

SURF

CALTECH



2016 Group Photo

July 2016

SURF Newsletter

Dear Friend of SURF,

SURF 2016 is well underway! Students are busy working on their projects with high hopes of achieving good results before the end of summer. With over 400 SURFers in all academic divisions, something wonderful is sure to be discovered!

However, beyond the scientific discoveries we know that SURF helps promote student achievement. Students like Ayush Gupta (featured below) are among those undergraduate researchers who graduate at higher rates, receive more honors, and win more academic prizes than those students who do not do research. We are so proud of our students and their accomplishments.

We hope you enjoy learning more about them.

Candace Rypisi
Director, Student-Faculty Programs





*Dr. Harry Gray and Ayush Gupta
Credit: Courtesy of the Caltech Library*

SURFer Ayush Gupta Wins Thesis Prize

By Mike Stefanko

Senior Ayush Gupta has won the 2016 Friends of the Library Senior Thesis Prize and the \$1,200 honorarium that accompanies it. Gupta was quoted as saying that writing a thesis to encompass all his research was a daunting task, but was greatly helped by being able to combine many of the smaller reports he created as part of the SURF program. His thesis was titled "Noncovalent Immobilization of Electrocatalysts on Carbon Electrodes via a Pyrenyl Ligand."

Ayush's 2015 SURF also focused on immobilization, studying fluorinated molecular catalysts on graphitic surfaces. At SURF Seminar Day 2015, Ayush reported on the synthesis of a new bipyridine ligand appended with two perfluorobiphenyl groups. A high surface-area carbon material was prepared and preliminary studies showed a wide range of stable potentials that can be applied. Experiments were continuing to determine the attachment and stability of the catalyst.

Ayush has been working in Professor Harry Gray's lab for the past three years looking into catalysis for the production of solar fuels. For Ayush the most satisfying aspect of the SURF program was being able to pursue his interests in his research full time. Outside of research he also enjoyed the slower pace of summer, allowing him to go camping or to see shows. Ayush felt that the biggest challenge he faced in SURF was learning to operate more independently as a researcher during his third SURF. He had to focus more on how to find information and troubleshoot problems on his own instead of asking his mentor or other grad students in the lab. Apparently Ayush successfully met this challenge, for at the Thesis Prize ceremony Professor Gray noted that Ayush had developed into an independent researcher who also effectively utilized library resources, an essential element considered by the Friends of the Library in awarding the Senior Thesis Prize.

SURF Seminar Days helped Ayush in compiling his thesis by providing an avenue to organize his thoughts and learning how to better focus on the more important information and present it in a logical manner. Ayush also credits Professor Gray and his SURF supervisor, Professor James Blakemore, with helping him find ways to blend the various parts of his research into a cohesive narrative. Gupta will be attending the University of Chicago in the fall to begin work on a PhD in chemistry. He feels that one of the most important things he will be taking from the SURF program is the vast improvement in his communication skills. This

comes both in the form of small group meeting presentations and the slides and posters he made for Seminar Day and other larger presentations. We feel confident that Ayush will have the same level of success in his graduate work that he did here at Caltech.



Students scatter after the official SURF photo
Credit: Courtesy of Petra Kneissl-Milanian

SURF 2016

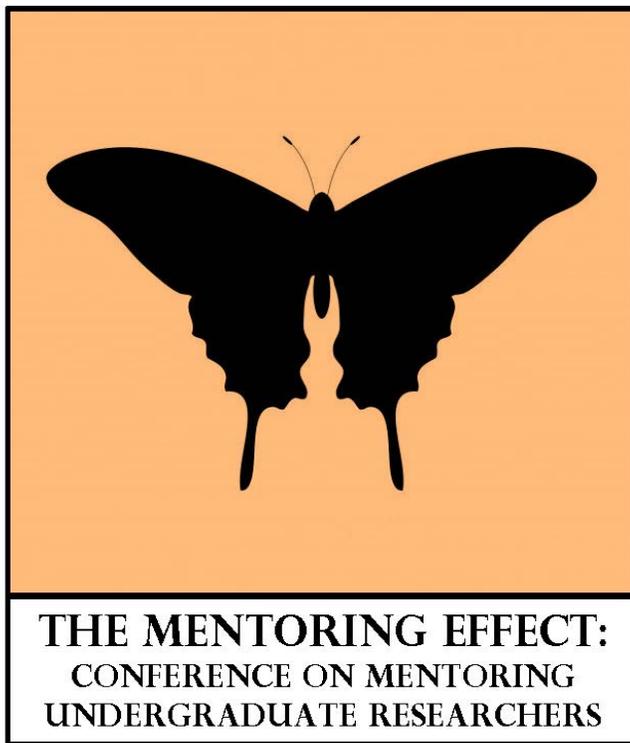
By Candace Rypisi

At many universities summer is a quiet time. Students go home, faculty travel, staff vacation...But at Caltech we SURF! This summer 404 students are immersing themselves in the research enterprise at Caltech, the Jet Propulsion Lab, and at colleges and universities across the globe. They are working with over 200 faculty mentors and 225 co-mentors, the graduate students and postdocs who often oversee the day-to-day progress of our undergraduate researchers.

Students are SURFing in all academic divisions. Here are just a few of the projects being undertaken this summer:

The Role of MicroRNA in Modulating HIV Infection
Modeling a Synthetic Genetic Circuit That Keeps Track of Time
The Role of Prefrontal Dopamine in Risky Decision-Making
Fabrication of Nanostructured Fuel Cell Cathodes by Needleless Electrospinning
Developing a Chemical Model for Ethanol Combustion
Design, Implementation, and Field Trial of Smart Electric Vehicle Charging System
Investigating the Colors of Small Jupiter Trojans
Investigating the Gutenberg-Richter Relationship for Deep Earthquakes
The Neural Computations of Social Learning: The Role of Implicit Bias
Women, Law, and Literature: Feminism in the 19th Century
A Lower Bound on Quantum Ramsey Numbers
Quantum Phase Transitions of Chromium

We can't wait to hear about the results of these projects at SURF Seminar Day on October 15.



Focus on Mentoring

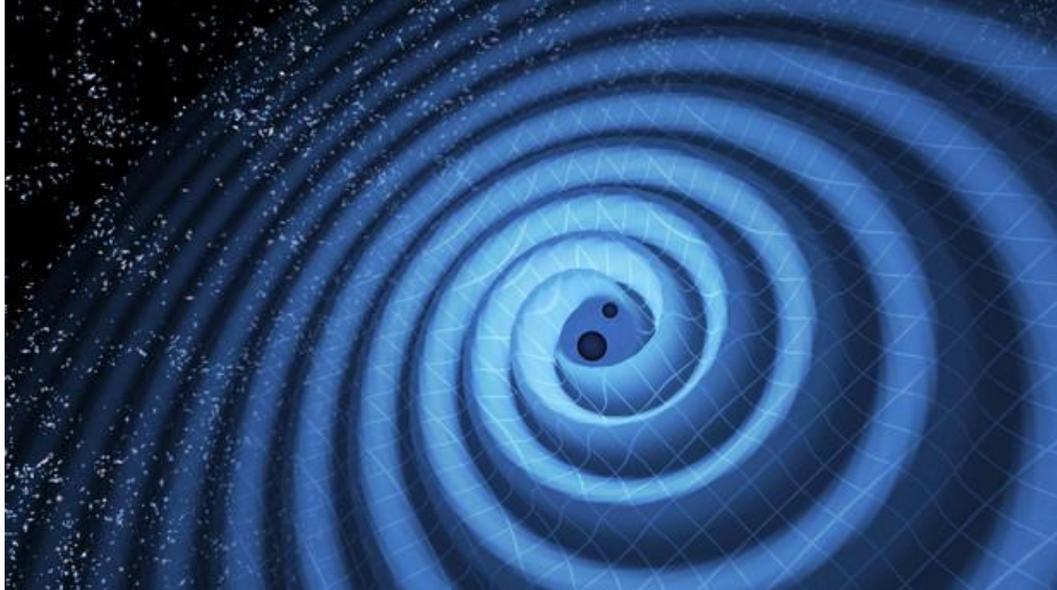
By Candace Rypisi

On May 26, over 80 faculty, postdoctoral scholars, and graduate students attended Caltech's first conference focused on the mentoring of undergraduate researchers. Attendees were treated to a keynote opening session given by Dr. Michael Alvarez, Professor of Political Science and two-time recipient of the Caltech Graduate Student Council Mentoring Award. Dr. Alvarez recognized the important role that mentors play in the academic, professional, and personal development of our undergraduate students and urged mentors to get to know and care for their students on a personal level. He reflected on his own experience as a SURF mentor and shared how many of his SURF summers have produced long-lasting, productive research relationships.

Throughout the day participants were able to attend talks during three different concurrent sessions. Talks focused on topics such as:

Identity and Unconscious Bias in Mentoring
Figuring Out What Your Mentee Knows, How They Know It, and How to Help
Teaching Writing and Communication to Novice Scientists and Engineers
What Makes for a Great Undergraduate Research Project?
How to Mentor the WHOLE Student
Next-Level Leadership: Giving and Receiving Constructive Feedback

And finally, the day ended with a faculty panel sharing their own thoughts and experiences as undergraduate research mentors.



Spiral Dance of Black Holes

Credit: LIGO/T. Pyle

SURFers and LIGO

By Susan Murakami

In February this year the news of the detection of gravitational waves by LIGO (the Laser Interferometer Gravitational Wave Observatory) detectors was released. On September 14, 2015, the twin LIGO detectors both measured ripples in the fabric of space time. This confirmed a major prediction of Albert Einstein's 1915 general theory of relativity. On December 26, 2015, the detectors caught a second robust signal. This has opened an unprecedented new avenue of research into the cosmos. Thanks to Caltech's SURF program, students have been a part of LIGO since the 1990s. Here are a few quotes from a couple of those students who participated last summer.

"Getting the opportunity to learn about the detector which measures signals on the order of one-thousandth of the diameter of a proton was truly amazing. The best part was the trip to the Livingston lab where we witnessed the working detector. My motivation to apply to graduate school has only grown since my SURF project at LIGO."

"I gained an appreciation for how much work goes into the LIGO collaboration from all fields of physics and engineering. I had the opportunity to network with several leading LIGO scientists. After participating in this program, the announcement in February about the first detection of gravitational waves is something I'll never forget. It was thrilling to witness history being made, but even more so because I had been invested and involved in contributing to this massive project."

For further information about LIGO and SURF, please check out this great [article](#) or [Caltech's LIGO Website](#)

Student-Faculty Programs