

# **ECE** News 2022-2023

Department of Electrical and Computer Engineering Hajim School of Engineering & Applied Sciences University of Rochester

# A Message from our Department Chair

I am incredibly proud of what the Department of Electrical and Computer Engineering at the University of Rochester has accomplished during the 2022-2023 academic year. Our faculty, staff and students had a very productive year, working together towards significantly successful outcomes! Some highlights of the year include:

 Our faculty was awarded over \$7.2M in new research funding. Some highlights include Michael Huang who, in collaboration with other ECE faculty members, Gonzalo Mateos, Zeljko Ignjatovic, Qiang Lin, Selcuk Kose, and Hui Wu, was awarded a DARPA Quantum-Inspired Classical Computing Grant. This could award could total \$6.1 million over fine years - to develop two novel Ising machines; Qiang Lin, who was awarded an NSF grant to develop a multifunctional integrated quantum photonic processor for quantum interconnects; and Thomas Howard, who won an NSF CAREER award to develop a more natural language model for human-robot interaction. As an example of the stellar outcomes of the department's sponsored research, a team led by Qiang Lin recently published impressive new advances in photonic devices and quantum computing.

- Our faculty receive numerous awards, including Mark Bocko who was honored by the Rochester Engineering Society with their 2022 Engineer of the Year, and Marvin Doyley who was named a fellow of the IEEE and of the AIUM.
- Our undergraduates also had an outstanding year. Charbel El Haddad and Sydney Haupt were recipients of the University's Donald M. Barnard Prize, which is awarded annually to junior or senior engineering students based on personal qualifications and achievement. Two ECE students were inducted into Tau Beta Pi, the engineering honor society. 12 out of 35 seniors were awarded degrees cum laude or magna cum laude. Congratulations to Jameson Morris, AME '23, one of this year's recipients of the Wells Award, given annually to Hajim School students who excel in both engineering or computer science and in the humanities.
- This summer, we hosted 11 undergraduates for 10 weeks as part of our NSF Research Experiences for Undergraduates program, "Imaging in medicine and biology for Underrepresented minorities". We had over 90 students apply from all over the country.
- Our department is excited to share our new logo which will now be used as part of our identification!

The activities highlighted in this newsletter represent a small fraction of what our incredible faculty, staff, students, and alumni have achieved in the 2022-2023 academic year; if you want to learn more, please send me a note at <u>m.doyley@rochester.edu</u> or visit our website <u>http://www.hajim.rochester.edu/ece/</u>



Marvin Doyley Chair of the Department of Electrical and Computer Engineering Wilson Professor of Electronic Imaging Professor of Electrical and Computer Engineering, Biomedical Engineering, and of Imaging Sciences

# **Celebrating the Class of 2023**



The Department of Electrical and Computer Engineering celebrated the Class of 2023 in Feldman Ballroom on May 13, 2023, followed by a reception on Wilson Quadrangle. The ceremony included remarks, faculty and student awards, and presentation of graduates.

#### For more photos:

https://eiohmediaservices.smugmug.com/gallery/n-n6z3ZN/

# **Events**

View a list of departmental events: hajim.rochester.edu/ece/news-events/events/index.html

**Doctoral Defenses in 2022:** 

# **Diversity, Equity, and Inclusion**

#### **DEI Special Events and Celebrations**

Hispanic Heritage Month \* September 2022

#### Hispanic Heritage Spotlight

In celebration of Hispanic Heritage Month, the Department of Electrical and Computer Engineering is spotlighting our faculty, graduate students, and alumni. We celebrate their contributions to the department, our community, and engineering. Their achievements are an inspiration to our future engineers.

#### International Week of Science and Peace \* November 7-13, 2022

#### 'Let's Stand with Iranians'

In solidarity with Iranians, learn more about the latest movement led by Iranian people, especially the Iranian women who are fighting for their basic rights.

#### Black History Month \* February 28, 2023

"What does it mean to be a conscious engineer?" A joint event between UR NSBE and ECE.

#### Women's History Month \* March 2023

DEI WHM Kick-off event, March 5, 2023 and highlighting extraordinary women.

#### Asian American and Pacific Islander Heritage Month \* May 2023

Spotlighting achievements and and contributions form the AAPI community AAPI 2023

#### 2022-2023 DEI Committee



Top row: Richard Afoakwa, Barbara Dick, Afagh Farhardi, Michele Foster. Second row: Evelyn Goldman, Michael Heilemann, William Knoff, Gonzalo Mateos. Third row: Khoi Phan, Abdel Qoutb, Linda Weidman, Hui Wu. Fourth row: Omar Zakaria, Neil Zhang. Not pictured: Richard Afoakwa.

# **New Faculty and Staff**

#### July 2022 Tong (Tony) Geng

<u>Tong (Tony) Geng</u>, joined us in July 2022 as a tenure-track assistant professor after serving as a postdoctoral research associate at the US Department of Energy's Pacific Northwest National Laboratory (PNNL). Tony's Intelligent Architecture (IntelliArch) research group will pursue new computer systems and architecture for emerging artificial intelligence methods through algorithm-architecture codesign. This work has potential applications for drug discovery, social media, smart traffic, and recommendation systems.



### September 2022 Kimanh (Kim) Phan

Kimanh (Kim) Phan joined ECE as the new Staff Accountant in September 2022. Kim comes to us from the Flaum Institute, Ophthalmology Department.



## **Research & Faculty News**

### September 2022 Thomas Howard - NSF CAREER Award : Teaching robots a sense of past and future

Thomas Howard received the National Science Foundation's Faculty Early Career Development (CAREER) award, which recognizes early-career faculty. Tom will develop algorithms that enable robots to respond to language that refers to the past, present, and future of their surroundings. Currently, for example, it is difficult for robots to understand instructions such as "Hand me the wrench I was using five minutes ago" or "Pick up the cup that is about to roll off the table," and respond in a timely fashion. That's because the robot would need to think carefully about all the past and future states of its surroundings.

Tom Howard's research at Rochester has advanced the ability of robots to infer "minimal but sufficient" representations of their surroundings so that only the objects needed to understand statements are interpreted from sensor data. The project will "more tightly couple algorithms that interpret language and sensor data" so humans can seamlessly use references to time and location when communicating back and forth with robots.



October 2022 Qiang Lin - A laser that could 'reshape the landscape of integrated photonics' A team of researchers led by Qiang Lin, a professor of electrical and computer engineering, has developed the first multi-color integrated Pockels laser that emits high-coherence light at telecommunication wavelengths, allows laser-frequency tuning at record speeds, and is the first narrow linewidth laser with fast configurability at the visible band. It will pave the way for new applications of integrated semiconductor lasers in LiDAR (Light Detection and Ranging) remote sensing that is used, for example, in self- driving cars. The technology could also lead to advances in microwave photonics, atomic physics, and AR/VR.



#### January 2023 Marvin Doyley - Named Fellow of the IEEE and AIUM

Congratulation to Marvin Doyley, the Wilson Professor of Electronic Imaging and chair of electrical and computer engineering, on being named a fellow of the Institute of Electrical and Electronics Engineering (IEEE) and of the American Institute of Ultrasound in Medicine (AIUM) for his advancement of novel imaging techniques to detect and track diseases, including ultrasound elastography using inverse methods.



### March 2023 Eby Friedman - New Book Examines VLSI Systems

Very large scale integrated (VLSI) systems consist of dozens of interconnected subsystems, hundreds of modules, and many billions of transistors and wires. Graph theory is crucial for managing and analyzing these pervasive systems.

In their new book, *Graphs in VLSI* (Springer International Publishing, 2023), Eby Friedman, Distinguished Professor of Electrical and Computer Engineering, and Eby's former PhD student Rassul Bairamkulov, now at École Polytechique Fédérale de Lausanne, discuss VLSI system design from the perspective of graph theory, connecting pure mathematics with practical product development.

Their book not only provides a review of established graph theoretic practices, but also discusses the latest advancements in graph theory driving modern VLSI technologies, covering a wide range of design issues such as synchronization, power network models and analysis, and interconnect routing and synthesis. Learn more.



#### March 2023 Michael Huang - Ising Machines

"Why the Russian Military Is Bogged Down by Logistics." "Allies Fail to Agree on Sending Tanks to Ukraine."

These recent headlines underscore the importance of logistics in warfare. Which weapons and supplies are needed? In what quantity? And equally importantly, what is the most economical wayto get these supplies to the right places, and at the right times, to soldiers in front lines spread over hundreds, even thousands of miles?

A team of Hajim School electrical and computer engineering faculty members led by Michael Huang believes their invention—a simple computing device like no other—can help solve military logistic optimization problems in complex battles in the future.

The Defense Advanced Research Projects Agency (DARPA) recently awarded the researchers, who also include **Zeljko Ignjatovic**, **Selcuk Kose**, **Qiang Lin**, **Gonzalo Mateos**, **and Hui Wu**, a <u>Quantum-Inspired Classical Computing grant</u> that could total **\$6.1 million over five years** to develop **two novel Ising machines**.

So what is an Ising Machine, and what makes it more efficient at solving these kinds of problems than conventional or even quantum computers? Learn more <u>here</u>.



Left to right, Michael Huang, Zeljko Ignjatovic, Selcuk Kose, Qiang Lin, Gonzalo Mateos, and Hui Wu of electrical and computer engineering will develop Ising machines with the support of a DARPA grant to help solve military logistic optimization problems in complex battles in the future. (Getty Images graphic)

### April 2023 Kevin J. Parker - Better breast cancer diagnosis through machine-learning ultrasound

Mammography is the gold standard for breast cancer diagnosis, but it's not reliably accurate in all cases, especially in people with dense breasts. Avice O'Connell, a professor of imaging sciences, Kevin Parker, a professor of electrical and computer engineering, and Jihye Baek, a former PhD student in electrical and computer engineering, <u>have launched a research project incorporating ultrasound with machine learning for previously detected masses</u>. The end result: nearly 98 percent accuracy in predicting breast cancer in these masses.



Kevin J. Parker and Avice O'Connell

#### May 2023 Mark Bocko - Rochester Engineering Society's 2022 Engineer of the Year

Mark Bocko, the Distinguished Professor of Electrical and Computer Engineering and director of the <u>Center for Emerging and Innovative Sciences</u> (CEIS), was named the Rochester Engineering Society's 2022 Engineer of the Year. The award recognizes outstanding achievement in and contributions to the profession by engineers in the Rochester region. The society named Bocko an Engineer of Distinction in 2021.

Bocko's academic career has spanned four decades at the University of Rochester, where he received his PhD in physics in 1984. Over the years, Bocko has explored multiple areas of basic and applied research on sensors, superconducting electronics, and acoustics. Early in his career, he collaborated on the first proposal for a practical superconducting quantum computer. Currently, his research includes the development of multimodal audio surfaces and 3D spatial sound reproduction and analysis. His work is reflected in more than 170 technical publications and 20 patents.

During his 15-year tenure as chair of the electrical and computer engineering department, he created a program in audio and music engineering that has grown to more than 100 undergraduates and master's students since 2013.

Bocko is a tireless advocate of the Rochester region's technology economy, university-industry collaboration, and technology transfer. With him at the helm, CEIS helped lay the groundwork for Rochester's participation in AIM Photonics, which provides access to state-of-the-art integrated photonics fabrication, packaging, and testing facilities and services; CEIS also founded the Light and Sound Interactive Conference and Showcase held in 2017 and 2019. He continues to explore the region's potential to become a major center for audio technology and sound/music production for new media.

• Discover how Bocko is designing a world of immersive sound.



### June 2023 Zhiayo Duan - Standout Paper at Conference on Signal Processing in the AI Era

A contingent of Hajim School faculty and students had a strong showing at IEEE's <u>2023 International</u> <u>Conference on Acoustics, Speech and Signal Processing (ICASSP)</u> in Rhodes Island, Greece.

A paper authored by electrical and computer engineering PhD students You (Neil) Zhang and Yuxiang Wang and Associate Professor Zhiyao Duan was recognized for being among the top three percent of all papers accepted at the conference. Their paper was titled "HRTF Field: Unifying Measured HRTF Magnitude Representation with Neural Fields."

Neil Zhang was also selected as one of the 24 presenters at the <u>inaugural "Rising Star Program in Signal</u> <u>Processing" workshop</u>. The new initiative aims to "foster the growth of the next generation of scientists and scholars who are at the forefront of research and innovation in the field of signal processing." He presented a poster titled "Personalized Immersive and Secure Audio for Metaverse."



Associate Professor Zhiyao Duan, left, and electrical and computer engineering PhD student You (Neil) Zhang, right, presenting at IEEE's 2023 International Conference on Acoustics, Speech and Signal Processing (ICASSP).

### July 2023 Qiang Lin's Team Advances Photonic Devices and Quantum Computing

A team of researchers led by <u>Qiang Lin</u>, a professor of <u>electrical and computer engineering</u> and optics, recently published impressive new advances in photonic devices and quantum computing.

In a new study in *Nature Photonics*, the team outlined an important step toward developing computers advanced enough to simulate complex natural phenomena at the quantum level. They developed a new chip-scale optical quantum simulation system that uses a synthetic space that mimics the physical world by controlling the frequency, or color, of quantum entangled photons as time elapses. <u>Read more about the full study at the News Center</u>.

Qiang and his team also recently published a *Nature Communications* study that describes a new tool for generating microwave signals that could help propel advances in wireless communication, imaging, atomic clocks, and more. They developed a new high-speed tunable microcomb, which Qiang calls "one of the hottest areas of research in nonlinear integrated photonics." <u>Read more about the study on the Hajim website</u>.

Congratulations to Qiang, lead authors Usman Javid '23 PhD and Yang He '20 PhD, and all the students involved in the study.



A new system developed by Professor Qiang Lin's research team allows them to conduct quantum simulations in a synthetic space that mimics the physical world by controlling the frequency, or color, of quantum entangled photons as time elapses. (University of Rochester illustration / Michael Osadciw

# By the Numbers





### **In Memoriam**

### September 2022 Sidney Shapiro – Professor Emeritus, Former Chair of Electrical and Computer Engineering

Professor Sidney Shapiro passed away on September 15, 2022, at the age of 90. During Shapiro's career in scientific research, he made several discoveries that helped confirm the theory of superconductivity and the Josephson Effect. While at the University of Rochester, as chair of electrical engineering, Shapiro proposed and saw through to full approval a new educational program for undergraduates. Titled "Take Five" it allows a tuition-free fifth year of study in subjects not part of the student's major.



### **Student News**

#### October 2022 Jamison Morris AME '23 - Wells Award Recipient

Congratulations to Jameson Morris, AME '23, one of this year's recipients of the Wells Award, given

annually to Hajim School students who excel in both engineering or computer science and in the humanities. The award was created by the family of Robert L. Wells, a '39 graduate of mechanical engineering who became a top executive at Westinghouse. Wells felt strongly that engineers "needed the balance of the humanities" to be competent in their field. An internship at the renowned Blackbird recording studio in Nashville this summer cemented Jameson "Max" Morris' desire to become an audio and music engineer. Thanks to his major in the field and his minor in music, this month's Outstanding Student knows what it is like to be on both sides of the microphone. He has recorded and mixed tracks of performances by some of the same student ensembles he performs with. Working with senior lecturer Stephen Roessner, a Grammy Award-winning sound engineer, was invaluable. So were classes on music theory and history. "When you're recording in a studio, obviously you need a lot of technical knowledge, but it is also important to really know music, to be able to communicate with musicians from many genres," Max says.



### October 2022 Kevin Fobare '24 ECE and Seth Roberts '23 AME recipients of the Patrick Lee Foundation Scholarship

The <u>Patrick Lee Foundation</u> provides scholarships to offset the cost of a college education for outstanding students in engineering and technical fields at nine colleges and universities. "Our scholars are entrepreneurial and embrace innovation," the foundation states. "They understand the importance of public service and are leaders in and out of the classroom."

Kevin and Seth are two of 10 students in the Hajim School of Engineering who received this award.



Kevin Fobare and Seth Roberts

#### December 2022 Hesham Elshafey - Grand Challenge Scholar

Hesham Elshafey '25, an electrical and computer engineering major, was well acquainted with grand challenges even before arriving on our campus. While growing up in Tanta, Egypt, Hesham attended <u>Gharbiya</u>—one of 14 Egyptian STEM high schools. The schools are unique in requiring students to work in teams to address the grand challenges that Egypt faces through hands-on, project-based learning.

Hesham is participating in our Grand Challenges Scholar program and is also finding the program a useful framework—to further develop his robotics skills. <u>Learn more</u>



#### March 2023 Joseph 'Tre' DiPassio - Graduate Research Symposium Winner

Congratulations to the winners of the <u>Second Annual Graduate Research Symposium</u>. our support of this event and to our own Tre DiPassio in the Engineering and Mathematics category!

- Engineering and Mathematics, Tre DiPassio, Electrical Engineering PhD, Interacting with Smart Audio Devices using Induced Structural Vibrations
- Humanities, Renee Jin, VCS PhD, The Reproductive Future: "Space Babies" in Chinese Propaganda Posters 1962–1989
- Social Sciences, Qinzhi Ruby Zeng, BCS PhD, Adapting a Language Transformer Model to Capture Subjective Human Judgements of Narrative Creativity

• Natural Sciences, Juan David Villada Morales, Chemistry PhD, Asymmetric Synthesis of cyclopropyl pyruvate pattern toward ring expansion reaction



#### April 2023 Steven Philbert receives Edward Curtis Peck Award

ECE PhD student, Steven Philbert, is one of the eleven University students who have been selected as recipients of the Edward Peck Curtis Award for Excellence in Teaching by a Graduate Student. This award was established by former life trustee Edward Peck Curtis in 1984 and recognizes graduate students who excel in advancing the teaching mission of the University by providing highly skilled and innovative instruction to Rochester's undergraduates.



### May 2023 Charbel El Haddad '23 (ECE) and Sydney Haupt '23 AME selected as for the Donald M. Barnard Prize

The Donald M. Barnard Prize is awarded to engineering students on the basis of personal qualification and achievement.Please join the department in congratulating this year's recipients of the Donald M. Barnard Prize, Charbel El Haddad (left) and Sydney Haupt (right). This recognition is well deserved!



# **Alumni News**

#### December 2022 Paul Muntner '91

Electrical engineering alumnus Paul Muntner '91, a professor of epidemiology and the associate dean for research at the University of Alabama at Birmingham's School of Public Health, recently <u>received the 2022</u> Joseph A. Vita Award from the American Heart Association. The award recognizes scientists whose research has had a major impact on the field of cardiovascular biology or cardiovascular health during the past five years. Paul's research focuses on identifying cardiovascular disease (CVD) isk factors and improving CVD prevention and treatment. He currently has 11 grant-funded studies in progress and has published more than 650 articles in peer-reviewed journals. While at Rochester, Paul was our first squash All-American and a Garnish Scholar, <u>earning him a place</u> in our University's Athletic Hall of Fame.



# The department is pleased to launch our new ECE Logo below! Look for this logo on all things ECE!



Cover photo credit goes to ECE PhD student, Chang Ye.

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