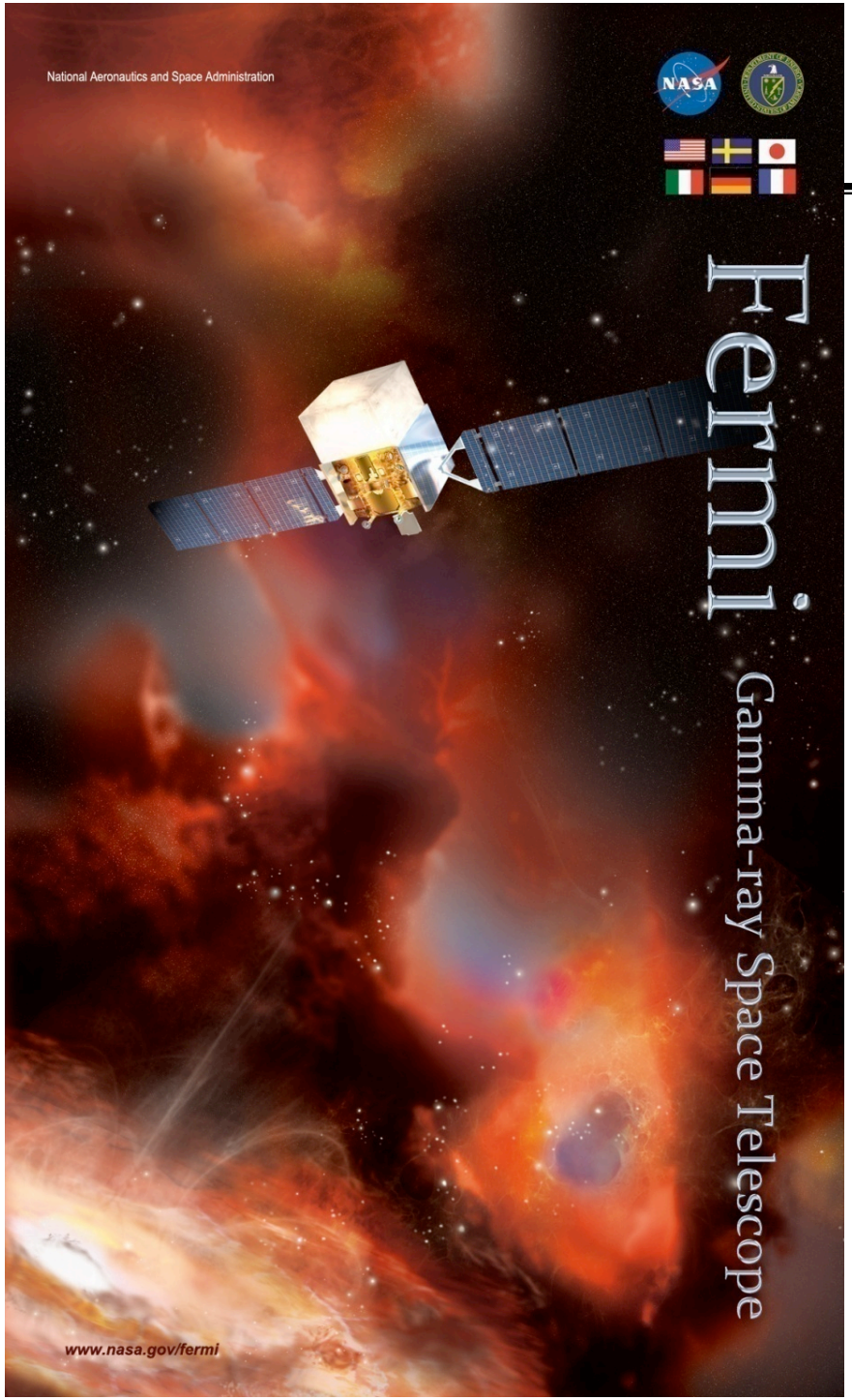


Fermi

Gamma-ray Space Telescope

Users Group Meeting
12 May 2010

Mission Status Update

J. McEnery, E. Hays

Status Highlights

- **Observatory is operating smoothly, FOT continues to look for ways to improve operations.**
  - **Solar eclipse predictions (last eclipse on Jan 15), implemented remote system for data redumps (very useful during recent snowstorm), other software updates**
  - **3 episodes of brief DAS (alerts) outages**
  - **battery management**
  - **FSW updates (LAT, GBM, spacecraft) for minor bug fixes, operations and science processing improvements**
  - **collision avoidance**
    - **Several planning exercises to test procedures and policies**
  - **continuously looking at robustness of fault management and opportunities for improvements**
  - **careful monitoring of all subsystems (including the reaction wheels)**
- **GI cycle 3 (see Chris's talk)**
- **Data analysis workshops (Chris/Liz)**
- **Press and outreach coordination and planning.**

Observations summary

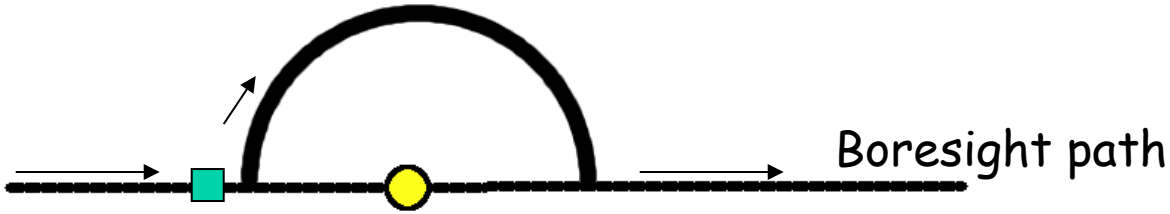
- Almost exclusively in nominal data taking in survey mode
  - 50 deg rocking angle from Sept 2, 2009
  - 45 deg rocking angle from April 29, 2010
- 15 ARRs (since 2009-05-10)
  - 5 hour pointed mode observations in response to bright GBM detected bursts.
- 1 ToO
  - 200 ks observation of 3C454.3 (V407 Cyg also in FoV)
- LAT Calibrations
  - none
- Anomalies/engineering
  - LAT processor reboot
    - ~9 hours of downtime, issue now resolved (bug in LAT FSW)
- Data recovery efficiency (do all the bytes reach the ground)
  - 1 packet lost on 09/321 -09:28:45 (out of ~1 billion packets since last October)

Upcoming Activities

- **GBM**
  - **(~<2 months) Modify config/FSW to collect extra TTE data over selected portions of the orbit (to enable sensitive ground searches for TGF.)**
- **LAT**
  - **(~<1 month) Update configuration of onboard GRB search.**
- **Observatory**
  - **(~ 1 month) Yaw steering algorithm modification (see next slide)**

Sun avoidance maneuver

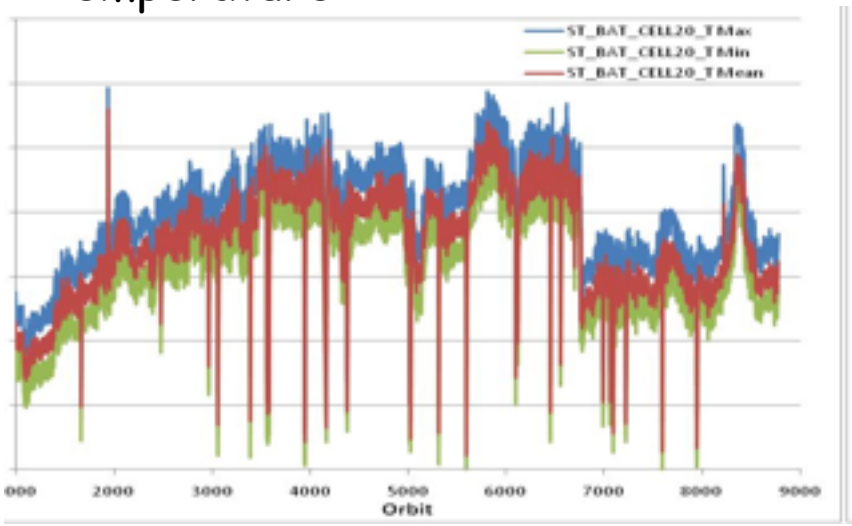
In sky survey mode the Sun is constantly moving w.r.t. the spacecraft frame. The Sun has to stay on the +X side of the observatory, so two times per orbit we rotate by 180 deg.



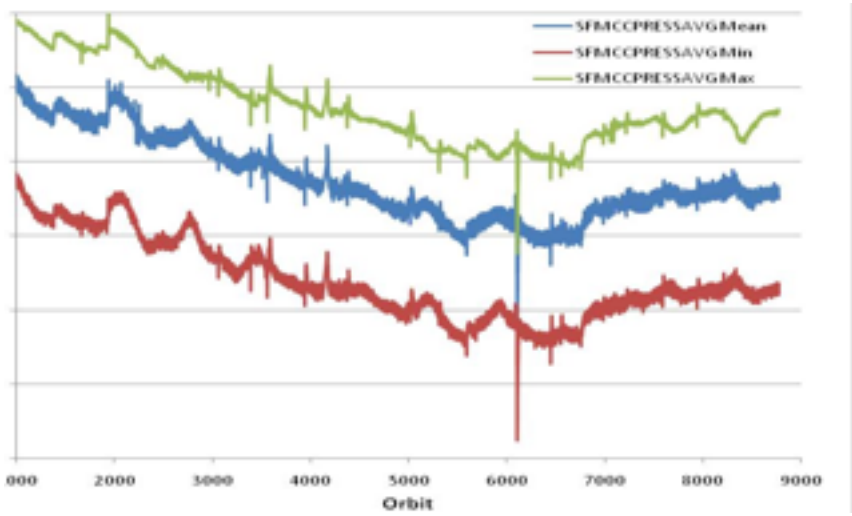
- **The required speed of the rotation depends on how close the Sun is to the Z-axis.**
  - **If the sun is directly on-axis, the rotation would need to be ~infinitely quick to satisfy the constraints on Sun on LAT radiators.**
    - **To address this we set a minimum angle between the Sun and the LAT boresight while performing the flip to keep the sun on the +X face.**
    - **However, there is another mode, which does not cause excursions and caps the slew rate to something manageable**
      - **The price is additional sun on the LAT radiator, but there are many advantages so we plan to implement this (as a trial) at the next sun avoidance season (June).**

Battery Status

Temperature

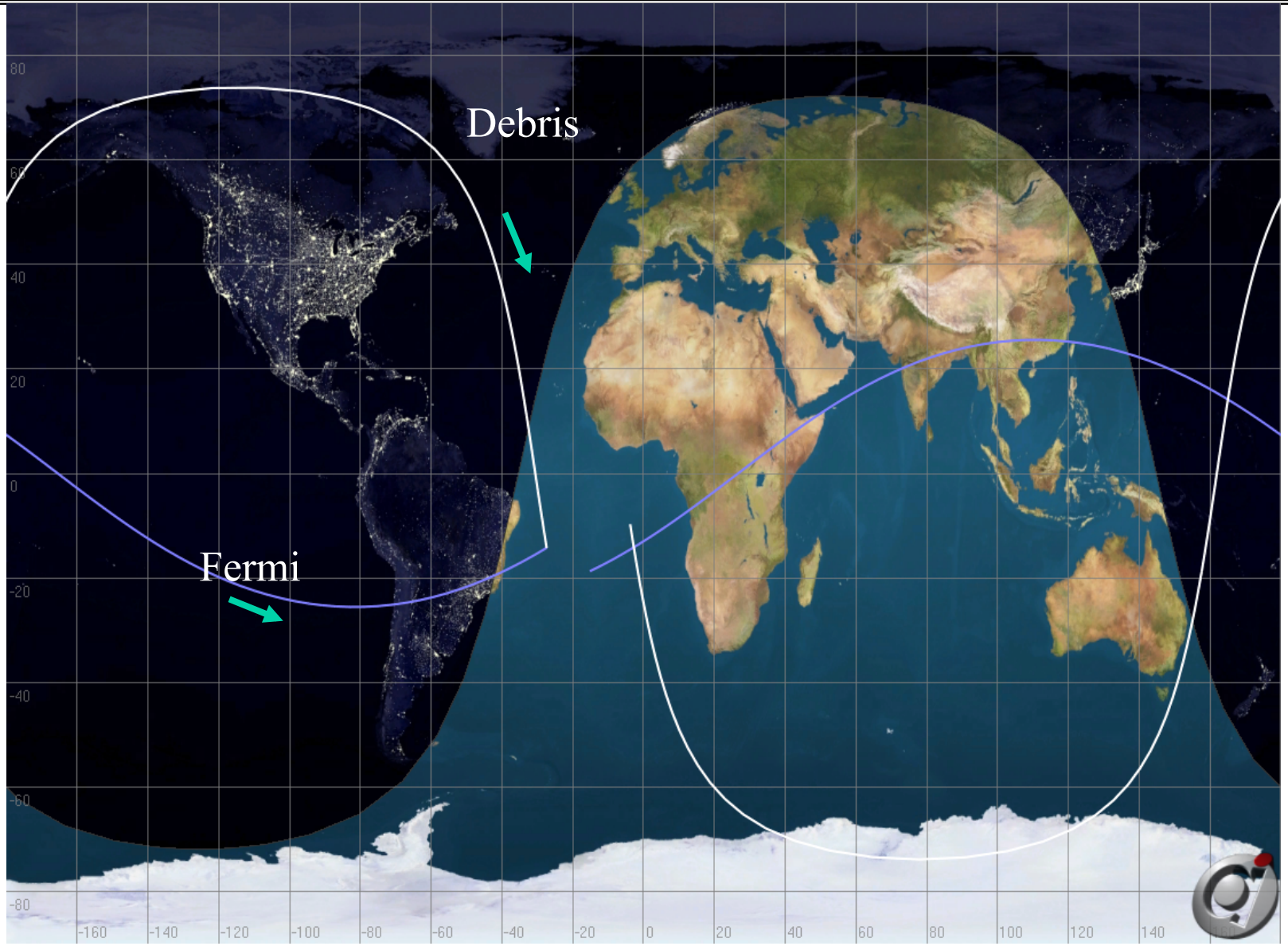


Pressure

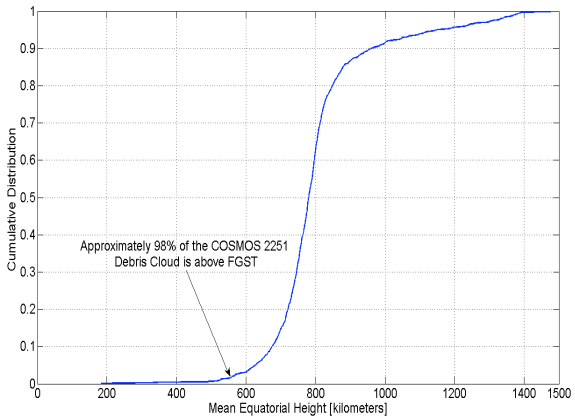


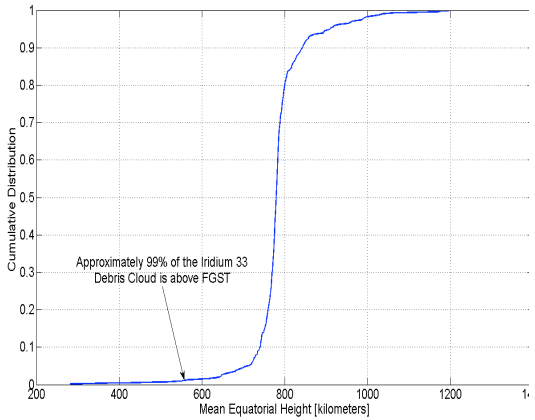
- **Move to 50 deg rocking angle on orbit 6760 was extremely successful!**
- **We are continuing to tweak charging parameters to verify that we are in a stable configuration.**
- **We switched to a 45 deg rocking profile to see if we can achieve stability at a slightly more scientifically beneficial survey profile.**

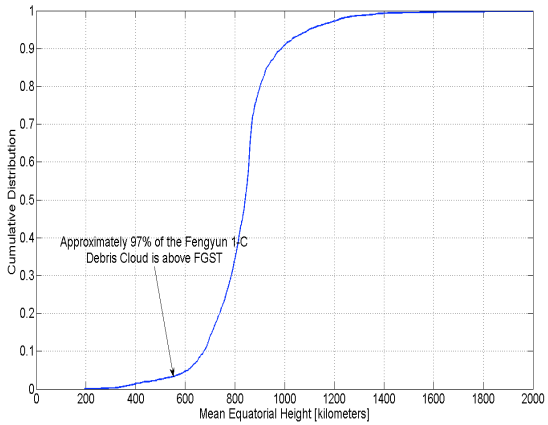
Conjunction assessment



Future plans for CA assessment



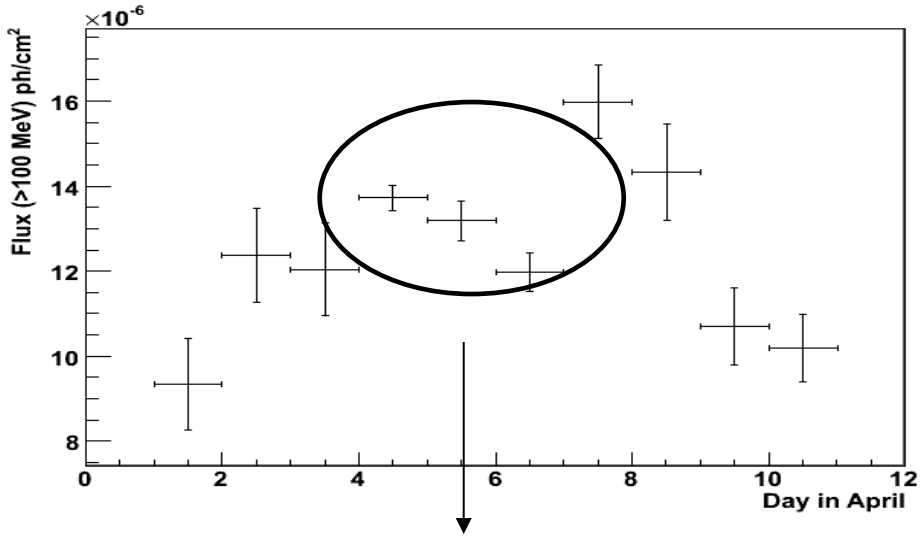




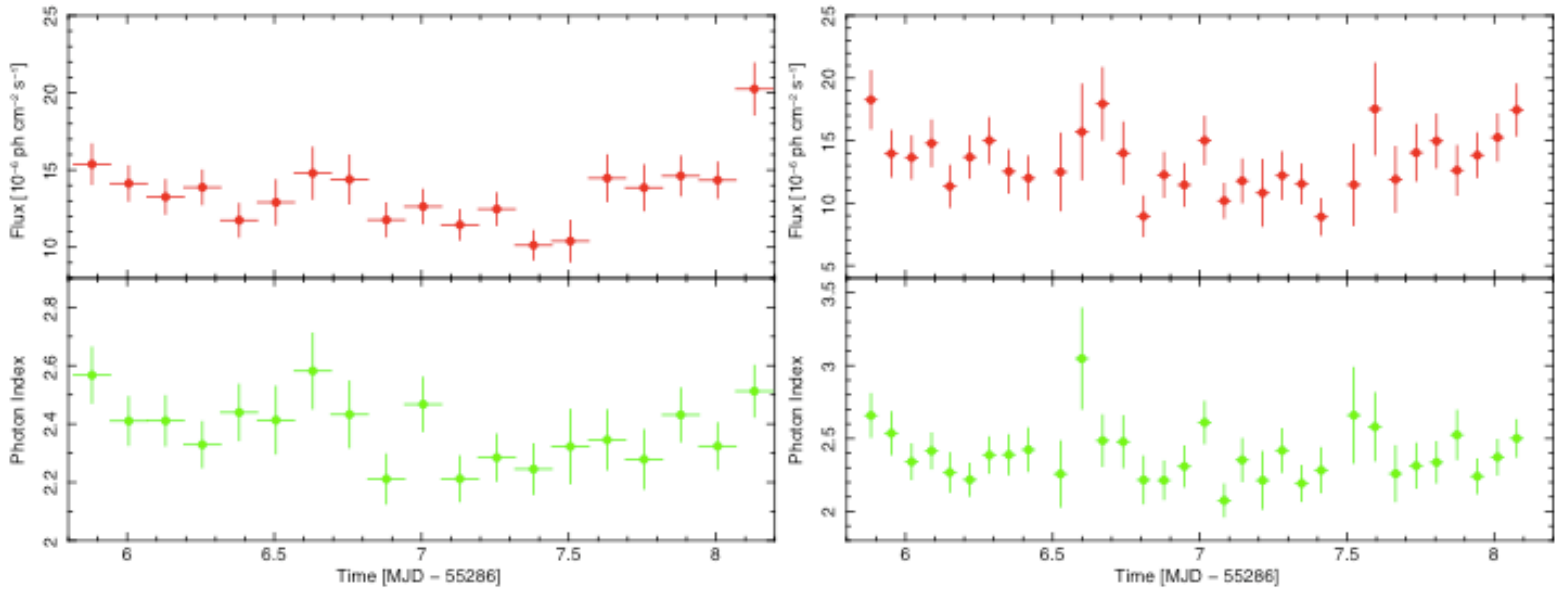
- **~20% of our current close approaches are from 3 new debris clouds, >97% of the debris still lies above us and will move to lower altitudes in the next few years**
- **Make an estimate of the evolution of 3 large debris clouds: Fenyun 1-C, Irridium 33 and COSMOS 2251.**
  - **Use this to come up with an estimate of the likelihood of needing to do a maneuver over the Fermi mission lifetime**

Pointed mode observations

2.5 day TOO on 3C454.3

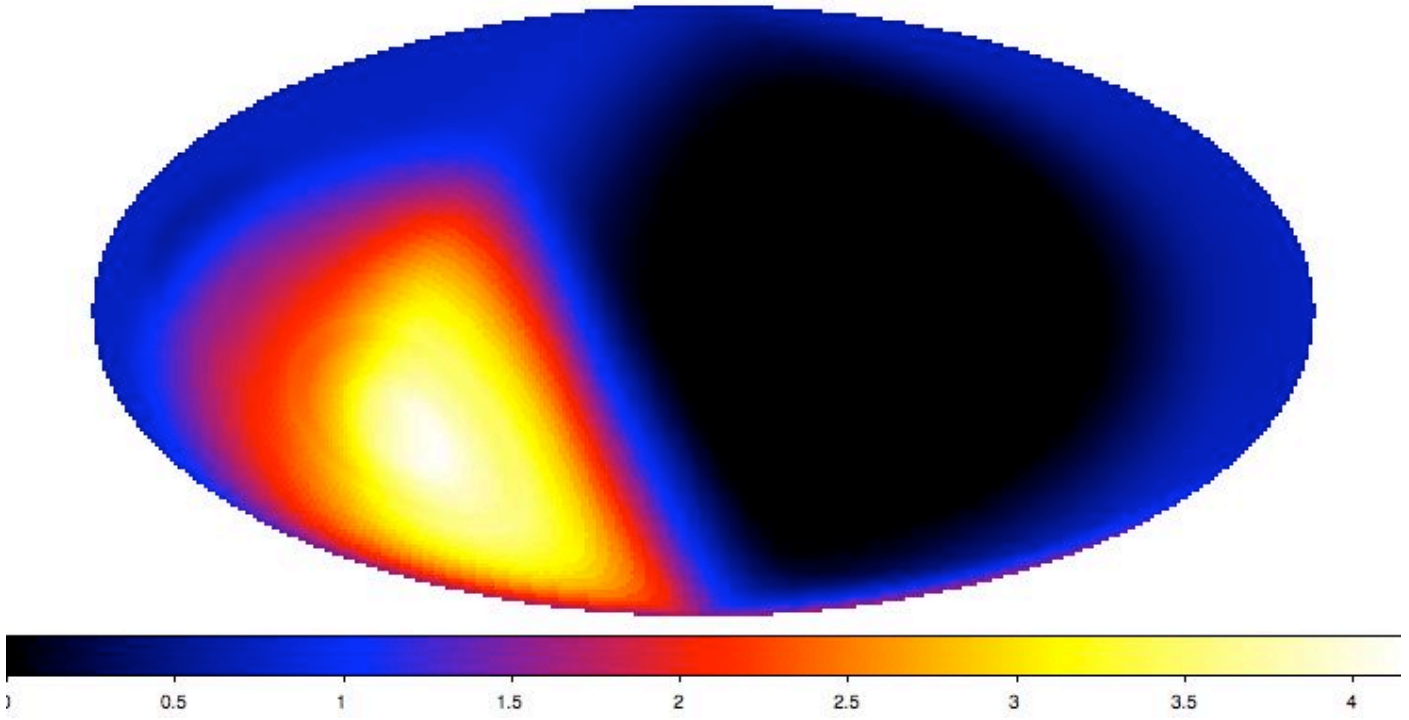


Allows production of lightcurves on <3 hour timescales (for very bright sources)



Foschini et al, 2010

Impact on rest of sky



- **Factor of ~4 exposure at 3C454.3, however large region with no exposure (including M87 which, was flaring at the time)**

Baseline plan for pointed observations

- All pointed mode observations
  - Offset pointing 10 deg towards Dec=0
    - Avoids potential on-axis systematic effects
    - Moves observation closer to orbit equator (minimizes amount of time that Earth limb is in FoV)
    - May choose to move 10 deg in a different direction if there are observations or targets of interest (listed in MW reporting page)
- Target of Opportunity
  - Limb following while target is occulted (I.e. take the shortest path around the Earth, 50 deg from limb)
- Planned observation
  - Sky survey - maximizes coverage of sky
- A guest investigator may wish to plan and propose a more highly tuned observation (perhaps to maximise coverage of multiple sources simultaneously).
  - We will accept and implement such proposals, but note that the software and responsibility to plan/evaluate these observations lies with the proposer.

Is this approach reasonable? Are there any additional considerations?

Fermi Gamma-ray Space Telescope

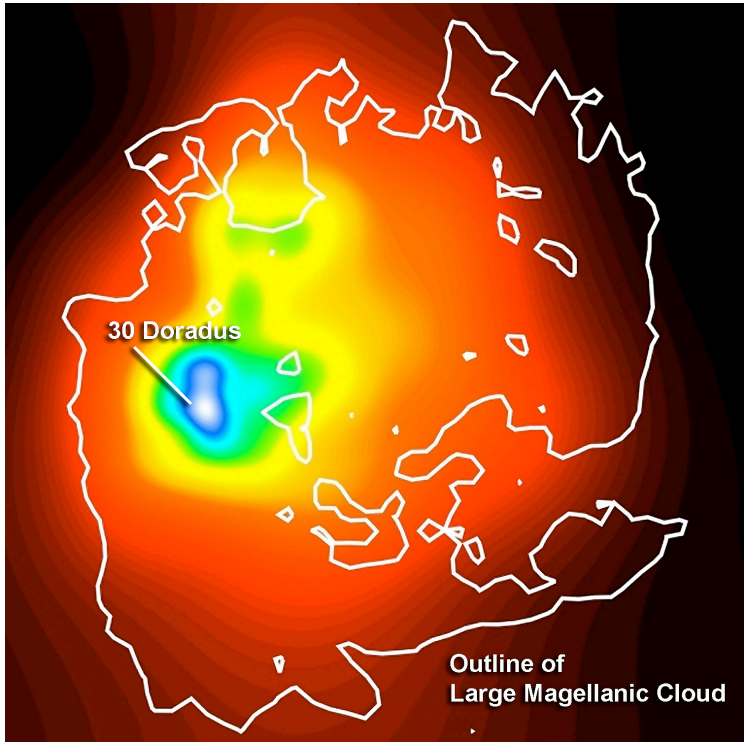
Questions?

Press/Web releases

- Starbursts and LMC
- Cygnus X3
- 3C454.3 flare
- ms pulsars
- Supernova remnants
- Extragalactic diffuse
- Cen A Lobes

Cosmic-Rays in other Galaxies

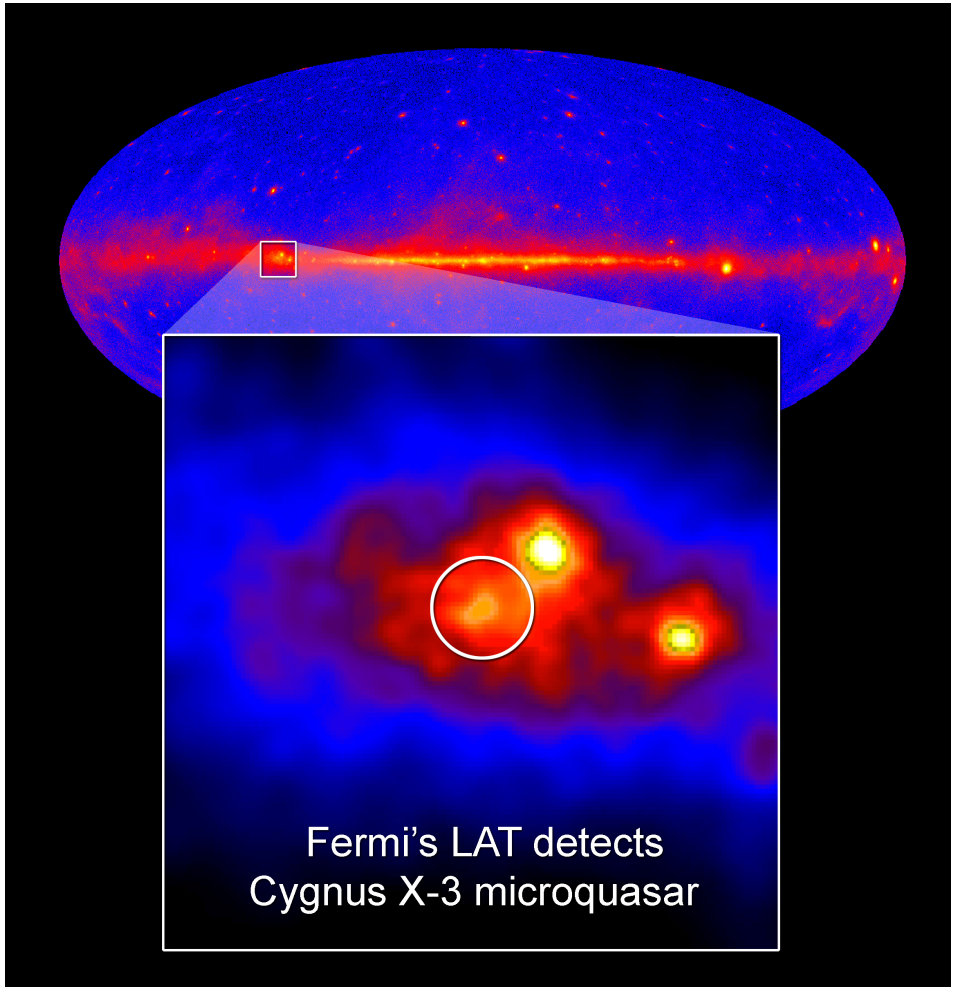
Large Magellenic Cloud



- **Gamma-rays produced from interactions between cosmic-rays and gas and starlight.**
- **LMC - Enhanced gamma-ray emission in the region of 30 Doradus - a star forming region.**
- **Also see the starburst galaxies M82 and NGC 253 with LAT**

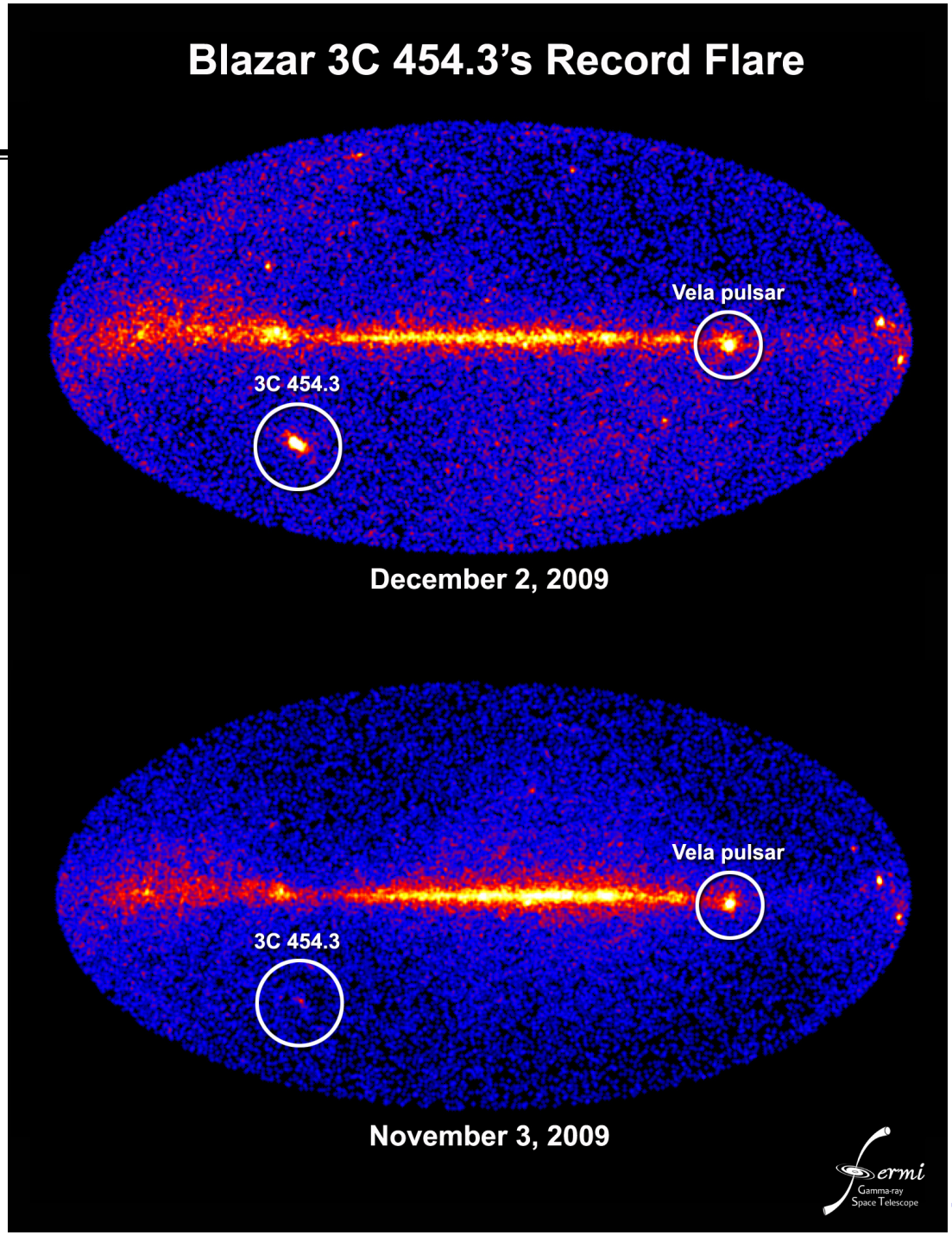
Cygnus-X3 - a long standing mystery

- **Detected orbital modulations in the gamma-ray signal from Cyg X3, nailing down the identification of this source.**

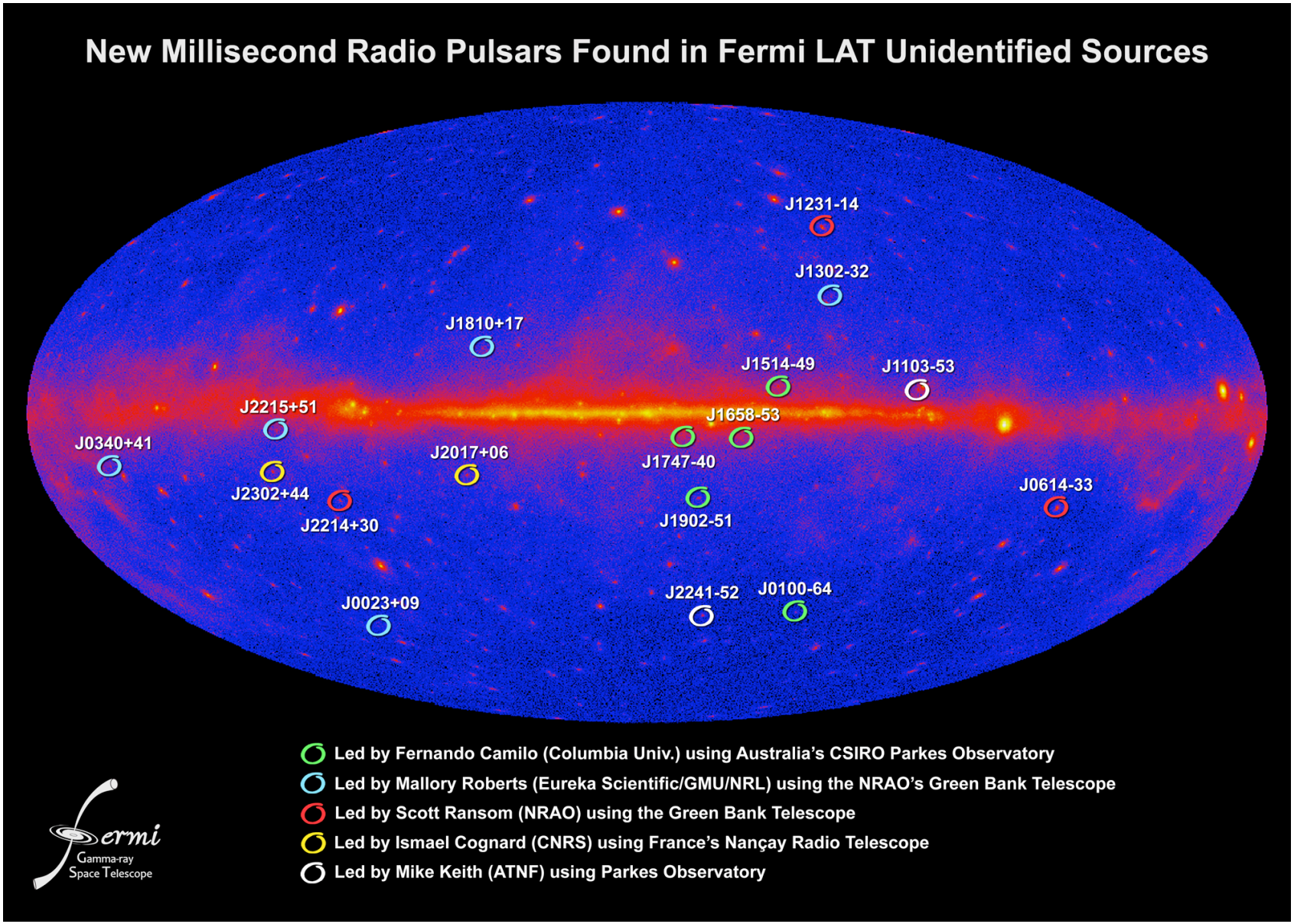


Blazar flare!

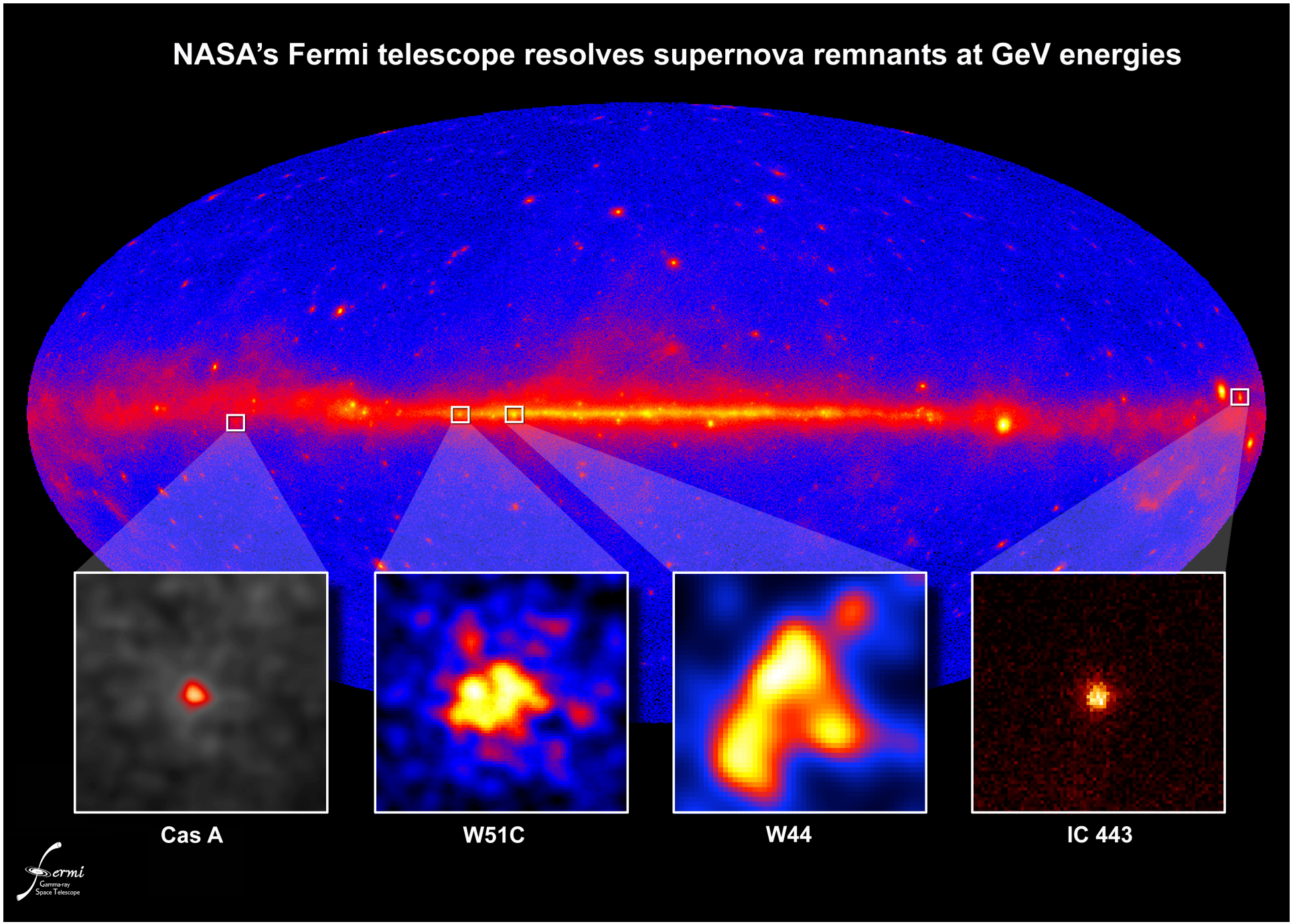
- 3C454.3
  - Became the brightest persistent source in the sky in early Dec.



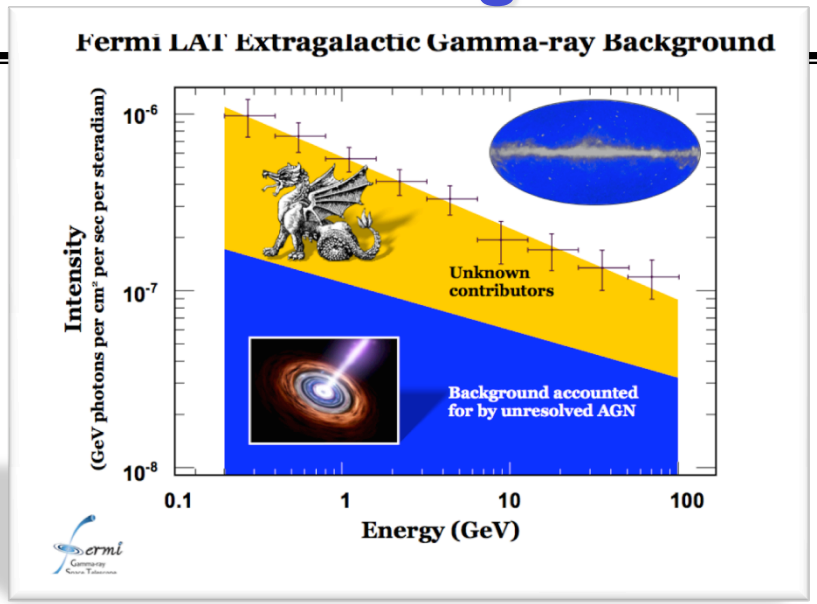
Millisecond pulsars and Fermi

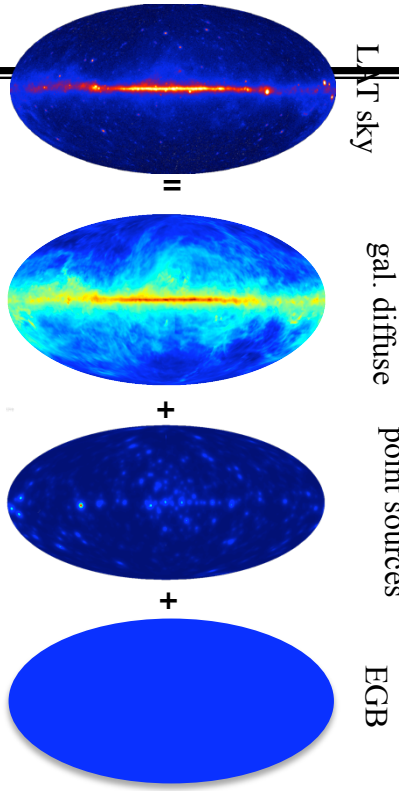


NASA's Fermi telescope resolves supernova remnants at GeV energies

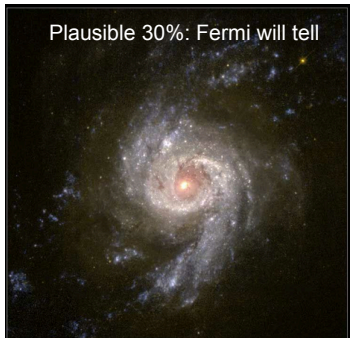


Extragalactic Diffuse

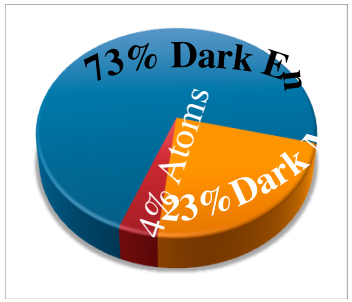




What could produce the remaining 70%?

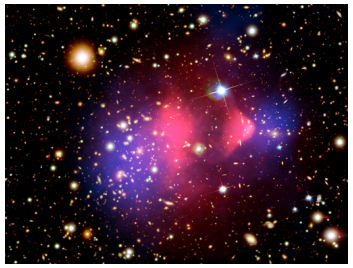


Emission from particles accelerated in supernovae explosions in star forming galaxies



Emission due to the annihilation of Cosmological Dark

Matter

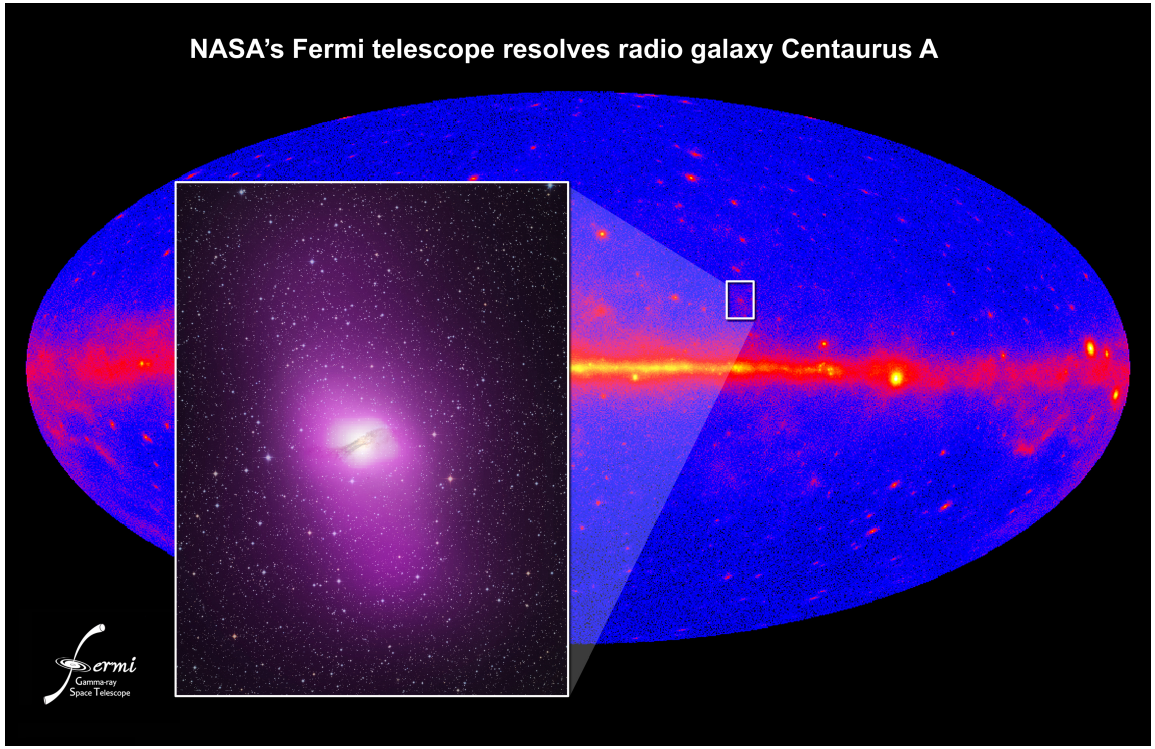


Emission from particles accelerated in Intergalactic shocks

Yet-to-be discovered population of extragalactic high energy gamma-ray

sources.

Giant Lobes in Centaurus A



Huge (10 deg) gamma-ray source!

Gamma-rays produced in interactions between relativistic particles in the lobes and the cosmic microwave background light.