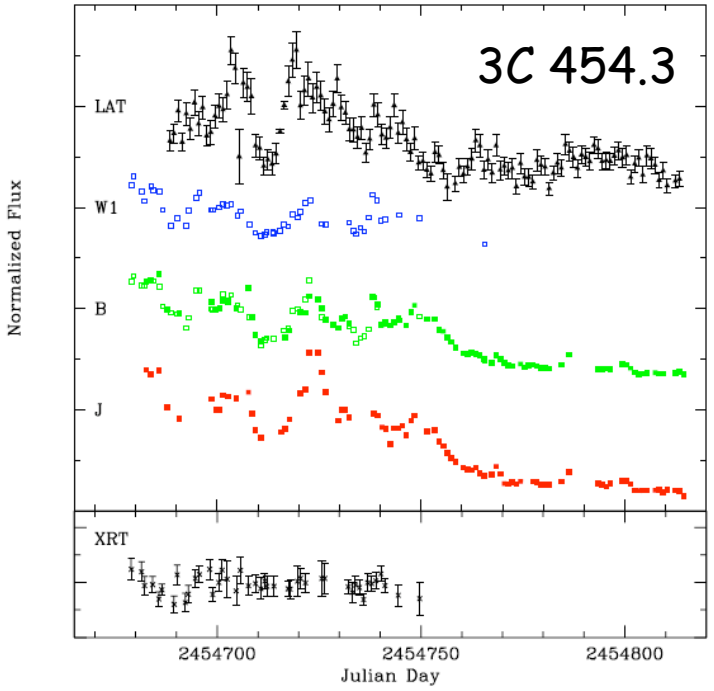


FIG. 1.— Multi-wavelength light curves of 3C 454.3 at (*top panel*) gamma-ray (0.1–300 GeV), UV (W1), optical (B), and IR (J) wavelengths from Fermi LAT, Swift UVOT, and SMARTS. Fluxes have been normalized to JD 2454700. Light curves are offset for clarity; minor tick spacing corresponds to 50% change. Fluxes at JD 2454700 are 2.83×10^{-6} cts s^{-1} at 0.1–300 GeV, 1.64×10^{-11} erg s^{-1} cm^{-2} in W1, 2.21×10^{-11} erg s^{-1} cm^{-2} in B, and 3.62×10^{-11} erg s^{-1} cm^{-2} in J. (*Bottom panel*) Swift XRT 2-10 keV light curve, normalized to flux at JD 2454700 (2.90×10^{-11} erg s^{-1} cm^{-2}). The IR/optical/UV variations are well correlated with the gamma-ray variations, with a lag of $\lesssim 1$ day, while the (minimal) X-ray variability is uncorrelated. The variability has much higher amplitude in the J-band than in B, which can be explained if there is an relatively constant blue component, as expected for an accretion disk. At z=0.859, Balmer continuum from an accretion disk, as well as Fe II and Mg II emission lines would be redshifted into the B and V bands; Hα is shifted into the J band.

Marscher et al, this meeting

Demonstrates the value of multiwavelength observations with Fermi data

Bonning et al arXiv:0812.4582v1

…also Jorstad et al poster.

LAT First Year Source Monitoring List

http://fermi.gsfc.nasa.gov/ssc/data/policy/LAT_Monitored_Sources.html

Light curves (daily and weekly integrations) in energy bands.

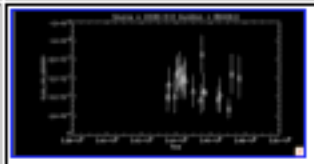
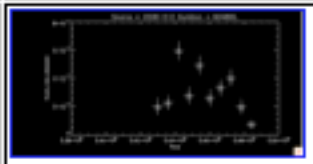
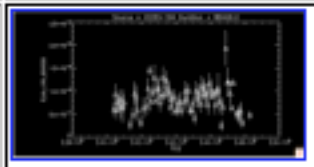
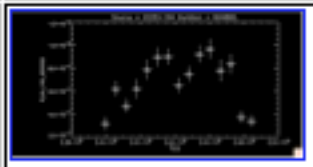
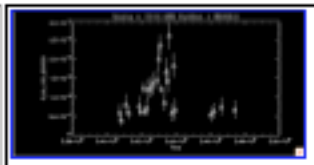
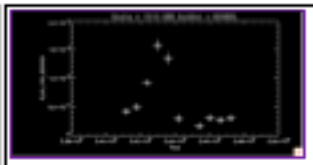
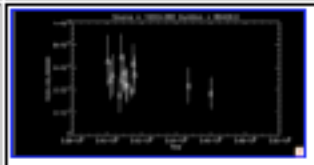
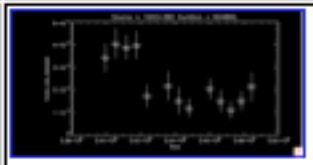
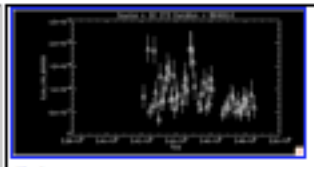
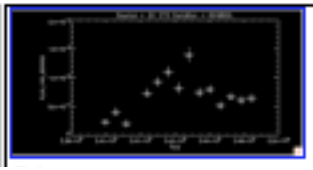
PLUS, same for any source flaring above 2e-6 ph/cm^2/s until the flux drops below 2e-7 ph/cm^2/s (two additional sources thus far: PKS 1454 and PKS 1502)

A "quicklook" analysis to get the results out as soon as possible. Tables may be updated as analysis and calibrations improve.

Source Type	Source Name	EGRET Name	Average or Min. Flux (10^{-8} γ $cm^{-2}s^{-1}$)	Galactic Lattitude	Redshift	TeV Source
Blazar	0208-512	3EGJ0210-5055	85.5 ± 4.5	-61.9	1.003	
	0235+164	3EGJ0237+1635	65.1 ± 8.8	-39.1	0.94	
	PKS 0528+134	3EGJ0530+1323	93.5 ± 3.6	-11.1	2.060	
	PKS 0716+714	3EGJ0721+7120	17.8 ± 2.0	28	0.3	
	0827+243	3EGJ0829+2413	24.9 ± 3.9	31.7	0.939	
	OJ 287	3EGJ0853+1941	10.6 ± 3.0	35.8	0.306	
	Mrk 421	3EGJ1104+3809	13.9 ± 1.8	65.0	0.031	Yes
	W Com 1219+285	3EGJ1222+2841	11.5 ± 1.8	83.5	0.102	
	3C 273	3EGJ1229+0210	15.4 ± 1.8	64.5	0.158	
	3C 279	3EGJ1255-0549	74.2 ± 2.8	57.0	0.538	
	1406-076	3EGJ1409-0745	27.4 ± 2.8	50.3	1.494	
	H 1426+428	NA		64.9	0.129	Yes
	1510-089	3EGJ1512-0849	18.0 ± 3.8	40.1	0.36	
	PKS 1622-297	3EGJ1625-2955	47.4 ± 3.7	13.4	0.815	
	1633+383	3EGJ1635+3813	58.4 ± 5.2	42.3	1.814	
	Mrk 501	NA		38.9	0.033	Yes
	1730-130 NRAO 530	3EGJ1733-1313	36.1 ± 3.4	10.6	0.902	
	1ES 1959+650	NA		17.7	0.048	Yes
	PKS 2155-304	3EG2158-3023	13.2 ± 3.2	-52.2	0.116	Yes
	BL_Lacertae (2200+420)	3EGJ2202+4217	39.9 ± 11.6	-10.4	0.069	Yes
	3C 454.3	3EGJ2254+1601	53.7 ± 4.0	-38.3	0.859	
	1ES 2344+514	NA		-9.9	0.044	Yes
HMXB	LSI+61 303 2CG135+01	3EGJ0241+6103	69.3 ± 6.1	1.0		Yes

Sample Monitored Source Lightcurves

- Proposals
- Data
- HEASARC
- Help

Source	RA	Dec	Daily	Weekly
0208-512	32.6930	-51.0170	 (lc)	 (lc)
0235+164	39.6620	16.6160	 (lc)	 (lc)
1510-089	228.170	-8.83000	 (lc)	 (lc)
1633+382	248.815	38.1350	 (lc)	 (lc)
3C 273	187.278	2.05200		

also releasing
GRB data

and planned Observatory
position and attitude

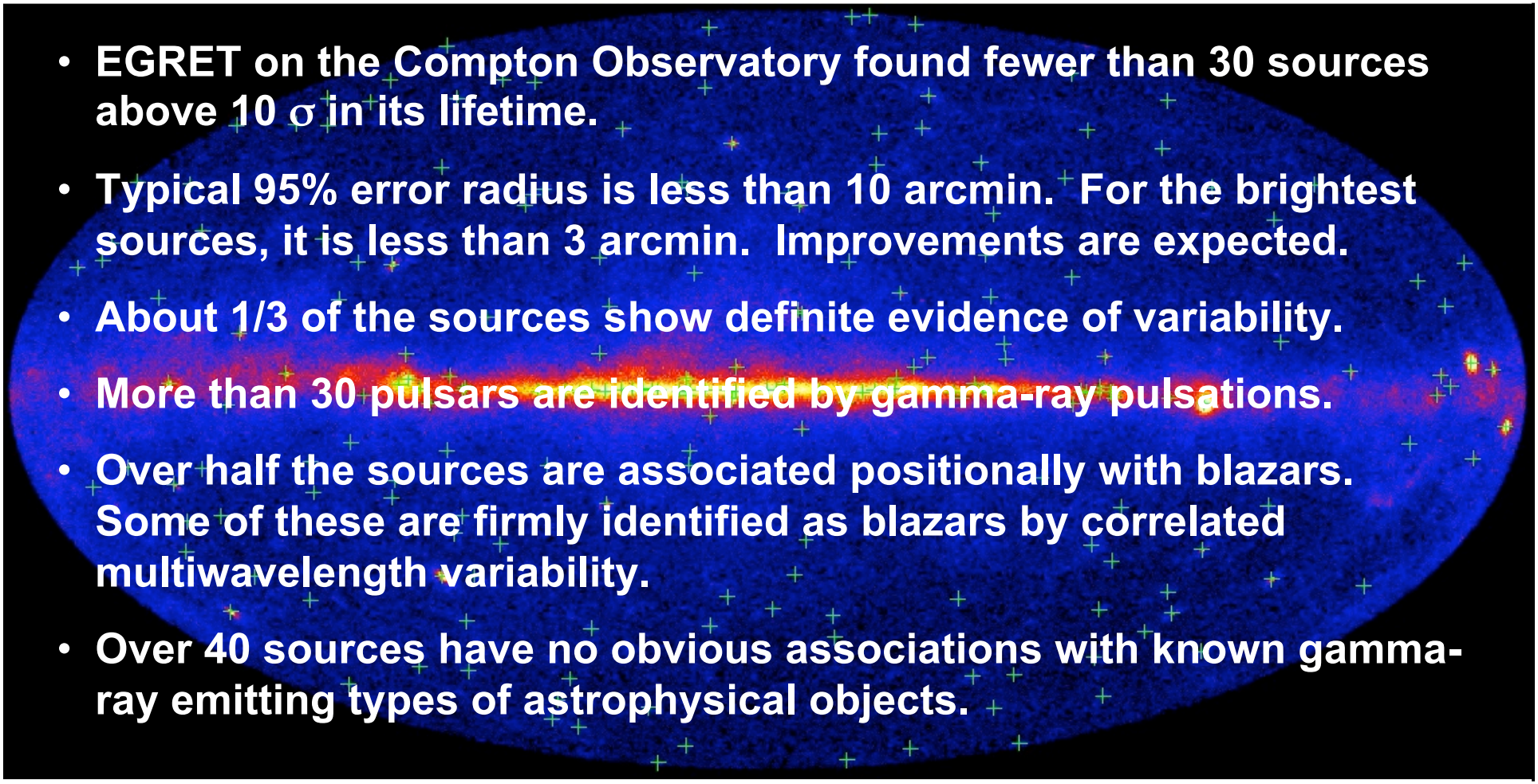
Plans for the LAT Bright Source List

- Releasing information about the brightest sources early has two principal goals:
  1. Provide opportunities for multiwavelength studies of these sources;
  2. Facilitate proposals for the second cycle of Fermi Guest Investigator proposals, due on March 6.
- The target release date for the bright source list is February 6.
  - **Source location and simple error radius (RA/DEC, L/B)**
  - **Flux and statistical error (F>100 MeV)**
  - **Test statistic/significance (with point source hypothesis)**
  - **Hardness ratio**
  - **Source associations where possible (including sources released as flaring objects)**
  - **Overall systematic error (in flux measurement)**
- First step toward the first LAT catalog, due in the late summer 2009.

Constructing the LAT Bright Source List

- First three months of all-sky scanning data, Aug. - Oct. 2008.
- Maximum likelihood analysis.
  - source significance, fluxes in two energy bands, locations, and variability information, all of which will be included in the list.
- Only sources with confidence level greater than 10σ
- **The resulting bright source list is not a catalog:**
  - Not complete - many more sources at lower significance
  - Not flux limited - cut is on confidence level
  - Not uniform - sources near the Galactic plane must be brighter because of the strong diffuse background.

205 Preliminary LAT Brightest Sources

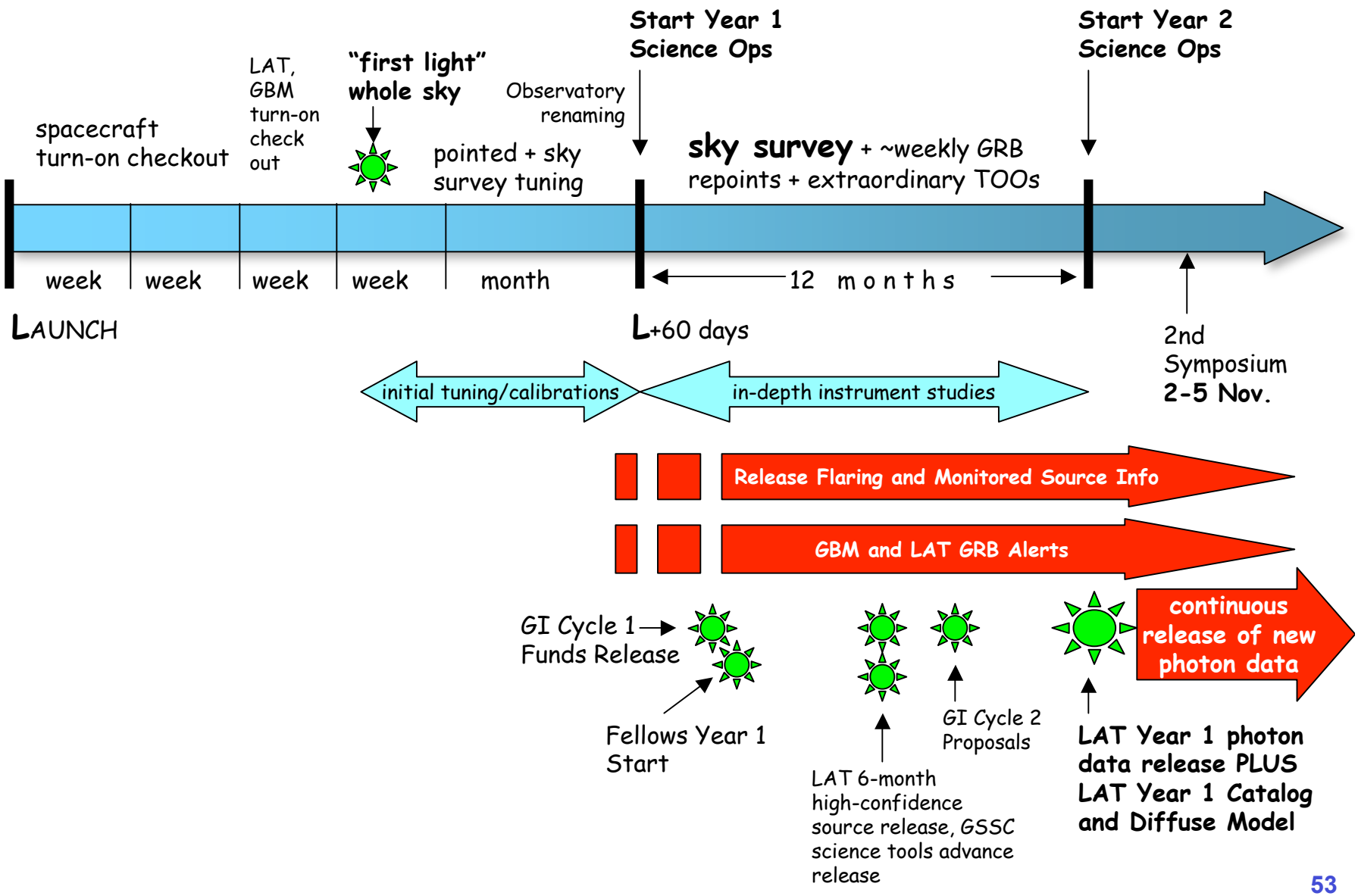


- EGRET on the Compton Observatory found fewer than 30 sources above 10 σ in its lifetime.
- Typical 95% error radius is less than 10 arcmin. For the brightest sources, it is less than 3 arcmin. Improvements are expected.
- About 1/3 of the sources show definite evidence of variability.
- More than 30 pulsars are identified by gamma-ray pulsations.
- Over half the sources are associated positionally with blazars. Some of these are firmly identified as blazars by correlated multiwavelength variability.
- Over 40 sources have no obvious associations with known gamma-ray emitting types of astrophysical objects.

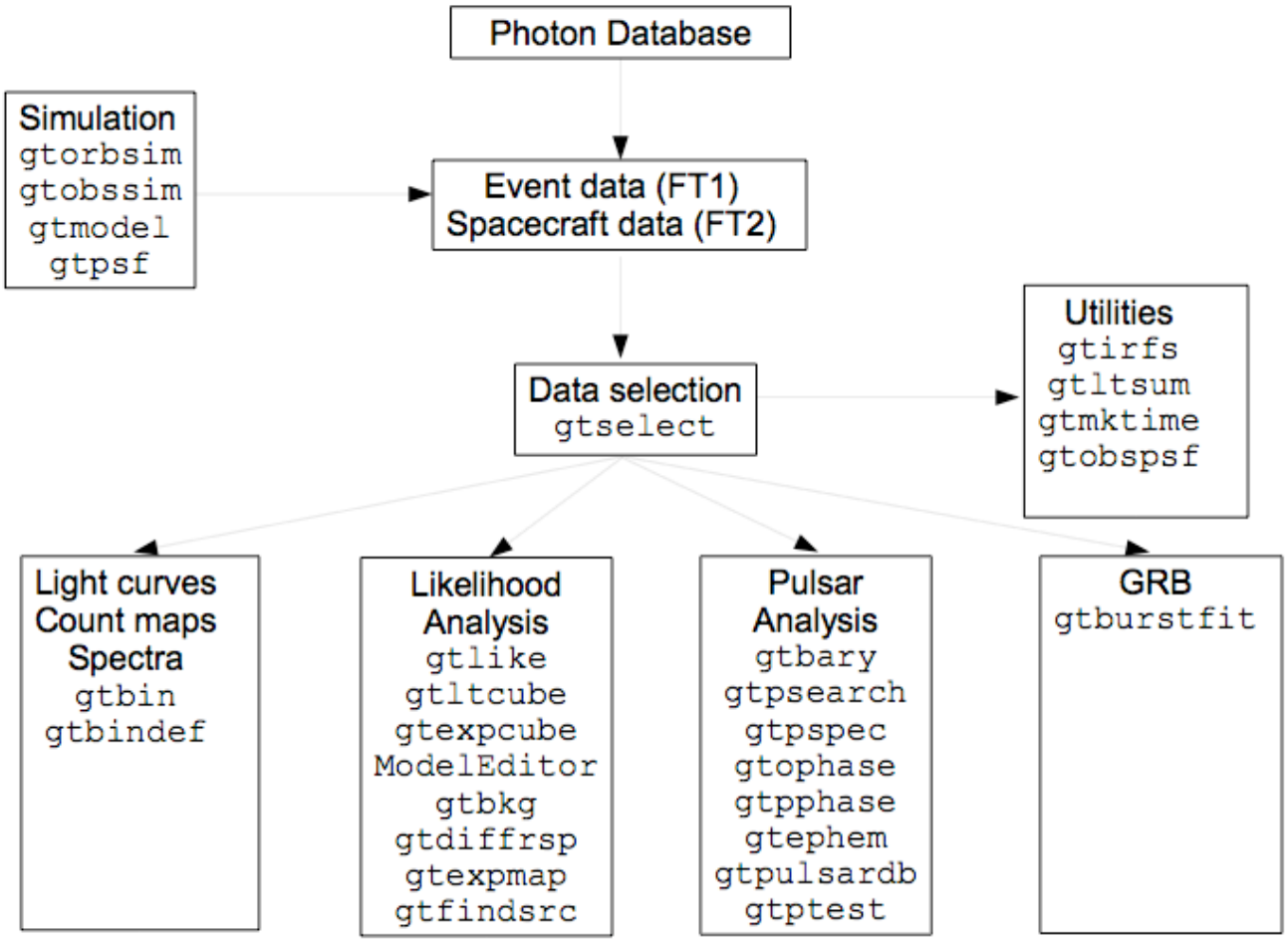
Crosses mark source locations, in Galactic coordinates.

A list, not a catalog!

Year 1 Science Operations Timeline Overview



Tools With the Photon Data



Users Group Members

- Josh Grindlay (Chair)
- Matthew Baring
- Mitch Begelman
- Pat Slane
- Buell Januzzi
- Don Kniffen
- Henric Krawczynski
- Reshmi Mukherjee
- Luigi Piro
- Scott Ransom
- Alicia Soderberg
- Jim Ulvestad
- Alan Marscher (incoming Chair)

Plus

- David Band
- Neil Gehrels
- Ilana Harrus
- Julie McEnery
- Chip Meegan
- Peter Michelson
- Steve Ritz
- Chris Shrader
- Dave Thompson
- Kathy Turner
- Lynn Cominsky

http://fermi.gsfc.nasa.gov/ssc/resources/fug/

Guest Investigator Cycle 2

Guest Investigator Cycle 2 proposals DUE March 6, 2009
See *http://fermi.gsfc.nasa.gov/ssc/proposals/cycle2/*

- **expect to fund ~75 regular and up to 8 large projects:**
  - **detailed analyses of LAT photon candidate events**
  - **analyses of monitored sources and summary data**
  - **Fermi-related MW observations**
    - **In addition, NRAO and NOAO MOUs provide joint observing time through the regular Fermi GI program. See FSSC site.**
  - **Fermi-related theory**
  - **Fermi-relevant data analysis methodology**

Summary: Results at AAS

- **Galactic Sources**
  - Vela (345.02), CTA 1 (345.03), J2021 (345.04), J1028 (345.06)
  - radio-quiet (blind) pulsar searches (612.02)
  - millisecond pulsars (345.05)
  - xrbs (468.11), transients (612.04)
- **AGN**
  - Early blazar detections (355.01, 468.08) and monitoring (468.09)
  - Initial look at populations (355.03) and variability studies (468.10) (326.03) (446.07)
  - PKS 2155, TeV connection, (355.02)
- **Diffuse Emissions**
  - first look (355.06)
  - modeling galactic diffuse (355.07)
  - Unidentified contributions (355.04)
  - Orion and Monoceros (468.12)
- **Solar system sources (355.05)**
- **GRB (345.08, 345.09)**
- **The Bright Source List (345.01)**
- **Instrument/Observatory Performance/FSSC (468.02 to 468.07)**

Summary

- **Fermi is off to a great start!**
  - **instruments are beautiful. The gamma-ray sky is keeping its promise. Great cooperation across the international team.**
- **Already addressing many important questions from EGRET era**
  - **new analysis techniques and approaches are essential -- new topics!**
  - **the challenge of great discovery potential**

- **Charter Fermi Fellows:**
  - » **Nathaniel R. Butler (Berkeley)**
  - » **Vasiliki Pavlidou (Caltech)**
  - » **Uri Keshet (Harvard)**
  - **Now transitioning to Einstein Fellows program**

Sign up for newsletters:
http://fermi.gsfc.nasa.gov/ssc/resources/newsletter/

- **Guest Investigator Cycle 2 proposals DUE March 6, 2009**
  - **See *http://fermi.gsfc.nasa.gov/ssc/proposals/cycle2/***

- **November 2-5 2009 International Fermi Symposium in Washington, DC**

- **let us hear from you (helpdesk email on the FSSC site)**
- **Gamma-ray data are for you! JOIN THE FUN!!**