



# The Global Telescope Network

Bringing Real-time Astronomical  
Observations into the Classroom

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# Why do astronomical research in the classroom?

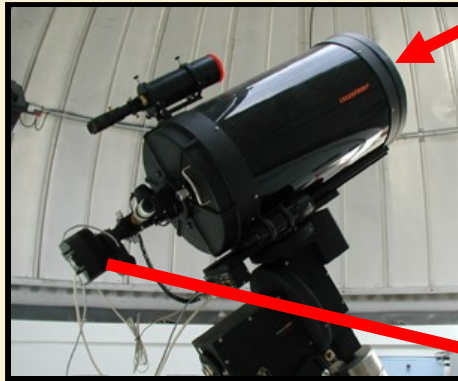
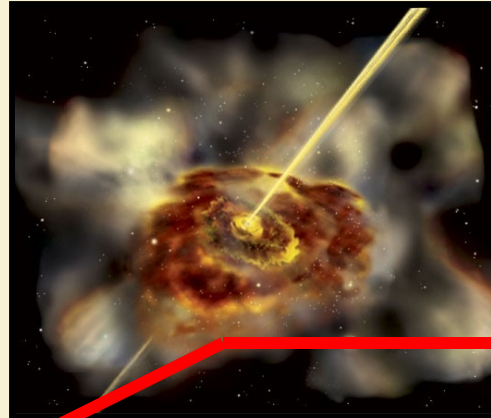
- Inspires students through excitement of real NASA science
- Learning scientific analysis techniques transcends astronomy
- Creates next generation of scientists and engineers through hands-on engagement with modern computer-controlled instrumentation





# What is the GTN?

Active galaxies  
and other  
exotic objects  
in space



Ground-based  
data from GTN

Students'  
brains!



High-energy data  
from GLAST or  
other satellites



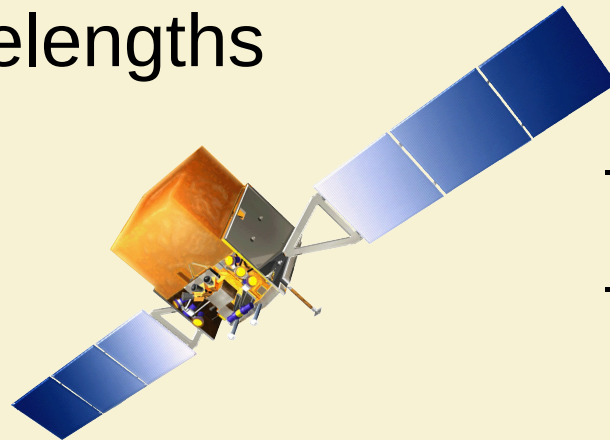
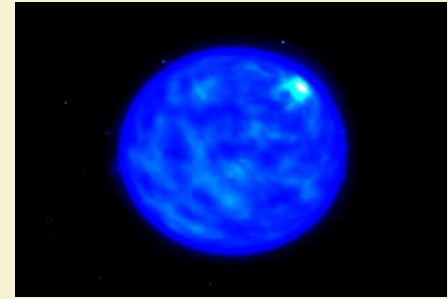
# Who is analyzing and/or acquiring GTN data?

- High school students
  - Roseland University Prep (CA)
  - Holton HS (Kansas),
  - Lick-Wilmerding HS (CA)
  - Hands On Universe
- College students
  - Sonoma State University
  - Western Kentucky University
- Amateurs
  - AAVSO
  - Observers in Finland, Australia, Italy, Mexico, Spain...



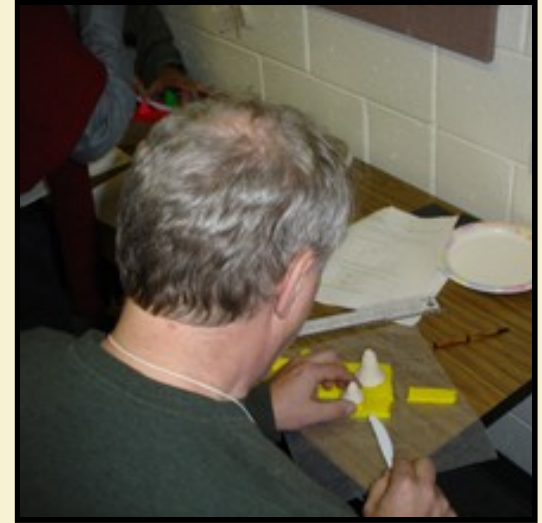
# What are we studying?

- Multi-wavelength data sets of time-variable exotic objects
  - Active galaxies
  - Gamma-ray bursts
  - Magnetic cataclysmic-variable binaries
- Ground-based visible light data combined with data at other wavelengths
  - GLAST
  - Swift
  - XMM-Newton
  - Spitzer
  - VERITAS

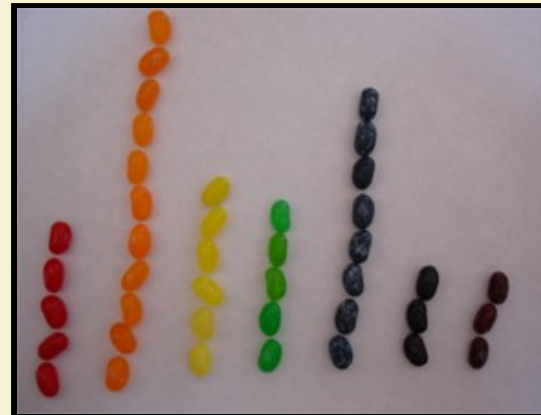


# What do we offer?

- Tutorials on astrometry and photometry
- Resources about robotic telescopes
- Software analysis tools
- Teacher training workshops
- Data archiving
- Partnerships with pro telescopes
  - PROMPT (Chile)
  - PI of the Sky (Poland)
- Museum partnerships
  - California Academy of Sciences
  - Morehead Planetarium (NC)
  - Adler Planetarium



Teacher doing “Cookie Cutter Photometry” workshop



Jellybean spectral energy distribution

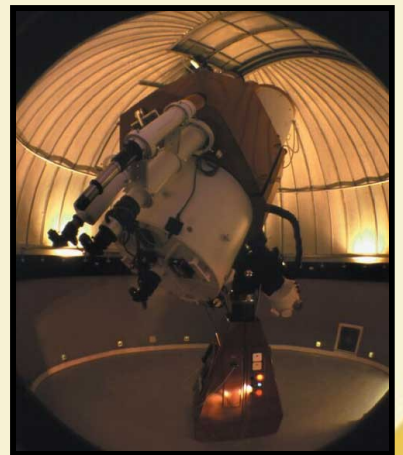


# How can you get involved?

- Become an associate
  - Analyze data from GTN telescopes
  - Propose your own observations
  - Long-term campaign or one-time observations
- Become a partner (have your own telescope)
  - Conduct your own observations
  - Schedule observations for associates
  - Reduce and archive data



Spitzer  
AGN obs  
by Deer  
Valley HS

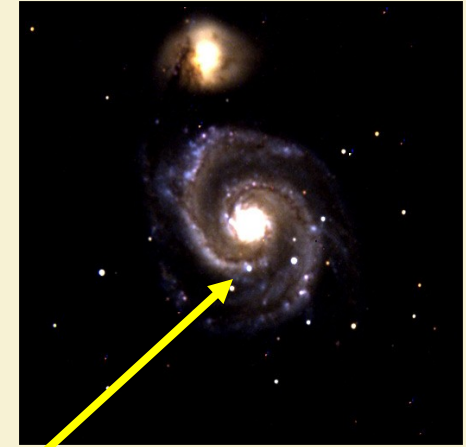


Spain

# GTN Research at SSU

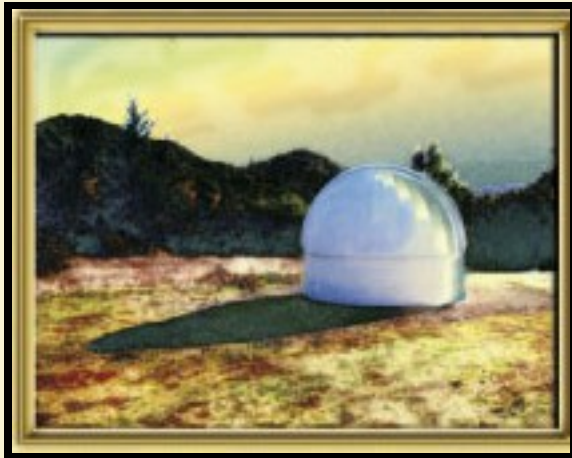


GLAST Optical Robotic Telescope at the California Academy of Science's Pepperwood Natural Preserve



Supernova in M51

Photometry of magnetic cataclysmic variable system

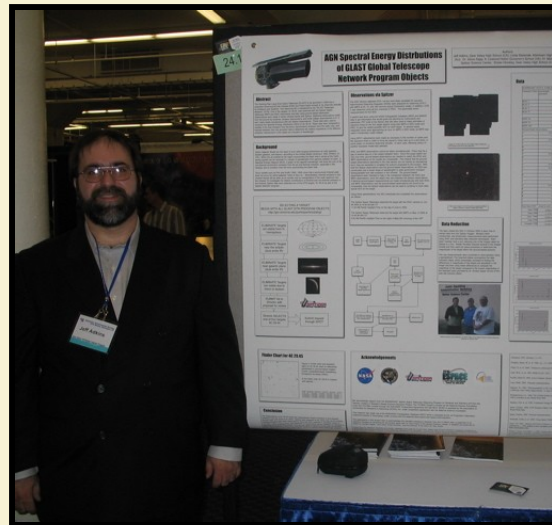






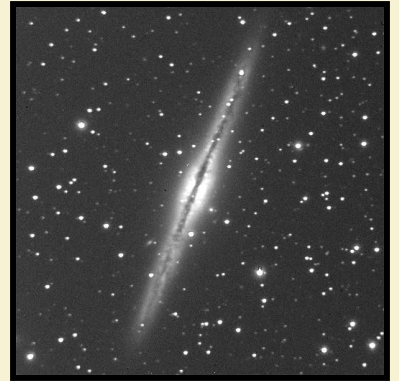
# GTN Research at Deer Valley High School, CA (Jeff Adkins)

- Spitzer observations of 4C29.45 and AO 0235+164 (AGN that are GTN targets)
  - Space-based IR and ground-based visible
  - Presented posters and wrote results
  - One DVHS student is now enrolled at SSU!



# GTN Research at Holton, Kansas HS (Mike Ford)

- Elk Creek Observatory
  - Monitors many AGN each night
  - Gamma-ray burst chasing
  - Featured on PBS NOVA



NGC 891



CCD camera



NOVA: Monster of the Milky Way



20 inch telescope



Come join us!



<http://gtn.sonoma.edu>

Global Telescope Network

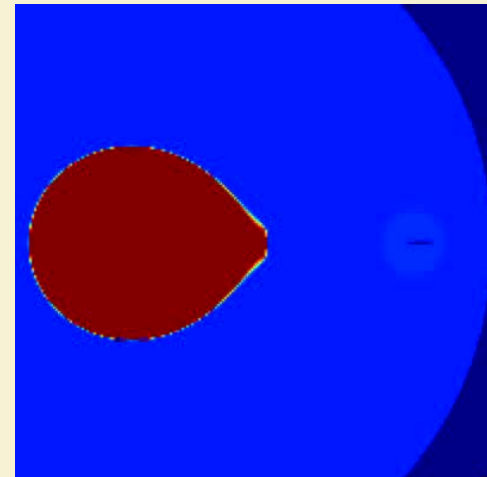
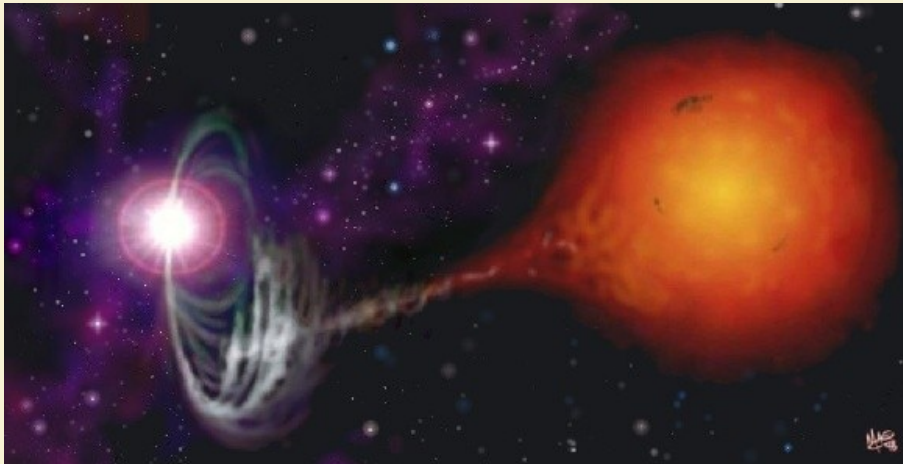
# Active Galaxies

- Galaxies with unusually bright nuclei
- Emission lines (narrow and/or broad)
- Some have jets
- All are believed to have super-massive black holes at their cores



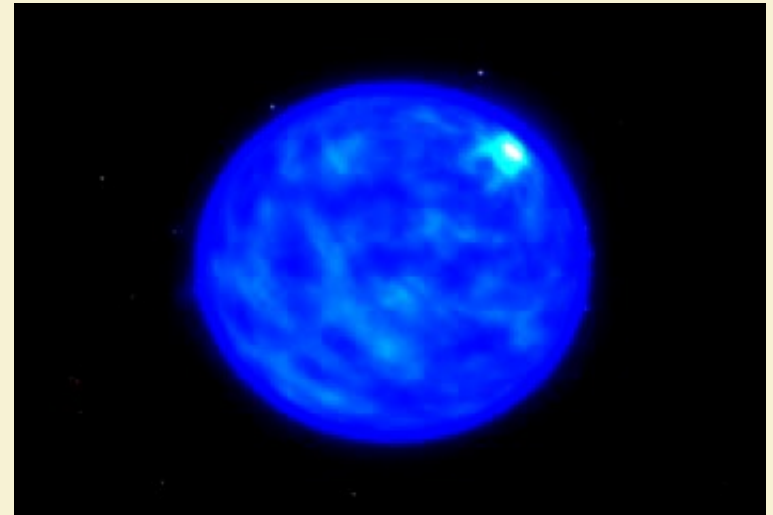
# Polars (Magnetic CVs)

- White dwarfs (dead stars) with unusually strong magnetic fields
- Orbit a “normal” star, draw matter off
- Matter falls right onto surface, burns explosively creating X-ray flares

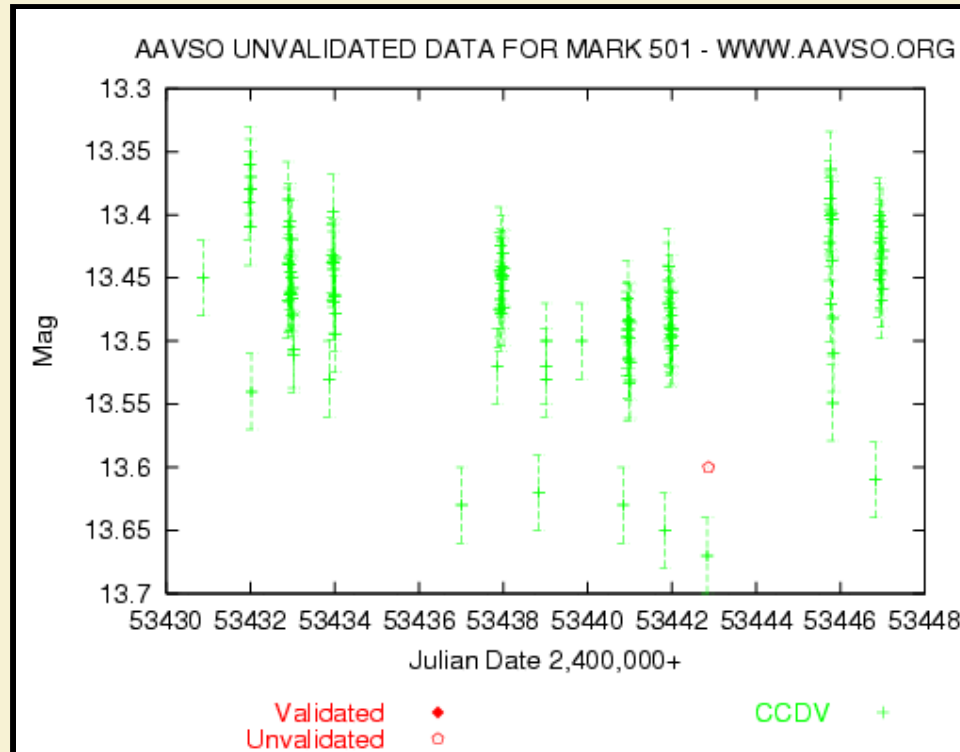


# Gamma-ray Bursts

- Incredible blasts of energy =  $10^{18}$  Suns
- 2-3 per week
- Flash may last seconds to minutes
- Optical observations of afterglow
- Birth of black holes



# GTN Research with AAVSO



- Multi-wavelength campaign on Mkn 501  
– Blazar with TeV and gamma-ray emission