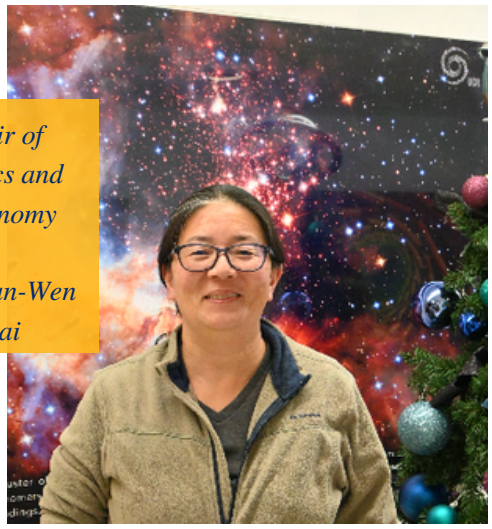
UCR PHYSICS & ASTRONOMY

Letter from the Chair



Chair of Physics and Astronomy

Dr. Shan-Wen Tsai

Greetings from the UCR Department of Physics and Astronomy!
Over the past year, we embarked on several exciting new endeavors and celebrated some remarkable achievements.

The College of Natural and Agricultural Sciences, or CNAS, and the Department of Physics and Astronomy at UC Riverside hosted a celebration on April 30 to honor Nobel laureate and Distinguished Professor Barry Barish, who received a National Medal of Science last year.
The event marked the start of our new Center for Experimental Cosmology and Instrumentation (CECI). The Center will encompass experimental cosmology, gravitational waves, and particle astrophysics, with a focus on the development of high precision instrumentation. The research will be highly collaborative with other research groups in the department, involving the latest developments in quantum technology, quantum materials, and the nanofabrication of new quantum devices. The CECI will enhance two department traditions: involvement of undergraduate students in research, where they receive highly skilled training, and outreach to the community and the general public. Regarding the latter, the Center has been organizing quarterly public lectures that have been a great success. There was one in the Spring and one in the Fall of 2024 – we hope you can join us for the upcoming ones.

The Department now has a new PhD program in Astronomy, which started out this Fall with a large applicant pool and 8 new incoming graduate students. The degree is designed to provide a broad background in observational, theoretical, and computational astrophysics through a combination of courses and research.

Our undergraduate physics majors continue to flourish, with approximately 175 students currently in the program. The Physics 41 introductory sequence for majors, now in its 15th year, has been remarkably successful. In the past year, we conducted a comprehensive study of our undergraduate program's effectiveness, examining Physics 41, undergraduate research opportunities, faculty advising, and the Physics 39 class on careers. The results are striking: before implementing Physics 41 and establishing our emphasis on undergraduate research, faculty advising, and career preparation, the retention rate for underrepresented minorities and economically disadvantaged students was only around half that of their peers. Today, this gap has essentially disappeared. The majority of our undergraduates now participate in research, either on campus or through paid positions at national laboratories or programs such as REU and SULI. Upon graduation, approximately half of our students pursue graduate studies at prestigious institutions.

UCR PHYSICS & ASTRONOMY

Image shows a 30 minute exposure of the spiral galaxy NGC 7331

Taken by students using the GMARS telescope

(UCR/ George Becker)

This past year, our graduates were accepted to Stanford, Princeton, Caltech, Cornell, and UCSB. They have earned major honors including national Goldwater and Churchill scholarships, the campus Rosemary Schraer Award, and the CNAS Academic Achievement award. Perhaps most remarkable is the extraordinary camaraderie and enthusiasm among our undergraduates, who provide much of the energy behind our outreach programs. To illustrate the impact of our program, I would like to share a quote from one of our students, who began her UCR journey as a Biochemistry major: "After finishing [Physics 41A] I took … the infamous 41B. I have never worked harder in a class. I recall telling my mom over the phone that this course was waterboarding me with information. Around week 5, I realized this 'Physics Bootcamp' was making me stronger. I was getting more creative with my problem solving and I was getting faster at understanding material I read in the textbook. As hard as it was, I felt absolutely invigorated by this course. The day after I took my 41B final exam I emailed my advisor to change my major to physics!"

This past year the department underwent its once-per-decade review of the graduate program. The review was conducted by a committee of prominent faculty from other universities. We were very pleased at the outcome of the review, with the final report stating that the committee was "impressed with the program, which we found to be very strong across the board" and that "UCR Physics and Astronomy is overachieving for the level of support they are afforded." These decadal reviews are critical for documenting our needs and securing expanded resources through multiple channels - including enhanced campus support, increased federal research grants, and congressional funding initiatives. Like other leading physics departments nationwide, we are taking crucial steps to strengthen our funding portfolio through strategic fundraising efforts as I will describe later in this letter.

This past year, two of our faculty received a prestigious DOE Early Career Scientist Award, Professors Miguel Arratia and Shawn Westerdale. Professor Arratia will lead a project entitled "Toward quantum imaging of nuclei." Professor Westerdale will lead a project entitled "Developing low-threshold liquid argon time projection chambers with photo-sensitive dopants for dark matter and neutrino experiments."

Also this past year, Professor Nathaniel Gabor was awarded a $7.5M grant from the Department of Defense to develop a Multidisciplinary University Research Initiatives (MURI) center on campus. Called QuVET, for the Center for Quantum Vibronics in Energy and Time, the center's co-principal investigators include Professor Vivek Aji and collaborators from Caltech, MIT, and Columbia University. In other news about grants, Professor Jing Shi was awarded $3.95M for a University of California Multicampus-National Labs proposal entitled "Antiferromagnetic spintronics for advanced memory and computing," with Professor Igor Barsukov as a co-PI. The subaward institutions are UCSD, UCD, UCLA, and LLNL. Professor Vivek Aji was the PI for our department's first Graduate Assistance in Areas of National Need (GAANN) Program award. The award is for slightly more than $1M over the next three years to support six or more graduate students per year.

In 2024, members of the department engaged in a large number of outreach events including the Summer Physics Teachers Academy, which the Department has been running every Summer since 2008, a STEM Summer Camp for High School students sponsored by Professor Bahram Mobasher, physics activities for local cub scouts organized by Dr. Robert Sanderson, a solar eclipse viewing event with approximately 500 attendees organized by Dr. Alex de la Vega and the UCR Astronomy Club, a "Particles and Waves" exhibit at the Palm Springs Art Museum with participation by Professor Nathaniel Gabor, and many other events. Dr. Alex de la Vega, Professor Anson D'Aloisio, the UCR Society of Physics Students, the UCR Astronomy Club, CECI, and members of the department hosted and volunteered at more than 60 events in the Inland Empire and neighboring regions.

The initiatives outlined above, in astronomy, experimental cosmology, quantum vibronics, and spintronics, provide exciting new opportunities for our students to participate in cutting-edge research of national importance. To support these programs, the department is expanding its philanthropic efforts. The collected funds will support undergraduate research scholarships, student tutoring, and outreach activities. Another goal is the establishment of endowed postdoctoral positions, a strategy that has been used by other UC campuses to successfully elevate their programs to the top echelon nationally. Please consider making a gift to the department or directly to the CECI cosmology center using the QR codes below. Even small donations are greatly appreciated and impactful. If you have specific questions or requests, please contact me directly.

As 2024 comes to a close, I am grateful for the incredible community that we share and for your dedication and friendship. On behalf of the UCR Department of Physics & Astronomy, I wish you a Happy New Year. If you have been away from campus, I invite you to stop by to visit, to connect, and to be a part of the exciting work ahead. Finally, we would like these newsletters to celebrate both our department and you, our valued alumni and friends. If you have a milestone or accomplishment you would like to share, please send a note to physics@ucr.edu . To help us organize submissions for future newsletters, please use the subject line format: "Physics Dept Alumni and Friend Note - [your name] - [date]."

PHYSICS & ASTRONOMY FUNDS
SCAN THIS QR CODE TO GIVE OR
CLICK HERE FOR THE LINK

COSMOLOGY FUND
SCAN THIS QR CODE TO GIVE OR
CLICK HERE FOR THE LINK

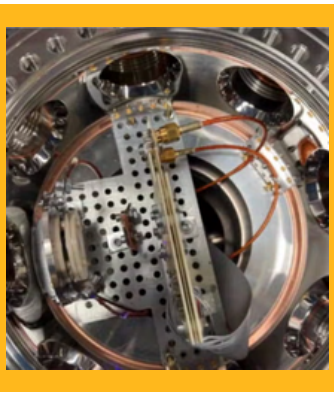
Shan-Wen Tsai
Chair and Professor
UCR Physics and Astronomy

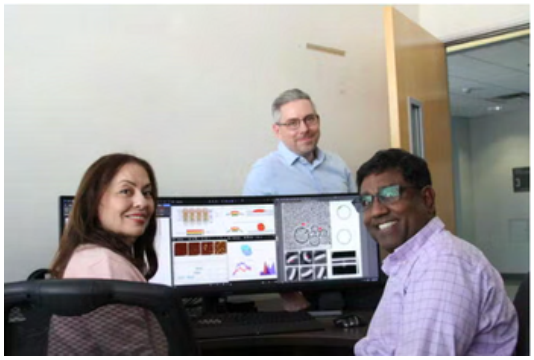
REACHING FOR THE STARS

Observational astronomy — the branch of astronomy concerned with recording data about the observable universe — just got more exciting for physics majors at UC Riverside. For the first time, the Department of Physics and Astronomy offered a course titled "Techniques of Observational Astronomy" that gave students the tools needed to plan, obtain, and analyze astronomical observations.

PHYSICS RESEARCH PUTS UCR ON LANDSCAPE OF PARTICLE MANIPULATION

A research team co-led by Boerge Hemmerling at the University of California, Riverside, has succeeded in confining free electrons in a special trap originally designed to trap atomic ions.



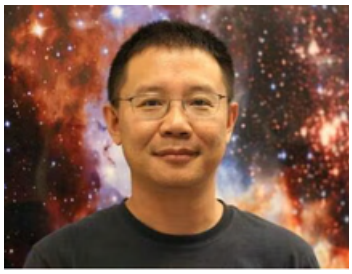


HOW THE SARS-COV-2 VIRUS ACQUIRES ITS SPHERICAL SHAPE

For centuries, coronaviruses have triggered health crises and economic challenges, with SARS-CoV-2, the coronavirus that spreads COVID-19, being a recent example. One small protein in SARS-CoV-2, the Membrane protein, or M protein, is the most abundant and plays a crucial role in how the virus acquires its spherical structure. Nonetheless, this protein's properties are not well understood.

GIFT TO UCR RESULTS IN NEW UNDERGRADUATE FELLOWSHIP

Aiden Wilkin, a fourth-year undergraduate student at UCR, has received a $3,000 fellowship made possible by a donation to the Department of Physics and Astronomy. The fellowship will support Wilkin's research with Jonathan Richardson, an assistant professor of physics and astronomy, helping him to continue working with the Laser Interferometer Gravitational-wave Observatory, or LIGO, experimental group at UCR.



PHYSICISTS SOLVE PUZZLE ABOUT ANCIENT GALAXY FOUND BY WEBB TELESCOPE

Last September, the James Webb Space Telescope, or JWST, discovered JWST-ER1g, a massive ancient galaxy that formed when the universe was just a quarter of its current age. Surprisingly, an Einstein ring is associated with this galaxy. That's because JWST-ER1g acts as a lens and bends light from a distant source, which then appears as a ring — a phenomenon called strong gravitational lensing predicted in Einstein's theory of general relativity.

UCR TEAM TO PARTICIPATE IN NATIONAL UNDERGRADUATE RESEARCH PROGRAM

A UC Riverside team has been accepted in the 2024-25 Scholars Transforming Through Research (STR) Program of the Council on Undergraduate Research (CUR). The multi-month program culminates in a two-day event in March 2025 on Capitol Hill in Washington, D.C.

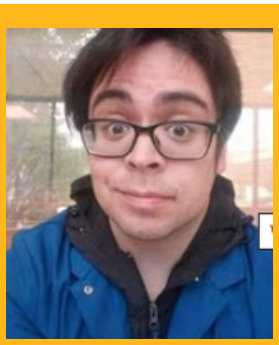
Vanessa Kwong

THE UC RIVERSIDE PHYSICS AND ASTRONOMY DEPARTMENT PRESENTS: FRONTIERS OF COSMOLOGY LECTURE

For centuries, coronaviruses have triggered health crises and economic challenges, with SARS-CoV-2, the coronavirus that spreads COVID-19, being a recent example. One small protein in SARS-CoV-2, the Membrane protein, or M protein, is the most abundant and plays a crucial role in how the virus acquires its spherical structure. Nonetheless, this protein's properties are not well understood.

GRADUATE STUDENTS WIN DISSERTATION COMPLETION FELLOWSHIP AWARDS

Graduate students Wayne Water Vigil Jr. and Giulia Alboreggia have each won a Dissertation Completion Fellowship Award. The award, given by the UCR Graduate Division, is given to doctoral students for up to two quarters.

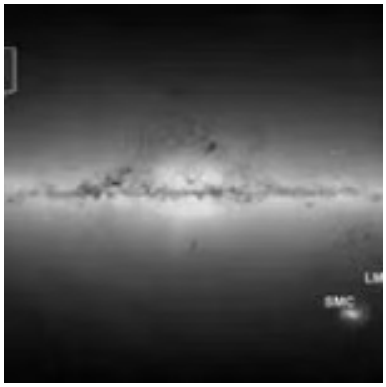


PHYSICISTS GAIN HANDS-ON EXPERIENCE USING CYCLOTRON AT UC DAVIS

Recently, a team of UC Riverside physicists led an experimental campaign at UC Davis, where they worked on a cyclotron, an apparatus that accelerates charged particles. The team, led by Barak Schmookler, an assistant project scientist in the lab of Miguel Arratia, an assistant professor of physics and astronomy, bombarded photosensors with proton beams from the cyclotron, causing degradation due to "radiation damage."

KEN BARISH IS NAMED CHAIR OF UCR ACADEMIC SENATE

Ken Barish has been elected chair of the UC Riverside Academic Senate. His two-year term begins on Sept. 1.

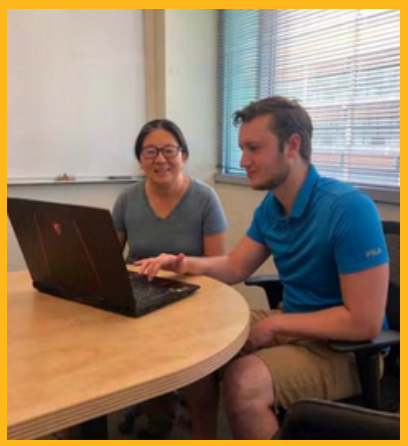


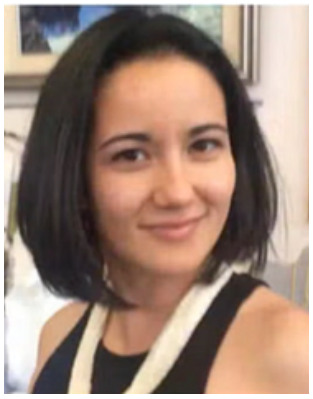
HOW DID A SATELLITE GALAXY OF THE MILKY WAY COME TO BE?

Crater 2, located approximately 380,000 light years from Earth, is one of the largest satellite galaxies of the Milky Way. Extremely cold and with slow-moving stars, Crater 2 has low surface brightness. How this galaxy originated remains unclear.

WITH SPIN CENTERS, QUANTUM COMPUTING TAKES A STEP FORWARD

Quantum computing, which uses the laws of quantum mechanics, can solve pressing problems in a broad range of fields, from medicine to machine learning, that are too complex for classical computers. Quantum simulators are devices made of interacting quantum units that can be programmed to simulate complex models of the physical world. Scientists can then obtain information about these models and, by extension, about the real world by varying the interactions in a controlled way and measuring the resulting behavior of the quantum simulators.



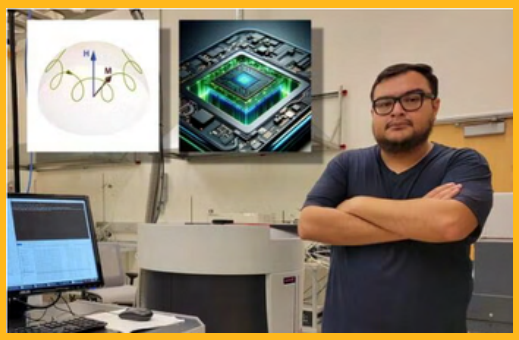


SUMMER PHYSICS ACADEMY BRINGS BACK AN ALUMNA TO CAMPUS

Alumna Christina Manzano, a former graduate student of Gabriela Canalizo, a professor of physics and astronomy, now teaches college freshmen and sophomores at Mt. San Jacinto College, a public community college in Riverside County.

MAKING FERROMAGNETS READY FOR ULTRA-FAST COMMUNICATION AND COMPUTATION TECHNOLOGY

An international team led by researchers at the University of California, Riverside, has made a significant breakthrough in how to enable and exploit ultra-fast spin behavior in ferromagnets. The research, published in Physical Review Letters and highlighted as an editors' suggestion, paves the way for ultra-high frequency applications.



NEW ASTROPHYSICS RESEARCH SUPPORTS THE EXISTENCE OF AN UNKNOWN INFLUENCE

The astrophysicists used the "Lyman-Alpha Forest," a powerful tool for mapping the distribution of hydrogen in the universe — and, indirectly, dark matter. The "forest," a series of absorption lines in the spectra of distant quasars and galaxies, is so named because in graphs it appears like a dense tangle of saplings. To analyze the forest, the scientists used a new model and simulations, which allowed them to reconstruct the distribution of matter, including dark matter, over a vast portion of the universe.

EXPERIMENTAL COSMOLOGY CENTER DRAWS CONGRESSMAN MARK TAKANO TO CAMPUS

Rep. Mark Takano, D-Riverside, visited UC Riverside on August 6 to learn about the new Experimental Cosmology Center in the Department of Physics and Astronomy. The center, spearheaded by Nobel laureate Barry Barish, a distinguished professor of physics and astronomy, was launched earlier this year.

UCR PHYSICISTS RECEIVE DOE GRANTS AS EARLY CAREER SCIENTISTS

Physicists Miguel Arratia and Shawn Westerdale at UC Riverside have each been awarded a grant from the U.S. Department of Energy, or DOE, to fund their research. Arratia will lead a project titled "Toward quantum imaging of nuclei." Westerdale will lead a project titled "Developing low-threshold liquid argon time projection chambers with photo-sensitive dopants for dark matter and neutrino experiments."

NSF FUNDS INSTRUMENTATION IN LAB LINKED TO LIGO RESEARCH

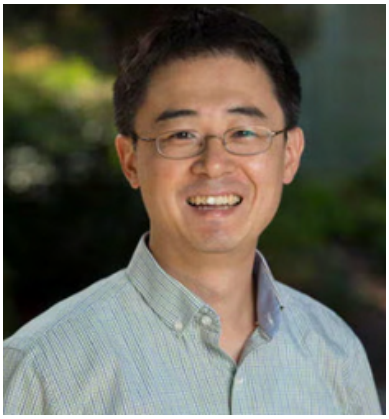
Jonathan Richardson, an assistant professor of physics and astronomy at UCR, has received a grant of $450,000 from the National Science Foundation to develop high-precision, low-noise laser wavefront control capabilities for LIGO, the Laser Interferometer Gravitational-wave Observatory based at sites in Louisiana and Washington. Such capabilities are needed to improve LIGO's sensitivity, enabling higher precision observations of more distant events.

DOE RENEWAL GRANT FUNDS STUDENT RESEARCH

Kenneth Barish, a professor of physics and astronomy, has received a three-year renewal grant of more than $1 million from the Department of Energy, or DOE, to support the activities of the Nucleon Spin Physics Group at UC Riverside. The group's research aims to unlock secrets about the fundamental structure of the universe by probing the internal structure of nuclei and understanding why the constituents of the proton are confined and where the proton's spin originates..

CAL-STATE UNIVERSITY SAN BERNARDINO VISIT DAY

California State University San Bernardino (CSUSB) physics students and faculty visited the UCR Department of Physics and Astronomy for tours of the condensed matter experimental labs at UCR for the second year in a row.

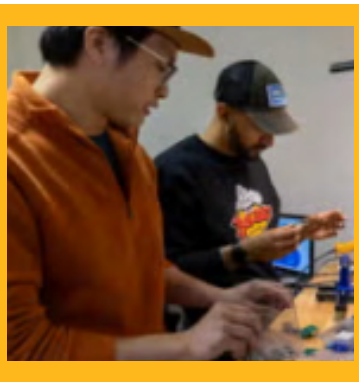


UNCONVENTIONAL INTERFACE SUPERCONDUCTOR COULD BENEFIT QUANTUM COMPUTING

A multi-institutional team of scientists in the United States, led by physicist Peng Wei at the University of California, Riverside, has developed a new superconductor material that could potentially be used in quantum computing and be a candidate "topological superconductor."

UC RIVERSIDE RECEIVES SEVEN GRANTS TOTALING $7M FOR GRADUATE EDUCATION

UC Riverside has received seven grants from the U.S. Department of Education's Graduate Assistance in Areas of National Need (GAANN) Program. The program offers grants to academic departments and programs at higher education institutions to fund graduate fellowships. Students with strong academic records and who have demonstrated financial need and intent to pursue the highest degree available in their field of study at the institution are eligible for the fellowships.



UCR STEM SUMMER CAMP INSPIRES FUTURE INNOVATORS TO EXPLORE STEM CAREERS

UC Riverside faculty and staff hosted the second annual STEM Summer Camp in late June 2024, bringing dozens of high school students to campus for an immersive, hands-on STEM experience and a taste of college life.

CONGRATULATIONS, DR. ERNEST MA!

Ernest Ma received the 2024 Distinguished Emeritus Award given by the UCR Emeriti Association.

Ron Bieniek '1970 visited us on June 18th. Aiden Wilkin '2024 was the recipient of the Ron Bieniek Fellowship for undergraduate research this year.

From left to right: Ron Bieniek, Shan-Wen Tsai, Umar Mohideen and Richard Seto.

CUB SCOUTS LEARN PHYSICS ON CAMPUS

Local cub scouts who visited campus on Nov. 3 got an early education in physics and astronomy. The two-hour event was arranged by Robert Sanderson, an instructional lab manager and lecture demonstration specialist in the Department of Physics and Astronomy.

Astronomers use hands-on demo to explain infrared radiation to the public

Love for astronomy begins in childhood. With that in mind, three UC Riverside astronomers gave a presentation on August 3 to hundreds of children on the Big Island of Hawai'i on what infrared radiation is and how telescopes use it.

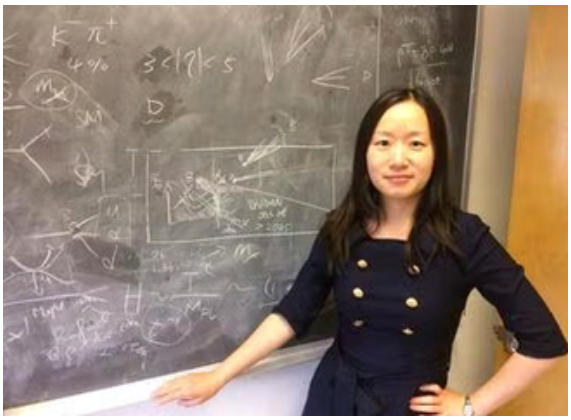
Infrared radiation is part of the electromagnetic spectrum that exists between visible light and radio waves. Invisible to human eyes, it can be detected as heat. By detecting near infrared and mid-infrared wavelengths, telescopes like the James Webb Space Telescope can reveal objects in the universe to astronomers that optical telescopes cannot see.

Gabriela Canalizo (red shirt) explains infrared to a child. (W. M. Keck Observatory/Kekoa Alip)

GRAVITATIONAL WAVES HINT AT DARK MATTER AND BIG BANG MYSTERIES

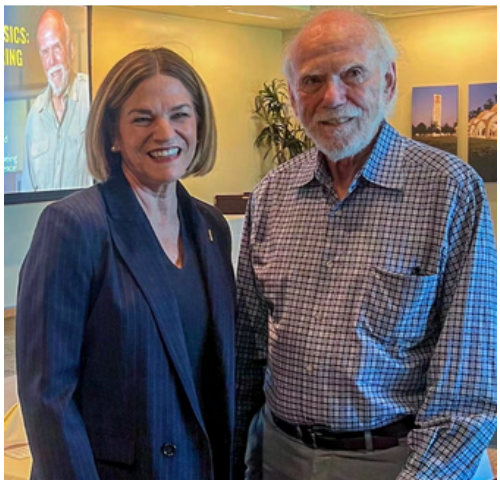
Study reports very simple forms of matter could generate detectable gravitational wave backgrounds soon after the Big Bang

Gravitational Waves, ripples in space-time predicted by Einstein almost a century ago, were detected for the first time in 2015. A new study led by Yanou Cui, an associate professor of physics and astronomy at UC Riverside, shows that very simple forms of matter could create detectable gravitational wave backgrounds soon after the Big Bang.

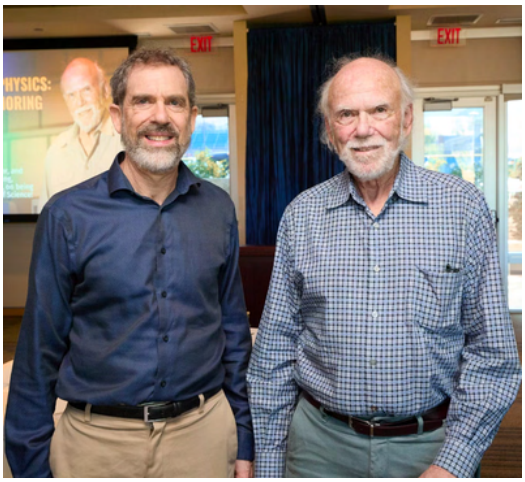


HONORING BARRY BARISH WITH A DAY RICH IN PHYSICS

The College of Natural and Agricultural Sciences, or CNAS, and the Department of Physics and Astronomy at UC Riverside hosted a celebration on April 30 to honor Nobel laureate Barry Barish. Barish, a distinguished professor of physics and astronomy, received a National Medal of Science from President Joe Biden last year.



Barry Barish (right) seen with Riverside Mayor Patricia Lock Dawson. (William Vasta)



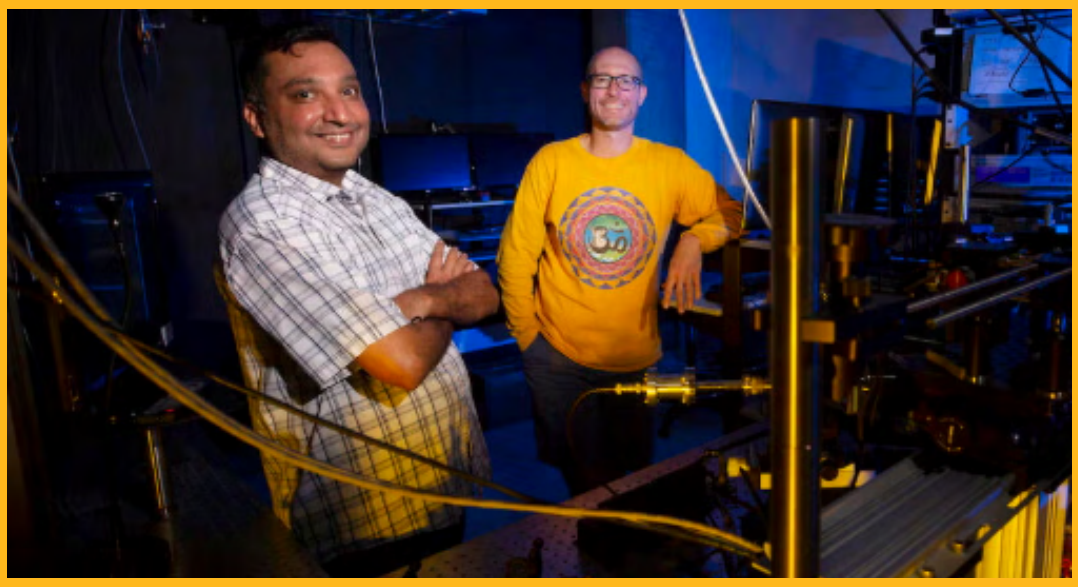
Kenneth Barish (left) seen with his father, Barry Barish. (William Vasta)

The occasion also marked the launch of a new center on campus that Barish is spearheading: the Experimental Cosmology Center, which will design equipment for experiments at the forefront of the field and train students to lead these experiments.

Barish was awarded the 2017 Nobel Prize in physics for the discovery of gravitational waves. He shared the prize with two other physicists. He earned his bachelor's degree in physics in 1957 and his doctorate in experimental particle physics in 1962, both from UC Berkeley. He led the Laser Interferometer Gravitational-wave Observatory, or LIGO, effort through the final design stages, and in subsequent discoveries. He joined the UCR faculty in 2018.

NEW CENTER POSITIONS UC RIVERSIDE AS A LEADER IN QUANTUM VIBRONICS

Physicist Nathaniel Gabor at the University of California, Riverside, has been awarded a $7.5M grant from the Department of Defense, or DoD, to develop a Multidisciplinary University Research Initiatives, or MURI, center on campus. Called QuVET for the Center for Quantum Vibronics in Energy and Time, the center's co-principal investigators are leading scientists at UCR, Caltech, MIT, and Columbia University.



"Vibronic," a portmanteau of vibrational and electronic, refers to transitions between molecular energy states. Vibronic behavior is central to both biological and material systems and could impact future technology's energy harvesting efficiency. Vibronic effects — vibrational transitions that accompany electronic transitions — occur in systems ranging from photosynthetic light-harvesting antennae to molecular gases and solid-state materials.

Gabor, a professor of physics and astronomy and the five-year grant's principal investigator, believes the strong partnership with DoD laboratories and industry will position QuVET to be a scientific and technological epicenter for quantum vibronics. He said the visionary science QuVet represents could place UCR at the head of a new era of science, where biology, physics, and chemistry are explored through the lens of quantum mechanics.

GRADUATION

2024

Graduate Recoginition

Outstanding Teaching Assistant

Jia-Mou Chen
En-De Chu
Robert Dawson
Henoc Ejigu
Adam Green
Fengyi “Sally” Li
Yifan Liu
Muhammad Faisal Manzoor
Ryan Milton

Albert Staats Award for Exceptional Skills in Designing and Building Physics Apparatus

Josiah Keagy (Prof. Jing Shi)

Benjamin C. Shen Memorial Award - Outstanding 1st Year Graduate Student

Haoyu “Asher” Sang

Benjamin C. Shen Memorial Award- Outstanding Junior Graduate Student Researcher

Demao Kong (Prof. Hai-Bo Yu)

Anne Kernan Award - Outstanding Senior Graduate Student Researcher

Archana Aravindan (Prof. Gabriela Canalizo) and Haoyu Liu (Prof. Jing Shi)

Robert T. Poe Memorial Scholarship Award for Outstanding PhD Graduate

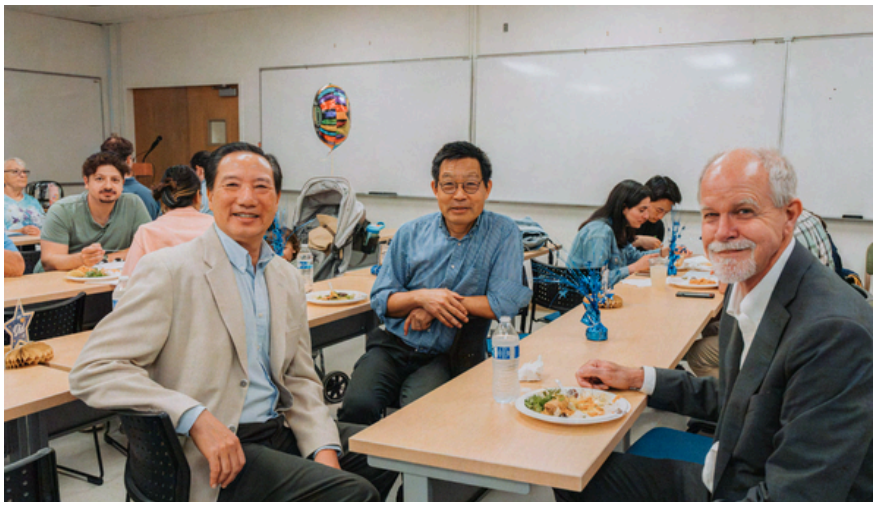
Ming-Feng Ho (Prof. Simeon Bird)

2024

GRADUATION

2024

DEPARTMENT EVENTS



Undergraduate Recoginition

Robert L. Wild Family Award - Outstanding 1st Year Undergraduate Student

Sumukh Mahesh

Michael Padilla

Brown Williams Endowment Award - Outstanding 2nd Year Undergraduate Student

Cynthia Liang

Nam Vu

R. Stephen White Endowment Award - Outstanding 3rd Year Undergraduate Student

Sarah Howick

Shane Levin

Matthew Lugatiman

R. Stephen White Endowment Award - Outstanding Senior Undergraduate

Peter Carney

Jared Hudnall

Juana Cecilia Martin-Gonzalez

Josh Roth

Allison Tousonian

Aiden Wilken

2024

DEPARTMENT EVENTS

DEPARTMENT EVENTS

DEPARTMENT EVENTS

Frontiers of Cosmology Public Lecture

DEPARTMENT EVENTS

Highlander Day

Dark Matter Day

Summer Physics Teacher's Academy

DEPARTMENT EVENTS

Discover UCR Day

Graduate Recruitment

DEPARTMENT OUTREACH

Our department outreach program reaches 5,000 people annually in Riverside County and nearby areas, led by postdoc Dr. Alex de La Vega, who is partly funded to run outreach.

At 4 events in the first half of 2024, we reached 750 people in your district with activities including telescope nights, library visits, and demos at public events. We host 60–80 events per year from LA to Joshua Tree, with volunteers from our faculty, postdocs, grad students, and undergrads.

DEPARTMENT OUTREACH

GIVING

Please consider making a donation to the Department of Physics and Astronomy. Even small gifts will help to support our student programs, as well as resources for graduation. Use the website link or QR code below for more information. Thank you for your generous support.

COSMOLOGY FUND
SCAN THIS QR CODE TO GIVE OR CLICK HERE FOR THE LINK

PHYSICS & ASTRONOMY FUNDS
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ALBERT STAATS FUND

ANNE KERNAN ENDOWED FUND FOR PHYSICS

BENJAMIN C. SHEN ENDOWED FUND IN PHYSICS

BROWN WILLIAMS ENDOWED UNDERGRADUATE STUDENT AWARD FUND

DR. THOMAS HALSEY ENDOWED SCHOLARSHIP FUND

B. WILLIAMS UG STUD ENDOWMENT

R. WILD FAMILY FOUNDATION

EXPERIMENTAL COSMOLOGY AND INSTRUMENTATION FUND

PHYSICS AND ASTRONOMY DEPARTMENT

R. STEPHEN WHITE ENDOWED FUND FOR PHYSICS

ROBERT WILD FAMILY ENDOWED SCHOLARSHIP FUND

SUN-YIU AND HELEN FUNG ENDOWED

GRADUATE STUDENT FELLOWSHIP FUND

This newsletter was assembled and designed by Melinda Hernandez Rogers. We would like to thank the Department of Physics and Astronomy staff for their assistance, Iqbal Pittalwala for the use of his news pieces, and the students and faculty who contributed articles, photos and other content.aragraph text