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## Conference Threads

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<td>Enhancing Science Communication Skills and Practices [SC]</td>
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</tr>
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<td>Improving Our Professional Practice [IP]</td>
<td>Other [OT]</td>
</tr>
</tbody>
</table>
Welcome to the ASP 2014 Annual Meeting. Thank you for participating in our long tradition of gathering the astronomy community together to improve our ability to teach astronomy in formal and informal settings, better communicate astronomy research, share our passion with our diverse local communities, and inspire generations to look up!

The first official Meeting of “Astronomical Society of the Pacific” was held on March 30, 1889 in San Francisco. The ASP was only five weeks old and boasted 40 charter members. Fifteen new astronomy enthusiasts joined the organization that evening, including its first female member, Rosa O’Halloran. Edward Holden, ASP founder, used the inaugural meeting to deliver an address on “The Work of an Astronomical Society” in which he presented a vision so profound and timeless that it continues to inform our mission and shape our Annual Meeting to this day.

Holden spoke eloquently about the ASP, describing the organization as a dynamic, diverse, and egalitarian community of professional astronomers, amateurs, and laypeople who would share their expertise and mentor each another. He believed that anyone with a passion for astronomy — regardless of their training — should be able to “find a sphere of interest in our program, a stimulus in our proceedings, and a support in our friendly organization.” He went on to describe his goal for ASP meetings as offering more than “mere lectures, no matter how interesting.” Instead, Holden envisioned a gathering that would engage people in “discussions, questions, remarks, interchange of ideas, and contact [with] active minds.”

Edward Holden would be delighted by this year’s annual meeting. Participants reflect the diversity that Holden envisioned, including professional research astronomers, aerospace engineers, amateur astronomy researchers, astrophotographers, science teachers, museum educators, park rangers, and the public. Plenary sessions will inspire thoughtful debate and discussion, hands-on workshops will engage in active learning experiences, and poster presentations will encourage rich discourse. There will also be many opportunities to network and socialize — including our 125th Anniversary dance party!

On behalf of the remarkable ASP staff and volunteers, thank you for joining us and for investing your increasingly scarce resources (time and money) in what we hope will be a truly meaningful and memorable Annual Meeting.

Linda Shore
Executive Director
Astronomical Society of the Pacific
The ASP thanks the following individuals and institutions for their generous support. Our conference would not be possible without their time and dedication.

### EPO Conference Program Committee
- Greg Schultz, Astronomical Society of the Pacific (Chair)
- Sanlyn Buxner, Planetary Science Institute, and the Univ. of Arizona (Co-Chair)
- Dennis Schatz, Pacific Science Center (Co-Chair)
- Linda Shore, Astronomical Society of the Pacific (Co-Chair)
- Lindsay Bartolone, Adler Planetarium
- John Beck, Stanford Univ.
- Gina Brissenden, Univ. of Arizona, and the American Astronomical Society
- Coral Clark, USRA and the NASA SOFIA Mission
- Hilarie Davis, Technology for Learning Consortium Inc.
- Nicholas Gross, Boston Univ.
- Judy Kass, American Association for the Advancement of Science (retired), and the ASP Board
- John Keller, California State Polytechnic Univ., San Luis Obispo
- Russanne (Rusty) Low, Institute for Global Environmental Strategies
- Bonnie Meinke, Space Telescope Science Institute
- Sara Mitchell, Syneren Technologies and NASA Goddard Space Flight Center
- Julia Plummer, Pennsylvania State Univ.
- Stephen Pompea, National Optical Astronomy Observatory
- Alex Rudolph, California State Polytechnic Univ., Pomona, and the ASP Board
- Thresa Schwerin, Institute for Global Environmental Strategies
- Christine Shupla, Lunar and Planetary Institute
- Gordon Squires, California Institute of Technology
- Connie Walker, National Optical Astronomy Observatory, and the ASP Board
- Ryan Watt, California Academy of Sciences
- Meeting web site and graphics: Leslie Proudfit
- Meeting coordination: Cindny Hart
- Meeting registrar: Albert Silva

### ASP Staff
- Linda Shore, Executive Director
- Jonathan Barnes, Conference Series Associate Editor
- Noel Encarnacion, Inventory and Customer Service Manager
- Suzanne Gurton, Astronomy Education Manager
- Kathryn Harper, Director of Development and Communications
- Blaine Haws, Conference Series Publication Manager
- Anna Hurst Schmitt, Astronomy Educator

### ASP Contractors
- Joseph Jensen, Conference Series Managing Editor
- Brian Kruse, Lead Formal Educator
- Cindy Moody, Conference Series Editorial Assistant
- Pablo Nelson, Project Coordinator, Astronomy from the Ground Up
- David Prosper, Communication Specialist
- Leslie Proudfit, Senior Designer/Webmaster
- Pepita Ridgeway, Conference Series Editorial Consultant
- Greg Schultz, Director of Education
- Albert Silva, Office Administrator
- Michael Sowle, Director of Finance and Operations
- Perry Tanke, Accounting Manager
- Vivian White, Astronomy Educator

### ASP Board Officers
- Gordon Myers (President), IBM (retired)
- Connie Walker (Vice President), National Optical Astronomy Observatory (NOAO)
- Chris Ford (Secretary), Pixar Animation Studios
- Cathy Langridge (Treasurer), Levi Strauss & Co.
- Linda Shore (Executive Director)

### Board of Directors
- Russ Carroll, Miva Merchant
- William Cochran, University of Texas at Austin
- Noelle Filippenko, pizone.org public outreach & education
- Chris Impey, University of Arizona
- Kelsey Johnson, University of Virginia/NRAO
- Christine Jones, Smithsonian Astrophysical Observatory
- Judy Kass, AAAS
- Schyleen Qualls, Arkeon Entertainment & Arkeon Education
- Alexander Rudolph, Cal Poly Pomona
Acknowledgements

Support and Sponsorship

The following organizations have contributed significant support to the success of this conference.

- NRAO
- Sky-Skan
- E&S
- Ball Aerospace & Technologies Corp.
- SOFIA
- CELESTRON®
- AAS
- EXPLORE™
Exhibits – Regency Ballroom

The following will be exhibiting during the conference in Regency Ballroom. Please be sure to stop by during exhibit hours.

Exhibit Hours:
- Monday, August 4: 9:00 a.m. to 6:00 p.m.
- Tuesday, August 5: 9:00 a.m. to 5:30 p.m.
- Wednesday, August 6: 9:00 a.m. to 5:30 p.m.

Astronomical Society of the Pacific (ASP)
The ASP’s diverse education and outreach programs include: Project ASTRO, the Night Sky Network/Sharing the Universe, Astronomy From the Ground Up/Sky Rangers, Galileo Educator Network, the Galileo Teacher Training Program, The Universe in the Classroom Teacher’s Newsletter, SOFIA Education & Public Outreach program, and The Universe at Your Fingertips 2.0 educational DVD. Your ASP membership or donation helps advance science literacy through astronomy! Please visit our booth to learn about our education programs and explore how you can partner with us. astrosociety.org

Evans & Sutherland
Evans & Sutherland (www.es.com) provides Digistar 5, the world’s most advanced digital fulldome planetarium system. Digistar 5 combines fulldome video playback in 2D and 3D with the most comprehensive real time 3D digital astronomy package ever assembled, all within a powerful easy-to-use graphical user interface that makes creating shows more intuitive than ever. Evans & Sutherland is also the world’s leading producer and distributor of digital fulldome shows. As a full-service system provider, E&S also offers Spitz domes, SciDome, hybrid planetarium systems and a full range of theater systems. E&S markets include planetariums, science centers, themed attraction venues, and premium large-format theaters. E&S products have been installed in over 1,300 theaters worldwide.

Field Tested Systems
Spectroscopy is a core concept in modern astronomy. But, it’s always been a difficult topic to teach. Now you can forget about those cumbersome rainbow glasses or foil slides you’ve used in the past – they’re so 20th century. With our $395 live video spectrometer, all of your students will clearly see and easily understand gas tube spectra! Great for hands-on labs or demonstrations. Come by our booth for a quick demonstration. Also: capture spectra of stars using our inexpensive grating, a small (6”) telescope or even DSLR, and our software! Winner of the Sky & Telescope Hot Product award, our software allows you to view live video spectra of stars, even from light-polluted locations. See the Hydrogen Balmer lines. Measure star temperature. Great for E/PO! You’ll be startled at what’s possible. Come by our booth and ask us about our special pricing for attendees. www.fieldtestedsystems.com

IOP Publishing
IOP Publishing provides a range of journals, magazines, books, websites and services that enable researchers and research organisations to reach the widest possible audience for their research. We combine the culture of a learned society with global reach and highly efficient and effective publishing systems and processes. With offices in the UK, US, Germany, China and Japan, and staff in many other locations including Mexico and Russia, we serve researchers in the physical and related sciences in all parts of the world. IOP Publishing is a truly collaborative partner who will work with you to develop your publishing programme, address your specific needs and opportunities, and promote and deliver your content globally. ioppublishing.org

Night Sky Network (NSN)
Managed by the ASP, the NASA Night Sky Network is a community of more than 400 astronomy clubs across the U.S. that share their time and telescopes to engage the public with unique astronomy experiences. The ASP provides training and materials to enhance clubs’ outreach activities, and inspires more than two million people through their participation in 20,000+ plus events. nightsky.jpl.nasa.gov
Exhibits – Regency Ballroom

Rice Space Institute — Discovery Dome

The Discovery Dome is an amazing interactive immersive digital theater. Show the stars, sure, but also fulldome shows on a variety of topics, and even fully immersive interactive explorations! Ride a monster truck on the Moon and drive down Shackleton Crater — can you stay on the road at 1/6 g? Fulldome shows on the history of astronomy, space science, space missions, earth science, human body, and more. One system can switch between regular projection, fulldome, and fully 3D. Come see us in the booth. All our shows can be watched online on our Youtube channel. Space Update software brings the best of the web to your school or museum safely. [www.spaceupdate.com](http://www.spaceupdate.com)

Simulation Curriculum

Simulation Curriculum develops and publishes best-in-class simulation software and curriculum for the K-12 and College markets world-wide. Our mission is to help fill the need for high quality, accurate simulation-based curriculum for topics in Astronomy, Earth Sciences and beyond. Our flagship products are Starry Night and SkySafari. Starry Night is in more than 10,000 classrooms worldwide, is bundled with most major college Astronomy textbooks and is the engine running the most advanced, teacher-friendly planetariums in the world. Starry Night gives educators powerful, accurate, reliable tools to inspire and engage students regardless of their level of content knowledge or technical expertise. SkySafari is an award-winning mobile astronomy app for iOS, Android, and Mac OS X. Acquired from Southern Stars in 2013, the SkySafari apps have been downloaded more than 4 million times. SkySafari is also the world's first telescope control solution for mobile apps, working with the SkyFi wireless telescope controller and SkyWire accessory, hardware products also acquired from Southern Stars. [www.simulationcurriculum.com](http://www.simulationcurriculum.com)

Sky-Skan

Sky-Skan planetariums inspire kids the world over to grow into the next generation of scientists and engineers. We've put planetariums on the Queen Mary 2 ocean liner, in dozens of museums and science centers around the world, in classrooms from high schools to Notre Dame University, and even on the White House south lawn. Our DigitalSky software combines the best of astronomical datasets (SDSS, 2MASS, Tully, CFHT Deep Fields, exoplanetary systems), the versatility for a university to incorporate their own datasets, volumetric galaxy and nebulae, and a fine night sky at whatever resolution you require. We design and install the world's top fulldome digital planetariums and visualization theaters. Our products and services range from Definiti theater systems to rendered content, full system training, project management, theater design, and related hardware and software. Sky-Skan's Definiti theaters immerse audiences in wondrous environments of time and space using a giant, seamless dome screen and surround sound. Typical shows include live real-time flights through astounding data sets, and playback shows with ultra-high definition video. Our customers include science centers and museums, universities, school districts, custom venues, and even residential installations. [www.skyskan.com](http://www.skyskan.com)

Stratospheric Observatory for Infrared Astronomy (SOFIA)

The world's largest flying observatory is called the Stratospheric Observatory for Infrared Astronomy or SOFIA. Operated by NASA, the SOFIA Mission is a modified Boeing 747SP with a 2.5 meter infrared telescope in the fuselage. SOFIA observes the night sky in infrared and is now observing planets, star-forming regions, and the interstellar medium. [www.sofia.usra.edu](http://www.sofia.usra.edu)
# General Daily Schedule

## Sunday, August 3, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:30 p.m.</td>
<td>Universe 2014 (Public Science Event)</td>
<td>Regency Ballroom</td>
</tr>
</tbody>
</table>

## Monday, August 4, 2014

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 a.m.</td>
<td>Conference Registration Desk Opens</td>
<td></td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td>Introduction to the Conference</td>
<td>Harbour Ballroom</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>Plenary Session 1: Federal STEM Policy and Politics, and Their Impact on Astronomy EPO: Reflections and Provocations</td>
<td>Harbour Ballroom</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>Poster/exhibit viewing</td>
<td>Regency Ballroom</td>
</tr>
<tr>
<td>10:30 a.m.</td>
<td>1-minute Poster Previews</td>
<td>Harbour Ballroom</td>
</tr>
<tr>
<td>11:45 a.m.</td>
<td>Lunch (on your own)</td>
<td></td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td>Plenary Session 2: Increasing Diversity in Earth and Space Science</td>
<td>Harbour Ballroom</td>
</tr>
<tr>
<td>2:45 p.m.</td>
<td>Poster/exhibit viewing</td>
<td>Regency Ballroom</td>
</tr>
<tr>
<td>3:15 p.m.</td>
<td>Concurrent Session 1: 1-Hour/2-Hour Workshops, Special Interest Group Discussions, 10-Minute Orals</td>
<td></td>
</tr>
<tr>
<td>4:15 p.m.</td>
<td>Transition Break</td>
<td></td>
</tr>
<tr>
<td>4:30 p.m.</td>
<td>Concurrent Session 2: 1-Hour/2-Hour Workshops, Special Interest Group Discussions, 10-Minute Orals</td>
<td></td>
</tr>
<tr>
<td>5:30 p.m.</td>
<td>Poster/exhibit viewing</td>
<td>Regency Ballroom</td>
</tr>
<tr>
<td>6:00 p.m.</td>
<td>Opening Reception &amp; 125th Anniversary Party</td>
<td>Regency Ballroom</td>
</tr>
</tbody>
</table>
## General Daily Schedule

**Tuesday, August 5, 2014**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>8:30 a.m.</td>
<td>Conference Registration Desk Opens</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td><strong>Plenary Session 3:</strong> Working with Scientists Who Interact with Public Audiences — Harbour Ballroom</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>Poster/exhibit viewing — Regency Ballroom</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td><strong>Concurrent Session 3:</strong> 1-Hour/2-Hour Workshops, Special Interest Group Discussions</td>
</tr>
<tr>
<td>11:00 a.m.</td>
<td>Transition Break</td>
</tr>
<tr>
<td>11:15 a.m.</td>
<td><strong>Concurrent Session 4:</strong> 1-Hour/2-Hour Workshops, Special Interest Group Discussions</td>
</tr>
<tr>
<td>12:15 p.m.</td>
<td>Lunch (on your own)</td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td><strong>Plenary Session 4:</strong> The Next Generation Science Standards (NGSS): How To Support Students, Teachers, and Districts — Harbour Ballroom</td>
</tr>
<tr>
<td>2:45 p.m.</td>
<td>Poster/exhibit viewing — Regency Ballroom</td>
</tr>
<tr>
<td>3:15 p.m.</td>
<td><strong>Concurrent Session 5:</strong> 1-Hour/2-Hour Workshops, Special Interest Group Discussions, 10-Minute Orals</td>
</tr>
<tr>
<td>4:15 p.m.</td>
<td>Transition break</td>
</tr>
<tr>
<td>4:30 p.m.</td>
<td><strong>Concurrent Session 6:</strong> 1-Hour/2-Hour Workshops, Special Interest Group Discussions, 10-Minute Orals</td>
</tr>
<tr>
<td>6:30 p.m.</td>
<td><strong>Awards Banquet</strong> — Poolside Pavilion</td>
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</tbody>
</table>
# General Daily Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>8:30 a.m.</td>
<td>Conference Registration Desk Opens</td>
</tr>
<tr>
<td>8:30 a.m.</td>
<td><strong>Plenary Session 5</strong>: Weighing the Balance of Science Literacy in Education and Public Policy — Harbour Ballroom</td>
</tr>
<tr>
<td>9:30 a.m.</td>
<td>Poster/exhibit viewing — Regency Ballroom</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td><strong>Concurrent Session 7</strong>: 1-Hour/2-Hour Workshops, Special Interest Group Discussion</td>
</tr>
<tr>
<td>11:00 a.m.</td>
<td>Transition Break</td>
</tr>
<tr>
<td>11:15 a.m.</td>
<td><strong>Concurrent Session 8</strong>: 1-Hour/2-Hour Workshops, Special Interest Group Discussion</td>
</tr>
<tr>
<td>12:15 p.m.</td>
<td>Lunch (on your own)</td>
</tr>
<tr>
<td>12:30 p.m.</td>
<td>ASP Town Hall and Member Meeting — Sandpebble AB</td>
</tr>
<tr>
<td>1:45 p.m.</td>
<td><strong>Keynote Plenary Session 8</strong>: Making the Case for the Total STEM Learning Ecosystem: Why Message Matters and Why the Old Ones are Killing Us — Harbour Ballroom</td>
</tr>
<tr>
<td>2:45 p.m.</td>
<td>Poster/exhibit viewing — Regency Ballroom</td>
</tr>
<tr>
<td>3:15 p.m.</td>
<td><strong>Concurrent Session 9</strong>: 1-Hour/2-Hour Workshops, 10-Minute Orals</td>
</tr>
<tr>
<td>4:15 p.m.</td>
<td>Transition Break</td>
</tr>
<tr>
<td>4:30 p.m.</td>
<td><strong>Concurrent Session 10</strong>: 1-Hour/2-Hour Workshops, Special Interest Group Discussions, 10-Minute Orals</td>
</tr>
<tr>
<td>5:30 p.m.</td>
<td><strong>Closing Reception &amp; Raffle</strong>: Regency Ballroom</td>
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</table>

## Raffle

Raffle tickets are available for purchase at the Registration Desk and ASP exhibit booth. $10 per ticket, 3 tickets for $25, or 7 tickets for $50. The drawing will be held at the Closing Reception on August 6. You need not be present to win!

Prizes:
- Celestron COSMOS 90GT telescope (*generously donated by Celestron*)
- Bresser AR-102S Comet Series telescope (*generously donated by Explore Scientific*)
<table>
<thead>
<tr>
<th>Time</th>
<th>Area</th>
<th>Session Details</th>
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<tbody>
<tr>
<td>8:00 – 8:30</td>
<td>Registration Desk</td>
<td>Registration Desk Open</td>
</tr>
<tr>
<td>8:30 – 9:00</td>
<td></td>
<td>125th Anniversary Party</td>
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<tr>
<td>9:00 – 10:00</td>
<td>Plenary Session 1</td>
<td>Schultz (moderator), Storksdieck, Canright: Federal STEM Policy and Politics, and Their Impact on Astronomy EPO: Reflections and Provocations</td>
</tr>
<tr>
<td>10:00 – 10:30</td>
<td></td>
<td>Poster Viewing/Break</td>
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<tr>
<td>10:30 – 11:30</td>
<td></td>
<td>1-minute Poster Presentations</td>
</tr>
<tr>
<td>11:45 – 1:30</td>
<td>Lunch on your own</td>
<td>Lunch on your own</td>
</tr>
<tr>
<td>1:45 – 2:45</td>
<td>Plenary Session 2</td>
<td>Meinke (moderator), Acevedo, Basri, Kenney, Lee: Increasing Diversity in Earth and Space Science</td>
</tr>
<tr>
<td>2:45 – 3:15</td>
<td></td>
<td>Poster Viewing/Break</td>
</tr>
<tr>
<td>3:15 – 4:15</td>
<td>Concurrent Session 1</td>
<td>1A Shackelford: The Great Society: An Introduction to Stereotype Threat and Social Perceptions (SPECIAL SESSION, Part 1 of 2) [MU]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1B Clark: Taking Outreach to New Heights with SOFIA’s Airborne Astronomy Ambassadors Program (SPECIAL SESSION) [IP]</td>
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<tr>
<td></td>
<td></td>
<td>1C LaConte: Tested Tools and Techniques for Promoting STEM Programming in Libraries [SC]</td>
</tr>
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<td></td>
<td></td>
<td>1D Lubowich: Bringing Astronomy to Outdoor Concerts — How to Create an Astronomy Festival [SC]</td>
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<td></td>
<td>Session Chair: Schatz</td>
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<td></td>
<td>1E.1 Davey: Professional Development: What EPO Professionals Want [IP]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1E.2 Grier: Understanding and Meeting the Needs of Scientists in E/PO — Survey Results, Responses and Strategies [SC]</td>
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<tr>
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<td></td>
<td>1E.3 Paschoff: Preparing for and Observing the 2017 Total Solar Eclipse [OT]</td>
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<tr>
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<td></td>
<td>1E.4 Huddle: Solar Eclipse Experiments for Students [CS]</td>
</tr>
<tr>
<td>4:15 – 4:30</td>
<td>Transition Break</td>
<td>Transition Break</td>
</tr>
<tr>
<td>4:30 – 5:30</td>
<td>Concurrent Session 2</td>
<td>2A Shackelford: The Great Society: An Introduction to Stereotype Threat and Social Perceptions (SPECIAL SESSION, Part 2 of 2) [MU]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2B Fraknoi: The Total Eclipse of the Sun of 2017: A Magnificent EPO Opportunity (SPECIAL SESSION) [OT]</td>
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<td>2C Scalise: Learning to Use a Quantitative Collaborative Impact Analysis Evaluation Method [OT]</td>
</tr>
<tr>
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<td></td>
<td>2D DeVore: Using Kepler Mission Data to Enhance Students’ Graphing Skills [CS]</td>
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<tr>
<td></td>
<td></td>
<td>Session Chair: Hurst Schmitt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2E.1 Plummer: Methods of Engaging Preschool-age Children in Science Practices during Astronomy Activities [IP]</td>
</tr>
<tr>
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<td></td>
<td>2E.2 Beaton: Assessments in Dark Skies, Bright Kids: How to Get the Most Bang from Each Volunteer Hour [EP]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2E.3 Petrie: Exploring 7th-12th Grade Attitudes, Motivation, and Content Knowledge in Astronomy [SC]</td>
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<tr>
<td></td>
<td></td>
<td>2E.4 Cobb: A Summer of Cosmic Chemistry [NG]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2E.5 Follette: The Development and Validation of an Assessment Tool for Evaluating Quantitative Literacy in Introductory Science Courses [IP]</td>
</tr>
<tr>
<td>6:00 – 9:30</td>
<td>Opening Reception</td>
<td>Opening Reception &amp; 125th Anniversary Party</td>
</tr>
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</table>

MONDAY, AUGUST 4, 2014  DETAILED SCHEDULE BY DAY • SESSIONS LISTED BY LEAD PRESENTER • CONFERENCE THREAD KEY ON PAGE 2
<table>
<thead>
<tr>
<th>Time</th>
<th>BAYSIDE A</th>
<th>BAYSIDE B</th>
<th>SANDPEBBLE AB</th>
<th>SANDPEBBLE CD</th>
<th>SANDPEBBLE E</th>
<th>HARBOUR BALLROOM</th>
<th>REGENCY BALLROOM/OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30</td>
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<td></td>
<td></td>
<td></td>
<td>Registration Desk Open</td>
<td></td>
</tr>
<tr>
<td>8:30 – 9:30</td>
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<td></td>
<td></td>
<td>Schatz (moderator), Gurton, McCann, Witzel: Working with Scientists Who Interact with Public Audiences</td>
<td></td>
</tr>
<tr>
<td>9:30 – 10:00</td>
<td>Poster Viewing/Break</td>
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<td>10:00 – 11:00</td>
<td>3A Davis: Measuring Impact in Specific Settings: Booths, Teacher PD, Student Activities, and Scientist Talks (SPECIAL SESSION, Part 1 of 2) (EP)</td>
<td>3B Schatz: Getting Beyond Your Expert Blind Spot: I get it, why don't they? (SPECIAL SESSION, Part 1 of 2) (OT)</td>
<td>3C Lawton: Using Authentic Science in the Classroom: NASA's Coordinated Efforts to Enhance STEM Education (SPECIAL SESSION) (MT)</td>
<td>3D Graff: Using Authentic Data to Facilitate Comparative Planetology &amp; Student-led Classroom Investigations (CS)</td>
<td>3E Mitchell: NASA's Space Forensics: Integrating Storytelling into STEM Education (SC)</td>
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<td>11:00 – 11:15</td>
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<td>12:15 – 1:45</td>
<td>BAYSIDE A</td>
<td>Lunch on your own</td>
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<td>1:45 – 2:45</td>
<td>BAYSIDE B</td>
<td>Plenary Session 4: Shore (moderator), Carlson, Cheung, Plummer: The Next</td>
<td>How To Support Students, Teachers, and Districts</td>
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<td>3:15 – 4:15</td>
<td>SANDPEBBLE AB</td>
<td>Concurrent Session 5: 1-Hour/2-Hour Workshops Special Interest Group (SIG)</td>
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<td>5C Ali: Communities of Practice — Professional Development through Fostering</td>
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<td>5D Fraknoi: Black Hole Songs, Constellation Pieces &amp; Walking on the Moon:</td>
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<td>HARBOUR BALLROOM</td>
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<td>5E.1 Smith: NASA Science Mission Directorate EPO: A Coordinated Program</td>
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<td>5E.3 Bartolone: Informal Education Community Needs: NASA SMD Science EPO</td>
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<td>5E.5 Manning: Flying the Infrared Skies: An Authentic SOFIA Educator</td>
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<td>6C Hart: AAS Astronomy Ambassadors: Training in the Trenches [SC]</td>
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<td>6D Low: Teaching Remote Sensing and Geospatial Technologies: Community</td>
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<td>6E.2 Solis: Approaching Astronomy to People in Chile [SC]</td>
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<td>6E.4 Harvey: Celebrating a Decade of Journey through the Universe [EP]</td>
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<td>6:30 – 9:00</td>
<td>SANDPEBBLE E</td>
<td>ASP Awards Banquet (Poolside Pavilion)</td>
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# Celebrating Science: Putting Education Best Practices to Work | Conference Program

## Wednesday, August 6, 2014 (AM)

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<th>Time</th>
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<td>8:30</td>
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<td><strong>Registration Desk Open</strong></td>
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<td>8:30 – 9:30</td>
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<td>Session 5</td>
<td>Plenary Session</td>
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<td>9:30 – 10:00</td>
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<td><strong>Poster Viewing/Break</strong></td>
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**BAYSIDE A**

- **7A** Berryhill: Best Practices in Online Astronomy Teaching (SPECIAL SESSION, Part 1 of 2) [MT]
- **8A** Berryhill: Best Practices in Online Astronomy Teaching (SPECIAL SESSION, Part 2 of 2) [MT]

**BAYSIDE B**

- **7B** Walker: Synergy between the Astronomy Community & Cosmic Light, a Cornerstone for the International Year of Light (SPECIAL SESSION, Part 1 of 2) [IP]
- **8B** Walker: Synergy between the Astronomy Community & Cosmic Light, a Cornerstone for the International Year of Light (SPECIAL SESSION, Part 2 of 2) [IP]

**SANDPEBBLE AB**

- **7C** Buxner: A Community Discussion about Sharing and Publishing Space Science Education Research and Evaluation (SPECIAL SESSION) [EP]
- **8C** Black: Connecting with the Science Fair to Enhance Science Communication Skills and Practices [CS]

**SANDPEBBLE CD**

- **8D** Plummer: Publishing Your Research in the Journal and Review of Astronomy Education and Outreach (SPECIAL SESSION) [IP]

**SANDPEBBLE E**

- **7E** Peruta: A Web-based Cosmology Curriculum [MT]
- **8E** Wojcik: Lessons That Last: Designing Dynamic Programs that Keep Up with the Ever-changing Field of Astronomy [SC]

**HARBOUR BALLROOM**

- Buxner (moderator), Impey, Johnson: Weighing the Balance of Science Literacy in Education and Public Policy

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**REGENCY BALLROOM/OTHER**
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<th>Time</th>
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<tr>
<td>12:15 – 1:45</td>
<td>BAYSIDE A</td>
<td>9A Follette: RE-NUMERATE: Restoring Essential Numerical Skills and Thinking in Astronomy Education (SPECIAL SESSION, Part 1 of 2) [IP]</td>
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<td>9B Hurst Schmitt: My Sky Tonight: Developmentally-Appropriate Activities for Engaging Preschool Children in Astronomy (SPECIAL SESSION, Part 1 of 2) [SC]</td>
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<td>9C Ricard: Beyond the Dome: Using a Variety of Venues for Astronomy Visualization and Interpretation (SPECIAL SESSION) [SC]</td>
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<td>9D Shupla: The Nature of Astronomy: Addressing the Nature of Science within NGSS (SPECIAL SESSION) [NG]</td>
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<td><strong>Session Chair:</strong> Meinke</td>
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<td>12:30 – 1:30</td>
<td>BAYSIDE B</td>
<td>Lunch on your own</td>
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<td>1:45 – 2:45</td>
<td>Plenary</td>
<td><strong>ASP Town Hall and Member Meeting</strong></td>
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<td>Session 6</td>
<td>Bartels: Making the Case for the Total STEM Learning Ecosystem: Why Message Matters and Why the Old Ones are Killing Us</td>
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<td>2:45 – 3:15</td>
<td>REGENCY BALLROOM</td>
<td>Poster Viewing/Break</td>
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<td>Session 9</td>
<td>9E.1 Gugliucci: Evaluating Motivations of Citizen Science and Impacts of Guerilla Outreach (EP)</td>
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<td>9E.2 Watzke: Public Engagement and Communication from the Chandra X-ray Center [SC]</td>
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<td>9E.3 Hurt: A Next-Gen Public Astronomical Image Archive Today: astropix.ipac.caltech.edu [MT]</td>
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<td>9E.4 Brinkworth: The Relationship between Knowledge and Attitudes in the Public Understanding of Science [IP]</td>
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<td>9E.5 Kohler: Lessons Learned from ComSciCon: A Science Communication Workshop for Graduate Students [SC]</td>
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<td>4:15 – 4:30</td>
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<td>4:30 – 5:30</td>
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<td>Session 10</td>
<td>10A Follette: RE-NUMERATE: Restoring Essential Numerical Skills and Thinking in Astronomy Education (SPECIAL SESSION, Part 2 of 2) [IP]</td>
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<td>10B Hurst Schmitt: My Sky Tonight: Developmentally-Appropriate Activities for Engaging Preschool Children in Astronomy (SPECIAL SESSION, Part 2 of 2) [SC]</td>
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<td>10C Walker: Using NGSS to Shape Research Projects with Citizen-Science Data (SPECIAL SESSION) [CS]</td>
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<td>10D Lee: Native Skywatchers: Kapennni. As it is Above, it is Below. A Hands-on STEM+Art+Culture Experience [OT]</td>
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<td>10E.2 Hufnagel: Interdependence: Entangling Students with the Community College [MU]</td>
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<td>10E.3 Impye: Studying Students’ Science Literacy: Non-Scientific Beliefs and Science Literacy Measures [SC]</td>
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<td>10E.4 Wenger: The Future of Online Learning with MOOCs in Astronomy [MT]</td>
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<td>10E.6 Brandt: Teaching the Exploration of Mars [NG]</td>
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<td>5:30 – 6:30</td>
<td>Closing Happy Hour/Reception</td>
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Monday August 4

Opening Ceremony
*Harbour Ballroom*
8:30 – 9:00 a.m.
Linda Shore, Astronomical Society of the Pacific

Opening Reception & 125th Anniversary Party
*Regency Ballroom*
6:00 – 9:30 p.m.

Light hors d’oeuvres will be served, along with one complimentary glass of champagne per person. No-host beer and wine will be available. Live music will be performed by The Quaadudes.

Tuesday August 5

2014 ASP Awards Banquet
*Poolside Pavilion*
6:30 p.m. Reception followed by a Banquet at 7:15 p.m.

ASP awards recognize meritorious work by professional and amateur astronomers, science educators, and those who engage in public outreach. Tickets must be purchased for this event. Tickets will be available for purchase until 6:00 p.m. on August 4.

Wednesday August 6

ASP Town Hall and Member Meeting
*Sandpebble AB*
12:30 – 1:30 p.m.

Bring a sandwich, soup or salad and join the ASP’s new executive director for a review and preview of all things ASP.

Closing Reception & Raffle
*Regency Ballroom*
5:30 p.m.

Please join us for refreshments at the closing ceremony. Raffle winners will be announced (see page 9 for raffle details).

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**2014 ASP Award Recipients**

**Maria and Eric Muhlmann Award**
For important research results based upon development of groundbreaking instruments and techniques
Harland Epps

**Klumpke-Roberts Award**
For outstanding contributions to the public understanding and appreciation of astronomy
Dennis Schatz

**Robert J. Trumpler Award**
For a recent Ph.D. thesis considered unusually important to astronomy
Brendan Bowler

**Amateur Achievement**
For significant observational or technical achievements by an amateur astronomer
Rod Stubbings

**Richard H. Emmons Award**
For excellence in college astronomy teaching
Laurence Marschall

**Las Cumbres Amateur Outreach Award**
For outstanding outreach by an amateur astronomer to children and the public
Dan Kaminsky

**Thomas J. Brennan Award**
For exceptional achievement related to the teaching of astronomy at the high school level
Vivian Hoette

**Catherine Wolfe Bruce Gold Medal**
Awarded since 1889 for a lifetime of outstanding research in astronomy
Kenneth Kellerman
A Public Afternoon of Science and Scientific Speculation

Regency Ballroom, Hyatt Regency Hotel, Burlingame, CA

Sunday, August 3, 2014
1:30–5:30 p.m.
Free, with a suggested donation of $10 per person

To celebrate its 125th year of service to the public understanding of the cosmos, the Astronomical Society of the Pacific invites you to an afternoon learning and thinking about some of the most exciting questions in our exploration of the universe.

What kind of planets orbit other stars? Is there an Earth 2.0 out there, just like us? Could life exist in strange environments, quite different from our planet’s? And could there be intelligent life beyond Earth? If so, how could we find them — or even have a conversation with them? Only in the last few decades have such questions moved from the realm of science fiction to the realm of scientific experiment. Come hear from some of the most articulate scientists in the Bay Area where we stand with our quest to explore planets and life beyond our own world.

1:30 p.m. Welcome by Linda Shore, ASP Executive Director
1:35–1:45 p.m. Introduction and Overview by Andrew Fraknoi (moderator)
1:45–2:35 p.m. Geoff Marcy (U. C. Berkeley)
Finding Habitable Worlds Around Other Stars
2:40–3:30 p.m. Christopher McKay (Planetary Scientist and Astrobiologist, NASA Ames Research Ctr.)
The Search for Life on Mars and the Moons of the Outer Planets
3:30–3:45 p.m. Break
3:45–4:35 p.m. Jill Tarter (Bernard Oliver Chair at the SETI Institute)
SETI: Finding Aliens and Finding Ourselves
4:40–5:30 p.m. Panel with Marcy, McKay, Tarter, and Andrew Fraknoi (moderator), discussion, and questions from the audience

Geoff Marcy is one of the pioneers and leaders in the discovery and characterization of planets around other stars. Professor Marcy’s research results have included detection of the first multiple-planet system, the first Saturn-mass planet and the first Neptune-mass planet. In recent years, Professor Marcy’s research has focused on the search for Earth-size planets around other stars. He is a co-investigator of Kepler, the NASA space-born telescope dedicated to identifying Earth-like planets, and is helping determine how many of these planets fall in the habitable zone with the potential for supporting life. In March, 2012, Professor Marcy was appointed to the Alberts Chair in the Search for Extraterrestrial Intelligence at the University of California, Berkeley. He is the recipient of the Carl Sagan Prize for Science Popularization (2009), the Shaw Prize (2005, shared with Michel Mayor), and the NASA Medal for Exceptional Scientific Achievement (2003).

Christopher McKay is a Planetary Scientist with the Space Science Division of NASA Ames. He has been involved in research in Mars-like environments on Earth, traveling to the Antarctic dry valleys, Siberia, the Canadian Arctic, and the Atacama, Namib, & Sahara deserts to study life in these Mars-like environments. He was a co-investigator on the Huygens probe to Saturn’s moon Titan in 2005, the Mars Phoenix lander mission in 2008, and the current Mars Science Laboratory mission (2012). His current research focuses on the evolution of the solar system and the origin of life. He is also actively involved in planning for future Mars missions including human exploration.

Jill Tarter holds the Bernard M. Oliver Chair for SETI Research at the SETI Institute in Mountain View, and serves as a member of its Board of Trustees. Tarter served as Project Scientist for NASA’s SETI program, the High Resolution Microwave Survey, and has conducted numerous observational programs at radio observatories worldwide. She was named one of the Time 100 in 2004, and one of the Time 25 in Space in 2012, received a TED prize in 2009, public service awards from NASA, and multiple awards for communicating science to the public. Since the termination of funding for NASA’s SETI program in 1993, she has served in a leadership role to design and build the Allen Telescope Array and to secure private funding to continue the exploratory science of SETI. Many people are now familiar with her work as portrayed by Jodie Foster in the movie Contact.

Andrew Fraknoi is the Chair of the Astronomy Department at Foothill College in Los Altos, Vice-President of the Lick Observatory Council, and a member of the Board of Trustees of the SETI Institute. He has been involved at the Astronomical Society of the Pacific for over 40 years, 14 of them as the Society’s Executive Director. He was named as the California Professor of the Year in 2007 by the Carnegie Endowment for Higher Education, and received the Gemant Prize of the American Institute of Physics and the Michael Faraday Prize for science communication of the National Science Teachers Association. Asteroid 4859 has been named Asteroid Fraknoi by the International Astronomical Union in recognition of his contributions to the public understanding of science.
Federal STEM Policy and Politics, and Their Impact on Astronomy EPO: Reflections and Provocations

Opening Plenary Session 1
Monday August 4
9:00 – 10:00 a.m.
Harbour Ballroom

Greg Schultz, Astronomical Society of the Pacific, moderator
Martin Storksdieck, Oregon State University, panelist
Shelley Canright, NASA Office of Education, panelist

The federal government across its various units invests more than $3 Billion each year in supporting STEM education and outreach. Efforts in recent years to understand and better coordinate these investments have resulted in considerable pushback, particularly those efforts that aimed at consolidation, and elimination of programs deemed ineffective or duplicative. While initial plans to streamline federal STEM education were defeated, many agencies nonetheless saw cuts and elimination, and a high-level effort to coordinate STEM education at the cross-agency level is now gaining steam (CoSTEM: Committee on Science, Technology, Engineering, and Mathematics Education). What do all of these developments mean for education and public outreach in astronomy and related fields? How should this community operate within the opportunities and threats that CoSTEM might pose? Former director of the National Academy of Science's Board on Science Education, and now director of the Center for Research on Lifelong STEM Learning, Martin Storksdieck, will reflect on past and recent developments from the perspective of a close observer, and from the perspective of someone who has been involved in astronomy education research and evaluation for nearly 20 years. And from the NASA Office of Education, Shelley Canright, Senior Advisor for Education Integration, will share her insights and perspectives with respect to CoSTEM and EPO, in particular from co-chairing the Federal Coordination in Science, Technology, Engineering, and Mathematics Education (FC-STEM) group.

Greg Schultz is Director of Education at the Astronomical Society of the Pacific (ASP), 2009-present, following 10 years at UC Berkeley's Center for Science Education at the Space Sciences Lab. He has been involved in more than 20 NASA and NSF education and public outreach (EPO) grants and projects, oversees ASP's various education programs and networks, and each year chairs the Program Committees for the ASP's Annual Meeting. Current grants he is involved with include the NASA Galileo Educator Network, the NASA Astrophysics E/PO Forum, the NASA SOFIA mission, and the NSF My Sky Tonight early childhood project. Greg earned a PhD in 1999 from UCLA Astronomy & Astrophysics, and was an NSF Postdoctoral Fellow in Science, Mathematics, Engineering and Technology Education. His primary professional interests have been teacher professional development, teacher education, undergraduate teaching, curriculum development, informal education, and developing and managing EPO projects and conferences — all in astronomy, space science, physics, earth science, and related fields. He served four years on the Board of Directors of the California Science Teachers Association, and for three years and running on the Board of Directors for Habitot Children's Museum in Berkeley.

Before becoming the Director of the Center for Research on Lifelong STEM Learning in June 2014, Martin Storksdieck served as the Director of the Board on Science Education (BOSE) at the National Research Council (NRC) of the National Academy of Sciences. As the BOSE Director he oversaw studies that address a wide range of issues related to science education and science learning, and provide evidence-based advice to decision-makers in policy, academia and educational practice. His prior research focused on what and how we learn when we do so voluntarily, and how learning is connected to our behaviors, identities and beliefs. This includes the role of personal perspectives in science learning, particularly related to controversial topics such as climate change or evolution, and how connections between school-based and out-of-school learning can create and sustain lifelong interest in science, but also learning itself. His research also focused on the role of science-based professionals and science hobbyists in communicating their passions to a broader public. Storksdieck has also previously served as director of project development and senior researcher at the non-profit Institute for Learning Innovation. In the 1990s he was a science educator with a planetarium in Germany, where he developed shows and programs on global climate change; served as editor, host, and producer for a weekly environmental news broadcast; and worked as an environmental consultant specializing in local environmental management systems. He holds an M.S. in biology from the Albert-Ludwigs University in Freiburg, Germany; an M.P.A. from Harvard University’s Kennedy School of Government; and a Ph.D. in education from Leuphana University in Lüneburg, Germany. Storksdieck also directs NRC’s Roundtable on Climate Change Education.
Celebrating Science: Putting Education Best Practices to Work | Conference Program

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Shelley Canright is Senior Advisor for Education Integration in the NASA Office of Education, Washington, DC. Her current focus is providing leadership for NASA’s efforts in engaging other federal agencies to collaborate on NASA’s education portfolio and addressing the five priority investment areas and implementation roadmaps in the Federal Science, Technology, Engineering and Mathematics (STEM) Education 5-Year Strategic Plan. Beginning in March 2014, Shelley stepped into the role as (acting) co-chair with NSF to the Federal Coordination in Science, Technology, Engineering, and Mathematics Education (FC-STEM). The purpose of FC STEM is to advise and assist the NSTC Committee on STEM and the Director of the Office of Science and Technology Policy on developing strategic investments in STEM education across Federal agencies. The FC-STEM serves as a forum for discussion and policy coordination to facilitate implementation of the Federal STEM Education 5-Year Strategic Plan. Shelley recently completed a one-year detail in the NASA Administrator’s Office serving as the executive officer to the Agency’s highest governance body and as team lead over the other Agency Councils. She previously served as the Program Manager over the Agency’s Elementary-Secondary Program, which included management of major digital learning products and educational technology projects. She began her NASA career at Langley Research Centers (Hampton, VA), where she served as the Center Education Program Officer, and began her education career over 25 years ago teaching at the elementary and middle school levels. Shelley received her bachelor’s degree in early and middle childhood education and her master’s degree in educational policy and leadership from the Ohio State University. She earned her doctorate in instructional systems with certification in distance education from Pennsylvania State University.

Increasing Diversity in Earth and Space Science

Plenary Session 2
Monday August 4
1:30 – 2:30 p.m.
Harbour Ballroom

Bonnie Meinke, Space Telescope Science Institute, moderator
Gibor Basri, University of California, Berkeley, panelist
Annette Lee, St. Cloud University, panelist
Karen Kenney, Girls Inc. of the Island City, panelist
Salvador Acevedo, Contemporanea, panelist

In this interactive discussion, panelists will share their perspectives from working with diverse audiences, including Native American, African American, Hispanic/Latino and girls and women. For the session objectives, attendees will:

1. Identify and discuss the challenges to engagement of specific audiences.
2. Learn strategies for connecting to your audience.
3. Understand how to adapt engagement for different educational settings with various audiences.

Panel moderator Bonnie Meinke is an Outreach Astronomer at the Space Telescope Science Institute in Baltimore, Maryland. Having grown up in Texas, where “the stars at night are big and bright,” she was inspired to pursue a career as a planetary astronomer. Through her work coordinating NASA Science4Girls and Their Families, Dr. Meinke is committed to bringing Earth and space science to underserved and underrepresented audiences via libraries. Beyond engaging girls in STEM, Dr. Meinke is interested in new technologies and partnerships to reach rural and economically-struggling communities via NASA Science4Girls. She is here today as part of a team from the NASA SMD E/PO Forums charged with exploring diversity issues in our work as E/PO practitioners.

Gibor Basri received his PhD in Astrophysics from the University of Colorado, Boulder in 1979. An award of a Chancellor’s Postdoctoral Fellowship brought him to UC Berkeley that year, where he joined the faculty of the Astronomy Department in 1982. He has worked on stellar magnetic activity and low mass stars (including the Sun) throughout his career. He was an active user of the Lick and Keck Observatories as well as a number of space telescopes. He was a pioneer in the discovery and study of magnetospheric accretion onto newly forming stars. He was a co-discoverer of brown dwarfs, and found and helped characterize the death of stellar chromospheres at the bottom of the main sequence. He has pioneered several means of directly measuring stellar magnetic fields, and studied their role in the angular momentum history of stars and brown dwarfs. Recently he has been utilizing stellar data from the Kepler mission to learn more about starspots. Back on Earth, he will soon step down from several years as the founding Vice Chancellor for Equity and Inclusion at UC Berkeley.

Annette Lee is an Associate Professor of Astronomy and Physics at St. Cloud State University in St. Cloud, Minnesota. Director of the SCSU Planetarium and Director of Native Skywatchers research & programming. The confluence of Astrophysics and Art meet in the studio of Annette Lee. An artist-scientist of Native American
ancient ancestry, Lee’s interdisciplinary work has reconnected the Dakota and Ojibwe tribes with the star knowledge her forefathers have shared for millennia. Her Native Starwatchers Project holds great meaning to the people of the Dakota and Ojibwe tribes, who see the stars as their pathway to the spirit world. Lee’s work has touched the hearts of students like Jeffrey Tibbetts, Title III project director at Fond du Lac Tribal and Community College in Cloquet, Minn., where Lee taught art, mathematics and astronomy from 2001 to 2005. “I used to look up and see the Greek constellations, like the Big Dipper, or Leo the lion,” Tibbetts says. “But now I know that there are stars up there that are ours. It does something to me inside, to have that relationship with the stars. It’s like finding a long-lost relative.”

Karen Kenney joined Girls Inc. of the Island City in 2005 as Executive Director. Previously, Karen was the Dean of Students at U.C. Berkeley. She worked at U.C. Berkeley for 28 years as a college instructor, recreation program developer and student affairs professional. Karen has received numerous recognitions including U.C. Berkeley’s highest staff award, the Berkeley Citation. Karen earned her Bachelor of Arts degree and Master of Arts degree in Physical Education from San Diego State University. Areas of emphasis were sociology of sports and history of sports. She completed post-graduate course work at U.C. Berkeley in women’s socio-cultural history.

Salvador Acevedo is first and foremost, a dot connector. He is always looking for ways to connect and communicate the insights he discovers in the communities he works with, with opportunities for growth and evolution. He is most interested in finding ways in which we are connected to each other, would it be common experiences, shared perspectives or points of arrival, parting from a multicultural perspective to arrive into an intercultural experience. For the last 20 years he has found ways to connect the social capital of organizations with business opportunities for growth, as an executive, consultant and researcher. Acevedo has worked with many informal education institutions, corporations and foundations in projects ranging from consumer intelligence to organizational transformation, always with the goal of adapting practices and policies to the changes in society. Being bilingual and bicultural has been extraordinarily helpful in achieving a perspective of common ground understanding. Salvador earned a masters degree in Communications from Universidad Iberoamericana in Mexico City, a diploma in marketing at University of California, Berkeley, and is certified by Research in Values and Attitudes, Inc. (RIVA, Inc.) as qualitative market researcher. He received the 2008 Latino Business Leadership Awards, by the San Francisco Hispanic Chamber of Commerce, San Francisco Business Times and Wells Fargo.

**Plenary Sessions**

**Working with Scientists Who Interact with Public Audiences**

**Plenary Session 3**
Tuesday August 5
8:30 – 9:30 a.m.
**Harbour Ballroom**

Dennis Schatz, *Pacific Science Center*, moderator
Lakisha Witzel, *UC San Francisco*, panelist
Sue Ellen McCann, *KQED and the Center for Advancing Informal Science Education*, panelist

President Obama has called for all STEM-based federal employees to share their expertise and passion with the public. Alan Leshner, Executive Director of AAAS, has advocated the same for all scientists. But what are the best ways to prepare scientists as effective science communicators? How do scientists find resources to become better science communicators? How do scientists connect with other scientists interested in education outreach? This panel, with representatives from an informal science education institution, a university, and a professional association, will offer insights to answer these questions from their multi-year experience of working with scientists engaged with public audiences.

Dennis Schatz is Senior Advisor at Pacific Science Center in Seattle, Washington, and a Program Director at the National Science Foundation. He is the author of 24 science books for children that have sold almost 2 million copies worldwide and have been translated into 23 languages. At NSF he leads the effort to develop an international informal STEM education partnership (Science Learning+) with the Wellcome Trust and the Economic and Social Research Council (ESRC) in the UK. At the Science Center, he has provided leadership to several of the Science Center’s major initiatives. He was Principal Investigator for *Portal to the Public*, an initiative to develop programs — both onsite and off — that engage scientist in working with public audiences to enhance the public’s understanding of the current science research being conducted across the state. He has won numerous awards, including the Faraday Science Communicator Award and Distinguished Service to
Plenary Sessions

Science Education Award from the National Science Teachers Association (NSTA). At this meeting he will receive the Klumpke-Roberts Award from the Astronomical Society of the Pacific, given for a lifetime of contributions to the public understanding of astronomy. More information about Dennis is at www.dennisschatz.org.

Lakisha Witzel has been an Academic Coordinator at the Science and Health Education Partnership (SEP) at UC San Francisco since 2008. Lakisha has coordinated a variety of programs that bring together scientists from UCSF and teachers from SFUSD to teach fun and engaging hands-on science lessons to K-12 students. Through these programs, teachers and their students are exposed to positive role models in science and have the opportunity to experience inquiry-based science learning. Lakisha also co-teaches the Teaching Workshops for Scientists, a series of interactive sessions that provide teaching strategies to SEP’s scientist volunteers. During the workshops, scientist volunteers learn how to ask questions that promote students’ critical thinking and learning, develop skills to design lesson plans that are informed by learning objectives, and experience strategies to engage a variety of learners. Lakisha is currently the program manager for SFUS2020, a new program led by SEP in collaboration with Techbridge, SFUSD, the city of San Francisco, and the Salesforce.com Foundation. In 2010, Lakisha received her M.S. from San Francisco State University where she investigated the benefits, as reported by 4th and 5th grade students, of having scientists in their classrooms. After 20 years of working in planetariums in some great cities across the country (Tucson, Chapel Hill, Los Angeles, Boulder, New York and Santa Fe), Suzanne Gurton has served as the education manager at the ASP for 14 years. During this time, she’s contributed to the development of hands on activities for families (Family ASTRO) and helped build Astronomy from the Ground Up and Sky Rangers, a community of over 1000 informal educators and interpretive rangers, as well as the NASA Night Sky Network, a network of over 450 amateur astronomy clubs.

Sue Ellen McCann is a Co-PI for the Center for the Advancement of Informal Science Education (CAISE), and the Executive in Charge of Science at KQED, the public broadcasting station in San Francisco. The KQED team is the largest journalism and education unit in California producing science news and features for TV, radio, web and social media as well as professional development for educators and interactive products for learning environments. Sue Ellen specializes in multi-platform productions and has a long and successful history working on local and national media projects and informal science education initiatives. The KQED science team has recently been honored with awards from AAAS, the Society of Environmental Journalists, the Society of Professional Journalists and the Northern California Emmy’s among others. Sue Ellen serves as the NSF PI for QUEST, a six-station public media science and environment reporting and education collaborative.

The Next Generation Science Standards (NGSS): How To Support Students, Teachers, and Districts

Plenary Session 4
Tuesday August 5
1:45 – 2:45 p.m.
Harbour Ballroom

Linda Shore, Astronomical Society of the Pacific, moderator
Julia Plummer, Pennsylvania State University, panelist
Caleb Cheung, Oakland Unified School District, panelist

The NGSS outlines a vision for STEM teaching and learning in which students engage in authentic science practices and use the foundational “crosscutting themes” of science to interpret results of investigations. In this plenary session, expert panelists will share what is known about student science learning and the best practices of science teacher professional development. You will learn what the astronomy education outreach community can do to help schools and districts helpfully adopted the NGSS.

Panel moderator Linda Shore is the newly appointed Executive Director of the Astronomical Society of the Pacific. Most recently, Shore served as Director of the Teacher Institute at San Francisco’s renowned science museum, the Exploratorium. While there she led a staff of scientists and educators, and created nationally recognized teaching programs. She was also responsible for fund development, grants program, and expanding institutional reach by forging collaborations with national and international museums and science centers. Shore has co-authored Exploratorium science and education books, and written articles about popular science and science education for the public. A native San Franciscan who has spent most of her life in the Bay Area, she holds a EdD in science education from Boston University, and a master's degree in physics and astronomy from San Francisco State University. Shore was also the recipient of a prestigious Smithsonian Pre-doctoral Fellowship to work at the Harvard-Smithsonian Center for Astrophysics where
she developed curriculum and conducted research on astronomy learning for the National Science Foundation funded program, Project STAR (*Science Teaching through its Astronomical Roots*).

**Julia Plummer** spent more than a decade teaching children and adults in planetariums and other informal settings as well as extensive experience teaching college-level introductory astronomy and science methods for preservice elementary teachers. Her research interests focus on how children and adults engage in scientific practices in the domain of astronomy. This includes investigating both formal and informal learning environments and the importance of spatial reasoning in the domain. Her research has led to the development of astronomy learning progressions focused on explaining celestial motion phenomena and connecting observations of the current Solar System to its formation model. Julia has co-authored a middle school astronomy curriculum and collaborated on the development of planetarium programs for children. She is co-PI on the NSF-funded My Sky Tonight, a research and development project focused on supporting informal educators in engaging young children in astronomy. Julia received a combined Ph.D. in Astronomy & Education from the University of Michigan.

**Caleb Cheung** taught middle school science for ten years in Oakland at Frick, Carter and Lowell Middle Schools before moving to the district’s science department in 2006. His educational background includes a BA in Biology from UC Berkeley and a MA in Curriculum and Teacher Education from Stanford University. He is also National Board Certified in Early Adolescent Science. In 2002, he was the Marcus A. Foster Educational Institute Distinguished Educator of the Year and in 2005, won the Presidential Award for Excellence in Math and Science Teaching. From 2006-2009, He served as a Commissioner and the Chair of the California Commission on Teacher Credentialing. Caleb is currently directing the Science Department, in addition to Health Education, Garden Education, and Physical Education in OUSD.

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**Weighing the Balance of Science Literacy in Education and Public Policy**

**Plenary Session 5**

Wednesday August 6

8:30 – 9:30 a.m.

*Harbour Ballroom*

Sanlyn Buxner, *Planetary Sciences Institute*, moderator

Chris Impey, *University of Arizona*, panelist

Bryce Johnson, *Exploratorium*, panelist

Science literacy is a concern of educators and policy makers in the United States and all over the world. It defines important knowledge for individuals defined by society which varies with culture and local knowledge systems. The technological societies of the western world have delegated the knowledge that underpins their everyday world — to mechanics who know how their cars work, technicians who know how their computers work, and policy wonks who know how their individual choices and actions will affect the environment and their health. The scientific principles that frame and sculpt the technological world are invisible and mysterious to most people. A question for debate is whether or not this is a healthy situation or not. And if not, what to do about it. Join our panelists as they share their prospects and challenges of building science literacy with individuals in the United States and with Tibetan monks. As they discuss their efforts working with these different populations, they will share lessons based on common issues and unique solutions based on local knowledge systems and communities of learners.

**Sanlyn Buxner** is a research scientist and education specialist at the Planetary Institute and an assistant research professor in science education in the College of Education at the University of Arizona. She has a background in formal and informal science education including curriculum development, planetarium show production, teacher professional development, undergraduate science education instruction and reform, and public outreach. Her research includes assessing science literacy and quantitative literacy with major and non-major undergraduate science students and examining the impact of research and industry work experiences for teachers.

**Chris Impey** is a University Distinguished Professor and Deputy Head of the Department at the University of Arizona, in charge of academic programs. He has over 170 refereed publications and 60 conference proceedings, and his work has been
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Making the Case for the Total STEM Learning Ecosystem: Why Message Matters and Why the Old Ones are Killing Us

Keynote Plenary Session 6
Wednesday August 6
1:45 – 2:45 p.m.
Harbour Ballroom

Dennis Bartels, Exploratorium

Many have argued that STEM is essential for all students for our national economic competitiveness and security; others for good citizenship. But these traditional frames miss the mark, and actually might do more harm than good. Dr. Bartels will present an alternative frame and reference some recent work on STEM communications strategies from the Frameworks Institute in Washington, DC.

Dennis M. Bartels, an internationally known science education and policy expert, became Executive Director of the Exploratorium in 2006. He holds a PhD in Education Administration and Policy Analysis from Stanford University, and his work has received more than $28 million in grants from the National Science Foundation (NSF) and other sources. He led a historic capital project and a $300 million capital campaign to relocate the Exploratorium to Piers 15/17 on San Francisco's famed waterfront. In 2009, he was appointed to the Education Working Group for the President's Council of Advisors on Science and Technology. Dr. Bartels has testified before committees of both the United States Senate and House of Representatives and before the full House Science Committee concerning the role of the NSF in K–12 science and math education. He's served on the Advisory Committees of the NSF’s Education and Human Resources Directorate and the Environmental Research and Education Directorate. He has also been an invited guest and speaker about science and mathematics education in England, France, the Netherlands, Japan, Malaysia, Brazil, and China. Dr. Bartels was elected an AAAS Fellow for his energetic leadership in systemic science education reform, informal science education, and research and development of innovative mathematics, science, and technology curricula. He is also an elected Fellow of the American Educational Research Association (AERA) and of the International Society for Design and Development in Education (ISDDE).
### Concurrent Session 1: 1-Hour/2-Hour Workshops, Special Interest Group Discussion

**Time:** Monday 3:15 p.m. – 4:15 p.m.

**Session Type:** 2-Hour Workshop (SPECIAL SESSION)

**Conference Thread:** Promoting Multicultural Diversity and Gender Equity

**Location:** Bayside B

### 1A The Great Society: An Introduction to Stereotype Threat and Social Perceptions (Part 1 of 2)

**Rikki Shackelford,** UC Berkeley Space Science Lab, Multiverse, rikkishack@ss.berkeley.edu

**Bonnie K. Meinke,** Space Telescope Science Institute, meinke@stsci.edu

**Nancy Alima Ali,** UC Berkeley Space Sciences Laboratory, nancy.ali@ssl.berkeley.edu

This workshop introduces the concept of stereotype threat, in which an individual's academic performance is affected by awareness of stereotypes. We explore how stereotype threat builds into perceptions and creates contradictions in our society that can impact work with particular groups, with an emphasis on working with Afro-American and urban audiences. Through the “The Great Society” activity, participants will work in groups to develop aesthetics and taboos for fictional societies. We will discuss the ways in which each group's values are compatible and conflicting, how they influence our perceptions of self and others, and how similar interactions may be experienced while working with diverse audiences in Earth and space science education and outreach efforts. This workshop seeks to give participants a conceptual framework for cultivating awareness of their own and their audience's perceptions, which can then be used to work with cultural sensitivity with diverse audiences.

**Outcomes:** Participants will:

- Gain or deepen awareness of the concepts of stereotype threat and social perceptions;
- Become more aware of the complexity of their own and others' perceptions;
- Become more prepared to respond with cultural sensitivity when working with diverse audiences.

### 1B Taking Outreach to New Heights with SOFIA's Airborne Astronomy Ambassadors Program

**Coral Clark,** NASA SOFIA, cclark@usra.edu

The Stratospheric Observatory for Infrared Astronomy (SOFIA) mission conducts an Education and Public Outreach program that exploits the unique attributes of this airborne observatory. The Airborne Astronomy Ambassadors (AAA) program strives to improve teaching, inspire students, and inform U.S. communities by incorporating educators into the crew, where they fly to the stratosphere and engage with scientists and mission specialists. Our 55 Ambassadors not only incorporate content knowledge and specific components of their experience into their curricula and education programming, they also appear and present at events in their communities. Their efforts to date have impacted thousands. This panel of SOFIA Ambassadors will provide an overview of this national program, share experiences during flight weeks, and present the spectrum of successful outreach efforts implemented.

**Outcomes:** Participants will obtain updates on the SOFIA AAA program, receive information on the future of this national program, and benefit from examples of using authentic science experiences to improve professional practices.

### 1C Tested Tools and Techniques for Promoting STEM Programming in Libraries

**Keliann LaConte,** Lunar and Planetary Institute, laconte@lpi.usra.edu

**Stephanie Shipp,** Lunar and Planetary Institute, shipp@lpi.usra.edu

**Christine Shupla,** Lunar and Planetary Institute, shupla@lpi.usra.edu

I discuss how to create an astronomy outreach program for thousands of people at outdoor concerts based on my NASA-funded Music and Astronomy Under the Stars (MAUS) program. MAUS brought astronomy to 50,000 music lovers at the National Mall (co-sponsor OSTP); Central Park Jazz, Newport Folk, Ravinia, or Tanglewood music festivals; and classical, folk, pop/rock, opera, Caribbean, or...
Concurrent Session 1: 10-Minute Orals

Session Chair: Dennis Schatz, Pacific Science Center

Time: Monday 3:15 p.m. – 4:15 p.m.

Session Type: 10-Minute Oral Presentation

Conference Thread: Improving Our Professional Practice

Location: Harbour Ballroom

1E.1  Professional Development: What EPO Professionals Want

Bradford Davey, TLC, Inc., bdavey01@gmail.com
Hilarie B. Davis, TLC, Inc., hilarie@techforlearning.org
Lindsay Bartolone, Adler Planetarium, lbartolone@adlerplanetarium.org

Over 50 professional development opportunities for EPO professionals have been planned and offered by the Science Mission Directorate over the last three years. What do EPO professionals want and need? What formats are available and have been used? In addition to the offerings by the Science Mission Directorate, where are EPO professionals going to get support and education for their work? In this session, we will preview these questions and more that arise in the group about professional development for EPO professionals, inviting additional conversation at the poster entitled “Cross-Forum Professional Development in NASA’s EPO: Successes, Challenges, and Opportunities.”

Outcomes: In this presentation, participants will:

- Hear about professional development for education and public outreach professionals;
- Hear about the efforts of the EPO forums within the Science Mission Directorate that have been offered the last three years;
- Be encouraged to continue the discussion in the matching poster session. This session will contribute to an understanding by EPO professionals about professional development for the community.

1E.2  Understanding and Meeting the Needs of Scientists in E/PO — Survey Results, Responses and Strategies

Jennifer Grier, Planetary Science Institute, jgrier@psi.edu
Sanlyn Buxner, Planetary Science Institute, buxner@psi.edu
Nick Schneider, Colorado University / LASP, Nick.Schneider@lasp.colorado.edu

The NASA Science Mission Directorate (SMD) Education and Public Outreach (E/PO) Forums actively engage with scientists to gain insights into their needs, barriers, and successes. This past year, we have conducted a series of semi-structured interviews with 25 planetary scientists, leveraging a relationship with the AAS DPS, which confirmed earlier survey results, offered new insights, and provided ideas for resources, products, and improvements that would facilitate scientist involvement in E/PO. This talk will present survey methods and results, compare these to previously existing data, and share new resources and possible strategies for further change that will enhance scientists ability to successfully engage in E/PO efforts.

Outcomes: This talk will present the results of interviews of planetary scientists (a selection of DPS members). The talk will provide enhanced understanding of the needs and perspective of scientists with regard to E/PO, information about new resources developed in response to the data, and ideas for how to continue to work with this population to grow E/PO involvement and interest.

Session Type: 10-Minute Oral Presentation

Conference Thread: Other

Location: Harbour Ballroom

1E.3  Preparing for and Observing the 2017 Total Solar Eclipse

Jay Pasachoff, Williams College — Hopkins Observatory, eclipse@williams.edu

I will discuss ongoing plans and discussions for E/PO and scientific observing of the 21 August 2017 total solar eclipse. I will discuss aspects of E/PO based on my experiences at the 59 solar eclipses I have seen. I will share cloud statistics along the eclipse path compiled by Jay Anderson, the foremost eclipse meteorologist. I will show some sample observations of composite imagery, of spectra, and of terrestrial temperature changes based on observations of recent eclipses, including 2012 from Australia and 2013 from Gabon. Links to various mapping sites of totality and partial phases and other eclipse-related information, including that provided by Fred Espenak (retired from NASA) and Xavier Jubier can be found on the website I run for the International Astronomical Union’s Working Group on Eclipses at http://www.eclipse.info.

Outcomes: I hope that participants will take away a better understanding of how and where they should plan for observing the 2017 total solar eclipse whose totality path will cross the continental United States, and of science and outreach that we hope will result.

Session Type: 10-Minute Oral Presentation

Conference Thread: Using Authentic Science and Citizen Science

Location: Harbour Ballroom

1E.4  Solar Eclipse Experiments for Students

James Huddle, U. S. Naval Academy, huddle@usna.edu

A total solar eclipse presents an exciting, fun and educational opportunity to teach young people about science. In this presentation, I will describe two experiments suitable for this
Concurrent Session 2: 1-Hour/2-Hour Workshops, Special Interest Group Discussion

**Time:** Monday 4:30 p.m. – 5:30 p.m.

**Session Type:** 2-Hour Workshop (SPECIAL SESSION)

**Conference Thread:** Promoting Multicultural Diversity and Gender Equity

**Location:** Bayside B

### 2A  The Great Society: An Introduction to Stereotype Threat and Social Perceptions (Part 2 of 2)

- **Rikki Shackelford**, UC Berkeley Space Science Lab, Multiverse, rikkishack@ss.berkeley.edu
- **Bonnie K. Meinke**, Space Telescope Science Institute, meinke@stsci.edu
- **Nancy Alima Ali**, UC Berkeley Space Sciences Laboratory, nancy.ali@ssl.berkeley.edu

Continued from the 3:15 session.

**Session Type:** 1-Hour Special Interest Group Discussion (SPECIAL SESSION)

**Conference Thread:** Other

**Location:** Sandpebble AB

### 2B  The Total Eclipse of the Sun of 2017: A Magnificent EPO Opportunity

- **Andrew Fraknoi**, Foothill College, fraknoiandrew@fhda.edu
- **Dennis Schatz**, Pacific Science Center, DSchatz@pacsci.org
- **Linda Shore**, Astronomical Society of the Pacific, lshore@astrosociety.org

The Aug. 21, 2017 solar eclipse (visible throughout the US) presents a major EPO opportunity, but also an open invitation to fraud and fear-mongering. In this open session we will discuss: 1. What plans are already in place for eclipse viewing and education; 2. What sorts of partnerships can leverage and scale up our efforts to cover large parts of the US; 3. What are the plans of federal and state agencies (NSF, NASA, Dept. of Education) and when and how do we get them involved; 4. What other groups should be part of our planning? E.g. what role might convention & visitors’ bureaus and optical/medical societies play before & during the eclipse; 5. What published, video, and web-based materials, activities, observing aids should we be planning? (For example, how will there be enough eclipse glasses for all interested observers?) Come with your plans/ideas/questions, and be ready to volunteer for various committees that might be formed. Bring materials (100 copies) to share.

**Outcomes:** Participants may be inspired to do one or more of the following: 1. start thinking about local plans for the eclipse at their institution; 2. join a committee to help plan the eclipse regionally or nationally; 3. join with others to continue working on a specific approach to eclipse education or planning; 4. throw up their hands in despair at the magnitude of the task of organizing the entire country to have a good eclipse experience.

**Session Type:** 1-Hour Workshop

**Conference Thread:** Other

**Location:** Sandpebble CD

### 2C  Learning to Use a Quantitative Collaborative Impact Analysis Evaluation Method

**Daniella Scalici**, NASA Astrobiology Institute, daniella.m.scalici@nasa.gov

**Hilarie B. Davis**, TLC Inc., hilarie@techforlearning.org

How well are you measuring impact? What impact are you having? What evidence do you have to support your conclusions about the impact you are having? In this one-hour workshop, you will use our Quantitative Collaborative Impact Analysis Evaluation Method to get a diagnostic score that both baselines your current evaluation efforts and helps you plan to increase the rigor of your evaluation. You will receive materials on the Method so you can use it with your own projects, your team, and/or your external evaluator. This Method has been used with 40 projects and E/PO professionals, with 100% reporting increased confidence and competence in thinking through their evaluation plans. They also report increased impact because of the knowledge and improved evaluation efforts gained by using the method. Integrating evaluation into the entire project cycle is a powerful tool for focusing everyone's efforts on outcomes and participant impact. See [http://www.techforlearning.org/evaluation.html](http://www.techforlearning.org/evaluation.html)

**Outcomes:** In this one-hour workshop participants will: 1) Learn about the Impact Analysis Method. 2) Use the Impact Analysis Method to diagnose the current rigor of their evaluation efforts. 3) Use the Impact Analysis Method to plan ways to improve the rigor of their evaluation efforts. This will contribute to the EPO community.
Providing preschool children with science learning experiences may improve their later science literacy. Further, research shows that children are capable of engaging in the same kinds of scientific reasoning as adults. The My Sky Tonight project is developing astronomy activities for informal science educators to use with young children. I have analyzed video of preschool astronomy workshops to understand how astronomy activities can support children's engagement in a broad spectrum of science practices. I have considered how we can overcome challenges in engaging children with experiences with astronomical phenomena, given that the timescales of many astronomical phenomena are beyond what we can include as part of a typical museum program. In this talk, I will present video clips showing how we engaged children in science practices in ways that highlight the sophistication of children's use of science practices, and how this was embedded in their understanding of astronomy.

**Outcomes:** Participants will leave the session with 1) an improved understanding of age-appropriate science practices for preschool-aged children, 2) specific ways that children can engage with the content of astronomy by using science practices, and 3) practical examples of instruction that leads to children engaged in these practices.
**Session Type:** 10-Minute Oral Presentation  
**Conference Thread:** Enhancing Science Communication Skills and Practices  
**Location:** Harbour Ballroom

2E.4   **A Summer of Cosmic Chemistry**  
**Whitney Cobb, McREL International, sweeks@mcrel.org**  
**Sandra Weeks, McREL International, wcobb@mcrel.org**

This research study will be conducted in July 2014 at Washington State University (WSU). Cougar Quest, WSU’s summer college-preparation summer camp for middle and high school students, will feature four sessions of “Astronomy 101” taught both in WSU’s planetarium and the Jewett Observatory and will focus on introductory Earth and Space Science concepts from the Next Generation Science Standards and WSU’s introductory astronomy course. In addition to the focus on content knowledge, this camp session seeks to understand the attitudes towards science and astronomy that these 7th-12th grade students have, as well as their motivation to pursue a career in physics and/or astronomy. Findings from this study may be of use to educational researchers and coordinators seeking to create, enhance, or promote similar types of activities.

**Outcomes:** Conference participants will gain an introductory understanding of the astronomy outreach initiatives that exist in the Palouse region of the inland northwest. The popularity and interest in astronomy in this region indicates the need for creative education strategies, particularly because this region has some of the lowest achieving school districts in the nation. An informal, non-classroom based introduction to astronomy could be an entry point into STEM for middle and high school students.

**Session Type:** 10-Minute Oral Presentation  
**Conference Thread:** Supporting the Next General Science Standards (NGSS)  
**Location:** Harbour Ballroom

2E.5   **The Development and Validation of an Assessment Tool for Evaluating Quantitative Literacy in Introductory Science Courses**  
**Katherine Follette, University of Arizona, kate.follette@gmail.com**  
**Donald McCarthy, University of Arizona, mccarthy@as.arizona.edu**  
**Erin Dokter, University of Arizona**  
**Sanlyn Buxner, University of Arizona**

Have college science courses become too qualitative? Interpretation of everyday scientific information hinges on quantitative savvy, as does the ability to distinguish science from pseudoscience. A scientifically literate citizen should be able to employ arithmetic, interpret numbers in context, read graphs, and confidently incorporate numbers in writing. Yet quantitative illiteracy is rampant among American adults, and many science instructors have shied away from mathematics in their courses as a result. Not only does this perpetuate the myth that “math is for math class”, it represents a missed opportunity to improve the quantitative skills and scientific literacy of our students in what is often their terminal science course in life. We present data from an educational study that documents the extent of quantitative illiteracy in introductory college science courses and shows that improvements in attitude and achievement are possible over the course of a semester of instruction.

**Outcomes:** Conference participants will gain an introductory understanding of the astronomy outreach initiatives that exist in the Palouse region of the inland northwest. The popularity and interest in astronomy in this region indicates the need for creative education strategies, particularly because this region has some of the lowest achieving school districts in the nation. An informal, non-classroom based introduction to astronomy could be an entry point into STEM for middle and high school students.

**Session Type:** 10-Minute Oral Presentation  
**Conference Thread:** Improving Our Professional Practice  
**Location:** Harbour Ballroom

2E.3   **Exploring 7th-12th Grade Attitudes, Motivation, and Content Knowledge in Astronomy**  
**Kaylan Petrie, Washington State University, kaylan.petrie@wsu.edu**

We often think of evaluation as something that happens at the end of an EPO activity, but best practices derived from evaluation methods can be embedded at every stage of a project’s life cycle to inherently increase impact and the ability to document it. Beginning with needs assessment, evaluation practices play a critical role in determining what will be done for whom in the EPO activity; those practices then apply to writing clear, measurable objectives, to maximizing design and implementation plans, and rigorously measuring impact on participants. We are all engaged in numerous EPO activities of different type - from teacher PD to booths at large public events. How do you design and evaluate for maximum impact in different settings? For each type of EPO activity, we will provide an overview, and example, and an opportunity for you to analyze and enhance the evaluation of one of your own activities.

**Outcomes:** Conference participants will gain an introductory understanding of the astronomy outreach initiatives that exist in the Palouse region of the inland northwest. The popularity and interest in astronomy in this region indicates the need for creative education strategies, particularly because this region has some of the lowest achieving school districts in the nation. An informal, non-classroom based introduction to astronomy could be an entry point into STEM for middle and high school students.

**Session Type:** 10-Minute Oral Presentation  
**Conference Thread:** Enhancing Science Communication Skills and Practices  
**Location:** Harbour Ballroom

2E.5   **The Development and Validation of an Assessment Tool for Evaluating Quantitative Literacy in Introductory Science Courses**  
**Katherine Follette, University of Arizona, kate.follette@gmail.com**  
**Donald McCarthy, University of Arizona, mccarthy@as.arizona.edu**  
**Erin Dokter, University of Arizona**  
**Sanlyn Buxner, University of Arizona**

Have college science courses become too qualitative? Interpretation of everyday scientific information hinges on quantitative savvy, as does the ability to distinguish science from pseudoscience. A scientifically literate citizen should be able to employ arithmetic, interpret numbers in context, read graphs, and confidently incorporate numbers in writing. Yet quantitative illiteracy is rampant among American adults, and many science instructors have shied away from mathematics in their courses as a result. Not only does this perpetuate the myth that “math is for math class”, it represents a missed opportunity to improve the quantitative skills and scientific literacy of our students in what is often their terminal science course in life. We present data from an educational study that documents the extent of quantitative illiteracy in introductory college science courses and shows that improvements in attitude and achievement are possible over the course of a semester of instruction.

**Outcomes:** Conference participants will gain an introductory understanding of the astronomy outreach initiatives that exist in the Palouse region of the inland northwest. The popularity and interest in astronomy in this region indicates the need for creative education strategies, particularly because this region has some of the lowest achieving school districts in the nation. An informal, non-classroom based introduction to astronomy could be an entry point into STEM for middle and high school students.
Tuesday, August 5, 2014 • 10:00 – 11:00 a.m.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Other
Location: Bayside B

3B Getting Beyond Your Expert Blind Spot: I get it, why don’t they? (Part 1 of 2)

Dennis Schatz, Pacific Science Center, schatz@pacsSci.org
Lakisha Witzel, Science Education Partnership, UCSF, Lakisha.Witzel@ucsf.edu

If you work with scientists who engage directly with the public, this is the workshop for you. Come experience proven strategies and explore resources to increase scientists’ communication skills — from understanding how people learn so they are not blinded by their expert blind spot, to helping them understand the value of asking questions and to knowing how to facilitate interactions with multi-generation groups, such as a grandmother with a 10-year-old granddaughter.

Outcomes: Participants will: 1) understand the value that scientists gain from receiving science communication training to work with public audiences; 2) receive and participate in a number of effective science communication professional development experiences that they can use with scientists; 3) receive additional resources for developing the skills of scientists to work with the public and that help scientists identify venues for their education outreach interests.

Session Type: 1-Hour Special Interest Group Discussion (SPECIAL SESSION)
Conference Thread: Engaging with 21st Century Media and Technology
Location: Sandpebble AB

3C Using Authentic Science in the Classroom: NASA’s Coordinated Efforts to Enhance STEM Education

Brandon Lawton, Space Telescope Science Institute, Lawton@stsci.edu
Russanne Low, Institute for Global Environmental Strategies, rusty_low@strategies.org

A key NASA education goal is to attract and retain students in science, technology engineering, and mathematics (STEM) disciplines. When teachers engage students in the examination of authentic data derived from NASA satellite missions, they simultaneously build 21st century technology skills as well as core content knowledge about the Earth and space. In this session, we highlight coordinated efforts by NASA Science Mission Directorate (SMD) Education and Public Outreach (E/PO) programs to enhance educator accessibility to data resources, distribute state-of-the-art data tools and expand pathways for educators to find and use data resources. The group discussion will explore how NASA SMD E/PO efforts can further improve teacher access to authentic NASA data, identify the types of tools and lessons most requested by the community, and explore how communication and collaboration between product developers and classroom educators using data tools and products can be enhanced.

Outcomes: We will present current coordinated efforts by the NASA SMD E/PO community to provide educators with access to NASA data resources and analysis tools. Participants will discuss strategies and make recommendations to further enhance access and usability of these resources for teachers. Special attention will be given to the challenge of supporting educators who need to address NGSS’ Cross-Cutting Concepts and Science & Engineering Practices along with Disciplinary Core Ideas in their lessons.

Session Type: 1-Hour Workshop
Conference Thread: Using Authentic Science and Citizen Science
Location: Sandpebble CD

3D Using Authentic Data to Facilitate Comparative Planetology & Student-led Classroom Investigations

Paige Graff, Jacobs @ NASA Johnson Space Center, paige.v.graff@nasa.gov
Susan Runco, NASA, susan.k.runco@nasa.gov

This session will engage participants in a hands-on activity that uses stunning NASA imagery from space to help participants gain an understanding of how scientists use Earth to gain a better understanding of other planetary bodies in the solar system. Participants will make observations, develop identification criteria, and use evidence to justify inferences made about processes sculpting the surface of different planetary worlds. Participants will also “build” a comparative planetology feature wall that will facilitate a comparative view of major geologic processes and features across the inner solar system. This session will highlight additional comparative planetology activities and demonstrate how the use of authentic data and imagery can help facilitate student-led research in the classroom, helping teachers address the Next Generation Science Standards.

Outcomes: Participants will take away both pedagogical and scientific knowledge. The activity will enable participants to experience authentic skills and practices used by scientists and experience the effectiveness of an activity designed using the 5E model of inquiry. Additionally, participants will gain a sense of how to use the power of inquiry and imagery from space as a hook to help facilitate student investigations in the classroom.

Session Type: 1-Hour Workshop
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Sandpebble E

3E NASA’s Space Forensics: Integrating Storytelling into STEM Education

Sara Mitchell, Syneren Technologies & NASA Goddard Space Flight Center, sara.mitchell@nasa.gov
Sarah Eyermann, Syneren Technologies & NASA Goddard Space Flight Center, sarah.e.eyermann@nasa.gov

NASA’s Space Forensics project takes students in formal and informal education settings through astronomy problem-solving narratives that parallel crime scene forensics. Each standards-aligned Space Forensics case fuses STEM and literacy, using mystery narratives and hands-on activities to take students through the process of scientific problem-solving. This approach tells the story of “doing science” and meets educators’ needs for resources that encourage reading, writing, and speaking outside of the English Language Arts classroom. In this one-hour workshop, we will share the philosophy and pedagogy behind Space Forensics, as well as preliminary evaluation results from pilot testing and professional development workshops. We also hope to inspire participants to adapt the idea of “STEM storytelling” into their own efforts. We are also proposing for a poster with broader information about the Space Forensics project to generate further discussion and partnership possibilities.

Outcomes: Participants will: (i) learn about the Space Forensics project and its resources, philosophy, pedagogy, and preliminary evaluation results; (ii) explore the overlap of STEM and literacy in educational best practices and Common Core; and (iii) discuss ways to incorporate “STEM storytelling” into other resources and opportunities.
Tuesday, August 5, 2014 • 11:15 a.m. – 12:15 p.m.

Concurrent Session 4: 1-Hour/2-Hour Workshops, Special Interest Group Discussion

Time: Tuesday 11:15 a.m. – 12:15 p.m.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Evaluating, Assessing and Documenting E/PO Impacts
Location: Bayside A

4A Measuring Impact in Specific Settings: Booths, Teacher PD, Student Activities, and Scientist Talks (Part 2 of 2)

Hilarie B. Davis, TLC Inc, hiliarie@techforlearning.org
Daniella Scalise, NASA Astrobiology Institute, daniella.m.scalise@nasa.gov

Continued from the 10:00 session.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Other
Location: Sandpebble CD

4D Reading, Writing, Talking: Scientific Practices that Support Space Science Learning

Carrie Strohl, The Lawrence Hall of Science, castrohl@berkeley.edu

Reading, writing, and talking are not only authentic to the discipline of science, but they are also required for college and career readiness. This presentation shares ways to use these disciplinary literacies to engage students in Next Generation Science Practices that support space science learning. Using examples from an integrated science and literacy framework, this session will focus on reading to obtain, evaluate and communicate information, writing to construct explanations, and discussing evidence to engage in argument. The content focus of this session will be the disciplinary core idea ESS1.B: Earth and the Solar System: The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. Examples from elementary and middle school instruction will be shared, including free Strategy Guides that complement any space science curricular program.

Outcomes: Participants will obtain, evaluate and communicate information from the elementary level text What About Pluto?, and then use models to investigate orbital patterns. Participants will use evidence to construct written explanations and then discuss the orbital pattern of Pluto. These disciplinary literacies will then be repeated with four middle school level instructional texts. Participants will gain an understanding of how a multimodal approach deepens sense-making about complex phenomenon.

Session Type: 1-Hour Workshop
Conference Thread: Using Authentic Science and Citizen Science
Location: Sandpebble E

4E A Solar Calendar and the Geometry of the Sky

Victoria Brady, The Exploratorium (retired), toryb9856@sbcglobal.net

Get an angle on the sky! We will explore the relationship between the celestial equator and the ecliptic path, and locate the Sun and stars on the celestial sphere. To illustrate the seasonal path
of the Sun, we will make a very handy device (a “Solar Motion Demonstrator”). We will look at the design of ancient observatories and learn how to locate sunrise and sunset for different dates at different latitudes, and we will discuss the analemma and the 18.6 year Lunar Standstill. This workshop is based on observations and activities done at the Cesar Chavez Memorial Solar Calendar in Berkeley, California. Slides will be shown.

Outcomes: Participants will create hands-on, take-home models to illustrate the intersection of the ecliptic and the celestial equator, and the (apparent) movement of the sun at different latitudes and different times of year. These activities help clear up common misconceptions about the relative positions of Earth and Sun, and the “reason for the seasons”. Participants will see that these activities are simple and practical for “citizen science” in an informal or outdoor setting.

Concurrent Session 5: 1-Hour/2-Hour Workshops, Special Interest Group Discussion

Time: Tuesday 3:15 p.m. – 4:15 p.m.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Bayside A

5A   Full STEAM Ahead with the NASA Opportunities in Visualization, Art, and Science Program (Part 1 of 2)

Daniel Zevin, Multiverse, UC Berkeley Space Sciences Laboratory, dzevin@ssl.berkeley.edu
Steve Croft, UC Berkeley Astronomy Department, scroft@astro.berkeley.edu
Leitha Thrall, Multiverse, UC Berkeley Space Sciences Laboratory, leitha@suncarth.ssl.berkeley.edu
Matthew Fillingim, UC Berkeley Space Sciences Laboratory, matt@ssl.berkeley.edu
Lynnette R. Cook, Illustrator/Fine Artist, lynnette@spaceart.org

There has been increasing interest in the use of art as a new tool in the teaching of STEM. The concept has received major consideration by our federal government (www.artofsciencelearning.org) and leading universities (https://tinyurl.com/STEAMatUCB). Many have in fact fully embraced this concept and it’s not unusual to see Art added to STEM to get STEAM. Would you like to explore the rise of STEAM and learn valuable skills for the application of STEAM in “out-of-school time” (OST) settings? If so, then please join us for this two-hour workshop that highlights how you can use art and multimedia to help you teach about STEAM research and knowledge in your afterschool, summer, or other OST program. Although NASA science and project outcomes from the NASA-funded NOVAS program will be highlighted, we will also discuss with you how our methodologies can be applied to just about any science subject and OST setting.

Outcomes: Participants will:
• Gain new knowledge about art and multimedia tools;
• Expand their understanding of the STEAM movement, and the many connections that can be made between art and science, and how best to connect them for learning;
• Acquire a better understanding of how and why artists and scientists collaborate;
• Receive a free resource guide on how to find resources for STEAM teaching.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Supporting the Next General Science Standards (NGSS)
Location: Bayside B

5B   Developing Astronomy Instruction that Supports the Goals of the NGSS (Part 1 of 2)

Julia Plummer, Pennsylvania State University, jdp17@psu.edu
Chris Palma, Pennsylvania State University
Alice Flarend, Pennsylvania State University
KeriAnn Rubin, Pennsylvania State University
Yann Shiong Ong, Pennsylvania State University
Scott McDonald, Pennsylvania State University
Heather Spotts, Pennsylvania State University

The Next Generation Science Standards (NGSS) describe an ambitious set of goals for K-12 science education. Through empirical research on student thinking, we have developed a learning progression that describes levels of increasing sophistication in students’ thinking about the big idea of the Solar System and its formation. To test the usefulness of this learning progression for designing instruction that moves students towards the goals of the NGSS, we analyzed pre/post interviews with students from a 6th grade classroom who participated in instruction designed around this big idea. This session will draw on our finding that the students made significant improvement in their understanding of Solar System astronomy. We will engage the audience in methods of: a) designing instruction towards this big idea using a coherent content storyline, and b) integrating the core ideas of the Solar System with science practices and cross-cutting concepts, as represented in the NGSS.

Outcomes: Participants will leave the session with 1) specific examples of instructional activities that address the NGSS astronomy standards, 2) an improved understanding of how to sequence instruction in ways that builds towards the big ideas of astronomy, and 3) practical examples of instruction that integrates science practices with Solar System astronomy.

Session Type: 1-Hour Special Interest Group Discussion
Conference Thread: Other
Location: Sandpebble AB

5C   Communities of Practice — Professional Development through Fostering Connections

Nancy Alima Ali, UC Berkeley, Space Sciences Lab, nancy.ali@ssl.berkeley.edu
Andi Nelson, Adler Planetarium, anelson@adlerplanetarium.org
Rikki Shackelford, UC Berkeley, Space Sciences Lab, rikkishack@ssl.berkeley.edu
Dawn Turney, John Hopkins University, Applied Physics Lab, Dawn.Turney@jhuapl.edu
Claire Raftery, UC Berkeley, Space Sciences Lab, clairee@ssl.berkeley.edu

A community of practice is a group of people informally bound together by shared expertise and passion for a joint enterprise. Through facilitated discussion, we will share best practices and research about communities of practice, and explore how they evolve as they grow. The target audience for this Special Interest Group session is Education/Public Outreach professionals who are interested in using communities of practice as a way to support the professional development of their audiences. This session will be of interest to people who want to learn more about communities of practice as well as those who are currently coordinating similar efforts. Participants
will have the opportunity to share their challenges and success, as well as gain new ideas for the planning, implementation and expansion of efforts. This session will be facilitated by the coordinators of NASA’s SMD Heliophysics E/PO Forum online community of practice for middle and high school science teachers.

**Outcomes:**
- Participants gain a better understanding of the nature and evolution of communities of practice;
- Participants share and gain ideas for planning, implementing and expanding a community of practice;
- Participants have the opportunity to network with other coordinators of communities of practice.

**Session Type:** 1-Hour Workshop

**Conference Thread:** Improving Our Professional Practice

**Location:** Sandpebble CD

**5D** Black Hole Songs, Constellation Pieces & Walking on the Moon: Music Inspired by Astronomy

**Andrew Fraknoi,** Foothill College, fraknoiandrew@fhda.edu

How many songs can you name that discuss black holes and contain reasonable science? In this light-hearted but educationally serious discussion, we will explore how astronomical ideas and discoveries have inspired a wide range of musical pieces over the years. Come prepared with your own favorite examples of astronomically inspired music and we’ll pool our ideas. We’ll explore constellation pieces written by composers from around the world who are or were active amateur astronomers, the little-known rock song that became a reference in the Astrophysical Journal, pieces that base the patterns of the music on the rhythms of astronomical phenomena and the song that compares walking on the Moon to being in love. Audio and video excerpts from some of the presenter’s favorite pieces will be played. We will also discuss how music can be used in classes and informal education settings and the way astronomy flows into popular culture in general.

**Outcomes:** Participants are likely to learn about music they have not heard before and find new ideas on how to use music for their classes, community outreach events, and personal enjoyment. Everyone will receive a list of 133 astronomically inspired pieces, organized into 22 subject categories. Musical suggestions from participants will be part of the fun.

**Concurrent Session 5: 10-Minute Orals**

**Session Chair:** Gregory Schultz, Astronomical Society of the Pacific

**Time:** Tuesday 3:15 p.m. – 4:15 p.m.

**Session Type:** 10-Minute Oral Presentation

**Conference Thread:** Improving Our Professional Practice

**Location:** Harbour Ballroom

**5E.1 NASA Science Mission Directorate EPO: A Coordinated Program Based on Scientist-Educator Partnerships**

**Denise A. Smith,** Space Telescope Science Institute, dsmith@stsci.edu

**Laura Petiолос,** University of California-Berkeley, laura@ssl.berkeley.edu

**Theresa Schwerin,** Institute for Global Environmental Strategies, theresa_schwerin@strategies.org

**Stephanie Shipp,** Lunar and Planetary Institute, shipp@lpi.usra.edu

**SMD Science Education and Public Outreach Forum Teams**

The NASA Science Mission Directorate (SMD) Education and Public Outreach (E/PO) community and Forum teams work together to capitalize on the cutting-edge discoveries of NASA’s science missions to support federal education priorities and public understanding. NASA SMD education and grant-based E/PO programs are uniquely poised to foster collaboration between scientists with content expertise and educators with pedagogy expertise. The SMD Forums maximize program efficiency, effectiveness, and coherence by: organizing collaborations that reduce duplication of effort; sharing best practices; aligning products to national education standards; creating and maintaining the NASA Wavelength online catalog of SMD education products; and disseminating metrics and evaluation findings. Along with the role of the scientist-educator partnership and coordination in the SMD E/PO program, we highlight examples of program impact and alignment with federal education priorities.

**Outcomes:** Participants will increase awareness of:
- Strength of partnering scientists and educators, as used by NASA SMD E/PO programs, to translate cutting-edge NASA science into new and effective learning tools;
- Coordination strategies that strengthen program effectiveness, efficiency, and coherence;
- Ways in which NASA SMD E/PO programs support federal education priorities.

**Session Type:** 10-Minute Oral Presentation

**Conference Thread:** Improving Our Professional Practice

**Location:** Harbour Ballroom

**5E.2 NASA SMD Science Education and Public Outreach Forums’ Formal Educator National Needs Survey Results**

**Andi Nelson,** Adler Planetarium, anelson@adlerplanetarium.org

**Cassie Soeffing,** NASA Science Mission Directorate E/PO Forums / IGES, cassie_soeffing@strategies.org

**Ruth Paglierani,** ruthhp@ssl.berkeley.edu

**Sheri Klug Boonstra,** Arizona State University, sklugboonstra@gmail.com

**Rachel Zimmerman-Brachman,** NASA JPL

**Lindsay Bartolone,** Adler Planetarium

**Liz Burck,** IGES

**Theresa Schwerin,** IGES

**Bradford Davey,** Technology for Learning Consortium

**Russanne Low,** IGES

A survey of over 1,100 formal and informal educators was conducted to assess who were using NASA resources, what educators were looking for when using NASA resources, and what attracted them to NASA workshops and other educational opportunities. This survey was conducted by the K-12 Working Group of the NASA Science Mission Directorate (SMD) Education and Public Outreach (E/PO) Forums and distributed through NASA and national education networks.

**Outcomes:** Participants will be aware of the purposes, methods and results of the Formal Educator National Survey Results. Participants will gain access to the full report.
Session Type: 10-Minute Oral Presentation
Conference Thread: Improving Our Professional Practice
Location: Harbour Ballroom

5E.3 Informal Education Community Needs: NASA SMD Science EPO Forum Survey Results

Lindsay Bartalone, NASA Science Mission Directorate E/PO Forums, lbartalone@adlerplanetarium.org
Suzanne Gurton, Astronomical Society of the Pacific, sgurton@astrosoc.org
Andrea Jones, Lunar and Planetary Institute, andrea.j.jones@nasa.gov
Keliann LaConte, Lunar and Planetary Institute, laconte@lpi.usra.edu
Michelle Nichols, Adler Planetarium, mniichols@adlerplanetarium.org

The NASA Science Mission Directorate (SMD) Science Education and Public Outreach Forums’ Informal Education Working Group recently conducted a national survey of informal educators. The results show the preferences of staff and volunteers from museums (both science- and non-science-focused), parks, public libraries, community/afterschool centers, government agencies, and other organizations with regard to professional development and material resources. Although specifically intended to inform current and future NASA SMD Education and Public Outreach (E/PO) efforts, the results are of interest to any provider of STEM professional development and resources. The results of the survey will be presented during this session.

Outcomes: Participants will be aware of the purposes, methods and results of the Informal Educator National Survey Results. Participants will gain access to the full report.

Session Type: 10-Minute Oral Presentation
Conference Thread: Other
Location: Harbour Ballroom

5E.4 Best Practices in NASA’s Astrophysics Education and Public Outreach Projects

Hashima Hasan, NASA Headquarters, hhassan@nasa.gov
Denise A. Smith, Space Telescope Science Institute, dsmith@stsci.edu

NASA’s Astrophysics Education and Public Outreach (E/PO) program has partnered scientists and educators since its inception almost twenty years ago, leading to authentic STEM experiences and products widely used by the education and outreach community. We present examples of best practices and representative projects. Keys to success include effective use of unique mission science/technology, attention to audience needs, and coordination of efforts, robust partnerships and publicly accessible repositories of E/PO products. Projects are broadly targeted towards audiences in formal education, informal education, and community engagement. All NASA programs are evaluated for quality and impact. New technology is incorporated to engage young students being raised in the digital age. All projects focus on conveying the excitement of scientific discoveries from NASA’s Astrophysics missions, advancing scientific literacy, and engaging students in science and technology careers.

Outcomes: Participants will learn how to introduce ground breaking scientific discoveries through new and effective learning tools to a broad audience ranging from K-12 educators and students to the general public. They will learn about the wide network of the NASA community of practice, how to interact with them, use NASA educational products, develop products of their own and advance their STEM programs.

Session Type: 10-Minute Oral Presentation
Conference Thread: Other
Location: Harbour Ballroom

5E.5 Flying the Infrared Skies: An Authentic SOFIA Educator Experience

James Manning, jim_manning@att.net

The NASA/DLR Stratospheric Observatory for Infrared Astronomy (SOFIA) flagship education effort is its Airborne Astronomy Ambassadors (AAA) program. The program flies teams of teachers on SOFIA research flights as part of an educator professional development effort enabling these teachers to experience firsthand the workings of the airborne observatory, to interact with scientists and technologists, to observe research in progress and how scientists use technology — all in support of national STEM goals. The presenter will share his own experience as an EPO escort on a recent SOFIA flight including two educator teams, providing a first-hand account of how an “authentic” science experience can exploit unique NASA assets to improve science teaching, inspire students, inform local communities, and contribute to the elevation of public science literacy.

Outcomes: Participants will gain perspective on the SOFIA AAA program as an example of an authentic science experience using NASA assets to advance STEM education goals.

Concurrent Session 6: 1-Hour/2-Hour Workshops, Special Interest Group Discussion
Time: Tuesday 4:30 p.m. – 5:30 p.m.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Bayside A

6A Full STEAM Ahead with the NASA Opportunities in Visualization, Art, and Science Program (Part 2 of 2)

Daniel Zevin, Multiverse, UC Berkeley Space Sciences Laboratory, dzevin@ssl.berkeley.edu
Steve Croft, UC Berkeley Astronomy Department, scroft@astro.berkeley.edu
Leitha Thrall, Multiverse, UC Berkeley Space Sciences Laboratory, leitha@sunearth.ssl.berkeley.edu
Matthew Fillingim, UC Berkeley Space Sciences Laboratory, matt@ssl.berkeley.edu
Lynette R. Cook, Illustrator/Fine Artist, lynette@spaceart.org

Continued from the 3:15 session.
Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Supporting the Next General Science Standards (NGSS)
Location: Bayside B

6B  Developing Astronomy Instruction that Supports the Goals of the NGSS (Part 2 of 2)
Julia Plummer, Pennsylvania State University, jdp17@psu.edu
Chris Palma, Pennsylvania State University
Alice Flarend, Pennsylvania State University
KeriAnn Rubin, Pennsylvania State University
Yann Shion Ong, Pennsylvania State University
Scott McDonald, Pennsylvania State University
Heather Spotts, Pennsylvania State University

Continued from the 3:15 session.

Session Type: 1-Hour Special Interest Group Discussion
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Sandpebble AB

6C  AAS Astronomy Ambassadors: Training in the Trenches
Quyen Hart, Regis University, Regis College, qhart@regis.edu
Nicole Gugliucci, SIUE/CosmosQuest
Meredith L. Rawls, New Mexico State University, mrawls@nmsu.edu

In 2013 the American Astronomical Society (AAS), in collaboration with the ASP and for the Center for Astronomy Education, launched its AAS Astronomy Ambassadors program to provide professional development for early-career astronomers to develop their communication skills and spearhead E/PO activities at their home institutions. This two-day intensive program includes workshops on presentation skills, implementation of high-impact activities, and creation of an outreach action plan. In this session, we will summarize the national impact of the AAS Astronomy Ambassadors thus far and detail specific aspects of the program that have informed and transformed our outreach efforts. We will encourage discussions about activities, innovations, and opportunities for professional development that early-career “outreachers” can use to become effective astronomy ambassadors.

Outcomes:
- Learn about AAS efforts on the professional development of early career scientists and highlight the impact on public outreach activities;
- Obtain a beginner’s perspective the best E/PO practices from Ambassadors in different stages of their career;
- Acquire examples of engaging activities developed for the AAS Ambassadors program and by some of the Ambassadors;
- Through round-table discussions, gain insights on how to begin astronomy outreach using main ideas from the session.

Session Type: 1-Hour Workshop
Conference Thread: Engaging with 21st Century Media and Technology
Location: Sandpebble CD

CANCELED:
6D  Teaching Remote Sensing and Geospatial Technologies: Community Co-creation of an On-line Course
Russanne Low, Institute for Global Environmental Strategies, rusty_low@strategies.org
Rebecca Boger, beckyboger@gmail.com

The availability of robust on-line data sets and analysis tools such as ArcGIS have revolutionized our capacity to teach skill-based geospatial courses, both face to face and on-line. Introduction to Geospatial Technologies is a 3-credit course taught collaboratively on-line by Brooklyn College and UNL. Originally developed as a graduate course for teachers, it has been subsequently modified to also serve both as an introductory course for undergraduates and the basis for a geospatial and sustainability science field school held in Barbuda. In this workshop, we seek a dialogue where participants will share resources that they have either vetted in a classroom setting or have developed themselves, with the objective of creating a truly collaborative community-developed course for teaching the fundamentals of remote sensing and geospatial technologies in any educational setting.

Outcomes:
- Participants will gain a working knowledge of TMT WEPOC plans and have an opportunity to become involved in TMT WEPOC planning and programs.

The Thirty Meter Telescope (TMT) will begin construction in the summer of 2014 and start science observations in the 2020s. As a collaboration between institutions in the US, Canada, China, India and Japan, TMT is truly an international endeavor. In this presentation, we will discuss TMT workforce pipeline, education, public outreach and communications (WEPOC) plans for the development and operations stage of the project. TMT seeks a truly worldwide impact, with programs that are scalable and transferable across the partnership, uniquely enabled by the partners and science of TMT. We will also discuss some unintended, but negative, impacts on international projects from recent changes in the US E/PO philosophy directed by CoSTEM, and programmatically in agencies such as NASA and others.

Outcomes: Participants will gain a working knowledge of TMT WEPOC plans and have an opportunity to become involved in TMT WEPOC planning and programs.
6E.2 Approaching Astronomy to People in Chile

Basilio Solis, Universidad Central de Chile, bsolis1984@gmail.com

Lately, astronomy has come to occupy an important place in sciences in Chile. The construction of the great observatories in the country has triggered great interest in students and the general public, which is why it has been vital to cooperate with scientists and national institutions to bring astronomy to the people. I want to share my experience in recent years I’ve been spreading astronomy throughout the country through lectures, workshops and practical activities, many of them founded in the ASP material. We use our excellent heavens to attract attention of people and to explain the phenomena that occur there. We have also rescued the legacy of ancient peoples of our country who watched the skies, bringing our culture to astronomy.

Outcomes: I think the importance of my talk is to know the reality of teaching astronomy in a country as large astronomical observatories with good skies for observation. Also, talk about the vision of the different ancient Chilenes about the stars, planets and the Milky Way, and how we have joined the culture astronomy closer to people.

6E.3 Teaching Inquiry in Nigeria: The West African Summer School for Young Astronomers

Linda Strubbe, Canadian Institute for Theoretical Astrophysics, linda@cita.utoronto.ca
Kevin Lepo, University of Toronto, lepo@astro.utoronto.ca
Heidi White, University of Toronto, white@astro.utoronto.ca
Jielai Zhang, University of Toronto, zhang.jielai@gmail.com
Bonaventure Okeke, Centre for Basic Space Science, Nsukka, Nigeria, ibokere2001@yahoo.com

In October 2013, over 75 undergraduate science students and teachers from Nigeria and Ghana attended the week-long West African International Summer School for Young Astronomers. The school was organized by a postdoctoral fellow (the lead author) and three graduate students from the University of Toronto, along with staff from the Nigerian National Space Research and Development Agency. We designed and led activities that taught astronomy content, promoted students’ self-identity as scientists, and encouraged students to think critically and figure out solutions themselves. I will discuss the innovative, inquiry-based, active learning techniques used in the school and share results from the qualitative and quantitative evaluations of student performance. I will also describe cultural differences in learning and communicating that we encountered, how we can understand these to teach more inclusively at home, and ways audience-members can get involved in similar projects in the future.

6E.4 Celebrating a Decade of Journey through the Universe

Janice Harvey, Gemini Observatory, jharvey@gemini.edu

With Journey through the Universe's tenth anniversary behind us, we can now see the impact on our community that this program has delivered. For the past decade astronomy educators and engineers have visited an average of 7,000 students in over 380 classrooms during our annual Journey through the Universe week. For the tenth anniversary 82 astronomers and engineers from across the country and the observatories on Mauna Kea inspired our students in the K-12 classrooms at 15 area schools. The Journey program provides workshops for teachers in STEM education, a career workshop that features a panel of employees from observatories on Mauna Kea, as well as family science events attended by thousands.

Outcomes: This presentation will share how a program of this magnitude has helped as we move towards adopting the NGSS in Hawaii. We will also give individuals, inquiry-based and examples from students that participated in the program and how they were influenced to pursue careers in science education and specifically how they are working towards their PhD in astronomy and astrophysics. For additional information please visit our website at www.gemini.edu/journey.

6E.5 Digital Planetariums and Immersive Visualizations for Learning Astronomy

Ka Yu, Denver Museum of Nature & Science, kcyu@dmns.org
Kamran Sahami, Metropolitan State University of Denver, ksahami@msud.edu

Modern “fulldome” video digital planetariums combine immersive projection that facilitate the understanding of relationships involving wide spatial angles, while 3D virtual environments facilitate learning of spatial relationships by allowing models and scenes to be viewed from multiple frames of reference. We report on an efficacy study of the use of digital planetariums for learning the astronomical topic of the seasons. Comparison of curriculum tests taken immediately after instruction versus pre-instruction show significant gains (at the 95% confidence level) for students who viewed visualizations in the immersive dome, versus their counterparts who viewed non-immersive content and those in the control group that saw no visualizations. The benefits to learning in the immersive dome can be traced to its ability to show phenomena that span wide spatial and angular scales, processes that are time variable, and both egocentric and exocentric viewpoints.

Outcomes: More than 1200 digital planetariums have opened worldwide, with increasing numbers of schools, universities, museums, and science centers adopting this technology. Yet few studies have been done to look at the effectiveness of digital dome systems for either formal or informal education. Attendees will gain an understanding of how digital planetariums can be used for astronomy education, including the benefits of using 3D virtual environments.
Wednesday, August 6, 2014 • 10:00 – 11:00 a.m.

Concurrent Session 7: 1-Hour/2-Hour Workshops, Special Interest Group Discussion

Time: Wednesday 10:00 a.m. – 11:00 a.m.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Engaging with 21st Century Media and Technology
Location: Bayside A

7A Best Practices in Online Astronomy Teaching (Part 1 of 2)
Katie Berryhill, Center for Astronomy & Physics Education Research/University of Wyoming, katie.berryhill@gmail.com
Kenneth Brandt, Center for Astronomy & Physics Education Research/University of Wyoming, ken.starsabove@gmail.com

We will share what works well in our online classes, and will request feedback from other online instructors at this session to develop a set of ‘here’s what works’ strategies we can all use to improve delivery of instruction, attrition rates, student interaction, and understanding/assessment of the astronomy content in the online environment.
Outcomes: New skills, activities and ideas for enhancing face-to-face, blended, and online astronomy teaching.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Improving Our Professional Practice
Location: Bayside B

7B Synergy between the Astronomy Community and Cosmic Light, a Cornerstone for the International Year of Light (Part 1 of 2)
Constance Walker, National Optical Astronomy Observatory, cwalker@noao.edu
Linda Shore, Astronomical Society of the Pacific, lshore@astrosociety.org
Stephen M. Pompea, NOAO, spompea@noao.edu
Sara Mitchell, NASA, Sara.Mitchell@nasa.gov
Richard Green, U. Arizona, rgreen@lbtso.org
Sarah Eyermann, NASA, Sarah.E.Eyermann@nasa.gov

Gina Brissenden, AAS, gina.brisenden@aas.org
Doug Arion, Carthage College, darion@carthage.edu

Planning is underway for the UN-endorsed International Year of Light (IYL) in 2015, spearheaded by the European physics community (http://www.iau.org/public/iyl/). IYL is showcasing the themes Science of Light, Light Technology, Light in Nature, and Light and Culture. IYL organizers have asked IAU to lead a cornerstone program called ‘Cosmic Light’ on global astronomy outreach activities. Astronomy themes naturally involve the nature of light, astronomical optics, and the cultural and scientific value of dark skies preservation. Given the relatively short lead-time, Cosmic Light activities and programs could be built on successful legacy projects from IYA2009. This Special Interest Group session will provide an overview of IYL and its themes, followed by breakout groups for participants to brainstorm, network, and collaborate about potential activities. Discussion and collaboration will continue beyond this SIG through an email list, as plans develop further.
Outcomes: The structure of the SIG session would be one of presentation-breakout-discussion. Participants will reconvene after breaking out into thematic groups and discuss the preliminary outcomes/interests of their subgroups. Plans and collaborations will be initiated. After the session, a listerv will be created to keep the community in contact and move plans forward. Input could also be given for a Cosmic Light webpage to be part of the IYL website.

Session Type: 1-Hour Special Interest Group Discussion (SPECIAL SESSION)
Conference Thread: Evaluating, Assessing and Documenting E/PO Impacts
Location: Sandpebble AB

7C A Community Discussion about Sharing and Publishing Space Science Education Research and Evaluation
Sanlyn Buxner, Planetary Science Institute and University of Arizona, buxner@psi.edu
Lindsay Bartolone, NASA SMD Forums, lbarolone@adlerplanetaryarium.org
Andrew Fraknoi, Foothill College, fraknoiandrew@fhda.edu
Julia Plummer, Pennsylvania State University, jdp17@psu.edu
Carolyn Brinkworth, Caltech, csb@ipac.caltech.edu

Gregory Schultz, Astronomical Society of the Pacific, gschultz@astrosociety.org

There is an ongoing concern in the community about the lack of space science education research articles. Additionally, there is a need for systematic system for sharing evaluation results of our projects. This special interest group discussion is for those interested in sharing results of their space science education and public outreach projects. Building upon previous discussions, this session is designed to share solutions to these concerns, including new opportunities to share results. Session participants will be asked to engage in the discussion to voice their continued concerns as well as opportunities that they want to share. Topics will include journals, agency specific mechanisms, and social media solutions both that exist and that are being planned.
Outcomes: Participants will learn about new opportunities to share results of their education and public outreach projects. Participants will share their ideas about solving the issues related to publishing and sharing results of space science E/PO projects. A collective list of resources and opportunities will be created to share back to the community in the conference proceedings.

Session Type: 1-Hour Workshop
Conference Thread: Evaluating, Assessing and Documenting E/PO Impacts
Location: Sandpebble CD

7D What’s Going on in There? Evaluating Process and Collaboration in E/PO Programs
Victor Yocco, Intuitive Company, vyocco@intuitivecompany.com
Jes Koepfler, Intuitive Company, jkoepfler@intuitivecompany.com
Sasha Palmquist, spalmquist@gmail.com

Evaluation of education and public outreach programming often focuses on measuring program outcomes. How outcomes are achieved by a project team often remains a mystery. Process and collaboration evaluation aims to address this by embedding measurements of the collaborative efforts of those involved in creating and implementing a program. Understanding how a group of people is working together or not can provide useful insights into what might need to be adjusted in terms of communication and project management efforts, increasing the likelihood that the program will be implemented as intended, and the desired outcomes.
Celebrating Science: Putting Education Best Practices to Work | Conference Program

Session Type: 1-Hour Workshop
Conference Thread: Engaging with 21st Century Media and Technology
Location: Sandpebble E

**7E A Web-based Cosmology Curriculum**

Carolyn Peruta, Sonoma State University, carolyn@universe.sonoma.edu
Kim Coble, Chicago State University, kcoble@csu.edu
Kevin McLin, Sonoma State University, mclin@universe.sonoma.edu
Janelle M. Bailey, Temple University, janelle.bailey@temple.edu
Anne Metevier, Sonoma State University, ametevier@gmail.com
Lynn Cominsky, Sonoma State University, lynnmc@universe.sonoma.edu
Kevin John, Sonoma State University, johnk@universe.sonoma.edu

Recent advances in our understanding of the Universe have revolutionized our view of its origin, composition and evolution. We have conducted research into student understanding of cosmological ideas so as to develop effective web-based tools to teach concepts important to modern cosmology. Our research uses several instruments to ascertain what students know regarding modern cosmological ideas, what common misunderstandings and misconceptions they entertain, and what sorts of materials can most effectively overcome students’ difficulty in learning this material. These data have been used to create a suite of interactive, web-based tutorials that address the major ideas in cosmology. The tutorials we developed include authentic student interaction with actual data where possible. Students master the scientific concepts and reasoning processes that lead to our current understanding of the universe through interactive tasks, prediction and reflection, experimentation, and model building.

**Outcomes:**
- Recognize the difference between process evaluation and other common types of evaluation (e.g. formative and summative);
- Be introduced to process evaluation methods such as observations and field notes, semi-structured interviews, interaction logs, and check-in surveys administered at regularly scheduled intervals;
- Understand how findings from process evaluation methods can be used throughout the life of a project to improve collaboration and the likelihood of achieving intended outcomes.

**Concurrent Session 8: 1-Hour/2-Hour Workshops, Special Interest Group Discussion**

Time: Wednesday 11:15 a.m. – 12:15 p.m.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Engaging with 21st Century Media and Technology
Location: Bayside A

**8A Best Practices in Online Astronomy Teaching (Part 2 of 2)**

Katie Berryhill, Center for Astronomy & Physics Education Research/University of Wyoming, katie.berryhill@gmail.com
Kenneth Brandt, Center for Astronomy & Physics Education Research/University of Wyoming, ken.starsabove@gmail.com

Continued from the 10:00 session.

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Improving Our Professional Practice
Location: Bayside B

**8B Synergy between the Astronomy Community and Cosmic Light, a Cornerstone for the International Year of Light (Part 2 of 2)**

Constance Walker, National Optical Astronomy Observatory, cwalker@noao.edu
Linda Shore, Astronomical Society of the Pacific, lshore@astrosociety.org
Stephen M. Pompea, NOAO, spompea@noao.edu
Sara Mitchell, NASA, Sara.Mitchell@nasa.gov
Richard Green, U. Arizona, rgreen@lbto.org
Sarah Eyermann, NASA, Sarah.E.Eyermann@nasa.gov
Gina Brissenden, AAS, gina.brissenden@aas.org
Doug Arion, Carthage College, darion@carthage.edu

Continued from the 10:00 session.

Session Type: 1-Hour Special Interest Group Discussion
Conference Thread: Using Authentic Science and Citizen Science
Location: Sandpebble AB

**8C Connecting with the Science Fair to Enhance Science Communication Skills and Practices**

Heidi Black, Santa Clara Valley Science and Engineering Fair Association
Coral Clark, cclark@usra.edu
Teresa Zarrin, Santa Clara Valley Science and Engineering Fair Association, tzarrin@yahoo.com
Raghad Ganesh
Ujjaini Mukhopadhyay
Abha Pandey
Ramya Balasingam
Vikas Bhetanabhotla
**Tanisha Joshi**
When supported by local industry and implemented in collaboration with informal learning institutions, participation in a science fair can have significant positive impact on students. The Santa Clara Valley Science and Engineering Fair Association (SCVAEFA) celebrated its 50th anniversary in 2010, endeavoring to awaken more students to the wonder and power of Science, Technology, Engineering, and Mathematics (STEM). They accomplish this by holding an annual regional Science and Engineering Fair, with often over 1000 student participants. Join this panel of enthusiastic science fair advocates: students from middle schools and high schools who will share their science fair experiences and relay the value and impact of their processes. Regional coordinators will also share expert advice on how industry and informal learning institutions can work together with schools to increase the value of these authentic science experiences.

**Outcomes**: Participants will benefit from student stories that highlight personal impacts from authentic science research experiences and real-world applications. Participants will also gain from expert advice on best practices for connecting with and involving industry and informal learning institutions for mutual advantage.

**Session Type**: EPO 1-Hour Workshop

**Conference Thread**: Improving Our Professional Practice

**Location**: Sandpebble CD

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**8E  Lessons that Last: Designing Dynamic Programs that Keep Up with the Ever-Changing Field of Astronomy**

**Emily Wojcik**, Pacific Science Center, ewojcik@pacificsciencecenter.org

**Alice Enevoldsen**, Pacific Science Center, aenevoldsen@pacificsciencecenter.org

Pacific Science Center’s Outreach Education program used grant funds from NASA to redevelop astronomy lessons. We updated two lessons that explore planet characteristics and Mars exploration. While valuable topics, the materials lacked clarity and much of the content was outdated. The program operates year-round, without the ability to update content more than every 5 years when materials are taken off-line for updates and repairs. We use non-consumable materials to reduce long term costs and restocking needs. In designing a lesson, we ask: Will the content be relevant for many years? Are the associated props reusable? Will the activities be successful in our limited classroom time? In this hands-on session, participants will use props from older iterations of these lessons to learn about the development process. Participants will assess the strengths and weaknesses of each activity, prioritize changes, and brainstorm new activities that will be relevant for the long term.

**Outcomes:**
- Brainstorm the characteristics of a lesson with long-term relevance;
- Engage in hands-on activities while learning about our successes and challenges in producing a new lesson;
- Work with other session participants to come up with original activity ideas that you can take away to your institution.

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**Concurrent Session 9: 1-Hour/2-Hour Workshops, Special Interest Group Discussion**

**Time**: Wednesday 3:15 p.m. – 4:15 p.m.

**Session Type**: 2-Hour Workshop (SPECIAL SESSION)

**Conference Thread**: Improving Our Professional Practice

**Location**: Bayside A


**Katherine Follette**, University of Arizona, kate.follette@gmail.com

**Donald McCarthy**, University of Arizona, mccarthy@as.arizona.edu

All who step in front of an introductory science course today encounter the same problems with introducing quantitative science—students’ gross lack of arithmetic skills, inability to think numerically and frequent pervasive fear of all things numerical. Although we can enhance appreciation of astronomy through qualitative methodologies, we do so at the expense of scientific authenticity and depth of understanding by excising the real and beautiful quantitative principles that underlie nature. We also reinforce the belief that numerical skills are not useful in everyday life. This workshop will show participants how to confront misconceptions, increase student motivation and self-awareness and improve arithmetic thinking using astronomy-specific materials. Participants will learn how to extend existing materials (e.g., Lecture Tutorials) for this purpose and will be introduced to new possibilities in labs, class activities, think-pair-share questions and homework assignments.

**Outcomes**: Participants will leave the workshop with concrete tools for incorporating numerical thinking into their already-existing course, as well as resources for assessing improvement in numerical thinking over the course of the semester. We hope that they will also leave with an increased appreciation of the importance of this endeavor.
Celebrating Science: Putting Education Best Practices to Work | Conference Program

Session Type: 2-Hour Workshop (SPECIAL SESSION)
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Bayside B

9B  My Sky Tonight: Developmentally-Appropriate Activities for Engaging Preschool Children in Astronomy (Part 1 of 2)

Anna Hurst Schmidt, Astronomical Society of the Pacific, ahurst@astrosociety.org
Julia Plummer, Pennsylvania State University, jdp17@psu.edu
Vivian White, Astronomical Society of the Pacific, vwhite@astrosociety.org
Alice Enevoldsen, Pacific Science Center, aenevoldsen@pacsci.org
Suzanne Gurton, Astronomical Society of the Pacific, sgurton@astrosociety.org
Gregory Schultz, Astronomical Society of the Pacific, gschultz@astrosociety.org

Young children are natural scientists, asking questions and experimenting with the world around them. In this workshop, we will present a framework of developmentally appropriate practices for guiding preschool children’s natural curiosity toward the sky, astronomy, and space, and provide participants with a set of tested hands-on activities, ready to use with their audiences. We will also share our experiences engaging audiences with these activities as part of the NSF-funded My Sky Tonight project, aimed towards bringing astronomy to their 3- to 5-year-old visitors.

Outcomes: Participants will leave the session with:
- An understanding of developmentally appropriate practices for engaging preschool-age children in science activities;
- Techniques for supporting young children in engaging in science practices during investigations of scientific phenomena;
- A set of tested, hands-on, astronomy activities for preschool-age children.

Session Type: 1-Hour Special Interest Group Discussion (SPECIAL SESSION)
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Sandpebble AB

9C  Beyond the Dome: Using a Variety of Venues for Astronomy Visualization and Interpretation

Elise Ricard, California Academy of Sciences, ericard@calacademy.org

Highly flexible “fulldome” video now exists in many planetariums, but the technology has its limitations. At Morrison Planetarium, the presenter's position behind the audience limits interactive opportunities, and during shows, dim lighting and steep stairs pose a safety concern, especially for younger guests. To overcome these challenges, we now use a variety of digital venues to present astronomy content to a wide range of guests. In particular, the Hohfeld Hall Space Science Exhibit is a 15’ by 40’ concave wall with edge-blended projectors that create a single 4k-by-1k image, displaying the same astronomy software employed in the planetarium. Over the course of three years, the venue has evolved from a queuing area showing a continuous loop of space images to a publicized visual presentation space attracting more than 80,000 visitors annually. The programs increase interactive astronomy experiences for all audiences and allow content creation opportunities for presenter staff.

Outcomes: Using the example of Hohfeld Hall at the California Academy of Sciences, participants will look at new ways to convey astronomy using visualization tools and live presentation. Participants will also explore ways to engage part-time staff in creative programming opportunities. We will lead a discussion in sharing ideas for how to use a variety of digital venues for translating planetarium-oriented content to other spaces.

Session Type: 1-Hour Workshop (SPECIAL SESSION)
Conference Thread: Supporting the Next General Science Standards (NGSS)
Location: Sandpebble CD

9D  The Nature of Astronomy: Addressing the Nature of Science within NGSS

Christine Shupla, Lunar and Planetary Institute, shupla@lpi.usra.edu

Sanlyn Buxner, Planetary Science Institute, buxner@psi.edu
Larry Lebofsky, Planetary Science Institute, lebofsky@lpi.az.edu
Sandra Weeks, McREL, sweeks@merel.org

The Next Generation Science Standards explicitly call out the Nature of Science (NOS) to be integrated within science education. NOS topics include understanding that scientific investigations use a variety of methods, that scientific knowledge is based on empirical evidence, that scientific explanations are open to revision in light of new evidence, understanding the nature of scientific models, laws, mechanisms, theories, and hypotheses, and much more. Astronomy offers a unique way to address the NOS in the classroom. In this workshop, we will review the NOS topics and engage participants in a variety of astronomical and planetary activities to model how incorporating explicit NOS discussion into the activity can support students’ understanding of scientific enterprise. Finally, we will provide a method to adapt participants’ favorite activities to address NOS.

Outcomes: Participants will receive an overview of the Nature of Science, model activities that can be used to address the NGSS standards on NOS, and participate in discussions and brainstorming designed to increase their ability to address NOS within their own curriculum.

Concurrent Session 9: 10-minute Orals
Session Chair: Bonnie Meinke, Space Telescope Science Institute

Time: Wednesday 3:15 p.m. – 4:15 p.m.

Session Type: 10-Minute Oral Presentation
Conference Thread: Evaluating, Assessing and Documenting E/PO Impacts
Location: Harbour Ballroom

9E.1  Evaluating Motivations of Citizen Science and Impacts of Guerilla Outreach

Nicole Gugliucci, SIUE/CosmosQuest, nicole@noisyastronomer.com
Pamela Gay, SIUE/CosmosQuest, pamela@starstryder.com
Georgia Bracey, SIUE/CosmoQuest, gbracey@siue.edu
CosmoQuest Team
CosmoQuest is a virtual research facility where anyone can help to analyze data from several NASA spacecraft. We follow up our previous citizen scientists survey with a larger sample surveyed from website users in 2014. In addition to collecting basic demographic data, we look for trends in repeat usage of the citizen science site tools and motivations for starting to work with CosmoQuest. For subjects who provide user names, we compare this to actual site use statistics. We are also planning to interview a cross-section of casual and heavy site users to further explore these motivations. The CosmoQuest team also engages the public through “guerilla outreach,” or showing up to outreach events at times that are not necessarily science-focused. We'll present the results of a survey of Dragon*Con attendees that visited the CosmoQuest booth in 2013 and determine the most helpful draws for our science outreach in public places.

Outcomes: Participants to this talk will learn the latest results from CosmoQuest's exploration of the motivation of citizen scientists from surveys given to online site users. This is meant to further the broader inquiry into citizen science motivations. This talk will also share techniques that worked and did not work according to a participant survey given to visitors of a CosmoQuest booth at a public, science-fictions/fantasy convention.

Session Type: 10-Minute Oral Presentation
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Harbour Ballroom

9E.2 Public Engagement and Communication from the Chandra X-ray Center

Megan Watzke, Chandra X-ray Center, mwatzke@cfa.harvard.edu
Kimberly Arcand, Chandra X-ray Center, kkwal@cfa.harvard.edu
Kathleen Lestition, Chandra X-ray Center, klestition@cfa.harvard.edu

The Chandra X-ray Center's multifaceted Public Communications & Engagement (formerly the Education and Public Outreach group) program encompassing press relations, public engagement, and education. Some of the main goals of our group are opening access to high-energy astrophysics, sharing new discoveries of the Chandra missions with diverse audiences, and engaging the imaginations of students, teachers, and the greater public while increasing learning opportunities for everyone. Our cycle of research and evaluation informs the group's practice at all points of program creation. This talk will discuss how the CXC is working to reach our goals through the current evolving landscape of science education and outreach at the federal level.

Outcomes: This talk will inform the audience about what public engagement and communications efforts from one of NASAs “Great Observatories.”

Session Type: 10-Minute Oral Presentation
Conference Thread: Engaging with 21st Century Media and Technology
Location: Harbour Ballroom

9E.3 A Next-Gen Public Astronomical Image Archive Today: astropix.ipac.caltech.edu

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Ryan Wyatt, California Academy of Sciences, RWyatt@calacademy.org
Gordon Squires, IPAC/Spitzer Science Center, squires@ipac.caltech.edu

Even in the Google era, finding the right astronomical image is a surprisingly serious challenge. Flat web searches yield a mixed mishmash of repeated — and often irrelevant — images with no clear way to find the source material with all of the contextual information intact. The AstroPix image archive is the product of a decade-long international collaboration to solve this key challenge for the outreach and public affairs community. Currently in a public beta release, AstroPix sports a growing library of over 5,600 images contributed by a variety of NASA, ESA, and ESO observatories spanning a range of ground- and space-based telescopes. Images are presented in context, including color spectral mapping tables and coordinate data available for viewing in context on the sky using Microsoft's WorldWide Telescope HTML5 web client. Images are tagged using the Astronomy Visualization Metadata (AVM) standard that adds astronomy-specific tags to well-established photographic schema.

Outcomes: Attendees will see an overview of the powerful educational features of the AstroPix site and gain an understanding of the full breadth of content (including NASAs Great Observatories and ESO, among others). Ways in which the site can be utilized on its own, or as a back-end to power other kinds of web clients or applications for formal or informal education, will be discussed.

Session Type: 10-Minute Oral Presentation
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Harbour Ballroom

9E.4 The Relationship between Knowledge and Attitudes in the Public Understanding of Science

Carolyn Brinkworth, IPAC/Caltech, csb@ipac.caltech.edu

Much of our work as EPO professionals is predicated on the belief that a more scientifically literate population will be more inclined to support science research. I present the results of an analysis of public understanding of science data in the US, looking at science literacy, interest in science, and attitudes towards science and scientists, and show which factors predict support for science, and federal funding for science research.

Outcomes: I will show what factors actually contribute to support for science and federal funding for research in the United States. The results of my study will inform our community of practice, guiding us towards the factors we should be emphasizing in our outreach and education efforts to the general public if we are looking to maximize support for science and funding.

Session Type: 10-Minute Oral Presentation
Conference Thread: Enhancing Science Communication Skills and Practices
Location: Harbour Ballroom

9E.5 Lessons Learned from ComSciCon: A Science Communication Workshop for Graduate Students

Susanna Kohler, University of Colorado Boulder, kohlers@colorado.edu

ComSciCon Organizing Committee

Effective science communication is imperative for the sharing of scientific ideas, continued funding and support from policy makers, and education of the public. Science graduate students are a prime population to target for communication training, as they will be our future scientists, educators, and EPO professionals. To this end, we developed ComSciCon, a national, annual science communication workshop organized by and for STEM graduate students. Here we present the results of our most recent analysis of the workshop's efficacy, including comparison of participants’ writing samples before and after the workshop, surveys gauging participants’
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**Session 10A: RE-NUMERATE: Restoring Essential Numerical Skills and Thinking in Astronomy Education**

**Location:** Bayside A

**Speakers:**
- Vivian White, Astronomical Society of the Pacific, vwhite@astrosociety.org
- Alice Enevoldsen, Pacific Science Center, aenevoldsen@pacificsci.org
- Suzanne Gurton, Astronomical Society of the Pacific, sgurton@astrosociety.org
- Gregory Schultz, Astronomical Society of the Pacific, gschultz@astrosociety.org

Continued from the 3:15 session.

**Outcomes:**
- Participants will gain insight on how native and non-traditional students might be drawn into STEM through integration of culture and art.
- Participants will understand how of native culture and science can be interwoven.
- Participants will understand how art and science can be infused.
- Participants will see examples of best practices of STEAM + culture used in community and K-12.

**Session 10B: My Sky Tonight: Developmentally-Appropriate Activities for Engaging Preschool Children in Astronomy**

**Location:** Bayside A

**Speakers:**
- Annette Lee, Planetary Science Institute, buxner@psi.edu
- Caren Cooper, Cornell Ornithology Lab, caren.cooper@cornell.edu
- Sean O’Connor, National Geographic Society, soconnor@ngs.org
- Stephen M. Pompea, NOAO, spompea@noao.edu

**Outcomes:**
- Participants will understand how art and science can be infused.
- Participants will see examples of best practices of STEAM + culture used in community and K-12.
- Participants will gain insight on how native and non-traditional students might be drawn into STEM through integration of culture and art.

**Session 10C: Using NGSS to Shape Research Projects with Citizen-Science Data**

**Location:** Sandpebble AB

**Speakers:**
- Constance Walker, National Optical Astronomy Observatory, cwalker@noao.edu
- Sanlyn Buxner, Planetary Science Institute, buxner@psi.edu
- Daniel Mennitt, National Park Service, daniel_mennitt@partner.nps.gov
- Caren Cooper, Cornell Ornithology Lab, caren.cooper@cornell.edu
- Sean O’Connor, National Geographic Society, soconnor@ngs.org
- Stephen M. Pompea, NOAO, spompea@noao.edu

**Outcomes:**
- Participants will understand how of native culture and science can be interwoven.
- Participants will see examples of best practices of STEAM + culture used in community and K-12.
- Participants will gain insight on how native and non-traditional students might be drawn into STEM through integration of culture and art.
We have been conducting a study of university students’ science literacy for the past 24 years. Based on the work of the National Science Board’s ongoing national survey of the US public, we have administered the same survey to undergraduate science students at the University of Arizona almost every year since 1989. Results have shown relatively little change in students’ overall science literacy, descriptions of science, and knowledge of basic science topics for almost a quarter of a century despite an increase in education interventions, the rise of the internet, and increased access to knowledge. Several trends do exist in students’ science literacy and descriptions of science. Students who exhibit beliefs in non-scientific phenomenon (e.g. lucky numbers, creationism) consistently have lower science literacy scores and less correct descriptions of scientific phenomenon. Although not surprising, our results support ongoing efforts to help students generate evidence based thinking.

Outcomes: Attendees will learn about an ongoing study of science literacy and implications for instruction.

Session Type: 10-Minute Oral Presentation
Conference Thread: Engaging with 21st Century Media and Technology
Location: Harbour Ballroom

10E.4 The Future of Online Learning with MOOCs in Astronomy
Matthew Wenger, University of Arizona, mwenger@email.arizona.edu
Chris D. Impey, University of Arizona, cimpey@email.arizona.edu

Online learning is experiencing tremendous growth and there is a need to find ways of facilitating high-quality, learner-centered experiences in MOOCs and other large-scale online classes. This talk will provide an overview of the current state of online learning, challenges, and possible solutions. This talk will initiate a conversation about MOOCs, the pitfalls and potential, and will stimulate the imaginations of participants in order to create partnerships and develop creative solutions.

Outcomes: The goal of this talk is to familiarize participants with the current state of large-scale online classes (MOOCs), to inform them about challenges and proposed improvements, and to initiate a conversation that will eventually lead to partnerships and creative solutions.
Session Type: 10-Minute Oral Presentation  
Conference Thread: Evaluating, Assessing and Documenting E/PO Impacts  
Location: Harbour Ballroom

10E.5 Online Classrooms: Powerful Tools for Rapid-Iteration Pedagogical Improvements

Lev Horodyskyj, Arizona State University, LevH@asu.edu  
Sanlyn Buxner, University of Arizona, buxner@email.arizona.edu  
Steve Semken, Arizona State University, semken@asu.edu  
Ariel Anbar, Arizona State University, anbar@asu.edu

The effectiveness of the traditional lecture-exam pedagogy (and its online spin-offs) is continually being called into question by education researchers. Over the past three years, Arizona State University developed and offered Habitable Worlds, an online-only astrobiology lab course featuring active learning tools. The course is offered in an intelligent tutoring system (ITS) that records a wealth of student data. In analyzing data from the Fall 2013 offering of the course, we were able to identify pre-post quiz results that were suboptimal and where in the lesson and how precisely students were missing concepts. The problem areas were redesigned and the improved lessons were deployed a few months later. We saw significant improvements in our pre-post quiz results due to the implemented changes. This demonstrates the effectiveness of using robust ITS not only to present content online, but to provide instantaneous data for rapid iteration and improvement of existing content.

Outcomes: Participants will become familiar with Smart Sparrow's Adaptive eLearning Platform (the ITS), how our course is constructed, the data that the ITS records, and how we've used (and are using) the data to improve the offering of the course over time.

Session Type: 10-Minute Oral Presentation  
Conference Thread: Supporting the Next General Science Standards (NGSS)  
Location: Harbour Ballroom

10E.6 Teaching the Exploration of Mars

Kenneth Brandt, Robeson Planetarium/University of Wyoming, brandt@uncp.edu

I've developed and taught a course about the past, present, and future of Mars exploration. I will demonstrate how this course can be modified for teaching from grades 4-20, and could even be delivered as part of a STEM summer or after school program.

Outcomes: A course they can incorporate into their institutional offerings.
**Conference Thread: Engaging with 21st Century Media and Technology**

**MT01 The Silicon Valley Astronomy Lectures: Using YouTube for World-wide Public Outreach**

*Andrew Fraknoi, Foothill College, fraknoiandrew@fhda.edu*

For 14 years, the Silicon Valley Astronomy Lectures, sponsored by four educational organizations, have brought six noted speakers per year to the large auditorium at Foothill College in Los Altos. Between 400 and 900 people attend each lecture. Speakers have included Vera Rubin, Frank Drake, Michael Brown, Arno Penzias, and dozens of other distinguished scientists. Recently, an anonymous donor has given us the funds to videotape each lecture and edit the visuals into the resulting video in a professional way. We have put the talks on their own YouTube channel. In the first year, we have attracted over 200,000 views, with viewership growing by several thousand per day in recent weeks. We get letters from around the world, thanking us for making these popular-level talks available without charge.

**Outcomes:** Those who come to the poster may be inspired to start their own lectures or to make use of our videos in their own education or outreach work.

**Conference Thread: Engaging with 21st Century Media and Technology**

**MT03 Youth Investigate the Universe with Skynet Junior Scholars**

*Vivian Hoette, The University of Chicago, vhoette@yerkes.uchicago.edu*

*Sue Ann Heatherly, National Radio Astronomy Observatory, sheather@nrao.edu*

*Kathryn Williamson, National Radio Astronomy Observatory, kwilliam@nrao.edu*

*a. Gurton, Astronomical Society of the Pacific, stgarton@astrsoc.org*

*Anna Hurst Schmitt, Astronomical Society of the Pacific, ahurst@astrosociety.org*

Skynet Junior Scholars (SJS) (NSF awards 1223687, 1223235, 1223345) engages middle and high school aged youth, including youth with visual and hearing impairments, in observing the Universe using the same tools as professional astronomers. SJS builds on successful precursor programs by:

- Targeting a national youth audience enrolled in the 4-H program;
- Integrating accessibility standards into the design of all components;
- Providing research quality, multi-wavelength telescopes that are in the Skynet Robotic Telescope Network.

Professional development for youth leaders involves both online workshops through the Astronomical Society of the Pacific and face-to-face workshops at partner institutions. To date, 62 youth leaders have completed professional development are beginning to host youth groups. In this poster, we will describe the SJS project, demonstrate the SJS web-portal and telescope interface and compare the two delivery modes for professional development.

**Conference Thread: Engaging with 21st Century Media and Technology**

**MT04 Observations of the Sun, Moon and Planets Simulated with Starry Night for Archaeoastronomy**

*Douglas Ingram, Texas Christian University, d.ingram@tcu.edu*

The Physics and Astronomy department at TCU has developed a new Archaeoastronomy course in order to provide a cultural awareness component for students trying to satisfy updated core requirements. As part of the course, we have developed several new labs using Starry Night sky simulation software, examples of which will be on display. The labs are largely focused on recreating naked eye observations over time in order to find patterns in lunar and planetary motion.

**Outcomes:** Participants will learn how to use sky simulation software in a creative way in order to teach naked eye astronomy and motions in the sky.

**Conference Thread: Engaging with 21st Century Media and Technology**

**MT05 Combining Real World Experience and WorldWide Telescope Visualization to Build a Better Parallax Lab**

*Edwin Ladd, Bucknell University, ladd@bucknell.edu*

*Patricia Udomprasert, Harvard-Smithsonian Center for Astrophysics, pudomprasert@cfa.harvard.edu*

*Evan Gingrich, Bucknell University, ecg009@bucknell.edu*

*Katharyn Nottis, Bucknell University, knottis@bucknell.edu*
Alyssa Goodman, Harvard-Smithsonian Center for Astrophysics, agoodman@cfa.harvard.edu

We present a lab activity designed to help students understand the concept of parallax in both astronomical and non-astronomical contexts. In an outdoor setting, students learn the methodology of distance determination via parallax. They identify a distant landmark to establish reference a direction, and then measure the change in apparent direction for more nearby objects as they change position in a 2 meter radius “orbit” around the “Sun.” This hands-on activity involves large, visually-discernable angles so that students can internalize the concept of parallax from everyday experience. However, students often have difficulty transferring this experience to the astronomical realm, so we pair this hands-on activity with a more explicitly astronomically-based activity using the WorldWide Telescope visualization environment. Students apply the same methodology in this environment and learn how the apparent motion of stars is related to their distance from Earth.

Outcomes: The combination of hands-on activity and computer-aided visualization is designed to produce a deeper understanding of parallax in the astronomical environment, and an improved understanding of the inherently three-dimensional distribution of objects in our universe. More formal assessment is underway. This research and development project is funded by the National Science Foundation through the TUES program (DUE-1140440).

Conference Thread: Engaging with 21st Century Media and Technology

MT06 From Picas to Pixels: An Astro 101 e-book
Stephen Shawl, University of Kansas, shawl@ku.edu
Gene Byrd, University of Alabama, byrd@bama.ua.edu
Susana Deustua, Space Telescope Science Institute, deustua@stsci.edu
Michael LoPresto, Henry Ford Community College, lopresto@hfcc.edu

What happens when a publisher discontinues publishing a textbook? That was the dilemma we were presented with. Given that we know we have a high quality product that can contribute to student understanding of science in general and astronomy in particular, and that significant efforts had already been expended on the project, we decided to self-publish, even knowing that the challenges, and the gamble in terms of time and personal expense, were great. Self-publication provides an opportunity to produce an updated edition at great cost savings to students — something faculty often say is an important consideration in their choice of a book. We discuss the many significant challenges, the greatest of which is marketing. We present the end result: a completed publication in various e-book formats and with links to the Discovering Astronomy Concept Videos made for the book. Details of the book, a sample chapter, and other information are available at discoveringastronomy@weebly.com.

Outcomes: Expressed in terms of important student outcomes such as:

• Recognize and characterize the scientific method;
• Characterize the appearance/motion of celestial objects;
• Identify key conceptual advances (and people involved) in the history of astronomy;
• Understand the relationship between light, matter, and energy in the universe;
• Identify the nature and evolution of planetary system, stars, galaxies, and the Universe;
• Understand telescopes’ functions and limitations in collecting data.

Conference Thread: Engaging with 21st Century Media and Technology

MT07 IAU astroEDU: An Open-Access Platform for Peer-Reviewed Astronomy Education Activities
Linda Strubbe, Canadian Institute for Theoretical Astrophysics, linda@ita.utoronto.ca
Edward Gomez, Las Cumbres Observatory Global Telescope, egomez@lcogt.net
Pedro Russo, Universe Awareness / Leiden University, russo@strw.leidenuniv.nl
Thilina Heenatigala, Universe Awareness / Leiden University, heenatigala@strw.leidenuniv.nl

There are many sources of educational resources for astronomy across the world. The quality of these resources is highly variable making the effectiveness to the end-user an unknown quantity. They are not maintained or updated regularly and have a limited content review. To address these issues and more, astroEDU follows a peer-reviewed process similar to what scholarly articles are based on. Activities submitted are peer-reviewed by an educator and a professional astronomer which gives the credibility to the activities. astroEDU activities are open-access in order to make the activities accessible to educators around the world while letting them discover, review, distribute and remix the activities. astroEDU is endorsed by the International Astronomical Union meaning each activity is given an official stamp by the international organization for professional astronomers. The first author is editor-in-chief for this new platform.

Outcomes: Participants will:

• Become familiar with a new online resource for peer-reviewed astronomy education activities, called astroEDU;
• Learn how to access activities from astroEDU;
• Learn how to submit activities to astroEDU;
• Learn how to volunteer as a referee for astroEDU;
• Be invited to share feedback on astroEDU.

Conference Thread: Engaging with 21st Century Media and Technology

MT08 Teaching Moon Phases with WorldWide Telescope and Physical Models, Phase 2
Patricia Udomprasert, Harvard College Observatory, pudompra@cfa.harvard.edu
Alyssa Goodman, Harvard College Observatory, agoodman@cfa.harvard.edu
Susan Sunbury, Smithsonian Astrophysical Observatory, ssunbury@cfa.harvard.edu
Zhihui Helen Zhang, Concord Consortium/Boston College, zhangle@concord.org
Philip Sadler, Harvard College Observatory
Erin Johnson, Harvard College Observatory
Erin Lotridge, Harvard College Observatory
Jonathan Jackson, Harvard College Observatory
Ana-Maria Constantin, Harvard College Observatory
Qin Wang, Smithsonian Astrophysical Observatory
Mary Dussault, Smithsonian Astrophysical Observatory

We designed a middle school lab on Moon phases/eclipses, using a combination of physical models (styrofoam balls/lamp) and computer models. In Phase I, we compared learning gains from two different computer models (a simplified 2D simulator vs. a complex 3D model in WorldWide Telescope, “WWT”). In Phase 2, all students used WWT, but half used the foam model first, while the other half used WWT first. The Phase 2 pilot (N=68) showed that level of prior knowledge may influence which model order would
be more beneficial to student learning. Three additional cohorts in 2013-14 (N=226) showed that performance on the multiple choice assessment is comparable regardless of model order, with a regression analysis showing a slight benefit to using WWT first. For two cohorts where we have coded open responses, students who used WWT first expressed fewer misconceptions about the cause of Moon phases on the posttest. Only 19% of students preferring having WWT first or wish they had WWT first.

Outcomes:
- We will share best practices learned from our study on how to implement new visualization technology in classrooms;
- Participants will learn how to download and use the WWT/Styrofoam Ball Moon Phases Lab in their teaching;
- Participants will have an opportunity to offer feedback on how to improve the lab further;
- Participants may be inspired to design and share new labs that use a blend of physical and virtual models to help students learn other key astronomical topics.

**Conference Thread: Engaging with 21st Century Media and Technology**

MT09  Astronomy for Astronomical Numbers: The Results of a 1-year Astronomy MOOC

Matthew Wenger, University of Arizona, mwenger@email.arizona.edu

Chris D. Impey, University of Arizona, cimpey@email.arizona.edu

Carmen L. Austin, University of Arizona, cla@email.arizona.edu

This poster presents the results of a one-year longitudinal study of an ongoing online astronomy course, also known as a MOOC, called Astronomy: State of the Art. There are currently more than 13,300 students enrolled in this course which consists of video lectures, live online discussions, and supplementary material in the form of readings and podcasts. In addition to the results of this study, the poster will also discuss directions for future development and research on MOOCs and tools for learning online.

Outcomes: Participants will receive information about the longitudinal results of an ongoing online astronomy course and will be invited to provide feedback, to participate in ongoing development, and will contribute to a discussion of future directions for these kinds of online courses.

**Conference Thread: More Than Pixels, Meaning! Empowering Imagery with Astronomy Visualization Metadata**

Ryan Wyatt, California Academy of Sciences, rwyatt@calacademy.org

Robert Hurt, IPAC / Spitzer Science Center, hurt@ipac.caltech.edu

Astronomical images inspire and engage, but to interpret these images properly requires additional (often missing) context. The "pretty pictures" also tell compelling science stories: clever file formats and smarter software can help unlock these narratives. New tools provide "one stop shopping" for EPO astronomical imagery, as well as the background information that allows educators to leverage images into meaningful experiences for a variety of audiences. The Astronomy Visualization Metadata (AVM) standard allows both general information (e.g., title, caption, credit) as well as astronomy-specific data (e.g., spectral data, coordinates) to be embedded directly into the images using well-established photographic schema. Learn how to use existing software and web services to get the most out of EPO imagery for schools, newsrooms, and planetariums. And get a glimpse at what the future holds for AVM-enabled astronomical images.

Outcomes: The poster will offer resources for educators to leverage imagery meaningfully into their projects and programs, citing specific software and tools including AstroPix from IPAC, WorldWide Telescope from Microsoft Research, and Digistar 5 from Evans & Sutherland. Participants will gain an introduction to the AVM standard and have the opportunity to provide input on the existing subject taxonomy of particular interest to educators.

**Conference Thread: Enhancing Science Communication Skills and Practices**

SC12  NASA SMD Resources and Tools for Engaging Scientists in Education and Public Outreach

Jennifer Grier, Planetary Science Institute, jgrier@psi.edu

Sanlyn Buxner, Planetary Science Institute, bxner@psi.edu

Bonnie K. Meinke, Space Telescope Science Institute, meinke@stsci.edu

Nicholas Gross, Boston College, gross@bu.edu

Morgan Woroner Institute for Global Environmental Strategies, morgan_woroner@strategies.org

The NASA Science Education and Public Outreach (E/PO) Forums support the NASA Science Mission Directorate (SMD) and its E/PO community by enhancing the coherency and efficiency of SMD-funded E/PO programs. The Forums foster collaboration and partnerships between scientists with content expertise and educators with pedagogy expertise. This poster will present resources and tools to encourage and support scientists’ engagement in E/PO
We designed a simple framework for presenting concepts to both students and the general public. We aimed for materials that would quickly review the basic concepts underlying the exoplanet search. And we aimed to not only share coronagraph science and technology, but also to share the human face behind that exciting work. We experimented with ways to simulate using a coronagraph for exoplanet detection, and ways to share their science with students, educators, and the general public.

**Conference Thread:** Enhancing Science Communication Skills and Practices

**SC13  No Longer Lost in the Glare: Detecting Hidden Planets Informal Outreach Materials & Activities**

Denise Henry, Ball Aerospace & Technologies Corp., dahenry@ball.com

Steve Kendrick, Ball Aerospace & Technologies Corp., skendric@ball.com

Scientists and engineers are continually researching and refining the coronagraph method of detecting exoplanets. Sharing this research and technology at education outreach events builds on people's inherent interest in the search for another Earth. A thorough review of available outreach materials related to the coronagraph method found a distinct gap. A NASA ROSES EPO grant enabled us to develop materials and activities for informal outreach. We aimed for materials that would be fun and simple to replicate and use. We aimed for materials that would quickly review the basic concepts underlying the exoplanet search. And we aimed to not only share coronagraph science and technology, but also to share the human face behind that exciting work. We experimented with ways to simulate using a coronagraph for exoplanet detection, and we designed a simple framework for presenting concepts to both children and adults.

**Outcomes:** Readers will:

- Learn about a low-cost, hands-on activity that they can use in either a classroom or at an informal outreach event;
- Learn how to contrast Kepler's transit method (which requires all of a star's light) to the coronagraph method (which requires blocking nearly all of a star's light), and effectively engage both children and adults;
- Become aware of PPT slide shows, posters, handouts, and bookmarks available for highlighting the coronagraph method.

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**Conference Thread:** Enhancing Science Communication Skills and Practices

**SC14  Investigating Undergraduate Students’ Science Literacy: Responses Related to Radiation and DNA**

Chris D. Impey, University of Arizona, cimpey@as.arizona.edu

Sanlyn Buxner, University of Arizona, buxner@email.arizona.edu

James M. Romine, University of Arizona, jmrpromine@email.arizona.edu

Megan Nieberding, University of Arizona, mnierberding@email.arizona.edu

In this poster, we present a subset of results from a 24-year study of undergraduate non-astronomy major students' science literacy. Included are students’ overall responses to questions assessing their knowledge of radiation and DNA. STEM majors were likely to describe radiation as an emission of energy or wave. Non-STEM majors were consistently less descriptive than STEM majors and used less informed descriptions. One in four non-STEM students described radiation as a harmful substance. Only 2% of students in non-STEM majors listed the electromagnetic spectrum as radiation, compared to 10-12% of STEM students. When asked about DNA, students most commonly related it to genetic material, almost half of descriptions doing so. In contrast, students shared many misconceptions about DNA, such as the idea that DNA is unique to humans or only associated with blood. Our results have important implications for educators working to improve students’ basic science literacy.

**Outcomes:** Visitors will learn about an ongoing study of students’ science literacy and responses, both on and off target, given to two open ended questions probing students' understanding of radiation and DNA. Students' responses to these basic scientific topics give insight into fundamental science misconceptions perpetuated through school into college. Insights into students' correct and incorrect understandings give practitioners ideas about targeting instruction to address students' understandings.

**Conference Thread:** Enhancing Science Communication Skills and Practices

**SC15  The Effects of Science Communication Training on STEM Students**

Susanna Kohler, University of Colorado Boulder, kohlers@colorado.edu

Seth Hornstein, University of Colorado Boulder, seth.hornstein@colorado.edu

The ability of scientists to effectively communicate with the public is imperative to our society, yet there exist few programs designed to provide scientists with the corresponding training. To explore this need, we target very-early-career scientists by integrating science communication training into five undergraduate/graduate science classes. By analyzing writing samples and gauging participants’ attitudes toward science communication throughout the semester-long classes, we seek to answer two questions: 1. Is integrating a small amount of written science communication training into existing science classes for majors sufficient to produce measurable improvement in students’ written public science communication skills? 2. Is there an optimal time in the undergraduate/early-graduate career to provide this training? We present the results of this study here.

**Outcomes:** By reporting these results, we hope to share our understanding of tactics for training future scientists to better communicate with the public. The results of the survey that probes the attitudes of the students toward science communication will also provide interesting insight into the current level of acceptance among early-career scientists for EPO and science communication.

**Conference Thread:** Enhancing Science Communication Skills and Practices

**SC16  Communication and Shared Practices Are Bringing NASA STEM Resources to Camp Youth**

Keliann LaConte, Lunar and Planetary Institute, laconte@lpi.usra.edu

Andy Shaner, Lunar and Planetary Institute, shaner@lpi.usra.edu

Stephanie Shipp, Lunar and Planetary Institute, shipp@lpi.usra.edu

The ability of scientists to effectively communicate with the public is imperative to our society, yet there exist few programs designed to provide scientists with the corresponding training. To explore this need, we target very-early-career scientists by integrating science communication training into five undergraduate/graduate science classes. By analyzing writing samples and gauging participants’ attitudes toward science communication throughout the semester-long classes, we seek to answer two questions: 1. Is integrating a small amount of written science communication training into existing science classes for majors sufficient to produce measurable improvement in students’ written public science communication skills? 2. Is there an optimal time in the undergraduate/early-graduate career to provide this training? We present the results of this study here.

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Barry Garst, American Camp Association, bgarst@acacamps.org

Ruth Netting, NASA, ruth.a.netting@nasa.gov

Kristen Erickson, NASA, kristen.erickson@nasa.gov

In 2012, NASA and the American Camp Association (ACA) entered into an alliance to further both organizations’ goals and objectives with regard to science, technology, engineering and mathematics (STEM) education. This alliance is providing camp staff — and their young audiences — access to NASA's resources. NASA disseminates resources (e.g. pathways for requesting guest presenters, informal learning lesson plans), conducts ACA professional development (online and at ACA conferences), and coordinates efforts around key events (e.g. spacecraft launches). ACA promotes awareness of NASA resources through their communications and services. Together, the organizations are working to inspire a new generation of scientists, engineers, explorers, educators, and innovators to pursue STEM careers. This poster highlights this successful collaboration between two organizations, as well as the needs of camp professionals that were elucidated and resources that are available through this effort.

Outcomes: Participants will become aware of:

• The collaborative approaches and joint activities of the ACA-NASA alliance;

• The needs of camp professionals elucidated through this collaboration;

• Online resources available for working with camps.

Conference Thread: Enhancing Science Communication Skills and Practices

SC17 Doodling During Class: Benefits of Real-time Feedback

Donald McCarthy, Jr., The University of Arizona, dmcCarthy@arizona.edu

Through experimentation in large astronomy classes to non-science majors, I discovered “doodling” is an effective method for enhancing learning and teacher evaluation. During class, students are encouraged to provide on-the-fly reactions through drawing and short statements. The resulting cartoons, graffiti, and reactions show wonderfully different perspectives and are often insightful and humorous. Doodling records fresh thoughts before they are fade as class progresses. When presented at the start of the next class, such material helps review concepts and benefits everyone. Students take pride in the selection of their material and often compete for this attention. Doodles also reveal misconceptions, and internal struggles, that appear during class and can be addressed by quick, personal feedback from the instructor. Doodling encourages students to stay on task, away from electronics, and to share their feelings and perspectives in a two-way “conversation.”

Outcomes: Participants will discover a potential new tool for interacting with their students and for quickly evaluating the effectiveness of classroom instruction. Potentially, a resource of doodles could be accumulated as a resource for instructors.

Conference Thread: Enhancing Science Communication Skills and Practices

SC18 NASA’s Space Forensics: Solving Cosmic Mysteries with Crime Scene Narratives

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Barbara Mattson, USRA/CRESST & NASA Goddard Space Flight Center, barb.mattson@nasa.gov

Explosions, collisions, births, and deaths — the Universe presents astronomers with an abundance of puzzles to analyze. The Space Forensics project takes students in formal and informal education settings through astronomy problem-solving narratives that parallel crime scene forensics. A series of standards-aligned Space Forensics curricula utilize mystery-themed readings and hands-on activities to take students through the process of scientific problem-solving. Our initial batch of cases introduces the “forensics” of supernova remnants, supermassive black holes, gamma-ray bursts, and more. In addition, we have partnered with a multimedia developer to bring these cases to the science-interested public through an online game. We intend Space Forensics to serve as a model (or potential partner) for others seeking to fuse STEM and storytelling. We have a one-hour workshop to share the Space Forensics philosophy, pedagogy, and preliminary evaluation results in greater depth.

Outcomes: Poster viewers will: (i) learn about the Space Forensics project and its resources; and (ii) experience select text and activities from the case curricula (and multimedia from the game if it is available by August); and (iii) engage with the Space Forensics team regarding potential opportunities for partnership, adaptation, and expansion.

Conference Thread: Enhancing Science Communication Skills and Practices

SC19 Night Sky Network: Study of Amateur Astronomers and Their Audiences

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Vivian White, Astronomical Society of the Pacific, vwhite@astrosociety.org

The NASA Night Sky Network (NSN) was launched in 2004, in response to a survey conducted by the Institute for Learning Innovation for the Astronomical Society of the Pacific (ASP). That survey included information on club demographics, members’ public outreach efforts through clubs, and barriers faced in engaging in effective astronomy outreach. As of 2014, the NSN includes over 450 clubs and has developed and distributed 11 outreach ToolKits, found at http://www.nightskynetwork.org. In 2014, two surveys re-assessed the current club landscape and future club needs. One survey revisited questions posed in the 2002 survey, with an eye to how club culture and outreach practices have changed. A second survey polled public visitors to club observing events to measure their reasons for attending, expectations of, and reactions to these events. Initial results will be shown along with a brief analysis of how the NSN can evolve to better meet the needs of both clubs and the public.

Outcomes: We hope to make participants aware of the usefulness and reach of the Night Sky Network and that we are taking care to keep the NSN relevant and vital for our target audiences.

Conference Thread: Evaluating, Assessing and Documenting E/PO Impacts

EP20 Evaluating the Effectiveness of Nevada's Climate High School Science Fair Network

Paul Buck, Nevada State College, paul.buck@nsc.edu

We report on a 3-year NSF-funded teacher professional development project in Nevada to increase climate change science (CCS) content knowledge & teaching effectiveness of in-service teachers; it also increased the number and quality of high school CCS projects competing in Nevada's regional Intel ISEF affiliated fairs. We increased the diversity of regional science fair competitors. We used a pre-and-post content test based on fundamentals of CCS. We used the STEBI-B evaluation instrument to assess participating teachers beliefs about teaching science. Teachers completed a post-program evaluation instrument. Teachers improved their
understanding of climate change science, became more confident in their ability to teach it, & rated the program as very effective. 70 climate change related projects were submitted to regional fairs; 12 won first place. In 2011, about 20% of projects submitted were from underrepresented students; in 2012 this increased to about 42%.

**Outcomes:** Participants will learn about Nevada teachers understanding of climate change research, understand a little better how in-service teachers feel about their ability to teach climate change science. The main accomplishment was an increase in the number and quality of climate change projects submitted by secondary students to regional science fairs; the program might be used as model for similar efforts in other places.

**Conference Thread:** Evaluating, Assessing and Documenting E/PO Impacts

**EP21 Investigating the Relationship between Students’ Science Knowledge and Their Sources of Information**

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Megan Nieberding, University of Arizona, mnieberding@email.arizona.edu

Building on a 25 year study of undergraduate students’ science literacy, we have been investigating where students report getting information about science. We investigated the relationship between students’ basic science knowledge, responses about studying something scientifically, and where they report gaining information about science. Our previous work has shown that although students report most often looking up information online, they do not consider online sources the most reliable. Our findings show no major difference in students’ scientific knowledge regardless of where they report getting information about science. In contrast, there was a difference in students’ demonstrated complexity of scientific understandings between those who reported professors and textbooks as most important than students’ ability to judge the reliability of the source of information.

**Outcomes:** Poster attendees will: Learn about an ongoing study of where students get their information about science. Will be given access to all instruments used for data collection and learn about data analysis. Engage in discussions about implications for undergraduate science students and members of the public.

**Conference Thread:** Evaluating, Assessing and Documenting E/PO Impacts

**EP22 Results of Using the Impact Analysis Method**

Hilarie B. Davis, TLC Inc, hilari@techforlearning.org

Daniella Scalice, NASA Astrobiology Institute

In the last 18 months, the Impact Analysis Method has been used with over 40 EPO projects. This poster will present how those projects have increased in quality at each stage of their life cycle, especially in documenting participant impact, through the use of the Method. In consultations between a professional external evaluator and the EPO project’s lead, the Impact Analysis Method was used to gather baseline data on the rigor of their efforts at each stage of the project’s life cycle. Based on these diagnostic sessions, EPO leads made their efforts more rigorous, and then collected data on the results. We will present these outcomes as case studies. The impact on the EPO professionals will also be presented.

**Outcomes:** As a result of this poster, participants will: 1) Be exposed to an overview of the Impact Analysis Method 2) View data on the impact on EPO professionals’ confidence and competence in using evaluation 3) Read synopses of case studies of projects affected by the Impact Analysis Method This poster will contribute to the field by providing evidence of the effect of the Impact Analysis Method on the rigor of evaluation, the extent of impact, and examples of impact analysis and improvement.

**Conference Thread:** Evaluating, Assessing and Documenting E/PO Impacts


Brian Kruse, Astronomical Society of the Pacific, bkruse@astrosociety.org

Kristin Bass, Rockman et al, kristin@rockman.com

Gregory Schultz, Astronomical Society of the Pacific, gschultz@astrosociety.org

With funding from a NASA EPOESS grant, the ASP developed the NASA Galileo Educator Network (GEN), a train-the-trainer teacher professional development program based in part on the Galileo Teacher Training Program. Formal evaluation of the program demonstrates both teacher trainers and teacher participants grew in their ability to utilize astronomy investigations focusing on science practices as described in the Next Generation Science Standards.

**Outcomes:** Participants will understand how the GEN program involved teacher professional developers and teacher participants to enhance student learning through the inclusion of astronomy investigations focusing on science practices. Participants will also learn about the impact of GEN through data provided by the formal program evaluation.
Conference Thread: Improving Our Professional Practice

IP25  NASA Astrophysics E/PO Community: Enhancing STEM Instruction

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NASA Astrophysics E/PO Community

The NASA Science Mission Directorate (SMD) Astrophysics Education and Public Outreach (E/PO) community and Forum work together to capitalize on the cutting-edge discoveries of NASA Astrophysics to support in-service and pre-service K-12 educators in Science, Technology, Engineering, and Math (STEM). The NASA SMD Astrophysics E/PO community has proven expertise in creating needs-based professional development, authentic educator research experiences, standards-based curriculum support materials, and partnerships that expand program impact at the local, regional, and national level. These mission- and grant-based E/PO programs are uniquely poised to foster collaboration between scientists with content expertise and educators with pedagogy expertise. We present examples of how the NASA Astrophysics E/PO community and Forum enhance STEM instruction in these ways, including associated metrics and evaluation findings.

Outcomes: Participants will increase awareness of:

- NASA Astrophysics Education and Public Outreach (E/PO) resources and opportunities that they can incorporate into their own E/PO efforts, and how to access resources and expertise;
- Strength of partnering scientists and educators, as used by NASA Astrophysics E/PO programs, to translate cutting-edge NASA science into new and effective learning tools;
- Ways in which NASA Astrophysics E/PO programs support federal education priorities.

Conference Thread: Improving Our Professional Practice

IP26  Cross-Forum Professional Development in NASA's SMD E/PO: Successes, Challenges, and Opportunities

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Over the past 5 years, NASA Science Mission Directorate has offered numerous Professional Development opportunities attended by hundreds and viewed thousands of times online in hopes of improving the educational and outreach efforts of their programs. Our 5-year retrospective on the successes, failures, and opportunities for the future reveals the importance of these professional development efforts, the necessity to continue to make these opportunities available online, and what future efforts may look like and how we might best utilize emerging technologies. With ever changing subjects and evolving audiences, it is critical that our efforts keep up with the changing nature of offering Education and Public Outreach on a national scale.

Outcomes: Conference attendees will have the opportunity to talk with the authors about our findings, what we have learned about PD over the past 5 years, how we have handled the challenges faced, and what our goals are for continued PD efforts into the future. They can also view some sample offerings, receive information about available PD, and discuss their and their audience needs.

Conference Thread: Improving Our Professional Practice

IP27  Professional Development for Informal Educators: Explore One Model that Worked!

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Earth to Sky Partnership (ETS) professional development events have engaged nearly 800 informal education specialists who in turn have reached well over 4 million visitors to National Parks and Wildlife Refuges with NASA science content. Our partnership between NASA, the National Park Service, the U.S. Fish and Wildlife Service, U.C. Berkeley and now NOAA, works in collaboration to design and deliver highly effective professional development based upon the Authentic Task Approach. We will share the methodology that has resulted in such high impact, focusing on ways you can replicate this proven professional development model with a variety of communities in your own work setting.

Outcomes: Attendees will:

- Become familiar with the ETS professional development model;
- Identify opportunities to replicate the model (or components of the model) in their own training events;
- Learn about the professional development needs of the National Park Service and the US Fish and Wildlife Service;
- Consider how they can become involved with the ETS community and contribute to future ETS professional development offerings.

Conference Thread: Improving Our Professional Practice

IP28  NASA’s Afterschool Universe and Family Science Night: Exciting New Content for Well-Tested Programs

Sarah Eyermann, Syneren Technologies & NASA Goddard Space Flight Center, Sarah.E.Eyermann@nasa.gov
Sara Mitchell, Syneren Technologies & NASA Goddard Space Flight Center, Sara.Mitchell@nasa.gov

Afterschool Universe and Family Science Night are both well-established and thoroughly evaluated NASA informal education curricula that have been run in sites around the country since 2008. Even though these programs might be considered “complete,” there has been significant demand from educators for additional content.
for both. With funding from a Hubble supplemental grant we are now creating entirely new sessions to be added to each program’s curriculum as well as establishing a system that will allow us to incrementally evaluate new program content as it is developed. Using this new system of evaluation, it is our hope that we will not only be able to create additional content ourselves, but also partner with others to include their content in these programs. Such a partnership will fulfill established educator demand and allow prospective partners to leverage the national networks of these popular programs at minimal cost.

Outcomes: Poster viewers will: (i) see visualizations about the current reach and impact of the Afterschool Universe and Family Science Night networks; (ii) learn about the current expansion of the Afterschool Universe and Family Science night programs; and (iii) engage with the Afterschool Universe and Family Science Night team members regarding potential opportunities for partnership, adaptation, and expansion.

Conference Thread: Improving Our Professional Practice

IP29 The NASA Forum Higher Education Working Group: Support for Higher Education
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Science education at the college and university level is becoming a more important resource for training the next generation of the STEM work force and the preparing the young citizens for entering into a technological society. Institutions of higher education are not only responsible for training the next generation of STEM professionals, such as research scientists and engineers, but also training the next generation of primary and secondary teachers who will be responsible for preparing a broader range of STEM technicians and consumers of STEM content. SMD science covers a broad swath of science disciplines covered in both introductory and advanced undergraduate courses, as well as graduate education. The NASA Education Forum Higher Education Working Group has taken on the task of providing support for undergraduate faculty and guidance for future programs supporting undergraduate education.

Conference Thread: Improving Our Professional Practice

IP30 Introducing Preschool-Age Children to Astronomy
Suzanne Gurton, Astronomical Society of the Pacific, sgurton@astrosociety.org
Vivian White, Astronomical Society of the Pacific, vwhite@astrosociety.org
Anna Hurst Schmitt, Astronomical Society of the Pacific, ahurst@astrosociety.org

The ASP and its collaborators are conducting a set of research and development activities (NSF Award #1217441) focusing on early childhood astronomy to increase the capacity of informal science education institutions to effectively engage their youngest visitors (ages 3–5) in astronomy. Leading the project is an Action Research Group comprised of the ASP; experts in cognitive development, early childhood, and astronomy learning progressions from UC Santa Cruz, Cal Poly San Luis Obispo, and Penn State; and the Lawrence Hall of Science at UC Berkeley. Children’s Discovery Museum of San Jose, and San Luis Obispo Children’s Museum as sites for research, field testing, and implementation. After a year of iterative design, the ASP hosted its first cohort of museum educators who are acting as field testers of the My Sky Tonight project toolkit. In this poster we report on the research that informed the activity development and the early results from that first workshop.

Conference Thread: Improving Our Professional Practice

IP31 Careers In Astronomy
Janice Harvey, Gemini Observatory, jharvey@gemini.edu

Learn about the types of careers, and the people, that allow observatories like Gemini to explore the very edge of the Universe. With the creation and distribution of this highly anticipated career brochure and accompanying video website, we are able to share staff jobs that are available at an observatory, what exactly the staff members do, and why they LOVE their work.

Outcomes: Our newly created brochure on careers at Observatories has been extremely well received from a broad community. The career brochure was intended for elementary to middle-school students but the broader impact has included all ages. Brochures will be available to take during the poster sessions for distribution throughout your community. Visit our Gemini career website at http://www.gemini.edu/careers.

Conference Thread: Improving Our Professional Practice

IP32 NASA Astrophysics E/PO Community: Increasing and Sustaining Youth and Public Engagement in STEM
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Bonnie K. Meinke, Space Telescope Science Institute, meinke@stsci.edu
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James Manning, NASA Astrophysics SEPOF, jim_manning@att.net

NASA Astrophysics E/PO Community

The NASA Science Mission Directorate (SMD) Astrophysics Education and Public Outreach (E/PO) community and Forum work together to capitalize on the cutting-edge discoveries of NASA Astrophysics missions to enable youth to engage directly in doing Science, Technology, Engineering, and Mathematics (STEM) inside and outside of school. The NASA SMD Astrophysics E/PO community has proven expertise in providing student opportunities that reinforce research skills; exhibits, multimedia shows, and visualizations that inspire and engage; professional development for informal educators; and partnerships that provide local, regional, and national reach. These mission- and grant-based E/PO programs are uniquely poised to foster collaboration between scientists with content expertise and educators with pedagogy expertise. We present examples of how the NASA Astrophysics E/PO community and Forum support youth and public engagement in STEM in these ways, including associated metrics and evaluation findings.
Outcomes: Participants will increase awareness of:
- NASA Astrophysics Education and Public Outreach (E/PO) resources and opportunities that they can incorporate into their own E/PO efforts, and how to access resources and expertise;
- Strength of partnering scientists and educators, as used by NASA Astrophysics E/PO programs, to translate cutting-edge NASA science into new and effective learning tools;
- Ways in which NASA Astrophysics E/PO programs support federal education priorities.

Conference Thread: Improving Our Professional Practice

IP34 NASA Astrophysics E/PO Community: Enhancing STEM Experience of Undergraduates

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NASA Astrophysics E/PO Community

The NASA Science Mission Directorate (SMD) Astrophysics Education and Public Outreach (E/PO) community and Forum work together to capitalize on the cutting-edge discoveries of NASA Astrophysics missions to enhance the Science, Technology, Engineering, and Math (STEM) experience of undergraduates. The NASA SMD Astrophysics E/PO community has proven expertise in providing both professional development and resources to faculty at 2- and 4-year institutions and in offering internships and student collaboration opportunities. These mission- and grant-based E/PO programs are uniquely poised to foster collaboration between scientists with content expertise and educators with pedagogy expertise. We present examples of how the NASA Astrophysics E/PO community and Forum engage the Higher Education community in these ways, including associated metrics and evaluation findings.

Outcomes: Participants will increase awareness of:
- NASA Astrophysics Education and Public Outreach (E/PO) resources and opportunities that they can incorporate into their own E/PO efforts, and how to access resources and expertise;
- Strength of partnering scientists and educators, as used by NASA Astrophysics E/PO programs, to translate cutting-edge NASA science into new and effective learning tools;
- Ways in which NASA Astrophysics E/PO programs support federal education priorities.

Conference Thread: Improving Our Professional Practice

IP35 NASA Astrophysics E/PO Community: Serving Groups Historically Underrepresented in STEM Fields

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Lindsay Bartolone, Adler Planetarium, lbartolone@adlerplanetarium.org
Gregory Schultz, Astronomical Society of the Pacific, gschultz@astrosociety.org
James Manning, NASA Astrophysics Forum, jim_manning@att.net

NASA Astrophysics E/PO Community

The NASA Science Mission Directorate (SMD) Astrophysics Education and Public Outreach (E/PO) community and Forum work together to capitalize on the cutting-edge discoveries of NASA Astrophysics missions to serve audiences that are historically underrepresented in Science, Technology, Engineering, and Math (STEM) fields. The NASA SMD Astrophysics E/PO community has proven expertise in providing resources, activities, and opportunities that address the needs of underrepresented groups by drawing on SMD science and technology; by providing mentors for developing STEM skills and identity; and by building the partnerships that broaden participation. These mission- and grant-based E/PO programs are uniquely poised to foster collaboration between scientists with content expertise and educators with pedagogy expertise. We present examples of how the NASA Astrophysics E/PO community and Forum engage underrepresented audiences in these ways, including associated metrics and evaluation findings.

Outcomes: Participants will increase awareness of:
- NASA Astrophysics Education and Public Outreach (E/PO) resources and opportunities that they can incorporate into their own E/PO efforts, and how to access resources and expertise;
- Strength of partnering scientists and educators, as used by NASA Astrophysics E/PO programs, to translate cutting-edge NASA science into new and effective learning tools;
### Conference Thread: Improving Our Professional Practice

**IP36  NASA SMD Science Education and Public Outreach Forums’ Formal Educator National Needs Survey Results**

Andi Nelson, Adler Planetarium, anelson@ AdlerPlanetarium.org  
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Ruth Paglierani, Center for Science Education, Space Sciences Laboratory, raphael@ssl.berkeley.edu  
Sheri Klug Boonstra, Arizona State University, sklugboonstra@gmail.com  
Rachel Zimmerman-Brachman, NASA JPL  
Lindsay Bartolone, Adler Planetarium  
Bradford Davey, TechforLearning  
Liz Burck, IGES  
Russanne Low, IGES  
Theresa Schwerin, IGES

A survey of over 1,100 formal and informal educators was conducted to assess who were using NASA resources, what educators were looking for when using NASA resources, and what attracted them to NASA workshops and other educational opportunities. This survey was conducted by the K-12 Working Group of the NASA Science Mission Directorate (SMD) Education and Public Outreach (E/PO) Forums and distributed through NASA and national education networks.

**Outcomes:** Participants will be aware of the purposes, methods and results of the Formal Educator National Survey results. Participants will gain access to the full report.

### Conference Thread: Improving Our Professional Practice

**IP38  A CoP Workspace to Connect Educators, Scientists, and the Public with NASA's Science E/PO Efforts**

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Lindsay Bartolone, Adler Planetarium, lbartolone@ AdlerPlanetarium.org  
Laura Petiolas, University of California - Berkeley, laura@sbg.berkeley.edu  
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Denise A. Smith, Space Telescope Inst., dsmith@stsci.edu

The workspace offers both audiences avenues to connect with SMD E/PO practitioners, to learn about SMD E/PO projects and impacts, to be aware of opportunities for involvement, and to explore resources to improve professional practice, including literature reviews, connections to Next Generation Science Standards, and best practices in evaluation and engaging diverse audiences. Visitors are encouraged to explore the growing collection of practitioner resources at [http://smdep.org](http://smdep.org).

**Outcomes:** The poster will introduce the workspace to interested educators, scientists, and members of the general public, and will highlight pathways to resources of interest to these audience members.

### Conference Thread: Improving Our Professional Practice

**IP39  Evidence-based Assessment of General Education Learning Outcomes in Introductory Astronomy**

Christopher Taylor, California State University, Sacramento, ctaylor@csus.edu

With an increasing focus on assessment, many institutions are revising learning goals, focusing on assessable learning outcomes. Sacramento State recently revised its baccalaureate goals, which are now based on the outcomes put forward by the Liberal Education and America’s Promise (LEAP) initiative. A ground-up effort has begun to revise the General Education learning goals to align with the LEAP outcomes. STEM faculty came together and created new outcomes for science GE courses at Sacramento State. The challenge is in implementing these ambitious outcomes at a regional, comprehensive public university with large class sizes. I present specific sets of exam questions from my introductory Astronomy GE course at Sacramento State which highlight pathways to resources of interest to these audience members.

### Conference Thread: Improving Our Professional Practice

**IP37  Training Preschool Educators in Astronomy**

Juan Seguel, Cerro Tololo Inter-American Observatory, CTIO/NOAO, jseguel@ctio.noao.edu

Claudia Jara, University Santo Tomas, claudiajara@santotomas.cl  
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Leonor Opazo, Cerro Tololo Inter-American Observatory CTIO/NOAO, lopazo@ctio.noao.edu,  
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We present our program of training of preschool educators in astronomy that was done in 2013 in the Region of Coquimbo. The program was implemented in conjuction with the School of Early Childhood Education from University Santo Tomas, and involves 3 steps: Training, accompanying projects and Astronomy Congress. 97 preschool educators were certified on the program and 12 of them present their project at the congress.

**Outcomes:** The poster will introduce the workspace to interested educators, scientists, and members of the general public, and will highlight pathways to resources of interest to these audience members.

### Conference Thread: Improving Our Professional Practice

**IP33  Ways in which NASA Astrophysics E/PO programs support federal education priorities.**

Leonor Opazo, Cerro Tololo Inter-American Observatory  
Robert Work, University of California - Berkeley, rwork@ssl.berkeley.edu

**Outcomes:** Participants will be aware of the purposes, methods and results of the Formal Educator National Survey results. Participants will gain access to the full report.

**Conference Thread: Improving Our Professional Practice**

**IP32  NASA SMD Science Education and Public Outreach Forums’ Formal Educator National Needs Survey Results**

Andi Nelson, Adler Planetarium, anelson@ AdlerPlanetarium.org  
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Sheri Klug Boonstra, Arizona State University, sklugboonstra@gmail.com  
Rachel Zimmerman-Brachman, NASA JPL  
Lindsay Bartolone, Adler Planetarium  
Bradford Davey, TechforLearning  
Liz Burck, IGES  
Russanne Low, IGES  
Theresa Schwerin, IGES

A survey of over 1,100 formal and informal educators was conducted to assess who were using NASA resources, what educators were looking for when using NASA resources, and what attracted them to NASA workshops and other educational opportunities. This survey was conducted by the K-12 Working Group of the NASA Science Mission Directorate (SMD) Education and Public Outreach (E/PO) Forums and distributed through NASA and national education networks.

**Outcomes:** Participants will be aware of the purposes, methods and results of the Formal Educator National Survey results. Participants will gain access to the full report.
Conference Thread: Promoting Multicultural Diversity and Gender Equity

 MU40  Multiverse: Increasing Diversity in Earth and Space Science through Multicultural Education

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 In 2014, the Center for Science Education at the University of California, Berkeley Space Sciences Laboratory changed its name to Multiverse. This transition reflects our commitment to increasing diversity in Earth and space science through multicultural education. Multiverse provides Earth and space science educational opportunities and resources for a variety of audiences, especially for those who are underrepresented in the sciences. We envision a world filled with science literate societies capable of thriving with today's technology, while maintaining a sustainable balance with the natural world; a world where people develop and sustain the ability to think critically using observation and evidence and participate authentically in scientific endeavors; a world where people develop and sustain the ability to think critically using observation and evidence and participate authentically in scientific endeavors; a world where people see themselves and their culture within the scientific enterprise, and understand science within the context that we are all under one sky and on one Earth.

 Outcomes: Participants will learn about the need for Earth and space science educational opportunities and resources for underrepresented and underserved audiences, and how Multiverse at UC Berkeley's Space Sciences Lab is meeting that need.

 Conference Thread: Promoting Multicultural Diversity and Gender Equity

 MU41  Snapshots of the Universe: A Multi-Lingual Astronomy Book

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 Kelsey Johnson, University of Virginia, kej7a@virginia.edu
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 Dark Skies, Bright Kids, University of Virginia, dsbk@virginia.edu

 Dark Skies, Bright Kids! (DSBK) is an outreach organization at the University of Virginia, focused on enhancing elementary level science education in underserved communities. Early in the program, our volunteers encountered difficulties connecting with "English as a second language" students. To meet that challenge, DSBK volunteers created art with short descriptions of astronomical objects in both Spanish and English to help communicate concepts across the language barrier. Building on this initial success, our simple art project has evolved into a full educational children's book targeted at 2nd - 5th grade students. Though originally in Spanish and English, a partnership with the University of Alberta (Canada) has produced a French translation of the text, broadening the outreach potential of the book. We present 'Snapshots of the Universe' for broad distribution to classrooms, school libraries and homes, with emphasis on those serving multi-lingual populations.

 Outcomes: Snapshots of the Universe is a multi-lingual platform for teaching astronomy terms and basic concepts. While it is aimed at elementary aged children, it is also a simple means for outreach volunteers to expand their vocabulary and better communicate with ESL audiences.

 Conference Thread: Promoting Multicultural Diversity and Gender Equity

 MU42  Art in Science Promoting Interest in Research and Exploration (ASPIRE)

 Matthew Fillingim, Space Sciences Laboratory, University of California, Berkeley, matt@ssl.berkeley.edu
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 "Look to the Stars" was a series of classes for 5th-8th grade students in Salinas, CA. A collaboration between the public library and the local community college planetarium, this project targeted students from Hispanic families. "Look to the Stars" was an effort to give students already enthusiastic about science a chance to explore...
In middle school girls through studying colors in nature. This poster will outline the first year of the program and our plans for the next three years of the program.

**Conference Thread:** Supporting the Next General Science Standards (NGSS)

**NG45  Supporting Preschoolers in Science and Astronomy: Applying the NGSS to Pre-Kindergarten Learning**

*Alice Enevoldsen,* Alice’s AstroInfo, AlicesAstroInfo@gmail.com

There is a lack of purposeful exposure to science before children reach Kindergarten. In my work with Pacific Science Center, and workshops with the ASP, it is clear that multiple groups are working to change this. The skills preschool children need to master revolve around socio-emotional growth and literacy rather than “memorizing facts.” Preschoolers are already natural scientists: questioning and exploring. We can support them as scientists and build core milestones at the same time. Few science standards are put forward for preschoolers. What little there is focuses almost entirely on living objects: pets, farms, and plants. Without standards, some teachers are intimidated by choosing what “counts” as teaching science, or by science itself. I have taken the NGSS for what children will be learning in school and constructed a simplified reading of the K-2 grade-band NGSS for preschool teachers. Using this guide, they can support science preparedness in their students.

**Outcomes:** Participants will:

- See an adaptation of the K-2 grade-band Next Generation Science Standards aimed for preschool teachers;
- Download a copy of the NGSS adaptation for preschool teachers for further dissemination;
- See pictures preschoolers engaged in age-appropriate science/astonomy activities;
- Read an article in the August 2014 Sky and Telescope about astronomy activities;
- Teachers are intimidated by choosing what “counts” as teaching science, or by science itself. I have taken the NGSS for what children will be learning in school and constructed a simplified reading of the K-2 grade-band NGSS for preschool teachers. Using this guide, they can support science preparedness in their students.
- Comment on the relevance of science standards in preschools.

**Conference Thread:** Supporting the Next General Science Standards (NGSS)

**NG46  The Size, Scale and Structure Concept Inventory (S3CI) for Astronomy**

*Evan Gingrich,* Bucknell University, ecg009@bucknell.edu

The NSF-funded Collaborative Research Project STEAM: Integrating Art with Science to Build Science Identities Among Girls is a four-year program exploring building science identity in middle school girls through the theme of “Colors of Nature.” Colors of Nature sponsors a two-week summer academy (offered in both Tucson, Arizona and Fairbanks, Alaska) for middle school girls. This four-year program explores building science identity in middle school girls through studying colors in nature. This poster will outline the first year of the program and our plans for the next three years of the program.
for anyone to participate in NASA science. In the site’s Educators’ Zone, we provide lesson plan materials for middle and high school educators that make use of the Mappers citizen science projects. Terraluna and InVestaGate are two, multi-week NASA approved lesson plans that teach planetary science and incorporate citizen science activities. This poster will describe some main features and activities of these lesson plans as well as the methods of creating them and outcomes from teacher professional development workshops and real use in the classroom. We will also highlight several short lesson plans that also align with NGSS that covers topics such as astronomy vs. astrology and galaxy collisions in conjunction with other CosmoQuest-related projects.

Outcomes: Visitors to this poster will get an overview of two NGSS-aligned multi-week units for middle school classrooms that incorporate CosmoQuest citizen science projects. They will also have an opportunity to learn about the use of these units in classrooms and the week-long professional development workshops for each one. Participants who want to put on their own such workshop in their locality are encouraged to contact the authors. Several short units and other teacher resources will be identified.

Conference Thread: Supporting the Next General Science Standards (NGSS)

NG48 RU SciTech: Designing a University-sponsored Summer Camp with State Science Standards & NGSS in Mind

Quyen Hart, Regis University, qhart@regis.edu

Several science and computer science faculty of Regis University launched RU SciTech, a summer science and technology camp, in July 2013. The goal of our faculty-led endeavor is to engage middle school students in a wide array of critical thinking tasks and hands-on activities centered on science and technology. The four-day camp rotated through many STEM modules, including optics, telescopes, computer hardware, and programming. We are striving to increase each student's exposure to the idea of college and potential STEM careers. This poster details the efforts of Regis University faculty and students to engage middle school students, particularly those underserved in our local community, in a diverse science and technology summer camp. In particular, we will discuss our efforts to connect the learning outcomes common across all the modules, specifically astronomy and physics, in support of specific state science standards and the Next Generation Science Standards.

Outcomes:
- Identify institutional support (infrastructure and faculty teachers) and sources of external funding needed to start a summer camp at one's institution;
- Obtain a sample schedule of science and compute science modules presented in this camp;
- Examine the content of the modules;
- Learn how to integrate college teaching assistants and use previous campers as mentors;
- Imagine how to scaffold camp activities to reach desired learning goals in support of a given science standard.

Conference Thread: Using Authentic Science and Citizen Science

CS49 Small Bodies, Big Concepts

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Small Bodies, Big Concepts is a professional development model that marries the tenets of effective science instruction with small bodies missions.

Outcomes: Join us for lessons learned — participants will learn how to make their teacher workshops more effective.

Conference Thread: Using Authentic Science and Citizen Science

CS50 Frontier Fields: A Cost-Effective Approach to Bringing Authentic Science to the Education Community

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For over two decades, the Hubble E/PO program has sought to bring the wonders of the universe to the education community and the public, and engage audiences in the adventure of scientific discovery. Program components include standards-based curriculum-support materials, exhibits and exhibit components, and professional development workshops. The main underpinnings of the program's infrastructure are scientist-educator development teams, partnerships, and an embedded program evaluation component. The Space Telescope Science Institute's Office of Public Outreach is leveraging this existing infrastructure to bring the Frontier Fields science program to the education community in a cost-effective way. Frontier Fields observations and results have been, and will continue to be, embedded into existing product lines and professional development offerings. We also are leveraging our new social media strategy to bring the science program to the public in the form of an ongoing blog.

Outcomes: 1. This poster will feature the goals and activities of the Frontier Fields E/PO project. 2. Participants will develop an understanding of how to bring authentic science to audiences in a cost-effective way by leveraging existing program infrastructure.

Conference Thread: Using Authentic Science and Citizen Science

CS51 Using Lunar Sample Disks and Resources to Promote Scientific Inquiry

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This poster presentation will illustrate the use of NASA Lunar Sample Disks and resources to promote scientific inquiry and address the Next Generation Science Standards. The poster will present information on the Lunar Sample Disks, housed and managed by the Astromaterials Research and Exploration Science (ARES) Directorate at the NASA Johnson Space Center. The poster will also present information on an inquiry-based planetary sample and impact cratering unit designed to introduce students in grades 4–10 to the significance of studying the rocks, soils, and surfaces of a planetary world. The unit, consisting of many hands-on activities, provides context and background information to enhance the impact of the Lunar Sample Disks.

Outcomes: Participants will take away both pedagogical and scientific knowledge. The resources presented in the poster will enable participants to see how they can utilize actual lunar samples along with hands-on activities to help students gain an understanding of the importance of current and future sample collection. Activities can be used in a formal or informal learning environment and can be extended to promote further investigations of lunar samples, surface features, or comparative planetology.
Conference Thread: Other

OT52  Astronomy Festival on the National Mall, Washington, DC

Donald Lubowich, Hofstra University, donald.lubowich@hofstra.edu

The Astronomy Festival on the National Mall, sponsored by Hofstra University, features telescope viewing of the Sun, planets, stars, and clusters; exhibits; hands-on activities; videos; large outdoor banners/posters; citizen science activities; hand-outs; teacher info; and a chance to meet astronomers. Representatives from some of the nation’s foremost scientific institutions presented exciting demonstrations and activities, and answered questions about careers in science, celestial objects, and the latest astronomical discoveries. Local amateur astronomers set up twenty telescopes on the Mall. Astronomer Caroline Herschel was there (portrayed by K. Lynn King), the first modern female astronomer and the sister of William Herschel. This event started in 2010 with co-sponsorship by the White House Office of Science and Technology Policy, as part of my NASA-funded grant, Music and Astronomy Under the Stars at outdoor concerts (there was a military band concert at the Sylvan Theater). Powerpoint: https://db.tt/cED7h2xe; 3D video (can be turned off in settings): http://www.youtube.com/watch?v=pEm1f7sJqHQ

Outcomes: Thousands of people came to these events including tourists, school children (schools were notified). Many scouts attended (some volunteered to assist) and were provided with information to help them earn their badges, patches, belt loops, and pins. How to solve the many logistic problems will be presented.

Conference Thread: Other

OT53  Beginning Astronomy Lab Tools at the Santa Fe Community College, New Mexico

Bernard Magrath, Santa Fe Community College, bernard.magrath@sfc.edu

The focus of the Santa Fe Community College (SFCC) Beginning Astronomy class is to foster a hands-on attitude toward science and an appreciation of the tremendous skies of New Mexico. To do this, I have selected a modern full-featured textbook (includes planetarium software and an e-text) and a Lab book, written by myself. This lab book features a complete set of lessons that feature the facilities at SFCC (features include an indoor and outdoor planetarium). I do this by using two identical classroom telescopes to observe the Sun, the Moon, and the Planets. I also use a simulated sky, using Planetarium software, or the real sky to point out the bright and colorful night time stars. The class also uses a unique “Sun Calendar” to observe, and mark the position of the setting sun throughout the year. A book has been written, “Beginning Astronomy Lab Exercises for ASTR 111,” that includes all the SFCC facilities and the lessons that are taught.

Outcomes: Participants will be introduced to lessons, and facilities, designed to teach a hands-on attitude with respect to astronomy and science.

Conference Thread: Other

OT54  ESSE: A Collaborative Model Integrating Solar Science & Solar Energy in K12 Professional Development

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Interest in renewable energy increases every year. Utility companies are installing demonstration solar panels at schools; Green Academies are teaching about solar energy and technologies. Students at these schools are already learning about solar energy, and through Energy From the Sun professional development they are also engaging in the rich science coming from NASA Heliophysics. We have conducted teacher workshops using Heliophysics K-12 tools and materials paired with energy resources developed by our partners, WeCare Solar, NEED and SMUD. By their own report, we have very effectively equipped educators with skills, confidence, and competence to teach solar science and solar energy. We will highlight best practices for and lessons learned through integrating solar science and energy, and effective NASA Heliophysics STEM resources for use in solar-oriented classrooms. Our fully-tested, workshop model is ready to expand to the broader E/PO community.

Outcomes: Participants will learn:

• Understand why integrating solar science and solar energy is so effective in K-12;
• Be familiar with effective NASA heliophysics resources to tie to energy topics;
• Be familiar with how to sequence solar science and solar energy activities;
• Be familiar with implementation of Energy From the Sun in classrooms, enrichment programs and after school programming;
• See the value of working with an expanded community of solar educators.

Conference Thread: Other

OT55  NASA Now: Using Data, Planetarium Technology and Youth Development to Connect People to the Universe

Emily Wojcik, Pacific Science Center, ewojcik@paccsc.org
Alice Enevoldsen, Pacific Science Center

Pacific Science Center is entering the last year of a five year grant from NASA. With live presentation at its center, the NASA Now program builds awareness of and excitement for space science, NASA’s mission and associated careers. This is accomplished through a three-strand approach:

• Live, in-person interpretation of cutting edge data inside the Science Center’s planetarium;
• Incorporating these data and new technologies into our outreach to schools and communities;
• An astronomy career pipeline for youth underrepresented in STEM fields, who help create content and activities to be shared with guests.

Through this project, Pacific Science Center is able to combine 21st century technology with human interaction, allowing us to both show and discuss current space science with the public.

Outcomes: Participants will learn:

• How this program helped three separate programs at Pacific Science Center that previously had very little overlap, collaborate successfully while bringing current astronomy research to the public;
• More about each program’s specific projects and lessons learned in order to help participants develop similar projects in the future.
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About the ASP

Astronomy sows the seeds of curiosity and discovery, critical thinking, quantitative fluency, comfort with data, and problem solving. These skills lay the foundation of science, technology, engineering and math (STEM), thus positioning astronomy as the gateway to STEM literacy.

For 125 years, the ASP has served at the forefront of science/STEM education and professional development:

- Our diverse programs empower formal and informal educators across the learning spectrum:
  - More than 2,000 Project ASTRO teacher/astronomer partners around the country have provided science inspiration and education to more than 175,000 classroom students
  - The Astronomy from the Ground Up/Sky Rangers network of museum, nature center and national park educators now numbers more than 1,000 from nearly 500 facilities and sites, incorporating ASP tools and training to introduce thousands to the universe
- Our publications serve professional astronomers and the wider scientific community:
  - PASP has published 941 issues
  - ASP Conference Series has published 486 volumes
- Our outreach to the active amateur community though the Night Sky Network has engaged 2.4 million people to date

Thank you for your support of the ASP by attending our 2014 Annual Meeting!

Combined Federal Campaign

ASP is proud to be a member of the Combined Federal Campaign (CFC) for federal employees (CFC#:10651). Individual CFC gifts to the ASP throughout the year directly support our diverse programs to advance science literacy through astronomy. Please consider this convenient avenue as a way to support the ASP.

Your contribution to the ASP is tax deductible as provided by law.