California Institute of Technology Pasadena, California 91125

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Caltech News

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Volume 40, Number 2 2006



Monsieur le President

A Send-Off for '06

The Literature Professor's Tale

Cannon-Gall Run

Red Eyes on the Skies



California Institute of Technology Volume 40, Number 2 2006

Caltech News

ON THE COVER After a day filled with meetings and introductions, new hire Jean-Lou Chameau can look forward to an interval of R&R as he heads for a picnic on the Caltech campus.

U p Front

ALLONS ENFANTS DE LA CALTECH



Infrarednecks

Infrared astronomy was largely born and certainly bred on the Caltech campus.

Firing Off on the Cannon Caper

Caltech Neus looks at the improbable life and incendiary times of an obsolete piece of military hardware.

Baker's Dozen, with Jenijoy La Belle

The literature professor answers 13 questions about her 37 years at Caltech.

Also in this issue

New NAS faculty; a new Feynman Professor; new Distinguished Alumni; new support for the Caltech Campaign; new beginnings at Commencement; and a new take on an old holiday tradition (on the back-page poster).

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A charmer. By birth, a Frenchman. A seasoned, visionary administrator. Provost of an institution that annually confers the largest number of engineering degrees in the nation. A Renaissance man. A Stanford PhD in civil engineering. A former dean of engineering. A connoisseur of fine food and wine, who once thought of opening his own restaurant. A charmer. A skilled advocate of interdisciplinary research, announced on May 26, amid a series of meetings held that day to introduce him to the campus community he will now lead.

Jean-Lou Chameau impressed us with his intelligence, his vision, his personality, and his extensive administrative and fund-raising experience and success," said David Stevenson, Van Osdol Professor of Planetary Science and head of the faculty presidential search committee. "We believe that he is well suited to the challenges and opportunities of the Caltech presidency in a time of change in the global environment of science, technology, and education. We expect him to be an engaging and energizing presence in our community." Added Stevenson, "You will find, as we did, that he is extremely charming." Up next at the podium, Trustee Chairman Kent Kresa praised Chameau's "wealth of managerial experience and a strong commitment to students, faculty, and research. He has done a terrific job at Georgia Tech, and I'm positive he will lead Caltech with the same energy, excitement, and wisdom he displayed there." And, of course, said Kresa, the same charm.

Jean-Lou Chameau (left) introduced himself to students and other members of the Caltech community during a lively campus picnic on May 26, the day it was annnounced he would step down from his current position as the provost of Georgia Tech to become the Institute's eighth president. The French-born Chameau, who spent a busy day on campus mingling with faculty, staff, and students while trying to get to know the place a bit better, will assume the presidency of Caltech on September 1. who has devoted much of his career to building bridges and transcending boundaries among academic fields. A wonderful listener and thoughtful conversationalist, fabled for his rapport with students. An effective and farsighted fundraiser. A committed proponent of diversity, entrepreneurship, and international collaborations in education. And, oh, did we mention a charmer.

Jean-Lou Charneau, the provost and vice president for academic affairs at the Georgia Institute of Technology, is set to become Caltech's eighth president on September 1, succeeding David Baltimore, who will step down from the presidency after nearly nine years to return to fulltime teaching and research. Charneau's selection was

Continued on page 9

Infrarednecks

HOW THREE CALTECH ALUMNI HELPED TAKE INFRARED ASTRONOMY FROM THE FARM TO THE MAJOR LEAGUES

BY MICHAEL ROGERS

These are heady times for infrared astronomy. As the Spitzer Space Telescope orbits overhead, hardly a week goes by without some provocative new piece of data, often accompanied by a glorious image, emerging from a cornucopia of cosmic heat and dust. The fact that infrared radiation (some of which humans perceive as heat) is able, unlike light, to escape from the interstellar and intergalactic dust that shields some of the most interesting and beautiful objects in the cosmos explains this heatseeking mission's appeal to astronomers and lay public alike. To date, the Spitzer Observatory, less than a meter in size, has turned in a sellar performance. It has detected evidence of planetary formation in the stark, inhospitable neighborhood of a dead neutron star; directly detected the heat from planets orbiting other stars; in the cosmos when it was one quarter its current age; and in general reiterated what new astronomical observations are always telling us-that the universe is an infinitely richer and stranger place rhan we already knew it to be. All this from a mission that on one occasion was canceled outright and later, as a last-ditch compromise, was downsized 75 percent before finally being launched in August 2003.

But infrared astronomy has always had an exceptional capacity to surprise. When Caltech astrophysicists produced the first infrared sky survey 40 years ago, using ground-based infrared detectors knocked off from military hardware, they opened an astonishing and previously unsuspected window onto the universe. A decade later, when balloon- and then satellite-borne infrared telescopes were launched above Earth's obscuting atmosphere, hundreds of thousands of additional new infrared sources were uncovered, including galaxies emitting huge amounts of infrared energy, incandescent regions of star formation within and beyond our own galaxy, and the first tantalizing hints of planets orbiting other stars. While many astronomers, astrophysicists, and engineers have contributed to the advancement of infrared astronomy, much of the credit for unveiling the infrared sky belongs to a small constellation of Caltech scientists who also happen to be Caltech alumni. For more than 30 years, they have worked together as a team, designing and building instruments, making pioneering observations, planning and operating facilities, and educating and mentoring a new generation of astronomers. The mainstays of the group are Gerry Neugebauer, PhD '60, the Millikan Professor of Physics, Emeritus; Tom Soifer '68, professor of physics and director of the Spitzer Science Center; and Keith Matthews '62, member of the professional staff in physics. Each has unique skills that have contributed to the development of infrared astronomy. And while Neugebauer is now retired, Soifer and Matthews continue to work together and to consult with Neugebauer, former director of the Palomar Observatory and former chair of Caltech's Division of Physics, Mathematics and Astronomy. And with the help of today's sophisticated instruments, including the Spitzer Space Telescope, the telescopes at the W. M. Keck Observatory in Mauna Kea, Hawaii, and the Palomar Observatory, they continue to produce increasingly detailed and dramatic pictures of the universe.

Neugebauer, Soifer, and Matthews are certainly not the only major players in infrared astronomy to come out of the Institute. The late Caltech physicist Robert Leighton '41, PhD '47, collaborated with Neugebauer to build Caltech's first infrared survey telescope, used on the Two Micron Sky Survey at Mount Wilson in the mid-1960s. Other prominent scientists who have worked in Caltech's infrared group include Eric Becklin, PhD '68, chief scientist and director designate of the science center of the Stratospheric Observatory for Infrared Astronomy, an airborne telescope set for flight testing later this year; Steven Beckwith, PhD '78, former director of the Space Telescope; and Stanford physicist and Nobel Laureate Douglas Osheroff '67, who crunched infrared data for Neugebauer as a Caltech undergraduate. But while Leighton passed through the field of infrared astronomy relatively quickly, and other scientists trained by Neugebauer came and went, Soifer and Matthews stayed. Over the years, they became good friends as well as colleagues who—like a seasoned jazz trio—jam harmoniously together.

WHERE NO ASTRONOMER HAD GONE BEFORE

When Neugebauer first went to work with Leighton, he recalls, most astronomers thought that they were running up a blind alley. The two had met when Gerry, then a Caltech graduate student in the high-energy physics group, worked with Leighton on a research project that involved using cloud chambers to investigate exotic subatomic particles produced in cosmic-ray decays. After getting his PhD, Neugebauer went to JPL in 1960 to complete his Army service, working on infrared detectors for the military. Returning to Caltech in 1962, he and Leighton got together to adapt the same detector technology for use in astronomy. "In general, the physics and astronomy faculty didn't care what we did," Neugebauer recalls. "The astronomers basically thought we were wasting our time, but they were so busy with Mount Wilson and Palomar and had enough respect for Leighton that they left us alone." Leighton and Neugebauer built a 62-inch reflecting dish, followed by an infrared instrument that, as Leighton recalled in a 1986 Caltech oral history interview, was "sufficiently sensitive to be interesting and sufficiently precise to be able to locate objects in the sky." The duo automated it so that it could rapidly image sources, tried it our on campus, and then brought it up to Mount Wilson in 1965 to begin the infrared sky survey. In 1966, they were joined by Soifer, who was just finishing up his sophomore year. Like nearly every Caltech student at that time, he had entered the Institute with the idea of becoming a high-energy physicist. Still, when his roommate, Ed Groth '68, encouraged him to take a part-time job helping Neugebauer, Soifer signed on. "The way it worked, they had someone paid to operate the telescope five nights a week," says Soifer. "Graduate students and undergraduates would operate it the other nights. So, every couple of months, I'd run the telescope."

The prototypical Caltech trio of (left to right) Tom Soifer, Keith Matthews, and Gerry Neugebauer takes a break at the Palomar Observatory in 1978. They would have to wait many more years before seeing infrared images like the one above of Comet 73P/Schwassmann-Wachmann 3, taken by the Spitzer Space Telescope on April 1.



Continued on page 10 . . .

Campus Update

FACULTY, ALUMNI NAMED TO NAS

Three Caltech professors have been elected to the National Academy of Sciences, one of the highest honors that can be accorded an American scientist or engineer. They were among 72 new members whose names were announced in April at the 143rd annual meeting of the Academy in Washington, D.C., and their election brings to 72 the number of Caltech faculty who are currently members of the Academy.

Caltech's newest NAS members are Mark Davis, the Schlinger Professor of Chemical Engineering; Chuck Steidel, PhD '90, the DuBridge Professor of Astronomy and executive officer for astronomy; and David Tirrell, chair of the Institute's chemistry and chemical engineering division, and the McCollum-Corcoran Professor and professor of chemistry and chemical engineering. Four Caltech alumni were also named to membership, and Vladimir Braginsky, a visiting associate in physics at Caltech and a member of the Moscow State University faculty, was elected one of 18 new foreign associates.

Davis's primary research interests include the creation of new catalytic materials, the synthesis of biomaterials, and gene therapy. The Davis research group also works on the synthesis of substances that are useful for delivering nucleic acids and has shown that these delivery systems can be used with RNA interference molecules to inhibit genes in rumors of animals to produce potent anticancer effects. The team hopes to move this system to the clinic in the near future.

Steidel's overarching research interest is the connection between galaxy formation and the evolution of strucrure in the universe. Much of his work involves large spectroscopic surveys of star-forming galaxies at various stages in cosmic history-research that is yielding fundamental new insights into large-scale distribution and populations of galaxies and their overall relationship to the development and shape of the cosmos. Tirrell's research combines organic, biological, and materials chemistry to make new macromolecular systems of controlled structure and function. He and his students are exploring artificial proteins made by expression of artificial genes in microbial cells, and the creation of novel amino-acid building blocks for use in protein design and analysis. Braginsky, a regular visitor at Caltech, works on the laser Interferometry Gravitational-Wave Observatory (LIGO) project and on other research involving gravitational physics. He has published more than 150 sci-







From the top, the Institute's newest members of the National Academy of Sciences are Mark Davis, Chuck Steidel, and David Tirrell.

entific papers, and since 1995 has been an adviser to the president of the Max Planck Society.

Four Caltech alumni at other instiutions were also elected to the NAS Caltech's newest Feynman Prize winner Richard Murray keeps an eagle eye on Caltech's automotive vehicle "Alice," as it competes in the DARPA Grand Challenge autonomous robot race through the California desert. He worked on the design and development of Alice with dozens of Institute students.



RICHARD MURRAY AWARDED FEYNMAN PRIZE

Richard Murray '85 was a freshman attending frosh camp on Catalina Island when he first encountered famed physicist Richard Feynman. "A professor sat down next to me and started talking about some shells he had found while he was swimming. Lo and behold, it was Richard Feynman although I was an engineering student and not in physics, and I'm not sure I knew who he was at the time. That willingness to talk to a student typified his approach to teaching."

Such willingness to engage and encourage students also typifies Murray's own approach, and now the professor, who was recently named Caltech's Everhart Professor of Control and Dynamical Systems, has been awarded the Institute's Richard P. Feynman Prize for Excellence in Teaching. The prize, handed out annually, is Caltech's most prestigious teaching honor. With it comes a \$3,500 cash award, plus an equivalent yearly raise in salary.

The Feynman Prize Selection Committee singled out Murray for his "enthusiasm, responsiveness, and innovation" in the classroom and for his "contribution to the undergraduate experience throagh teaching outside the conventional classroom."

"I think the field I do research in is very exciting, so I try to teach in a way that conveys the flavor of why I find it exciting," says Murray, whose work includes high-confidence control of cooperative systems and nonlinear control theory.

Murray was also commended for his determination to make sure his students understand the material he teaches. For example, he encourages students to anonymously fill out index cards, dubbed "Mud" cards, at the end of each class, asking questions about anything they found confusing (or "muddy"). Answers to the students' questions are posted on the class website the same day.

"You have to be willing to take questions, because you know you are going to miss the mark sometimes," Murray says. This commitment to learning is not lost on his students. "In all my classes I have never before had a professor that was so dedicated to answering students' questions and making sure that students understood the material," wrote one undergraduate in nominating Murray for the award. Another student called Murray "without a doubt one of the most talented teachers I have ever met."

Murray also served as leader of Team Caltech, the group of abour 50 undergraduates who created "Alice," Caltech's most recent entry in the Defense Advanced Research Projects Agency (DARPA) Grand Challenge autonomous vehicle race through the Southern California desert. In a letter recommending Murray to the Feynman Prize selection committee, Antony Fender, a lecturer in engineering and also a member of Team Caltech, said, "The students involved in this project received an education unlike anything I've ever seen before," adding that they would "carry this experience with them for their entire lives."

Murray says that he was surprised and "very honored" to receive the Feynman award. "I've known many faculty who received it and always looked up to them as being great teachers. It's a

this year. They are Brian Hoffman, PhD, '67, professor of chemistry at Northwestern University; Robert P. Lin '62, professor of physics and director of the Space Sciences Laboratory at UC Berkeley; José Onuchic, PhD '87, codirector, Center for Theoretical Biological Physics, and professor of physics, UC San Diego; and Arthur Riggs, PhD '66, director of the Beckman Research Institute at City of Hope, Duarte, California. big honor to be among them."

ELACHI NAMED ONE OF "AMERICA'S BEST LEADERS"

JPL director Charles Elachi, PhD '71, has been named one of "America's Best Leaders" by U.S. News and World Report and the Center for Public Leadership at Harvard's Kennedy School of Government. He will be profiled, along with 17 other leaders, in a special issue of the magazine later this year. Previous holders of the designation have included Bill and Melinda Gates, Steve Jobs, Oprah Winfrey, Antonio Villaraigosa, and Condoleeza Rice. More details about previous winners can be found at http://www.usnews.com/usaews/news/ articles/051031/31/inrro.htm.

For an up-to-data list of awards and bours bestowed recently upon Caltech faculty and swiff, go to http://tuday.caltech.edu/tuday/on-campus.tel and swoll down to Homos and Awards in the right-band column, as well as to the Archives link in that section.

4 California Institute of Technology . VOLUME 40 No. 2, 2006

CH...CH...CHANGES-CALTECH GRADUATES (AND PRESIDENT) TRACE TIME AT COMMENCEMENT

After nearly a decade as president of Caltech, the Institute's 2006 commencement speaker, David Baltimore, has decided that it's time to open the next chapter, which in his case includes an ambitious bid to help fight the HIV/AIDS pandemic.

"Nine years ago, I came to Caltech as a freshman. Not being as well prepared as the high-school graduates we accept, it has taken me nine years to graduate. Bur J have finally made it as a member of the class of 2006," he told a sea of robed commencement candidates under a glimmery gray and sometimes misty sky. "For me it has been as much of an education as you have received.

"And I have been lucky to have wonderful Techers as reachers," the outgoing president said on June 9, at Caltech's 112th commencement.

He spoke enthusiastically about how Caltech's size made it possible to see the place from all perspectives, including those of students and their parents, as well as of faculty, staff, trustees, vice presidents, and division chairs, and even that of his wife, Alice Huang, faculty associate in biology and senior councilor for external relations. In Caltech, he discovered a plethora of perspectives, "all wrapped into a tidy package. It has been a glorious education, and I thank you all for it. Having learned my lessons, I can now take a place among the educated, as a member of that most wonderful group on campus, the faculty."

Baltimore plans to return to fulltime work as a professor of biology, focusing on teaching and research in his lab. He will be supported by a grant of \$13.9 million from the Bill and Melinda Gates Foundation for his proposal "Engineering Immunity Against HIV and Other Dangerous Pathogens," whichwill attempt to create immunological methods to deal with chronic diseases. Baltimore received the Nobel Prize in Physiology or Medicine in 1975 for his work on the genetic mechanisms of viruses. He received the National Medal of Science in 1999 from President Bill Clinton, and the Warren Alpert Foundation Scientific Prize in 2001 for pioneering work leading to improved cancer therapies. Baltimore was recently named president-elect of the American Association for the Advancement of Science.







cocreator and executive producer of the CBS television program Namb3rs, and actor David Krumboltz, who plays math professor Charlie Eppes. Charlie works at an institution known as CalSci, a fictional name for its inspirarion, Caltech. Said Baltimore, "I never thought I would find myself praising a television program, but Pasadena has brought to America a program that embodies the virtues of mathematically based thinking."

Baltimore contrasted the impassioned, albeit factional, celebration of rigorous thinking and fact-based reasoning portrayed in *Numbirs* with the flawed assumptions he sees in much of today's domestic politics. "An ideology of American hegemony and executive infallibility has ruled, leaving no place for calculating the consequences of actions, for thinking out strategies that respond to likely circumstances, for being prepared for the challenges of the natural world."

An Inconvenient Truth, Al Gore's documentary about global warming, is a reminder of the looming, and long-ignored, environmental problems facing the world, Baltimore added. "With little science advice available to Congress or the president, the 'inconvenient truths' being uncovered by scientists ger little hearing. Inconvenience is truly what truth generates; all scientists know this." The reward, of course, for discovering and acknowledging an inconvenient scientific truth is that it forces scientists to rethink previously unassailable ideas, which in turn leads to enhanced knowledge and deeper understanding. Take the leap that the future offers, Baltimore urged the graduates of 2006. That unknown territory will likely reside outside their comfort zone, but it will lead the way to richer and more meaningful lives.





Caltech, Baltimore told them, they leave "the neck of the hourglass" and enter the wider realm of work and research. Their solid and sophisticated foundation of quantitative skills, he said, must be complemented by an equally important skill set—the ability to communicate.

Goodhue to design the magnificent National Academy building in Washington, and who, of course, built the Yerkes Observatory, the Mount Wilson Observatory, and the [200-inch] Palomar telescope, now known as the Hale Telescope. He lived up to a line attributed to him: 'Never do a small thing when you can carry our a big one." Hale's outsized accomplishments embody the true purpose of education, Baltimore said, which is to release a person's inner self. That great principle is not only a Caltech but also an American tradition, and it provided the inspiration for two of the Institute's quintessential innovators and benefactors-Gordon Moore and Arnold Berkman. "Entrepreneurship is all about risk, and I leave you with one piece of advice: Do not be alraid to take risks." Baltimore welcomed as special com-. mencement guests Cheryl Heaton,

Calrech's new president, Jean-Lou Chameau, rhe current provost at the Georgia Institute of Technology, will take office on or before September 1 (see arricle, page 2).

The class of 2006 includes 247 recipients of the bachelor's degree, with an additional 120 MS and 177 PhD recipients. As they depart from One icon who passed through the midpoint of the hourglass and emerged to take the wider world by storm was George Ellery Hale, whom Baltimore called "Caltech's true father."

"He was a great man of science who focused intently on solar astronomy, but he was also a great man of public affairs, institutions, culture, and aesthetics who convinced Henry Huntington to leave his library to posterity, who convinced the city of Pasadena to build its magnificent city hall, who started the Proceedings of the National Academy of Sciences, who chose Bertram

RHONDA HILLSENS

Friends

there's only **one.caltech**

CAMPAIGN HIGHLIGHTS

New gifts and grants to the "There's only one. Caltech" campaign will support a wide range of new research initiatives in areas ranging from the development of innovative medical therapies to research aimed at deciphering the history of the universe.

A \$10 million gift from the late Dr. Joseph J. Jacobs has helped Caltech to establish the Joseph J. Jacobs Institute for Molecular Engineering for Medicine to develop innovative methodologies for diagnosing and treating disease. David Tirrell, McCollum-Corcoran Professor and chair of the Division of Chemistry and Chemical Engineering, will be the inaugural director of the new institute, which will bring together Caltech scientists and international medical experts to conduct research that has the potential to provide significant improvement in treating human disease.

Industry leader and philanthropist Jacobs was founder and chairman of the board of Pasadena-based Jacobs Engineering Group, Inc., one of the world's largest engineering and construction firms.

The Gordon and Betry Moore Foundation has awarded Caltech grants to underrake new research initiatives in genomics and cosmology. A grant of \$7.9 million has funded the Caltech Proteome Exploration Laboratory. Along with two existing facilities on campus, the lab is designed to make the Institute a world leader in the most advanced technologies for studying human genome products that specify rhe chemistry of life, and for investigating how the genome directs proteins to give rise to an organism. The principal investigator is Raymond Deshaies, professor of biology and a Howard Hughes

in outcome-based projects that will improve the quality of life for future generations. Funding is organized around large-scale initiatives in science, environmental conservation, and the San Francisco Bay Area.

DARYN KOBATA

INSTITUTE RECEIVES GRANT TO START TRAINING PROGRAM IN STEM-CELL RESEARCH

Caltech has been awarded \$2.3 million by the California Institute for Regenerative Medicine (CIRM) to support postdoctoral scholars in the Caltech Stem Cell Biology Training Program. The grant is one of 16, collectively totaling \$12.1 million, awarded by the state stem-cell agency following passage of the Stem Cell Initiative last year.

The program will educate 10 postdoctoral scholars in both stem-cell biology and its potential biomedical applications. In addition to current courses, the Institute will add a bioethics course that emphasizes the social, ethical, and legal issues raised by srem-cell research, and host a new stem-cell seminar and journal club program and an annual symposium. A collaboration with the Keck School of Medicine at USC and Children's Hospital of Los Angeles will provide opportunities for basic scientists to become familiar with clinical stem-cell issues and the potential application of their findings to disease.

"Caltech is already undertaking many stem-cell research projects, and 1 think this will stimulate considerable additional interest," says Paul Patterson, training program director and Biaggini Professor of Biological Sciences. "This is the first step in expanding out efforts in this area." Relevant areas of current campus research include embryonic and adult stem-cell plasticity, stem cells and cancer, embryonic development, imaging technology, tissue engineering and macromolecular fabrication, computational biology, nanoscale biology and chemistry, and the basic science of hematopoietic, muscle, endothelial, and neural stem cells.







The official dedication of the Combined Array for Research in Millimeter-wave Astronomy (CARMA) facility took place on May 5 at Cedar Flat in the Inyo Mountains near Bishop, California, almost 21 years to the day (May 4) after the dedication of its predecessor, the Owens Valley Radio Observatory (OVRO). A joint venture of Caltech, UC Berkeley, the University of Illinois at Urbana-Champaign, and the University of Maryland, CARMA consists of the six 10-meter millimeter-wave telescopes transported from OYRO, along with nine six-meter telescopes from the Berkeley-Illinois-Maryland Association (BIMA) array that have been relocated to the new Cedar Flat location, about 13 miles east of Big Pine, by mountain route. Speaking at the dedication, CARMA director and Rosen Professor of Astronomy An neila Sargent, PhD '77 (shown, above right, officially baptizing the array) hailed the new facility's high, dry location as one that will provide radio astronomers with an extremely clear view of the universe. CARMA's telescopes will investigate interstellar molecular gas and dust clouds that give rise to stars and planetary systems, and will also study planet-forming disks around other stars, nearby galaxies, and galaxies so distant that they must have formed very early in cosmic history. CARMA funding was made possible by the Kenneth and Eileen Norris Foundation, the Gordon and Betty Moore Foundation, and the Associates of Caltech.

AND PARALLEL

Medical Institute investigator.

Supported with a \$5.6 million grant, the Center for Theoretical Cosmology and Physics will study questions related to dark matter, dark energy, and the early universe, drawing on the Institute's wealth of observational cosmology data. Led by Marc Kamionkowski, professor of theoretical physics and astrophysics, the program will unite senior scientists, visiting scholars, and postdoctoral scholars as they investigate fundamental cosmological questions aimed at advancing our understanding of the history of the universe.

Established in 2000, the Gordon and Betty Moore Foundation invests



Associate Professor of Geophysics Mark Simons (right) describes the 2048processor supercomputer in the GPS Parallel Computing Facility to Caltech trustee and Associate Ted Jenkins '65, MS '66, and Associate Kathy Wiltsey. The occasion was an Associates luncheon and tour, showcasing the geological and planetary sciences (GPS) division's Parallel Computing Facility and newly renovated media center. The Institute support group has chosen the GPS supercomputer for its 2006 campaign project. Funded by Dell, Intel, Myricom, and the Fletcher Jones Foundation, the pioneering technology is used to support numerous projects throughout the division, including theoretical seismology and studies of climate change, large-scale terrestrial motions, and planetary atmospheres. To find out more, please contact Arlana Silver, executive director of the Associates, at 626-395-3919. To read more about the facility, go to http://pr.caltech.edu/periodicals/CaltechNews/articles/v37/seismic.html.

6 California Institute of Technology • Volume 45 No. 2, 2006

Firing off on the cannon caper

BY RHONDA HILLBERY

Now safely resting in front of Steele House after its 6,000-mile journey, the Fleming House cannon looks no worse for wear, despite its brief stint as a prisoner of war.

Its April 19 return provided welcome closure to Doyl (Ted) Dickel '07, a physics major who served as official cannon master for two full years.

The duties of the cannon master include trekking around campus to obtain administrative approval signatures before each firing. The cannon master also maintains a large red binder filled with cannon history, lore, and firing protocol.

Most importantly, the cannon master unlocks the breech and then fires the 19th century relic to mark the end of rotation, end of classes, Ditch Day, and the conclusion of commencement (a battery-operated fuse sets off the blank charge to achieve a satisfying bang). In addition, the cannon is fired during certain special events, such as its dramatic return to Caltech in April.

Over a late-afternoon lunch of pizza in Chandler Dining Hall, Ted was happy to talk cannon history. Built in France in 1878, the weapon was intended for use in the Spanish-American War. But by the time it was available for action and had reached Florida, it was obsolete. "The model was discontinued shortly thereafter, when they changed to smokeless powder," says rhe lanky native of South Carolina, speaking rapidly and without a trace of a southern accent. "It was only made for a short period and is a relatively tare model. So it's been hard to get information about it." It was especially hard during those few days after a campus security bulletin documented the cannon's mystetious departure on March 28. The snatchers had apparently taken advantage of its removal to a new, unsecured location in front of Steele House while the South Houses, which include Fleming, were being renovated. Since the cannon vanished close to the anniversary of its hijacking 20 years ago by Harvey Mudd students, the first thought around Caltech was that the same culprits had struck again. In fact, Tom Mannion, assistant vice president for student life, called the dean at Harvey Mudd to try to figure out if he

knew what was going on. "He hadn't heard anything," Mannion recounts. "There was no chatter on his campus."

But soon enough, an anonymous caller assured Caltech security chief Gregg Henderson that the cannon was safe, and that all would soon be revealed. And as the world now knows, the cannon turned up 3,000 miles away on the campus of MIT.

Then it all made sense. MIT had swiped Fleming House's beloved mascot as payback for a raft of recent Caltech-engineered pranks, including





miffed that MIT was able to spirit it away so easily. On April 10, Ted joined the red-shirted Fleming contingent that traveled to Cambridge, Massachusetts, to retrieve it. The red-eye journey was too stressful to be fun. "Nerveracking," is how he describes it. On April 19, the cannon was restored, with a padlock this time, to its temporary home in front of Steele House.

Trustee (and former Flem) Philip Neches '73, PhD '83, on campus at the time for a trustee meeting, was invited to don protective earmuffs and fire the cannon in honor of its return. The resulting explosion touched off a few car alarms in the nearby Holliston Avenue parking garage.

> For the New Jersey– based businessman, it was an opportunity to reprise an important role he had played in the cannon's inaugural firing at Caltech nearly 35 years earlier.

Until its 1972 arrival at Caltech, the cannon had sat for about 45 years in front of Southwestern Academy in San Marino, a former military school. By the late 1960s the weapon was falling into disrepair. The school had changed its mission, and the Vietnam Wat controversy only underscored the sense that the old relic no longer belonged, Neches says. "One individual suggested to Fleming House that perhaps it would be willing to provide it with a new

Reunited, and it feels so good. Members of Fleming House (below, left) push their venerable symbol back into position. Above, cannon master Ted Dickel '07 poses with the antique siege gun after its return to campus. He was part of an honor guard of Flems that flew to Cambridge, Massachusetts, in April to retrieve it from MIT.

the term, Fleming House freshmen showed up with ropes and pulled the thing through the streets of San Marino to campus," Neches recalls.

Once it was delivered, the enthusiastic Techers naturally wanted to see the thing fired. "Being the only Fleming House resident (out of 80 in the House) with a Visa card got me appointed to run to the gun shop, where I bought a pound of black powder."

The rest is history, or at least part of a 3^{1/2}-page typewritten account tucked into the official cannon binder: "Curiosity eventually led Fleming [House] to wonder, 'How loud a noise can we make?' Up until then the 12-poundcapacity breech had never been loaded with more than two pounds of powder, but a 3^{1/2}-pound charge demonstrated just what this machine was capable of. The lowered muzzle aimed at Page [House] didn't help."

The outcome could have been predicted—the blast shattered two glass doors and several windows at Page House.

Since the cannon is inexorably linked to Fleming House, how have other students reacted to all the brouhaha that surrounds the latest cannonnapping?

Says Sean Mattingly, who wrote a humorous piece about the cannon and its retrieval cost in the California Tech, "It's amazing how much Flems get worked up over that cannon." Most students, he says, were amused, not outraged. "People were laughing at Fleming when it got stolen, when it showed up at MIT, and then didn't really care when they brought it back." He admirs, however, that he was happy to see if return. In keeping with tradition, cannon master Ted fired the cannon one last time on Ditch Day 2006 (May 17), when the rights and responsibilities of the job were transferred to Meng Tan '09. The cannon is expected to return to its permanent home along the Olive Walk when the South Houses renovation is completed in early 2007.

the one in 2005, when unsuspecting MIT prefrosh were handed T-shirts that read "MIT" on the front, and on the back "...because not everyone can go to Caltech." During that same event, Caltech students had also altered an MIT sign to read "The Other Institute of Technology."

With the facts finally out, Flems reacted with mixed emotions, relieved that their iconic symbol was found and

home."

Neches, who was a senior at the time, adds, "Southwest Academy was happy to get rid of it, but we didn't tell the freshman Flems that."

Figuring out how to transport an apparatus designed to be conveyed by 17 horses was a challenge, but of course Caltech ingenuity was up to the task. After freeing the wheels from a bed of concrete, the Flems spent weeks building a special dolly to support and help steer the heavy tailpiece. Finally, all was in readiness, and a large contingent dressed in black set out in the dead of night.

"One fine Saturday night, early in

Baker's Dozen

WITH JENIJOY LA BELLE

The early career of Caltech literature professor Jenijoy La Belle reads like a plot from one of those self-referential novels set in academia: As the Sixties draw to a close, a brand new PbD becomes the first female hired on the tenure track by a university that has just begun to admit undergraduate women. Still very much in the minority eight years later at an institution she has come to love, she is denied tenure and decides to challenge the decision. A charge of sex discrimination follows, leading to an investigation, a settlement, and, in 1979, a second tenure review, at which point La Belle did receive tenure and settled into a long career of teaching literature to predominantly math and science students. The author of two books and numerous articles, she wrote a regular column for the Los Angeles Times in the mid-1990s and in recent years has focused her teaching and research on Shakespeare and poetry. In nearly 40 years at the Institute, she's certainly compiled enough material to write her own novel, but says it's more likely to be a memoir. Caltech News editor Heidi Aspaturian served up thirteen questions to one of the Institute's senior bumanities scholars and its longest-serving female professor.

In a 1996 piece that you wrote for the Los Angeles Times, you called teaching "one of the eternal mysteries." What did you mean?

I meant that one is never quite sure how learning takes place. Good teaching stirs the students, and lousy teaching stifles them, but it's hard to say what works and what doesn't. I try to create in my students an awareness of what literature is and what it can give them. But there are days when I feel that I'm just pontificating, and that I'm teaching the subject and not the students. And sometimes the students say nothing, and I can hear them saying nothing. Those are the days when I go back to my office and drip with despair. Other times, somehow I'm able to bring light to the poetry and the prose, and the students are alive, and everything is wonderful. Patience is a great virtue in the classroom. It's taken me a long long time to learn that the way to draw out a snail is not to grasp its horns.

How do you engage Calteeb students, whose main interests are usually elsewhere, in your subject?

I think I starr with the idea that literature can be a kind of liberation—not to be confused with escapism—for our students. That it can offer a whole other way of looking at the universe. Not the material universe, but the human universe—the inner world of the mind. If they can perceive it as an alternative way of thinking about their lives, that's what I think will interest them.

Aside from their obvious intelligence, what do Caltech undergrads bring to the study of literature, and what do they take away from the experience?

What stands out for me is their passion-almost a rage-to excel. The introduc-



would become a scholar and a literary critic, which is what I did. I thought, "I know I can't hope to compete with T. S. Eliot, but if I can't even write as well as the girl sitting next to me, I'd better go into another field." And that girl who sat next to me in class grew up to be Tess Gallagher, the acclaimed poet. So, the moral is: Be careful whom you sit next to.

Do you still write poetry?

I write verse. I wouldn't call it poetry.

Who are a couple of your favorite authors, and are there any you particularly like whom you consider underrated?

I love the Renaissance poets—Sidney, Spenser, Surrey, Suckling, Herbert, and Herrick. Among contemporary writers, I like the novelists Elizabeth Taylor and Elizabeth von Arnim. I love Anita Brookner. All three are stylistically brilliant and have a keen sense of irony. Among underrated writers, Chidiock Tichborne leaps immediately to mind—such a wonderful name. His most famous poem is the "Elegy" he wrote in 1586 in the Tower of London while awaiting execution. He was involved in a plot to assassinate Queen Elizabeth I, and he was publicly disemboweled while he was still alive—the penalty for treason.

Another poet I think is greatly underrated is Edward Young. He belonged to the "graveyard school" of poets, and his 1740 poem "Night Thoughts" was perhaps

Robespierre slept with "Night Thoughts" under his pillow. So do I.

tory humanities courses here are pass/fail, and it would be perfectly easy for students to write mediocre papers and still pass the courses. And they don't. They don't want to just pass. They want to surpass—if "surpass" can be an intransitive verb—and that always amazes me. What I hope they take away from these classes is a larger sense of what it means to be human, a larger sense of the varieties of human experience, and, at least for some of them, an appreciation of aesthetic forms and an awareness that literature can be just as complex and as intellectually demanding as the sciences.

Suppose you had not become a professor-what is your career path not taken?

I grew up thinking I would be a poet—a famous poet, of course. My mother, who was a teacher, brought me up on verse. She started with nursery rhymes and then moved quickly to Blake and Keats and Dickinson and Yeats. And when I went to the University of Washington, I had some wonderful writers as teachers, including the American poet Theodore Roethke and the English poet Henry Reed. But year after year, in verse writing classes, I sat next to a girl named Theresa Bond. And no matter what kind of poem I wrote, hers was better. Also, she had such a store of painful material to write about. She was the oldest of five children, her father was an alcoholic longshoreman, and her family constantly quarreled. For a while, I was actually upset that my parents had given me such an exquisitely happy childhood. So after a few years, and, having at least learned a lot about the craft of poetry, I decided I

reprinted more than any other work in the 18th century. Robespierre slept with "Night Thoughts" under his pillow. So do I. It makes for good, lugubrious reading in the middle of the night.

As a teacher and scholar of Shakespeare, do you have a favorite play?

Othello. It's so beautiful. Each time I read it, I hope it will come out differently.

What do you say these days to people who maintain that Shakespeare couldn't possibly have written his own works? You've written and lectured on this topic.

This is an idea I find so tiresome that I will no longer talk about it at cocktail parties. I think I hear it most from lawyers and retired army colonels. It's gotten to the point where if someone says, "Don't you think so-and-so really wrote Shakespeare's plays?" I will say, "Why, yes. Yes, I do." Because anti-Stratfordians are emotional and completely illogical. It's like listening to someone insist that the earth is flat. There is not a shred of hard evidence against Shakespeare's authorship. Anyone is a noodle who thinks someone other than Shakespeare wrote the plays.

8 California Institute of Technology • VOLUME 40 NO. 2, 2006

Are you interested in science after nearly four decades at Caltech?

The field of science I'm most interested in lately is gerontology, for obvious reasons. But mostly what I've learned from science, I've found out from scientists themselves. What I know about physics, I learned from Richard Feynman. He used to take me to lunch, and he would use the salt and pepper shakers to explain to me the structure of subatomic particles. And I would always feel that for a moment I had a glimmer of understanding. But, of course, what was really exciting and interesting to me was simply watching him, being with him, and being infused with his enthusiasm for his subject. I never saw him in the classroom, but he was always teaching. And being with him inspired me to take that kind of energy back to my own work. I would come back to my classes, and try to translate his zeal for his subject into how I taught and thought about literature.

What was Feynman's take on your subject-literature?

Richard did tell me once that he did not like fiction, because it was not factual. I tried to argue with him that while fiction wasn't factual, it was nevertheless true great literature has its own commitment to reality. But that didn't cut much ice. He did like some poetry. We would read some of William Blake's poetry together. His favorite Blake poem was "Fair Elenor," which may be the worst poem Blake ever wrote.

I'd like to briefly revisit your tenure battle in the 1970s. In 1977, after being denied tenure you filed a complaint with the Equal Employment Opportunity Commission, which, after an investigation, charged the Institute with sex discrimination. The committee that Caltech appointed to look into the matter recommended that you and the Institute settle out of court, so under an agreement you came back, went through another tenure review, and became a tenured professor in 1979. How do you view all this in retrospect? May I start with a comment that you made to The Chronicle of Higher Education in 1970 shortly after joining the Caltech faculty: "In general, it seems to me that women have equal opportunities. . . . I'm not about to throw away my eyelashes or my lingerie,"— I see you have your head down on your desk.

First, that remark is simply—what can I say? I was insufferable. That much is obvious. But I did like my eyelashes. I'd put them on now except that I can't see well enough. All that glue can be such a problem.

Okay, I was clueless. But I didn't then, and I still do not think today, that my tenure issue was exclusively one of discrimination against women. That is what I had to use, because we fight with the weapons we have. The real issue was a division chairman who, in my view, thought he could play fast and loose with the rules. And this subsequently got him into a lot of trouble when he was chancellor of UC Santa Barbara. The main reason that I protested—and I would not have otherwise—was that I always had the complete support of everyone in Caltech's literature department. It was the fact that the division chair dismissed their opinions, and then went about systematically soliciting opinions that supported his own and disregarding those that didn't, that was so troubling. I was young, and I knew I could get another teaching position. But I wanted to stay here. I was near the Huntington Library, which is an incredible resource for scholars in my field. I had friends here; and I loved my job. Why would I have wanted to go somewhere else?

Before all that, I was not a very political creature; quite the reverse. But I had complete faith that it would work out at Caltech because I knew that once people knew the truth about what had gone on, I would prevail. I never felt that everyone at Caltech, or the administration itself, was against me. And by the time it was all over, I had become a feminist. I like to think that I have since become a resource for other women who have come to me when they're facing similar situations. I try to give them the benefit of my experience so that they don't waste a lot of time initially barking up all the wrong trees, like I did. They usually want to keep my involvement a secret, and that's fine. I always try to tell people not to get so depressed over these kinds of issues. It's an adventure—I found it terribly exciting. Don't get defeated by it. Enjoy it. And afterward, don't look back in anger. And never be bitter: it's ruinous to your looks.

Chameau . from page 2

Speaking in an elegant, Frenchacccented English that bore nary a trace of 15 years in Georgia, Chameau said his appointment left him feeling "privileged" and "humbled." "As a person who loves science and technology," he said, "I cannot imagine a better and more exciting opportunity than to serve Caltech at this point of my career. Caltech's commitment to and history of excellence are unequaled. I look forward to working with such an exceptional group of faculty, staff, students, and trustees." He added that it had been a long while, and he expected that it would be again, before he heard himself described as "charming" so often in so short a time.

On that score, however, he spoke too soon: By the end of the day, campus wags were already referring to "Dr. ChaRmeau."

For the faculty and trustee committees who chose Caltech's new president after an exhaustive eight-month nationwide search, it was apparent that the real charm resided in an impressive résumé and compelling personal style. Since 2001, Chameau has served as provost and vice president for academic affairs at Georgia Tech, where he also holds the Hightower Chair in Environmental Technologies and is a Georgia Research Alliance Eminent Scholar in Environmental Technology. Before becoming provost, he spent four years as dean of the university's College of Engineering, the largest in the country, overseeing educational and research programs in nine engineering disciplines.

As Georgia Tech's provost, Chameau has had programmatic, strategic, and financial responsibilities for the academic and research programs of the university. His office has also overseen Georgia Tech's continuing and executive education, economic development, and commercialization programs.

Chameau's Georgia Tech colleagues say that throughout his career there, he has worked tirelessly to establish the university as a worldwide model for interdisciplinary education and research, technology innovation, and entrepreneurship, and to promote these activities as a catalyst for economic development. They praise his commitment to developing multidisciplinary talent in faculty and students, and his successful efforts to create environments that support such activities. In recent years, he has fostered the creation of major complexes for bio-environmental-materials and nanotechnology, facilities that reflect his vision for interdisciplinary "research neighborhoods." Chameau is also known for placing strong emphasis on improving the educational experience of students, increasing diversity, and fostering research, entrepreneurial, and international

opportunities for faculty and students. He has been a strong proponent of programs that have contributed to Georgia Tech's leadership in educating minority students in engineering, and he has actively promoted the recruitment, retention, and promotion of women on the faculty. Georgia Tech colleagues say that he was instrumental in enhancing the university's international profile through the creation of innovative educational and research programs and partnerships around the world, including campuses and programs in Asia and Europe.

Global sustainability has been a leitmotif of Chameau's research, teaching, and administrative career, and he has played a key role in initiatives to educate Georgia Tech students about their role in creating a more prosperous and sustainable society. He led efforts to establish the university's Center for Sustainable Technology, which later became the Institute for Sustainable Technology and Development. Today the Institute promotes educational and research activities that address the global, complex nature of environmental issues and emphasize the linkages between science, technology, society, and the environment.

As part of his responsibilities at Georgia Tech, Chameau has been involved in numerous development activities, leading efforts to secure major donations for the university's endowment. He was also active in state and federal relations and professional organizations such as the U.S. Council on Competitiveness and the Government-University-Industry Research Roundtable.

Born in the French province of Normandy, Chameau received his secondary and undergraduate education in France before coming to Stanford for his PhD. In 1980 he joined the civil engineering faculty at Purdue University, where he subsequently became full professor and head of the geotechnical engineering program. In 1991, he became the director of the School of Civil and Environmental Engineering at Georgia Tech. In 1994–95, he was the president of

Do you ever think of writing about the case?

I've considered making it part of a memoir that I'd like to call *My Unauthorized Autobiography*. I might write that after I retire, which I also often think about. I read just the other day that Cary Grant walked away from the movies at 62. Just walked away. It's always good to know when it's time to do that since we can't possibly know what will happen in the time we have left.

Don't you think that's just as well?

I'm not sure. Sometimes I think if we were all issued with an expiration date, we'd make better use of our time.

Golder Associates, Inc., an international geotechnical consulting company.

Chameau's research interests include sustainable technology; environmental geotechnology; soil dynamics; earthquake engineering; and liquefaction of soils. He was the recipient of a National Science Foundation Presidential Young Investigator Award, the ASCE A. Casagrande Award, and the Rodney Chipp Memorial Award from the Society of Women Engineers.

Caltech's new president is married to Carol Carmichael, senior research scientist with Georgia Tech, and director of the university's Institute for Sustainable Technology and Development. She too is said to be very charming.

HEIDI ASPATURIAN



Infrarednecks . . . from page 3

The telescope made a sweep of the sky every hour, and Soifer's job was to orient the instrument hourly to make sure that it was mapping the proper slice of the heavens. "It was a great experience, working with lots of bright, young, enthusiastic people," Soifer says. "We worked hard. We'd show up at noon and work till 3 a.m., then go to Tiny Naylor's and have breakfast. There was a tremendous amount of excitement, and it was an enormous amount of fun."

Among the most interesting discoveries to emerge from the survey were stars that barely registered at visible wavelengths, but radiated copiously in the infrared. "They were so cool that they were not even red; they were brown," recalled Leighton. These socalled "dark brown stars" turned out to be old stars that were producing dust in their atmospheres and ejecting it into the interstellar medium. Even more interesting than the individual discoveries was their sheer abundance. "Altogether," said Leighton, "we found some tens of thousands of sources. These were a lot more than anybody

thought we would ever come across

The 2.2-micron infrared telescope (above left) was built on the Caltech campus by Gerry Neugebauer and Robert Leighton (left to right, in photo at left) and then brought to the Mt. Wilson Observatory where it was put to use in an unprecedented sky survey. The telescope was eventually sent to the Smithsonian, where it was displayed at the National Air and Space Museum at the museum's lvar-Hazy Center near Dulles Airport outside Washington, D.C.



from 1983 to 1997. It is now on view

physics, emeritus. But by the 1960s, the particle accelerators were putting the cloud chambers out of business. "Cloud chambers were horse and buggy stuff, in a way," Matthews says. "When Fermilab turned on in 1972, one pulse wiped us out."

From his early days growing up in Staten Island, New York, it was clear that Matthews was a born instrument builder. As a kid, he tinkered with Heathkit projects in his basement, and by the time he got to Caltech, he was more than ready, as he says, "to play around" in a more challenging arena. "I wasn't ever interested in being an astronomer," he says, but in 1972, when cloud-chamber research dried up, he went to work for Neugebauer and the infrared-astronomy group, building detectors and other instrumentation for Palomar. Matthews says that he knew Neugebauer a bit, and Cowan may have heard that there was a job available with him, but he doesn't remember exactly who arranged the switch.

By this time, Soifer had abandoned any idea of a career in particle physics and had decided to throw in with astrophysics. He went to graduate school at Cornell, where he was hoping to get involved in radio astronomy, since Cornell had just built a big radio telescope. But he was assigned instead to an astronomer who was helping to launch the burgeoning field of spacebased astronomy. "I learned about what was going on there and got excited about that, exploring the wavelengths that hadn't been observed before," Soifer says. Putting telescopes into space would be particularly important for infrared observations, since much of infrared radiation, particularly at longer wavelengths, is simply absorbed by Earth's atmosphere before it can reach ground-based telescopes. Soifer spent most of his four years at Cornell building instruments that rode rockets into space, gathering infrared data during suborbital flights

that lasted only a few minutes. "No one had done this from space before," Soifer says. Traveling to New Mexico with his first payload, he watched the first launch at the White Sands missile range. "The rockers shor like a buller out of the tower at 5 g's. I thought, There's no way my payload will survive this.' But my advisor had said, 'If it survived the truck drive across the country, it will survive the rocket launch.' And it did." Soifer would analyze the data from one launch while building the payload for the next.

After Cornell and a year as a postdoc at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, he was hired by UC San Diego, where he continued to build instruments and carry out observational work, some of it aboard the Kuiper Airborne Observatory-a Lockheed C-141 transport plane that flew with an infrared telescope. Back at Caltech, his undergraduate mentor, Neugebauer, had just been named chief scientist on the new JPL mission to launch the first orbiting infrared telescope, the Infrared Astronomical Satellite (IRAS). Soifer was now an assistant professor at San Diego, but when Neugebauer invited him to come back to the Institute as senior researcher for both IRAS and ground-based astronomy programs, he

went. "It was a risky move to give up a tenure-track position, but I was young and foolish," Soifer says. (He would be named a Caltech professor in 1989.)

Launched in January 1983, IRAS scanned more than 96 percent of the sky during its 10 months of operation, providing the first view of the infrared universe unencumbered by atmospheric distortions. Encased, as Neugebauer fondly put it, "in a thermos jug filled with liquid helium" (which kept the detectors cold enough to prevent their heat emissions from interfering with infrared observations), the 24-inch telescope was equipped with 62 detectors arranged to look at four different wavelength bands, each keyed to temperature ranges associated with specific astronomical objects or phenomena.

"The detectors were extremely sensirive," Neugebauer told his audience at a 1984 Caltech Warson lecture that presented IRAS's achievements to the public. "If we had IRAS in California and none of Earth's atmosphere in the way, and we threw a baseball up high enough in New York City, we could have detected it."

IRAS didn't find any baseballs up in space (unless you count the six new comets it identified) and, like its ground-based predecessor at Mount Wilson, one of its key achievements

"The Two Micron Survey was a path-breaking work in that it was one of the things that made people understand what infrared astronomy could do-what the potential was," Soifer says. "Until you can look at the sky without prejudice, without bringing in your preconceived notions, you'll miss the importance of looking at the universe at new wavelengths. The survey provided an unbiased and, at that time, unprecedented view of the sky."

While Neugebauer, with Soifer in tow, was launching the infrared-astronomy field up at Mount Wilson, Keith Matthews was down on campus, participating in the end-stages of a different chapter in science-the cloud-chamber era in particle physics. He enjoyed working with Eugene "Bud" Cowan, PhD '48, now a Caltech professor of



The image above, assembled from six months of data taken in 1983 by the Infrared Astronomical Satellite, shows the plane of the Milky Way in the center bright band.

to California Institute of Technology . VORSME 40 No. 8, 2006





"It's a profound and bistorical thing when humans have detected directly the light from a planet orbiting another star," Soifer says.

was to document rhe extraordinary number of infrared objects in the cosmos. It detected about 500,000 infrared sources, twice the number of all previously catalogued astronomical phenomena. "It was the first all-sky infrared survey that probed in the thetmal infrared across the entire galaxy and out to a substantial distance in the universe, revealing phenomena never before seen," says Soifer. Among its highlights, he lists the discovery of ultraluminous infrared galaxies, disks of planetary debris orbiting nearby stats, and some of the best views ever obtained of the early stages of star formation. IRAS also provided unprecedenred images of the Milky Way's galactic center, which is too obscured by gas and dust to be investigated at visible wavelengths; uncovered strong infrared emissions from interacting, or colliding, galaxies; and provided compelling evidence that quasars-the most distant and radiant objects in the universe-are fueled by black holes. "There was such great science," Soifer says. "Almost too much to enumerate." Soifer's primary role in the mission was to organize and oversee the daraprocessing component of the project, which was carried out at the Infrared Processing and Analysis Center, otherwise known as IPAC: a JPL-NASA facility based at Caltech. "We needed to process the data a certain way to find individual infrared sources in the data stream," Soifer says. "It was a complicated and iterative process" that involved building a simulator of the sky survey so the software engineers would know how to handle the data once it actually started coming in. "I was a lot more confident that the data processing would work than that the satellite would work." But both succeeded, and scientists ate still mining the data from the IRAS mission.

Although much of his time was taken up with IPAC, Soifer continued to work with Neugebauer and Matthews on the design and fabrication of new infrared instruments for the Palomat Observatory, as well as carrying out observing runs there. Meanwhile, Matrhews had become well known in the astronomical community as a superb instrument builder, and in 1980 he was the only Caltech scientist named to the design committee of what would eventually become the W. M. Keck Observatory.

Matthews had built an infrared camera for Palomar during 1987 and 1988, and in 1989 he started work on a similar instrument for the Keck, which was then under construction by Caltech and the University of California. Quips Soifer, the coprincipal investigator on the project, "It was my job to keep people off Keith's back. I'd take care of reporting to committees and let Keith build the best possible instrument."

Surprisingly, there were few other teams gearing up at that time to build instruments for the Keck. Marthews's explanation for this is simple: "It was hard work. You didn't get much out of it—just enough money to build the instruments. I was very worried, and I wrote a memo saying we should be careful and make sure that at least one of the instruments is ready before the Mauna Kea, where Soifer and Neugebauer joined him for the first observing run. While his colleagues mapped out the astronomy objectives, Matthews focused on making the balky instrument work.

"I had to pump the vacuum chamber and cool it with liquid helium every day," he says. "I'd get up at 2 p.m., drive up the mountain, pump ir, fill it with liquid helium, stay up there all night for the observing tun, go back down the mountain at 9 a.m. for breakfast, then go to sleep and get up again at 2 p.m. to go back up the mountain to pump it again. It was leaking but it was working. You could do that forever, but eventually I brought it back to Caltech and replaced the leaking piece."

Sensitive enough to detect a candle flame on the moon, the NIRC snapped pictures of what at the time were the most distant known galaxies and quasars in the cosmos. It also revealed that an extremely luminous object discovered by IRAS was actually a quasar hidden behind a galaxy. "This meant that the apparent luminosity was 'magnified,' and so the quasar appeared to be 30 to 100 times greater than its actual luminosity," Soifet says.

In 2001, Matthews installed a second infrared camera on the newly complered Keck II Telescope, which had now joined its twin on Mauna Kea. A more sophisticated imager, NIRC II was designed to work with the Keck's adaptive-optics technology-a kind of corrective lens system that compensates to varying degrees for the atmospheric distortion of starlight, producing images that are 10 to 20 times better than they otherwise would be. In his more than three decades in Calrech's infrared-astronomy group, Matthews has built or upgraded numerous infrared instruments and devices, primarily attached to ground-based optical telescopes. Asked if he has a favorite project, he says, "Not really. Some were more successful than others, but some were a pain, even though they were successful." Almost sounding concerned that his instruments might experience jealous pangs if they deduced that their creator had a favorite, he adds noncommittally, "You get enjoyment out of doing things."

Tom Soifer and Keith Matthews (Keith is the one in the center photo, communing with a dewar in the infrared clean room) have collaborated for nearly 30 years, developing a deep friendship during that time.

part, highly customized to the purpose at hand and frequently one of a kind. "There's no sense in building an oscilloscope," he says. "If you can buy it and it works, you buy it. You modify things to work or do stuff that does the job that hasn't been done. I never build stuff for the fun of building it. I always build stuff for some purpose.

"My bottom line is that I want the instruments to be the most sensitive. I don't want to make a big telescope into a little telescope" by putting on an inferior instrument or one that doesn't take full advantage of the telescope's capabilities. Although he's not officially an academic advisor, Matthews also routinely helps graduate students on their instrumentation projects, from design through the building and operating phases.

Matthews proudly admits that he's considered something of a "dinosaur" in the world of astronomical instrument builders. He hates reporting to committees and, all things being equal, prefers to design and build instruments by himself with minimal outside interference. As a result, he has largely stayed away from space-based astronomy, which typically involves huge budgets, multiple oversight committees, and, of course, those mandatory meetings.

BODY HEAT

In 1984, with IRAS an unqualified success, serious plans got under way to design and launch its successor-a next-generation infrared space telescope dubbed the Space Infrared Telescope Facility (SIRTF). Matthews participared in the early design work, but then, citing obligations to Keck, stepped aside. But Soifer, with his months of IPAC management under his belt, got deeply involved, joining the SIRTF team designing the telescope's infrared spectrograph. By 1990, NASA had designated SIRTF as the highest priority project for the astronomical community and announced plans to lavish \$2 billion on the observatory. But then came the disaster with the Hubble Space Telescope's warped mirror, and the ambitious plans for SIRTF crashed abruptly back to earth. "There was a point in 1992 or 1993

telescope is. It would be very embarrassing to have the telescope just sitting there with norhing to put on it."

As it turned out, Matthews's instrument, the Near Infrared Camera (NIRC), was the only instrument completed when the Keck Observatory began operaring in March 1993, and when a last-minute problem surfaced, it rook all of Marthews's fabled ingenuity and somewhat cranky perfectionism to resolve ir. About a month before the cameta was scheduled to be shipped to Hawaii, he discovered that the tank of liquid helium used for cooling the detector was leaking. He tried to plug the hole with different materials, and at one point a pressure hose gave way, spraying him and his lab with an oily film. With time running out, he brought his detector-leak and all-ro

His instruments are, for the most

Continued on page 14

Alumni Update

THINK GLOBALLY, ACT TO SUPPORT CALTECH, SAYS ASSOCIATION PRESIDENT

With the arrival of Jean-Lou Chameau, a gadzart, I am reminded that we are being implored today to think globally. For a Caltech alumnus, this is old hat, since the first principles we learned and use were discovered outside of the Western Hemisphere, and a whole generation of us became what we are because of Sputnik, with hefty contributions made in between by U.S. immigrants displaced by World War II. In spite of it all, the American Research University in the 21st century is still the envy of the world. There are some uniquely American aspects of that educational enterprise seen from the 'wretched refuse" point of view.

I began writing this piece in early May. The class of 2010 had just sent in their deposits for seats on the bus to frosh camp in September. A couple of weeks later, the class of 2006 donned medieval costume for graduation. In between came Mother's Day and our Reunion Weekend. A gathering of alumni at their alma mater is a celebration, like Mother's Day, that is uniquely American.

Another quintessentially American practice is seeking direct philanthropic and alumni financial support for private universities. Midway through the penultimate year of the "There's only one. Caltech" campaign, it is gratifying to see that it is on schedule and on target, having recently reached the \$1.1 billion mark. In spite of the Caltech Alumni Association's independence, its president and vice president are included *ex officio* in various fund-raising committees. In this connection, I have noticed a few idiosyncrasies.

University alumni associations in the United States are essentially affinity clubs that, I speculate, fulfill a need for many Americans because of our recent ancestral movement to the Western Hemisphere. (The majority of the successful Europeans and Asians never left, of course, since things were good ar home, with nepotism or the class structure sheltering the less able.) The extended family in the Old World was the mother of affinity groups in the New. We can see how this plays out in academia by reflecting on how many alumni regularly declare their allegiance to their colleges and universities by wearing athletic sweatshirts emblazoned with the institutional logo (now a global fashion statement). This public display of one's alma mater has permeated all of our activities: license plates, credit cards, coffee mugs, and those decals that obscure the SUV rear windows with curricula vitae of entire families. The Caltech Alumni Association would like you to demonstrate

your fealty by sending your dues, as well. Remember this the next time you pull on that sweatshirt.

Athletic sweatshirts reflect another uniquely American activity-intercollegiate sports. The relationship between alumni associations and athletics has been studied in depth by James Shulman and William Bowen (president of Princeton, 1972-88, and now president of the Mellon Foundation). Their The Game of Life (Princeton University Press, 2001) noted among "key empirical findings [that]. . . athletes are leaders in large numbers in two specific areas: alumni/ae activities and youth groups This is clearest in the case of alumni/ae leadership." Shulman and Bowen also note that above-average giving rates are observed in three groups: former athletes, high academic achievers, and those who were heavily involved in extracurricular activities as



available), Caltech and MIT are tied at 7th rank, overall. The alumni giving rate for MIT was 12th, with 37 percent, and Caltech's was 23rd, with 32 percent (nota bene, Georgia Tech was 22nd, also at 32 percent). This is all peripheral to the research and educational mission, but as with intercollegiate athletics, one needs only to beat the point spread. They do yield bragging rights.

Only 5 percent separates 12th from 23rd in the alumni giving category that is to say, a difference of 1,000 Caltech alumni. We are about 14 percent under our peak years, which essentially means that about 3,000 alumni have not gotten around to sending in their annual gift lately.

Again, the rate of giving counts, not just the amount. Here is an opportunity to make up the difference, and to finish the "There's only one. Caltech" campaign with a BANG (allusion to



students. Keep in mind that one of the selling points of Caltech is that anyone can take part in sports, since there is no athletic professionalism, and many of us do. So, my fellow alums, as we are also ALL high academic achievers, you Graduating from president to past president of the Alumni Association, Ponzy Lu '64 (far right) poses with fellow CAA board members for 2006–07, From left are Kelly Beatty '73, secretary; Chris Wheeler '78, treasurer; and Bob Kieckhefer '74, vice president. Not pictured: new president—and new mother (May 2006). And Speaking of Caltech Alumni—the CAA initiated two new Honorary members at its annual dinner in June—Dr. William Caton III, (right) chairman of neurosurgery and director of neurosciences at Pasadena's Huntington Hospital, and Dr. Kevin Austin, director of health and counseling services at Caltech. Caton was honored for his work with Caltech premed students at Huntington Hospital; Austin for the physical and emotional support he has provided the Caltech community, particularly its students, since his arrival in 1990.

degrees only. MIT claims 61 total—25 alumni and 14 graduate alumni. (You competitive types will note that the Caltech–MIT scaling in the category of alumni laureates is not 5 but 1.5.) Of Caltech's 207 Distinguished Alumni, 120 have graduate degrees only.

In the past year, as a semipro, I have paid more attention to the solicitations by Caltech and its peers. There is very little to no effort targeted at the PhD alumni. It is true that one would expect them to have greater affinity to their undergraduate institutions. But Caltech is small, with fewer students per class or year than the average high school. One expects the smaller organization to instill more loyalty than would usually be the case-especially in those who have had the memorable experience of completing an advanced degree, to Caltech's standards. The two major benefactors of the Institute, Arnold Beckman and Gordon Moore, were graduate students. Add in the fact that Caltech graduate students represent the desirable "overachieving end" of their respective undergraduate schools. We should be searching for creative ways to more actively engage our graduate alumni.

Are there innovative approaches that go beyond the undergraduate anniversary reunions whose years are pegged to a denominator of 5? MIT has a Matching Fibonacci Challenge. As for Caltech, in a perhaps unique instance of leading by example, Robert Millikan's "last gesture . . . was a bargain [that] he signed with the Forest Lawn Association [for] it . . . to contribute a sum of money to his beloved Caltech for the support of research in return for [the cemetery's] privilege" of having his remains interred there. Hubert Eaton, the founder of Forest Lawn, another cutting-edge institution in Southern California, had as part of his vision the founding of an American Pantheon and needed a Nobel laureate's remains. A fuller version of this story can be found in the 1963 edition of Millikan's The Electron (University of Chicago Press), edited by J. W. Dumond '16, PhD, '29. We have a lot of distinguished faculry and alumni, worthy of any pantheon.

should all be giving at a high rate.

Since we compete in the hide-andseek--the-cannon league, how do we compare with that Other Institute of Technology? Caltech numbers are very similar to MIT's, once the giving data is scaled to account for the fact that our student and alumni numbers are almost exactly one-fifth of MIT's. The two schools' endowment per student is virtually identical, as well as our alumni giving rates (fund-raising professionals compare rates of giving, distinct from amounts).

In September 1999, Caltech was ranked #1 by U.S. News and World Report, and MIT was tanked #3. In that issue of the magazine, we were 6th in alumni giving at 46 percent, with MIT ranked 8th, at 44 percent. In the past year (September 2005, most recent data

2006)—Angie Bealko '96.

the cannon intended). There is also the direct effect that alumni giving rates have on that ephemeral, but highly publicized, U.S. News ranking.

From the MIT Alumni Association Annual Report for 2004–05, one can see that David Baltimore is leading by example. Caltech's president is listed as an MIT donor at the "President's Fund" level, with an annual contribution that works out to between \$1 and \$2 per Caltech student. He was a graduate student at MIT only briefly, in 1960–61.

Looking more closely at the subgroup of high academic achievers, of the 32 Nobel prizes claimed by the *Caltech Catalog*, 17 have been awarded to alumni, of whom 11 have graduate



New Association president Angie Bealko '96 will take over this column in the next issue of Caltech News.



President David Baltimore (third from left) poses with Distinguished Alumni recipients on Seminar Day. From left, Yuh Nung Jan, Lily Jan, Carver Mead, Sean Solomon, and Michael Turner were recipients of Caltech's highest honor. The sixth honoree, George Housner, was unable to attend.

ALUMNI AWARDS, PLANETARY PROJECTIONS HIGHLIGHT SEMINAR DAY

Approximately 1,250 alumni and their guests came to campus for the Alumni Association's 69th Annual Seminar Day, attending lectures, visiting exhibits, and taking tours, all designed to showcase pioneering research under way at the Institute. At the day's general session, Caltech honored five of its graduates with the Distinguished Alumni Award. David Baltimore, officiating at his final Seminar Day as Caltech's president, did the honors, presenting framed certificates and engraved Tiffany pewter bowls to Lily Jan, Yuh Nung Jan, Carver Mead, Sean Solomon, and Michael Turner. The sixth awardee, Caltech's renowned "father" of earthquake engineering, George Housner, was unable to attend, but was later presented with the award at his Pasadena home.

It is no exaggeration to say that tens of thousands of Californians owe their safety and in many cases their lives to research pioneered by George Housner, PhD '41, Caltech's Braun Professor of Engineering, Emeritus. Beginning with his PhD thesis, "An Investigation of the Effects of Earthquakes on Buildings," his research has illuminated the characteristics of destructive ground shaking and has led to widespread improvements in seismic design methods for structures. A member of both the National Academy of Sciences and the National Academy of Engineering, Housner has served on many seismic-related consulting projects and committees, both in the United States and abroad.

Neuroscientists Lily Jan, PhD '74, and her husband, Yuh Nung Jan, PhD '75, both received their master's degrees in physics at Caltech before switching to biology. After earning their doctorates, they did postdoctoral work in the lab of Caltech neuroscientist Seymour Benzer, where they began research on the *Shaker* gene that eventually led to the cloning of the first potassium channel. Moving on to Harvard, they made the key discovery that peptides can function as neurotransmitters. In 1979, the Jans started their own lab at UC San Francisco, where they have carried out groundbreaking research into neural development, with particular emphasis on how neuronal diversity arises during the wiring up of the embryonic nervous system. Today at UCSF, Lily Jan is the Lange Professor of Physiology and Biophysics; Yuh Nung Jan is the Lange Professor of Molecular Physiology.

Carver Mead '56, PhD '60, Caltech's Moore Professor of Engineering and Applied Science, Emerirus, began teaching at the Institute in 1958 and was appointed assistant professor in 1959, before even receiving his PhD. Known internationally for his pioneering work in solid-state electronics and the management of complexity in the design of very large-scale integrated (VLSI) circuits, Mead has written widely, holds numerous patents, and has founded more than 20 companies. While some of his later work has emphasized the construction of silicon models of neural systems, his current focus is on a new approach to problems of electromagnetic theory.

Scan Solomon '66 is director of the department of terrestrial magnetism at the internationally known science research center, the Carnegie Institution of Washington, and principal investigator for the MESSENGER mission, now en route to the planet Mercury. He spent more than 20 years on the faculty of MIT, where he worked on a wide range of problems in earthquake seismology, geodynamics, magmatism, and the geological and geophysical evolution of the terrestrial planets, and served on science teams for the Magellan mission to Venus and the Mars Global Surveyor mission. The National Science Foundation's assistant director for mathematical and physical sciences, and the Rauner Distinguished Service Professor at the University of Chicago, Michael Turner '71 did pioneering interdisciplinary work in cosmology and elementary particles, research that has greatly enlarged our understanding of the earliest moments of cosmic creation. A member of the National Academy of Sciences, Turner has served on and chaired committees for the Department of Energy, NASA, NSF, the American Physical Society, and other organizations. Following the award ceremony, Caltech professor of planetary astronomy Michael Brown presented the day's general session address, focusing on his 2005 discovery of what is being called the sun's 10th planet. Brown discussed his and his colleagues' discovery of 2003 UB313, the largest object found orbiting the sun since the 1846 discovery of Neptune, and the putative 10th planet. He also talked about what constitutes a planer, why conferring "planethood" is difficult, and what he thinks the criteria should be. Basically, he said, in this context, size matters; if it's larger than Pluto, it's a planet. Brown closed the talk with the tantalizing prediction that within the next 15 years, many objects bigger than Pluto are likely to be found in the far reaches of the solar system.

ALUMNI COLLEGE FOCUSES ON RENEWABLE RESOURCES, PLANETARY PRESERVATION

Join fellow alumni and friends of Caltech to examine concerns surrounding the effects of energy production on Earth's environment and natural resources. Take an inside look at how Institute research is defining the issues and offering innovative and viable solutions. The 2006 Alumni College, on the topic of "Energy, Earth, & the Environment," will be held September 15–16 (Friday and Saturday) on the Caltech campus. This year's cross-disciplinary program will feature speakers from the divisions of chemistry and chemical engineering, geological and planetary sciences, humanities and social sciences, and engineering and applied science. Topics for the two-day program include technologies for protecting water resources, breakthroughs in fuel-cell design, and approaches to resolving the tension between environmental protection and economic growth.

Nathan Lewis '77, MS '77, the Institute's Argyros Professor and professor of chemistry, will deliver the keynote address, "Scientific Challenges in Sustainable Energy Technology," an assessment of the technical, political, and economic challenges associated with the widespread adoption of renewable energy technologies.

Space is limited, so mark your calendars. And keep an eye on your mail and on http://alumni.calrech.edu for more details.

NEW IN 2006: HOUSE REUNIONS AT CALTECH

Save the dates Saturday and Sunday, September 16 and 17, for the first-ever Caltech Alumni Association House Reunions. Each year the CAA will invite alumni from two of the undergraduate Houses to participate, while continuing the class year reunions held each May. This year, all Page and Ruddock House alumni are invited to gather on campus to reunite with old friends and meet new ones, and to reminisce, celebrate their unique house traditions, and share other Caltech memories.

Please note that on Friday, September 15 and Saturday, September 16, the Alumni Association will hold its Ninth Annual Alumni College (see above article). So why not attend Alumni College and your House Reunion together for a full weekend of nostalgia, tradition, and learning.

If you or someone you know would like to help plan your reunion, contact Jennifer Schmidt at 626/395-8363 or jennifer@alumni.caltech.edu. For more information visit http://alumni.caltech.edu/reunions/house_reunions.

BASKING IN BAJA

Join us for the next Alumni Travel program June 23-30, 2007, and explore Baja and the Sea of Cortez aboard a private ship. The intimate Sea Voyager is fully equipped with Zodiacs, kayaks, and a convenient swimming platform on the stern. Snorkeling and scuba diving are also available. Whale watch from the deck of our ship, hike uninhabited beaches and desert, observe myriad seabirds, and enjoy the serenity of a sunset beach barbecue. We will be accompanied by Caltech Professor of Geology and Geophysics Joann Stock, who recently returned from a sabbatical at the University of Sonora, in Mexico.

For more information, e-mail travel@alumni.caltech.edu or call 626/395-6592. And visit our travel page at http://alumni.caltech.edu/learning/travel.

NEW CAA BYLAWS

The Alumni Association has updated its bylaws. To request a copy, call 626/395-6592 or email information@alumni.caltech.edu.

This past spring, more than 50 alumni and guests traveled with the Caltech Alumni Association to the Eastern Mediterranean to witness the total solar eclipse that took place on March 29. Accompanied by Caltech planetary scientist Andy Ingersoll, one group of participants also explored the Greek Islands by private ship (shown below), visiting ancient cities at various ports of call throughout the Aegean Sea. The second group toured Turkey, with its spectacular mosques and palaces, and

witnessed the marriage of Bruce Carter, MS '65, PhD '80, and fiancée Kathy Mufich at the Temple of Artemis at Ephesus.



13 Calters News

Infrarednecks . . . from page 11

when the congressional appropriation language explicitly said that no money could be spent on the SIRTF project," recalls Soifer. "NASA was still trying to support our development efforts, so they sent money to JPL to study infrared observatories and were very careful not to label it SIRTF. It was certainly a depressing time. We were really concerned that the project might not survive, and the dedication of the science team was really crucial to continue pushing NASA, Congress, and other government agencies to support it."

SIRTF escaped cancellation, although its budget was slashed from \$2 billion to \$500 million, a move that Soifer thinks reflected NASA's new devotion to its "faster, better, cheaper" mantra. To meet the constraints of the revised budget, the SIRTF designers were supposed to eliminate the telescope's moving parts—all 11 of them—and did eventually succeed in whittling the number down to two.

They also refined the telescope's cooling system, reducing the components to a size "that allowed the mission to be launched on a much smaller rocket," Soifer says. "We came out with something more elegant, clever, and cost effective then what we started with." In 1997, Soifer was named director of the Caltech-based SIRTF Science Center, which operates the science program, dara processing, and public outreach for the telescope.

SIRTF was launched in August 2003 and, in December, just after it went into full operation, it was renamed the Spitzer Space Telescope in honor of astrophysicist Lyman Spitzer Jr., the first person to propose putting a large telescope in space. Somewhat larger than IRAS, at 0.85 meters in size, the telescope is equipped with an infrared



array camera, an infrared spectrograph, and a photometer-camera, and is expected to operate at full sensitivity for three more years.

These days, Spitzer seems to produce a steady stream of discoveries, making more headlines than any other astronomical instrument currently in operation. The observatory recently found the first evidence that materials around a dead star might be the ingredients for forming new planets. It surprised astronomers with the discovery of planet-forming disks around two massive stars whose size was supposed to be inimical to planetary formation. It detected light from what may be the earliest objects in the universe-stars more than 13 billion years in age-and it recorded the first emanations of heat from a planerary body outside our solar system.

"To me, the most exhilarating discovery is measuring that thermal radiation of a planet orbiting another star," says Soifer. "It's a profound and historical thing when humans have detected directly the light from a planet orbiting another star. We never thought we could do this with Spitzer, and it's really a tribute to the quality of the instruments and the observatory that we could make this extremely precise observation.

"A lot of running Spitzer is administrative and there's a lot of management, which are not the kinds of things one generally enjoys," Soifer admits. "But the science is rremendously rewarding. It's gratifying to feel that you're a significant part of what is truly exciting science."

For Soifer, working with Spitzer is not only about watching other scientists have fun. He gets to carry out investigations with the telescope and has used it to study dust-enshrouded galaxies that were formed when the universe was about 1/3 its present age, and that are 1,000 times more luminous than the Milky Way. "We think these are a new class of extragalactic objects which we're trying to understand. Most likely they're quasarlike objects hidden in dust."

These new observations have brought Soifer back together with



new, but the synergy between Neugebauer, Soifer, and Matthews is noteworthy for both its sustained level of productivity and its duration. Although Neugebauer, who retired as professor emeritus in 1998, now lives in Tucson, Arizona, he keeps in close contact with his former colleagues, while Soifer and Marthews stay in touch with each other daily, via phone calls, walks around campus, or coffee klatches at the Red Door Café, or some combination of all three. Before Neugebauer retired, the three of them could usually be spotted lunching together, often with a group of graduate students.

Former graduate students have also benefited from the camaraderie of this infrared troika. "I felt like I was part of a family," says Andrea Ghez, PhD '93, who today is a professor of astronomy at UCLA. "Gerry was like the father advisor, Tom was like the uncle advisor, and Keith taught me how to observe. He's not only a brilliant instrumentalist, but a brilliant observer too."

"I think there is something special about them," says Alycia Weinberger, PhD '98, now on the scientific staff in the Department of Terrestrial Magnetism at the Carnegie Institution of Washington. "The fact that they've gotten along for so many years is really astounding."

Like Ghez, Weinberger says that Matthews was integral to her work. "Keith was essential to any infrared project. He liked to be a little obscure. That may have been part of the teaching process, not showing you all the steps and forcing you to think through things. I still talk to him regularly." And, she adds, Neugebauer set very high standards, which pushed all the graduate students to excel. "He worked long hours and expected the same level of commitment from us. When he was chair of the [PMA] division, he would spend his days running the division, go home for dinner, and then come back to do science at night. We always joked that if he didn't see us at night, he'd

often exhibits a divide between those who build the instruments and those who actually use them. "Typically, there is very much a division between observers and instrument builders," Soifer says. "Most astronomers aren't involved in the process of instrument building and just want to know, 'How can I use the instruments that are available?' Or if they see someone else's instrument, they'll say, 'I want one of those.' Most astronomers take whatever is available to them without trying to envision what's useful."

If the Caltech infrared group is different, it is perhaps because Leighton, who helped start it all with Neugebauer, loved to build instruments, setting a precedent that allowed other instrument builders/observers like Soifer and Matthews to flourish. Soifer, for one, says that his early involvement in instrument building gave him "a deeper appreciation of the importance of new instrumentation and instrumentalists in advancing the field. My background has given me a greater sense than most observers of the value of new technolo-

For all the successes that Neugebauer, Soifer, and Matthews have achieved, there may be a bittersweet ending to their infrared astronomy story.

gies and telescopes in opening new areas of research in astronomy. That is why I enjoy that aspect of astrophysical research so much. A major part of the tension between observers and instrumentalists, in my opinion, is that most observers do not recognize that what they are doing is made possible by superb instrumentalists. This leads to a view that the science is done by the observer, rather than as a collaboration between the instrument and telescope builders and users. "I think that the creation of new instruments is the heart and soul of observational astronomy," Soifer says. "You can't make progress in understanding the universe without building new instruments. Keith is a master instrument builder, but he's also a user. He understands how it all fits together and how it will be used. He has a real breadth of understanding of hardware and what technology can deliver in terms of making measurements and how instruments interact with the telescope."

The Spitzer Space Telescope (above) nearly fell under the budget ax, but since its launch in 2004, it has produced impressive results. The images at the top right of spiral galaxy M51 show several differences between images taken with Kitt Peak National Observatory's 2. I-meter optical telescope, and Spitzer Space Telescope's infrared array camera. The Spitzer image reveals unusual structures bridging the gaps between the spiral arms.

Matthews to build a new instrument for the Keck—a near-infrared echelle spectrometer, which will look at the spectra of those unusual extragalactic objects. "Spitzer gave us some information, but the new instrument will answer other questions, like what causes this huge amount of energy to be generated," Soifer says. "We hope to diagnose the internal physical processes in the objects by finding various spectral features that are characteristic of either bursts of star formation or AGN [active galactic nuclei, thought to usually involve black holes] power sources." Soifer says he expects the instrument to be operational before another year is out.

THE THREE AMIGOS

Scientific collaborations are nothing

assume that we hadn't been there the whole day."

Neugebauer says that the reason that he, Soifer, and Matthews have worked so compatibly for so many years is that they have approached science in the same way. "I think the thing we have in common is that we all have the same attitude to what is 'good' science and how to do it versus what is 'bad' science and a waste of time." Asked to explain, he says, "This is very subjective, and the reason Tom, Keith, and I get along is that we agree on what's important without having to spell it out. Basically, it's the goal to represent scientific data truthfully and to get the most out of it without embellishing it."

Their relationship is also marked by a level of mutual appreciation that is somewhat rare in astronomy, which

Continued on page 18 . . .

14 California Institute of Technology . Volume 40 No. 2, 2006

Alumni

Notes

1940

George R. Brown, of Midland, Texas, writes that he has visited some little-known places in West Texas. One, the Horsehead Crossing of the Pecos rivers, is where "cattle were driven from Texas to New Mexico both before and after the Civil War. No marker or identification was placed on the east side of the river but a granite boulder was placed on the west side," which, Brown reports, "the 'old' timers say is mislocated." He adds that "the Butterfield Overland Stage Route (St. Louis to San Francisco) was well known but I was quite surprised to find that the route went through the Horsehead Crossing just before the Civil War."

Robert Cox is still in business at the age of 88, having owned Lauderdale Marina for 58 years now, but he has left politics. Though still a registered Professional Engineer, most of his consulting is done for his business. He started a new boat-building company in New York last year, and built a new wine and spirits store in Chaumont, New York, in a historic building originally constructed in 1872. He reports that the antique-boat museum he started 40 years ago in Clayton, New York, is doing fine. He adds that he is "working on making 100."

Victor Wouk, MS, PhD '42, has been named posthumously the recipient of the 2005 Sperry Award "in recognition of his work developing hybrid vehicles." Unique in that it is the only transportation engineering honor presented jointly by six professional engineering societies, the Sperry Award includes a medal and certificate as well as a commemorative award booklet. The award "was established in 1955 to commemorate the life of Elmer A. Sperry, whose many inventions-including the gyroscope, the first electric automobile, and air and sea navigarional aids-contributed to the advancement of many modes of transportation," and it "is given in recognition of a distinguished engineering contribution which, through application, proved in actual service, has advanced the art of transportation."

1943

Ray W. Clough, MS, a professor emeritus in civil and environmental engineering at UC Berkeley, has been chosen by the Franklin Institute, a science museum based in Philadelphia, to receive a 2006 Benjamin Franklin Medal. His medal, in civil engineering, is "for revolutionand will also support student scholarships. Dickinson spent 40 years with Texaco as an engineer and executive.

Henry L. Richter, PhD '56, of Palm Springs, California, writes: "I suddenly have an exhibit in the new Smithsonian Air and Space Museum. My wife and I were driving from D.C. to Lynchburg and decided to stop by the new Air and Space Museum near Dulles Airport. We did not have a lot of time so took a quick swing, particularly around the Space Shuttle area." They noticed a small display case behind the Shuttle where some Explorer items were on display. "WERE WE SURPRISED on the backside of the case to see the Explorer I flight spare transmitter on display, with a nice card with my name on it (wrong middle initial)." He rescued it from the trash while he was still at JPL in the late '50s, and it sat in his junk box in his garage for years. "I offered it to JPL, but Dr. Pickering said that it was a national artifact, and thus belonged to the Smithsonian." Richter offered it to them, but they said they had to get permission from NASA before accepting it. After months of paperwork, they said OK. Richter restored it-he says that the batteries were badly corroded-and sent it to them. "I presumed it would sit in some basement archive, but what a surprise to see it on display!"

1956

Raymond L. Orbach, director of the Office of Science at the Department of Energy, has been selected by President Bush to be Under Secretary for Science at the Department of Energy. Orbach previously served as chancellor of UC Riverside for 10 years, and prior to that was provost of the College of Letters and Science at UCLA. He received his PhD from UC Berkeley.

1960

Leroy Hood, PhD '68, president and cofounder of the Institute for Systems Biology, has joined the scientific advisory board of Lumera Corporation, a nanotechnology company. Recognized for his work in molecular biotechnology and genomics, including his role in the Human Genome Project, Hood holds numerous patents and awards for his scientific breakthroughs, has published more than 600 peer-reviewed papers, and has coauthored textbooks in biochemistry, immunology, molecular biology, and genetics. The recipient of an MD from Johns Hopkins University in 1964, he served as a professor at tion, "Sketchpad: A Man Machine Graphical Communication System," represented a groundbreaking interactive computer-aided design system. Sutherland joined Calteeh as a professor of computer science in 1976, and in 1980 he became a vice president of the consulting firm Sutherland, Sproull and Associates, which Sun Microsystems acquired in 1990 to form the basis of its research lab. Sutherland's many awards include the ACM Turing Award (1988), the IEEE Emanuel R. Piore Award (1986), and the IEEE John von Neumann Medal (1998). He is a fellow of both the National Academy of Sciences and the National Academy of Engineering.

1961

Rick A. Foster writes: "Having drifted from mathematics to the theater thirty-some years ago and become a not-quite starving playwright, I am now completing the circle, sort of, with my new play *The Starry Messenger*, about Galileo. My company, Duende: Drama & Literature, will begin touring this play to schools in Central California in October. More about my recent work can be found on our website www.duendedrama.org."

1962

Stanley Flatté, professor of physics, emeritus, at UC Santa Cruz, has been honored by a colloquium, organized by the department of physics for May 11. Scheduled speakers discussed Flatté's contributions to particle physics, to seismology, and to ocean acoustics. A fellow of the American Physical Society, the Acoustical Society of America, the Optical Society of America, and the American Association for the Advancement of Science, Flatté joined the UCSC faculty in 1971. He received his PhD in physics from UC Berkeley. Daniel Romm reports that he has been included in Who's Who in America, 2006 Platinum Edition. He has a new book, Things Your Bridge Teacher Won's Tell You, coming out in July from Master Point Press. His previous book was A Grain of Salt.

1965

Douglas Beder, PhD, of Vancouver, British Columbia, has joined the board of directors of Current Technology Corporation. A professor emeritus in the University of British Columbia's department of physics and astronomy, Beder has been a consultant to Current Technology since 1991. His past research appointments have included the Los Alamos National Laboratory; the Lawrence Radiation Laboratory in Berkeley, California; and the European Center for Nuclear Research in Geneva, Switzerland. At the University of British Columbia, his research and academic responsibilities included serving as Faculty of Science Coordinator for the University Industry Liaison Office.

James J. Duderstadt, MS, PhD '68, former president of the University of Michigan, has been appointed by the University of California regents to a committee for improving the regents' oversight of the university system's execurive compensation practices. The regents have been under pressure from faculty and legislators to justify pay and benefits to administrators. The committee will include academicians, business executives, and former legislators.

Li-San Hwang, PhD, is chairman, president, and CEO of Tetra Tech Inc., which has been awarded a five-year \$50 million indefinitedelivery/indefinite-quantity contract from the Environmental Protection Agency to perform scientific, technical, research, engineering, and

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izing engineering and scientific computation, and engineering design methods." He and his fellow recipients were honored at a dinner at the institute on April 27.

1952

Richard R. Dickinson and his wife, Barbara, have donated \$400,000 to the Collin County Community College District to establish the Florence Marie Dickinson Endowed Chair in Nursing at the Central Park Campus, in McKinney, Texas. The gift is in memory of his mother. "She was a very, very dedicated nurse and I just thought this would be something she would have liked," Dickinson said. "My mother had a pretty strenuous childhood." (Her Swedish-immigrant parents died when she was young, and she spent much of her childhood as an orphan.) According to the college, the endowment will "further the attraction and retention of a highly qualified nursing faculty" Caltech from 1970 to 1992 and as chair of the Division of Biology from 1980 to 1989. He is currently a visiting associate in biology.

Ivan Sutherland, MS, vice president and fellow at Sun Microsystems, has received the 2005 Computer History Museum Fellow Award from the Computer History Museum in Mountain View, California. The presentation of the award took place on October 18, and the festivities included a talk on the link between research and fun by Sutherland at the museum's Hahn Auditorium on October 19. Sutherland, who received the honor in recognition of his Sketchpad computer-aided design system and for his contributions to computer graphics and education, believes that "research is fun! Like a team sport, the hunt for new knowledge brings purpose, comradeship, conversation, competition, and appreciation." After earning his MS at Caltech, Sutherland went on to receive a PhD in electrical engineering from MIT. His disserta-

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15 Callech News

modeling support (STREAMS). Awarded in various forms to Tetra Tech five consecutive times, the contract will involve conducting laboratory and pilot-scale studies, modeling development and verification, and technical research, and will study contaminated sediments and soils, endocrine disrupting compounds, confined animal feedlot operations, biosolids and wastewater treatment, ecosystem restoration, watershed stressors, brownfields revitalization, sustainability, and groundwater.

1966

James Roger Angel, MS, has been selected by the American Astronomical Society to receive the 2006 Joseph Weber Award for Astronomical Instrumentation "for his superlative work spanning two decades on the development of a new generation of large telescopes, his establishment of the Steward Observatory Mirror Lab, and a host of extraordinary conceptual ideas that have been turned into practical engineering solutions for astronomy." Presented annually since 2002, the award consists of \$2,500 and a certificate. A Regents' Professor at the University of Arizona who is on the faculty of the university's astronomy department and College of Optical Sciences, Angel is the director of the Steward Observatory Mirror Laboratory and the Center for Astronomical Adaptive Optics. Angel is a member of the National Academy of Sciences, a MacArthur Fellow, and a Fellow of the Royal Society. He received his doctorate from Oxford University in 1967, then taught physics and worked in X-ray astronomy for six years at Columbia University. He joined the University of Arizona in 1974.

1971

Rena Bizios, MS, has been named a Peter T. Flawn Distinguished Professor of Biomedical Engineering at the University of Texas at San Antonio (UTSA). She is one of two winners of the 2005-06 Peter T. Flawn Distinguished Professorships, which are the namesake of the UTSA president who served from 1973 to 1977 and are awarded to faculty considered to "epitomize the best qualities of the UT System and higher education in Texas. The recipient of several honors retated to engineering and biomaterials science, Bizios has established three patents, published nearly a hundred journal articles, and submitted and presented papers at conferences worldwide. She has served on the editorial boards of five bioscience journals and on the Committee of Examiners for the GRE Engineering Test. Bizios received her PhD in biomedical engineering from MIT.

Terrence M. Morris, MS, has joined the board



A FISHY STORY. Anthony Gharrett (above) '67, professor of fisheries at the University of Alaska Fairbanks (UAF), has received the research award that is one part of UAF's tripartite 2006 Emil Usibelli Distinguished Teaching, Research, and Public Service awards. During his three decades on the Alaska faculty, Gharrett has focused his research on Alaska fish, primarily salmon and rockfish, and genetic markers within their populations. The award, which includes a \$10,000 prize, recognizes Gharrett both as an international leader in his field of genetics and an outstanding mentor to students.

ceremonies, in recognition of his outstanding achievements. A fellow of the American Physical Society and the American Academy of Arts and Sciences and a member of the National Academy of Sciences, Turner received his doctorate in physics from Stanford University in 1978. His research focuses on the earliest moments of the universe, and he is regarded as an important contributor to inflationary universe theory, to Big Bang nucleosynthesis theory, and to our understanding of dark energy and how galaxies and larger structures formed.

1973

Pierre H. Jungels, PhD, former chief execurive officer of Enterprise Oil PLC, has been appointed a director of Baker Hughes Incorporated, which provides drilling, formation evaluation, and other products and services to the oil and gas industry worldwide. Jungels will serve on the compensation and finance committees. A Chartered Engineer, he served until December 2003 as president of the Institute of Petroleum, and from 1996 through 2001 as a director and chief executive officer of Enterprise Oil, one of the largest independent European oil companies at the time. Prior to that, he worked in a variety of positions in the oil and gas industry. Jungels is also a director of Woodside Petroleum Ltd. and of Imperial Tobacco Group PLC. The recipient in 1989 of an Honorary Commander of the British Empire (CBE), he resides in Newbury, England.

of science and writing and senior lecturer in physics at MIT, and has headed the Program in Writing and Humanistic Studies there. He is currently an adjunct professor of humanities.

1974

Michael Hunkapiller, PhD, has joined the board of directors of NuGEN Technologies, a privately held company that develops and commercializes amplification and detection systems for genomic and proteomic research. A partner in the venture-investing firm Alloy Ventures since 2004, Hunkapiller spent the previous 21 years at Applied Biosystems (ABI)-a company that supplies instrument and reagent systems for life science research-which during his tenure grew from a start-up to almost \$2 billion in annual revenues. At ABI, he held several positions, most recently as president and general manager, and he helped found ABI's sister company Celera Genomics and served as senior vice president of Applera Corporation (their parent company). A former senior research fellow at Caltech, Hunkapiller during his career has authored more than 100 scientific publications and has served on the editorial boards of several journals. He is an inventor on more than two dozen patents.

1975

Paul Goodson has been appointed senior director, investor relations, for XOMA Ltd., a biopharmaceutical company in therapeutic antibodies. With more than 20 years of investor-relations and general-management experience, Goodson comes to XOMA from Shareholder Value Partners, an investor-relations and management-consulting firm he founded in 2003. Prior to that he served as vice president of investor relations at Invitrogen Corporation, and earlier as president of two research and development firms. After graduating from Caltech, Goodson received an MS in chemical engineering from the University of Wisconsin and an MBA from UCLA.

1976

Howard Bubb has been appointed to the board of directors of Kasenna, the IPTV Company, "a leading provider of video-on-demand (VOD) content and MPEG-4 ready IPTV applications for Triple Play services over broadband networks." Bubb, who is chairman and chief executive officer of Ambric, an early-stage start-up specializing in semiconductor development and design, has held previous executive positions at Intel Corporation, Dialogic, and Lexar.

1977

1978

Dwight Decker, PhD, chairman and chief executive of Conexant Systems Inc., a Newport Beach maker of chips for broadband devices, has also assumed the role of president. He will oversee the general managers of Conexant's four business groups, as well as its president of operations in India.

Phil Engelauf has been appointed NASA's

new chief flight director and will oversee the space shuttle and International Space Station missions as well as plans for missions to the moon and Mars: A flight director since 1990, he has led flight-control teams for 29 space shurtle missions, of which he was the lead flight director for 11. He was lead of the space shurtle flight-director ream for three years before being promoted to deputy chief of the Flight Director Office in March 2005. Before becoming a flight director, he worked as a flight planner in the Mission Control Center, beginning with STS-4 in 1982. He had transferred to the Johnson Space Center that same year after beginning his career with NASA at the Ames Research Center in Sunnyvale, California, in 1978. He received the NASA Distinguished Service Medal, the agency's highest honor, in 2004 in recognition of his having supported more missions as lead flight director than any other flight director throughout NASA's history of human spaceflight.

1979

Liew-Chuang Chiu, MS '80, PhD '83, who joined Optical Communication Products Inc. in 2005 as director of manufacturing, has been promoted to vice president of manufacturing. Prior to joining OCP, Chiu served for a year as director of operations at JDS Uniphase Corporation. From 1998 to 2004, he held the position of vice president of operations at E2O, a fiberoptic subsystems company that JDS acquired in 2004. Earlier be had served as manager of research and development with Hewlett-Packard's components operation in Singapore. OCP designs, manufactures, and sells fiber-optic subsystems and modules for metropolitan, local, and storage area networks.

Anna Slomovic, a privacy issues expert, has joined Revolution Health Group as chief privacy officer; she will oversee data protection and privacy practices. She previously served as chief privacy officer and senior privacy strategist at SRA International, a provider of technology and consulting services in the national-security, health-care, and public-health arenas, and prior to that she managed privacy issues at ValueOptions, a behavioral health-care management company owned by FHC Health Systems. Slomovic has a PhD in public-policy analysis from the RAND Graduate School and an MBA from Loyola Marymount University.

of directors of Natural Health Trends Corporation, an international direct-selling company operating in more than 30 markets throughout Asia, North America, Eastern Europe, and Latin America. A general partner at Morningside Ventures, Morris serves as the firm's president and managing director and directs its private venture capital portfolio. Prior to Morningside, he worked at IBM's Warson Research Center, Baxter Healthcare, the Boston Consulting Group, and Bay Partners, and he is a current or past member of the boards of directors of Family Education Network, Variagenics, Eurona Medical AB, Cell Therapeutics, and Dendreon. Mortis is a graduate of the Harvard Business School.

Michael S. Turner, Rauner Distinguished Service Professor at the University of Chicago and assistant director of the National Science Foundation for Mathematical and Physical Sciences, received an honorary degree from Michigan State University during its fall commencement Alan Lightman, MS, PhD '74, has been selected by Sigma Xi, the Scientific Research Society, to receive the 2006 John P. McGovern Science and Society Award, presented annually since 1984 "for contributions to science and society." The award consists of a medal and \$4,000. A physicist, novelist, and essayist, Lightman has served on the faculty at Harvard University, and from 1979 to 1989 was a research scientist at the Harvard-Smithsonian Center for Astrophysics. His essays about science, as well as short fiction and reviews, have appeared in many publications, including Harper's, the New Yorker, Smithsonian, Discover, Nature, and the New York Times. His books include The Diagnosis, Rennion, A Seme of the Mysterious, and The Discoveries, and his 1993 povel, Einstein's Dreams, was an international best seller. He has served as professor

Beatriz V. Infante, MS, has been appointed CEO of VoiceObjects, "the worldwide leader in Voice Application Management Systems." She will also take a sear on the company's board of directors. She has served in executive positions at Sychron, Aspect Communications, and Oracle Corporation, and she is currently on the boards of Netli and of Joint Venture Silicon Valley Network, as well as on the advisory board to the Princeton University School of Engineering.

Jay Puri, MS, has joined NVIDIA Corporation as senior vice president of worldwide sales. Puri spent 22 years at Sun Microsystems, where he held positions in sales, marketing, and general management. He has also held marketing, management-consulting, and product-development positions at Hewlett-Packard, Booz Allen & Hamilton, and Texas Instruments. Considered the worldwide leader in programmable graphics processor technologies, NVIDIA is headquartered in Santa Clara, California.

1984

Stuart E. Goodnick has been appointed vice president of professional services and support by Liquid Machines Inc., a firm specializing in enterprise rights management. He will oversee professional services, custom consulting, and solution implementation services. Goodnick joined Liquid Machines in 2004 as part of that company's acquisition of Omniva Policy Systems, and has been serving as director of technical services. With more than 18 years of experience in engineering and operational management, he has held executive positions at Omniva Policy Systems and with the Compumotor division of Parker Hannifin. Goodnick earned his MS in physics at UC Santa Cruz.

1985

Richard Gilbrech, MS, PhD '91, has been named director of NASA's Stennis Space Center. Gilbrech has served as deputy director of NASA's Langley Research Center and of NASA's Engineering Safety Center. He started his career at Stennis in 1991, and he has worked at the Johnson Space Flight Center's White Sands Facility, the Marshall Space Flight Center, and the Glenn Research Center.

John Platt, MS, PhD '89, a senior researcher at Microsoft, has received an Academy Award for technical achievement. He shared the award with University of Toronto professor Demetri Terzopoulos for techniques they developed in the 1980s that make computer-simulated cloth look and move like the real thing. Accepting the award at the technical and scientific ceremony that preceded the televised Oscar ceremony, Platt received a laugh from the audience by thanking Rachel McAdams, the actress hosting the ceremony, for reducing his "Kevin Bacon number" to three, a reference to the tongue-incheek game in which people determine their "degree of separation" from the actor. In fact, Platt did the work when he was a grad student at Caltech: he and Terzopoulos developed an algorithm, based on real-world physics, that simulated cloth with unprecedented accuracy. Platt joined Microsoft in 1997 and is currently manager of Microsoft Research's Knowledge Tools Group.

1986

William J. Dally, PhD, Bell Professor of Computer Science and Electrical Engineering and chairman of the computer science department at Stanford University, has been named a new independent member of PortalPlayer Inc.'s board of directors. A fellow of the Institute of Electrical and Electronics Engineers (IEEE) and the Association for Computing Machinery (ACM), Dally's numerous honors include the IEEE Seymour Cray Award and the ACM Maurice Wilkes Award. He currently heads projects on highspeed signaling, computer architecture, network architecture, and programming systems, and he is an author of the textbooks Digital Systems Engineering and Principles and Practices of Interconnection Networks. He has published more than 170 papers. Prior to joining Stanford in 1997. he was a professor at MIT for 11 years. He also cofounded Velio Communications, a provider of high-speed interconnect and switch fabric that

YOU SPEND YOUR LIFE HELPING OTHERS HAVE A FUTURE. WE SPEND OURS HELPING YOU HAVE ONE.

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FINANCIAL SERVICES

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was acquired by LSI Logic in 2004, and Stream Processors Inc., a semiconductor company providing high-performance signal and image processors. PortalPlayer develops semiconductor, firmware, and software platforms for portable multimedia products such as personal media players and notebook computers enabling secondary display.

Taylor W. Lawrence has been appointed by the Raytheon Company as vice president, engineering, technology and mission assurance, effective April 10. He comes to Raytheon from Northrop Grumman, which he joined in 1999 as vice president, products and technology, for the company's Systems Development and Technology Division; he was promoted to sector vice president and general manager of that division in 2001, and was appointed sector vice president and general manager for the Electronic Systems Division in 2004. Before joining Northrop Grumman, Lawrence held a variety of scientific and research leadership positions in both government and industry. He serves on the board of directors of the Air Force Studies Board of the National Academies, is an advisor to the Defense Science Board and Defense Policy Board, and is a lifetime member of the American Institute of Aeronautics and Astronautics. Lawrence received his PhD in applied physics from Stanford in 1992, and he was honored in 1996 with the Secretary of Defense Medal for Meritorious Civilian Service.

Sandra L. Lee writes: "Life is wonderful. Everything has changed. In November 2005, I married Ken Silbernagel, and in April, I moved to the Okanagan Valley, British Columbia, Canada. After 13 years in ful-time massage practice, I am now doing new bealing work. I am a Certified Healing Codes Coach. This is an incredibly effective healing modality that people do for themselves. So much of my work is by telephone. I work with Ziquin Educational Group's extraordinarily effective nutritional products. With this combination, I feel like 1 have found the answer for healing. I am speaking before larger groups of people, and making a bigger difference. Now, here's something for you. Breather."

Daniel E. Loob reports that he is still working in Statistical Arbitrage at Susquehanna International Group. In what he calls his nonexistent spare time, he is also part of a group working on a new nonprofit volunteer-based online community newspaper, *The Philadelphia Jewish Voice* (http://www.pjvoice.com). He can be reached at publisher@pjvoice.com. His family is expecting its fourth child. "Helen and I, Gabby, Jonathan and Benjamin can't wait!"

1987

Rosemary Macedo has been elected executive director of the Thomas J. Watson Fellowship, a program of the Thomas J. Watson Foundation. The directorship rotates among former fellows, with each term lasting two or three years. Macedo, who will be based in New York, takes over on July 1. Until March she had served as senior vice president at Bailard Inc., where she created and managed domestic, global, and international equity strategies, for the past 11 years managing the company's international equity mutual fund, which covers more than 50 countries. Her research has been published in numerous financial journals and as chapters in investment books.

Robert M. Waymouth, PhD, Swain Professor in Chemistry at Stanford University, has been named the Stanford Friends University Fellow in Undergraduate Education, one of the fifth and final group of Bass University Fellows in Undergraduate Education. Nine university professors have been chosen for the fellowship, "which recognizes exceptional commitment to teaching and mentoring undergraduate students." A major initiative of the \$1 billion Campaign for Undergraduate Education, the program is named in recognition of Anne T. and Robert M. Bass, Stanford MBA '74. Fellowship appointments are for five years.

1990

David B. Kirk, MS, PhD '93, chief scientist at NVIDIA Corporation, has been elected to the National Academy of Engineering in recognition of his role in bringing high-performance graphics to personal computers. "Among the highest professional distinctions accorded to an engineer," academy membership "honors those who have made outstanding contributions" to engineering. According to NVIDIA, Kirk "is the inventor of 50 patents, patent applications, and articles relating to graphics design and has published more than 50 articles on graphics technology." In 2002 he received the SIGGRAPH Computer Graphics Achievement Award. Considered the worldwide leader in programmable graphics processor technologies, NVIDIA is beadquartered in Santa Clara, California.

1992

Bonnie Wallace and Kevin Archie welcomed the arrival of Fiona Skye Archie Wallace on January 20, 2006. "She's happy and growing and very interested in learning how to sit."

1994

Jason T. Lee reports that he has finally completed eight years of postgraduate surgical training, having spent six years in general surgery at Harbor-UCLA Medical Center and two years in vascular and endovascular surgery at Stanford University Medical Center. He will now join the faculty at Stanford University School of Medicine as an assistant professor of surgery and will serve as chief of vascular surgery at the Veterans Affairs hospital in Palo Alto, California. His research interests will focus on minimally invasive approaches to ancurysm diseases of the moting visual arts in general." They now offer a line of T-shirts featuring art-related quotations. and their products "have received a considerable amount of attention from art educators," The company offers custom designs for fund-raisers and other promotions, and can be contacted at http://artoutoftheframe.com. "We currently offer quotes from a diverse group of artists including Andy Warhol, Vincent van Gogh, Marc Chagall, Pablo Picasso, Rene Matisse, Wassily Kandinsky and many other influential artists. The quotations focus on art and how it relates to life. For example, the Marc Chagall quote reads, 'Great art picks up where nature ends." The website provides short biographical sketches for each artist quoted, highlighting some of the more interesting aspects of each artist's life, plus links to more complete biographies.

Keith Kuwata, PhD, associate professor in the chemistry department of Macalester College in St. Paul, Minnesota, has been granted tenure status. A physical chemist with a background in laser spectroscopy and atmospheric chemistry, Kuwata has been teaching at Macalester since 2000. His research involves the use of both quantum chemistry and statistical rate theory to unravel the mechanisms of reactions in the atmosphere, with a particular interest in studying the tole of ozone in the production of OH radicals. Several of his numerous publications include Macalester student coauthors, and he has received grants from the American Chemical Society's Petroleum Research Fund and the National Science Foundation.

Hilla Shaviv has been appointed product manager by MIV Therapeurics subsidiary SagaX, whose Aortic Embolic Protection Device is being developed to reduce stroke occurrence following heart surgery. Shaviv received an MSc in biomedical engineering from Tel Aviv University, and she has specialized in the cardiovascular system and the mechanics of blood flow. During her work at Caltech she designed and constructed a novel, feedback-controlled, valveless heart-assist device, and as an R&D engineer at Biometrix she managed the development of novel medical equipment, from concept to prototype. MIV Therapeutics Inc. is a developer of biocompatible coatings and advanced drug-delivery systems for cardiovascular stents and other implantable medical devices.

2001

James Cooley married Rebecca Edson in Boston on January 28. The wedding and reception were held at the Cyclorama, Boston Center for the Arts. Edson received her bachelor's in architecture from the University of Virginia, is studying for her master's in architecture at MIT, and is due to graduate in 2007. Cooley is studying at Princeton for his doctorate in aerospace engineering. The couple spent their honeymoon in Vermont and resides in Cambridge, Massachusetts.

Infrarednecks . . . from page 14

Matthews, who says that Soifer has been his constant sounding board and has made invaluable contributions to many of his instruments, sums up the situation rather succinctly: "Without being able to measure things, astronomy is like religion. Astronomy isn't science unless you observe. It's speculation. I concentrated on instruments, which is astronomy too. I think it was [UCLA astronomer Lawrence] Aller who once said, 'The telescope should get the medals.'"

Characteristically, Matthews also has his own take on the distinction between observers and astronomers, saying, "I'm a plumber, I'm not a high priest." While he enjoys building instruments, he also likes the more immediate gratification that comes from observing by coming up with "techniques to measure things that are hard to measure" or are unknown.

For all the successes that Neugebauer, Soifer, and Matthews have achieved, there may be a bittersweet ending to their infrared astronomy story, in that the research environment that made their collaborations so fruitful appears to be going the way of cloud-chamber physics. In a sense, infrared astronomy has become a casualty of its own success—so popular that it is now dominated by large-scale projects and staffed by scores of astronomers and engineers at many institutions. All in all, says Neugebauer, it's taken a bit of the joy out of astronomical exploration.

"Infrared astronomy has become such a part of regular astronomy that the fun of experimenting has gone from it," Neugebauer says. "It's true that results are more remarkable than ever. The line between producing exciting results and getting personal satisfaction is, however, impossible to define. What's missing is not the pleasure of doing something worthwhile—and perhaps even fundamental—but the pleasure—to paraphrase Leighton—of doing something worthwhile and important that no one else is doing, or

PROTEAN PYROTECHNICS

With the July 4 holiday gone but not forgotten, Caltech News takes pleasure in presenting, on our back-page poster, this explosive image of cosmic fireworks, courtesy of the Spitzer Space Telescope. Lest readers conclude that the image is evidence of a spectacular new extragalactic phenomenon, we should note that some artistic license has been taken with the picture, which actually merges two unrelated images. The one on top, resembling a psychedelic jellyfish, is actually a composite image of the Carrwheel Galaxy as seen by four instruments, including the Spitzer's infrared array camera. The image in the lower half (also taken by Spitzer's infrared array camera), which looks like an accelerating rocket or a tornado, is known as Herbig-Haro 49/50, and it's a shock front created by a jet of material thrown off by a newborn and still-forming star. The jer has slammed into the surrounding dust clouds at more than 100 miles per second, heating the dust to incandescence and causing the region to glow with infrared light. The images were released in January 2006. For more on Spitzer and on Caltech's role in the birth and evolution of infrared astronomy. see the article that begins on page 3.

aorta, medical device design and clinical trials, surgical simulation and education, and vascular surgery outcomes. "Please visit our vascular surgery website where I am the webmaster, vascular stanford.edu. In personal news, my wife, Maisie, and I also recently welcomed the birth of our first son, Justin, on February 17."

1998

Martin Gremm, PhD, a narive of Germany, came to the United States to pursue an academic career in physics. He spent a few years in academia after receiving his doctorate from Caltech, but then changed direction and began applying his mathematical experience to trading in the financial markets, which is still his main occupation. He spends his spare time, however, running Art out of the Frame LLC, of Bellaire, Texas, with vice president and cofounder Esther Sung, who is a historian by training. They founded the company in 2004 "with a focus on promoting Texas Art. More recently the company has expanded its scope to include pro-

2003

Alice Shapley, PhD, an astrophysics professor at Princeton University, has received a 2006 Sloan Research Fellowship. "There are no strings attached," she remarked to the *Daily Princetonian.* "Maybe I'll buy a nice car." Previously a Miller Fellow at UC Berkeley, she joined the Princeton faculty in the fall of 2005. She plans to use some of the fellowship money to travel to observational facilities and make use of resources such as the Hubble Space Telescope. "Recently I've been studying how galaxies contribute to the re-ionization of the universe ... as well as how galaxies are growing in size." doing it in a unique way.

But as long as there are new telescopes, there will be a need for the latest generation of infrared instruments, keeping scientists like Matrhews and Soifer in business for the rest of their careers. And with Caltech, the University of California, Canadian universities, and a handful of other institutions joining forces to build an unprecedented 30-meter ground-based telescope (now dubbed the TMT), they could have many years of professional challenges ahead. Faced with that prospect, however, Marthews simply says, "I don't even want to think about the TMT." Which, in his idiosyncratic way, means that he's probably thinking a lot about it.



Obituaries

1922 George C. Henny, MS, on September 14, 1988.

1932

E. Nelson Harshman, MS '33, on March 16, 2005; Randal Maass, on February 10, 2001; William C. Rau, on April 15, 1992.

1933

Willard C. Robinette, on May 5, 1999; Dean F. Saurenman, on July 8, 1997.

1934

Jack M. Desmond, on November 24, 1997; Francis W. Wyatt, on June 7, 2001.

1935

Chester A. Davis, on March 29, 1998; James J. Halloran, on April 24, 2001.

1937

Milton W. Arnold, MS, on May 27, 2004; Robert A. Becker, MS, PhD '41, on August 19, 1997; Paul C. Schaffner, on October 31, 2004.

1938

Will G. Geselbracht, MS, on August 13, 1994; Oran A. Graybeal, on February 25, 2005; William W. Woodbury, on June 20, 2004.

1939

John W. Black, on December 11, 2003; Richard A. Fischer, on February 3, 2003; Michael E. Hiehle, on August 30, 1993; Harlowe J. Longfelder, BS '40, Eng '41, on February 17, 2005; James C. Ritchey, on February 28, 2005.

1940

Leo Brewer, on February 22, 2005; Mortimer H. Staatz, on April 16, 2004.

1941 Robert B. Galeski, on July 13, 2000.

1942

John C. Freeman, MS, on November 18, 2004; Robert S. Worthington, MS, on April 7, 2002.

1943

John W. Bewley, on April 1, 1997; James M. Brown, MS, on March 2, 2005; Redgnald D. Bushell, MS, on March 12, 2001; Ted L. Crosthwait, MS, on January 7, 2001; Hewson Lawrence, MS, on December 12, 2006; Like F. Baser, MS, on December

1946

Charles G. Beatty, MS, on December 22, 2004; Theodore R. Goodman, MS, on February 1, 1998.

1947

James A. Lewis, on November 10, 2001.

1948 Gerald D. Ryan, MS, on November 12, 2004.

1949

Lowell G. Wayne, PhD, on November 9, 2001.

1950

Stanley Campbell Burket, PhD, on October 12, 2005; Richard M. McIntyre, on March 13, 1993.

1951

William E. Eilau, on February 16, 2005; Robert E. Odening, MS, on January 2, 2005; Manuel A. Sanchez, MS, on January 21, 2005.

1953

Alan Haber, on February 12, 2005.

1954

Robert D. Dikkers, MS, on January 17, 2004.

1955

Donald A. Vogel, on February 2, 2003.

1957

R. Darden Powers, MS, PhD '62, on February 24, 2005.

1960

William A. Sinoff, on December 23, 1992.

1961

John Lawrence "Larry" Long, Eng, on February 20, 2005.

1963

E. Leon DeLano Jr., MS, on August 14, 2003; Anthony S.-Y. Lau, on November 15, 1994.

1965

Theodore W. Parry, MS, on February 15, 2005.

1968

Kenneth P. Bogart, PhD, on March 30, 2005.

1971

Conrad J. Kowalski, MS, PhD '74, on December 11, 2004.

RUBEN F. METTLER 1924-2006

Ruben F. Mettler '44, PhD '49, a guiding force in the American aerospace program, advocate of the disadvantaged, and a longtime Caltech trustee, died May 23. He was 82.

Mettler was responsible during his tenure at TRW Inc. for the Pioneer and the Orbiting Geophysical Observatory satellites, as well as the lunar module descent engine used for the moon landings. Prior to that, he was responsible for technical supervision of the Atlas, Titan, and Minuteman missile programs at the Ramo-Wooldridge Corporation, which later becme TRW.

Born in Shafter, California, in February 1924, Mettler briefly attended Stanford University as a Gamble Scholar before transferring to Caltech, where he earned his bachelor's degree in electrical engineering. After a stint with the army during World War II, when he specialized in radar systems, he returned to Caltech for his PhD and then began his career in the aeronautics industry at Hughes Aircraft as associate systems director for systems research and development.

After serving as special assistant to the assistant secretary of defense in the Eisenhower Administration, he went to work at Ramo-Wooldridge Corp., and in 1958 began his long association with TRW Inc., where he rose to the positions of chairman, CEO, and director.

Mettler was also widely known for his advocacy of programs for the disabled. In a 1986 article in the Caltech research publication *Engineering & Science*, he spoke of his experiences with his autistic son Daniel, a musical prodigy who had been unable to speak during early childhood. Mettler's own ability to play the piano led to his initial communication breakthrough with his son, he said.

Mettler had a keen interest in the welfare of all people suffering from the problems associated with physical, economic, or ethnic disadvantage. Appointed in 1977 by President Carter to develop a program to promote the hiring of Vietnam vererans, Mettler spearheaded a program for locating employment for several hundred thousand disadvantaged Americans, including 150,000 veterans. This work was credited for driving the unemployment rate of Vietnam veterans down from 15 percent per year to less than 8 percent. Mettler was credited with raising \$110 million in two years as chairman of the national campaign for the United Negro College Fund, and he was honored in 1979 with the National Human Relations Award of the National Conference of Christians and Jews.



Engineer Award in 1954 from Eta Kappa Nu; the One of Ten Outstanding Young Men of America award from the U.S. Junior Chamber of Commerce in 1955; the Meritorious Civilian Service Award from the Department of Defense in 1969; and the Roy Wilkins Memorial Award from the L.A. Chapter of the NAACP in 1981.

Mettler, who chaired Caltech's Board of Trustees from 1985 to 1993, was a board member from 1968 to the time of his death. He was also a life member of the Caltech Associates, the President's Circle, and the Caltech Alumni Association. His many gifts to Caltech included the funding of the Ruben and Donna Mettler Professorship.

According to longtime friends and associates at Caltech, Mettler was especially proud of his having been a member of the undefeated Caltech football team in 1944. He and other team members had entered Caltech as part of the armed forces' V-12 training program, and their skill on the football field led to an aggregate point total of 159–0 for the season.

He is survived by his wife, Donna Jean Smith, and his sons, Matrhew Frederick Metrler, an engineer at TRW

 2004; John E. Pearson, MS, on February 1, 2005; Walter F. Rhoades, MS, on May 6, 1998.

1944

Herbert R. Belcher, CAVU, on July 25, 1985; Ralph Brown Jr., CAVU, on February 28, 2005; Lawrence E. Hughes Jr., MS, on May 24, 2004; Irwin I. "Wynn" Kent, CAVU, on February 2, 2005; Donaid E. Ogden, CAVU, on March 31, 2003; William Wilkes Olenbush, on January 20, 2005; H. Brian Proctor, on February 12, 2005; Mayo G. Shults, MS, on March 11, 2005; Lawrence G. Stevenson, CAVU, on January 1, 1998.

1945

Kenneth G. Anderson, on January 5, 2005; Shib-Wei Loo, PhD, on September 24, 1998; Robert E. Phillips, BS '48, PhD '53, on March 1, 2005. 1973

Douglas C. Mohr, PhD, on March 11, 2005.

1974 James A. Boa, PhD, on May 12, 2001.

OBITUARIES HAVE MOVED ONLINE

The full Calueb News obitinaries have moved online to http:// alumin.caltech.echi/network/obituaries, where readers can browse expanded content and additional biographical information about the alumni listed here.

His many other honors include the Nation's Most Outstanding Electrical Inc., and Daniel Frederick Mettler, who resides at the Jay Nolan Center in Canyon Country, California.

Caltech News

