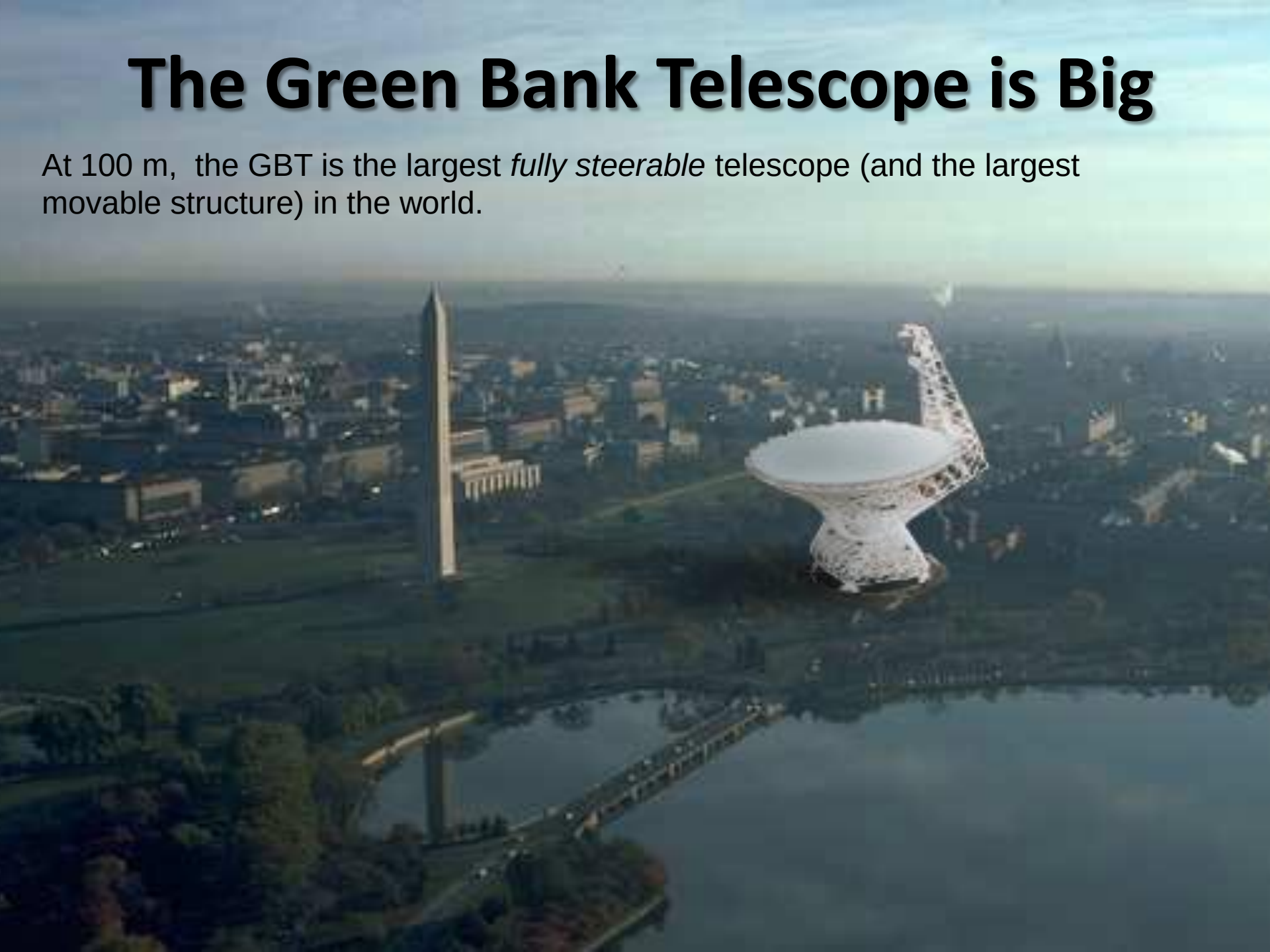
The Green Bank Observatory

A National STEM Facility

Sue Ann Heatherly
Senior Education Officer

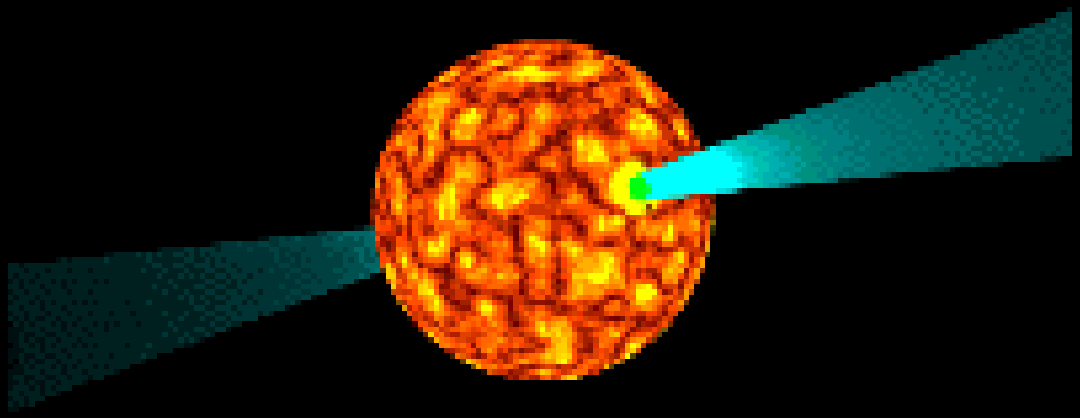
The Green Bank Telescope is Big

At 100 m, the GBT is the largest *fully steerable* telescope (and the largest movable structure) in the world.



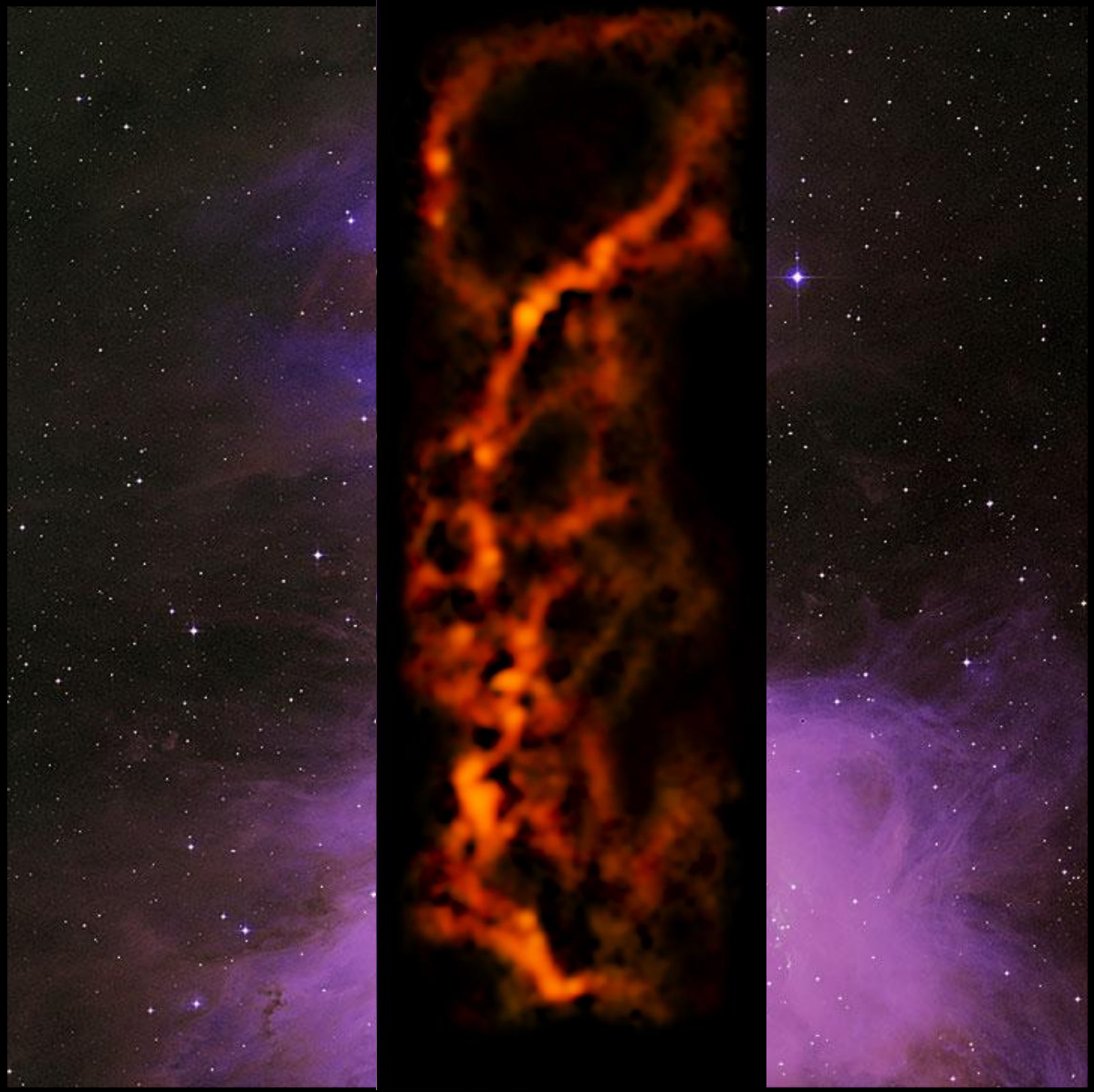
No, Really

GBT Science Examples



Detection of Gravitational Waves

Building Blocks for Planet Formation in Orion

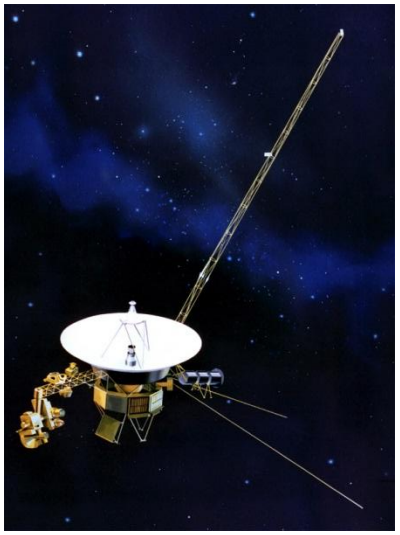


August 27, 2014 Press Release

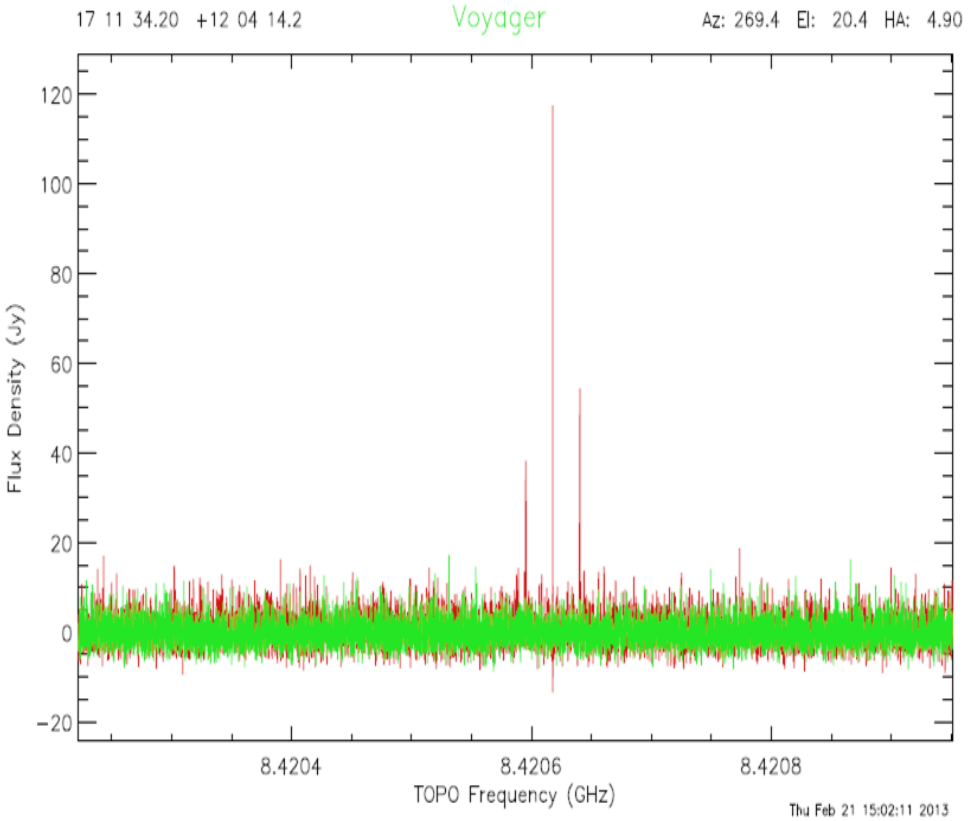
“After all, if you want to build a house, it’s best to start with bricks rather than gravel, and something similar can be said for planet formation."

Radio /optical composite showing GBT data in orange. Optical image from NASA's SkyView Facility located at NASA Goddard Space Flight Center

GBT & Voyager



- **ONE SECOND** of data from GBT
- Data processed in near real time (within seconds of receipt)



Voyager 1 with GBT:
February 21, 2013

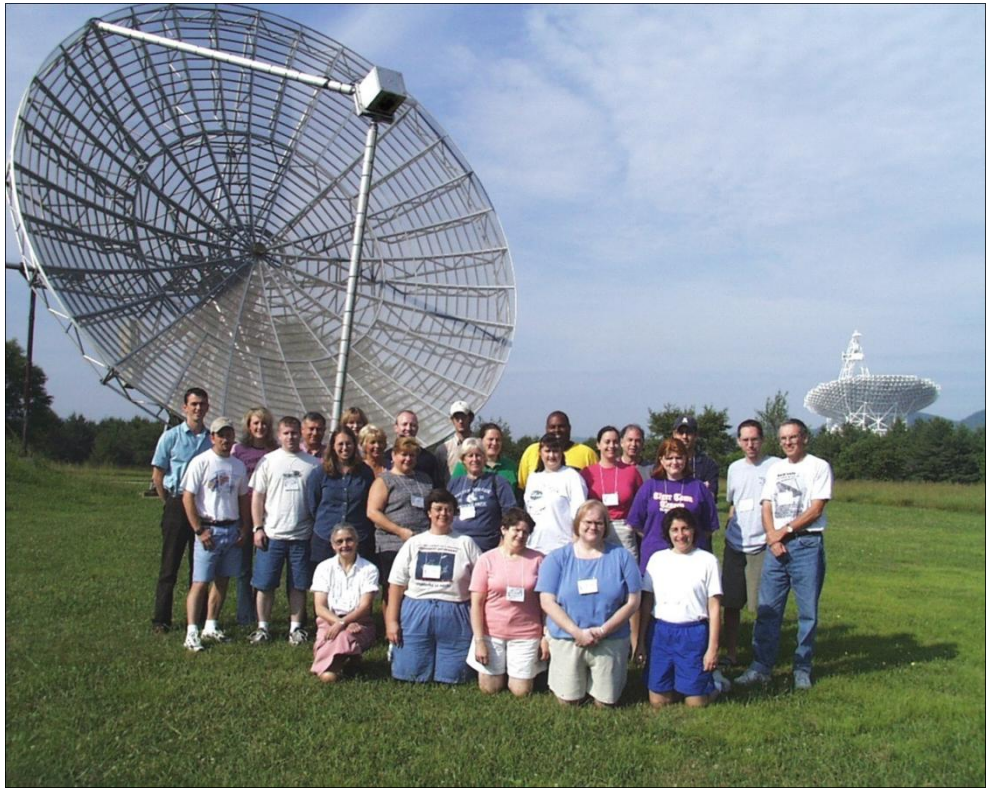
- Red line - LCP ; Green line - RCP
- Only LCP detected, as expected
- Signal strength is 117 Jy
- Frequency matches JPL Horizons prediction
- Voyager distance 124 AU

Spacecraft images courtesy NASA/JPL

Programs for teachers and students

First Major Program: 1987. Two-week residential summer program for teachers across the U.S.

- Funded by grants from the National Science Foundation.
- More than 1100 teachers, since 1987.
- Hands-on projects with radio telescope.
- Data analysis.



Teachers and the 40 Foot educational telescope

Since then, we have expanded our programs for teachers and students

Pulsar Search Collaboratory

NSF award DRL # 0737641

- Can middle school/high school students participate in radio astronomy research to find and time new pulsars?
- Does this motivate students to consider careers in STEM?

Geographic distribution of PSC teachers and schools.

Seventeen hundred students have been exposed to astronomical research through the PSC ;

One hundred-six teachers and 191 students from 18 states have participated in summer workshops;

Eight hundred and eight students are full PSC members (305 girls, 303 boys);

As of 2/01/2014, PSC students have analyzed **2,150,970 pieces of data!**

Seven pulsars and two transient objects have been discovered by PSC students.

Rigorous External Evaluation shows that the PSC:

- **increases interest in STEM Careers in all students;**
- **increases self-efficacy and scientific identity in girls, two key predictors of future success in completing STEM majors.**

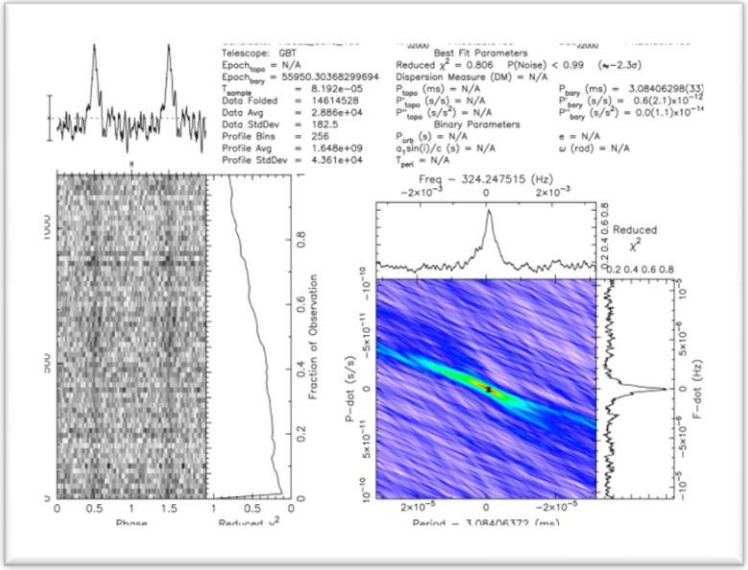


Figure 4. Discovery made by PSC students in January 2012. Left: Pulsar hunters Sydney Dydiw of Trinity High School, Emily Phan of George C. Marshall High School, Anne Agee of Roanoke Valley Governor's School, and Jessica Pal of Rowan County High School. Not pictured: Max Sterling of Langley High School. Right: Part of the Discovery Plot.

The PSC is successful because students are part of the professional community and work with professional Scientists and Engineers.

All-night observing session on the GBT with high school students.

These can be:

- NRAO staff
- Graduate Students
- Undergraduate Students

Skynet Junior Scholars

NSF Award DRL #s 1223687, 1223235 and 1223345

Can we inspire and prepare youth to consider STEM careers through the study of the Universe in an **online** environment?

Skynet Junior Scholars is such an experiment.

Training 4-H Leaders, museum educators, youth leaders who then introduce SJS to youth.

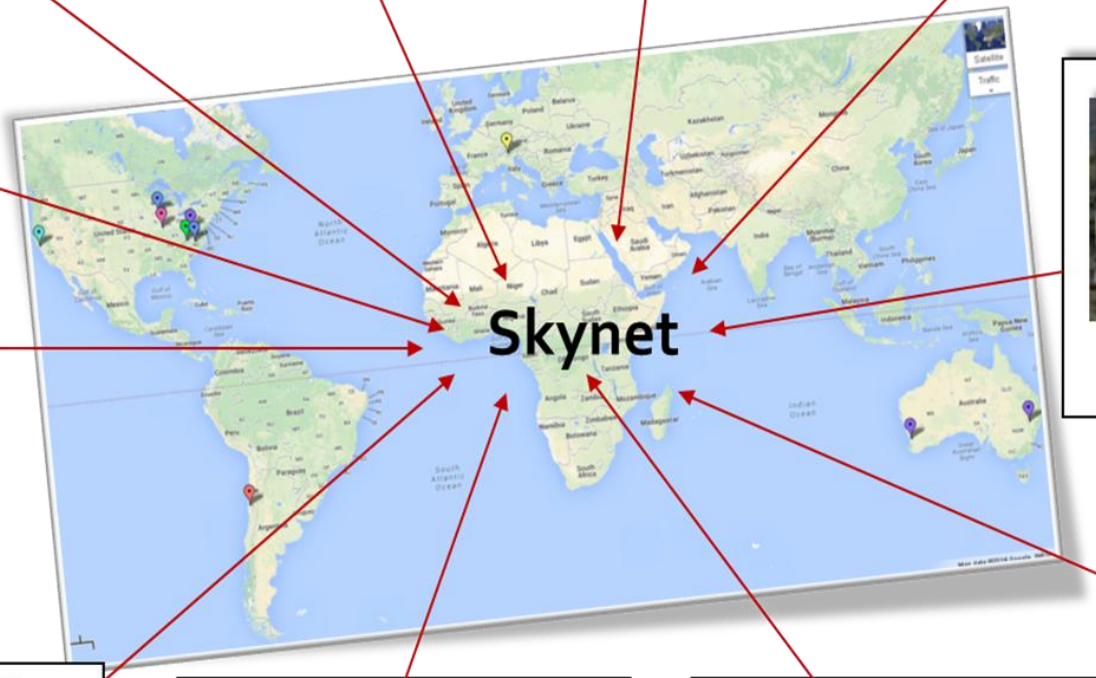
Yerkes

GORT

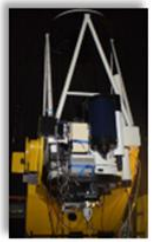
Dolomiti

UNC-Morehead

DSO-14



PROMPT-AU



DSO-32

R-COP

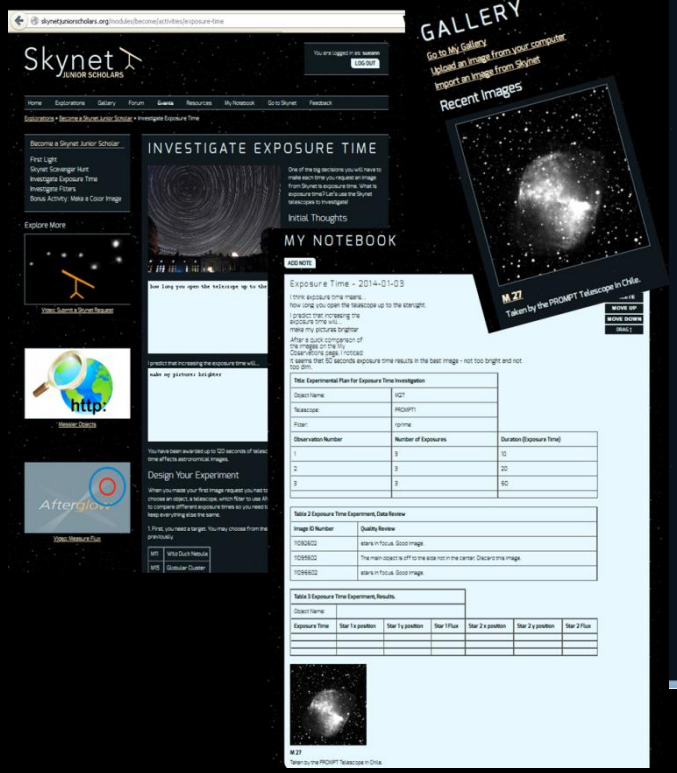
Green Bank 20m

ARO

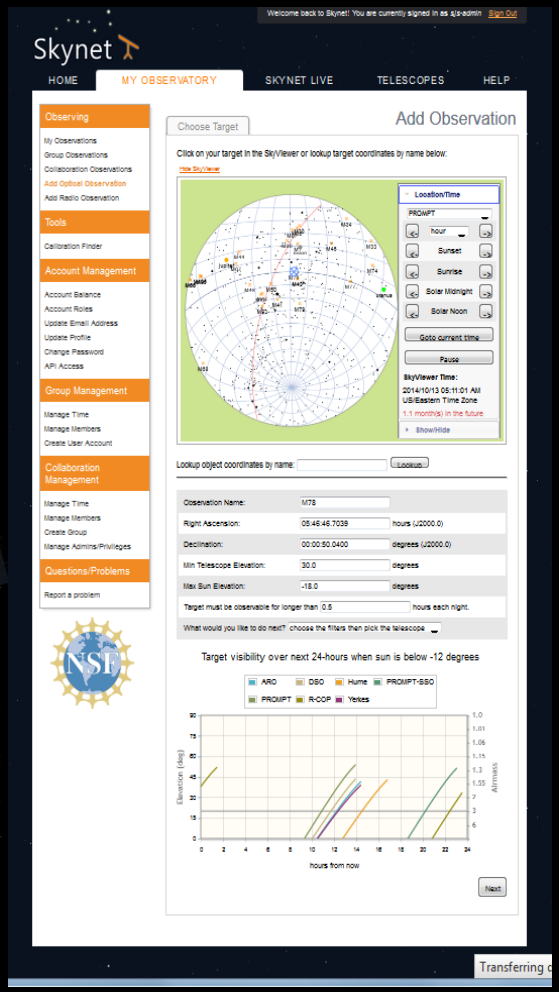
PROMPT

Interactive Web portal:

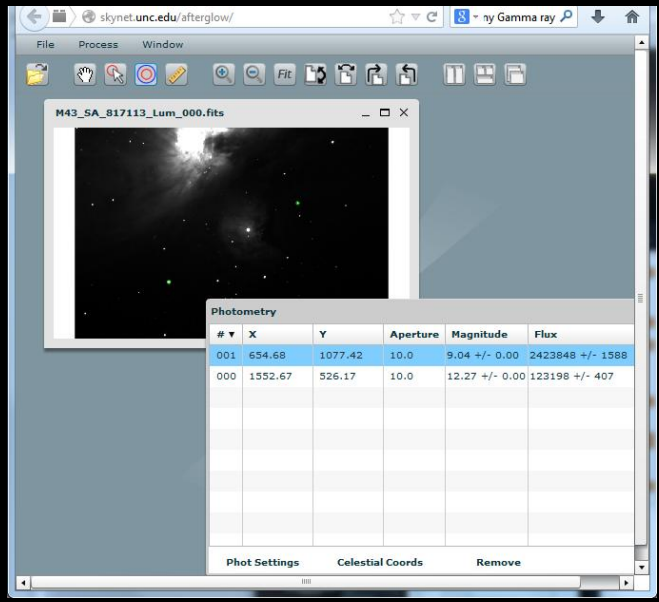
Explorations
Gallery
Notebook
Forum



Skynet Telescope Interface (Skynet)



AfterGlow
Data Analysis

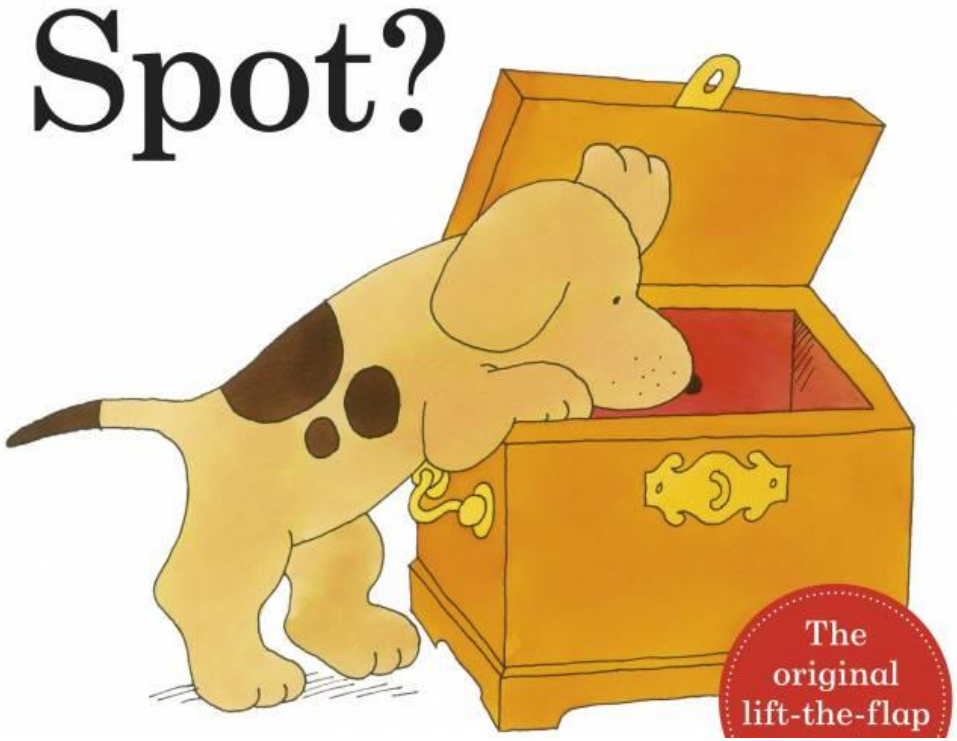


skynetjuniorscholars.org

Outreach: Taking the Message to the People

WV SPOT Program

Tune in tomorrow for Justin Smith's Talk at 8:25 AM!



Thank you!

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