



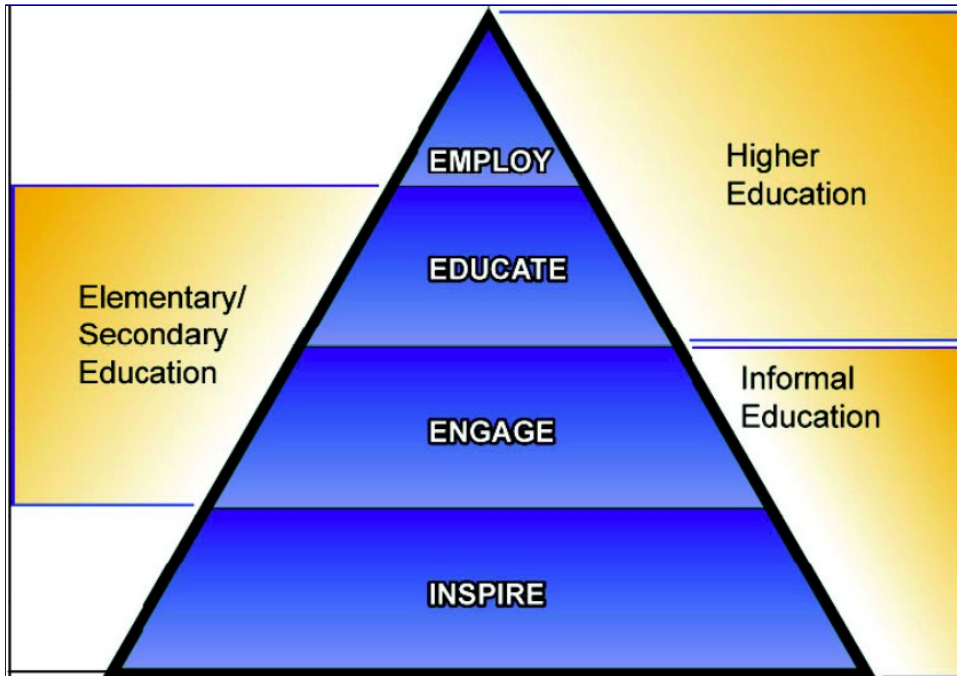
# **XMM-Newton Education and Public Outreach Program**

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Lynn Cominsky  
Sonoma State University  
May 15, 2008



# New NASA Education Framework




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

**Emphasis on workforce development for under-represented populations**



# XMM-Newton E/PO website

 **GODDARD SPACE FLIGHT CENTER**

  **Sonoma State University**

[NASA Homepage](#)  
[GSFC Homepage](#)  
[XMM Homepage](#)

**Search the XMM-Newton site:**  
enter search text

**HEASARC Quick Links**  
---Quick Links---

**HEASARC HOME** | **XMM-NEWTON HOME** | **ARCHIVE** | **DATA ANALYSIS** | **PROPOSALS & TOOLS** | **EDUCATION & PUBLIC INFO**

 **XMM-NEWTON**

**EDUCATORS** | **PUBLIC** | **MULTIMEDIA GALLERY** | **PRESENTATIONS** | **RELATED LINKS**

## XMM-Newton Education and Public Outreach

XMM-Newton is a joint NASA-European Space Agency (ESA) orbiting observatory, designed to observe high-energy X-rays emitted from exotic

**Latest Swift Outreach News**  
[XMM-Newton scores 1000 top-class science results](#)  
[Space Place Black Hole Rescue!](#)

- One-NASA format now redone



# Night Sky Network Toolkit

- SUPERNOVA!
- Joint with Swift, GLAST and Suzaku
- Developed by Astronomical Society of the Pacific
- Now finished and approved by NASA Product Review



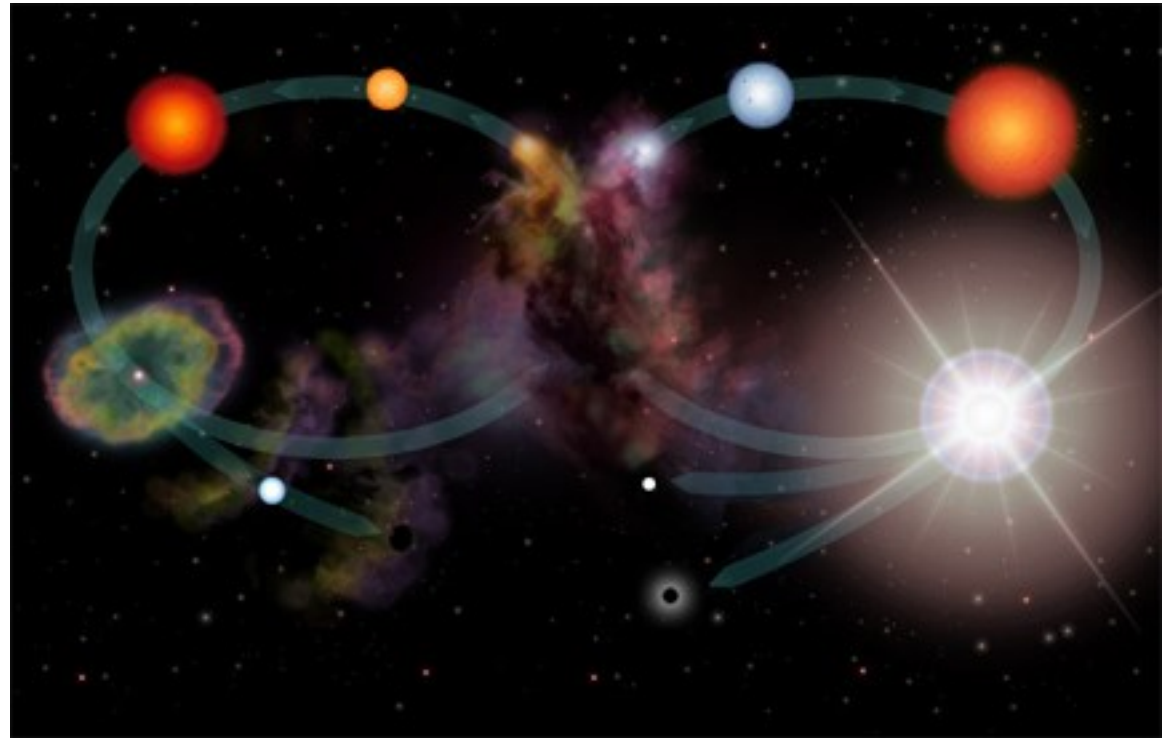
- Distributed to over 200 amateur astronomy clubs in 5/08



# SUPERNOVA! Activities

- Supernovae in the Lives of Stars

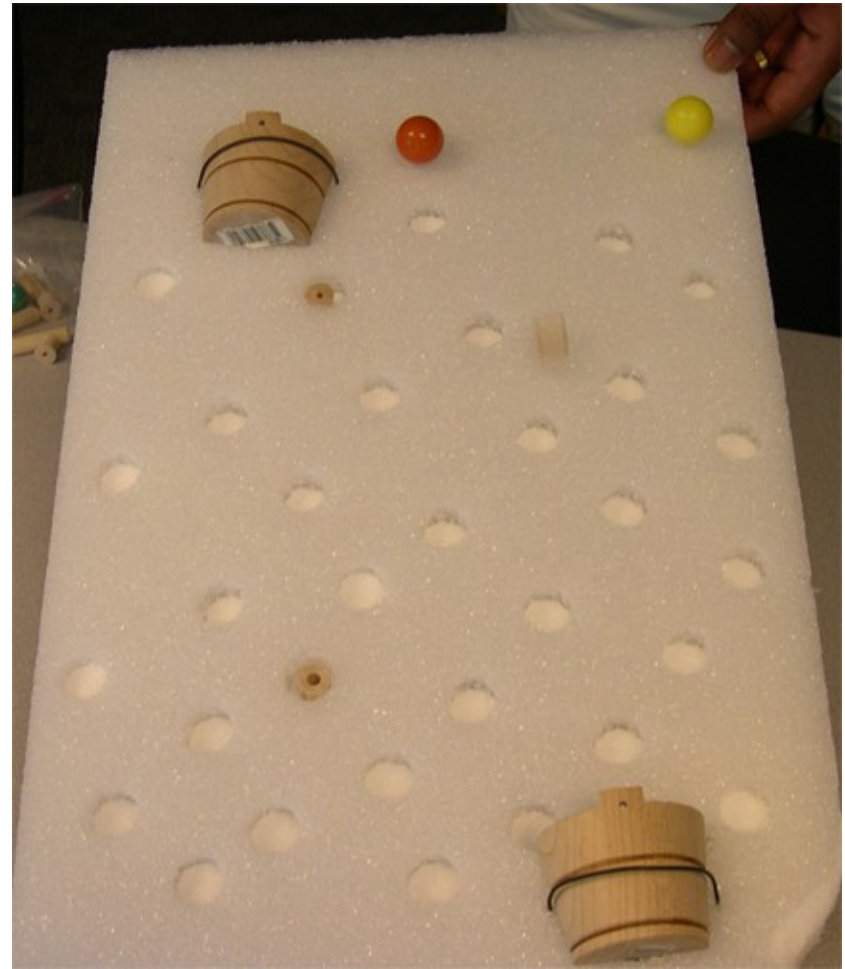
- Life Cycles of Stars poster
- Let's Make a Supernova
- Star Maps: Stars Likely to Go Supernova





# 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
- Supernova Education Unit CD
- DVD training video
- Ppts and other resources

**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 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

**Common Elements originating from small stars**

Nitrogen  
Carbon  
Lithium

**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



# 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

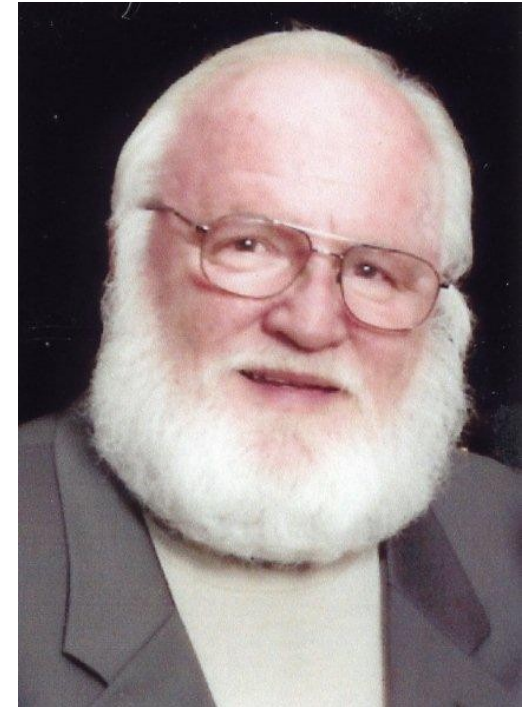
Will do  
this again  
in June,  
2008 for  
rising  
seniors



# Educator Ambassadors

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- XMM-Newton supports 2 Educator Ambassadors
  - We have been missing one for the past year.
  - New one identified – Bill Panczner, Tampa FL – will start after...
  - Next training July 28-Aug 1, 2008 at SSU
  - Focus on supernovae and cosmology
- XMM-Newton workshops and talks have directly reached over 3800 students, teachers, and members of the general public through 51 talks and workshops in 2003-2008

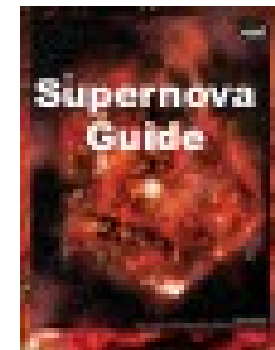


Bill Panczner



# Supernova Education Unit – with GLAST

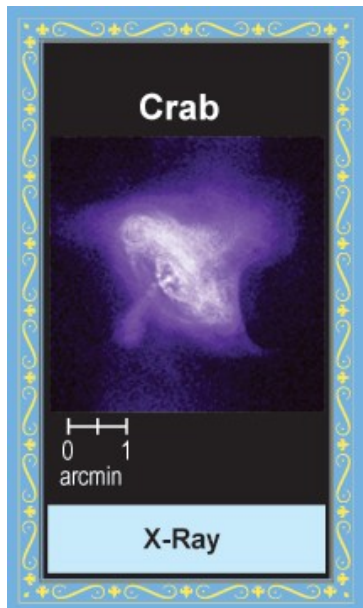
- 50-page full-color Educator's Guide
  - Background information for the teachers and students
  - Fishing for Supernovae (grades 7-8)
    - Separate file for card images
  - Crawl of the Crab (grades 9-12)
    - Electronic version and animation
    - Paper and pencil version
  - Magnetic Poles and Pulsars
  - Scientific Literacy Activity
  - Math and science standards alignment information
  - Assessment rubrics for all activities
- Submitted to NASA Product Review and WestEd 4/08
- <http://xmm.sonoma.edu/edu/supernova/index.html>





# Fishing For Supernovae

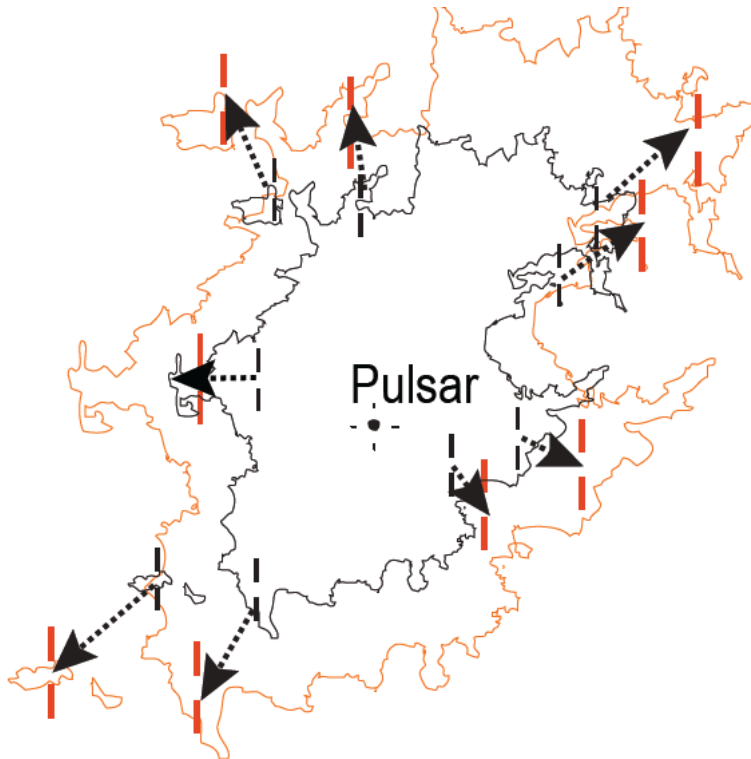
- Multi-wavelength card game like “Go Fish”
  - Asks students to measure and compare X-ray images for 2 SNe at different distances but ~ same age (Tycho and Kepler) and predict apparent diameter for a third SN (Cas A)





# Crawl of the Crab

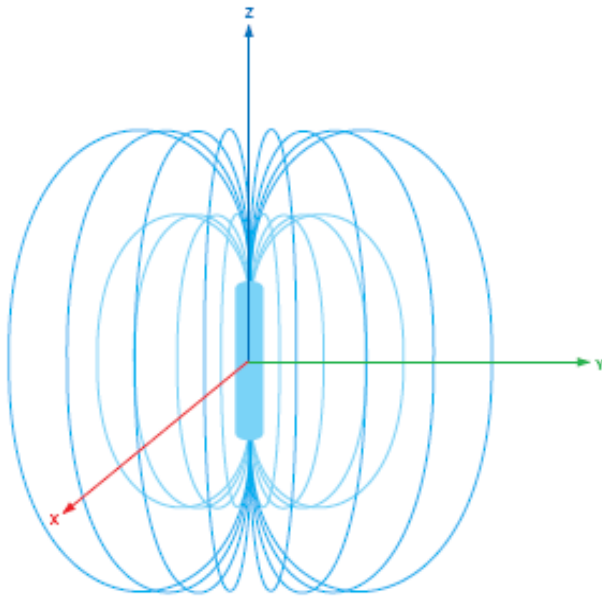
- Classic activity with two images from 1956 and 1999
- Both Excel and paper/pencil versions





# Magnetic Poles and Pulsars

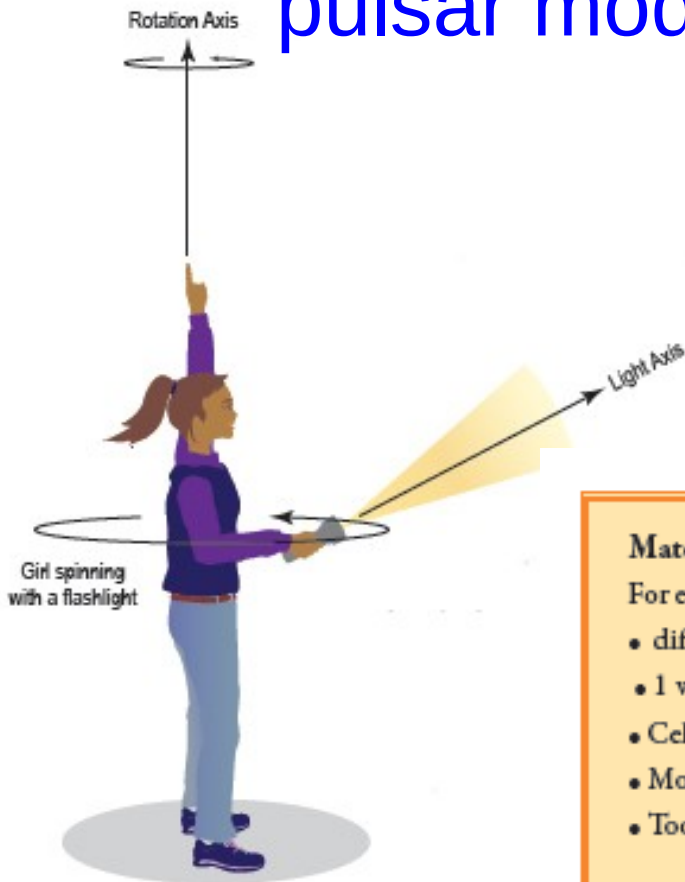
- Seeing Magnetic Fields: Starts with 2D iron filings, transitions to 3D magnetic globe demo



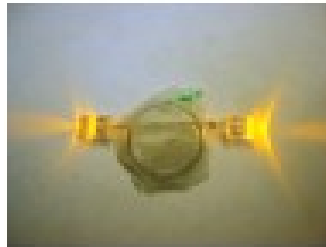


# Magnetic Poles and Pulsars

- Make Your Own Pulsar: students build pulsar model



Two pulsar prototypes  
your students may design:



## Materials:

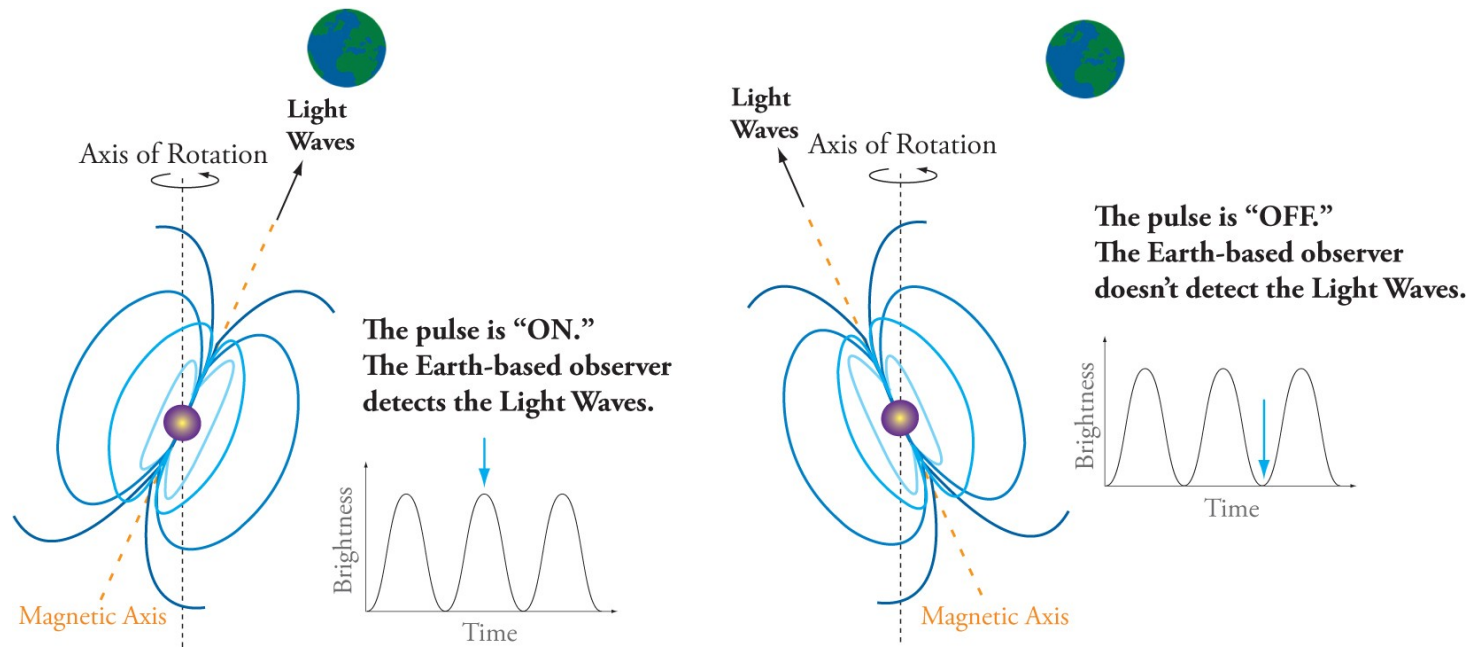
For each pulsar you will need;

- different colors of light emitting diodes (LEDs)
- 1 watch battery
- Cellophane (Scotch) tape
- Modeling clay or aluminum foil
- Toothpick or skewer



# Magnetic Poles and Pulsars

- Understand the pulsar light curve







# Magnetic Poles and Pulsars

- Comparing the Earth to a Pulsar: Extension activity compares field/rotation rate of pulsars to Earth's magnetic field/rotation rate then predicts for Jupiter and AE Aqr (magnetic WD)

Object	Magnetic Field-Strength (Tesla)	Radius (km)	Rotation
Earth's field at ground level	$0.5 \times 10^{-4}$	$6.40 \times 10^3$	24 hours
Jupiter field	$10^{-1}$	$7.10 \times 10^4$	10 hours
White Dwarf AE Aquarii	$10^4$	$6.40 \times 10^3$	33 s
Neutron star surface	$10^8$	$1.00 \times 10^1$	$10^{-3}$ s to 100 s



# Science literacy activity

- Neutron Stars in the News
- Students read and analyze 2 news articles from XMM
  - Compare measurements of pulsar magnetic fields

**XMM-Newton makes the first measurement of a dead star's magnetism**

Bignami et al. June 11, 2003 Nature

**'Starquake' reveals star's powerful magnetic field**  
by David Shiga

Guver et al. September 2007 New Scientist



# eXtreme Universe Planetarium Show

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- For portable (inflatable) Planetaria
- Planetarium show student manual and teacher's guide already completed
- Beta test version now available, was piloted but we were not happy with it – uses Stellarium 0.8.1
- Version 0.9 is now out, so we are redoing the software....



## Plans for 2008/9

- After-School Programs with Under-represented Students
  - Continue work with Cali and RUP students
  - bring NASA content into national MESA (Math, Engineering, Science Achievement)
  - Start MESA chapter at SSU
- Expand work with MESA to local community colleges and MESA schools program
- Develop new workshop for Supernova Education Unit and train EAs during July 2008, also using SUPERNOVA! toolkit
- Reprint rulers if funding allows
- Get second EA on board again, train in July 2008
- Finish planetarium show, write script.



# E/PO Summary

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- **XMM-Newton E/PO is exciting the public and students of all ages**
- **Supernova Educator Unit now finished, submitted to product review**
- **Over 3,800 teachers have been trained in 5 years by XMM-Newton Educator Ambassadors**
- **Night Sky Network kit now finished and approved**