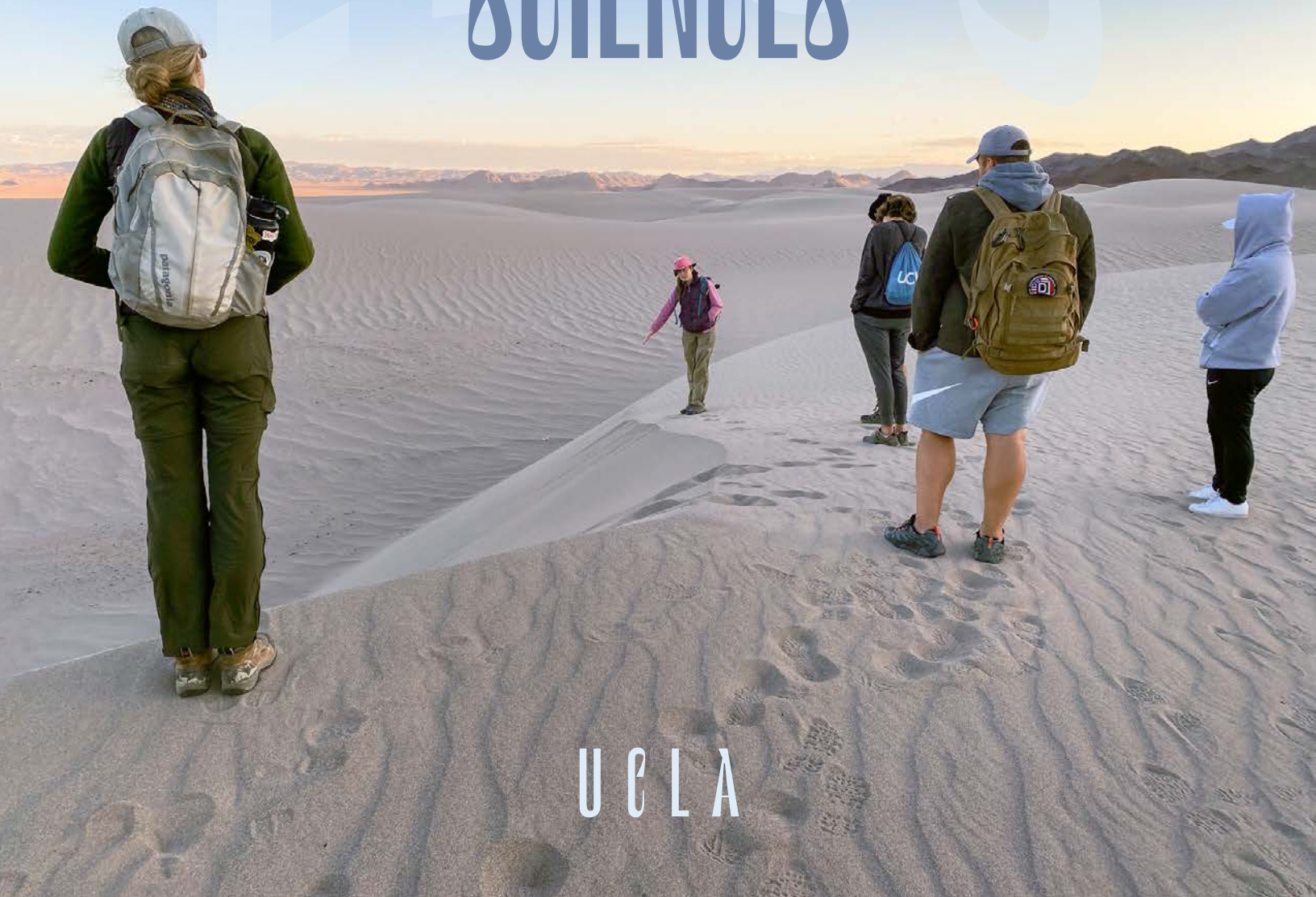
2022 NEWSLETTER

EARTH, PLANETARY & SPACE SCIENCES



UCLA

Greetings from *the Chair*

We hope you enjoy reading this special double-issue of the annual newsletter for the Department of Earth, Planetary, and Space Sciences. In this issue we highlight the 2020-2021 and 2021-2022 academic years.

As one might imagine, a big focus over these two years has been keeping everyone safe and productive during the COVID-19 pandemic, and eventually gradually reopening the department, along with the rest of the campus. Our students, staff, faculty, and researchers adapted and persevered, and the work of education, discovery, and outreach has continued right on through. At the time of this writing, classes are back to meeting in-person, the UCLA campus is as crowded and lively as it was before the shutdown in March 2020, and research and teaching trips to the field are frequent.

Bringing people back together from the past two years, it's fitting that a theme of connections runs through many of the articles in the 2022 newsletter. These include literal connections between LEGO SPIKE blocks to make physical representations of computing code in Professor Aurnou's Introduction to Computing for Geoscientists class (p. 13), connecting undergraduate and graduate students through the EPSS Family Mentorship Program (EFMP; p. 19), connecting the Los Angeles-area public with our Meteorite Gallery through a UCLA Centennial exhibit at the Fowler Museum (p. 14), and ongoing efforts to detect life on other planets through the Search for Extraterrestrial Intelligence (SETI, p. 6).

The return of students, staff, and faculty to the UCLA campus has been a welcome change for the EPSS community. We look forward to visits and news from our friends and alumni, and hope to be able to invite you to more on-campus events in the near future.

Warm regards,

Edwin Schauble

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Front Cover
EPS SCI 103B 2021 Death Valley Field Trip
Photo credit: Wynn Tranfield

Back Cover
Summer Field 2021 Field Trip Day
Photo credit: Rachel Tripoli

> **Earth: *Our Home in the Universe***
>
> **EPSS: *Our Home at UCLA***

Image (above): *Carolina Lithgow-Bertelloni and Edwin Schauble at the 2022 EPSS Champagne Celebration.*

Welcoming the *Incoming Chair*

Hello world! As the incoming department chair of EPSS, I want to take this opportunity to greet our wider EPSS family, valued alumni, former staff and faculty, and friends of the department. Let me also take the chance to thank Edwin for his service to EPSS during very challenging times. Throughout the COVID-19 pandemic he has maintained calm, equanimity and good humor, and kept the department in very good shape.

For my part, I am honored, humbled, thrilled and apprehensive about the task ahead. I believe strongly in the scientific and educational excellence of this department (and the honors page is a great reflection of it!), and my goal will be to preserve and enhance it. My top priorities for the next three years are to maintain and strengthen our academic reputation; foster social and scientific interaction within the department; increase our undergraduate population and pursue a self-sustaining master's degree program; continue, and improve, our outreach and diversity, equity, and inclusion (DEI) mission; and strengthen the relationships with our alumni and friends of EPSS.

You will hear more on these priorities next year in the 2022-2023 newsletter, after my first year as chair – how we go about achieving them, and what we have accomplished. If you are so inclined, and are able, please do consider making a gift to help make these goals possible. Your support is very much appreciated and we are most grateful to include you in the EPSS family.

Carolina

Collapse Pits and Lava Tubes as Cozy Havens for Astronauts on the Moon

By Tyler Horvath

In 2009, the Japanese Space Agency satellite SELENE discovered the first pit crater on the Moon, a feature formed by the collapse of material into a hollow cavity. This collapse pit, dubbed the Marius Hills pit, is believed to be the collapsed ceiling of a lava tube that formed while the Moon was still volcanically active billions of years ago. Additional observations using SELENE and NASA's Lunar Reconnaissance Orbiter (LRO) have since discovered hundreds of collapse pits, but only sixteen are thought to be caused by a lava tube under the surface. High resolution pictures from the LRO camera found that three of these collapse pits are potentially skylights, openings to lava tubes through which the tubes may be accessed. EPSS Professor David Paige, University of Colorado Boulder Professor (and EPSS Alumnus) Paul Hayne, and I recently published a manuscript detailing the thermal environment of these features.

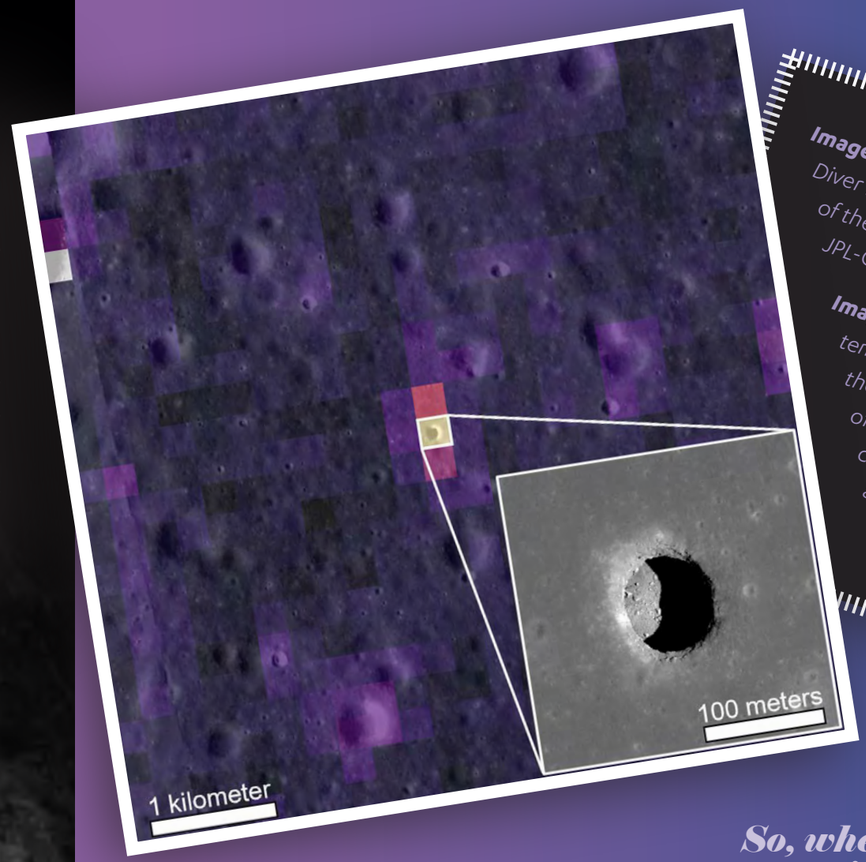


Image (pg. 3): *Artist's rendition of the Moon Diver mission concept rappelling down the wall of the Mare Tranquillitatis pit.* ***Credit:*** *NASA/JPL-Caltech*

Image (pg. 4): *Nighttime Diviner temperature measurements centered on the Mare Tranquillitatis pit. Inset image of the pit (LROC NAC M1718359001) corresponding to the center pixel as seen with Diviner.* ***Credit:*** *Tyler Horvath/NASA/GSFC/ASU*

We initially started this work to support the engineering and operations of a proposed rover mission from NASA's Jet Propulsion Laboratory (JPL) named Moon Diver. Its goal was to rappel down into the football-field-sized Mare Tranquillitatis pit and analyze the unique layers of lava flows present in the pit wall, seeking to understand how the Moon evolved after its formation and explore a potential cave underneath the surface. We created computational thermal models to ascertain the environment the rover might traverse so we could assess how to prevent overheating, but our initial thermal results revealed something interesting — the pit interior stays much warmer than the surface during the lunar night.

Using thermal images from the Diviner Lunar Radiometer Experiment aboard LRO, we found that the temperature of the pit's floor stays above -10 °F throughout the night, which is much more tolerable than the frigid -280 °F on the surface. Using additional computational models, we found that regions under the surface where Diviner cannot see should maintain a near constant temperature of 63 °F.

So, whether the surface is experiencing extreme cold at night or extreme heat (over 300 °F) during the day, these pits and caves remain a cozy haven for any astronaut exploring our Moon.

During the Apollo missions, astronauts had to wear bulky suits packed with insulation to stay cool when wandering the surface during the scorching daytime, and they did not dare venture out during the lunar night. But operations in these temperate caves would be as pleasant as an astronaut could hope for while far away from Earth.

In addition to providing shelter from extreme temperature swings at the lunar surface, these pits and caves also would protect explorers and their equipment from micrometeorites, cosmic rays, and solar radiation. Thus, many of the difficulties associated with supporting human life beyond Earth could be mitigated in the comfort of lunar caves and pits, presenting exciting possibilities for extraterrestrial travel and habitation.

UNLEARNING RACISM IN GEOSCIENCE: THE UCLA URGE POD

By Saeed Mohanna, Jaahnavee Venkatraman, Hannah Tandy, and Lars Stixrude

The Unlearning Racism in Geoscience (URGE) initiative is a project funded by the National Science Foundation that began in January 2021. URGE is motivated, in part, by the events surrounding the death of George Floyd. The closely-aligned Black Lives Matter movement sparked difficult conversations about racism and the need for institutions to move towards active anti-racism. Since geoscience continues to be one of the least diverse STEM disciplines nationally, URGE evolved as an effort to promote diversity, equity, and inclusion in the geosciences. *Though there is still much work to be done, we are proud to report that EPSS diversity has steadily increased over the past decade; the undergraduate student population has expanded to well over 50% female, with minorities (~70%) and Latinx (33%) proportions tracking above the Division of Physical Sciences by approximately 10 percentage points.* URGE has four primary objectives as laid out on the main website (https://urgeoscience.org):

1. Deepen the geoscience community's knowledge of the effects of racism on the participation and retention of people of color in the discipline

2. Draw on existing literature, expert opinions, and personal experiences to develop anti-racist policies and resources

3. Share, discuss, and modify anti-racist policies and resources within a dynamic community network and on a national stage

4. Implement and assess anti-racist policies and resources within Geoscience workplaces

Nearly 300 geoscientist groups across the country are now a part of URGE and are actively working towards anti-racist goals within their own departments. Facilitated by Prof. Lars Stixrude, our own UCLA URGE pod was formed in April 2021 from a cross section of EPSS students, faculty, researchers, and lecturers.

Over the course of the 2021 Spring quarter and the 2021-2022 academic year, the EPSS pod met weekly to discuss readings and interviews intended to inform participants on topics ranging from the history of racism in the geosciences, to the modern implications of white privilege for academic environments, to ideas for improving DEI in academic units. Drawn from the URGE curriculum, these materials are publicly available (https://urgeoscience.org/curriculum/). After each session, we assigned deliverables to be completed by pod members. The action items included changes to departmental policy that could help establish a more diverse, equitable and inclusive environment (e.g., policies for admissions, hiring, complaints, and working with communities of color) as well as establishing ground rules for constructive and respectful interaction among the pod members. Our draft deliverables are available on the department's URGE website (https://urge.epss.ucla.edu/), and we encourage anyone with ideas for improving them to reach out to us at https://urge.epss.ucla.edu/feedback-contact-us/.

Image: *Left to right: Hannah Tandy, Saeed Mohanna, Lars Stixrude, Jaahnavee Venkatraman, Leslie Insixiengmay*

New Milestones for the UCLA SETI Group

By Jean-Luc Margot

The search for life in the universe represents one of humanity's most profound scientific endeavors. The UCLA SETI Group was launched in 2016, offering the first full-length university course focused on the Search for Extraterrestrial Intelligence (SETI). So far, more than 120 undergraduate students and 10 graduate students have taken the annual SETI course and learned about radio astronomy, signal processing, statistics and collaborative software development. Students have access to the largest fully-steerable telescope on Earth, the 100m Green Bank Telescope, to observe thousands of stars and search for "technosignatures." These are signs of possible technological activity, for example, radio emissions concentrated in a narrow range of frequencies (i.e., narrowband) that natural sources cannot produce. Unlike biosignatures, which are prone to natural confounders and are detectable only around the Sun and nearby stars, radio technosignatures cannot be confused with natural emissions, and are detectable throughout the galaxy.

We have observed over 40,000 stars and detected over 60 million narrowband signals to date. In comparison, a recent Breakthrough Listen survey in the same frequency band using the same telescope and detection threshold yielded 37 million narrowband signals. To sift through the millions of candidate signals, we developed software that automatically classifies 99.8% of the signals as anthropogenic radio frequency interference. As a graduate student, Paul Pinchuk implemented a powerful machine learning classifier to facilitate this task. In 2021, Paul joined the exclusive group of approximately ten Earthlings who have obtained a PhD in SETI.

SETI research and teaching at UCLA were enabled by initial gifts from Janet Marott and subsequent gifts from Larry Lesyna, Michael Thacher and Rhonda Rundle, among others. In 2020, the Queen's Road Foundation, chaired by EPSS Board member Fritz Demopoulos, accelerated our search with a $50,000 gift. Recently, NASA's Exoplanet Research Program awarded a three-year grant to the UCLA SETI Group, enabling the recruitment of incoming EPSS graduate student Megan Li. NASA has previously funded a few instrumentation grants, commensal searches and theoretical efforts, but the award to the UCLA SETI Group appears to be the first grant awarded by NASA to fund a dedicated search in almost 30 years. Regrettably, the grant does not allow the purchase of equipment or telescope time. The generosity of our alumni and friends is needed to expand the search and continue to involve students in the search. With seed grants from The Planetary Society and NASA, we will soon launch a citizen science platform to make SETI accessible to citizen scientists all over the world. Learn more about the UCLA SETI Group at ***https://seti.ucla.edu/.***

Image: *National Radio Astronomy Observatory's Green Bank Telescope in West Virginia, used by the UCLA SETI group to scan the sky for technosignatures.*
Credit: *Jee Seymour*

A Visit to Green Lake, Modern Analog of Ancient Oceans

By Emily Klonicki

Known for its strikingly scenic, clear green water, Green Lake in Fayetteville, New York attracts over one million visitors per year. Most come to enjoy the multitude of summer and winter recreational activities the lake has to offer. However, for the Treude Lab at UCLA and the Lyons Lab at UC Riverside, this lake presents a unique opportunity to investigate the past.

Green Lake is the first of multiple Archean Earth Analogue sites identified by the NASA-funded Interdisciplinary Consortia for Astrobiology Research (ICAR) study. It contains a similar environment to the modeled Proterozoic Oceans, which existed from 2500 to 543 million years ago. This lake provides a glimpse into Earth's evolutionary history, yielding insights that may help to constrain the habitability of extraterrestrial worlds.

Green Lake is a deep (up to 53 meters), permanently stratified, meromictic lake, meaning there is no seasonal mixing of surface and bottom waters. A steep chemical gradient, known as the chemocline, separates the upper oxygen-rich and lower oxygen-deficient bottom waters. This leads to a plethora of distinct geochemical and microbial niches. Microbial photosynthetic activity near the surface drives calcium carbonate formation, resulting in the turquoise green hue of the water, as well as reef-like structures called thrombolites around the edge of the lake. Adding to the distinct environment, the lake sits on a Vernon Shale bed, which introduces sulfate and mineral-rich groundwater. The sulfate is metabolized through microbial activity, creating highly sulfidic bottom waters. This is evident from the strong rotten-egg smell researchers encounter during sampling.

The research team collected water column and sediment samples at various depths in Green Lake during the Summer of 2022. These samples were processed to study geochemistry, pyrite formation, nutrient cycling, and molecular biology. The Treude Lab injected both water column and sediment samples with radioactive material to determine microbial metabolic rates and dominant processes. Additional samples were taken to investigate electron transport, microbial interactions, and thrombolite formation. Analysis is ongoing, with the goal of "providing a new and more holistic view of Earth's evolutionary history in order to help guide NASA's mission-specific search for life on distant worlds."

Image (lower left, pg. 7): *A view of a Green Lake sampling station with the sediment core team (UC Riverside and Hamilton College) on the pontoon boat.*

Image (upper left, pg. 8): *Water column sampler used to collect samples at depths of interest (Emily Klonicki from UCLA).*

Image (middle left, pg. 8): *Water column sampling from the row boats (Dr. Tina Treude from UCLA and Dr. Charles Diamond).*

Image (middle right, pg. 8): *Preparing to collect a sediment core (Dr. Timothy Lyons and Dr. Charles Diamond from UC Riverside and Dr. Michael McCormick from Hamilton College).*

Image (lower left, pg. 8): *Thrombolite collected from an outcrop on the edge of the lake.*

Image (lower right, pg. 8): *A sediment core that was collected from the deepest part of the lake (53 meters).*

AN OUT-OF-THIS-WORLD ADDITION:

NEW EPSS PLANETARY SCIENCE GRADUATE PROGRAM

By David Paige

UCLA has long had a world-class research program in the field of Planetary Science: the scientific study of planetary bodies, a class of celestial objects that generally orbit stars. Planetary bodies are distinct from stars, however, in that their internal energy is not derived from nuclear fusion. These bodies abound in our Solar System, and include the eight planets orbiting our Sun and their satellites, the dwarf planets Ceres and Pluto, and minor planets such as asteroids and comets. Peering further into the broad expanse of our galaxy, the count increases as we detect similar bodies orbiting other stars (exoplanets) or ejected from their parent planetary system; these are considered planetary bodies as well.

Last year, EPSS initiated a new graduate degree program in Planetary Science, adding to its three existing graduate degree programs in Geology, Geochemistry, and Geophysics and Space Physics. The first cadre of four new planetary M.S. and Ph.D. students was admitted to the program in Fall 2022, joining the eighteen EPSS faculty members already actively engaged in planetary research on a full or part-time basis. The new degree program, already the most applied-to in the department, will focus on training the next generation of planetary scientists by providing a curriculum of graduate-level courses along with opportunities to conduct research at the forefront of knowledge in the field. The scope of the program includes the formation and evolution of planetary bodies, as well as their physical and chemical properties, dynamical interactions, geology, climate, and habitability. Research approaches used to learn and explore include theory, numerical modeling, space-based telescopes, planetary spacecraft missions, and experimental and observational studies using Earth analogues. Financial support is available through merit-based and competitive fellowship awards provided by the College of Letters and Science and private contributions.

For more details, and to explore opportunities, see:

https://epss.ucla.edu/graduate/programs/planetary-science

Image: *Artist's depiction of a collision between two planetary bodies. Such an impact between Earth and a Mars-sized object likely formed the Moon.*

Credit: *NASA/JPL-Caltech*

Image (to left): *Aradhna Tripati*

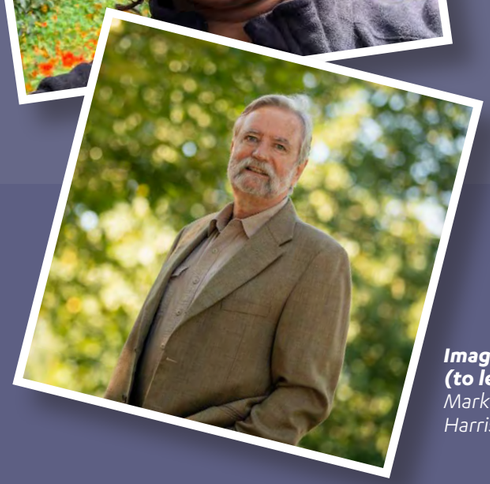


Image (to left): *Mark Harrison*

EPSS CLEANS UP WITH 2021 AGU AWARDS!

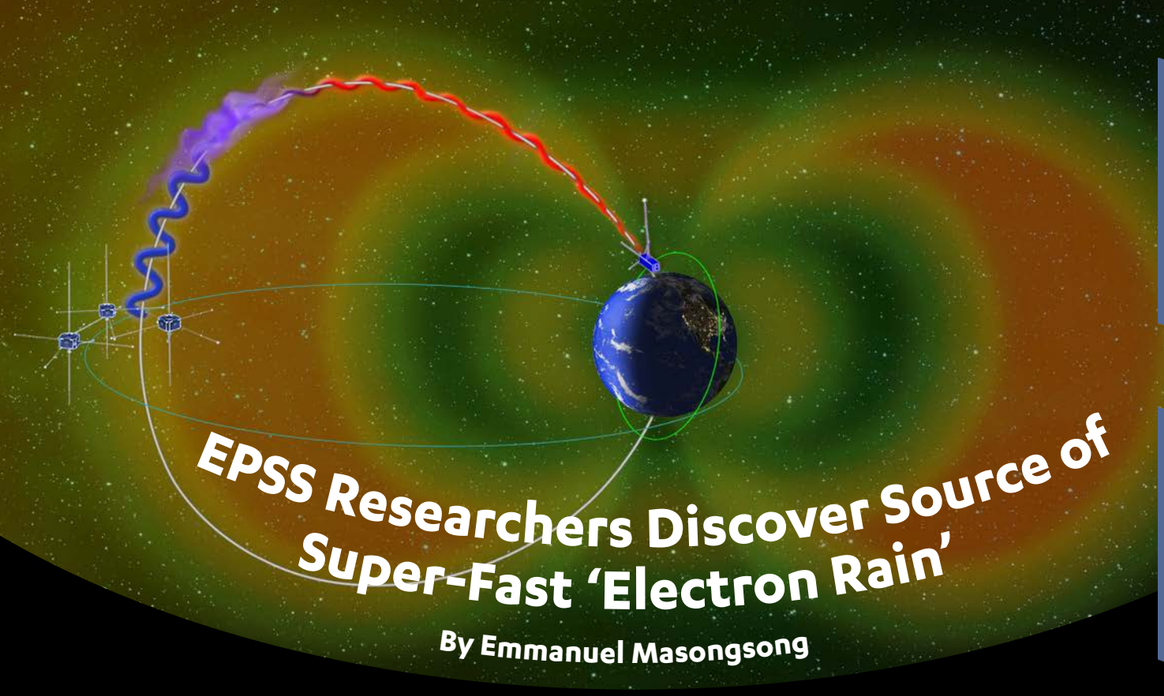
Professors Aradhna Tripati and Mark Harrison both received prestigious American Geophysical Union awards in 2021. Aradhna Tripati was awarded the Willi Dansgaard Award for paleoceanography and paleoclimate research, as well as the Ambassador Award (which also conferred Fellowship in AGU) for "outstanding contributions to one or more of the following areas: societal impact, service to the Earth and space community, scientific leadership, and promotion of talent/career pool. Prof. Mark Harrison was named winner of the Walter H. Bucher Medal, a lifetime award recognizing "original contributions to the basic knowledge of crust and lithosphere." This award is named in honor of Walter Bucher, a former president of AGU and prominent researcher on the deformation of the Earth's crust. Congratulations to our faculty members for these outstanding achievements!

Image (to right): *Margaret Kivelson*

2021 MAXWELL PRIZE AWARDED TO PROF. MARGARET KIVELSON, AMONG OTHER HONORS

Distinguished Professor Emerita Margaret "Margy" Kivelson was awarded the prestigious James Clerk Maxwell Prize for Plasma Physics in 2021. Bestowed by the American Physical Society, the prize was named in honor of the Scottish mathematician whose seminal work led to equations unifying the physical behavior of electricity, magnetism, and light. In addition, Prof. Kivelson was honored in 2020 as an Elected Foreign Member of the Royal Society of London, recipient of the Centennial Medal of Harvard University Graduate School of Arts and Sciences, and recipient of an honorary degree as Doctor of Science, at University of Leicester, UK.

Throughout her highly decorated career, Professor Kivelson has advanced our understanding of magnetic fields across the solar system, revealing how plasma waves can affect the dynamic space environment. Having received her Ph.D. from Radcliffe College at Harvard in 1957, she spearheaded the inclusion of women scientists in STEM and has tirelessly worked to increase their representation ever since. Her many Ph.D. student "children" and "grandchildren" have become faculty and researchers at major institutions and leaders of NASA missions. What a wonderful testament to her dedication to space research and education at UCLA. A heartfelt congratulations and thank you for all your contributions, Margy!



EPSS Researchers Discover Source of Super-Fast 'Electron Rain'

By Emmanuel Masongsong

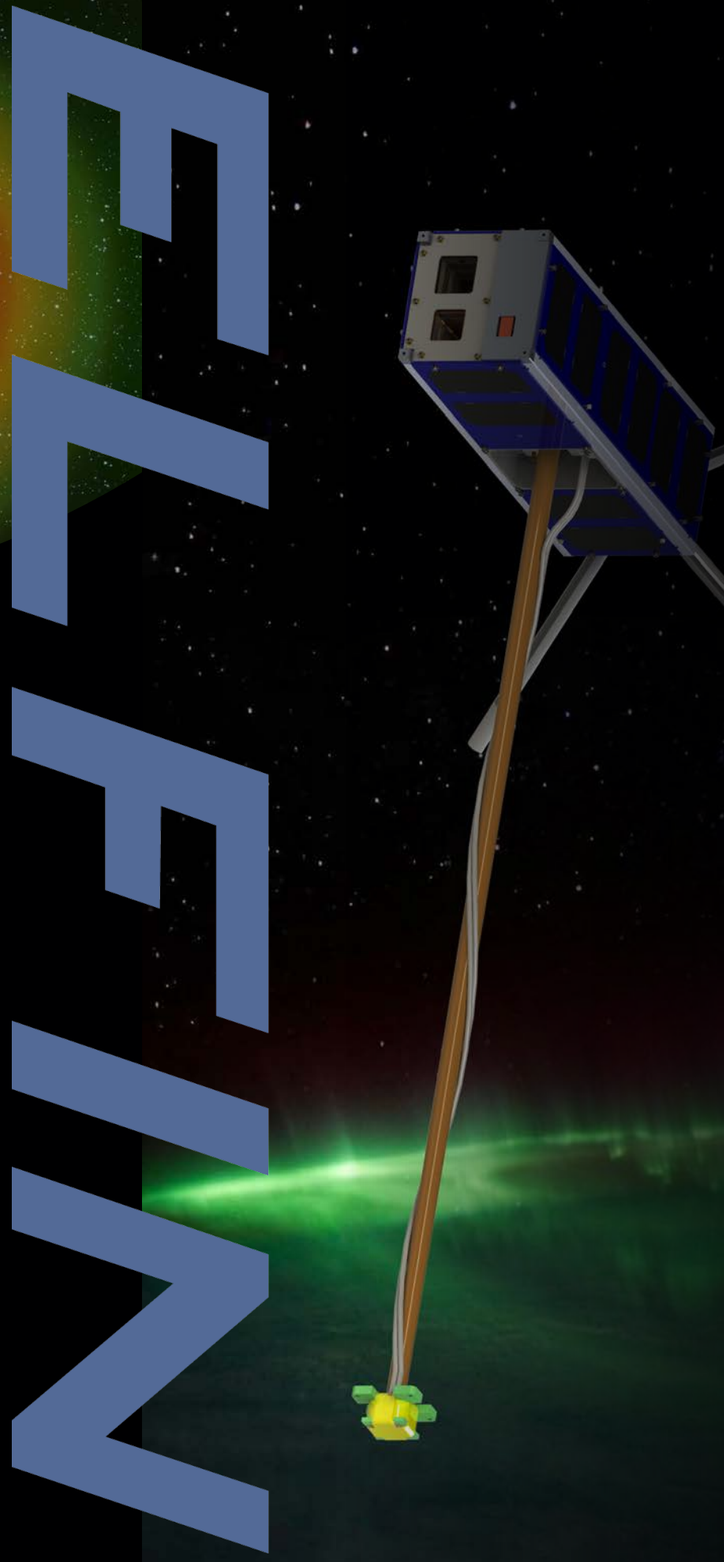
EPSS researchers and students discovered a new source of super-fast, energetic electrons raining down on Earth's atmosphere. This phenomenon contributes to the colorful aurora borealis but also poses hazards to satellites, spacecraft and astronauts. Researchers observed unexpected, rapid "electron precipitation" from low-Earth orbit using the ELFIN (Electron Losses and Fields investigation) mission, a pair of tiny satellites built and operated on the UCLA campus by undergraduate and graduate students guided by a small team of staff mentors.

By combining the ELFIN data with more distant observations from NASA's THEMIS satellites, scientists determined that the sudden downpour was caused by whistler waves: a type of electromagnetic wave that ripples through plasma in space and affects electrons in the Earth's magnetosphere, causing them to "spill over" into the atmosphere. Their findings, published in Nature Physics, demonstrate that whistler waves are responsible for far more electron rain than current theories and space weather models predict.

"ELFIN is the first satellite to measure these super-fast electrons," said Xiaojia Zhang, lead author and a researcher in EPSS. "The mission is yielding new insights due to its unique vantage point in the chain of events that produces them."

The key region driving this process, called the Van Allen radiation belts, is filled with charged particles orbiting in giant rings around our planet. Electrons in these belts travel in Slinky-like spirals that literally bounce between the Earth's north and south poles. Under certain conditions, whistler waves are generated within the radiation belts, energizing and speeding up the electrons. This effectively stretches out the electrons' travel path so much that they fall out of the belts and precipitate into the atmosphere, creating the electron rain.

One can imagine the Van Allen belts as a large reservoir filled with water — or, in this case, electrons. As the reservoir fills, water periodically spirals down into a relief drain to keep the basin from overflowing. When large waves occur in the reservoir, the sloshing water spills over the edge, faster and in greater volume than the relief drainage. ELFIN, which is downstream of both flows, can properly measure the contributions from each flow.



The low-altitude electron rain measurements by ELFIN, combined with THEMIS observations of whistler waves and sophisticated computer modeling, allowed the team to understand in detail the process by which the waves cause rapid torrents of electrons to flow into the atmosphere.

The findings are particularly important because current theories and space weather models, while accounting for other sources of electrons entering the atmosphere, do not predict this extra whistler wave–induced electron flow. Such a flow can affect Earth's atmospheric chemistry, pose risks to spacecraft and damage low-orbiting satellites.

The researchers further showed that this type of radiation belt electron loss to the atmosphere can increase significantly during geomagnetic storms, disturbances caused by enhanced solar activity that can affect near-Earth space and Earth's magnetic environment.

Although space is commonly thought to be separate from our upper atmosphere, the two are inextricably linked. Understanding how they're linked can benefit satellites and astronauts passing through the region, which is increasingly important for commerce, telecommunications and space tourism.

Since its inception in 2013, more than 300 UCLA students have worked on ELFIN, which is funded by NASA and the National Science Foundation. The two microsatellites, each about the size of a loaf of bread and weighing roughly eight pounds, were launched into orbit in 2018. Since their launch, the microsatellites have been observing the activity of energetic electrons and helping scientists to better understand the effect of magnetic storms in near-Earth space. The satellites are operated from the UCLA Mission Operations Center on campus.

"It's so rewarding to have increased our knowledge of space science using data from the hardware we built ourselves," said Colin Wilkins, a co-author of the current research, instrument lead, and EPSS Space Physics graduate student.

For more on ELFIN, see: ***ELFIN.igpp.ucla.edu***

Image (upper left, pg. 11): *Electrons in the outer Van Allen radiation belt (blue) encounter whistler waves (purple) and are sent raining toward the north pole (red). THEMIS satellites are seen near the radiation belt, while UCLA's ELFIN satellite hovers above Earth.* ***Credit:*** *E. Masongsong, X.-J. Zhang, UCLA EPSS*

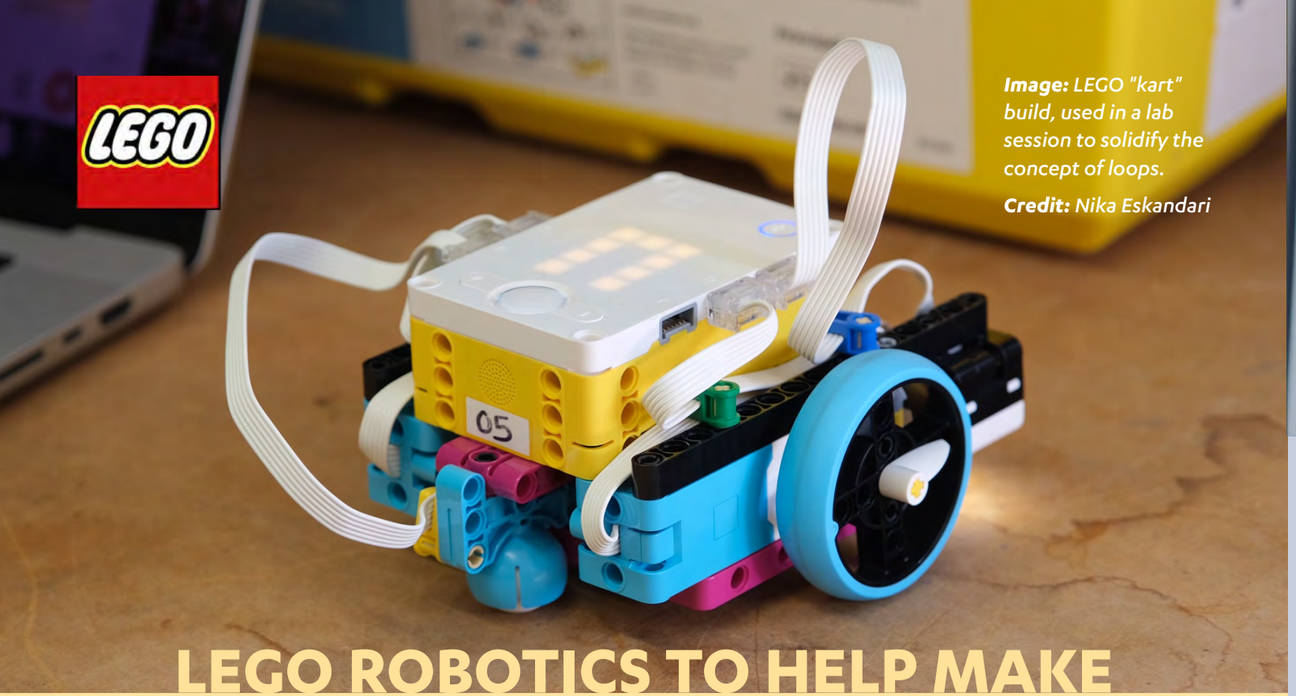


Image: *LEGO "kart" build, used in a lab session to solidify the concept of loops.*

Credit: *Nika Eskandari*

LEGO ROBOTICS TO HELP MAKE PROGRAMMING MORE ACCESSIBLE

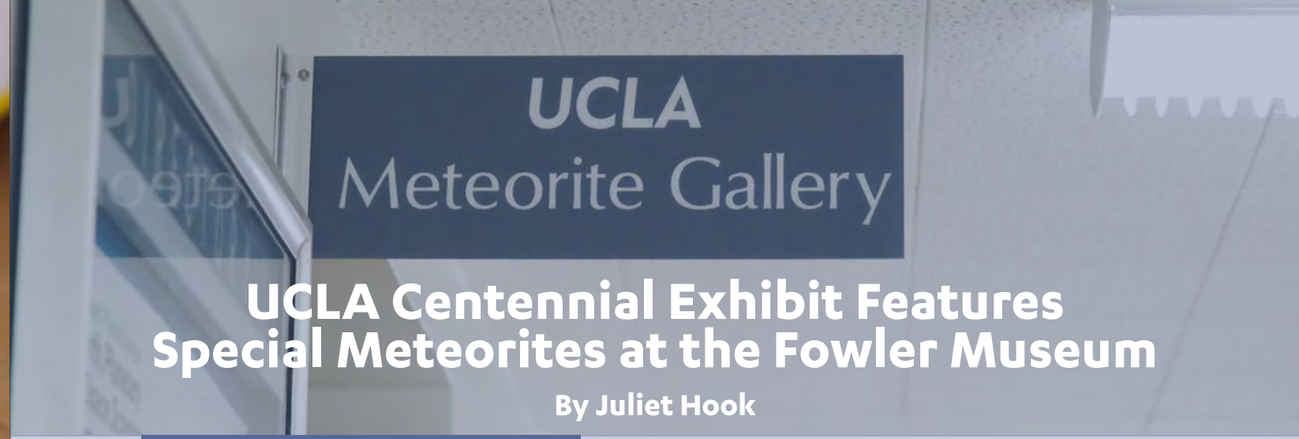
By Rachel Tripoli

Over the last year, current and past EPSS students have been working with Professor Jonathan Aurnou to add a lab component to Introduction to Computing for Geoscientists (EPS SCI M71). An important foundational class for both EPSS and AOS majors, the course teaches students the fundamentals of Python and data analytics. Programming in general, however, can be incredibly daunting for those without exposure to any form of coding. Jon and the LEGO team have addressed this steep learning curve with the planned addition of a new M71 lab, beginning in Fall 2022.

The lab's goal is to make coding more approachable by using LEGO SPIKE kits to physically visualize how the code runs. The kits are composed of LEGO robotic parts and familiar building blocks, along with an accompanying software program that utilizes both Scratch and MicroPython languages. Students will use the program in conjunction with physical LEGOs to gain a more intuitive understanding of programming.

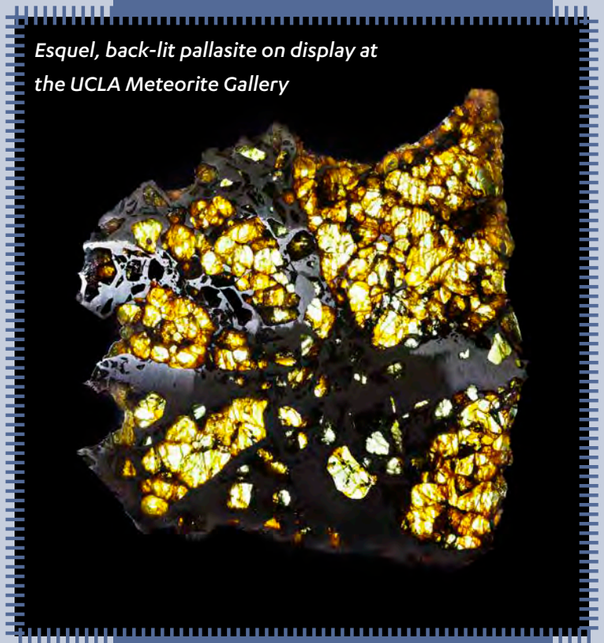
The labs teach key coding principles such as adding variables, implementing booleans (logic tests with only two possible outcome values: true or false), creating for-loops (loops that run the code within them repeatedly until a specific condition has been fulfilled), troubleshooting errors, and commenting out code for context and better clarity. These learning objectives are bolstered by the versatility and variety of builds possible with the LEGO kits. Students will have the opportunity to build a dancing robot, a CNC machine, a remote controlled "kart," and a meteorological device that draws wind speeds over time, called a Hayes Chart. Students also will incorporate real-world data, such as wind direction and velocity within Jupiter's Great Red Spot, to demonstrate the importance of visualizing data in research.

These lab sessions are intended to foster a low-stress environment where students can learn by collaborating, asking questions, and having fun experimenting with LEGOs. Since Fall 2022 is the first quarter M71 will have a lab component, students taking the course will fill out weekly feedback surveys about their lab session experiences. The LEGO team will continue to develop and refine the labs, with the aim of making coding more accessible and helping students program more confidently and effectively!



UCLA Centennial Exhibit Features Special Meteorites at the Fowler Museum

By Juliet Hook



Esquel, back-lit pallasite on display at the UCLA Meteorite Gallery

Canyon Diablo iron meteorite on display at the UCLA Meteorite Gallery

In honor of the university's centennial, the UCLA Meteorite Collection and Gallery participated in the exhibit "The Map and the Territory: 100 years of collecting at UCLA." This interdisciplinary exhibit was unveiled at the Fowler Museum on campus and created in partnership with the Fowler Museum, the Hammer Museum and the UCLA Library. It showcased 13 collections from university-stewarded libraries, archives, and museums including seven meteorites hand-picked from our collection. The specimens were displayed under the thematic title "Beyond" which highlighted how humans have interpreted, imagined and connected to the universe through objects. Meteorites represent a tangible resource that have provided important information about the origin of the solar system, the formation of the planets, and the final gasps of dying stars. "The Map and the Territory" debuted during Summer 2021 and was open through the fall.

The meteorites were the oldest objects in the exhibit, ranging in age from the formation of our solar system 4.5 billion years ago to the crystallization of shergottite basalts on Mars about 175 million years ago. One of the founding meteorites of our collection, iron meteorite Canyon Diablo (from Meteor Crater, Arizona), was presented next to the stony-iron pallasite meteorites Springwater (from Canada), Esquel (Argentina), and Seymchan (Russia). Also presented were the Martian meteorite Los Angeles, and our 126-kg specimen of iron meteorite Buenaventura (Mexico). These seven meteorites represent a variety of types that have fallen across the world. These meteorite specimens and about 100 others are currently on display in the UCLA Meteorite Gallery, located in Room 3697 of the Geology Building.

INAUGURAL CENTENNIAL MENTORSHIP AWARD GOES TO VASSILIS ANGELOPOULOS

In May 2021, the UCLA Division of Physical Sciences bestowed EPSS Geophysics and Space Physics Professor Vassilis Angelopoulos with a Centennial Mentorship Award. This new award recognizes faculty who have demonstrated their commitment to and success in mentoring research students from diverse backgrounds, while also promoting equity and inclusivity. His uncompromising ambition, dedication to science, and fostering of fruitful collaborations, along with his encouragement and teaching skill, have benefitted the many students, postdocs, and researchers who have worked with him.

As the principal investigator of several NASA missions, THEMIS-ARTEMIS and ELFIN, Vassilis has created free software analysis tools for spacecraft data and fostered collaborative spaces to enable thousands of early-career researchers across the globe. He has built mentor-partnerships with Santa Monica College, Auburn University, Peking University, and the University of Science and Technology in China (USTC). These partnerships empower undergraduate and graduate students to pursue space science at UCLA and develop their own research projects, leading to peer-review publications, long-term funded collaborations, and even researcher positions in EPSS.

With the NASA/NSF-funded ELFIN CubeSat mission, Angelopoulos mentored over 300 undergraduate students and several graduate students in end-to-end satellite mission development, testing, operations and analysis, all while breaking new ground in the fields of geophysics, space physics, and radiation belt science. Thanks to his tireless work as a mentor and research advisor, his students have achieved leadership positions in industry, government, and academia. The students have stated effusively that ELFIN was a transformative experience for them and their careers, providing opportunities and challenges they would not have otherwise had, thanks to his expert guidance.

Image (top): *Vassilis Angelopoulos*
Image (middle): *ELFIN Team, Spring 2022*
Image (bottom): *Angelopoulos and the twin ELFIN spacecraft*

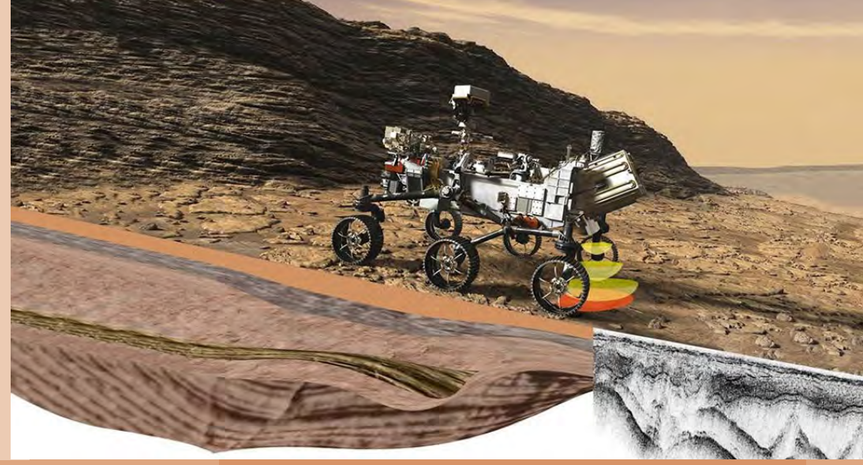
"I am really happy the ELFIN project was able to blossom at EPSS as a model for future programs, expanding our abilities in space education and exploration," Angelopoulos said.

"We are lucky to be at a unique position to do such things thanks to our talented staff and students."

Congratulations, Vassilis!

REVEALING SECRETS BENEATH THE SURFACE OF MARS WITH RIMFAX

By Valeria Lopez Robles



Imagine a rover treading its way across Mars' rocky terrain, enduring the frigid cold and wind-blown dust. Equipped on the rover is a first-of-its-kind radar instrument performing analyses below the surface of the red planet... and UCLA EPSS has a front-row seat!

NASA's Perseverance rover, which landed on Mars in early 2021, is currently exploring Jezero Crater and beyond in search of ancient life and clues about the planet's climatology and geomorphology. RIMFAX–whose deputy principal investigator is UCLA EPSS Professor David Paige–is a ground-penetrating radar built by the Norwegian Defense Research Establishment (FFI) that provides a comprehensive view of Martian subsurface structure and composition. Its ability to detect features including ice, brines, and liquid water is especially valuable for assessing the early history of Mars and narrowing down targets to search for potential biosignatures. The water-bearing minerals RIMFAX locates can provide clues that ancient Martian environments once had conditions suitable for life.[1]

Since the rover operates on Mars time, where a day (sol) is about 24.5 Earth hours long, responsibility for RIMFAX operations is shared between international teams based in the US and Norway. Professor Paige and his research group carry out Science and Operations responsibilities. The research group, composed of students and staff, utilizes a set of software applications to ensure that the rover operates nominally and maintains a healthy status while reviewing downlinked radar data products. A typical workflow schedule includes participating in a series of meetings about current science objectives, an assessment of the rover's whereabouts, and RIMFAX operations-related activities. Another important objective is to optimize the collaboration of the seven instruments on the rover so as to achieve the overall proposed science goals. Between each meeting, group members create a report to reflect statistics such as the instrument's behavior, distance traveled, health levels, and software status. The group members are responsible for ensuring that the instrument runs as planned, and they work together with the JPL tactical team to resolve any anomalies that may occur.

Perseverance, along with the helicopter Ingenuity, is part of the Mars 2020 NASA mission, which aims to better understand the morphology of Mars and seek signs of past habitability. The rover collects rock and soil samples, stores the samples on the Martian surface to be returned to Earth in a future mission, and examines human exploration possibilities! Mars 2020 is under the Mars Exploration Program (MEP), which is a NASA initiative that focuses on exploring Mars through a set of robotic orbiters, landers, and laboratories. Previous MEP missions uncovered features quite different from the Mars we know today, and now, with RIMFAX, we continue to ask: was there ever ancient microbial life on Mars? And could Mars one day support human life and work?

Image: *Perseverance's Radar Imager for Mars' Subsurface Experiment (RIMFAX) uses radar waves to probe the ground, revealing the unexplored world that lies beneath the Martian surface.* ***Credit:*** *NASA/JPL-Caltech/FFI*

1 "RIMFAX" NASA Science MARS 2020 MISSION PERSEVERANCE ROVER, NASA, https://mars.nasa.gov/mars2020/spacecraft/instruments/rimfax/

HOW THE CRITICAL ZONE TRIGGERS LANDSLIDES:
Using Geophysics to Study Natural Disasters in the Mountains of Oregon

By Justin Higa

The "critical zone" defines a geologic conveyor belt that extends from treetop to bedrock. In this zone, water, plants, animals, and air break down and chemically transform deep bedrock into shallow layers of fractured rock and fertile soil. This process is central to the life cycle of Earth's mountains, and provides nutrients for all living things on land.

The critical zone also plays an essential role in the natural plumbing system of mountains. Variations of layer thickness and fractures affect how groundwater funnels into different parts of a landscape. Wet soils caused by this groundwater flow can make landslides more likely, particularly after heavy rainfall. Therefore, studying the critical zone is vital for protecting people from these devastating natural disasters.

For eight days in the summer of 2022, Prof. Seulgi Moon and students Justin Higa, Boontigan Kuhasubpasin, and Josh Lee of the UCLA Geomorphology Lab traveled to the southwestern part of the Oregon Coast Range to analyze the effects of the critical zone on landslides. They were joined by researchers from UC Berkeley, the University of Colorado Boulder, the University of Texas at Austin, the University of Oregon, and the University of Hawaii at Manoa. They were also assisted by UCLA grad student Valeria Jaramillo, who had scouted the area several months earlier. Together, the team headed to a small valley with a 40-year record of landslide studies, ideal for understanding the effects of the critical zone.

Here, they conducted geophysical surveys to take valuable snapshots of bedrock, weathered rock, and soil layers up to 30 meters deep in the critical zone. Similar to how doctors use ultrasound waves to see the internal structures of a person's body, the team used seismic waves to probe the subsurface layers of the critical zone. After setting up rows of tiny sensors across the terrain, they struck a metal plate on the ground with a sledgehammer to generate seismic waves. By untangling the pattern of "mini-earthquakes" recorded by the sensor array, the team could paint a detailed picture of the critical zone.

Next, the UCLA Geomorphology Lab compared their real-world critical zone observations from geophysical surveys with critical zone parameters generated by computer simulations. These sophisticated simulations can calculate how bedrock weathers into various critical zone layers. If critical zone field measurements match the computer model predictions, the simulations are assumed to accurately reflect real-world groundwater plumbing systems. This research is important since climate change will exacerbate dangerous landslides by inducing more intense wildfires and rainstorms that can loosen rock and soil from steep hillslopes. Advancements in modeling can improve the realism and reliability of landslide predictions, helping to better protect people from impending slope failures. By bridging fieldwork and computer simulations, this study brings the UCLA Geomorphology Lab closer to understanding how the critical zone impacts life on Earth.

Image (upper left, pg. 17): *The UCLA Geomorphology Lab after a long day of fieldwork.*

Image (upper right, pg. 18): *Students conducting a geophysical survey.*

Image (below, pg. 18): *An impromptu lesson in the field.*

EPSS FAMILY MENTORSHIP PROGRAM:
HELPING STUDENTS SUCCEED

By Valeria Jaramillo

When we entered the extended pandemic-related campus shutdown, everyone was deprived of the ability to collaborate, interact, and learn with one another in ways EPSS was accustomed to, presenting significant additional challenges for students. Those starting new undergraduate and graduate programs in Fall 2020 faced a previously unknown, remote learning environment that made connecting with classmates particularly difficult. For incoming transfer students who wanted to discuss which classes they should take, seniors trying to find out about graduate programs, or new graduate students struggling to balance course requirements, teaching, and research, clearly there existed a great need for enhanced interaction and collaboration.

Enter the EPSS Family Mentorship Program (EFMP)! The idea behind EFMP was to build a mutually supportive platform for students at all stages of undergraduate and graduate study. A pilot program was launched in Spring 2021, creating six families with 36 students, ranging from undergraduate freshmen to senior graduate students. Through EFMP, students could connect, share, and learn from each other in areas such as personal wellbeing, academic success, and professional development, while also maintaining a socially cohesive and inclusive community within the department. The program successfully provided networking, learning resources, job and research opportunities, and created many positive memories. As a testament to the popularity of the program, the number of members nearly doubled in Fall 2021, and the inaugural dinner celebration brought a renewed spirit to the department.

We are so proud of everyone's commitment to meet with their families, join academic and social events, and foster a collaborative and welcoming atmosphere among the EPSS student body. We are grateful for the continued support from our department chair, faculty, staff, and postdocs that have helped us along the way, and we are eager to see the program continue to grow!

Website: ***https://sites.epss.ucla.edu/efmp/***

VISIT OUR INSTAGRAM FOR EVENTS, UPDATES, AND MORE!

Image (top): EFMP Committee members Korean BBQ dinner
Image (middle): EFMP Spring Potluck 2022
Image (bottom): EFMP Fall 2021 hike to Los Liones Trail

Stratigraphic Puzzles: EPS SCI 111

By Mackenzie Day

Camped at the edge of the wilderness, the 2022 class of Stratigraphic and Field Geology (EPS SCI 111) rises at dawn for a day of mapping and hiking through the Orocopia Mountains. Every year, students in this class travel together to the desert to create a geologic map using their own measurements and observations. Equipped with compass, map board, and plenty of water, the students build from basement rock and slowly disentangle the puzzle in the landscape. The terrain and geologic complexity in the Orocopia Mountains represent a significant step up from the introductory structures of Rainbow Basin, and for this year's enthusiastic group in particular, represented an extra post-pandemic challenge. In 2022, some students were experiencing geology in the field for the first time.

Reading and interpreting a geologic map is fundamental to many endeavors in Earth Science. By making their own geologic map, students in EPS SCI 111 learn from first principles how these products are made, and understand the limitations and uncertainties inherent in their construction. Nowadays, making a geologic map has become easier with technology. During the Spring 2020 and 2021 quarters, EPS SCI 111 students created geologic maps remotely using Geographic Information Systems software. Turning lemons into lemonade, the class used the necessity of remote learning to go beyond Earth and make geologic maps on Mars, one of which was later published on the May 2022 cover of the journal 'Remote Sensing.'

Back on Earth, students in the field create their geologic maps with only a compass, topographic basemap, and their intellect. Later, they will compare their work to satellite images while digitizing their maps into a professional product. The different perspective of an orbital view answers some questions and raises others, but at the end of the day the students are one step closer to solving the puzzle in the rocks.

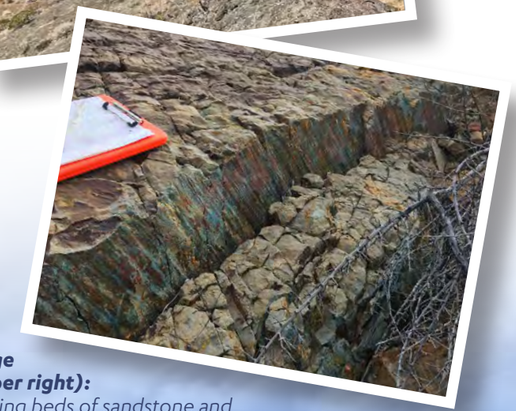


Image (upper right): *Dipping beds of sandstone and mudstone in the Diligencia formation give the Orocopia Mountains their distinctive bright coloration.*

Image (lower right): *Slickensides in the sandy mudstone of the Diligencia Formation show where friction has polished the rock surface along this small normal fault.*

Image: *Students in EPS SCI 111 map from a high peak in their study area to get a good view of the area's geologic structures.*

Return to the Field:

3 EPSS Geology Field Trips in 2021-2022

Led by Dr. Kevin Coffey

EPS SCI 61:
Geologic Maps

For this class, Instructor Kevin Coffey took students on a trip to Rainbow Basin, near Barstow in San Bernardino County, CA, during November 2021. The goal was for students to complete their first geologic mapping projects: navigating across a topographic map, locating and following contacts between geologic units, measuring orientations, and identifying and constraining geologic structures with increasing independence as fieldwork progressed. The resulting map and geologic cross sections formed their final project for the class.

Sunrise in camp for EPS SCI 61, Credit: Kevin Coffey

Students hiking in EPS SCI 61 Credit: Kevin Coffey

EPS SCI 61 class climbing a peak in front of the field area Credit: Kevin Coffey

EPS SCI 112:
Structural Geology

In Structural Geology, students traveled to Painted Canyon, near Mecca in Riverside County, CA, then to Anza-Borrego State Park, near Borrego Springs in San Diego County, CA, February 2022. The goal was for students to see, identify, measure, and interpret a variety of structural features in the field. In Painted Canyon, students worked their way down the canyon in a structural transect, making observations and structural measurements wherever possible. The canyon is adjacent to the San Andreas fault, and so many recent and dramatic faults and folds are present. In Anza-Borrego, students examined and measured mylonitic fabrics within a ductile shear zone. Measured fault orientations were aggregated, then interpreted during lecture using Anderson Fault Theory.

EPS SCI 112 students around the campfire in Painted Canyon Credit: Hearth O'Hara

EPSS Adventures

memories & friendship & learning to last a lifetime

EPS SCI 133 students in Grand Canyon Credit: Chester Li

EPS SCI 112 students on San Andreas fault Credit: Yutong Yi

EPS SCI 112 students at ductile shear zone Credit: Gwyneth Stolo

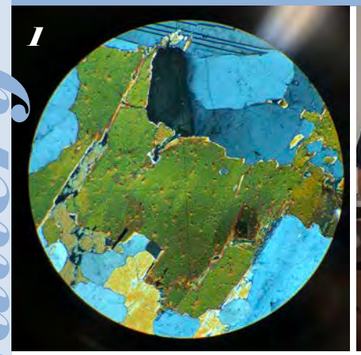
Below: Kevin Coffey with student Grace Elias, explaining the geologic features of Zion, Credit: Nika Eskandari

EPS SCI 133:
Historical & Regional Geology

In Spring 2022, students in EPS SCI 133 had the chance to explore the various-aged regional geologic features of the American Southwest in a location-hopping trip across four state lines and three beautiful parks: Valley of Fire State Park, NV; Zion National Park, UT; and the North Rim of Grand Canyon National Park, AZ. Over five days, we worked our way from the San Andreas transform boundary eastward through deformation associated with Basin and Range extension, Sevier thrusting, Colorado Plateau uplift, and even a bit of Laramide deformation. We also worked back in time from the urban geology of Los Angeles, through the Cenozoic, Mesozoic, and Paleozoic, to the Precambrian rocks beneath the Grand Canyon's Great Unconformity. Throughout the trip, students practiced field observation, map interpretation, and note-taking skills. The field trip content reinforced and clarified the geologic evidence for the history of the western United States over the past half-billion years, which the students researched and presented in class for the several weeks prior to the trip.

In all three cases (EPS SCI 61, 112, and 133), these were the first times the field trips were run since coming back from remote instruction during the pandemic. In the case of EPS SCI 133, it was the first field trip in a few years, and a return to the 133 trip led for many years by Professors Peter Bird and Raymond V. Ingersoll, which had not been run in nearly a decade.

EPSS Photo Gallery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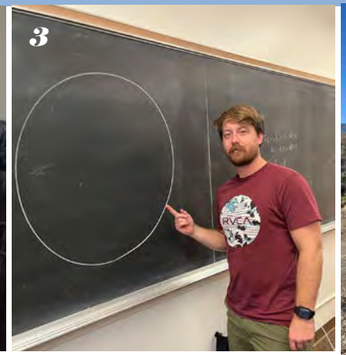
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1) Beautiful bird's eye extinction in biotite, taken during EPS SCI 103A. Credit: Jennifer Martinez

2) Thanksgiving between EPSS graduate students Daniel Sepulveda, Hanzhang Chen, Liuwei Xu, Boontigan Kuhasubpasin, Xuesong Ding (Postdoc), Justin Higa.

3) Nathan Miles draws an impressive circle on the blackboard while working on a final project. Credit: Kyle Webster

4) EPSS Geology Summer Field 2022. Credit: An Yin

5) EPSS graduate students show off their hat fashion and UCLA spirit before going to the 2022 Annual MPSC Keg Race. EPSS continued our long running tradition of winning the race by tying first with Physics.

6) Posing near the cactus gardens in Joshua Tree National Park during the annual EPSS graduate student camping trip (2021).

7) EPSS graduate students take a fun trip to gold prospect on the Yuba River in the Sierra Mountains in 2022. Credit: Alexandra Pouliasi

8) Students in the Ford during the EPS SCI 103B Death Valley Field Trip in 2021. Credit: Rachel Tripoli

9) Graduate students in the field for EPSS 262 Advanced Remote Sensing and Field Class in Winter 2022, checking backscatter signatures of alluvial surfaces in Death Valley using radar images from NASA legacy mission SIR-C. Left to right, graduate students: Julia Miller, Jacob Widmer, Daniel Sepulveda, Valeria Jaramillo, Zachary Plante.

10) 262 Remote Sensing in the Field fieldtrip: looking at stars in Death Valley. Pictured: Valeria Jaramillo, Julia Miller, Daniel Sepulveda, Jacob Widmer, Zach Plante.

11) SWG (Society for Gender Equity in Geosciences) Meeting in Fall 2021. Left to right: Hayley Bricker, Daniel Sepulveda, Valeria Jaramillo and Julia Miller.

12) Summer Field 2021, exploring near Devil's Postpile. Credit: Rachel Tripoli

13) One of my favorite college memories having a grand time with my geology squad at the Grand Canyon. Credit: Alana Archbold

14) Mackenzie Day's Advanced Sedimentology trip to the Grand Canyon. Left to right: Elisha Jhoti, Jaahnavee Venkatraman, Jake Widmer, Zach Plante, Julia Miller.

15) EPS SCI 143/243 students active learning at the Grand Canyon. Credit: Carlene Brown

16) The beautiful Barstow syncline, taken during an EPS SCI 61 field trip. Credit: Jennifer Martinez

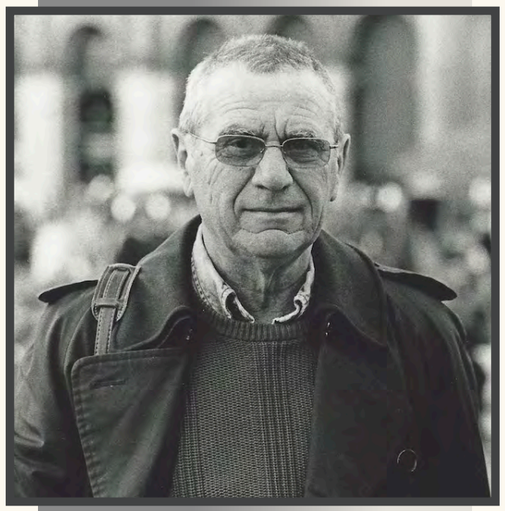
17) EPSS graduate students attend a Dodgers vs. Giants game.

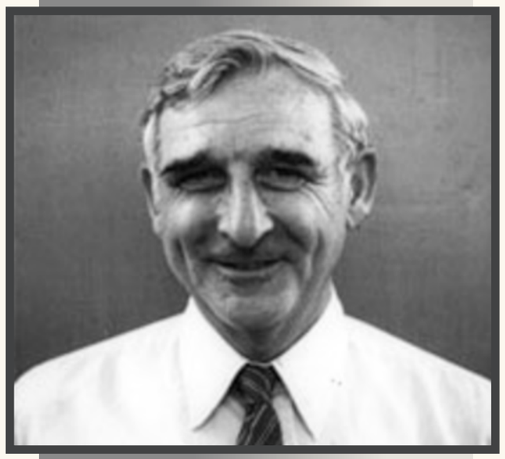
18) EPSS 262 Remote Sensing in the Field fieldtrip: on lava flows in Mojave National Preserve. Credit: Daniel Sepulveda

19) Dave Paige's research group at the Diviner meeting in Hawaii. Diviner is the thermal camera onboard the Lunar Reconnaissance Orbiter.

20) EPSS students gather to celebrate together in 2021.

In Memoriam





Yan Kagan
1935-2022

Yan Kagan, longtime researcher in EPSS, passed away on June 28, 2022. Yan was exceptional in many ways, even ordinary ones. His work was thorough and precise; he read thousands of scientific papers and books, formally and informally reviewed many hundreds, and published a few hundred scientific journal papers in Russian and English. Many of his intellectual products were collected and unified in his 2013 book, *Earthquakes: models, statistics, testable forecasts*. His works were read and referred to by mathematicians, statisticians, physicists, seismologists, and geologists across the globe. In statistical seismology, Yan was the "go-to-guy" to answer questions about earthquake catalogs, data uncertainties, probability density functions, correlations between features on a sphere, and many other topics. His broad knowledge in these areas was hard-earned: from extensive reading, in both Russian and English; conversations with colleagues; and deep thinking at his desk.

One of Yan's signal characteristics was a logical "x-ray vision." He could read a scientific paper and identify the unstated assumptions therein. If scholars found that earthquakes commonly occurred shortly after some observable phenomenon, Yan was first to ask how many occurred without that phenomenon, and how often the phenomenon was NOT followed by a similar earthquake. Because of Yan's standards of logical precision, many in the scientific community who held onto long accepted ideas resisted, even bristled at, critical views held by Yan and his knowledgeable colleagues. Nevertheless, his penetrating analyses energized an emerging field of statistical seismology. Scientific progress relies on people like Yan Kagan, as rare as they are. He will be greatly missed.

David D. Jackson, professor emeritus

Image (top): *Yan Kagan*

Ian Kaplan
1929-2021

Professor emeritus Issac (Ian) Kaplan passed away on November 11, 2021. Ian joined the UCLA faculty in 1965, following a Ph.D. at USC (1961), postdoctoral work with Sam Epstein at Caltech (1961-1962), and a visiting scholar position at Hebrew University (1962-1965). At UCLA, Ian started a world-leading stable isotope laboratory with a special emphasis on carbon and sulfur. With his many students and postdocs, Ian made early contributions that spawned entire fields of geochemical inquiry, including isotopic signatures of microbial processes, the influence of pore water chemistry on diagenesis, organic geochemistry of meteoritic materials, microbial sulfur cycling, gas hydrate geochemistry, and the organic geochemistry of Precambrian sediments.

The scope of his contributions is encapsulated in the Geochemical Society's Special Publication Volume 9: *Geochemical Investigations in Earth and Space Science: A Tribute to Issac R. Kaplan*. Ian's pioneering research in organic geochemistry was recognized with the 1993 Treibs Medal of the Geochemical Society. He also was elected a Foreign Member of the Russian Academy of Natural Science (1998), and he received the American Association of Petroleum Geologists Division of Environmental Geology President's Award for career achievement in the field of environmental geology (2002). Ian founded the Global Geochemistry Corporation in 1975, which applied geochemical principles to molecular characterization, age dating, and kinetics of diagenetic transformations of organic compounds – essentially a commercial application of what he termed "forensic environmental geochemistry." Ian transitioned to emeritus status in 1993, but continued to be active in the department for many years. He is missed for his insightful, innovative perspectives and warm collegiality.

Professor Craig Manning

Image (middle): *Ian Kaplan*

Gerhard Oertel
1920-2021

Gerhard Oertel was a quiet achiever who joined the UCLA Department of Geology in 1960 and retired from the Department of Earth and Space Sciences in 1990. He earned a Doctorate in the Natural Sciences (Dr. rer. nat.) with Hans Cloos at the University of Bonn and began work in Scotland in 1948 at the University of Edinburgh, before undertaking geological mapping in Goa. During 1966-1967, he returned to the University of Edinburgh with a Guggenheim Fellowship, and continued a long collaboration with paleontologist Gordon Craig, including an influential article on deterministic models for populations of living and fossil animals.

At UCLA, Gerhard worked collaboratively with Doug Rumble on a structural test of X-ray petrographic analysis, with Clem Nelson and John Christie on the emplacement of the Papoose Flat pluton, with An Yin on the Ninemile fault and Lewis thrust of Montana, and on other small and large tectonic problems. Gerhard used geometry and physics to understand the deformation of rocks and developed a rigorous, mathematically-based tool for structural analysis. He was admired for his sense of humor, his kindness, the careful and thoughtful way in which he addressed scientific issues, the breadth of his interests outside of science, his loyalty to family and friends, and his concern for the less fortunate.

In later years, Gerhard moved to Wisconsin to join the structural geology group at the University of Wisconsin-Madison as a tutor and role model for graduate students. Eventually he settled in Santa Rosa and passed peacefully there on January 14, 2021 after a short illness and nearly 101 years. Those of us who remember Gerhard are grateful for the privilege of knowing him.

Bruce Runnegar, professor emeritus

Image (bottom): *From left to right: John Christie, Art Sylvester, Gerhard Oertel, Clem Nelson. 19 June 1992.* ***Credit:*** *Arthur G. Sylvester, UCSB*

2021 EPSS COMMENCEMENT 2022

JUNE 12, 2021 — JUNE 11, 2022

Bachelor of Arts

Jacob Alexander Hoffman
Jocelyne Reyes
Golda Sharaf
Alondra Ureña
Chase Eliza Miranda Wheeler

Bachelor of Science

Faisal Sami Almaghlouth
Amelia Claire Campos
Julianna Zulema Cativo
Norma Angelica Contreras
Claire Elizabeth Divola
Fiona Hernit Grant
Albino Guatemala
Jennifer Vanessa Guzman
Amanda Roeliza Guilalas Hunt
Christopher Takahiro Lambert
Alexis Light
Maynard (Micky) Roberts Maganini
Monica Eliza Mendoza
Abdullah Hasif Bin Mohd Lokman
Nabila Nizam
Abraham Joseph Okayli Masaryk
Alexa Terrazas
Diana Jean Urda
Valeria Villa
Jade Carrillo Wight
Simone (Karen) Yeager

Minors

Kyle Warren Davis
Kevin Kenpo Eng
Thomas Michael Mancinelli
Jackie Panaro
Venezia Ramirez
Riley Thomas Russell
Gisselle Sainz
Hazel (Huanqi) Shan
Kirtana Valluri
Christy Zhao

Master of Science

Xiyuan Bao
Jordan Bretzfelder
Justin Takeshi Higa
Leslie Insixiengmay
Valeria Guadalupe Jaramillo Hernandez
Jiarui Liu
William Kennedy Misener
Ashley Marie Schoenfeld
Francisco Eduardo Spaulding-Astudillo
Colin William Wilkins
David John Yousavich

Doctor of Philosophy

Lydia Alexandra Adair
Alexandra Elyse Doyle
Richard Allen Hart
Jamie Kaaren Lucarelli
Jeffrey Thomas Osterhout
Krista Lynn Sierra Sawchuk
Xu Zhang

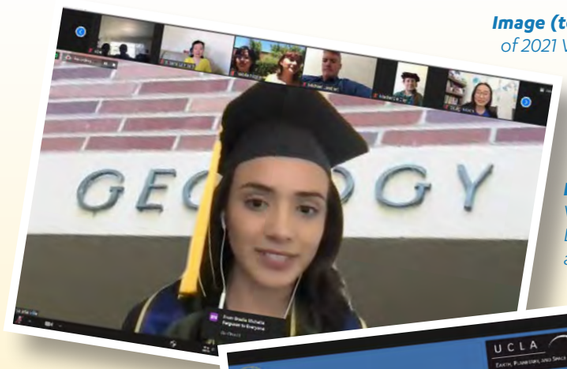


Image (to left): *EPSS Class of 2021 Valedictorian Valeria Villa presents valedictory remarks via Zoom.*

Image (below): *EPSS Class of 2021 Valedictorian Christopher Takahiro Lambert gives his valedictory remarks at virtual commencement.*

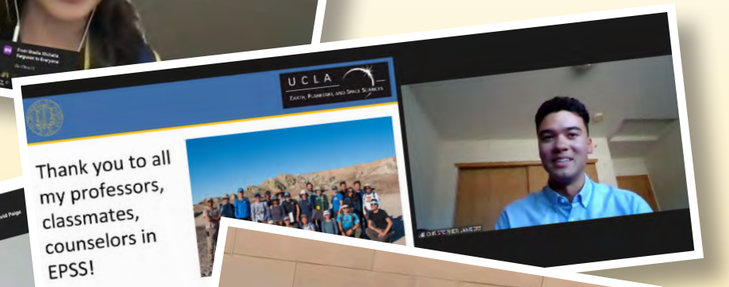
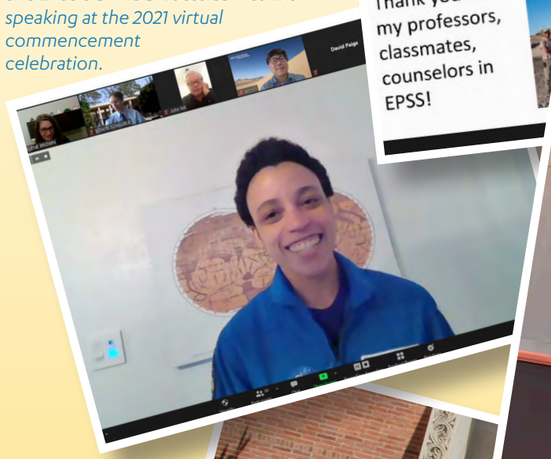


Image (below): *NASA Astronaut and EPSS alumna Dr. Jessica Watkins speaking at the 2021 virtual commencement celebration.*



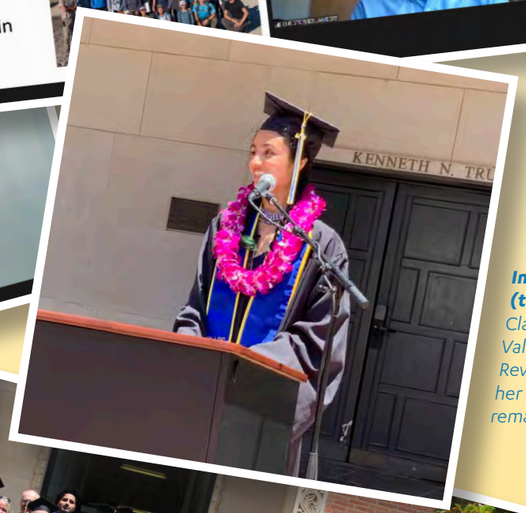


Image (to left): *EPSS Class of 2022 Valedictorian Reva Kakaria gives her valedictory remarks.*

Image (to right): *EPSS Class of 2022 in front of the Geology Building.*

Bachelor of Arts

Adam Tabor Beck
Fihr Chaudhary
Grace M Elias
Theodore Butler Herring
Leslie June
Luis Manuel Lopez
Sophia Ruth Wong
Jisoo Yu

Bachelor of Science

Abel Joseph Aragon
Alana Archbold
Morgan Alexandria Carrington
Nika Eskandari
Breeann Michelle Getman
Emery Grahill-Bland
Skye Alexander Grim
Teresa Megan Huang
Reva Kakaria
Joshua Anthony Lee
Zhuofu (Chester) Li
Arthur (Wan Ki) Lo
Clare Bonnie Madera
Jennifer Estrella Martinez
Irvin Wilfredo Matamoros
Quinlan Raymond Parker
Camille Lyn Pierce
Jeanette Kaur Ralph
Danielle Shields
Rachel Elise Tripoli

Minors

Christopher Desmond Derdena
Cora Elizabeth Fahringer
Zoe Juneau
James Joshua Khor
Terry Wai Ho Lee
Jonathan Quinn Sachrison
Nicholas M Stoner
Lawrence (Hezhou) Zhang

Master of Science

Jewel Alessandra Abbate
Marina Olivia Argueta
Matthew Walter Bogumil
Hanzhang Chen
Francis Nicholas Dragulet
Travis James Gilmore
Zesen Huang
Mark Alexander Hubbert
Boontigan Kuhasubpasin
Zachary Plante
Xiaofei Shi
Hannah Tylee Tandy
Mai Tran
Ethan Tsai
Yingchi Wang

Doctor of Philosophy

Ashna Aggarwal
Tian Feng
Daniel Fineman
Ariel Graykowski
Heather Margaret Kirkpatrick
Sebastian Krause
Kaitlyn Anne McCain
Liutauras Rusaitis
Simran Singh Sangha
Erik Christopher Weidner
Yuqing Xie

2021 2022 STUDENT AWARDS

Eugene B. Waggoner Scholarship
Christopher Takahiro Lambert

John & Frances Handin Scholarship
Valeria Villa

Deane Oberste-Lehn Scholarship
Claire Elizabeth Divola
Amanda Roeliza Guilalas Hunt
Nabila Nizam
Alexa Terrazas
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ANGELOPOULOS, VASSILIS
2021 UCLA Physical Sciences Centennial Mentorship Award

DAY, MACKENZIE
2022 Ronald Greeley Early Career Award in Planetary Science from AGU
2021 NSF CAREER Award

HARRISON, MARK
2021 AGU Walter H. Bucher Medal

KAVNER, ABBY
2020 Fulbright Scholar Award, from Fulbright España

KIVELSON, MARGARET
2021 Maxwell Prize of the Division of Plasma Physics, American Physical Society
2020 Elected Foreign member of the Royal Society of London
2020 Recipient of the Centennial Medal of Harvard University Graduate School of Arts and Sciences (GSAS)
2020 Honorary degree: Doctor of Science, University of Leicester, UK

LITHGOW-BERTELLONI, CAROLINA
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LIU, TERRY Z.
2021 AGU Editors' Citation for Excellence in Refereeing for JGR-Space Physics

MCKEEGAN, KEVIN
2022 Leonard Medalist of the Meteoritical Society

MCPHERRON, BOB
2020 AGU James Van Allen Lecturer

MOON, SEULGI
2022 AGU Luna B. Leopold Early Career Award in Earth and Planetary Surface Processes section
2022 AGU Robert Sharp Lecture
2022 Alfred P. Sloan Fellowship

SCHOPF, J. WILLIAM
2020 University of Concepción, Chile: Centennial University Medal for "international academic excellence"
2020 UCLA College Magazine, Special Centennial Issue: Discovery of world's oldest fossils included among "100 defining moments" in UCLA's 100-year history

TRIPATI, ARADHNA
2022 Center for Diverse Leadership in Science - INSIGHT Into Diversity Magazine's Inspiring Programs in STEM Award
2021 AGU Willi Dansgaard Award
2021 AGU Fellow
2021 AGU Ambassador Award
2021 California Academy of Sciences Fellow
2021 Geochemical Society and European Society of Geochemistry Fellow
2021 Royal Society Wolfson Visiting Fellowship
2020 AGU Presidential Citation for No Time for Silence as a contributing author
2020 UCLA Senate Faculty Award for Career Commitment to Diversity, Equity, and Inclusion

VELLI, MARCO
2022 AGU Eugene Parker Lecture in Space Physics and Aeronomy
2021 International Academy of Astronautics (IAA) Laurels - Team Achievement Award for Parker Solar Probe

YIN, AN
2022 GSA Penrose Medal

YOUNG, ED
2021 Class of AGU Fellows

NASA GROUP ACHIEVEMENT AWARD: EUROPA CLIPPER MAGNETOMETER TEAM *(2022)*
UCLA faculty, researchers, and staff included in this award are:
Ryan Caron
William Greer
Steven Joy
Krishan Khurana
Margaret Kivelson
Michael Lawson
David Leneman
Jiang Liu
Christopher Russell
Ryan Seaton
Kyle Stewart
Robert Strangeway
Catherine Woodall

ACADEMY OF ASTRONAUTICS (IAA) LAURELS TEAM AWARD *(2022)*
Marco Velli & the Parker Solar Probe Team

DONOR RECOGNITION

Thank you for your generous gifts and for your commitment to our mission. Donors who made gifts to the Department of Earth, Planetary, and Space Sciences between July 1, 2020 and June 30, 2022 are listed on page 33. Gifts made after June 30 will be acknowledged in the 2022-2023 newsletter.

We want to express our sincere gratitude to donors who have created endowments in the department (listed below and to the right). Endowments are impactful gifts that provide permanent, ongoing support for our faculty, students and programs, helping to ensure that the department has the resources to meet future needs. As we experience reduced state support and fluctuating grant support, endowments ensure that we can continue to improve the quality of EPSS research and teaching, and elevate the Department's worldwide reputation.

UCLA Dean of Physical Sciences Miguel García-Garibay is dedicating resources to inspire others to give through the Physical Sciences Matching Gift Program, aimed at significantly transforming the future of UCLA Physical Sciences through endowed support. We recognize the importance of increasing the diversity of our faculty, staff, and student body. A broader pool of talent fosters greater scientific accomplishments and empowers underrepresented communities that significantly benefit our society.

As a commitment to these efforts, gifts in support of diversity, equity, and inclusion will be considered at a more significant match.

Diversity, Equity, and Inclusion

Qualifying gifts of $100,000 to $1 million to any Physical Sciences endowment aimed at increasing diversity, equity and inclusion will be matched at 100%.

Other Endowments

Qualifying gifts of $100,000 to $1 million to all other Physical Sciences endowments will be matched at 50%.

To learn how you can establish your legacy through an endowment, or make a donation to support the Department of Earth, Planetary, and Space Sciences, please contact Loida De Leon at ***ldeleon@support.ucla.edu*** or (310) 405-3043.

NEWLY ENDOWED FUNDS

Bryan L. Horning Endowed EPSS Fund

Alumnus Bryan Horning of Mesquite, NV. received his doctorate degree from our department in 1975, under the guidance of Professors Robert McPherron and Gerald Schubert, and went on to a career in aerospace. He was extremely grateful for their encouragement and guidance while a student at UCLA, and has chosen to pay it forward by establishing two separate funds. The Bryan L. Horning Endowed EPSS Fund will support both undergraduate and graduate students of high academic achievement in EPSS, and in Physics & Astronomy.

Mark D. and Doniphan P. Howland Summer Field Endowed Fund

After completing his B.S. degree in Geology at UCLA, Mark Howland earned a master's degree in hydrogeology at Stanford University and worked in government, industry, and consulting for the next 25 years. He and his wife, Doniphan, now live on their beef cattle farm in central Virginia. Mark would like to acknowledge the professors who inspired him while he was an undergraduate, from 1972 to 1974, among them Dr. John Christie, Dr. Gary Ernst, Dr. Clarence Hall, Dr. Helen Loeblich, Dr. Paul Merifield, Dr. Clem Nelson, Dr. John Rosenfeld, and Dr. Ronald Shreve. This endowment will support activities in the department's summer field program, with an emphasis on undergraduate students from historically underrepresented backgrounds.

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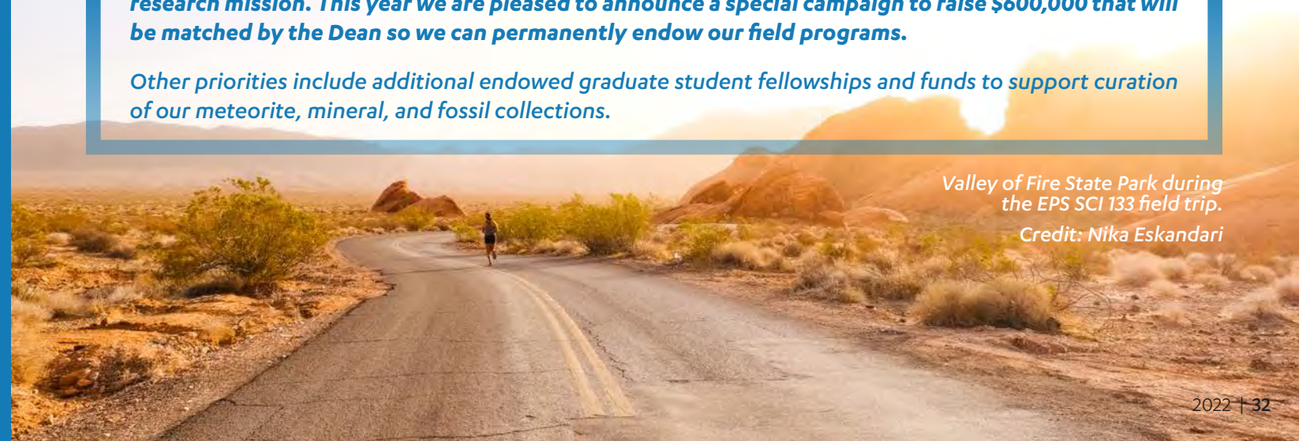
CURRENT PRIORITIES

The department is very grateful for your continuous generous support of our educational and research mission. This year we are pleased to announce a special campaign to raise $600,000 that will be matched by the Dean so we can permanently endow our field programs.

Other priorities include additional endowed graduate student fellowships and funds to support curation of our meteorite, mineral, and fossil collections.



Valley of Fire State Park during the EPS SCI 133 field trip.
Credit: Nika Eskandari

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INTRODUCING THE QUEEN'S ROAD UNDERGRADUATE RESEARCH FELLOWSHIP

Image (below): *Gwyneth Stolo, with research advisor Aradhna Tripati and Queen's Road EPSS liaison Abby Kavner, holding the Queen's Road award.*

The newly established Queen's Road Undergraduate Research Fellowship is awarded annually to one student in each academic department of the Physical Sciences division, aiming to bolster gender diversity in the physical sciences and prepare students for graduate studies in the field. Recipients gain the opportunity to collaborate with a faculty mentor on a research project during their junior and senior years at UCLA, as well as receiving a $15,000 stipend. The inaugural Queen's Road recipient in EPSS is Gwyneth Stolo, with research advisor Aradhna Tripati; congratulations, Gwyneth!

Image (to left): *The new 2022 Chevrolet Suburban, lovingly dubbed "The Spaceship" by students due to its out-of-this world luxury experience.*

ALL HAIL THE NEW EPSS FIELD VEHICLE

Image (to right): *The old 2011 GMC Yukon being rescued at summer field.*

As those who have done fieldwork know, few things are more satisfying, after a long day in the hot sun, than sinking into a comfy SUV and blasting the A/C on the bumpy road back to camp. The EPSS vehicles are the backbone of our field programs to provide hands-on learning experiences and important data-gathering for geological and geophysical research. We heavily depend on these trusty 4X4s to ferry students, faculty, researchers, and their gear to remote and rugged locations all across the West, and we expect them to function reliably and return everyone safely from the field, important data in hand. Despite great efforts to keep the vehicles well-maintained and ready for adventure, the inevitable wear and tear of such challenging conditions takes its toll, and eventually they must be retired. The photo on the far right shows one of the last rescues of our 2011 GMC Yukon, at summer field camp last year. It was replaced by a brand new 2022 Chevrolet Suburban, made possible with the generous support of donors, alumni, and friends of EPSS!

The new Suburban is diesel-powered, in compliance with the University of California's greenhouse gas emissions goals. We are happy to do our part for sustainability, taking small steps to reduce pollution and lower our carbon footprint. One noticeable benefit of diesel: refueling stops in the new vehicle are significantly less frequent than gas-powered vehicles, which extends the trip range and leaves some reserve for unanticipated detours. Huge thanks to building manager Eric Wessenauer for keeping all of the EPSS vehicles in top shape, and to everyone who coordinated the purchase and made it possible. Long live the new Suburban!

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