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## **GLAST E/PO Program Status**

**GLAST User's Committee 5/8/06**

Lynn Cominsky  
Sonoma State University

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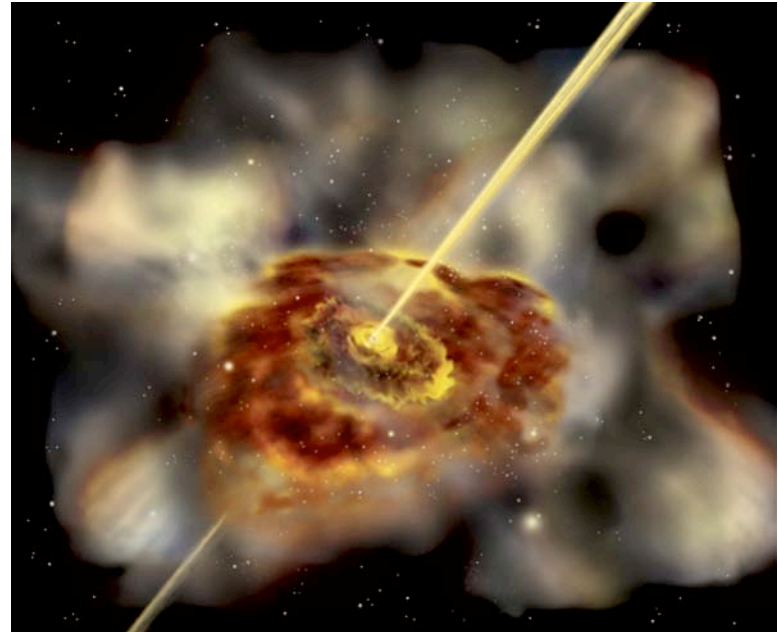
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# E/PO Work Breakdown Structure

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- 1) Management
- 2) Web based Materials
  - Web Site
  - Space Mysteries
- 3) Educator Training
  - Educator Ambassadors Program
  - Conference participation
- 4) Printed materials
  - TOPS Lesson Modules
  - Posters and Educator Guides
- 5) SLAC Virtual Visitor Center
- 6) PBS documentary and planetarium show (Tom Lucas)
- 7) Global (formerly GLAST) Telescope Network
- 8) Assessment and Evaluation (WestEd)





## GLAST Science and E/PO Goals

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How do active galactic nuclei (AGN) form and evolve?	Use Active Galaxies as an engagement to teach basic principles in physical science and math for grades 9-12
What is the nature of jets emanating from AGNs and Galactic black holes?	Use the mystery of jets coming out of black holes to inform and excite students and the public, and to teach about the properties of gamma-ray light
What is the origin of the isotropic "diffuse" gamma-ray background?	Facilitate understanding of the physical properties of different wavelengths of light and how scientists use light to study the Universe.
What are the sites and mechanisms of cosmic-ray acceleration?	Use observations of supernova remnants as an engagement to teach students about the relationship between the acceleration of charged particles and the creation of high-energy light



## GLAST Science and E/PO Goals

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What are gamma-ray bursts and how do they generate high-energy radiation?	Use GRBs as an engagement to teach students about the electromagnetic spectrum, as well as the interactions between energy and matter
What are the unidentified high-energy gamma-ray sources?	Use the map of the gamma-ray sky to illustrate the diversity of objects in the high-energy Universe, compare them to the visible sky and teach about the properties of different energies of light
Is it possible to detect any signatures of galactic dark matter?	Facilitate understanding of the different components that make up the Universe and how they form and evolve
How do rotation-powered pulsars generate high-energy gamma-rays?	Use pulsars as an engagement to teach about magnetic fields and magnetism



## Space Mysteries

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- <http://mystery.sonoma.edu>
  - Two new Space Mysteries coming soon!
    - Galactic Doom
    - Solar Supernova



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## Educator Ambassadors

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CA BC WY AZ KS MI IL CT MI NJ

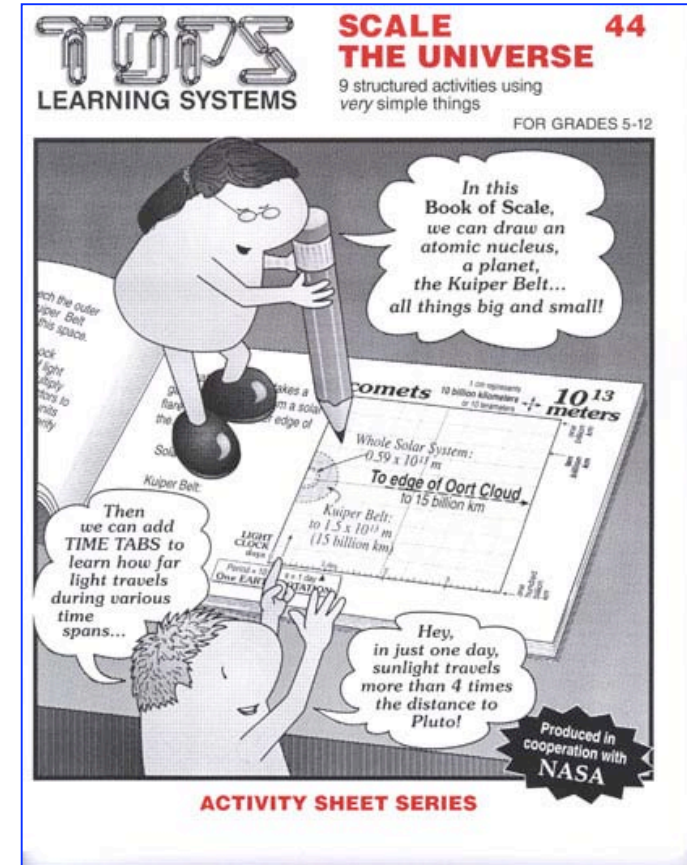
- GLAST supports 10 Educator Ambassadors
  - Master teachers selected in national competition
  - Training July 10-14, 2006 at SSU
  - Volunteers?
- Over 22,000 teachers directly trained since 2002 in over 240 different workshops





# TOPS Learning Systems

- FAR OUT MATH (2002)
- SCALE THE UNIVERSE (2004)
  - Reviewed by NASA Ed Product Review – Recommended for distribution via Teacher Workshops for grades 7-12



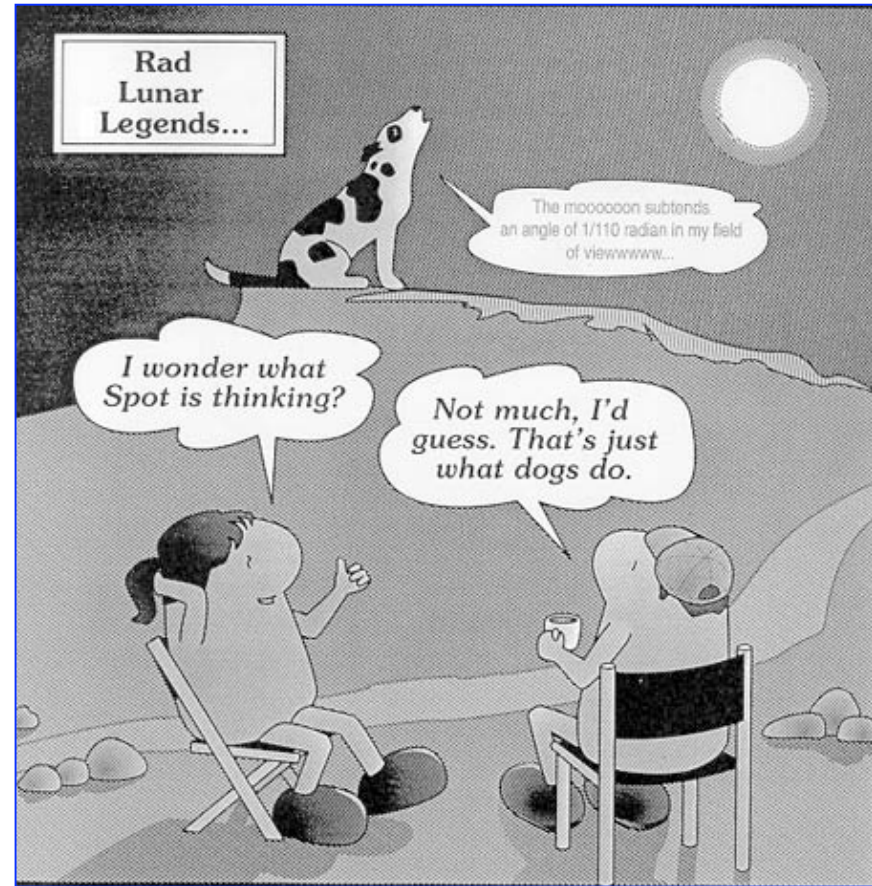
<http://www.topscience.org/>

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# TOPS Learning Systems

- Pi in the Sky (2005)
  - Degrees, radians and angular sizes of astronomical objects
  - Reviewed by NASA Ed Product Review – Recommended via Teacher Workshops
- This completes the TOPS series



<http://www.topscience.org/>

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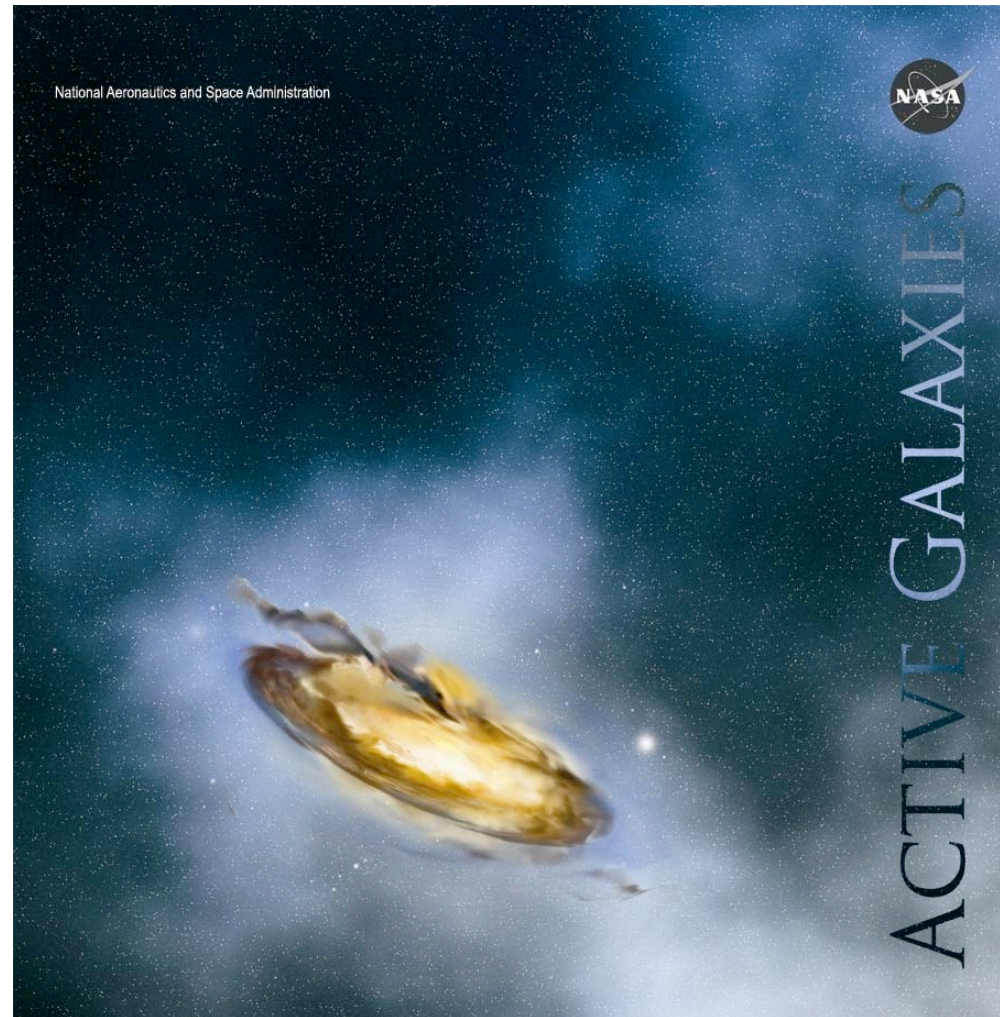




# AGN Popup Book

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- Now at printers!
  - Tasty Active Galaxy activity
  - “How the Galaxy Got Its Jets” children’s story
  - Description of active galaxies, components, and glossary





## Supernova Educator Unit – with XMM

Reviewers needed –  
draft now available

- **3 activities**

- Biography of a Supernova
- The Crawl of the Crab
- At the Heart of a Supernova



- **Poster of Supernovae**

- Images of real Supernovae
- Shows what a Supernova looks like during different stages of the explosion – timeline used for biography

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# Supernova Educator Unit





## Other printed materials

- GLAST Race Card Game

- “Magic” style game to build GLAST and observe astronomical objects



- GTN Observing activities tutorials

- Cookie Cutter Astrophysics – now on line
- Astrometry tutorial – being written up
- Jelly bean Spectroscopy – write up now in review
- User’s Manual now being written up



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## GLAST Mission Poster

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Reprinted – now  
available again!



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## PBS Television Special

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- Tom Lucas productions – *Monster of the Milky Way* is scheduled to air on NOVA 9/26/06
- Planetarium show: *Black Holes: The Other Side of Infinity* premiered January 30, 2006 at Denver Museum of Nature and Science
- GLAST E/PO seed funding led to \$1.2 M NSF grant to finish TV show, do planetarium show
- SSU E/PO group is doing teacher workshops at each museum that leases the planetarium show – new Black Holes Educator Guide is now being distributed – first workshop was 3/4/06 in Denver – next will be Baton Rouge – Chabot (Oakland, CA) under negotiation

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## Black Holes Educator Guide

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- Cover illustration (from planetarium show)
  - The formation of BH (2 activities)
  - The gravity of the situation (around BH)
  - Travel inside the BH at the center of the Milky Way (Science Fiction or fact?)
  - The Search for BH



## Press coverage of planetarium show

# New York Times

# Rocky Mountain News



## Black holes get turned inside out

### CU astronomer's work with planetarium a scientific thrill-ride

By Katy Human  
Denver Post Staff Writer

In a 1992 episode of the cartoon *Ren & Stimpy*, a black hole sucks up the characters' spaceship and hurls it onto the surface of a very strange planet.

Clouds float by in psychedelic shapes. Ren's eyes slip off his head, Stimpy's nose comes off on his finger.

"It's a beautiful, artistic interpretation of black holes, which warp everything," said University of Colorado astronomer Andrew Hamilton, who studies black holes. "I loved it."

Hamilton's own vision is different. The physicist started with Einstein's theory of general relativity —

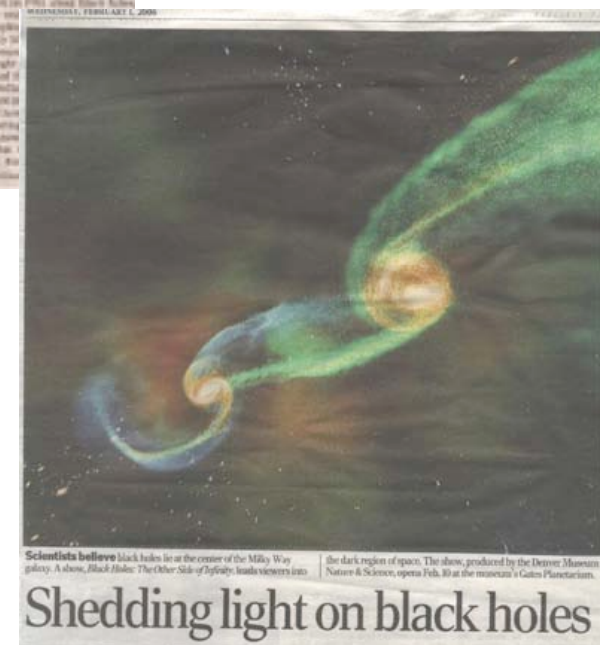


Nathryn Scott Osler | The Denver Post

Philip Plait, science consultant from Sonoma State University in California, previews the two-year project to portray black holes.

> See SHOW on 48

# Denver Post



**Scientists believe** black holes lie at the center of the Milky Way galaxy. A show, *Black Holes: The Other Side of Infinity*, leads viewers into

## Shedding light on black holes



## Black Hole Brochure

- Funded primarily with EXIST mission concept study funds, but partly subsidized by GLAST
- Accompanies planetarium show
- Future print runs will be funded by and will feature GLAST
- Spanish version now in progress







## SLAC Virtual Visitor's Center



Interactive web activity – uses FRED to do simulations –  
we are waiting for scientists to verify our images

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## Global Telescope Network as of 5/06

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- Simple image reduction and analysis of ~25 AGN to establish variability baselines
- GORT north of SSU
- OR, NM, PA, LA, AZ, OH
- ATA, Rome, Italy
- Working on Las Campanas partner through NASA Telescopes in Education project
- AAVSO
- Hands On Universe
- Elk Creek Observatory at Holton, Kansas HS
- Agrupacion Astronomica de Sabadell. Barcelona, Spain
- Tonantzintla Observatory  
Tonantzintla, Mexico
- Universidad Nacional de La Plata Buenos Aires, Argentina
- Bernard Heathcote. Victoria, Australia
- Carnes Hill Observatory.  
Sydney, Australia
- Nyrola Observatory  
Muurame, Finland
- Western Kentucky University

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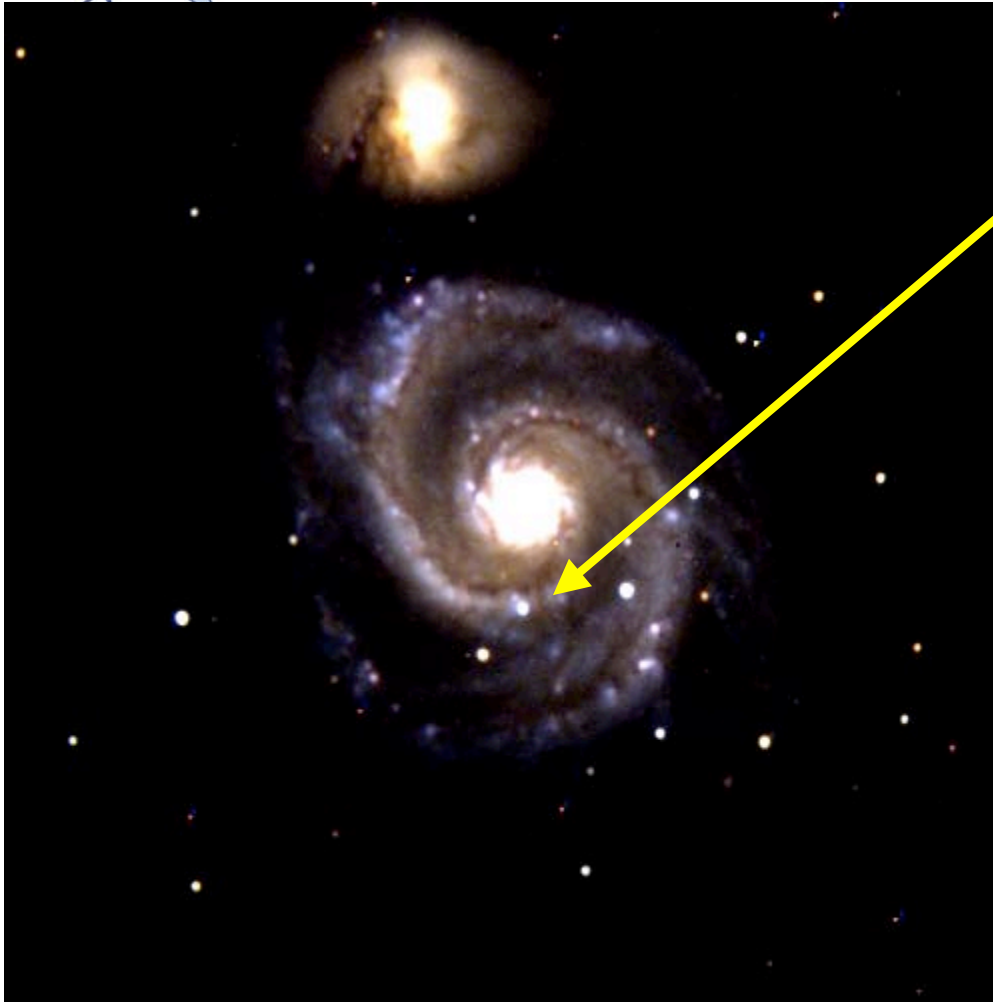
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# GLAST



## Image from GORT

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- Supernova in M51
- True color composite image from R, G & B

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## Evaluation Process

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- All GLAST products are internally evaluated by SSU E/PO, then tested by EAs, then evaluated by our external evaluators, WestEd (led by Dr. Ted Britton)
- All products then sent through NASA product review, and entered into SSERD
- We started with evaluating our teacher training workshops, then our teachers' workshops, and now we are beginning to measure impacts of our work into the classrooms of our trained teachers



## E/PO Summary

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- **GLAST E/PO is exciting the public and students of all ages**
- **We are on budget and moving ahead on all scheduled items**
- **Over 22,000 teachers have been trained to date**
- **GLAST E/PO materials are in the hands of over 20,000 teachers nationwide**