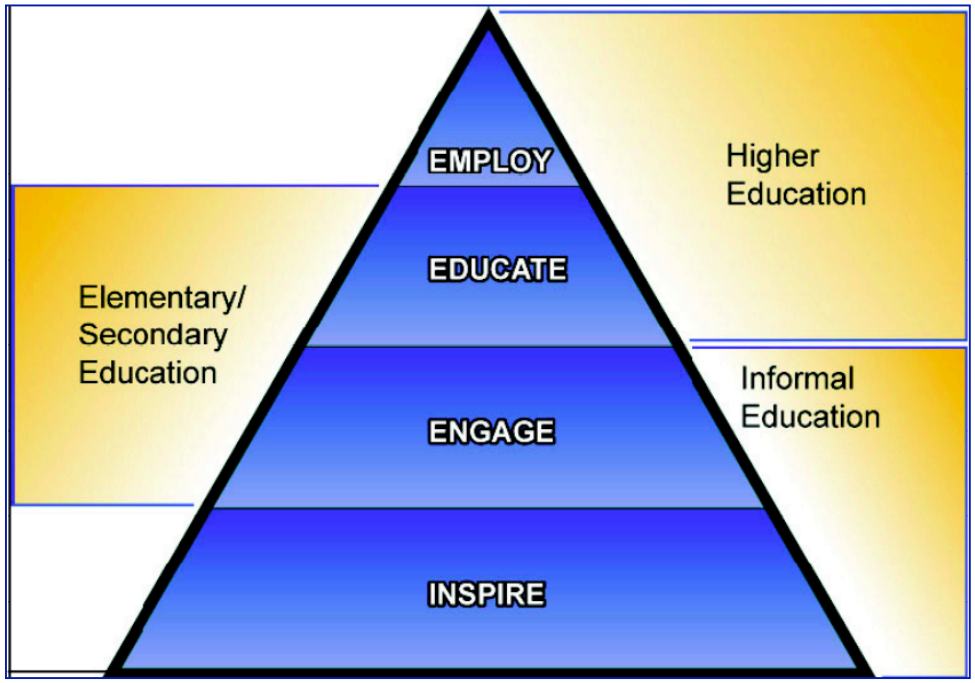
GLAST E/PO Program Status

GLAST User's Committee 3/3/08

Lynn Cominsky

Sonoma State University

New NASA Education Framework

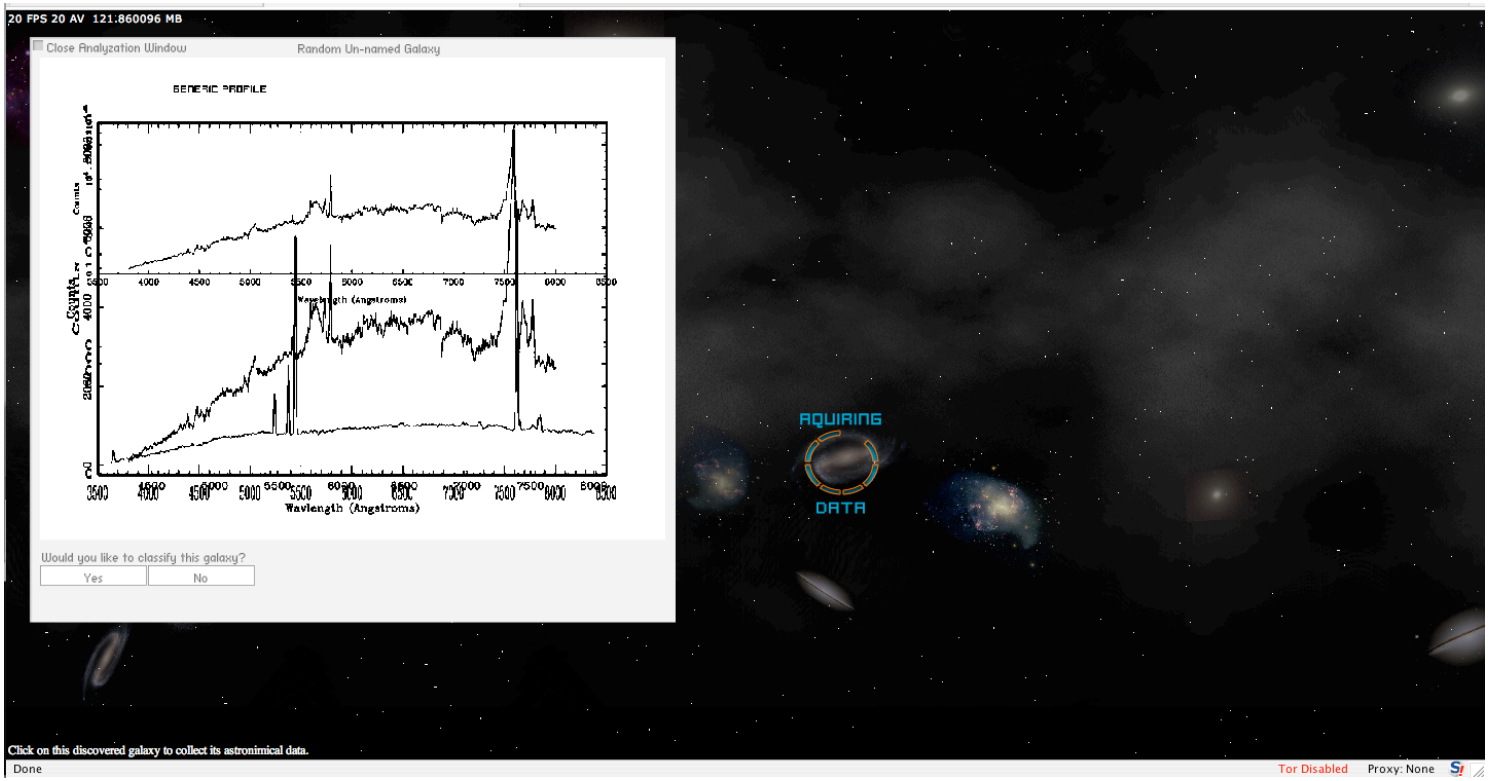


- Informal education and public outreach
- Elementary & Secondary education
- Higher Education

Emphasis on workforce development for under-represented populations

Space Mysteries

- http://mystery.sonoma.edu
  - Galactic Doom Space Mystery still being reworked



GLAST in the MySpace community

GLAST

"Can't Wait 'till Launch!"

Male
20 years old
ROHNERT PARK, CALIFORNIA
United States

http://www.myspace.com/glast

Latest blog entry – rocket arrives at KSC

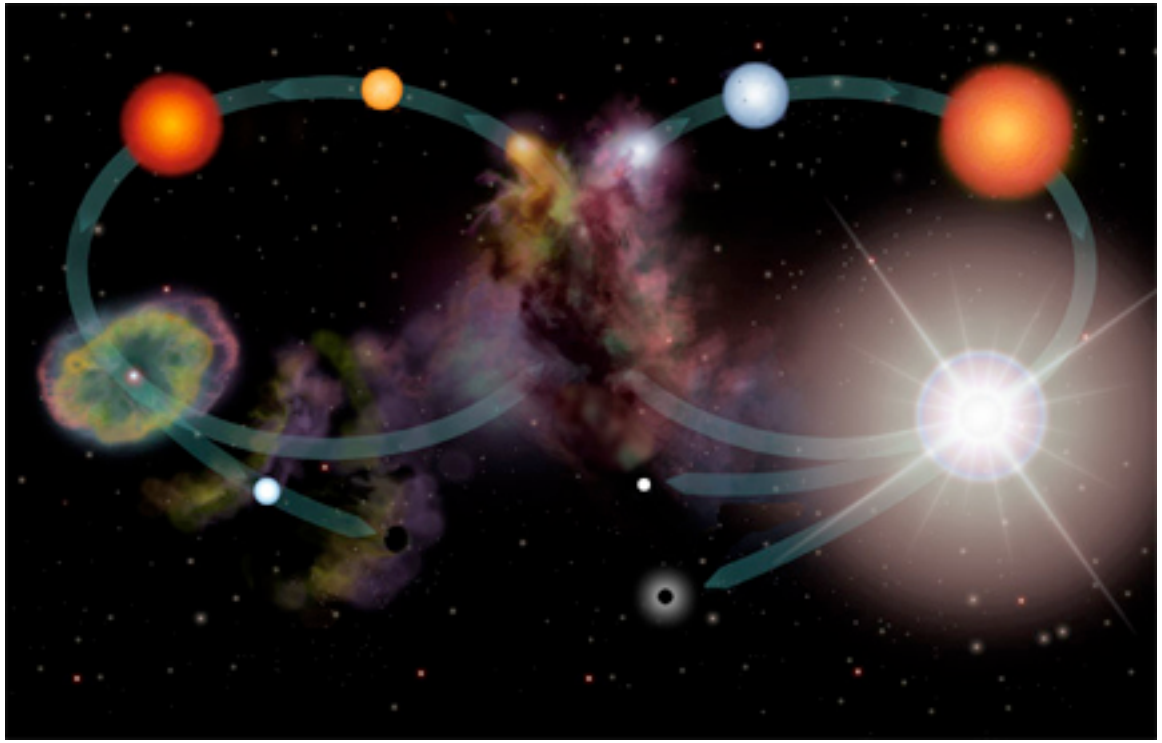
GLAST now has 235 friends, and a blog

Night Sky Network Toolkit

- SUPERNOVA!
- Joint with Swift, XMM-Newton and Suzaku
- Developed by Astronomical Society of the Pacific
- Final testing now in progress

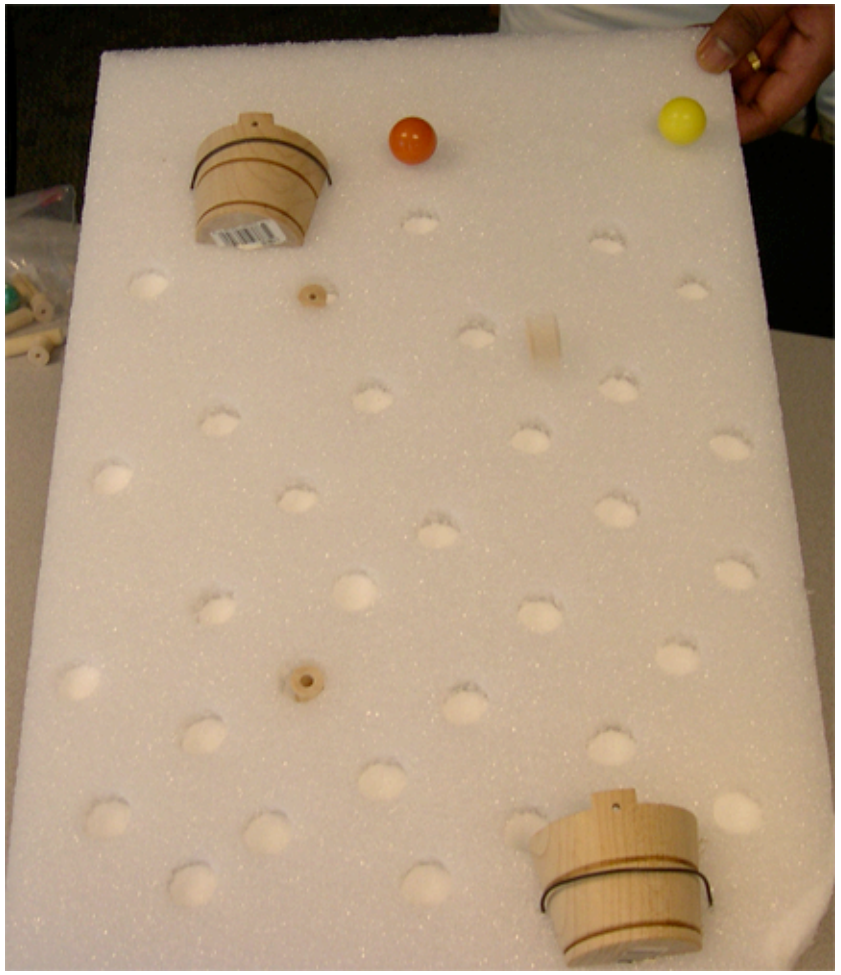
Supernova! Activities

- Supernovae in the Lives of Stars
  - Life Cycles of Stars poster
  - Let's Make a Supernova
  - Star Maps: Stars Likely to Go Supernova



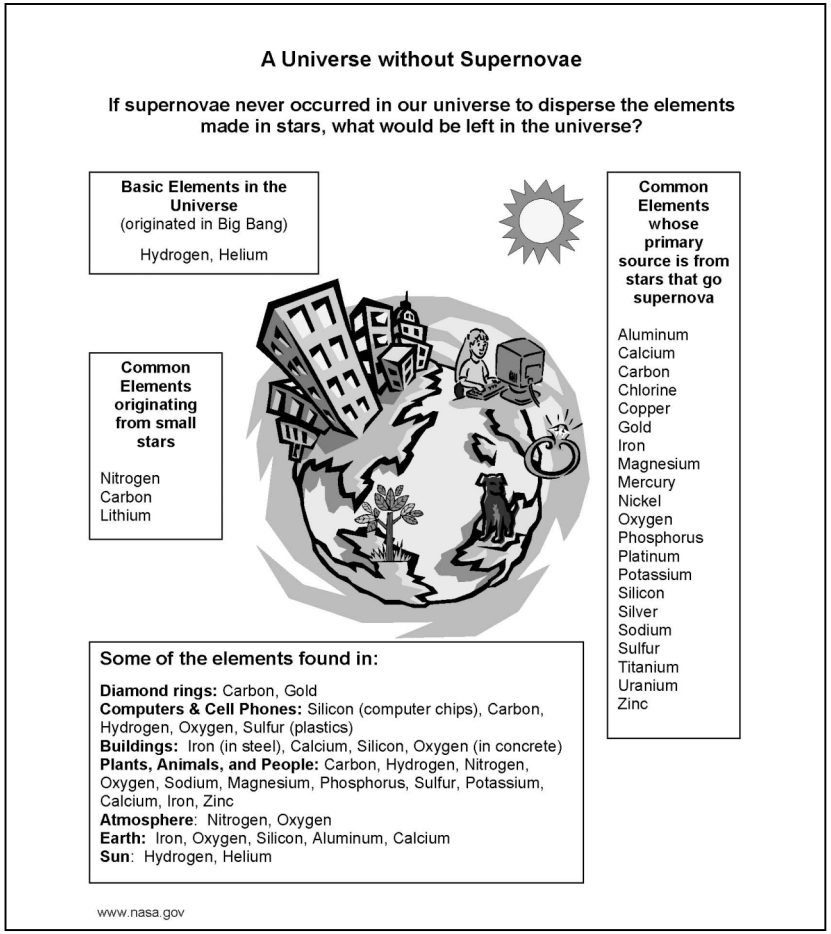
Supernova! Activities

- Protecting the Earth from Cosmic Radiation
  - Nuclear Fusion, Cosmic Radiation and Supernovae
  - Protecting the Earth Activity
  - Air as a Shield
  - Gamma-ray Bursts



Supernova! Activities

- Universe without Supernovae
  - Cosmic Connection to the Elements (GSFC)
  - Activity, Guide and Poster



A Universe without Supernovae

If supernovae never occurred in our universe to disperse the elements made in stars, what would be left in the universe?

Basic Elements in the Universe
(originated in Big Bang)

Hydrogen, Helium

Common Elements originating from small stars

Nitrogen
Carbon
Lithium

Common Elements whose primary source is from stars that go supernova

Aluminum
Calcium
Carbon
Chlorine
Copper
Gold
Iron
Magnesium
Mercury
Nickel
Oxygen
Phosphorus
Platinum
Potassium
Silicon
Silver
Sodium
Sulfur
Titanium
Uranium
Zinc

Some of the elements found in:

Diamond rings: Carbon, Gold
Computers & Cell Phones: Silicon (computer chips), Carbon, Hydrogen, Oxygen, Sulfur (plastics)
Buildings: Iron (in steel), Calcium, Silicon, Oxygen (in concrete)
Plants, Animals, and People: Carbon, Hydrogen, Nitrogen, Oxygen, Sodium, Magnesium, Phosphorus, Sulfur, Potassium, Calcium, Iron, Zinc
Atmosphere: Nitrogen, Oxygen
Earth: Iron, Oxygen, Silicon, Aluminum, Calcium
Sun: Hydrogen, Helium

www.nasa.gov

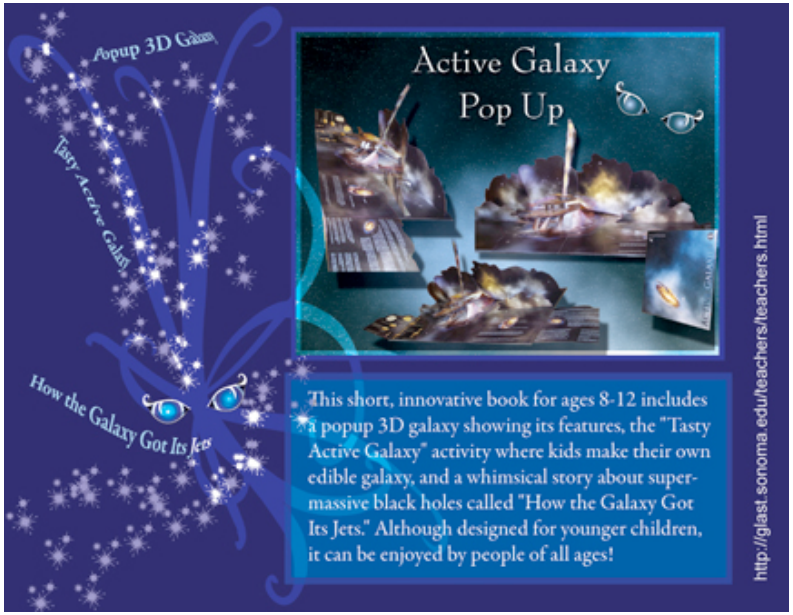
1st AstronomyCast questions show online

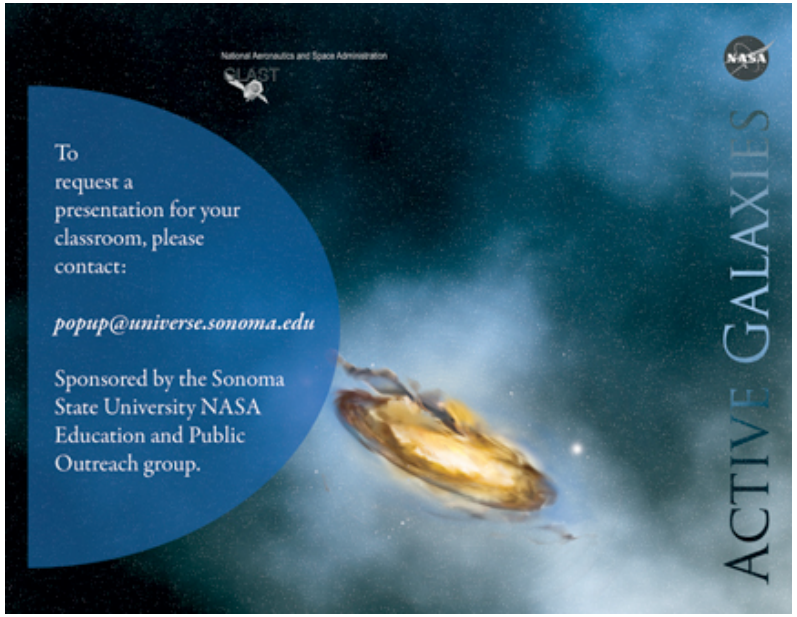
- Questions in first show from Farmersburg School
  - The Sky (2)
  - Optics (2)
    - —Light as a Particle (2)
  - Stars and Stellar Evolution (4)
  - Understanding by Starlight (3)
    - —Light and Color (1)
    - —The Earth's Atmosphere and the Electromagnetic Spectrum (2)
  - Stellar Evolution II: High mass stars (1)
    - —Limits on Maximum Star Size (1)
  - Extragalactic Astronomy and Cosmology (3)
  - Bonus: Black Holes, Redux (3)
    - —Blackhole Feeding Habits (2)
    - —Detecting Blackholes (1)

http://astronomycast.com/educate

Black Holes update

- Black Holes: The Other Side of Infinity
  - Will be starting at the National Air and Space Museum in March
- Pop-up book classroom presentations



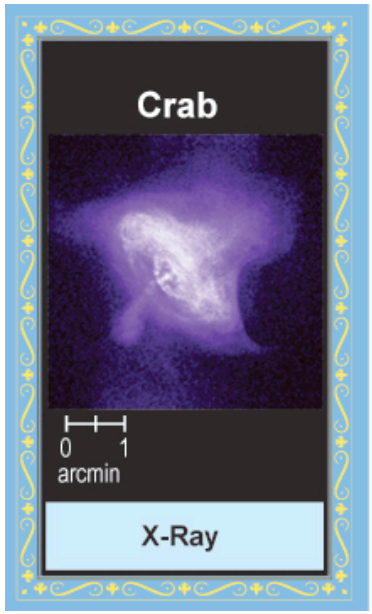


Launch Education Plans

- Working on a webcast of launch with various science museums
- May still do limited webcast with Adler
- Looking into organizing teacher's workshop at KSC with EAs
- 5-min video being produced by E/PO add-on grant, will be released in time for launch on PBS, YouTube, etc.

Supernova Educator Unit – with XMM

- 3 activities now 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



After-school programs

- Roseland University Prep
  - 2/3 of seniors now admitted to 4-year college for F2008
  - >90% Hispanic, low-income
  - After-school club since 2005
- MESA Schools Program
  - Opened center at Cali Calmecac
- MESA Engineering Program
  - In progress at SSU

Lynn and Aurore at Cali Calmecac

RUP student working on college applications

RUP Summer Experience

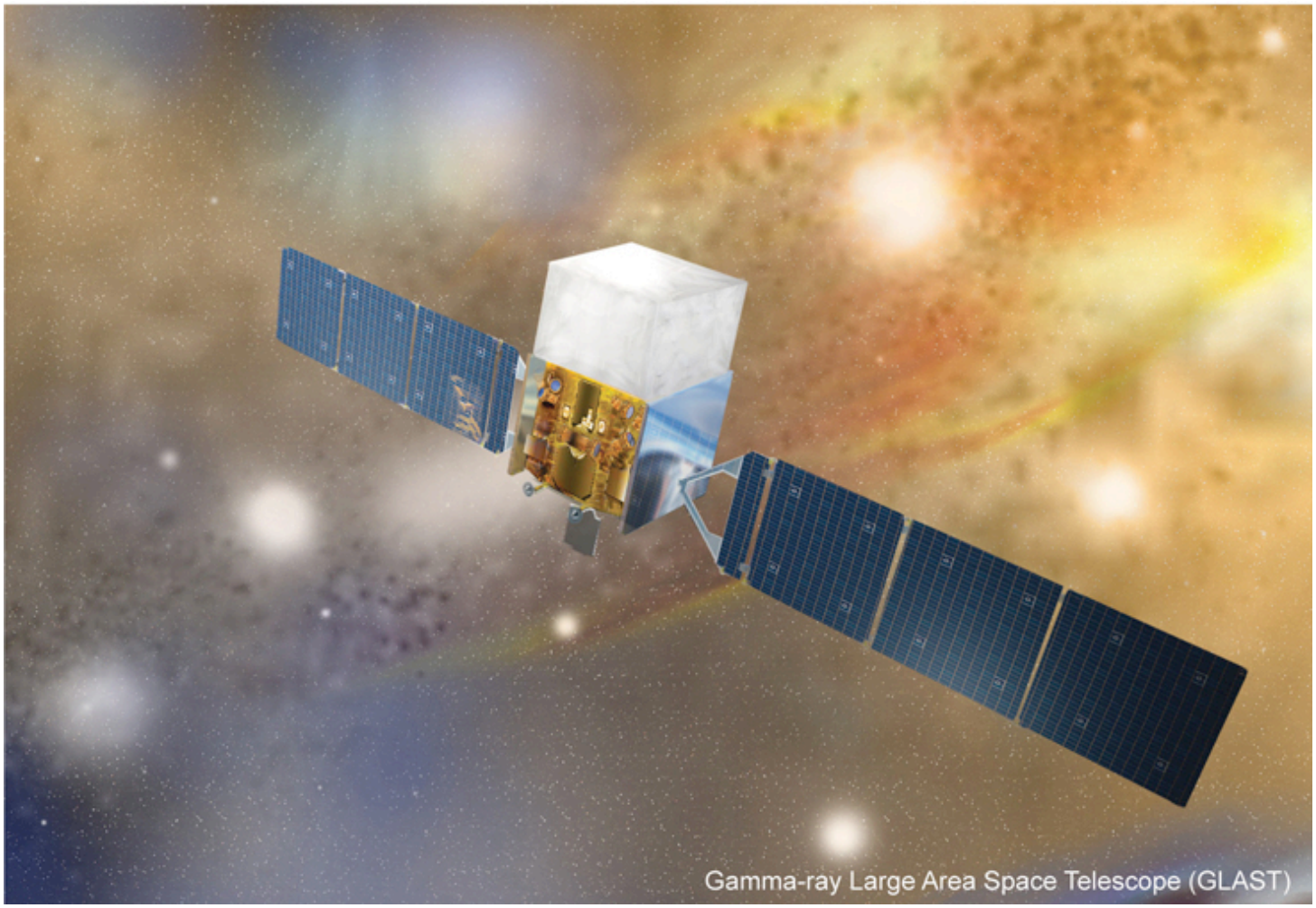
Last summer's group

Will do this again in June, 2008 for rising seniors

Global Telescope Network 2/08

- New website about to debut
  - http://gtn.sonoma.edu:81 right now
- 24 Member Institutions
- Jeff Adkins at Deer Valley High School is doing blazar monitoring project with students
- New partnership with Dr. Kim Coble at Chicago State University to develop college curriculum and work with African-American students
- Will try to track career outcomes of students

GLAST Litho (awaiting GSFC number)



GLAST Litho (back)

Exploring the Extreme Universe

Launch: 2008

GLAST Mission Science

Gamma rays are the most energetic form of electromagnetic radiation, typically a million or more times more energetic than visible light. They are produced by some of the Universe's most powerful and exotic phenomena including flares on the Sun, pulses from rapidly spinning neutron stars and super-massive black holes at the centers of galaxies. In these sources and many others, the exact mechanisms that produce the gamma rays are not known, in part, because the enormous energies of gamma rays inhibit our ability to study them. The fact that gamma rays in GLAST'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 celestial gamma rays, an international group of scientists has built a next-generation space telescope that will detect gamma rays with unprecedented sensitivity. The Gamma ray Large Area Space Telescope, or GLAST, 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 monstrous black holes at the cores of distant galaxies ("active galaxies"), spinning collapsed stars that emit pulses of gamma-ray light ("pulsars"), and tremendous blasts of gamma radiation known as gamma-ray bursts (GRBs.) GLAST will study these known gamma-ray sources in detail but will also discover thousands of new gamma-ray sources in its five-year nominal mission.

The main mission objectives for GLAST are to:

- Explore the most extreme environments in the Universe, where nature harnesses 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 immense jets of material to nearly light speed.
- Help crack the mysteries of the stupendously 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.

GLAST Instrumentation and Spacecraft:

There are two science instruments on board GLAST:

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 the direction in the sky from which it came, both to unprecedented accuracy.

2. GLAST Burst Monitor (GBM): The GBM views the entire sky not occulted by Earth to detect GRBs a few times per week and extends the energy range for GRB observations by many decades.

The LAT and the 12 detectors that make up the GBM are mounted on a spacecraft bus which provides power to the instruments through solar panels, includes momentum wheels and star trackers to point and steer the spacecraft, and provides antennae and on-board computing for data communications and data storage.

Data from the GLAST spacecraft are transmitted to Earth via NASA's Tracking and Data Relay Satellite System, where they are analyzed by scientists at Instrument Science Operations Centers at Stanford University and the National Space Science and Technology Center. The mission is managed and operated by NASA/Goddard Space Flight Center, which also staffs the GLAST Science Support Center.

GLAST will also harness the power of thousands of professional and amateur astronomers around the world by rapidly notifying them of GRBs and powerful flares from active galaxies that it detects. The astronomers can then choose to employ other telescopes using the full electromagnetic spectrum to observe the sources of the gamma rays.

GLAST will see the high-energy gamma-ray universe like never before. Centuries of astronomy have taught us that viewing the Universe with higher resolution and greater sensitivity produces amazing surprises. GLAST will provide answers to questions that have puzzled scientists for decades, but even more important, it will reveal things we had not expected, and it will raise questions we did not previously think to ask.

Pulsar Activity

You will need:
- 2 light emitting diodes (LEDs)
- 1 watch battery
- Cellophane (Scotch) tape
- Modeling clay or aluminum foil
- Toothpick, skewer, or string (optional)

1.) Using cellophane tape, attach the two LEDs to the battery so that they face in opposite directions. Make sure that one lead of LED is touching the positive side of the battery and the other lead is touching the negative side; Fig. 1.

Fig. 1

2.) Using either the modeling clay or aluminum foil make a round ball that encases the battery while exposing the LEDs. Note: If you are going to use aluminum foil, please make sure that the battery and the LED leads are completely encased by tape otherwise the LEDs will not light up; Fig.2.

Fig. 2

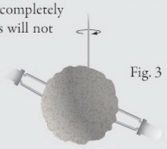


Fig. 3

3.) Insert the toothpick or skewer into the ball, or hang the ball from a string. Spinning the ball then gives you an idea of how a pulsar creates the pulses that we see.; Fig.3.

National Aeronautics and Space Administration
Sonoma State University, NASA E/PO
1801 E Cotati Avenue
Rohnert Park, CA 94928
glast.sonoma.edu

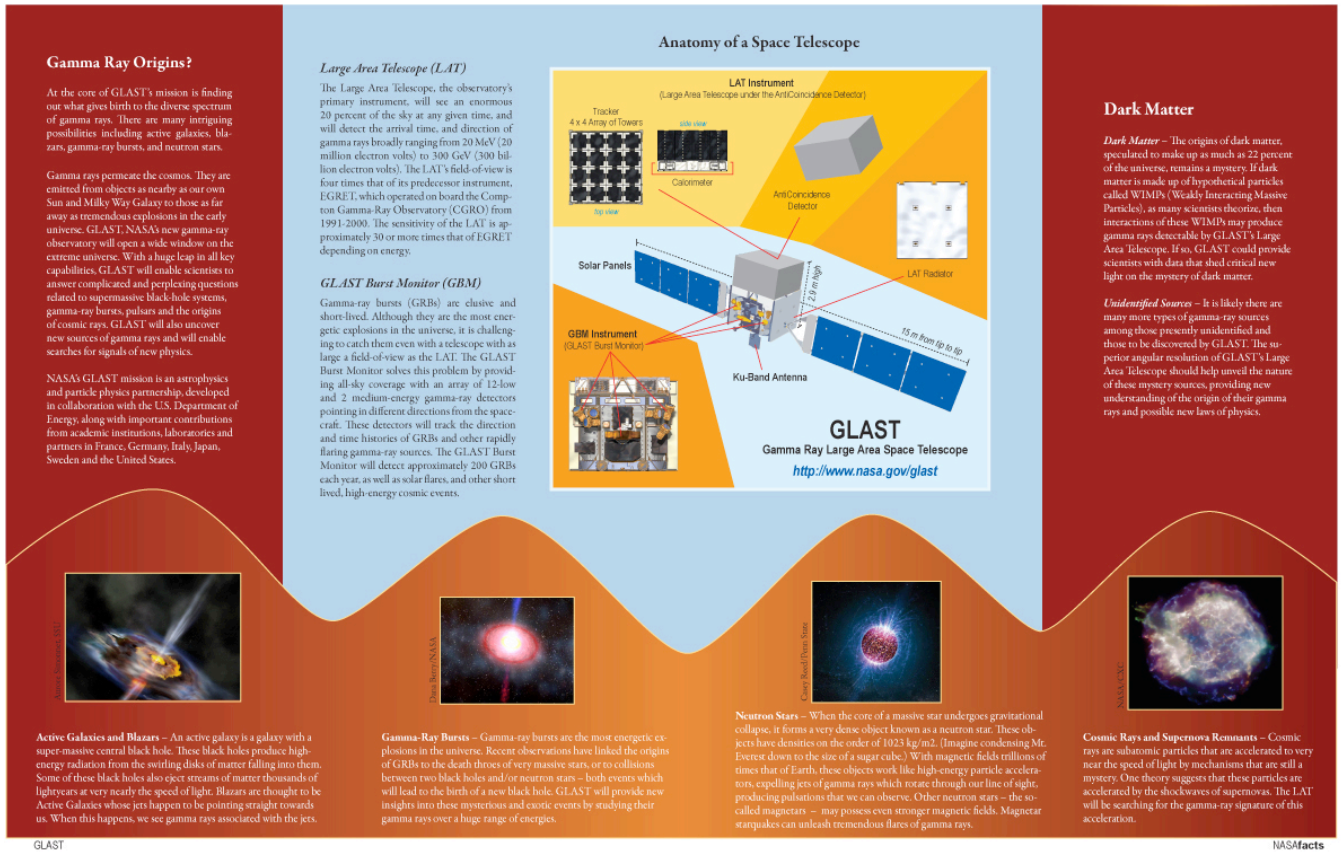
http://www.nasa.gov

Front: GLAST silhouetted against the simulated gamma-ray sky in the region of the galactic anti-center. The bright source above the line of gamma-emission from the Milky Way is "Geminga" - a gamma-ray pulsar. The brighter source below the Milky Way is the Crab pulsar, and the fainter source is the quasar PKS0528+134.

"Mystery creates wonder and wonder is the basis of man's desire to understand." - Neil Armstrong

GLAST Launch Materials

- GLAST launch factsheet – still in review
- GLAST public brochure – needs revisions



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.

Large Area Telescope (LAT)

The Large Area Telescope, the observatory's primary instrument, will see an enormous 20 percent of the sky at any given time, and will detect the arrival time, and direction of gamma rays broadly ranging from 20 MeV (20 million electron volts) to 300 GeV (300 billion electron volts). The LAT's field-of-view is four times that of its predecessor instrument, EGRET, which operated on board the Compton Gamma-Ray Observatory (CGRO) from 1991-2000. The sensitivity of the LAT is approximately 30 or more times that of EGRET depending on energy.

GLAST Burst Monitor (GBM)

Gamma-ray bursts (GRBs) are elusive and short-lived. Although they are the most energetic explosions in the universe, it is challenging to catch them even with a telescope with as large a field-of-view as the LAT. The GLAST Burst Monitor solves this problem by providing all-sky coverage with an array of 12-low and 2 medium-energy gamma-ray detectors pointing in different directions from the spacecraft. These detectors will track the direction and time histories of GRBs and other rapidly flaring gamma-ray sources. The GLAST Burst Monitor will detect approximately 200 GRBs each year, as well as solar flares, and other short lived, high-energy cosmic events.

Anatomy of a Space Telescope

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 1023 kg/m2. (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.

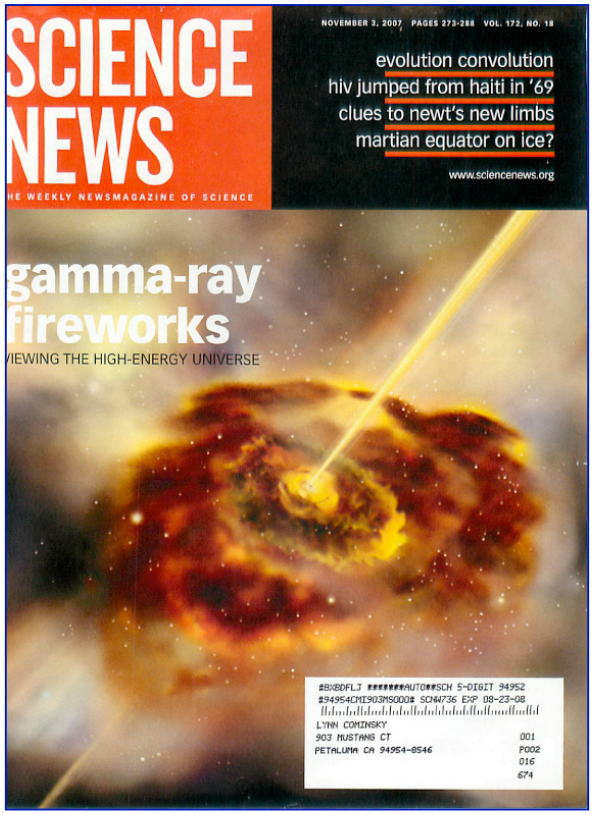
Cosmic Rays and Supernova Remnants – Cosmic rays are subatomic particles that are accelerated to very near the speed of light by mechanisms that are still a mystery. One theory suggests that these particles are accelerated by the shockwaves of supernovas. The LAT will be searching for the gamma-ray signature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

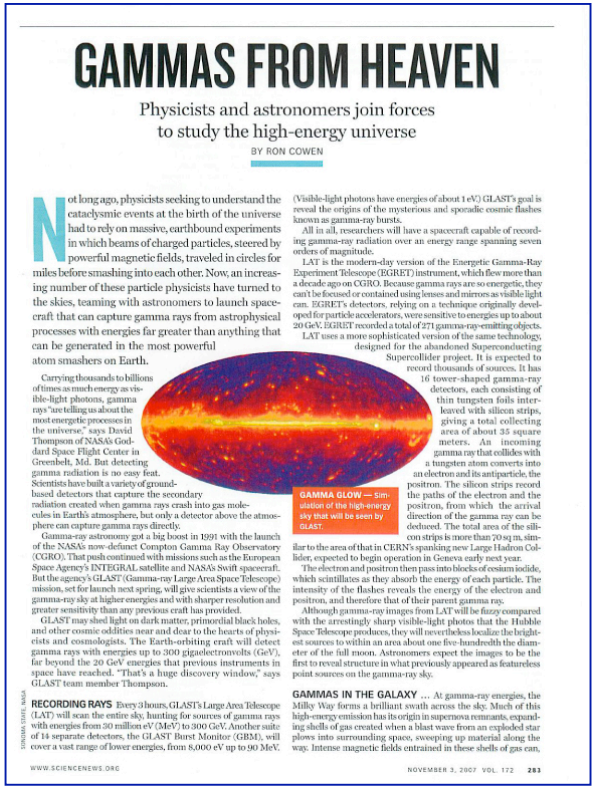
GLAST

NASA**facts**

PR Update

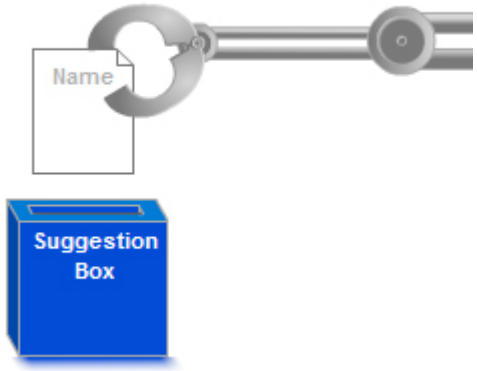
- GLAST Media Day 9/19/07 at GSFC
  - 16 reporters attended, many stories resulted – AP too





GLAST Naming Suggestion Box

- NASA HQ press release on 2/7/08 – site went live
- About 8200 responses world-wide to date, including famous dead scientists and also famous living people (against the rules), acronyms, and funny ideas
- Featured in 2/22 Science magazine but they seem to think that GRBs is all GLAST will see
- Opt-in for certificate and press release
- http://glast.sonoma.edu/glastname



Top names as of 2/29/08

- Satellite of Love 267 (This is from a Lou Reed song)
- Hulk/Banner 238
- Sagan 153
- Villard 120 (French discoverer of gamma-rays in 1900, worked with the Curies who gave him radium)
- GLAST 109
- Einstein 82 (probably already used)
- Stargazer 77
- Looking Glass 62
- GREAT 48 (Gamma-Ray Energy Astronomical Telescope or Extensive Area Telescope)
- Hawking 40 (not eligible)
- Fermi is in 16th place with about 27 entries, tied with Rutherford and Enterprise (like the starship)

GLAST Naming Certificate

National Aeronautics and Space Administration

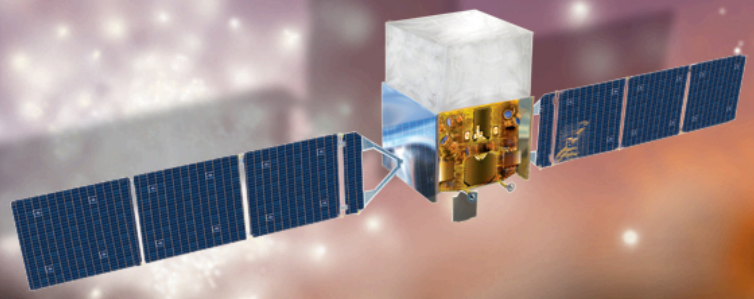
NASA

NAME THAT SATELLITE!
CERTIFICATE OF PARTICIPATION

Thank you for contributing to renaming the

Gamma-ray Large Area Space Telescope, (GLAST)

a satellite that will explore the extreme Universe



Prof. Lynn Cominsky,
GLAST E/PO Team Leader

Lynn R Cominsky

Press Releases from HQ or GSFC

- Next: GLAST Observatory arrives at Cape Canaveral for rocket integration – in progress!!
- February 13, 2008: GLAST's Delta II Rocket's First Stage Arrives in Cape Canaveral
- February 7, 2008: NASA Calls for Suggestions to Re-Name Future Telescope Mission
- December 19, 2007: NASA's GLAST Satellite Gets Unwrapped for the Holidays
- November 30, 2007: NASA's GLAST Satellite Arrives at Naval Research Lab for Testing

PR and E/PO Summary

- We are working on a few more things for launch – possible educator event at KSC
- GLAST Media Guide – updated, will be reprinted
- NASA portal site – http://www.nasa.gov/glast - being updated for each press release
- Still in progress for launch:
  - **Fact sheet – being reviewed**
  - **Brochure – still needs updates**