

CONNECTIONS

DEPARTMENT of ELECTRICAL & COMPUTER ENGINEERING A. JAMES CLARK SCHOOL of ENGINEERING

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Robotics The Road To Innovative Research Programs

PROGRAM HIGHLIGHT Major Updates to the Electrical Engineering Undergraduate Program | **RESEARCH** UMD Wins \$5M Phase 2 NSF Convergence Accelerator Award | **ALUMNI** Four New Distinguished Alumni Named **FACULTY NEWS** Khaligh Wins Nagamori Award | **PHILANTHROPY** Gary Connor Undergraduate Advising Fund

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message from the chair

Welcome to the Spring 2022 edition of *Connections*, the annual publication for the Electrical and Computer Engineering Department (ECE) of the A. James Clark School of Engineering. As we resumed in-person classes this fall, I know I feel the same sentiment as many: great joy to be back together on campus. As of November 2021, more than 98 percent of faculty, staff, and students of the University of Maryland have been vaccinated, and with masks being mandatory in campus buildings, the COVID transmission rate has been extremely low. While classes and labs are full of students, departmental events are being held in-person but with virtual options to provide flexibility for those who still wish to attend remotely. We are navigating our new hybrid environment, incorporating innovative technologies into education, business operations, and research, and getting used to our new normal.

For this issue of *Connections*, we are pleased to highlight ECE's progress in robotics and autonomous systems, an area that we are planning to significantly grow in the next few years. Robots are transforming the future in many ways, from cloud-connected home robots to drone-use for public security, autonomous vehicles, robots for healthcare, and more. Researchers in ECE are working diligently to advance the field, creating applications and solutions in a number of exciting areas. The new Undergraduate Minor in Robotics and Autonomous Systems, administered by the Maryland Robotics Center (MRC), part of the Institute for Systems Research (ISR), was launched this fall with great interest from students in aerospace engineering, mechanical engineering, electrical and computer engineering, and computer science.

In addition, we are thrilled to announce the hiring of two new assistant faculty members who will be joining the department in Fall 2022. These individuals will bring diverse experience and knowledge in the field of machine learning. Dr. Sanghamitra Dutta's research focuses on machine learning, information theory, and statistics with applications to algorithmic fairness, explainability, policy, and law. Dr. Kaiqing Zhang's research interests include machine/reinforcement learning, multi-agent systems, game theory, and control theory. ECE is planning to significantly grow its faculty ranks over the next several years in multiple strategic areas. This year, we are conducting faculty searches in computer engineering, microelectronics, cybersecurity, robotics and automation, AI and machine learning, and quantum technology.

To address the continually changing landscape of electrical engineering education, the Electrical Engineering program has undergone some major changes. We have completely revamped our EE curriculum, reducing the number of required courses to make room for more senior electives so that students can have more flexibility in focusing on one of several possible specialization tracks. We are also making changes to the Honors Program by creating more experiences for students to fulfill the honors requirements, including adding a "service learning" component.

Faculty in the department have received many large grants to fund research on exciting areas of importance. The Quantum Technology Center has received funding from the National Science Foundation (NSF) for a variety of projects, including a competitive \$5M phase 2 Convergence Accelerator award to develop quantum interconnects for ion trap quantum computers. Prof. Pamela Abshire has received nearly \$3M NSF funding to enhance understanding of how the parts of a single neuron contribute to neuronal networks' overall learning and computation abilities. Prof. Min Wu has also received funding from NSF for a new \$1.2M grant for AI research into the relationship between ECG and PPG monitoring technologies.

Our ECE faculty members have won many prestigious awards this year from both the University and professional societies, with a strong footing in IEEE awards and recognitions. Prof. Min Wu has been elected 2024 President of the IEEE Signal Processing Society; Prof. Yanne Chembo has been elected to the IEEE Photonics Society Board of Governors; Prof. Gang Qu has been named a Fellow of IEEE; Prof. Alireza Khaligh won the prestigious Nagamori Award; Prof. Pamela Abshire was named a Distinguished Scholar-Teacher by UMD; and College Park Prof. and former ECE Chair Rama Chellappa has been named a National Academy Inventor.

ECE has also been committed to improving the spaces in which students learn, study, and take their breaks. Specifically, I'd like to give a special mention of appreciation to ECE alumnus Mr. Gary Connor ('73). Mr. Connor has generously invested in the ECE Department's Undergraduate Advising and Mentoring Fund this year, which has made an immediate impact on students in our department, ranging from expanding tutoring and advising programs to providing resources to design a new maker-space undergraduate lab.

The time, prowess, and financial support of our alumni, whether personal or through industry sponsorship, are vital to the success of our programs. It is my hope that you will take the opportunity to help ECE in whatever way is most purposeful to you. To learn more about our department or to discuss any of the subjects outlined in *Connections*, please contact ece-pr@umd.edu.

Thank you.

Joseph F. Jeik

PROFESSOR AND INTERIM CHAIR



CONNECTIONS is published once a year for alumni and friends of the Department of Electrical and Computer Engineering at the A. James Clark School of Engineering, University of Maryland, College Park. Your alumni news and comments are welcome. Please send them to: 2455 A.V. Williams Building, College Park, MD, 20742. Visit our website at: **www.ece.umd.edu**.

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ECE'S EMBEDDED SYSTEMS AND INTERNET OF THINGS PROGRAM (ESIOT) LAUNCHES INTO ITS FIRST YEAR

The Bachelor of Science in Embedded Systems and Internet of Things (ESIOT) is the latest bachelor's degree program offered by the Department of Electrical and Computer Engineering at the University of Maryland, and the first undergraduate engineering program to be held at the Universities at Shady Grove in Rockville, Md.

The program's curriculum is a combination of relevant topics from electrical and computer engineering, computer science, and networking. It is a two-year program intended for transfer students pursuing a STEM program at any community college in Maryland.

The curriculum is unique and provides rigorous training in hardware and software with specializations in networks, cybersecurity, and machine learning. Students develop foundational knowledge in their junior year, including analog circuits, discrete mathematics, computer organization, networks, and microelectronics. Students also learn C, Python, Java, and Verilog coding. Senior-level coursework includes courses on firmware development, real-time operating systems, network security, hardware security, machine learning focused on embedded systems, and a year-long culminating capstone design project. The balance between theory and real-world, hands-on experience firmly grounds students in solid engineering principles that prepare them to pursue exceptional careers in software and hardware development, data analytics, application development, cybersecurity analytics, and more.

"Embedded systems and IoT have been transformative in many facets of our economy," says ESIOT Program Director and Professor Romel (Mel) Gomez. "This includes manufacturing, transportation, building infrastructure, healthcare, logistics, weather prediction, disaster management, agriculture, energy sustainability, intelligent homes, and of course, entertainment, to name a few. Many companies utilize this technology to improve products and services, reduce cost, and expand markets while protecting from malicious cyber threats."

To learn more about the program, visit shadygrove.ece.umd.edu.





MEET KELVIN QUACOE, SECOND-YEAR ESIOT STUDENT

Tell us about yourself!

I started off at Montgomery College (MC), where I got my Associates Degree in General Studies with a STEM concentration. My hobbies included making YouTube videos about technology and being physically active (going to the gym/sporting activities, etc.).

Why did you choose the ESIOT Program?

I chose the program because it gave me the opportunity to be a pioneer in a new and emerging field. There was also the convenience factor, which came from the program being out of the Universities at Shady Grove, which was closer to home. I heard about the program through a seminar at MC.

What project have you enjoyed the most thus far in your coursework?

There have been a multitude of projects that I have enjoyed working on while in the program. It's difficult

to choose because there is a lot of overlap in the program and the projects we do. An example of this would be the project in which we used the MX chip and connected it to the Azure cloud and utilized a machine-learning algorithm to predict the weather.



What are you looking forward to this year in the program?

This year I am looking forward to my capstone project and taking some of my classes in person.

What are your plans after graduation?

After graduation, my plan is to get a job in product management/solutions architecture in the STEM field, and then possibly go on to get my M.B.A.

Major Updates to the Electrical Engineering Undergraduate Program

The Electrical Engineering program is undergoing a major change. The department is reducing the number of required courses to make room for more 400-level electives so that students get more flexibility in their major, and can pursue more topics that are of interest to them. To do this, most of the 300-level courses are changing to streamline some of the topics. In particular, the 303-313 and 381-382 sequences are each becoming a single course, and ENEE 200 is going to be allowed to satisfy one of the general-ed requirements.

Faculty will define "tracks" that will give guidance to students in terms of which 400-level courses they should take. The tracks will also be designed around the new required 300-level courses. In particular, although 303-313 and 381-382 are being consolidated, some of the more advanced topics from these courses will be moved to

other courses that could be taken by students who are interested in the corresponding tracks. So, only a core set of topics from these courses will be required of all EE majors. Students who wish to dive more deeply can follow the corresponding track.

There will also be a new math course taught by ECE faculty, which will combine differential equations, linear algebra, and complex variables. This new math course will replace the current 246 course on differential equations. This new math course will better prepare students for the 300-level ECE courses.

These changes will also affect Computer Engineering students who may also take the new ECE math course and the new 300-level courses.



Honors Program Completely Revamped

The department is creating more experiences for students to fulfill the honors requirements, in particular adding a "service learning" component. For the new Honors Program, students can earn "participation points" in three areas: academic preparation, experiential learning, and service learning. The academic preparation area can be fulfilled by taking either honors (H) courses within the ECE majors, or by taking graduate-level courses. For the experiential learning area, students will complete either an academic or industry research project. For example, students could carry out research as part of an ENEE 499 course. For the service learning area, students will take a new course on service learning and will be given the opportunity to apply topics from the course by participating in one of several service activities. For example, being either a UTF or a tutor in the ECE tutor program. In total, students need to complete four participation points, and the four points need to come from at least two of the three aforementioned areas.

feature story

Robotics: The Road to Innovative Research Programs

The Electrical and Computer Engineering Department has expanded widely in the areas of robotics and autonomous systems. Robots are transforming the future in many ways, from cloud-connected home robots to drone-use for public security, autonomous vehicles, robots for healthcare, and much more. The use of robotics will increase productivity, reduce human error, save time, and prove to be safer to use in many different environments and ways. Researchers in the Department are conducting research in several aspects of robotics, and are gaining funding from a variety of organizations for their work.

Autonomous Driving

Autonomous driving has become one of the most anticipated technologies in both industry and academic research groups. Most of the current efforts in autonomous driving have found success in idealistic conditions such as sparse and homogeneous traffic on highways and urban areas. Distinguished University Professor Dinesh Manocha's Geometric Algorithms for Modeling, Motion and Animation (GAMMA) research group is working on advanced autonomous driving research in highly dense and heterogeneous traffic conditions that characterize social and psychological aspects of human drivers in uncertain environments. They have developed new techniques for perception, behavior modeling, and navigation in challenging urban environments. They are collaborating with many industry partners and have also released datasets for the research community.



Robot Motion Planning and Navigation

Manocha's group has also been working on singleand multi-robot planning algorithms. Their earlier work focused on proximity detection algorithms and systems, which are widely used in the research community and industry. They have also developed novel methods for

multi-agent collision avoidance using reciprocal velocity obstacles and their extensions. All these methods have been integrated into ROS as well as game engines. Their recent work has focused on developing novel sensor-based navigation algorithms in dense indoor and outdoor environments with uneven terrains and crowded scenarios.



Self-Driving E-Scooters

"E-scooters are envisioned to be a vital part of a new urban mobility model that promises improvements in sustainability, accessibility, and equity over current modalities like cars and buses for short travel distances," says Derek Paley, Director of the Maryland Robotics

Center. The EPA estimates that eliminating half of U.S. car trips less than one mile would save \$575M/year in fuel costs and \$900M/year in maintenance and tire replacement. Municipalities in the U.S. and internationally by scooter are serviced operators-38.5 million trips were taken on e-scooters in Derek Paley, director of the Maryland 2018, more than twice as many Robotics Center, recruited students as the year before—usually University of Maryland. with appropriate permitting to



enforce best practices concerning safety and etiquette. Large scooter fleets are expensive to maintain and do not guarantee easy access for riders. E-scooters that reposition themselves provide value to both end-users and operators by improving rider experience, increasing scooter usage, decreasing servicing costs, and aiding the regulatory process.

Multi-Vehicle Control for Underwater Environment

The long-term goal of this project, led by Professor Paley, is to enable teams of autonomous underwater vehicles to coordinate their movements without revealing their positions to an adversary, e.g. by interacting using passive sensing based on visual, hydrodynamic, tactile, and/or acoustic signals. The specific research objective is to

apply tools from biology, engineering dynamics, fluid dynamics, and control systems to solve the problem of multi-vehicle control for close-proximity operations in the underwater domain.



AI and Autonomy for Multi-Agent Systems

An interdisciplinary research team led by the University of Maryland, College Park (UMD) and in partnership with the University of Maryland, Baltimore County (UMBC) has entered into a cooperative agreement with the U.S. Army Research Laboratory (ARL) worth up to \$68M.

The agreement brings together a large, diverse collaborative of researchers—leveraging the University System of Maryland's national leadership in engineering, robotics, computer science, operations research, modeling and simulation, and cybersecurity—to drive transformational advances in artificial intelligence (AI) and autonomy. The five-year agreement will accelerate the development and deployment of safe, effective, and resilient capabilities and technologies, from wearable devices to unmanned aircraft, that work intelligently and in cooperation with each other and with human actors across multiple environments.

The robust effort encompasses three areas of research thrusts, each supported by a team of faculty, staff, and students. The new collaboration builds on a more than 25-year research partnership between UMD and ARL in AI, autonomy, and modeling and simulation to spur the development of technologies that reduce human workload and risk in complex environments such as the battlefield and search-and-rescue operations.

The long-term goal of this cooperative agreement is to enable dual-use capabilities and technologies in uncrewed assets and smart devices that work intelligently in cooperation with each other and human actors across multiple domains. The specific research objectives include science-focused and science-led application of tools from engineering, computer science, operations research, cybersecurity, and robotics to solve the problem of endowing embodied mobile platforms and equipment with the requisite intelligence and autonomy to support high-tempo movement and maneuver, secure logistics, and enable situational awareness in complex environments while reducing human workload and risk.



New Undergraduate Minor in Robotics and Autonomous Systems

During Fall 2021, the University of Maryland began offering a new undergraduate minor in Robotics and Autonomous Systems (RAS). With automated systems becoming more central to the STEM industries in which engineering and computer science graduates work, robotics has become a "must-know" field. Robotics courses generate long wait



lists and a demand for more classes and sections.

The new minor is administered by the Maryland Robotics Center (MRC), part of the Institute for Systems Research within the Clark School of Engineering. The MRC currently provides technical direction to the Maryland Applied Graduate Engineering (MAGE) Master of Engineering program in Robotics and will expand its educational offerings with the introduction of the new crossdisciplinary minor.

Qualified students in aerospace engineering, mechanical engineering, electrical and computer engineering, and computer science are eligible to apply to the program.

"We are pleased to partner with these four departments to offer the new RAS minor for undergraduate students in the participating departments," said MRC Director and Professor Derek Paley (AE/ISR). "Our mission is to advance robotic systems, underlying component technologies, and applications of robotics through research and educational programs that are interdisciplinary in nature and based on a systems approach."

The RAS minor will teach students about robotics design, control, and programming, as well as integrating robotics and autonomous systems. They will gain practical skills through coursework, group projects, and research, with an emphasis on hands-on experiences. The minor program will also include regular interactions with academic, corporate, and/or governmental leaders in robotics, who will serve as both mentors and professional contacts. Students will have the opportunity to become peer mentors and tutors themselves.

feature story

Safety and Resilience in Collaborative **Operation of Human-Robot Teams**

resilience in collaborative operation of human-robot teams maintenance operations), as well as in uncoordinated graduate studies. activity (e.g. humans at or near a crosswalk encountering highly automated cars). In the Intelligent Servosystems Laboratory (ISL), led by Professor P. S. Krishnaprasad, their current work is focused on understanding the Chemicals in the Air problem of human activity in proximity to robots. Mathematical models of such activity are being developed by abstracting knowledge of observed regularities in human movements. The resulting models take the form of differential equations on matrix Lie groups with control inputs. Just as models built on motion in the rigid motion group are pertinent to robotics, equations evolving on the affine group prove to be appropriate for representing human movement. Some empirical work in ISL along these lines includes measuring trajectory properties associated with human locomotion. Ongoing work has led to new insights into patterns of collectives on the affine group, suggesting applications to teams of multiple (human and robotic) agents. Some aspects of this work are generously supported by Northrop Grumman.



Many alumni of ISL are making their mark in projects of national importance. Dr. Philip Twu is a Robotics System Engineer in the Aerial and Orbital Image Analysis Group of NASA's Jet Propulsion Laboratory. He is currently the systems engineer for rover navigation on the Mars 2020 Perseverance Rover mission. The rover is designed to detect signs of ancient life and collect samples of rock and regolith (broken rock and soil) for possible return to Earth. It was launched July 30, 2020, and will land February 18, 2021, on the Jezero Crater, Mars.

Twu completed his B.S. in both electrical engineering and and computer science at the University of Maryland in 2008, and his Ph.D. in electrical and computer engineering at Georgia Institute of Technology in 2012. Twu worked in ISL from 2007-2008.

Dr. George Kantor (Ph.D. '99) of Carnegie Mellon University's (CMU) AI Institute for Resilient Agriculture, is leading CMU's work in the USDA-NIFA AI Institute for Resilient A key challenge for robotics is ensuring safety and Agriculture (AIIRA), which is focused on AI and robotics in agriculture. The work is being funded by the National (e.g. on the manufacturing floor, warehouse settings, Science Foundation. Kantor worked in ISL during his

"Smellicopter" Drone used to Detect

Researchers from the University of Washington and the University of Maryland associated with the Air Force Center of Excellence on Nature-Inspired Flight Technologies and Ideas (NIFTI) have developed "Smellicopter," an autonomous drone that uses a live antenna from a moth to navigate toward smells. Smellicopter also can sense and avoid obstacles as it travels through the air. The results were recently published in the journal IOP Bioinspiration & Biomimetics.

NIFTI, established by the Air Force Office of Scientific Research in 2015 with \$9M in funding, is creating solutions for challenging problems related to small, remotely operated aircraft with ideas based on how animals move, navigate, and use their senses. The Clark School currently has four faculty involved in NIFTI efforts. Professor Pamela Abshire (ECE/ISR) is one of the five NIFTI leads. She is joined by Professor Nuno Martins (ECE/ISR), Professor Miao Yu (ME/ISR) and ISR-affiliated Associate Professor Timothy Horiuchi (ECE).

Drones hold great potential for performing tasks in difficult, dangerous places, including search and rescue in unstable structures following a natural disaster or navigating a region with unexploded devices. To assist in these tasks, researchers are developing technology for drones that can sense chemicals in the air. But most artificial sensors are not sensitive or fast enough to be able to find and process specific smells while flying through patchy odor plumes.

Smellicopter takes a different approach to get around these limitations by incorporating a live antenna from a moth as a sensor.



Robot Companions

For the past few years, Professor Gil Blankenship's research team has been developing robot "companions" for the elderly or infirm living at home. The robots are mobile, able to navigate in an enclosed space, and avoid people. All interaction with the robots are via voice command based on the Amazon Alexa system. Each robot is



equipped with simple sensors, one or more cameras, and a high performance microcomputer with GPU capabilities. The robots are able to detect falls and report them via a wireless link, and they can report extended inactivity and other indicators of potential problems. They can provide reminders of medications or appointments. More recent versions can provide entertainment such as playing games (chess, Jeopardy) with their owners. Some can even dance with a person. They use video analytics (pose

detection and tracking) to assess quality of movement and exercise, even teaching yoga. All robots are "networked" and can share information about their owners or other people they encounter in the home. Currently, Prof. Blankenship's students are developing small, fast robots that can collaborate to solve a maze in a "team." The fastest team wins with plans to commercialize these robots in the near future.

Foundational and Applied Research in Robotics

Prof. John Barashasbeen leading research on robots, robotic arms, robotic grippers, unmanned aerial vehicles (UAV), ground mobile autonomous robots, and autonomous cars. Foundational aspects of robotics research include trusted autonomy (autonomous systems that can self-monitor execution of tasks, self-correct execution, and self-learn), robots learning tasks, teaching robots tasks, models for human decision making, human-robot collaboration, safe learning, and models and methods for collaborative robotics. Applications include smart manufacturing, sophisticated manipulation tasks by robots, highway traffic control and management, urban traffic control and management, autonomous vehicle maneuvers (passing a car, changing lanes), collaborative robotics for search and rescue, for surveillance of factories for hazards and failures, for surveillance of agricultural fields, assisted living, and package delivery by autonomous ground and aerial vehicles. The research often utilizes inspiration from biology and physics. In almost all areas, a holistic systems approach is supported by pioneering methods and tool suites for Model-Based Systems Engineering (MBSE). Recently there is an effort to integrate model-based methods with data-based methods (i.e. machine learning (ML) and artificial intelligence (AI)). The research involves a balanced approach between theory, applications, and hands-on experiments, and tests both via sophisticated

simulations as well as with real robots in the lab or in the field. The research is supported by two state-of-theart laboratories, which Prof. Baras directs: the Systems Engineering and Integration Laboratory (SEIL), and the Autonomy Robotics and Cognition (ARC) Laboratory. There is a rich program of collaboration with industry and government labs and associated student internships. There is also close collaboration with researchers at the Technical University of Munich in Germany, and the Royal Institute of Technology (KTH) in Sweden.



NEWLY-OPENED SMART BUILDING TO SPUR **AUTONOMY RESEARCH**

The University of Maryland, already a leader in autonomy and unmanned systems research, is poised for further innovation with the launch of a state-of-the-art facility at the University System of Maryland at Southern Maryland (USMSM).

The new Southern Maryland Autonomous Research and Technology (SMART) Building, located in St. Mary's County, includes underwater, air, and land testing facilities that are expected to be utilized widely by researchers at UMD's A. James Clark School of Engineering, the

Department of Computer Science, the Institute for Systems Research, the Maryland Robotics Center (MRC), and other departments, centers, and units at UMD.

The \$86M, 84,000-squarefoot building is home



the 2020-2021 graduating class



Bachelor of Science Degrees were awarded 65 in the Fall164 in the Spring

COMPUTER ENGINEERING

82%

employed or attending graduate school (72% employed, 10% grad school)

\$92K

Average Starting Salary

TOP EMPLOYERS FOR CE:

- Northrop Grumman
- Amazon
- Capital One
- Microsoft
- Epic Systems

ELECTRICAL ENGINEERING

80%

employed or attending graduate school (69% employed, 11% grad school)

\$79K

Average Starting Salary

TOP EMPLOYERS FOR EE:

- Northrop Grumman
- JHU Applied Physics Lab (APL)
- Boeing
- Leidos
- NASA

student NEWS

Student Spotlight: Neehar Peri



Neehar Peri was selected as one of Maryland's 'Undergraduate Researchers of the Year' for 2021. He was nominated by Computer Science Assistant Professor John Dickerson.

The award is eligible for exemplary seniors who have been nominated by their faculty advisors. This year's ceremony will feature a multimedia presentation to celebrate each honorees' accomplishments, and Peri will receive \$1K and a plaque for his achievement.

Neehar's papers have focused chiefly on robust machine learning. He first started pursuing research in computer vision with College Park Professor Rama Chellappa in 2018, working on deep representation learning for vehicle re-identification. In addition to his research, Neehar currently works at Mukh Technologies, a startup led by Chellappa that focuses on deploying robust facial recognition solutions. Neehar is currently leading a research project that aims to improve low-light facial recognition using multi-modal image synthesis.

This past summer, Neehar was accepted to the Robotics Institute Summer Scholars program at Carnegie Mellon University, and was advised by Professor Deva Ramanan.

At UMD, Neehar was part of the QUEST Honors Program and served as an Undergraduate Teaching Fellow (UTF) for ENEE244 in Spring 2019 with Dr. Manoj Franklin. He received honorable mention in the Computer Science Department's CRA Outstanding Undergraduate Researcher Program, and was selected for the Sujan Guha Memorial Award in Electrical Engineering for the best written thesis by a graduating senior. This fall, Neehar joined Carnegie Mellon University to pursue his Ph.D. in robotics.

Zachary Breit Named 2021-22 Merrill Scholar



Zachary Breit (Computer Engineering) has been announced by the university and Undergraduate Studies as a 2021-22 Merrill Scholar. These are students who are academically outstanding and have distinguished themselves during their academic career.

The Merrill Presidential Scholars Program honors the University of Maryland's most successful seniors and their designated university faculty and K-12 teachers for their mentorship. Breit's faculty mentor is Fawzi Emad, Computer Science.

UNDERGRADUATE AWARDS

Eleven students were recognized in Spring 2021 for excellence in academics, leadership, and service by the Clark School and ECE Department.

ECE Outstanding Academic Performance Award Zachary Breit

ECE Service Award

Timothy Henderson Daojun (June) Xu

ECE Chair's Award, Electrical Engineering Beniamin Honecker Pratik Rathore **Benjamin Seufert**

ECE Chair's Award, Computer Engineering John Heide Mihailo Rancic Xinyi Shi

Center for Minorities in Science and **Engineering Service Award** Excel Alale

Ashley Henriquez

student NEWS

UMD Researchers Create On-Demand Cold Spots to Generate Electromagnetic Cone of Silence

In modern society, we are accustomed to having electronic systems that always work, regardless of the conditions. Protection of sensitive electronics to interference through unwanted coupling between components or intentional electromagnetic attack is important to ensure uninterrupted service. However, the environments in which we operate are growing increasingly complex and the electromagnetic spectrum is more congested. Additionally, certain environments such as a passenger cabin on an aircraft or train can act as reverberant cavities, resulting in random fluctuations in signal levels. These effects are dynamic, so preventing significant performance degradation necessitates an approach that is capable of adapting to changing conditions.

An electromagnetic enclosure can be characterized by its scattering parameters, which are voltage to voltage transfer functions defining the behavior of transmission and reflection between inputs and outputs. One method of dynamically changing the scattering parameters is to install a programmable metasurface inside the cavity. A programmable metasurface consists of multiple unit cells, each of which can modify its reflection coefficient, allowing the direction of reflected rays to be adjusted on the fly.

Researchers in the Wave Chaos Group at the University of Maryland, College Park (UMD) have used this approach to create on-demand cold spots, or nulls in transmission, effectively generating an electromagnetic cone of silence. Their work, published on December 29, 2021, in *Physical Review Research*, used a binary tunable metasurface manufactured by the Johns Hopkins University Applied Physics Laboratory. The relationship between commands and cavity scattering parameters is extremely complex. SO simple linear techniques fail to converge. The team, led by electrical and computer engineering Ph.D. student Benjamin Frazier, developed an efficient stochastic algorithm experimentally and demonstrated the ability to generate cold spots at arbitrary frequencies, with arbitrary bandwidths, and even when driving multiple inputs.



"Chaotic microwave cavities are extremely useful as surrogates to probe the behavior of electromagnetic waves in larger complicated enclosures and are used in many of the research projects being investigated both by our group and collaborators at facilities such as the Naval Research Lab," said Frazier. "The ability to dynamically modify the cavity in a very detailed and controllable manner is a significant advancement towards harnessing waves as they propagate through these rich scattering environments."

Other authors of the paper include ECE Professors Thomas M. Antonsen and Edward Ott, and ECE Affiliate and Physics Professor Steven M. Anlage. ■

2020-2021 Distinguished Dissertation Fellows

The fellowships are awarded to outstanding students in the final stages of dissertation work in recognition of their research excellence. The following authors' dissertations were selected by a search committee: Professor Eyad Abed, Professor Shuvra Bhattacharyya, Professor Cheng Gong, Professor Agis Iliadis, and Professor Shihab Shamma.



Abhishek Chakraborty

Dissertation: "Design Techniques for Enhancing Hardware-Oriented Security Using Obfuscation"

Advisor: Professor Ankur Srivastava



Joshua Pranjeevan Kulasingham

Dissertation: "Time-Locked Cortical Processing of Speech in Complex Environments"

Advisor: Professor Jonathan Simon

STUDENT SPOTLIGHT: CATHERINE GAO



Catherine Gao is a senior studying Electrical Engineering at UMD. She is actively involved in the ECE department as the President of the IEEE student branch at UMD, a member of the ECE Undergraduate Affairs Committee, and a mentor in the ECE Peer Mentorship Program. She enjoys organizing events to provide academic and professional resources for ECE students, and also loves to guide new students in their transition to college. Additionally, she serves as the IEEE Region 2 Student Representative, organizing student activities and advocating for more than 2,600 IEEE student members in Region 2. Outside of the department, she is a member of the Technica hackathon organizing team, a student in the Honors College's University Honors Program, and an Honors Ambassador. She previously interned at the U.S. Patent and Trademark Office, Texas Instruments, and NVIDIA, and will be joining NVIDIA full-time as a Patent Engineer after graduation. She is an aspiring patent

attorney and plans to attend law school in the near future.

Wylie Dissertation Fellowship Winners



Usman Fiaz, Chistos Mavridis, and Sai Rambhatla are three of 14 Clark School students pursuing their Ph.D.s in engineering who have been awarded Ann G. Wylie Dissertation Fellowships by the University of Maryland Graduate School. Dissertation fellowships provide support to excellent UMD doctoral candidates who are in the latter stages of writing their dissertations. The specific goal of the fellowship is to provide students with time to focus on writing and completing their dissertation in order to reduce time-to-degree, increase degree completion, and enhance the quality of the graduate student experience.



Usman Fiaz, Electrical and Computer Engineering

Advisor: John Baras, Lockheed Martin Chair and Distinguished University Professor

Research focus: Robotics, control, and machine learning; his dissertation topic is "Assured Autonomy in Multi-Agent Systems with Safe Learning." Fiaz has worked with ABB Future Labs, Nokia Bell Labs, Mitsubishi Electric Research Labs, and CERN. He is a current graduate research assistant in the Maryland Robotics Center. He is also the recipient of the Maryland Graduate School's 2021 Michael J. Pelczar Award for Excellence in Graduate Study, and won a University of Maryland Outstanding Graduate Assistant Award in 2018.



Christos Mavridis, Electrical and Computer Engineering

Advisor: John Baras, Lockheed Martin Chair and Distinguished University Professor

Research focus: Design for a universal learning architecture based on well-established architectural abstractions of the processing system of the auditory and visual cortex of humans, and learning the intrinsic laws of complex networked systems, ranging from animal flocks to social networks. Mavridis won the Clark School Distinguished Graduate Fellowship Award, University of Maryland Outstanding Graduate Assistant Award, the Outstanding Graduate Research Assistant Award, and the Future Faculty Fellowship. He completed internships at Nokia Bell Labs and Xerox PARC.



Sai Rambhatla, Electrical and Computer Engineering

Advisor: Rama Chellappa, College Park Professor

Research focus: Developing algorithms for training computer vision models using imperfect data supervision, which can occur due to unconstrained and ambiguous data collection efforts. Rambhatla's primary focus has been on designing novel algorithms to improve video-based person retrieval, object discovery, and sub-action discovery. His current research attempts to develop algorithms to train machine-learning models using missing annotations and to detect falsified media. His research has far-reaching practical implications, such as deploying computer vision systems in the real world and detecting fake news.

UMD Wins \$5M Phase 2 NSF Convergence Accelerator Award

The National Science Foundation (NSF) has awarded a \$5M, two-year award to a multi-institutional team led by the University of Maryland to develop quantum interconnects for ion trap quantum computers.

The team, QuaNeCQT (Quantum Networks to Connect Quantum Technology), is part of the 2020 Cohort's Quantum Technology Track, and one of 10 teams to be selected for a phase 2 award.

Team members include Electrical and Computer Engineering Professor and Quantum Technology Center (QTC) Associate Director Edo Waks; Physics Assistant Professor and QTC Fellow Norbert Linke; and Mid-Atlantic Crossroads (MAX) Executive Director and Division of IT Assistant Vice President/CTO Tripti Sinha. Additionally, the team includes the co-PIs of the NSF-funded Engineering Research Center for Quantum Networks (CQN): Dirk Englund of the Massachusetts Institute of Technology and Saikat Guha of the University of Arizona.

This past year, the team has been developing the quantum version of a modem and router that will enable quantum computers to exchange quantum information over kilometer distances. They will deploy this technology in the Mid-Atlantic Region Quantum Internet (MARQI), UMD's regional quantum network footprint. The MARQI network will interconnect quantum computers at UMD,

the Army Research Laboratory, MAX, and lonQ, with the potential for significant future scalability.

A quantum network would revolutionize numerous industries that take advantage of quantum computing including computing, banking, medicine, and data analytics. It would also connect multiple



small quantum computers to powerful distributed quantum computers that can solve problems that have significant societal impact. Quantum networks would significantly increase the user base for quantum computers by providing secure access to end users as well as accuracy of the quantum computation. As quantum technology converges with the internet, a new technology sector would emerge bringing with it the potential for major economic growth by producing rapid technological innovation and creating a large number of new jobs for the future "quantum workforce," just as the emergence of the internet did toward the late 20th century.

Micron-Scale NMR Spectroscopy using Diamond

Nuclear magnetic resonance (NMR) spectroscopy is a widely used tool for chemical analysis and molecular structure determination. A conventional NMR spectrometer requires sample volumes of roughly a milliliter in order to obtain sufficient sensitivity. In a paper published in *PRX Quantum*, a collaborative team of researchers led by Quantum Technology Center (QTC) Postdoctoral Fellow Dr. Nithya Arunkumar, under the guidance of QTC Director and Electrical and Computer Engineering Professor Ronald L. Walsworth, demonstrate a quantum sensing technique using nitrogen-vacancy (NV) quantum defects that improves the sensitivity of a high-resolution NMR spectroscopy, so measurements can be made on sample volumes small enough to contain just a single biological cell.

To achieve this advance, the researchers used an ensemble of nitrogen-vacancy (NV) quantum defects in a diamond chip and utilized a technique called SABRE (signal amplification by reversible exchange) that boosts the attainable NMR signal by hyperpolarizing the nuclear spins in the sample. SABRE-enhanced NV-NMR may become a high-impact tool for biological applications, such as tracking and monitoring the chemical reactions of

metabolites in single cells.

NV quantum defects in a diamond are an exciting new modality for sensitive

magnetic field sensing with high spatial-resolution and operation under ambient conditions, including NMR spectroscopy at small length scales (nanometers to microns).

"By combining the advantages of SABRE with nitrogen-vacancy



centers, we have demonstrated the capability to perform high-resolution NMR at the level of a single cell," says Dr. Arunkumar. "This is an important result and has broad applications in both biology and chemistry."

QTC Awarded \$1.5M from DoE for Research on Quantum Diamond Magnetometers

QTC has received \$1.5M from the U.S. Department of Energy (DOE) for their project titled "High-Field Quantum Diamond Magnetometers" in collaboration with Commonwealth Fusion Systems (CFS), a Massachusetts Institute of Technology (MIT) spin-out commercializing fusion energy. Led by QTC Founding Director Ronald Walsworth and QTC Scientist Dr. Matthew Turner, their project utilizes advancements in quantum sensing with Nitrogen Vacancy (NV) centers in diamond to enable diagnostic capabilities in extreme environments necessary for practical commercial fusion device operation and other applications using high magnetic fields. The threeyear project is intended to focus on Quantum Information Science (QIS) with applications to fusion and plasma science.

The goal of the project is to develop robust magnetometers, based on quantum defects in diamond, that can operate in the intense environment inside a tokamak fusion device. Arrays of high-field (between 1 and 20 Tesla) magnetometers are necessary for control and performance optimization of fusion plasmas. No existing magnetometers are known to meet the requirements of the extreme radiation, magnetic field, and temperature environment in a tokamak fusion device. Diamond is known to be robust to extreme radiation in other applications and theoretical estimates indicate that the diamond approach will be sensitive enough for the intended fusion applications.

"The DOE grant will enable experimental validation of the high-field quantum diamond magnetometers and demonstration of robustness in extreme environments," said Walsworth, who is also a Minta Martin Professor of Electrical and Computer Engineering and Physics.

"I'm pleased that the University



A render of the Commonwealth Fusion Systems (CFS) Magnet. Credit: CFS.

of Maryland will be receiving new funding from the Department of Energy for projects in fusion energy sciences," said House Leader Rep. Steny Hoyer in the DOE announcement, whose district includes the University of Maryland. "With this funding, the University of Maryland will help lead critical research on fusion energy, which is vital in our work to combat the climate crisis and move our nation toward cleaner sources of energy. I congratulate the University on this exciting funding and look forward to seeing the research they produce."

UMD E.A. Fernandez IDEA Factory Set to Open WMM

In Fall 2018, University of Maryland, state, and local leaders gathered with donors and supporters to celebrate the groundbreaking of the E.A. Fernandez IDEA (Innovate, Design and Engineer for America) Factory.

Opening in early 2022 to students, faculty, and researchers, the IDEA Factory will incorporate open design to enable collaboration between diverse areas of engineering, business, and science. Experts in robotics, quantum technology, rotorcraft, and transportation will work alongside entrepreneurial students, faculty, and partners to inspire creative thinking, new products, and research breakthroughs.

The 60,000-square-foot facility is connected to the Jeong H. Kim Engineering Building. With five floors, the IDEA Factory will include open workspaces for students, dedicated areas for student competition teams, and a new home for UMD's student-run incubator, Startup Shell. It will house the Alfred Gessow Rotorcraft Center, Robotics Realization Laboratory, Quantum Technology Center, and Maryland Transportation Institute.

The \$50M project was made possible by private philanthropy supporting Fearless Ideas: The Campaign for Maryland, UMD's \$1.5B fundraising campaign.



Photo: Eric Kruszewski.

quantum research NEWS

Hafezi and Waks Receive Competitive DURIP Grants

Mohammad Hafezi



"Wide-Band Ultrafast Laser System for Solid-State-Photonic Hybrid Quantum Systems & Laser and Detection System for Topological Light Sources"

Awarding offices: Air Force Office of Scientific Research, Office of Naval Research

Dr. Hafezi's research focuses on nanophotonics and quantum optics. His group investigates quantum properties of light-matter interaction for applications in classical and quantum information processing and sensing. The DURIP funding will allow his group to investigate fundamental aspects of light-matter interaction in solidstate systems, in particular 2D materials, for a wide range of frequencies.

Edo Waks



"Experimental Testbed for a Quantum Router Using Optical Quantum Memory"

Awarding office: Air Force Office of Scientific Research

Dr. Waks' research focuses on the application of photonic crystals to

quantum information processing and the use of photonic crystals for practical tools in optical telecommunication and sensing. This project will develop a low-temperature optical probe station to enable optical quantum memories for quantum networks; the equipment will support an ongoing AFOSR MURI.

WAKS RECEIVES UMD RESEARCH INSTRUMENTATION FUND AWARD

Launched in March 2021, the University of Maryland Research Instrumentation Fund was created to support faculty and core facilities through significant investments to replace or upgrade research equipment.

Waks received the award for a "Multi-Chamber Plasma Etching and Deposition System." Plasma processing systems are important research instruments widely used by faculty from a broad range of disciplines for making devices ranging from transistors to quantum circuits to biosensors. This new plasma etching and deposition system will allow faculty from across campus to conduct a wide variety of nanofabrication tasks, while providing indispensable tools for cutting-edge research and student training in many fields of science and engineering.

Gong Lab Publishes Two Papers Related to 2D Quantum Materials Sensors

Electrical and Computer Engineering Assistant Professor and Quantum Technology Center (QTC) Fellow Cheng Gong, and first-year Ph.D. students in his group, have recently published two papers related to 2D quantum materials sensors.



Their paper, "Understanding

and Optimization of Graphene Gas Sensors," published in *Applied Physics Letters*, demonstrates their use of graphene (2D quantum materials) to sense toxic gas (NO2), with extreme sensitivity, which is the ability to detect one NO2 molecule out of 100 billions of neutral gas molecules background. "The superior sensitivity results from the 'surface is all' nature of the atomically thin 2D quantum material," says Gong. "Even a single molecule attached to the quantum membrane can cause an appreciable response."

Their second paper, published in *npj 2D Materials and Applications* and titled "Ambient Effect on the Curie Temperatures and Magnetic Domains in Metallic Two-Dimensional Magnets," revealed that 2D magnets are sensitive to the ambient (predominantly O2). Gong pioneered the discovery of the first 2D magnet in 2017, and now steps further to study the interaction of 2D magnets with environments. "Bulk magnets are robust against the environmental disturbance because the surface interaction stops there and protects the interior, but atomic-thin magnets are super sensitive," Gong explains. "This environmental sensitivity gives us great opportunities to develop magnetoelectric sensors therefrom."

"Prof. Gong leveraged quantum materials to detect extremely tiny quantities of airborne molecules," says UMD Professor and QTC Founding Director Ronald Walsworth. "This new capability has wide-ranging technological implications with positive societal benefit, from chemical plant safeguarding, to diagnosis of early-stage disease, and avoidance of food spoilage."

"Innovative sensors such as those from the Gong Lab could positively impact Army capabilities due to their ability to detect toxic gases," says Fredrik Fatemi, Associate QTC Director & Branch Chief for Quantum Sciences, DEVCOM-Army Research Lab.

In addition, Prof. Gong has received funding for his sensor research under the Maryland Innovation Initiative (MII). MII promotes commercialization of research conducted in partnership universities and leverages each institution's strengths.

UMD is Partner of NSF-funded Revolutionary \$25M Center for Optoelectronic, Quantum Technologies

On September 9, 2021, the National Science Foundation (NSF) announced that it will fund a new endeavor to bring atomic-level precision to the devices and technologies that underpin much of modern life, and will transform fields like information technology in the decades to come. The five-year, \$25M Science and Technology Center grant will fund the Center for Integration of Modern Optoelectronic Materials on Demand—or IMOD—a collaboration of scientists and engineers at 11 universities, including the University of Maryland (UMD), and led by the University of Washington.

UMD faculty involved with IMOD include Edo Waks, professor of electrical and computer engineering (ECE) and physics, and Quantum Technology Center (QTC) associate director; Ronald Walsworth, professor of ECE



and physics, and founding director of QTC; and Mohammad Hafezi, professor of ECE and physics, and fellow of QTC.

"Our work will <u>deve</u>lop new classes

of colloidal materials that can generate quantum light with unprecedented efficiency, and enable strong photonphoton interactions," says Waks, who serves as UMD's lead investigator. "These are the key building blocks for photonics-based quantum information processing."

"As a key part of IMOD, QTC researchers will lead efforts to establish a new class of quantum materials that combine pristine optical properties and long qubit coherence times," says Walsworth. "The goal is to realize high-impact platforms for quantum networking and sensing."

IMOD research will center on new semiconductor materials and scalable manufacturing processes for new optoelectronic devices for applications ranging from displays and sensors to a technological revolution, under development today, that's based on harnessing the principles of quantum mechanics.

"IMOD could pave the way towards quantum devices that are easy to process and process, potentially making quantum technology available to a much broader user base," says Waks. "It will also engage students from chemistry, physics, and electrical engineering, who will form the future quantum workforce."

Original story by James Urton, University of Washington.

CONNECT WITH QTC LINKEDIN: LINKEDIN.COM/COMPANY/QTC-UMD TWITTER: @QTC_UMD

UMD Leads New \$25M NSF Quantum Leap Challenge Institute for Robust Quantum Simulation

The University of Maryland has been tapped to lead a multiinstitutional effort supported by the NSF that is focused on developing quantum simulation devices that can understand, and thereby exploit, the rich behavior of complex quantum systems.



The NSF Quantum Leap Challenge Institute for Robust Quantum Simulation, announced on September 2, 2021, brings together computer scientists, engineers, and physicists from five academic institutions and the federal government. Funded by a \$25M award from NSF, researchers in the UMD-led institute will develop theoretical concepts, design innovative hardware, and provide education and training for a suite of novel simulation devices that can predict and understand quantum phenomena.

"Maintaining and growing our global leadership in quantum science and technology is important for the state of Maryland and a top strategic priority for its flagship campus, the University of Maryland," said UMD President Darryll J. Pines. "The Quantum Leap Challenge Institute for Robust Quantum Simulation positions us to tackle grand challenges in quantum information science and quantum computing, and it further elevates our region as the Capital of Quantum."

Quantum simulation is a fundamental step toward realizing a world where general-purpose quantum computers can transform medicine, break encryption, and revolutionize communications.

Andrew Childs, a UMD professor of computer science and co-director of the Joint Center for Quantum Information and Computer Science (QuICS), is the lead principal investigator of the NSF award and will serve as director of the new institute.

In addition to Childs, leadership roles in the NSF Quantum Leap Challenge Institute for Robust Quantum Simulation will be filled by Ian Spielman from NIST (associate director for research), Mohammad Hafezi from UMD (associate director for education), Gretchen Campbell from NIST (associate director for diversity and inclusion), as well as co-principal investigators Kenneth Brown and Christopher Monroe (Duke), Alicia Kollár (UMD), and Jeff Thompson (Princeton).

Original story by Abby Robinson, College of Computer, Mathematical, and Natural Sciences, University of Maryland.

research NEWS

SRIVASTAVA WINS NSF FUNDING FOR IC FABRICATION SECURITY



ISR Director Ankur Srivastava is the principal investigator for a three-year, \$500K National Science Foundation Secure and Trusted Cyberspace award, "A High Level Synthesis Approach to Logic Obfuscation."

Use of untrusted foundries for integrated circuit (IC) fabrication has raised piracy and overproduction

concerns. Logic/design locking (also known as logic obfuscation) can secure design details from an untrusted fabrication facility by incorporating a locking key that hides the circuit's functional and structural information.

Prof. Srivastava's project will develop a system-level methodology to design locked digital circuits that are rendered useless if the attacker uses any incorrect key and are resilient to state-of-the art attacks such as a satisfiability attack (SAT).

A NEW WAY TO MONITOR MENTAL HEALTH CONDITIONS



Professor Carol Espy-Wilson and her team have developed a speech inversion system that uses machine-learning technology to convert acoustic signals into articulatory trajectories that can capture changes in speech gesture coordination related to mental health.

Using only the articulatory coordination features of speech, the system can classify depression with an accuracy of 85-90 percent. It also is able to classify schizophrenia that presents with symptoms such as delusions and hallucinations with 89 percent accuracy.

The goal is to incorporate this digital health technology system into a smartphone app that patients will find easy to use between visits to a healthcare professional. They would be encouraged to use the app for their own health, security, and safety. The app would ask the patient questions, then use the articulatory markers present in their speech as they reply to alert their clinician to a worsening condition.

WU, RANADIVE DEVELOPING ACCURATE, CONVENIENT HOME HEART MONITORING SYSTEM

Professor Min Wu has received National Science Foundation (NSF) funding to use artificial intelligence to develop a heart monitoring method that's as reliable as an electrocardiogram (ECG)—the gold standard used in hospitals and clinics—but as convenient as a device that can be worn at home. "Explainable Learning of Heart Actions from Pulse to Broaden Cardiovascular Healthcare Access" is a four-year, \$1.2M NSF "Smart Connected Health" grant. Wu is collaborating with Assistant Professor Sushant Ranadive (SPH), an expert in cardiovascular physiology and kinesiology.

The team is developing an innovative way to understand the relationship between results from an ECG—where electrodes are placed on the patient's chest—and those from a method known as photoplethysmogram (PPG), which measures cardiac activity by monitoring changes in blood volume beneath the skin through a sensor that could be worn on a finger. (While it's currently possible to obtain instant ECG data through a smartwatch or special smartphone attachment, these methods are impractical for long-term monitoring, the researchers said.)

However, while PPG is cheaper, more convenient, and more accessible than traditional ECG testing, it provides

less direct information on cardiac activity and is not as well understood by researchers or clinicians. The main goal of the NSF-funded project is to compensate for that gap by using AI to reconstruct ECG-quality results with PPG data, said Wu.

The research team plans to work closely with Clifton Watt, M.D., a cardiologist at the University of California, San Francisco, to transfer the substantial ECG medical knowledge base to the PPG domain.

Using an existing dataset from other researchers, her team has already carried out preliminary studies on a few hundred hospitalized patients. The NSF funding will allow exploration of a wide range of research questions the team hopes will result in a user-friendly self-monitoring system.



Somersaulting Photons

In a paper published in the *Journal Optica*, Professor Howard Milchberg's group demonstrates the surprising result that photons in a vacuum can have orbital angular momentum (OAM) vectors pointing sideways—at 90 degrees to the direction of propagation—a result literally orthogonal to the decades-long expectation that OAM vectors could only point forward or backward.

The research team, including graduate student and lead author Scott Hancock, postdoc Sina Zahedpour (EE Ph.D. '17), and Milchberg, did this by generating a donut pulse they dub an "edge-first flying donut," depicted in the diagram (its more technical name is "spatio-temporal optical vortex" or STOV). Here, the donut hole is oriented sideways, and because the rotational circulation now occurs around the ring, the angular momentum vector points at right angles to the plane containing the ring. To prove that this sideways-pointing OAM is associated with individual photons and not just the overall shape of the flying donut, the team sent the pulse through a nonlinear crystal (shown in diagram) to undergo a well-known process called "second harmonic generation," where two red photons are converted into a single blue photon with double the frequency. This reduces the number

of photons by a factor of two, which means each blue photon should have twice the sideways-



pointing OAM—and this is exactly what the measurements showed. As seen in the diagram, the angular momentum of the flying donut (or STOV)—represented by the red and twice-longer blue arrows—is the composite effect of a swarm of photons somersaulting in lockstep.

The angular momentum conservation embodied by somersaulting photons may make STOV beams resistant to breakup by atmospheric turbulence, with potential application to free-space optical communications. In addition, because STOV photons must occur in pulses of light, such pulses could be used to dynamically excite a wide range of materials or to probe them in ways that exploit the OAM and the donut hole. "STOV pulses could play a big role in nonlinear optics," says Milchberg, "where beams can control the material they propagate in, enabling novel applications in beam focusing, steering, and switching."

Exploring the "Rules of Life" of Natural Neuronal Networks Could Lead to Faster, More Efficient Computers

Biological systems—brains, for example—do the same things computers do: they engage in goal-oriented activity. They find, gather, process, structure, and manage information. They solve problems. Networks of neurons in brains are remarkably fast and efficient at solving pattern recognition and classification problems. In fact, they are far better at dealing with challenges like these than the most sophisticated computers.

One of the reasons scientists want to better understand how the brain works is so they can develop better algorithms and engineering models to increase the speed and abilities of computers. So far, however, researchers have made only limited progress in understanding what underlies the brain's remarkable capabilities. For example, they do not yet understand the physical mechanisms inside a living neuron and its networked neighbors.

Now, more than \$2.9M in National Science Foundation funding will help University of Maryland researchers explore the "rules of life" of neuronal networks.

Professor Pamela Abshire is the principal investigator and Professor Timothy Horiuchi and Professor Ricardo Araneda (biology) are the co-PIs for "Learning the Rules of Neuronal Learning," a five-year grant in NSF's Emerging Frontiers "Understanding the Rules of Learning" program. The researchers will bring together recent technological advances in patterning, electrical recording, optical stimulation, and genetic manipulation of neurons to study how to nurture a healthy culture of neurons while continuously observing and stimulating them at fine scale. They hope to uncover how the individual parts of a single neuron contribute to the overall learning and computation of the neural network.

The research should have significant implications for the scientific understanding of natural neuronal computation, and would introduce a completely new set of engineering tools for interacting with living neurons and exploring what is computationally possible. The project began Jan. 1, 2022.



imothy Horiuchi & Ricardo Araneda (UMCP)

Programming a single neuron to respond selectively to one pattern out of many. Source: Pamela Abshire Distinguished Scholar-Teacher Lecture, Oct. 29, 2021. Image courtesy P. Abshire, T. Horiuchi, R. Araneda.

faculty NEWS

Abshire Named Distinguished Scholar-Teacher



The Distinguished Scholar-Teacher Program, established in 1978, honors a small number of senior faculty who have demonstrated outstanding success in both scholarly accomplishment and excellence in teaching.

Abshire's areas of research specialty are in the fields of VLSI circuit design and bioengineering, focusing on better understanding the trade offs between performance and resources in natural and engineered systems. Her interests include information theory for physical systems; noise theory for electronic, photonic, and biological systems; analysis and design of sensory information processing systems; and algorithm, VLSI circuit, and microsystem design, especially for low-power applications.

Abshire was named an ADVANCE Professor—senior faculty members who identify as women and serve as strategic mentors and knowledge brokers for faculty within their college—by UMD in 2020-2021 and again in 2021-2022. She has also received the Clark School's E. Robert Kent Outstanding Teaching Award for Junior Faculty, an NSF CAREER award, and is an IEEE fellow.

Hafezi Promoted to Professor and Receives Minta Martin Chair Position

Mohammad Hafezi has been promoted to the rank of professor with tenure by University of Maryland (UMD) President Darryll J. Pines. Hafezi was also appointed as a Minta Martin Professor of the A. James Clark School of Engineering. This five-year appointment is in recognition of Hafezi's high-impact and outstanding research contributions to the College.

Hafezi holds appointments in the Departments of Electrical and Computer Engineering and Physics and the Institute for Research in Electronics and Applied Physics. He is a fellow of the Quantum Technology Center and the Joint Quantum Institute.

Hafezi's research focuses on nanophotonics and quantum optics. His group investigates quantum properties of light-matter interaction for applications in classical and quantum information processing and sensing. He is known for his contributions in a number of works to synthesize and characterize quantum many-body and topological physics beyond electronic systems. Examples of his contributions include cold atoms, and superconducting qubits and photons, which have helped shape the field of topological photonics.

In 2021, he was elected a Fellow of the American Physical Society (APS). He was nominated for the honor by the society's Division of Atomic, Molecular and Optical Physics (DAMOP) for "pioneering theoretical

and experimental work in topological photonics and quantum synthetic matter."

In 2020, he was awarded the Simons Investigator Award in Physics by the New York-based Simons Foundation. He was named a finalist for the second year in a row of



the Blavatnik National Awards for Young Scientists by the Blavatnik Family Foundation and the New York Academy of Sciences. He received a Multidisciplinary University Research Initiative (MURI) award from the Department of Defense for a team project titled "Photonic High Order Topological Insulators." Hafezi, along with JQI Graduate Researchers Alireza Seif and Hwanmun Kim, received an award from Google to support research identifying and developing problems that simple quantum computers might help solve.

In 2017 he received the George Corcoran Memorial Teaching Award for Faculty from the Electrical and Computer Engineering Department. In 2015 he was named an Office of Naval Research Young Investigator and he received a Sloan Research Fellowship from the Alfred P. Sloan Foundation.

Chellappa, Manocha, and Liu Ranked Top Scientists in the World by Guide2Research

On May 11, 2021, Guide2Research released its seventh edition of the top scientists ranking for computer science and electronics. The rankings acknowledge the contributions of these top researchers and recognize them as leaders in the field. Guide2Research ranked UMD computer scientists as #9 in the world and #8 in the nation.

College Park Professor Ramalingam "Rama" Chellappa (ranked #56 in the world, #39 in the nation), is a pioneer in facial recognition technology. He is currently the Bloomberg Distinguished Professor in the Departments of Electrical and Computer Engineering and Biomedical Engineering (School of Medicine) at Johns Hopkins.

Dinesh Manocha (ranked #76 in the world, #51 in the nation), is a Distinguished University Professor of the University of Maryland, where he is the Paul Chrisman Iribe Professor of Computer Science and Professor of Electrical and Computer Engineering. He is also affiliated with the Institute for Systems Research and the Robotics Center. Manocha's research focuses on AI and robotics, computer graphics, augmented/virtual reality, and

scientific computing. Manocha is a member of the ACM SIGGRAPH Academy, and a Bézier Award recipient from the Solid Modeling Association.

K. J. Ray Liu (ranked #273 in the world, #177 in the nation), is a Distinguished University Professor of the University of Maryland, where he is the Christine Kim Eminent Professor of Information Technology. Recognized by Web of Science as a Highly Cited Researcher, he is a fellow of IEEE, AAAS, and U.S. National Academy of Inventors. Liu is the 2022 IEEE President.



L-R: Professors Rama Chellappa, Dinesh Manocha, and K.J. Ray Liu.

ANTONSEN NAMED 2022 IEEE MARIE SKLODOWSKA-CURIE AWARD RECIPIENT



Distinguished University Professor Thomas Antonsen has been named recipient of the 2022 IEEE Marie Sklodowska-Curie Award for "seminal contributions in theoretical plasma physics and radiation science, and for the development of comprehensive design codes for vacuum electronics devices."

The Marie Sklodowska-Curie Award is given annually by the IEEE Board of Directors for outstanding contributions to the field of nuclear and plasma sciences and engineering. It is a Technical Field Award that was established in 2008. Prof. Antonsen will receive a bronze medal, certificate, and honorarium.

Prof. Antonsen joined the University of Maryland faculty in 1984. He is a professor of electrical and computer engineering and physics. ■

CHEMBO ELECTED TO IEEE PHOTONICS SOCIETY BOARD OF GOVERNORS



Professor Yanne Chembo has been elected to the IEEE Photonics Society Board of Governors. This Board oversees an organization of the IEEE members involved with devices, systems, and products connected to quantum electronics and photonics. The society focuses on and provides

resources for photonics research, development, design, and manufacturing.

Prof. Chembo joined the Electrical and Computer Engineering Department in January 2019. Prior to that, he was a research director at the French Center for Scientific Research (CNRS), where he explored nonlinear, quantum and stochastic phenomena in optoelectronics, microwave photonics, and laser physics. At UMD, he continues his work in these areas as applicable to aerospace systems, optical communications, time-frequency metrology, signal detection, and sensors.

PROFESSOR MAYERGOYZ AND ALUMNUS TYAGI PUBLISH BOOK, *PULSE WIDTH MODULATION IN POWER ELECTRONICS*



A new book titled *Pulse Width Modulation in Power Electronics,* written by Distinguished University Professor Isaak Mayergoyz and Dr. Siddarth Tyagi (Ph.D. '21), was recently published by the World Scientific Publishing Company. The book provides a theoretical discussion of pulse width modulation (PWM) in power electronic inverters.

Mayergoyz and Tyagi detail various PWM techniques with a focus on the optimal time-domain PWM techniques.

While at Maryland, Tyagi was advised by Professor Mayergoyz. Tyagi recently completed his Ph.D. in electrical engineering, with experience in power electronics, power systems, controls theory, and optimization.

Nicole Mogul Receives Outstanding Faculty Service Award



Clark School Lecturer Nicole Mogul is the 2020 recipient of the A. James Clark School Outstanding Faculty Service Award. The award is given to a Clark School faculty member whose service to the department, to the Clark School, and to the university has been judged outstanding. The selection

committee specifically noted Mogul as being one of the most innovative educators in the Clark School, bringing innovative pedagogy to courses in the Science, Technology, and Society (STS) Scholars program and the Electrical and Computer Engineering Department.

Mogul has been teaching a course on engineering ethics for the ECE Department since 2013. Other courses she teaches include The Future of Science Communication, Infrastructure, and Society, and the capstone in Science, Technology, and Society.

LIU CO-AUTHORS BOOK, RECIPROCITY, EVOLUTION, AND DECISION GAMES IN NETWORK AND DATA SCIENCE



Distinguished University Professor K.J. Ray Liu has co-authored the book *Reciprocity, Evolution, and Decision Games in Network and Data Science,* published by Cambridge University Press. Written with graduate students and researchers in networking, communications, and signal processing in mind, this book provides a broad understanding of

evolutionary games, indirect reciprocity, and sequential decision making by describing applications of gametheoretic models in real-world systems, including wireless and social networks.

Liu leads the University of Maryland Signal and Information Group (SIG). Three alumni of this group are the co-authors of this book: Yan Chen, University of Science and Technology of China; Chih-Yu Wang, Academica Sinica, Taipei; and Chunxiao Jiang, Tsinghua University, Beijing.

Khaligh Wins Nagamori Award



Professor Alireza Khaligh is the winner of the sixth Nagamori Award, a prestigious honor in the fields of power electronics and electric machines. He won the award for "Pioneering research and development on design and control of high-efficiency and high-power-density electric-motorintegrated wide bandgap power

electronics."

The Nagamori Award "honors those who bring vitality to technological research of motors and related fields, such as generators and actuators, and supports the researchers and development engineers who strive each day to fulfill their dreams."

Motors are indispensable and their use is rapidly expanding as electrification and automation progresses. They already consume more than 55 percent of the world's power today, and the foundation believes motor research is extremely important if people are to maintain affluent lives while conserving the global environment. The Nagamori Award was created "to vitalize the research and development of motor, power generator, actuator, and other related technologies, and support research and development engineers."

Biofilm-fighting Catheter Insert Research Named "Featured Article" in IEEE TBME

Published research by University of Maryland scientists on a novel system to combat biofilm in urinary catheters has been named a featured article for November by *IEEE Transactions on Biomedical Engineering* (TBME). The paper also has led to a recent patent application.

The authors are alum Ryan Huiszoon (BIOE Ph.D. '20), a senior process engineer at Facebook Reality Labs; alum Sangwook Chu (ECE Ph.D. '18), a process engineer at Applied Materials; ECE Ph.D. students Jinjing Han and Justin Stine; UMD Research Associate Luke Beardslee; and Professor Reza Ghodssi. Huiszoon, Chu, Han and Stine are advisees of Dr. Ghodssi.

"Integrated System for Bacterial Detection and Biofilm Treatment on Indwelling Urinary Catheters" represents substantial progress on a flexible biofilm detection and treatment system—UMD research that originally began in 2007. Bacterial biofilms are a major cause of infection in hospital settings. They are difficult to remove and contribute to the rapid evolution of antibioticresistant bacterial strains. Biofilms can occur in an array of moist, inaccessible environments with complex curved geometries, such as prosthetic implants and urinary catheters.

The integrated system described in the paper can be inserted inside catheters. It uses the impedance of electricity to effectively monitor biofilm status, and is able to treat it through the bioelectric effect, which combines low voltages of electricity with small doses of antibiotics.

Realistic Bladder Model



Environmental chamber 37°C

Chellappa and Alumnus S. Kevin Zhou Named NAI Fellows

Ramalingam "Rama" Chellappa, a College Park Professor in electrical and computer engineering with an appointment in the University of Maryland Institute of Advanced Computer Studies (UMIACS), and S. Kevin Zhou (EE Ph.D. '04), a Professor at the Medical Imaging, Robotics, Analytical Computing Laboratory & Engineering (MIRACLE) group of the Key Laboratory of Intelligent Information Processing of the Chinese Academy of Sciences, have been named 2020 Fellows by the National Academy of Inventors (NAI), joining the ranks of some of the nation's most prestigious and creative academic inventors.

Election to NAI Fellow is the highest professional distinction accorded solely to academic inventors. The 2020 Fellow class represents 115 research universities



and governmental and non-prof research institutes worldwide.

Chellappa was a longtime orofessor and chair in the Department of Electrical and Computer Engineering (ECE) whose work has been central to such fields as computer vision and machine learning. "I was inspired to choose engineering as my career soon after I listened to the 1969 landing of Apollo 11 on my home radio in India. I am honored, 50 years later, to be recognized as a fellow of the National Academy of Inventors," Chellappa said.

He left the University of Maryland in July 2021 after 28 years and is now at Johns Hopkins University as a Bloomberg Distinguished Professor. He maintains close ties to UMD through his appointments in the ECE Department and UMIACS.



S. Kevin Zhou obtained his Ph.D. degree in electrical engineering from the University of Maryland in 2004 and was advised by Chellappa.

"I am honored to be elected, especially together with my dear advisor Professor Chellappa, and I will always be honored to have been his student," said Zhou. At

Maryland, Zhou did pioneering work on unconstrained face recognition in Chellappa's laboratory. Zhou received the ECE Distinguished Alumni Award in 2017. ■

faculty NEWS

Faculty Spotlight: Dutta and Zhang to Join the ECE Department in Fall 2022

We are thrilled to announce the addition of two new assistant faculty members who will be joining the department in Fall 2022. These individuals will bring diverse experience and knowledge in the field of machine learning.



Sanghamitra Dutta

Dutta completed her Ph.D. at Carnegie Mellon University (CMU) in 2021 and was advised by Prof. Pulkit Grover.

Prior to joining CMU, she graduated from IIT Kharagpur

with a B.Tech. in Electronics and Electrical Communication. Her undergraduate thesis was advised by Prof. Arijit De.

Her research interests revolve around machine learning, information and coding theory, causality, and statistics. Her Ph.D. thesis received the A. G. Milnes Award from the

ECE Department at CMU for the graduating class of 2021.

In her prior work, she has examined problems in reliable computing, proposing novel algorithmic solutions for large-scale machine-learning in the presence of faults and failures, using tools from coding theory (an emerging area called "coded computing").

Dutta joined JP Morgan Chase AI Research in July 2021 as a researcher and will be joining the Department of Electrical and Computer Engineering at the University of Maryland as a tenure-track assistant professor in Fall 2022.



Kaiqing Zhang

Zhang is currently a postdoctoral scholar affiliated with the Laboratory for Information & Decision Systems (LIDS) and Computer Science and Artificial Intelligence Laboratory (CSAIL) at Massachusetts Institute

of Technology (MIT). He works jointly with Prof. Asu Ozdaglar, Prof. Russ Tedrake, and Prof. Constantinos Daskalakis of MIT. He received his Ph.D. from the Department of Electrical and Computer Engineering (ECE) at the University of Illinois at Urbana-Champaign (UIUC), advised by Prof. Tamer Başar. He received two M.S. degrees in ECE and applied math from UIUC, and B.E. from Tsinghua University. His research interests lie broadly in control theory, game theory, reinforcement learning, robotics, and their intersections. He will be joining the Department of Electrical and Computer Engineering at the University of Maryland as a tenure-track assistant professor in Fall 2022.

Ulukus Wins Two IEEE ComSoc Awards



Professor Sennur Ulukus has been chosen for the Distinguished Technical Achievement Recognition Award by the IEEE Communications Society (ComSoc) Technical Committee on Green Communications and Computing (TCGCC).

The annual award is given to a ComSoc member in good standing of the IEEE ComSoc TCGCC, who has a high degree of visibility and technical contributions to the research field of Green Communications, Networks, and Computing.

Ulukus received the award "for her outstanding technical leadership and achievement in green wireless communications and networking."

She was also selected as the recipient of the IEEE Communications Society's (ComSoc) 2020 WICE Outstanding Achievement Award.

Ulukus received the award "for outstanding technical work and for achieving a high degree of visibility in the field of communications engineering, through research and service."

This annual award recognizes members of IEEE ComSoc who have been involved with the Women in Communications Engineering (WICE) Standing Committee, have done outstanding technical work in the broad field of communications engineering, and have achieved a high degree of visibility in the field. With about 30,000 members, ComSoc is one of the largest societies of IEEE. ■

Espy-Wilson Named IEEE Fellow



Professor Carol Espy-Wilson (ECE/ISR) was elevated to IEEE Fellow on January 1, 2022. The IEEE Board of Directors issued the following citation, "for contributions to speech enhancement and recognition."

Espy-Wilson is renowned for her research in speech communication, particularly in the areas of speech and speaker

recognition, speech production, speech enhancement and single-channel speech segregation. She leads the University of Maryland Speech Communication Lab and focuses on digital signal processing, speech science, speech acoustics, linguistics, and machine learning. She is the founder of OmniSpeech, a company that is developing technology that will suppress background noise while enabling enhanced speech ability in any device, app or platform. She won UMD's Invention of the Year award in 2019 in the Information Science category for OmniSpeech's groundbreaking speech extraction technology, OmniClear.

Espy-Wilson joined the UMD faculty in 2001. She is a Fellow of the International Speech Communication Association, the Acoustical Society of America and the Radcliffe Institute for Advanced Study at Harvard. She recently received the Campus Woman of Influence Award in 2021 and was recognized at UMD's First to ADVANCE Celebration in 2019. Prof. Espy-Wilson is the first African American woman, and first African American, in the Department of Electrical and Computer Engineering to receive tenure and be promoted to full professor.

She has also received the Institute for Systems Research Senior Faculty Fellow Award, the UMD Jimmy Lin Award for Innovation in Electrical and Computer Engineering, and the UMD Distinguished Scholar-Teacher Award. In June 2021, she was the Keynote Speaker for the 180th Meeting of the Acoustical Society of America.

K.J. Ray Liu Named IEEE President



As the first University of Maryland faculty member elected lead the to Institute of Electrical and Electronics Engineers (IEEE), Distinguished University Professor and Christine Kim Eminent Professor of Information Technology K.J. Ray Liu began serving as IEEE President on January 1, 2022.

"I am forever grateful for the strong support I received to make this possible," says Liu. "Now the work begins to deliver my pledge of making IEEE a better place for all of us. I look forward to continuing the journey of advancing technology for the benefit of humanity."

Liu joined the Electrical and Computer Engineering Department in 1990, and leads the University of Maryland Signal and Information Group. His research lies in signal processing and communications, with a recent focus on wireless sensing and tracking.

"I'd like to wish a hearty congratulations to Professor Liu on this major accomplishment to lead this prestigious engineering society in 2022," says University of Maryland President Darryll J. Pines. "I'd like to wish him the best of luck as he takes the helm during these very challenging times."

Liu has been recognized internationally with numerous awards. He is the recipient of two IEEE Technical Field Awards, including the 2021 IEEE Fourier Award for Signal Processing and the 2016 IEEE Leon K. Kirchmayer Graduate Teaching Award. He received the IEEE Signal Processing Society 2009 Technical Achievement Award, 2014 Society Award for "influential technical contributions and profound leadership impact," and more than a dozen best paper/invention awards. Recognized as a Web of Science Highly Cited Researcher, Liu is a Fellow of IEEE, AAAS, and the U.S. National Academy of Inventors.

Liu has trained more than 68 Ph.D. students and postdocs, of whom 10 have become IEEE Fellows and most are active in major universities and industries worldwide.

Liu founded Origin Wireless, further developing a wireless Al platform consisting of many analytic engines that can detect human motion, fall, and vital signs such as breathing rate and heartbeat, human biometric, and monitor sleep and well-being, without any wearables by using commodity WiFi. His invention, the Time Reversal Machine, recently won two CES 2021 Best Innovation Awards.

Liu retired on January 1, 2022 after 31 years at the University of Maryland, College Park. ■

faculty NEWS

Wu Elected President of IEEE SPS



Professor and Associate Dean of Engineering, Min Wu, been elected has as the 2022-2023 President-Elect of IEEE Signal the Processing Society (IEEE SPS). Wu is the first woman of color to be elected for this position, and she will begin serving as SPS President on January 1, 2024.

Wu is an international expert on multimedia signal processing, media forensics, and information security. She is a Distinguished Scholar-Teacher at Maryland who is affiliated with the Institute for Systems Research (ISR) and holds a joint appointment in the University of Maryland Institute for Advanced Computer Studies (UMIACS).

As an active member of IEEE SPS for more than 25 years, Wu has served in a number of leadership roles for the society, including vice president for finance, chair of the IEEE Information Forensics and Security Technical Committee, editor-in-chief of the IEEE *Signal Processing Magazine*, and in many major conferences. For her outstanding contributions to regional activities, she was recognized with the SPS Meritorious Service Award in 2016.

"I am deeply honored by the overwhelming support from members who recognize the effort and experience I have brought to the Signal Processing Society on multiple fronts, as well as the need and benefit of a diverse leadership," said Wu. "The pursuit of excellence with diversity and inclusion is a continuous process, and builds on nurturing an open mind and being persistent to lean in and contribute."

As SPS President, Wu plans to increase diversity and inclusivity, address members' needs in different regions, sectors, and career stages, and improve financial sustainability and growth within the society.

"Given her stellar research record and her relentless efforts on behalf of the professional community, Professor Wu is imminently qualified to lead the IEEE SPS into a bright future," said Joseph JaJa, professor and chair of the ECE Department.

"Congratulations to Professor Min Wu on her historic achievement: It's a testament to a career of impactful work and breaks another barrier in the pursuit of a more equitable and representative engineering profession," said Samuel Graham, dean of Maryland's A. James Clark School of Engineering. "We pride ourselves on setting trends at Maryland Engineering—from cutting-edge research to the development of leaders in our respective fields—and are proud Min's accomplishment continues that tradition."

Founded as IEEE's first society in 1948, the SPS is the world's premier association for signal processing engineers and industry professionals. Its deeply rooted history spans more than 70 years, featuring a membership base of nearly 20,000 researchers in about 100 countries worldwide.

Qu Named IEEE Fellow



Professor Gang Qu's citation reads, "for contributions to hardware intellectual property protection and security."

Qu holds a joint appointment with the Institute for Systems Research, and his main research interests are in VLSI design for embedded

systems with focus on low power and energy efficient embedded system design; and hardware related security, privacy and trust issues. His research group works in the general area of cybersecurity with focus on hardware security and trust. His group has developed methods that use the hardware and physical characteristics of Internet of Things devices to build lightweight security primitives such as authentication protocols for data, users, and devices. Qu and his students use traditional CMOS, emerging nonvolatile memory technologies, and voltage over scaling technique for user and device authentication as well as GPS spoofing detection. These practical approaches are promising alternatives for the classical crypto-based authentication protocols for the embedded and IoT devices in the smart world. On hardware-related security, privacy and trust issues, Qu's research efforts have been focused on how hardware can help make the system more secure and trustworthy.

Manocha's Research Team Honored with Invention of the Year Award Nomination

Announced April 21, 2021, at the Innovate Maryland event, which was part of UMD President Darryll Pines' Inauguration Week activities, Professor Dinesh Manocha's team was nominated for their project, "Using Artificial Intelligence to Recognize Emotion." The team is composed of students and faculty in ECE, computer science, and the University of Maryland Institute for Advanced Computer Studies (UMIACS).

With potential applications for advertising, gaming and entertainment, and more, this invention—an emotion recognition algorithm—uses three different factors (face, speech, and text) to accurately determine human emotions.

Simon and Babadi Receive \$2.88M in NIH Funding

A new five-year, \$2.88M grant from the National Institute on Deafness and other Communication Disorders at the National Institutes of Health will bring researchers another step closer to fully understanding the system and ultimately being able to develop better hearing assistive devices.



Professor Jonathan Simon is the principal investigator for the grant "Multilevel Auditory Processing

of Continuous Speech, from Acoustics to Language." Co-PIs are Associate Professor Behtash Babadi, Associate Professor Samira Anderson (HESP), and Stefanie Kuchinsky (HESP affiliate).

In this new project, the researchers will use EEG and MEG to simultaneously measure both midbrain and cortical speech processing. Long term, the researchers aim to improve their ability to both measure and mitigate the communication challenges people face in their daily lives.

The researchers hope to find the acoustic and neural conditions under which intelligible speech is perceived. They believe a grounded understanding of how speech processing progresses through a network path, and learning what compensating mechanisms the brain employs to perceive speech under degraded hearing conditions, will result in foundational principles that can be used to develop "brain-aware" and automatically tuning hearing assistive devices for persons with hearing and related disorders.

ECE Student & Staff Awards

Mendez and Caal Win Staff Service Award

Cassandra Mendez and Janeth Caal have received ECE's 2021 Staff Service Award. The award is given in recognition of their dedication, excellence in performance, and commitment to service to the department this year.

Nouketcha Wins Graduate Student

Service Award

Franklin Nouketcha is the recipient of this year's Graduate Student Service Award. This award is presented to a graduate student in recognition of exceptional service to the Department.

Singh and Soleimani Win George Corcoran Memorial Award

Akshay Singh and Behrad Soleimani have received ECE's 2021 George Corcoran Memorial Award. This award is presented to two graduate teaching assistants in recognition of excellence in teaching.

Wu Wins Jimmy H.C. Lin Innovation Award

The Jimmy H. C. Lin Award for Innovation has been awarded to Professor Min Wu, and her former student, Chau-Wai Wong (EE Ph.D. '17) for their patent "Counterfeit Detection Scheme Using Paper Surfaces and Mobile Cameras." Chau-Wai Wong is currently an assistant professor in the Department of Electrical and Computer Engineering and the Forensic Sciences Cluster at North Carolina State University.

The Lin Innovation Award is given to promote innovation among ECE students, staff, and faculty by stimulating, encouraging, and rewarding the invention and patenting process, and to help students, staff, and faculty move their ideas forward through the complicated and often expensive patenting process.

alumni NEWS

Kim Develops Bioelectric Effect Toothbrush

A Clark School of Engineering alum has transferred his Ph.D. research on the bioelectric effect into a pioneering consumer product that improves mouth and gum health. Young Wook Kim (ECE Ph.D. '14) is the founder of ProxiHealthcare Inc., which manufactures the new TROMATZ toothbrush. First available in South Korea, the toothbrush employs the bioelectric effect to effectively attack the mouth's plaque and tartar biofilms. It has received FDA and FCC approval in the United States and is available for purchase on Amazon.

Bacterial biofilms form in a variety of moist, inaccessible environments—like the mouth—where bacteria can adhere to complex curved surfaces like teeth. Given a little time, bacteria encase themselves in an extracellular matrix, forming biofilm. This matrix offers the bacteria significant protection and makes it easy for them to spread.

Dental plaque, and its hardened state, tartar, are types of



biofilm. Left unchecked, plaque and tartar contribute to bad breath, gum disease, and eventually the loss of teeth. While we brush our teeth several times a day to remove this film, there is room for improvement in the tools we use.

Eden Inducted Into Innovation Hall of Fame



The A. James Clark School of Engineering inducted J. Gary Eden (EE '72) into its Innovation Hall of Fame (IHOF) for his legacy of trendsetting work with optics, lasers, and microplasma devices.

Eden received his B.S. degree in electrical engineering from

the University of Maryland in 1972. He received an M.S. and a Ph.D. degree in electrical engineering at the University of Illinois, Urbana.

He is a pioneer in the discovery, development, and applications of ultraviolet (UV) lasers and lamps,

as well as microplasma-based optical and chemical processing systems. As a research physicist during the late 1970s in the U.S. Naval Research Laboratory (NRL) in Washington, D.C., he discovered several UV and visible lasers, one of which (krypton chloride) is a member of the excimer lasers. Today, this family of lasers is pivotal to instruments and systems devoted to medical procedures and phototherapy such as LASIK and the treatment of psoriasis, the patterning of micro- and nano-electronic and photonic devices by photolithography, and semiconductor processing.

Eden is currently the Intel Alumni Endowed Chair Emeritus at the University of Illinois. He was honored in 2016 for the Distinguished Alumni Award from the Electrical and Computer Engineering Department.

El Gamal Named <mark>Engineering Associate Dean for Academic</mark> Affairs at the University of Sydney



Alumnus Hesham El Gamal (EE Ph.D. '99) was appointed Engineering Associate Dean of Academic Affairs at the University of Sydney. His new position comes after 20 years at Ohio State University, where he most recently served as Chair of the Electrical and Computer Engineering Department and Co-Director of the Institute of Cybersecurity and Digital Trust.

His main area of research is information theory, which includes studies in proactive communications, space-time coding and decoding, and graphical code design.

Chakrabarti Wins ASU's Joseph C. Palais Distinguished Faculty Scholar Award



Chaitali Chakrabarti (M.S. '86, Ph.D. '90) has received the Joseph C. Palais Distinguished Faculty Scholar Award for excellence in research, teaching, and community service at Arizona State University (ASU). The award was established in 2016 and celebrates outstanding faculty members of the Fulton School's electrical engineering program. Chakrabarti joined ASU in 1990. She is a world-renowned and passionate researcher on algorithm-architecture co-design of signal processing and communication systems, low-power embedded system design, reliable and energy-efficient in-memory computing, and secure edge computing.

While at Maryland, Chakrabarti was advised by Professor and Interim Department Chair Joseph JaJa. She attributes her passion for research and teaching to his superb mentorship. Chakrabarti received the Electrical and Computer Engineering Department's Distinguished Alumni Award in 2013.

Bader Receives 2021 Sidney Fernbach Award



David Bader (Ph.D. '96) is the recipient of the 2021 Sidney Fernbach Award from the IEEE Computer Society (IEEE CS). Bader is a distinguished professor and founder of the Department of Data Science, and inaugural director of the Institute for Data Science, at the New Jersey Institute of Technology. recognizes outstanding contributions in the application of high-performance computers using innovative approaches. Bader was cited for "the development of Linux-based massively parallel production computers and for pioneering contributions to scalable discrete parallel algorithms for real-world applications."

Bader is the 2012 inaugural recipient of University of Maryland's Electrical and Computer Engineering Distinguished Alumni Award. During his time at UMD, Bader was advised by ECE Interim Chair and Professor Joseph JaJa, and founded and served as president of the Electrical and Computer Engineering Graduate Student Association (ECEGSA).

The Sidney Fernbach Award, established in 1992,

Stamm Named to Popular Science's Brilliant 10 of 2021



Alumnus Matthew Stamm (Ph.D. '12) has been selected as one of *Popular Science's* "Brilliant 10 of 2021." This annual award recognizes the most innovative researchers who are discovering new approaches to a variety of cross-disciplinary challenges, including climate change, clean water, surgical pathology, and adaptive technology.

Stamm's research, titled "Dusting for Fingerprints to Find Deepfakes," addresses the increasing problem of alterations to digital objects through AI. Stamm received his B.S., M.S., and Ph.D. from the Department of Electrical and Computer Engineering. He earned his Ph.D. in 2012 after being advised by Distinguished University Professor K. J. Ray Liu, to whom he has said "I want to thank you so much for the mentoring and guidance you have given me. The training you gave me in graduate school and the example you have set as a researcher have profoundly shaped my career. Thank you so much for helping put my career on the path for this to be possible."

Stamm is an Associate Professor in Electrical and Computer Engineering at Drexel University College of Engineering, which he joined in 2013. He leads the Multimedia and Information Security Lab (MISL). ■

alumni N≣WS Alumni Profile: Sarbari Gupta



In 2001, Sarbari Gupta founded Electrosoft, an IT and professional services firm specializing in cybersecurity. As Chief Executive Officer, Dr. Gupta leads corporate strategy and vision, shapes corporate culture, and cultivates business relationships to enable Electrosoft to thrive. Her

extensive background spans software development and professional services serving both public and private sectors. Dr. Gupta has a broad base of knowledge and experience in the areas of cybersecurity, risk management, privacy, and cryptographic solutions.

"Starting my own company has given me a vehicle and a path to do innovative things, define technical strategies and solutions, and build teams to achieve the goals I have set for the company," said Dr. Gupta. "Entrepreneurship is not an easy path, but it is an exhilarating path that gives you the freedom and confidence to do what you want. It is also unforgiving in the sense that you have no one but yourself to blame if things don't work out the way you expected."

Dr. Gupta received M.S. and Ph.D. degrees in electrical engineering from the University of Maryland, College Park.

Dr. Gupta is an active alumna of the University of Maryland. She participated in an ECE IEEE Leadership Seminar in 2019 and joined the Women in Engineering (WIE) Board.

Dr. Gupta recently established a scholarship in honor of her late mother, Sipra Gupta, who passed away in December 2020 after a brief fight with COVID-19. "My mother always championed equal treatment and respect for girls and women," said Dr. Gupta. "It was largely her encouragement and support that enabled my sister and me to pursue technical professional fields and to excel in the tracks we chose. Through the scholarship, I hope to celebrate her viewpoint and commemorate her support for young women who choose to pursue a STEM career."

H. Neal Reynolds Named 2021 Health Care Heroes Physician of the Year



The Daily Record has named Dr. H. Neal Reynolds (EE '70) a 2021 Health Care Heroes Physician of the Year.

After graduating from the University of Maryland, Reynolds continued his education at the University of Maryland School of Medicine. He became board certified in Internal Medicine after

residency at the University of Hawaii. He later obtained certification in Critical Care Medicine from Wayne State School of Medicine in Michigan, and he is currently practicing at the University of Maryland Shock Trauma Center in Baltimore.

By drawing on his education in electrical engineering, Dr. Reynolds has done extensive work in using robotic technology as part of TeleHealth and Tele-ICU programs. The Daily Record is a Maryland-based newspaper that reports on business and legal news.

Dr. Reynolds has been widely recognized for his work during the Covid-19 pandemic.

Abhishek Motayed's Company, N5 Sensors, Named "Startup of the Year"



Abhishek Motayed, CEO of N5 Sensors, Inc., is a scientistturned-entrepreneur with 15 years of experience in the field of semiconductors. Abhishek brings cutting-edge ideas to life through technological development and execution of effective strategies. He specializes in semiconductor processing and manufacturing,

wide-bandgap technology, and bringing science-based R&D to market.

Abhishek founded N5 Sensors, Inc. in 2012, a University of Maryland (UMD) spinoff based in Rockville, Maryland, and is developing next-generation chemical/gas sensors utilizing innovations in nano engineering. His company makes advanced gas and chemical sensors small enough to be wearable on a firefighter's coat. The fingertip-size devices also detect many more gases and are more sensitive than traditional sensors. N5 Sensors was named "Startup of the Year" in April during the virtual 2021 UMD Innovate Maryland event.

Abhishek received his master's degree from Howard University in 2003 and his Ph.D. in electrical engineering from UMD in 2007. While at Maryland, he was advised by Professor Emeritus John Melngailis.

In Memoriam: John William Fritz



John William Fritz of Baltimore, Maryland, passed away in June 2020 at just 25 years old due to complications from a rare heart condition. He was an avid runner proud finisher of two marathons and two obstacle course races keen outdoorsman, and fierce friend. He touched the hearts of

many, and his loss is felt deeply by everyone in his life.

John, a 2017 electrical engineering graduate from the University of Maryland, College Park, was employed from 2018-2020 with Northrop Grumman's Electronics Division in Linthicum, Maryland.

Faculty of the Electrical and Computer Engineering Department remember John as a wonderful and hardworking student. "John was an excellent student and had almost perfect scores on his lab reports," said Dr. Steve Tretter, John's professor in the Electrical and Computer Engineering Department's Communications Design Laboratory course.

Professor Carol Espy-Wilson and her Teaching Assistant Ganesh Sivarman also noted that John was a quiet and sincere student who worked hard on his projects. "John's final group project in my course was on 'Password based image encryption,' which was demonstrated in Matlab. It was a nice project idea and implementation," said Espy-Wilson.

Heart disease is the leading cause of death in the United States, and every 36 seconds, someone dies of heart disease. John's family and friends "Rocked on for John" by participating in the Greater Maryland Heart Walk this past October. Together, they raised money and awareness to increase the availability of treatment, advance cutting edge research and new technology, and support national education campaigns to prevent and treat heart disease.

Banas Family Supports Keystone Program with \$25K Gift

Introduction to Engineering Design (ENES100) is a required course in the University of Maryland's Keystone Program for all first-year engineering students. It is the only course in the Clark School that is taken by all engineering students from all disciplines. It is a project-based curriculum that requires working in teams to develop a complex and multidisciplinary product. For Casey Banas ('21, computer engineering), this course made a truly lasting impact and essentially shaped the rest of her college career.

"I really enjoyed being a student in the program," said Casey. "The group projects provided me with crucial experience in engineering design. The faculty and program coordinators were very caring and passionate about their students, and it felt like a family within a bigger family."

During her sophomore year, she became a teaching assistant for the course, and after graduated with her bachelor's degree in May 2021, she joined L3Harris as a software engineer.

Casey's parents, Rob and Karen Banas, have been present during Casey's journey in engineering every step of the way, and they have generously gifted the Keystone Program \$25,000.

"Seeing how Casey benefited from the program, we wanted to give back and funnel support to keep the program running, and give staff and coordinators the support they need," said Rob, Senior Vice President of Property and Buildings at WSP USA. "We were so thrilled when Casey chose to major in computer engineering, and the Keystone Program played a large role in that decision."

"I am so grateful to the Banas family for their generous donation to support the Keystone Program," said Kevin Calabro, Director of the Keystone Program. "This gift will help us to provide future students with similar experiences as Casey received while an undergraduate student. Specifically, this gift will help us to beautify and modernize our first- and second-year makerspaces and to support our undergraduate teaching fellow program."



ECE Names 2021 Distinguished Alumni

The Electrical and Computer Engineering Department has selected Craig Lawrence, Johannes Thorsteinsson, Mustafa Kemal Sönmez, and Haitao (Heather) Zheng as Distinguished Alumni for their leadership and meritorious contributions to the field of engineering, their humanitarian efforts, and the application of their engineering education to other disciplines.

Craig Lawrence

Research areas: Optimization, AI, Machine Learning



Dr. Craig Lawrence is the Director for Systems Research at the Applied Research Laboratory for Intelligence and Security and a Visiting Research Scientist with the Institute for Systems Research at the University of Maryland at College Park. Prior to the University of Maryland, Dr. Lawrence was a Program Manager for the Defense Advanced Research Projects

Agency (DARPA) Strategic Technology Office. At DARPA, Dr. Lawrence created and managed the Battle Management Command and Control (BMC2) portfolio of programs, where he was responsible for five major DARPA programs, including the creation of a family of four unique programs (plus multiple studies, SBIR projects, and a young faculty award) valued at more than \$180M addressing critical BMC2 technology gaps within the services and to provide key enablers for the DARPA/STO system of systems (later "Mosaic Warfare") vision. Dr. Lawrence was awarded the DARPA Meritorious Public Service Medal for his service in 2019.

From 1999 to 2013, Dr. Lawrence was in industry, culminating with the position of Technical Director in the Technology Solutions division (now Fast Labs) at BAE Systems where he managed a group focused on defense and intelligence R&D. He was recognized with the BAE Systems Bronze Chairman's Award in 2005, and later the BAE Systems Technology Transition of the Year award, for the development of Intelligence, Surveillance, and Reconnaissance (ISR) planning tools. Dr. Lawrence ran the DARPA Conflict Modeling, Planning, and Outcome Experimentation (COMPOEX) program developing a modeling and simulation framework, planning tools, and modeling technologies in support of country-level strategic planning. He was recognized with the BAE Systems Bronze Chairman's Award in 2008. Dr. Lawrence also led the DARPA Behavioral Learning and Adaptive Electronic Warfare (BLADE) program (recipient of the Technology Solutions Best Collaboration of the Year award for the proposal effort) applying machine learning technology to learn behaviors of complex unknown RF threats in real-time and developing control-based technologies to construct surgical jamming strategies.

Lawrence received his B.S., M.S., and Ph.D. in electrical engineering from the University of Maryland, College Park. He was nominated by Professor Andre Tits for this award.

Mustafa Kemal Sönmez

Research areas: Machine Learning for Precision Medicine and Early Detection of Cancer, Computational Genomics/Biology, Speech Recognition



Dr. Kemal Sönmez is a co-founder and Chief Scientific Officer of Omics Data Automation (ODA), whose mission is to power Precision Medicine by integrating patient data at scale and enabling collaboration across medical centers to generate actionable insights from large patient cohorts. He is also an Associate Professor at the Knight Cancer Institute (Cancer Early Detection

Advanced Research Center) at Oregon Health and Science University School of Medicine and an affiliated faculty member at Children's Cancer Therapy Development Institute.

After a career that spanned roles in engineering research and development in Silicon Valley working on various aspects of speech technology at SRI International, Kemal became part of several DARPA initiatives on Systems Biology and made a career transition to academic biomedical research to join OHSU School of Medicine as a faculty member in 2008. At OHSU, he led a large collaboration with Intel, Dana Farber Cancer Institute, and Ontario Institute for Cancer Research on building a Collaborative Cancer Cloud (CCC) for secure federated learning across institutions. He joined the Knight Cancer Institute's Cancer Early Detection Advanced Research (CEDAR) center in 2016, and currently works on using large-scale analyses of electronic health records and insurance claims data for identifying high-risk populations for early detection.

In 2016, Kemal became the co-founder and CSO of Omics Data Automation, a medical data integration startup that aims to bring together all patient data across institutions to enable automated integration and large-scale machinelearning solutions in order to improve care, primarily in oncology. ODA has found prominent academic medical center partners such as UCLA (ATLAS, population health initiative), UCSF (HOPE consortium for pregnancy and infant outcomes), and Providence Cancer Center (virtual molecular tumor boards).

Kemal received his Ph.D. from the University of Maryland and did postdoctoral work in computational biology at the Department of Applied Mathematics at Brown University. Kemal lives with his wife and two children in Portland. He was nominated by Professor John Baras for this award.

Johannes Thorsteinsson

Research Area: Telecommunications, Media and Technology Investment Banking



Johannes Thorsteinsson serves as SVP Finance and Treasurer of T-Mobile, where he leads the Company's Capital Structure Strategy and Capital Markets Issuances, Structured Finance, Risk Insurance Management, and Cash Management. Under his leadership, T-Mobile has been one of the most active and successful issuers in the U.S. debt capital markets, including the most active corporate issuer

of IG debt in 2020 and most active issuer of HY debt in 2021, all while significantly decreasing the average cost of debt of T-Mobile's capital structure and simultaneously increasing its weighted average maturity.

Prior to T-Mobile, he served as Managing Director for Deutsche Bank in its Telecom, Media and Technology Investment Banking Group. In his 13-year career at Deutsche Bank, Johannes worked on debt and equity capital markets and mergers and acquisitions transactions with more than \$100B of completed transaction value, including advising SoftBank on their acquisition of Sprint in 2012 and all of T-Mobile's capital market transactions since 2013. During his investment banking career, he worked closely with many of the world's leading communication and technology companies across multiple sectors and geographies.

Johannes holds an M.B.A. and a Master of Science in Electrical Engineering from the University of Maryland, and a Bachelor of Science in Computer Engineering from the University of Iceland. A native of Iceland, he grew up in Germany but has called the U.S. his home for the past two decades.

Johannes lives with his wife and three children in Seattle, Washington. Thorsteinsson was nominated by Professor Ray Liu for the award.

Haitao (Heather) Zheng

Research areas: Wireless Networking, Mobile Systems



Haitao (Heather) Zheng is a Neubauer Professor of Computer Science at the University of Chicago. She received her Ph.D. in Electrical and Computer Engineering from University of Maryland, College Park in 1999. Prior to joining University of Chicago in 2017, She spent six years in industry labs (Bell-Labs, New Jersey, and Microsoft Research, Asia), and 12 years at

the University of California, Santa Barbara. At UChicago, she co-directs the SAND Lab (Security, Algorithms, Networks and Data) together with Prof. Ben Y. Zhao. She was selected as one of *MIT Technology Review's* TR 35 (Innovators Under 35, 2005) for her work on cognitive radios; her work was featured by *MIT Technology Review* as one of the 10 Emerging Technologies (2006). She is a fellow of the World Technology Network, and an IEEE Fellow.

Throughout her 20 years in research labs and academia, her research has evolved and adapted to target important high-impact research problems. In the past, this has covered significant ground in wireless networking, mobile systems, network measurements, and security. Most recently, she has focused her attention on two broad areas: mobile/IoT sensing and its implications on security and privacy; and security and privacy of deep-learning systems. Her research has been frequently featured by media outlets such as *The New York Times, Boston Globe, LA Times,* and *MIT Technology Review.* Zheng was nominated by Professor Ray Liu for the award.

Laroia Elected to National Academy of Engineering



Rajiv Laroia (M.S. '89, Ph.D. '92) has been elected to the 2021 Class of the National Academy of Engineering (NAE) "for contributions to adaptive multiuser orthogonal frequency division multiplexing for cellular voice and data systems."

Election to NAE is considered one of the highest professional

recognitions in an engineer's career. Academy members are peer-selected for pioneering new technologies, advancing engineering education, outstanding business and government leadership, and contributions to engineering research and practice.

Laroia is an authority in wireless communication networks and data transmission, information theory, optics, and digital imaging technology. He is the cofounder and CTO of Light, a perception technology company that essentially allows cameras to see, detect, measure, and understand the world around them with astonishing accuracy.

Laroia received his Ph.D. and master's degrees in electrical engineering, working with advisor and former Clark School Dean and UMD Provost Nariman Farvardin. He has 400 issued patents and more than 400 pending. Laroia has won numerous industry awards, including the IEEE Industrial Innovation Award in 2013 and the IEEE Alexander Graham Bell Medal in 2020. He was inducted to the Clark School's Innovation Hall of Fame in 2006. He served on the Institute for Systems Research Strategic Advisory Council from 2006-2009 and the Department of Electrical and Computer Engineering (ECE) Advisory Board from 2017-2019. In 2013, he won the University of Maryland ECE Distinguished Alumni Award.

clark school NEWS

Samuel Graham, Jr. Named Dean of Clark School



On October 1, 2021, The University of Maryland named Samuel Graham, Jr. dean of the A. James Clark School of Engineering. As dean, Graham will provide leadership and vision for the Clark School, while sharing the school's mission with students, faculty, staff, alumni, public agencies, and supporters, and fostering an environment of excellence in teaching and learning.

"I am honored to be appointed dean of Maryland's A. James Clark School of Engineering, a research powerhouse and home to world-class faculty, staff, and students," said Graham. "I look forward to contributing to its legacy of excellence and leading the next generation of diverse Terrapin engineers poised to improve our world through innovations in technology."

Graham previously served as the Eugene C. Gwaltney, Jr. Chair of the George W. Woodruff School of Mechanical Engineering at the Georgia Institute of Technology. He also holds a courtesy appointment in the School of Materials Science and Engineering at Georgia Tech and a joint appointment with the National Renewable Energy Laboratory. He joined the George W. Woodruff School in 2003 and was promoted to professor in 2013.

"Please join me in congratulating Dr. Samuel Graham, Jr. as the new dean of the A. James Clark School of Engineering and welcoming him to the University of Maryland. He brings an outstanding record of success in academic leadership and engineering research and aligns with our vision for excellence and an unwavering commitment to a multicultural campus," said UMD Interim Senior Vice President and Provost Ann G. Wylie. "I have every confidence that Dr. Graham is the best person to lead our Clark School of Engineering students, faculty, and staff into the future." Graham's research centers on the development of electronics made from wide bandgap semiconductors for a range of applications in communications, power electronics, and neuromorphic computing. His research is focused on engineering the electrothermal response of the devices in order to enhance heat dissipation and improve device reliability. In addition, he is creating physics-based models and unique experimental tools for verification that will enable the optimization and digital engineering of these electronics. Through his work with DOE National Laboratories, he is also developing thermal storage materials for use in building energy systems.

Prior to joining the faculty at Georgia Tech, Graham was a senior member of technical staff at Sandia National Laboratory in Livermore, California. Over the years, he has served as a member of the Defense Science Study Group and the Air Force Scientific Advisory Board and was the recipient of a National Science Foundation CAREER Award. Presently, he serves on the advisory board of the Engineering Science Research Foundation of Sandia National Laboratories and the Emerging Technologies Technical Advisory Committee of the U.S. Department of Commerce. He is also a fellow of the American Society of Mechanical Engineers and a senior member of the Institute of Electrical and Electronics Engineers.

To fill this position, a national search was launched after the school's former dean, Darryll J. Pines, was appointed president of UMD. Robert Briber served as interim dean of the Clark School.

Graham earned his B.S. from Florida State University and his M.S. and Ph.D. in mechanical engineering from Georgia Tech. ■

corporate partner SPOTLIGHT

Booz Allen Hamilton Revamps ECE's Reverse Engineering Course

Electrical and Computer Engineering long-time partner Booz Allen Hamilton has recently helped revamp ECE's Reverse Engineering and Hardware Security Laboratory course (ENEE459B).

The objectives of this redesigned course are to understand security vulnerabilities in hardware design, physical tamper and side channel attacks to systems, learn the fundamentals and practical techniques to design secure and trusted digital systems, become familiar with hardware security primitives, master techniques for writing and analyzing x86 assembly code, develop reverse engineering skills with IDA Pro, practice secure programming, and use Wireshark for protocol and packet analysis.

Students are able to design/conduct experiments and analyze/interpret data, design a system, component, or process to meet needs, identify, formulate, and solve engineering problems, understand professional and ethical responsibilities, gain knowledge of contemporary issues as well as techniques, skills, and modern engineering tools necessary for practice.

Booz | Allen | Hamilton

philanthropy spotlight

The Gary Connor Undergraduate Advising Fund

Originally from New Jersey, Gary Connor is retired and living in San Jose, California. He received his bachelor's degree from UMD, and has an M.B.A. from San Jose State University. Gary has established the Gary Connor Undergraduate Advising Fund to support advising, tutoring, and mentoring expenses in the ECE Department. Gary had a great experience at UMD, and is very passionate about the University.

His gift to the Department of Electrical and Computer Engineering has made an enormous difference to many undergraduate students during the pandemic.

IMPACT

Undergraduate Tutoring Program

The gift supported 10 tutors during the 2020-21 academic year. Collectively, these tutors held more than 120 tutoring sessions with undergraduates across 12 electrical and computer engineering courses.

10

Tutors supported by Connor's gift

Undergraduate Advising

The ECE Department offers 1:1 advising sessions to more than 900 undergraduates each semester. With the gift, the Department hired a dedicated graduate assistant in the Office of Undergraduate Studies during the 2020-21 academic year. This position advises a caseload of 140 students, assists with new student orientation in the fall and spring, and helps with group advising for first-year students.



Undergraduates received 1:1 advising

Make It/Break It Lab

When completed, this lab will offer undergraduate students the opportunity to test ideas and collaborate on applied projects outside the classroom. It will also contain a dedicated meeting space for student teams and clubs. The Department's Technical Operations Team will manage the lab spaces and will provide support and mentorship to students utilizing the facilities and equipment, including a variety of measurement and fabrication tools. The lab is currently being designed for two adjoining spaces in the A.V. Williams Building and will be open during the Spring 2022 semester.

1800 Square feet of proposed space for the undergraduate Make It/Break It Lab.



Department of Electrical and Computer Engineering 2455 A.V. Williams Building University of Maryland College Park, MD 20742

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ECE EXPRESSES SINCERE THANKS FOR THE FOLLOWING CORPORATE AFFILIATES WHO WILL SUPPORT OUR STUDENTS AND RESEARCH IN 2022:



When the most powerful organizations in \odot DC require new solutions...

When global industry leaders need

innovators with fresh 🗑 ideas...

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