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- Campus life redefined
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To Capture a Comet

Since 2010, the JPL mission NEOWISE has scanned the skies for asteroids and comets. On March 27, 2020, it identified a bright comet approaching the sun. Comet NEOWISE emerged from behind the sun on July 3 and, in the following weeks, dazzled the public and inspired amateur astronomers to capture photos, including the one at left, taken by Corey Husic, a graduate student in the lab of Assistant Professor of Chemistry Maxwell Robb. Of the image, Husic says: "I've been interested in nature photography for some time. More recently, I've become fascinated by astrophotography. I'm blown away by the idea that the same camera I use to take a photograph of a butterfly right in front of me can also take pictures of distant objects in space. I was very excited about the discovery of Comet NEOWISE, since there hadn't been a comet this bright since the mid-'90s. I traveled to darker skies in the San Gabriel Mountains and Mojave Desert to see the comet. But given NEOWISE's connections to Caltech/JPL, I thought it would be cool to view it from campus. I knew it would be a challenge because of the light pollution here in Pasadena. Even on the darkest of nights, it can be difficult to make out more than a few stars, but I had to give it a try. Armed with binoculars and camera, I ventured out onto Beckman Lawn on the evening of July 20. With a bit of searching, using the Big Dipper as a guide, I found the comet. With the naked eye, it was just a faint smudge, although binoculars revealed a bit of the tail. I set up my camera on a tripod, focused on a bright nearby star, and took a six-second exposure, trying to balance light coming in from the faint comet with the overpowering lights in the foreground of the image. The final image is actually a stack of multiple exposures of the same scene, a trick used to combat thermal noise, which becomes a big problem on digital camera sensors on warm summer nights. The final result is the image you see!"

Data from NEOWISE are processed at IPAC, an astronomy center at Caltech.

Learn more at neowise.ipac.caltech.edu



Together, *from a distance*

Michael Alexander, Caltech's public programming director, likes to say he is in the "people-gathering business." At the helm of CaltechLive!, which brings musicians, actors, and dancers to Beckman Auditorium, Alexander has cultivated opportunities to attract diverse audiences and bring people together for informal post-performance discussions at the Red Door Marketplace.

The COVID-19 pandemic changed all that. With all performances online for now, Alexander has had to adapt the series. A live YouTube concert in April with Irish fiddler Eileen Ivers featured both music and banter as Ivers fielded questions from Alexander and responded to comments from the chat stream. The event attracted more than 1,000 viewers and bolstered Alexander's confidence in the viability of an online-only program.

"We are not in a position to create something that is going to compete with a Broadway show or a commercial network presentation," says Alexander, who came to the Institute in 2018. "What we *can* do is create unique conversations with a Caltech stamp that cannot be replicated elsewhere. We are looking at opportunities to find artists who have some kind of connection to science and are addressing issues that are uniquely appropriate for Caltech."

Here is what Alexander and his team have planned this fall for the series now named **The Show Must Go On(line)**:

Live theater

"In November, we will be presenting a live play called *Blood Sugar* by actor Diana Wyenn, who is a Type I diabetic. The play will actually be produced in her house with a three-camera shoot that she and her husband will manage, with the director sitting about 3 miles away, looking at the screens and deciding which camera to use at a given moment. And at the end of this 65-minute play, we will switch into a dialogue-friendly program where audience members and Caltech scientists can discuss the play. I've seen the play before onstage, and it's a very, very powerful piece. At one post-performance conversation, I heard a diabetic say it was the first time they'd ever seen their story onstage."

Author interviews

"At this point, we have three great authors who we're working with. One of them, Blake Hill-Saya, wrote about her great-great-grandfather, Aaron McDuffie Moore, who was the first Black physician in Durham, North Carolina. And then we've got a memoir by [Caltech vice provost, English professor, and chief diversity officer] Cindy Weinstein about her mother's struggle with Alzheimer's, which she co-authored with a physician. Our third author, Indre Viskontas, is a neuroscientist and also an operatic soprano who teaches at the music conservatory of San Francisco. She has a book about how the brain turns sounds into music. These presentations will follow the model I often hear on public radio, with a host in conversation with the author and time set aside for the author to read one or two passages from the book."

Music and dialogue

"Konstantin Batygin (MS '10, PhD '12) [professor of planetary science] is one of three faculty members, along with Julia Greer [materials science professor] and Lucy Jones [visiting associate in geophysics], who were probably at some point in their life caught in that spot of, 'Am I going to be a musician or a scientist?' Konstantin is a rock and roll musician, Julia is a concert pianist, and Lucy plays the viola da gamba. We will be presenting short programs in which they will play some of their music and then we will have some dialogue about the role that art plays in their lives. It is part of what we can do to help the community stay in touch in the absence of those occasional encounters at the Athenaeum and at the Red Door."



For more details, go to events.caltech.edu

The Fight to Save Mount Wilson

On September 6, a wildfire began deep in the San Gabriel Mountains. Dubbed the Bobcat fire, it quickly grew and began to threaten several of the foothill communities near Pasadena; it also began to move westward into Santa Anita Canyon, heading rapidly up the slopes toward the Mount Wilson Observatory, the home of modern observational cosmology and the site of some of the world's most significant astronomical discoveries, including evidence for the expansion of the universe and the first evidence of dark matter. Also located within the perimeter of the observatory is the Caltech-operated Mount Wilson Seismic Station, one of the first six seismic stations installed in Southern California in the 1920s. Data from this seismic station have been used to locate and determine the magnitudes of earthquakes for the past 100 years.

The historic mountaintop site was evacuated on September 7, and the staff, from a safe distance, watched the approaching flames (captured by the observatory's webcam) and took to social media to share updates and extend their gratitude to the firefighters.

One of those anxious observers was Sam Hale, chairman of the board of trustees of the Mount Wilson Institute and grandson of George Ellery Hale, the astronomer who founded the observatory in 1904 and was one of Caltech's founders. In a note to supporters of the observatory on September 15, Sam Hale pointed out that personnel had been preparing all year for a fire, "as we do every year." He continued:



"Trees have been cut. New high-flow hydrants have just been installed a few months ago to help replenish the fire department's tanker trucks with water. ... Our giant 530,000-gallon reservoir has just been topped off and is ready to supply 33 hydrants across the observatory. ... Another 270,000-gallon tank, belonging to the U.S. Forest Service and maintained by the observatory, lies just outside our main gate to help defend the observatory and the broadcast towers, which provide radio, television, and communications to most of the LA Basin.

"As we go to battle, a skeleton crew of four of our maintenance staff will be on hand to assist the firefighters until such time as they are ordered to leave. They have been working all week in extremely smoky conditions readying hoses on all the hydrants, lowering metal shutters on building windows, and countless other critical fire-safety preparations. ...

"While we hope the observatory makes it through relatively unscathed, the battle could go either way. ... We cherish the historic telescopes on the mountain that revolutionized humanity's understanding of the cosmos and hope they will be safe. That is the most important thing."

The firefighters were successful in pushing back that initial threat to the observatory. As of press time, Mount Wilson was still safe.

Watch webcam footage of the fire's approach at mtwilson.edu

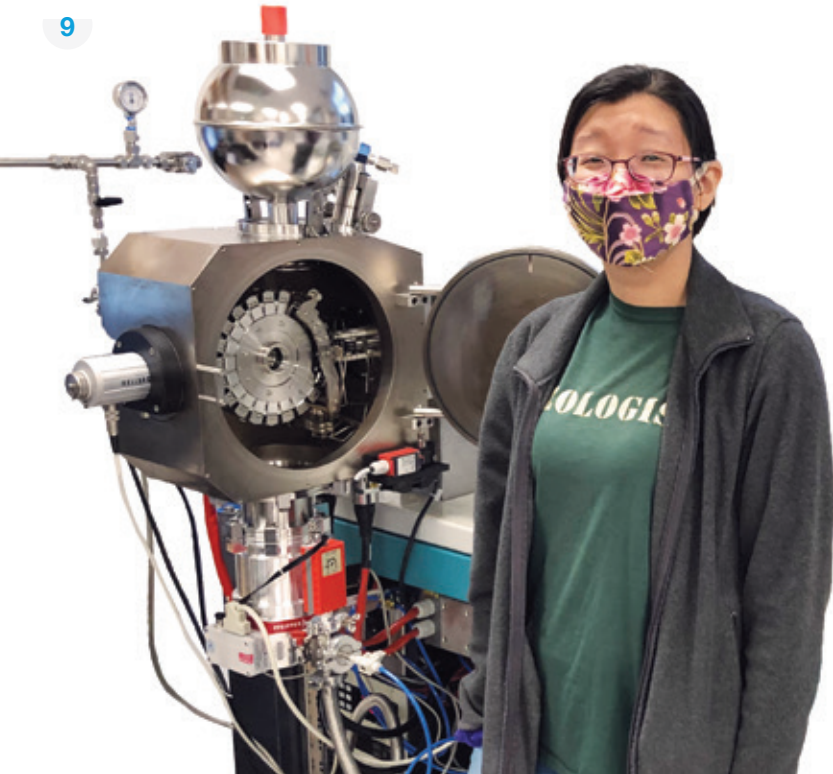
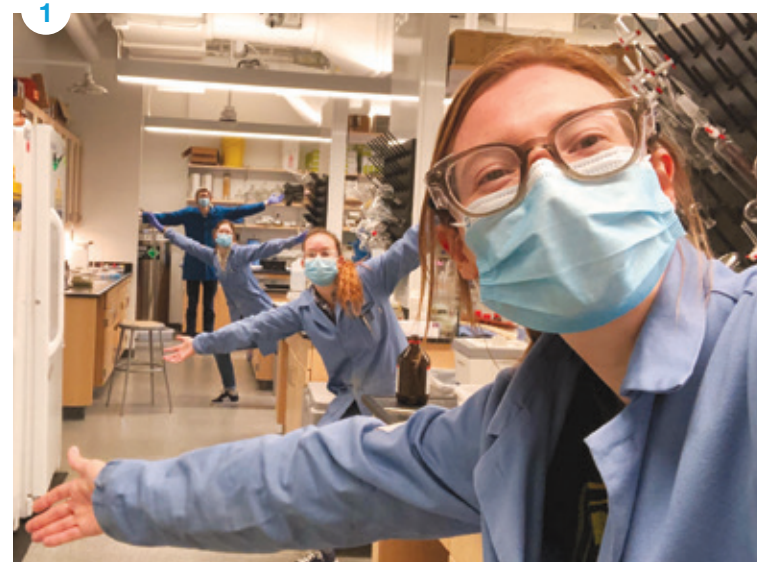


The latest issue of **The Caltech Effect**, an e-magazine featuring stories from the *Break Through* campaign, is now available online at breakthrough.caltech.edu. This issue features researchers who redirected technologies for vital new uses, two graduate students who joined forces to fight cancer, a host of initiatives made possible through leadership chair funding, and five members of the Caltech community on the moments that transformed their careers.



Working it out: on campus today

Over the past seven months, the Institute's response to COVID-19 has focused on prioritizing the health and well-being of students, faculty, and staff through a number of preventative measures to reduce transmission of SARS-CoV-2. These efforts have significantly reduced the number of people physically on campus each day in order to allow others to safely advance the research and education initiatives that are so central to Caltech. A recent call for images of this new normal drew photos of **1)** chemistry graduate student Molly McFadden and colleagues in Maxwell Robb's lab; **2)** the entrance to a shared instrument facility with sticky notes on a white board indicating who is inside (maximum capacity: four); **3)** painter Steve Benson as he takes care of business; **4)** an oddly quiet Red Door Marketplace; **5)** Darrell Goudeau, manager of mail services, at the Caltech post office; **6)** a teacher and a preschooler enjoying the sunshine at the Caltech Child Educational Center; **7)** the office setup of Computing and Mathematical Sciences Teaching Assistant Professor Konstantin Zuev, ready for fall teaching; **8)** chemistry graduate student Jake Evans as he records an upcoming online lecture; **9)** postdoctoral scholar in geochemistry Eugenia Hyung in the lab; **10)** social distancing outside Sherman Fairchild Library.



Annabel Gomez (sophomore)

#SoCaltech is an occasional series celebrating the diverse individuals who give Caltech its spirit of excellence, ambition, and ingenuity. Know someone we should profile? Send nominations to magazine@caltech.edu.

Annabel Gomez is a sophomore at Caltech majoring in mechanical engineering (with a minor in aerospace engineering). This past summer, she participated in Caltech's SURF (Summer Undergraduate Research Fellowships) program, which, for the first time, was conducted remotely. Gomez, the 2020 Northern California Associates SURF Fellow, talked with Caltech magazine about her experience in the midst of the 10-week program.

"As a first-generation Mexican American and the first female in my family to pursue a degree in STEM, my dream has always been to work for NASA. When I got to Caltech and realized that JPL was offering SURF positions, I was determined to land one. This was a big accomplishment for me, and I feel very fortunate. My SURF experience allows me to use my skill set to contribute to the foundation and development of a project that will eventually impact the lives of many people around the world. My mentor [JPL senior research technologist Xiaoqing Pi] and I plan to use machine learning to generate small-scale ionospheric irregularity predictions that will help improve the accuracy and integrity of navigation and communication signals. The exciting thing is that the impact of my SURF trickles down to everyone I interact with. It motivates my little brother, who wants to follow in my footsteps, and it inspires my cousins to pursue a college education, which up until recently they thought was impossible. Most importantly, it has changed my family's perception of higher education; now they realize its importance, especially for women, and no longer see it as a waste of time. My SURF is more than just a summer internship. It's propelled me one step closer to achieving my dream of working for NASA."



For more #SoCaltech, go to tinyurl.com/MagSoCaltech

Watch Convocation 2020 at studentaffairs.caltech.edu/convocation

CONVOCATION 2020

"This diverse population of scholars, namely you, your peers, and your teachers, must be nurtured in an environment in which you are free to express your ideas boldly and fully, and have those ideas challenged and rebutted, shaped, and honed. ...

"You need to understand other cultures and perspectives. ... Virtually, and as soon as it's safe to do so in person, you need to take advantage of theater and art and music on campus. A humanistic education helps us to function as life thrusts us into situations where we have to conceive problems outside of the structures that define them. What better description of the moment we face now? It provides us with an elasticity of thought and familiarity of experience not fully our own, while challenging us to define the essence of what we believe."

— Caltech President Thomas F. Rosenbaum welcoming new undergraduate students at a virtual convocation ceremony, aired on September 21, 2020



New Amazon Quantum Center

Preparations are underway for the new Amazon Web Services Center for Quantum Computing, scheduled to open in spring 2021.

The two-story, 21,000-square-foot facility, which will be located on South Holliston Avenue, will bring together leading researchers and engineers from Amazon, Caltech, and other academic institutions to accelerate advances in quantum computing technology.

Led by Oskar Painter (MS '95, PhD '01), the John G Braun Professor of Applied Physics and Physics, and Fernando Brandão, Bren

Caltech
Together

Together, we can stay healthier.

Follow these steps to help protect yourself and the Caltech community.

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1. Mask on
Wear a face covering indoors and outdoors
- 

2. Spread out
Maintain 6' of distance from anyone outside your household
- 

3. Wash up
Wash hands often and use hand sanitizer
- 

4. Check in
If you work on campus, submit your COVID-19 symptom report every day



together.caltech.edu
United in keeping one another safe and well
THANK YOU for respecting our learning and research community!

Sandwich board signs in high-traffic areas remind those on campus of the steps to follow to protect themselves and the community. The signs are part of Caltech Together, a new campuswide initiative designed to help community members support one another and take responsibility for their collective health and well-being during the pandemic. As well as communicating clear guidelines, Caltech Together aims to bolster a sense of connection and provide wellness support during this time of change and isolation.

Professor of Theoretical Physics, the researchers already involved in the work of the center are aiming to develop more powerful quantum computing hardware and software, and to identify new applications for quantum technologies. Such technologies have the potential to drive transformative advances in areas such as data security, machine learning, medicine development, and sustainability.



Metal-Eating Microbes

Caltech microbiologists have discovered bacteria that feed on manganese. “These are the first bacteria found to use manganese as their source of fuel,” says Jared Leadbetter, professor of environmental microbiology, who made the discovery with postdoctoral scholar Hang Yu (MS ’13, PhD ’17). Leadbetter found the bacteria after performing unrelated experiments using a light chalk-like form of manganese. He had left a glass jar soiled with the substance to soak in his Caltech office sink before departing for several months to work off campus. When he returned, the jar was coated with a dark material that tests revealed to be oxidized manganese generated by newfound bacteria that had likely come from the tap water itself. Further research revealed that these bacteria can also use manganese to convert carbon dioxide into biomass. Previously, researchers knew of bacteria and fungi that could oxidize manganese, but they had only speculated that microbes might be able to harness the process to drive growth.

Find out more at magazine.caltech.edu/post/metal-eaters