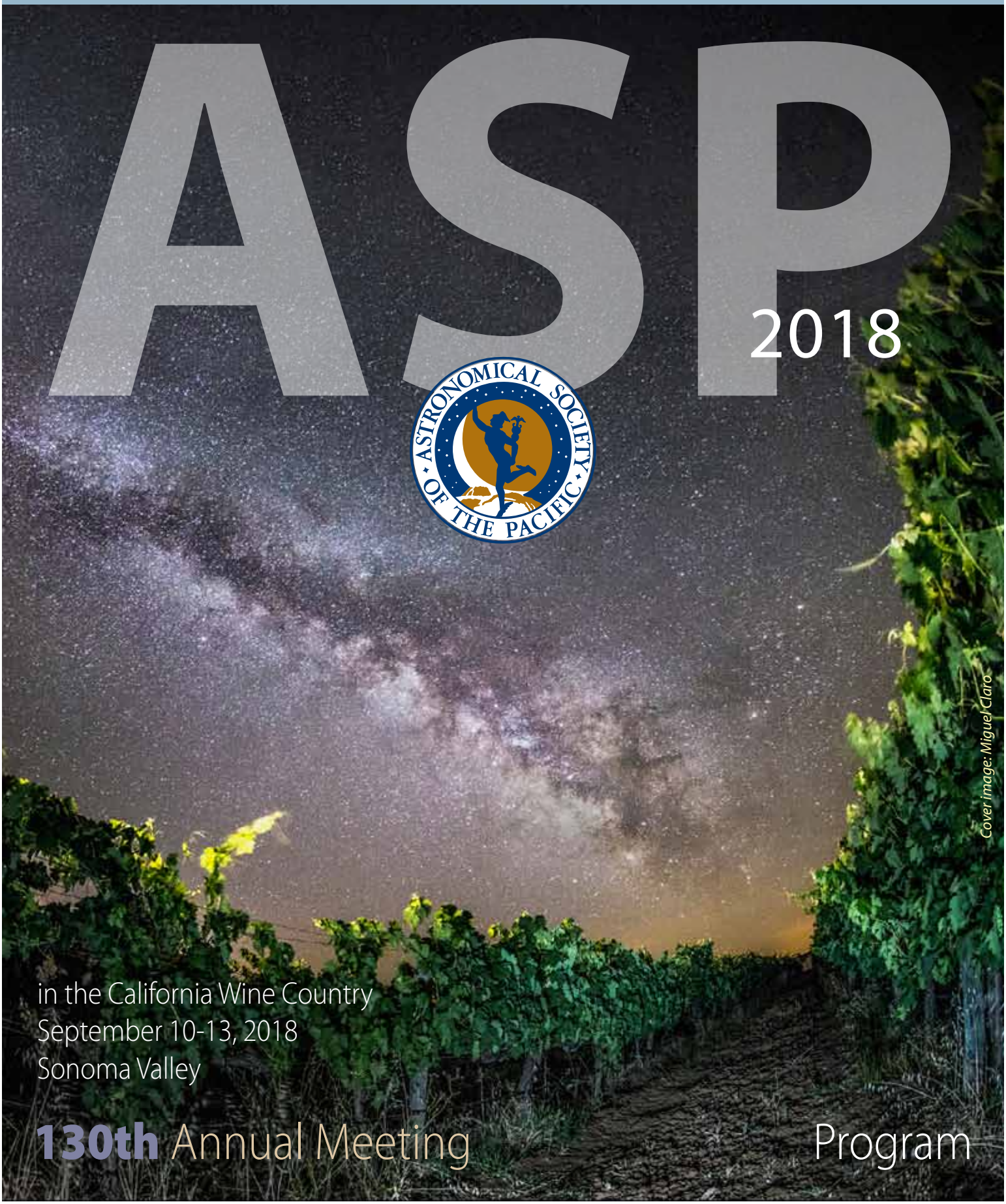
Advancing Astronomy for All

ASP 2018



Cover image: Miguel Claro

in the California Wine Country
September 10-13, 2018
Sonoma Valley

130th Annual Meeting Program

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#ASP2018

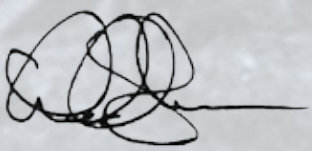
Welcome

Welcome to the Astronomical Society of the Pacific's 130th Annual Meeting, ASP2018:*Advancing Astronomy for All*. Sonoma Valley is our venue this year for many reasons. There is the beautiful scenery, fabulous late summer weather, and proximity to some of the best wine growing regions in the world. But most importantly, we chose this location because this is where a group of intrepid astronomers gathered to witness and photograph the total solar eclipse that passed through northern California on January 1, 1889. The ASP was founded a little over a month later when the group met in San Francisco to share stories, images, and lessons learned – and we have been meeting annually ever since.

You are about to be part of our very long tradition of gathering the astronomy community together to promote science literacy generally. More recently, our meetings have paid particular attention to issues of diversity and inclusion in astronomy. You will notice many of the sessions focus on equity. You'll also find sessions focused on incorporating the arts into astronomy outreach activities and how to user social media and the web to reach new audiences.

As I have encouraged you in previous years, please use this meeting to network and meet new colleagues, learn about the many exciting programs across the country, and discover astronomy education resources to help you plan exciting programs for the audiences you serve. Thank you for making the conference possible through your participation.

I wish you all a productive and inspirational meeting!



Linda Shore
Executive Director
Astronomical Society of the Pacific

Acknowledgements

The ASP thanks the following individuals and institutions for their generous support. Our conference would not be possible without their time and dedication.

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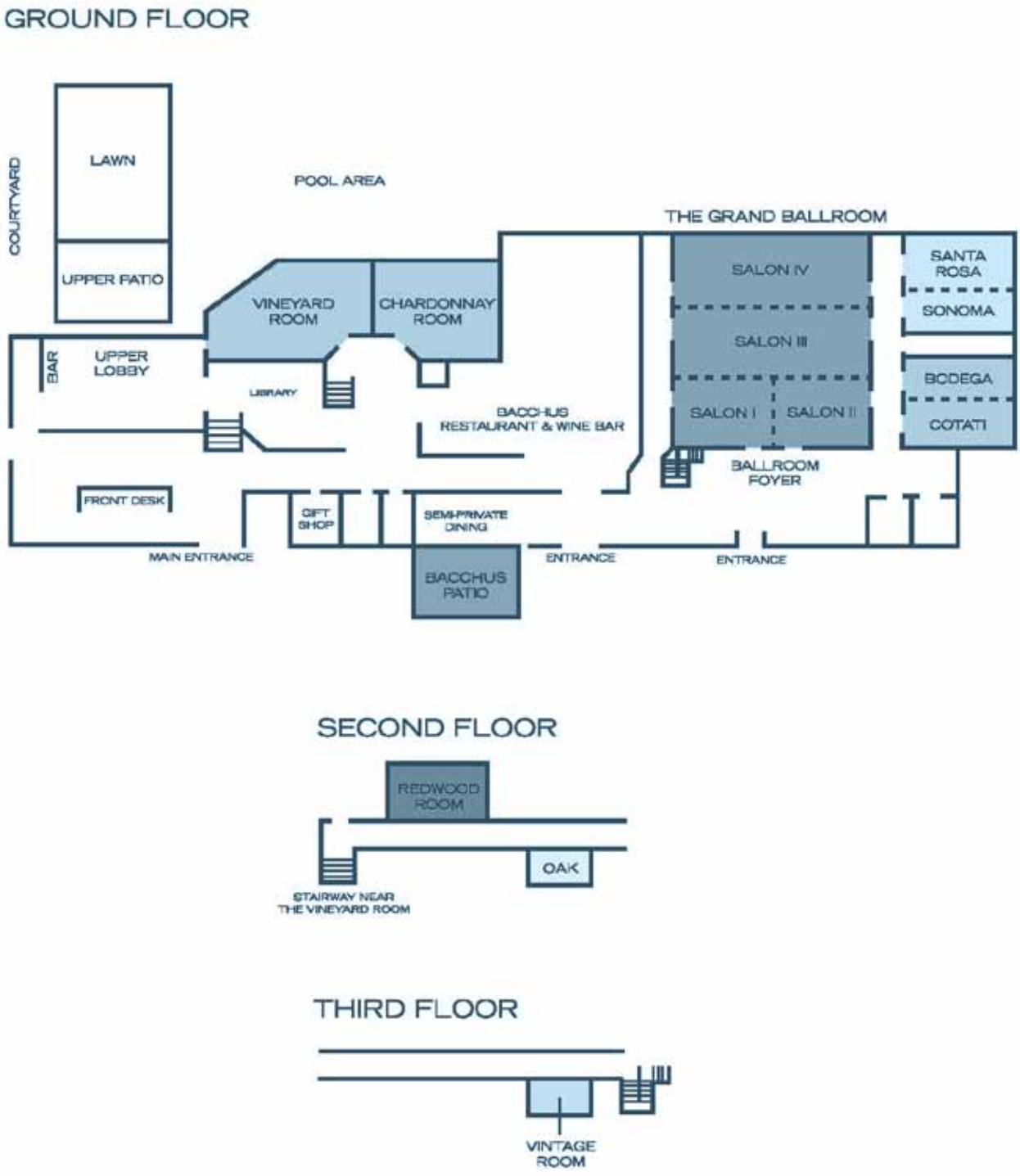
Map

Doubletree by Hilton
Sonoma Wine Country



Monday, September 10, 2018 DETAILED SCHEDULE BY DAY • SESSIONS LISTED BY LEAD PRESENTER

ROOM	SALON IV	SALON I	SALON II	SALON III	COTATI	OTHER
4:00 p.m. Ballroom Foyer						**Meeting Check-In & Badge Pickup**
7:00 p.m. Upper Patio						**Opening Reception**

Tuesday, September 11, 2018 DETAILED SCHEDULE BY DAY • SESSIONS LISTED BY LEAD PRESENTER

ROOM	SALON IV	SALON I	SALON II	SALON III	COTATI	OTHER
7:30 – 8:30 a.m. **Breakfast**		Breakfast Buffet, Coffee & Tea	Breakfast Buffet, Coffee & Tea			
7:30 – 9:30 a.m. Ballroom Foyer						**Posters Set-up** Ballroom Foyer
8:30 – 8:45 a.m. **Welcome**	**Introduction to the Conference** *(Shore/Schultz)*					
8:45 – 9:45 a.m. **Plenary Session 1**	**Karl, Santiago** *Broadening Participation Using Media and Educational Outreach*					
9:45 – 10 a.m. **Transition Break**						
10 – 11 a.m.	**1-minute Poster Previews**					**Posters Session I** Ballroom Foyer (with refreshments)
11 a.m. – 12 p.m. **Plenary Session 2**	**Shore (moderator), Aguilar, Bennett, Dalton, Fraknoi** *Let Their Imaginations Roam: Children's Books in Astronomy*					
12 – 1:30 p.m. **Lunch** (on your own)						**Lunch** (on your own)
1:30 – 2:30 p.m. **Concurrent Session 1** 1-Hour Workshops /SIGs 10-minute orals	10-minute Orals **Nowinski, Herrold, Blanco, Rosano** **Kruse (chair)**	**Hart** *Advancing Your Outreach Ideas: Strategies and Resources*	**Fraknoi** *Using Music Inspired by Astronomy in Education and Outreach*	**Santiago** *The SciGirls Strategies: Encouraging ALL girls in STEM!*		
2:30 – 2:45 p.m. **Transition Break**						
2:45 – 3:45 p.m. **Plenary Session 3**	**Basri, Norman, Rodriguez Wimberly, Rudolph (chair)** *Barriers to Equity, Inclusion, and Diversity in Astronomy*					
3:45 – 4:15 p.m. Ballroom Foyer						**Posters Session II** Ballroom Foyer (with refreshments)
4:15 – 5:15 p.m. **Concurrent Session 2** 1-Hour Workshops/SIGs 10-minute orals	10-minute Orals **Norman, Gurton, Meredith, Krawiec White (chair)**	**Shupla** *Authentic Partnerships for Engaging Diverse Audiences*	**Wenger** *Communicating Astronomy with Online Videos*	**Kruse** *From Pinholes to Space Telescopes*	**Bennett** *Story Time from Space*	
5:15 – 6:00 p.m. **Break before Dinner**						**Break before Dinner**
6:00 p.m. **Dinner**		**Buffet Dinner**	**Buffet Dinner**	**Buffet Dinner**		
8:00 p.m.	**Documentary Feature Film: *Chesley Bonestell: A Brush with the Future***					

Wednesday, September 12, 2018 DETAILED SCHEDULE BY DAY • SESSIONS LISTED BY LEAD PRESENTER

ROOM	SALON IV	SALON I	SALON II	SALON III	COTATI	OTHER
7:30 a.m. **Breakfast**		Breakfast Buffet, Coffee & Tea	Breakfast Buffet, Coffee & Tea			
8:30 – 9:30 a.m. **Plenary Session 4**	**Hodari** *Instantiating Inclusion: Results from STEM Environments in which Women of Color Thrive*					
9:30 – 10 a.m. Ballroom Foyer						**Posters Session III** Ballroom Foyer (with refreshments
10 – 11 a.m. **Concurrent Session 3** 1-Hour/2-Hour Workshops/SIGs 10-minute orals	10-minute Orals **Buxner, Moroney, Peticolas, Montgomery Schultz (chair)**	**Fahy** *Building Community Around Girl Scout Space Science Badges – PART 1*	**Walker** *Enabling Awareness through Environmental Action – PART 1*	**Sparks** *Using Astrophotography In Science Communication*	**Kilburn** *Implicit Bias in Physics as a Barrier in Astronomy*	
11 – 11:15 p.m. **Transition Break**						
11:15 a.m.– 12:15 p.m. **Concurrent Session 4** 1-Hour/2-Hour Workshops/SIGs 10-minute orals	10-minute Orals **Harvey, Harris, Rowbotham, Bakerman Schultz (chair)**	**Fahy** *Building Community Around Girl Scout Space Science Badges – PART 2*	**Walker** *Enabling Awareness through Environmental Action – PART 2*	**Hufnagel** *On-Line Astronomy Education: Projects and Resources*	**Randall** *Match Made In Heaven: Library and Astronomy Club Partnership*	
12:15 – 1:45 p.m. **Boxed Lunch Provided** Foyer						**Boxed Lunch** Foyer
1:45 – 2:45 p.m. **Plenary Session 5**	**Gurton (moderator), Hurst, Blinderman, Schonleber** *Preschool Science: Reaching Our Youngest Astronomers*					
2:45 – 3:15 p.m. Ballroom Foyer						**Posters Session IV** Ballroom Foyer (with refreshments)
3:15 – 4:15 p.m. **Concurrent Session 5** 1-Hour/2-Hour Workshops/SIGs 10-minute orals	10-minute Orals **Harman, Simmons, Ben Freed (chair)**	**Maryboy** *Indigenous Knowledge in 21st Century Science – PART 1*	**Mitchell** *STEM Served Family-Style: Improving Attitudes & Achievement – PART 1*	**Shore** *25 Years of Project ASTRO*	**Udomprasert** *Visualizing Seasons and Moon Phases with WorldWide Telescope*	
4:15 – 4:30 p.m. **Transition Break**						
4:30 – 5:30 p.m. **Concurrent Session 6** 1-Hour/2-Hour Workshops/SIGs	**Schultz** *Saving the Dark: Screening of New Documentary Movie*	**Maryboy** *Indigenous Knowledge in 21st Century Science – PART 2*	**Mitchell** *STEM Served Family-Style: Improving Attitudes & Achievement – PART 2*	**Larson** *Astronomy for the Sight Impaired*	**Lamb** *GAVRT Project: Bringing the Universe to America's Classrooms*	

Thursday September 13, 2018 DETAILED SCHEDULE BY DAY • SESSIONS LISTED BY LEAD PRESENTER

ROOM	SALON IV	SALON I	SALON II	SALON III	COTATI
7:30 – 8:30 a.m. **Breakfast**		Breakfast Buffet, Coffee & Tea	Breakfast Buffet, Coffee & Tea		
8:30 – 9:30 a.m. **Plenary Session 6**	**Freed (moderator), Bentley, Minor, Wyatt** *Communicating Science to Diverse Audiences Through Digital and Social Media Platforms*				
9:30 – 10 a.m. Ballroom Foyer					**Posters Session IV** Ballroom Foyer (with refreshments)
10 – 11:00 a.m. **Concurrent Session 7** 1-Hour/2-Hour Workshops/SIGs 10-minute orals		**Lee** *Our Brains Wired for Storytelling...* *– PART 1*	**Buxner** *Astronomy Education Research: Special Interest Group*	**Bartolone** *Planning for the South American Solar Eclipses*	**Kang** *Combining Hands-On and Virtual for Active Visitor Engagement*
11 – 11:15 a.m. **Transition Break**					
11:15 a.m. – 12:15 p.m. **Concurrent Session 8** 1-Hour/2-Hour Workshops/SIGs 10-minute orals		**Lee** *Our Brains Wired for Storytelling...* *– PART 2*	**White** *Supporting Amateur Astronomers' Engagement in Outreach*	**Enevoldsen** *Lesson Examples about Diversity/ Bias Grades 10 - "14"*	**Perkins** *Sonified Universe: Cosmos' Electroacoustic Ensembles*

Special Events

Monday, September 10

Early Check in

Ballroom Foyer

4:00 – 6:30 p.m

Welcome Reception, meeting check in

Upper Patio

7:00 – 9:00 p.m.

Join us outdoors for an ASP-hosted evening reception with light appetizers and a cash bar to kick off our three-day Annual Meeting. Enjoy the warm weather as you meet new people and see old acquaintances.

Tuesday, September 11

Buffet Dinner & Documentary Feature Film: Chesley Bonestell: A Brush with the Future

Salon I-III, IV

6:00 p.m. Buffet Dinner Salon I, II, III

8:00 p.m. Film showing Salon IV

The ASP dinner includes a special film screening of ***Chesley Bonestell: A Brush with the Future,*** fresh off its debut at the Newport Beach Film Festival, where it sold out and won the Audience Award for Art, Architecture + Design. Recent showings include the International Space Development Conference, Comic-Con International Film Festival, and Worldcon76.

The film celebrates Bonestell's artistry with those who were influenced by or knew Chesley personally, and is punctuated with a rare interview with Chesley himself. This documentary chronicles the extraordinary life of a quiet, artistic visionary, whose beautiful paintings continue to inspire us to reach for the stars.

Meet Guest Host and Filmmaker **Douglass M. Stewart Jr.** after the showing for a short Q&A about making the film.

Special Film-Ticket-Only Fundraiser: Single Day Registrants and the Public are invited to attend the special film screening by purchasing $20 Donation tickets. Limited Seats Available.

Poster Sessions

Tuesday, September 11

Refreshments included

Ballroom Foyer

10:00 – 11:00 a.m.

3:45 – 4:15 p.m.

Wednesday, September 12

Refreshments included

Ballroom Foyer

9:30 -10:00 a.m.

2:45 – 3:15 p.m.

Thursday, September 13

Refreshments included

Ballroom Foyer

9:30 -10:00 a.m.

Plenary Sessions
Tuesday, September 11

8:45 a.m. – 9:45 a.m.

Plenary 1

Broadening Participation Using Media and Educational Outreach

Rita Karl
Alicia Santiago

Rita Karl and Dr. Alicia Santiago, producers of the Emmy Award-winning SciGirls program, will talk about how the multimedia project excites and engages upper-grade and middle-school tweens in STEM. SciGirls is a multiplatform STEM education project produced by Twin Cities PBS (tpt), that combines a PBS television series, digital content on PBS KIDS.org and PBS Learning Media, and direct community outreach to drive STEM curiosity and learning. SciGirls also empowers educators to create a more inclusive and gender-equitable STEM environment that inspires, engages, and retains ALL girls in STEM. Rita and Alicia will also share how SciGirls is reaching and engaging with the Hispanic community. SciGirls is addressing multiple STEM barriers that Hispanic girls face and helping them create positive identities with STEM through media, outreach and role models.


Rita Karl


Alicia Santiago

11:00 a.m. – 12:00 p.m.

Plenary 2

Let Their Imaginations Roam: Children's Books in Astronomy

Linda Shore (moderator)
David Aguilar
Jeffrey Bennett
Angela Dalton
Andrew Fraknoi

Young children are innately fascinated about the natural world, including being curious about the sky above them. Increasingly, museum educators, youth leaders, librarians, and amateur astronomers are seeking materials, activities, and resources to help them reach their very youngest audiences. One way to reach children is through literature, and there are a number of excellent astronomy-focused books currently on the market. In this interactive session, authors of several popular children's astronomy books will share their work. Have you ever wanted to use astronomy storybooks for your outreach efforts and need some good ideas? Have you considered writing children's astronomy books and want to know where to start? Then this session is for you!


Linda Shore


David Aguilar


Jeffrey Bennett


Angela Dalton


Andrew Fraknoi

Plenary Sessions
Tuesday, September 11

2:45 p.m. – 3:45 p.m.

Plenary 3

Barriers to Equity, Inclusion, and Diversity in Astronomy

Alexander Rudolph (moderator)
Gibor Basri
Dara Norman
M. Katy Rodriguez Wimberly

Astronomy, like many other sciences, has struggled to engage and include traditionally underrepresented groups such as underrepresented minorities (URMs), women, members of the LGBTQ+ community, disabled persons, and others. The reasons for this struggle are many and various, but three important, well-known, well-studied issues are: Stereotype Threat, Imposter Syndrome, and Implicit Bias. These issues can arise in a variety of settings: in the classroom, in research settings, in mentor/adviser relations, and in community outreach. This highly interactive session will help participants learn about these three topics and how they manifest themselves in their work engaging various constituencies in appreciating, studying, and practicing astronomy.


Alexander Rudolph


Gibor Basri


Dara Norman


M. Katy Rodriguez Wimberly

Plenary Sessions
Wednesday, September 12

8:30 am – 9:30 a.m.

Plenary 4

Instantiating Inclusion: Results from STEM Environments in which Women of Color Thrive

Apriel Hodari

From a study of out-performing STEM departments in the United States and United Kingdom in which women of color are thriving, I will present common approaches across these departments that promote inclusive environments. My team takes seriously the Advance HE criteria on gender and race, so our findings address inclusivity by class, gender identity, sexual orientation, family structure and family/community culture. I invite you to consider how the practices we've identified might help you address issues of inclusion in your own setting.


Apriel Hodari

Plenary speaker bios found in next section, starting page 12.

Plenary Sessions
Wednesday, September 12

1:45 p.m. – 2:45 p.m.

Plenary 5

Preschool Science: Reaching Our Youngest Astronomers

Suzanne Gurton (moderator)
Ellen Blinderman
Anna Hurst
Nanette Schonleber

Young children are often described as natural scientists, but what can they understand regarding the complex science of astronomy? While preschoolers are not yet capable of intricate reasoning about astrophysics, they are enthusiastic observers of the world around them, such as the changes they see in the day and night sky. How can we build on children's natural curiosity about the Sun, Moon, and stars to promote early engagement in science? Panelists will discuss their work in connecting young children with science, and the joys and challenges of introducing astronomy to this young age group.


Suzanne Gurton


Ellen Blinderman


Anna Hurst


Nanette Schonleber

Plenary speaker bios found in next section, starting page 12.

Plenary Sessions
Thursday, September 13

8:30 am – 9:30 a.m.

Plenary 6

Communicating Science to Diverse Audiences Through Digital and Social Media Platforms

Rachel Freed (moderator)
Molly Bentley
Nicole Minor
Ryan Wyatt

Reaching diverse and global audiences is becoming standard practice in 21st century education, and is therefore a responsibility of the profession. The means to accomplish this are numerous and growing rapidly, and in this session we will hear from speakers who have been pushing the boundaries in communicating cutting-edge astronomy and science to the public world-wide through state-of-the-art technologies and media platforms.

In this session, the panelists will share their programs about incorporating the latest science and astronomical data into engaging videos, radio shows, podcasts and full-dome data-visualization planetarium shows – and how they have been making science accessible to the public through these avenues for many years.


Rachel Freed


Molly Bentley


Nicole Minor


Ryan Wyatt

Plenary Bios

Rita Karl
Plenary 1

An accomplished leader of high profile STEM (Science, Technology, Engineering and Mathematics) media and education initiatives, Rita serves as the Executive Producer of PBS SciGirls and the Senior Managing Director of the STEM Media & Education Department for Twin Cities PBS.

The Emmy award-winning SciGirls program is funded by the National Science Foundation and draws on cutting-edge research about what engages girls in STEM learning and career paths.

The SciGirls television series, website and national outreach initiative reach millions of youth and thousands of educators nationwide. In 2016, *SciGirls Stories: Real Women, Real Jobs,* a series of short films of young women in non-traditional STEM jobs, won a Regional Emmy for best teen show.

Rita previously served as the Director of Education at the Challenger Center for Space Science Education in Washington, D.C., leading STEM education programs for an international network of science centers. Rita led an award-winning USAID team that trained 2,000 Egyptian K-12 educators and administrators in technology-enhanced student-centered instruction, affecting over 25,000 students. Early in her career at the NASA Johnson Space Center, Rita designed and led the NASA award-winning Texas Aerospace Scholars program, now in its eighteenth year, encouraging students to consider engineering careers at NASA.

Alicia Santiago
Plenary 1

Alicia Santiago is a bilingual research scientist and a Diversity Consultant. Alicia has a Ph.D. in cell and developmental biology – specializing in neurodevelopment from the University of California, Davis. Her studies include research into the mechanisms involved in neuronal guidance in the peripheral and visual nervous systems.

Since 2007, Dr. Santiago has been involved in the development and implementation of innovative direct and mass-media science and health education national-level programs for the Latino community. Her expertise also includes professional development on cultural competence to assist science educators in cross-cultural understanding and teaching effectiveness, and translation of scientific and technical language and concepts for professional and lay audiences, including Spanish-speaking Latino audiences.

Dr. Santiago is a Co-Principal Investigator for SciGirls CONNECT2, Latina SciGirls, and SciGirls CONNECT, three Federally-funded media and community-based outreach projects designed to inspire and encourage STEM learning and participation for all girls and develop their interest in STEM careers. She is also a Co-Principal Investigator for BRAINedu/CEREBROedu: A Window into the brain/Una ventana al cerebro, a project funded by the National Institutes of Health (NIH) that provides Hispanic students and families with bilingual resources about brain structure and function, neuroscience careers, and mental health. Alicia was also a Co-Principal Investigator on SciGirls en Español and SciGirls en la Familia.

Alicia lives in the Washington Metro Area and enjoys traveling and beekeeping!

Linda Shore
Plenary 2

Throughout my career, I have been passionate about improving public understanding of science, and most especially astronomy. So I am very proud and honored to serve as the Chief Executive Officer of the Astronomical Society of the Pacific. I am a native San Franciscan who has spent most of my life in the Bay Area. I hold a master's degree in physics and astronomy from San Francisco State University and an Ed D in science education from Boston University. Before coming to the ASP, I was a Staff Scientist and Director of the Teacher Institute at the Exploratorium – San Francisco's renowned science museum. During my 21-year tenure at the Exploratorium, I led the development and implementation of an internationally acclaimed science teacher professional development program, including an innovative beginning science teacher program and a teacher leadership program. I have co-authored several science activity books for children and written numerous popular science articles. I have also conducted research on student astronomy learning, science teacher induction and retention, and gender equity in science. My other passions include writing science fiction short stories, knitting, and spending time with my husband and two rescue greyhounds.

David Aguilar
Plenary 2

David A. Aguilar is the former Director of Science Information and Public Outreach at the Harvard-Smithsonian Center for Astrophysics in Cambridge, MA. In 2015 he joined NASA's New Horizons Mission Special Media Team to publicize the historic Pluto Flyby. In 2018-2019 he re-joined NASA's mission team on the Ultima Thule Kuiper Belt (KBO) Flyby. He is author-illustrator of eight National Geographic and three Random House space science books, including this year's stellar adventure, *7 Wonders of the Solar System,* that details a lively celestial journey through our own solar neighborhood. Upcoming books include: *7 Wonders of the Milky Way,* scheduled for release in December 2018, and *LUNA: The Science and Stories of Our Moon,* in May 2019. He is a frequent onscreen contributor and space artist for the History Channel's *UNIVERSE* series and the Science Channel's NASA's *Unexplained Files.* In 2010 Asteroid 1990DA was named to honor his exceptional work in science education outreach and he is a Grammy-nominated musician. Today he continues with astronomy study tours for Harvard Alumni Travels and Smithsonian Journeys. When not touring, he can be found at his own research observatory just outside Aspen, CO. For more information visit www.aspenskies.com.

Plenary Bios

Jeffrey Bennett

Plenary 2

Jeffrey Bennett, founder of Big Kid Science, received a B.A. in biophysics from UC San Diego and an M.S. and Ph.D. in astrophysics from the University of Colorado (1987). He specializes in science and math education and has taught at every level from preschool through graduate school. Career highlights include serving 2 years as a visiting senior scientist at NASA headquarters, where he developed programs to build stronger links between research and education, and proposing and helping to develop the Voyage scale model solar system on the National Mall (Washington, DC). He is the lead author of bestselling college textbooks in astronomy, astrobiology, mathematics, and statistics, and of critically acclaimed books for the public including *Beyond UFOs, Math for Life, What Is Relativity?, On Teaching Science,* and *A Global Warming Primer*. He is also the author of six science picture books for children, including *Max Goes to the Moon, The Wizard Who Saved the World,* and *I, Humanity,* and creator of the free, Totality app for learning about upcoming solar eclipses. His books have received numerous awards, including the American Institute of Physics Science Communication Award, and all six of his children's books are currently aboard the International Space Station where they have been read aloud by astronauts for NASA's Story Time From Space program.

Jeff lives in Boulder, CO; his personal website is www.jeffreybennett.com.

Angela Dalton

Plenary 2

Angela Dalton was once a producer of online kids' games and other cool things. She likes to think that she chose writing but, the truth is, writing chose her.

She now lives in Oakland, California, where she spends her time looking up to the sky and writing the stories the universe inspires her to share. If You Look Up to the Sky is her first children's book, and her website is http://angeladalton.com/.

Andrew Fraknoi

Plenary 2

Andrew Fraknoi recently retired as the Chair of the Astronomy Department at Foothill College, and now teaches non-credit astronomy courses for seniors at the University of San Francisco and San Francisco State. He served as the Executive Director of the Astronomical Society of the Pacific for 14 years and still assists the Society occasionally with educational programs. While at the Society, he created Project ASTRO and introduced The Universe in the Classroom newsletter for educators. With Sidney Wolff, he was a founding editor of the journal Astronomy Education Review.

Fraknoi appears regularly on local and national radio, explaining astronomical developments in everyday language, and was the California Professor of the Year in 2007. He is the lead author on a free, open-source college astronomy textbook published by the non-profit OpenStax project at Rice University. He has written two children's books and two activity guides for teachers on astronomical topics. He also writes science fiction stories, and has had two of them published in anthologies during the last two years. The International Astronomical Union has named Asteroid 4859 Asteroid Fraknoi to honor his contributions to the public understanding of science.

Alexander Rudolph

Plenary 3

Alexander Rudolph is Professor of Physics and Astronomy at California State Polytechnic University (Cal Poly Pomona). He received his bachelor's degree from Haverford College in 1982, and his Ph.D. in physics from the University of Chicago in 1988. Before joining the faculty at Cal Poly Pomona, he was on the faculty of Harvey Mudd College from 1994-2001. He also spent a year teaching high school science and math.

Professor Rudolph has conducted research with over 20 undergraduates on the properties of outflows from forming stars and circumstellar disks around such stars; the dependence of abundance gradients on galactocentric radius in the Milky Way; searches for Brown Dwarfs; and the properties of HII regions in the outer Galaxy.

He is Director of two NSF-funded programs, CAMPARE and Cal-Bridge, to promote minority and female involvement in research in Astronomy, Planetary Science, and Astrobiology, and to increase their numbers obtaining Ph.D.s in those and other related fields.

- CAMPARE consists of students from 33 community college and California State University (CSU) campuses in California participating in summer research with scientists from 13 world-class research institutions in California and across the country.
- The Cal-Bridge program is a partnership of over 50 faculty from 15 CSU and University of California (UC) campuses forming a CSU-UC PhD Bridge program designed to help qualified minority and female CSU students bridge into UC or other PhD programs in Astronomy, Physics, or related fields.

Professor Rudolph is also involved in research into the effectiveness of interactive learning strategies in general education astronomy (Astro 101) classes, publishing results of his research in numerous journals, including Physics Today. Professor Rudolph has significant K-12 outreach experience, including yearlong partnerships with elementary school teachers (Projects ASTRO, FOSTER); conducting an Astrobiology workshop for elementary school teachers; and promoting interactive learning and the use of clickers at local schools in Pomona, California.

Plenary Bios

Gibor Basri

Plenary 3

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 stepped down in 2015 from 8 years as the founding Vice Chancellor for Equity and Inclusion at UC Berkeley.

Dara Norman

Plenary 3

Dr. Dara Norman is the Deputy Associate Director of the National Optical Astronomy Observatory's Community Science and Data Center in Tucson, AZ. Her research interests include the study of Active Galactic Nuclei and their influence on galaxy evolution.

Dr. Norman is also the AURA Diversity Advocate at NOAO. The duties of this position include creating and advancing opportunities at NOAO/AURA to bring more underrepresented minorities and women into the "astronomy enterprise," which includes research science, engineering, data science, and instrument building. She recently served on the governing board of the American Astronomical Society, where she chaired the taskforce to revise the Society's Ethics Code.

Dr. Norman has been an active member of the AAS's Committee on the Status of Minorities in Astronomy and was chair of the astronomy and astrophysics section of the National Society of Black Physicists. She has participated in numerous public outreach programs including ASP's Project Astro at NOAO and University of Washington, the NSF's Research Experiences for Undergraduates at NOAO and CTIO, and as a speaker for the Astronomy Teen Café at NOAO. In 2009, she attended the first White House Star Party, where she met astronauts Sally Ride and Mae Jamison, and showed the President and first family Jupiter and its moons through a small telescope.

Dr. Norman holds M.S. and Ph.D. degrees in Astronomy from the University of Washington and a B.S. in Earth, Atmospheric and Planetary Science from the Massachusettes Institute of Technology.

M. Katy Rodriguez Wimberly

Plenary 3

M. Katy Rodriguez Wimberly is a graduate student at University of California, Irvine (UCI) in their Physics & Astronomy Department. She is a National Science Foundation Graduate Research Fellow and the first Junior Board Fellow of the Astronomical Society of the Pacific. She earned her Bachelor's of Science degree, with a math minor, from California State University, Long Beach in May 2015.

At UCI she is working with Prof. Michael Cooper on galaxy evolution research, which studies the coming together of satellite galaxies onto massive clusters of galaxies by comparing large cosmological simulations to observational data. Katy's research interests lie in galaxy evolution and observational cosmology.

Additionally, she loves and conducts astronomy outreach with underrepresented minorities, focusing primarily on K-12 Special Needs students (including children on the Autism Spectrum and those with Down Syndrome.)

Apriel Hodari

Plenary 4

Dr. Apriel Hodari, is a recognized expert in science, technology, engineering and mathematics (STEM) education research; STEM educational equity and workforce diversity; and the culture of STEM disciplines. Currently a Principal Investigator at Eureka Scientific, her current research includes conducting critical ethnographies of programs that have an established record of promoting success for women of color in STEM.

Apriel earned a BS in Electrical Engineering from Purdue University and a MS and PhD in Physics from Hampton University, where she was the first African-American woman to receive a PhD in Physics from the university. After completing her PhD, she joined the Physics Education Research Group at the University of Maryland as a National Science Foundation Postdoctoral Fellow, focusing on undergraduate physics learning at historically black colleges and universities and at women's colleges. From 2000-2001, Apriel served as an American Association for the Advancement of Science (AAAS) Congressional Science Fellow, managing a portfolio of issues including education, health care disparities and science research funding. She also worked in the Public Research Division of the Center for Naval Analysis.

Apriel was Co-Leader of the US Delegations to the Second and Fourth International Union of Pure and Applied Physics Conferences on Women in Physics. She serves on the AAAS Science & Technology Fellowship Advisory Committee and previously served as a member of the American Physical Society's Committee on the Status of Women in Physics.

Congratulations to Dr. Apriel Hodari, Purdue-Alpha alumna, a Distinguished Alumnae Award recipient.

Plenary Bios

Suzanne Gurton

Plenary 5

Suzanne Gurton now heads the education and public outreach efforts at the National Radio Astronomy Observatory. Since the reorganization of NRAO by NSF, it lost the majority of STEM/STEAM programs because they are at Green Bank Observatory. It is an exciting challenge to gradually grow a new set of programs in New Mexico and Virginia. Starting from scratch with limited resources, they chose to be strategic in their efforts to connect to the diversity pipeline that NRAO's Office of Diversity and Inclusion has been creating for university students. Her previous 16 years were as an educator and manager of educational programs at the Astronomical Society of the Pacific. During that time, she was a part of programs that expanded Project ASTRO to Family ASTRO, Astronomy from the Ground Up professional development for museum educators to be inclusive of park rangers, and managed the establishment of the NASA Night Sky Network. The last program that she was a PI for before leaving the ASP was the My Sky Tonight NSF-funded program to develop activities to encourage the practices of science in preschoolers. It filled a gap in the ASP portfolio and has been a grand adventure to learn from the partners that made this a wonderfully successful program.

Ellen Blinderman

Plenary 5

Ellen Blinderman is a Child Development instructor at Los Medanos College in Pittsburg, CA, and is the former director of early childhood programs at UC Berkeley's Lawrence Hall of Science. She has shared her passion for science exploration and discovery with young children and their families for over 25 years. She has contributed to a number of early childhood STEM curriculum projects and led extensive professional development for early childhood professionals to help them build confidence and enthusiasm for early science and math.

Anna Hurst

Plenary 5

Anna Hurst is the Director of Museum, Park, and Library Programs at the Astronomical Society of the Pacific. She has worked at the ASP since 2005, creating professional development and hands-on educational materials for museum educators and park rangers.

Since 2012, Anna has been the lead educator on the ASP's My Sky Tonight program, bringing the excitement of astronomy to pre-K children and their families at museums across the U.S.

Nanette Schonleber

Plenary 5

Dr. Nanette (Sheri) Schonleber is a professor in the Early Childhood Studies department at Sonoma State University. She received her Ph.D. in Educational Psychology from the University of Hawai`i at Manoa. Her Master's in Education with an early childhood emphasis is from Chaminade University of Honolulu. Her doctoral dissertation won the award for Outstanding Dissertation by the American Montessori Society in 2006.

Her research interests include the intersection and role of language and culture in the development of complex thinking and development in young children. She is also interested investigating how exposure to the natural world changes children's stress levels and academic achievement.

Rachel Freed

Plenary 6

Rachel Freed is a co-founder of the Institute for Student Astronomical Research (InStAR), as well as a seminar instructor, with a mission to incorporate true scientific research into secondary and undergraduate education. She is also a faculty lecturer in the School of Education at Sonoma State University and on the Science Organizing Committee for the annual conference on Robotic Telescopes, Student Research, and Education (RTSRE).

After earning a degree in Biology from UC Davis, she went on to earn a M.S. in Neuroscience from Northwestern University. Rachel then taught high school chemistry and astronomy over the course of the next 15 years, during which time she conducted research on chemistry education, helping to design, build, and evaluate an online formative assessment system for high school chemistry. She is involved in curriculum design and implementation, and trains educators in the use of technology as a vehicle for change in education.

Rachel has been an amateur astronomer for over 15 years and is involved in public outreach bringing astronomy and spectroscopy to the general public. She is a public speaker with a focus on bringing telescopes to students around the globe. Her degrees in biology and neuroscience help to inform Rachel's work in development of educational tools and curricula as well as outreach programs and teacher training.

Molly Bentley

Plenary 6

Molly is the co-host and oversees the production of Big Picture Science. She's worked in public radio for 20 years, half of that as a science journalist with BBC Science Radio, including World Service, Radio 4, and Science/Nature Online. She has also written for *New Scientist*. For ten years, she taught

Plenary Bios

a course on writing for radio and producing podcasts at the University of California, Santa Cruz, Science Writing Program.

She's been an invited participant to a number of workshops about helping scientists communicate more effectively with science journalists, including: the Aldo Leopold Leadership Program, Switzer Environmental Fellowship workshop, and the Scripps Institution of Oceanography Science Communication Workshop, sponsored by the Metcalf Institute and funded in part by the National Science Foundation.

She has attended two of M.I.T.'s Knight Science Journalism workshops. Her radio career began when she wandered into Wisconsin Public Radio one day and landed a job answering the phones for the early-morning call-in show, then graduated on to assistant producer of the national radio magazine, *To the Best of Our Knowledge*.

Nicole Minor

Plenary 6

Nicole Minor is the director of Moving Images(M.I.), a group of media content creators at the Exploratorium. M.I. produces video, live webcasts, art installations, podcasts, music compositions, and other content for both the Exploratorium website and the museum floor, much of which you can see on their media portal. While guiding live programming and projects in astronomy, physics, environmental education, and more, Nicole is also interested in ways that science, art, and human perception overlap and manifest in public spaces and online.

Nicole has served on film juries for the San Francisco International Film Festival, participated on panels related to media and the web, and guest taught classes for local universities such as the University of San Francisco and the San Francisco Art Institute. She was a co-P.I. on a recent grant with NASA education to cover the solar eclipses in 2016 and 2017, and worked on a recent project with Jet Propulsion Laboratory.

Ryan Wyatt

Plenary 6

Ryan Wyatt is Senior Director of Morrison Planetarium and Science Visualization at the California Academy of Sciences in San Francisco. Wyatt oversees a team that creates visualization-based content for planetariums, exhibits, and online resources. He wrote and directed the Academy's six award-winning planetarium shows, using real data and immersive technology to transform how audiences experience current science. Previously, Wyatt was Science Visualizer at the American Museum of Natural History in New York City. Wyatt is a founding director of Immersive Media Entertainment, Research, Science & Arts (IMERSA), a professional organization advancing the art and technology of immersive digital experiences, he is actively involved with the International Planetarium Society's "Data to Dome" initiative, and he currently co-chairs the Gordon Research Conference on Visualization in Science and Education.

Concurrent Sessions
Tuesday, September 11

Time: 1:30–2:30 p.m.

10-Minute Oral Presentations — Salon IV

Session Chair: **Brian Kruse**

Slack and Stone Edge Observatory—Where Astronomy Happens

Matt Nowinski
Stone Edge Observatory
mcnowinski@gmail.com

Amanda Pagul
Stone Edge Observatory
amendochka@gmail.com

Kate Meredith
Yerkes Observatory
kate8meredith@gmail.com

Remotely-controlled telescopes have significantly enhanced our ability to expose students to observational astronomy. However, with the freedom to reach students around the world comes the challenge of effectively organizing an educational program in which students and teachers are separated geographically and by time zone. The Stone Edge Observatory has successfully employed Slack, a cloud-based collaboration tool, to meet this challenge. Using Slack, students and educators across the globe can exchange ideas, plan activities, and access the telescope to perform astronomical observations.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities Out of School Learning for Children

Exploring Big Data with the Large Synoptic Survey Telescope

Ardis Herrold
Large Synoptic Survey Telescope
aherrold@lsst.org

The Education and Public Outreach Team is developing investigations that will enable users to explore data from the Large Synoptic Survey Telescope (LSST). The topics cover common introductory astronomy concepts that best align with LSST science domains.

Online notebooks will make large data sets easily available to students. Interactive widgets within the notebooks will be used to query and explore data, eliminating the need to download and maintain files and software. This will shorten the time needed to conduct investigations and will shift emphasis to understanding the science.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Professional Development Programs Curriculum Development

Lessons Learned from Teaching Astronomy with Virtual Reality

Philip Blanco
Grossmont College
philip.blanco@gcccd.edu

Gur Windmiller
San Diego State University
ortica3@gmail.com

William Welsh
San Diego State University
wwelsh@sdsu.edu

We report on the initial phase of an ongoing, multi-stage investigation of how to incorporate Virtual Reality (VR) technology in teaching introductory astronomy concepts. Our goal was to compare the efficacy of VR vs. conventional teaching methods in one specific topic - Moon phases and eclipses.

An ASTRO-101 cohort was separated into 3 groups: traditional lecture, "hands-on" activity, or individual VR experience. All students were tested prior and post lesson. While preliminary, our results can serve as a useful guide to expanding the role of VR in the astronomy classroom.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Education Research and Evaluation Studies Curriculum Development

Time: 1:30–2:30 p.m. (cont.)

Using Google Hangouts to Connect to Students

Ron Rosano
Galactic Unite
ron@rosano.com

Since 2013, longtime ASP Project Astro participant Ron Rosano has organized 200+ video sessions with over 350 classes on behalf of Virgin Galactic, with whom he will take a suborbital flight into space. Connecting VG staff with students in class period-long Q&A sessions ("virtual field trips") has been valuable and enriching for all involved. Ron will discuss methods for reaching teachers, technical considerations, and best practices for organizations to reach classrooms.

Strand:	Science Communication
Audiences:	K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities Social Media and Traditional Media

Special Interest Group (SIG) Discussion — Salon I

Advancing Your Outreach Ideas: Strategies and Resources

Quyen Hart
Regis University
qhart@regis.edu

Sanlyn Buxner
Planetary Science Institute
buxner@psi.edu

Greg Schultz
Astronomical Society of the Pacific
gschultz@astrosociety.org

Do you have an outreach event or program that you want to start at your home institution? Are you trying to figure out how to advance your idea, especially if your full-time duties are not focused on outreach? This special interest group is for those who have successfully started a program at the university level or in collaboration with other astronomy groups and for those who want to learn how to make their outreach ideas reality. We will discuss institutional challenges and solutions, brainstorm ideas to move your project forward, and identify resources to support your program.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students Other
Strategies/Practices:	Professional Development Programs

Hands-on Workshop — Salon II

Using Music Inspired by Astronomy in Education and Outreach:

Andrew Fraknoi
University of San Francisco Fromm Institute
fraknoiandrew@fhda.edu

I've collected 250+ examples of music seriously influenced by astronomical ideas. Newly discovered pieces include: an opera about Galileo, a pop song whose video is about going to a star party, "The Hubble Cantata," and a piano piece that uses "sonification" of supernova data.

These days almost all the pieces are available free on YouTube or other web channels. I will sample music that is most useful for astronomy education and outreach. Participants will get a link to where all the pieces are listed and explained (with URLs.) Bring you own examples of astronomical music and share them.

Strand:	Science Communication
Audiences:	Higher Education: Instructors and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Social Media and Traditional Media Professional Development Programs

Hands-on Workshop — Salon III

The SciGirls Strategies: Encouraging ALL Girls in STEM!

Alicia Santiago
Twin Cities PBS
santiago554@gmail.com

Rita Karl
Twin Cities PBS
rkarl@tpt.org

The SciGirls Strategies are a set of research-based strategies for engaging middle-school girls in STEM. They are designed to develop confidence

and persistence, and to motivate girls towards developing a STEM identity during a crucial time in their academic and personal growth. In this session,you will learn about the latest research on gender equity and culturally responsive education for exciting and engaging ALL girls in STEM, engage in a hands-on activity that illustrates the SciGirls Strategies; and discover online resources that enhance teaching and learning experiences for all kids.

Strand:	Science Education
Audiences:	K-12: Teachers and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities Out of School Learning for Children

Time: 4:15–5:15 P.M.

10-Minute Oral Presentations — Salon IV

Session Chair: **Vivian White**

Can Big Data Lead an Inclusion Revolution?

Dara Norman
NOAO
dnorman@noao.edu

There are 2 trends taking place in astronomy right now: 1) ground-based astronomy research is evolving into an era of large surveys and big datasets and 2) the recognition that our field must evolve to be more diverse and inclusive in order to realize the best science.

In this talk, I will show that the move toward large surveys and big datasets is an opportunity for a research 'Inclusion Revolution' by providing data and data products for use by ALL members of the science community. I will describe programs at NOAO to support broad use of current data holdings and near-term public surveys.

Strand:	Diversity In Science
Audiences:	Higher Education: Instructors and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities

Bringing Diversity to the STEM Career Pipeline at NRAO

Suzanne Gurton
NRAO
sgurton@nrao.edu

Lyndele von Schill
NRAO
lvonschi@nrao.edu

Jessica Harris
NRAO
jharris@nrao.edu

NRAO is committed to recruiting and hiring a diverse workforce, but stats show underrepresented minority (URM) students move away from STEM fields as they progress in school. In response, NRAO partnered with a number of HBCUs and the National Society of Black Physicists to create a competitive program designed to support URM students through their undergrad into grad school and/or STEM career. We report on the strategies and successes of the National Astronomy Consortium, now in its sixth year, and on the new EPO programs that will extend the diversity pipeline from high school to postgrad.

Strand:	Diversity In Science
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities

When Diversity is a Necessity - IDATA Undergrad Mentors

Kate Meredith
Yerkes Observatory
kate8meredith@gmail.com

What happens when you immerse a group of blind and low vision and fully sighted undergraduates in a vibrant astronomy and STEM education setting for a seven- week summer experience? The original goal of the 2017 summer program was to teach this group everything they would need to know to become role models and mentors for an NSF project called Innovators Developing Accessible Tools for Astronomy (IDATA). What happened was so much deeper than the original intent that IDATA decided to take a second look in what might well be the final summer of operation for the historic Yerkes Observatory.

Strand:	Diversity In Science
Audiences:	Higher Education: Instructors and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities

Time: 4:15–5:15 P.M. (cont.)

Astrophysicists' Attitudes Towards Outreach: A Case Study

Christina Krawiec
University of Pennsylvania
ckrawiec@sas.upenn.edu

Arya Farahi
University of Michigan
aryaf@umich.edu

Andres Plazas
Jet Propulsion Laboratory & Astronomical Society of the Pacific
plazasmalagon@gmail.com

Rachel Wolf
Stanford University
rcwolf@stanford.edu

Ravi Gupta
Lawrence Berkeley National Laboratory
raviryan@gmail.com)

I will present a case study of physicists' and astronomers' attitudes towards education and public outreach (EPO) using 131 survey responses from members of the Dark Energy Survey. In the study, we find a disparity between the types of EPO activities scientists deem valuable and those in which they participate. Most respondents are motivated to engage in EPO by a desire to educate the public. Lack of time and perceived cultural stigma are the main deterrents. We explore the value of centralized EPO efforts and conclude with recommendations for increasing scientists' engagement.

Strand:	Science Communication
Audiences:	Education Research and Evaluation Studies Professional Development Programs

Special Interest Group (SIG) Discussion — Salon I

Authentic Partnerships for Engaging Diverse Audiences

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

Laura Peticolas
Sonoma State University
laurap@universe.sonoma.edu

Edgard Rivera-Valentin
Lunar and Planetary Institute/
Rivera-Valentin@lpi.usra.edu

Isabel Hawkins
The Exploratorium
ihawkins@exploratorium.edu

Partnerships are often used to expand program reach. However, serving diverse audiences can require deeper authentic partnerships, in which members of the audience participate in co-designing the program. The program objectives need to fit both partners' missions, needs, and schedules. Building these partnerships requires extended time to build understanding and trust. Come hear from panelists about the need for these partnerships and their experiences developing programs with partners.

Strand:	Diversity In Science
Audiences:	Citizen Scientists and Amateur Astronomers Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities

Hands-on Workshop — Salon II

Communicating Astronomy with Online Videos

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

Pamela Gay
Astronomical Society of the Pacific
pamela@astrosociety.org

Online video is an important way to reach modern digitally native audiences to teach them about astronomy. This online video space is both more important, and more competitive than ever. Join us for this workshop where you will learn how to create engaging online videos, and how to use platforms such as YouTube and Twitch to build and maintain an audience. Participants will have the opportunity to apply lessons to their own projects and receive feedback from fellow professionals.

Strand:	Science Communication
Audiences:	Higher Education: Instructors and Students General Public
Strategies/Practices:	Social Media and Traditional Media Other

Hands-on Workshop — Salon III

From Pinholes to Space Telescopes

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

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

Linda Shore
Astronomical Society of the Pacific
lshore@astrosociety.org

David Prosper
Astronomical Society of the Pacific
dprosper@astrosociety.org

Eva Furmanska
Astronomical Society of the Pacific
efurmanska@astrosociety.org

While most people have a basic idea of how optical systems work, they frequently don't consider the importance of the aperture, or how telescopes use lenses and mirrors together to organize light to form images of distant objects. Optical system components are easily investigated with a pinhole viewer and lenses with different focal lengths. An examination of the properties of both light and lenses help in developing a more complete understanding through constructing a physical model.

ASP engaged 250 educators in professional development exploring this phenomena, including the Galileoscope as a system model.

Strand:	Science Education
Audiences:	K-12: Teachers and Students
	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities

Hands-on Workshop — Cotati

Story Time From Space -- Science and Literacy Together

Jeffrey Bennett
Big Kid Science
jeff@bigkidscience.com

IMAGINE astronauts on the International Space Station reading science-inspired stories to the children of Earth, in an exciting new program that combines literacy and science education. IMAGINE videos of the readings, along with demos to illuminate key science concepts, all online for easy access. Now, imagine no more, because it is already happening. Come hear the author of 6 books selected for the program discuss how you can use this fantastic and free resource in your classroom. Suitable for all teaching levels.

Strand:	Science Education
Audiences:	K-12: Teachers and Students
	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities Curriculum Development

Concurrent Sessions
Wednesday, September 12

Time: 10:00–11:00 a.m.

10-Minute Oral Presentations — Salon IV

Session Chair: **Greg Schultz**

MOOC Learners' Motivation and Course Performance

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

Martin Formanek
University of Arizona
martinformanek@email.arizona.edu

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

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

This study reports on learners enrolled in an astronomy cohort-based Massive Open Online Course. Using an existing survey of course motivation, we studied the relationship between learners' intrinsic and extrinsic motivations and course performance including final grades, video usage, and participation in discussion forums and peer grading assignments. Data were collected from over 2,000 participants between 2016 and 2018. The most important motivational factors for finishing the course were self-determination, self-efficacy, and subjective importance of the reputation of the instructor.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students Citizen Scientists and Amateur Astronomers
Strategies/Practices:	Education Research and Evaluation Studies Professional Development Programs

Online Astronomy Lab Courses – Important Basic Elements

Sean Moroney
Windward Community College
moroney@hawaii.edu

Windward Community College now offers an Online Astronomy Laboratory Course. Using proprietary software and animations freely available on the internet, we devised experiments that combined data collection, analysis, and interpretation; scientific rigor is a prerequisite for any experimental design used.

Data sheets and graphs are designed to be downloadable. Lab reports are submitted weekly. Interaction between all course members is encouraged by discussion questions and by online office hours. Success is being measured by surveys and by the fact that the Lab section fills quickly each term.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students Citizen Scientists and Amateur Astronomers
Strategies/Practices:	Confronting Political Challenges to Science and Science Education Engaging with Diverse and Underserved Communities

NASA's Pre-Service Teacher Faculty Support by SSU

Laura Peticolas
Sonoma State University
laurap@universe.sonoma.edu

Lindsay Bartolone
Sonoma State University
lindsayb@universe.sonoma.edu

Lynn Cominsky
Sonoma State University
lynnc@universe.sonoma.edu

NASA's Universe of Learning (UoL) partner Sonoma State University (SSU) supports faculty throughout the California State University System by co-designing unit modules for inclusion in their Science Methods courses for teacher credentialing programs. In Summer of 2018, initial meetings were held to form partnerships and explore resources from UoL and the Alliance for Science Educators (ASET) networked improvement community. Piloting of the modules is expected through the 2018-2019 school year. Preliminary drafts of the modules which incorporate NASA resources will be discussed.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities Professional Development Programs

Time: 10:00–11:00 a.m. (cont.)

Problem Solving - Mice vs. Astronomy Students

Michele Montgomery
UCF
montgomery@physics.ucf.edu

Given a choice at a maze intersection, mice tend to take the path with a guaranteed small morsel of cheese rather than risking an uncertain route. Are the meta-cognitive reasonings of general education undergraduate astronomy students similar? To test this, students are given a visual python numerical coding assignment several weeks prior to assessment. Multiple choice assessment questions include opt-out options, but with assessed penalties. In this work, we present our findings on the meta-reasonings of general education astronomy students in comparison with that of mice.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students
Strategies/Practices:	Education Research and Evaluation Studies

Two-hour Special Session — Salon I

Building Community Around Girl Scout Space Science Badges–Part 1

Jean Fahy
Girl Scouts of Northern California
jfahy@girlscoutsnorcal.org

Jessica Henricks
Girl Scouts of Northern California
jhenricks@girlscoutsnorcal.org

Pamela Harman
SETI Institute
pharman@seti.org

Vivian White and **Theresa Summer,** *Astronomical Society of the Pacific;* **Joanne Berg, Wendy Chin** and **Cole Grissom,** *Girl Scouts of the USA;* **Wendy Friedman,** *Girl Scouts Research Institute;* **Don McCarthy** and **Larry Lebofsky,** *University of Arizona;* **Louis Mayo,** *ARIES Scientific;* **Elspeth Kersh,** *Girl Scouts of Northern California*

New, national Girl Scout space science badges were just released, and the astronomy community will be a vital part of their success! These badges, funded by the NASA Science Mission Directorate, encourage Girl Scouts to engage with experts in their community. Discover best practices for working with Girl Scouts and explore the badge content areas.

This interactive session will focus on the new Daisy(K-1), Brownie(2-3), and Junior(4-5) level badges. Whether you're with an astronomy club, planetarium, science center, or university, get ready to welcome young girls into the space science field.

Strand:	Diversity In Science
Audiences:	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc. Other
Strategies/Practices:	Engaging with Diverse and Underserved Communities Out of School Learning for Children

Two-hour Special Session — Salon II

Enabling Awareness through Environmental Action-Part 1

Constance Walker
National Optical Astronomy Observatory
cwalker@noao.edu

Stephen Pompea
National Optical Astronomy Observatory
spompea@noao.edu

The Quality Lighting Teaching Kit was born out of IYL grants from IAU & OSA. The collaborative effort between NOAO, lighting societies & IDA brought the kit to 32 countries. Using problem-based learning, students address 6 real lighting challenges. The activities (in English & Spanish) are optimized for 11-14 year olds. How-To tutorial videos are at www.noao.edu/education/qltkit.php. The kit is being manufactured & distributed worldwide as part of an IAU100 flagship project. A 2- hour workshop would help students become makers of change in reducing light pollution through awareness and action.

Strand:	Science Education
Audiences:	K-12: Teachers and Students
Strategies/Practices:	Professional Development Programs

Special Interest Group (SIG) Discussion — Salon III

Using Astrophotography in Science Communication

Robert Sparks
National Optical Astronomy Observatory
rsparks@noao.edu

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

Advances in technology have made it easier than ever to produce high quality images illustrating astronomical phenomena. These range from cellphones with apps for night sky photography to DLSR tracking mounts allowing for longer exposures of the night sky. This Special Interest Group will discuss how to capture various types of events in the night sky that combine aesthetic appeal while illustrating the science behind astronomical phenomena, the equipment needed to capture these images, and how to distribute the images and information to traditional and social media platforms.

Strand:	Science Communication
Audiences:	Citizen Scientists and Amateur Astronomers Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Social Media and Traditional Media Other

Special Interest Group (SIG) Discussion — Cotati

Implicit Bias in Physics as a Barrier in Astronomy

Micha Kilburn
University of Notre Dame
mkilburn@nd.edu

The lack of diversity in physics is a known problem, and the field suffers from a stronger gender bias than other sciences. Due to physics requirements for astronomy students, and combination of P&A departments, the same implicit bias that prevents non-dominant groups from thriving in physics also creates a barrier for astronomy undergraduate and graduate students. This SIG will discuss published research on implicit bias in multiple contexts (classrooms, graduate recruiting, hiring faculty, and university policies) with respect to how it hinders diversity within the field of astronomy.

Strand:	Diversity In Science
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities Education Research and Evaluation Studies

Time: 11:15 a.m.–12:15 p.m.

Two-hour Special Session — Salon I

Building Community Around Girl Scout Space Science Badges–Part 2

Jean Fahy
Girl Scouts of Northern California
jfahy@girlscoutsnorcal.org

Jessica Henricks
Girl Scouts of Northern California
jhenricks@girlscoutsnorcal.org

Pamela Harman
SETI Institute
pharman@seti.org

Vivian White and **Theresa Summer,** *Astronomical Society of the Pacific;* **Joanne Berg, Wendy Chin** and **Cole Grissom,** *Girl Scouts of the USA;* **Wendy Friedman,** *Girl Scouts Research Institute;* **Don McCarthy** and **Larry Lebofsky,** *University of Arizona;* **Louis Mayo,** *ARIES Scientific;* **Elspeth Kersh,** *Girl Scouts of Northern California*

New, national Girl Scout space science badges were just released, and the astronomy community will be a vital part of their success! These badges, funded by the NASA Science Mission Directorate, encourage Girl Scouts to engage with experts in their community. Discover best practices for working with Girl Scouts and explore the badge content areas. This interactive session will focus on the new Daisy(K-1), Brownie(2-3), and Junior(4-5) level badges. Whether you're with an astronomy club, planetarium, science center, or university, get ready to welcome young girls into the space science field.

Strand:	Diversity In Science
Audiences:	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc. Other
Strategies/Practices:	Engaging with Diverse and Underserved Communities Out of School Learning for Children

Time: 11:15 a.m.–12:15 p.m. (cont.)

Two-hour Special Session — Salon II

Enabling Awareness through Environmental Action–Part 2

Constance Walker
National Optical Astronomy Observatory
cwalker@noao.edu

Stephen Pompea
National Optical Astronomy Observatory
spompea@noao.edu

The Quality Lighting Teaching Kit was born out of IYL grants from IAU & OSA. The collaborative effort between NOAO, lighting societies & IDA brought the kit to 32 countries. Using problem-based learning, students address 6 real lighting challenges. The activities (in English & Spanish) are optimized for 11-14 year olds. How-To tutorial videos are at www.noao.edu/education/qltkit.php. The kit is being manufactured & distributed worldwide as part of an IAU100 flagship project. A 2- hour workshop would help students become makers of change in reducing light pollution through awareness and action.

Strand:	Science Education
Audiences:	K-12: Teachers and Students
Strategies/Practices:	Professional Development Programs

10-Minute Oral Presentations — Salon IV

Session Chair: **Greg Schultz**

Gemini's STEM/Career Awareness Evaluation Pilot Program

Janice Harvey
Gemini Observatory
jharvey@gemini.edu

Gemini Observatory conducted a pilot program to assess the STEM/Astronomy Career Awareness program for local students and teachers. The objectives were to establish a baseline evaluation process that provides actionable data/metrics on changes in awareness, attitudes and perception in a controlled program environment.

The evaluation provided data on pre- and post- surveys from K-12 students and teachers in schools on the Big Island of Hawaii. Included in the pilot program and under the umbrella of the Journey through the Universe program were:

1) Classroom visits
2) Career panels

Strand:	Science Education
Audiences:	K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities

Unveiling of the NRAO RAP Residential Camp

Jessica Harris
National Radio Astronomy Observatory
jharris@nrao.edu

Judy Stanley
National Radio Astronomy Observatory
jstanley@nrao.edu

Suzanne Gurton
National Radio Astronomy Observatory
sgurton@nrao.edu

The National Radio Astronomy Observatory (NRAO) in New Mexico has piloted a one-week residential camp on the campus of New Mexico Tech for rising 9th grade students called the Radio Astronomy and Physics (RAP) camp. This camp provides an opportunity for students to participate in an immersive science research experience. Students also participate in engaging lessons and hands-on activities designed to enhance their knowledge and enthusiasm for physics and radio astronomy. We will report on the development of radio astronomy lessons, best practices, and evaluation report of our 2018 camp.

Strand:	Science Education
Audiences:	K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities

Time: 11:15 a.m. – 12:15 p.m. (cont.)

Promoting Leadership in STEAM Education Outreach Programs

Kara Rowbotham
Yerkes Observatory, Williams Bay High School
krowbotham@williamsbayschool.org

Kate Meredith
Yerkes Observatory
katemeredith@uchicago.edu

Marc Berthoud
Yerkes Observatory
berthoud@yerkes.uchicago.edu

The McQuown Scholars education outreach program at Yerkes Observatory creates STEAM leaders by including students in the design of summer Technology Camps for younger students. Older students focus on a common goal to brainstorm activities, build and test prototypes, and mentor campers as they cooperate to learn technology and leadership skills. Camp students experience unique student-tested STEAM enrichment with student role models who help guide their future as STEAM leaders. We would like to share what we have learned in creating this synergistic learning culture.

Strand:	Science Education
Audiences:	K-12: Teachers and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Out of School Learning for Children

Motivations of Online Astronomy Citizen Scientists

Maya Bakerman
Planetary Science Institute
mbakerman@psi.edu

Sanlyn Buxner
Planetary Science Institute
buxner@psi.edu

Nicole Gugliucci
Saint Anselm College
ngugliucci@Anselm.Edu

Georgia Bracey
Southern Illinois University Edwardsville
gbracey@siue.edu

This study reports findings from interviewing 33 participants who engaged in online astronomy citizen science projects. Participants included individuals from a broad age range and different STEM related and non-STEM related careers. Each person was interviewed about their motivations for participating in citizen science projects, how often and how long they engaged in projects, and other activities that they engaged in. Prominent motivators included an interest in the subject, a desire to give back, wanting to learn about the topic, and wanting to be a part of science.

Strand:	Science Education
Audiences:	Citizen Scientists and Amateur Astronomers
Strategies/Practices:	Social Media and Traditional Media Education Research and Evaluation Studies

Special Interest Group (SIG) Discussion — Salon III

On-Line Astronomy Education: Projects and Resources

Beth Hufnagel
Anne Arundel Community College
hufnagel@comcast.net

Andrew Fraknoi
U. of San Francisco FROMM Program
fraknoiandrew@fhda.edu

Katie Berryhill
Los Medanos College/Solano Community College/Las Positas College
katie.berryhill@gmail.com

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

This 2-hour session would begin with a panel of key people involved in on-line astronomy education, followed by contributed oral papers (and associated poster papers) and then a general discussion. The focus will be a wide range of tools, including on-line textbooks and labs, ancillary resources, educational apps and applets, MOOC's and other on-line course approaches, test-question, short-video, and image banks, course management systems, interdisciplinary resources, and much more. If you are interested in participating, please contact Andrew Fraknoi at: fraknoi@fhda.edu

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students Citizen Scientists and Amateur Astronomers
Strategies/Practices:	Professional Development Programs Curriculum Development

Time: 11:15 a.m.–12:15 p.m. (cont.)

Special Interest Group (SIG) Discussion — Cotati

Match Made In Heaven: Library and Astronomy Club Partnership

Cynthia Randall
Cornerstones of Science
cynthia.randall@cornerstonesofscience.org

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

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

The universe continues to tantalize the public. But who is there to guide them? There are over 300 amateur astronomer-public librarian partnerships across the nation, serving as gatekeepers to help the public decode the science and magic of the cosmos. Results of a recent national survey explore this partnership. Cynthia Randall, Cornerstones of Science, Vivian White and Anna Hurst, Astronomical Society of the Pacific will discuss these findings, provide researchers strategies to reach the public and explore ways to expand the potential of these partnerships to bringing astronomy to all.

Strand:	Science Education
Audiences:	Citizen Scientists and Amateur Astronomers Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities Education Research and Evaluation Studies

Time: 3:15–4:15 p.m.

10-Minute Oral Presentations — Salon IV

Session Chair: **Rachel Freed**

Building Girl Scout Space Science Badges, Bridges, and Teams

Pamela Harman
SETI Institute
pharman@seti.org

Wendy Chin
Girl Scouts USA
wchin@girlscouts.org

Cole Grissom
Girl Scouts USA
CGrissom@girlscouts.org

Wendy Friedman
Girl Scouts Research Institute
WFriedman@girlscouts.org

Jean Fahy, Jessica Henricks, Elspeth Kersh, Theresa Summer, Vivian White, Don McCarthy, Larry Lebofsky, Lou Mayo

Reaching for the Stars: NASA Science for Girls is a NASA SMD funded project. The SETI Institute and Co-Is, ARIES, ASP, U of AZ, Girl Scouts of the USA, GSRI, and GS NorCal, collaborated to develop age-appropriate astronomy activities for Girl Scout badges, enhancing STEM literacy for girls. K-5th grade badges will be released in August 2018, followed by 6th-12th grade badges in 2019. This talk highlights lessons learned as the SMEs and Girl Scout partners worked together via in person road-mapping meetings, and webinars to draft and test space science badges for an out of school environment.

Strand:	Diversity In Science
Audiences:	Citizen Scientists and Amateur Astronomers Other
Strategies/Practices:	Engaging with Diverse and Underserved Communities Out of School Learning for Children

Time: 3:15–4:15 p.m.

Reaching Underserved Communities Worldwide

Mike Simmons
Astronomers Without Borders
mikes@astronomerswithoutborders.org

Astronomers Without Borders serves underserved and isolated schools and the public worldwide by providing astronomy resources for STEM education. Recent examples include telescopes for a STEM education program for girls in Nigeria, and telescopes and other astronomy resources for isolated schools in Puerto Rico. Support augments already existing local programs. Inclusive grassroots astronomy programs provide hope and inspiration through connections to those in other countries. Astronomy for the physically impaired is also a growing area.

Strand:	Diversity In Science
Audiences:	K-12: Teachers and Students Citizen Scientists and Amateur Astronomers
Strategies/Practices:	Engaging with Diverse and Underserved Communities Other

Hawai`i's Journey to the Sun with National Solar Observatory

Tishanna Ben
The National Solar Observatory
tben@nso.edu

Claire Raftery
The National Solar Observatory
craftery@nso.edu

Journey to the Sun (JTTS) is NSO's solar science program developed specifically for Maui County public schools, which include those from rural islands Moloka`i and Lana`i. The program provides solar physics professional development for teachers, solar STEM lessons & activities for students, and an H-alpha solar telescope to schools. JTTS has also partnered with the Hawaiian Immersion program, `O Hina i ka Malama, where Hawaiian culture is the foundation, and students perpetuate Hawaiian practices. Early Hawaiians were astronomers, and we advocate for Hawaiian leaders in solar astronomy.

Strand:	Diversity In Science
Audiences:	K-12: Teachers and Students General Public
Strategies/Practices:	Engaging with Diverse and Underserved Communities Professional Development Programs

Special Interest Group (SIG) Discussion — Salon IV

Saving the Dark: Screening of New Documentary Movie

Greg Schultz
Astronomical Society of the Pacific (ASP)
gschultz@astrosociety.org

Sriram Murali (Filmmaker)
International Dark-Sky Association
savingthedark@gmail.com

Connie Walker
NOAO
cwalker@noao.edu

"Saving the Dark" is a new nonprofit documentary movie on astronomy and light pollution, to be made available online to watch for free. It is about the significance of astronomy and the night sky, and the effects of light pollution on astronomy, human health, wildlife and beyond - and what we can do to fight it.

The movie shows how light pollution costs a lot of money, affects our health, wildlife and environment; shows the work of nonprofits fighting to preserve dark skies; tells what people can do to fight light pollution; and talks to citizens that have successfully handled this issue.

Strand:	Science Communication
Audiences:	Citizen Scientists and Amateur Astronomers General Public
Strategies/Practices:	Confronting Political Challenges to Science and Science Education Social Media and Traditional Media

Two-hour Special Session — Salon I

Indigenous Knowledge in 21st Century Science–Part 1

Nancy Maryboy

Indigenous Education Institute
dilyehe@gmail.com

David Begay
Indigenous Education Institute
dbegay@gmail.com

Ka'iu Kimura
`Imiloa Astronomy Center of Hawai`i
kkimura@imiloahawaii.org

Aparna Venkatesan
University of San Francisco
avenkatesan@usfca.edu

Isabel Hawkins (Exploratorium) and **Kimberly Coble (San Francisco State University)**

It is increasingly evident that there is an interconnection between astronomical scientific & educational activities and Indigenous Knowledge (IK). To be more equitable and inclusive, it is incumbent on the astronomy community to respect, dialog, and partner with Indigenous knowledge holders in scientific and educational endeavors. A panel of astronomers expert in Navajo, Maya, Inka, Hawaiian, Hindu, and western sky traditions will share how the richness of IK can be juxtaposed with western astronomy to enhance science education & research while honoring the integrity of diverse perspectives.

Strand:	Diversity In Science
Audiences:	Higher Education: Instructors and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Confronting Political Challenges to Science and Science Education Engaging with Diverse and Underserved Communities

Two-hour Special Session — Salon II

STEM Served Family-Style: Improving Attitudes & Achievement–Part 1

Sara Mitchell
CRESST/University of Maryland & NASA Goddard
sara.mitchell@nasa.gov

Sarah Eyermann
CRESST/University of Maryland & NASA Goddard
sarah.e.eyermann@nasa.gov

Support STEM success through "family professional development"! Engaging whole families in specially-designed programs forges connections between adults, children, and learning that continue beyond a single event. During our workshop, participants will learn about research and best practices in whole-family learning and how we have incorporated them into our programs. We will engage participants in activities designed to bring the whole family together and discuss effective strategies for working with this audience. This experiential workshop approach to whole-family learning requires 2 hours.

Strand:	Science Education
Audiences:	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc. Other
Strategies/Practices:	Curriculum Development Out of School Learning for Children

Special Interest Group (SIG) Discussion — Salon III

25 Years of Project ASTRO

Linda Shore
Astronomical Society of the Pacific
lshore@astrosociety.org

Donovan Domingue
Georgia College and State University
donovan.domingue@gcsu.edu

Janice Harvey
Gemini Observatory
jharvey@gemini.edu

Robert Sparks
NOAO
rsparks@noao.edu

Karen Schwarz, Brian Kruse

Conceived in 1993, Project ASTRO is one of the oldest science education programs in the country. Since its inception, Project ASTRO has partnered an estimated 3,200 classroom teachers with perhaps 2,500 volunteer astronomers, reaching up to a half million students!

In this panel discussion, find out from current Project ASTRO site leaders about the impact the program has had in their communities, and on their outreach practices. And, how the program has remained relevant after all these years.

Strand:	Science Education
Audiences:	K-12: Teachers and Students
Strategies/Practices:	Citizen Scientists and Amateur Astronomers Professional Development Programs Other

Time: 3:15–4:15 p.m. (cont.)

Hands-on Workshop — Cotati

Visualizing Seasons and Moon Phases with WorldWide Telescope

Patricia Udomprasert
Harvard University
pudompra@cfa.harvard.edu

Harry Houghton
Harvard University
henry.houghton@cfa.harvard.edu

Susan Sunbury
Smithsonian Astrophysical Observatory
ssunbury@cfa.harvard.edu

Julia Plummer
Pennsylvania State University
jdp17@psu.edu

Erika Wright, Alyssa Goodman, Erin Johnson, Helen Zhang, Abha Vaishampayan, Kyungjin Cho

WorldWide Telescope (WWT) is a powerful visualization program that allows users to connect Earth-based and space-based views of the Sun-Earth-Moon system. By blending hands-on physical activities with WWT's virtual models, students can visualize spatially complex concepts like Seasons, Moon phases, and Eclipses. In this workshop, we will demonstrate how WWT and the physical models are used together in our WWT ThinkSpace curriculum, developed with funding from the National Science Foundation. We will also present student learning outcomes based on written assessments and student interviews.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Education Research and Evaluation Studies Curriculum Development

Time: 4:30–5:30 p.m.

Two-hour Special Session — Salon I

Indigenous Knowledge in 21st Century Science–Part 2

Nancy Maryboy

Indigenous Education Institute
dilyehe@gmail.com

David Begay
Indigenous Education Institute
dbegay@gmail.com

Ka'iu Kimura
`Imiloa Astronomy Center of Hawai`i
kkimura@imiloahawaii.org

Aparna Venkatesan
University of San Francisco
avenkatesan@usfca.edu

Isabel Hawkins (Exploratorium) and **Kimberly Coble (San Francisco State University)**

It is increasingly evident that there is an interconnection between astronomical scientific & educational activities and Indigenous Knowledge (IK). To be more equitable and inclusive, it is incumbent on the astronomy community to respect, dialog, and partner with Indigenous knowledge holders in scientific and educational endeavors. A panel of astronomers expert in Navajo, Maya, Inka, Hawaiian, Hindu, and Western sky traditions will share how the richness of IK can be juxtaposed with Western astronomy to enhance science education & research while honoring the integrity of diverse perspectives.

Strand:	Diversity In Science
Audiences:	Higher Education: Instructors and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Confronting Political Challenges to Science and Science Education Engaging with Diverse and Underserved Communities

Time: 4:30–5:30 p.m. (cont.)

Two-hour Special Session — Salon II

STEM Served Family-Style: Improving Attitudes & Achievement–Part 2

Sara Mitchell
CRESST/University of Maryland & NASA Goddard
sara.mitchell@nasa.gov

Sarah Eyermann
CRESST/University of Maryland & NASA Goddard
sarah.e.eyermann@nasa.gov

Support STEM success through "family professional development"! Engaging whole families in specially-designed programs forges connections between adults, children, and learning that continue beyond a single event. During our workshop, participants will learn about research and best practices in whole-family learning and how we have incorporated them into our programs. We will engage participants in activities designed to bring the whole family together and discuss effective strategies for working with this audience. This experiential workshop approach to whole-family learning requires 2 hours.

Strand:	Science Education
Audiences:	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc. Other
Strategies/Practices:	Curriculum Development
	Out of School Learning for Children

Hands-on Workshop — Salon III

Astronomy for the Sight Impaired

Ana Larson
University of Washington
anamunn@uw.edu

Every student should have access to meaningful astronomy curriculum, as an understanding of astronomy is an expectation of national and state standards. Current astronomy tools emphasize visual aids, aids that are generally not accessible to sight-impaired students. We have created and tested on blind students an extensive middle-school curriculum for sight-impaired students, where they develop an intuitive understanding of astronomical scales, stellar life cycles, and composition of planets, stars and galaxies. We will be giving an overview and demonstrations of our work during this workshop.

Strand:	Science Communication
Audiences:	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities

Hands-on Workshop — Cotati

GAVRT Project: Bringing the Universe to America's Classrooms

Lisa Lamb
Lewis Center for Educational Research
llamb@lcer.org

Steven Levin
NASA/JPL
steven.m.levin@jpl.nasa.gov

Shannon McConnell
NASA/JPL
shannon.mcconnell@jpl.nasa.gov

Ryan Dorcey
Lewis Center for Educational Research
rdorcey@lcer.org

The workshop will be facilitated by Dr. Steve Levin, GAVRT Lead Scientist and Juno Project Scientist, and Lisa Lamb, Educator and Lewis Center CEO. Participants will be introduced to hands-on classroom activities and remotely run a live scan on a radio telescope. Once fully trained, GAVRT teachers join a partnership of professional NASA/JPL scientists, educators and engineers to operate one of two radio telescopes within NASA's Deep Space Network to support student participation in the "real science" experience of working within the international radio astronomy community. GAVRT supports NGSS.

Strand:	Science Education
Audiences:	K-12: Teachers and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities

Professional Development Programs

Concurrent Sessions
Thursday, September 13

Time: 10:00–11:00 a.m.

Two-hour Special Session — Salon I

Our Brains Wired for Storytelling...–Part 1

Annette Lee
St. Cloud State University
aslee@stcloudstate.edu

Daniella Scalice
NASA - Education and Communications Lead, NASA Astrobiology Program American Indian/Alaskan Native Working Group Lead, NASA Science Mission Directorate
daniella.m.scalice@nasa.gov

Erin Kraal
Kutztown University
kraal@kutztown.edu

Humans have relied on storytelling as a primary means of communication since our infancy as a species over 30,000 yrs. ago. Native cultures have practiced oral tradition for at least 10,000 years. Medical research has shown that our brains are wired to learn and remember better by stories. With the two-fold goal of (1) attracting and retaining more people, especially underrepresented groups, and (2) improving science communication, three groups have used different approaches and strategies all woven together by the use of the narrative-science storytelling as a powerful tool for communication.

Strand:	Science Communication
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities Curriculum Development

Special Interest Group (SIG) Discussion — Salon II

Astronomy Education Research: Special Interest Group

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

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

Join us for this special interest group to discuss topics related to astronomy education research and evaluation. Topics will include generating a current list of journals, books, reports, and other resources important to the community. We will also share ways to access to literature, places to publish, and resources for conducting research and evaluation in your own educational settings. Network with other professionals who are interested in this topic and share your own knowledge and resources. All information will be compiled and published in the conference proceedings.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Education Research and Evaluation Studies

Special Interest Group (SIG) Discussion — Salon III

Planning for the South American Solar Eclipses

Lindsay Bartolone
Astronomers Without Borders
lindsay@astronomerswithoutborders.org

Mike Simmons
Astronomers Without Borders
mikes@astronomerswithoutborders.org

Looking for partners, fellow grant proposers and suggestions for planning education or outreach in South America as we anticipate the 2019 and 2020 solar eclipses? Let's not lose momentum from conversations at the 2017 ASP meeting. Facilitated by AWB staff, informal conversations will lead to group discussion for next steps around efficient strategies to share these exciting inspirational events. Supporting outreach for annular eclipses worldwide can be discussed as well.

Strand:	Science Communication
Audiences:	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc. General Public
Strategies/Practices:	Engaging with Diverse and Underserved Communities Out of School Learning for Children

Hands-on Workshop — Cotati

Combining Hands-On and Virtual for Active Visitor Engagement

Hannah Kang
California Academy of Sciences - Morrison Planetarium
hkang@calacademy.org

Digital assets allow guests to visualize complex astronomy concepts ranging from exoplanetary life to gravitational waves—concepts that could otherwise prove very challenging for general audiences. Morrison Planetarium educators seek to augment conventional hands-on approaches with visualizations and digital tools. Come try some of our digital enhancements to the widely available NISE (National Institute for STEM Education) activities. We'll also be discussing best practices for connecting digital visualizations with physical demonstrations.

Strand:	Science Communication
Audiences:	K-12: Teachers and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Curriculum Development

Time: 11:15 a.m.–12:15 p.m.

Two-hour Special Session — Salon I

Our Brains Wired for Storytelling...–Part 2

Annette Lee
St. Cloud State University
aslee@stcloudstate.edu

Daniella Scalice
NASA - Education and Communications Lead, NASA Astrobiology Program American Indian/Alaskan Native Working Group Lead, NASA Science Mission Directorate
daniella.m.scalice@nasa.gov

Erin Kraal
Kutztown University
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Humans have relied on storytelling as a primary means of communication since our infancy as a species over 30,000 yrs. ago. Native cultures have practiced oral tradition for at least 10,000 years. Medical research has shown that our brains are wired to learn and remember better by stories. With the two-fold goal of (1) attracting and retaining more people, especially underrepresented groups, and (2) improving science communication, three groups have used different approaches and strategies all woven together by the use of the narrative-science storytelling as a powerful tool for communication.

Strand:	Science Communication
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities Curriculum Development

Special Interest Group (SIG) Discussion — Salon II

Supporting Amateur Astronomers' Engagement in Outreach

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

Elysa Corin
elysa.corin@freechoicelearning.org

Theresa Summer
tsummer@astrosociety.org

Amateur astronomers are a heavily utilized but under-appreciated source of astronomy education in our communities. From star parties to classroom visits, much outreach to the public comes through hobbyists, not scientists or professional educators. These volunteers have the knowledge and enthusiasm, but most are not trained educators. Hear from several projects about amateurs' motivations, audiences, barriers to engaging in outreach, and successful training methods. Session participants will share training ideas and engage in techniques useful for improving hobbyists' outreach.

Strand:	Science Education
Audiences:	Citizen Scientists and Amateur Astronomers Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Education Research and Evaluation Studies Professional Development Programs

Share-a-Thon-type Organized Session — Salon III

Lesson Examples about Diversity/ Bias Grades 10 - "14"

Alice Enevoldsen
South Seattle College
alice.enevoldsen@seattlecolleges.edu

Abigail Daane
abigail.daane@seattlecolleges.edu

How do college faculty integrate an intentional focus on diversity into classrooms and assignments for introductory astro/physics classes? How can informal and K- 12 lessons be adapted to work for introductory college-level classes?

Faculty and educators from a variety of institutions will showcase actual assignments and lessons for grades 10 through early college classes that specifically address the topics of diversity and bias or use active learning techniques to directly work at better serving diverse and underserved student populations. There will be time for collaboration & discussion.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students K-12: Teachers and Students
Strategies/Practices:	Engaging with Diverse and Underserved Communities Curriculum Development

Hands-on Workshop — Cotati

Sonified Universe: Cosmos' Electroacoustic Ensembles

Deborah Kala Perkins
InfinitiEd
starbirthlife@gmail.com

The universe has a soundtrack; space can wabble like a drum. Acoustics adds a sonic composition to our understanding of cosmos. This workshop explores excellent resources for educators at the forefront of sonifying astronomical data to understand, communicate and delve creatively into wonders of our universe at the frontiers of the new field of Acoustic Astronomy. From Kepler's sonified light curves of exoplanets to ALMA's musician's Soundbank; harmonics of the Big Bang, to the bow shock of Earth's magnetic field, and new solar research from blind astronomers, we explore cosmic symphonics.

Strand:	Science Education
Audiences:	K-12: Teachers and Students Citizen Scientists and Amateur Astronomers Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities Social Media and Traditional Media

BAKERMAN

1. Science Gets Twitchy

Maya Bakerman
Planetary Science Institute
mbakerman@psi.edu

Pamela Gay
Astronomical Society of the Pacific
pamela@astrosociety.org

Matt Richardson
Planetary Science Institute
mrichardson@psi.edu

Andrés Alejandro Plazas Malagó
Astronomical Society of the Pacific

Science is finding its way into new corners of the internet thanks to the flexibility of social sharing platforms, and platforms like Twitch are making these incursions interactive thanks to built in tools for chat, polling, and other active learning techniques. This platform also has the potential to be self-funding thanks to a community willing to financially support what they lack through built-in donation mechanisms. In this poster, we review the potential of Twitch for science education, and use the CosmoQuestX platform as an example of building toward success.

Strand: Science Communication

Audiences: General Public

Strategies/Practices: Social Media and Traditional Media

BARTOLONE

2. Results From the AWB Building on the Eclipse Program

Lindsay Bartolone
Astronomers Without Borders
lindsay@astronomerswithoutborders.org

Mike Simmons
Astronomers Without Borders
mikes@astronomerswithoutborders.org

Astronomers Without Borders "Building on the Eclipse Education Program" explored how to impact science identity, attitudes towards STEM and inspire audience to explore careers in STEM. Inspired by the eclipse, educators and scientists were brought together in an online community to support one another in learning about the Sun and light after audiences were inspired by the 2017 Solar Eclipse. The program was rebooted in Spring 2018 and continued to collect and analyze data in an attempt to collect information on audiences for the next US total solar eclipse in 2024.

Strand: Science Education

Audiences: K-12: Teachers and Students
Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.

Strategies/Practices: Professional Development Programs

BUXNER

3. New Practical Research Volumes for Astronomy Education

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

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

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

We present two new volumes for undergraduate and online astronomy teaching. These eBooks will be published through Institute of Physics (IoP) in a new series on Astronomy Education and are based on best practices for teaching and learning drawing from relevant research literature. Each chapter is written by a researcher practitioner with specific recommendations for instructors. Chapter topics include learner centered teaching, active engagement, instructional design, assessment, citizen science, research projects, community college, online tools, social media, adaptive online courses, and other online resources.

Strand: Science Education

Audiences: Higher Education: Instructors and Students

Strategies/Practices: Education Research and Evaluation Studies
Curriculum Development

CHAMBERLAIN

4. Inclusion as a Topic of Investigation in the Classroom

Leslie Chamberlain
The Harpeth Hall School

leslie.chamberlain@harpethhall.org

In the science classroom, we rarely get the opportunity to directly discuss themes of equity and inclusion. However, when this subject matter is used as the topic of investigation, it offers students a chance to refine their investigative design and data analysis skills and push towards stronger analytical thinking. Here, high school students in an advanced physics class were asked to investigate causes of racial disparities in the physics workforce. I will present the motivation, process, and results of this project and share student work.

Strand: Diversity In Science

Audiences: Higher Education: Instructors and Students K-12: Teachers and Students

Strategies/Practices: Curriculum Development

CRAIN

5. Elementary School STEM Projects with Sky Brightness Measures

Eric Craine
STEM Laboratory, Inc/Western Research Company, Inc, Tucson, AZ.
ercraine@wrc-inc.com

Jennifer DeBenedetti
Catalina Foothills School District/The Gregory School, Tucson, AZ
jenniferdebenedetti@gmail.com

Brian Crai
STEM Laboratory, Inc/Western Research Company, Inc.
blcraine@wrc-inc.com

Sky brightness measurements are relevant to STEM projects in elementary school. Temporal variations in sky brightness relate to astronomy, environmental impact studies, and wildlife behavior. We describe sky brightness measurement methodology that has been used in all of these applications and discuss elementary school STEM projects used to address learning goals. We outline possible projects and provide examples of data that can be collected by students. We also discuss how those data can be used to achieve specific STEM learning goals, and how to enable student ownership of the data.

Strand: Science Education

Audiences: K-12: Teachers and Students

Strategies/Practices: Curriculum Development

DEBENEDETTI

6. Strategies for Broadening Learning Goals in STEM Projects

Jennifer DeBenedetti
Catalina Foothills School District/The Gregory School, Tucson, AZ
jenniferdebenedetti@gmail.com

Model rocketry can introduce basic physics, but motors pose risks. An alternative fuel is compressed air. We increase interest using competitions and understanding rocket parameters to reach planetary goals. One innovation is virtual bank accounts for students to "purchase" fuel for trial flights. Students use flight experiences to reach scale orbits laid out on the school grounds. They study various planets, write about motivations for going, and make financial plans to reach them. We describe the program and the advantages of this innovative experience for STEM students.

Strand: Science Education

Audiences: K-12: Teachers and Students

Strategies/Practices: Curriculum Development

EYERMANN

7. A Stellar Approach: Choosing Stars Activities that Fit

Sarah Eyermann
CRESST/University of Maryland & NASA Goddard
Sarah.E.Eyermann@nasa.gov

Sara Mitchell
CRESST/University of Maryland & NASA Goddard
Sara.Mitchell@nasa.gov

Not all students learn in the same way, and not every activity is right for every educational setting. It can be frustrating if the only activities available for a topic don't meet your needs, but sometimes we can approach the same topic in a variety of ways. This poster will highlight examples of activities available about the life cycle of stars - a topic that can be approached through math, arts and crafts, reading and writing, demos, hands-on activities, and kinesthetics. This diversity allows us to reach different learning styles and different ages, finding something for nearly everyone.

Strand: Science Education

Audiences: K-12: Teachers and Students

Strategies/Practices: Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Curriculum Development
Out of School Learning for Children

FRAKNOI

8. In Their Own Words: Collecting ASP Articles by Discoverers

Andrew Fraknoi
San Francisco State U. OLLI
fraknoiandrew@fhda.edu

I am giving a progress report on a new project: an electronic book that collects some of the best articles from the ASP's *Astronomy Beat, Mercury,* and *The Leaflets,* in which astronomer such as Edwin Hubble, Clyde Tombaugh, William Hartmann, John Mather, Frank Drake, and many others describe their astronomical work and discoveries first hand in non-technical language. This is a unique and valuable record, worth preserving. In the process, we will be producing a subject index of the full run of *Mercury* and *Astronomy Beat.*

Strand: Science Education

Audiences: Higher Education: Instructors and Students
General Public

Strategies/Practices: Professional Development Programs
Curriculum Development

HARMAN

9. Engage with Girl Scouts and their Space Science Badges

Pamela Harman
SETI Institute
pharman@seti.org

Wendy Chin
Girl Scouts USA
wchin@girlscouts.org

Cole Grissom
Girl Scouts USA
CGrissom@girlscouts.org

Edna De Vore
SETI Institute
edevore@seti.org

Jean Fahy, Jessica Henricks, Elspeth Kersh, Theresa Summer, Vivian White, Don McCarthy, Larry Lebofsky, Lou Mayo

Reaching for the Stars: NASA Science for Girls is a NASA SMD funded project. The SETI Institute and Co-Is, ARIES, ASP, U of AZ, Girl Scouts of the USA, and GS NorCal, collaborated to develop age-appropriate astronomy activities for Girl Scout badges, enhancing STEM literacy for girls. K-5th grade badges will be released in August 2018, followed by 6th-12th grade badges in 2019. Subject Matter Experts played a significant role in the badge development. This poster highlights learning outcomes, lessons learned, activities, and opportunities for amateur astronomers to engage with Girl Scouts.

Strand: Diversity In Science

Audiences: Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Other

Strategies/Practices: Education Research and Evaluation Studies
Out of School Learning for Children

HART

10. Science Outreach Hosted by Introductory Science Students

Quyen Hart
Regis University
qhart@regis.edu

One goal of many introductory astronomy courses is for students to understand the big ideas in astronomy. Drawing on the idea that we learn best when we teach others, I will describe a unique learning and teaching experience for introductory astronomy students, where they prepare and facilitate hands-on activities for a half-day science open house at a small liberal arts college. In this poster, I will describe the STEM outreach event, project expectations for the students, assessment requirements of the instructor, and share student feedback about their required participation in the event.

Strand: Science Education

Audiences: Higher Education: Instructors and Students

Strategies/Practices: Curriculum Development

HARVEY

11. Journey through the Universe, 14 Years and Counting

Janice Harvey
Gemini Observatory
jharvey@gemini.edu

Journey through the Universe is Gemini Observatory's flagship outreach program that caters to K-12 students on Hawaii Island. Due to the significant outreach and educational resources available to Gemini and the Maunakea Observatories, as well as the ongoing professional relationship with the Hawaii State Department of Education, Gemini recently celebrated the culmination of the 14th year of the Journey program.

Strand: Science Education

Audiences: K-12: Teachers and Students

Strategies/Practices: Engaging with Diverse and Underserved Communities

KILBURN

12. Inclusive K-12 Outreach Using Evidence-Based Interventions

Micha Kilburn
University of Notre Dame
mkilburn@nd.edu

A predominant outreach practice is to provide programs to specific underrepresented groups to increase diversity. However, oftentimes the well-meaning modification involves the identity of participants, but not the content, pace, or environment of the outreach program itself. A plethora of research, from psychology and K-12 STEM education, provides evidenced-based interventions that can increase interest and a sense of belonging for students. I will explain how JINA-CEE uses such research in developing the curriculum and informing other aspects of its nuclear astrophysics outreach programs.

Strand:	Diversity In Science K-12: Teachers and Students
Audiences:	Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities Out of School Learning for Children

LAMB

13. Goldstone Apple Valley Radio Telescope Project

Lisa Lamb
Lewis Center for Educational Research
llamb@lcer.org

Shannon McConnell
NASA/Jet Propulsion Laboratory
shannon.l.mcconnell@jpl.nasa.gov

Steven Levin
NASA/Jet Propulsion Laboratory
steven.levin@jpl.nasa.gov

The Goldstone Apple Valley Radio Telescope Project (GAVRT) is a partnership between NASA, Jet Propulsion Laboratory, and the Lewis Center for Educational Research, a K-12 Charter School in Apple Valley, California. GAVRT trains educators on the basics of radio astronomy, technical topics pertinent to the project's science observation campaigns, and telescope operations. Once trained, educators schedule time on the radio telescope for their class to collect data on a strong radio source. Current sources of study include Jupiter, Black Holes, and SETI. GAVRT is "Real Science, Real Learning."

Strand:	Science Education
Audiences:	K-12: Teachers and Students
Strategies/Practices:	Professional Development Programs Other

LEVINE

14. A Science Attitude Survey (SAS)

Deborah Levine
Anne Arundel Community College
dalevine@aacc.edu

Introductory astronomy is a "terminal" science class-- the majority of students won't take further coursework in science. It is a "last chance" to help students understand what science is and why it matters, with the hope they will go on to support and value science as citizens and members of the voting public. After reviewing existing surveys, I created the SAS based on the TOSRA (Fraser, 1981, Australian Council for Educational Research) as a short pre/post survey to determine student attitude towards science, scientists and funding. I will present the SAS instrument and preliminary results.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students
Strategies/Practices:	Confronting Political Challenges to Science and Science Education Education Research and Evaluation Studies

MONTGOMERY

15. Why So Many Crescents Seen During Partial Solar Eclipses?

Michele Montgomery
UCF
montgomery@physics.ucf.edu

Brian Allen
Renesas Electronics Americ
BrianAllen@intersil.com

Michael Eberly
Raytheon
MikeEberly@Raytheon.com

John Carpenter, Jr.
Renases Electronics America
JohnCarpenter@Intersil.com

During partial eclipses on bright sunny days, hundreds of crescent shapes are seen on bright concrete pavement below leafy green trees. However, before or after the eclipse, hundreds of circular sun shapes are not seen. Why? We suggest the combination of diffraction and the principle of superposition. We use amateur astronomer images taken during peak, and after, partial solar eclipse of 2017 as seen from Morrisville, NC, and from Dallas, TX, to demonstrate this combined effect. We suggest other amateur astronomers followup with similar studies for comparisons.

Strand:	Science Education
Audiences:	Higher Education: Instructors and Students Citizen Scientists and Amateur Astronomers
Strategies/Practices:	Education Research and Evaluation Studies

RUDOLPH

16. Cal-Bridge: Engaging Underrepresented Students in Astronomy

Alexander Rudolph
Cal Poly Pomona
alrudolph@cpp.edu

The Cal-Bridge has the mission of increasing participation of groups traditionally underrepresented in astronomy, through financial support, intensive, joint mentoring by CSU and UC faculty, professional development workshops, and exposure to a wide variety of research opportunities, creating a national impact on their numbers successfully pursuing a PhD in the field. In the first three years, 18 of 20 Cal-Bridge Scholars have begun or will be attending PhD programs in astronomy or physics at top PhD programs nationally. Five (5) of these 20 scholars have won NSF Graduate Research Fellowships.

Strand: Diversity In Science

Audiences: Higher Education: Instructors and Student

Strategies/Practices: Engaging with Diverse and Underserved Communities
Education Research and Evaluation Studies

SANTIAGO

17. Investigating Use of Gender Equitable Teaching Strategies

Alicia Santiago
Twin Cities PBS
santiago554@gmail.com

Rita Karl
Twin Cities PBS
rkarl@tpt.org

The project examines how the gender equitable and culturally responsive strategies currently employed in SciGirls influence girls' STEM identity formation. Findings, in tandem with a literature review, will result in a set of updated strategies. This poster describes the process for conducting the literature review on the most recent research on gender equity in STEM to identify factors that impact the development of girls' positive STEM identities. It also describes instructional themes for building girls' interest and identity in STEM fields, and the steps to update the SciGirls Strategies.

Strand: Science Education

Audiences: K-12: Teachers and Students
Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.

Strategies/Practices: Engaging with Diverse and Underserved Communities
Out of School Learning for Children

SCHULTZ

18. The Silicon Valley Astronomy Lectures: 2 Million Views Plus

Greg Schultz
Astronomical Society of the Pacific
gschultz@astrosociety.org

Andrew Fraknoi
U. of San Francisco FROMM Program
fraknoiandrew@fhda.edu

For 18 years, the Silicon Valley Astronomy Lectures (jointly sponsored by the ASP, the SETI Institute, NASA Ames, and Foothill College) have featured free public talks by noted astronomers, attended by 400 to 900 people each. The professionally recorded and edited lectures are on their own YouTube Channel, where they have garnered more than 2 million views and are a rich resource for students and the public.

Strand: Science Communication

Audiences: General Public

Strategies/Practices: Engaging with Diverse and Underserved Communities

SCHWARZ

19. The Effectiveness of Informal Learning in the Planetarium

Karen Schwarz
West Chester University
kschwarz@wcupa.edu

In an attempt to design more effective planetarium programming, I interviewed 52 elementary students (grades 3-5) about the phases of the Moon. This was done prior to their visit to the planetarium but after all classroom instruction had taken place, and again after their planetarium visit. The planetarium presentation was specifically designed to show students how the phases of the Moon are created from multiple perspectives (Earth view vs. orrery view). Interviews showed that the programming wasn't as effective as hoped. However information was obtained about additional preconceptions.

Strand: Science Education

Audiences: K-12: Teachers and Students

Strategies/Practices: Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Education Research and Evaluation Studies
Out of School Learning for Children

SHORE

20. Proceedings to Celebrate the 2017 Eclipse

Linda Shore
Astronomical Society of the Pacific
lshore@astrosociety.org

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

Joe Jensen
Astronomical Society of the Pacific
jjensen@aspbooks.org

Blaine Haws
Astronomical Society of the Pacific
blaine.haws@gmail.com

Cindy Moody, Jonathan Barnes

We present a new ASP Proceedings volume to celebrate the 2017 Eclipse and share lessons learned to prepare for upcoming eclipses, including the one in Chile in 2019 and the next one in the US in 2024. Contributions include strategies for planning for the eclipse, tips for photographing the eclipse, student projects related to the eclipse, NASA programs, studies of changes in living organisms during the eclipse, descriptions of successful events across the country, and resources for engaging audiences in a variety of settings.

Strand:	Science Communication
Audiences:	Citizen Scientists and Amateur Astronomers General Public
Strategies/Practices:	Social Media and Traditional Media Out of School Learning for Children

SHUPLA

21. Leveraging to Maximize Public Engagement

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

Andrew Shaner
Lunar and Planetary Institute
shaner@lpi.usra.edu

Amanda Smith Hackler
Lunar and Planetary Institute
smithhackler@lpi.usra.edu

The Lunar and Planetary Institute (LPI) conducts various public engagement events, including the Cosmic Exploration public lecture series and Sky Fest events with activities, speakers, and telescope observations. LPI leverages a variety of factors to best meet audience needs, including planetary scientists, upcoming NASA mission and night sky events, partnerships with other organizations, libraries and parks as additional venues for offsite events, and evaluation results. This poster will share the role that these resources play in conducting these events and the impact they've had.

Strand:	Science Communication
Audiences:	Citizen Scientists and Amateur Astronomers Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Education Research and Evaluation Studies Out of School Learning for Children

SPARKS

22. Communicating Light Pollution Awareness with Citizen-Science

Robert T. Sparks
National Optical Astronomy Observatory
rsparks@noao.edu

Constance E. Walker
National Optical Astronomy Observatory
cwalker@noao.edu

Stephen M. Pompea
National Optical Astronomy Observatory
spompea@noao.edu

Globe at Night is an international citizen science campaign encouraging the general public to become more aware of light pollution issues by rating local night sky brightness. Data is easily taken with a smart phone or activity guide in 26 languages. 80 countries have contributed over 180,000 measurements, which have been used in monitoring temporal changes and effects on animals as well as in passing laws. Partnering with Scistarter.com has allowed for projects with the Girl Scouts and school districts. GaN was rated in the top 10 citizen science programs of 2017.

Strand:	Science Communication
Audiences:	K-12: Teachers and Students Citizen Scientists and Amateur Astronomers
Strategies/Practices:	Confronting Political Challenges to Science and Science Education Out of School Learning for Children

SPEAR

23. Authentic Research Pathways with Robotic Telescopes

Gordon Spear
Education and Public Outreach Group, Sonoma State University
spear@sonoma.edu

Mary Dussault
Science Education Dept., Smithsonian Astrophysical **Observatory**
mdussault@cfa.harvard.edu

Universe of Learning Team (NASA)

Sonoma State University and the Smithsonian Astrophysical Observatory have been working together to develop tools and resources for a progression of student and citizen science research projects observing variable objects. These authentic investigations support novice observers in using MicroObservatory Robotic Telescopes to study eclipsing binaries, Cepheids, and Mira variables, and then guide advancing learners in using the Global Telescope Network, and the GORT Robotic Telescope to pursue deeper analysis of more complex systems, including CVs, AGNs, and newly-discovered variable objects.

Strand:	Science Education
Audiences:	K-12: Teachers and Students Citizen Scientists and Amateur Astronomers
Strategies/Practices:	Curriculum Development Out of School Learning for Children

SUMMER

24. Girl Friendly Amateur Astronomy Outreach Skill Development

Theresa Summer
Astronomical Society of the Pacific
tsummer@astrosociety.org

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

Jessica Henricks
Girl Scouts of Norther California
JHenricks@girlscoutsnorcal.org

Pamela Harman
SETI Institute
pharman@seti.org

Jean Fahy, Elspeth Kersh

The ASP is preparing amateur astronomers to welcome Girl Scouts as they complete the new Space Science badges released by Girl Scouts USA in 2018-19. Free in-person workshops and online resources support amateurs' desire to make their outreach more girl-friendly and inclusive. Discover the highlights and challenges encountered in this project, as well as surprising insights from two years of delivering workshops, and upcoming plans.

Strand:	Diversity In Science
Audiences:	Citizen Scientists and Amateur Astronomers Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Engaging with Diverse and Underserved Communities Professional Development Programs

UDOMPRASERT

25. Cultivating Curiosity with Life in the Universe and WWT

Patricia Udomprasert
Harvard University
pudompra@cfa.harvard.edu

Harry Houghton
Harvard University
henry.houghton@cfa.harvard.edu

Susan Sunbury
Smithsonian Astrophysical Observatory
ssunbury@cfa.harvard.edu

Erika Wright
Smithsonian Astrophysical Observatory
erika.wright@cfa.harvard.edu

Alyssa Goodman, Erin Johnson, Allison Bishop

Cultivating Curiosity with Life in the Universe is an informal education curriculum designed for middle school students. It can be used by after school or summer science programs looking to provide an engaging STEM experience. Interactive media called "Tours" are designed in WorldWide Telescope (WWT), to orient students to their place in our Solar System, Milky Way Galaxy, and Universe; teach students how astronomers look for planets around other stars and evaluate whether they might support life; and imagine whether we might be able to communicate with or visit life on other planets.

Strand:	Science Education
Audiences:	K-12: Teachers and Students Informal Audiences at Museums, Parks, Libraries, Afterschool, etc.
Strategies/Practices:	Curriculum Development Out of School Learning for Children

VENTEICHER

26. Rural Poverty and Gender Parity Initiatives at Yerkes

Sheila Venteicher
Yerkes Observatory
sheila.venteicher@starsatyerkes.net

Through strong outreach efforts, Yerkes Observatory has forged alliances with several local school districts and the American Association of University Women to achieve gender parity in STEAM programming at all grade levels. Girls Who Code, McQuown Scholars and Yerkes Astrophysics Academy for Young Scientists summer camps provide unique immersive educational opportunities. The organic, intellectual culture of the observatory and these programs is such that recruitment efforts to engage underserved populations have been led by students, staff, and volunteers all who identify as stakeholders.

Strand: Diversity In Science

Audiences: K-12: Teachers and Students
Citizen Scientists and Amateur Astronomers

Strategies/Practices: Engaging with Diverse and Underserved Communities

WALKER

27. Using Teen Astronomy Cafés to Excite Youth about STEM

Constance Walker
National Optical Astronomy Observatory
cwalker@noao.edu

Stephen Pompea
National Optical Astronomy Observatory
spompea@noao.edu

NOAO EPO designed an outside-of-school program to excite the interest of talented youth to enter STEM disciplines. One Saturday morning a month, high school students interact with expert astronomers who work with large astronomical data sets. The scientists play a key role in increasing student interest in research, showing scientists as people and research as connecting with everyday life. After the astronomer's short presentation, food & discussion, students use the same computer program & data as the scientist. Visit our poster for more details on this & our five high school youth leaders.

Strand: Science Education

Audiences: K-12: Teachers and Students

Strategies/Practices: Out of School Learning for Children

WENGER

28. Teach Astronomy: Online Resources and New Features

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

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

Alexander Danehy
University of Arizona
adanehy@email.arizona.edu

Teach Astronomy is an online resource for astronomy instructors, outreach professionals, and amateur astronomers. Our user-friendly website is designed to encourage astronomy students of all levels to learn and explore. In the last year we have updated back-end services, improved availability, and added functionality. In addition to the updated and free online textbook and wiki-map style concept mapping tools, Teach Astronomy offers a Quiz Tool with real-time feedback and improved searches, including new answers to frequently asked astronomy questions from our students and online users.

Strand: Science Education

Audiences: Higher Education: Instructors and Students
Citizen Scientists and Amateur Astronomers

Strategies/Practices: Other

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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 over 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 nearly 1,000 issues.
- **ASP Conference Series** has published over 500 volumes.

★ Our outreach to the active amateur community though the **Night Sky Network** has engaged over 3 million people to date.

Thank you for your support of the ASP by attending our 2018 Annual Meeting!

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