



# An Unexpected NITARP Adventure

or

*I wish I had known that!*

Peggy Piper  
Lincoln Way High School  
New Lenox, Illinois

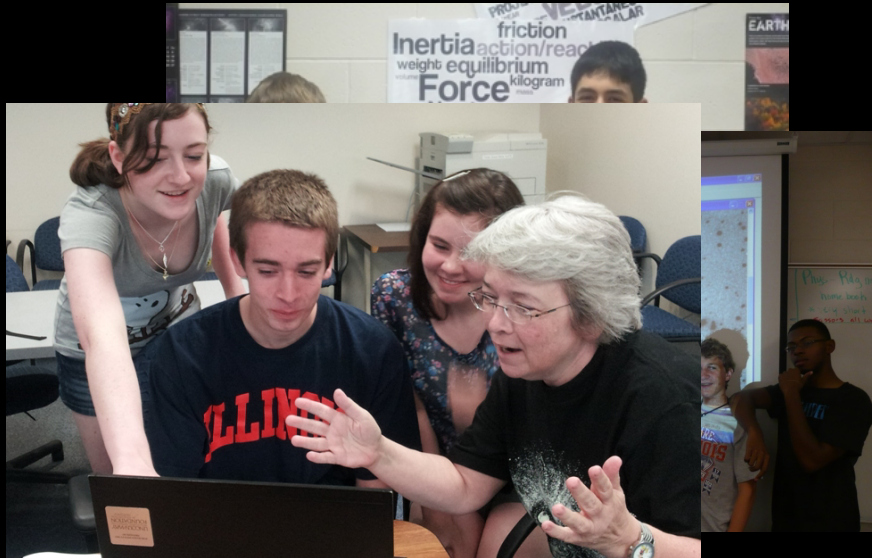
3<sup>rd</sup> time's a charm



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# Workshop



## NITARP AAS Workshop - Sunday 6 Jan 2013

Room 203A of the Long Beach Convention Center.

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- 9:00-9:30 Welcome and general introduction. Introduce everyone to everyone (Gorjian/Rebull)
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- 9:45-10:25 [General description of program milestones and goals](#) (Rebull/Gorjian)
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- 11:15-11:45 [Intro to IPAC archives IRSA, NED, SHA](#) (Rebull)
- 11:45- 1:30 Lunch/work time with your team
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**Monday night, Jan 7, 7-9pm (Regency Ballroom D of the Hyatt)** -- wrap up and discussion of NITARP 2012, plus advice for NITARP 2013! Please try to grab some food ahead of time, we will have light snacks.

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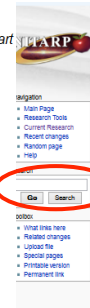


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7:30am	Session Chair Breakfast, 7:30am-8:00am, Room 203A Speaker Ready Room, 7:30am-4:00pm, Room 203C Registration, 7:30am-5:00pm, Promenade Level 1 Lobby
8:00am	100 Plenary Sessions: Welcome Address by AAS President David Helfand, 8:00am-8:30am, Grand Ballroom Cyber Cafe, 8:00am-6:30pm, Promenade Level 1 Lobby Career 101: Career Planning Workshop for Graduate Students and Postdocs, 8:00am-10:00am, Regency Ballroom I (Hyatt Long Beach)
8:30am	101 Plenary Sessions: Kavli Lecture: The Spitzer Space Telescope: Science Return and Impact, B.T. Soffel (Spitzer Science Center, Caltech), 8:30am-9:20am, Grand Ballroom Career Center, 9:00am-6:30pm, Exhibit Hall A
9:00am	Exhibit Hall, 9:00am-6:30pm Posters, 9:00am-6:30pm, Exhibit Hall A
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	151 HAD IV History of Astronomy 152 Large Scale Structure, Cosmic Distance Scale and GRBs 153 NASA's Physics of the Cosmos (POCS) studies on Gravitational Wave and X-ray Mission Concepts 154 Pulsars, Neutron Stars 155 Relativistic Astrophysics, Gravitational Lenses & Waves 156 Specialized Observatories and Light Pollution 157 Starburst Galaxies 158 Stars, Cool Dwarfs, Brown Dwarfs 159 The Sun
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11:30am	118 Plenary Session: A Modernized Discussion about Interesting Careers in Aerospace and Mission Operations, Kathryn Managan (STScI) and Jeffrey Grant (Northrop Grumman Aerospace Systems), 8:00pm-9:30pm, Grand Ballroom	8:00pm	140 Plenary Session: A Modernized Discussion about Interesting Careers in Aerospace and Mission Operations, Kathryn Managan (STScI) and Jeffrey Grant (Northrop Grumman Aerospace Systems), 8:00pm-9:30pm, Grand Ballroom

# Block Schedule



Monday, 7 January 2013		Monday, 7 January 2013 Continued	
7:30am	Session Chair Breakfast, 7:30am-8:00am, Room 203A Speaker Ready Room, 7:30am-4:00pm, Room 203C Registration, 7:30am-5:00pm, Promenade Level 1 Lobby	11:40am	118 Plenary Session: Galaxy Clusters in the Golden Age of High-Energy Astrophysics, Mark Beuzit (MIT) Institute for Astrophysics & Space Research, 11:40am-12:30pm, Grand Ballroom
8:00am	100 Plenary Session: Welcome Address by AAS President David Helfand, 8:00am-8:30am, Grand Ballroom Cyber Cafe, 8:00am-6:30pm, Promenade Level 1 Lobby Career 101: Career Planning Workshop for Graduate Students and Postdocs, 8:00am-10:00am, Regency Ballroom I (Hyatt Long Beach)	12:30pm	RE-NUMERATE: A Workshop to Restore Essential Numerical Skills and Thinking via Astronomy Education, 12:30pm-2:00pm, Room 203B
8:30am	101 Plenary Session: Kavli Lecture: The Spitzer Space Telescope: Science Return and Impact, B.T. Soffel (Spitzer Science Center, Caltech), 8:30am-9:20am, Grand Ballroom Career Center, 9:00am-6:30pm, Exhibit Hall A	12:45pm	119 Town Hall: HAD Business Meeting, 12:45pm-1:45pm, Room 104B 120 Town Hall: NASA Physics of the Cosmos (POCS) Gravitational Wave and X-ray Astronomy Town Hall, 12:45pm-1:45pm, Room 104B
9:00am	Exhibit Hall, 9:00am-6:30pm Posters, 9:00am-6:30pm, Exhibit Hall A 141 Astronomy Outreach to the Public 142 Binary Stellar Systems, X-ray Binaries 143 Black Holes 144 Circumstellar Disks 145 Dust 146 Elliptical and Spiral Galaxies 147 Evolution of Galaxies 148 Evolved Stars, Cataclysmic Variables, Novae, Wolf-Rayet Phenomena 149 Extrasolar Planets: Detection 150 From Star Formation to Cosmology: Astrophysics with CCAT in the Next Decade	1:00pm	Career Hour 1: Having the Right Stuff: Outstanding Career Opportunities in Academia and Industry, 1:00pm-2:00pm, Regency Ballroom I (Hyatt Long Beach)
9:30am	Coffee Break, 9:30am-10:00am, Exhibit Hall A	2:00pm	Special and Oral Sessions 122-137, 2:00pm-3:30pm 122 Andromeda and Local Group Dwarf Galaxies 123 Black Holes 124 Exoplanet Interiors 125 Dark Matter 126 Exoplanet Interiors 127 Family Leave Policies and Childcare for Graduate Students and Postdocs 128 Galaxies 129 Galaxy Evolution at z > 12
10:00am	Special and Oral Sessions 101-117, 10:00am-11:30am 102 Career Options Panel: Discussion: Professional Feedback: Trained Astronomers in Aerospace and Industry Room 201A 103 AGN: Jets and Feedback Room 101A 104 Circumstellar Disks Room 202B 105 Cosmic Microwave Background I Grand Ballroom 106 Cosmology I Room 103B 107 Dwarf and Irregular Galaxies: I Origins and Dynamics Room 104A 108 Early Science Results from the Hydragen Epoch of Reionization Arays (HERA) Room 101B 109 Exoplanet Discovery: Finding Habitable Planets Room 105B 110 From Star Formation to Cosmology: Astrophysics with CCAT in the Next Decade Room 102C 111 Galaxy Clusters I Room 103A 112 Galaxy Evolution at z > 12 Room 105A 113 HAD III/HEAD I: Fifty Years of Celestial X-ray Astronomy Room 201B 114 Relativistic Astrophysics, Gravitational Waves, and Cosmology: Women and Minorities in Astronomy Room 102A 115 Science Highlights from NASA's Astrophysics Data Analysis Program I: Galactic Astrophysics Room 202A 116 Science Highlights from NASA's Astrophysics Data Analysis Program I: Galactic Astrophysics Room 202A 117 Young Stellar Objects, Very Young Stars, T-Tauri Stars, HH Objects Room 102B	3:40pm	118 Plenary Session: Henry Norris Russell Lecture: Thinking and Computing, David Arnett (Steward Obs.), 3:40pm-4:30pm, Grand Ballroom
10:30am	Coffee Break, 10:30am-11:00am, Exhibit Hall A	4:30pm	119 Plenary Session: From Gas to Stars Over Cosmic Time, Mordecai-Mark Mac Low (American Museum of Natural History), 4:30pm-5:20pm, Grand Ballroom
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# Scavenger Hunt



hARP


## Peggy AAS 2012

here's an example of how we can share info using our wiki. If you are new to wiki, feel free to take a look at what you see here. The click the edit tab above to see what I actually entered. Between all Luke's sweet tutorials and steaming format from pages you like, you'll be an expert in no time.)

AAS 2012 was my first time at a convention and it was a marathon event. I had a lot more connections than the go-round which made the experience richer. I knew the lay of the land and was able to target what I wanted to do. I had also... we do not have some of the newbies and my... students this their way. My confidence level speaking to this last assortment of Astronomy professionals has risen significantly and this translated directly to my ability to convey what I have learned and experienced to not only my daughter...  
--Peggy Piper 18:38, 13 January 2012 (PST)


### Sunday Jan 8 - Day 1 AAS workshop and many receptions

We started off bright and early Sunday morning as the hARP group of 2012. I could see the same enthusiasm and fear in the eyes of the new... (second time around) we broke in to our groups and started discussing the possibilities for our research experience. We are fortunate to have seen... (before to see out the best) they candidates and keep the essentially more probable candidates. In the next few days we need to fi... (for what... proceed. Luke gave us a super quick tutorial and YSOs and the methods used for choosing likely candidates, but at this point it is... (to see... see related papers. We will be using VHSB data so I will definitely be stopping by the VHSB booth to say hi.



AAS 2012 YSO group


The evening was filled with the Educators, the Undergraduate, and the Opening Reception. I had 3... (school students... present a poster on determining the light curve of... (of an asteroid. All of these students are seniors in high school and the opportunity to meet... (the work... of eye opening experience. All of the adults they met... (were very encouraging of my proposal and asked questions about the... (they were... their future of... a exposure was not only a boost to their confidence, but a nice splash of



Me and VHSB


### Monday Jan 9 - Day 2 Poster presentation, talks and Spitzer reception

The Pipettes showed up dressed for success to present their poster to the astronomical community. They showed great maturity, and poise as they described their journey into astronomical research and the results of their research. When asked about their future plans, I heard each student describe their college hopes and their plans seemed bigger and more full of promise than I had heard in the past. (before hearing the attention of such an distinguished audience raised their expectations of themselves. This work was done independently of my college group, but with the support of many outside groups. The group was especially inspired by their talk with Alan Tuhnner and took his suggestion to bring their musical instruments to their afternoon session to heart.




The Pipettes and present

At the Spitzer booth, both Sebastes demonstrated what looks like a very promising spreadsheet template that looks the something I can use in my astronomy classes. One spreadsheet may be that it is a google doc which my school district at this point does, but I can probably find a way around that. Our YSO group had another quick meeting to move a little further towards a target for our research, doing some quick literature searches. The fact that 1548 has not been nearly explored was very intriguing.



Jennifer at the AAS



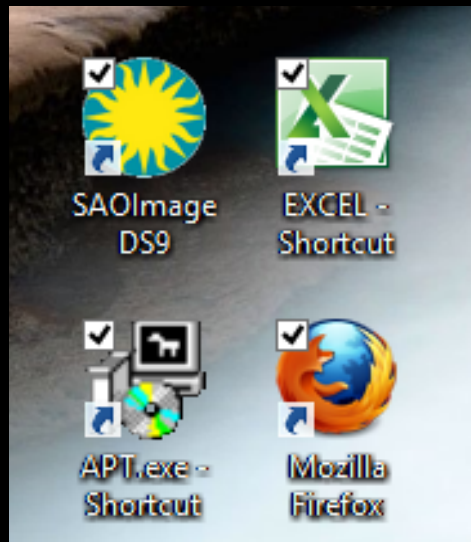
Including astronomy and music

Navigation: Main Page, Research Tools, Current Research, Recent changes, Main page, Help

Search: Go, Search

What this here: Reverted changes, Upload file, Special pages, Private version, Permanent link

# Spring - Prepare for Caltech



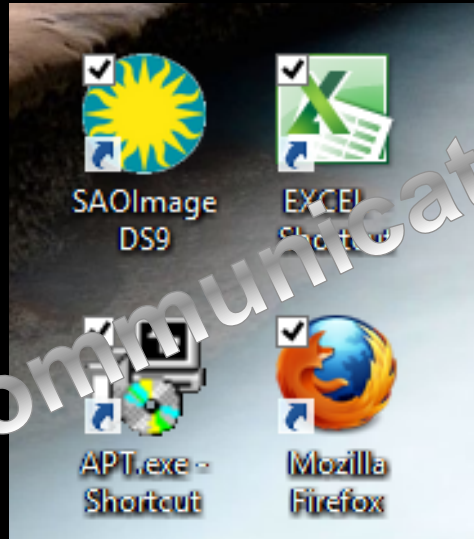
SAOImage DS9

EXCEL - Shortcut

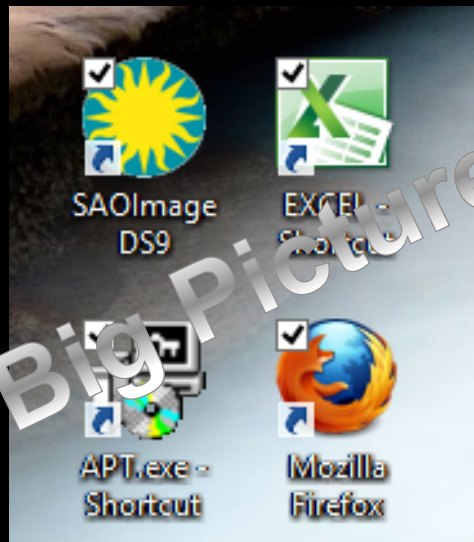
APT.exe - Shortcut

Mozilla Firefox

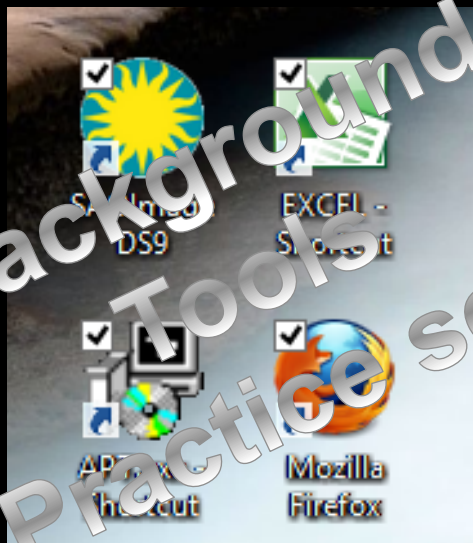
# Spring – Prepare for Caltech



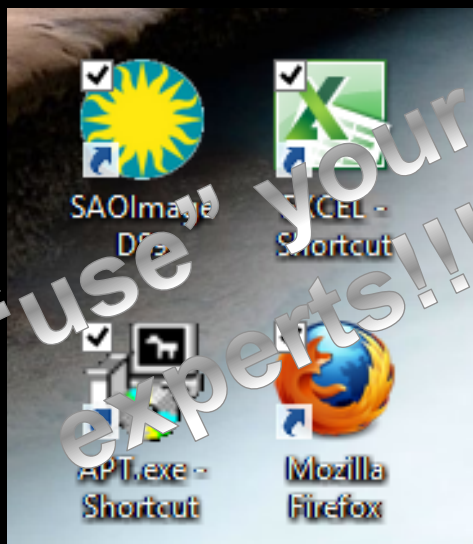
# Spring – Prepare for Caltech



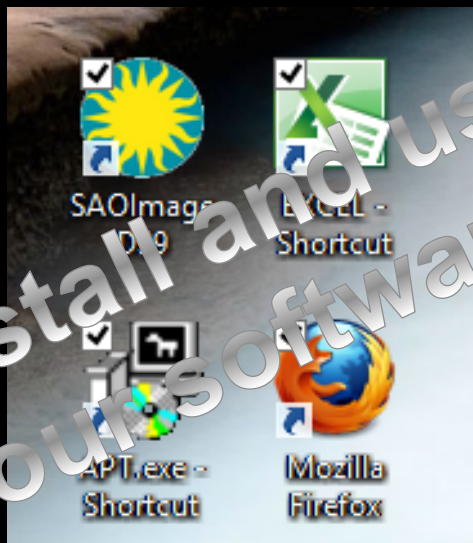
# Spring – Prepare for Caltech



# Spring – Prepare for Caltech

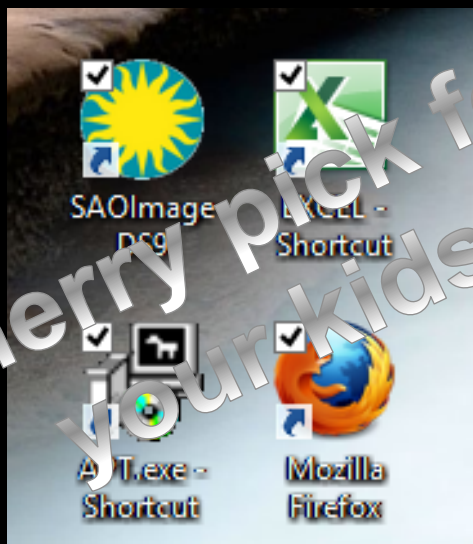


# Spring – Prepare for Caltech



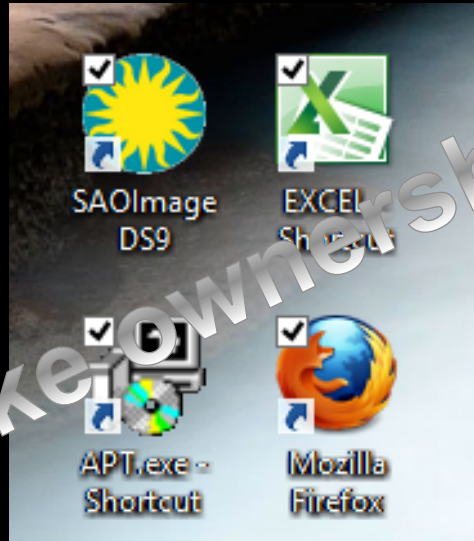
Install and use  
your software!!

# Spring – Prepare for Caltech



Cherry pick for  
your kids

## Spring – Prepare for Caltech



## Summer Visit





# Fall Follow up



**CWAYS – Cool, WISE, and Young Stars:  
ANITARP 2012 search for YSOs using primarily  
WISE data**

**Abstract**  
We searched for new candidate stars in the clouds (YSOs) using primary WISE data. We identified 1000 WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates.

**Background**  
We have been looking for new candidate stars in the clouds (YSOs) using primary WISE data. We identified 1000 WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates.

**Results**  
We identified 1000 WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates.

**Next Steps**  
We will continue to search for new candidate stars in the clouds (YSOs) using primary WISE data. We identified 1000 WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates. We searched for WISE data within 20 arcseconds radius of WISE YSO candidates.

Still in progress

# Fall Follow up



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Proprietary



# AAS 2014



# AAS 2014



# AAS 2014



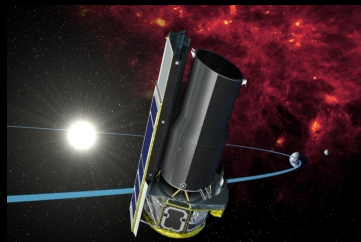
Practice  
handshakes



# NITARP



- NASA/IPAC Teacher Archive Research Program
- Spitzer Archival Data
- Team with Astronomer and other Teacher/Student Teams
- Authentic Research
- Present findings at AAS

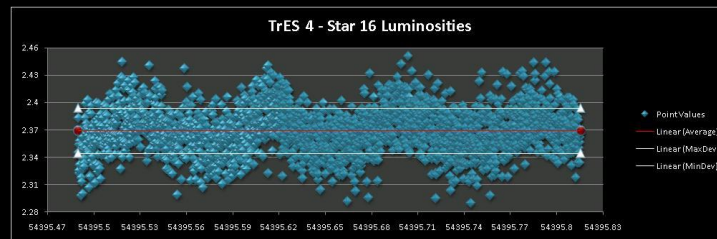


[nitarp.ipac.caltech.edu](http://nitarp.ipac.caltech.edu)  
Links at – [starsatyerkes.net](http://starsatyerkes.net)

# NITARP



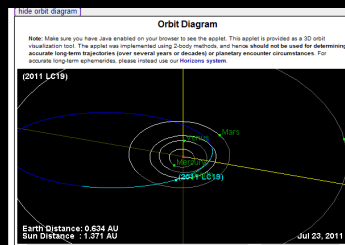
- Image Processing
  - DS9
  - APT (Aperture Photometry Tool)
  - IRAF (Image Analysis and Reduction Facility)
- Export to Excel to create light curves



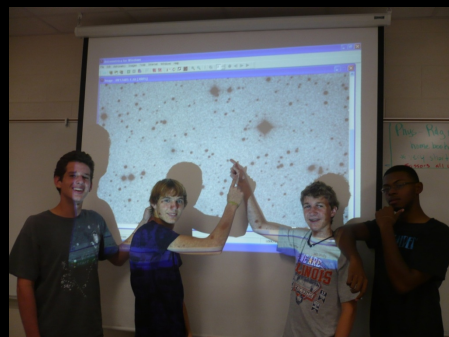
# IASC - WISE



- Image Processing
  - Astrometrica
- Online Resources
  - Minor Planet Center for Ephemeris
  - JPL Near Earth Program for orbit diagrams and known info
- Provide location to MPC to help better define their orbits and...



**LWN**  
**Asteroid Hunters**  
**Saving the world!!!**



# IASC – WISE



- International Astronomical Search Collaboration
- Wide-field Infrared Survey Explorer
- WISE pinpoints location
- Bob Holmes, Charleston, IL, provides multiple ground based images
- IASC assigns image sets



# SOFIA



- Color Filters
  - Understand how eye works
  - Relate to use of filters for other wavelengths
- IR detectors
  - Digital cameras “see” IR
  - Solar cells collect IR
  - IR video camera – new\*\*
- Python Programming
  - Used to gather and analyze data from camera (HAWC)
  - Basic programming in Physics classroom



Search – SOFIA Active Astronomy Links at – [starsatyerkes.net](http://starsatyerkes.net)

# The SOFIA Experience



# NASA's Infrared Missions



Spitzer Space Telescope



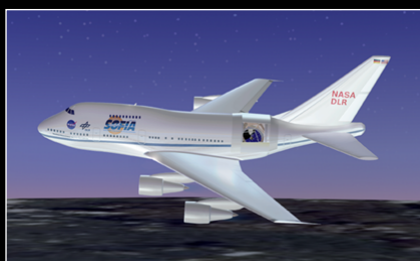
WISE



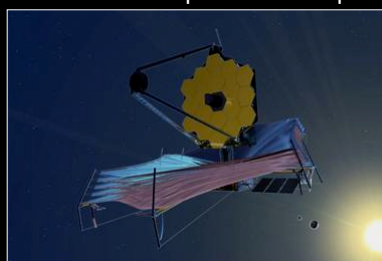
Hubble WFC3 2009



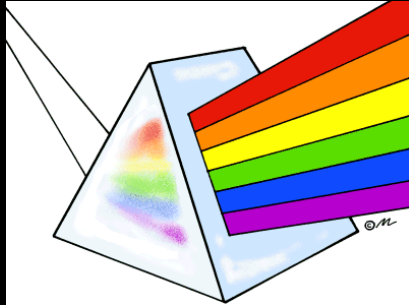
SOFIA



James Webb Space Telescope



# White Light



Contains all the frequencies of light.

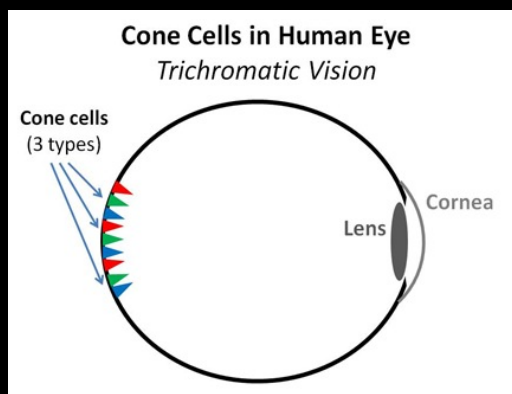
# Our Eyes are Detectors



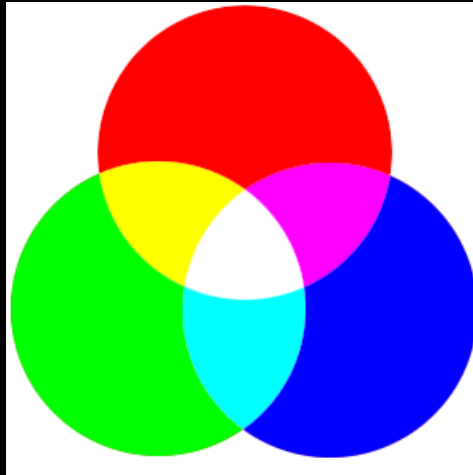
**Cones on retina detect color**

**We have 3 types**  
**Red**  
**Blue**  
**Green**

**That's all we can see!!!!**



## Mixing Colors of Light



Red, Green and Blue cones are each stimulated by certain frequencies.

Our brain mixes colors to give us all the colors of the spectrum.

## Gel Color Code



- **Red** – shows in red, disappears in others
- **Blue** – shows in blue, disappears in others
- **Green** – shows in green, disappears in others
- **White** – shows in all three gels

\*our red works the best!

## Gel Color Code



- **Red** – shows in red, disappears in others
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\*our red works the best!

## Helix Nebula

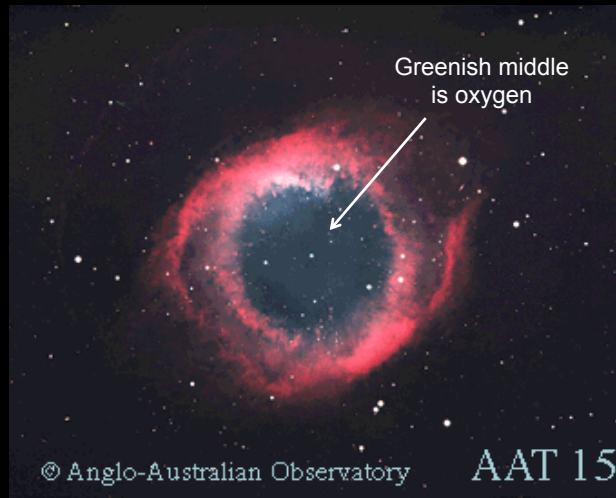


© Anglo-Australian Observatory

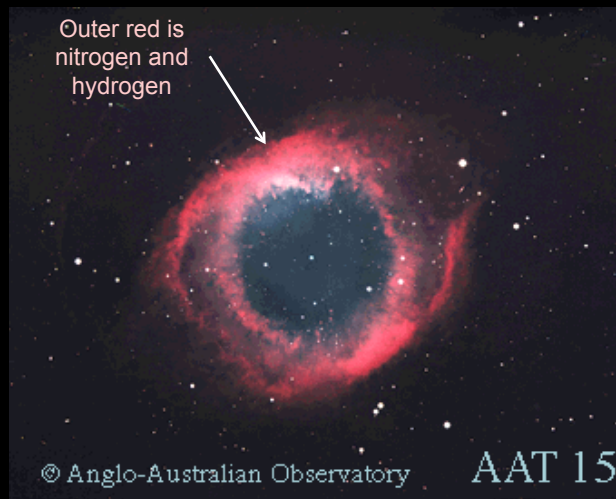
AAT 15



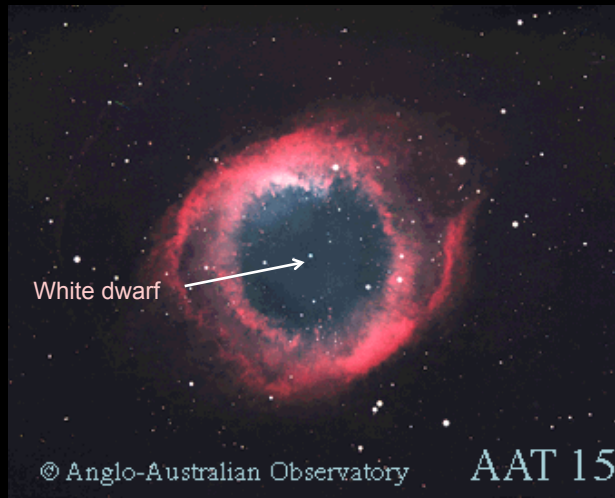
# Helix Nebula



# Helix Nebula

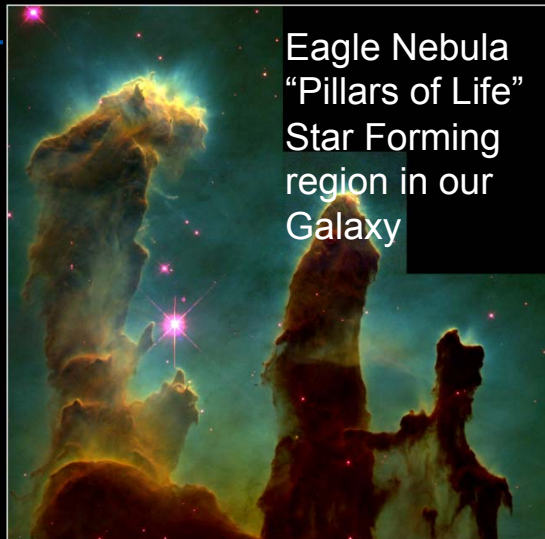


# Helix Nebula



© Anglo-Australian Observatory

AAT 15

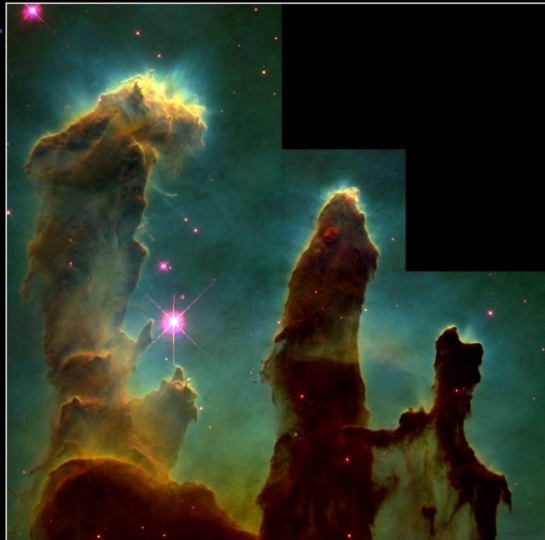


Eagle Nebula  
"Pillars of Life"  
Star Forming  
region in our  
Galaxy

Gaseous Pillars • M16

HST • WFPC2

PRC95-44a • ST ScI OPO • November 2, 1995  
J. Hester and P. Scowen (AZ State Univ.), NASA



Red = singling ionized sulfur

Green = hydrogen

Blue = doubly ionized oxygen

**Gaseous Pillars • M16**

HST • WFPC2

PRC95-44a • ST ScI OPO • November 2, 1995  
J. Hester and P. Scowen (AZ State Univ.), NASA



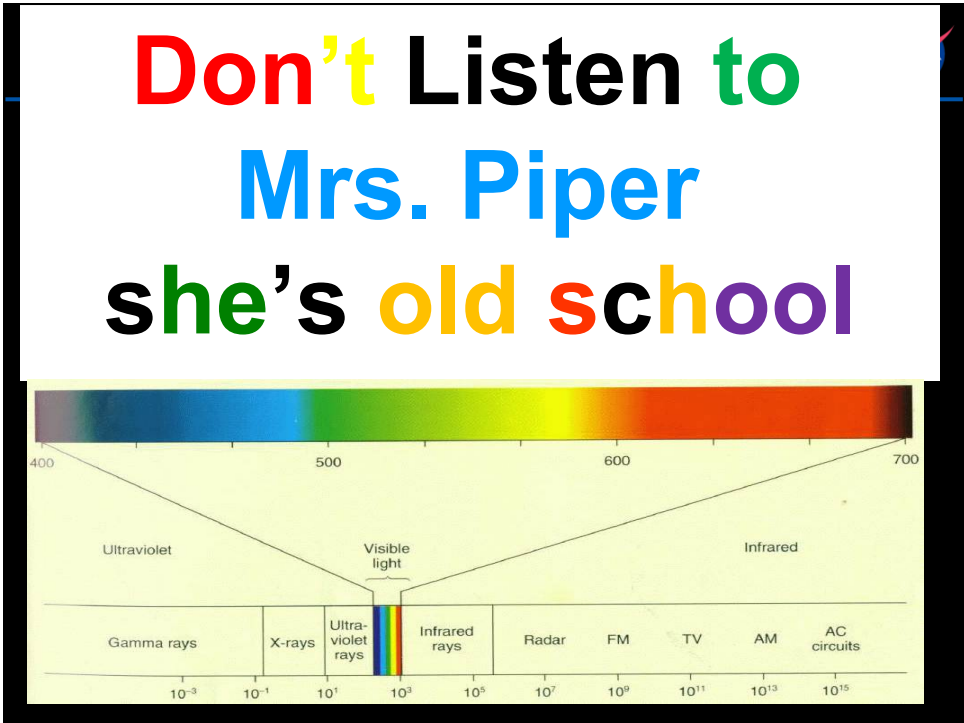
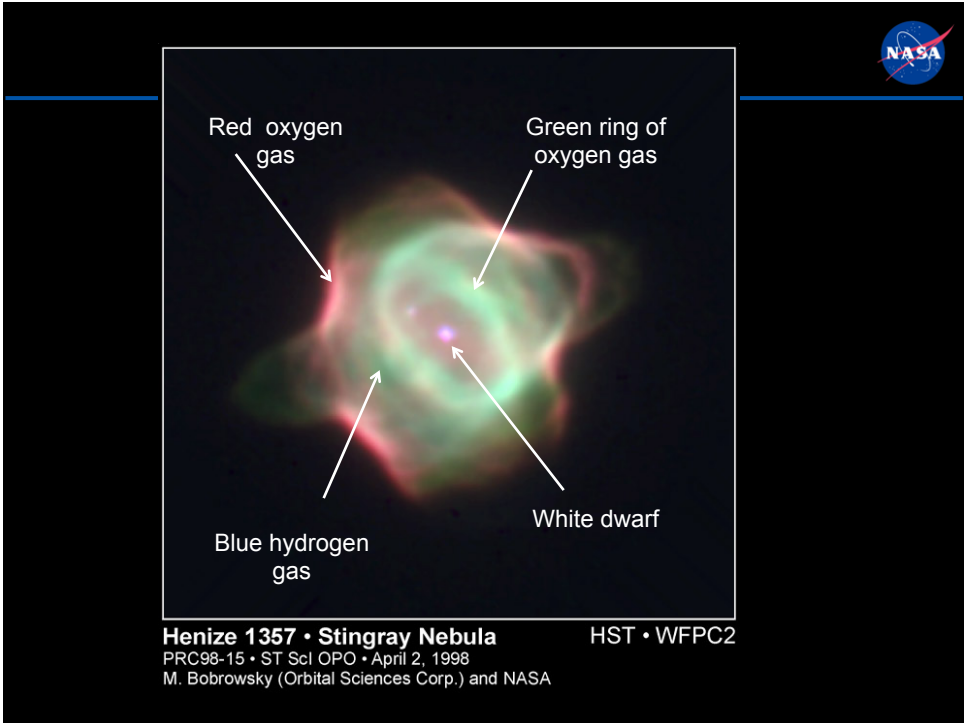
Planetary Nebula  
An exploded star!



**Henize 1357 • Stingray Nebula**

HST • WFPC2

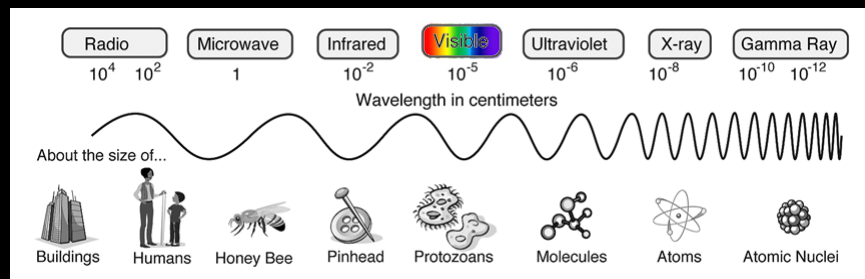
PRC98-15 • ST ScI OPO • April 2, 1998  
M. Bobrowsky (Orbital Sciences Corp.) and NASA



# The Spectrum of Light



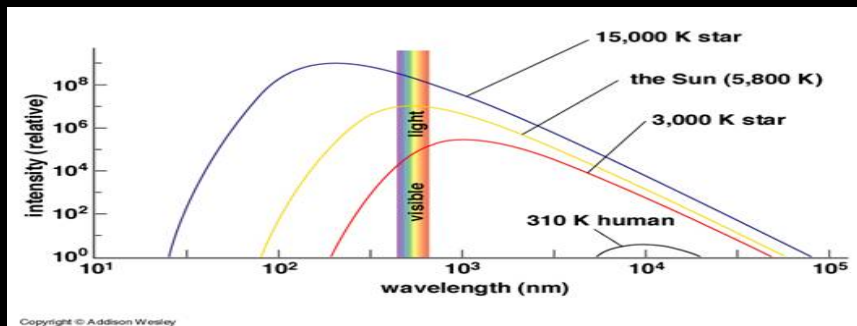
- Visible light is a tiny fraction of the *Electromagnetic Spectrum*
- Gamma rays--billions of waves per inch
- Radio waves--up to miles-long wavelengths



Low Energy Waves

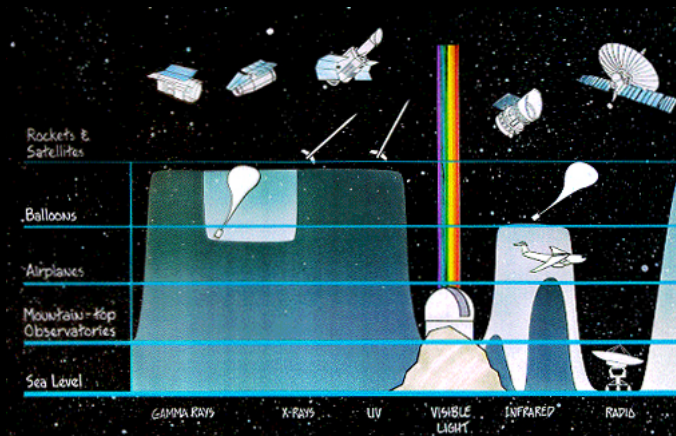
High Energy Waves

# The Physics of Light



- All objects in the Universe emit light depending on their temperature.
- Cool objects emit primarily long wavelength light
- Hot objects emit primarily short wavelength waves

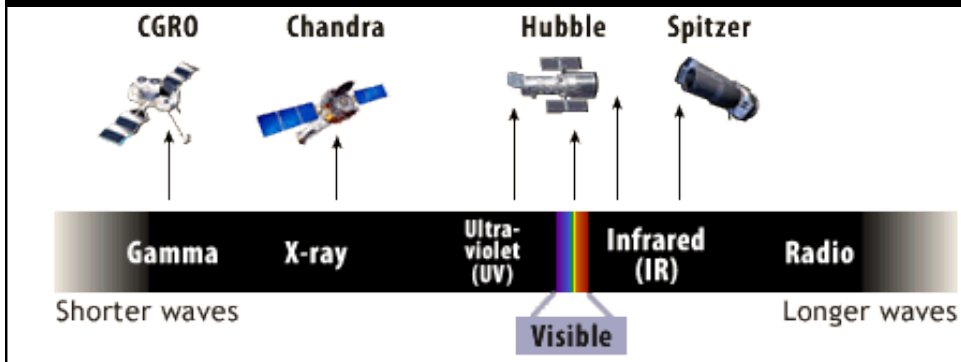
# But there's a Challenge...



- Earth's atmosphere blocks or absorbs almost all incoming radiation
- Even mountain-top observatories get a limited view of the universe

Infrared telescopes need to observe from high altitude or in space

# NASA Great Observatories

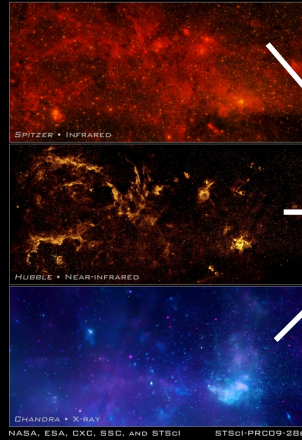


Telescopes capture images in different frequencies  
(CGRO is no longer in operation)

# Putting them all together



CENTER OF THE MILKY WAY GALAXY  
NASA'S GREAT OBSERVATORIES



CENTRAL REGION OF THE MILKY WAY  
NASA'S GREAT OBSERVATORIES



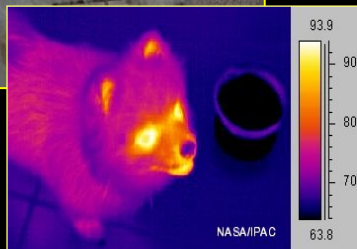
NASA, ESA, CXO, SSC, AND STSCI

STSCI-PRC09-28A

# We all produce . . .



# . . . Infrared Light



# Why Study Infrared?



- Visible: dark nebula, heavily obscured by interstellar dust ("Horsehead Nebula")
- Near-Infrared: dust is nearly transparent, embedded stars can be observed forming
- Mid- and Far-Infrared: glow from cool dust is directly observable



Visible



Near Infrared

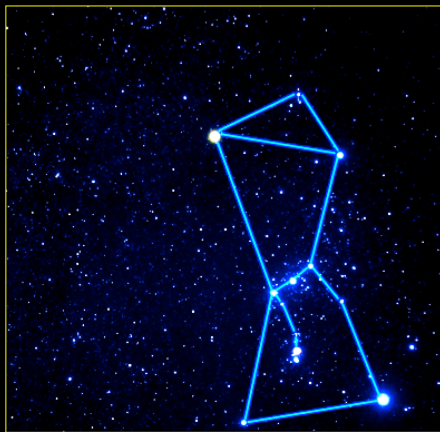


Mid-Infrared

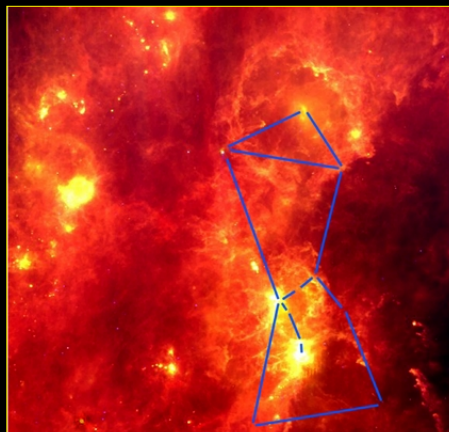
# Two Views of Orion



Visible Light (Akira Fujii)



Infrared (IRAS)





# NASA's Infrared Missions



Spitzer Space Telescope



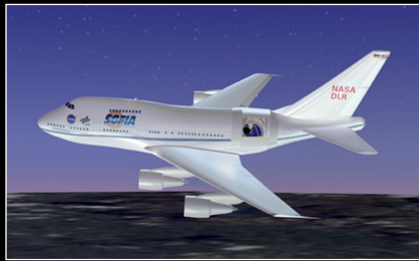
WISE



Hubble WFC3 2009



SOFIA



James Webb Space Telescope



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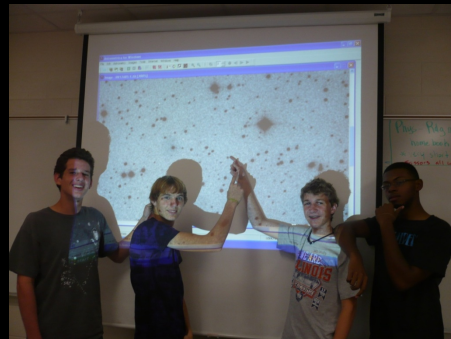
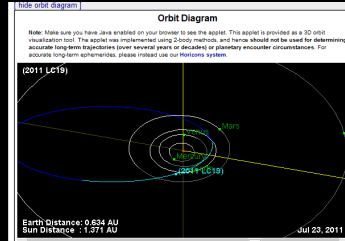


# IASC - WISE



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  - Astrometrica
- Online Resources
  - Minor Planet Center for Ephemeris
  - JPL Near Earth Program for orbit diagrams and known info
- Provide location to MPC to help better define their orbits and...

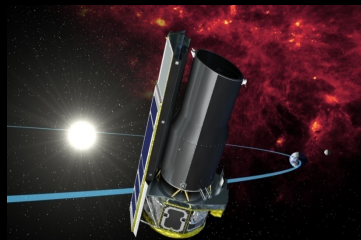
**LWN**  
**Asteroid Hunters**  
**Saving the world!!!**



# NITARP



- NASA/IPAC Teacher Archive Research Program
- Spitzer Archival Data
- Team with Astronomer and other Teacher/Student Teams
- Authentic Research
- Present findings at AAS

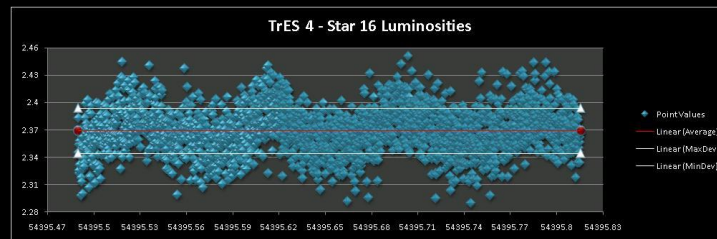


[nitarp.ipac.caltech.edu](http://nitarp.ipac.caltech.edu)  
Links at – [starsatyerkes.net](http://starsatyerkes.net)

# NITARP



- Image Processing
  - DS9
  - APT (Aperture Photometry Tool)
  - IRAF (Image Analysis and Reduction Facility)
- Export to Excel to create light curves



# The SOFIA Experience



# SOFIA



- Color Filters
  - Understand how eye works
  - Relate to use of filters for other wavelengths
- IR detectors
  - Digital cameras “see” IR
  - Solar cells collect IR
  - IR video camera – new\*\*
- Python Programming
  - Used to gather and analyze data from camera (HAWC)
  - Basic programming in Physics classroom



Search – SOFIA Active Astronomy Links at – starsatyerkes.net

# The SOFIA Experience



Search – SOFIA Education Outreach Links at – starsatyerkes.net

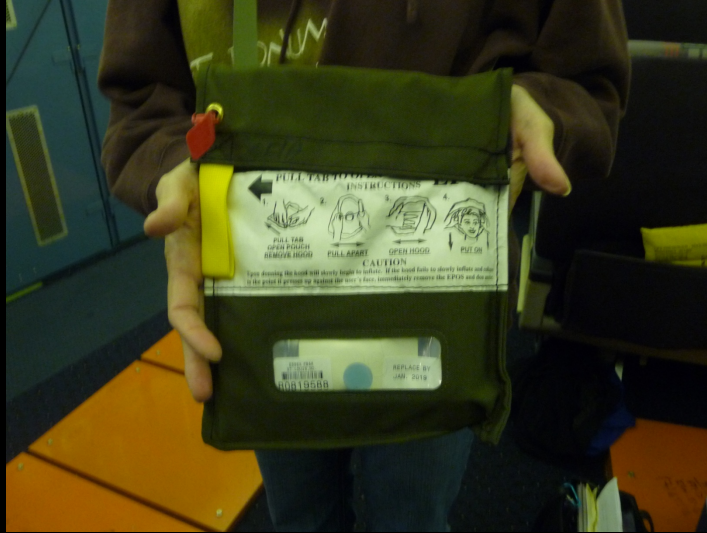
# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience

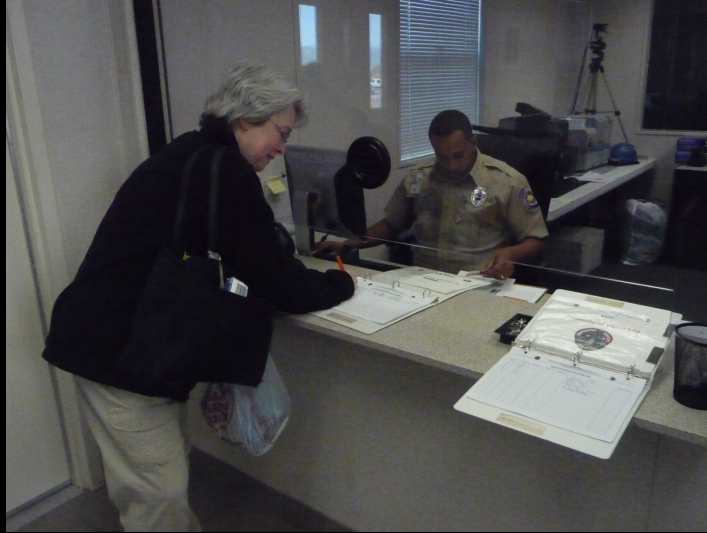


# The SOFIA Experience

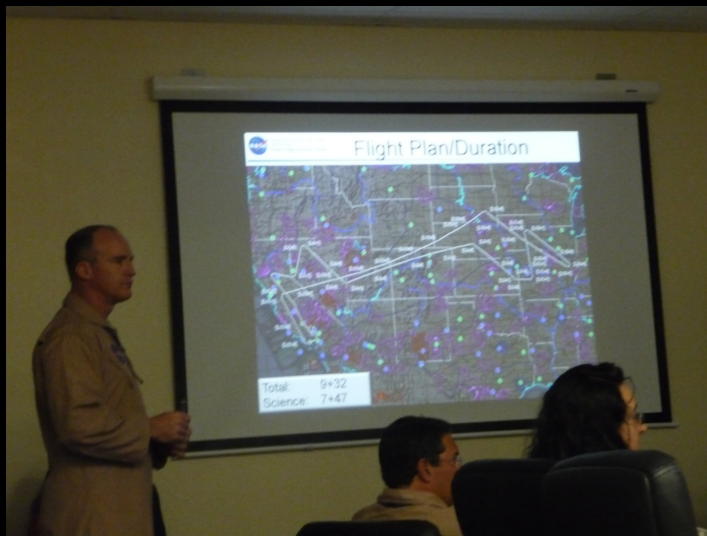




# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



Station Times	
1900	Doors Closed / Safety Briefing
1915	Engine Start
1945	Takeoff
0530	Landing
0630	Debrief

# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



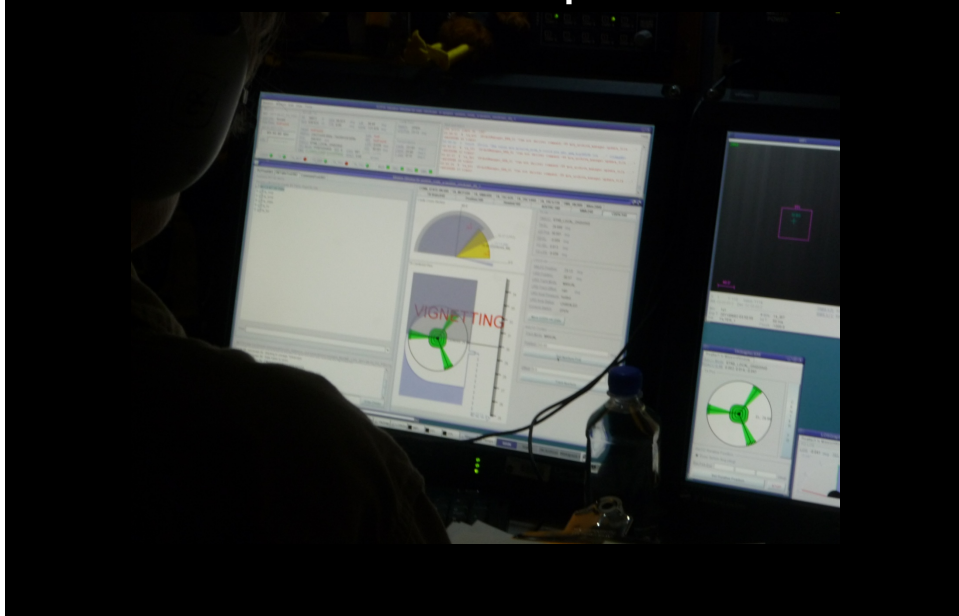
# The SOFIA Experience



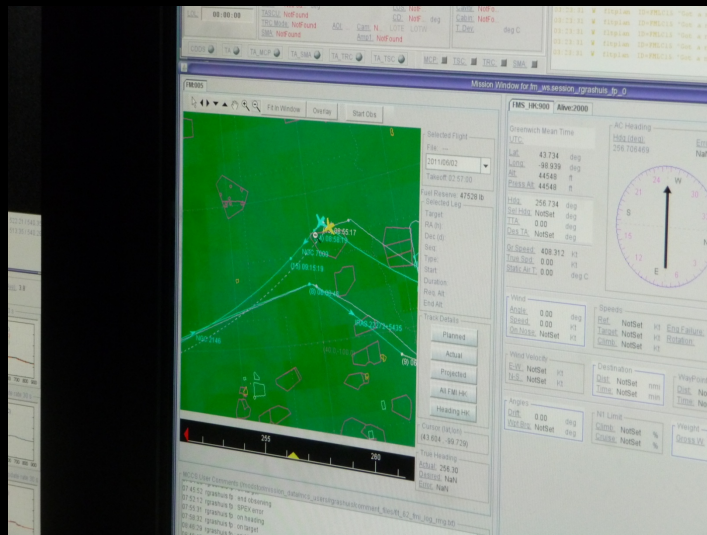
# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience





# The SOFIA Experience



# The SOFIA Experience



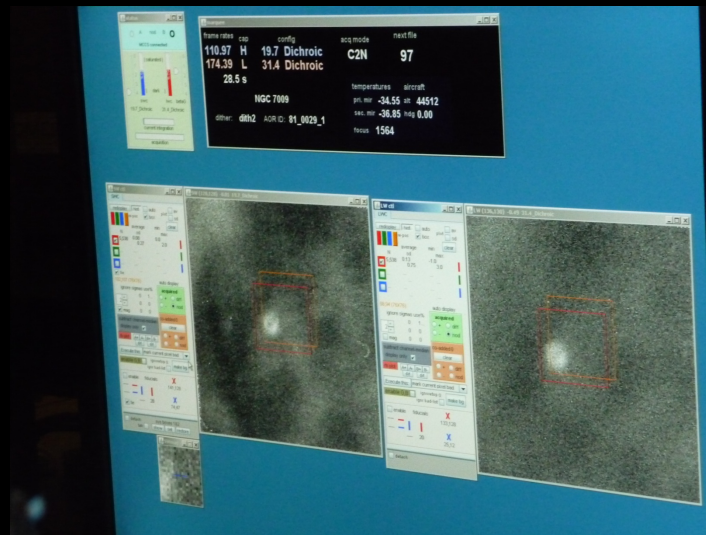
# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience



# The SOFIA Experience

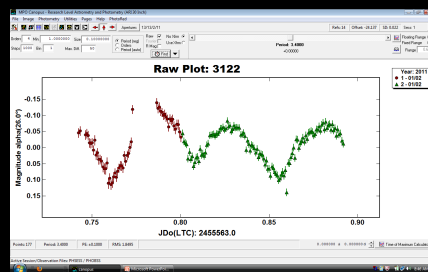
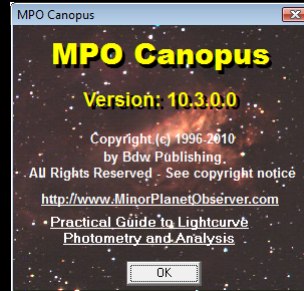


Search YouTube for -  
Peggy Piper SOFIA Flight  
Peggy Piper SOFIA Training

# Asteroid Light Curves



- Image Processing
  - MPO Canopus
- Resources
  - Bob Holmes, ARI
  - Tyler Linder, EIU
  - Bob Conwell, EIU
- Why Define Light Curves
  - Add to developing data
  - Publish
  - Determine shape and composition

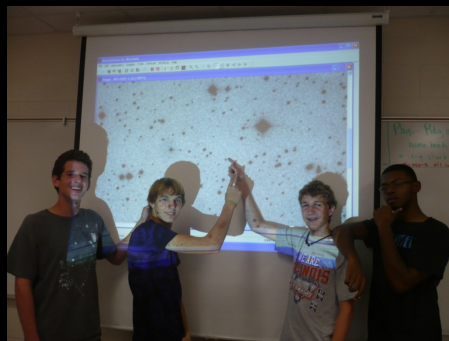


# Asteroid Light Curves



- Hopes
  - Develop and document technique
  - Request own images using skynet
  - Take images on own telescope!

**LWN  
Asteroid Hunters  
Saving the  
world!!!**



# New Hubble Images



Using new  
infrared  
camera  
installed  
summer of  
2009



Looks back 13  
billion years!!!