INTERACTIONS

THE DEPARTMENT OF **PHYSICS** AND **ASTRONOMY** 2024 - 2025

From Particle Physics to Industry Success: Professor Andreas Jung's Impact at CERN and Beyond

Professor Andreas Jung is making waves in both cutting-edge research and industry innovation. As a key contributor to CERN's Compact Muon Solenoid (CMS) detector, he and his team have played a crucial role in advancing our understanding of particle physics.

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MESSAGE from the HEAD

Hello Boilermakers!

We have had an amazing year in Physics and Astronomy. The Department continues to ascend in our sciences and work as a collaborative unit. We continue to produce outstanding science and to attract significant funding resources.

We are celebrating the International Year of Quantum Science and Technology, and we are highlighting our achievements in this field. We are proud of the recent results from Microsoft Quantum West Lafayette and recognize larger grants our PQSEI-affiliated faculty are involved in, such as the DOE funded Quantum Science Center and the NSF-funded Center for Quantum Technologies. Furthermore, our faculty play leadership roles in two recently awarded prestigious Keck Foundation Grants in the quantum area.

We are also celebrating outstanding research, such as those resulting from tracking mercury in the mammalian brains and a host of new results enabled by the James Webb Space Telescope which expand our understanding of the universe. Our outreach program continues to impress in mid-central Indiana but also went all the way to Colombia this past year to spread our love of astrophysics to children around the world. Furthermore, we are recognizing new funding secured from the DOE for the CMS Experiment, another large grant for work on relativistic heavy ion collisions and for geomechanics research funded by the Pacific Northwest National Laboratory and the DOE.

With our highs also came sorrow this year as we said goodbye to faculty who have passed such as my predecessor, Professor John Finley. Although he has passed, we will always feel his presence in our classrooms, halls and labs, and at our Colloquia.

In this edition of Interactions, we present you with this snapshot of our department, but there is so much happening it is difficult to contain in one newsletter. Our faculty members are constantly devising new ways to keep the public informed. Whether it is publishing a new book about interference, starting an astrophysics podcast, creating a website and videos for quantum physics, or working with media to help lay audiences understand what we are doing here at Purdue, our faculty hope to deliver the next giant leap in science to the public.

As head, I am proud of our alumni, faculty, staff and students and honored to watch as they progress. I see every day one Boilermaker after another helping the next generation of Boilermakers ready themselves for their own successful careers. This is the way we collectively and boldly move our sciences forward. I want to say thank you to the alumni who continue to show up, mentor our students and help them achieve their own academic and career successes. If you are an alumnus who'd like to become more involved, please do give me a call or email, I look forward to our conversation.

As always, to all 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

PURDUE UNIVERSITY | Department of Physics and Astronomy

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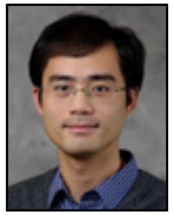
EA/EOU

2024
FACULTY AWARDS AND HONORS

Paul Duffell
- The Ruth and Joel Spira Award for Outstanding Graduate Teaching
- Excellence in Graduate Advising

Arnab Banerjee
- W. M. Keck Foundation Grant



Qi Zou
- Purdue University Faculty Scholar

Danny Milisavljevic
- Spira Award for Outstanding Undergraduate Teaching

Gabor Csathy
- 2024 American Physical Society Fellow

Tongcang Li
- College of Science Research Award

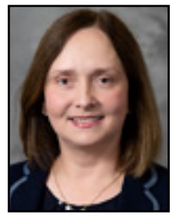
Chris Greene
- 2024 Purdue University Morrill Award

2024
FACULTY/STAFF YEARS OF SERVICE AWARDS

George Jackson
Associate Research Scientist, PRIME Lab
- 25 years

Janice Thomaz
Undergraduate Advisor
- 25 years

Yuli Lyanda-Geller
Professor
- 20 years



Oana Malis
Professor
- 15 years

Michael Manfra
Professor
- 15 years

Greg Chmiel
Laboratory Technician, PRIME Lab
- 15 years

Tongcang Li
Professor
- 10 years

Kristin Deweese
Administrative Assistant
- 5 years

FACULTY PROMOTIONS/PROFESSORSHIPS

T. Matthew Jones
- Promoted to Professor

Kyoung-Soo Lee
- Promoted to Professor

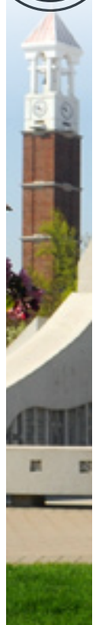
FACULTY RETIREMENTS

Ephraim Fischbach
Retired May 2024
- 55 years

David Koltick
Retired December 2024
- 44 years

Lynn Bryan
Retired December 2024
- 20 years

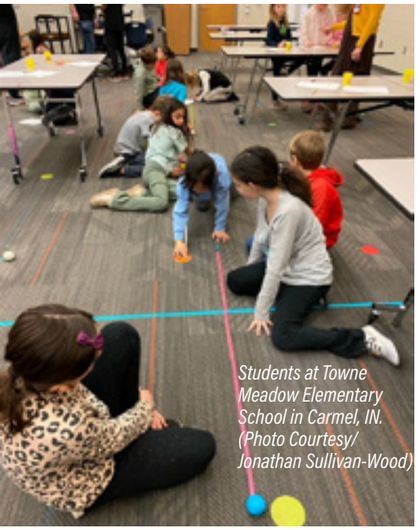
MEMORIALS



It is with great sadness that we announce those who we have lost over the past year. These Boilermakers influenced our lives in so many ways. They were scientists, leaders, educators, helpers, problem solvers, and family. The imprint they leave on our department is immeasurable. Our halls are forever changed due to their presence.

- **Professor Anant Ramdas**
- **Professor Norman Fuchs**
- **Professor Ian Shipsey**
- **Professor Sherwin Love**
- **Professor Virgil E. Barnes, II**
- **Ken Mueller, Accelerator Engineer**

K-12 PhysAstro Outreach with Dr. David Sederberg



Students at Towne Meadow Elementary School in Carmel, IN. (Photo Courtesy/ Jonathan Sullivan-Wood)

By David Siple

The Outreach philosophy in Physics and Astronomy at Purdue focuses on creating opportunities for Indiana K-12 students and teachers to engage with and develop enthusiasm for science, providing high-quality professional development for K-12 teachers, and collaborating with faculty to leverage resources and expertise to enhance science education in classrooms and community.

Saturday Morning Astrophysics at Purdue (SMAP) is a premier outreach program that offers live monthly Zoom sessions for students in grades 8-12, not only locally but around the globe. Physics and Astronomy faculty present background and breakout room activities on space, the cosmology, historical and cutting-edge discoveries, exploring engaging topics beyond the typical classroom curriculum.

Outreach Coordinator David Sederberg led his team of volunteers to Towne Meadow Elementary School in Carmel, IN, for a lesson in modeling the Earth and Moon. (Photo Courtesy/ Jonathan Sullivan-Wood)

Some of the latest videos from the PhysAstro K-12 Outreach Program

HOW FAR FOR A TOTAL ECLIPSE

This video demonstrates a hands-on student experiment to model a total solar eclipse to scale. Using proportionally sized representations of the Sun, Moon, and Earth, students walk the path to totality, count their steps, and calculate the scaled distance to the Sun. This interactive outdoor activity combines astronomy, earth science, and math to engage learners in understanding solar eclipses with no eclipse glasses required!

MY SUMMER AT YERKES

This video follows Purdue Physics and Astronomy undergrad Dylan Caudill as he embarks on a summer internship at Yerkes Observatory. From working with historic hundred-year-old glass plates to exploring the cutting edge of astronomy, Dylan shares his experiences and daily life as an astronomer in this exciting cosmic adventure.

MAKING YOUR OWN SUN PROJECTOR

This video features SMAP teaching assistants demonstrating how to create pinhole viewers for safely observing the Sun. They start with a simple cereal box version and scale up to a 60-inch shipping box that projects images large enough to characterize sunspots. Learn how the size of the pinhole affects resolution and discover the best materials to use for a clear solar image that makes it perfect for eclipse viewing.

HOW TO MEASURE EARTH

This video guides you through recreating Eratosthenes' famous 2,000-year-old experiment to measure the Earth's circumference. Using just a vertical pole, a measuring tape, and the noonday sun, you'll record shadow lengths and latitude to calculate Earth's size with surprising accuracy. Collect and share your data with others, across the country and world-wide.

INTERESTED IN KNOWING MORE?

Purdue Physics and Astronomy Outreach makes Classroom Calls, providing resources and expertise for the K-12 classroom teachers. Whether we provide a "Scientist on Site" for a classroom talk and demonstration, support for lesson design and implementation, or work with teachers to provide a novel learning experience, Physics and Astronomy Outreach is eager to spread our enthusiasm for learning science.

PHYSICS INSIDE OUT

Physic Inside Out is a five-day summer program at Purdue's West Lafayette campus designed for students in grades 7 and 8. Through interactive, hands-on lessons and activities, young learners explore fundamental principles of physics and their real-world applications, fostering curiosity and a deeper understanding of the physical world in an engaging and immersive environment. Check out our Physics Inside Out video:

For more information on any of our programs, please contact:

David Sederberg
Director of Physics & Astronomy Outreach
dsederbe@purdue.edu

PURDUE
CLICK HERE TO SUPPORT OUTREACH

From Particle Physics to Industry Success:

Professor Andreas Jung's Impact at CERN and Beyond

Professor Andreas Jung is making waves in both cutting-edge research and industry innovation. As a key contributor to CERN's Compact Muon Solenoid (CMS) detector, he and his team have played a crucial role in advancing our understanding of particle physics. Beyond academia, his entrepreneurial pursuits have also gained significant traction, with his Purdue University-connected software company Quantum Research Sciences recently achieving notable success in the industry. In this feature, we explore three recent news articles that highlight his groundbreaking work at CERN, contributions to physics research, and impressive strides in the business world.

Quantum Research Sciences wins DLA contract to develop Product Obsolescence Prediction tool

AI, quantum computing will power the innovation

Written by Steve Martin, originally published in Purdue University News

Purdue University-connected software company Quantum Research Sciences (QRS) has received a Phase I Small Business Innovation Research contract from the Defense Logistics Agency (DLA), which contracts, purchases, distributes, stores and disposes of items for the Department of Defense.

QRS will leverage artificial intelligence, machine learning and quantum computing technologies to create the Product Obsolescence Prediction (POP) tool. This tool will enhance the DLA's supply chain management capabilities and reduce the challenges associated with obsolescence.

Quantum Research Sciences has received a contract from the Defense Logistics Agency to create a tool to enhance DLA's supply chain management capabilities and reduce the challenges associated with obsolescence. QRS personnel are (left to right) Andreas Jung, chief operating officer and Purdue University associate professor of physics and astronomy; CEO Ethan Krimins; and AJ Wildridge, chief technology officer and Purdue University doctoral student. (Purdue Research Foundation photo/Jennifer Mayberry)

Headquartered in Lafayette, QRS is a Purdue Innovates client company and an affiliate company of the Purdue Quantum Science and Engineering Institute.

Ethan Krimins, chief executive officer of QRS, said the ability of the DOD to effectively defend the nation hinges on the efficient functioning of its thousands of systems, all of which are reliant on parts, materials and code.

"However, the life cycle of these components is not infinite, and any unplanned obsolescence threatens operational efficiency and force readiness," he said. "Predicting and managing obsolescence is a complicated task. It necessitates a delicate balance between fulfilling combat requirements, budgeting, ensuring supplier stability, mitigating material failures, accommodating design alterations and monitoring system life cycles, among many other variables."

Krimins said effective obsolescence management is fundamental to DLA's mission and a cornerstone of a resilient and effective logistical operation.

"Managing obsolescence will streamline the procurement and upkeep of components within the supply chain, reducing operational disruptions and bolstering readiness," he said. "This capability not only ensures the availability of needed parts but also contributes to a robust supply chain that can adeptly respond to evolving demands."

Andreas Jung is chief operating officer at QRS and an associate professor of physics and astronomy in Purdue's College of Science. He said leveraging the POP tool's cutting-edge computing technologies will improve the DLA's ability to manage part obsolescence.

"Combined, these technologies will provide predictive capabilities, analyze the complex web of interdependencies and automate obsolescence management processes that are, today, largely manual," he said. "By innovating with AI/ML/QC-powered obsolescence process, DLA can also work toward its overarching objectives of supporting nuclear enterprise, force readiness and efficacy, and supply chain innovation and assurance."

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

CERN's CMS detector observes quantum entanglement at highest energy ever

Purdue researchers on the CMS team led early indicators that proves high-energy colliders are useful tools for measuring and observing entanglement

Written by Cheryl Pierce

The romantic notion of entangled particles presumes that once two particles become entangled, they are forever bonded no matter how far apart from one another they are. This relationship has puzzled physicists ever since Erwin Schrödinger coined the term "entanglement" in 1935. Though scientists have observed this phenomenon in many ways, there has been no research at high energies such as provided by large-scale labs like the Large Hadron Collider.

In an article published in Nature, the ATLAS collaboration reports how it succeeded in observing quantum entanglement at the LHC for the first time, between fundamental particles called top quarks at the highest energies yet. First reported by ATLAS in September 2023 and confirmed in March 2024 by the CMS collaboration, this result has opened up a new perspective on the complex world of quantum physics. This discovery includes four researchers from Purdue University's College of Science.

In a CERN press release, ATLAS and CMS teams observed quantum entanglement between a top quark and its antimatter counterpart. The observations follow a recent proposal of using pairs of top quarks produced at the LHC as a new system to study entanglement.

Modern day scientists see great potential in the behavior of entangled particles because of their vast potential in quantum mechanics. The CMS is a general-purpose detector that sits at one of the four collision points of the Large Hadron Collider, the largest and most powerful particle accelerator ever built. Researchers have recently begun using the CMS detector to study quantum entanglement. Andreas Jung, associate professor of Physics and Astronomy at the Purdue University College of Science, led a team of researchers that used the CMS data to form the early discovery of the observed quantum entanglement.

This result is also featured in a Nature News article highlighting the details of the data analysis done by the Purdue group.

Jung is the Principal Investigator and leader of the analysis team dedicated to the measurement of top quark quantum entanglement using CMS data. He served as the CMS TOP physics analysis group convener in 2020-2022 and his group is also a major contributor to the CMS detector upgrade of the silicon tracking devices.

"Entanglement is a new probe to study quantum mechanics at fundamental level and to understand bare top quark properties in order to reveal beyond the Standard Model contributions," he says.

"While particle physics is deeply rooted in quantum mechanics, the observation of quantum entanglement in a new particle system and at much higher energy than previously possible is remarkable," says ATLAS spokesperson Andreas Hoecker. "It paves the way for new investigations into this fascinating phenomenon, opening up a rich menu of exploration as our data samples continue to grow."

Jung's team included Giulia Negro, a postdoc, and two PhD candidates: Andrew J Wildridge and Lingqiang He, all from Purdue University. The CMS internal review was led by the Analysis Review Committee chair Javier F. Menendez (Oviedo U.), and CMS TOP physics analysis group conveners Alexander Grohsjean (DESY), Jan Kieseler (KIT). "After a thorough internal review, we are very happy to see this measurement being released to the public", comment the CMS top group conveners Alexander Grohsjean (DESY) and Jan Kieseler (KIT).

Negro is currently the detector performance group coordinator, as well as the Deputy Run Coordinator of the CMS detector and hence, plays a critical role in overseeing the large complex task of CMS detector operation. As such, she is part of the CMS Management Board. In 2021, she received a CMS award in recognition of "crucial contributions to the refurbishment and the operation of the CMS Pixel Detector." She is also a recipient of the Ross-Lynn Fellowship at Purdue University.

"It's fascinating how the largest accelerator on earth can enable us not only to probe the Standard Model of particle physics but also to explore fundamental quantum mechanics effects," says Negro.

"This measurement showing that the top quarks are indeed entangled is exciting to me because it is paving the way for the fascinating ideas in quantum information theory to be applied and studied on fundamental particles beyond the electron and photon," says Wildridge, who is involved in the analysis of the data.

Jung's team authored early results from this study at the beginning of this year. At that time, they were hoping the CMS results would confirm the earlier ATLAS findings. "The new CMS result confirms the existence of entanglement between the top quark and its antiparticle beyond reasonable doubt," says Jung. "The two states are found entangled with a significance exceeding the famous five standard deviations discovery threshold and in agreement with the Standard Model prediction."

This giant leap in quantum particle physics aligns with a mission from Purdue University. Quantum science and engineering is one of four dimensions within Purdue Computes, a major initiative that enables the university to advance to the forefront with unparalleled excellence at scale. The team plans to move forward with more research with the CMS detector and this discovery throws the doors open for new discoveries.

"The results also open new paths in the particle-physics arena," says CMS spokesperson Patricia McBride in CERN's press release. "With measurements of entanglement and other quantum concepts at an energy range beyond what was previously accessible, we can test the Standard Model of particle physics in new ways and look for any signs of new physics that may lie beyond it."

According to Jung, "Quantum information at particle colliders is a new exciting field of research, which is now producing six times the number of papers on preprint servers (arXiv) compared to ten years ago. It allows us to challenge our understanding of quantum field theories with many prospects to discover new physics and phenomena."

This research is funded by the U.S. Department of Energy program under Award Number(s) DE-SC0007884 titled "An Experimental and Theoretical High Energy Physics Program" and under Award Number(s) DE-SC00023700 titled "AI for a more precise future of the top quark."

Above: Prof. Andreas Jung (middle), Lingqiang He (left) and Andrew J. Wildridge stand in front of a true-to-size mural of the CMS detector that can be seen on the third floor of the Purdue Physics Building.

To the right: Giulia Negro, postdoc working with Jung's team, stands in front of the CMS detector where she is currently working remotely at CERN. Photo provided by Negro.

Below: *Members of the Jung research group, back row from left to right: Michael Wasem, Lingqiang He, Prof Andy Jung, David Ruiter, Osama Dawood; front row from left to right: Santosh Bhandari, Heather Martin, Andrew J. Wildridge, Juan Quirros.*

The BTST, a key piece of the Upgraded CMS Detector, arrives at CERN

In a massive step toward CMS' High-Luminosity era detector, a key component of the build has arrived at the CERN laboratories

Written by Alessandro Lapertosa & Adi Bornheim, originally published on CERN

CMS has received a very big box! The BTL-Tracker Support Tube (BTST) is a carbon fibre cylindrical structure designed to sustain the future CMS silicon Tracker and the Barrel Timing Layer (BTL), key components of the future CMS detector.

In preparation for CERN's High-Luminosity LHC, all the particle detectors on the LHC are undergoing vast changes. This is to make the most of the increased luminosity and to continue recording as many interesting collision events as possible, even in conditions much harsher than the current ones.

The BTST is 5.3 metres long, almost 2.5 in diameter, and perfectly cylindrical, with only one and a half millimetres of distortion allowed. It is an essential component, built to be able to support a combined mass of about 5 tons between the Tracker and the BTL – all while weighing only about 600 kg itself!

In order to create something both so strong and so lightweight, the design is made of 2 carbon fibre sheets enveloping a light, honeycomb structure, for a combined thickness of just 3 cm.

This specialized design was a joint project of the Tracker and BTL engineers and physicists, under the leadership of the Purdue CMS group and the Composites Manufacturing & Simulation Center (CMSC) at Purdue University. The tube itself was manufactured in industry by a specialized company in California, Rock West Composites Inc. in 2023.

However, after production in San Diego, it had to make its way in perfect condition all the way to Switzerland. It took a long road trip to Purdue for quality checks and extensive testing to make sure the minute tolerance was not exceeded, which took several months of precise measurements. Then it traveled onwards to Chicago O'Hare airport.

During the transport between Purdue and the airport, the box was damaged in a road accident and had to be returned to Purdue University. After 3 months of extensive inspections at Purdue (visual, laser, ultrasonic tests) it was confirmed that the BTST was in perfect condition. A final test, loading a weight of 2800 kg, validated the strength of the BTST structure. After a formal review of the results, the BTST was declared ready for onward transport to CERN.

The large box holding the BTST, although huge, does fit into an airplane - just. In order for it to fit, the edges of the container box had to be cut off! However, cargo planes able to transport such huge boxes cannot just land anywhere, and the closest possible airport was in Luxemburg, where it was loaded onto a truck and driven to Geneva. It made it through import formalities and acceptance checks before finally arriving at CERN.

Now the tube is being checked before the next steps: its outer surface will be covered with heating foils to thermally insulate the Tracker and BTL. This is because they need to be kept at -30°C, achieved through CO_2 based cooling, whereas the tube will be surrounded by other components at around 10°C. That is a difference of approximated 40°C across those tiny 3 cm!

Then, the BTL will be installed on the inner surface of the tube: 72 trays full of BTL modules will be inserted. The BTL modules were designed to be very thin, using the best precision-timing technology available: a crystal scintillator coupled to silicon photomultipliers. This will allow to achieve a time resolution of about 35 ps.

The full Tracker will be installed inside the Tube: the Outer Tracker (6 layers and 10 wheels, 5 for each side, of double-sensor modules) and the Inner Tracker (4 layers and 24 disks, 12 for each side), for a total weight of about 2500 kg. The Inner Tracker will need to be installed in another tube, being built at Purdue, Inner Tracker Support Tube (ITST), again in carbon fibre composite material, and installed once the Outer Tracker is completed.

All the teams are very excited about the arrival of the BTST and are eager to dive into the next steps towards that High Luminosity era: the Tracker and BTL assembly can officially start!

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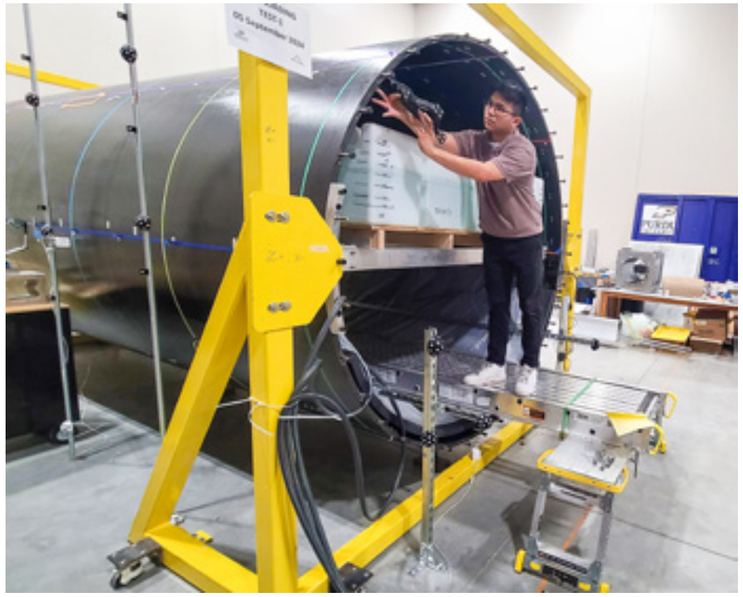
Watch a time lapse of the unboxing of the tube at CERN



The BTST being tested at Purdue University

On the left is the original box that was just too big to fit on the plane, and on the right is the modified box to get it onto the plane.

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

Shining a Light on the Cosmos: Purdue's Passionate Physics Lecturer

By David Siple

In the bustling corridors of the Physics Building at Purdue University, where groundbreaking research and transformative education intersect, Dr. Robert A. Austin, Ph.D., stands out as a luminous figure and a beacon of inspiration, curiosity, and unwavering dedication. As a Lecturer in Physics at Purdue, Austin brings a lifetime of intellectual passion, hands-on expertise, and enthusiasm to his classroom, turning the world of physics into an adventure for students and colleagues alike. Rooted in a childhood dream and nurtured by a lifelong love for the universe, he embodies the spirit of discovery that defines Purdue's academic community.

Austin's journey into the field of physics began at the age of eight, sparked by a historic moment that captured the world's attention: Purdue's most famous graduate, Neil Armstrong, taking his first steps on the moon. "I was eight years old when Neil Armstrong stepped on the moon, and watching that event unfold on television transformed my dream of becoming a scientist," explains Austin, recalling that summer night in 1969. That single experience laid the foundation for his lifelong pursuit of knowledge, which continued through high school as he took his initial steps toward a career in physics. "My early interest in space travel evolved into a desire to become a physicist when my eighth-grade English teacher "loaned" me his copy of Einstein: The Life and Times by Ronald W. Clark. I still have it on my bookshelf," says Austin.

Austin would then move on to the University of Chicago for the first two years of his collegiate career. He would then obtain a BS in physics at Purdue University. "I've known Purdue nearly all my life because I moved to Lafayette when I was four years old," says Austin. "Purdue has a strong physics department, and with its world-renowned engineering school, it draws a lot of highly motivated and intelligent students from around the world. The size of its campus is intimidating, but a benefit of its size is its extraordinary range of cultural offerings." Austin then served his country in the Navy and returned to Purdue to earn his MSc and PhD degrees in physics.

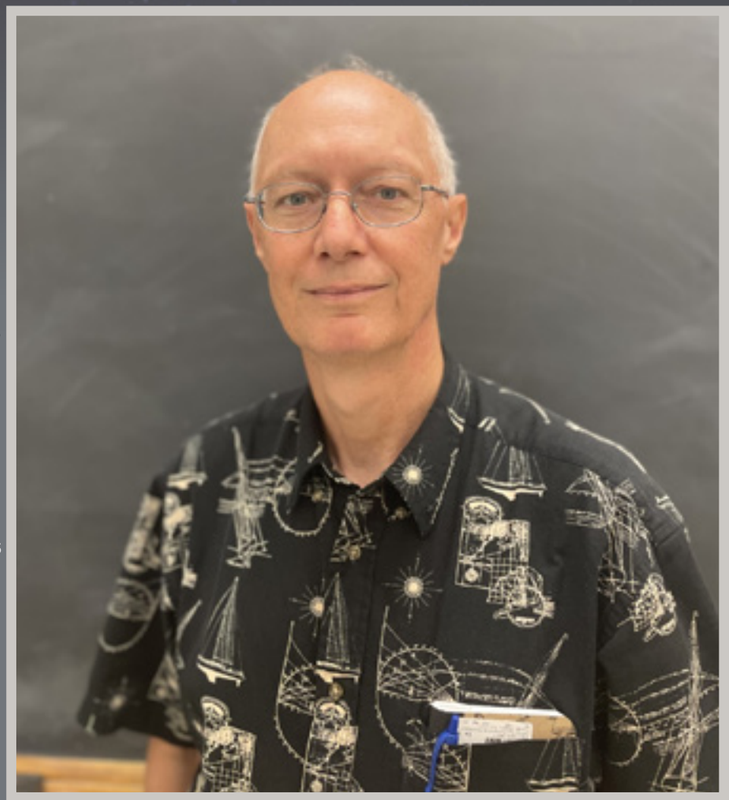
For Austin, the role of a Physics Lecturer at Purdue is not just a profession but a calling, offering a blend of freedom, mentorship, and joy that he finds deeply rewarding. "I enjoy a higher degree of autonomy than I ever experienced as a researcher, and I have the satisfaction of knowing that I am helping young people pursue their dreams," says Austin. "I get to think a lot about physics without the pressure of publishing papers, writing proposals, and attending conferences." But he cherishes the work-life balance his role offers, allowing him to pour his heart into teaching while maintaining a fulfilling personal life. "I usually get a good night's sleep. I can spend weekends at home, and I can take long vacations," adds Austin. In his words, his family is very happy to see him doing something he enjoys, and they feel he is having a positive impact on society.

At the heart of Austin's teaching is his commitment to making physics not only understandable but also engaging for his students. He engages in a dynamic, hands-on approach, using demonstrations and real-world analogies to spark curiosity and bridge the gap between abstract theories and everyday experiences. "I use demonstrations as much as possible to raise questions in students' minds about how the world works," he says. "If I am lucky, I can then lead them through the process of making a prediction and testing it with another demonstration. I also try to speak in terms of things students are familiar with, like skateboards, bicycles, cell phones, basketballs, etc." He believes this method advances a deeper connection, transforming equations into vibrant, relatable ideas that resonate with students from all backgrounds.

Austin's rich research background further supplements his teaching, providing a unique perspective that bridges theory and real-world application. His expertise lies in the field of radiation detection, particularly for X-ray astronomy, medical imaging, and homeland security, with a specialization in high-pressure xenon-filled ionization detectors. His past work continues to inform his lectures, offering students a glimpse into the cutting-edge applications of physics that shape our understanding of the universe and improve society. "Just like using X-rays to peer inside the human body, astronomers can use X-rays to peer close to the source of their generation and study the hottest, most dynamic regions of these celestial objects. I designed and tested detectors that allow astronomers to study celestial objects using the X-rays they emit," says Austin.

His time at the Space Science Lab at NASA's Marshall Space Flight Center was one he will never forget. He spent part of his career at the intersection of groundbreaking science and visionary storytelling, but he's also had the rare privilege of witnessing history unfold. "I actually did witness a historical discovery firsthand," he says. "I was working in the same building as Gerald Fishman and the BATSE (Burst and Transient Source Experiment) team when they made their surprising discovery that gamma-ray bursts come from objects at cosmological distances."

While at Marshall Space Flight Center, he achieved what he considers his most significant scientific accomplishment: developing a prototype for the first hard X-ray imaging polarimeter. This groundbreaking work paved the way for instruments now operating in space. Most nota-



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bly, the Imaging X-ray Polarimetry Explorer (IXPE), which is capturing the first-ever imaged polarization measurements of high-energy astrophysical sources, like black holes, neutron stars, pulsars, and gamma-ray bursts.

Austin, R.A.; Ramsey, B.D. Optical imaging chamber for X-ray astronomy. Opt. Eng. 1993, 32, 1990–1994.

As for the discoveries he wishes he could have seen unfold, "Of all scientific discoveries, I most wish I was working with Watson and Crick when they unraveled the structure of DNA." A moment that changed biology, it's a breakthrough that still captivates him today.

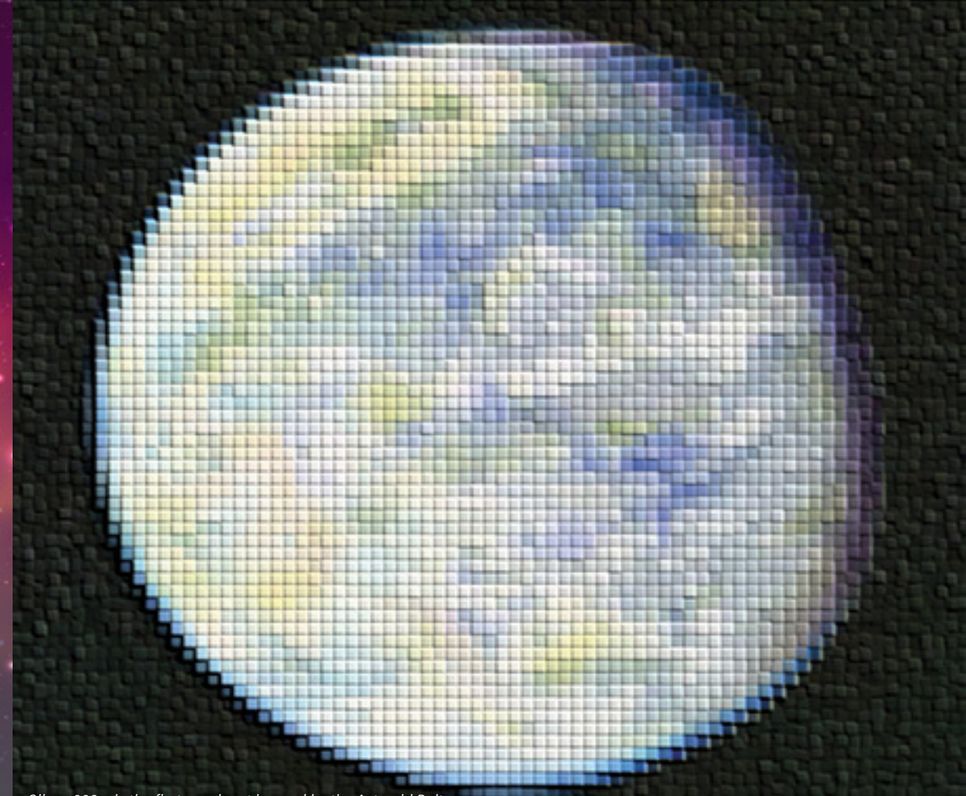
In late 2015, Austin wrote an award-winning article titled "Megatelescope Releases its First Image," which was featured in Physics Today in December 2016. The article describes the construction and first image release of the Asteroid Belt Astronomical Telescope (ABAT), a massive space-based observatory inspired by Purdue professor Andy Pillmaier's early 21st-century research. The project utilizes advanced quantum computing and powerful lasers to shape and align millions of mirror facets. Despite being only 1% complete, ABAT has already captured an unprecedentedly detailed image of the exoplanet Gliese 832 c.

The telescope's innovative "Devil's Footprint" shielding technique and self-replicating microscopic sensors ensure its effectiveness. Expected to be fully operational by 2216, ABAT represents a major leap in observational astronomy, with potential future expansions into the Kuiper Belt and beyond.

Austin's story is a testament to the power of curiosity and dedication. "I have wanted to be a scientist since I was in the first grade when I was asked to draw a picture showing what I wanted to be when I grew up. I drew a picture of a man in a lab coat holding a test tube over a flame. The title on the picture was "I want to be a scientist," says Austin. His journey from a wide-eyed child captivated by the moon landing to a beloved physics lecturer serves as an inspiration to all who cross his path.

Through his passion, mentorship, and innovative teaching methods, Austin continues to light the way for the next generation of physicists. From being a part of the Degrowth Study Group backed by Purdue's Institute for a Sustainable Future, Austin's legacy will ensure that the spirit of discovery burns brightly at Purdue University and beyond. When asked what advice he would give students considering a career in physics, Austin responded, "I would encourage them to become physicists only for the love of doing physics. Don't look at it as a career choice, consider it a vocation."

Austin stands as a shining example of what it means to be an educator, a researcher, a lifelong learner, and a Boilermaker. His legacy, built on a foundation of curiosity and connection, will undoubtedly inspire generations of Boilermakers to reach for the stars both literally and figuratively.



Gliese 832 c is the first exoplanet imaged by the Asteroid Belt Astronomical Telescope. This image, with a resolution of 10 meters, was released last month by ABAT, after the telescope's construction was 1% completed. (Courtesy of Laura Kim.)

A picture taken during the late 1990s in a hangar in Ft. Sumner, NM. This is from Austin's scientific ballooning days while working at NASA's Marshall Space Flight Center. Left to right: George Nystrom, Vesa Kuosmanen, Jonathan Grindlay, Martin Weisskopf, Takahisa Minamitani, Robert Austin, and Brian Ramsey. Photo provided by Robert Austin.

Francis Walz, Purdue University photo/Brian Powell

Student Spotlight: Francis Walz

Femtoseconds and Attoseconds: The Key to Controlling Electron-Matter Interactions

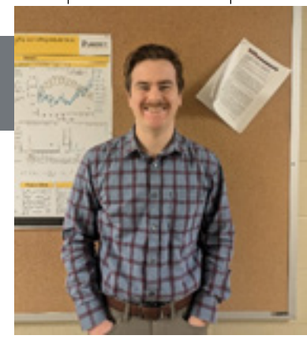


Photo courtesy/Francis Walz

By David Siple

A graduate student in Purdue University's Department of Physics and Astronomy is making waves in the world of Atomic, Molecular, and Optical (AMO) physics. With a passion for understanding the intricate dance between light and matter, Francis Walz has found a home in the Ultrafast Quantum Dynamics Laboratory, where he explores electronic dynamics using cutting-edge laser technology.

Walz describes that, "In Atomic, Molecular, and Optical (AMO) physics research we study the fundamental interaction between light and matter." He explains that AMO physics encompasses a wide range of topics, including "quantum optics, precision measurements of fundamental constants, atomic clocks, and laser cooling of atoms." His specific work, however, zeroes in on "researching ultrafast electronic dynamics in atoms and molecules using femtosecond and attosecond laser pulses." Why does this matter? "If you can observe these dynamics, you can then control their behavior to drive novel electron-matter interactions," Walz says. This will ultimately be a prospect that could unlock new frontiers in science and technology.

Originally from Baltimore, Maryland, Walz earned his undergraduate degree in Applied Physics from Towson University in 2019, graduating Magna Cum Laude. He explains how his interest in physics began, saying, "I took my first physics class as a junior and thoroughly enjoyed learning this subject and solving the problems in class." By his senior year, advanced physics solidified his path. "I decided I wanted to study the subject in college." Research experiences during his undergraduate years further fueled his ambition, leading him to pursue a PhD. "I was lucky enough to have good research experiences that helped hone my interests and decided to pursue a PhD after I saw what opportunities a PhD could open for me," he says.

Purdue's reputation as a "cutting-edge research institution" with a "wide variety of interesting research" drew Walz to West Lafayette. "I came in undecided on what I wanted to study and having this variety was a top priority for me," he notes. Since arriving, he's immersed himself in the Ultrafast Quantum Dynamics Laboratory under the guidance of Professor Niranjan Shivaram.

His research has already gained recognition, earning an Editor's Pick award for his first published paper, Electric field measurement of femtosecond time-resolved four-wave mixing signals in molecules (Optics Express, 2022). As one of Shivaram's first graduate students, Walz has been pivotal in establishing the lab. His work in the Ultrafast Quantum Dynamics Laboratory has given him hands-on experience designing and constructing laser beampaths for experiments, something that has not only helped him hone his technical skills but also develop a deeper understanding of optics and laser physics.

Graduate students play a vital role in shaping the research landscape at Purdue, often taking on foundational work that drives innovation forward. Dr. Niranjan Shivaram, an assistant professor in the Department of Physics and Astronomy, reflects on the impact of Walz, one of his first graduate students, and his contributions to the ultrafast laser lab. "Walz is the first graduate student who joined my group when I started as an assistant professor here at Purdue. Being the first graduate student of my PhD adviser myself, I know how special this academic relationship can be," says Shivaram. "Frank, along with my other graduate student at the time, Sidd Pandey, who graduated last year, built most of my ultrafast laser lab. I have been very fortunate to have an excellent graduate student like Frank in my research group."

"Frank has an excellent work ethic. He is very consistent with his lab work and has a "just get it done" approach that I admire. He has exceptional skills with hands-on work particularly with laser related tasks," says Niranjan. "Walz takes pride in his work. As they say, excellence is an attitude and Walz personifies that. I think the desire to do well in any task he promises to complete is what motivates him in addition to his interest in physics."

Outside the lab, Walz appreciates the strong sense of community he has built at Purdue. "I have enjoyed working with all my fellow graduate students in the lab. We try to have some fun in and outside the lab as much as we can," he says. "We go on picnics and get coffee during the day and try to build a solid group culture." On a personal note, he finds a unique joy in sharing the department with his wife. Walz says, "I find my wife working in the same department as me very enjoyable. We are very fortunate that we can work at the same location."

Adjusting to West Lafayette from Baltimore hasn't been a drastic shift for Walz. "Living in Lafayette isn't too different than Baltimore. There are less people, but everything that I enjoy doing is still around," he says. He enjoys playing tennis and pickle ball with his wife, as well as golfing, and appreciates the lower cost of living. "I can afford to do more things around town," says Walz. The college town vibe, with its coffee shops and bookstores within walking distance, adds a charm distinct from his suburban Baltimore upbringing.

His family has been incredibly supportive of his academic journey. "My family has always been very supportive of me studying physics. Both my father and mother have given me so many good pieces of advice, especially as I have moved on closer towards graduation. My other eight siblings also helped me stay connected to my family and offered support when needed." Having a large support system has played an important role in his journey,

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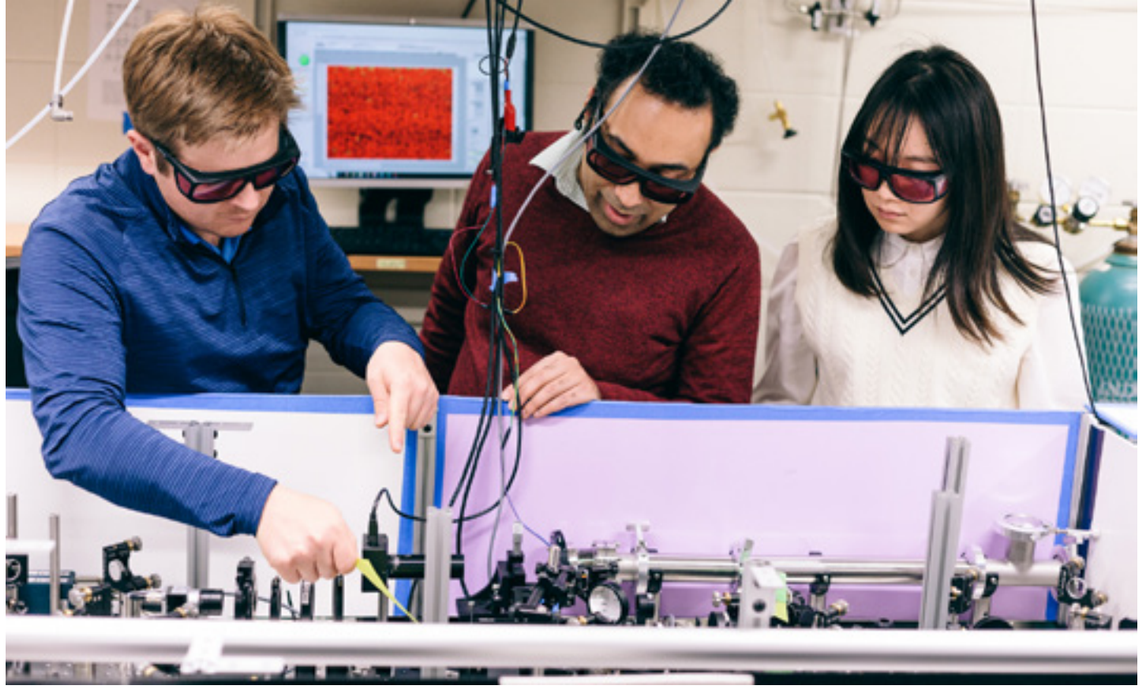


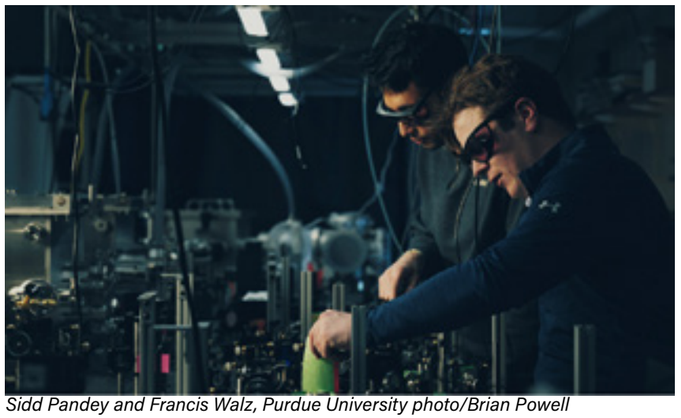
Graduate student Francis Walz is advised by Prof. Niranjan Shivaram. From left to right, Francis Walz, Niranjan Shivaram, and Yuyan Zhong. Photo by Brian Powell.

helping him maintain a balance between his academic and personal life.

Walz has made a lasting impact through his work, demonstrating technical expertise and leadership. Shivaram shares high praise for Walz's skills and the qualities that set him apart as a researcher and collaborator. "Walz is an excellent experimental physicist with particular strength in ultrafast laser research," says Shivaram. "He has very strong experimental skills and a great temperament for research. He is a very good team player and, at the same time, has what it takes to lead a team. In my opinion, he will be highly successful in his future endeavors, and any team he joins in the future will be fortunate to have him."

Looking ahead, Walz is keeping his options open post-graduation. "I hope to find a job in an industry setting. I would be interested in optical engineering or laser design," he says. "I am also interested in researching optical systems as an optical physicist." While he's applied to a variety of positions, including post-doctoral opportunities, he's ready to see "where life takes me."

His journey through Purdue has been one of exploration, discovery, and growth. "I enjoy all the people I've met here; I think I have been very fortunate to meet some wonderful people personally and professionally who helped me grow and develop into the man I am today," Walz says, reflecting on his time at Purdue University. As he prepares to take the next step into the professional world, his passion for physics, research, and innovation remains steadfast. Whether in academia or industry, it's clear that Walz will continue to push the boundaries of physics and light-matter interactions for years to come.



Sidd Pandey and Francis Walz, Purdue University photo/Brian Powell

ALL HAIL

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THE DEPARTMENT OF PHYSICS AND ASTRONOMY WELCOMES NEW FACULTY

Merel van ‘t Hoff,

Fall 2024 new faculty member

Prof. Merel van ‘t Hoff, assistant professor, is an expert in astrophysics, astrochemistry, and astronomy. Her research aims to understand how planets form and how prevalent planets like Earth might be in the Milky Way and other galaxies.

Prior to joining Purdue, Prof. van ‘t Hoff was a postdoctoral researcher in the Michigan Society of Fellows at the University of Michigan, collaborating with Edwin Bergin. She received her Ph.D. from Leiden University in the Netherlands in astronomy and astrophysics, where she studied with Ewine van Dishoeck on the astrochemistry of planet formation. She earned bachelor and master degrees in life science and technology, and astrophysics, also from Leiden University.

“I study the environments in which planets form: disks of gas and dust around newly born stars,” she says. “I use observations of molecules obtained with state-of-the-art telescopes such as ALMA and JWST to unravel the chemical composition of the planetary building blocks as well as to constrain the physical conditions that control how planets form. By establishing how common or rare the conditions are that led to the formation of our own Solar System and Earth, we will be able to predict how likely it is to find a planet like Earth around stars other than the Sun.”

Prof. van ‘t Hoff’s passion for teaching dates to her early childhood, where she set up a small chalkboard in her family’s home to teach her younger siblings what she had learned in school.

“As an instructor I strive to make my classes interesting, engaging and an environment where everyone can grow and succeed,” she says. “I believe that making students feel that they belong in the classroom and the field is of paramount importance to their success, and that I as a teacher can help facilitate this by not only discussing course material but also the human aspect behind it. For example, by sharing personal experiences and highlighting contributions from scientists with underrepresented identities.”

Prof. van ‘t Hoff will teach Astronomy 364: Stars and Galaxies, in the upcoming spring semester. The class is calculus-based content for science and engineering majors.

In her free time, Prof. van ‘t Hoff enjoys nature photography and goldsmithing.

BOILER UP!

Abigail Polin

Fall 2024 new faculty member

Prof. Abigail Polin, assistant professor, is a theoretical and computational astrophysicist. She creates hydrodynamical simulations to examine the theory behind astrophysical explosions, then performs radiative transport calculations to produce testable predictions that can be compared directly to observed data.

“My research spans the gamut of astrophysical transients,” she says. “I employ a combination of analytic, numerical and high-performance computing techniques to study the physics driving astrophysical explosions and I specialize in connecting that theory to observed transient phenomena.”

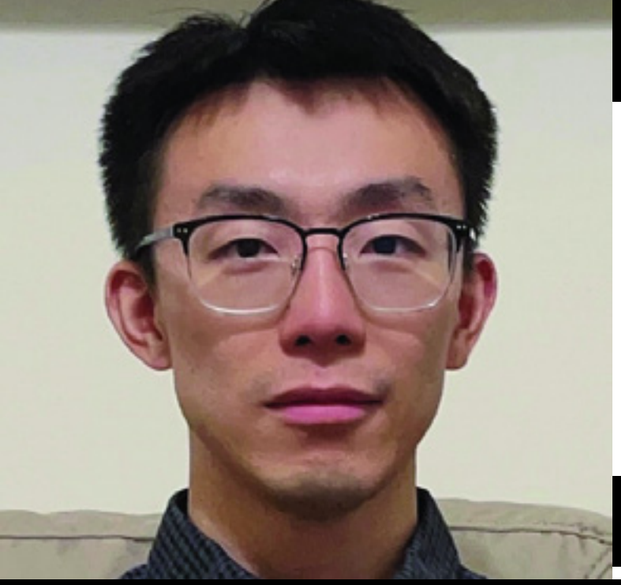
Prior to her arrival at Purdue, Prof. Polin was a joint postdoctoral research fellow at Carnegie Observatories and Caltech. She earned a master’s and doctoral degree in physics from the University of California, Berkeley, where she worked with thesis advisors Peter Nugent and Dan Kasen. Prof. Polin earned her bachelor’s degree in physics from New York University.

In 2021, she was awarded the NERSC Early Career Award for high impact scientific achievement. She is also a Scialog Fellow.

Prof. Polin summarizes her teaching philosophy with three tenets. “First, students learn best through active participation and collaborative learning,” she says. “Second, it is important for instructors to integrate technical skills such as computing and data analysis techniques throughout the curriculum. And third, physics is an inherently difficult subject, and students shouldn’t be expected to understand everything the first time they see it. Transparency as a teacher and a mentor is vital for student retention.”

Prof. Polin has taught multiple subjects in physics and astronomy, including high performance scientific computing, introductory mechanics, introduction to astrophysics and observational astronomy. She is looking forward to teaching graduate stellar evolution this spring.

THE DEPARTMENT OF PHYSICS AND ASTRONOMY WELCOMES NEW FACULTY



Yihang Zeng

Spring 2025 new faculty member

Prof. Yihang Zeng, assistant professor, will teach PHYS 272H Electric and Magnetic Interactions in spring 2025.

Zeng is fascinated by the idea of breaking down materials into incredibly thin layers, down to just as thin as an atom. This is called two-dimensional materials. "In doing so, we create artificial materials that exhibit physical phenomena beyond the current understanding in physics," says Zeng. "We investigate these mysterious phenomena by looking at how they evolve with variables and try to come up with clues to the mystery. Our effort largely originates from curiosity about nature but can have practical consequences. For example, some of these phenomena are useful for building faster computers, energy-saving electronics, etc. Please contact me if this interests you and if you'd like to join our team."

Prior to joining Purdue, Zeng acquired a B.S. in physics from Peking University in 2015. Zeng then earned a Ph.D. in physics from Columbia University in 2021 under the guidance of Cory Dean. Between 2021 and 2024, Zeng was a postdoc at Cornell with advisors Kin Fai Mak and Jie Shan. Now, Zeng is excited to be part of a "strong physics program" here at Purdue University.

Zeng grew up in Guangzhou which is a large city in South China. Zeng describes that "it's totally different from West Lafayette." Zeng likes sports, including basketball, badminton, ping-pong, tennis, volleyball, rock climbing, and weightlifting.

BOILER UP!

Claudio Chamon

Fall 2025 new faculty member

Prof. Claudio Chamon is an expert in electron fractionalization and topology. His research has revealed the existence of fractionally charged topological excitations in systems where time-reversal symmetry is respected. His research has been cited over 13,000 times and over 5,000 times since 2019.

"I study how particles behave when they interact in large groups and the unique forms of quantum matter that result from these interactions," said Chamon. "Some special systems behave as if their building blocks carry only a fraction of an electron's charge. The unusual properties of these fractionalized building blocks — called fractional quasiparticles — could be useful for processing quantum information and creating stable qubits for quantum computers. My work has focused on how to understand and build quantum states containing these fractional quasiparticles."

The talent-based Moveable Dream Hires program is piloted by the Deans and Provost to attract high-performing, top-caliber faculty to Purdue even when the topic-based openings in a given year do not match the moveable talent. It complements typical topic-based faculty searches across the University and enables the recruitment of faculty who may not be actively on the job market. These recruits are tenure-track or tenured faculty.

Chamon received his bachelor's, master's, and doctorate degrees from the Massachusetts Institute of Technology, finishing in 1996. He was awarded an NSF Early CAREER Award in 1999 and was elected a Fellow of the American Physical Society in 2008. His research focuses on strongly correlated quantum matter and the out-of-equilibrium dynamics of classical and quantum systems.

His research winds through the ever-growing field of electron fractionalization, from quantum Hall states that are sustained at large magnetic fields, to a novel type of quantum Hall fluid that he and co-workers theoretically predicted and that were recently observed experimentally to exist at zero magnetic field. He also proposed fractionalization in graphene-like structures.

"My current research focuses on leveraging symmetry principles to design superconducting circuits capable of realizing these quantum states, creating blueprints tailored to specific target certain states. At Purdue, I will ramp up this effort, which bridges both quantum science and quantum engineering."

2024 UNDERGRADUATE STUDENT AWARDS

Ramdas Award
Gabriel Skowronek
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.

Spira Undergraduate Summer Research Award
Jordan Gaines
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
Amelia Binau
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
Dylan Caudill and Grace Katz
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
Briana Chen, Jaiveer Dutta, and Boyle Chen
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
Mason Giacchetti
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
Allison Loper and Ashley Ortiz
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
Stephen G. Reeves
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
Gabriel Goodwin, William Messman, and Owen Odney
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
Mason Giacchetti
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
James Gabriel Strayhorn, Jordan Larson, and Kyle Ohlin
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

Astronaut Award
Santiago Lopez
Briana Chen
(External - 2024)

College of Science Alumni Summer Research Fellowship
Thomas Slamecka

College of Science Outstanding Student
Ishaan Signh - Freshman
Boyle Chen - Sophomore
Briana Chen - Junior
Arianna Meenakshi McNamara - Senior

Science Physics Scholarships
Jacob Tyler Larson
Santiago Lopez
Zachary Miles
Yutika Sawant
Darin Tsai
Rana Yuvraj

NSF Graduate Research Fellowship (GRFP) and also 2024 AWM Schafer Prize Winner
Arianna Meenakshi McNamara

NSF Graduate Research Fellowship Program (GRFP) Honorable Mention
Sara Cuevas-Quiñones

CONGRATS!

2024 GRADUATE STUDENT AWARDS

Ramdas Prize in Honor of Professor CV Raman
Dr. Cheng-An Chen
(Nominated by Chen-Lung Hung)
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.

NOTE: Purdue community mourns the loss of Prof. Anant Ramdas
Renowned Purdue physicist and professor passes away at 93

It is with great sadness that we share the passing of Professor Anant Ramdas, an esteemed emeritus faculty member in the Department of Physics and Astronomy at Purdue University. Throughout his distinguished career, Professor Ramdas inspired countless students, colleagues, and researchers with his deep dedication to science and education. His contributions to the field and his enduring impact on the university will never be forgotten. As a generous scholarship donor, his legacy will continue to empower and support future generations of scholars in physics and astronomy, ensuring his influence lives on. Our thoughts are with his wife Vasanti Ramdas, family, friends, and all who were fortunate to know him.

Karl Lark-Horovitz Award
Bhagya Subrayan (nominated by Danny Milisavljevic)
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
Ben Simon (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
Soumik Chandra (nominated by Wei Xie)
Dillon Hasenour (nominated by Paul Duffell)
Kwing Lam Leung (nominated by Nima Lashkari)
Bhagya Subrayan (nominated by Danny Milisavljevic)
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
Haoyun Huang (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
Bhagya Subrayan
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
Bowen Yan (nominated by Shawn Xingshan Cui)
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
Ranadeep Dastidar (nominated by Paul Duffell
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
Caden T. LaFontaine (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
Jijun Chen (nominated by David Koltick)
Tatiana de Picoli Ferreira (nominated by Erica Carlson)
Razan Hamed (nominated by Sanjay Rebello)
Ramya Suresh (nominated by Erica Carlson)
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
Arghya Ranjan Das, Dipanjan Das, and Tess Hoover
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.

Bilsland Dissertation Fellowship
The Bilsland Dissertation Fellowship provides support to outstanding Ph.D. candidates in their final year of writing.
Batao Du (2023-24)
Jonah Quirk (2023-24)
Deepak Suresh (2023-24)
Xinchao Zu (2023-24)

PURDUE UNIVERSITY: LEADERS IN QUANTUM RESEARCH

Story by David Siple

The Purdue Quantum Science and Engineering Institute (PQSEI) has new leadership as quantum computing expert Michael Manfra takes the helm. He is the Bill and Dee O'Brien Distinguished Professor of Physics and Astronomy, a professor of Electrical and Computer Engineering, and a professor of Materials Engineering. He is also the Scientific Director of Microsoft Quantum Lab, West Lafayette. Manfra is widely recognized as a groundbreaking researcher in quantum science and technologies.

He led a team of Purdue scientists who demonstrated definitive evidence of the existence of anyons, a type of subatomic particle that is especially significant in efforts to build a utility-scale quantum computer. This work is a testament to Manfra's qualifications to provide leadership in advancing Purdue's quantum initiatives. He is fortunate to work with many leading faculty scholars across the College of Science and College of Engineering who strive to translate scientific discovery into useful technology. This transition in PQSEI leadership marks the beginning of a new era for PQSEI, building on its strong foundation in pioneering quantum research.

Purdue University ranks among the top 20 institutions globally for quantum research, highlighting its strong programs and breakthroughs. Partnership with Microsoft, along with large-scale federal support from the Department of Energy through Purdue's role as principal university partner in the Quantum Science Center led by Oak Ridge National Laboratory demonstrate Purdue's dedication to advancing quantum technologies. Many faculty members across the Purdue campus including Manfra enhance Purdue's status for as a global hub for quantum innovation, attracting talented partners and elevating its international standing. Quantum is a pillar of President Mung Chiang's Purdue Computes initiative. The department of Physics and Astronomy has made several strategic faculty hires over the past five years to significantly enhance our participation in several exciting disciplines in quantum research.

Collectively, these initiatives showcase Purdue's comprehensive approach to quantum research. The department of Physics and Astronomy plays a key role in connecting theoretical and experimental efforts in these initiatives.

Purdue Quantum Science and Engineering Institute (PQSEI)

A cornerstone of Purdue's quantum efforts, PQSEI integrates research and education to advance quantum technologies.
Learn more at quantum.research.purdue.edu.

Microsoft Quantum Lab West Lafayette

This laboratory is an integrated component in Microsoft Quantum's effort to build full stack solutions for quantum computing hardware and software. . Microsoft Quantum employees work on the Purdue campus, side-by-side with Purdue academic researchers. Visit manfragroup.org for insights into Michael Manfra's group.

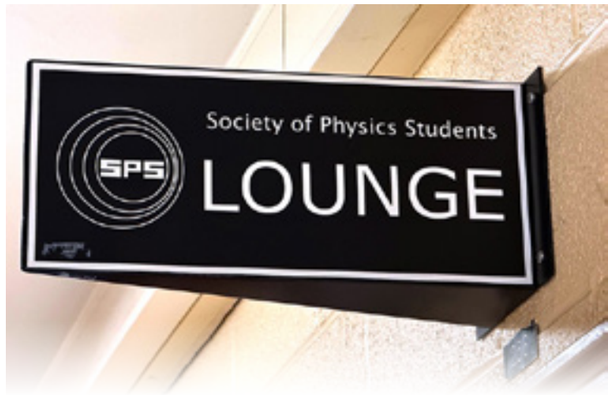
Quantum Photonics and Integrated Design Center

This United States DOE-funded center is directed by Libai Huang, professor in the James Tarpo Jr. and Margaret Tarpo Department of Chemistry. This center explores quantum photonics and integrated systems. Huang explains, "This center will focus on making better quantum light sources using solid state materials. Purdue traditionally has strength in photonics research and recent investments in quantum on campus will complement the center."
Learn more: https://purduesci.com/QuPIDC

Graphic by Adobe.

Purdue Society of Physics Students

From first steps to final strides: A freshman and senior's journey in the world of Purdue physics



By David Siple

Physics is often considered one of the most challenging subjects in academia. A student organization at Purdue works diligently to ensure that students eager to explore the mysteries of the universe do not have to do it alone. The Society of Physics Students (SPS) is a national organization committed to building a strong community among physics students while offering resources, networking opportunities, and tools for professional development. The Purdue chapter of SPS brings these goals to campus, creating an environment where students passionate about physics can connect, collaborate, and grow.

The organization promotes engagement among students, faculty, and the larger physics community. By hosting events for faculty and students and providing professional development opportunities, SPS supports its members in developing vital skills and connections. In collaboration with the physics department, the organization ensures that students have the required support and resources to excel academically and professionally.

SPS at Purdue is a vital link between students and the physics community more broadly, helping them navigate their academic and professional journeys. Through academic support, game nights, research collaborations, and outreach events, SPS is committed to making Purdue students feel at home for anyone interested in physics.

For many students, joining SPS is about finding a sense of belonging. Adina Margineantu, a freshman majoring in physics, described the club as a crucial support system. "SPS is a physics club at Purdue, but it's so much more than that. It brings together the physics community by giving us a place to get to know each other and hang out," she said. "There's also the SPS lounge in the physics building, which is a great place to relax between classes, talk to people, or buy a snack. Whenever I'm having a hard time in my classes, SPS and its members will be there to support me."

Margineantu has been fascinated by physics since she was quite young. She read books on astronomy and astrophysics, and she fell in love with thinking about the world in new ways. "I love math, which closely supports physics, so I knew that I had to pursue a career in physics. I like research and the pursuit of discovering new ideas, and it felt like physics and science were the culmination of everything I was interested in. I chose Purdue because of the wide range of research opportunities here."

The lounge, located in the physics building (PHYS 236), is a quiet study area, but it is also a hub for students to socialize, work on assignments, and seek academic help. Mason Giacchetti, a senior double majoring in physics and mathematics, spoke about the welcoming nature of the organization. "All students are welcome to participate in SPS. One of our major goals is to provide a friendly space for people interested in physics to engage with one another, explore this interest together, or just socialize," he said

Giacchetti has been a member of the SPS since his sophomore year and an active member in leadership within the group since he was a junior. His interest in physics began a little later in high school when he took calculus. He credits his teachers who helped him discover his passion in physics and math. However, learning about these subjects didn't end when he left the classroom. "I also began learning more about different topics in physics on my own time through watching things such as lectures at the Royal Institute online," says Giacchetti. "This content helped to further encourage my interest in physics as I wanted to learn more about the seemingly magical stuff that I was learning through this content. I chose physics as my major when I applied to college, and I haven't looked back since."

SPS is known for its engaging events and activities, which help students take a break from their rigorous coursework. Among the most popular events are weekly game nights on Saturdays, where members come together to play board games, card games, and video games. "Almost all of our active members have attended game nights at some point," Giacchetti shared. "It's a staple of our organization and a great way for students to unwind. We give all our members opportunities to meet with others to achieve this, and we have always been extremely welcoming and open with these events to ensure that all our members feel like they belong."

Another fantastic SPS tradition is the Professor Dinner nights, where students share a meal with Purdue physics faculty and learn more about their research and careers. "The monthly professor dinners are a great place to get to know faculty and ask them any questions about themselves," says Margineantu. Giacchetti also appreciates these dinners because it "gives students a chance to learn about specific research being conducted here at Purdue and the people behind it," he says.

Seasonal outings also bring the group together in unique ways. "We have a yearly trip to a corn maze at Exploration Acres, which is always a hit," Giacchetti said. "Students get to enjoy the maze, eat great food, and just have fun away from campus." In the winter, the club organizes ice skating trips, and in the spring, they wrap up the year with a cookout.

While SPS is a great place to socialize, it also serves as an academic lifeline for students struggling with coursework. The club hosts study sessions before major physics exams and provides a network of upperclassmen eager to help younger students.

"In theme with trying to build a strong physics community among students here at Purdue, if students need help with coursework or class material, we provide resources for them to find other members who might be able to assist them, or we provide recommendations on how to get help," Giacchetti explained. " Apart from connecting members to help one another with coursework, for exams in the major classes (such as PHYS 172 or 272), we will host review sessions to help students prepare for these exams. We focus on connecting members so that they can help each other."

For Margineantu, the support of SPS members made all the difference when she encountered her first academic challenge at Purdue sharing a personal experience, "During my first month at Purdue, I was having trouble with a physics lab that required coding, so I walked into the physics lounge and asked the first person I saw for help (Grace Katz). It just happened that a python coding expert (Braden Garretson) was in the room, and I got told to work with him. Although I had almost never talked to these people before, they kindly helped me, and within 10 minutes, I was done with my lab. This day sticks out to me because it shows the nature of SPS so clearly: they are

Professor Dinner Night with Professor Nolte and Professor Pyrak-Nolte (Photo Courtesy/SPS President Lauren Bell)

The Society of Physics Students Lounge in PHYS 236. (Photo Courtesy/David Siple)

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there to help and support other physics majors. Plus, it was the day I met my new friends."

SPS is also about giving back and pushing the boundaries of science. One of the club's biggest initiatives is the Faculty vs. Students Fundraiser. In this competition, students take on professors in physics-related challenges to raise money for the Techpoint Foundation for Youth, which is an Indiana-based organization that aims to provide STEM-based learning opportunities to underserved and underrepresented students within Indiana.

This will be the second time Purdue SPS hosts the event, and Giacchetti gives us a glimpse of this year's fundraiser, "We will be mixing up the style of the fundraiser this year so that students will compete against faculty in a set of chosen games. We are very excited about the second year of this fundraiser, and we are looking forward to April 18th.

In addition to the Faculty vs. Students fundraising event, Giacchetti says the group is working on different projects to help improve the services SPS offers students. "We are interested in bringing back large projects that will allow our members to engage in physics-related research in an introductory and low-stress environment," explains Giacchetti. "The SPS at Purdue has led many such projects in the past (such as a motorized couch), and we feel like our members could benefit from having these projects again."

One of their larger goals is to create opportunities for members to engage with the physics community on a more professional level. One such opportunity might be a trip to the American Physical Society's March meeting or even to Fermilab, where members can learn about national labs and the work that gets done there.

The group considers many ideas, but these are the most significant. The SPS fundraiser remains a high priority. This initiative presents an opportunity for SPS to give back that unites faculty and students. By expanding the fundraiser, SPS aims to enhance its impact and further strengthen the physics community at Purdue. Giacchetti says, "These are some of the many ideas that we have been discussing in order to improve the SPS, and we look forward to being able to turn these dreams into reality."

If you're on the fence about joining SPS, Giacchetti and Margineantu have the same advice: go for it!

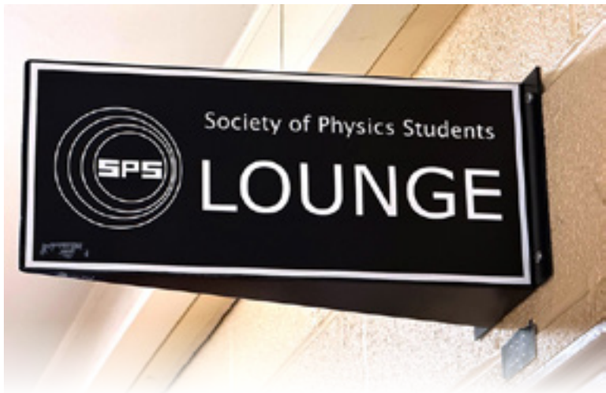
"We understand completely that it can be intimidating to join organizations such as ours, especially if you are not a physics major and if you don't know anyone in the club," says Giacchetti. "However, the SPS offers enormous benefits both on a personal and professional level, so don't be afraid to try it out. Everyone is very friendly and understanding, so there is no pressure whatsoever. Exploration is a huge component of self-discovery, and you never know how big of an impact the SPS can have on you until you give it a shot. Don't be afraid to just go for it!"

Margineantu echoed that sentiment, encouraging students to stop by the SPS lounge and introduce themselves. "It might be scary at first, but don't hesitate to walk into the lounge to say hi or eat lunch. Everyone is very friendly and who knows, you might find yourself wanting a physics minor. (or major!)."

Getting involved in SPS is easy. As both Giacchetti and Margineantu said, students can stop by the SPS lounge in PHYS 236, attend an event, or join the club's Discord server after paying a small membership fee.

By becoming a member, students gain access to exclusive events, networking opportunities, and a strong support system.

Mason Giacchetti and Professor Ritchie at one of SPS's fundraisers. (Photo Courtesy/ Ethan Pinarski)

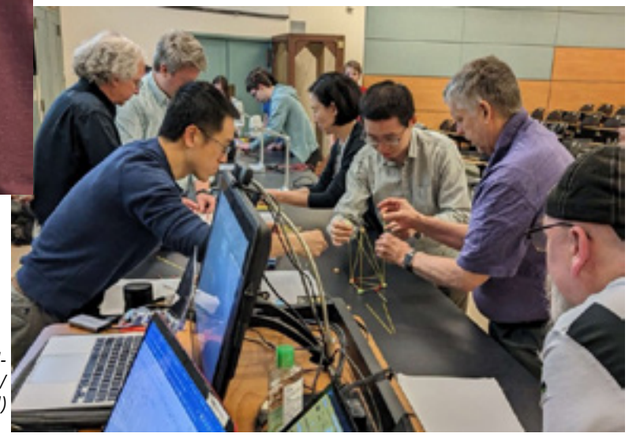


"Through access to our events, fellow members, and connections, you can learn about various opportunities to advance yourself professionally, and you can meet wonderful people who can help you navigate the difficulties of the college environment in physics or otherwise," says Giacchetti.

SPS is always striving to grow and improve. From the student's first year at Purdue to the last, the Purdue Society of Physics Students continues to be a cornerstone of the Purdue physics community, proving that science is best explored together.

Margineantu says, "Sometimes it can feel like the physics community is small on campus. This can feel isolating and unmotivating, but SPS is there to help everyone feel that they are not alone. SPS is a place of understanding because we all go through very similar things as physic majors. Whether it is trying to look for research opportunities or struggling with linear algebra, someone has gone through it before who can give you advice. This is how the support and community of SPS is built. I think SPS is always looking to get more people involved and to try out some new types of events. I hope to continue being an avid member and provide support to anyone who joins in the upcoming years."

SPS explored the physics of knocking down pins with an orb at a bowling event this semester. Members of faculty, including department head Gabor Csathy, bowled with members of SPS at the Purdue Memorial Union. (Photo courtesy of Purdue SPS instagram)



SPS Faculty vs. Student fundraising event. (Photo Courtesy/ Jonathon Sullivan-Wood)

SPS roller skating social night. (Photo Courtesy/SPS)

Materials developed at Purdue University incorporated into new Microsoft Quantum qubit platform

Story by Mary Martialay
This story originally published on Purdue News, February, 2025

WEST LAFAYETTE, Ind. — Microsoft Quantum published an article in Nature on Feb. 19 detailing recent advances in the measurement of quantum devices that will be needed to realize a topological quantum computer. Among the authors are Microsoft scientists and engineers who conduct research at Microsoft Quantum Lab West Lafayette, located at Purdue University. In an announcement by Microsoft Quantum, the team describes the operation of a device that is a necessary building block for a topological quantum computer. The published results are an important milestone along the path to construction of quantum computers that are potentially more robust and powerful than existing technologies.

"Our hope for quantum computation is that it will aid chemists, materials scientists and engineers working on the design and manufacturing of new materials that are so important to our daily lives," said Michael Manfra, scientific director of Microsoft Quantum Lab West Lafayette and the Bill and Dee O'Brien Distinguished Professor of Physics and Astronomy, professor of materials engineering, and professor of electrical and computer engineering at Purdue. "The promise of quantum computation is in accelerating scientific discovery and its translation into useful technology. For example, if quantum computers reduce the time and cost to produce new lifesaving therapeutic drugs, that is real societal impact."

The Microsoft Quantum Lab West Lafayette team advanced the complex layered materials that make up the quantum plane of the full device architecture used in the tests. Microsoft scientists working with Manfra are experts in advanced semiconductor growth techniques, including molecular beam epitaxy, that are used to build low-dimensional electron systems that form the basis for quantum bits, or qubits. They built the semiconductor and superconductor layers with atomic layer precision, tailoring the material's properties to those needed for the device architecture.

Manfra, a member of the Purdue Quantum Science and Engineering Institute, credited the strong relationship between Purdue and Microsoft, built over the course of a decade, with the advances conducted at Microsoft Quantum Lab West Lafayette. In 2017 Purdue deepened its relationship with Microsoft with a multiyear agreement that includes embedding Microsoft employees with Manfra's research team at Purdue.

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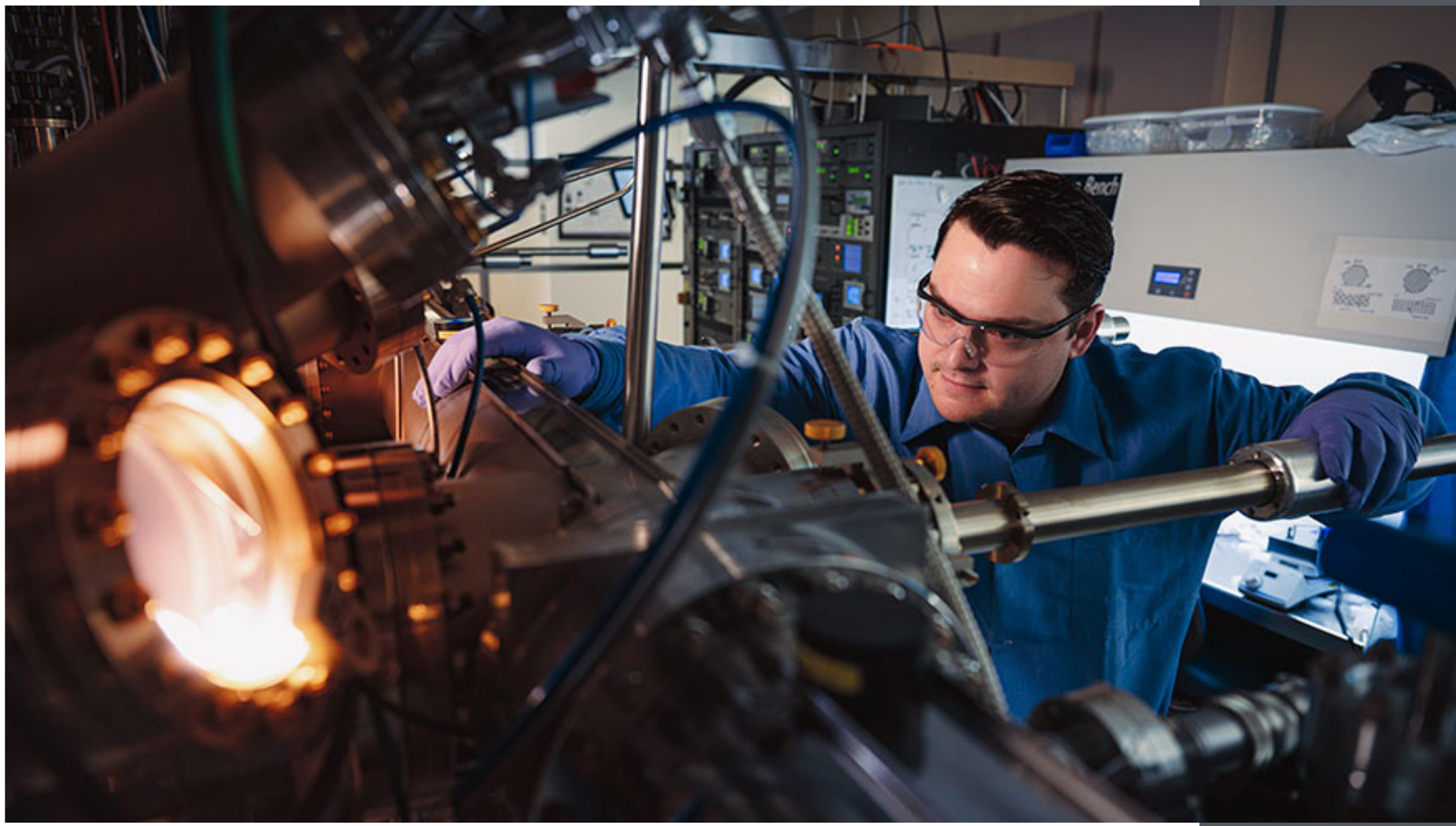


Tyler Lindemann, a researcher in the Microsoft Quantum Lab West Lafayette and a Purdue University doctoral student, uses a molecular beam epitaxy system to create hybrid superconductor-semiconductor structures. (Purdue University photo/Charles Jischke)

"This was a collaborative effort by a very sophisticated team, with a vital contribution from the Microsoft scientists at Purdue," Manfra said. "It's a Microsoft team achievement, but it's also the culmination of a long-standing partnership between Purdue and Microsoft. It wouldn't have been possible without an environment at Purdue that was conducive to this mode of work — I attempted to blend industrial with academic research to the betterment of both communities. I think that's a success story."

Quantum science and engineering at Purdue is a pillar of the Purdue Computes initiative, which is focused on advancing research in computing, physical AI, semiconductors and quantum technologies.

"This research breakthrough in the measurement of the state of quasi particles is a milestone in the development of topological quantum computing, and creates a watershed moment in the semiconductor-superconductor hybrid structure," Purdue President Mung Chiang said. "Marking also the latest success in the strategic initiative of Purdue Computes, the deep collaboration that Professor Manfra and his team have created with the Microsoft Quantum Lab West Lafayette on the Purdue campus exemplifies the most impactful industry research partnership at any American university today."

Most approaches to quantum computers rely on local degrees of freedom to encode information. The spin of an electron is a classic example of a qubit. But an individual spin is prone to disturbance — by relatively common things like heat, vibrations or interactions with other quantum particles — which can corrupt quantum information stored in the qubit, necessitating a great deal of effort in detecting and correcting errors. Instead of spin, topological quantum computers store information in a more distributed manner; the qubit state is encoded in the state of many particles acting in concert. Consequently, it is harder to scramble the information as the state of all the particles must be changed to alter the qubit state.

In the Nature paper, the Microsoft team was able to accurately and quickly measure the state of quasi particles that form the basis of the qubit.

"The device is used to measure a basic property of a topological qubit quickly," Manfra said. "The team is excited to build on these positive results."

"The team in West Lafayette pushed existing epitaxial technology to a new state-of-the-art for semiconductor-superconductor hybrid structures to ensure a perfect interface between each of the building blocks of the Microsoft hybrid system," said Sergei Gronin, a Microsoft Quantum Lab scientist.

"The materials quality that is required for quantum computing chips necessitates constant improvements, so that's one of the biggest challenges," Gronin said. "First, we had to adjust and improve semiconductor technology to meet a new level that nobody was able to achieve before. But equally important was how to create this hybrid system. To do that, we had to merge a semiconducting part and a superconducting part. And that means you need to perfect the semiconductor and the superconductor and perfect the interface between them."

While work discussed in the Nature article was performed by Microsoft employees, the exposure to industrial-scale research and development is an outstanding opportunity for Purdue students in Manfra's academic group as well. John Watson, Geoffrey Gardner and Saeed Fallahi, who are among the coauthors of the paper, earned their doctoral degrees under Manfra and now work for Microsoft Quantum at locations in Redmond, Washington, and Copenhagen, Denmark. Most of Manfra's former students now work for quantum computing companies, including Microsoft. Tyler Lindemann, who works in the West Lafayette lab and helped to build the hybrid semiconductor-superconductor structures required for the device, is earning a doctoral degree from Purdue under Manfra's supervision.

"Working in Professor Manfra's lab in conjunction with my work for Microsoft Quantum has given me a head start in my professional development, and been fruitful for my academic work," Lindemann said. "At the same time, many of the world-class scientists and engineers at Microsoft Quantum have some background in academia, and being able to draw from their knowledge and experience is an indispensable resource in my graduate studies. From both perspectives, it's a great opportunity."

Purdue For Life:

Meet Erica Brand, Senior Director of Development

Hello Boilermaker,

My name is Erica Stickler and I'm a Senior Director of Development with the College of Science. I'm honored to be able to serve as a liaison for the Department of Physics and Astronomy. I've already enjoyed getting to meet many of you!

My educational experience is in nonprofit management and philanthropy. It has been such a gratifying experience getting to work with Purdue alumni and their families since joining the Purdue For Life team more than 3 years ago.

My favorite part of this job is hearing your Purdue stories and learning how your time on campus influenced who you are today. If you're interested in learning how you can make an impact in Physics and Astronomy, or simply want to learn more about the department, please feel free to email me at epstickler@purdueforlife.org.

Boiler Up!

Erica Brand
Senior Director of Development | College of Science

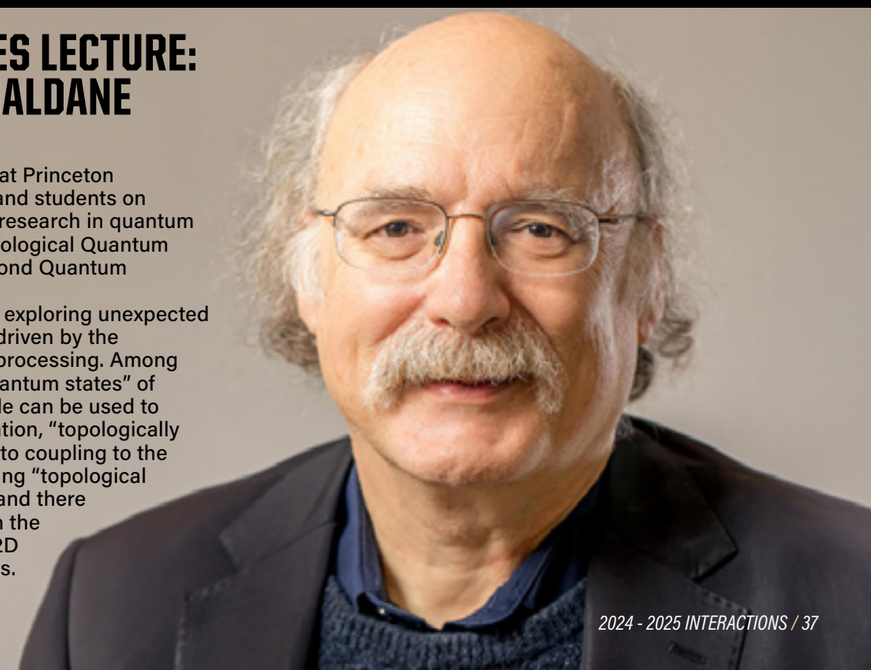
PURDUE PHYSICS AND ASTRONOMY HUBERT JAMES LECTURE SERIES

2024 HUBERT JAMES LECTURE: F. DUNCAN M. HALDANE

F. Duncan M. Haldane, Professor at Princeton University, spoke with faculty staff and students on March 6, 2025 about his renowned research in quantum mechanics. His talk was titled, "Topological Quantum Matter, Entanglement, and the 'Second Quantum Revolution.'"

There is great renewed activity in exploring unexpected properties of quantum mechanics, driven by the possibility of quantum information processing. Among those surprises are "Topological quantum states" of condensed matter, which in principle can be used to store and process quantum information, "topologically protected" from decoherence dues to coupling to the local environment. Recently a working "topological q-bit" has finally been announced, and there have been exciting developments in the study of exotic electronic states in 2D materials that could host such q-bits.

This talk was hosted by Prof. Michael Manfra.



Prof. Jeffrey Gerber teaching a class of physics students in the new Indianapolis physics labs. Purdue University photo/Alisha Willett

Purdue's new cutting-edge physics labs ignite innovation in Indianapolis

INDIANAPOLIS —Purdue University is expanding hands-on learning in the capital city with a new state-of-the-art physics labs, providing students with cutting-edge facilities to enhance hands-on education in STEM fields.

Designed to offer immersive, real-world experiences, the new physics labs serve as a hub for experimentation and discovery. The advanced facility equips future scientists, engineers, and innovators with the tools to apply physics concepts in meaningful ways, reinforcing Purdue's commitment to experiential learning in Indianapolis. The labs include specialized equipment such as motion-tracking devices, electric coils, magnetic field generators, and other essential tools that immerse students in active learning.

"At Purdue, we know that the best way to learn is through hands-on experience and direct interaction with the material," said Jeffrey Gerber, assistant professor of practice in the Department of Physics and Astronomy, who is leading the laboratory setup and management.

"These labs allow students to engage with physics concepts in real-time, reinforcing what they learn in lectures with practical application. This hands-on learning is key to developing problem-solving skills, and these new labs provide an environment where students can explore, test, and innovate," said Gerber.

Gerber received valuable support from graduate students Sean Savage, Nikhil Borse, Ravishankar Chatta Subramanium, Alex Whitman, and Winter Allen during the initial setup phase. Many of these graduate students also serve as teaching assistants for laboratory courses. Physics Professors Sanjay Rebello and Ian Arnold contributed to the laboratory setup.

The new facility features two fully-equipped lab rooms, currently serving approximately 350 students currently taking physics courses to satisfy their degree requirement. By fall 2025, enrollment is expected to expand to 500 students, demonstrating the growing demand for hands-on physics education.

"We are especially excited about these new lab spaces because they provide students with opportunities to apply physics principles in meaningful ways," said Jonathan Rienstra-Kiracofe, associate dean for undergraduate STEM education in the College of Science.

Rienstra-Kiracofe also emphasized the significance of this development: "We are especially pleased with our new physics lab spaces as they ensure that our Purdue students studying in Indianapolis are receiving the same high-quality physics teaching lab experience as students studying in West Lafayette."

Purdue's expansion in the capital city reflects its commitment to providing students with world-class learning opportunities. "Teaching and educating students is a passion of mine," Gerber added. "I'm excited to help shape these courses with new physics education research and provide Indianapolis students with an unparalleled opportunity for hands-on learning."

"We're thrilled to expand our services to Purdue University in Indianapolis, upholding the same level of excellence and innovation as at West Lafayette. With state-of-the-art facilities and a devoted faculty team, we are committed to offering students a top-quality education along with practical experience. We look forward to nurturing the next generation of scientists and engineers in Indianapolis with the same Boilermaker spirit that propels us forward," says Gabor Csathy, professor and head of the Department of Physics and Astronomy.

About Purdue University in Indianapolis

Purdue University in Indianapolis is a fully integrated expansion of West Lafayette, extending to central Indiana the academic rigor and accessible excellence for which Purdue is known. As the state's only top 10 public university, most trusted university and most innovative university, Purdue is focused and committed to strengthening its presence in Indiana's industrial and technological center. Purdue University in Indianapolis is creating an innovative, STEM-based collegiate experience by connecting future-ready Purdue students and faculty in Indianapolis to local businesses to accelerate Indiana's STEM pipeline and tech ecosystem, fueling impact for our region and the world.

Purdue University students take part in activities at the newly-created physics labs in Indianapolis. Purdue University photo/Alisha Willett

Dr. Wendell Lutz was an original signer of the tandem accelerator in the PRIME Lab. He helped setup and conduct some of the first experiments under the guidance of Prof. Rolf Scharenberg.

Original signer of the tandem accelerator returns

Alumnus Wendell Lutz revisits the lab where he worked as a student, finding change amid familiarity

Story by Cheryl Pierce

The Purdue Rare Isotope Measurement Lab, commonly known as PRIME Lab, lies at the lowest level of the Physics building and requires security clearance to enter. Once inside, one can tell that this lab has been around for a great many years and is expansive. Last June, Wendell Lutz visited the Purdue Physics and Astronomy Department to tour the PRIME Lab. He was no ordinary visitor… he was one of the original grad students who helped bring the facility online and one of the first to conduct experiments with the large tandem accelerator

Today, the lab has been converted and now uses the accelerator for mass spectrometry. But initially, the accelerator was designed to study the nucleus of the atom. After its installation a tradition grew in which graduate students, upon finishing their studies, would sign the tandem accelerator. All those signatures are visible today. During Lutz's visit, he was able see his, as well as his friends and colleague' signatures, from so many years ago. The signers of the accelerator didn't have Sharpie markers back in the 70s. Lutz said that they dipped a small brush in black paint in a tuna can in order to sign their names over 50 years ago. He was the seventh signer, 1973.

Wendell looks back fondly at the years he spent at Purdue under the guidance of Prof. Rolf Scharenberg. The tandem accelerator was installed in 1969, during Lutz's time as a Purdue graduate student. In fact, five of the first twelve signers were Rolf's students (see signature photo on page 42). Lutz says, "All five of us helped with the installation of the tandem under the supervision of knowledgeable professors and together with Rolf did some of the first experiments. These connections with the early days provided a bond that has kept us linked for all these years and continues today."

Left, Rolf Scharenberg, with Wendell Lutz at a Purdue seminar in 1999. Photo provided by Wendell Lutz.

As an example of this link, the five wrote letters collectively to their advisor Rolf many decades later in honor of his 90th birthday. Lutz wrote in part, "It's really impossible for me to express how grateful I am to have had you as a major professor and been part of the tandem accelerator group. It certainly saved my graduate career. During that period, I failed, then occasionally succeeded, then failed again, and so forth. All the time you minimized the failures and encouraged the next effort. Along the way I learned a lot about physics and about being part of a team, and gained self-confidence."

Of the five from Rolf's group, four went on to have successful careers in the medical field (Bob Beyer, Piran Sioshansi, Ron Larsen, Wendell Lutz) and one (Jim Thomson) was very important in the fields of domestic, US governmental and international policy analysis. None of them went into purely physics fields. With a smile, Lutz says that if he could give current students advice, it would be that careers can take twists and turns and you may not end up in the field you expected so be open to the wide possibilities that earning a degree in physics can bring.

The tandem accelerator was acquired to study the properties of the nucleus of the atom. "For perspective, if a typical atom were the size of Purdue's Ross Ade Football Stadium, then the nucleus, which contains virtually all the mass of the atom, would be approximately the size of a pea and the rest of the 'stadium' would be filled with very light electrons," says Lutz. "These electrons form a kind of a cloud around the nucleus. Our interest was in what's going on inside that pea, the nucleus of the atom. How is it all put together? What is its structure?"

Lutz explained that when experiments were running, work was conducted non-stop. Students and professors worked around the clock in shifts in order to get the most out of their 72 hours of beam time.

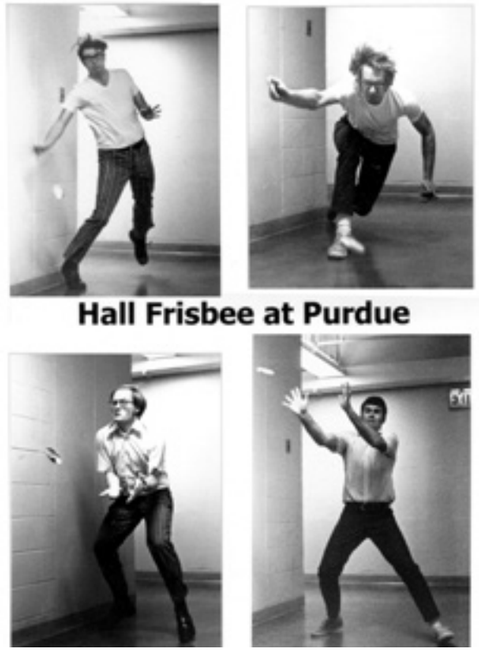
"In our experiments we used the tandem to accelerate light nuclei, like oxygen and sulfur, to high speeds (something like 10,000 miles per second) and then blasting them into heavy nuclei like palladium or erbium that we wanted to study," he said. "We created nuclear reactions and measured and analyzed the pieces that came out, trying to understand how the nucleus was put together. If we were successful, each experiment yielded a little additional information about the nature of those heavy nuclei."

It wasn't all work and no play in the lab. The grad students would routinely go to lunch at McDonalds on Northwestern Avenue. Yes, the same McDonalds. Once they received small Frisbees from the restaurant which were being used as soft drink caps.

"Back at the lab, I tried throwing these little 3 ½ inch diameter Frisbee caps in the hallway outside our offices," said Lutz. "They didn't fly worth a darn. So I started experimenting duct taping pennies to the inside perimeter of these little Frisbees. All of a sudden, these things became a 'weapon' and could be thrown at high speeds."

Thus started the game of hall Frisbee which consisted of two-man teams at each end of the hallway with one team attempting to throw these fast-moving missiles past the other team. This became a noontime game which Rolf found very unprofessional at first but later came to accept as the group's real work did get done.

"Here's another less amusing story," he said. "In some of our experiments we were accelerating sulfur



Noontime Frisbee competition at Purdue was popular with the tandem students. Pictured clockwise from upper left: Jim Thomson, Wendell Lutz, Allan Garber, Ron Larsen. Photo provided by Ron Larsen.

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nuclei and blasting them into our targets. The source of the sulfur nuclei was hydrogen sulfide gas. I had made a bad connection when feeding the pressurized hydrogen sulfide gas into the accelerator. When the accelerator is running, because of the radiation levels, the accelerator room is sealed off from the experimenters at the controls or in the data gathering room. Hydrogen sulfide gas was leaking into the accelerator room, but we couldn't smell it. Unknown to us the room shared the air handling system with the entire physics building. After a couple of hours of hydrogen sulfide leakage word came down to us that the entire building stunk of rotten eggs! What are you guys doing down there? It was traced back to me with substantial embarrassment. In response we built a containment shed of wood and clear plastic with an outside exhaust to house the gas input system feeding into the accelerator. Our shed was affectionately called 'the chicken coop.'"

While visiting Purdue, Wendell met with students who had earned summer scholarships through the Rolf Scharenberg Graduate Endowment that was set up in 2017 by Wendell to honor his advisor. This fellowship allows first or second year graduate students to work with a research advisor for a summer prior to joining a research group. Summer research is important to Wendell because it was instrumental in his ability to forge his own path while a student at Purdue.

He also had an opportunity to walk down memory lane when he visited his old basement apartment. He was delighted to see that the house was still there and that his basement was giving shelter to students to this day.

Lutz received his B.S. degree in physics in 1966 from Wittenberg University in Springfield, Ohio, and his Ph.D. from Purdue in 1973. From 1973 until 1978 he taught undergraduate physics at Pahlavi University in Shiraz, Iran, and at the U.S. Coast Guard Academy in New London, Connecticut. In 1978 he developed an interest in medical physics and began his training in radiological physics at Harvard Medical School. He is known both nationally and internationally

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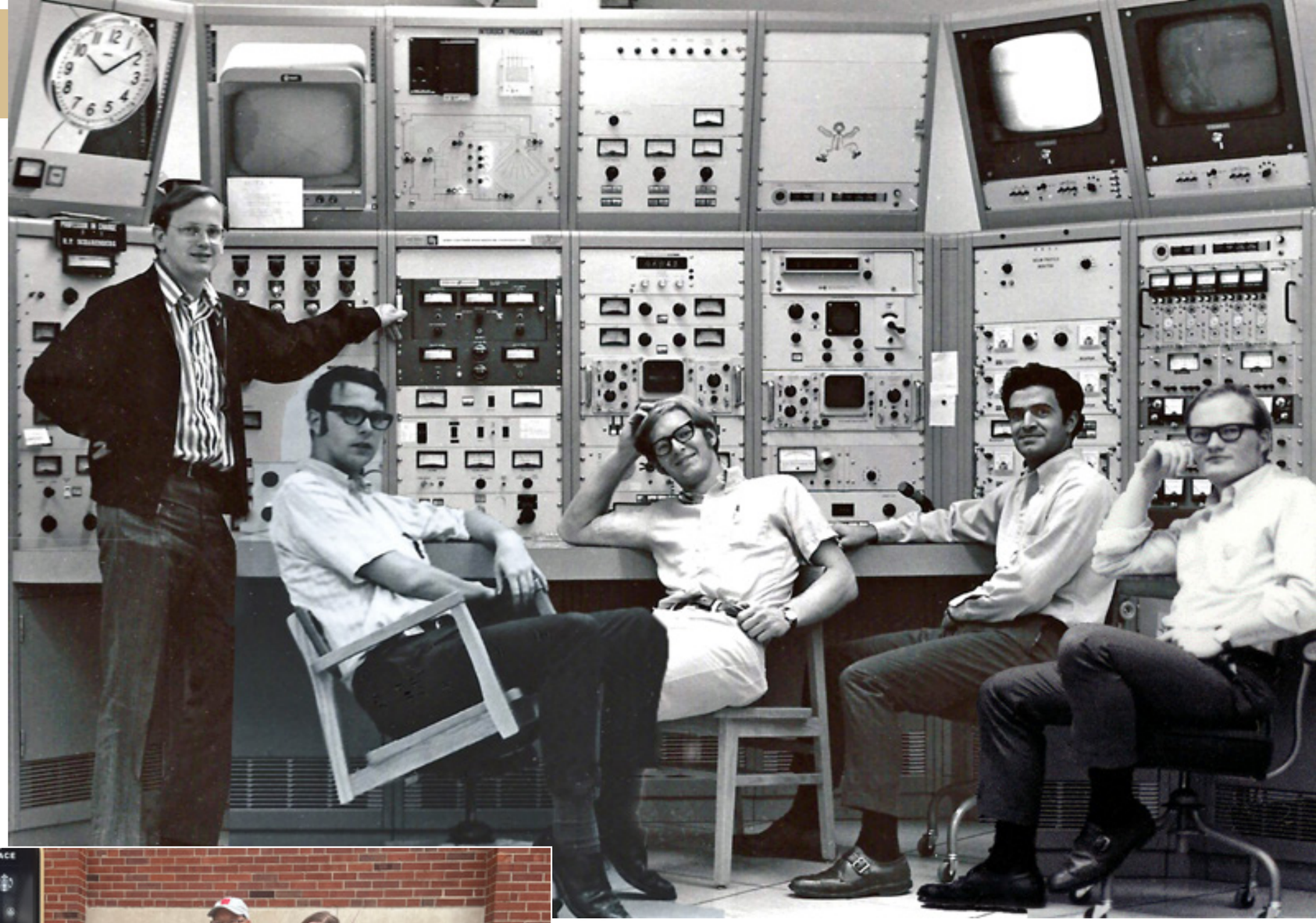
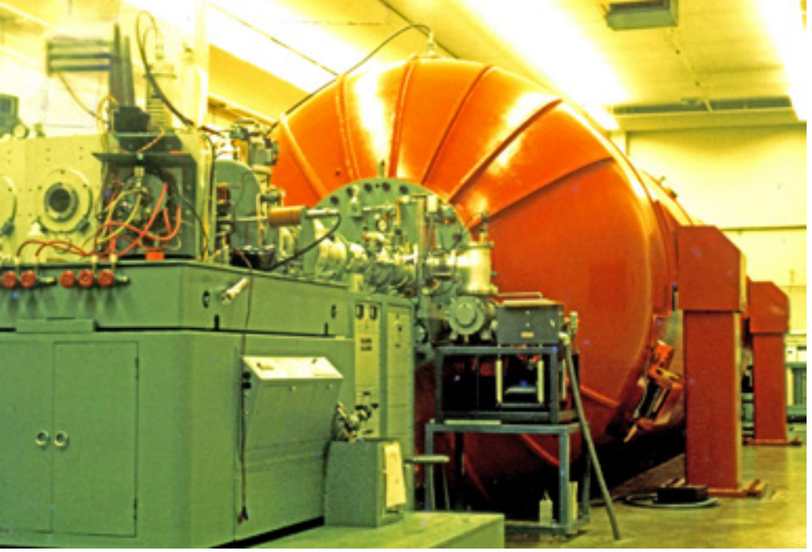


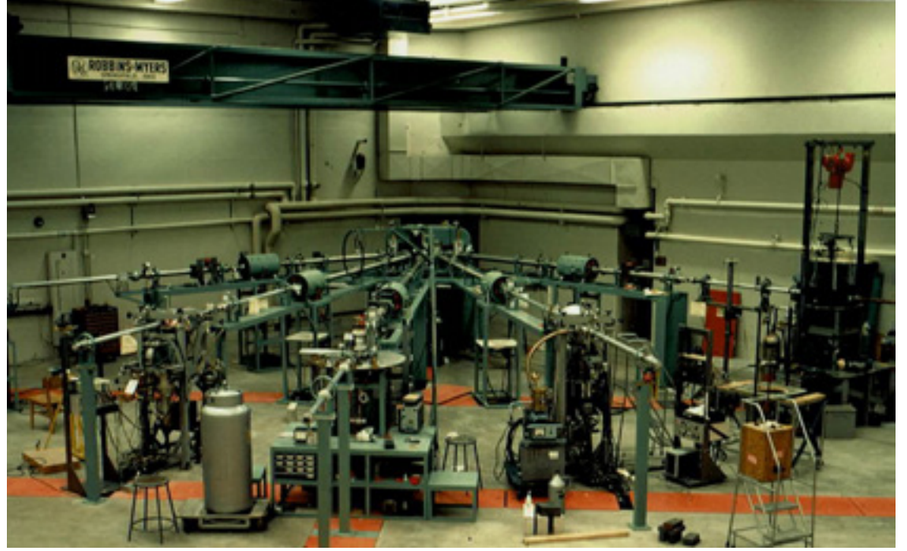
This composite posed picture at the controls of the tandem accelerator from 1971, shows left to right: Joe Tesmer, a postdoc, and four of Prof. Rolf Scharenberg's students: Jim Thomson, Wendell Lutz, Piran Sioshansi, and Ron Larsen. Photo provided by Rom Larsen.

"Did we really know what all those dials did?!"
- Wendell Lutz

Left: Wendell met with students who benefited from the endowments he had set up for summer research opportunities.
From left to right: Kevin Barrow, Tess Hoover, Dr. Wendell Lutz, Abigail Wesolek
Photo by Erica Stickler.

Right: While a student at Purdue, Lutz lived in a basement apartment near campus. Above, he is standing in the same doorway he once called home. Photo by Erica Stickler.





Above: The tandem accelerator changed through time and has been contributing to scientific discovery throughout its storied existence. The photo at the above left was taken when Lutz was still at Purdue as a graduate student and the accelerator was used for nuclear physics experiments. Lutz said that particles were accelerated from the injector toward the far end of the room. From there, the path of the particles went to the Beam Line Room pictured above middle. Original signatures of the tandem pictured at the right. Photos provided by Wendelll Lutz.

> “I’m proud to be a Boilermaker!”
>
> — *Wendell Lutz*

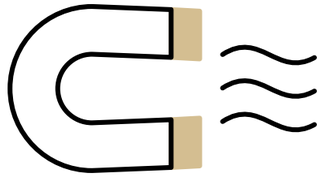
CONTINUED FROM PREVIOUS PAGE

for his many contributions to radiation oncology research and development, teaching and clinical care. He was co-designer of a low-cost linac stereotactic radiosurgery system to precisely treat brain tumors.

According to colleague and co-signer of the tandem, Ron Larsen, “Precision radiation therapy in the brain used to be only available with the Gamma Knife. It was very expensive and somewhat limited in field size. It employed several hundred radioactive cobalt sources located in a semi-spherical helmet placed over the head with apertures pointed at the tumor. Wendell revolutionized our ability to do this kind of treatment by using our existing linear accelerator equipment. Later developments by medical physicists and radiation oncologists extended this general technique to other parts of the body.”

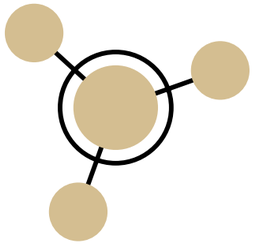
Lutz chose not to patent his method but published it as opensource in order to make the treatment less expensive, more widely available and to encourage innovation. He assisted, to varying degrees, about forty institutions in initiating his stereotactic radiosurgery program always insisting that the important safety features of the design be used.

He also developed a total-body, high energy x-ray facility that assisted in successful bone marrow transplants. These projects, the stereotactic radiosurgery and the total-body x-ray facility, were completed at the Radiation Oncology Department of Harvard Medical School. He received an Honorary Doctor of Science from Wittenberg University in 1991, and Harvard endowed the Lutz-Winston fellowship in his honor in 1992. He was named a Purdue Distinguished Alumnus in 1994. He also received prestigious lifetime achievement awards from both the National Medical Physics Society in 2016 and the National Radiation Oncology Society in 2022.



KEEP UP WITH WHAT'S HAPPENING AT PURDUE PHYSICS AND ASTRONOMY!

The Department of Physics and Astronomy is constantly pushing the limits of the world's collective knowledge of our physical world. We persistently pursue the next giant leap in our sciences and explore avenues of outreach. Below is a sampling of the ways you can keep up with what is happening in the department. Boiler up!



Website: physics.purdue.edu

Departmental Social Media:

Instagram: @purduephysastro

Facebook: Purdue Physics and Astronomy

LinkedIn: Purdue Physics and Astronomy

Galileo Unbound:

galileo-unbound.blog

This blog is an ongoing series by Professor David Nolte, the Edward M. Purcell Distinguished Professor of Physics and Astronomy. He discusses all things physics and takes you on a roller coaster ride into the history of our sciences. You can also keep up with Galileo Unbound on the YouTube page.

The Astrophysics Podcast:

rss.com/podcasts/astrophysics

Once a month, Purdue University's Professor Paul Duffell discusses astronomy and astrophysics with experts from around the world on The Astrophysics Podcast. Duffell and guests discuss supernovae, galaxies, planet formation, black holes, and the nature of space and time.

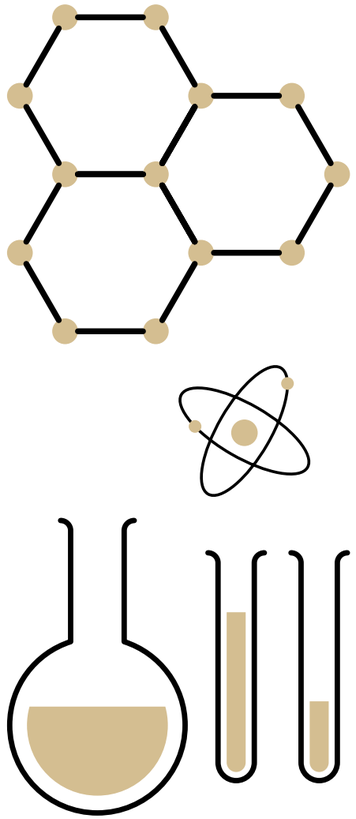
The Quantum Age:

thequantumage.com

As host of The Quantum Age, Professor Erica Carlson takes you through the ins, outs, ups and downs of the quantum world. Using everyday objects and creative analogies, she makes quantum materials exciting and easy to understand. In addition to her stunning website, you may find The Quantum Age on Dr. Carlson's YouTube page.

Purdue Physics and Astronomy K-12 Outreach: physics.purdue.edu/outreach

Physics and Astronomy Outreach is ran by Dr. David Sederberg. It has many programs but also makes Classroom Calls, providing resources and expertise for the K-12 classroom teachers. Whether we provide a "Scientist on Site" for a classroom talk and demonstration, support for lesson design and implementation, or work with teachers to provide a novel learning experience, Physics and Astronomy Outreach is eager to spread our enthusiasm for learning science. Keep up with the latest on K-12 outreach on the outreach website, their YouTube page, or on Twitter/X.



DEGREE RECIPIENTS

SPRING 2024

Shiqi Kuang, Bachelor of Science
Hari R. Malladi, Bachelor of Science
John Frandina, Bachelor of Science
Mia A. Caruso, Bachelor of Science
John N. Mburu, Bachelor of Science
Gage G. Gardinier, Bachelor of Science
Gabriel C. Skowronek, Bachelor of Science
Nuo Chen, Bachelor of Science
Josuan Vega, Bachelor of Science
Caden M. Glenn, Bachelor of Science
Ethan J. Pinarski, Bachelor of Science
Elliot D. Grant, Bachelor of Science
Jessie M. Lanzer, Bachelor of Science
Maxim M. Barskiy, Bachelor of Science
Adam D. Clay, Bachelor of Science
Alexander M. Johnston, Bachelor of Science
Dean A. Schmidt, Bachelor of Science
Morgan M. O'Keefe, Bachelor of Science
Adit Batra, Bachelor of Science
Gustavo A. Saez Cruz, Bachelor of Science
Melody A. Shimba, Bachelor of Science
Ryan P. Lakamp, Bachelor of Science
Arianna M. Mcnamara, Bachelor of Science
Eleazar M. Gonzalez, Bachelor of Science
Elijah R. Van Grootheest, Bachelor of Science
Wyatt T. Montgomery, Bachelor of Science
Rebecca J. Hackett, Bachelor of Science
Yaroslav Ivanov, Bachelor of Science
Claire E. Pritts, Bachelor of Science
Sara C. Cuevas Quinones, Bachelor of Science
Brianne Checketts, Bachelor of Science
Delaney M. Koi, Bachelor of Science
Amelia R. Binau, Bachelor of Science
Dylan S. Caudill, Bachelor of Science
Jared E. Bland, PhD, Doctor of Philosophy
Gabriel S. Bury, PhD, Doctor of Philosophy
Michael Allan Carlson, PhD, Doctor of Philosophy
Jijun Chen, PhD, Doctor of Philosophy
Amy J. Damitz, PhD, Doctor of Philosophy
Zachary K. Davis, PhD, Doctor of Philosophy
Ahmed Aly Elkamshishy, PhD, Doctor of Philosophy
Kunaal Joshi, PhD, Doctor of Philosophy
Guangjie Li, PhD, Doctor of Philosophy
Soham Mandal, PhD, Doctor of Philosophy
Shoy Ouseph, PhD, Doctor of Philosophy
Siddhant Pandey, PhD, Doctor of Philosophy
Xiaobing Shi, PhD, Doctor of Philosophy
Hao Wang, PhD, Doctor of Philosophy
Teng Zhang, PhD, Doctor of Philosophy

SUMMER 2024

Ace Rounds, Bachelor of Science
Benjamin J. Hartley, Bachelor of Science
Nicholas G. Erikson, Bachelor of Science
Miguel A. Alarcón, PhD, Doctor of Philosophy
Penghua Chen, PhD, Doctor of Philosophy
Peng Ju, PhD, Doctor of Philosophy
Shuang Liang, PhD, Doctor of Philosophy
Yuming Shi, PhD, Doctor of Philosophy
Bhagya Madimugar Subrayan, PhD, Doctor of Philosophy

FALL 2024

Ian M. Peterson, Bachelor of Science
Aiden J. Dillard, Bachelor of Science
Gabriel K. Goodwin, Bachelor of Science
Benjamin D. Harvey, Bachelor of Science
Yi Mao, Bachelor of Science
Haixuan Huang, Bachelor of Science
Ryan E. Rushing, Bachelor of Science
Jason N. Becker, Bachelor of Science
John Arnesh Divakaruni Daniel, PhD, Doctor of Philosophy
Kiranmayi Dattatreya Dixit, PhD, Doctor of Philosophy
Anirban Dutta, PhD, Doctor of Philosophy
Xingyu Gao, PhD, Doctor of Philosophy
Shiva Teja Konakanchi, PhD, Doctor of Philosophy
Andrew Stewart Longman, PhD, Doctor of Philosophy
Deepak Aditya Suresh, PhD, Doctor of Philosophy
Sachin B. Vaidya, PhD, Doctor of Philosophy
Bowen Yan, PhD, Doctor of Philosophy

CONGRATULATIONS

TO OUR NEWEST ALUMNI!

PURDUE
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Department of Physics and Astronomy

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