

THE

LOWELL OBSERVER

ISSUE 115 SPRING 2019

THE QUARTERLY NEWSLETTER OF LOWELL OBSERVATORY CELEBRATING 125 YEARS

"The shoveling today marks the first step on the next 125 years of Lowell Observatory research and co-discovery," said Percival Lowell's great grandnephew Lowell Putnam at the groundbreaking ceremony, Saturday, Sept. 29 on Mars Hill.



Breaking Ground for the GODO

By Bonnie Stevens, Editor of Flagstaff Business News

Michael Beckage was 11 years old when the night sky changed his life. Peering through a high-precision telescope, he observed the golden-ringed magnificence of Saturn. The mesmerizing moment never left his heart or mind. The Seal Beach, California resident now sets up telescopes on the town's pier to share the enchantment of the universe with neighbors and visitors. He also serves as Lowell Observatory's advisory board chairman and is a staunch supporter of the facility's mission to bring the cosmos to the public while conducting world-class research.

Beckage, as both the adult who can make a difference and the boy who was filled with wonder, was among the group of about 100 local leaders, donors, astronomers and educators reaching for the stars while standing under the pines on Mars Hill, Saturday, Sept. 29, celebrating the launch of the Giovale Open Deck Observatory (GODO).

Sole Trustee W. Lowell Putnam welcomed the gathering and noted 100 years of scientific research at the observatory founded by his great

granduncle Percival Lowell. "Percival's request of us to do astronomical research also meant engaging the public in the wonder and joy of discovery. In his opinion, it was imperative that the researcher explain and present their work in such a way as to allow others to be, in his word, 'co-discoverers.' Today, we gather to start the creation of a world-class venue that will help make that happen."

Longtime Lowell Observatory supporters, advisors and visionaries John and Ginger Giovale provided the project's lead gift. "Ginger and I are excited about the vision that Lowell Observatory has for creating an

continued on page 11

Star Flung into Galactic Halo by Massive Black Hole

See page 4 for more!

IN THIS ISSUE

- 2 Director's Update
- 2 Trustee's Update
- 3 GODO Update



- 5 Dispatches from the Universe
- 6 New Names on the Moon
- 7 2018 DON Tour



- 8 Tombaugh's Forgotten Legacy (Part 2)
- 9 Meet Ken & Audrey Spencer
- 10 Farewell Bill, Mica, & Peter
- 11 Ayers Sciences Fund Supports 5th-Graders
- 11 Gift Shop Modifications
- 12 Special Events



DIRECTOR'S UPDATE

By Jeffrey Hall

As part of our evening programs for the recent lunar eclipse, I gave a talk in the Steele Visitor Center about the recent exploration of Pluto and what is and isn't a planet, something our visitors are always eager to discuss. One distinction between planets and stars, I noted, is that stars self-generate energy through thermonuclear fusion in their cores, principally via the conversion of four hydrogen atoms into one helium atom.

A nine-year-old raised his hand. How exactly does smashing hydrogen atoms together make rays of light, he wanted to know, and anyway, why doesn't the process make beryllium rather than helium? Thus ensued a delightfully unexpected discussion of nuclear physics with him and

the rest of our guests. After the talk, his older brother, who had earlier asked his own good question about Jupiter's cloud belts, said to me, "It's OK—he talks about this stuff at the dinner table too, and we're like What did you just say?"

At the conclusion of every day, someone's outlook on the Universe is a little different because of Lowell Observatory. Perhaps it's a professional astronomer who has just read something in one of the journals by one of our faculty that challenges or provides new perspective on a facet of astronomy or planetary science. Perhaps it's a very young man who heads home to read more about the proton-proton chain and to absorb the difference between atomic number and atomic mass. In either case, day by day, person by person, we at Lowell communicate science in all its rigor and splendor and, I hope, change lives for the better as we do. I'm lucky and honored to be a small part of the team making that happen. ☺



TRUSTEE'S UPDATE

By W. Lowell Putnam

I noted in my remarks at the groundbreaking of the Giovale Open Deck Observatory that Percival was a proponent for researchers also engaging the general public with their research. In Percival's time that was primarily through publishing books and public lectures around the country and world. Today there are many more options for engagement, both one-on-one

and en masse. But still, the best way to "co-discover" is to share an observation of the night sky with someone and to talk about what you are looking at. Our staff does that a lot, and an increasing number of visitors to Lowell have enjoyed that experience. This past year, Mars Hill was host to nearly 105,000 visitors, mostly at night. The building of the GODO, revised road work and new overflow parking lot are all parts of our effort to serve our visitors better. Many of you have contributed to help with that effort and I thank all of you. If you have experienced the joy of "co-discovery" and feel it is important to share with others, please continue to help us make Lowell a success and contact our development office. ☺



On May 28, 1894, Percival Lowell arrived in Flagstaff, AZ, officially opening Lowell Observatory. This year we are proud to be celebrating our 125th anniversary. To commemorate this milestone, we will be using a special 125th anniversary logo throughout 2019.

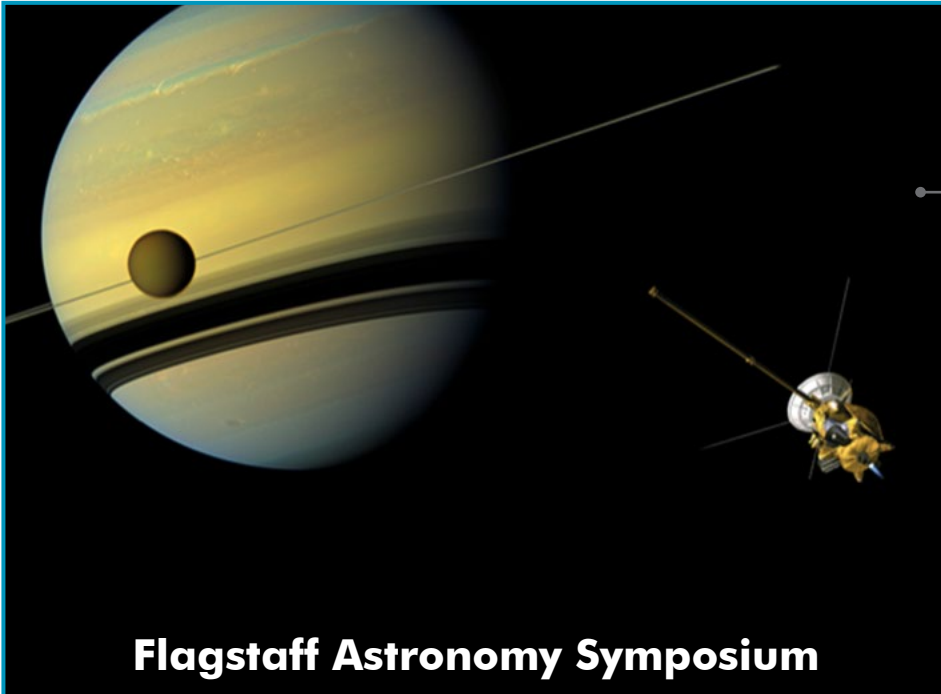


Removal of the old water tanks | Image: Dyer Lytle

existing garage and provide other needed storage. IT staff C.J. von Buchwald-Wright and Scott Do have installed a construction camera near the GODO site so anyone can keep track of progress. The link is at https://lowell.edu/godoftp/godo_live.php and the image refreshes every minute.

GODO Update

The GODO site has been cleared of trees and the old water tanks removed. One was taken down piece-by-piece, while the other was detached intact and relocated to Fort Tuthill County Park to be used for rainwater harvesting. Meanwhile, the loop road and technical support facilities site clearing is underway. The loop road, which will start at the southwest corner of the visitor parking lot and exit onto Mars Hill Road just south of the Business Office Building, is being completed now to create a one-way loop in and out of the visitor parking lot for improved traffic flow and safety. The tech facilities site, just south of the visitor parking lot, is being cleared to make room for the construction of a warehouse to replace the



Shy Dustrud, an NAU graduate student in chemistry and a Lowell research assistant, presented a talk on modeling the properties of Titan's lakes. This picture shows an image of Titan against Saturn, with an image of the Cassini-Huygen spacecraft inserted. | Image: NASA

Flagstaff Astronomy Symposium

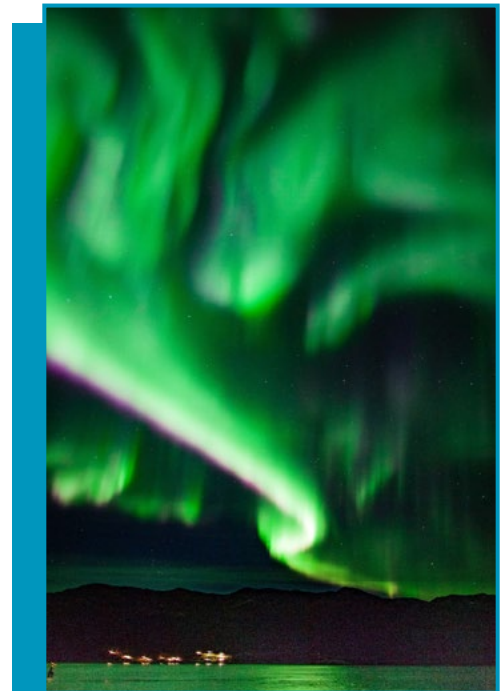
By Phil Massey, Astronomer

Lowell Observatory hosted the fourth annual Flagstaff Astronomy Symposium (FAS) on September 21. Thirty astronomers and planetary scientists from the Flagstaff community gave short presentations about their recent research to an audience of 80. This year we had excellent representation from graduate students, postdoctoral researchers, and faculty from Northern Arizona University (NAU), the United States Geological Survey (USGS), the United States Naval Observatory (USNO), and Lowell Observatory. Topics were as diverse as the 2018 eruption of the Kilauea volcano on Hawaii (Elise Rumpf, USGS), a summary of 25 years of stellar cycle observations (Jeff Hall, Lowell), and a program aimed at teaching blind students relative dimensions in space (Kathy

Eastwood, NAU), to name only a tenth of the talks.

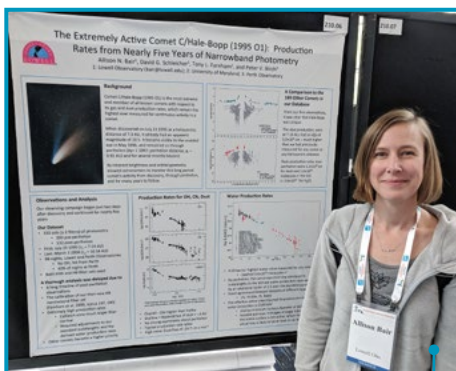
The FAS came into being in 2015 thanks to David Trilling (NAU) and Phil Massey (Lowell). With an ever-growing number of astronomers and planetary scientists in Flagstaff, and the start of the graduate program at NAU, there was a need to provide an opportunity for researchers to meet each other and learn what everyone was working on. The format of the program—five-minute talks followed by two minutes for questions and discussion—was based on the long-running “Internal Symposium” at the University of Arizona’s Steward Observatory.

If anything, the FAS has become a victim of its own success: in 2017 there were so many requests for speaking spots that the program ran all afternoon to 6 p.m. Starting this year the event is now



Dr. Joe Llama recently visited Tromsø, Norway to photograph the Northern Lights. The green color is caused by solar particles colliding with oxygen and the red from collisions with nitrogen at an altitude of 150 miles above the surface of the Earth.

broken down into a Fall and a Spring session in order to accommodate the increased demand. 📧

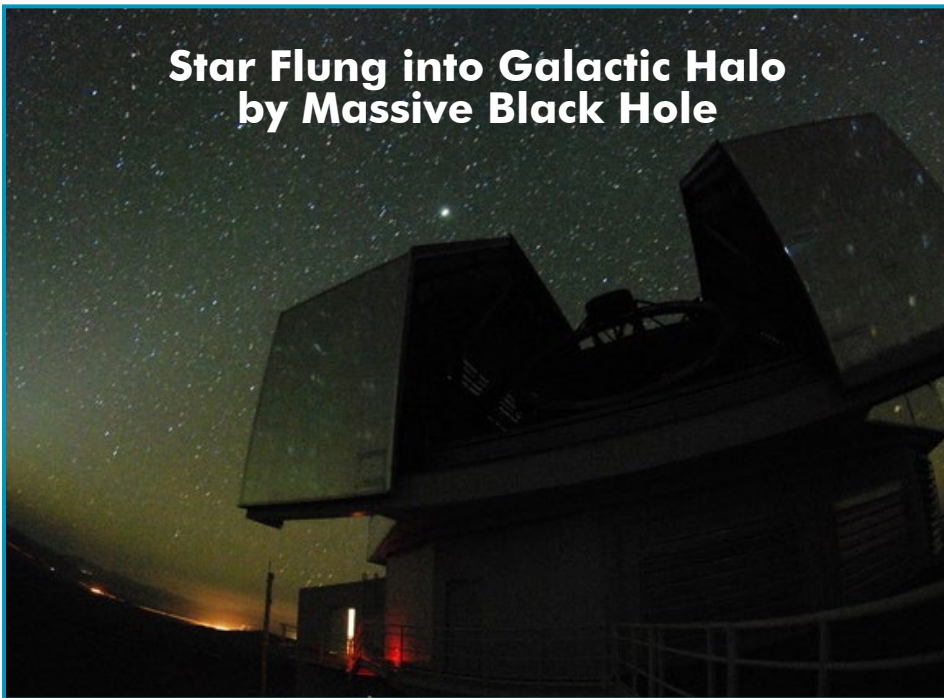


Allison Bair stands in front of a poster on which she collaborated.

Lowell at DPS Meeting

In October, several Lowell staff members joined more than 700 astronomers in Knoxville, Tennessee at the 50th annual Division of Planetary Sciences (DPS) meeting. Research by Allison Bair, Tom Bida, Amanda Bosh, Brian Burt, Maxime Devogèle, Ted Dunham, Will Grundy, Jennifer Hanley, Stephen Levine, Michael Mommert, Nick Moskovitz, Dave Schleicher, Brian Skiff, Audrey Thirouin, and Larry Wasserman was featured in numerous presentations, with topics including comets, asteroids, trans-Neptunian objects, the seas of Saturn’s moon Titan, the atmosphere and geology of Pluto, the first confirmed interstellar body in our solar system Oumuamua, and many more.

Star Flung into Galactic Halo by Massive Black Hole



By Phil Massey, Astronomer

My colleague Ted Dunham once laughed and advised, “Science is hard!” The past year has shown it can also be quite circuitous. We recently discovered a star in the halo of the Milky Way moving very fast: 300 kilometers per second (or 660,000 miles/hour)—at that rate you could travel from Los Angeles to New York in 13 seconds! Our paper, just published in the *Astronomical Journal*, demonstrates that the most likely explanation is that it was flung there by a close encounter with the massive black hole in the center of the Galaxy. Here is how the story evolved.

When Kathryn Neugent was a summer student back in 2008 she identified yellow supergiants in the Small Magellanic Cloud (SMC) by measuring their speeds towards or away from us. One star stood out as very peculiar, with a very abnormal high velocity. At the time, I insisted this was nothing much—probably just a binary that we caught on an off-day. But over the years Kathryn persisted that we should take additional measurements to see what was up. Our colleague Nidia Morrell at Las Campanas Observatory obliged, and repeated measurements confirmed the result—this was no binary. The most likely explanation was that this star was a yellow supergiant in the SMC, and had been flung off when a companion star exploded.

Then, along came Gaia, a European satellite measuring distances to billions of stars and their apparent motions. Our star

was included in their latest data release which revealed, much to our chagrin, that the star was a member of the Milky Way’s own halo, and not the SMC. This was shocking not just because we had gotten the story wrong, but because we had actually carefully considered the possibility that it was a Milky Way halo star, and rejected it.

As Lowell astronomer Brian Skiff had pointed out, our star was not particularly lacking in heavier elements. Halo stars are old, among the first stars formed, and their elemental content quite primitive. The Sun is mostly hydrogen and helium, but about 1.5% consists of heavier elements. Halo stars have 0.05% or 30 times fewer heavier elements than that. Our star had ten times that amount, or about 0.5%, similar to other stars in the SMC.

How did such a star wind up in the galactic halo, traveling so fast? We interested Lowell astronomer Stephen Levine, an expert in the internal

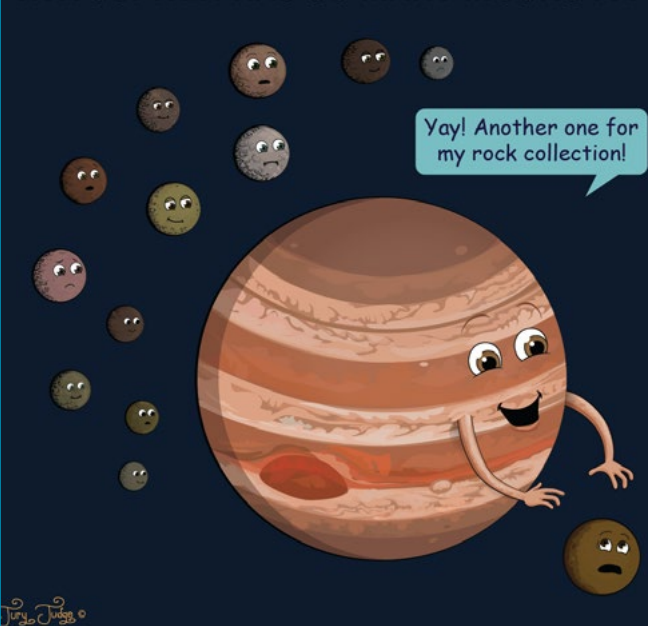
motions of galaxies, in the project. Stephen made use of all of the Gaia data (measurements of sideways motions and distance) and our ground-based radial velocity, and computed the star’s orbit, which proved to be almost purely radial relative to the center of the Milky Way—as if something had flung it straight out from the center. The obvious culprit is the central black hole, a monster with a mass of four million Suns. However, such an event would require a very near encounter. The star would have had to come almost 100 times closer to the black hole than our nearest neighbor Proxima Centauri is to our Sun. Stephen computed what would be required, and it was well within the uncertainties of the Gaia data.

There are a few dozen other stars whose odd motion have been attributed to ejection by the central black hole, but ours is the first example backed up by orbital calculations. We believe (for now) that the mystery has been solved. Still, “science is hard,” and you never know what we might learn next. ☹

Astronomy Comedy

By Jury Judge (Former Retail Associate Briana Jameyson)

WHY JUPITER HAS SO MANY MOONS . . .



DISPATCHES FROM THE UNIVERSE

By Michael West, Deputy Director for Science



Heaven, Hell, and Everything In Between

Earthquakes. Hurricanes. Fires. Tornados. Tsunami. Sometimes it seems as if our planet is trying to kill us. As the English writer Aldous Huxley once quipped, “Maybe this world is another planet’s hell.”

Yet Earth seems pretty cozy when you consider the alternatives.

On Neptune, winds howl at 700 miles per hour. Venus, often called our sister planet, is hotter than an oven and has a heavy, toxic atmosphere that would crush you. And if you suddenly found yourself on faraway Pluto you’d freeze to death faster than you could say “What am I doing here?”


Less than a quadrillionth of a quadrillionth of our solar system has conditions suitable for human life. To put it in perspective, if you could shrink the entire solar system down to the size of Earth, the region in which humans can survive would be about the size of a grain of sand. Most of the solar system, as well as the rest of the universe, doesn’t seem to have been designed with us in mind.

In fact, much of our own home planet doesn’t really suit us either. We humans inhabit a thin sliver of space wedged between land and sky, limited by the narrow range of conditions we can endure. We can’t survive for long above 25,000 feet—an altitude known to mountaineers as the “death zone”—because the thin air doesn’t hold enough oxygen for us to breathe. And we’d drown in the oceans that cover most of our planet’s surface.

Yet countless other creatures thrive in such conditions.

Microbes have been found miles above Earth’s surface, where they spend their lives riding air currents and feasting on molecules high in the atmosphere. Others live miles underground, warmed not by sunlight but by naturally occurring radioactivity in the rocks. For them, the oxygen-rich air we breathe is poisonous. And entire communities of creatures have been discovered at the bottom of the deepest, darkest oceans, huddled around geysers that warm the frigid water and belch forth a chemical stew that serves as food.

As the number of planets discovered around other stars grows, and with it the hope of finding extraterrestrial life someday, we should remember the incredible diversity of environments in which life is found on our own planet. As anyone who has ever been to a yard sale knows, one person’s junk is sometimes another person’s treasure.

And one organism’s hell might just be another’s heaven. 



Deputy Director for Science
Michael West

Dark Sky Brewing Supports Lowell

The year 2019 marks the 50th anniversary of mankind’s first steps on another world, and Flagstaff’s Dark Sky Brewing is celebrating with a fundraiser for Lowell. Every month the company will pick a beer and give 10 percent of the sales of that specific beer to Lowell Observatory for our educational programs. Dark Skies co-founder Nick Irvine explained, “We love this town. We love this community.” Funds raised for Lowell are part of an overall goal of \$20,000 the company plans to raise for different organizations and causes in 2019.

New Names on the Moon: A New Flagstaff Lunar Legacy



Iconic Earthrise image taken by Bill Anders, showing location of Anders' Earthrise and 8 Homeward.

By William Sheehan, Astronomy Historian

This year and next, Flagstaff celebrates, through its Lunar Legacy series, this small city's outsized scientific role in the Apollo Moon missions of 50 years ago.


Among the most historic of these missions was Apollo 8 in December 1968, when astronauts Frank Borman, Jim Lovell, and Bill Anders became the first men to reach the Moon, enter orbit around it, and return to Earth. Though many of Flagstaff's older citizens will remember the mission well, only one in four Flagstaffians had yet been born, and know it only from the history books. Apollo 8 was risky in the extreme, and achieved a number of space "firsts," including what is likely the most significant: a view, for the first time with human eyes, of Earth rising over the Moon.

The Earthrise sighting took place on Christmas Eve 1968. As Apollo 8 came out from behind the Moon for the fourth time, Borman rolled the spacecraft so that Lovell could do a navigational sighting. Anders was in the right-hand seat taking pictures of the Moon. It was only because Borman was rolling the spacecraft that Earthrise came into view. For a long time NASA misidentified the voices on the onboard

tape recorder. It was, however, Anders who cried out, "Oh, my God! Look at that picture over there! Here's the Earth coming up! Wow, is that pretty!" Strangely, NASA had never thought of photographing Earth from the Moon, and—since the Moon is completely grey—had even questioned the need to bring color film. Fortunately, they were overruled. Anders caught one image on black and white and switched to color film, and then captured—perfectly framed—an image that will be a hinge of history, when humans for the first time viewed their home planet as "small, limited and fragile," as Anders described it.

Though in 1970 the Apollo 8 astronauts were honored by having small far-side craters named for them, none of these craters had any connection with the flight—long a source of annoyance to the astronauts. In September of this year, I joined other members of the Working

Group on Planetary System Nomenclature of the International Astronomical Union (IAU) to take up this matter during a meeting at Lowell Observatory. It was decided to name two small craters visible in the iconic Earthrise image named "Anders' Earthrise" and "8 Homeward," in honor of Bill Anders and Frank Borman. (Jim Lovell had already had the lunar mountain, Mount Marilyn, named for his wife, approved last year.)

The craters are small—only 40- and 12-kilometers in diameter, respectively—but great in significance: they will show for all time just where Apollo 8 was when humans first saw Earth as it really is. And they add another to Flagstaff's list of lunar legacies. 

Participants in the Working Group of Planetary System Nomenclature September meeting at Lowell Observatory. Pictured, left to right, are Rose Hayward, Chuck Wood, Tenielle Gaither, Bill Anders, Rita Schulz, Rosaly Lopes, Guy Consolmagno and Bill Sheehan.





Left: 2018 DON tour group at the Duomo in Milan.
Right: 16" Bruce double astrograph, Heidelberg.



The 2018 DON Tour: A History of Astronomy

By Art & Sharon Storbo, DON* members

Our group of 24, led by Jeff Hall, met in London September 9 for an eight-day tour. On a morning bus excursion, we familiarized ourselves with the city. Highlights in England at the Royal Observatory in Greenwich (1676) were the 28-inch Great Equatorial Telescope (1893 refractor) and learning about development of chronometers in the 1700s to help mariners and astronomers determine precise longitude. Bussing to Stonehenge, we marveled at this historic observatory, built 4500 years ago. At Salisbury Cathedral, constructed in the 1200s, our tour and organ concert were a special treat.

From England we traveled to Germany to visit Heidelberg Observatory, home of the Max Planck Institute. Its role

in astrophysics research and astronomy was explained. We saw the 28-inch Waltz and 16-inch Bruce refractors and learned about their discoveries. We saw a glass plate on which planet Pluto was found several years after Clyde Tombaugh's discovery of it.

Traveling through Germany and Switzerland, we arrived in Milan, Italy. There we toured Brera Observatory and Museum, viewing telescopes and instruments from the 1700s and 1800s. The letters exchanged between Percival Lowell and Giovanni Schiaparelli were fascinating. In the rooftop observatory we saw Schiaparelli's 218-millimeter Merz refractor (1865). After a walk to Milan's Duomo and a bus ride through the Po River valley, we arrived in Florence.

In the Galileo Museum we saw Galileo's original 2-inch refractor through which he viewed Jupiter's four big moons (1610), supporting his conclusion that Earth revolves around the Sun. We heard a final lecture about Leonardo da Vinci's Codex Leicester, and then concluded our tour with an outdoor restaurant dinner overlooking Florence.

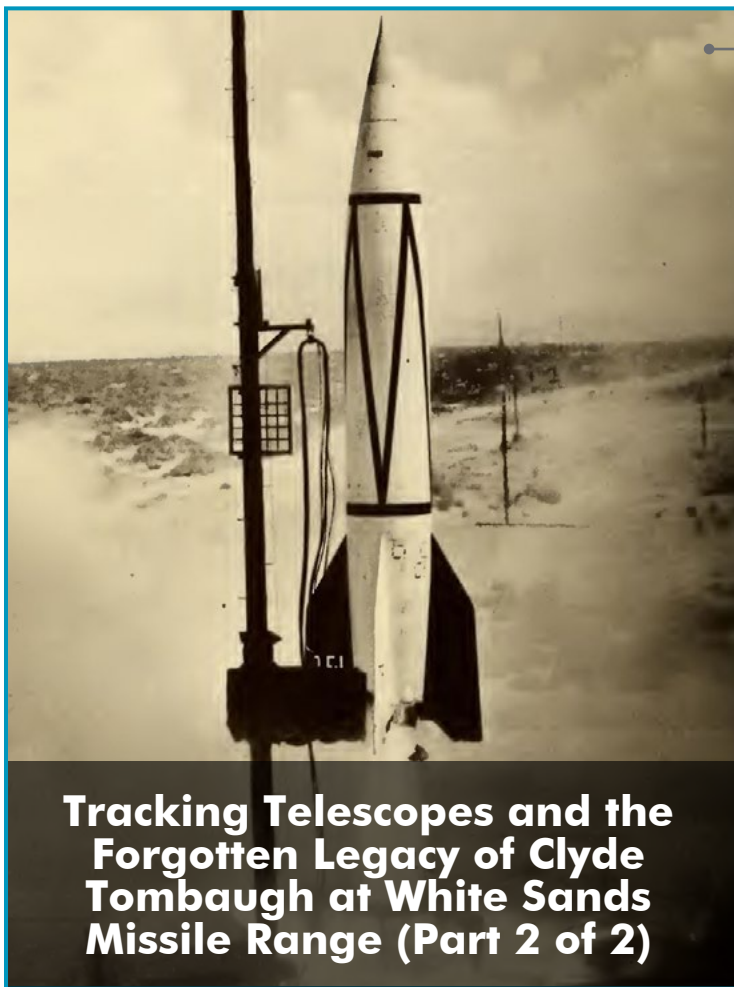
**DON stands for the Director's Opportunity Network and is an opportunity fund that gives Director Jeff Hall the flexibility to invest in new ideas, programs or opportunities at Lowell. For information on joining, please contact Lisa Actor at (928) 255-5047 or lactor@lowell.edu.*



Illustrator Jay Inge prepares "gores" for a lunar map in 1968.

Online Lunar Legacy Exhibit

As part of Flagstaff's Lunar Legacy celebration, Lowell Observatory's archives and communication staff installed an exhibit in the Putnam Collection Center called Lowell's Lunar Legacy. It highlights the observatory's contribution to the space program, particularly Moon mapping and astronaut training. A complementary online exhibit features a rich collection of photographs and text that tell the story of the "Next Nine" astronauts' 1963 visit to northern Arizona and the lunar mapping program. Illustrator Patricia Bridges provided many of the photos, which are available online for the first time. View the exhibit at <https://collectionslowellobservatorylunarlegacy.omeka.net/exhibits>.



V-2 Rocket with Clyde Tombaugh paint design

Tracking Telescopes and the Forgotten Legacy of Clyde Tombaugh at White Sands Missile Range (Part 2 of 2)

By Bill Godby, Archaeologist at White Sands Missile Range

Our story of Clyde Tombaugh at White Sands Missile Range (WSMR) left off with him becoming Chief of the Optical Measurements Branch and embracing the prototype tracking telescope Little Bright Eyes or T-1 (Telescope 1), a yet to be proven, ground-breaking asset for optical data collection. Although T-1 was functional, there remained a great deal of fine tuning to be done. There were problems with image capture, atmospheric boiling, focal length and film exposure. As colleague Frank Edson knew, Tombaugh's background was perfectly suited to address these problems. Between July and December 1946, the team reduced the focal length to 20 feet, introduced Shellburst Panchromatic film, repainted the rocket with calibration striping, and most importantly, established set rocket firing times aligned with the optimal time of day.

Skepticism existed at WSMR regarding the viability of tracking

telescopes. Radars were seen as the future; in Edson's words, "White Sands in those days was dominated by electronicers; they took a scornful view of optics". All that changed on December 5, 1946, when Tombaugh and crew, through a series of fortuitous events, particularly a delay in the firing time, successfully recorded a V-2 shot fired just before sunset. Images were captured that in Tombaugh's words "showed a precessing-yawing behavior after burn-out, which had never been photographed before".

Translated, the rocket was tumbling. There were also remarkable changes in the flame that had not been detected before. The photographs were presented at the post-shoot critique the next day and they "stole the show". Aberdeen Proving Ground, where the telescopes were assembled for distribution, was "besieged with urgent requests for more tracking telescopes". From this point on the tracking telescope became an essential tool for optical data collection.

Now, with full mission support, Tombaugh continued to refine his tracking telescopes and developed four new models. T-2 and T-3 were similar with minor changes, although T-2 was modified to allow for spectrographic data collection, supporting Edson's research on flame behavior. T-4 was a departure; although still a Newtonian reflector, it utilized a 90-millimeter gun mount. A 16-inch parabolic mirror focused light onto

a 45° mirror, which in turn reflected the image into a set of 80-power lenses located in front of the 35-millimeter Mitchell camera. A January 1948 issue of *Mechanics Illustrated* featured the T-4, stating that "His big glass eye can follow a V-2 zooming 3,500 m.p.h. and tell you just what it does at the 100-mile peak of its flight". The T-5 was known as the Twin-10, and was a one-man tracker with a twin-tube Cassegrain system.

Tombaugh's last contribution to tracking telescopes was his significant involvement with the development of the IGOR (intercept ground optical recorder). The IGOR replaced the long focal-length T series and was mounted on a 5-inch Navy gun mount, requiring two operators for horizontal and vertical axes. Its purpose was to record missile intercepts and misses. IGOR represented the first production model tracking telescope. Used from 1951-1965, it was a great success and workhorse, with a total of 15 in operation. Many variations of the tracking telescope have appeared since, although largely sharing the same basic characteristics. Nineteen are presently in use and referred to as KTMs (Kineto Tracking Mounts). They remain a highly essential tool in present-day missile research, design and testing.

Both Clyde Tombaugh and James Edson, astronomers and former alumni of Lowell Observatory, provided highly significant and lasting contributions in the realm of rocketry and its history in the United States and will be remembered here at White Sands Missile Range. 📍



Image of T-4 from *Mechanics Illustrated*, Volume 152, Number 1 (January 1948)




Meet Ken and Audrey Spencer

By Mattie Harrington, Executive Assistant

Ken and Audrey Spencer's interest in astronomy began in the 1990's, and they take any opportunity to gaze at the stars. During a cross-country trip in the 80's, while driving on I-40, the Spencers were passing through Flagstaff, Arizona and decided to visit Lowell Observatory. They immediately fell in love. After Ken retired, they moved to Arizona and became 'Friends' of Lowell Observatory. Having an affinity for outreach, Ken was working with Arizona SciTech Festival and wanted to get Lowell Observatory involved. He worked with former Annual Fund Officer Mica Gratton to secure Lowell's involvement and because of this, the Spencers continue to give to Lowell through the annual fund campaign.

This year, the Spencers were invited to attend Lowell's annual Percival Lowell Society luncheon. The Percival Lowell Society is a group of individuals who have made arrangements to leave a bequest to the observatory in their estate plans. During lunch, Ken heard Michael and Karen Kitt's story of involvement with Lowell Observatory and their newly endowed Historical Preservation Fund.

Ken was moved by the story the Kitts told and wanted to show support by being the first donor to their fund. The Spencers believe Lowell Observatory has a very significant historical place, not only in astronomy as the home of Pluto, but also in Arizona history for the astronomical contributions the observatory has made, including its work with the Apollo manned Moon missions. Ken says, "We love Lowell Observatory and we will support it forever." 



New Fleet Vehicle

Lowell Observatory has secured a partnership with Findlay Toyota of Flagstaff. In exchange for admission passes and a Findlay Toyota Community Day event at Lowell, the observatory received a fully wrapped 2018 RAV4. The vehicle stands out with an image of the Clark and Flagstaff's famous starry skies on the sides. Education and communications staff will use the vehicle for offsite programs and promotion.

Boston Astronomy Social

In early December, several Lowell staff members hosted an Astronomy Social at the American Academy of Arts and Sciences in Boston. Three dozen Boston area guests, including a half dozen Lowell family members, attended, including (left to right) Emeritus Trustee Michael Putnam, Barbara Post, Polly Chatfield and Kenneth Gaulin.



Percival's Family Views Mars

The chance to view Mars at opposition brought Lowell family members to their Uncle Percy's observatory last August. Katharine "Kit" Graham, Kay Corbin, Edward Streeter, and Lowell Putnam, Percival Lowell's great grand nieces and nephews, visited the 24-inch Clark Telescope during the day and returned at night to view the red planet. The skies were crystal clear over Mars Hill that night. In spite of the dust storm that made Mars appear more yellow than red, all agreed it was an exciting experience.

Kit Graham recreates the iconic pose of her Uncle Percy at the 24-inch Clark Telescope

Farewell Bill, Mica, and Peter

Three esteemed staff members recently left Lowell. Telescope Facilities Manager Bill DeGroff, who started working here in 2007, oversaw the operation and maintenance of Lowell’s Discovery Channel Telescope (DCT) and the Anderson Mesa site. Of particular note, he oversaw final construction and first light of the DCT. Annual Gifts Officer Mica Gratton, at Lowell since 2013, cultivated donors and worked with them in matching their philanthropic interests with the needs of Lowell. She also led the planning for several major fundraising events, including the 2017 Solar Eclipse Experience in Oregon. Archival Restoration Specialist Peter Rosenthal also arrived in 2013, to help renovate the 24-inch Clark Telescope. He helped restore the Abbott Lawrence Lowell (Pluto Discovery) Telescope and fixed or rebuilt a variety of antique telescopes and other instruments. Thanks to Bill, Mica, and Peter for your hard work and valued friendship. Good luck in your future endeavors!



Top: Bill DeGroff in the center of the primary mirror of Lowell’s Discovery Channel Telescope prior to realumization.

Bottom Left: Mica Gratton (right) at Lowell’s 2014 fundraising gala with MC Alice Ferris.

Bottom Right: Peter Rosenthal with the restored Clark Telescope.



At the Pluto Discovery (Lawrence Lowell) Telescope, staff and guests pay tribute to Advisory Board member Alan Stern with a “Pluto Salute”. Left to right: Lowell historian Kevin Schindler, Deputy Director for Outreach Samantha Gorney, Brian May, Dave Eicher, Development Manager Stephen Riggs, and Astronomy magazine travel coordinator Cody Carter.

Brian May Visits Lowell

Advisory Board member/ Astronomy magazine editor Dave Eicher has written a new book, *Mission Moon 3-D*, and in September he brought his co-author, Brian May, to Lowell for a visit. May has a PhD in astrophysics but is probably better known for his work in the entertainment industry—he is a co-founder and lead guitarist of the rock band Queen.

Pluto Podcast

In connection with their book *Pluto and Lowell Observatory: A History of Discovery at Flagstaff*, Lowell’s Will Grundy and Kevin Schindler appeared on the Science History Podcast, hosted by Northern Arizona University Biological Sciences Professor Frank von Hippel. The podcast may be heard at <http://sciencehistory.libsyn.com/website> (scroll down to Episode 4).

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.

Agarwal, J.; Mommert, M. Nucleus of active asteroid 358P/Pan-STARRS (P/2012 T1). *Astronomy & Astrophysics*, Volume 616, id.A54

Image: Neugent/Massey/Lowell Obs./NSF



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

GODO GROUNDBREAKING
continued from page 1

upgraded visitor experience,” said John. “We saw this telescope plaza project as an opportunity to kick-start that process. That’s why we jumped in and did what we did.”

The construction of the Giovale Open Deck Observatory (GODO), is the first phase of a long-range expansion plan to reach more people with astronomy education. It is also the first component of Lowell’s strategic plan to be the premiere astronomy education destination in the Americas.

“We want to be not merely an attraction, but a destination for astronomy and science education. We want that to benefit not only us, but Flagstaff and the region through increased visibility, and through higher and longer visitation,” said Lowell Director Jeff Hall. “Lowell is unique in being able to connect its thriving research programs to its outreach programs, giving our visitors the opportunity not only to learn about current research in

astronomy, but to meet the professional astronomers carrying out those projects.”

The \$3 million GODO will include a 4,300-square-foot, elevated plaza along with a roll-off building that will house a suite of six sophisticated telescopes. These will be used for observing through eyepieces, as well as projecting images onto monitors.

“Those of us who support the GODO do so because we know that experiences at Lowell Observatory change lives forever,” said Beckage, who expressed this sentiment that he and his wife, Bridget, share. “Our longstanding mission to comprehend the mysteries of the universe, and to share the magic of that knowledge



Ginger and John Giovale provided the lead gift on the \$3 million project designed to bring the universe closer to more visitors at Lowell Observatory.

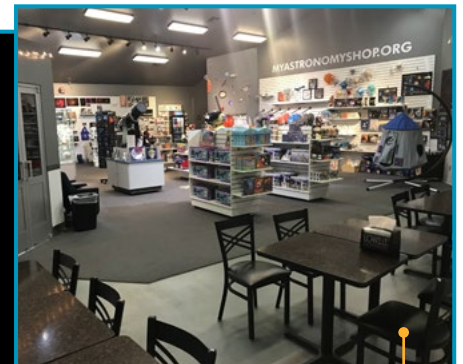
with the public, drives our desire to offer ever more magical experiences on Mars Hill.”

Ayers Sciences Fund Supports 5th-Grade Visits

The Ayers Sciences Fund, under the leadership of longtime Advisory Board member Robert Ayers, is funding all 5th-grade classes in the Flagstaff Unified School District to visit Lowell. Each of the 36 classes will spend two hours at Lowell, splitting that time between a workshop activity and facility tour. Master Teacher Todd Gonzales has spearheaded the programming aspects of this effort, which significantly expands on similar programs from years past. With the help of several Lowell staffers, as well as scientists and educators from Northern Arizona University and the United States Geological Survey, Gonzales devised a pilot activity called “Engineering in Elementary.” This ties directly to the Arizona Science Standard for 5th graders, “Describe effort to explore space.” It also helps students participate in Flagstaff Lunar Legacy, the 18-month long celebration of northern Arizona’s role in the first Moon landings and other contributions to space sciences.

Thanks to Bob Ayers and the Ayers Sciences Fund for this generous support!

The “Engineering in Elementary” activity teaches students to learn by doing.



The expanded gift shop now features a small eating area, packaged food, and more space to display a greater variety of products.

Gift Shop Modifications

Lowell’s gift shop continues to expand in order to better meet the needs of our ever-growing attendance. Earlier this year, staff relocated the shop into the much-larger space previously used as the exhibit hall. Now, guests have the opportunity to purchase packaged sandwiches and other food products, a welcome option especially for those spending hours exploring the observatory. An eating area is also now available on one side of the new gift shop area.

THE LOWELL OBSERVER

UPCOMING SPECIAL EVENTS

OPEN YEAR-ROUND

Monday - Saturday: 10:00 a.m. - 10:00 p.m.

Sunday: 10:00 a.m. - 5:00 p.m.

RECURRING EVENTS

Cosmic Questions | MAR 1, 8, 15, 22, 29 | APR 5, 12, 19, 22, 26 | MAY 3, 10, 17, 24, 31 | 8 - 10 p.m.

LOCKS Preschool | MAR 2 & 16 *Matter: Phases of Matter* | APR 6 & 20 *Earth: Layers of the Earth* | MAY 4 & 18 *Thermodynamics: Temperature* | 10:30 a.m. - Noon

Meet an Astronomer | MAR 2, 9, 16, 23, 30 | APR 6, 13, 20, 27 | MAY 4, 11, 18, 25 | 8 - 10 p.m.

MARCH

SAT 16 | Lowell42

(7 p.m.) *"Deep Time: The Solid Earth Meet the Night Sky"*
- Dr. G. Kent Colbath

APRIL

MON 22 | Cosmic Questions: Meteor Shower Edition

(8 - 10 p.m.) *Learn about the Lyrids Meteor Shower during an informal discussion with one of our educators.*

MAY

FRI 3 | Cosmic Questions: Meteor Shower Edition

(8 - 10 p.m.) *Learn about the Eta Aquarids Meteor Shower during an informal discussion with one of our educators.*

SAT 18 | Lowell42

(7 p.m.) *"Guided by the Night: Can Animals See the Stars?"*
- Dr. Michael West

SAT 25 | "Dinosaurs, Plankton, and Asteroids"

(7 p.m.) *"The Science Behind Understanding Mass Extinctions"*
- Dr. Kent Colbath

For more special event information visit:

www.lowell.edu/visit/special-events

www.lowell.edu

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170