



Lick Observer

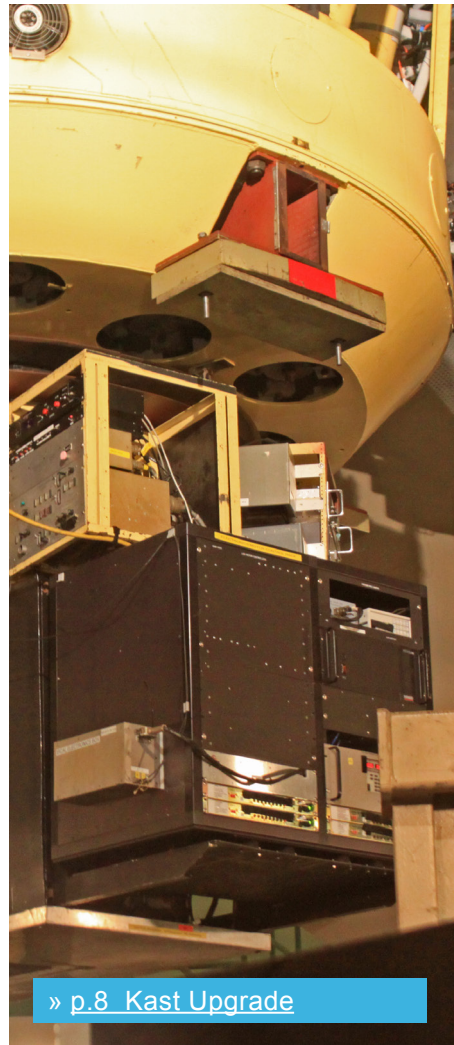
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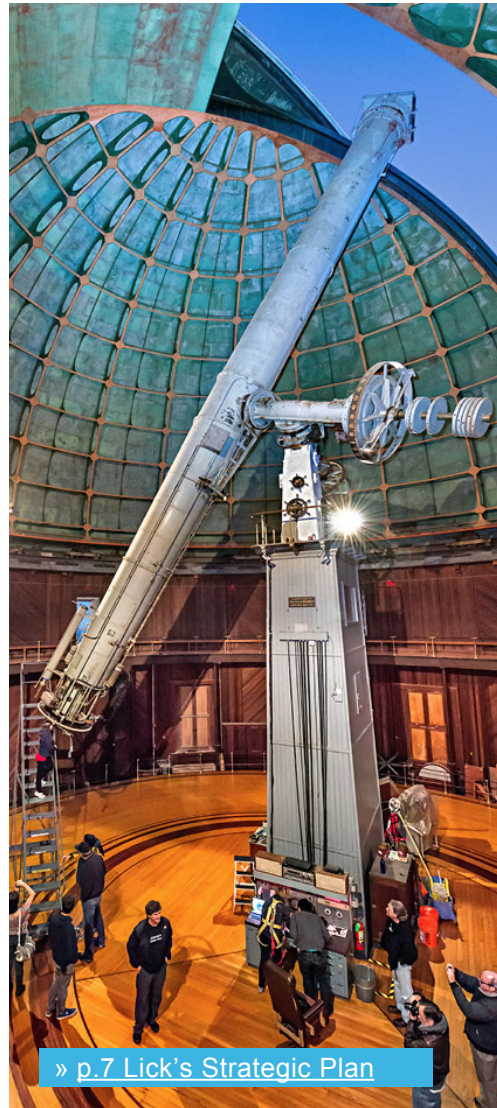


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-UC Provost Aimee Dorr

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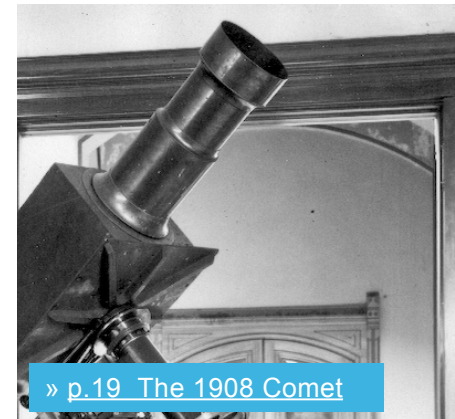
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FROM THE DIRECTOR'S DESK



Dear Colleagues and Friends,

In October, we received news that was both positive and far-reaching for Lick Observatory.

After many discussions, UC Provost Aimee Dorr and UC Executive Vice President Nathan Brostrom issued a letter reversing their previous

decision to pull funding from Lick Observatory by 2018. The new letter stated that the Lick Observatory funding "ramp-down" announced last year has been rescinded, committed UC to a steady UC Observatories base budget of \$5.04 million per year for the coming five years, and gave UCO considerable flexibility in its internal budget allocations and planning (p.6).

Things are definitely looking up for Lick Observatory!

There is now a strong level of cooperation between UC Observatories and the UC Office of the President. Morale at UCO and at Lick is on the upswing. Based on UCOP's commitment to a steady level of base funding for the next five years, we have started to bring in external funding for Lick from individual donors and corporations, charitable foundations, and the National Science Foundation.

The news story describing Lick's improved future prospects spread quickly, and spanned publications ranging from *Nature Magazine* to the *New York Times*. Our own press release reached 11,000 people and generated 1,120 likes, comments, and shares on Facebook alone. In the days after the news release, we saw visits to our website at an all time high.

One thing is clear: a lot of people love Lick Observatory and what we're doing.

The expert engineers and technicians at the UCO instrument facilities are working on two major instrument projects for Lick, the Kast Spectrograph

Red-Side Upgrade (p.8) and the new Shane AO Laser Guide Star (p.10). We had another sold-out Summer Visitors' Program at Mt. Hamilton this summer (p.17), with positive and informative feedback from more than 150 event attendees. Our faculty, students, and research assistants continue to make fascinating discoveries with the Automated Planet Finder and the other Lick telescopes (p.12).

With this strong momentum, we will be looking to the longer range future in 2015. We now have funds to sustain Lick's base operating budget through the next five years, albeit at a frugal level. We must develop strategic plans, cultivate partnerships, and ask the bigger questions about Lick's future for the coming decade.

We plan to press forward with UC astronomers and with dedicated members of the Lick Observatory Council to develop innovative strategies for the future. In this strategic planning process we will be aided by SeriesC, a renowned marketing agency founded by Andy Cunningham (p.7). The firm will conduct stakeholder audits and analysis, hold two strategy workshops with us, and help us to develop both a scientific plan and a marketing plan for the coming decade.

The goal is to determine how best to position Lick Observatory, and how to maintain our reputation of creativity and excellence in an increasingly competitive astronomical environment once the James Webb Space Telescope begins operations in 2018, and the Thirty Meter Telescope begins operations in 2024.

This strategic planning work is just beginning. But with improved relationships, new partnerships, and a renewed positive spirit, the future of Lick Observatory is looking bright.

Claire Max
Interim Director of UC Observatories



(LEFT) Debbie Chen (far left), Aimee Dorr (middle), and Michael Witherell (back) during a visit to the UCO technical facilities. David Hilyard (right), an optician, gives a tour of the optical lab. (RIGHT) UC Provost Aimee Dorr meets with Jean Brodie, UC Santa Cruz Professor of Astronomy and Astrophysics during a visit to the UCO headquarters at UC Santa Cruz. (Photos by Michael Bolte)



(ABOVE) Members of the UC Office of the President visit Lick Observatory in October. (Pictured from left) Joseph Halay, Graeme Smith, Claire Max, Michael Witherell, Anna Korossy-Eredia, Aimee Dorr, Debbie Chen, David Klinger, Elinor Gates, Brad Holden, Paul Lynam, Kostas Chloros. (Photo by Michael Bolte)

UC SUPPORTS LICK'S FUTURE

HILARY LEBOW

The University of California Office of the President reversed a previous decision to pull funding from Lick Observatory by 2018, according to a written statement issued by UC Provost Aimee Dorr in October.

The [letter](#) confirms that Lick Observatory operations will continue under the management of UC Observatories (UCO), the multi-campus astronomical research unit headquartered at UC Santa Cruz.

In the letter to UCO Interim Director Claire Max, Dorr wrote: "Given the current state of affairs and trajectory for UCO and UC astronomy, we are rescinding the stipulations in our September 16, 2013 letter as to how Lick is to be funded and managed. It is no longer UCOP's intention to require that Lick Observatory be self supporting, begin a glide path to self-supporting status no later than FY 2016-17, or be managed by an entity other than UCO."

The letter gives the UCO Director, with advice from the UCO Advisory Committee and others, the flexibility to determine the best distribution of available UC resources between Lick and other UC-related astronomical facilities such as the 10-meter Keck Telescopes in Hawaii, the instrumentation labs at UC Santa Cruz and UCLA, and the future Thirty Meter Telescope, now under construction.

"We are thrilled to hear this news," Max said. "This letter is confirmation of UCOP's support for Lick, which will allow us to focus our attention on building partnerships for research



The moon rises over Lick Observatory on Mt. Hamilton. (Photo by [Laurie Hatch](#))

and public outreach for the future."

Max said that there are sufficient funds in the projected budgets of UCO to run Lick Observatory at a frugal level for the next five years. Lick currently has an annual operating budget of approximately \$1.5 million. This much needed base budget provides a platform for pursuing the critical component, donor and foundation funding.

Ongoing fundraising efforts and potential partnerships currently being explored may provide additional funding for Lick.

Lick Observatory, established in 1888 on Mt. Hamilton near San Jose, benefits from state-of-the-art instrumentation and serves as an active facility for astronomers and students to conduct research and test next-generation technologies.

"The facilities at Lick offer students unmatched hands-on experience and ample observing time, a huge

benefit compared with the extremely competitive demand for observing time on larger telescopes," Max said. "Lick Observatory is a truly valuable resource for our students and astronomers, along with the Keck 10-meter telescopes in Hawaii and the future Thirty Meter Telescope."

In her letter, Dorr recognized the valuable role of Lick Observatory. "Indeed, we see the Lick, Keck, and Thirty Meter Telescope Observatories as an integrated ecosystem that can together maintain and grow UC's leadership in astronomy," she wrote.

Max said she feels optimistic about ongoing discussions and support from UCOP.

"Now that we are all on the same page, we can move forward to put the past behind us and ensure that Lick Observatory has a vibrant future," she said. ■

A STRATEGIC PLAN FOR LICK

SANDRA FABER, FORMER DIRECTOR

With UC's new long-term commitment to Lick Observatory recently expressed by the Office of the President (see previous page) comes the opportunity - and responsibility - to craft a long-term strategic plan for the observatory.

The [Lick Observatory Council](#) has been taking the lead in this and has put the observatory in contact with [SeriesC](#), a leading Silicon Valley branding and positioning firm that helps organizations to strategize, innovate, and bring new products to market.

SeriesC was created in 2012 by Silicon Valley marketing veteran Andy Cunningham - a three-time entrepreneur and marketing partner to some of the world's top tech brands, including Google, Apple, IBM, Sybase, and many

more. The goals for the Lick effort are far ranging and include major new science initiatives, an education and outreach center, and even commercial and tourist activities. Literally, no ideas are off the table.

The planning process will start with detailed in-depth interviews with dozens of potential stakeholders, including UC students and officials, representatives of local governments, donors, and members of the media and general public. The goal of these interviews is to find out how these constituencies view Lick and what the expectations, opportunities, and resources are for the observatory going forward.

Separately, a committee of UC astronomical researchers will

tackle the same set of questions from the scientific side. Once all the ideas are collected, SeriesC will help the council and UCO administration to synthesize the new vision and - very important - to craft a plan to communicate that vision to the wider world.

The goal is to complete the whole process and announce the new plan by June 2015.

The spectacular turnaround in Lick's prospects was due in part to the success of the "[Save Lick](#)" website, which communicated the importance of preserving the observatory to the wider world. Now that that need is accepted, the website will be renamed "Launch Lick" and will carry up to date news as the new plan takes shape.

Stay tuned! ■



(LEFT) The public observes through the historic 36-inch [Great Lick Refractor](#) on special program nights. (Photo by [Laurie Hatch](#))

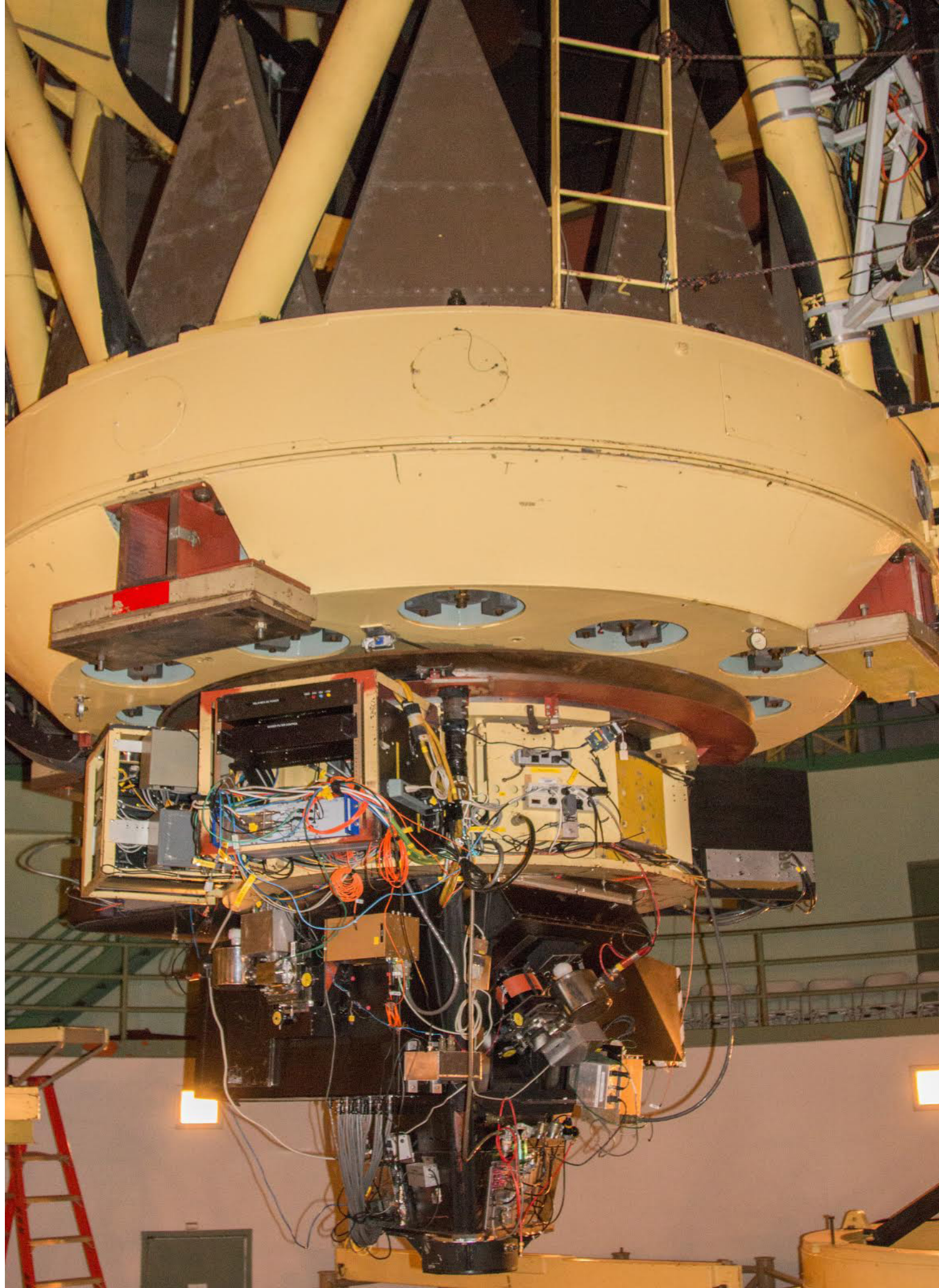


(RIGHT) The [Shane 3-meter](#) telescope lit up at twilight. (Photo by [Laurie Hatch](#))

(RIGHT) The Kast Spectrograph is the most used instrument on the Shane 3-meter telescope. (Photo by Elinor Gates)

“We will be able to more accurately calibrate supernovae in our quest to understand the nature of the dark energy that is accelerating the expansion of the universe.”

- Alex Filippenko, professor of astronomy at UC Berkeley



UPGRADE FOR THE KAST SPECTROGRAPH

HILARY LEBOW

UC Santa Cruz has been awarded \$350,000 in combined grant and donor funds for a major upgrade to the Kast Spectrograph at Lick Observatory.

Astronomers throughout the UC system use the Kast Spectrograph for scientific research across a broad range of observational programs. Its powerful and flexible double-camera design makes it the most important and most used instrument on the 3-meter Shane Telescope at Lick Observatory.

Bill and Marina Kast, the donors for whom the instrument is named, initiated the current upgrade program with a \$50,000 donation announced early in 2014. Major funding for the upgrade was provided by a \$300,000 grant from the Heising-Simons Foundation.

Black Holes and Supernovae

The spectrograph is used to analyze faint celestial objects at distances ranging from our own solar system to the far reaches of the universe. Astronomers research the chemical composition of stars, probe the surroundings of massive black holes, and study massive intergalactic hydrogen clouds, among other projects.

Alex Filippenko, professor of astronomy at UC Berkeley, said the Kast Spectrograph is crucial for his team's long-term study of supernovae, or exploding stars. "The Kast spectrograph is unique at Lick Observatory," said Filippenko. "It allows astronomers to obtain spectra of objects over the complete optical range, from the near-ultraviolet to the near-infrared."

The spectrograph itself is two distinct instruments. Separate CCD detectors

analyze and record wavelengths in the blue and red ranges independently and at the same time.

The blue and red spectra are then combined to form a spectrum that covers the entire visible wavelength band, giving astronomers a more complete view of distant objects.

With the new funding, the UC Observatories instrument labs at UC Santa Cruz will modernize the red detector to make it as sensitive and powerful as the blue side of the spectrograph.

"With the upgraded red side of the Kast spectrograph, our data will be even better," said Filippenko, who played a major role in securing both the grant and private donation.

"For example, we will be able to more accurately calibrate supernovae in our quest to understand the nature of the dark energy that is accelerating the expansion of the universe."

City Lights

The new red-side detector will also have properties that allow for more accurate removal of light from the city lights of the Santa Clara valley. Up on Mount Hamilton, 16 miles east of San Jose, the emission of nearby city lights can occasionally dilute the view through the telescopes.

With greatly improved sensitivity at redder wavelengths, the upgrade will help astronomers probe deeper into the distant universe and observe it as it appeared at earlier times.

"When the Kast was first designed and built in the early 1990s, it was right

(Continued on next page)

at the cutting edge in spectrometer efficiency and precision,” said Michael Bolte, a professor of astronomy and astrophysics at UC Santa Cruz who helped to secure the grant.

“Although we have made a number of improvements to continually modernize the instrument, the work funded by the Kasts and Heising-Simons Foundation will allow us to bring the instrument right to the world-leading forefront again. This is wonderful news for UC astronomers.”

The Heising-Simons Foundation was established in 2007 by Mark Heising and Elizabeth Simons to advance sustainable solutions in the environment, enhance the education of young learners, and support groundbreaking research in science.

“With this award, we will be bringing the Kast up to the standards of the best observatories in the world,” said Brad Holden, a research astronomer at UC Santa Cruz and principal investigator for the Kast upgrade project. “We will be able to make observations that can



The Kast Spectrograph was designed by former director Joseph Miller and built in the technical facilities at UCSC. Pictured is electronics technician Barry Alcott (now retired) working on the instrument. (Photo by Michael Bolte)

currently only be done at a handful of places.”

News of the secured funds for the upgrade project came just after UC announced their continued support of Lick Observatory at the end of October.

“This is more great news for Lick Observatory,” said Claire Max, interim director of UC Observatories. “This upgrade will help keep Lick Observatory

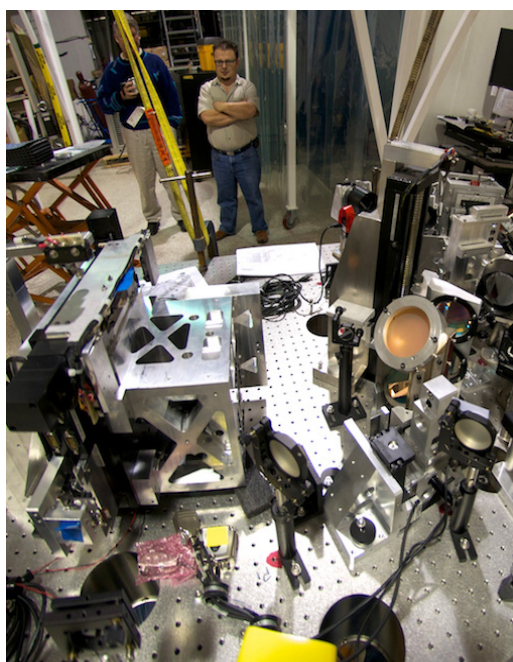
at the forefront of astronomical surveys and research for the future.”

Max said this is an exciting time to bring new projects onboard. “Our staff at the instrument labs will continue to push the envelope with next generation technology for Keck, the Thirty Meter Telescope, and now Lick Observatory.” ■

SHANE AO LASER UPGRADE



(LEFT) The Shane AO Laser guidestar in operation. (Photo by Laurie Hatch)
(RIGHT) Daren Dillon, development engineer, with the laser upgrade. (Photo by Michael Bolte)



Also in instrument news, the Shane Adaptive Optics (AO) Laser is currently being upgraded at the technical facilities at UC Santa Cruz.

ShaneAO is a second generation adaptive optics system for the Shane 3-meter telescope. A robust facility instrument, it is achieving nearly perfect AO correction at 2 microns.

With a new laser bought with a generous donation by Gordon and Betty Moore, ShaneAO will approach Hubble performance at red optical wavelengths. ■

THE TUNABLE HETERODYNE SPECTROMETER (SHS)

SONA HOSSEINI, UC DAVIS

Sona Hosseini is an astronomy graduate student at UC Davis.

For my dissertation I developed a tunable spatial heterodyne spectrometer (SHS) called Khayyam at the fixed focus of the Coudé Auxiliary Telescope (CAT) in the Shane Telescope at Lick Observatory .

SHS instruments are a class of interferometric sensor capable of providing a combination of large étendue (i.e., high resolving power [$R=\lambda/d\lambda \sim 10^5$] and wide field of view [FOV~0.5 degree]), and a compact format.

Khayyam is designed for optical wavelengths, but because it has an all-reflective design it has no wavelength limitations due to refractor optics.

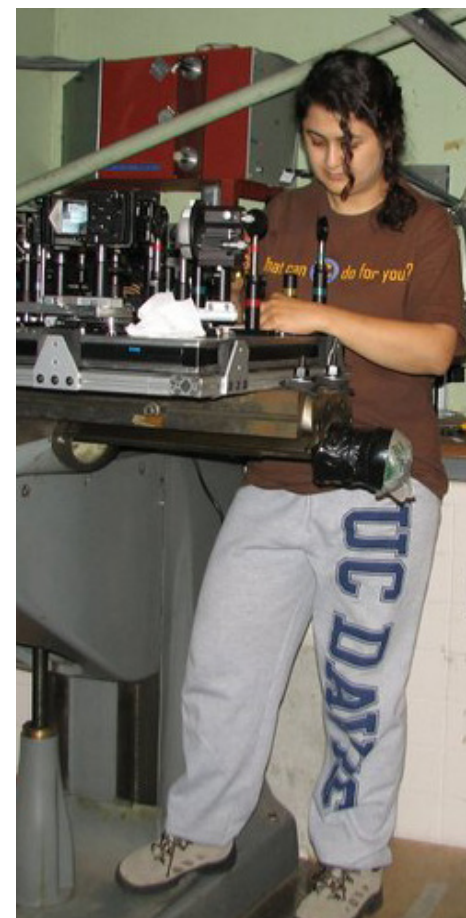
Due to Khayyam’s large field of view at the 0.6m CAT, the main science goals are extended targets such as comets and planetary atmospheres, as well as Earth atmospheric science. It can also look at smaller targets when coupled to the 3-meter Shane Telescope.

I started working on my instrument in 2010. I assembled an optical lab

at the UC Davis campus and another lab at Lick Observatory.

Following the completion of the instrument at the UCD campus, I moved to Lick in December 2010 and was living and working there until summer 2014.

During this period, my responsibilities on this project included all aspects of instrumentation design and development from the mathematical concept, optical design, mechanical design, machining, purchasing, ray tracing, to environmental stability, to data acquisition, data reduction coding, and optimization. ■



(BELOW) The Tunable Heterodyne Spectrometer being built.
(LEFT) Sonia Hosseini, an astronomy graduate student at UC Davis, working on her instrument for the Shane Telescope.



THE AUTOMATED PLANET FINDER'S FIRST YEAR

JENNIFER BURT, UC SANTA CRUZ



Jennifer Burt is an astronomy graduate student at UCSC.

With five radial velocity planet detections published in the *Astrophysical Journal* in 2014 - and another three planets currently being written up - the *Automated Planet Finder* telescope at Lick Observatory has made a strong showing in its first full year of scientific operation.

The observing efforts are being spearheaded by PhD students Jennifer Burt at UCSC, Lauren Weiss at UCB and BJ Fulton and Evan Sinukoff at the University of Hawaii, all of whom are using the telescope as a key part of their PhD thesis work.

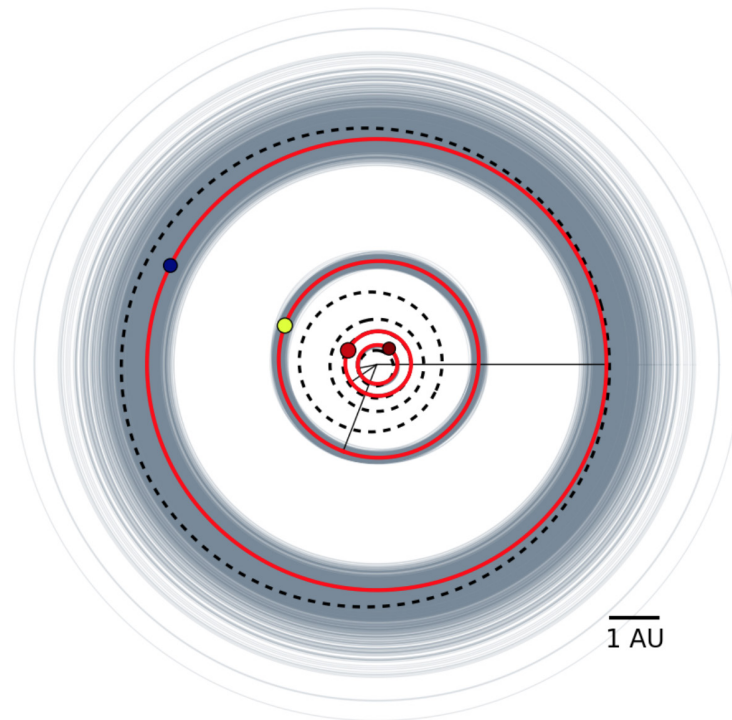
Having proven the telescope's ability to reach down to 1m/s precision and detect planets with some human assistance, the APF observers have now set their sights on achieving truly automated observing - only partially driven by their desire to go to bed at night!

The key to this next step is developing software capable of dynamically selecting the best stars to observe throughout the

evening. This software must compare the science goals (what we want to observe based on scientific interest) and the engineering constraints (what we can observe based on current atmospheric conditions) to determine the optimal target at any given time.

Two successful dynamic schedulers have been developed, one by BJ Fulton and another by Jennifer Burt and former UCSC undergraduate student Russell Hanson.

These successes mean that the APF is now officially earning the 'A' in its name and is paving the way for the long term, low-interaction observing campaigns necessary to find solar systems like our own around other stars. ■



(LEFT) The fully-robotic Automated Planet Finder (APF) at Lick Observatory. (Photo by Laurie Hatch)
(RIGHT) Red lines show the orbits of the planetary system around HD141399 (found using APF data). Dotted black lines are the orbital paths of our inner solar system planets (Mercury through Jupiter) provided for scale.

FINDING THE LEVY PLANETARY SYSTEM

LAUREN WEISS, UC BERKELEY



Lauren Weiss is an astronomy graduate student at UC Berkeley and Ken & Gloria Levy Fellow.

Over the past year, Lick Observatory's *Automated Planet Finder* (APF) Telescope has played a major role in the discovery of the Levy Planetary System. Just 54 lightyears away, at least three mini-Neptunes (planets between the mass of Earth and Neptune) orbit a small cool star, HD 7924.

The three planets dance around their star in quick orbits of 5.4, 15.3, and 24.5 days, and each has a mass between five and ten times the mass of the Earth. Other planets of similar masses in similar orbits consist of a rocky core smothered by a thick gaseous atmosphere, and so the Levy Planets likely have this structure as well.

The APF discovered the Levy Planetary System by monitoring the motion of the host star HD 7924.

The star and its planets all orbit the center of mass of the system, and so the star's motion reveals the orbital periods and masses of the planets. Since the star is very massive compared to the planets, its motion is quite small.

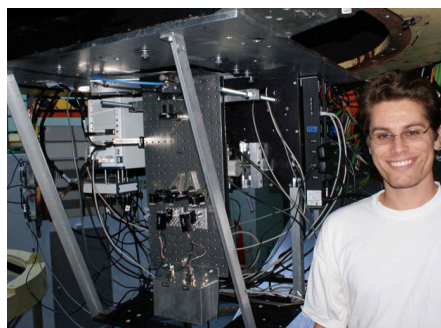
The APF's Levy Spectrometer, a high-resolution echelle spectrometer, detects the 1-2 meters per second stellar motion that each planet induces. It does so by measuring the tiny Doppler shift of the stellar spectrum due to the star's motion. ■



(ABOVE) The Levy Planetary System is named in honor of the Ken (right) and Gloria Levy, (left) who have generously contributed the Levy Spectrometer for the APF. Lauren Weiss is pictured in the middle.

A GLIMMER OF LIGHT FROM POLARIZED WORLDS

SLOANE WIKTOROWITZ, UC SANTA CRUZ



Sloane Wiktorowicz is an astronomy postdoc at UCSC.

Even with 1,500 confirmed exoplanets, and another 3,000 awaiting confirmation, very few have had their atmospheres studied directly.

Scattered light from planets may allow us to uncover the existence of clouds, surfaces, oceans, and possibly even vegetation on their surfaces.

As a planet orbits its host star, the change in geometry causes the polarization of scattered light to vary depending on the size, shape, and index of refraction (composition) of the scattering particles.

For instance, both the discovery of Venus' sulfuric acid clouds, and the measured size and non-spherical shape of Titan's haze particles, were made with polarimetry decades ago. Now, technology has matured to the point where such investigations are possible for exoplanets.

At the Lick 3-m telescope, POLISH2 searches for tiny changes in the polarization of star + planet light, which amount to ten planetary photons for every million from the host star.

Even with a modest \$45k spent on hardware and a 60-year-old

telescope overlooking the 10th largest city in the US, POLISH2 is the most sensitive, aperture-integrated polarimeter in the world; its nightly stability to polarized light rivals the photometric stability of NASA's Kepler space telescope.

Since 2011, POLISH2 has extensively observed the well studied, transiting hot Jupiters HD 189733b and WASP-12b, which orbit their stars with known geometry. The latter planet, orbiting its host star every 26 hours, is likely non-spherical due to the proximity of its host star.

Our measured amplitude of nightly variability in HD 189733b is consistent with recent Hubble measurements of the planet's albedo (reflectivity), suggesting the first ground-based detection of scattered light from an exoplanet is on the horizon. ■

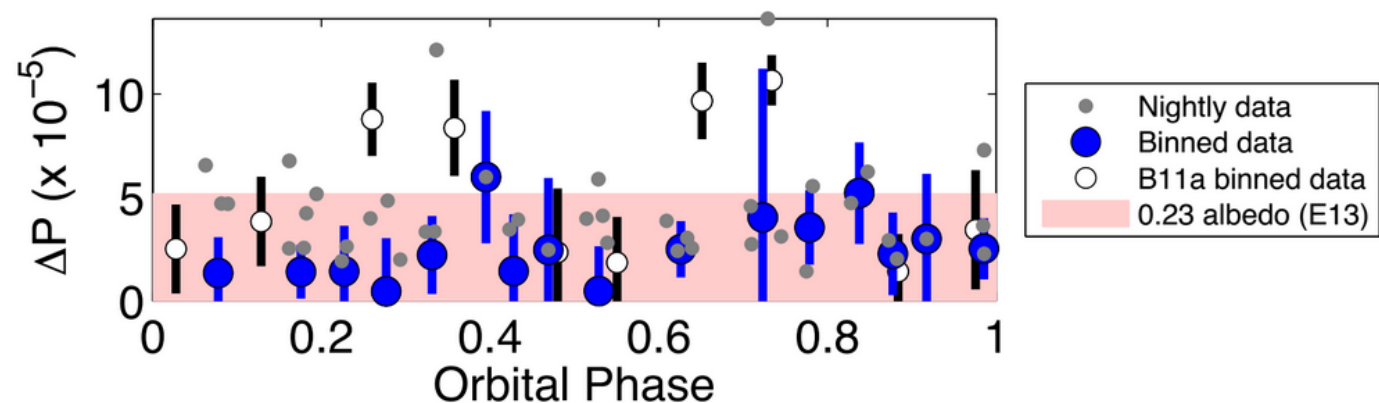


Figure caption: Nightly changes in the fraction of polarized light from the HD 189733 star + planet system. Each grey (single-night) and blue (combined from multiple nights) orbital phase point corresponds to a certain position in the orbit of the planet. Similar to Mercury, Venus, and the Moon as seen from Earth, polarization changes depending on orbital position.

Lick Observatory data show no polarization signal greater than the pink band, which represents the expected polarization based on the planetary albedo (reflectance) measured by Hubble (Evans et al. 2013, ApJ, 772, L16 [E13]). Our data are inconsistent, with 7.5σ confidence, with a previous detection that required an unphysically large planetary albedo (Berdyugina et al., 2011, ApJ, 728, L6 [B11a]).

GRADUATE WORKSHOP 2014

GRAEME SMITH, ASSISTANT DIRECTOR

The 2014 Mary Lea and C. Donald Shane Observational Astronomy Workshop was held at Lick Observatory from October 16-20.

Twenty students from six different UC campuses attended, being housed in dormitories at Mount Hamilton for the duration of the workshop.

Activities at the workshop included an extensive walking tour of the Mount Hamilton site, a talk on the history of Lick Observatory, viewing through the 36-inch refractor, lectures on observatory astronomy techniques (e.g., celestial coordinate systems, CCDs,

planning an observing run, near infrared techniques and adaptive optics, data reduction), night sky orientation, and ultimately conducting observing runs and obtaining both spectroscopic and imaging data with the Shane 3-meter, Nickel 1-meter, and Coude Auxiliary telescopes.

Lick support astronomers Dr. Elinor Gates and Dr. Paul Lynam put an enormous amount of effort into organizing and conducting this workshop.

In addition, we had the support of a remarkable volunteer, Patrick Maloney, who assisted with the operation of the 36-inch refractor and Nickel telescopes. ■

Our sincere thanks to UC Irvine Professor Virginia Trimble, whose generous financial sponsorship made this event possible.

- Kyle Boone, UCB
- Matthew Oliver Bowman, UCLA
- Marie D. Galapa, UCSC
- Devin Chu, UCLA
- Louise Daniels, UCR
- Bili Dong, UCSD
- Mohamed Hamdy Elhashash, UCR
- Katherina Feng, UCSC
- Tara Fetherolf, UCR
- Abhimat Gautam, UCLA
- Eric Gentry, UCSC
- Neil Goeckner-Wald, UCB
- John Groh, UCB
- Tiffany Hsyu, UCSC
- Man-To Hui, UCLA
- Chun Kwan Leung, UCSD
- James McElveen, UCD
- Erfan Nourbakhsh, UCD
- Omid Sameie, UCR
- Anowar Jaman Shajib, UCLA

(LEFT) Graduate students receive a lecture inside the dome of the Shane 3-meter telescope. (RIGHT) Graduate students from six UC campuses attend the graduate workshop. (Photos by Elinor Gates)



HOW FRIENDS OF LICK OBSERVATORY GOT STARTED

BOB & MICHELLE KIBRICK, LICK COUNCIL

Some of our fondest family memories are connected with Lick Observatory: viewing the Moon, Saturn, and the Ring Nebula through the Great Lick 36" Refractor and Nickel 1-meter telescopes, watching a meteor shower, and hiking and picnicking on Mt. Hamilton.

We have been affiliated with Lick Observatory (and with the UCSC campus) for over 38 years, and through those years, our affection for the Observatory has never waned.

But we did notice that due to dwindling UC funding, maintenance of facilities and enhancements to visitor programs on Mt. Hamilton were being deferred. We wanted to help.

We are longtime members of several

UCSC Friends groups which assist various campus programs with fundraising and public outreach, and we realized that there was no official Friends group for Lick Observatory. We decided to change that.

In 2011, we and several other people began the planning process for Friends of Lick Observatory (FoLO). Although Lick Observatory is a UC systemwide facility that serves eight campuses and two UC-managed labs, much of its technical and administrative staff are housed at its headquarters on the UCSC campus. Thus, it seemed appropriate to affiliate FoLO with the Santa Cruz campus.

We researched support groups for other observatories and UCSC friends groups and came up with

a mission for FoLO. The new group would foster broader public participation in the Observatory by augmenting Lick's research and educational efforts, visitor programs and exhibits, and the preservation of historical materials.

FoLO became chartered as a UCSC Friends group in June 2012, coinciding with the transit of Venus across the Sun. Due to further cuts in UC funding, FoLO's mission has been expanded to also help support basic Observatory operations.

Since its inception, over 450 people have joined FOLO, from California and 22 other states.

For more details, see [FoLO's web page](#). We look forward to seeing you at the Observatory. ■



(ABOVE) FoLO membership-kickoff event during the June 5, 2012 transit of Venus. (LEFT) FoLO volunteers manned a table at the 'Splashdown 45' event in July, which celebrated Lick's role in the the Apollo 11 moon-landing mission in 1969. FoLO volunteers operated two solar telescopes to allow the public to observe the sun and its spots.

LICK OBSERVATORY VOLUNTEER PROGRAM

PATRICIA MADISON, PUBLIC PROGRAMS COORDINATOR



(LEFT) The main building at Lick Observatory during a music of the spheres concert, a program heavily run by volunteers. (RIGHT) Performers at a Music of the Spheres concert. (Photos by Michael Bolte)

If you have ever attended one of Lick Observatory's [Summer Visitor Programs \(SVP\)](#) or [Music of the Spheres concerts \(MoS\)](#), you might not realize it takes a large and dedicated group of volunteers to make each event possible.

A typical SVP program requires 28 or more staff and volunteers: four public program assistants for event set up and tear down and parking, front door staff, gift shop staff, a history talk speaker, a science talk speaker, host, public programs coordinator, a 40" telescope operator, a 40" control room volunteer, two 36" telescope operators, a science talk videographer, seven or more additional inside volunteers, and four to six outside telescope volunteers,

who bring and operate their own personal telescopes.

A typical MoS program requires a few additional staff and volunteers – one or two more public program assistants for parking, and a wine glass and coffee mug distributor.

In spring of 1997, Ron Bricmont and Lick Observatory employee Lotus Baker, launched the Lick Observatory Volunteer Program to help run the Music of Spheres Programs. Many of the original volunteers came from the Halls Valley Astronomical Group (HVAG). The HVAG is a subdivision of the Friends of the Grant Ranch, the volunteer organization at the Grant Ranch County Park, eleven miles down the road from the observatory.

Labor Day weekend 2014 marked

the end of the 18th season for the Lick Observatory Volunteer Program. There were nine SVP programs, four MoS programs, two Saturday Stars programs, and additional public events such as the STEAM Festival at Reid Hillview Airport and Splashdown 2014 at U.S.S. Hornet.

In 2014, a total of 85 volunteers helped at these events. More than 65 of the volunteers helped two or more times, making their efforts the equivalent of over 260 volunteer opportunities.

The Lick Observatory volunteers are a dedicated collection of people interested in astronomy and eager to share their enthusiasm for Lick Observatory and the skies above.

Thank you to both the staff members and the volunteers for making the summer programs possible. For more information, e-mail volunteers@ucolick.org. ■

THE VIEW FROM MOUNT ISABEL

RON BRICMONT, LICK COUNCIL



The view of Lick Observatory from Mount Isabel at 3,760 feet. (Photo by Ron Bricmont)

To the southeast of Lick Observatory, across the 2000-foot deep gorge of Sulfur Creek, rises the gently rounded, chaparral and scrub oak covered summit of Mount Isabel. The second highest peak in the Diablo Range, only 130 feet lower than Mount Copernicus, its 4230-foot summit is 14 feet higher than Lick's iconic Main Building.

From Mount Isabel, the views of Lick Observatory are impressive. Until recently, this has been private ranch land and these views have been the privilege of very few. That is about to change.

Since the fall of 2012, most of the western side of the mountain has been part of Grant Ranch County Park. The top 230 feet of elevation of Mount Isabel is part of the Lick Observatory Reserve. Up to an elevation of 4000 feet, however, the mountain, and the views from it, will soon be open to the public.

I took the photo above from an elevation of 3760 feet. From this vantage point, there is

an unsurpassed view of the observatory. With the precipitous gorge of Sulfur Creek Canyon at one's feet, the full expanse of the observatory is spread out before one. All of the domes can be seen, as well as nearly all of the other buildings.

At the left, on Rattlesnake Ridge, is the dome of the historic 36-inch Crossley Reflector. To the right, on Observatory Peak, is the Main Building, with the domes of the Great Lick Refractor and the 40-inch Nickel Reflector. To the right of that, on diminutive Huygens Peak, is the small dome of the 22-inch Tauchmann Reflector.

Next to the right, on Tycho Peak, are the small domes of the Automated Planet Finder and the 20-inch Double Astrograph; as well as the large dome of Lick's largest telescope, the 3-meter Shane Reflector. At the far right, on Kepler Peak, is the Katzman Automated Telescope, celebrated for its discovery of supernovae

beyond our galaxy.

Farther to the right, beyond the scope of this photograph, is Mount Copernicus, surmounted by a fire lookout tower. At 4363 feet, it's the highest point in the Diablo Range, 500 feet higher than Mount Diablo.

When the Sulfur Creek Ranch addition to Grant Ranch Park is opened to the public in the near future, those who are willing and able to make the rigorous hike up Mount Isabel will be able to enjoy not only this superb view of the observatory, but many other fine views of it from lower on the mountain.

As one climbs the Mount Isabel Trail, along the spine of the western spur of the mountain, the observatory can be seen at many points in a constantly changing series of inspiring views.

For those looking for a much easier hike, there will be other excellent views from the lower elevation Lick View Trail, which rises more gently on the southern side of Sulfur Creek Canyon. ■

ANNE GLANCY AND THE COMET OF 1908

TONY MISCH, LICK HISTORIAN

In the autumn of 1908 Comet Morehouse appeared in the northern sky. Its beauty and the complexity of its shifting form were at least the equal of its far more famous cousin Halley, which would cause such wide excitement two years later.

Comet Morehouse was followed by observers around the world. At Lick, its spectrum was studied by Director W. W. Campbell and astronomer Sebastian Albrecht. Direct imaging was taken up by one of Lick's first female graduate students, Anne Estelle Glancy.

By 1908, women were routinely employed as "computers" in the astronomical workshops of major observatories, measuring photographic plates and performing complex, repetitive calculations. But their work was invariably in support of observing projects initiated and carried out by the academic fraternity of male astronomers. Womens' supposed physical frailty, deficient creativity, and the lack of separate accommodations for them at observatories were chief among the stubborn Victorian prejudices that effectively barred them from the telescope.

A 1917 letter of reference on behalf of a student applying for a Lick graduate fellowship all-too-plainly illustrates the prevailing attitude: "While unfortunately she is not a man, I believe she is handicapped by her sex less than any aspirant I have known." (The applicant, Edith Cummings, was awarded the fellowship, and went on to build Lick's first photoelectric photometer.)

Lick, though not entirely immune to such prejudices, was notably progressive in the early admission of women to its graduate program, and those women—Estelle Glancy

first among them—used the telescopes on Mt. Hamilton.

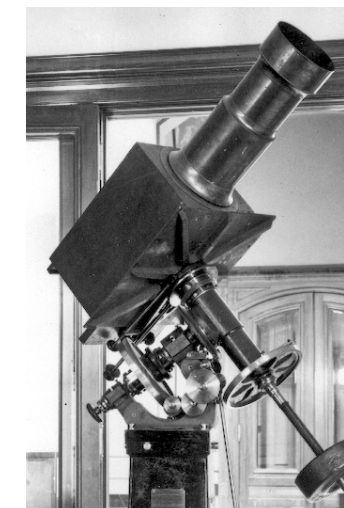
To photograph Comet Morehouse, Glancy used the observatory's 6-inch Willard and Dallmeyer cameras, mounted on the Crocker Telescope, simultaneously making long exposures with the former and shorter pairs with the latter. She took advantage of every night that weather and moonlight permitted, throughout the three months of the comet's brightest apparition, and though hampered by a particularly inclement fall, obtained more than eighty 8 x 10 inch plates, resulting in a superb series of images that beautifully illustrate the comet's changing shape.

In 1913, Glancy—whom the head of the UC astronomy department, Armin Leuschner, described as "brilliant,

industrious, and accurate"—and her classmate Phoebe Waterman became the first women to receive astronomy PhDs from UC. Waterman married soon after and, in a time when a married woman had little chance of pursuing an independent career in academia, left astronomy.

Glancy spent the next five years as an observer at the Argentine National Observatory in Cordoba. Returning to the US in 1918, she took a job with the American Optical Company, where, for the next 33 years, she distinguished herself in mathematical optics and lens design. Dr. Anne Estelle Glancy died in 1975 at age 91. ■

See the Lick Observatory Historical Collection at collections.ucolick.org



(TOP) The comet near the height of its apparition in 1908. (Lick Historical Collection)
(LEFT) The Crocker Telescope with the Willard Lens in 1892. (UCSC Digital Collections)
(RIGHT) Dr. Glancy with colleague Dr. Edgar Tillyer in 1930. (Jacob Edwards Library Collection)



2015 Summer Visitors Program

Lick Observatory hosts a popular Summer Visitors Program for the public to hear lectures about astronomical research and history. The public can also observe through both the 36-inch Great Lick Refractor and Nickel 40-inch Reflecting Telescope. Tickets will go on sale April 2015. FoLO members will receive advanced ticket purchase opportunities.

Friday, June 12 Friday, July 24
Saturday, June 13 Friday, August 7
Friday, June 26 Friday, August 21
Friday, July 10

2015 Music of the Spheres Program

Our Music of the Spheres concert series is held annually in the summer as well. Tickets will go on sale April 2015. FoLO members will receive advanced ticket purchase opportunities.

Saturday, June 27 Saturday, August 8
Saturday, July 11 Saturday, August 22
Saturday, July 25

Lick Observer

The Lick Observer is a periodic publication showcasing the scientific accomplishments, research, discoveries, instruments, and programs at Lick Observatory for the UC astronomy community and beyond.

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If you have ideas for the next edition of the Lick Observer, please e-mail your suggestions to jbrodie@ucsc.edu and lebow@ucolick.org.

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