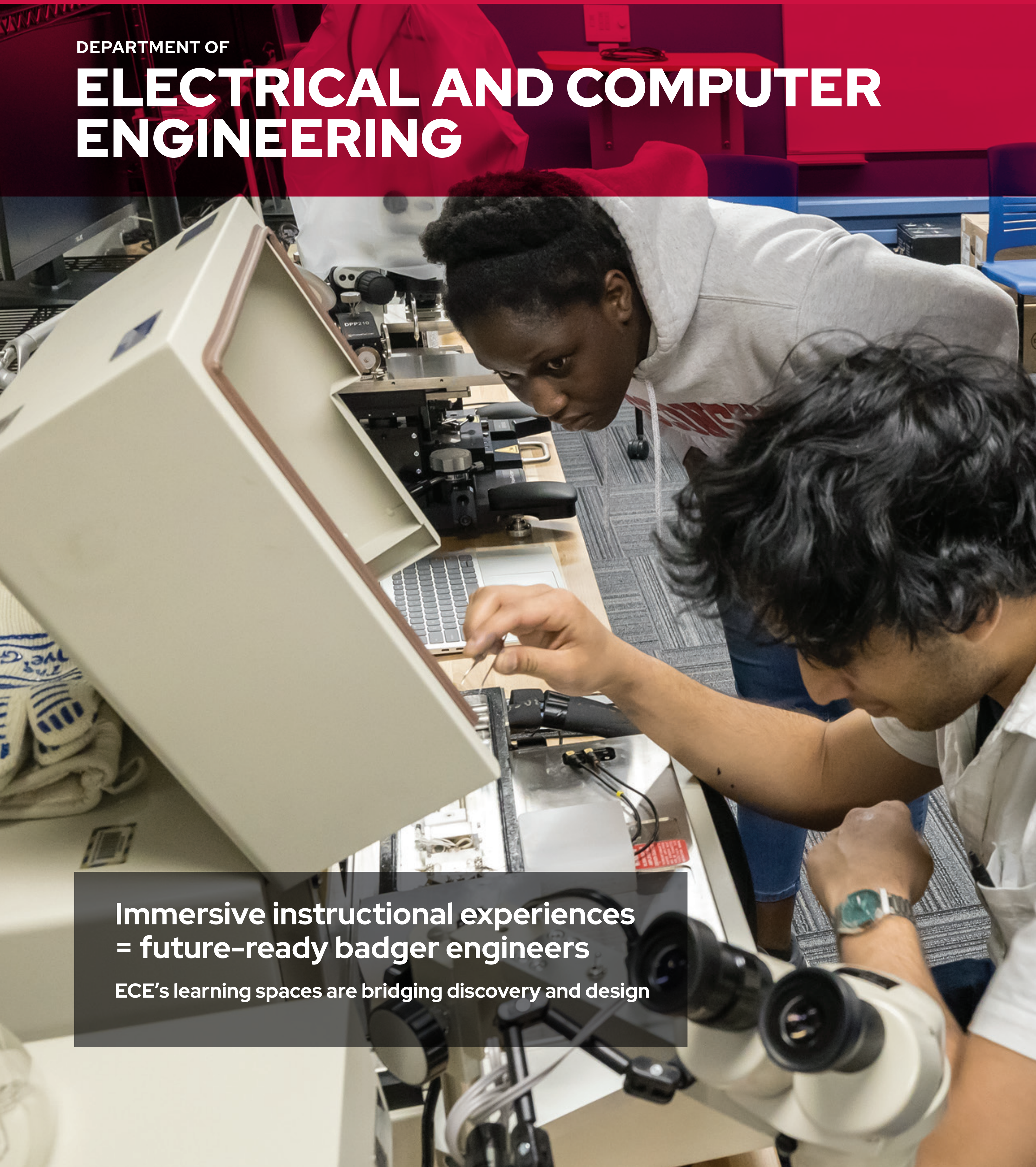
College of Engineering
UNIVERSITY OF WISCONSIN–MADISON

SPRING 2025 NEWSLETTER

DEPARTMENT OF

ELECTRICAL AND COMPUTER ENGINEERING



Immersive instructional experiences = future-ready badger engineers

ECE's learning spaces are bridging discovery and design

Dear alumni, colleagues and friends,

I am inspired and energized by our UW-Madison ECE department's strong tradition of innovation combined with societal impact. We are driven by the Wisconsin Idea: that what we do here in research and education should enhance the lives of every person in the state of Wisconsin, as well as across the nation and the world. In a nutshell, it's "engineering beyond boundaries."

For example, earlier this year, the U.S. Department of Energy awarded a grant of up to $50 million to Alliant Energy, a Wisconsin-based utilities company, in partnership with the College of Engineering, to bring smart grid technology to rural communities throughout Wisconsin. ECE Associate Professor Line Roald, an expert in power grid resilience, is serving as the technical lead on this project. Her expertise was also recently tapped by the National Academies for a panel focusing on the implications of AI data center electricity use and emissions.

Closer to home, we are rejoicing that microwave ablation technology developed through a collaboration between ECE and radiology faculty and graduate students played a key role in treating one of our own teaching faculty. Commercialized more than a decade ago, the technology was part of teaching faculty member Eric Hoffman's life-saving cancer treatment protocol. Eric has continued pursuing his passion for teaching senior capstone design courses this year. It is a powerful reminder of the real-world impact of our innovations that quite literally saves lives.

Looking ahead, we are excited about our strategic plan for 2025-2030, which renews our commitment to our core values, including fostering an environment that welcomes and supports all members of our diverse community of students, faculty and staff.

One of our strategic priorities focuses on preparing our students to meet the technological demands of this rapidly changing world. Toward this end, we are expanding undergraduate educational opportunities both inside and outside the classroom. We are excited to announce a new semiconductor engineering named option within our BS degrees in electrical engineering and computer engineering. Our students continue to excel in extracurricular design competitions such as the Spaceport America Cup and Badger Solar Racing, and in undergraduate research. This spring we will host the inaugural ECE Undergraduate Research Symposium, where undergraduate students will showcase their research while our ECE advisory board members are in town.

We remain steadfast in our commitment to advancing teaching excellence and engineering education innovation. Associate Professor Josh San Miguel is our most recent recipient of the College of Engineering's Benjamin Smith Reynolds Award for Excellence in Teaching, adding to a long list of ECE faculty who have, in total, received more than 20 college- or campus-level teaching awards over the last 20 years.

This spring, we are conducting a pilot study on the impact of an AI learning assistant tool in a core first-year undergraduate computer engineering course, an initiative that may pave the way for changing how we teach. And back in the fall, we launched the David and Sarah Epstein Teaching Assistant (TA) Fellows program, which fosters a community of practice for PhD students serving as TAs in support of faculty-led instruction.

Another strategic priority focuses on enabling research excellence, impact and growth in engineering areas of vital importance to society. Investments in state-of-the-art research facilities, including a new MOCVD reactor for wide-bandgap semiconductors and a new power grid simulator, are expanding our capabilities as we grow our faculty. The campus-wide Wisconsin Research, Innovation and Scholarly Excellence (RISE) Initiative is driving our faculty recruitment efforts in AI and clean energy technologies and I look forward to sharing good news soon about faculty search outcomes this year.

I'm delighted to share that our faculty received some of the highest possible recognitions for their research impact over the past several months. Professor Mikhail Kats received a Presidential Early Career Award for Science and Engineering (PECASE), Professor Umit Ogras was elevated to IEEE Fellow, Professor Kats became a fellow of SPIE and Optica, and Professor Andreas Velten also became an Optica Fellow.

As we navigate the challenges and opportunities ahead, we remain deeply grateful for the support and engagement of our alumni and friends of the department. Your contributions and achievements continue to inspire our students and faculty. We invite you to stay connected, share your experiences, and support the next generation of ECE Badgers who will shape the future of our field.

On, Wisconsin!

Susan C. Hagness
Department Chair, Philip D. Reed Professor of Electrical and Computer Engineering
Maria Stuchly Professor in Electrical Engineering
(608) 265-5739
susan.hagness@wisc.edu

engineering.wisc.edu/ece
go.wisc.edu/linkedin-ece
@UW-Madison ECE
@uwmadisonece
@uwmadisonece

On the cover: Undergraduate students in ECE's recently renovated Semiconductor Engineering Instructional Laboratory are analyzing the properties of semiconductor material samples using instruments like the Hall effect measurement system. Photo: Joel Hallberg

FOCUS ON NEW FACULTY

Jennifer Volk is building highly efficient computing systems using unconventional circuits

Photo: Todd Brown.

Estimates show that in the near future, traditional semiconductors will no longer keep up with our computing demands. That has led to a wave of interest in unlocking the potential of nontraditional computer technologies, including superconducting and quantum computing, spintronics and other emerging alternatives. While many of these technologies show promise, most are far from practical, large-scale integration, and their futures are unclear.

Jennifer Volk, who joined ECE in January 2025 as the John D. Wiley Assistant Professor, is working to develop a vision of what a future could look like with such nontraditional technologies.

Volk, who completed her PhD in electrical and computer engineering at the University of California, Santa Barbara, in 2024, is ready to engineer these next-generation devices. “The challenge comes from the complexity of these nontraditional technologies, which is considered to be very high compared to more traditional technologies,” she says. “Their fundamental device physics break many, if not all, design abstractions and conventional wisdom about trade-offs across the compute stack.”

This, along with slow-to-advance fabrication processes, has limited their adoption and led many researchers to scratch their heads on how to turn single devices into high-performance computers.

Volk’s approach starts with practical innovations for superconductor electronics. These devices are extremely efficient and high speed. They have a relatively mature fabrication process and could have a major impact on data centers, quantum computing, satellite communications, advanced astronomy, and many other computation-intensive applications.

But superconductors come with a catch: because their operating mechanics are fundamentally different from conventional semiconductors, they also require a different design approach. In some cases, researchers force-fit superconductors into conventional computing schemes, which don’t take advantage of their strengths.

In contrast, Volk’s approach focuses on examining and exploiting the opportunities created by the absence of resistance and the intrinsic characteristics of superconducting electronic devices at various levels. “I take a look across the entire compute stack, from architecture down to logic and circuits, and see what’s a good fit for this technology,” she says. “When I started this work, the field was lacking a clear, winning solution for logic, memory, and fan-out—essentially everything that you’d need in a computer.”

Her work has delivered several designs that significantly bolster the density of computation on superconducting chips, as well as a superconducting memory that promises at least two to three orders of magnitude improvement over current state-of-the-art storage density. She has experimentally verified her designs through MIT Lincoln Laboratory, where she has fabricated her designs for the last five years.

At UW-Madison, Volk is building on her superconducting research advances to date, scaling up experimental demonstrations of her solutions. She also believes she can use insights gained from her work on superconductor electronics to advance other emerging technologies.

Joining UW-Madison, Volk says, gives her an opportunity to enrich her work at all levels. “There is a wonderful collection of folks in ECE, computer science and physics working on superconductors and who are interested in or already working on other nontraditional technologies,” she says. “There are a lot of really cool opportunities to expand our superconducting efforts and to branch out to some other technologies.”

Photo: Todd Brown.

FOCUS ON NEW FACULTY

George Tzimpragos is reimagining computer microarchitecture to overcome scaling slowdowns

Over the past 80 years, computers have progressed from room-sized collections of vacuum tubes and mechanical relays to the tiny digital devices we now carry in our pockets. Along with the hardware changes, computer architecture—the organization and design of computer systems and the way components work together—has also evolved, but not always in the best direction.

Many approaches underpinning the way modern computers operate are based on past constraints, like the types of materials and components available, computing power and operating software. Now, as quantum computing, superconducting materials, and other big changes come to computing, it's worth evaluating whether different architectures might be better approaches.

"My research seeks to challenge long-standing assumptions in computer architecture," says George Tzimpragos, who joined ECE as the James E. Smith Assistant Professor in January 2025.

His favorite types of questions challenge the status quo; for example, "Are binary codes and Boolean logic always the most efficient approach to computation?" or "Are conventional memory structures optimal across all technologies?"

Tzimpragos earned a PhD in computer science from the University of California, Santa Barbara in 2022. He was an assistant professor in electrical engineering and computer science at the University of Michigan for two and a half years before coming to Madison.

Among his many ideas, Tzimpragos advocates rethinking the established analog-digital boundary in data representation and processing. He proposes that time should be treated as a computing resource—like its role in the brain—rather than merely a performance metric. This perspective, he argues, offers transformative possibilities, including new methods for embedding computational capabilities into sensors, scaling up pulse-based and quantum computing, and advancing hardware security and formal verification.

When it comes to computer memory, Tzimpragos suggests revisiting ideas from historical machines like ENIAC, the first general-purpose computer developed in 1945, where a technology called delay lines served as storage media. While such an approach might be unreasonable for semiconductors, new superconducting electronics could take advantage of the technique. "This isn't just a solution for superconductor memory," he explains, "but a paradigm shift in computer architecture. It's a departure from current trends of minimizing data movement by adding transistors. Instead, we capitalize on the inexpensive data movement in superconducting interconnects to maximize energy efficiency and minimize hardware complexity, bringing this technology closer to practicality."

These concepts, Tzimpragos believes, could have wide application. "Many of our current technologies have stood the test of time because they are simple and efficient. Other ideas, though equally elegant, may have simply failed to align with the devices of their era," he says. "Now is the perfect moment to revisit them, and UW-Madison offers an excellent environment for such explorations."

The university, he says, is in a unique position, combining a rich history of pioneering work in computer architecture with a recent influx of talented young researchers in electrical and computer engineering, physics, and computer science. In addition, Tzimpragos admits a personal attachment to UW-Madison. Over his academic career, he has both drawn inspiration from and collaborated with Professor Emeritus James E. Smith, a luminary in computer architecture. "It is an honor to hold a professorship named after him. When I think of computer architecture and innovative, out-of-the-box thinking, Jim is the first person who comes to mind," Tzimpragos says.

Mikhail Kats receives Presidential Early Career Award for Scientists and Engineers

Mikhail Kats

Jack St. Clair Kilby and Antoine-Bascom Professor Mikhail Kats received a 2025 Presidential Early Career Award for Scientists and Engineers (PECASE). Established in 1996, the award is the highest honor bestowed by the U.S. government on outstanding scientists and engineers early in their careers. The PECASE recognizes researchers who show exceptional potential for leadership and is typically awarded to 60 to 100 individuals per year across all fields of science and engineering.

Kats, who joined ECE in 2015, engages in experimental and theoretical exploration of topics across the fields of optics and photonics, device physics, nanoscale science and quantum technologies. The goal of his research group is to investigate fundamental problems in optics and photonics and to create next-generation optical components to emit, modulate and detect light across the visible and infrared spectral ranges.

"I'm thrilled to receive the PECASE, which is representative of efforts and support from my research group, colleagues, collaborators, current and former mentors, administrative staff and family," says Kats, who was nominated for the award by the Office of Naval Research. "Without that big extended team, sustained success is not possible."

For instance, Kats points to Chenghao Wan, his first PhD student, who was instrumental in performing simulations and creating figures for his first research proposal to the Office of Naval Research (ONR)—a proposal to the Young Investigator Program. That proposal resulted in funding and a long, fruitful relationship with ONR, which led to an early career grant with a broad scope of developing infrared optics with engineered optical materials.

"Within the Office of Naval Research, I received mentorship from Program Officer Ryan Hoffman, who has supported and championed my research now over many years," says Kats. "I am deeply grateful for this support."

Professor Kats is the fourth ECE faculty member at UW-Madison to be honored with a PECASE.

Tervo leads breakthrough in heat-to-electricity conversion with novel semiconductor device

Using innovative semiconductor fabrication techniques, an ECE team led by Assistant Professor Eric Tervo has developed a new type of device that can convert heat directly into electricity. The innovation—a near-field thermophotovoltaic device—could lead to new or more efficient energy sources. It could also enable the generation of electricity by harvesting waste heat from industrial processes like cement or steel production.

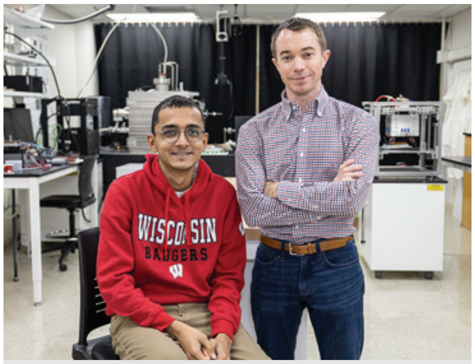
"This device checks every single box—low-maintenance, high-power-density and scalability," says Tervo. "You can use it with a huge variety of heat sources across a very large range of temperatures. It could be slotted into all sorts of energy systems, whether those are renewables or classic fossil fuel or nuclear systems. It opens up new technology and system options that you don't have with these other types of heat engines."

Much of today's energy comes indirectly from heat: For example, coal, some natural gas power plants and nuclear reactors boil water, producing steam that spins electricity-producing turbines. But these processes are large, maintenance-heavy and centralized.

Thermophotovoltaics are simpler. They convert infrared radiation (a form of heat) directly into electricity, similar to the way in which solar cells convert sunlight into electricity—no steam or turbines necessary.

Current state-of-the-art thermophotovoltaics harvest what is called far-field infrared energy, which is emitted from all hot objects. These devices, however, are not very energy dense, meaning they have limited applications.

A more promising type of radiation called near-field infrared is more energy dense but can only be captured if the cell is extremely close to the hot object. Currently, harvesting this infrared energy is a difficult physics and engineering problem: Near-field devices require a nanoscale gap between their emitter layer, which collects heat and gives it off as infrared radiation, and the thermophotovoltaic cell itself.



ECE graduate student Parth Solanki (left) and Assistant Professor Eric Tervo. Photo: Joel Hallberg

Tervo and his team pioneered a process to fabricate a precise nanogap using novel semiconductor deposition and etching techniques. Tests show the near-field thermophotovoltaic device works as predicted, producing 25 times more energy than the same cells set up to harvest far-field infrared energy.

Importantly, the fabrication technique is compatible with current semiconductor materials and fabrication technologies, making it easily scalable without major retooling or process changes.

Photo: Joel Hallberg.

New semiconductor learning lab is just the latest hands-on opportunity for ECE badgers

Semiconductors are at the heart of almost all computing, communications, and sensing technologies. That isn't going to change anytime soon. In fact, industry and academia are innovating new types of advanced materials and devices that can improve power, efficiency and longevity. Major investments in expanded and new chip manufacturing facilities around the United States mean that graduates entering the workforce with experience in designing, fabricating, and characterizing semiconductor materials and devices and advancing chip technologies will be critical to future growth.

Preparing students to join industry with a strong mix of fundamental theory and hands-on experience is the gold standard in the College of Engineering. That's why the ECE department has a longstanding emphasis on rigorous, experiential learning for our undergraduate students.

The most recent innovation is the Semiconductor Engineering Instructional Laboratory, completed in fall 2024. The classroom is a state-of-the-art interactive learning space for undergraduates to get a feel for semiconductor materials and devices and learn to master some of the techniques and tools they would encounter in industry. The space is equipped with brand-new probe stations for C-V and I-V measurements of semiconductor devices and equipment and software to measure important characteristics like Hall effect, photoluminescence, light absorption and transmission, and thin-film thickness.

"Being an engineer is in large part about being hands-on and wanting to understand how things work, to 'look inside' and find out how something is made or what makes it work the way it does. Hands-on classes and labs give exactly these experiences to ECE students, which is why I enjoy teaching them. I love sharing what I know about semiconductor-related topics with students, having interesting discussions, and answering their questions."
–ECE Teaching Faculty Srdjan Milicic

This gives students in courses like ECE 305: *Semiconductor Properties Laboratory* a head start on learning how to characterize semiconductor materials using industry-standard tools and techniques. In fact, students use the college's Nanoscale Fabrication Center to build their own MOS (metal oxide semiconductor) devices before using the tools in the lab to measure a variety of characteristics.

The Semiconductor Engineering Instructional Laboratory is not the only innovative instructional space to open recently in ECE. The James H. Thompson Electronics Design Studio, funded by alumnus Jim Thompson (BSEE '85, MSEE '87, PhDEE '91), retired chief technical officer of Qualcomm, has quickly become a favored learning space. Over the past three years, the bright, adaptable work area, with its state-of-the-art circuits design stations, has empowered hands-on learning and encouraged collaboration starting as early as the first semester, and hosted capstone design learning experiences for undergraduates.

That impact builds on the opportunities created by the Plexus Collaboratory; celebrating its 10th anniversary, it is a classroom and laboratory space that enabled ECE transition to the flipped course model—a learning mode ECE helped to pioneer. The model allows instructors to spend their time fostering customized and project-based learning during class and for students to focus on theory at their own pace, in advance of class, by viewing recorded mini-lectures. Not only does the arrangement make the best use of limited course time, it helps develop skills like teamwork and hands-on problem solving that employers look for.

Those types of active-learning innovations led to a 2018 Electrical and Computer Engineering Heads Association Innovative Program Award for ECE. Since then, faculty and staff have continued to develop more hands-on facilities and opportunities, capstone experiences, and evidence-based teaching innovations, with more on the way.

A legacy of outstanding educators

Over the last 20 years, ECE faculty have received dozens of awards for teaching innovation and quality, creating a legacy that benefits generation after generation of ECE students.

College of Engineering James G. Woodburn Award for Excellence in Undergraduate Teaching
2024 Eduardo Arvelo; 2022 Stephen Fredette; 2020 Joe Krachey; 2011 Irena Knezevic

College of Engineering Harvey Spangler Award for Innovative Teaching and Learning Practices
2022 Giri Venkataramanan;
2018 John Booske; 2014 Barry Van Veen

College of Engineering Benjamin Smith Reynolds Award for Excellence in Teaching
2025 Joshua San Miguel; 2021 Kassem Fawaz;
2019 Dimitris Papailiopoulos;
2017 Barry Van Veen; 2014 Susan Hagness;
2008 Giri Venkataramanan

UW-Madison Emil Stieger Distinguished Teaching Award
2022 Kassem Fawaz;
2021 Dimitris Papailiopoulos

UW-Madison Chancellor's Distinguished Teaching Award
2020 Irena Knezevic; 2015 Barry Van Veen;
2011 Giri Venkataramanan

IEEE Education Society Mac Van Valkenberg Early Career Teaching Award
2021 Dimitris Papailiopoulos;
2007 Susan Hagness

UW System Alliant Energy Underkofler Excellence in Teaching Award
2009 Susan Hagness

IEEE Educational Activities Board Major Educational Innovation Award
2014 John Booske

Innovative Program Award ECE Department Heads Association
2018 John Booske

Professor Giri Venkataramanan tests the circuit board of Asish Das. Photo: Allyson Crowley.

Students connect theory to application in experiential electronics circuits design

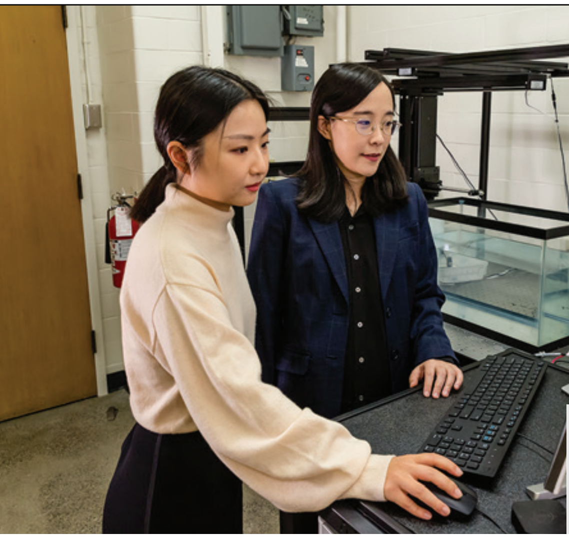
As part of its commitment to preparing undergraduate students to meet the demands of a rapidly evolving technological landscape, ECE is continuously evaluating its course offerings, identifying opportunities to revise or augment the curriculum with new experiences or technology. A case in point is ECE 342: *Electronic Circuits II*. In fall 2024, Keith and Jane Morgan Nosbusch Professor Giri Venkataramanan challenged students to master concepts ranging from advanced transistor amplifier analysis and feedback effects to designing analog filters, oscillators, power amplifiers and converters.

The final project for the fall 2024 semester asked students to design and assemble a USB equalizer circuit. This device adjusts volume, bass, treble, high-definition sound, and the balance of left and right speakers. Supported by funds from Venkataramanan's professorship, the students' projects exemplified the course's emphasis on merging theoretical knowledge with practical application.

Students followed a process that mirrored real-world practices. Beginning with board design, they moved on to performing a part-ordering simulation, then assembling and analyzing the circuits. Each project took six to eight hours to complete. On the last day of class, students' USB equalizers were tested for the very first time. Venkataramanan and teaching assistants Olivia D'Souza and Hardik Chhabra played classical music recordings using each of the boards and gave feedback on their performance.

D'Souza emphasized the project's benefits. "The final project for ECE 342 is such an integral part of the curriculum," she says. "The entire process, from developing understanding of the schematic and board design to ordering parts and building the final product, is an important experience that helps prepare students for internships and the workforce. It also helps students to develop intuition between classwork and application."

Overall, Venkataramanan says that including this hands-on learning experience in the course was a positive change. "Adding the hardware project that has replaced the final exam for the course has brought genuine authenticity to the end-of-term assessment, while taking away some of the anxiety and stress," he says. "I am tending toward integrating a similar experience in all my courses."



PhD student Jinuan Lin (left) and ECE Assistant Professor Chu Ma. Photo: Joel Hallberg.

New far-field imaging technique brings deeper clarity to ultrasound

Dugald C. Jackson Assistant Professor Chu Ma and PhD student Jinuan Lin have developed a new technique for improving the penetration and resolution of ultrasound—an imaging tool that's not only commonly used in medicine, but also in everything from building inspections to underwater navigation.

"It's a new imaging framework," says Ma. "We are able to show an order of magnitude improvement of resolution compared to conventional ultrasonic imaging."

The pair combined a new imaging technique they call spatial mixing with new computational reconstruction algorithms to collect information from far-field wavelengths—allowing ultrasound to peer deeper into an object with better resolution than conventional methods.

In ultrasound imaging, a probe transmits high-frequency sound waves into an object which then reflect off objects, allowing the system to build an image from the information. However, because of fundamental physical limits, the deeper acoustic waves travel into an object, the fuzzier the resulting image becomes.

In some cases, it's possible to get around these limits by using specially designed materials, called "controlled labels," which must either remain motionless or be tracked precisely during imaging. That limits the applications for which subwavelength ultrasound can be used.

In their new technique, which is compatible with current ultrasound hardware, Ma and Lin use "blind labels," which are scattered randomly, eliminating the need to track the material or keep it in a static location. Instead, the ultrasound's acoustic waves bounce off the blind-label particles wherever they may be, and an algorithm uses that data to piece together the scattered signals and create an image.

The resulting system, which Ma is licensing and patenting through the Wisconsin Alumni Research Foundation, can produce clearer subwavelength images in many more situations, like imaging blood vessels and structures hidden below underwater vegetation.

An ocean of possibilities: Electrostatic machines could make wave energy a reality

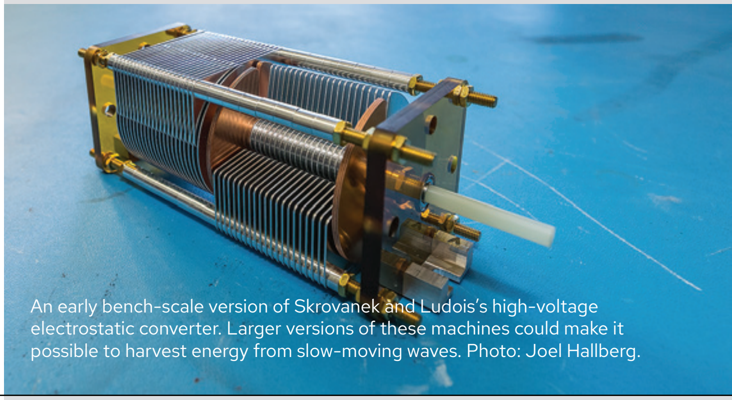
There's enough energy produced by ocean waves and tides around the world to exceed all human energy needs—if we can unlock it. David Skrovanek, who graduated with his PhD in December 2024, and Professor Daniel Ludois recently developed a device which can do just that, as part of the U.S. Department of Energy's Innovating Distributed Embedded Energy Prize (InDEEP) competition.

Most electricity is produced using electromagnetic induction, in which an electromagnet spins rapidly inside a stationary magnetic field. Wave energy, however, is slow and irregular, and would need to be repeatedly stepped up to higher voltages to be used in the power grid. "If you compare that to the way we generally produce electricity with fast-spinning turbines, there's an inherent mismatch," says Skrovanek. "Another challenge is transmitting that power to land, where it's going to be used."

One possible solution is electrostatic motors, which are powered by Coulomb force (aka static electricity)—or the attraction and repulsion between opposite or like electrical charges—instead of electromagnetism. "Electrostatics are sort of binary; they're really good with things moving really slow or moving really fast," says Ludois.

Electrostatic machines can produce high-voltage electricity directly from the waves—meaning there's no need to step up the juice using giant aircraft-carrier-sized converting platforms. Instead, the electricity could be sent directly into the grid using high-voltage direct current (HVDC) transmission.

A prototype device Skrovanek and Ludois developed was impressive enough to make it into the second round of the DOE competition. While there are many other hurdles in the way of harvesting wave energy, the researchers believe the technology could provide energy-conversion solutions for any marine technology, whether that's offshore wind farms, floating or undersea nuclear power, tides or waves.



An early bench-scale version of Skrovanek and Ludois's high-voltage electrostatic converter. Larger versions of these machines could make it possible to harvest energy from slow-moving waves. Photo: Joel Hallberg.

Retirements

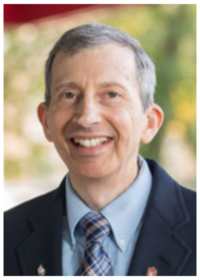
Philip Dunham Reed Professor Dan Botez is a renowned expert in photonics and semiconductor lasers. His groundbreaking research has shaped the field and inspired countless students.

Botez earned his PhD from the University of California, Berkeley, in 1976 before beginning a career in industry, including research positions at IBM, RCA Labs and the TRW Research Center. In 1993, he joined UW-Madison as a member of the ECE faculty.

His research focuses on three areas of semiconductor-laser physics: high-power, coherent grating-coupled surface-emitting lasers, and quantum cascade lasers. He has published 399 papers in refereed journals and received 56 patents, with two pending. He is a life fellow of IEEE, among many other awards and honors. In 1984, he co-founded the IEEE/Photonics Society Semiconductor Laser Workshop, which is now held annually.

Botez also co-founded spin-off companies Alfalight, which produces high-power aluminum-free diode lasers, and Intraband LLC, which is developing quantum cascade lasers.

“I vividly remember Dan asking me a challenging question during my interview talk in ECE at UW-Madison 27 years ago,” says ECE chair Susan Hagness. “That has been his hallmark: getting to the heart of the science behind our advances and innovations. Since then, he has been an extraordinary supporter and champion not only for me, but for our entire department.”



Professor John Gubner leaves behind a legacy of steadfast commitment and leadership. Throughout his tenure, Gubner played a vital role in shaping the department’s operations, providing invaluable guidance on curriculum development, faculty governance and student support initiatives.

Gubner earned his PhD in electrical engineering from the University of Maryland, College Park, in 1988, joining UW-Madison soon after. His research focuses on applications of probability and statistics along with numerical methods to address various problems in information theory, low-light-level imaging, wireless sensor networks and detection systems, multipath channel modeling, and financial engineering.

His career is highlighted by his commitment to students and service to the ECE department. He taught 16 different courses at all levels, writing a textbook on probability for electrical and computer engineers. He also developed ECE 735, a graduate-level course on signal synthesis and recovery.

Over the years, he served on numerous committees, most recently as vice chair/associate chair for operations (2015–2024). That included the difficult task of quickly rescheduling all courses in the summer, fall and spring during the COVID-19 pandemic and accommodating international students.

“Over the past decade or more, the department has experienced considerable growth in size, scope, excellence, inclusivity and impact, even though operating in the higher education environment has grown much more complex and challenging,” says John Booske, the Keith and Jane Morgan Nosbusch Professor Emeritus and former department chair. “John’s effective and generous leadership as associate chair for operations during this challenging phase has been a crucial, albeit selflessly behind-the-scenes, enabler for the remarkable success of that growth.”

Grainger STAR Professor Luke Mawst is a leading expert in semiconductor lasers and photonic devices. As a dedicated educator, he inspired and guided students, fostering both technical excellence and innovative thinking.

Mawst received his PhD from the University of Illinois, Urbana-Champaign, in 1987 before joining the research and development staff at TRW. In 1993, he joined ECE as a staff scientist, becoming a member of the faculty in 1996.

Mawst’s research focuses on the synthesis of semiconductor materials using metalorganic chemical vapor deposition (MOCVD), including nanostructures like quantum dots and a variety of semiconductor lasers. This work has led to two spinoff companies: Alfalight, which produces high-power diode lasers, and Intraband LLC, which is developing quantum cascade lasers.

He is a fellow of IEEE, received the IEEE Photonics Society Aron Kressel Award and has been recognized by UW-Madison with a Vilas Associates Award. Over his time in ECE, Mawst has taught 12 different courses, two of which he developed. He has advised 22 PhD students and 13 master’s students.

Chemical and Biological Engineering Professor Emeritus Thomas Kuech reflects on his work with Mawst. “I have enjoyed a decades-long collaboration with Professor Mawst, who brought enthusiasm, creativity and broad insight to the research while being an involved mentor to his students,” says Kuech. “I learned a great deal from him as he approached new and difficult problems. It has been great fun!”

In Memoriam

David W. Grainger III (BSEE '50) passed away in January 2025. He was CEO and chair of industrial supply and distribution firm W.W. Grainger and an incredibly generous supporter of the university and ECE.

Through his family's charitable nonprofit, The Grainger Foundation, he supported numerous building projects and initiatives in the UW School of Business and gave more than $100 million in total support to the College of Engineering. That includes a $25 million grant in 2014 to establish the Grainger Institute for Engineering and helped expand the college's facilities, including its Grainger Engineering Design Innovation Laboratory; a $22 million contribution in 2015 to improve the experience for engineering undergraduates; and a $32 million pledge in 2020 to fund growth across the college, including $20 million to support the Strategic Targeted Achievement Recognition (STAR) Scholarship program.

"David exemplified what it means to be a UW-Madison engineer and to give back to a college for which he felt so much passion," says Ian Robertson, Grainger Dean of the College of Engineering. "Through decades of generous support through The Grainger Foundation, David also left an indelible mark on our College of Engineering. His gifts transformed our facilities, elevated our programs and services, and importantly, empowered countless students and faculty to achieve their highest potential."

Read more about ECE's extraordinary alumnus David Grainger.

Meet the college's next dean

Devesh Ranjan, an alumnus, mechanical engineer and a leader at one of the country's largest and highest-ranked engineering programs, will be the college's 10th dean. He will begin on June 16.

Ranjan, the Eugene C. Gwaltney Jr. School Chair and Professor of Mechanical Engineering at the Georgia Institute of Technology, remembers the promise he felt when he first arrived at UW-Madison in 2003 to begin graduate school in the college he will now lead.

"I've been blessed from that day onward," Ranjan says. "The thing I say about UW-Madison is if you dream about doing something here, it will happen. It will happen because of the opportunity and the support here for you at UW-Madison."

Read more about incoming Dean Ranjan.

Faculty news

Dugald C. Jackson Assistant Professor Jennifer Choy was selected for a 2024 National Academies panel that completed a review of the Army Research Lab's research and development portfolio in photonics, electronics, and quantum sciences.

Assistant Professor Tsung-Wei (TW) Huang received the 2024 ICCAD 10-Year Retrospective Most Influential Paper Award from the IEEE/ACM International Conference on Computer Aided Design.

Associate Professor Andreas Velten and Jack St. Clair Kilby and Antoine-Bascom Professor Mikhail Kats were elected fellows of Optica (formerly the Optical Society of America). Kats was also elevated to the rank of fellow by SPIE, the international society for optics and photonics.

Gene Amdahl Professor Umit Yusuf Ogras was named a fellow of IEEE for his contributions to research into networks-on-chip for heterogeneous manycore architectures. He also received the best paper award at the 2024 International Conference on Compilers, Architectures, and Synthesis for Embedded Systems.

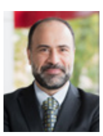
Associate Professor Line Roald is a partner on a U.S. Department of Energy Grid Resilience and Innovation Partnerships Program grant awarded to Alliant Energy. The grant, up to $50 million, aims to bring smart grid technology to rural and underserved communities throughout Wisconsin. Roald was also selected as a speaker at a National Academies workshop in November 2024 to discuss the energy challenges of AI data centers and has been appointed to the National Academies Roundtable on Artificial Intelligence and Climate Change.

Assistant Professor Eric Tervo received a National Science Foundation grant to develop quantum-engineered photovoltaic cells that convert long-wavelength infrared light, a type of heat, into electricity.



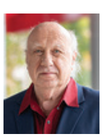

A project including Dugald C. Jackson Assistant Professor Dominic Gross, Thomas A. Lipo Assistant Professor Mahima Gupta, Thomas A. Lipo Assistant Professor Jinia Roy, and Keith and Jane Morgan Nosbusch Professor in Engineering Education Giri Venkataramanan was selected as one of six campus finalists for the 2024 Wisconsin Alumni Research Foundation Innovation Awards. The team developed smaller, less bulky power-converter circuits for high-performing, high-voltage direct-current systems, which could spur quicker adoption of green energy sources.

Grainger Professor Zongfu Yu was included on the Clarivate Web of Science Highly Cited Researchers list for 2024, honoring researchers ranking in the top 1% of cited papers. Yu has made the list every year since 2018.



McFarland-Bascom Professor Nader Behdad has been selected to receive the 2025 IEEE Antennas and Propagation Society John Kraus Antenna Award. He will be honored with this recognition at the 2025 IEEE International Symposium on Antennas and Propagation and North American Radio Science Meeting this summer.

Tech transfer recognitions




Philip Dunham Reed Professor Dan Botez and Grainger STAR Professor Luke Mawst received a state economic engagement and development grant to grow their spinoff company Intraband, LLC, which is developing semiconductor-based quantum cascade lasers for use in communications.

ECE PhD student Sanket Deshpande has co-founded Dirac Labs, with support from Jack St. Clair Kilby and Antoine-Bascom Professor Mikhail Kats and Dugald C. Jackson Assistant Professor Jennifer Choy as co-founding scientific advisors, the UW-Madison Technology Entrepreneurship Office, and the NASA/NSF I-Corps program. Their start-up joined the Chicago Quantum Exchange as a corporate partner in March, 2025.

College awards

McFarland-Bascom Professor Nader Behdad received the 2025 Byron Bird Award for Excellence in a Research Publication.

Associate Professor Joshua San Miguel received the 2025 Benjamin Smith Reynolds Award for Excellence in Teaching.

Investiture

The department held an investiture ceremony to honor faculty who have received named professorships over the past several years. Among them are Antoine-Bascom Professor Mikhail Kats, Grainger STAR Professor Luke Mawst, Gene Amdahl Professor Umit Yusuf Ogras, Keith and Jane Morgan Nosbusch Professor in Engineering Education Giri Venkataramanan, Grainger Professor Zongfu Yu, Grainger Institute for Engineering Associate Professor Kassem Fawaz, Jay and Cynthia Ihlenfeld Associate Professor Dimitris Papailiopoulos, Mark and Jenny Brandemuehl Assistant Professor Jeremy Coulson; Dugald C. Jackson Assistant Professors Jennifer Choy, Dominic Gross, Kangwook Lee, Chu Ma, Ramya Korlakai Vinayak and Ying Wang; Thomas A. Lipo Assistant Professors Mahima Gupta and Jinia Roy, and Charles Ringrose Assistant Professor Bhuvana Krishnaswamy.

Student news

Computer engineering senior Jaime Campos received the 2024 Alliant Energy Erroll B. Davis, Jr. Achievement Award, which honors the outstanding scholarship and community service of traditionally underrepresented students.

PhD student Brandon Cortez is serving on the Chancellor's Visioning Committee, a group of 30 faculty, staff and students from across UW-Madison that will help develop a long-term strategic framework for the university.

PhD student Sanket Deshpande received a College of Engineering Grainger Fellowship, which will support his research on developing nanophotonic devices with applications in quantum sensing.

PhD student Minjeong Kim won a best poster award during the 2024 Materials Research Society fall meeting for her work using nitrogen-vacancy centers in diamond to develop advanced sensing devices.

First-year PhD student Yuki Gao received an IEEE AP-S doctoral research grant for her research on developing a new ground-penetrating radar system.

Recent PhD graduate David Skrovanek and graduate student Peter Kaladius both made it to the finals of the UW-Madison 3-Minute Thesis competition, in which students must effectively explain their research to a general audience.

PhD student Taha Sultan was among 31 graduate students across campus to receive a UW-Madison teaching assistant recognition. Sultan received the Capstone Teaching Award, which recognizes dissertators at the end of their graduate program with an outstanding teaching record over the course of their PhD studies.

PhD students Asmita Pal, Elise Song and Zhewen Pan earned first place in the N+1 Institute Reverse Pitch Competition sponsored by Google for their approximate computing solution to reduce power consumption of AI data centers.

Department of Electrical and Computer Engineering
UNIVERSITY OF WISCONSIN–MADISON

1415 Engineering Dr., Room 2415
Madison, WI 53706
engineering.wisc.edu/ece

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An invaluable undergraduate research experience inspires alum to give back

Over the past decade, Junjue "Jay" Wang (BSCmpE '14) has experienced all aspects of the tech research ecosystem: he interned with industry giants like Google, Microsoft and Qualcomm; earned a PhD at Carnegie Mellon University, cut his teeth working for startups in Silicon Valley, and currently works as a researcher at Apple, developing AR and VR technologies.

But none of those experiences was quite as formative as his time at UW-Madison, where as a computer engineering and computer science double major, he first encountered research as an undergrad. Now, Wang is endowing a Hilldale Undergraduate Research Fellowship for electrical engineering and computer engineering majors, giving back to one of the programs that ignited his passion for research.

During his freshman year in 2011, Wang was selected for the Undergraduate Research Scholars Program, where he met many students interested in research. As part of that program, Wang was paired with Professor (now-Emeritus) Yu Hen Hu as his research mentor. Over the course of the school year, Wang worked with Hu on developing a facial recognition app for the Android operating system. The research was difficult, he says, and involved learning how to program for Android, which was totally new. But it was also exhilarating, and Wang found himself hooked on the research process.

From there, Wang worked in various labs in ECE and computer science, earning a Hilldale Fellowship himself and establishing relationships that would lead him to Carnegie Mellon University, where he worked on augmented and virtual reality for his PhD.

"These were research projects at all different layers of computer systems," he says. "I think these experiences really helped teach me how to do research and how to ask the right research questions."

Now, Wang hopes that supporting an ECE Hilldale Fellowship could guide another undergraduate student into the research community. "I really cherished my undergraduate research experience," he says, "and hopefully we can make the same opportunity available for one more undergraduate."

Junjue "Jay" Wang and his wife Han Wang. Submitted photo.