THE
LOWELL OBSERVER
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THE QUARTERLY NEWSLETTER OF LOWELL OBSERVATORY
HOME OF PLUTO

Dr. Jennifer Hanley in the Astrophysical Materials Laboratory at Northern Arizona University.

Meet Jennifer Hanley

By Jennifer Hanley, Astronomer

**Effective January 1, Jennifer Hanley and Michael Mommert accepted tenure-track astronomer positions at Lowell. To introduce themselves to you, each of them has contributed an article to this edition of The Lowell Observer. Michael's story is on page 3.*

My research interests span across the solar system, focusing on the stability of liquids on Mars, Titan and Europa. Before accepting this position, I had been working at Lowell with Drs. Will Grundy and Henry Roe since fall 2015 as a postdoctoral researcher on a grant from the John and Maureen Hendricks Charitable Foundation.

I earned a B.A. from Cornell University in 2006 in Science of Earth Systems and then lived in New Zealand for a year before returning to my passion, planetary science. I received my Ph.D. from the University of Arkansas in Space and Planetary Sciences in 2013. My dissertation was titled "On chlorine salts: Their detection, stability and implications for water on Mars and Europa". I measured evaporation rates of salt solutions under Martian surface conditions, modeled the interactions between water and various salts, and acquired reflectance spectra of chlorine salts under Martian and Europan conditions. I'm currently working on a grant funded by NASA to map chlorine salts on the surface of Mars using spectra acquired from the Mars Reconnaissance Orbiter.

While a graduate student I interned at the Jet Propulsion Laboratory (JPL) in Pasadena, California. My project was to measure spectra of chlorine salts at low temperatures and see if they were present on Jupiter's moon Europa. This started my interest in the outer solar system. Since then I have continued my research into the composition of Europa, observing the moon with NASA's Infrared Telescope Facility (IRTF) and Lowell's Discovery Channel Telescope. I also participated in the Planetary Science Summer School, which is a one week

continued on page 4

IN THIS ISSUE

Meet Michael Mommert

See page 3 for more!

DIRECTOR'S UPDATE

By Jeffrey Hall

I'm writing this note on a hot, cloudless June afternoon a few days before the solstice. Just over a week ago, we wrapped up the annual meeting of our Advisory Board. The Board has grown, since its inception nearly 30 years ago, into a broad group of individuals from many different backgrounds. I'm pleased that *Astronomy* magazine editor Dave Eicher has recently joined the Board (see p. 7) as well as New Horizons Principal Investigator Alan Stern (see p. 11). In addition to its original role of providing guidance to the Trustee, the Board plays a crucial role today in getting the word out about Lowell Observatory and connecting us to interested individuals, corporations, and foundations nationwide.

This interest, we are learning, is widespread, and there just isn't enough time for our staff to hit the road and talk with everyone who wants to learn more about Lowell. We do as much as we can, but like most non-profits, we run lean and mean; and there are, as I like to remind everyone, only 36 hours in a day. We are most grateful to the time and energy our Board puts in to helping spread the word.

But everyone who gets the *Observer* can do so as well. Pass your issue along to a friend, or, if you've visited here, let some folks know about our cool outreach programs and all the science being done at the DCT. We repeatedly hear that the growing word of mouth about the exciting present and even more exciting future on Mars Hill is a major driver of our growing visitor attendance, philanthropic support, and ongoing success. As always, thank you for your continued interest and help!

TRUSTEE'S UPDATE

By W. Lowell Putnam

As I write this column I am looking out the window from the trustees residence at the major earth-moving equipment that is redoing the access roads in preparation for a new water tank. This represents the very beginning steps of the new Mars Hill campus. Elsewhere in this issue you will read about the Giovale Open Deck Observatory, which should be ready for use by next spring. This is the beginning of an exciting new era here at Lowell, where we will be establishing ourselves as the premier astronomy destination in the Americas, if not in the world. There will undoubtedly be a few challenges along the way, but the support from the community, the staff here on Mars Hill, and the friends of Lowell will carry the day, I am sure. As the Chinese expression goes "we are living in interesting times, but these also present us with opportunities to do better". Your support helps make that happen.

Receive Your *Observer* Digitally

As membership has grown at Lowell Observatory, so has the cost of production of our quarterly publication *The Lowell Observer*, adding up to thousands of dollars and hundreds of trees. In an effort to be economically and environmentally friendly, we invite you to elect to receive your copy of the *Observer* digitally. If this interests you, email Shannon Gonzales at sgonzales@lowell.edu.

From left, Professor Amanda Bosh, Tomás Cabrera, Jocelyn Reahl, Teaching Assistant Ryuga Hateno, Kishore Patra, Abbie Burrus, Karisa Zdanky, and Michaye Ledford at Wupatki National Monument.

MIT Field Camp Returns to Lowell

This January I got the opportunity to attend the 31st-ish MIT Astronomy Field Camp at Lowell Observatory alongside fellow students Abbie Burrus (Wellesley College 2019), Tomás Cabrera (MIT 2019), Michaye Ledford (MIT 2020), Kishore Patra (MIT 2018), and Karisa Zdanky (Wellesley 2019). During my three weeks in Flagstaff, I worked alongside Dr. Maggie McAdam to build a prototype planetary surface-simulating mineral spectroscopy lab for the Northern Arizona University (NAU) Physics and Astronomy Department. When I wasn't working, I attended colloquia and weekly science discussions at Lowell and NAU, toured local telescope facilities like Lowell's DCT and NPOI, and hiked in Northern Arizona's geological and historical wonders like the Grand Canyon and Wupatki National Monument, as well as cooked dinners and talked with local astronomers. I was very busy, but I had a lot of fun and learned so much about what it's like to do real research!

— Jocelyn Reahl, Wellesley College Student

Meet Michael Mommert

Astronomer Michael Mommert

Michael Mommert spends a considerable amount of time obtaining observations for his research using Lowell Observatory telescopes at Anderson Mesa.

By Michael Mommert, Astronomer

Considering myself a planetary astronomer, I am mostly interested in the physical properties of asteroids and comets. By studying their characteristics, I can open a window into the solar system's past and learn about its evolution. One specific example of my research is the exploration of objects that were long known as asteroids, but suddenly show comet-like activity. While bodies like these initially challenged our view of the solar system, they are now considered to provide important information on the properties of both asteroids and comets—which are not that different after all.

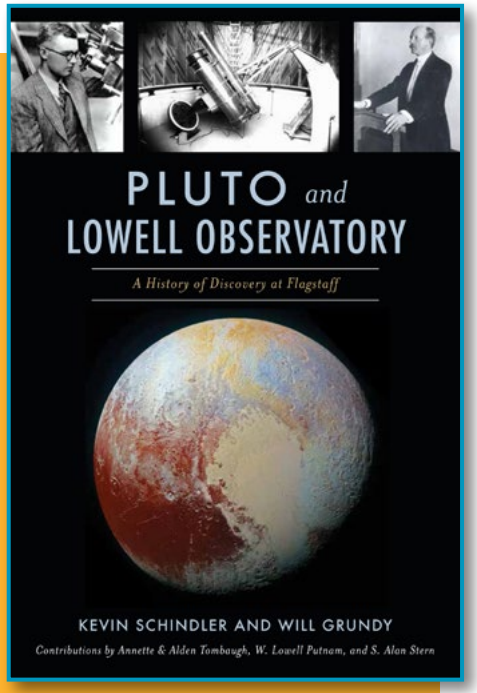
For my observational studies, I use a wide range of ground-based and space-based observatories. Lowell's Discovery Channel Telescope has always been an important asset for my work and will now become my main workhorse. In the future, I plan to utilize newly available observatories, including a fleet of small robotic telescopes, the James Webb Space Telescope and the Large Synoptic Survey Telescope in Chile. All these new assets will revolutionize astronomy in different ways and require a deep understanding of data analysis techniques.

Hence, I am also interested in the development of data analysis techniques and scientific software that I provide to the community. I am the author of a software package that fully automates the cumbersome process of astronomical image analysis and I am the main author of a different software package that combines a wide range of functionality that is used by asteroid and comet researchers on a daily basis. The motivation behind both projects is to enhance the productivity of researchers by providing useful software tools to them that would take weeks-to-months to build from scratch. This software will especially help students and young researchers to get started in their research projects without spending too much time on writing their own software. The need for such a software package has been acknowledged by NASA, which is funding this project.

I studied physics and astronomy at Heidelberg University and received a Ph.D. in earth sciences from the Free University in Berlin. After enduring the German weather for 31 years, I moved to Flagstaff to become a postdoctoral researcher at Northern Arizona University, swapping cloudy days for sunny days. My new appointment with Lowell Observatory means not only an opportunity to work in an excellent research environment, but also that my family and I can spend more time in beautiful Flagstaff.

In my free time, I enjoy exploring places near and far, camping under the stars, hiking in the wilderness, and spending time with my family.

I look forward to becoming a part of the Lowell team, which I have gotten to know and appreciate during my time in Flagstaff. My interests and skills complement Lowell's current expertise in solar system research, which has long roots ranging back all the way to Percival Lowell and Clyde Tombaugh.



New Pluto Books

Three books about Pluto have just been published: *Chasing New Horizons* (Alan Stern and David Grinspoon) tells the exciting story of the first mission to Pluto; *Discovering Pluto* (Dale Cruikshank and William Sheehan) comprehensively covers the history of Pluto research; (pictured) *Pluto and Lowell Observatory* (Kevin Schindler and Will Grundy) focuses on the role of Flagstaff and, particularly, Lowell, in the history of this storied planet.

MEET JENNIFER HANLEY
Continued from page 1

boot camp at JPL where students team up with engineers to mock design a NASA mission. Our mission was a Venus lander, and thus I now have a soft spot for Venus missions.

After completion of my Ph.D., I was a postdoctoral researcher at Southwest Research Institute in Boulder, Colorado from 2013-2015, where I performed laboratory experiments to test the effect of salt and water on Martian soil mechanics.

Currently, I am studying the stability of the lakes and seas of Titan in the Astrophysical Materials Laboratory at Northern Arizona University (NAU). I recently received a grant from NASA to simulate the surface pressure, temperature, and composition of Titan to understand how methane, ethane, and nitrogen interact with one another. I collaborate with other NAU researchers to model chemical interactions of exotic ices, study volatiles and health hazards to astronauts from asteroids, and build a Mars chamber for regolith experiments. Other interests include the applicability of these experiments to other icy and small bodies throughout the solar system. I am also part of a newly selected NASA Solar System Exploration Research Virtual Institute (SSERVI) called ESPRESSO (Exploration Science Pathfinder Research for Enhancing Solar System Observations) which seeks to develop capabilities required to safely assess targets, sites, and samples for their scientific value and resource potential on future human exploration missions.

Dr. Jennifer Hanley on top of Mauna Kea in Hawaii during an IRTF run in March 2015.

In my spare time, I enjoy traveling and anything outdoors, such as hiking, camping, and skiing. I am originally from Buffalo, New York, and eagerly await the next Bills Super Bowl appearance.

Celebrating the Lowell Prize

In 1918, Constance Lowell established the Lowell Prize, in memory of Percival, to honor the NAU student in the physical sciences with the most outstanding academic record. Since 2018 was the centenary of the award, Dean Paul Jagodzinski of NAU presented Jeff Hall with a beautiful framed commemoration of 100 years of Lowell's support of academic excellence at NAU.

All Systems GODO!

Construction is underway on the first phase of the Mars Hill campus expansion project that will lead to the grand opening of the Giovale Open Deck Observatory (GODO) in the spring of 2019! The contractor selected to manage the construction effort is Building & Engineering Contractors (BEC) Southwest. Some of you may recognize the name, as BEC also constructed the DCT. The first order of business is the construction of the new water tank, pump house, and access road. Once the new water works is operational, the existing water tanks will be demolished to make way for the premier site of the GODO and its adjacent "wash house". The designs for the GODO and wash house are complete, and their construction is expected to start in the fall of 2018.

What is an observatory without telescopes? In order to ensure we have our premier telescopes available when the GODO is complete, we have orders in place for the StarStructure 32-inch Dobsonian, the Moonraker 8-inch Refractor, the TEC refractor, and the Planewaves. These telescopes are custom-built with premium optics and will take as long to construct as the GODO itself!

— David Sawyer, Technical Project Manager

Architect's rendering of the GODO in the "open" observing configuration. The "schematic design" phase is complete, architectural and engineering details are being finalized, and construction documents are being prepared. The building plans will be submitted to the city for review and approval this summer.

StarStructure 32-inch telescope.

The GODO Telescopes

By Jim Cole, Educator

As part of the new facilities expansion for the public program at Lowell Observatory, the Giovale Open Deck Observatory (GODO) will be the first component to be realized. Construction should start soon and be completed by end of year or in early 2019. We have worked hard to select a state-of-the-art collection of permanently mounted telescopes to occupy the main observing deck.

The group of telescopes as a whole was selected to provide a wide range of observing capabilities for our visitors and, along with our outstanding indoor presentations, will give them a more complete picture of the universe.

The largest telescope in the GODO will be a joint project utilizing a StarStructure 32-inch f/3.0 Horizon structure and world class quartz mirrors by Mike Lockwood. The special quartz optics will adjust to fast dropping nighttime temperatures common in Flagstaff much quicker than standard glass, providing faster access to sharper, more stable views for the visitor. The massive light grasp of this scope will allow visitors to see details of galaxies, planetary nebulae, globular clusters, and emission nebulae like never before.

A magnificent, bespoke, Victorian style 8-inch f/12 refractor with outstanding optics from APM Germany will be created by telescope magician Mark Turner of Moonraker Telescopes in the United Kingdom. This 10-foot-long, red and brass telescope will not only be beautiful to behold in daylight, but will offer the visitor white light daytime views of the Sun and sharp and contrasty views of the Moon, planets, double stars and star clusters at night. This one-of-a-kind telescope will forge together the look of 19th century telescopes with modern technology to link Lowell Observatory's past and present.

Two of the telescopes will be manufactured by PlaneWave, a 17-inch and a 14-inch Corrected Dall-Kirkham Astrograph (CDK). These world-class telescopes—made by the same company that is providing the new one-meter telescopes for the Naval Precision Optical Interferometer on Anderson Mesa—will be used primarily with electronic devices, a video camera (MallinCam) and a Shelyak spectrograph with output directed to large video monitors. The MallinCam mounted on the 14-inch CDK will provide live, time integrated images allowing the public to see detail and real color in deep space objects that is impossible through purely visual telescopes. The 17-inch with the spectrometer will show real time spectra from objects in space, helping visitors to understand how astronomers know what things are made of and how fast and in which direction they are moving. If mounted with the optional equatorial wedge and four-port instrument selector, the CDK telescopes will provide after-hours capabilities for scientific data collection by Lowell's astronomers and for special public programs including astrophotography classes.

The last telescopes of the group are a 140-millimeter TEC refractor and an already-donated Meade 16-inch Modified Ritchey-Chretien telescope.

GODO Funding Opportunities

Roll Off Building:
$250,000

GODO Exhibit Sponsor:
$100,000

Spectrum Exhibit:
$120,000

Educational Exhibits:
4 panels needed at $10,000 each

WiFi Connectivity:
$10,000

Perimeter Benches:
8 benches needed at $5,000 each

Tiles with Science Quotes:
100 tiles available starting at $2,000 each

Tiles with Science Equations:
10 tiles available at $2,000 each

If you would like to purchase a quote or equation in support of the GODO, you can do so on this webpage:

lowell.edu/donate/godo-quotes

DISPATCHES FROM THE UNIVERSE

By Michael West, Deputy Director for Science

The Man Who Saved the Universe

In 1949, James Mangan walked into the office of the Recorder of Deeds and Titles in Cook County, Illinois with one goal: to save the universe.

To do this, he'd come to register a new country—one that encompassed all of space. Mangan called it the Nation of Celestial Space, or Celestia for short.

To describe Mangan as eccentric would be an understatement. Before appointing himself as First Representative of Celestia, he was a prolific author of books with titles like *The Secret of Perfect Living*, *You Can Do Anything!*, and *The Knack of Selling Yourself*. These books dispensed nuggets of wisdom, such as:

> *"Believe nothing till it's understood, till it's clearly proven."*

> *"Who you are or what you are means nothing."*

> *"The narrow mind stays rooted in one spot; the broad mind is free, inquiring, unprejudiced; it seeks to learn both sides of the story."*

In his 1947 autobiography, Mangan boasted of being an internationally famous speaker, a world-champion spinner of tops, and one of the best grass cutters in America. He even wrote a popular song titled *We're All Americans*, which composer Irving Berlin called the worst song ever written.

According to Mangan, he founded Celestia on behalf of the entire human race to ensure the peaceful use of space, free from military barbarism or commercial exploitation. *The Declaration by the Nation of Celestial Space* made clear that only space was being claimed, "specifically exempting from claim every celestial body, whether star, planet, satellite or comet." Mangan described the new nation's guiding philosophy as "joy through peace."

Getting the rest of the world to recognize the sovereign nation of Celestia was, predictably, not easy. Mangan sent letters to 74 nations asking for official recognition, but received no replies. His request for membership in the United Nations was also rejected, though the U.N. briefly flew Celestia's flag on one occasion. When the space race began with the launch of Sputnik in 1957, Mangan quickly denounced it as trespassing.

Frustrated by the lack of international recognition, in 1968 Mangan declared:

> *"I'm invoking the 20-year statute of limitations because everyone ignored me. Since nobody has objected for 20 years to my Nation of Celestial Space it means all rules inaugurated by that nation hold unchallenged from now on."*

Celestia minted its own coins, issued passports, and printed stamps. To raise money for the fledgling nation, Mangan planned to sell parcels of space, roughly the size of earth, for a dollar apiece. He never did, however, and those who eagerly sent him their money had it returned.

Celestia's raison-d'etre largely vanished after 1967, when the United Nations declared that no nation could claim sovereignty over space, followed by a 1979 ban on private ownership.

But Mangan never gave up on the idea of Celestia. "We are basically sky people—not earth people," he said. Before he died, he willed the cosmic nation to his children and grandchildren, bestowing titles on them such as "Duke of the Moon" and "Princess of the Nation of Celestial Space."

So, was this guy crazy? Maybe. A charlatan? Perhaps. But his heart was in the right place. As the Irish playwright George Bernard Shaw once said, "Life isn't about finding yourself. Life is about creating yourself."

And if you want to save the universe, sometimes you just have to trust the voices inside your head.

Deputy Director for Science Michael West

David Eicher is Editor-in-Chief of *Astronomy* magazine, the world's largest publication on the subject.

David Eicher Joins Advisory Board

By David Eicher, Lowell Advisory Board member and *Astronomy* magazine Chief Editor

I'm very proud to have joined the Advisory Board of Lowell Observatory. I became interested in astronomy at age 14 and soon was hooked on observing galaxies, nebulae, and clusters. What followed was the creation of *Deep Sky Monthly*, which became *Deep Sky Magazine*, and then a career at *Astronomy* magazine, where I've been for more than 35 years. I've been the Chief Editor for 16 years, have written 21 books on science and history, and am on the Board of Directors of the Starmus Festival, serve as the Editor-in-Chief of the Asteroid Day project, and have been president of the Astronomy Foundation. Aside from astronomy, I'm a drummer who loves blues and rock, an avid history buff, a mineralogy enthusiast and collector, and a Green Bay Packers fan.

In my early days, I made friends with some of the active writers who focused on deep-sky objects, who included Brian Skiff and David Levy. Traveling around with them, I visited Lowell quite a number of times in the 1980s and 90s, and in 1985 even "worked" for 10 days as an assistant with Brian on the 21-inch photometric telescope, collecting data. I also got to know other icons of the area: Clyde Tombaugh, Gene and Carolyn Shoemaker, and others. So memories of Lowell and some of its special people, along with a deep reverence for the institution's history with Mars, Pluto, and everything else, live deep in my core.

I'm tremendously proud to be a part of the Lowell experience these days and so happy to know the current, amazing group of people associated with the observatory. It is unique in science!

2017 in Review: Visitation

Visitors again flocked to Lowell in 2017.

Our total visitation for the year was 98,463, our best ever. For some historical perspective, during the first full year that the Steele Visitor Center was in operation (1995) attendance was 64,371. It soon climbed over 70,000 and hit the 80,000 mark for the first time in 2008. Each of the past three years has seen a jump past 90,000. This includes 97,364 in 2015, 98,105 in 2016, and last year's total that included a spike in August thanks to the solar eclipse.

2017 in Review: Fundraising

2017 was a banner year for Lowell fundraising, with the observatory receiving more than $4.3 million in gifts and memberships. This includes an acquisition of more than 2,500 new members, a new record. The funds were used to support archives work, begin construction planning for the new Giovale Open Deck Observatory (coming in 2019), and support our powerful education programs such as Lowell Observatory Camps for Kids (LOCKs) and the Navajo-Hopi Program. They also sustained the superlative research work being performed at Lowell. Thank you for your generous support!

Master Teacher Todd Gonzales launches a bottle rocket with campers during a recent LOCKs camp.

2017 Team of the Year

The Discovery Channel Telescope (DCT) continues to operate extremely efficiently. Many people contribute to this, but this year observatory leadership wanted to recognize those who keep things running so smoothly throughout the year in the dark of night: our DCT Telescope Operator team. Our astronomers and those from our partner institutions much appreciate their work. Congrats and thanks to them all for their part in enabling so much science at DCT.

Observer Andrew Hayslip at the DCT.

Observers Heidi Larson, Jason Sanborn, and Teznie Pugh at the Giovale-Millis Lodge.

2017 Employee of the Year

Our Employee of the Year for 2017 was Nicole Bird, our controller.

Nicole implemented a number of changes in procedure that reduced overhead and made various reports considerably simpler, and she played a major role in keeping Lowell's administrative functions running effectively and efficiently. Many thanks to Nicole for all her efforts on behalf of the observatory! We also wish Nicole well with her relocation to New York.

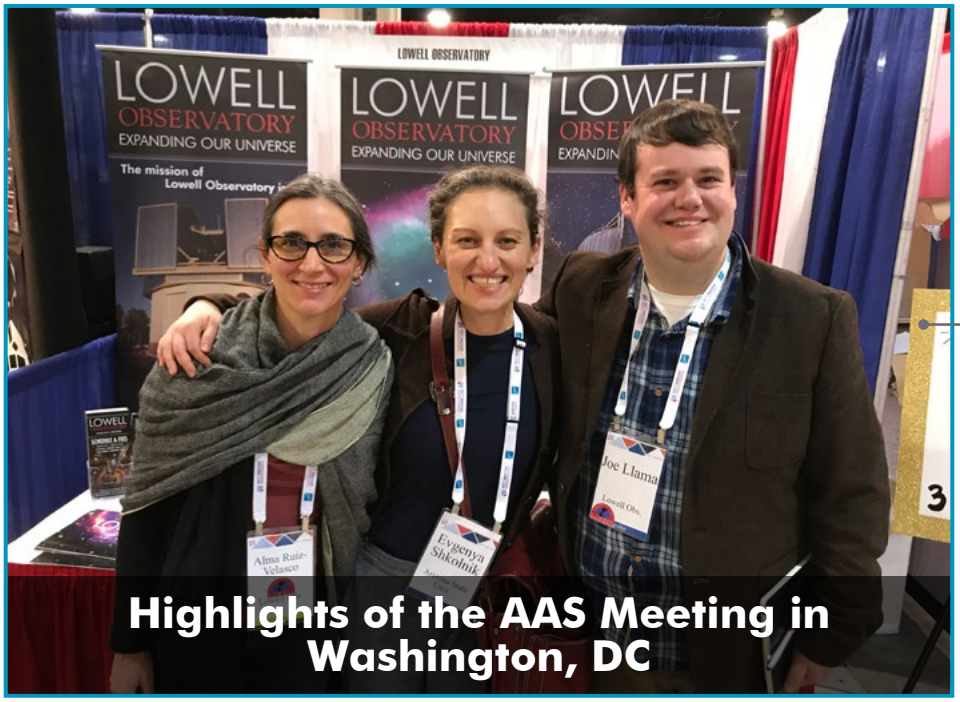
W. Lowell Putnam addresses the crowd of graduates, parents, NAU faculty and staff, and others during the May 12 commencement ceremonies at NAU's J. Lawrence Walkup Skydome.

NAU Awards Honorary Doctorate to Lowell Putnam

At its spring commencement ceremonies, Northern Arizona University (NAU) awarded Sole Trustee W. Lowell Putnam an Honorary Doctor of Humane Letters degree.

The award reinforces the century-long association between NAU and Lowell Observatory. Since the early 1900s, the observatory has awarded the Lowell Prize to an NAU graduate earning a bachelor's degree who has maintained the highest average in scholarship during four years of residence. NAU annually presents another award, the Vesto M. Slipher Scholarship, named after longtime observatory astronomer Vesto Melvin (V.M.) Slipher, to an outstanding junior chemistry major. NAU is also one of the partner institutions of Lowell's Discovery Channel Telescope.

Putnam is the ninth person with strong Lowell Observatory ties to receive an honorary doctorate from NAU, following V.M. Slipher (1957), Clyde Tombaugh (1960), E.C. Slipher (1961), Gene Shoemaker (1965), John Hall (1976), Henry Giclas (1979), Carolyn Shoemaker (1989), and Bob Millis (2009).



Astronomy Liaison Alma Ruiz-Velasco, Adjunct Astronomer Evgenya Shkolnik, and Astronomer Joe Llama at the Lowell Observatory booth during the AAS winter meeting.

Highlights of the AAS Meeting in Washington, DC

By Alma Ruiz-Velasco, Astronomy Liaison

In January several Lowell staff traveled to Washington D.C. to attend the American Astronomical Society's (AAS) winter meeting. Our representatives actively participated by giving presentations, presenting posters, attending special topic meetings, offering educational activities, and operating an information booth.

Director Dr. Jeff Hall presented a talk about light pollution and what the city of Flagstaff is doing to keep the skies dark. Flagstaff is not only the first international Dark Sky City in the world, but also is an example of how to implement lighting ordinances that benefit the environment and are economically feasible

Drs. Gerard van Belle, Joe Llama, Lisa Prato, and George Jacoby presented their research during the corresponding poster sessions. In particular, Gerard's poster was very popular among the attendees due to his very creative design (The POKEMON Speckle Survey of Nearby M-Dwarfs).

Historian Kevin Schindler participated in a panel discussion about the preservation and use of photographic glass plates and Event Coordinator Jelena Lane led groups of middle school students in creating scale models of the solar system. I attended several press conferences and other media-related activities and Communication Manager Molly Baker headed our team in the exhibit hall that shared information about happenings at Lowell,

The AAS is one of the largest scientific groups in North America. It has more than 7,000 members and organizes two meetings during the year, one during the summer and another one during the winter. This winter meeting in particular often features dramatic discoveries that could change the field of astronomy.

Probably my favorite topic at this meeting was gravitational waves. I found it amazing that just two years ago during the winter meeting in Florida you would not see anything related to the topic. Gravitational waves were still something fantastic to think about, but yet to be discovered.

We were flooded with the latest results of LIGO (Laser Interferometer Gravitational-Wave Observatory), the detection of a light counterpart of the gravitational detection. This is the beginning of a new era, the era of "multi-messenger astrophysics". This features multi-wavelength astrophysics in which we can not only study an object by using different wavelengths such as optical, radio, infrared, x-ray, etc., but a different kind of signal.

Somewhere in the universe, two neutron stars merged. The cataclysmic event caused ripples in the fabric of space-time and traveled at the speed of light, reaching Earth 130 million years later. What was left, nobody knows. A black hole? A giant neutron star? The explosion shone so bright that it reached a magnitude of 17 in the optical, bright enough to be seen with a 24-inch telescope.

This raised the question of whether the LIGO and Virgo would consider making public the alerts of their detections so anyone can point to the sky and find the light (they will probably do so at some point).

Alma Ruiz-Velasco and Jelena Lane lead a kids activity.

The Lowell Observatory Foundation – Supporting Lowell Observatory

Through a combination of donor contributions and good markets the Lowell Observatory Foundation experienced 173% growth between December 31, 2015 and the end of 2017, growing from $1.9 million to $5.2 million. The Foundation has received generous donations from many Lowell Observatory supporters in the past two years, and we are grateful.

To assure Lowell Observatory's long-term success, Director Jeff Hall has set a goal to have $20 million in endowments by December 31, 2024. Foundation funds and their values at the end of 2017 were:

The Endowment Fund | $10,678
The Exploration Fund | $1,575,806
The Instrumentation Fund | $575,594
Marcus Cometary Research Fund | $233,068
The Mars Hill Fund | $52,780
Giovale Endowed Fund for Astronomical Research | $500,000
Waddell Fund | $101,634
Millennium Fund | $2,055,340*
Big Red Fund | $100,000**

For more information about the Foundation's funds, and investment and spending policies, visit **foundation.lowell.edu** or contact Lisa Actor at (928) 255-5047 or lactor@lowell.edu.

**The Executive Committee, which retains responsibility for the Millennium Fund, administers this fund as an endowment. For more information go to: lowell.edu/donate/millennium-fund.*

***A restricted fund in support of Percival Lowell's 1911 Stevens-Duryea car.*

Astronomer Dave Schleicher Receives Grant from NASA

Astronomer Dave Schleicher's grant proposal, "Physical and Chemical Studies of Comets," was accepted for funding by NASA's Solar System Observations program. A three-year grant, it will fund Schleicher to spend about half of his time on the research that includes observing and modeling gas and dust jets in Comets 21P/Giacobini-Zinner and 46P/Wirtanen and analyses of several other comets observed in the past few years using Lowell's DCT and the John S. Hall 42-inch telescope. The $750,000 grant also supports former Lowell post-doc Matthew Knight (now at the University of Maryland) and Research Assistant Allison Bair.

Image: Neugent/Massey/Lowell Obs./NSF

See our website:
www.lowell.edu/research/recent-publications
for more publications

Recent Publications

Keep up with our astronomers' research by reading their recent publications. Below is just one example of their work. See our website for more.

Thirouin, Audrey; Sheppard, Scott S. (2017). A Possible Dynamically Cold Classical Contact Binary: (126719) 2002 CC249. *The Astronomical Journal*, Volume 154, Issue 6, article id. 241, 8 pp.

Lowell History Highlighted

Lowell Observatory history has been featured in several recent periodicals: "Canal Mania" by Klaus Brasch, *Sky & Telescope* (July 2018); "Percival Lowell and the Canals of Mars" by Matthew Sharps, *Skeptical Inquirer* (May/June 2018); "How Pluto got its Name" by Kevin Schindler and Lauren Amundson, *Discover* (May 2018); "The Photographic Legacy of Lowell's Great Refractor" by Klaus Brasch, *Astronomy* (March 2018); "Seeing Arizona, Imagining Mars" by Mike Amundson, *The Journal of Arizona History* (Winter 2017).

Coming in the Next Issue of *The Lowell Observer*

In recent months we celebrated the reopening of the newly renovated Lawrence Lowell (Pluto Discovery) Telescope with both public and private ceremonies. In the next issue of the *Observer*, we'll share pictures and stories from those events.

New Horizons Principal Investigator Alan Stern addressed an audience on June 9 that included members of the Lowell, Slipher, Sykes, Putnam, Tombaugh, and Christy families, as well as many modern Pluto scientists and supporters.

Astronomy Comedy

by Jury Judge (Former Retail Associate Briana Jameyson)

Annual Fund donations are supporting Lowell staff to move all of the historic documents and artifacts, often stored in less-than-ideal conditions as shown here, into the Putnam Collection Center.

Annual Fund Supports Collections

Gifts from a recent Annual Fund appeal are helping to preserve Lowell's history and make it accessible to historians and the public. Lowell's archivists and volunteers have already moved half of the collections in the Slipher Building basement to the Putnam Collection Center (PCC). The process of moving all the precious materials from locations around campus into the PCC will be a multi-year process, but with donor support we are able to begin this project ahead of schedule.

GODO Quotes & Equations

Help finish funding the Giovale Open Deck Observatory (GODO) by selecting a scientific quote or equation that changed our knowledge of the universe. These will be integrated, along with the donor's name, into the GODO structure for visitors to enjoy. View available quotes and equations—and give one—at:

lowell.edu/donate/godo-quotes

RECURRING EVENTS

LOCKs Preschool | **JUL 21** *(Electricity & Magnetism: Simple Circuits)* **AUG 4 and AUG 18** *(Our Moon: Phases of the Moon)* | **SEP 1 and SEP 15** *(Light & Optics: Telescopes)* | 10:30 a.m. - Noon

Meet an Astronomer | **JUL 14, 21, 28** | **AUG 4, 11, 18, 25 SEP 1, 8, 15, 22, 29** | 8 - 10 p.m.

JULY

FRI 27 | Delta Aquarid Meteor Shower
(8 - 10 p.m.) *Come and talk to one of our educators under the night sky (weather permitting) about meteor showers and viewing tips*

TUE 31 | Edison and the Eclipse that Enlightened America
(7 - 8 p.m.) *Author David Baron will talk about the 1878 total solar eclipse that crossed America's western frontier*

AUGUST

FRI 10 | Perseid Meteor Shower
(8 - 10 p.m.) *Come and talk to one of our educators under the night sky (weather permitting) about meteor showers and viewing tips*

SEPTEMBER

MON 3 | Community Day
(10 a.m. - 10 p.m.) *Free admission for Coconino County residents and NAU students. Proof of address or NAU ID required.*

For more special event information visit:
www.lowell.edu/outreach/special-events

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