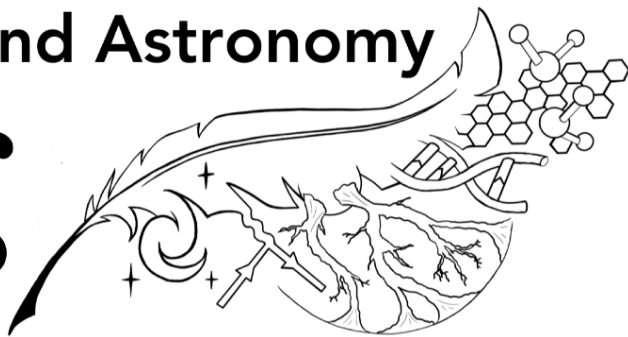


**UCI** Physics and Astronomy

**Blog**



# 2022 Spring Quarter Newsletter

*Volume 4, Issue 3*

---

**Student Spotlight**



Manuel Pasqual Paul is a 5th year Ph.D. student in Physics and Astronomy who also has been the Physics Graduate Caucus (PGC) administrator since his first year as at UCI. He led the efforts to revive PGC, solidify its structure, and expand the function and reach of the organization. PGC is a graduate student-run organization within the Department of Physics and Astronomy that seeks to support and improve academic and career success, foster individual and community well-being, and be a voice for graduate students within our department. Prior to Manuel's involvement in PGC, the organization only

centered around creating social gatherings between graduate students. Manuel stepped up to be the first Administrator to lead a newly revamped PGC. Over 5 years, Manuel oversaw many new initiatives for PGC, including developing TA and prospective graduate surveys as well as creating new PGC officer positions that range from floor representatives to organization representatives. Under Manuel's efforts, PGC became a central hub that keeps physics and astronomy graduate students and organizations connected with each other and with the department. Read more [here](#).

We are taking nominations for the Student Spotlight! If you want to nominate a graduate student you know, you can do so using the google form located [here](#).

## Question of the Quarter

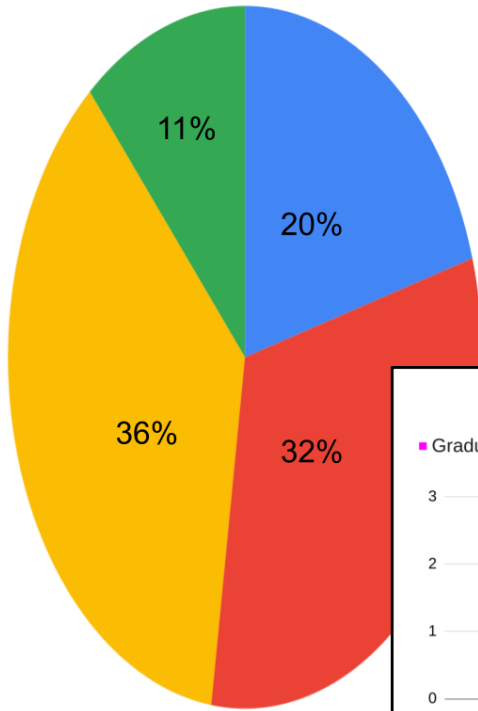
Thank you to everyone who participated in our question of the quarter!

See our results below and please take a brief moment to answer our question for the next newsletter. Let's let the physics and mathematics speak for itself:

["Which Equation/Law/Theorem is best?"](#)

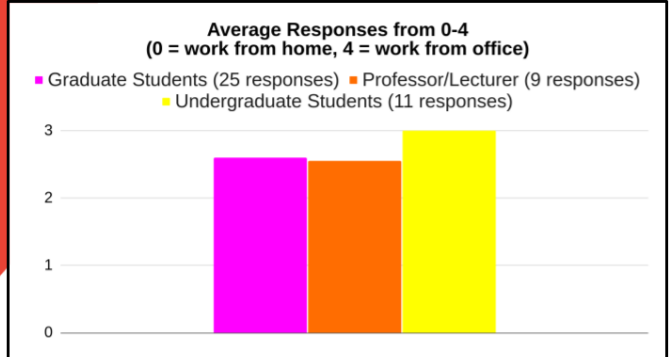
---

## What does your ideal work situation look like?



- Full-time work in the office (5 days per week)
- Half and Half
- Mostly in the office (3-4 days per week)
- Mostly work-from-home (3-4 days per week)

(Out of 45 responses, no one said 100% at home!)



## Is there anything about being back in the office that you're looking forward to? Or anything about working from home that you'll miss?

I miss people

Having coffee with my friends!

I look forward to talking to people in the hallway.

I will miss being able to adjust the temperature of my room. The office is so cold!

There are many great things about being in the office. In person meetings, large whiteboards, plus Yuri Shirman's coffee machine and Katherine Dugas' tea kettle. The best part of working from home is seeing daylight.

Looking forward to freezing in the office, gonna always be a balmy 68 compared to the 95 of my apartment

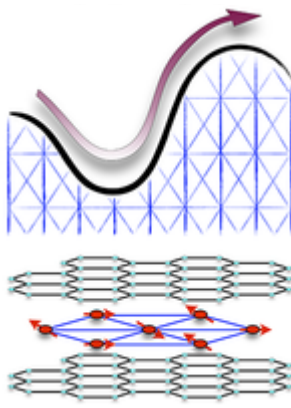
Access to a printer.

I love seeing my students in person! But I miss going for a run sometimes in the afternoon if I'm mentally stuck on my research.

## Research Content

Professor Sasha Chernyshev recently published a research article in the APS journal Physical Review X. This interdisciplinary journal highlights important research from all areas of physics. The full text of the paper entitled “Roller Coaster in a Flatland: Magnetoresistivity in Eu-Intercalated Graphite” can be read [here](#), and an accessible summary is as follows:





The diverse physical properties of 2D atomically thin graphene and its multilayered cousins are the subject of intense and highly publicized experimental and theoretical investigations that define modern condensed-matter physics and materials science. They realize previously unexplored physical regimes in electron transport, superconductivity, magnetism, and topological phenomena and also hold a significant promise for future technology. Our theoretical study focuses on a lesser-known predecessor—the graphite compound  $\text{EuC}_6$ —and explains highly unusual behavior in its resistivity.

In  $\text{EuC}_6$ , magnetic atoms of europium (Eu) insert themselves between 2D layers of graphite, forming a “magnetically intercalated” material, in which conduction electrons in graphite layers and magnetic moments (or spins) of Eu are strongly coupled. The Eu atoms form triangular lattice layers in which their spins realize one of the iconic models of frustrated magnetism—the triangular lattice antiferromagnet, the spin configuration of which follows a specific sequence of patterns under the applied magnetic field.

The resistivity of this material has a unique “roller-coaster” behavior, wherein the resistance varies in a highly nonmonotonic, oscillatory way as the magnetic field increases from zero to about 20 T. We show that this roller-coaster behavior is caused by the scattering of electrons on magnons, the elementary spin excitations of triangular Eu planes. Namely, magnetic-field-induced changes in the spin configuration result in dramatic changes in the electron-magnon scattering rate that determines the electrical resistivity of the material.

Our investigation yields predictions of new field- and doping-induced phenomena in magnetically intercalated graphite and related systems. It lays out the theoretical framework for treating electron-magnon interaction in frustrated quantum magnets and points out several promising research directions that appear to be within the reach of modern experimental

capabilities.

---

M.D./Ph.D. students Haytham Effarah and Trevor Reutershan recently co-first-authored two papers with Professor Christopher P. J. Barty that have been published in a special issue of *Applied Optics* entitled [Radiography, Applied Optics, and Data Science](#).

["Computational method for the optimization of quasimonoeenergetic laser Compton x-ray sources for imaging applications"](#) describes and validates a method to speed up the computationally costly simulations required to capture the details of x-ray spectra generated through relativistic Compton scattering. Being able to quickly simulate detailed x-ray spectra is necessary for on-the-fly optimization of precision imaging experiments.

["Numerical evaluation of high-energy, laser-Compton x-ray sources for contrast enhancement and dose reduction in clinical imaging via gadolinium-based K-edge subtraction"](#) describes the first simulation study regarding the use of a realistic laser-Compton x-ray spectrum to evaluate whether these cutting-edge x-ray sources could utilize gadolinium (Gd), a commonly used image contrast agent in magnetic resonance imaging (MRI), as a contrast agent for high-resolution and low-dose breast mammography. Using contrast agents in mammography is especially important for people with dense breasts that can easily hide potential tumors.

---



Ph.D. student Kyle Chesnut, working with Professor Christopher P. J. Barty, gave a presentation entitled "Analysis of Chirped Pulse Juxtaposed With Beam Amplification (CPJBA): a Nd:Glass Laser Architecture for Exawatt-Class Peak-Power Pulses" at the Optica High-Brightness Sources and Light-Driven Interaction Congress in Budapest, Hungary. His presentation discussed a novel architecture and proof-of-concept simulation results to build the most powerful and intense laser system in the world.

Haytham Effarah, an M.D./Ph.D. student of Professor Barty, also gave presentations entitled "Rapid Generation of Simulated Laser Compton X-ray Beams While Preserving Angle-Correlated Local Spectra," based on a previous publication, and "Scanning K-Edge Subtraction Imaging is Enabled by the Angle-Correlated Spectra of Laser Compton X-ray Sources," a discussion on a novel spectral imaging technique that utilizes spatial variations in x-ray energy to get more information per image. He also presided over the conference session on the Imaging and Biomedical Applications of compact extreme-UV and x-ray sources.



M.D./Ph.D. student Trevor Reutershan (also working with Professor Bartly) not only presented at the conference, but also won the student paper award at the Optica High-Brightness Sources and Light-Driven Interactions Congress!

His conference paper was entitled "Low-Dose, Dual-Energy Medical Imaging of Gadolinium Contrast Agents Using Laser-Compton X-ray Sources," a follow-up and elaboration of his recent publication. Congratulations!

---

Check out the UCI Physics and Astronomy blog's [recent bite-sized physics article](#) on finding the mass of dark matter in the Milky Way!

---

## Department News



Congratulations to the following Ph.D. students who recently defended their theses since our last newsletter publication!

**Dr. Yvonne Ng:** "Searches for Anomalous Resonances in the Large Hadron Collider for New Physics"

**Dr. Arianna Long:** "Taming Giants: Studies on the Growth, Regulation, and Evolution of Dusty, Star-Forming Galaxies in the Early Universe"

**Dr. Jessica Howard:** "Advancing Particle Physics with Sophisticated Computational Frameworks"

---

Congratulations to all of the Physics and Astronomy undergraduate students who will be receiving their degrees at the end of this quarter! Here is a sampling of the graduate's future plans:

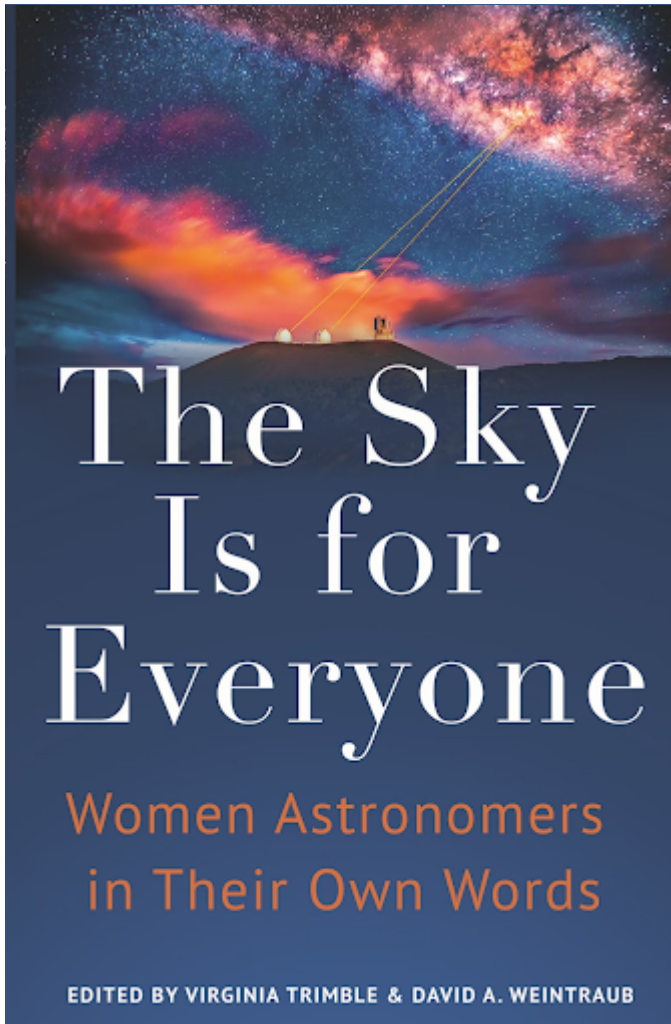
**Roles of graduates entering industry:** data scientist, staff scientist at tech startup, engineering intern, technical sales application engineer (American Bright Optoelectronics Corp.)



**Roles of graduates pursuing further education:** applied physics Ph.D. (Caltech), aerospace engineering graduate degree, physics Ph.D. (UC Berkeley)

---

---

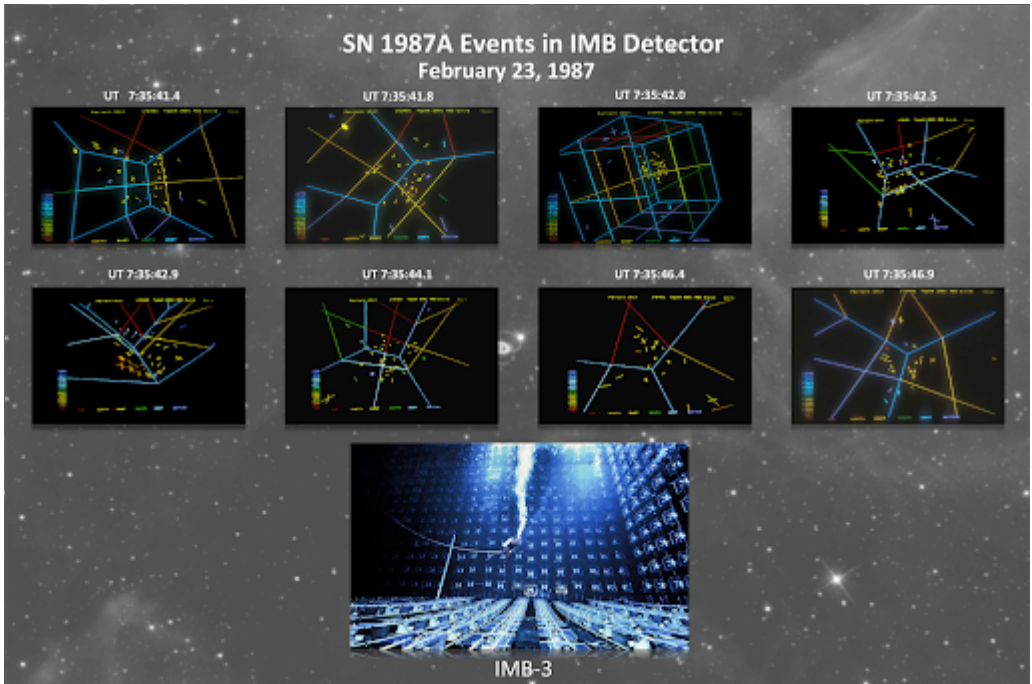


Professor Virginia Trimble has co-edited a new book which will be published by Princeton University Press in June. The book is entitled: “The Sky Is for Everyone: Women Astronomers in Their Own Words”. The publisher describes the book as follows:

“The Sky Is for Everyone is an internationally diverse collection of autobiographical essays by women who broke down barriers and changed the face of modern astronomy. Virginia Trimble and David Weintraub vividly describe how, before 1900, a woman who wanted to study the stars had to have a father, brother, or husband to provide entry, and how the considerable

intellectual skills of women astronomers were still not enough to enable them to pry open doors of opportunity for much of the twentieth century. After decades of difficult struggles, women are closer to equality in astronomy than ever before. Trimble and Weintraub bring together the stories of the tough and determined women who flung the doors wide open. Taking readers from 1960 to today, this triumphant anthology serves as an inspiration to current and future generations of women scientists while giving voice to the history of a transformative era in astronomy.”

---



The 2022 APS Historic Sites Committee has selected the Morton Salt Mine, the site of the IMB (Irvine-Michigan-Brookhaven) experiment, as a 2022 APS Historic Site. The mine is located in Ohio on the south shore of Lake Erie. It is noted as one of the two sites where the first supernova neutrinos were detected in the proposed citation:

“On February 23, 1987, on this site, at a depth of about 600 meters, the IMB (Irvine-Michigan-Brookhaven) detector observed a burst of neutrinos emitted by the explosion of Supernova 1987A in a nearby galaxy. The neutrinos had traveled about 170,000 years to reach the Earth. The observation, which was corroborated by a coincident detection in Kamioka, Japan, was the first of its kind, and served as a verification of the theory of supernovae. It is considered the birth of neutrino astronomy.”

Pictured are displays of the eight neutrino events which the IMB experiment



observed in 1987. Congratulations to the UCI participants in this experiment, including Professor Hank Sobel, on this honor!

---

Prof. Stacy Copp and her research group are doing exceptional outreach work in partnership with Los Alamos National Lab. Professor Copp describes this outreach as follows:

“We participate every year in the Los Alamos National Lab Summer Physics Camp for Young Women ([link](#)) which reaches girls from small towns in my home state of New Mexico, and now also Hawaii, for a two-week virtual all-day workshop with hands-on demos, tours of labs, and talks from role model scientists. Last summer the Copp lab developed and led two hands-on activities using common household items (for covid reasons) to demonstrate the physics of self-assembly and analytical chromatography separation. This year we are expanding our participation to also include a contest with Foldscopes, paper microscopes, that the Copp lab is providing to each participant. Girls will take pictures using these little microscopes, and we will pick the most creative photos, with winners getting a prize.”

---



This quarter Nobel Laureate Donna Strickland presented the 2022 Reines Lecture on “Generating High-Intensity, Ultrashort Optical Pulses”. The lecture was given online, but a group of graduate and undergraduate students gathered to watch the lecture in the astronomy conference room.



The spring quarter Magnifying Voices in Physics (MVP) seminar was given by Dr. Marlene Patino on “The road to becoming a fusion material scientist: from dielectric barrier discharges to tungsten fuzz”. Many department members enjoyed food and beverages while listening to Dr. Patino give an inspiring talk on her work and path to becoming a research scientist.





This Earth Day, undergraduate and graduate students made up a strong contingent of physicists at a rally on UCI's campus calling for the UC system to stop burning fossil fuels and enact a UC Green New Deal. This proposal for the entire UC system would eliminate the burning of fracked methane on all 10 UC campuses, which currently emit an annual total of 1 million metric tons of CO<sub>2</sub>. You can use these links to learn more about the [UC Green New Deal](#) and [sign a petition](#) if you would like to voice your support, view data on [UC's emissions](#), and follow [Sunrise Movement OC](#) for future climate action.

---



A softball team composed of Physics and Astronomy graduate students has been dominating the intramural co-rec league with an undefeated regular season record and an upcoming trip to the finals. The final game will be at **7:30 pm June 1st at the ARC fields.**

---

## Events

The 2021-2022 Department Awards ceremony will be held on **June 2nd at 3:30pm.** It will be held **in person** in RH 101. Please save the date and join in

recognizing more than 100 students, staff, and faculty for their achievements and contributions to the department in the last year.

---

The PGC Summer Kickoff Party is scheduled for **June 10th!** Location is TBA, but graduate students should save the date.

---

Keep an eye out for upcoming PhD Thesis Defenses! Find the full list [here](#).

---

## Resources

This quarter's MVP speaker, Dr. Marlene Patino, compiled a slide with many external funding opportunities and was kind enough to share it with UNITY. Follow [this link](#) to view the slide, especially if you are interested in fusion energy research.

---

To keep up to date on department seminars and colloquia, you can subscribe to the seminar listserv to get announcements in your inbox. Subscribe here: <https://maillists.uci.edu/mailman/listinfo/physics-astronomy-seminars>

---

Interested in communicating science to a public audience? The UCI Physics and Astro Blog is accepting guest submissions of "bite-sized" physics articles to feature on our website! These are short, jargon-free articles on some aspect of physics or astronomy, whether it be a recent [research paper](#) or [something more creative](#). Anything aimed at a broader audience is welcome to be considered. You can send an email to [physastroblog@uci.edu](mailto:physastroblog@uci.edu) with any submissions, ideas, or questions about writing a guest article.

---

---