

THE LOWELL OBSERVER

EXPANDING OUR UNIVERSE

The quarterly newsletter of Lowell Observatory

Issue 98

Fall 2013

Nick Moskovitz Coming to Lowell

by Tom Vitron

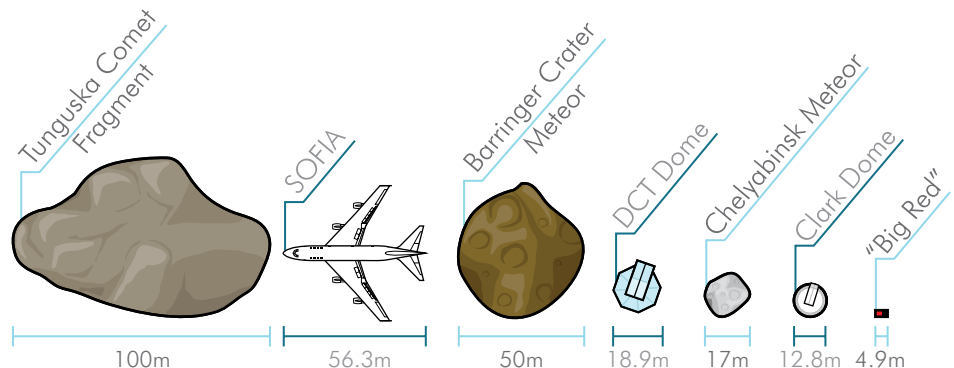
On February 15th, Earth witnessed two close-up Near-Earth Object (NEO) events, a predicted nearby pass and the Chelyabinsk, Siberia event. Questions arose immediately: were the two events related? What kind of meteor was seen brilliantly exploding in the numerous car dashboard videos from Siberia? When the world went looking for answers, one of the leading experts quoted was astronomer Nick Moskovitz of MIT, who will be joining Lowell in 2014.

"I was at Kitt Peak [National Observatory near Tucson] to see the flyby as we had one chance to try to see it well," recounts Dr. Moskovitz. "We had some interviews that night about the flyby and [the interviewers] started asking about Chelyabinsk. I hadn't heard much yet. We were able to see news about the event more closely in the night. It added to the whole excitement. For weeks, there were some heated emails about the flyby and meteor being related or not. I was pretty sure there was no connection."

The clear skies of rural California had a big impact on Dr. Moskovitz's youth. When he worked the night shift in high school, he made it a habit to pull over to the side of the road after work and take a star chart out so he could learn the sky. By his junior year of high school, he knew he wanted to be an astronomer, maybe even an astronaut.

Still not fully settled on planetary science when he arrived at the University of Hawaii for graduate school, Dr. Moskovitz took advantage of its diverse astronomy department to try several areas. But planetary science would prevail. "It came down to the fact that things that are

(Right) Nick Moskovitz poses in front of the SOAR 4-m telescope on Cerro Pachon in Chile, where he was observing near-Earth asteroids. The figure below illustrates the sheer size of various NEOs. The meteor from the Chelyabinsk event was only slightly smaller than the DCT dome, and more than three times as large as "Big Red", Percival Lowell's 1911 Model Y Stevens-Duryea touring car. The Barringer Meteor created Meteor Crater in Arizona, whereas the Tunguska Comet explosion was the largest impact event on or near Earth in recorded history, occurring in 1908 near the Podkamennaya Tunguska River in Siberia.



going on out in our Solar System are so tied to our existence, the origin of life and such. That's the most interesting thing to me," says Dr. Moskovitz. "We can send spacecraft to [solar system bodies]! These are geologic playgrounds that we can send robots to and analyze the surface. We will never send spacecraft outside our galaxy."

Focusing on what interested him most, Dr. Moskovitz gravitated to small bodies like Kuiper Belt Objects, Main Belt Asteroids, and NEOs. "Astronomy is trending towards exploring the time domain and evolution over time. NEOs are perfect laboratories for testing phenomena. It's important to keep the big picture in mind. [NEOs and other small bodies] are not worth studying if you're not thinking of how they inform the evolution of the Solar System," he adds.

With a distant eye on possibly still joining the astronaut corps (since he points out that the average acceptance age is 37/38), Dr. Moskovitz is eager to take advantage of Arizona's dark skies. ☺

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Director's Update

by Jeffrey Hall

A few weeks ago, I was talking with our Deputy Director for Science, Deidre Hunter, about agenda items for a staff meeting, and she mentioned we needed to be thinking about what we want Lowell Observatory to look like scientifically in ten to twenty years – a “science master plan” for Lowell as it were.

It will take us some time to sort that out, but there are a few things that can be said up front.

By that time, we should have a formidable suite of observing facilities: The Discovery Channel Telescope should be long since into full operations, delivering upwards of 300 science nights per year for Lowell and our partner institutions; we hope the Navy Precision Optical Interferometer will be peering skyward with greatly increased sensitivity; and we will surely be observing with a diverse set of current, planned, and not-yet-imagined instruments – perhaps even telescopes – of wonderful accuracy and precision.

We will continue to have a science staff of the first rank. We have been successful

the past several years in hiring into tenure-track positions our scientific staff's very top choices; in January 2014, Dr. Nick Moskovitz, yet another top choice, will join our staff, reinforcing our long-standing excellence of research on small solar system bodies and near-Earth asteroids.

Our staff will – if our attempts to engineer it bear fruit – labor under somewhat reduced dependence on federal grants for their salaries. We aim not to eliminate working through and with today's mainstream system, for doing so is healthy and maintains competitiveness. But we do wish to reduce the proposal-writing burden around here and to enable our staff to pursue projects that might be precluded because they are difficult to get funded, perhaps because they are risky or speculative, or because the accepted wisdom is that we already know the answer, or because they are simply unglamorous.

Beyond these items, the crystal ball becomes a bit murkier. Perhaps we will have a larger graduate student presence, building on the predoctoral program started some years ago with substantial success by Lisa Prato and Will Grundy. Maybe our tenured and tenure-track staff itself will have grown or perhaps we will have made an effort to expand our intellectual environment through expanded capacity to host researchers on sabbaticals or in visiting positions. Maybe we have expanded infrastructure to accommodate these activities.

Then there is the question of what we will be studying. Our astronomers enjoy a scientific blank check to pursue the topics that interest them the most. I am very much inclined to keep things that way, but it still doesn't hurt to explore some options. Do we diversify into new areas or expertise? Build on existing ones? How do we work with our partners to maximize our mutual interests and expertise?

At the center of all these conversations will be the preservation and vitality of the centerpiece of our

mission, which is research and discovery in astronomy and planetary sciences. All our friends and supporters continue to play a vital role in enabling us to carry out that mission, a role that takes on increasing importance as we work to diversify the sources of support for our science. We'll keep you up to date on how these deliberations progress as we go into 2014 and our new telescope comes increasingly close to full science operations. Thank you for supporting our second century of discovery! 🍷

The Whirlpool Galaxy (M51) and its interacting companion (NGC 5195) are among the best-known astronomical objects. M51 is located about 7.7 Mpc (25 million light-years) away in the constellation Canes Venatici. The bright blue fuzzy objects are recently-formed star clusters. This image was taken as part of the commissioning process with the Large Monolithic Imager on the Discovery Channel Telescope. This color composite came from seven 1-min exposures in B and R, and five 1-min exposures in V. Image credit: Massey/Neugent/Lowell Observatory/NSF



Percival Lowell Society: Joe Sims

by Tom Vitron

A great journey on the mighty iron horse (a.k.a. railroad) brought pioneers westward, including Percival Lowell and the Clark Telescope to Flagstaff in the mid-to-late 1890s. A similar journey brought Percival Lowell Society member Joe Sims and his mother Marjorie to Mars Hill a century later for an immersive and unforgettable visit in 1998.

“We set out for Lowell taking the southern passageway and upon leaving Flagstaff would return via the northern route,” recalls Joe, a retired schoolteacher who taught for 30 years in South Carolina. “We stayed in Flagstaff for a week, seeing the Grand Canyon, Meteor Crater, and visiting Lowell daily day and night. My mom and I thoroughly fell in love with Lowell not only because of the interesting things to see and learn about and its historical significance, but because every staff member we met or came across was very friendly and welcoming.”

Joe’s love of astronomy began early, drawn by the wonders of the night sky along the Long Island Sound in his hometown of Larchmont, NY. A ninth-grade Earth science class exposed him to astronomy and geology. Like Percy’s mother had done for her curious child, Joe’s parents bought him a 2.5” refractor, coincidentally very similar to Percy’s first telescope, which is on display in the Rotunda Museum.

Eager to share one of his passions of science with students, Joe initiated an after-school meteorology club for those interested in grades three through five. After the January 1986 Challenger Space Shuttle accident, and the popular arrival of Comet Halley, the class turned into an astronomy club due to a greater interest in the subject. “During the life of the club, I was able to take students along with their parents down to Florida’s Space Camp on three occasions and one time to Huntsville, AL where at the time (early 1990s) we toured Marshall Space Center and observed the current space station being developed.” Joe also put in extra hours to assist the award-winning school newsletter and develop a morning news program, other non-traditional educational vehicles to extend learning beyond the classroom. “The reason I began these clubs was to give as many students as possible an opportunity to experience something they may never have gotten to do otherwise,” says Joe. “During my studies of astronomy with my students, they learned about the planets and that’s when I became aware of Lowell and Pluto.”

After Joe and his mother visited, Lowell remained in his heart and he became a member. In 2009, when Joe was diagnosed with cancer, he put Lowell in his estate plans. “I wanted to help in the preservation of [the Observatory’s] historical value, current studies and exploration, community involvement and, more personal to me, the fact that Lowell was the final place my mom and I enjoyed traveling to together.”

“Being a Friend of Lowell means so much to me. Everyone I’ve met at Lowell seems so dedicated and even in their busy



(Above) Joe Sims and his mother Marjorie at the Flagstaff train station after visiting Lowell in June, 1998. (Below) Marjorie looking through Lowell’s solar telescope.



schedules have taken the time to stop and answer questions,” adds Joe, who was presented his Percival Lowell Society Mars globe by Lowell advisory board member Greg Mort in 2010. “I believe that involving children early on and making science fun (not just astronomy) is the key to grabbing one’s interest at any age. Allowing everyone to experience the views that Percy had through the Clark and the historical items in the Rotunda should never cease. I’ve also made a donation for an office in the new Library/Collections Center which I hope to dedicate to my mom and our lasting memories there.”

Mort & Menke Cosmic Cocktail Party

Greg and Nadine Mort and John and Meg Menke hosted an afternoon cosmic cocktail party at the Mort’s Maryland home honoring Lowell Observatory’s past and imagining its future. Outreach Manager Kevin Schindler was on hand to discuss the archival collections and the new building which will house them as well as the library. Trustee Designate Lowell Putnam tied past discoveries at Lowell with a talk about current research being done using the Discovery Channel Telescope. New Friends of Lowell were made, along with donations for the new William Lowell Putnam Collection Center.

For more information about how to make a donation or become a Percival Lowell Society member, please contact Antoinette Beiser at asb@lowell.edu or (928) 233-3216.

Comet ISON is Coming!

by Matthew Knight

Comet ISON will pass extraordinarily close to the Sun on Thanksgiving Day and is predicted to briefly get very bright, quite likely surpassing the brilliance of Venus and Jupiter. Media reports declaring it the “Comet of the Century” are, unfortunately, over-hyping it. Such reports overlook the fact that ISON will be brightest when it is only a few degrees from the Sun, i.e., during daylight. Compared with the Sun’s brilliance, we are unlikely to be able to easily see ISON at this time. (Also, PLEASE remember the dangers of looking close to the Sun!)

But all is not lost! “Sungrazing” comets like ISON shed a lot of material in a very short time when near the Sun, creating very long, impressive tails. Assuming ISON survives the Sun’s intense radiation and gravitational pull (both non-trivial) during the close encounter, it is likely to be visible to the naked eye throughout the Northern Hemisphere shortly before dawn in early December. If we are lucky, ISON will have a nearly straight tail stretching up from the eastern horizon for tens of degrees. As it recedes from the Sun throughout December, ISON will fade, but will also get higher in the sky. By the end of the year it will be up all night but will likely require binoculars or a small telescope to be seen. Counterintuitively, if ISON is destroyed as it grazes the Sun, it may be even more spectacular, appearing as a short-lived “headless” tail before rapidly fading away in early December.

Lowell astronomer Dave Schleicher and I have been studying Comet ISON since early 2013, including making the first successful measurements of its gas. Along with colleagues around the world, we are eagerly awaiting the spectacle at the end of the year. Stay tuned to various Lowell media channels for our scientific results. ☺

Comet ISON as observed by the Discovery Channel Telescope on September 13, 2013. This is a false-color image where white is bright and blue/black is dark. Comet ISON’s tail is visible stretching to the top right. A few background stars are visible as white dots.

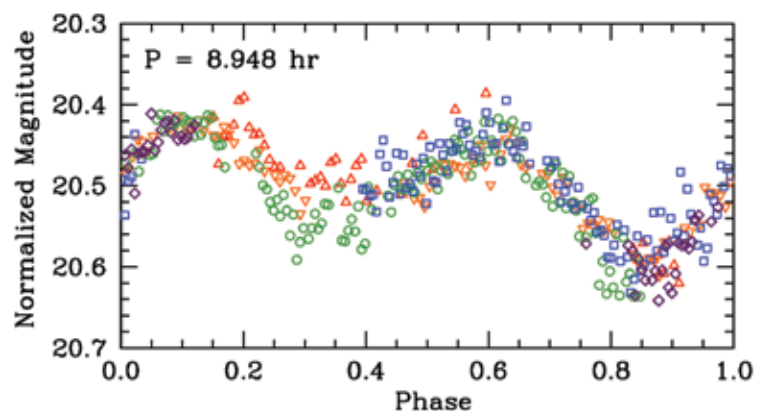
For brightness updates and the latest Comet ISON news & blogs visit: isoncampaign.org

Comet ISON imaged by Discovery Channel Telescope 2013 September 13



Early Science with the Discovery Channel Telescope

A transition is taking place this year as science operations ramp up with work on commissioning the Discovery Channel Telescope (DCT) beginning to taper off. While only about 10% of nights were scheduled for science programs in the first quarter, more than 35% are planned for science in the final three months of 2013. Matthew Knight, Stephen Levine, and I are pleased to report that the results of a project we conducted early in the year have recently been accepted for publication in the *Astronomical Journal*, the first refereed paper based on DCT observations. We measured the brightness variations that take place as the nucleus of Comet Tempel 2 rotates, allowing us to precisely determine its rotation period (8.948 hr) and, when combined with prior observations, unambiguously determine its direction of rotation as being prograde, i.e. in the same direction as its orbital motion. DCT was required, as the comet was at its greatest distance from the Sun (nearly out to Jupiter’s orbit) and the nucleus is only about 12 km in length, and so less than 20th magnitude in brightness. — Dave Schleicher



Brightness variations of Tempel 2’s nucleus obtained on five nights in January, March, and April 2013 (each night is a different color) are combined above. Since the nucleus is very elongated, the amount of light reflected is a maximum when we view it side-on, and is a minimum when it is end-on. These data also imply that the shape of the nucleus is quite irregular.



Sole Trustee William Lowell Putnam III, Collection Center Committee Chair Kent Robinson, committee member Mike Kitt, and Observatory Director Jeffrey Hall (pictured left to right) broke ground on the Collection Center during the advisory board meeting in May.

Breaking Ground


by Lauren Amundson, Samantha Thompson,
& Tom Vitron

If you've been up the Hill recently, you probably noticed the construction work. Aside from additional waterproofing and retrofitting to the Slipher Building, the main activity centers on the Library and Collection Center, which officially broke ground during the advisory board meeting in May. Sole Trustee William Lowell Putnam III, Collection Center Committee Chair Kent Robinson, committee member Mike Kitt, and Observatory Director Jeffrey Hall officiated the ceremonial groundbreaking. We are close to the \$2.2 million needed to finish the building. During the event, Robinson proudly announced that the building would be named after Putnam, who was not aware beforehand. Putnam has always had a deep interest in the history of the Observatory and has written several books using the Observatory's archives. His support has been crucial to the project's success.

This 8,000-square-foot state-of-the-art facility will include a library, collections repository, processing room, reading room and offices. It will also feature a lobby for exhibits that highlight items from the Observatory's collection of

historic papers, artifacts, and glass plates, including Clyde Tombaugh's Pluto search plates and V.M Slipher's spectroscopic plates that provided evidence of the expansion of the universe. Architect Jim Roberts, who also worked with the Museum of Northern Arizona on their collection center, designed our building to complement the existing buildings on campus. Construction is expected to conclude by Spring of 2014. However, the building won't be complete for several months while preparations for the move have already begun.

Under the direction of Observatory staff, Advisory Board member Mike Kitt and a team of volunteers have begun cleaning and organizing the current storage areas of the Observatory's collections. Artifacts and unprocessed archival material have been consolidated and the storage areas made more easily accessible. Historic instruments have been relocated to a single, secure location and Restoration Specialist Peter Rosenthal has begun cleaning and restoring select instruments.

We look forward to the building's completion and wish to thank everyone who has supported the project. If you are interested in making an end-of-the-year gift to help us wrap up the Collection Center capital campaign, please contact Antoinette Beiser at asb@lowell.edu or (928) 233-3216. 



Construction on the new building is moving quickly with an expected completion date of Spring 2014.



Microthermograph in the Lowell Observatory collections.

Thanks to a generous donation from John and Meg Menke, Ray Bowen was able to photograph more than 500 historic artifacts in the Observatory's collection, which have since been placed in the library's online catalog. Objects range from boxes of lenses to microthermographs. Volunteers have been actively trying to identify all objects in the catalog. If you are interested in assisting with the project, contact Samantha Thompson at sthompson@lowell.edu or (928) 233-3233.

The Evolving Universe

by Samantha Thompson

The universe constantly changes. Stars are born, live out their lives, and die – sometimes calmly, sometimes violently. Galaxies form, grow, and collide dramatically.

The ever-changing cosmos takes center stage at the Steele Visitor Center exhibit hall with the arrival of our latest exhibit *The Evolving Universe*. Visitors will take a mind-bending journey from present-day Earth to the far reaches of space and distant past. They can explore how stars and galaxies – even the universe itself – change from birth to maturity to death, much like living things on Earth. Breathtaking full-color photographs capture the awe-inspiring beauty of the cosmos as seen through high-powered terrestrial and orbiting telescopes.

Light from stars and galaxies has traveled for hundreds, millions or even billions of years. The light from the Sun – a mere 93 million miles away – travels to Earth in only eight minutes. Light from the center of the Milky Way Galaxy has taken more than 26,000 years



*Background Image - The Center of the Milky Way
Image Credit - X-ray: NASA/CXC/UMass/ D. Wang et al.; Optical: NASA/ESA/STScI/D. Wang et al.; IR: NASA/ JPL-Caltech/SSC/S. Stolovy*

to reach Earth. When that light left its source, humans were becoming adept basket makers. Also included in the exhibition is an image of the microwave radiation emitted shortly after the Big Bang – a snapshot of the newborn universe 13.6 billion years ago, long before the first stars and galaxies formed. The universe has been expanding ever since.

Visitors to the exhibition can choose one of two paths to explore the cosmos. They can begin close to home with our solar system and move outward to the farthest reaches of the universe or they can begin 13.7 billion years ago at the moment of the Big Bang and move forward in time to the present day. Along

their journey they will learn how a variety of telescopes and instruments reveal the fascinating history of the expanding universe.

The Evolving Universe is organized by the Smithsonian's National Museum of Natural History in collaboration with the Smithsonian Astrophysical Observatory. Lowell Observatory is the first stop on an exciting sixteen-city tour through 2017. 🌐

We would like to extend a special thank you to Susanne Durling for her generous support of September's exhibit, *Earth from Space*.

Coming Soon...



"Of all the conceptions of the human mind... the most fantastic is the black hole: a hole in space into which anything can fall and out of which nothing can escape; a hole with a gravitational force so strong that even light is caught and held in its grip; a hole that curves space and warps time."

— Kip S. Thorne, *Black Holes & Time Warps: Einstein's Outrageous Legacy*

Coming January 2014! Black holes, the most mysterious and powerful objects in the universe, are regions in space with gravity so dominant that nothing can escape. *Black Holes: Space Warps & Time Twists* will guide visitors on a journey to the edge of these strange objects to discover how the latest research is turning science fiction into fact, challenging our notions of space and time in the process. Developed by the Harvard-Smithsonian Center for Astrophysics, this exhibit immerses visitors in the modern search for black holes through a variety of interactive and multimedia experiences. If you would like to offer full or partial support of this exhibit please contact Antoinette Beiser at asb@lowell.edu or (928) 233-3216.



Lowell Webcam Debuts

Deja view? After months of testing, the Lowell webcam is now officially launching. A soft launch in April revealed a few possible concerns but those have been addressed. The camera pans from the southeast towards Northern Arizona University, to the north towards the San Francisco Peaks and back again from Lowell’s Mars Hill campus, just west of downtown Flagstaff. We thank AVDomotics (owned by Andy and Charlie White, sons of retired astronomer Nat White) for donating the webcam, which now lives on the roof of the house they grew up in on Mars Hill! We also thank CommSpeed for donating a much-needed wireless internet connection. You can view the webcam by visiting:

www.lowell.edu/webcam.php

ARRIVALS

- Kelsey Banister - Retail Sales Associate
- Scott A Do - IT Systems Support Specialist
- Elizabeth Gehret - Public Program Educator
- Jeffrey Gehring - Machinist
- Cathleen Halstead - Retail Sales Associate
- Jaime Lange- Accountant
- Erik Lehmkuhl - Public Program Educator
- Eric Nolan - Public Program Educator
- John O’Reilly - Public Program Educator
- Kristen Rakes - Retail Sales Associate
- Peter Rosenthal - Archival Restoration Specialist
- Max Schwartz - Retail Sales Associate

DEPARTURES

- Liam Andrus - Opto-Mechanical Engineer Intern
- Travis Barman - Astronomer
- Stephanie Bewley - Accountant
- Benjamin Dirgo - Research Intern
- Pdraig Houlahan - Director of Info Technology
- Paula Johns - Research Assistant
- Nicole Karnath - Research Assistant
- Bruce Koehn - Research Scientist
- Alex McCanna - Public Program Educator
- Katrina McLaughlin - Public Program Educator
- Genady Pilyavsky - Photometry Pipeline Specialist
- Dary Ruiz Rodriguez - Research Assistant
- Thomas Vitron - Media & Public Relations Manager
- Aaron Walker - Public Program Educator

Restore the Clark Thank You

Thanks for your support! After two intense months of campaigning, the “Restore The Clark” campaign came to a successful conclusion in May. Ralph Nye and crew can now forge ahead with the much-needed restoration. Below, campaign team Kevin Schindler, Tom Vitron, and Samantha Christensen (left to right) stand in front of the Clark.



Experiments at 6 PM and 8 PM

Science Talk Featuring a Lowell Astronomer at 7 PM

2nd Friday Science Nights

Looking for an exciting and educational experience for your family? Lowell Observatory’s Second Friday Science Nights are just the ticket! Join us for an unforgettable night filled with fascinating experiments that are sure to amaze adults and kids alike. Have a burning question about black holes? Ask one of our astronomers, who will be on hand to answer questions like this and more.

November 8, 2013 - Physics: Optics & Optical Illusions

December 13, 2013 - Engineering “Magic”



The Evolving Universe: Exhibit open 10/12/13 - 1/5/14

OCTOBER

Regular Public Hours:

M/W/F/Sat 9:00 a.m. - 9:30 p.m.

T/TH/Sun 9:00 a.m. - 5:00 p.m.

WED 30

Spooky Space

(5:00 p.m. - 9:30 p.m.) – Kids (and kids at heart) will enjoy an evening of special Halloween activities including creepy campus tours where you may just run into Percival Lowell's ghost or an alien on the loose, our haunted Pluto dome, and other hair-raising spectacles! Indoor programs feature spine-chilling celestial objects and the "darker" side of space, as well as terrifying telescope viewing, weather permitting. Wear your costume and receive ½ off your price of admission!

NOVEMBER

Regular Public Hours:

M/W/F/Sat Noon - 9:30 p.m.

T/TH/Sun Noon - 5:00 p.m.

Special Closures:

Wed 27 Noon - 5:00 p.m.

Thur 28 Closed

FRI 8

Second Friday Science Night

(6:00 p.m. - 9:30 p.m.) – Optics and Optical Illusions. See experiments at 6 p.m. and 8 p.m. and a presentation by Lowell astronomer Kevin Covey at 7 p.m., "Nasty, Brutish and Short: The Lives (and Deaths) of Star Clusters in the Milky Way."

SAT 16

Leonid Meteor Shower Program

(7:00 p.m.) – Indoor programs will focus on meteor showers such as the upcoming Leonids. Telescope viewing of various celestial objects is included in the evening's activities.

FRI 29

Black Friday Sale Extravaganza & Thanksgiving Weekend Celebration

(8:00 a.m. - 9:30 p.m.) – Everything in the Starry Skies Shop is on sale today!

SAT 30

Thanksgiving Weekend Celebration

(9:00 a.m. - 9:30 p.m.) – Lowell Observatory will extend our open daytime hours and offer indoor programs and building tours.



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The Lowell Observer is published quarterly by
Lowell Observatory, 1400 W. Mars Hill Road, Flagstaff, AZ 86001
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928.233.3210 • www.lowell.edu • Find us on Facebook
Contents Copyright 2013 by Lowell Observatory ISSN 1054-0059

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Non-Profit
Orig:
U.S. Postage
PAID
Flagstaff, AZ
Permit No.
170