

# UCLA

## Earth, Planetary, and Space Sciences

2019-2020 Newsletter



# Greetings from the Chair

Welcome to the annual newsletter for the Department of Earth, Planetary, and Space Sciences. We are happy to share highlights from our faculty, students, staff, and alumni from the 2018-2019 academic year.

I am writing this greeting in 2020, as UCLA is adapting to the COVID-19 crisis. Our instructors and TAs have switched to teaching classes online, our students are learning remotely, and research activities in the lab and in the field have ramped down to make sure that our community remains as safe as possible. Nonetheless, faculty, staff and students carry on the work of the department and look forward to returning to campus and fieldwork in the coming months. The spirit of EPSS has remained strong.



As you will see in the following pages, EPSS makes outsized contributions to the research, teaching, and public service missions of UCLA. We make new discoveries, expanding the boundaries of scientific understanding, while teaching cutting-edge knowledge and skills to future generations of scientists and leaders. While they work on their degrees, our students reach out to serve the community, including public events such as Exploring Your Universe and visits to K-12 schools in the Los Angeles area. Our alumni show their devotion to the department at activities and events (pages 9 and 10) and through generous contributions that are critical to maintaining our programs (pages 25 and 26). Our staff support these efforts along the way.

EPSS faculty have received many awards this year. Of particular note are the many career-spanning honors awarded to Prof. Margaret Kivelson. In addition to the Jean Dominique Cassini Medal of the European Geosciences Union, Prof. Kivelson was awarded the Gold Medal of the Astronomical Society, an honor she shares with Edwin Hubble and Leon Knopoff (page 3). As this issue goes to press, Prof. Kivelson has just been elected a Foreign Member of the Royal Society. You may have seen her recently on the front page of the *New York Times*, or in the most recent physical sciences video (<https://www.physicalsciences.ucla.edu/videos/>).

While it is true that faculty awards and research (pages 2, 18, and 20) help give EPSS its strong international reputation, the department's dedication to teaching has lasting effects on generations of Bruins. You will see that Prof. An Yin continues our decades-long tradition of intensive summer field instruction (page 11). This year, sedimentary petrology students explored Death Valley with Prof. Mackenzie Day (page 7) while our general education students learned about the solar system with Prof. Hilke Schlichting in EPSS 9 (page 14). EPSS celebrated our newest class of graduates in June 2019 (pages 21 and 22).

You will also see in these pages multiple examples of the department engaging with the public. Graduate students have created models to help explain the work of the Mars Insight rover to younger students (page 12). Prof. Jean-Luc Margot organized a seminar to help faculty, post-docs and graduate students learn how to communicate science effectively, featuring a range of experts (page 16). Faculty, staff and students represented EPSS at local events (page 15, 17, and 19) to give hands-on demonstrations of science. Between CicLAvia, International Observe the Moon Night, Youth Mobilization LA, and Exploring Your Universe, EPSS spoke to more than 20,000 members of the Los Angeles community.

We hope you are as proud as we are to celebrate the continued tradition of excellence within our department. Thank you for your support of Earth, Planetary, and Space Sciences at UCLA.

Warm regards,  
Edwin Schauble

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White Dwarfs (page 2)  
Photo credit: Mark Garlick

### Back Cover

Death Valley Field Trip  
Photo credit: Mackenzie Day

## White Dwarfs: Using Ancient Stars to Explore the Geochemistry of Extrasolar Rocks

By Alexandra Doyle

The characterization of exoplanets (planets outside of the Solar System) is an emerging area of research in the natural sciences. In my time at UCLA, I have been a part of the research studying the geochemistry of rocky exoplanets. To confidently characterize these bodies, it is important to study the geochemistry of the rocks themselves, just as we study rocks from planets in the Solar System. While finding an extrasolar meteorite would be convenient, it is unlikely, thus driving scientists to find creative alternatives to evaluate rocky exoplanetary compositions. Through collaborations between geochemists and astronomers, we can make these evaluations by observing white dwarf stars that have been “polluted” by rocks falling onto them.

White dwarf stars represent the last known phase of stellar evolution for sun-like stars. When a star about the mass of the Sun dies, it evolves into a white dwarf. This evolution can be very chaotic for the planetary system surrounding the star. As a star expands and collapses into a white dwarf, the orbits of smaller bodies will change. Some of these small rocky bodies will be sent on trajectories towards the star, which will shred them into a disk of rocky debris (much like the disk seen around Saturn). White dwarfs are about half the mass of the sun, and about the size of Earth. The extreme gravity of these dense stars means that elements heavier than helium will rapidly sink out of sight. Yet, we observe rock-forming elements in the outer layers of white dwarfs. These white dwarfs are being polluted by the debris disk,

which slowly falls onto the star. This is why studying white dwarf stars is critical to studying rocky exoplanets: we are evaluating the rocks directly, because the observed elemental abundances come from the rocky bodies themselves.

Using white dwarfs in this way is an area of exoplanet research that was pioneered at UCLA. Most recently, we showed that the oxidation states of rocky exoplanets, as calculated from how much iron (Fe) is bonded to oxygen (O) in the rocky pollutants, is similar to most planets found in the Solar System. This technical geochemical parameter, called “oxygen fugacity,” has implications for geophysical aspects of a planet, such as how large the iron metal core will be (which can determine the existence of a magnetic field), or what kind of atmosphere a planet may have. Finding that the geochemistry of these rocky bodies is similar to planets in the Solar System suggests that some rocky exoplanets should have geophysical characteristics that are similar to Earth, as well.

This study, published in *Science* in October 2019, brings us one step closer to understanding the ubiquity or scarcity of Earth-like planets in the Galaxy. Plus, this work shows that we can apply the same, highly technical, geochemical parameters used to characterize rocks in our solar system to rocks that have formed in other planetary systems.

**Image (L-R):** Benjamin Zuckerman, Beth Klein, Alexandra Doyle, Hilke Schlichting, Edward Young. **Photo credit:** Christelle Snow

# Margaret Kivelson Wins 2019 Gold Medal

EPSS Professor Margaret G. Kivelson was awarded the 2019 Gold Medal, the Royal Astronomical Society's highest honor. The Gold Medal, which often recognizes lifetime achievement, has been awarded previously to Albert Einstein, Edwin Hubble, Arthur Eddington and Stephen Hawking. Prof. Kivelson is cited "for a lifetime of outstanding achievement in understanding planetary magnetospheres and their connections to the planets they surround."



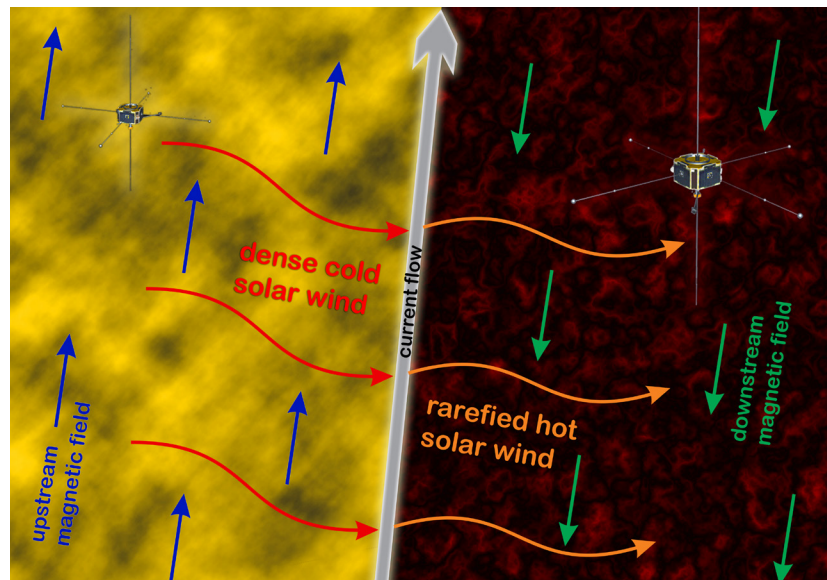
Photo credit: Jenna Schoenefeld/The New York Times

# Macelwane Award to Anton Artemyev

Congratulations to Anton Artemyev for winning this year's American Geophysical Union's prestigious Macelwane Medal. The medal is awarded yearly to early career scientists across all fields of AGU for the impact, creativity, depth and breadth of their research, as well as service, outreach and diversity. Anton obtained his Ph.D. in 2012 from Moscow's Space Research Institute, and has been at UCLA since 2015. He is world-renowned for his theoretical work on wave-particle interactions in space plasmas, incorporating non-linear effects into their



description, with application at Earth's radiation belts. Anton is also highly recognized for his contributions to the description and dynamics of plasma current sheets at Earth, Mars and Jupiter. He works closely with experimentalists and modelers, to further ensure that his elegant theories are grounded in reality. He previously was awarded the Zeldovich Medal (2014) from the Committee on Space Research, and is Associate Editor of the AGU journal, *JGR Space*. His international reach is evidenced by strong collaborations with scientists and advising of students not only at UCLA, but also at UC Berkeley, and in Italy, France and Russia.



# EPSS Wins Bruin Day Best Department Booth



Congratulations to our dedicated volunteers who represented EPSS at UCLA Bruin Day 2019, working hard to bring recruiting and science materials to our tent at the academic fair on Saturday, April 13. For their energy and enthusiasm for EPSS and the academic programs we offer, as well as answering questions from new admits, family and friends, the University Bruin Day Judges awarded EPSS the 2019 "Bruin Day Best Booth" trophy. The trophy will reside here in the department for a year. The booth pre-

sented the breadth of what EPSS offers to the new Bruin community: touching the giant museum-quality quartz and tourmaline crystals, viewing a meteorite under a microscope, spying our Sun through a telescope, seeing videos of our geophysics fieldwork in Hawaii, drone mapping in the Mojave desert and holding ELFIN, UCLA's first student-built satellite.

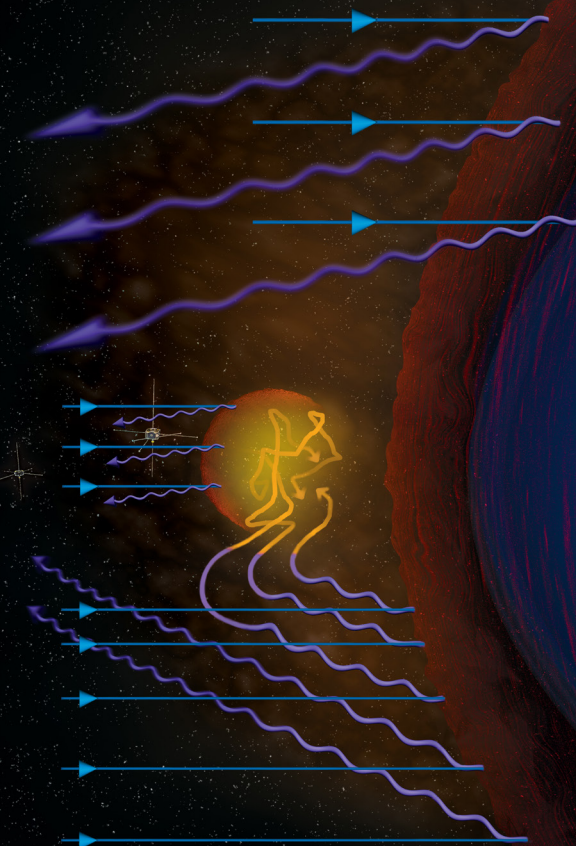


**Right:** UCLA 2019 Best Booth trophy awarded to EPSS at the annual Transfer Bruin Day Stakeholder Training and Orientation Lunch on May 6, 2019. From left: La'Tonya Rease Miles, Director, UCLA First Year Experience & Strategic Initiatives; Bill Gordon, Director, UCLA College Academic Mentoring and Peer Learning; Lauri Holbrook, EPSS Student Affairs Officer; Jade Wight, undergraduate Geophysics major and EPSS Academic Services assistant; Sarah Weinstock, Senior Event Manager, UCLA Strategic Communications/Special Events & Protocol.

# Terry Liu Wins Fred Scarf Award

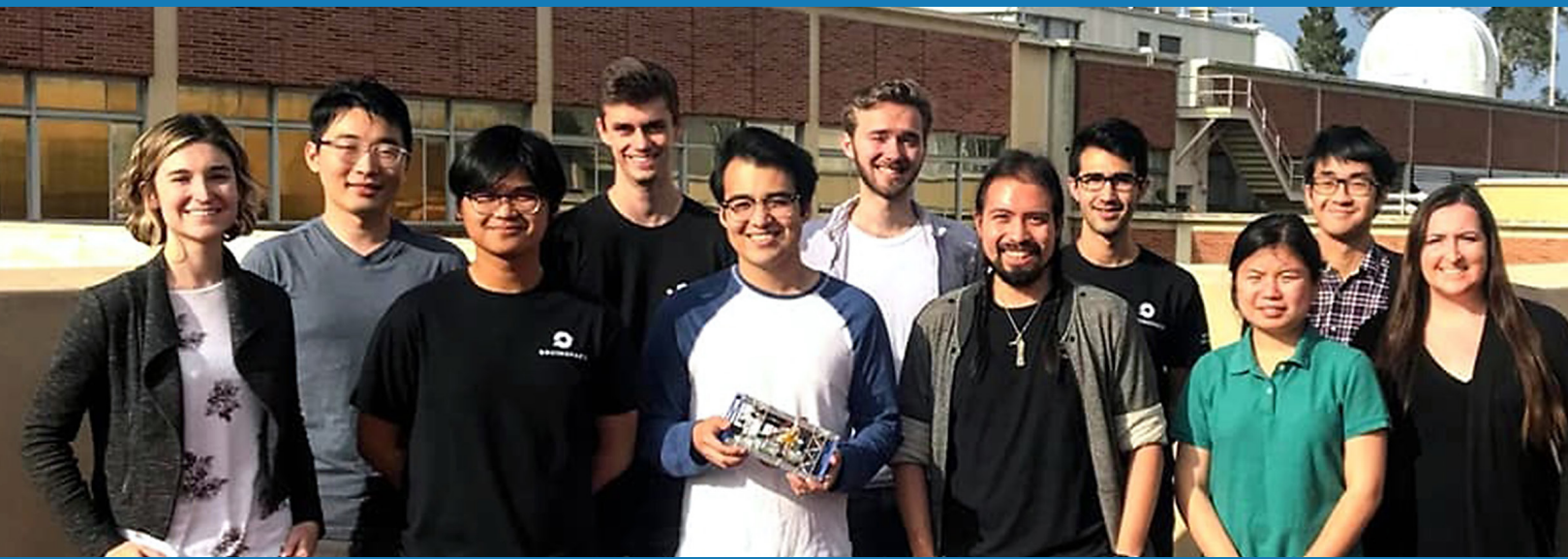
By Emmanuel Masongsong

Congratulations to Terry Liu (Ph.D., UCLA 2018, Advisor: Vassilis Angelopoulos) for being this year's recipient of the Fred L. Scarf award, which is awarded at the AGU Meeting for an outstanding dissertation. Terry's thesis has revolutionized our understanding of how shocks in space and astrophysical plasmas operate, and how they accelerate particles to high energies. Such acceleration is key to our understanding of space weather and the generation of cosmic rays. In eight highly cited AGU and Science Advances publications, Liu showed how newly discovered phenomena called "foreshock transients" form, grow and evolve ahead of Earth's own bow shock to create a highly dynamical setting where ions and electrons get accelerated. He used comprehensive, multi-spacecraft data analysis to develop powerful analytical models, which he then compared with computer simulations. His work has turned foreshock transients from an intellectual curiosity five years ago, to a required element of modern-day plasma shock acceleration models. Terry is also a recent recipient of the prestigious, NASA-sponsored Jack Eddy Postdoctoral Fellowship. Way to go, Terry!



# BruinSpace: EPSS Students Send a Fluids Experiment Into Microgravity

By Emmanuel Masongsong and Emily K. Hawkins



**“...Blue Dawn completed its flight into a low-Earth orbit and free-fall — thereby becoming the first space payload developed and built entirely by a UCLA student group.”**

It only took 10 minutes and a ride aboard the Blue Origin New Shepard reusable rocket for 11 students in the UCLA Bruin Spacecraft Group, founded jointly in the EPSS and Mechanical and Aerospace Engineering (MAE) departments in 2015, to make history. At 6:32 a.m. on May 2, 2019, their experimental fluid pump designed for use in zero-gravity environments, named Blue Dawn, completed its flight into a low-Earth orbit and free-fall — thereby becoming the first space payload developed and built entirely by a UCLA student group.

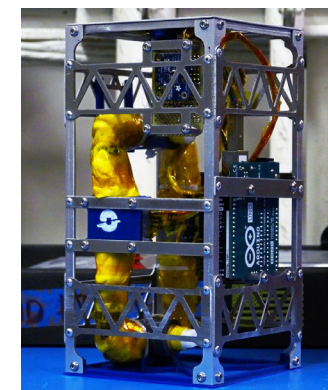
“Our goal was to see if we could design an efficient fluid pump without any moving parts to operate in zero-gravity, which has never been done before,” said Lydia Bingley, a fifth-year EPSS Ph.D. student and project manager of the student mission. Such a low-maintenance pump would be ideal for moving various

liquids on the International Space Station, and could reduce the risk of motorized pump failures for rovers and even future bases on the moon or Mars.

The New Shepard rocket roared into the deep blue West Texas sky, ferrying a suite of 38 separate micro-gravity research experiments, including eight NASA research and technology payloads and two payloads built by student groups at UCLA and Case Western Reserve University. For Blue Dawn, the UCLA team designed a system containing the fluid, pump tubing, magnets and electronics in a custom aluminum frame roughly the size of a football, with a maximum weight of 1.1 pounds.

Work began on this project in the fall of 2017. After completing a design, the team of 11 students from several majors then manufactured and tested the pump entirely on campus. The group secured primary funding for their project in 2017 by winning a grant

from the American Society for Gravitational and Space Research (ASGSR) Ken Souza Spaceflight Competition. Team members said that mission success would not have been possible without the expert guidance of two Geophysics and Space Physics (G&SP) Ph.D. students: science advisor Emily Hawkins and project manager Lydia Bingley. The group was also supported by MAE professor Richard Wirz and EPSS professor Christopher Russell, whose prototyping lab facilities were used to build and test Blue Dawn.



*The flight model of Blue Dawn, the 2U cubesat engineered by Bruin Spacecraft Group, carrying an enclosed magneto-hydrodynamic pump circuit.*

“It’s very exciting to directly apply the knowledge we gained in classes and actually build something that went into space,” said Andrew Evans, a fourth-year MAE undergraduate major who served as chief engineer. He stressed the value of hands-on team experience gained in such projects. “That’s what the Bruin Spacecraft Group is all about, solving real science questions while giving students an opportunity to fulfill their dreams of spaceflight,” Evans said.

To be judged a success, Blue Dawn had to operate fully autonomously during its 10-minute flight and free-fall back to Earth. Once the capsule chutes deployed and it touched down softly in the desert, David James, fourth-year EPSS and Computer Science undergraduate major and assembly and integration lead, breathed a sigh of relief. “Seeing all of our hard work pay off with a perfect launch and landing, it was nothing short of amazing,” James said. The payload and flight data were returned to UCLA one month after flight so the team could begin to analyze the pump’s performance in microgravity. They expect the flow in space to be more efficient compared to its performance in ground tests under the influence of gravity. The team plans to publish results of this study and present at conferences, allowing students the experience of seeing a space mission end-to-end.

What’s next for the Bruin Spacecraft Group? “In addition to several weather balloon projects, we are now developing a high power cubesat bus capable of supporting electric propulsion,” Evans said. The spacecraft in development, named the UCLA Research Satellite (URSa), will feature the Miniature Xenon Ion (MiXI) engine built by the Wirz Plasma and Space Propulsion Laboratory at UCLA as a first technology demonstration. The group is always looking for new members at both the undergraduate and graduate level, particularly in the EPSS department.



**Above:** Project engineers and scientists gather in the EPSS building to watch the live flight of their payload via the Blue Origin New Shepard 11 test flight.

**Left:** Blue Dawn mission members of the UCLA Bruin Spacecraft Group.

# Trekking Through Death Valley

By Taylor Dorn

Asking people what comes to mind of when they hear “Death Valley” will lead to many different answers. Death Valley is the fifth largest national park; the only ones that are larger are located in Alaska. The heat, the lowest point in North America, the complex structural geology and rocks sliding across flat playas are just a small sample of what someone will encounter during their trip. There is a lot happening in this complex ecosystem and each visit will provide a unique experience.

Each year, students enrolled in Sedimentary Petrology take a four-day trip through Death Valley and surrounding vistas. An initial stop in the Nopah Range Wilderness Area offers great examples of oolitic limestone, hummocky cross stratification, and current ripples. The end of the day is punctuated by two highlights: hunting for trilobites just off the Old Spanish Trail Highway and cooling off with a date shake at China Ranch Date Farm & Bakery.

The following days are dominated by the complex geology of Death Valley National Park. Roadside stops are aplenty, each emphasizing the many unique offerings of Death Valley such as Badwater Basin and Devils Golf Course. Mosaic Canyon, a hike just re-opened from a recent flash flood several months ago,

began the day in the park. While many tourists on the trail could see the stunning ‘mosaicked’ breccia, students in EPSS 103B (Sedimentary Petrology) took time along the four-mile hike to study not only these angular clasts, but the imbricated rocks indicating a paleo flow direction, the faults running through the canyon and the dry falls that seem innocuous until you consider what happens during a flash flood. A short hike to Darwin falls closes out the final night of the trip. Water pours over a 15-foot drop among lush vegetation, something not normally associated with any desert, let alone one called Death Valley.

While sleeping in tents is common during geology field trips, we were fortunate to stay at the Shoshone Education and Research Center (SHEAR), a facility that has been home to many geology field trips, as evidenced by the articles tacked onto the ceiling and walls throughout the house. This oasis in a town of 13 residents has been inhabited by some of the biggest names in the field. Seeing notes left behind by previous generations of geologists is a reminder that there is so much more to discover in Death Valley, on Earth, and beyond.

*Photo: Students on the dunes at Death Valley National Park.*



**Top:** Students in EPSS 103B Sedimentary Petrology exploring evaporite deposits at the Devil's Golf Course in Death Valley National Park.



**Right:** Students in EPSS 103B watching the sunset from the top of Fossil Falls on a field trip across eastern California.

**Bottom:** Students in EPSS 111 Stratigraphic and Field Geology after mapping a square mile for their final exam.



Support EPSS field trips at <https://epss.ucla.edu/giving>

# UCLA EPSS Alumni Field Trips

**Long Valley and Mono Craters - September 2018**

**Owens Valley & White-Inyo Mountains - October 2019**



## In late September 2018,

33 EPSS (formerly known as ESS) alumni from the late 1970s and early '80s met in Mammoth Lakes, CA for a field trip to the Long Valley and Mono Craters. The trip celebrated the 42nd anniversary of the 1976 Fall Field Trip to eastern California, led by then graduate student Steve Lipshie. The trip also celebrated the 3rd edition of Steve's 1976 volume, *Geologic Guidebook to the Long Valley-Mono Craters Region of Eastern California*.

The trip, organized by alumni Allen Glazner and Bruce Bilodeau, kicked off with a beer fest and slide show of bygone days. Starting in Bishop, Steve led the group on three days of geological bliss, touring spectacular geologic sites in Owens Valley, Long Valley and Mammoth area, ending on the shore of Mono Lake.

Many of the original 1976 field trip participants were present along with spouses, relatives, friends and former White Mountain Research Center employees: John Alderson, Mick Apted, John Barron, Bruce Bilodeau, Elizabeth Caplun, Lang Farmer, Elisabeth Fourtanier, Angela Haworth, Carol Heinrich, Scott Hetzler, Mike Houseman, Mike Garcia, Allen Glazner, Carl Jacobson, Martin Johnson, Flip Koch, Bill Krebs, Steve Lipshie, Lidia Lustig, Diana Maldonado, Duck Mittlefehldt, Nurit Mittlefehldt, Mary Olney, Cecil Patrick, Wendy Phillips, Joe Polovina, Wayne Sawka, Skip Stoddard, Dorothy Sundbye, Warren Thomas, Dee Trent, Glenn Waychunas, and Deborah Wechsler.

**Above:** September 2018 field trip participants.

## In early October 2019,

29 EPSS alumni from the late 1970s and early '80s and friends took another break from retirement and met at the Owens Valley Station of the White Mountain Research Center (WMRC) near Bishop, CA. The trip celebrated the 39th anniversary of the 1980 Fall Field Trip to eastern California led by Professor Clem Nelson. It was organized by alumni Allen Glazner and Bruce Bilodeau.

The trip kicked off with an all-day excursion to Papoose Flat led by alum Art Sylvester, who worked extensively on the Papoose Flat pluton with John Christie, Gerhard Oertel, and Clem Nelson.

After examining the geology around the Owens Valley, the group peregrinated to the WMRC Crooked Creek Station where they spent another two days visiting clas-

sic geological features of the Whites, catching up with friends they might not have seen for 40 years. A highlight was climbing the recently named Clem Nelson Peak near Schulman Grove.

Many of the original 1980 field trip participants were present along with spouses, relatives, friends and former WMRC employees: John Barron, John Bacheller, Sue Ann Bacheller, Bruce Bilodeau, Elizabeth Caplun, Robert de Lastic, Elisabeth Fourtanier, Angela Haworth, Scott Hetzler, Mike Houseman, Allen Glazner, Elizabeth Glazner, Ray Ingersoll, Carl Jacobson, Martin Johnson, Flip Koch, Bill Krebs, Steve Lipshie, Marc Mayes, Dave Miller, Duck Mittlefehldt, Nurit Mittlefehldt, Mary Olney, Alison Ord, Cecil Patrick, Art Sylvester, Rodney Thompson, Glenn Waychunas and Deborah Wechsler.



**Left:** Back Row (L-R): Elizabeth Caplun, Glenn Waychunas, Martin Johnson, Allen Glazner, Duck Mittlefehldt, Flip Koch, Dave Miller, Alison Ord, Mary Olney, Sue Ann Bacheller, John Bacheller, Bruce Bilodeau. Middle Row: Angela Haworth, Rodney Thompson, Carl Jacobson, Steve Lipshie, Nurit Mittlefehldt. Front Row: John Barron, Bill Krebs, Elisabeth Fourtanier, Robert de Lastic, Mike Houseman, Ray Ingersoll, Scott Hetzler.

**Bottom left:** Beautiful Papoose Flat. Back Row (L-R): Art Sylvester, Allen Glazner, Glenn Waychunas, Mike

Houseman, Bill Krebs, Sue Ann Bacheller, Robert de Lastic, John Bacheller, Mary Olney, Alison Ord, Angela Haworth, Martin Johnson, Deborah Wechsler, Bruce Bilodeau. Front Row: Marc Mayes, Scott Hetzler, Carl Jacobson, Steve Lipshie, Flip Koch, Elizabeth Caplun, Cecil Patrick.



**Above:** Clem Nelson Peak, looking NE. Schulman Grove Visitor Center is in the foreground.

# A Summer of Strikes (and Dips)

By Christian Levine, Beaux Guajardo, and Jimmy Yang



UCLA Summer Field 2019 participants at Convict Lake. Photo credit: Renee Delamater

The first day of Summer Field 2019 started in classic UCLA Geology field trip fashion at the loading dock. After packing up our gear, we received individual care packages filled with snacks from the ever-thoughtful Student Affairs Officer Lauri Holbrook – these came in handy throughout our trip. Before long, we arrived in eastern California, with Sierra Nevada’s snow-capped peaks to our west and the White-Inyo Mountains to our east. We would spend the next month living in the White Mountains, learning field geology from Professor An Yin and our two TAs, Kevin Coffey and Abijah Simon.

A typical day started at 5:30 a.m. with boots on the ground by 6:30 a.m. At Poleta Folds, our field area, we spent the day mapping and doing our best to make sense of the complicated geology, ending by 2:00 p.m. unless more observation was required. After mapping, we would take a quick dip in the revitalizing Owens River and then head into Big Pine to stop at Carroll’s Market for the highlight of the day: ice cream and refreshments. After returning to camp by 6:00 p.m., we cooked dinner, then worked for another few hours before heading to bed by around 10:00 p.m.

Once a week, we took amazing field trips around eastern California. From the lowest point in North America, Death Valley’s Badwater Basin, to a beautiful geologic hike at 11,000 feet in the Sierras, we were exposed to a variety of geological processes and questions. During these field trips, Professor Yin pushed us to think deeply about what we were observing and how to explain it, while our TAs were an indispensable resource in the field.

Visiting scholars from China also enriched our experience by contributing their unique perspectives within a collaborative framework. We all worked hard toward the same goal: a better understanding of geology and how to apply it in the field.

Summer Field concluded with a bang: a luau complete with an entire pig (courtesy of An) buried and cooked overnight. That final evening was full of merriment as we celebrated a successful month in the field. Soon after we returned home, projects were submitted and UCLA Summer Field 2019 was finished.

Following this whirlwind experience, we reflected on our personal takeaways. Beaux grew up in a small desert town and had never seen real snow. On a field

trip to the Sierras, he was able to experience a snowball fight, which felt like Christmas in July. For Jimmy, the group presentation really hit home. An’s focus on thinking critically, taking a systematic perspective and developing teamwork and communication had fully materialized. The sense of pride in his team and accomplishment he felt was unmatched when An praised their presentation.

Finally, for Christian, everything came together late

one night as he spoke with his mapping partner. They spent an hour hypothesizing on the formation of the Poleta Folds, to a degree that never would have been possible before this trip. When An’s interpretation of the area proved nearly identical to theirs, Christian felt validated, excited and accomplished. This was only possible due to the unparalleled quality of education, instructors and peers at UCLA. Our Summer Field experience was a unique and memorable journey that we will always cherish.

## MinSight: A Multi-Million Dollar Mission to Mars (and the Classroom)

By Una Schneck

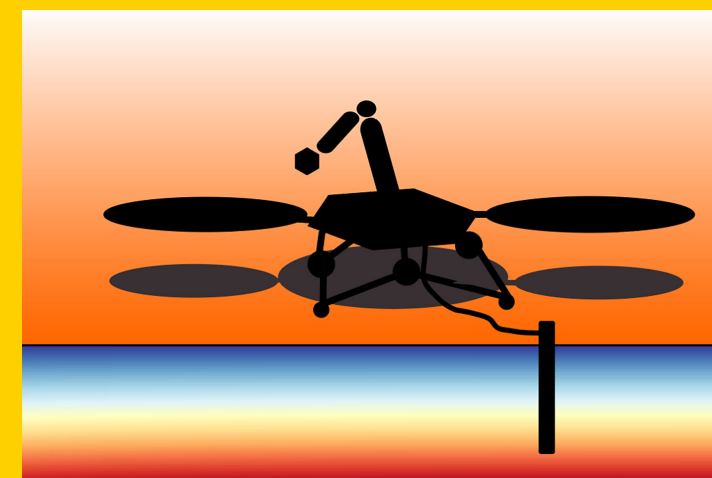
The landing of NASA’s InSight mission on the surface of Mars on November 26, 2018 promised an enticing peek into the red planet’s internal thermal state. The InSight lander carried on board the Heat Flow and Physical Properties Package (HP3): a hammer-headed tether studded with heat sensors designed to burrow five meters below the surface to measure the thermal conductivity of Martian soil. However, within minutes of the initial hammering, the probe’s progress was stalled.

While we wait for the mission to resume, we have developed a miniature model of the InSight’s HP3 probe (affectionately named “MinSight”) to provide hands-on understanding of how the instrument can use thermal gradients to derive heat flow under the surface. The EPSS Advanced Computing (171) class used the first phase of the MinSight project to calculate the thermal diffusivity of the “Martian regolith” from the variation in heat imposed by the seasonal changes in insolation. After a full modeled year, the class found the thermal diffusivity for their unknown regolith (e.g., coarse-grain sand) to be within 75 percent of published values for dry sand!

The actual InSight mission landed near the Martian equator and dug well below the surface to escape the effect of seasonal variations on the measured heat flux.

So, the next phase of MinSight applied a constant heat flux from the base to find the thermal conductivity of the regolith to better model heat being lost from the core as radioactive elements decay (see figure below). Initial results again agree with the published values for the thermal conductivity and specific heat capacity for dry, coarse sand.

Tensions are high, but hope is not yet lost for the HP3 probe. In the meantime, the next EPSS Advanced Computing class can study the properties of unknown regolith using the same general heating scenario as that found on Mars by the InSight lander.



Cartoon of InSight lander on Martian surface with model of steady-state basal heat flux superimposed in the subsurface (surface heat flux contributions are neglected).

# Society of Women Geoscientists at UCLA

By Emily K. Hawkins

About a year ago, several female graduate students from the Department of Atmospheric and Oceanic Sciences (AOS) and I bonded over coffee to discuss our experiences at the recent American Geophysical Union meeting in Washington, D.C., along with our shared identity as an underrepresented group in STEM. While we talked, a common theme emerged: UCLA needed a campus group designed for women in the geosciences. And so we set forth to establish the Society of Women Geoscientists (SWG) at UCLA.

We developed a constitution and launched SWG as a registered student organization in 2019. Our mission is to promote and uplift women in the geophysical sciences through outreach, community building, institutional reform and career development. The group is open to anyone with a broad interest in the geosciences and planetary sciences, both those who identify as females (members) and allies.

Since the kick-off dinner in September 2019, more than 50 active group members and allies have joined SWG, representing EPSS, AOS, Physics, Geography and the Institute of the Environment and Sustainability.

With support from EPSS and AOS, the society has held successful events, including biweekly Tea Tuesdays to discuss shared values and experiences, and participated

in major outreach programs. At the 2019 Exploring Your Universe event, we used colorful rheoscopic fluids to demonstrate basic geophysical phenomena for thousands of children, including common fluid motions occurring in the Earth's ocean.

We also partnered with Project Scientist, an organization that provides enriching experiences for young females interested in STEM, to host a group of elementary and middle school girls for a campus visit. The students toured laboratories in EPSS and AOS, observed science experiments and listened as we discussed our personal journey of becoming a female scientist.

Our first annual SWG Fall Dinner was held on November 21, 2019, with keynote speaker Professor Mackenzie Day sharing her experiences as a woman in STEM. SWG is planning other events for UCLA students, including a workshop on imposter syndrome. We also enjoy building community through participation in an intramural volleyball league.

*“UCLA needed a campus group designed for women in the geosciences.”*

 *The Society of Women Geoscientists is eager to connect with alumni and donors interested in supporting this group, and welcomes you to email us for more information at [swg@atmos.ucla.edu](mailto:swg@atmos.ucla.edu).*

 **Find us on instagram! @steminismatucla**



SWG members at a pre-Fall Quarter kick-off dinner.



Three of the five founding members of SWG at the Graduate Resource Fair with SWG pup, Balto.

# Merging Art and Science: the Creation of “New Insights”

By Emilie Eshbaugh



Even though I've always been fascinated by outer space, I never thought I would get the chance to study it. I dreaded math classes and until recently had resigned myself to never understanding much in scientific fields.

So, when I enrolled in EPSS 9 Solar Systems and Planets last January to satisfy my major's physical science requirement, I was more than a little apprehensive. I worried the course would frustrate me and that I would struggle to keep up with my more math-oriented peers.

After a week or two, however, my attitude changed. Hilke Schlichting, my professor, explained everything very clearly. Not only did I understand the material, I enjoyed it. From the beginning, Professor Schlichting showed an obvious desire to instill understanding in everyone, even if they had a limited scientific background. Never was this more apparent than when she announced to the class that she was looking for someone to help her make educational videos based on her research – videos that anyone could appreciate, regardless of their previous knowledge.

As a film major, I had done some animating before,

but never anything on this scale. I saw it as an opportunity to not only hone my animating skills, but also to broaden my understanding of the universe. I approached Professor Schlichting about animating the videos and she sent me one of her research papers to read.

At first I was overwhelmed. The paper used language and concepts far beyond my knowledge, and I had to read it four times before I started to grasp the material. I met with Professor Schlichting several times to be sure I

understood the key concepts before I even opened up any animation software.

Writing the script was the most challenging part. With only a tentative grasp of the content, it was difficult to simplify the material enough for other people to understand. With Professor Schlichting's help, additional research and re-reading the research paper multiple times, it became less intimidating, and I had a rough script within a couple of weeks.

*“..videos that anyone could appreciate, regardless of their previous knowledge.”*

The next challenge was the animation itself. Though I was familiar with the software, I soon realized that animating is a very time-consuming process. My lowest point was when I spent two weeks animating a single tree! But with more practice, even that

became easier, and soon I developed a system to make the process more efficient.

Three months later, I uploaded our first video onto our YouTube channel, “New Insights.” Though far from perfect, it is a great source of pride for me. The video represents three months of hard work, many late nights re-drawing an asteroid until it looked “just right” and, of course, embracing a field that used to terrify me.



# International Observe the Moon Night

By Dave Jewitt

About a dozen volunteers from EPSS ran a very successful International Observe the Moon Night (IOTMN) in 2019. Led by Emmanuel Masongsong and Dave Milewski, it was our best-attended IOTMN, with more than 700 visitors coming up to the roof of the Math Sciences building between 7:00 p.m. and 9:30 p.m. Under perfect skies, visitors used six different telescopes to view the Moon, Jupiter (with all four Galilean satellites neatly aligned) and Saturn (with rings, of course). In addition, samples of mare and highland dust brought back by the Apollo astronauts and a large lunar meteorite were on hand, as well as various Apollo artifacts (courtesy of Mike Rich from Physics and Astronomy). A continuous loop movie projected on the side of a dome attracted a lot of interest, as did a non-stop Q&A aided by an interactive digital Moon. A “selfie-yourself on the Moon” backdrop was also popular. Most visitors attended every station, some returning for another look through the same telescope or to ask a scientist another question.

“...our best attended IOTMN, with more than 700 visitors”



Local families enjoy the wonders of looking up during IOTMN.

Photo credits: Dave Jewitt



Crowds gather near the telescope dome for a spectacular view of our nearest neighbor in space.

# Communicating Science in Today's World

By Jean-Luc Margot

EPSS secured funding from the Luskin Endowment for Thought Leadership to organize a daylong event focused on science communication on May 21, 2019. The daytime program consisted of an excellent science communication workshop by Amy and Roger Aines, authors of *Championing Science*. The workshop consisted of presentations, group activities and video playback of graduate student talks, through which Amy and Roger conveyed the importance and art of communicating science effectively. About 40 students from UCLA departments in the physical and life sciences attended.

Feedback from student attendees was uniformly positive. The evening program consisted of

“...a daylong event focused on science communication”

a reception and panel discussion during which experts discussed communicating science through film, TV and news. Physical Sciences Dean Miguel García-Garibay introduced the event, which was moderated by former EPSS Chair Jean-Luc Margot and attended by over 250 alumni and friends. Panelists included:

- Lawrence Bender, producer and political activist. His film “An Inconvenient Truth” raised unprecedented awareness about climate change and won the Academy Award for Best Documentary Feature.

- Nadia Drake, science journalist for *National Geographic*. Her work has also appeared in *Science News*, *Nature*, *The Proceedings of the National Academy of Sciences* and *Wired*.
- Jacob Margolis, science reporter at KPCC – Southern California Public Radio and host of the podcast “The Big One: Your Survival Guide.”
- Deborah Netburn, science reporter for *The Los Angeles Times*.
- David Saltzberg, Professor of Physics and Astronomy at UCLA. He has been the science consultant for the hit TV show “The Big Bang Theory” since its pilot episode.

The discussion covered a range of topics, including the challenges that science communicators face and the profound impact that science communication has on our policy choices (e.g., public health and public safety). Panelists described their personal experiences and opined on the influence of the war on facts, pre-existing beliefs and social influences on the acceptance of scientific results. The energy in the room was palpable, even after the formal event concluded: many attendees continued to engage with the panelists for quite some time. The event was made possible by a grant from the Luskin Endowment for Thought Leadership.

## Hugh Kieffer's Birthday



Former EPSS faculty member Hugh Kieffer celebrated his 80th birthday in Tempe, AZ. In attendance were three former UCLA undergraduates who worked with Hugh on the Viking project in the 1970s and later went on to be principal investigators on Mars missions and instruments, and faculty members at leading universities. Pictured from left to right: Dave Paige (UCLA), Hugh Kieffer, Phil Christensen (ASU) and Bruce Jakosky (CU Boulder)

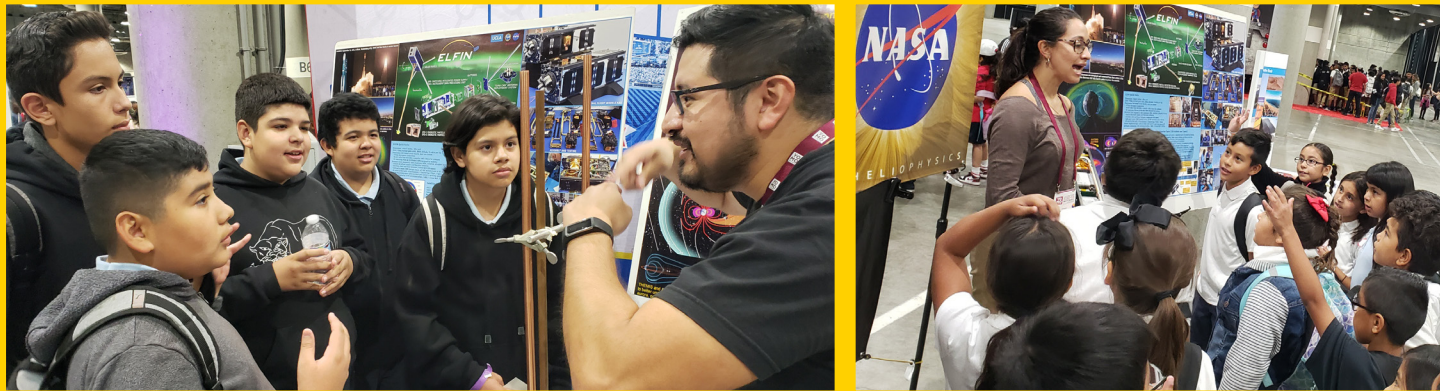
# EPSS at YOMO

By Emmanuel Masongsong and Henry Gonzalez

EPSS was invited to present at Youth Mobilization LA (YOMO-LA), an enormous STEM festival at the LA Convention Center on October 22-24, 2019. With over 17,000 K-12 attendees, this event offered an incomparable opportunity to connect face to face with our local community and excite kids about pursuing STEM degrees at UCLA EPSS.

We were able to increase awareness of the department and the field of geophysics/planetary science, not to

mention the ELFIN CubeSat, UCLA's first satellite mission built by students. Speaking to thousands of kids, teachers, and education program directors over three days, we emphasized how EPSS values its students and the breadth of their training by enabling public outreach. Aside from leading hands-on demonstrations, EPSS volunteers represented the diversity and inclusivity of our department, making the young minority students feel welcome and inspire them that they too could one day engage in research. Most importantly,



*“With over **17,000** K-12 attendees, this event presented an incomparable chance to connect with our local community and excite kids about pursuing STEM degrees at UCLA EPSS.”*



our volunteers shared their personal transformative experiences, and showed the students how sampling different areas of science can lead to discovering something new, encouraging anyone to succeed in STEM if they believe in and challenge themselves!

Outreach is far more than volunteering; the ability to

articulate concepts clearly and engagingly to peers and non-experts is a crucial part of any EPSS student's academic success. In developing creative analogies to explain the science, EPSS students build their confidence while learning to effectively promote their own research and inspire others to engage in STEM careers.

## Earthquakes Breaking a Network of Faults

By Lingsen Meng

The 2019 M7.4 Ridgecrest earthquake occurred on July 6 along the Little Lake Fault zone in the northern Eastern California shear zone. This unexpected event, together with its M6.4 foreshock on July 4, generated broadly-felt ground shaking and broke the silence of big earthquakes in southern California since the 1999 M7.1 Hector Mine earthquake. The Ridgecrest sequence was a seismic standout for many reasons,

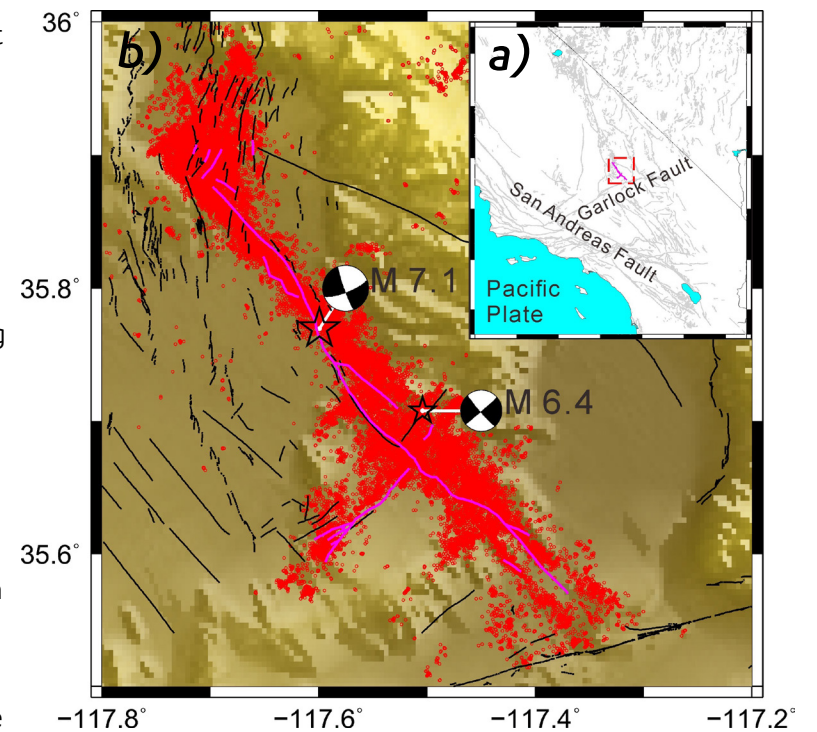
*“...previously unrecognized network of perpendicular faults.”*

not the least of which is that it broke multiple segments of a previously unrecognized network of perpendicular faults. EPSS faculty Lingsen Meng is leading a group effort

(with postdoctoral scholar Hui Huang and graduate students Yuqing Xie and Han Bao) to study this mysterious event. He used an EPSS-developed source imaging technique to track the rupture growth of the M6.4 and M7.1 events, which pinpoints the exact fault segments that broke in each quake. The technique is similar to how a smartphone user's location can be determined by triangulating the times that phone signals arrive at cellphone antenna towers.

His team is also building a high-resolution earthquake catalog to map the geometry of active faults at depths, including structures that link and transfer deformation between faults. EPSS professor Gilles Peltzer is also mapping the earthquake-induced surface displacement by examining the satellite radar images. These efforts

will help us to understand the conditions of connectivity between adjacent faults during large earthquakes, which is crucial in the precise quantification of regional seismic hazard.



(a) The distribution of seismic stations (triangles) around the Ridgecrest area (red dashed rectangle). (b) high-precision seismicity locations (red dots) from January 1 to August 1, 2019. The gray diamonds denote repeating earthquakes (indicating fault creep) while the purple ones highlight those occurring before the July 6 Mw 7.1 mainshock.

# CicLAvia

By Emmanuel Masongsong



EPSS was featured at the popular event CicLAvia on October 6, 2019, when miles of streets throughout Downtown Los Angeles were closed off for more than 10,000 cyclists, walkers, skaters and strollers to safely enjoy these neighborhoods.

UCLA's Centennial celebration organized a huge exhibition in front of Los Angeles City Hall for guests of all ages to interact with UCLA's history and its present endeavors. EPSS was invited to promote Exploring Your Universe with the Augmented Reality (AR) Sandbox, ELFIN CubeSat, and the GALE Lab. All of these booths were sustainably run by LADWP solar power. Thanks to our dedicated outreach volunteers, we reached over a thousand people, many of them fellow Bruin alumni.

Taylor Dorn, a grad student in Prof. Mackenzie Day's Geomorphology and Aeolian Landscape Evolution (GALE) lab explained how wind erosion on Mars offers clues about its past, which can teach us about Earth and other planets and moons. He also shared about his lab's role in the upcoming NASA Mars 2020 rover mission, which will land in Jezero Crater to examine evidence of how ancient water and wind flows sculpted the landscape.

Henry Gonzalez and Sourav Saha showcased the AR

Sandbox, used to teach undergrads about topographic maps in 3D. Kids of all ages packed the tent, digging in and building volcanoes, canyons and islands, making it rain and seeing how water interacts with landforms. Everyone exclaimed in awe when we induced a "climate change" flood and saw the low lying areas turn into lakes. Nothing beats hands-on education.

Last but not least, riders dismounted to interact with the tiny ELFIN CubeSat, UCLA's first satellite built and operated by students in EPSS. A popular selfie destination, visitors posed with a life-size test model of the satellite, played with magnetic field demonstrations and a solar-magnetic motor and saw the Sun up close through a special solar telescope.

A discussion about space weather wouldn't be complete without a space rock that fell to Earth. Visitors examined a rare metal-stony meteorite under a microscope, with shiny metal veins of iron and nickel resulting from shock-melting after an ancient impact in space (donated by J.D. Hodder). Thanks to geophysics/space physics students Fik Beyene and Laura Iglesias, and alumni volunteers Mike Hartinger (SSI), and Reuben Rozario (SpaceX) for spending their Sunday in the sun for EPSS.

# Interstellar Interlopers

By Dave Jewitt

The first interstellar comet, 2I/Borisov, was discovered in 2019 and immediately became the intense focus of astronomers around the world. Borisov is only the second interstellar object (after 'Oumuamua) ever observed in the solar system.

Unlike other comets, Borisov is moving too fast to be held by the gravity of the Sun, giving its trajectory a distinctive hyperbolic shape. It is likely to have been ejected from the planetary system of another star and to have spent millions or even billions of years wandering amongst the stars of the Milky Way.

EPSS's David Jewitt started a program of study using telescopes on the ground and also secured emergency observations using the Hubble Space Telescope. The newly acquired images show a tiny nucleus, probably less than 1 km in size, emitting a cloud of large particles.

Whereas Borisov looks, at least superficially, like a normal, solar system comet, 'Oumuamua appeared completely inactive, and had a strange, rocket-like shape different from any asteroid or comet observed before. A major question to be addressed with further observation and study is why these two might be so different.

“  
Unlike other  
comets, Borisov  
is moving too fast  
to be held by the  
gravity of the Sun  
”

*Image: Hubble Space Telescope image of Comet Borisov showing the asymmetric coma of ejected dust, in part pushed back from the nucleus by the pressure of sunlight. Region shown is about 100,000 km across.*

# Commencement 2019



UCLA Class of 2019 graduates proudly posing for celebration photos. Photo credit: Hilda Avanesian.



Centennial Commencement Speaker, Dr. John Phillips, NASA astronaut and EPSS Alumni. Photo credit: Hilda Avanesian.

## Degrees

### Bachelor of Arts

Ashley Michelle Arcos	Robert William Ly
Genesis Garcia	Laura Yaritza Rebolledo
Camille Kimberly Hoskins	Clarissa Alexis Valadez-Luna
Jordan Alexander Larrea	Janae Oiyee Yip

### Bachelor of Science

Jessica Elizabeth Artinger	Fiona Catita Ann McCarthy
Madeline Janet Biebel	Martha Michelle Mejia
Matthew Walter Bogumil	Kenton William Reiss
Ellen Ann Hoppe	Anthony Luke Sampayo
David Abraham James	Raman (Ramanjot) Sandhu
Rabbi Tshiyoyo Kankolongu	Audrey Michelle Sapien
Christina Ran Kitamikado	Yingchi Wang
Armineh Jean Koshkaryana	Wei-Ji Jimmy Yang
Kamryn Rika Kubose	

### Master of Science

Ashna Aggarwal	Dave Gerald Milewski
Fekireselassie Beyene	Lauren Mae Santi
Lydia Alexandra Bingley	Krista Lynn Sierra Sawchuk
Dylan Dempster	Alexandra Elyse Schneider
Daniel Z. Fineman	Alexander Paul Woodward Sedlak
Sebastian Jian Ernst Krause	Steve Michael Tomlinson
Jamie Kaaren Lucarelli	

### Doctor of Philosophy

Zagid M. Abatchev	Lior Rubanenko
Kevin Thomas Coffey	Emily Foote Smith
Kynan Horace George Hughson	Wentao Xu
Erin Janelle Leonard	Ailin Zhang
Nathaniel Nels Monson	Cong Zhao

# Student Awards

## Undergraduate Awards

### John & Frances Handin Scholarship

Mitchell Marine Metz  
Wei-Ji Jimmy Yang

### Deane Oberste-Lehn Field Award

Madeline Janet Biebel  
Ellen Ann Hoppe  
Christina Ran Kitamikado  
Fiona Catita Ann McCarthy

### Clarence A. Hall, Jr. Summer Field Award

Shane Kenyon Houchin

### Dean Oberste-Lehn Summer Field Award

Michelle Elizabeth Carter  
Ife Dafunsi  
Renee Eirene Delamater-Droungas  
Alexandra Rose Denny  
Suzanna Gevorgyan  
Martha Michelle Mejia

### Horodyski Summer Field Award

Travis James Gilmore

### Oberste-Lehn Research Scholarship Award

Renee Delamater-Droungas  
Christina Ran Kitamikado  
Martha Michelle Mejia

### Eugene B. Waggoner Scholarship

Matthew Walter Bogumil  
Robert William Ly

### Clem Nelson Summer Field Award

Beaux Fernando Guajardo  
Jacob Joseph Thomas Uphoff

### Walter S. Harris Summer Field Award

Erick Edward Teck  
Wei-Ji Jimmy Yang

### Kenneth D. Watson Summer Field Award

Christian Duran Levine  
Arturo Sotomayor, Jr.

### Donald Carlisle Undergraduate Research Award

Matthew Walter Bogumil

### Straus Family Undergraduate Research Award

Rebecca Anne Lewis  
Maria Vincent

### J. Douglas and Patricia Traxler Research Scholarship Award

Travis James Gilmore

## Graduate Awards

### Eugene B. Waggoner Scholarship

Presented to graduate students on the basis of merit, endowed by alumnus Eugene B. Waggoner

Han Bao  
Lior Rubanenko

### Harold and Mayla Sullwold Scholarship

Presented to graduate students on the basis of merit, endowed by Harold and Mayla Sullwold

Ariel Graykowski  
Akash Gupta  
Haotian Xu  
Xu Zhang

### Extramural Funding Award

Presented to graduate students who secured multi-year funding from an extramural agency

Colin Wilkins

### Outreach Award

Presented to graduate students to recognize excellence in education and public outreach

Dave Milewski  
Raquel Nuno  
Krista Sawchuk  
Ashley Schoenfeld  
Abijah Simon  
Robert Ulrich

### Outstanding Teaching Assistant

Presented to graduate students to recognize outstanding performance in teaching

Ellen Alexander  
Han Bao  
Alexandra Doyle  
Jeffery Osterhout  
Andrew Parisi  
Tyler Powell

## Student Spotlight



Kaitlyn McCain won the Rowland Hill Award for the best student presentation at the 22nd International Conference on Secondary Ion Mass Spectrometry held in Kyoto. Her paper was entitled "Calibration of matrix-dependent biases in isotope and trace element analyses of carbonate minerals".

## Comings and Goings

The Department welcomed six new administrative staff members this year:

- Sarah Dornish is our new chair's coordinator.
- Vanessa Garcia is our new purchasing coordinator.
- Julie Huning is our new personnel manager.
- Ana Mariscal is a part-time purchasing assistant.
- Kate McMillan is our new personnel and payroll analyst.
- Dennisse Pereira is a part-time academic personnel analyst.

Four staff members departed during the past year:

- Monica Alfredsen, Hilda Avanesian, Francesca Masi and Steve Zuniga were promoted to other positions on campus.

# Donor Recognition

We are extremely grateful for the gifts that enable our mission. Donors who made gifts to the Department of Earth, Planetary, and Space Sciences between July 1, 2018 and June 30, 2019 are listed on the opposite page. Gifts made after June 30 will be acknowledged in the 2020 newsletter.

We would especially like to thank those donors who have contributed endowed gifts to the Department (listed below). Endowed gifts are particularly helpful because they enable initiatives in perpetuity. 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.

For a limited time, EPSS has a rare opportunity to secure a 1-to-1 match for any endowment between \$100,000 and \$1,000,000. Please contact the EPSS Chair or Brooke Sanders (bsanders@support.ucla.edu) for details.

## **Donald Carlisle and Gloria Gálvez-Carlisle**

Donald Carlisle Undergraduate Research Endowed Fund

## **W. Gary and Charlotte Ernst**

W. Gary Ernst Endowed Graduate Fellowship

## **John and Frances Handin**

John and Frances Handin Endowed Scholarship

## **Charlotte H. Johnston**

Walter S. Harris Summer Field Endowed Fund

## **Joanne V.C. Knopoff**

Leon and Joanne V.C. Knopoff Term Chair in Physics and Geophysics

## **Nathan P. Myhrvold**

Nathan P. Myhrvold Graduate Fellowship

## **Deane Oberste-Lehn**

Deane Oberste-Lehn Endowed Scholarship

## **Robert and Jeannette Paschall**

Robert and Jeannette Paschall Endowed Fund

## **John L. Rosenfeld**

John L. and Juanita B. Rosenfeld Endowed Graduate Fellowship

## **J. William and Jane Shen Schopf**

J. William and Jane Shen Schopf Endowed Faculty and Staff Enrichment Fund

J. William and Jane Shen Schopf Endowed EPSS Spousal/ Partner Employment Opportunity Fund

## **Wilbur B. Sherman**

Wilbur B. Sherman Endowed Fellowship

## **Joe and Andrea Straus**

Joe and Andrea Straus Endowment for Undergraduate Opportunity

## **Harold and Mayla Sullwold**

Harold and Mayla Sullwold Endowed Scholarship

## **J. Douglas and Patricia Traxler**

J. Douglas and Patricia Traxler Scholarship

## **Eugene B. and Winifred Waggoner**

Eugene B. Waggoner Endowed Scholarship

## **Mary Lou and Ward Whaling**

Louis B. and Martha B. Slichter Endowed Chair in Geosciences

Vassilis Angelopoulos and Mary Christianakis  
Jonathan Aurnou and Sarah Kremen  
Hilda Avanesian  
Tiffany and David Ayres  
Maryam Azad  
Marilyn and Steven Bachman  
Jessica Ban  
Brian Bartelt and Marta Costello  
Melanie and Richard Baum  
Paula and Uri Bernstein  
Nancy and Gary Beverage  
Richard Bild and Karen Robinson  
Bruce Bilodeau and Deborah Wechsler  
Michael Binder and Sheila Etkorn  
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Rose and Charles Blount  
Penelope Borax and John Donald  
Matthew Bourke  
Jonathan Bridgeman  
Tomas Capaldi  
Gabriele and Dwight Carey  
Caryl Carothers  
Vallabh Chauhan  
Lucy Chen  
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Beatriz and Miguel Garcia-Garibay  
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Collette and Hektor Gibson  
Mary and M. Charles Gilbert  
Raymond Goodrich  
Terry Grant  
Julie and David Grover  
Donald Hagen  
Clarence Hall and Lauri Holbrook  
Babette and Tod Harding  
Eileen and Sam Hasegawa  
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Robert Kawaratanani  
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Patrick Lam  
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Guan Le and Zhi Wang  
Rhonda and Keith Lee  
Larry Lesyna  
Shanshan Li  
Beth and Timothy Lincoln  
Hsiu-Yin and Juhn Liou  
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Inge and James Logar  
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Chris Mattinson  
Naomi and John McCormick  
David McCoard  
Richelle and David McComas  
Grace and Kevin McKeegan  
Robert Meade  
Carrie Menkel-Meadow and Robert Meadow  
Paul Merifield  
Helen and John Meyers  
Kathleen Micham  
Suzanne and David Michels  
Monica and Toby Moore  
Renata and Randolph Mulder  
Beth Mensing-Nahama and Joseph Nahama  
Bill Neill and Kathryn Albright  
Margo Odum  
Briande O'Hara and Nguyen Quan  
Hetty and Keith Olwin  
Steven Persh and Jennifer Newbury  
Hilary and Daniel Petrizzo  
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Astrid and Howard Preston

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Frank Ramos  
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Gudrun and John Wasson  
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David Whitney  
John Williams  
Elizabeth Woodrow  
Cathy and Glen Wyatt  
Sami Yanikian  
Sandy and An Yin  
Xiaoyan Zhou  
Lujia Zhu  
Joanne Jubelier and James Zidell  
Denise and Joseph Ziony  
Linda Chu and Jeffrey Zukin

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