W. M. Keck Observatory
Annual Report 2007

VISION

A world in which all humankind is inspired and united by the pursuit of knowledge of the infinite variety and richness of the universe.

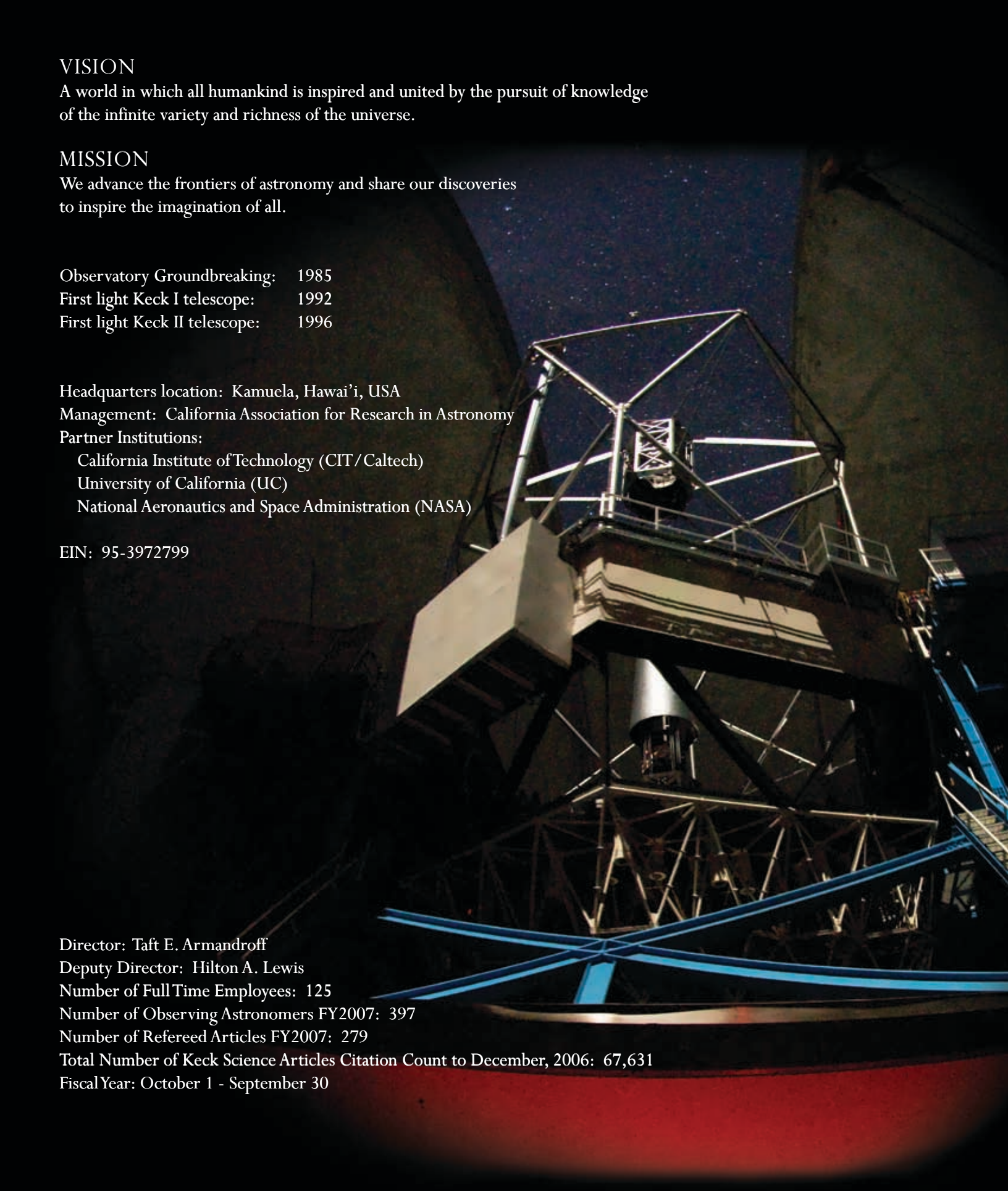
MISSION

We advance the frontiers of astronomy and share our discoveries to inspire the imagination of all.

Observatory Groundbreaking: 1985
First light Keck I telescope: 1992
First light Keck II telescope: 1996

Headquarters location: Kamuela, Hawai'i, USA
Management: California Association for Research in Astronomy
Partner Institutions:
California Institute of Technology (CIT/Caltech)
University of California (UC)
National Aeronautics and Space Administration (NASA)

EIN: 95-3972799



Director: Taft E. Armandroff
Deputy Director: Hilton A. Lewis
Number of Full Time Employees: 125
Number of Observing Astronomers FY2007: 397
Number of Refereed Articles FY2007: 279
Total Number of Keck Science Articles Citation Count to December, 2006: 67,631
Fiscal Year: October 1 - September 30

Cover photo:
The twin 10-meter telescopes peer into the cosmos from the stunning summit of Mauna Kea.

Dr. Taft E. Armandroff
Director
W. M. Keck Observatory

"It is with great pleasure that I welcome you to the 2007 annual report of the W. M. Keck Observatory. The past year has been noteworthy in both the measure of Keck's scientific achievement and in our continued leadership in breakthrough technologies and innovation. In the following pages, we will share highlights of recent accomplishments and introduce you to some of my colleagues who helped make this an exceptional year.

One of the key metrics for evaluating the success of our Observatory, and indeed any scientific enterprise, is the number of scholarly articles published in top academic journals. Keck Observatory surpassed a major milestone in fiscal year 2007 having 279 papers published in professional astronomy journals. This is a record for Keck, and it significantly exceeds the number of papers published per telescope of any ground-based observatory worldwide. More sophisticated metrics that track not only the number of papers published, but also how impactful each paper is to change a scientific area or spawn a new field of research, confirm that Keck is the most scientifically productive observatory on Earth.

The range and depth of the scientific discoveries achieved with the Keck telescopes in 2007 is inspiring. Dan Stark, Richard Ellis and colleagues revealed the oldest, most distant galaxies in the universe using our large 10-meter telescopes, strengthened further by using the powerful cosmic phenomenon of gravitational lensing. The light from these galaxies has travelled for over 13 billion years before reaching the Keck telescopes. Closer to home but equally spectacular were discoveries made by studying new images of the rings of Uranus captured with Keck's adaptive optics system with unprecedented clarity. Highlights of other recent discoveries are in the pages that follow.

This year witnessed the supercharging of our world-class adaptive optics systems via the installation and commissioning of the next-generation wavefront controller on both Keck I and II. The new technology built into these systems enabled Keck astronomers to easily surpass previous image clarity records for key scientific targets, such as the Galactic center, Pluto, and star forming nurseries.

Other programs to enhance our telescopes, instruments and engineering continued strongly in 2007. While the Keck Observatory is a leader in efficiently obtaining spectra of hundreds of astronomical sources simultaneously in the optical portion of the electromagnetic spectrum, until recently, the technology was not available in the infrared. However, scientific imperative, technological developments, and a public-private funding partnership have enabled the Observatory to develop a breakthrough multi-object spectroscopic instrument for the infrared: MOSFIRE. This past year, MOSFIRE transitioned from its design phase into fabrication. The integration of MOSFIRE systems will begin in January 2008, and we expect this uniquely capable instrument to be delivered to our Mauna Kea summit facilities in late 2009.

Also underway this year was the development of a new laser guide star adaptive optics system for the Keck I telescope. This new system will use technological advances to surpass the world-leading performance of the current Keck II adaptive optics system. Progress was also made this year in two other technology enhancements: 1) upgrading our popular first-generation optical spectrograph LRIS to increase its performance and efficiency and 2) making improvements to our acquisition/guide cameras to better track the science targets in the sky.

During 2007, the Keck Observatory Advancement Advisory Council was formed to provide wisdom and expertise to the Observatory in the realm of private fundraising. I am thrilled at the caliber and commitment of these Observatory supporters who have agreed to serve on our Council. With federal sources of funding not at the scale needed for modern technological advances, private philanthropy and the work of the Advancement Advisory Council are crucial for our future success.

Throughout its young history, Keck Observatory and the world's most accomplished scientists have been at the leading edge of astronomical research and innovation. In closing, may I take this opportunity to thank our governing board, professional staff and Observatory donors for their encouragement and for their unwavering commitment to exemplary scientific achievement."

Inside cover: Enclosed in a dome that reaches 15 stories high, the revolutionary Keck telescope weighs 300 tons yet rotates easily on an oil azimuth ring to track celestial objects.

CONTENTS

Model of the enhanced dewar and focus mechanism for the LRIS red channel detector upgrade.

3 Letter from the Director

5 Vision

6 Milestones

7 Science Community

8 Research Highlights

10 Impact

11 People of Keck

14 Technology Highlights

18 Education and Outreach

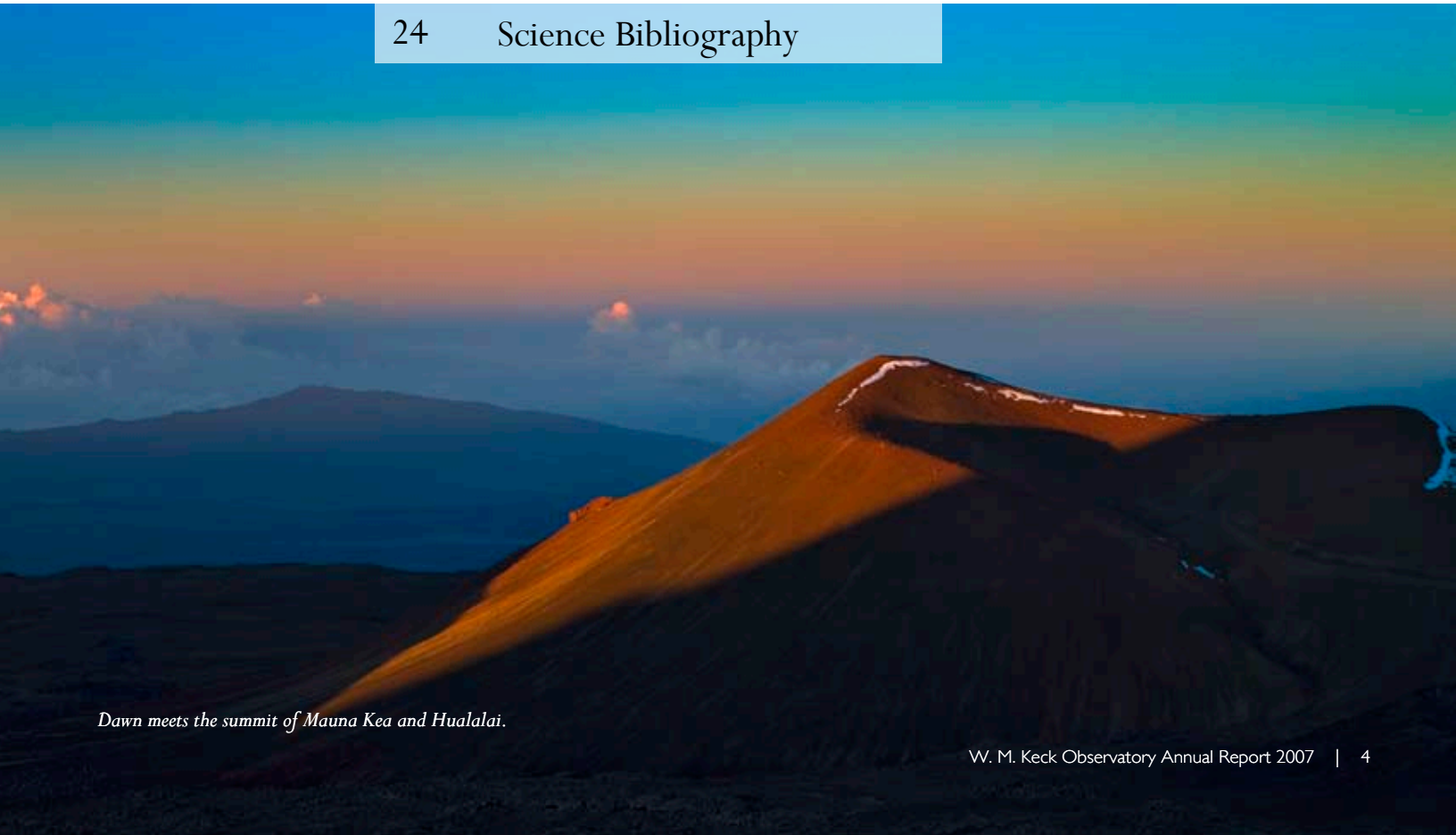
19 Next Generation Workforce

22 Advancing Keck Observatory

22 Financials

24 Science Bibliography

Information technology student intern Eric Dela Rosa learning the computer intricacies that power the Keck telescopes.



Dawn meets the summit of Mauna Kea and Hualalai.

VISION

At its inception in the 1980's, the W. M. Keck Observatory radically challenged the scientific status quo. For forty years prior, the 5-meter (200") Palomar telescope had reigned supreme. To produce the next leap in telescope design, astronomers and engineers at UC and Caltech, under the leadership of Project Scientist, Dr. Jerry Nelson, came up with an innovative and controversial design to build a mosaic mirror from segments rather than using a single giant piece of glass. Many in the astronomy community were convinced the concept would fail. The visionary design did, however, capture the attention of the W. M. Keck Foundation. The Foundation's namesake, William Myron Keck, an entrepreneur and founder of Superior Oil Company of California, was familiar with high risk and bold moves, and his foundation recognized an extraordinary opportunity to advance science. The Keck Foundation funded both the original Keck I 10-meter telescope and six years later, its twin on the summit of Mauna Kea. The total grant of $138 million represented 25% of the Foundation's assets, and, at the time, was also the largest charitable contribution of its kind ever made. The project was managed by the world's leading centers for astronomical research, the University of California and Caltech, who formed an enduring partnership of pioneering science and technology. In 1996, the National Aeronautics and Space Administration (NASA) joined as a one-sixth partner in the Observatory.

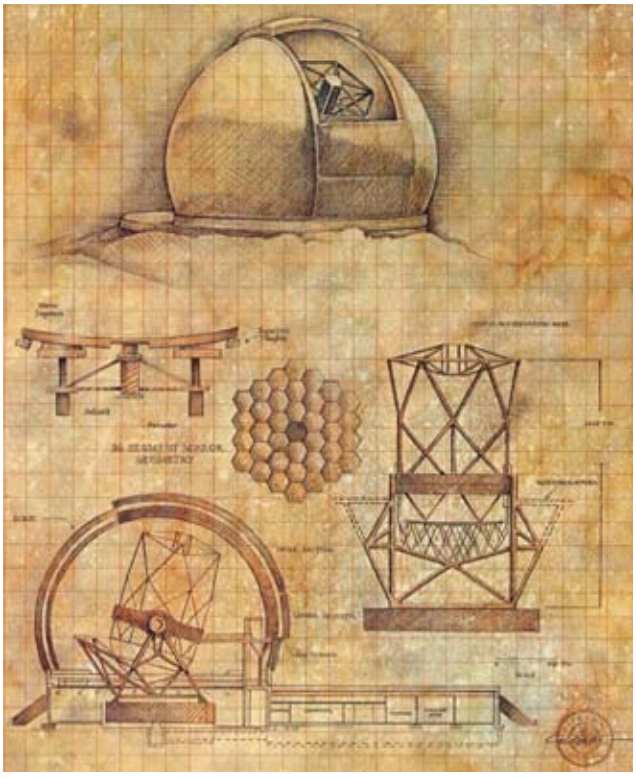
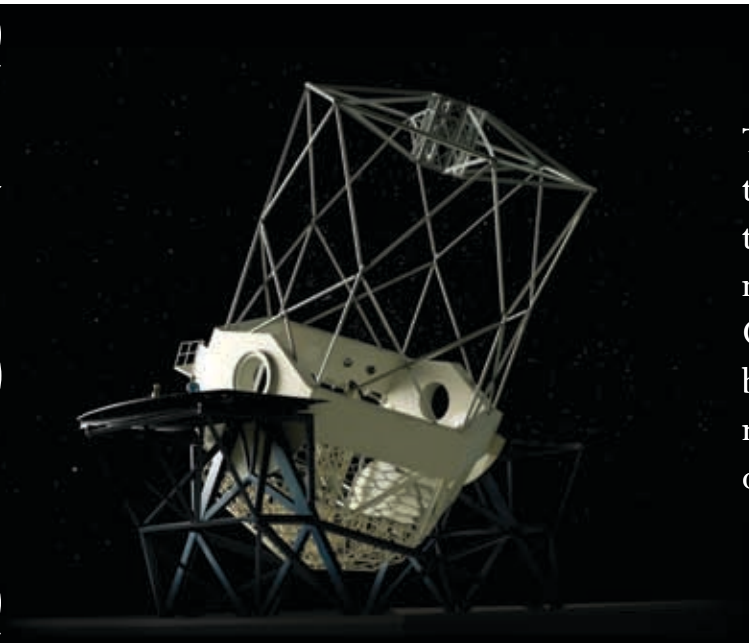


Illustration of the Keck I Telescope by Kirk Caldwell for a May 24, 1987 Los Angeles Times Magazine article, "Building the World's Largest Telescope: Mr. Keck's Bequest."

Today, Keck Observatory is managed by the California Association for Research in Astronomy as a private 501(c)3 research and education corporation. Charged with sustaining the Observatory at the vanguard of world astronomy, the governing board membership in 2007 and their institutional affiliation were Chair Dr. Edward C. Stone, California Institute of Technology; Vice-Chair and Chancellor Dr. France A. Cordova, University of California at Riverside; Alphonso V. Diaz, University of California at Riverside; Dr. Shrinivas Kulkarni, California Institute of Technology; Dr. Michael Bolte, University of California Observatories/Lick Observatory; and Dr. Thomas Tombrello, California Institute of Technology. Liaisons to the board were Dr. Stephen Ridgway, NASA and Theodore J. Keck, the W. M. Keck Foundation.

In the photograph above, taken on campus at Caltech in November, 2007, are standing left to right: Tom Soifer, Science Steering Committee Co-Chair; Shrinivas Kulkarni, Board member; Michael Bolte, Board member; Jean Brodie, Science Steering Committee Co-Chair 2008; Taft Armandroff, Observatory Director; Edward Stone, Board Chair; George Blumenthal, Board Vice-Chair 2008; Margarita Scheffel, Keck Chief Financial Officer; Hilton Lewis, Deputy Director; Thomas Tombrello, Board member; T. J. Keck, Keck Foundation liaison; and Elaine Stamman, Board secretary.

MILESTONES



The revolutionary twin Keck telescopes are the most powerful tools to study the cosmos. The milestones below represent the Observatory's commitment to being first and foremost in the rapidly evolving technical field of astronomical research.

1974	Jerry Nelson presents initial design concept for 10-meter telescope
January 3, 1985	Presidential telegram sent by Ronald Reagan acknowledging $70 million donation from the W. M. Keck Foundation to construct the world's largest telescope
September 12, 1985	Ground blessing, W. M. Keck Observatory - summit of Mauna Kea
November 24, 1990	First light – Keck I Telescope - 9 segments installed
November 7, 1991	Dedication of Keck I Telescope and Keck II ground blessing
April 14, 1992	First light – Keck I Telescope - 36 segments installed
May 21, 1993	First light – LRIS (Low Resolution Imaging Spectrometer)
May 8, 1996	Dedication of Keck II Telescope
February 5, 1999	First light – Adaptive optics instrument on Keck II telescope
March 13, 2001	Interferometer - First fringes with the Keck telescopes
December 23, 2001	First laser guide star over Mauna Kea created with the Keck II sodium laser
June 3, 2002	First light – DEIMOS instrument (DEep Imaging Multi-Object Spectrograph)
September 9, 2003	First light – AO LGS system (Adaptive Optics Laser Guide Star)
August 25, 2004	First light – Upgraded HIRES (High Resolution Echelle Spectrometer) CCD detectors
February 22, 2005	First light – OSIRIS instrument (OH-Suppressing Infra-Red Imaging Spectrograph)
January 27, 2007	First light – Cassegrain ADC (Atmospheric Dispersion Corrector)
February 27, 2007	First light – NGWFC (Next Generation Wavefront Controller)

SCIENCE COMMUNITY

Access to the Keck telescopes is highly prized and the 365 nights of observing time are divided each year among its partner institutions, Caltech (36.5%), UC (36.5%), NASA (14.5%), and the University of Hawai'i (UH) (12.5%). In 2007, the Observatory also provided observing time to other astronomy communities through the Telescope System Instrumentation Program (TSIP) funded by the National Science Foundation and administered by the National Optical Astronomy Observatory (NOAO), and through specific time exchanges with both the Gemini Observatory and Subaru Observatory in order to access some of their instrument capabilities that are not emphasized at Keck. Each observing community has its own Time Allocation Committee (TAC) that reviews proposals semi-annually and approves them based upon their scientific merit.

A Science Steering Committee, comprised of 11 astronomers from the partner institutions, meets regularly to develop the priorities of the Keck science community and communicate them to Observatory leadership. The co-chairs of the Science Steering Committee in 2007 were Tom Soifer, representing the California Institute of Technology, and Ian McLean, from UCLA, representing the University of California astronomy community.

The annual Keck Science Meeting was held September 19, 2007, on the campus of Caltech in Pasadena, with resounding participation by the Keck observing community. The breadth of science presented at the meeting ranged from physics of the onset of galaxy formation to measurements of solid methane on Saturn's largest moon Titan, reflecting the diverse scientific themes pursued by Keck's astronomers. The consensus of the assembled astronomers is that Keck's investment in our laser guide star adaptive optics system and related infrared spectroscopy tools, particularly our new OSIRIS instrument, is clearly positioning Keck at the forefront of several scientific fields. For example, OSIRIS has become a unique tool for long-term studies of the physical conditions, chemistry, and cloud cover in the atmospheres of solar system bodies, including Titan. This type of research was once the exclusive domain of space probes.

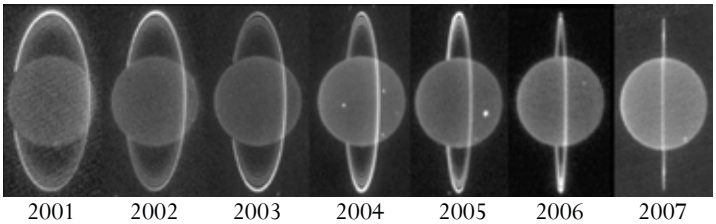
Keck astronomer Alex Filippenko (at right) and UC Berkeley graduate student Ryan Foley make adjustments to their science plans from remote observing at headquarters.

RESEARCH HIGHLIGHTS

Hawai`i's view of the myriad stars, dust and gas of our magnificent Milky Way galaxy.

OBSERVING A RARE OPPORTUNITY

The rings of Uranus were oriented "edge-on" to Earth in 2007 and were imaged for the first time from Earth by Keck Observatory. The solar system's seventh planet was discovered in 1781, but its rings were not found until 1977. NASA's Voyager 2 spacecraft sent back the first images of the rings in 1986. The "ring plane crossing" event in 2007 provided a rare opportunity (not to be repeated for another 42 years) to observe their dark (unlit) side. Observations showed that the ring system, in particular the distribution of dust, had changed dramatically since previous views, suggesting that Uranus has suffered occasional large impacts over the past 21 years. Imke de Pater of the University of California, Berkeley, led the study.



The rings of Uranus oriented toward Earth through time.

SOLVING THE MISSING DWARF GALAXY PUZZLE

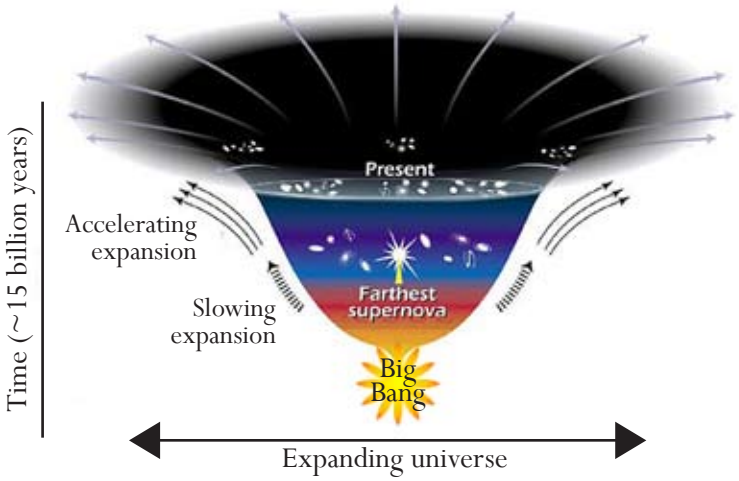
Measurements of stars' velocities using the Keck II telescope and its leading wide field multi-object spectrograph DEIMOS have shown that some recently discovered very low mass galaxy companions to the Milky Way are completely dark matter dominated. The study may be the first step in solving the "Missing Dwarf Galaxy Puzzle." The puzzle is the lack of hundreds of small dwarf galaxies surrounding large galaxies like our Milky Way, and it comes from a prediction of the "Cold Dark Matter" model for the formation of galaxies and other large structures in the Universe. This result is being closely studied by astronomers interested in galaxy formation.

The "Cold Dark Matter" model postulates that dwarf galaxies form first and are the building blocks for larger galaxies. After most of these building blocks merge to form the large galaxies like our Milky Way, some should remain intact surrounding the large galaxies. The Keck result has shown that these dwarf galaxies are significantly more common around the Milky Way than previously believed. The lead author on this study is Josh Simon, Millikan Postdoctoral Scholar at Caltech.

PRIZE-WINNING SCIENCE

Saul Perlmutter, pictured here, and the members of the Supernova Cosmology Project shares the 2007 Gruber Cosmology Prize with competitors, the High-Z Supernova Search Team, in the discovery of the accelerating expansion of the universe.

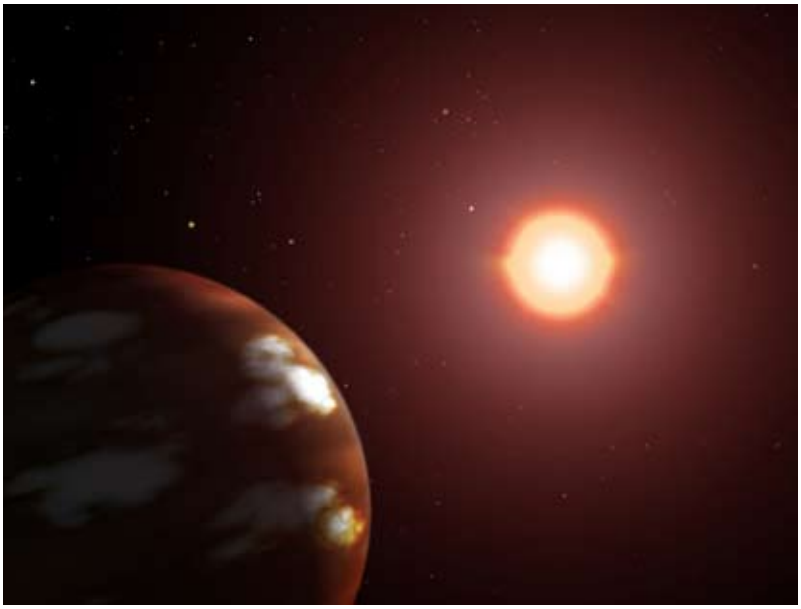
Saul Perlmutter of the University of California at Berkeley and Lawrence Berkeley National Laboratory and Brian Schmidt of Australian National University and their teams: the Supernova Cosmology Project and the High-z Supernova Search Team, independently discovered that the expansion of the universe is accelerating. Their discovery, based on observations of distant supernovae from Keck Observatory, led to the idea of a repulsive force, known as dark energy. This implied that the fate of the universe is to just keep expanding at an ever faster rate. The physical origin of dark energy is widely believed to be one of the most important open questions in physics today. The 2007 Gruber Cosmology Prize was awarded jointly to Saul Perlmutter, Brian Schmidt, and the members of their two international teams for their discovery. This same research has been honored previously, most recently by the $1 million Shaw Prize that was shared by Perlmutter, Schmidt, and Adam Reiss in 2006.



This diagram reveals changes in the rate of expansion since the universe's birth 14 billion years ago. The more shallow the curve, the faster the rate of expansion. The curve changes noticeably about 5 billion years ago, when objects in the universe began flying apart as a faster rate. Astronomers theorize that the faster expansion rate is due to a mysterious, dark energy that is pushing galaxies apart.

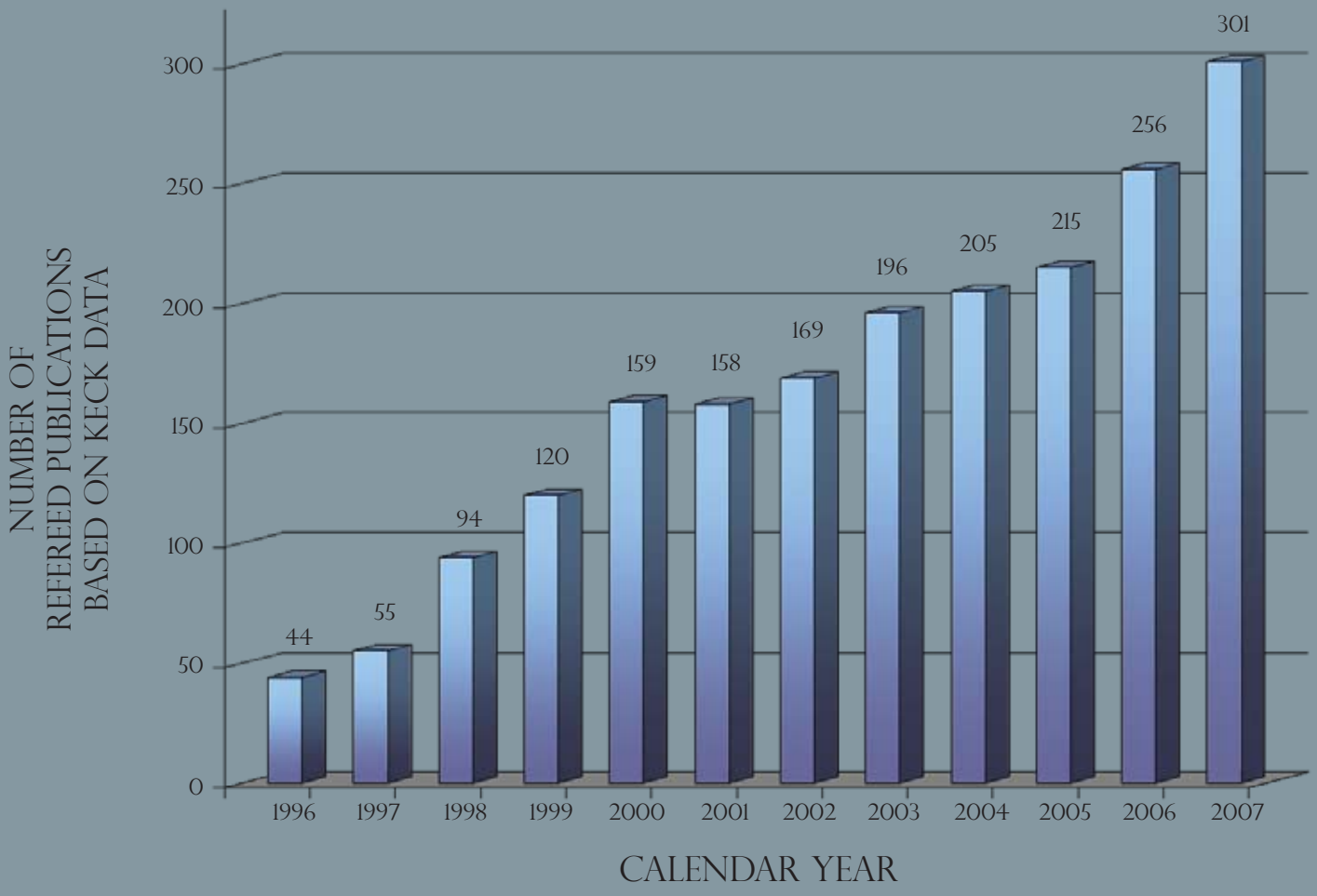
28 MORE EXOPLANETS

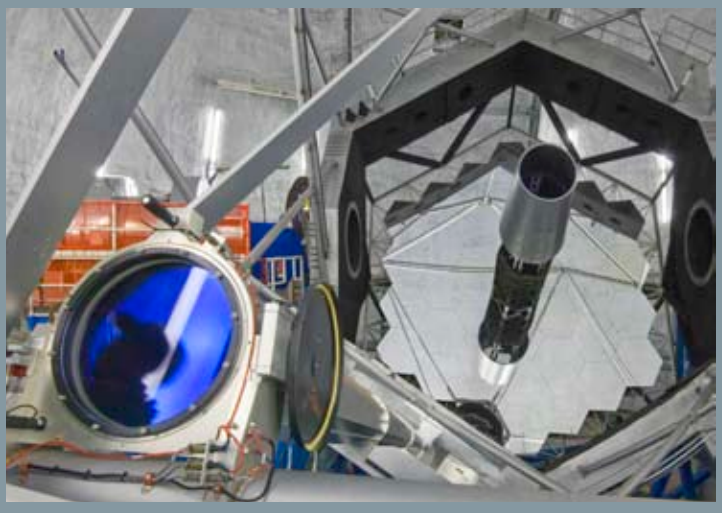
Keck Observatory, with its HIRES spectrometer, is a leading facility for detecting planets around nearby stars using the Doppler wobble technique. At the summer 2007 meeting of the American Astronomical Society held in Honolulu, the California and Carnegie Planet Search team and the Anglo-Australian Planet Search team jointly announced the discovery of 28 new planets outside our solar system, increasing to 221 the total number of known exoplanets orbiting nearby stars. In addition, this group highlighted the star Gliese 436, located only 30 light years from Earth. This star features a planet, discovered using Keck data, that passes in front of the star, or transits, as viewed from Earth. From the small sample of transiting planets that also have Doppler wobble measurements, one can deduce the density of the planet. Gliese 436 was found by researchers to have a planet of 22.4 Earth masses, slightly larger than the mass of Neptune (17 Earth masses). The planet's radius and density are also similar to Neptune's. The Gliese 436 planet's density is two grams per cubic centimeter, twice that of water, suggesting it is 50 percent rock and about 50 percent water. According to Geoff Marcy of the University of California at Berkeley and a leader of the California and Carnegie Planet Search team, "So this planet has the interior structure of a hybrid super-Earth/Neptune, with a rocky core surrounded by a significant amount of water compressed into solid form at high pressures and temperatures."



This artist's concept shows the newly discovered Neptune-sized extrasolar planet circling the star Gliese 436. Gliese 436 is a type of low-mass star called an M dwarf, about four-tenths the size of our Sun. It appears reddish because it is cooler than a typical Sun-like star. The new planet is only the second to be found orbiting an M dwarf star, and is one of the smallest extrasolar planets detected to date. It circles Gliese 436 every 2.6 days at a small fraction of the distance between the Sun and Earth, or 4.1 million kilometers (2.6 million miles).

IMPACT





Keck II laser launch tube positioned next to the primary mirror.

The measure of success in a research facility like Keck Observatory is the advancement of knowledge, which is ultimately gauged by breakthrough discoveries that can cause paradigm shifts in the way we view the universe and our place in it. The professional metric is the number of high quality scientific publications, typically enumerated as the number of refereed journal articles, and the citation rate of these articles, produced by data derived from observations using the Keck telescopes. Over the past few years the number of papers and their scientific impact represented by Keck astronomy has far surpassed other comparable observatories, sometimes by a factor of 2 to 2.5. The continued growth of publications indicates that the full potential of the telescopes to contribute to our total knowledge of astronomy is yet to be realized. A complete Keck Observatory Science Bibliography for FY07 is presented on pages 24 to 35.

Imke de Pater: Astronomer

Imke de Pater has never forgotten the kind gentleman who first sparked her interest in astronomy, back in high school in the Netherlands. A friend's father gave her an astronomy book and set up meetings in the neighboring town of Utrecht for Imke to learn more about this field. Imke went on to earn a Ph.D. in Astronomy from the University of Leiden, in the Netherlands, with a specialization in planetary astronomy. Imke has since emigrated to the U.S. to pursue her career and her research, and she currently works as a professor of astronomy at the University of California at Berkeley. The 2001 book Planetary Sciences, co-authored by Imke de Pater and Jack Lissauer, is regarded as the definitive textbook in the planetary sciences.

Though Imke began her career specializing in radio astronomy, the 1994 collision of comet Shoemaker-Levy 9 with Jupiter, almost simultaneously with the Keck II Telescope coming online, inspired her to expand her wavelength range to the infrared portion of the electromagnetic spectrum. Imke assembled a group to observe the impacts. "We suddenly, in real time, saw a fireball much brighter than Jupiter itself rising up. I have never since observed an event which was as dramatic as this one, with such impressive real-time changes," says Imke.

Imke recently used the OSIRIS instrument at Keck Observatory to obtain the first-ever spectrum of a volcanic eruption on Io, one of Jupiter's moons. Imke has also used the Keck Telescopes to observe Jupiter's Red Oval, which formed between 1998 and 2000 when three white ovals south of the Great Red Spot merged and later turned red. Imke used the NIRC2 instrument at Keck to image Uranus's rings during the recent ring plane crossing (when the rings were edge on). Imke's team discovered that the dust in this ring system had changed dramatically since the rings were imaged by Voyager in 1986, suggesting that Uranus's rings are much dustier than previously thought. Using OSIRIS Imke's group discovered that Titan, Saturn's largest moon, is covered globally by a methane cloud and that on the morning side of the moon, near the highland called Xanadu, there is a persistent drizzle at lower altitudes.

"I love to find the unexpected, the superb image quality, and working at the limits of what is possible with the Keck Adaptive Optics staff. As astronomers, we know the science and what we want to observe, and together with the Keck support astronomers, we figure out how to accomplish this."

The People of Keck

Bob Goodrich: Senior Manager, Observing Support Group

Bob Goodrich knew he wanted to be an astronomer at a very young age. He single-mindedly pursued his passion, and in 1977 he earned an undergraduate degree in astronomy from Caltech. "I graduated at the top of my class, but also at the bottom, because I was the only astronomy major that year," jokes Bob. The thinking at that time was that would-be astronomers should major in physics as undergraduates, then specialize in astronomy at graduate school. In Bob's opinion, Caltech, considered one of the nation's premier schools for astronomy, did not shirk on its physics requirements. He went on to earn his Ph.D. in astronomy at UC Santa Cruz, specializing in the study of quasars in active galaxies.

Bob is a world expert in polarimetry, a technique used to analyze light from a celestial object to determine more about its geometry. He built the polarimeter for the low resolution imaging spectrograph before being recruited to work at the Observatory as a support astronomer in 1996. Bob now manages the observing support group consisting of support astronomers (SAs), observing assistants and night attendants. He is also a member of Keck's senior management team, the Observatory Council.

Bob proudly refers to the support astronomers as his "black belts." They serve as the primary contact for visiting astronomers who have been awarded observing time on the Keck Telescopes. To further optimize the use of Keck's instrumentation suite, support astronomers are also assigned roles either as instrument master or backup, responsible for the overall performance of their assigned instruments. Support astronomers are responsible for ensuring that each instrument is calibrated and working properly before each observing run. "The support astronomer's oversight is key to keeping our astronomers happy - so that they can take maximum advantage of their precious time at the telescope," explains Bob.

The remaining 20 percent of SAs' time is allocated for independent research. **"When they do their own research, the support astronomers become more familiar with and adept at using Keck instruments. We encourage them to utilize instruments at our neighboring telescopes, as well, so that they learn how to use new instruments and continue expanding their knowledge base. Our support astronomers are very creative and talented people, and earning research time on the best telescopes in the world helps to sustain their passion and commitment for their work."**

The People of Keck continued on next page.

Sam Ragland: Interferometer Operations Manager/Scientist

Linking the Keck I and Keck II Telescopes together as the equivalent of an 85-meter telescope has been a strategic goal for the Observatory since the second telescope was funded in 1991. Development of the interferometer, an instrument which combines the light from the twin telescopes to achieve extremely high angular resolution, began in 1996, and the first interferometer science results were published in 2004. With its recently completed nuller mode, the Keck Interferometer is now poised to produce unprecedented science.

In 2001 Sam won a prestigious Michelson Fellowship to work at the Harvard-Smithsonian Center for Astronomy and Astrophysics in Boston. The chance to utilize the IOTA interferometer in Arizona to do scientific research was enough to lure Sam Ragland away from his native India. Sam spent his fellowship years demonstrating that three telescopes at the IOTA array could be successfully linked interferometrically to reconstruct images. When Sam left Boston in 2004 to take a job at Keck Observatory, he continued this research work through an NSF grant. Last year Sam's team found that nearly a third of the red giants they surveyed were not uniformly bright across their face, but were patchy. This data has important implications for the last stages of stellar evolution, when stars like the Sun are evolving into planetary nebulae. In 2007 Sam and his collaborators submitted their first interferometric image and the accompanying science paper for publication in the Astrophysical Journal.

Sam Ragland currently manages the science operations of the Keck Interferometer and will oversee the final performance validation run of the Keck Interferometer's nulling mode, scheduled for late 2007. This new technique will become available for science runs in February 2008. Nulling combines the light from both telescopes and cancels, or nulls, the light from a star. Future plans for the Keck Interferometer include measuring general relativity effects around the super-massive black hole at the center of our own galaxy.

"Keck Observatory has demonstrated that new technologies like the segmented mirrors, laser guide star adaptive optics, and large aperture interferometry really work and produce outstanding science. This kind of success gives me confidence that we will continue to lead the way, using cutting-edge technology to decipher the mysteries of our universe."

The People of Keck

Merlita Evanoff: Office Administrator

Merlita Evanoff was born and raised on Kaua`i, where her father worked for the sugar cane plantations. Earning $6 a day, it took her dad ten years, from 1946 to 1956, to be able to afford to bring Merlita's mom and four older siblings to Hawai`i from the Philippines. Merlita was the fifth of six children who shared a 900 square foot plantation house.

When Merlita finished her schooling, she felt she needed to experience life in the big city. She moved to San Francisco, then to Albuquerque, and then to Denver, where she spent several years working as a secretary for a large defense contractor. Along the way, Merlita and her husband had four sons. Every year the family came home to Hawai`i to visit relatives. In 2000, Merlita and her husband purchased a small parcel of land in North Kohala, thinking that someday they would retire there. A few years later, they decided that they had had enough of city life, and they packed up and moved to Kohala.

Merlita's family is now enjoying fresh fruits from their orchard, the close-knit community here on the island, and the slower pace of life. Merlita landed a job at Keck in 2004, a few months after she moved here, as administrative assistant to several different departments within the Observatory. Merlita's duties range from researching employee benefits and ordering office supplies, to scheduling use of facilities, supervising front desk staff and arranging catering for in-service trainings. "My main priority is making sure that our employees' needs are taken care of. It is never boring working here and I am always learning something new," says Merlita.

"Our Keck `ohana works well together to carry out our mission. We inspire interest in our young adults in science and technology, and we give back to our Island community. Our Keck employees are out in the community sharing their knowledge and passion about astronomy, and their helping hands."

Jim Bell: Senior Mechanical Engineer

Like many residents of our Island community, Jim Bell made his way to Hawai`i from the distant shores of Alaska, where he ran his own commercial fishing business until age 31. After the birth of two of his three children, Jim decided to try his hand at a career that didn't require weeks at sea away from the family. "I was a late bloomer," he chuckles.

He went back to school, first at the University of Alaska, and then finishing his mechanical engineering degree at the University of Hawai`i (UH) at Manoa. After graduating, Jim accepted a job in the aerospace industry in California, working on communications and defense satellites. Five years later, Jim returned to Hawai`i to work for an alternative energy firm in Honolulu and worked on a geothermal project in Puna, on Ocean Thermal Energy Conversion in Kona, and on a biomass gasifier project on Maui. In 1996 funding for alternative energy projects reached a low ebb, and Jim made another shift in his career. He landed a job designing astronomical instrumentation for the Institute for Astronomy at UH. In 1998, when a mechanical engineering position opened up at Keck Observatory, Jim jumped at the opportunity to work here. Nearly ten years later, Jim has no regrets.

A resident of Waimea, Jim rides his bike to work most days. He splits his time between two Observatory development projects: MAGIQ and NGAO. The MAGIQ (multi-function acquisition, guiding, and image quality) project will replace obsolete guide cameras and software for the Keck Telescopes' observing instruments and improve overall image quality. Jim is Project Manager for MAGIQ, overseeing the work of 12 members of the advanced guider system team. Installation of the first new guider system will take place on Keck's NIRSPEC instrument in December 2007 with upgrades to the remaining instruments to follow. The balance of Jim's time is spent working on a conceptual design for some of the NGAO (Next Generation Adaptive Optics) opto-mechanical components.

"Our goal is to maximize the quality of the science done here and to make observing time even more valuable. We always find a way to do it better – that's our engineering function. Being part of this community is the best!"

Allen Agliam: Facilities Systems Maintenance Technician

Allen Agliam grew up in the small village of Honohina on the Hamukua Coast of Hawai`i Island. When the sugar plantation closed in 1970, the village of Honohina was torn down, and its few hundred residents were relocated to neighboring communities. Allen Agliam was 18 years old, and he had already spent three years working as a part-time laborer in the sugar cane fields. Determined to find alternative work, Allen earned a degree in Machine Shop Technology from Hawai`i Community College (HCC) in Hilo. After college Allen still worked off and on for the sugar cane industry, but as a machinist overseeing mill operations. In 1980 Allen accepted a full-time job with the Hawai`i Army National Guard, responsible for training weekend soldiers. Allen spent the next 20 years as a sergeant with the National Guard in Hilo, administering the weekend training program, including coordination of resources, maintenance of a fleet of 80 vehicles, setting training schedules, and teaching soldiers reconnaissance skills and use of various weapons systems.

When Allen retired from the National Guard in 2000, he still had a mortgage to pay. Allen landed a temporary machinist position at Keck Observatory, and three months later he was promoted into a regular position in the facilities department. Allen's first priority is to perform scheduled preventative maintenance and to maintain a parts inventory for the summit facilities. When this work is done, Allen focuses on special projects. He recently assisted in the design of an automated cleaner to remove oil, grease, and dust from the telescopes' drive track mechanisms. This cleaner is activated electrically every time the telescopes are rotated, and it eliminates the need for five people to do this task manually. Allen is currently working on an upgrade to install new safety features to the segment crane which is used to lift mirror segments from the Keck II Telescope, and on the installation of new air compressors for both the Keck I and Keck II Telescopes.

"I love working here. All our departments have talented and skilled personnel with the desire to do an outstanding job and provide outstanding service. The people here go the extra mile to provide service from the heart. We enjoy the work and the sense of accomplishment when we get the job done."

The People of Keck continued on page 17.

Hilton A. Lewis
Deputy Director

Keck Observatory is all about cutting-edge technology and visionary science. In this, we are guided by four broad strategic goals:

- *Achieving highly efficient operations*
- *Maintaining scientific leadership through state of the art instrumentation*
- *Maintaining world leadership in high angular resolution astronomy*
- *Complementing (the next generation of) extremely large telescopes*

These goals form the framework for all activities at the Observatory, both in routine operations and the development of new capabilities. Translating these broad goals to a practical operating philosophy is the role of the leadership team – the Board, Science Steering Committee, Directorate and senior management at the Observatory. One of the great strengths of the Observatory is the close connection between this leadership, the astronomer users, our staff at Keck and the instrument builders.

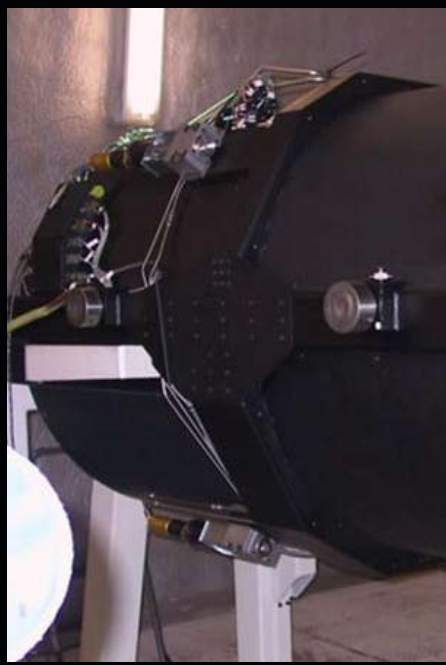
The Observatory continues its vigorous program to develop new scientific capabilities. The foundation for new capabilities is state-of-the-art technical advances. These include advanced laser technology, advanced computing hardware and sophisticated high performance software, cryogenic components that operate just a few degrees above absolute zero and ultra-sensitive detectors for optical and infra-red light. As challenging as the technology itself is managing the dramatically increased complexity that is a natural consequence of ambitious instrumentation. In many ways, it is system complexity that limits the ability to field instruments that are reliable enough for sophisticated observational programs. In addition to the technology and the complexity issues, all installations and upgrades have to be planned in great detail to minimize the impact on nightly observing, a very tough challenge in a fully operational facility.

In 2007, three major new capabilities were brought on line for science use. The highly successful Next Generation Wavefront Controller funded by grant from the Keck Foundation was completed on schedule and within budget. This system, which is at the heart of the adaptive optics systems, determines the correction to be made to the incoming light up to 2,400 times per second. This upgrade has exceeded our expectations for technical performance and provides a major enhancement to both natural and laser guide star adaptive optics.

After several years of work, an atmospheric dispersion compensator (ADC) was commissioned. This instrument counteracts a property of the earth's atmosphere which spreads out light into its component colors. It is currently used in conjunction with the Low Resolution Imaging Spectrograph (LRIS), the most efficient optical spectrograph in the world and one of the most productive instruments at Keck Observatory. The ADC further improves spectrograph efficiency by up to 20%, enabling science that was formerly out of reach. The combination of LRIS' capabilities and the ADC has made Keck Observatory the definitive leader in ground-based ultra-violet/blue spectroscopy and imaging.

TECHNOLOGY HIGHLIGHTS

Keck Interferometer nuller co interferometer for new scienc



The new Cassegrain Atmospheric Dispersion Correct

ommissioned in 2007 preparing the
e capabilities.

Facilities Senior manager Dennis McBride assesses damage at headquarters. A stopped clock shows when the 6.7 magnitude quake hit.

Robert Novak (left) and Gary Anderson (right) repair the Keck II telescope control system damaged by the October 2006 earthquake.

or.

The complex inner workings of Keck's leading edge adaptive optics system.

Finally the Nuller, an instrument that works with the Keck Interferometer, was commissioned this year. The Nuller, which was funded and built by NASA's Jet Propulsion Laboratory is a particularly challenging instrument and makes extraordinary demands on the Observatory infrastructure, requiring sophisticated technology to deal with vibration and turbulence. It functions by suppressing the light from a star, leaving the faint glow from the dust surrounding the star. This remaining light allows astronomers to study the formation of planets around young stars and the life cycle of dying stars as they blow off their outer layers.

New capabilities are the key to sustaining long term competitiveness and the science output of the twin telescopes rests on our ability to provide a high level of service to astronomers. Our staff and leadership are completely committed to this goal. The telescopes have to be ready for use every night, 365 nights per year. Every day our crew of technicians and engineers confront a challenging mix of preparing the telescope and instruments for the upcoming night, performing maintenance and upgrading or installing equipment. All of this has to be done at the summit of Mauna Kea at nearly 14,000 feet altitude and ready in time for the evening's observing. Supporting this effort is a headquarters staff, responsible for all technical and logistical issues, as well as for the detailed planning essential for efficient execution.

An excellent example of the service ethic that is central to Keck's success is given by our response to the major earthquake we experienced in the past year. On October 15th, 2006 Hawaii Island experienced a magnitude 6.7 earthquake. Both Keck telescopes suffered significant damage, though very fortunately the key optics were spared. Our headquarters in Waimea also sustained moderate damage, but we were able to continue to occupy them. Recovery efforts were focused initially on restoring our operational capability as quickly as possible. Through intense effort and extraordinary team work, we were able to return to close to full operations on both telescopes within six weeks. This remarkable achievement was accomplished safely through the dedication, skill and unwavering commitment of our entire staff, a fact of which we are very proud.

Keck's summit crew prepares for another day of servicing the telescopes.

Cindy Chong: Purchasing Agent

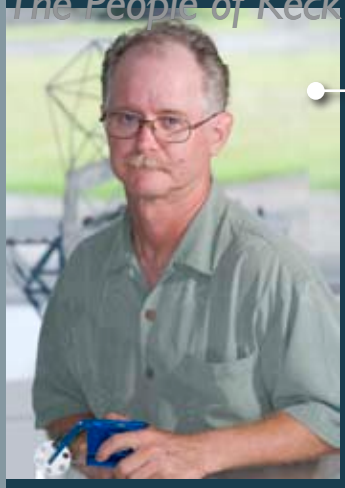
Cindy is an Island girl, born and raised in the town of Honoka`a. Cindy worked as a bank teller in Waimea for ten years before Keck Observatory was built, when the majority of town consisted of cow pastures. When the Observatory moved its permanent headquarters to Waimea, Cindy was hired as a mail clerk. "There was not much for me to do here back then," says Cindy, "with only a handful of employees." Not liking to be idle, Cindy took on the task of sorting and paying bills, then took the initiative to help out with other tasks.

For the past 16 years Cindy has overseen the purchasing of most of the goods and services for the Observatory. Once a purchase has been approved by the respective department manager, Cindy takes over to work out the details. "I use good common sense to ensure that we do business in the best interest of the company," says Cindy. Goods purchased by Keck range from paper booties for use by clean room personnel, to furniture, to one-of-a-kind components for the telescopes. Cindy also sets up consultant contracts for services such as the production of the Advancement e-magazine and the maintenance of elevators at the summit. Keck uses local vendors whenever possible, and Cindy prides herself on doing her job right from start to finish.

"Meeting the demands of my co-workers, who are driven by schedules to develop, repair, or improve the operations of the Observatory so that our astronomers are able to make good use of their observing time can be very challenging. I look forward to coming to work and doing my part to keep the Observatory at the forefront of astronomy."

After work Cindy paddles with the Kawaihae Canoe Club, which allows her to unwind and feel the wind on her face. Cindy was part of the first women's crew to cross the treacherous Alenuihaha Channel between Hawai`i Island and Maui, and they recently paddled in the Na Wahine O Ke Kai Race from Moloka`i to Waikiki in just under seven hours. "It's a spiritual experience," she says.

Allan Honey: Software Engineer



Allan (Al) Honey joined the Keck team as one of the Observatory's first software engineers over 20 years ago. He originally planned to stay at Keck for 5 years. The rewards and challenges of his job designing software programs for the telescope and instrument motor control systems have kept him here much longer. Though Al is far from his native British Columbia, Hawai`i is now home.

As a member of the Island `ohana (family), Al has given generously of himself. His service includes 14 years as a scouting leader, 8 years with the YMCA sailing program, 8 years conducting classroom presentations on science and technology, 6 years mentoring school-based engineering projects, and 2 years as a board director for the West Hawai`i Tennis Association.

During the regular work day, Al is part of Keck's operations team. To keep the twin 300 ton telescopes and multiple sophisticated instruments operating smoothly is a daily challenge, and Al and his colleagues are busy people. Al is on call one out of every 11 nights, available to consult with observing assistants at the summit to resolve issues that arise when the telescopes are "on sky." Most problems are fixed fairly quickly, thanks to the copious observing logs that the Observatory maintains, enabling Keck software engineers to precisely diagnose problems in normal operations.

Another of Al's tasks is to brainstorm how best to upgrade infrastructure at the Observatory, as certain components of the system age and spare parts become increasingly difficult to come by. Al enjoys working with staff members in many departments to upgrade existing systems and to think through new ways to improve the capabilities of the Keck Telescopes and instruments. "We have not yet tapped the full potential of the Keck Telescopes," explains Al. Figuring out how to fully exploit the vast power of the telescopes will keep Al and his colleagues busy for years to come.

"The large number of disciplines needed to construct and maintain a modern observatory requires a well educated community and, therefore, provides a career path and a place of employment for the members of this community. Astronomy is essentially a 'clean industry,' pushing on the leading edges of science and technology."

The People of Keck continued on page 21.

Keck Observatory technical and professional staff together at headquarters in Waimea.

EDUCATION AND OUTREACH

The discoveries made by Keck astronomers have given humanity new scientific insights into the origin, structure, and evolution of the universe. Sharing these discoveries through news releases, special publications, educational programs, an annual open house and other events is an important part of the Observatory's mission. In FY2007, 23 news releases were distributed by Keck Observatory to a growing worldwide audience with keen interest in exploration of the cosmos. The Observatory's E-magazine, Cosmic Matters produced four issues of multimedia feature articles showcasing Keck's research and achievements to a subscriber list of 1,133 astronomy professionals, enthusiasts and admirers. Observatory headquarters' Hualalai Learning Theatre hosted nine astronomer presentations in 2007 to local audiences through the popular public lecture series. The lectures are also available by podcast on the Observatory's web site **www.keckobservatory.org**.

Each year, Keck supports an active public outreach team made up of both astronomers and engineers who, in 2007, offered their enthusiasm and expertise to spark Hawai'i students in science, mathematics and engineering. In addition to classroom visits, students took part in special tours of the Observatory, mentorship programs, stargazing events, and family science nights designed to further their skills and passion for astronomy.

Through the initiative of Keck support astronomer Marc Kassis, the Observatory received a grant in 2007 from the Astronomical Society of the Pacific's new SEED (Simple Ef-

fective Education and Dissemination) program to build upon the efforts of Keck's outreach staff to present astronomy related programs for the Hawai'i Island community. The new SEED grant provided funds to purchase hands-on equipment that will demonstrate to middle and high school students how spectroscopy is used by astronomers in their search to understand cosmic phenomena.

All staff members at Keck are encouraged to contribute up to 2% of their work time to community service projects of their choice. Some of the activities receiving support from Keck employees include R.O.V. Underwater Competition, the Hawai'i BotBall Competition, American Cancer Society's Relay for Life, Hawai'i Island United Way, the Kahilu Summer Arts program, and West Hawai'i GEMS (Girls Exploring Math and Science). In 2007 Keck Observatory mentors Liz Chock, Kellee Summers and Al Honey had a hand in supporting Waimea students taking first place in the State BotBall robotics competition. The team from Earl's Garage mentored by Keck went undefeated. Keck mentors Rick Johnston and Kim Sweeney helped Kohala High School students enter their electric car project in a national competition in Portland, Oregon in the spring of 2007 and the Hawai'i Island students garnered fourth place.

NEXT GENERATION OBSERVATORY WORKFORCE

In addition to education and outreach, Keck Observatory also has a commitment to building career pathways for the next generation of scientists and engineers. The Observatory's High School Student Employment Program employs North Hawai'i students in most departments within the Observatory. Many of these students continue their higher education in science and engineering. In 2007 the Observatory employed the following high school students: Amber Alvarez, Tiare Devenot, Alohilani Fero, Zen Kuriyama, Korina Leong, Whitney Parker, Leilani Rapaport, and Rene Scofield.

High school intern Korina Leong is mentored by Keck IT staff Branning Sung.

2007 Akamai Observatory students begin their summer internships with a tour of Mauna Kea and the observatories.

The "Akamai Observatory Internship," funded by the National Science Foundation's Center for Adaptive Optics and coordinated locally by Keck Observatory's Sarah Anderson, continued to make its impact on Hawai'i undergraduate students and on Keck Observatory. The program prepares participants for careers in the field of astronomy through an intensive academic short course, inquiry-based activities and authentic workplace internships with the Mauna Kea Observatories. The 2007 cohort participants were Isaac Crosson, Jaqueline Mena, and Joseph Hernandez for Keck Observatory and Dustyn Iwamoto, Travis Prose, Jessica Solano, Dex Alpiche, James Linden, Sarah Stoebner, Eric Dela Rosa, and Jamie Cookson for the other observatories.

The Keck II laser creates an artificial star and measures atmospheric distortions, providing unprecedented image clarity of cosmic phenomena being studied at the frontiers of astronomy.

Tomas Krasuski: Electronics Engineer

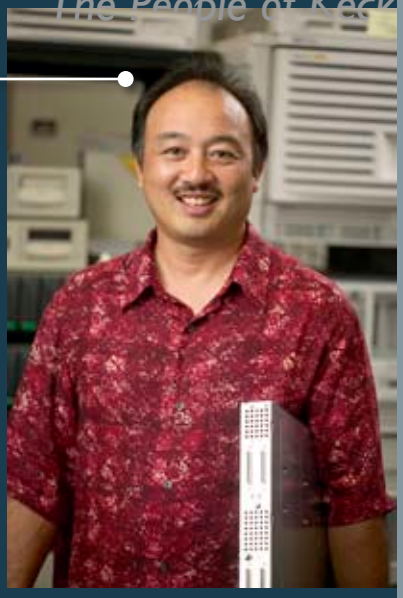
Before coming to Hawai`i in 2005, Tomas was on another island in the Pacific, Kwajalein, where he honed his skills designing and installing radar and sonar systems for the U.S. test missile range there. Employed by the defense industry for 20 years, Tomas pioneered use of parametric sonar, a technique to mix different frequencies to obtain a pencil-thin beam which can travel long distances underwater. He has a deep affinity for the ocean, and for the past 16 years he has pursued a secondary career as an underwater educational filmmaker. Tomas's cinematography has won several awards, including an Emmy Award for "Underwater New England."

While filming, Tomas spent many evenings onboard a boat gazing up at the stars. "I have always had an interest in the objects out there in the universe," he recalls. When a job opened up for an electronics engineer at Keck Observatory in 2006, Tomas applied and joined the professional staff. As part of the Keck operations team, he is charged with maintaining the electronics equipment on both telescopes. Tomas is applying his systems approach knowledge and experience to the task of collecting and analyzing telescope performance data. Tomas creates graphical representations of this data, in order to identify areas that are not working properly and to strategize how to make day-to-day operations more efficient. The ultimate goal is to streamline operations with existing instruments, so as to free up time and resources to work on new projects, like Next Generation Adaptive Optics.

Tomas likes the openness and camaraderie of the staff at Keck. He appreciates the fact that he can freely exchange ideas with the Directorate of the Observatory in a focused environment which fosters results.

"The Observatory's greatest challenge is to continue to push the envelope of what is possible. There are always more questions, which require more advanced capabilities. To move forward requires the continued perseverance and ingenuity of everyone at Keck."

Jonathan Chock: Computer and Network Systems Manager



When Jon Chock was growing up on O`ahu, a friend's cousin suggested that since Jon was good at math, he should consider a career in the computer field. This seemed like a reasonable option to Jon, so he enrolled in his first BASIC programming class at McKinley High School. Jon went on to earn a B.S. from UH Manoa in Information Computer Science, a popular major in the early 1980s when the first PCs were being released on the market. After college, Jon worked for the U.S. Army Corps of Engineers and for Hughes Aircraft Company in Los Angeles, doing primarily systems administration work. Jon missed Hawai`i, especially the rural lifestyle on the outer islands, so when a position doing systems administration opened up at Keck Observatory in 1992, Jon moved home.

Jon and his staff of three manage roughly 250 PCs, 150 Sun computers, and 200 network devices. Jon and another team member specialize in the Unix operating system, which the Observatory uses to run the telescopes and scientific applications, and the other two team members specialize in the Windows operating system, which is used for business operations. Jon and his group work on about 20 major projects in the course of a year, such as reconfiguring the networks to accommodate new instruments at the Observatory. In the course of a day, team members may also be called upon to troubleshoot user or network problems, something which can happen frequently in a system with 400+ computers.

Jon is currently working on upgrading the speed of the network connecting Keck Headquarters to the summit to 1 gigabit per second. This upgrade should be completed by year end 2007, and "it will make a huge difference," says Jon, in the speed at which information can be transferred from the telescopes to astronomers in Waimea or elsewhere in the world.

"When something is not working here, we do not leave until it is fixed. We do what it takes to get the job done. This is true across the board. The dedication of our staff makes possible the wonderful discoveries at Keck that people all over the world have benefited from."

ADVANCING KECK OBSERVATORY

Throughout history, private philanthropy has been instrumental in driving advances in the study of astronomy. Four hundred years ago, Galileo Galilei and the world's first telescope received critical funding and endorsement from Christina and Ferdinand Medici, a wealthy family in Florence, Italy. Keck Observatory's predecessor in U.S. ground-based astronomy, Mount Palomar's Hale telescope, was financed through the generosity of The Rockefeller Foundation. And the revolutionary twin Keck telescopes were funded almost entirely by the W. M. Keck Foundation.

It is the leadership of visionary philanthropists that will encourage the continued increase of charitable giving to causes that matter most to humanity. In 2007 the Keck Observatory was fortunate to gain the expertise and alliance of a new Advancement Advisory Council. Under the leadership of San Francisco businessman Sanford (Sandy) Robertson, the Council will champion the Observatory's need to generate philanthropic revenue as core to the long term success of Keck. In addition to Robertson, the other foundational Council members are Jeanne Robertson, Marc and Lynne Benioff, Clive and Carol Davies, Art and Rita Levinson, Wally and Bobbie Jean Hooser, Gordon and Betty Moore, Rob and Terry Ryan, and Doug Troxel. The job of linking these incredible luminaries in their respective fields to the greater Keck community is entrusted to Observatory Director Taft Armandroff and governing board members Mike Bolte and Shri Kulkarni.

The role of the Observatory's Advancement advocates is to connect the Observatory's accomplishments, assets, and spirit to individuals who are inspired and will contribute to its continued success. A key initiative to accomplish this in 2007 was the signature Evenings with Astronomers winter lecture series sponsored by the Rob and Terry Ryan Foundation and held at The Fairmont Orchid at Mauna Lani Resort. In an elegant setting surrounded by distinguished friends of the Observatory, five prominent Keck astronomers presented research on the frontiers of astronomy: Dr. Taft Armandroff, Dr. Mike Brown, Dr. Claire Max, Dr. Charles Beichman, and Dr. Ed Stone.

In April, a new giving program was initiated that invites individuals to contribute to planetary ($1,500), stellar ($3,000), and galactic ($10,000) annual giving levels. These donations go toward the highest priorities of the Observatory, including enhancements to Keck's research tools and systems.

In FY07, the Observatory received 49 gifts and pledges which totaled $940,226 in support of the observatory's major funding priorities. This brings the total amount raised to $6.1 million by the Advancement program just completing its second year.

FINANCIALS

The capital cost for the Observatory was funded through a generous donation of $138 million made by the W. M. Keck Foundation. The project was managed by the world's premier centers for astronomical research, the University of California and Caltech. An agreement between Caltech and the University of California ensures operating support at the level of approximately $11.3 million annually (CPI adjusted annually) for the Observatory through 2018. As a one-sixth partner in the Observatory, NASA provided $2.2 million in operating support in 2007. In addition, new awards in 2007 from public grants and contracts totaled over $7.4 million. Almost $1 million in charitable donations from the private sector provided additional support. Audited financials are available upon request.

A widely viewed total lunar eclipse August 28, 2007 is captured as Earth's orange shadow of sunlight is scattered and refracted by the atmosphere.

The W. M. Keck Observatory gratefully acknowledges the following benefactors of the 2007 fiscal year for their generous contributions to advance humanity's understanding of the universe.

Individuals

Liz and Taft Armandroff
Doris and Earl Bakken
Paola and Robert Blelloch
Diana and Andrew Bonnici
Rosalind and Stephen Butterfield
Carol and Clive Davies
Richard Dekany
Peggy and Peter Georgas
Deborah Goodwin
Susan and Peter Jobs
Valerie Kim and Gerald Weldon
Gregory A. Koestering
Hiromi Komiya and Shrinivas Kulkarni
Earl D. Laing
Phoebe Kwan and Ralph Leighton
Rita and Art Levinson
Carol and Richard Little
Suzanne Hill and Mike Luce
William Manns
Linda and Mike Markkula
Michael A. Mayda
Betty and Gordon Moore
Milly and Mac Morris
Kim and Jim Ed Norman
Phyrne and David Osborne
R. Michael Rich
Jeanne and Sanford Robertson
Janet Gimbel Rogers and Stephen Rogers
Alison and Geoffry Rusak
Terry and Rob Ryan
Margarita and Thomas Scheffel
Joan Morgan and Richard Schleicher
Nike and David Speltz
Judi and Joe Wagner
Leslie and Richard Wallis
Alison and Woodson Woods

Thank you

Corporations, Foundations and Agencies

Astronomical Society of the Pacific
Blue Hawaiian Helicopters
Change Happens Foundation
The Fairmont Orchid
Hilton Waikoloa Village
Liberty League International, LLC
The Markkula Foundation
Microsoft Corporation
Mt. Cuba Astronomical Foundation
The William J. and Dorothy K. O'Neill Foundation
Rob and Terry Ryan Foundation
Rusack Vineyards
Salesforce.com Foundation
The Society of Forensic Engineers and Scientists

Members of the Keck Advancement Advisory Council charting a successful future for the Observatory.

SCIENCE BIBLIOGRAPHY

KEY TO PUBLICATIONS:

A&A	Astronomy and Astrophysics
AJ	Astronomical Journal
ApJ	Astrophysical Journal
ApJL	Astrophysical Journal Letters
ApJS	Astrophysical Journal Supplement Series
ChJAS	Chinese Journal of Astronomy and Astrophysics Supplement
GeoRL	Geophysical Research Letters
JGRE	Journal of Geophysical Research (Planets)
JPhCS	Journal of Physics Conference Series
MNRAS	Monthly Notices of the Royal Astronomical Society
PASP	Publications of the Astronomical Society of the Pacific

Aldering , G.; Antilogus , P.; Bailey, S.; et. al.
Nearby Supernova Factory Observations of SN 2005gj: Another Type Ia Supernova in a Massive Circumstellar Envelope
ApJ 650 510 2006 October 10

An, T.; Goss, W.; Zhao, J.; et. al.
Simultaneous Multi-Wavelength Spectrum of Sgr A* and Long Wavelength Cutoff at > 30 cm
JPhCS 54 381 2006 December

Armitage, P.
Massive Planet Migration: Theoretical Predictions and Comparison with Observations
ApJ 665 1381 2007 August 20

Aspin, C.; Greene, T.
High Spectral Resolution Near-IR Observations of ESO-Ha 279A and 279B
AJ 133 568 2007 February

Assémat, F.; Gendron, E.; Hammer, F.
The FALCON concept: multi-object adaptive optics and atmospheric tomography for integral field spectroscopy – principles and performance on an 8-m telescope
MNRAS 376 287 2007 March

Auger, M.; Fassnacht, C.; Abrahamse, A.; et. al.
The Gravitational Lens-Galaxy Group Connection. II. Groups Associated with B2319+051 and B1600+434
AJ 134 668 2007 August

Bai, L.; Marcillac, D.; Rieke, G.; et. al.
IR Observations of MS 1054-03: Star Formation and Its Evolution in Rich Galaxy Clusters
ApJ 664 181 2007 July 20

Bakos, G. Á.; Noyes, R. W.; Kovács, G.; et. al.
HAT-P-1b: A Large-Radius, Low-Density Exoplanet Transiting One Member of a Stellar Binary
ApJ 656 552 2007 February 10

Barger, A.; Cowie, L.; Wang, W.
The Microjansky Radio Galaxy Population
ApJ 654 764 2007 January 10

Barrado Y Navascués, D.; Bayo, A.; Morales-Calderón, M.; et. al.
The young, wide and very low mass visual binary Lambda Orionis 167
A&A 468 L5 2007 June

Barth, Aaron J.
A Normal Stellar Disk in the Galaxy Malin 1
AJ 133 1085 2007 March

Bean, J.; McArthur, B.; Benedict, G.; et. al.
The Mass of the Candidate Exoplanet Companion to HD 33636 from Hubble Space Telescope Astrometry and High-Precision Radial Velocities
AJ 134 749 2007 August

Becker, G.; Rauch, M.; Sargent, W.
The Evolution of Optical Depth in the Lya Forest: Evidence Against Reionization at z˜6
ApJ 662 72 2007 June 10

Berger, E.; Fox, D.; Kulkarni, S.; et. al.
The ERO Host Galaxy of GRB 020127: Implications for the Metallicity of GRB Progenitors
ApJ 660 504 2007 May 1

Berta, S.; Lonsdale, C. J.; Siana, B.; et. al.
Keck spectroscopy of z = 1-3 ULIRGs from the Spitzer SWIRE survey
A&A 467 565 2007 May

Berthoud, M. G.; Keller, L. D.; Herter, T. L.; et. al.
Near-IR CO Overtone Emission in 51 Ophiuchi
ApJ 660 461 2007 May

Block, D.; Combes, F.; Puerari, I.; et. al.
Keck spectroscopy and Spitzer space telescope analysis of the outer disk of the Triangulum spiral galaxy M 33
A&A 471 467 2007 August

Bloom, J.; Perley, D.; Chen, H.; et. al.
A Putative Early-Type Host Galaxy for GRB 060502B: Implications for the Progenitors of Short-Duration Hard-Spectrum Bursts
ApJ 654 878 2007 January 10

Bonanos, A.; Stanek, K.; Kudritzki, R.; et. al.
The First DIRECT Distance Determination to a Detached Eclipsing Binary in M33
ApJ 652 313 2006 November 20

Bonev, B.; Mumma, M.; DiSanti, M.; et. al.
A Comprehensive Study of Infrared OH Prompt Emission in Two Comets. I. Observations and Effective g-Factors
ApJ 653 774 2006 December 10

Bonev, B.; Mumma, M.
A Comprehensive Study of Infrared OH Prompt Emission in Two Comets. II. Implications for Unimolecular Dissociation of H2O
ApJ 653 788 2006 December 10

Bonev, B.; Mumma, M.; Villanueva, G.; et. al.
A Search for Variation in the H2O Ortho-Para Ratio and Rotational Temperature in the Inner Coma of Comet C/2004 Q2 (Machholz)
ApJ 661 L97 2007 May 20

Bornancini, C.; De Breuck, C.; de Vries, W.; et. al.
Imaging and spectroscopy of ultrasteep spectrum radio sources
MNRAS 378 551 2007 June

Bosler, T.; Smecker-Hane, T.; Stetson, P.
The chemical abundances of the stellar populations in the Leo I and II dSph galaxies
MNRAS 378 318 2007 June

Bower, G.; Saul, D.; Bloom, J.; et. al.
Submillijansky Transients in Archival Radio Observations
ApJ 666 346 2007 September 1

Brand, K.; Dey, A.; Desai, V.; et. al.
Optical Line Diagnostics of z ~ 2 Optically Faint Ultraluminous Infrared Galaxies in the Spitzer Boötes Survey
ApJ 663 204 2007 July 1

Bresolin, F.
The Oxygen Abundance in the Inner H II Regions of M101: Implications for the Calibration of Strong-Line Metallicity Indicators
ApJ 656 186 2007 February 10

Bridge, C. R.; Appleton, P. N.; Conselice, C. J.; et. al.
The Role of Galaxy Interactions and Mergers in Star Formation at z<=1.3: Mid-Infrared Properties in the Spitzer First Look Survey
ApJ 659 931 2007 April 20

Brittain, S.; Simon, T.; Najita, J.; Rettig, T.
Warm Gas in the Inner Disks around Young Intermediate-Mass Stars
ApJ 659 685 2007 April 10

Brodwin, M.; Brown, M.; Ashby, M.; et. al.
Photometric Redshifts in the IRAC Shallow Survey
ApJ 651 791 2006 November 10

Brown, M.; Barkume, K.; Blake, G.; et. al.
Methane and Ethane on the Bright Kuiper Belt Object 2005 FY9
AJ 133 284 2007 January

Brown, M.; Barkume, K.; Ragozzine, D.; Schaller, E.
A collisional family of icy objects in the Kuiper belt
Nature 446 294 2007 March

Brown, M.; Schaller, E.
The Mass of Dwarf Planet Eris
Science 316 1585 2007 June 15

Brown, T.; Smith, E.; Ferguson, H.; et. al.
The Detailed Star Formation History in the Spheroid, Outer Disk, and Tidal Stream of the Andromeda Galaxy
ApJ 652 323 2006 November 20

Brown, T.; Smith, E.; Ferguson, H.; et. al.
The Extended Star Formation History of the Andromeda Spheroid at 21 kpc on the Minor Axis
ApJ 658 L95 2007 April 1

Bundy, K; Ellis, R.; Conselice, C.; et. al.
The Mass Assembly History of Field Galaxies: Detection of an Evolving Mass Limit for Star-Forming Galaxies
ApJ, 651, 120 2006 November 1

Bundy, K.; Treu, T.; Ellis, R.
The Mass Assembly History of Spheroidal Galaxies: Did Newly Formed Systems Arise via Major Mergers?
ApJ 665 L5 2007 August

Burgasser, A.; Kirkpatrick, J. D.; Cruz, K.; et. al.
Hubble Space Telescope NICMOS Observations of T Dwarfs: Brown Dwarf Multiplicity and New Probes of the L/T Transition
ApJS 166 585 2006 October

Busch, M.; Kulkarni, S.; Conrad, A.; Cameron, P.
Keck adaptive optics imaging of near-Earth Asteroid 2004 XP14
Icarus 189, 589 2007 August

Butler, R.; Johnson, J.; Marcy, G.; et. al.
A Long-Period Jupiter-Mass Planet Orbiting the Nearby M Dwarf GJ 849
PASP 118 1685 2006 December

Cameron, P.; Kulkarni, S.
Near-Infrared and X-Ray Observations of the Enigmatic G70.7+1.2
ApJ 665 L135 2007 August 20

Cenarro, A.; Beasley, M.; Strader, Jay; et. al.
Stellar Populations of Globular Clusters in the Elliptical Galaxy NGC 1407
AJ 134 391 2007 July

Chapman, S.; Peñarrubia, J.; Ibata, R.; et. al.
Strangers in the Night: Discovery of a Dwarf Spheroidal Galaxy on Its First Local Group Infall
ApJ 662 L79 2007 June 20

Chapman, S. C.; Ibata, R.; Lewis, G. F.; et. al.
A Kinematically Selected, Metal-poor Stellar Halo in the Outskirts of M31
ApJ 653 255 2006 December 10

Chen, H.; Prochaska, J.; Ramirez-Ruiz, E.; et. al.
On the Absence of Wind Signatures in GRB Afterglow Spectra: Constraints on the Wolf-Rayet Winds of GRB Progenitors
ApJ 663 420 2007 July 1

Chesneau, O.; Nardetto, N.; Millour, F.; et. al.
AMBER/VLTI interferometric observations of the recurrent Nova RS Ophiuchii 5.5 days after outburst
A&A 464 119 2007 March

Chien, L.; Barnes, J.; Kewley, L.; Chambers, K.
Multiobject Spectroscopy of Young Star Clusters in NGC 4676
ApJL 660 L105 2007 May 10

Chiu, K.; Bamford, S.; Bunker, A.
The Tully-Fisher relation of galaxies at z ~ 0.85 in the DEEP2 survey
MNRAS 377 806 2007 May

Churchill, C.; Kacprzak, G.; Steidel, C.; Evans, J.
On the Heterogeneity of Metal-Line and Lya Absorption in Galaxy ``Halos" at z ~ 0.7
ApJ 661 714 2007 June

Close, L.; Zuckerman, B.; Song, I.; et. al.
The Wide Brown Dwarf Binary Oph 1622-2405 and Discovery of A Wide, Low Mass Binary in Ophiuchus (Oph 1623-2402): A New Class of Young Evaporating Wide Binaries?
ApJ 660 1492 2007 May 10

Cochran, A.; Jackson, W.; Meech, K.; Glaz, M.
Observations of Comet 9P/Tempel 1 with the Keck 1 HIRES instrument during Deep Impact
Icarus 187, 156 2007 March

Cohen, J.
The Not So Extraordinary Globular Cluster 037-B327 in M31
ApJ 653 L 21 2006 December 10

Cohen, J.; McWilliam, A.; Christlieb, N.; et. al.
A New Type of Extremely Metal-poor Star
ApJ 659 L161 2007 April

Coil, A.; Hennawi, J.; Newman, J.; et. al.
The DEEP2 Galaxy Redshift Survey: Clustering of Quasars and Galaxies at z = 1
ApJ 654 115 2007 January 1

Conroy, C.; Prada, F.; Newman, J.; et. al.
Evolution in the Halo Masses of Isolated Galaxies between z ~ 1 and z ~ 0: From DEEP2 to SDSS
ApJ 654 153 2007 January 1

Conselice, C.; Newman, J.; Georgakakis, A.; et. al.
AEGIS: The Diversity of Bright Near-IR-selected Distant Red Galaxies
ApJ 660 L55 2007 May

Cooper, M.; Newman, J.; Coil, A.; et. al.
The DEEP2 galaxy redshift survey: evolution of the colour-density relation at 0.4 < z < 1.35
MNRAS 376 1445 2007 April 21

Cordiner, M.; Sarre, P.
The CH2CN- molecule: carrier of the 8037 diffuse interstellar band?
A&A 472 537 2007 September

Cortese, L.; Marcillac, D.; Richard, J.; et. al.
The strong transformation of spiral galaxies infalling into massive clusters at z ~ 0.2
MNRAS 376 157 2007 March

Cruz, K.; Reid, I. N.; Kirkpatrick, J.; et. al.
Meeting the Cool Neighbors. IX. The Luminosity Function of M7-L8 Ultracool Dwarfs in the Field
AJ 133 439 2007 February

Davis, M.; Guhathakurta, P.; Konidaris, N.; et. al.
The All-Wavelength Extended Groth Strip International Survey (AEGIS) Data Sets
ApJ 660 L1 2007 May 1

de Pater, I.; Hammel, H.; Showalter, M.; van Dam, M.
The Dark Side of the Rings of Uranus
Science 317, 1888 2007 September

Dello Russo, N.; Vervack, R. J.; Weaver, H. A.; et. al.
Compositional homogeneity in the fragmented comet 73P/Schwassmann–Wachmann 3
Nature 448, 172 2007 July 12

Disanti, M.; Villanueva, G.; Bonev, B.; et. al.
Temporal evolution of parent volatiles and dust in Comet 9P/Tempel 1 resulting from the Deep Impact experiment
Icarus 187, 240 2007 March

Djorgovski, S. G.; Courbin, F.; Meylan, G.; et. al.
Discovery of a Probable Physical Triple Quasar
ApJ 662 L1 2007 June

Dow-Hygelund, C. C.; Holden, B. P.; Bouwens, R. J.; et. al.
Spectroscopy of z ~ 6 i-Dropout Galaxies: Frequency of Lya Emission and the Sizes of Lya-emitting Galaxies
ApJ 660 47 2007 May 1

Dubus, G.; Taam, R.; Hull, C.; et.al.
Spitzer Space Telescope Observations of the Magnetic Cataclysmic Variable AE Aquarii
ApJ 663 516 2007 July 1

Duchêne, G.; Beust, H.; Adjali, F.; et. al.
Accurate stellar masses in the multiple system T Tauri
A&A 457 L9 2006 October

Durant, M.; van Kerkwijk, M.
Multiwavelength Variability of the Magnetar 4U 0142+61
ApJ 652 576 2006 November 20

Dye, S.; Smail, I.; Swinbank, A.; et. al.
Separation of the visible and dark matter in the Einstein ring LBG J213512.73-010143
MNRAS 379 308 2007 July

Eisner, J. A..; Graham, J. R.; Akeson, R. L.; et. al.
Stellar and Molecular Radii of a Mira Star: First Observations with the Keck Interferometer Grism
ApJL 654 L77 2007 January 1

Eisner, J. A.
Water vapour and hydrogen in the terrestrial-planet-forming region of a protoplanetary disk
Nature 447, 562 2007 May 31

Ellison, S.; Hennawi, J.; Martin, C.; Sommer-Larsen, J.
Coincident, 100 kpc scale damped Lya absorption towards a binary QSO: how large are galaxies at z ~ 3?
MNRAS 378 801 2007 July

Ellison, S.; Prochaska, J.; Lopez, S.
The Galactic deuterium abundance and dust depletion: insights from an expanded Ti/H sample
MNRAS 380 1245 2007 September

Eluszkiewicz, J.; Cady-Pereira, K.; Brown, M.; Stansberry, J.
Interpretation of the near-IR spectra of the Kuiper Belt Object (136472) 2005 FY9
JGRE 112 2007 June

Evstigneeva, E.; Gregg, M.; Drinkwater, M.; Hilker, M.
Internal Properties of Ultracompact Dwarf Galaxies in the Virgo Cluster
AJ 133 1722 2007 April

Faber, S.; Willmer, C.; Wolf, C.; et. al.
Galaxy Luminosity Functions to z~1 from DEEP2 and COMBO-17: Implications for Red Galaxy Formation
ApJ 665 265 2007 August 10

Fang, T.; Gerke, B.; Davis, D.; et. al.
AEGIS: Chandra Observation of DEEP2 Galaxy Groups and Clusters
ApJ 660 L27 2007 May

Fassnacht, C. D.; McKean, J. P.; Koopmans, L. V. E.; et. al.
Three Gravitational Lenses for the Price of One: Enhanced Strong Lensing through Galaxy Clustering
ApJ 651 667 2006 November 10

Foellmi, C.; Dall, T.; Depagne, E.; et. al.
On the abundances of GRO J1655-40
A&A 464 61 2007 March

Foley, R.; Smith, N.; Ganeshalingam, M.; et. al.
SN 2006jc: A Wolf-Rayet Star Exploding in a Dense He-rich Circumstellar Medium
ApJL 657 105 2007 March 10

Frye, B.; Coe, D.; Bowen, D.; et. al.
The Sextet Arcs: A Strongly Lensed Lyman Break Galaxy in the ACS Spectroscopic Galaxy Survey toward Abell 1689
ApJ 665 921 2007 August 20

Fu, H.; Stockton, A.
Integral Field Spectroscopy of the Extended Emission-Line Region of 4C 37.43
ApJ 666 794 2007 September 10

Fulbright, J.; McWilliam, A.; Rich, R.
Abundances of Baade's Window Giants from Keck HIRES Spectra. II. The Alpha and Light Odd Elements
ApJ 661 1152 2007 June 1

Fynbo, J.; Watson, D.; Thöne, C.; et. al.
No supernovae associated with two long-duration gamma-ray bursts
Nature 444, 1047 2006 December 21

Gal-Yam, A.; Leonard, D.; Fox, D.; et. al.
On the Progenitor of SN 2005gl and the Nature of Type IIn Supernovae
ApJ 656 372 2007 February 10

Gastaldello, F.; Buote, D.; Humphrey, P.; et. al.
Serendipitous XMM-Newton Discovery of a Cluster of Galaxies at z = 0.28
ApJ 662 923 2007 June

Geier, S.; Nesslinger, S.; Heber, U.; et. al.
The hot subdwarf B + white dwarf binary KPD 1930+2752. A supernova type Ia progenitor candidate
A&A 464 299 2007 March

Georgakakis, A.; Nandra, K.; Laird, E.; et. al.
AEGIS: The Environment of X-Ray Sources at z ~ 1
ApJ 660 L15 2007 May

Gerke, B.; Newman, J.; Faber, S.; et. al.
The DEEP2 galaxy redshift survey: the evolution of the blue fraction in groups and the field
MNRAS 376 1425 2007 April

Gerke, B.; Newman, J.; Lotz, J.; et. al.
The DEEP2 Galaxy Redshift Survey: AEGIS Observations of a Dual AGN at z = 0.7
ApJ 660 L23 2007 May

Gezari, S.; Martin, D.; Milliard, B.; et. al.
Ultraviolet Detection of the Tidal Disruption of a Star by a Supermassive Black Hole
ApJ 653 L25 2006 December 10

Gharanfoli, S.; Kulkarni, V.; Chun, M.; Takamiya, M.
Emission-Line Spectroscopy of a Damped Lya-absorbing Galaxy at z = 0.437
AJ 133 130 2007 January

Gibb, E.; Disanti, M.; Magee-Sauer, K.; et. al.
The organic composition of C/2001 A2 (LINEAR): II. Search for heterogeneity within a comet nucleus
Icarus 188 224 2007 May

Gibb, E.; Van Brunt, K.; Brittain, S.; Rettig, T.
Warm HCN, C2H2, and CO in the Disk of GV Tau
ApJ 660 1572 2007 May 10

Gilbert, K.; Guhathakurta, P.; Kalirai, J.; et. al.
A New Method for Isolating M31 Red Giant Stars: The Discovery of Stars out to a Radial Distance of 165 kpc
ApJ 652 1188 2006 December 1

Giveon, U.; Richter, M.; Becker, R.; White, R.
High-Resolution Mid-Infrared Imaging of Radio Ultracompact H II Regions
AJ 133 639 2007 February

Glikman, E.; Djorgovski, S.; Stern, D.; et. al.
Discovery of Two Spectroscopically Peculiar, Low-Luminosity Quasars at z ~ 4
ApJ 663 L73 2007 July 10

Guimarães, R.; Petitjean, P.; Rollinde, E.; et. al.
Evidence for overdensity around zem > 4 quasars from the proximity effect
MNRAS 377 657 2007 May

Hammel, H.; Sitko, M.; Lynch, D.; et. al.
Distribution of Ethane and Methane Emission on Neptune
AJ 134 637 2007 August

Hammel, H. B.; Lockwood, G. W.
Long-term atmospheric variability on Uranus and Neptune
Icarus 186 291 2007 January

Harrison, T.; Howell, S.; Szkody, P.; Cordova, F.
The Nature of the Secondary Star in the Black Hole X-Ray Transient V616 Mon (=A0620-00)
AJ 133 162 2007 January

Hennawi , J.; Prochaska , J.; Burles, S.; et. al.
Quasars Probing Quasars. I. Optically Thick Absorbers near Luminous Quasars
ApJ 651 61 2006 November 1

Hennawi, J.; Prochaska, J.
Quasars Probing Quasars. II. The Anisotropic Clustering of Optically Thick Absorbers around Quasars
ApJ 655 735 2007 February 1

Henry, A.; Turner, J.; Beck, S.; et. al.
Brackett Lines from the Super Star Cluster Nebulae in HE 2-10
AJ 133 757 2007 March

Henry, R.; Prochaska, J.
The Chemical Evolution of High-z Galaxies from the Relative Abundances of N, Si, S, and Fe in Damped Lya Systems
PASP 119 962 2007 September

Herbig, G. H.
EX Lupi: History and Spectroscopy
AJ 133 2679 2007 June

Hornstein, S. D.; Matthews, K.; Ghez, A. M.; et. al.
Infrared/X-ray intensity variations and the color of Sgr A*
JPhCS 54 399 2006 December

Howell, S.; Walter, F.; Harrison, T.; et. al.
Mass Determination and Detection of the Onset of Chromospheric Activity for the Substellar Object in EF Eridani
ApJ 652 709 2006 November 20

Hrivnak, B.; Geballe, T. R.; Kwok, S.
A Study of the 3.3 and 3.4 μm Emission Features in Proto-Planetary Nebulae
ApJ 662 1059 2007 June 20

Hsiao, E.; Conley, A.; Howell, D.; et.al.
K-Corrections and Spectral Templates of Type Ia Supernovae
ApJ 663 1187 2007 July 10

Hultzsch, P.; Puls, J.; Méndez, R.; et. al.
Central stars of planetary nebulae in the Galactic bulge
A&A 467 1253 2007 June

Humphrey, A.; Villar-Martín, M.; Fosbury, R.; et. al.
Giant Lya nebulae around z > 2 radio galaxies: evidence for infall
MNRAS 375 705 2007 February

Ibata, R.; Chapman, S.; Irwin, M.; et al.
A near-zero velocity dispersion stellar component in the Canes Venatici dwarf spheroidal galaxy
MNRAS 373 L70 2006 November

Inada, N.; Oguri, M.; Becker, R.; et. al.
Two New Gravitationally Lensed Double Quasars from the Sloan Digital Sky Survey
AJ 133 206 2007 January

Ireland, M.; Monnier, J.; Tuthill, R.; et. al.
Born-Again Protoplanetary Disk around Mira B
ApJ 662 651 2007 June 10

Janknecht, E.; Reimers, D.; Lopez, S.; Tytler, D.
The evolution of Lyman a absorbers in the redshift range 0.5 < z < 1.9
A&A 458, 427 2006 November

Jeltema, T.; Mulchaey, J.; Lubin, L.; Fassnacht, C.
The Evolution of Galaxies in X-Ray-luminous Groups
ApJ 658 865 2007 April 1

Jensen, E.; Dhital, S.; Stassun, K.; et. al.
Periodic Accretion from a Circumbinary Disk in the Young Binary UZ Tau E
AJ 134 241 2007 July

Johnson, J.; Gal-Yam, A.; Leonard, D.; et. al.
A High-Resolution Spectrum of the Extremely Metal-rich Bulge G Dwarf OGLE-2006-BLG-265
ApJL 655 L33 2007 January 20

Johnson, J.; Fischer, D.; Marcy, G.; et. al.
Retired A Stars and their Companions: Exoplanets Orbiting Three Intermediate-Mass Subgiants
ApJ 665 785 2007 August

Juhász, A.; Horányi, M.; Morfill, G.
Signatures of Enceladus in Saturn's E ring
GeoRL vol. 34 2007 May

Jura, M.; Farihi, J.; Zuckerman, B.
Externally Polluted White Dwarfs with Dust Disks
ApJ 663 1285 2007 July 10

Kacprzak, G.; Churchill, C.; Steidel, C.; et. al.
A Correlation between Galaxy Morphology and Mg II Halo Absorption Strength
ApJ 662 909 2007 June 20

Kalas, P.; Fitzgerald, M.; Graham, J.
Discovery of Extreme Asymmetry in the Debris Disk Surrounding HD 15115
ApJ 661 L85 2007 May 20

Kanekar, N.; Chengalur, J. N.; Lane, W. M.
HI 21-cm absorption at z ~ 3.39 towards PKS 0201+113
MNRAS 375 1528 2007 March

Kaplan, D.; Levine, A.; Chakrabarty, D.; et. al.
Lost and Found: A New Position and Infrared Counterpart for the X-Ray Binary Scutum X-1
ApJ 661 437 2007 May

Kaplan, D.; van Kerkwijk, M.; Anderson, J.
The Distance to the Isolated Neutron Star RX J0720.4-3125
ApJ 660 1428 2007 May 10

Kartaltepe, J.; Sanders, D.; Scoville, N.; et. al.
Evolution of the Frequency of Luminous (>=L*V) Close Galaxy Pairs at z < 1.2 in the COSMOS Field
ApJS 172 320 2007 September

Kassin, S.; Weiner, B.; Faber, S.; et. al.
The Stellar Mass Tully-Fisher Relation to z = 1.2 from AEGIS
ApJ 660 L35 2007 May

Kim, J.; Kim, S.; Geballe, T.; et. al.
High-resolution spectroscopy of Saturn at 3 microns: CH4, CH3D, C2H2, C2H6, PH3, clouds, and haze
Icarus 185 476 2006 December

Kim, S.; Figer, D.; Kudritzki, R.; Najarro, F.
The Arches Cluster Mass Function
ApJ 653 L113 2006 December 20

Kiminki, D.; Kobulnicky, H.; Kinemuchi, K.; et. al.
A Radial Velocity Survey of the Cyg OB2 Association
ApJ 664 1102 2007 August 1

Kirby, E.; Guhathakurta, P.; Faber, S.; et. al.
The DEEP2 Galaxy Redshift Survey: Redshift Identification of Single-Line Emission Galaxies
ApJ 660 62 2007 May 1

Klesman, A.; Sarajedini, V.
Optical Variability of Infrared Power-Law–Selected Galaxies and X-Ray Sources in the GOODS-South Field
ApJ 665 225 2007 August 10

Koch, A.; Wilkinson, M.; Kleyna, J.; et. al.
Stellar Kinematics and Metallicities in the Leo I Dwarf Spheroidal Galaxy–Wide-Field Implications for Galactic Evolution
ApJ 657 241 2007 March 1

Konidaris, N. P.; Guhathakurta, P.; Bundy, K.; et. al.
AEGIS: Galaxy Spectral Energy Distributions from the X-Ray to Radio
ApJ 660 L7 2007 May 1

Konopacky, Q.; Ghez, A.; Duchêne, G.; et. al.
Measuring the Mass of a Pre-Main-Sequence Binary Star through the Orbit of TWA 5A
AJ 133 2008 2007 May

Konopacky, Q.; Ghez, A.; Rice, E.; Duchêne, G.
New Very Low Mass Binaries in the Taurus Star-forming Region
ApJ 663 394 2007 July 1

Krabbe, A.; Iserlohe, C.; Larkin, J.; et. al.
Diffraction Limited Imaging Spectroscopy of a Sgr A* Flare with OSIRIS
JPhCS 54 406 2006 December

Kraus, A.; Hillenbrand, L.
USco J1606-1935: An Unusually Wide Low-Mass Triple System?
ApJ 664 1167 2007 August 1

Krisciunas, K.; Garnavich, P.; Stanishev, V.; et. al.
The Type Ia Supernova 2004S, a Clone of SN 2001el, and the Optimal Photometric Bands for Extinction Estimation
AJ 133 58 2007 January

Krumpe, M.; Lamer, G.; Schwope, A.; Husemann, B.
RBS1423 - a new QSO with relativistic reflection from an ionised disk
A&A. 470 497 2007 August

Kulkarni, S.; Ofek, E.; Rau, A.; et. al.
An unusually brilliant transient in the galaxy M85
Nature 447 458 2007 May 24

Kwan, J.; Edwards, S.; Fischer, W.
Modeling T Tauri Winds from He I 10830
ApJ 657 897 2007 March

Lacy, M.; Petric, A.; Sajina, A.; et. al.
Optical Spectroscopy and X-Ray Detections of a Sample of Quasars and Active Galactic Nuclei Selected in the Mid-Infrared from Two Spitzer Space Telescope Wide-Area Surveys
AJ 133 186 2007 January

Laird, E.; Nandra, K.; Hobbs, A.; Steidel, C.
The X-ray emission of Lyman break galaxies
MNRAS 373 217 2006 November

Lane, B. F.; Sokoloski, J. L.; Barry, R. K.; et. al.
Interferometric Observations of RS Ophiuchi and the Origin of the Near-Infrared Emission
ApJ 658 520 2007 March 20

Laver, C.; de Pater, I.; Roe, H.; Strobel, D.
Temporal behavior of the SO 1.707 μm ro-vibronic emission band in Io's atmosphere
Icarus 189 401 2007 August

Law, D.; Steidel, C.; Erb, D.; et. al.
The Physical Nature of Rest-UV Galaxy Morphology during the Peak Epoch of Galaxy Formation
ApJ 656 1 2007 February

Le Floc'h, E.; Willmer, C.; Noeske, K.; et. al.
Far-Infrared Characterization of an Ultraluminous Starburst Associated with a Massively Accreting Black Hole at z=1.15
ApJ 660 L65 2007 May

Lewis, G. F.; Ibata, R. A.; Chapman, S. C.; et. al.
Inside the whale: the structure and dynamics of the isolated Cetus dwarf spheroidal
MNRAS 375, 1364 2007 March

Lin, L.; Koo, D.; Weiner, B.; et. al.
AEGIS: Enhancement of Dust-enshrouded Star Formation in Close Galaxy Pairs and Merging Galaxies up to z ~ 1
ApJL 660 L51 2007 May 1

Lu, J. R.; Ghez, A. M.; Hornstein, S. D.; et. al.
Galactic Center Youth: Orbits and Origins of the Young Stars in the Central Parsec
JPhCS 54 279 2006 December

Ly, C.; Malkan, M.; Kashikawa, N.; et. al.
The Luminosity Function and Star Formation Rate between Redshifts of 0.07 and 1.47 for Narrowband Emitters in the Subaru Deep Field
ApJ 657 738 2007 March 10

Maness, H.; Marcy, G.; Ford, E.; et. al.
The M Dwarf GJ 436 and its Neptune-Mass Planet
PASP 119 90 2007 January

Marchis, F.; Kaasalainen, M.; Hom, E. F. Y.; et. al.
Shape, size and multiplicity of main-belt asteroids
Icarus 185, 39 2006 November

Martin, N.; Ibata, R.; Chapman, S.; et. al.
A Keck/DEIMOS spectroscopic survey of faint Galactic satellites: searching for the least massive dwarf galaxies
MNRAS 380 281 2007 September

Martinache, F.; Lloyd, J.; Ireland, M.; et. al.
Precision Masses of the Low-Mass Binary System GJ 623
ApJ 661 496 2007 May

Mauerhan, J.; Muno, M.; Morris, M.
Discovery of Hot Supergiant Stars near the Galactic Center
ApJ 662 574 2007 June 10

Max, C.; Canalizo, G.; de Vries, W.
Locating the Two Black Holes in NGC 6240
Science 316 1877 2007 June

Mazzali, P.; Foley, R.; Deng, J.; et. al.
Keck and European Southern Observatory Very Large Telescope View of the Symmetry of the Ejecta of the XRF/SN 2006aj
ApJ 661 892 2007 June

McCrady, N.; Graham, J.
Super Star Cluster Velocity Dispersions and Virial Masses in the M82 Nuclear Starburst
ApJ 663 844 2007 July 10

McElwain, M.; Metchev, S.; Larkin, J.; et. al.
First High-Contrast Science with an Integral Field Spectrograph: The Sub-Stellar Companion to GQ Lupi
ApJ 656 505 2007 February 10

McGreer, I.; Becker, R.; Helfand, D.; White, R.
Discovery of a z = 6.1 Radio-Loud Quasar in the NOAO Deep Wide Field Survey
ApJ 652 157 2006 November

McKean, J. P.; Koopmans, L. V. E.; Flack, C. E.; et. al.
High-resolution imaging of the anomalous flux ratio gravitational lens system CLASS B2045+265: dark or luminous satellites?
MNRAS 378 109 2007 June

McLean, I.; Prato, L.; McGovern, M.; et. al.
The NIRSPEC Brown Dwarf Spectroscopic Survey. II. High-Resolution J-Band Spectra of M, L, and T Dwarfs
ApJ 658 1217 2007 April

Melbourne, J.; Phillips, A.; Harker, J.; et. al.
Radius-dependent Luminosity Evolution of Blue Galaxies in GOODS-N
ApJ 660 81 2007 May 1

Melbourne, J.; Dawson, K. S.; Koo, D. C.; et. al.
Rest-Frame R-Band Lightcurve of a z ~ 1.3 Supernova Obtained with Keck Laser Adaptive Optics
AJ 133 2709 2007 June

Melendez, J.; Cohen, J.
Magnesium Isotopes in Metal-poor Dwarfs: The Rise of AGB Stars and the Formation Timescale of the Galactic Halo
ApJL 659 L25 2007 April 10

Mesinger, A.; Haiman, Z.
Constraints on Reionization and Source Properties from the Absorption Spectra of z > 6.2 Quasars
ApJ 660 923 2007 May 10

Metchev, S.; Hillenbrand, L.
HD 203030B: An Unusually Cool Young Substellar Companion near the L/T Transition
ApJ 651 1166 2006 November 10

Miknaitis, G.; Pignata, G.; Rest, A.; et. al.
The ESSENCE Supernova Survey: Survey Optimization, Observations, and Supernova Photometry
ApJ 666 674 2007 September 10

Misawa, T.; Charlton, J.; Eracleous, M.; et. al.
A Census of Intrinsic Narrow Absorption Lines in the Spectra of Quasars at z = 2-4
ApJS 171 1 2007 July

Monnier, J. D.; Tuthill, P. G.; Danchi, W. C.; et. al.
The Keck Aperture-masking Experiment: Near-Infrared Sizes of Dusty Wolf-Rayet Stars
ApJ 655 1033 2007 February 1

Moran, S.; Miller, N.; Treu, T.; et. al.
Dynamical Evidence for Environmental Evolution of Intermediate-Redshift Spiral Galaxies
ApJ 659 1138 2007 April 20

Moran, S.; Loh, B.; Ellis, R.; et. al.
The Dynamical Distinction between Elliptical and Lenticular Galaxies in Distant Clusters: Further Evidence for the Recent Origin of S0 Galaxies
ApJ 665 1067 2007 August 20

Moraux, E.; Bouvier, J.; Stauffer, J.; et. al.
The lower mass function of the young open cluster Blanco 1: from 30 MJup to 3 M
A&A 471 499 2007 August

Moro-Martín, A.; Carpenter, J.; Meyer, M.; et. al.
Are Debris Disks and Massive Planets Correlated?
ApJ 658 1312 2007 April 1

Moustakas, L.; Marshall, P.; Newman, J.; et. al.
A Strong-Lens Survey in AEGIS: The Influence of Large-Scale Structure
ApJL 660 31 2007 May 1

Muench, A.; Lada, C.; Luhman, K.; et. al.
A Spitzer Census of the IC 348 Nebula
AJ 134 411 2007 July

Murphy, M.; Tzanavaris, P.; Webb, J.; Lovis, C.
Selection of ThAr lines for wavelength calibration of echelle spectra and implications for variations in the fine-structure constant
MNRAS 378 221 2007 June

Nandra, K.; Georgakakis, A.; Willmer, C.; et. al.
AEGIS: The Color-Magnitude Relation for X-Ray-selected Active Galactic Nuclei
ApJ 660 L11 2007 May

Narayanan, A.; Misawa, T.; Charlton, J.; Ganguly, R.
The Advantage of Increased Resolution in the Study of Quasar Absorption Systems
AJ 132 2099 2006 November

Noeske, K.; Faber, S.; Weiner, B.; et. al.
Star Formation in AEGIS Field Galaxies since z=1.1: Staged Galaxy Formation and a Model of Mass-dependent Gas Exhaustion
ApJ 660 L47 2007 May

Noeske, K.; Weiner, B.; Faber, S. M.; et.al.
Star Formation in AEGIS Field Galaxies since z=1.1: The Dominance of Gradually Declining Star Formation, and the Main Sequence of Star-forming Galaxies
ApJL 660 43 2007 May 1

O'Donovan , F.; Charbonneau , D.; Mandushev, G.; et. al.
TrES-2: The First Transiting Planet in the Kepler Field
ApJL 651 L61 2006 November 1

O'Donovan, F.; Charbonneau, D.; Bakos, G.; et. al.
TrES-3: A Nearby, Massive, Transiting Hot Jupiter in a 31 Hour Orbit
ApJ 663 L37 2007 July 1

O'Meara, J.; Burles, S.; Prochaska, J; et. al.
The Deuterium-to-Hydrogen Abundance Ratio toward the QSO SDSS J155810.16-003120.0
ApJL 649 L61 2006 October 1

O'Meara, J.; Prochaska, J.; Burles, S.; et. al.
The Keck+Magellan Survey for Lyman Limit Absorption. I. The Frequency Distribution of Super Lyman Limit Systems
ApJ 656 666 2007 February 20

Ofek, E.; Cameron, P.; Kasliwal, M.; et. al.
SN 2006gy: An Extremely Luminous Supernova in the Galaxy NGC 1260
ApJ 659 L 13 2007 April 10

Olkin, C. B.; Young, E. F.; Young, L. A.; et. al.
Pluto's Spectrum from 1.0 to 4.2 μm: Implications for Surface Properties
AJ 133 420 2007 February

Osorio, M.; Martín, E.; Béjar, V.; et. al.
Space Velocities of L- and T-Type Dwarfs
ApJ 666 1205 2007 September 10

Patat, F.; Chandra, P.; Chevalier, R.; et. al.
Detection of Circumstellar Material in a Normal Type Ia Supernova
Science 317 924 2007 August

Patel, S.; Vogt, S.; Marcy, G.; et.al.
Fourteen New Companions from the Keck and Lick Radial Velocity Survey Including Five Brown Dwarf Candidates
ApJ 665 744 2007 August 10

Pavlenko, Ya.; Jones, H.; Martín, E.; et. al.
Lithium in LP944-20
MNRAS 380 1285 2007 September

Phillips, M.; Li, W.; Frieman, J.; et. al.
The Peculiar SN 2005hk: Do Some Type Ia Supernovae Explode as Deflagrations?
PASP 119 360 2007 April

Pian E.; Mazzali P.
Anisotropies in core collapse supernovae
ChJAS 6a 335 2006 December

Pierce, C.; Lotz, J. .; Laird, E.; et. al.
AEGIS: Host Galaxy Morphologies of X-Ray-selected and Infrared-selected Active Galactic Nuclei at 0.2 <= z < 1.2
ApJ 660 L19 2007 May

Pollack, L. K.; Max, C. E.; Schneider, G.
Circumnuclear Star Clusters in the Galaxy Merger NGC 6240, Observed with Keck Adaptive Optics and the Hubble Space Telescope
ApJ 660 288 2007 May

Prato, L.
A Survey for Young Spectroscopic Binary K7-M4 Stars in Ophiuchus
ApJ 657 338 2007 March 1

Prochaska, J.
On the Perils of Curve-of-Growth Analysis: Systematic Abundance Underestimates for the Gas in Gamma-Ray Burst Host Galaxies
ApJ 650 272 2006 October 10

Prochaska, J.; Wolfe, A.; Howk, J.; et. al.
The UCSD/Keck Damped Lya Abundance Database: A Decade of High Resolution Spectroscopy
ApJS 171, 29 2007 July

Prochaska, J.; Chen, H.; Dessauges-Zavadsky, M.; Bloom, J.
Probing the Interstellar Medium near Star-forming Regions with Gamma-Ray Burst Afterglow Spectroscopy: Gas, Metals, and Dust
ApJ 66 267 2007 September 1

Prochaska, J. X.; Chen, H.-W.; Bloom, J. S.; et. al.
The Interstellar Medium of Gamma-Ray Burst Host Galaxies. I. Echelle Spectra of Swift GRB Afterglows
ApJS 168 231 2007 February

Rafelski, M.; Ghez, A.; Hornstein, S.; et. al.
Photometric Stellar Variability in the Galactic Center
JPhCS 54 316 2006 December

Rafelski, M.; Ghez, A.; Hornstein, S.; et. al.
Photometric Stellar Variability in the Galactic Center
ApJ 659 1241 2007 April 20

Rau, A.; Kulkarni, S.; Ofek, E. O.; Yan, L.
Spitzer Observations of the New Luminous Red Nova M85 OT2006-1
ApJ 659 1536 2007 April 20

Rau, A.; Schwarz, R.; Kulkarni, S.; et. al.
The Incidence of Dwarf Novae in Large Area Transient Searches
ApJ 664 474 2007 July 20

Rea, N.; Torres, M.; Jonker, P.; et. al.
Accurate X-ray position and multiwavelength observations of the isolated neutron star RBS 1774
MNRAS 379 1484 2007

Reddy, N.; Steidel, C.; Erb, D.; et. al.
A Spectroscopic Survey of Redshift 1.4<~z<~3.0 Galaxies in the GOODS-North Field: Survey Description, Catalogs, and Properties
ApJ 653, 1004 2006 December 20

Reid, I.; Turner, E.; Turnbull, M.; et. al.
Searching for Earth Analogs Around the Nearest Stars: The Disk Age-Metallicity Relation and the Age Distribution in the Solar Neighborhood
ApJ 665 767 2007 August 10

Reiners, A.; Basri, G.
The First Direct Measurements of Surface Magnetic Fields on Very Low Mass Stars
ApJ 656 1121 2007 February 20

Reiners, A.; Schmitt, J.; Liefke, C.
Rapid magnetic flux variability on the flare star CN Leonis
A&A 466, L13 2007 May

Reiners, A.; Seifahrt, A.; Käufl, H.; et. al.
Spectral-type dependent rotational braking and strong magnetic flux in three components of the late-M multiple system LHS 1070
A&A 471 L5 2007 August

Reuland, M.; van Breugel, W.; de Vries, W.; et. al.
Metal-Enriched Gaseous Halos around Distant Radio Galaxies: Clues to Feedback in Galaxy Formation
AJ 133 2607 2007 June

Reynolds, M.; Callanan, P.; Filippenko, A.
Keck infrared observations of GRO J0422+32 in quiescence
MNRAS 374 657 2007 January

Rich, R.; Origlia, L.; Valenti, E.
The First Detailed Abundances for M Giants in the Inner Bulge from Infrared Spectroscopy
ApJ 665 L119 2007 August 20

Richard, J.; Kneib, J.; Jullo, E.; et. al.
A Statistical Study of Multiply Imaged Systems in the Lensing Cluster Abell 68
ApJ 662 781 2007 June 20

Riess, A.; Strolger, L.; Casertano, S.; et. al.
New Hubble Space Telescope Discoveries of Type Ia Supernovae at z = 1: Narrowing Constraints on the Early Behavior of Dark Energy
ApJ 659 98 2007 April 10

Robin, A.; Rich, R.; Aussel, H.; et. al.
The Stellar Content of the COSMOS Field as Derived from Morphological and SED-based Star/Galaxy Separation
ApJS 172 545 2007 September

Robinson, S.; Ammons, S.; Kretke, K.; et. al.
The N2K Consortium. VII. Atmospheric Parameters of 1907 Metal-rich Stars: Finding Planet-Search Targets
ApJS 169 430 2007 April

Rodighiero, G.; Gruppioni, C.; Civano, F.; et. al.
Hidden activity in high-redshift spheroidal galaxies from mid-infrared and X-ray observations in the GOODS-North field
MNRAS 376 416 2007 March

Sahai, R.; Sánchez Contreras, C.; Morris, M.; Claussen, M.
A Quadrupolar Preplanetary Nebula: IRAS 19475+3119
ApJ 658 410 2007 March 20

Salyk, C.; Blake, G. A.; Boogert, A. C. A.; Brown, J. M.
Molecular Gas in the Inner 1 AU of the TW Hya and GM Aur Transitional Disks
ApJ 655 L105 2007 February 1

Sánchez-Blázquez, P.; Forbes, D.; Strader, J.; et. al.
Spatially resolved spectroscopy of early-type galaxies over a range in mass
MNRAS 377 759 2007 May

Sánchez Contreras, C.; Le Mignant, D.; Sahai, R.; et. al.
Adaptive Optics Imaging of IRAS 18276-1431: A Bipolar Preplanetary Nebula with Circumstellar "Searchlight Beams" and "Arcs"
ApJ 656 1150 2007 February 20

Schaefer, G.H.; Simon, M.; Beck, T. L.; et. al.
Dynamical Mass Estimates for Incomplete Orbits: Young Multiple Stars in Taurus and Ophiuchus
AJ 132 2618 2006 December

Schaller, E.; Brown, M.; Roe, H.; et. al.
Dissipation of Titan's south polar clouds
Icarus 184, 517 2006 October

Schiavon, Ricardo P.; Faber, S. M.; Konidaris, Nicholas; et. al.
The DEEP2 Galaxy Redshift Survey: Mean Ages and Metallicities of Red Field Galaxies at z ~ 0.9 from Stacked Keck DEIMOS Spectra
ApJL 651 93 2006 November 1

Schwarz, G.; Woodward, C.; Bode, M.; et. al.
The Early Spectrophotometric Evolution of V1186 Scorpii (Nova Scorpii 2004 No. 1)
AJ 134 516 2007 August

Shapley, A.; Steidel, C.; Pettini, M.; et. al.
The Direct Detection of Lyman Continuum Emission from Star-Forming Galaxies at z~3
ApJ, 651, 688 2006 November 10

Siegler, N.; Close, L.; Burgasser, A.; et. al.
Discovery of a 66 mas Ultracool Binary with Laser Guide Star Adaptive Optics
AJ 133 2320 2007 May

Smail, I.; Swinbank, A.; Richard, J.; et. al.
A Very Bright, Highly Magnified Lyman Break Galaxy at z = 3.07
ApJL 654 L33 2007 January 1

Smith, G.; Siegel, M.; Shetrone, M.; Winnick, R.
Spectroscopy of Six Red Giants in the Draco Dwarf Spheroidal Galaxy
PASP 118 1361 2006 October

Smith, G.; Shetrone, M.; Strader, J.
Carbon Isotope Ratios on the Upper Red Giant Branch of Messier 71
PASP 119 722 2007 July

Smith, N.; Bally, J; Walawender, J.
And in the Darkness Bind Them: Equatorial Rings, B[e] Supergiants, and the Waists of Bipolar Nebulae
AJ 134 846 2007 August

Smith, N.; Li, W.; Foley, R.; et. al.
SN 2006gy: Discovery of the Most Luminous Supernova Ever Recorded, Powered by the Death of an Extremely Massive Star like Carinae
ApJ 666 1116 2007 September 10

Soderberg, A.; Nakar, E.; Cenko, S.; et. al.
A Spectacular Radio Flare from XRF 050416a at 40 Days and Implications for the Nature of X-Ray Flashes
ApJ 661 982 2007 June 1

Sohn, S.; Majewski, S.; Muñoz, R.; et. al.
Exploring Halo Substructure with Giant Stars. X. Extended Dark Matter or Tidal Disruption?: The Case for the Leo I Dwarf Spheroidal Galaxy
ApJ 663 960 2007 July 10

Soria, R.; Wong, D.
A ultraluminous X-ray source associated with a cloud collision in M 99
MNRAS 372 1531 2006 November

Sozzetti, A.; Torres, G.; Charbonneau, D.; et. al.
Improving Stellar and Planetary Parameters of Transiting Planet Systems: The Case of TrES-2
ApJ 664 1190 2007 August 1

Stark, D.; Ellis, R; Richard, J.; et. al.
A Keck Survey for Gravitationally Lensed Lya Emitters in the Redshift Range 8.5<z<10.4: New Constraints on the Contribution of Low-Luminosity Sources to Cosmic Reionization
ApJ 663 10 2007 July 1

Stern, D.; Kirkpatrick, J.; Allen, L.; et. al.
Mid-Infrared Selection of Brown Dwarfs and High-Redshift Quasars
ApJ 663 677 2007 July 1

Stockton, A.; McGrath, E.; Canalizo, G.
Extremely Red Objects in Two Quasar Fields at z ~ 1.4
ApJ 650 706 2006 October 20

Strader, J.; Beasley, M.; Brodie, J.
Globular Cluster Metallicity Subpopulations in NGC 4472
AJ 133 2015 2007 May

Symeonidis, M.; Rigopoulou, D.; Huang, J.-S.; et. al.
AEGIS: Infrared Spectral Energy Distributions of MIPS 70 μm-selected Sources
ApJ 660 L7 2007 May

Takata, T.; Sekiguchi, K.; Smail, I.; et. al.
Rest-Frame Optical Spectroscopic Classifications for Submillimeter Galaxies
ApJ 651 713 2006 November 10

Takeda, G.; Ford, E.; Sills, A.; et. al.
Structure and Evolution of Nearby Stars with Planets. II. Physical Properties of ~1000 Cool Stars from the SPOCS Catalog
ApJS 168 297 2007 February

Tanner, A.; Beichman, C.; Akeson, R.; et. al.
SIM PlanetQuest Key Project Precursor Observations to Detect Gas Giant Planets around Young Stars
PASP 119 747 2007 July

Torres, G.; Bakos, G.; Kovács, G.; et. al.
HAT-P-3b: A Heavy-Element-rich Planet Transiting a K Dwarf Star
ApJ 666 L121 2007 September 10

Tran, K.; Franx, M.; Illingworth, G.; et. al.
A Keck Spectroscopic Survey of MS 1054-03 (z = 0.83): Forming the Red Sequence
ApJ 661 750 2007 June 1

Treu, T.; Woo, J.; Malkan, M; Blandford, R.
Cosmic Evolution of Black Holes and Spheroids. II: Scaling Relations at z=0.36
ApJ 667 117 2007 September 20

Trujillo, C.; Brown, M.; Barkume, K.; et. al.
The Surface of 2003 EL61 in the Near-Infrared
ApJ 655 1172 2007 February 1

Tuthill, P.G.; Lloyd, J.P.
A Symmetric Bipolar Nebula around MWC 922
Science, 316 247 2007 April

Vacca, W.; Sheehy, C.; Graham, J.
Imaging of the Stellar Population of IC10 with Laser Guide Star Adaptive Optics and the Hubble Space Telescope
ApJ 662 272 2007 June

van Dokkum, P.; van der Marel, R.
The Star Formation Epoch of the Most Massive Early-Type Galaxies
ApJ 655 30 2007 January 20

Venemans, B. P.; Röttgering, H. J. A.; Miley, G. K.; et. al.
Protoclusters associated with z > 2 radio galaxies . I. Characteristics of high redshift protoclusters
A&A 461 823 2007 January

Villanueva, G.; Bonev, B.; Mumma, M.; et. al.
The Volatile Composition of the Split Ecliptic comet 73P/Schwassmann-Wachmann 3: A Comparison of Fragments C and B
ApJL 650 L87 2006 October 10

Villar-Martín, M.; Humphrey, A.; De Breuck, C.; et. al.
Lya excess in high-redshift radio galaxies: a signature of star formation
MNRAS 375 1299 2007 March

Villar-Martín, M.; Sánchez, S.; Humphrey, A.; et. al.
VIMOS-VLT spectroscopy of the giant Lya nebulae associated with three z ~ 2.5 radio galaxies
MNRAS 378 416 2007 June

von Hippel, T.; Thompson, S.
Discovery of Photospheric Calcium Line-Strength Variations in the DAZd White Dwarf G29-38
ApJ 661 477 2007 May 20

Wahhaj, Z.; Koerner, D.; Sargent, A.
High-Resolution Imaging of the Dust Disk around 49 Ceti
ApJ 661 368 2007 May 20

Weedman , D.; Soifer ,B.; Hao, L.; et. al.
Spitzer IRS Spectra of Optically Faint Infrared Sources with Weak Spectral Features
ApJ 651 101 2006 November 1

Weiner, B.; Willmer, C.; Faber, S.; et. al.
A Survey of Galaxy Kinematics to z˜1 in the TKRS/GOODS-N Field. II. Evolution in the Tully-Fisher Relation
ApJ 653 1049 2006 December 20

Weiner, B.; Willmer, C.; Faber, S.; et. al.
A Survey of Galaxy Kinematics to z˜1 in the TKRS/GOODS-N Field. I. Rotation and Dispersion Properties
ApJ 653 1027 2006 December 20

Weiner, B.; Papovich, C.; Bundy, K.; et. al.
AEGIS: Extinction and Star Formation Tracers from Line Emission
ApJ 660 L39 2007 May

Williams, K.; Bolte, M.
A Photometric and Spectroscopic Search for White Dwarfs in the Open Clusters NGC 6633 and NGC 7063
AJ 133 1490 2007 April

Willner, S. P.; Coil, A. L.; Goss, W. M.; et. al.
Mid-Infrared Identification of 6 cm Radio-Source Counter parts in the Extended Groth Strip
AJ 132 2159 2006 November

Wilson, G.; Huang, J.-S.; Fazio, G.; et. al.
AEGIS: A Panchromatic Study of IRAC-selected Extremely Red Objects with Confirmed Spectroscopic Redshifts
ApJ 660 L59 2007 May

Winn, J.; Johnson, J.; Marcy, G.; Butler, R. P.; Vogt, S.; et. al.
Measurement of the Spin-Orbit Alignment in the Exoplanetary System HD 189733
ApJ 653 L69 2006 December 10

Winn, J.; Johnson, J.; Peek, K.; et. al.
Spin-Orbit Alignment for the Eccentric Exoplanet HD 147506b
ApJ 665 L167 2007 August 20

Wittenmyer, R.; Endl, M.; Cochran, W.; Levison, H.
Dynamical and Observational Constraints on Additional Planets in Highly Eccentric Planetary Systems
AJ 134 1276 2007 September

Wolf, A.; Laughlin, G.; Henry, G.; et. al.
A Determination of the Spin-Orbit Alignment of the Anomalously Dense Planet Orbiting HD 149026
ApJ 667 549 2007 September 20

Wong, M.; de Pater, I.; Showalter, M.; et. al.
Ground-based near infrared spectroscopy of Jupiter's ring and moons
Icarus 185 403 2006 December

Wood-Vasey, W.; Miknaitis, G.; Stubbs, C.; et. al.
Observational Constraints on the Nature of Dark Energy: First Cosmological Results from the ESSENCE Supernova Survey
ApJ 666 694 2007 September 10

Wright, J.; Marcy, G.; Fischer, D.; et. al.
Four New Exoplanets and Hints of Additional Substellar Companions to Exoplanet Host Stars
ApJ 657 533 2007 March 1

Wright, S.; Larkin, J.; Barczys, M.; et. al.
Integral Field Spectroscopy of a Candidate Disk Galaxy at z ˜ 1.5 Using Laser Guide Star Adaptive Optics
ApJ 658 78 2007 March

Yan, L.; Sajina, A.; Fadda, D.; et. al.
Spitzer Mid-Infrared Spectroscopy of Infrared Luminous Galaxies at z ˜ 2. I. The Spectra
ApJ 658 778 2007 April 1

Editor
Debbie Goodwin

Featured Writers and Contributors
Taft Armandroff
Dawn Q. Brown
Linda Copman
Debbie Goodwin
Peggi Kamisato
Hilton Lewis
Margarita Scheffel

Graphic Design and Production
WisdomSource Technologies

Printing
Service Printers Hawaii, Inc.

Photo credits
(t = top, b = bottom, l = left, m = middle, r = right)

Sarah Anderson/WMKO: 2, 3, 11t, 15tr, 15mr, 17b, 19t, 19b
John Baldwin/WMKO: 8t
Andrew Cooper/WMKO: 15t, 22
Dave Cowley/UCO/Lick: 14b
Imke de Pater: 8b
Laurie Hatch: 7, 10, 20
Chris Lockwood/UCO/Lick: 14b
Los Angeles Times: 5b
NASA: 9b
NASA/STScI/Ann Field: 9tr
Saul Perlmutter: 9l
Rick Peterson: cover, 4t, 4b, 6, 11b, 12t, 12b, 13t, 13b, 15br, 16, 17t, 18, 21t, 21b, 23
Robert Shallenberger: 24 – 35
Peter Tutill/Caltech: 36
Michelle Vine/Caltech: 5t

Discovered in 2007 using the Keck and Hale telescopes, the Red Square nebula reflects breathtaking beauty and symmetry within the universe.

W. M. KECK OBSERVATORY
On the summit of Mauna Kea, Island of Hawai'i

For more information contact:
Debbie Goodwin, Director of Advancement
65-1120 Mamalahoa Highway
Kamuela, Hawai'i 96743
808.881.3814
www.keckobservatory.org