UNLV | COLLEGE OF SCIENCES

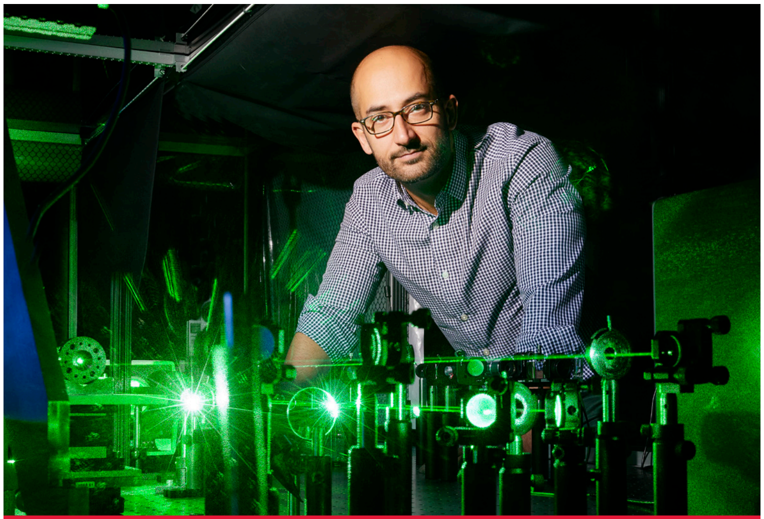
FALL 2020

UNLV and University of Rochester Physicists Observe Room-Temperature Superconductivity

THE DISCOVERY, REPORTED IN THE JOURNAL *NATURE*, OPENS DOOR FOR REIMAGINING THE ENERGY GRID, TECHNOLOGY, SOCIETY.

Physicists from the University of Nevada, Las Vegas and the University of Rochester have made a breakthrough in the long sought-after quest for a room-temperature superconductor, what they call the “holy grail” of energy efficiency.

The research team led by University of Rochester physicist Ranga Dias in collaboration with Ashkan Salamat, assistant professor of physics and astronomy at UNLV, established room-temperature superconductivity in a diamond anvil cell — a small, handheld, and commonly used research device that enables the compression of tiny materials to extreme pressures — pressures that you’d only find at the center of the Earth.



UNLV physicist Ashkan Salamat and colleagues established room-temperature superconductivity in a diamond anvil cell. He called the breakthrough a “revolutionary game changer”.

Though the phenomena observed by the research team and reported as the cover story in the journal *Nature* was at an early stage, or fundamental level, the discovery has implications for how energy is stored and transmitted. It could also one day change how everyday technological devices — from laptops to MRI machines — are powered, how people and goods are transported, and how the whole of society could operate years into the future.

“It’s a revolutionary game changer,” said Salamat, who leads the Nevada Extreme Conditions Lab at UNLV, a newly formed, multidisciplinary group that explores fundamental experimental, computational, and engineering problems of materials under high pressure. “The discovery is new, and the technology is in its infancy and a vision of tomorrow, but the possibilities are endless. This could revolutionize the energy grid, and change every device that’s electronically driven.”

Superconductivity is a remarkable quantum phenomena as its hallmark properties include the expulsion of magnetic fields and zero resistance electrical flow, meaning that the energy current passing through a circuit is conducted infinitely and perfectly, with no loss of power.

Since its first observation in 1911, scientists have observed superconductivity only at very low temperatures — temperatures within a few degrees of absolute zero, (minus 273 degrees Celsius), which would make widespread and practical application unattainable. In 1968, however, scientists predicted that metallic hydrogen — accessed at very high pressures — could be the key ingredient to discovering superconductivity at or above room temperature.

“Because of the limits of low temperature, materials with such extraordinary properties have not quite transformed the world in the way that many might have imagined. However, our discovery will break down these barriers and open the door to many potential applications,” Dias said in a University of Rochester release.

In Dias’ lab at the University of Rochester, the research team worked to chemically synthesize hydrogen in an effort to solve the century-old problem. Like a materials search engine, Salamat and Dias used the diamond anvil cell to scan through temperature and pressure space to find the right combination that would drive carbon sulfur hydrogen first into a metallic state, and then even further into a room-temperature superconducting state.

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Room-Temperature Superconductivity Continued

Finalist for *Physics World* Breakthrough of the Year for 2020

Physicist Ashkan Salamat's research about room-temperature superconductivity with colleague Ranga Dias from the University of Rochester was announced as one of 10 finalists in *Physics World* magazine's Breakthrough of the Year for 2020.

This year's Top 10 Breakthroughs were selected by a crack team of five *Physics World* editors, who have sifted through hundreds of research updates published on the website this year. In addition to having been reported in Physics World in 2020, selections must meet the following criteria:

- **Significant advance in knowledge or understanding**
- **Importance of work for scientific progress and/or development of real-world applications**
- **Of general interest to *Physics World* readers**

The U.S. energy grid, Salamat notes, which is made up of metallic cables loses about $20 billion a year to dissipating current. Though a metal like copper exhibits the least resistance of nearly all metals, it's still resistant. Running current through copper and other metals generates heat, and as a consequence energy is lost (think of the heat exiting the bottom of your laptop).

Room-temperature superconductivity would allow current to flow through a closed loop forever, meaning that no energy would be lost. In the long distant future, such a state could enable a solar farm in the Southwest U.S. to transport energy to the East Coast with no loss, or MRI machines - which currently need liquid helium to operate - to be deployed to war zones. It could change how electronics are designed and built, and could revolutionize the transportation system.

Salamat calls it a "paradigm-shifting" discovery, which was made possible, in part, by the Early Career Award he received from the U.S. Department of Energy in 2019. The competitive DOE program bolsters financial support for exceptional talent during crucial early career years, when many scientists do their most formative work, and was the catalyst for Salamat to focus on the problem of identifying a room-temperature superconductor.

Crushed between two diamonds, a compound of hydrogen, sulfur, and carbon superconducts at room temperature. Photo courtesy of J. Adam Fenster/University of Rochester

The discovery also dovetails perfectly into Salamat's broader research priorities, which are identifying the precise makeup of metal superhydrides – extremely hydrogen-rich materials – and techniques to readily synthesize them.

The discovery of the room-temperature superconductor, Salamat said, was not what you would call a "eureka" moment, but rather, a methodical, targeted effort by he and Dias. They're next step is to develop a protocol that releases the pressure for these materials while also retaining their superconducting properties.

To support their continued work on the problem, Dias and Salamat have started a new company, Unearthly Materials, to find a path to room temperature superconductors that can be produced at scale at ambient pressure.

"We live in a semiconductor society," Salamat said. "With this kind of technology, you can take society from a semi-conducting society into a superconducting society."

Coauthors on the *Nature* paper include Keith Lawler of UNLV's Nevada Extreme Conditions Lab; Elliot Snider, Nathan Dasenbrock-Gammon, Raymond McBride, Kevin Vencatasamy and Hiranya Vindana, all of the Dias lab at the University of Rochester; and Mathew Debessai of Intel Corporation.

UNLV Scientist on a Mission to the Red Planet

GEOSCIENTIST LIBBY HAUSRATH GIVES AN INSIDER GLIMPSE AT HER ROLE AS ONE OF 15 SCIENTISTS SELECTED BY NASA TO WORK ON MARS SAMPLE RETURN ON THE 2020 ROVER MISSION.

Silver, bug-eyed extraterrestrials zooming across the cosmos in bullet-speed spaceships. Green, oval-faced creatures hiding out in a secret fortress at Nevada's Area 51 base. Cartoonish, throaty-voiced relatives of Marvin the Martian who don armor and Spartan-style helmets.

We humans are fascinated with the possibility of life on the Red Planet.

One UNLV geoscientist, Elisabeth "Libby" Hausrath, is on a mission to find out if there's any truth behind our leather-bound and silver-screen musings. She's among an international panel of 10 North American and five European scientists tapped by NASA to help design and implement the upcoming Mars 2020 rover mission, and select which rock and soil samples the rover will grab (and eventually return to Earth) as it combs the planet for signs of life.

We caught up with Hausrath for a behind-the-scenes look at the rover mission and its significance, the impact of the COVID-19 pandemic on the project, and how she hopes her participation inspires girls, young women, and anyone interested in science.

Geoscientist Libby Hausrath

What is the Mars 2020 rover mission, and what is your role in it?

The Mars 2020 rover Perseverance will be landing on Feb. 18, 2021 in Jezero crater, Mars. One of its primary goals is to seek signs of past life, and to collect samples for return from Mars to Earth. These will be the first samples returned to Earth from Mars, and will provide incredible, exciting new information about Mars. I am a Returned Sample Science Participating Scientist, which means I am part of the Mars 2020 science team, and my job is to help select the samples for return. I am very excited to be participating in this mission!

How has the COVID-19 pandemic affected the Mars 2020 launch?

The COVID-19 pandemic pushed back the rover launch date several times to late July. It's also meant that we, the science team, have been working remotely.

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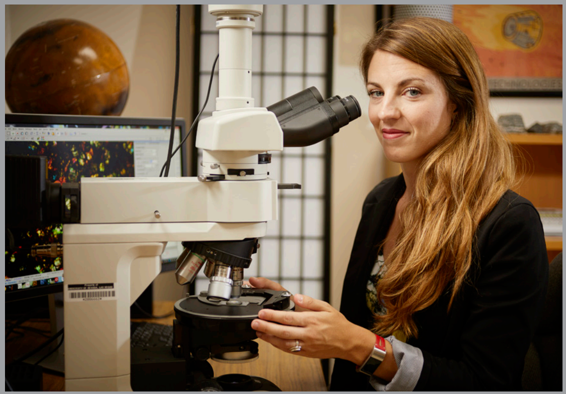
Geoscientist Arya Udry Named Mars 2020 Participating Scientist

Geoscientist Arya Udry also was recently named one of 13 to the Mars 2020 Participating Scientist Program. Her proposal, "Using Jezero Crater Igneous Compositions to Constrain Martian Interior and Surface Processes from the Noachian to Amazonian" was recently selected for funding.

There are several instruments on the Mars 2020 Perseverance rover that will measure rock chemistry and mineralogy. Udry will help to better constrain the formation of the magmatic rocks in Jezero crater (the landing site of the rover) and better understand the magmatic martian evolution. She also will advise on the selection of samples that will be brought back from to Earth.



"This is the biggest accomplishment of my career, and a lifelong dream for me," Udry said. "As a martian meteorite expert, being able to study rocks directly on the martian surface, help with Mars 2020 science operations, and advise the team about the selection of the samples that will be returned to Earth could not be more exciting. This opportunity will also likely help me in studying martian meteorites, the only martian samples that we currently possess, with a different perspective."

UNLV Scientist on a Mission to the Red Planet Continued

Of course, I and many others would have been working remotely anyway, since the science team contains people from all over the country and the world, but it has meant that on our teleconferences sometimes people have their children running and talking in the background! NASA's Jet Propulsion Laboratory actually filmed one of our teleconferences to show as part of the activities for the Mars 2020 launch, and to document how we are working in this unprecedented time.

How long will it take Perseverance to reach Mars, and how long will it be stationed there?

Perseverance will leave Earth during its launch window of July 30 to Aug. 15, 2020, and will land on Mars on Feb. 18, 2021, so it will take about seven months to arrive there. Its mission will be at least one Mars year, which is about 687 Earth days.

Perseverance will land at Jezero crater, which was chosen because it used to be a lake, and was therefore likely a habitable environment where evidence of past life could have been preserved. We will select samples for return to Earth that can tell us about this past lake, and any potential past life that may have lived there.

This artist's rendition depicts NASA's Mars 2020 rover studying rocks with it robotic arm. (NASA/JPL-Caltech)

Does your team already have in mind what specific kinds of samples you're looking for, and why?

Yes, we are currently going through a selection process to determine which kinds of samples would be the most ideal to collect once we land. I am co-leading the subgroup planning for the Jezero crater delta, and I am also currently helping construct the document we will fill out with different measurements once we collect the soil and rock samples.

When the samples are returned to Earth during the second phase of the mission, who will be in charge of storing them and distributing them to scientists for research?

Since the Mars samples will be international treasures, they will be stored in a curation facility similar to the 2,196 lunar samples collected during the Apollo missions, and distributed to scientists for research, similar to the way Mars meteorites are currently distributed.

What will it be like to witness the launch of Perseverance, knowing that you're part of this historic moment?

I am so excited to watch Perseverance launch! It's amazing to know that it will be landing on a planet so far away from Earth that, to the naked eye, it looks like a tiny dot in the sky! I am also happy because enthusiasm about space translates into excitement about science, which can help encourage a large number of young people to study science — greatly benefiting society.

Originally there was going to be a Mars 2020 science team meeting in Florida, and we were all going to be able to watch the launch together in person. However, due to COVID-19, the in-person team meeting has been cancelled. However, there is still going to be a remote team meeting, and the launch is incredibly exciting whether we get to be there in person or not!

Have you always been into space and Mars, even as a child? Early in your career, did you envision participating in a mission like this as a goal?

I actually was interested in all sorts of things when I was younger — reading, music, history, as well as science. I didn't really decide I wanted to be a scientist until I was in college. I have been working towards participating in a mission like this for about 15 years, but it always seemed like a far off dream. I can't believe it is actually happening!

What's your message to girls and young women considering careers in science?

I would strongly encourage girls, young women, and everybody who is interested in science to pursue their dreams and to persevere. Science benefits — and we all benefit — when talented scientists from all backgrounds are included and encouraged to participate. You also don't have to know from a young age that you want to be a scientist — I didn't, for example. I hope that the full diversity of people will pursue science, and I encourage everybody to persevere (the Mars 2020 Perseverance rover is well named — that is what science takes), even when it is difficult. Science is hard for everybody, so when it is hard for you, too, that is normal. You can reach out for help, and keep working at it; it doesn't mean that you aren't good enough to do science. Please persevere!

Astronomers Discover Clues that Unveil the Mystery of Fast Radio Bursts

UNLV ASTROPHYSICIST BING ZHANG CONTRIBUTES TO UNDERSTANDING THE PHYSICAL MECHANISMS OF FAST RADIO BURSTS IN THREE PAPERS PUBLISHED IN *NATURE*.

Fast radio bursts, or FRBs – powerful, millisecond-duration radio waves coming from deep space outside the Milky Way Galaxy – have been among the most mysterious astronomical phenomena ever observed. Since FRBs were first discovered in 2007, astronomers from around the world have used radio telescopes to trace the bursts and look for clues on where they come from and how they're produced.

UNLV astrophysicist Bing Zhang and international collaborators recently observed some of these mysterious sources, which led to a series of breakthrough discoveries reported in the journal *Nature* that may finally shed light into the physical mechanism of FRBs.

The first paper, for which Zhang is a corresponding author and leading theorist, was published in the Oct. 28 issue of *Nature*.

"There are two main questions regarding the origin of FRBs," said Zhang, whose team made the observation using the Five-hundred-meter Aperture Spherical Telescope (FAST) in Guizhou, China. "The first is what are the engines of FRBs and the second is what is the mechanism to produce FRBs. We found the answer to the second question in this paper."

Two competing theories have been proposed to interpret the mechanism of FRBs. One theory is that they're similar to gamma-ray bursts (GRBs), the most powerful explosions in the universe. The other theory likens them more to radio pulsars, which are spinning neutron stars that emit bright, coherent radio pulses. The GRB-like models predict a non-varying polarization angle within each burst whereas the pulsar-like models predict variations of the polarization angle.

The Five-hundred-meter Aperture Spherical radio Telescope in Guizhou, China. (Photo credit: Bojun Wang, Jinchen Jiang & Qisheng Cui).

The team used FAST to observe one repeating FRB source and discovered 11 bursts from it. Surprisingly, seven of the 11 bright bursts showed diverse polarization angle swings during each burst. The polarization angles not only varied in each burst, the variation patterns were also diverse among bursts.

"Our observations essentially rules out the GRB-like models and offers support to the pulsar-like models," said K.-J. Lee from the Kavli Institute for Astronomy and Astrophysics, Peking University, and corresponding author of the paper.

Four other papers on FRBs were published in *Nature* on Nov. 4. These include multiple research articles published by the FAST team led by Zhang and collaborators from the National Astronomical Observatories of China and Peking University. Researchers affiliated with the Canadian Hydrogen Intensity Mapping

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Fast Radio Bursts Named Remarkable Discovery of 2020

A fast radio burst in our own galaxy was named as one of 10 remarkable discoveries of 2020 by *Nature* magazine. Three papers published in *Nature* report the detection of a phenomenon called a fast radio burst (FRB) coming from a source in our Galaxy. Intriguingly, the FRB was accompanied by a burst of X-rays.

This FRB is the first for which emissions other than radio waves have been detected, the first to be found in the Milky Way, and the first to be associated with a stellar remnant called a magnetar — proving that magnetars can drive FRBs.

What Happens in Vegas, May Come from the Arctic?

STUDY FROM UNLV CLIMATE SCIENTIST MATTHEW LACHNIET LINKS ARCTIC AND TROPICAL PACIFIC WARMING TO ANCIENT CLIMATE RECORDS, PROVIDING PARALLELS TO TODAY.

A cave deep in the wilderness of central Nevada is a repository of evidence supporting the urgent need for the Southwestern U.S. to adopt targets aimed at reducing greenhouse gas emissions, a new UNLV study finds.

UNLV climate scientist Matthew Lachniet and colleagues have compiled a detailed, 13,000-year climate history from stalagmite specimens in Leviathan Cave, located in the southern Great Basin, which provides clues for the mitigation of climate change today.

These ancient climate records show that Nevada was even hotter and drier in the past than it is today, and that one 4,000-year period in particular may represent a true, "worst-case" scenario picture for the Southwest and the Colorado River Basin — and the millions of people who rely on its water supply.

Geoscience professor Matthew Lachniet in his lab.

At that time, the long-term hot and dry climate of the region was linked to warm Arctic seas and a lack of sea ice, as well as warming in the western tropical Pacific Ocean, the cave record shows.

This parallels today and the near future, as the release of human carbon emissions into the atmosphere will warm the Arctic and possibly the western tropical Pacific, and is expected to result in long-term arid conditions for Nevada and the broader Colorado River Basin.

If the arid conditions become permanent, then the water supply in the Colorado River Basin is expected to decrease, which researchers say would imperil critical water resources for millions of people who live in the Southwest U.S.

"The last few decades have seen increasingly severe 'hot droughts' in the Colorado River Basin, when high temperatures coincide with less rainfall, and which have startled climate scientists and water policy managers," Lachniet said. "But these dry intervals don't usually last more than a few decades. In contrast, our new data show that Nevada climate can experience an extended interval of aridity for thousands of years, not just a few decades."

The recent Southwestern U.S. drought that began in 2001, which has resulted in historic low reservoir levels in Lake Mead, is one indicator of the gravity of the problem. The Colorado River and Rio Grande basins are critical human support systems as their headwaters in the Rocky Mountains supply snow-fed water for myriad economic uses and support 56 million residents throughout the region.

"'Business as usual' scenarios for anthropogenic warming carry the risk of tipping the Southwest into an extended state of aridification," researchers wrote.

The paper, published in the journal *Paleoceanography and Paleoclimatology*, provides a clearer and more comprehensive picture of the Southwest's climate history compared to tree ring records which extend only 2,000 years into the past.

Stalagmites — like those located in Leviathan Cave — are common cave formations that act as ancient rain gauges to record historic climate data. Stalagmites grow upward at rates of inches every few hundred years as mineral-rich waters seep through the ground above and drop from the tips of stalactites on cave ceilings.

These deposits more accurately represent a long-term shift toward a more arid climate as they hold data that extends deeper into the past.

A former analysis of one tree ring record, for example, pointed to a 10-year drought in the Medieval era as being a

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What Happens in Vegas, May Come from the Arctic? Continued

"worst case" predictor of a future, comparable drought, as compared to the more persistent and sustained 4,000-year period of aridity presented in Lachniet's new study.

Regionally, paleoclimate records from other sources like lakes, landforms, pollen, and others, also support the conclusion of warmth and aridity during the same 4,000-year period.

Researchers also found that the Leviathan Cave region, where the stalagmite specimen was collected, is representative of climate conditions in most of the Mojave Desert and the southern Great Basin, and that the data has implications for the broader desert region.

Lachniet and colleagues say that their study can be a resource for policymakers today in adopting measures to reduce greenhouse gas emissions which will in turn "minimize oceanic and Arctic warming."

"There already is evidence that droughts in the Southwest are partly caused by humans because of the higher temperatures and more evaporation in surface waters like Lake Mead," Lachniet said. "The new fossil-fuel climate might end up making these droughts permanent."

Mystery of Fast Radio Bursts Continued

Experiment (CHIME) and the Survey for Transient Astronomical Radio Emission 2 (STARE2) group also partnered on the publications.

"Much like the first paper advanced our understanding of the mechanism behind FRBs, these papers solved the challenge of their mysterious origin," explained Zhang.

Magnetars are incredibly dense, city-sized neutron stars that possess the most powerful magnetic fields in the universe. Magnetars occasionally make short X-ray or soft gamma-ray bursts through dissipation of magnetic fields, so they have been long speculated as plausible sources to power FRBs during high-energy bursts.

The first conclusive evidence of this came on April 28, 2020, when an extremely bright radio burst was detected from a magnetar sitting right in our backyard – at a distance of about 30,000 light years from Earth in the Milky Way Galaxy. As expected, the FRB was associated with a bright X-ray burst.

"We now know that the most magnetized objects in the universe, the so-called magnetars, can produce at least some or possibly all FRBs in the universe," said Zhang.

The event was detected by CHIME and STARE2, two telescope arrays with many small radio telescopes that are suitable for detecting bright events from a large area of the sky.

Zhang's team has been using FAST to observe the magnetar source for some time. Unfortunately, when the FRB occurred, FAST was not looking at the source. Nonetheless, FAST made some intriguing "non-detection" discoveries and reported them in one of the Nov. 4 *Nature* articles. During the FAST observational campaign, there were another 29 X-ray bursts emitted from the magnetar. However, none of these bursts were accompanied by a radio burst.

"Our non-detections and the detections by the CHIME and STARE2 teams delineate a complete picture of FRB-magnetar associations," Zhang said.

To put it all into perspective, Zhang also worked with *Nature* to publish a single-author review of the various discoveries and their implications for the field of astronomy.

"Thanks to recent observational breakthroughs, the FRB theories can finally be reviewed critically," said Zhang. "The mechanisms of producing FRBs are greatly narrowed down. Yet, many open questions remain. This will be an exciting field in the years to come."

Charting a Course for Math, Undaunted

College of Sciences Alumna of the Year Susan Corbett (pictured below) arrived in Las Vegas in the late 1980s with a specific game plan: Enroll at UNLV to pursue a master's degree in math education so she could go on to teach high-level math courses. Immediately, though, Corbett was forced to call a life audible when she learned that the College of Education's graduate program didn't offer a math specialty.

Reluctantly, she walked across campus to the College of Sciences and began inquiring about its mathematical science master's program. Now, to the layperson, the degree of difficulty involved in earning a master's in math education as opposed to math science probably seems negligible. Corbett knew otherwise.

"It was a definite change in my mindset, as a graduate degree in math sciences required a much more daunting path filled with additional and much more challenging coursework than a master's in education," she said. "But I went to the math department and found professors who were more than happy to guide me through the program."

Corbett rose to the challenge and completed her master's degree in mathematical science in 1991, and she's spent the last three decades sharing her math knowledge with thousands of high school and college students, inspiring many of them to push beyond their perceived mathematical limitations to learn sophisticated concepts.

Following stints teaching math at UNLV and the University of Maryland, Corbett transitioned to Rancho High School, where she currently teaches Advanced Placement Calculus BC, an intense college-level course for which students can earn as many as eight college credits.

Along her teaching expedition, Corbett has been recognized with several awards, including the national College Board Siemens Award for AP Math and Science Teachers for being one of the nation's Top 10 AP Math and Science Teachers for the 2004-05 school year. Two years later, the state's chapter of the Air Force Association named Corbett Nevada's Teacher of the Year. Also, in 2016, she was a finalist for the Kiwanis Clark County Educator of the Year.

As appreciative as she is for such accolades, Corbett's primary satisfaction comes from seeing her students overcome challenges similar to the one she did when she was forced to shift gears in her graduate studies.

"I truly enjoy when, time after time, students come back from their universities and thank me for teaching them how to study at a university level," said Corbett, who is one of only a handful of Clark County School District teachers with a master's in mathematical science. "I am a much better teacher because of my training in math at UNLV."

What's the one challenge you've faced in your career that you conqured thanks to lessons learning durng your days at UNLV?

Learning advanced math topics, persevering through the tough courses and teaching college students while a UNLV graduate student taught me the importance of pushing my students to work hard and resist placing limitations on their ability to learn. I have high expectations for my students and teach my course at a college level. Not only does this result in my students often earning exemplary AP scores and eight college credits, but it ensures they're well-prepared for the work to come in any future college course.

Finish this sentence: When I look back at my time at UNLV, I'm most grateful for ...

… the professors in the math department who believed in me and helped me believe in myself. I wasn't sure I could finish a graduate degree in math sciences, as I wasn't a traditional student. I finished undergrad 14 years prior, had two children (ages 5 and 7 at the time), and my husband was an Air Force officer who was out of town at least two weeks out of every month.

My professors also helped me get a graduate assistantship where I was teaching college algebra, which paid for my master's program. I then ended up teaching full time in the department, which gave me invaluable experience that I apply to my high school teaching to this day.

What advice do you have for today's UNLV students as they try to navigate our change world?

Believe in yourself. You can do anything you put your mind to, regardless if the world is changing or not. It takes hard work, preparation, and perseverance, but anything — even excelling in math — is possible.

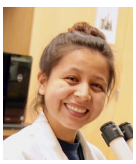
Awards, Recognition, and Recent Grants

OFFICE OF UNDERGRADUATE RESEARCH AWARDS

Champions of Undergraduate Research Award
School of Life Sciences

Outstanding Faculty Mentor Award
Kathryn Rafferty, Life Sciences

Outstanding Undergraduate Research Award
Mary Blankenship, Chemistry and Biochemistry & **Economics**

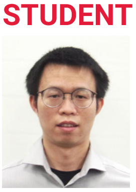


Best Poster Presenation Award in Health & Natural Sciences & Engineering
Iris Nava, Life Sciences

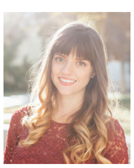
COLLEGE OF SCIENCES AWARDS

Alumna of the Year
Susan Corbett, Mathematical Sciences, Class of 1991

STUDENT AWARDS



Outstanding Dissertation Award
Rihui Lan, Mathematical Sciences



Outstanding Thesis Award
Lara Turello, Chemistry and Biochemistry

Outstanding Graduate Student Teaching Award
Rebecca Lim, Chemistry and Biochemistry

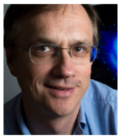
RECENT GRANTS

Ashkan Salamat, Physics and Astronomy
Project: "The synthesis of supernitride compounds via extreme (pressure, temperature) conditions: a new generation of high-energy density materials"
Agency: Air Force Office of Scientific Research
Amount: $452,184

Hui Zhang and **Hong Sun, Chemistry and Biochemistry**
Project: "Regulation of SOX Proteins by Methylation-dependent Proteolysis in Stem Cells and Development"
Agency: National Institutes of Health
Amount: $1,238,360

Rebecca Martin, Physics and Astronomy
Project: "Formation and evolution of misaligned disks and planets in binary star systems"
Agency: NASA Exoplanets Research
Amount: $541,460

Allyson Hindle, Life Sciences
Project: "Epigenetic pathways to regulate homeostatic resilience: Model-based discovery of rules across diverse mammals"
Agency: National Science Foundation
Amount: $884,080



Daniel Proga, Physics and Astronomy
Project: "Global models of accretion and outflows in astrophysical disks: A new DAWN (Disk Accretion & Winds Network)"
Agency: NASA
Amount: $547,598

Chao-Chin Yang, Physics and Astronomy
Project: "Dynamical instabilities in the aid of planet formation in circumstellar disks"
Agency: NASA
Amount: $184,911

Continued on Page 11

Awards, Recognition, and Recent Grants Continued

Arya Udry, Geocience
Project: "Constraining parental melt compositions and mineral formation in martian nakhlite and chassignite meteorites"
Agency: NASA
Amount: $455,000

Arya Udry, Geocience
Project: "Using Jezero crater igneous compositions to constrain martian interior and surface processes from the Noachian to Amazonian"
Agency: NASA
Amount: $93,000

Helen Wing, Life Sciences
Project: "Understanding Transcriptional Silencing & Anti-silencing Mechanisms in Shigella"
Agency: National Institutes of Health
Amount: $444,540

Jichun Li, Mathematics
Project: "Robust and Efficient Numerical Methods for Electromagnetic Wave Propagation in Complex Media"
Agency: National Science Foundation
Amount: $252,172

Pengtao Sun, Mathematics
Project: "Collaboration Grants for Mathematicians"
Agency: Simons Foundation
Amount: $42,000

Cory Rusinek, Chemistry and Biochemistry
Project: "Single- and Polycrystalline Diamond Electrodes for Spectroelectrochemical Characterization of Various Molten Salts"
Agency: US Department of Energy
Amount: $480,000

Matthew Petrie, Life Sciences
Project: "Beyond broad climate: how short duration climate pulses may initiate forest and woodland declines in the southwestern United States through reductions in natural regeneration"
Agency: National Science Foundation
Amount: $168,647

Matthew Petrie, Life Sciences
Project: "Can management actions support forest regeneration across the diverse landscapes and climate change futures of the southwestern US?"
Agency: US Geological Survey
Amount: $96,079

Matthew Petrie, Life Sciences
Project: "Regeneration failures may decrease ecosystem resilience and erode habitat quality in intermountain west ponderosa pine forests in the 21st century"
Agency: USDA Forest Service
Amount: $60,000