Mission and Research Scientists in NASA E/PO and STEM Education: The Results of 15 Years of E/PO

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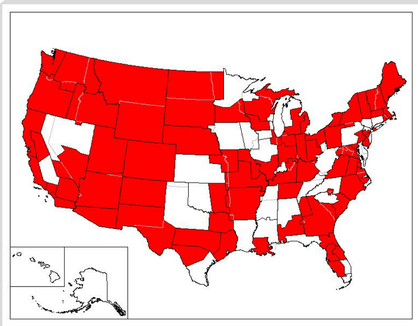
1. A Long-Term Collaboration

Exploration of the Solar System and beyond is a team effort, from research programs to space missions. The same is true for science education. The JWST/NIRCam E/PO Team has teamed with Girl Scouts of Southern Arizona to bring quality STEM content, as well as role models and inspiration, to thousands of Girl Scouts and others in southern Arizona. Nationally we have trained a network of 249 adults from 80 councils in 41 states, the District of Columbia, Guam, and Japan and continue to provide them with up-to-date information about the night sky and recent astronomy discoveries through our monthly newsletters and updates on recent events and discoveries.



2. A Local Collaboration

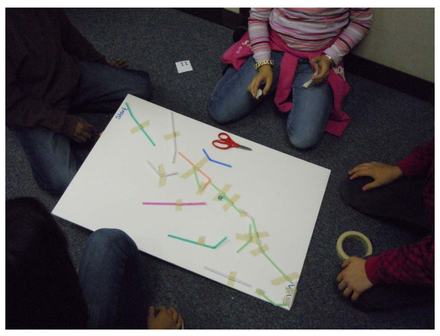
We are now teaming with PSI, OSIRIS-REx, NOAO, and Arts Integration Solutions, bringing additional planetary research and science education expertise into the mix. This expanded team has enabled us to collaborate with urban and rural school districts, libraries, museums, and science centers. Through Girl Scouts of Southern Arizona, we are also part of ASTEC (Arizona , a statewide collaborative supported nationally by the National Girls Collaborative Project.

girl scouts of southern arizona

PSI

3. Local Programs

UAZ and PSI have a nearly 25-year history of pre-college teacher professional development, bringing grade-level appropriate activities, science content, and personal science experience to teachers in Tucson and nationally. For the last 15 years, we have become more involved directly in the classroom and in informal settings. This includes in-school programs, family science nights, overnight programs, and special events. While in-class activities may involve only 15 to 30 students, family science nights typically reach 200 or 300 children and adults and special events can reach more than a 1,000 children and adults. Again, the scientists bring their knowledge, expertise, and research to the activity/event and can act as role models for future scientists and engineers.



Children create a marble maze to see which team can make the marble go the slowest down a ramp . With this activity elementary-age children learn about the process of science and STEM.

Observing a solar eclipse, safely, using telescopes purchased with a NASA E/PO grant.

Observing Jupiter and its satellites in collaboration with volunteers and staff from PSI, the University of Arizona, and NOAO.

An overnight for girls was used to decorate, construct, and use a Human Orrery. They modeled day and night, the motion of the planets in their orbits around the Sun, as well as the positions of the planets in the sky from the perspective of the Earth. The positions of the 13 zodiacal constellation are also shown.

4. Astronomy Camp for Adult Girl Scout Volunteers and Staff

In the three-day camps, adult Girl Scout volunteers and staff are provided with hands-on activities to bring back to their councils. They are provided with science content background about the planets, stars, galaxies, and the formation and evolution of the Universe. UAZ scientists and graduate students connect the activities to ongoing scientific research and discuss their own areas of research and expertise.

The first evening, before going out to observe the night sky, the adult volunteers and staff are taught how to navigate the sky with a planisphere. They are told sky stories from cultures around the world. All evenings emphasize telescope equipment, observing the night sky, and planning star parties back home. The last evening is spent at the Kuiper 1.54 m telescope at the Catalina Observatories on Mt. Lemmon.

Adult volunteers and staff participate in a classification activity called Constellation Sorting Cards which shows information on individual stars, their constellations, their brightnesses, their distances, etc. A more advanced set includes absolute magnitudes, types, and spectral classes.

5. A National Program

Our local experiences do not just stay in Tucson, and the Astronomy Camp experience does not end with the end of the Camp. The authors have presented activities, teaching techniques, and science content at various venues for other scientists and science educators: AAS, ASP, DPS, NSTA. We have a monthly Newsletter and science updates that go to our Camp participants and classroom teachers. The prior knowledge and extent of the programs that the Astronomy Camp participants brought with them spanned the range from never having looked through a telescope to running major amateur astronomy programs. However, even the most experienced participants went away with new ideas and continue to take advantage of our scientific expertise. At the same time, while a "typical" participant many reach a few hundred girls and families, several participants republish our monthly Newsletter and occasional topics of interest, reaching hundreds a month and one astronomy club reaches more than 2,000 people a year! Figure captions:1. Robo Fingers at NSTA; 2. scale of the Earth and Moon at NSTA; 3. learning about meteorites (an SOI grant) at NSTA; 4. inspiring girls by connecting them directly to NIRCam: NIRCam's optical bench is etched "Go Girl Scouts"; 5. star party in AL; 6. star party in GA; 7. integrating astronomy and math in AZ; 8. It's Your Planet, Love It in AZ; 9. Thinking Day in VA ; 10. presentation on the Solar System at Alachua Astronomy Club star party in FL; 11. Thinking Day in PA; 12. Thinking Day in OK. For the beginners, we provide the confidence to do activities and star parties and provide them with information about what is up in the sky and how to connect activities to astronomy in the news. For the more advanced participants, we provide them with the activities and help "fill in the gaps" of the science content knowledge. Scientists and science educators who are also involved in astronomy can provide all of this as well as act as role models for participants and their scouts/students.

4 **Celebrating NIRCam's completion & transfer to NASA**

FROM: Girl Scouts at Lockheed-Martin

TO: Girl Scouts at Goddard

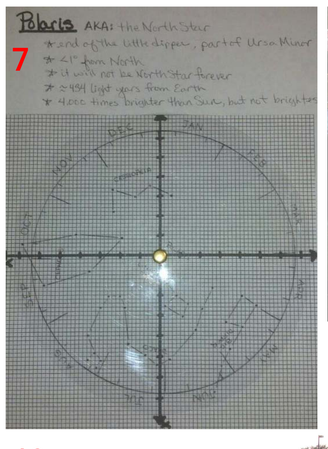
An educational day at Lockheed-Martin

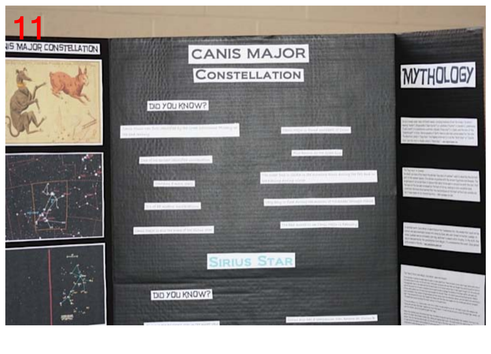
Girl Scouts, scientists, and the LM team

NIRCam is etched *"Go Girl Scouts"* to honor our E/PO partners

experiments , lab tours, presentations, and fun, …

June 18, 2013





6. Contact Information

Activities: lebofsky@lpl.arizona.edu; Girl Scouts of Southern Arizona: mhiggins@girlscoutssoaz.org
NIRCam Astronomy Camp for Girl Scout Leaders: dwmccarthy@gmail.com, www.astronomycamp.org

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