NEWS BRIEFS

ECE ALUMNA APPOINTED CHIEF OF STAFF IN BIDEN'S OFFICE OF SCIENCE

Tanya Das, who received her PhD in electrical and computer engineering from UC Santa Barbara in 2017, has been appointed to a senior position in the Department of Energy (DOE) by President Joe Biden's administration. She is the new chief of staff to the Office of Science.

"This position is a dream job," said Das, who was a member of associate professor **Jon Schuller**'s research group at UCSB, where she studied the effects of light engineering on multipolar resonances in nanoparticles. "It is an incredible honor to be appointed to advance climate change and racial-equity policies for an administration led by one of the politicians I most respect, President Joe Biden, and the first Black and South Asian and first female vice president, Kamala Harris."

With a $7 billion budget, the Office of Science supports research in the physical sciences, stewards ten of DOE's seventeen national laboratories, and supports workforce development and training programs for teachers and students in the science, technology, engineering, and mathematics (STEM) fields.

"My job is to implement the priorities of the Biden-Harris administration at the Office of Science," said Das. "I hope to support the phenomenal staff at the office by rebuilding its focus on climate science, climate adaptation and mitigation, and clean energy, while strengthening partnerships with the frontline communities who have experienced the worst effects of climate change. I also hope to advance programs that instill the principles of diversity, equity, and inclusion in STEM programs and the national labs that the Office of Science supports."

Since earning her doctorate from UCSB, Das has been applying her training as a scientist to evaluate and improve policy in Washington, D.C. She was named a 2017-18 Arthur H. Guenther Congressional Fellow by the Society of Photo-Optical Instrumentation Engineers and The Optical Society of America (SPIE/OSA), serving a one-year term as a special assistant on the staff of U.S. Senator Chris Coons, of Delaware. The fellowship provided Das with the opportunity to gain substantial insight into the inner workings of government while supporting the senator's economic policy team and professional training opportunities offered by the American Association for the Advancement of Science (AAAS). After the fellowship, she joined the U.S. House of Representatives Committee on Science, Space and Technology as a professional staff member, where she worked on a range of issues in clean energy and manufacturing policy until her appointment to the Office of Science.

Das says that it was both inside and outside of the research lab at UCSB where she developed the skills necessary to succeed in Washington. She worked with Professor Schuller in the field of metamaterials, exploring new ways of using nanoparticles to manipulate light. For two years, she also was a program evaluator at UCSB's Center for Science and Engineering Partnerships (CSEP), which focuses on improving the educational and career outcomes of current and future scientists and engineers.

Tanya Das (PhD '17), chief of staff, Office of Science

She worked at CSEP on the American Institute for Manufacturing Integrated Photonics (AIM Photonics) initiative, to assess the needs of the photonics industry in California, as well as on various other projects at UCSB and the University of Washington to evaluate the effectiveness of STEM diversity programs and to assess learning in STEM courses. Das said that her work beyond the lab helped her understand the broader context of her research and how it fit into the nation's scientific goals.

"The work I did with CSEP helped me realize how I could apply my scientific skills to policy," said Das. "CSEP programs and staff are underappreciated jewels of the university that have helped countless UCSB graduates, like myself, develop the skills they need to be successful professionals — essential skills that can't be learned from just doing research. Without the experience and mentoring that I gained with CSEP, I would not be on the career path I'm on today."

FACEBOOK, IEE PARTNER TO PURSUE DATA CENTER EFFICIENCY

Facebook has provided the Institute for Energy Efficiency (IEE) in UC Santa Barbara's College of Engineering with a three-year, $1.5 million grant to support research aimed at enhancing energy efficiency in data centers and in artificial intelligence (AI).

Researchers at the IEE and Facebook will partner to investigate advanced energy-efficient data-center infrastructure, including low-power optical (ligh-based) interconnects for compute networks and machine learning (ML), in the interest of reducing Facebook's carbon footprint. The company has committed to reaching net zero emissions across its value chain by 2030.

"We are deeply grateful to Facebook for their generosity and support of the university and the Institute for Energy Efficiency," said **Rod Alferness**, dean of the College of Engineering. "This gift will drive collaborative discoveries of potentially world-changing solutions to substantially reduce the energy required to drive vital next-generation data centers and applications of machine learning."

"For more than ten years, Facebook has been focused on designing, building, and operating some of the most efficient data-center facilities in the world," said **Rachel Peterson**, VP of Data Center Strategy at Facebook. "We are thrilled that our research team will partner with UCSB's Institute for Energy Efficiency to help drive innovation and bring energy efficiency to the next level."

Facebook will also help develop research projects and provide IEE researchers with insight gained from their prior experience designing and operating data centers. The tech leader currently has eight operational data-center sites in the U.S., with five more announced but not yet operating.

"Facebook is a world leader in data-center efficiency, and we are happy to partner with them to drive the next generation of technologies to deliver efficiency gains," said IEE Director **John Bowers**, a distinguished professor of materials and electrical and computer engineering, and an internationally renowned authority on silicon photonics and optoelectronics.

Data centers have become much more energy efficient in recent years, but new technologies are still urgently needed to offset the growing demand being driven by ML, AI, and video. With the partnership powering its research endeavors, IEE expects to make significant headway on two grand challenges: achieving multiple orders-of-magnitude improvement in the efficiency of data centers and doing the same in terms of AI/ML workloads.

To that end, IEE researchers are targeting efficiency improvements in multiple areas. Computer science professor **Timothy Sherwood** is leading efforts to develop new hardware and architecture to improve the efficiency of servers and processes and reduce power used for cooling. Computer science assistant professor **William Wang** is working with colleagues to improve algorithmic efficiency, which is expected to yield significant reductions in the data-center power footprint associated with AI and ML applications. Further, IEE's world-class photonics faculty are focused on unlocking the next wave of efficiency breakthroughs associated with interconnects, the essential technologies that provide high-bandwidth connections among compute nodes and to users.

"Last summer, we collaborated with the Facebook AI Group to build an inference engine for Natural Language Processing that achieved ten times the energy efficiency of the current model," said Wang. "It further demonstrates the importance and potential impact of working with industrial partners to understand real-world problems and connect scientific research and engineering."

In recognition of Facebook's gift, the university will name one of the experimental data-center laboratories in Henley Hall the "Facebook Data Center Energy Efficiency Lab." A dedication and recognition ceremony will be scheduled at a later date, once state and county public health restrictions related to the coronavirus are lifted.

A $1.5 million grant from Facebook will support research at Henley Hall, the new home of the Institute for Energy Efficiency, which opened last summer.

CHEMICAL ENGINEERING DEDICATES ROBERT G. RINKER TEACHING LAB

A decade-long effort to modernize the UC Santa Barbara Chemical Engineering Department's undergraduate laboratory facilities culminated with a virtual celebration last fall. Scores of alumni and department supporters participated in a virtual dedication of the **Robert G. Rinker** Chemical Engineering Teaching Laboratory, which was made possible by the completion of a $1 million endowment fund named after Rinker, the first chemical engineering faculty member hired by UCSB.

"I am truly humbled and honored to have my name attached to this generous gift and to the education of our future chemical engineers," said Rinker, a professor emeritus of the department, during the event. "Thank you to all of the alumni who have contributed to the endowment, for their generosity, foresight, and persistence in creating this $1 million endowment for the UCSB undergraduate teaching laboratory. The undergraduate lab must evolve as our discipline evolves, and that takes funding."

Thanks to the endowment, overseen by the university's Office of Development for Engineering, assistant teaching professor **Joseph Chada** will have the opportunity to create a unique and continuously modernized lab for students, ensuring that they receive the hands-on learning experience they need to succeed.

"The endowment makes the lab even more special," said **Rachel**

Ready to experiment: the renovated Robert G. Rinker Chemical Engineering Teaching Laboratory, located in Engineering II.

Segalman, chair of the Chemical Engineering Department. "We're one of the only campuses that now has a dedicated ability to modernize the lab via endowment, to look at it through new developments of the world and new problems in the world and think about what laboratory experience students will need to address them."

Rinker came to UCSB in 1965 as the university's first chemical engineering faculty member. The department officially began in 1966 with two faculty members, Rinker and his first hire, **John E. Myers,** and six undergraduate students. They then recruited an entire faculty, with whom they developed undergraduate and graduate curricula, established the master's and PhD programs, and designed and built laboratories, laying a foundation for the department being recognized today as one of the top ranked programs in the nation.

The event included a video tour to give guests a glimpse of the updated laboratory. A commemorative plaque, unveiled outside the facility, included words of gratitude, as well as the names of the companies and families who contributed to the endowment, which was started in 2006 by then department chair, **Michael Doherty**.

THE CRAFT OF COMPUTING

Jennifer Jacobs, assistant professor in the Media Arts and Technology program at UC Santa Barbara, and two professors at the University of New Mexico have received a $1.4 million grant from the National Science Foundation to examine ways of integrating computational design and fabrication techniques into the production of traditional crafts. Their focus will be on traditional ceramics, with an eye to ensuring that the findings can be generalized to other domains.

Jacobs researches ways to support expressive computer-aided "making" by developing technologies that integrate computational design and digital fabrication with traditional materials and practices. Her collaborators are UNM associate professors Leah Buechley, who runs the Hand and Machine lab there and is a pioneer in paper and fabric-based electronics, and Manuel Montoya, who has worked with rural communities and is leading aspects of the project that investigate craft business practice.

"There's a strong connection between computation and many forms of craft that involve some series of procedures," Jacobs explains. "Textiles, knitting, weaving, and embroidery all map very clearly onto the process of defining a design as a series of instructions and then producing different variations by changing variables in them."

Further, she adds, "Many forms of craft involve the creation of algorithmic patterns or aesthetics. For example, certain forms of Acoma Pueblo ceramics have decorative tessellations and geometric elements that can also be understood through formal mathematic representation."

She is especially interested in the area of computational design and digital fabrication, in which computer programming is used to design and control machines that make, physical objects. "You have the opportunity, quite literally, to write a program that produces a vase from a 3D printer, or a sweater from a computer-controlled knitting machine," she says.

During craft-residencies to be hosted (post-pandemic) at UCSB and UNM, researchers and artisans will collaborate to identify opportunities for, and barriers to, integrating traditional ceramics craft and computational fabrication, and develop new computational fabrication technologies inspired by traditional ceramic craft practice. Business-development workshops will be aimed at further understanding and supporting rural craft businesses, which is Montoya's focus.

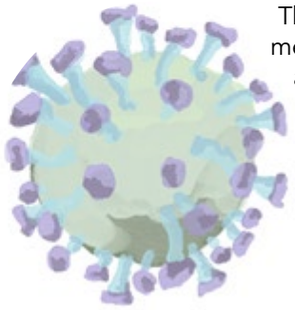
"A big part of what I do is to think about how one develops value propositions around creative work, particularly craft work, the benefits of it; how one thinks about its connection to community, and the greater implications of that," he says. "I'm interested in how this project avoids the false dichotomy asserting that people who are craft workers are backward or tradition-oriented at best, and that technology is always progress-oriented. I like that our aim is to understand how technology and craft intersect while attending to the populations for which both of those points are extremely important."

By hand and machine: this handcrafted cup has a computationally generated surface pattern. Photograph courtesy of Leah Buechley.

"As a technology developer," says Buechley, "I think that many people think of technology as synonymous with fast production —

A SECOND LOOK AT SUNLIGHT

A team of researchers from UC Santa Barbara, Oregon State University, the University of Manchester, and ETH Zurich are urging a closer examination of the SARS-CoV-2 virus's vulnerability to sunlight. The researchers wrote a letter in the *Journal of Infectious Diseases*, asserting that it might be more than UV-B rays that explain sunlight's ability to inactivate the virus.



The idea that an additional mechanism might be in play arose when the team compared data from a July 2020 study that reported rapid sunlight inactivation of SARS-CoV-2 in a lab setting with a theory of coronavirus inactivation by solar radiation that had been published just a month earlier.

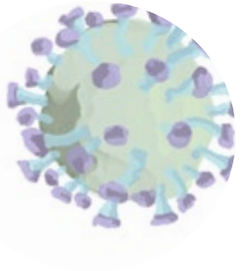
"The theory assumes that inactivation works by having UV-B hit the RNA of the virus, damaging it," said UCSB mechanical engineering assistant professor and lead author **Paolo Luzzatto-Fegiz.** Judging from the discrepancies between the experimental results and the predictions of the theoretical model that preceded it, however, the research team felt that RNA inactivation by UV-B might not be the whole story.

According to the letter, the experiments demonstrated virus inactivation times of about ten to twenty minutes — much faster than predicted by the theory.

"The theory predicts that inactivation should happen an order of magnitude slower," Luzzatto-Fegiz said. In the experiments, viruses in simulated saliva exposed to UV-B lamps were inactivated more than eight times faster than the theory would predict, while those cultured in a complete growth medium before exposure to UV-B were inactivated more than three times faster than expected. To make the math of the theory fit the data, according to the letter, SARS-CoV-2 would have to exceed the highest UV-B sensitivity of any currently known virus.

Or, Luzzato-Fegiz and his colleagues reasoned, there could be another mechanism at play in addition to the inactivation of RNA by UV-B rays. For instance, UV-A, another, less energetic component of sunlight, might be playing a more active role than anyone had thought previously.

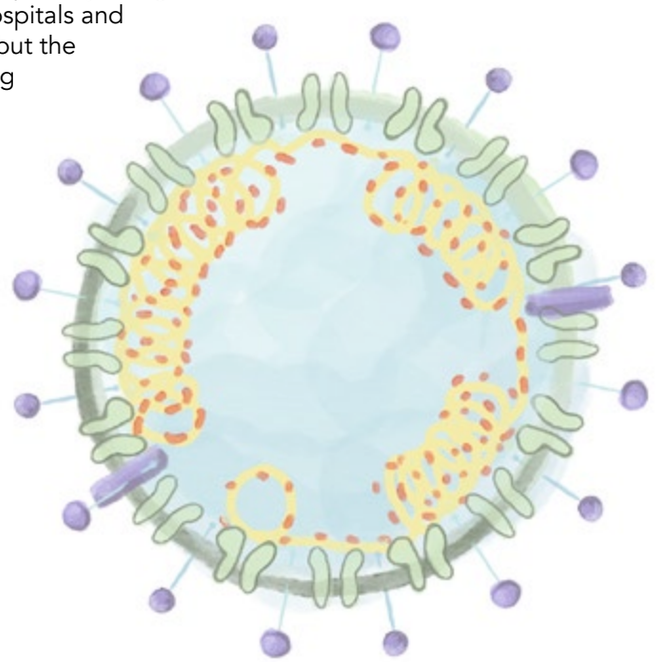
"People think of UV-A as not having much of an effect, but it might be interacting with some of the molecules in the medium," he said. Those reactive intermediate molecules could, in turn, be interacting with the virus, hastening inactivation. It's a concept familiar to those who work in wastewater treatment and other environmental science fields.



"So, scientists don't yet know what's going on," Luzzatto-Fegiz said. "Our analysis points to the need for additional experiments to separately test the effects of specific light wavelengths and medium composition."

Results of such experiments might provide clues into new ways of managing the virus with widely available and accessible UV-A and UV-B radiation. While UV-C radiation has proved effective against SARS-CoV-2, that wavelength does not reach the Earth's surface and must be manufactured. Although UV-C is presently used in air filtration and other technologies, its short wavelengths and high energy also make it the most damaging form of UV radiation, limiting its practical application and raising other safety concerns.

Co-author and UCSB mechanical engineering assistant professor **Yangying Zhu** added that it could be very advantageous if UV-A turns out to be capable of inactivating the virus, because inexpensive LED bulbs that are many times stronger than natural sunlight are now widely available and could be used to accelerate inactivation times. UV-A could potentially be used far more broadly to augment air filtration systems at relatively low risk to human health, especially in high-risk settings such as hospitals and public transportation, but the specifics of each setting warrant consideration.



The coronoravirus's vulnerability to sunlight suggests more research is needed to find out why.