

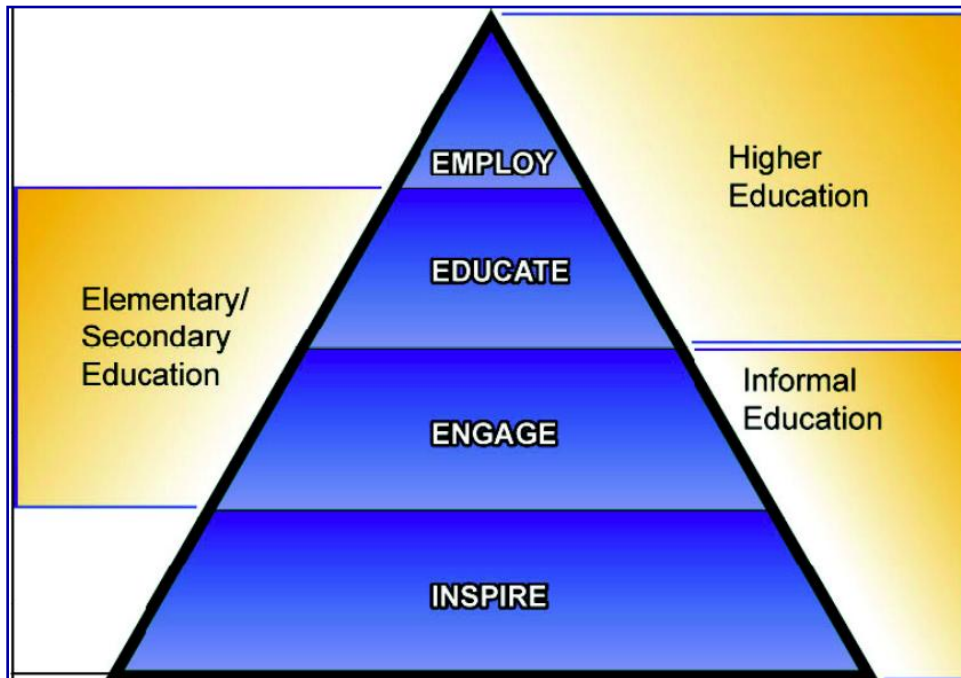


XMM-Newton Education and Public Outreach Program

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**

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[GSFC Homepage](#)
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XMM-NEWTON

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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, Blue, Black, Help, 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



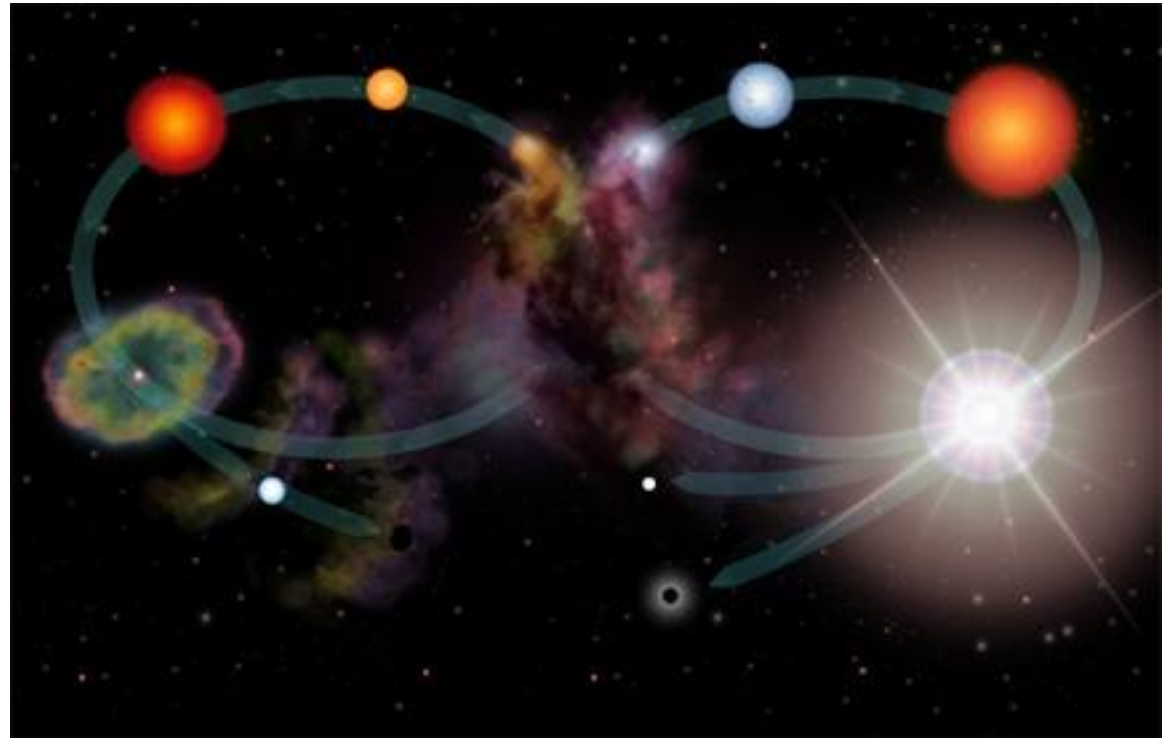
- Distributed to over 200 amateur astronomy clubs in 5/08



SUPERNOVA! Activities

- Supernovae in the Lives of Stars

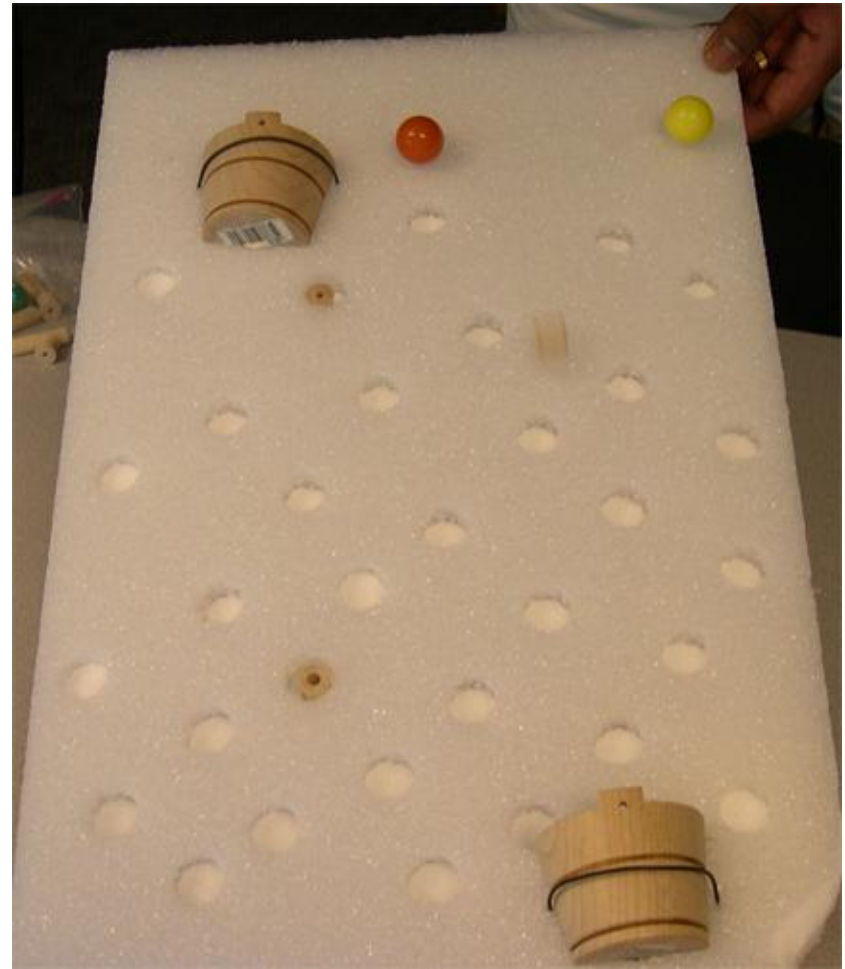
- Life Cycles of Stars poster
- Let's Make a Supernova
- Star Maps: Stars Likely to Go Supernova





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



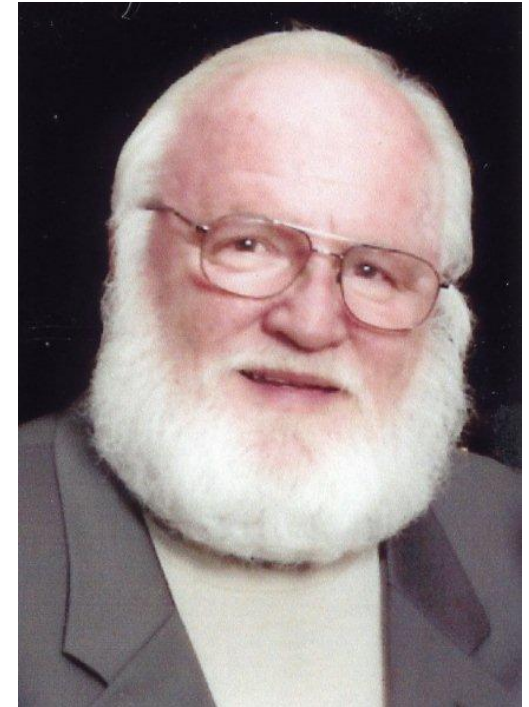
Last summer's group

Will do this again in June, 2008 for rising seniors



Educator Ambassadors

- 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

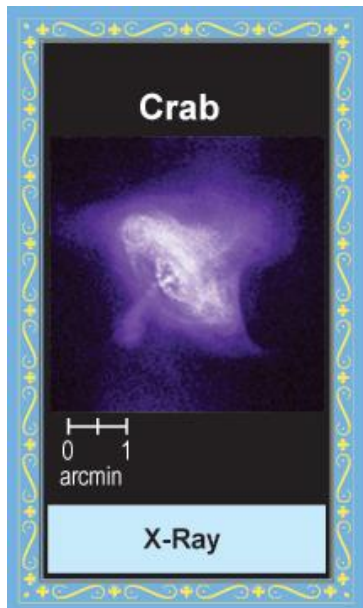
- 50-page full-color Educator's Guide
 - Background information for the teachers and students
 - Fishing for Supernovae (grades 7-8)
 - Separate file for card images
 - Crawl of the Crab (grades 9-12)
 - Electronic version and animation
 - Paper and pencil version
 - Magnetic Poles and Pulsars
 - Scientific 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

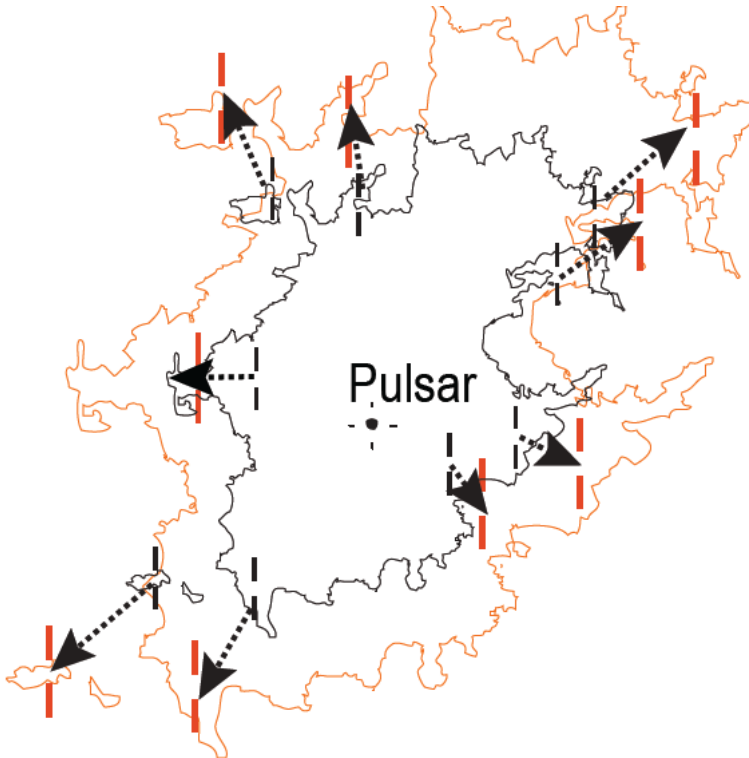
- Multi-wavelength card game like “Go Fish”
 - Asks students to measure and compare X-ray images for 2 SNe at different distances but ~ same age (Tycho and Kepler) and predict apparent diameter for a third SN (Cas A)





Crawl of the Crab

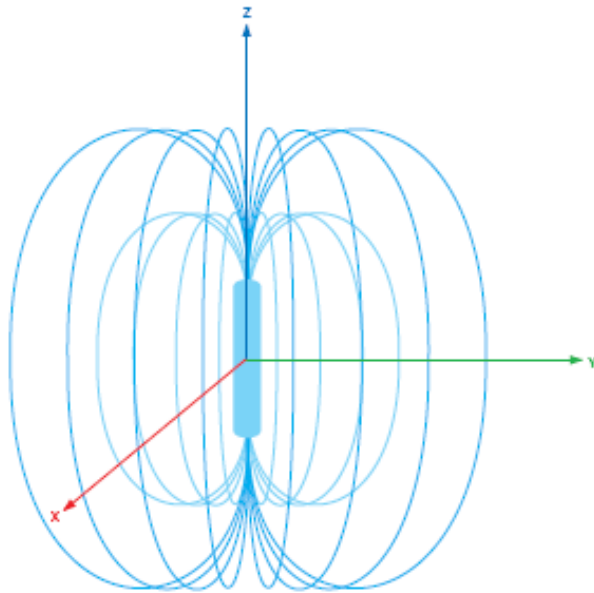
- Classic activity with two images from 1956 and 1999
- Both Excel and paper/pencil versions





Magnetic Poles and Pulsars

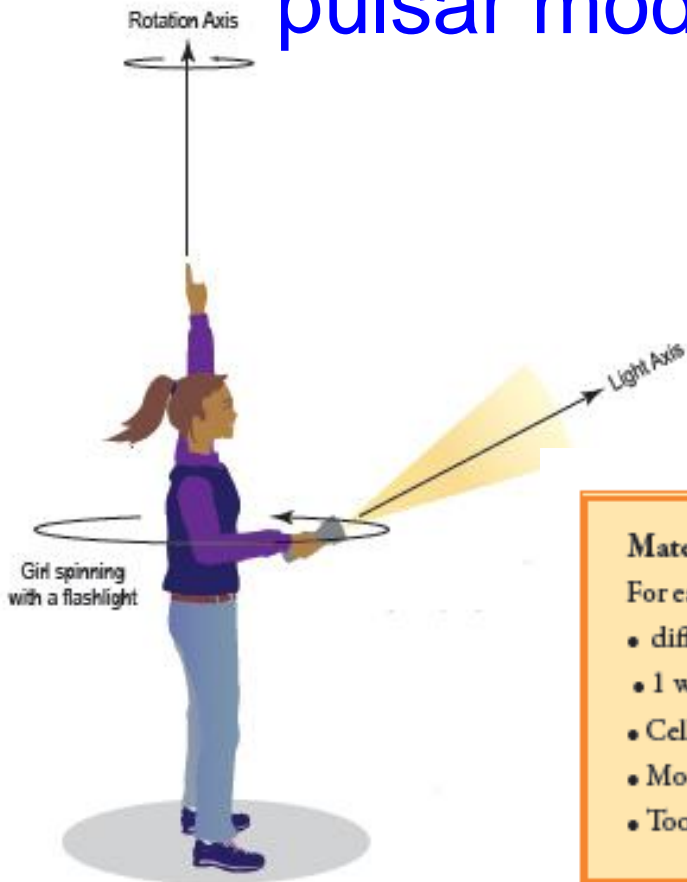
- Seeing Magnetic Fields: Starts with 2D iron filings, transitions to 3D magnetic globe demo





Magnetic Poles and Pulsars

- Make Your Own Pulsar: students build pulsar model



Two pulsar prototypes
your students may design:



Materials:

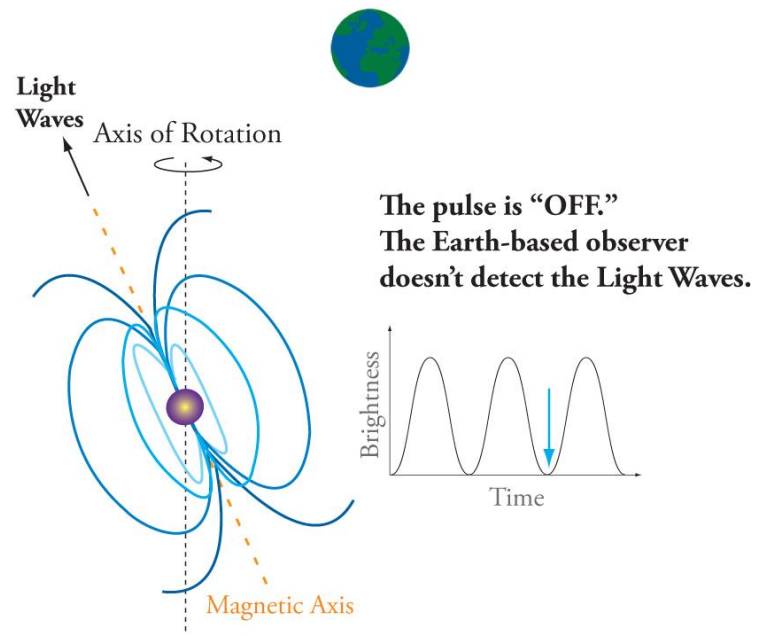
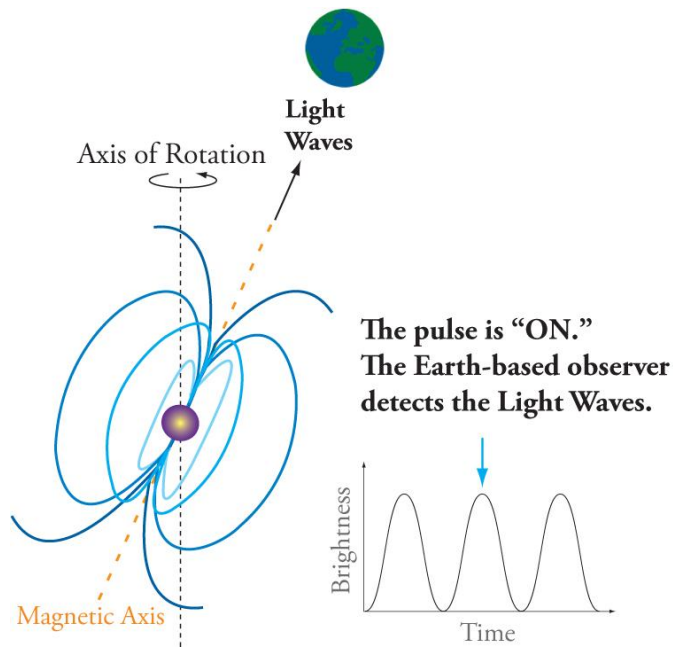
For each pulsar you will need;

- 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 | 0.5×10^{-4} | 6.40×10^3 | 24 hours |
| Jupiter field | 10^{-1} | 7.10×10^4 | 10 hours |
| White Dwarf AE Aquarii | 10^4 | 6.40×10^3 | 33 s |
| Neutron star surface | 10^8 | 1.00×10^4 | 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

- 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

- **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**