

UC DAVIS

COLLEGE OF LETTERS AND SCIENCE

Department of Physics and Astronomy

Physical Interactions

Message from Department Chair Professor Richard Scalettar



Dr. Richard Scalettar

Greetings from the Physics and Astronomy Department at UC Davis! We are looking forward to an exciting year of learning and research, and to re-establishing face-to-face connections within our community after two years of disruption by the pandemic. We welcome your continuing involvement in our community.

Dr. Richard Scalettar, Chair
Department of Physics and Astronomy
College of Letters and Science, UC Davis

Comings and Goings

Matthew Citron will be joining our faculty this January. He is an experimentalist working at the Large Hadron Collider at CERN. His expertise is looking for dark matter and particles from “dark sectors.” He joins Alex Thomson, a condensed matter theory theorist who was highlighted in our previous newsletter, who joined us this summer.

A number of our faculty members are retiring this year: Daniel Cox, Daniel Ferenc, Tony Tyson, and Gergely Zimanyi. All will continue to be active members of the



Matthew Citron

department and continue in their physics research, and Cox and Zimanyi are involved in starting new companies.

Undergraduate Curriculum Reboot

The department has undertaken a top-to-bottom revision of our undergraduate curriculum. The new curriculum will include a strengthened emphasis on computational physics, will better integrate transfer students into the program, and add more flexibility to the physics major. A big thanks to faculty members Shirley Chiang, Mike Mulhearn, and Pat Boeshaar for spearheading this important work!

Broadening Participation in the PhD Program

In the Spring of 2021 the faculty adopted a plan for increasing the number of our graduate students who belong to groups currently underrepresented in physics and astronomy. This plan includes efforts on multiple fronts.

Creating a welcoming and inclusive environment: The department undertook a rigorous climate survey of the department to give us data on our successes and challenges. The data collected is extremely rich and informative. The key findings and recommendations are summarized in [this report](#).

Recruiting students: This fall the physics and astronomy department will hold an online “open house” recruiting event for prospective graduate students. We will be reaching out to students throughout the world, with particular attention to students from institutions with a higher percentage of under-represented minorities. We are also taking advantage of a UC Davis Graduate Studies program to pay the application fees for some applicants to reduce what can be a significant barrier for some students.

Financial support: The department has begun an endowed fellowship to support promising incoming graduate students who have not had the same privileges as many of their peers. Our endowment target is \$1M. We began our fundraising efforts close to home with faculty and students last year, and we are already about a quarter of the way there. Over 80% of physics faculty have contributed, and we have an unprecedented level of student donations. We expect to award our first fellowship for the 2023-2024 school year. If you are interested in supporting this effort, please contact Professor Lloyd Knox at lknox@ucdavis.edu or give directly [here](#).

An Asteroid for Tony Tyson

UC Davis Distinguished Professor of Physics and Astronomy Tony Tyson was honored by NASA by having an asteroid named after him. [Asteroid \(179223\)](#)

[Tonytyson](#) was discovered in 2001 by the Sloan Digital Sky Survey. It is in a circular orbit beyond Mars, and Tyson assures us that there is “no danger of striking earth!” Tyson is Chief Scientist with the Rubin

Observatory Large Scale Synoptic Telescope (LSST) and served as LSST Director from 2003 to 2013. LSST will find millions of asteroids, and will accurately measure the orbits for most of the remaining known [Earth threatening asteroids](#).



Tony Tyson

Honors and Prizes for Graduate Students

We are proud of our students who received special recognition this year:

Pratik Gandhi: Frontera Computational Science Fellowship

Shruti Paranjape: UCD Chancellor's postdoc fellow

Joseph Levine and Bianca Nino: HEPCAT fellows

Visit by Professor Sir Michael Berry

Michael Berry from the University of Bristol, U.K. visited UC Davis as Distinguished Lecturer in the Department of Physics and Astronomy, hosted by Warren Pickett. The visit was being supported by the Department, The College of L&S, APS, and the Moore Foundation. Sir Berry's visit was supposed to happen last January but was postponed due to Covid. On October 12, Sir Michael gave a Public Lecture entitled "The Physics of Light in Eighty Pictures." The following day he gave a special Colloquium on "Geometric Phases Old and New". Department staff, especially Kimberly Robben, played a big part in making this visit a success.



Sir Michael Berry



Secrets of the Universe

A special screening of the film "Secrets of the Universe" was held at the Mondavi Center on October 26. The film embarks on a journey into one of the most amazing scientific instruments ever built, the Large Hadron Collider. Filmed at CERN, this 45 minute film follows UC Davis professor Manuel Calderón de la Barca Sánchez and his graduate students as they use the world's largest particle collider to recreate conditions a microsecond after the Big Bang and reveal clues about the strongest force of the universe.

The film explores how the questions explored at the collider are connected to the larger questions we have been asking in Science through the centuries.

Physics News!

(Click to read more on each headline)



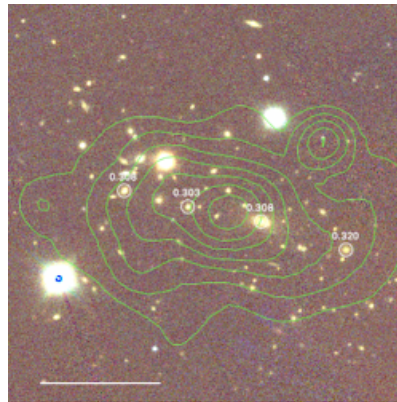
Inna Vishik Selected as 2022 Dean's Faculty Fellow



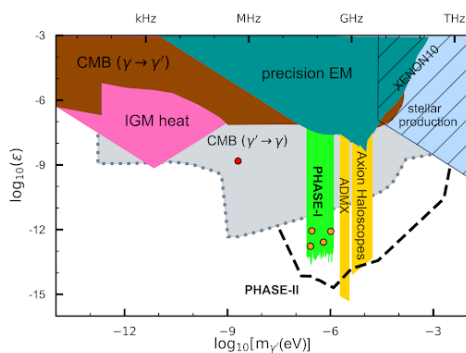
Mukund Rangamani Elected Fellow of the International Society



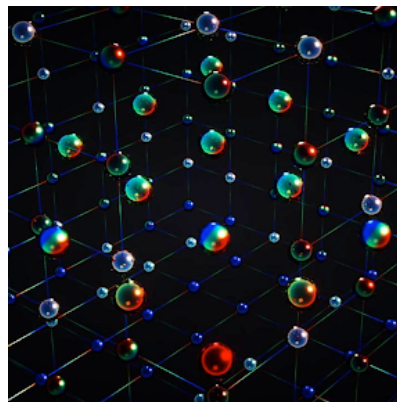
Anticipating Earthquakes



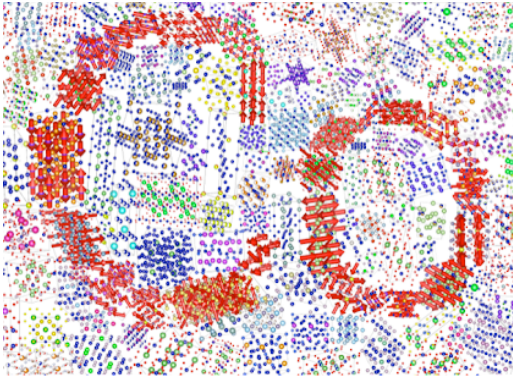
Galaxy Cluster Collisions



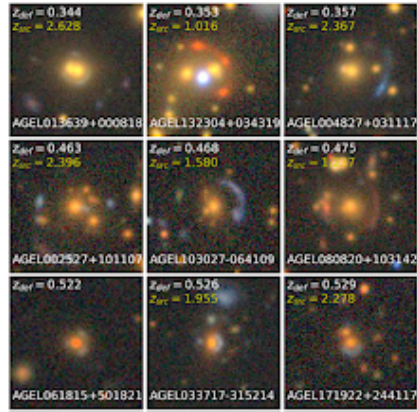
Laboratory Search for Dark Photon Dark Matter



Ultracold Antiferromagnetic Correlations



A New Method to Accelerate Material Discovery



Newly Discovered Gravitational Lenses Could Reveal Ancient Galaxies and the Nature of Dark Matter

Momentum Computing: The Next Cool Thing?

Electronic circuits generate a lot of heat, as you will have noticed if you have had a laptop actually in your lap. That represents wasted energy, and even more energy has to be used to keep racks of servers cool. This becomes a major problem – and a cost – as server farms become larger.

James Crutchfield, a physics professor and director of the Complexity Sciences Center at UC Davis and graduate student Kyle Ray have a cooler proposal, and it involves a fundamental shift in how computers handle information.

A paper about the work is currently available as a preprint and was featured on the cover of the July issue of Scientific American.

The new approach could reduce energy costs for computing at least 1000 to 10,000-fold, Crutchfield said.

“Likely more, if we devote more effort to optimization,” he said.



From left to right: Kris Mortensen (grad student), Keerthi Vasan G. C. (grad student), Sunny Rhoades (grad student), Ryan Sanders (postdoc), Erin Huntzinger (grad student). On screen: Yuguang Chen (postdoc)

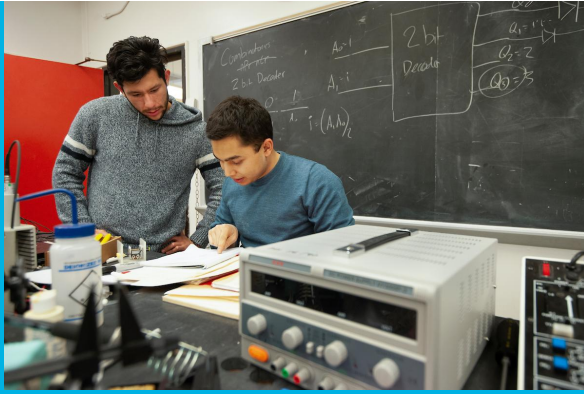
Crutchfield and Ray's solution to the heat dissipation limit is to use the momentum, not position, of particles to carry information. Momentum carries information as both position and velocity, they reason. Through a series of simulations, they show that momentum computing can be performed with very low energy dissipation.



James Crutchfield, a physics professor and graduate student Kyle Ray

You Can Still Make an Impact!

Support underrepresented graduate students in the fields of physics and astronomy! By donating to the Opportunity Fellowship Fund, you are supporting students in their first and second year who have taken a non-traditional path to graduate school.



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