

THE

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# LOWELL OBSERVER

THE QUARTERLY NEWSLETTER OF LOWELL OBSERVATORY

HOME OF PLUTO

In this 2008 image taken just north of Flagstaff, a lenticular cloud caps the San Francisco Peaks while the plane of the Milky Way Galaxy arcs diagonally from the lower left to the upper right.  
Credit: Dan & Cindy Duriscoe, FDSC, Lowell Observatory, USNO.



## Dark Skies

By Jeff Hall

I'm starting to feel like graduate school was sometime back in the Pleistocene, but I clearly recall my first class, in which we worked through a book titled *Radiative Processes in Astrophysics*, better known to astronomers as *Rybicki & Lightman*. It's all about how light interacts with matter. That's appropriate for someone setting out to learn astronomy. Our understanding of the cosmos stems fundamentally from understanding the light that makes its long journey across space to Earth. And Lowell's Discovery Channel Telescope and its instruments are sensitive to vanishingly small amounts of light.

Today's steady growth of light pollution is therefore a threat to the viability of our science. It also has numerous other negative impacts, including on migration and reproduction of various species, adverse human health impacts, negative effects on safety when overly bright and glare-heavy lighting is used, and the loss of our personal connection to the beauty of a star-filled sky. Lowell has therefore been working locally and statewide, in concert with Arizona's many other observatories, to protect our dark skies.

We are at a critical juncture worldwide in dark-sky protection with the steady transition of outdoor lighting from older fixtures such as high-pressure sodium lamps (a dominant component of the illumination you see below you during a nighttime flight) to light emitting diodes (LED). There are compelling economic and maintenance reasons to switch to LEDs, but the typical LED solution incorporates white, high-temperature luminaires. (Phoenix, for example, is right now proposing to retrofit 90,000 street lights with such fixtures.) These are ruinous for astronomy due to their very broad-spectrum emission, and further ruinous to visual appreciation of the night sky due to their blue-rich spectral content,

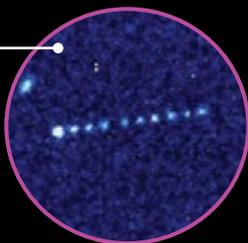
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**Summer Camp  
Registration Now Open**

See page 11 for more!

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### DIRECTOR'S UPDATE

By Jeffrey Hall

I've been traveling almost every week this month. Everyone loves to hate the airlines, but apart from the expected fatigue after three road-warrior weeks, I rather enjoy my time getting to and from points around the country.

I always reserve a window seat: because I am a science geek, I enjoy studying the weather patterns and using GPS apps to keep track of the natural and manmade features going by below. I consider myself lucky to have a view to our planet few humans have had the privilege of having.

I also usually wear the team colors – the red shirt with the

Lowell Observatory logo used by our educators to be easily identifiable to our guests on campus. It's amazing how often that starts conversations in airports or in planes, whether about observatories and astronomy in general, or about Lowell in particular. Sometimes folks end up with my card; sometimes it's answering questions about black holes from an excited eleven-year-old. In any case, the interest in our field and our institution is broad and enthusiastic, and it's wonderful to see.

In the adjacent column, our Trustee Lowell Putnam writes about his positive experience at the NEAF convention, and the recognition and respect held for Lowell Observatory among its attendees. My experiences on travel are the same, and I'm grateful for all the interest and engagement from so many. We want to be a connection to the Universe for all of you and will continue to do so. 



### TRUSTEE'S UPDATE

By W. Lowell Putnam

I recently attended the annual Northeast Astronomy Forum (NEAF) convention in New York and was humbled by how well regarded Lowell Observatory is within the amateur astronomical community. People were very interested in all aspects of the observatory, history, current research, and, of course, the state of Pluto!

I went very quickly from there out to Flagstaff to participate in two days of planning meetings. Over the past year the efforts by our Outreach and Communication staff have resulted in a 30% increase in attendance, year over year. This started with the *New Horizons* fly-by of Pluto

last July, but has continued throughout the winter and into this spring. People continually post about how great their experience is. While we are glad with this response, we now need to think about how to handle this growing number of guests to Mars Hill and what it will take to maintain or (better) improve their visit. Parking, space and amenities all will need work.

The second set of meetings were to address the best ways to support our science and research efforts going forward. We are very fortunate that the science capabilities of the DCT and the NPOI will be increased dramatically over the next few years. This will give our researchers an unmatched set of "tools" to do their work. We need to figure how to support all this research capacity while also addressing the expansion needs on the Hill.

As always, your support and enthusiasm for Lowell are appreciated and we look forward to your help as we search for the right solutions. 

## The Science of Space

Join Lowell Observatory on June 4, 2016 as we host our 5th Annual Gala, The Science of Space. This is sure to be an exciting evening as we share discoveries about our solar system and beyond. This special event will feature a presentation by Dr. Stamatios (Tom) Krimigis, the Principal Investigator on most of NASA's planetary flyby missions. Plus, Lowell astronomers will explain their research as part of a Space Expo. This will be a one-of-a-kind evening, featuring great food, a spectacular auction, and much more!

Science Expo, Silent Auction & Cocktail Hour begin at 6 p.m.  
Dinner and Dr. Krimigis' program begins at 7 p.m.

**Tickets: \$125 each or \$1,000 for a table of eight.**

To purchase tickets or sponsorships contact Mica Gratton at (928) 255-0229, email at [mica@lowell.edu](mailto:mica@lowell.edu), or visit our website at

[www.lowell.edu/2016-science-of-space-gala](http://www.lowell.edu/2016-science-of-space-gala)



## Meet Percival Lowell Society Members Bill and Susan Ahearn

By Antoinette Beiser

Bill and Susan Ahearn have been visiting Lowell Observatory since long before there was a formal membership program. In fact, their individual relationships with the observatory began before they met!

As a young person, Bill knew Pluto was discovered at Lowell but didn't know the observatory was in Flagstaff. While vacationing here with her parents in 1967, Susan learned the astronauts had visited Lowell and trained in Flagstaff.

The Ahearns believe Lowell Observatory is a national treasure. They love that the only planet discovered in the United States was found here, on Mars Hill. They like

envisioning Percival Lowell sitting at the Clark telescope observing Mars. They appreciate V.M. Slipher's discovery of the expanding universe. Getting the chance to meet current astronomers doing research through Lowell's Discovery Channel Telescope is a special treat.

The Ahearns' planned gift will help support the next 100 years of exploration and discovery at Lowell Observatory! If you'd like to include the observatory in your estate plans please contact Antoinette Beiser, Leadership Gifts Officer at (928) 255-0186 or [asb@lowell.edu](mailto:asb@lowell.edu).

Bill and Susan Ahearn are the newest members of the Percival Lowell Society. Retired and living in Phoenix, they enjoy hiking and camping in the forests around Flagstaff and the Grand Canyon. They also visit Lowell Observatory several times each year to enjoy special program and events.



## Cocktails with Alan Stern

**We invite our Pluto Circle members to join us on July 6th for an exclusive cocktail reception with Alan Stern, principal investigator of the New Horizons mission to Pluto.**

Come hear what the New Horizons team has learned about Pluto and Charon. Keep an eye out for an upcoming invitation!



## Director Jeffrey Hall Honored

On March 5, the Flagstaff Arts Council awarded the 2016 Viola Award for Excellence in Leadership to Jeffrey Hall. The Viola Awards recognize artists, educators, organizations, and leaders who contribute to the advancement of the arts and sciences in Flagstaff. This year, 620 people attended the awards ceremony. Hall was recognized for his leadership in a variety of areas, including both research and management at Lowell, dark skies advocacy, Flagstaff STEM initiatives, the Flagstaff Symphony Orchestra, Northland Preparatory Academy, and Coconino Community College.

Jeffrey Hall accepts the Viola Award for Leadership at the 8th Annual Viola Awards Gala. The event was held at Flagstaff's High Country Conference Center at Northern Arizona University.

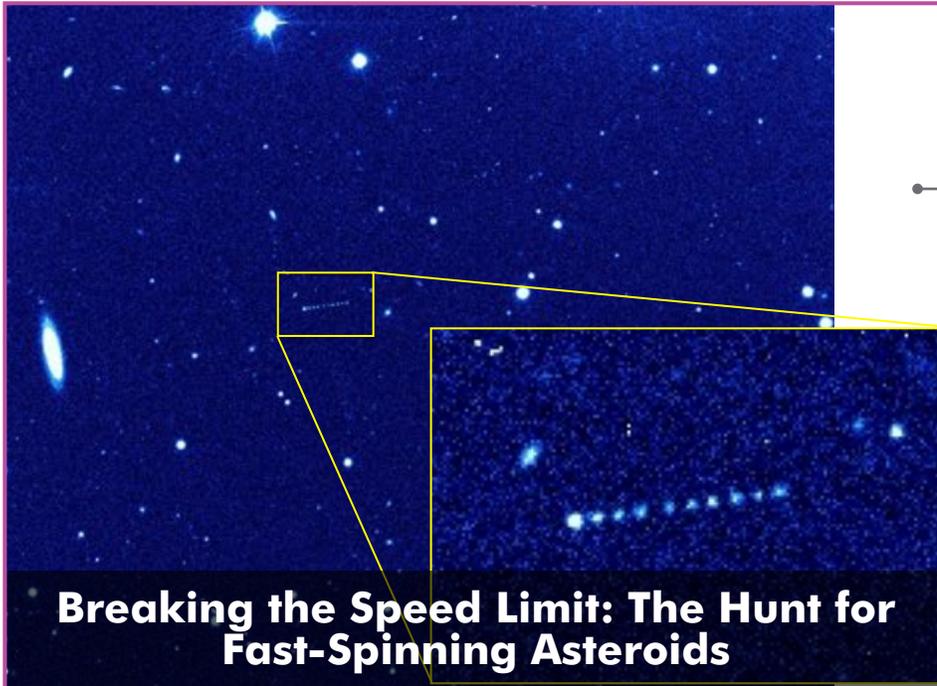


Figure 1: Stacked images of rapid rotator (455213) 2000 OE84 taken with DCT/LMI spanning about 45 minutes on March 10, 2016. The brightness variations of the asteroid are apparent as it moves across the image from left to right (inset).

## Breaking the Speed Limit: The Hunt for Fast-Spinning Asteroids

By Nick Moskovitz (Lowell Observatory) and David Polishook (Weizmann Institute of Science in Israel)

Asteroids come in a variety of sizes, shapes, and compositions, all of which reveal clues about the origin and evolution of our solar system. Recent work by our team, which includes Lowell post-doc Audrey Thirouin, is providing new insights into the diversity of asteroid properties.

It is believed that most large >300 meter asteroids are loosely bound collections of boulders, rocks, and dust called rubble piles, whereas small <300 meter asteroids can be monolithic blocks liberated via collisions from the surfaces of larger parent asteroids. While this size dependence is consistent with current data, the interiors of asteroids remain unexplored and thus the extent of internal segregation is unknown. This information is important for understanding the collisional evolution of small bodies in the solar system and the potential hazard that an asteroid could pose if one were to impact Earth.

Fortunately, by measuring rotation rates, internal structures can be indirectly inferred. As an irregularly shaped asteroid rotates it reflects variable amounts of sunlight (Figure 1). Observing these brightness fluctuations provides a measure of rotation rate. Asteroid rotation rates span many orders of magnitude, from hundreds of days to just a few seconds. If

an asteroid is a rubble pile then it can only spin so fast before it literally tears itself apart as centrifugal forces overcome the forces of gravity and cohesion that keep the rubble pile bound. This rubble pile spin limit is 2.2 hours (Figure 2) and thought to be regulated by mass loss which causes fast-spinning asteroids to lose angular momentum and slow down. In contrast a solid monolithic body can spin much faster without undergoing any major disruption or mass loss.

Recently, an international team including astronomers from Lowell discovered that the 1-km-size asteroid (60716) 2000 GD65 was spinning with a period equal to 1.95 hours, just above the rubble pile spin limit. An even more dramatic case is that of the 700-meter near-Earth asteroid 455213 (2001 OE84), which is large enough to be a rubble pile but is spinning with a period of only 30

minutes. Recent observations of 455213 from the DCT (Figure 1) confirm this rapid rotation but also find that the spin of this asteroid has slowed down by about 0.125 seconds over the past 15 years. This is only the sixth asteroid for which such rotational changes have ever been detected. Aside from exotic physical properties, e.g. an unusually cohesive rubble pile, an explanation for these outliers is that they represent a (geologically) short period of evolution in an asteroid's lifetime in which they can break through the 2.2-hour spin barrier for a brief time before slowing back down to join the crowd. However, the physics of such an evolutionary scenario remain a mystery.

The fastest known rotation rates are found amongst the smallest, presumably monolithic, asteroids. As part of ongoing studies of near-Earth asteroids at the DCT two record breakers have recently been found. The small 5 to 10-meter-size asteroids 2014 RC and 2015 SV6 have measured periods of 15.8 and 17.6 seconds respectively, making them the fastest rotating minor planets discovered to date. Ongoing work will help to determine whether these objects are rare outliers or representatives of a much larger and yet unexplored population of ultra-rapid rotators. 

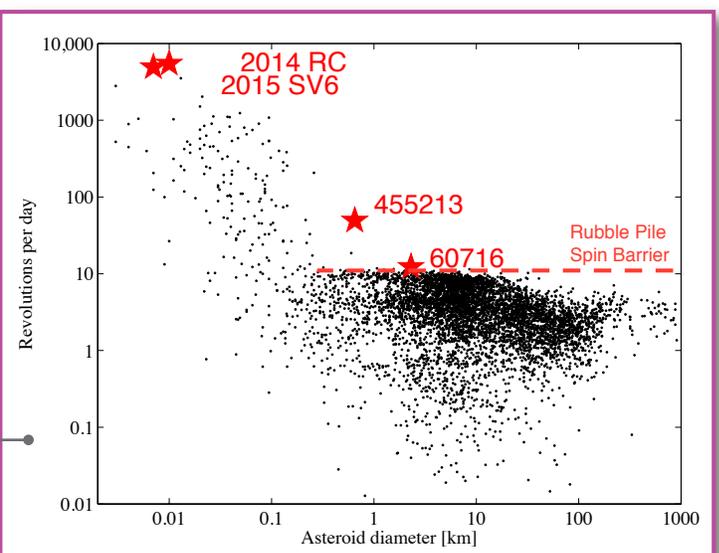
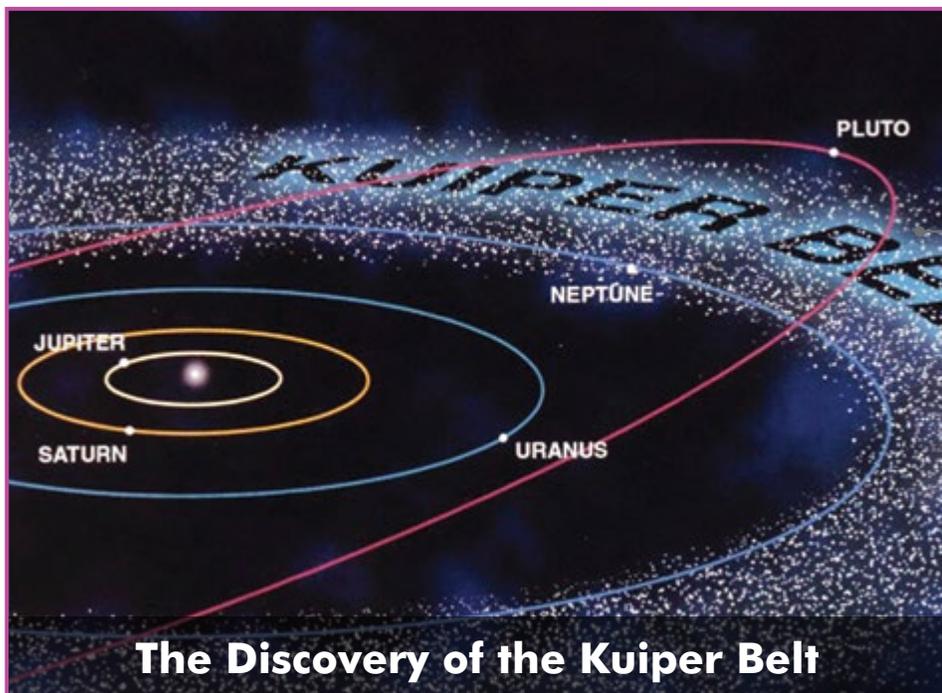


Figure 2: Spin rate versus asteroid diameter. Each point represents a single asteroid. The rapid rotators discussed here (stars) are challenging the upper limits of what is known about asteroid spin states.



## The Discovery of the Kuiper Belt

By Michael Kitt

In August of 1988 I had the pleasure of a conversation with Clyde Tombaugh, in which I expressed my views on whether Pluto should be considered a planet. To my surprise, he said that he had always harbored doubts about whether Pluto was truly a full-fledged planet. These reservations began immediately after he reviewed the Pluto discovery plates. His reasoning was that the object he had blinked was considerably dimmer than what was expected for a planet at the calculated distance. His first reaction was that he had come across an asteroid or a comet, but that notion was quickly dispelled.

Shortly after Pluto's discovery, when its orbital parameters were being calculated, it was determined that this new object had an orbit that was far more eccentric than any of the other planets and which was steeply

inclined to the orbital plane of the eight known planets. This cast serious doubt on Pluto's planetary status.

Roger Lowell Putnam, then sole trustee of the observatory, made the following comment at the time: "The new object, whatever it is, is a most interesting discovery. If it is not strictly planetary, it comes into a wholly new class, which is, in some ways, more exciting. Altogether I think it is a great piece of work that everybody has done. One of the things of which I am anxious to get an idea is the approximate size." Putnam was quite prescient, for when the size and mass of Pluto were accurately determined, there could be little doubt that Pluto was not the Planet X Percival Lowell had sought.

One of the great ironies of Pluto's discovery is that although it was found very close to the position Percival Lowell

The Kuiper belt is a disc of icy bodies located beyond the orbit of Neptune and extending from about 30 to 55 AU from the Sun. It contains Pluto, several other known dwarf planets, and trillions of comets and other debris dating back to the formation of the solar system.

Credit: NASA

had calculated many years before, those calculations are now known to have no basis in fact. Lowell's primary inputs were the unexplained "residuals" in the orbits of Uranus and Neptune, after accounting for all known gravitational effects. More than half a century later, new calculations based on measurements by the *Voyager* spacecraft revealed that the orbits of Uranus and Neptune are just fine on their own and no Planet X is required to explain their motions.

It is interesting to speculate on what would have happened if Pluto had been immediately determined to be, in Roger Lowell Putnam's words, "not strictly planetary". Of course, back in 1930, who would have imagined that hundreds of thousands of solar system objects lurked beyond the orbit of Neptune? Twenty-one years would pass before Gerard Kuiper would postulate the existence of a belt of icy objects that now bears his name. And the first Kuiper Belt Object (other than Pluto) would not be discovered until 1992.

I don't think Clyde Tombaugh would have been the slightest bit bothered by the reclassification of Pluto from planetary status. Instead, he would have been gratified to have been able to play a role in the far more momentous discovery of the first Kuiper Belt Object. I tend to side with Roger Lowell Putnam. The discovery of this wholly new class of objects is a more exciting thing for Lowell Observatory to be proud of, and places it in the unique position of having played a key role in discovering both the expanding universe and the expanded solar system. ☺

## Pluto Renovation Fundraising

This year, the team responsible for the incredible restoration of the 24-inch Clark Refractor is turning its attention to the Pluto Discovery Telescope. The astrograph Clyde Tombaugh used to find the distant world in 1930 is one of the most important instruments in our care. If you're interested in contributing a gift to bolster our fundraising campaign for the telescope, please contact Antoinette Beiser at (928) 255-0186 or [asb@lowell.edu](mailto:asb@lowell.edu), or go to <https://lowell.edu/priority-projects/pluto-telescope> to make a donation online. Help us save this important piece of American history for our visitors to enjoy for years to come!

The Pluto Telescope and its dome were built in 1928-1929 and used not only by Clyde Tombaugh to discover Pluto, but by later astronomers to study comets, asteroids, and the proper motion of stars.



# DISPATCHES FROM THE UNIVERSE

By Michael West

“Sleep is the best meditation,” the Dalai Lama once said. But in today’s fast-paced 24/7 world a lot happens while we snooze. Here’s what you missed if you got a full eight hours of sleep last night.

While you slept, Earth traveled 536,864 miles in its orbit around the Sun. You’d have to sail around the world more than twenty times to cover the same distance.

The hair on your head grew by about the thickness of a sheet of paper.

The Moon continued to drift slowly away from Earth, receding by a distance equal to the size of one of your skin cells. It might not seem like much, but over the course of a year the Moon moves nearly two inches farther away.

The sun’s weight shrunk by 135 billion tons last night as some of its atoms were converted into sunlight.

While you were warm and cozy under your blankets, the Andromeda Galaxy came two million miles closer as it continued its inevitable collision course with our home galaxy, the Milky Way. There’s no need to

lose sleep, however, since the two galaxies won’t collide for another four billion years.

Trillions of ghostly subatomic particles called neutrinos passed right through your body as if you weren’t even there. Most of them came from the Sun. Before zipping through you they zipped right through Earth as if it were invisible too.

Approximately 122,000 new people were born on our planet. Exactly zero people were born on Mars.

About 36 tons of cosmic dust particles, mostly from comets and asteroids, fell from space while you slept. This, coincidentally, is about half the weight of food that an average American eats during his or her lifetime.

On a planet with enough resources to feed everyone, about 8,000 people died of hunger or malnutrition while Flagstaff slept. Most of them were children.

Nearly a million stars ended their lives with a violent explosion – a supernova – somewhere in the observable universe. The blasts destroyed planets orbiting them. An unimaginably larger number of stars expired quietly as they ran out of fuel, dooming any life-bearing planets around them to a slow death.

An area of forest equal to the size of the city of Flagstaff disappeared on Earth overnight.

You had a dream last night, which you probably don’t remember. In it you realized that you’d like to know more about astronomy and the amazing universe we live in. In this dream, you promised yourself to go outside and look at the stars for a few minutes on the next clear night. After all, as the English poet John Milton observed, “What hath night to do with sleep? 🌙”



## While Flagstaff Slept

### Join us for Solar Eclipse 2017

On August 21, 2017 a narrow swathe of the U.S. will experience a total solar eclipse. Join Lowell Observatory outside of Bend, Oregon for this extraordinary event.

From August 20 – 22, we will convene in Bend with telescopes, astronomers, and educators for three days of astronomy. Make your reservations now at a hotel or campground near Bend and enjoy this once-in-a-lifetime experience with Lowell Observatory. See more information in future *Lowell Observers*.

Visualization of the 2017 total solar eclipse, showing the diamond ring effect. This phenomenon is visible during the moments just before and after totality. Credit: NASA’s Goddard Space Flight Center





## Slipher Building Centennial

By Hannah Brower

On the afternoon of July 7, 1915, Lowell staff began planning for a new administration building. It was to serve as the new entrance point to Lowell Observatory, with a driveway leading up to a beautiful domed library highlighted by a central fountain. The staff needed a better office space because resources were scattered in houses around the observatory. Thus, that August 2nd, excavation for a new building started.

Originally called simply the administration building or main building, it was placed in line with the equinoctial sunrise and set back westward on the hill in order to save some native oak trees that Lowell was fond of. The east corner was designed to be the director's office with a covered back porch leading off it. In the basement, the Herring-Hall-Marvin Safe

Company was hired to set a bulkhead-like structure in the west end for an archives and photographic plate room. This would result in two floors, featuring a mysterious solar lab and the library called the 'cella,' presently known as the Rotunda Museum.

Rumor has it that Guy Lowell, Percival's cousin, designed the building, but from my research there is not a shred of proof and rather a lot of evidence supporting Percival and his wife Constance as the designers. Constance indeed had a strong influence on the building when it came to design, internal set up and the Rotunda. V.M. Slipher wished for the Rotunda dome to be shaped as an octagon so that it wouldn't be mistaken for a telescope dome. Yet Constance insisted that a round dome, with a ringed balcony outside at the same height as the upstairs bookshelves inside,

The Slipher Building as it looked after initial construction. The basement contained darkrooms, the furnace, and storage vaults, while the main floor housed staff offices. The flat roof soon began leaking from snow and rain, so in 1923 the upper floor and attic, with gabled roof, was added.

would be better so as to imitate the planet Saturn. The balcony was abandoned, yet the ring around the dome was still built. All the walls were covered with Malpais volcanic rock. Staff began moving into the building in late 1916; finishing touches on the exterior were completed in 1918.

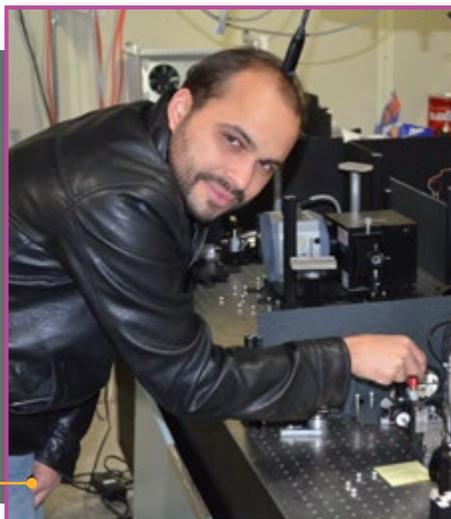
In September of 1915, Percival Lowell decided on a flat roof – topped with terraces and a castle-like design in front – rather than Constance's hipped roof design. However, the roof leaked so badly that workers added a second floor in 1923. Constance also tried to add a pipe organ into the Rotunda a few years later but never did, maybe because of the echoing nature of the room? Or perhaps it never fit next to the round stone fireplace? A skylight was placed in the top of the Rotunda to allow more light into the library, but this was covered over in later years due to a water leak.

When people come to Lowell Observatory they always see this building, and no matter how much it's changed it remains central to the observatory, housing astronomers who have been solving the mysteries of the universe for a hundred years. With the dome repainted last month and a great renovation for the Rotunda doors I can only see it lasting another century. Happy 100th Birthday, Slipher Building! 🎂

## Pre-doctoral Fellow Victor Garcia

For the past three years, Victor Garcia has served as a Lowell Pre-doctoral Fellow, working on a new instrument for the Navy Precision Optical Interferometer (NPOI). Victor is originally from Los Angeles and spent part of his childhood in the Dominican Republic. He earned a BS in physics from Johns Hopkins University in 2009 and an MA in physics in 2012 from Fisk University through the Fisk-Vanderbilt Masters to PhD Bridge Program. He just finished his PhD this spring and will be leaving Lowell to take a job at the Lawrence Livermore National Laboratory.

For his PhD work, Victor Garcia led the development of the world's first fully interfering six-telescope visible-light beam combiner, the Visible Imaging System for Interferometric Observations at NPOI (VISION).





## Changes to Public Program

By Kelly Ferguson

Lowell Observatory has already seen record numbers walk through the Steele Visitor Center this year with a little over 11,000 guests in the month of March alone. With this significant increase in attendance, the Public Program has had to ramp up both daytime and nighttime programming. This includes extra tours and activities during the day and more shows at night. All of this could not be possible without the help and support of the awesome Lowell Observatory volunteers.

Our docents have been paramount in this transition. They have graciously

taken on more tours and some have even received formal training with curator Sam Thompson at the Putnam Collection Center. This has helped out the entire observatory tremendously, especially when it comes to those days with record-breaking attendance.

These volunteers bring so much more than just an extra body for busy days. Kris Naylor, a 10-year Lowell Observatory veteran, joins us on weekends and fascinates us all with her background in rocket science. Jonna Peterson and her binoculars can be seen with a long line of excited guests on a nice Monday night.

Kris Naylor has volunteered in Lowell's public program for more than a decade, setting up telescopes for visitors, pointing out constellations and other features of the night sky, and explaining astronomy in an understandable way. Her enthusiasm and positive attitude are typical of Lowell's team of volunteers.

And Klaus Brasch, emeritus professor of biology, not only has a mini observatory in his backyard, but most importantly for this author, he is the reason I work at Lowell Observatory. I moved to Flagstaff from Dallas two years ago to work on a master's degree in planetary science but I wanted to be much more involved in the astronomical community. Klaus, who I knew through my undergrad advisor, took me under his wing and convinced me I would be a perfect fit as an observatory educator. And the rest, as they say, is history.

So thank you, past, present, and future volunteers, for all you have done, all you are doing, and everything you will continue to do. 🌌

**SPACEGUARD**  
ACADEMY

Coming soon to Lowell Observatory, Space Guard Academy is a new interactive exhibit where science fiction meets science fact. Mind-blowing digital interactives will put you on the frontline of asteroid detection, classification, and more!

**OPENS MAY 22, 2016**

Like Lowell's 24-inch Clark Telescope, the 23-inch Clark of the Charles E. Daniel Observatory is now devoted solely to outreach, with a goal to "educate, to inspire, and to entertain visitors". Public observing sessions are offered in conjunction with programs in an adjoining planetarium. *Credit: Joe Sims*

Near the mountains of South Carolina lies an Alvan Clark telescope, considered to be an older sister scope of the one at Lowell. She is a 23-inch beauty built in 1881 and originally located at Princeton University's Halstead Observatory, just 15 years older than Lowell's 24-inch wonder. It was finished in time to observe and record the 1882 transit of Venus and was later featured in Orson Welles' "The War of the Worlds" broadcast on October 30, 1938.

The telescope remained at Halstead Observatory until 1964, when she was sold to the U.S. Naval Observatory and relocated to Flagstaff. However, funding cuts in Washington, D.C. prevented her from the plan of studying binary stars so the telescope remained in storage until 1978. The Greenville, South Carolina School District then purchased it for \$1. Funding to restore the scope to operational didn't come on until 1985. The following year, the telescope was moved to the Charles E. Daniel Observatory, located at the newly opened Roper Mountain Science Center (RMSC) just outside of Greenville. She has remained an active operational telescope for the public ever since.

If you are not familiar with RMSC and live on or travel to the East Coast it is well worth visiting. When you enter the observatory it's almost like looking at Lowell's giant telescope but housed in a



## Clark Telescope Ties in South Carolina

By Joe Sims

much newer structure with no car wheels to rotate on.

The science center features numerous classrooms, an auditorium, an organic farm, a butterfly garden, a large planetarium, an aquarium as well as historical buildings. The center provides educational programs for students during the school year and teachers during each summer. Every Friday night the planetarium shows programs and the observatory is open for viewing objects of interest. With all that goes on for the public some 10,000 annual visitors attend 2nd Saturday events and approximately 150,000 attend year round. Additionally, the science center sponsors the local astronomy club, the Roper Mountain Astronomers (RMA), which has been in existence since 1987. The club meets

monthly and has prominent speakers/presenters while holding regularly-scheduled star parties.

Besides the similarity of its Clark Telescope, another significant tie to Lowell Observatory is the library of one-time Lowell astronomer Charles Capen, who sold his library of records and research to RMSC back in the 1980s. Another important person who visited RMSC during its opening year was Clyde Tombaugh, who donated a print to the newly opened science center after having visited their new observatory.

With all of these ties between the two observatories it's nice to know how well they are related and supported while continuing to provide access to large antique Clark telescopes. 



## Space Guard Member Event

On May 21, 2016, we invite our planetary members (and above), to a sneak peek of the new Space Guard Academy exhibit. You will be transformed into Space Guard recruits and choose between fact and fiction from popular misconceptions about asteroids. This interactive exhibit appeals to all ages. Bring the kids and enjoy light, child friendly appetizers as you test your knowledge at the Academy. This event runs from 1 – 3 p.m.

The exhibit utilizes infographics, text panels, videos, interactive touch screens, and hands-on activities to teach visitors about asteroids.

## Bruce Kosaveach is New Philanthropy Manager

Bruce Kosaveach joined the Lowell staff in April as the Philanthropy Manager. He will be working with both individuals and corporations to secure higher level gifts, with a focus on southern Arizona. Bruce earned his BS in Secondary Education from Ball State University and is a retired United States Navy captain, having served 28 years in that branch of the service. From 1994-2014, he served as business development manager at GE Capital Fleet Services in Phoenix. In this capacity, he developed and managed financial lease and services businesses for clients. Bruce already has strong ties to Lowell, where he is a member of the Percival Lowell Society. He also was a founding board member of the Lowell Observatory Foundation, resigning from that post in order to accept his new position.

Bruce Kosaveach brings years of business experience to his new position as Philanthropy Manager at Lowell. His ties in both professional and community circles will be critical to securing large donations.



Docent Stan Sutherland manned the Lowell table and chatted with attendees about the observatory's many volunteer opportunities

## Flagstaff Volunteer Experience

The first Flagstaff Volunteer Experience, a collaborative community event held in March at the Coconino Center for the Arts, provided an opportunity for many local arts, science and education-based non-profits to share information about their volunteer programs and missions. Dozens of prospective volunteers chatted with organization representatives about how their time and talents might be used to make a difference in our community.

## Seattle Pluto Experience

On May 22, Lowell astronomer Dr. Will Grundy will speak at the Pacific Science Center in Seattle. A leader of the *New Horizons* surface composition team, Grundy will present close-up images of Pluto taken with *New Horizons*. The reception for Lowell Observatory members begins at 1:30 p.m. and presentation is at 2:15 p.m. For more information, contact Shannon Gonzales at [sgonzales@lowell.edu](mailto:sgonzales@lowell.edu).

## 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.

Holler, B. J. ; Young, L. A. ; Grundy, W. M. ; Olkin, C. B. (2016). On the surface composition of Triton's southern latitudes. *Icarus*, Volume 267, p. 255-266.

Image: Neugent/Massey/Lowell Obs./NSF

See our website:  
[www.lowell.edu/research/recent-publications](http://www.lowell.edu/research/recent-publications)  
for more publications

DARK SKIES  
continued from page 1

which creates glare and to which the dark-adapted human eye is particularly sensitive.

Flagstaff is no different, and will be converting its street lights to LED in upcoming years. However, as we have been for nearly 60 years, we wish to remain a world leader in dark-sky protection and model outdoor lighting. We are working with the City and a broad group of stakeholders to implement a dark-sky friendly LED solution, using fixtures that more closely resemble the exceptional dark-sky friendly, but increasingly obsolete, amber low-pressure sodium lamps that are the hallmark of Flagstaff lighting. We hope our new standards will be a national model that other communities can adopt either in whole or in part – one size does not fit all, and there are a variety of more dark-sky friendly LED options than the brilliant white fixtures.

Arizona’s observatories have also worked at the state level over the past few years, opposing and defeating legislation that would allow the proliferation of electronic billboards around the state. These horizontally-emitting displays can create light pollution at very large distances from the source, so even the darkest, most sparsely populated areas can be impacted by them.

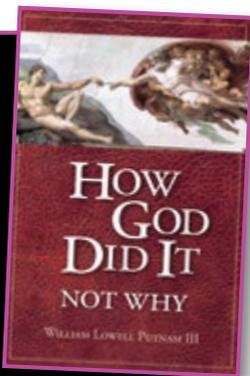
It is clear that continued urban growth and the increasing pressure of diverse interests including astronomy, astro-tourism, recreation, outdoor advertising, and city budgets will require a coordinated, proactive effort to control light pollution. This effort is underway. It will keep Arizona’s billion-dollar astronomy industry vital and will help ensure our children will not lose sight, as Carl Sagan put it, of “that Cosmos, ancient and vast, from which we spring.” ☺



For more than 50 years, Lowell Observatory has played a leading role in the protection of dark skies. Thanks in part to these efforts, in 2001 Flagstaff was designated as the world’s first International Dark Sky City.

## Review of Bill Putnam’s Last Book

**William Lowell Putnam III (1924-2014) wrote twenty books, the final one being *How God Did It, Not Why*.**



William Nietman, emeritus professor of philosophy at Northern Arizona University, has written a review of this book that starts: “As literary work this book is abounds with allusions to history, poetry, and science skillfully woven together to bring us into the world of his concern: namely the future of the human race in light of what the earth sciences have established about the causes of climate change.” To read the entire review, see the link below.

**Click Here To Read The Full Review**

## Summer Camp Registration Now Open

Summer is right around the corner and that means we are gearing up for camps! Our week-long astronomy camps are for children in grades 1 - 9. Besides learning about various topics in astronomy, campers also build skills like teamwork and cooperation. Topics are on a rotating basis, meaning a child can attend each year and not repeat a topic. This summer, the camp schedule includes:

**1st and 2nd grade** – Campers will enjoy learning about the moon with fun activities that include creating their own space suits and constructing craters.

**3rd and 4th grade** – Activities will focus on the Sun, using solar telescopes and other devices to observe our closest star.

**5th and 6th grade** – Campers will construct spectrometers and participate in activities designed to teach them about the electromagnetic spectrum.

**Middle school** (children going into 7th, 8th, and 9th grade) – Campers will learn about the different types of instruments used in astronomical research and even build a reflecting telescope.

For more information about camps, see:

**[www.lowell.edu/outreach/locks](http://www.lowell.edu/outreach/locks)**





**RECURRING EVENTS**

**2<sup>nd</sup> Friday Science Night** | **JUNE 10** (Chemistry II), **JULY 8**  
(Electricity and Magnetism I), **AUGUST 12** (Electricity and Magnetism II)  
Show at 6 p.m.

**Stars on Mars Hill** | **JUNE 29**, **JULY 27**, **AUGUST 31**  
6 p.m. | Free

**Coconino Astronomical Society Monthly Meeting** | **JULY 16**,  
**AUGUST 13**  
6:45 - 8 p.m. | Free

**JUNE**

**SAT 4** | Lowell's 5th Annual Gala, The Science of Space

**THU 30** | Asteroid Day

**JULY**

**WED 6** | Pluto Flyby Revisited with Alan Stern  
*Exclusive for Pluto Circle members and above*

**THU 28** | Delta Aquarid Meteor Shower  
(6 and 8 p.m.) Family-friendly meteor shower activities  
(7 p.m.) Lecture about the source of the meteor shower and viewing tips

**AUGUST**

**THU 11** | Perseid Meteor Shower  
(6 and 8 p.m.) Family-friendly meteor shower activities  
(7 p.m.) Lecture about the source of the meteor shower and viewing tips

**For more special event information visit:**  
[www.lowell.edu/outreach/special-events](http://www.lowell.edu/outreach/special-events)



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