

THE

ISSUE 104 SUMMER 2015

LOWELL OBSERVER

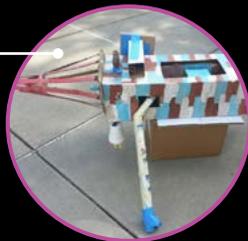
THE QUARTERLY NEWSLETTER OF LOWELL OBSERVATORY EXPANDING OUR UNIVERSE

An artist's concept of Kepler-22b, detected by NASA's Kepler mission and the first exoplanet confirmed to orbit within a star's habitable zone. It is 2.4 times the size of Earth and is the type of planet for which EXPRES will search. Credit: NASA/Ames/JPL-Caltech



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Lowell Welcomes Yale as DCT Partner

By Kevin Schindler

Yale University has joined Lowell as a Discovery Channel Telescope (DCT) scientific partner. This collaboration will bring a state-of-the-art instrument to the DCT to perform a key project dedicated to detecting Earth-like planets around distant Sun-like stars.

As part of the partnership agreement Yale will pay Lowell \$1 million, with additional funds to be raised in upcoming years to pay for the full observing time required for the project.

Debra Fischer, an astronomy professor at Yale, is a worldwide leader in the search for exoplanets. The instrument her team will design and deliver to the DCT for detecting Earth-like planets is called EXPRES, the EXtreme PREcision Spectrometer. The new partnership with Lowell will allow astronomers to couple this high-precision, high-resolution spectrograph via a fiber-optic feed to the powerful 4.3-meter DCT.

Lowell Director Jeffrey Hall said, "Debra's original name for the exoplanet

search was 100 Earths, and her goal is to find 100 Earth-like planets, meaning ones in the habitable zone of a Sun-like star. We've expanded the idea to include not just 100 Earths but also 100 Suns, because at the same time that we search for planets, we'll be characterizing in great detail the activity and variations of the stars that the planets orbit."

EXPRES has a precision capable of detecting planetary motions around other stars of a minuscule 10 centimeters per second – ten times industry norms. This accuracy is critical for detecting Earth-sized planets. Hall said, "What you're looking for are Doppler shifts

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REU Student Ryan Muzzio Returns for His Third Summer at Lowell

See page 4 for more!



DIRECTOR'S UPDATE

By Jeffrey Hall

It's been a generation since *Voyager 2* brought us the vistas of Jupiter, Saturn, Uranus, and Neptune on its remarkable trek through the outer solar system. I remember waiting for the images to appear on TV or in the newspaper, wondering what amazing sights the giant planets and their moons would have in store.

All that excitement has returned over the past month with the steadily improving views of Pluto and its moons from *New Horizons*, and the experience has been much more visceral thanks to the Internet, letting us follow along with the mission team almost in real time.

I'm sometimes asked why we bother spending time and

money on pure research as opposed to more "practical" matters. Flinging a little ship three billion miles across the solar system, putting it exactly where we want it, and returning glorious high-resolution images of a distant world inspires us all, including the young eyes of the next generation after *Voyager*, the explorers who will succeed us in understanding other worlds as well as our own. That is both practical as well as so very worthwhile on its own merits.

We won't stop here, of course. If funded to do so, *New Horizons* will continue to another exciting encounter in early 2019. Other missions to other destinations in the solar system are happening and will continue to happen. Lowell astronomers will continue their exploration of worlds near and far, the stars they orbit, and the galaxies of which they are a part.

It's a valuable and thrilling human enterprise, and it's a privilege to be part of it. ☺



TRUSTEE'S UPDATE

By W. Lowell Putnam

The *New Horizons* team and their supporting organizations deserve a great "Thank you!" from the country/world and particularly the scientific community. Now the real science, the purpose of the mission, can begin.

I would note that Percival Tombaugh found it, and current (and many former) Lowell staff are now going to be studying it.

That said, in another few weeks, Pluto will be back to being a small blob of light and the ongoing work of

Ted Dunham, Will Grundy, Stephen Levine, Henry Roe, Larry Wasserman and others at Lowell will be important to extending our understanding of Pluto and the edges of our solar system.

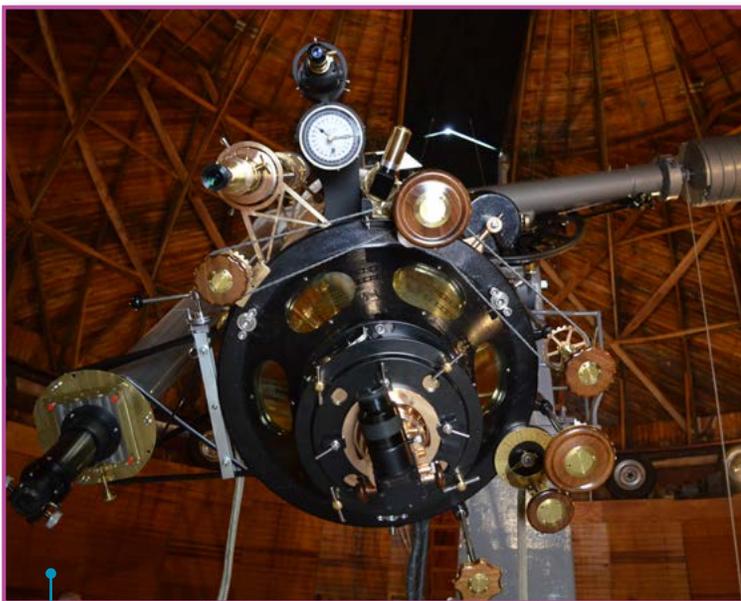
For perspective, we have only "seen" Pluto for 1/3 of its "year", and only gotten "details" for less than 1/10 of a Pluto year. It will require the persistence of a long-term, focused institution like Lowell to put together the rest of the story.

I feel comfortable saying we will because, of all the organizations involved in *New Horizons* and its mission to Pluto, we were the one organization that was there from the beginning and is still part of the discovery process going forward.

It is an honor and a trust to continue that. ☺

For the latest Pluto photos and updates from NASA visit:

<http://pluto.jhuapl.edu/>



The business end of the soon-to-be-completed Clark Telescope was completely overhauled and now features repaired or replaced control elements that are stunning in their beauty.

Clark Update

In late spring, Ralph Nye and the Clark restoration team reinstalled the mount and tube assembly of the Clark Telescope. This involved using a crane to lift the massive parts back into the dome and precisely position them into place so the crew could then bolt them down. Since several hundred pounds of unneeded weight had been removed from the tube during renovation, the entire system also had to be carefully rebalanced. The team has since been busy rewiring the archaic and hazardous electrical system of the facility and testing various components of the telescope and dome, ensuring that all components are working properly. With just a handful of minor issues to work out, the renovation project is nearing completion. We anticipate putting the telescope back into normal operation soon. Stay tuned for information about the reopening and special events celebrating the Clark!



The Navajo-Hopi Astronomy Outreach Program includes visits by Lowell astronomers to 5th-8th-grade classrooms and field trips to both Anderson Mesa and Mars Hill. Evening star parties allow students to look through telescopes at the night sky, often for the first time.

Help Fund This Award-Winning Program!

By Antoinette Beiser

The Lowell Observatory Navajo-Hopi Astronomy Outreach Program is a science enrichment and outreach program for Navajo and Hopi teachers and their students in 5th-8th grade. The program is primarily focused in Coconino, Navajo and Apache counties in Northern Arizona, where childhood poverty is well above the national and state averages.

Reservation schools have little opportunity for science enrichment activities due to their isolated locations and limited budgets. Thus significant excitement and interest is generated in the classrooms during visits by astronomers and educators from Lowell Observatory!

There will be a record nine astronomer-teacher partnerships during the 2015-16

school year, positively impacting seven schools in the following communities: Tsaile, Ganado, Fort Defiance, Lukachukai, Dennehotso, Jeddito and Winslow. Lowell staff visits on average five times throughout the year, leading science discussions and hands-on activities along with the teachers. Evening star parties are held for students and parents, and tribal educators take part by presenting traditional astronomical knowledge. All partnerships culminate in a field trip to Lowell Observatory where approximately 180 students, plus their teachers, tour the Lowell campus during the day and observe the night sky through our Mars Hill telescopes. Teacher training is also emphasized with a multi-day workshop held every third year at Lowell

for participating teachers and a colleague from their schools. The next workshop, scheduled for spring 2017, is planned for 25 teachers.

The Navajo-Hopi Outreach program was started in 1996 by Lowell astronomers Deidre Hunter and Amanda Bosh. Dr. Hunter was awarded the American Astronomical Society's Education Prize in 2014 for her efforts on behalf of this program. The award recognizes outstanding contributions to the education of the public, students and/or the next generation of professional astronomers. 

If you are interested in helping support this award-winning program please contact Antoinette Beiser at asb@lowell.edu or call (928) 864-9527 for more information.

Funding is urgently needed for the 2015-16 school year!

Announcing the Lowell Observatory Foundation

We are pleased to announce the creation of the Lowell Observatory Foundation, an independent 501(c)(3) that receives, manages, and invests gifts to benefit Lowell Observatory's mission in perpetuity. The board of seven Foundation trustees elected David Connell as Chair and Bruce Kosaveach as Vice-Chair at their first meeting on June 13, 2015. For more information about the Lowell Observatory Foundation or to make a contribution, contact me at lactor@lowell.edu or (928) 255-5047. — Lisa Actor

Lowell Observatory Foundation Board (bottom row, left to right) Bruce Kosaveach, David Connell, David Chase, W. Lowell Putnam; (2nd-4th rows, bottom to top) Mike Beckage, Mary Lockett, Sue Durling.





EXPRES is a large instrument that will not be attached to the DCT instrument cube but instead be stored in a thermally controlled vacuum environment downstairs in the dome. It will be attached to the DCT via an optical fiber.

LOWELL WELCOMES YALE AS DCT PARTNER
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in the spectrum of a star. As a planet orbits a star, the star moves slightly due to the gravitational tug of the planet. This is detected by slight changes in the wavelengths of lines in the star's spectrum. The smaller the planet, the less the tug and thus the more difficult to detect it. That's why a high-precision instrument like EXPRES is necessary."

Fischer's background in exoplanet studies includes leadership on several search programs. She developed FINDS Exo-Earths (the Fiber-Optic Improved Next-Generation Doppler Search for Exo-Earths) and is the primary investigator on CHIRON, a high-resolution, fiber-fed spectrometer at the Cerro Tololo Inter-American Observatory in Chile. She also works on the team — led by

Geoff Marcy of the University of California, Berkeley — that discovered the first-known multiple-planet system and 2/3 of the first 100 extrasolar planets.

Yale is the fifth DCT science partner with Lowell, joining Boston University, the University of Maryland, the University of Toledo, and Northern Arizona University. Hall said, "We are pleased to welcome Yale on board as a DCT partner. This relationship will complement stellar and exoplanet research we already do, and may help us answer age-old questions about the existence and nature of Earth-like planets and, by extension, life, in the universe. At the same time, other research projects can be done with EXPRES, and we hope all our partners will benefit from having this world-class instrument at DCT." 

New Deputy Director for Science Michael West



Dr. West comes to Lowell from Nantucket's Maria Mitchell Association, where he served as Director of Astronomy since

2013. He earned his PhD in Astronomy from Yale University in 1987 and has since acted as astronomy professor at the University of Hawaii, Head of Science Operations at the Gemini South Observatory in Chile, and Head of Science at the European Southern Observatory's facilities in Chile. At Lowell, he will split his time equally between research and deputy director duties, which will include helping develop a long-range scientific vision and overseeing the education and outreach efforts.

REU Student Ryan Muzzio Returns for His Third Summer at Lowell

After two summers as a Public Programs and exhibits intern at Lowell, Ryan Muzzio has returned this summer as an REU (Research Experiences for Undergraduates) student. Ryan works under the guidance of astronomer Lisa Prato and postdoc Tom Allen reducing and analyzing binary star data. Muzzio first learned about Lowell through a friend whose mother was good friends with Bill Putnam. This eventually led to Muzzio's interning at Lowell. He said, "I loved my first two summers at Lowell. It solidified my love of astronomy, working and living at an observatory. I met so many people that did what I wanted to do, and they actually cared about who I was and what I was interested in. This inspired me to study harder during the school year so I could come back." A native of Washington, D.C., Muzzio now studies physics at Kenyon College, a small liberal arts school in Ohio. He ultimately wants to earn a PhD in astrophysics. He said, "My work at Lowell has allowed me to get a head start on my goals in life, and I am truly thankful for that."

— Samantha Thompson

Ryan Muzzio is back for his third summer of work at Lowell, this time helping Lisa Prato and Tom Allen with their binary star studies.



Monday Nights at Lowell Observatory



By Andy Odell

My association with Lowell Observatory began a third of a century ago, when I moved from Tucson to Flagstaff in order to teach and research at Northern Arizona University (NAU). At first, I collaborated with several of the astronomers at Lowell, attended colloquia, and used the library. Some of that changed in 2001 when I retired from NAU and soon became a volunteer in Lowell's Public

Andy Odell sets up his telescope for the public.

Program, bringing my Celestron-8 to the campus to share views of the night sky.

I tell everyone that I do it to help pay Lowell back for all the things it has done for me, including embarrassingly large amounts of research telescope time. The truth is, I enjoy the contact with visitors very much — just don't let that cat out of the bag!

It has been surprising and rewarding to watch public program attendance grow over the years. At first I was dismayed by the changes on the hill as the pine trees and parking area were

turned into a mud bog which was to be the foundation of the Steele Visitor Center. But when it was finished, I realized that the new trustee, Bill Putnam, was bringing Lowell Observatory into the 21st century.

A couple of experiences stand out for me over the years. One night, a family that had just viewed Saturn through the Clark Telescope walked down to my telescope in front of the Rotunda. The wife/mother looked at the moon through my

telescope, stepped back, and said, "This is incredible, but believable. That (referring to seeing Saturn through the Clark) is NOT BELIEVABLE!" And I have to agree with her; Saturn through the Clark looks like a picture. Actually, it looks better than any picture I've seen. It's like seeing a photograph of the Grand Canyon, and thinking you appreciate and understand it, and then seeing the real thing.

Another night, a father and daughter came over to my telescope, again looking at the moon. The father said, "Look, honey, it's a half moon tonight." She put her hands on her hips and corrected him, "It's called first quarter, dad!" I asked him how old she was, and he said five years. I didn't even know the moon EXISTED when I was five. Stories like this give me hope for future generations.

The other part I like about volunteering at Lowell is the camaraderie. As we interact with the public in front of the Rotunda, we volunteers banter among ourselves about who will get to point to what object, and what we've been up to since last week.

It certainly doesn't seem like 13 years has passed since I started volunteering. I don't know what I would do with myself on Monday nights if I couldn't go to Lowell Observatory. ☺

Upward Bound

In June, ten Upward Bound Summer Academy students assisted Lowell staff with summer camp, archives, and exhibits. Upward Bound is a U.S. Department of Education program that helps students transition from high school to college.



Welcome Anne LaBruzzo

Anne LaBruzzo joined the Lowell staff on June 30 as our new Deputy Director for Administration. Anne earned a bachelor's degree in Business Administration/Accounting from California State University, Northridge and has experience in accounting, compliance, and grant management. After working for several years in California at a number of educational, manufacturing, and research facilities, she moved to Arizona to work at Prescott College. She worked there for the past four years, most recently in the position of Chief Financial Officer.

Anne LaBruzzo brings a variety of experience that makes her an ideal fit for the Deputy Director for Administration position.

Fourth Annual Gala Draws 300 Guests

More than 300 people gathered at Northern Arizona University in Flagstaff on June 13, 2015 for the Pluto and Beyond gala presented by APS. VIP guests enjoyed a champagne reception sponsored by Blue Cross Blue Shield of Arizona at the 1899 Bar and Grill. The party then moved across the street to the main event at the High Country Conference Center. The spotlight that evening was on three of our very own: Kevin Schindler spoke about Lowell's Pluto Legacy, Dr. Gerard van Belle told us how our favorite world has captivated him both personally and professionally, and Dr. Henry Roe shared hints as to what we might expect to learn about Pluto in the coming weeks, months, and years. The observatory netted more than \$50,000 for the evening – a fantastic result! Thank you again to our sponsors: Stowebridge Promotion Group for the beautiful pint glasses and Northern Trust for the stunning centerpieces! — Mica Gratton

Guests listen to Dr. Henry Roe discuss future plans to study Pluto and other icy bodies in the Kuiper Belt.



Welcome to the Director's Opportunity Network

The Director's Opportunity Network (DON) is a group of supporters who provide \$10,000 or more annually to allow Director Jeff Hall to invest in exploration, education, and outreach at Lowell Observatory. DON investors will have opportunities to travel to foreign countries with Lowell astronomers for behind-the-scenes tours at partner observatories. For more information or to join DON, contact Lisa Actor at lactor@lowell.edu or (928) 255-5047.



Librarian/Archivist Lauren Amundson and Curator Samantha Thompson with the MAA Award in front of the Putnam Collection Center.

Lowell Wins Award

In May the Museum Association of Arizona (MAA) awarded Lowell the 2015 Professional Recognition Award for Institutional Excellence. Lowell was recognized for "its great work to preserve the history and heritage of all the great discoveries that have gone on over the years. The interpretive center and new collection center have been vital to this effort."

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.

Elmegreen, Bruce G. ; Hunter, Deidre A. (2015). A Star Formation Law for Dwarf Irregular Galaxies. *The Astrophysical Journal*, Volume 805, Issue 2, article id. 145

Image: Neugent/Massey/Lowell Obs./NSF

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



This summer, 5th–6th graders in Lowell's Elementary School Summer Camp designed and built this rover for a theoretical trip to Jupiter's moon Europa. Students broke into several teams — design, communications, etc. — and learned to problem-solve in order to create and assess components of the rover, which they named "The Ice Breaker".

information for themselves, rather than being told the answers."

Third and fourth graders focused on galaxies and created their own versions, from inches-wide dwarfs to feet-long ellipticals, out of household products such as cotton (to represent gas and dust) and glitter (as stars).

Fifth and sixth graders studied life on other worlds. The highlight of their week was building a rover they designed to explore Europa. Flagg said this was a fascinating process to watch because the students at first worked independently but eventually learned that only through teamwork and communication could they succeed as a group.

For middle schoolers, building their own light meters and taking measurements from various places around town proved to be a lot of fun. How much did the students enjoy this experience? One night, Educator/Counselor Todd Gonzales was driving a group of student home from gathering light readings at Anderson Mesa. One of the students urged Todd to turn on the vehicle's dome light, and when Todd asked why, thinking maybe the student wanted to plug in her phone, the student replied she was anxious to start calculating the reading averages.

One of the most significant aspects of the camps is the inclusion of certified teachers in delivering the curriculum. This allows us to potentially reach a much broader community in Arizona because the teachers can take the lessons they've learned in the camps back to their classrooms. 

Summer Campers Vote on Pluto, Build Rovers

By Samantha Gorney

In early June, several first and second graders gathered behind closed doors to debate a question hot in professional astronomical circles — "Is Pluto a planet?" After much adult-free conversation (chaperones did carefully monitor the discussion through the slightly ajar doors to the room), the students mimicked the IAU and held their own vote. Such is the scene during summer camps at Lowell, where some students debate planetary nomenclature while others design rovers for far-flung worlds.

The Lowell Observatory Camps for Kids (LOCKS) program is in its fourth year and continues to grow. Campers from as far away as Texas, many of them repeat attendees, flocked to Lowell to experience hands-on astronomical programs while learning about team building and project management.

An overarching goal of the camps is to teach people not just the cool facts about astronomy, but what it means to do science and be a scientist.

Major donors to this year's camps included the Arizona Community Foundation of Flagstaff, the Geofund, Don Paul, W.L. Gore & Associates, the Arizona Community Foundation of Flagstaff, and Tom Ensign. These critical donations allowed Lowell to enhance programming and increase the number of available scholarships.

Multiple sessions, consisting of both lessons and extended projects, made for a busy Lowell campus in June and July. First and second graders learned about the solar system and their "Pluto Vote" was a typical learning experience. Education Coordinator Samantha Flagg said, "For this activity the students learned how to interpret

Dedicating the Tombaugh Apartment

On June 12, staff and guests dedicated the second-floor apartment in the Slipper Building as the "Tombaugh Apartment" in honor of Clyde Tombaugh, who lived there when he discovered Pluto in 1930. Director Jeff Hall introduced Clyde Tombaugh's children and spouses, who traveled from New Mexico for the dedication. Kevin Schindler spoke about the history of the Slipper Building and Samantha Thompson described pictures that will hang in the apartment. Trustee Lowell Putnam then presented the Tombaughs with a framed collection of Pluto trading cards, produced here at Lowell.

Pictured here after receiving their frames from Lowell Putnam are (left to right): Clyde's daughter Annette Tombaugh-Seitz, her husband Wilbur, Clyde's son Alden Tombaugh, and his wife Cheryllee.



ISSUE 104 SUMMER 2015
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.
Extended Hours: Sunday, Sep 6 & 27 | 10 a.m. - 10 p.m.

RECURRING EVENTS

2nd Friday Science Night | **AUG 14** (*Electricity & Magnetism II*), **SEP 11** (*Engineering "Magic"*), **OCT 9** (*Optics and Optical Illusions*) | Shows at 6, 7, and 8 p.m.

Coconino Astronomical Society Meeting | **AUG 22** (*Kevin Mullins, CCC, Topic: Glacial Velocities with Satellite Imagery*), **SEP 19** (*Dr. Will Grundy, Lowell Observatory, Topic: Early Results from the New Horizons Encounter*), **OCT 24** (*Brent Archinal, USGS Astrogeology Sci. Ctr., Topic: How to Map the Solar System*) | Wednesdays, 6:45 - 8 p.m. | **FREE**

AUGUST 31 - SEPTEMBER 6 | Neptune Week
(Daily, 6 and 8 p.m.) *Family-friendly Neptune-themed activities*
(Daily, 7 p.m.) *Lecture about Neptune*

SEPTEMBER

MON 7 | School is Out and Kids are Free
(10 a.m. - 5 p.m.) *Free admission for kids 17 and under until 5 p.m.*

SAT 19 | International Observe the Moon Night
(6 and 8 p.m.) *Family-friendly Moon-themed activities*
(7 p.m.) *Lecture about the Moon*

SUN 27 | Total Lunar Eclipse Viewing Event
(6 - 10 p.m.) *Learn about the cause of lunar eclipses during a talk at 6 p.m. and view the eclipse through telescopes afterward. Hours extended until 10 p.m.*

OCTOBER

10-17 | Uranus Week
(Daily, 6 and 8 p.m.) *Family-friendly Uranus-themed activities*
(Daily, 7 p.m.) *Lecture about Uranus*

WED 21 | Orionids Meteor Shower Activities
(6 and 8 p.m.) *Family-friendly meteor shower activities*
(7 p.m.) *Lecture about the source of the meteor shower and viewing tips*

30-31 | Halloween at Lowell Observatory
(5 - 10 p.m.) *"Freaky Physics" and "Scary Astronomy" shows plus Haunted Observatory Tours and telescope viewing*

For more special event information visit:

www.lowell.edu/outreach/special-events

Find us on Social Media!

Facebook.com/LowellObservatory

Twitter: @PercivalLowell

Instagram: @LowellObservatory



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