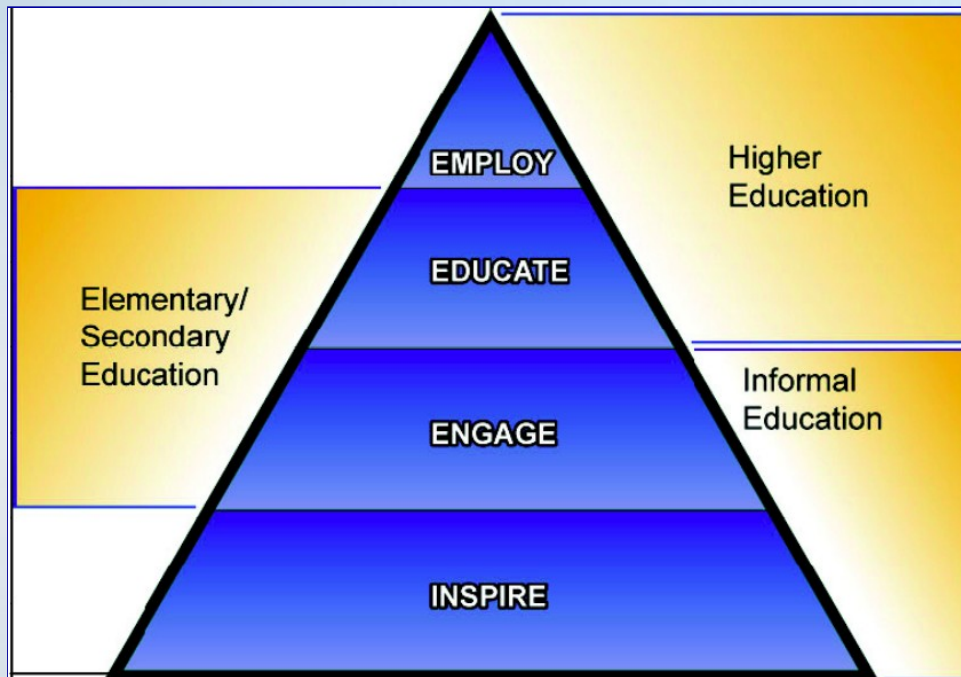


# **Education and Public Outreach Program Status Fermi User's Group 9/27/08**

Prof. Lynn Cominsky  
Sonoma State University

# NASA Education Framework



- Informal education and public outreach
- Elementary & Secondary education
- Higher Education

Emphasis on workforce development for under-represented populations

# Fermi in the MySpace community



"Yippeee! I am in  
spaaaaaaaaacccccccccccccceeeeeeeeeeeeeee!"

Male  
22 years old  
ROHNERT  
PARK,  
CALIFORNIA  
United States

<http://www.myspace.com/glast>

Fermi now has 281  
friends, and a blog

USRA PBS video is  
linked via YouTube

French GLAST video also  
linked.

And Ritz blog..... And  
more!

# Epo's Chronicles

- New weekly webcomic – debuted right after Fermi was launched
- Special Fermi renaming “eposode”
- Main story line follows Epo, a sentient spaceship and her humanoid companion Alkina as they search the Universe to discover their origins.
- Now being translated into French, Italian and Spanish



Alkina



Epo

# Epo's Chronicles



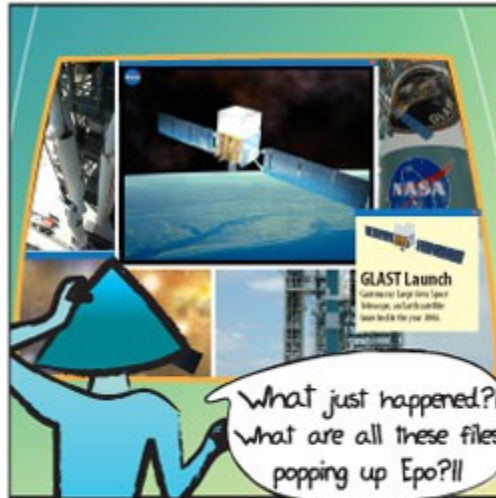
This special episode of Epo's Chronicles is not part of the main storyline.



Well Epo,  
let me see if I can  
restore some of your  
memory ...

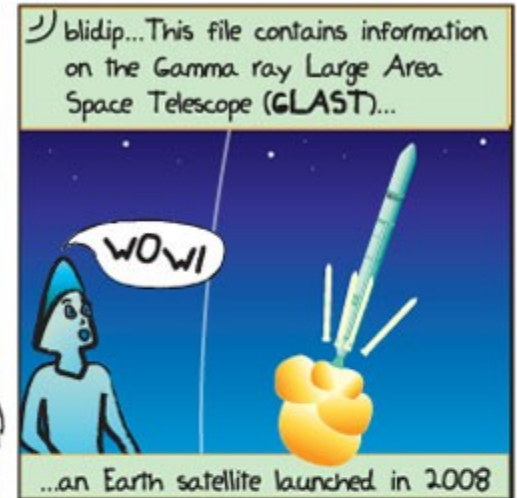
blidi...bidibisshhh...

WHAT  
...?!?



GLAST Launch  
Gamma-ray Large Area Space  
Telescope, on Earth earlier  
than here in the year 2008.

What just happened?!  
What are all these files  
popping up Epo?!!



blidip... This file contains information  
on the Gamma ray Large Area  
Space Telescope (GLAST)...

WOW!

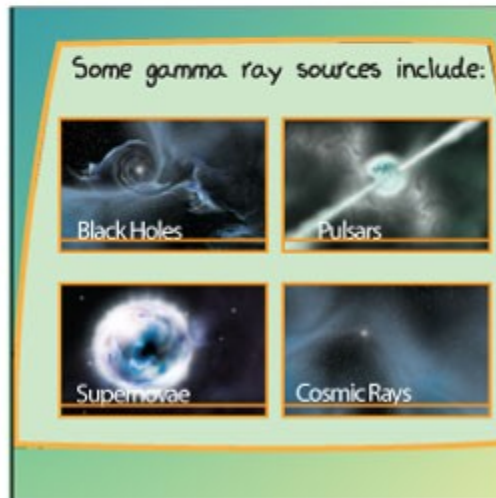
...an Earth satellite launched in 2008



Gamma rays are the highest energy  
rays in the EM spectrum, created by  
the most energetic events in the universe.

Radio Microwave Infrared Visible Ultraviolet X-ray Gamma Ray

What kind of  
events are that  
energetic?



Some gamma ray sources include:

Black Holes Pulsars  
Supernovae Cosmic Rays



Amazing!  
I want to learn  
more about them all!

Don't worry Alkina, I have a feeling  
we will be seeing a lot more of these  
in our upcoming adventures...

# Epo's Chronicles



This special episode of Epo's Chronicles is not part of the main storyline.

Alkina, do you recall GLAST?

Yes, the gamma ray space telescope we discovered in your database a few weeks ago.



It appears that the satellite was later renamed to Fermi Gamma-ray Space Telescope.



Enrico Fermi? The famous scientist?

Indeed, the Italian physicist from the 20th century. I have a holographic profile of him in my database.



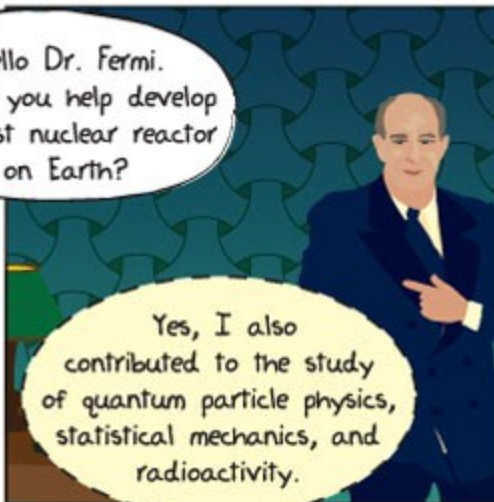
Can you please activate it?

Ciao Alkina!

Hello Dr. Fermi. Didn't you help develop the first nuclear reactor on Earth?



Yes, I also contributed to the study of quantum particle physics, statistical mechanics, and radioactivity.

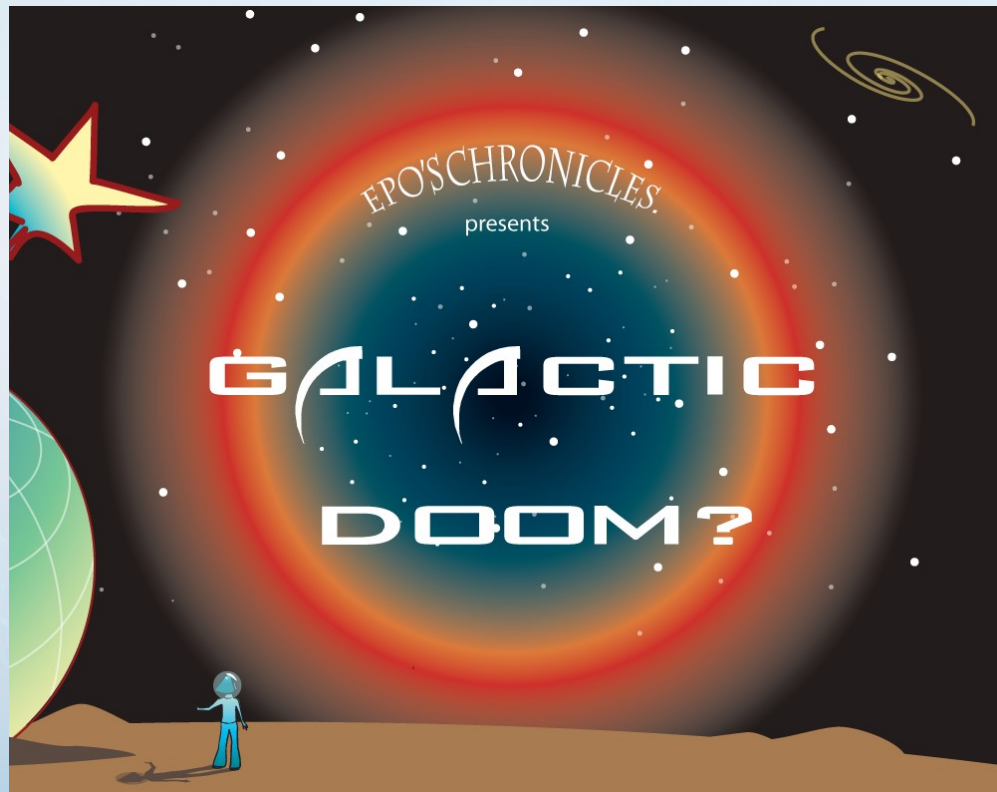


No wonder they re-named GLAST after you! It is a fitting name for a satellite that studies gamma rays.



# Space Mysteries

- <http://mystery.sonoma.edu>
  - Galactic Doom Space Mystery finally in test phase (again!)





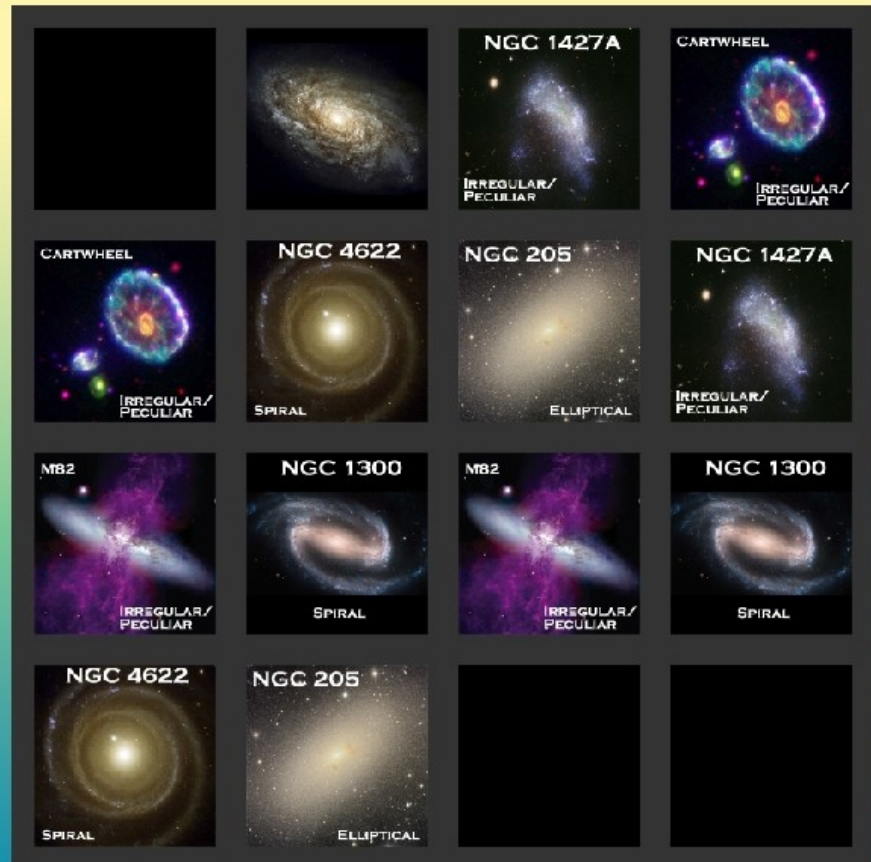
# Space Mysteries

- First phase – teaching about galaxy types

– Matching game

- Click on two squares to reveal galaxies
- Keep clicking until you match up the images
- Once you find a match, the name and type of the galaxy will be revealed.
- You can only click on two at a time, so remember where each one is!
- Once you have matched all the galaxies, click on an image to expand it and study its name and type closely.

Continue to next step >>







# Space Mysteries

- Second part teaches about active galaxies vs. quiescent galaxies

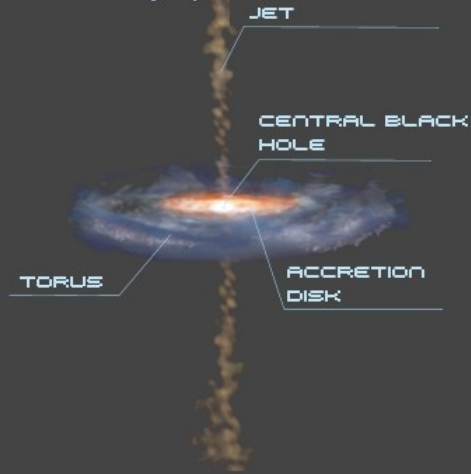
EPO'S DATABASE  
ACTIVE GALAXIES



Continue

Click on the different regions of the AGN to learn more about its components

At the center of every galaxy a dense core of stars called a 'nucleus' is surrounded by stars and gas. Normally, the core of a disk or elliptical galaxy is small, relatively faint, and composed of older, redder stars. However, in some galaxies the core is intensely bright, shining with power equivalent to trillions of suns, easily outshining the rest of the light of the galaxy combined. A galaxy that emits such tremendous amounts of energy is called an active galaxy.





# Space Mysteries

- Third part teaches about spectra and morphology
  - Compare active vs. inactive using real data (visible light but also some x-ray and other wavelengths)

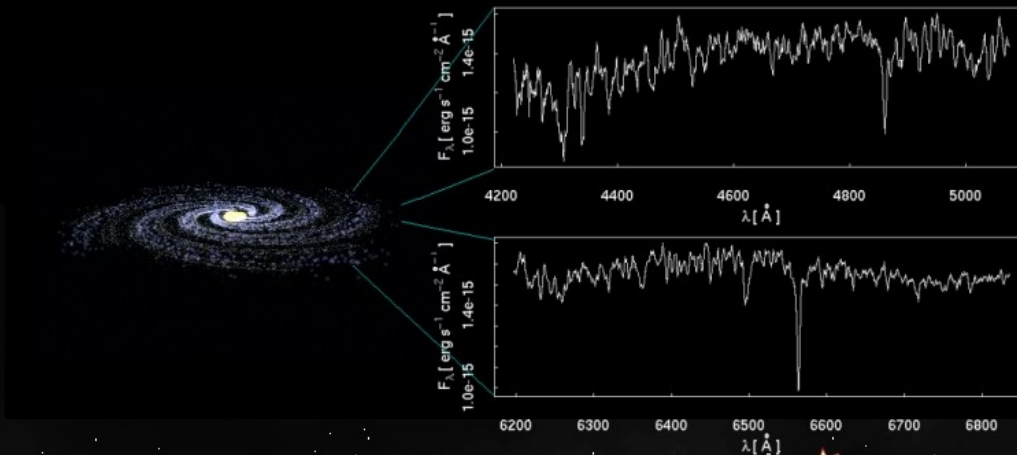




# Space Mysteries

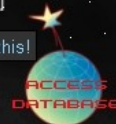
- Final part asks student to analyze our galaxy
  - Uses model as if viewed from outside

This is Epo's galactic model! It is a model of the Milky Way that has been created from adding up data from its different components. Epo and many other astronomers carefully gathered this data over the past century! But remember, unlike the galaxies you studied before, we can't take pictures of the galaxy we're in. To fly out there would take too long



Choose carefully space sluth! you only get one chance at this!

- 
- 
- 
- 



Are we  
doomed?

## Night Sky Network Toolkit

- SUPERNOVA!
- Joint with Swift, XMM-Newton and Suzaku
- Developed by Astronomical Society of the Pacific
- Finished in May 2008 – distributed to over 200 clubs



## 2 AstronomyCast questions shows

- Questions from Farmersburg School and Curtis High School
  - The Sky (2)
  - Optics (2)
    - Light as a Particle (2)
  - Stars and Stellar Evolution (6)
  - Understanding by Starlight (3)
    - Light and Color (1)
    - The Earth's Atmosphere and the Electromagnetic Spectrum (2)
  - Our Sun and Life on the Main Sequence (2)
  - Stellar Evolution II: High mass stars (1)
    - Limits on Maximum Star Size (1)
  - Extragalactic Astronomy and Cosmology (8)
  - Dark Matter (1)
  - Bonus: Black Holes, Redux (6)
    - Blackhole Feeding Habits (2)
    - Blackhole's Mathematical Sibling: The White Hole (2)
    - Detecting Blackholes (1)
  - Human Exploration (3)



<http://astronomycast.com/education>

## Pre-Launch Workshops

- Two teacher's workshops at KSC:
- 30 Pre-service teachers – Lynn and Dave Thompson
  - 1 hour – Friday June 6
- 25 In-service teachers – Lynn, Kamal and EAs
  - 3 hours – Saturday June 7
  - Active Galaxy pop-up book – Tasty Active Galaxy activity
  - Active Galaxy Educator's Guide – Paper AG activity
  - GLAST litho - Make your own pulsar activity



Making tasty  
active galaxies



Pulsar  
model

Tasty and paper AGs



# Supernova Educator Unit – with XMM

- **3 activities in guide**
  - Fishing for Supernovae
  - Crawl of the Crab
  - Magnetic Poles and Pulsars
- **+ Science literacy activity**
  - Two news articles from XMM
  - Compare measurements of pulsar magnetic fields



Approved by NASA Product Review – July 2008



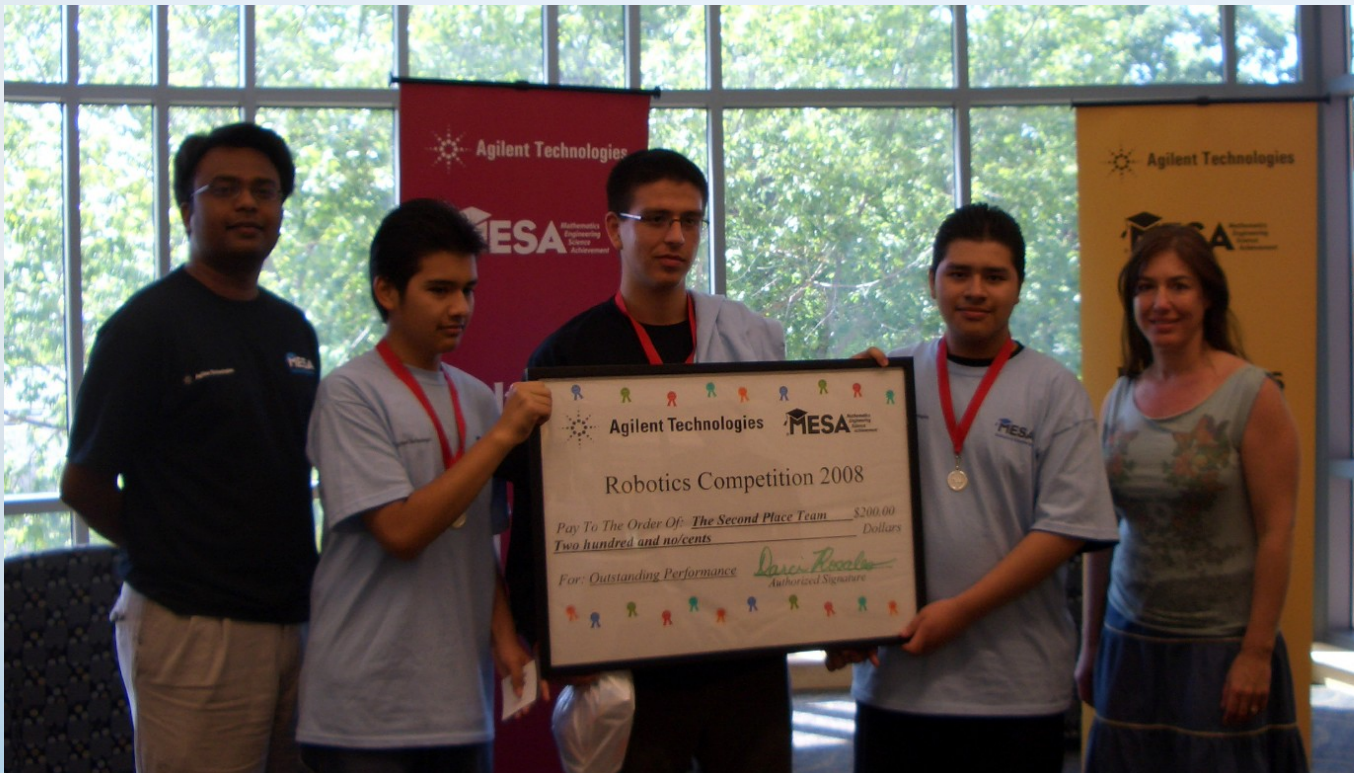
## Educator Ambassador Training 2008

- July 28 - August 1, 2008 at SSU
- Focus was on 2-day “Dark Universe” mini-course and “EA Share-a-Thon”



## After-school programs

- Roseland University Prep
  - Robotics competition – 2<sup>nd</sup> place
  - Summer Program – 2<sup>nd</sup> year



## After-school programs

- Cali Calmecac afterschool program in year 2



Kevin John with 4-6 graders

Jessica Olivera with 1-3 graders



## RUP Summer Experience 2008



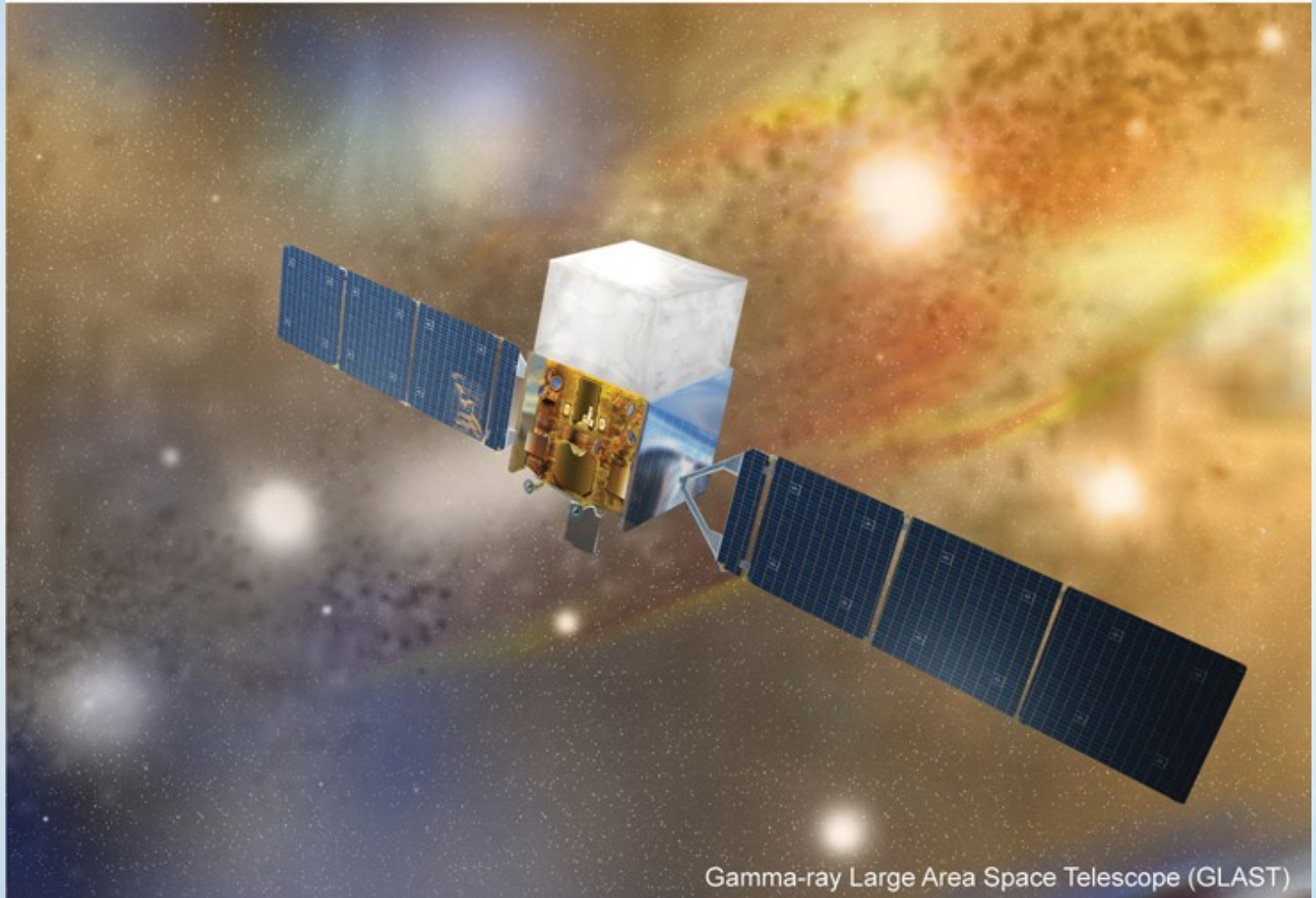
29 out of 65 graduates from May 2008 are now enrolled at SSU!

# Global Telescope Network 8/08

- New website now online
- 23 Member Institutions
- Jeff Adkins at Deer Valley High School had AAS paper on GTN object with Spitzer data (too)
  - Dr. Kim Coble at Chicago State University has been testing our activities and had two students working with GTN data who gave talks in Chicago
  - We have extensive photometric data on 3C454.3 campaign and also BL Lac campaign



# GLAST Litho



Approved by NASA Product Review, distributed at launch

# GLAST Launch Materials

- GLAST launch factsheet – approved by NASA product review, distributed at launch
- GLAST public brochure – revised for launch

### Gamma Ray Origins?

At the core of GLAST's mission is finding out what gives birth to the diverse spectrum of gamma rays. There are many intriguing possibilities including active galaxies, blazars, gamma-ray bursts, and neutron stars.

Gamma rays permeate the cosmos. They are emitted from objects as nearby as our own Sun and Milky Way Galaxy to those as far away as tremendous explosions in the early universe. GLAST, NASA's new gamma-ray observatory will open a wide window on the extreme universe. With a huge leap in all key capabilities GLAST will enable scientists to answer complicated and perplexing questions related to supermassive black-hole systems, gamma-ray bursts, pulsars and the origins of cosmic rays. GLAST will also uncover new sources of gamma rays and will enable searches for signals of new physics.

NASA's GLAST mission is an astrophysics and particle physics partnership, developed in collaboration with the U.S. Department of Energy, along with important contributions from academic institutions, laboratories and partners in France, Germany, Italy, Japan, Sweden and the United States.

### Anatomy of a Space Telescope

**LAT Instrument**  
(Large Area Telescope under the AntiCoincidence Detector)

Tracker  
4 x 4 Array of Towers

Collimator

AntiCoincidence Detector

LAT Radiator

Solar Panels

GBM Instrument  
(GLAST Burst Monitor)

Ku-Band Antenna

**GLAST**  
Gamma Ray Large Area Space Telescope  
<http://www.nasa.gov/glast>

### Dark Matter

**Dark Matter** – The origins of dark matter, speculated to make up as much as 22 percent of the universe, remains a mystery. If dark matter is made up of hypothetical particles called WIMPs (Weakly Interacting Massive Particles), as many scientists theorize, then interactions of these WIMPs may produce gamma rays detectable by GLAST's Large Area Telescope. If so, GLAST could provide scientists with data that shed critical new light on the mystery of dark matter.

**Unidentified Sources** – It is likely there are many more types of gamma-ray sources among those presently unidentified and those to be discovered by GLAST. The superior angular resolution of GLAST's Large Area Telescope should help unveil the nature of these mystery sources, providing new understanding of the origin of their gamma rays and possible new laws of physics.

**Active Galaxies and Blazars** – An active galaxy is a galaxy with a super-massive central black hole. These black holes produce high-energy radiation from the swirling disks of matter falling into them. Some of these black holes also eject streams of matter thousands of lightyears at very nearly the speed of light. Blazars are thought to be Active Galaxies whose jets happen to be pointing straight towards us. When this happens, we see gamma rays associated with the jets.

**Gamma-Ray Bursts** – Gamma-ray bursts are the most energetic explosions in the universe. Recent observations have linked the origins of GRBs to the death throes of very massive stars, or to collisions between two black holes and/or neutron stars – both events which will lead to the birth of a new black hole. GLAST will provide new insights into these mysterious and exotic events by studying their gamma rays over a huge range of energies.

**Neutron Stars** – When the core of a massive star undergoes gravitational collapse, it forms a very dense object known as a neutron star. These objects have densities on the order of 10<sup>12</sup> kg/m<sup>3</sup>. (Imagine condensing Mt. Everest down to the size of a sugar cube.) With magnetic fields trillions of times that of Earth, these objects work like high-energy particle accelerators, expelling jets of gamma rays which rotate through our line of sight, producing pulsations that we can observe. Other neutron stars – the so-called magnetars – may possess even stronger magnetic fields. Magnetar starquakes can unleash tremendous flares of gamma rays.

**Cosmic Rays and Supernova Remnants** – Cosmic rays are subatomic particles that are accelerated to very near the speed of light by mechanisms that are still a mystery. One theory suggests that these particles are accelerated by the shock waves of supernovas. The LAT will be searching for the gamma-ray signature of this acceleration.

## Post-launch E/PO Plans

- Increased emphasis on GTN, after-school programs and the pipeline
- Continue teacher workshops
- Update all materials
- New litho set featuring first sky map and discoveries for each type of object
- Cosmology on-line course
  - Needs additional funding (two proposals have been submitted)
  - Has publisher support (Kendall-Hunt)
- International Year of Astronomy (2009)
  - NASA coordinated activities
- Fermi data into WWT (tours), Google Earth



## PR Update

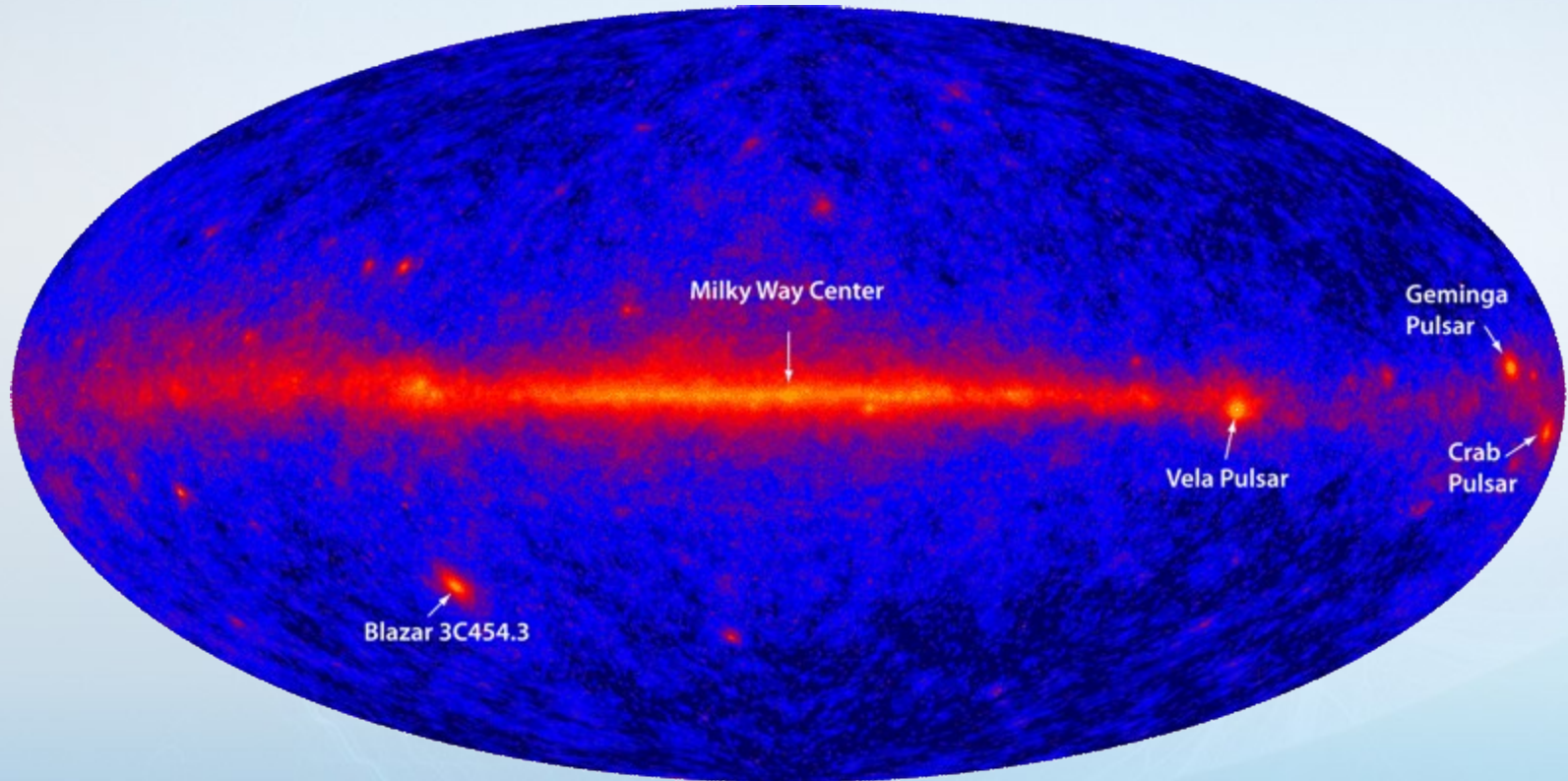
- **At KSC:**
  - Pre-launch briefings
  - Rob Gutro and LRC staffed the press room, answering questions from reporters, and writing launch delay reports.
  - LRC did stand ups with local TV crews on launch day
- **New science writer at GSFC – Francis (Frank) Reddy, who is now running bi-weekly PR telecons and writing release drafts**

## Scene at the “Press Site” near KSC



## PR Update

- First Light Telecon 8/26/08
  - 16 reporters called in, many stories resulted



## GLAST Renaming

- Announced in first light telecon
- E-mails sent to over 8000 suggestors with new name and info
- Web sites being changed (slowly....)



Logo by Aurore Simonnet

***Press Release: NASA Renames Observatory for Fermi,  
Reveals Entire Gamma-Ray Sky***

## Press Releases from HQ or GSFC since March 3, 2008

- GLAST Spacecraft Arrives in Florida to Prepare for Launch 3/4/08
- NASA's GLAST Satellite gets Twin Solar Panels in Prep for Launch 3/31/08
- NASA Selects Three Research Fellows for GLAST Mission 4/7/08
- GLAST has Eyes for Gamma Rays 4/8/08
- NASA Opens GLAST Monitor Center 4/9/08
- GLAST Rocket Coming Together 4/14/08
- Powerful Antenna Attached to NASA's GLAST Satellite 4/21/08

## Press Releases from HQ or GSFC since March 3, 2008

- NASA's GLAST Gets Shades, Blankets for the Beach 5/13/08
- Excitement Builds as GLAST Readies Its Gamma-ray Vision! 5/30/08
- GLAST is Ready to Go! 6/10/08
- GLAST Successfully Launched 6/11/08
- GLAST Safely in Orbit, Getting Check-ups 6/18/08
- GLAST Mission Operations at NASA Goddard Powered Up 7/2/08
- GLAST Team Fine-Tuning Instrument and Operations 7/28/08

## New Exhibit Booth graphic

- May debut at Huntsville GRB Meeting



Plus new  
giveaway!



## PR and E/PO Summary

- Emphasis post-launch will be on widening our scope from active galaxies, supernovae, pulsars and GRBs to include cosmology (especially dark matter)
- Increased coordination with other NASA E/PO programs, especially for IYA
- Increased penetration into the Web 2.0 world using Fermi data – WWT, Google Earth, IYA activities