Education and Public Outreach
Program Status
Fermi User’s Group 02/06/09

Prof. Lynn Cominsky
Sonoma State University
Emphasis on workforce development for under-represented populations
Post-launch E/PO Plans – underway!

- 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 – not yet*
- Cosmology on-line course
  - Needs additional funding (one proposal still pending)
  - Has publisher support (Kendall-Hunt)
- International Year of Astronomy (2009)
  - NASA coordinated activities
- Fermi data into WWT (tours), Google Earth
Fermi in the Web 2.0 community

"Yippee! I am in spaceeeeeeeeee!

Male
22 years old
ROHNERT PARK, CALIFORNIA
United States

New blog entries:
Fermi discovers a dozen new pulsars

http://www.myspace.com/glast

Fermi now has 325 friends on MySpace and 321 on Facebook
Epo’s Chronicles – IYA update

• Doing special IYA “episodes” for the first Monday each month featuring NASA’s “Go Observe” objects

http://eposchronicles.org
IYA From the Earth to the Universe

- Fermi is helping to sponsor small traveling exhibit of 14 NASA images that will go around the SF Bay Area
- Larger exhibit of 50 images will be in residence at Cal Academy and San Jose Tech Museum
- Partnership with NASA/LSI, Ames, SETI Institute, UCB/CSE, Kepler, SOFIA
IYA Exhibit

• Big images for museums and small images for traveling venues
Space Mysteries

- http://mystery.sonoma.edu
  - Galactic Doom Space Mystery needs testers – any volunteers?
Educator Ambassador Workshops

• 39 since last FUG meeting (9/27/08) at venues such as: National Science Teacher’s Association Regional meetings (Cincinatti, Portland, Charlotte), National meeting (Boston), Illinois Science Teacher’s Meeting, Detroit Area Mathematics Teachers, Kentucky Science Teachers, New Jersey Science Educators Association,
After-school programs

- Roseland University Prep Pre-MESA day competition:
  - 1st and 3rd place in Mousetrap cars
  - Tie for 1st place in Algebra 2, First place in Pre-calculus and in Calculus

- Field trip to San Jose Tech Museum with MESA club
Global Telescope Network 2/09

- Two poster papers on this work at AAS in Long Beach – “Undergraduate Research using GTN” and “Transforming Introductory Astronomy in the Urban University”
- We got our first GRB afterglow robotically!
  GRB081203A
- Campaigns: Mkn 401 and 1ES1959+650
Exploring the Extreme Universe

The Main Mission Objectives for Fermi are to:

- Explore the extreme environments in the Universe, where extreme energies far beyond anything possible on Earth.
- Search for signs of new laws of physics and what composes the mysterious Dark Matter.
- Explain how black holes accelerate enormous jets of material to a near light-speed.
- Help track the mysteries of the surprisingly powerful explosions known as gamma-ray bursts.
- Answer long-standing questions across a broad range of topics, including solar flares, pulsars and the origin of cosmic rays.

Fermi Law and Spacecraft:

There are two major instruments on board Fermi:

1. Large Area Telescope (LAT). The LAT has a very wide field of view and is able to determine the energy of an incoming gamma-ray as well as its direction in the sky from which it came, both to unprecedented accuracy.
2. Gamma-ray Burst Monitor (GBM). The GBM views the entire sky near the Earth in seven GRBs a few times per week, and extends the energy range for GBM observations by many decades.

Fermi is bringing the power of thousands of professional and amateur astronomers around the world by rapidly notifying them of GRBs and powerful bursts from active galaxies that it detects. The astronomers can then deploy to observe other telescopes using the full electromagnetic spectrum to observe the sources of the gamma rays.

Fermi is setting the high-energy gamma-ray universe on a new level.

Fermi Mission Science:

Gamma-rays are the most energetic form of electromagnetic radiation, typically one million or more times more energetic than visible light. They are produced by some of the Universe's most powerful and exotic phenomena including: the cores of the Sun, pulsar (spinning neutron stars) and super massive black holes at the centers of galaxies. In these sources and many others, the same mechanisms that produce the gamma rays are not known, in part, because the enormous energies of gamma rays preclude one ability to study them. The fact that gamma rays from Fermi's energy band are absorbed in our atmosphere and never reach the Earth's surface means we must send instruments above the atmosphere in order to detect these gamma rays from the extreme Universe.

On the Shoulders of Giants...

In an effort to better understand colossal gamma rays, an international group of scientists has built a new generation space telescope that will focus on gamma rays with unprecedented sensitivity. The Gamma-ray Space Telescope is the successor to the Compton Gamma Ray Observatory (CGRO) that orbited the Earth during the 1990s. CGRO studied gamma rays from many types of celestial objects, including massive black holes at the cores of distant galaxies (active “galactic” centers), colliding galaxy stars that exist outside our gamma-ray galaxy (the “pulsar”), and tremendous blasts of gamma rays known as gamma-ray bursts (GRBs). Fermi will study these known gamma-ray sources in detail and will also discover thousands of new gamma-ray sources in its five-year control mission.

Pulsar Activity

You will need:
- Light emitting diodes (LEDs)
- Batteries
- Colored (scotchlite) tape
- Modeling clay or aluminum foil
- Tweezers, scissors, or cutting (optional)

1. Using scotch tape, attach the two LEDs to the battery so that they face in opposite directions. Make sure that one end of the LED is facing the positive side of the battery and the other end is facing the negative side. See Fig. 1.
2. Using either the modeling clay or aluminum foil make a round ball that encloses the battery while exposing the LEDs. Next, if you are going to use aluminum foil, please make sure that the battery and the LED leads are completely covered by tape otherwise the LEDs will not light up. See Fig. 2.
3. Insert the tweezers or scissors into the ball, then hang the ball from a string. Spinning the ball on a string is an idea of how a pulsar can speed up when we see it. See Fig. 3.

From: Fermi, a new-generation space telescope, or the origin of the galaxy and its center. The bright source above the line of Lietz's gamma-rays is the “Super Pulsar” neutron black hole. The bright source below the Milky Way is the Crab pulsar, and the fainter source is the quasar B2355+58.

“Mystery creates wonder and wonder is the basis of man’s desire to understand.” - Neil Armstrong
• Now updated – need additional content for the back page
• Used to have lists of countries and heads of instruments
• What should we put instead?
Fermi Card Game

• Being revised in response to NASA Product Review recommendations

The Experience Cards:

Blue cards with an “E” in the upper right corner are Experience cards. Note how each “E” card is split in two halves for Stage 1 and Stage 2 (image to the right). In Stage 1, each card is worth 1 experience point. In Stage 2, each card has its listed value in the lower right corner.

There are three types of Experience cards all labeled with an “E” in the upper right corner: Science Team (flags icon), Educators (or ED), and Wild Card (see icons below).

All three cards have a factoid about Fermi on them. Although they are not part of the game play, it is an interesting thing to know about Fermi and the objects it studies.
Fermi Card Game

- Rules are being simplified

Turn example:
Let’s say you want to play the “Spacecraft Body” Satellite card—you need to have 1 ED card and 2 Science Team cards.

Place the “S” card on the mat and discard the Experience cards used after showing them to your opponent.
Fermi Card Game

- Cards are being updated
A new direction – Educational Research

• We are responding to NASA’s new metrics that want us to show the need for our products
• Conducting a survey to find out what A101 students know about Fermi-related topics such as the structure and contents of the Universe
• Results will be published in AER
Black Hole Show Analysis

• We accumulated data about the Black Hole planetarium show (pre- and post-) to try to figure out what people might have learned – the results were interesting but disappointing

• Conclusion: engaging visuals are not sufficient to create learning, especially when complicated images are shown to non-scientists
Example of results from survey

pre-show

Do black holes have mass?

- 43% Yes, the mass can be measured by observing the black hole's effect on nearby objects.
- 19% No, black holes have no mass; they are voids in space.
- 38% Scientists have no direct evidence that black holes have mass, so this question cannot be answered at the present time.

post-show

- 72%
- 16%
Example of results from survey

What shape is the event horizon around a black hole?

pre-show

show

post-

- Event horizons are disk shaped.
- Event horizons are funnel shaped.
- Event horizons are spherical.
- Event horizons are shaped like a waterfall.
PR Update

• Fermi press releases since last FUG:
  – January 6, 2009
    NASA'S Fermi Telescope Unveils a Dozen New Pulsars – press conference at AAS with Roger Romani and Alice Harding
  – October 16, 2008
    NASA'S Fermi Telescope Discovers First Gamma-Ray-Only Pulsar – NASA HQ release
  – New: Sent to HQ this week: release on SGR J1550-5418 – joint with Swift
PR Update

- Animation for AAS Press conference
  - Outer magnetospheric model
The Pulsing Sky (Romani)

Pulses at $1/10^{th}$ true rate

Fermi Pulsar Detections

- New pulsars discovered in a blind search
- Millisecond radio pulsars
- Young radio pulsars
- Confirmed pulsars seen by Compton Observatory EGRET instrument
PR and E/PO Summary

• We are moving forward on all planned activities (except have not started new litho set yet, awaiting a few more discoveries.)

• Look for updated litho, factsheet by the summer AAS. Card game needs product review approval before we reprint it.

• PR is starting, but results are challenging to explain, especially in today’s media world