First International GLAST Symposium Summary

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Some Questions

• What can you do with so few photons?
• Why should I devote my precious observatory time to your future satellite? (Come back after it's launched, if it works!)
• What's new?
• What will be new?
• Where's the physics?
• Why are you doing this?
• Who will win a Nobel prize?
**GLAST**

**LAT**
- 0.02 - 300 GeV, ~0.1 energy resolution
- 2.5 sr, 10,000 cm²
- 5° - 5’ resolution
- 3 x 10⁻⁹ cm² s⁻¹ (>0.1 GeV, point source)
- 10,000 sources mostly blazars + unidentified
- 10⁹ photons
- Negligible deadtime
- Cover sky every 3hr

**GBM**
- 0.01-30 MeV, ~0.1 energy resolution
- 9sr
- Degree resolution
- All sky

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*Ritz, Michelson*

nb AGILE, VERITAS4 in spring

*Tavani Kieda*
Data and Service Challenges

- Great progress handling simulated data, testing pipelines etc
- Integration with Science Working Groups
- Do we need Science Challenges?
- The Making of Lists  
  - 10,000 blazars, 100 pulsars 50/200 GRB/yr(LAT/GBM), 50 SNR/PWN, 10 HMXB….
  - Unidentified?

red: 0.1-0.4 GeV
green: 0.4-1.6 GeV
blue: >1.6 GeV
Stars

- **Sun**  
  - Flares  
  - Solar minimum→maximum  
  - Observe neutrons  
  - Radiation hazard  
    - *Minutes!*

- **3 HMXB**
  - LSI+61 303  
    - *NS-Be*  
    - *P=27d*  
    - *e ~0.7*  
    - *i ~ 60°*  
  - PWN orbiting Be excretion disk?

*Dubus*  
*Cortina*  
*Hermsen*
Jet Physics

- **Blazar**
  - AGN classification
  - Blazar sequence (10^{-4} of galaxies)
    - FR2->FR1?
    - GLAST observe more RG
  - Variability
    - M87
    - Mk 501
    - Contrary evolutions
      - Fukazawa

- **GRB**
  - Ptran, Granot
    - Long - collapsars; short- NS coalescence??
    - Late emission, plateau, chromatic breaks
    - Faster than Blazar jets

- **Jet Physics**
  - Emission mechanism
  - SSC vs EC
  - Opacity, location
  - Bulk Comptonization and Cooling
  - Composition, Structure, Confinement
  - Impact

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Pulsar Physics

• **Detection**
  - 100s pulsars?
  - 50 RQ pulsars?
  - 10 MSP
  - RRATS
  - Blind searches

• **How do pulsars shine?**
  - Polar cap vs slot gaps vs outer gaps
  - Locate gamma ray and radio emission
  - Does gamma ray power ~ $V$?

• **Force free models**
  - Compute pulse profiles for different emission sites and fit to radio, gamma ray observations
  - Is the rotating vector model really supported by observations?
    • **Orthogonal polarization!**
Supernova Remnants

- **Nonthermal accelerators**
  - $>100\text{TeV}$
  - Spectral curvature
- **Hadronic vs leptonic**
  - n problem or B problem?
  - GLAST should decide
  - Local FIR not CMB?
- **Acceleration**
  - PeV-$\mu$G
  - DSA vs F2 vs ?
  - If DSA do not need scattering behind shock!
Backgrounds

- **Interplanetary**
  - C\(^{-1}\) starlight

- **Diffuse interstellar**
  - GeV excess? Cygnus TeV? \(\text{Digel, Knodelseder, Abdo}\)

- **Extragalactic gamma ray background**
  - Sum of sources or new component? \(\text{Dermer}\)

- **Extragalactic X-ray background**
  - INTEGRAL reports HEAO-1 spectrum x 1.1

- **Extragalactic stellar background**
  - TeV observations vs Spitzer - limits on Pop III contribution?
  - GLAST will see to greater distance and study evolution

- **Extragalactic cosmic ray background**
  - AGN vs GRB
  - Hard for UHECR to escape either environment

- **Dark matter annihilation background**
  - Lines?
    - *No “no go” theorem*
  - Bump
    - *Validation of DM signal will be a challenge*
    - *Confusion with PWN etc?*

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F. Aharonian et al. 2006, Nature 440, 1018 (April 20)

Hartmann

Kuhlen, Wai, Koushiappas
The Multiwavelength Challenge

- **Blazars - radio catalog**,  
  - Suzaku, Spitzer, Swift, LMT…
- **Pulsars - timing models**
- **GRBs - Swift**  
  - 10yr, 0.25 overlap
- **Suzaku, LMT**
- **IDs**  
  - Figure of merit  
  - Variability  
  - Statistical
- **Discover new sources!!**
Summary

- GLAST links great discoveries of X-ray astronomy to tremendous advances in TeV range
- Poised to address fundamental high energy astrophysics questions through observing AGN, GRB, PSR, PWN, SNR...
- Physical processes are generic - laboratories to study emission mechanisms, RMHD, relativistic plasmas, particle acceleration, transport processes
- Investigations are mostly multi-wavelength over whole 70 octave EM spectrum (+ν, CR, GW)
- Much work - instrumental, computational, observational and theoretical - needs to be done prior to launch