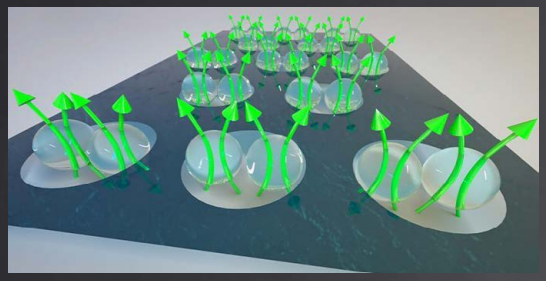
INTERACTIONS

THE DEPARTMENT OF **PHYSICS** AND **ASTRONOMY** 2022 - 2023



Prof. Gabor Csathy has had an extremely productive year. He went from Interim Head to Department Head and still makes time for teaching and ground-breaking research. Learn about his latest research as written by the Purdue University Office of Research.

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MESSAGE from the HEAD

Hello Boilermakers!

As you may know, I took over as the Department Head for the Purdue University Department of Physics and Astronomy last July. Prior to this, I served as the Interim Head. I step in this role after John Finley's hugely successful tenure from 2015 to 2021. I have really enjoyed seeing the growth of the department since I came to Purdue in 2006. The faculty's persistent pursuit of the next breakthrough in physics and astronomy is thrilling to watch as it unfolds. Our department is constantly growing, publishing, and adapting as our collective sciences move innovation forward.

During my tenure here as a professor and especially over the last two years in leadership role, I got to know the Department as a closely knit community. The Department is clearly on an ascending path and the positive changes over the last decade or so reflect the efforts of all our stakeholders, from faculty, staff, students, to alumni. I am optimistic about the future and immensely proud to lead the department through our next stage of growth.

As head, I am honored that Purdue University, a land grant university, allows faculty such as myself the opportunity to continue our research as we teach the next generation of Boilermakers to forge their own paths and make their own giant leaps. Each generation building on the science of the last is how we move our collective and collaborative sciences forward. I personally work in the field of condensed matter physics and am broadly interested in the field of topological physics. That being said, it's exciting to see each faculty and each lab take on a life of their own in different areas of research. I see every day the spark of innovation as our faculty finds ways to work collaboratively across the university in areas on everything from supernovae, semiconductors, dark matter, quantum computing, and all things in between.

I'd like to give a huge shout out of thanks to the alumni who have come back in the past few years to reconnect with the department, share their exciting professional news, and mentor our next generation of Boilermakers. If you are an alumnus who'd like to visit, please contact the department and let us know so we can welcome you back and fill you in on our momentous growth that you helped make possible. We love hearing from you!

To all the current faculty, staff, and students, thank you for all that you are doing to elevate our program.

Boiler up!

Gabor Csathy
Department Head and Professor of Physics and Astronomy

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PURDUE UNIVERSITY®

Department of Ph ics and Astronomy

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FACULTY AWARDS AND HONORS

Chris Greene
- Spira Award for Outstanding Graduate Teaching

Danny Milisavljevic
- PGSA Outstanding Advisor Award
- Exceptional Early Career Teaching Award for Purdue University

Tongcang Li
- Purdue University Faculty Scholar

Arnab Banerjee
- Spira Award for Outstanding Undergraduate Teaching

Laura Pyrak-Nolte
- American Academy of Arts and Sciences (elected)

Ian Arnold
- College of Science Outstanding Service Award

COLLEGE OF SCIENCE STAFF AWARDS

Jim Corwin
Machinist
- Outstanding Service Award

Debbie Nahlik
Executive Assistant
- Leadership Award

Thomas Woodruff
Accelerator Mass Spectrometry Operations and Data Scientist
- Leadership Award

Brandy Pinkard
Schedule Deputy and Undergraduate Office Coordinator
- Customer Service Achievement Award

Mark Linvill
Senior Research Analyst
- Professional Achievement Award

Jeaneen Morris
Senior Administrative Assistant
- Professional Achievement Award

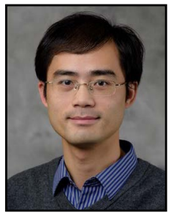
Mark Smith
Supervisor of Electronics Shop
- Outstanding Service Award

Steve Plunkett
Mechanical Technician
- Customer Service Achievement Award

FACULTY PROMOTIONS/PROFESSORSHIPS

Gabor Csathy
- Appointed Department Head

Dimitrios Giannios
- Promoted to Full Professor



Qi Zhou
- Promoted to Full Professor

FACULTY/STAFF YEARS OF SERVICE AWARDS

Gary Hudson
Demonstration Assistant
- 10 years in the Department

Chris Orr
UNIX Systems Administrator
- 10 years in the Department

Andrzej Lewicki
Assistant Department Head
- 30 years in the Department

MEMORIALS

Professor Sol Gartenhaus **January 3, 1929 - June 9, 2022**

Solomon Gartenhaus, Professor Emeritus of Purdue, passed away on June 9, 2022, at the age of 93 at Westminster Village, West Lafayette. He was born in Kassel, Germany on January 3, 1929, and immigrated to the U.S in 1937 with his mother, father, and four siblings. He graduated from South Philadelphia High School for Boys in 1947 and attended the University of Pennsylvania from 1947 to 1951 where he graduated Cum Laude with a Bachelor of Arts. He was accepted for graduate studies in physics at the University of Illinois in Urbana, where he received his M.S. in 1953 and his Ph.D. in 1955. He came to the Physics Department at Purdue as an Assistant Professor in 1958, following a three-year stint at Stanford University as an instructor.

Minxi Yang **Student**

Minxi Yang was a PhD student conducting research in the area of experimental particle physics. He passed away in August 2022. The Purdue University Board of Trustees awarded him a posthumous Doctor of Philosophy degree in Fall 2022.

K-12 OUTREACH:

PROMOTING STEM ACROSS THE WORLD AND TO ALL AGES

Written by: Boshra Afra, Assistant Department Head of the Department of Physics and Astronomy

The awareness and understanding of the importance of STEM education has been and still is on the rise around the globe. With tremendous opportunities in STEM careers and needs of nations for a STEM-educated diverse workforce, early exposure and inspiration of younger students in STEM subjects have become essential. Outreach activities play a critical role in this regard.

Purdue's Department of Physics and Astronomy's K-12 outreach programs have a great breadth and depth, and in the past 10 years have offered a wide range of opportunities for students of all ages. David Sederberg, the department's outreach coordinator, has brought the joy of STEM and the name of Purdue into the hearts and aspirations of young students and attracted a community of learners and trainers both at Purdue and beyond.

One of the outreach programs Sederberg initiated is called Saturday Morning Astro at Purdue (SMAP). The monthly program introduces seventh- through 12th-grade students and teachers to learning experiences that are not typically part of their regular classroom instruction. The popular in-person sessions brought in local participants to present a variety of experiments on topics, including the search for dark matter; optics, mirrors and telescopes; gravitational waves; and scaling the cosmos.

Due to the pandemic, in-person sessions became impossible, but Sederberg seized the opportunity of remote learning and even expanded the reach of SMAP. Within a year, the SMAP enrollment doubled, with participants joining from across the United States and from India, Thailand, China, Cambodia, Canada and Australia.

In addition to engaging and increasing the literacy of K-12 students, Sederberg also has been successful in involving students in the mission of outreach. A SMAP student visiting Purdue from Texas in summer 2021 had the chance to meet with Sederberg. The discussion led to a joint video presentation on the Doppler effect, which now has over 1,600 views on YouTube.

Sederberg recently expanded his outreach activities to Colombia when he brought his SMAP program to K-12 school students in Medellin via Zoom sessions. After the program, the San José de las Vegas School students reflected on the experience and summarized the impact of SMAP as positive and joyful. In addition to the students' enthusiasm for learning about exoplanets and the Stellarium app, they noted the excitement for learning and exploring that Sederberg and his team shared and inspired.

In concert with the College of Science, Sederberg runs multiple in-person and online teachers' workshops during the summer. He hosts teachers from across the country and provides lessons, pedagogy and assessment. The themed teacher workshops are built around multiple learning goals. For example, Sederberg recruited upper elementary and middle school teachers for a "Lazy Days" workshop, introducing 10 hands-on activities with which students experience Newton's laws.

A teacher who participated in the Lazy Days workshop said, "Thank you for sharing the PD [Professional Development] workshop video. I have so many applicable takeaways. Very rare that I can use everything from a PD. I really like the cake analogy. Especially the frosting = cross cutting concepts." The videos of the workshops are accessible on Sederberg's YouTube channel, and his comprehensive lesson plans and handouts are available on his website.

In addition to running several K-12 programs, having an active social media presence, supporting engagement with underserved communities and running service-learning courses, Sederberg also continuously supports faculty members with the broader impact of their research. This past year, he contributed to broader impact components and letters of endorsement for 13 faculty, at least two of whom submitted multiple proposals.

Sederberg also works closely with the physics and astronomy faculty and staff who actively participate in his programs and contribute to different presentations and workshops. He serves as a mentor for Purdue undergraduate and graduate students who share his passion of teaching and outreach for K-12 students. Sederberg's YouTube channel is full of examples of their impactful collaborations. He prides himself on successfully being able to leverage and bring together multiple shareholders to a common goal.

Gabor Csathy, professor and head of the Department of Physics and Astronomy, regards Sederberg as "an asset to the department, an enthusiastic and energetic educator, who has demonstrated that studying STEM subjects can be fun, creative and empowering. He has widely collaborated with faculty and staff at Purdue, as well as K-12 teachers and educators and facilitated delivery and access of STEM experiences and activities. He has inspired many students and consistently received appreciative feedback from teachers, parents and faculty. We are grateful for all David does for our department and are excited for his next outreach adventure."

David Sederberg in a video presentation on his Saturday Morning Astrophysics at Purdue YouTube channel.

During the summer of 2022, David Sederberg hosted students at the Purdue University Physics building in West Lafayette to have fun with physics. These middle school students received hands on experience with physics from students at Purdue University.

Prof. Gabor Csathy:
Leading the Department and Innovative Research

Prof. Gabor Csathy
Department Head,
Purdue University Department of Physics and Astronomy

Prof. Gabor Csathy has had an extremely productive year. He went from Interim Head to Department Head and still makes time for teaching and groundbreaking research. Below we feature his research as written by the Purdue University Office of Research.

Written by Mary Martialay,
Purdue University Office of Research

This article originally published by the Purdue Office of Research

Discovery of the 'bubble phase of composite fermions' confirms existence of a new family of quantum matter

WEST LAFAYETTE, Ind. – Like finding a hidden world, physicists dialing up the magnetic field on a semiconducting material have discovered the first in a new family of matter that flowers from the bizarre realm of the quantum scale. In what researchers dubbed the bubble phase of composite fermions, pairs of quasiparticles – particle-like entities arising from the interaction of particles – align in a crystalline pattern, allowing electricity to flow along the edge of the material.

The discovery represents a previously unobserved arrangement of composite fermions, which are entities that behave like particles and are formed from the interaction between electrons and magnetism. The bubble phase of composite fermions falls into a category of matter properly called topological insulators, which denotes that electricity flows only along the outer surface or edge of the material, while the cross-section does not conduct electricity. While dozens of topological insulators have been discovered by condensed matter physicists, the combined paired and periodic structure of the bubble phase represents an entirely new family or sub-category of "highly correlated topological phases" that had been theorized but not previously observed.

"As the first member of a new family of highly correlated topological phases, this new phase expands our understanding and offers a glimpse of the role of electronic interactions in generating higher order correlations in electronic systems," said Gabor Csathy, a Purdue University professor and head of the Department of Physics and Astronomy.

For the moment, the discovery, published recently in Nature Physics, is largely a curiosity. While future applications may be developed in areas like quantum computing and information storage, the search for topological insulators is driven by a spirit of exploration.

"Can we find more topological materials beyond what is known? And what will that teach us about the relationship between those topological phases," Csathy said. "It's a stimulating field, with a lot of new ideas that's building out what we can think of as almost a periodic table of matter."

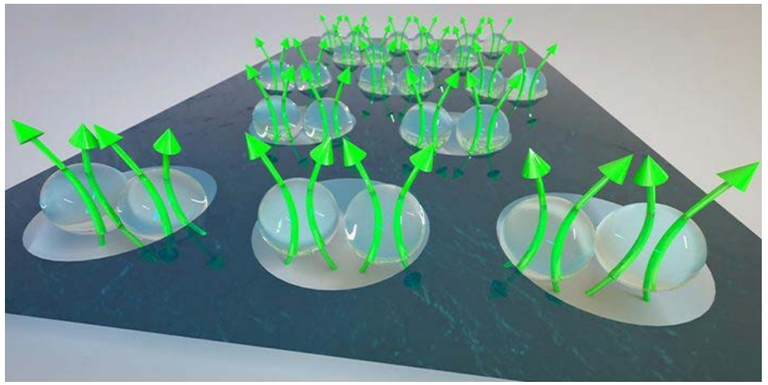
Csathy is an expert in cryogenic techniques that supercool materials for testing, which subdues matter to its least excited state and makes it easier to discern one individual electronic arrangement from another. Advances in cryogenic technology and techniques as well as the purity of testing materials made it possible to find this more obscure topological phase. To find the bubble phase, Csathy used an ultrapure wafer of gallium arsenide sandwiched between layers of aluminum gallium arsenide. A wafer about 16 square millimeters was prepared by collaborators led by Loren Pfeiffer, a Princeton University senior research scholar.

The sandwich construction of the wafer confines electrons to the gallium arsenide, effectively creating a single sheet of electrons, to which an electric current is applied. With the wafer cooled to 0.012 degrees Kelvin, Csathy increased magnetic field strength on the wafer while measuring current flow along, and resistance across, the sample. Two lines on a resulting graph show the gallium arsenide slipping in and out of previously known topological phases as the magnetic field strength rises. But at a magnetic field strength of about 7.76 Teslas, voltage along the wafer dropped to zero, revealing the new phase.

The known categories of topological insulators can be organized by increasing complexity. The simplest category can be envisioned by imagining the electron as carrying the electrical charge, with the charge equaling that of one electron. But one step up in complexity is a different story. In this category, the composite fermion – which arises from the collective interactions of electrons and magnetic flux quanta – carries the charge. At this point, described in physics as the fractional quantum Hall effect, it's helpful to think of the basic unit of electricity as an object charged with a fraction of the charge of an electron. And sure enough, even though that object, in this case the composite fermion, arises from the interaction of more than one electron, it carries only a fraction of an electron's charge.

Physicists have long predicted an even greater level of complexity, one in which a sufficient density of composite fermions would cause the quasiparticles themselves to interact, forming bunches or bubbles that align in a periodic pattern. Csáthy's discovery of the bubble phase of composite fermions proves the existence of this fundamental new type of highly correlated topological phase.

"Our experiment demonstrated that this regime of complex order is experimentally accessible by observing a new phenomenon, the so-called reentrance of the fractional quantum Hall effect," Csathy said.



The combined paired and periodic structure of the bubble phase of composite fermions represents an entirely new family of matter.

VIEW THE NATURE PHYSICS PUBLICATION HERE.

A highly correlated topological bubble phase of composite fermions

Vidhi Shingla, Haoyun Huang, Ashwani Kumar, Loren N. Pfeiffer, Kenneth W. West, Kirk W. Baldwin, & Gábor A. Csáthy

Nature Physics, February 2023 https://doi.org/10.1038/s41567-023-01939-2

For the latest news in research at the Purdue University Department of Physics and Astronomy, visit physics.purdue.edu/news

STEM students, like Faith Bergin pictured in the middle above, have found dance at Purdue University as a fun and creative outlet for marrying their sciences with the arts.

WHEN SCIENCE MEETS ART:

Dance steps lead Physics and Astronomy students to their own GIANT LEAPS

By Cheryl Pierce

Who better understands the conservation of angular momentum than a ballroom dancer performing a series of spins in tandem with a partner? That is a question posed by Faith Bergin, senior at Purdue University majoring in Physics with a Minor in Astronomy. She says that a large majority of the dancers on the Purdue Latin and Ballroom Dance Team (PLBDT) come from STEM backgrounds.

"To dance is to use a new language to interact with and understand the world. I think it makes me a much more creative and well-rounded thinker," explains Bergin. "I find that dancing can give me a new perspective on certain physics problems. In my experience, many who are in the STEM fields enjoy a good challenge, and dance is a challenge to the body as science is a challenge to the mind. Dance is extremely fulfilling creatively, and I think that attracts a lot of people who want to explore what they can do outside of their careers and studies. And the bonus is that it helps me stay in shape. The exercise can serve as a great stress reliever during exam season and can help me clear my head if I am particularly stuck on a homework problem."

There are many students in Physics and Astronomy who enjoy dancing. Aubrey Fuhrman, senior studying Physics, also finds that STEM students like her are drawn to dance.

"I think people in STEM are drawn to dance because it is an exciting way to both express artistry and stay healthy," she says. "Plus, there's no wrong way to do it! It's a great way to relieve mental and physical stresses, and it allows analytical thinkers an opportunity to branch out into more creative territories."

For students at Purdue, there are many avenues to explore the wide world of dance. Aubrey, who has chosen dance as a minor, studies dance through curriculum and competition. Students can also dance recreationally or competitively in student clubs, like Faith, who has now danced in over a dozen competitions while a student at Purdue.

Student dancers at Purdue may have been taking dance lessons since they were two, like Aubrey, or never have taken a dance class before Purdue like Faith. At any level of dance, there is a place for students who wish to enjoy dancing at Purdue.

Faith had a background in theatre in high school but was seeking an avenue to meet friends and enjoy dance when she happened upon a poster callout for PLBDT during her first semester in Fall 2019 and decided to check it out. Taking this small step has changed the trajectory of her course at Purdue. She now practices four days a week and dances competitively with the club. She has learned 19 different styles of ballroom and Latin dancing, including the tango, foxtrot, cha-cha, samba, rumba, and more. Her favorites are the Viennese waltz, samba, paso doble, and quickstep. The PLBDT competed at Nationals over Spring Break (March 17-19, 2023) in St. Louis, Missouri and placed first. Currently, Purdue is the top collegiate ballroom team in the United States!

"As many freshmen do, I was looking for a fun club to get involved in and make friends. I thought, why not try dancing, something I've always wanted to learn. I went to the callout showcase and after seeing the head coaches of the team, Daniel Dilley and Dr. Yuehwern Yih, professor of Industrial Engineering, perform an amazing rumba, I joined. After attending my first competition at the University of Illinois Urbana-Champaign in September 2019, I fell completely in love. I have danced in over a dozen competitions across the Midwest, including Ohio Star Ball, the largest Dancesport Competition in the United States, and the 2022 National Collegiate Dancesport Championships in Pittsburgh. Our team also hosts the Purdue Ballroom Classic, the largest collegiate competition in the Midwest, every fall semester. Aside from competing, we also host social dances that are purely for fun. We also go on team outings, and after competitions, we go to team dinners to celebrate our hard work. I've truly found a family with PLBDT. Some of my best friendships in the world were formed through the team. I've been able to meet people from all disciplines and across the Greater Lafayette community. I've loved every second, and I'm terribly sad to have to leave when I graduate in 2024."

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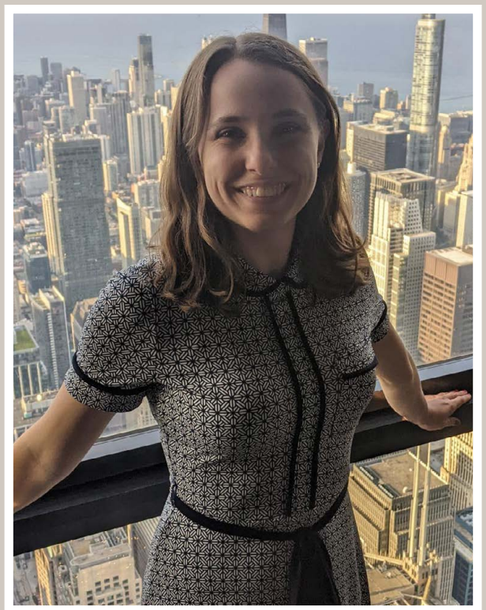
Faith Bergin, seen here accepting the Margie and Don Bottorff Physics Scholarship at a ceremony last year, has racked up medals for competitive dance. She is wearing three medals earned at 2022 Nationals which qualified her as a nationally ranked collegiate ballroom dancer.

Faith is currently involved with astrophysics research and in the Time Domain Astrophysics group headed by Dr. Danny Milisavljevic, assistant professor of Physics and Astronomy. After graduation, she plans to obtain a Ph.D. in Astrophysics and perhaps become a professor.

Aubrey was no stranger to dance when she came to Purdue. In fact, she had been dancing from a very young age and was part of a competitive dance company for ten years prior to arriving at Purdue.

"I am a dance minor, so I take classes through Purdue's Division of Dance," she explains. "I have been and am currently involved in XSeries through the Dance Division as a dancer, choreographer, assistant director (2020-2021), and co-director (2021-2022). I have also been involved in Higher Ground Dance Company for 5 semesters. When I am not on stage, I help stage manage Purdue Contemporary Dance Company's Concerts (2021 Winter Works and 2022 Winter Works before finals week!) I mainly study modern dance within the dance division. However, I am also trained in ballet, tap, improvisation, contemporary, jazz, and musical theater. Thankfully, at Purdue, there are so many opportunities for dancers and movers of every background. Even in the dance division, classes are open to people who have danced for 12 years or 12 days. I have made many friends through the groups I am involved in, and they are always excited to welcome new members. Newcomers can find new ways to learn about and express themselves through dance, and experienced dancers can find new challenges outside of their comfort zone."



Aubrey Fuhrman is senior studying Physics and has been dancing since she was two years old. She is minoring in Dance at Purdue.

Aubrey enjoys learning about sound waves and oscillations in her physics courses and plans to explore a career in Acoustic Consulting after she graduates. She said this field is about helping people understand and control the sound in their spaces or buildings.

Wherever a student starts in dance, there is a place for them to explore dance at Purdue. But what about those students who'd like to get involved but don't think they would be good at dance? Aubrey says there is a place for those students as well.

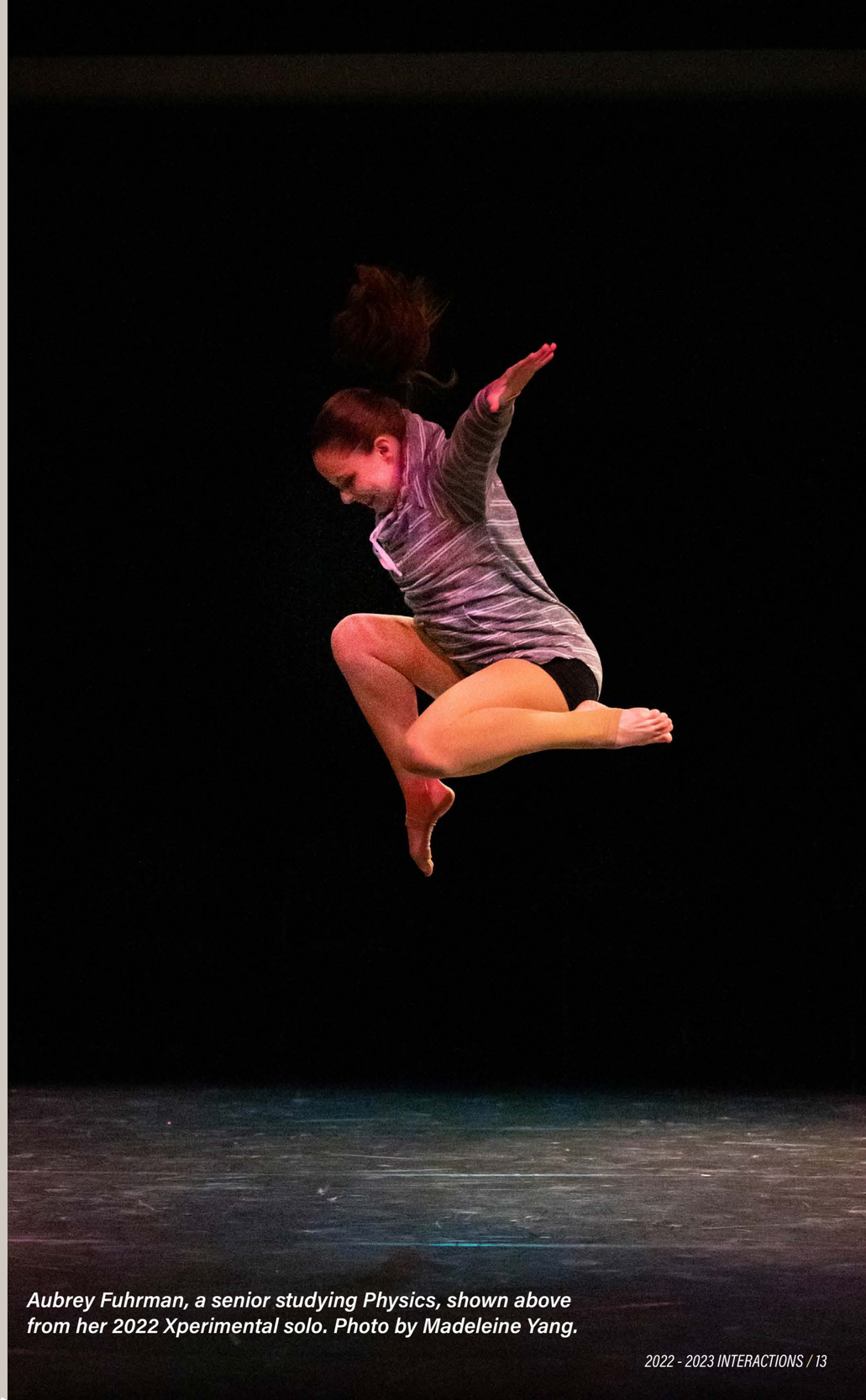
"If you want to be involved in dance, but you prefer the production side of it, there are so many opportunities here, too," she says. "Some clubs look for stage managers, light and sound operators, designers, organizers, etc! Not to mention, being an attentive, exciting audience member is such an important role in the world of dance as well! It's a great way to be involved in the world of dance if being on stage isn't your forte."

When asked about their fondest memory of dance at Purdue, both Faith and Aubrey had the same thing to say. It's simply too difficult to pick just one.

"Ugh, there are so many!" says Aubrey. "One of my most recent dancing memories was performing a self-choreographed solo in front of about 300 people for Xperimental 2022. I also fondly remember the support and love from my fellow dancers when I co-directed 2 dance concerts during the 2021-2022 school year. I also really enjoy the Higher Ground Dance Company showings because everyone is so excited and supportive of other people's work."

"It is so hard to pick just one!," says Faith. "I would say some of my fondest memories happened during Ohio Star Ball. For the collegiate sector, there is a portion of the competition known as Team Match, where one couple from each university is chosen to represent the school in 8 different dances (so 8 couples total) and compete to see which school comes out on top. I was chosen to dance the Team Match Samba with my dance partner. I was so nervous that I had to represent PLBDT! Once I stepped on the floor and the music started playing, I just got lost in the dancing and had so much fun! Everyone was cheering for me and I danced my heart out. Later on, when the awards were given out, Purdue got 2nd place out of over a dozen schools represented! It was so awesome to be a part of the team and celebrate that win with everyone who danced and with the whole team."

Is there a connection to small dance steps taking STEM students to giant leaps at Purdue University? There appears to be supporting evidence that says yes.



Aubrey Fuhrman, a senior studying Physics, shown above from her 2022 Xperimental solo. Photo by Madeleine Yang.

Student Spotlight: Jijun Chen

Taking the next giant leap into particle physics with tenacious Mu2e research

By Cheryl Pierce

Jijun Chen, a PhD student with Purdue Physics and Astronomy, knew from an early age that she wanted to be a scientist. She moved around the world to take her studies to a new level at Purdue University. Her research and thesis involve the Mu2e (Muon to electron) experiment at Fermilab National Accelerator Laboratory. The project is a search for Charged Lepton Flavor Violation at the level of 1 part in 1017. Jijun, who goes by JJ, is working on her thesis, "Normalization of the Charged Lepton Violation Experiment." She mainly focuses on simulating the particle reaction in the Mu2e experiment, which will eventually lead to more extensive experimentation at Fermilab (beginning in 2025).

"My research is about finding a lepton flavor number violation (non-conservation) process," she explains. "There are some particles that never undergo strong interaction. The first particle they found in this category is an electron, which has light mass. They call these kinds of particles lepton. Lepton literally means 'light.' Later, they found muon, tau particle and their corresponding neutrino that also belong to these lepton family. People found these family members always show up together in the process by some way, they called it as lepton flavor conservation. It is just like energy and momentum conservation; people always want to find some conservation in some process. My research focuses on finding charged lepton-flavor number violation (non-conservation) process."

Jijun, pictured above, conducts an experiment in the lab at Purdue.

JJ's research experiment will search for Beyond-the-Standard-Model, the neutrinoless conversion in the field of an aluminum nucleus, which is the Charged Lepton Flavor Violation (CLFV) process, with a single event sensitivity surpassing the current world's best limit by 10,000 times. Her thesis delves into the difficult process of counting the 1017 observed muons expected in the experiment... the experiment is sensitive to 1010 muon decays per second. This is the equivalent of more decays in a second than heart beats a person would have if they lived 300 years!

"To report a reliable result, the number of stopped muons will be normalized to 10% precision utilizing a combination of two γ-ray and one x-ray transitions," she says. "The first, directly proportional to the CLFV signal is the 1808.7 keV γ-ray emitted promptly in the muon capture process. The second, is the 346.8 keV x-ray emitted promptly from the 2p→1s muonic atomic transition in Al, from muon stops in the target. The third, is the 844 keV γ-ray from the β-decay. The stopped-muon rate measurement will use two complementary photon counting detectors. One of them, the LaBr3 detector, is capable of high-rate operation up to and above 800 kcps, with 0.7 % energy resolution. The other, the HPGe detector is capable of energy resolution of 0.1%, however, its rate capability is limited to an estimated ~100 kcps."

JJ is responsible for the design, modeling, and protection of the detector system used to count this very large number of muon decays. She has also given a public talk, "APS Division of Particles & Fields (DPF), July 12-14th 2021: Normalization of the Mu2e Charged Lepton Flavor Violation Experiment." Additionally, she is an author of two publications involving Mu2e:

- "arXiv, October 20, 2022: Mu2e Run I Sensitivity Projections for the Neutrinoless μ − → e − Conversion Search in Aluminum "https://arxiv.org/pdf/2210.11380.pdf
- "arXiv, October 5th 2021: Muχe - A Search for Familons in Muon Decay Using HPGe Detectors https://arxiv.org/abs/2110.02164".

She has made two presentations at the American Physical Society meetings regarding these publications. Last year she wrote 10 internal Mu2e technical notes and made weekly presentations to the Fermilab Stopping Target Monitoring Group, the Slow Controls Group, and participated in the Collaboration meetings.

JJ is also involved in experimental physics. She has performed two test beam experiments at the Helmholtz Zentrum Dredsen Rosendorf Laboratory in Germany. Due to the pandemic, there was no travel options, so JJ's tenacity shined through as she set up her experimentation remotely.

Jijun Chen, Purdue Physics and Astronomy PhD student

She is advised by Dr. David Koltick, who is a Professor of Physics and Astronomy, the Director of the Applied Physics Laboratory, and Coordinator of the Center for Science and Technology at Purdue University. According to him, the remote experimentation was quite difficult but highly successful.

"The laboratory was excited to have a remote experiment to prove that even during the pandemic the laboratory could continue to operate and produce physics," says Koltick. "Jijun was up to the demands being responsible for the data collection and working with the machine operators and technicians, to install the experiments, talking them through, how to operate the experiments, collect the data and preforming data checks, all remotely. No small task!"

Before coming to Purdue, she was a gifted scientist but wasn't well versed in the science of particle physics. She says Professor Koltick is very patient with students and suggests reading materials and experimentation that will help them be more versed in the science. She said he treats his students like family and will have the whole lab group out to his family farm. "Professor Koltick is very patient person with sense of humor," she says. "Around the bonfire, we would share our funny stories or meaningful memories in our life."

According to Koltick, JJ is, "an exceptional student in both her understanding of the theoretical and experimental aspects of elementary particle physics. During her time in our group, she has shown her deep excitement of physics. On the theoretical side, when she first joined the group, she demanded to have a reading course in theoretical physics in order to learn how to calculate elementary particle reaction rates starting from basic principles; meaning starting from Feynman Diagrams. Of course, her studies were excellent. And again, at the start of the pandemic, when the university was shut down, she demanded that I teach a course on Standard Model Gauge Theory. I agreed and to my surprise 24 Purdue physics graduate students from around the world wanted to participate. The course was very exciting as what better way to spend our time locked down than to study such a beautiful physics topic."

CONTINUES ON PAGE 15

JJ was born and raised in Shenzhen, China. It is the southernmost place in China and she describes the weather as being very much like Miami, Florida. She completed her bachelor's degree in Shenzhen and packed up to come to the United States for graduate school... Miami University. Miami University is nothing like Miami, Florida.

"Before I came here, I went to Miami University, it has a confusing name because it is in Oxford, Ohio. I received my master's degree in physics there. The first winter I was in Ohio, I thought I couldn't survive the coldness. West Lafayette is pretty much like Ohio: corn, cold, they are like brother and sister states."

After she gets her PhD with Purdue, JJ has big plans. She hopes to stay in the United State and would like to work with projects involving Artificial Intelligence and how it applies to an aging population. Then, when not tackling the not-so-small problem of curing the curse of aging, she'd like to write a novel in her spare time. If anyone can accomplish these goals, it's JJ Chen. This Boilermaker is using every opportunity at Purdue to make her own giant leaps in the scientific field.

"I think I Purdue is much like a fertile soil that if you work harder, you can gain more," she says. "I think behind each one's progress is hard-work and sacrifice. I know I will miss Purdue very much when I leave.

JJ, pictured above in a pink coat, is surrounded by her lab-mates and Professor Koltick's family at one of the visits to the Koltick family farm. Professor Koltick, pictured seated above at the left, treats his students like family.

PHYSICS & ASTRONOMY WELCOMES NEW FACULTY

Dr. Laimei Nie

Spring 2023 new faculty member

The Department of Physics and Astronomy at Purdue University welcomes a new member to the faculty in the spring of 2023, Dr. Laimei Nie. Nie is a condensed matter theorist who plans to further her investigative research here at Purdue.

"I am broadly interested in the quantum mechanical properties of systems with many particles, such as crystals and ultracold atomic gases," explains Nie. "Interesting behaviors tend to occur in both equilibrium and non-equilibrium states of the system when the particles are strongly interacting with each other, and/or when there is disorder (impurities). Previously I have worked on the equilibrium aspects, and currently my research is focused on characterizing non-equilibrium physics (dynamics) in such systems. Examples include chaotic dynamics, where initial information spreads very fast under the time evolution, and localization, where the degrees of freedom are frozen due to the interplay of interactions and disorder. Decoding these fascinating non-equilibrium phenomena will assist us in understanding and designing quantum materials and synthetic quantum matter. Furthermore, it is also connected to some of the most exciting recent developments in high energy physics and quantum information, including resolving the black hole information paradox and building quantum computers."

Nie is an assistant professor currently teaching PHYS 172 (Modern Mechanics) for engineering freshmen. In the future, she plans to teach specialized physics classes for both undergraduate physics majors and graduate students.

"I am excited to become a part of the team, working on pioneering discoveries, contributing to the education of students, and making a positive impact on the community," she says.

Originally from China, Nie attended undergraduate school, Tsinghua University, in Beijing, China. She then obtained her PhD from Stanford University in 2017 and has been conducting postdoctoral research in the Midwest United States. Her postdoctoral research was conducted at the Kadanoff Center for Theoretical Physics at the University of Chicago and the Institute for Condensed Matter Theory at the University of Illinois Urbana-Champaign. She began teaching and research at Purdue University in January of 2023.

"First and foremost, Purdue has a strong and collaborative community of researchers in condensed matter physics, equipped with cutting-edge facilities and resources," she says when asked about why she chose Purdue. "Moreover, the thriving communities in high energy, quantum information, and atomic physics at Purdue offer numerous opportunities for interdisciplinary collaborations. This dynamic and collaborative environment provides an ideal setting for me to further my career."

When not teaching or conducting research, Nie leads a full life of art and adventure. She enjoys a variety of outdoor activities like rock climbing and ultimate frisbee. She's also an amateur pianist.

"I have been fascinated by the beautiful mathematical structures behind some of the greatest pieces in classical music," says Nie.

The Department of Physics and Astronomy is excited that Nie will be taking her next giant leap onto the West Lafayette campus and looks forward to seeing her visions for condensed matter theory expand.

UNDERGRADUATE STUDENT AWARDS

Ramdas Award
Justin Copenhaver (nominated by Jukka Vayrynen)
The Ramdas Award award was establish in 2018 by Anant K. Ramdas, the Lark-Horovitz Distinguished Professor of Physics and his wife, Vasanti Ramdas. The purpose of the Ramdas Award is to recognize an exceptional senior who has completed a unique project in the Department of Physics and Astronomy.

Judith Peters Humnicky Award
Cameron Shane, Nicholas Sylvester, Erin Smith, Grace Katz, and Amelia Binau
Judith Peters Humnicky was relentless in pursuit of her goals and this award honors her memory by recognizing the persistence, diligence, and hard work necessary to obtain an undergraduate degree in physics and enhances the gender diversity of among the Department's undergraduates. This award is made possible due to the generosity of Mr. Michael Humnicky (BS1970).

Spira Undergraduate Summer Research Award
Bianca Caminada
This award supports one or more students working on a research project under the supervision of a faculty member in the Department of Physics and Astronomy and/or the Department of Mathematics. The Spira Summer Research Award is made possible thanks to the generosity of Dr. Joel S. (BS1948) and Mrs. Ruth R. Spira.

Lijuan Wang Memorial Award
Bianca Caminada (nominated by Ken Ritchie)
Meenakshi McNamara (nominated by Andreas Jung)
The Lijuan Wang Memorial award is given annually to one or more outstanding undergraduate physics majors who promote the gender diversity of the department through participation in Women in Physics. Lijuan Wang was a graduate student in the department from 1989 until her untimely death in 1992.

Ralph Lefler Memorial Award
Benjamin D. Simon (nominated by Miaoyuan Liu)
Alan Jeffrey Wright (nominated by David Sederberg)
This award recognizes outstanding undergraduate students in the Department of Physics and Astronomy who have demonstrated interest or commitment in teaching K-12 programs after graduation. The award also recognizes students who significantly contribute to Physics and Astronomy outreach programs offered to K-12 students. Professor Ralph Lefler was a pioneer of physics education at Purdue and the Ralph Lefler Memorial Award is made possible due to the generosity of a group of his former students.

Frederik J. Belinfante Scholarship in Physics
Colton Griffin
This scholarship recognizes outstanding physics upperclassmen. The scholarship is possible due to the generosity of Dr. Robert Newcomb (BS 1955).

Shalim and Paula Sargis Memorial Scholarship
Gabriel Skowronek
The Sargis Scholarship recognizes a physics upperclassman from outside the state of Indiana who also graduated from a U.S. high school. This scholarship is made possible due to the generosity of Dr. James Sargis (BS 1958).

David G. Seiler Physics Scholarship
Grace Francis
The Seiler Scholarship recognizes an outstanding physics upperclassman who is involved in Women in Science or Women in Physics programs. This scholarship is possible due to the generosity of Dr. David G. Seiler (PhD 1969).

Arthur N. Pozner Memorial Scholarship
Meenakshi McNamara
This scholarship recognizes outstanding physics upperclassmen. The scholarship is possible due to the generosity of the Arthur N. Pozner Trust.

Kenneth S. and Paula D. Krane Physics Scholarship
Leland Bednarz and Gabriel Goodwin
The Krane Scholarship recognizes outstanding physics upperclassmen. The scholarship is possible due to the generosity of Dr. Kenneth S. (PhD 1970) and Mrs. Paula D. Krane.

Robert L. Mieher Physics Scholarship
Joshua Friedman
The Mieher Scholarship recognizes outstanding physics upperclassmen and is made possible through the generosity of Dr. Edward B. and Dr. Barbara A. Hale.

Margie and Don Bottorff Undergraduate Physics Scholarship
Faith K. Bergin and Braden L. Garretson
The Bottorff Scholarship is made possible by a gift from Ms. Celeste Bottorff (MS 1975). The scholarship is a 1-year award made to outstanding physics upperclassmen.

COLLEGE OF SCIENCE AND EXTERNAL AWARDS

Barry Goldwater Scholarship
Colton Griffin (2022)
Arianna Meenakshi McNamara (2022)

College of Science Ambassadors Graduating Seniors
Allison Earnhardt
Nicole Osborn

College of Science Championing Diversity Award
Claire Landgraf

The Astronaut Scholarship
Arianna Meenakshi McNamara (2022)

College of Science Honors Convocation Student Honorees
Jaiveer Dutta - Freshman
Meenakshi McNamara - Sophomore
Colton Griffin - Junior
Justin Copenhaver - Senior

NSF Graduate Research Fellowship Program (GRFP)
Allison Earnhardt
Swagat Bhattacharyya

Undergraduate Merit Scholarship
Chandler Albright
Peter Salisbury
Bahaa Elshimy
Ashley Ortiz
Amit Rajapurohita
Danny Kim

CONGRATS!

GRADUATE STUDENT AWARDS

Ramdas Prize in Honor of Professor CV Raman
Dr. Abigail Kopec
(Nominated by Rafael Lang)
The Raman Prize recognizes a Ph.D. student or recent alumni for their outstanding dissertation. The award was made possible through the generosity of Anant K. Ramdas, the Lark-Horovitz Distinguished Professor of Physics and Astronomy (emeritus), and his wife Vasanti Ramdas.

Karl Lark-Horovitz Award
Chenwei Lv (nominated by Qi Zhou)
Our Department's most prestigious graduate student honor, the Lark-Horovitz Award recognizes outstanding research accomplishments. The award is possible through the generosity of the faculty as well as the family, friends, and associates of Prof. Lark-Horovitz in memory of his great contribution to the growth and development of the Department of Physics and Astronomy.

Gabriele F. Giuliani Award
Jared Newton (nominated by Anderzej Lewicki)
Established in 2013 in memory of Prof. Gabriele F. Giuliani, this award honors excellence in teaching by first- or second-year graduate students. These graduate students show dedication and dependability, and, like Professor Giuliani, demonstrate a passion for physics that contributes to a rich learning environment.

George W. Tautfest Award
Keiichiro Furuya (nominated by Nima Lashkari)
Dmitry Kondratyev (nominated by Norbert Neumeister)
This award honors outstanding physics graduate students in high energy particle physics, high energy nuclear physics, or astrophysics. Prof. Tautfest was the leader of the Purdue High Energy Physics group until his death in 1967 at age 41. The award was established in 1969 by his colleagues and the Purdue Alumni Foundation.

H. Y. Fan Award
Sean Myers (nominated by Gabor Csathy)
The Fan Award recognizes outstanding graduate research in condensed matter physics, biological physics, or AMO physics. The award was established in recognition of Prof. Fan's many contributions to condensed matter physics, particularly in the area of infrared studies of semiconductors, and to the Department of Physics and Astronomy.

Charlotte Ida Litman Tubis Award
Amanda Depoian-Baxter
The Charlotte Ida Litman Tubis Award was established in her memory by her husband, Prof. Emeritus Arnold Tubis, to promote clear and concise communication of scientific ideas beyond the physics and astronomy community.

Dr. Warner Black Award
Francis Walz (nominated by Niranjan Shivaram)
The Black Award recognizes graduate students whose research has the potential to bring physics to the people and to help them improve their lives by using a deep knowledge of fundamental and applied physics to make practical and useful inventions that have a real and lasting impact.

Edward S. Akeley Award
Keiichiro Furuya (nominated by Nima Lashkari)
This award recognizes outstanding physics graduate students in theoretical physicists. The Akeley Award is made possible through the generosity of Instructor Emeritus Anna M. Akeley.

Akeley-Mandler Award for Teaching Excellence
Dewan Woods (nominated by Andrezej Lewicki)
The Akeley-Mandler Award recognizes exceptional graduate student teaching assistants who excel beyond the mere requirements of the job, investing their effort to ensure that they provide the best education possible to their students. This award is made possible thanks to a gift made by Instructor Emeritus Anna Akeley in memory of her husband, Prof. Edward S. Akeley, and brother, Kurt Mandler.

Lijuan Wang Memorial Awards
Kiranmayi Dixit (nominated by Arnab Banerjee)
Norhan Eassa (nominated by Arnab Banerjee)
Amanda Depoian-Baxter (nominated by Rafael Lang)
The Lijuan Wang Memorial award is given annually to one or more outstanding graduate student majors who promote the gender diversity of the department through participation in Women in Physics. Lijuan Wang was a graduate student in the department from 1989 until her untimely death in 1992.

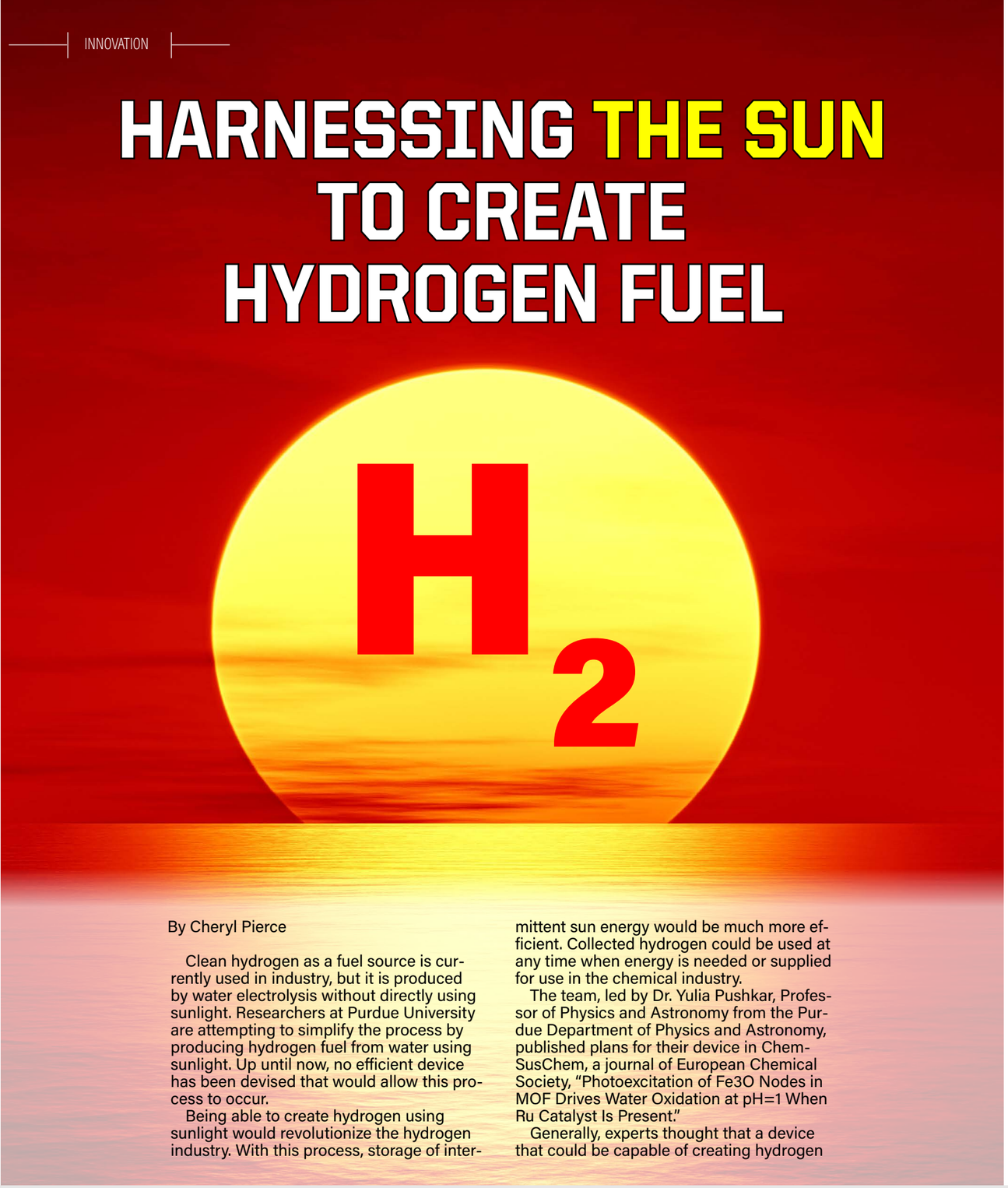
Rolf Scharenberg Graduate Summer Research Fellowship
Danielle Dickinson (nominated by Danny Milisavljevic)
Sai Satyam Samal (nominated by Jukka Vayrynen)
Hongshan Xu (nominated by Miaoyuan Liu)
This Fellowship was established in 2017 through the generosity of Wendell and Nancy Lutz and allows 1st- or 2nd-year graduate students to work with a research advisor for a summer prior to joining a research group permanently.

Teaching Academy Graduate Teaching Award for Physics and Astronomy
Amanda Depoian-Baxter | Robert Orlando
This award honors graduate students with teaching responsibilities from across campus for their dedication to Purdue students and their outstanding teaching contributions.

Lee Osheroff Richardson (LOR) Science Prize
Dr. James Nakamura
(PhD Advisor: Prof. Michael Manfra) James is recognized for the first direct observation of anyonic braiding statistics for quasiparticles at the v=1/3 fractional quantum Hall state. The Lee Osheroff Richardson Science Prize promotes and recognizes the novel work of young scientists working in the fields of low temperatures and/or high magnetic fields or surface science in North and South America.

Springer Thesis Awards
Dr. Cheng-An Chen
(PhD Advisor: Prof. Chen-Lung Hung) Thesis: Probing Nonequilibrium Dynamics in Two Dimensional Quantum Gases. The series "Springer Theses" brings together a selection of the very best Ph.D. theses from around the world and across the physical sciences.

HARNESSING THE SUN TO CREATE HYDROGEN FUEL



By Cheryl Pierce

Clean hydrogen as a fuel source is currently used in industry, but it is produced by water electrolysis without directly using sunlight. Researchers at Purdue University are attempting to simplify the process by producing hydrogen fuel from water using sunlight. Up until now, no efficient device has been devised that would allow this process to occur.

Being able to create hydrogen using sunlight would revolutionize the hydrogen industry. With this process, storage of intermittent sun energy would be much more efficient. Collected hydrogen could be used at any time when energy is needed or supplied for use in the chemical industry.

The team, led by Dr. Yulia Pushkar, Professor of Physics and Astronomy from the Purdue Department of Physics and Astronomy, published plans for their device in ChemSusChem, a journal of European Chemical Society, "Photoexcitation of Fe3O Nodes in MOF Drives Water Oxidation at pH=1 When Ru Catalyst Is Present."

Generally, experts thought that a device that could be capable of creating hydrogen on industrial scale would operate at pH=1 similar to most efficient proton exchange membrane (PEM) electrolizers. However, the device conceptualized at Purdue uses light driven water splitting at pH=1. This is possible due to suitable materials in the device which would be both active with visible light and stable at pH=1.

The research team consisted mostly of researchers from Pushkar's lab. Dr. Roman Ezhov, postdoctoral research associate, led the study while Dr. Alireza Ravari, former graduate student, helped with laser-based measurements. Dr. Sergei Savikhin, Professor of Physics and Astronomy from the Purdue Department of Physics and Astronomy, provided access to femtosecond laser system. Alexander Loomis, former undergraduate student at Purdue, also helped conduct research. Researchers outside of Purdue included Argonne Scientist, Debora M. Meira, who assisted with remote data collection at Advanced Photon Source and Dr. Mark Palenik, Purdue Physics and Astronomy alumnus, who is a long term theoretical collaborator on the project.

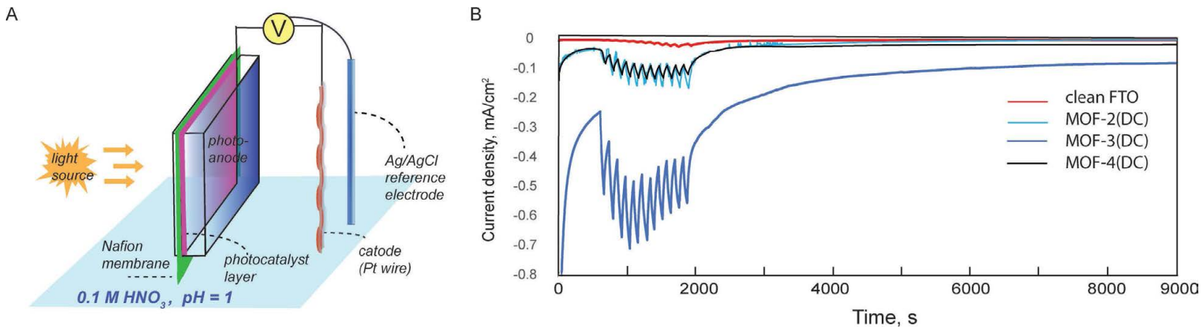
"We learn from natural photosynthesis which converts the sunlight into chemical fuels," says Pushkar. "Here we have Metal organic framework (MOF) material which works like Lego bricks. We put together chlorophyll analog = Fe3O node and photosystem II active center analog = molecular Ru catalysts. When we shine light, they work together like in the photosynthetic protein and split water into O2, protons and electrons. But the MOF system is much more stable than a protein as it is a 3-dimentional porous material. Electrons ripped off water molecules are passed through the wire and combine with protons on cathode to make hydrogen."

According to Pushkar, one industry that might be drastically changed by a usable device that harnesses the power of the sun to create hydrogen is the fertilizer industry. She says the production of fertilizers currently use "dirty and unsustainable" hydrogen generated from breaking methane (natural gas, CH4, note also price fluctuations).

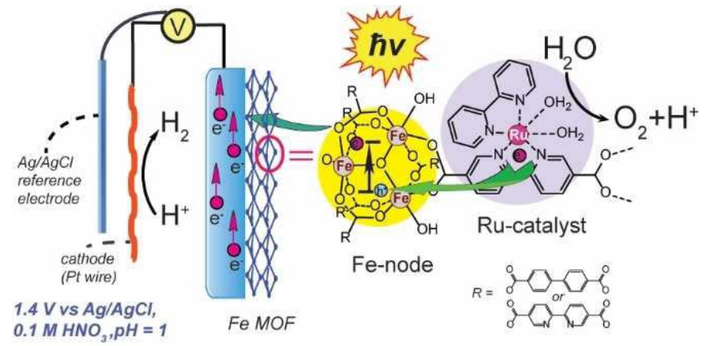
The next giant leap in hydrogen creation is an ongoing work in progress. Pushkar's lab continues to work on this device in the experimental phase. Purdue researchers have been working on this issue since 2008 and this is the first viable device created.

"All prior systems we researched were too far removed from any hope of practical applications," says Pushkar. "Purdue allowed the team to start a long-time collaboration with former PhD graduate Dr. Palenik and to work with the Savikhin lab which allows for additional spectroscopic characterization."

Funding for this research is provided by the National Science Foundation and is on-going (CHE-2155060).



Above is a sketch of the device conceptualized at Purdue. To the left, photo-anode material absorbs light and evolves oxygen; Nafion membrane transports protons; Pt cathode generates hydrogen which can be easily collected. On the right, current through the device is measured. Light/dark cycles (1 minute light/1 minute dark) show how material response to light can be improved via photoanode engineering.



Above is the proposed mechanism of the light-induced function of the Ru-doped Fe-based Metal Organic Framework photoanode.

[VIEW THE ChemSusChem PUBLICATION HERE.]

Photoexcitation of Fe3O Nodes in MOF Drives Water Oxidation at pH=1 When Ru Catalyst Is Present

Dr. Roman Ezhov, Dr. Alireza K. Ravari, Dr. Mark Palenik, Alexander Loomis, Dr. Debora M. Meira, Dr. Sergei Savikhin, Dr. Yulia Pushkar

First published: 07 December 2022 https://doi.org/10.1002/cssc.202202124

For the latest news in research at the Purdue University Department of Physics and Astronomy, visit physics.purdue.edu/news

Sun photo by Adobe.

Alumnus Spotlight: Nick Edison, Ph.D.

Purdue education opened up a world of travel and experiences for Purdue alumnus

Dr. Nick Edison, Purdue Physics alumnus, recently came to the West Lafayette campus to speak with students in the PHYS 235 class. Dr. Edison enjoys mentoring and comes back often to help next generation of Boilermakers prepare to make their own giant leaps.

Although he graduated Purdue University in 1985, Dr. Nick Edison is a familiar element in the halls of the Physics Building at Purdue University. He loves returning to campus and routinely meets with students and faculty, often advising students. He is welcomed back annually to mentor the next generation of Boilermakers.

"I love returning to campus either for a sports event or to meet with students and faculty," says Nick Edison, Ph.D., who is a Senior Scientist at Naval Surface Warfare Center, Crane Division (NSWC Crane). "I try to catch one football and one basketball game every year as well as meet with the PHYS235 class."

Dr. Edison credits his undergraduate degree with Purdue Physics as a steppingstone that opened up the world to him. His degree and subsequent education has allowed him to travel the world. He arrived at Purdue University in the fall of 1981 and graduated in 1985 with a B.S. in physics. This led to acceptance in the Applied Science Department in the University of California, Davis and a Department of Energy Fellowship at Lawrence Livermore National Laboratory leading to a Ph.D. in plasma physics. He grew up in South Bend, IN and currently lives in Bloomington, IN which he affectionately calls "enemy territory."

"My physics degree from Purdue has opened up a world of travel and experience that I never would have dreamed of as a student," he says. "In the course of work, I have had the pleasure to visit many interesting and beautiful places and people all over the world including France, the UK, Germany, Siberia, Italy, Norway, and the list goes on."

At the Naval Surface Warfare Center, Crane Division, Edison works with hardware-in-the-loop simulators. The simulators are used to economically evaluate the operation of hardware and software prior to deploying material in fielded systems. He also enjoys mentoring young scientists and engineers. His goal with mentoring is to help these young people become highly valuable employees who will eventually become leaders and experts in their fields research.

"All of the roles that I have had since graduating Purdue have been a combination of physics and engineering. My work is highly technical and requires a good understanding of the basics of physics especially mechanics, optics, heat, and thermodynamics," says Edison.

He finds that he often uses lessons he learned at the undergraduate level in his day-to-day life.

"I have found that even the simplest of physics concepts can be used to understand the operation of many complex systems," he says. "For example, the simple physics behind parallel wires carrying current interact with their mutual magnetic fields describes how the high current discharges in the Z-machine produce extremely energetic implosions."

While at Purdue, Edison was advised by Prof. Arnold Tubis and Prof. Nicholas Giordano, both of which are now emeritus faculty and once chaired the Physics Department. Prof. Giordano advised his senior research project which later resulted in a paper published in the Journal of Low Temperature Physics.

When asked what advice he would give to current Purdue students studying Physics, he says, "I hope that the reason you are studying physics is because you love the subject and want to learn what makes the universe go. I came to Purdue wanting to make a career in particle physics or astronomy. During my sophomore year, I fell in love with light and the magical things you can do with lasers. There are so many interesting fields that involve physics that you should never be at a loss finding something new to investigate. Purdue is a highly recognized institution around the world. Use that to your advantage in pursuing employment and graduate level education. After graduating, be flexible and creative in how you approach employment. Not all paths lead to academics. Lots of jobs out in the real world ask for a particular degree that can easily be performed with a solid background in physics. Most of my post-doctoral employment has involved engineering to one degree or another."

While at Purdue as an undergrad, Edison formed many fond memories. He participated in intramural sports at Wiley Hall and Harrison Hall. He spent a year in the Army ROTC and participated on the AROTC rifle team club.

"I have many fond memories of student life at Purdue, selecting among them is difficult," says Edison. "However, during my freshman year at a home football game, I was searching for one of my high school friends on the field. Instead, I discovered a different friend that I played high school football with suited-up as a back-up safety. The following year I was thrilled to see another classmate on the sidelines cheering Purdue on as a member of the Pep Squad. It was really exciting seeing students from my high school performing in visible roles for the University."

Alumnus Spotlight: Nate Essington

Converting a love of physics and space systems into a fulfilling career

Alumnus Nate Essington took a longer path toward getting his physics degree. After graduating high school from Westfield, Indiana, he enlisted in the military as a Space Systems Operator, which is now operating under the Space Force umbrella of the United States military. He spent nine years on Active Duty then decided to come to Purdue University in 2015 to further his career path in space systems. He received a BS in Applied Physics in 2019 from the Department of Physics and Astronomy.

He gained extensive knowledge with his military and university experiences and reshaped this into a career. He currently works for Raytheon Technologies. He was hired in as a Radar Systems Engineer and is now working as a Space Systems Engineer.

He says that he uses his physics knowledge gathered at Purdue in his current role. Essington makes it a point to return to campus quarterly and finds ways to help give back to the students at Purdue. He mentors the student organization Purdue Orbital and has done so for a few years now.

He has advice for students who are approaching their entry into the work force.

"Use your Purdue Alumni network to find and land jobs," he says. "When you graduate, apply to jobs and grad school. Select the best combination of circumstances for your situation. The world doesn't owe you anything you have to find the opportunity and make it happen."

He goes on to say that students should always research, then ask and find answers to their own questions. "This will make you a subject matter expert," he says.

Essington really enjoyed his time at Purdue University and credits Undergraduate Advisor Janice Thomaz as one of his best influences while a student. He also enjoyed student life and working with on-campus military groups.

"Studying with friends was always fun," he says. "Doing Research with professors was fantastic. I supported the veteran's organization for the entire time that I was at Purdue. Working with veterans and their issues was both challenging and rewarding."

Being a recent alumnus, the future looks bright for Essington. The Department of Physics and Astronomy looks forward following his next Giant Leaps.

Nate Essington
Raytheon Technologies
Space Systems Engineer

SAVE THE DATE!

APRIL 26, 2023

PURDUE DAY OF GIVING 04 | 26 | 23

BE PART OF THE NEXT GIANT LEAP

This April 26 is more than just another day — it's a day to note the incredible impact of 10 years of giving back, 10 years of paying it forward, 10 years of opportunities granted, and 10 years of making giant leaps for Purdue! Join Purdue alumni and students, friends and family, faculty, staff, retirees, and fans from West Lafayette, across the country, and around the globe, as we come together to celebrate the 10th annual Purdue Day of Giving — and be part of Purdue's next giant leap!

HELP YOUR FAVORITE UNIT AS YOU HELP PURDUE!

On Purdue Day of Giving, donation and participation leaderboards as well as hourly and full-day challenges will give you dozens of chances to win bonus funds that can push your favorite unit (campus, college, school, program, or student organization) to the top!

Scholarship Endowment Spotlight: The Frederick P. Longwell Memorial Endowment

Edmonds family honors memory of Frederick Paul Longwell (alumnus 1942) with endowment to Purdue Physics and Astronomy

By Cheryl Pierce

Frederick Paul Longwell graduated from Purdue University in 1942 and went on to have an illustrious career as an optical engineer. As a tribute to Frederick, his family has created the Frederick P. Longwell Memorial Endowment to honor him. His daughter, Ruth Edmonds and her husband Ted Edmonds created this gift to the Purdue University Department of Physics and Astronomy to honor his commitment to secondary education. The newly created "Frederick P. Longwell Memorial Scholarship" will allow future Boilermakers to obtain scholarships in perpetuity to help them create their own giant leaps.

Longwell, born in rural Pennsylvania in 1919, was the first in his family to attend college. He worked for two years after graduating from high school in upstate New York to afford a college education. Torn between the humanities and science, he made the choice to major in Physics and become a scientist. During his career as an optical engineer, he worked for multiple esteemed institutions such as Bell Labs, Hughes Aircraft, Martin Marietta, and Chrysler.

According to his family, he well understood the value of higher education. He remembered with gratitude his four years at Purdue University and graduated in 1942. He appreciated the ideals and economy of a land grant university. This life changing experience is an American value he would want to support for future generations.

While his career remained in science and engineering, his interests always bridged the chasm he identified as CP Snow's "two cultures," the divergence between science and the humanities in institutions of learning. His family lovingly refers to him as a gifted writer with a sharp wit and say that his interest in the classics ensured that his family embraced correct language and classic literature.

Frederick was a family man. He and his wife Margaret prioritized the education of their five children. Ted and Ruth Edmonds wanted to honor his commitment to education by setting up this endowment. This gift is greatly appreciated by the Department of Physics and Astronomy and will aid an untold number of Boilermakers prioritized their own education with supplementary funding.

Frederick Paul Longwell

Recent publications from the Purdue University Department of Physics and Astronomy

The Department of Physics and Astronomy is constantly pushing the limits of the world's collective knowledge of our physical world. Our faculty persistently pursues the next giant leap in our sciences and publishes their findings in scholarly journals and publications. Below is a sampling of the works published by our faculty in the past year. These are listed alphabetically by faculty's last name.

HADISEH ALAEIAN
- Magnetic Phases of Spatially-Modualted Spin-1 Chains in Rydberg Excitons: Classical and Quantum Simulations, M. Sajjan, H. Alaeian, and S. Kais, J. Chem. Phys. 157, 22411 (2022) [https://arxiv.org/abs/2209.11881]
- Purcell-enhanced dipolar interaction in nanostructures, A. Skljarow, H. Kübler, C. S. Adams, T. Pfau, R. L w, and H. Alaeian, Phys. Rev. Research 4, 023073 (2022) [https://arxiv.org/abs/2112.11175]
- Exact multistability and dissipative time crystals in interacting fermionic lattices, H. Alaeian and B. Buca, Commun. Phys. 5, 318 (2022) [https://arxiv.org/abs/2202.09369] (behind the paper Nature blog post about the results)

ERICA CARLSON
- Basak, M. Alzate Banguero, L. Burzawa, F. Simmons, P. Salev, I. K. Schuller, M.M. Qazilbash, D. N. Basov, L. Aigouy, A. Zimmers, and E. W. Carlson, "Deep Learning Hamiltonians from Disordered Image Data in Quantum Materials," arXiv:2211.01490 (2022).
- C.-L. Song, E. J. Main, F. Simmons, S. Liu, B. Phillabaum, K. A. Dahmen, E. W. Hudson, J. E. Hoffman, E. W. Carlson, "Critical Nematic Correlations Throughout the Superconducting Doping Range in BSCO" arXiv:2111.05389 (2021).
- Liu, E. W. Carlson, and K. A. Dahmen, "Connecting complex electronic pattern formation to critical exponents," Condensed Matter 6, 39 (2021).

DIMITRIOS GIANNIOS
- Maria Petropoulou, Philippos Psarras, and Dimitrios Giannios, "Hadronic signatures from magnetically dominated baryon-loaded AGN jets", MNRAS, 518, 2719 (2023)
- Zacharias Davis, Jesus Rueda-Becerril, and Dimitrios Giannios, "Balancing turbulent heating with radiative cooling in blazars", MNRAS, 513, 5766 (2022)
- Haocheng Zhang, Xiaocan Li, Dimitrios Giannios, et al., "Radiation and Polarization Signatures from Magnetic Reconnection in Relativistic Jets. II", ApJ, 924, 90 (2022)

CHRIS GREENE
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DEGREE RECIPIENTS

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Michael N. Agrillo, Bachelor of Science
Moira L. Andrews, Bachelor of Science
Swagat Bhattacharyya, Bachelor of Science
Grace J. Bowling, Bachelor of Science
Braden R. Burdette, Bachelor of Science
DongPing Chen, Bachelor of Science
Cameron T. Chevrier, Bachelor of Science
Justin M. Copenhaver, Bachelor of Science
Nicolas Cubides Ospina, Bachelor of Science
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Rhys C. Dudzik, Bachelor of Science
Daniel Echeverry, Bachelor of Science
Isaiah J. Ertel, Bachelor of Science
Darrell L. Fischer, Bachelor of Science
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Jeremy T. Frederick, Bachelor of Science
Emerson N. Halbleib, Bachelor of Science
Ethan C. Halloran, Bachelor of Science
Stephen P. Hardin, Bachelor of Science
Benjamin J. Hartings, Bachelor of Science
Liam M. Hunsberger, Bachelor of Science
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Yun Huang, Doctor of Philosophy
Liyang Jiang, Doctor of Philosophy
Jeremy M. Munsell, Doctor of Philosophy
Arindam Nandi, Doctor of Philosophy
Trang T. Nguyen, Doctor of Philosophy
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Allison N. Earnhardt, Bachelor of Science
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John D. Banovetz, Doctor of Philosophy
Tzu-Han Chang, Doctor of Philosophy
Lingyi Dong, Doctor of Philosophy
Brandon W. Dzuba, Doctor of Philosophy
Rishabh Khare, Doctor of Philosophy
Chenwei Lv, Doctor of Philosophy
Sean A. Myers, Doctor of Philosophy
Dewan J. Woods, Doctor of Philosophy
Zhujing Xu, Doctor of Philosophy
Kui Zhang, Doctor of Philosophy
Ming Zhu, Doctor of Philosophy
Irakli Giorgadze, Master of Science
Guga Khundzakishvili, Master of Science

FALL 2022
Austin C. Beasley, Bachelor of Science
Benjamin D. Simon, Bachelor of Science
Yuting Wei, Bachelor of Science
Kunal R. Zalani, Bachelor of Science
Amanda L. Baxter, Doctor of Philosophy
Yu-Hsin Chen, Doctor of Philosophy
Zhen Hua, Doctor of Philosophy
Shihua Huang, Doctor of Philosophy
Dmitry Kondratyev, Doctor of Philosophy
Junxu Li, Doctor of Philosophy
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Soutick Saha, Doctor of Philosophy
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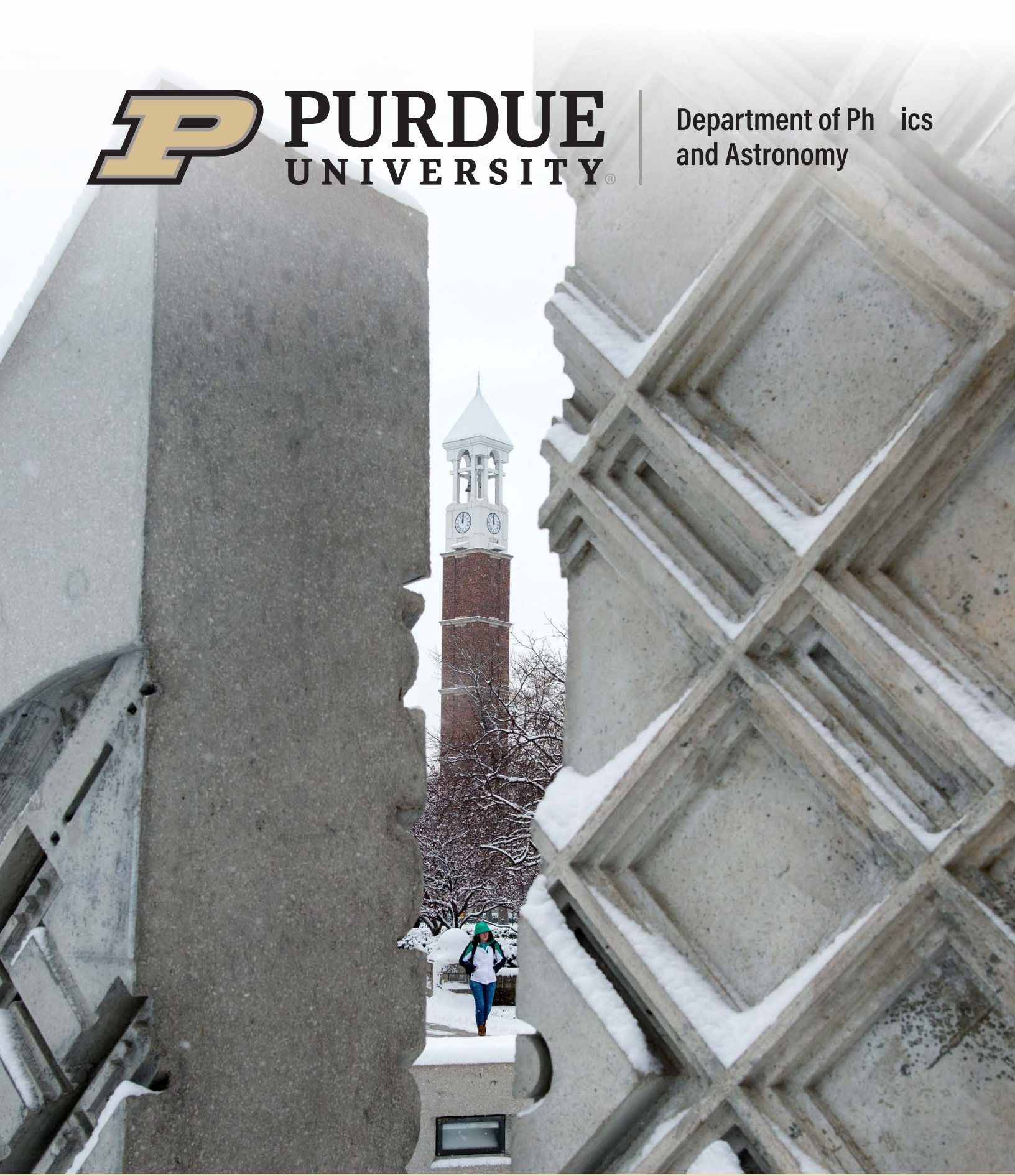

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