June 2022 HAD Meeting: Pasadena

Note: Session numbers will be updated when available

The LeRoy E. Doggett Prize Lecture

Tuesday, June 14th; 8:10-9:00 am Convention Center Hall C
Presented by William H. Donahue

The Most Fascinating Piece of Paper in the Universe

Early in the spring of 1602, Johannes Kepler picked up a quill pen, dipped it into brown ink, and wrote out a mathematical analysis of orbital models that would eventually put an end to planetary astronomy as it had been understood for over 1,000 years. At first, he had no idea of the profound implications of his line of thought—he had not even started on a clean sheet of paper. But by the time he had obtained the small but puzzling discrepancy in his results, near the bottom of the back of the sheet, he knew he was on to something really big. Drawing a wavy line around the concluding computations, he sketched out his proposal for eliminating the discrepancy: the orbit of Mars (and by extension, the orbits of all planets) are not circular.

Through analysis of detailed step-by-step photos of the sheet of paper (now in the archives of the St. Petersburg branch of the Russian Academy of Science), the lecture follows the course of Kepler's thought in undermining centuries of astronomical theory. We see his errors and frustrations as well as his analytical brilliance. But most importantly, we get to look over Kepler's shoulder, as it were, to watch as his pen sketches out one of the most significant discoveries of modern science, writing at the actual moment of discovery.

HAD I: Special Session (Interactive Activity): A New Observatory Is Coming to Your Neighborhood

Tuesday, June 14th; 10:00 -11:30 am Sheraton Hotel Cyprus Room
Session Chair: Steven Gullberg

At the end of 2020, a joint committee was created to systematically gather information and study the historical and current encounters between astrophysicists, observatories, local (indigenous) people, and local organizations, especially at observatories built on sacred sites. This is a joint initiative between the IAU, the AAS, and the RAS and it was decided to name it the Sensitive Sites Committee. This presentation introduces the committee, and then lays the foundation for the next interactive activities. Participants will be asked to complete a short survey as we wait for attendees.

xxx.01 Interactive Activity — A New Observatory Is Coming to Your Neighborhood, Part 1: Joint Committee for Culturally Sensitive Sites (CSS) – Welcome; the CSS Mission and its Past, Present, and Future Activities

10:00 Steven Gullberg[1] and Javier Mejuto[2]
[1]University of Oklahoma, Eureka, MO, [2]HAD Affiliate, Tegucigalpa, Honduras

At the end of 2020, a joint committee was created to systematically gather information and study the historical and current encounters between astrophysicists, observatories, local (Indigenous) people, and local organizations, especially at observatories built on sacred sites. This is a joint initiative between the IAU, the AAS, and the RAS and it was decided to name it the Culturally Sensitive Sites Committee. The Sensitive Sites committee brings together members of the American Astronomical Society, the Royal Astronomical Society, and the International Astronomical Union, as well as those in the International Society for Archaeoastronomy and Astronomy in Culture and the Sociedad Interamericana de Astronomia en la Cultura. Committee members largely have astronomy backgrounds but also include anthropologists and other interdisciplinary scientists. A summary of past and future activities, as well as the goals and objectives of the committee will be presented. This presentation both introduces the committee and also lays the foundation for the session's interactive activities to follow.

xxx.02 A New Observatory Is Coming to Your Neighborhood, Part 2: The Enacted Scenario - The Proposed Telescope, The County Planning Office's Response, The Heritage Alliance's Position

10: 20 Jarita Holbrook[1], Danielle Adams[2]

[1]University of Edinburgh, Edinburgh, United Kingdom, [2]Lowell Observatory, Flagstaff, AZ

New observatories, new telescopes, and new instruments are among the many things that make astrophysics cutting edge. What is proposed here is the mythical next big radio telescope (OGRE). This is explored through a hypothetical example enacted by the presentation team. The County Planning Office will present how the nearby town and the county will benefit from the building of the mythical radio telescope. Included will be how many jobs will be created, important for a relatively poor county. This will outline astronomy's position in the matter. After hearing the presentation from the Scientists proposing the telescope and the response of the County Planning Office, next the Heritage Alliance takes the podium. The Heritage Alliance is concerned about the mythical telescope endangering local historical sites and those yet to be discovered. They present their numerous objections to moving forward with this radio telescope project.

xxx.03 A New Observatory Is Coming to Your Neighborhood, Part 3: Group Discussion, Group Voting with 3 Guiding Questions, Report Back

10:40 Saeko Hayashi[1]

[1]National Astronomical Observatory of Japan, Pasadena, CA

As part of this interactive live session, participants will actively engage in a group discussion of the proposed new telescope (OGRE) to be built in "their community." As part of the participatory experience and following preceding sessions that deliver relevant content on the imaginary new telescope, this session will facilitate deeper discussion. Audience members will be divided into groups to discuss the merits of the case. Everyone is encouraged to voice their emotions, concerns, and excitement about the new mythical telescope. Given the previous presentations, are there additional points that should be considered? This discussion is critical to the process so that all stakeholders can be heard. Only by considering all voices can those individuals that hold the power make the most informed and inclusive choices. This session will include discussion leading to a group vote. Here are the relevant ballot questions:

(a) Should OGRE be built (with key reason why or why not)?
(b) Are their other considerations not presented in the scenario that your group has identified as important? If so, what?
(c) Given your decision on OGRE, what compromise offering(s) can be made to those who may be disappointed by what you have decided?

This presentation is part of learning about the complexity of negotiating meanings and ownership of prime observing sites. The discussion and vote are critical to the process so that all stakeholders can be heard. Only by considering all voices can those individuals that hold the power make the most informed and inclusive choices. The vote allows for a clear, measurable summary of opinions. After the voting, each participating group will appoint a spokesperson to present the groups' process and deciding vote. What opinions or insights came forth and was there a group consensus? Did new points and arguments arise? Were there any suggestions going forward?

xxx.04 A New Observatory Is Coming to Your Neighborhood, Part 4: Vote Summary, World Site Concerns with Discussion Among Session Presenters, Audience Comments, Questions, and Answers, Summary and Conclusion

11:00 Annette S. Lee[1,2,3]

[1]Arizona State University, Tempe, AZ, [2]University of Southern Queensland, Toowoomba, Australia, [3]University of California, Santa Cruz, CA

AAS members have been actively engaged in their support of the rights of Indigenous communities as part of expressing their own indigenous identities and making space for other indigenous astrophysicists. Academic communities connected to the University of California and University of Hawaii have expressed their position in an open letter in support of indigenous rights by requesting that these two universities divest from Mauna Kea. Our graduate students have crafted an open letter to the astrophysics community requesting further dialogue with indigenous communities rather than relying upon police and military interventions. Observatories do have programs to facilitate improved relations with local indigenous populations, but the work is ongoing. The AAS, the Royal Astronomical Society and IAU Division C Working Group on Archaeoastronomy and Astronomy in Culture have partnered to create a new initiative focused on culturally sensitive sites.

HAD II: Centennial of an Eclipse: The 1922 Expedition that Clinched the Case for General Relativity

Tuesday, June 14th; 2:00 – 3:30 pm Sheraton Hotel Cyprus Room
Session Chair: Jay Pasachoff

Two years ago, we celebrated (AAS meeting 235 session 001) the centennial of the "Eddington expeditions" whose reports at meetings of the Royal Astronomical Society and the Royal Society in late 1919 brought Einstein's General Theory of the Relativity to the scientific and nonscientific world, and made Einstein a figure not only in science but also in Popular Culture. A Lick Observatory expedition in 1922 led to even better results on the observational agreement with Einstein's theory. We devote this special centennial session to discussing the Lick expedition and the artifacts that survive, to the role of the expedition in scientific history, similar observations made at the 2017 Great American Eclipse and plans for similar eclipse-deflection observations planned for the April 8, 2024, total solar eclipse to be observed, according to the cloudiness statistics available at http://eclipsophile.com probably mostly from Mexico before the eclipse path enters the United States, and also prospectively from U.S. sites.

xxx.01 Centennial of Definitive Verification of Einstein's GR: 1922-2022

2:00 Jay Pasachoff[1]

[1]Williams College, Williamstown, MA

Two years ago, we celebrated (AAS meeting 235 session 001) the centennial of the "Eddington expeditions" whose reports at meetings of the Royal Astronomical Society and the Royal Society in late 1919 brought Einstein's General Theory of the Relativity to the scientific and nonscientific world, and made Einstein a figure not only in science but also in Popular Culture. A Lick Observatory expedition in 1922 led to even better results on the observational agreement with Einstein's theory. We devote this special centennial session to discussing the Lick expedition and the artifacts that survive, to the role of the expedition in scientific history, similar observations made at the 2017 Great American Eclipse and plans for similar eclipse-deflection observations planned for the April 8, 2024, total solar eclipse to be observed probably from Mexico before the eclipse path enters the United States.

xxx.02 Replication in Adversity: The 1922 Eclipse Expedition and its Successors as Case Studies in the Art of Scientific Replication

2:15 Daniel Kennefick[1]

[1]University of Arkansas, Fayetteville, Fayetteville, AR

The eclipse test of general relativity is generally acknowledged as one of the key experiments of the 20th century. It is not surprising therefore that replication of this experiment remained an objective of many astronomers for many decades. Indeed such was the importance of replication in this case that it has been claimed that the Lick Observatory's measurement of 1922 counts as even more important than the famous expeditions of 1919. This talk will chart the course of replications of this experiment in the 20th century. The aims of the expeditions aiming to replicate the experiment changed with time. Up until 1929 the goal was to confirm (or the opposite) the falsification of Newtonian gravity by the original teams of 1919. From 1936 to 1955 the aim was to improve certain technical aspects of the experiment to provide a check on the confirmation of general relativity established (but with caveats) in the previous era. From 1955 to 1970 there may have been a hiatus. In 1970 and 1973 a new era of theory testing dawned with the effort to test the Jordan-Brans-Dicke theory. After 1973 radio astronomers measuring occulting quasars took over the field and there was no longer a need for professional astronomers to mount such expeditions.

xxx.03 A Decade-Long Engagement: Lick Observatory and General Relativity, 1912-1922

2:30 Tony Misch[1]

[1]University of California Observatories, San Jose, CA

Lick Observatory's celebrated verification of General Relativity at the 1922 eclipse in Wallal Australia was the consummation of its decade-long, sometimes star-crossed pursuit of a seductive but demanding observational problem. We follow the course of Lick's involvement from Director W. W. Campbell's introduction to the Einstein test by Erwin Finlay-Freundlich in 1912, to Lick's disappointment in 1914 at the cloud-covered and war-darkened Russian eclipse, to the clear skies but inconstant observations at Goldendale Washington in 1918, through Eddington's thunderous announcement the following year, and finally to its happy conclusion at Wallal. The strength of Lick's observations owed much to Campbell's deep experience with the challenges of eclipse observing and his meticulous attention to detail. We illustrate the story with artifacts from the Lick Observatory Historical Collections.

xxx.04 Measuring Gravitational Deflections is Really Hard

2:45 Donald Bruns[1]

[1]Amateur, San Diego, CA

Between 1922 and 2017, astronomers had some great opportunities to measure the gravitational deflection of starlight by observing the Sun during a total eclipse. The 1922 eclipse gave good results, but bad weather or equipment problems plagued many of the later expeditions. Starting in the 1970s, radio telescope measurements yielded much better results, generally reducing the interest in optical measurements. Orbiting optical observatories gave nearly perfect values starting in the 1990s. However, the interest in repeating Eddington's experiment was revived in 2017, probably due to the convenience of the total eclipse that passed over the USA. While at least nine amateur astronomers or teams set up to repeat this experiment, most of them still had problems with weather or equipment. This talk will discuss the difficulties experienced since 1922, and how the combination of good weather, amateur equipment, and careful planning resulted in the best deflection values ever measured during a solar eclipse.

xxx.05 Gravitational Deflection on a Shoestring

3:00 Richard Berry[1]

[1]AAVSO, Dallas, OR

Although careful preparation is desirable, it is not always possible. My personal observatory, Alpaca Meadows Observatory (44.7909, -122.6096) located in Lyons, Oregon, was less than a kilometer from the center line. If offered electric power and Internet access. When Toby Dittrich proposed performing the Eddington Experiment and then received funding, we raced to prepare for the event using equipment already on hand: a TeleVue Genesis 100 mm f/5 refractor, an SBIG STT-8300 chosen for its rapid image readout, and a Celestron AVX equatorial mount.

By June the equipment was set up in a compact roll-off shelter. Testing revealed that the Genesis needed to be stopped down to 80 mm, and its wobbly focuser had to be preloaded with springs. We determined the exposure time for the eclipse by imaging earthshine on the crescent Moon. To provide an astrometric reference field, we planned to slew the telescope west after mid-eclipse. Because there was no time to automate the imaging sequence, the students and I worked out a system where, working in alternation, they performed the necessary steps. Eclipse day was clear and the sky was smoke free. The students performed their roles perfectly.

We obtained 23 images of the eclipsed Sun -- rotating through 0.6, 1.0, and 1.6 second exposures -- and 10 reference images. The telescope was immediately capped, the shelter rolled on, and we collected 500 dark frames. We made flat-field frames that evening. Six months after the eclipse, I shot reference images of the eclipse field at the same hour angle as on eclipse day.

After calibrating the eclipse and reference images, the corona gradient was removed using wavelet filtering. The eclipse images contain 60 stars, of which 20 gave reliable centroids. Unfortunately, the plate scales of the eclipse frames, eclipse reference frames, and six-month eclipse field frames did not exactly match. As had been the case for Dyson a century earlier, which data to trust was a judgment call. We characterize the result as 1.7 ± 0.8 arcseconds deflection at the solar limb. Later analysis showed star positions were affected by severe turbulence on eclipse day. Thanks to the two students, Abraham Salazar and Jacob Sharkansky, Toby Dittrich, and especially Donald Bruns for his assistance in the reduction of the data.

xxx.06 Modern Eddington Experiment 2024

3:15 Toby Dittrich[1]

[1]*Portland Community College, Vancouver, WA*

During the 2017 eclipse in North America, I obtained two telescope/camera systems capable of performing the Modern Eddington Experiment (MEE). Four students (Andrew Joswiak, Steve Pinkston, Jacob Sharkansky, and Abraham Salazar) were guided by the expertise of Richard Berry and were successful in measuring the Einstein Coefficient (1.68 compared to theoretical value 1.72). They became the first students to have ever measured the curvature of space. Since then I have received NASA funding for two more stations for a total of four for the 2024 eclipse. I am speaking here about the plans for performance of the MEE in Mexico at the point of maximum eclipse and directly on centerline. The El Salto Technological Institute is partnering with Portland Community College for support and logistics. The experiment will be performed at a gated resort hacienda, at 8000' with ideal viewing conditions. The goal is to recruit as many as eight more stations from colleges and universities, as well as individual amateur astronomers for a total of twelve telescope/camera stations. With this number of experimenters, up to 10,000 stellar data points could be obtained compared to the several hundred in past experiments (Eddington himself had 14!). With good fortune, and many additions experimenters, this could become the most accurate performance of the Modern Eddington Experiment ever.

HAD III: Oral Presentations

Wednesday, January 15th; 10:00 – 11:30 am Sheraton Hotel Cyprus Room
Session Chair:

xxx.01 Plato's Planetary Power Proportions Led to Kepler's Third Law

10:00 George Latura[1]

[1]*Independent researcher, Trumbull, CT*

Kepler articulated what became known as his Third Law of Planetary Motion in *Harmonices Mundi* (1619): 'But it is absolutely certain and exact that the proportion between the periodic times of any two planets is precisely the sesquialterate proportion of their mean distances…' (tr. Aiton *et al.*, 1997: 411). The sesquialterate proportion is the ratio of one to one-and-a-half, or, of 2 to 3. Kepler formulated a sesquialterate power proportion (square to cube) between planetary speeds and distances. Such a planetary power relationship existed in antiquity. In Plato's *Timaeus* (c. 360 BCE), the Demiurge fashions the cosmic Soul – invisible template of the universe – from an elemental mix of Same, Different, and Being. From this mixture, he takes various proportions that yield seven numbers: 1, 2, 3, 4, 9, 8, 27 (*Timaeus*, 35b-c), that are tied, through the Circle of the Different (*Timaeus*, 36d), to the celestial Wanderers (*Timaeus*, 38c). The Academy scholarch Crantor arranged these numbers in the shape of the letter *Lambda*, with 1 at the top, even numbers down one side (2, 4, 8), odd numbers down the other (3, 9, 27). This arrangement highlights the squares (2x2, 3x3) and cubes (2x2x2, 3x3x3) in Plato's planetary ratios. According to Plutarch's *On the Generation of the Soul in Timaeus* (c. 100 CE), scholars of his time sought Plato's power proportions in planetary structure: 'Yet certain people look for the prescribed proportions in the velocities of the planetary spheres, certain others rather in their distances…' (tr. Cherniss, 1976: 321). In *Mathematics Useful for Understanding Plato* (c. 120 CE), Theon of Smyrna discussed two numerical 'quaternaries:' the Pythagorean *Tetraktys* and the Platonist *Lambda*: 'There are then two quaternaries of numbers, one which is made by addition, the other by multiplication, and these quaternaries encompass the musical, geometric and arithmetic ratios of which the harmony of the universe is composed.' (tr. Lawlor, 1979: 62-63). After stating his planetary sesquialterate power ratio in *The Harmony of the World*, Kepler uses Plato's planetary power proportions to illustrate his discovery: 'Let the periodic times of two planets be 27 and 8… Hence the semidiameters of the orbits will be as 9 to 4. For the cube root of 27 is 3; that of 8 is 2; and the squares of these roots are 9 and 4…' (tr. Aiton et al., 1997: 413). Planetary power proportions traveled, over about two thousand years, from Plato, to Crantor, to Cicero, to Plutarch, to Theon, to Calcidius, to Macrobius, to Proclus, and finally to Kepler, who illustrated his newly discovered planetary power law with Plato's planetary power proportions from *Timaeus*.

xxx.02 150th Anniversary of an Historic Telescope

10:10 Brian Mason[1]

[1]*US Naval Observatory, Washington, DC*

12 November 2023 commemorates the sesquicentennial of first light for the 26" Great Refractor of the U.S. Naval Observatory (USNO). At the time, and for the next seven years, this was the largest telescope in the world. The Navy needed a large telescope to determine positions of the moons of the outer planets, which would allow the planets masses to be determined. Those masses were important for accurate predictions for the position of Jupiter, an important body frequently used in celestial navigation. A few years after first light, Asaph Hall, in August 1877 discovered the two moons of Mars: Phobos and Deimos. Solar System work continued but slowly decreased into the 1960s with the most recent observation taken in 2003.

Since First Light the other major observing program of the 26" is double stars. In addition to his success observing Solar System objects, Hall was also a prolific observer of double stars and while there were other successful observers of double stars, the program began its greatest period of productivity in the 1960s when two programs began regular operation. Charles Worley began his filar micrometry program observing on close pairs. Also, the eyepiece end of the telescope was modified to allow for a "Hertzsprung Style" photographic double star camera due to the efforts of Kai Strand, Jerry Josties and others for precise measurement of wide pairs. The photographic program continued into the 1980s before giving all double star time to micrometry. In the early 1990s Worley abandoned micrometry for the relatively new technique of speckle interferometry. The speckle program continues to this day and as a result of these dedicated programs conducted over a long time the 26" telescope has the most double star observations of any telescope.

xxx.03 Simon Newcomb's Curious Eclipse

10:20 Thomas Hockey[1]

[1]*University of Northern Iowa, Cedar Falls, IA*

Every astronomer has had his or her observing plan go awry. The same was true in the 19th century.

In 1869, A total eclipse of the Sun was to be visible diagonally across the United States. For the first time, many astronomers--including Simon Newcomb--traveled to observe such an event.

Before leaving Washington, Newcomb scheduled all that was supposed to happen. Upon arriving at Des Moines, Iowa, he attached to the county courthouse (his temporary “observatory” grounds) “screens” of different angular sizes. He intended to *block* most of the apparition in order to better see various total-eclipse phenomena far from the center of the Sun—perhaps even the imagined planet Vulcan.

His principal observational target was the corona, of which little was known. This study should not take too long. Everyone had been told by those who had seen it before that there would not be much to see.

During the real 1869 total eclipse of the Sun, this program went out the proverbial window. Long creamy streamers radiated from the corona. The Sun was no longer a circle. Newcomb was soon transfixed by what he was seeing. The language used by this man of numbers is remarkable: The solar corona was, "glorious beyond description . . . . Its structure was not uniform . . ."

The most common description of the corona’s shape by the peregrinating mathematicians observing the total solar eclipse was that of a “trapezoid.”

Newcomb *abandoned* his telescope, which he had chaperoned all those many kilometers, and examined the corona with his naked eye.

The story of carefully laid observing plans being hijacked by a compulsion to gawk, without anything between the witness and the spectacle, was repeated over and over during the 1869 total eclipse of the Sun. As Samuel Langley explained, “Special observations of precision in which I engaged would not interest the reader; but while trying to give my undivided attention to these, a mental photograph of the whole spectacle seemed to be taking without my volition.”

The 1869 corona was not what astronomers had expected. It always had been depicted as a more circular ring without further morphology. The most recent total eclipse, well-observed by astronomers, was that of 1860.

The year 1860 was a sunspot maximum year. The Sun was halfway through its eleven-year cycle. During the next cycle, the year 1869 occurred after sunspot minimum had just passed, in March 1867. The result was a brighter but more asymmetric and less broad corona than astronomers had been led to believe they would encounter.

From the 1869 TSE on, the nature of the corona became a driving force in the study of the Sun. American astronomers would participate significantly.

xxx.04 The Meinels: Aden and Marjorie

10:30 James Breckinridge[1,2]

[1]Caltech, Pasadena, CA, [2]College of Optical Sciences, U of A, Tucson, AZ

This story of Aden and Marjorie Meinel covers the dawn of modern ground and space large telescope astrophysics, space astronomy, and the rebirth of the nascent scientific/engineering field of modern optical sciences. Together they also established the firm engineering foundation for solar thermal energy production in use today. The scientific method requires the cycle: theory, prediction, observation and continuous revision to theory, more prediction, new observations & measurements, etc. In this paper we will review how the “observe and measure” phase of the scientific method cycle accelerated by Aden Meinel as a result of his WW2 military career, charismatic leadership, building an observatory for all astronomers, expanding the astronomy program at the U of A, creating a national center of excellence in the optical sciences and his inspirational collaborations at NASA and the Jet Propulsion Laboratory for generations of future explorers of the universe.

xxx.05 Astronomy's Lingua Franca

10:40 Joseph S. Tenn[1]

[1]Sonoma State Univ., Rohnert Park, CA

Data collected for the Historical Astronomy Division's Astronomy Genealogy Project (AstroGen: https://astrogen.aas.org/) can be used for many purposes. One example is to study the evolution of the language used in astronomical writing, as shown by doctoral theses (dissertations) over the past 175 years. We examine the languages used in several countries where we have a "nearly complete" data set and where English is not the primary language. Latin predominated for astronomy-related theses written in Europe until about 1870. After that, the national language was usually used. Gradually, English took over in most of these countries, to the point where today a student can earn a Ph.D. in any of a number of non-English speaking countries without ever learning the local language. Since the year 2000, the majority of astronomy-related doctoral theses have been in English in Austria, Denmark, Finland, Israel, Netherlands, Sweden, and Switzerland, and if we only go back to 2010, we can add Germany and Spain to this list. Just as the universal knowledge of Latin among European scholars once made it easier for the German- and Polish-speaking Copernicus to study in Italy, today a knowledge of English enables students from anywhere to study almost anywhere.

xxx.06 The Gradual Realization that Astronomical Information is Bounded, 1965-2020

10:50 Martin Harwit[1]

[1]Cornell University, Ithaca, NY

Following the discovery of the Cosmic microwave background radiation in 1965 several astrophysicists began to realize that the energies of many cosmic messengers could well be bounded through a titanic clash between high energy radiations generated in a supernova explosion and the ubiquitous microwave background photons that would collide with these radiations, confining their energies to finite bounds.

These, however, are not the only bounds limiting information reaching Earth from cosmic domains. A variety of different interstellar and intergalactic processes had, over the decades also been found to deflect and or decelerate messengers reaching us from astronomical sources. Many are due to interactions with distinct gaseous regions along the messengers’ trajectories. Observations with different types of messengers can help us disentangle some of these ambiguities but a fundamental bound must exists, below which these uncertainties will not be overcome. That bound is due to an intrinsic unruliness of the Cosmos --- the existence, along any messengers’ trajectories of myriad undetected low-mass bodies. General relativity teaches us that such gravitational attractors delay, deflect and split beams of every kind of messenger identically. Multi-messenger comparisons thus will not disentangle where and how the messengers’ trajectories were distorted. Precision astronomy will have reached its bounds.

I estimate that, at current funding levels world-wide over the next century or two, advances in astronomical instrumentation will lead to angular, temporal and spectral resolving powers comparable to predictable levels of uncertainty in the directions from which messengers are arriving, the relative times at which they were generated at their sources, and the spectral changes associated with those two uncertainties. Although instruments with enhanced

capabilities could still be constructed, they would not remove the ambiguities induced by these intrinsic gravitational deflections. Astronomers will then need to determine how else to gain information on cosmic processes that no astronomical messengers will transmit. Such processes could well exist, though we would be unable to observe them.

Elevating Observers of the Night Sky (CfA Digital History Initiative)

xxx.07 Rebecca Charbonneau[1]

[1]*Harvard University, Cambridge, MA*

Elevating Observers of the Night Sky (EONS) is a digital public history project under development at the Harvard-Smithsonian Center for Astrophysics' Wolbach Library. EONS' main goal is to connect people with resources to help them understand and appreciate different astronomical cultures, as well as meaningfully engage in conversations about how colonialism and racism have been, and continue to be, facets of astronomical pursuits. It will do so by examining the asterisms historically excluded from the official IAU catalogue of constellations and bringing attention to the rich variety of astronomical heritage of cultures around the world. In this talk, Rebecca Charbonneau, CfA's Historian-in-Residence and co-leader of EONS, will explain how integrating humanities research into STEM institutions can aid the development of novel solutions to cultural and historically rooted challenges in contemporary science.

HAD Town Hall

Wednesday, June 15th 12:45-1:45 pm Sheraton Hotel Cyprus Room
Session Chair: Ken Rumstay

HAD IV: iPoster Presentations

Wednesday, January 15th 5:30-6:30 pm Convention Center Hall A/B

xxx.01 Not at all Sad: The Heritage of Arabian Astronomy's "Auspicious Asterisms"—from Sadachbia to Sadalsuud

Danielle Adams[1]

[1]*Lowell Observatory, Flagstaff, AZ*

The region of sky spanning Capricornus, Aquarius, and western Pegasus contains a large number of third-magnitude stars, many of which bear names—approved by the IAU Working Group on Star Names—that reflect a common origin in indigenous Arabian astronomy. Although only a few of these Arabic-derived star names in use today begin with the prefix "Sad-", each of these stars formerly belonged to Arabian asterisms that bore formulaic Arabic names that began with the term *saʿd*, which indicated something auspicious, commonly a star or asterism. These formulaic star names—known collectively in Arabic as "the Auspicious Asterisms" *(as-suʿūd)*—appeared in this particular region of sky alone, and the resulting collection of ten asterisms (mostly pairs of stars) rose heliacally within the space of just five weeks, from mid-January to mid-February, as viewed from Arabia in the 9th century CE.

Drawing from 9th and 10th century CE Arabic texts by Quṭrub (d. 821 CE), Ibn Qutayba (d. 889 CE), and aṣ-Ṣūfī (d. 986 CE), this talk reveals the unique heritage of indigenous Arabian astronomy in this region of the sky. The research begins by locating the group of ten asterisms in the modern sky and connecting the roots of their Arabic names to the vestiges that remain in modern star catalogues. The researcher then examines the seasonal significance of these Auspicious Asterisms *(as-suʿūd)* within Arabian culture during the first millennium CE, including the use of rhymed prose that had become attached to four of the ten asterisms to tie their heliacal risings to the meteorological and cultural happenings of Arabian winters. The results of this original research demonstrate the historical significance of these stars names that continue in use today.

xxx.02 Remembering Carolyn Shoemaker

Kevin Schindler[1]

[1]*Lowell Observatory, Flagstaff, AZ*

Carolyn Shoemaker was a late comer to astronomy, not entering the field until 1980 when she was 51 years old. Like the famous comet-hunting Caroline of two centuries prior—Caroline Herschel—Shoemaker went into astronomy to support a family member: Herschel with her planet-discovering brother William and Shoemaker with her astrogeology husband Gene. For Carolyn, this came about because she had finished raising the Shoemaker's three children and had free time on her hands, so she asked Gene for suggestions on how to fill it. He was then leading a project using Palomar Observatory's 18-inch Schmidt telescope to search for potentially hazardous asteroids and comets. This work involved photographing segments of the sky and then scanning the resulting films with a stereomicroscope for suspects. Gene suggested Carolyn join the project and she took to it immediately. By the time she finished her career in astronomy, she discovered or co-discovered 32 comets, 377 numbered asteroids, and many more unnumbered ones. Comet-Shoemaker-Levy 9 was her most famous discovery, made in 1993 while teamed with Gene and David Levy. The year after its discovery. this icy body dramatically collided with Jupiter in an event observed by astronomers around the world. This was the first time in recorded history that humans observed two solar system bodies colliding, and it brought the discoverers international recognition. Several years later, Carolyn was severely injured in an automobile accident that saw Gene die. After recovering, Carolyn continued her research for several years and also frequently spoke at star parties and other astronomy events around the world. In August 2021, at the age of 92, this grande dame of astronomy passed away.

xxx.03 AstroGen: A Dissertation Resource for Observatory Bibliographies

Sherry Winkelman[1], Joseph Tenn[2]

[1]Center for Astrophysics | Harvard-Smithsonian, Cambridge, MA, [2]Sonoma State Univ., Santa Rosa, CA

Observatory bibliographies track publications, including dissertations, which analyze data from the observatory. While ADS allows curators to readily find journal articles of interest, the coverage of dissertations continues to be problematic. The aggregation of links to dissertations which the Astronomy Genealogy Project provides makes this an important new resource for finding observatory-related dissertations.

The Astronomy Genealogy Project (AstroGen: https://astrogen.aas.org/) sponsored by the AAS Historical Astronomy Division and hosted online by the AAS, currently lists about 38000 people, all of whom have either earned astronomy-related doctorates or supervised them. Thirty countries are now deemed "nearly complete," and more are being added all the time. The Chandra Data Archive (CDA) has begun searching the AstroGen database in a systematic way to expand the Chandra dissertation collection and has incorporated AstroGen metadata into the Chandra Bibliography to create a prototype for a maintainable Chandra dissertation genealogy. In this poster we present an update to the AstroGen project and details of the Chandra projects, new discoveries, and difficulties encountered along the way.

xxx.04 Working Group on the Preservation of Astronomical Heritage 2022

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Astronomy has a rich history extending backwards in time for millennia to the oldest recorded observations on cuneiform tablets. In North and South America, records of astronomical activities begin with indigenous archaeoastronomy sites and continue in modern observatories. Archived observations, whether sketched by hand or captured in photographs or recorded on electronic media, document the sky at moments that will never be repeated. Access to such records stretches the baseline of time-domain astronomy backwards qualitatively for centuries and quantitively for about 120 years, greatly exceeding the span of modern electronic records. Unfortunately, rapidly evolving technology can render digital data obsolete and unreadable after only a few years unless precautions are taken to convert the information continuously to

the latest format. The tools and instruments used by former astronomers demonstrate how they accomplished their science. Although their technologies and processes may be outdated, their work laid the foundation for our current astronomical endeavors. Those practices and the personal experiences of our predecessors provide insight into how the culture of astronomy has evolved and should inform efforts to improve our profession today. The Working Group on the Preservation of Astronomical Heritage (WGPAH) is charged with ensuring heritage resources remain available to astronomers, historians of astronomy, and all interested individuals.

Consisting of 14 specialists from 7 disciplines, the WGPAH seeks to establish criteria and priorities for preserving astronomical sites, facilities, instruments, and records. In addition, we work to develop and disseminate the best practices for preservation efforts. In doing so, we advise institutions and teams engaged in or considering preservation projects. We also partner with organizations such as the Historical Astronomy Division (HAD) of the AAS, the International Glass Plates Group, and the recently formed Historic Site Designation Task Force, whose missions overlap with ours. We welcome the participation of everyone.

To access WGPAH resources, please visit our website (https://aas.org/comms/working-group-preservation-astronomical-heritage-wgpah).

To contribute to WGPAH discussions and activities, please join our low-volume mailing list (https://lists.aas.org).

xxx.05 Evaluating the Merits and Design of an Astronomical Historic Site Designation Program

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Programs recognizing locations of historical and scientific significance, such as the American Physical Society's Historic Site Initiative or the American Chemical Society's National Historic Chemical Landmarks, provide opportunities to identify and promote a science's impact throughout history, as well as to highlight its connections to the history of a unique place. At the request of the Working Group for the Preservation of Astronomical Heritage (WGPAH) and the Historical Astronomy Division (HAD) Executive Committee, the AAS has established a task force to consider the desirability, benefits, and costs of establishing such a program. The task force will also recommend procedures for nominating, evaluating, and honoring designated sites. This poster will provide an introduction to different aspects of historical site designation programs to be considered by the task force, give examples of similar programs, and present ways to provide input to the task force about concerns, interests, or suggestions regarding historic site designation.

xxx.06 The International Glass Plates Group: Resources for Astronomical Plate Preservation

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The International Glass Plates Group is a recently-formed gathering that includes astronomers, librarians, historians, curators, and others with representation from a host of countries. What has brought us together is our assumed curatorship of collections of astronomical photographic plates and associated records that were once open resources in our respective departments and observatories. Some of the collections reach back a century or more. The Group meets monthly to share information, experiences and ideas, to understand and evaluate the potential of the collections or individual items, and to work out a strategy for moving forward to make these data discoverable, accessible, and usable.

Each month, an IGPG subgroup presents a topic via Zoom after which discussion ensues. The discussion topics have covered preservation practices; transcribing metadata from observing logbooks and assembling this information in searchable form; digitization methods; building a census of collections; scientific use cases; accessibility of the contents of the collections to external researchers; and much more. We are working to inform ourselves of other relevant efforts, and we are taking advantage of communities with aligned interests. In addition, the Group is planning an in-person, 3-day conference in May 2023. Overall, the Group provides a

forum to explore solutions to common problems. This poster describes Group activities to encourage interest by newcomers and to identify opportunities for wider collaborations.

xxx.07 50 Years of Research and Education at MIRA: Past, Present, and Future

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This year marks the 50th anniversary of the Monterey Institute for Research in Astronomy (MIRA). As a small, independent, non-profit observatory, MIRA has been dedicated to research and education for the last 50 years. Here we present some of the scientific highlights of our past research, a summary of our current interests and education programs, and a look toward what the future can bring us. We maintain a very well-equipped 36-inch telescope at an excellent dark site in the coastal mountains of Monterey County, California. In the past astronomers at MIRA have contributed to NASA's WISE mission, obtained ground-based observations of the Deep Impact mission, created the first successful machine-learning stellar classification scheme, published observational and statistical studies of Young Stellar Objects, and generated an extensive near-IR stellar atlas with two-dimensional classification criteria. Continuing research topics include searching for near-earth asteroids, studying cometary debris trails, a non-TE stellar atmosphere simulation, and calibration of gravitational lens observations. The newest research at the institute focuses primarily on stellar astrophysics with astronomers studying topics such as asteroseismology, stellar polarimetry, stellar activity, and star formation. MIRA is an integral part of the local community, providing outreach and education activities for all ages. Each summer high school and college level students work with astronomers directly on their research through our thriving intern program. We plan to expand our research pursuits and outreach capabilities to further the inclusion of future generations of astronomers.

xxx.08 **Reaching for the Stars with the North American Regional Office of Astronomy for Development**

Timothy Spuck[1], Yasmin Catricheo[1], Shari Lifson[2], Kate Meredith[3], Laura Trouille[4]

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The International Astronomical Union (IAU) North American Regional Office of Astronomy for Development (NA-ROAD) is a collaboration that includes the Adler Planetarium in Chicago, IL, Associated Universities, Inc. (AUI) in Washington, D.C., Association of Universities for Research in Astronomy (AURA) in Washington, DC, Geneva Lake Astrophysics and STEAM, (GLAS Education) in Williams Bay, WI, and the Office of Astronomy for Development in Cape Town, South Africa. The NA-ROAD is working to use the power of astronomy to facilitate economic, social, and educational development across North America including the United States and U.S. Territories, Canada, Mexico, Greenland, and the island nations of the Caribbean. NA-ROAD efforts target five specific areas: 1) astronomy for science diplomacy through collaborative activities that bridge across countries and cultures, 2) use of astronomy and astronomy facilities/resources to support economic development in local communities, 3) use astronomy to facilitate STEM interest, education and outreach, 4) the use of astronomy to promote STEM interest, careers and employment for incarcerated individuals, and 5) advance collaboration and sharing of astronomical knowledges to support the general well-being of Indigenous communities and peoples. Come learn about this new initiative and how you can engage with the NA-ROAD.