

THE LOWELL Observer

THE QUARTERLY NEWSLETTER OF LOWELL OBSERVATORY

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Raising the Curtain on a Comet's Behavior

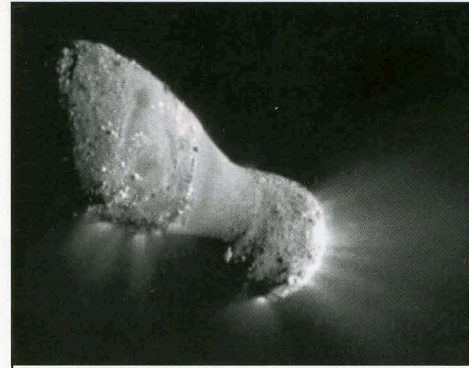
By Dave Schleicher

Last autumn, another comet took center stage in the astronomical theater when a recycled spacecraft made observations during a close fly-by. Discovered rather recently (in 1986), Comet 103P/Hartley 2 had only been observed a few times prior. The prologue (these previous studies, some of which I was involved in) revealed a small but very active body, releasing gas and dust from most of the surface of its nucleus. Separately, another star of the show -- NASA's EPOXI spacecraft -- previously had a mega-hit in another role as Deep Impact during a close encounter with Comet Tempel 1 in 2005. In that epic, part of the Deep Impact spacecraft intentionally hit Tempel 1, causing a great explosion of material and creating a crater. The resulting size and shape of both the ejecta plume and the resulting crater provide crucial clues as to the physical composition and structure of the comet's surface. Following a close-up look at the explosion, the EPOXI "mother-ship" continued in orbit around the Sun, before being given another starring role.

In the first act, new observations were obtained of Hartley 2 as it approached the Sun in 2010. First came brightness measurements using the Hubble Space Telescope (HST), suggesting that Hartley 2's nucleus rotated every 16 to 17 hours. Then I (in various supporting roles on every spacecraft mission to a comet) obtained measurements showing that the comet's rate of outgassing was only about half of what it had been in the 1990s; this lower rate continued throughout the 2010 apparition, confirming that the spacecraft could safely approach the comet to the desired distance.

Next, with the Hall 42-inch telescope on Anderson Mesa, post-doctoral research fellow Matthew Knight discovered interesting morphology when he obtained images of cyanogen (CN) gas in August that should not have existed had the entire surface really been active; if ice was vaporizing uniformly, then the gas coma should also have been uniform and show no structure. Moreover, the CN had a spiral-like shape and rotated with time, consistent with HST results. By the following month, Matthew obtained additional data, as did colleagues at other institutions using telescopes at Kitt Peak, and these efforts were repeated again in October (observations were typically obtained on three to six nights near new moon each month). Note that as Hartley 2 and Earth moved along their respective orbits, the relative positions continued to change. This results in coma morphology slowly altering in appearance due to the change in viewing position. Here, the somewhat face-on spiral in August changed to a pair of cork-screw jets (one north and one south, see the figure on page 2) by the time of the spacecraft encounter in early November.

From prior experience with Comets Hale-Bopp and Hyakutake, we know that seeing a jet from a set of



Comet Hartley 2's nucleus. (NASA)

viewpoints will permit us to sort out the 3-D orientation of the jet(s) and of the rotating nucleus from which they emerge. Thus, as soon as Matthew discovered a spiral jet in August, I held that, given the very favorable

circumstances (Hartley 2 passed within 0.12 AU of Earth in October, just two weeks before the spacecraft flyby), a successful 3-D model could be easily produced -- a brief but easy-to-solve mystery.

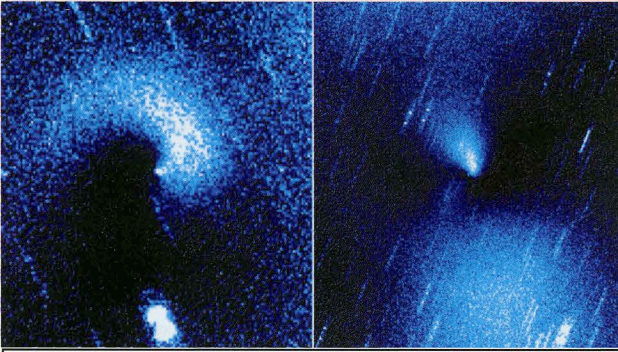
However, by the second act, the scene -- while easier to see as the comet approached and brightened -- became increasingly murky. The CN jet morphology, that had been repeating nicely every 17 hours, no longer matched as well from one cycle to the next. Also, the EPOXI spacecraft itself was closing in on the comet such that its small telescope could make round-the-clock observations. These showed a small, stubby dust jet rotating along with brightness variations having a periodicity of longer than 17 hours. By late October, the spacecraft and multiple Earth-based telescopes revealed that the period had reached 18 hours and no two cycles looked quite the same; there was also evidence for everything to be better matched after three cycles than after one.

Surely the mystery would be exposed when the third (and final) act took place on November 4th with EPOXI's 700 km passage by the nucleus. Indeed, the encounter was a complete success (see photo), with jets of material visible at one end of the bowling pin-shaped nucleus. However, the encounter was so brief (the relative velocities were more than 12 km per

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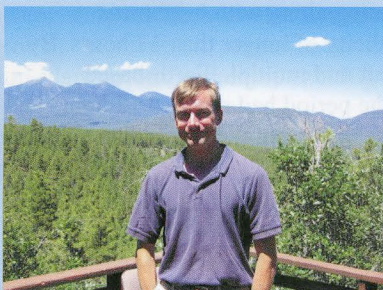
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The CN gas jets in comet's coma in Sept. (left) and a new viewpoint in Nov. Each image is 50,000 km wide.

second!) that the spacecraft could barely detect any rotation of the nucleus before the nucleus again appeared to shrink back to a point of light. Also, it was not evident whether or not the jets seen emerging from the nucleus are the same jets as we had been observing from Arizona; after all, the "guilty party" could have been hiding on the far side of the nucleus at the time of the flyby.

Four months later, as I write this, some items are clearer but many of the mysteries still remain. Fortunately, significant progress should be made soon; a workshop will be held in Tucson in April, where everyone having relevant observations will present details and, hopefully, a single solution will be figured out. After all, while we don't yet know "who done it", as in every good mystery, the identity will be revealed by the closing curtain.



Director's Update

by Jeffrey Hall

Mars Hill offers a spectacular view across Flagstaff to the eastern horizon. While shuttling my kids to school during winter months, I enjoy real-time astronomy watching the Sun at about the same time each day. After the winter solstice, it takes forever for the Sun to peek above the horizon as we pass the Mars Hill Road overlook, usually happening around President's Day. But on the morning I'm writing this, just 10 days later, we were practically blinded by a Sun well above the horizon and noticeably farther north. It's a fun way to work sines and orbital inclinations into commuting banter, not to mention getting a visceral feel for how rapidly things evolve in a seemingly slow-paced sky.

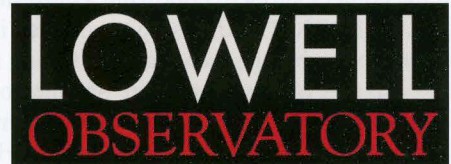
The sense of fast evolution doesn't stop with sunrises. It's easy to feel like any one day has been another unbroken span of meetings and e-mails, but since the last *Observer*, which I think you received sometime near the solstice, the signs of a place heading increasingly rapidly

New Online Tools, Redesigned Observer Coming Soon!

By summer, a revamped and retooled lowell.edu will make its debut. Aside from the valuable information currently housed on the site -- including public program details, current project updates, staff bios and contact information -- the new-look lowell.edu will be a more complete portal designed to engage, enlighten, and entertain Lowell's friends and fans.

Beginning with the summer issue, the Observer will adopt the same look as the new Web site. It will continue to be your link to Lowell's scientists, the groundbreaking research they are conducting, and all the updates from friends and staff that you've come to enjoy. The new Observer will also include a section on amateur astronomy, a kids corner, and other valuable content.

You will also soon begin receiving periodic multimedia e-mails from us that highlight current happenings at our three campuses. These e-mails will include video updates from our director, Jeff Hall. In this exciting year for the Observatory, a year in which we will complete our alignment with the largest and most potent cross-platform educational media company in the world (The Discovery Channel), you really do need to stay tuned!



up and north are all there.

We've met with the new managers of Lowell's trust, now charged with active management of the funds that underpin the observatory and that ultimately will let us manage and eliminate debt incurred in construction of the Discovery Channel Telescope (DCT). New staff members have joined or will soon join us in several areas and during the past few weeks, we have interviewed highly skilled applicants for a new astronomer position. And we continue to seek partners to join our adventure with the DCT. This increase in personnel will demand increase in our physical capacity as well, and to that end we are developing a master plan for Mars Hill to build capacity to support the growth of staff, our research, and our outreach.

You are receiving this newsletter because you are, in one way or another, part of our progress. The plans we're putting into place to deal with the advent of the DCT are not meant to overturn or radically transform the wonderful place Lowell is, but to let it grow naturally into its new, larger, and more prominent self. We will continue to try to be good stewards of your interest and support through careful management of our internal and contributed funds and through lasting enhancements to our capacity.

By the next solstice, I'll be done watching sunrises on school commutes but you'll still read in these pages about the many ways Lowell continues to evolve. I hope you enjoy our ongoing communications and thanks for your support.

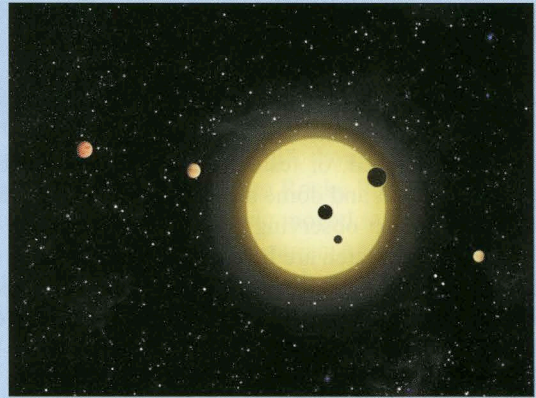
The Worlds Beyond: New Kepler Finds

By Tom Vitron

An essential precursor to discovery is imagination. In the early 1990s, while working at NASA's Ames Research Center, Lowell astronomer Ted Dunham crossed paths with Bill Borucki, who had the vision of finding planets the size of Earth orbiting other stars. Working from an example of one (our own solar system), Borucki, Dunham, and Dave Koch launched a most audacious search for distant solar systems containing extra-solar planets (also known as exoplanets) that would eventually become the Kepler Mission. In just four months of observations, studying only a small section of the sky between the constellations Lyra and Cygnus, the Kepler spacecraft is producing jaw-dropping results. "In a sense, what we're seeing isn't such a surprise," says Dunham, the project's science team lead. "You don't know what you're going to find. You discover what is. What we're finding is that planets are really common."

So far, the Kepler team has identified more than 1,200 planet candidates. Though many still need confirmation through follow-up work, most will turn out to be planets, according to Dunham. Of greatest interest is the discovery of Earth-sized planets; the team has identified 68 such candidates so far, defined as less than or equal to 1.25 times Earth's diameter. "I think the most profound outcome of the day is that we can now give a reasonably well-informed estimate of the odds of finding planets ranging in size from Earth to Jupiter orbiting other stars in the short-period orbits we're sensitive to so far, generally shorter period than Mercury in our own solar system. This turns out to be something like 25 percent," Dunham explains. "Considering that it is likely that there are more with longer orbital periods, the odds that a given star will have one or more planets seems to be very high. People have speculated about this for thousands of years. Now we know. It's not often you get to say something like that."

Though clearly excited by the task, Dunham's role as the project's science team lead is typically filled by a scientist at Ames, the Kepler Mission's home base near San Jose, CA. "It's a strategic job," Dunham says. "It's about taking account of where we are now and where we need to be." Aside from this most crucial assignment -- as well as his essential work on both the SOFIA airborne observatory and the DCT -- Dunham also leads a team working on the complicated and equally precious task of understanding the cacophony of what is called "noise", or unwanted variations in the Kepler data. Because the Kepler system is 50 to 100 times more precise than any ground-based apparatus, understanding the origins of its noise is tricky. "Noise is what Kepler's all about," explains Dunham. "Noise is the opposite of sensitivity. Understanding what we can do, what's real and what isn't is the crux of the issue." Since almost all stars at Kepler's level of sensitivity are variable, or subject to changes in their brightness, they produce a large amount of noise. Dunham's team must also understand systematic issues that can influence the data. "We have to



A NASA rendering of the six-planet system.

figure out which part of the noise is from the stars and what part is from us," says Dunham. Mitigating the combined noise is essential to the mission's successful data acquisition.

Recently, mission scientists announced the discovery of a six-planet system. According to Dunham, the system is interesting because "two of its six planets are strongly interacting, causing their transit times [or the time at which the Kepler team sees them pass in front of the star they orbit] to shift around. Furthermore, three of the others are also interacting with each other, causing a more complicated version of the same thing. This is in fact how we are certain that these are real planets and not some other kind of astrophysical system." Also interesting is that this system is flat, much the way of our solar system, in which you find the eight major planets orbiting the Sun in a single plane. "We're finding so many multiple systems that it shows they've got to be pretty flat," Dunham adds.

The Kepler Mission is also about the stars. An independent team of astrophysicists is closely studying the behavior of the stars and will be able to "plumb their depths," Dunham says. "They look at the pulsations that happen in all stars," he adds. "It's kind of like learning about Earth from seismic waves." Crucial insights gleaned can include the amount of helium in a star's core, a star's age, its precise radius, and its mean density. Truly, the Kepler project is a major undertaking whose findings will continue to move modern astronomy forward for years to come.

However, when the project's concept first took form, it is unlikely Dunham could have really imagined what he is seeing now. The Kepler Mission is discovering thousands of worlds, hopefully finding some by the end of the mission that might be able to host life. The game plan is to produce a catalog of the project's finds that will lay the groundwork for more ambitious projects to come. "[Kepler] is doing what it's supposed to do," adds Dunham. "I guess we could have hardly believed that it would work this well." With more data releases to come, Dunham clams up when I ask what other fantastic planetary finds might soon become public. "There's more to come," Dunham says with a wry smile. "But I can't tell you yet!"

For more information about the Kepler Mission, please refer to Dr. Dunham's Observer articles related to Kepler (Summer 2009 and Spring 2010) and kepler.nasa.gov.

DCT Update

By Stephen Levine



The DCT team recently began the telescope's transition from construction to commissioning operations. Not all the subsystems are finished, or tested, but we have enough that we can use the mount and dome at night, in much the way we would during science observing. Not surprisingly, we have turned up problems, which are being fixed one by one.

Working from the outside inwards, the DCT team repaired the dome shutter and it is now working nicely. We are finishing up the necessary software to control the dome from the telescope control system. After finding a problem with the telescope mount unexpectedly going into an oscillatory motion mode, we tracked down the cause to misaligned elevation encoder read heads. All misaligned heads were realigned and the problem has not since recurred. Also, the team fixed a slightly damaged handful of the 120 axial supports for the primary mirror; the team is running a full check out of the M1 supports in preparation for putting the primary mirror into the mirror cell and then mounting it on the telescope in early April. As testing of the primary mirror support system winds down, work is ramping up on the software for the overall active optics system control. The secondary mirror figuring and polishing is on schedule at Brashear. At last report, they had the figure to within a micron of its desired shape.

We have taken pointing data on several nights, which we used to construct a model for the mount. That model is now good enough that, typically, the telescope is pointing to within a few to a few tens of arcseconds of the requested position, which means that when we move to a new object, that object is within the field of view of the pointing camera, even though its field is rather small. As more data are acquired, I expect this to improve. In parallel, the instrument group has been testing out sending guide corrections to the telescope mount from the pointing telescope.

In the near future, we will use an assembled guider probe at prime focus to test out the wave front sensing system and its integration with the active optics system that supports the primary mirror. The active optics system is critical to the successful operation of the telescope; if it does not work properly, we do not get good images of the sky. This project is expected to last through much of the summer, and will allow us to begin to test out and set up one of the DCT's most complex systems: keeping the mirror the proper shape.

Lowell Employee of the Year: Byron Smith



At Lowell's annual staff holiday party in December, DCT project manager Byron Smith was honored as the Observatory's 2010 Employee of the Year. As the anticipated date of the DCT's "first light" approaches (Fall 2011), Byron's tireless shepherding of this very complex project is deserving of praise. "I'm honored, but have to share the credit for the DCT progress with all my colleagues at Lowell who've helped out," Byron said.

New Faces in Lowell's Public Program



Four new educators recently joined Lowell's public program staff. They are Steve DaCosta, Alethia Little, Jamie Money and Chase Zwissler (not pictured).

Improvements to the Steele Visitor Center

By Kevin Schindler

The DCT era is a time of unprecedented growth and modernization at Lowell. In the public program, our immediate goals are to bring more guests to Lowell and enhance the visitor experience. Ideally, the initial guest interaction serves as the beginning of a relationship that continues with membership, return visits, word-of-mouth marketing, and financial support. Therefore, we need to put our best foot forward; to help accomplish this, we are working on ways of maximizing our current facilities and programming.

During busy times such as holiday weekends and summer nights, the Steele Visitor Center (SVC) lobby can be very crowded. In the past, most of the activity centered around the gift shop, where staff had to admit visitors, sell gift shop items, answer phone inquiries, and generally serve as the point of contact for guests. If we are to meet our 2011 attendance goal of 90,000 visitors (up 25% from 2010; this would exceed our best attendance in both 2008 and 2009 by 10,000), this physical set-up will not work effectively. Thus, in early 2011 we will modify the SVC lobby in a two-phase project. First, we added a new counter that, during busy times, will be operated solely as the admissions center. We will use both paid staff and volunteer greeters to welcome guests, tell them what activities are happening, and introduce them to the Friends program.

Second, we are modifying the gift shop to maximize available square footage. We are removing the large desk/computer station and replacing this with a combination display counter/glass wall. This gives us more display space and a secure barrier that maximizes our ability to showcase gift shop items. The check-out area will utilize much less space than before and be located where the poster bin currently resides. The combination of the new admissions area and modified gift shop will allow us to provide our guests with faster service and a more enjoyable experience.

Meet Our New Advisory Board Members

By Tom Vitron

Lowell Observatory recently welcomed four new members to its board of advisors. We are very excited since these new advisors add to the board's wide range of professional expertise, personal interests, and geographic backgrounds.

Mike Kitt



A lifelong amateur astronomer, Mike Kitt first came to Lowell in the early 1970s because of his fascination with history-rich astronomical facilities; his pilgrimages from New York to the Southwest also included stops at a coincidental namesake, Kitt Peak. When he and his wife Karen moved to California's Palm Desert region in 2003, they started coming to Lowell more frequently, stepped up their involvement in the Friends program, and, more recently, he got invited to attend the board of advisors' meetings. Membership on the board logically followed. "I think it's pretty apparent that the Observatory is going through a major change driven by the DCT," says Kitt. "It's a critical time and the advisory board can play a part in changing in the right way, without losing the culture."

A veteran of the pharmaceutical industry, Kitt knows it is a challenge to maintain an enterprise's culture during a time of expansion. While working on technology and quality control projects at Pfizer, Kitt saw the company go from a family-oriented firm to the massive multinational corporation best known for blockbuster drugs such as Lipitor and Viagra. Such change can come at a cost if it is not ushered in correctly. "I hope [Lowell's] advisory board will be a better asset than ever before," says Kitt.

Currently working with development manager Rusty Tweed to run field trips for astronomy clubs, he is eager to forge a greater link between amateur astronomers and the observatory. Author of "The Moon: an observing guide for backyard telescopes," Mike has also written articles for Astronomy Magazine and lectured at many a star party. In addition, he is an amateur librarian and will serve on the committee for the new library/collections center project. Bringing pertinent perspectives on topics important to Lowell, Mike and Karen Kitt are very welcome additions to our family. "One of the reasons we have gotten involved is the truly unique nature of Lowell Observatory," says Mike. "The facility and the people are amazing."

Sue Durling



From her native shores of Lake Erie to the Big Sky country of northern Arizona, Sue Durling's journey to Lowell has included stops in Virginia, New York City, San Francisco, and, yes, Ajo. Retired from a career in research

information that spanned both academia and the private sector, Durling is all about getting close to the action. "I just like being around people who are doing science," she says.

Durling first moved to Arizona when her husband retired as an administrative law judge in 1990. They lived in Ajo, an experience she calls "wonderful", though it is a town best known for being on the road to Rocky Point, Mexico. After her husband's passing, Durling moved to Flagstaff and, in 2004, met longtime Lowell librarian Antoinette Beiser at a reception. She now works as a volunteer librarian at Lowell. "Using what I know to aid a library that needs extra help is really nice," Durling explains. "I have so much fun up here that I would have paid to come!"

Joining Lowell's board of advisors is a natural extension to Durling's steady involvement during the past decade. Aside from her financial support and volunteer activity, she is also on the committee working to bring a new library/collections center to the Mars Hill campus. "[Joining the board] is a new chapter to a fun and exciting Lowell experience," says Durling. And the next chapter in her vacation travels? Canada's lovely capital, Ottawa.

Kent Robinson



For Kent and Barbara Robinson, moving to Prescott made perfect sense because it met an important criterion. "[We decided to retire in] an area with clear and dark night skies so that I could build a small observatory at home and pursue my interest in astronomy," says Kent, an amateur astronomer for the last 20 years. Retiring in 2004 after a 37-year, globe-trotting engineering career that included 18 household moves, the Robinsons knew they were settling down in the right spot.

Kent and Barbara soon became Friends of Lowell, paying special attention to fundraising needs, the then-proposed DCT project, as well as the observatory's history and scientific accomplishments. In 2009 and 2010, the Robinsons contributed a total of eight weeks to the cataloguing and restoration of the 1,700-book Lampland collection housed in the Rotunda Museum. A trained book restorer, Barbara is also working to preserve Percival's book collection. "Whether as a company manager, board member or non-profit organization volunteer, it has always been important to us to leave things better and more successful than we find them," says Kent.

Dedicated to helping Lowell achieve its goals, this West Virginia native is confident that, as an advisory board member, he will make a difference. "I see great potential for the observatory, both in terms of its science program achievements and its education/outreach programs," explains Kent. "I see the observatory, led by the DCT development, at an important point in its history. It has the opportunity to position itself as a premier science and cultural resource to the State of Arizona."

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Brewing up a Lifetime of Support

By Rusty Tweed

When Don and Joyce Chriscoe first visited Lowell Observatory in the mid-1980s, "it was just like what I pictured an observatory to look like," Don remarked. "It was in the woods on a mountaintop at the end of a long winding road. I felt as though I was stumbling upon something in the woods, like one might happen upon a moonshine still." The comparison is appropriate given that Don is known among the staff as the volunteer that is also a self-described zymurgist, aka, a brewer.

Don volunteers his time and skills working for Padraig Houlahan on Lowell's network infrastructure. Not only is he immersed in the cords and cables that make up the computer network, he also enjoys the job because he gets to work with the network of Lowell staff. "It's a great way to slowly meet all the Lowell people because eventually everyone has a computer, printer or network problem," said Don (above). "As I make the rounds, I get to see how each person fits in to the organization."

Having been introduced to Percival Lowell's work and Lowell Observatory in the 1950s, the Chriscoes' journey to Lowell was therefore very deliberate. During a vacation to northern Arizona in the 1980s, they made sure to allow time to visit Lowell and look through the telescopes, and they also became members of the Friends of Lowell. They were still living in Maryland at the time, where Don was working for the State of Maryland as an information systems manager and Joyce was in the midst of a 29-year career with the U.S. Navy.

During that visit, they considered Flagstaff as a place to eventually retire. In 1991, they purchased land outside of Flagstaff and, in 1996, they relocated. They weren't quite ready to retire, however. Joyce retrained as a certified nursing assistant and also volunteered with the Flagstaff Police Department and Coconino County Search and Rescue. Now, she makes crafts under the name Rabbit Hill Crafts and is deeply involved with a network of craft shows and people. Don continued his career in network systems first with Coconino County, then with Northern Arizona University. He says he has now retired for the last time.

In 1999, the Chriscoes formalized their plans for the management of their estate by creating a revocable living trust. When naming the trust's beneficiaries, they considered organizations of importance to them and Lowell Observatory was among these. Don said that two of the more important considerations for him were the fact that Lowell is a private institution, and the importance of preserving institutions that specialize in scientific research.

He explained that the process of establishing the trust was very simple; with the help of a local lawyer, they were able to

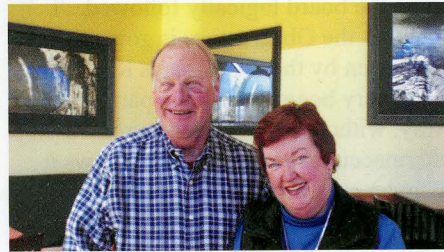
accomplish everything that they had wanted in the trust. "The trust is comprehensive and flexible. It worked well for what we wanted to accomplish, such as avoiding probate; the tax implications were less important to us." This past June, Don and Joyce were recognized as members of the Percival Lowell Society and presented with a bronze replica of one of Percival Lowell's globes of Mars.

As I sample Don's homebrew of the month, a brown ale, I am reminded, again, of what a unique place Lowell is and how lucky we are to have Don and Joyce Chriscoe involved in and supporting our activities on so many levels.

We are very appreciative of the Chriscoes' commitment to helping ensure the long-term success and future financial stability of Lowell Observatory through their membership in the Percival Lowell Society. We thank them for their generosity and support, and for sharing their story. Please use the enclosed envelope to request information about planned giving, the Percival Lowell Society, or to make a charitable gift to the Observatory.

Simplifying the Friendship

By Antoinette Beiser



When Donna and Roger Muhlenkamp moved to Flagstaff late in 2001, they hadn't heard of Lowell Observatory. However, after their first visit, they found

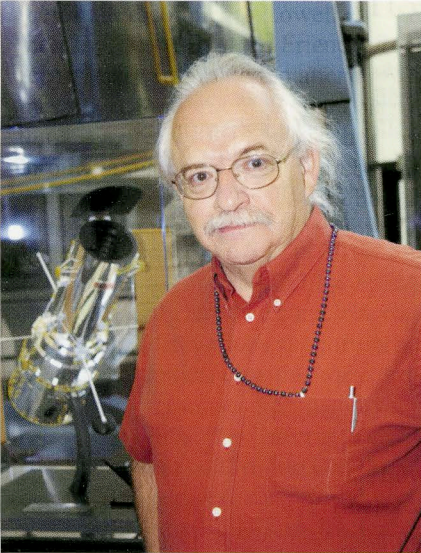
the Observatory to be a real gem; a treasure which depends in part on private funds to offer first rate programs and exhibits. They decided to become members of the Friends of Lowell in 2003. Although the Muhlenkamps are not amateur astronomers, they find the research that is done here very interesting and read the newsletter cover to cover. They are interested in the Observatory's public outreach programs, particularly getting school children involved both on site and through the Navajo-Hopi educational programs on the reservation. The Muhlenkamps have increased their giving level during the last seven years and, at the start of 2011, decided to become members at the Lowell Associate level. Although they normally make their contribution at the end of the year, they decided it would be easier to budget by making automatic monthly payments on their credit card. This eliminates the need for reminder mailings and makes the whole process of giving, in Donna's words, "painless. The decision about how much to give is made once a year, the contribution automatically occurs monthly, and I don't have to think about remembering to mail in a check." Roger adds, "There are good people at Lowell and we want to support them." *If you are interested in pursuing this method of contribution, please contact Antoinette Beiser at 928-233-3216 or asb@lowell.edu.*

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David DeVorkin

Last but not least, David DeVorkin is the lone West Coast native in this advisory board class. Born and raised in Los Angeles as the eldest of three boys, DeVorkin is currently senior curator of the history of astronomy and the space sciences at The Smithsonian Institution's National Air and Space Museum in Washington, D.C. His career also includes stops at Lick Observatory, Yerkes Observatory (home to an even bigger Clark telescope than ours), and the American Institute of Physics.

Like many a budding astronomer, David avidly read *Sky & Telescope* as a child, which is how he first learned of Lowell Observatory. He also studied E.C. Slipher's photographs of Mars, taken mostly with the Clark Telescope. Involved in preserving Australia's Mount Stromlo



Observatory as a national astronomy museum and heritage site, DeVorkin espouses the tasks that come with being at the forefront of his field. "It is a personal responsibility to do what I can to promote astronomy and the preservation of astronomical institutions," he says.

It is with this spirit and sense of duty that David joins Lowell's board of advisors. "I will learn as much as possible

about the new Lowell Observatory and look for ways to preserve its fascinating history," he explains. "[This] will help to illuminate not only the present facility, but the many facets of the history of astronomy in the past 150 years."

With sincere gratitude, we excitedly welcome Mike, Sue, Kent, David, and their families to these important roles in the Observatory's family. Their keen, thoughtful, and diligent guidance as advisory board members is greatly appreciated!

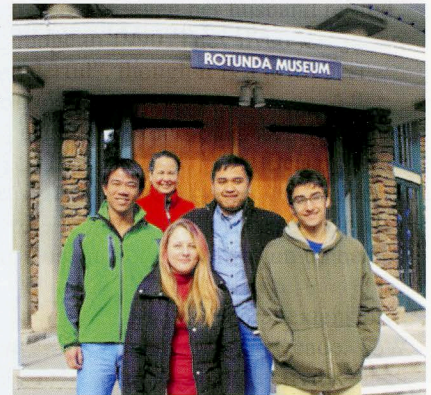
For more on these stories, as well as news items and other happenings at Lowell, check us out on Facebook or go to lowell.edu

MIT Field Camp Immerses Students in Research

This January, five students and staff from the Massachusetts Institute of Technology (MIT) spent three insightful weeks at Lowell Observatory, working on research projects with Lowell staff members.

Stephanie Gibson (sophomore from Florida, majoring in planetary science) worked with Edward Bowell and Brian Skiff on near-Earth

asteroids. Matt Sooknah (sophomore from Rhode Island, physics) worked with Ted Dunham and Georgi Mandushev on the HIPO camera for SOFIA, the airborne observatory. Fakhri Zahedy (sophomore from Indonesia, physics) worked with Deidre Hunter and Megan Jackson on dwarf irregular galaxies. Howard Yue (graduate student from Canada, aeronautics & astronautics) served as the teaching assistant for the field camp. Amanda Bosh, former Lowell staff member and currently a lecturer at MIT, led the class. The group cooked together almost every night, inviting several staff members over to the Slipher Building apartment for dinner. Tours of the DCT, the Navy Prototype Optical Interferometer, and the U.S. Naval Observatory were graciously given by Lowell astronomer Stephen Levine and USNO astronomer Robert Zavala. In their free time, the students toured the Grand Canyon, Sedona, and Meteor Crater, and did some astrophotography at Lowell's Anderson Mesa site.



(Clockwise from left) Howard Yue, Amanda Bosh, Fakhri Zahedy, Matt Sooknah, and Stephanie Gibson.

SAVE THE DATE!

The next Friends of Lowell event will take place on the Mars Hill Campus, in and adjacent to the Clark Telescope Dome, on the evening of Sunday, June 12th.

Invitations will be sent to members of Lowell at the Primary Level and up.

For more information and to make reservations, please contact to Rusty Tweed at 928-233-3267 or tweedr@lowell.edu



Lowell Observatory 1400 W. Mars Hill Road Flagstaff AZ 86001 928-774-3358
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2011 Lowell Observatory Special Events

April Regular Hours: M/W/F/Sat 9:00 a.m. - 9:30 p.m.
T/Th/Sun 9:00 a.m. - 5:00 p.m.

Sun 3 **Spring Break Star Fest** (5:00 p.m. - 9:30 p.m.)
This special event will feature indoor programs and telescopes set up for viewing celestial objects. Experience our mini-planetarium and enjoy exciting multimedia programs.

Wed 6 **Flagstaff Night** (5:00 p.m. - 9:30 p.m.)
Flagstaff residents pay only half the regular admission rate after 5:00 p.m. You will be educated and entertained while viewing breathtaking celestial objects through telescopes, experiencing live presentations with our mini-planetarium, and enjoying exciting multimedia programs.

Fri 15 **Astronomy in Siberia** (5:00 p.m. - 9:30 p.m.)
Join us at 7:00 p.m. for a program by Northern Arizona University Adjunct Professor of Biology Nancy Muleady-Mecham. She will discuss astronomy in Siberia, including cultural ties to the night sky, and also take a special look inside the Yuri Gagarin Cosmonaut Center at Star City.

Wed 20 **Lyrind Meteor Shower** (5:00 p.m. - 9:30 p.m.)
Join an indoor program at 7:00 p.m. that will focus on meteor showers such as the Lyrids. Observe breathtaking objects through telescopes, experience live presentations with our mini-planetarium, and enjoy exciting multimedia programs.

May Regular Hours: M/W/F/Sat 9:00 a.m. - 9:30 p.m.
T/Th/Sun 9:00 a.m. - 5:00 p.m.

Sat 7 **National Astronomy Day** (9:00 a.m. - 9:30 p.m.)
The Coconino Astronomical Society and Lowell Observatory will celebrate with day/evening activities and prizes!

Sun 8 **Mother's Day Star Fest** (5:00 p.m. - 9:30 p.m.)
All mothers are admitted for free! This special event will feature our panoply of exciting indoor programs, as well as telescopes set up for viewing celestial objects.

Mon 31 **School's Out & Kids are Free** (9:00 a.m. - 9:30 p.m.)
Kids' activities including science demonstrations, solar viewing, tours, and multimedia presentations will be offered throughout the day. Children must be accompanied by an adult or responsible guardian.

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For comments about the newsletter, contact
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