ECE News

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Newsletter of the Department of Electrical and Computer Engineering

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Mason's Rocketry Club, including members Alex Maxseiner (left), Eric Dau, Joe Coffin, and Peter Goffe

Mason's Rocketry Club Wins Target Altitude Event at Battle of the Rockets

BY NANCI HELLMICH

Mason's Rocketry Club captured first place in the target altitude event at the Battle of the Rockets competition in Culpeper, Virginia, this past April.

The club also placed third in the sounding rocket event. It was the group's first time participating in the competition.

"We were surprised that we won an event at our first competition," says computer engineering major Alex Maxseiner, president and founder of the club.

The objective of the event was to fly a rocket as close as possible to the targeted altitude of 1,312 feet. The club got three shots at reaching that goal; scoring was based on their best two attempts. Mason's team was off by only 115 feet in their best two shots.

"The challenge is keeping the altitude consistent between launches because of the wind and other factors," Maxseiner says. "There's a lot of stress at the two-day event because you want your rocket to perform, and any error in the launch could result in [having to make] repairs with a limited amount of time."

The club members built two rockets this year. They had several practice launches before the competition. The project was sponsored by the Department of Electrical and Computer Engineering.

"I didn't know much about amateur rocketry before joining the club, but now I am pursuing my level 1 certification," says mechanical engineering major Peter Goffe, the club treasurer. "We accept people from all academic backgrounds. The club is flexible with schedules, but we must meet deadlines."

Maxseiner says he founded the club in 2016 because he and his peers wanted to get hands-on experience using the information they were learning in their classes. "I thought this was a cool application of it. We all like space. I am considering working in the space industry when I graduate."

LETTER FROM THE CHAIR

Dear Alumni and Friends,

As we wrap up another successful academic year, the Electrical and Computer Engineering Department is very excited to share many accomplishments and initiatives with our alumni and friends. These initiatives range from new international educational partnerships and student research accomplishments to a new program specialization.

New International Program

Based on discussions with a number of Mason's current international partners, a memorandum of understanding (MOU) for a new 3+1+1 program has been approved. There are now close to 30 institutions, primarily in China but also in Indonesia, Spain, and the United Arab Emirates, with whom the 3+1+1 program is being discussed. So far, I have visited and given presentations at nine universities in four different cities in China to promote this program and to establish partnerships in education, research, teaching, and student/faculty exchanges. The interest expressed by these universities for these programs has been phenomenal. The ECE Department and George Mason University are excited about these new opportunities for international exchanges.

Student Accomplishments

At the Battle of the Rockets competition held in April 2018, six members of Mason's Rocketry Club captured first place in the target altitude event and third place in the sounding rocket event. You may read more about this event in our cover story.

ECE students also continued to shine within Mason Engineering, winning several awards for their projects at the annual Undergraduate Research Celebration. The project "Optical Pointer" earned the keynote speaker's spot at this event, while "Swarm Robotics" won the People's Choice Award by majority vote. For the project "LENS: A Robotic Eye System Using Artificial Muscles," which was presented to the Dean's Advisory Board, students demonstrated the potential of nylon-based artificial muscles for recreating the precise movements of the human eye. This project, advised by Professor Feitian Zhang (ECE) and Professor Qi Wei (Bioengineering) was also voted winner of the ECE Department's spring senior design presentations, which featured more that 60 students, mentored by 10 different professors, for 12 different projects.

Specialization in Power Systems

Associate Professor Liling Huang is developing a new specialization in power systems within our department, and her efforts are generating a lot of interest among our students and power companies. After beginning with one undergraduate course this year that filled to capacity, she has plans to expand the offering to more courses next year, with graduate courses to come in the following year. She is now working with the Northern Virginia Electric Cooperative to develop a power systems lab to support her courses.

We also invite you to follow us on Facebook, and I look forward to sharing more news and stories in the future.

Monson H. Hayes
Chair, Department of Electrical and Computer Engineering

INSIDE

ALUMNI PROFILE

Esmael Dinan

This Electrical Engineering Alum Is on a Mission to Invent the Fastest Wireless Technologies

Esmael Dinan, PhD Electrical and Computer Engineering '01, wants to be a major player in the wireless technology world. Since earning a PhD in 2001, he has made considerable headway toward that goal. A prolific inventor, Dinan has worked for several large wireless technology companies, and he founded Ofinno Technologies in Herndon, Virginia. He recently talked about his work:

Why did you decide to come to Mason for your PhD?

I was a PhD student in École Nationale Supérieure des Télécommunications in Paris in 1997 when I met Bijan Jabbari, a professor of electrical and computer engineering from Mason. He was in Paris for a research project involving the two universities, and we clicked. I was fascinated by many of his research ideas. I moved to the United States to work with him and get my PhD at Mason Engineering.

What did you like most about your academic experience here?

I had a lot of choices on which courses I wanted to take, and the professors were very dedicated and friendly. I spent a lot of time in the Communications and Networking Lab, founded by Dr. Jabbari. We were a group of graduate students working as a team. I always had funding for research projects. WorldCom (now bought by Verizon) was one of the companies that funded my research, and they hired me right before I graduated.

How did your career unfold?

I was always passionate about research and innovation. My dissertation was about advanced wireless systems, and Mason filed six patents for my inventions. After graduating with my PhD, I worked in the research and development departments of technology firms. I led research and development projects in various areas of wireless and wireline networking technologies.

In 2011, I was laid off by Sprint, which motivated me to fulfill my dream to start my own company. [My wife and I] called it Ofinno Technologies. It was my wife's idea. It comes from "of innovations." I love inventing and teaching other people how to invent.

We are a technology research lab and develop some of the most amazing wireless technologies implemented in LTE-advanced and 5G wireless networks. 5G wireless technology brings ultrafast wireless speeds and intelligence to people and machines.

I want to have a company with the greatest number of prolific inventors from all over the world.

I want to create the same sense of community in Ofinno that Mason created for me. We are a proud winner of the Corporate Culture Award from CEO Report, which honors "companies that foster a creative, collaborative workplace culture to enhance performance and sustain a competitive advantage."

I am an inventor in more than 700 patents or patent applications. However, Ofinno was by far my most important invention.

How do you know when something you've invented is worth patenting?

The challenge is in identifying great ideas from the ones that are not so great. Even some of the large enterprises don't know how to figure it out. Unlike what most people think, innovative solutions are not formed in a flash of insight. Most inventions come from lots of research and the clash between different ideas.

First, we spend a lot of time to research existing technologies and their deficiencies. Second, we work in teams that criticize each other's work in a trusting environment. Then, we identify the inventions that are worth filing as a provisional patent.

How did you make the transition from engineer/employee to owning your own company?

I read a lot of books about research, leadership, and business. I had to re-invent myself a few times. For two years, I worked in my basement. I provided consulting services to cover the cost of operations and spent almost all my savings on a few research projects. The risks were dramatically higher at that time.

Now, my challenges are about scaling the business model, maintaining an innovative corporate culture, collaborating with other companies, and supporting everyone on my team. We had an unconventional approach about growing the company. We have achieved so much without a penny of loan or investment money and plan to continue growing with this approach. That is very challenging.

ALUMNI PROFILE

Sandra Cauffman Shares Lessons Learned

BY JOHN HOLLIS

Sandra Cauffman, BS Electrical Engineering '88, BS Physics '88, MS Electrical Engineering '95, serves as the deputy director of the Earth Science Division in NASA's Science Mission Directorate.

She provides critical executive leadership, strategic direction, and overall management of the space agency's entire $2 billion Earth science portfolio while keeping a watchful eye on the 16 satellites her division currently has in orbit.

Cauffman is also overseeing 16 new space missions planned for launch between 2018 and 2022. Four of these missions will launch this year.

In May, Cauffman was recognized by the Mason Alumni Association as a part of its 50th Anniversary Celebration. The Costa Rica native spoke with Mason communications officer John Hollis about five things she gained from her Mason experience that helped prepare her for the job she has today.

"All of our professors in the engineering school were extremely good and very, very knowledgeable."

Mason was where I learned to speak good English:

When I first came to Mason, I had already been in college for three and a half years in Costa Rica. I had taken three years of English in high school, but I hadn't taken any during college. George Mason had a great English Language Institute, where you could really immerse yourself in English. That was the first time that I had done that, and Mason's large international student population really helped make me feel at ease while doing it. I got to meet people from all over the world and learn English with them. It was really nice.

Everything we did at Mason was very hands-on:

The degree I received in electrical engineering was very hands-on. It wasn't just learning about things in the classroom. We were able to get into the lab and learn by building things from scratch. That was invaluable in allowing me to feel very comfortable in any lab environment.

I met my husband at Mason:

I met my husband, Stephen Cauffman, while we were both students at Mason. We both graduated from the physics program. We started dating on October 19, 1987, and we got married 11 months later in September 1988. We'll be celebrating our 30th anniversary this fall.

I grew as a person because of Mason's diversity:

When I was growing up in Costa Rica, the diversity was not great. I met mostly Americans and folks from other Central American countries. It was amazing arriving at Mason and meeting so many people from all over the world. I met people from England; I met people from Egypt and from all over. I actually dated a Korean guy. You get to see that diversity at Mason, and you see that we all want the same thing. We all want the best for our kids, the best for ourselves. It was very eye-opening.

I learned from some of the best teachers:

There were world-class professors in engineering. They had come to Mason from some of the biggest named universities out there, such as Harvard and MIT. We learned from the best.

RESEARCH SPOTLIGHT

Stepping up to Manage Big Data

BY GERRY TIAN, PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING

There is a data deluge emerging from many interdependent networks and infrastructures, such as structural health monitoring systems, vehicular networks, and brain networks. As big data applications continue to grow in size and number, it is crucial that only measurements that are informative for a specific inference task be used in order to limit the required sensing cost and the related costs of storing or communicating the data.

Supported by a National Science Foundation (NSF) grant, a Mason signal processing and communications research group (SPCOM), led by Professor Zhi Tian, is conducting research that aims to transform classical sensing methods into low-cost compressive sensing mechanisms that are designed for specific inference tasks, such as estimation, detection, and learning. Such a task-cognizant sparse sensing framework leads to major sensing energy savings that could markedly impact a variety of signal processing applications, such as location-aware services, weather monitoring, and radio spectrum management.

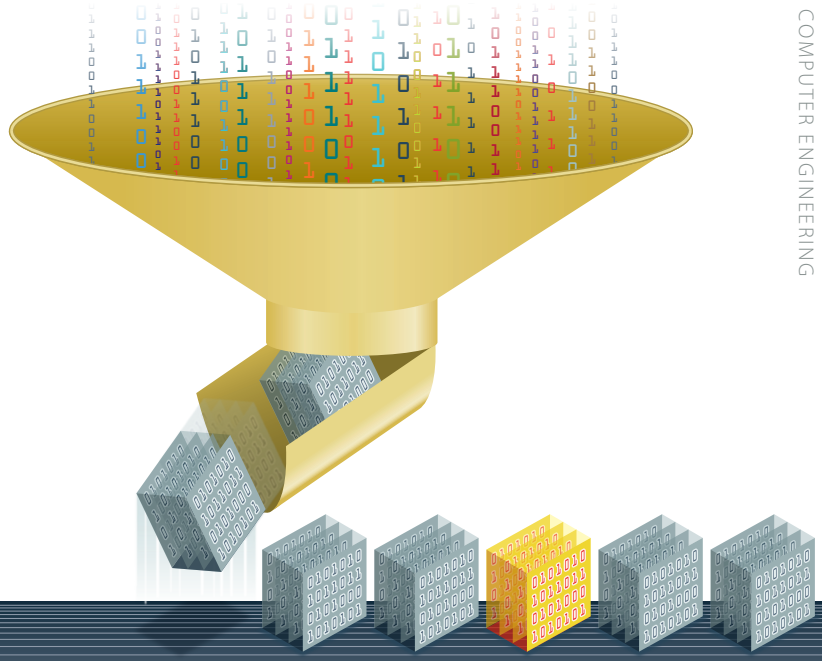
SPCOM is engaged in basic research in the areas of signal processing, machine learning, information fusion, and optimization, with applications in wireless communications, distributed sensor networks, and large-scale information networks. Presently, the group consists of two postdoctoral researchers, two PhD students, and several visiting PhD students.

Another SPCOM project involves energy-efficient sensing to support the vision for smart and resilient cities. Individuals and communities increasingly coexist with machines—from traffic signals to pollution sensors to security alarms—that sense and share vast quantities of information collectively known as big sensory data. While intended to make communities run more smoothly, such data can overwhelm the machines collecting it and the people, including community leaders, analyzing it. The SPCOM group is studying the collection and computation of big sensory data in the quest for solutions that are actionable for machines and intuitive for humans.

This study is supported by a recent grant from the BIGDATA program at NSF. Mason leads a collaborative team, which includes three other universities: the George Washington University, Georgia State University, and Virginia Commonwealth University. The Office of the Chief Technology Officer (OCTO) of the District of Columbia is also on board, helping test the research group's techniques on real-world datasets collected by OCTO through its Smarter DC initiative. The ultimate outcomes of this research will include new methodologies, algorithms, and tools—all of which will improve not only academic understanding, but also the real-world experience for those interacting with smart technology.

Smart city applications also drive the need for advanced wireless communication technologies. These technologies will provide pervasive wireless connectivity with high data rates, low latency, large capacity, and satisfactory customer experience. They also equip the internet of things (IoT) with reliable and secure services at low costs. Propelled by such needs, the SPCOM research group is currently engaged in research on key fifth-generation (5G) technologies, including cognitive radio for dynamic spectrum access and massive MIMO systems for both millimeter-wave communications and IoT connectivity. These technologies are expected to alleviate today's spectrum scarcity problem and provide enhanced link reliability and data rates.

In collaboration with researchers from the University of Illinois at Urbana-Champaign and the University of Maryland Baltimore County, the SPCOM group is also studying effective ways to detect and mitigate radio frequency interference. The underlying objective is to alleviate the growing tension between the increasing demand for greater spectrum use by active radios and the pressing need for quiet spectrum by passive systems, such as radio astronomy services and earth exploration satellite services.



ECE Researcher Joins Transdisciplinary Center Team

BY QILIANG LI, PROFESSOR OF ELECTRICAL AND COMPUTER ENGINEERING

The Quantum Materials Center (QMC), led by **Patrick Vora,** assistant professor in the Department of Physics and Astronomy; **Qiliang Li,** professor in the Department of Electrical and Computer Engineering; and **James Glasbrenner,** assistant professor in the Department of Computational and Data Sciences; has been selected as one of two Mason transdisciplinary centers.

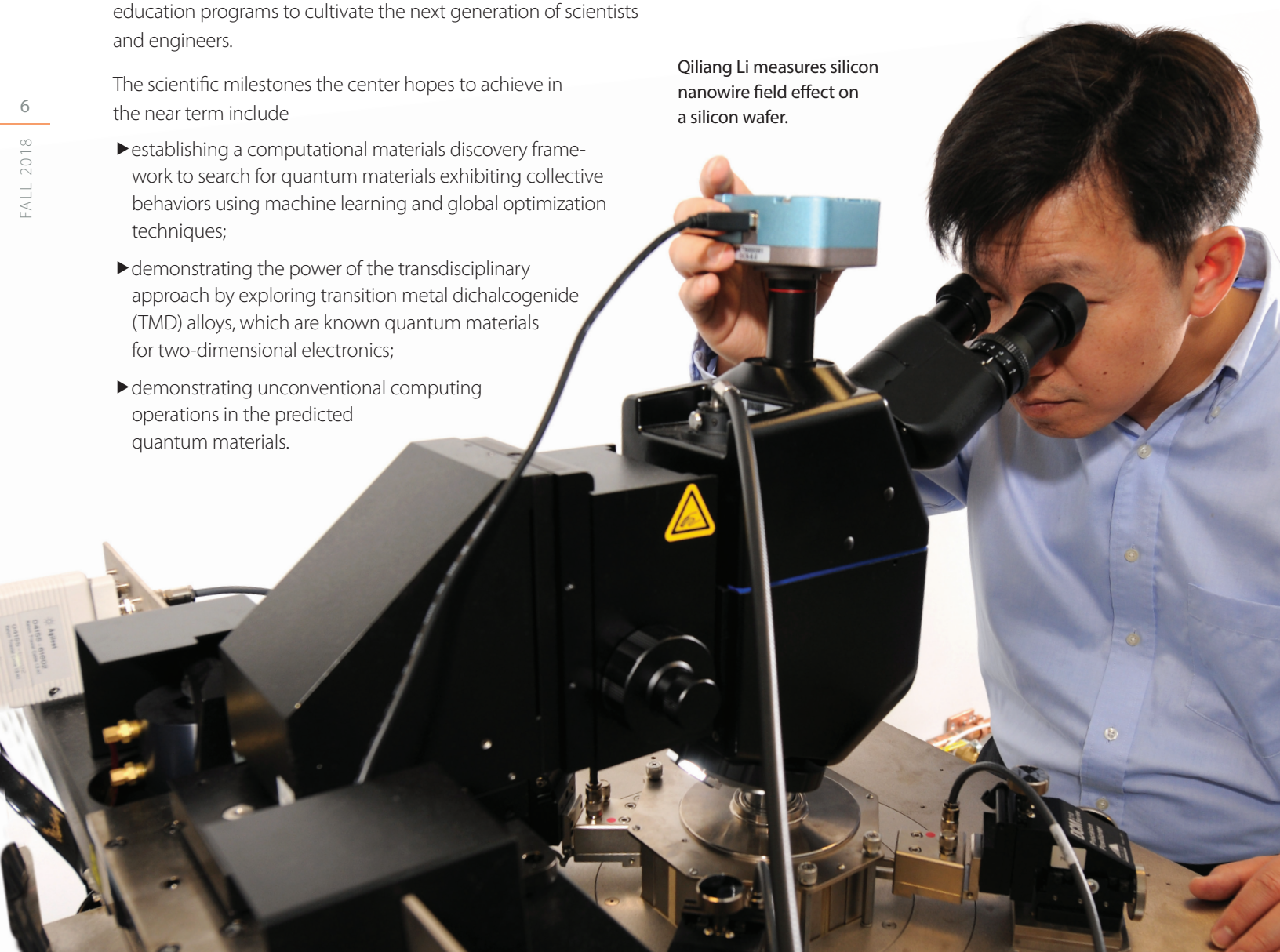
The QMC aims to establish a transdisciplinary approach by combining the expertise of George Mason University physicists, electrical and mechanical engineers, and data scientists to discover and develop quantum materials suitable for novel computation technologies. One of the foci of the center is to integrate advanced research in quantum computation with education programs to cultivate the next generation of scientists and engineers.

The scientific milestones the center hopes to achieve in the near term include

- establishing a computational materials discovery framework to search for quantum materials exhibiting collective behaviors using machine learning and global optimization techniques;
- demonstrating the power of the transdisciplinary approach by exploring transition metal dichalcogenide (TMD) alloys, which are known quantum materials for two-dimensional electronics;
- demonstrating unconventional computing operations in the predicted quantum materials.

The QMC has ongoing research collaborations with the National Institute of Standards and Technology, the Naval Research Laboratory, and Pennsylvania State University in the fabrication and characterization of nanoscale quantum materials and devices. In the next 5 to 10 years, the QMC will strengthen the existing relationships with these prestigious national institutes, grow a community of Mason quantum materials researchers, and establish a leading national center in quantum materials and devices.

The QMC will receive base funding support from Mason's Office of the Provost for five years, which will be renewable thereafter for an additional five years.



Qiliang Li measures silicon nanowire field effect on a silicon wafer.

Department Collaborates with Industry to Implement Power Engineering Specialization

Ludovit Hintos, BS '08, started his career at Dominion Energy right after graduating from Mason. In the last 10 years, he has completed his master's degree in electrical engineering, earned his professional engineer (PE) license, and been promoted from entry-level engineer to manager of electric distribution design and project management.

Hintos is now helping the Electrical and Computer Engineering Department in developing the power engineering specialization for the Electrical Engineering Program. He has also helped facilitate student field visits to Dominion's facilities and has advised students on class projects for electric power systems courses.

In this interview, Hintos shares from his experiences at Mason and provides valuable advice for the department and prospective ECE students.

Can you tell us what it is like to be an alumnus who has progressed in his career from an engineer to a manager and has become a PE?

I began my career in the electric distribution design department at Dominion Energy. I was responsible for designs of new distribution lines and improvement of existing lines in Northern Virginia.

After one year, I was promoted and transferred to the electric distribution reliability department, where my main responsibility was developing methods to improve electric reliability of the existing power distribution infrastructure under various capital budgets. The work involved research, fieldwork, and project management. During this time, I also got the opportunity to learn the operation of electric distribution grid and substations.

From November 2012 to May 2014, I was back in the electric distribution design department as a supervisor, and my job profile shifted to management. In February 2017, I was promoted to manager of electric distribution design and project management, leading a team of 123 employees, including eight supervisors and five project managers.

Ludovit Hintos on site. He says, "Mason helped me get to where I am right now, and I'm glad to give back."

I am passionate about learning and always put 120 percent effort toward my job. While working full time at Dominion Energy, I completed my master's degree at Mason and also earned my PE license. I believe that receiving the MS degree and PE license was beneficial for my career, and it earned me a new level of respect among my fellow engineers.

What motivated you to help the ECE Department establish a specialization in power engineering?

There are no schools in [the] immediate area offering accredited power engineering programs. The power industry is in a state of change, and there is a huge need for power engineers to [not only] support the grid but also to support the growth of data centers and other technologically advanced companies located in our area. Northern Virginia has become a center for innovation and technology, and that's why I think we could benefit from this program.

What particular topics should the new program include to prepare power engineers for the future?

The power grid is the largest infrastructure in the nation. I recommend covering the important topics of planning and reliability, power quality, fault analysis, power system protection, load flow analysis, rotating machines, GIS systems, and renewable energy.

Which course or sequence of courses did you find most useful in preparing you for your current work?

The circuit analysis courses, robotics class, and various labs were all beneficial for my current work. However, every course I took had either [a] direct or indirect positive impact on my career. Overall, the engineering program changed the way I solve problems. It was a very rewarding experience that paved the way for a successful career.

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