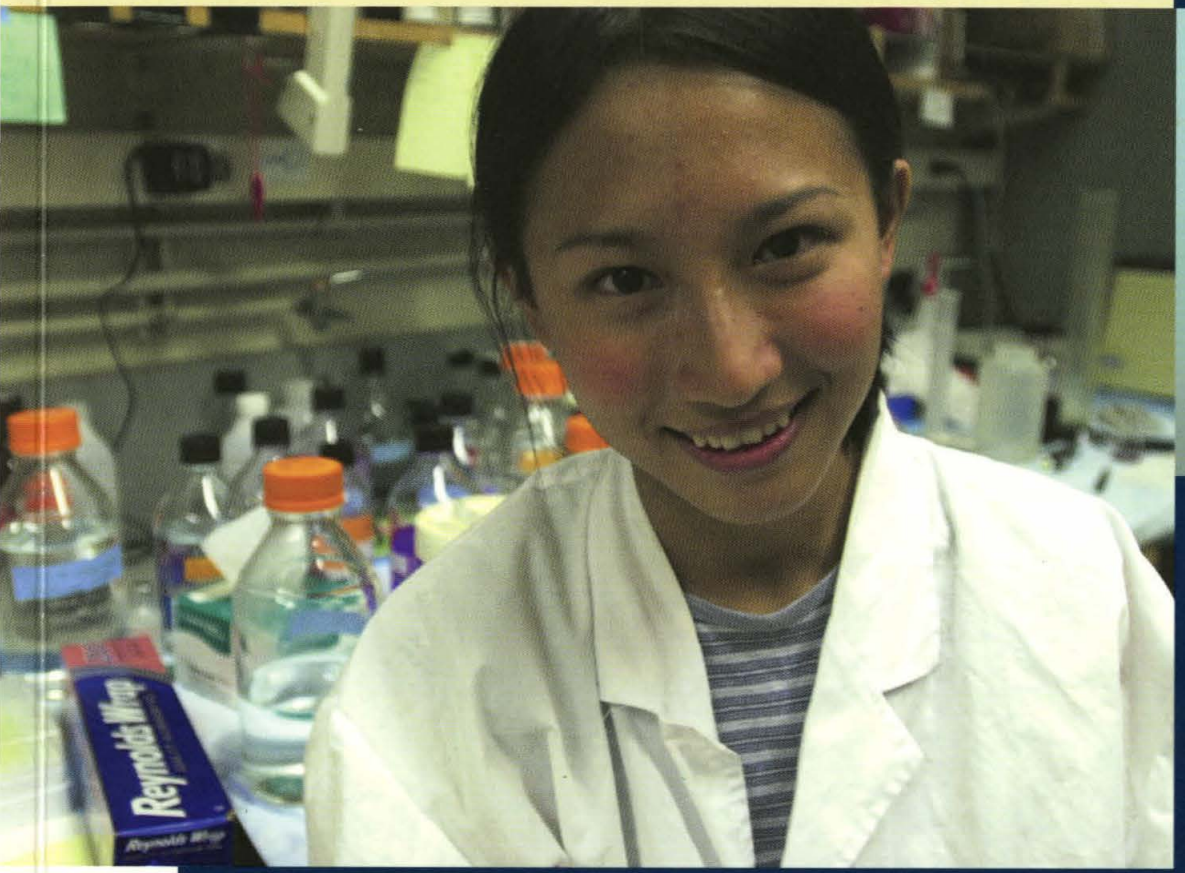
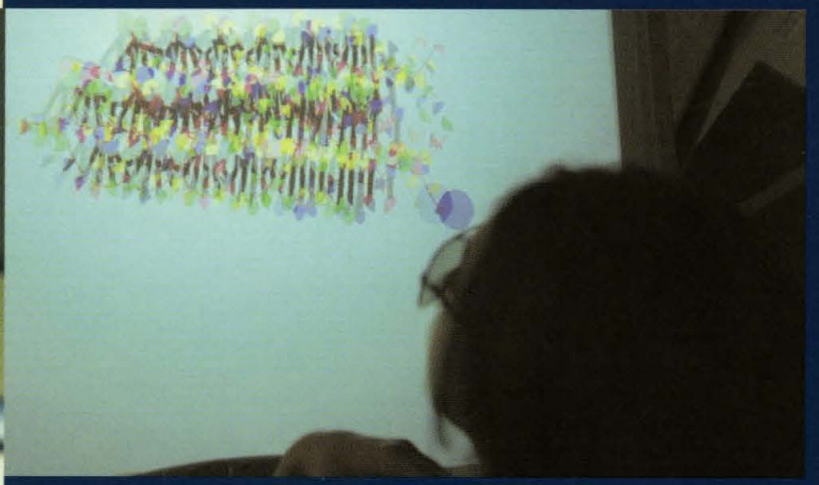
SURF 2003

California Institute *of* Technology

Summer Undergraduate Research Fellowships





CELEBRATING

25 YEARS

SURF 2003 is dedicated to Tom Tombrello, William R. Kenan, Jr., Professor and Professor of Physics, in recognition of his long commitment to undergraduate research and education. Tom has encouraged students to engage in research since he became a faculty member at Caltech, and over SURF's 25 years, he has mentored 29 SURF students and developed opportunities for countless others. During the early days of the program, he enthusiastically assisted SURF in securing funding for student stipends. He has always given good advice and wise counsel and remains active as a mentor, reviewer, AdComm member, and good friend of the SURF program.

SURF has been dedicated to the following people:

1985 Dr. Ernest Swift
1986 Dr. Lee A. DuBridge
1987 Dr. Robert P. Sharp
1988 Dr. Ray D. Owen
1989 Dr. Hans W. Liepmann
1990 Dr. Fredrick H. Shair
1991 Dr. Lew Allen Jr.
1992 Dr. John D. Roberts
1993 Dr. Robert E. Bacher
1994 Dr. Edward C. Posner
1995 Mr. Samuel P. Krown
1996 Dr. Edward B. Lewis
1997 Dr. Harold Brown
1998 Dr. Thomas E. Everhart
1999 Dr. Ward Whaling
2000 Dr. Terry Cole
2001 Dr. William Whitney
2002 Dr. Edward C. Stone
2003 Dr. Thomas A. Tombrello, Jr.

PRESIDENT'S MESSAGE

Congratulations to SURF on its 25th year! I am very proud of this program that provides extraordinary opportunities for students to become immersed in the environment of research and scholarship at the forefront of science and engineering. Widely recognized as the premier undergraduate research program in the country, SURF is one of the enterprises that keep Caltech prominent in higher education in the world.

SURF is deeply embedded in the Caltech culture. Most faculty have undergraduate researchers in their laboratories each year, and most students participate in SURF. Faculty and JPL staff mentors have coached many generations of students, helping them sink their roots in the environment of their disciplines. Graduate students and postdoctoral scholars train students in research methods and the development of laboratory skills, even as they hone their own mentoring abilities. Staff throughout the Institute attend to the administrative details that ensure the program runs smoothly.

SURF depends upon the personal and financial commitment of many individuals and groups, and I want to thank these dedicated partners who have helped the program grow and mature over the last quarter century. Through generous annual contributions and gifts of endowment, a large and loyal cadre of donors has built a solid foundation to provide stipends for Caltech SURF students. Alumni, faculty, and student volunteers lend time and effort to enhance and enrich the SURF program. These good friends have made important investments in the futures of our students. The Institute deeply values your partnership.

The Institute is committed to fully endowing this remarkable program to ensure that all future generations of students will reap the benefits of collaborating with faculty mentors. We look to SURF's future with optimism and enthusiasm. — *David Baltimore*

Murph Goldberger

The SURF timeline

1 2 3 4 5

Betty Nickerson

1979
- SURF is founded by Caltech Professor of Chemical Engineering Fred Shair. With staff support from Carolyn Ash, the summer program starts off with a budget of $36,000 to fund 18 students for a 10-week research period.
- Caltech President Marvin L. Goldberger praises the new program, which has in its first class senior Kenneth G. Libbrecht, now a Caltech professor of physics, working under the sponsorship of Professor of Physics Steven E. Koonin (currently Caltech provost).

1980
- Senior Development Officer Edward Baum joins the SURF team and launches SURF's successful fundraising component, introducing corporate representatives and members of The Associates and the Alumni Association to the SURF program.

Edward Baum, Carolyn Ash, and SURF founder Fred Shair

1981
- Caltech junior Julia A. Kornfield, currently a Caltech professor of chemical engineering, SURFs during the summer under the auspices of professor of physics Jerome Pine.

SURF student Julia Kornfield

1982
- Associates Samuel and Frances Krown become SURF's founding donors, contributing the first gift to SURF.

Samuel and Frances Krown

1983
- Associate Betty Nickerson organizes the first annual SURF Kickoff Dinner.
- Samuel and Frances Krown establish the first SURF endowment.
- SURF Board is established by Samuel Krown and Fred Shair.
- Lew Allen, director of the Jet Propulsion Laboratory (JPL), and Terry Cole, JPL chief technologist, bring SURF to the Lab.
- Jeannie Cass creates a communication program to help students prepare for their final oral presentations.

FROM THE SURF BOARD

It is my pleasure to report on the annual activities of the SURF Board. Each year finds the SURF program expanding its influence, opening new horizons of research for undergraduates, and providing the means to accomplish all this and more. It is my particular enjoyment to lead the SURF Board as it passes several important milestones: SURF's 25th year; close to 450 student SURFers, the largest class in program history; and receipt of the first SURF endowments credited to the capital campaign, "There's only one. Caltech."

SURF's strengths lie in its ability to match unbridled curiosity found in talented undergraduates both at Caltech and beyond with the mature vision of professors who define the expertise found in a variety of academic endeavors. By providing the bridge between each, SURF facilitates the education of undergraduates in the world of research while giving faculty and staff the satisfaction that they are working with the leaders of tomorrow. These elements make SURF a rich and dynamic program that benefits participants.

Congratulations to the SURF Board on completion of the first SURF Board Endowment, a joint effort of all the Board members as the start of an effort to raise $10 million to permanently secure the future of SURF. SURF is recognized as one of the truly unique and defining experiences for many Caltech students and, as such, is included as one of the goals for Caltech's capital campaign.

It is my pleasure to announce that Carl and Shirley Larson, who have been tireless and enthusiastic supporters of SURF, have provided two endowed SURFs, the Doris Everhart SURF and the David C. Elliot SURF. We are deeply grateful for their leadership and commitment and their recognition of these members of the Caltech community.

We also thank The Associates for designating the gifts from the 2002 annual solicitation to increase The Associates SURF Endowment. Seventy-five individuals and families responded to the request, increasing the endowment by close to $143,000.

Funding for SURF stipends comes from several sources, including individual contributions, Caltech, JPL, and various corporations and foundations. We gratefully acknowledge the many individuals and groups who have contributed to SURF over the last 25 years and who have enabled SURF's growth and maturity. The future will only be secured through the endowment of the entire program. It is a high goal but one that I am convinced can be accomplished by the SURF circle of friends. All funds contributed to SURF through endowment or through annual gifts are used to support Caltech students working with faculty on campus or at other institutions.

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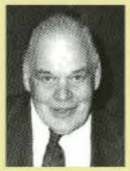
1984

- The SURF Administrative Committee is formed by President Murph Goldberger, with representation from each academic division and JPL.
- Special seminars on career planning and graduate school applications are held for the first time.
- Samuel Krown introduces fellow Associate Hugh Colvin to SURF. Hugh becomes an enthusiastic supporter and provides strong financial leadership by establishing nine endowments.



Hugh Colvin, SURF friend

1985

- The 1985 program is dedicated to Caltech emeritus professor Ernest Swift, in recognition of his early participation in undergraduate research during the 1920s with Arthur Amos Noyes. A new tradition is born.
- For the first time three SURF students are invited to speak at Alumni Seminar Day. Subsequently the Alumni Association assumes the task of providing session chairs for SURF Seminar Day.
- The Alumni Association appoints a liaison to the SURF Board, and the Association provides its first annual SURF student stipend.
- The first non-Caltech student, Leila Belkora from Cornell, does a SURF project.
- Two Caltech students do off-campus SURF projects.

SURF '86

1987

- SURF emerges on the national front at the first National Conference on Undergraduate Research. Three SURF students attend and Fred Shair becomes a member of the Governing Board. SURF at Caltech is recognized as an excellent and unique model of an institutionalized student research program.
- all students receive stipends rather than a mix of academic credit and wages;
- stipend support is raised from private, external sources;
- nineteen % of the eligible student body participates, the highest in the nation.

1988

- SURF celebrates its 10th program!
- Thomas E. Everhart becomes Caltech president. "I am pleased to have joined an institution where the hard work and support of so many dedicated people have resulted in a superb program such as SURF," he said. "I look forward to being a part of SURF's continued growth."
- SURF administration becomes a line item in the Institute budget.

Thomas E. Everhart

The SURF Board was originally formed in 1983 with the mission of providing financial support for the program. Established by individuals, faculty, and staff with vision and dedication to undergraduate research at Caltech, the SURF Board now comprises 28 members representing business, academia, alumni, Associates, and friends to provide advice, encouragement, and financial support that keeps SURF on its path to the future.

It is my pleasure to announce the election of John Gee as the new chairman of the SURF Board for the next two years. John has been a dedicated member of the SURF Board for three years. Carel Otte will serve as Vice Chairman. Carel has provided years of attention to the direction of SURF and is committed to expanding his role with SURF.

In addition to the newly elected officers, we welcome Ms. Gabrielle Adelman (BS '87, SURF '85, '86), Ms. Karen Carlson (CIT Alumni Association), Dr. Mary Bothwell (JPL), Dr. Jim Cutts (BS '54), and Mr. Sam Vodopia (BS '54) to the SURF Board. Re-elected SURF Board members include Dr. Robert Parker, Mr. Dave Rossum, Dr. Ward Whaling, and Dr. Roy Ritchie. I know I express the thanks of the Caltech community—faculty, students, and staff—for the SURF Board's interest and dedication.

We deeply appreciate the personal and financial contributions of our retiring SURF Board members: Dr. Werner R. Kirchner, Dr. Cornelius J. Pings, Mrs. Toni Perpall, Mrs. Edith Roberts, and Dr. Peter Mason. All have provided years of support and guidance to SURF, and we look forward to their continued advocacy as "Friends of SURF."

We were deeply saddened by the passing of Doug Nickerson who provided SURF with years of dedicated involvement as a charter member of the SURF Board, serving as chairman from 1996-1997. Doug is survived by his wife, Betty, who also served as Chair from 1985 to 1988 and holds SURF close to her heart. The SURF family extends its sympathy to the Nickerson family along with thanks for their unflagging support over the years.

As the SURF Board Chair, it has been my honor to work with a great executive committee—Bob Perpall, Fred Shair, John Gee, and Carolyn Ash. Their advice, wisdom, and experience made my tenure as Chair rewarding and fun. Many thanks!

I thank Sam Vodopia for chairing the SURF 25 Committee (with members Ed Bryan, Carel Otte, Fred Shair, and Ward Whaling) for the planning of festivities and events to celebrate this important milestone. And thanks to Sean Upchurch for chairing the SURF Seminar Day committee with members Michael Hartl, Leslie Maxfield, Carel Otte, and Al Ratner.

It probably comes as no surprise to the many people involved with SURF over the years that SURF has survived and flourished to reach its 25th year. But when one considers the challenges of

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1989
- Northern California Associates establish a SURF endowment.
- Fred Shair leaves Caltech to become Dean of Natural Sciences at Cal State Long Beach and Carolyn Ash becomes director of SURF.
- Terry Cole becomes chair of the SURF Administrative Committee.

Jack Roberts with SURF group

1990
- Dr. William M. Whitney, a Caltech alumnus, JPL division technologist, and a member of both the SURF Administrative Committee and the SURF Board, creates the Monday Evening Career Discussions to help students make short-term educational and professional decisions in the context of long-term life and career goals.

Caltech hosts 5th National Conference on Undergraduate Research

1991
- Caltech hosts the 5th annual National Conference on Undergraduate Research (NCUR); close to 1,100 students, faculty, and administrators from colleges and universities across the country attend.
- David Van Essen, then a Caltech professor of biology, organizes the Minority Undergraduate Research Fellowships (MURF) program to increase the number of underrepresented students in biology and chemistry. Nine students participate the first year.
- SURF becomes an international program when two students from the United Kingdom participate in SURF at JPL.

1992
- Institute agrees to underwrite SURF stipends against future fundraising.

First MURF group

1993
- SURF founds, and Caltech hosts, the first annual Southern California Conference on Undergraduate Research (SCCUR). Modeled on NCUR, SCCUR is multidisciplinary, including the sciences, mathematics, engineering, humanities, and the fine and performing arts.
- The SURF Board votes to increase the endowment and other sources of revenue and not to seek agency funding because federal sources remain uncertain from year to year.

coordinating people, resources, and funding for a quarter of a century, the significance of the concept of SURF combined with the effort of so many people becomes apparent. This really is a major milestone and the SURF Board extends a hearty thanks to everyone involved in making SURF possible.

As Chair of the SURF Board I have the chance to work with a vast group of individuals, all focused on what is best for SURF. I admire their dedication and support. It has been a pleasure and honor to serve as chair of the SURF Board and I look forward to SURF's continued growth and influence on the world of undergraduate research. Many thanks to everyone involved and I would like to especially acknowledge Carolyn Ash and her staff for keeping the wheel on the cart, so to speak, as the SURF program launches into its next 25 years.

— John H. Glanville, Chair, SURF Board

FROM THE SURF ADMINISTRATIVE COMMITTEE

The role of the SURF AdComm is to set academic policy for SURF, oversee the intellectual standards of the program, and advise the administration on long-term plans for the development of SURF and the programs allied with SURF. Each academic division, JPL technical staff, students, and administrative staff are represented on the AdComm, and all of the faculty members have served as mentors to undergraduate students.

I am delighted to announce a new effort this year to provide support and training for the graduate students and postdoctoral scholars who have the day-to-day supervision of SURF students. We are listing this cohort as "co-mentors" in SURF publications to give them the recognition they deserve for their significant contributions to the undergraduate SURF experience. Many of these individuals mentored students for the first time;

David Baltimore

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1994
- Caltech hosts second annual SCCUR.
- For the first time, all funds for student stipends are received by March 1, when applications are due!
- Robert C. Perpall creates the Doris S. Perpall SURF Speaking Awards to recognize the best oral presentations given on SURF Seminar Day. Students receive cash awards: $500, first prize; $300, second; $200, third.
- Carol Casey joins the SURF staff.

1995
- SURF Student Advisory Council (SURFSAC) is formed to provide a student voice in planning and implementation of the program, to gain on-going feedback on activities, and to coordinate social and cultural events for SURF students during the summer.

1996
- SURFSAC publishes the first *Caltech Undergraduate Research Journal (CURJ)*.

1997
- David Baltimore becomes president of Caltech.
- JPL Undergraduate Scholars (JPLUS) program is formed. Fred Shair, then manager of educational affairs at JPL, creates the program with Richard Alvidrez to recognize the top students at southern California community colleges. JPLUS scholars have the opportunity to compete for a SURF award at some time during their undergraduate careers.

1998
- SURF celebrates its 20th program!
- Caltech Merit Scholars participate in SURF in the summer preceding their freshman year. Twenty-two frosh SURFs join the 1998 SURF class.
- Marcella Bonsall establishes the Marcella and Joel Bonsall SURF Prize for Technical Writing.
- The Beckman Scholars Program is created by a generous grant from the Arnold and Mabel Beckman Foundation.

others are more experienced. The purpose of this program is to facilitate opportunities for new co-mentors to ask questions and seek advice from faculty members and from their more experienced colleagues. We carried out this function through a series of division-based workshops led by graduate students or postdoctoral scholars with participation by faculty. We also held sessions during the summer to allow new mentors and co-mentors to ask questions or raise issues they have encountered.

We applaud the efforts of 2003 graduate Sindy Tang for developing an undergraduate research exchange program between SURF and several universities in Hong Kong. Sindy collaborated with Caltech alumni Drs. Roger Ng, James Ng, Ken Chow, Ming Chung Chu, and York Liao to establish the details of the exchange. Three Caltech students were selected to work with faculty in Hong Kong. Before the summer began the students elected to withdraw from the program because of the SARS epidemic.

AdComm members reviewed close to 400 SURF applications, consulted on the participation of students in SURF's allied programs including MURF; Beckman Scholars; Axline SURF; LIGO (Laser Interferometry Gravitational-Wave Observatory); JPLUS (JPL Undergraduate Scholars); the exchange programs with the University of Cambridge, National University of Singapore, and the Caltech-Hong Kong Undergraduate Research Program; and NASA's USRP, PGGURP, and Space Grant programs.

The AdComm, SURF Board, and SURFSAC (SURF Student Advisory Council) held a joint meeting in October 2002. These three committees strongly support SURF in various ways, and the meeting provided an excellent chance for them to exchange information and ideas.

I wish to thank the members of the AdComm for their enthusiastic support and thoughtful consideration of the issues that arise. SURF succeeds because of the dedication of many individuals. It is my pleasure to work with this dedicated committee to the benefit of the students participating in the SURF program.

— *Fredrick H. Shair, Founder, SURF Program Chair, SURF Administrative Committee*

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1999
- The visiting committee of the Western Association of Schools and Colleges, the organization that awards Caltech's accreditation, recommends that the Institute continue its effort to endow the SURF program.
- George and MaryLou Boone make arrangements through their estate plan to provide a gift of $1 million for the SURF endowment.
- An exchange program between Caltech and the National University of Singapore is created to allow students from each institution to experience doing science or engineering in a different academic culture.

2000
- A connection is established between SURF and the Huntington Library, Art Collections, and Botanical Gardens under the enthusiastic leadership of Bill Deverell, associate professor of history. Four SURF students work with Caltech faculty and curators at the Huntington Library.
- The SURF AdComm holds the first annual mentor orientation to provide program information about the SURF program, help formulate expectations about undergraduate research, and answer questions from new and experienced mentors.
- Carolyn Ash reviews undergraduate research at six research universities for the Association of American Universities.

2001
- Under the leadership of John Gee (BS '53), the SURF Board develops the SURF Alumni Network to encourage former SURF students to remain involved with the program.
- Sean Upchurch (SURF '92, '93, BS '96) becomes first chair of the SURF Seminar Day committee, recruiting all the session chairs and alternates to ensure a successful event.
- Ram Srinivasan (SURF '98, '99, '01, BS '02) becomes managing editor of the *Caltech Undergraduate Research Journal (CURJ)* and reinvents the journal as a high quality publication that features the best undergraduate research and that is interesting and intelligible to the general reader.
- An exchange program with the University of Cambridge is created.

2002
- The SURF Board, SURF AdComm, and SURFSAC hold the first annual joint meeting to share information and ideas among the three groups that support the SURF program.
- Caltech hosts the 10th Southern California Conference on Undergraduate Research (SCCUR). More than 500 students attend to present their research in a wide variety of disciplines.
- The Graduate Student Council initiates connections with the SURF program to provide support for graduate students as they undertake their first mentoring responsibilities.
- Caltech launches a capital campaign to raise $1.4 billion; one goal of the campaign is to raise $10 million for SURF!

2003
- SURF celebrates its 25th program!
- SURF develops a program to support and train SURF co-mentors, the graduate students and postdoctoral scholars who have day-to-day supervision of undergraduate researchers, and forms the Co-Mentor SURF Advisory Committee.
- Sindy Tang (SURF '00, BS '03) creates an exchange program between Caltech and some of the universities in Hong Kong to allow students to do research in another academic culture over the summer.

since 1979, the SURF program has expanded to include students working on campus and at JPL, the addition of non-Caltech student participants, and Caltech students doing SURFs at other universities in the US and abroad. The SURF model with its rigorous application, proposal, and review procedures; its broad range of professional development activities and social events; and its oral and written reporting requirements has been adopted, not only at other institutions, but also within Caltech itself. SURF now comprises ten other programs that provide funding for particular groups. The focus of all the programs under the SURF umbrella is undergraduate research, the collaboration between mentor and protégé.

SURF is modeled on the grant-seeking process. Students collaborate with potential mentors to define and develop a project. The students write research proposals for the work, and a faculty committee reviews the proposals. Awards are made on the basis of reviewer recommendation and available funding. Students carry out the work over a 10-week period in the summer, and at the conclusion, they submit a technical paper and give an oral presentation at SURF Seminar Day, a symposium modeled on a professional technical meeting.

Caltech's MURF program provides support for talented undergraduates to spend a summer working in a research laboratory on the Caltech campus. The MURF program aims to increase the representation of underrepresented students in science and engineering graduate programs and to make Caltech's programs more visible to students not traditionally exposed to Caltech. The program supports Caltech's commitment to training a diverse set of science, technology, engineering, and math leaders. This year 27 students participated in the program.

The Beckman Scholars program, funded by a grant from the Arnold and Mabel Beckman Foundation, awards biology or chemistry students fellowships to do research over two summers and the intervening academic year. The grant also provides money for students to attend conferences and buy the supplies and equipment they need for their research. A faculty committee selects two sophomore students each spring to win this award.

The JPL Undergraduate Scholars (JPLUS) program recognizes and encourages scholarly achievement and creativity in students majoring in engineering, mathematics, computer science, and the physical sciences at 25 local community colleges. The students have the opportunity to apply for a SURF during their undergraduate careers. This summer seven JPLUS students participated in SURF.

NASA's Undergraduate Student Research Program (USRP), Planetary Geology and Geophysics Research Program (PGGURP), and Space Grant programs offer students from across the United States mentored research experiences at the NASA Centers. This summer 62 students collaborated with technical staff members at JPL through these three programs. Students lived on campus and participated fully as SURF students.

Eight students participated in the Axline SURF program this summer. The program allows selected incoming freshmen to do research with Caltech faculty or JPL technical staff.

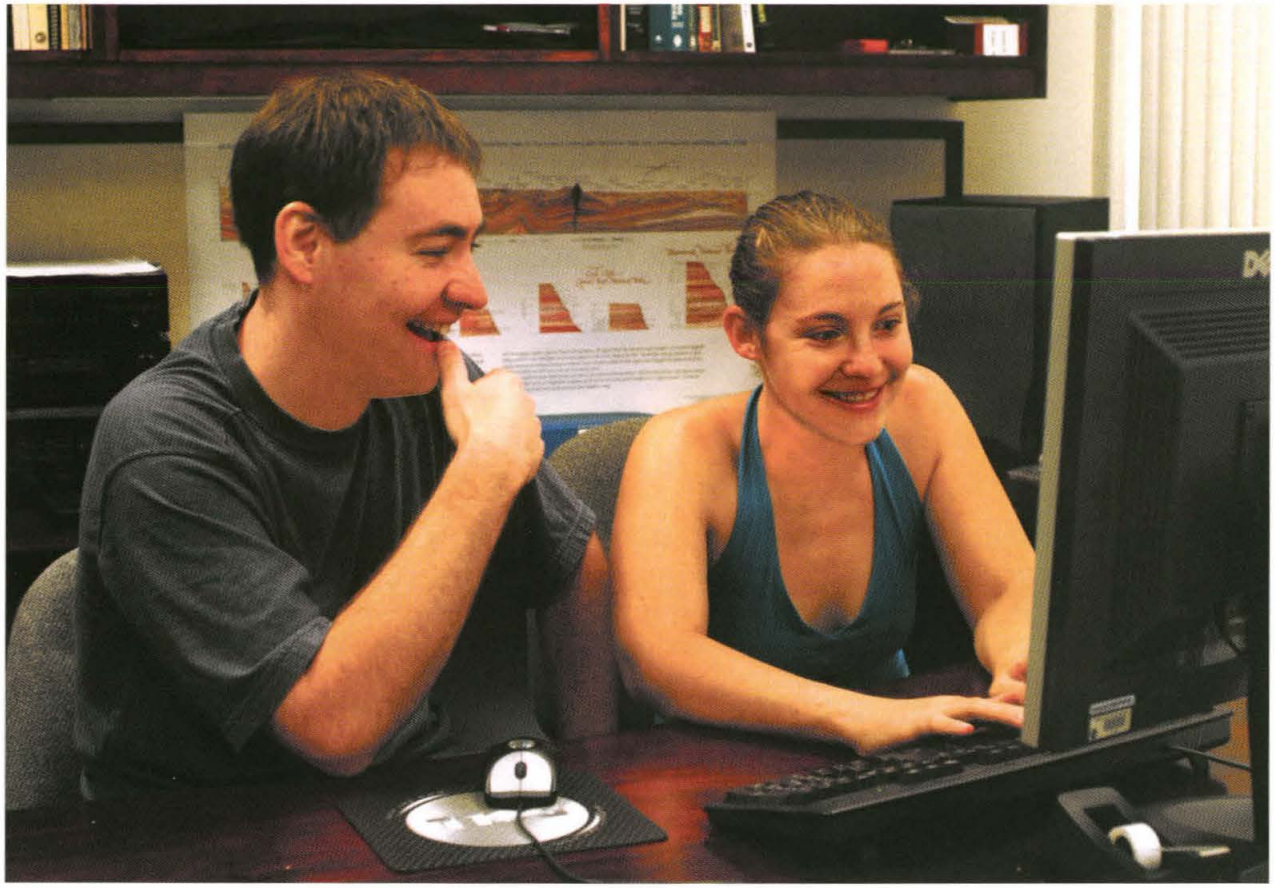
The Laser Interferometer Gravitational-Wave Observatory (LIGO) project in the physics department included 32 students this year supported by a grant from the National Science Foundation.

Two exchange programs expand opportunities for our students. The Caltech-National University of Singapore Exchange program allows two Caltech students to do research at NUS and two NUS students to come to Caltech for the summer. Students gain the undergraduate research experience while broadening their perspectives through living and working in another country. Caltech-Cambridge Exchange brought seven students from Cambridge to the campus this summer.

serving as a mentor *to a young scientist is an important role. Students are invited into the community of researchers and scholars as colleagues. Mentors pass on the nature and culture of science to the next generation and play a significant role in providing intellectual stimulation for their student protégés. Sometimes the relationships formed through scholarly collaboration last long after the student completes his or her degree and ultimately develop into strong professional interactions. Mentoring helps students develop career focus. They gain important insight into the kinds of careers available and potentially attractive to them through their undergraduate research experiences. Mentors play a key role by providing advice, making observations, and giving feedback.*

Mentors gain personal satisfaction from working with students. They often enjoy training the next generation, watching students mature intellectually, and knowing that they played an integral part in that process. Students can bring a fresh perspective to the work because they have not developed biases about what should or should not happen, and they might ask the simple questions that are often overlooked when one has been immersed in the research for a long time.

Carolyn Ash interviewed two groups of mentors and students. These are their stories. They speak to the essence of SURF—the interaction between mentor and protégé.



Mark Richardson (SURF '91), Assistant Professor of Planetary Science, and Melissa Strausberg, SURF Board SURF Fellow.

THE EXPERIENCE WAS FANTASTIC. THE REAL SIGNIFICANT THING IS THAT I WOULD NOT BE HERE TODAY HAD IT NOT BEEN FOR WORKING WITH TERRY THROUGH SURF IN 1991. — *Mark Richardson*

Dr. Terry Martin, Professor Mark Richardson, and SURF student Melissa Strausberg, represent two generations of mentors and protégés, and they exhibit dynamic relationships that richly enhance the undergraduate research experience.

Mark Richardson, assistant professor of planetary science at Caltech, was a SURF student from Imperial College, London, in 1991. He is the third SURF student to become a faculty member at Caltech. His expertise in Mars climate modeling started with his own SURF project, "Martian Dust Opacity Mapping," under the mentorship of Dr. Terry Martin at JPL. He credits his SURF experience with leading him to graduate school at UCLA and back to Caltech as a postdoctoral scholar and now a faculty member.

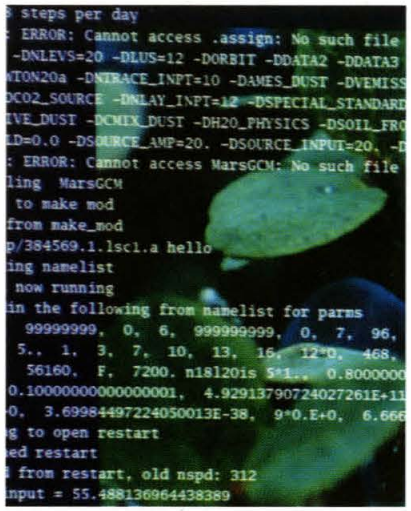
The collaboration began when Mark contacted Terry about doing a

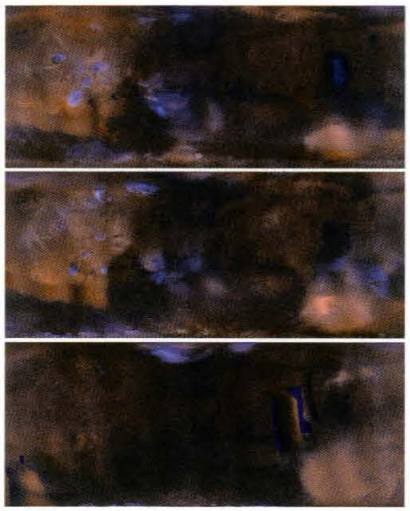
SURF project. Terry says, "I suggested that Mark work on data from the Viking space mission, but he wanted to work on a project to map dust storm behavior on Mars." Turning to Mark, he wonders, "Were you interested in Mars atmospheric behavior prior to doing your SURF?" Mark replies that he only had a vague sense of wanting to do something in planetary science. His subsequent educational and professional experiences have continued to foster his interest in atmospheric behavior.

Mark says of his SURF, "The experience was fantastic. It was my first research experience and my first exposure to planetary science." He co-authored a paper on Martian dust storm mapping. In addition to working on his research, Mark attended presentations to learn about applying to graduate school in the US. "The real significant thing is that I would not be here today had it not been for working with Terry through SURF in 1991. It led to my applying to UCLA for graduate school and being involved with Mars missions."

Mark discussed the importance of his undergraduate research experience explaining, "The undergraduate program in England is quite different from the US. We had a three-year program focused on sitting in lectures and taking notes. Any laboratory experience included pre-set experiments. There was no emphasis on doing research and little discussion of what research meant. Terry helped me figure out how I should think about doing the project—not mechanically going about doing things, but thinking about why we were doing it." He continues, "We would send our results to people working on global circulation models, and they would use our data as a constraint on their models to help them understand how global storms develop." SURF student Melissa Strausberg interjects, "Ten years later you are the one using the results of your SURF to constrain your models of these global dust events."

Melissa will be a senior majoring in planetary science. This SURF is her fourth at Caltech, and she remarks that her research experiences have helped shape her career plans. She has learned from her mentors what kind of scientist, group manager (and SURF mentor!) she hopes to become. She comments that her research has helped her realize the importance of the foundation material she learns in class. "When I took a planetary surfaces class, I saw how to put the lessons we were learning into a broader context of Mars research. I could make connections between the surface properties that





are seen and atmospheric phenomenon that I learned about earlier," she says. "Certainly I think that research is incredibly valuable, especially within the context of a Caltech education."

Mark observes the differences between being a student and a mentor, saying, "When you get to the mentor side you realize there is a lot more work than it appeared to be. From the student point of view it feels like someone tells you what to do, and you feel like you are the one doing all the work. It is a lot harder to make it look that easy! I have to make sure the project is scoped to a point where it can be achieved in the ten-week period. I have to make sure that the student doesn't get hung up on piddly things that can bog down the project. There is a lot of thought required to do it well."

Terry adds that he enjoys the synergy brought by interaction between himself and his students. "There is nothing like having the daily informal chatter," he says. Mark agrees saying, "I got a lot of ideas about graduate school and the field through my continuing conversations with Terry." Melissa notes that mentors provide excellent advice on graduate schools because their research interests are aligned with the student's interests and abilities and they often know colleagues at other universities who are working on interesting problems.

Dr. Adrian Ponce (PhD '00), JPL technical staff and Caltech visiting associate, serves as a mentor to four students this summer: Neil Tiwari, a Beckman Scholar; Margot Kimura; Michael Schiraldi, a NASA USRP student from Fordham; and Hannah Shafaat. In addition, Elizabeth Lester, a 2002 MURF student, now works with Adrian as a Caltech graduate student.

When I arrive for my interview with the Ponce group, Adrian is talking animatedly on the phone. Several students sit around his small office, and Elizabeth is looking up equipment costs in a catalog for him as he carries on his conversation. It is apparent that this lab is energetic, friendly, collaborative, and that students and mentor work together well.

Adrian got his start as a researcher when he was an undergraduate at Michigan State University, and he credits his enthusiasm for working with SURF students to that earlier experience. He had a desk in a laboratory where he did his homework while working on experiments. As a colleague with the graduate students, faculty, and others in that laboratory, he participated in the scientific and social life of the lab, even publishing papers. Adrian wants to promote similar experiences for the current generation of students, allowing them to develop excitement for and curiosity about science. He finds them as focused, productive, and hard working as graduate students. Undergraduates are the engine of his research program, and he meets with the students weekly when each person gives a 10-15 minute presentation of his or her work.

Hannah will be a sophomore majoring in biology. This SURF is her first research experience, and she says it is fun, hard, and busy. "Sometimes I get frustrated. I spent half my summer looking at the side aspects of what happens in my project. This isn't really my main focus, but it was relevant, and it needed to be explored. I like developing questions and finding out answers."

Michael, a senior majoring in natural science, initially got involved with his project at Fordham where his faculty advisor collaborates with Adrian Ponce. Through that connection Michael learned about the USRP program and SURF. "It has been a great experience. I am in the process of applying to graduate school in the health care professions. Medicine is applied science and you are solving problems in novel ways, just as we do here in the laboratory. Doing undergraduate research is a good way to learn technique. I have become a much more precise person over the course of the summer working on this project."

Elizabeth Lester, a 2002 MURF student from Baylor University, was planning to go to medical school when she came to work with Adrian on an anthrax detection device. Her project was highly successful and she co-authored an article "An Anthrax Smoke Detector: Online Detection of Aerosolized Bacterial Spores" in *IEEE Engineering in Medicine and Biology: Special Biodefense Issue.* Newspapers all over the world picked up the story, and Elizabeth was even invited to speak on a Spanish TV channel. She admits it is fun when people recognize her from her TV appearances and photos in publications and on websites. At Baylor she was asked to participate in the biology department seminar series. "They were really impressed to have one of their own students give a presentation. They treated me like a real visiting professor. It felt really good and made me realize how much I loved what I was doing. I love talking about my work. My MURF research experience got me hooked, and I decided to apply to graduate school, and I was accepted at Caltech."

Michael, Margot, and Hannah agree that the SURF experience has been priceless. "In classes you learn theory, but research offers the chance to dive in and become a scientist. In many respects, it is easier to memorize facts and take a test than to actually work through problems on your own in the laboratory, but you really learn better doing the hands-on work," they say. Elizabeth adds that she took chemistry classes when she returned to Baylor after her MURF project. She understood the material better and got better grades because she had already applied the concepts to her project.

The students appreciate Adrian's coaching. "He is always aware of what we are doing, but he doesn't micromanage. He will stop what he is doing if we need help. He is good at trouble shooting, asking 'what exactly did you do and when did the problem arise?'" Hannah notes that all the students in the group come with different levels of experience, and

Adrian remembers what it was like before he knew something. "He never seems to mind if you are having trouble," she says, "and he will explain it and discuss it until you understand what you are doing and why you are doing it."

Adrian wants the students to know that he is just another person in the laboratory, not the source of all knowledge about the work. He encourages the students to think independently and to challenge him when they think he is wrong. He wants them to think critically, learn to follow a research protocol, and learn to test and verify things. He hopes that he can impart his own excitement and enthusiasm about research to his students. He considers it a great privilege to work with undergraduates. "They are a breath of fresh air," he says. As he looks back over the summer, he is amazed to realize that everyone will get a publication from this summer's work, and Hannah may even get three publications. Not bad for a summer's work.

Hannah S. Shafaat, Mrs. Edwin L. Cline SURF Fellow; Adrian Ponce, Senior Member of the Technical Staff, JPL, and Visiting Associate in Chemistry; Margot C. Kimura.

THE SURF PROGRAM WAS A FUN AND INVALUABLE WAY TO BEGIN MY (HOPEFULLY LONG) RESEARCH CAREER. I EXPERIENCED AN ENTIRELY DIFFERENT FACET OF MY EDUCATION FROM MY LECTURE OR LAB CLASSES. — *Hannah Shafaat*

funding SURF

Endowments

An endowment has been created to ensure continuation of the SURF program. Individuals or groups may establish an endowment to support one student each year in perpetuity; the cost of an endowment is $125,000.

Arthur R. Adams SURF Fellowship
Carolyn Ash SURF Endowment
The Associates SURF Endowment
Robert L. Blinkenberg Memorial SURF Fund
Marcella Bonsall SURF Endowment
Bristol-Myers SURF Endowment
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Erika C. Vote SURF Endowment

SURF Prize Endowments

Marcella and Joel Bonsall SURF Prize for Technical Writing
Doris S. Perpall SURF Speaking Award

New Endowments

We are delighted to announce the establishment of new SURF endowments!

Mr. John Glanville, Mrs. Nancy Glanville Jewell, and the Glanville Family Foundation half-funded the new SURF Board Endowment as a challenge to the other board members to complete the endowment. We thank the Glanville family and the members of the SURF Board for their generous gifts and for investing in the future of the SURF program and its students.

We are deeply grateful to Carl and Shirley Larson for creating two new SURF endowments designated to honor Doris Everhart for the many contributions she made to the Institute during her tenure as Caltech's first lady and David C. Elliot to recognize his commitment to education and his teaching ability. "He made history fun," Carl says.

The Associates designated contributions from the 2002 annual solicitation for The Associates SURF Endowment, and we thank the 75 individuals and families who donated close to $143,000.

We heartily thank these generous donors for moving SURF toward achievement of its $10 million campaign goal.

Endowments Through Planned Gifts

Dr. and Mrs. George Boone
Dr. Paraskeva N. Danailov Endowed SURF Fellowship in Biology

Gifts to Endowments

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Dr. Carol J. Vote

A portion of the following endowment, established for the Department of Environmental Science and Engineering, is used to support SURF stipends.

DEPARTMENT OF ENVIRONMENTAL SCIENCE AND ENGINEERING, CALTECH
Mr. Gordon P. Treweek *

SURF Stipend Funding

For the ten-week fellowship, SURF students receive a stipend of $5,000; stipend funds come from many sources as shown below. Mentors pay all research-related costs. The total cost of student stipends for the 440 2003 SURF students was $2.2 million.

The SURF office, in partnership with the Institute, raises funds to support Caltech SURF students working with faculty on campus or at other universities. Typically faculty mentors pay half the students' stipends, and monies contributed by individuals, corporations, foundations, and the endowment are used as matching funds. We thank the annual donors for their generosity and support. We are also deeply grateful to the individuals, groups, and corporations that have established 46 endowments to support 60 students each summer in perpetuity.

The allied programs (MURF, USRP, PGGURP, Space Grant, Axline SURF, Beckman Scholars, JPLUS, JPL SURF, LIGO) provide the funds for students admitted to those programs. NASA directly pays the stipends of the USRP, PGGURP, and Space Grant students, and these stipends are not reflected in the chart below.

Funding Profile

Individuals	5%
Corporations/Foundations	5%
Faculty	32%
Endowment	26%
Allied programs	32%
	100%

Annual Gifts

GIFTS TO SURF ANNUAL STIPEND FUND

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* These individuals contributed the amount of one or more SURF stipends.

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SURF Volunteers

SURF depends upon the assistance of many individuals to review students' proposals and submissions for the Marcella and Joel Bonsall Prize for technical writing, serve as session chairs on SURF Seminar Day, and judge presentations for the Doris S. Perpall prize for excellent oral communication. We thank the following people for their help with SURF 2003:

Dr. Arden Albee
Dr. Fred C. Anson
Dr. Frances H. Arnold
Dr. Kevin Austin
Dr. Jesse L. Beauchamp
Dr. Patricia Beauchamp
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SURF 2003

STUDENT PROFILE

Division	*Total # of Students*	*CIT Students*	*Non-CIT Students*	*Mentors*
Biology	49	36	13	23
Chemistry and Chemical Engineering	59	38	21	26
Engineering and Applied Science	88	63	25	43
Geological and Planetary Sciences	25	18	7	15
Humanities and Social Sciences	11	7	4	6
Physics, Math, and Astronomy	71	42	29	36
JPL 144	106	26 23	113 83	65
Off Campus	28	18	10	25
International	3	3	0	3
TOTAL	440	248	192	242

341 SURF
180 Affiliated Programs
521

2004 519 275 244

Women	40%
Minorities	12%
Average GPA	3.71/4.0*

Caltech students only, excluding pre-frosh and freshmen

Class Level	*Percent*	2004
Pre-Freshman	2%	1
Freshman	19%	16
Sophomore	30%	36
Junior	37%	34
Senior	11%	9
Graduate	1%	1

SURF Statistics from Caltech's 2003 Graduating Class

	2004		
Total # of graduates:	208	242	
Total # of SURFers	59% 123	148	61%
Total # of graduates w/ honors	107	122	50% of the graduating class
Total # of SURFers w/ honors	79	80	66%
Total # of prizes awarded	188	173	
Total # of prizes awarded to SURF students	149	142	82%

PROGRAM HIGHLIGHTS

Co-Mentor Program

This year we initiated a new program to provide training and support for co-mentors, the graduate students and postdoctoral scholars who have the day-to-day responsibility for supervising SURF students. This group is important to the success of SURF. Serving as a mentor to a young scientist is a significant role that can be mutually rewarding to both student and mentor. Mentors are pivotal in ensuring that students have good research experiences. They teach skills, methods, and techniques as they pass on the nature and culture of science or engineering to the next generation of researchers.

The purpose of this new program is to provide a forum for those with experience to share ideas and accumulated wisdom with new co-mentors and to allow all co-mentors to ask questions and get the advice and assistance they need.

Professional Development Workshops

The weekly professional development workshops help students make short-term educational and career decisions in the context of longer-term life and career goals. Session topics and participants:

THINKING ABOUT CAREERS
Dr. William M. Whitney (BS '51), Deputy Manager, *Education Office, JPL*
Dr. Jerry Houser, *Director, Career Development Center*

COMMUNICATION IN CAREERS
Ms. Mary Ann Ahart, *Communication Consultant*

WHAT'S YOUR PERSONALITY TYPE?
Career Development Center Staff

SCIENTISTS AS SPEAKERS
Dr. Janet Hering, *Professor of Environmental Science and Engineering*

INTELLECTUAL PROPERTY
Dr. Rich Wolf (PhD '94), *Office of Technology Transfer*

WHAT CAN YOU DO WITH A TECHNICAL BACKGROUND?
Ms. Gabrielle Adelman (SURF '85, '86; BS '87), Dr. John Davis (SURF '91; PhD '00), Mr. John Gee (BS '53), Dr. Giorgio Isella (PhD '01), Mr. David Krider (SURF '92; BS '93), Dr. Elizabeth Krider (SURF '93; PhD '01), Dr. Jason Lee (SURF '92, '93; BS '94)

GRADUATE SCHOOL: THE NUTS AND BOLTS OF THE APPLICATION PROCESS
Career Development Center Staff

JPL Friday Seminars

Each Friday, members of the JPL staff presented talks to SURF, USRP, PGGURP, and Space Grant students. Speakers and topics this year were:

RON G. BLOM
Lead Scientist, Terrestrial Science Research Element
Application of Space Technology to Discovery of Ancient Desert Trade Routes in the Southern Arabian Peninsula

REBECCA CASTAÑO
Supervisor, Machine Learning Systems Group
Rover Traverse Science: Training a Rover to Understand the Image Data it Collects

LLOYD C. FRENCH
Senior Engineer
Subsurface Exploration in Icy Environments

TERRY HUNTSBERGER
Mobility Systems Concept Development Section
Planetary Surface Robotic Research at JPL: Past, Present, and Future

DEBORAH JACKSON
Quantum Computing Technologies Group
Quantum Computing for Dummies

VICTORIA MEADOWS
JPL/Caltech/NASA/Astrobiology Institute
The Search for Habitable Worlds

ROBERT SHOTWELL
Senior Systems Engineer, Microspacecraft Development
Mars Atmospheric Constellation (MACO)

LINDA J. SPILKER
Cassini Deputy Project Scientist
The Cassini Mission

RANDII R. WESSEN
Navigator Program Engineer
The Future of U.S. Robotic Planetary Exploration

Caltech Wednesday Seminars

This year, nine seminars were given on Wednesdays at noon by members of the Caltech faculty, covering areas of their research. The speakers and topics were:

PAMELA CONRAD
Element Lead, JPL
Looking for Life on Other Planets: Mars as a Model

MARK E. DAVIS
Warren and Katharine Schlinger Professor of Chemical Engineering
Engineering of Synthetic Gene Delivery Systems

JEAN E. ENSMINGER
Professor of Anthropology
Experimental Economics in the Bush

HARRY B. GRAY
Arnold O. Beckman Professor of Chemistry
Powering the Planet: Fuel From Sunlight and Water

HENRY A. LESTER
Bren Professor of Biology
The Response to Nicotine

MARK I. RICHARDSON (SURF '91)
Assistant Professor of Planetary Science
Current Problems in Mars Climate Dynamics: Dust Storms and Ice Sheets

ANNELIA I. SARGENT
Professor of Astronomy
Searching for Other Solar Systems

ERIK WINFREE
Assistant Professor of Computer Science and Computation and Neural Systems
Teaching DNA Algorithmic Tricks

NAI-CHANG YEH
Professor of Physics
Recent Advances in the Science and Technology of Superconductivity

Special Events

Again this year, Dr. and Mrs. George Boone sponsored a behind-the-scenes tour of The Huntington Library, Art Collections, and Botanical Gardens. The Boones hosted a reception for students in their sculpture garden following the tour.

Former astronaut Dr. Robert A. Parker of the NASA Management Office at JPL presented a talk called "So You Want to Be an Astronaut?" This popular event attracted many students and sparked a long and lively discussion.

This year about 30 students went to Mt. Wilson Observatory to view the famous 100" Hale telescope and the 24" telescope, and to hear the his-

toric Mt. Wilson story. We thank Mr. Don Nicholson for coordinating this event. Students enjoyed a picnic supper on the mountain as they watched the sun set and the lights in the valleys come on.

Awards and Prizes

Robert C. Perpall (BS '52, MS '56), endowed a prize in memory of his late wife, Doris S. Perpall, to encourage students to prepare excellent SURF presentations. Winners of the 2002 Perpall prize were:

Kristin Shantz	1st Prize
Rachel Thessin	2nd Prize
Hermes Huang	3rd Prize

The late Marcella Bonsall, a longtime member of the SURF Board, endowed the Marcella and Joel Bonsall Prize for Technical Writing as an incentive for students to develop strong technical writing skills. Winners of the 2002 Bonsall Prize were:

Paul Choi
Christopher Franco
Tin Yiu "Tammy" Lam
Po-Shen Loh
Dagny Looper
Tyrel McQueen
Kristin Shantz

Conferences

SURF SEMINAR DAY was held October 18, 2003, on the Caltech campus. The SURF program requires students to give either an oral or poster presentation to an audience of peers, faculty, mentors, alumni, donors, families, and prospective students. This presentation is the capstone of the SURF experience.

NATIONAL CONFERENCE ON UNDERGRADUATE RESEARCH (NCUR) drew over 2,000 undergraduates, faculty, and administrators to the University of Utah in March. Students presented their research, scholarly, and creative activities in oral and poster sessions. Caltech presenters for 2003 were:

Hermes Huang
Nitzan Roth
Kristin Shantz
Justin White

SOUTHERN CALIFORNIA CONFERENCE ON UNDERGRADUATE RESEARCH (SCCUR), started at Caltech in 1993, brought over 500 students, faculty, and administrators to the campus in November to celebrate the first decade of the conference. SCCUR is multi-disciplinary including the sciences, math, engineering, the humanities, social sciences, art, and performance. Students present their research and scholarly activities in oral and poster sessions. SURF student presenters at SCCUR 2002 were:

Sangeeta Bardhan
Mark Bilinski
Jennifer Caron
Judy Chen, *Cerritos College*
Xuejing Chen
Wei Lien Dang
Timothy Dong
Melanie Goodrich
Nzinga Harris, *Mount St. Mary's College*
Sarah Hörst
Cristian Jitianu
Eric Kort, *Pomona College*
Tin Yiu (Tammy) Lam
Tyrel McQueen, *Harvey Mudd College*
Kevin Nielson, *California State University, Los Angeles*
Eunice Rivas, *Mount St. Mary's College*
Kristin Shantz
Joanthan So
Melissa Strausberg
Phuong To, *Mount St. Mary's College*
Victor Tsai
Andrea Vasconcellos
Valerie Villareal, *California State University, Los Angeles*
Cecilia Zurita, *California State University, Los Angeles*

SURFSAC Suppers

Again this year, the SURF Student Advisory Council coordinated weekly informal suppers for Caltech faculty and small groups of students at local restaurants. We thank the MOSH for subsidizing the cost of these popular suppers.

MEGUMI ABE
Edward W. Hughes SURF Fellow
Junior, Ch

Kinetic and Mechanistic Comparison Studies of Ligand Exchange Processes of Zwitterionic and Cationic Palladium(II) Complexes

Mentor: Jonas C. Peters, *Assistant Professor of Chemistry*

NEIL G. ADAMS
Hugh F. and Audy Lou Colvin International SURF Fellow
Senior, ME; University of Strathclyde

Design of a Micro Aerial Vehicle

Mentors: Morteza Gharib, *Hans W. Liepmann Professor of Aeronautics and Bioengineering*, and John O. Dabiri, *Graduate Student in Bioengineering*

SARAH M. ADAMS
Richard and Dena Krown SURF Fellow
Freshman, ChE

The History of Human Passions and Scientific Rationality: A Study of the Emotions and Passions That Inspired Lavoisier and Curie

Mentor: Diana L. Kormos-Buchwald, *Associate Professor of History*

REBECCA A. ADLER
J. Kent Clark SURF Fellow
Freshman, Bi/SES

Albert Einstein, Zionism, and The Hebrew University

Mentor: Diana L. Kormos-Buchwald, *Associate Professor of History*

NEDA AFSARMANESH
Edward W. Hughes SURF Fellow
Junior, Bi

Gaze and Attractiveness: A Psychophysical Study of Preference Judgment

Mentors: Shinsuke Shimojo, *Professor of Biology*, and Claudiu Simion, *Graduate Student in Biology*

BENJAMÍN J. ALEMÁN
The James Irvine Foundation MURF Fellow
Junior, Ph/Ma/Bi; University of Oregon

On the Biofunctionalization of Gold-Patterned Silicon Substrates for Regenerable Biosensing Nanoelectromechanical Systems

Mentor: Michael L. Roukes, *Professor of Physics, Applied Physics, and Bioengineering*

MARYAM ALI
William N. Lacey SURF Fellow
Sophomore, ChE

Tensile Testing of Photocrosslinked Protein Films

Mentor: David A. Tirrell, *Ross McCollum-William H. Corcoran Professor and Professor of Chemistry and Chemical Engineering*

MICHELLE K. ALLIS
NASA USRP Fellow
Senior, EAS (Ae)

Cross Section Measurements for Ion Thrusters

Mentor: Lee K. Johnson, *Research Scientist, JPL*

KERIS E. ALLRICH
Freshman, ChE

A Fluorimetric, Kinetic Method to Detect Trace Metals With Complexes of 2,6-diacetylpyridine Dioxime

Mentors: Eric Anslyn, *University Distinguished Teaching Professor of Chemistry, University of Texas at Austin*, Paola Gomez-Tagle, *Postdoctoral Scholar in Chemistry, University of Texas at Austin*, and Robert H. Grubbs, *Victor and Elizabeth Atkins Professor of Chemistry*

LAUREN K. ANNIS
Senior, Ge; California State Polytechnic University, Pomona

Analysis of Iceberg Furrows in the Western Ross Sea

Mentors: Joann M. Stock, *Professor of Geology and Geophysics*, and Min Chen, *Graduate Student in Geophysics*

ANTHONY ANNUNZIATA
NASA Space Grant Fellow
Sophomore, Ph; Colgate University

Production and Analysis of Electric Discharge Pulses on Electron and Plasma Ion Irradiated Dielectric Materials

Mentor: Arthur R. Frederickson, *Principal Engineer, JPL*

MATTHEW M. ARMENTROUT
Freshman, Ch

Experimental and Theoretical Studies of the Reaction of Re^+ With Methane

Mentors: Peter B. Armentrout, *Distinguished Professor of Chemistry, University of Utah*, and Jesse L. Beauchamp, *Mary and Charles Ferkel Professor of Chemistry*

KAROLINA ÅSEBY
Howard Hughes Medical Institute SURF Fellow
Junior, BE; Linköping University

An Investigation of Factors Determining the Unexpected Conformational Equilibria of 1,4-Butanedioate in Non-Polar Solvents

Mentor: John D. Roberts, *Institute Professor of Chemistry, Emeritus*

VINCENT C. AUYEUNG
Beckman Scholar
Sophomore, Bi

Analysis of RNAi Effects in Transgenic Mice Carrying an Integrated shRNA Expression Cassette

Mentors: David Baltimore, *President of Caltech; Professor of Biology*, and Xiao-Feng Qin, *Postdoctoral Scholar in Biology*

BRIAN E. AYDEMIR
The Aerospace Corporation SURF Fellow
Junior, EAS

Event Detection Systems for Crisis Management

Mentors: K. Mani Chandy, *Simon Ramo Professor and Professor of Computer Science*, and Daniel M. Zimmerman, *Instructor of Computer Science*

ADAM D. AZARCHS
Sophomore, Ph

Galaxy Morphologies With Evolutionary Algorithms

Mentors: S. George Djorgovski, *Professor of Astronomy*, and Ashish Mahabal, *Senior Postdoctoral Scholar in Astronomy*

EDWARD R. BALLISTER
Howard Hughes Medical Institute SURF Fellow
Freshman, Molecular and Cell Bi; University of California, Berkeley

A Crystallographic Investigation Into the Interaction of Human Immunoglobulin Alpha and Its Receptor

Mentors: Pamela J. Bjorkman, *Professor of Biology; Investigator, Howard Hughes Medical Institute*, and Andrew Herr, *Postdoctoral Scholar in Biology*

DREW BARKER
Junior, Ph; United States Naval Academy

Beam Centering on LIGO Test Masses

Mentor: Michael Landry, *Senior Postdoctoral Scholar in Physics*

TIMOTHY R. BARNES
Freshman, Bi

Reduction of Specimen Charging in Helium-Cooled TEMs Through Titanium Coating

Mentors: Grant J. Jensen, *Assistant Professor of Biology*, and William Tivol, *Staff Member in Biology*

PAVEL G. BATRACHENKO
Axline SURF Fellow
Pre-Freshman

Using Genetic Algorithms to Study Galaxy Morphologies

Mentors: S. George Djorgovski, *Professor of Astronomy*, and Ashish Mahabal, *Senior Postdoctoral Scholar in Astronomy*

BRETT BEACH-KIMBALL
NASA USRP Fellow
Junior, Ay; Wesleyan University

Investigating the Thermal Response of Saturn's Rings Using IDL

Mentor: Glenn S. Orton, *Senior Research Scientist, JPL*

TAMARA R. BECHER
Marcella Bonsall SURF Fellow
Junior, EAS

Understanding Short-Term Visual Memory Limitations

Mentors: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*, and Patrick Wilken, *Postdoctoral Scholar in Biology*

KELLY R. BEFFERT
NASA Space Grant Fellow
Junior, Ch/Ma; Carroll College

Exploring the Ground Data System of the Visual and Infrared Mapping Spectrometer (VIMS) and Imaging Science Subsystem (ISS) Instruments of Cassini

Mentor: Charles C. Avis, *Member of the Technical Staff, JPL*

RACHEL BERKOWITZ
Pre-College, Ph; Hanford High School

Identifying Resonances in the Hanford 2k and 4k Interferometers

Mentor: Michael Landry, *Senior Postdoctoral Scholar in Physics*

CAITLIN R. BERRY .
Sophomore, Illustration; Art Center College of Design

Investigating the Nature of Perception Using the Wagon Wheel Illusion

Mentors: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*, and Leila Reddy, *Graduate Student in Computation and Neural Systems*

NAMAN J. BHATT
Sophomore, Ph

Characterization, Commissioning, and Implementation of the Optical Lever System at Caltech's 40m Advanced LIGO Prototype Lab

Mentor: Alan J. Weinstein, *Professor of Physics*

PARAG D. BHAYANI
Freshman, ACM

Ultraviolet Spectroscopy Using the Galaxy Evolution Explorer

Mentors: Christopher Martin, *Professor of Physics*, and Todd A. Small, *Senior Research Fellow in Physics*

MARIA L. BIGWOOD
NASA Space Grant Fellow
Senior, Aerospace Eng; University of Minnesota

Mars Exploration Rovers (MER) Flight Rules Database With FileMaker Pro

Mentor: Arthur V. Amador, *Member of the Technical Staff, JPL*

SIDDARAYAPPA A. BIKKANNAVAR
Junior, Ph/Ma; Principia College

Identifying the Highest-Redshift Galaxies

Mentor: Peter Eisenhardt, *Research Scientist, JPL*

NICHOLAS BLUDWORTH
NASA Space Grant Fellow
Junior, EE; New Mexico State University

Network Security Using Micro Security Domains

Mentor: Yih-Chiao J. Liu, *Member of the Technical Staff, JPL*

CHARLES BORDIER
Senior, Mechanics; INSA de Lyon

Thermal Noise Fighting: Production and Measurement of a Flex-Joint for Mirror Suspensions

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

EDWARD J. BRAMBLEY
Caltech-Cambridge Exchange
Junior, Ma; University of Cambridge

Gravitational Wave Bursts: Characterization of Transients in LIGO Interferometer Data

Mentors: John G. Zweizig, *Staff Member in Physics*, and Szabolcs Marka, *Senior Postdoctoral Scholar in Physics*

ADAM L. BRAY
Pre-College, Ph/Philosophy; Louisiana School for Math, Science, and the Arts

Analyzing the Correlation Between Gulf Wave Patterns and Microseismic Phenomena at the LIGO Livingston Observatory

Mentors: Andri Gretarsson, *Staff Member in Physics*, and John E. O'Reilly, *Staff Scientist, LIGO*

MARISA S. BRIONES
Howard Hughes Medical Institute MURF Fellow
Junior, Bi; California State University, Northridge

Design and Testing of Engineered IgG Antibodies With Increased *in vivo* Half-Lives

Mentors: Pamela J. Bjorkman, *Professor of Biology; Investigator, Howard Hughes Medical Institute*, and Devin Tesar, *Graduate Student in Biology*

KORI N. BROWN
The James Irvine Foundation MURF Fellow
Junior, CS/Ma; Texas Southern University

Imaging Shallow Structure of the San Andreas Fault With Seismic Refraction Data

Mentors: Robert W. Clayton, *Professor of Geophysics*, and Zhimei Yan, *Graduate Student in Geophysics*

STEVEN L. BRUNTON
Freshman, Ma

Symmetry Reduction and Stability Analysis of the Full Two-Body Problem

Mentors: Jerrold E. Marsden, *Carl F Braun Professor of Engineering and Control and Dynamical Systems*, and Shane D. Ross, *Graduate Student in Control and Dynamical Systems*

JUSTICE E. BRUURSEMA
Senior, Ph; Arizona State University

Calibrating the LIGO Interferometer Using the Recoil of Photons

Mentor: Daniel Sigg, *Senior Scientist in Physics*

JACOB S. BURNIM
Mr. and Mrs. Richard M. Rosenberg SURF Fellow
Freshman, EAS (CS)/Ma

Applying Evolutionary Algorithms to the Graph Ramsey Avoidance Game

Mentors: William Gasarch, *Professor of Computer Science, University of Maryland, College Park*, and Jason J. Hickey, *Assistant Professor of Computer Science*

GEORGE H. CADENA
NSF Center for Neuromorphic Systems Engineering MURF Fellow
Junior, EE; Georgia Institute of Technology

Production of a Chirped Bragg Grating in an Iron-Doped Lithium Niobate Crystal ($LiNbO_3$)

Mentor: Demetri Psaltis, *Thomas G. Myers Professor of Electrical Engineering*

ERIC J. CADY
Victor Neher SURF Fellow
Sophomore, Ph

An Analytic Detector Model for KamLAND

Mentors: Robert D. McKeown, *Professor of Physics*, and Glenn Horton-Smith, *Senior Postdoctoral Scholar in Physics*

BRANT E. CARLSON
Sophomore, Ph

Reconstruction, Simulation, and Visualization for the California High School Cosmic Ray Observatory

Mentor: Robert D. McKeown, *Professor of Physics*

STACY A. CARRIER
NASA USRP Fellow
Junior, Ma; Mount Holyoke College

Spectroscopy of Methanol in Infrared

Mentor: Linda R. Brown, *Research Scientist, JPL*

CALLAWAY J. CASS
Senior, EE; Virginia Polytechnic Institute and State University

Direct Digital Down-Conversion for LIGO Wavefront Sensor Applications

Mentor: Jay W. Heefner, *Staff Member in Physics*

BURAK I. CENDEK
Junior, EE

Cooperative Control of Semi-Autonomous Vehicles

Mentor: Richard M. Murray, *Professor of Mechanical Engineering*

MARKO CETINA
Thomas C. Hays SURF Fellow
Junior, APh

Design and Fabrication of a Planar Photonic Crystal Air Channel Waveguide

Mentors: Oskar J. Painter, *Assistant Professor of Applied Physics*, and Stefan Maier, *Postdoctoral Scholar in Applied Physics*

ANINDITA CHAKRABARTI
NASA USRP Fellow
Senior, Bioch; Boston University

Microbial Diversity of Payload Hazardous Servicing Facility Air

Mentor: Kasthuri J. Venkateswaran, *Member of the Technical Staff, JPL*

LYLE J. CHAMBERLAIN
Sophomore, EAS

Rover Behavior Coordination for Reconfigurable Shoulder Control in All Terrain Exploration

Mentor: Terry Huntsberger, *Senior Member of the Technical Staff, JPL*

KEVIN T. CHAN
Junior, Ma; Harvard University

Evaluation of Techniques to Identify Coincident Bursts in Data From Two LIGO Interferometers

Mentors: Alan J. Weinstein, *Professor of Physics*, and Julien Sylvestre, *Postdoctoral Scholar in Physics*

GRANT CHANG-CHIEN
Freshman, ChE/BEM

Synthesis and Characterization of the Thermoelectric Filled Skutterudite Compounds - $Ce_1Fe_{4-x}Ru_xSb_{12}$

Mentor: Jeff Sakamoto, *Member of the Technical Staff, JPL*

YUAN-HENG CHAO
Junior, EE

Nonlinear Trajectory Generation for Kinematical and Dynamic Robots on the RoboFlag Testbed

Mentors: Richard M. Murray, *Professor of Mechanical Engineering*, and Raktim Bhattacharya, *Postdoctoral Scholar in Control and Dynamical Systems*

CHRISTIE CHATTERLEY
NASA Space Grant Fellow
Senior, ME; Idaho State University

Advanced Technologies for Microspacecraft: Thermal Control for Multifunctional Structures (MFS)

Mentor: Georg Siebes, *Supervisor, Thermal and Fluids Systems Group, JPL*

JOY M. CHAVEZ
The James Irvine Foundation MURF Fellow
Sophomore, Ph; University of Houston

How to Best Observe Radio Line Emission From High Redshift Galaxies

Mentor: Andrew W. Blain, *Assistant Professor of Astronomy*

JEFFREY CHEEK
Junior, Aerospace Eng; University of Arizona

MMARC(Mars Microsatellite Atmospheric Research Constellation): Science

Mentor: Lloyd C. French, *Systems Architect, JPL*

JONATHAN E. CHEN
Arthur R. Adams SURF Fellow
Sophomore, Ch

Synthesis of Building Blocks of a Chondroitin Sulfate Library

Mentors: Linda C. Hsieh-Wilson, *Assistant Professor of Chemistry*, and Sarah Tully, *Graduate Student in Chemistry*

JUDY Y. CHEN
JPLUS SURF Fellow
Junior, Ch; Cerritos Community College

Determination of the Preferred Monoanion Found in the Ionization of Methylsuccinic Acid Studies by Carbon-13 NMR Spectroscopy and Equilibrium Calculations in D_2O

Mentors: John D. Roberts, *Institute Professor of Chemistry, Emeritus*, and Krag Petterson, *Staff Member in Chemistry*

NICHOLAS K. CHIANG
Junior, EE

Photophysical Characterization of Silicon Nanocrystals for Device Applications

Mentors: Harry A. Atwater, *Howard Hughes Professor and Professor of Applied Physics and Materials Science*, and Robert Walters, *Graduate Student in Applied Physics*

ANITA S. CHOI
Hannah Bradley SURF Fellow
Junior, Ch

Novel Fluorescent Sensors for Neuronal Zn^{2+}: Synthesis and Characterization of Zinpyr-Type Sensors With Pendant Biotin Moieties

Mentors: Stephen J. Lippard, *Arthur Amos Noyes Professor of Chemistry, Massachusetts Institute of Technology*, and Dennis A. Dougherty, *George Grant Hoag Professor of Chemistry*

JUNGMIN CHOI
Sophomore, EE; Rose-Hulman Institute of Technology

Coastal Ocean Circulation, Carbon Pathways, and Pollution Hazards off California: Wavelet Analysis of Ocean Color Images

Mentors: Paul DiGiacomo, *Scientist, JPL*, and Corey C. Harmon, *Academic Part Time, JPL*

BENJAMIN CHU
NASA USRP Fellow
Junior, EE/Ph; Carleton College

Modeling Atmospheric OH Behavior Over Table Mountain Facility

Mentor: Richard P. Cageao, *Member of the Technical Staff, JPL*

RUMI CHUNARA
Marcella Bonsall SURF Fellow
Junior, EE

Improved Design of 2D Polarization Contrast Retina

Mentors: Andreas Andreou, *Professor of Electrical and Computer Engineering, Johns Hopkins University*, and Seyed-Ali Hajimiri, *Associate Professor of Electrical Engineering*

SARA E. CINA
Sidney R. and Nancy M. Petersen SURF Fellow
Junior, Ge

Human Magnetoreception: A Possible Sixth Sense?

Mentors: Joseph L. Kirschvink, *Professor of Geobiology*, and Benjamin P. Weiss, *Postdoctoral Scholar in Planetary Science*

PATRICK J. CODD
The Associates SURF Fellow
Junior, Bi

Morphological Characterization of Spindle Cell Neurons in the Anterior Cingulate and Frontoinsular Cortices

Mentors: John M. Allman, *Frank P. Hixon Professor of Neurobiology*, and Karli Watson, *Graduate Student in Biology*

FRANCESCA K. COLONNESE
Freshman, Ay

Extraction of Echelle Spectra: Using the IRAF DOECSLIT Task to Reduce Stellar Spectra for the Study of Planetary Formation

Mentors: Lynne Hillenbrand, *Assistant Professor of Astronomy*, and Russel White, *Postdoctoral Scholar in Astronomy*

CALVIN COOPMANS
NASA Space Grant Fellow
Junior, Computer Eng/CS; Montana State University

MMARC (Mars Microsatellite Atmospheric Research Constellation): Avionics Subsystem

Mentor: Robert F. Shotwell, *Senior Systems Engineer, JPL*

BRANDI M. COSSAIRT
Bristol-Myers SURF Fellow
Freshman, Ch

Fluorescence Detection of Mobility Separated Laser Desorbed Biomolecules in the Gas Phase

Mentors: Jesse L. Beauchamp, *Mary and Charles Ferkel Professor of Chemistry*, and Ronald L. Grimm, *Graduate Student in Chemistry*

FRANCESCO COSTAGLIOLA
Junior, Ph; University of Pisa

Analysis of Thermal Noise of Newly Proposed Design and Material for the Advanced LIGO Suspensions

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

ANGELINA M. CRANS
Freshman, Bi

Mitochondria, Tissue-Specificity, and Aging in *Drosophila*

Mentors: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*, and David Walker, *Postdoctoral Scholar in Biology*

PAOLA A. CRESSY
Howard Hughes Medical Institute MURF Fellow
Junior, Bi; State University of New York at Stony Brook

Analysis of the Competence of the Most Anterior Region of the Neural Tube (Telencephalon) to Produce Neural Crest Cells

Mentors: Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology*, and Peter Lwigale, *Postdoctoral Scholar in Biology*

ABIGAIL T. CRITES
Freshman, Ph

Observation of Galactic Synchrotron Radiation Using a Small Radio Telescope

Mentors: Andrew E. Lange, *Marvin L. Goldberger Professor of Physics*, and Brian G. Keating, *NSF Astronomy and Astrophysics Postdoctoral Fellow*

AIDAN CROOK
Junior, Ph; University of Oxford

Feasibility Study of Implementing Photon Actuation to Control the Length of the LIGO Laser Cavities

Mentor: Michael R. Smith, *Staff Member in Physics*

TAIS DAHL
Junior, Ph/Geoph; University of Copenhagen

An Investigation of the Extent of Mixing During Planet Collision in the Scope of Self-Similar Rayleigh-Taylor Instability

Mentor: David J. Stevenson, *George Van Osdol Professor of Planetary Science*

WEI LIEN S. DANG
Arthur Rock SURF Fellow
Sophomore, EAS (MS)

Carbon Nanotube Field Emitters for Miniature Mass Spectrometers and Nanoklystrons

Mentors: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics*, and Ali Husain, *Graduate Student in Electrical Engineering*

SANJAY DASTOOR
NASA USRP Fellow
Senior, ME; University of California, Berkeley

Sensory Feedback for a Biomorphic Robotic Arm

Mentor: Mitra Hartmann, *Postdoctoral Scholar, JPL*

ANKUR DATTA
Junior, CS; University of Central Florida

Airborne Automated Geologic Field Analyzer

Mentor: Wolfgang Fink, *Senior Researcher, JPL*

MICHAEL E. DAVENPORT
Dr. and Mrs. Lew Allen, Jr. SURF Fellow
Junior, Ph

Gravitational Waves From Galactic Binary Stars

Mentors: E. Sterl Phinney, *Professor of Theoretical Astrophysics*, and Alison Farmer, *Graduate Student in Astronomy*

AME C. DE LEON
Howard Hughes Medical Institute MURF Fellow
Junior, Ch; University of Texas, Pan American

Molecular Architecture of the Vitreous Humor

Mentors: Julia A. Kornfield, *Professor of Chemical Engineering*, and Charles S. Nickerson, *Graduate Student in Chemistry*

NORA L. DEDONTNEY
Honeywell SURF Fellow
Sophomore, ME

Influences of Water on Booming Sand Dunes

Mentors: Melany L. Hunt, *Professor of Mechanical Engineering*, and Gustavo Joseph, *Graduate Student in Mechanical Engineering*

ROBIN C. DEIS
Junior, Bi/Lit

A Comparative Study of Immunoglobulin G Fc Receptors in α-Herpesviruses and Human Cytomegalovirus

Mentors: Pamela J. Bjorkman, *Professor of Biology; Investigator, Howard Hughes Medical Institute*, and Elizabeth Sprague, *Postdoctoral Scholar in Biology*

CESAR A. DEL SOLAR
Northrop Grumman SURF Fellow
Junior, EE

Cooperative Control of Semi-Autonomous Vehicles

Mentor: Richard M. Murray, *Professor of Mechanical Engineering*

GILBERTO DESALVO
Freshman, Bi; University of California, Santa Barbara

A Study of the Efficiency of an Insulated Lentiviral Vector to Block Enhancer and Chromosomal Positioning Effects

Mentor: Barbara J. Wold, *Bren Professor of Molecular Biology*

VINOD DEVANATHAN
Junior, Ge/Astroph; International University Bremen

QUEST for Cosmic Explosions

Mentors: Shrinivas R. Kulkarni, *John D. and Catherine T. MacArthur Professor of Astronomy and Planetary Science*, and Derek Fox, *Postdoctoral Scholar in Astronomy*

YILE DING
Junior, Bi

A Dominant Modifier Genetic Screen for Regulators of γ-secretase

Mentors: Bruce A. Hay, *Associate Professor of Biology*, and Ming Guo, *Assistant Professor of Neurology, University of California, Los Angeles*

RAGHUVEER DODDA
Senior, CS; Southeastern Louisiana University

Impact of Imperfect Optics on the Performance of Laser Interferometer Gravitational Wave Observatory (LIGO)

Mentors: Hiroaki Yamamoto, *Member of the Professional Staff in Physics*, and Msamu Miyakawa, *Postdoctoral Scholar in Physics*

TIMOTHY DONG
J. Weldon Green SURF Fellow
Freshman, Ch

Exploring the Possible Link Between Sleep and Nutrition in *Drosophila*

Mentors: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*, and Pankaj Kapahi, *Postdoctoral Scholar in Biology*

JESSICA J. DUAN
Porter Beach Foundation SURF Fellow
Junior, Ec; Yale University

Characterization of *Adenomatous Polyposis Coli (APC)* in Chick Neural Crest Development

Mentors: Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology*, and Lisa T. Ziemer, *Postdoctoral Scholar in Biology*

COLIN M. DUNDAS
Junior, PISc

Stereo Analysis of the Fine-Scale Roughness of Mars

Mentor: Oded Aharonson, *Assistant Professor of Planetary Science*

CHRISTINA A. DWYER
Sophomore, Ge

Magnetism of Lunar Impact Spherules: A Preliminary Study

Mentors: Joseph L. Kirschvink, *Professor of Geobiology*, and Benjamin P. Weiss, *Postdoctoral Scholar in Planetary Science*

LOUISE R. EDWARDS
Caltech-Cambridge Exchange
Junior, Ge; University of Cambridge

Calibration of an Extended and Improved Fractionation Model

Mentor: Paul D. Asimow, *Assistant Professor of Geology and Geochemistry*

MATTHEW S. EICHENFIELD
Senior, Ph; University of Nevada, Las Vegas

Modelling and Commissioning the Wavefront Sensing Auto-Alignment System of a Triangular Mode Cleaner Cavity

Mentor: Alan J. Weinstein, *Professor of Physics*

ABIGAIL M. ELLIOTT
Sophomore, Bi

Cre Conditional Knockouts: Level of SynGAP and Severity of Phenotype

Mentors: Mary B. Kennedy, *Allen and Lenabelle Davis Professor of Biology*, and Irene Knuesel, *Postdoctoral Scholar in Biology*

AZIEL C. EPILEPSIA
The James Irvine Foundation MURF Fellow
Junior, EE; University of Washington

Thermal Actuation of Microfluidic Devices Using a Silicone Elastomer Bimorph

Mentor: Stephen R. Quake, *Associate Professor of Applied Physics and Physics*

AARON P. ESSER-KAHN
Warren and Katharine Schlinger SURF Fellow
Junior, Ch

Synthesis of 4,4,4-trifluorovaline and 5,5,5-trifluoroisoleucine

Mentor: David A. Tirrell, *Ross McCollum-William H. Corcoran Professor and Professor of Chemistry and Chemical Engineering*

THOMAS ESSINGER-HILEMAN
Sophomore, Ph; Pennsylvania State University

Experimental Test of the Feasibility of Photon Actuation for Advanced LIGO Length Control Systems

Mentor: Michael R. Smith, *Staff Member in Physics*

ELENA FABRIKANT
Freshman

Characterizing the Role of *Drosophila* Gene *Takeout* in Nutrient Modulated Lifespan Changes

Mentors: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*, and Pankaj Kapahi, *Postdoctoral Scholar in Biology*

ANDREI FARAON
Mr. and Mrs. Alfred Munger SURF Fellow
Junior, Ph

Electron-Phonon Coupling in a Nanothermometer

Mentors: Michael L. Roukes, *Professor of Physics, Applied Physics, and Bioengineering*, and Chung Wah Fon, *Graduate Student in Applied Physics*

TIFFANY FINDLEY
Junior, Ph; Southeastern Louisiana University

The Dynamics of Suspended Optics

Mentor: Sanichiro Yoshida, *Assistant Professor of Physics, Southeastern Louisiana University*

KATHRYN W. FITCH
Sophomore, Geobi

Characterization of Fe(III) Reduction Mutants of *S. oneidensis* MR-1

Mentors: Dianne K. Newman, *Clare Booth Luce Assistant Professor of Geobiology and Environmental Science and Engineering*, and Doug Lies, *Staff Member in Geological and Planetary Sciences*

SUVI F. FLAGAN
Glen Cass SURF Fellow
Junior, EAS (ESE)

The Physiological Ecology of Pepper Associated Capsaicin Degraders

Mentor: Jared R. Leadbetter, *Assistant Professor of Environmental Microbiology*

THOMAS S. FLETCHER
Arthur Vining Davis SURF Fellow
Junior, Ch

George Damon: A Pasadena Visionary

Mentor: William F. Deverell, *Associate Professor of History*

BARBARA J. FLEURY
Junior, Env Science; Medgar Evers College

Lithium Battery Research

Mentor: Marshall Smart, *Senior Member of the Technical Staff, JPL*

REBECCA A. FLINT
Junior, Ph

Quantum Communication Through Spin Chains of Varied Geometries

Mentors: John P. Preskill, *John D. MacArthur Professor of Theoretical Physics*, and Sougato Bose, *Postdoctoral Scholar in Physics*

WILLIAM T. FONG
Junior, ACM

Characterization of Extrasolar Terrestrial Planets: Disk-Averaged Spectra of Earth

Mentor: Victoria Meadows, *Research Scientist, JPL*

ANGELA D. FORTNER
Howard Hughes Medical Institute MURF Fellow
Sophomore, Ch; Jackson State University

Designing a Viable System for Studying Protein Translocation of Fluorophore-Labeled Oligonucleotide Substrates by Fluorescence Resonance Energy Transfer

Mentor: Charles P. Collier, *Assistant Professor of Chemistry*

CHRISTOPHER B. FRANCO
Sophomore, Bi

Analysis of the Downstream Effects of PU.1 in Developing T Lymphocytes

Mentors: Ellen Rothenberg, *Professor of Biology*, and Angela Weiss, *Postdoctoral Scholar in Biology*

MENG-MENG FU
Freshman, Bi

Various Phytochemicals as Agonists of Peroxisome Proliferator-Activated Receptor Alpha and Gamma (PPARα and PPARγ)

Mentors: Neil F. Shay, *Associate Professor of Biological Sciences, University of Notre Dame*, and David C. Chan, *Assistant Professor in Biology*

LISA FUKUI
Mr. and Mrs. Donald M. Alstadt SURF Fellow
Sophomore, EAS (CS)

Timing of the Deployment of Top-Down Attention for High Level and Low Level Tasks

Mentors: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*, and Dirk Walther, *Graduate Student in Computation and Neural Systems*

MELANIE A. GAINEY
NASA USRP Fellow
Senior, Bi; Boston University

Coastal Ocean Carbon Observations and Applications

Mentor: Paul DiGiacomo, *Scientist, JPL*

STEVEN S. GAO
Mr. and Mrs. John E. Young SURF Fellow
Freshman, ME

In situ UV Spectrum Analysis of Chemical Vapor Deposition

Mentors: David G. Goodwin, *Professor of Mechanical Engineering and Applied Physics*, and David A. Boyd, *Postdoctoral Scholar in Applied Physics*

EDGARDO GARCÍA
NSF Center for Neuromorphic Systems Engineering MURF Fellow
Sophomore, Ch; University of Puerto Rico, Cayey

Multiple Chemistries Capped Gold Nanocrystals and Modificated/Gold Silica Chemiresistors Nanoparticles Synthesis for Use in the Electronic Nose

Mentors: Nathan S. Lewis, *George L. Argyros Professor and Professor of Chemistry*, and Ting Gao, *Postdoctoral Scholar in Chemistry*

MERSE E. GASPAR
Junior, Ph; Eotvos Lorand University of Sciences Budapest

Expectations on the Gravitational Wave Signals Associated With Cosmic Brehmsstahlung Events

Mentor: Szabolcs Marka, *Senior Postdoctoral Scholar in Physics*

ELAINE P. GEE
Carolyn Ash SURF Fellow
Junior, Ph

Flow and Steady Wins the Race: *In vitro* Protein Transcription/Translation in Microfluidic Molecular Chemostats

Mentors: Stephen R. Quake, *Associate Professor of Applied Physics and Physics*, and Frederick Balagadde, *Graduate Student in Applied Physics*

JOSHUA S. GEIPLE
NASA Space Grant Fellow
Senior, Aerospace Eng; Pennsylvania State University

MMARC (Mars Microsatellite Atmospheric Research Constellation): Mission Design

Mentor: Robert F. Shotwell, *Senior Systems Engineer, JPL*

JOHN D. GEISZLER
Professor Fredrick H. Shair SURF Fellow
Junior, APh

Experimental Investigation of Two Applications for Hollow-Cathode Microplasma Reactors

Mentors: Konstantinos P. Giapis, *Associate Professor of Chemical Engineering*, and Mohan Sankaran, *Graduate Student in Chemical Engineering*

EVAN A. GOETZ
Junior, Ph/Ma; University of Washington

Analysis of the LIGO Interferometer Optical Control Signals

Mentor: Richard Gustafson, *Research Scientist, LIGO*

BENJAMIN GOLUB
Axline SURF Fellow
Pre-Freshman

A Partitioning Method for High-Order Interpolation of Coarsely Sampled Surfaces

Mentors: Oscar P. Bruno, *Professor of Applied and Computational Mathematics*, and Matthew Pohlman, *Postdoctoral Scholar in Applied and Computational Mathematics*

YIYANG GONG
Sophomore, EE

Characterization, Numerial Analysis, and Design of SQUID Devices

Mentors: Inseob Hahn, *Research Scientist, JPL*, Peter Day, *Member of the Technical Staff, JPL*, and David L. Goodstein, *Professor of Physics and Applied Physics and Frank J. Gilloon Distinguished Teaching and Service Professor*

YUAN GONG
Axline SURF Fellow
Pre-Freshman

The Kinetics of a Tetracycline-Repressed Gene in L929 Cells

Mentor: Anand R. Asthagiri, *Assistant Professor of Chemical Engineering*

JOSEPH E. GONZALEZ
Freshman, ECE

A New Algorithm for Evaluating Line-of-Sight on Digital Elevation Maps

Mentor: Robert G. Chamberlain, *Principal, Modeling and Simulation Technologies Group, JPL*

MELANIE A. GOODRICH
Arthur Vining Davis SURF Fellow
Junior, BEM

Nineteenth Century Ballot Reform in California: A Study of the Huntington Library's Political Ephemera Collection

Mentor: R. Michael Alvarez, *Professor of Political Science*

CRISTIAN GRADINARU
Junior, Ch; Cornell University

Multistep Electron Transfer Between Free Radicals in Proteins

Mentors: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*, and Jeremiah Miller, *Graduate Student in Chemistry*

VIVIANA GRADINARU
Sophomore, Ph

Investigations Into Human Spatial Navigation: Pilot Studies for a Virtual Navigation Task

Mentors: Erin M. Schuman, *Associate Professor of Biology; Associate Investigator, Howard Hughes Medical Institute*, and Jessica Edwards, *Graduate Student in Biology*

BENJAMIN R. GRANETT
Alain Porter Memorial SURF Fellow
Junior, Ay

Exploring Variability With the Palomar-QUEST Survey

Mentors: S. George Djorgovski, *Professor of Astronomy*, and Ashish Mahabal, *Senior Postdoctoral Scholar in Astronomy*

ERIK M. GRANSTEDT
Dr. and Mrs. George F. Smith SURF Fellow
Junior, EE

High-Speed Scintillator for X-Ray Detection in Spheromak Plasma

Mentors: Paul M. Bellan, *Professor of Applied Physics*, and Setthivoine You, *Postdoctoral Scholar in Applied Physics*

JESSICA L. GRAY
Sophomore, EAS

Time Lapse of Frog Embryo Development From MRI Data

Mentor: Peter Schröder, *Professor of Computer Science and Applied and Computational Mathematics*

DAVID A. GREER
Caltech-Cambridge Exchange
Junior, Ph; University of Cambridge

Determining an Upper Limit at the 90% Confidence Level for the Branching Fraction $B^+/B^- \rightarrow$ Invisible $(+\gamma)$

Mentors: David G. Hitlin, *Professor of Physics*, and Frank C. Porter, *Professor of Physics*

THERESA M. GRIECO
Freshman, Bi

Expression-Pattern Based Identification and Characterization of Novel Regulators of Neural Crest Development

Mentors: Carole B. LaBonne, *Assistant Professor of Biology, Northwestern University*, and Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology*

DAVID R. GRISWOLD
Mr. and Mrs. Charles J. Pankow SURF Fellow
Sophomore, EAS (CS)

Using Artificial Images to Enhance the Local and Global Reconstruction of Specular Surfaces

Mentors: Pietro Perona, *Professor of Electrical Engineering*, and Silvio Savarese, *Graduate Student in Electrical Engineering*

KELLY GRITTON
NASA Space Grant Fellow
Senior, EE; University of Nevada, Reno

Estimation of Microwave Power Margin Losses Due to Transhorizontal Propagation in 3-30 GHz Frequency Range

Mentor: Christian Ho, *Senior Telecommunications System Engineer, JPL*

ROBERTO GUERRA
Junior, Ph; University of Pisa

LIGO Suspension Control Algorithms

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

NANCY GUILLÉN
Howard Hughes Medical Institute MURF Fellow
Junior, Industrial Biotechnology; University of Puerto Rico, Mayagüez

Structure and Energetics of λ N-Peptide/BoxB RNA Interactions

Mentor: Richard W. Roberts, *Assistant Professor of Chemistry*

CHONGQIN GUO
Roy Owen SURF Fellow
Freshman, Bi

Understanding the *Deadringer* Gene in the Early Development of the *Asterina miniata* Embryo: A Preliminary Characterization of a Starfish e-ARID Transcription Factor

Mentors: Eric H. Davidson, *Norman Chandler Professor of Cell Biology*, and Gabrielle Amore, *Postdoctoral Scholar in Biology*

BRADLEY J. GUSSIN
Freshman, EE; Northwestern University

Passive Heat Pump Using Ferrofluids

Mentor: José I. Rodriguez, *Principal Member of the Technical Staff, JPL*

GEORGE I. HAGSTROM
Freshman, Ph

Using Avida to Test the Effects of Natural Selection of Phylogenetic Tree Reconstruction

Mentors: Charles A. Ofria, *Assistant Professor of Computer Science and Engineering, Michigan State University*, and Christoph C. Adami, *Faculty Associate in Computation and Neural Systems*

MARGARET L. HAINLINE
Junior, Bi; Grinnell College

Role of the SXV-Motif of SynGAP in Synapse Formation

Mentors: Mary B. Kennedy, *Allen and Lenabelle Davis Professor of Biology*, and Luis E. Vazquez, *Graduate Student in Biology*

NICHOLAS W. HALPERN-MANNERS
Freshman, Ch

Synthesis and Modification of Sensitizer-Tethered Substrate Electrodes for Use in the Oxidative Chemistry of Myeloperoxidase

Mentors: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*, and Stephen M. Contakes, *Postdoctoral Scholar in Chemistry*

JEEHEE HAN
Senior, Graphic Design; Art Center College of Design

The New Language in Mechanism Design

Mentor: John O. Ledyard, *Allen and Lenabelle Davis Professor of Economics and Social Sciences*

STEVEN HAN
NSF Center for the Science and Engineering of Materials MURF Fellow
Senior, Ch; California State University, Los Angeles

Analysis and Characterization of Fluoro-Alkyl Ended PEGs With ^{19}F Relaxation NMR and CP-MAS ^{13}C NMR

Mentors: Julia A. Kornfield, *Professor of Chemical Engineering*, and Yong Ba, *Assistant Professor of Chemistry, California State University, Los Angeles*

THOMAS J. HARDCASTLE
Caltech-Cambridge Exchange
Sophomore, Ma; University of Cambridge

Some Problems in Metrically Homogeneous Spaces

Mentors: Alexander S. Kechris, *Professor of Mathematics*, and John Clemens, *Instructor of Mathematics*

SEAN S. HARDESTY
The Aerospace Corporation SURF Fellow
Junior, Ph

Finite Element Approximation of Coupled Structural and Acoustical Resonant Modes of a Violin-Like Cavity

Mentors: Oscar P. Bruno, *Professor of Applied and Computational Mathematics*, and Christophe Geuzaine, *Postdoctoral Scholar in Applied and Computational Mathematics*

PHILIP C. HARRIS
Sophomore, Ph

A Low Pressure RPC for Use in PMTs

Mentor: Douglas G. Michael, *Senior Research Associate in Physics*

LINDSAY HAYS
NASA USRP Fellow
Junior, Ge; Massachusetts Institute of Technology

Coastal Ocean Carbon Observations and Applications

Mentor: Lloyd C. French, *Systems Architect, JPL*

SUSAN Y. HE
Sophomore, EE

The Electronics of the Electronic Nose

Mentor: Nathan S. Lewis, *George L. Argyros Professor and Professor of Chemistry*

JAMES W. HEGEMAN
The Associates SURF Fellow
Junior, Ma

Type II Matrices and Nomura Algebras Arising From Orthogonal Array Graphs

Mentors: Richard M. Wilson, *Professor of Mathematics*, and Ada S. Chan, *Instructor of Mathematics*

MORGAN HENDRY
NASA USRP Fellow
Sophomore, Aeronautics and Astronautics; University of Southern California

Coastal Ocean Carbon Observations and Applications

Mentor: Lloyd C. French, *Systems Architect, JPL*

ERIK M. HENRIKSON
Senior, ME; Arizona State University

MMARC (Mars Microsatellite Atmospheric Research Constellation): Attitude Control System

Mentor: Lloyd C. French, *Systems Architect, JPL*

BENJAMIN D. HERBERT
NASA Space Grant Fellow
Sophomore, Applied and Eng Ph; Cornell University

Evidence for Volatile Transport on the Surface of Triton

Mentor: Bonnie J. Buratti, *Principal Research Scientist, JPL*

ADRIAN J. HERNANDEZ
JPLUS SURF Fellow
Sophomore, ME; College of the Canyons

Mars Project for JPL Microspacecraft Program

Mentor: Lloyd C. French, *Systems Architect, JPL*

WENDY J. HEROLD
Howard Hughes Medical Institute MURF Fellow
Junior, ECE; Carnegie Mellon University

Design of a Micro-Fluidic Constant-Flow Drug Delivery Device

Mentor: Stephen R. Quake, *Associate Professor of Applied Physics and Physics*

ISAAC A. HILBURN
The Associates SURF Fellow
Junior, Geoph

Placing Constraints on the Huronian Supergroup Polar Wander Path From 2.47-2.22 Ga: Inferences on Climate and the Rise of Atmospheric Oxygen

Mentors: Joseph L. Kirschvink, *Professor of Geobiology*, and Benjamin P. Weiss, *Postdoctoral Scholar in Planetary Science*

LEA HILDEBRANDT
Class of '36 SURF Fellow
Freshman, ChE

Photochemistry of Frozen Aqueous Pyruvic Acid Solutions: Relevance to the Reliability of Ice Core Records

Mentors: Michael R. Hoffmann, *James Irvine Professor of Environmental Science*, and Agustín J. Colussi, *Senior Research Fellow in Environmental Science and Engineering*

BRIONY HORGAN
Junior, Ph; Oregon State University

Time-Dependence of Test Mass Modes and Possible Correlations With External Influences

Mentors: Andri Gretarsson, *Staff Member in Physics*, and John E. O'Reilly, *Staff Scientist, LIGO*

SAMUEL HSIUNG
Junior, EAS

Climate Modeling of Extrasolar Planets

Mentor: Victoria Meadows, *Research Scientist, JPL*

HERMES C. HUANG
The Aerospace Corporation SURF Fellow
Junior, APh

Microfabricated Fiber-to-Chip Optical Coupling

Mentors: Oskar J. Painter, *Assistant Professor of Applied Physics*, and Stefan Maier, *Postdoctoral Scholar in Applied Physics*

DIMITRI O. HUGHES
The James Irvine Foundation MURF Fellow
Sophomore, ME; University of Virginia

Developing Methods for Controlling Shrinkage and Porosity of Single Chamber Solid Oxide Fuel Cell Anodes

Mentors: Sossina M. Haile, *Associate Professor of Materials Science and Chemical Engineering*, and Zongping Shao, *Postdoctoral Scholar in Materials Science*

PATRICK A. HUMMEL
Samuel P. and Frances Krown SURF Fellow
Freshman, Ma

On *ab initio* Predictions of the Structure and Function of Odor Receptors

Mentors: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry, Materials Science, and Applied Physics*, and Nagarajan Vaidehi, *Staff Member in Chemistry*

PASHA L. HUNT
NSF Center for the Science and Engineering of Materials MURF Fellow
Senior, Bi/Bioch; California State University, Los Angeles

Reactivity of α-diiminemethyl-platinum(II) Complexes With Singlet Oxygen

Mentors: John E. Bercaw, *Centennial Professor of Chemistry*, David Weinberg, *Graduate Student in Chemistry*, and Matthias Selke, *Professor, Department of Chemistry and Biochemistry, California State University, Los Angeles*

MICHELLE HURST
NASA USRP Fellow
Senior, Ge; Brigham Young University

Secondary Crater Morphology Within Gusev Crater and Isidis Planitia, Mars

Mentor: Matthew P. Golombek, *Principal Scientist, JPL*

MILOS ILAK
Junior, Eng/Ph; Swarthmore College

A Spacecraft Engineering Model in MATLAB for Probabilistic Determination of Design Margins in Conceptual Level Design

Mentors: Joel C. Sercel, *Lecturer in Aeronautics*, and Daniel Thunnissen, *Graduate Student in Mechanical Engineering*

DEREK M. INABA
NASA Space Grant Fellow
Graduate Student, Aeronautics and Astronautics; University of Washington

MMARC (Mars Microsatellite Atmospheric Research Constellation): Mission Design

Mentor: Robert F. Shotwell, *Senior Systems Engineer, JPL*

DAY S. IVY
Howard Hughes Medical Institute EXROP Fellow
Freshman, ChE/BEM

tRNA Import Into Mitochondria: Finding the Hidden Pathway

Mentor: Larry Simpson, *Professor of Microbiology, Immunology, and Molecular Genetics, University of California, Los Angeles; Investigator, Howard Hughes Medical Institute*

BRIAN K. JACKSON
Junior, Ph; Georgia Institute of Technology

Titan's Surface Visibility in the Near and Mid IR

Mentor: Glenn S. Orton, *Senior Research Scientist, JPL*

TRACY E. JANOV
Donald S. Clark SURF Fellow
Sophomore, ME

Processing and Characterizing Bulk Metallic Glasses (BMGs) and BMG Composites

Mentor: Ersan Üstündag, *Assistant Professor of Materials Science*

DAVIT JANVELYAN
JPLUS SURF Fellow
Junior, Computer Sci and Eng; University of California, Los Angeles

The Role of Sleep in Learning and Memory: Directed Forgetting--Useful Versus Useless Memory

Mentors: Shinsuke Shimojo, *Professor of Biology*, and Bhavin Sheth, *Postdoctoral Scholar in Biology*

JEFFREY JAUREGUI
Sophomore, Ma; Harvey Mudd College

Simulating the LIGO Laser Phase Change Resulting From Gravitational Waves

Mentors: Hiroaki Yamamoto, *Member of the Professional Staff in Physics*, and Msamu Miyakawa, *Postdoctoral Scholar in Physics*

QINZI JI
Freshman, Bi

Structural Analysis of the NMDA Receptor Complex

Mentors: Michael Stowell, *Assistant Professor of Biology, University of Colorado, Boulder*, and Mary B. Kennedy, *Allen and Lenabelle Davis Professor of Biology*

LIANG JIANG
Øistein and Rita A. Skjellum SURF Fellow
Junior, Ph

Quantum Cryptography: Security of Quantum Key Distribution and Possible Implementation

Mentor: John P. Preskill, *John D. MacArthur Professor of Theoretical Physics*

FRANKLIN S. JIRÓN
Freshman, EAS

Modeling the Swiss Cheese Pattern on Mars

Mentor: Andrew P. Ingersoll, *Earle C. Anthony Professor of Planetary Science*

CRISTIAN S. JITIANU
Dr. Terry Cole SURF Fellow
Junior, Bi/Ch

Inhibition of Cyclin D1 Gene Expression With Synthetic DNA-Binding Ligands

Mentors: Peter B. Dervan, *Bren Professor of Chemistry*, and Bogdan Olenyuk, *Postdoctoral Scholar in Chemistry*

ANGELIQUE C. JOHNSON
NSF Center for Neuromorphic Systems Engineering MURF Fellow
Junior, Ma/Computer Eng; University of Maryland-Baltimore County

A Biocompatible NeuroChip

Mentors: Yu-Chong Tai, *Professor of Electrical Engineering*, and Angela C. Tooker, *Graduate Student in Electrical Engineering*

MATTHEW R. JOHNSON
Junior, EE; Colorado State University

Investigations Into the Effects of Operation at Cryogenic Temperatures on Various Electronic Components

Mentors: Gary R. Burke, *Technical Group Supervisor, JPL*, and Raymond S. Cozy, *Member of the Technical Staff, JPL*

MATTHEW L. JOHNSTON
Sophomore, EE

Microfluidic Logic Devices: Passive Valve Design for Microfluid Channels

Mentors: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics*, and Guy A. DeRose, *Member of the Professional Staff and Lecturer in Applied Physics and Electrical Engineering*

HARLAN M. KADISH
Freshman, ACM

Generalizing a Theorem of Gauss to a Fermat Curve of Exponent 7

Mentor: Edray H. Goins, *Irvine Foundation Instructor of Mathematics*

MAZIYAR A. KALANI
Sophomore, Bioch; University of California, Los Angeles

An *ab initio* Structure and Function Study of 11 Human Olfactory Receptors

Mentors: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry, Materials Science, and Applied Physics*, and Nagarajan Vaidehi, *Staff Member in Chemistry*

KAMALDEEP KALSI
Caltech-Cambridge Exchange
Sophomore, ME; University of Cambridge

Computation of Bubble-Fluid Interaction in the Potential Flow Around a Sphere

Mentor: Christopher E. Brennen, *Professor of Mechanical Engineering*

AKASH KANSAGRA
Sophomore, Ph/Ma; Massachusetts Institute of Technology

Coordinate Compactifications and Hyperboloidal Slices in Numerical Relativity

Mentors: Lee A. Lindblom, *Senior Research Associate in Theoretical Astrophysics*, and Mark Scheel, *Postdoctoral Scholar in Physics*

ENGIN KARABUDAK
Senior, Ch; Bilkent University

Cation Size Effect on the Superprotonic Behavior of $Cs_xRb_{1-x}H(PO_3H)$

Mentors: Sossina M. Haile, *Associate Professor of Materials Science and Chemical Engineering*, and Lisa A. Cowan, *Graduate Student in Materials Science*

PAUL G. KARAYAN
Freshman, Bi; Duke University

The Effects of Varying Nutrient Environments on *Drosophila melanogaster*

Mentors: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*, and Horng-Dar Wang, *Postdoctoral Scholar in Biology*

BRANDON L. KARLSON
NASA Space Grant Fellow
Sophomore, Aerospace Eng; University of Washington

Coastal Ocean Carbon Observations and Applications

Mentor: Paul DiGiacomo, *Scientist, JPL*

ELLIOTT M. KARPILOVSKY
Junior, EAS

State-Based Automata System for Crisis Management

Mentors: K. Mani Chandy, *Simon Ramo Professor and Professor of Computer Science*, and Daniel M. Zimmerman, *Instructor of Computer Science*

FELICIA R. KATZ
Freshman, Bi

In vivo Magnetic Resonance Imaging on Cuttlefish

Mentors: Ray L. Nunnally, *Director, Lewis Center for Neuro Imaging, University of Oregon*, and Oskar J. Painter, *Assistant Professor of Applied Physics*

HELENA M. KAUPPILA
Junior, Ma

Representations of the Hyperoctahedral Group and Related Algebras

Mentors: Vladimir Baranovsky, *Scott Russell Johnson Senior Research Fellow in Mathematics*, and Alexei Borodin, *Professor of Mathematics*

ERIC D. KELSIC
Freshman, Ph

Writing Dynamics in Highly Birefringent Photoaddressable Thin Polymer Films

Mentors: Harry A. Atwater, *Howard Hughes Professor and Professor of Applied Physics and Materials Science*, and Beth Lachut, *Graduate Student in Materials Science*

MARGOT C. KIMURA
Sophomore, ME

Mesoscale Self-Assembly

Mentor: Adrian Ponce, *Visiting Associate in Chemistry; Senior Member of the Technical Staff, JPL*

MELISSA E. KING
Howard Hughes Medical Institute MURF Fellow
Sophomore, Bi; Mount St. Mary's College

Dependence of DNA-Protein Cross-Linking on DNA Sequence

Mentor: Eric D.A. Stemp, *Visiting Associate in Chemistry*

PATRICK N. KIRUKI
Sophomore, Product; Art Center College of Design

The Turing Tournament

Mentor: John O. Ledyard, *Allen and Lenabelle Davis Professor of Economics and Social Sciences*

JESSIE M. KNEELAND
Doris Everhart SURF Fellow
Junior, Ge

A Model of Oceanic Salinity From Pore Fluid Chlorinity Profiles

Mentor: Tapio Schneider, *Assistant Professor of Environmental Science and Engineering*

BENCE KOCSIS
Senior, Ph; Eotvos Lorand University of Sciences Budapest

Expectations on the Gravitational Wave Signals Associated With Cosmic Brehmsstahlung Events

Mentor: Szabolcs Marka, *Senior Postdoctoral Scholar in Physics*

KEIKO KOKEYAMA
Junior, Ph; Ochanomizu University

End-to-End Modeling of the LIGO Detectors

Mentors: Hiroaki Yamamoto, *Member of the Professional Staff in Physics*, and Msamu Miyakawa, *Postdoctoral Scholar in Physics*

PRIYA KOLLIPARA
Freshman, Ay

An Automated Process for the Visual Differentiation of Cometary Bodies From Asteroids

Mentor: Raymond J. Bambery, *Principal Investigator, JPL*

MICHAEL H. KOLODRUBETZ
Axline SURF Fellow
Pre-Freshman

Linear and Non-Linear Impedance of Multielectrode Arrays

Mentors: Jerome Pine, *Professor of Physics*, and Daniel A. Wagenaar, *Graduate Student in Physics*

ANGEL P. KONG
Thomas E. Everhart SURF Fellow
Junior, EE

A Study of Good Protographs for Construction of Low-Density Parity Check (LDPC) Codes

Mentor: Robert J. McEliece, *Allen E. Puckett Professor and Professor of Electrical Engineering*

DANIEL J. KOSLOVER
Freshman, Bi

Characterizing the Role of TSC, TOR, and S6 Kinase in Nutrition Modulated Lifespan Changes Using *Drosophila*

Mentors: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*, and Pankaj Kapahi, *Postdoctoral Scholar in Biology*

IAN M. KRAJBICH
Sophomore, Ph

Direct Digital Down-Conversion for LIGO Applications

Mentor: Jay W. Heefner, *Staff Member in Physics*

ERIC C. KWEI
Ms. Jane Chen SURF Fellow
Freshman

Understanding the Asymmetric Tsuji Reaction

Mentors: Brian M. Stoltz, *Assistant Professor of Chemistry*, and Doug Behenna, *Graduate Student in Chemistry*

CHARLES LA
Marcella Bonsall SURF Fellow
Junior, EAS (CS)

Interactive System for Named Entity Recognition

Mentors: Dan Roth, *Professor of Computer Science, University of Illinois at Urbana-Champaign*, and Pietro Perona, *Professor of Electrical Engineering*

JOLENE L. LAU
Junior, Ch

Development of a New Fluorinated Oxetane Photoresist Polymer for 157 nm Lithography

Mentors: Robert H. Grubbs, *Victor and Elizabeth Atkins Professor of Chemistry*, and Daniel Sanders, *Graduate Student in Chemistry*

STEPHAN T. LAVAVEJ
Junior, EAS

Expressing Parallelism in SCORE

Mentor: André M. DeHon, *Assistant Professor of Computer Science*

RICHARD LEASE
NASA PGGURP Fellow
Sophomore, Geosciences; Princeton University

Martian Boulder Fields

Mentor: Matthew P. Golombek, *Principal Scientist, JPL*

ESTHER S. LEE
Caltech-NUS Exchange
Freshman, Bi

A Survey of Air Quality in Singapore

Mentor: Rajasekhar Balasubramanian, *Senior Lecturer in Chemical and Environmental Engineering, National University of Singapore*

JASON J. LEE
Sophomore, Bi

Crystal Structure of *E. coli* Alkaline Phosphatase at Atomic Resolution

Mentors: Douglas C. Rees, *Professor of Chemistry; Investigator, Howard Hughes Medical Institute*, and Ivana D. Hughes, *Graduate Student in Chemistry*

LUCIE S. LEE
Rita A. and Øistein Skjellum SURF Fellow
Sophomore, Ch

Investigating the Effects of Phenylalanine Analog Incorporation on Activity of Glutathione-S-Transferase

Mentor: David A. Tirrell, *Ross McCollum-William H. Corcoran Professor and Professor of Chemistry and Chemical Engineering*

RACHEL LEE
NASA PGGURP Fellow
Junior, Geosciences; Trinity University

Autonomous Scene Classification of Earth Observer-1 Hyperion Hyperspectral Data

Mentor: Ashley G. Davies, *Lead Scientist, NMP-ST6 Autonomous Sciencecraft Experiment, JPL*

SHAUN P. LEE
Sophomore, ECE

Algorithmic Self-Assembly Movies

Mentors: Erik Winfree, *Assistant Professor of Computer Science and Computation and Neural Systems*, and Paul W. Rothemund, *Senior Research Fellow in Computation and Neural Systems and Computer Science*

JEREMY M. LEIBS
Samuel P. and Frances Krown SURF Fellow
Freshman, EAS

Characterization of Biochemical Gates Based on DNA Catalysis

Mentor: Erik Winfree, *Assistant Professor of Computer Science and Computation and Neural Systems*

JOSEPH LEVY
NASA USRP Fellow
Junior; Ge/Geoph; University of Chicago

Characterization of the 2000-2001 Mars Orbiter Camera State Change

Mentor: Deborah Bass, *Member of the Technical Staff, JPL*

JENNIFER X. LI
David C. Elliot SURF Fellow
Sophomore, Bi

The Effect of Administering IL-6, TNF-α, and IL-1 α Into the Maternal Circulation During Pregnancy Upon Offspring Behaviour in *Mus musculus*

Mentors: Paul H. Patterson, *Professor of Biology*, and Limin Shi, *Staff Member in Biology*

ROBERT L. LI
Junior, Bi

Simulating Biological Methanogenesis in Early Oceans

Mentor: Victoria Meadows, *Research Scientist, JPL*

TING XI T. LIAO
Flintridge Foundation SURF Fellow
Sophomore, Ph

Star Formation History of Field Early-Type Galaxy

Mentors: Richard S. Ellis, *Steele Family Professor of Astronomy*, and Tomasso Treu, *Postdoctoral Scholar in Astronomy*

CATRISSA L. LIGHTFOOT
Howard Hughes Medical Institute MURF Fellow
Junior, Bioch; Mount St. Mary's College

DNA-Protein Crosslinking From Guanine Oxidation: Dependence Upon DNA Sequence as Visualized by Fluorescence With Alexa Fluor

Mentor: Eric D.A. Stemp, *Visiting Associate in Chemistry*

MANIT M. LIMLAMAI
NASA Space Grant Fellow
Junior, APh/EE; Rensselaer Polytechnic Institute

MMARC (Mars Microsatellite Atmospheric Research Constellation): Instruments

Mentor: Robert F. Shotwell, *Senior Systems Engineer, JPL*

ALICE LIN
Sophomore, Bi/BEM

Characterization of JAMM Motif Proteins

Mentors: Douglas C. Rees, *Professor of Chemistry; Investigator, Howard Hughes Medical Institute*, and Xavier Ambroggio, *Graduate Student in Biology*

ERIC S. LIN
Junior, Ph

Synthesis and Experimentation of Carbon Nanotubes

Mentor: Marc W. Bockrath, *Assistant Professor of Applied Physics*

LOGAN T. LINDERMAN
Sophomore, Geobi

Testing for Human Magnetoreception Through GSR Analysis in Conditioning Experiments

Mentors: Joseph L. Kirschvink, *Professor of Geobiology*, and Benjamin P. Weiss, *Postdoctoral Scholar in Planetary Science*

JOEL LINDOP
Caltech-Cambridge Exchange
Junior, Eng; University of Cambridge

Prior Distributions for a Bayesian Approach to One-Shot Learning of Object Categories

Mentors: Pietro Perona, *Professor of Electrical Engineering*, and Fei Fei Li, *Graduate Student in Electrical Engineering*

SAMUEL D. LINDSAY-LEVINE
Junior, Ph

Tracking Mirror Velocities in the LIGO Livingston Observatory

Mentors: Andri Gretarsson, *Staff Member in Physics*, and John E. O'Reilly, *Staff Scientist, LIGO*

BINGHAI LING
Rossum Family SURF Fellow
Sophomore, Ch

Synthesis and Assessment of N-Substituted Puromycin Derivatives

Mentor: Richard W. Roberts, *Assistant Professor of Chemistry*

ZHIHAO LIU
Freshman, EAS (CS)

Finite Euclidean Ramsey Theorems

Mentor: Richard M. Wilson, *Professor of Mathematics*

ERICA D. LIVELY
NASA Space Grant Fellow
Sophomore, EE; University of Idaho

Cassini Information Management System Statistics: A General Study of the Time Ordered Listing and SPASS Requests

Mentor: Theresa M. Anderson, *Member of the Technical Staff, JPL*

DANIEL H. LO
Sophomore, Bi; University of California, Berkeley

Homeostatic Control of Feeding in *Drosophila*: Appetitive vs. Avoidance Behavior

Mentors: David J. Anderson, *Professor of Biology; Investigator, Howard Hughes Medical Institute*, and Greg Suh, *Postdoctoral Scholar in Biology*

ETHELMAE V. LOEWER
Elizabeth Nickerson SURF Fellow
Sophomore, ChE

Aerosol Formation by Atmospheric Reaction of Cycloheptene With Ozone in an Acidic Environment

Mentors: Richard C. Flagan, *Irma and Ross McCollum Professor of Chemical Engineering and Professor of Environmental Science and Engineering*, and Roya Bahreini, *Graduate Student in Environmental Science and Engineering*

PO-RU LOH
Axline SURF Fellow
Pre-Freshman

Stepping to Infinity Along Gaussian Primes

Mentor: Dinakar Ramakrishnan, *Professor of Mathematics*

PO-SHEN LOH
Dr. and Mrs. J. Howard Marshall SURF Fellow
Junior, Ma

Stochastic Construction of Expander Graphs

Mentor: Leonard J. Schulman, *Associate Professor of Computer Science*

GERARDO LOPEZ-MENA
NASA Space Grant Fellow
Junior, Ch; Pomona College

Preparation of Hybrid Microhotplate-Based Sensor Arrays With Polymer-Carbon Black Composites and Titanium Dioxide Sensing Films

Mentor: Margie Homer, *Senior Member of the Engineering Staff, JPL*

GALEN R. LORAM
Mr. and Mrs. Robert L. Noland SURF Fellow
Sophomore, Ec

The Effect of Differences in Learning Environments on Changes in Job Structure

Mentors: Colin F. Camerer, *Rea A. and Lela G. Axline Professor of Business Economics*, and Meghana Bhatt, *Graduate Student in Humanities and Social Sciences*

MANISHA U. LOTLIKAR
Sophomore, Bi

Investigating the Link Between Long-Lived Lines of *Drosophila melanogaster*

Mentors: Seymour Benzer, *James G. Boswell Professor of Neuroscience, Emeritus*, and Brian Zid, *Graduate Student in Biology*

KEVIN K. LUI
Freshman, Ph

Investigation of the "Ice Spikes" Phenomenon

Mentors: Kenneth G. Libbrecht, *Professor of Physics*, and Eric Black, *Lecturer in Physics*

JULIA S. MA
Freshman, ECE

Subdivision of Surfaces: A Comparative Analysis of Different Methods

Mentor: Peter Schröder, *Professor of Computer Science and Applied and Computational Mathematics*

TAMMY Y. MA
Erika C. Vote SURF Fellow
Sophomore, EAS (Ae)

Design and Development of a Motor-Controlled Positioning System for Use in Thruster Plume Analysis

Mentor: David Conroy, *Senior Postdoctoral Scholar in Aeronautics*

YUSSANNE P. MA
Junior, ACM

Oxygen Sensing

Mentor: John A. Moss, *Visiting Associate in Environmental Science and Engineering*

MEGAN MACDONALD
NASA Space Grant Fellow
Junior, Aerospace Eng; University of Kansas

Aerogravity Assist Trajectories to the Outer Planets

Mentor: Eugene Bonfiglio, *Member of the Technical Staff, JPL*

DAVIN B. MADDOX
Bob and Carole Chapman Minority SURF Fellow
Sophomore, Ma

On a Statistical Approach to Finding Elliptic Curves of High Rank

Mentor: Edray H. Goins, *Irvine Foundation Instructor of Mathematics*

ASITHA MALLAWAARACHCHI
Caltech-NUS Exchange
Sophomore, EE; National University of Singapore

Seeing Energy: Creating Three-Dimensional Graphics for Visualization of Thermodynamic Stability Relations

Mentor: Paul D. Asimow, *Assistant Professor of Geology and Geochemistry*

ANDREA V. MANZO
Junior, Bi

Identification of Genes Involved in Trigeminal Placode Induction in the Chick

Mentors: Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology*, and Kathryn McCabe, *Postdoctoral Scholar in Biology*

JARED MARKOWITZ
Junior, Ph; Carnegie Mellon University

Development of a Readout Scheme for High Frequency Gravitational Waves

Mentor: Paul Schwinberg, *Staff Member in Physics*

IVY MARR
NASA USRP Fellow
Senior, Ch; Cornell University

1. Design and Implementation of an Educational Research Database for the Education and Public Outreach Community

Mentor: Rebecca Knudsen, *Education Research Specialist, JPL*

2. Fabrication and Calibration of a Methanol Concentration Sensor for Inclusion in a 300 W Direct Methanol Fuel Cell

Mentors: Sekharipuram R. Narayanan, *Group Supervisor, Electrochemical Technologies Group, JPL*, and Thomas I. Valdez, *Member of the Technical Staff, JPL*

THOMAS U. MARRON
Sophomore, Bi; University of Virginia

Creating a Huntington's Disease Model in Yeast to Investigate the Mechanism of Mutant Huntingtin Aggregation Using Novel Single Chain Monoclonal Antibodies

Mentors: Paul H. Patterson, *Professor of Biology*, and Ali Khoshnan, *Postdoctoral Scholar in Biology*

PETER C. MARSDEN
Freshman; Pomona College

Small Craters on the Martian Southern Polar Layered Deposits

Mentor: Bruce C. Murray, *Professor of Planetary Science and Geology, Emeritus*

NICHOLAS MARSHALL
Howard Hughes Medical Institute SURF Fellow
Junior, Ch/Ma; Kennesaw State University

Conformation of Malic Acid by NMR Spectroscopy

Mentors: John D. Roberts, *Institute Professor of Chemistry, Emeritus*, and Krag Petterson, *Staff Member in Chemistry*

JAMES R. MARTIN
Freshman, Ch

Human Magnetoreception Testing Through GSR Analysis and Conditioning

Mentors: Joseph L. Kirschvink, *Professor of Geobiology*, and Benjamin P. Weiss, *Postdoctoral Scholar in Planetary Science*

RAFAEL A. MARTINEZ
Senior, Aerospace Eng; University of Michigan

Ion Energy Analysis of the Plasma Exhaust Plume of a 200 W Hall Effect Thruster

Mentor: David Conroy, *Senior Postdoctoral Scholar in Aeronautics*

CHRISTOPHER L. MCCLENDON
Arthur A. Noyes SURF Fellow
Sophomore, Bi

New Charge Equilibrium Methods for Molecular Dynamics Simulations of Biological Molecules

Mentors: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry, Materials Science, and Applied Physics*, and Nagarajan Vaidehi, *Staff Member in Chemistry*

DAVID MCKINNEY
Mrs. Ralph Jones SURF Fellow
Sophomore, Bi

Investigating Meristem Regulation in *Arabidopsis thaliana*

Mentors: Elliot M. Meyerowitz, *George W. Beadle Professor of Biology*, and Frank Wellmer, *Postdoctoral Scholar in Biology*

JOHN W. MCNAMARA
Freshman, Bi

The Effect of Concurrent Novel Object Related Exploration on Rate of Fear Extinction in C57BL/6N Mice

Mentors: Christof Koch, *Lois and Victor Troendle Professor of Cognitive and Behavioral Biology and Professor of Computation and Neural Systems*, and Colm O'Tuathaigh, *Postdoctoral Scholar in Computation and Neural Systems*

ALEJANDRO D. MERUELO
Freshman, Bi

A Bioinformatical Approach to Genome-Wide Identification of *lin-3* Regulatory Sites in *C. elegans* and *C. briggsae*

Mentors: Paul W. Sternberg, *Professor of Biology; Investigator, Howard Hughes Medical Institute*, and Byung J. Hwang, *Postdoctoral Scholar in Biology*

SUKHESH MIRYALA
Sophomore, EE; University of Pennsylvania

Developing Instrumentation for High Temperature and High Frequency Impedance Analysis

Mentors: Sossina M. Haile, *Associate Professor of Materials Science and Chemical Engineering*, and Dane Boysen, *Graduate Student in Materials Science*

TOMONARI S. MIYASHITA
Sophomore, Ph

A Radiotelescope for Observations of Astrophysical Polarized Radiation

Mentors: Andrew E. Lange, *Marvin L. Goldberger Professor of Physics*, and Brian G. Keating, *NSF Astronomy and Astrophysics Postdoctoral Fellow*

SWATI MOHAN
Senior, Aerospace Eng; Cornell University

Characterization of Martian Gullies to Determine Orientation Dependence

Mentor: Matthew P. Golombek, *Principal Scientist, JPL*

SHELBY A. MONTAGUE
Freshman, Bi

A Passion for Science

Mentor: Diana L. Kormos-Buchwald, *Associate Professor of History*

JULIE M. MORRISON
NASA Space Grant Fellow
Senior, Microbi; University of Maine

Development of Biosensor Probes for Detection of *Bacillus* Spores

Mentor: Ying Lin, *Member of the Technical Staff, JPL*

TAHIRIH MOTAZEDIAN
Junior, Geoph; University of Oregon

Thermal Properties of Dark Slope-Streaks on Mars

Mentors: Oded Aharonson, *Assistant Professor of Planetary Science*, and Norbert Schorghofer, *Postdoctoral Scholar in Planetary Science*

ANAH MOURANT
Junior, Ph; University of New Mexico

Estimation of Parameters of Simulated Gravitational-Wave Signals From Neutron Stars

Mentor: Gregory Mendell, *Scientist, LIGO Hanford Observatory*

DANIEL J. MOYERS
NASA Space Grant Fellow
Graduate Student, CS/ME; West Virginia University

Path Planning and Task Sequence Generation for Mars Exploration Rover Surface Operations via Three-Dimensional Visualization of Rover Image Data

Mentor: Arthur V. Amador, *Member of the Technical Staff, JPL*

EVA R. MURDOCK
Freshman, Bi

An Analysis of the Diurnal and Seasonal Trends of Peroxyacetyl Nitrate in the Harvard Forest

Mentors: J. William Munger, *Senior Research Fellow in Geological and Planetary Sciences, Harvard University*, and Michael R. Hoffmann, *James Irvine Professor of Environmental Science*

ROHAN MURTY
Sophomore, CS; Cornell University

A Distributed Passive Monitoring System for FAST

Mentors: Steven H. Low, *Associate Professor of Computer Science and Electrical Engineering*, and Cheng Jin, *Postdoctoral Scholar in Computer Science*

ARVIND MURUGAN
Junior, Ma

Path Integral Quantization of Gauge Theories

Mentor: Anton N. Kapustin, *Assistant Professor of Theoretical Physics*

PAUL H. NAGAMI
Freshman, Bi

The Greening of *Arabidopsis*: Protein Visualization in the Apical Meristem

Mentors: Elliot M. Meyerowitz, *George W. Beadle Professor of Biology*, and Venugopala Gonehal, *Postdoctoral Scholar in Biology*

GAUTHAM P. NAIR
Samuel P. and Frances Krown SURF Fellow
Junior, Ch

Surface Modification and Electron Transport Studies of Structurally Porous Silicon

Mentor: Nathan S. Lewis, *George L. Argyros Professor and Professor of Chemistry*

SIMONE NAPOLITANO
Junior; University of Pisa

Non-Destructive Qualitative Analysis of Crystallinity via X-Ray Diffraction Measurements

Mentor: Riccardo DeSalvo, *Member of the Professional Staff in Physics*

MATTHEW S. NEEL
NASA Space Grant Fellow
Senior, Ph; Whitman College

Producing and Analyzing Electric Discharge Pulses on Electron Irradiated Printed Circuit Boards

Mentor: Arthur R. Frederickson, *Principal Engineer, JPL*

LYDIA W. NG
Axline SURF Fellow
Pre-Freshman

Making a Better Mouse: Is a C-Terminal PDZ Domain Required to Restore Normal GAT1 Function in Fluorescent Protein-Tagged Knock-in Mice?

Mentors: Henry A. Lester, *Bren Professor of Biology*, and Joanna L. Jankowsky, *Senior Research Fellow in Biology*

KEVIN NIELSON
NSF Center for the Science and Engineering of Materials MURF Fellow
Senior, Ch/Ph/Bi; California State University, Los Angeles

Reactive Force Field Modeling of Co and Cu Catalyzed Carbon Cage Formation

Mentors: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry, Materials Science, and Applied Physics*, Jonas Oxgaard, *Postdoctoral Scholar in Chemistry*, and Wayne Tikkanen, *Professor, Department of Chemistry and Biochemistry, California State University, Los Angeles*

MARIYA H. NOMANBHOY
Freshman, EAS

Analysis of the Scarps and Troughs of the Mars Polar Layered Deposits

Mentor: Bruce C. Murray, *Professor of Planetary Science and Geology, Emeritus*

HUNG D. NONG
Samuel P. and Frances Krown SURF Fellow
Sophomore, ACM

Discrete Exterior Calculus and Its Implementation

Mentors: Jerrold E. Marsden, *Carl F Braun Professor of Engineering and Control and Dynamical Systems*, and Anil Hirani, *Graduate Student in Computer Science*

MARK NOWAKOWSKI
Sophomore, Materials Eng; University of Illinois at Urbana-Champaign

Preparation of Ge (100) Substrates For High Quality Epitaxial Growth of Group IV Materials and Quantum Dots

Mentor: Shouleh Nikzad, *Technical Group Supervisor, JPL*

SHANNON O'BRIEN
NASA Space Grant Fellow
Junior; CS/Ma; Carroll College

Updating the Automated Sequence Processor and Coding Flight Rules for Stardust

Mentor: Laura M. Needels, *Group Supervisor, Mission Applications Software Engineering Group, JPL*

DANIEL C. O'HANLON
Freshman, Ph

Enhancements in Solar Cell Efficiencies With Mixed Halide Redox Couples

Mentors: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*, and Kristine Kilså Jensen, *Postdoctoral Scholar in Chemistry*

MARTIN E. O'LEARY
Caltech-Cambridge Exchange
Sophomore, Ma; University of Cambridge

Sets With Partial Hindman Properties

Mentor: Richard M. Wilson, *Professor of Mathematics*

KARIN I. ÖBERG
Samuel P. and Frances Krown SURF Fellow
Sophomore, Ch

Keck Infrared Spectroscopy of Edge-On Circumstellar Disks

Mentors: Geoffrey A. Blake, *Professor of Cosmochemistry and Planetary Sciences and Professor of Chemistry*, and Abraham Boogert, *Senior Postdoctoral Scholar in Astronomy*

EVAN OCHSNER
Junior, Ph; University of Chicago

Recognition of Gravitational Waves From Binary Neutron Star Inspirals in LIGO Data

Mentors: Alan J. Weinstein, *Professor of Physics*, and Peter Shawhan, *Senior Scientist, LIGO*

GWENDOLYN G. ONG
Sophomore, Ch

Cis-Regulatory Analysis of *SpFoxB*

Mentors: Eric H. Davidson, *Norman Chandler Professor of Cell Biology*, and Takuya Minokawa, *Postdoctoral Scholar in Biology*

LEONARD ONG
Sophomore, Molecular and Cell Bi; University of California, Berkeley

Prediction of 3D Structures and Function of Mouse Olfactory Receptors

Mentors: William A. Goddard III, *Charles and Mary Ferkel Professor of Chemistry, Materials Science, and Applied Physics*, and Nagarajan Vaidehi, *Staff Member in Chemistry*

JAMES P. ORARA
NASA Space Grant Fellow
Senior, CS; Clemson University

Optimization Techniques for Quantum Circuits Using Generalized Singular Value Decompositions

Mentor: Jonathan P. Dowling, *Principal Scientist, JPL*

SANDRA N. OTTENSMANN
Sophomore, Ch

The Thermoelectric Properties of $YbZn_2Sb_2$, $YbCd_2Sb_2$, and $Yb_{14}ZnSb_{11}$

Mentor: G. Jeffrey Snyder, *Senior Member of the Technical Staff, JPL*

MELINDA T. OWENS
Beckman Scholar
Junior, Bi

Dendritic Protein Synthesis and Electrical Stimulation of Hippocampal Neurons

Mentors: Erin M. Schuman, *Associate Professor of Biology; Associate Investigator, Howard Hughes Medical Institute*, and Changan Jiang, *Postdoctoral Scholar in Biology*

TIFFANY A. PALANCA
The James Irvine Foundation MURF Fellow
Sophomore, Bi; Oberlin College

Enrichment and Isolation of Local Spirochetes and Ascorbate Biodegraders

Mentor: Jared R. Leadbetter, *Assistant Professor of Environmental Microbiology*

PANKHUDI PANKHUDI
Junior, EAS

Construction and Manipulation of DNA Tiles in 3D

Mentors: Peter Schröder, *Professor of Computer Science and Applied and Computational Mathematics*, and Steven Schkolne, *Graduate Student in Computer Science*

AMAR PATEL
Howard Hughes Medical Institute SURF Fellow
Freshman, Bi/Ch; Harvard University

Dynamic Glycosylation of CREB: A Determination of the Specific Sites of O-GlcNAc Addition and the Effects of Glycosylation on Transcriptional Activity

Mentors: Linda C. Hsieh-Wilson, *Assistant Professor of Chemistry*, and Cristal I. Gama, *Graduate Student in Biochemisitry and Molecular Biophysics*

AMISH A. PATEL
Lester Lees Aeronautics SURF Fellow
Freshman, Ae

Spectroscopic Temperature and Species Measurements in Hydrocarbon Flames

Mentors: Paul E. Dimotakis, *John K. Northrop Professor of Aeronautics and Professor of Applied Physics*, and Jeffrey Bergthorson, *Graduate Student in Aeronautics*

WERONIKA A. PATENA
Sophomore, Bi

Inductive Depletion of Serotonin in the *Drosophila* Brain and the Generation of Gal4-Geneswitch Lines Under Enhancers With Serotonergic Neuron Expression in the Adult *Drosophila* Brain

Mentors: David J. Anderson, *Professor of Biology; Investigator, Howard Hughes Medical Institute*, and Tim J. Lebestky, *Postdoctoral Scholar in Biology*

GALE L. PAULSEN
NASA Space Grant Fellow
Graduate Student, ME; University of Nebraska, Lincoln

All Terrain Exploration With Cliff-bot: Control of Cooperative Robots Using Implicit Communication

Mentor: Eric T. Baumgartner, *Senior Engineer and Group Supervisor, Mechanical and Robotics Technology Group, JPL*

RUXANDRA G. PAUN
Freshman, CS

Empirical Quantification of Pathfinder Route Quality on Mesh Style Networks

Mentor: André M. DeHon, *Assistant Professor of Computer Science*

MARTIN PEEK
Freshman, ChE

Identifying Genes Controlling Biofilm Formation in *Shewanella oneidensis* MR1

Mentor: Alfred M. Spormann, *Associate Professor of Civil and Environmental Engineering, Stanford University*, and Morteza Gharib, *Hans W. Liepmann Professor of Aeronautics and Bioengineering*

KATHERINE PEGORS
Junior, Ph; Purdue University

Upgrade of the LIGO Tidal Actuator via an Improved Reference Cavity Temperature Control System

Mentors: Richard L. Savage, *Member of the Professional Staff in Physics*, and Hugh C. Radkins, *Staff Member in Physics*

BENJAMIN J. PELLETIER
Freshman, EE

Bounding the Fan-Out of Processing Elements in Field-Programmable Gate Arrays While Minimizing Additional Resource Requirements

Mentor: André M. DeHon, *Assistant Professor of Computer Science*

KEVIN A. PENG
Freshman, EE

Probing Redox Chemistry at the Active Site of Cytochrome P450 Using Substrate-Tether Modified Electrodes

Mentors: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*, and Andrew Udit, *Graduate Student in Chemistry*

RICHARD L. PEPE
NASA Space Grant Fellow
Junior, Aerospace Eng; Syracuse University

Flight Hardware Logistics Program: An Organizational Group Assigned With the Task of Supplying Hardware Cheaper, Better, and Faster

Mentor: Kevin P. Clark, *Manager, Flight Hardware Logistics Program, JPL*

BELLE E. PHILIBOSIAN
Barbara and John Gee SURF Fellow
Sophomore, Ge

Remote Digital Tectonic Mapping of the Tabriz Fault, Northwestern Iran, and Error Assessment of Applied Methods

Mentors: Kerry E. Sieh, *Robert P. Sharp Professor of Geology*, and Eric Cowgill, *O.K. Earl Postdoctoral Scholar in Geology*

CARLOS PINEDO
The James Irvine Foundation MURF Fellow
Junior, Aerospace Eng; Massachusetts Institute of Technology

Fuel Mixture Imaging Using Planar Laser Induced Fluorescence of Acetone

Mentors: Fred E.C. Culick, *Richard L. and Dorothy M. Hayman Professor of Mechanical Engineering and Professor of Jet Propulsion*, and Albert Ratner, *Postdoctoral Scholar in Aeronautics*

CODY E. PINION
NASA Space Grant Fellow
Senior, ME; Montana State University

MMARC (Mars Microsatellite Atmospheric Research Constellation): Thermal Design

Mentor: Robert F. Shotwell, *Senior Systems Engineer, JPL*

NICHOLAS A. PIRO
Ernest H. Swift SURF Fellow
Junior, Ch

Synthesis and Metalation of 1,3-Bis(imino)pyridine-2-ylidene Pincer Ligands

Mentors: John E. Bercaw, *Centennial Professor of Chemistry*, and Jonathan Owen, *Graduate Student in Chemistry*

ADAM P. PLESNIAK
NASA Space Grant Fellow
Sophomore, ME; Rensselaer Polytechnic Institute

MMARC (Mars Microsatellite Atmospheric Research Constellation): Structure and Configuration

Mentor: Robert F. Shotwell, *Senior Systems Engineer, JPL*

JILL POCOCK
NASA Space Grant Fellow
Sophomore, MS/Eng; University of Nevada, Reno

Epoxy: The Study of the Adhesive Properties of Polymers Used for Bonding Nanolaminates to Graphite Composites in Actuated Hybrid Mirrors

Mentor: Gregory S. Hickey, *Manager, Actuated Hybrid Mirror Project, JPL*

JOSEF M. POHL
NASA Space Grant Fellow
Graduate Student, CS; University of Wyoming

Creating a Continental-Scale Stream Extractions Algorithm With an Implementation for Computational-Grid Based Systems

Mentor: David W. Curkendall, *Manager, Earth System Information Technology Office, JPL*

BENJAMIN J. POLLARD
NASA Space Grant Fellow
Sophomore, Ph; University of Idaho

Satellite Induced Wave Structure in Saturn's Rings: A Search for and Analysis of Wavelike Features in Voyager RSS and PPS Occultation Data

Mentors: Linda J. Spilker, *Principal Research Scientist, JPL*, and Stuart H. Pilorz, *Scientist, JPL*

DAVID N. POWERS
Peter A. Lindstrom, Jr., SURF Fellow
Sophomore, Ch

Detection of Atmospherically Important Peroxy Radicals

Mentors: Mitchio Okumura, *Associate Professor of Chemical Physics*, and Andrew Mollner, *Graduate Student in Chemistry*

SAMUEL J. PRENTICE
Junior, CS/EE; Massachusetts Institute of Technology

Feature Extraction and Classification of Hyperspectral Imagery

Mentor: Rebecca Castaño, *Member of the Technical Staff, JPL*

MICHAEL O. PRIOLO
Mr. and Mrs. Clyde C. Chivens SURF Fellow
Sophomore, EAS (Ae)

Binary Asteroid Pairs: A Numerical Investigation of the Full 2-Body Problem

Mentors: Jerrold E. Marsden, *Carl F Braun Professor of Engineering and Control and Dynamical Systems*, and Shane D. Ross, *Graduate Student in Computation and Neural Systems*

ANTHONY R. PULLEN
Junior, Ph; Southern University and A&M College

Optical Lens System and Magic T Waveguide for Q/U Imaging Experiment (QUIET) Array to Detect Cosmic Microwave Background (CMB) Polarization

Mentor: Todd C. Gaier, *Principal Member of the Technical Staff, JPL*

YAN QI
Sophomore, Ch

Recognition of Base Mismatches in DNA by Novel Rhodium (III) Complexes

Mentors: Jacqueline K. Barton, *Arthur and Marian Hanisch Memorial Professor and Professor of Chemistry*, and Jonathan Hart, *Graduate Student in Chemistry*

JASON D. QUIMBY
Junior, EAS

The Effect of AMSH on the Phosphorylation and Levels of R-Smad Proteins

Mentors: Raymond J. Deshaies, *Associate Professor of Biology; Assistant Investigator, Howard Hughes Medical Institute*, and Gabriela Alexandru, *Postdoctoral Scholar in Biology*

MICHAEL R. QUINN
Mr. and Mrs. Roy F. Destabelle SURF Fellow
Sophomore, Ph

Stability of the Jovian Zonal Jets Under a Global Shallow Water Model

Mentor: Andrew P. Ingersoll, *Earle C. Anthony Professor of Planetary Science*

ANDREAS K. RAHIM
Howard Hughes Medical Institute SURF Fellow
Junior, BE; Royal Institute of Technology

Using High-Resolution Liquid Crystal Nuclear Magnetic Resonance Spectroscopy (Licry-NMR) and the Snyder Equation to Determine the Dihedral Angle in the Gauche Conformation of the Monoprotic Species of Succinic Acid

Mentor: John D. Roberts, *Institute Professor of Chemistry, Emeritus*

ANNE M. RAJALA
Freshman, Ay

Creating a Panoramic Digital Image of the Entire Northern Sky: Background Subtraction

Mentors: S. George Djorgovski, *Professor of Astronomy*, and Ashish Mahabal, *Senior Postdoctoral Scholar in Astronomy*

SURJEET RAJENDRAN
Junior, Ma

Efficient Classical Simulation of Slightly Entangled Quantum Spin Chains

Mentors: John P. Preskill, *John D. MacArthur Professor of Theoretical Physics*, and Guifré Vidal, *Postdoctoral Scholar in Physics*

DANNY MARIA RAMIREZ
Howard Hughes Medical Institute MURF Fellow
Junior, Bi; University of La Verne

Investigation Into the Interaction Between KSR and MEK During T Cell Development

Mentors: José Alberola-Ila, *Assistant Professor of Biology*, and Micheline N. Laurent, *Postdoctoral Scholar in Biology*

CHRISTOPHER B. RAUB
Howard Hughes Medical Institute SURF Fellow
Junior, Molecular Bi; Harvey Mudd College

Cdc6, a DNA Replication Protein, Is Also Involved in Regulating the Timing of Mitosis

Mentors: Judith L. Campbell, *Professor of Chemistry and Biology*, and Susanna Boronat, *Postdoctoral Scholar in Chemistry and Chemical Engineering*

AMANDA RAYA
NASA USRP Fellow
Junior, Ch; Pomona College

Preparation of Hybrid Microhotplate-Based Sensor Arrays With Polymer-Carbon Black Composites and Titanium Dioxide Sensing Films

Mentor: Margie Homer, *Senior Member of the Engineering Staff, JPL*

ELIZABETH H. REGO
Arthur Vining Davis SURF Fellow
Sophomore, Ay

William Morris and *Synthetic* Dyes?

Mentor: Shelley M. Bennett, *Lecturer in Art History*

LUTHER RICHARDSON
NASA Space Grant Fellow
Graduate Student, Ph; Auburn University

MMARC (Mars Microsatellite Atmospheric Research Constellation): Power Subsystem Design

Mentor: Robert F. Shotwell, *Senior Systems Engineer, JPL*

THARATHORN RIMCHALA
Mr. and Mrs. Downie D. Muir III SURF Fellow
Freshman, Bi

ELISA (Enzyme-Linked Immunosorbent Assay) Method for β-catenin Detection in Tumorigenic and Non-Tumorigenic Cells

Mentors: Anand R. Asthagiri, *Assistant Professor of Chemical Engineering*, and Nicholas A. Graham, *Graduate Student in Chemical Engineering*

MICHAEL S. ROBERTS
NASA Space Grant Fellow
Junior, ME; Polytechnic University

Lambda Plate Design and Testing: Used to Help Assist With Superfluidity Experiments

Mentor: Yuanming Liu, *Member of the Technical Staff, JPL*

ROBERT W. ROBERTSON
Freshman, Ph

Average Overdensity of Galaxy Environments as a Function of Galaxy Luminosity and Color

Mentors: Marc P. Kamionkowski, *Professor of Theoretical Physics and Astrophysics*, and Andrew Benson, *Postdoctoral Scholar in Astronomy*

LEONID ROZENBERG
The Aerospace Corporation SURF Fellow
Junior, EAS

Deformed Mesh Matching Using the Minimization Variant of the Generalized Distributive Law

Mentors: Jerrold E. Marsden, *Carl F Braun Professor of Engineering and Control and Dynamical Systems*, and Anil Hirani, *Graduate Student in Computer Science*

EVAN D. RUSHTON
Sophomore, Bi

Finding the Downstream Target Genes of the AGAMOUS Gene in *Arabidopsis thaliana*

Mentors: Elliot M. Meyerowitz, *George W. Beadle Professor of Biology*, and Toshiro Ito, *Postdoctoral Scholar in Biology*

MEREDITH RUSSELL
NASA USRP Fellow
Junior, Ch; Clemson University

Nano/Micro-Precipitate Formation in Bi_2Te_3-PbTe and Sb_2Te_3-PbTe Thermoelectric Materials

Mentor: G. Jeffrey Snyder, *Senior Member of the Technical Staff, JPL*

KATHERINE E. RUTLEDGE
Sophomore, Ch; Williams College

Vicinal Coupling Constants as Determined by NMR Spectrometry for Succinic-1,4-$^{13}C_2$ Acid

Mentors: John D. Roberts, *Institute Professor of Chemistry, Emeritus*, and Krag Petterson, *Staff Member in Chemistry*

JAROSLAW P. RZEPECKI
Senior, Ph; Nicolaus Copernicus University

1. Studies of Sky Subtraction From Bolocam: A Millimeter Wave Bolometric Camera
2. Improving the Accuracy of Numerical Integration of Scalar and Tensor Functions on a Sphere in the Software Package HelPix

Mentor: Krzysztof Gorski, *Member of the Technical Staff, JPL*

JOHN P. SADOWSKI
Axline SURF Fellow
Pre-Freshman

Characterizing the Biopassivation Process for Silicon Nanowires: Applications for Bionanotechnology

Mentor: James R. Heath, *Elizabeth W. Gilloon Professor and Professor of Chemistry*

MONICA R. SALAZAR
NASA Space Grant Fellow
Junior, Marine Science; Maine Maritime Academy

Viable but Non-Cultivable State of *Stenotrophomonas maltophilia*, an Opportunistic Pathogen, Whose Genetic Sequences Are Retrieved From the Drinking Water of the International Space Station

Mentor: Kasthuri J. Venkateswaran, *Member of the Technical Staff, JPL*

SARA SALHA
JPLUS SURF Fellow
Junior, Ph; University of California, Los Angeles

Tomographic Reconstruction: A Theoretical Study of the Wind Velocity Reconstruction Through the Correlation of Shack Hartmann Centroid Data

Mentors: Richard Dekany, *Member of the Professional Staff in Astronomy*, and Matthew Britton, *Postdoctoral Scholar in Planetary Science*

KAMBIZ SAMADI
Senior, Computer Eng; California State University, Fresno

Bit Error Rate Estimation of a Multiple Antenna Communication System Using Importance Sampling

Mentor: Babak Hassibi, *Assistant Professor of Electrical Engineering*

KAYLENE J. SCHAEFER
Senior, Aeronautical Eng; Embry-Riddle Aeronautical University

MMARC (Mars Microsatellite Atmospheric Research Constellation): Propulsion

Mentor: Lloyd C. French, *Systems Architect, JPL*

MICHAEL SCHIRALDI
NASA USRP Fellow
Senior, Natural Science; Fordham University

Bacterial Spore Detection: Increasing the Binding Affinity of Terbium(III) Ions to Dipicolinic Acid

Mentor: Adrian Ponce, *Visiting Associate in Chemistry; Senior Member of the Technical Staff, JPL*

HILKE E. SCHLICHTING
Junior, Ph; University of Cambridge

Infrared Properties of Very Luminous Dusty Galaxies

Mentors: Andrew W. Blain, *Assistant Professor of Astronomy*, and Scott Chapman, *Senior Postdoctoral Scholar in Astronomy*

BRITNEY SCHMIDT
NASA USRP Fellow
Junior, Astronomy; University of Arizona

Evidence for Volatile Transport on the Surface of Triton

Mentor: Bonnie J. Buratti, *Principal Research Scientist, JPL*

ADRIANA SCHOW
JPLUS SURF Fellow
Sophomore, Ch; Golden West College

Optimization of Microfluidic "Lab-on-a-Chip" Components

Mentor: Danielle Svehla, *Member of the Engineering Staff, JPL*

RICHARD W. SCHREYER
Sophomore, CS; University of California, Santa Barbara

Implementation of a Web Map Server

Mentor: Lucian Plesea, *Senior Staff, Information Systems and Computer Science, JPL*

LISA A. SEEMAN
Thomas A. Tombrello, Jr. SURF Fellow
Freshman, EE

Upgrading to Super BaBar: The Modeling and Optimization of a Liquid Xenon Calorimeter

Mentor: David G. Hitlin, *Professor of Physics*

JOHN S. SEGUÍ
JPLUS SURF Fellow
Sophomore, Information and Computer Sci; Riverside Community College

Comparing the Internet and Private Lines for SLE Traffic

Mentors: David B. Childs, *Member of the Technical Staff, JPL*, and Gary Ramah, *Engineer, JPL*

CANDACE S. SEU
Sophomore, ChE

Directed Chemical Fixation of Carbon Dioxide

Mentor: Marc M. Baum, *Visiting Associate in Environmental Science and Engineering*

HANNAH S. SHAFAAT
Mrs. Edwin L. Cline SURF Fellow
Freshman, Bi

Terbium-Catalyzed Degradation of Dipicolinic Acid Due to Microwave Irradiation: Observations in Water and Glycerol

Mentors: Adrian Ponce, *Visiting Associate in Chemistry; Senior Member of the Technical Staff, JPL*, and Karn Sorasaenne, *Postdoctoral Scholar in Chemistry*

RAMAN A. SHAH
Freshman, Ch

Writing Proteins on Glass

Mentors: Charles P. Collier, *Assistant Professor of Chemistry*, and Hyungil Jung, *Postdoctoral Scholar in Chemistry*

KRISTIN R. SHANTZ
The Associates SURF Fellow
Junior, ECE

Using Fluorescence to Characterize DNA Transcriptional Circuits

Mentors: Erik Winfree, *Assistant Professor of Computer Science and Computation and Neural Systems*, and Jongmin Kim, *Graduate Student in Biology*

MAYRA H. SHEIKH
Freshman, Ch

Corrole Photophysics

Mentors: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*, and Jeremy Weaver, *Graduate Student in Chemistry*

STEVEN P. SHEPARD
NASA Space Grant Fellow
Senior, Aerospace Eng; University of Michigan

Formulation of a Grid Clearing Circuit for the Nuclear Electric Xenon Ion System (NEXIS)

Mentor: James E. Polk, *Member of the Technical Staff, JPL*

MATTHEW L. SHEWMAKER
NASA Space Grant Fellow
Senior, ME; University of Idaho

Packbot: Assembling, Testing, and Verifying the Design of an Urbie Rover Hybrid

Mentor: Eric T. Baumgartner, *Senior Engineer and Group Supervisor, Mechanical and Robotics Technology Group, JPL*

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Cooperative Control of Semi-Autonomous Vehicles

Mentors: Richard M. Murray, *Professor of Mechanical Engineering*, and Raktim Bhattacharya, *Postdoctoral Scholar in Control and Dynamical Systems*

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Freshman, APh

Surface Plasmon Enhanced Visible Light Emission in InGaN/GaN Material

Mentors: Axel Scherer, *Bernard Neches Professor of Electrical Engineering, Applied Physics, and Physics*, and Koichi Okamoto, *Postdoctoral Scholar in Electrical Engineering*

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Design of a Micro Aerial Vehicle

Mentors: Morteza Gharib, *Hans W. Liepmann Professor of Aeronautics and Bioengineering*, and John O. Dabiri, *Graduate Student in Bioengineering*

ISBA SILVA
NSF Center for the Science and Engineering of Materials MURF Fellow
Sophomore, Bioch; California State University, Los Angeles

Novel Applications in Microfluidic Devices for Biological Assays

Mentors: Stephen R. Quake, *Associate Professor of Applied Physics and Physics*, Michael Van Dam, *Graduate Student in Applied Physics*, and Frank Gomez, *Professor, Department of Chemistry and Biochemistry, California State University, Los Angeles*

JONATHAN SIMON
Junior, Ph

An Analytic Approach to the Lensing Magnification Distribution Due to CDM Halos

Mentor: Asantha Cooray, *Sherman Fairchild Senior Research Fellow in Physics*

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Mr. Robert M. Abbey SURF Fellow
Junior, Ph

Microstrip Transmission Lines: A Means of Studying Photon-Assisted Tunneling

Mentors: James P. Eisenstein, *Professor of Physics*, and Ian B. Spielman, *Graduate Student in Physics*

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Sophomore, Ph

Measuring the Relaxation Time of Polarized ^{3}He via Adiabatic Fast Passage NMR

Mentors: Robert D. McKeown, *Professor of Physics*, and Lars Hannelius, *Graduate Student in Physics*

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NSF Center for the Science and Engineering of Materials MURF Fellow
Junior, Computer Eng; California State University, Los Angeles

Refinement of Optical Equipment for the Fabrication and Testing of Micro-Resonators

Mentors: Oskar J. Painter, *Assistant Professor of Applied Physics*, Stefan Maier, *Postdoctoral Scholar in Applied Physics*, and Fereydoun Daneshgaran, *Professor of Electrical and Computer Engineering, California State University, Los Angeles*

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Freshman, Ch

Synthesis and Reactivity of Manganese (V) Imido Complexes

Mentor: Marc M. Baum, *Visiting Associate in Environmental Science and Engineering*

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Mr. and Mrs. John E. Young SURF Fellow
Sophomore, APh

A Highly Parallel Site-Directed Mutagenesis Chip

Mentors: Stephen R. Quake, *Associate Professor of Applied Physics and Physics*, and Sebastian Maerkl, *Graduate Student in Biochemistry and Molecular Biophysics*

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Junior, Aeronautics and Astronautics; Massachusetts Institute of Technology

ORION Mission

Mentors: Lloyd C. French, *Systems Architect, JPL*, and Corey C. Harmon, *Academic Part Time, JPL*

MORTEN O. SOMMER
Junior, Bioph; University of Copenhagen

Crystallization of Biological Macromolecules Using Microfluidics

Mentors: Stephen R. Quake, *Associate Professor of Applied Physics and Physics*, and Carl Hansen, *Graduate Student in Applied Physics*

RICHARD W. SPJUT
Junior, Ma

Coastal Wind Observations: A Focus on SAR and Scatterometer Experimental Modes

Mentor: Benjamin Holt, *Member of the Technical Staff, JPL*

ARTHI G. SRINIVASAN
Freshman, EE

Bringing the Science of Space Exploration to the Public

Mentor: Phillips W. Davis, *Staff Member, JPL*

LEO C. STEIN
Freshman, Ph

Developing Methods to Determine Orientation of Anisotropic Crystals From Infrared Spectra

Mentor: Paul D. Asimow, *Assistant Professor of Geology and Geochemistry*

JESSICA J. STOCKBURGER
Samuel P. and Frances Krown SURF Fellow
Freshman, Bi

Vital Attraction: The Role of DCC (Deleted in Colon Cancer) Netrin Receptor in Commissural Axon Guidance at the Midline in Zebrafish Forebrain

Mentors: Scott E. Fraser, *Anna L. Rosen Professor of Biology*, and Magdalena Bak, *Graduate Student in Biology*

DANIEL J. STOLARSKI
Freshman, Ph

Optimizing Bismuth Telluride for a Segmented Thermoelectric Generator

Mentor: G. Jeffrey Snyder, *Senior Member of the Technical Staff, JPL*

JENNIFER A. STOLPER
Arthur Vining Davis SURF Fellow
Sophomore, American History; Harvard College

Conversion to Polygamy: A Microhistory

Mentor: William F. Deverell, *Associate Professor of History*

KATHERINE D. STOY
Sophomore, ME

Rat Whisker Models for Obstacle Avoidance and Object Exploration

Mentor: Mitra Hartmann, *Postdoctoral Scholar, JPL*

MELISSA J. STRAUSBERG
SURF Board SURF Fellow
Junior, PlSc

Modelling the Martian Water Cycle

Mentor: Mark I. Richardson, *Assistant Professor of Planetary Science*

ARVIND R. SUBRAMANIAM
Junior, Metallurgical Eng; Indian Institute of Technology, Madras

Effects of the Titanium Precursor on Sol-Gel Synthesis of Lead Barium Titanate

Mentors: Sossina M. Haile, *Associate Professor of Materials Science and Chemical Engineering*, and Stacey Boland, *Graduate Student in Materials Science*

CHRISTOPHER T. SUNG
Samuel P. and Frances Krown SURF Fellow
Junior, Bi/Ch

The Role of the Small Ubiquitin-Like Modifier (SUMO) in Heat Shock Factor Localization

Mentor: Carl S. Parker, *Professor of Biochemistry*

ELIZABETH SUTTON
NASA USRP Fellow
Junior, Ch; Northeastern University

Characterization of Spore Surface Properties and Spore Associated Particles

Mentor: Ying Lin, *Member of the Technical Staff, JPL*

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Mr. and Mrs. Robert E. Anderson SURF Fellow
Freshman, Ay

Searching the Deep Lens Survey for Galaxy Clusters

Mentor: Judith G. Cohen, *Professor of Astronomy*

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NASA USRP Fellow
Senior, Aeronautics and Astronautics; University of Michigan

Indium FEEP Thruster Beam Diagnostics

Mentor: John K. Ziemer, *Member of the Technical Staff, JPL*

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Howard Hughes Medical Institute SURF Fellow
Junior, Ch; Wellesley College

Conformational Preferences of 2-Fluorosuccinic Acid

Mentors: John D. Roberts, *Institute Professor of Chemistry, Emeritus*, and Krag Petterson, *Staff Member in Chemistry*

MAZHAREDDIN TAGHIVAND
Dr. and Mrs. Peter S. Cross SURF Fellow
Sophomore, ECE

Demonstration of Solitons on a Discrete Non-Linear Transmission Line

Mentors: Seyed-Ali Hajimiri, *Associate Professor of Electrical Engineering*, and Ehsan Afshari, *Graduate Student in Electrical Engineering*

DARCI D. TAYLOR
Senior, Ph/Ma; Westminster College

Surface Optimization of Wafer Bonded Ge/Si Heterostructures for Integration of III/V Semiconductors With Si Substrates

Mentors: Harry A. Atwater, *Howard Hughes Professor and Professor of Applied Physics and Materials Science*, and James Zahler, *Graduate Student in Chemical Engineering*

VERA L. TE VELDE
Axline SURF Fellow
Pre-Freshman

Hubble Space Telescope Observations of the First Galaxy Identified at Redshift z>5

Mentor: Daniel Stern, *Scientist, JPL*

MATTHEW A. TERREL
Arthur E. Lamel Memorial SURF Fellow
Junior, Ph

Analysis of Silica-Based Air Core Bragg Fibers

Mentor: Amnon Yariv, *Martin and Eileen Summerfield Professor of Applied Physics and Professor of Electrical Engineering*

COURTNEY L. TERRELL
Freshman, Ay/Ph; Drake University

Subsurface Ice Probe

Mentor: Michael Hecht, *Project Manager, JPL*

ROHIT P. THOMAS
Sophomore, Ma

Multiple Vertex-Switching Reconstruction

Mentors: Richard M. Wilson, *Professor of Mathematics*, and Ada S. Chan, *Instructor of Mathematics*

JUSTIN R. THOMPSON
NASA Space Grant Fellow
Senior, Ph/AMa; University of Arkansas

Subsurface Ice Probe (SIPR): Simulation Experiments

Mentor: Michael Hecht, *Project Manager, JPL*

ROBERT W. THOMPSON
NASA Space Grant Fellow
Junior, Aerospace Eng; Georgia Institute of Technology

Coastal Ocean Carbon Observations and Applications

Mentor: Lloyd C. French, *Systems Architect, JPL*

CHIRATH N. THOUPPUARACHCHI
Caltech-NUS Exchange
Sophomore, EAS

Multi-Robot Exploration Methods

Mentor: Chong Jin Ong, *Associate Professor of Mechanical Engineering, National University of Singapore*

JIAN YUAN THUM
Arthur R. Adams SURF Fellow
Junior, Bi

Marine Invertebrates: A Study of Ctenophore Genes and Sea Creatures of Oahu, Hawaii

Mentors: Mark Q. Martindale, *Associate Professor of Biology, University of Hawaii*, and Marianne Bronner-Fraser, *Albert Billings Ruddock Professor of Biology*

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Junior, History; Princeton University

A Tale of Two Freeways: Route 210 and Route 710 in the Pasadena Area

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Freshman, Ch

Cleaner Energy With Dye-Sensitized Titanium Dioxide Solar Cells

Mentors: Nathan S. Lewis, *George L. Argyros Professor and Professor of Chemistry*, and Elizabeth I. Mayo, *Graduate Student in Chemistry*

MONICA TIRTADIDJAJA
JPLUS SURF Fellow
Junior, ChE; University of California, Los Angeles

Directed Evolution of LuxR

Mentors: Frances H. Arnold, *Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry*, and Cynthia Collins, *Graduate Student n Biochemistry and Molecular Biophysics*

NEIL K. TIWARI
Beckman Scholar
Sophomore, Ch

Lanthanide-Based Detection of Bacterial Spores: Enhancing the Sensitivity

Mentors: Adrian Ponce, *Visiting Associate in Chemistry; Senior Member of the Technical Staff, JPL*, and Karn Sorasaenne, *Postdoctoral Scholar in Chemistry*

YOLANDA V. TORRES
Senior, Space Sciences; Florida Institute of Technology

Mars Global Surveyor TES, Viking IRTM, and Telescopic History of the Hellas Cloud

Mentor: Leslie K. Tamppari, *Project Scientist, JPL*

VI T. TRAN
Sophomore, Ch

Development of Novel Electrochemical DNA Biosensor Devices on Carbon Electrodes

Mentors: Jacqueline K. Barton, *Arthur and Marian Hanisch Memorial Professor and Professor of Chemistry*, and Thomas G. Drummond, *Graduate Student in Chemistry*

JENNIFER B. TREWEEK
Robert K. and Alice L. Roney SURF Fellow
Junior, Ch

Testing the Stereo- and Regiospecificity of the Ribosome Using Puromycin Analogues

Mentor: Richard W. Roberts, *Assistant Professor of Chemistry*

KEVIN D. TROTTER
Northern California Associates SURF Fellow
Freshman, EAS

Optical Spectroscopy of the Metal-to-Metal Charge-Transfer Absorption in Transition-Metal Cyanides Bound to TiO_2 Nanoparticles

Mentors: Harry B. Gray, *Arnold O. Beckman Professor of Chemistry*, and Elizabeth I. Mayo, *Graduate Student in Chemistry*

SALOMON J. TRUJILLO
Junior, ME

Repeatability Study of a Biomorphic Two-Link Planar Robotic Arm

Mentor: Chris Assad, *Senior Member of the Technical Staff, JPL*

VIVIAN U
Freshman, Ay

Massive Red Galaxies: An Infrared Perspective

Mentors: Richard S. Ellis, *Steele Family Professor of Astronomy*, and Christopher J. Conselice, *Postdoctoral Scholar in Astronomy*

BRIAN S. UNDERWOOD
Dr. and Mrs. Daniel C. Harris SURF Fellow
Sophomore, Ch

Modular Synthesis of Terpenoids

Mentors: Brian M. Stoltz, *Assistant Professor of Chemistry*, and Jeremy May, *Graduate Student in Chemistry*

JAIME M. VALLE
William H. and Helen Lang SURF Fellow
Sophomore, Ph

Simulation of Quantum Cellular Automata

Mentors: John P. Preskill, *John D. MacArthur Professor of Theoretical Physics*, and Dave M. Bacon, *Postdoctoral Scholar in Physics*

NICHOLAS J. VAN BUER
Sophomore, Ge

Xenotime Dating of Neoproterozoic Rifting and Glaciations of South Australia and Southwest Laurentia

Mentors: Brian P. Wernicke, *Chandler Family Professor of Geology*, and Ryan Petterson, *Graduate Student in Geology*

WILLIAM R. VAN DE WATER
Sophomore, Ph

Tomographic Reconstruction of Atmospheric Turbulence Using Adaptive Optics

Mentors: Richard Dekany, *Member of the Professional Staff in Astronomy*, and Matthew Britton, *Postdoctoral Scholar in Planetary Science*

ZHU YING
Freshman, Bi

Proteins Enter the Nucleus With the Aid of Specific Transporter Molecules

Mentor: Carl S. Parker, *Professor of Biochemistry*

WILLIAM C. YOUNG
Sophomore, Ph/Ma

Development of a Fast Ion Energy Analyzer

Mentors: Paul M. Bellan, *Professor of Applied Physics*, and Setthivoine You, *Postdoctoral Scholar in Applied Physics*

THEODORE E. YU
Junior, EE

Symbolic Circuit Analysis: Achieving Low-Entropy Forms Through Pattern Recognition Techniques

Mentor: Glen A. George, *Lecturer in Computer Science and Electrical Engineering*

ANDREA R. YUNG
Sophomore, Materials Sci and Eng, Northwestern University

Software Tools for Diffraction: The Eshelby Model

Mentor: Ersan Üstündag, *Assistant Professor of Materials Science*

DAVID Y. ZHANG
Junior, Bi/ECE/BEM

Binary and Linear-Threshold Gates via DNA

Mentor: Erik Winfree, *Assistant Professor of Computer Science and Computation and Neural Systems*

LIBIN ZHANG
Arthur R. Adams SURF Fellow
Sophomore, Geobi

Very Rare Isotopologues of N_2O

Mentors: John M. Eiler, *Associate Professor of Geochemistry*, and Edwin Schauble, *Postdoctoral Scholar in Geochemistry*

ZHIPENG ZHANG
Junior, Ph

A Micro-Fluidic Counter

Mentor: Stephen R. Quake, *Associate Professor of Applied Physics and Physics*

KRISTEN K. ZORTMAN
Sophomore, EAS (Ae)

NASA Mathematical Education Lesson Review and Alignment

Mentor: Rebecca Knudsen, *Education Research Specialist, JPL*

PHILLIP G. ZUKIN
Dr. Chandler C. Ross SURF Fellow
Freshman, EAS (Ae)

Force Optimization of Pitching and Translating Airfoils

Mentors: Anthony Leonard, *Theodore von Kármán Professor of Aeronautics*, and Michele Milano, *Postdoctoral Scholar in Aeronautics*

CORINNA ZYGOURAKIS
Shirley and Carl Larson SURF Fellow
Freshman, Bi

The Role of the Frontoinsular Cortex in Social Cognition

Mentors: John M. Allman, *Frank P. Hixon Professor of Neurobiology*, and Karli Watson, *Graduate Student in Biology*

LEGEND

Ae	Aeronautics
ACM	Applied and Computational Mathematics
AMa	Applied Mathematics
APh	Applied Physics
Astroph	Astrophysics
Ay	Astronomy
BE	Bioengineering
BEM	Business Economics and Management
Bi	Biology
Bioch	Biochemistry
Ch	Chemistry
ChE	Chemical Engineering
CS	Computer Science
EAS	Engineering and Applied Science
Ec	Economics
ECE	Electrical and Computer Engineering
EE	Electrical Engineering
Eng	Engineering
ESE	Environmental Science and Engineering
Ge	Geology
Geobi	Geobiology
Geoch	Geochemistry
Geoph	Geophysics
H	History
Ma	Mathematics
ME	Mechanical Engineering
MS	Materials Science
Ph	Physics
PlSc	Planetary Science
Psy	Psychology
SES	Science, Ethics, and Society
SS	Social Science

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